4200, 4300 and 4400 Compact Utility Tractors

TECHNICAL MANUAL

John Deere
Lawn & Grounds Care Division

TM1677 (Apr01)
Replaces TM1677 (Jul99)

Litho in U.S.A

M91749

4200 Tractor

M91750

4300 Tractor

M91814

4400 Tractor

This technical manual is written for an experienced technician and contains sections that are specifically for this product. It is a part of a total product support program.

The manual is organized so that all the information on a particular system is kept together. The order of grouping is as follows:

- Table of Contents
- Specifications
- Component Location
- System Schematic
- Theory of Operation
- Troubleshooting Chart
- Diagnostics
- Tests & Adjustments
- Repair

Note: Depending on the particular section or system being covered, not all of the above groups may be used.

Each section will be identified with a symbol rather than a number. The groups and pages within a section will be consecutively numbered.

We appreciate your input on this manual. To help, there are postage paid post cards included at the back. If you find any errors or want to comment on the layout of the manual please fill out one of the cards and mail it back to us.

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.

SAFETY

RECOGNIZE SAFETY INFORMATION

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

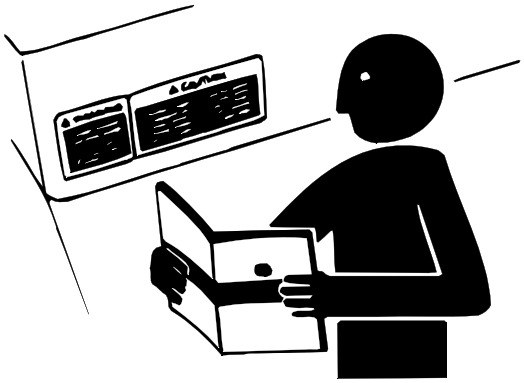
Follow recommended precautions and safe servicing practices.

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.

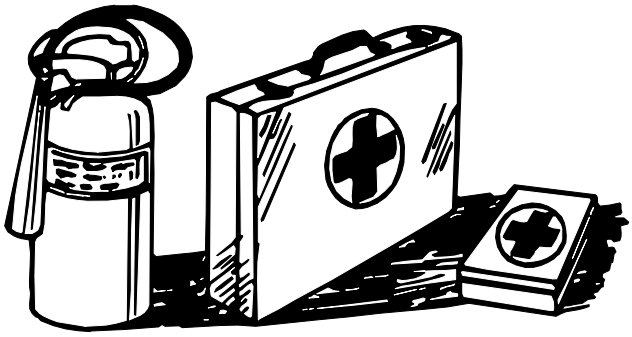
REPLACE SAFETY SIGNS



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

HANDLE FLUIDS SAFELY-AVOID FIRES

Be Prepared For Emergencies



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.

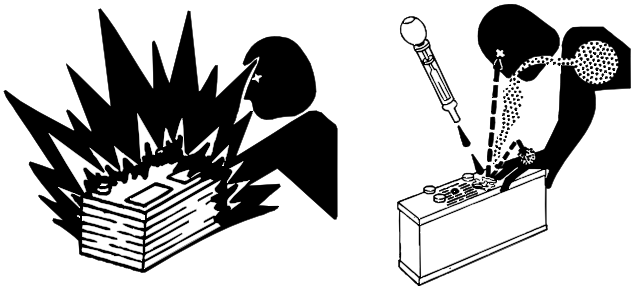
Do not store oily rags; they can ignite and burn spontaneously.

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.

USE CARE IN HANDLING AND SERVICING BATTERIES



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)**.

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 acid burns 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:**

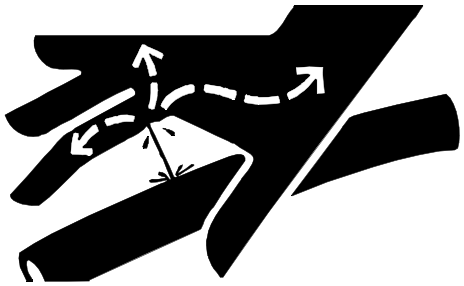
1. Flush your skin with water.
2. Apply baking soda or lime to help neutralize the acid.
3. Flush your eyes with water for 10 – 15 minutes.
4. Get medical attention immediately.

- **If acid is swallowed:**

1. Drink large amounts of water or milk.
2. Then drink milk of magnesia, beaten eggs, or vegetable oil.
3. Get medical attention immediately.

USE CARE AROUND HIGH-PRESSURE FLUID LINES

Avoid High-pressure Fluids



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

Avoid injury from escaping fluid under pressure by stopping the engine and relieving pressure in the system before disconnecting or 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.

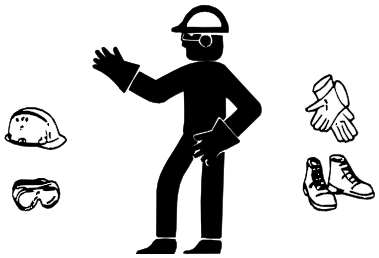
If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury should reference a knowledgeable medical source. Such information is available from Deere & Company Medical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

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 be accidentally cut when heat goes beyond the immediate flame area.

USE SAFE SERVICE PROCEDURES

Wear Protective Clothing

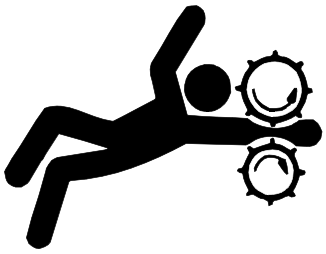


Wear close fitting clothing and safety equipment appropriate to the job.

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.

Service Machines Safely



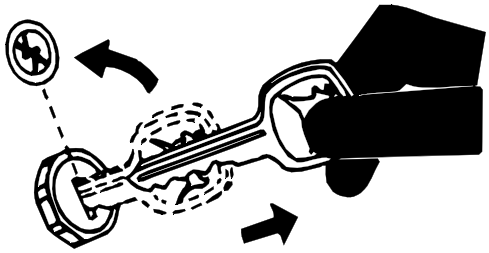
Tie long hair behind your head. Do not wear a necktie, scarf, loose clothing, or necklace when you work near machine tools or moving parts. If these items were to get caught, severe injury could result.

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

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.

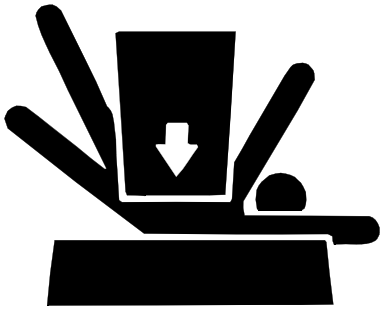
Park Machine Safely



Before working on the machine:

1. Lower all equipment to the ground.
2. Stop the engine and remove the key.
3. Disconnect the battery ground strap.
4. Hang a “DO NOT OPERATE” tag in operator station.

Support Machine Properly And Use Proper Lifting Equipment



If you must work on a lifted machine or attachment, securely support the machine or attachment.

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.

Lifting heavy components incorrectly can cause severe injury or machine damage. Follow recommended procedure for removal and installation of components in the manual.

Work In Clean Area

Before starting a job:

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

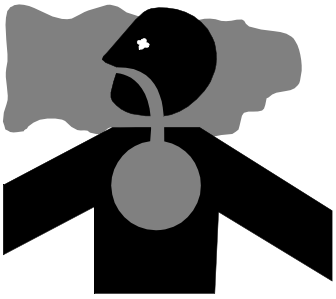
Using High Pressure Washers

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.

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.

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.

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.

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. Do all work outside or in a well ventilated area. Dispose of paint and solvent properly. Remove paint before welding or heating: 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.

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. Keep bystanders away from the area.

SERVICE TIRES SAFELY

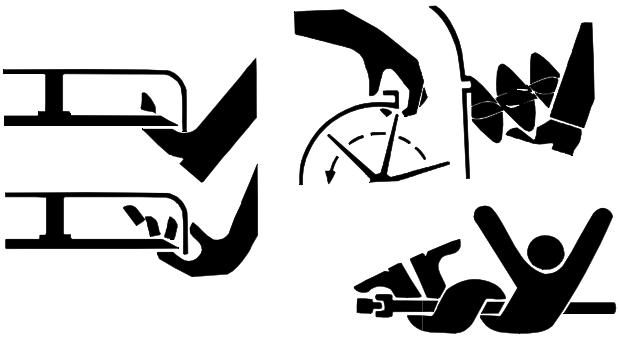
Explosive separation of a tire and rim parts can cause serious injury or death.

Do not attempt to mount a tire unless you have the proper equipment and experience to perform the job. Always maintain the correct tire pressure. Do not inflate the tires above the recommended pressure. Never weld or heat a wheel and tire assembly. The heat can cause an increase in air pressure resulting in a tire explosion. Welding can structurally weaken or deform the wheel.

When inflating tires, use a clip-on chuck and extension hose long enough to allow you to stand to one side and NOT in front of or over the tire assembly. Use a safety cage if available.

Check wheels for low pressure, cuts, bubbles, damaged rims or missing lug bolts and nuts.

AVOID INJURY FROM ROTATING BLADES, AUGERS AND PTO SHAFTS



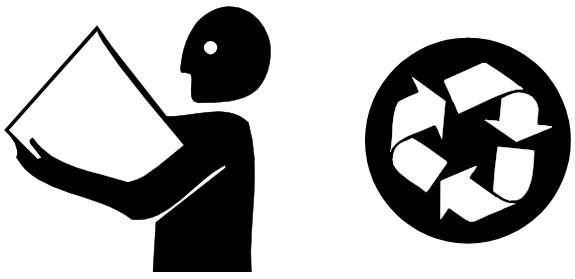
Keep hands and feet away while machine is running. Shut off power to service, lubricate or remove mower blades, augers or PTO shafts.

SERVICE COOLING SYSTEM SAFELY

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

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

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.

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

LIVE WITH SAFETY

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

CONTENTS

Page

GENERAL VEHICLE SPECIFICATIONS* – 4200

	4200 CST	4200 HST
ENGINE		
Make	John Deere/Yanmar	John Deere/Yanmar
Model	3TNE78A	3TNE78A
Type	4-cycle Diesel	4-cycle Diesel
Bore and Stroke	78x84 mm (3.07x3.31 in.)	78x84 mm (3.07x3.31 in.)
Cylinders	3	3
Valves	Overhead Valves	Overhead Valves
Displacement	1204 cm^3 (73.5 cu in.)	1204 cm^3 (73.5 cu in.)
Compression Ratio	18.0:1	18.0:1
Gross Engine Power	19.6 kW (26.3 hp)	19.6 kW (26.3 hp)
Torque (at rated speed)	63.2 N•m (46.6 lb-ft)	63.2 N•m (46.6 lb-ft)
Torque (max. @ 1600 rpm)	78.5 N•m (57.9 lb-ft)	78.5 N•m (57.9 lb-ft)
Lubrication	Full pressure	Full pressure
Oil filter	Standard Single Element	Standard Single Element
Oil Capacity (w/filter)	3.8 L (4.0 qt)	3.8 L (4.0 qt)
Engine Rated Speed	2700 rpm	2700 rpm
Engine Slow Idle Speed	950 ± 50 rpm	1000 ± 50 rpm
Engine Fast Idle Speed	2920 ± 25 rpm	2920 ± 25 rpm
Cooling system	Liquid w/Pump & Radiator	Liquid w/Pump & Radiator
Air cleaner	Dry-Type w/Safety Element	Dry-Type w/Safety Element
ELECTRICAL		
Volts	12 VDC	12 VDC
Battery Size - 12V (CCA)	500 Cold Cranking Amps	500 Cold Cranking Amps
Alternator	40 amp	40 amp
Regulator	Internal, Current Limiting	Internal, Current Limiting
Starting Motor	1.2 kW (1.61 hp)	1.2 kW (1.61 hp)
Headlights	37.5 W Halogen Bulb	37.5 W Halogen Bulb
Tail Lights	5 W Bayonet Base	5 W Bayonet Base
Hazard Lights	Type 1156	Type 1156
Instrument Panel Lamps	1.7 W Bayonet Base	1.7 W Bayonet Base

*Specifications and design subject to change without notice.

	4200 CST	4200 HST
FUEL SYSTEM		
System Type	Direct Fuel Injection	Direct Fuel Injection
Injection Pump	In-Line w/Solenoid Shutoff	In-Line w/Solenoid Shutoff
Fuel type	Diesel	Diesel
Fuel Tank Capacity	37.9 L (10.0 gal)	37.9 L (10.0 gal)
Fuel Filter	Clear Bowl Water Separator with Disposable Paper Element, Water Floating Red Ring	Clear Bowl Water Separator with Disposable Paper Element, Water Floating Red Ring
DRIVE TRAIN		
Type	9 x 3 Collar Shift	HST and Gear
Mechanical Front Wheel Drive (4-WD)	Yes (Option)	Yes (Option)
Front Axle Fluid Capacity	3.8 L (1.0 gal)	3.8 L (1.0 gal)
Differential Lock	Standard; Foot Operated	Standard; Foot Operated
Number of Speeds	9 Forward, 3 Reverse	Infinite / 3 Range
Final Drive	Spur Gear	Spur Gear
Brakes	Wet Disk	Wet Disk
Steering	Hydraulic Power Assist	Hydraulic Power Assist
Drawbar Tongue Weight Vertical Capacity Rating	500 kg (1102 lb)	500 kg (1102 lb)
PTO (PTO Shaft Speed Measured at 2700 Engine rpm)		
Type	Independent	Idenpendent
Rotation Direction	Clockwise	Clockwise
Clutch	Multiple Wet Disk	Multiple Wet Disk
Brake	Wet Disk	Wet Disk
Rear Shaft Speed	540 rpm	540 rpm
Mid Shaft Speed	2100 rpm	2100 rpm
2 - Speed Shaft Speeds	540 rpm and 750 rpm	540 rpm and 750 rpm
PTO Output Power	16.0 kW (21.5 hp)	14.9 kW (20.0 hp)
3–POINT HITCH		
Type	Category One	Category One
Lift Capacity at 61.0 cm (24 in.) Behind Link Arms	771 kg (1700 lb)	771 kg (1700 lb)

	4200 CST	4200 HST
CLUTCH		
Type Disk	Wet Multiple	None
HYDRAULIC SYSTEM		
	(Measurements Taken At 2700 Engine rpm)	(Measurements Taken At 2700 Engine rpm)
Type	Open Center System	Open Center System
Tran/Hydr Fill Capacity	24 L (6.3 gal)	26 L (6.8 gal)
Working Pressure	14652 kPa (2125 psi)	14652 kPa (2125 psi)
Pump	Open Ctr/Gear	Open Ctr/Gear
Front Pump Capacity	19.3 L/min (5.1 gpm)	19.3 L/min (5.1 gpm)
Rear Pump Capacity	27.6 L/min (7.3 gpm)	27.6 L/min (7.3 gpm)
Total Fluid Capacity	46.9 L/min (12.4 gpm)	46.9 L/min (12.4 gpm)
GROUND SPEEDS		
Range A, Gear 1	1.3 km/h (0.8 mph)	6.0 km/h (3.7 mph)
Range A, Gear 2	2.0 km/h (1.3 mph)	
Range A, Gear 3	2.7 km/h (1.7 mph)	
Range B, Gear 1	3.7 km/h (2.3 mph)	10.5 km/h (6.5 mph)
Range B, Gear 2	5.6 km/h (3.5 mph)	
Range B, Gear 3	7.5 km/h (4.7 mph)	
Range C, Gear 1	10.5 km/h (6.5 mph)	21.1 km/h (13.1 mph)
Range C, Gear 2	15.9 km/h (9.9 mph)	
Range C, Gear 3	21.2 km/h (13.2 mph)	
Range A, Reverse 1	1.3 km/h (0.8 mph)	6.0 km/h (3.7 mph)
Range B, Reverse 1	3.7 km/h (2.3 mph)	10.5 km/h (6.5 mph)
Range C, Reverse 1	10.1 km/h (6.3 mph)	21.1 km/h (13.1 mph)
WEIGHT		
w/ROPS, 3PT	1213 kg (2675 lbs)	1304 kg (2875 lbs)
TIRES		
Front (Standard)	7.00 - 12 R1	7.00 - 12 R1
Rear (Standard)	12.4 - 16 R1	12.4 - 16 R1

GENERAL VEHICLE SPECIFICATIONS* – 4300

	4300 CST	4300 SRT	4300 HST
ENGINE			
Make	John Deere/Yanmar	John Deere/Yanmar	John Deere/Yanmar
Model	3TNE84	3TNE84	3TNE84
Type	4-cycle Diesel	4-cycle Diesel	4-cycle Diesel
Bore and Stroke	84x90 mm (3.31x3.54 in.)	84x90 mm (3.31x3.54 in.)	84x90 mm (3.31x3.54 in.)
Cylinders	3	3	3
Valves	Overhead Valves	Overhead Valves	Overhead Valves
Displacement	1496 cm^3 (91.3 cu in.)	1496 cm^3 (91.3 cu in.)	1496 cm^3 (91.3 cu in.)
Compression Ratio	18.0:1	18.0:1	18.0:1
Gross Engine Power	24.0 kW (32.2 hp)	24.0 kW (32.2 hp)	24.0 kW (32.2 hp)
Torque (at rated speed)	78.5 N•m (57.9 lb-ft)	78.5 N•m (57.9 lb-ft)	78.5 N•m (57.9 lb-ft)
Torque (max. @ 1700 rpm)	99.1 N•m (73.1 lb-ft)	99.1 N•m (73.1 lb-ft)	99.1 N•m (73.1 lb-ft)
Lubrication	Full pressure	Full pressure	Full pressure
Oil filter	Standard Single Element	Standard Single Element	Standard Single Element
Oil Capacity (w/filter)	4.3 L (4.6 qt)	4.3 L (4.6 qt)	4.3 L (4.6 qt)
Engine Rated Speed	2700 rpm	2700 rpm	2700 rpm
Engine Slow Idle Speed	950 ± 50 rpm	950 ± 50 rpm	1000 ± 50 rpm
Engine Fast Idle Speed	2920 ± 25 rpm	2920 ± 25 rpm	2920 ± 25 rpm
Cooling system	Liquid w/Pump & Radiator	Liquid w/Pump & Radiator	Liquid w/Pump & Radiator
Air cleaner	Dry-Type w/Safety Element	Dry-Type w/Safety Element	Dry-Type w/Safety Element
ELECTRICAL			
Volts	12 VDC	12 VDC	12 VDC
Battery Rating	45 amp-hr	45 amp-hr	45 amp-hr
Battery Size - 12V (CCA)	500 Cold Cranking Amps	500 Cold Cranking Amps	500 Cold Cranking Amps
Alternator	40 amp	40 amp	40 amp
Regulator	Internal, Current Limiting	Internal, Current Limiting	Internal, Current Limiting
Starting Motor	1.4 kW (1.88 hp)	1.4 kW (1.88 hp)	1.4 kW (1.88 hp)
Headlights	37.5 W Halogen Bulb	37.5 W Halogen Bulb	37.5 W Halogen Bulb
Tail Lights	5 W Bayonet Base	5 W Bayonet Base	5 W Bayonet Base
Hazard Lights	Type 1156	Type 1156	Type 1156
Instrument Panel Lamps	1.7 W Bayonet Base	1.7 W Bayonet Base	1.7 W Bayonet Base

*Specifications and design subject to change without notice.

	4300 CST	4300 SRT	4300 HST
FUEL SYSTEM			
System Type	Direct Fuel Injection	Direct Fuel Injection	Direct Fuel Injection
Injection Pump	In-Line w/Solenoid Shutoff	In-Line w/Solenoid Shutoff	In-Line w/Solenoid Shutoff
Fuel type	Diesel	Diesel	Diesel
Fuel Tank Capacity	37.9 L (10.0 gal)	37.9 L (10.0 gal)	37.9 L (10.0 gal)
Fuel Filter	Clear Bowl Water Separator with Disposable Paper Element, Water Floating Red Ring	Clear Bowl Water Separator with Disposable Paper Element, Water Floating Red Ring	Clear Bowl Water Separator with Disposable Paper Element, Water Floating Red Ring
DRIVE TRAIN			
Type	Collar Shift	SyncReverser™	Hydrostatic
Mechanical Front Wheel Drive (4-WD)	Yes (Option)	Yes (Option)	Yes (Option)
Front Axle Fluid Capacity	3.8 L (1.0 gal)	3.8 L (1.0 gal)	3.8 L (1.0 gal)
Differential Lock	Standard; Foot Operated	Standard; Foot Operated	Standard; Foot Operated
Number of Speeds	9 Forward, 3 Reverse	12 Forward-12 Reverse	Infinite / 3 Range
Final Drive	Spur Gear	Spur Gear	Spur Gear
Brakes	Wet Disk	Wet Disk	Wet Disk
Steering	Hydraulic Power Assist	Hydraulic Power Assist	Hydraulic Power Assist
Drawbar Tongue Weight Vertical Capacity Rating	500 kg (1102 lb)	500 kg (1102 lb)	500 kg (1102 lb)
PTO (PTO Shaft Speed Measured at 2700 Engine rpm)			
Type	Independent	Independent	Independent
Rotation Direction	Clockwise	Clockwise	Clockwise
Clutch	Multiple Wet Disk	Multiple Wet Disk	Multiple Wet Disk
Brake	Wet Disk	Wet Disk	Wet Disk
Rear Shaft Speed	540 rpm	540 rpm	540 rpm
Mid Shaft Speed	2100 rpm	2100 rpm	2100 rpm
2 - Speed Shaft Speeds	540 rpm and 750 rpm	540 rpm and 750 rpm	540 rpm and 750 rpm
PTO Output Power	20.0 kW (26.8 hp)	20.0 kW (26.8 hp)	18.9 kW (25.3 hp)
3–POINT HITCH			
Type	Category One	Category One	Category One
Lift Capacity at 61.0 cm (24 in.) Behind Link Arms	999 kg (2200 lb)	999 kg (2200 lb)	999 kg (2200 lb)

*Specifications and design subject to change without notice.

	4300 CST	4300 SRT	4300 HST
CLUTCH			
Type Disk	Wet Multiple	Wet Multiple	None
HYDRAULIC SYSTEM			
	(Measurements Taken At 2700 Engine rpm)	(Measurements Taken At 2700 Engine rpm)	(Measurements Taken At 2700 Engine rpm)
Type	Open Center System	Open Center System	Open Center System
Tran/Hydr Fill Capacity	24 L (6.3 gal)	24 L (6.3 gal)	26 L (6.8 gal)
Working Pressure	17238 kPa (2500 psi)	17238 kPa (2500 psi)	17238 kPa (2500 psi)
Pump	Open Ctr/Gear	Open Ctr/Gear	Open Ctr/Gear
Front Pump Capacity	19.3 L/min (5.1 gpm)	19.3 L/min (5.1 gpm)	19.3 L/min (5.1 gpm)
Rear Pump Capacity	31.4 L/min (8.3 gpm)	31.4 L/min (8.3 gpm)	31.4 L/min (8.3 gpm)
Total Pump Capacity	50.7 L/min (13.4 gpm)	50.7 L/min (13.4 gpm)	50.7 L/min (13.4 gpm)
GROUND SPEEDS			
Range A, Gear 1	1.6 km/h (1.0 mph)	0.6 km/h (0.4 mph)	7.1 km/h (4.4 mph)
Range A, Gear 2	2.4 km/h (1.5 mph)	1.5 km/h (0.9 mph)	
Range A, Gear 3	3.2 km/h (2.0 mph)	1.6 km/h (1.0 mph)	
Range A, Gear 4		2.3 km/h (1.4 mph)	
Range B, Gear 1	4.4 km/h (2.7 mph)	3.1 km/h (1.9 mph)	12.4 km/h (7.7 mph)
Range B, Gear 2	6.6 km/h (4.1 mph)	4.2 km/h (2.6 mph)	
Range B, Gear 3	8.9 km/h (5.5 mph)	4.6 km/h (2.8 mph)	
Range B, Gear 4		6.4 km/h (4.0 mph)	
Range C, Gear 1	12.4 km/h (7.7 mph)	8.6 km/h (5.3 mph)	24.9 km/h (15.5 mph)
Range C, Gear 2	18.7 km/h (11.6 mph)	11.9 km/h (7.4 mph)	
Range C, Gear 3	21.2 km/h (13.2 mph)	18.1 km/h (11.2 mph)	
Range C, Gear 4		24.2 km/h (15.0 mph)	
Range A, Reverse 1	1.6 km/h (1.0 mph)	0.6 km/h (0.4 mph)	7.1 km/h (4.4 mph)
Range A, Reverse 2		1.5 km/h (0.9 mph)	
Range A, Reverse 3		1.6 km/h (1.0 mph)	
Range A, Reverse 4		2.3 km/h (1.4 mph)	
Range B, Reverse 1	4.4 km/h (2.7 mph)	3.1 km/h (1.9 mph)	12.4 km/h (7.7 mph)
Range B, Reverse 2		4.2 km/h (2.6 mph)	
Range B, Reverse 3		4.6 km/h (2.8 mph)	
Range B, Reverse 4		6.4 km/h (4.0 mph)	
Range C, Reverse 1	11.9 km/h (7.4 mph)	8.6 km/h (5.3 mph)	24.9 km/h (15.5 mph)

	4300 CST	4300 SRT	4300 HST
Range C, Reverse 2		11.9 km/h (7.4 mph)	
Range C, Reverse 3		18.1 km/h (11.2 mph)	
Range C, Reverse 4		24.2 km/h (15.0 mph)	

WEIGHT

w/ROPS, 3PT	1236 kg (2725 lbs)	1281 kg (2825 lbs)	1315 kg (2900 lbs)

TIRES

Front (Standard)	7.00-14 R1	7.00-14 R1	7.00-14 R1
Rear (Standard)	11.2-24 R1	11.2-24 R1	11.2-24 R1

GENERAL VEHICLE SPECIFICATIONS* – 4400

	4400 SRT	4400 HST
ENGINE		
Make	John Deere/Yanmar	John Deere/Yanmar
Model	3TNE88	3TNE88
Type	4-cycle Diesel	4-cycle Diesel
Bore and Stroke	88x90 mm (3.465x3.54 in.)	88x90 mm (3.465x3.54 in.)
Cylinders	3	3
Valves	Overhead Valves	Overhead Valves
Displacement	1642 cm^3 (100.2 cu in.)	1642 cm^3 (100.2 cu in.)
Compression Ratio	18.0:1	18.0:1
Gross Engine Power	27.6 kW (37.0 hp)	27.6 kW (37.0 hp)
Torque (at rated speed)	87.7 N•m (64.7 lb-ft)	87.7 N•m (64.7 lb-ft)
Torque (max. @ 1700 rpm)	109.8 N•m (81.0 lb-ft)	109.8 N•m (81.0 lb-ft)
Lubrication	Full pressure	Full pressure
Oil filter	Standard Single Element	Standard Single Element
Oil Capacity (w/filter)	4.3 L (4.6 qt)	4.3 L (4.6 qt)
Engine Rated Speed	2700 rpm	2700 rpm
Engine Slow Idle Speed	950 ± 50 rpm	1000 ± 50 rpm
Engine Fast Idle Speed	2920 rpm ± 25 rpm	2920 rpm ± 25 rpm
Cooling system	Liquid w/Pump & Radiator	Liquid w/Pump & Radiator
Air cleaner	Dry-Type w/Safety Element	Dry-Type w/Safety Element
ELECTRICAL		
Volts	12 VDC	12 VDC
Battery Rating	45 amp-hr	45 amp-hr
Battery Size	500 Cold Cranking Amps	500 Cold Cranking Amps
Alternator	40 amp	40 amp
Regulator	Internal, Current Limiting	Internal, Current Limiting
Starting Motor	1.4 kW (1.88 hp)	1.4 kW (1.88 hp)
Headlights	37.5 W Halogen Bulb	37.5 W Halogen Bulb
Tail Lights	5 W Bayonet Base	5 W Bayonet Base
Hazard Lights	Type 1156	Type 1156
Instrument Panel Lamps	1.7 W Bayonet Base	1.7 W Bayonet Base

*Specifications and design subject to change without notice.

	4400 SRT	4400 HST
FUEL SYSTEM		
System Type	Direct Fuel Injection	Direct Fuel Injection
Injection Pump	In-Line w/Solenoid Shutoff	In-Line w/Solenoid Shutoff
Fuel type	Diesel	Diesel
Fuel Tank Capacity	37.9 L (10.0 gal)	37.9 L (10.0 gal)
Fuel Filter	Glass Bowl Water Separator with Disposable Paper Element	Glass Bowl Water Separator with Disposable Paper Element
DRIVE TRAIN		
Type	SyncReverser™	Hydrostatic
Mechanical Front Wheel Drive (4WD)	Standard Equipment	Standard Equipment
Front Axle Fluid Capacity	7.8 L (1.8 gal)	7.8 L (1.8 gal)
Differential Lock	Standard; Foot Operated	Standard; Foot Operated
Number of Speeds	12 Forward, 12 Reverse	Infinite / 3 Range
Final Drive	Spur Gear	Spur Gear
Brakes	Wet Disk	Wet Disk
Steering	Hydraulic Power Assist	Hydraulic Power Assist
Drawbar Tongue Weight Vertical Capacity Rating	500 kg (1102 lb)	500 kg (1102 lb)
PTO (PTO Shaft Speed Measured at 2700 Engine rpm)		
Type	Independent	Independant
Rotation Direction	Clockwise	Clockwise
Clutch	Multiple Wet Disk	Multiple Wet Disk
Brake	Wet Disk	Wet Disk
Rear Shaft Speed	540 rpm	540 rpm
Mid Shaft Speed	2100 rpm	2100 rpm
2 - Speed Shaft Speeds	540 rpm and 750 rpm	540 rpm and 750 rpm
PTO Output Power	22.0 kW (29.5 hp)	21.3 kW (28.6 hp)
3–POINT HITCH		
Type	Category One	Category One
Lift Capacity at 61.0 cm (24 in.) Behind Link Arms	999 kg (2200 lb.)	999 kg (2200 lb.)

	4400 SRT	4400 HST
CLUTCH		
Type Disk	Wet Multiple	None
HYDRAULIC SYSTEM		
	(Measurements Taken At 2700 Engine rpm)	(Measurements Taken At 2700 Engine rpm)
Type	Open Center System	Open Center System
Tran/Hydr Fill Capacity	24 L (6.3 gal)	26 L (6.8 gal)
Working Pressure	17238 kPa (2500 psi)	17238 kPa (2500 psi)
Pump	Open Ctr/Gear	Open Ctr/Gear
Front Pump Capacity	19.3 L/min (5.1 gpm)	19.3 L/min (5.1 gpm)
Rear Pump Capacity	31.4 L/min (8.3 gpm)	31.4 L/min (8.3 gpm)
Total Pump Capacity	50.7 L/min (13.4 gpm)	50.7 L/min (13.4 gpm)
GROUND SPEEDS		
Range A, Gear 1	0.6 km/h (0.4 mph)	7.1 km/h (4.4 mph)
Range A, Gear 2	1.6 km/h (1.0 mph)	
Range A, Gear 3	1.7 km/h (1.0 mph)	
Range A, Gear 4	2.4 km/h (1.5 mph)	
Range B, Gear 1	3.2 km/h (2.0 mph)	12.4 km/h (7.7 mph)
Range B, Gear 2	4.4 km/h (2.7 mph)	
Range B, Gear 3	4.7 km/h (2.9 mph)	
Range B, Gear 4	6.6 km/h (4.1 mph)	
Range C, Gear 1	8.9 km/h (5.5 mph)	24.9 km/h (15.5 mph)
Range C, Gear 2	12.4 km/h (7.7 mph)	
Range C, Gear 3	18.7 km/h (11.6 mph)	
Range C, Gear 4	25.1 km/h (15.6 mph)	
Range A, Reverse 1	0.6 km/h (0.4 mph)	7.1 km/h (4.4 mph)
Range A, Reverse 2	1.6 km/h (1.0 mph)	
Range A, Reverse 3	1.7 km/h (1.0 mph)	
Range A, Reverse 4	2.4 km/h (1.5 mph)	
Range B, Reverse 1	3.2 km/h (2.0 mph)	12.4 km/h (7.7 mph)
Range B, Reverse 2	4.4 km/h (2.7 mph)	
Range B, Reverse 3	4.7 km/h (2.9 mph)	
Range B, Reverse 4	6.6 km/h (4.1 mph)	
Range C, Reverse 1	8.9 km/h (5.5 mph)	24.9 km/h (15.5 mph)
Range C, Reverse 2	12.4 km/h (7.7 mph)	

	4400 SRT	4400 HST
Range C, Reverse 3	18.7 km/h (11.6 mph)	
Range C, Reverse 4	25.1 km/h (15.6 mph)	

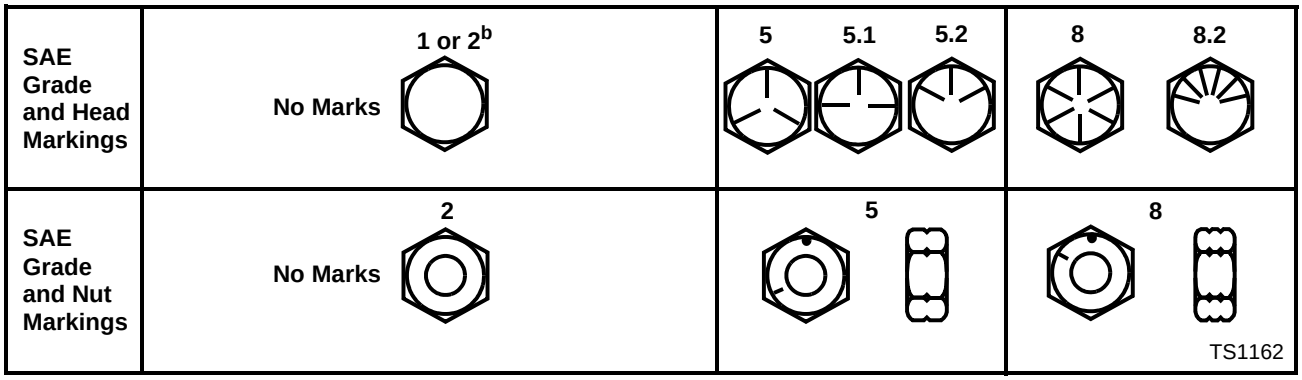
WEIGHT

w/ROPS, 3PT	1283 kg (2830 lbs)	1326 kg (2925 lbs)

TIRES

Front (Standard)	7.00 - 14 R1	7.00 - 14 R1
Rear (Standard)	11.2 - 24 R1	11.2 - 24 R1

INCH FASTENER TORQUE VALUES



	Grade 1				Grade 2[b]				Grade 5, 5.1 or 5.2				Grade 8 or 8.2			
	Lubricated[a]		Dry[a]		Lubricated[a]		Dry[a]		Lubricated[a]		Dry[a]		Lubricated[a]		Dry[a]	
SIZE	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft
1/4	3.7	2.8	4.7	3.5	6	4.5	7.5	5.5	9.5	7	12	9	13.5	10	17	12.5
5/16	7.7	5.5	10	7	12	9	15	11	20	15	25	18	28	21	35	26
3/8	14	10	17	13	22	16	27	20	35	26	44	33	50	36	63	46
7/16	22	16	28	20	35	26	44	32	55	41	70	52	80	58	100	75
1/2	33	25	42	31	53	39	67	50	85	63	110	80	120	90	150	115
9/16	48	36	60	45	75	56	95	70	125	90	155	115	175	130	225	160
5/8	67	50	85	62	105	78	135	100	170	125	215	160	215	160	300	225
3/4	120	87	150	110	190	140	240	175	300	225	375	280	425	310	550	400
7/8	190	140	240	175	190	140	240	175	490	360	625	450	700	500	875	650
1	290	210	360	270	290	210	360	270	725	540	925	675	1050	750	1300	975
1-1/8	470	300	510	375	470	300	510	375	900	675	1150	850	1450	1075	1850	1350
1-1/4	570	425	725	530	570	425	725	530	1300	950	1650	1200	2050	1500	2600	1950
1-3/8	750	550	950	700	750	550	950	700	1700	1250	2150	1550	2700	2000	3400	2550
1-1/2	1000	725	1250	925	990	725	1250	930	2250	1650	2850	2100	3600	2650	4550	3350

DO NOT use these hand torque values if a different torque value or tightening procedure is given for a specific application. Torque values listed are for general use only and include a ±10% variance factor. Check tightness of fasteners periodically. DO NOT use air powered wrenches.

Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical grade.

Fasteners should be replaced with the same grade. Make sure fastener threads are clean and that you properly start thread engagement. This will prevent them from failing when tightening.

When bolt and nut combination fasteners are used, torque values should be applied to the **NUT** instead of the bolt head.

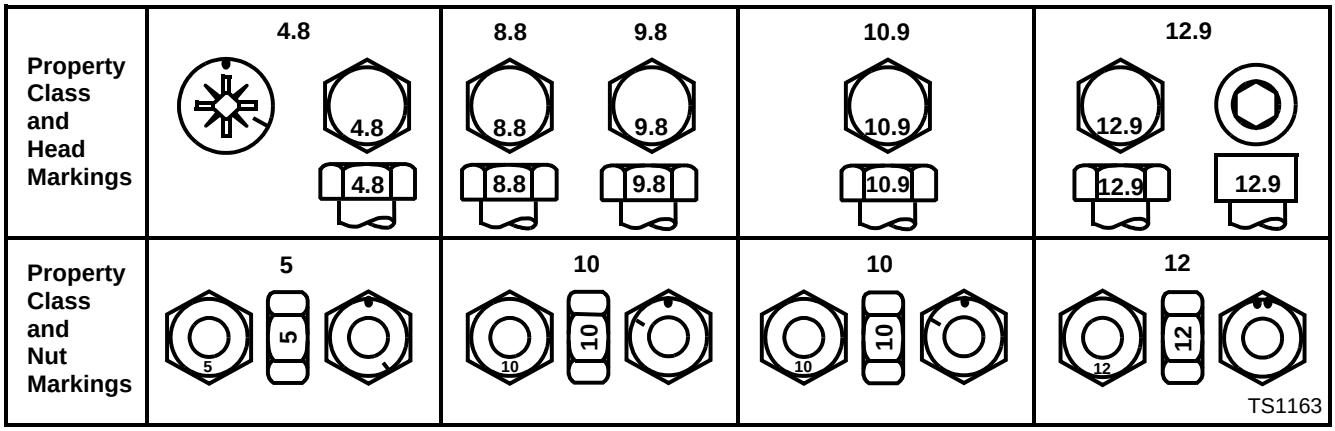
Tighten toothed or serrated-type lock nuts to the full torque value.

a *"Lubricated" means coated with a lubricant such as engine oil, or fasteners with phosphate and oil coatings. "Dry" means plain or zinc plated (yellow dichromate - Specification JDS117) without any lubrication.*

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

Reference: JDS—G200.

METRIC FASTENER TORQUE VALUES



	Class 4.8				Class 8.8 or 9.8				Class 10.9				Class 12.9			
	Lubricated[a]		Dry[a]		Lubricated[a]		Dry[a]		Lubricated[a]		Dry[a]		Lubricated[a]		Dry[a]	
SIZE	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft
M6	48	3.5	6	4.5	9	6.5	11	8.5	13	9.5	17	12	15	11.5	19	14.5
M8	12	8.5	15	11	22	16	28	20	32	24	40	30	37	28	47	35
M10	23	17	29	21	43	32	55	40	63	47	80	60	75	55	95	70
M12	40	29	50	37	75	55	95	70	110	80	140	105	130	95	165	120
M14	63	47	80	60	120	88	150	110	175	130	225	165	205	150	260	109
M16	100	73	125	92	190	140	240	175	275	200	350	225	320	240	400	300
M18	135	100	175	125	260	195	330	250	375	275	475	350	440	325	560	410
M20	190	140	240	180	375	275	475	350	530	400	675	500	625	460	800	580
M22	260	190	330	250	510	375	650	475	725	540	925	675	850	625	1075	800
M24	330	250	425	310	650	475	825	600	925	675	1150	850	1075	800	1350	1000
M27	490	360	625	450	950	700	1200	875	1350	1000	1700	1250	1600	1150	2000	1500
M30	675	490	850	625	1300	950	1650	1200	1850	1350	2300	1700	2150	1600	2700	2000
M33	900	675	1150	850	1750	1300	2200	1650	2500	1850	3150	2350	2900	2150	3700	2750
M36	1150	850	1450	1075	2250	1650	2850	2100	3200	2350	4050	3000	3750	2750	4750	3500

DO NOT use these hand torque values if a different torque value or tightening procedure is given for a specific application. Torque values listed are for general use only and include a ±10% variance factor. Check tightness of fasteners periodically. DO NOT use air powered wrenches.

Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical grade.

Fasteners should be replaced with the same grade. Make sure fastener threads are clean and that you properly start thread engagement. This will prevent them from failing when tightening.

When bolt and nut combination fasteners are used, torque values should be applied to the **NUT** instead of the bolt head.

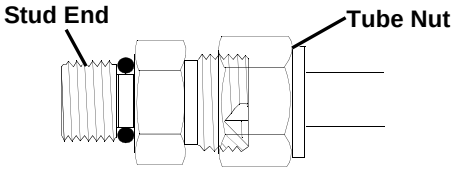
Tighten toothed or serrated-type lock nuts to the full torque value.

[a] *"Lubricated" means coated with a lubricant such as engine oil, or fasteners with phosphate and oil coatings. "Dry" means plain or zinc plated (yellow dichromate - Specification JDS117) without any lubrication.*

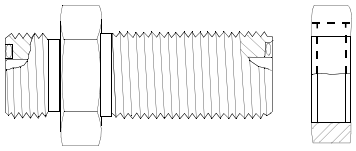
Reference: JDS—G200.

O-RING SEAL SERVICE RECOMMENDATIONS

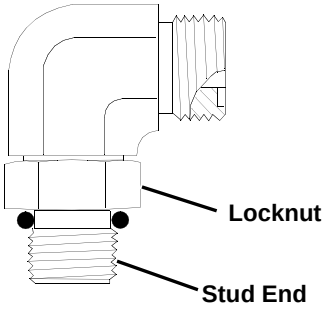
FACE SEAL FITTINGS WITH INCH STUD ENDS TORQUE



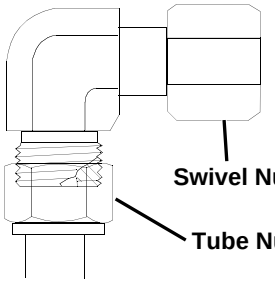
Stud Straight and Tube Nut



Bulkhead Union and Bulkhead Locknut



90 Adjustable Stud Elbow

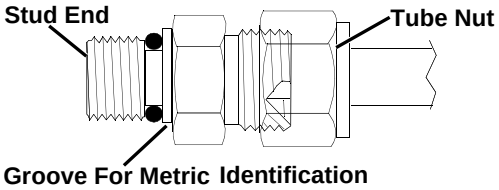


90 Swivel Elbow and Tube Nut

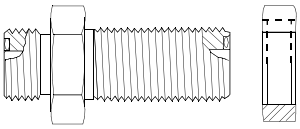
Nominal Tube O.D./Hose I.D.				Face Seal Tube/Hose End					O-ring Stud Ends		
Metric Tube O.D.	Inch Tube O.D.			Thread Size	Tube Nut/ Swivel Nut Torque		Bulkhead Locknut Torque		Thread Size	Straight Fitting or Locknut Torque	
mm	Dash Size	in.	mm	in.	N•m	lb-ft	N•m	lb-ft	in.	N•m	lb-ft
	-3	0.188	4.76		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

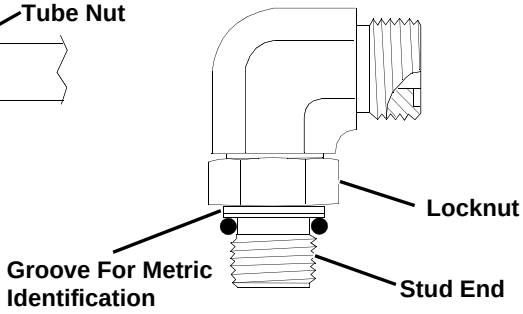
NOTE: Torque tolerance is +15% / –20%.

FACE SEAL FITTINGS WITH METRIC STUD ENDS TORQUE

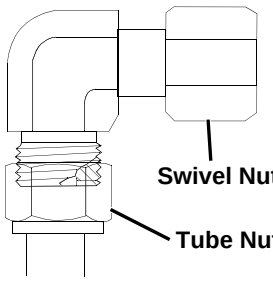


Stud Straight and Tube Nut


Bulkhead Union and Bulkhead Locknut



90 Adjustable Stud Elbow

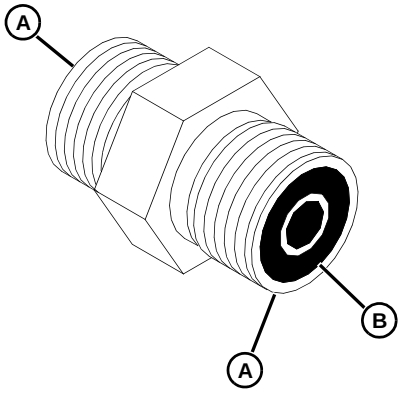


90 Swivel Elbow and Tube Nut

Nominal Tube O.D./Hose I.D.				Face Seal Tube/Hose End						O-ring Stud Ends, Straight Fitting or Locknut					
Metric Tube O.D.	Inch Tube O.D.			Thread Size	Hex Size	Tube Nut/ Swivel Nut Torque		Bulkhead Locknut Torque		Thread Size	Hex Size	Steel or Gray Iron Torque		Aluminum Torque	
mm	Dash Size	in.	mm	in.	mm	N•m	lb-ft	N•m	lb-ft	mm	mm	N•m	lb-ft	N•m	lb-ft
6	-4	0.250	6.35	9/16-18	17	16	12	12	9	M12X1.5	17	21	15.5	9	6.6
8	-5	0.312	7.94												
										M14X1.5	19	33	24	15	11
10	-6	0.375	9.52	11/16-16	22	24	18	24	18	M16X1.5	22	41	30	18	13
12	-8	0.500	12.70	13/16-16	24	50	37	46	34	M18X1.5	24	50	37	21	15
16	-10	0.625	15.88	1-14	30	69	51	62	46	M22X1.5	27	69	51	28	21
	-12	0.750	19.05	1-3/16-12	36	102	75	102	75	M27X2	32	102	75	46	34
22	-14	0.875	22.22	1-3/16-12	36	102	75	102	75	M30X2	36				
25	-16	1.000	25.40	1-7/16-12	41	142	105	142	105	M33X2	41	158	116	71	52
28										M38X2	46	176	130	79	58
32	-20	1.25	31.75	1-11/16-12	50	190	140	190	140	M42X2	50	190	140	85	63
38	-24	1.50	38.10	2-12	60	217	160	217	160	M48X2	55	217	160	98	72

NOTE: Torque tolerance is +15% / –20%.

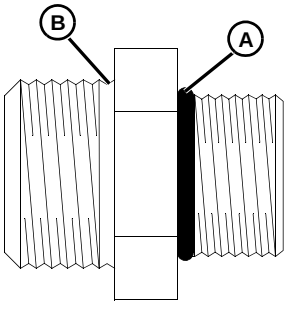
O-RING FACE SEAL FITTINGS



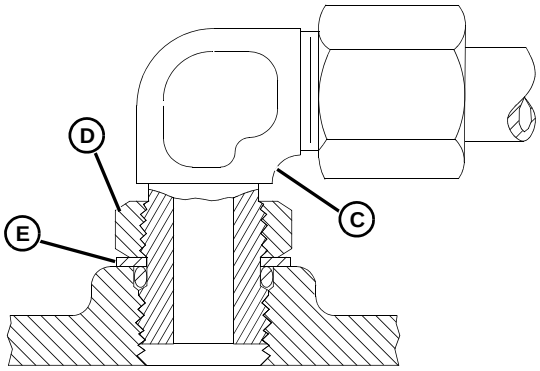
1. Inspect the fitting sealing surfaces (A). They must be free of dirt or defects.
2. Inspect the O-ring (B). It must be free of damage or defects.
3. Lubricate O-rings and install into groove using petroleum jelly to hold in place.
4. Push O-ring into the groove with plenty of petroleum jelly so O-ring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

O-RING BOSS FITTINGS

1. Inspect boss O-ring boss seat. It must be free of dirt and defects. If repeated leaks occur, inspect for defects with a magnifying glass. Some raised defects can be removed with a slip stone.



2. Put hydraulic oil or petroleum jelly on the O-ring (A). Place electrical tape over the threads to protect O-ring from nicks. Slide O-ring over the tape and into the groove (B) of fitting. Remove tape.



3. For angle fittings (C), loosen special nut (D) and push special washer (E) against threads so O-ring can be installed into the groove of fitting.
4. Turn fitting into the boss by hand until special washer or washer face (straight fitting) contacts boss face and O-ring is squeezed into its seat.
5. To position angle fittings, turn the fitting counter-clockwise a maximum of one turn.
6. Tighten straight fittings to torque value shown on chart. For angle fittings, tighten the special nut to value shown in the chart while holding body of fitting with a wrench.

STRAIGHT FITTING OR SPECIAL NUT TORQUE

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

a. Torque tolerance is ± 10 percent.
b. To be used if a torque wrench cannot be used. After tightening fitting by hand, put a mark on nut or boss; then tighten special nut or straight fitting the number of flats shown.

DIESEL FUEL SPECIFICATIONS

DIESEL FUEL

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

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

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

• Cetane Number 40 (minimum)

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

• Cold Filter Plugging Point (CFPP)

The temperature at which diesel fuel **begins to cloud or jell.** Use diesel fuels with a CFPP which is at least 5 °C (9 °F) below the expected low air temperature.

• Sulfur Content of 0.05% (maximum)

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

If diesel fuel being used has a sulfur content **greater than 0.5%, reduce the service interval for engine oil and filter by 50%**.

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

WARNING

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

DIESEL FUEL LUBRICITY

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

DIESEL FUEL STORAGE

IMPORTANT: 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: 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.

ENGINE OIL

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

The following John Deere oils are **PREFERRED:**

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

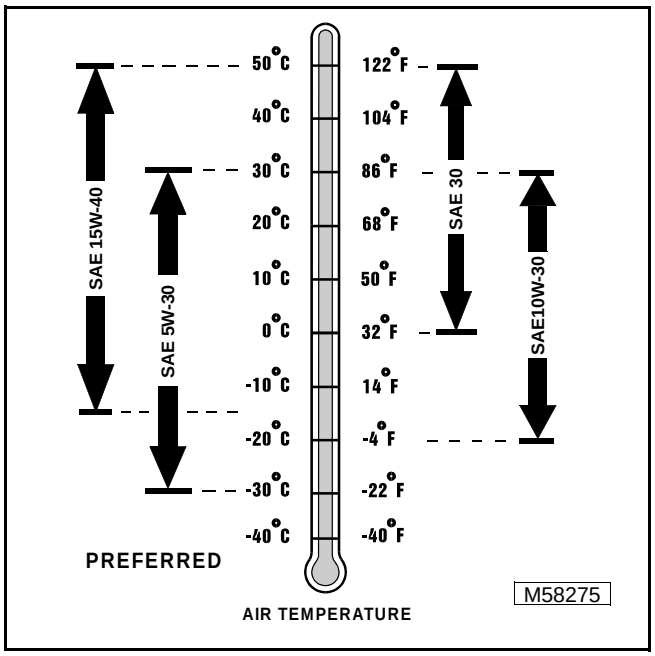
The following John Deere oils are **also recommended**, based on their specified temperature range:

- **TURF–GARD®—SAE 10W-30;**
- **PLUS–4®—SAE 10W-30;**
- **TORQ–GARD SUPREME®—SAE 30.**
- **UNI–GARD™—SAE 10W-30;**
- **UNI–GARD™—SAE 30.**

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

- SAE 15W-40—API Service Classification CF–4 or higher;
- SAE 5W-30—API Service Classification CC or higher;
- SAE 10W-30—API Service Classification CF or higher;
- SAE 30—API Service Classification CF or higher.
- CCMC Specification D4 or Mercedes Benz MB228.1 or higher.

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



John Deere Dealers: You may want to cross-reference the following publications to recommend the proper oil for your customers:

- Module DX,ENOIL in JDS–G135;
- Section 530, Lubricants & Hydraulics, of the John Deere Merchandise Sales Guide;
- Lubrication Sales Manual PI7032.

BREAK–IN ENGINE OIL

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

The following John Deere oil is **PREFERRED**:

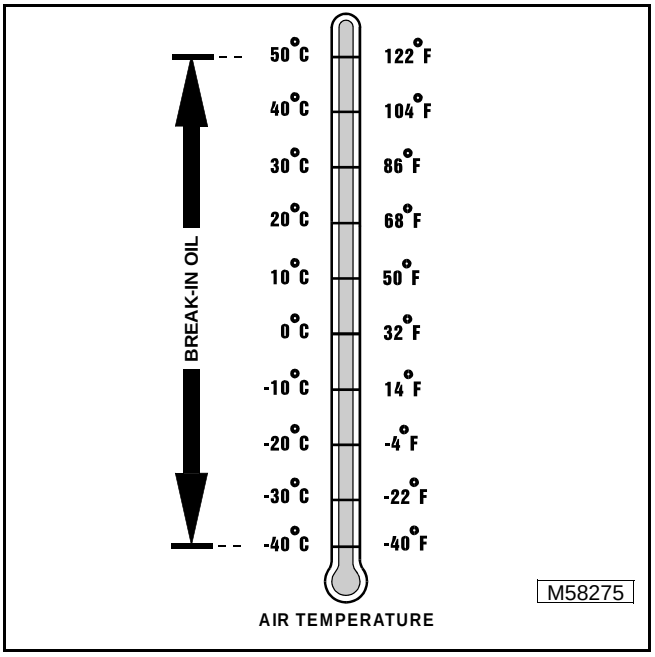
- **BREAK–IN ENGINE OIL**.

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

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

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

- API Service Classification CE or higher.
- CCMC Specification D4 or higher.



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

John Deere Dealers: You may want to cross-reference the following publications to recommend the proper oil for your customers:

- Module DX,ENOIL4 in JDS–G135;
- Section 530, Lubricants & Hydraulics, of the John Deere Merchandise Sales Guide;
- Lubrication Sales Manual PI7032.

TRANSMISSION & HYDRAULIC OIL

The same type of oil is recommended for all transmissions in the 45, 46, 4700 tractors. Use the appropriate oil viscosity based on these air temperature ranges. Operating outside of these recommended oil air temperature ranges may cause premature hydrostatic transmission or hydraulic system failures.

IMPORTANT: Mixing of LOW VISCOSITY HY–GARD® and HY–GARD® oils is permitted. DO NOT mix any other oils in this transmission. DO NOT use engine oil or "Type F" (Red) Automatic Transmission Fluid in this transmission.

The following John Deere transmission and hydraulic oil is **PREFERRED**:

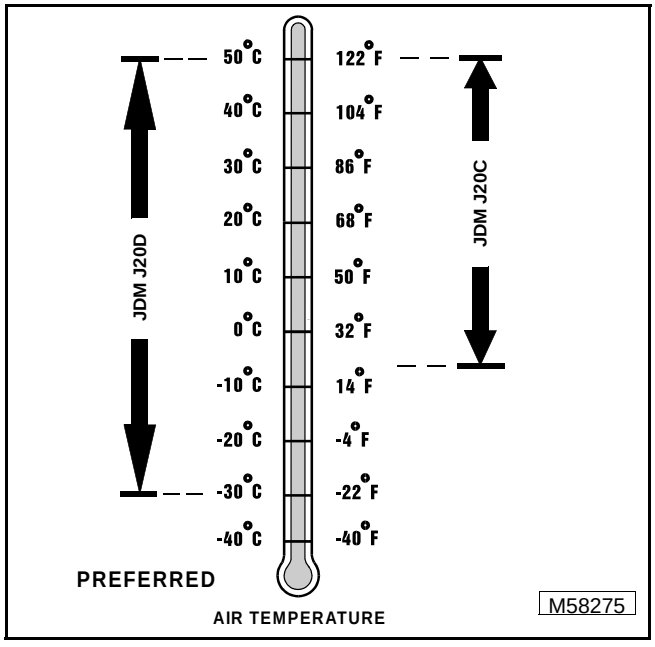
- **LOW VISCOSITY HY–GARD®—JDM J20D**.

The following John Deere oil is **also recommended** if above preferred oil is not available:

- **HY–GARD®—JDM J20C.**

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

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



John Deere Dealers: You may want to cross-reference the following publications to recommend the proper oil for your customers:

- Module DX,ANTI in JDS–G135;
- Section 530, Lubricants & Hydraulics, of the John Deere Merchandise Sales Guide;
- Lubrication Sales Manual PI7032.

CHASSIS GREASE

IMPORTANT: ONLY use a quality grease in this application. DO NOT mix any other greases in this application. DO NOT use any BIO–GREASE in this application.

The following John Deere greases are **PREFERRED**:

- **MOLY HIGH-TEMPERATURE EP GREASE®**—JDM J25C, NLGI Grade 2;
- **HIGH-TEMPERATURE EP GREASE®**—JDM J13E4, NLGI Grade 2.
- GREASE–GARD™—JDM J25C, NLGI Grade 2.

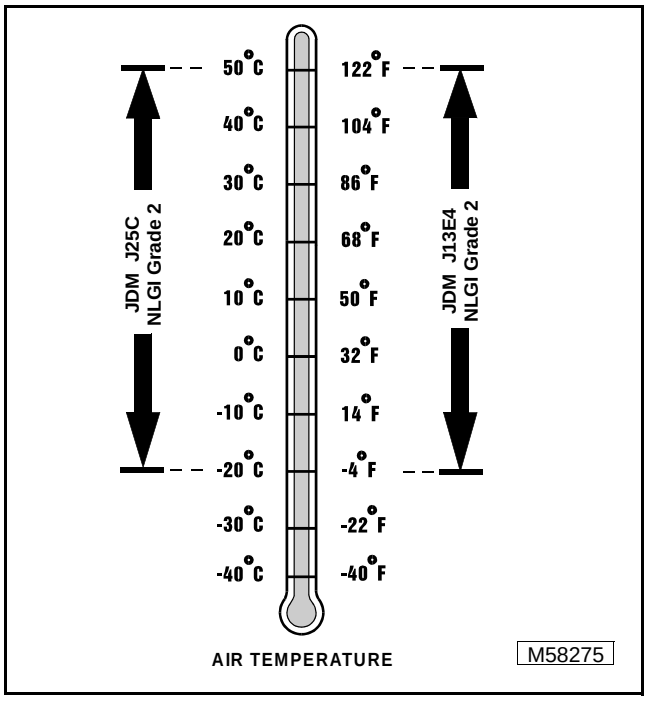
Other greases may be used if above preferred John Deere greases are not available, provided they meet one of the following specifications:

- John Deere Standard JDM J25C, NLGI Grade 2;
- John Deere Standard JDM J13E4, NLGI Grade 2.

IMPORTANT: If minimum air temperature should fall below -10 °C (14 °F), the grease must be heated to at least five degrees above the lower limit before start-up or components may be damaged.

John Deere Dealers: You may want to cross-reference the following publications to recommend the proper grease for your customers:

- Module DX,GREA1 in JDS–G135;
- Section 530, Lubricants & Hydraulics, of the John Deere Merchandise Sales Guide;
- the Lubrication Sales Manual PI7032.



ALTERNATIVE LUBRICANTS

Conditions in certain geographical areas outside the United States and Canada may require different lubricant recommendations than the ones printed in this technical manual or the operator's manual. Consult with your John Deere Dealer, or Sales Branch, to obtain the alternative lubricant recommendations.

IMPORTANT: 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.

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 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.

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.

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.

OIL FILTERS

IMPORTANT: 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.

John Deere Dealers: You may want to cross-reference the following publications to recommend the proper oil filter for your customers:

- Module DX,FILT in JDS–G135;
- Section 540, Lubricants & Hydraulics, of the John Deere Merchandise Sales Guide;
- Lawn & Grounds Care Tune-Up Guide PI672.

COOLANT

The engine cooling system when filled with a proper dilution mixture of antifreeze and deionized or distilled water provides year-round protection against corrosion, cylinder or liner pitting, and winter freeze protection down to –37 °C (–34 °F).

The following John Deere coolant is **PREFERRED:**

- **PRE-DILUTED DIESEL ENGINE ANTIFREEZE/ SUMMER COOLANT™ (TY16036)**.
- **COOL–GARD COOLANT CONCENTRATE™.**

This coolant satisfies specifications for "Automobile and Light Duty Engine Service" and is safe for use in equipment, including aluminum block gasoline engines and cooling systems.

The above preferred pre-diluted antifreeze provides:

- adequate heat transfer
- corrosion-resistant chemicals for the cooling system
- compatibility with cooling system hose and seal material
- protection during extreme cold and extreme hot weather operations
- chemically pure water for better service life
- compliance with ASTM D4656 (JDM H24C2) specifications

If above preferred pre-diluted coolant is not available, the following John Deere concentrate is **recommended**:

- DIESEL ENGINE ANTIFREEZE/SUMMER COOLANT CONCENTRATE™ (TY16034).

If either of above recommended engine coolants are available use any Automobile and Light Duty Engine Service **ethylene glycol base coolant**, meeting the following specification:

- ASTM D3306 (JDM H24C1).

Read container label completely before using and follow instructions as stated.

IMPORTANT: To prevent engine damage, DO NOT use pure antifreeze or less than a 50% antifreeze mixture in the cooling system. DO NOT mix or add any additives/conditioners to the cooling system in equipment. Water used to dilute engine coolant concentrate must be of high quality—clean, clear, potable water (low in chloride and hardness–Table 1) is generally acceptable. DO NOT use salt water. Deionized or distilled water is ideal to use. Coolant that is not mixed to these specified levels and water purity can cause excessive scale, sludge deposits, and increased corrosion potential.

Table 1: Water Quality

Property	Requirements
Total Solids, Max	340 ppm (20 grns/gal)
Total Hardness, Max	170 ppm (10 grns/gal)
Chloride (as Cl), Max	40 ppm (2.5 grns/gal)
Sulfate (as SO_4), Max	100 ppm (5.8 grns/gal)

Mix 50 percent antifreeze concentrate with 50 percent distilled or deionized water. This mixture and the pre-diluted mixture (TY16036) will protect the cooling system down to -37 °C (-34 °F) and up to 108 °C (226 °F).

Certain geographical areas may require lower air temperature protection. See the label on your antifreeze container or consult your John Deere dealer to obtain the latest information and recommendations.

COOLANT DRAIN INTERVAL

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 or **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 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.

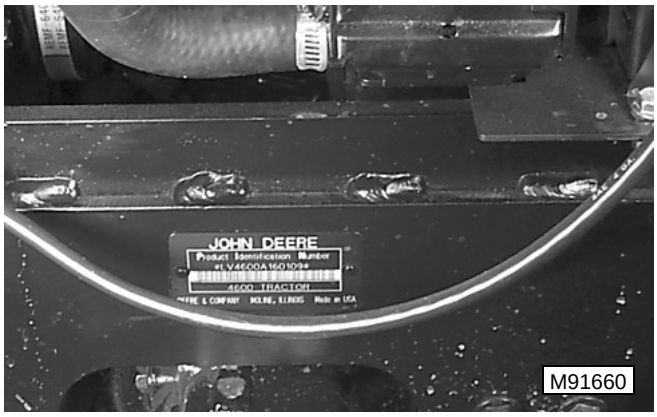
PRODUCT IDENTIFICATION LOCATIONS

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

The location of the product identification numbers and component product identification numbers are shown.

PRODUCT IDENTIFICATION NUMBER

Located on frame above RH front axle.



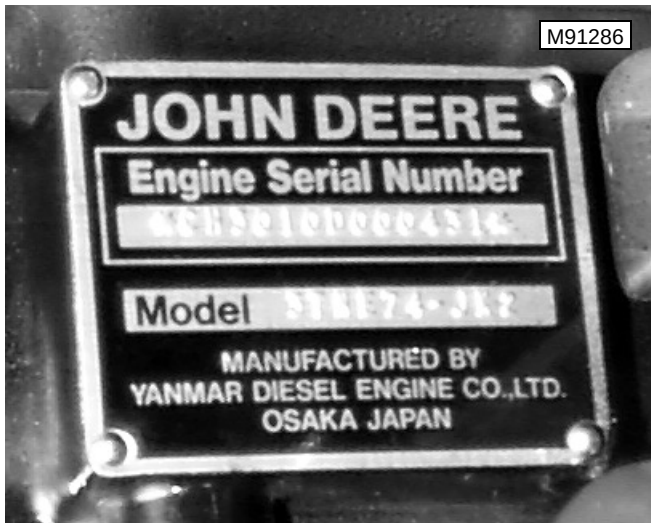
4200:
LV4200C120001–3270000 Gear (CST)
LV4200C327001– Sync Shift (SST)
LV4200H120001– Hydro (HST)
LV4200E229001– Export (All models)

4300:
LV4300C130001–335000 Gear (CST)
LV4300C335001– Sync Shift (SST)
LV4300H130001– Hydro (HST)
LV4300S130001– SyncReverser™ (SRT)
LV4300E239001– Export (All models)

4400:
LV4400H140001– Hydro (HST)
LV4400S140001– SyncReverser™ (SRT)
LV4400E249001– Export (All models)

ENGINE PRODUCT IDENTIFICATION NUMBER

Located on top center of engine.



Non-EPA Engines:
4200 (Engine S/N –016705) (All models)
4300 (Engine S/N –011018) (All models)
4400 (Engine S/N –004914) (All models)

EPA Certified Engines:
4200 (Engine S/N 016706–) (All models)
4300 (Engine S/N 011019–) (All models)
4400 (Engine S/N 004915–) (All models)

CONTENTS

SPECIFICATIONS

GENERAL SPECIFICATIONS

Make	Yanmar
Model 4200 (Non-EPA –016705, EPA Certified 016706–)	3TNE78A
Model 4300 (Non-EPA –011018, EPA Certified 011019–)	3TNE84
Model 4400 (Non-EPA –004914, EPA Certified 004915–)	3TNE88
Type	4-Cycle Diesel
Gross Power	
4200 @ 2700 rpm	19.6 kW (26.3 hp)
4300 @ 2700 rpm	24.0 kW (32.2 hp)
4400 @ 2700 rpm	27.6 Kw (37.0 hp)
Torque (at rated speed)	
4200 @ 2700 rpm	63.2 N•m (46.6 lb-ft)
4300 @ 2700 rpm	78.5 N•m (57.9 lb-ft)
4400 @ 2700 rpm	87.7 N•m (64.7 lb-ft)
Torque (max)	
4200 @ 1600 rpm	78.5 N•m (57.9 lb-ft)
4300 @ 1700 rpm	99.1 N•m (73.1 lb-ft)
4400 @ 1700 rpm	109.8 N•m (81.0 lb-ft)
Number of Cylinders (All)	3
Bore	
4200	78 mm (3.07 in.)
4300	84 mm (3.31 in.)
4400	88 mm (3.465 in.)
Stroke	
4200	84 mm (3.31 in.)
4300	90 mm (3.54 in.)
4400	90 mm (3.54 in.)
Displacement	
4200	1.204 L (73.5 cu in.)
4300	1.496 L (91.3 cu in.)
4400	1.642 L (100.2 cu in.)
Firing Order	1—3—2
Direction of Rotation	Counterclockwise (viewed from flywheel)
Combustion System	Direct Injection Type
Compression Ratio	18 to 1
Cooling	Liquid
Oil Capacity (w/filter)	
4200	Approximately 3.82 L (4.04 qt)
4300, 4400	Approximately 4.31 L (4.55 qt)
Governor	Centrifugal
Slow Idle	
CST, SST and SRT	950 ± 50 rpm
HST	1000 ± 50 rpm
High Idle (All - No Load)	2920 ± 25 rpm

REPAIR SPECIFICATIONS

Valve Train

Rocker Arm Shaft OD (All) . . . . . 15.97 - 15.98 mm (0.628 - 0.629 in.)
Wear Limit . . . . . 15.95 mm (0.628 in.)
Rocker Arm and Shaft Support Bushing ID (All) 16.00 - 16.02 mm (0.630 - 0.631 in.)
Wear Limit 16.09 mm (0.633 in.)
Oil Clearance (All) 0.02 - 0.05 mm (0.001 - 0.002 in.)
Wear Limit 0.15 mm (0.006 in.)
Push Rod Bend (All) . . . . . 0.0 - 0.03 mm (0.0 - 0.001 in.)

Cylinder Head and Valves

Cylinder Head Distortion (All) . . . . . 0.0 - 0.05 mm (0.0 - 0.002 in.)
Wear Limit . . . . . 0.15 mm (0.006 in.)
Intake Valve Seat Width
4200 . . . . . 1.36 - 1.53 mm (0.054 - 0.060 in.)
4200 (Wear Limit) . . . . . 1.98 mm (0.078 in.)
4300, 4400 . . . . . 1.07 - 1.24 mm (0.042 - 0.049 in.)
4300, 4400 (Wear Limit) . . . . . 1.74 mm (0.069 in.)
Exhaust Valve Seat Width
4200 . . . . . 1.66 - 1.87 mm (0.066 - 0.074 in.)
4200 (Wear Limit) . . . . . 2.27 mm (0.089 in.)
4300, 4400 . . . . . 1.24 - 1.45 mm (0.042 - 0.049 in.)
4300, 4400 (Wear Limit) . . . . . 1.94 mm (0.076 in.)
Intake Valve Stem OD
4200 . . . . . 6.95 - 6.96 mm (0.274 - 0.274 in.)
4200 (Wear Limit) . . . . . 6.9 mm (0.272 in.)
4300, 4400 . . . . . 7.96 - 7.98 mm (0.313 - 0.314 in.)
4300, 4400 (Wear Limit) . . . . . 7.9 mm (0.311 in.)
Exhaust Valve Stem OD
4200 . . . . . 6.94 - 6.96 mm (0.273 - 0.274 in.)
4200 (Wear Limit) . . . . . 6.9 mm (0.272 in.)
4300, 4400 . . . . . 7.96 - 7.97 mm (0.313 - 0.314 in.)
4300, 4400 (Wear Limit) . . . . . 7.9 mm (0.311 in.)
Valve Head Thickness (All)
Intake . . . . . 1.24 - 1.44 mm (0.049 - 0.057 in.)
Exhaust . . . . . 1.35 - 1.55 mm (0.053 - 0.061 in.)
Wear Limit . . . . . 0.50 mm (0.020 in.)
Intake Valve Recession
4200 . . . . . 0.30 - 0.50 mm (0.012 - 0.020 in.)
4300, 4400 . . . . . 0.31 - 0.51 mm (0.012 - 0.020 in.)
Wear Limit (All) . . . . . 1.00 mm (0.039 in.)
Exhaust Valve Recession (All) . . . . . 0.3 - 0.5 mm (0.012 - 0.020 in.)
Wear Limit . . . . . 1.00 mm (0.039 in.)
Valve Guide Stem-To-Guide Oil Clearance
Intake (All) . . . . . 0.04 - 0.07 mm (0.001 - 0.003 in.)
Exhaust (All) . . . . . 0.05 - 0.08 mm (0.002 - 0.003 in.)
4200 (Wear Limit) . . . . . 0.18 mm (0.007 in.)
4300, 4400 (Wear Limit) . . . . . 0.20 mm (0.008 in.)
Valve Guide ID
4200 . . . . . 7.00 - 7.02 mm (0.275 - 0.276 in.)
4200 (Wear Limit) . . . . . 7.08 mm (0.279 in.)
4300, 4400 . . . . . 8.01 - 8.03 (0.315 - 0.316 in.)
4300, 4400 (Wear Limit) . . . . . 8.10 mm (0.319 in.)
Valve Guide Projection
4200 . . . . . 12 mm (0.472 in.)
4300, 4400 . . . . . 15 mm (0.591 in.)

Valve Spring Free Length
- 4200 . . . . . 44.4 mm (1.748 in.)
- 4300, 4400 . . . . . 42.0 mm (1.654 in.)

Maximum Spring Inclination (All) . . . . . 1.10 mm (0.044 in.)

Valve Spring Tension (Measured With Spring Compressed 1.0 mm (0.039 in.)
- 4200 . . . . . 3.61 - 2.71 kg (7.96 - 5.98 lb)
- 4300, 4400 . . . . . 2.36 - 3.10 kg (5.20 - 6.83 lb)

Valve Seat Surface Angle (All)
- Exhaust Valve . . . . . 45°
- Intake Valve . . . . . 30°

Valve Timing (All)
- Intake Valve Opens . . . . . 10° - 20° BTDC
- Intake Valve Closes . . . . . 40° - 50° ABDC
- Exhaust Valve Opens. . . . . 51° - 61° BBDC
- Exhaust Valve Closes . . . . . 13° - 23° ATDC

Piston-to-Cylinder Head Clearance (All). . . . . 0.66 - 0.78 mm (0.026 - 0.031 in.)

Connecting Rod

Large End Bearing ID
- 4200 . . . . . 46.00 - 46.02 mm (1.811- 1.812 in.)
- 4300, 4400 . . . . . 51 - 51.01mm (2.008 - 2.008 in.)

Large End Bearing Thickness (All) . . . . . 1.49 - 1.50 mm (0.059 - 0.059 in.)
- Oversize . . . . . 1.625 mm (0.064 in.)

Oil Clearance
- 4200 . . . . . 0.04 - 0.09 mm (0.002 - 0.004 in.)
- 4200 (Wear Limit). . . . . 0.25 mm (0.010 in.)
- 4300, 4400 . . . . . 0.04 - 0.07 mm (0.002 - 0.003 in.)
- 4300, 4400 (Wear Limit). . . . . 0.16 mm (0.006 in.)

Connecting Rod Side Play (All) . . . . . 0.2 - 0.4 mm (0.008 - 0.016 in.)

Piston Rings

First Compression Piston Ring Groove Width
- 4200 . . . . . 2.04 - 2.05 mm (0.080 - 0.081 in.)
- 4300 . . . . . 2.07 - 2.08 mm (0.081 - 0.082 in.)
- 4400 . . . . . 2.06 - 2.08 mm (0.081 - 0.082 in.)

First Compression Piston Ring Width
- 4200 . . . . . 1.94 - 1.96 mm (0.076 - 0.077 in.)
- 4300, 4400 . . . . . 1.97 - 1.99 mm (0.078 - 0.078 in.)

First Compression Piston Ring Minimum Side Clearance (All) . . . . . 0.08 - 0.11 mm (0.003 - 0.004 in.)

Second Compression Piston Ring Groove Width
- 4200, 4300 . . . . . 2.04 - 2.05 mm (0.080 - 0.081 in.)
- 4400 . . . . . 2.03 - 2.04 mm (0.080 - 0.080 in.)

Second Compression Piston Ring Width
- 4200 . . . . . 1.98 - 1.99 mm (0.078 - 0.078 in.)
- 4300, 4400 . . . . . 1.97 - 1.99 mm (0.078 - 0.078 in.)

Second Compression Piston Ring Minimum Side Clearance
- 4200, 4400 . . . . . 0.04 - 0.07 mm (0.001 - 0.003 in.)
- 4300 . . . . . 0.05 - 0.08 mm (0.002 - 0.003 in.)

Oil Control Piston Ring Groove Width
- 4200 . . . . . 3.02 - 3.03 mm (0.119 - 0.119 in.)
- 4300, 4400 . . . . . 4.02 - 4.03 mm (0.158 - 0.159 in.)

Oil Control Piston Ring Width
- 4200 . . . . . 2.97 - 2.99 mm (0.117 - 0.118 in.)
- 4300, 4400 . . . . . 3.97 - 3.99 mm (0.156 - 0.157 in.)

Oil Control Piston Ring Minimum Side Clearance (All). . . . . 0.03 - 0.06 mm (0.001 - 0.002 in.)

Piston Ring End Gap (All). . . . . 0.20 - 0.40 mm (0.008 - 0.016 in.)
- Wear Limit . . . . . 1.50 mm (0.059 in.)

Piston Pin

Piston Pin OD
- 4200 . . . . . 22.99 - 23.00 mm (0.905 - 0.906 in.)
- 4200 (Wear Limit). . . . . 22.90 mm (0.902 in.)
- 4300, 4400 . . . . . 25.99 - 26.00 mm (1.023 - 1.024 in.)
- 4300, 4400 (Wear Limit). . . . . 25.90 mm (1.020 in.)

Piston Pin Bushing ID
- 4200 . . . . . 23.02 - 23.04 mm (0.906 - 0.907 in.)
- 4200 (Wear Limit). . . . . 23.10 mm (0.909 in.)
- 4300, 4400 . . . . . 26.03 - 26.04 mm (1.025 - 1.025 in.)
- 4300, 4400 (Wear Limit). . . . . 26.10 mm (1.028 in.)

Piston Pin-To-Rod Bore Oil Clearance (All) . . . . . 0.03 - 0.05 mm (0.001 - 0.002 in.)
- Wear Limit . . . . . 0.2 mm (0.008 in.)

Piston Pin Bore (In Piston) ID
- 4200 . . . . . 23.00 - 23.01 mm (0.906 - 0.906 in.)
- 4200 (Wear Limit). . . . . 23.02 mm (0.906 in.)
- 4300, 4400 . . . . . 26.00 - 26.01 mm (1.024 - 1.024 in.)
- 4300, 4400 (Wear Limit). . . . . 26.02 mm (1.024 in.)

Piston Pin-To-Piston Oil Clearance (All). . . . . 0.00 - 0.02 mm (0 - 0.001 in.)
- Wear Limit . . . . . 0.12 mm (0.005 in.)

Piston

Standard Piston OD
- 4200 . . . . . 77.95 - 77.98 mm (3.069 - 3.070 in.)
- 4200 (Wear Limit). . . . . 77.90 mm (3.067 in.)
- 4300 . . . . . 83.95 - 83.98 mm (3.305 - 3.306 in.)
- 4300 (Wear Limit). . . . . 83.90 mm (3.303 in.)
- 4400 . . . . . 87.95 - 87.98 mm (3.462 - 3.464 in.)
- 4400 (Wear Limit). . . . . 87.90 mm (3.461 in.)

Oversize Piston OD
- 4200 . . . . . 78.20 - 78.23 mm (3.079 - 3.080 in.)
- 4200 (Wear Limit). . . . . 78.15 mm (3.077 in.)
- 4300 . . . . . 84.20 - 84.23 mm (3.315 - 3.316 in.)
- 4300 (Wear Limit). . . . . 84.10 mm (3.311 in.)
- 4400 . . . . . 88.20 - 88.23 mm (3.472 - 3.474 in.)
- 4400 (Wear Limit). . . . . 88.10 mm (3.469 in.)

Cylinder Bore ID

Standard Bore ID
- 4200 . . . . . 78.00 - 78.03 mm (3.071 - 3.072 in.)
- 4200 (Wear Limit). . . . . 78.20 mm (3.079 in.)
- 4300 . . . . . 84.00 - 84.03 mm (3.307 - 3.308 in.)
- 4300 (Wear Limit). . . . . 84.20 mm (3.315 in.)
- 4400 . . . . . 88.00 - 88.03 mm (3.465 - 3.466 in.)
- 4400 (Wear Limit). . . . . 88.20 mm (3.472 in.)

Oversize Bore ID
- 4200 . . . . . 78.25 - 78.28 mm (3.081 - 3.082 in.)
- 4300 . . . . . 84.25 - 84.28 mm (3.317 - 3.318 in.)
- 4400 . . . . . 88.25 - 88.28 mm (3.474 - 3.476 in.)

Piston-to-Cylinder Clearance
- 4200 . . . . . 0.050 mm (0.002 in.)
- 4300, 4400 . . . . . 0.055 mm (0.002 in.)

Cylinder Roundness (All) . . . . . 0.00 - 0.01 mm (0 - 0.0004 in.)
- Wear Limit . . . . . 0.03 mm (0.001 in.)

Cylinder Taper (All). . . . . 0.00 - 0.01 mm (0 - 0.0004 in.)
- Wear Limit . . . . . 0.03 mm (0.001 in.)

Deglazing (All) . . . . . 30 - 40° crosshatch pattern

Reboring (All) . . . . . 30 - 40° crosshatch pattern

Crankshaft and Main Bearings

Connecting Rod Crankshaft Journal OD
- 4200 . . . . . 42.95 - 42.96 mm (1.691 - 1.691 in.)
- 4200 Wear Limit . . . . . 42.91 mm (1.689 in.)
- 4300, 4400 . . . . . 47.95 - 47.96 mm (1.888 - 1.888 in.)
- 4300, 4400 Wear Limit . . . . . 47.91 mm (1.886 in.)

Main Bearing Journal OD
- 4200 . . . . . 46.95 - 46.96 mm (1.848 - 1.849 in.)
- 4200 (Wear Limit) . . . . . 46.91 mm (1.847 in.)
- 4300, 4400 . . . . . 53.95 - 53.96 mm (2.124 - 2.124 in.)
- 4300, 4400 (Wear Limit) . . . . . 53.91 mm (2.122 in.)

Main Bearing Oil Clearance
- 4200 . . . . . 0.04 - 0.09 mm (0.002 - 0.004 in.)
- 4200 (Wear Limit) . . . . . 0.25 mm (0.010 in.)
- 4300, 4400 . . . . . 0.04 - 0.07 mm (0.002 - 0.003 in.)
- 4300, 4400 (Wear Limit) . . . . . 0.16 mm (0.006 in.)

Crankshaft Bend (Maximum- All) . . . . . 0.02 mm (0.001 in.)

Crankshaft End Play (All) . . . . . 0.09 - 0.27 mm (0.004 - 0.011 in.)

Camshaft

Camshaft End Play (All) . . . . . 0.05 - 0.25 mm (0.002 - 0.010 in.)

Camshaft Bend (All) . . . . . 0 - 0.02 mm (0 - 0.001 in.)
- Wear Limit . . . . . 0.05 mm (0.002 in.)

Camshaft Side Gap (All) . . . . . 0.05 - 0.25 mm (0.002 - 0.010 in.)

Lobe Height- Intake and Exhaust (All) . . . . . 38.64 - 38.77 mm (1.521 - 1.526 in.)
- Wear Limit . . . . . 38.40 mm (1.512 in.)

Bearing Journal OD (All)
- Flywheel Side and Gear Side . . . . . 44.93 - 44.95 mm (1.769 - 1.770 in.)
- Intermediate Journal . . . . . 44.91 - 44.94 mm (1.768 - 1.769 in.)
- Wear Limit . . . . . 44.85 mm (1.766 in.)

Oil Clearance (Gear and Flywheel Ends) . . . . . 0.04 - 0.13 mm (0.002 - 0.005 in.)

Oil Clearance (Intermediate) . . . . . 0.07 - 0.12 mm (0.003 - 0.005 in.)

Camshaft Followers

Stem OD (All) . . . . . 11.98 - 11.99 mm (0.471 - 0.472 in.)
- Wear Limit . . . . . 11.93 mm (0.470 in.)

Bore ID (All) . . . . . 12.00 - 12.02 mm (0.472 - 0.473 in.)
- Wear Limit . . . . . 12.05 mm (0.474 in.)

Oil Clearance (All) . . . . . 0.01 - 0.04 mm (0.0004 - 0.0016 in.)
- Wear Limit . . . . . 0.12 mm (0.005 in.)

Idler Gear

Shaft OD (All) . . . . . 45.95 - 45.98 mm (1.809 - 1.810 in.)
- Wear Limit . . . . . 45.93 mm (1.808 in.)

Bushing ID (All) . . . . . 46.00 - 46.03 mm (1.811 - 1.812 in.)
- Wear Limit . . . . . 46.08 mm (1.814 in.)

Clearance (All) . . . . . 0.15 mm (0.006 in.)

Oil Pump

Rotor Shaft OD to Side Cover Hole ID Clearance (All) . . . . . 0.01 - 0.04 mm (0.001 - 0.002 in.)
- Wear Limit . . . . . 0.20 mm (0.008 in.)

Inner Rotor and Outer Rotor-to-Pump Body Side Clearance
- 4200 . . . . . 0.05 - 0.10 mm (0.002 - 0.004 in.)
- 4300, 4400 . . . . . 0.03 - 0.09 mm (0.001 - 0.004 in.)

Wear Limit (All) . . . . . 0.15 mm (0.006 in.)
Outer Rotor to Pump Body Clearance (All) . . . . . 0.10 - 0.16 mm (0.004 - 0.006 in.)
Wear Limit . . . . . 0.25 mm (0.010 in.)
Inner Rotor to Outer Rotor Clearance Wear Limit (All) . . . . . 0.15 mm (0.006 in.)

TESTS AND ADJUSTMENT SPECIFICATIONS

Valve Clearance . . . . . 0.15 - 0.25 mm (0.006 - 0.010 in.)
Connecting Rod Side Play . . . . . 0.2 - 0.4 mm (0.008 - 0.016 in.)
Connecting Rod Bearing Clearance . . . . . 0.04 - 0.07 mm (0.002 - 0.003 in.)
Crankshaft End Play . . . . . 0.09 - 0.27 mm (0.004 - 0.011 in.)
Crankshaft Main Bearing Clearance . . . . . 0.04 - 0.07 mm (0.001 - 0.003 in.)
Camshaft End Play . . . . . 0.05 - 0.25 mm (0.002 - 0.010 in.)
Timing Gear Backlash
All Except Oil Pump Gear . . . . . 0.07 - 0.15 mm (0.003 - 0.005 in.)
Oil Pump Gear . . . . . 0.11 - 0.19 mm (0.004 - 0.008 in.)
Fuel Injection Nozzle
Opening Pressure . . . . . 19600 +1000/–0 kPa (2843 + 145/–0 psi)
Leakage at 11032 kPa (1600 psi) . . . . . None For A Minimum of 10 Seconds
Chatter and Spray Pattern at 19600 ± 1000 kPa (2843 ± 145 psi):
Slow Hand Lever Movement . . . . . Chatter Sound
Slow Hand Lever Movement . . . . . Fine Stream
Fast Hand Lever Movement . . . . . Fine Atomized Spray, 150° Spray Pattern
Alternator Drive Belt Deflection . . . . . 10 - 15 mm (0.4 - 0.6 in.)
Fuel Injection Pump Static Timing (All) . . . . . 14 ± 1° BTDC

OPERATIONAL TESTS

Cooling System Test Pressure . . . . . 88 ± 15 kPa (12.8 ± 2.2 psi)
Thermostat Opening Temperature . . . . . 69.5 - 72.5° C (157 - 163° F)
Minimum Lift Height above 85° C (185° F) . . . . . 8.0 mm (0.315 in.)
Radiator Cap Opening Pressure (All) . . . . . 0.9 ± 0.15 kg/cm^2, 88 ± 15 kPa, 12.8 ± 2.2 psi
Cylinder Compression Pressure
4200 . . . . . 3138 ± 98 kPa (455 ± 14 psi)
4200 (Minimum) . . . . . 2555 ± 98 kPa (370 ± 14 psi)
4300 . . . . . 3236 ± 98 kPa (469 ± 14 psi)
4300 (Minimum) . . . . . 2550 ± 98 kPa (370 ± 14 psi)
4400 . . . . . 3432 ± 98 kPa (498 ± 14 psi)
4400 (Minimum) . . . . . 2746 ± 98 kPa (398 ± 14 psi)
Difference Between Cylinders (Maximum- All) . . . . . 245 ± 49 kPa (36 ± 7 psi)
Oil Pressure
4200 (Rated Speed) . . . . . 0.29 ± 0.05 MPa (42 ± 7.2 psi)
4300, 4400 (Rated Speed) . . . . . 0.34 ± 0.05 MPa (49 ± 7.2 psi)
Slow Idle (All - Minimum) . . . . . 0.06 MPa (8.7 psi)
Oil Relief Valve Opening Pressure (All) . . . . . 294 - 392 kPa (43 - 57 psi)
Oil Pressure Switch Opening Pressure (All) . . . . . 41 - 62 kPa (6 - 9 psi)

TORQUE VALUES, NON-STANDARD FASTENERS

Cylinder Head Bolts (Lubricating Oil Applied)
- 4200 . . . . . 67 - 71 N•m (49 - 52 lb-ft)
- 4300, 4400 . . . . . 85 - 91 N•m (63 - 67 lb-ft)

Connecting Rod Bolts (Lubricating Oil Applied)
- 4200 . . . . . 37 - 41 N•m (27 - 30 lb-ft)
- 4300, 4400 . . . . . 44 - 54 N•m (33 - 40 lb-ft)

Flywheel Mounting Bolts (All - Lubricating Oil Applied) . . . . . 83 - 88 N•m (62 - 65 lb-ft)

Main Bearing Bolts (Lubricating Oil Applied)
- 4200 . . . . . 76.5 - 80.4 N•m (56 - 59 lb-ft)
- 4300, 4400 . . . . . 96 - 100 N•m (71 - 74 lb-ft)

Crankshaft Pulley Bolt (All - Lubricating Oil Applied) . . . . . 113 - 122 N•m (83 - 90 lb-ft)

Fuel Injector Nozzle Nut (All) . . . . . .6.8 - 8.8 N•m (5 - 6.5 lb-ft)

Governor Weight Support Nut (All) . . . . . 44 - 49 N•m (33 - 36 lb-ft)

Rocker Arm Mounting Cap Screw and Nut (All) . . . . . 26 N•m (19 lb-ft)

Oil Pump Mounting Cap Screw (All) . . . . . 25 N•m (18 lb-ft)

Starting Motor Mounting Bolts . . . . . 47 N•m (35 lb-ft)

SPECIAL TOOLS

NOTE: Order tools according to information given in the U.S. SERVICE-GARD™ Catalog or in the European Microfiche Tool Catalog (MTC).

Number	Name	Use
JDG991	Fast Idle Adjustment Tool	Use to set fast idle.
D15001NU	Magnetic Follower Holder Kit	Hold cam followers when removing and installing camshaft.
JDF13	Nozzle Cleaning Kit	Use to clean fuel injection nozzles.
D-20019WI	Valve Guide Knurler	Use to knurl inside diameter of valve guides.
JDE118	Valve Guide Driver	Use to remove and install valve guides in cylinder head.
D-20021WI	Valve Guide Reamer	Use to ream out valve guides.

OTHER MATERIALS

Number	Name	Use
TY15130 LOCTITE® No. 395	John Deere Form-In-Place Gasket	Seals rear oil seal case and flywheel housing to engine block. Seals oil pan to timing gear housing and engine block.
TY9370 LOCTITE No. 242	Thread Lock and Sealer (Medium Strength)	Apply to threads of crankshaft pulley cap screw.

LOCTITE® is a registered trademark of the Loctite Corp.

THEORY OF OPERATION

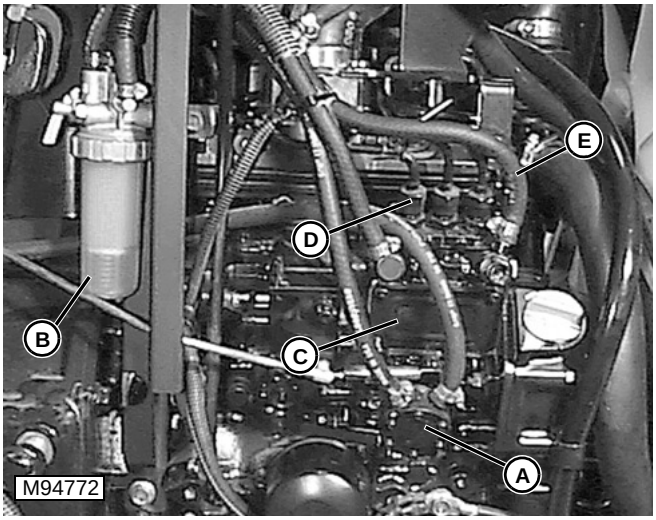
FUEL AND AIR SYSTEM OPERATION

Function:

Fuel system supplies fuel to injection nozzles.

The air intake system filters and supplies air needed for combustion.

Theory of Operation:



Fuel System:

A mechanical fuel transfer pump (A) draws fuel from the tank outlet. The low pressure fuel from the fuel pump flows through the filter/water separator (B) to the fuel the injector pump inlet (C). The injection pump then directs high pressure fuel through the injector lines (D) for combustion. Excess fuel is returned, along with fuel from the injectors, through the return line (E) to the fuel tank.

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 rod. The rod 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 solenoid also closes if the tractor is operated in an unsafe condition. (See “ENGINE SHUTOFF CIRCUIT OPERATION” in the Electrical section.)

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.

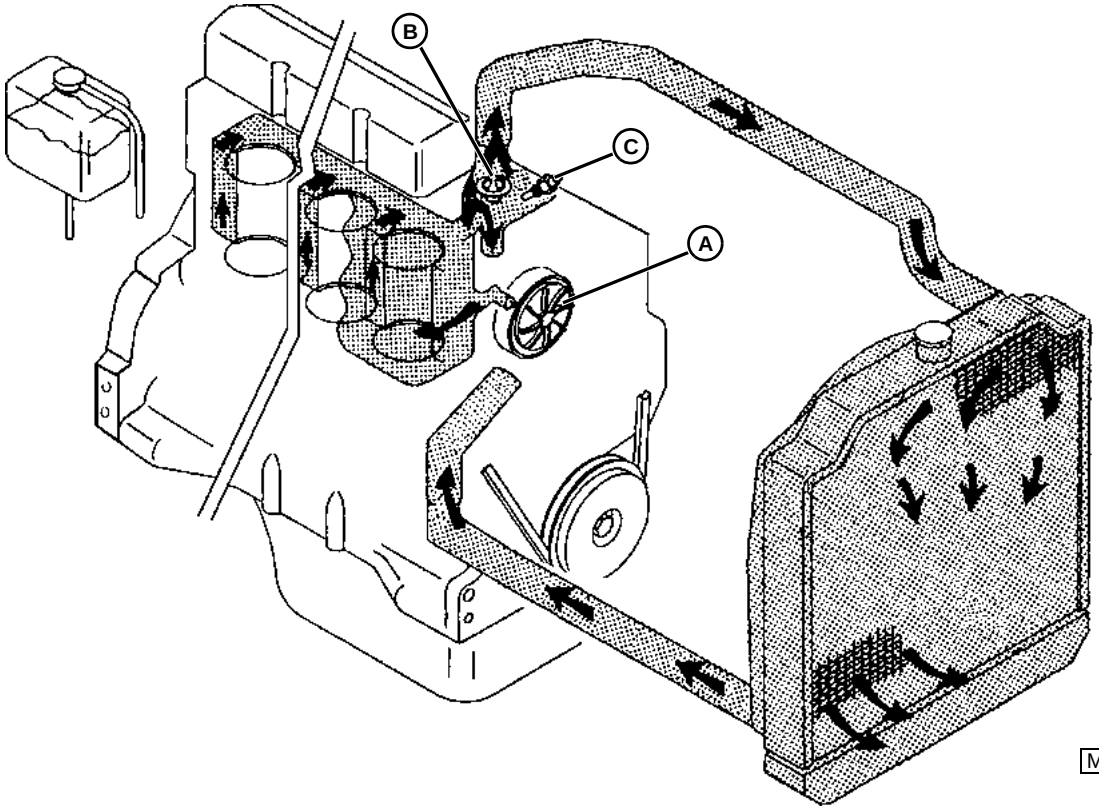
A fuel level sensor mounted in the fuel tank informs the operator of the fuel level.

Air Intake System:

Engine intake air enters the inlet hose (A) behind the grille, and flows into the air filter body (B). The air cleaner also has a rubber, one way, unloading valve (C), that ejects heavy dirt particles from the air stream during engine operation before they reach the filters. The operator can squeeze the valve to remove the large particles. The air cleaner elements filter the air, which then flows through hose (D) to the intake manifold.

An air filter restriction indicator (E) at the rear of the air cleaner informs the operator when the air filter needs servicing.

COOLING SYSTEM OPERATION



Function:

The coolant pump (A) circulates coolant through the cooling system, drawing hot coolant from the engine block, circulating it through the radiator for cooling.

Theory of Operation:

The pressurized cooling system includes the radiator, water pump, fan and thermostat (B).

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 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.

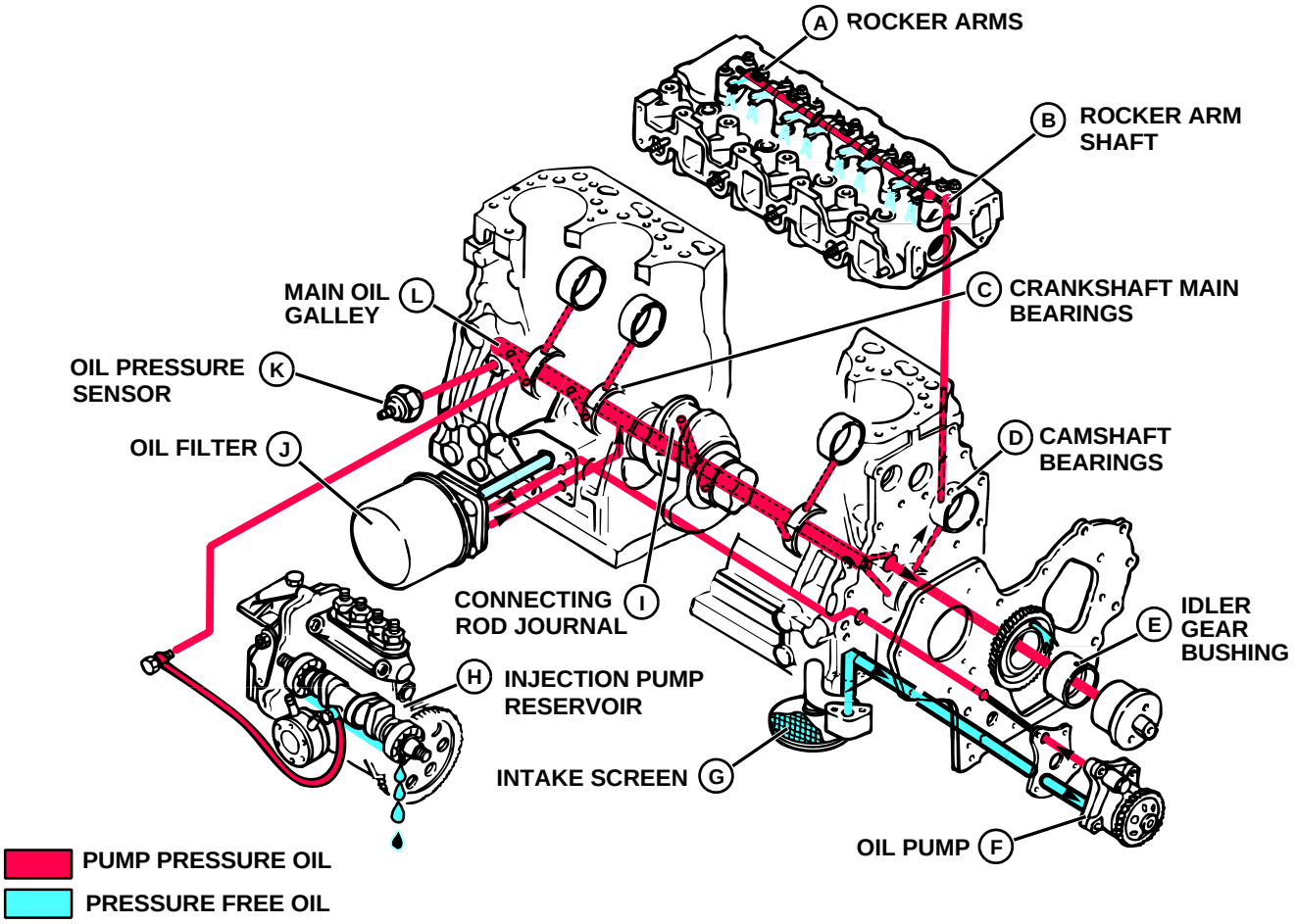
When coolant system pressure exceeds **48 kPa (7 psi)**, a valve in the radiator cap opens to allow coolant to discharge into the coolant recovery tank.

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 sensor (C) informs the operator of the engine coolant temperature and warns of a high temperature condition by lighting a lamp.

Start To Open . . . . . .69.5 - 72.5° C (157 - 163° F)
Fully Opened . . . . . .85° C (185° F)

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 (F), oil strainer (G), full flow oil filter (J), oil pressure regulating valve and an electrical pressure warning switch. (K)

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 (L).

From the main oil galley, oil is forwarded under pressure to the crankshaft main bearing journals (C) and idler gear bushing (E). Drilled cross-passages in the crankshaft (I) 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 (D).

A drilled passage from the rear camshaft bearing through the cylinder block and cylinder head supplies lubricating oil to the rocker arm shaft (B). The hollow shaft distributes oil to the rocker arms (A), cam followers and valves.

Lubrication oil is supplied to the fuel injection pump (H) from the main oil galley through external oil lines.

An oil pressure sensor (K) activates an indicator light to alert the operator to shut down the engine if oil pressure drops below specification.

TROUBLESHOOTING CHART

	Problem or Symtom / Cause	Engine will not start			Low engine output			Poor exhaust color		Loud knocking noise during combustion	Misfiring	Uneven combustion sound	Engine surges		Excessive engine vribration	Poor return to low speed	Excessive fuel comsumption	Lubricating Oil				Low compression	Coolant		Intake manifold pressure		Exhaust temperature too high	Problem or Symptom / Solution
		Engine will not start	Engine starts but does not continue to run		Exhaust Color			Under load					During Idling	Under Load				Excessive oil consumption	Fuel oil in crankcase	Water in crankcase	Low oil pressure		Overheating	Low water temperature	Low pressure	High pressure		
			Exhaust smoke																									
			No smoke	Excess smoke	Normal	White	Black	White	Black																			
Engine System	Improper intake or exhaust valve clearance	●	●		●						●														●		●	Adjust valve clearance
	Compression leakage from valve seat				●		●		●		●						●					●			●		●	Grind valve seat, regrind valves
	Seized intake/exhaust valve	●		●	●		●		●		●			●	●				●			●			●			Replace valve and check valve guide
	Leaking cylinder head gasket				●															●			●					Replace head gasket
	Broken or seized piston ring	●		●		●		●			●		●		●			●	●			●	●				●	Replace rings and check cylinder
	Piston ring, piston or cylinder worn	●		●		●		●										●	●			●						Bore or hone cylinder & replace piston
	Crankshaft pin or bearing seized	●	●								●		●	●	●							●						Regrind crank and replace bearings
	Piston ring end gaps not correct		●			●												●				●						Stagger piston ring gaps
	Piston rings installed incorrectly					●		●										●				●						Install piston rings correctly
	Crankshaft pin or bearing worn				●						●		●	●	●						●							Regrind crank and replace bearings
	Connecting rod bolt loose										●				●						●							Check for damage and re-torque bolts
	Foreign matter in combustion chamber	●									●							●				●						Remove head and inspect for damage
	Excessive timing gear backlash										●																	Measure timing gear backlash
	Intake/exhaust valve guides worn					●												●				●						Check valve guides and stems
	Governor not functioning properly		●										●	●	●	●												Repair or replace governor
	Improper timing between injection pump, intake & exhaust valves	●				●	●	●	●		●																	Adjust valve clearance. Check vlave timimg
Cooling System	Engine running too cool							●									●						●					Check thermostat
	Engine running too hot						●															●				●		Check thermostat, fan belt tension
	Coolant level low						●															●				●		Check cooling system for level/leaks
	Cracked water jacket																			●	●	●						Repair or replace water jacket
	Malfunctioning thermostat						●															●	●					Check or replace thermostat
	Water pump/alternator belt loose						●															●				●		Adjust fan belt tension

TROUBLESHOOTING CHART

Problem or Symtom / Cause		Engine will not start			Low engine output			Poor exhaust color		Loud knocking noise during combustion	Misfiring	Uneven combustion sound	Engine surges	
			Engine starts but does not continue to run		Exhaust Color			Under load						
		Engine will not start	Exhaust smoke		Normal	White	Black	White	Black				During Idling	Under Load
			No smoke	Excess smoke										
Engine System	Improper intake or exhaust valve clearance	●	●		●						●			
	Compression leakage from valve seat				●		●		●		●			
	Seized intake/exhaust valve	●		●	●		●		●		●			●
	Leaking cylinder head gasket				●									
	Broken or seized piston ring	●		●		●		●			●		●	
	Piston ring, piston or cylinder worn	●		●		●		●						
	Crankshaft pin or bearing seized	●	●								●		●	●
	Piston ring end gaps not correct		●			●								
	Piston rings installed incorrectly					●		●						
	Crankshaft pin or bearing worn				●						●		●	●
	Connecting rod bolt loose										●			
	Foreign matter in combustion chamber	●									●			
	Excessive timing gear backlash										●			
	Intake/exhaust valve guides worn					●								
	Governor not functioning properly		●										●	●
	Improper timing between injection pump, intake & exhaust valves	●				●	●	●	●		●			
Cooling System	Engine running too cool							●						
	Engine running too hot						●							
	Coolant level low						●							
	Cracked water jacket													
	Malfunctioning thermostat						●							
	Water pump/alternator belt loose						●							

	Uneven combustion sound	Engine surges: During Idling	Engine surges: Under Load	Excessive engine vribration	Poor return to low speed	Excessive fuel comsumption	Lubricating Oil: Excessive oil consumption	Lubricating Oil: Fuel oil in crankcase	Lubricating Oil: Water in crankcase	Lubricating Oil: Low oil pressure	Low compression	Coolant: Overheating	Coolant: Low water temperature	Intake manifold pressure: Low pressure	Intake manifold pressure: High pressure	Exhaust temperature too high	Problem or Symptom / Solution
														●		●	Adjust valve clearance
						●					●			●		●	Grind valve seat, regrind valves
			●	●				●			●			●			Replace valve and check valve guide
									●			●					Replace head gasket
		●		●			●	●			●	●				●	Replace rings and check cylinder
							●	●			●						Bore or hone cylinder & replace piston
		●	●	●							●						Regrind crank and replace bearings
							●				●						Stagger piston ring gaps
							●				●						Install piston rings correctly
		●	●	●						●							Regrind crank and replace bearings
				●						●							Check for damage and re-torque bolts
							●				●						Remove head and inspect for damage
																	Measure timing gear backlash
							●				●						Check valve guides and stems
		●	●	●	●												Repair or replace governor
																	Adjust valve clearance. Check vlave timimg
						●							●				Check thermostat
												●				●	Check thermostat, fan belt tension
												●				●	Check cooling system for level/leaks
									●	●		●					Repair or replace water jacket
												●	●				Check or replace thermostat
												●				●	Adjust fan belt tension

	Problem or Symtom / Cause	Engine will not start	Engine starts but does not continue to run	Low engine output	Poor exhaust color	Loud knocking noise during combustion	Misfiring	Uneven combustion sound	Engine surges		Excessive engine vibration	Poor return to low speed	Excessive fuel comsumption	Lubricating Oil				Low compression	Coolant		Intake manifold pressure		Exhaust temperature too high	Problem or Symptom / Solution
			Exhaust smoke	Exhaust Color	Under load																			
		Engine will not start	No smoke	Excess smoke	Normal	White	Black	White	Black					During Idling	Under Load				Excessive oil consumption	Fuel oil in crankcase	Water in crankcase	Low oil pressure		Overheating	Low water temperature	Low pressure	High pressure		
Lubricating Oil System	Improper engine oil viscosity/type	●	●		●														●			●	●						Replace engine oil and filter
	External/internal oil leak																		●			●							Repair
	Oil pump worn																												Check and repair oil pump
	Oil filter clogged																					●	●						Replace oil filter
	Oil pressure relief valve worn																					●							Clean, adjust or replace relief valve
	Oil level low																					●							Add oil
Fuel System	Advanced fuel injection pump timing							●	●	●						●													Check and adjust injection pump timing
	Retarded fuel injection pump timing					●	●	●	●								●											●	Check and adjust injection pump timing
	Wrong type of fuel				●	●	●	●	●			●																	Drain and replace fuel
	Water in fuel	●		●		●		●				●	●	●															Check and repair
	Fuel filter clogged	●	●		●																								Replace fuel filter
	Air entering fuel system	●	●		●												●												Check and repair fuel supply system
	Clogged or cracked fuel lines	●	●		●																								Clean or replace fuel lines
	Fuel volume to injection pump low	●	●		●																								Check or replace fuel transfer pump
	Uneven volume of fuel injected					●	●	●	●			●	●	●	●													●	Check fuel injector pump and injectors
	Excessive volume of fuel injected								●								●	●				●	●			●	●	●	Check fuel injector pump and injectors
	Poor fuel injection pattern					●	●	●	●			●	●	●	●		●												Clean or replace fuel injector nozzles
Air/Exhaust	Clogged air filter			●			●		●			●														●			Clean or replace air filter
	Engine at high altitude/temperature						●		●															●		●			Use higher output engine
	Clogged exhaust pipe						●		●			●																●	Clean exhaust pipe
Electrical	Starting motor defective	●																											Repair or replace starting motor
	Alternator defective	●																											Repair or replace alternator
	Open circuit in wiring	●																											Repair wiring
	Battery voltage low	●																											Recharge battery

Problem or Symtom / Cause		Engine will not start			Low engine output			Poor exhaust color						Engine surges	
			Engine starts but does not continue to run		Exhaust Color			Under load							
			Exhaust smoke												
		Engine will not start	No smoke	Excess smoke	Normal	White	Black	White	Black	Loud knocking noise during combustion	Misfiring	Uneven combustion sound	During Idling	Under Load
Lubricating Oil System	Improper engine oil viscosity/type	●	●		●									
	External/internal oil leak													
	Oil pump worn													
	Oil filter clogged													
	Oil pressure relief valve worn													
	Oil level low													
Fuel System	Advanced fuel injection pump timing							●	●	●				
	Retarded fuel injection pump timing					●	●	●	●					
	Wrong type of fuel				●	●	●	●	●			●		
	Water in fuel	●		●		●		●				●	●	●
	Fuel filter clogged	●	●		●									
	Air entering fuel system	●	●		●									
	Clogged or cracked fuel lines	●	●		●									
	Fuel volume to injection pump low	●	●		●									
	Uneven volume of fuel injected					●	●	●	●			●	●	●
	Excessive volume of fuel injected								●					
	Poor fuel injection pattern					●	●	●	●			●	●	●
Air/Exhaust	Clogged air filter			●			●		●			●		
	Engine at high altitude/temperature						●		●					
	Clogged exhaust pipe						●		●			●		
Electrical	Starting motor defective	●												
	Alternator defective	●												
	Open circuit in wiring	●												
	Battery voltage low	●												

Uneven combustion sound	Engine surges: During Idling	Engine surges: Under Load	Excessive engine vribration	Poor return to low speed	Excessive fuel comsumption	Lubricating Oil: Excessive oil consumption	Lubricating Oil: Fuel oil in crankcase	Lubricating Oil: Water in crankcase	Lubricating Oil: Low oil pressure	Low compression	Coolant: Overheating	Coolant: Low water temperature	Intake manifold pressure: Low pressure	Intake manifold pressure: High pressure	Exhaust temperature too high	Problem or Symptom / Solution
						●			●	●						Replace engine oil and filter
						●			●							Repair
																Check and repair oil pump
									●	●						Replace oil filter
									●							Clean, adjust or replace relief valve
									●							Add oil
			●													Check and adjust injection pump timing
					●										●	Check and adjust injection pump timing
●																Drain and replace fuel
●	●	●														Check and repair
																Replace fuel filter
				●												Check and repair fuel supply system
																Clean or replace fuel lines
																Check or replace fuel transfer pump
●	●	●	●												●	Check fuel injector pump and injectors
					●	●				●	●			●	●	Check fuel injector pump and injectors
●	●	●	●		●											Clean or replace fuel injector nozzles
●													●			Clean or replace air filter
											●		●			Use higher output engine
●															●	Clean exhaust pipe
																Repair or replace starting motor
																Repair or replace alternator
																Repair wiring
																Recharge battery

ENGINE SYSTEM DIAGNOSIS

Test Conditions:

- Machine parked on level surface.
- Park brake engaged.
- Key switch in OFF position unless indicated otherwise.

Test Location	Normal	If Not Normal
1. Engine dipstick and exterior engine surface.	Oil level is between “L” and “H” marks. Oil filter clean.	Fill oil to correct level. Change oil and filter.
	Oil is not burnt, or contaminated with metal particles, fuel, or coolant.	Change oil and filter. Inspect for source of contamination.
	No external leakage.	Check gaskets, seals, plugs, cylinder head, block, intake manifold and breather.
2. Coolant tank and radiator.	Coolant level is between marks on tank when engine is warm. Coolant in radiator is full to top.	Add proper coolant.
	Coolant is not contaminated with oil, fuel or discolored brown.	Drain and flush system. Check for source of contamination.
	Radiator screen free of debris.	Clean or replace.
	Water pump not leaking.	Inspect water pump.
	Hoses not cracked or leaking.	Pressure test radiator and cap.
	Clamps and radiator cap tight.	Tighten cap and clamps.
	Fan belt tight, not glazed or cracked.	Replace belt and adjust tension.
	Fan blades not damaged or warped.	Replace fan.
3. Fuel tank, pump, lines, filter shutoff valve.	Fuel level correct, not contaminated. Correct grade of fuel, no water in fuel.	Drain and clean fuel tank. Add fresh fuel.
	Fuel pump in-line filter free of debris.	Replace filters.
	Fuel shutoff valve in “ON” position.	Move to “ON” position.
	Fuel hoses not cracked or leaking.	Replace.
	Fuel hose clamps tight.	Replace or tighten.
4. Air filter and air intake.	Air filter hose not cracked, clamps tight.	Replace and tighten clamps.
	Element not plugged. Air filter housing sealed, no dirt tracking inside filter element.	Replace element or housing.
5. Fuel shutoff solenoid. (Key in RUN position.)	Fuel shutoff solenoid must pull in and stay in. Solenoid must bottom out. Shutoff shaft must still move slightly.	Clean any dirt from under solenoid boot. If solenoid will not pull in and hold in, See “Fuel Shutoff Solenoid Circuit Diagnosis” in ELECTRICAL section.

TESTS AND ADJUSTMENTS

CYLINDER COMPRESSION TEST

Reason:

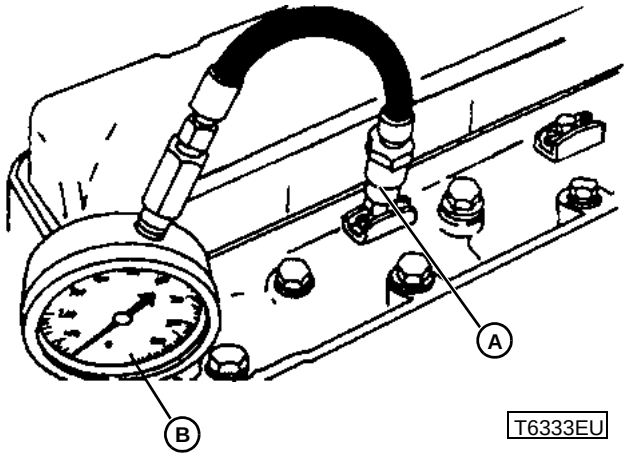
To determine the condition of the pistons, rings, cylinder walls and valves.

Equipment:

- JT01682 Compression Gauge Assembly
- JDG560 Adapter

Procedure:

1. Remove the injection nozzles.



2. Install the heat protector from end of injector and install JDG560 adapter (A).
3. Install JT01682 Compression Gauge Assembly (B) and JDG560 Adapter.
4. Disconnect the fuel control solenoid connector.

IMPORTANT: DO NOT overheat starting motor during test.

5. Crank the engine for five seconds with the starting motor. Minimum cranking speed is 250 rpm.
6. Record the pressure reading for each cylinder.

Specifications:

Cylinder Compression Pressure
4200 . . . . . 3138 ± 98 kPa (455 ± 14 psi)
4200 (Minimum) . . . . 2555 ± 98 kPa (370 ± 14 psi)
4300 . . . . . 3236 ± 98 kPa (469 ± 14 psi)
4300 (Minimum) . . . . 2550 ± 98 kPa (370 ± 14 psi)
4400 . . . . . 3432 ± 98 kPa (498 ± 14 psi)
4400 (Minimum) . . . . 2746 ± 98 kPa (398 ± 14 psi)

Difference Between Cylinders
(max- All) . . . . . 245 ± 49 kPa (36 ± 7 psi)

Results:

- If the pressure reading is below specification, squirt clean engine oil into the cylinders through the injector ports and repeat the test.
- If the pressure increases significantly, check piston, rings, and cylinder walls for wear or damage.
- If the pressure does not increase significantly, check for leaking valves, valve seats or cylinder head gasket.

SLOW IDLE ADJUSTMENT

IMPORTANT: The slow idle adjustment is the only adjustment that can be made on this engine.

The fast idle and torque capsule adjustments are pre-set by the engine manufacturer to comply with strict EPA/CARB emissions requirements, and are adjustable ONLY by authorized diesel service facilities.

Reason:

To achieve proper slow idle rpm setting. Provides adequate rpm to keep the engine running smoothly without stalling.

Equipment:

- JT05719 Hand Held Digital Tachometer

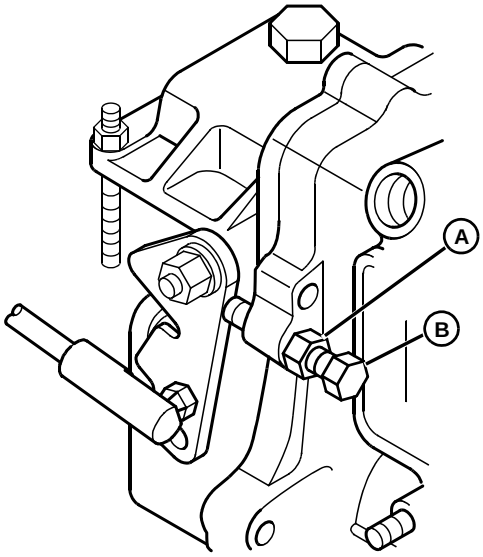
NOTE: Make sure the air cleaner is clean and not restricted. Replace the air cleaner element as necessary.

Procedure:

1. Place a small piece of reflective tape on the crankshaft pulley.
2. Start the engine and run for 5 minutes to attain operating temperature.
3. Move the throttle lever to slow idle position.
4. Use JT05719 Hand Held Digital Tachometer to check engine speed at the crankshaft pulley.
5. Visually check that the injection pump throttle lever is against slow idle stop screw. Slow idle speed is set to specification.

Specification:

CST and SRT Tractors . . . . . 950 ± 50 rpm
HST Tractors . . . . . 1000 ± 50 rpm



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.

VALVE CLEARANCE ADJUSTMENT

Reason:

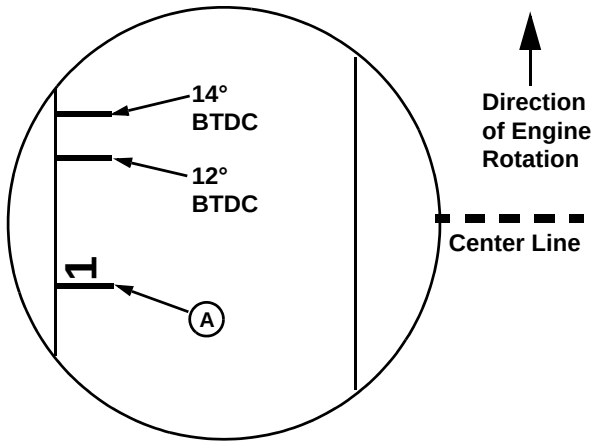
To be sure the valves are fully opening and closing at the correct time, and not wearing the valve train unnecessarily.

Equipment:

- Feeler Gauge
- 10 mm End Wrench
- Flat Blade Screwdriver
- 17 mm Wrench

Procedure:

1. The engine must be cool (room temperature) before the valve clearance is checked.
2. Be sure ignition key is OFF before attempting to turn engine by hand.
3. Open the hood and remove the engine side covers.
4. Remove the rocker arm cover. (See “ROCKER ARM COVER REMOVAL AND INSTALLATION”).



Flywheel Timing Marks

5. Locate the inspection hole in right side of the transmission tunnel. The flywheel can be seen inside the inspection hole.

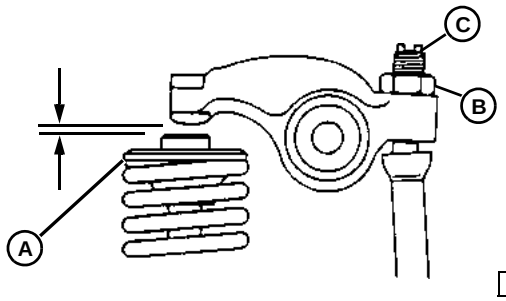
NOTE: “Top Dead Center (TDC)” is when the piston is at it’s highest point of travel in the cylinder on the compression stroke.
Number one cylinder is located at rear of engine (flywheel side).

6. Turn the crankshaft pulley while watching the flywheel inside the inspection hole. Align the number one TDC mark (A) on the flywheel with the pointer on the tunnel.

NOTE: When top dead center is reached, the rocker arms for that cylinder will be motionless as the crankshaft is rotated. If rocker arms are still moving when TDC is approached, rotate crankshaft one full revolution and try again.

7. 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.



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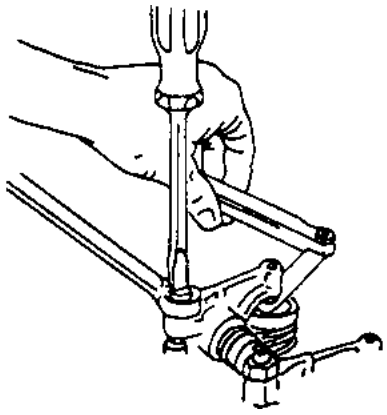
8. Slide a feeler gauge between the valve cap (A) and rocker arm to measure the clearance.



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9. To adjust the valves, loosen the lock nut (B) and turn the adjusting screw (C) until the blade of the feeler gauge can be inserted between the rocker arm and valve cap. Hold the adjusting screw while tightening the lock nut.
10. Recheck the valve clearance after tightening the lock nut.

Specification:

Valve Clearance . 0.15 – 0.25 mm (0.006 – 0.010 in.)

Normal **Not Normal**

11. Check that the valve cap on the valve stem remained seated on the valve and inside the valve spring retainer.
12. Turn the crankshaft pulley counter clockwise (as viewed from operator's seat or flywheel end) approximately 2/3 of a revolution (240°) while watching the observation hole for the number three timing mark.
13. Check that the rocker arms and push rods for cylinder number three are loose.
14. Repeat steps 7 – 13 for number three cylinder.
15. Repeat steps 7 – 11 for number two cylinder.
16. Replace the rocker arm cover, air cleaner bracket and housing, and the muffler.
17. Replace the engine side covers and hood.

CONNECTING ROD SIDE PLAY CHECK

Reason:

To determine proper side clearance between the crankshaft and the connecting rod.

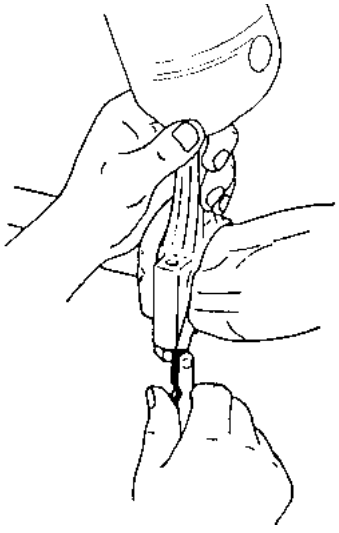
Equipment:

- Feeler Gauge

NOTE: The engine must be removed from the tractor to perform this test.

Procedure:

1. Remove the oil pan, crankcase extension, oil pick-up, and balancer assembly.
2. Insert a feeler gauge, according to specifications, between the connecting rod cap and the crankshaft.



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3. Connecting rod side play is **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.

CONNECTING ROD BEARING CLEARANCE CHECK

Reason:

To measure oil clearance between connecting rod bearing and crankshaft journal.

Equipment:

- PLASTIGAGE®

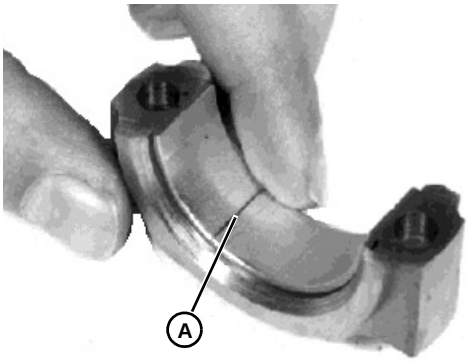
NOTE: The engine must be removed from the tractor to perform this procedure.

Procedure:

1. Remove the oil pan, and oil pickup.

IMPORTANT: The connecting rod caps must be installed on the same connecting rod and in the same direction to prevent crankshaft and connecting rod damage.

2. Remove the connecting rod cap.
3. Wipe oil from the bearing insert and the crankshaft journal.
4. Put a piece of PLASTIGAGE® (A), or an equivalent, along the full length of the bearing insert approximately **6 mm (0.25 in.)** off center.



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5. Turn the crankshaft approximately 30° from bottom dead center.
6. Install the connecting rod end cap and original rod bolts. Tighten the rod bolts to specification.

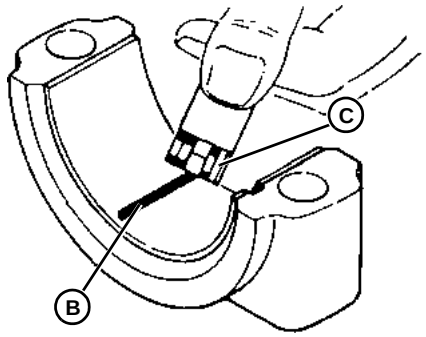
Specification:

Connecting Rod Bolt Torque
4200 . . . . . .37 - 41 N•m (27 - 30 lb-ft)
4300, 4400 . . . . . .44 - 54 N•m (33 - 40 lb-ft)

7. Remove the rod bolts and the connecting rod cap.

NOTE: The flattened PLASTIGAGE (B) will be found on either the bearing insert or crankshaft journal.

8. Use the graduation marks on the envelope (C) to compare the width of the flattened PLASTIGAGE 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.



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9. Measure the connecting rod bearing oil clearance.

Specification:

Connecting Rod Bearing Oil Clearance
4200 . . . . . 0.04 - 0.09 mm (0.002 - 0.004 in.)
Wear Limit . . . . . 0.25 mm (0.010 in.)
4300, 4400 . . . . . 0.04 - 0.07 mm (0.002 - 0.003 in.)
Wear Limit . . . . . 0.16 mm (0.006 in.)

Result:

- If the clearance exceeds the wear limit specification, replace the bearing inserts.

10. Remove the PLASTIGAGE®.

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CRANKSHAFT END PLAY CHECK

Reason:

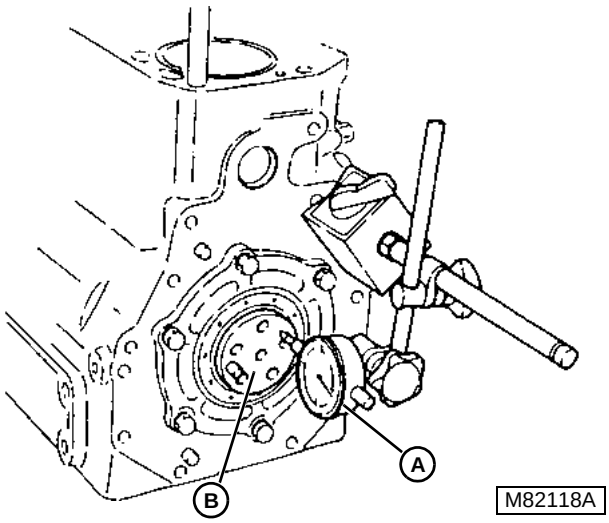
To determine proper side clearance between the crankshaft and the engine block.

Equipment:

- 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 (B) to engine and position indicator tip on end of crankshaft (A).

IMPORTANT: 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.
5. Crank shaft end play is **0.09 - 0.27 mm (0.004 - 0.011 in.).**

Results:

- If the end play exceeds **0.27 mm (0.011 in,)**, replace the thrust bearings.

CRANKSHAFT MAIN BEARING CLEARANCE CHECK

Reason:

To measure oil clearance between main bearing and crankshaft journal.

Equipment:

- PLASTIGAGE®

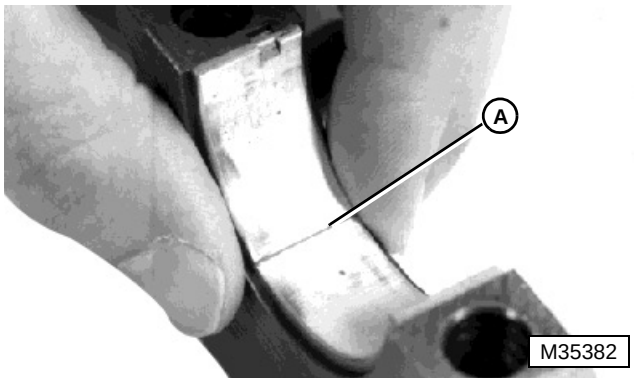
NOTE: The engine must be removed from the tractor to perform this test.

Procedure:

1. Remove the oil pan, and oil pickup.

IMPORTANT: Main bearing caps must be installed on the same main bearing and in the same direction to prevent crankshaft and main bearing damage.

2. Remove the main bearing cap.
3. Wipe oil from the bearing insert and the crankshaft journal.
4. Put a piece of PLASTIGAGE® (A), or an equivalent, along the full length of the bearing insert approximately **6 mm (0.25 in.)** off center.



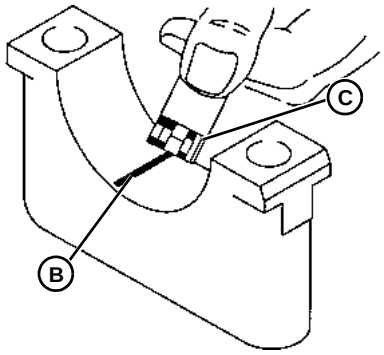
5. Install the main bearing cap and bolts. Tighten the bolts to specification.

Specification:

Main Bearing Bolt Torque
4200 . . . . . .76.5 - 80.4 N•m (56 - 59 lb-ft)
4300, 4400 . . . . . .96 - 100 N•m (71 - 74 lb-ft)

6. Remove the bolts and main bearing caps.

NOTE: The flattened PLASTIGAGE® (B) will be found on either the bearing insert or crankshaft journal.



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7. Use the graduation marks (C) on the envelope to compare the width of the flattened PLASTIGAGE® 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.

Specification:

Main Bearing Oil Clearance

4200 . . . . . 0.04 - 0.09 mm (0.002 - 0.004 in.)
Wear Limit. . . . . 0.25 mm (0.010 in.)
4300, 4400 . . . . . 0.04 - 0.07 mm (0.002 - 0.003 in.)
Wear Limit. . . . . 0.16 mm (0.006 in.)

Result:

- If the clearance exceeds the wear limit specification, replace the bearing inserts.

8. Remove PLASTIGAGE®.

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VALVE LIFT CHECK

Reason:

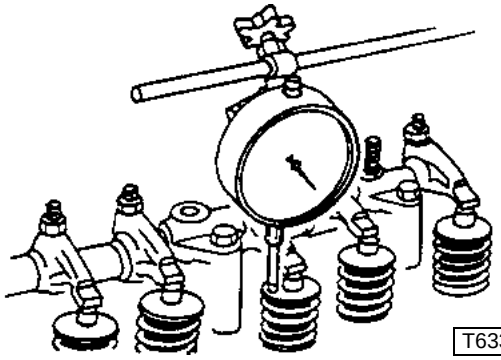
Check wear on cam lobes, followers, and/or push rods.

Equipment:

- Dial Indicator

Procedure:

1. Remove the rocker arm cover. (See “ROCKER COVER REMOVAL AND INSTALLATION”).
2. Adjust the valve clearance.



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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 clockwise (from the fan end).
6. Observe the dial indicator as the valve is moved to the full open position. Repeat for each valve.

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 “CAMSHAFT”) in this section. If the camshaft, followers and push rods are within specification remove and inspect the cylinder head. (See “CYLINDER HEAD AND VALVES REMOVAL AND INSTALLATION”).

CAMSHAFT END PLAY CHECK

Reason:

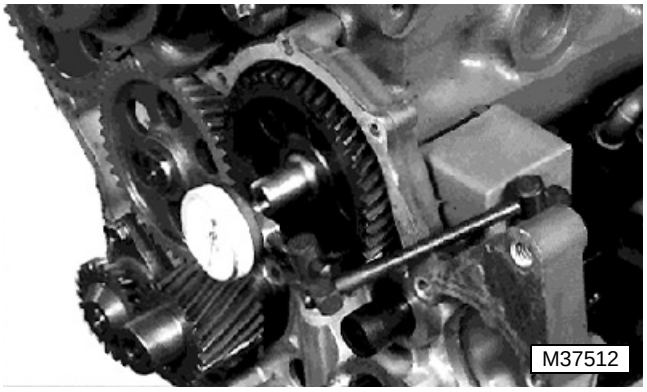
To determine proper side clearance between camshaft gear end journal and thrust plate.

Equipment:

- Dial Indicator

Procedure:

1. Remove the timing gear cover. (See “TIMING GEAR COVER”).
2. Fasten the dial indicator to the engine and position indicator tip on end of camshaft.
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.



6. Standard end play is **0.05 - 0.25 mm (0.002 - 0.010 in.).**

Results:

- If the end play exceeds **0.25 mm (0.010 in.)**, remove the camshaft and replace the thrust plate. (See “CAMSHAFT”).

TIMING GEAR BACKLASH CHECK

Reason:

To check for wear between meshing gears, resulting in excessive noise and poor engine performance.

Equipment:

- Dial Indicator

Procedure:

1. Measure the backlash between meshing gears.
2. The backlash for all gears EXCEPT the oil pump gear is **0.07 - 0.15 mm (0.003 - 0.006 in.).**
3. The backlash for the oil pump gear is **0.11 - 0.19 mm (0.004 - 0.008 in.).**

Results:

- If the backlash exceeds specifications, replace meshing gears as a set:

Idler Gear, Camshaft Gear, Crankshaft Gear, Oil Pump Gear AND/OR Idler Gear, Fuel Injection Pump Gear.

FUEL INJECTION NOZZLE TEST

⚠ CAUTION

Escaping fluid under pressure can penetrate the skin causing serious injury. Avoid the hazard by relieving pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure. Search for leaks with a piece of cardboard. Protect hands and body from high pressure fluids.

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

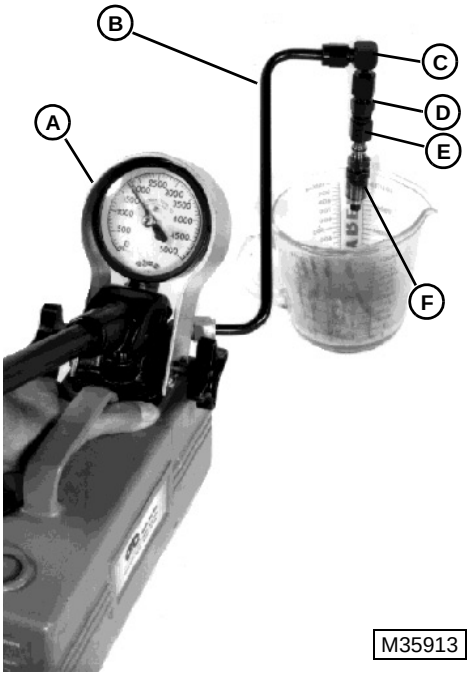
Reason:

To determine opening pressure, leakage, chatter and spray pattern of the fuel injection nozzle.

Equipment:

- D01109AA Diesel Fuel Injection Nozzle Tester
- D01110AA Adapter Set
- 23622 Straight Adapter
- Container

Connections:



1. Connect the fuel injection nozzle (F) to D01109AA Diesel Fuel Injection Nozzle Tester (A) using parts 36352 (B), 23617 (C), 23621 (D) from D01110AA Adapter Set, and 23622 straight adapter.

IMPORTANT: 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 is **19600 +1000/–0 kPa (2843 +145/–0 psi).**

Results:

- If the pressure reading does not meet specification, disassemble the injection nozzle and inspect for contamination or a stuck valve. If necessary, add or remove shims to change opening pressure.

Procedure 2:

Test fuel injection nozzle **leakage** following the nozzle tester manufacturer's instructions.

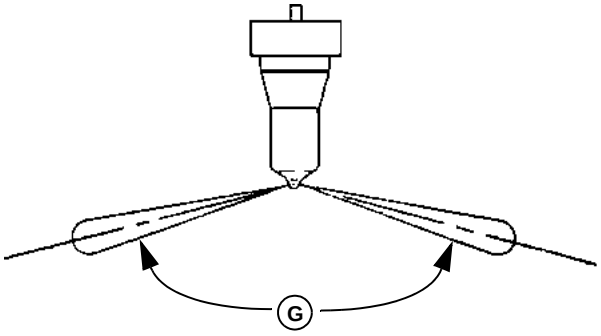
1. Dry the nozzle completely using a lint-free cloth.
2. Pressurize the nozzle to **19600 kPa (2843 psi)**.
3. Watch for leakage from nozzle spray orifice.

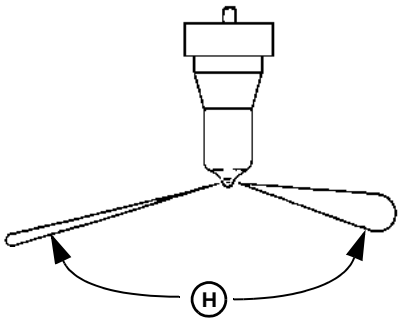
Results:

- 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:

1. Test the fuel injection nozzle **chatter and spray pattern** following the nozzle tester manufacturer's instructions.
2. Pressurize nozzle to **19600 kPa (2843 psi).**
3. With slow hand lever movement there should be a “chatter” sound.
4. With fast hand lever movement the nozzle should exhibit an even, fine atomized spray pattern (G).
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.

THERMOSTAT OPENING TEST

Reason:

To determine opening temperature of thermostat.

Equipment:

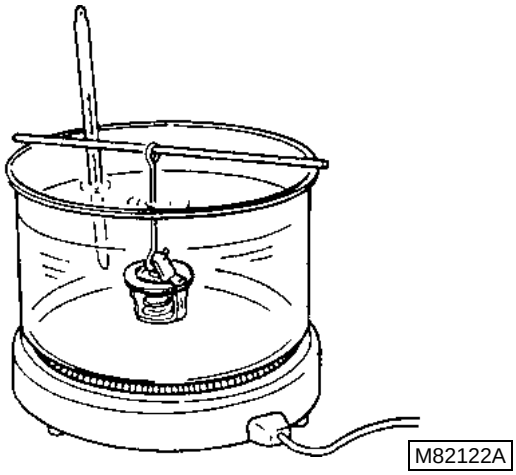
- Thermometer
- Glass Container
- Heating Unit

Procedure:

⚠ CAUTION

DO NOT allow thermostat or thermometer to rest against the side or bottom of glass container when heating water. Either may rupture if overheated.

1. Suspend the thermostat and a thermometer in a container of water.
2. Heat and stir the water. Observe the opening action of the thermostat as the water heats up.
3. Remove the thermostat and observe the closing action as it cools.


M82122A

Results:

- The thermostat should begin opening at **69.5 - 72.5° C (157 - 163° F)** and be fully open at **85° C (185° F)**.
- Replace the thermostat if the fully open lift height is less than **8 mm (0.31 in.)**, or if the closing action is not smooth and slow.

INJECTION PUMP STATIC TIMING ADJUSTMENT (NON-EPA ENGINES)

4200 (-016705)
4300 (-011018)
4400 (-004914)

Reason:

To make sure that the injection pump timing is set to manufacturers specification.

Equipment:

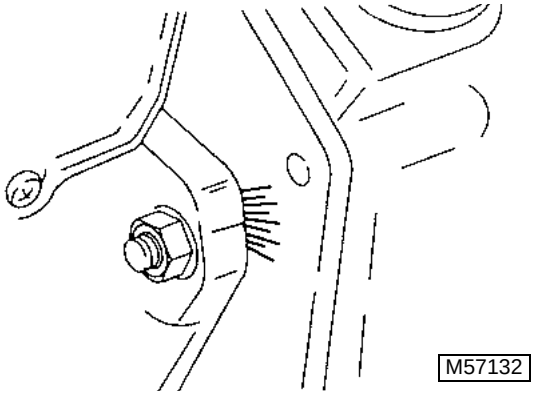
- Timing Tool (Made from high pressure pipe, nut and a clear plastic straw**)
  ** straw from WD40, carburetor cleaner, brake parts cleaner, etc.
- External fuel supply

Procedure:

IMPORTANT: The injection pump timing should be correct. The timing is set at the factory, and will not normally change during the life of the engine. Check and adjust the timing only as the last option, or if there is reason to believe the timing has been altered.
Check the fuel, fuel supply system, injectors, air intake system and cylinder compression before continuing.

NOTE: If the injection pump has been removed from engine without disturbing engine crankshaft and pump gear, perform step 1 to obtain a close starting point, then perform the entire timing procedure.

1. Align the arrow or line on the injection pump flange on the mark noted during pump removal.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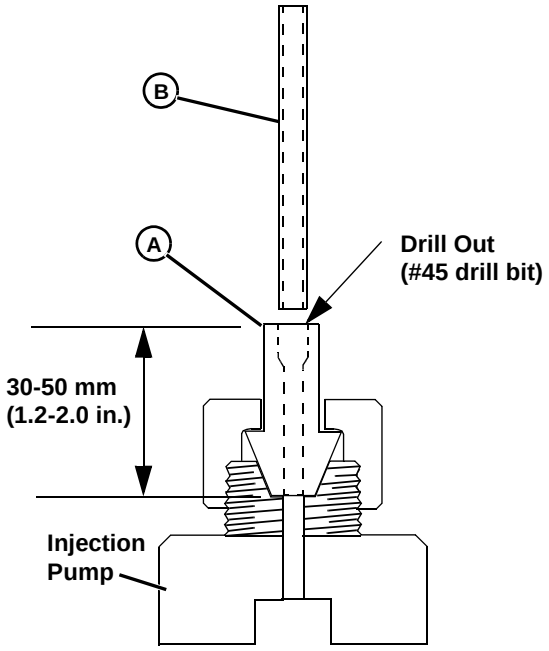
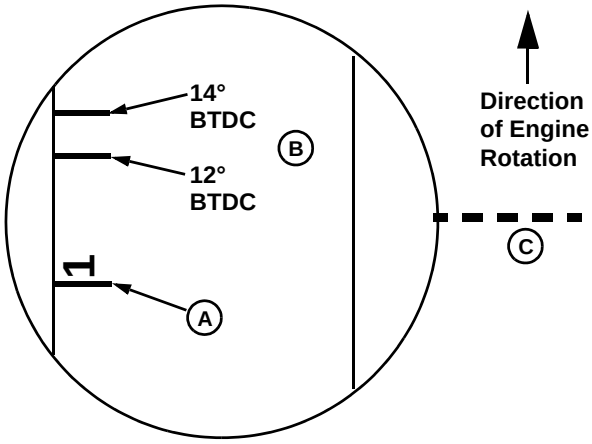
NOTE: Normal rotation, as viewed from the flywheel end, is counterclockwise. The number one fuel injection line is toward the flywheel.

2. Remove the number one fuel injection line.



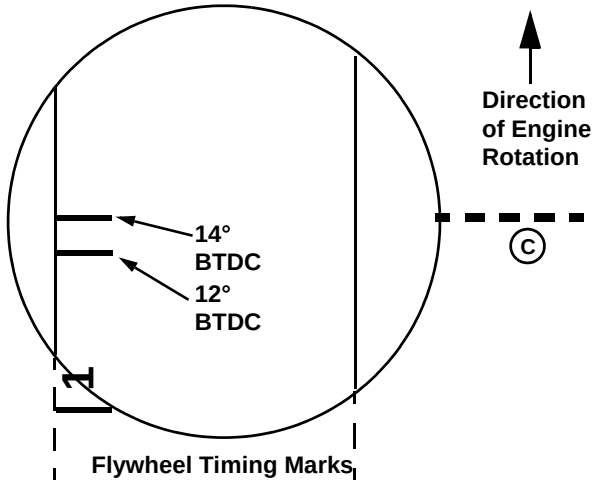
3. Install the timing tool (A) and clear straw (B).
4. Remove the access panel from the flywheel housing.
5. Prime the pump to fill it with fuel.
6. Disconnect battery negative (–) terminal and remove fuel shutoff solenoid.
7. Turn the flywheel counterclockwise (as viewed from the flywheel end) until the timing tool straw has fuel showing.



Flywheel Timing Marks

8. Turn the crankshaft pulley clockwise (back) until the No. 1 cylinder top dead center (TDC) mark (A) and pump timing marks (B) have gone past the center of the timing hole in the flywheel housing (C) by at least 50 mm (2 in.).
9. Snap the straw with your finger until the level of the fuel, or a bubble, is set part way up the straw. This will be the point to watch for fuel movement.
10. Slowly turn the flywheel counterclockwise (as viewed from the flywheel end) until the fuel in the straw just starts to move. Stop rotating the flywheel the instant the fuel begins to move.

NOTE: If there is no fuel movement, engine may be on exhaust stroke. Rotate flywheel 360° and repeat test.



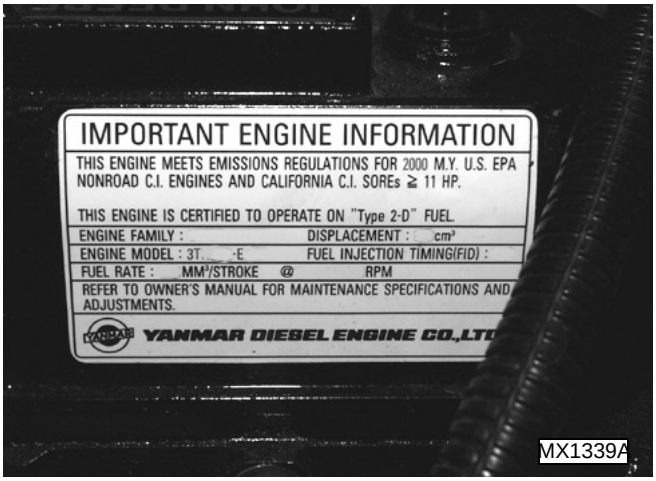
Flywheel Timing Marks

11. Check the injection pump timing marks on the flywheel. The 14° mark on the flywheel must line up with the center of the timing hole (C) in the flywheel housing.

Results:

- If the timing is not within specifications, loosen the pump mounting bolts and turn the pump toward the engine block to retard the timing or away from the block to advance the timing. Recheck the timing.
  If the timing did not change, remove pump and have tested by an authorized diesel injection service shop.
- If the timing is correct, remove timing tool, install number one injection line, install the access cover to the flywheel housing.

INJECTION PUMP TIMING ADJUSTMENT (EPA ENGINES)



EPA engines have EPA compliance sticker on rocker arm cover as shown above.

ATTENTION!

DO NOT attempt to adjust the fuel injection pump timing. For most engine problems, the fuel injection pump timing will not have to be adjusted. If the engine performed well at one time, then performance dropped, the fuel injection timing is NOT the problem. Fuel injection timing, once set by the engine manufacturer, should NOT change during the life of the engine.

IMPORTANT: Fuel injection pump timing should NOT change during the life of the engine unless the pump has been altered illegally, or there is excessive wear to the camshaft injection pump cam lobes and lifters.

First check the fuel quality, fuel supply, fuel injectors, air intake system, and engine compression in all cylinders before considering fuel injection timing problems.

If all other possibilities have been ruled out and it is determined that the fuel injection pump and governor assembly are in need of repair, they must be replaced ONLY as complete assemblies.

Only an authorized factory trained technician is allowed to remove and install these assemblies.

FAN/ALTERNATOR DRIVE BELT ADJUSTMENT

Reason:

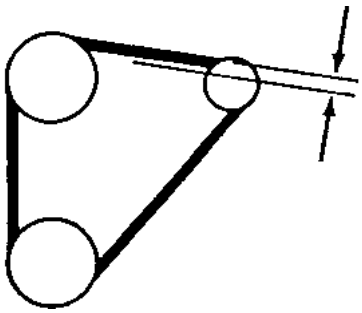
To keep proper tension on the belt to drive the water pump and the alternator.To prevent shortened belt and bearing life.

Equipment:

- JDG529 or JDST28 BeltTension Gauge
- Straight Edge

Procedure:

1. Check the belt tension between the fan and alternator using a belt tension gauge and a straight edge.



2. With applied force of **98 N (22 lb-force)** the belt deflection is **10 - 15 mm (0.4 - 0.6 in.)**.

Results:

- If deflection is not within specifications, loosen both alternator mounting cap screws/nuts. Apply force to FRONT alternator housing only (near the belt) until tension is correct. Tighten cap screws/nuts.

RADIATOR BUBBLE TEST

Reason:

To determine if compression pressure is leaking from cylinder.

Equipment:

- JDG560 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 cap from the recovery tank.
3. Check for bubbles coming from the overflow hose at the bottom of the tank.

- **If bubbles are present, isolate the source of the compression leak.**

4. Remove the injection nozzles.
5. Install JDG560 Adapter in the injection port of the cylinder to be tested.
6. Move the piston to the bottom of the stroke with intake and exhaust valves closed.
7. Connect the hose from a compressed air source to the adapter.
8. Apply shop air pressure into the cylinder.
9. Check for bubbles in the recovery tank or air escaping from the muffler, air cleaner or oil fill opening.
10. 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.

COOLING SYSTEM PRESSURE TEST

Reason:

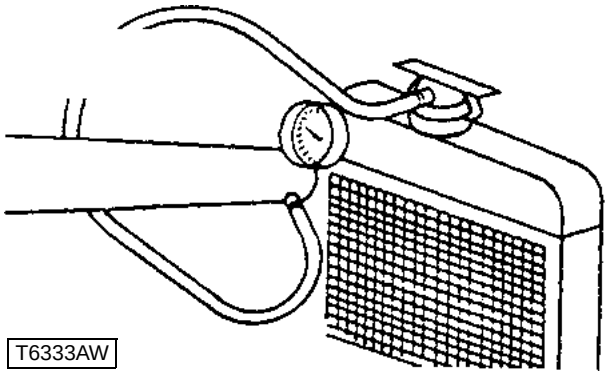
Inspect the cooling system for leaks.

Equipment:

- D05104ST Cooling System Pressure Pump
- JDG692 Radiator Pressure Test Kit (Adapters)

Procedure:

1. Remove the cap and attach the pressure pump to radiator.
2. Apply pressure according to specifications, not to exceed **97 kPa (14 psi).**
3. Check for leaks throughout the cooling system. After **15 seconds** the minimum pressure is **88 kPa (12.8 psi)**.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Results:

- Pressure should hold to **88 ± 15 kPa (12.8 ± 2.2 psi)**. If pressure decreases, check for leaks. Repair leaks or replace parts as necessary.
- If the 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. (See “RADIATOR BUBBLE TEST”).

RADIATOR CAP PRESSURE TEST

Reason:

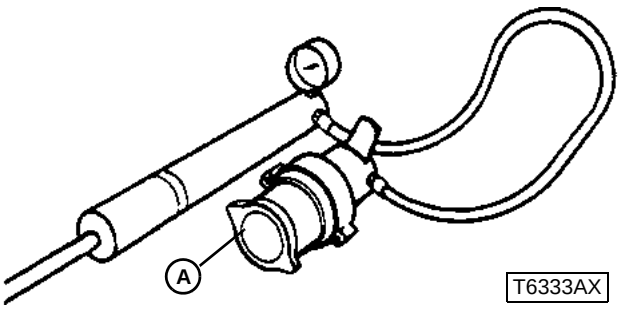
Test the radiator cap for operating in the correct pressure range.

Equipment:

- D05104ST Cooling System Pressure Pump
- JDG692 Radiator Pressure Test Kit (Adapters)

Procedure:

1. Install the radiator cap (A) on the pressure pump.
2. Apply pressure. Pressure valve in the cap should open at **88 kPa (12.8 psi)**.



Results:

- If the cap leaks, retighten and test again. Replace the cap if pressure is not within specification.

ENGINE OIL PRESSURE TEST

Reason:

To determine if the engine bearings or the lubrication system components are worn.

Equipment:

- JT03017 Hose Assembly
- JT05577 Pressure Gauge (100 psi)
- JT03349 Connector

Procedure:

1. Remove the oil pressure sender.
2. Install JTO3349 Connector.
3. Connect JTO3017 Hose Assembly and JTO5577 Pressure Gauge.

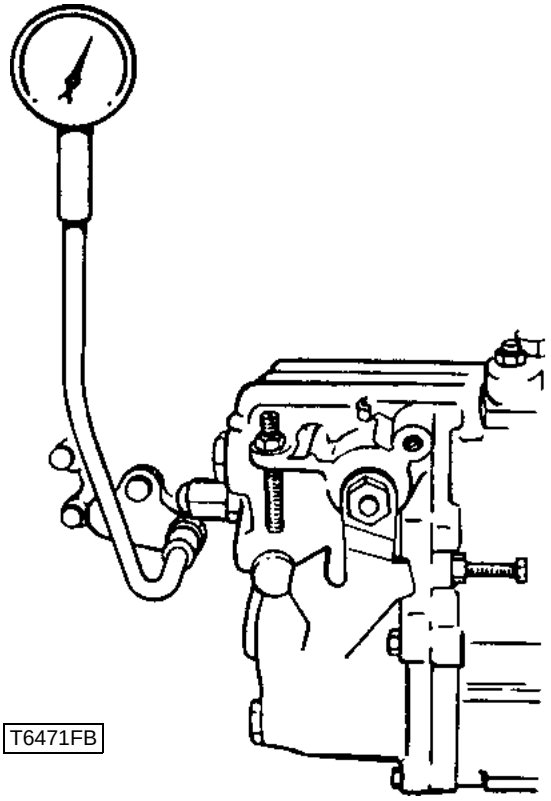
IMPORTANT: DO NOT run the engine if there is insufficient oil pressure!

4. Start the engine. If the pressure reading is below **0.06 MPa (8.7 psi) at slow idle rpm, STOP THE ENGINE**.
5. If the oil pressure is at least **0.06 MPa (8.7 psi)** run the engine approximately five minutes to heat the oil. Check the oil pressure at **2700 rpm.**

Specification:

Oil Pressure

4200 . . . . . 0.29 ± 0.05 MPa (42 ± 7.2 psi)
4300, 4400 . . . . . 0.34 ± 0.05 MPa (49 ± 7.2 psi)



Results:

- If the oil pressure is not within specifications, inspect the oil pump.
- If the oil pump is within specifications, the engine may have parts worn beyond specifications. See the TROUBLESHOOTING CHART for more information.

FUEL TRANSFER PUMP TESTS

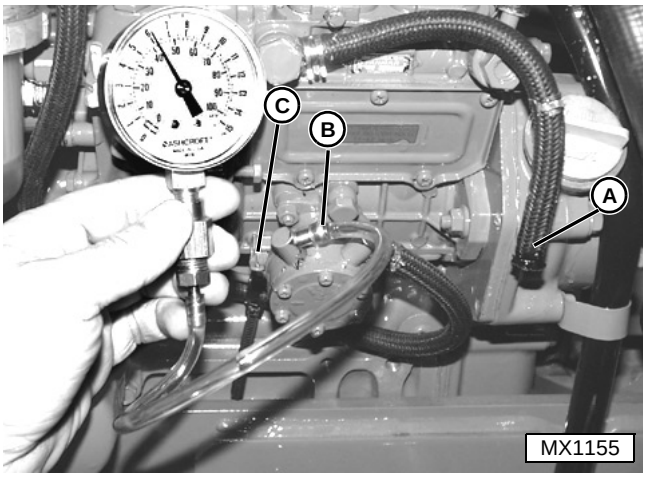
PRESSURE TEST

Reason:

To determine supply pump operating pressure.

Equipment:

- JDG356 Fuel Pump Pressure Test Kit



Procedure:

1. Disconnect the transfer pump to injector pump hose (A).
2. Install the hose and gauge to outlet side of transfer pump (B).
3. Crank or start engine, or operate transfer pump with hand primer lever (C) if equipped.
4. Record fuel pressure reading on gauge.

Results:

If the pressure is below specification, replace the fuel supply pump.

Specification:

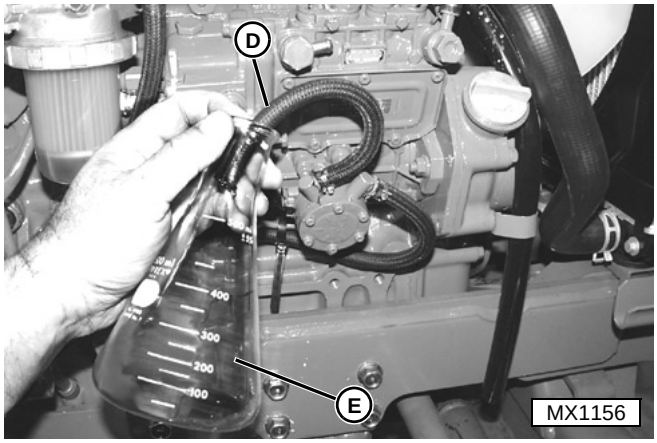
Fuel pressure . . . . . 29 kPa (4.2 psi) min.

FLOW TEST

Conditions:

Fuel temperature for tests. . . . . .15-25°C (59-77°F)

1. Disconnect fuel shutoff solenoid wire.



2. Disconnect fuel transfer pump outlet hose from fuel injection pump (D). Collect fuel in graduated container (E) as key switch is turned to “START” position to crank engine 15 seconds. Compare fuel amount to specification.

Specification:

Fuel flow 15 sec.. . . . . .50 mL (1.5 oz. min.)

FUEL SYSTEM LEAKAGE TEST

Reason:

Tests the 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 the fuel supply line and return line at the fuel tank.
2. Place the fuel return line into a suitable container to catch drained fuel.

⚠ CAUTION

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.
4. Plug the end of the fuel return hose.
5. Apply **34 - 69 kPa (5 - 10 psi)** air pressure to the fuel system at the fuel supply line. DO NOT exceed a maximum pressure of **103 kPa (15 psi)**.

6. 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.

BLEED FUEL SYSTEM

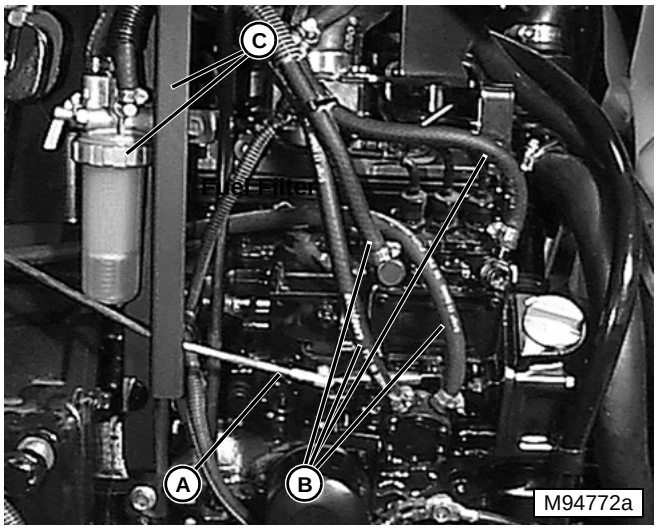
All engines are equipped with an automatic air venting system which makes the fuel system self-bleeding.

- Assure that all fuel line connections are securely tightened.
- Add fuel to the fuel tank.
- Crank the engine to allow fuel system to bleed itself.

ENGINE REPAIR

ENGINE REMOVAL

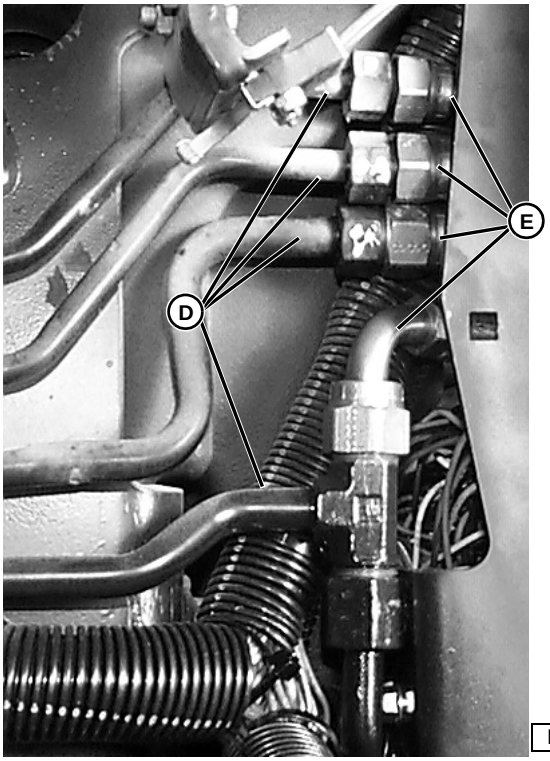
1. Split the tractor between the flywheel housing and the tunnel. (See “TRACTOR SPLITTING FRONT”) in the Hydrostatic Power Train section for HST tractors; (“TRACTOR SPLITTING FRONT”) in the Gear Power Train section for CST tractors; or (“TRACTOR SPLITTING FRONT”) in the SyncReverser Power Train section for SRT tractors.)
2. Remove the hood.
3. Drain the coolant from the radiator and the engine block.
4. Drain the lubrication oil, and the fuel tank.
5. Remove the battery.
6. Remove the muffler.
7. Remove the coolant overflow tank.
8. Remove the air cleaner.
9. Remove the radiator coolant hoses.
10. Disconnect the hydraulic cooler lines.
11. Remove the radiator.
12. Remove the dipstick and tube.
13. Remove the starting motor wires.
14. Disconnect the intake manifold air heater.



15. Disconnect the throttle rod (A).
16. Label and disconnect the fuel hoses (B).
17. Remove the fuel filter shield and fuel filter (C) from the engine.
18. Disconnect the fuel solenoid.
19. Disconnect the oil pressure sending unit.
20. Remove the hood support.
21. Disconnect the fuel tank sending unit.
22. Remove the flasher, if equipped.
23. Remove the steering wheel.
24. Remove the control panel.
25. Remove the left side shield.
26. Disconnect the wiring harness, oil pressure switch, and ground wires from the engine.
27. Remove the return springs, and the left side brake pedals.
28. Remove the bushing from the brake pedal shaft.
29. Remove the return spring, cotter pin, and washer from the brake pedal shaft, and remove the right side pedal with the pedal shaft from the tractor.
30. Label and remove the fuel hoses from the fuel tank.
31. Loosen the dash board support, and pull the support toward the rear of the tractor.
32. Lift out the fuel tank.
33. Remove the pedal support.
34. Install lifting brackets to the cylinder head.
35. Install the engine hoist to the lift brackets. Lift the engine slightly and safely support the tractor frame.

NOTE: Use more than one support to support the frame. The frame will pivot on the front axle, and could slip off of a single support.

36. Disconnect the front wiring harness.



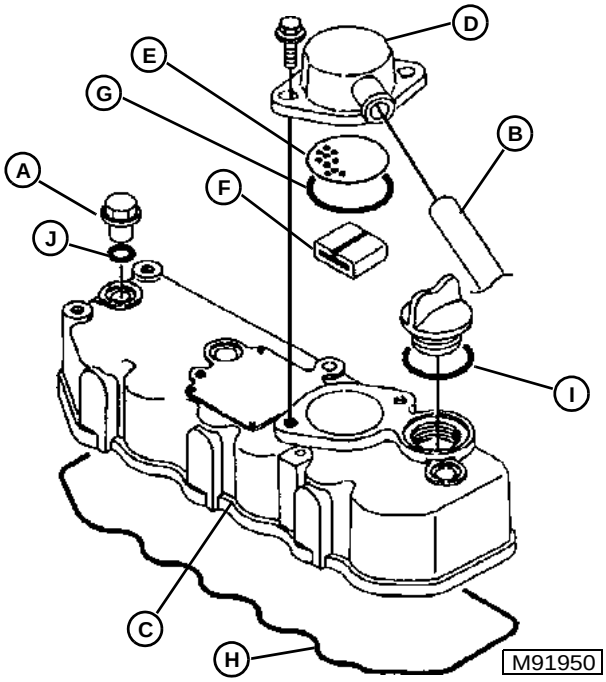
37. Label the hydraulic lines (D) and hoses from the steering control unit (E) and disconnect.
38. Remove the flywheel from the engine. (See "FLYWHEEL").
39. Remove the flywheel housing from the engine.

NOTE: The flywheel housing is heavy. Use an assistant, and proper tools to remove and lift the flywheel housing.
The starting motor may be removed with the flywheel housing.

40. With the frame supported, and the engine attached to the engine hoist, remove the cap screws that fasten the engine oil pan to the frame (eight on each side). Lift and slide the engine out of the back of the frame. Place the engine on a bench or suitable engine stand.

NOTE: The engine is heavy and is a tight fit to the frame. Use an engine hoist and an assistant to remove the engine from the frame.

ROCKER COVER REMOVAL/ INSTALLATION



1. Remove the air cleaner and muffler.
2. Remove three rocker cover nuts (A).
3. Remove the breather hose (B).
4. Remove the rocker cover (C) from the cylinder head.
5. Remove the breather cap (D), plate (E), and baffle (F).
6. Wash the baffle in a safe solvent and blow dry with air. Replace the baffle if it comes apart or is deteriorated.
7. Install the baffle.
8. Install the breather plate and a new O-ring (G) before replacing breather cover.
9. Inspect the rocker cover gasket (H), and O-rings (I) and (J) for before reinstalling the rocker arm cover. Replace if damaged.
10. Clean the cylinder head surface and install the rocker cover to the cylinder head. Install the rocker cover nuts.

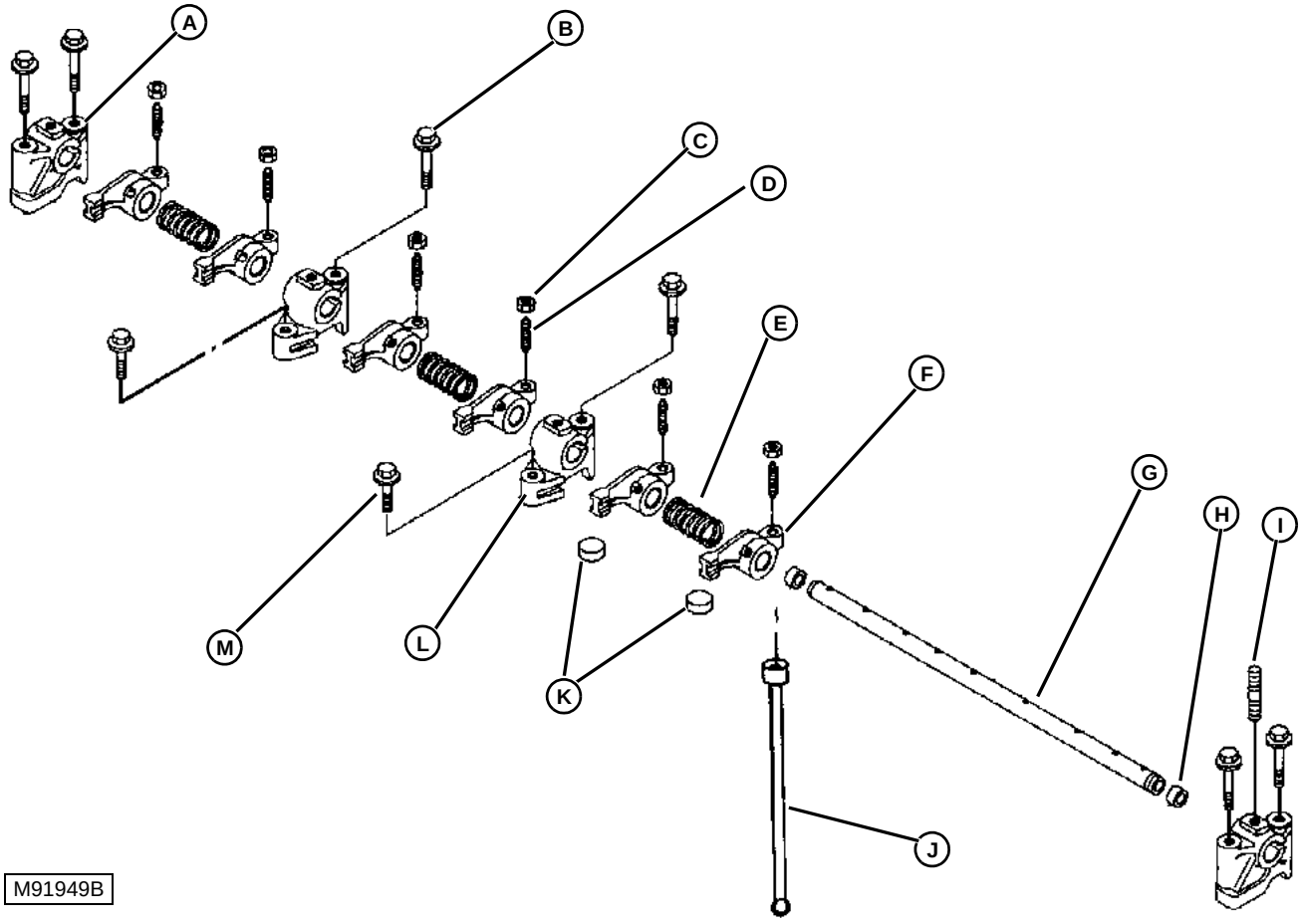
ROCKER ARM ASSEMBLY

Removal/Installation and Disassembly/Assembly:

1. Remove the rocker cover. (See “ROCKER COVER REMOVAL/ INSTALLATION”).
2. Remove the rocker arm end support and rocker arm center support mounting cap screws.
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.
7. Reinstall the push rods to their original location in the cylinder head, with the ball shaped end down in head.
8. Lubricate all parts with clean oil during assembly.
9. Assemble the rocker arm assembly components in the reverse order of removal.
10. Place the rocker arm assembly on the cylinder head.
    - Align the rocker arms with the valves and push rods.
    - Align the rocker arm end supports and center supports with the corresponding holes in the head.
11. Install the rocker arm support cap screws. Tighten the cap screws to **26 N•m (19 lb-ft).**
12. Adjust the valve clearance.



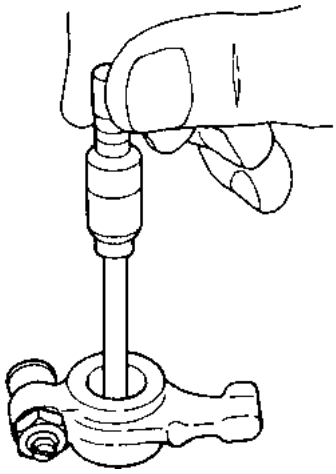
M91949B

A. Shaft End Support (2)
B. Cap Screw M8X50 (6)
C. Jam Nut (6)
D. Adjuster Screw (6)
E. Spring (3)
F. Rocker Arm
G. Rocker Arm Shaft
H. Plug (2)
I. Stud
J. Push Rod (6)
K. Valve Caps (6)
L. Center Support (2)
M. Cap Screw M8X25

Inspection:

M35262

1. Measure the outer diameter of the rocker arm shaft.
- Rocker arm shaft OD is **15.97 - 15.98 mm (0.628 - 0.629 in.).**
- Replace the rocker arm shaft if the OD is less than **15.95 mm (0.628 in.).**

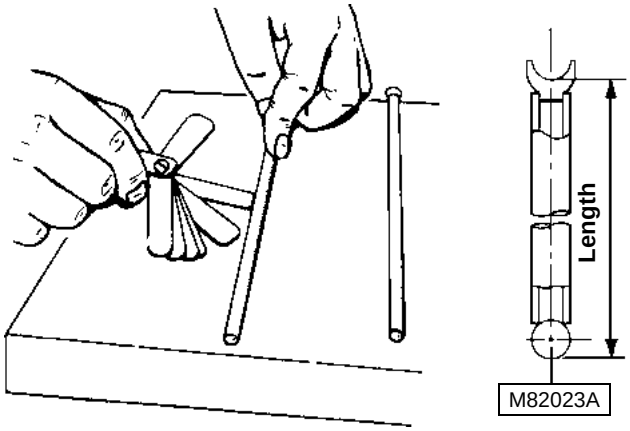


M82022A

2. Measure the inner diameters of the rocker arms and supports.
- Standard ID is **16.00 - 16.02 mm (0.630 - 0.631 in.).**
- Replace the rocker arms or supports if the ID is more than **16.09 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.
- Standard oil clearance is **0.02 - 0.05 mm (0.001 - 0.002 in.)**.
- If the clearance exceeds **0.14 mm (0.006 in.)** replace the rocker arm shaft and rocker arms.

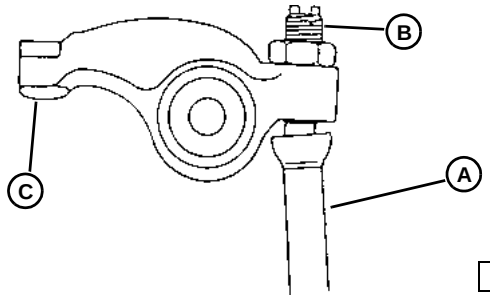
Measure bending of push rod:



M82023A

1. Place the push rod on a flat surface. Use a feeler gauge to measure any gaps between the push rod and flat surface.
- Replace any push rod with more than **(0.03 mm (0.001 in.)** bend.

Inspect Rocker Arm Contact Surfaces:



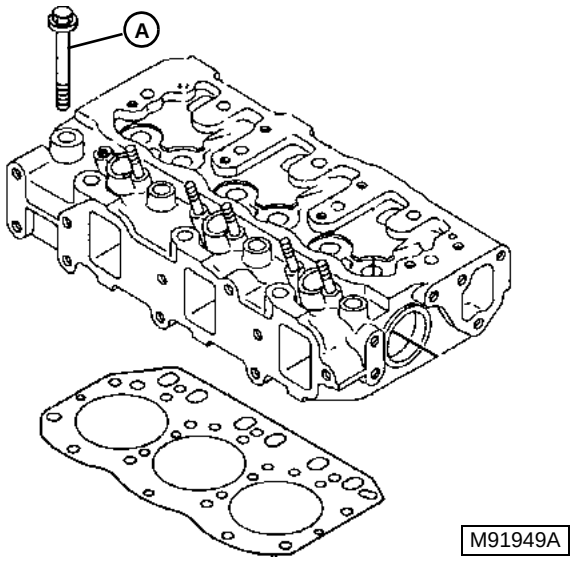
M76398

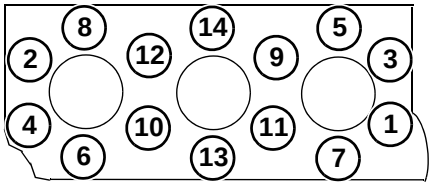
1. Check the surface of the adjusting screw that contacts the push rod (A) for wear. Replace the adjusting screw (B) if it is worn or damaged.
2. Check the surface (C) of the rocker arm that comes in contact with the valve cap for wear. Replace rocker arm if necessary.
3. Check the socket portion of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

CYLINDER HEAD AND VALVES REMOVAL AND INSTALLATION

Removal:

1. Remove the rocker arm cover. (See “ROCKER COVER REMOVAL/ INSTALLATION”).
2. Remove the rocker arm assembly, push rods and valve caps. (“See ROCKER ARM ASSEMBLY”).
3. Remove the exhaust and intake manifolds. (See “EXHAUST MANIFOLD” and “INTAKE MANIFOLD”.)
4. Remove the water pump. (See “THERMOSTAT AND WATER PUMP”).
5. Remove the fuel injection nozzles. (See FUEL INJECTION NOZZLES”).





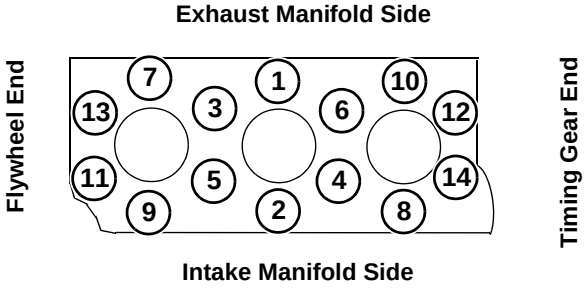
6. Remove the cylinder head bolts (A) in the order shown.
7. Remove the cylinder head from the engine block. The edge opposite the water pump hangs over the engine block. Use this edge to aid in removing the cylinder head. Before using force to remove head, verify that all the bolts are removed from the cylinder head.
8. Disassemble and inspect the cylinder head and valves. (See “CYLINDER HEAD AND VALVES DISASSEMBLY AND ASSEMBLY”).

Installation:

1. Reassemble the cylinder head and valves. (See “CYLINDER HEAD AND VALVES DISASSEMBLY AND ASSEMBLY”).

IMPORTANT: 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.



Cylinder Head Bolt- Tightening Order

4. Dip the head bolts in clean engine oil, install and tighten in the sequence shown, in three stages of gradually-increasing torque. Tighten the head bolts to specification.

Specification:

Cylinder Head Bolt Torque
4200 . . . . . .67 - 71 N•m (49 - 52 lb-ft)
4300, 4400 . . . . . .85 - 91 N•m (63 - 67 lb-ft)

IMPORTANT: Cylinder head bolts must be checked for proper torque after 50 hours of engine operation.

5. Install the fuel injection nozzles. (See FUEL INJECTION NOZZLES”).
6. Install the water pump. (See “THERMOSTAT AND WATER PUMP”).
7. Install the exhaust and intake manifolds. (See “EXHAUST MANIFOLD” and “INTAKE MANIFOLD”.)
8. Install the rocker arm assembly, push rods and valve caps. (See “ROCKER COVER REMOVAL/ INSTALLATION” and “ROCKER ARM ASSEMBLY”).

CYLINDER HEAD AND VALVES DISASSEMBLY AND ASSEMBLY

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. Replace the guides only if necessary. (See VALVE GUIDES").
4. The valve seats are not replaceable. If inspection of the cylinder head reveals valve seats that are damaged or worn beyond repair, the cylinder head must be replaced. (See "CYLINDER HEAD AND VALVES DISASSEMBLY AND ASSEMBLY").
5. Inspect all remaining parts for wear or damage. (See "CYLINDER HEAD AND VALVES DISASSEMBLY AND ASSEMBLY").

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

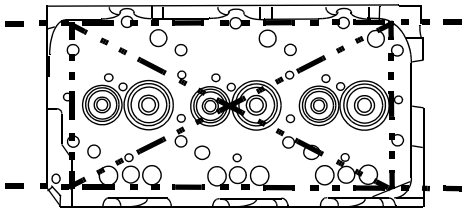
6. Install new valve stem seals over the valve guides.
7. Apply clean engine oil on intake and exhaust valve stems during assembly.
8. Install the valve springs with smaller pitch end or paint mark toward cylinder head.
9. Compress the valve springs and retainer until the collet halves are able to be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

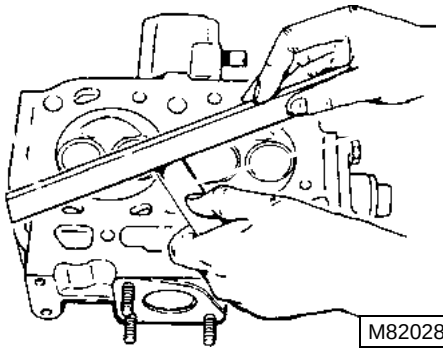
NOTE: After each valve has been assembled, tap on top of valve stem with a plastic hammer to seat retainer.

Inspection/Replacement:

Before inspection, thoroughly clean all components of carbon or dirt.

Cylinder Head:

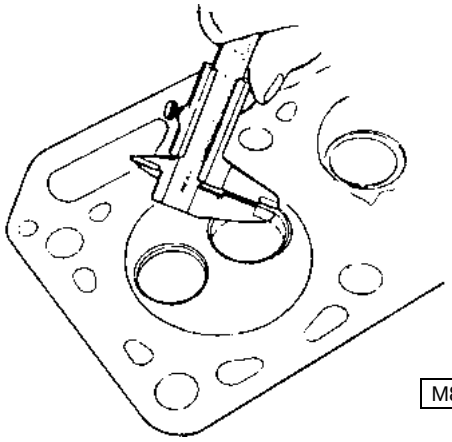




1. To measure the cylinder head flatness, place a straightedge along each of the four sides and each diagonal. Measure clearance between straight edge and combustion surface with a feeler gauge.
- Standard distortion is **0.05 mm (0.002 in.)** or less.
- If the distortion exceeds **0.05 mm (0.002 in.), but is less than 0.15 mm (0.006 in.)** resurface the cylinder head.
- If the distortion is **0.15 mm (0.006 in.) or more,** replace the cylinder head.

2. If the cylinder head was resurfaced:
- Measure piston-to-cylinder head clearance. (See "MEASURE CYLINDER HEAD TO PISTON CLEARANCE").
- Measure valve recession. (See "CYLINDER HEAD AND VALVES DISASSEMBLY AND ASSEMBLY").
- Measure valve seat width. (See "VALVE SEATS").

VALVE SEATS



M82029A

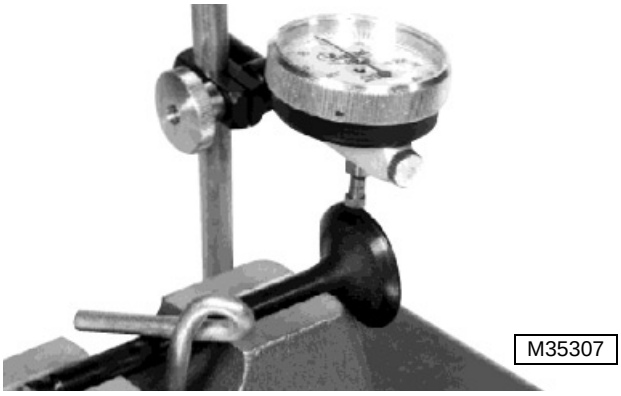
1. Measure the valve seat widths.

SpecificationSpecificationIntake Valve Seat Width
42001.36 - 1.53 mm (0.054 - 0.060 in.)
Wear Limit1.98 mm (0.078 in.)
4300, 44001.07 - 1.24 mm (0.042 - 0.049 in.)
Wear Limit1.74 mm (0.069 in.)

Exhaust Valve Seat Width
4200 . . . . . 1.66 - 1.87 mm (0.066 - 0.074 in.)
Wear Limit . . . . . 2.27 mm (0.089 in.)
4300, 4400 . . . . . 1.24 - 1.45 mm (0.049 - 0.057 in.)
Wear limit . . . . . 1.94 mm (0.076 in.)

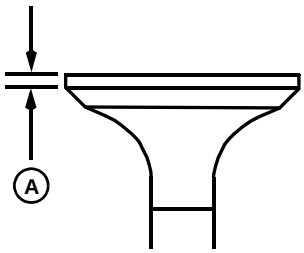
2. If necessary, grind the valve seats to meet specifications. (See “GRIND VALVE SEATS”).

Intake and Exhaust Valves:

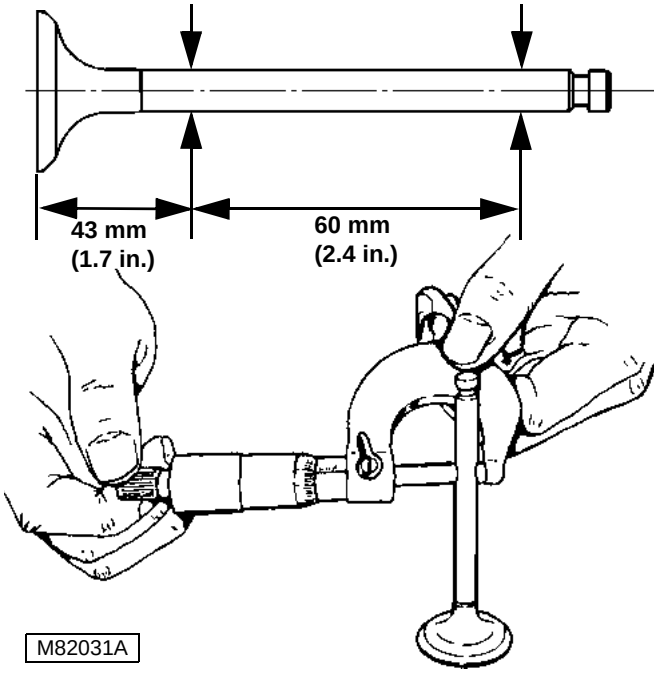


M35307

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



2. If the valve faces are worn, burned or pitted, grind valves to proper face angle.
- If the valve head thickness (A) is less than **0.50 mm (0.020 in.)** after grinding, replace the valve.



M82031A

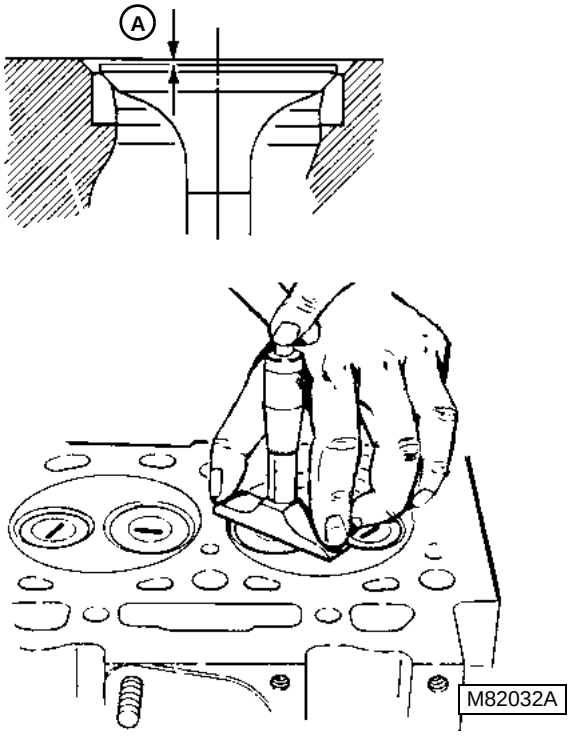
3. Measure the valve stem diameter at two locations, as shown.

Specification:

Intake Valve Stem OD
4200 . . . . . 6.95 - 6.96 mm (0.274 - 0.274 in.)
Wear Limit . . . . . 6.90 mm (0.272 in.)
4300, 4400 . . . . .7.96 - 7.98 mm (0.313 - 0.314 in.).
Wear Limit . . . . . 7.90 mm (0.311 in.)
Exhaust Valve Stem OD
4200 . . . . . 6.94 - 6.96 mm (0.273 - 0.274 in.)
Wear Limit . . . . . 6.90 mm (0.272 in.)
4300, 4400 . . . . . 7.96 - 7.97mm (0.313 - 0.314 in.).
Wear Limit . . . . . 7.90 mm (0.311 in.)

- If the valve stem diameter is less than the wear limit, replace the valve.

VALVE RECESSION



1. Measure valve recession (A) using a depth gauge.

Specification:

Intake Valve Recession
4200 . . . . . 0.30 - 0.50 mm (0.012 - 0.020 in.)
Wear Limit . . . . . 1.00 mm (0.039 in.)
4300, 4400 . . . . . 1.07 - 1.24 mm (0.042 - 0.049 in.)
Wear Limit . . . . . 1.00 mm (0.039 in.)
Exhaust Valve Recession
All. . . . . 0.3 - 0.5 mm (0.012 - 0.020 in.)
Wear Limit . . . . . 1.00 mm (0.039 in.)

VALVE GUIDES

1. Clean the valve guides using a valve guide brush.
2. Measure the valve guide inside diameter.

Specification:

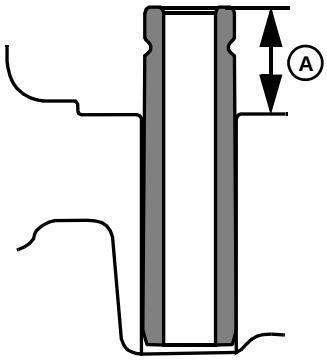
Intake Valve ID
4200 . . . . . 7.00 - 7.015 mm (0.275 - 0.276 in.)
Wear Limit . . . . . 7.08 mm (0.279 in.)
4300, 4400 . . . . . 8.01 - 8.03 mm (0.315 - 0.316 in.).
Wear Limit . . . . . 8.10 mm (0.319 in.)
Exhaust Valve Recession
All. . . . . 0.3 - 0.5 mm (0.012 - 0.020 in.)
Wear Limit . . . . . 1.00 mm (0.039 in.)

3. Subtract the valve stem OD from the valve guide ID to obtain the oil clearance.

Specification:

Valve Stem-To-Guide Oil Clearance
Intake Valve
All. . . . . 0.04 - 0.07 mm (0.001 - 0.003 in.)
Wear Limit- 4200. . . . . 0.18 mm (0.007 in.)
Wear Limit- 4300, 4400. . . . . 0.20 mm (0.008 in.)
Exhaust Valve
All . . . . . 0.05 - 0.08 mm (0.002 - 0.003 in.)
Wear Limit- 4200. . . . . 0.18 mm (0.007 in.)
Wear Limit- 4300, 4400. . . . . 0.20 mm (0.008 in.)

- If the ID of the valve guide is less than the wear limit, 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 using D-20019WI Valve Guide Knurler
- If clearance exceeds **0.20 mm (0.008 in.)**, replace valve guides using JDE118 Valve Guide Driver.



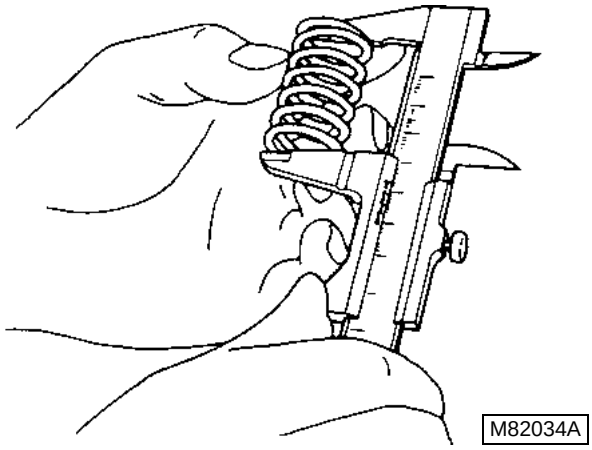
- New valve guides must be cooled in a container of liquid nitrogen or equivalent before driving into cylinder head.
- The intake and exhaust valve guides are different. The exhaust valve guide has one groove and the intake valve guide has none.
- Install the valve guides with the tapered ends down. Push the valve guides into the cylinder head until the valve guide projection (A) is within specification.

Specification:

Valve Guide Projection
4200 . . . . . 12 mm (0.472 in.)
4300, 4400 . . . . . 15 mm (0.591 in.)

- Ream the inside diameter of valve guides using D-20021WI Valve Guide Reamer.

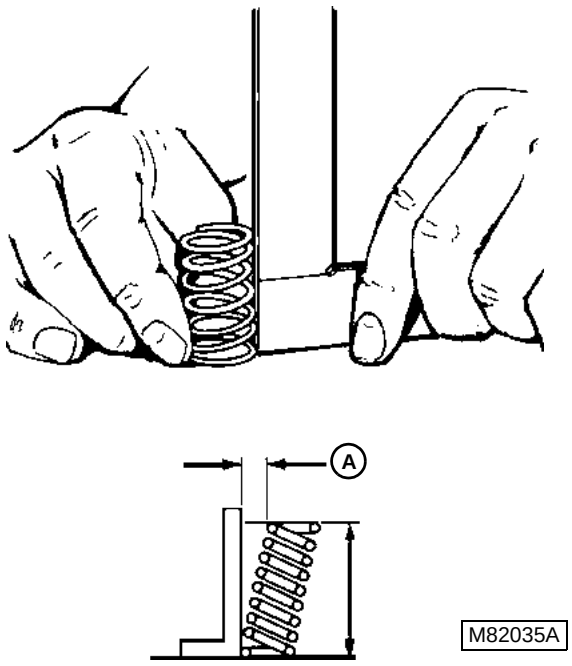
VALVE SPRINGS



1. Measure the valve spring free length.

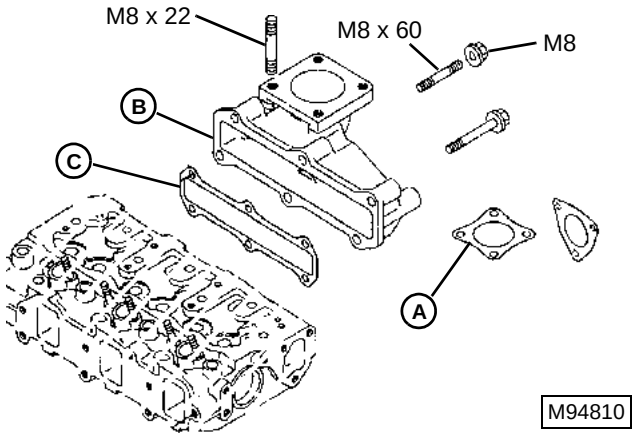
Specification:

Valve Spring Free Length
4200 . . . . . 44.4 mm (1.75 in.)
4300, 4400 . . . . . 42 mm (1.654 in.)



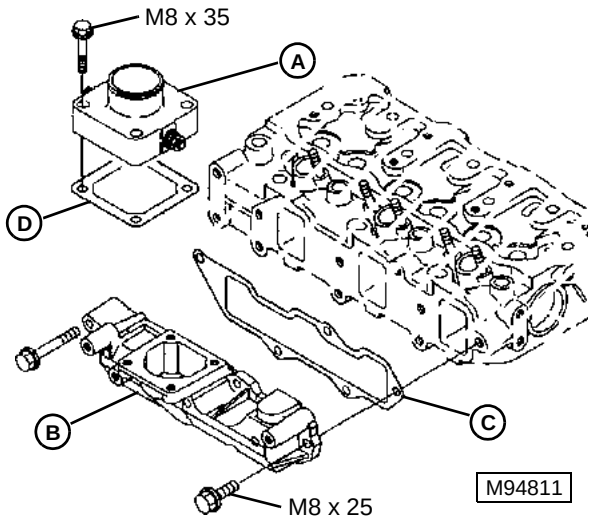
2. Measure the spring inclination (A).
• Replace the spring if the measurement exceeds **1.10 mm (0.044 in.)**

EXHAUST MANIFOLD



1. Remove the muffler and gasket (A).
2. Remove the exhaust manifold (B) and gasket (C).
3. Clean the mating surfaces, and replace the exhaust manifold gasket.
4. Install the exhaust manifold. Tighten all fasteners.

INTAKE MANIFOLD

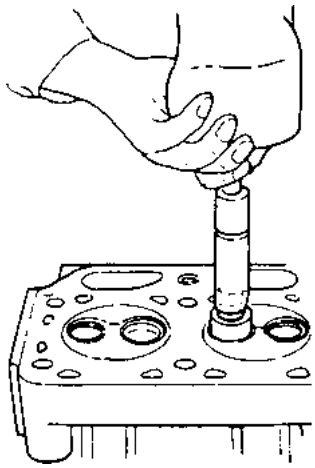


1. Remove the fuel filter bracket (not shown).
2. Remove the intake air heater (A).
3. Remove the fuel injection lines (not shown).
4. Remove the intake manifold (B).
5. Clean the mating surfaces, and replace the intake manifold gasket (C).
6. Install the intake manifold.
7. Replace the intake air heater gasket (D), and install the intake air heater.
8. Install the fuel injection lines.
9. Tighten all fasteners to specification.

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 manufacturers instructions.



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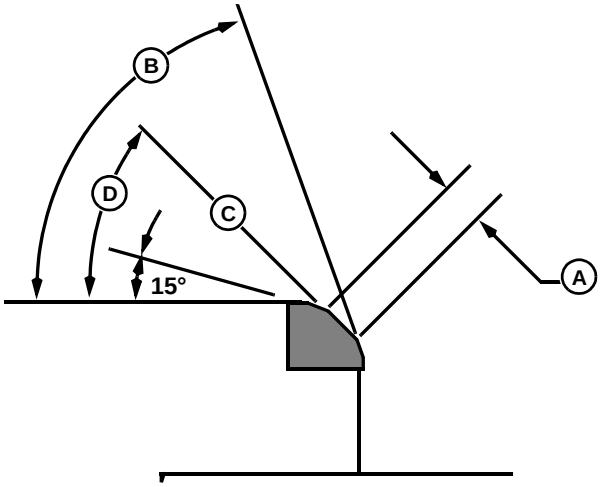
2. Measure the valve seat width after grinding.

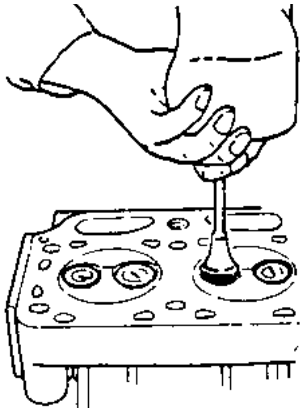


3. If the seat width (A) is too wide after grinding, grind the lower seat surface (B) using a 70° seat grinder until the seat width is close to specifications.
4. Grind the upper seat surface (C) using a 15° seat grinder until the seat width is narrowed to specifications.
5. If the valve seats (D) are ground, measure valve recession. (See “CYLINDER HEAD AND VALVES DISASSEMBLY AND ASSEMBLY”) Check the contact pattern between the seat and valve with bluing dye.
6. Lap the valves. (See “LAP VALVES”).

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

LAP VALVES

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



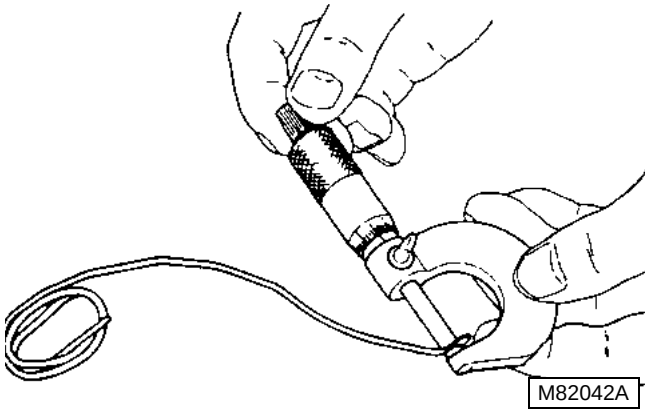
M82041A

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.
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.

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 “CYLINDER HEAD AND VALVES REMOVAL AND INSTALLATION”).
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.

• If the clearance is less than **0.64 - 0.82 mm (0.025 - 0.032 in.)**, replace cylinder head. (See "CYLINDER HEAD AND VALVES REMOVAL AND INSTALLATION").

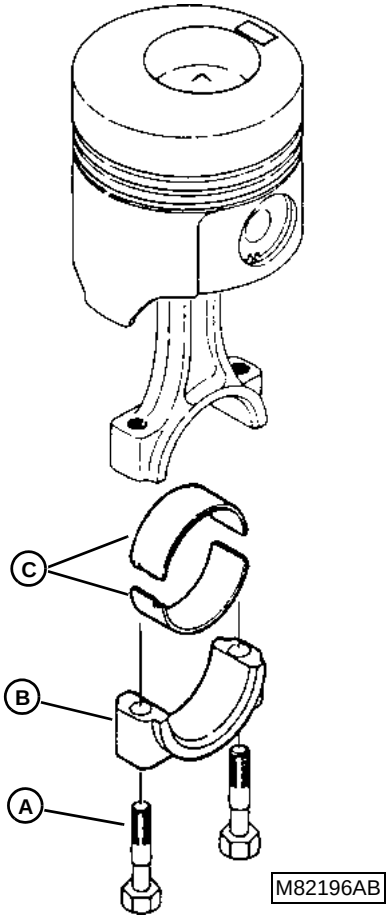
PISTON AND CONNECTING ROD

NOTE: The engine must be removed from the tractor to perform this procedure.

Removal:

1. Remove the oil pan, and oil pickup tube.
2. Remove the cylinder head. (See "CYLINDER HEAD AND VALVES REMOVAL AND INSTALLATION").
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 "CONNECTING ROD SIDE PLAY CHECK").
6. Measure the crankshaft end play. (See "CRANKSHAFT END PLAY").
7. Measure the connecting rod bearing clearance. (See "CONNECTING ROD BEARING CLEARANCE CHECK").

IMPORTANT: 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 bolts (A), connecting rod cap (B) and bearing inserts (C).

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

9. Note the connecting rod alignment mark in relation to the cylinders. Starting at the flywheel end with cylinder number one, then two, 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. (See "PISTON CLEARANCE CHECK").
12. Inspect the cylinder bore. (See "CYLINDER BORE").

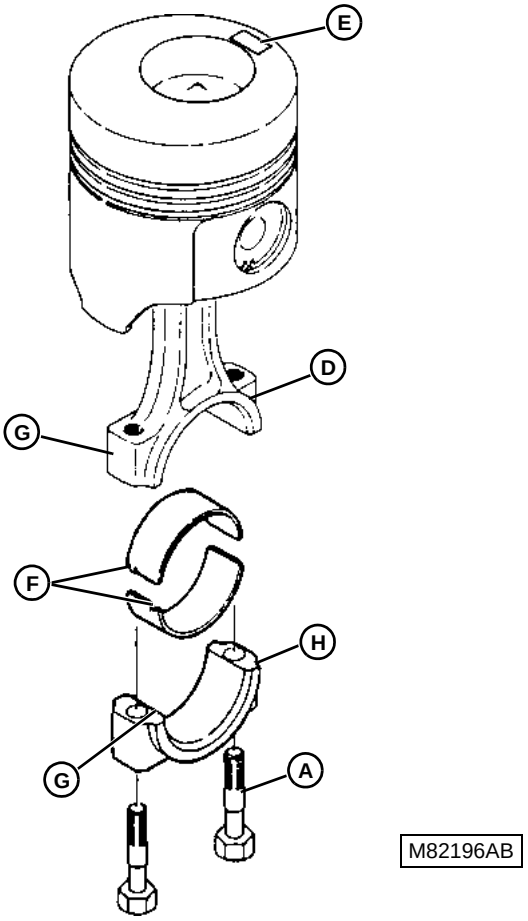
Installation:

• Apply clean engine oil to all parts during installation.

• Always replace the connecting rod bolts. DO NOT reuse the bolts.

IMPORTANT: 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 "Disassembly" below.)



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: 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: 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 bolt in clean engine oil. Install new bolts and tighten to specification.

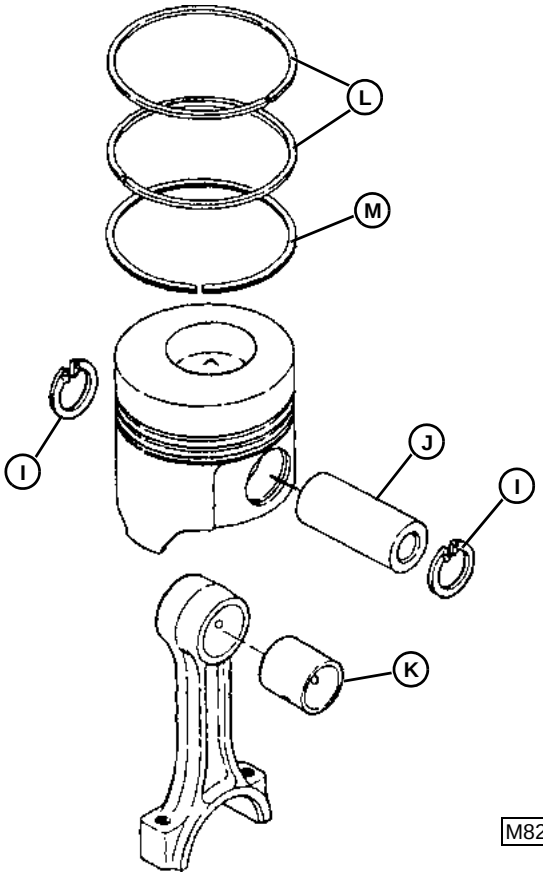
Specification:

Connecting Rod Bolt Torque
4200 . . . . . .37 - 41 N•m (27 - 30 lb-ft)
4300, 4400 . . . . . .44 - 54 N•m (33 - 40 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 "CYLINDER HEAD AND VALVES REMOVAL AND INSTALLATION").
8. Install the oil pan, and oil pickup tube.

Disassembly:

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



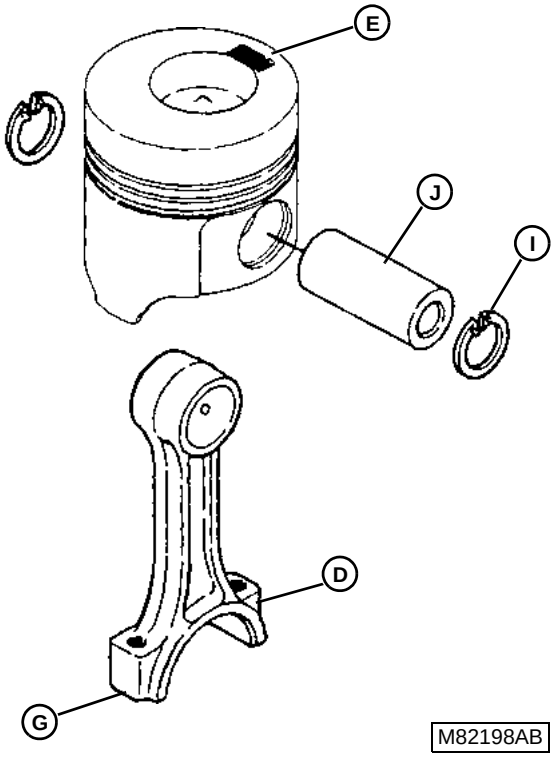
- Put a mark on each piston and connecting rod to aid in assembly.

- Remove snap rings (I) from piston pin (J) and remove pin.
- The piston pin bushing (K) is a press fit in the connecting rod. Remove the bushing only if replacement is necessary.
- Inspect all parts for wear or damage. Replace as necessary.
- Remove the 1st and 2nd compression rings (L) and oil ring with expander (M).

Assembly:

- Apply clean engine oil to all parts during assembly.

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



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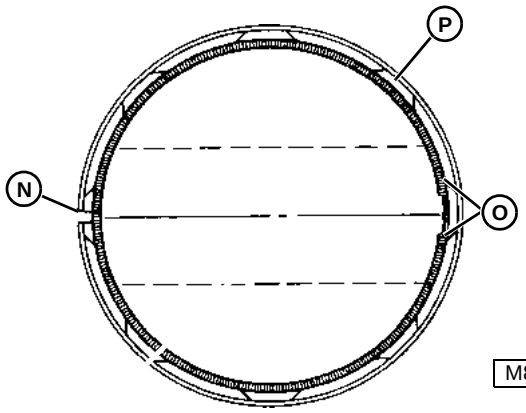
1. Assemble the piston to the connecting rod with piston mark (E) on the same side as the connecting rod stamped mark (D). If a new connecting rod is used, assemble the piston to the connecting rod with piston mark opposite the connecting rod bearing insert groove (G). Be sure the oil hole in the piston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



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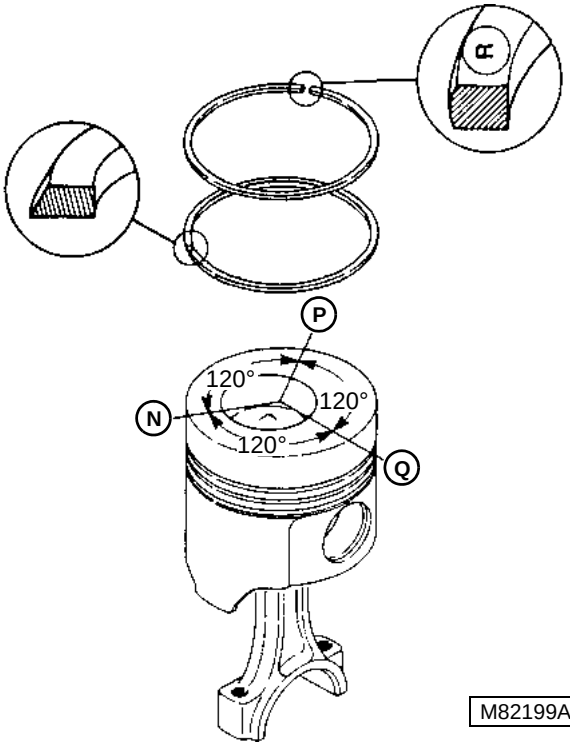
4. Install the oil ring over the expander with the ring gap (N) opposite (180°) of the expander ends (O).
5. Install the second compression ring, with the small diameter of taper toward top of piston, in the middle groove. Turn the ring until the gap (P) is 120° away from the oil ring gap (N).



M82199A

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 (Q) is 120° away from the second ring gap.

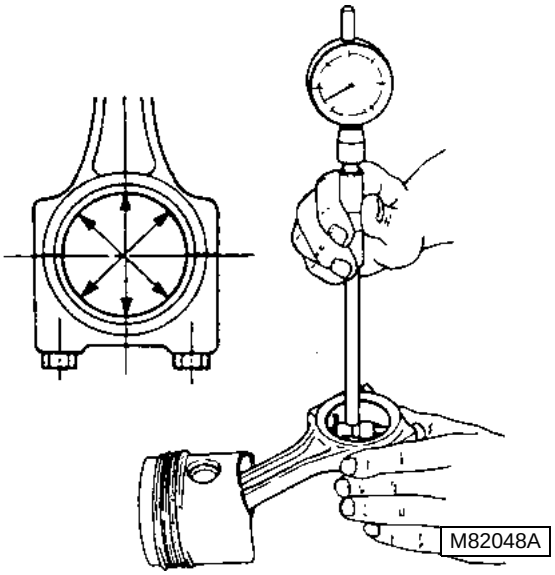
PISTON INSPECTION

Connecting Rod Bearing

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

Specification:

Connecting Rod Bolt Torque
4200 . . . . . .37 - 41 N•m (27 - 30 lb-ft)
4300, 4400 . . . . . .44 - 54 N•m (33 - 40 lb-ft)



2. Measure the connecting rod bearing diameter.

Specification:

Connecting Rod Bearing ID
4200 . . . . . 46.00 - 46.02 mm (1.811 - 1.812 in.)
4300, 4400 . . . 51.00 - 51.01 mm (2.008 - 2.008 in.)

Result

- Replace the bearing inserts if the bearing diameter is not within specification.

3. Measure the oil clearance between the bearing inserts and the crankshaft, and verify that the clearance is within specification.

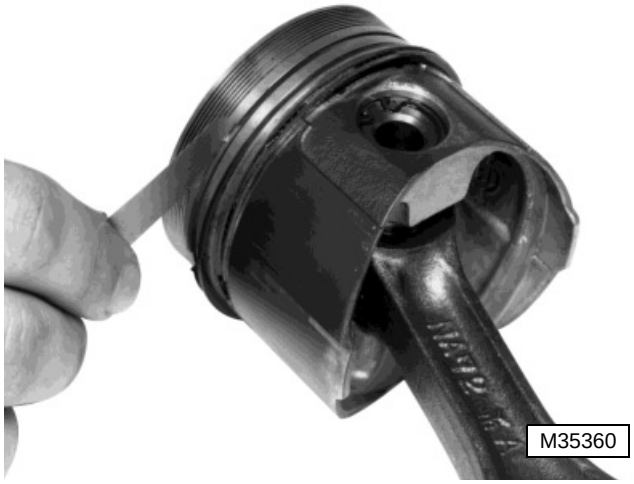
Specification:

Connecting Rod Bearing Oil Clearance
4200 . . . . . 0.04 - 0.09 mm (0.002 - 0.004 in.)
Wear Limit. . . . . 0.25 mm (0.010 in.)
4300, 4400 . . . . . .0.04 - 0.07mm (0.002 - 0.003 in.)
Wear Limit. . . . . 0.16 mm (0.006 in.)

Result:

- 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.

Piston Ring Groove

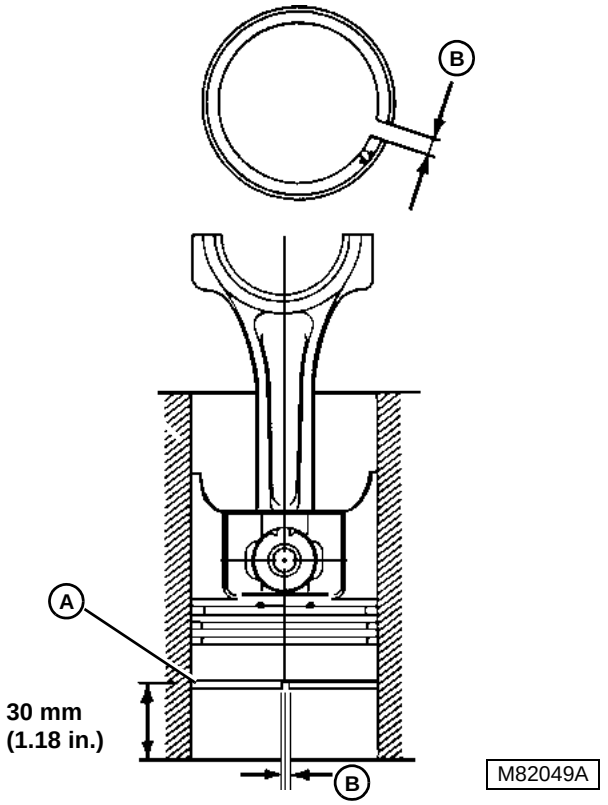


1. With the rings installed on the piston, measure the piston ring groove side clearance. Measure at several places around each piston.
2. Replace the rings or the piston if the clearances exceed specification.

Specification:

First compression ring groove- side clearance
All . . . . . 0.08 - 0.11 mm (0.003 - 0.004 in.)
Second compression ring groove- side clearance
4200, 4400 . . . . . 0.04 - 0.07 mm (0.001 - 0.003 in.)
4300 . . . . . 0.05 - 0.08 mm (0.002 - 0.003 in.)
Oil control ring groove- side clearance
All . . . . . 0.03 - 0.06 mm (0.001 - 0.002 in.)

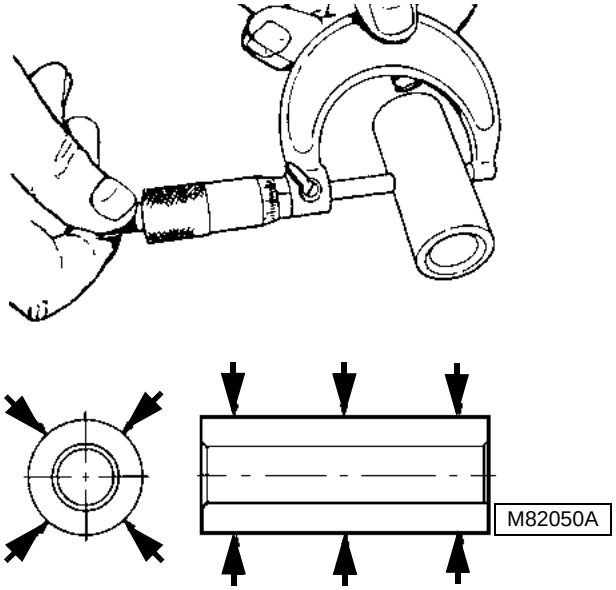
Piston Ring End Gap



1. Use a piston to push the ring (A) approximately **30 mm (1.18 in.)** from the bottom of the cylinder bore. Measure the piston ring end gap (B).

Specification:

Piston Ring End Gap
All . . . . . 0.20 - 0.40 mm (0.008 - 0.016 in.)
Wear Limit. . . . . 1.50 mm (0.059in.)

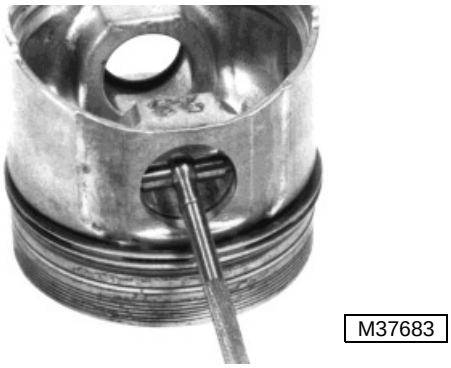


1. Measure the piston pin diameter. Measure the diameter at six places. Replace any pin that is not within specification.

Specification:

Piston Pin OD
4200 . . . . . 22.99 - 23.00 mm (0.905 - 0.906 in.)
Wear Limit. . . . . 22.90 mm (0.902 in.)
4300, 4400 . . . 25.99 - 26.00 mm (1.023 - 1.024 in.)
Wear Limit. . . . . 25.90 mm (1.020 in.)

Piston Pin Bore:



1. Measure the pin bore diameter in the piston.

Specification:

Piston Pin Bore ID
4200 . . . . . 23.00 - 23.01 mm (0.906 - 0.906 in.)
Wear Limit. . . . . 23.02 mm (0.906 in.)
4300, 4400 . . . 26.00 - 26.01 mm (1.024 - 1.024 in.)
Wear Limit. . . . . 26.02 mm (1.024 in.)

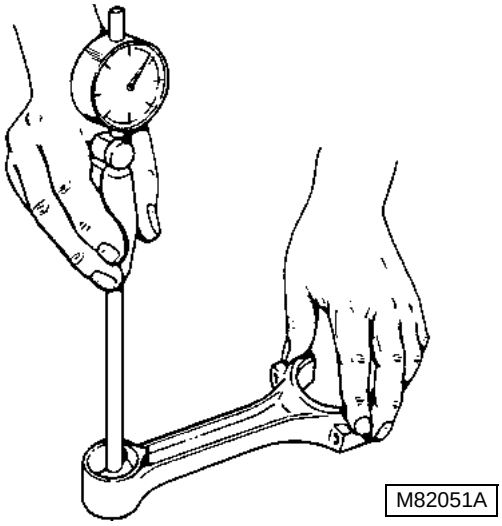
2. Piston pin-to-piston oil clearance is the bore ID minus the pin OD.

Specification:

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

- 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.

Piston Pin Bushing



1. Measure the piston pin bushing diameter in the connecting rod.

Specification:

Piston Pin Bushing ID
4200 . . . . . 23.02 - 23.04 mm (0.906 - 0.907 in.)
Wear Limit . . . . . 23.10 mm (0.909 in.)
4300, 4400 . . . 26.03 - 26.04 mm (1.025 - 1.025 in.)
Wear Limit . . . . . 26.10 mm (1.028 in.)

- If the bushing diameter exceeds the wear limit, replace bushing.

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.

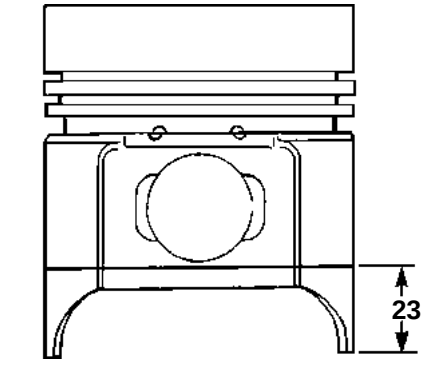
Specification:

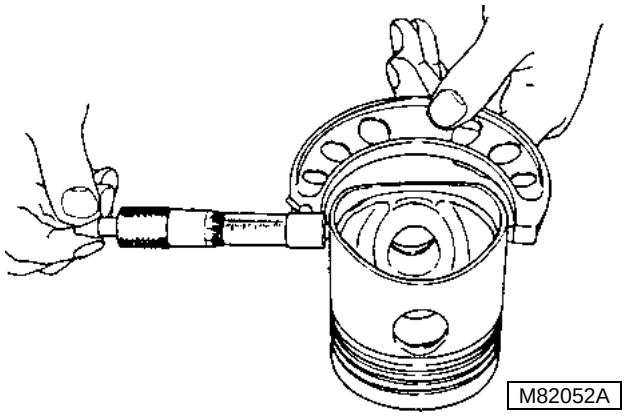
Piston Pin-to-Rod Bore Oil Clearance
All . . . . . 0.03 - 0.05 mm (0.001 - 0.002 in.)
Wear Limit . . . . . 0.20 mm (0.008 in.)

NOTE: The piston pin bushing is a 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.

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.*





1. Measure the piston diameter perpendicular to the piston pin bore **23 mm (0.905 in.)** from the bottom of the piston skirt.

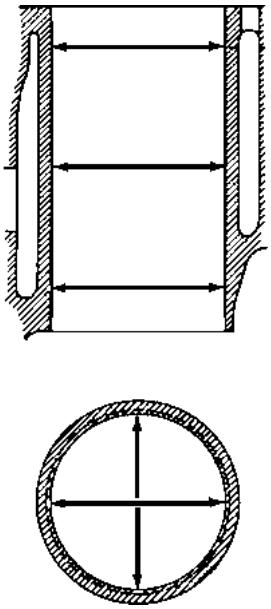
Specification:

Standard Piston OD
4200 . . . . . 77.95 - 77.98 mm (3.069 - 3.070 in.)
Wear Limit . . . . . 77.90 mm (3.067 in.)
4300 . . . . . 83.95 - 83.98 mm (3.305 - 3.306 in.)
Wear Limit . . . . . 83.90 mm (3.303 in.)
4400 . . . . . 87.95 - 87.98 mm (3.462 - 3.464 in.)
Wear Limit . . . . . 87.90 mm (3.461 in.)
Oversize Piston OD
4200 . . . . . 78.20 - 78.23 mm (3.079 - 3.080 in.)
Wear Limit . . . . . 78.15 mm (3.077 in.)
4300 . . . . . 84.20 - 84.23 mm (3.315 - 3.316 in.)
Wear Limit . . . . . 84.10 mm (3.311 in.)
4400 . . . . . 88.20 - 88.23 mm (3.472 - 3.474 in.)
Wear Limit . . . . . 88.10 mm (3.469 in.)

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

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.*



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1. Measure the cylinder bore diameter at three positions; top, middle and bottom. At these three positions, measure in both directions; along the crankshaft center line and the direction of the crankshaft rotation.

Specification:

Standard Cylinder Bore ID
4200 . . . . . 78.00 - 78.03 mm (3.071 - 3.072 in.)
Wear Limit. . . . . 78.20 mm (3.079 in.)
4300 . . . . . 84.00 - 84.03 mm (3.307 - 3.308 in.)
Wear Limit. . . . . 84.20 mm (3.315 in.)
4400 . . . . . 88.00 - 88.03 mm (3.465 - 3.466 in.)
Wear Limit. . . . . 88.20 mm (3.472 in.)
Oversize Cylinder Bore ID
4200 . . . . . 78.25 - 78.28 mm (3.081 - 3.082 in.)
4300 . . . . . 84.25 - 84.28 mm (3.317 - 3.318 in.)
4400 . . . . . 88.25 - 88.28 mm (3.474 - 3.476 in.)
Piston-to-Cylinder Clearance
4200 . . . . . 0.050 mm (0.002 in.)
4300, 4400 . . . . . 0.055 mm (0.002 in.)
Cylinder Roundness
All. . . . . 0.00 - 0.01 mm (0.00 - 0.000 4in.)
Wear Limit. . . . . 0.03 mm (0.001 in.)
Cylinder Taper
All. . . . . 0.00 - 0.01 mm (0.00 - 0.0004 in.)
Wear Limit. . . . . 0.03 mm (0.001 in.)

- If the cylinder bore standard ID exceeds the wear limit, have the cylinder rebored.
- If the cylinder is rebored, oversize pistons and rings must be installed.
- If the cylinder bore exceeds the oversize bore ID, replace the cylinder block.
- If the piston-to-cylinder bore clearance (cylinder bore ID minus piston OD) exceeds specification, replace the cylinder block, piston or both; or rebore cylinder and install oversize piston and rings.
- Slight uneven wear, flaws, or minor damage may be corrected by deglazing. (See “CYLINDER BORE”).

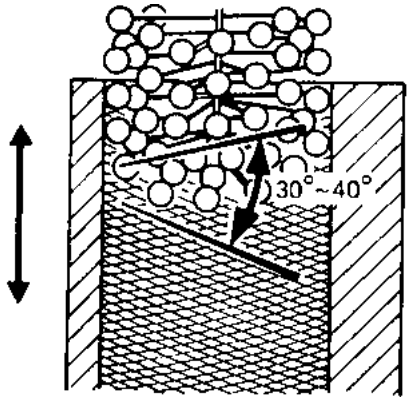
Deglazing:

IMPORTANT: 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: 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.



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Reboring:

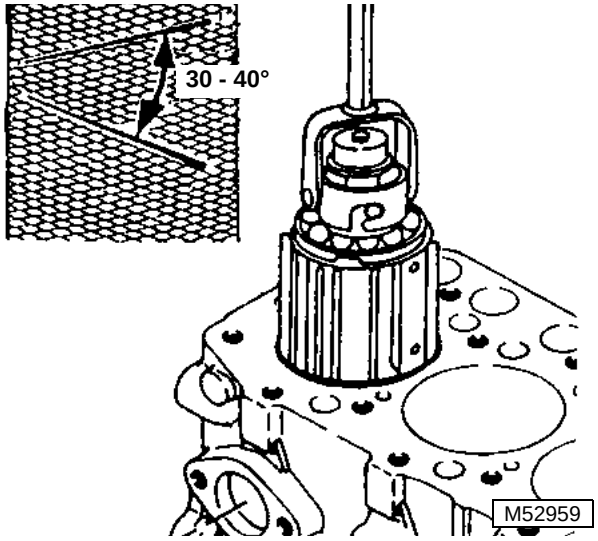
NOTE: The cylinder block can be rebored to use

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: 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, taper and out-of-round. (See *Inspection* procedures.)

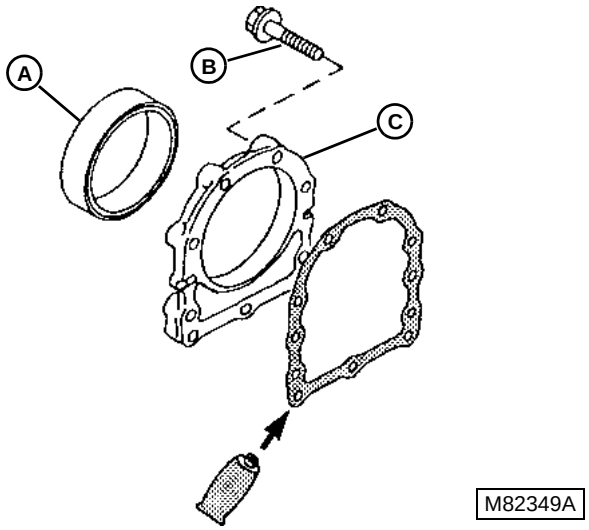
IMPORTANT: Do not use solvents to clean the cylinder bores. Solvents will not remove all the metal particles and abrasives produced during honing.

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

CRANKSHAFT REAR OIL SEAL

Replacement:

1. Split the tractor between the flywheel housing and the tunnel. (See “TRACTOR SPLITTING FRONT”) in the Hydrostatic Power Train section for HST tractors; (“TRACTOR SPLITTING FRONT”) in the Gear Power Train section for CST tractors; or (“TRACTOR SPLITTING FRONT”) in the SyncReverser Power Train section for SRT tractors.)
2. Remove the drive coupling.
3. Remove flywheel. (See “FLYWHEEL”).

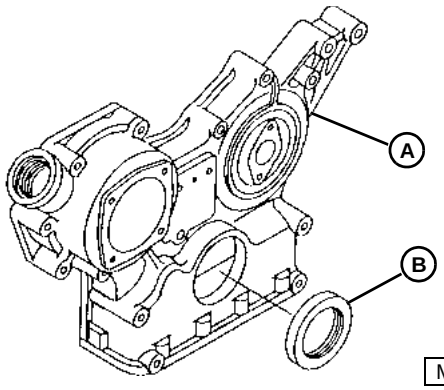


4. Remove the rear oil seal (A), case-to-crankcase extension cap screws and the oil seal case-to-crankcase cap screws (B).
5. Remove the rear oil seal case (C).
6. Replace the oil seal. Install the seal, with the lip toward the cylinder block, flush with the surface of the oil seal case.

*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.*

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

CRANKSHAFT FRONT OIL SEAL



1. Remove the timing gear cover (A). (See “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.

CRANKSHAFT AND MAIN BEARINGS

Removal:

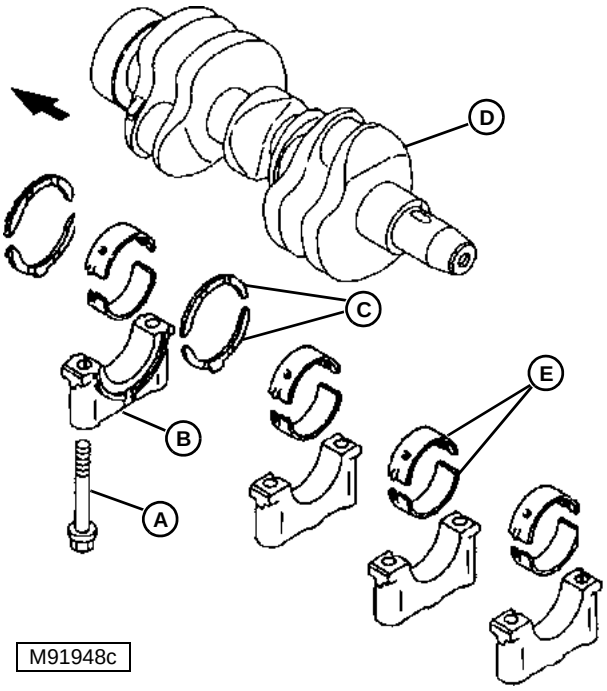
1. Check the crankshaft end play. (See “CRANKSHAFT END PLAY CHECK”).
2. Remove the cylinder head. (See “CYLINDER HEAD AND VALVES REMOVAL AND INSTALLATION”).
3. Remove the rear oil seal. (See “CRANKSHAFT REAR OIL SEAL”).
4. Remove the timing gear cover mounting plate. (See “TIMING GEAR COVER”).
5. Check the crankshaft rod bearing clearance. (See “CONNECTING ROD BEARING CLEARANCE CHECK”).

IMPORTANT: 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 “CRANKSHAFT MAIN BEARING CLEARANCE CHECK”).

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

7. Remove the connecting rod bolts and rod caps. Discard the connecting rod bolts.
8. Push the pistons and connecting rods away from crankshaft.



9. Remove the main bearing bolts (A), caps (B) and cap 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:

- Apply clean engine oil to all parts during installation.

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

1. Install the grooved bearing inserts in the crankshaft bearing bores, aligning the tangs with the slots in the bores.
2. Install the block thrust bearings with the oil grooves facing away from the engine block.
3. Install the crankshaft.
4. 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.

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

IMPORTANT: DO NOT use high speed power tools or air wrenches to tighten main bearing bolts.

7. Dip each main bearing bolt entirely in clean engine oil. Install the bolts and tighten. DO NOT tighten to specifications.
8. Using a soft-faced hammer, tap the front end of the crankshaft then the rear end of the crankshaft to align the thrust bearings.
9. Tighten the main bearing bolts 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 Bolt Torque
4200 . . . . . .76.5 - 80.4 N•m (56 - 59 lb-ft)
4300, 4400 . . . . . .96 - 100 N•m (71 - 74 lb-ft)

IMPORTANT: The connecting rod caps must be installed on the same connecting rods they were removed from.
Never reuse connecting rod bolts, replace with new.

10. Match the connecting rod caps to the rods using alignment marks. Install the caps to the rods.
11. Dip entire connecting rod bolt in clean engine oil. Install new bolts to the rods, and tighten to specification.

Specification:

Connecting Rod Bolt Torque
4200 . . . . . .37 - 41 N•m (27 - 30 lb-ft)
4300, 4400 . . . . . .44 - 54 N•m (33 - 40 lb-ft)

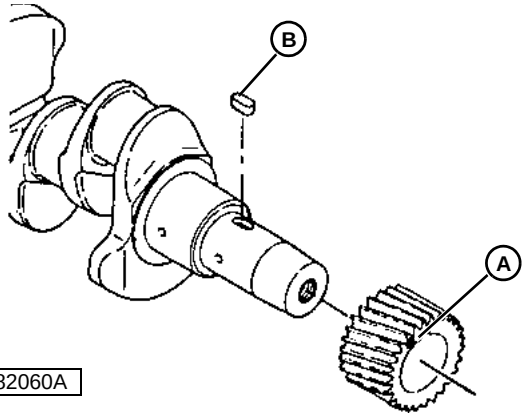
12. Install the timing gear cover mounting plate. (See "TIMING GEAR COVER MOUNTING PLATE").
13. Install the rear oil seal. (See "CRANKSHAFT REAR OIL SEAL
14. Install the flywheel. (See "FLYWHEEL").
15. Install the timing gear cover. (See "TIMING GEAR COVER").
16. Install the front oil seal. (See "CRANKSHAFT FRONT OIL SEAL".)
17. Install the oil pan.

Inspection/Replacement:

- Inspect the crankshaft gear for chipped or broken teeth. Replace if necessary.

To Replace Gear:

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



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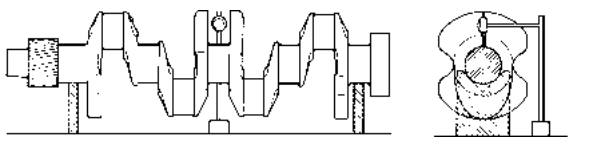
2. Heat new gear to approximately **150°C (302°F)**. Install gear with timing mark (A) toward press table. Align slot in gear with key (B) in shaft. Press crankshaft into gear until gear is tight against crankshaft shoulder.

⚠ CAUTION

DO NOT heat oil over 182° C (360° F). Oil fumes or oil can ignite above 193° C (380° F). Use a thermometer. Do not allow a flame or heating element to come in direct contact with the oil. Heat the oil in a well-ventilated area. Plan a safe handling procedure to avoid burns.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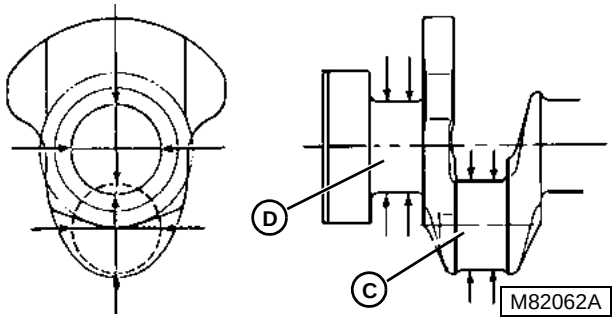
3. Inspect the crankshaft for bend using V-blocks and a dial indicator. Turn the crankshaft slowly and read variations on the indicator. If the variation is greater than **0.02 mm (0.001 in.)**, replace the crankshaft.
4. Measure the crankshaft connecting rod journal and main bearing journal diameters at several places around each journal.



Specification:

Connecting Rod Journal OD (C):
4200 . . . . . 42.95 - 42.96 mm (1.691 - 1.691 in.)
Wear Limit . . . . . 42.91 mm (1.689 in.)
4300, 4400 . . . 47.95 - 47.96 mm (1.888 - 1.888 in.)
Wear Limit . . . . . 47.91 mm (1.886 in.)

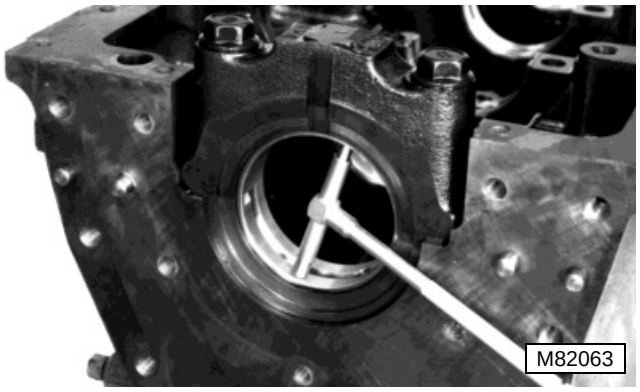
Main Bearing Journal OD (D):
4200 . . . . . 46.95 - 46.96 mm (1.848 - 1.849 in.)
Wear Limit . . . . . 46.91 mm (1.847 in.)
4300, 4400 . . . 53.95 - 53.96 mm (2.124 - 2.124 in.)
Wear Limit . . . . . 53.91 mm (2.122 in.)

- If the journal diameter (C) 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.

5. Install the bearing inserts and main bearing caps on the main bearings. Tighten the main bearing bolts to specification.

Specification:

Main Bearing Bolt Torque
4200 . . . . . .76.5 - 80.4 N•m (56 - 59 lb-ft)
4300, 4400 . . . . . .96 - 100 N•m (71 - 74 lb-ft)



6. Measure the main bearing inner diameter.
- Subtract the main bearing journal OD of the crankshaft from the main bearing ID to obtain the main bearing oil clearance.

Specification:

Main Bearing Oil Clearance
4200 . . . . . 0.04 - 0.09 mm (0.002 - 0.004 in.)
Wear Limit . . . . . 0.25 mm (0.010 in.)
4300, 4400 . . . . . 0.04 - 0.07 mm (0.002 - 0.003 in.)
Wear Limit . . . . . 0.15 mm (0.006 in.)

- If the crankshaft is within specification, but the main bearing oil clearance exceeds the wear limit, replace the bearing inserts.
- If the crankshaft is not within specification, have crankshaft journals ground undersize by a qualified machine shop and install undersized bearing inserts.
- If the crankshaft is worn past the wear limit, replace the crankshaft.

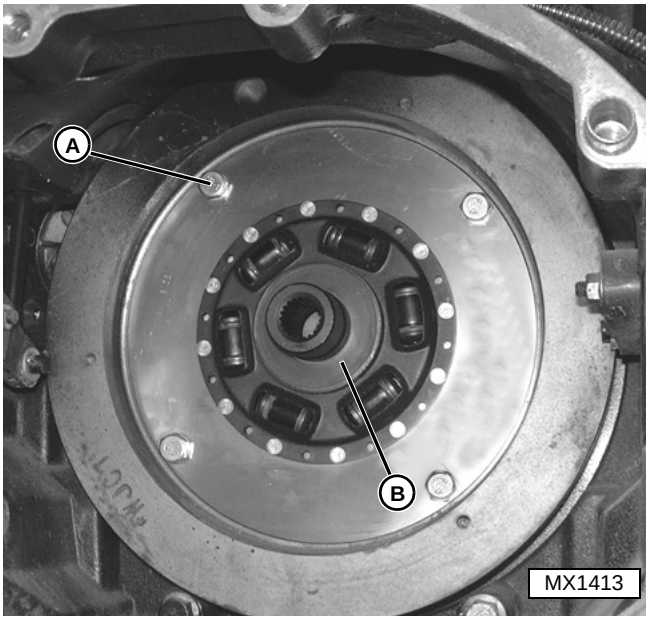
7. Clean and inspect the oil passages in the main bearing journals, connecting rod journals and main bearing bores in cylinder block.
8. Inspect the crankshaft for cracks or damage. Replace if necessary.

FLYWHEEL AND COUPLING

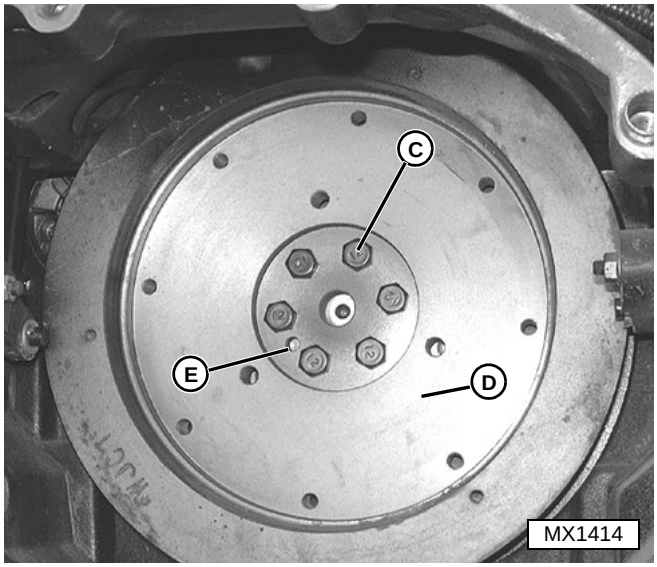
Removal/Installation:

IMPORTANT: Always install new flywheel mounting bolts.

1. Split the tractor between the flywheel housing and the tunnel. (See “TRACTOR SPLITTING FRONT”) in the Hydrostatic Power Train section for HST tractors; (“TRACTOR SPLITTING FRONT”) in the Gear Power Train section for CST tractors; or (“TRACTOR SPLITTING FRONT”) in the SyncReverser Power Train section for SRT tractors.)



2. Mark coupling as to which side faces flywheel for proper reassembly.
3. Remove four coupling cap screws (A) and remove coupling (B) from the flywheel.



4. Remove the flywheel mounting cap screws (C) and remove the flywheel (D) from crankshaft.
5. Dowel pin (E) in the crankshaft correctly locates the flywheel on the crankshaft.
6. Install the flywheel. Apply lubrication oil to the flywheel bolts and tighten to specification.

Torque Specification:

Flywheel Bolts . . . . . 83 - 88 N•m (62 - 65 lb-ft).

7. Installation of the flex-plate, clutch or coupling, is the reverse of removal.

CAMSHAFT

Removal:

1. Remove the rocker arm assembly and push rods. (See “ROCKER ARM ASSEMBLY”).
2. Remove the timing gear cover. (See “TIMING GEAR COVER”).
3. Check the camshaft end play. (See “CAMSHAFT END PLAY CHECK”).
4. Check the backlash of the timing gears. (See “TIMING GEAR BACKLASH CHECK”).

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 a magnetic follower holder kit such as D15001NU.
6. Rotate the crankshaft and align the timing marks.

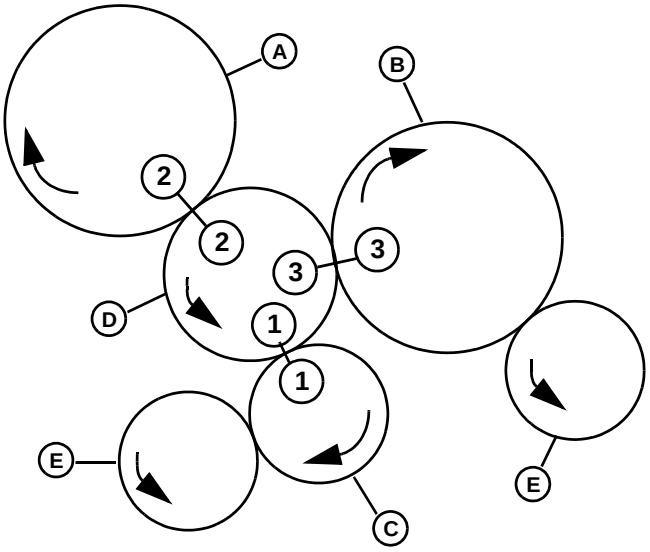
IMPORTANT: DO NOT allow the camshaft lobes to hit any bearing surfaces while removing the camshaft. Machined surfaces can be damaged.

7. Remove two thrust plate mounting cap screws, the thrust plate, and the camshaft.
8. Inspect all parts for wear or damage.

Installation:

- Apply clean engine oil on all parts during installation.

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



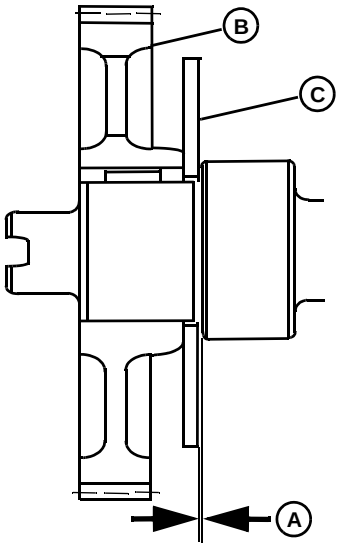
(Viewed From Gear Case)

1. Rotate the crankshaft to align the timing marks (1, 2 and 3).

NOTE: The fuel injection drive gear (A), the camshaft gear (B) and the crankshaft gear (C) all must be correctly timed to the idler gear (D). It is not necessary to time the oil pump gear (E). Due to the odd number of teeth on the idler gear, timing marks will only align periodically.

2. Install the camshaft.
3. Install the thrust plate and cap screws.
4. Install the timing gear cover. (See "TIMING GEAR COVER").
5. Install the push rods and rocker arm assembly. (See "ROCKER COVER REMOVAL/ INSTALLATION").

Inspection/Replacement:



1. Check the camshaft side gap using a feeler gauge.
- If the side gap (A) exceeds **0.05 - 0.25 mm (0.002 - 0.010in.)**, remove the camshaft gear (B) and replace thrust plate (C).
2. Remove the gear (if required) from camshaft using a knife-edge puller and a press.
- Inspect the gear for chipped or broken teeth. Replace the gear if necessary.

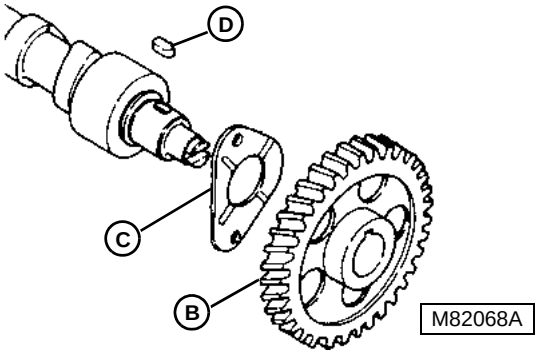
Gear Removal/Installation:

⚠ CAUTION

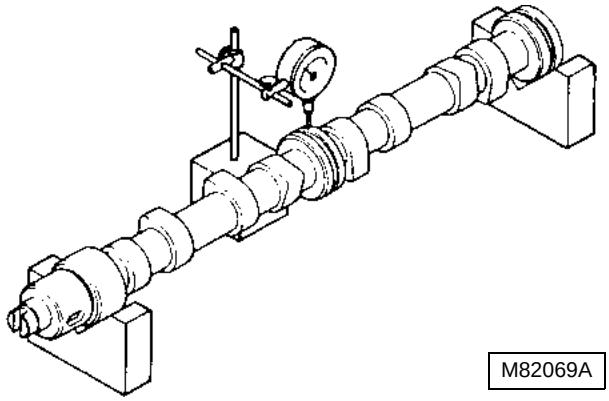
DO NOT heat oil over 182° C (360° F). Oil fumes or oil can ignite above 193° C (380° F). Use a thermometer. Do not allow a flame or heating element to come in direct contact with the oil. Heat the oil in a well-ventilated area. Plan a safe handling procedure to avoid burns.

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

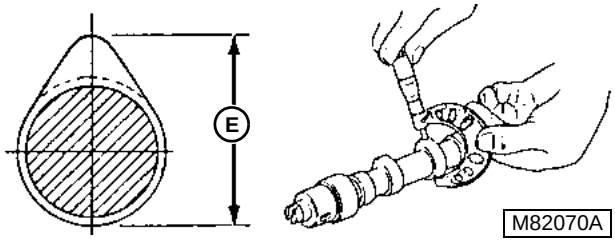
IMPORTANT: Be sure thrust plate is not between camshaft gear and camshaft shoulder while installing gear.



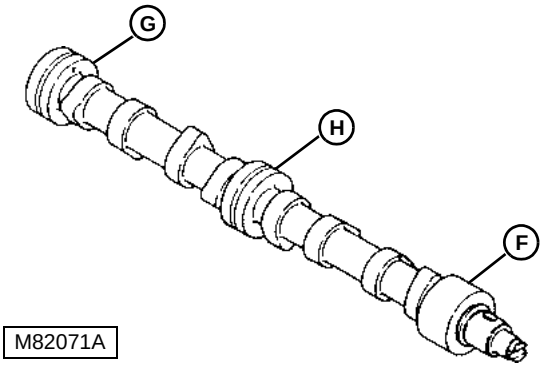
2. Install the thrust plate (C) if removed. Install the gear (B) with timing mark “C” side toward press table. Align the slot in the gear with key (D) in shaft. Press the camshaft into gear until gear is tight against camshaft shoulder.
- Thrust plate must spin freely on camshaft.



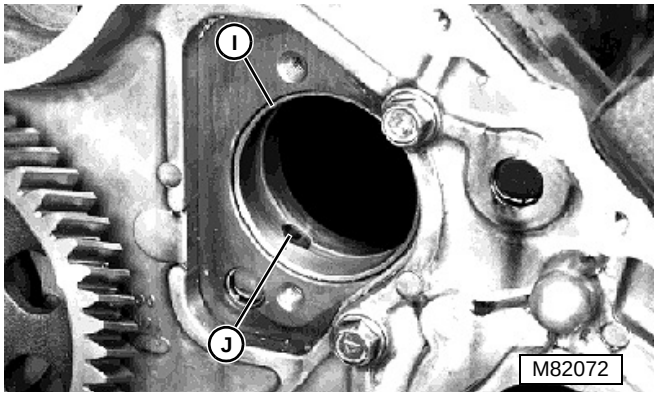
3. Inspect the camshaft for bend using V-blocks and a dial indicator. Turn the camshaft slowly and read variations on the indicator.
- If the variation is greater than **0.02 mm (0.001 in.)**, replace the camshaft.



4. Measure the camshaft lobe height (E).
- Camshaft lobe height is **38.64 - 38.77 mm (1.521 - 1.526 in.).**
- If the lobe height is less than **38.40 mm (1.512 in.)**, replace the camshaft.



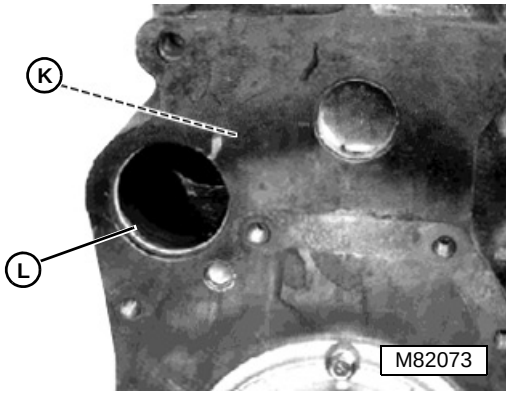
5. Measure the camshaft journal diameters.
- Gear housing (F) and flywheel (G) end camshaft journal OD is **44.93 - 44.95 mm (1.769 - 1.770 in.)**
- Intermediate (H) camshaft journal OD is **44.91 - 44.94 mm (1.768 - 1.769 in.).**
- If the journal diameters are less than **44.85 mm (1.766 in.)**, replace the camshaft.



6. Measure the camshaft bushing (I) diameter at the gear housing end.
- Standard camshaft bushing ID is **44.99 - 45.06 mm (1.771 - 1.774 in.)**
- Replace the bushing If the diameter exceeds **45.10 mm (1.776 in.).**
- If the bushing clearance (bushing ID minus camshaft journal OD) exceeds **0.20 mm (0.008 in.)**, replace the bushing, camshaft or both.

7. Replace the camshaft bushing using a chisel. Be careful not to push the bushing inside the engine.

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



9. Measure the intermediate (K) and flywheel end (L) camshaft bore diameters.
- Standard camshaft bore ID is **45.00 - 45.025 mm (1.772 - 1.773 in.)**
- If the bore diameter exceeds **45.10 mm (1.776 in.)**, replace cylinder block.
- If the bore clearance (bore ID minus camshaft journal OD) exceeds **0.20 mm (0.008 in.)**, replace camshaft, cylinder block or both.
- 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.

CAMSHAFT FOLLOWERS

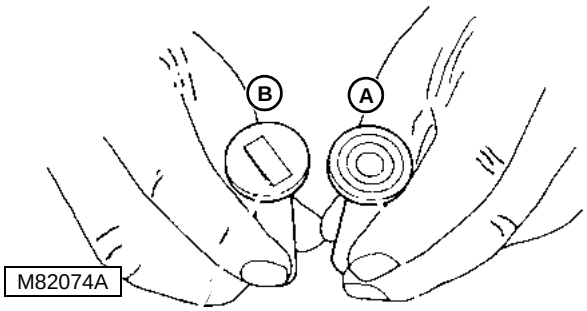
Removal/Installation:

1. Remove the camshaft. (See “CAMSHAFT”).
2. Remove the oil pan and strainer.

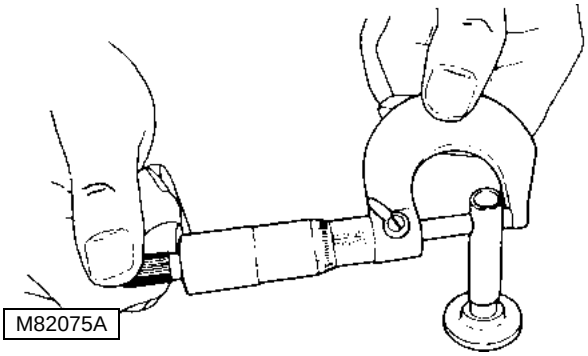
IMPORTANT: Cam followers must be installed in the same bores from which they were removed.

3. Put a mark on each cam follower and the cylinder block bore to aid in installation.
4. Remove the cam followers.
5. Inspect all parts for wear or damage.
6. Apply clean engine oil to all parts during installation.
- Installation is done in the reverse order of removal.

Inspection:



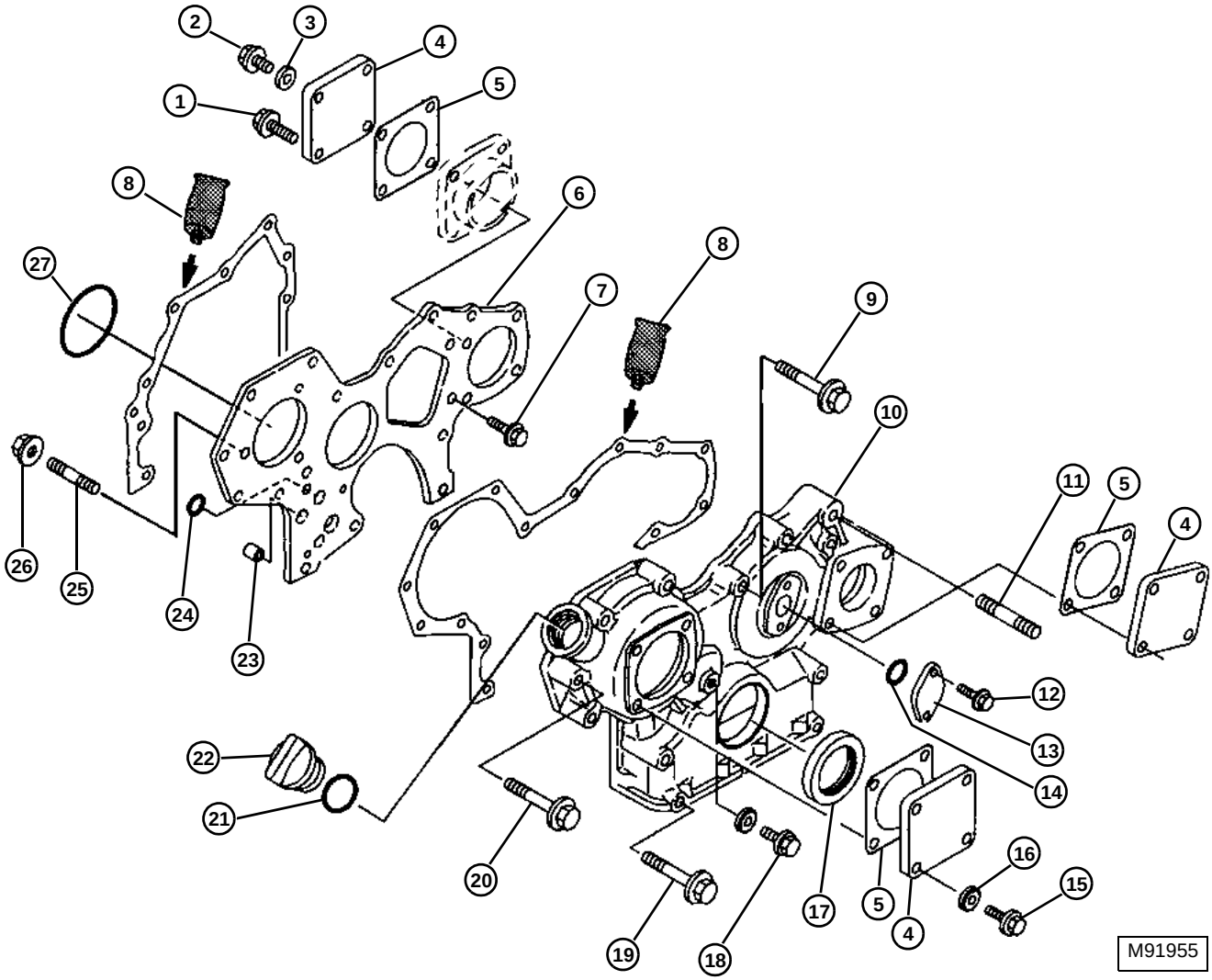
7. Inspect the cam follower contact surface for normal contact (A) or abnormal wear (B). Replace if necessary.



8. Measure the cam follower stem diameter.
- Standard cam follower stem OD is **11.98 - 11.99 mm (0.471 - 0.472 in.)**
- If the stem diameter is less than **11.93 mm (0.470 in.)**, replace cam follower.

9. Measure the cam follower bore diameter in the cylinder block.
- Standard cam follower bore ID is **12.00 - 12.02 mm (0.472 - 0.473 in.)**
- If the cam follower bore diameter exceeds **12.05 mm (0.474 in.)**, replace the cylinder block.
- Standard cam follower bore clearance is **0.01 - 0.04 mm (0.0004 - 0.002 in.)**.
- If the bore clearance (bore ID minus follower stem OD) exceeds **0.12 mm (0.005 in.)**, replace the cam follower, cylinder block or both.

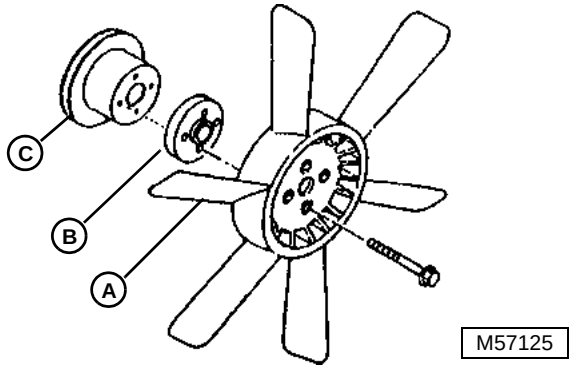
TIMING GEAR COVER



1. Cap Screw M8x30	8. Form-In-Place Gasket	15. Cap Screw M8x12	22. Oil Fill Cap
2. Cap Screw M8x20	9. Cap Screw M8x55	16. Seal Washer M8	23. Dowel
3. Seal Washer	10. Timing Gear Cover	17. Oil Seal	24. O-Ring
4. Cover	11. Stud M10	18. Cap Screw M8x16	25. Stud M8x22
5. Gasket (3 used)	12. Cap Screw	19. Cap Screw M8x85	26. Nut
6. Mounting Plate	13. Cover (3 used)	20. Cap Screw M8x45	27. O-Ring
7. Bolt M8x16	14. O-Ring	21. O-Ring	

Removal/Installation:

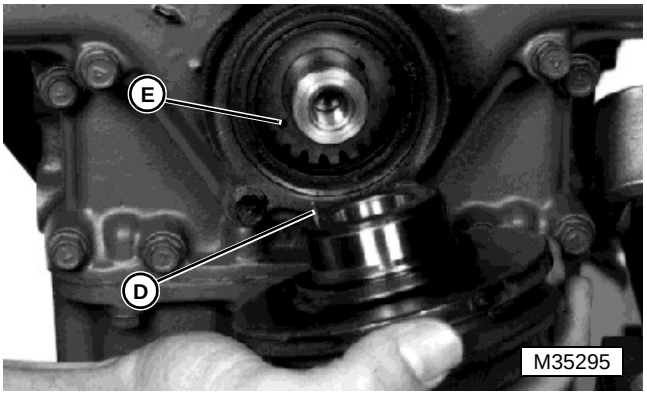
1. Remove the alternator and belt.



2. Remove the fan (A), spacer (B) and pulley (C).
3. Remove the crankshaft pulley cap screw and washer.
4. Remove the crankshaft pulley using a two-jaw 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 the mounting cap screws and timing gear cover.
6. Inspect the crankshaft oil seal for wear or damage. Replace if necessary.
- Replace the oil seal using a driver set. Install the seal with lip toward inside of gear housing cover. Install the seal flush with surface of cover.



7. Installation is done in the reverse order of removal.
- Replace the seal washer.
- Align the pin (D) in crankshaft pulley with the hole (E) in the crankshaft gear. Install the crankshaft pulley.
- Adjust the fan/alternator drive belt tension.

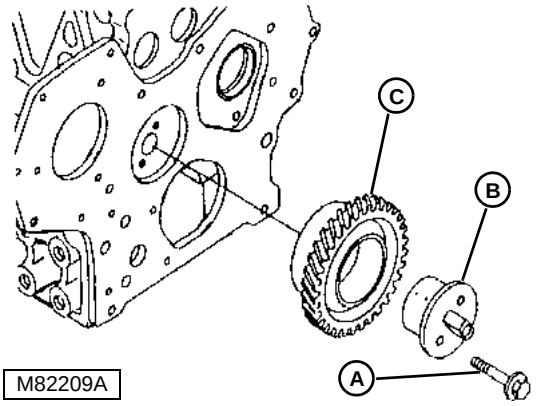
IDLER GEAR

Removal/Installation:

1. Remove the timing gear cover. (See “TIMING GEAR COVER”).
2. Check the backlash of timing gears. (See “TIMING GEAR BACKLASH CHECK”).

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 water pump is at TDC on compression stroke. Number one cylinder is closest to the flywheel.

3. Rotate the crankshaft and align the timing marks.



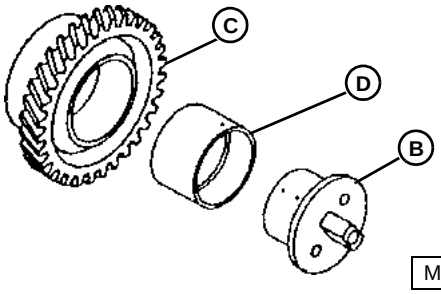
4. Remove two cap screws (A), shaft (B) and 43T gear (C).
5. Inspect all parts for wear or damage.

Installation is done in the reverse order of removal.

6. Inspect the gear for chipped or broken teeth. Replace if necessary.
- Measure the idler gear shaft diameter.
- Standard idler gear shaft OD is **45.95 - 45.98 mm (1.809 - 1.810 in.)**
- If the shaft diameter is less than **45.93 mm (1.808 in.)**, replace idler gear shaft.

7. Measure the idler gear bushing diameter.
- Standard idler gear bushing ID is **46.00 - 46.03 mm (1.811 - 1.812 in.)**.
- Replace the bushing if diameter exceeds **46.03 mm (1.812 in.).**
- If the bore clearance (bushing ID minus shaft OD) exceeds **0.15 mm (0.006 in.),** replace the bushing, shaft, or both.

To Replace The Bushing:



1. Replace the bushing using a driver set.
2. Align the oil holes in bushing (D) and idler gear (C).
3. Install the bushing flush with surface of idler gear.

TIMING GEAR COVER MOUNTING PLATE

Removal/Installation:

1. Remove the camshaft. (See “CAMSHAFT”).
2. Remove the idler gear. (See “IDLER GEAR”).
3. Remove the fuel injection pump.
4. Remove the oil pump. (See “OIL PUMP”).
5. Remove the mounting cap screws and plate.
6. Replace the O-rings.
7. Installation is the reverse of removal.

OIL PAN AND STRAINER

Removal/Installation:

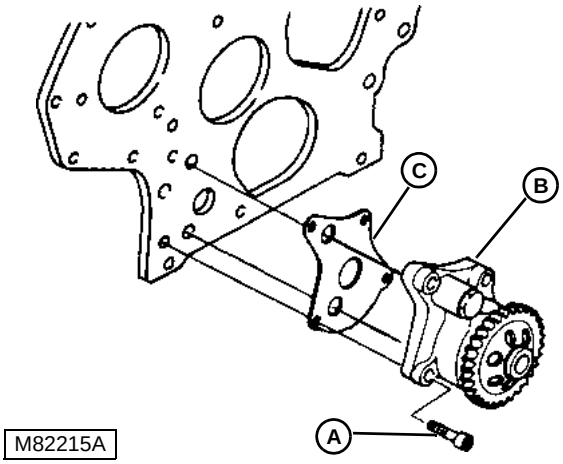
NOTE: The engine must be removed from the tractor to remove the oil pan.

1. Remove the oil pan.
2. Remove the oil pick up strainer.
3. Clean and inspect all parts.
4. Install the oil pick up strainer.
5. Install the oil pan.
6. Fill the engine with correct engine oil.

OIL PUMP

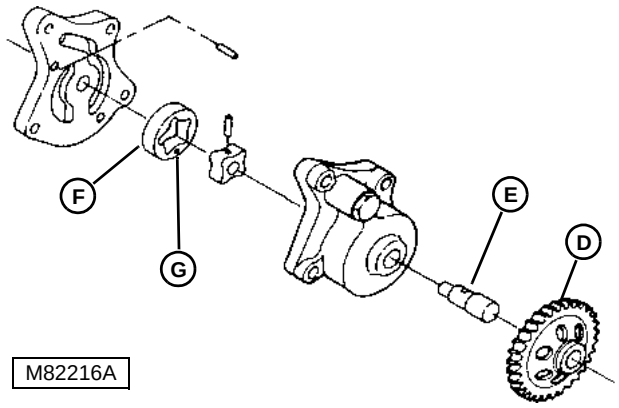
Removal/Installation:

1. Remove the timing gear cover. (See “TIMING GEAR COVER”).
2. Check the oil pump gear backlash. Replace the oil pump assembly if backlash is more than **0.12 mm (0.005 in.)**.



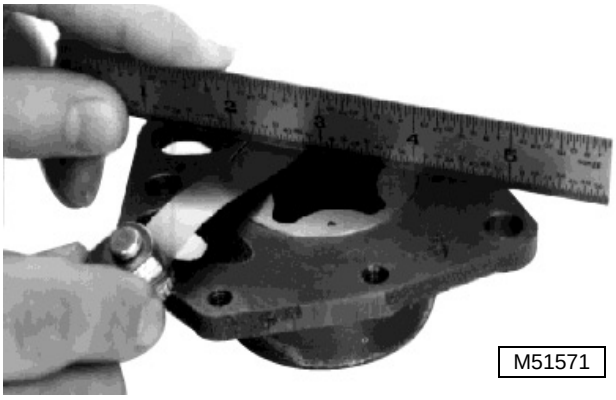
3. Remove the mounting cap screws (A), the oil pump (B) and gasket (C).
4. Inspect all parts for wear or damage.

Oil Pump Disassembly/Assembly:



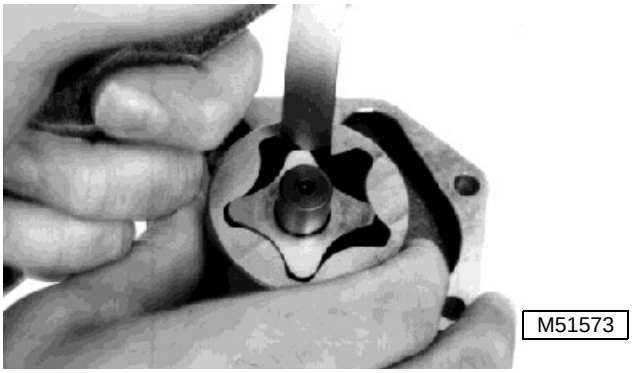
1. The gear (D) is press fit on rotor shaft (E). Remove gear using a knife edge puller and a press.
2. Inspect all parts for wear or damage.
3. Coat all parts with clean engine oil.
4. Install the outer rotor (F) with identification mark (G) facing toward rotor shaft assembly.
5. Measure the rotor shaft outer diameter and the shaft hole diameter in cover.

- Standard clearance is **0.01 - 0.04 mm (0.001 - 0.002 in.)**.
- Replace the pump if the clearance is greater than **0.2 mm (0.008 in.).**

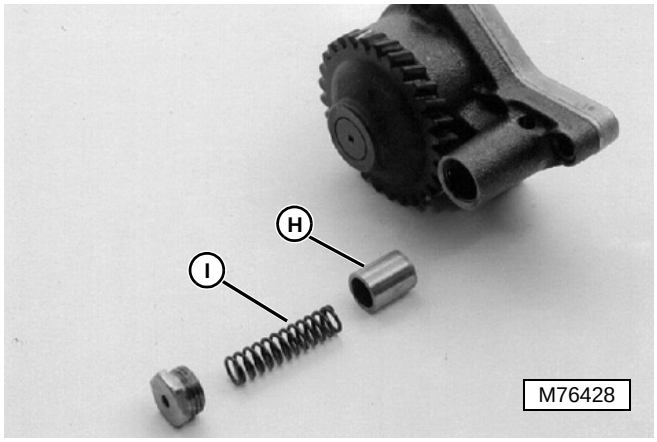


6. Check the rotor recess.
- Standard rotor recess is **0.03 - 0.09 mm (0.001 - 0.004 in.).**
- Replace the pump if the recess exceeds **0.15 mm (0.006 in.).**

7. Measure outer rotor-to-pump body clearance.
- Standard clearance is **0.10 - 0.16 mm (0.004 - 0.006 in.).**
- Replace the pump if the clearance is more than **0.25 mm (0.010 in.)**.



8. Check inner-to-outer rotor clearance.
- Replace the pump if clearance is more than **0.15 mm (0.006 in.)**.

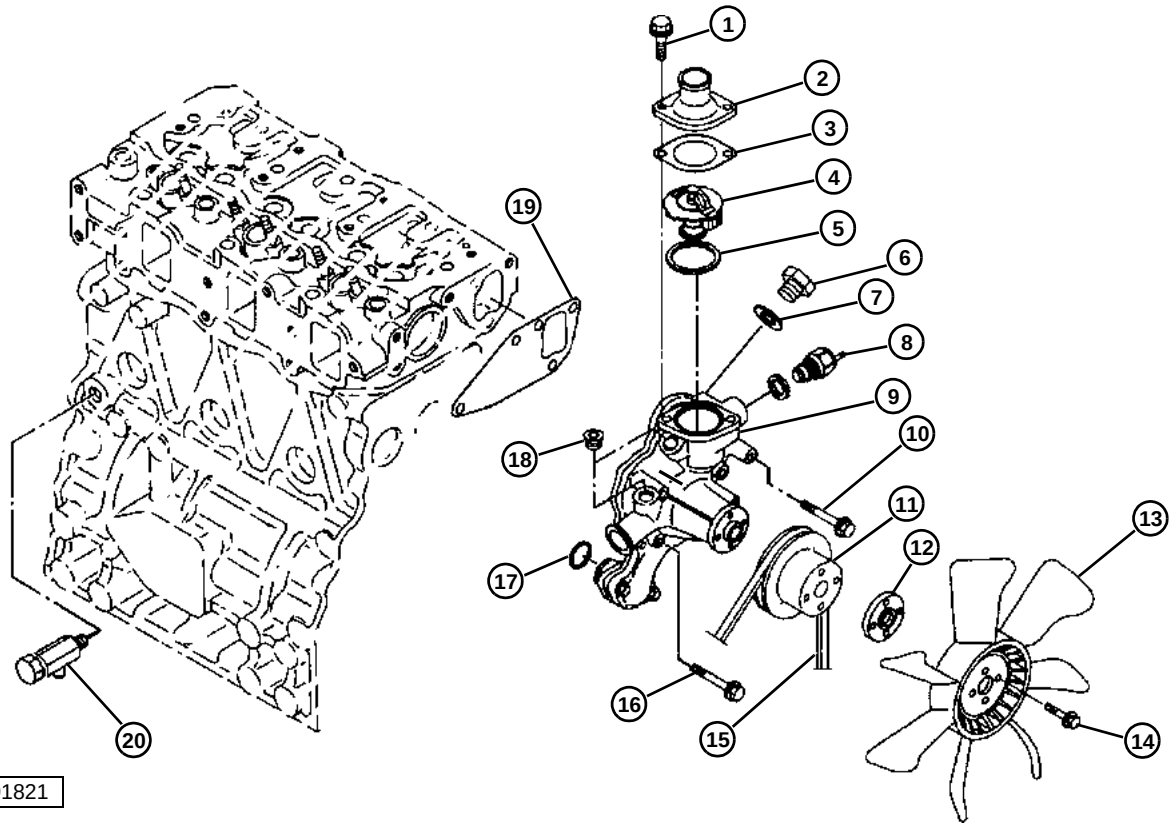


9. Check the oil pressure relief valve. If the relief valve piston (H) is sticking in the pump body, clean parts to allow free movement of the piston in pump body.
10. Inspect the spring (I) for cracks. The spring is not serviceable. If damage is identified, replace the oil pump assembly.

THERMOSTAT AND WATER PUMP

Inspection:

1. Inspect the water pump for coolant leakage. If the origin of the leak cannot be determined, test the cooling system. (See "COOLING SYSTEM PRESSURE TEST").
   - If coolant is leaking at the pulley flange:
     The shaft seal is defective. Replace the water pump.
   - If coolant is leaking between the cylinder head and the pump housing:
     The gasket between the head and the pump is defective. Remove the water pump and replace the gasket.
2. Inspect the water pump for a worn bearing shaft by removing the fan belt and checking for excessive movement of the fan. Replace the water pump if excessive movement is noticed.
   - If the bearing shaft is making noise when operating:
     Check the fan belt tension. If adjustment does not relieve the noise, the bearing shaft is defective. Replace the water pump.



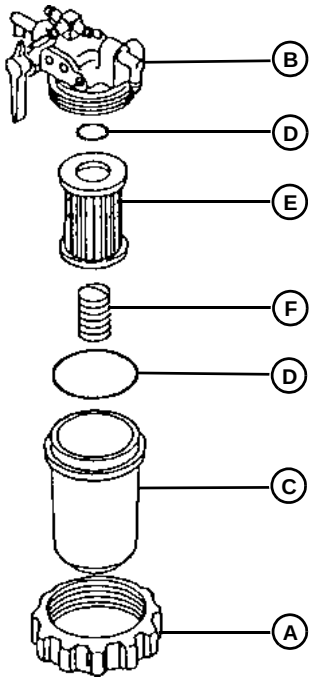
M91821

1. Cap Screw M8x20	6. Plug	11. Pulley	16. Cap Screw m8x55
2. Cover	7. Gasket	12. Spacer	17. Gasket
3. Gasket	8. Temperature Switch	13. Fan	18. Plug
4. Thermostat	9. Water Pump	14. Cap Screw w/Washer M6x25	19. Gasket
5. Gasket	10. Cap Screw M8x60	15. Fan Belt	20. Drain Valve

Replacement:

1. Open the engine drain valve to drain coolant.
2. Disconnect the coolant temperature sensor lead.
3. Disconnect the upper and lower radiator hoses.
4. Remove the fan/alternator drive belt.
5. Remove the cap screws, fan, spacer and pulley.
6. Remove the mounting cap screws, pump and gasket.
7. Inspect the pump for wear or damage.
8. Test the thermostat for proper operation. (See "THERMOSTAT OPENING TEST").
9. Installation is done in the reverse order of removal.
10. Adjust the fan/alternator drive belt tension.

FUEL FILTER ASSEMBLY

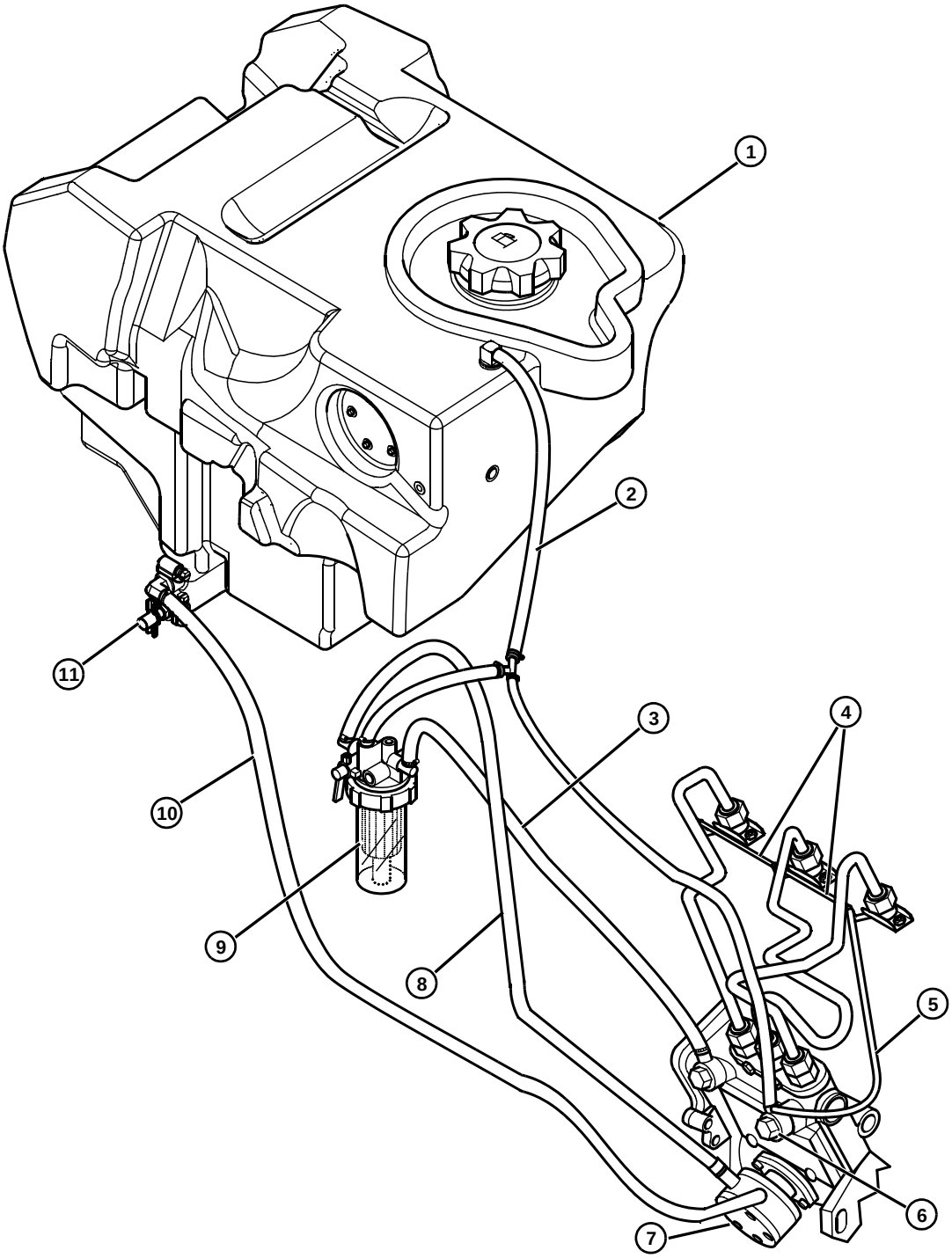


M82370B

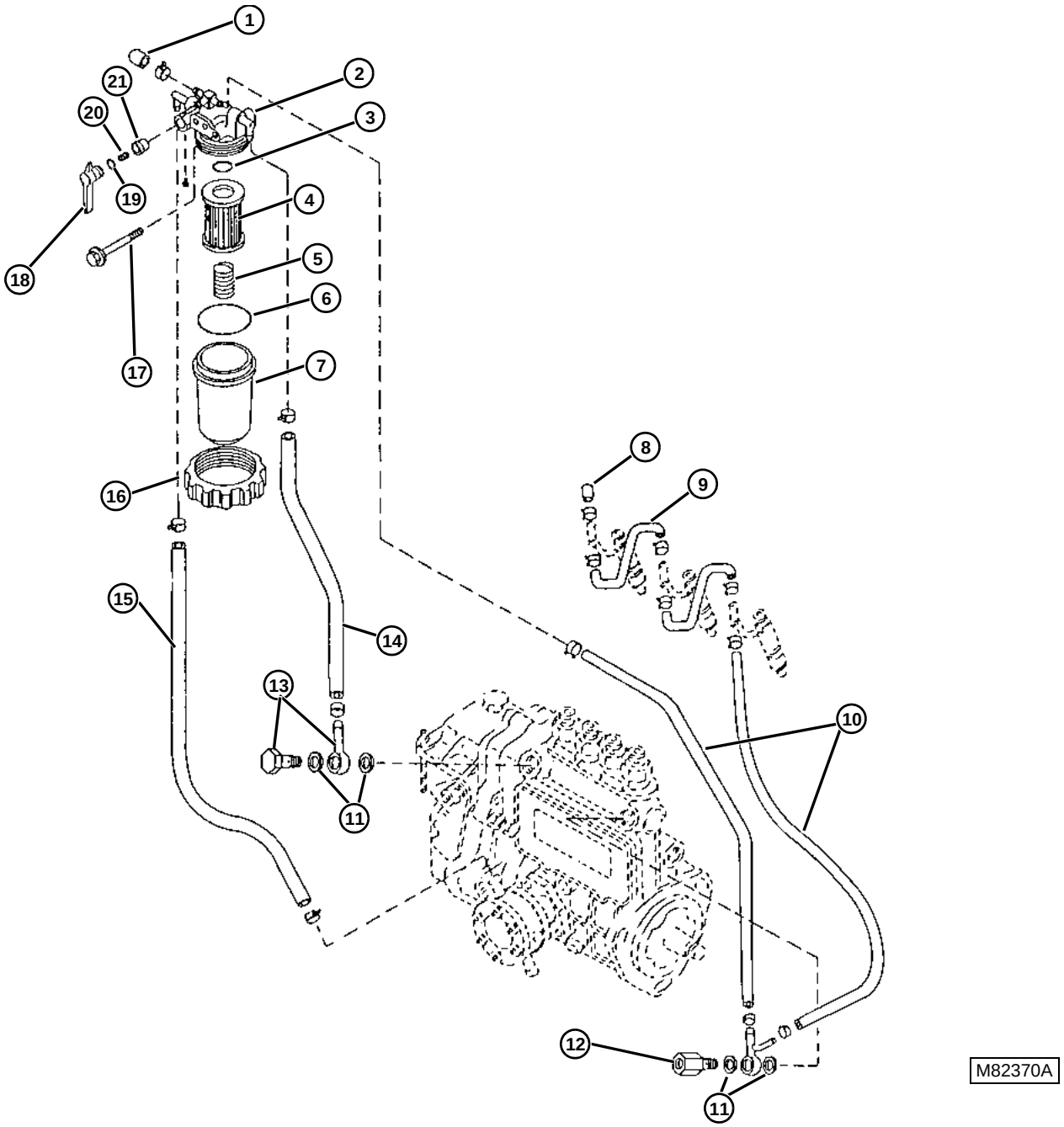
1. Remove the retaining ring (A) from the mounting base (B) while holding on to the filter cover (C).
2. Remove the filter cover from the mounting base.
3. Remove and replace the O-rings (D) and filter element (E).
4. Be sure the spring (F) is in the filter cover and place the filter element in the filter cover.
5. Before installing the filter cover and element in the mounting base, verify the O-ring is in the groove inside the mounting base.
6. Install the filter cover and the element in the mounting base.
7. Place the retaining ring over filter cover and screw on the mounting base to retain filter cover to mounting base.

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

COMPONENT LOCATION - FUEL SUPPLY



1. Fuel Tank	4. Nozzle Leak-Off Hose (Short)	7. Transfer Pump	10. Fuel Tank-to-Transfer Pump Hose
2. Return Fuel Hose	5. Nozzle Leak-Off Hose (Long)	8. Transfer Pump-to-Filter Hose	11. Drain Valve
3. Fuel Filter-to-Injection Pump Hose	6. Air Vent Check Valve	9. Fuel Filter	



1. Fuel Return To Tank	7. Filter Bowl	13. Banjo Bolt & Fitting	19. O-Ring
2. Filter Mounting Base	8. Cap	14. Hose, Filter to F.I.P	20. Spring
3. O-Ring	9. Injector Fuel Return	15. Hose	21. Shutoff Valve
4. Filter	10. Return Fuel Lines	16. Retaining Ring	22.
5. Spring	11. Copper Washers	17. Cap screw	23.
6. O-Ring	12. Check Valve	18. Shut Off Lever	24.

FUEL INJECTION PUMP (NON EPA ENGINES)

Removal:

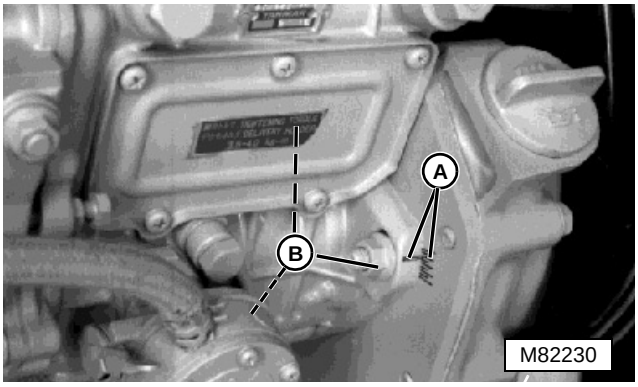
CAUTION

Escaping fluid under pressure can penetrate the skin causing serious injury. Avoid the hazard by relieving pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure. Search for leaks with a piece of cardboard. Protect hands and body from high pressure fluids.

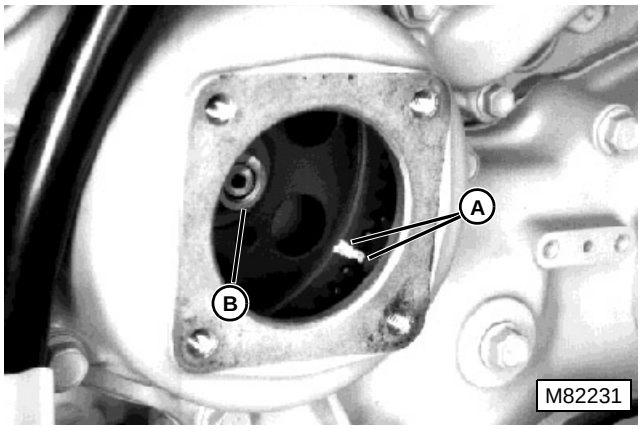
If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury should reference a knowledgeable source. Such information is available from the Deere & Company Medical Department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

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

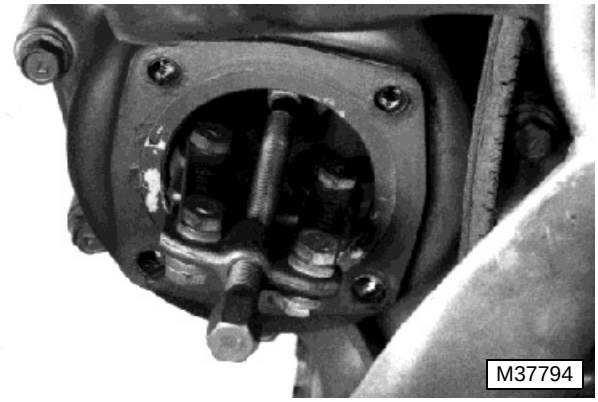
1. Clean the injection pump lines and area around the pump using parts cleaning solvent or steam cleaner.
2. Loosen the fuel injection line connectors slightly to release pressure in the fuel system. When loosening the connectors, use another wrench to keep the delivery valves from loosening.
3. Loosen the line clamps, and remove the fuel injection lines.
4. Disconnect the fuel filter hoses.
5. Remove the external lube line.
6. Disconnect the fuel shutoff solenoid link.



7. Note the position of the timing marks (A) on the injection pump and the gear cover mounting plate.
8. Remove three mounting nuts (B).



9. Remove four cap screws, washers, the cover and gasket.
10. Use chalk or paint to mark the injection pump gear to the idler gear (A).
11. Remove the nut and lock washer (B).



12. Use a puller to remove the gear from the injection pump shaft.
13. Remove the injection pump and O-ring.

DO NOT attempt to service the injection pump or governor. If the unit is in need of repair, it must be serviced by a qualified fuel injection repair shop.

Installation:

1. Install a new O-ring to the injection pump.
2. Put the injection pump onto the back of the gear cover mounting plate. Align the key on the shaft with the keyway in the gear. Be sure to align the marks on gears made during removal.
3. Install lock washer and nut. Tighten to specification.
4. Install a new gasket, cover, four washers and cap screws.
5. Install three mounting nuts. Do not tighten.

6. Align the timing marks on the mounting plate and injection pump to the same place as when removed. Tighten the mounting nuts to specifications.
7. Connect the fuel shutoff solenoid link.
8. Connect the fuel filter hoses.
9. Install fuel injection lines and tighten line clamp cap screws.

IMPORTANT: If the oil has been drained out of the fuel injection pump housing, add oil as necessary. The fuel injection pump can be damaged if operated without the proper amount of oil.

10. Remove the fill plug and add clean engine oil to the housing. Add until the oil begins to drip out of external lube line inlet.
11. Install the external lube line. When installing the line, put one copper washer between the mounting bolt head and lube line and the other between the lube line and housing.

If a new injection pump is being installed, check and adjust injection pump static timing. (See “INJECTION PUMP STATIC TIMING ADJUSTMENT PRE-EPA ENGINES”).

FUEL INJECTION PUMP (EPA ENGINES)

Removal:

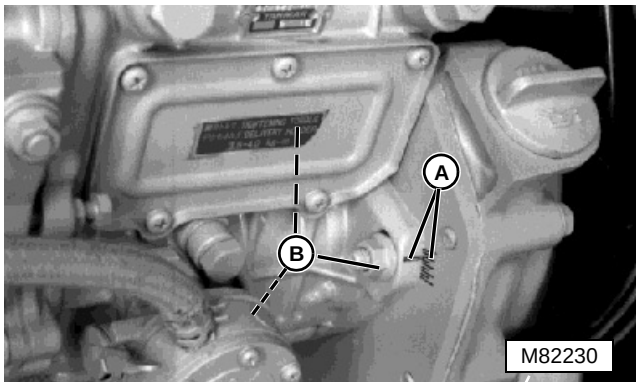
⚠ CAUTION

Escaping fluid under pressure can penetrate the skin causing serious injury. Avoid the hazard by relieving pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure. Search for leaks with a piece of cardboard. Protect hands and body from high pressure fluids.

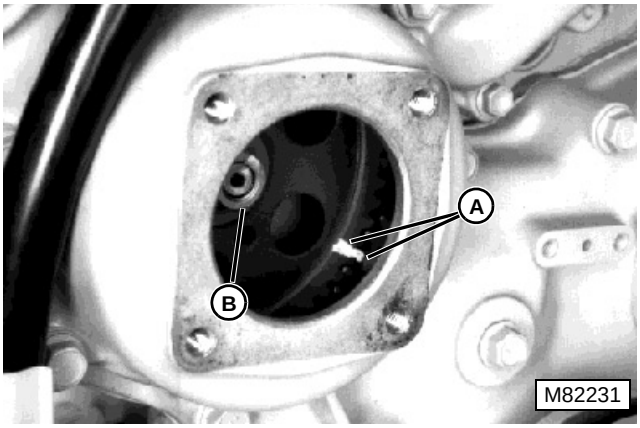
If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury should reference a knowledgeable source. Such information is available from the Deere & Company Medical Department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

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

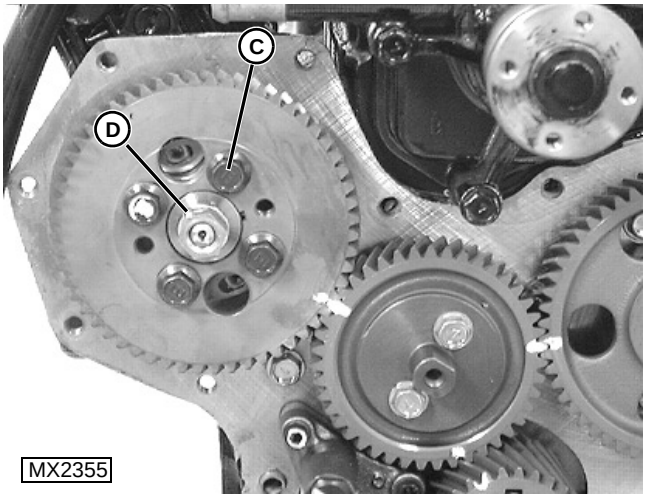
1. Clean the injection pump lines and area around the pump using parts cleaning solvent or steam cleaner.
2. Loosen the fuel injection line nuts. When loosening the nuts on the injector pump, use another wrench to keep the delivery valves from loosening.
3. Loosen the line clamps, and remove the fuel injection lines.
4. Disconnect the fuel filter hoses.
5. Remove the external lube line.
6. Disconnect the fuel shutoff solenoid.



7. Note the position of the timing marks (A) on the injection pump and the gear cover mounting plate.
8. Remove three mounting nuts (B).



9. Remove four cap screws, washers, the cover and gasket.
10. Use chalk or paint to mark the injection pump gear to the idler gear (A).



NOTE: Timing gear cover removed for photo only. Timing gear cover does not need to be removed for injector pump removal.

IMPORTANT: DO NOT loosen four cap screws (C) attaching gear to hub! This gear/hub assembly times the injector pump camshaft in relation the crankshaft for precise timing of EPA engines. This procedure is done at the pump manufacturing plant and cannot be duplicated in the field!

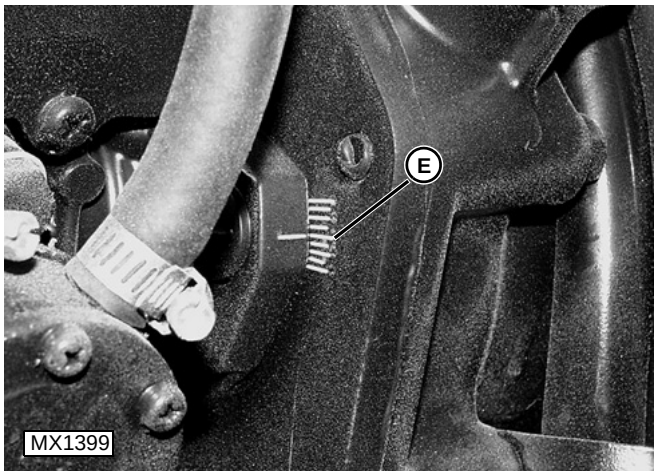
11. Remove nut (D).

12. Use a puller to remove the gear from the injection pump shaft.
13. Remove the injection pump and O-ring.

IMPORTANT: If it is determined that either the fuel injection pump and governor assembly are in need of repair, they must be replaced ONLY as complete assemblies. Only an authorized factory trained technician is allowed to remove and install these assemblies. If replacement is necessary, remove and install the fuel injection pump/governor assembly as a complete, assembly.

Installation:

1. Install a new O-ring to the injection pump.
2. Put the injection pump onto the back of the gear cover mounting plate. Install three mounting nuts. Do not tighten. Align the key on the shaft with the keyway in the gear. Be sure to align the marks on gears made during removal.
3. Install nut. Tighten to specification.
4. Install a new gasket on the cover, and install the cover with four washers and cap screws.



5. Align the timing mark on the pump flange to the fifth mark (E) from the top of the mounting plate. Tighten the mounting nuts.
6. Connect the fuel shutoff solenoid.
7. Connect the fuel filter hoses.
8. Install fuel injection lines and tighten to specification. Install line clamps.

Specification:

Injector line nuts . . . . . 30-35Nm (22-25 lb ft)

IMPORTANT: If the oil has been drained out of the fuel injection pump housing, add oil as necessary. The fuel injection pump can be damaged if operated without the proper amount of oil.

9. Remove the fill plug and add clean engine oil to the housing. Add until the oil begins to drip out of external lube line inlet.
10. Install the external lube line. When installing the line, put one copper washer between the mounting bolt head and lube line and the other between the lube line and housing.

If a new injection pump is being installed, check and adjust injection pump static timing. (See “INJECTION PUMP STATIC TIMING ADJUSTMENT PRE-EPA ENGINES”).

FUEL INJECTION NOZZLES

Removal/Installation:

IMPORTANT: 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.

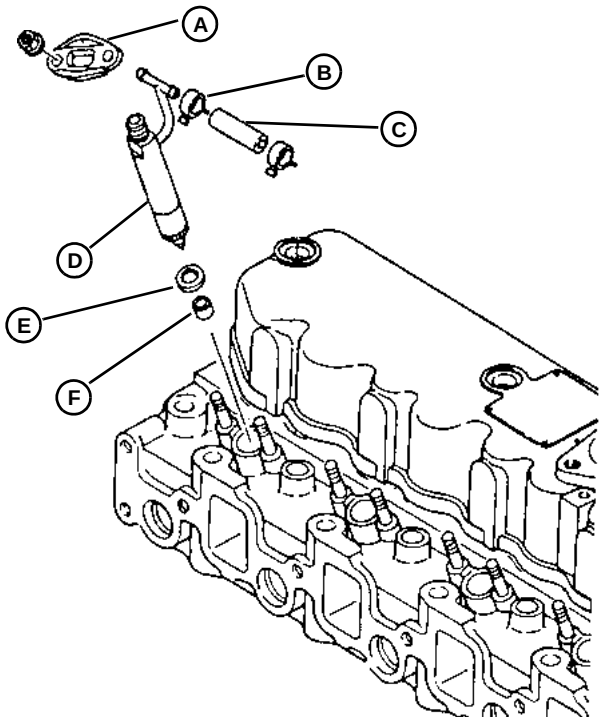
⚠ CAUTION

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.

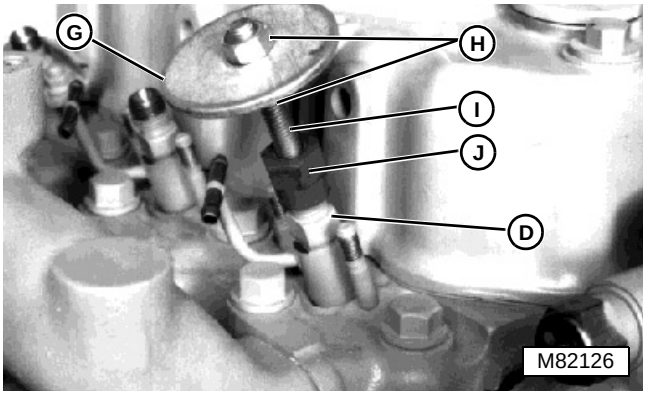
If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury should reference a knowledgeable source. Such information is available from the Deere & Company Medical Department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

NOTE: Nozzles are matched to the cylinders. If removing more than one nozzle, tag nozzles, according to the cylinder from which it was removed.

2. Loosen fuel injection line connectors-to-nozzles slightly to relieve pressure in the fuel system.
3. Loosen line clamp(s) and remove fuel injection lines.



4. Remove clamps (B) and leakoff hoses (C).
5. Remove nuts and retaining plates (A).
6. Remove injection nozzle (D), ring (E) and Teflon heat protector (F). If ring and protector stay in cylinder head, thread a cap screw into protector and pull from cylinder head.



If nozzles are stuck in cylinder head:

- Grind the head of a cap screw (I) so it fits inside a nut from an old injection line (J).
- Use two nuts (H) to attach a large flat washer (G) to the cap screw.
- Install assembly onto nozzle (D) and use a puller and slide hammer to pull nozzle from cylinder head.

7. Test injection nozzles. (See "FUEL INJECTION NOZZLE TEST").

Installation:

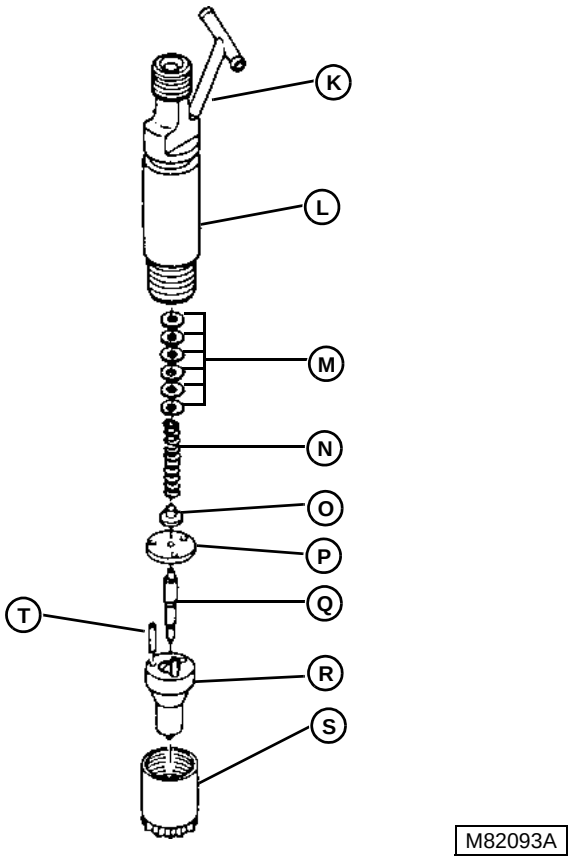
Installation is done in reverse order of removal.

- Install a new ring and heat protector when installing injection nozzles.

Disassembly/Assembly:

NOTE: If servicing more than one nozzle, keep parts for each nozzle separate from one another.

1. Remove retaining nut (S) and disassemble internal parts of injection nozzle. Keep parts organized for ease of assembly.
2. Clean and inspect nozzle assembly. (See "CLEANING/INSPECTION").

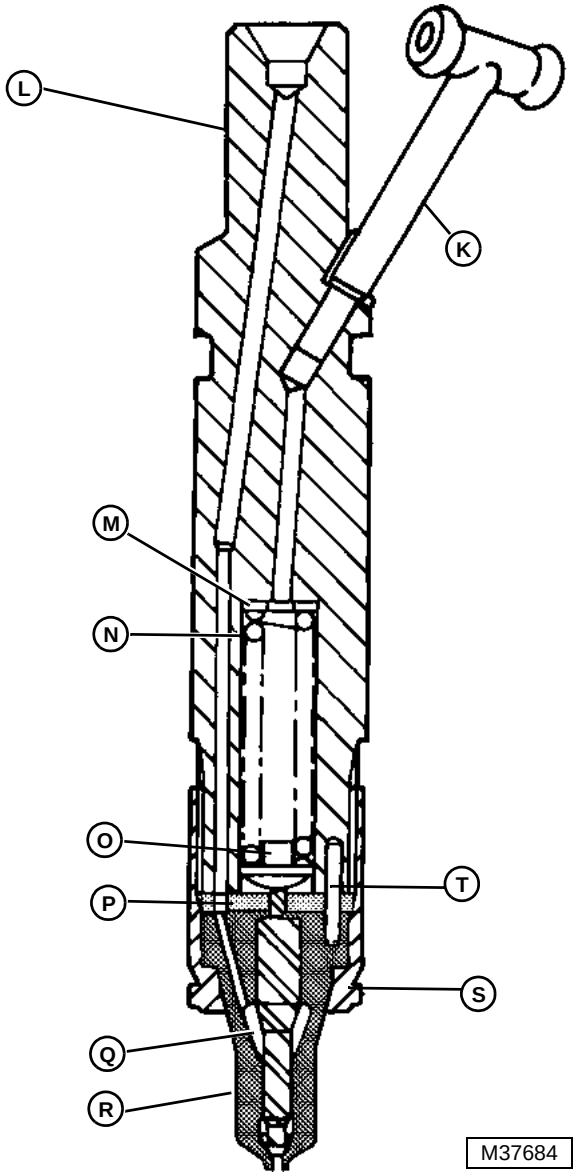


3. Carefully clamp injector body (L) in a soft-jaw vice.

NOTE: Insert the same number of shims (M) that were removed from injector. Number of shims will affect the opening pressure of the fuel nozzle and will be tested after assembly.

4. Reassemble fuel nozzle in the order shown above.
5. Tighten retaining nut to **6.8 - 8.8 N•m (60 - 78 lb-in.)**.
6. After assembly is complete, test injection nozzle. (See "FUEL INJECTION NOZZLE TEST").

Cross Section



K. Return Pipe
L. Injector Body
M. Shim(s)
N. Spring
O. Spring Seat
P. Separator Plate
Q. Nozzle Valve
R. Nozzle Body
S. Retaining Nut
T. Index Pin

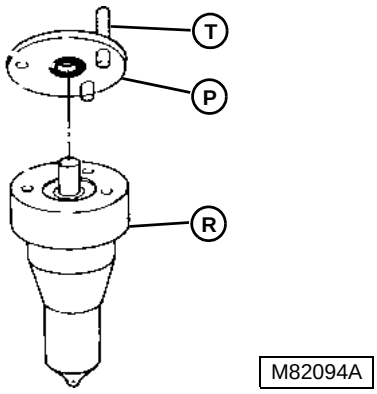
Cleaning/Inspection:

NOTE: To clean nozzles properly, JDF13 Nozzle Cleaning Kit is recommended. The Cleaning Kit is available through the John Deere SERVICEGARD™ Catalog.

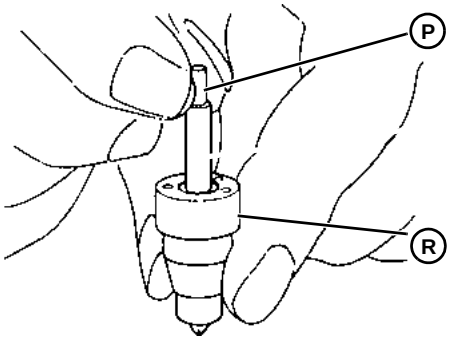
1. Remove anti-corrosive grease from new or reconditioned nozzles by washing them thoroughly in diesel fuel.

IMPORTANT: 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 Nozzle Cleaning Kit).



3. After removing carbon or lacquer from the exterior of nozzle, inspect sealing surfaces between separator plate (P) and nozzle body (R) 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.
5. Check nozzle contact surface on separator plate for wear. If contact surface is more than **0.10 mm (0.004 in.)**, replace nozzle assembly.



6. Inspect the piston (large) part of nozzle valve (P) 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:

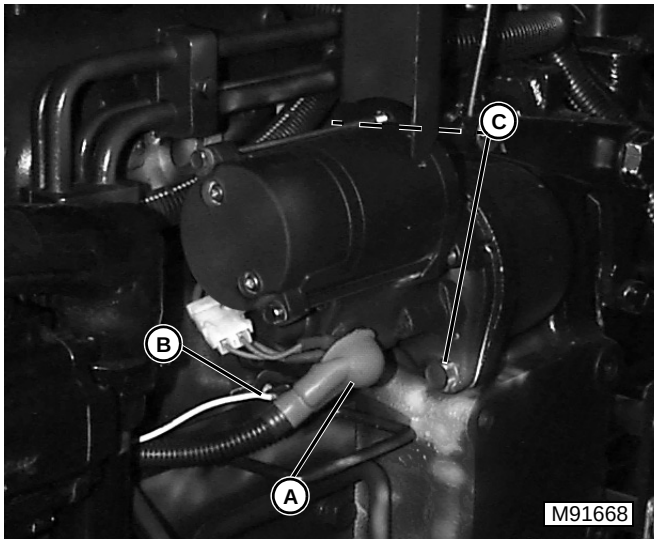
- Dip the nozzle valve (P) in clean diesel fuel. Insert valve in nozzle body (Q).
- Hold nozzle vertical, and pull valve out about 1/3 of its engaged length.
- Release valve. Valve should slide down to its seat by its own weight.

Replace nozzle assembly if the valve does not slide freely to its seat.

STARTING MOTOR REMOVAL AND INSTALLATION

Removal:

IMPORTANT: Always disconnect the negative cable from the battery before working on any electrical components.



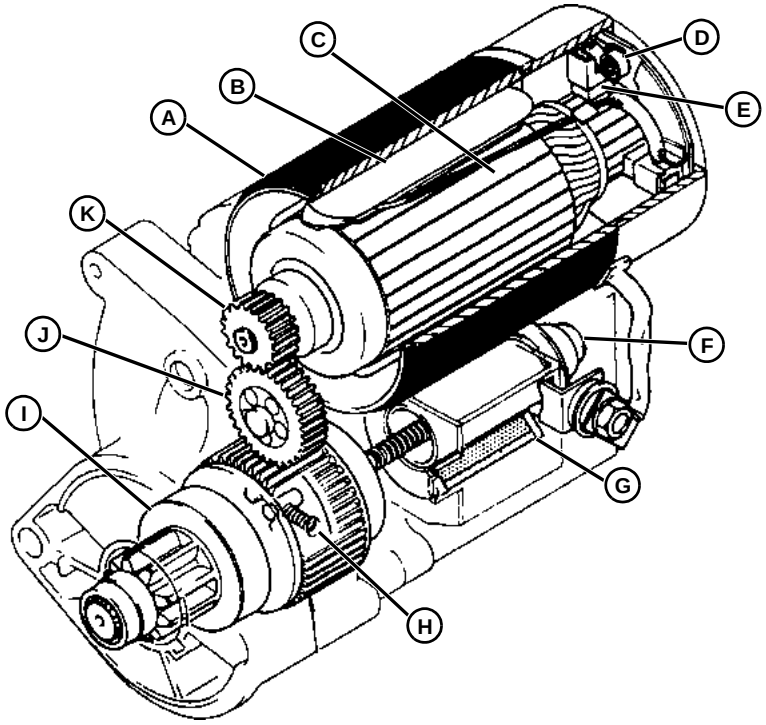
1. Remove the alternator. (See “ALTERNATOR REMOVAL AND INSTALLATION”).
2. Remove the nut securing the battery cable and wires on the starting motor (A).
3. Disconnect the starting motor solenoid wire (B).
4. Remove the cap screws securing the starting motor to the bell housing. Remove the starting motor.

Installation:

Installation is done in the reverse order of removal.

- **DO NOT overtighten the starting motor cap screws! Tighten the starting motor cap screws to 88 N•m (65 lb-ft).**

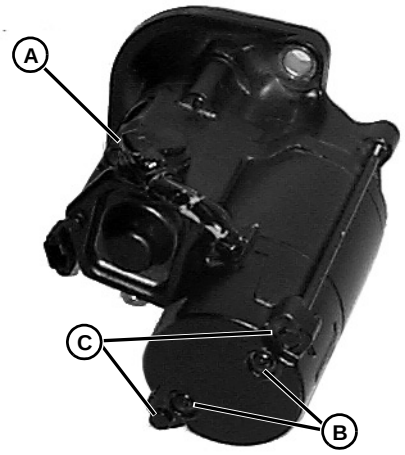
STARTING MOTOR DISASSEMBLY AND ASSEMBLY



M94643

A. Motor	D. Brush Spring	G. Solenoid	J. Idler Gear
B. Field Coil	E. Brush	H. Overrunning Clutch	K. Drive Gear
C. Armature	F. Plunger	I. Pinion	

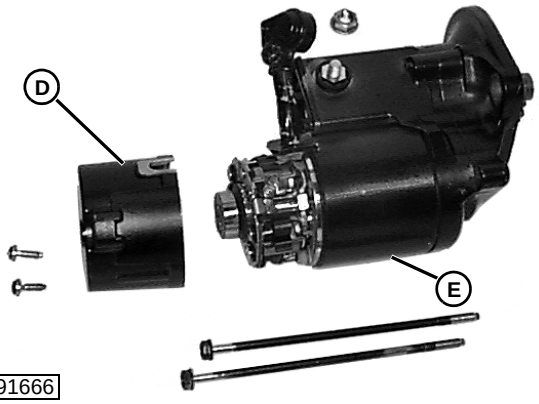
Disassembly:



M82233A

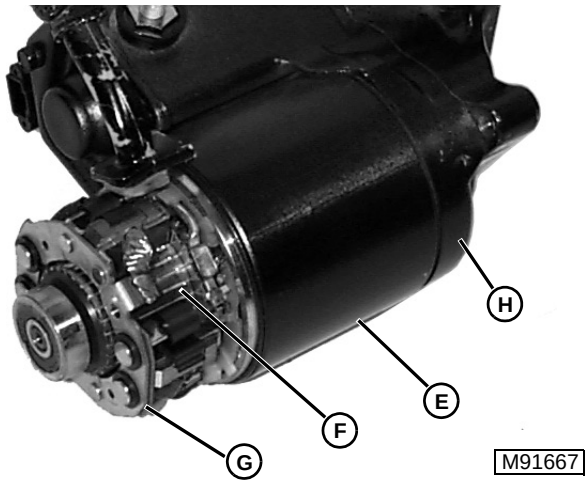
1. Disconnect the field lead (A).
2. Remove the cover screws (B).

3. Remove the cap screws (C) that secure the motor to the clutch housing.



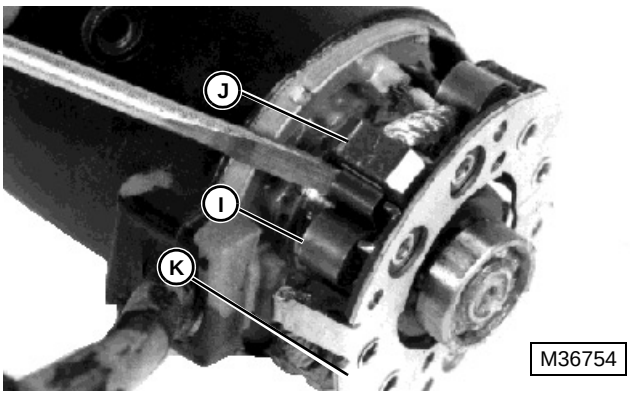
M91666

4. Separate the cover (D) from the motor (E).

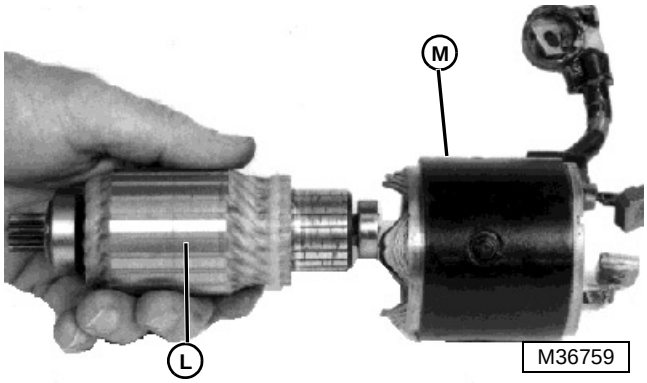


5. Remove motor (E), armature (F), and brush holder (G) as a unit from the clutch housing (H).

NOTE: Brushes are not serviceable separately. If the brushes require replacement, the entire brush holder, with brushes attached, must be replaced.



6. Pry the brush springs (I) away and pull the negative brushes (J) up enough to allow the springs to hold the brushes in place.
7. Remove the brush holder (K).

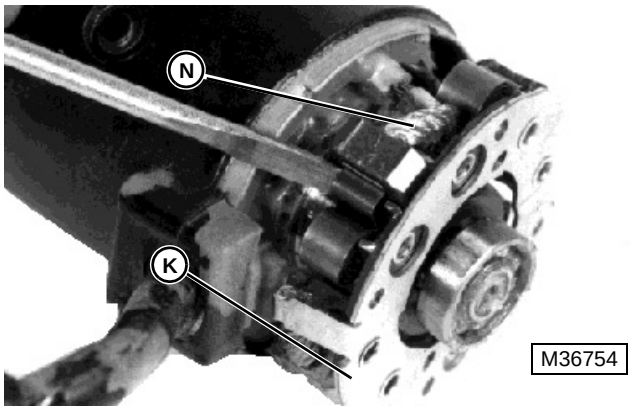


8. Remove the armature (L) from the field coil housing (M).
9. Inspect and test the brushes, holder, field coil and armature. (See “STARTING MOTOR INSPECTION/ TEST”).

Assembly:

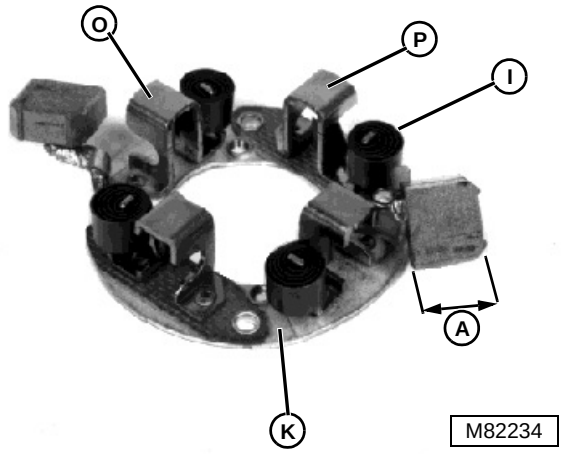
Assembly is done in the reverse order of disassembly.

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



IMPORTANT: When installing the rear cover, be sure the field coil brush wires (N) do not touch the cover. Turn the brush holder (K) slightly to take up slack in the brush wires. Press the wires inward to clear the rear cover.

STARTING MOTOR INSPECTION/ TEST



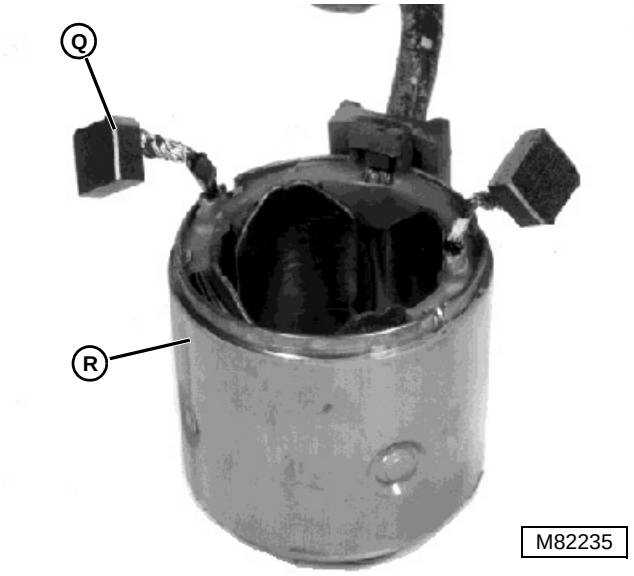
M82234

1. Measure brush lengths (A). Minimum brush length is **8.5 mm (0.335 in.)**. Replace brush if length is below minimum.

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

2. Test brush holder (K):
- Touch one probe of tester to negative brush holder (O) and other probe to field brush holder (P).
- If there is continuity, replace the brush holder.

3. Inspect springs (I) for wear or damage. Replace if necessary.



M82235

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

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

4. Test for grounded field winding:
- Touch one probe of tester to field coil brush (Q) and other probe to field coil housing (R).
- 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.

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 which might cause short circuits between bars. If necessary, clean and touch up with 400 sandpaper. NEVER use emery cloth. Clean all dust from armature when finished.

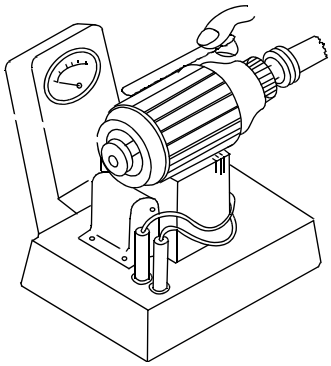
NOTE: Test armature windings using an ohmmeter or test light.

M82236

8. Test for grounded windings:
- Touch probes on one commutator bar (S) and armature shaft (T). 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 commutator bars.
- If test shows no continuity, there is an open circuit and the armature must be replaced.

-



M82125A

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.

To Replace Bearings:

M82237

1. Remove the bearings using a knife-edge puller set.

NOTE: The bearings are press fit.

IMPORTANT: Install both bearings with the sealed side toward armature.

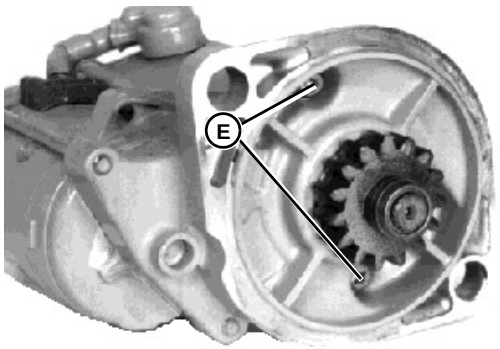
2. Install a new housing bearing (U) tight against the shoulder of the shaft using an appropriate size socket that only presses on the inner race of the bearing.
3. Install a new cover bearing (U) tight against the shoulder of the shaft using a driver set.

STARTING MOTOR GEAR TRAIN

Disassembly/Inspection:

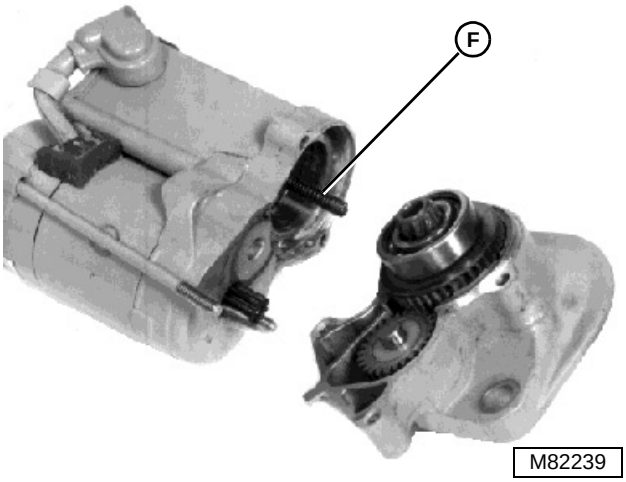
M82233

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

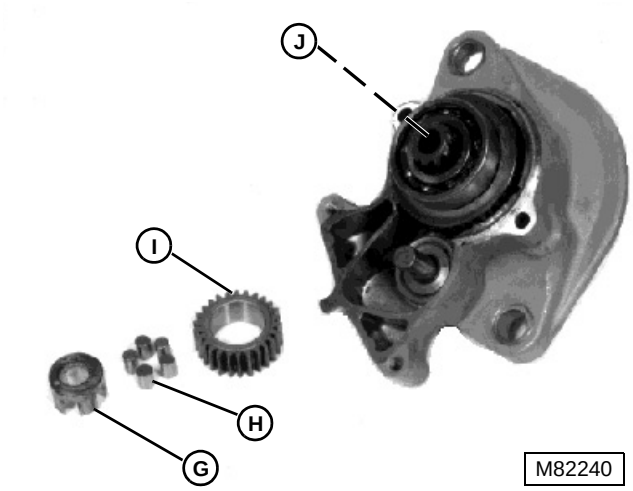


M82238

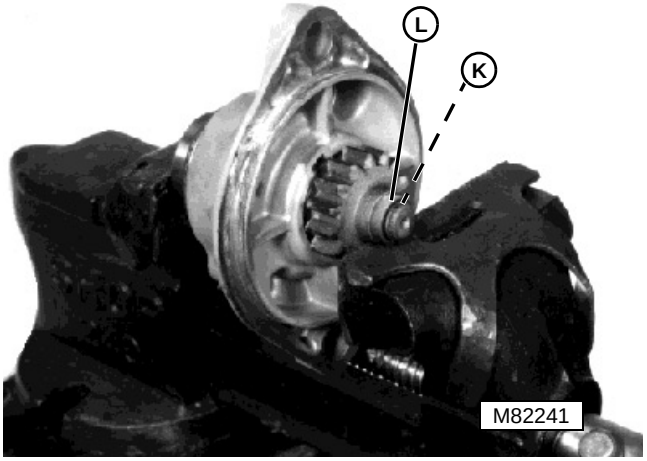
3. Remove two clutch housing-to-solenoid housing screws (E) to separate the clutch housing from the solenoid/motor assembly.



4. Remove the plunger spring (F).



5. Remove the retainer (G), five rollers (H), and pinion gear (I).
6. Remove the steel ball (J).

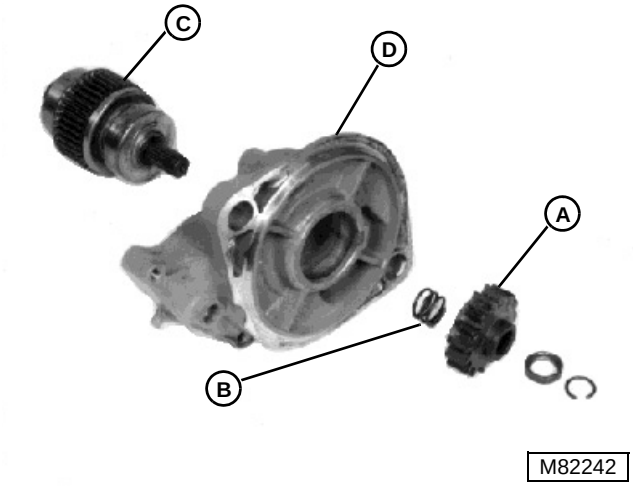


7. Put the clutch housing assembly into a soft-jawed vice, as shown.
8. Tighten the vise slowly, until the drive gear compresses.
9. Remove the circlip (K) and retainer (L).

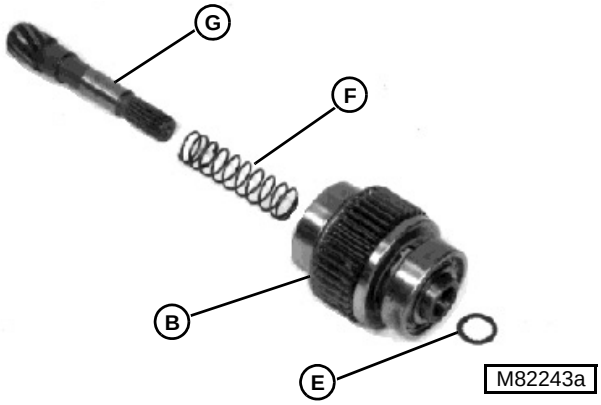
CAUTION

The shaft could be propelled from the clutch unit with considerable force if the spring is not allowed to extend fully while in the vise!.

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



11. Remove the drive gear (A), spring (B), and clutch (C) assembly from the housing (D).



12. Remove the toothed washer (E), spring (F), and clutch shaft (G).
13. Inspect all parts for wear or damage.

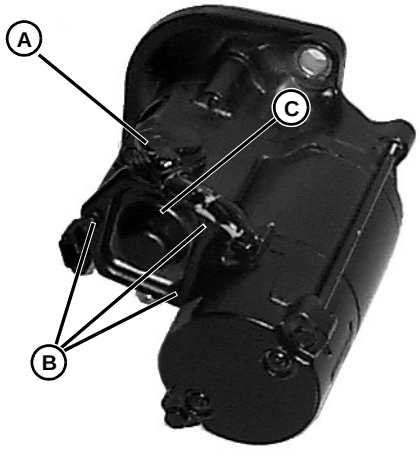
Assembly:

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 the large washer with the flat side toward the clutch assembly.
- Install the retainer with the cupped side away from the clutch assembly.

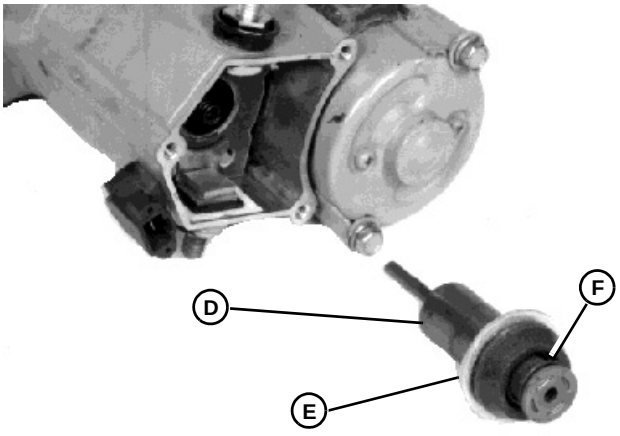
STARTING MOTOR SOLENOID

Disassembly/Inspection:



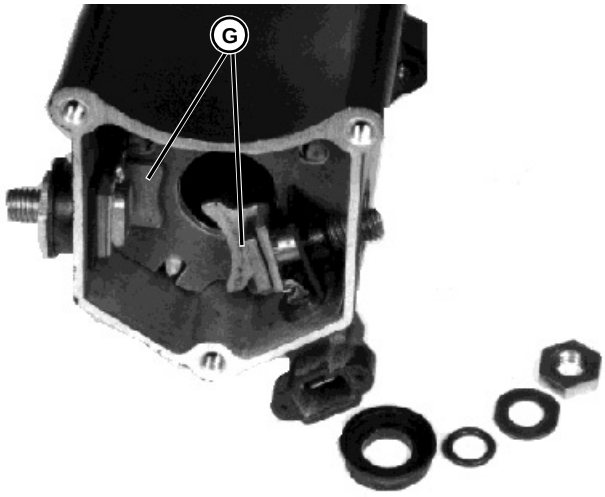
M82233A

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



M82245

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

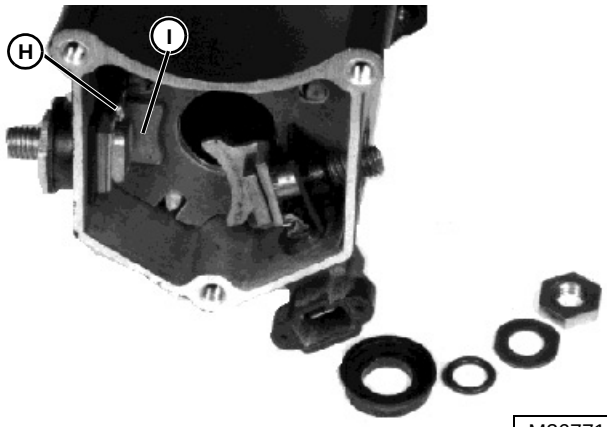


M36771

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

Assembly:

Assembly is done in the reverse order of disassembly.



M36771

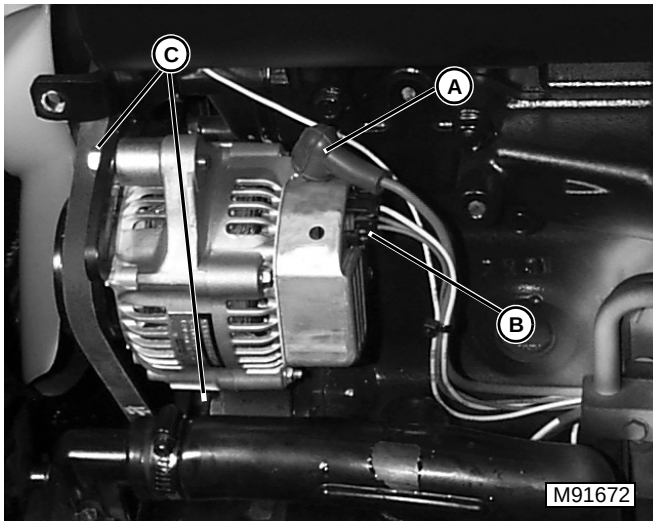
NOTE: The assembly sequence of the left and right terminals is similar. Be sure solenoid terminal lead (H) is installed between terminal bolt and contact plate. Also, be sure smaller contact plate (I) is on the left side.

ALTERNATOR REMOVAL AND INSTALLATION

Removal:

IMPORTANT: Always disconnect the negative cable from the battery before working on any electrical components.

1. Remove the negative cable from the battery.
2. Remove the left side panels as required to access the alternator.



3. Lift the plastic protective cover (A) from the positive (red) lead. Remove the nut and washer, and remove the lead from the alternator stud.
4. Remove the wire harness connector (B) from the alternator and move the wiring harness to the side
5. Remove the mounting bolts (C). Remove the alternator.

Installation:

Installation is done in the reverse order of removal.

- Tighten the drive belt. (See "FAN/ALTERNATOR DRIVE BELT ADJUSTMENT").

ALTERNATOR DISASSEMBLY

Equipment:

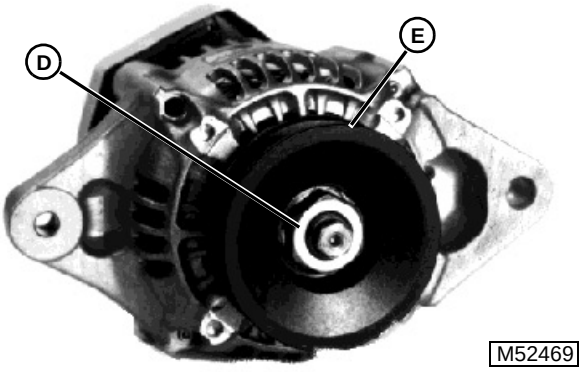
- Volt-Ohm-Amp Meter
- 13 Ton Bearing Puller Set
- Soldering Gun (120 Watt Capacity)
- Solder (Only 60-40 Resin Core)
- Sandpaper (No. 00 or 400-grit silicon carbide paper).

Specification:

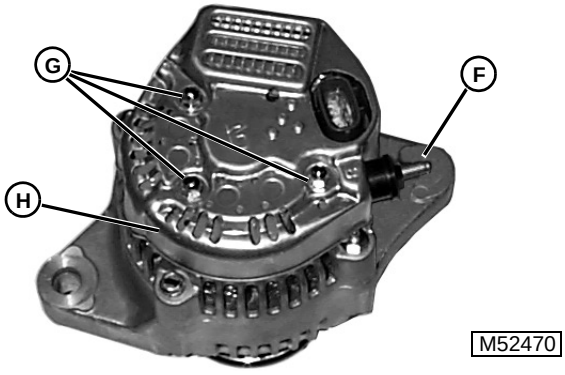
Exposed Brush Length
Minimum . . . . . 4.5 mm (0.17 in.)
Maximum. . . . . 10.5 mm (0.41 in.)
Rotor Slip Ring Diameter (Min.) . . . 14 mm (0.55 in.)
Pulley Nut Torque. . . . . .69 N•m (51 lb-ft)
Belt Deflection at 98 N (22 lb-force):
. . . . . 10 - 15 mm (0.4 - 0.6 in.)

Disassembly:

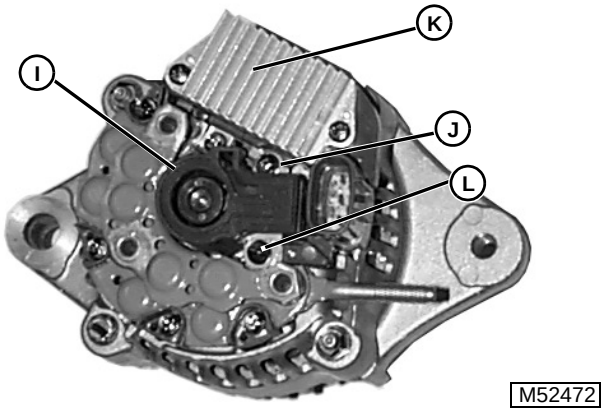
NOTE: Clamp the pulley in a soft jaw vise and use an air impact wrench to remove the pulley nut.



1. Remove the pulley nut (D) and pulley (E).



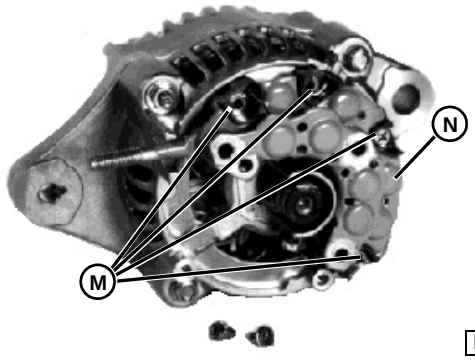
2. Remove the nut, washer and insulator from the battery terminal post (F).
3. Remove three screws (G) securing the cover (H) to the body. Remove the cover.



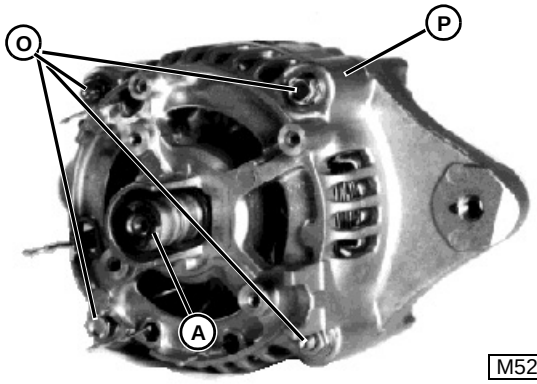
4. Remove two screws securing the brush holder and cover to the body. Remove the brush holder and cover.

NOTE: Remember the location of the short screw (J) on the regulator tab, and the long screw (L) on the brush holder.

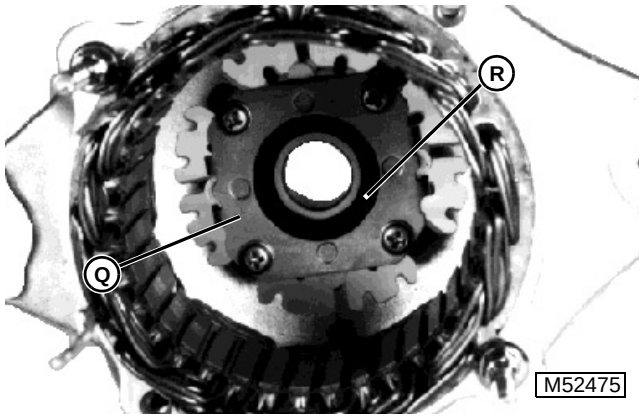
5. Remove the three screws securing the voltage regulator (K) to body. Remove the voltage regulator.



6. Remove four screws (M) and straighten the wire leads.
7. Remove the rectifier (N).

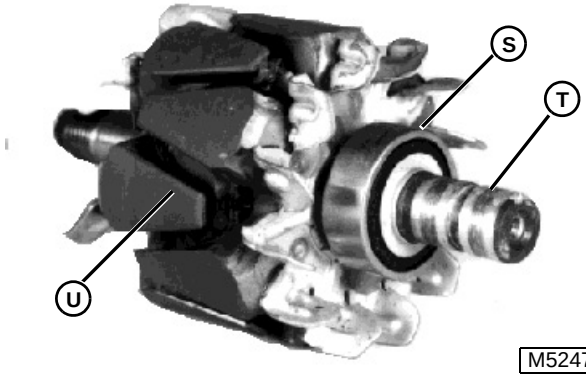


8. Remove cap screws and nuts (O) and slide off the rear case assembly (P).



9. Slide the rotor out of the front frame.
10. Remove the bearing retainer plate (Q).
11. Press bearing (R) from the case.

Inspection:

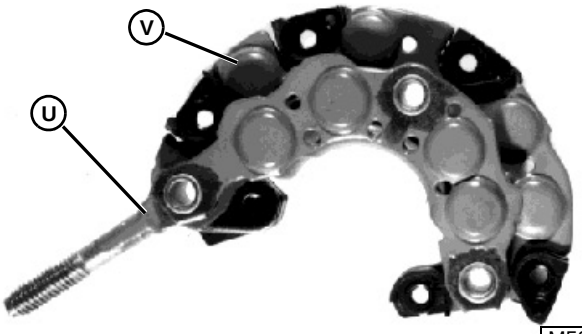


1. Inspect bearing (S) for smooth rotation. Replace if necessary.
2. Inspect slip rings (T) for dirt or rough spots. If necessary, use No. 00 sandpaper or 400-grit silicon carbide paper to polish the rings.
3. Measure the outer diameter of the slip rings. Replace the rotor if less than **14 mm (0.55 in.)**.
4. Check for continuity between slip rings using an ohmmeter or continuity tester. Replace the rotor assembly if there is no continuity.
5. Check for continuity between the slip rings and the rotor core (U). Replace the rotor assembly if there is continuity.

NOTE: Use an ohmmeter that is sensitive to 0—1 ohm.

6. Inspect the stator for defective insulation, discoloration, or burned odor.
7. Check for continuity between each of the four stator leads and the body. Replace the frame assembly if there is continuity.

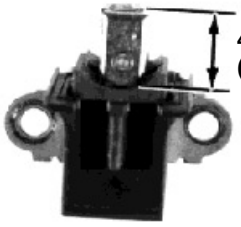
NOTE: The stator is not serviced separately. If the stator is bad it must be replaced as part of the frame assembly.



M52477

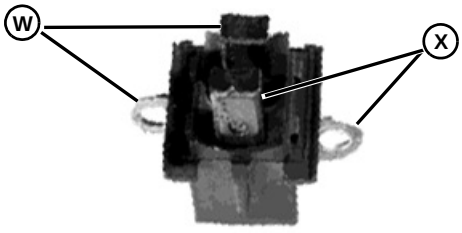
NOTE: Set the ohmmeter to the K ohm range.

8. Check for continuity between the main lead (U) and each diode lead (V). Reverse the ohmmeter leads and recheck. If there is continuity in one direction, but not the other, the diode is working correctly. Replace any diode or rectifier plate that is not working correctly.



M52478

9. Measure the length of the brush protruding from the holder. The minimum dimension is **4.5 mm (0.17 in.)**. Replace the brushes if worn below the minimum. Maximum exposed new brush length is **10.5 mm (0.41 in.)**.



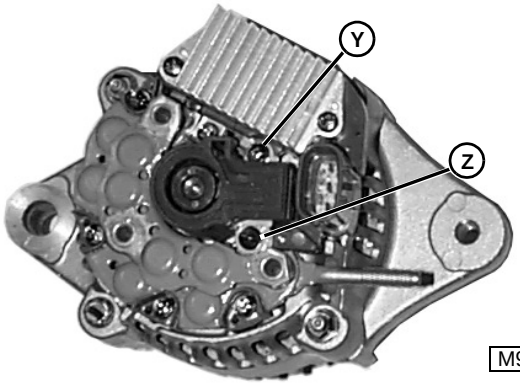
M52479

10. Check for continuity between the brush and terminal (W). Check for continuity between the brush and terminal (X). There should be continuity only at these points.

Assembly:

Assembly procedure is the reverse of disassembly.

NOTE: Check that the rotor fan does not contact the case, and that the rotor assembly turns smoothly in the bearing.

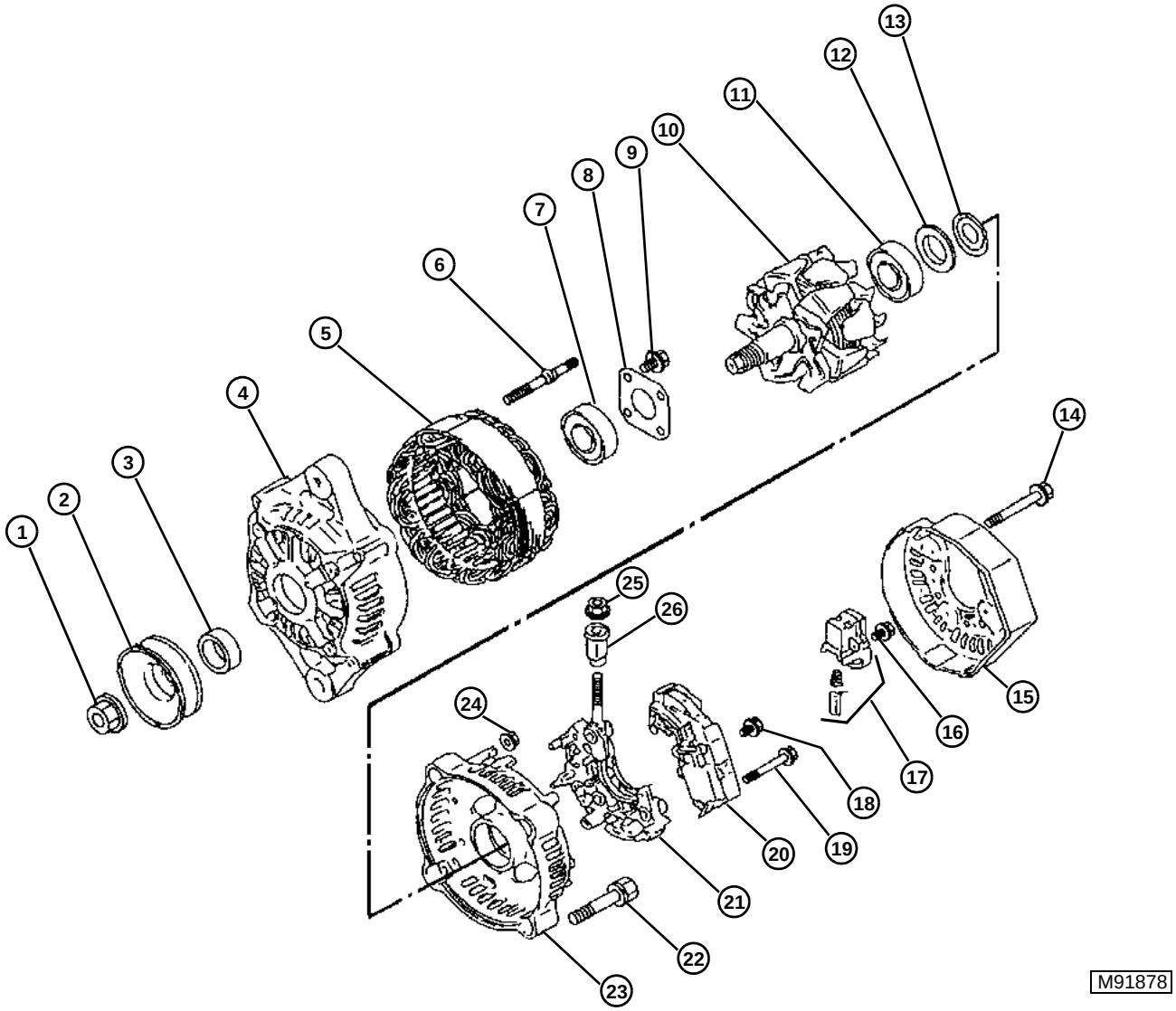


M91674

IMPORTANT: The short screw is installed in the regulator tab (Y). If the longer screw (Z) is installed in the brush holder. If installed in the wrong position it will contact the frame and will cause damage to the charging system.

- Clamp the pulley in a soft jaw vise. Install the pulley nut. Tighten the nut to **69 N•m (51 lb-ft)**.

ALTERNATOR COMPONENTS



1. Nut	2. Pulley	3. Spacer (40 amp only)	4. Front Frame
5. Stator	6. Stud	7. Bearing	8. Cover
9. Screw	10. Rotor	11. Bearing	12. Cover
13. Thrust Washer (40 A)	14. Cap Screw	15. Cover	16. Screw
17. Brush Assembly	18. Screw	19. Screw	20. Regulator
21. Diode Assembly	22. Cap Screw	23. Rear Frame	24. Nut
25. Nut	26. Insulator Bushing		

CONTENTS

Page

Page

Page

Page

READING ELECTRICAL SCHEMATICS

The schematic is made up of individual circuits laid out in a sequence of related functions. It is formatted with all power wires (A) across the top and all ground wires (B) across the bottom. Current flow is generally from top to bottom through each circuit and component. All components are shown in the OFF position. The diagram does not list connector (C) information unless needed to avoid confusion. If the connector is shown, the number next to it is the terminal pin location (D) in the connector.

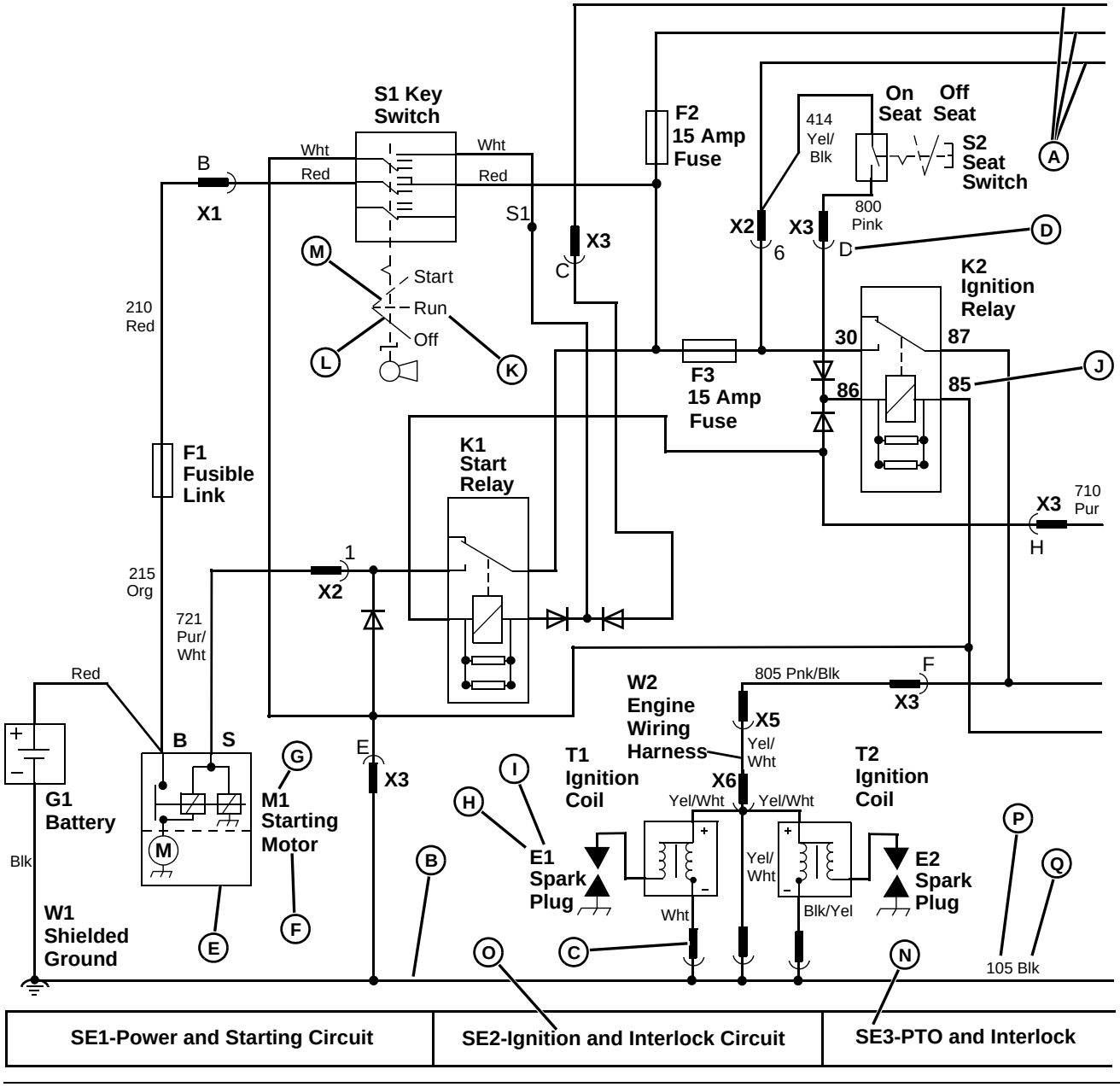
Each component is shown by a symbol (E), its name (F), and an identification code (G). The identification code contains a device identifying letter (H) and number (I).

The identifying letter is always the same for a specific component, but the identifying numbers are numbered consecutively from upper left to lower right. The terminal designation (J) is placed directly outside the symbol next to the connecting wire path. Switch positions (K) are also placed directly outside the symbol. The solid line (L) shows the position the switch is currently in and dash lines (M) represent other switch positions.

Each circuit is identified at the bottom of the drawing by a section number (N) and section name (O).

The circuit number (P) and wire color (Q) of the wires are shown directly next to the wire path.

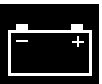
The same component name and identification code are used consistently on all diagrams in this section. Components can be easily cross-referenced.



THEORY AND DIAGNOSTIC INFORMATION

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.



DIAGNOSTIC INFORMATION

The diagnostic procedures is used to test the complete circuit regardless of the problem or complaint. Select a symptom or system from the quick check or troubleshooting chart and follow the test procedures under that heading.

The diagnostic procedure lists:

- Test conditions
- Test sequence
- Test location
- Normal reading
- Check or test to perform if reading is not normal

When performing the test or check, be sure to set your machine up to the test conditions listed and follow the sequence carefully. The middle **“NORMAL”** column gives the reading or condition that should be obtained when performing the test or check. If the results of the test or check are not normal, perform the test, check, or adjustment listed in the third **“IF NOT NORMAL”** column to repair the malfunction. The detailed tests or adjustments referred to in the **“IF NOT NORMAL”** column are located at the end of that group. The system diagram that accompanies each test procedure is drawn to resemble machine components. The key number on the art matches the number in the **“TEST LOCATION”** column and the leader line points to the exact point the test is to be made.

WIRE COLOR ABBREVIATION CHART

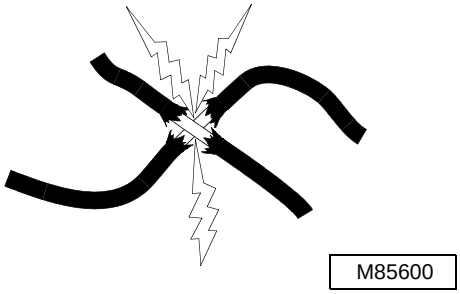
Blk	Black
Blu	Blue
Brn	Brown
Grn	Green
Gry	Gray
Org	Orange
Pnk	Pink
Pur	Purple
Red	Red
Tan	Tan
Wht	White
Yel	Yellow
Blk/Wht	Black/White
Blu/Wht	Blue/White
Brn/Wht	Brown/White
Brn/Yel	Brown/Yellow
Dk Blu	Dark Blue
Dk Brn/Lt Grn	Dark Brown/Light Green
Dk Brn/Red	Dark Brown/Red
Dk Brn/Yel	Dark Brown/Yellow
Dk Grn	Dark Green
Lt Blue	Light Blue
Lt Grn	Light Green
Org/Wht	Orange/White
Pnk/Blk	Pink/Black
Pur/Wht	Purple/White
Red/Blk	Red/Black
Red/Wht	Red/White
Wht/Blk	White/Black
Wht/Red	White/Red
Yel/Blk	Yellow/Black
Yel/Red	Yellow/Red
Yel/Wht	Yellow/White

COMMON CIRCUIT TESTS

Shorted Circuit:

A shorted circuit may result in the wrong component operating (i.e. improper wire-to-wire contact). To test for a shorted or improperly wired circuit:

1. Turn component switch ON.
2. Start at the controlling switch of the component that should not be operating.
3. Follow the circuit and disconnect wires at connectors until component stops operating.
4. Shorted or improper connections will be the last two wires disconnected.



M85600

High Resistance or Open Circuit:

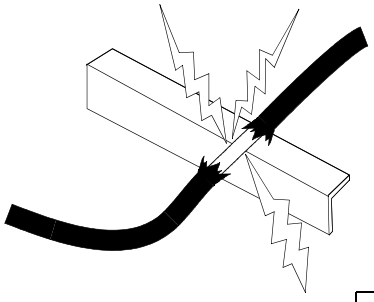
High resistance or open circuits usually result in slow, dim or no component operation (i.e. poor, corroded, or disconnected connections). Voltage at the component will be low when the component is in operation. To test for high resistance and open circuits:

1. Check all terminals and grounds of the circuit for corrosion.
2. If terminals are not corroded or loose, the problem is in the component or wiring.

M85601

Grounded Circuit:

Grounded circuits usually result in no component operation or a blown fuse.



M85602

CONDUCTORS FOR 12 VOLT CIRCUITS

STRANDED CONDUCTORS FOR 12 VOLT CIRCUITS						
SAE WIRE SIZE (GAUGE)	20	18	16	14	12	10
METRIC WIRE SIZE (MM)	0.5	0.8	1.0	2.0	3.0	5.0
TYPICAL STRANDING	7 X 28	16 X 30	19 X 29	19 X 27	19 X 25	19 X 23
MINIMUM CONDUCTOR AREA IN CIRCULAR MILS	1072	1537	2336	3702	5833	9343

SPECIFICATIONS (NORTH AMERICAN AND EUROPEAN)

Battery:

Voltage . . . . . 12 VDC
BCI Group U-1
CCA Rating (Amps at –18° C (0° F)) . . . . . 600 Amps
Reserve Capacity (minutes) 38
Specific Gravity at full charge (26.7°C (80°F)) . . . . . 1.265 or above
Electrolyte Required Fill (Approx.) . . . . . 1.9 L (2.0 qt)
Load test (minimum) . . . . . 325 amp for 15 seconds

Starting Motor:

Type . . . . . Solenoid Shift
Size . . . . . 2.0 kW (2.68 hp)
Amp Draw (on vehicle) . . . . . 300 amps (max.)
No-load Amp Draw (free running) . . . . . 325 amps for 15 seconds

Alternator:

North American / European
Rating (Standard) . . . . . 40 amps
Unregulated Amperage . . . . . 40 amps (min.)
European
Rating (Standard) . . . . . 55 amps
Unregulated Amperage . . . . . 55 amps (min.)
Regulated Voltage . . . . . 12.4 – 13.2 VDC
Unregulated Voltage . . . . . 50 VAC

Fuel Shutoff Solenoid (Dual Coil):

Voltage . . . . . 12 VDC
Pull-in voltage . . . . . 6.8 VDC
Hold voltage . . . . . 3.0 VDC

Sensors:

Fuel Gauge Resistance (variable) . . . . . approximately 5 – 110 ohms
Fuel Gauge Voltage Drop Across Gauge (full – empty) . . . . . 5.72 – 0.87 VDC
Engine Coolant Temperature (variable) . . . . . approximately 40 – 700 ohms
Engine Oil Pressure Switch . . . . . Closes (Light from ON to OFF) at 49 kPa (7.1 psi)

Manifold Heater:

Resistance (through element) . . . . . approximately 0.3 – 0.5 ohms

Lighting:

Headlights (halogen) . . . . . 37.5 Watts
Tail Light . . . . . 5 Watts–Bayonet Base
Hazard Lights . . . . . 32 Candle Power, Single Element, Type 1156
Instrument Panel Lamps . . . . . 1.7 Watts–Bayonet Base

NORTH AMERICAN ELECTRICAL SECTION

ELECTRICAL SCHEMATIC AND WIRING HARNESS LEGEND

B1—Fuel Gauge Sensor (SE5, W1)

B2—Engine Oil Pressure Switch (SE5, W1)

B3—Engine Coolant Temperature Sensor (SE6, W1)

E1—LH Tail Light (SE4, W1)

E2—LH Hazard Light (SE4, W1)

E3—RH Tail Light (SE4, W1)

E4—RH Hazard Light (SE5, W1)

E5—LH Headlight (SE6, W1)

E6—RH Headlight (SE6, W1)

E7—LH Work Light (Option)(SE6, W1)

E8—RH Work Light (Option)(SE6, W1)

F1—Fuse - 30 amp (SE1, W1)

F2—Fuse - 30 amp (Option)(SE4, W1)

F3—Fuse - 30 amp (SE4, W1)

F4—Not Used

F5—Fuse - 10 amp (SE2, W1)

F6—Fuse - 20 amp (SE5, W1)

F7—Fuse - 20 amp (SE5, W1)

F8—Fuse - 20 amp (Option)(SE5, W1)

G1—Battery (SE1, W1)

G2—Alternator (SE3, W1)

H1—RH Turn Light (SE5, W1)

H2—LH Turn Light (SE5, W1)

H3—PTO Light (SE5, W1)

H4—Discharge Light (SE5, W1)

H5—Cold Start Light (SE5, W1)

H6—Park Brake Light (SE5, W1)

H7—Engine Oil Pressure Light (SE5, W1)

H8—Cruise Control Indicator Light (Option)(SE5, W1)

H9—Backup Alarm (SE2, W1)

K1—Manifold Heater Relay (SE2, W1)

K2—Start Relay (SE1, W1)

K3—Fuel Shutoff Relay (SE2, W1)

K4—Engine Run Relay (SE2, W3)

K5—Safety Relay (SE2, W1)

K6—Safety Relay (SE2, W1)

K7—Accessory Relay (SE4, W1)

K8—Cruise Control Relay (Option)(SE5, W1)

K9—Rear PTO Relay (SE2, W1)

M1—Starting Motor (SE1, W1)

P1—Engine Tachometer (SE5, W1)

P2—Hour Meter (SE5, W1)

P3—Fuel Gauge (SE5, W1)

P4—Engine Coolant Temperature Gauge (SE5, W1)

R1—Manifold Heater (SE2, W1)

R2—Variable Thermistor (SE2, W1)

S1—Key Switch (SE1, W1)

S2—Seat Switch (SE2, W1)

S3—Transmission Neutral Switch (Hydrostatic - HST, and SyncReverser™ - SRT) (SE2, W1)

S4—Transmission Neutral Switch (Gear - CST Only)(SE2, W1)

S5—Rear PTO Switch (SE2, W1)

S6—Mid PTO Switch (Option)(SE2, W1)

S7—Park Brake Switch (SE2, W1)

S8—Turn Signal Switch (SE5, W1)

S9—Light Switch (SE5, W1)

S10—Cruise Control Switch (Option)(SE5, W1)

S11—Brake Switch (SE5, W1)

V1—Diode Block (SE2, W1)

V2—Diode (SE2,W1)

W1—Battery Frame Ground (SE1, W1)

Y1—Starting Motor Solenoid (SE1, W1)

Y2—Fuel Shutoff Solenoid (SE2, W1)

Y3—Cruise Control Magnet (Option)(SE5, W1)

CONNECTORS:

X1—W1 Main Wiring Harness to Fusible Link (SE1, W1)

NOTE: X2 supplied with cap and jumper wire if X3 is connected to transmission neutral switch on gear (CST) tractors.
X3 supplied with cap and jumper wire if X2 is connected to transmission neutral switch on hydrostatic (HST) or SyncReverser™ - (SRT) tractors.

X2—W1 Main Wiring Harness to W3 Neutral Start Wiring Harness (HST and SRT) (SE2, W1)

X3—W1 Main Wiring Harness to S4 Transmission Neutral Switch Wiring Harness (CST Only) (SE2, W1)

X4—W1 Main Wiring Harness to W2 Fuel Shutoff Solenoid Wiring Harness (SE2, W1)

X5—W1 Main Wiring Harness to S6 Mid PTO Switch (Option) (SE2, W1)

X6—W1 Main Wiring Harness to Control Panel Circuit Board (SE5, W1)

X7—W1 Main Wiring Harness to Control Panel Circuit Board (SE5, W1)

X8—W1 Main Wiring Harness to Control Panel Circuit Board (SE5, W1)

X9—W1 Main Wiring Harness to W4 Cruise Control Wiring Harness (SE4, W1)

X10—W4 Cruise Control Wiring Harness to S10 Cruise Control Switch (SE5, W4)

X11—W4 Cruise Control Wiring Harness to S11 Brake Switch (SE5, W4)

X12—W4 Cruise Control Wiring Harness to W5 Cruise Control Magnet Wiring Harness (SE5, W4)

X13—W1 Main Wiring Harness to W8 Trailer Connector Wiring Harness (SE4/SE5/SE6, W1)

X16—W1 Main Wiring Harness to E8 RH Work Light (Option) (SE6, W1)

X17—W1 Main Wiring Harness to E7 LH Work Light (Option) (SE6, W1)

X18—W1 Main Wiring Harness to E1 LHTail Light (SE4, W1)

X19—W1 Main Wiring Harness to E2 LH Hazard Light (SE4, W1)

X20—W1 Main Wiring Harness to E1 LH Tail Light and E2 LH Hazard Light (SE4, W1)

X21—W1 Main Wiring Harness to E3 RH Tail Light (SE4, W1)

X22—W1 Main Wiring Harness to E4 RH Hazard Light (SE4, W1)

X23—W1 Main Wiring Harness to E3 RH Tail Light and E4 RH Hazard Light (SE4, W1)

X24—W1 Main Wiring Harness to H9 Backup Alarm (SE2, W1)

WIRING HARNESSES:

W1—Main Wiring Harness

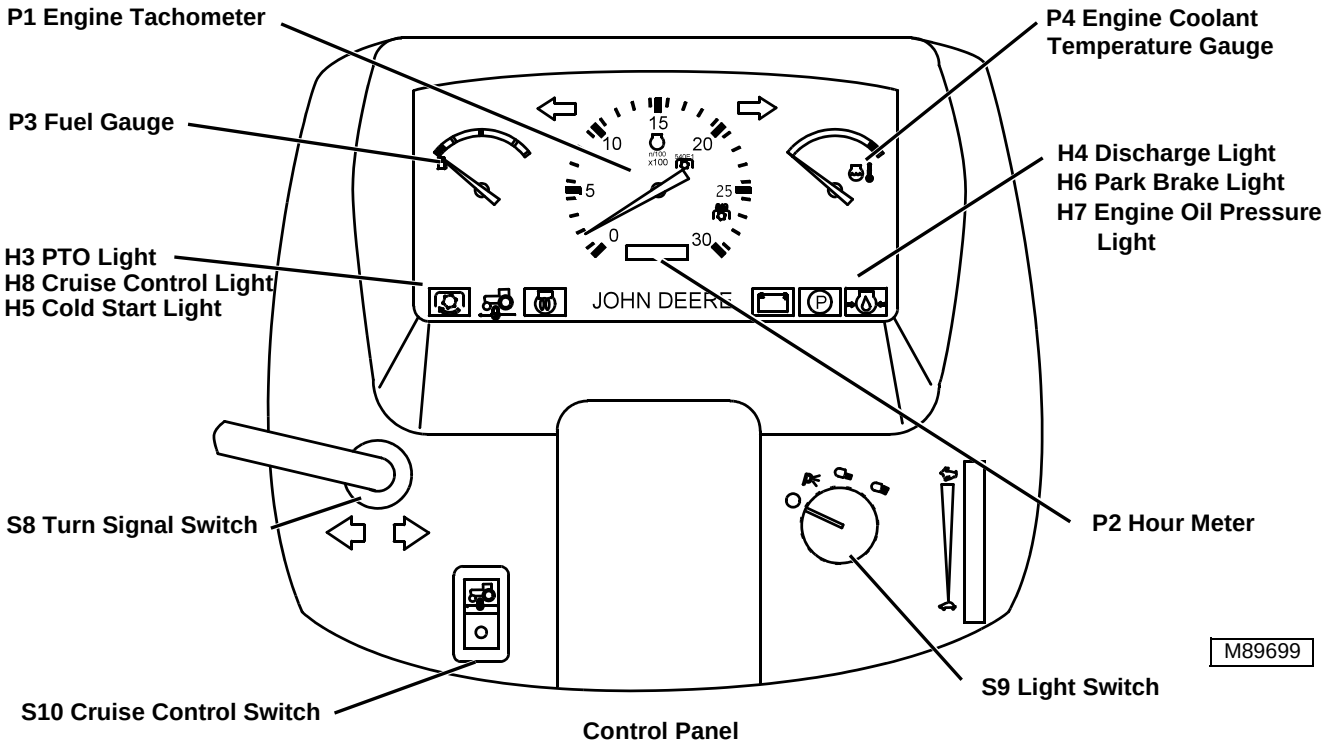
W2—Fuel Shutoff Solenoid Wiring Harness

W3—Neutral Start Wiring Harness (HST & SRT) (included in the W4 Wiring Harness protective wrap)

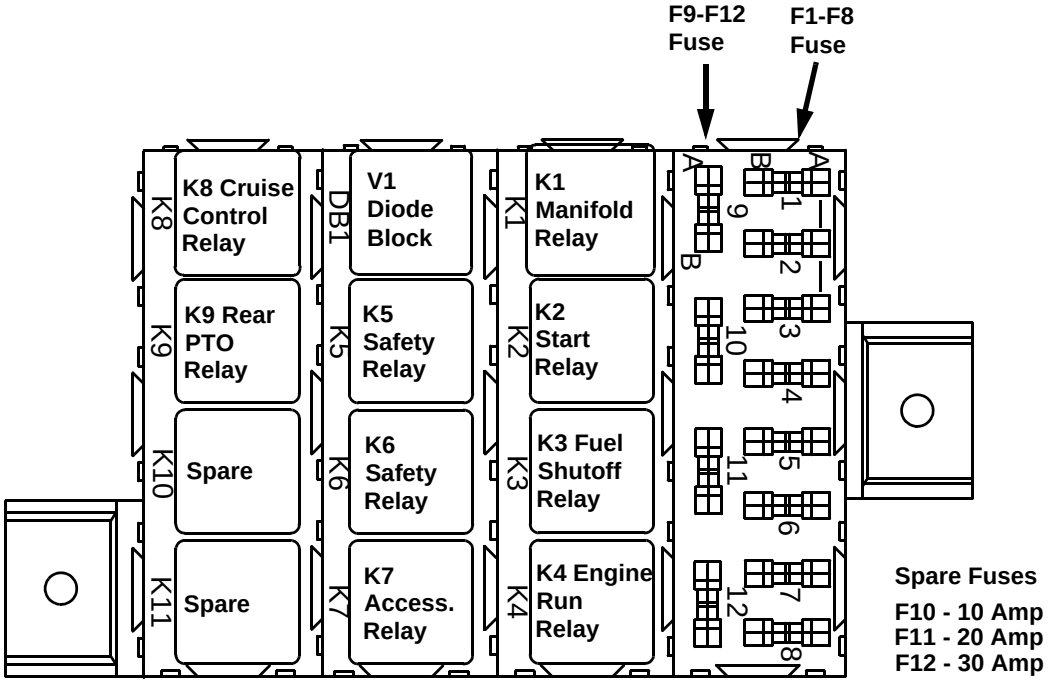
W4—Cruise Control Wiring Harness

W5—Cruise Control Magnet Wiring Harness

COMPONENT LOCATION – CONTROLS & LOAD CENTER

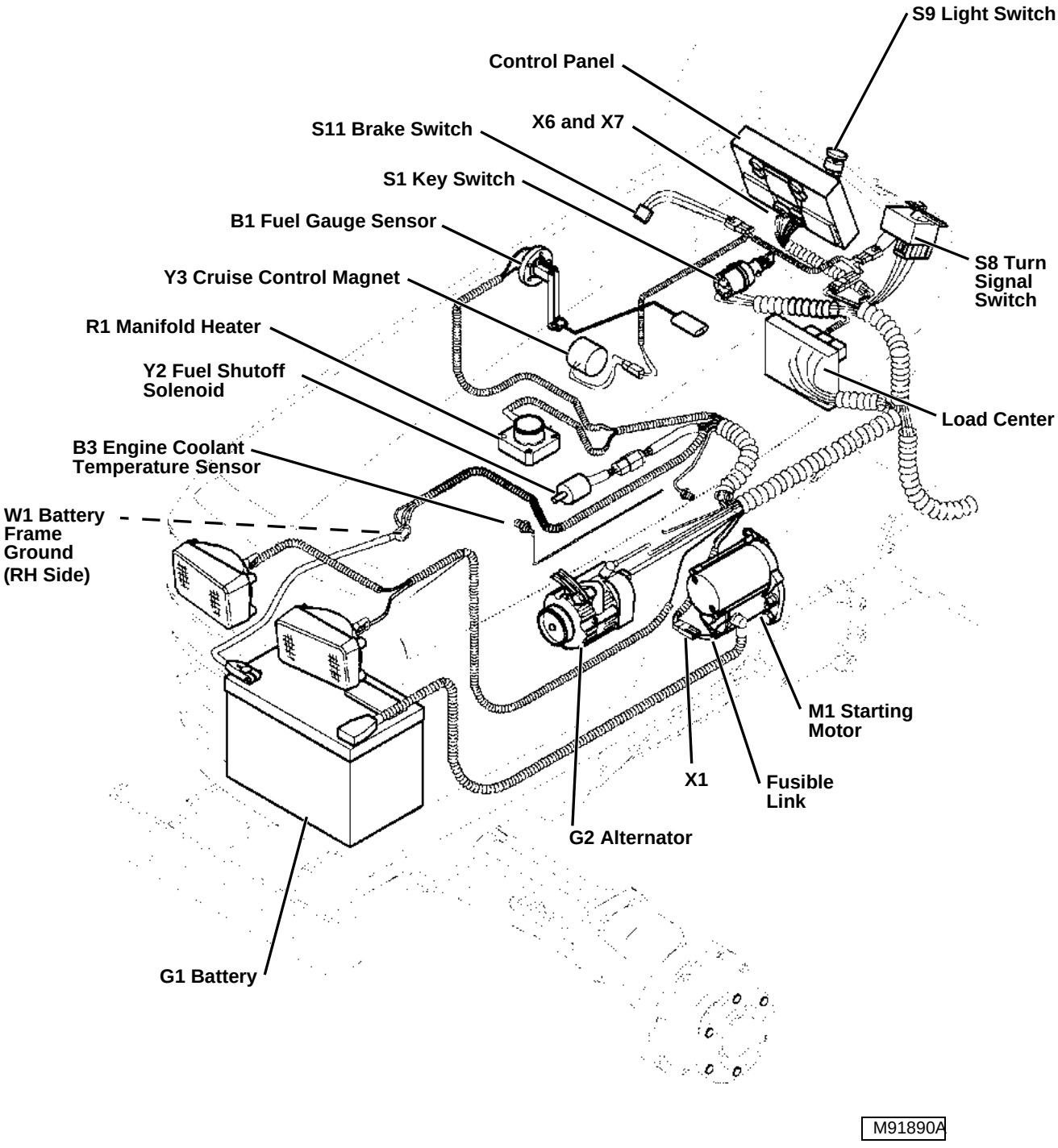


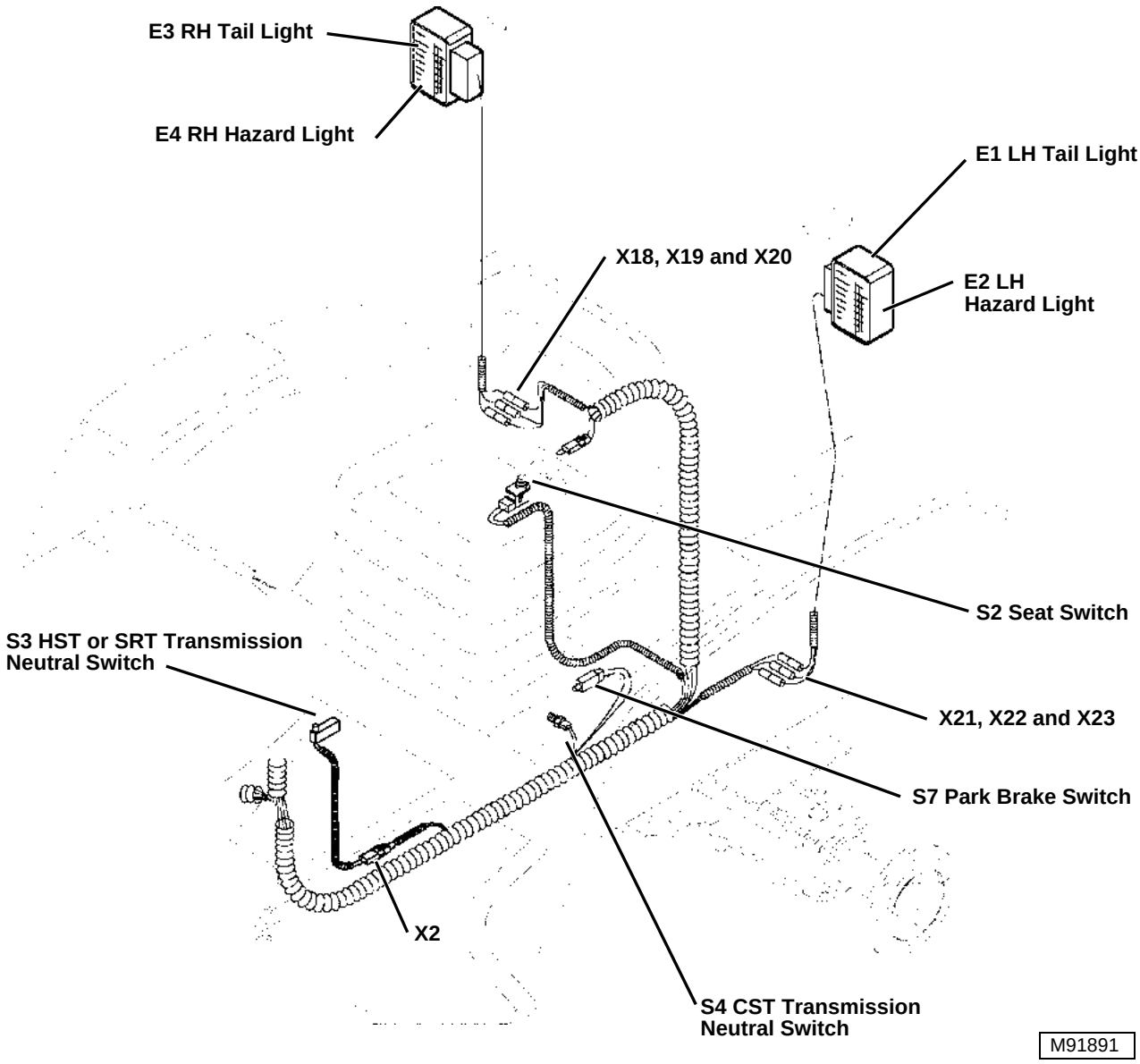
Control Panel



Relay / Diode Block / Fuse Load Center

COMPONENT LOCATION – TRACTOR




E3 RH Tail Light
E4 RH Hazard Light
E1 LH Tail Light
X18, X19 and X20
E2 LH
Hazard Light
S2 Seat Switch
S3 HST or SRT Transmission
Neutral Switch
X21, X22 and X23
S7 Park Brake Switch
X2
S4 CST Transmission
Neutral Switch
M91891

SCHEMATICS AND WIRING HARNESSES

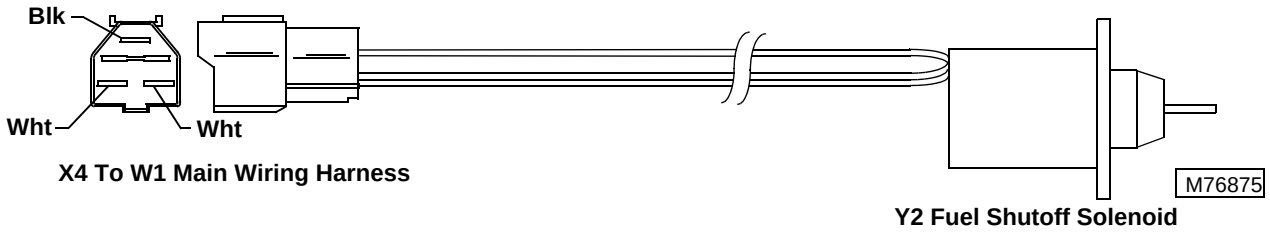
WIRE COLOR CODES (OLD)

Circuit Number	Wire Size	Color	Termination Points
002A	5.0	Red	M1, G2
002B	5.0	Red	X1 (Fusible Link), K1(30)
002C	5.0	Red	X1 (Fusible Link), Splice 002
002D	5.0	Red	Splice 002, F2
002E	1.0	Red	Splice 002, K4(30)
010A	1.0	Blk	E6, Splice 010
010B	1.0	Blk	E5, Splice 010
010C	5.0	Blk	W1, Splice 010
010D	0.8	Blk	DB1-7, Splice 010
010E	0.5	Blk	DB1-7, K2(85)
010F	0.5	Blk	K2(85), K3(85)
010G	0.8	Blk	Splice 010, X20
010H	0.8	Blk	Splice 010, X17
010J	2.0	Blk	Splice 010, X13
010K	0.8	Blk	Splice 010, X16
010L	0.8	Blk	Splice 010, X23
010N	1.0	Blk	X4, W1
010T	(–)	Therm.	K3(85), R2
012	5.0	Red	S1, F1
050A	2.0	Blk	W1, Splice 050
050B	0.5	Blk	K1(85), Splice 050
050C	0.5	Blk	K1(85), K4(85)
050D	0.5	Blk	K4(85), K5(85)
050E	0.5	Blk	K5(85), K6(85)
050F	0.5	Blk	K6(85), K7(85)
050G	0.5	Blk	K7(85), K8(85)
050H	0.5	Blk	K8(85), K9(85)
050J	0.8	Blk	Splice 050, X9
050K	1.0	Blk	Splice 050, X6
050L	0.5	Blk	B1, Splice 050
072A	1.0	Red	X6, Splice 072
072B	1.0	Red	S1, Splice 072
072C	0.8	Red	Splice 072, F5
072D	0.8	Red	Splice 072, G2
103A	1.0	Org	S9, Splice 103
103B	1.0	Org	Splice 103, S8
103C	1.0	Org	Splice 103, F8
115A	1.0	Dk Grn	S8, Splice 115
115B	0.8	Dk Grn	X7, Splice 115
115C	0.8	Dk Grn	Splice 115, X22
115D	0.8	Dk Grn	Splice 115, X21
115E	1.0	Dk Grn	Splice 115, X13
118	1.0	Gry	F8, X13
119A	1.0	Wht	E6, Splice 119
119B	1.0	Wht	E5, Splice 119
119C	2.0	Wht	Splice 119, F7
119D	0.8	Wht	Splice 119, X6
122A	1.0	Red	S8, Splice 122
122B	3.0	Red	S9, Splice 122
122C	3.0	Red	F3, Splice 122
125A	1.0	Dk Grn	S8, Splice 125
125B	0.8	Dk Grn	X7, Splice 125
125C	0.8	Dk Grn	Splice 125, X19
125D	0.8	Dk Grn	Splice 125, X18
125E	1.0	Dk Grn	Splice 125, X13
138	2.0	Gry	S9, F7
143	2.0	Org	S9, F6
147A	2.0	Pur	F6, Splice 147
147B	0.8	Pur	Splice 147, X17
147C	2.0	Pur	Splice 147, X13

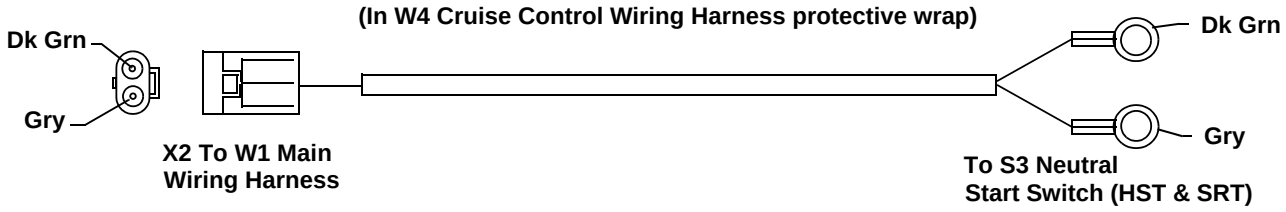
Circuit Number	Wire Size	Color	Termination Points
147D	0.8	Pur	Splice 147, X16
209	0.8	Wht	X9, S1
212	0.5	Red	K7(86), S1
222	2.0	Red	K7(87), X13
238	0.8	Gry	X9, K8(86)
247	0.8	Pur	X9, K8(87)
252	2.0	Red	K7(30), F2
264A	0.8	Yel	K8(30), X9
264B	0.8	Yel	K8(30), X6
302A	1.0	Red	DB1- 8, Splice 302
302B	1.0	Red	K4(87), Splice 302
302C	1.0	Red	Splice 302, X4
309	1.0	Wht	K2(87), M1
319	(+)	Therm.	K3(87a), R2
325	0.8	Dk Grn	X6, G2
329A	1.0	Wht	X4, K3(30)
329B	1.0	Wht	K3(30), K3(86)
334	0.8	Yel	X7, G2
347	0.5	Pur	X6, B2
353	0.5	Org	X6, B1
359	0.5	Wht	X6, B3
383	3.0	Org	K1(87), R1
385A	0.8	Dk Grn	X7, Splice 385
385B	0.8	Dk Grn	Splice 385, S1
385C	0.5	Dk Grn	Splice 385, K1(86)
505	0.5	Dk Grn	X2, X3
518A	0.5	Gry	DB1- 6, K2(86)
518B	0.5	Gry	K2(86), X2
521	0.5	Brn	K4(86), DB1- 5
533	0.5	Org	K5(87), K6(87a)
539A	0.5	Wht	DB1- 1, DB1- 4
539B	0.5	Wht	DB1- 4, S2

Circuit Number	Wire Size	Color	Termination Points
546	0.5	Lt Blu	K5(30), S7
556	0.5	Lt Blu	K6(86), DB1- 2
562A	0.8	Red	F5, Splice 562
562B	0.5	Red	K9(30), Splice 562
562C	0.5	Red	Splice 562, S7
562D	0.5	Red	S5, Splice 562
562E	0.5	Red	Splice 562, S2
562F	0.5	Red	Splice 562, X5
572A	1.0	Red	S1, K2(30)
572B	0.8	Red	K2(30), DB1- 3
573A	0.5	Org	Splice 573, S5
573B	0.5	Org	V2, Splice 573
573C	0.5	Org	K9(86), Splice 573
574	0.5	Yel	K9(87a), X7
586	0.5	Lt Blu	S7, X6
587A	0.5	Pur	X2, Splice 587
587B	0.5	Pur	V2, Splice 587
587C	0.5	Pur	K5(86), Splice 587
587D	0.5	Pur	K6(30), Splice 587
594	0.5	Yel	S7, X5

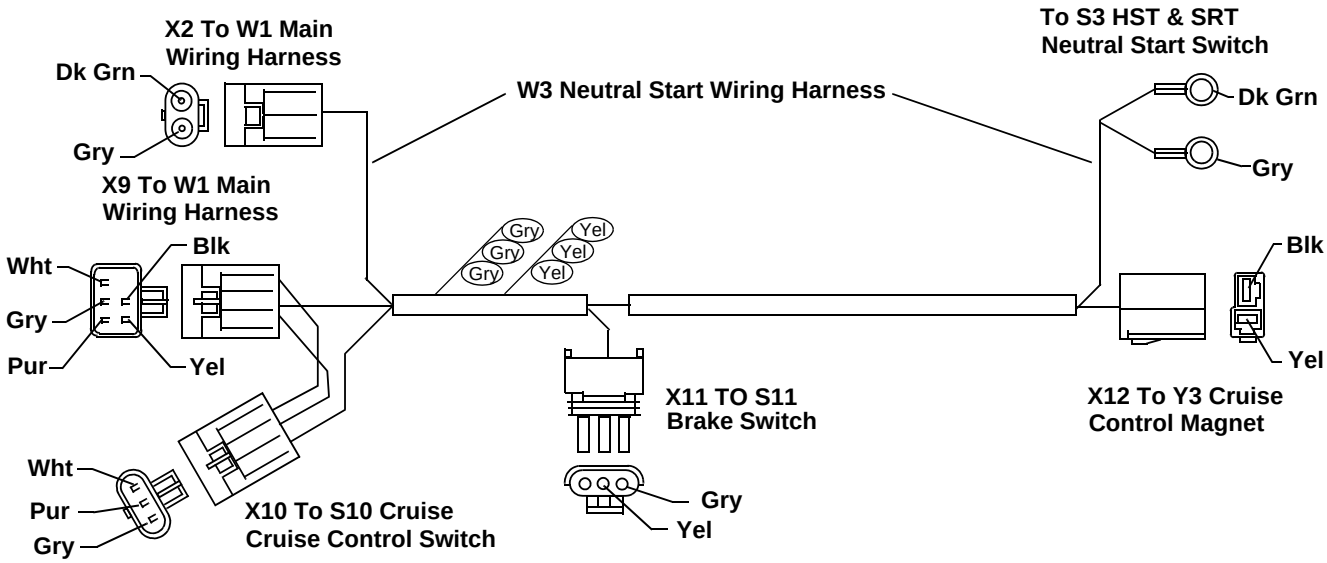
W2 FUEL SHUTOFF SOLENOID WIRING HARNESS



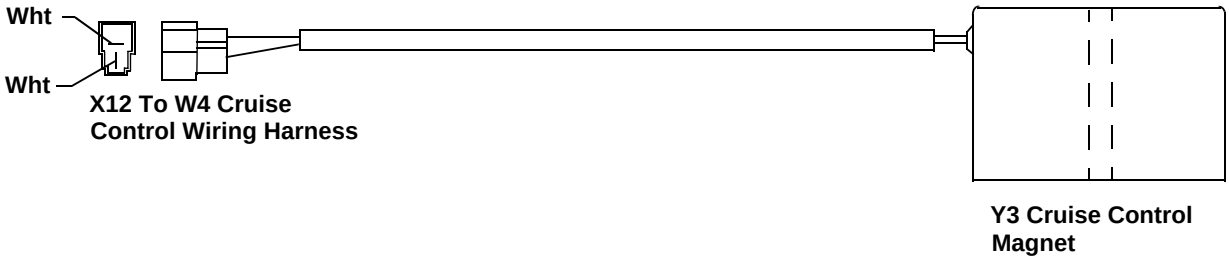
W3 NEUTRAL START WIRING HARNESS



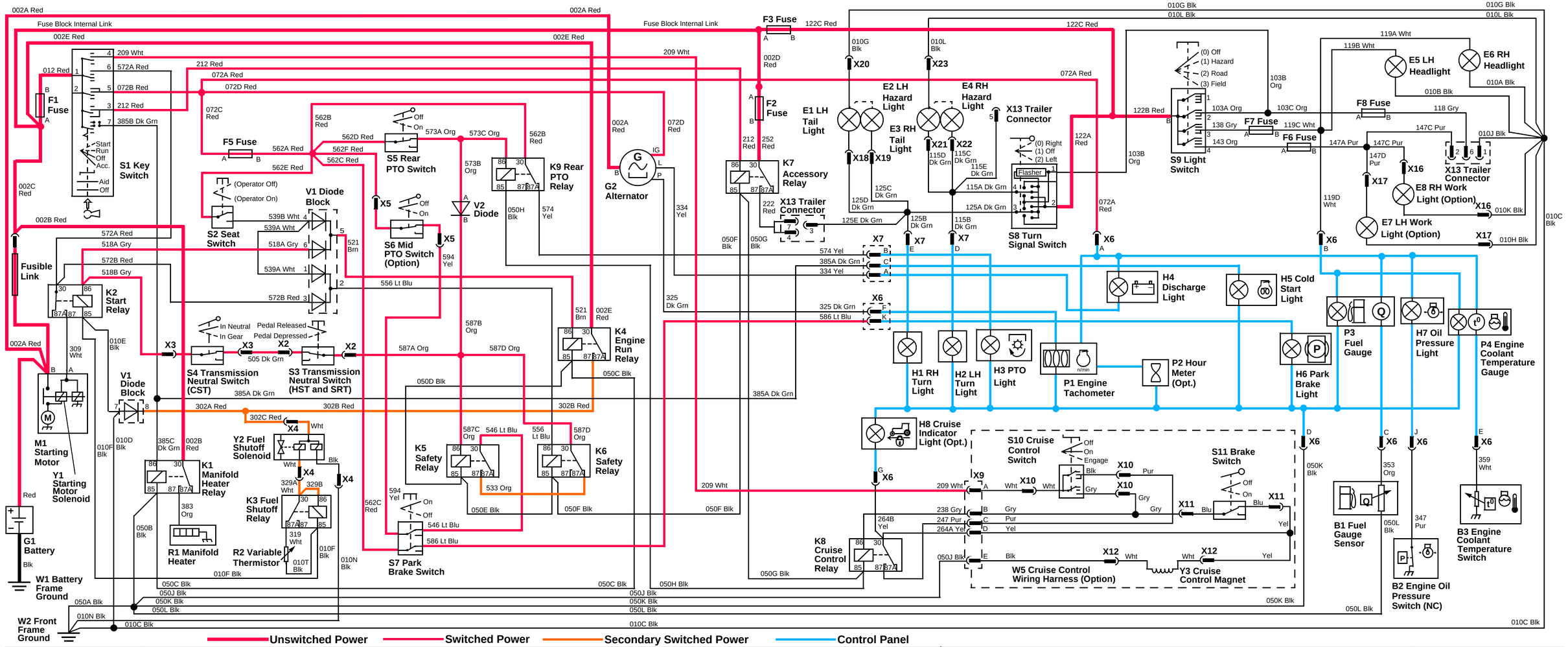
W4 CRUISE CONTROL WIRING HARNESS



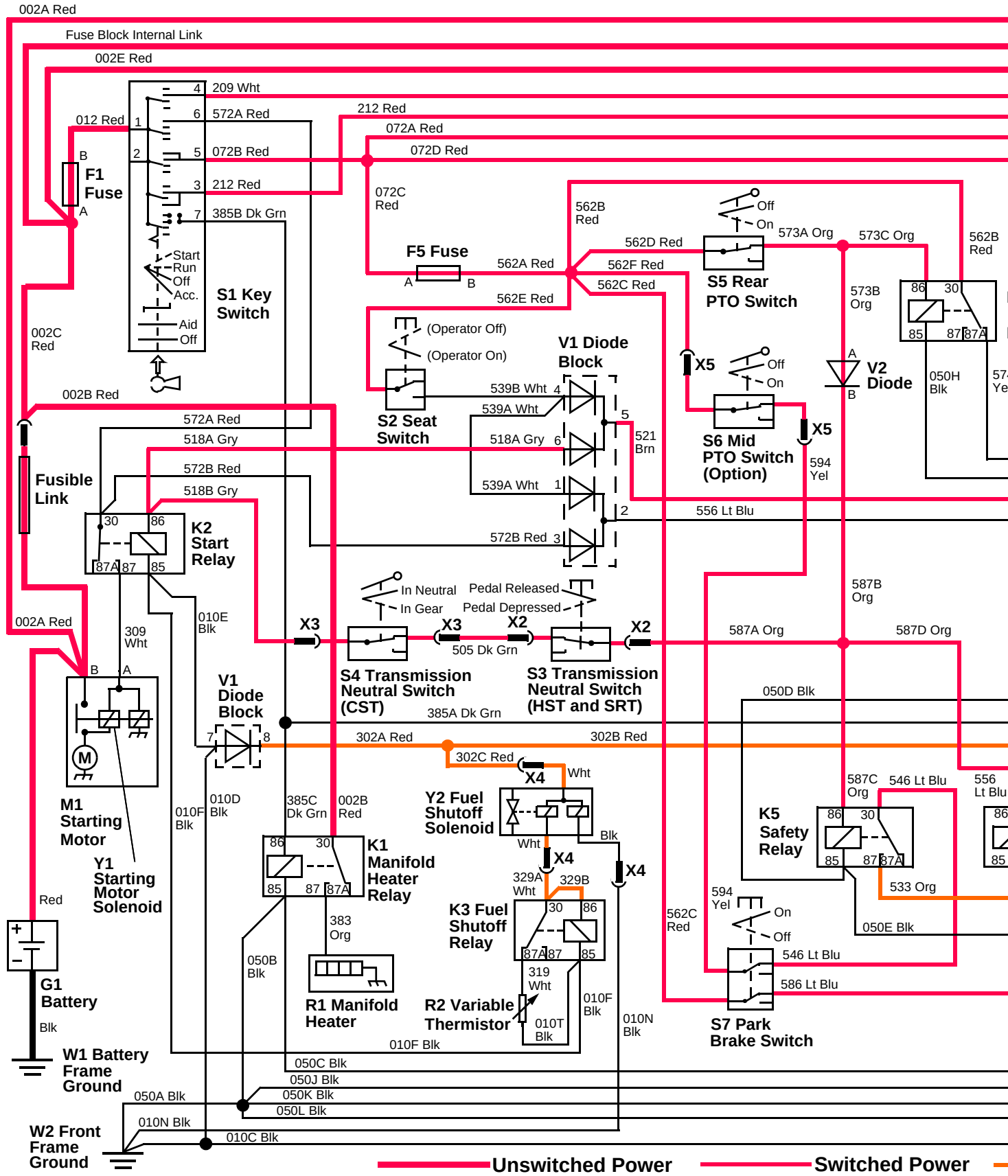
W5 CRUISE CONTROL MAGNET WIRING HARNESS

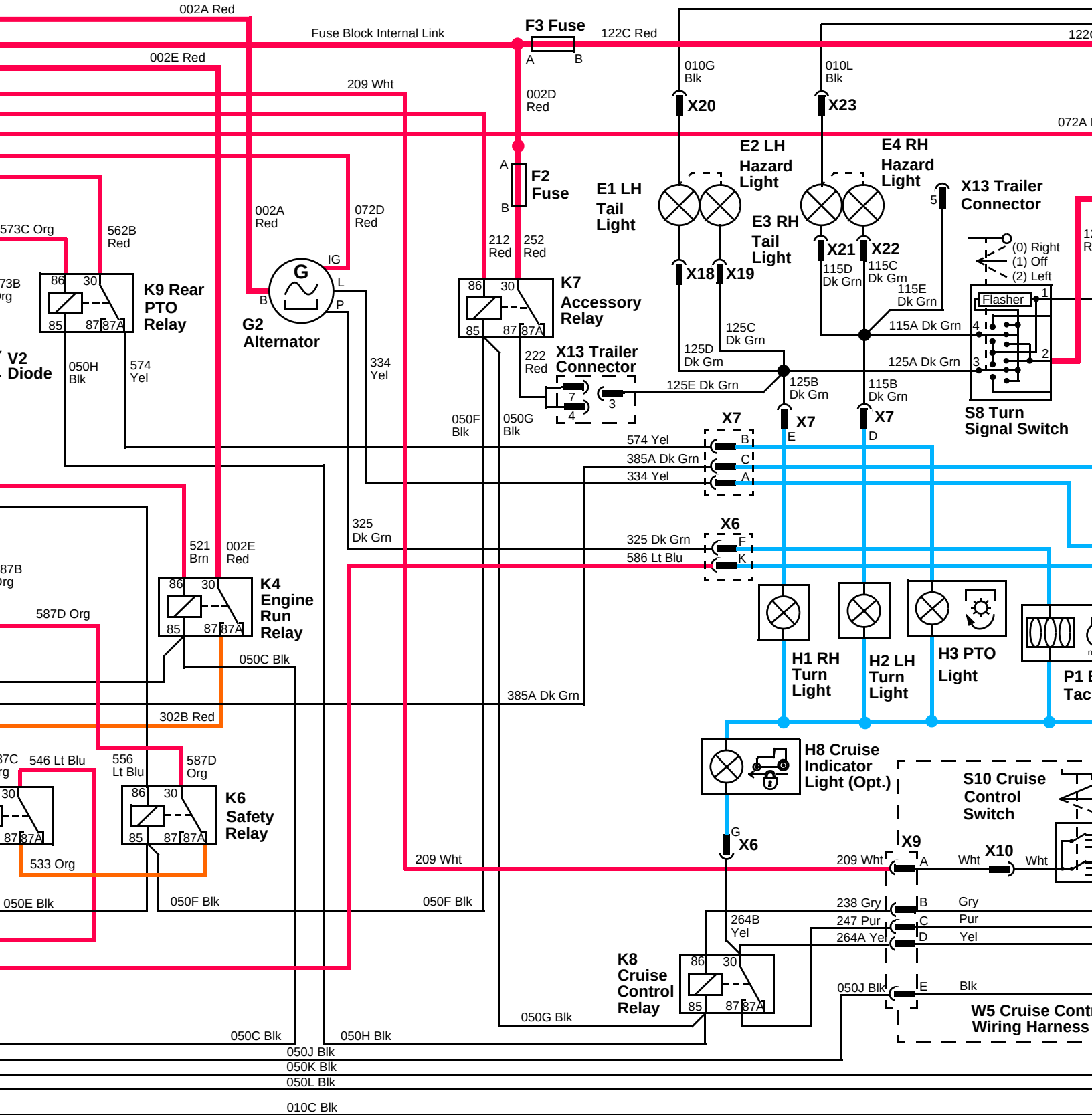


MAIN ELECTRICAL SCHEMATIC–4200/4300/4400 NA (OLD)



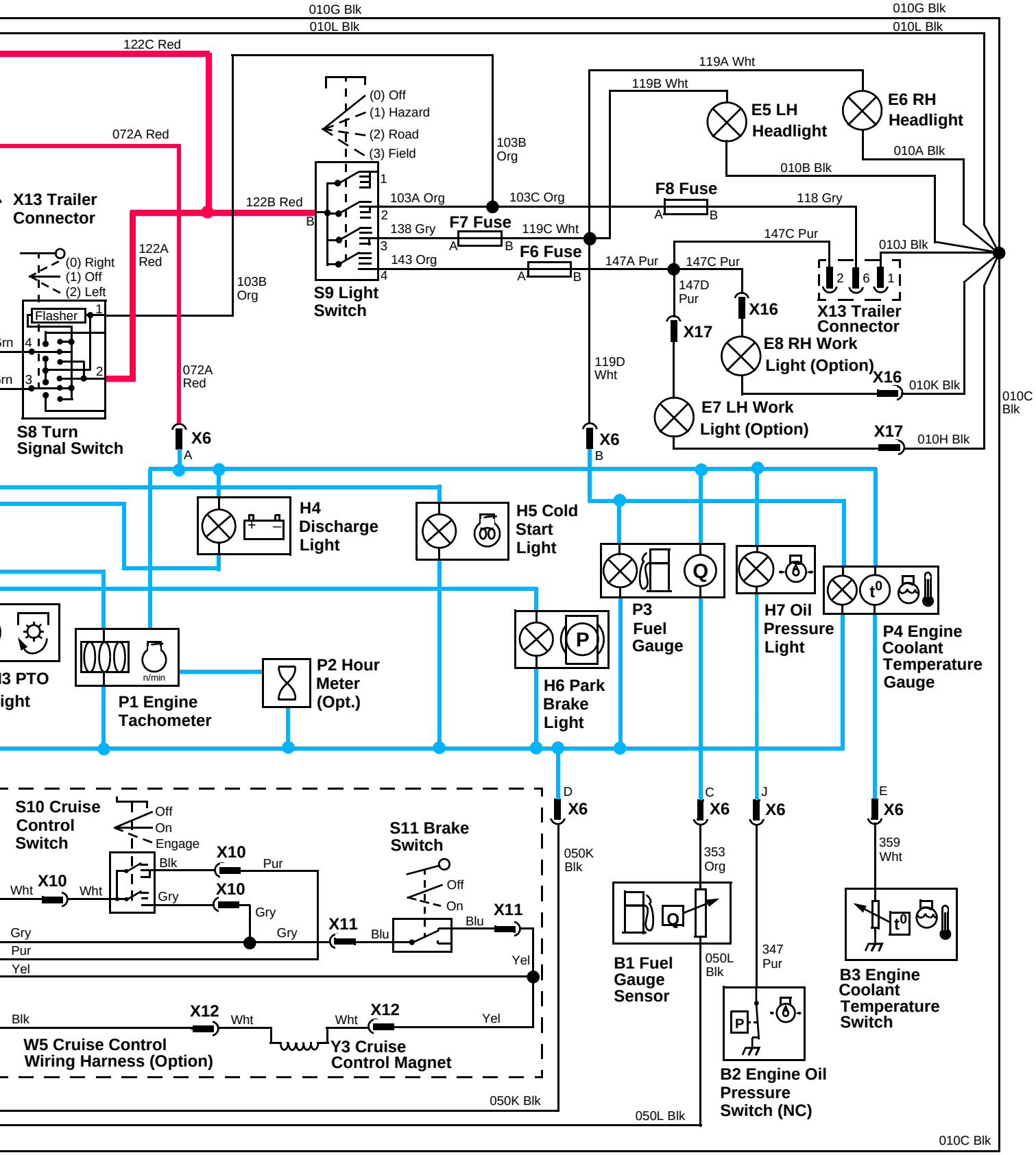
MAIN ELECTRICAL SCHEMATIC–4200/4300/4400 NA (OLD)





ched Power — Secondary Switched Power — Control Panel

SE3 - CHARGING | SE4 - ACCESSORIES



SE5 - INSTRUMENTATION	SE6 - LIGHTS

MAIN WIRING HARNESS–4200/4300/4400 NA (OLD)

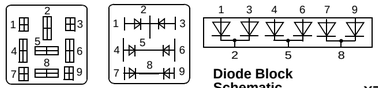
FUSE WIRE CONNECTIONS

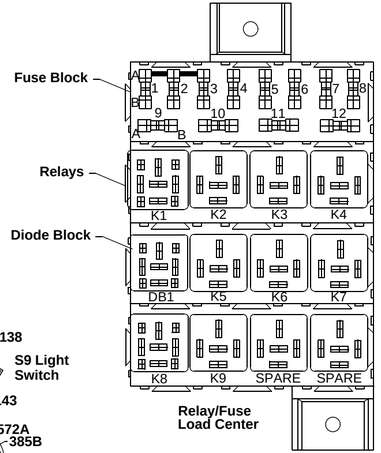
#	SIZE	A	B
F1	30A	002	012
F2	30A	002D	252
F3	30A	002	122C
F4	– – –	– – –	– – –
F5	10A	072C	562A
F6	20A	0143	147A
F7	20A	138	119C
F8	20A	103C	118

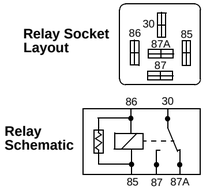
NOTE: Fuses F2 and F4 are used with trailer connection option, Fuse F6 is used with work light option.

DIODE BLOCK

#	1	2	3	4	5	6	7	8	9
DB1	539A	556	572B	539A/539B	521	518A	010D/010E	302A	– – –



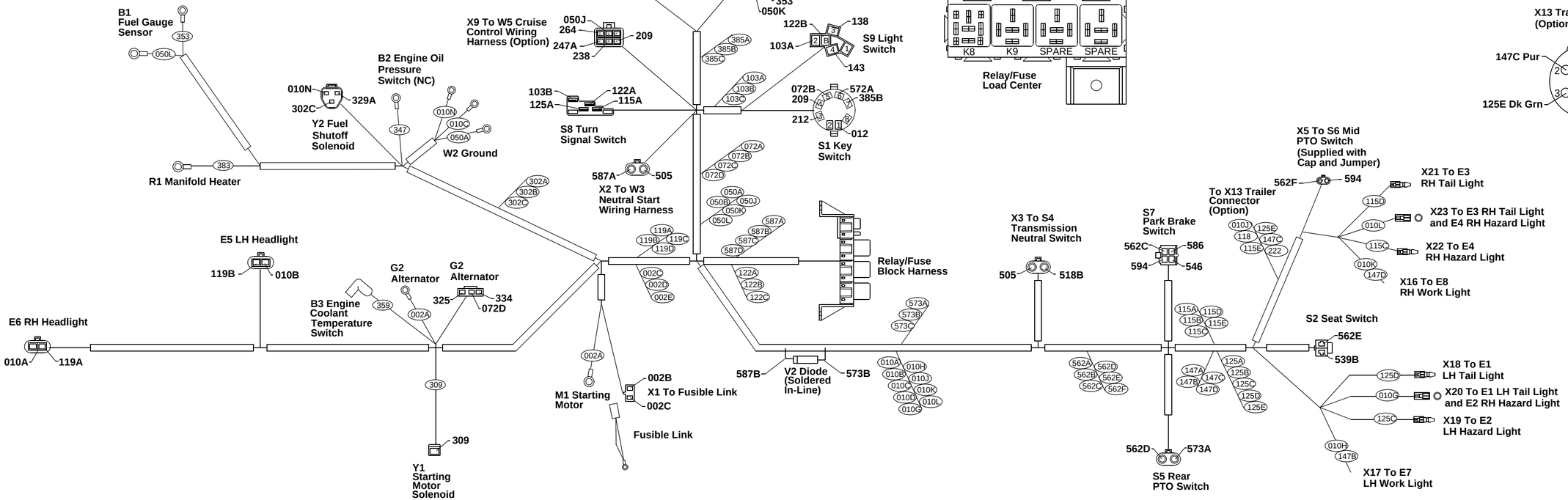


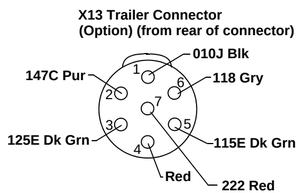


RELAYS

Relay #	86	85	30	87	87A
K1	385C	050B/050C	002B	383	– – –
K2	518A/518B	010E/010F	572A/572B	309	– – –
K3	329B	010F/010T	329A/329B	– – –	319
K4	521	050C/050D	002E	302B	– – –
K5	587C	050D/050E	546	533	– – –
K6	556	050E/050F	587D	– – –	533
K7	212	050F/050G	252	222	– – –
K8	238	050G/050H	264A/264B	247	– – –
K9	573C	050H	562B	– – –	574

NOTE: K7 Accessory relay is used with trailer connection option, K8 cruise control relay is used with cruise control option.





MAIN WIRING HARNESS–4200/4300/4400 NA (OLD)

FUSE WIRE CONNECTIONS

#	SIZE	A	B
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F2	30A	002D	252
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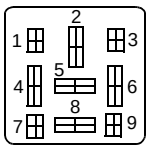
F4	– – –	– – –	– – –
F5	10A	072C	562A
F6	20A	0143	147A
F7	20A	138	119C
F8	20A	103C	118

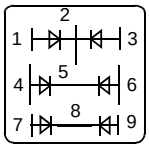
NOTE: Fuses F2 and F4 are used with trailer connection option, Fuse F6 is used with work light option.

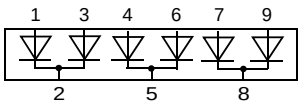
DIODE BLOCK

#	1	2	3	4	5
DB1	539A	556	572B	539A/539B	521



Diode Block Socket Layout





Diode Block Schematic

X7 To C Panel C

125B
115B
385A
574

B1 Fuel Gauge Sensor
353
050L

X9 To W5 Cruise Control Wiring Harness (Option)
050J
264
247A
238

B2 Engine Oil Pressure Switch (NC)
010N
329A
302C
Y2 Fuel Shutoff Solenoid
347
010N
010C
050A
W2 Ground
383
R1 Manifold Heater

103B
125A
S8 Turn Signal Swi

587A
X2 Ne Wi
302A
302B
302C

E5 LH Headlight
119B
010B

G2 Alternator
G2 Alternator
325
334
072D

B3 Engine Coolant Temperature Switch
359
002A

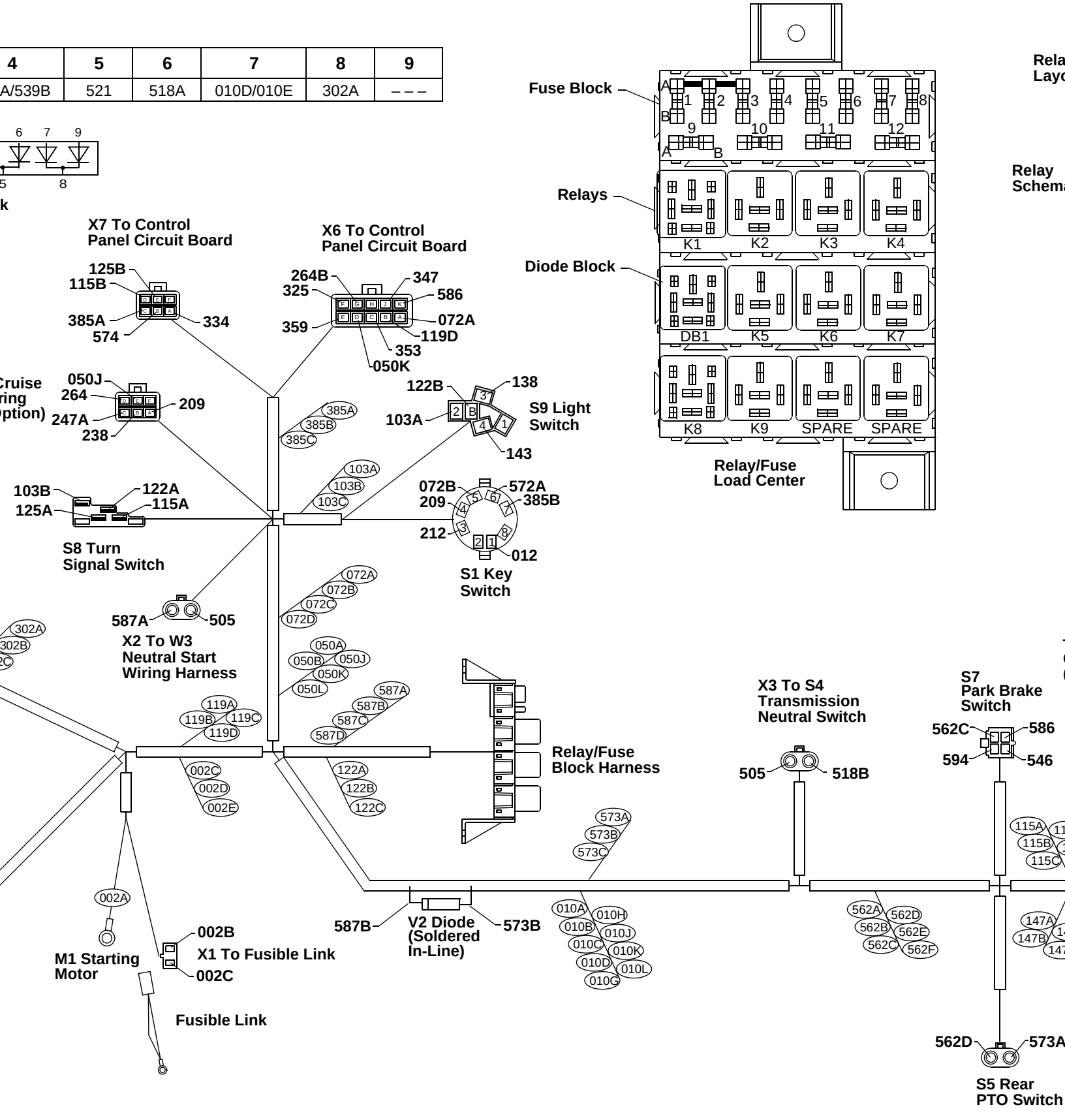
E6 RH Headlight
010A
119A

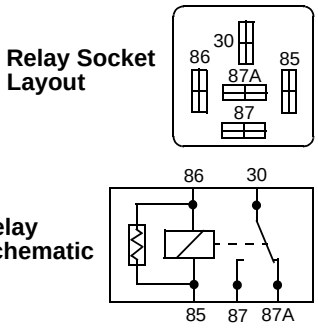
002A
M1 Starting Motor

309
309
Y1 Starting Motor Solenoid

4	5	6	7	8	9
A/539B	521	518A	010D/010E	302A	– – –

k

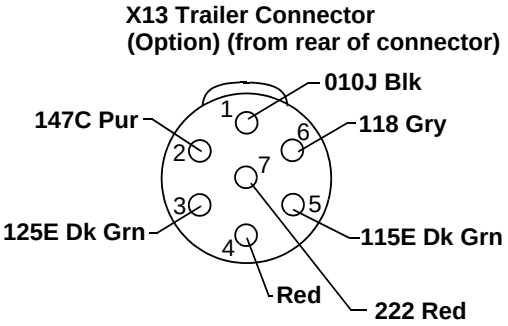


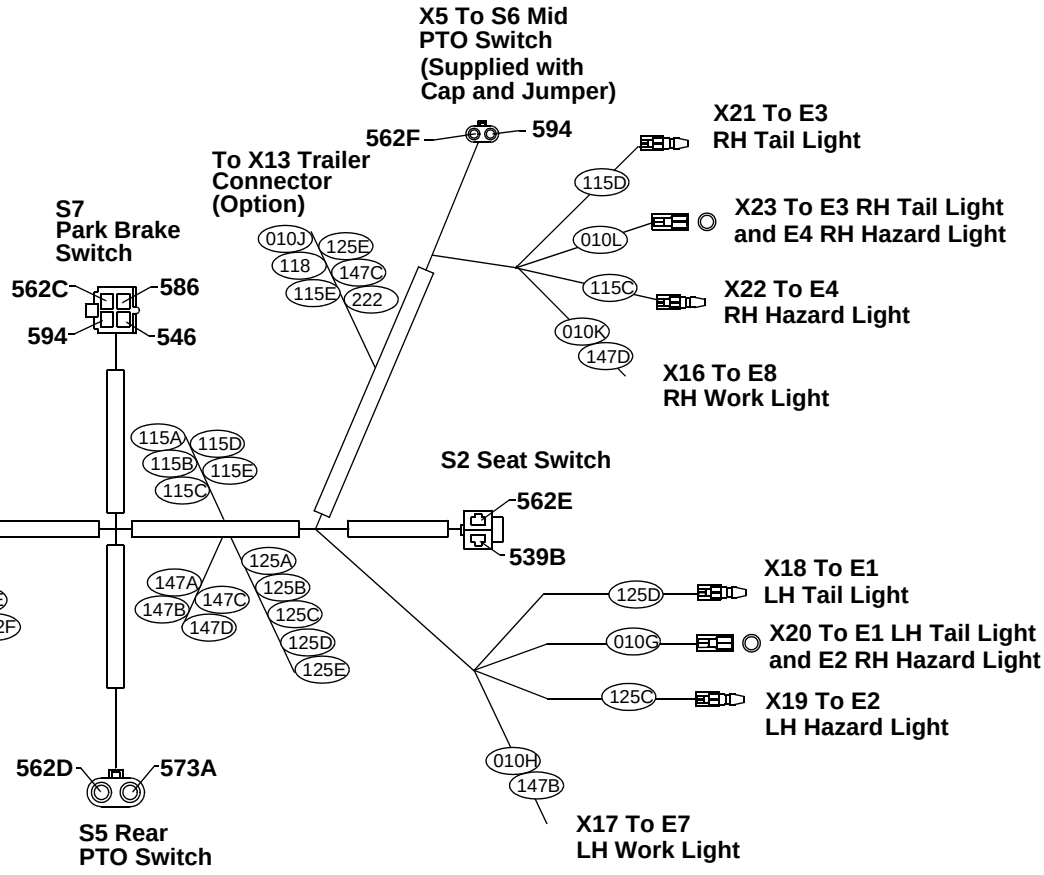


RELAYS

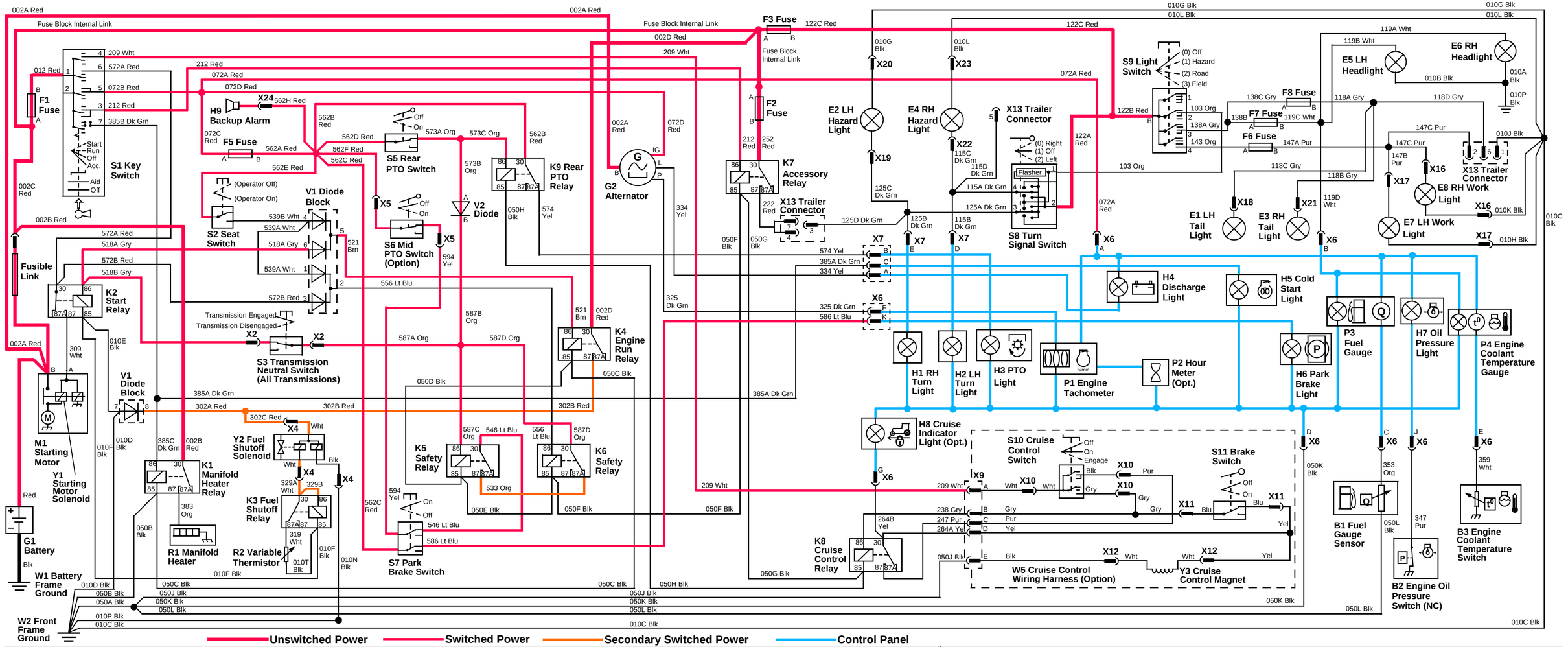
Relay #	86	85	30	87	87A
K1	385C	050B/050C	002B	383	– – –
K2	518A/518B	010E/010F	572A/572B	309	– – –
K3	329B	010F/010T	329A/329B	– – –	319
K4	521	050C/050D	002E	302B	– – –
K5	587C	050D/050E	546	533	– – –
K6	556	050E/050F	587D	– – –	533
K7	212	050F/050G	252	222	– – –
K8	238	050G/050H	264A/264B	247	– – –
K9	573C	050H	562B	– – –	574

NOTE: K7 Accessory relay is used with trailer connection option, K8 cruise control relay is used with cruise control option.

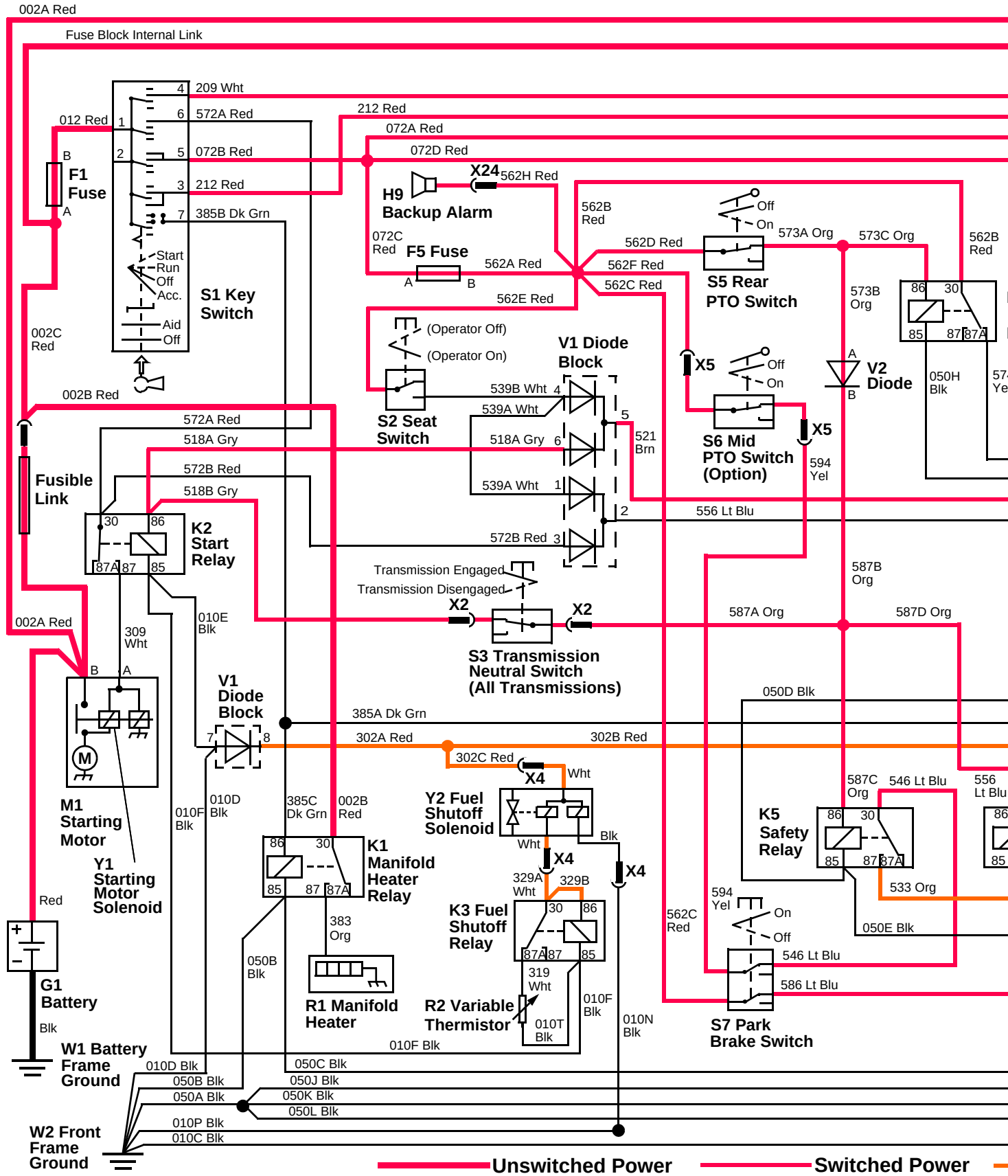


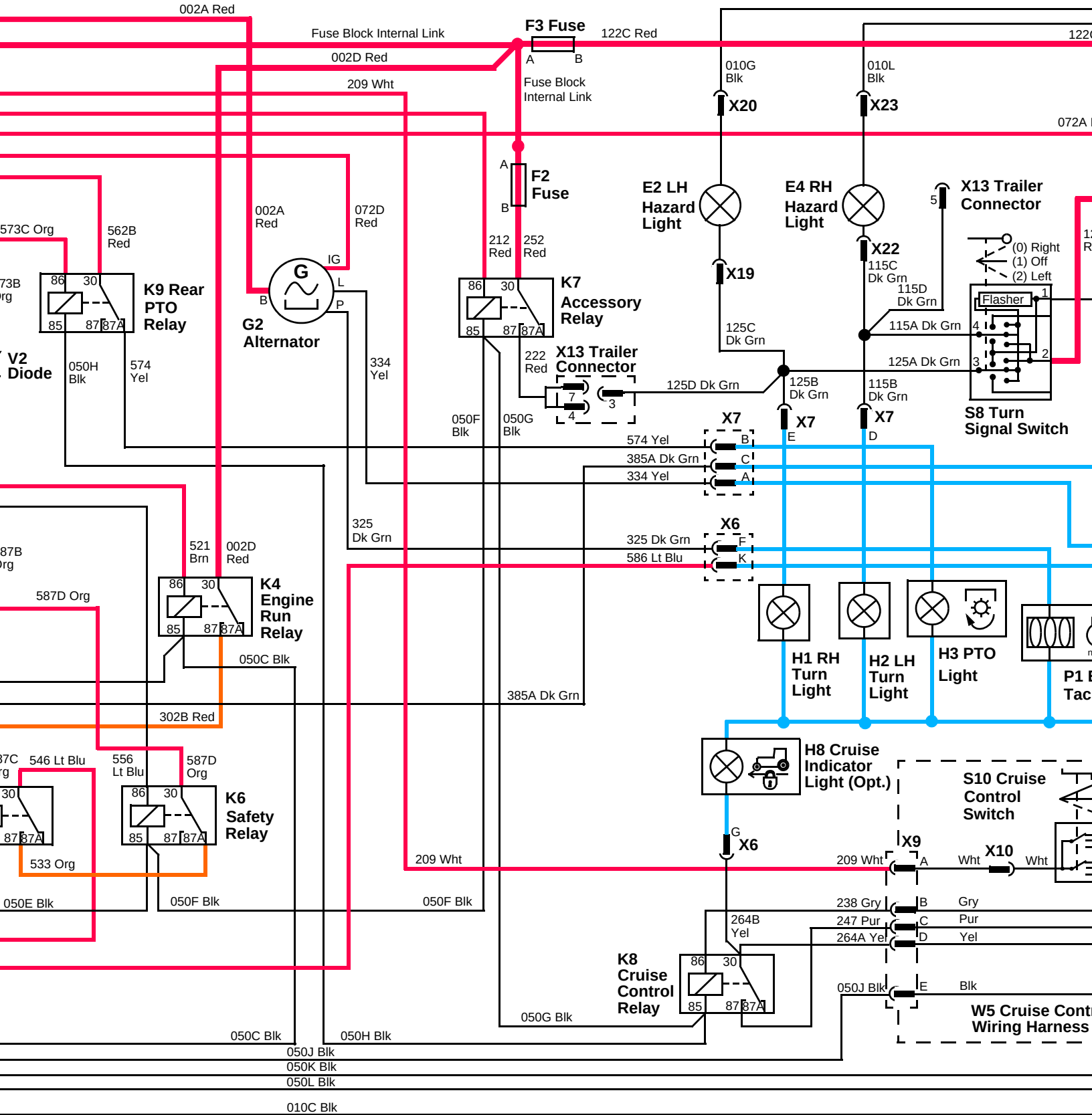


MAIN ELECTRICAL SCHEMATIC–4200/4300/4400 NA (NEW)



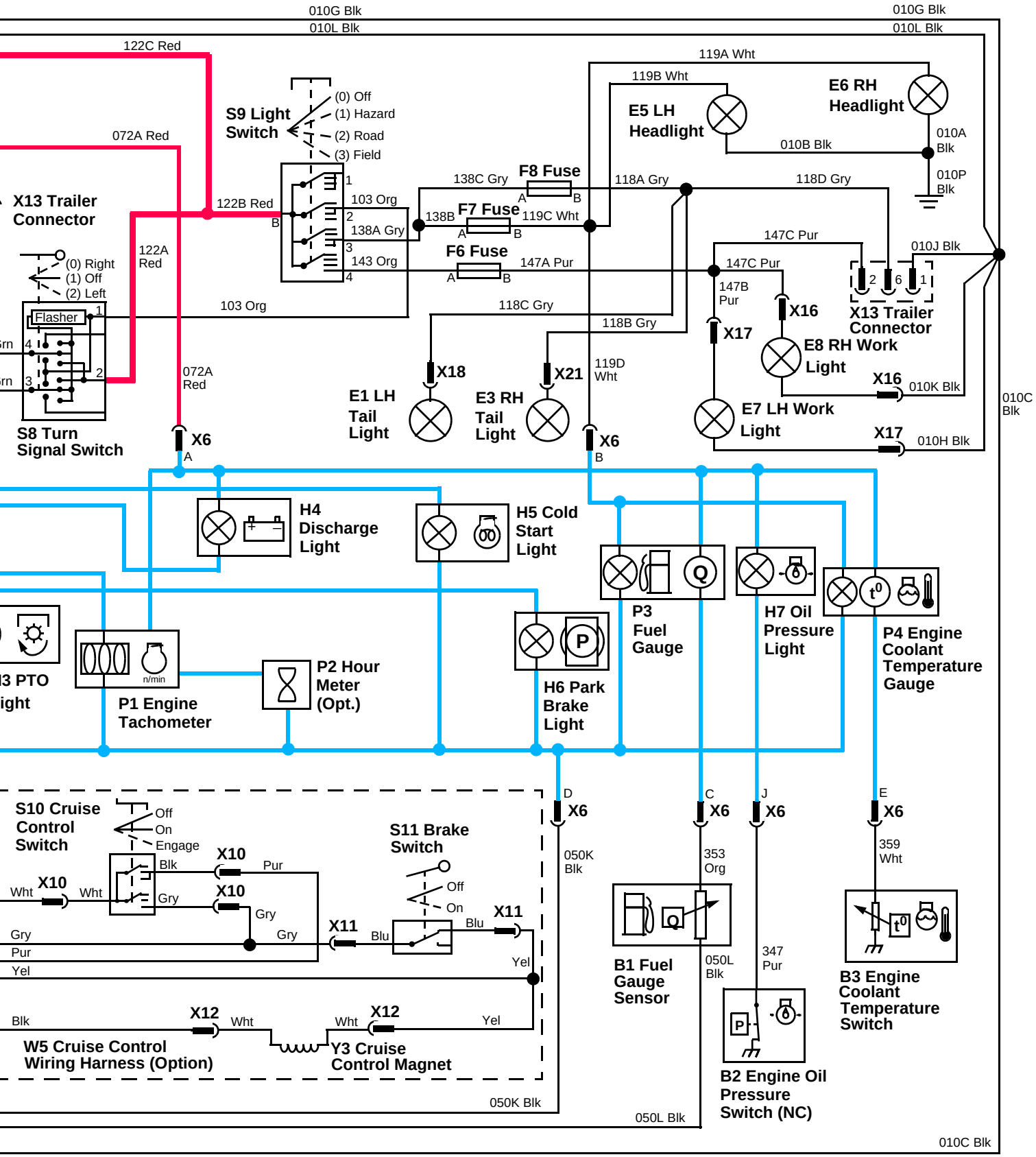
MAIN ELECTRICAL SCHEMATIC–4200/4300/4400 NA (NEW)





ched Power — Secondary Switched Power — Control Panel

	SE3 - CHARGING	SE4 - ACCESSORIES	



SE5 - INSTRUMENTATION	SE6 - LIGHTS

MAIN WIRING HARNESS–4200/4300/4400 NA (NEW)

FUSE WIRE CONNECTIONS

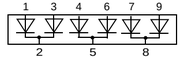
#	SIZE	A	B
F1	30A	002	012
F2	– – –	002C	252
F3	30A	002D	122C
F4	– – –	– – –	– – –
F5	10A	072C	562A
F6	20A	143	147A
F7	20A	138B	119C
F8	20A	138C	118A

NOTE: Fuses F2 and F4 are used with trailer connection option, Fuse F6 is used with work light option.

DIODE BLOCK

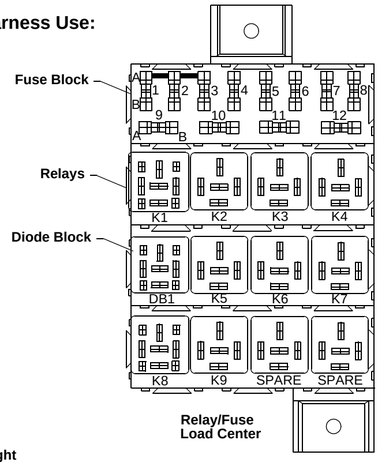
#	1	2	3	4	5	6	7	8	9
DB1	539A	556	572B	539A/539B	521	518A	010D/010E	302A	– – –

Diode Block Socket Layout



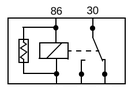
Diode Block Schematic

Serial Numbers for Wiring Harness Use:
LV4200C327136–
LV4200H320279–
LV4300C335215–
LV4300S336172–
LV4300H330219–
LV4400S334080–
LV4700H340245–



Relay/Fuse Load Center

Relay Socket Layout

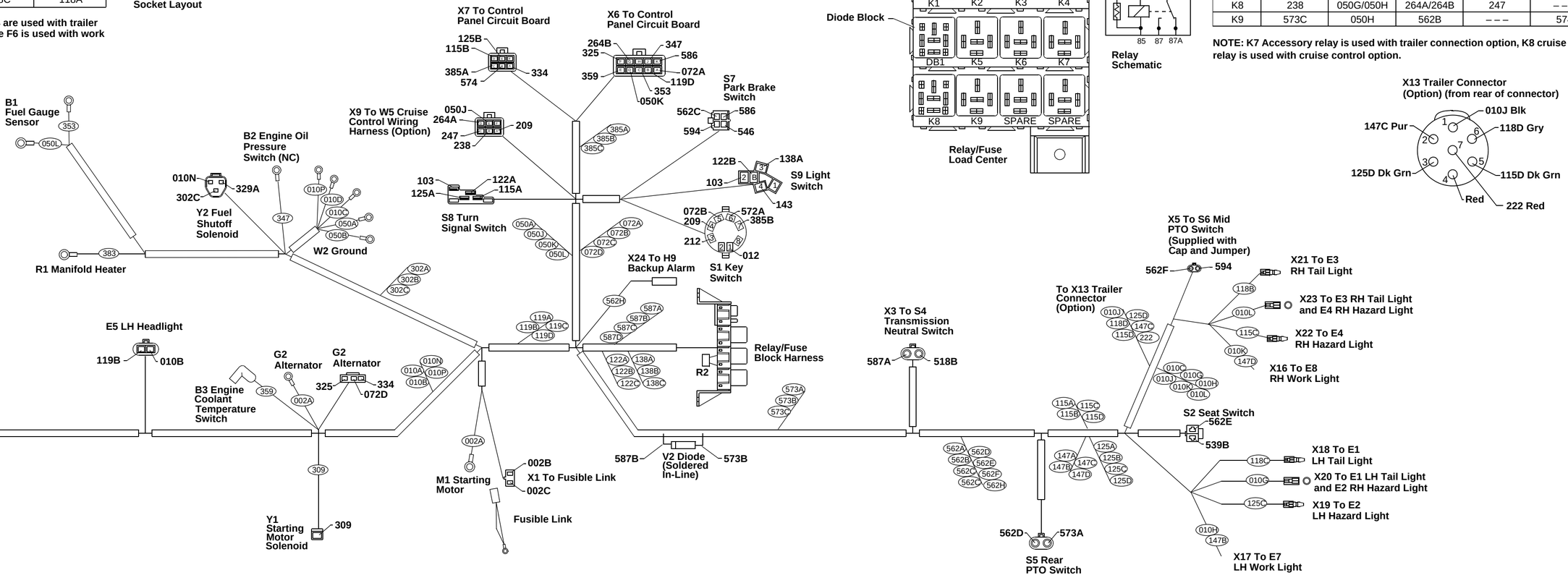


Relay Schematic

RELAYS

Relay #	86	85	30	87	87A
K1	385C	050B/050C	002B	383	– – –
K2	518A/518B	010E/010F	572A/572B	309	– – –
K3	329B	010F/010T	329A/329B	– – –	319
K4	521	050C/050D	002D	302B	– – –
K5	587C	050D/050E	546	533	– – –
K6	556	050E/050F	587D	– – –	533
K7	212	050F/050G	252	222	– – –
K8	238	050G/050H	264A/264B	247	– – –
K9	573C	050H	562B	– – –	574

NOTE: K7 Accessory relay is used with trailer connection option, K8 cruise control relay is used with cruise control option.



MAIN WIRING HARNESS–4200/4300/4400 NA (NEW)

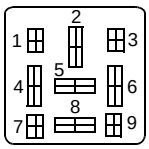
FUSE WIRE CONNECTIONS

#	SIZE	A	B
F1	30A	002	012
F2	– – –	002C	252
F3	30A	002D	122C
F4	– – –	– – –	– – –
F5	10A	072C	562A
F6	20A	143	147A
F7	20A	138B	119C
F8	20A	138C	118A

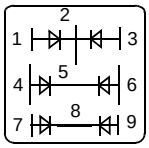
NOTE: Fuses F2 and F4 are used with trailer connection option, Fuse F6 is used with work light option.

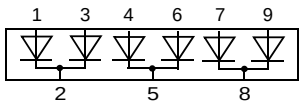
DIODE BLOCK

#	1	2	3	4	5	6	7
DB1	539A	556	572B	539A/539B	521	518A	010D/

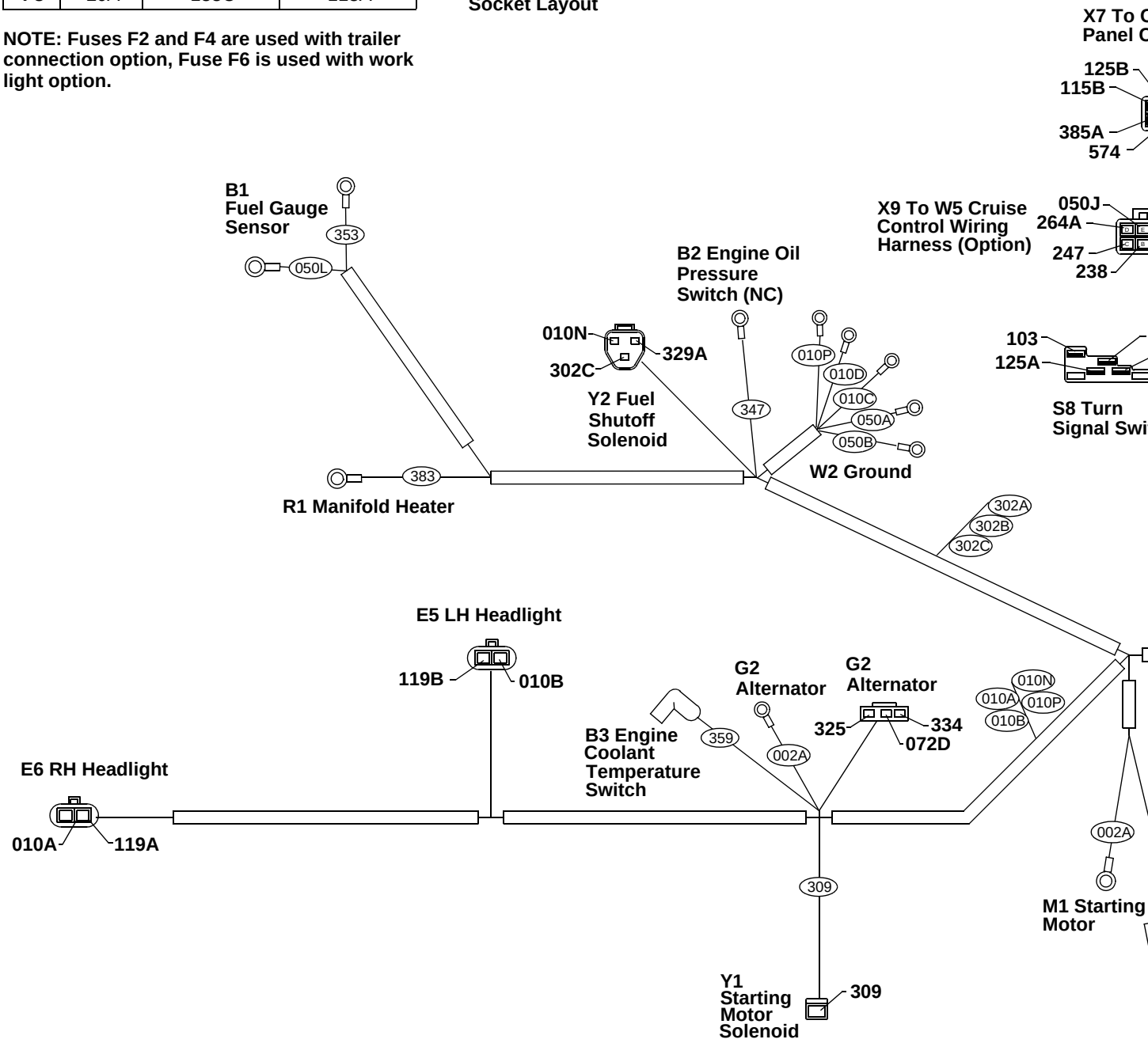


Diode Block Socket Layout



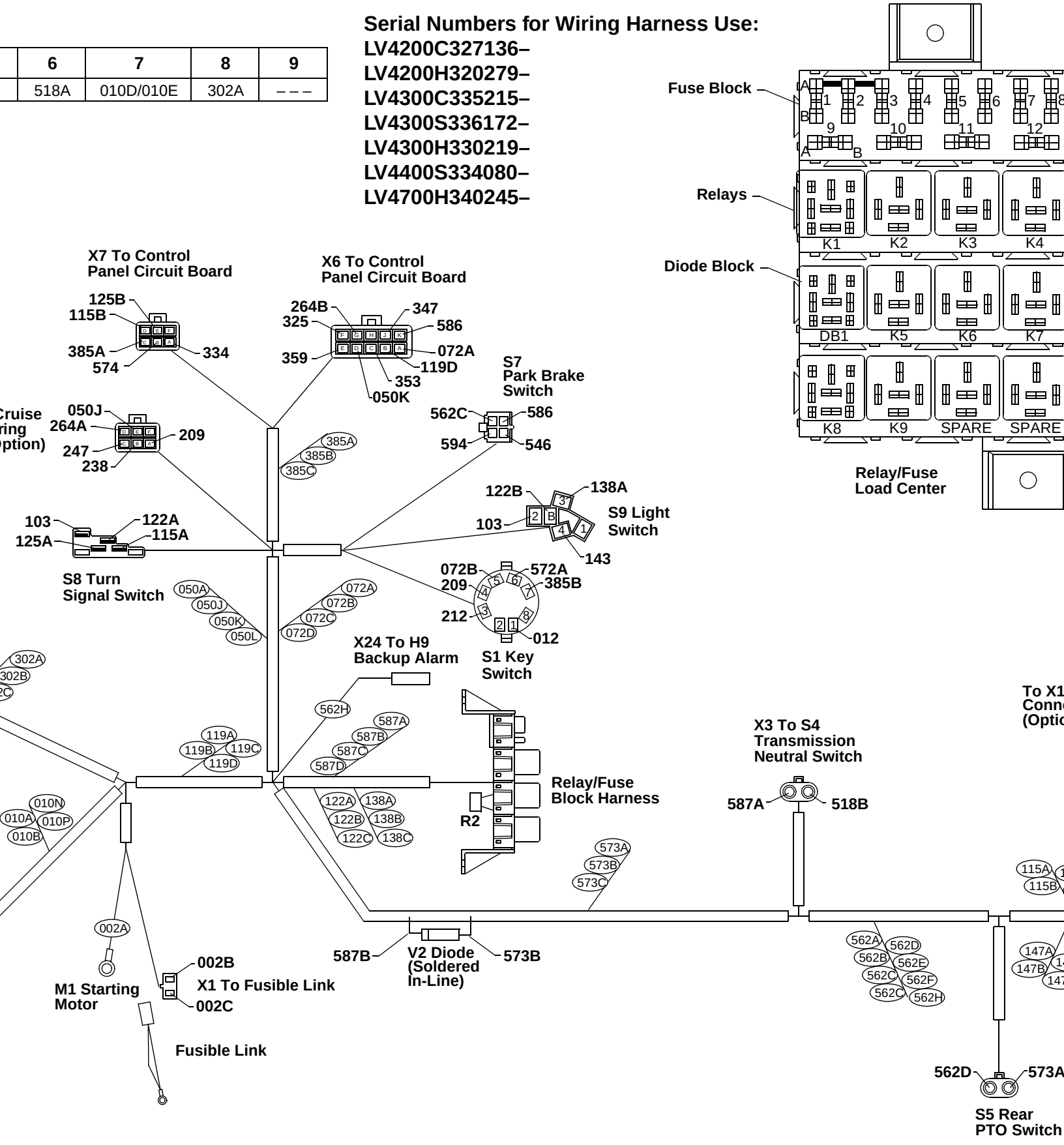


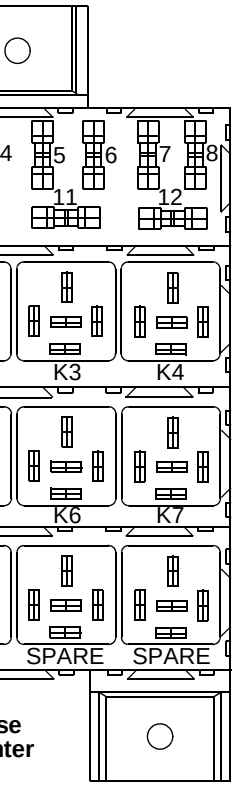
Diode Block Schematic

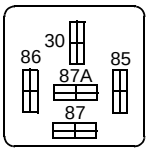


	6	7	8	9
	518A	010D/010E	302A	– – –

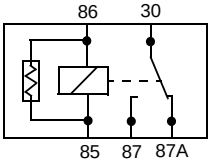
Serial Numbers for Wiring Harness Use:
LV4200C327136–
LV4200H320279–
LV4300C335215–
LV4300S336172–
LV4300H330219–
LV4400S334080–
LV4700H340245–







Relay Socket Layout



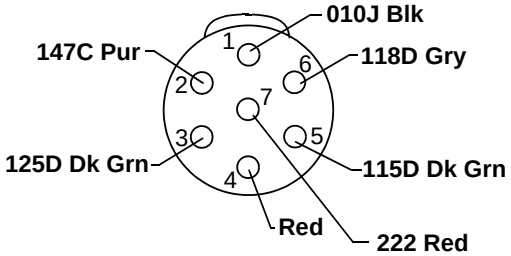
Relay Schematic

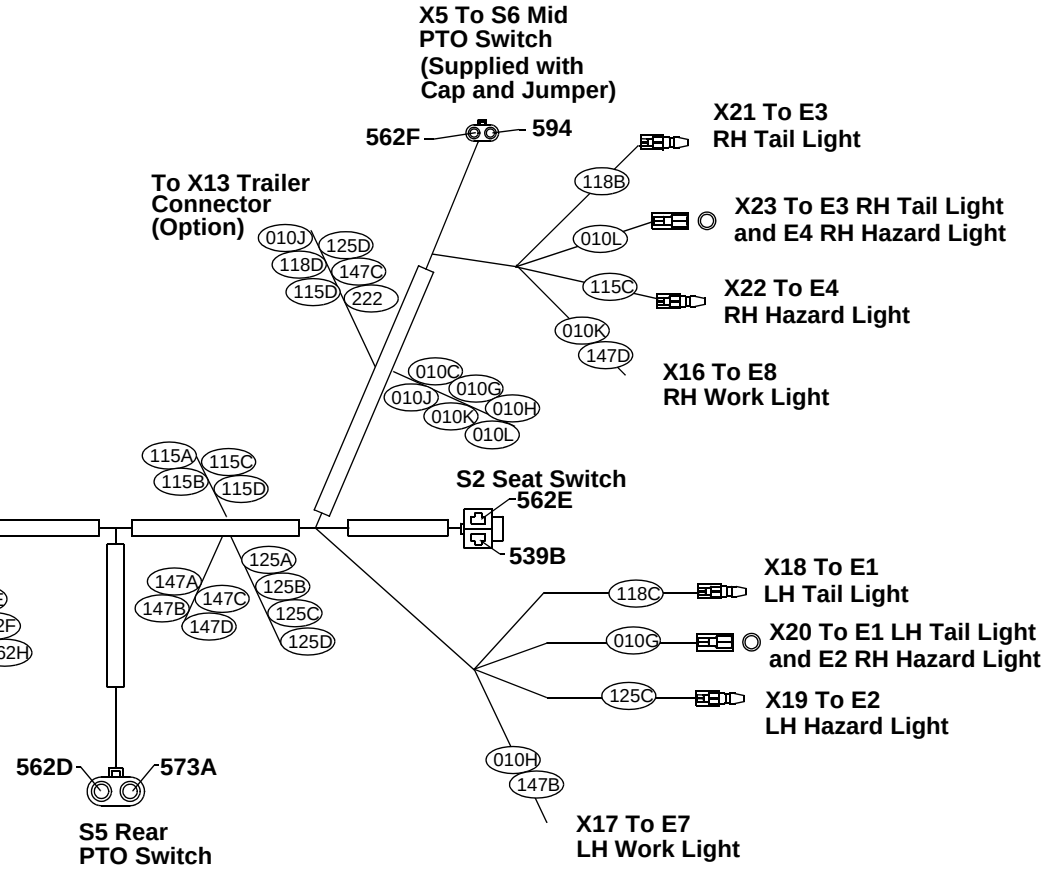
RELAYS

Relay #	86	85	30	87	87A
K1	385C	050B/050C	002B	383	– – –
K2	518A/518B	010E/010F	572A/572B	309	– – –
K3	329B	010F/010T	329A/329B	– – –	319
K4	521	050C/050D	002D	302B	– – –
K5	587C	050D/050E	546	533	– – –
K6	556	050E/050F	587D	– – –	533
K7	212	050F/050G	252	222	– – –
K8	238	050G/050H	264A/264B	247	– – –
K9	573C	050H	562B	– – –	574

NOTE: K7 Accessory relay is used with trailer connection option, K8 cruise control relay is used with cruise control option.

X13 Trailer Connector (Option) (from rear of connector)





WIRE COLOR CODES (NEW)

Circuit Number	Wire Size	Color	Termination Points
002A	5.0	Red	M1, G2
002B	5.0	Red	X1 (Fusible Link), K1(30)
002C	5.0	Red	X1 (Fusible Link), Splice 002
002D	5.0	Red	Splice 002, F2
010A	1.0	Blk	E6, Splice 010
010B	1.0	Blk	E5, Splice 010
010C	5.0	Blk	W2, Splice 010
010D	0.8	Blk	DB1-7, W2
010E	0.5	Blk	DB1-7, K2(85)
010F	0.5	Blk	K2(85), K3(85)
010G	0.8	Blk	Splice 010, X20
010H	0.8	Blk	Splice 010, X17
010J	2.0	Blk	Splice 010, X13
010K	0.8	Blk	Splice 010, X16
010L	0.8	Blk	Splice 010, X23
010N	1.0	Blk	X4, Splice 010
010P	1.0	Blk	Splice 010, W2
010T	(–)	Therm.	K3(85), R2
012	5.0	Red	S1, F1
050A	2.0	Blk	W2, Splice 050
050B	0.5	Blk	K1(85), W2
050C	0.5	Blk	K1(85), K4(85)
050D	0.5	Blk	K4(85), K5(85)
050E	0.5	Blk	K5(85), K6(85)
050F	0.5	Blk	K6(85), K7(85)
050G	0.5	Blk	K7(85), K8(85)
050H	0.5	Blk	K8(85), K9(85)
050J	0.8	Blk	Splice 050, X9
050K	1.0	Blk	Splice 050, X6
050L	0.5	Blk	B1, Splice 050
072A	1.0	Red	X6, Splice 072
072B	1.0	Red	S1, Splice 072
072C	0.8	Red	Splice 072, F5
072D	0.8	Red	Splice 072, G2
103	0.8	Org	S8, S9
115A	1.0	Dk Grn	S8, Splice 115
115B	0.8	Dk Grn	X7, Splice 115
115C	0.8	Dk Grn	Splice 115, X22
115D	1.0	Dk Grn	Splice 115, X13
118A	1.0	Gry	F8, Splice 118
118B	0.8	Gry	Splice 118, X13
118C	0.8	Gry	Splice 118, X18
118D	1.0	Gry	Splice 118, X21
119A	1.0	Wht	E6, Splice 119
119B	1.0	Wht	E5, Splice 119
119C	2.0	Wht	Splice 119, F7
119D	0.8	Wht	Splice 119, X6
122A	1.0	Red	S8, Splice 122
122B	3.0	Red	S9, Splice 122
122C	3.0	Red	F3, Splice 122
125A	1.0	Dk Grn	S8, Splice 125
125B	0.8	Dk Grn	X7, Splice 125
125C	0.8	Dk Grn	Splice 125, X19
125D	1.0	Dk Grn	Splice 125, X13
138A	2.0	Gry	S9, Splice 138
138B	2.0	Gry	Splice 138, F7
138C	1.0	Gry	Splice 138, F8
143	2.0	Org	S9, F6
147A	2.0	Pur	F6, Splice 147
147B	0.8	Pur	Splice 147, X17
147C	2.0	Pur	Splice 147, X13
147D	0.8	Pur	Splice 147, X16

Circuit Number	Wire Size	Color	Termination Points
209	0.8	Wht	X9, S1
212	0.5	Red	K7(86), S1
222	2.0	Red	K7(87), X13
238	0.8	Gry	X9, K8(86)
247	0.8	Pur	X9, K8(87)
252	2.0	Red	K7(30), F2
264A	0.8	Yel	K8(30), X9
264B	0.8	Yel	K8(30), X6
302A	1.0	Red	DB1- 8, Splice 302
302B	1.0	Red	K4(87), Splice 302
302C	1.0	Red	Splice 302, X4
309	1.0	Wht	K2(87), M1
319	(+)	Therm.	K3(87a), R2
325	0.8	Dk Grn	X6, G2
329A	1.0	Wht	X4, K3(30)
329B	1.0	Wht	K3(30), K3(86)
334	0.8	Yel	X7, G2
347	0.5	Pur	X6, B2
353	0.5	Org	X6, B1
359	0.5	Wht	X6, B3
383	3.0	Org	K1(87), R1
385A	0.8	Dk Grn	X7, Splice 385
385B	0.8	Dk Grn	Splice 385, S1
385C	0.5	Dk Grn	Splice 385, K1(86)
505	0.5	Dk Grn	X2, X3
518A	0.5	Gry	DB1- 6, K2(86)
518B	0.5	Gry	K2(86), X2
521	0.5	Brn	K4(86), DB1- 5
533	0.5	Org	K5(87), K6(87a)
539A	0.5	Wht	DB1- 1, DB1- 4
539B	0.5	Wht	DB1- 4, S2
546	0.5	Lt Blu	K5(30), S7

Circuit Number	Wire Size	Color	Termination Points
556	0.5	Lt Blu	K6(86), DB1- 2
562A	0.8	Red	F5, Splice 562
562B	0.5	Red	K9(30), Splice 562
562C	0.5	Red	Splice 562, S7
562D	0.5	Red	S5, Splice 562
562E	0.5	Red	Splice 562, S2
562F	0.5	Red	Splice 562, X5
562H	0.5	Red	Splice 562, X24
572A	1.0	Red	S1, K2(30)
572B	0.8	Red	K2(30), DB1- 3
573A	0.5	Org	Splice 573, S5
573B	0.5	Org	V2, Splice 573
573C	0.5	Org	K9(86), Splice 573
574	0.5	Yel	K9(87a), X7
586	0.5	Lt Blu	S7, X6
587A	0.5	Pur	X2, Splice 587
587B	0.5	Pur	V2, Splice 587
587C	0.5	Pur	K5(86), Splice 587
587D	0.5	Pur	K6(30), Splice 587
594	0.5	Yel	S7, X5

TROUBLESHOOTING

Problem or Symptom / Check or Solution	Starter cranking problems	Engine cranks but will not start	Engine will not shut off	Improper component operating with switch	Engine oil light problem	Battery goes dead, discharges or overcharges	Discharge light problem	Engine coolant temperature light problem	Engine will not run when operator leaves seat	Instrument lights problems	Headlight problem	Fuel gauge does not work properly
See Power Circuit Diagnosis	●	●									●	
See Engine Shutoff Circuit Diagnosis	●	●	●						●			
See Cranking Circuit Diagnosis	●											
Check ground circuit	●	●										
Test battery and battery connections	●											
See Manifold Heater Circuit Diagnosis		●										
See Fuel Supply Circuit Diagnosis		●	●									
See Charging Circuit Diagnosis						●	●					
See Control Panel Indicator Diagnosis					●		●	●		●		●
See Lights Circuit Diagnosis											●	
Check for shorted circuit			●	●								●

THEORY AND DIAGNOSIS

POWER CIRCUIT OPERATION

Function:

Provides unswitched and switched power to the primary components whenever the battery is connected.

The power circuits are divided among the unswitched power circuit, switched power circuits (key switch in RUN, START, or AID positions), and secondary power circuits. The secondary power circuits become energized when switched power circuits energize relays, providing current paths to the secondary circuits. The secondary power circuits will not be energized if the relays controlling the current path(s) fail.

Detailed Theory of Operation, Schematics, and Troubleshooting of circuits are provided throughout the electrical section.

Unswitched Power:

Voltage must be present at the following components with the key switch in the OFF position:

- Battery Positive Terminal
- Starting Motor Terminal B
- F1 Fuse
- Key Switch Terminal 1
- Alternator Terminal B
- Manifold Heater Relay Terminal 30
- Engine Run Relay Terminal 30
- F3 Fuse
- Light Switch Terminal B
- Turn Signal Switch Terminal 2
- F2 Fuse
- Accessory Relay Terminal 30

The positive battery cable connects the battery to the starting motor. The starting motor bolt is used as the 12 Volt DC tie point for the rest of the electrical system.

The battery cables and the starting motor tie point connections must be good 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.

With the exception of the B terminal of the alternator, the electrical circuit is protected by the fusible link beyond the starting motor tie point. The fusible link is a short piece of wire that is designed to fail if current load is too high or a short occurs.

Switched Power - Run:

In addition to the voltage present at the locations of the unswitched power circuits, voltage must be present at the following components with the key switch in the RUN ("ON") position, transmission in NEUTRAL, PTO(s) in NEUTRAL, park brake ENGAGED, and operator NOT ON seat:

- Key Switch Terminals 3, 4, and 5
- Alternator Terminal IG
- F5 Fuse
- Rear PTO Switch
- K9 Rear PTO Relay Terminals 86 and 30
- X5 Connector (562F Red wire)

NOTE: X5 connector has jumper wire installed unless Mid PTO option is installed.

- Park Brake Switch Terminals A, B, C and D
- K5 Safety Relay Terminals 86 and 30
- K6 Safety Relay Terminal 30
- Seat Switch
- X9 Connector Terminal A
- Cruise Control Switch
- X6 Connector Terminals A and K
- X7 Connector Terminal A
- Accessory Relay Terminal 86
- X2 Connector (573A Org wire); or, X3 Connector (505 Dk Grn wire)

NOTE: The S4 Transmission Neutral Switch is installed in collar shift gear drive (CST) tractors; a jumper wire is installed in the X2 connector, and the S3 Transmission Neutral Switch is not used.
In hydrostatic drive (HST) and SyncReverser™ (SRT) tractors the S3 Transmission Neutral Switch is used, and a jumper wire is installed in the X3 connector - eliminating the S4 switch.

- Start Relay Terminal 86
- Diode Block Terminal 6
- Engine Run Relay Terminal 86

Secondary Switched Power - Run:

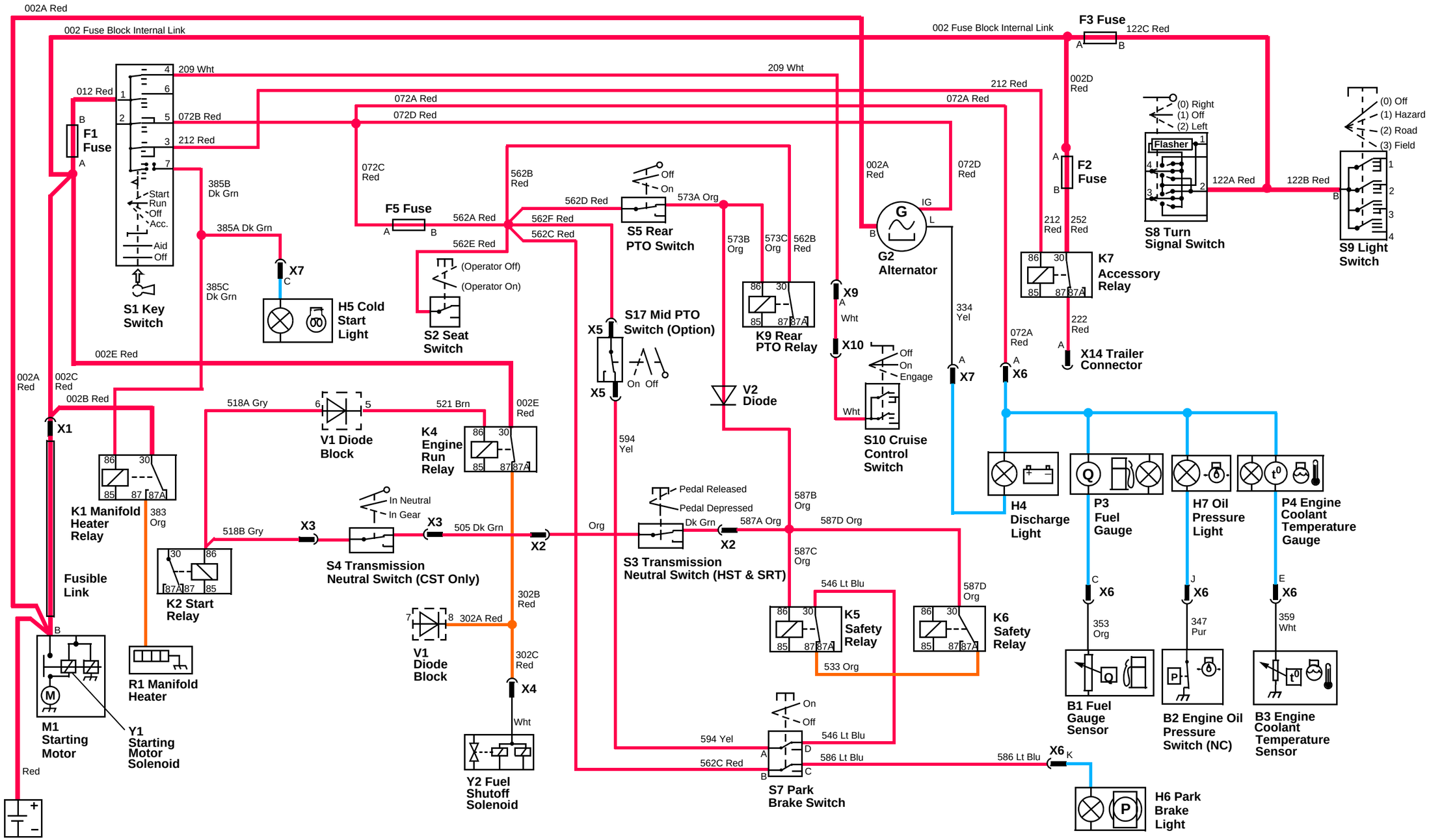
Voltage must be present at the following components with the key switch in the RUN ("ON") position, transmission in NEUTRAL, PTO(s) in NEUTRAL, park brake ENGAGED, and operator NOT ON seat:

- K5 Safety Relay Terminal 87
- K6 Safety Relay Terminal 87a
- Engine Run Relay Terminal 87
- X4 Connector (302C Red wire)

Switched Power - Aid:

Voltage must be present at the following components with the key switch in the AID position (key pushed in

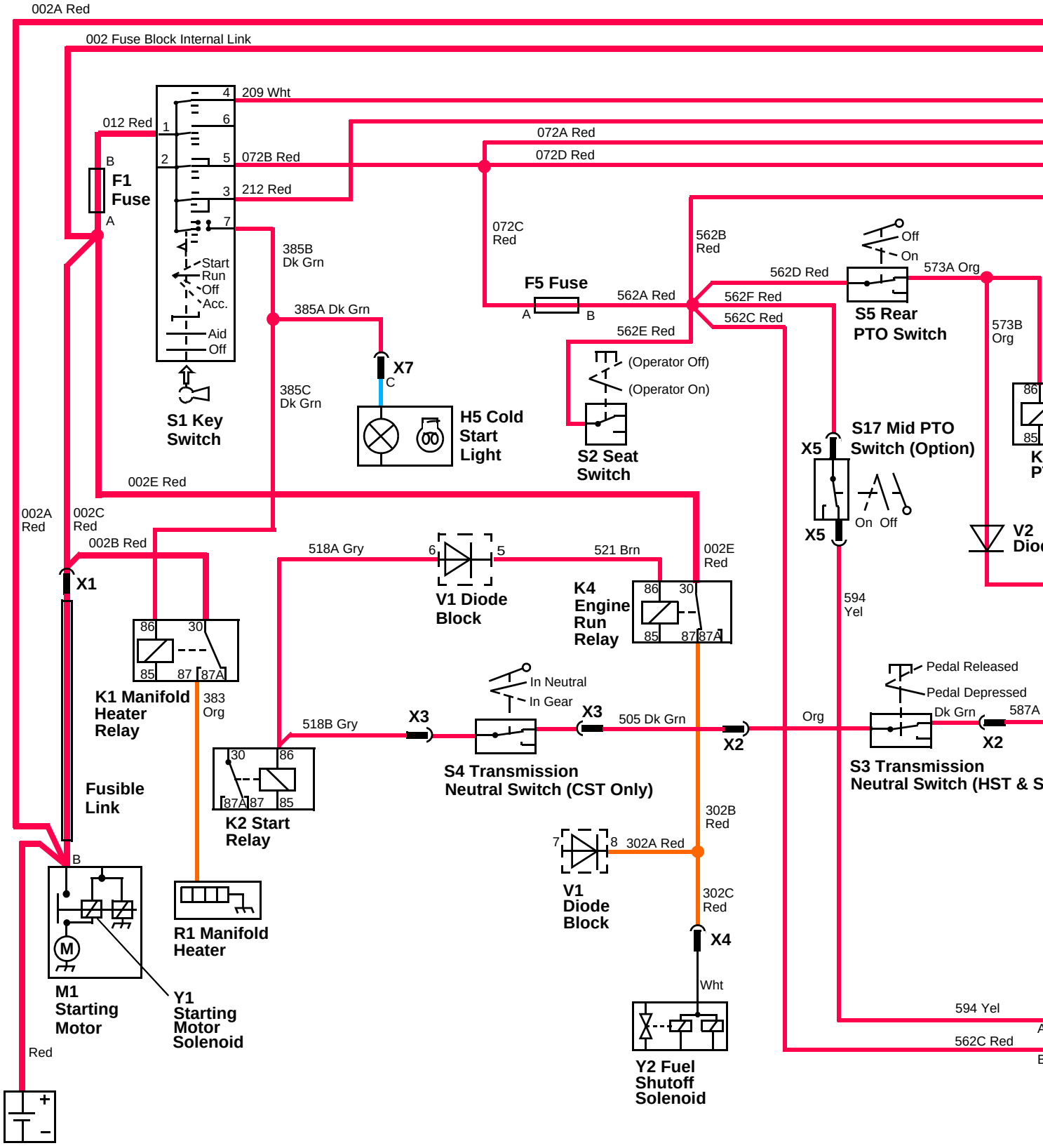
POWER CIRCUIT ELECTRICAL SCHEMATIC - RUN / AID



Unswitched Power | Switched Power | Secondary Switched Power | Control Panel Circuit Board

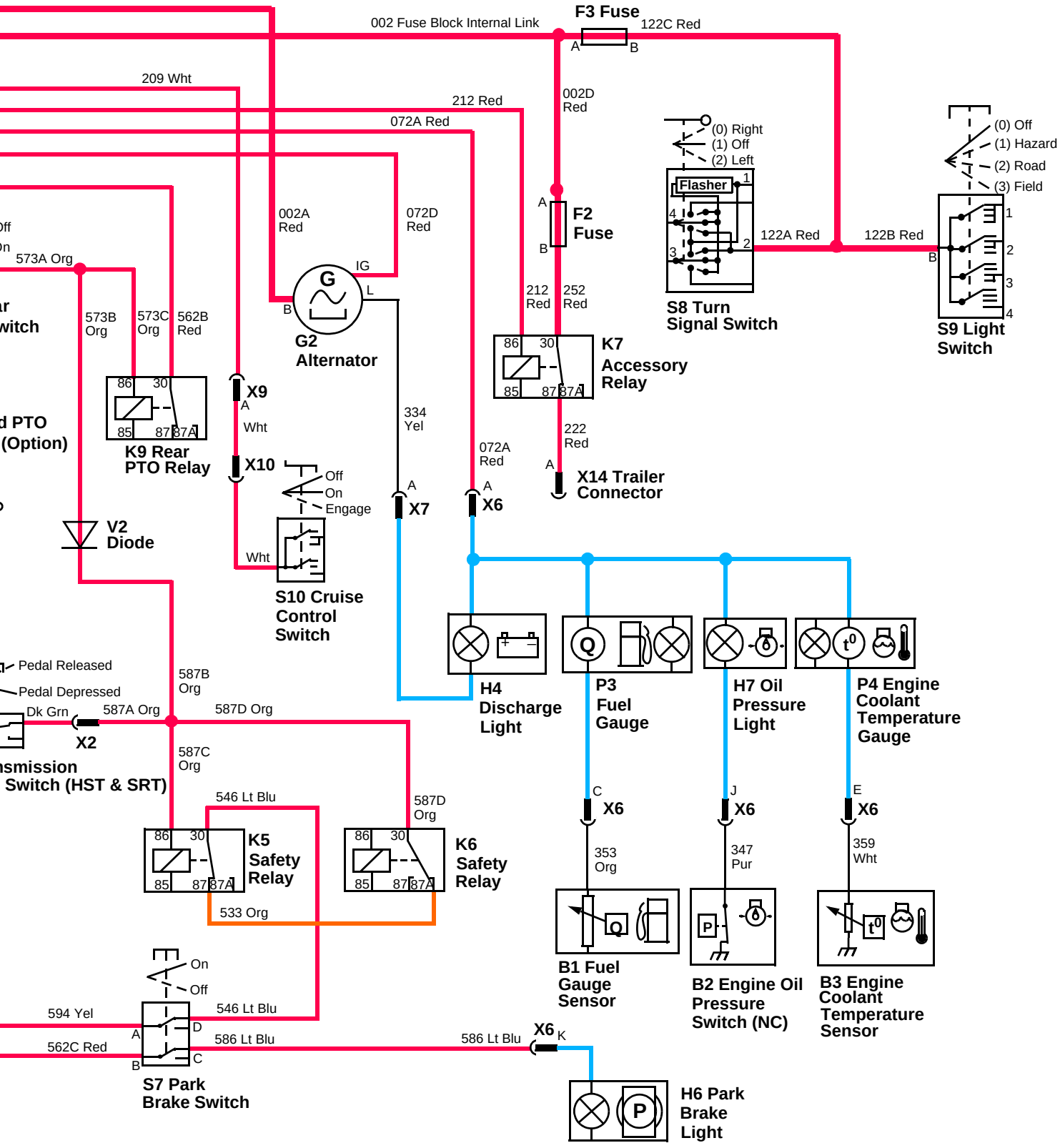
SE1 - STARTING	SE2 - IGNITION	SE3 - CHARGING	SE4 - ACCESSORIES	SE5 - INSTRUMENTATION	SE6 - LIGHTS

POWER CIRCUIT ELECTRICAL SCHEMATIC - RUN / AID



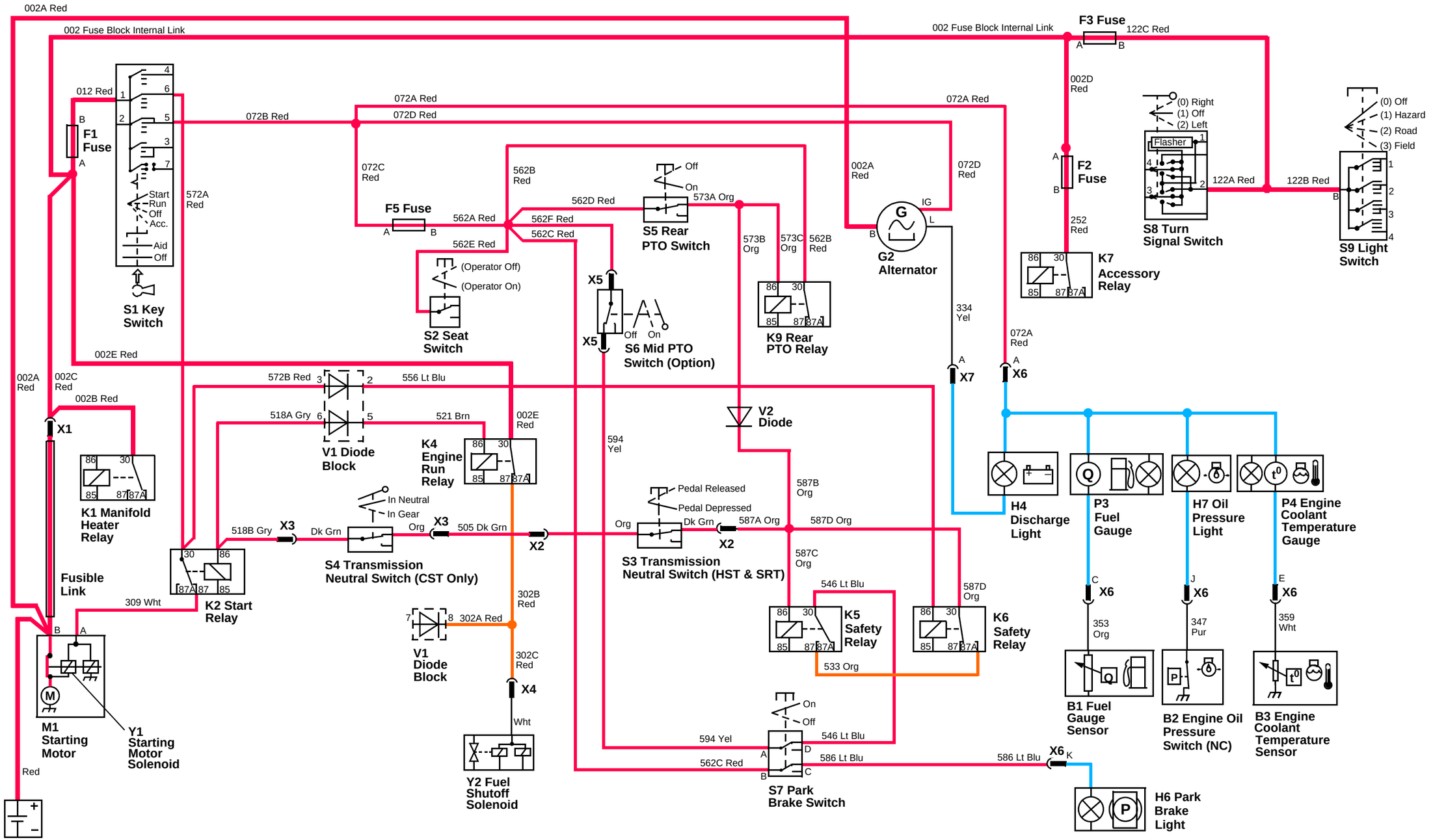
Unswitched Power | Switched Power | Secondary Switched Power

SE1 - STARTING	SE2 - IGNITION



tched Power — Control Panel Circuit Board

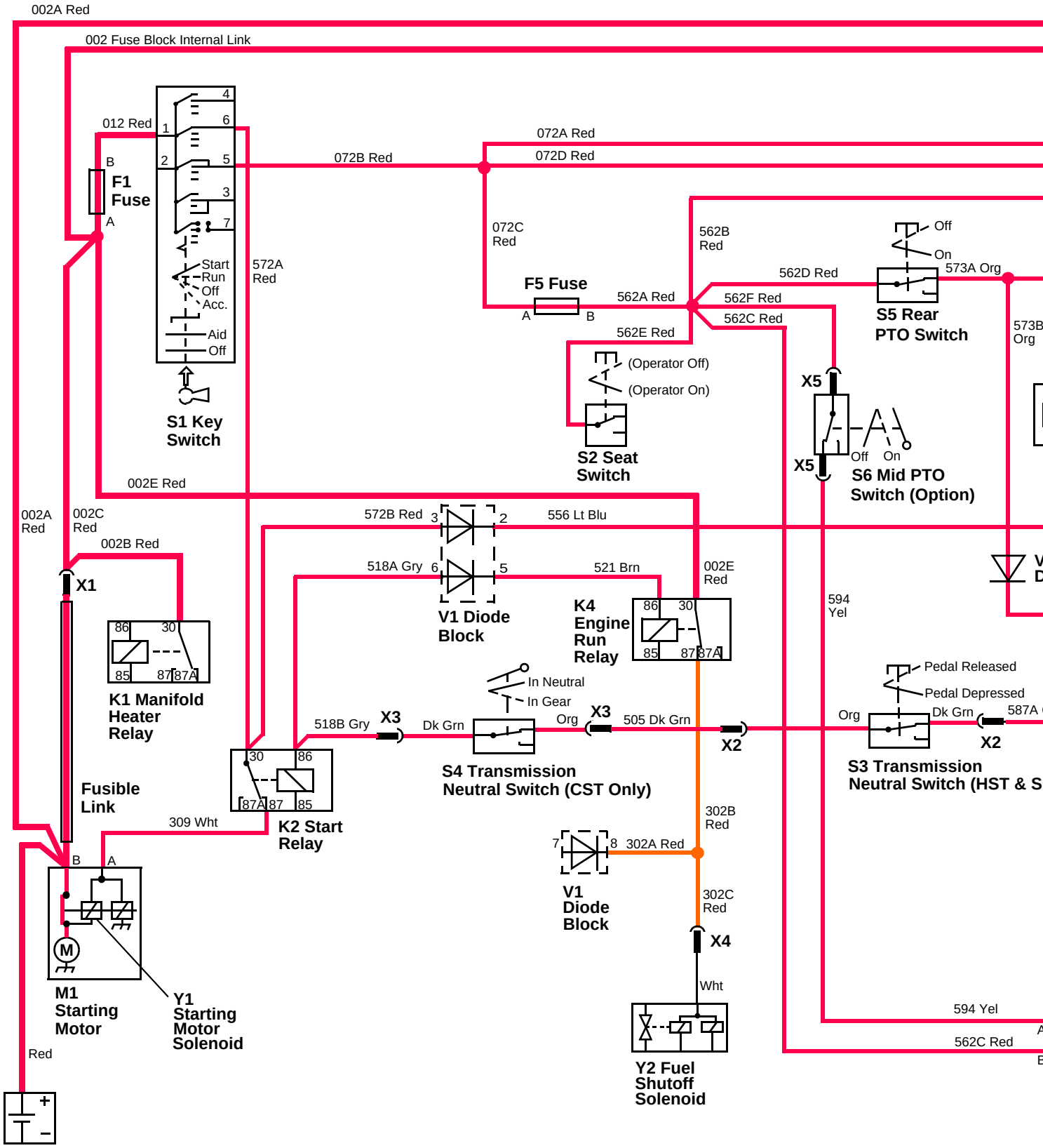
POWER CIRCUIT ELECTRICAL SCHEMATIC - START



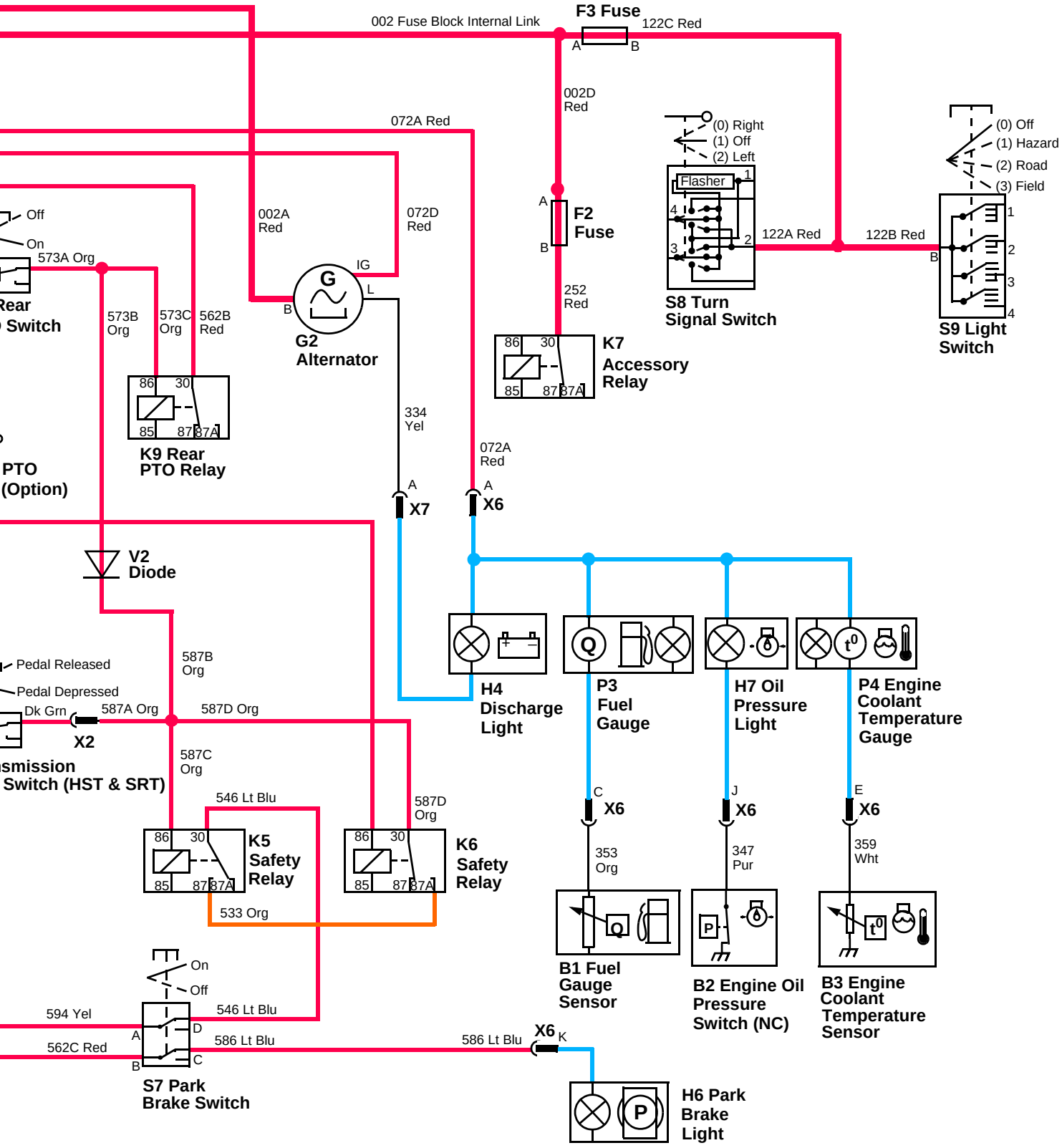
Unswitched Power | Switched Power | Secondary Switched Power | Control Panel Circuit Board

SE1 - STARTING	SE2 - IGNITION	SE3 - CHARGING	SE4 - ACCESSORIES	SE5 - INSTRUMENTATION	SE6 - LIGHTS

POWER CIRCUIT ELECTRICAL SCHEMATIC - START



SE1 - STARTING	SE2 - IGNITION



Switched Power — Control Panel Circuit Board

when placed in the RUN or START position), transmission in NEUTRAL, PTO(s) in NEUTRAL, park brake ENGAGED, and operator NOT ON seat:

- Key Switch Terminal 7
- Manifold Heater Relay Terminal 86

These circuits are controlled by the key switch and are protected by the fusible link and the F1 fuse.

Secondary Switched Power - Aid:

Voltage must be present at the following components with the key switch in the AID position (key pushed in when placed in the RUN or START position):

- Manifold Heater Relay Terminal 87
- Manifold Heater

(See "MANIFOLD HEATER OPERATION").

Switched Power - Start:

Voltage must be present at the following components with the key switch in the START position, transmission in NEUTRAL, PTO(s) in NEUTRAL, park brake ENGAGED, and operator NOT ON seat:

- Key Switch Terminals 5 and 6
- Start Relay Terminal 30
- Diode Block Terminal 3
- K6 Safety Relay Terminal 86
- Start Relay Coil (If start criteria are met)

NOTE: These components are in addition to the components that would have power with the key switch in the RUN position. However, voltage would not be present at the cruise control switch, or at the accessory relay (terminal 86) with the key switch in the START position.

Secondary Switched Power - Start:

Voltage must be present at the following components with the key switch in the START position, transmission in NEUTRAL, PTO(s) in NEUTRAL, park brake ENGAGED, and operator NOT ON seat:

- Start Relay Terminal 87
- Starting Motor Terminal A

See "CRANKING CIRCUIT OPERATION".

POWER CIRCUIT DIAGNOSIS

Test Conditions:

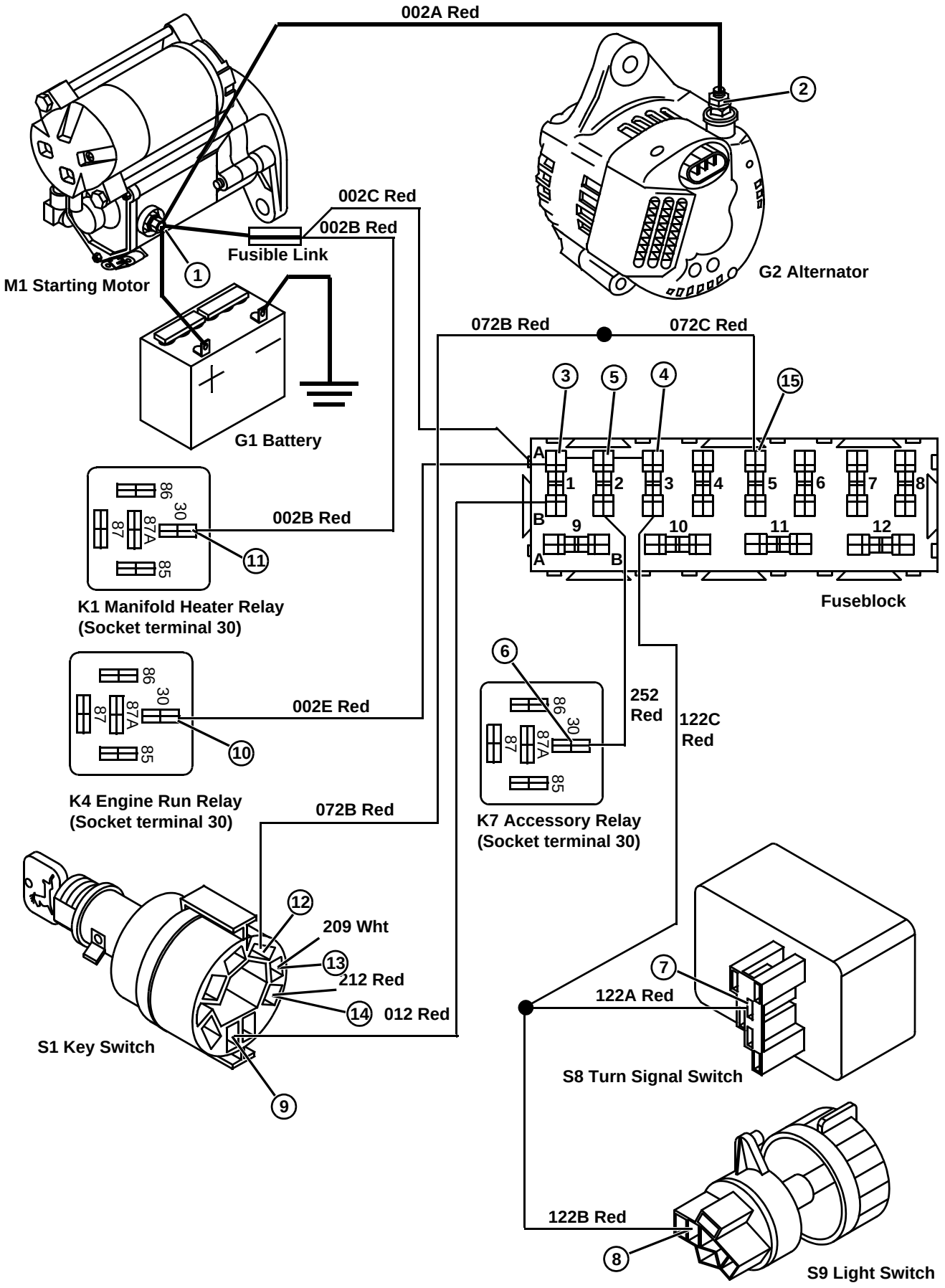
- Key switch in OFF position
- Park brake ENGAGED
- Transmission in NEUTRAL
- PTO DISENGAGED

Test/Check Point	Normal	If Not Normal
1. Starting motor battery (B) terminal	Battery voltage	Check cable to battery. Test battery.
2. Alternator (B terminal)	Battery voltage	Check 002A Red cable and connections.
3. Fuse block (F1 fuse)	Battery voltage	Check fusible link, 002C Red wire and connections.
4. Fuse block (F3 fuse)	Battery voltage	Check internal fuse connection in load center (tie to F1 fuse).
5. Fuse block (F2 fuse)	Battery voltage	Check 002D Red wire and connections.
6. Accessory relay socket	Battery voltage	Check F2 fuse, 252 Red wire and connections.
7. Turn signal switch	Battery voltage	Check F3 fuse, 122C and 122A Red wires and connections.
8. Light switch	Battery voltage	Check F3 fuse, 122C and 122B Red wires and connections.
9. Key switch	Battery voltage	Check F1 fuse, 012 Red wire and connections.
10. Manifold heater relay socket (terminal 30)	Battery voltage	Check fusible link, 002B Red wire and connections.
11. Engine run relay socket (terminal 30)	Battery voltage	Check fusible link, 002E Red wire and connections.

Test Conditions:

- Key switch in RUN position
- Engine OFF
- Park brake ENGAGED
- Transmission in NEUTRAL
- K2, K5, K6, and K9 relays removed from load center
- PTO DISENGAGED, Rear PTO switch disconnected

12. Key switch	Battery voltage	Test key switch (See "KEY SWITCH TEST"). Replace switch as necessary.
13. Key switch	Battery voltage	Test key switch (See "KEY SWITCH TEST"). Replace switch as necessary.
14. Key switch	Battery voltage	Test key switch (See "KEY SWITCH TEST"). Replace switch as necessary.
15. Fuseblock (F5 fuse)	Battery voltage	Check 072A and 072B Red wires and connections.
16. Seat switch	Battery voltage	Check F5 fuse, 562A and 562E Red wires and connections.
17. Park brake switch	Battery voltage	Check 562C Red wire and connections.

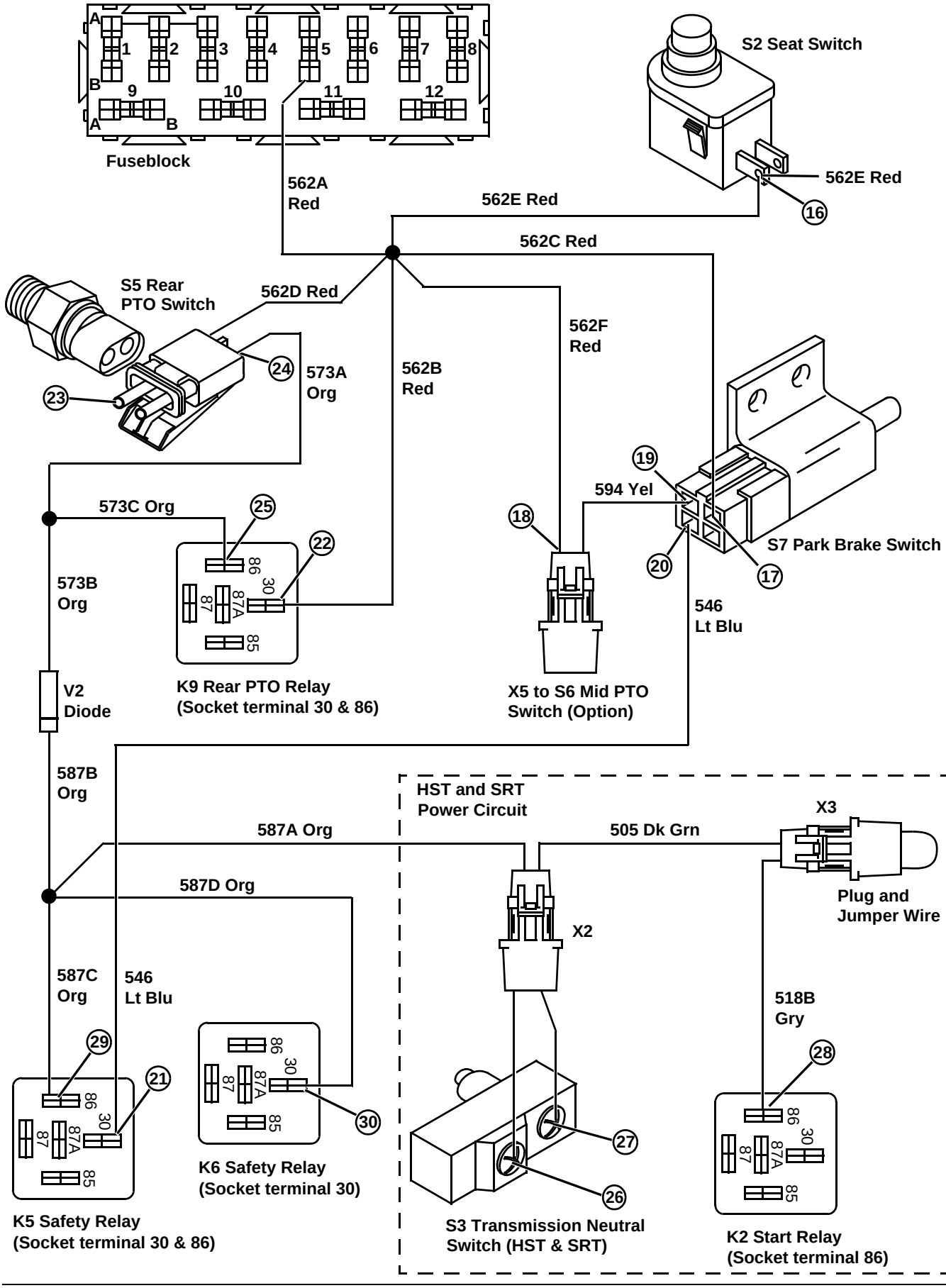

002A Red
002C Red
002B Red
Fusible Link
M1 Starting Motor
G2 Alternator
G1 Battery
072B Red
072C Red
002B Red
K1 Manifold Heater Relay
(Socket terminal 30)
Fuseblock
002E Red
K4 Engine Run Relay
(Socket terminal 30)
252
Red
122C
Red
K7 Accessory Relay
(Socket terminal 30)
072B Red
209 Wht
212 Red
012 Red
S1 Key Switch
122A Red
S8 Turn Signal Switch
122B Red
S9 Light Switch

Test/Check Point	Normal	If Not Normal
18. X5 to S6 Mid PTO switch (Option)	Battery voltage	Check 562F Red wire and connections.
19. Park brake switch	Battery voltage	Ensure Mid PTO is DISENGAGED. Test switch - if installed (See "REAR AND MID PTO SWITCH TEST"). Check 594 Yel wire and connections.
20. Park brake switch	Battery voltage	Ensure park brake is ENGAGED.Test park brake switch. (See PARK BRAKE SWITCH TEST").
21. K5 Safety relay socket (terminal 30)	Battery voltage	Check 546 Lt Blu wire and connections.
22. K9 Rear PTO relay socket (terminal 30)	Battery voltage	Check 562B Red wire and connections.
23. Rear PTO switch	Battery voltage	Check 562D Red wire and connections.

Test Conditions:

- S5 rear PTO switch connected to wiring harness

24. Rear PTO switch	Battery voltage	Ensure PTO is DISENGAGED. Test rear PTO switch. (See "REAR AND MID PTO SWITCH TEST").
25. K9 Rear PTO relay socket (terminal 86)	Battery voltage	Check 573A and 573C Org wires and connections.
NOTE: The following three steps are for Hydrostatic (HST) and SyncReverser (SRT) tractors. The X3 connector is fitted with a plug and jumper wire. For Collar Shift tractors (CST) tractors see steps 31 and 32.		
26. S3 transmission neutral switch	Battery voltage	Check X2 connector. Check 573B Org wire, V2 diode (See "V2 DIODE TEST"), 587B and 587A Org wires and connections.
27. S3 transmission neutral switch	Battery voltage	Ensure forward pedal linkage is depressing switch, adjust switch position if needed. Test switch. (See "TRANSMISSION NEUTRAL SWITCH TEST - HST AND SRT").
28. Start relay socket (terminal 86)	Battery voltage	Check 505 Dk Grn wire, X3 connector and jumper wire, 518B Gry wire and connections.
29. K5 safety relay socket (terminal 86)	Battery voltage	Check 587C Org wire and connections.
30. K6 safety relay socket (terminal 30)	Battery voltage	Check 587D Org wire and connections.
NOTE: The following two steps are for Gear Collar Shift (CST) tractors. The X2 connector is fitted with a plug and jumper wire. For Hydrostatic (HST) and SyncReverser (SRT) tractors see step 26.		


A
1
2
3
4
5
6
7
8
B
9
10
11
12
A
B
Fuseblock
562A
Red
S2 Seat Switch
562E Red
16
562E Red
562C Red
S5 Rear
PTO Switch
562D Red
24
573A
Org
23
562B
Red
562F
Red
19
594 Yel
18
20
17
S7 Park Brake Switch
546
Lt Blu
573C Org
25
22
573B
Org
86
30
87
87A
85
K9 Rear PTO Relay
(Socket terminal 30 & 86)
X5 to S6 Mid PTO
Switch (Option)
V2
Diode
587B
Org
HST and SRT
Power Circuit
X3
587A Org
505 Dk Grn
Plug and
Jumper Wire
587D Org
X2
587C
Org
546
Lt Blu
518B
Gry
29
21
30
28
27
26
K6 Safety Relay
(Socket terminal 30)
K5 Safety Relay
(Socket terminal 30 & 86)
S3 Transmission Neutral
Switch (HST & SRT)
K2 Start Relay
(Socket terminal 86)

Test/Check Point	Normal	If Not Normal
31. S3 Transmission neutral switch	Battery voltage	Check 587A Org wire, X2 connector and jumper wire, 505 Dk Grn wire, and X3 connector and connections.
32. Start relay socket (terminal 86)	Battery voltage	Check 505 Dk Grn wire, X2 connector and jumper wire, 518B Gry wire and connections.

Test Conditions:

- V1 diode block removed from load center

33. Diode block socket (terminal 6)	Battery voltage	Check 518A Gry wire and connections.

Test Conditions:

- V1 diode block installed in load center

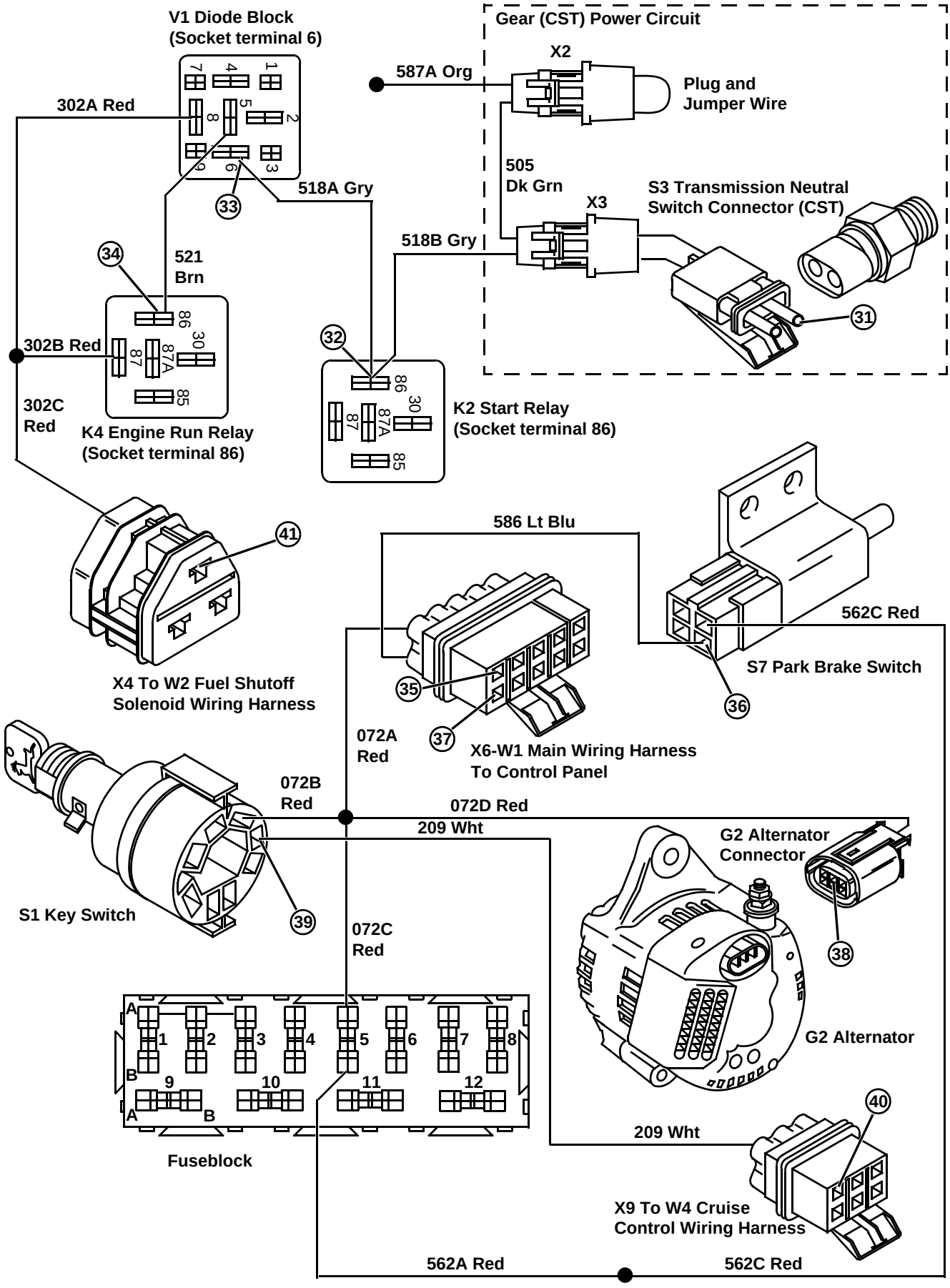
34. Engine run relay socket (terminal 86)	Battery voltage	Ensure diode block is fully seated.Test diode block (See "DIODE BLOCK TEST"). Check 521 Brn wire and connections.
35. X6 connector to control panel	Battery voltage	Check 072B and 072A Red wires and connections.
36. Park brake switch	Battery voltage	Ensure park brake is ENGAGED.Test switch (See "PARK BRAKE SWITCH TEST"). Check 562C Red wire and connections.
37. X6 connector to control panel	Battery voltage	Check 586 Lt Blu wire and connections.
38. Alternator IG Terminal	Battery voltage	Check 072B and 072D Red wires and connections.
39. Key switch	Battery voltage	Test key switch. (See "KEY SWITCH TEST").
40. X9 connector	Battery voltage	Check 209 Wht wire and connections.

Test Conditions: Secondary Power

NOTE: The following test is the fuel shutoff solenoid that receives power after the K4 relay is activated when voltage is provided to the relay coil. The circuit needs to have the K4 relay in place to perform this test. For further detail see "FUEL SUPPLY OPERATION".

- Key switch in RUN position
- Engine OFF
- Park brake ENGAGED
- Transmission in NEUTRAL
- PTO DISENGAGED

41. X4 connector to fuel shutoff solenoid	Battery voltage Battery voltage cannot be tested at the diode block socket. The diode block needs to be installed to energize the engine run relay coil.	Ensure K4 engine run relay coil is powered. See step 34. Check relay. (See "RELAY TEST") Check 302B and 302C Red wires and connections.


V1 Diode Block
(Socket terminal 6)
Gear (CST) Power Circuit
X2
587A Org
Plug and
Jumper Wire
302A Red
505
Dk Grn
X3
S3 Transmission Neutral
Switch Connector (CST)
518A Gry
518B Gry
33
34
521
Brn
31
32
302B Red
302C
Red
K4 Engine Run Relay
(Socket terminal 86)
K2 Start Relay
(Socket terminal 86)
41
586 Lt Blu
562C Red
S7 Park Brake Switch
36
X4 To W2 Fuel Shutoff
Solenoid Wiring Harness
35
37
072A
Red
X6-W1 Main Wiring Harness
To Control Panel
072B
Red
072D Red
209 Wht
G2 Alternator
Connector
S1 Key Switch
39
072C
Red
38
G2 Alternator
Fuseblock
40
209 Wht
X9 To W4 Cruise
Control Wiring Harness
562A Red
562C Red

CRANKING CIRCUIT OPERATION

Function:

To energize the starting motor solenoid and engage the starting motor to crank the engine.

Operating Conditions:

- Key switch in START position
- Transmission in NEUTRAL
- Rear PTO DISENGAGED (disengages mid PTO)

Theory of Operation:

The power circuit (fusible link, 002C Red wire, F1 fuse, and 012 Red wire) provides voltage to the key switch.

When placed in the START position, the key switch provides current to the start relay contact (572A Red to terminal 30 of start relay).

The start relay coil is energized through a circuit consisting of: the key switch (terminal 5), 072B and 072C Red wires, F5 fuse, 562A and 562D Red wires, PTO switch (OFF position), 573A and 573B Org wires, V2 diode, 587B and 587A Org wires, X2 (with jumper wire), 505 Dk Grn wire, S4 transmission neutral switch, and 518B Gry wire on CST tractors; or, 587A Org wire to S3 transmission neutral switch, 505 Dk Grn wire, X3 (with jumper wire), and 518B Gry wire on HST and SRT tractors.

NOTE: The S4 Transmission Neutral Switch is installed in collar shift gear drive (CST) tractors; a jumper wire is installed in the X2 connector, and the S3 Transmission Neutral Switch is not used.
In hydrostatic (HST) and SyncReverser (SRT) tractors the S3 Transmission Neutral Switch is used, and a jumper wire is installed in the X3 connector - eliminating the S4 switch.

When the start relay coil is energized, the K2 relay contacts close and current flows to the starting motor solenoid (309 Wht).

With the starting motor solenoid energized, the starting motor solenoid contacts close and high current from the battery passes through the battery cable and solenoid contacts to the starting motor. The starting motor cranks the engine.

CAUTION

To avoid injury, ALWAYS engage park brake when starting the engine.

MANIFOLD HEATER OPERATION

Function:

To provide an added source of heat for combustion.

Operating Conditions:

- Key switch must be in the START or RUN position and pushed in to the AID position.

Theory of Operation:

The ignition system is designed to inject diesel fuel into the piston cylinder where heat from compression ignites the fuel and air mixture.

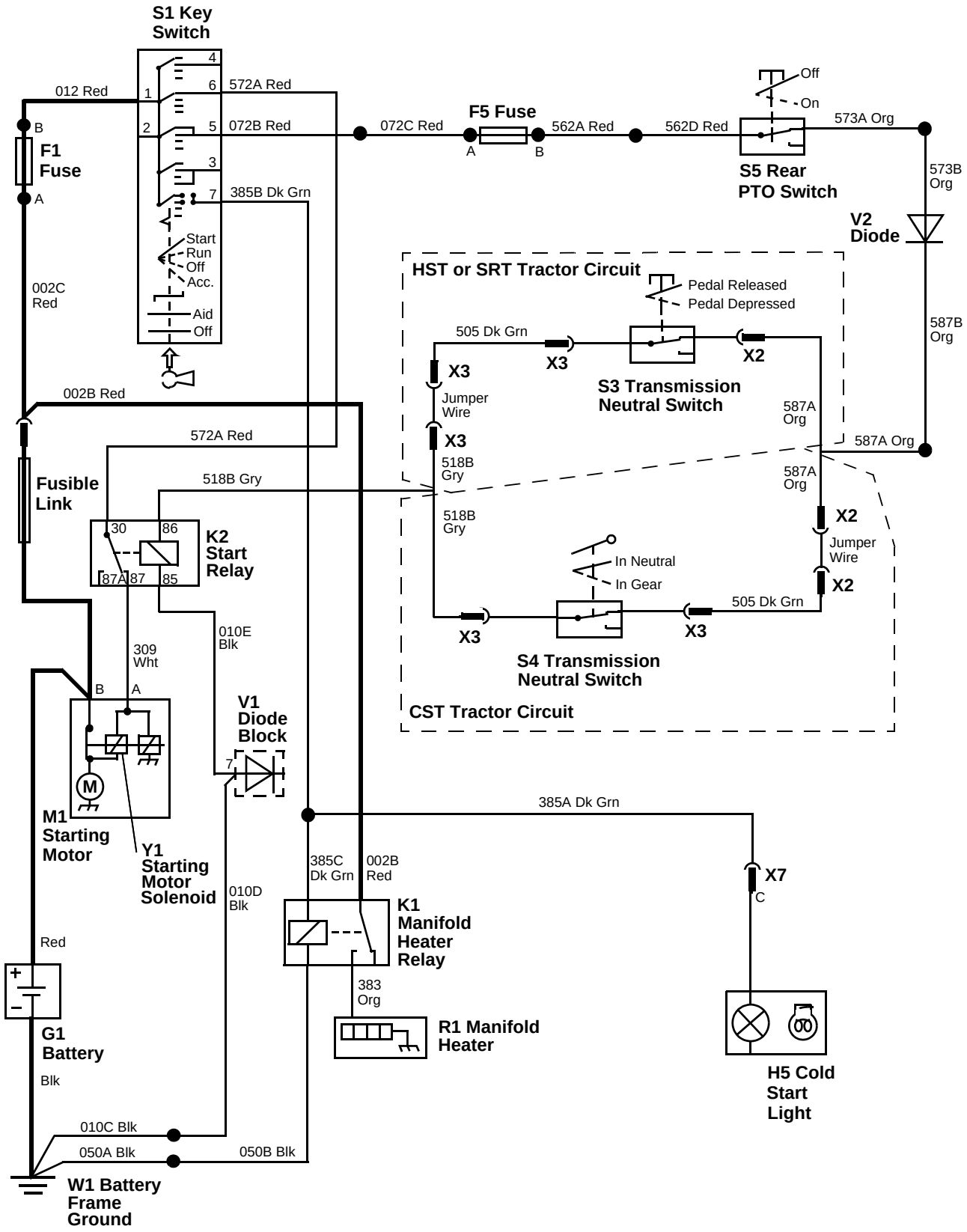
When starting a cold engine, compression may not provide enough heat to ignite the fuel. The manifold heater is installed to provide added heat to the incoming combustion air.

The manifold heater is energized (heated) when the key switch is placed in the AID position (key pushed into switch). The key can be pushed into the AID position with the key in either the START or RUN position. The manifold may be preheated by pushing in the key, with the switch in the RUN position, for up to 3 seconds before turning the key to the START position.

When the key switch is in the AID position, current is provided to the K1 manifold heater relay coil (terminal 86) through the 385B and 385C Dk Grn wires. When the relay coil is energized, the relay contacts close and unswitched power (002B Red wire - terminal 30) flows through the contacts and 383 Org wire to the manifold heater.

The H5 cold start indicator light in the control panel provides a visual indication that the key is in the AID position and the manifold heater relay is being energized. The indicator lamp is powered through the 385B and 385A Dk Grn wires, X7 connector (terminal C), and control panel circuit board. (See "CONTROL PANEL INDICATOR LIGHTS").

CRANKING CIRCUIT ELECTRICAL SCHEMATIC



SE1 - STARTING	SE2 - IGNITION

CRANKING CIRCUIT DIAGNOSIS

Test Conditions:

- Park brake ENGAGED
- Key switch in OFF position
- Transmission in NEUTRAL
- PTO DISENGAGED

Test/Check Point	Normal	If Not Normal
1. Key switch	Battery voltage	Check 200 Red wire and F1 fusible link. (See "POWER CIRCUIT DIAGNOSIS")

Test Conditions:

- Park brake ENGAGED
- Transmission in NEUTRAL
- K1 start relay unplugged
- S5 rear PTO switch disconnected from main wiring harness
- PTO DISENGAGED
- Key switch in START position

2. Key switch	Battery voltage	Test switch. (See "KEY SWITCH TEST") Replace key switch as necessary.
3. F5 fuse	Battery voltage	Check 072B and 072C Red wires and connections.
4. Rear PTO switch connector	Battery voltage	Check F5 fuse and 562A and 562D Red wires and connections.

Test Conditions:

- S5 rear PTO switch connected to wiring harness

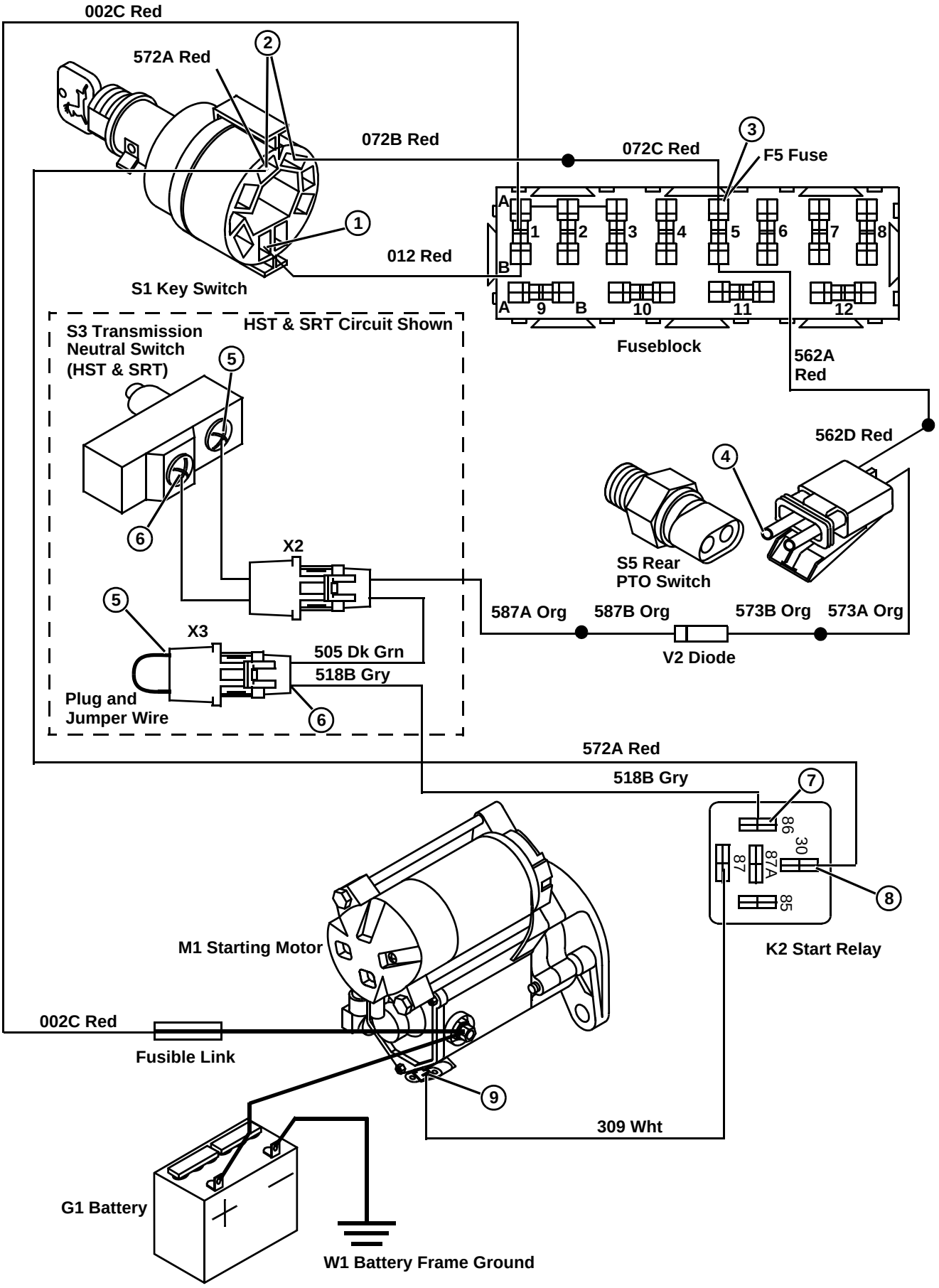
5. Transmission neutral switch	Battery voltage	Ensure PTO is DISENGAGED. Check 573A and 573B Org wires, V2 diode (See "V2 DIODE TEST"), 587B and 587A Org wires, and X2 connector. (X2 connector/jumper wire and 505 Dk Grn wire for CST tractors)
6. Transmission neutral switch	Battery voltage	Check switch. (See "TRANSMISSION NEUTRAL SWITCH TEST - HST AND SRT"); or, (See TRANSMISSION NEUTRAL SWITCH TEST - CST AND SST"). Adjust or replace switch as needed.
7. K2 start relay socket (terminal 86)	Battery voltage	Check 505 Dk Grn wire, X3 connector (jumper wire), and 518B Gry wire and connections.
8. K2 start relay socket (terminal 30)	Battery voltage	Check 572A Red wire and connections.

Test Conditions:

- Park brake ENGAGED
- Transmission in NEUTRAL
- X4 to fuel solenoid wiring harness disconnected
- K1 start relay installed in load center
- PTO DISENGAGED
- Key switch in START position

CAUTION: Engine may start during this procedure. Disconnect fuel shutoff solenoid.

9. Starting motor	Battery voltage	Check 309 Wht wire and connections. Check K2 start relay. (See "RELAY TEST")


002C Red
572A Red
072B Red
072C Red
F5 Fuse
012 Red
S1 Key Switch
Fuseblock
562A Red
562D Red
S5 Rear PTO Switch
S3 Transmission Neutral Switch (HST & SRT)
HST & SRT Circuit Shown
X2
X3
505 Dk Grn
518B Gry
Plug and Jumper Wire
587A Org
587B Org
573B Org
573A Org
V2 Diode
572A Red
518B Gry
M1 Starting Motor
K2 Start Relay
002C Red
Fusible Link
309 Wht
G1 Battery
W1 Battery Frame Ground

MANIFOLD HEATER CIRCUIT DIAGNOSIS

Test Conditions:

- Park brake ENGAGED
- Key switch in OFF position
- K1 manifold heater relay removed

Test/Check Point	Normal	If Not Normal
1. Key switch	Battery voltage	(See "POWER CIRCUIT DIAGNOSIS")
2. Manifold heater relay socket	Battery voltage	Check 002B Red wire and connections. (See "POWER CIRCUIT DIAGNOSIS")

Test Conditions:

- Park brake ENGAGED
- K2 start relay removed from load center
- K1 manifold heater relay removed from load center
- Key switch in RUN position; key in AID position (pushed in)

3. Key switch	Battery voltage	Check key switch. (See "KEY SWITCH TEST"). Replace switch as needed.
4. Manifold heater relay socket	Battery voltage while key switch is in AID position	Check 385B and 385C Dk Grn wires and connections.

Test Conditions:

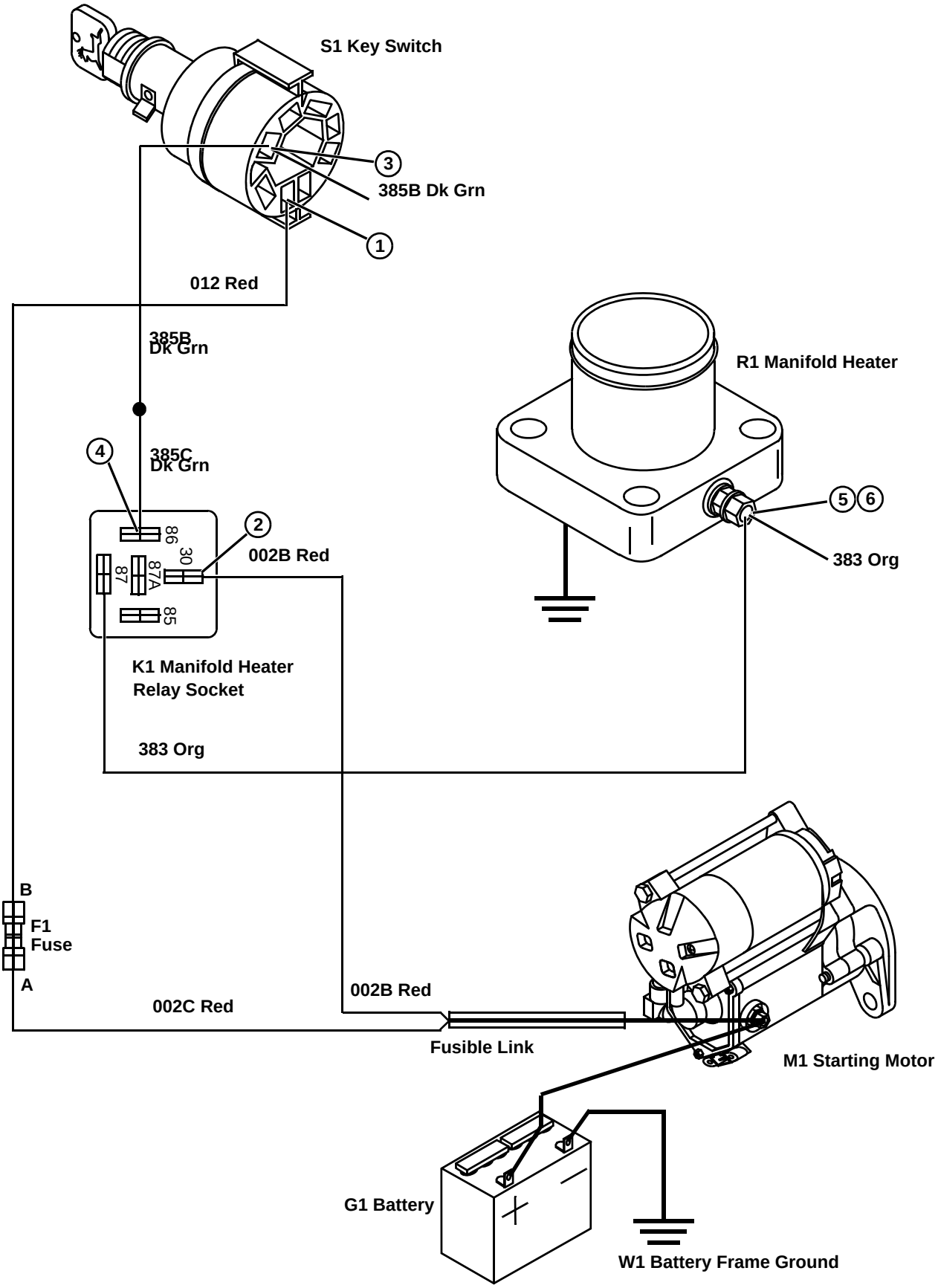
- Park brake ENGAGED
- K1 manifold heater relay installed in load center
- Key switch in RUN position; key in AID position (pushed in)

5. Manifold heater	Battery voltage	Check 383 Org wire and connections. Check K1 relay. (See "RELAY TEST"). Replace relay as needed.

Test Conditions:

- Park brake ENGAGED
- Meter set to ohm scale
- Meter negative lead connected to frame ground
- Key switch in OFF position

6. Manifold heater module	Maximum 0.1 ohm resistance	Check manifold heater element. Replace manifold heater as needed.


S1 Key Switch
3
385B Dk Grn
1
012 Red
385B
Dk Grn
R1 Manifold Heater
4
385C
Dk Grn
5
6
2
002B Red
383 Org
86
30
87
87A
85
K1 Manifold Heater
Relay Socket
383 Org
B
F1
Fuse
A
002C Red
002B Red
Fusible Link
M1 Starting Motor
G1 Battery
W1 Battery Frame Ground

FUEL SUPPLY OPERATION

Function:

To start or stop the supply of fuel to the engine.

Operating Conditions (Starting Tractor):

- Key switch must be in the START position.
- Operator ON seat
- PTO DISENGAGED
- Transmission in NEUTRAL

Operating Conditions (Running Tractor):

- Key switch must be in the RUN position.
- Operator ON seat
- PTO ENGAGED
- Transmission in any GEAR

Operating Conditions (Running Tractor):

- Key switch must be in the RUN position.
- Operator ON seat
- PTO DISENGAGED
- Park brake ENGAGED

Operator can leave seat. (See "ENGINE SHUTOFF CIRCUIT OPERATION")

- PTO can be ENGAGED

Fuel Supply Theory of Operation

The fuel system is designed to inject fuel into the piston cylinder where heat from compression ignites the fuel and air mixture.

Fuel is provided to the engine when the fuel shutoff solenoid is energized. The fuel shutoff solenoid contains two coils to open the fuel valve. The pull-in coil, in conjunction with the hold-in coil, overcomes the spring loaded fuel valve. The hold-in coil keeps the fuel valve open after the pull-in coil current is reduced through the R2 thermistor.

The fuel shutoff solenoid is initially energized and pulled in when the engine run relay contacts close. Voltage is provided to both of the fuel shutoff solenoid coils (pull-in and hold-in), which provide enough pull on the solenoid plunger to overcome the shutoff solenoid spring.

The fuel shutoff solenoid pull-in coil needs a high current pulse through it to overcome the solenoid spring. After the solenoid opens (overcomes the spring) a lower current will hold the solenoid open. The combination of the K3 fuel shutoff relay and R2 variable thermistor provide a means to reduce the current flow through the fuel shutoff solenoid pull-in coil after the solenoid opens.

The initial high current flows through the 329A Wht wire to the K3 fuel pull-in relay (terminal 30), through the contacts, and through the 319 Wht wire to the R2 variable thermistor. The thermistor has a low resistance to the current initially (lower than the resistance through the K3 fuel shutoff relay coil). As the current flows through the thermistor, it heats up and the resistance through it increases (higher than the resistance through the K3 fuel shutoff relay coil).

While the current flow through the thermistor is reduced, the voltage difference across the thermistor is increased. When the voltage difference is increased enough to activate the coil of the K3 fuel shutoff relay (329B Wht), the coil opens the relay contacts and the variable thermistor is removed from the circuit.

NOTE: The variable thermistor will heat to a maximum temperature of approximately 180° F (82° C) during the brief period of time required to overcome the fuel shutoff solenoid spring.

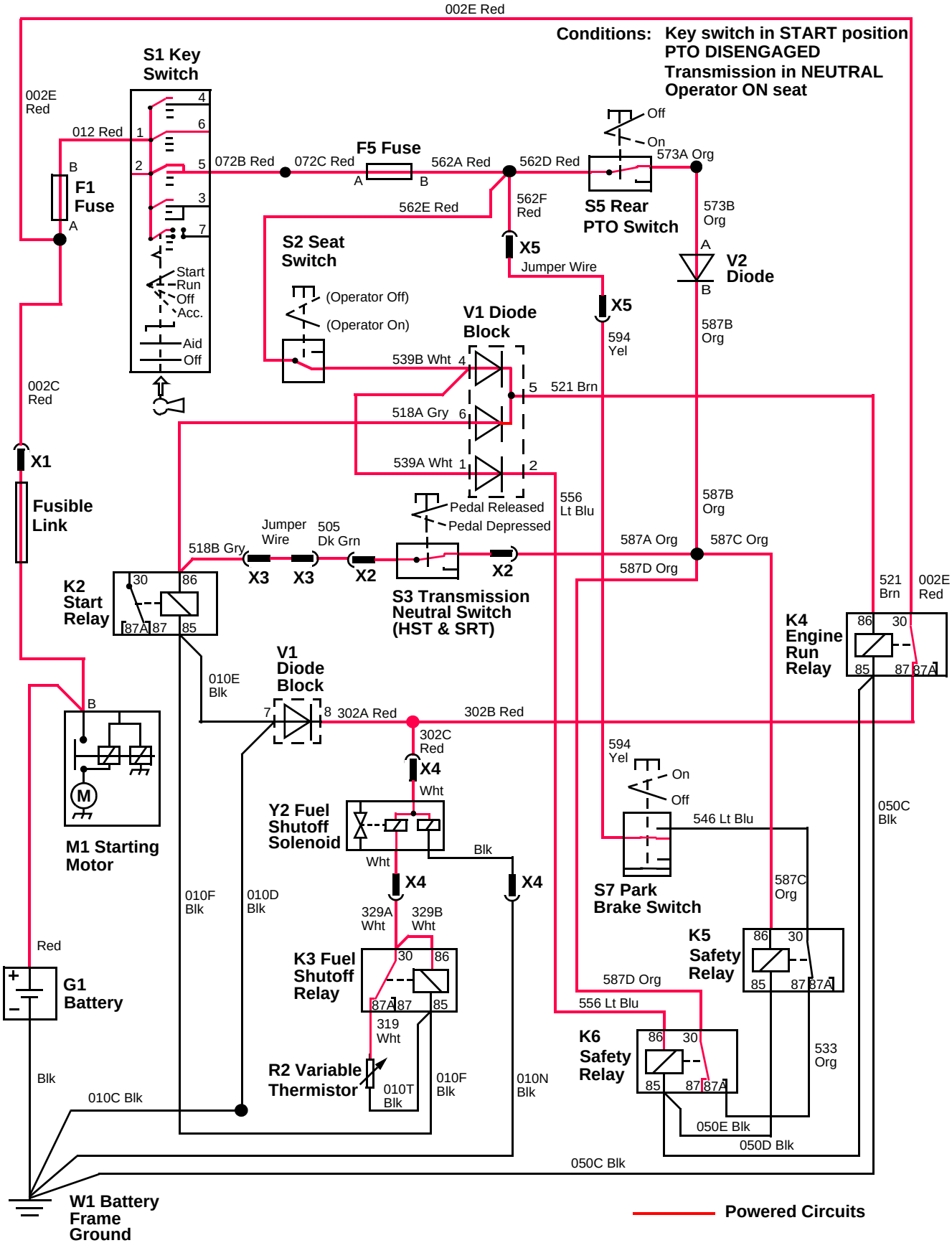
With the thermistor removed from the circuit, a ground path is provided for the fuel shutoff solenoid pull-in coil through the 329A and 329B Wht wires, the fuel shutoff relay coil, and the 010F, 010E, 010D and 010C Blk wires. A ground path for the fuel shutoff solenoid hold-in coil is provided through the 010N Blk wire.

A latching circuit is provided to maintain voltage to the engine run relay after the PTO is ENGAGED. The latching circuit is energized only if the operator is OFF the seat, the PTO is DISENGAGED, and the park brake is ENGAGED. The latching circuit remains energized, while the park brake is ENGAGED, after the PTO is ENGAGED. This circuit allows the operator to leave the seat, with the park brake ENGAGED and the transmission in NEUTRAL, and then ENGAGE the PTO. (See "ENGINE SHUTOFF CIRCUIT OPERATION").

Fuel is provided to the engine through the Y2 fuel shutoff solenoid, provided that operating conditions are met. If the operating criteria are not met, the engine run relay opens and stops voltage energizing the fuel shutoff solenoid coils. The fuel shutoff solenoid closes and fuel to the engine is shut off. (See "ENGINE SHUTOFF CIRCUIT OPERATION").

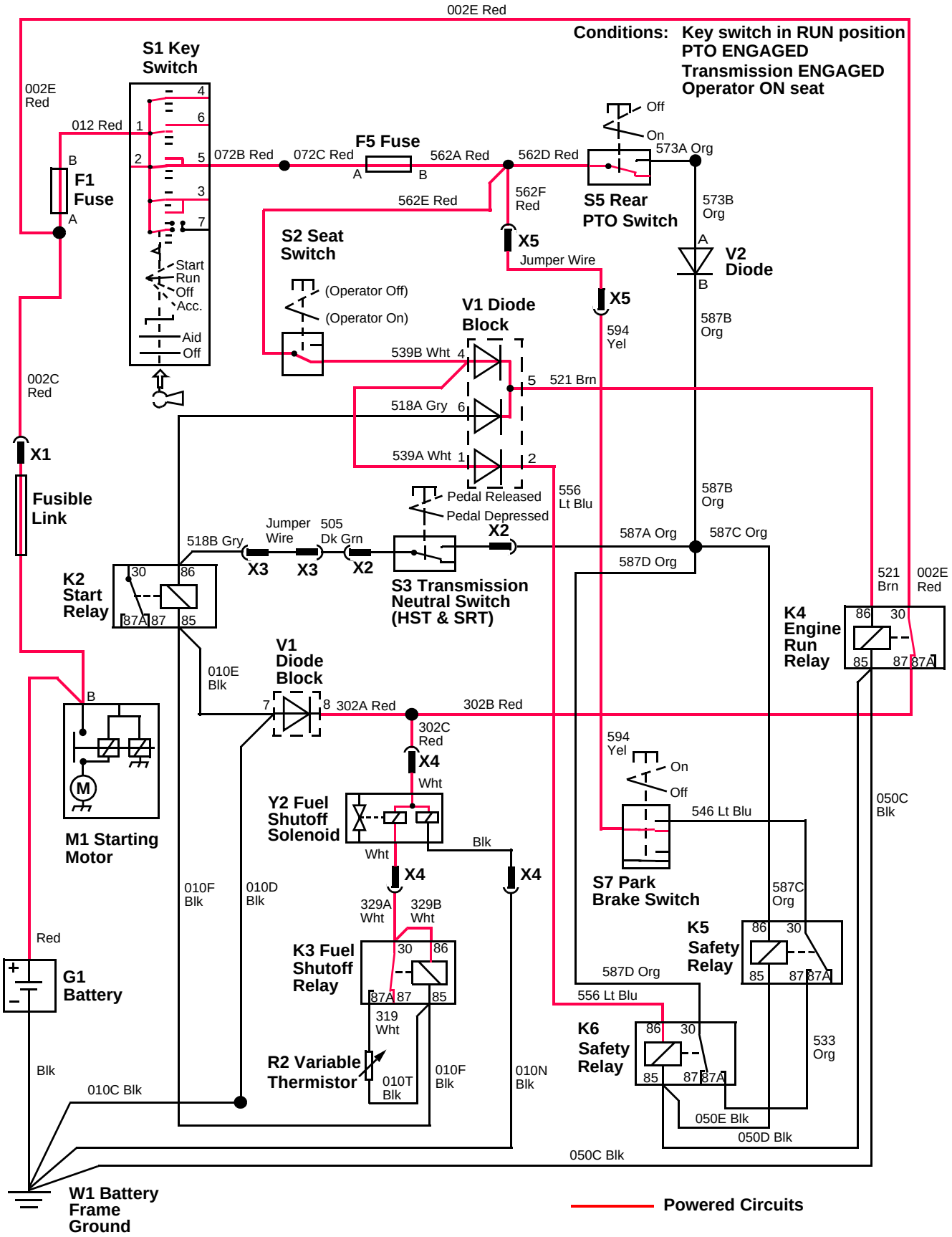
NOTE: The S3 transmission neutral switch is shown in this diagnostic section. This switch is used, in conjunction with the jumper wire in the X3 connector, for tractors with a hydrostatic (HST) or SyncReverser (SRT) transmission. For tractors with a gear shift transmission (CST), a jumper wire is used in the X2 connector and the S4 transmission neutral switch is used in the X3 connector.

FUEL SUPPLY ELECTRICAL SCHEMATIC



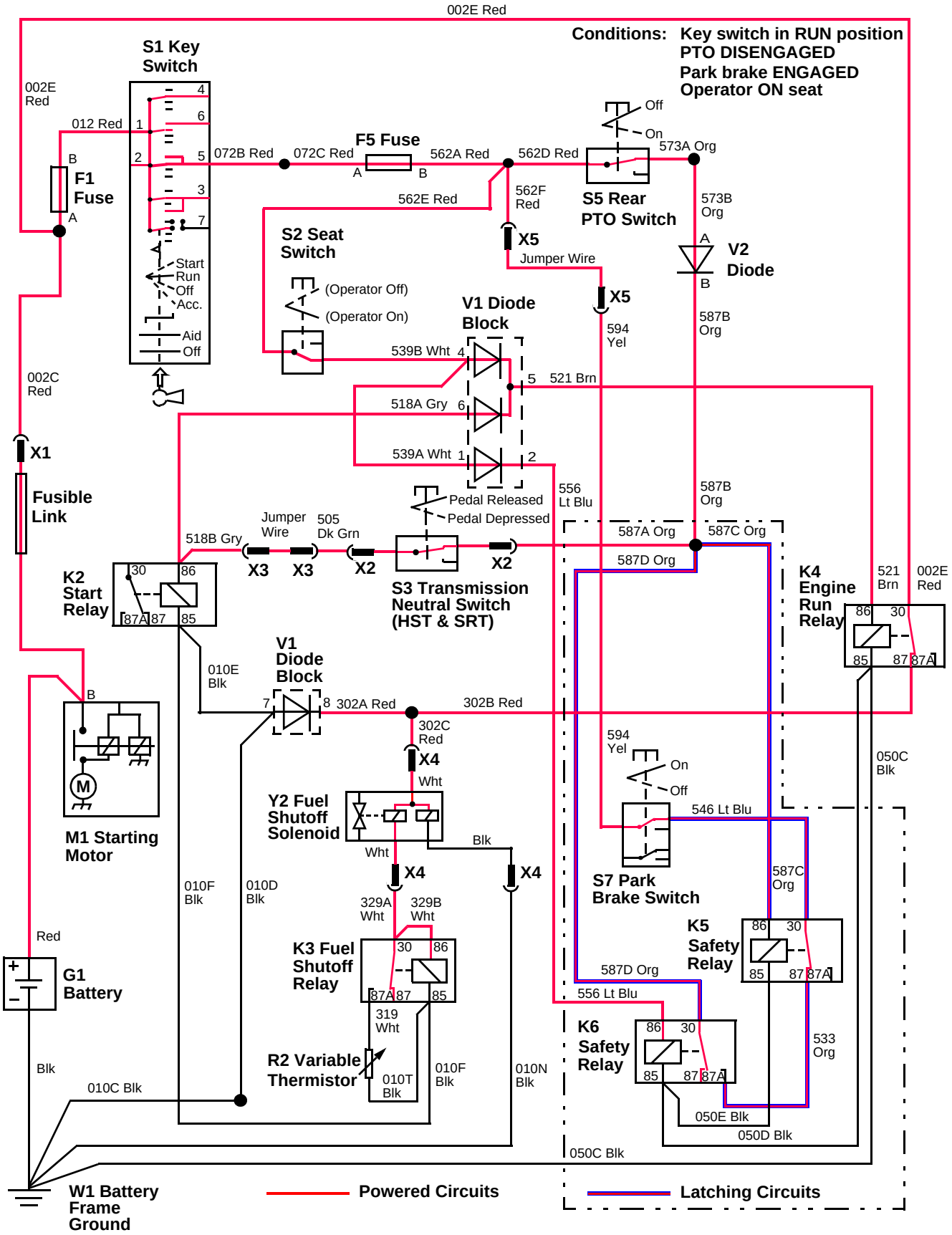
SE1 - STARTING	SE2 - IGNITION

FUEL SUPPLY ELECTRICAL SCHEMATIC



SE1 - STARTING	SE2 - IGNITION

FUEL SUPPLY ELECTRICAL SCHEMATIC



SE1 - STARTING	SE2 - IGNITION

FUEL SUPPLY DIAGNOSIS

Test Conditions:

- Park brake ENGAGED
- Key switch in RUN position (Engine NOT running)
- V1 diode block removed from load center
- PTO DISENGAGED
- Transmission in NEUTRAL
- Seat switch closed (Operator ON seat)

Test/Check Point	Normal	If Not Normal
1. Rear PTO switch connector	Battery voltage	(See “POWER CIRCUIT DIAGNOSIS”.)
2. Transmission neutral switch	Battery voltage	(See “POWER CIRCUIT DIAGNOSIS”.)
3. Diode block socket (terminal 6)	Battery voltage	Check transmission switch. (See “TRANSMISSION NEUTRAL SWITCH TEST – HST & SRT”.) Check 518B and 518A Gry wires and connections.
4. Seat switch	Battery voltage	(See “POWER CIRCUIT DIAGNOSIS”.)
5. Diode block socket (terminal 4)	Battery voltage	Check seat switch. (See “SEAT SWITCH TEST”.) Check 539B Wht wire and connections.

Test Conditions:

- Park brake ENGAGED
- Key switch in RUN position
- PTO DISENGAGED
- Transmission in NEUTRAL
- Seat switch open (Operator OFF seat)
- V1 diode block installed; K4 engine run relay removed from load center

6. Engine run relay socket (terminal 85)	Battery voltage	Check diode block (terminals 6 to 5). (See “DIODE BLOCK TEST”.) Check 521 Brn wire and connections.

Test Conditions:

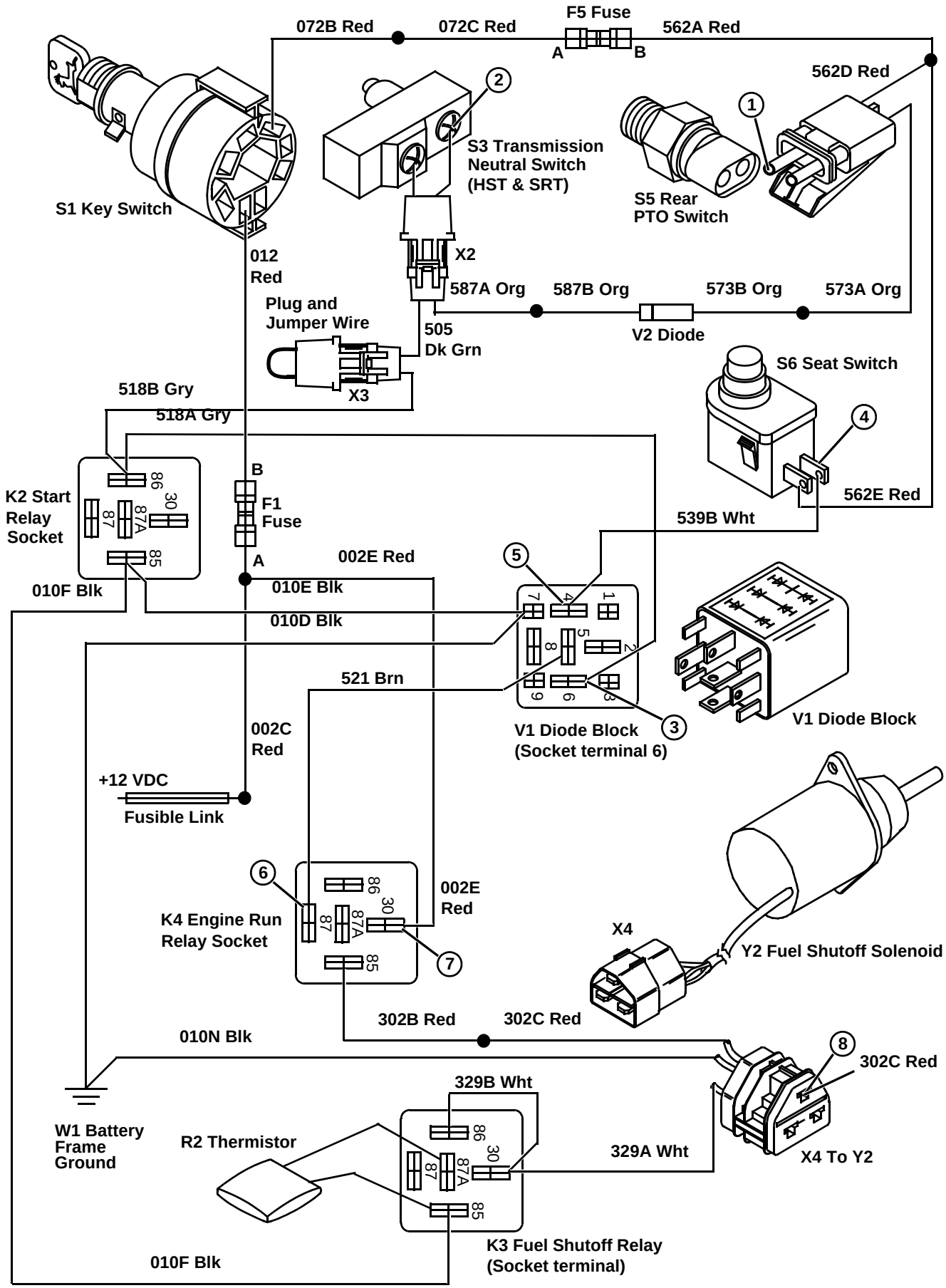
- Park brake ENGAGED
- Key switch in RUN position
- PTO DISENGAGED
- Transmission in GEAR
- Seat switch closed (Operator ON seat)

7. Engine run relay socket (terminal 85)	Battery voltage	Check diode block (terminals 4 to 5). (See “DIODE BLOCK TEST”.)

Test Conditions:

- Park brake ENGAGED
- Key switch in RUN position
- PTO DISENGAGED
- Transmission in GEAR
- Seat switch closed (Operator ON seat)
- K4 engine run relay installed in load center

8. Fuel solenoid connector	Battery voltage	Check 302B and 302C Red wires and connections.


072B Red
072C Red
F5 Fuse
A
B
562A Red
562D Red
S1 Key Switch
S3 Transmission Neutral Switch (HST & SRT)
S5 Rear PTO Switch
012 Red
X2
587A Org
587B Org
573B Org
573A Org
Plug and Jumper Wire
505 Dk Grn
X3
V2 Diode
S6 Seat Switch
518B Gry
518A Gry
562E Red
539B Wht
K2 Start Relay Socket
86
30
87
87A
85
B
F1 Fuse
A
002E Red
010F Blk
010E Blk
010D Blk
521 Brn
002C Red
V1 Diode Block (Socket terminal 6)
V1 Diode Block
+12 VDC
Fusible Link
K4 Engine Run Relay Socket
002E Red
X4
Y2 Fuel Shutoff Solenoid
302B Red
302C Red
010N Blk
302C Red
329B Wht
W1 Battery Frame Ground
R2 Thermistor
329A Wht
X4 To Y2
K3 Fuel Shutoff Relay (Socket terminal)
010F Blk

ENGINE SHUTOFF CIRCUIT OPERATION

Engine Shutoff Function:

To stop the tractor engine in an unsafe operating condition.

Operating Conditions:

- Engine running
- Operator on seat

Engine MUST STOP if:

- PTO is ENGAGED, and
- Operator gets out of seat

or;

- Transmission is ENGAGED, and
- Operator gets out of seat

NOTE: If transmission is in NEUTRAL and the PTO is disengaged, and then the park brake is set, the operator can leave the seat and the PTO can be reengaged.

or;

- Transmission is in GEAR, and
- Operator gets out of seat

NOTE: The S3 transmission neutral switch is shown in this diagnostic section. This switch is used in conjunction with a jumper wire in the X3 connector for tractors with a hydrostatic (HST) or SyncReverser (SRT) transmission. For tractors with a gear (CST) transmission the jumper wire is used in the X2 connector and the S4 transmission neutral switch is used in the X3 connector.

Theory of Operation:

Fuel is supplied to the engine provided that operating conditions are met. (See "FUEL SUPPLY OPERATION"). If an unsafe condition is created, the engine will stop by having the fuel supply to the engine shut off.

The fuel supply is shut off when voltage to the K4 engine run relay coil is removed, its contacts open, power to the Y2 fuel shutoff solenoid coils is removed and the solenoid closes.

Power to the K4 engine run relay coil comes from the V1 diode block (terminal 5), and is provided to the diode block (terminals 4 or 6) through different circuits. The different circuits allow for a variety of operating conditions to exist and maintain fuel supply to the engine.

The main and most direct circuit, provides power to the K4 engine run relay coil through the key switch, 072B and 072C Red wires, F5 fuse, 562A and 562E Red wires, S2 seat switch (operator ON seat), 539B Wht wire, V1 diode block (terminals 4 to 5), and 521 Brn wire. This circuit provides voltage to the engine run relay for normal operation of the tractor.

A second circuit provides power through the key switch, 072B and 072C Red wires, F5 fuse, 562A and 562D Red wires, rear PTO switch (PTO DISENGAGED), 573A and 573B Org wires, V2 diode, 587B and 587A Org wires, S3 or S4 transmission neutral switch, 518B and 518A Gry wires, V1 diode block (terminals 6 to 5), and 521 Brn wire. This circuit provides voltage to the engine run relay if the PTO is DISENGAGED and the transmission is in NEUTRAL, with or without the operator in the seat.

A third circuit provides power through the park brake switch, and the K5 and K6 safety relays. The park brake switch and the K5 and K6 relays, in conjunction with the PTO switch, create a self-latching circuit. The PTO must be DISENGAGED, the park brake must be ENGAGED, and the operator must be OFF the seat to create the circuit. Once the latch circuit is established the PTO can be ENGAGED. The latching circuit will remain energized until the operator gets ON the seat and the K6 safety relay coil is energized opening the circuit path through the K6 contacts, or; the park brake switch is DISENGAGED, eliminating power to the circuit.

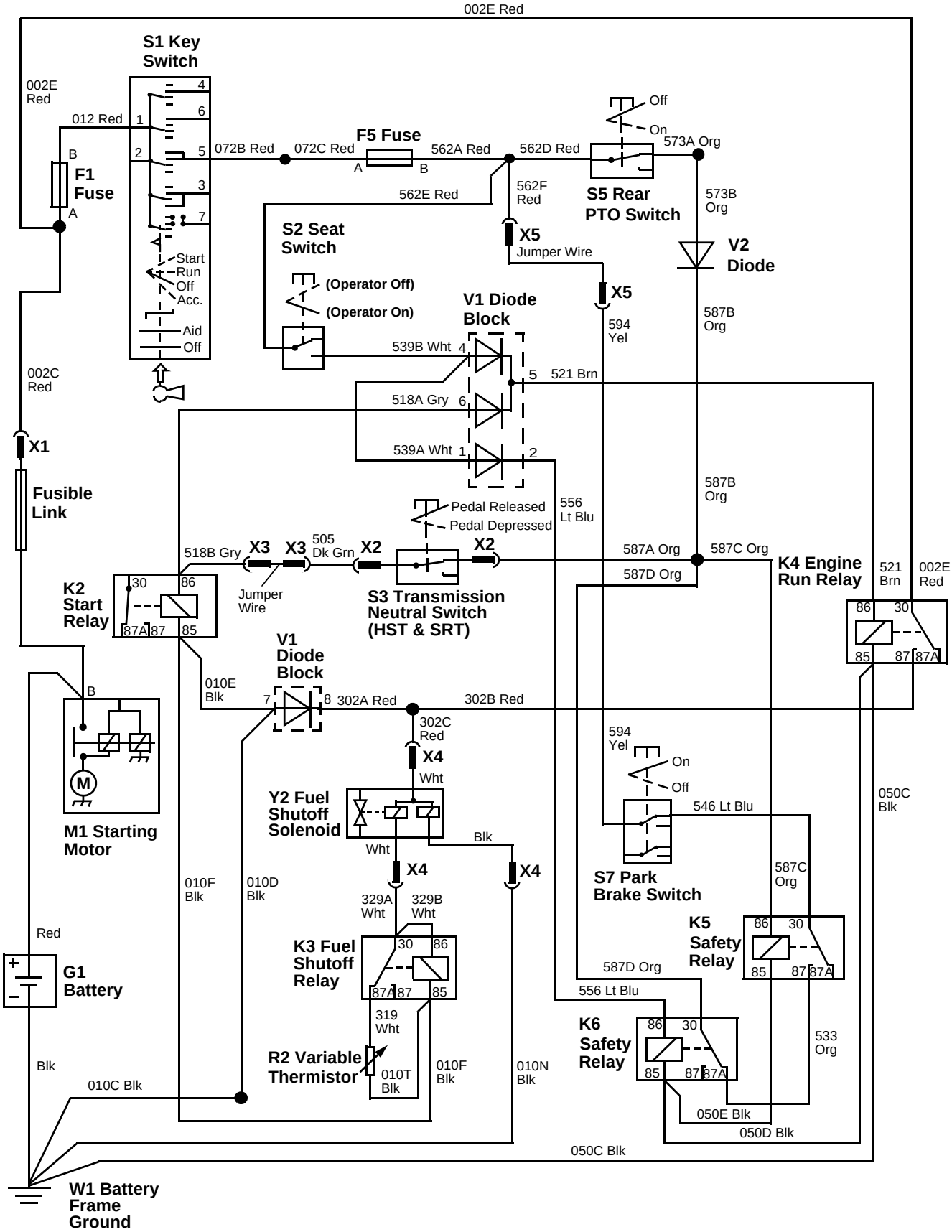
Power is provided to the S7 park brake switch through the key switch, 072B and 072C Red wires, F5 fuse, 562F Red wire, X5 connector and jumper wire, and 594 Yel wire. With the park brake ENGAGED, power is provided through the park brake switch and 546 Lt Blu wire to the K5 safety relay (terminal 30). Power is provided to the K5 safety relay coil (terminal 86) through the rear PTO switch (PTO DISENGAGED), the 573A and 573B Org wires, V2 diode, and 587B and 587C Org wires.

With the K5 coil energized, and power to the K5 contact (terminal 30), power is provided through the K5 contacts and 533 Org wire to the K6 relay (terminal 87A). The power continues through the K6 contacts, and the 587C and 587D Org wires to the K5 coil (terminal 86).

The PTO can now be ENGAGED, and power will remain to the K4 engine run relay through the park brake switch, latching relay circuit (S7, 546 Blu wire, K5 relay contacts, 533 Org wire, K6 relay contacts, 587C and 587D Org wires), and the 587A Org wire, S3 or S4 switch, 518B and 518A Gry wires, V1 diode block, and 521 Brn wire.

If the park brake is DISENGAGED without the operator ON the seat, the engine will stop.

ENGINE SHUTOFF CIRCUIT ELECTRICAL SCHEMATIC



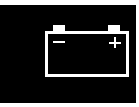
SE1 - STARTING	SE2 - IGNITION

ENGINE SHUTOFF CIRCUIT DIAGNOSIS

Test Conditions:

- Park brake ENGAGED
- Operator OFF seat
- PTO DISENGAGED
- Transmission in NEUTRAL position
- V1 diode block, K2, K4, K5, and K6 removed from load center
- Key switch in RUN position (engine OFF)

NOTE: The S3 transmission neutral switch is shown in this diagnostic section. This switch is used in conjunction with the jumper wire in the X3 connector for tractors with a hydrostatic (HST) or SyncReverser (SRT) transmission. For tractors with a gear shift (CST) transmission the jumper wire is used in the X2 connector and the S4 transmission neutral switch is installed in the X3 connector.



Test/Check Point	Normal	If Not Normal
1. K2 relay socket (terminal 86)	Battery voltage	Ensure PTO is DISENGAGED and transmission is in NEUTRAL. Check F5 fuse. (See "POWER CIRCUIT DIAGNOSIS")
2. V1 diode block socket (terminal 6)	Battery voltage	Check 518A Gry wire and connections.
3. K5 relay socket (terminal 86)	Battery voltage	Check V2 diode. (See "V2 DIODE TEST"), Check 587B and 587C Org wires and connections.
4. K6 relay socket (terminal 30)	Battery voltage	Check 587D Org wire and connections.
5. Park brake switch	Battery voltage	(See "POWER CIRCUIT DIAGNOSIS")
6. Park brake switch	Battery voltage	Test switch. (See "PARK BRAKE SWITCH TEST")
7. K5 relay socket (terminal 30)	Battery voltage	Check 546 Lt Blu wire and connections.
8. Seat switch	Battery voltage	Check 562E Red wire and connections.

Test Conditions:

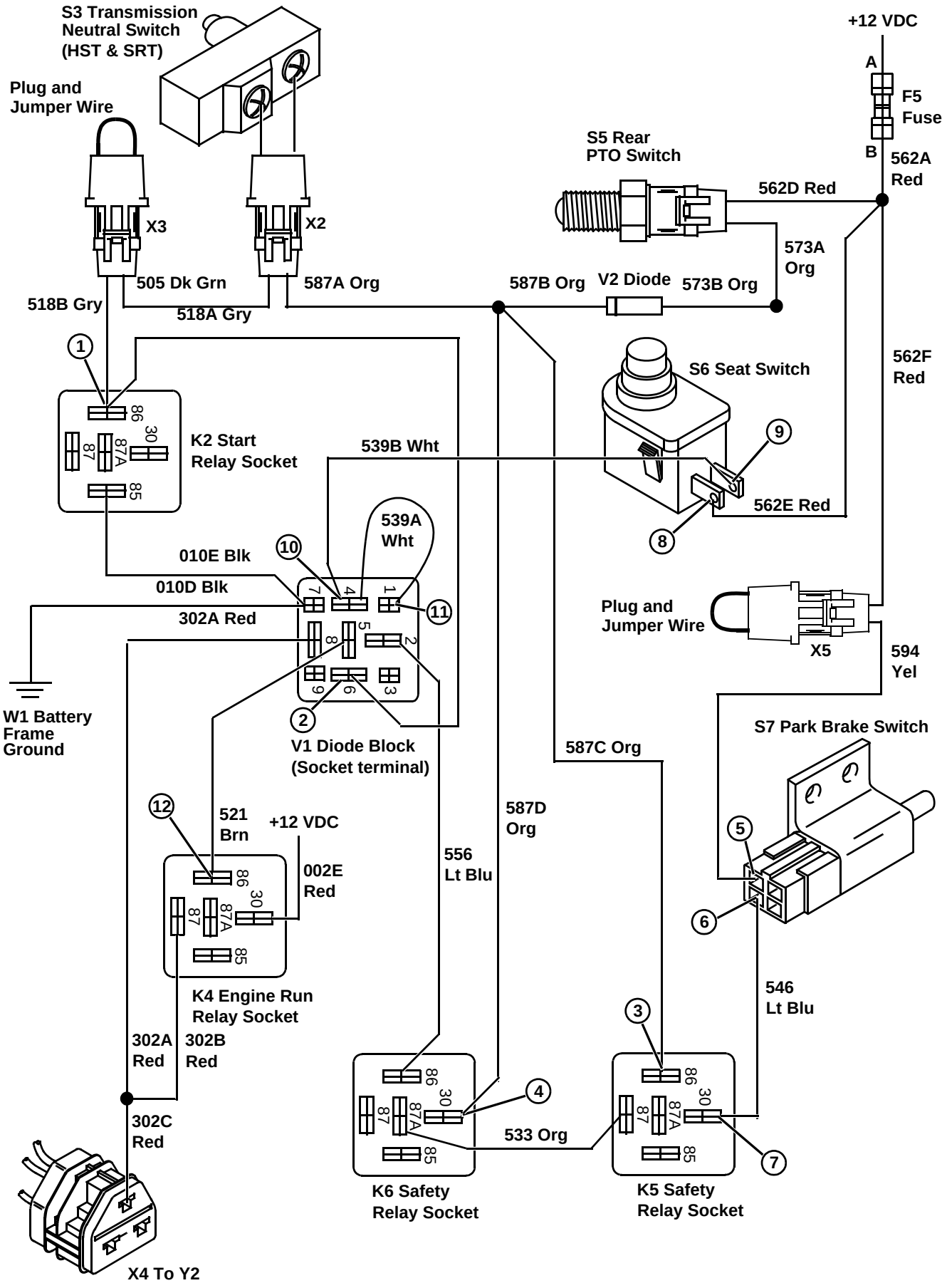
- Park brake ENGAGED
- PTO DISENGAGED
- Seat switch in OPERATOR ON position (pushed in)
- Transmission in NEUTRAL position
- Key switch in RUN position (engine OFF)

9. Seat switch	Battery voltage	Test seat switch. (See "SEAT SWITCH TEST") Replace seat switch.
10. V1 diode block socket (terminal 4)	Battery voltage	Check 539B Wht wire and connections.
11. V1 diode block socket (terminal 1)	Battery voltage	Check 539A Wht jumper wire and connections.

Test Conditions:

- Park brake ENGAGED
- Operator ON seat
- PTO DISENGAGED
- Transmission in NEUTRAL position
- V1 diode block installed in load center
- Key switch in RUN position (engine OFF)

12. K4 relay socket (terminal 86)	Battery voltage	Test diode block. (See "DIODE BLOCK TEST") Check 521 Brn wire and connections.
13. K6 relay socket (terminal 86)	Battery voltage	Test diode block. Check 556 Lt Blu wire and connections.


S3 Transmission Neutral Switch (HST & SRT)
Plug and Jumper Wire
X3
X2
505 Dk Grn
587A Org
518B Gry
518A Gry
+12 VDC
A
F5 Fuse
B
562A Red
S5 Rear PTO Switch
562D Red
573A Org
587B Org
V2 Diode
573B Org
562F Red
S6 Seat Switch
539B Wht
562E Red
K2 Start Relay Socket
86
30
87
87A
85
539A Wht
010E Blk
010D Blk
302A Red
Plug and Jumper Wire
X5
594 Yel
W1 Battery Frame Ground
V1 Diode Block (Socket terminal)
S7 Park Brake Switch
587C Org
587D Org
521 Brn
+12 VDC
002E Red
556 Lt Blu
546 Lt Blu
K4 Engine Run Relay Socket
302A Red
302B Red
302C Red
533 Org
K6 Safety Relay Socket
K5 Safety Relay Socket
X4 To Y2

Test/Check Point	Normal	If Not Normal

Test Conditions:
- Park brake ENGAGED
- Operator OFF seat
- PTO DISENGAGED
- Transmission in NEUTRAL position
- Key switch in RUN position (engine OFF)

14. K4 relay socket (terminal 86)	Battery voltage	Test diode block. (See "DIODE BLOCK TEST") Check 521 Brn wire and connections.

Test Conditions:
- Park brake ENGAGED
- Operator ON seat
- PTO DISENGAGED
- Transmission in NEUTRAL position
- K6 safety relay installed
- Key switch in RUN position (engine OFF)

15. K5 relay socket (terminal 87)	Battery voltage	Test K6 relay (See "RELAY TEST"), Check 533 Org wire and connections.

Test Conditions:
- Park brake ENGAGED
- Operator OFF seat
- PTO DISENGAGED
- Transmission in NEUTRAL position
- K5 safety relay installed
- Key switch in RUN position (engine OFF)

Test Conditions: AFTER the above conditions are set
- ENGAGE PTO

16. K4 relay socket (terminal 86)	Battery voltage	Check ground circuit of relays. See next step.

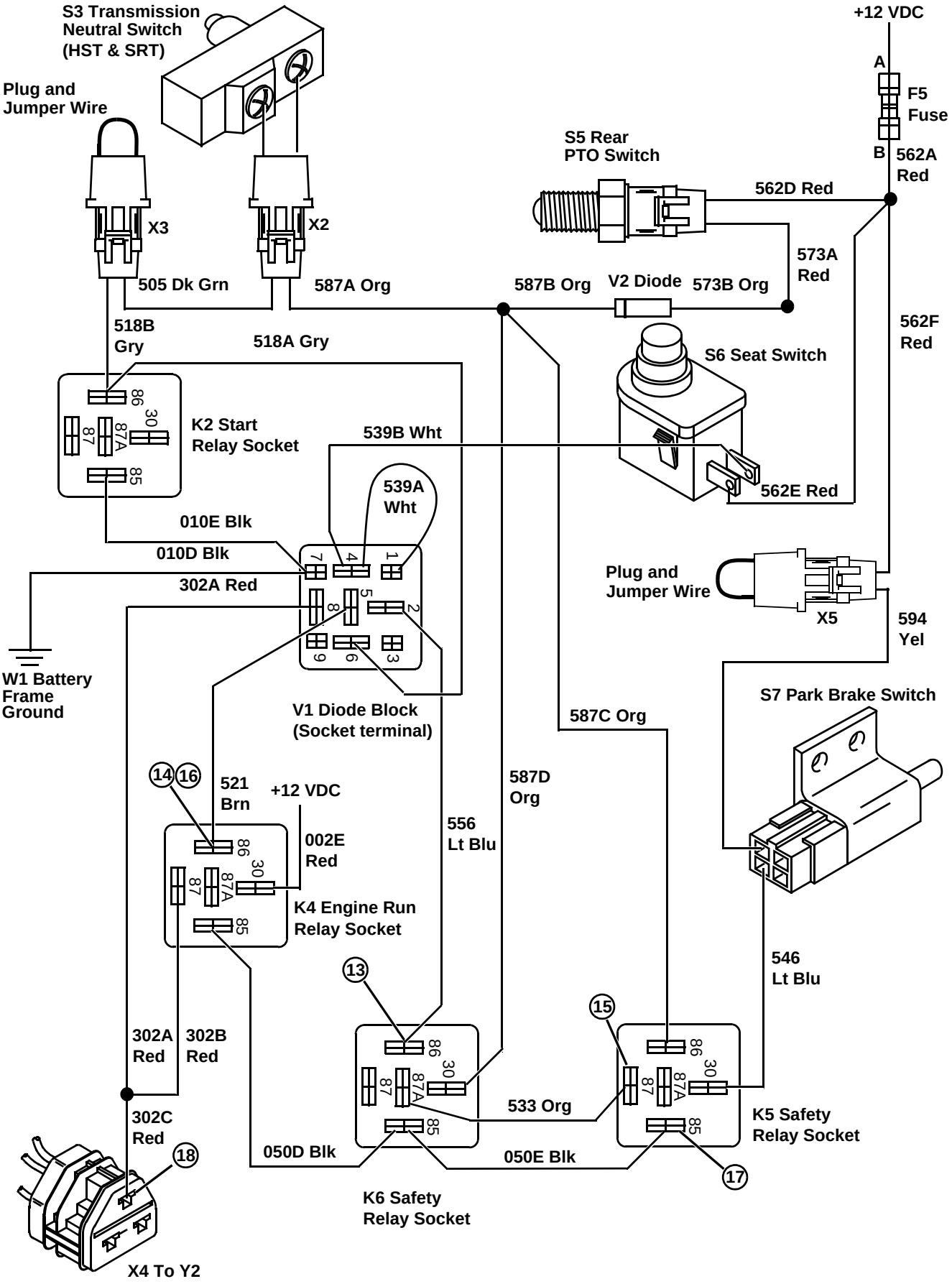
Test Conditions:
- Park brake ENGAGED
- Operator OFF seat
- PTO DISENGAGED
- Gear range lever in NEUTRAL position
- Key switch in OFF position (engine OFF)
- K5 relay removed

17. K5 relay socket (terminal 85)	Continuity to frame ground (0.5 ohms or less)	Check 050E, 050D, and 050C Blk wires and connections.

Test Conditions:
- Park brake ENGAGED
- Operator OFF seat
- PTO DISENGAGED
- Gear range lever in NEUTRAL position
- K5 safety relay installed
- Key switch in RUN position (engine OFF)

Test Conditions: AFTER the above conditions are set
- PTO ENGAGED
- Check for voltage at K4 relay socket (terminal 86); RELEASE park brake

18. X4 connector to fuel shutoff solenoid	NO voltage after park brake is RELEASED	Test K4 relay. (See "RELAY TEST") Replace relay as needed. (See "POWER CIRCUIT DIAGNOSIS")


S3 Transmission Neutral Switch (HST & SRT)
Plug and Jumper Wire
X3
X2
505 Dk Grn
587A Org
518B Gry
518A Gry
+12 VDC
A
F5 Fuse
B
562A Red
S5 Rear PTO Switch
562D Red
573A Red
587B Org
V2 Diode
573B Org
562F Red
S6 Seat Switch
562E Red
K2 Start Relay Socket
86
30
87
87A
85
539B Wht
539A Wht
010E Blk
010D Blk
302A Red
Plug and Jumper Wire
X5
594 Yel
W1 Battery Frame Ground
V1 Diode Block (Socket terminal)
S7 Park Brake Switch
587C Org
14
16
521 Brn
+12 VDC
002E Red
556 Lt Blu
587D Org
K4 Engine Run Relay Socket
546 Lt Blu
13
15
302A Red
302B Red
533 Org
K5 Safety Relay Socket
302C Red
18
050D Blk
050E Blk
17
K6 Safety Relay Socket
X4 To Y2

CHARGING CIRCUIT OPERATION

FUNCTION:

To maintain battery voltage between 12.4 and 13.2 volts.

OPERATING CONDITIONS:

- Key switch in RUN position
- Engine running

SYSTEM OPERATION:

The charging system consists of the G2 alternator with an integrated voltage regulator/rectifier. Charging output is controlled by a regulator/rectifier. The status of the charge rate is indicated by the H4 discharge light.

With the key switch in the RUN position, battery sensing circuit current flows from battery positive terminal to the starting motor terminal, fusible link, 002C Red wire, F1 fuse, 012 Red wire, S1 key switch, 072B and 072D Red wires to the alternator voltage regulator/rectifier. The battery sensing circuit allows the voltage regulator/rectifier to monitor battery voltage.

A rotating permanent magnet in the alternator induces AC current in the alternator stator coils. The AC current flows to the voltage regulator/rectifier. The voltage regulator/rectifier converts AC current to DC current needed to charge the battery.

If battery voltage is low, the regulator/rectifier allows DC current to flow to the battery to charge it through the battery charging circuit (002A Red). When the battery is fully charged, the voltage regulator/rectifier stops current flow to the battery.

If the alternator output current falls below system usage or is insufficient to maintain a preset voltage, the voltage regulator/rectifier provides current to turn on the discharge light through the 334 Yel wire, X7 connector, and the control panel circuit board runs.

The alternator is grounded through the mounting hardware to the engine.

If the voltage regulator is grounded to the alternator cover, the alternator produces unregulated amperage. (See "UNREGULATED AMPERAGE TEST").

TACHOMETER CIRCUIT OPERATION

FUNCTION:

To indicate engine rpm to the operator.

OPERATING CONDITIONS:

- Key switch in RUN position
- Engine running

SYSTEM OPERATION:

Pulsed current flows from the "P" terminal of the alternator to the control panel (X6 connector, terminal F) through the 325 Dk Grn wire.

HOUR METER CIRCUIT OPERATION

FUNCTION:

To indicate engine hours of use to the operator.

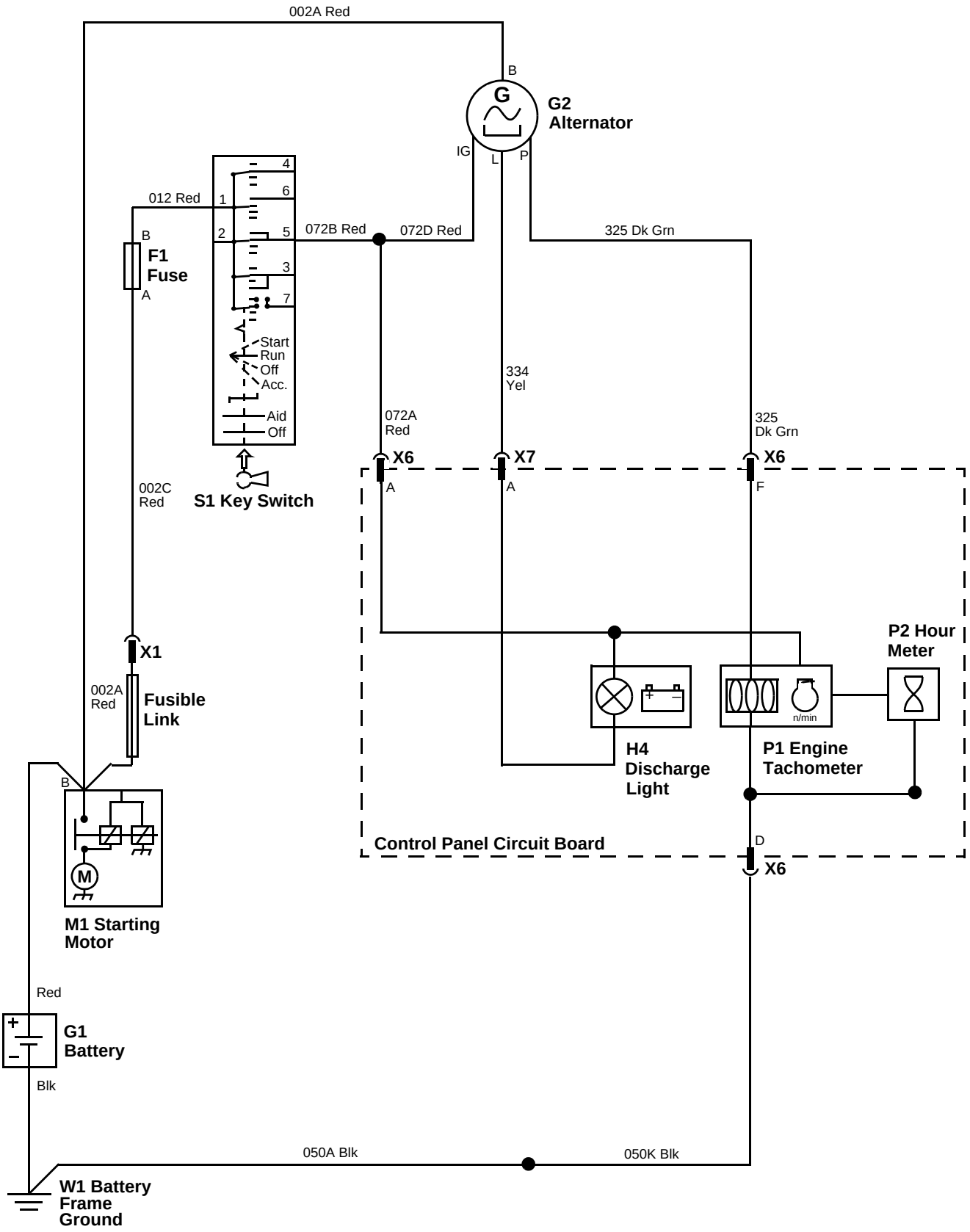
OPERATING CONDITIONS:

- Key switch in RUN position
- Engine running

SYSTEM OPERATION:

The hour meter is integrated into the control panel and does not have any external wiring. The hour meter operates only when the engine is running. The hour meter uses the engine tachometer circuit for power. If the tachometer is not functioning, the hour meter will not work. (See "CHARGING CIRCUIT DIAGNOSIS") for information on tachometer and hour meter diagnosis.

CHARGING CIRCUIT ELECTRICAL SCHEMATIC



SE1 - STARTING	SE3 - CHARGING	SE5 - INSTRUMENTATION

CHARGING CIRCUIT DIAGNOSIS

Test Conditions:

- Key switch in OFF position
- Park brake ENGAGED
- Transmission in NEUTRAL position
- PTO DISENGAGED

Test/Check Point	Normal	If Not Normal
1. Battery positive terminal	Battery voltage	Test battery. (See "BATTERY TEST")
2. Starting motor "B" terminal	Battery voltage	Check battery and starting motor cable connections.
3. Alternator "B" terminal	Battery voltage	Check battery negative cable, alternator ground, connections, and engine ground connections.

Test Conditions:

- Engine OFF
- Park brake ENGAGED
- Disconnect alternator connector
- Key switch in RUN position

4. Alternator connector (072D Red wire terminal)	Battery voltage	Check 072D and 072B Red wires and connections. (See "POWER CIRCUIT DIAGNOSIS")

Test Conditions:

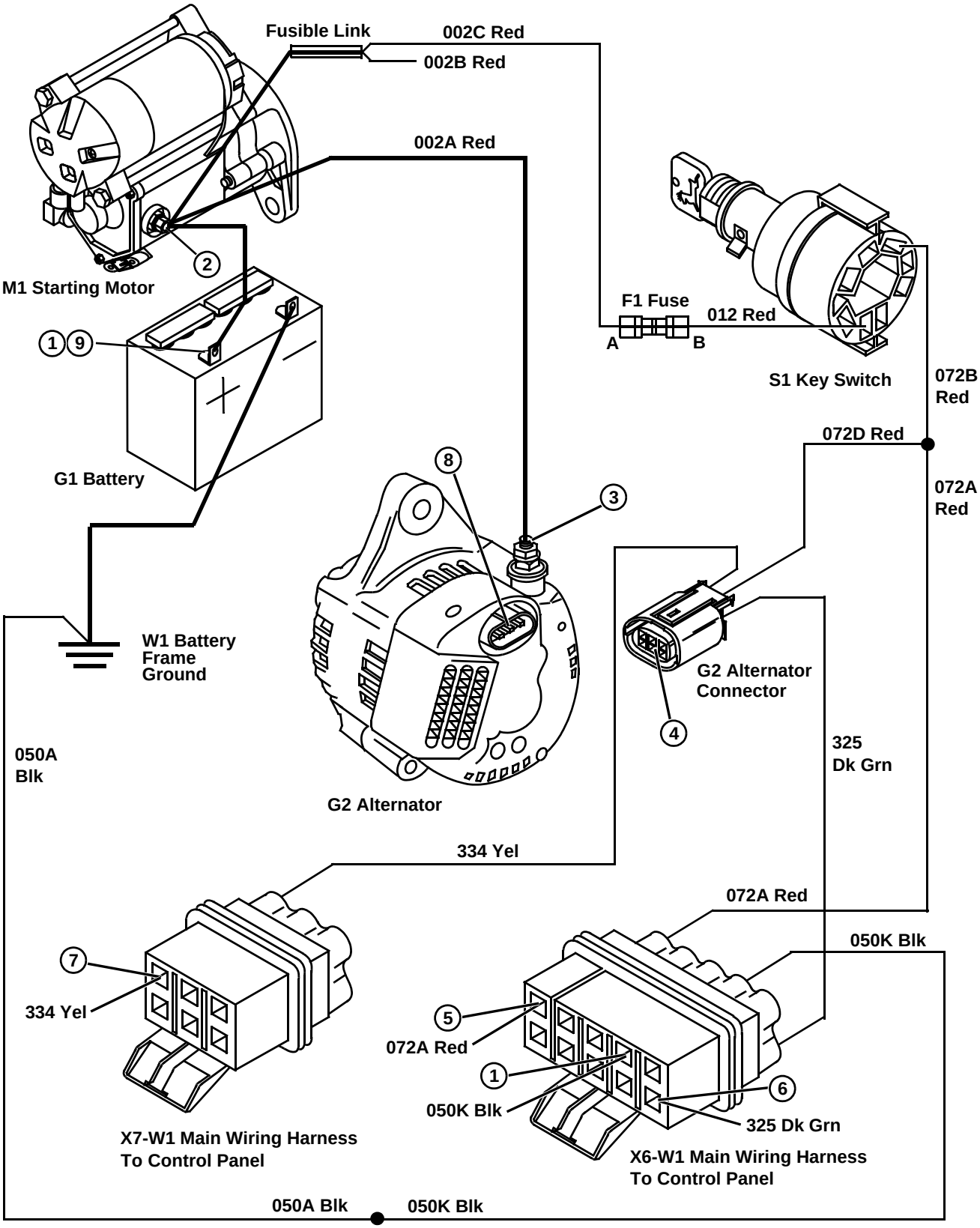
- Key switch in RUN position
- Engine OFF
- Park brake ENGAGED
- Connect alternator connector
- Disconnect control panel connectors

5. X6 connector (terminal A)	Battery voltage	Check 072A and 072B Red wires and connections.
6. X6 connector (terminal F)	0.04 VDC	Check 325 Dk Grn wire and connections.
7. X7 connector (terminal A)	0.45 VDC	Check 334 Yel wire and connections.

Test Conditions:

- Park brake ENGAGED
- Transmission in NEUTRAL
- PTO DISENGAGED
- Engine RUNNING

8. Alternator	Minimum 12.2 to 14.8 volts	(See "REGULATED AMPERAGE AND VOLTAGE TESTS") Replace voltage regulator/rectifier.
9. Battery	Voltage above 12.4 - 13.2 VDC.	Check for excessive load on electrical system.


Fusible Link
002C Red
002B Red
002A Red
M1 Starting Motor
2
1
9
G1 Battery
F1 Fuse
012 Red
A
B
S1 Key Switch
072B Red
072D Red
072A Red
8
3
W1 Battery Frame Ground
G2 Alternator Connector
4
050A Blk
325 Dk Grn
G2 Alternator
334 Yel
072A Red
050K Blk
7
334 Yel
5
072A Red
1
050K Blk
6
325 Dk Grn
X7-W1 Main Wiring Harness To Control Panel
X6-W1 Main Wiring Harness To Control Panel
050A Blk
050K Blk

ENGINE OIL PRESSURE LIGHT

Function:

To alert operator of low engine oil pressure.

Operating Condition:

- Key switch must be in RUN or START position.

Theory of Operation:

With the engine OFF and key in RUN position, engine oil pressure will be below **49 kPa (7.1 psi)**. The oil pressure switch will be in the normally closed position. The closed position completes a circuit path to ground and illuminates the H7 light. This informs the operator that the light is functional.

The light goes out when the engine oil pressure is at or above **49 kPa (7.1 psi)**, opens the B2 engine oil pressure switch, and removes the ground circuit from the engine oil pressure light.

ENGINE COOLANT TEMPERATURE GAUGE

Function:

Inform the operator of engine and coolant operating temperature.

Operating Condition:

- Key switch must be in RUN or START position.

Theory of Operation:

The engine coolant temperature sensor is a variable resistor**,** providing a ground circuit path for the temperature gauge. As the engine coolant heats, the resistance decreases. The temperature gauge circuit is part of the tractor control panel.
The engine coolant temperature sensor resistance is approximately **40 - 700 ohms**.

FUEL GAUGE

Function:

Inform the operator of the fuel level in the fuel tank.

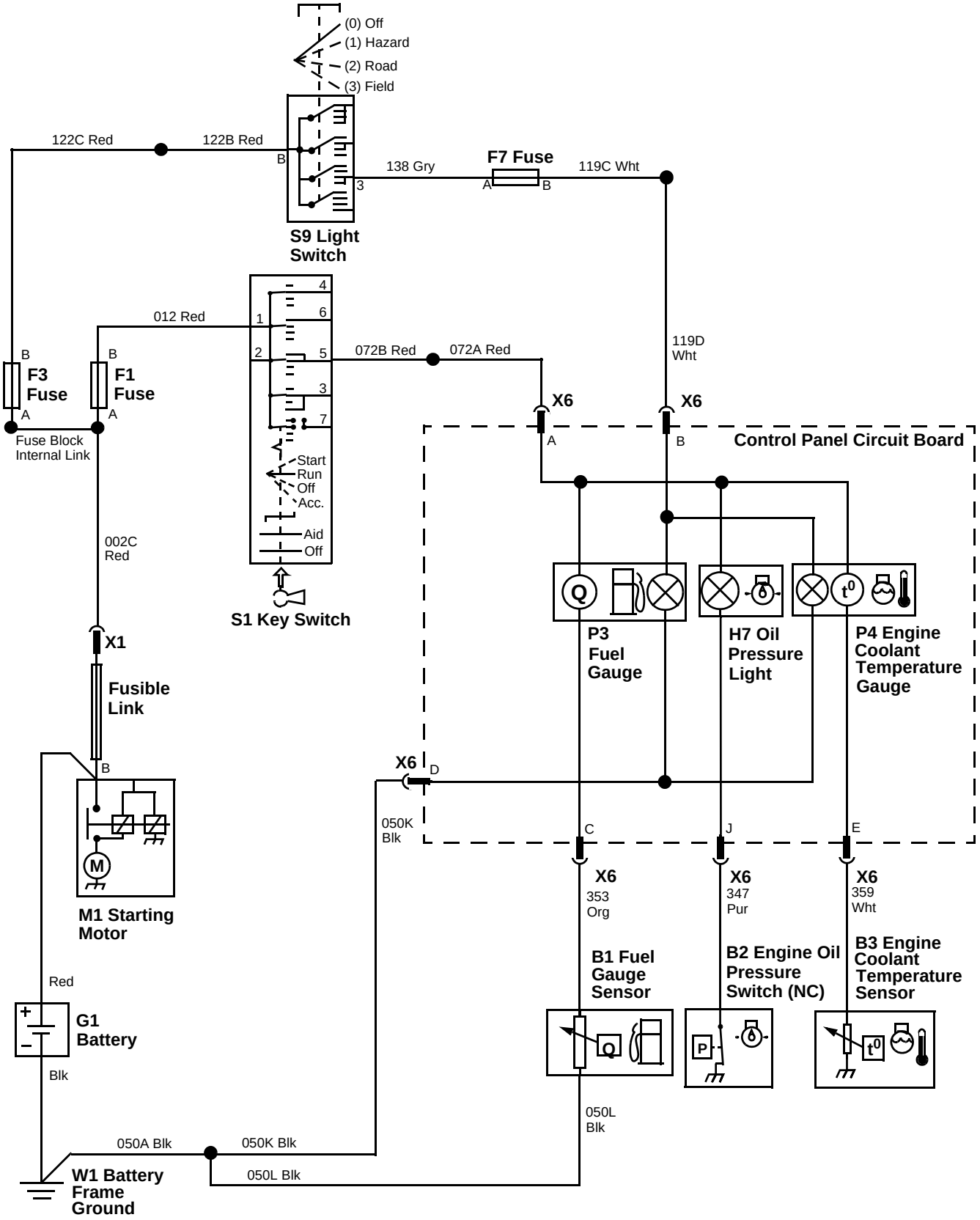
Operating Condition:

- Key switch must be in RUN or START position.

Theory of Operation:

The fuel level in the fuel tank is measured by the B1 fuel gauge sensor. The sensor is a variable resistor. The resistance is set by movement of a mechanical linkage connected to a float in the fuel tank. The **5 to 95 ohm** variable resistance creates a variable voltage difference across the P1 fuel gauge. The voltage difference ranges from approximately **5.72 VDC** (fuel tank FULL) to approximately **0.87 VDC** (fuel tank EMPTY).

CONTROL PANEL GAUGES ELECTRICAL SCHEMATIC



SE2 - IGNITION	SE5 - INSTRUMENTATION

CONTROL PANEL GAUGES DIAGNOSIS

Test Conditions:

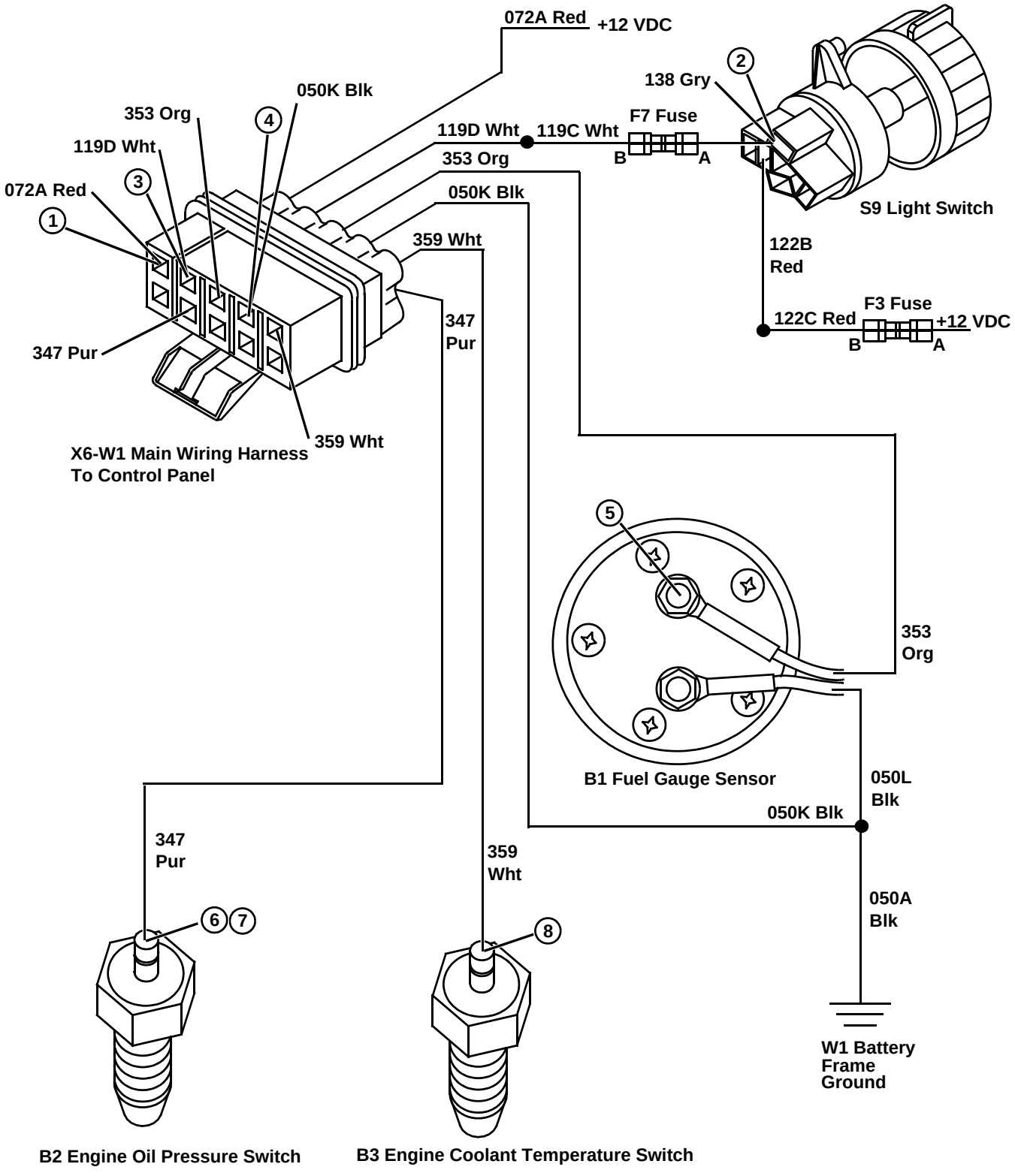
- X6 to control panel disconnected
- Key switch in RUN position, engine OFF
- PTO in NEUTRAL
- Transmission in NEUTRAL
- Park brake ON
- Light switch in ROAD or FIELD position

Test/Check Point	Normal	If Not Normal
1. X6 connector (terminal A)	Battery voltage	(See "POWER CIRCUIT DIAGNOSIS")
2. Light switch	Battery voltage	Check F3 fuse. Test light switch. (See "LIGHT SWITCH TEST")
3. X6 connector (terminal B)	Battery voltage	Check 138 Gry, F7 fuse, 119C and 119D Wht wires and connections.
4. X6 connector (terminal D)	Less than 0.1 ohms resistance to ground	Check 050K and 050A Blk wires and connections.

Test Conditions:

- Transmission in NEUTRAL
- PTO in NEUTRAL
- Park brake ON
- X6 to control panel connected
- Key switch in RUN position, engine OFF
- Light switch in OFF position

5. Fuel gauge sensor	Tank empty – approximately 0.1 VDC Tank full – approximately 5.7 VDC	Check 353 Org wire and connections. Check battery negative cable, 050L and 050A Blk wires and connections. Test fuel sensor (See "FUEL GAUGE SENSOR TEST"). Use a jumper wire to connect 353 Org wire to battery frame ground. Fuel gauge should move to maximum position. Gauge does not move. - Replace control panel.
6. Engine oil pressure switch	Less than 0.1 VDC	Check 347 Pur wire and connections.Test switch (See "ENGINE OIL PRESSURE SWITCH TEST"). Replace switch as needed.
7. Engine oil pressure switch (347 Pur wire lead disconnected)	Less than 0.1 ohms resistance to ground	Check engine ground. If engine ground OK: Replace switch.
8. Engine coolant temperature sensor	Continuity to ground through sensor – resistance depends on engine temperature (40 - 700 ohms). Sensor threads not corroded.	Disconnect temperature sensor lead. Use a jumper wire to connect 359 Wht wire to ground. Temperature gauge should move to maximum temperature position. Gauge does not move. - Check 359 Wht wire and connections. Replace control panel. Gauge moves. - Replace sensor.


072A Red
+12 VDC
138 Gry
2
050K Blk
353 Org
4
119D Wht
119D Wht
119C Wht
F7 Fuse
B
A
353 Org
3
072A Red
050K Blk
1
359 Wht
S9 Light Switch
122B
Red
347
Pur
F3 Fuse
122C Red
+12 VDC
B
A
347 Pur
359 Wht
X6-W1 Main Wiring Harness
To Control Panel
5
353
Org
B1 Fuel Gauge Sensor
050L
Blk
050K Blk
347
Pur
359
Wht
050A
Blk
6
7
8
W1 Battery
Frame
Ground
B2 Engine Oil Pressure Switch
B3 Engine Coolant Temperature Switch

CONTROL PANEL INDICATOR LIGHTS

PTO LIGHT

Function:

To alert operator of PTO being ENGAGED.

Operating Condition:

- Key switch in START or RUN position
- PTO ENGAGED.

Theory of Operation:

With the key in START or RUN position, battery voltage is provided to the rear PTO switch through the S1 key switch, 072B and 072C Red wires, F5 fuse and 562A and 562D Red wires.

Voltage is also supplied to the K9 rear PTO relay (terminal 30) through the S1 key switch, 072B and 072C Red wires, F5 fuse, 562A and 562B Red wires. (See "POWER CIRCUIT DIAGNOSIS").

When the PTO is not engaged, the PTO switch is in the OFF (normally closed) position. The closed switch contacts provide voltage to the K9 rear PTO relay coil (terminal 86) through the 573A and 573C Org wires. With voltage to the coil, the K9 rear PTO relay contacts close (terminal 30 to terminal 87). The voltage to the K9 rear PTO relay contacts (terminal 30) stops. The contact output (terminal 87) is not connected to any component.

With the PTO ENGAGED, the rear PTO switch is in the ON (open) position, and voltage is removed from the K9 rear PTO relay (terminal 86). With the voltage to the relay coil removed, the contacts return to the normally closed position (terminal 30 to terminal 87A), and voltage is provided through the 574 Yel wire, and X7 connector (terminal A) to the control panel circuit board. A circuit board run provides voltage to the H3 PTO indicator light.

A ground circuit path for the control panel circuit board is provided though the X6 connector (terminal D), and 050K and 050A Blk wires.

PARK BRAKE LIGHT

Function:

To alert operator of park brake being ENGAGED.

Operating Condition:

- Key switch in START or RUN position
- Park brake ENGAGED.

Theory of Operation:

With the key in START or RUN position, battery voltage is provided to the park brake switch through the S1 key switch, 072B and 072C Red wires, F5 fuse and 562A and 562C Red wires. (See "POWER CIRCUIT DIAGNOSIS").

With the park brake ENGAGED. the park brake switch contacts close. Voltage is provided through the park brake switch contacts (terminals B to C), 586 Lt Blu wire, and X6 connector (terminal K) to the control panel circuit board. A circuit board run provides voltage to the H6 park brake indicator light.

A ground circuit path for the control panel circuit board is provided though the X6 connector (terminal D), and 050K and 050A Blk wires.

COLD START LIGHT

Function:

To indicate to operator that voltage is being provided to the manifold heater.

Operating Condition:

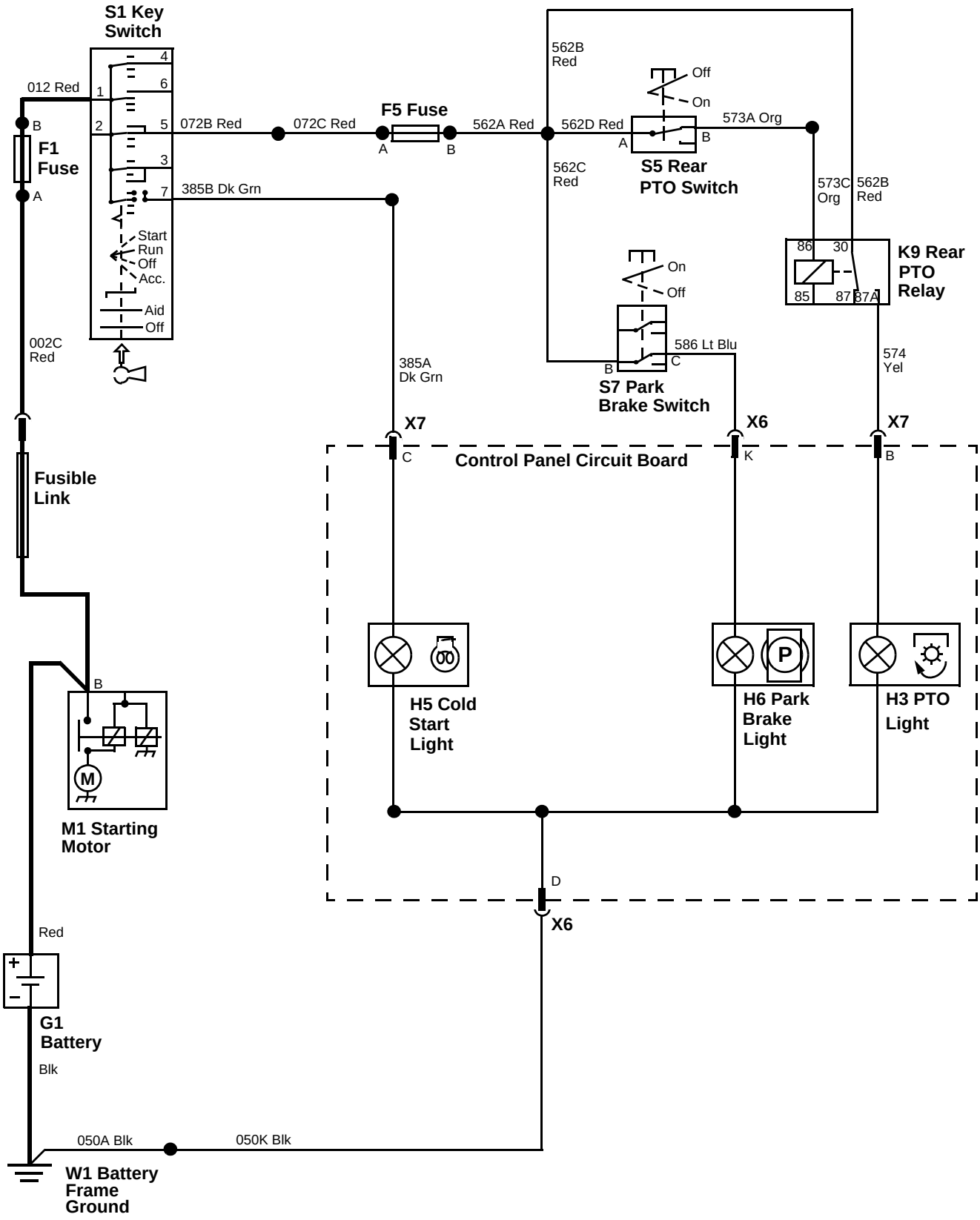
- Key switch in ON or START position, and the key pushed in to the switch to the AID position. (See "MANIFOLD HEATER OPERATION").

Theory of Operation:

With the key in the START or RUN position, and the key switch in the AID position, battery voltage is provided to the H5 cold start light through the 385B and 385A Dk Grn wires, X7 connector (terminal C), and control panel circuit board. A circuit board run provides voltage to the H5 cold start light.

A ground circuit path for the control panel circuit board is provided though the X6 connector (terminal D), and 050K and 050A Blk wires.

CONTROL PANEL INDICATOR LIGHTS SCHEMATIC



SE1 - STARTING	SE5 - INSTRUMENTATION

CONTROL PANEL INDICATOR LIGHTS DIAGNOSIS

Test Conditions:

- Key switch in RUN position, engine OFF
- PTO DISENGAGED
- Transmission in NEUTRAL
- S5 rear PTO switch disconnected from wiring harness
- Park brake OFF
- K9 rear PTO relay removed from load center

Test/Check Point	Normal	If Not Normal
1. PTO switch	Battery voltage	Check F5 fuse. Check 562A and 562D Red wires and connections.
2. Park brake switch	Battery voltage	Check 562A and 562C Red wires and connections.
3. Rear PTO relay socket (terminal 30)	Battery voltage	Check 562A and 562B Red wires and connections.

Test Conditions:

- Key switch in RUN position, engine OFF
- S5 rear PTO switch connected to wiring harness
- X6 and X7 to control panel disconnected
- K9 rear PTO relay installed
- PTO DISENGAGED
- Park Brake ENGAGED
- Transmission in NEUTRAL

4. Park brake switch	Battery voltage	Test switch (See "PARK BRAKE SWITCH TEST"). Replace as needed.
5. X6 connector (K terminal)	Battery voltage	Check 586 Lt Blue wire and connections.
6. Rear PTO switch	Battery voltage	Ensure PTO is disengaged. Test switch (See "REAR AND MID PTO SWITCH TEST"). Replace switch as needed.
7. X7 connector (B terminal)	Battery voltage	Check 574B and 574AYel wires and connections.

Test Conditions:

- Key switch in RUN position, engine OFF
- Transmission in NEUTRAL
- PTO DISENGAGED
- Park Brake ENGAGED
- Connect multimeter to battery frame ground and X7 connector (C terminal). After the connections are made, push key into switch to the AID position.

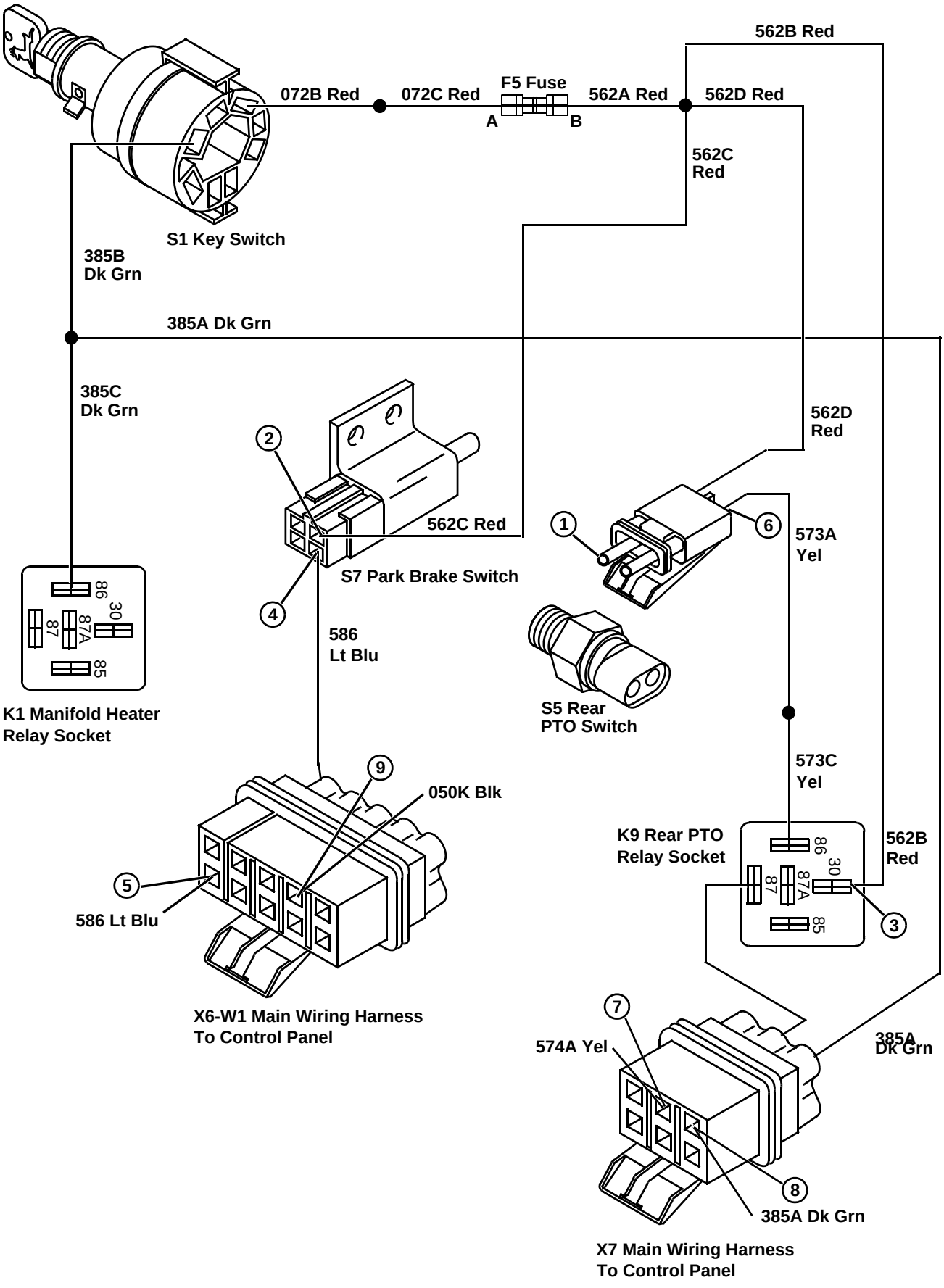
8. X7 connector (C terminal)	Battery voltage	Check 385A and 385B Dk Grn wires and connections. (See "MANIFOLD HEATER OPERATION").

Test Conditions:

- Key switch in OFF position
- Transmission in NEUTRAL
- X6 and X7 to control panel disconnected
- PTO DISENGAGED
- Park Brake ENGAGED

9. X6 connector (K terminal)	Continuity to battery frame ground. Less than 0.1 ohms.	Check 050K and 050A Blk wires and connections.

NOTE: If all of the tests above are performed, and the control panel lamps are good, and the indicator lights still do not work, replace the control panel.


562B Red
072B Red
072C Red
F5 Fuse
A
B
562A Red
562D Red
562C Red
S1 Key Switch
385B Dk Grn
385A Dk Grn
385C Dk Grn
562D Red
2
562C Red
S7 Park Brake Switch
1
6
573A Yel
4
586 Lt Blu
86
30
87
87A
85
K1 Manifold Heater Relay Socket
S5 Rear PTO Switch
573C Yel
9
050K Blk
5
586 Lt Blu
K9 Rear PTO Relay Socket
562B Red
3
X6-W1 Main Wiring Harness To Control Panel
7
574A Yel
385A Dk Grn
8
385A Dk Grn
X7 Main Wiring Harness To Control Panel

LIGHTS OPERATION (OLD)

Light Switch Function:

Provides power to the headlights, tail lights, hazard lights, work lights and control panel lights, in combinations depending upon the position the light switch is placed in.

Operating Conditions:

- Light switch in either HAZARD, ROAD or FIELD position.

Theory of Operation:

Power for the light switch is provided through the load center F5 fuse, 122C and 122B Red wires. Power for the turn signal light switch is provided through the F5 fuse, 122C and 122A Red wires.

Light Switch Hazard Position:

In the HAZARD position, voltage is provided from the light switch (terminal 2) through the 103A and 103C Org wires, F8 fuse, and the 118 Gry wire to the X13 Trailer connector (terminal 6). Voltage is also provided from the light switch (terminal 2) through the 103A and 103B Org wires to the S8 turn signal switch.

Light Switch Road Position:

In the ROAD position, voltage is provided from the light switch (terminal 2) through the same circuits as when the light switch is in the HAZARD position.

In addition, voltage is provided from the light switch (terminal 3) though the 138 Gry wire to the F7 fuse. The F7 fuse provides voltage to the LH headlight through the 119C and 119B Wht wires; and to the RH headlight through the 119C and 119A Wht wires. Voltage is also provided to the control panel gauge lights through the 119C and 119D Wht wires and X6 connector (B terminal).

Light Switch Field Position:

In the FIELD position, voltage is removed from the turn signal switch (terminal 1). However, voltage remains to the headlights (light switch terminal 3), and is provided to the work lights (light switch terminal 4).

Voltage is provided from the light switch (terminal 4), through the 143 Org wire to the F6 fuse. The F6 fuse provides voltage, through the 147A, 147B and 147D Pur wires, to the work lights. Voltage is also provided to the X13 trailer connector (terminal 2) through the 147A and 147C Pur wires.

Turn Signal Switch Function:

Provides intermittent power to the tail lights and hazard lights.

Operating Conditions:

- Turn signal switch OFF position
- Light switch in either HAZARD or ROAD position; or, turn signal switch in the LEFT position, light switch in any position; or, turn signal switch in the RIGHT position, light switch in any position.

Theory of Operation:

Unswitched power is provided to the turn signal switch through the 122A Red wire (terminal 2). Switched power is provided from the light switch (terminal 2) through the 103A and 103B Org wires (terminal 1).

With the turn signal switch in the OFF position, and the light switch in either the HAZARD or ROAD position, voltage enters the turn signal switch through the 103B Org wire (terminal 1). The voltage from the 103B Org wire goes to the flasher unit inside the turn signal switch. The flasher unit produces an intermittent voltage output that is provided to the center contacts of both the LH and RH switch. With the turn signal switch in the OFF position, both the LH and RH switch provide an intermittent output voltage to the wiring harness (terminals 3 and 4).

Intermittent voltage is provided to the LH tail light and LH hazard light through the 125A, 125C and 125D Dk Grn wires. Intermittent voltage is provided to the RH tail light and RH hazard light through the 115A, 115C and 115D Dk Grn wires.

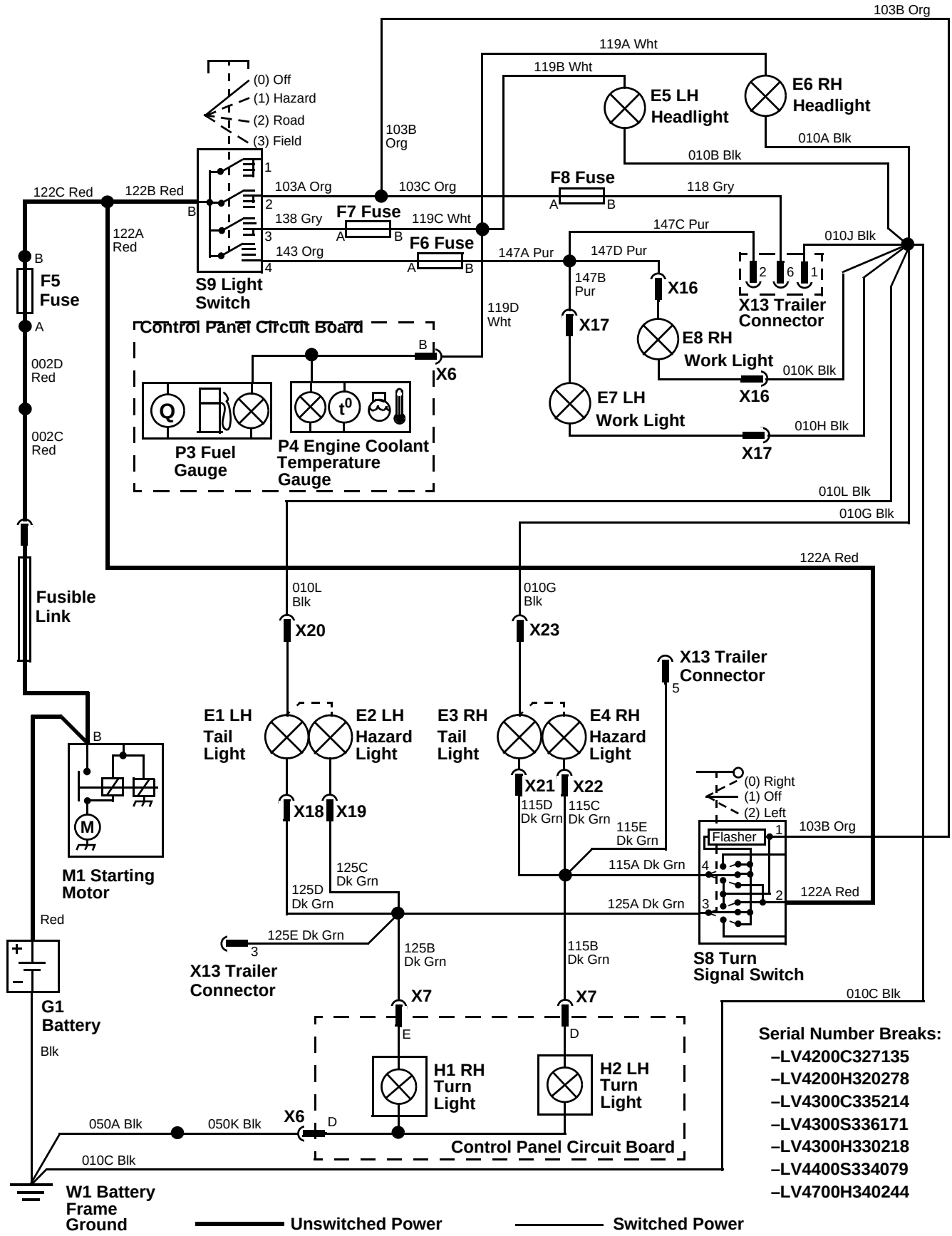
Turn Signal Switch Left Position:

With the light switch in any position, and the turn signal switch in the LEFT position, constant voltage is provided to the RH switch contact. The contact provides constant voltage (terminal 4) to the RH tail light and hazard light. Constant voltage is also provided from the S8 RH switch contact to the flasher unit in the turn signal switch. The flasher unit provides intermittent voltage to the S8 LH switch contact. The intermittent voltage is provided (terminal 3) to the LH tail light and hazard light.

Turn Signal Switch Right Position:

With the light switch in any position and the turn signal switch in the RIGHT position, constant voltage is provided to the S8 LH switch contact. The contact provides constant voltage (terminal 3) to the LH tail light and hazard light. Constant voltage is also provided from the S8 LH switch contact to the flasher unit in the turn signal switch. The flasher unit provides intermittent voltage to the S8 RH switch contact. The intermittent voltage is provided (terminal 4) to the RH tail light and hazard light.

LIGHTS ELECTRICAL SCHEMATIC



Serial Number Breaks:

–LV4200C327135
–LV4200H320278
–LV4300C335214
–LV4300S336171
–LV4300H330218
–LV4400S334079
–LV4700H340244

SE1 - STARTING	SE6 - LIGHTS

LIGHTS DIAGNOSIS

Test Conditions:

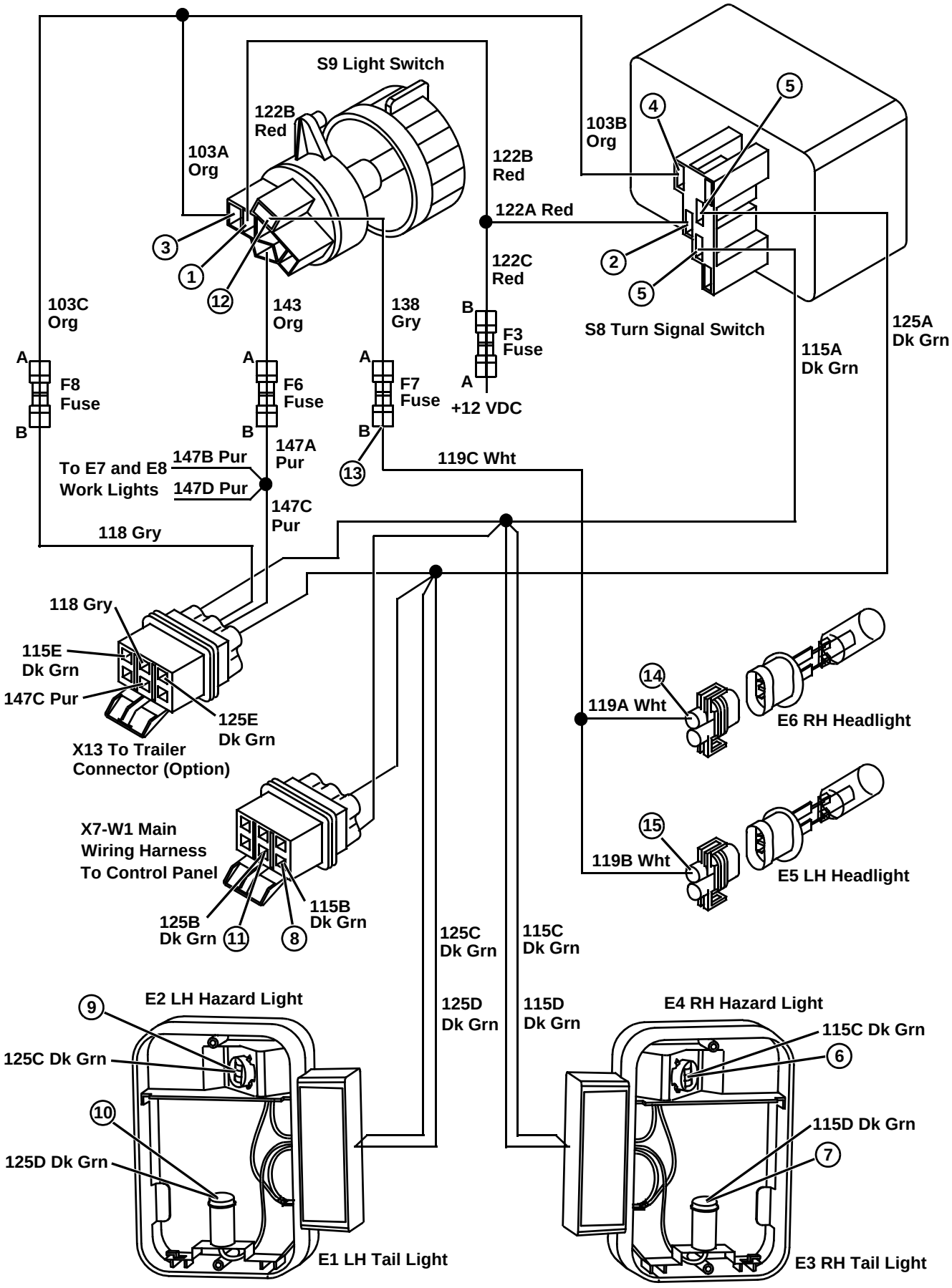
- Key switch in OFF position
- Engine OFF
- Light switch in HAZARD position
- X7 to control panel disconnected

Test/Check Point	Normal	If Not Normal
1. Light switch	Battery voltage	Check F3 fuse (See "POWER CIRCUIT DIAGNOSIS").
2. Turn signal switch	Battery voltage	Check F3 fuse (See "POWER CIRCUIT DIAGNOSIS").
3. Light switch	Battery voltage	Test light switch (See "LIGHT SWITCH TEST").
4. Turn signal switch	Battery voltage	Check 103A and 103B Org wires and connections.
5. Turn signal switch (115A and 125A Dk Grn wires)	Intermittent battery voltage	Test switch (See "TURN SIGNAL SWITCH TEST"). Replace as needed.
6. RH hazard light	Intermittent battery voltage	Check 115A and 115C Dk Grn wires and connections.
7. RH tail light	Intermittent battery voltage	Check 115A and 125D Dk Grn wires and connections.
8. X7 control panel connector (terminal D)	Intermittent battery voltage	Check 115A and 115B Dk Grn wires and connections.
9. LH hazard light	Intermittent battery voltage	Check 125A and 125C Dk Grn wires and connections.
10. LH tail light	Intermittent battery voltage	Check 125A and 125D Dk Grn wires and connections.
11. X7 control panel connector (terminal E)	Intermittent battery voltage	Check 125A and 125B Dk Grn wires and connections.

Test Conditions:

- Key switch in OFF position
- Engine OFF
- Light switch in ROAD position
- X7 to control panel connected

12. Light switch	Battery voltage	Test light switch. (See "LIGHT SWITCH TEST").
13. F7 fuse	Battery voltage	Check F7 fuse. Check 138 Gry wire and connections.
14. RH headlight	Battery voltage	Check 119C and 119A Wht wires and connections.
15. LH headlight	Battery voltage	Check 119C and 119B Wht wires and connections.
NOTE: With the light switch in ROAD position, and the turn signal in the OFF position, battery voltage and intermittent battery voltage will be provided in the same locations as Steps 4 through 11 above. These voltages are in addition to the voltage at the F7 fuse and RH and LH headlights.		


S9 Light Switch
122B Red
103A Org
122B Red
103B Org
122A Red
122C Red
S8 Turn Signal Switch
103C Org
143 Org
138 Gry
F3 Fuse
F8 Fuse
F6 Fuse
F7 Fuse
+12 VDC
125A Dk Grn
115A Dk Grn
147B Pur
147A Pur
To E7 and E8 Work Lights
147D Pur
147C Pur
119C Wht
118 Gry
115E Dk Grn
147C Pur
125E Dk Grn
X13 To Trailer Connector (Option)
119A Wht
E6 RH Headlight
X7-W1 Main Wiring Harness To Control Panel
119B Wht
E5 LH Headlight
125B Dk Grn
115B Dk Grn
125C Dk Grn
115C Dk Grn
125D Dk Grn
115D Dk Grn
E2 LH Hazard Light
E4 RH Hazard Light
125C Dk Grn
125D Dk Grn
115C Dk Grn
115D Dk Grn
E1 LH Tail Light
E3 RH Tail Light

Test/Check Point	Normal	If Not Normal

Test Conditions:

- Key switch in OFF position
- Engine OFF
- Light switch in FIELD position

16. Light switch	Battery voltage	Test light switch (See "LIGHT SWITCH TEST").
17. F6 fuse	Battery voltage	Check F6 fuse. Check 143 Org wire and connections.
18. X13 connector	Battery voltage	Check 147A and 147C Pur wires and connections.
NOTE: With the light switch in FIELD position, and the turn signal in the OFF position, battery voltage will be provided in the same locations as Steps 12 through 15 above.		

Test Conditions:

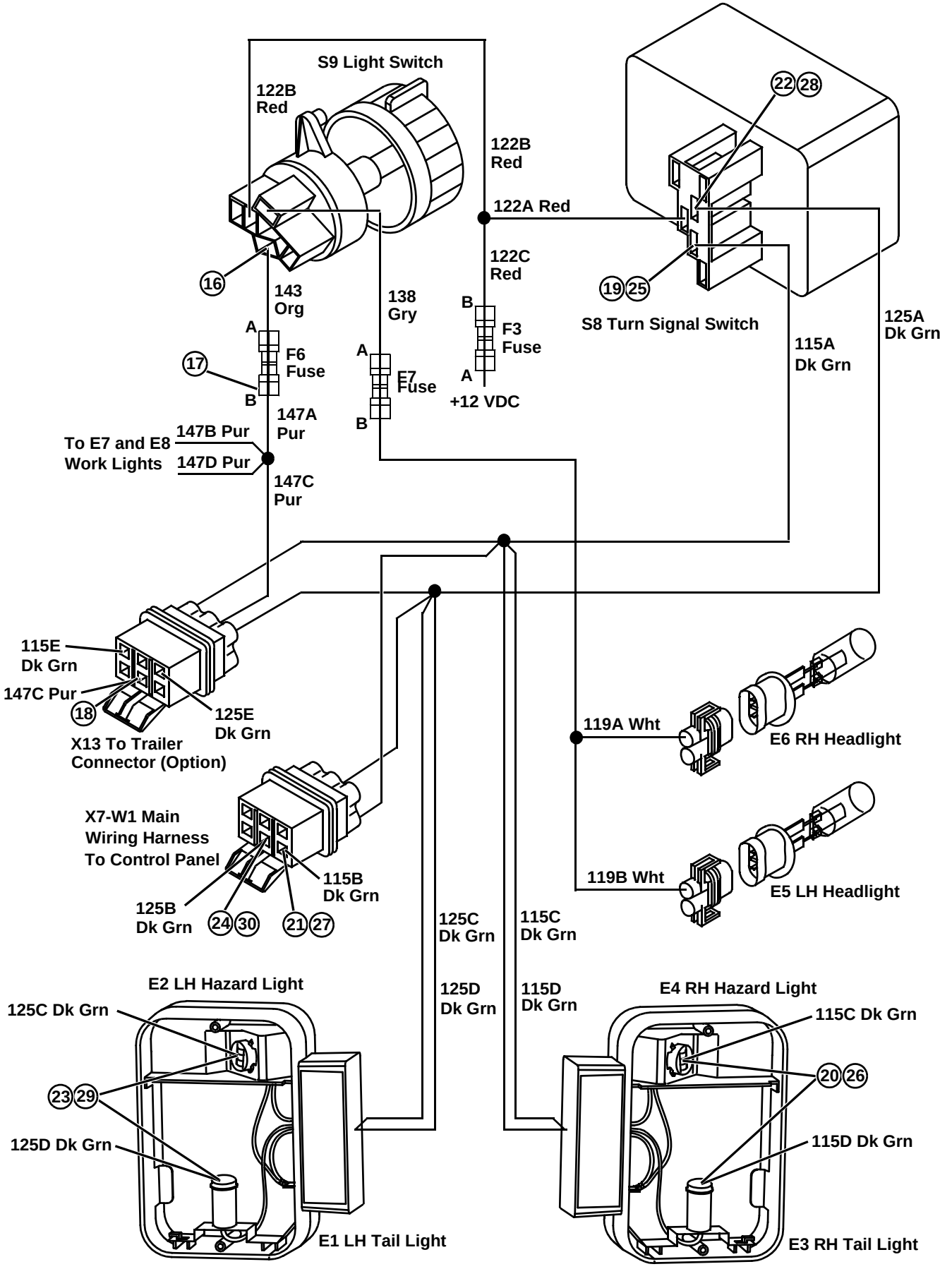
- Key switch in OFF position
- Engine OFF
- Light switch in OFF position
- Turn signal switch in LEFT position

19. Turn signal switch	Battery voltage	Test switch (See "TURN SIGNAL SWITCH TEST"). Replace as needed.
20. RH hazard light and RH tail light	Battery voltage	Check 115A, 115C and 125D Dk Grn wires and connections.
21. X7 connector (terminal D)	Battery voltage	Check 115A and 115B Dk Grn wires and connections.
22. Turn signal switch	Intermittent battery voltage	Test switch (See "TURN SIGNAL SWITCH TEST"). Replace as needed.
23. LH hazard light and LH tail light	Intermittent battery voltage	Check 125A, 125C and 125D Dk Grn wires and connections.
24. X7 connector (terminal E)	Intermittent battery voltage	Check 125A and 125B Dk Grn wires and connections.

Test Conditions:

- Key switch in OFF position
- Engine OFF
- Light switch in OFF position
- Turn signal switch in RIGHT position

25. Turn signal switch	Intermittent battery voltage	Test switch (See "TURN SIGNAL SWITCH TEST"). Replace as needed.
26. RH hazard light and RH tail light	Intermittent battery voltage	Check 115A, 115C and 125D Dk Grn wires and connections.
27. X7 control panel connector (terminal D)	Intermittent battery voltage	Check 115A and 115B Dk Grn wires and connections.
28. Turn signal switch	Battery voltage	Test switch (See "TURN SIGNAL SWITCH TEST"). Replace as needed.
29. LH hazard light and LH tail light	Battery voltage	Check 125A, 125C and 125D Dk Grn wires and connections.
30. X7 control panel connector (terminal E)	Battery voltage	Check 125A and 125B Dk Grn wires and connections.


S9 Light Switch
122B Red
122B Red
122A Red
122C Red
22 28
16
143 Org
138 Gry
B
F3 Fuse
A
19 25
S8 Turn Signal Switch
125A Dk Grn
115A Dk Grn
A
F6 Fuse
17
B
147A Pur
A
F7 Fuse
B
+12 VDC
To E7 and E8 Work Lights
147B Pur
147D Pur
147C Pur
115E Dk Grn
147C Pur
18
125E Dk Grn
X13 To Trailer Connector (Option)
119A Wht
E6 RH Headlight
X7-W1 Main Wiring Harness To Control Panel
115B Dk Grn
119B Wht
E5 LH Headlight
125B Dk Grn
24 30
21 27
125C Dk Grn
115C Dk Grn
E2 LH Hazard Light
125C Dk Grn
125D Dk Grn
115D Dk Grn
E4 RH Hazard Light
115C Dk Grn
23 29
20 26
125D Dk Grn
115D Dk Grn
E1 LH Tail Light
E3 RH Tail Light

LIGHTS OPERATION (NEW)

Light Switch Function:

Provides power to the headlights, tail lights, hazard lights, work lights and control panel lights, in combinations depending upon the position the light switch is placed in.

Operating Conditions:

- Light switch in either HAZARD, ROAD or FIELD position.

Theory of Operation:

Power for the light switch is provided through the load center F5 fuse, 122C and 122B Red wires. Power for the turn signal light switch is provided through the F5 fuse, 122C and 122A Red wires.

Light Switch Hazard Position:

In the HAZARD position, voltage is provided from the light switch (terminal 2) through the 103 Org wire to the S8 turn signal switch.

Light Switch Road Position:

In the ROAD position, voltage is provided from the light switch (terminal 2) through the same circuits as when the light switch is in the HAZARD position.

In addition, voltage is provided from the light switch (terminal 3) though the 138A, 138B and 138C Gry wires to the F7 and F8 fuses. The F7 fuse provides voltage to the LH headlight through the 119C and 119B Wht wires, and to the RH headlight through the 119C and 119A Wht wires. Voltage is also provided to the control panel gauge lights through the 119C and 119D Wht wires and X6 connector (B terminal).
The F8 fuse provides voltage to the LH taillight through the 118A and 118C Gry wires, and the RH taillight through the 118A and 118B Gry wires. Voltage is also provided to the X13 trailer connector (terminal 1) through the 118A and 118D Gry wires.

Light Switch Field Position:

In the FIELD position, voltage is removed from the turn signal switch (terminal 1). However, voltage remains to the headlights (light switch terminal 3), and is provided to the work lights (light switch terminal 4).

Voltage is provided from the light switch (terminal 4), through the 143 Org wire to the F6 fuse. The F6 fuse provides voltage, through the 147A, 147B and 147D Pur wires, to the work lights. Voltage is also provided to the X13 trailer connector (terminal 2) through the 147A and 147C Pur wires.

Turn Signal Switch Function:

Provides intermittent power to the tail lights and hazard lights.

Operating Conditions:

- Turn signal switch OFF position
- Light switch in either HAZARD or ROAD position; or, turn signal switch in the LEFT position, light switch in any position; or, turn signal switch in the RIGHT position, light switch in any position.

Theory of Operation:

Unswitched power is provided to the turn signal switch through the 122A Red wire (terminal 2). Switched power is provided from the light switch (terminal 2) through the 103 Org wire (terminal 1).

With the turn signal switch in the OFF position, and the light switch in either the HAZARD or ROAD position, voltage enters the turn signal switch through the 103 Org wire (terminal 1). The voltage from the 103 Org wire goes to the flasher unit inside the turn signal switch. The flasher unit produces an intermittent voltage output that is provided to the center contacts of both the LH and RH switch. With the turn signal switch in the OFF position, both the LH and RH switch provide an intermittent output voltage to the wiring harness (terminals 3 and 4).

Intermittent voltage is provided to the LH hazard light through the 125A and 125C Dk Grn wires. Intermittent voltage is provided to the RH hazard light through the 115A and 115C Dk Grn wires.

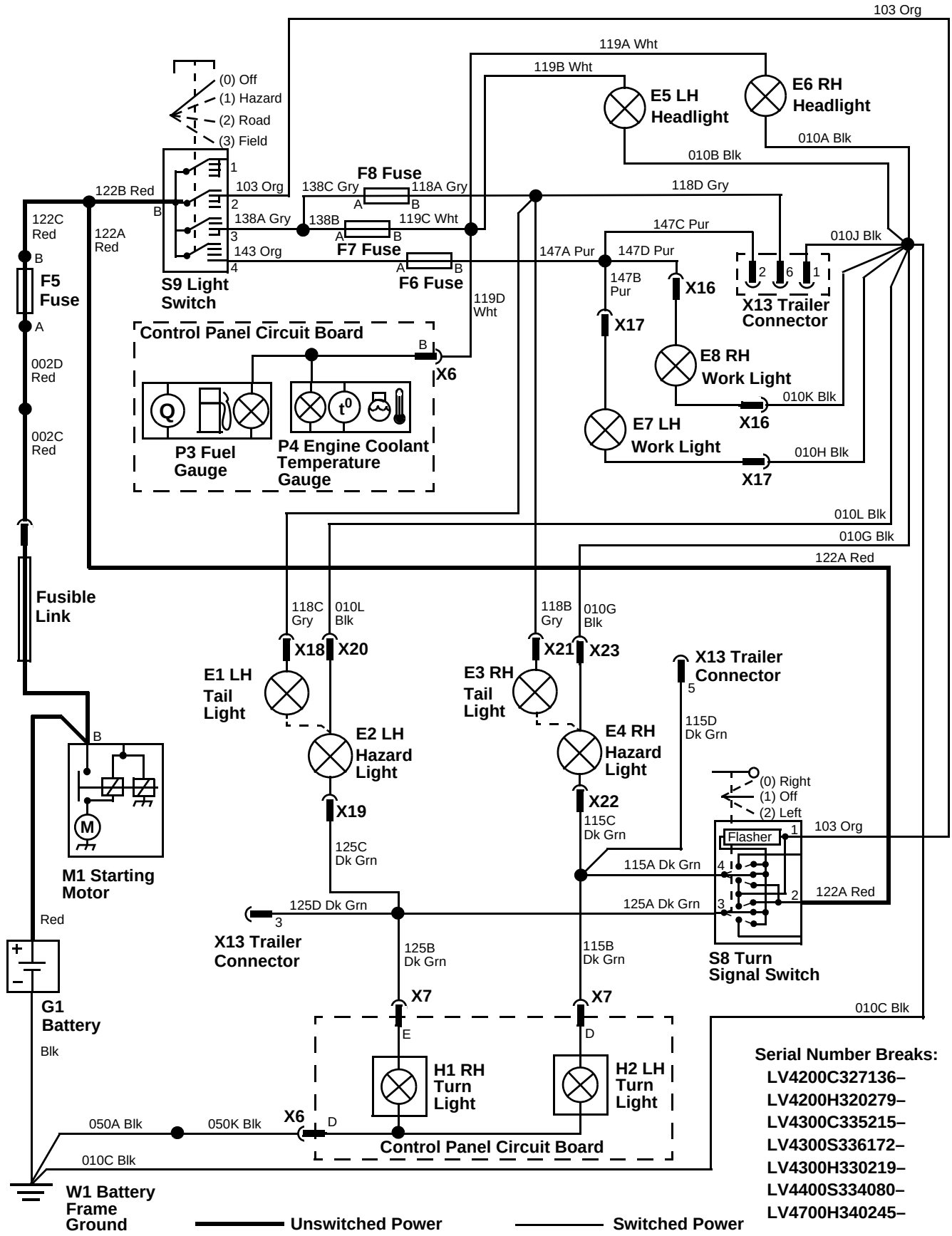
Turn Signal Switch Left Position:

With the light switch in any position, and the turn signal switch in the LEFT position, constant voltage is provided to the RH switch contact. The contact provides constant voltage (terminal 4) to the RH hazard light. Constant voltage is also provided from the S8 RH switch contact to the flasher unit in the turn signal switch. The flasher unit provides intermittent voltage to the S8 LH switch contact. The intermittent voltage is provided (terminal 3) to the LH hazard light through the 115A and 115C Dk Grn wires.

Turn Signal Switch Right Position:

With the light switch in any position and the turn signal switch in the RIGHT position, constant voltage is provided to the S8 LH switch contact. The contact provides constant voltage (terminal 3) to the LH hazard light. Constant voltage is also provided from the S8 LH switch contact to the flasher unit in the turn signal switch. The flasher unit provides intermittent voltage to the S8 RH switch contact. The intermittent voltage is provided (terminal 4) to the RH hazard light through the 125A and 125C Dk Grn wires.

LIGHTS ELECTRICAL SCHEMATIC



SE1 - STARTING	SE6 - LIGHTS

LIGHTS DIAGNOSIS

Test Conditions:

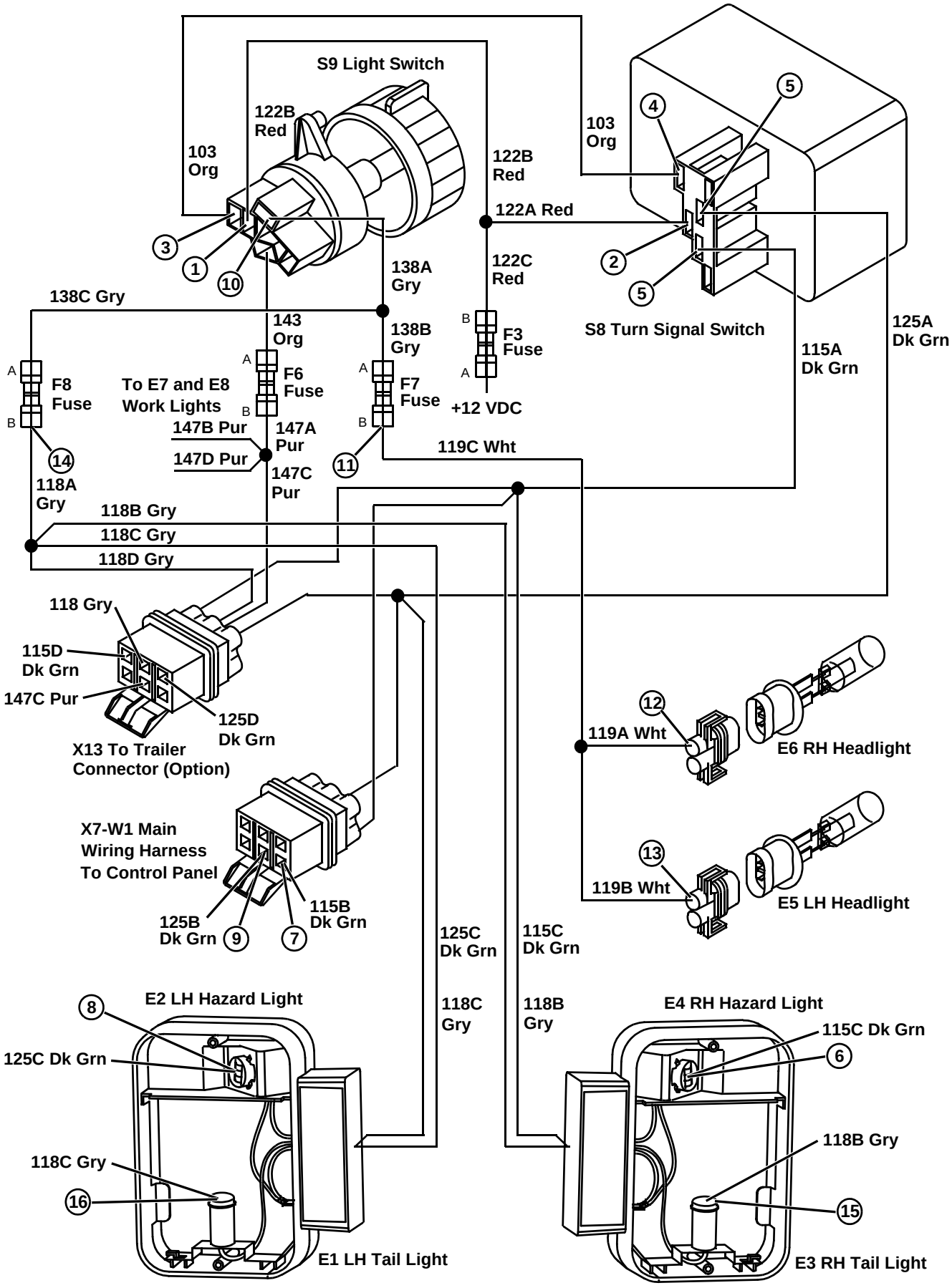
- Key switch in OFF position
- Engine OFF
- Light switch in HAZARD position
- X7 to control panel disconnected

Test/Check Point	Normal	If Not Normal
1. Light switch	Battery voltage	Check F3 fuse (See "POWER CIRCUIT DIAGNOSIS").
2. Turn signal switch	Battery voltage	Check F3 fuse. (See "POWER CIRCUIT DIAGNOSIS").
3. Light switch	Battery voltage	Test light switch (See "LIGHT SWITCH TEST").
4. Turn signal switch	Battery voltage	Check 103 Org wire and connections.
5. Turn signal switch (115A and 125A Dk Grn wires)	Intermittent battery voltage	Test switch (See "TURN SIGNAL SWITCH TEST"). Replace as needed.
6. RH hazard light	Intermittent battery voltage	Check 115A and 115C Dk Grn wires and connections.
7. X7 control panel connector (terminal D)	Intermittent battery voltage	Check 115A and 115B Dk Grn wires and connections.
8. LH hazard light	Intermittent battery voltage	Check 125A and 125C Dk Grn wires and connections.
9. X7 control panel connector (terminal E)	Intermittent battery voltage	Check 125A and 125B Dk Grn wires and connections.

Test Conditions:

- Key switch in OFF position
- Engine OFF
- Light switch in ROAD position
- X7 to control panel connected

10. Light switch	Battery voltage	Test light switch. (See "LIGHT SWITCH TEST").
11. F7 fuse	Battery voltage	Check F7 fuse. Check 138A and 138B Gry wires and connections.
12. RH headlight	Battery voltage	Check 119C and 119A Wht wires and connections.
13. LH headlight	Battery voltage	Check 119C and 119B Wht wires and connections.
14. F8 fuset	Battery voltage	Check F8 fuse. Check 138A and 138C Gry wires and connections.
15. RH tail light	Battery voltage	Check 118A and 118B Gry wires and connections.
16. LH tail light	Battery voltage	Check 118A and 118C Gry wires and connections.
NOTE: With the light switch in ROAD position, and the turn signal in the OFF position, battery voltage and intermittent battery voltage will be provided in the same locations as Steps 4 through 16 above. These voltages are in addition to the voltage at the F7 fuse and RH and LH headlights.		


S9 Light Switch
122B Red
103 Org
122B Red
103 Org
122A Red
122C Red
138A Gry
138C Gry
143 Org
138B Gry
F3 Fuse
S8 Turn Signal Switch
125A Dk Grn
115A Dk Grn
F8 Fuse
F6 Fuse
F7 Fuse
To E7 and E8 Work Lights
+12 VDC
147B Pur
147A Pur
147D Pur
147C Pur
119C Wht
118A Gry
118B Gry
118C Gry
118D Gry
118 Gry
115D Dk Grn
147C Pur
125D Dk Grn
X13 To Trailer Connector (Option)
X7-W1 Main Wiring Harness To Control Panel
125B Dk Grn
115B Dk Grn
119A Wht
E6 RH Headlight
119B Wht
E5 LH Headlight
125C Dk Grn
115C Dk Grn
118C Gry
118B Gry
E2 LH Hazard Light
E4 RH Hazard Light
125C Dk Grn
115C Dk Grn
118C Gry
118B Gry
E1 LH Tail Light
E3 RH Tail Light

Test Conditions:

- Key switch in OFF position
- Light switch in FIELD position
- Engine OFF

17. Light switch	Battery voltage	Test light switch.
18. F6 fuse	Battery voltage	Check F6 fuse. Check 143 Org wire and connections.
19. X13 connector (if used)	Battery voltage	Check 147A and 147C Pur wires and connections.
NOTE: With the light switch in FIELD position, and the turn signal in the OFF position, battery voltage will be provided in the same locations as Steps 10 through 16 above.		

Test Conditions:

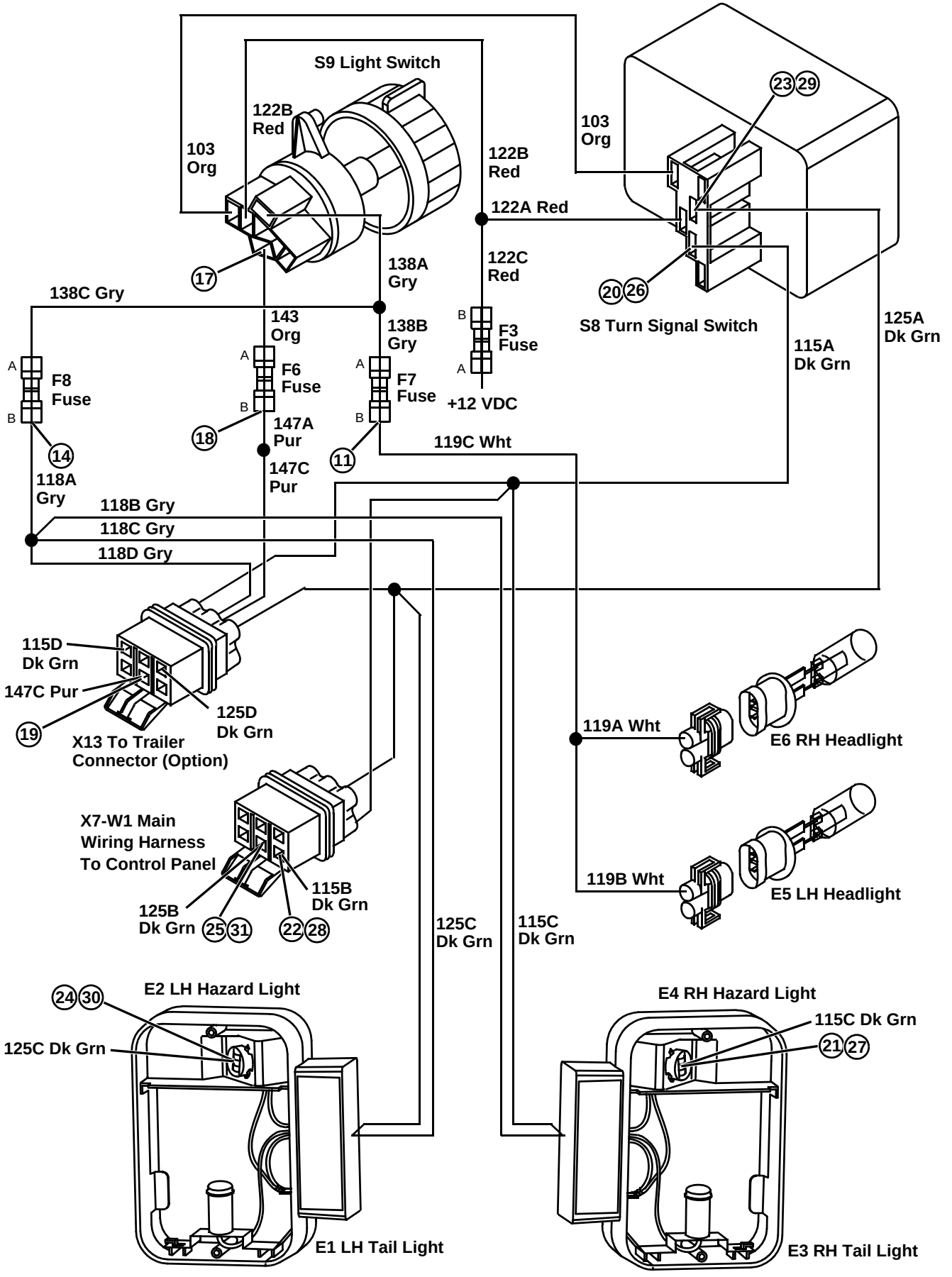
- Key switch in OFF position
- Engine OFF
- Light switch in OFF position
- Turn signal switch in LEFT position

20. Turn signal switch	Battery voltage	Test switch (See "TURN SIGNAL SWITCH TEST"). Replace as needed.
21. RH hazard light	Battery voltage	Check 115A and 125C Dk Grn wires and connections.
22. X7 connector (terminal D)	Battery voltage	Check 115A and 115B Dk Grn wires and connections.
23. Turn signal switch	Intermittent battery voltage	Test switch (See "TURN SIGNAL SWITCH TEST"). Replace as needed.
24. LH hazard light	Intermittent battery voltage	Check 125A and 125C Dk Grn wires and connections.
25. X7 connector (terminal E)	Intermittent battery voltage	Check 125A and 125B Dk Grn wires and connections.

Test Conditions:

- Key switch in OFF position
- Engine OFF
- Light switch in OFF position
- Turn signal switch in RIGHT position

26. Turn signal switch	Intermittent battery voltage	Test switch (See "TURN SIGNAL SWITCH TEST"). Replace as needed.
27. RH hazard light	Intermittent battery voltage	Check 115A and 115C Dk Grn wires and connections.
28. X7 control panel connector (terminal D)	Intermittent battery voltage	Check 115A and 115B Dk Grn wires and connections.
29. Turn signal switch	Battery voltage	Test switch (See "TURN SIGNAL SWITCH TEST"). Replace as needed.
30. LH hazard light	Battery voltage	Check 125A and 125C Dk Grn wires and connections.
31. X7 control panel connector (terminal E)	Battery voltage	Check 125A and 125B Dk Grn wires and connections.


S9 Light Switch
122B Red
103 Org
122B Red
103 Org
23 29
122A Red
17
138A Gry
122C Red
20 26
S8 Turn Signal Switch
125A Dk Grn
115A Dk Grn
138C Gry
143 Org
138B Gry
B
F3 Fuse
A
F8 Fuse
F6 Fuse
F7 Fuse
+12 VDC
18
147A Pur
11
119C Wht
14
118A Gry
147C Pur
118B Gry
118C Gry
118D Gry
115D Dk Grn
147C Pur
19
125D Dk Grn
X13 To Trailer Connector (Option)
119A Wht
E6 RH Headlight
X7-W1 Main Wiring Harness To Control Panel
115B Dk Grn
125B Dk Grn
25 31
22 28
119B Wht
E5 LH Headlight
125C Dk Grn
115C Dk Grn
24 30
E2 LH Hazard Light
E4 RH Hazard Light
115C Dk Grn
21 27
125C Dk Grn
E1 LH Tail Light
E3 RH Tail Light

CRUISE CONTROL

Cruise Control Function:

Provides an electro-mechanical means to control the forward speed of the tractor.

Operating Conditions:

- Key switch in RUN position
- Brake not depressed
- Cruise control switch momentarily in ENGAGE position, and then released to the ON position.

The cruise control will remain ENGAGED until the brake is depressed; the key switch is turned to the OFF position; or, the cruise control switch is placed into the OFF position.

Theory of Operation:

When the Y3 cruise control electromagnet is energized, the forward pedal is held in whatever position it is in when the magnet is energized. The cruise control magnet is energized through the cruise control relay contacts. The brake switch provides a latching circuit for the cruise control relay. When the brake pedal is depressed, the normally open brake switch contacts open and the latching circuit is removed. With the latching circuit removed, the cruise control relay contacts open, and the cruise control magnet is deenergized - releasing the forward pedal.

Power for the cruise control circuit is provided to the X9 connector, from the key switch (terminal 4), through the 209 Wht wire.

Power is provided from the X9 connector to the cruise control switch through the W4 wiring harness Wht wire, and X10 connector. The cruise control switch is a double pole switch with OFF, ON, and momentary ENGAGE positions.

When the cruise control switch is placed in the momentary ENGAGE position, power is provided through the switch, X10 connector, W4 wiring harness Gry wire, X9 connector, and 238 Gry wire to the K8 cruise control relay (terminal 86). With power provided, the relay coil energizes and the contacts (terminal 30 and terminal 87) close. At the same time (cruise control switch placed in the momentary ENGAGE position), power is provided through the X10 connector, W4 wiring harness Pur wire, X9 connector, and 247 Pur wire to the K8 cruise control relay contacts (terminal 87).

With the contacts closed, power is provided through the relay contacts (terminals 87 and 30) to the cruise control indicator light through the 264B Yel wire, X6 connector (terminal G), and control panel circuit board.

Latching Circuit:

Power is also provided from the cruise control relay (terminal 30) to the S11 brake switch and Y3 cruise control magnet through the 264A Yel wire, X9 connector, W4 wiring harness Yel wires, and X11 connector and X12 connector respectively.

When power is provided to the cruise control magnet, it is energized and creates a magnetic field that holds the forward pedal in a locked position.

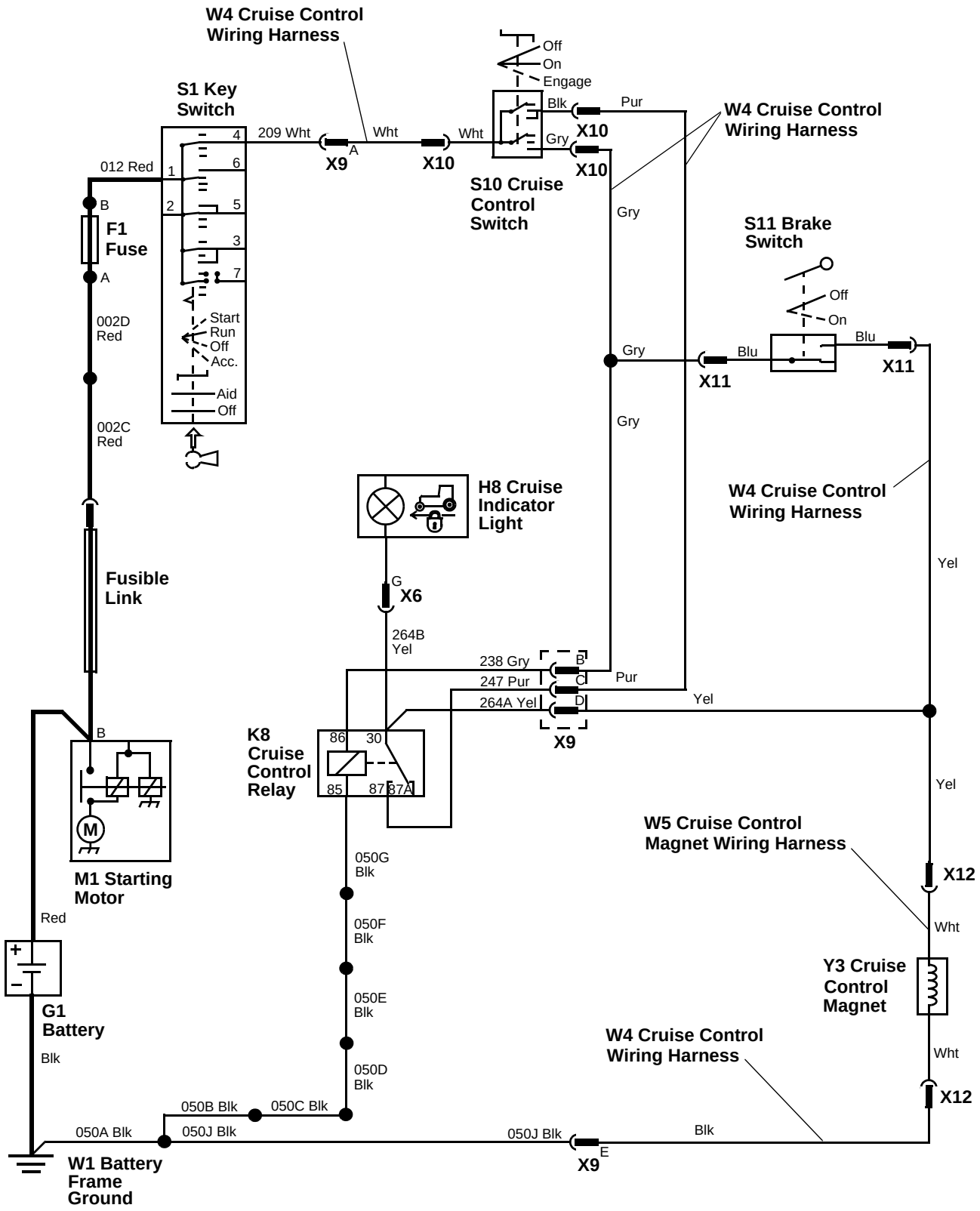
When power is provided to the S11 brake switch, and the brake switch contacts are closed (brake NOT depressed), power is provided through the X11 connector, W4 wiring harness Gry wires, X9 connector and 238 Gry wire to the cruise control relay (terminal 86). This circuit latches the cruise control relay by keeping the cruise control relay coil energized.

The latching circuit keeps the cruise control relay coil energized until the brake pedal is depressed. When the pedal is depressed, the S11 brake switch contacts open and power is removed from the cruise control relay coil.

When the cruise control relay coil is deenergized, the relay contacts open, and power provided to the cruise control indicator light and the cruise control magnet is removed. Without power, the cruise control magnet releases the forward pedal.

Placing the cruise control switch into the OFF position stops power to the cruise control relay coil and contacts.

CRUISE CONTROL ELECTRICAL SCHEMATIC



SE1 - STARTING	SE4 - ACCESSORIES	SE5 - INSTRUMENTATION

CRUISE CONTROL DIAGNOSIS

Test Conditions:

- Key switch in RUN position, engine OFF
- PTO in NEUTRAL
- Transmission in NEUTRAL
- Park brake ENGAGED
- K8 cruise control relay removed
- Disconnect X9 connector

Test/Check Point	Normal	If Not Normal
32. Key switch	Battery voltage	Test key switch (See "KEY SWITCH TEST"). Replace switch as needed.
33. X9 connector (terminal A)	Battery voltage	Check 209 Wht wire and connections.

Test Conditions:

- X9 connector connected
- Park brake ENGAGED
- X10, X11 and X12 disconnected
- Key switch in RUN position, engine OFF

34. X10 connector (Wht wire terminal)	Battery voltage	Check X9, Wht wire, X10 and connections.

Test Conditions:

- X10 to cruise control switch connected
- Place and hold cruise control switch in ENGAGE position
- Park brake ENGAGED
- Key switch in RUN position, engine OFF

35. K8 relay socket (terminal 86)	Battery voltage	Ensure cruise control switch is in ENGAGE position. Test switch (See "CRUISE CONTROL SWITCH TEST"). Check X10 connector, Gry wire, X9 connector, and 238 Gry wires and connections.
36. K8 relay socket (terminal 87)	Battery voltage	Test cruise control switch. Check X10 connector, Pur wire, X9 connector, and 247 Pur wires and connections.
37. X11 connector (Gry wire)	Battery voltage	Check Gry wire and connections.

Test Conditions:

- Cruise control switch in ON position
- K8 relay installed

38. X6 (terminal G)	Battery voltage	Test K8 cruise control relay.

Test Conditions:

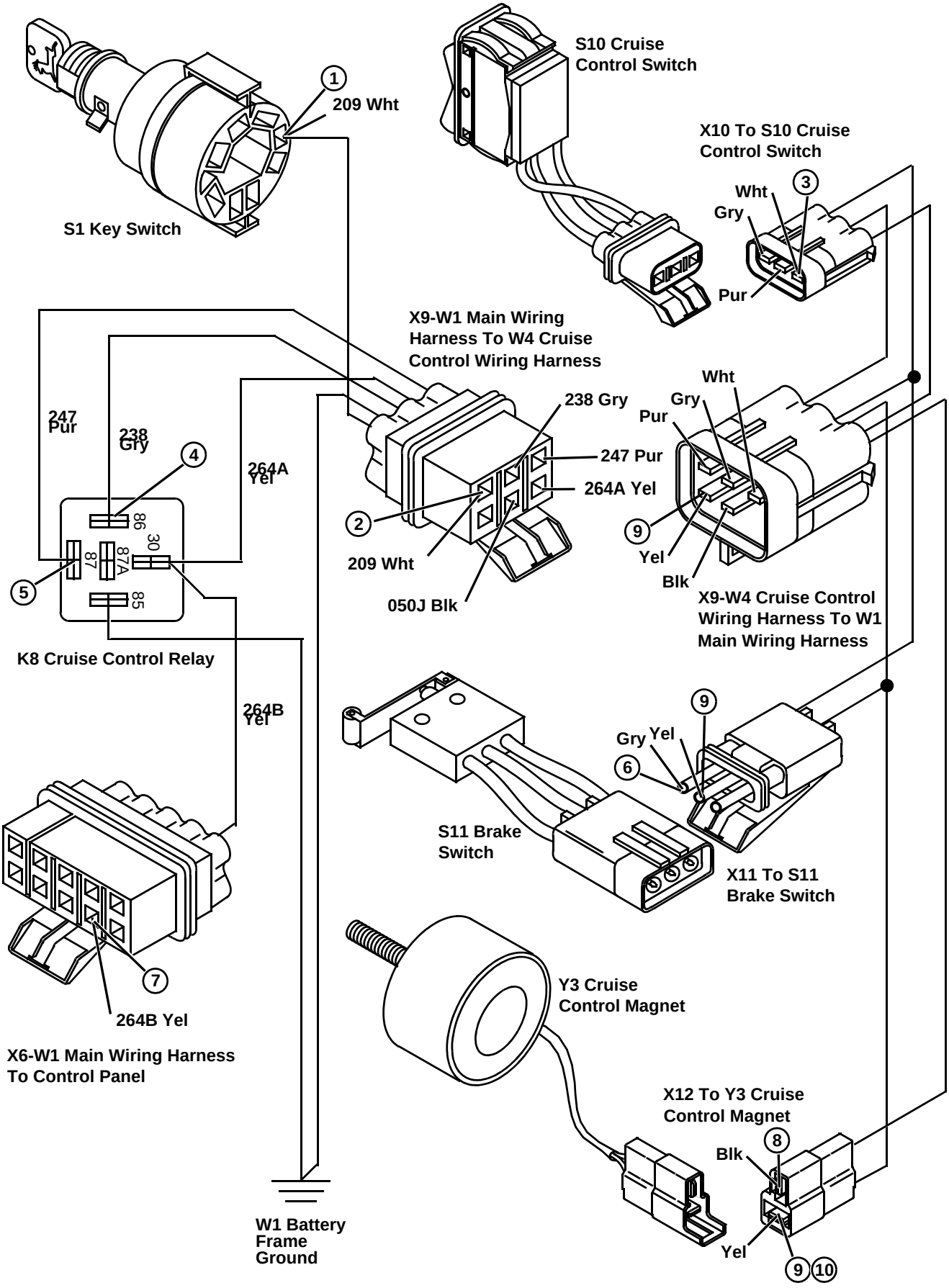
- Key switch in OFF position

39. X12 to frame ground (Blk wire)	Less than 0.1 ohms resistance	Check Blk wire, X9 connector, and 050J and 050A Blk wires and connections.
40. X9 to X11 to X12 (Yel wires)	Less than 0.1 ohms resistance	Check Yel wires and connections.

Test Conditions:

- X11 connected
- Key switch in RUN position (Engine OFF)
- Cruise control switch in ON position
- Brake pedal NOT depressed

41. X12 connector (Yel wire)	Battery voltage	Test brake switch (See "BRAKE SWITCH TEST").


1
209 Wht
S1 Key Switch
S10 Cruise
Control Switch
X10 To S10 Cruise
Control Switch
Wht
Gry
Pur
3
X9-W1 Main Wiring
Harness To W4 Cruise
Control Wiring Harness
247
Pur
238
Gry
4
264A
Yel
238 Gry
247 Pur
264A Yel
2
209 Wht
050J Blk
Wht
Gry
Pur
9
Yel
Blk
X9-W4 Cruise Control
Wiring Harness To W1
Main Wiring Harness
86
30
87
87A
85
5
K8 Cruise Control Relay
264B
Yel
9
Gry
Yel
6
S11 Brake
Switch
X11 To S11
Brake Switch
7
264B Yel
X6-W1 Main Wiring Harness
To Control Panel
Y3 Cruise
Control Magnet
X12 To Y3 Cruise
Control Magnet
Blk
8
Yel
9
10
W1 Battery
Frame
Ground

TESTS AND ADJUSTMENTS

GROUND CIRCUIT TEST

Reason:

To check for open circuits, loose terminal wire crimps, poor connections, or corrosion in the ground circuit.

Equipment:

- Ohmmeter or Voltmeter

NOTE: The voltmeter method checks ground connections under load.

Procedure—OHMMETER METHOD:

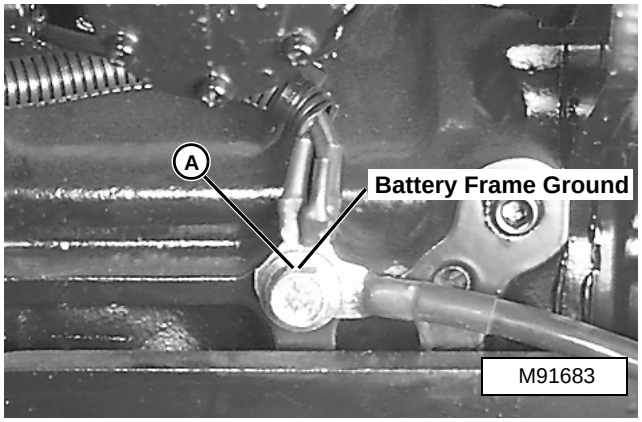
1. Park machine on level surface.
2. Disengage PTO.
3. Turn key switch to OFF position.
4. Engage park brake.
5. Raise hood.
6. Remove engine side covers.
7. Connect ohmmeter negative (black) lead to negative terminal of battery. Connect meter positive (red) lead to negative terminal of battery and record reading.
8. Connect ohmmeter red lead to ground terminal of circuit (A) or component to be tested that is closest to the battery negative terminal. **Resistance reading must be the same or very close to as 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 ohms**. The problem is between the last two test points. If a problem is indicated, disconnect the wiring harness connector to isolate the wire or component and check resistance again. **Maximum allowable resistance in the circuit is 0.1 ohms**. Check both sides of the connectors closely, as disconnecting and connection may **temporarily** solve problem.

Procedure—VOLTMETER METHOD:

1. Park machine on level surface.
2. Disengage PTO.
3. Turn key switch to ON position.
4. Engage park brake.
5. Raise hood.
6. Remove engine side covers.
7. Connect voltmeter negative (black) lead to negative terminal of battery.
8. 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.



BATTERY TEST

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:

1. Filling batteries in a well-ventilated area.
2. Wearing eye protection and rubber gloves.
3. Avoiding breathing fumes when electrolyte is added.
4. Avoid 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 1.9 L (2 qts.).
3. Get medical attention immediately.

Reason:

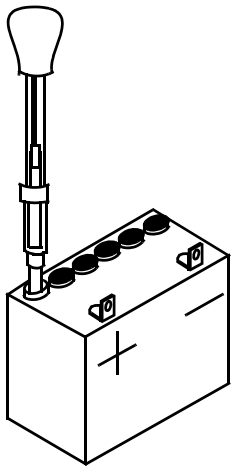
To check condition of battery and determine battery voltage.

Equipment:

- Hydrometer
- Voltmeter or JTO5685 Battery Tester

Procedure:

1. Park machine on level surface.
2. Disengage PTO.
3. Turn key switch to OFF position.
4. Engage park brake.
5. Raise hood.
6. Clean cable ends, battery terminals and top of battery.
7. Remove battery.
8. Inspect battery terminals and case for breakage or cracks.
9. Check electrolyte level in each battery cell. Add clean, soft water as needed. If water is added, charge battery for **20 minutes at 10 amps**.
10. Remove surface charge by placing a small load on the battery for 15 seconds.



11. Use an hydrometer to check for a **minimum specific gravity of 1.265 with less than 50 point variation in each cell at full charge at 26.7°C (80°F).**

Results:

- If all cells are less than 1.175, charge battery at 10 amp rate.
- If all cells are less than 1.225 with less than 50 point variation, charge battery at 10 amp.
- If all cells are more than 1.225 with less than 50 point variation, load test battery.
- If more than 50 point variation between cells, replace battery.

12. Use a voltmeter or JTO5685 Battery Tester to check for a **minimum battery voltage of 12.4 VDC**.

Results:

- If battery voltage is less than 12.4 VDC, charge battery.
- If battery voltage is more than 12.4 VDC, test specific gravity. (See Step 12.)

13. Install battery.

CHARGE BATTERY

Reason:

To increase battery charge after the battery has been discharged.

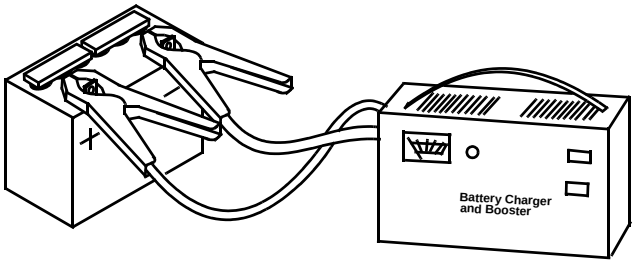
Equipment:

- Battery charger (variable rate).

Procedure:

NOTE: See BATTERY TEST in this group before charging battery.

1. Park machine on level surface.
2. Disengage PTO.
3. Turn key switch to OFF position.
4. Engage park brake.
5. Raise hood.
6. Remove engine side covers.
7. Clean cable ends, battery terminals and top of battery.
8. Remove battery and check water level.
9. Connect variable rate charger to battery.
10. Start charger at SLOW rate. Increase charge rate ONE setting at a time. Check charger ammeter after 1 minute at each setting. Maintain 10 amp charge rate. Use boost setting as necessary.
11. Check if battery is accepting 10 amp charge rate after 10 minutes at boost setting.



Results:

- If battery WILL NOT accept 10 amp charge after 10 minutes at boost setting, replace battery.
- If battery is accepting 10 amp charge after 10 minutes at boost setting, and battery did NOT need water, go to Steps 12 and 13.
- If battery is accepting 10 amp charge after 10 minutes at boost setting, but battery DID need water or all cells were BELOW 1.175, go to Steps 10 and 11.

12. Set charger at 15 – 25 amps.

IMPORTANT: Decrease charge rate if battery gases or bubbles excessively or becomes too warm to touch.

13. Check specific gravity after 30 minutes (60 minutes for maintenance-free battery).

Results:

- If MORE THAN 50 point variation between cells, replace battery.
- If LESS THAN 50 point variation between cells, go to Step 14.

NOTE: If battery was discharged at slow or unknown rate, charge battery at 10-15 amps for 6-12 hours. (Maintenance-free battery: 4-8 hours).

14. Continue to charge battery until specific gravity is **1.265 points at 26.7°C (80°F).**
15. Load test battery.
16. Install battery.

LOAD TEST BATTERY

Reason:

To check condition of battery under load.

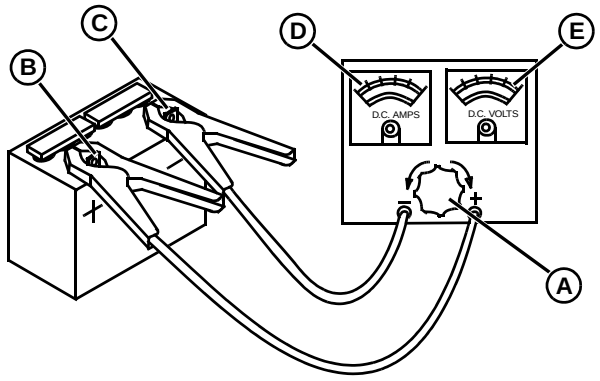
Equipment:

- JTO5685 Battery Tester

Procedure:

1. Park machine on level surface.
2. Disengage PTO.
3. Turn key switch to OFF position.
4. Engage park brake.
5. Raise hood.
6. Clean cable ends, battery terminals and top of battery.
7. Remove battery.
8. Turn load knob (A) counterclockwise to OFF position.
9. Connect tester positive (red) cable to battery positive (+) terminal (B).
10. Connect tester negative (black) cable to battery negative (–) terminal (C).
11. Turn load knob (A) of tester clockwise (in) until amperage reading (D) is equal to:
    - cold cranking amperage rating of battery (use blue scale).
      or
    - three times ampere hour rating (use black scale).
12. Hold for 15 seconds and turn load knob (A) of tester counterclockwise (out) into OFF position.

13. Repeat Steps 8 and 9 above and read condition of battery at DC Volts scale (E).



Results:

- If battery DOES NOT pass test and has NOT been charged, charge battery and retest.
- If battery DOES NOT pass test and HAS BEEN charged, replace battery.

UNREGULATED AMPERAGE TEST

40 AMP ALTERNATOR

Reason:

To determine charging output of the alternator stator.

Equipment:

- JTO5712 Current Gun

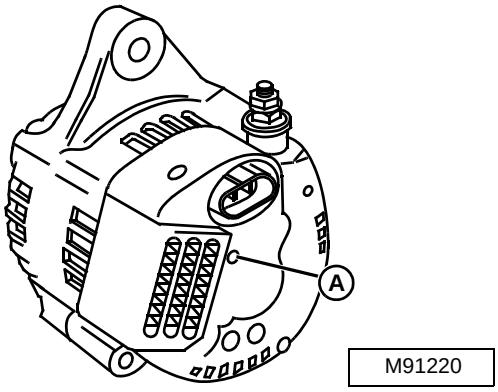
Connections:

1. Put JTO5712 Current Gun over alternator Red wire. Set current gun for DC current.

Procedure:

IMPORTANT: Perform this test quickly to prevent damage to the battery. DO NOT apply full load to battery for more than 10 seconds.

2. Start and run engine at high idle.



3. Insert a small Phillips screwdriver through the hole (A) in rear cover of alternator to ground the regulator to the rear cover. Read amperage on current gun.

Specifications:

Minimum unregulated amperage . . . . . 40 amps

Results:

- If reading does not meet specifications, verify voltage at the alternator regulated terminal and good alternator ground. If voltage and ground are OK, replace the alternator.

REGULATED AMPERAGE AND VOLTAGE TESTS

Reason:

To determine the regulated voltage (charging) output of the alternator.

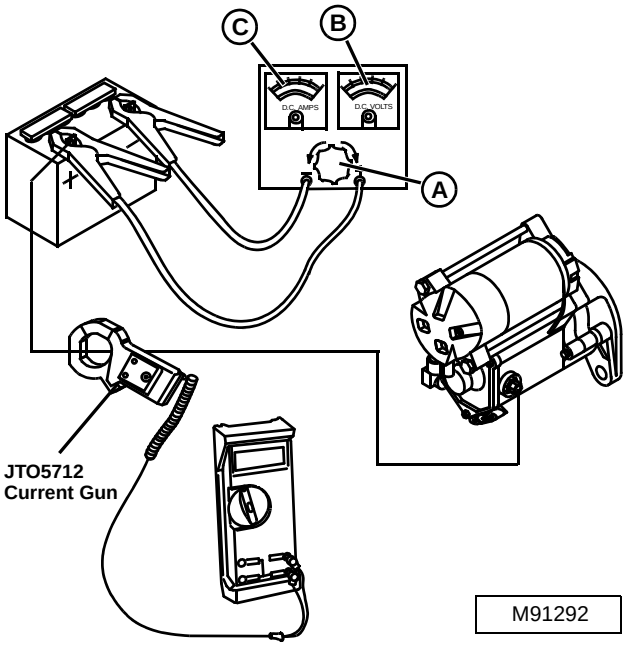
Equipment:

- JTO5712 Current Gun
- Voltmeter
- JTO5685 Battery Tester

Procedure:

1. Park machine on level surface.
2. Disengage PTO.
3. Turn key switch to OFF position.
4. Engage park brake.
5. Raise hood.
6. Remove engine side covers.
7. Disconnect three pin connector from alternator.

NOTE: Battery must be in a good state of charge.



8. Connect JTO5712 Current Gun to voltmeter and put around positive (red) battery cable going to starting motor. Set current gun for DC current.

IMPORTANT: Turn load knob (A) fully counterclockwise (out) into OFF position BEFORE making any test connections.

9. Connect battery tester to battery.

IMPORTANT: Perform this test quickly to prevent damage to battery tester. DO NOT apply full load to battery for more than 5 – 10 seconds.

10. Turn load knob clockwise (in) until voltage on voltage tester scale reads **11 volts for 5 seconds only** to partially drain battery.
11. Quickly turn load knob completely counter-clockwise (out) to OFF position.
12. Start and run engine at **fast idle (2850 rpm)**. Battery voltage should read **between 12.2 – 15.0 VDC**.
13. Turn load knob clockwise (in) until voltage on tester voltage scale (B) reads 11 volts and look at current gun for a minimum reading of **13.5 amps**.
14. Quickly turn load knob completely counter-clockwise (out) to OFF position.
15. After load test, battery voltage (B) should return to the voltage level prior to test.

Results:

- If current gun amp reading is BELOW specification, test for unregulated voltage output. If unregulated voltage output test meets specifications and you have verified voltage to ground to regulator/ rectifier, replace regulator/rectifier.
- If at any time voltage increase exceeds **14.7 VDC**, replace regulator/rectifier.

STARTING MOTOR SOLENOID TEST

Reason:

To determine if starting motor is defective.

Equipment:

- Jumper wire

CAUTION

This test will cause engine to turn over. Engine may start. Ensure tractor drive is disengaged. Ensure PTO is disengaged.

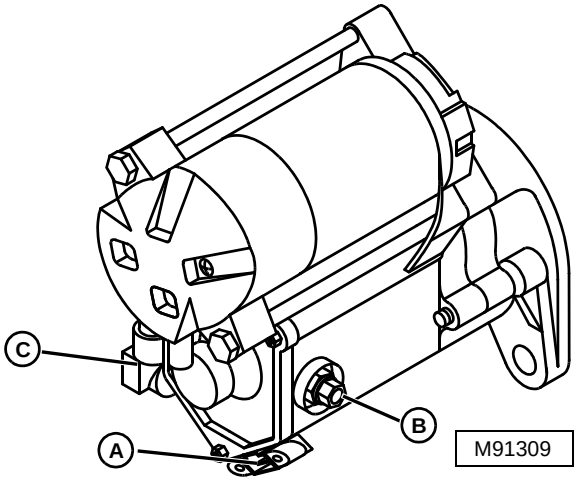
Procedure:

1. Park machine on level surface.
2. Place drive in NEUTRAL.
3. Disengage PTO.
4. Turn key switch to OFF position.
5. Engage parking brake.
6. Raise hood.
7. Remove left engine side cover.
8. Disconnect fuel shutoff solenoid wire connector.
9. Disconnect 309 Wht wire from starting motor solenoid terminal (A).
10. Connect jumper wire to positive (+) battery terminal and briefly jump to starting motor solenoid terminal (A).

Results:

- Starting motor runs—solenoid is good, test cranking circuit wiring.
- Starting motor DOES NOT run—go to next step.

11. Remove rubber boot from terminal (B).
12. Remove plastic cover from terminal (C).
13. Connect jumper wire between starting motor solenoid large terminals (B and C).



Results:

- Starting motor runs—replace starter.
- Starting motor DOES NOT run—check battery cables, then replace starting motor.

STARTING MOTOR AMPERAGE DRAW TEST

Reason:

To determine the amperage required to crank the engine and check starter motor operation under load.

Equipment:

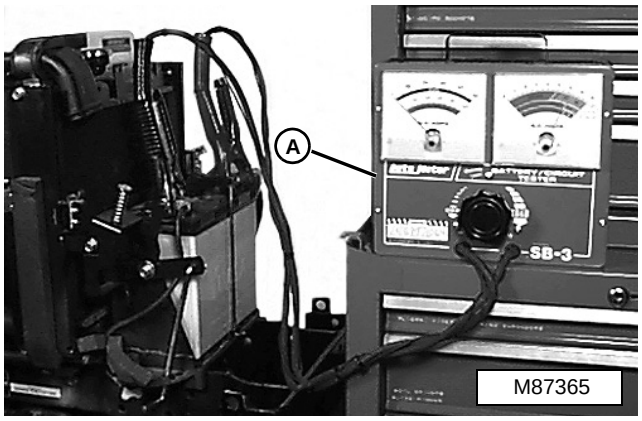
- JTO5685 Battery Tester

Procedure:

1. Park machine on level surface.
2. Disengage PTO.
3. Turn key switch to OFF position.
4. Engage park brake.
5. Raise hood.
6. Remove engine front and left side covers.
7. Test ground connections and battery.
8. Disconnect fuel shutoff solenoid connector.

IMPORTANT: Turn load knob (B) fully counter-clockwise before making any test connections.

9. Connect JTO5685 Battery Tester (A) to battery.
10. Crank engine and read voltage.
11. Turn key switch to the OFF position. Adjust load knob until battery voltage reads the same as when cranking.
12. Read amperage on meter.
13. Turn load knob fully counterclockwise.



Results:

- If **amperage is greater than 150 amps,** test starting motor No-Load RPM and Amperage to determine if the starting motor is binding or damaged.
- If the starting motor is good, check internal engine components for binding or damage.

NO-LOAD AMPERAGE DRAW AND RPM TESTS

STARTING MOTOR

Reason:

To determine if starter is binding or has excessive amperage draw under no-load.

Equipment:

- JTO2153 Current Clamp
- JT05791 Multitester
- JTO5719 Hand-Held Digital Tachometer
- Jumper Cables
- Jumper wire

Procedure:

NOTE: Check that battery is fully charged and of proper size to ensure accuracy of test.

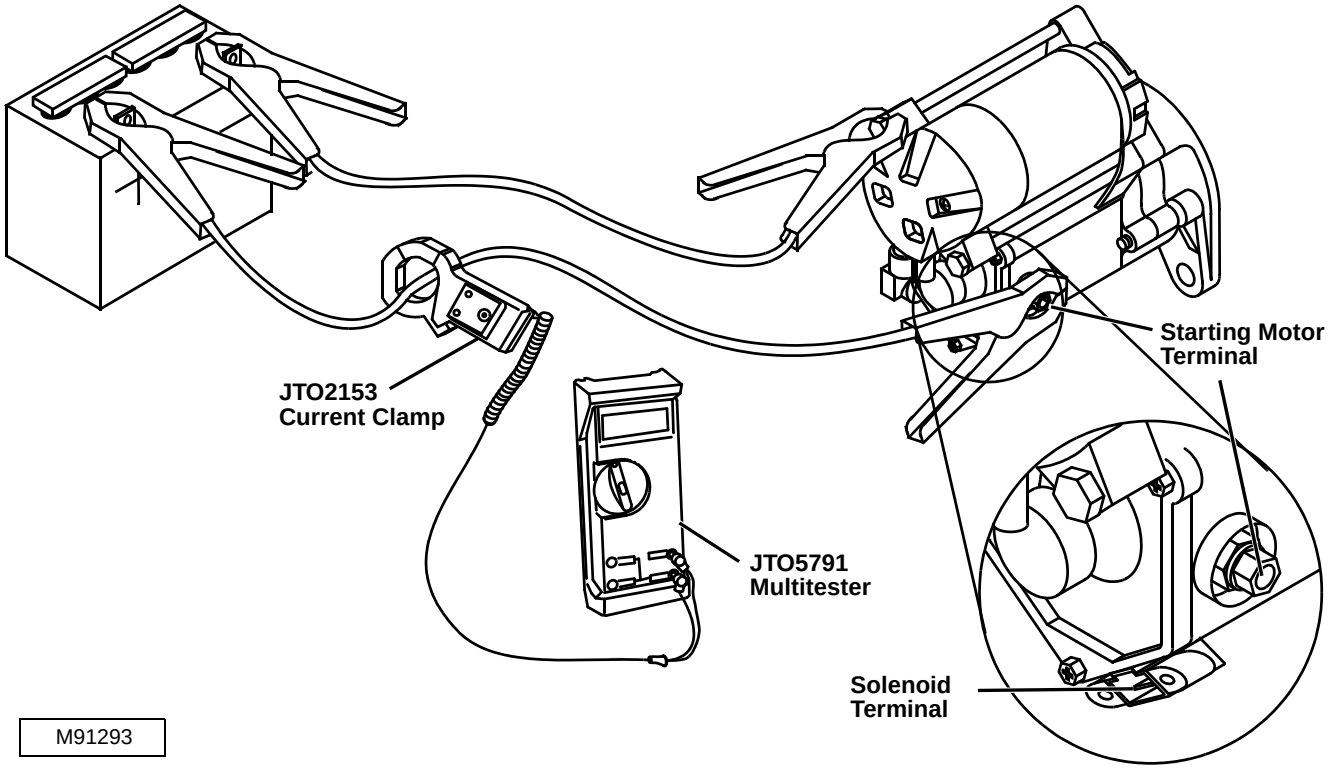
1. Park machine on level surface.
2. Disengage PTO.
3. Turn key switch to OFF position.
4. Engage park brake.
5. Raise hood.
6. Remove left engine side cover.
7. Remove starting motor assembly from tractor and place starting motor in vice.
8. Connect jumper cables to a 12 volt battery
9. Connect positive (+) cable to solenoid battery terminal on starting motor.
10. Connect negative (–) cable to starting motor body.
11. Attach Current Gun to positive (+) cable.

IMPORTANT: Complete this test in 20 seconds or less to prevent starting motor damage.

12. Use a jumper wire to briefly connect positive (+) starting motor terminal to solenoid terminal. Starting motor should engage and run.
13. Read and record starting motor amperage and rpm.

Results:

- If solenoid “clicks” or chatters and starting motor does not turn, replace starting motor.
- If pinion gear engages and starting motor doesn’t turn, replace starting motor.
- If starting motor engages and runs, but **amperage is more than 60 Amps at 4440 rpm,** repair or replace starting motor.
- If **free-running rpm is less than 4000 rpm**, repair or replace starting motor.



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RELAY TEST

Reason:

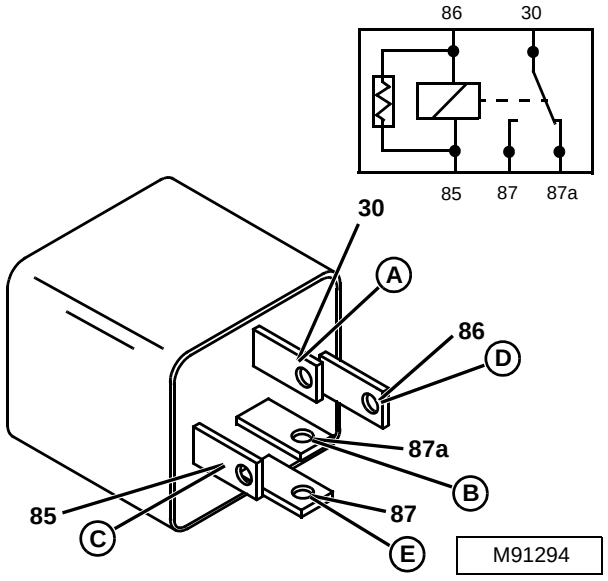
To check relay terminal continuity in the energized and de-energized condition.

Equipment:

- Ohmmeter or continuity tester
- 12 volt battery and small jumper wires

Procedure:

1. Park machine on level surface.
2. Disengage PTO.
3. Turn key switch to OFF position.
4. Engage park brake.
5. Open plastic panel below steering column support.
6. Remove relay from fuse and relay load center.
7. Check terminal continuity using an ohmmeter or continuity tester.



Results:

- There should be continuity between terminals A (30) and B (87a).
- There should be approximately 80 ohms resistance between terminals C (85) and D (86).
- There should NOT be continuity between any other terminals.

8. Connect a small jumper wire from battery positive (+) terminal to relay terminal C (85). Connect a small jumper wire from relay terminal D (86) to battery negative terminal (–).

Results:

- There should be continuity between terminals A (30) and E (87).
- If continuity is NOT correct, replace relay.

ENGINE COOLANT TEMPERATURE SENSOR TEST

Reason:

To verify coolant temperature sensor is functioning properly.

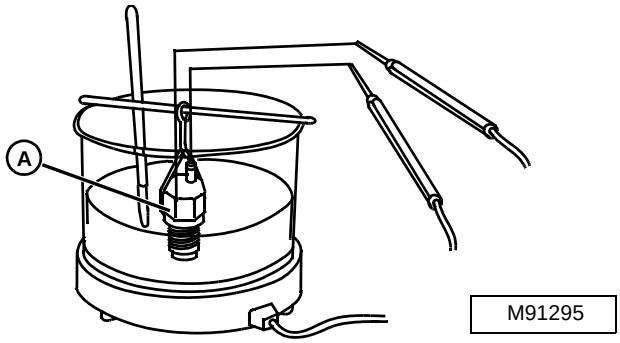
Equipment:

- Ohmmeter

Procedure:

NOTE: Perform test with engine at room temperature.

1. Park machine on level surface.
2. Disengage PTO.
3. Turn key switch to OFF position.
4. Engage park brake.
5. Raise hood.
6. Remove engine side covers.
7. Disconnect 359 Wht wire from engine coolant temperature sensor.
8. Measure resistance between terminal and sensor body.



9. If resistance does not meet specification, replace coolant temperature switch.
10. Drain engine coolant and remove coolant temperature switch.
11. Place sensor (A) in antifreeze solution heated to approximately 96°C (205°F). Measure resistance while sensor is heated.
12. If resistance does not meet specification, replace coolant temperature sensor.

Specifications:

Variable Resistance . . . . . 40 – 700 ohms

ENGINE OIL PRESSURE SWITCH TEST

Reason:

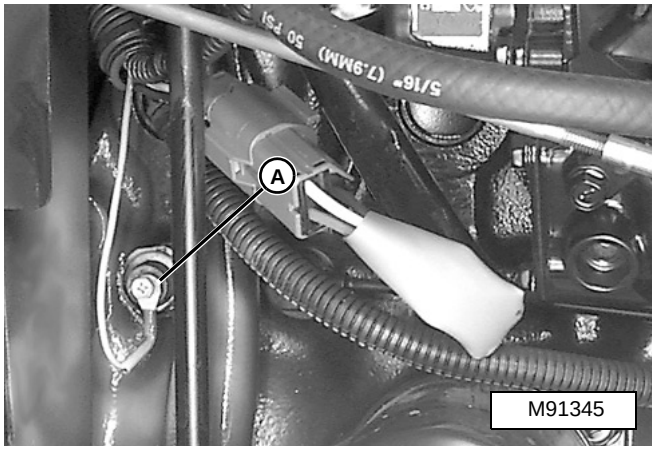
To determine if engine oil pressure switch is functioning properly, to warn operator that oil pressure has dropped below minimum operating pressure.

Equipment:

- Ohmmeter

Procedure:

1. Park machine on level surface.
2. Disengage PTO.
3. Turn key switch to OFF position.
4. Engage park brake.
5. Raise hood.
6. Remove right engine side cover.
7. Disconnect 347 Pur wire from oil pressure switch (A).
8. Connect black lead of ohmmeter to engine block and red lead of ohmmeter to terminal of switch.
9. Measure resistance between terminal and engine block.



Results:

- There should be continuity between terminal and ground.
- If there is NO continuity between terminal and ground; replace the oil pressure switch.

NOTE: Be sure to apply Pipe Sealant with TEFLON® to threads of switch anytime it is installed.

® TEFLON is a registered trademark of the DuPont Company.

10. Start and run engine.
11. Measure resistance between terminal and engine block.

Results:

There should be NO continuity between switch terminal and ground with the engine running.

- If the switch DOES have continuity to engine block (ground) with engine running, check engine oil pressure.
- If oil pressure meets specification; replace the oil pressure switch.

MANIFOLD HEATER TEST

Reason:

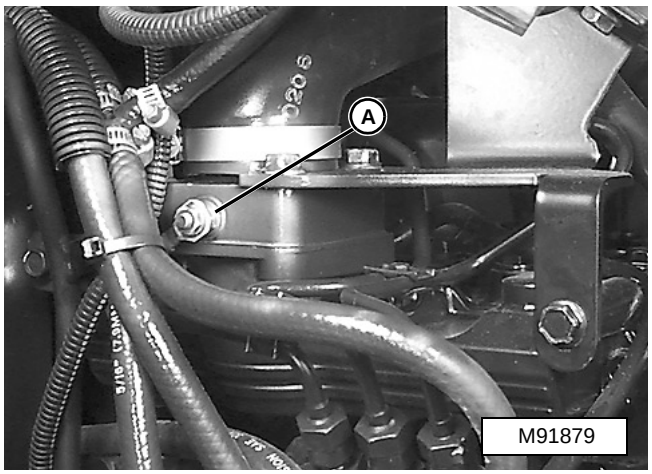
To test proper operation of manifold heater.

Equipment:

- Ohmmeter

Procedure:

1. Park machine on level surface.
2. Disengage PTO.
3. Turn key switch to OFF position.
4. Engage park brake.
5. Raise hood.
6. Remove right engine side cover.
7. Remove manifold heater lead from terminal (A).
8. Check continuity across terminal (A) and frame ground. The reading should be between **0.3 – 0.5 ohms.**



Results:

- If manifold heater does not have between **0.3 – 0.5 ohms** resistance, replace heater unit.

DIODE BLOCK TEST

Reason:

To verify that diodes in diode block are functioning properly.

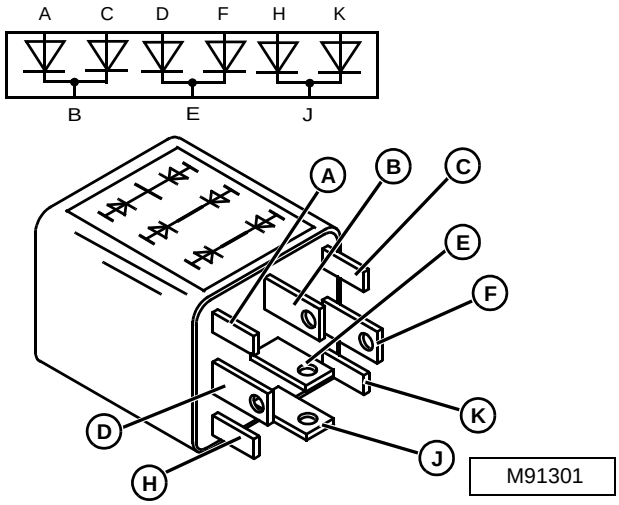
Equipment:

- Ohmmeter, continuity tester or diode tester

Procedure:

NOTE: Terminal positions are indicated on diode block.

1. Remove diode block from load center.
2. Connect ohmmeter or continuity tester to each diode as indicated in table.
3. Check for continuity.



Continuity:

Red Test Lead (+)	Black Test Lead (–)	Continuity
A	B	Yes
C	B	Yes
D	E	Yes
F	E	Yes
H	J	Yes
K	J	Yes

Results:

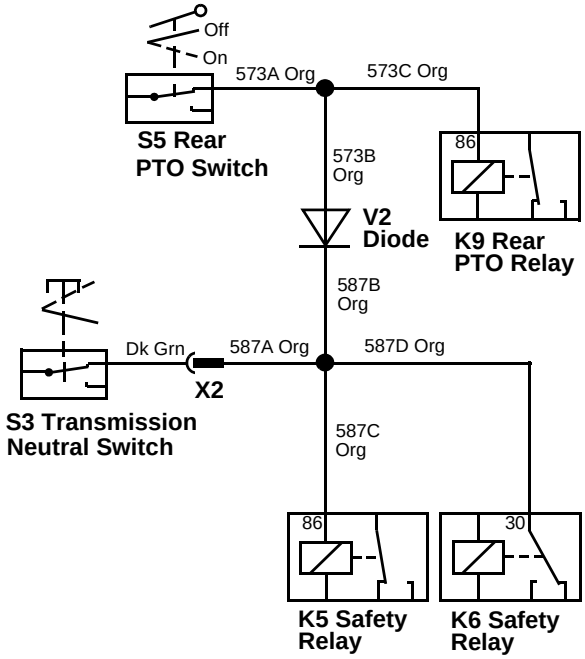
- Each diode should have continuity in one direction only.
- If a diode has continuity in both directions, or has no continuity, replace diode block.

V2 DIODE TEST

Reason:

To verify that the V2 diode is functioning properly.

NOTE: The V2 diode is soldered in-line and located in the main wiring harness protective wrap. This procedure isolates the diode from other components and allows testing of the diode without removing it.

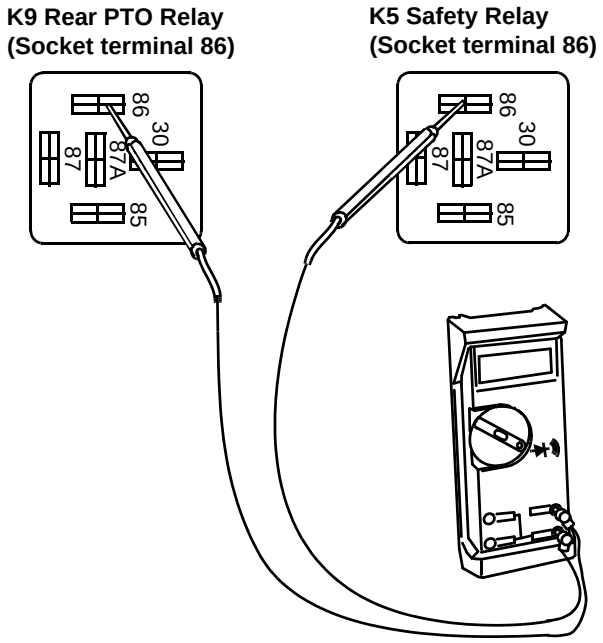


Equipment:

- Ohmmeter, continuity tester or multimeter

Procedure:

1. Park machine on level surface.
2. Disengage PTO.
3. Turn key switch to OFF position.
4. Engage park brake.
5. Disconnect main wiring harness connector from rear PTO switch and from transmission neutral switch.
6. Remove K5, K6 and K9 relays from load center.



7. Set multimeter to diode test range.

NOTE: The multimeter will measure and display voltage drop across diode when set to diode test range.

8. Connect multimeter leads to the K5 and K9 relay sockets, both at terminal 86. Check meter.
9. Reverse position of multimeter leads and retest.

NOTE: If using ohmmeter for test, resistance in one direction will be approximately 80,000 ohms, and reading will "fall" during testing. Ohmmeter reading in opposite direction will be between 4 and 5 mega-ohms and "rise" during testing.

Results:

- Meter should "beep" once in one meter lead position only.
- Meter has continuous tone in either position, diode is shorted, replace diode.
- Meter displays "OL" in both positions, diode is "open", replace diode.

FUSE TEST

Reason:

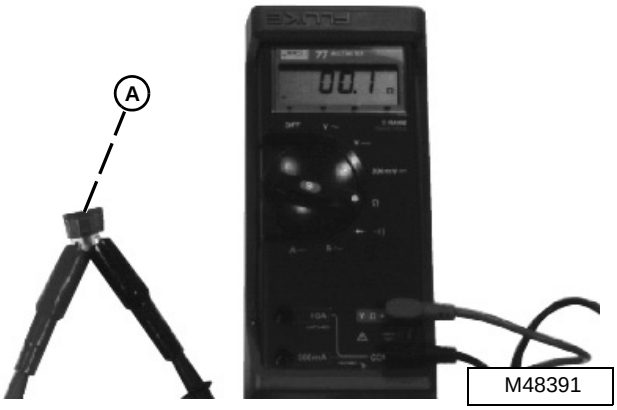
To verify that fuse has continuity.

Equipment:

- Ohmmeter or continuity tester

Procedure:

1. Remove fuse from connector.
2. Check visually for broken filament (A).
3. Connect ohmmeter or continuity tester to each end of fuse.
4. Check for continuity.



Results:

- If continuity is not indicated, replace the fuse.

CONTROL PANEL LIGHT TEST

Reason:

To verify that the bulb has continuity.

Equipment:

- Ohmmeter or continuity tester

Procedure:

1. Remove bulb from socket.
2. Check visually for broken filament (A).
3. Connect ohmmeter or continuity tester to each terminal of bulb.
4. Check for continuity.

Results:

- If continuity is not indicated, replace bulb.

KEY SWITCH TEST

Reason:

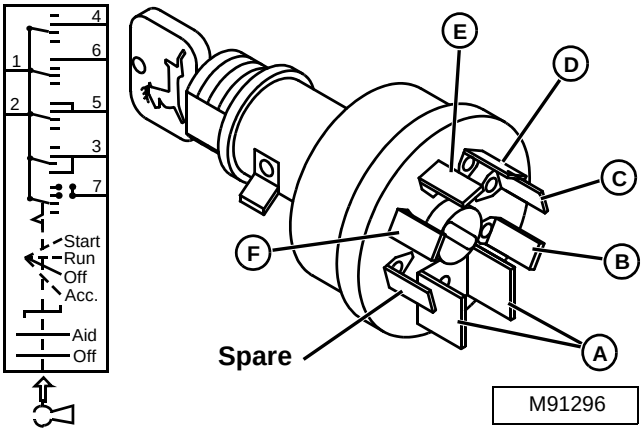
To verify that key switch functions properly.

Equipment:

- Ohmmeter or continuity tester

Procedure:

1. Park machine on level surface.
2. Disengage PTO.
3. Turn key switch to OFF position.
4. Engage park brake.
5. Disconnect and lift control panel.
6. Disconnect key switch from wiring harness.
7. Remove key switch from tractor.
8. Use an ohmmeter or continuity tester to test switch continuity in OFF, RUN, START, and AID (key pushed in) positions.



Key Switch Continuity:

Switch Position	Terminal Continuity
OFF	A and A
ACCESSORY	A and B
RUN	A and B
	A and C
	A and D
START	A and D
	A and E
AID (Key in RUN position & PUSHED IN)	A and B
	A and C
	A and D
	A and F

Results:

- If any continuity is NOT correct, replace the switch.

LIGHT SWITCH TEST

Reason:

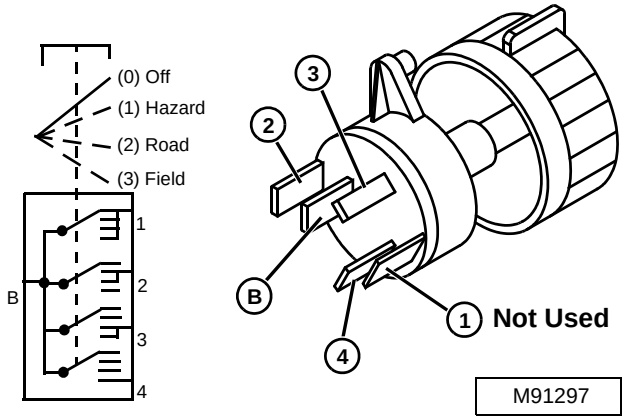
To verify that light switch functions properly.

Equipment:

- Ohmmeter or continuity tester

Procedure:

1. Park machine on level surface.
2. Disengage PTO.
3. Turn key switch to OFF position.
4. Engage park brake.
5. Remove screws securing control panel and lift control panel.
6. Disconnect light switch connector from harness.
7. Use an ohmmeter or continuity tester to test switch continuity.



Light Switch Continuity:

Switch Position	Terminal Continuity
OFF	B and 1
HAZARD	B and 2
	B and 1
ROAD	B and 2
	B and 3
	B and 1
FIELD	B and 3
	B and 4
	B and 1

Results:

- If any continuity is NOT correct, replace the switch.

SEAT SWITCH TEST

Reason:

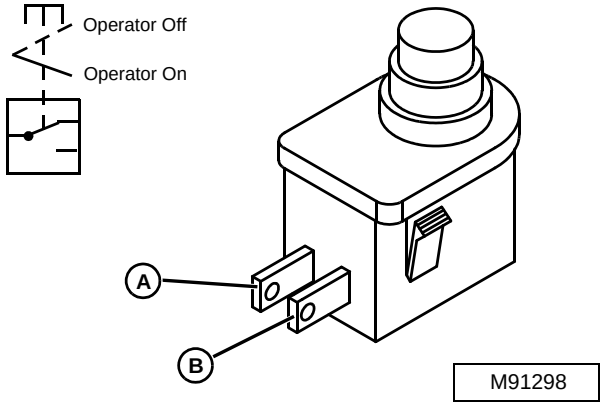
To verify that seat switch functions properly.

Equipment:

- Ohmmeter or continuity tester

Procedure:

1. Park machine on level surface.
2. Disengage PTO.
3. Turn key switch to OFF position.
4. Engage park brake.
5. Raise seat.
6. Disconnect seat switch from wiring harness.



7. Check continuity across switch terminals. There should be no continuity.
8. Depress seat switch plunger. Continuity should exist between terminals A and B.

Results:

- If any continuity is not correct, replace seat switch.

TRANSMISSION NEUTRAL SWITCH TEST – CST

Reason:

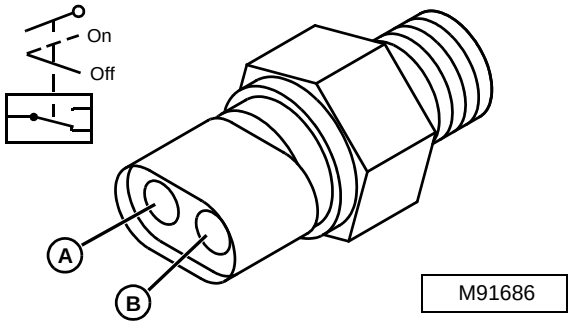
To verify that switch functions properly.

Equipment:

- Ohmmeter or continuity tester

Procedure:

1. Park machine on level surface.
2. Disengage PTO.
3. Turn key switch to OFF position.
4. Engage park brake.
5. Place gear selector lever in NEUTRAL.
6. Disconnect neutral start switch from harness.
7. Check for continuity between terminals (A) and (B). If no continuity exists, ensure that gear selector is in NEUTRAL.



8. If continuity can be obtained when transmission is in NEUTRAL;
   - Place gear selector in any gear,
   - Check for continuity through switch. There should be NO continuity.
9. If continuity does not match specifications:
   - Remove switch(es) from transmission housing.
   - Test switch(es) for continuity. Each switch is normally closed. Depress contact ball on end of switch and check continuity. Switch should be open (NO continuity with ball depressed.
10. Replace switch if correct continuity can not be obtained.

Switch Continuity:

Switch Position	Terminal Continuity
NORMALLY CLOSED	**A and B**
BALL DEPRESSED (OPEN)	**None**

TRANSMISSION NEUTRAL SWITCH TEST – HST & SRT

Reason:

To that verify switch functions properly.

Equipment:

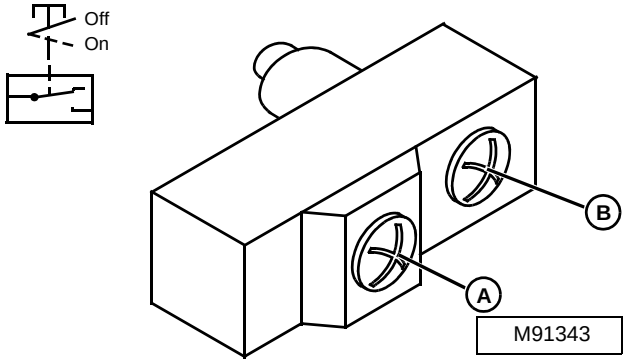
- Ohmmeter or continuity tester

Procedure:

1. Park machine on level surface.
2. Disengage PTO.
3. Turn key switch to OFF position.
4. Engage park brake.
5. Place gear range selector lever in NEUTRAL.
6. Disconnect neutral start switch from harness.

NOTE: Switch is normally open. When the pedals are not pushed, the pedal linkage closes the contacts. Depressing either forward or reverse directional pedal allows switch to open.

7. Check for continuity between terminals (A) and (B). If no continuity exists, ensure that directional pedals for transmission are not depressed.



8. Press down on forward directional pedal. No continuity should exist between terminal (A) and terminal (B).
9. Press down on reverse directional pedal. No continuity should exist between terminal (A) and terminal (B).
10. If continuity is not correct, replace switch.
11. Adjust switch as needed.
    - Switch should close when forward directional pedal is depressed **0.25 - 0.375 in. (6 - 9 mm)**.

TURN SIGNAL SWITCH TEST

Reason:

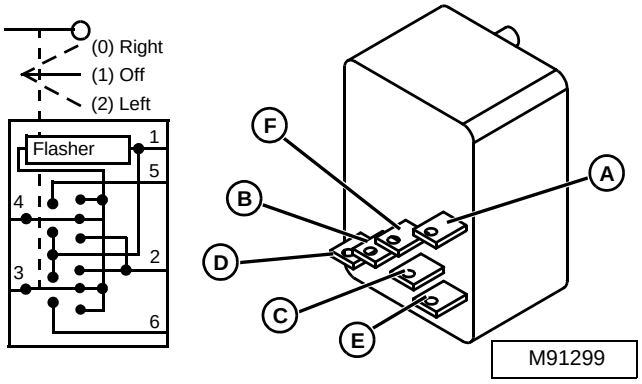
To verify that turn signal switch functions properly.

Equipment:

- Ohmmeter

Procedure:

1. Park machine on level surface.
2. Disengage PTO.
3. Turn key switch to OFF position.
4. Engage park brake.
5. Remove screws securing control panel, and lift panel.
6. Disconnect turn signal switch connector from harness.
7. Use an ohmmeter or continuity tester to test switch continuity in OFF, L.H., and R.H. positions.



Turn Signal Switch Continuity:

Switch Position	Terminal Resistance
OFF	
A to B	**25 ohms**
A to C	**25 ohms**
B to C	**0.1 ohms**
L.H. POSITION	
A to B	**variable**
A to C	**25 ohms**
A to D	**open**
A to E	**26 ohms**
A to F	**variable**
B to F	**0.1 ohms**
R.H. POSITION	**A and C**

Results:

- If any resistance value is NOT correct, replace the switch.

HAZARD SWITCH TEST

Reason:

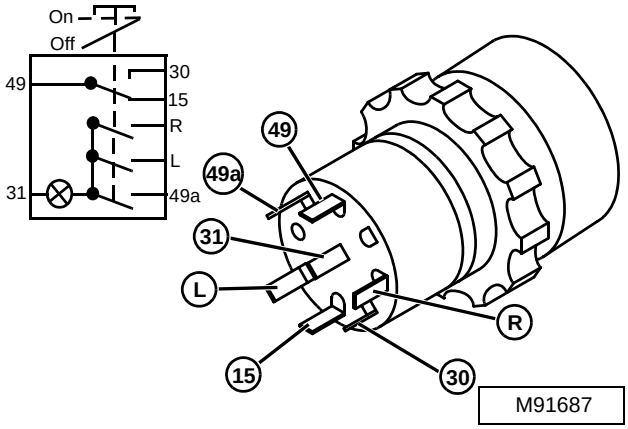
To verify that hazard switch functions properly.

Equipment:

- Ohmmeter or continuity tester

Procedure:

1. Park machine on level surface.
2. Turn key switch to OFF position.
3. Engage park brake.
4. Remove plastic kick panel from below steering column support.
5. Disconnect hazard lights switch connector from harness.
6. Use an ohmmeter or continuity tester to test switch continuity in OFF and ON positions.



Hazard Switch Continuity:

Switch Position	Terminal Continuity
OFF (Depressed)	**49 and 15**
ON (Released)	**49 and 30**
	49a and R
	49a and L
	R and L
49a to 31	**approximately 24 ohms**
R to 31	**approximately 24 ohms**
L to 31	**approximately 24 ohms**

Results:

- If any resistance value is NOT correct, replace the switch.

REAR & MID PTO SWITCH TEST

Reason:

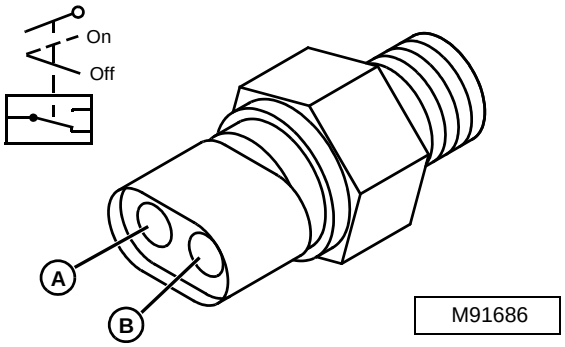
To verify that switch functions properly.

Equipment:

- Ohmmeter or continuity tester

Procedure:

1. Park machine on level surface.
2. Turn key switch to OFF position.
3. Engage park brake.
4. Disengage PTO.
5. Disconnect switch from wiring harness.



6. Using an ohmmeter or continuity tester, check continuity through switch. The switch should be closed (continuity with rear PTO DISENGAGED), and the switch should be open (no continuity with rear PTO engaged).
7. If continuity does not match specifications:
   - Remove switch(es) from transmission housing.
   - Test switch(es) for continuity. Each switch is normally closed. Depress contact ball on end of switch and check continuity. Switch should be open (NO continuity) with ball depressed.
8. Replace switch if correct continuity can not be obtained.

Switch Continuity:

Switch Position	Terminal Continuity
NORMALLY CLOSED	A and B
BALL DEPRESSED (OPEN)	None

2-SPEED PTO SWITCH TEST

Reason:

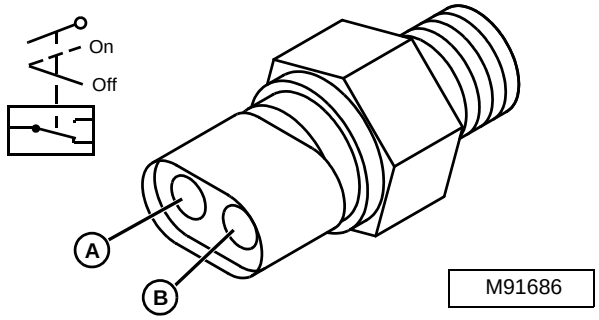
To verify that switch functions properly.

Equipment:

- Ohmmeter or continuity tester

Procedure:

1. Park machine on level surface.
2. Turn key switch to OFF position.
3. Engage park brake.
4. Disengage PTO. Shift 2-speed PTO selector lever to low (540 rpm) range.
5. Disconnect wiring harness connectors from PTO 540 rpm and 750 rpm speed range switches.



6. Using an ohmmeter or continuity tester, check continuity through each switch. One switch should be closed (continuity), and the other switch should be open (no continuity).
7. Shift 2-speed PTO selector lever to high (750 rpm) range.
8. Using an ohmmeter or continuity tester, check continuity through each switch. The continuity should be reversed through each switch.
9. If continuity does not match specifications:
   - Remove switch(es) from transmission housing.
   - Test switch(es) for continuity. Each switch is normally closed. Depress contact ball on end of switch and check continuity. Switch should be open (NO continuity) with ball depressed.
10. Replace switch if correct continuity can not be obtained.

Switch Continuity:

Switch Position	Terminal Continuity
NORMALLY CLOSED	A and B
BALL DEPRESSED (OPEN)	None

FRONT PTO SWITCH TEST

Reason:

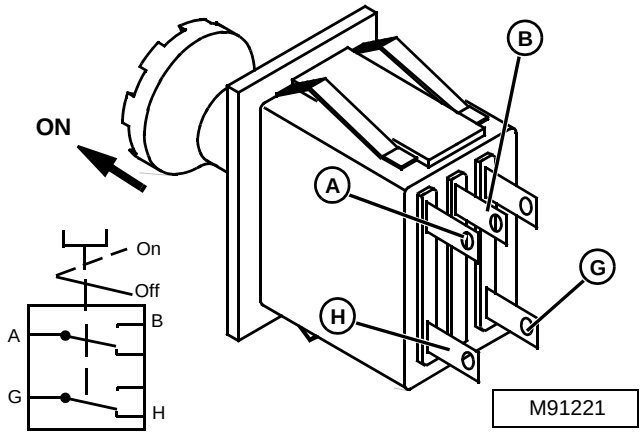
To verify that PTO switch functions properly.

Equipment:

- Ohmmeter or continuity tester

Procedure:

1. Park machine on level surface.
2. Disengage PTO.
3. Turn key switch to OFF position.
4. Engage park brake.
5. Remove plastic kick panel from below steering column support.
6. Disconnect PTO switch connector from harness.
7. Use an ohmmeter or continuity tester to test switch continuity.



Switch Continuity:

Switch Position	Terminal Continuity
ON	A and B
OFF	G and H

Results:

- If continuity is NOT correct, replace the switch.

FRONT PTO SOLENOID TEST

Reason:

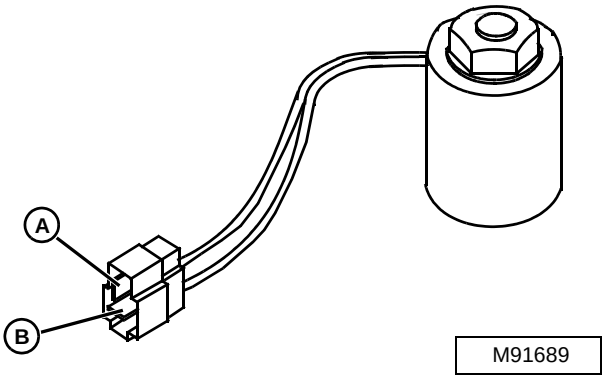
To verify that the solenoid coil is operating properly.

Equipment:

- Ohmmeter or continuity tester
- Voltmeter

Procedure:

1. Park machine on level surface.
2. Disengage PTO.
3. Turn key switch to OFF position.
4. Engage park brake.
5. Remove tunnel cover and rock shaft valve panel.



6. Disconnect PTO solenoid connector.
7. Using an ohmmeter or continuity tester, check if continuity exists between solenoid terminals.

Results:

8. If resistance does not meet specifications, replace solenoid.

Specifications:

A to B. . . . . 8.0 – 9.0 ohms

9. Check for grounds or shorts by connecting tester to one coil terminal and the other to bare metal of coil case.

Results:

- Replace PTO solenoid if continuity is present from either terminal to solenoid coil case.

CRUISE CONTROL SWITCH TEST

Reason:

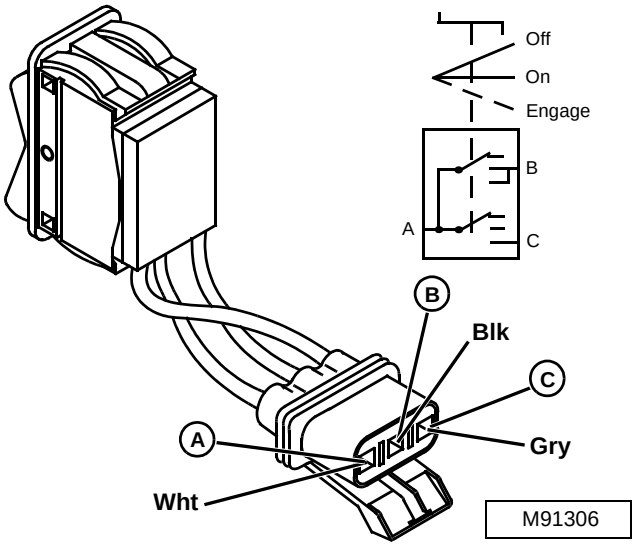
To verify that cruise control switch functions properly.

Equipment:

- Ohmmeter or continuity tester

Procedure:

1. Park machine on level surface.
2. Disengage PTO.
3. Turn key switch to OFF position.
4. Engage park brake.
5. Disconnect and raise control panel.
6. Disconnect cruise control switch connector from harness.
7. Use an ohmmeter or continuity tester to test switch continuity.



Switch Continuity:

Switch Position	Terminal Continuity
OFF	None
ON	A and B
ENGAGE (momentary)	A, B, and C

Results:

- If continuity is NOT correct, or exists in any other combination than shown above, replace the switch.

CRUISE CONTROL MAGNET TEST

Reason:

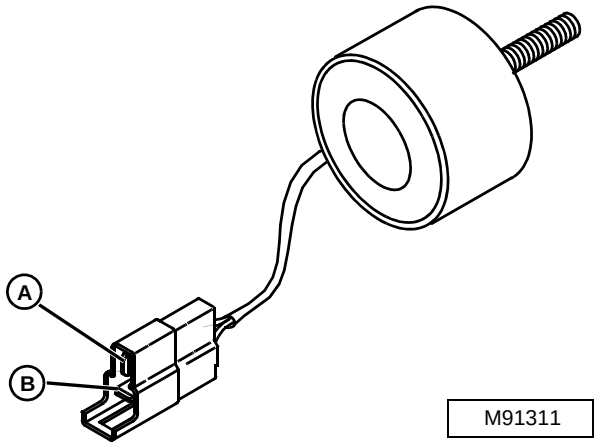
To verify that cruise control magnet is operating properly.

Equipment:

- Ohmmeter or continuity tester

Procedure:

1. Park machine on level surface.
2. Disengage PTO.
3. Turn key switch to OFF position.
4. Engage park brake.
5. Disconnect cruise control magnet connector from harness.
6. Use an ohmmeter or continuity tester to test magnet and housing continuity.



Magnet Continuity:

A to B	Approximately 20 ohms
A to MAGNET HOUSING	None
B to MAGNET HOUSING	None

Results:

- If resistance and continuity are NOT correct, replace the magnet.

BRAKE SWITCH TEST

Reason:

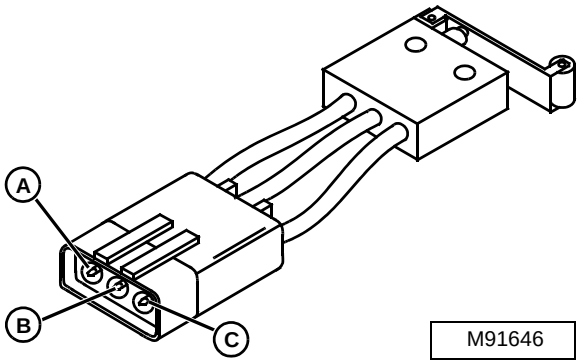
To verify that switch functions properly.

Equipment:

- Ohmmeter or continuity tester

Test Procedure:

1. Park machine on level surface.
2. Disengage PTO.
3. Turn key switch to OFF position.
4. Disconnect brake switch connector.
5. Use an ohmmeter or continuity tester to test switch continuity.



Switch Continuity:

Switch Position	Terminal Continuity
RELEASED	B and C
DEPRESSED	A and B

Results:

- If continuity is NOT correct, or continuity exists in any other combination than listed above, replace switch.

Adjustment Procedure:

1. Release brake pedal.
2. Loosen switch bracket hardware.
3. Move switch until switch plunger closes.
4. Check that switch does not bottom when brake pedal is released.
5. Tighten bracket hardware.
6. Check that switch opens when brake pedal is depressed.

PARK BRAKE SWITCH TEST

Reason:

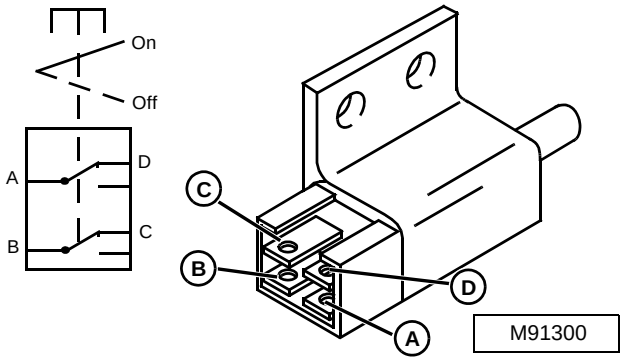
To verify that switch functions properly.

Equipment:

- Ohmmeter or continuity tester

Test Procedure:

1. Park machine on level surface.
2. Disengage PTO.
3. Turn key switch to OFF position.
4. Release parking brake.
5. Disconnect brake switch connector.
6. Use an ohmmeter or continuity tester to test switch continuity.



Switch Continuity:

Switch Position	Terminal Continuity
RELEASED	B and C
	A and D

Results:

- If continuity is NOT correct, or continuity exists in any other combination than listed above, replace switch.

Adjustment Procedure:

1. Engage parking brake.
2. Loosen switch bracket hardware.
3. Move switch until switch plunger is about **3 mm (1/8 in.)** from bottoming.
4. Check that switch does not bottom when parking brake is fully set. Increase clearance if needed.
5. Tighten bracket hardware.
6. Check switch operation.

FUEL GAUGE SENSOR TEST

Reason:

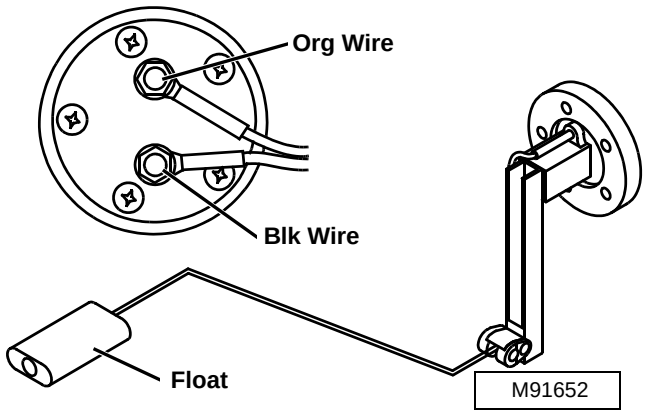
To verify that the fuel gauge sensor is operating properly.

Equipment:

- Ohmmeter or continuity tester

Procedure:

1. Park machine on level surface.
2. Disengage PTO.
3. Engage park brake.
4. Raise hood.
5. Turn key switch to ON position.
6. Disconnect Org wire from fuel sensor and check fuel gauge. The fuel gauge must drop to EMPTY. If not, see "POWER CIRCUIT DIAGNOSIS".
7. Short the Org wire to the black wire connector on the fuel sensor. The gauge must rise to FULL. If not, test the fuel sensor ground circuit.
8. If the gauge does not correctly indicate fuel levels based on the two tests above, proceed to step 9.
9. Disconnect fuel gauge sensor wires.
10. Remove sensor from fuel tank.
11. Using an ohmmeter connected to fuel gauge sensor contacts, check if continuity exists between terminals. If continuity exists, measure resistance across terminals as float and float arm are moved through full range of motion.



Results:

12. If resistance does not meet specifications, replace fuel gauge sensor.

Specifications:

Variable Resistance . . . . . 5 – 95 ohms

FUEL SHUTOFF SOLENOID TESTS

Reason:

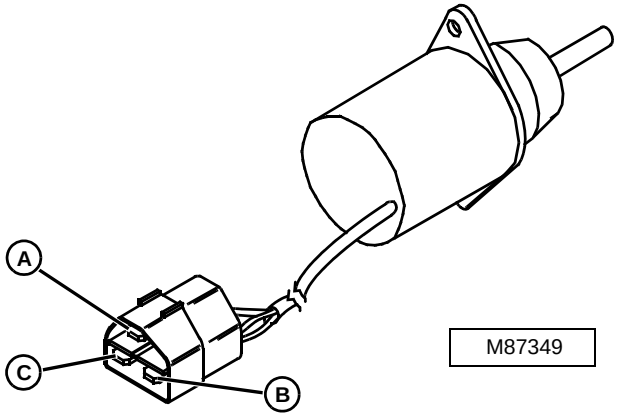
To verify that the solenoid coils are operating properly.

Equipment:

- Ohmmeter or continuity tester
- Voltmeter

Procedure:

1. Park machine on level surface.
2. Disengage PTO.
3. Turn key switch to OFF position.
4. Engage park brake.
5. Raise hood.
6. Remove right engine side cover.
7. Disconnect fuel shutoff solenoid connector.
8. Using an ohmmeter or continuity tester, check if continuity exists between all solenoid terminals.



Results:

9. If resistance does not meet specifications, replace fuel shutoff solenoid.

Specifications:

A to B. . . . . .0.4 ohms
A to C. . . . . .12.4 ohms
B to C. . . . . .12.0 ohms

10. Check for grounds or shorts by connecting tester to one coil terminal and the other to bare metal of coil case.

Results:

- Replace fuel shutoff coil if continuity is present.

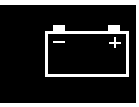
11. Connect fuel shutoff solenoid connector.
12. Listen for click when fuel shutoff solenoid pulls in when either:
    - Operator on seat with or without park brake engaged and key switch turned to ON position;

or:

    - Operator off seat with park brake engaged and key switch turned to ON position;

Results:

- If click is not heard when fuel shutoff solenoid pulls in, see "FUEL SUPPLY OPERATION".



EUROPEAN ELECTRICAL SECTION

The European road tractors have the same electrical circuits as the North American tractors with the addition of lighting circuits required to meet EEC Machinery Directives.

The main electrical wiring harness is specific to the European models, and is identical among all of the European 4200, 4300 and 4400 series tractors.

Lighting additions include the hazard lights switch, flasher relay, brake lights, position lights, and additional control panel indicator lights (2-speed PTO, and trailer indicator lights).

The European tractors have front and 2-speed PTOs (540 and 750 rpm) with control panel indicator lights.

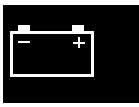
The European tractor wiring harness contains the same wires (both color and number) as the North American tractors, with additional wires required for the additional circuits.

There are variations between the North American and European main wiring harnesses in connector to wire pin locations and numbers. While some circuits such as the Cranking Circuit may be identical, other circuits contain differences that require using the diagnosis sections specific to either North American or European tractors.

Common components (such as the key switch, fuel shutoff solenoid, or park brake switch) are cross referenced to the shared Electrical Tests and Adjustments section. (See “TESTS AND ADJUSTMENTS”). The tests and adjustments given in this section can be used by any North American or European service technician.

ELECTRICAL SCHEMATIC AND WIRING HARNESS LEGEND

NOTE: The wiring harness changed at serial numbers:
LV4200E329006–
LV4300E339506–
LV4400E349015–
X3 was eliminated and all neutral transmission switches now plug into X2.
X15 and the 2-speed PTO wiring harness were eliminated. X36 and X37 were added to connect directly to S14 and S15 (540 rpm and 750 rpm PTO switches).



B1—Fuel Gauge Sensor (SE5, W1)

B2—Engine Oil Pressure Switch (SE5, W1)

B3—Engine Coolant Temperature Sensor (SE5, W1)

B4—Horn (SE5, W1)

E1—LH Front Turn/Hazard Light (SE5, W1)

E2—LH RearTurn/Hazard Light (SE5, W1)

E3—RH Front Turn/Hazard Light (SE5, W1)

E4—RH RearTurn/Hazard Light (SE5, W1)

E5—LH Headlight (SE6, W1)

E6—RH Headlight (SE6, W1)

E7—LH Work Light (Option)(SE6, W1)

E8—RH Work Light (Option)(SE6, W1)

E9—LH Front Position Light (SE6, W1)

E10—LH Rear Position Light (SE6, W1)

E11—LH Brake Light (SE6, W1)

E12—RH Front Position Light (SE6, W1)

E13—RH Rear Position Light (SE6, W1)

E14—RH Brake Light (SE6, W1)

E15—License Plate Light (SE6, W1)

F1—Fuse - 30 amp (SE1, W1)

F2—Fuse - 30 amp (Option)(SE4, W1)

F3—Fuse - 30 amp (SE4, W1)

F4—Fuse - 20 amp (SE4, W1)

F5—Fuse - 10 amp (SE1, W1)

F6—Fuse - 20 amp (SE5, W1)

F7—Fuse - 20 amp (SE5, W1)

F8—Fuse - 20 amp (SE6, W1)

F9—Fuse - 20 amp (SE6, W1)

G1—Battery (SE1, W1)

G2—Alternator (SE3, W1)

H1—RH Turn Light (SE5, W1)

H2—LH Turn Light (SE5, W1)

H3—(Not Used)
H4—Discharge Light (SE5, W1)
H5—Cold Start Light (SE5, W1)
H6—Park Brake Light (SE5, W1)
H7—Engine Oil Pressure Light (SE5, W1)
H8—Cruise Control Indicator Light (SE5, W1)
H9—Mid PTO Light (SE5, W1)
H10—540 PTO Light (SE5, W1)
H11—750 PTO Light (SE5, W1)
H12—Bulb Integrity Light (SE5, W1)
H13—Trailer 1 Light (SE5, W1)
H14—Trailer 2 Light (SE5, W1)
H15—Front PTO Light (SE5, W1)
H16—Backup Alarm (SE2, W1)
K1—Manifold Heater Relay (SE2, W1)
K2—Start Relay (SE1, W1)
K3—Fuel Shutoff Relay (SE2, W1)
K4—Engine Run Relay (SE2, W3)
K5—Safety Relay (SE2, W1)
K6—Safety Relay (SE2, W1)
K7—Accessory Relay (SE4, W1)
K8—Cruise Control Relay (Option)(SE5, W1)
K9—Rear PTO Relay (SE2, W1)
K10—Mid PTO Light Relay (Option) (SE2, W1)
K11—Brake Light Relay (SE5, W1)
K12—Flasher Relay (SE5, W1)
M1—Starting Motor (SE1, W1)
P1—Engine Tachometer (SE5, W1)
P2—Hour Meter (SE5, W1)
P3—Fuel Gauge (SE5, W1)
P4—Engine Coolant Temperature Gauge (SE5, W1)
R1—Manifold Heater (SE1, W1)
R2—Variable Thermistor (SE2, W1)
S1—Key Switch (SE1, W1)
S2—Seat Switch (SE1, W1)
S3—Transmission Neutral Switch (HST and SRT) (SE2, W1)
S4—Transmission Neutral Switch (CST)(SE1, W1)
S5—(Not Used)
S6—Rear PTO Switch (SE2, W1)
S7—Park Brake Switch (SE2, W1)
S8—Turn Signal Switch (SE5, W1)
S9—Light Switch (SE5, W1)
S10—Cruise Control Switch (Option)(SE5, W1)
S11—Brake Switch (Option)(SE5, W1)
S12—Horn Switch (SE5, W1)
S13—Hazard Switch (SE5, W1)
S14—540 PTO Switch (Option)(SE2, W1)
S15—750 PTO Switch (Option)(SE2, W1)
S16—Brake Switch (SE5, W1)
S17—Mid PTO Switch (Option)(SE2, W1)
S18—Front PTO Switch (Option)(SE2, W1)
V1—Diode Block (SE2, W1)
V2—Diode (SE2, W1)
W1—Battery Frame Ground (SE1, W1)
Y1—Starting Motor Solenoid (SE1, W1)
Y2—Fuel Shutoff Solenoid (SE2, W1)
Y3—Cruise Control Magnet (Option)(SE5, W1)
Y4—Front PTO Solenoid (Option)(SE2, W1)

CONNECTORS:

X1—W1 Main Wiring Harness to Fusible Link (SE1, W1)

NOTE: Early Model Tractors: X2 supplied with cap and jumper wire if X3 is connected to transmission neutral switch on or gear (CST) tractors.
X3 supplied with cap and jumper wire if X2 is connected to transmission neutral switch on hydro (HST) or SyncReverser™ (SRT) tractors.
Later Model Tractors: X2 is used for all model tractors to connect the transmission neutral start switch.
LV4200E329006–
LV4300E339506–
LV4400E349015–
The 2-speed PTO harness was eliminated and the main wiring harness connects directly to the two separate PTO switches (S14 and S15). connector X15 replaced by X36 and X37.

X2—W1 Main Wiring Harness to W3 HST Neutral Start Wiring Harness (HST and SRT) (SE2, W1)
X3—W1 Main Wiring Harness to S4 Transmission Neutral Switch (Gear Only) (SE2, W1)
X4—W1 Main Wiring Harness to W2 Fuel Shutoff Solenoid Wiring Harness (SE2, W1)
X5—W1 Main Wiring Harness to S17 Mid PTO Switch (Option) (SE2, W1)
X6—W1 Main Wiring Harness to Control Panel Circuit Board (SE4/SE5, W1)
X7—W1 Main Wiring Harness to Control Panel Circuit Board (SE4/SE5, W1)
X8—W1 Main Wiring Harness to Control Panel Circuit

Board (SE5, W1)

X9—W1 Main Wiring Harness to W4 Cruise Control Wiring Harness (SE4, W1)

X10—W4 Cruise Control Wiring Harness to S10 Cruise Control Switch (SE5, W4)

X11—W4 Cruise Control Wiring Harness to S11 Brake Switch (SE5, W4)

X12—W4 Cruise Control Wiring Harness to W5 Cruise Control Magnet Wiring Harness (SE5, W4)

X13—W1 Main Wiring Harness to W6 Trailer Connector Wiring Harness (SE5/SE6, W1)

X14—W1 Main Wiring Harness to W6 Trailer Connector Wiring Harness (SE4, W1)

X15—W1 Main Wiring Harness to W7 2-Speed PTO Wiring Harness (SE2, W1) (Early Models Only)

X16—W1 Main Wiring Harness to E8 RH Work Light (Option) (SE6, W1)

X17—W1 Main Wiring Harness to E7 LH Work Light (Option) (SE6, W1)

X18—W1 Main Wiring Harness to E1 LH FrontTurn/ Hazard Light

X19—W1 Main Wiring Harness to E2 LH Rear Turn/ Hazard Light

X20—W1 Main Wiring Harness to E9 LH Front Position Light

X21—W1 Main Wiring Harness to E1 LH FrontTurn/ Hazard Light and E9 LH Front Position Light

X22—W1 Main Wiring Harness to E10 LH Rear Position Light

X23—W1 Main Wiring Harness to E11 LH Brake Light

X24—W1 Main Wiring Harness to E2 LH Rear Turn/ Hazard Light, E10 LH Rear Position Light, and E11 LH Brake Light

X25—W1 Main Wiring Harness to E3 RH Front Turn/ Hazard Light

X26—W1 Main Wiring Harness to E4 RH Rear Turn/ Hazard Light

X27—W1 Main Wiring Harness to E13 RH Rear Position Light

X28—W1 Main Wiring Harness to E14 RH Brake Light

X29—W1 Main Wiring Harness to E4 RH Rear Turn/ Hazard Light, E13 RH Rear Position Light, and E14 RH Brake Light

X30—W1 Main Wiring Harness to E12 RH Front Position Light

X31—W1 Main Wiring Harness to E3 RH Front Turn/ Hazard Light and E12 RH Front Position Light

X32—W1 Main Wiring Harness to E15 License Plate Light

X33—W1 Main Wiring Harness to S16 Brake Switch

X34—W1 Main Wiring Harness to W8 Front PTO Wiring Harness (Option)(SE2, W1)

X35—W8 Front PTO Wiring Harness to Y4 Front PTO Solenoid (Option)(SE2, W1)

X36—W1 Main Wiring Harness to S14 540 Rear PTO Switch (SE2, W1) (Later Models)

X37—W1 Main Wiring Harness to S16 750 Rear PTO Switch (SE2, W1) (Later Models)

WIRING HARNESSES:

W1—Main Wiring Harness

W2—Fuel Shutoff Solenoid Wiring Harness

W3—HST Transmission Neutral Start Wiring Harness - included in the W4 Wiring Harness protective wrap

W4—Cruise Control Wiring Harness (Option)

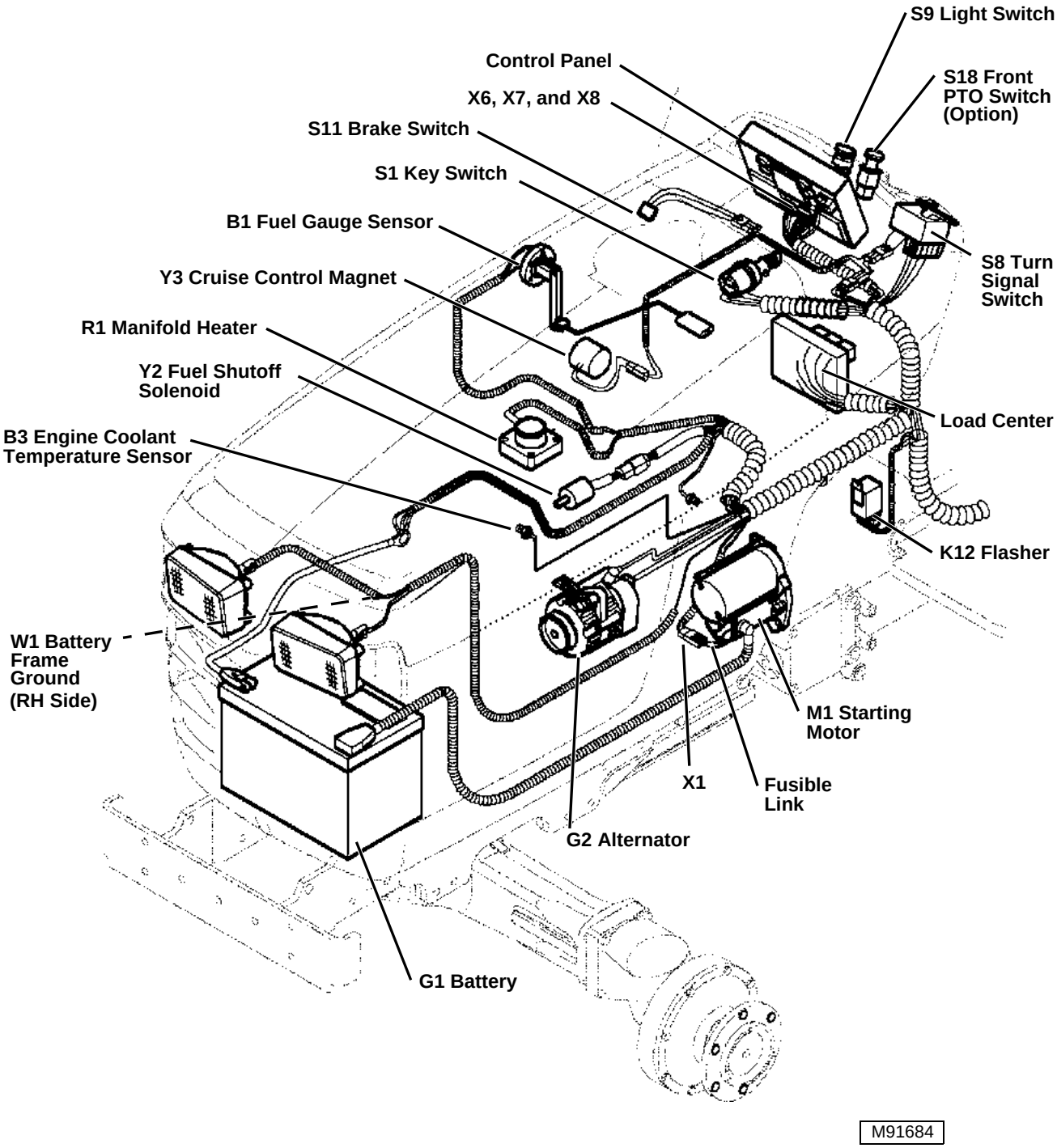
W5—Cruise Control Magnet Wiring Harness (Option)

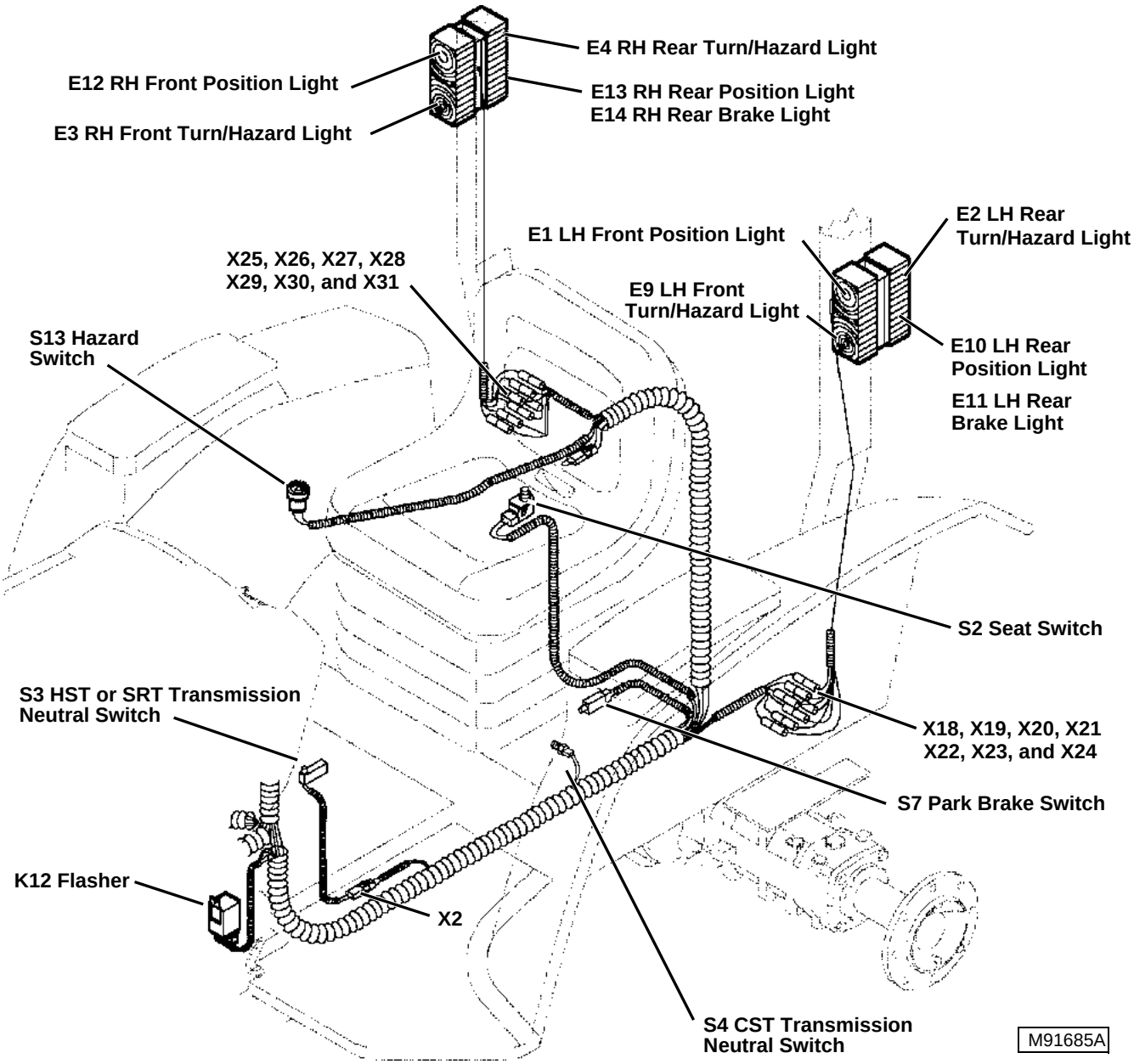
W6—Trailer Connector Wiring Harness (Option)

W7—2-Speed PTO Wiring Harness (Early Models Only)

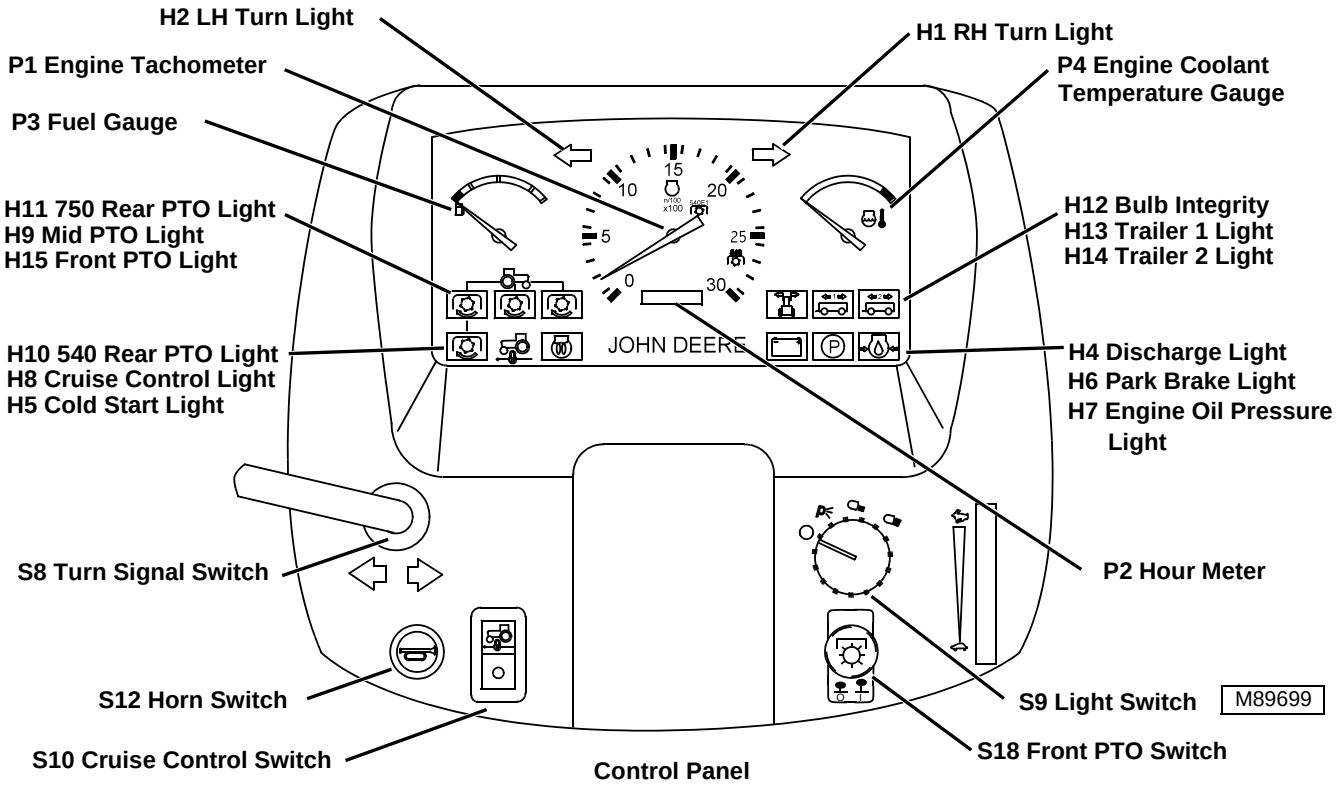
W8—Front PTO Wiring Harness (Option)

COMPONENT LOCATION – TRACTOR

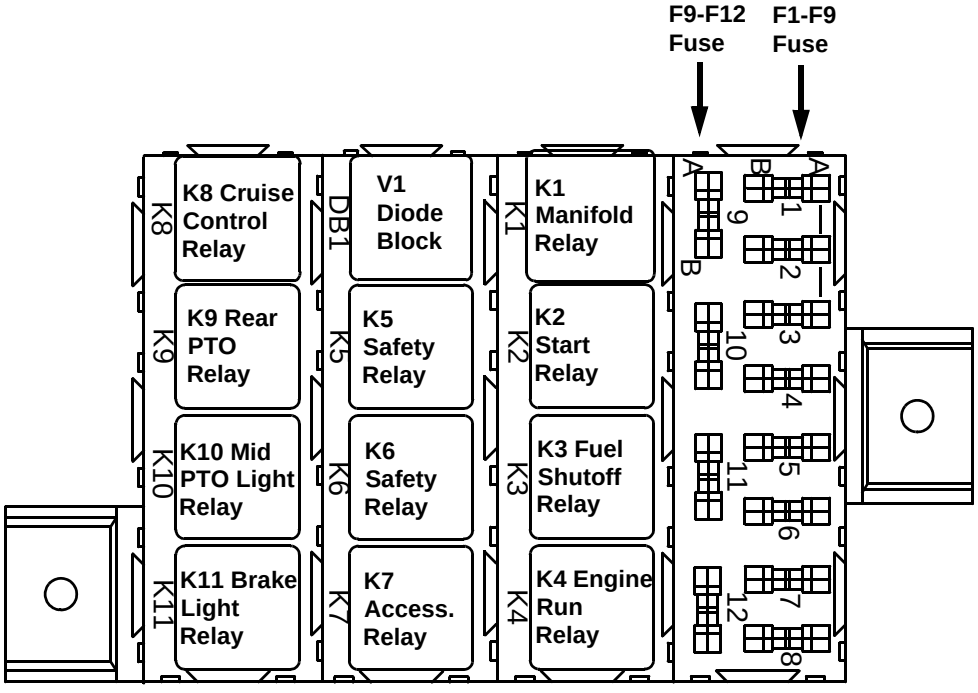



E4 RH Rear Turn/Hazard Light
E12 RH Front Position Light
E13 RH Rear Position Light
E14 RH Rear Brake Light
E3 RH Front Turn/Hazard Light
E1 LH Front Position Light
E2 LH Rear
Turn/Hazard Light
X25, X26, X27, X28
X29, X30, and X31
E9 LH Front
Turn/Hazard Light
S13 Hazard
Switch
E10 LH Rear
Position Light
E11 LH Rear
Brake Light
S2 Seat Switch
S3 HST or SRT Transmission
Neutral Switch
X18, X19, X20, X21
X22, X23, and X24
S7 Park Brake Switch
K12 Flasher
X2
S4 CST Transmission
Neutral Switch
M91685A

COMPONENT LOCATION – CONTROLS & LOAD CENTER



Control Panel



Load Center
Relays / Diode Block / Fuses

WIRE COLOR CODES (EARLY MODELS)

Circuit Number	Wire Size	Color	Termination Points
002A	5.0	Red	M1, G2
002B	5.0	Red	X1 (Fusible Link), K1(30)
002C	5.0	Red	X1 (Fusible Link), Splice 002
002D	5.0	Red	Splice 002, F2
002E	1.0	Red	Splice 002, K4(30)
010A	1.0	Blk	E6, Splice 010a
010B	1.0	Blk	E5, Splice 010a
010C	5.0	Blk	W1, Splice 010b
010D	0.8	Blk	DB1-7, Splice 010a
010E	0.5	Blk	DB1-7, K2(85)
010F	0.5	Blk	K2(85), K3(85)
010G	0.8	Blk	Splice 010b, X21
010H	0.8	Blk	Splice 010b, X17
010J	2.0	Blk	Splice 010b, X13
010K	0.8	Blk	Splice 010b, X16
010L	0.8	Blk	Splice 010b, X29
010N	1.0	Blk	X4, Splice 010a
010P	1.0	Blk	Splice 010b, S13
010Q	0.8	Blk	Splice 010b, X31
010R	0.8	Blk	Splice 010b, X32
010S	0.8	Blk	Splice 010b, X24
010T	(–)	Therm.	K3(85), R2
010U	0.8	Blk	Splice 010a, B4
010V	5.0	Blk	Splice 010a, W1
010X	1.0	Blk	Splice 010a, K12
012	5.0	Red	S1, F1
042A	2.0	Red	F4, Splice 042
042B	1.0	Red	Splice 042, K11(30)
042C	1.0	Red	Splice 042, S13
042D	0.8	Red	Splice 042, X33
050A	2.0	Blk	W1, Splice 050
050B	0.5	Blk	K1(85), Splice 050
050C	0.5	Blk	K1(85), K4(85)
050D	0.5	Blk	K4(85), K5(85)
050E	0.5	Blk	K5(85), K6(85)
050F	0.5	Blk	K6(85), K7(85)
050G	0.5	Blk	K7(85), K8(85)
050H	0.5	Blk	K8(85), K10(85)
050J	0.8	Blk	Splice 050, X9
050K	1.0	Blk	Splice 050, X6
050L	0.5	Blk	B1, Splice 050
050M	0.5	Blk	K10(85), K11(85)
050N	0.5	Blk	K11(85), K9(85)
072A	1.0	Red	X6, Splice 072
072B	1.0	Red	S1, Splice 072
072C	0.8	Red	Splice 072, F5
072D	0.8	Red	Splice 072, G2
072E	0.8	Red	Splice 072, S13
102	1.0	Red	K12, S13
103A	1.0	Org	S9, Splice 103
103B	1.0	Org	Splice 103, F9
103C	1.0	Org	Splice 103, F8
115A	1.0	Dk Grn	S8, Splice 115
115B	0.8	Dk Grn	X7, Splice 115
115C	0.8	Dk Grn	Splice 115, X26
115D	0.8	Dk Grn	Splice 115, X25
115E	1.0	Dk Grn	Splice 115, X13
115F	1.0	Dk Grn	Splice 115, S13
116	0.8	Lt Blu	X33, K11(86)
118A	2.0	Gry	F8, Splice 118
118B	1.0	Gry	Splice 118, X13
118C	0.8	Gry	Splice 118, X20
118D	0.8	Gry	Splice 118, X27
118E	0.8	Gry	Splice 118, X32
119A	1.0	Wht	E6, Splice 119
119B	1.0	Wht	E5, Splice 119
119C	2.0	Wht	Splice 119, F7
119D	0.8	Wht	Splice 119, X6
122A	1.0	Red	S12, Splice 122
122B	3.0	Red	S9, Splice 122
122C	3.0	Red	F3, Splice 122
125A	1.0	Dk Grn	S8, Splice 125
125B	0.8	Dk Grn	X7, Splice 125
125C	0.8	Dk Grn	Splice 125, X19
125D	0.8	Dk Grn	Splice 125, X18
125E	1.0	Dk Grn	Splice 125, X13
125F	1.0	Dk Grn	Splice 125, S13
127A	1.0	Pur	S8, Splice 127
127B	1.0	Pur	Splice 127, S8
127C	1.0	Pur	Splice 127, S13
127D	1.0	Pur	Splice 127, K12
128A	2.0	Gry	F9, Splice 128
128B	1.0	Gry	Splice 128, X13
128C	0.8	Gry	Splice 128, X30
128D	0.8	Gry	Splice 128, X22
136A	2.0	Lt Blu	K11(87), Splice 136
136B	1.0	Lt Blu	Splice 136, X13
136C	0.8	Lt Blu	Splice 136, X23
136D	0.8	Lt Blu	Splice 136, X28
138	2.0	Gry	S9, F7
143	2.0	Org	S9, F6
144	0.8	Yel	K12(C3), X8
146	0.8	Lt Blu	K12(C2), X8
147A	2.0	Pur	F6, Splice 147
147B	0.8	Pur	Splice 147, X17
147D	0.8	Pur	Splice 147, X16
148	0.8	Gry	K12(C), X8
209	0.8	Wht	S1, X9
212	0.5	Red	S1, K7(86)
222	2.0	Red	K7(87), X14
238	0.8	Gry	X9, K8(86)
247	0.8	Pur	X9, K8(87)
252	2.0	Red	F2, K7(30)
264A	0.8	Yel	K8(30), X9
264B	0.8	Yel	K8(30), X6
302A	1.0	Red	DB1- 8, Splice 302
302B	1.0	Red	K4(87), Splice 302
302C	1.0	Red	Splice 302, X4
309	1.0	Wht	K2(87), M1
319	(+)	Therm.	K3(87a), R2
325	0.8	Dk Grn	G2, X6
329A	1.0	Wht	X4, K3(30)
329B	1.0	Wht	K3(30), K3(86)
334	0.8	Yel	G2, X7
347	0.5	Pur	X6, B2
353	0.5	Org	X6, B1
359	0.5	Wht	X6, B3
383	3.0	Org	K1(87), R1
385A	0.8	Dk Grn	Splice 385, X7
385B	0.8	Dk Grn	S1, Splice 385
385C	0.5	Dk Grn	Splice 385, K1(86)
505	0.5	Dk Grn	X2, X3
518A	0.5	Gry	K2(86), DB1- 6
518B	0.5	Gry	X3, K2(86)
521	0.5	Brn	DB1- 5, K4(86)
533	0.5	Org	K5(87), K6(87a)
539A	0.5	Wht	DB1- 4, DB1- 1
539B	0.5	Wht	S2, DB1- 4
546	0.5	Lt Blu	S7, K5(30)
556	0.5	Lt Blu	DB1- 2, K6(86)
562A	0.8	Red	F5, Splice 562
562B	0.5	Red	Splice 562, K9(30)
562C	0.5	Red	Splice 562, S7
562D	0.5	Red	Splice 562, X34
562E	0.5	Red	Splice 562, S2
562F	0.5	Red	Splice 562, X5
562G	0.5	Red	Splice 562, S6
572A	1.0	Red	S1, K2(30)
572B	0.8	Red	K2(30), DB1- 3
573	0.5	Org	X34, V2
574A	0.5	Yel	Splice 574, X15
574B	0.5	Yel	K9(87a), Splice 574
574D	0.5	Yel	Splice 574, K10(30)
575A	0.5	Dk Grn	S6, K9(86)
575B	0.5	Dk Grn	S6, X34
586	0.5	Lt Blu	S7, X6
587A	0.5	Pur	Splice 587, X2
587B	0.5	Pur	V2, Splice 587
587C	0.5	Pur	K5(86), Splice 587
587D	0.5	Pur	K6(30), Splice 587
594A	0.5	Yel	K10(86), S7
594B	0.5	Yel	X5, K10(86)
737	0.5	Pur	X34, X7
743	0.5	Org	K10(87a), X8
757	0.5	Pur	X15, X7
777	0.5	Pur	X15, X7
903	0.8	Org	S12, B4

WIRE COLOR CODES

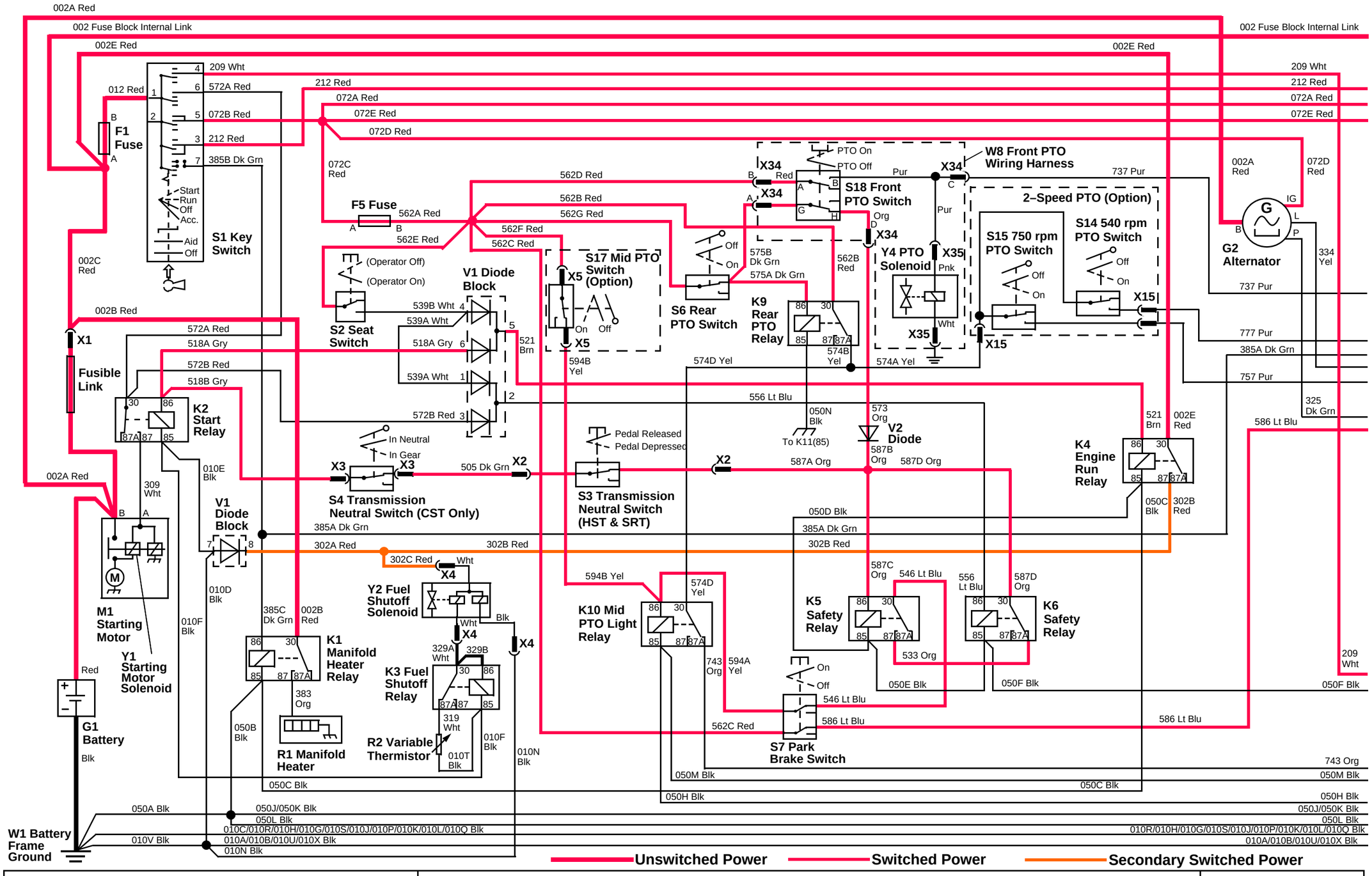
(EARLY MODELS)

Circuit Number	Wire Size	Color	Termination Points
002A	5.0	Red	M1, G2
002B	5.0	Red	X1 (Fusible Link), K1(30)
002C	5.0	Red	X1 (Fusible Link), Splice 002
002D	5.0	Red	Splice 002, F2
002E	1.0	Red	Splice 002, K4(30)
010A	1.0	Blk	E6, Splice 010a
010B	1.0	Blk	E5, Splice 010a
010C	5.0	Blk	W1, Splice 010b
010D	0.8	Blk	DB1-7, Splice 010a
010E	0.5	Blk	DB1-7, K2(85)
010F	0.5	Blk	K2(85), K3(85)
010G	0.8	Blk	Splice 010b, X21
010H	0.8	Blk	Splice 010b, X17
010J	2.0	Blk	Splice 010b, X13
010K	0.8	Blk	Splice 010b, X16
010L	0.8	Blk	Splice 010b, X29
010N	1.0	Blk	X4, Splice 010a
010P	1.0	Blk	Splice 010b, S13
010Q	0.8	Blk	Splice 010b, X31
010R	0.8	Blk	Splice 010b, X32
010S	0.8	Blk	Splice 010b, X24
010T	(–)	Therm.	K3(85), R2
010U	0.8	Blk	Splice 010a, B4
010V	5.0	Blk	Splice 010a, W1
010X	1.0	Blk	Splice 010a, K12
012	5.0	Red	S1, F1
042A	2.0	Red	F4, Splice 042
042B	1.0	Red	Splice 042, K11(30)
042C	1.0	Red	Splice 042, S13
042D	0.8	Red	Splice 042, X33
050A	2.0	Blk	W1, Splice 050
050B	0.5	Blk	K1(85), Splice 050
050C	0.5	Blk	K1(85), K4(85)
050D	0.5	Blk	K4(85), K5(85)
050E	0.5	Blk	K5(85), K6(85)
050F	0.5	Blk	K6(85), K7(85)
050G	0.5	Blk	K7(85), K8(85)
050H	0.5	Blk	K8(85), K10(85)
050J	0.8	Blk	Splice 050, X9
050K	1.0	Blk	Splice 050, X6
050L	0.5	Blk	B1, Splice 050
050M	0.5	Blk	K10(85), K11(85)
050N	0.5	Blk	K11(85), K9(85)
072A	1.0	Red	X6, Splice 072
072B	1.0	Red	S1, Splice 072
072C	0.8	Red	Splice 072, F5
072D	0.8	Red	Splice 072, G2
072E	0.8	Red	Splice 072, S13
102	1.0	Red	K12, S13
103A	1.0	Org	S9, Splice 103
103B	1.0	Org	Splice 103, F9
103C	1.0	Org	Splice 103, F8
115A	1.0	Dk Grn	S8, Splice 115
115B	0.8	Dk Grn	X7, Splice 115
115C	0.8	Dk Grn	Splice 115, X26
115D	0.8	Dk Grn	Splice 115, X25
115E	1.0	Dk Grn	Splice 115, X13
115F	1.0	Dk Grn	Splice 115, S13
116	0.8	Lt Blu	X33, K11(86)
118A	2.0	Gry	F8, Splice 118
118B	1.0	Gry	Splice 118, X13
118C	0.8	Gry	Splice 118, X20
118D	0.8	Gry	Splice 118, X27
118E	0.8	Gry	Splice 118, X32
119A	1.0	Wht	E6, Splice 119
119B	1.0	Wht	E5, Splice 119
119C	2.0	Wht	Splice 119, F7
119D	0.8	Wht	Splice 119, X6
122A	1.0	Red	S12, Splice 122
122B	3.0	Red	S9, Splice 122
122C	3.0	Red	F3, Splice 122
125A	1.0	Dk Grn	S8, Splice 125
125B	0.8	Dk Grn	X7, Splice 125
125C	0.8	Dk Grn	Splice 125, X19
125D	0.8	Dk Grn	Splice 125, X18
125E	1.0	Dk Grn	Splice 125, X13
125F	1.0	Dk Grn	Splice 125, S13
127A	1.0	Pur	S8, Splice 127
127B	1.0	Pur	Splice 127, S8
127C			
127D			
128A			
128B			
128C			
128D			
136A			
136B			
136C			
136D			
138			
143			
144			
146			
147A			
147B			
147D			
148			
209			
212			
222			
238			
247			
252			
264A			
264B			
302A			
302B			
302C			
309			
319			
325			
329A			
329B			
334			
347			
353			
359			
383			
385A			
385B			
385C			

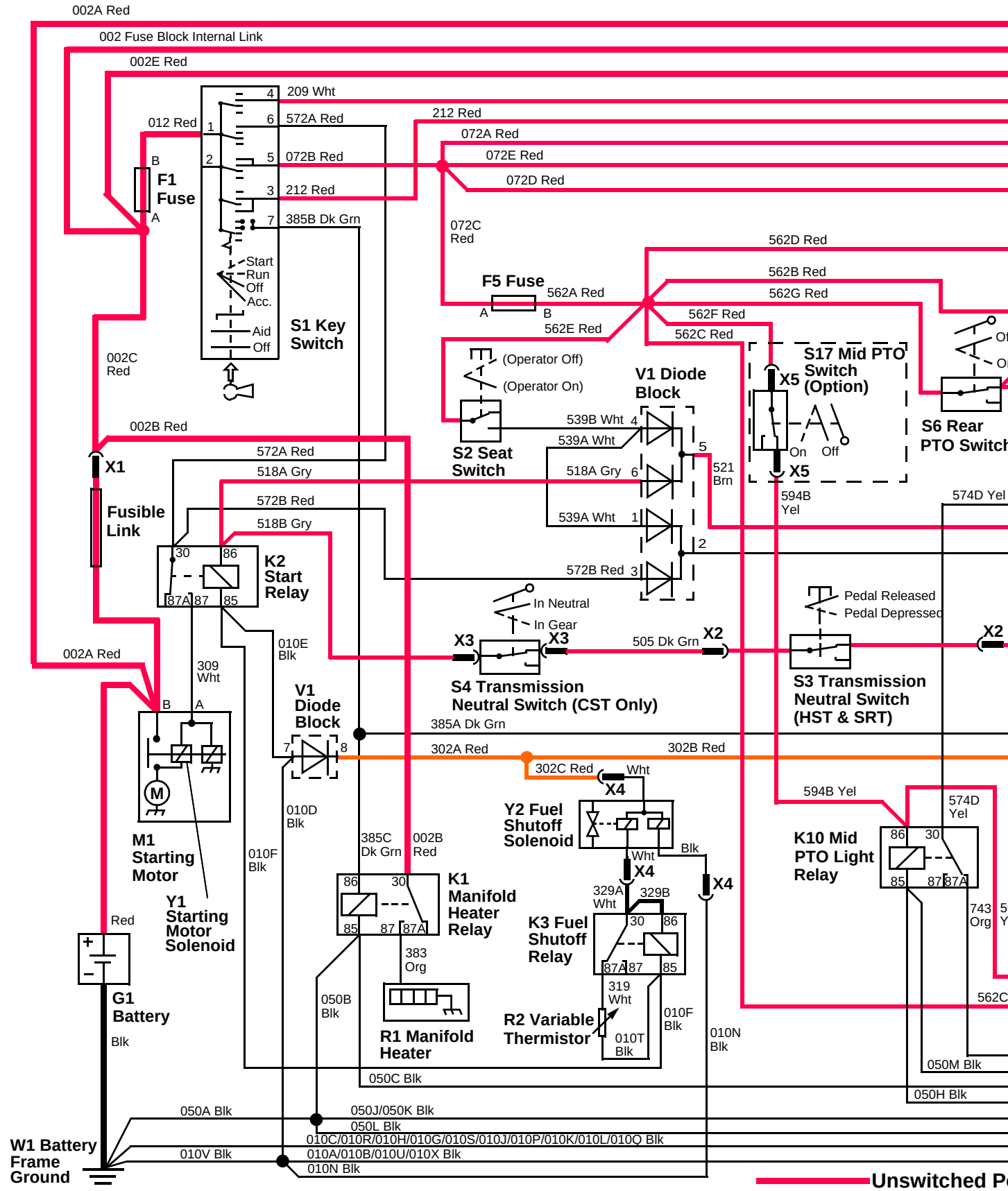
Circuit Number	Wire Size	Color	Termination Points
127C	1.0	Pur	Splice 127, S13
127D	1.0	Pur	Splice 127, K12
128A	2.0	Gry	F9, Splice 128
128B	1.0	Gry	Splice 128, X13
128C	0.8	Gry	Splice 128, X30
128D	0.8	Gry	Splice 128, X22
136A	2.0	Lt Blu	K11(87), Splice 136
136B	1.0	Lt Blu	Splice 136, X13
136C	0.8	Lt Blu	Splice 136, X23
136D	0.8	Lt Blu	Splice 136, X28
138	2.0	Gry	S9, F7
143	2.0	Org	S9, F6
144	0.8	Yel	K12(C3), X8
146	0.8	Lt Blu	K12(C2), X8
147A	2.0	Pur	F6, Splice 147
147B	0.8	Pur	Splice 147, X17
147D	0.8	Pur	Splice 147, X16
148	0.8	Gry	K12(C), X8
209	0.8	Wht	S1, X9
212	0.5	Red	S1, K7(86)
222	2.0	Red	K7(87), X14
238	0.8	Gry	X9, K8(86)
247	0.8	Pur	X9, K8(87)
252	2.0	Red	F2, K7(30)
264A	0.8	Yel	K8(30), X9
264B	0.8	Yel	K8(30), X6
302A	1.0	Red	DB1- 8, Splice 302
302B	1.0	Red	K4(87), Splice 302
302C	1.0	Red	Splice 302, X4
309	1.0	Wht	K2(87), M1
319	(+)	Therm.	K3(87a), R2
325	0.8	Dk Grn	G2, X6
329A	1.0	Wht	X4, K3(30)
329B	1.0	Wht	K3(30), K3(86)
334	0.8	Yel	G2, X7
347	0.5	Pur	X6, B2
353	0.5	Org	X6, B1
359	0.5	Wht	X6, B3
383	3.0	Org	K1(87), R1
385A	0.8	Dk Grn	Splice 385, X7
385B	0.8	Dk Grn	S1, Splice 385
385C	0.5	Dk Grn	Splice 385, K1(86)

Circuit Number	Wire Size	Color	Termination Points
505	0.5	Dk Grn	X2, X3
518A	0.5	Gry	K2(86), DB1- 6
518B	0.5	Gry	X3, K2(86)
521	0.5	Brn	DB1- 5, K4(86)
533	0.5	Org	K5(87), K6(87a)
539A	0.5	Wht	DB1- 4, DB1- 1
539B	0.5	Wht	S2, DB1- 4
546	0.5	Lt Blu	S7, K5(30)
556	0.5	Lt Blu	DB1- 2, K6(86)
562A	0.8	Red	F5, Splice 562
562B	0.5	Red	Splice 562, K9(30)
562C	0.5	Red	Splice 562, S7
562D	0.5	Red	Splice 562, X34
562E	0.5	Red	Splice 562, S2
562F	0.5	Red	Splice 562, X5
562G	0.5	Red	Splice 562, S6
572A	1.0	Red	S1, K2(30)
572B	0.8	Red	K2(30), DB1- 3
573	0.5	Org	X34, V2
574A	0.5	Yel	Splice 574, X15
574B	0.5	Yel	K9(87a), Splice 574
574D	0.5	Yel	Splice 574, K10(30)
575A	0.5	Dk Grn	S6, K9(86)
575B	0.5	Dk Grn	S6, X34
586	0.5	Lt Blu	S7, X6
587A	0.5	Pur	Splice 587, X2
587B	0.5	Pur	V2, Splice 587
587C	0.5	Pur	K5(86), Splice 587
587D	0.5	Pur	K6(30), Splice 587
594A	0.5	Yel	K10(86), S7
594B	0.5	Yel	X5, K10(86)
737	0.5	Pur	X34, X7
743	0.5	Org	K10(87a), X8
757	0.5	Pur	X15, X7
777	0.5	Pur	X15, X7
903	0.8	Org	S12, B4

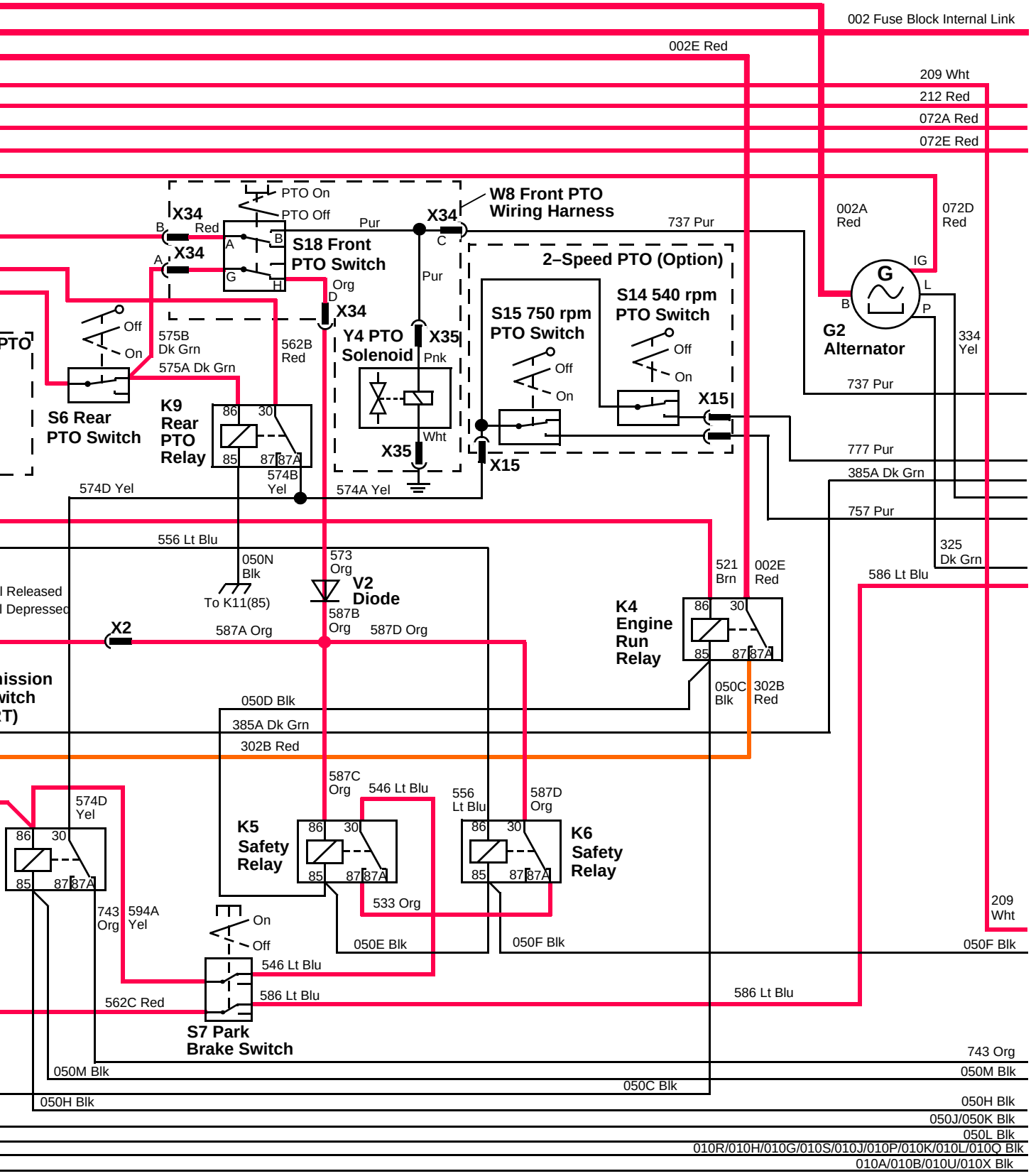
MAIN ELECTRICAL SCHEMATIC–4200/4300/4400 EUROPEAN



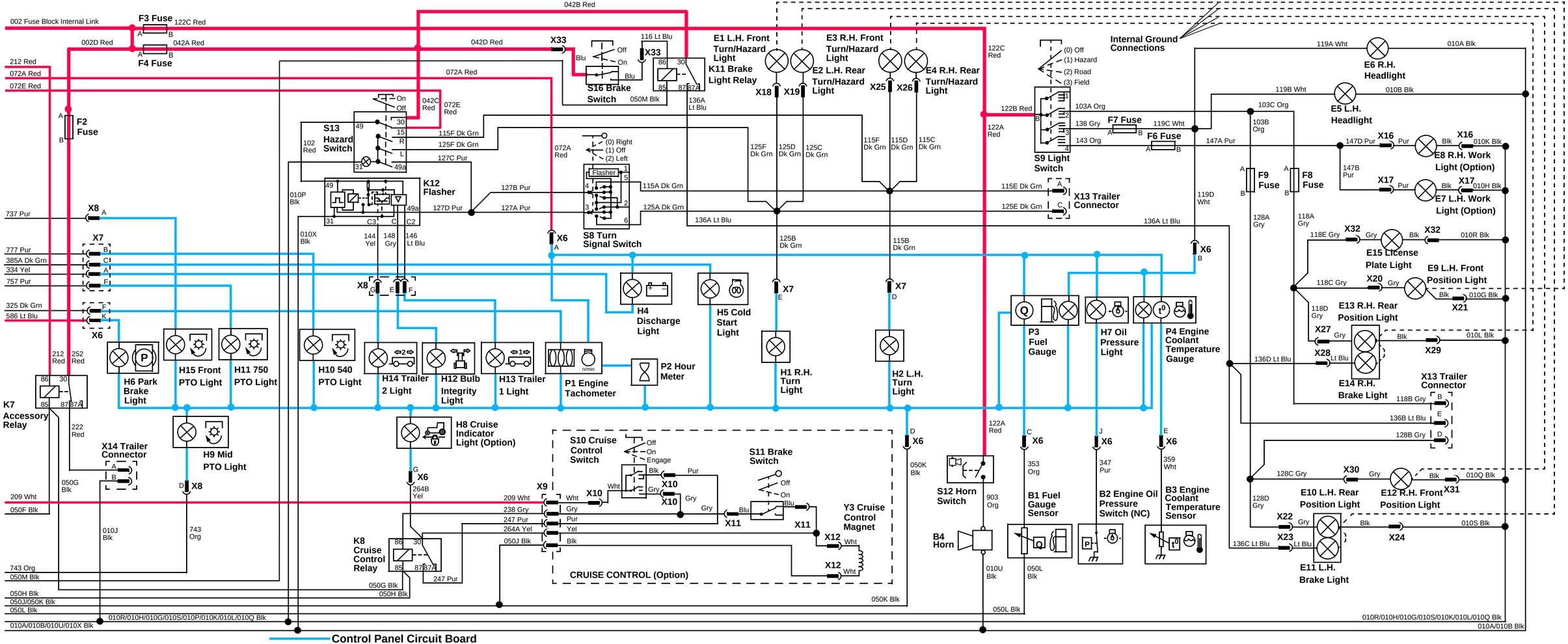
MAIN ELECTRICAL SCHEMATIC–4200/4300/4400 EUROPEAN



SE1 - STARTING	

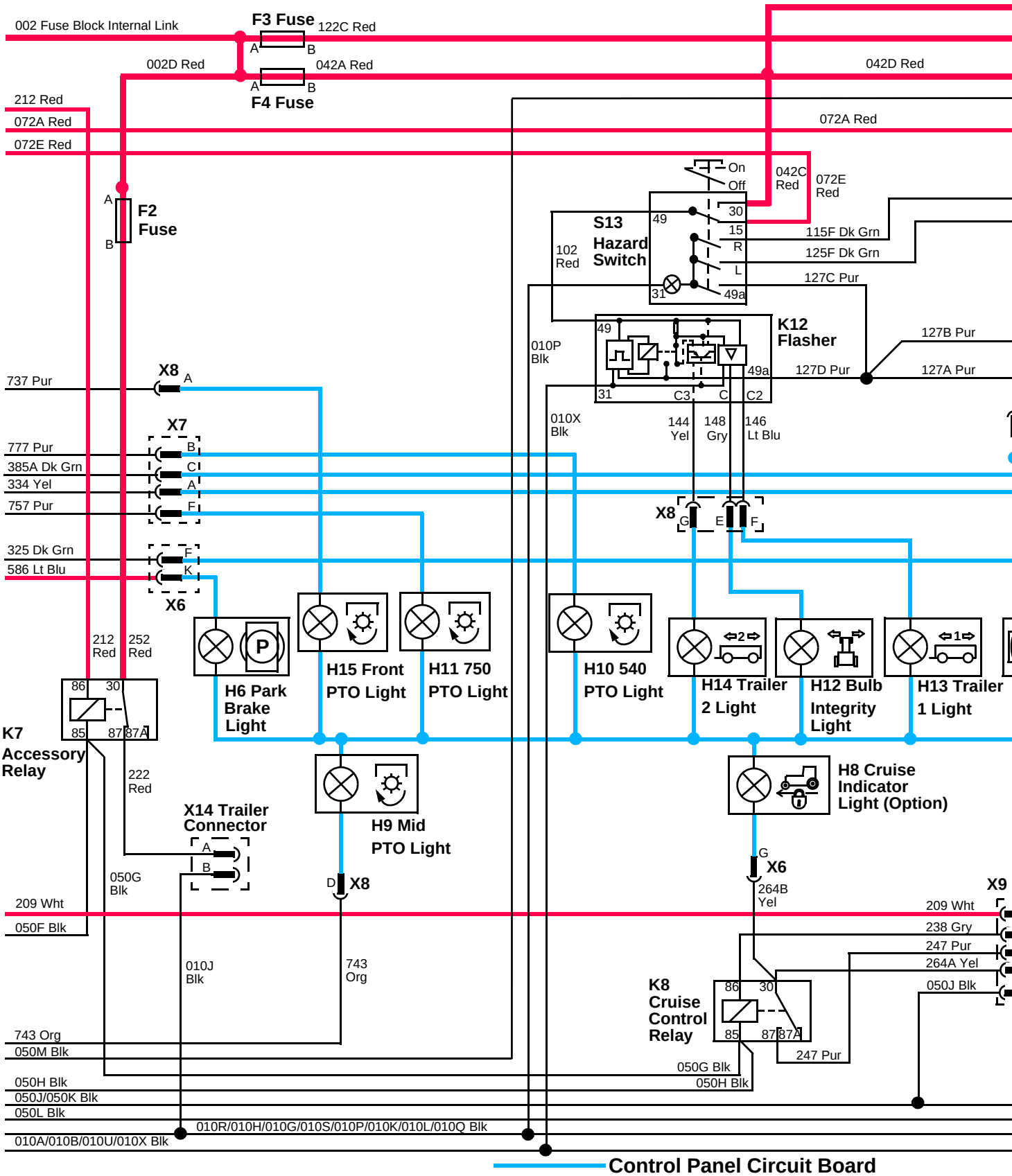

002 Fuse Block Internal Link
002E Red
209 Wht
212 Red
072A Red
072E Red
W8 Front PTO Wiring Harness
PTO On
PTO Off
X34
S18 Front PTO Switch
2–Speed PTO (Option)
S15 750 rpm PTO Switch
S14 540 rpm PTO Switch
Y4 PTO Solenoid
X35
X15
002A Red
072D Red
G2 Alternator
334 Yel
737 Pur
575B Dk Grn
575A Dk Grn
562B Red
S6 Rear PTO Switch
K9 Rear PTO Relay
574B Yel
574D Yel
574A Yel
777 Pur
385A Dk Grn
757 Pur
325 Dk Grn
556 Lt Blu
050N Blk
To K11(85)
573 Org
V2 Diode
587B Org
587A Org
587D Org
X2
521 Brn
002E Red
586 Lt Blu
K4 Engine Run Relay
050C Blk
302B Red
050D Blk
385A Dk Grn
302B Red
587C Org
546 Lt Blu
556 Lt Blu
587D Org
K5 Safety Relay
K6 Safety Relay
533 Org
743 Org
594A Yel
050E Blk
050F Blk
209 Wht
546 Lt Blu
562C Red
586 Lt Blu
S7 Park Brake Switch
743 Org
050M Blk
050C Blk
050H Blk
050J/050K Blk
050L Blk
010R/010H/010G/010S/010J/010P/010K/010L/010Q Blk
010A/010B/010U/010X Blk
Unswitched Power
Switched Power
Secondary Switched Power
SE2 - IGNITION
SE3 - CHARGING

MAIN ELECTRICAL SCHEMATIC–4200/4300/4400 EUROPEAN

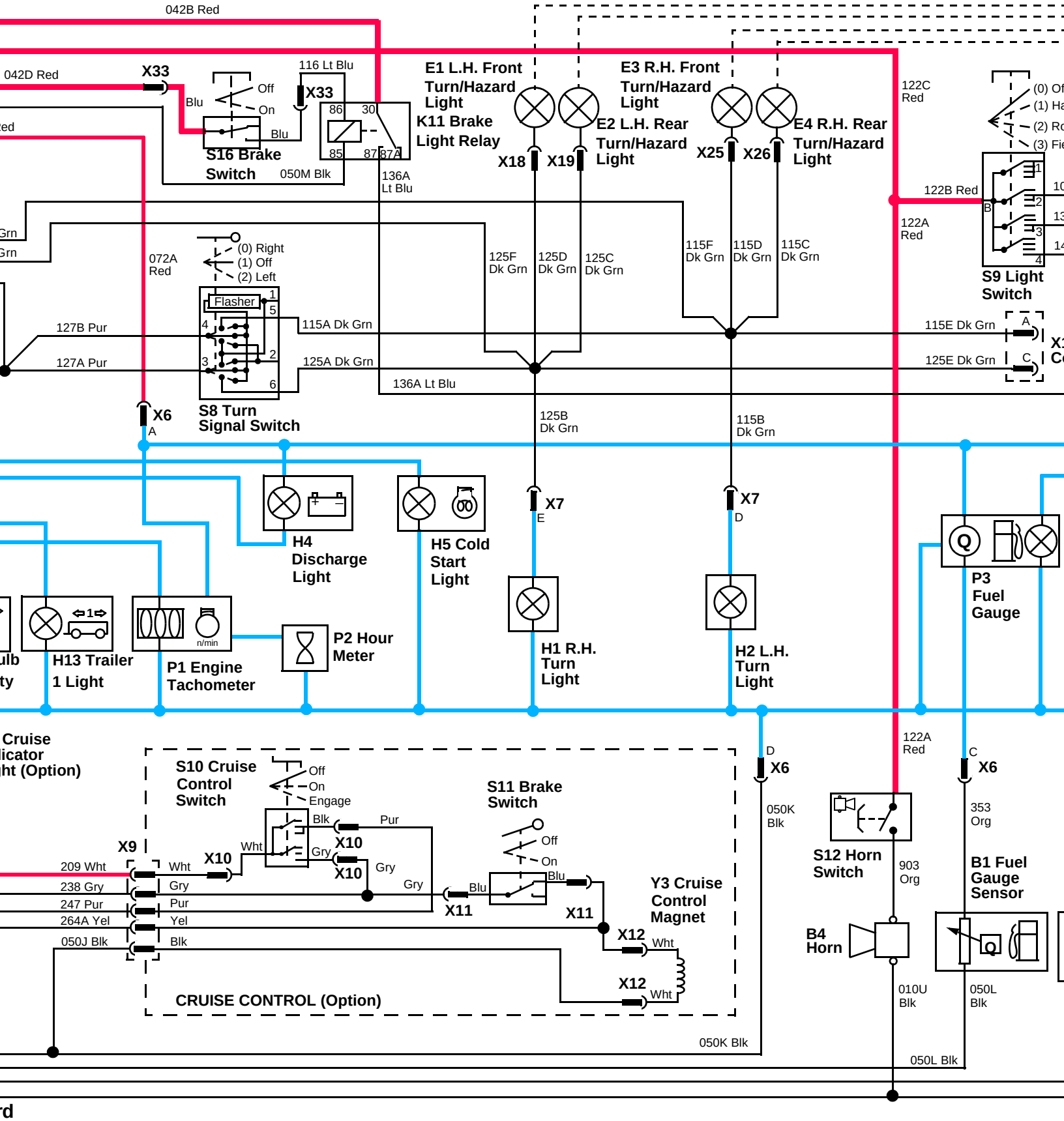


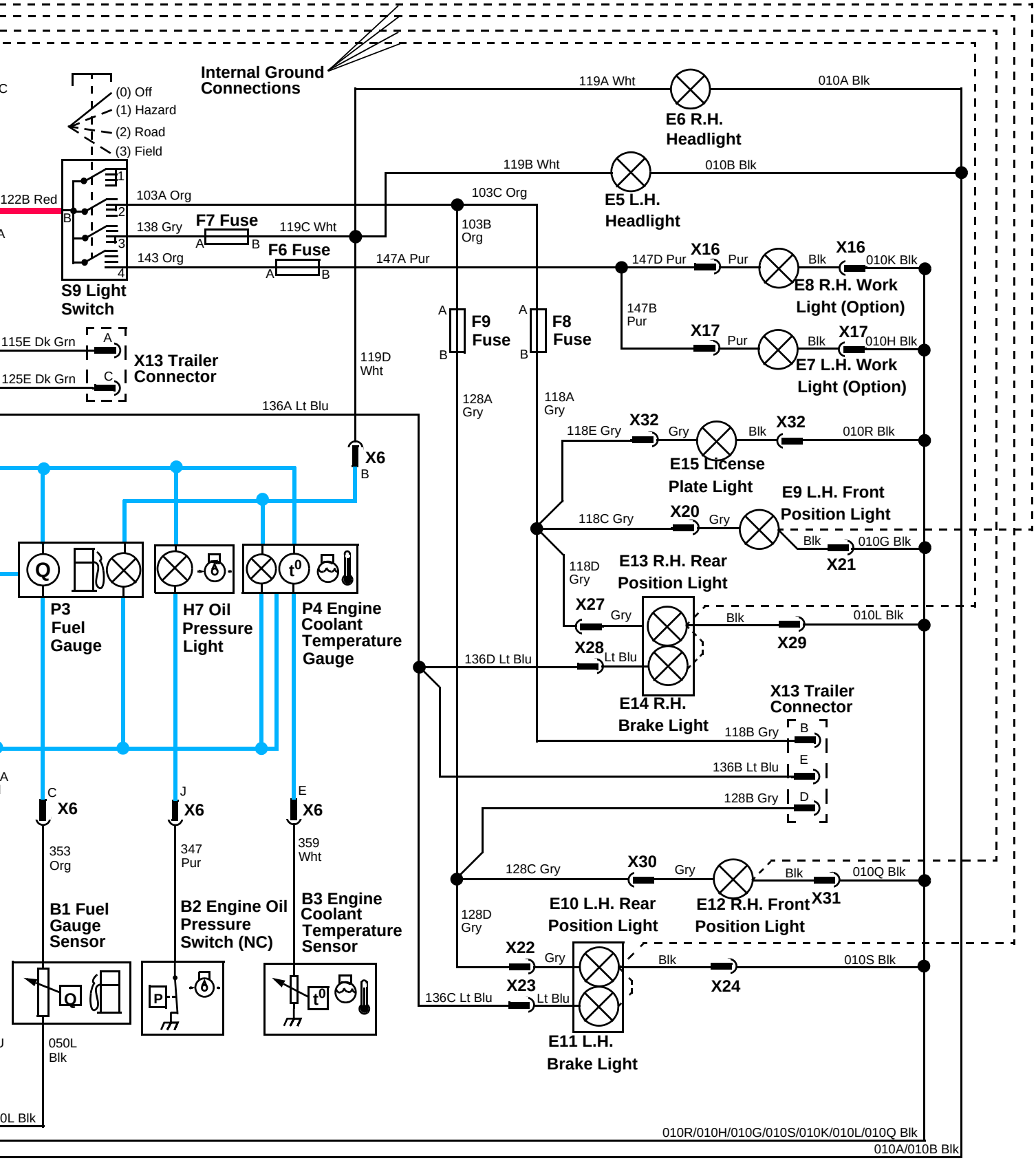
SE4 - ACCESSORIES	SE5 - INSTRUMENTATION	SE6 - LIGHTS

MAIN ELECTRICAL SCHEMATIC–4200/4300/4400 EUROPEAN



SE4 - ACCESSORIES	


042B Red
042D Red
X33
Off
On
Blu
Blu
S16 Brake Switch
050M Blk
116 Lt Blu
X33
86
30
85
87
87A
136A Lt Blu
K11 Brake Light Relay
E1 L.H. Front Turn/Hazard Light
X18
X19
E2 L.H. Rear Turn/Hazard Light
E3 R.H. Front Turn/Hazard Light
X25
X26
E4 R.H. Rear Turn/Hazard Light
122C Red
122B Red
122A Red
S9 Light Switch
072A Red
(0) Right
(1) Off
(2) Left
Flasher
S8 Turn Signal Switch
127B Pur
127A Pur
115A Dk Grn
125A Dk Grn
125F Dk Grn
125D Dk Grn
125C Dk Grn
115F Dk Grn
115D Dk Grn
115C Dk Grn
115E Dk Grn
125E Dk Grn
136A Lt Blu
X6
A
125B Dk Grn
115B Dk Grn
X7
E
X7
D
H4 Discharge Light
H5 Cold Start Light
H1 R.H. Turn Light
H2 L.H. Turn Light
P3 Fuel Gauge
H13 Trailer 1 Light
P1 Engine Tachometer
P2 Hour Meter
S10 Cruise Control Switch
Off
On
Engage
S11 Brake Switch
X9
209 Wht
238 Gry
247 Pur
264A Yel
050J Blk
X10
X11
X12
Y3 Cruise Control Magnet
CRUISE CONTROL (Option)
D
X6
050K Blk
050K Blk
122A Red
C
X6
353 Org
S12 Horn Switch
903 Org
B1 Fuel Gauge Sensor
B4 Horn
010U Blk
050L Blk
050L Blk


Internal Ground Connections
(0) Off
(1) Hazard
(2) Road
(3) Field
S9 Light Switch
122B Red
103A Org
138 Gry
143 Org
F7 Fuse
F6 Fuse
119C Wht
103C Org
103B Org
147A Pur
119A Wht
010A Blk
E6 R.H. Headlight
119B Wht
010B Blk
E5 L.H. Headlight
147D Pur
X16
Pur
Blk
010K Blk
E8 R.H. Work Light (Option)
147B Pur
X17
010H Blk
E7 L.H. Work Light (Option)
F9 Fuse
F8 Fuse
115E Dk Grn
125E Dk Grn
X13 Trailer Connector
119D Wht
128A Gry
118A Gry
136A Lt Blu
X6
118E Gry
X32
010R Blk
E15 License Plate Light
E9 L.H. Front Position Light
118C Gry
X20
X21
010G Blk
118D Gry
E13 R.H. Rear Position Light
X27
X28
X29
010L Blk
Lt Blu
136D Lt Blu
E14 R.H. Brake Light
118B Gry
136B Lt Blu
128B Gry
P3 Fuel Gauge
H7 Oil Pressure Light
P4 Engine Coolant Temperature Gauge
353 Org
347 Pur
359 Wht
B1 Fuel Gauge Sensor
B2 Engine Oil Pressure Switch (NC)
B3 Engine Coolant Temperature Sensor
050L Blk
128C Gry
X30
X31
010Q Blk
E10 L.H. Rear Position Light
E12 R.H. Front Position Light
128D Gry
X22
X23
X24
010S Blk
136C Lt Blu
E11 L.H. Brake Light
010R/010H/010G/010S/010K/010L/010Q Blk
010A/010B Blk

	SE6 - LIGHTS

MAIN WIRING HARNESS–4200/4300/4400 EUROPEAN

FUSE WIRE CONNECTIONS

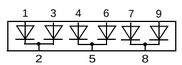
#	SIZE	A	B
F1	30A	002	012
F2	30A	002D	252
F3	30A	002	122C
F4	20A	002	042A
F5	10A	072C	562A
F6	20A	143	147A
F7	20A	138	119C
F8	20A	103C	118A
F9	20A	103B	128A

DIODE BLOCK

#	1	2	3	4	5	6	7	8	9
DB1	539A	556	572B	539A/539B	521	518A	010D/010E	302A	– – –

Diode Block Socket Layout

Diode Block Internal



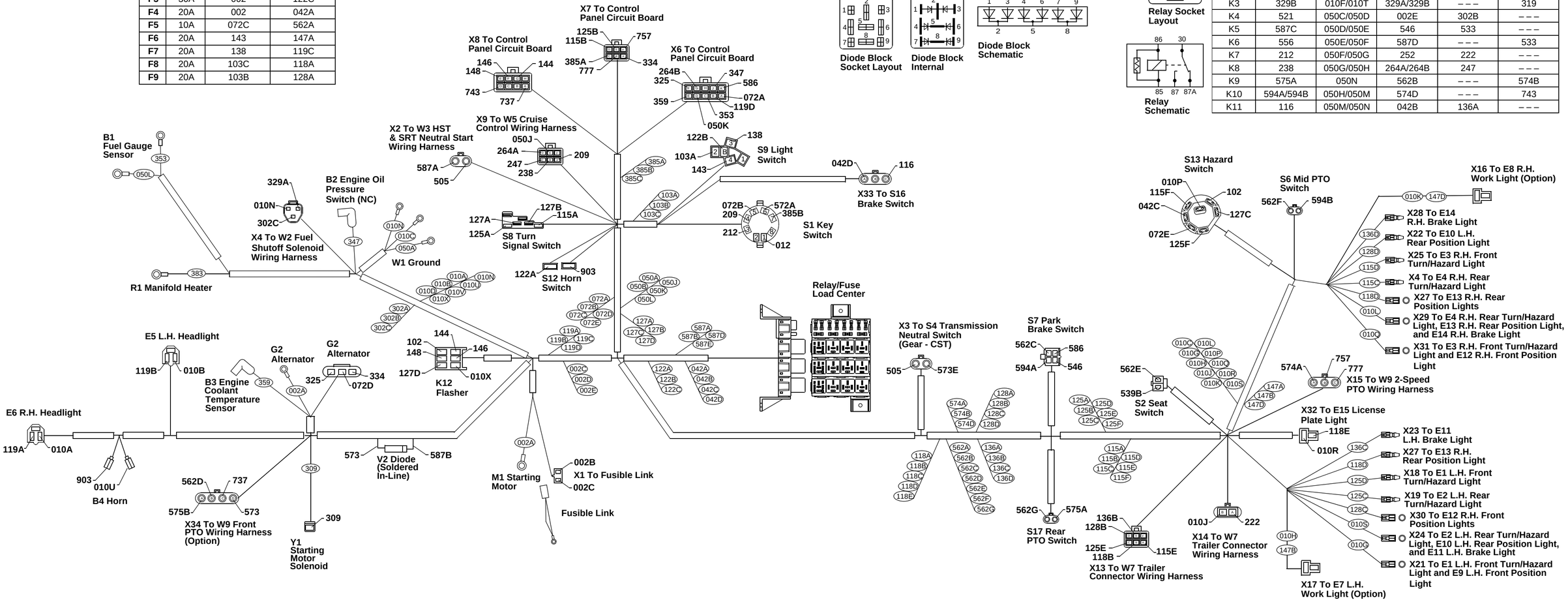
Diode Block Schematic

Relay Socket Layout

Relay Schematic

RELAYS

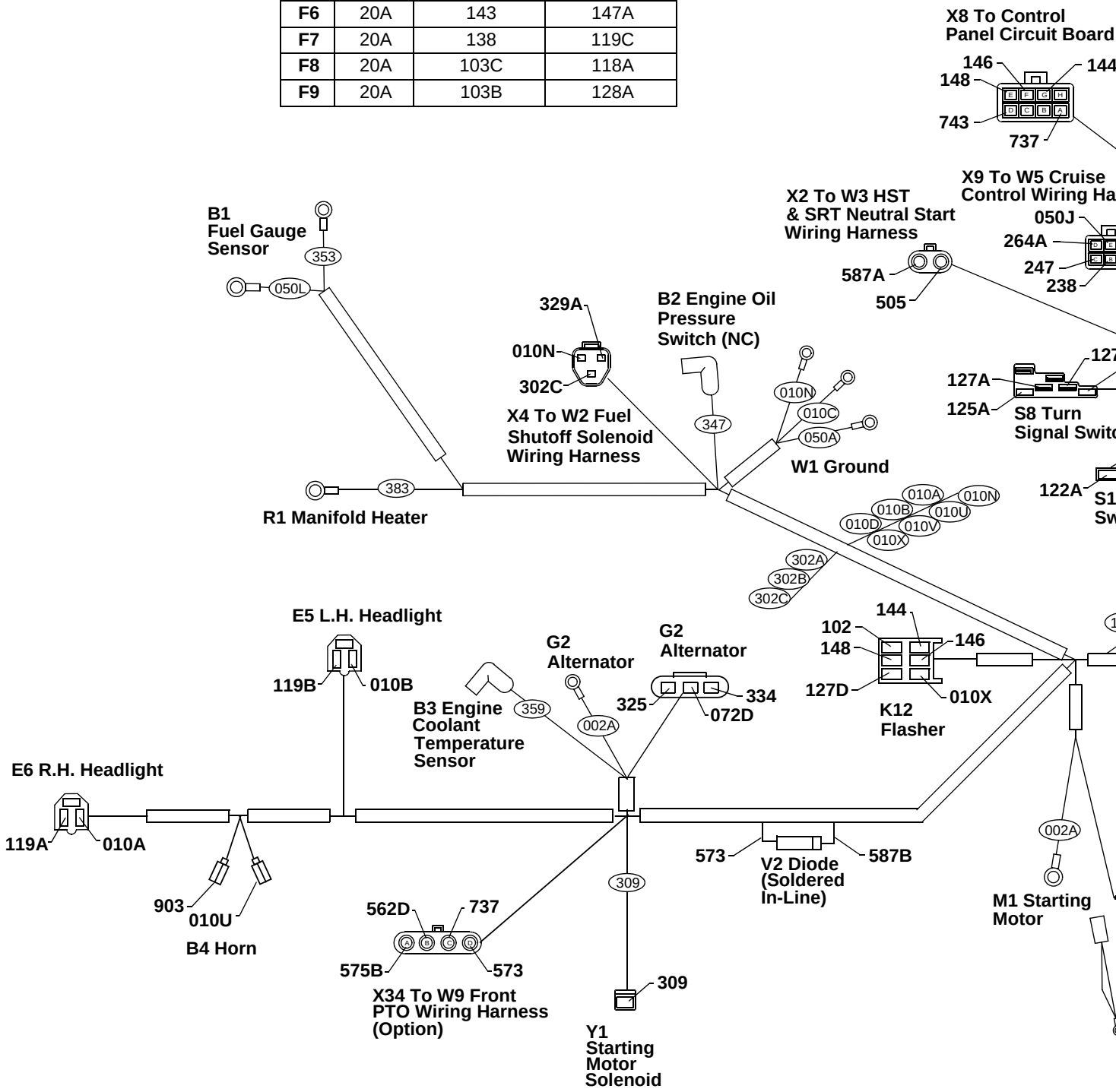
Relay #	86	85	30	87	87A
K1	385C	050B/050C	002B	383	– – –
K2	518A/518B	010E/010F	572A/572B	309	– – –
K3	329B	010F/010T	329A/329B	– – –	319
K4	521	050C/050D	002E	302B	– – –
K5	587C	050D/050E	546	533	– – –
K6	556	050E/050F	587D	– – –	533
K7	212	050F/050G	252	222	– – –
K8	238	050G/050H	264A/264B	247	– – –
K9	575A	050N	562B	– – –	574B
K10	594A/594B	050H/050M	574D	– – –	743
K11	116	050M/050N	042B	136A	– – –



MAIN WIRING HARNESS–4200/4300/4400 EUROPEAN

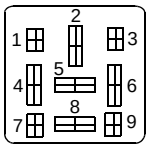
FUSE WIRE CONNECTIONS

#	SIZE	A	B
F1	30A	002	012
F2	30A	002D	252
F3	30A	002	122C
F4	20A	002	042A
F5	10A	072C	562A
F6	20A	143	147A
F7	20A	138	119C
F8	20A	103C	118A
F9	20A	103B	128A

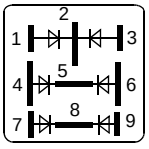


DIODE BLOCK

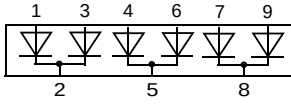
#	1	2	3	4	5	6	7	8
DB1	539A	556	572B	539A/539B	521	518A	010D/010E	302A



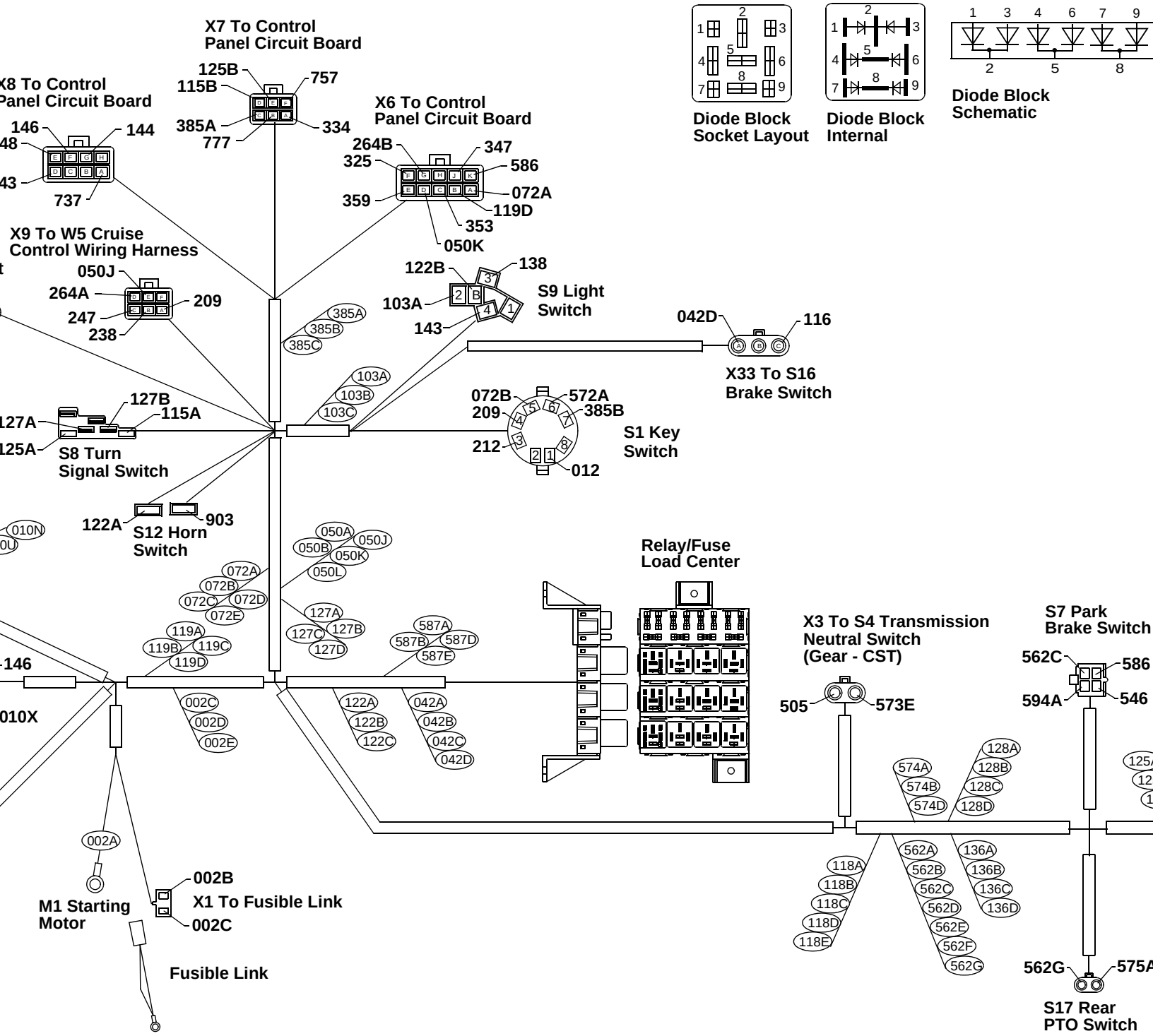
Diode Block Socket Layout



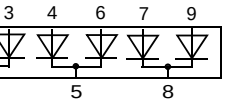
Diode Block Internal



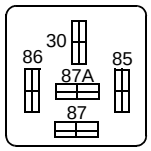
Diode Block Schematic



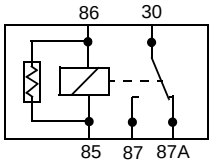
7	8	9
10D/010E	302A	– – –



Block
matic



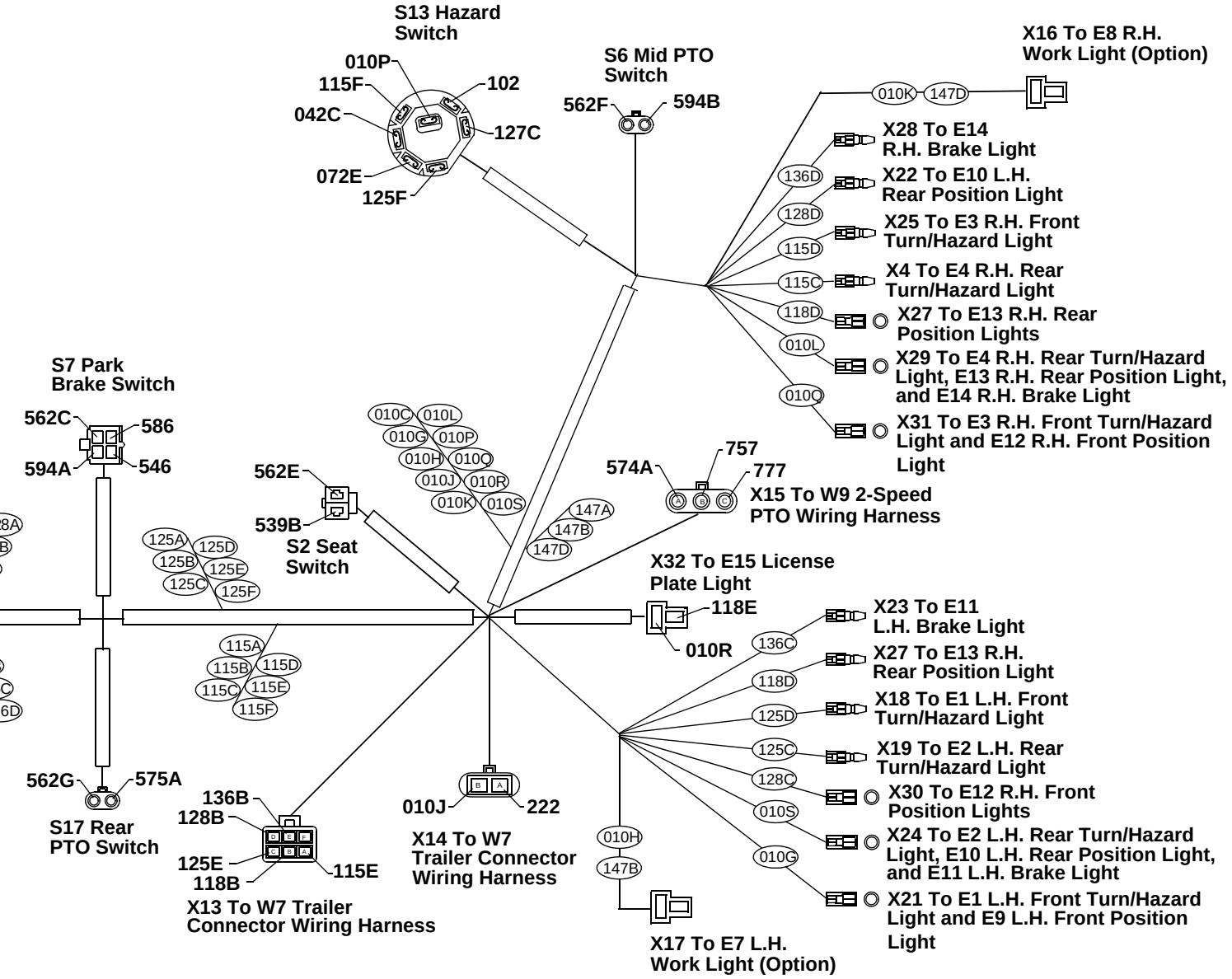
Relay Socket Layout



Relay Schematic

RELAYS

Relay #	86	85	30	87	87A
K1	385C	050B/050C	002B	383	– – –
K2	518A/518B	010E/010F	572A/572B	309	– – –
K3	329B	010F/010T	329A/329B	– – –	319
K4	521	050C/050D	002E	302B	– – –
K5	587C	050D/050E	546	533	– – –
K6	556	050E/050F	587D	– – –	533
K7	212	050F/050G	252	222	– – –
K8	238	050G/050H	264A/264B	247	– – –
K9	575A	050N	562B	– – –	574B
K10	594A/594B	050H/050M	574D	– – –	743
K11	116	050M/050N	042B	136A	– – –



WIRE COLOR CODES

(LATER MODELS)

Serial Numbers:

LV4200E329006 –

LV4300E339506 –

LV4400E349015 –

Circuit Number	Wire Size	Color	Termination Points
002A	5.0	Red	M1, G2
002B	5.0	Red	X1 (Fusible Link), K1(30)
002C	5.0	Red	X1 (Fusible Link), Splice 002
002D	2.0	Red	F2, K4(30)
010A	1.0	Blk	E6, Splice 010a
010B	1.0	Blk	E5, Splice 010a
010C	5.0	Blk	W1, Splice 010b
010D	0.8	Blk	DB1-7, Splice 010a
010E	0.5	Blk	DB1-7, K2(85)
010F	0.5	Blk	K2(85), K3(85)
010G	0.8	Blk	Splice 010b, X21
010H	0.8	Blk	Splice 010b, X17
010J	3.0	Blk	Splice 010b, X13
010K	0.8	Blk	Splice 010b, X16
010L	0.8	Blk	Splice 010b, X29
010N	1.0	Blk	X4, Splice 010a
010P	1.0	Blk	Splice 010b, S13
010Q	0.8	Blk	Splice 010b, X31
010R	0.8	Blk	Splice 010b, X32
010S	0.8	Blk	Splice 010b, X24
010T	(–)	Therm.	K3(85), R2
010U	0.8	Blk	Splice 010a, B4
010V	5.0	Blk	Splice 010a, W1
010X	1.0	Blk	Splice 010a, K12
012	5.0	Red	S1, F1
042A	2.0	Red	F4, Splice 042
042B	1.0	Red	Splice 042, K11(30)
042C	1.0	Red	Splice 042, S13
042D	0.8	Red	Splice 042, X33
050A	2.0	Blk	W1, Splice 050
050B	0.5	Blk	K1(85), Splice 050
050C	0.5	Blk	K1(85), K4(85)
050D	0.5	Blk	K4(85), K5(85)
050E	0.5	Blk	K5(85), K6(85)
050F	0.5	Blk	K6(85), K7(85)
050G	0.5	Blk	K7(85), K8(85)
050H	0.5	Blk	K8(85), K10(85)
050J	0.8	Blk	Splice 050, X9
050K	1.0	Blk	Splice 050, X6
050L	0.5	Blk	B1, Splice 050
050M	0.5	Blk	K10(85), K11(85)
050N	0.5	Blk	K11(85), K9(85)
072A	1.0	Red	X6, Splice 072
072B	1.0	Red	S1, Splice 072
072C	1.0	Red	Splice 072, F5
072D	0.8	Red	Splice 072, G2
072E	0.8	Red	Splice 072, S13
072F	0.8	Red	Splice 072,To Cab
102	1.0	Red	K12, S13
103A	2.0	Org	S9, Splice 103
103B	2.0	Org	Splice 103, F9
103C	2.0	Org	Splice 103, F8
115A	1.0	Dk Grn	S8, Splice 115
115B	0.8	Dk Grn	X7, Splice 115
115C	0.8	Dk Grn	Splice 115, X26
115D	0.8	Dk Grn	Splice 115, X25
115E	1.0	Dk Grn	Splice 115, X13
115F	1.0	Dk Grn	Splice 115, S13
116	0.8	Lt Blu	X33, K11(86)
118A	2.0	Gry	F8, Splice 118
118B	1.0	Gry	Splice 118, X13
118C	0.8	Gry	Splice 118, X20
118D	0.8	Gry	Splice 118, X27
118E	0.8	Gry	Splice 118, X32
119A	1.0	Wht	E6, Splice 119
119B	1.0	Wht	E5, Splice 119
119C	2.0	Wht	Splice 119, F7
119D	0.8	Wht	Splice 119, X6
122A	1.0	Red	S12, Splice 122
122B	3.0	Red	S9, Splice 122
122C	3.0	Red	F3, Splice 122
125A	1.0	Dk Grn	S8, Splice 125
125B	0.8	Dk Grn	X7, Splice 125
125C	0.8	Dk Grn	Splice 125, X19
125D	0.8	Dk Grn	Splice 125, X18
125E	1.0	Dk Grn	Splice 125, X13
125F	1.0	Dk Grn	Splice 125, S13
127A	1.0	Pur	S8, Splice 127
127B	1.0	Pur	Splice 127, S8
127C	1.0	Pur	Splice 127, S13
127D	1.0	Pur	Splice 127, K12
128A	2.0	Gry	F9, Splice 128
128B	1.0	Gry	Splice 128, X13
128C	0.8	Gry	Splice 128, X30
128D	0.8	Gry	Splice 128, X22
136A	2.0	Lt Blu	K11(87), Splice 136
136B	1.0	Lt Blu	Splice 136, X13
136C	0.8	Lt Blu	Splice 136, X23
136D	0.8	Lt Blu	Splice 136, X28
138	2.0	Gry	S9, F7
143	2.0	Org	S9, F6
144	0.8	Yel	K12(C3), X8
146	0.8	Lt Blu	K12(C2), X8
147A	2.0	Pur	F6, Splice 147
147B	0.8	Pur	Splice 147, X17
147D	0.8	Pur	Splice 147, X16
148	0.8	Gry	K12(C), X8
209	0.8	Wht	S1, X9
212	0.5	Red	S1, K7(86)
222	2.0	Red	K7(87), X14
238	0.8	Gry	X9, K8(86)
247	0.8	Pur	X9, K8(87)
252	2.0	Red	F2, K7(30)
264A	0.8	Yel	K8(30), X9
264B	0.8	Yel	K8(30), X6
302A	1.0	Red	DB1- 8, Splice 302
302B	1.0	Red	K4(87), Splice 302
302C	1.0	Red	Splice 302, X4
309	1.0	Wht	K2(87), M1
319	(+)	Therm.	K3(87a), R2
325	0.8	Dk Grn	G2, X6
329A	1.0	Wht	X4, K3(30)
329B	1.0	Wht	K3(30), K3(86)
334	0.8	Yel	G2, X7
347	0.5	Pur	X6, B2
353	0.5	Org	X6, B1
359	0.5	Wht	X6, B3
383	3.0	Org	K1(87), R1
385A	0.8	Dk Grn	Splice 385, X7
385B	0.8	Dk Grn	S1, Splice 385
385C	0.5	Dk Grn	Splice 385, K1(86)
518A	0.5	Gry	K2(86), DB1- 6
518B	0.5	Gry	X2, K2(86)
521	0.5	Brn	DB1- 5, K4(86)
533	0.5	Org	K5(87), K6(87a)
539A	0.5	Wht	DB1- 4, DB1- 1
539B	0.5	Wht	S2, DB1- 4
546	0.5	Lt Blu	S7, K5(30)
556	0.5	Lt Blu	DB1- 2, K6(86)
562A	0.8	Red	F5, Splice 562
562B	0.5	Red	Splice 562, K9(30)
562C	0.5	Red	Splice 562, S7
562D	0.5	Red	Splice 562, X34
562E	0.5	Red	Splice 562, S2
562F	0.5	Red	Splice 562, X5
562G	0.5	Red	Splice 562, S6
562H	0.5	Red	Splice 562, H16
572A	1.0	Red	S1, K2(30)
572B	0.8	Red	K2(30), DB1- 3
573	0.5	Org	X34, V2
574A	0.5	Yel	Splice 574, X36/S14
574B	0.5	Yel	K9(87a), Splice 574
574D	0.5	Yel	Splice 574, K10(30)
574E	0.5	Yel	Splice 574, X37/S15
575A	0.5	Dk Grn	S6, K9(86)
575B	0.5	Dk Grn	K9(86), X34
586	0.5	Lt Blu	S7, X6
587A	0.5	Pur	Splice 587, X2
587B	0.5	Pur	V2, Splice 587
587C	0.5	Pur	K5(86), Splice 587
587D	0.5	Pur	K6(30), Splice 587
594A	0.5	Yel	K10(86), S7
594B	0.5	Yel	X5, K10(86)
737	0.5	Pur	X34, X7
743	0.5	Org	K10(87a), X8
757	0.5	Pur	X15, X37/S15
777	0.5	Pur	X15, X36/S14
903	0.8	Org	S12, B4

WIRE COLOR CODES

(LATER MODELS)

Serial Numbers:

LV4200E329006 –

LV4300E339506 –

LV4400E349015 –

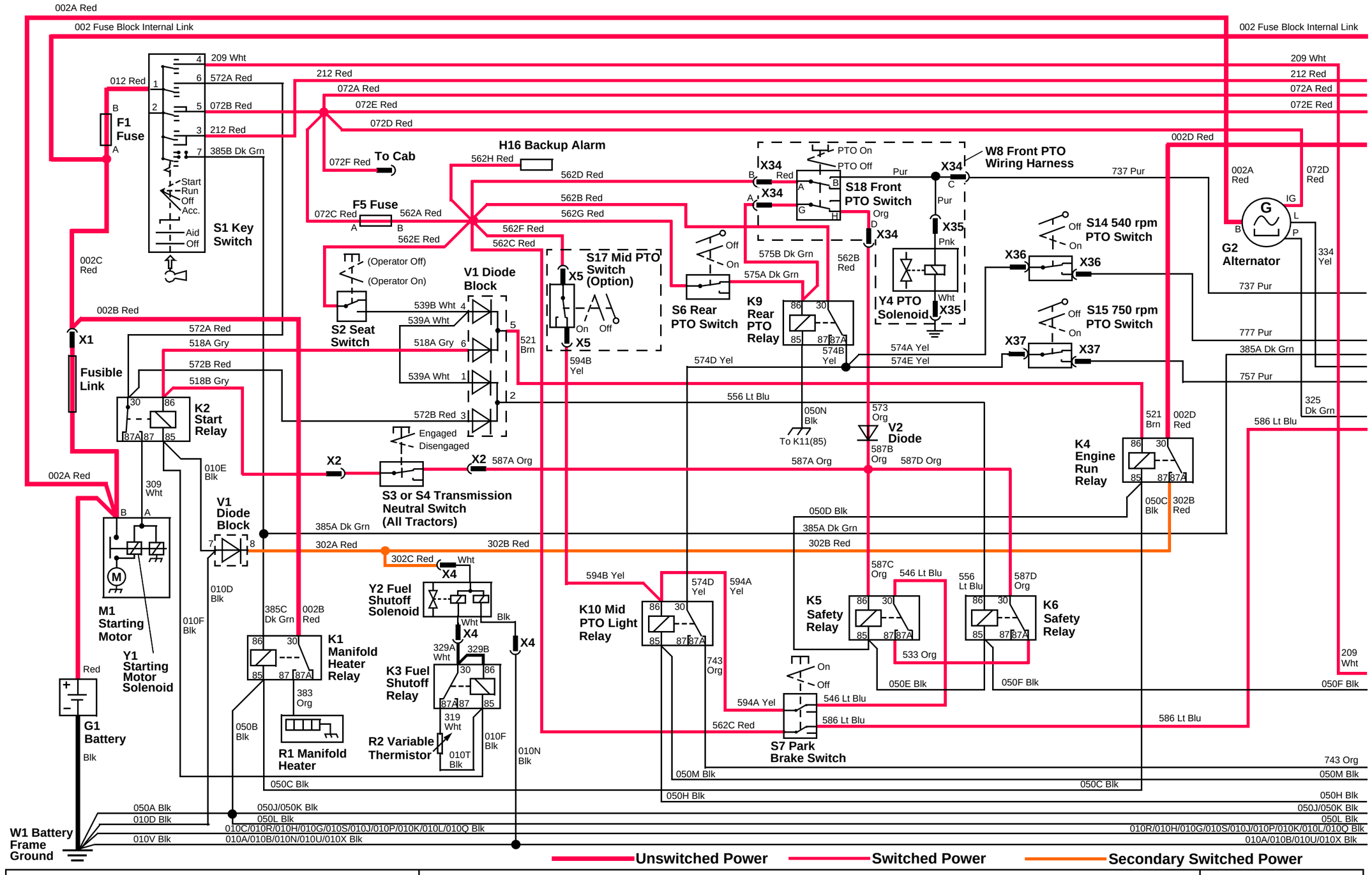
Circuit Number	Wire Size	Color	Termination Points
002A	5.0	Red	M1, G2
002B	5.0	Red	X1 (Fusible Link), K1(30)
002C	5.0	Red	X1 (Fusible Link), Splice 002
002D	2.0	Red	F2, K4(30)
010A	1.0	Blk	E6, Splice 010a
010B	1.0	Blk	E5, Splice 010a
010C	5.0	Blk	W1, Splice 010b
010D	0.8	Blk	DB1-7, Splice 010a
010E	0.5	Blk	DB1-7, K2(85)
010F	0.5	Blk	K2(85), K3(85)
010G	0.8	Blk	Splice 010b, X21
010H	0.8	Blk	Splice 010b, X17
010J	3.0	Blk	Splice 010b, X13
010K	0.8	Blk	Splice 010b, X16
010L	0.8	Blk	Splice 010b, X29
010N	1.0	Blk	X4, Splice 010a
010P	1.0	Blk	Splice 010b, S13
010Q	0.8	Blk	Splice 010b, X31
010R	0.8	Blk	Splice 010b, X32
010S	0.8	Blk	Splice 010b, X24
010T	(–)	Therm.	K3(85), R2
010U	0.8	Blk	Splice 010a, B4
010V	5.0	Blk	Splice 010a, W1
010X	1.0	Blk	Splice 010a, K12
012	5.0	Red	S1, F1
042A	2.0	Red	F4, Splice 042
042B	1.0	Red	Splice 042, K11(30)
042C	1.0	Red	Splice 042, S13
042D	0.8	Red	Splice 042, X33
050A	2.0	Blk	W1, Splice 050
050B	0.5	Blk	K1(85), Splice 050
050C	0.5	Blk	K1(85), K4(85)
050D	0.5	Blk	K4(85), K5(85)
050E	0.5	Blk	K5(85), K6(85)
050F	0.5	Blk	K6(85), K7(85)
050G	0.5	Blk	K7(85), K8(85)
050H	0.5	Blk	K8(85), K10(85)
050J	0.8	Blk	Splice 050, X9
050K	1.0	Blk	Splice 050, X6
050L	0.5	Blk	B1, Splice 050
050M	0.5	Blk	K10(85), K11(85)
050N	0.5	Blk	K11(85), K9(85)
072A	1.0	Red	X6, Splice 072
072B	1.0	Red	S1, Splice 072
072C	1.0	Red	Splice 072, F5
072D	0.8	Red	Splice 072, G2
072E	0.8	Red	Splice 072, S13
072F	0.8	Red	Splice 072,To Cab
102	1.0	Red	K12, S13
103A	2.0	Org	S9, Splice 103
103B	2.0	Org	Splice 103, F9
103C	2.0	Org	Splice 103, F8
115A	1.0	Dk Grn	S8, Splice 115
115B	0.8	Dk Grn	X7, Splice 115
115C	0.8	Dk Grn	Splice 115, X26
115D	0.8	Dk Grn	Splice 115, X25
115E	1.0	Dk Grn	Splice 115, X13
115F	1.0	Dk Grn	Splice 115, S13
116	0.8	Lt Blu	X33, K11(86)
118A	2.0	Gry	F8, Splice 118
118B	1.0	Gry	Splice 118, X13
118C	0.8	Gry	Splice 118, X20
118D	0.8	Gry	Splice 118, X27
118E	0.8	Gry	Splice 118, X32
119A	1.0	Wht	E6, Splice 119
119B	1.0	Wht	E5, Splice 119
119C	2.0	Wht	Splice 119, F7
119D	0.8	Wht	Splice 119, X6
122A	1.0	Red	S12, Splice 122
122B	3.0	Red	S9, Splice 122
122C	3.0	Red	F3, Splice 122
125A	1.0	Dk Grn	S8, Splice 125
125B	0.8	Dk Grn	X7, Splice 125
125C	0.8	Dk Grn	Splice 125, X19
125D	0.8	Dk Grn	Splice 125, X18

Circu Num
125E
125F
127A
127B
127C
127D
128A
128B
128C
128D
136A
136B
136C
136D
138
143
144
146
147A
147B
147D
148
209
212
222
238
247
252
264A
264B
302A
302B
302C
309
319
325
329A
329B
334
347
353
359

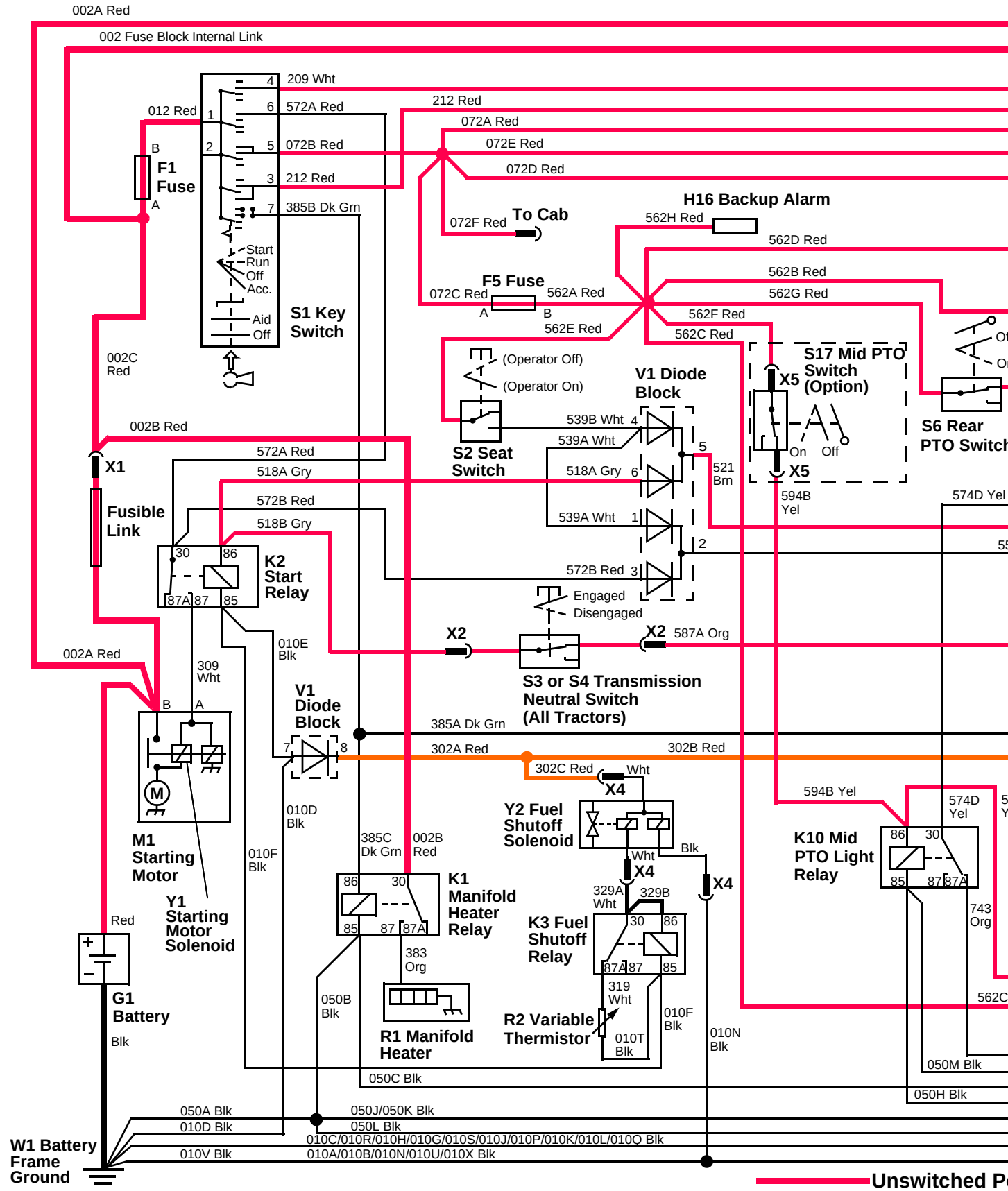
Circuit Number	Wire Size	Color	Termination Points
125E	1.0	Dk Grn	Splice 125, X13
125F	1.0	Dk Grn	Splice 125, S13
127A	1.0	Pur	S8, Splice 127
127B	1.0	Pur	Splice 127, S8
127C	1.0	Pur	Splice 127, S13
127D	1.0	Pur	Splice 127, K12
128A	2.0	Gry	F9, Splice 128
128B	1.0	Gry	Splice 128, X13
128C	0.8	Gry	Splice 128, X30
128D	0.8	Gry	Splice 128, X22
136A	2.0	Lt Blu	K11(87), Splice 136
136B	1.0	Lt Blu	Splice 136, X13
136C	0.8	Lt Blu	Splice 136, X23
136D	0.8	Lt Blu	Splice 136, X28
138	2.0	Gry	S9, F7
143	2.0	Org	S9, F6
144	0.8	Yel	K12(C3), X8
146	0.8	Lt Blu	K12(C2), X8
147A	2.0	Pur	F6, Splice 147
147B	0.8	Pur	Splice 147, X17
147D	0.8	Pur	Splice 147, X16
148	0.8	Gry	K12(C), X8
209	0.8	Wht	S1, X9
212	0.5	Red	S1, K7(86)
222	2.0	Red	K7(87), X14
238	0.8	Gry	X9, K8(86)
247	0.8	Pur	X9, K8(87)
252	2.0	Red	F2, K7(30)
264A	0.8	Yel	K8(30), X9
264B	0.8	Yel	K8(30), X6
302A	1.0	Red	DB1- 8, Splice 302
302B	1.0	Red	K4(87), Splice 302
302C	1.0	Red	Splice 302, X4
309	1.0	Wht	K2(87), M1
319	(+)	Therm.	K3(87a), R2
325	0.8	Dk Grn	G2, X6
329A	1.0	Wht	X4, K3(30)
329B	1.0	Wht	K3(30), K3(86)
334	0.8	Yel	G2, X7
347	0.5	Pur	X6, B2
353	0.5	Org	X6, B1
359	0.5	Wht	X6, B3

Circuit Number	Wire Size	Color	Termination Points
383	3.0	Org	K1(87), R1
385A	0.8	Dk Grn	Splice 385, X7
385B	0.8	Dk Grn	S1, Splice 385
385C	0.5	Dk Grn	Splice 385, K1(86)
518A	0.5	Gry	K2(86), DB1- 6
518B	0.5	Gry	X2, K2(86)
521	0.5	Brn	DB1- 5, K4(86)
533	0.5	Org	K5(87), K6(87a)
539A	0.5	Wht	DB1- 4, DB1- 1
539B	0.5	Wht	S2, DB1- 4
546	0.5	Lt Blu	S7, K5(30)
556	0.5	Lt Blu	DB1- 2, K6(86)
562A	0.8	Red	F5, Splice 562
562B	0.5	Red	Splice 562, K9(30)
562C	0.5	Red	Splice 562, S7
562D	0.5	Red	Splice 562, X34
562E	0.5	Red	Splice 562, S2
562F	0.5	Red	Splice 562, X5
562G	0.5	Red	Splice 562, S6
562H	0.5	Red	Splice 562, H16
572A	1.0	Red	S1, K2(30)
572B	0.8	Red	K2(30), DB1- 3
573	0.5	Org	X34, V2
574A	0.5	Yel	Splice 574, X36/S14
574B	0.5	Yel	K9(87a), Splice 574
574D	0.5	Yel	Splice 574, K10(30)
574E	0.5	Yel	Splice 574, X37/S15
575A	0.5	Dk Grn	S6, K9(86)
575B	0.5	Dk Grn	K9(86), X34
586	0.5	Lt Blu	S7, X6
587A	0.5	Pur	Splice 587, X2
587B	0.5	Pur	V2, Splice 587
587C	0.5	Pur	K5(86), Splice 587
587D	0.5	Pur	K6(30), Splice 587
594A	0.5	Yel	K10(86), S7
594B	0.5	Yel	X5, K10(86)
737	0.5	Pur	X34, X7
743	0.5	Org	K10(87a), X8
757	0.5	Pur	X15, X37/S15
777	0.5	Pur	X15, X36/S14
903	0.8	Org	S12, B4

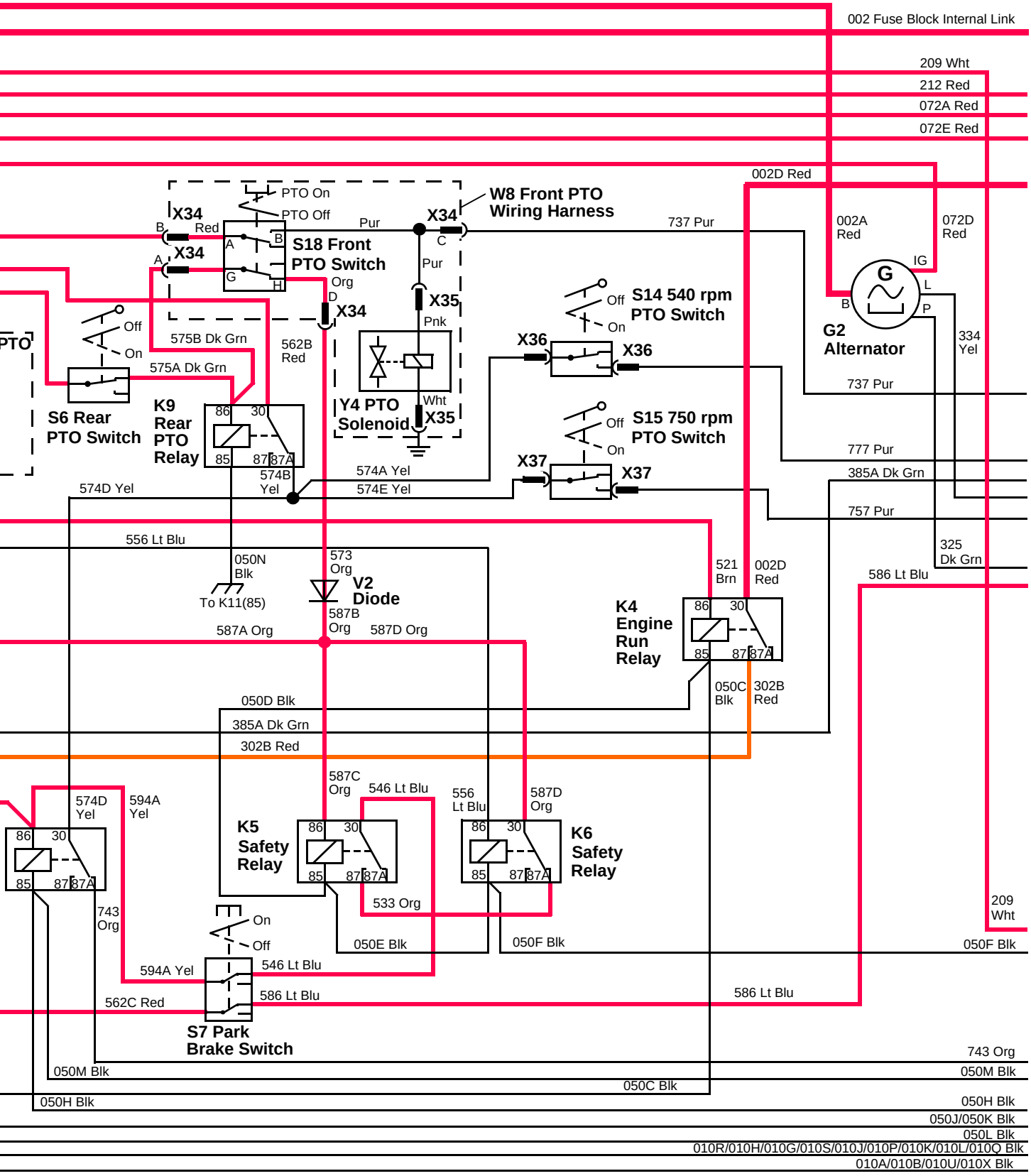
MAIN ELECTRICAL SCHEMATIC–4200/4300/4400 EUROPEAN



MAIN ELECTRICAL SCHEMATIC–4200/4300/4400 EUROPEAN



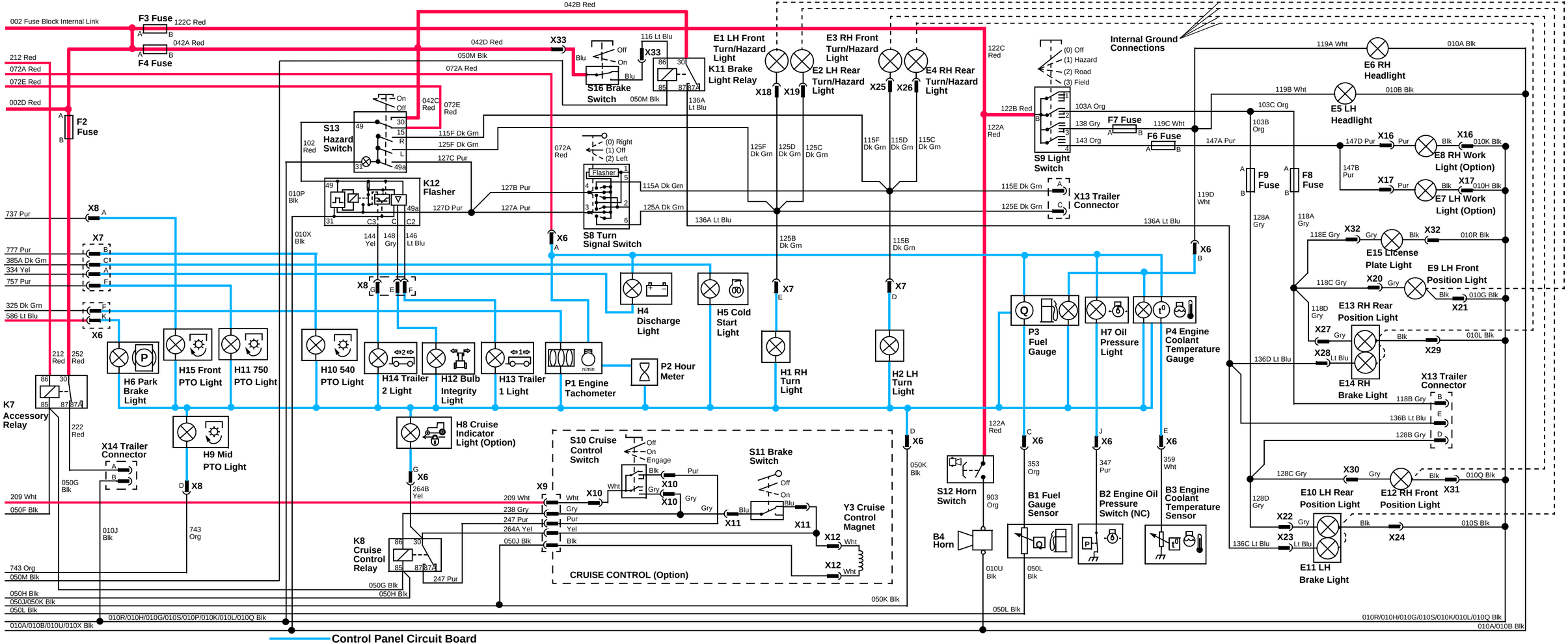
SE1 - STARTING



Unswitched Power **Switched Power** **Secondary Switched Power**

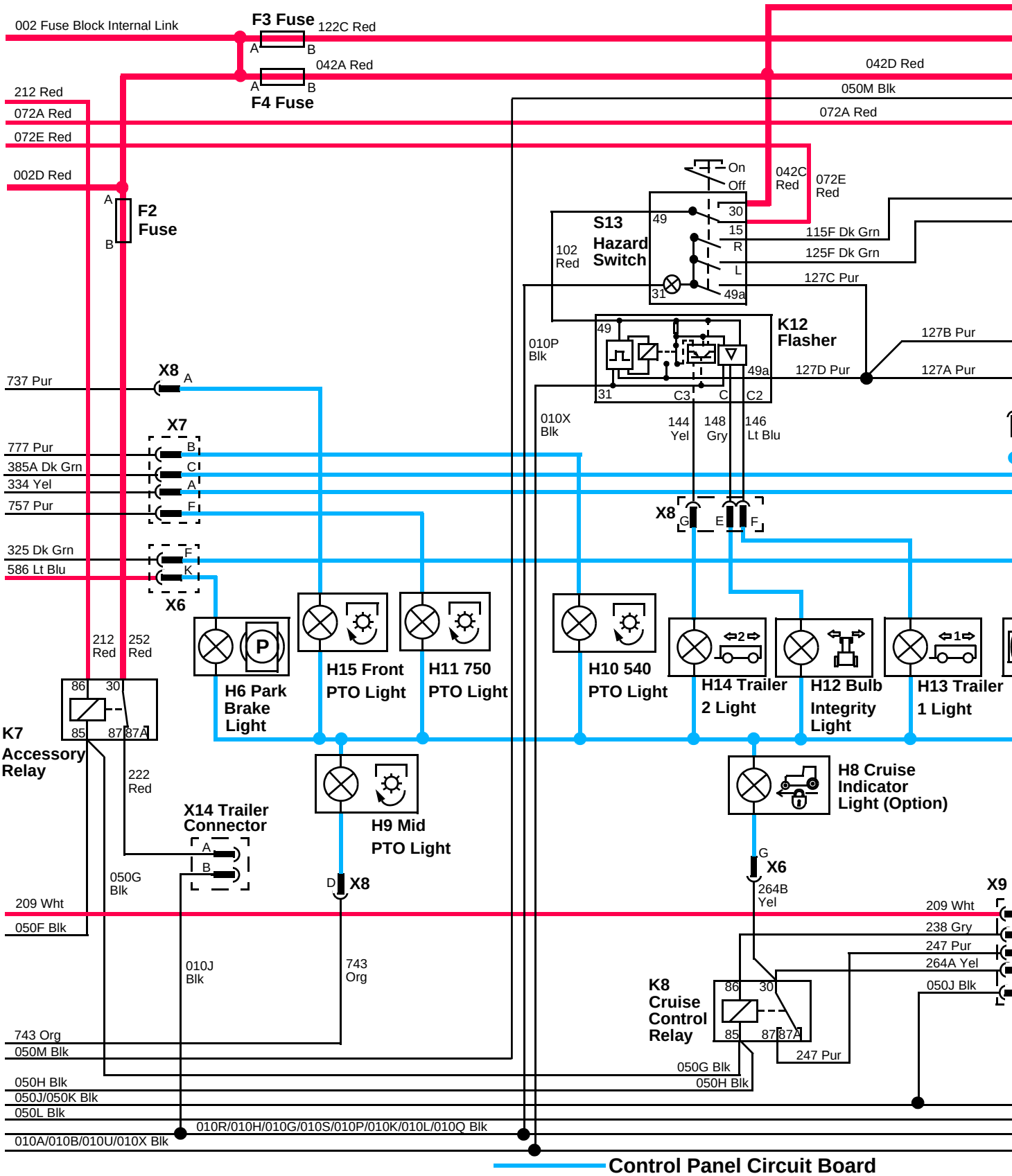
SE2 - IGNITION	SE3 - CHARGING

MAIN ELECTRICAL SCHEMATIC–4200/4300/4400 EUROPEAN

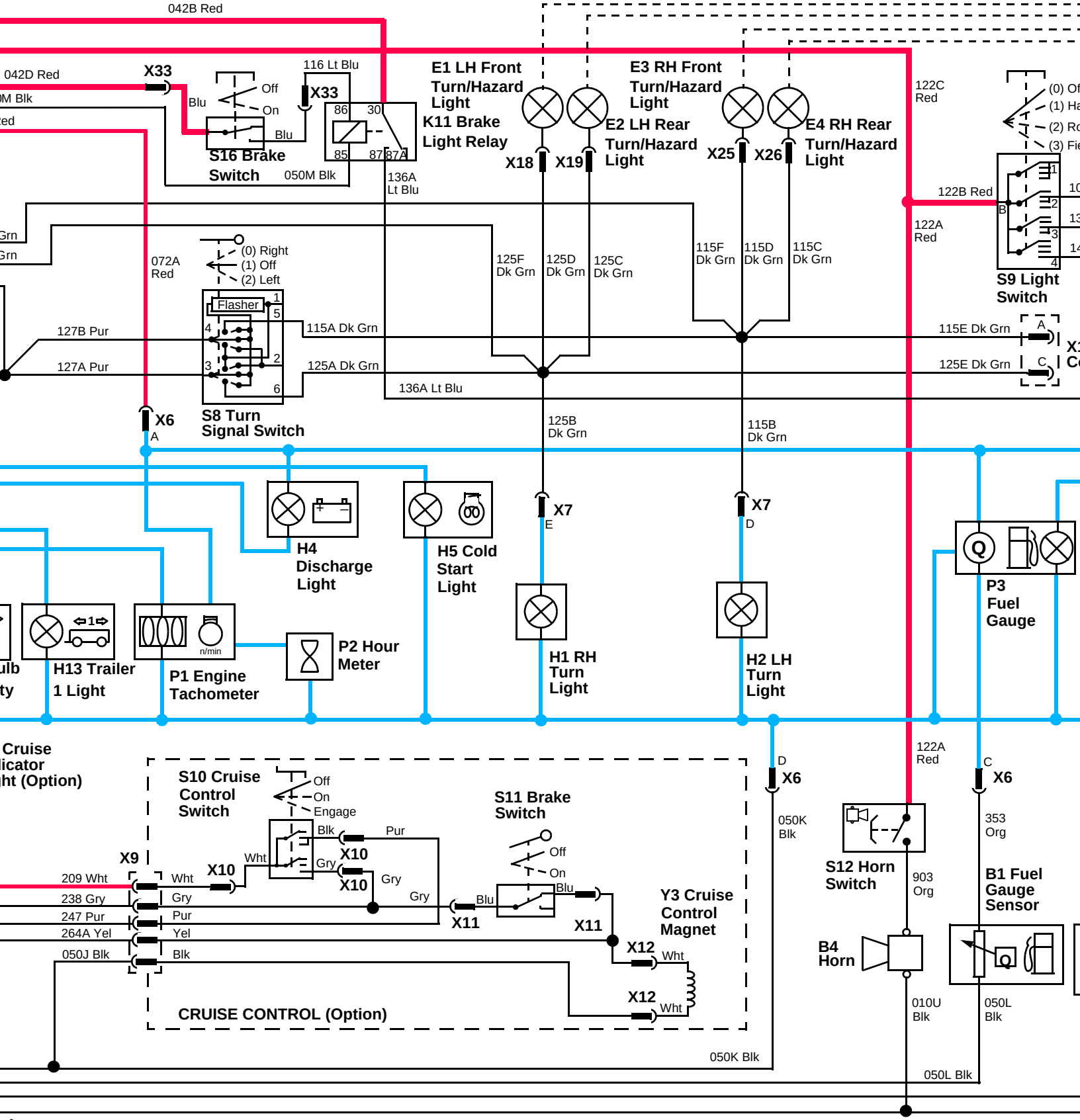


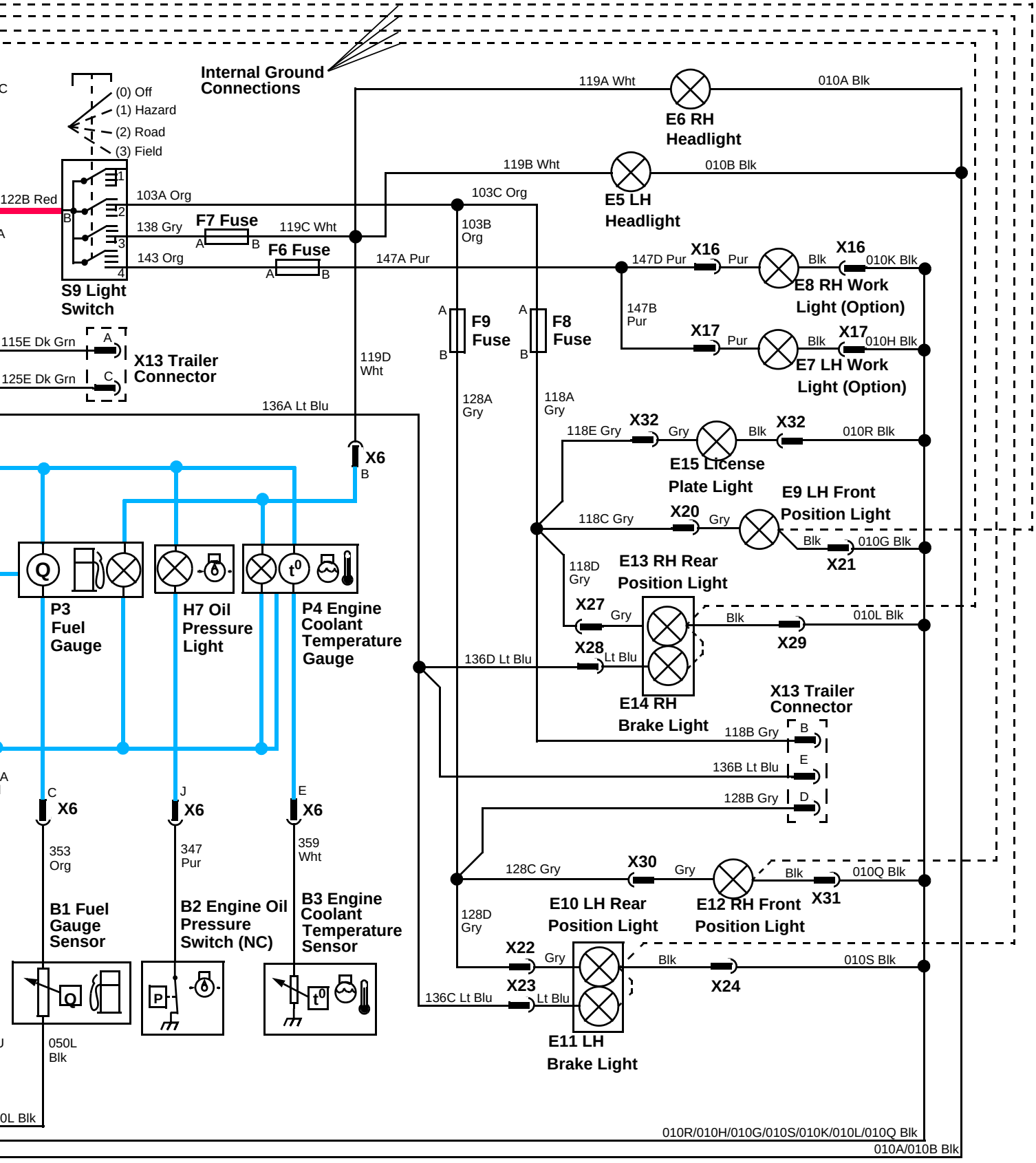
SE4 - ACCESSORIES	SE5 - INSTRUMENTATION	SE6 - LIGHTS

MAIN ELECTRICAL SCHEMATIC–4200/4300/4400 EUROPEAN



SE4 - ACCESSORIES	


042B Red
042D Red
X33
Off
On
Blu
Blu
116 Lt Blu
X33
86
30
85
87
87A
S16 Brake Switch
050M Blk
136A Lt Blu
K11 Brake Light Relay
E1 LH Front Turn/Hazard Light
X18
X19
E2 LH Rear Turn/Hazard Light
E3 RH Front Turn/Hazard Light
X25
X26
E4 RH Rear Turn/Hazard Light
122C Red
122B Red
122A Red
S9 Light Switch
072A Red
(0) Right
(1) Off
(2) Left
Flasher
S8 Turn Signal Switch
127B Pur
127A Pur
115A Dk Grn
125A Dk Grn
125F Dk Grn
125D Dk Grn
125C Dk Grn
115F Dk Grn
115D Dk Grn
115C Dk Grn
115E Dk Grn
125E Dk Grn
136A Lt Blu
X6
A
125B Dk Grn
115B Dk Grn
X7
E
X7
D
H4 Discharge Light
H5 Cold Start Light
H1 RH Turn Light
H2 LH Turn Light
P3 Fuel Gauge
H13 Trailer 1 Light
P1 Engine Tachometer
P2 Hour Meter
S10 Cruise Control Switch
Off
On
Engage
S11 Brake Switch
X9
X10
X11
X12
209 Wht
238 Gry
247 Pur
264A Yel
050J Blk
Y3 Cruise Control Magnet
CRUISE CONTROL (Option)
D
X6
050K Blk
050K Blk
122A Red
C
X6
353 Org
S12 Horn Switch
903 Org
B1 Fuel Gauge Sensor
B4 Horn
010U Blk
050L Blk
050L Blk


Internal Ground Connections
(0) Off
(1) Hazard
(2) Road
(3) Field
S9 Light Switch
122B Red
103A Org
138 Gry
143 Org
F7 Fuse
F6 Fuse
119C Wht
103C Org
103B Org
147A Pur
119A Wht
010A Blk
E6 RH Headlight
119B Wht
010B Blk
E5 LH Headlight
147D Pur
X16
Pur
Blk
010K Blk
E8 RH Work Light (Option)
147B Pur
X17
010H Blk
E7 LH Work Light (Option)
F9 Fuse
F8 Fuse
115E Dk Grn
125E Dk Grn
X13 Trailer Connector
119D Wht
128A Gry
118A Gry
136A Lt Blu
X6
118E Gry
X32
010R Blk
E15 License Plate Light
E9 LH Front Position Light
118C Gry
X20
010G Blk
X21
118D Gry
E13 RH Rear Position Light
X27
X28
Lt Blu
010L Blk
X29
136D Lt Blu
E14 RH Brake Light
X13 Trailer Connector
118B Gry
136B Lt Blu
128B Gry
P3 Fuel Gauge
H7 Oil Pressure Light
P4 Engine Coolant Temperature Gauge
353 Org
347 Pur
359 Wht
B1 Fuel Gauge Sensor
B2 Engine Oil Pressure Switch (NC)
B3 Engine Coolant Temperature Sensor
050L Blk
128C Gry
X30
010Q Blk
X31
E10 LH Rear Position Light
E12 RH Front Position Light
128D Gry
X22
X23
010S Blk
X24
136C Lt Blu
E11 LH Brake Light
010R/010H/010G/010S/010K/010L/010Q Blk
010A/010B Blk

	SE6 - LIGHTS

MAIN WIRING HARNESS–4200/4300/4400 EUROPEAN

Serial Numbers for Wiring Harness Use:
LV4200E329006–
LV4300E339506–
LV4400E349015–

FUSE WIRE CONNECTIONS

#	SIZE	A	B
F1	30A	002C	012
F2	30A	002D	252
F3	30A	002	122C
F4	20A	002	042A
F5	10A	072C	562A
F6	20A	143	147A
F7	20A	138	119C
F8	20A	103C	118A
F9	20A	103B	128A

DIODE BLOCK

#	1	2	3	4	5	6	7	8	9
DB1	539A	556	572B	539A/539B	521	518A	010D/010E	302A	– – –

Diode Block Socket Layout

Diode Block Internal

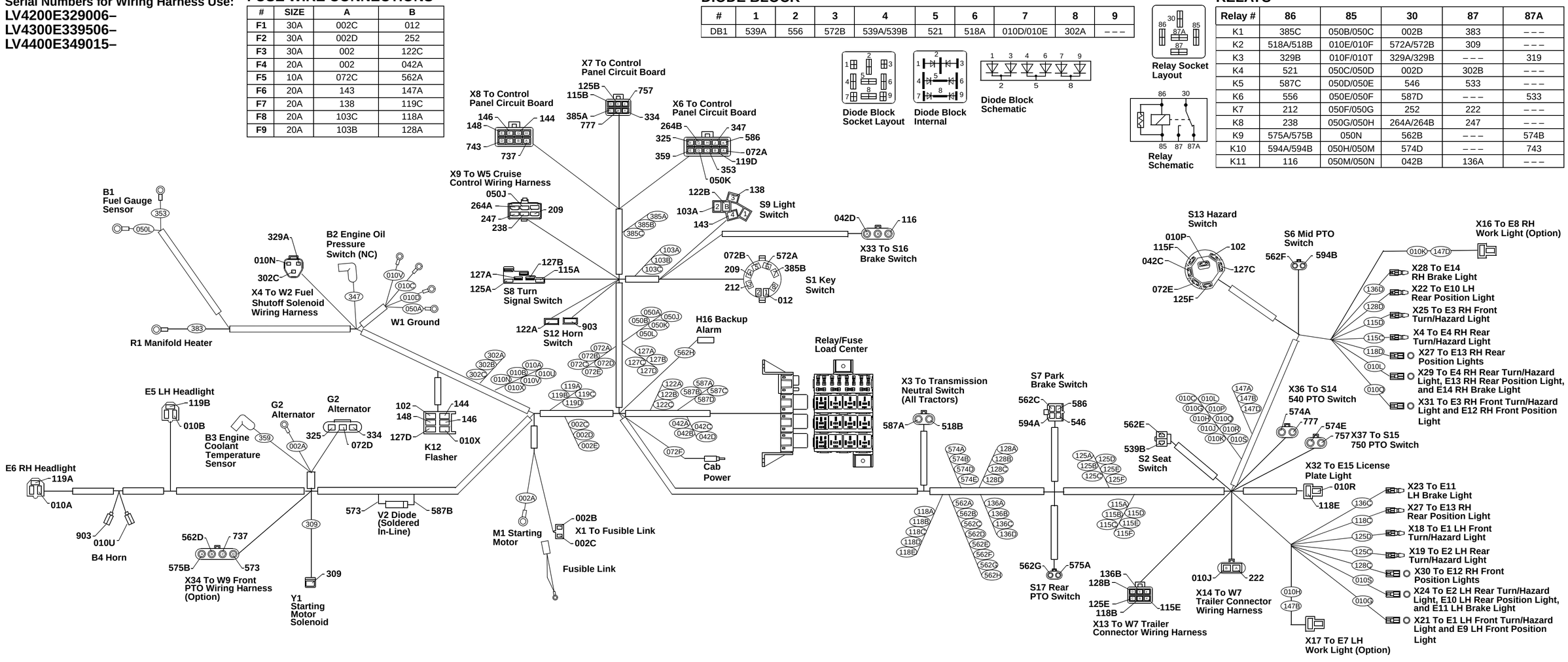
Diode Block Schematic

Relay Socket Layout

Relay Schematic

RELAYS

Relay #	86	85	30	87	87A
K1	385C	050B/050C	002B	383	– – –
K2	518A/518B	010E/010F	572A/572B	309	– – –
K3	329B	010F/010T	329A/329B	– – –	319
K4	521	050C/050D	002D	302B	– – –
K5	587C	050D/050E	546	533	– – –
K6	556	050E/050F	587D	– – –	533
K7	212	050F/050G	252	222	– – –
K8	238	050G/050H	264A/264B	247	– – –
K9	575A/575B	050N	562B	– – –	574B
K10	594A/594B	050H/050M	574D	– – –	743
K11	116	050M/050N	042B	136A	– – –

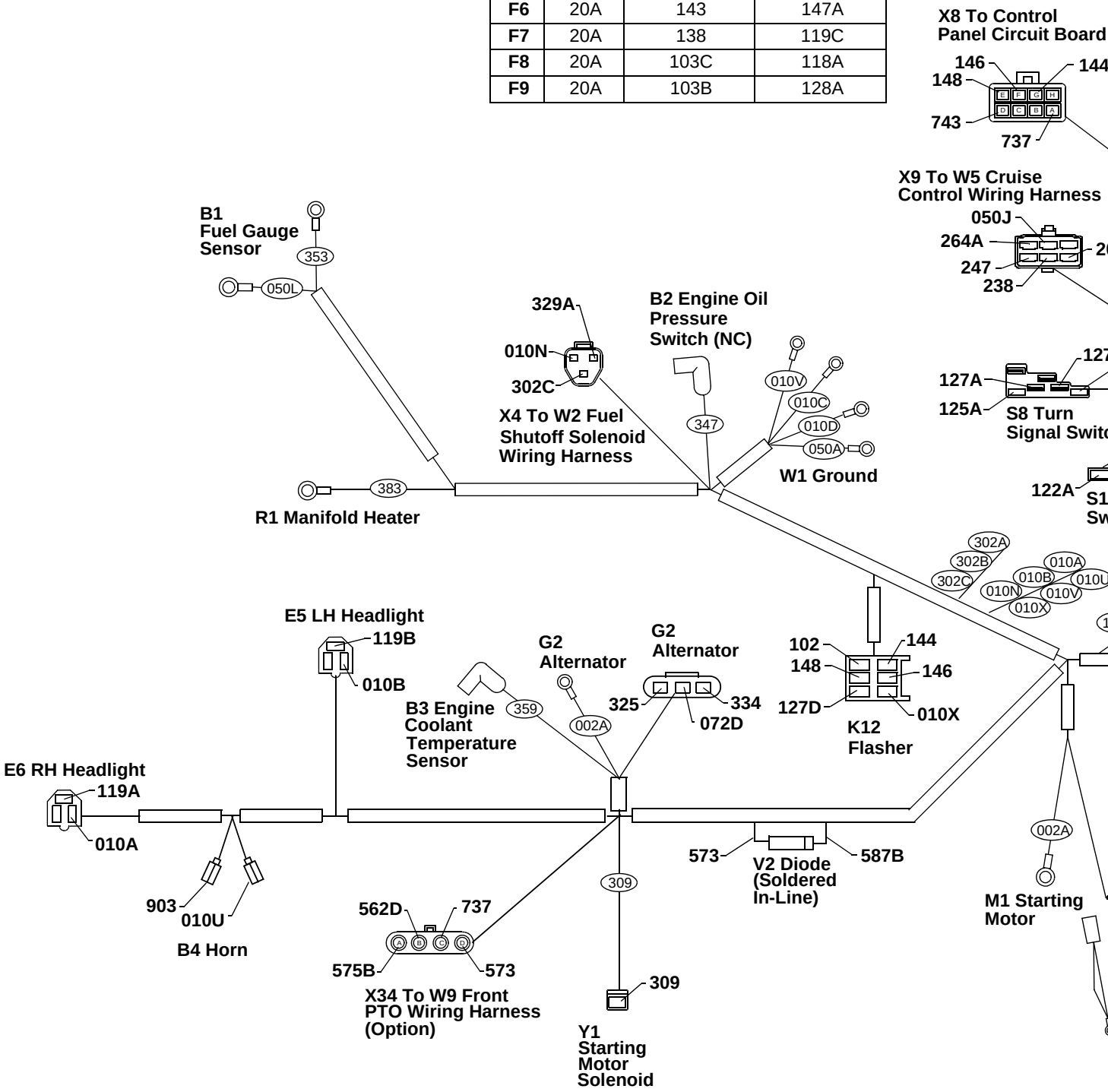


MAIN WIRING HARNESS–4200/4300/4400 EUROPEAN

Serial Numbers for Wiring Harness Use:
LV4200E329006–
LV4300E339506–
LV4400E349015–

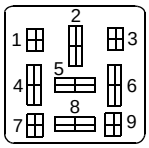
FUSE WIRE CONNECTIONS

#	SIZE	A	B
F1	30A	002C	012
F2	30A	002D	252
F3	30A	002	122C
F4	20A	002	042A
F5	10A	072C	562A
F6	20A	143	147A
F7	20A	138	119C
F8	20A	103C	118A
F9	20A	103B	128A

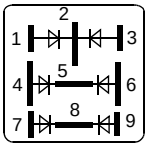


DIODE BLOCK

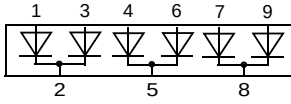
#	1	2	3	4	5	6	7	8
DB1	539A	556	572B	539A/539B	521	518A	010D/010E	302A



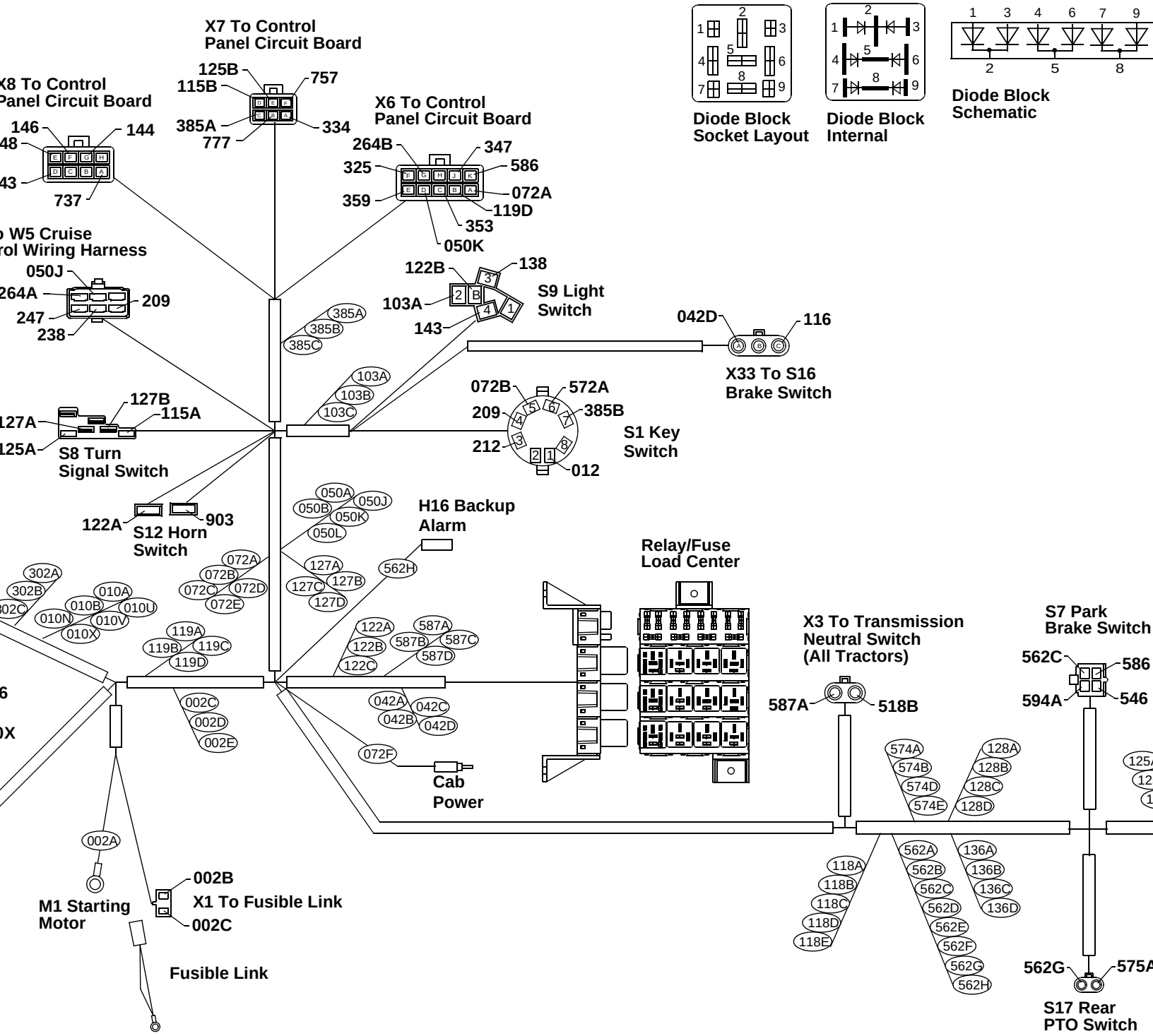
Diode Block Socket Layout



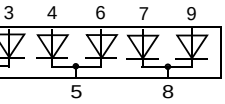
Diode Block Internal



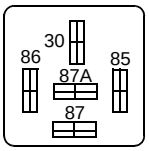
Diode Block Schematic



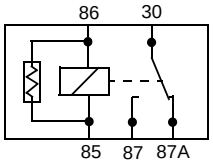
7	8	9
10D/010E	302A	– – –



Block
matic



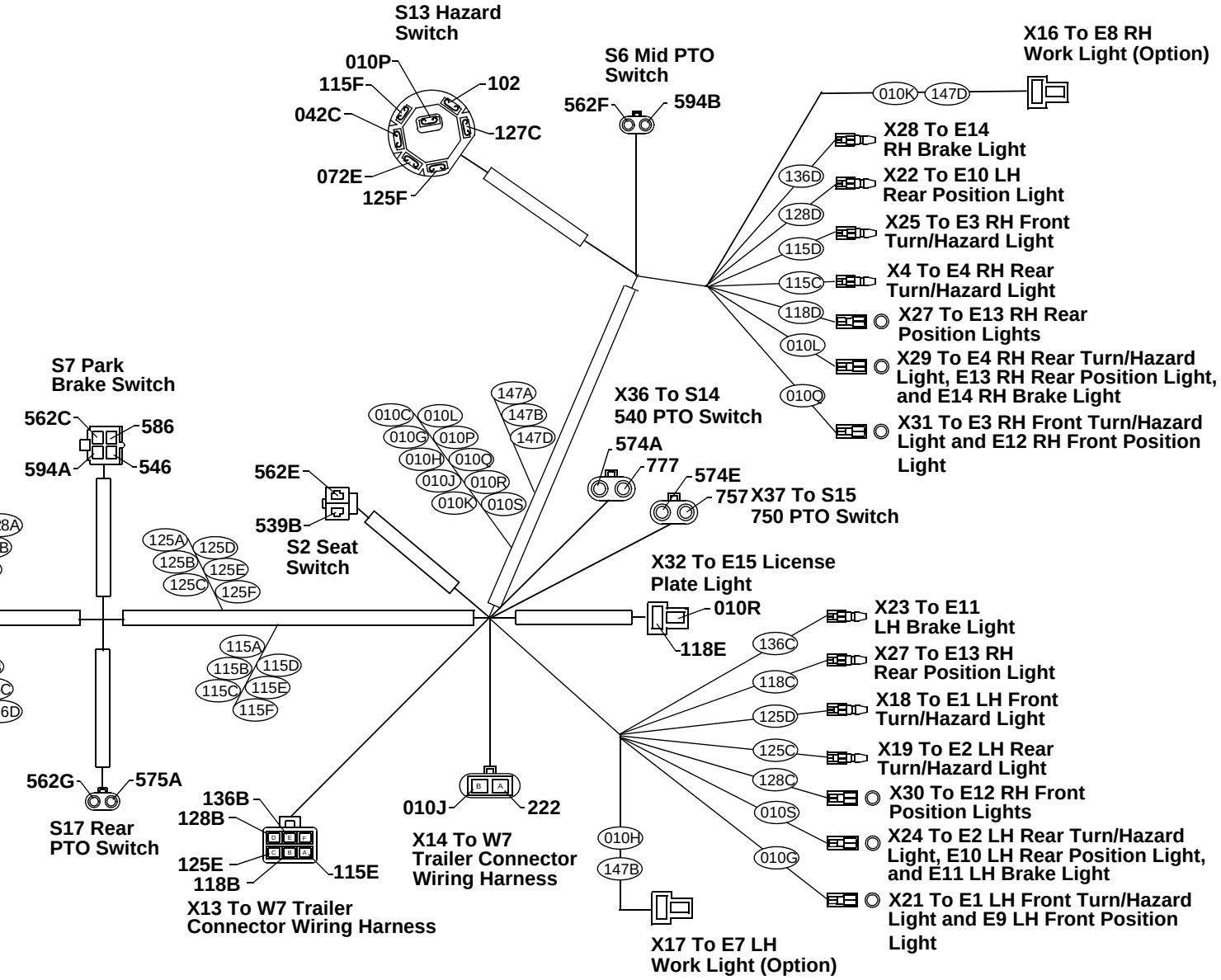
Relay Socket Layout



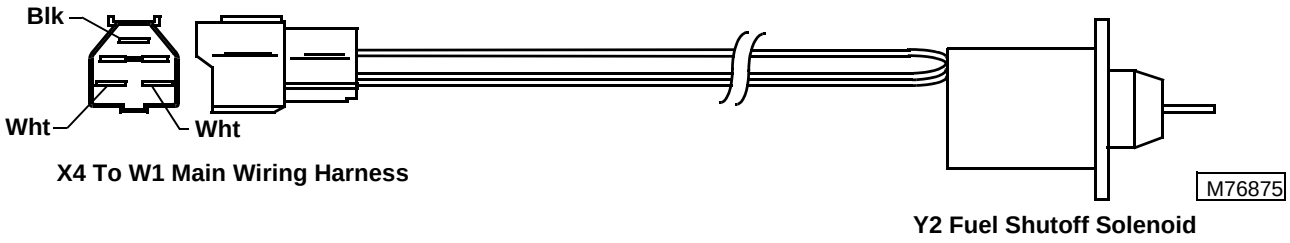
Relay Schematic

RELAYS

Relay #	86	85	30	87	87A
K1	385C	050B/050C	002B	383	– – –
K2	518A/518B	010E/010F	572A/572B	309	– – –
K3	329B	010F/010T	329A/329B	– – –	319
K4	521	050C/050D	002D	302B	– – –
K5	587C	050D/050E	546	533	– – –
K6	556	050E/050F	587D	– – –	533
K7	212	050F/050G	252	222	– – –
K8	238	050G/050H	264A/264B	247	– – –
K9	575A/575B	050N	562B	– – –	574B
K10	594A/594B	050H/050M	574D	– – –	743
K11	116	050M/050N	042B	136A	– – –



W2 FUEL SHUTOFF SOLENOID WIRING HARNESS

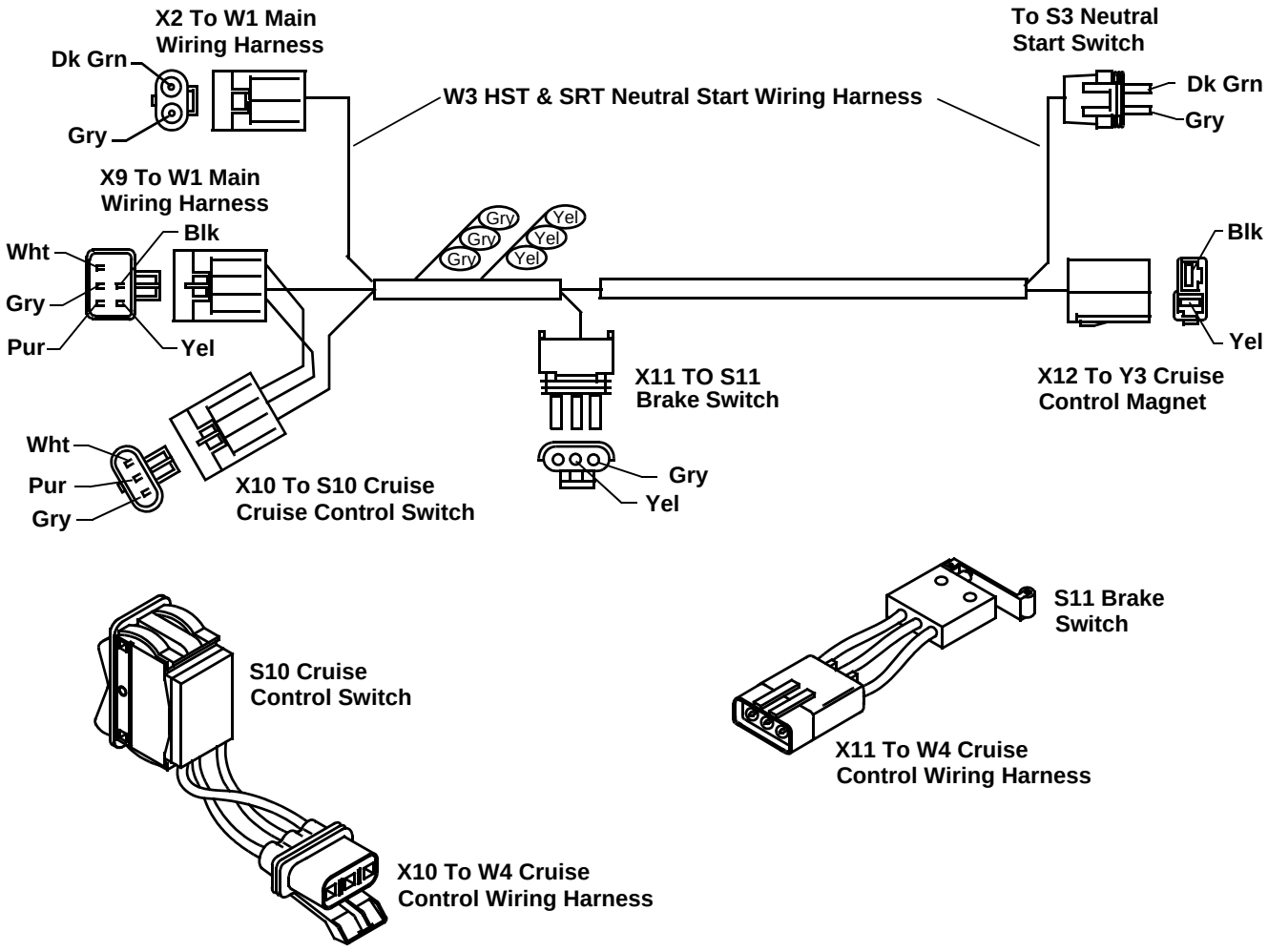


W3 HST NEUTRAL START WIRING HARNESS

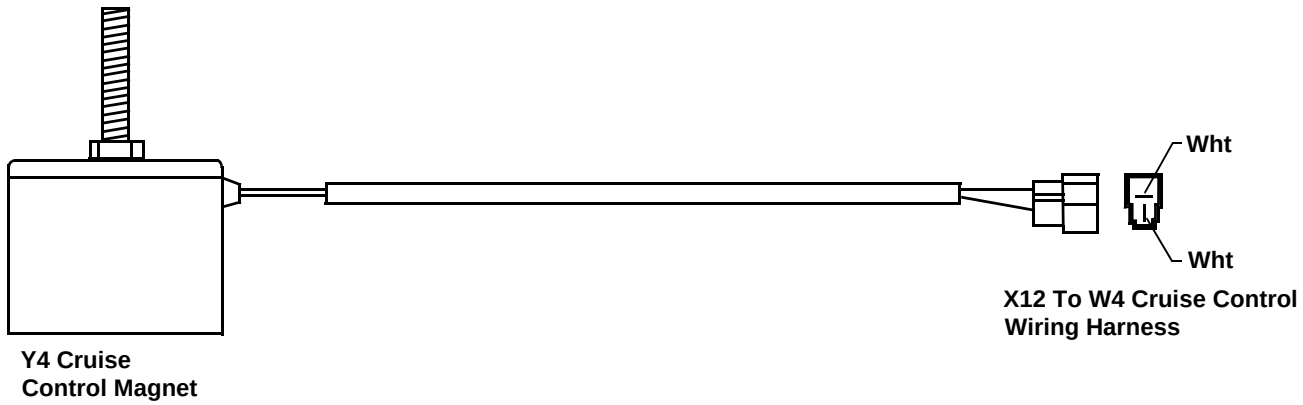
(Note: Included in W4 Cruise Control Wiring Harness protective wrap)

W4 CRUISE CONTROL WIRING HARNESS

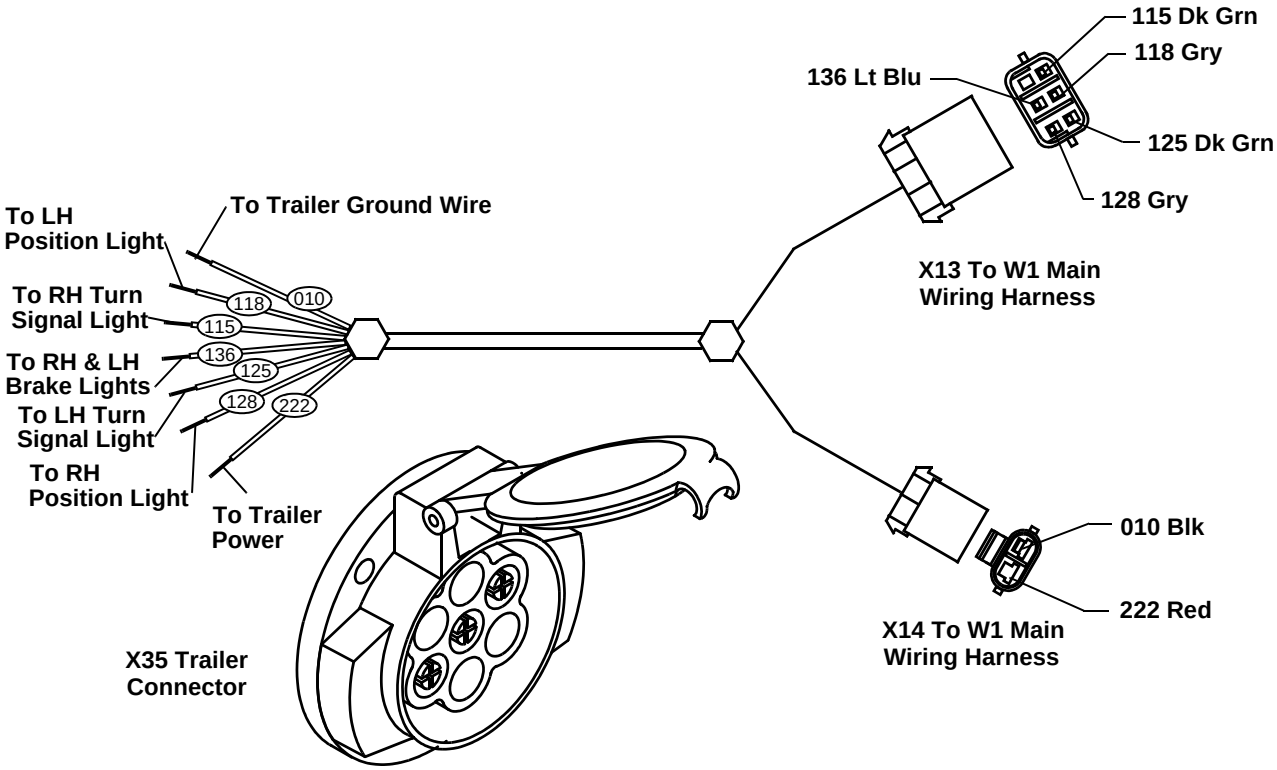
NOTE: Connector X2, and the Dk Grn and Gry wires are the W3 HST & SRT Neutral Start Wiring Harness.



W5 CRUISE CONTROL MAGNET WIRING HARNESS

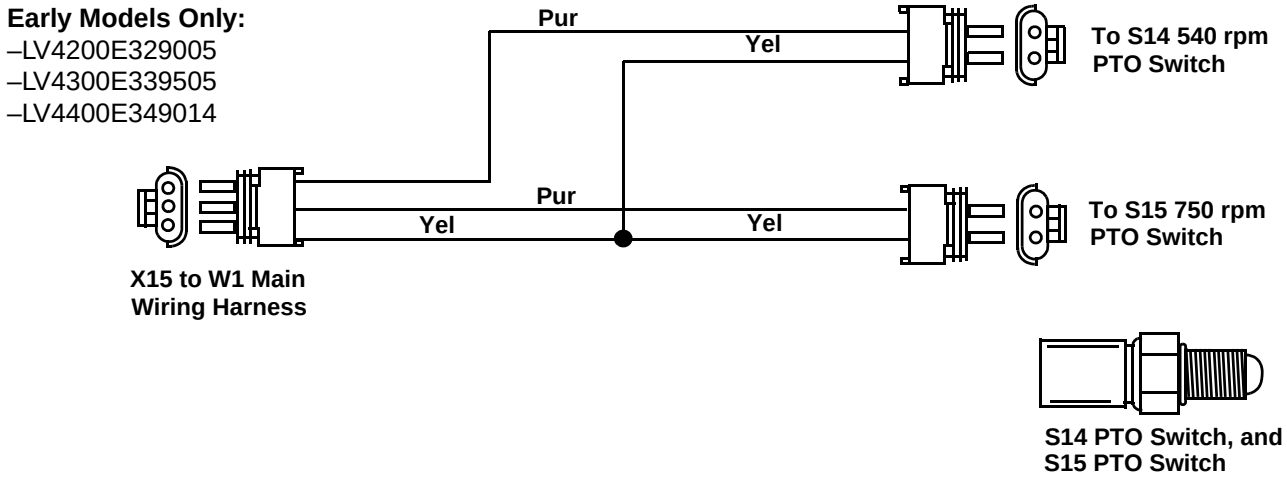


W6 TRAILER CONNECTOR WIRING HARNESS

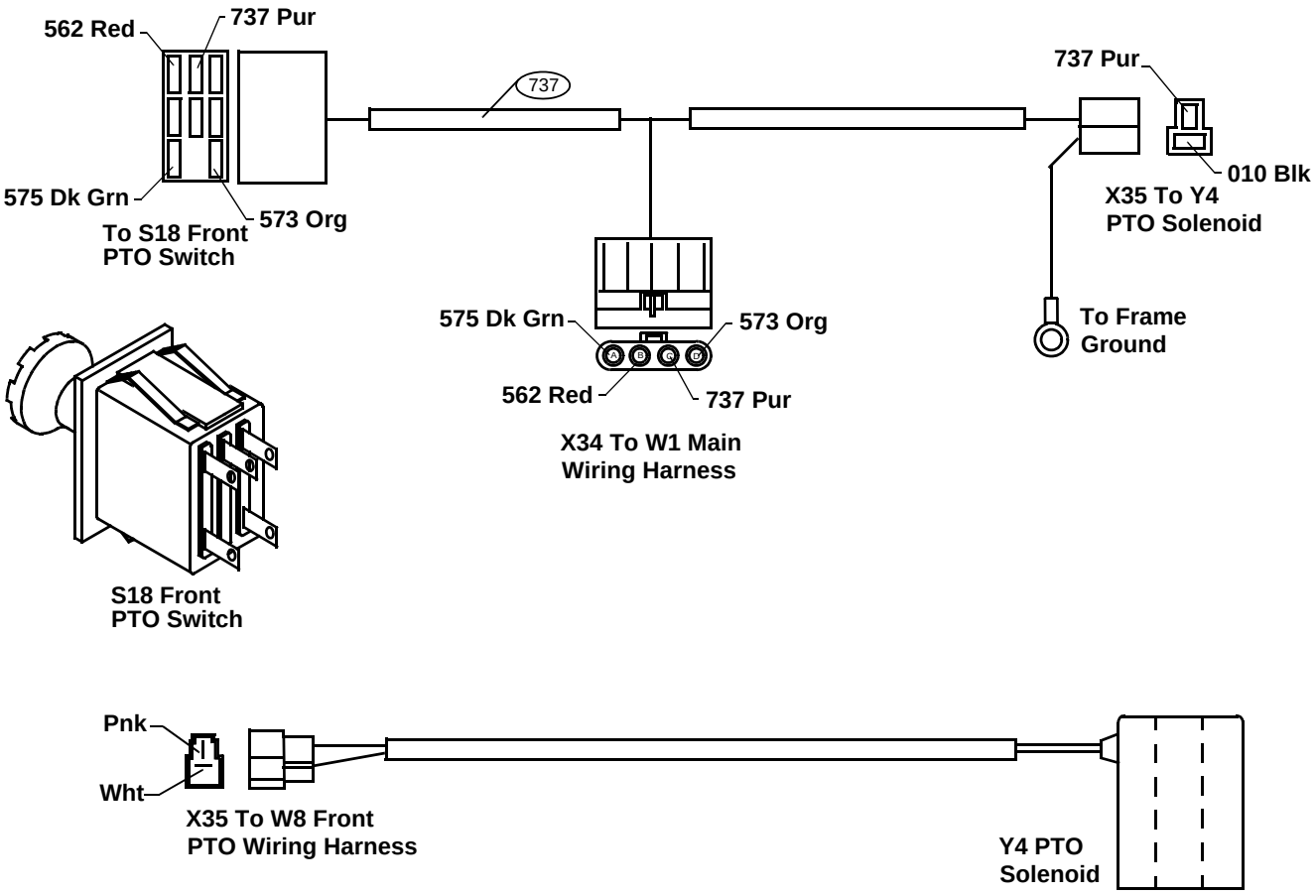


Circuit Number	Wire Size	Color	Termination Points	Main Harness Connection
010	3.0	Blk	X35 - Pin 3, Ground Wire Socket	X14 (to 010J Blk)
115	1.0	Dk Grn	X35 - Pin 4, RHTurn Signal Light Socket	X13 (to 115E Dk Grn)
118	1.0	Gry	X35 - Pin 5, LH Position Light Pin	X13 (to 118B Gry)
125	1.0	Dk Grn	X35 - Pin 1, LHTurn Signal Light Pin	X13 (to 125E Dk Grn)
128	1.0	Gry	X35 - Pin 7, RH Position Light Pin	X13 (to 128B Gry)
136	1.0	Lt Blu	X35 - Pin 6, LH and RH Brake Lights Socket	X13 (to 136B Lt Blu)
222	2.0	Red	X35 - Pin 2, Power Wire Socket (Accessory)	X14 (to 222 Red)

W7 2–SPEED PTO WIRING HARNESS



W8 FRONT PTO WIRING HARNESS



TROUBLESHOOTING

Problem or Symptom / Check or Solution	Starter cranking problems	Engine cranks but will not start	Engine will not shut off	Improper component operating with switch	Engine oil light problem	Battery goes dead, discharges or overcharges	Discharge light problem	Engine coolant temperature light problem	Engine will not run when operator leaves seat	Instrument lights problems	Headlight problem	Fuel gauge does not work properly
See Power Circuit Diagnosis	●	●									●	
See Engine Shutoff Circuit Diagnosis	●	●	●						●			
See Cranking Circuit Diagnosis	●											
Check ground circuit	●	●										
Test battery and battery connections	●											
See Manifold heater Circuit Diagnosis		●										
See Fuel Supply Circuit Diagnosis		●	●									
See Charging Circuit Diagnosis						●	●					
See Control Panel Indicator Diagnosis					●		●	●		●		●
See Lights Circuit Diagnosis											●	
Check for shorted circuit			●	●								●

THEORY AND DIAGNOSIS

POWER CIRCUIT OPERATION

Function:

Provides unswitched and switched power to the primary components whenever the battery is connected.

The power circuits are divided among the unswitched power circuit, switched power circuits (key switch in RUN, START, or AID positions), and secondary switched power circuits. The secondary switched power circuits become energized when switched power circuits energize relays, providing current paths to the secondary circuits. The secondary power circuits would not be energized if the relays controlling the current path(s) failed.

Detailed Theory of Operation, Schematics, and Troubleshooting of

Unswitched Power:

Voltage must be present at the following components with the key switch in the OFF position:

- Battery Positive Terminal
- Starting Motor Terminal B
- F1 Fuse
- Key Switch Terminal 1
- Alternator Terminal B
- Manifold Heater Relay Terminal 30
- Engine Run Relay Terminal 30
- F2 Fuse
- Accessory Relay Terminal 30
- F3 Fuse
- Light Switch Terminal B
- Horn Switch
- F4 Fuse
- Hazard Switch Terminal 30
- Brake Switch

The positive battery cable connects the battery to the starting motor bolt (terminal B). The starting motor bolt is used as the 12 Volt DC tie point for the rest of the electrical system.

The battery cables and the starting motor tie point connections must be good 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.

With the exception of the alternator B terminal, the electrical circuit is protected by the fusible link beyond the starting motor tie point. The fusible link is a short piece of wire that is designed to fail if current load is too high or a short occurs.

Switched Power - Run:

In addition to the voltage present at the locations of the unswitched power circuits, voltage must be present at the following components with the key switch in the RUN ("ON") position, transmission in NEUTRAL, PTO(s) in NEUTRAL, park brake ENGAGED, and operator NOT ON seat:

- Key Switch Terminals 3, 4, and 5
- Alternator Terminal IG
- F5 Fuse
- X5 Connector (562F Red wire)

NOTE: X5 connector has jumper wire installed (562F Red to 594B Yel) unless Mid PTO option is installed (includes S6 switch).

- S6 Rear PTO Switch
- X34 Connector (562D Red & 575B Dk Grn)

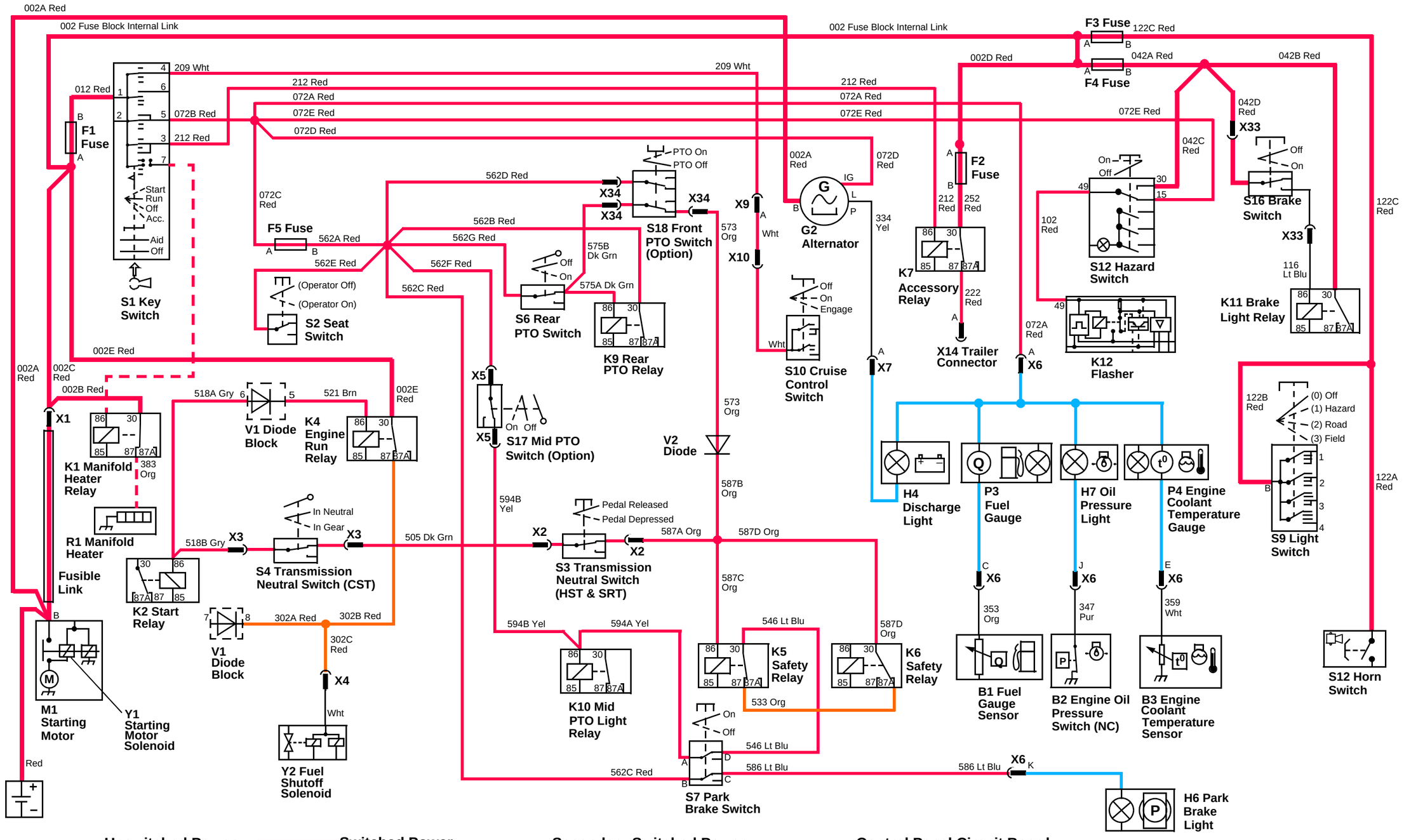
NOTE: X34 connector has jumper wire installed (575B Dk Grn to 573 Org) unless Front PTO option is installed (includes S18 switch).

- K9 Rear PTO Relay Terminals 30 and 86
- K10 Mid PTO Light Relay Socket Terminal 86
- Park Brake Switch Terminals A, B, C and D
- K5 Safety Relay Terminals 86 and 30
- K6 Safety Relay Terminal 30
- Seat Switch
- X9 Connector Terminal A
- Cruise Control Switch
- Hazard Switch Terminal 15
- K12 Flasher Terminal 49
- X6 Connector Terminals A and K
- X7 Connector Terminal A
- K7 Accessory Relay Terminal 86
- X2 Connector (587A Org wire); or, X3 Connector (505 Dk Grn wire)

NOTE: The S4 Transmission Neutral Switch is installed in collar shift gear drive (CST) tractors; a jumper wire is installed in the X2 connector, and the S3 Transmission Neutral Switch is not used.
In hydrostatic drive (HST) and SyncReverser™ (SRT) tractors the S3 Transmission Neutral Switch is used, and a jumper wire is installed in the X3 connector - eliminating the S4 switch.

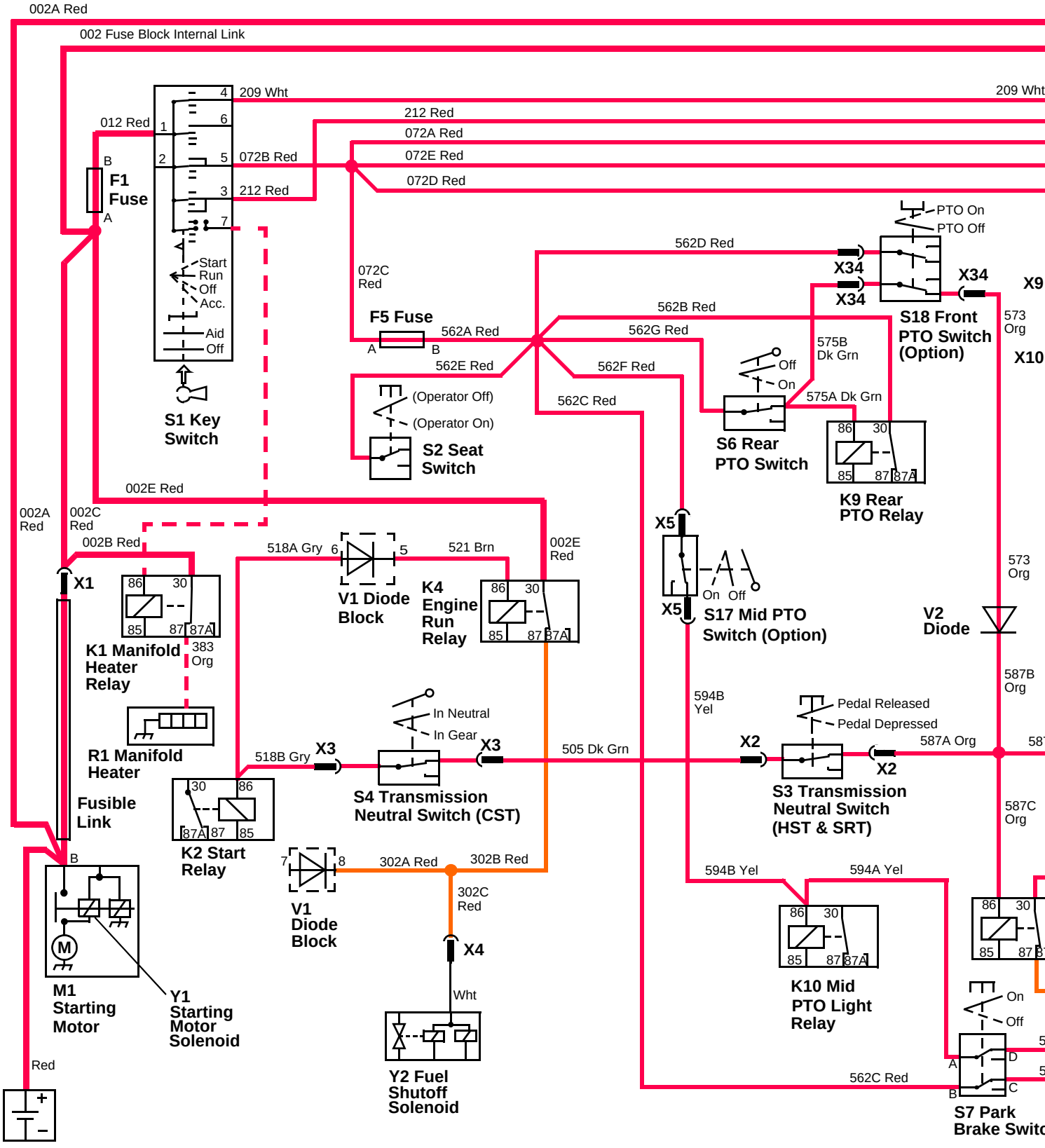
- Start Relay Terminal 86
- Diode Block Terminal 6
- Engine Run Relay Terminal 86

POWER CIRCUIT ELECTRICAL SCHEMATIC - RUN / AID



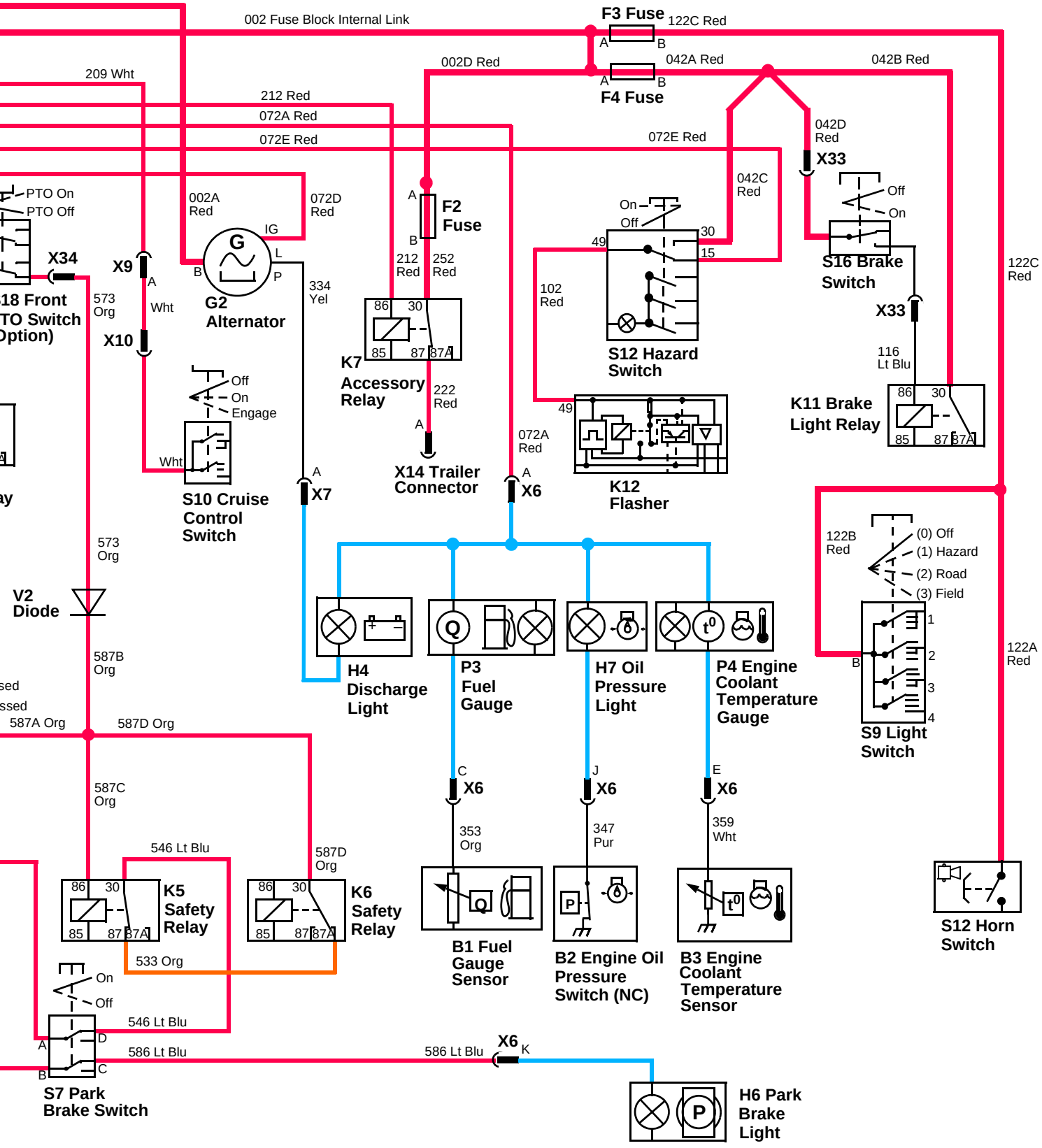
SE1 - STARTING	SE2 - IGNITION	SE3 - CHARGING	SE4 - ACCESSORIES	SE5 - INSTRUMENTATION	SE6 - LIGHTS

POWER CIRCUIT ELECTRICAL SCHEMATIC - RUN / AID



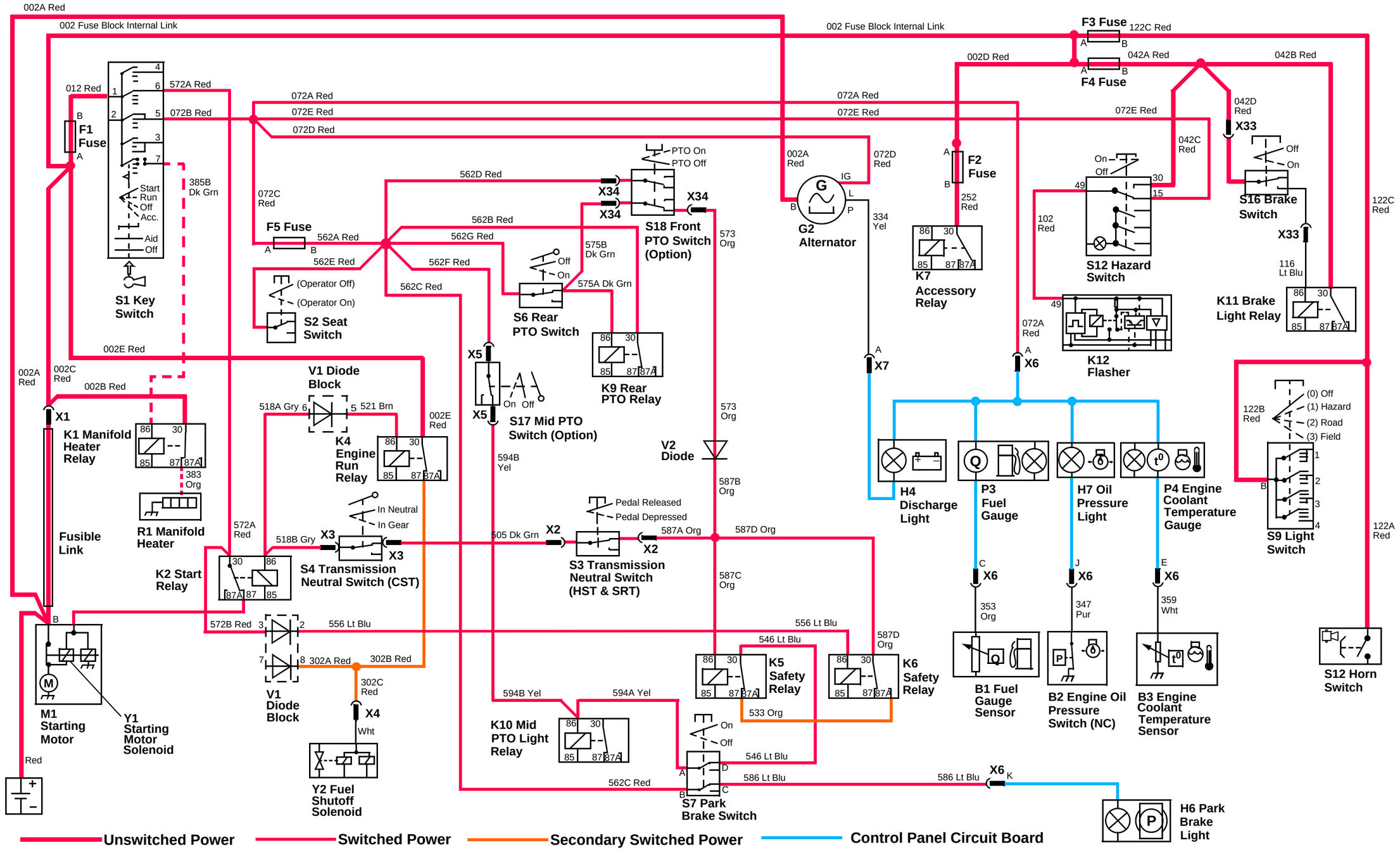
Unswitched Power — Switched Power — Secondary Switched Power

SE1 - STARTING	SE2 - IGNITION

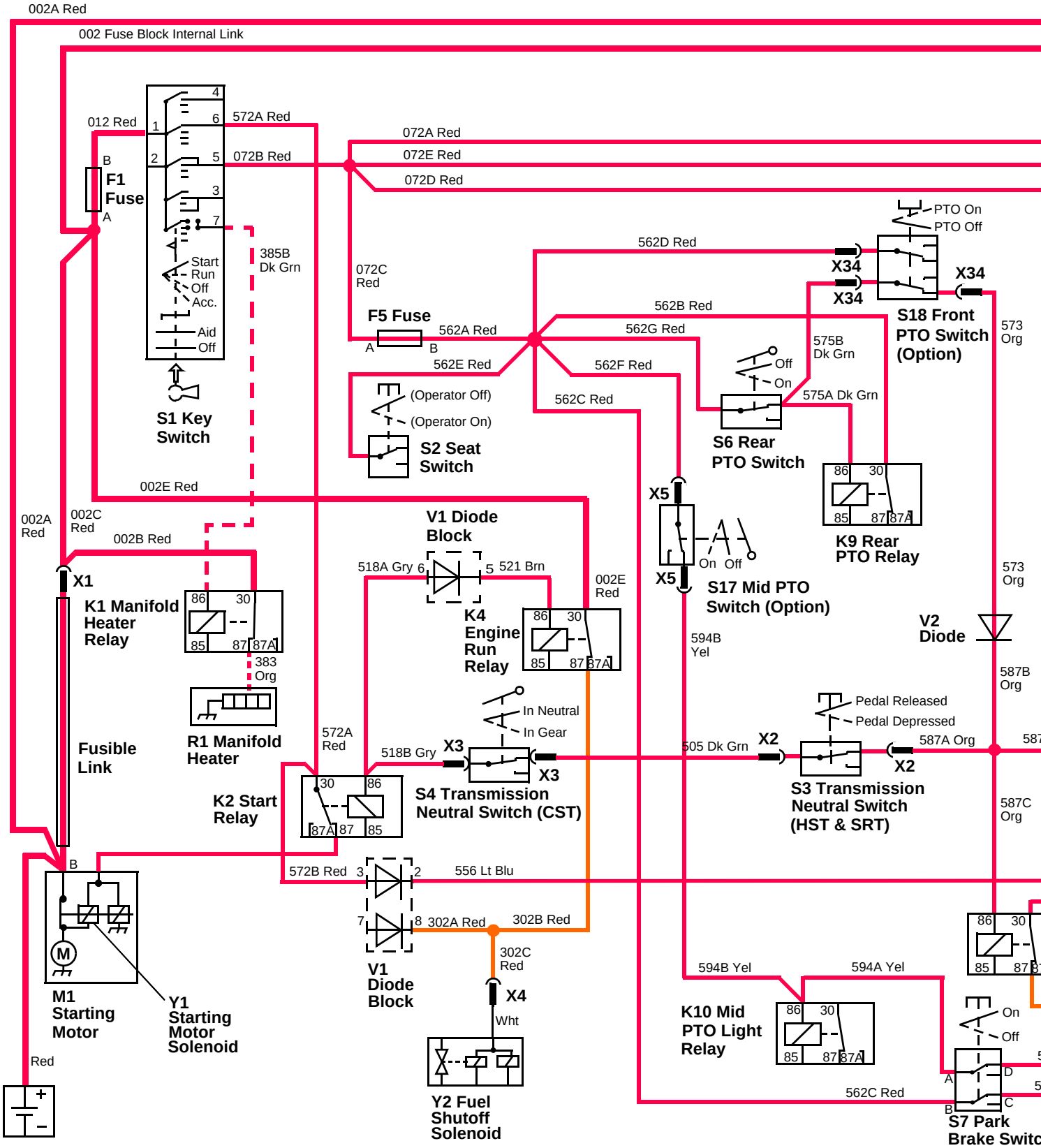


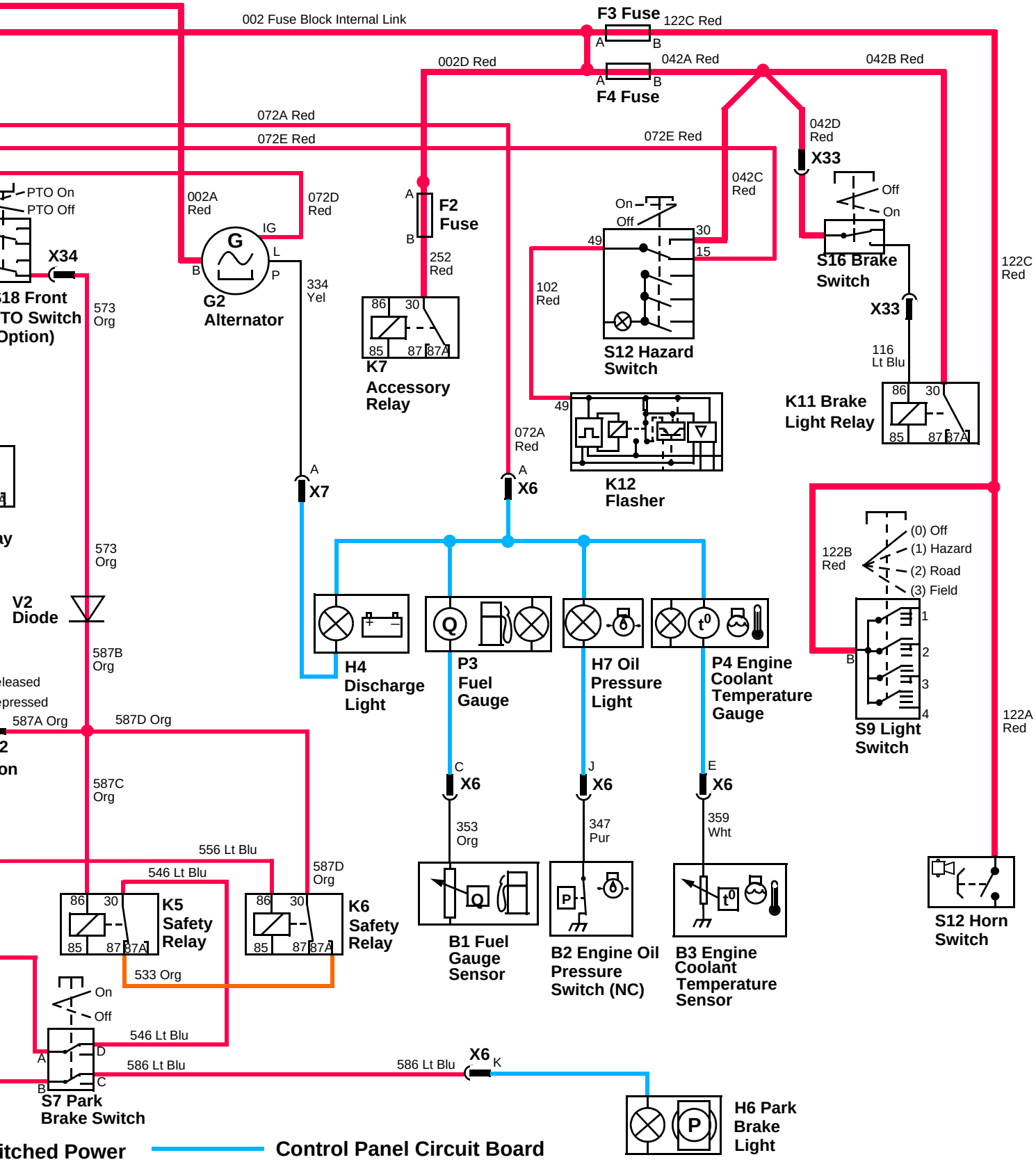
	SE3 - CHARGING	SE4 - ACCESSORIES	SE5 - INSTRUMENTATION	SE6 - LIGHTS

POWER CIRCUIT ELECTRICAL SCHEMATIC - START



POWER CIRCUIT ELECTRICAL SCHEMATIC - START




002 Fuse Block Internal Link
F3 Fuse
122C Red
A
B
002D Red
042A Red
042B Red
F4 Fuse
072A Red
072E Red
072E Red
042D Red
X33
042C Red
PTO On
PTO Off
002A Red
072D Red
IG
L
P
G
G2 Alternator
334 Yel
F2 Fuse
252 Red
86
30
85
87
87A
K7 Accessory Relay
On
Off
49
30
15
S12 Hazard Switch
102 Red
Off
On
S16 Brake Switch
X33
122C Red
116 Lt Blu
K11 Brake Light Relay
X34
573 Org
072A Red
X7
X6
K12 Flasher
V2 Diode
573 Org
587B Org
H4 Discharge Light
P3 Fuel Gauge
H7 Oil Pressure Light
P4 Engine Coolant Temperature Gauge
122B Red
(0) Off
(1) Hazard
(2) Road
(3) Field
S9 Light Switch
122A Red
587A Org
587D Org
587C Org
C
X6
J
X6
E
X6
353 Org
347 Pur
359 Wht
556 Lt Blu
546 Lt Blu
587D Org
K5 Safety Relay
K6 Safety Relay
B1 Fuel Gauge Sensor
B2 Engine Oil Pressure Switch (NC)
B3 Engine Coolant Temperature Sensor
S12 Horn Switch
533 Org
On
Off
546 Lt Blu
586 Lt Blu
586 Lt Blu
X6
K
S7 Park Brake Switch
H6 Park Brake Light
itched Power
Control Panel Circuit Board

Secondary Switched Power - Run:

Voltage must be present at the following components with the key switch in the RUN ("ON") position, transmission in NEUTRAL, PTO(s) in NEUTRAL, park brake ENGAGED, and operator NOT ON seat:

- K5 Safety Relay Terminal 87
- K6 Safety Relay Terminal 87A
- Engine Run Relay Terminal 87
- X4 Connector (302C Red wire)

Switched Power - Aide:

Voltage must be present at the following components with the key switch in the AID position (key pushed in when placed in the RUN or START position).

- Key Switch Terminal 7
- Manifold Heater Relay Terminal 86

These circuits are controlled by the key switch and are protected by the fusible link and the F1 fuse.

Secondary Switched Power - Aide:

Voltage must be present at the following components with the key switch in the AID position (key pushed in when placed in the RUN or START position):

- Manifold Heater Relay Terminal 87
- Manifold Heater

See "MANIFOLD HEATER OPERATION".

Switched Power - Start:

Voltage must be present at the following components with the key switch in the START position, transmission in NEUTRAL, PTO(s) in NEUTRAL, park brake ENGAGED, and operator NOT ON seat:

- Key Switch Terminals 5 and 6
- Start Relay Terminal 30
- Diode Block Terminal 3
- K6 Safety Relay Terminal 86
- Start Relay Coil (If start criteria are met)

NOTE: These components are in addition to the components that would have switched power with the key switch in the RUN position. Voltage would not be present at the cruise control switch, or at the accessory relay (terminal 86) with the key switch in the START position.

Secondary Switched Power - Start:

Voltage must be present at the following components with the key switch in the START position, transmission in NEUTRAL, PTO(s) in NEUTRAL, park brake ENGAGED, and operator NOT ON seat:

- Start Relay Terminal 87
- Starting Motor Terminal A

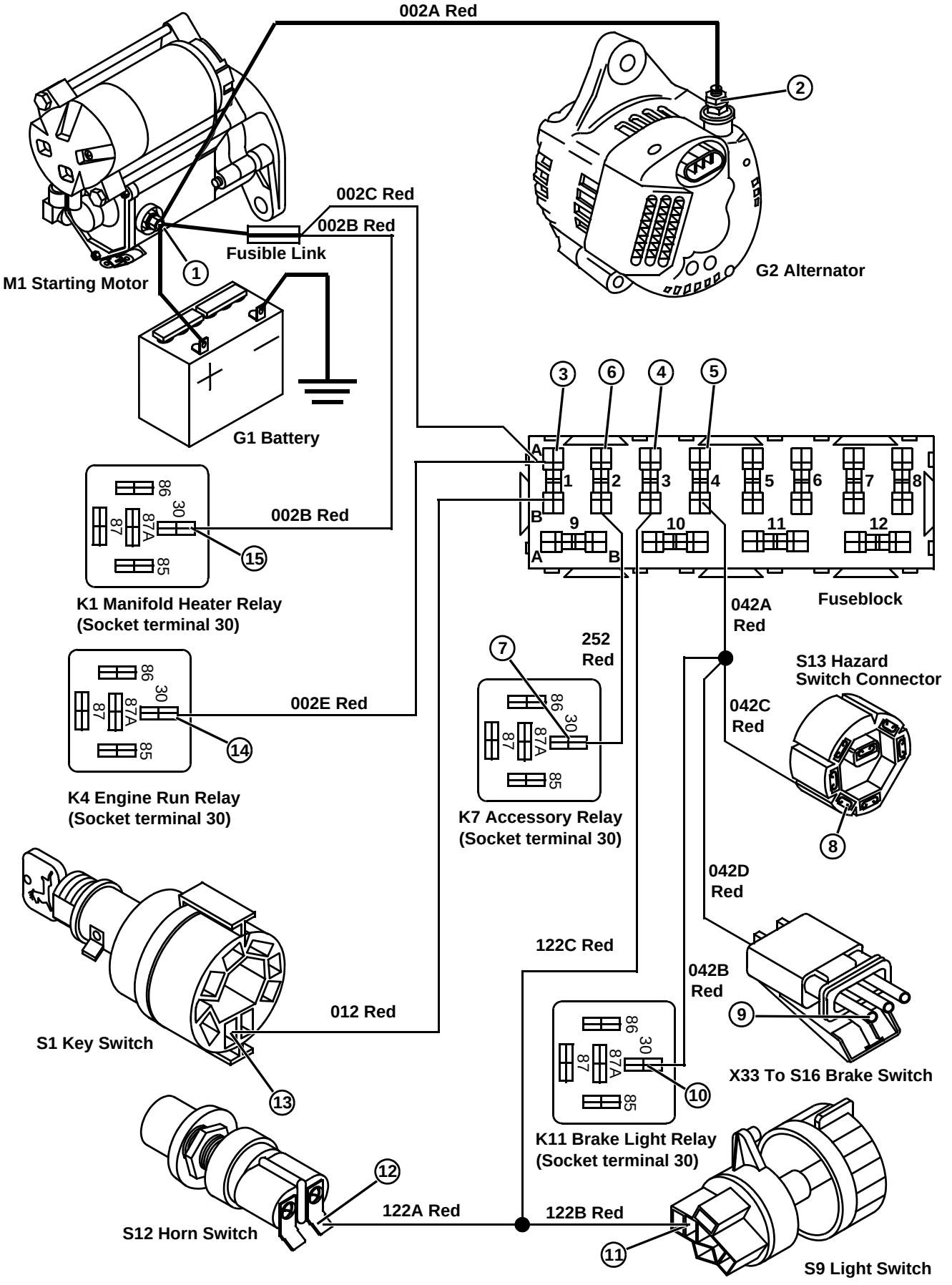
See "CRANKING CIRCUIT OPERATION".

POWER CIRCUIT DIAGNOSIS

Test Conditions: (For Unswitched Power)

- Key switch in OFF position
- Park brake ENGAGED
- Transmission in NEUTRAL
- PTO DISENGAGED

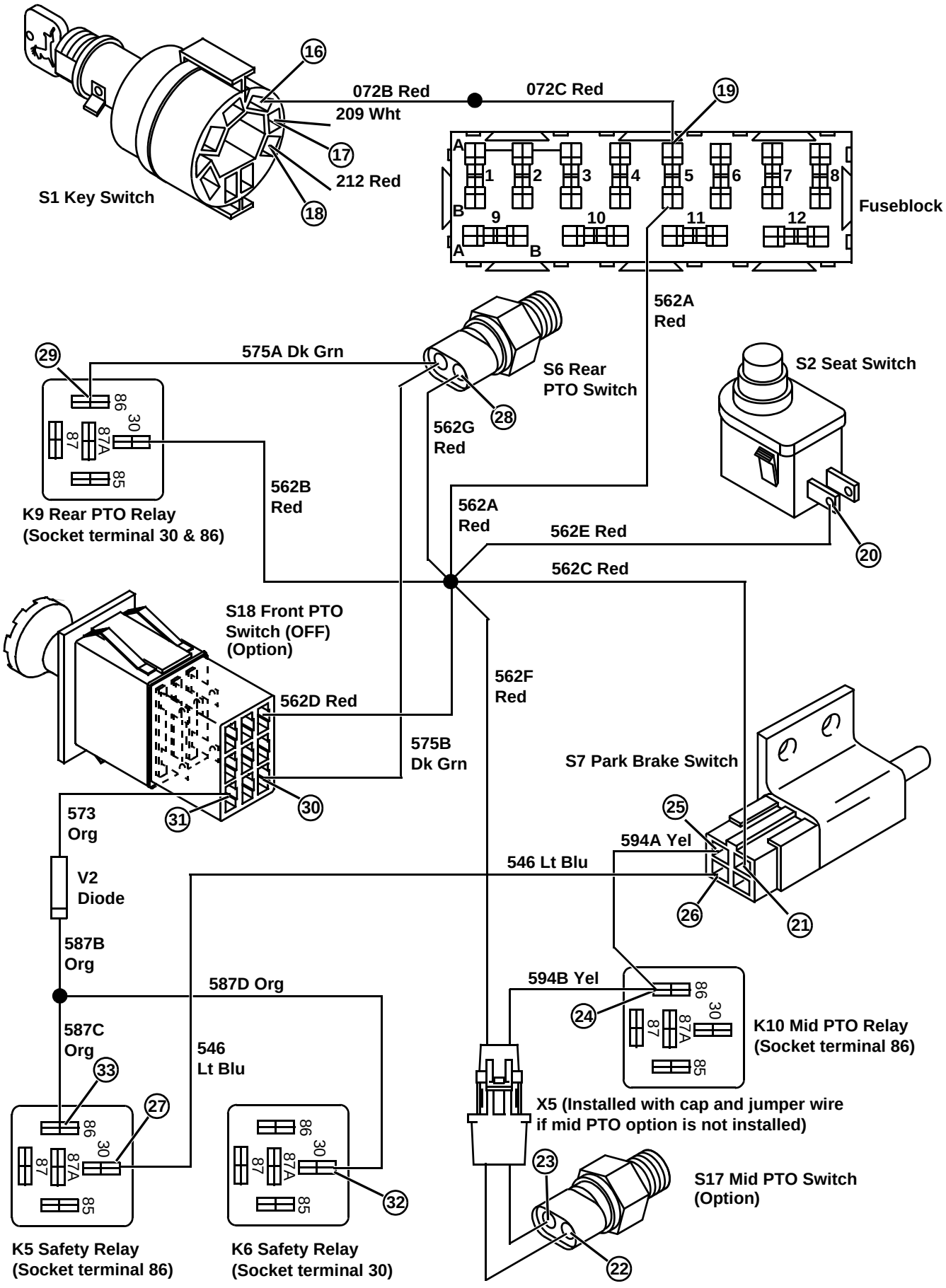
Test/Check Point	Normal	If Not Normal
1. Starting motor battery (B) terminal	Battery voltage	Check cable to battery. Test battery.
2. Alternator (B terminal)	Battery voltage	Check 002A Red cable and connections.
3. Fuse block (F1 fuse)	Battery voltage	Check fusible link, 002C Red wire and connections.
4. Fuse block (F3 fuse)	Battery voltage	Check internal fuse connection in load center (tie to F1 fuse).
5. Fuse block (F4 fuse)	Battery voltage	Check internal fuse connection in load center (tie to F1 fuse).
6. Fuse block (F2 fuse)	Battery voltage	Check 002D Red wire and connections.
7. Accessory relay socket	Battery voltage	Check F2 fuse, 252 Red wire and connections.
8. Hazard switch connector	Battery voltage	Check F4 fuse, 042A and 042C Red wires and connections.
9. X33 connector to S16 brake switch	Battery voltage	Check F4 fuse, 042A and 042D Red wires and connections.
10. Brake light relay socket (terminal 30)	Battery voltage	Check F4 fuse, 042A and 042B Red wires and connections.
11. Light switch	Battery voltage	Check F3 fuse, 122C and 122B Red wires and connections.
12. Horn switch	Battery voltage	Check F3 fuse, 122C and 122A Red wires and connections.
13. Key switch	Battery voltage	Check F1 fuse, 012 Red wire and connections.
14. Engine run relay socket (terminal 30)	Battery voltage	Check fusible link, 002E Red wire and connections.
15. Manifold heater relay socket (terminal 30)	Battery voltage	Check fusible link, 002B Red wire and connections.


002A Red
2
002C Red
002B Red
Fusible Link
1
M1 Starting Motor
G2 Alternator
G1 Battery
3
6
4
5
A
1
2
3
4
5
6
7
8
B
9
10
11
12
A
B
Fuseblock
042A
Red
86
30
87
87A
85
002B Red
15
K1 Manifold Heater Relay
(Socket terminal 30)
002E Red
14
K4 Engine Run Relay
(Socket terminal 30)
7
252
Red
K7 Accessory Relay
(Socket terminal 30)
S13 Hazard
Switch Connector
042C
Red
8
042D
Red
122C Red
042B
Red
9
X33 To S16 Brake Switch
012 Red
S1 Key Switch
13
10
K11 Brake Light Relay
(Socket terminal 30)
12
122A Red
122B Red
S12 Horn Switch
11
S9 Light Switch

Test Conditions: (For Switched Power)

- Key switch in RUN position
- Park brake ENGAGED
- Transmission in NEUTRAL
- PTO DISENGAGED

Test/Check Point	Normal	If Not Normal
16. Key switch	Battery voltage	Test key switch (See "KEY SWITCH TEST"). Replace switch as necessary.
17. Key switch	Battery voltage	Test key switch.
18. Key switch	Battery voltage	Test key switch.
19. Fuseblock (F5 fuse)	Battery voltage	Check 072B and 072C Red wires and connections.
20. Seat switch	Battery voltage	Check F5 fuse, 562A and 562E Red wires and connections.
21. Park brake switch	Battery voltage	Check 562C Red wire and connections.
22. Mid PTO switch (Option)	Battery voltage	Check 562F Red wire and connections.
23. Mid PTO switch (Option)	Battery voltage	Ensure Mid PTO is DISENGAGED. Test switch (See "REAR AND MID PTO SWITCH TEST").
24. Mid PTO relay socket (terminal 86)	Battery voltage	Check 594B Yel wire and connections.
25. Park brake switch	Battery voltage	Check 594A Yel wire and connections.
26. Park brake switch	Battery voltage	Ensure park brake is ENGAGED. Test switch. (See "PARK BRAKE SWITCH TEST").
27. K5 Safety relay socket (terminal 30)	Battery voltage	Check 546 Lt Blu wire and connections.
28. S6 rear PTO switch	Battery voltage	Check 562G Red wire and connections.
29. K9 rear PTO relay socket (terminal 86)	Battery voltage	Ensure PTO is DISENGAGED. Check 575A Dk Grn wire and connections. Test rear PTO switch. (See "REAR AND MID PTO SWITCH TEST").
30. PTO switch (X34 if Front PTO option is not installed)	Battery voltage	Check S6 switch. Check 575B Dk Grn wire, X34 and connections.
31. PTO switch	Battery voltage	Ensure PTO switch is in OFF position. Test switch (See "FRONT PTO SWITCH TEST").
32. K6 safety relay (terminal 30)	Battery voltage	Check 573 Org wire, V2 diode (See "V2 DIODE TEST"), 587B and 587D Org wires and connections.


16
072B Red
209 Wht
17
212 Red
18
S1 Key Switch
072C Red
19
A
1 2 3 4 5 6 7 8
B
9 10 11 12
A B
Fuseblock
562A
Red
29
575A Dk Grn
S6 Rear
PTO Switch
28
562G
Red
S2 Seat Switch
86 30 87 87A 85
562B
Red
K9 Rear PTO Relay
(Socket terminal 30 & 86)
562A
Red
562E Red
20
562C Red
S18 Front PTO
Switch (OFF)
(Option)
562F
Red
562D Red
575B
Dk Grn
S7 Park Brake Switch
31
30
573
Org
25
594A Yel
546 Lt Blu
V2
Diode
26
21
587B
Org
587D Org
594B Yel
24
K10 Mid PTO Relay
(Socket terminal 86)
587C
Org
546
Lt Blu
33
27
X5 (Installed with cap and jumper wire
if mid PTO option is not installed)
23
S17 Mid PTO Switch
(Option)
32
K5 Safety Relay
(Socket terminal 86)
K6 Safety Relay
(Socket terminal 30)
22

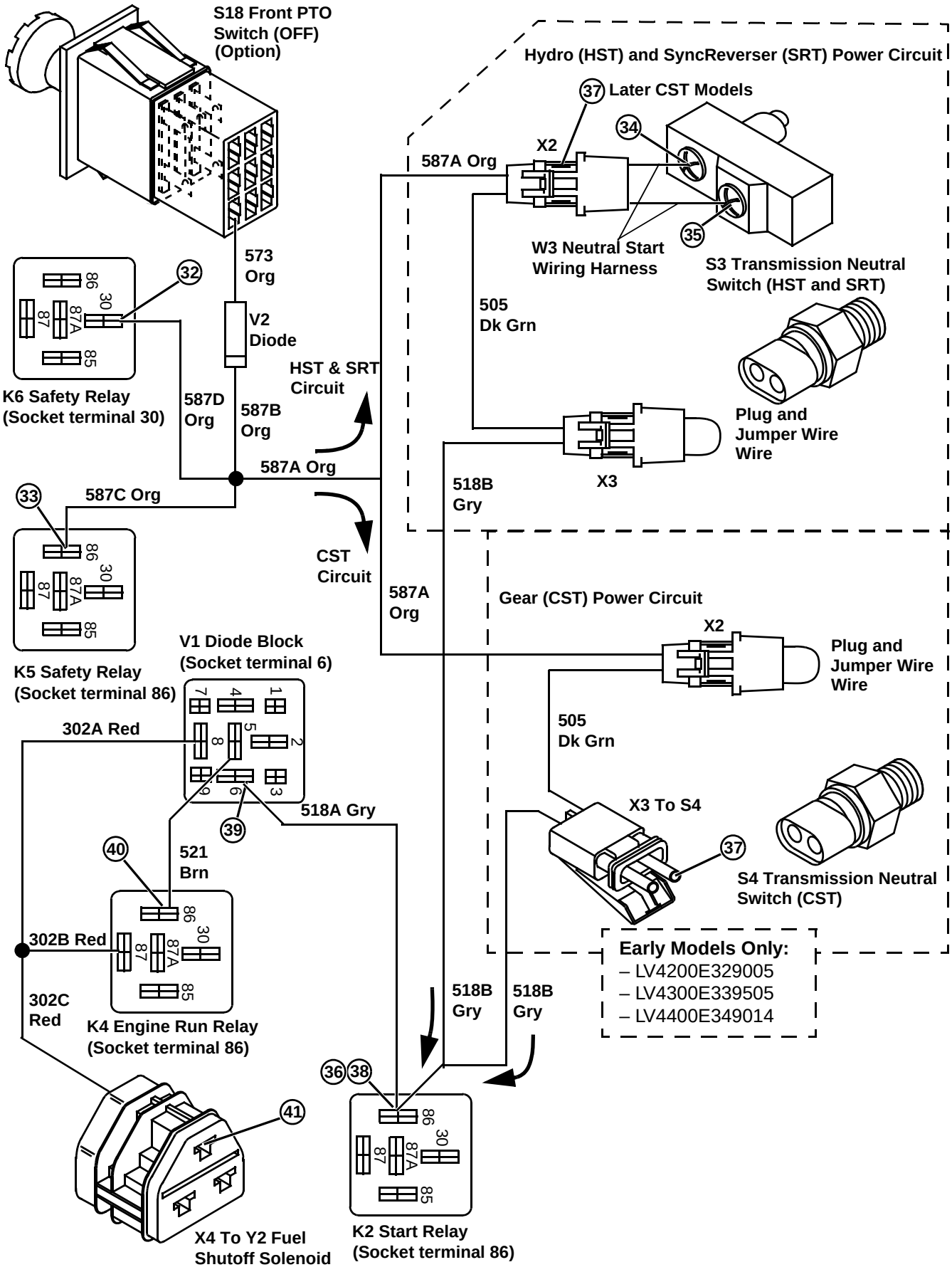
Test/Check Point	Normal	If Not Normal
33. K5 safety relay (terminal 86)	Battery voltage	Check 587C Org wires and connections.
NOTE: The following three steps are for Hydro (HST) and SyncReverser (SRT) tractors. The X3 connector is fitted with a plug and jumper wire. For Gear Collar Shift (CST) tractors see step 36.		
34. S3 transmission neutral switch	Battery voltage	Check 573 Org wire, V2 diode (See "V2 DIODE TEST"), 587B and 587A Org wires and connections.
35. S3 transmission neutral switch	Battery voltage	Ensure forward pedal linkage is depressing switch, adjust switch position if needed. Test switch. (See "TRANSMISSION NEUTRAL SWITCH TEST– HST&SRT").
36. Start relay socket (terminal 86)	Battery voltage	Check X3 connector and jumper wire, 505 Dk Grn wire, X4 and connections. Check 518B Gry wire and connections.
NOTE: The following two steps are for Gear Collar Shift (CST) tractors only.		
37. X3 to S3 Transmission neutral switch (Early Models) X2 to S3 Transmission neutral switch (Later Models)	Battery voltage	Check 573 Org wire, V2 diode, 587B and 587A Org wires, X2 connector and jumper wire, and 505 Dk Grn wire.
38. Start relay socket (terminal 30)	Battery voltage	Ensure transmission is in NEUTRAL. Test S4 transmission switch. (See "TRANSMISSION NEUTRAL SWITCH TEST– CST") Check 518B Gry wire and connections.
39. Diode block socket (terminal 6)	Battery voltage	Check 518A Gry wire and connections.
40. Engine run relay socket (terminal 86)	Battery voltage	Ensure diode block is fully seated. Test diode block (See "DIODE BLOCK TEST"). Check 521 Brn wire and connections.

Test Conditions: (For Secondary Switched) Power

NOTE: The following test is for the fuel solenoid that receives power after a relay is activated. This circuit needs to have all of the relays in place to perform this test.

- Key switch in RUN position
- Engine OFF
- Park brake ENGAGED
- Transmission in NEUTRAL
- PTO DISENGAGED
- Fuel solenoid DISCONNECTED

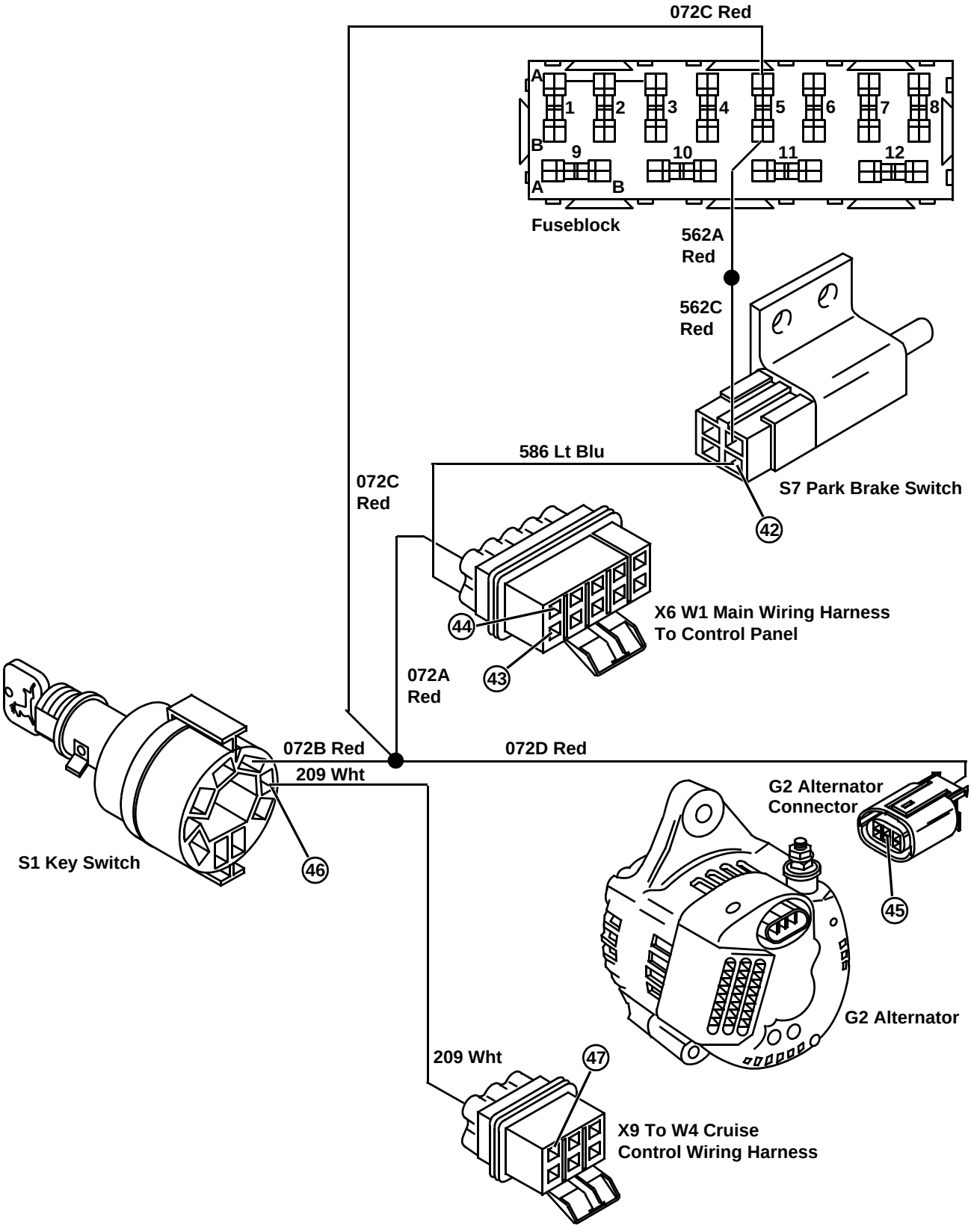
41. X4 connector to fuel shutoff solenoid	Battery voltage Note: Battery voltage can not be tested at the diode block socket. The diode block needs to be in place.	Ensure K4 engine run relay coil is powered. See step 40. Check engine run relay (See "RELAY TEST").Check 302B and 302C Red wires and connections.


S18 Front PTO Switch (OFF) (Option)
Hydro (HST) and SyncReverser (SRT) Power Circuit
37 Later CST Models
34
X2
587A Org
35
W3 Neutral Start Wiring Harness
S3 Transmission Neutral Switch (HST and SRT)
573 Org
32
86
30
87
87A
85
V2 Diode
505 Dk Grn
HST & SRT Circuit
K6 Safety Relay (Socket terminal 30)
587D Org
587B Org
Plug and Jumper Wire Wire
X3
587A Org
518B Gry
33
587C Org
CST Circuit
587A Org
Gear (CST) Power Circuit
X2
Plug and Jumper Wire Wire
K5 Safety Relay (Socket terminal 86)
V1 Diode Block (Socket terminal 6)
505 Dk Grn
302A Red
X3 To S4
518A Gry
39
37
S4 Transmission Neutral Switch (CST)
40
521 Brn
Early Models Only:
– LV4200E329005
– LV4300E339505
– LV4400E349014
302B Red
518B Gry
518B Gry
302C Red
K4 Engine Run Relay (Socket terminal 86)
36
38
41
X4 To Y2 Fuel Shutoff Solenoid
K2 Start Relay (Socket terminal 86)

Test Conditions: (For Switched Power - continued)

- Key switch in ON position
- Engine OFF
- Park brake ENGAGED
- Transmission in NEUTRAL
- PTO DISENGAGED

Test/Check Point	Normal	If Not Normal
42. Park brake switch	Battery voltage	Ensure park brake is set. Check voltage from 562C Red wire. Test switch (See "PARK BRAKE SWITCH TEST").
43. X6 connector to control panel	Battery voltage	Check 586 Lt Blu wire and connections.
44. X6 connector to control panel	Battery voltage	Check 072A Red wire and connections.
45. Alternator IG Terminal	Battery voltage	Check 072B and 072D Red wires and connections.
46. Key switch	Battery voltage	Test key switch (See "KEY SWITCH TEST").
47. X9 connector	Battery voltage	Check 209 Wht wire and connections.


072C Red
A
1
2
3
4
5
6
7
8
B
9
10
11
12
A
B
Fuseblock
562A
Red
562C
Red
586 Lt Blu
S7 Park Brake Switch
42
072C
Red
44
X6 W1 Main Wiring Harness
To Control Panel
072A
Red
43
072B Red
209 Wht
072D Red
G2 Alternator
Connector
45
S1 Key Switch
46
G2 Alternator
209 Wht
47
X9 To W4 Cruise
Control Wiring Harness

CRANKING CIRCUIT OPERATION

Function:

To energize the starting motor solenoid and engage the starting motor to crank the engine.

Operating Conditions:

- Key switch in START position
- Transmission in NEUTRAL
- Rear PTO DISENGAGED (disengages mid PTO)

CAUTION

To avoid injury, ALWAYS engage parking brake when starting or cranking the engine.

Theory of Operation:

The power circuit (fusible link, 002C Red wire, F1 fuse, and 012 Red wire) provides voltage to the key switch.

When placed in the START position the key switch provides voltage to the K2 start relay contact (572A Red to terminal 30 of start relay).

The start relay coil is energized through a circuit consisting of the key switch (terminal 5), 072B and 072C Red wires, F5 fuse, 562A and 562G Red wires, rear PTO switch (PTO DISENGAGED), 575B Dk Grn wire, X34 and jumper wire (S18 front PTO switch if option is installed), 573 Org wire, V2 diode, 587B and 587A Org wires, S3 transmission neutral switch, 505 Dk Grn wire, X3 with jumper wire, and 518B Gry wire on HST and SRT tractors; or, X2 with jumper wire, 505 Dk Grn wire, S4 transmission neutral switch, and 518B Gry wire on CST tractors.

NOTE: The S4 Transmission Neutral Switch is installed in collar shift gear drive (CST) tractors; a jumper wire is installed in the X2 connector, and the S3 Transmission Neutral Switch is not used.
In hydrostatic drive (HST) and SyncReverser™ (SRT) tractors the S3 Transmission Neutral Switch is used, and a jumper wire is installed in the X3 connector - eliminating the S4 switch.

When the start relay coil is energized, the relay contacts close and current flows to the starting motor solenoid (309 Wht).

With the starting motor solenoid energized the starting motor solenoid contacts close and high current from the battery passes through the battery cable and solenoid contacts to the starting motor. The starting motor cranks the engine.

MANIFOLD HEATER OPERATION

Function:

To provide an added source of heat for combustion.

Operating Conditions:

- Key switch must be in the START or RUN position and key pushed into switch to the AID position.

Theory of Operation:

The ignition system is designed to inject diesel fuel into the piston cylinder where heat from compression ignites the fuel and air mixture.

When starting a cold engine, compression may not provide enough heat to ignite the fuel. The manifold heater is installed to provide added heat to the incoming combustion air.

The manifold heater is energized (heated) when the key switch is placed in the AID position. The key can be pushed into the AID position with the key in either the START or RUN position. The manifold may be preheated by pushing in the key, with the switch in the RUN position, for up to 3 seconds before turning the key to the START position.

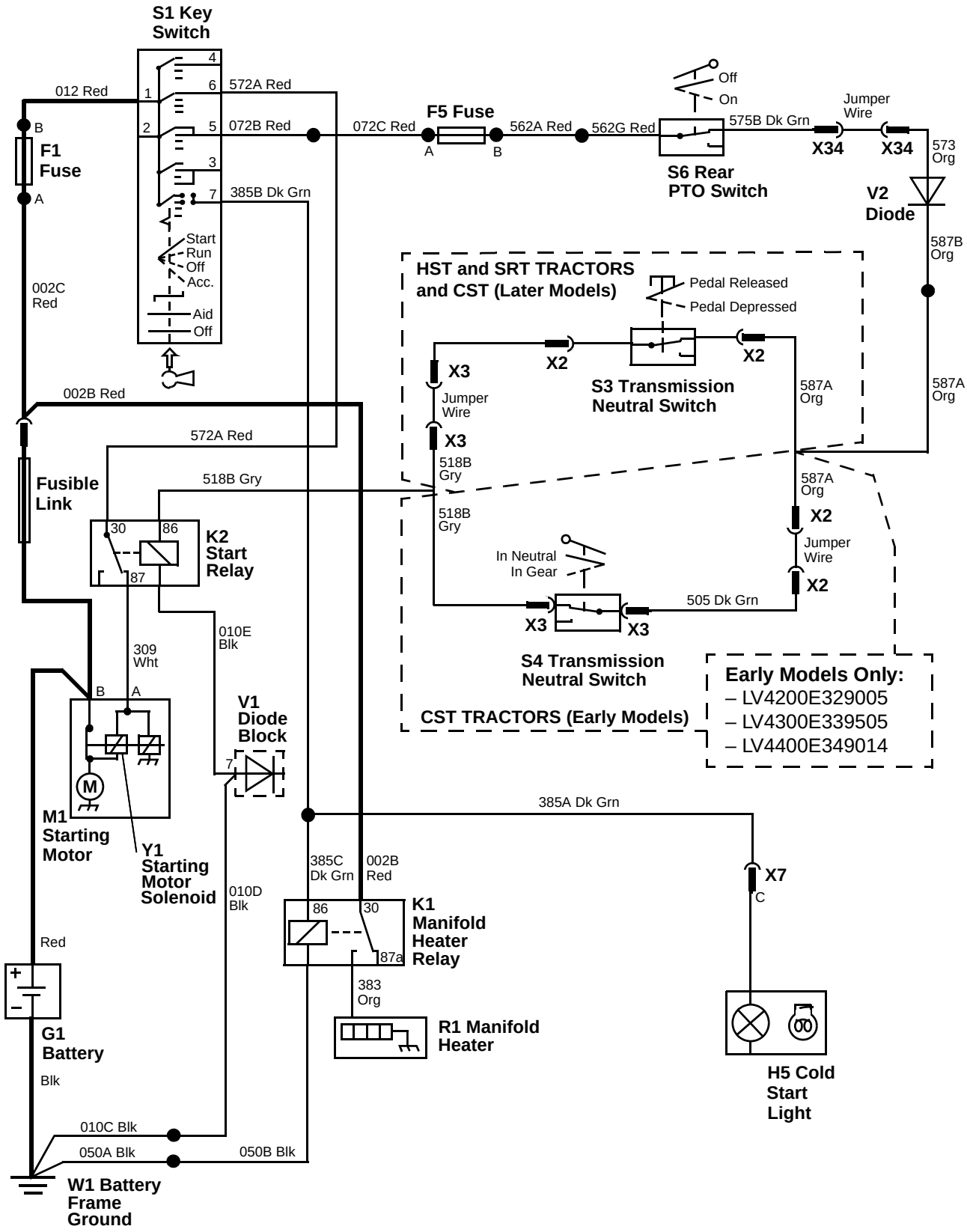
When the key switch is in the AID position, current is provided to the K1 manifold heater relay coil (terminal 86) through the 385B and 385C Dk Grn wires. When the relay coil is energized, the relay contacts close and unswitched power (002B Red wire - terminal 30) flows through the contacts and 383 Org wire to the manifold heater.

The H5 cold start indicator light in the control panel provides a visual indication that the key is in the AID position and the manifold heater relay is being energized.

With the key in the START or RUN position, and the key switch in the AID position, battery voltage is provided to the H5 start light through the 385B and 385A Dk Grn wires, X6 connector (terminal K), and control panel circuit board.

A ground circuit path for the control panel circuit board is provided though the X6 connector (terminal D), and 050K and 050A Blk wires.

CRANKING CIRCUIT ELECTRICAL SCHEMATIC



SE1 - STARTING	SE2 - IGNITION

CRANKING CIRCUIT DIAGNOSIS

Test Conditions:

- Park brake ENGAGED
- K2 start relay unplugged
- Transmission in NEUTRAL
- PTO(s) DISENGAGED
- Key switch in START position

Test/Check Point	Normal	If Not Normal
1. Key switch	Battery voltage	(See "POWER CIRCUIT DIAGNOSIS") Test switch. (See "KEY SWITCH TEST") Replace key switch as necessary.
2. F5 fuse	Battery voltage	Check 072B and 072C Red wires and connections.
3. S6 rear PTO switch	Battery voltage	Check F5 fuse. Check 562A and 562G Red wires and connections.
4. S18 rear PTO switch	Battery voltage	Check 575B Dk Grn wire and connections. Ensure PTO is disengaged. Check S6 switch (See "REAR AND MID PTO SWITCH TEST").
5. S18 rear PTO switch	Battery voltage	Ensure PTO switch is in OFF position. Test switch (See "FRONT PTO SWITCH TEST").Replace switch as needed.
6. Transmission neutral switch	Battery voltage	Check 573 Org wire, V2 diode (See "V2 DIODE TEST"), 587B and 587A Org wires, and X2 connector.
7. Transmission neutral switch	Battery voltage	Check switch*. (See "TRANSMISSION NEUTRAL SWITCH TEST – CST") or (See "TRANSMISSION NEUTRAL SWITCH TEST – HST&SRT") Adjust or replace switch as needed.
8. K2 start relay socket (terminal 86)	Battery voltage	Check 505 Dk Grn wire, X3 connector and jumper wire, and 518B Gry wire and connections.*
9. K2 start relay socket (terminal 30)	Battery voltage	Check 572A Red wire and connections.

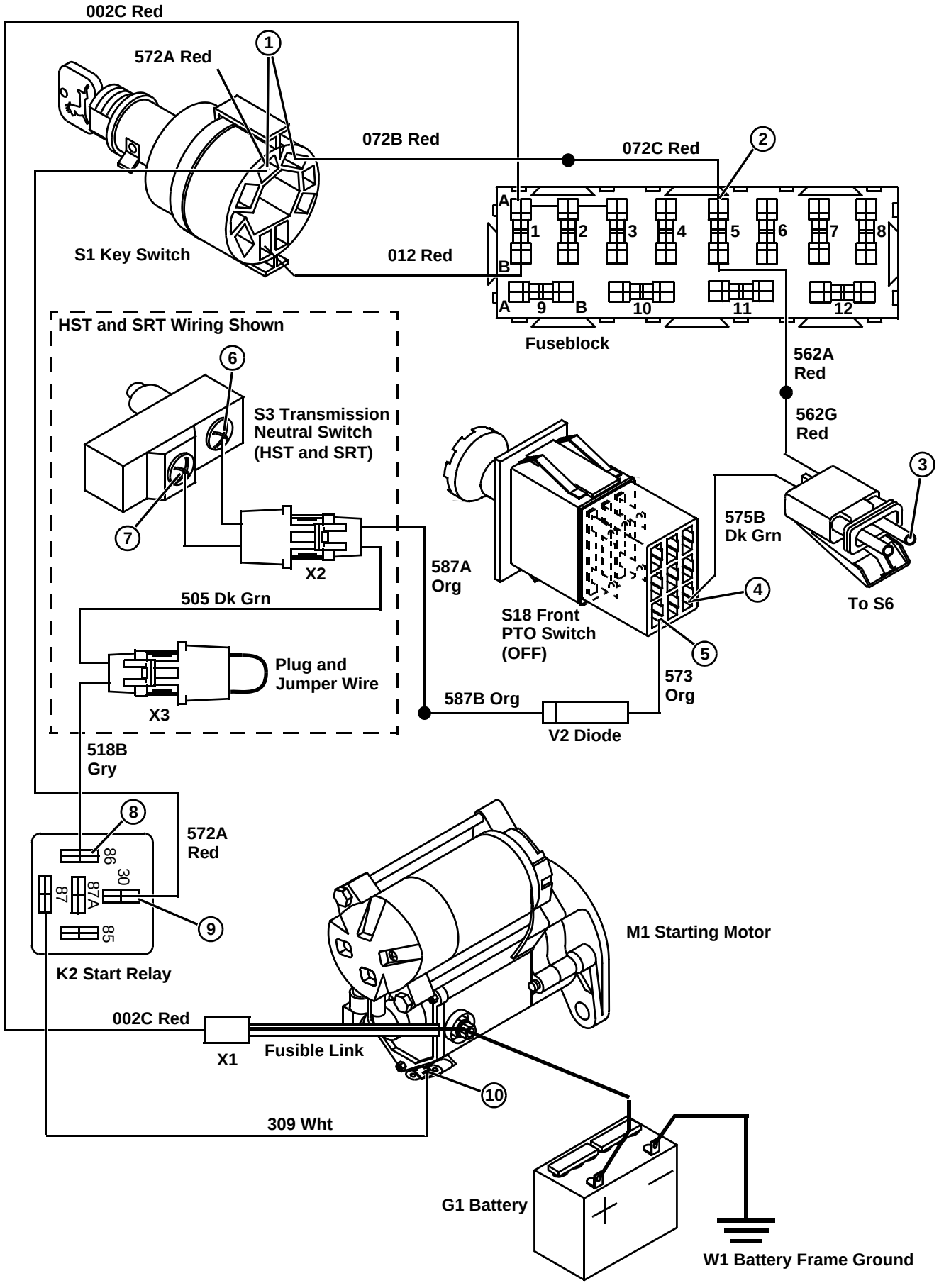
Test Conditions:

- Park brake ENGAGED
- Transmission in NEUTRAL
- Disconnect wiring harness connector to fuel solenoid
- K2 start relay plugged in
- PTO(s) DISENGAGED
- Key switch in START position

⚠**CAUTION:** Engine may start during this procedure. Disconnect fuel shutoff solenoid.

10. Starting motor	Battery voltage	Check 309 Wht wire and connections. Check K2 start relay (See "RELAY TEST").Replace relay as needed.

* Note: This procedure is for HST and SRT tractors. For CST tractors, jumper wire is installed in X2 and S4 neutral transmission switch is installed and connected to X3.


002C Red
572A Red
1
072B Red
072C Red
2
S1 Key Switch
012 Red
A
B
1
2
3
4
5
6
7
8
A
9
B
10
11
12
Fuseblock
HST and SRT Wiring Shown
6
S3 Transmission
Neutral Switch
(HST and SRT)
7
X2
505 Dk Grn
X3
Plug and
Jumper Wire
587A
Org
562A
Red
562G
Red
575B
Dk Grn
3
To S6
4
S18 Front
PTO Switch
(OFF)
5
573
Org
587B Org
V2 Diode
518B
Gry
8
572A
Red
86
30
87
87A
85
9
K2 Start Relay
M1 Starting Motor
002C Red
X1
Fusible Link
10
309 Wht
G1 Battery
W1 Battery Frame Ground

MANIFOLD HEATER CIRCUIT DIAGNOSIS

Test Conditions:

- Park brake ENGAGED
- Key switch in OFF position
- Unplug K1 manifold heater relay

Test/Check Point	Normal	If Not Normal
1. Key switch	Battery voltage	(See "POWER CIRCUIT DIAGNOSIS").
2. Manifold heater relay socket	Battery voltage	Check 002B Red wire and connections. (See "POWER CIRCUIT DIAGNOSIS").

Test Conditions:

- Park brake ENGAGED
- Unplug K2 start relay
- Unplug K1 manifold heater relay
- Key switch in RUN position; key in AID position (pushed in)

3. Key switch	Battery voltage	Check key switch (See "KEY SWITCH TEST"). Replace switch as needed.
4. Manifold heater relay socket	Continuous battery voltage while key switch is in AID position	Check 385B and 385C Dk Grn wires and connections.
5. X6 connector to control panel	Continuous battery voltage while key switch is in AID position	Check 385B and 385A Dk Grn wires and connections.

Test Conditions:

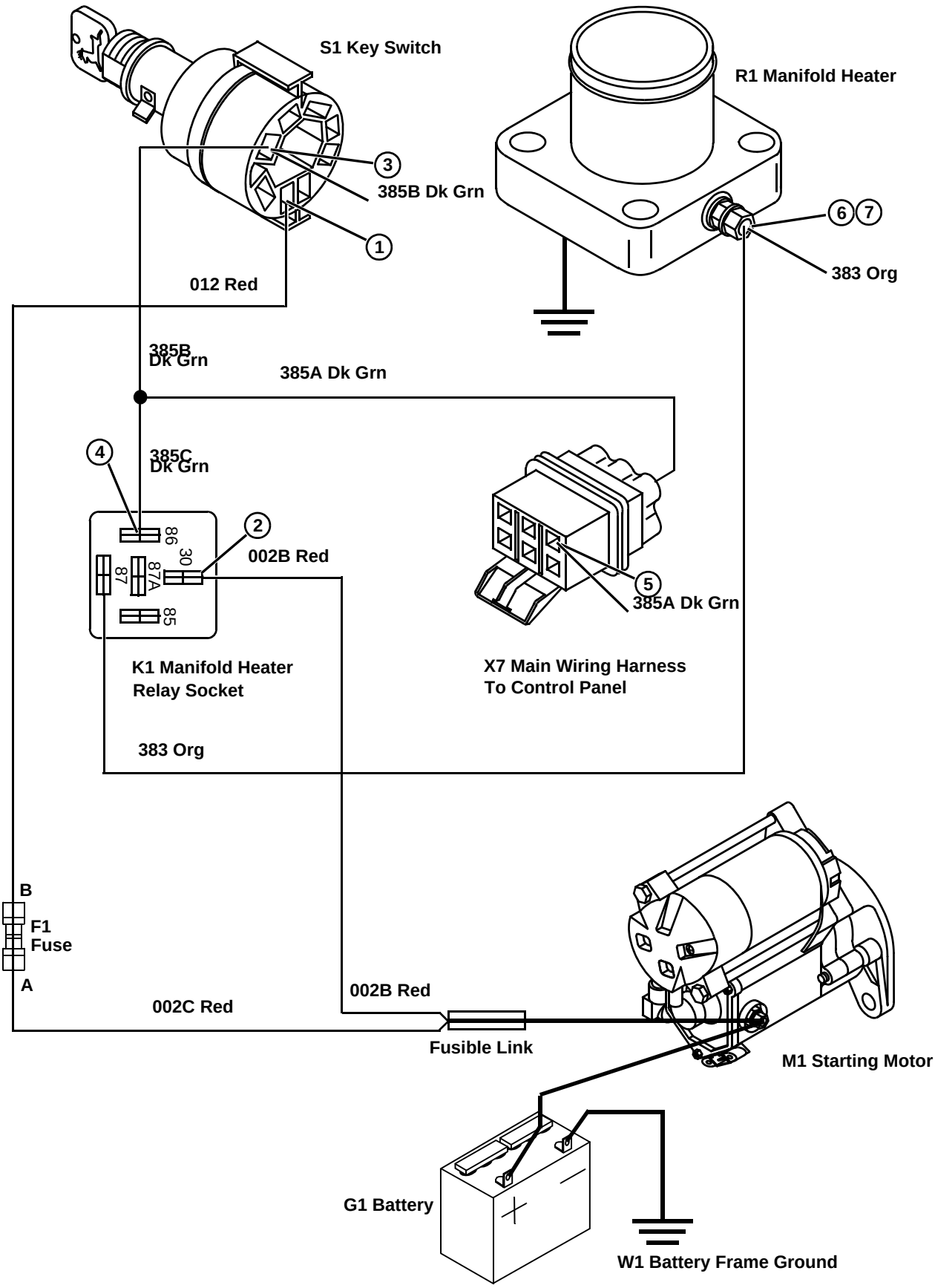
- Park brake ENGAGED
- Unplug K2 start relay
- Plug K1 manifold heater relay into socket
- Key switch in RUN position; key in AID position (pushed in)

6. Manifold heater	Battery voltage	Check 383 Org wire and connections. Check K1 relay (See "RELAY TEST"). Replace relay as needed.

Test Conditions:

- Park brake ENGAGED
- Change meter to ohm scale
- Meter negative lead connected to frame ground
- Key switch in OFF position

7. Manifold heater module	Maximum 0.1 ohm resistance	Check manifold heater element. Replace manifold heater as needed.


S1 Key Switch
R1 Manifold Heater
3
385B Dk Grn
1
6
7
383 Org
012 Red
385B Dk Grn
385A Dk Grn
4
385C Dk Grn
2
002B Red
86
30
87
87A
85
5
385A Dk Grn
K1 Manifold Heater Relay Socket
X7 Main Wiring Harness To Control Panel
383 Org
B
F1 Fuse
A
002C Red
002B Red
Fusible Link
M1 Starting Motor
G1 Battery
W1 Battery Frame Ground

FUEL SUPPLY OPERATION

Function:

To start or stop the supply of fuel to the engine.

Operating Conditions (Starting Tractor):

- Key switch must be in the START position.
- Operator ON seat
- PTO in NEUTRAL
- Transmission in NEUTRAL

Operating Conditions (Running Tractor):

- Key switch must be in the RUN position.
- Operator ON seat
- PTO ENGAGED
- Transmission in any GEAR

Operating Conditions (Running Tractor):

- Key switch must be in the RUN position.
- Operator ON seat
- PTO DISENGAGED
- Park brake ENGAGED

Operator can leave seat.

- PTO can be ENGAGED

Fuel Supply Theory of Operation

The fuel system is designed to inject fuel into the piston cylinder where heat from compression ignites the fuel and air mixture.

Fuel is provided to the engine when the fuel shutoff solenoid is energized. The fuel shutoff solenoid contains two coils to open the fuel valve. The pull-in coil, in conjunction with the hold-in coil, overcomes the spring loaded fuel valve. The hold-in coil keeps the fuel valve open after the pull-in coil current is reduced through the R2 thermistor.

The fuel shutoff solenoid is initially energized and pulled in when the engine run relay contacts close. Voltage is provided to both of the fuel shutoff solenoid coils (pull-in and hold-in), which provide enough pull on the solenoid plunger to overcome the shutoff solenoid spring.

The fuel shutoff solenoid pull-in coil needs a high current pulse through it to overcome the solenoid spring. After the solenoid opens (overcomes the spring) a lower current will hold the solenoid open. The combination of the K3 fuel shutoff relay and R2 variable thermistor provide a means to reduce the current flow through the fuel shutoff solenoid pull-in coil after the solenoid opens.

The initial high current flows through the 329A Wht wire to the K3 fuel pull-in relay (terminal 30), through the contacts, and through the 319 Wht wire to the R2 variable thermistor. The thermistor has a low resistance to the current initially. As the current flows through the thermistor, it heats up and the resistance through it increases.

While the current flow through the thermistor is reduced, the voltage difference across the thermistor is increased. When the voltage difference is increased enough to activate the coil of the fuel pull-in relay (329B Wht), the coil opens the relay contacts and the variable thermistor is removed from the circuit.

NOTE: The variable thermistor will heat to a maximum temperature of approximately 180° F (82° C) for the brief period of time required to overcome the fuel shutoff solenoid spring.

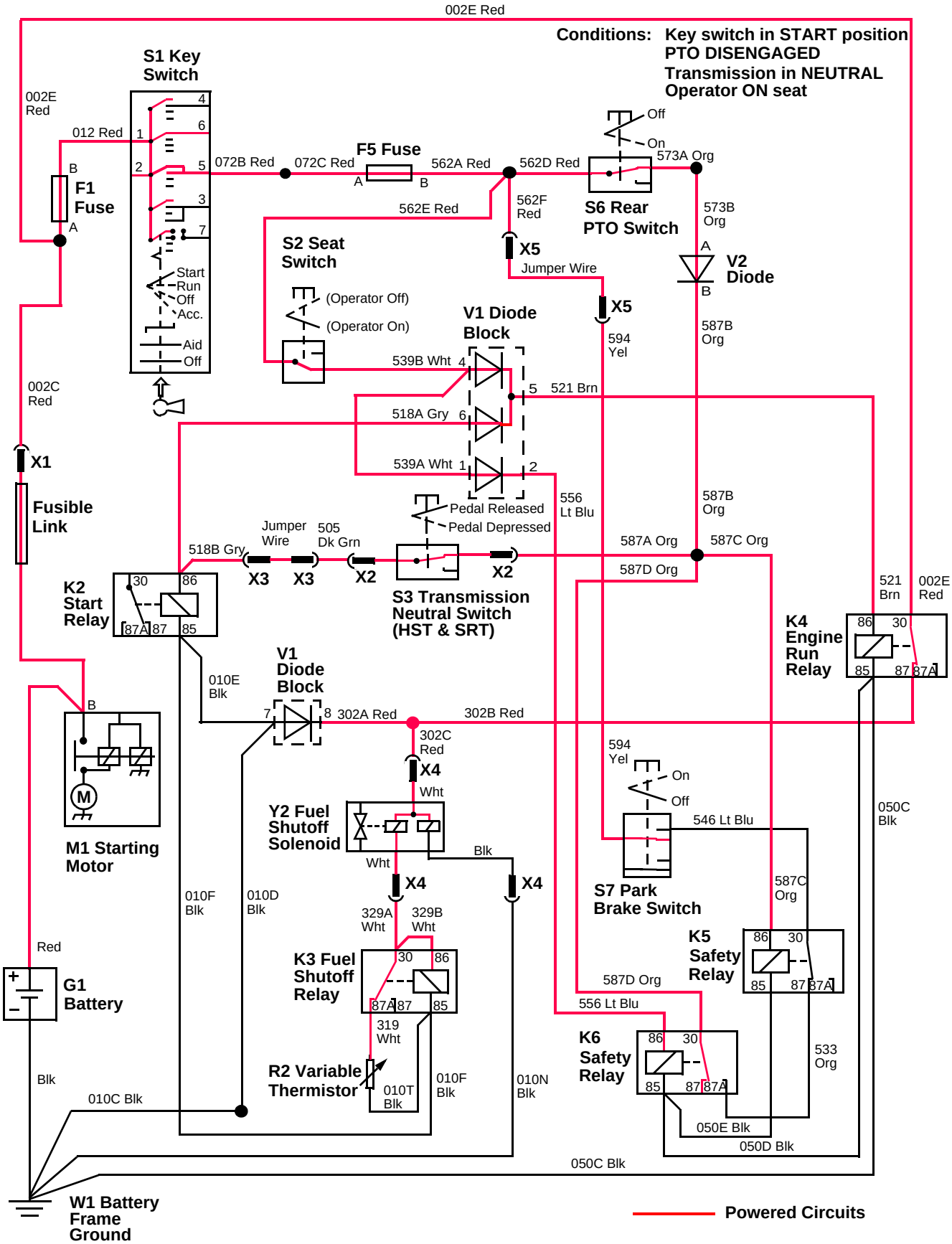
With the thermistor removed from the circuit, a ground path is provided for the fuel shutoff solenoid pull-in coil through the 329A and 329B Wht wires, the fuel pull-in relay coil, and the 010F, 010E, 010D and 010C Blk wires. A ground path for the fuel shutoff solenoid hold-in coil is provided through the 010N Blk wire.

A latching circuit is provided to maintain voltage to the engine run relay after the PTO is ENGAGED. The latching circuit is energized only if the operator is OFF the seat, the PTO is DISENGAGED, and the park brake is ENGAGED. The latching circuit remains energized while the park brake is ENGAGED after the PTO is ENGAGED. This circuit allows the operator to leave the seat, with the park brake ENGAGED and the transmission in NEUTRAL, and ENGAGE the PTO. (See "ENGINE SHUTOFF CIRCUIT OPERATION").

Fuel is provided to the engine through the Y2 fuel shutoff solenoid provided that operating conditions are met. If the operating criteria are not met, the engine run relay opens and stops voltage energizing the fuel shutoff solenoid coils. The fuel shutoff solenoid closes and fuel to the engine is stopped. (See "ENGINE SHUTOFF CIRCUIT OPERATION").

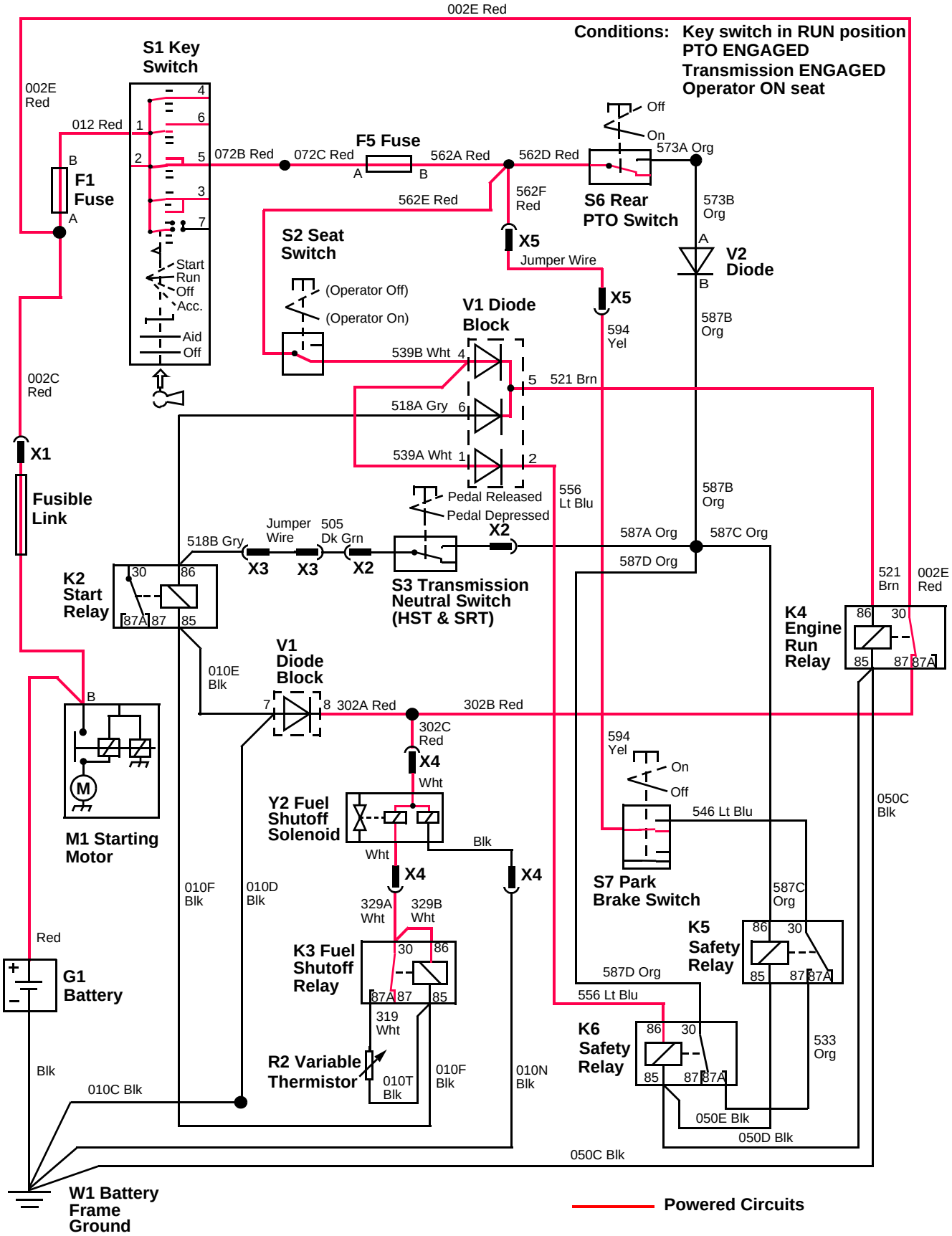
NOTE: The S4 transmission neutral switch is shown in this diagnostic section. This switch is used in conjunction with the jumper wire in the X2 connector for tractors with a gear (CST) transmission. For tractors with a hydro shift or SyncReverser™ transmission, the jumper wire is used in the X3 connector and the S3 transmission neutral switch is connected to the X2 connector.

FUEL SUPPLY ELECTRICAL SCHEMATIC



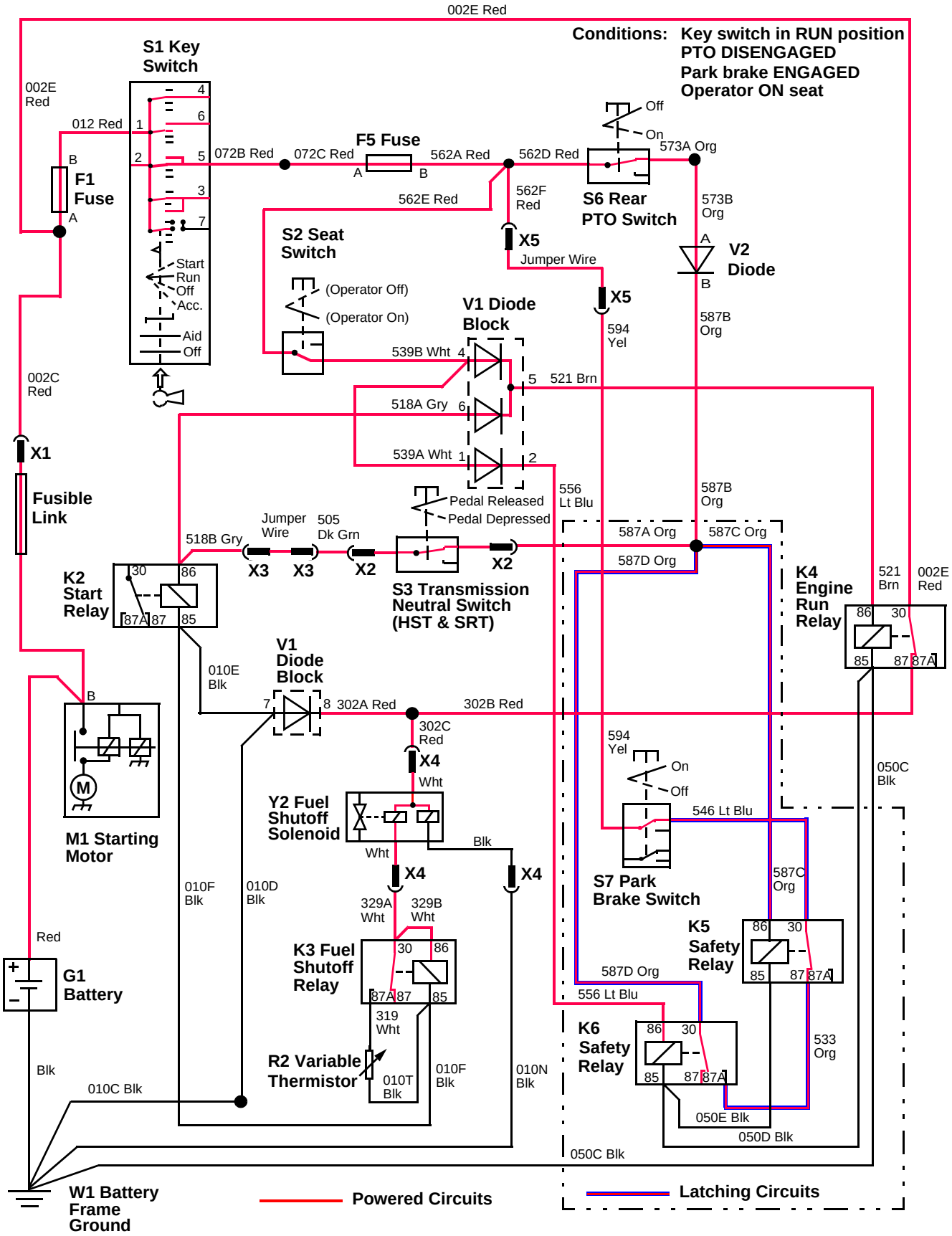
SE1 - STARTING	SE2 - IGNITION

FUEL SUPPLY ELECTRICAL SCHEMATIC



SE1 - STARTING	SE2 - IGNITION

FUEL SUPPLY ELECTRICAL SCHEMATIC



SE1 - STARTING	SE2 - IGNITION

FUEL SUPPLY DIAGNOSIS

Test Conditions:

- Park brake ENGAGED
- Key switch in RUN position (Engine NOT running)
- V1 diode block removed from load center
- PTO DISENGAGED
- Transmission in NEUTRAL
- Seat switch closed (Operator ON seat)

Test/Check Point	Normal	If Not Normal
1. Rear PTO switch	Battery voltage	(See “POWER CIRCUIT DIAGNOSIS”.)
2. Transmission neutral switch	Battery voltage	(See “POWER CIRCUIT DIAGNOSIS”.)
3. Diode block socket (terminal 6)	Battery voltage	Check transmission switch. (See “TRANSMISSION NEUTRAL SWITCH TEST – HST & SRT”.) Check 518B and 518A Gry wires and connections.
4. Seat switch	Battery voltage	(See “POWER CIRCUIT DIAGNOSIS”.)
5. Diode block socket (terminal 4)	Battery voltage	Check seat switch. (See “SEAT SWITCH TEST”.) Check 539B Wht wire and connections.

Test Conditions:

- Park brake ENGAGED
- Key switch in RUN position
- PTO(s) DISENGAGED
- Transmission in NEUTRAL
- Seat switch open (Operator OFF seat)
- Install V1 diode block; Remove K4 engine run relay

6. Engine run relay socket (terminal 86)	Battery voltage	Check diode block (terminals 6 to 5). (See “DIODE BLOCK TEST”.) Check 521 Brn wire and connections.

Test Conditions:

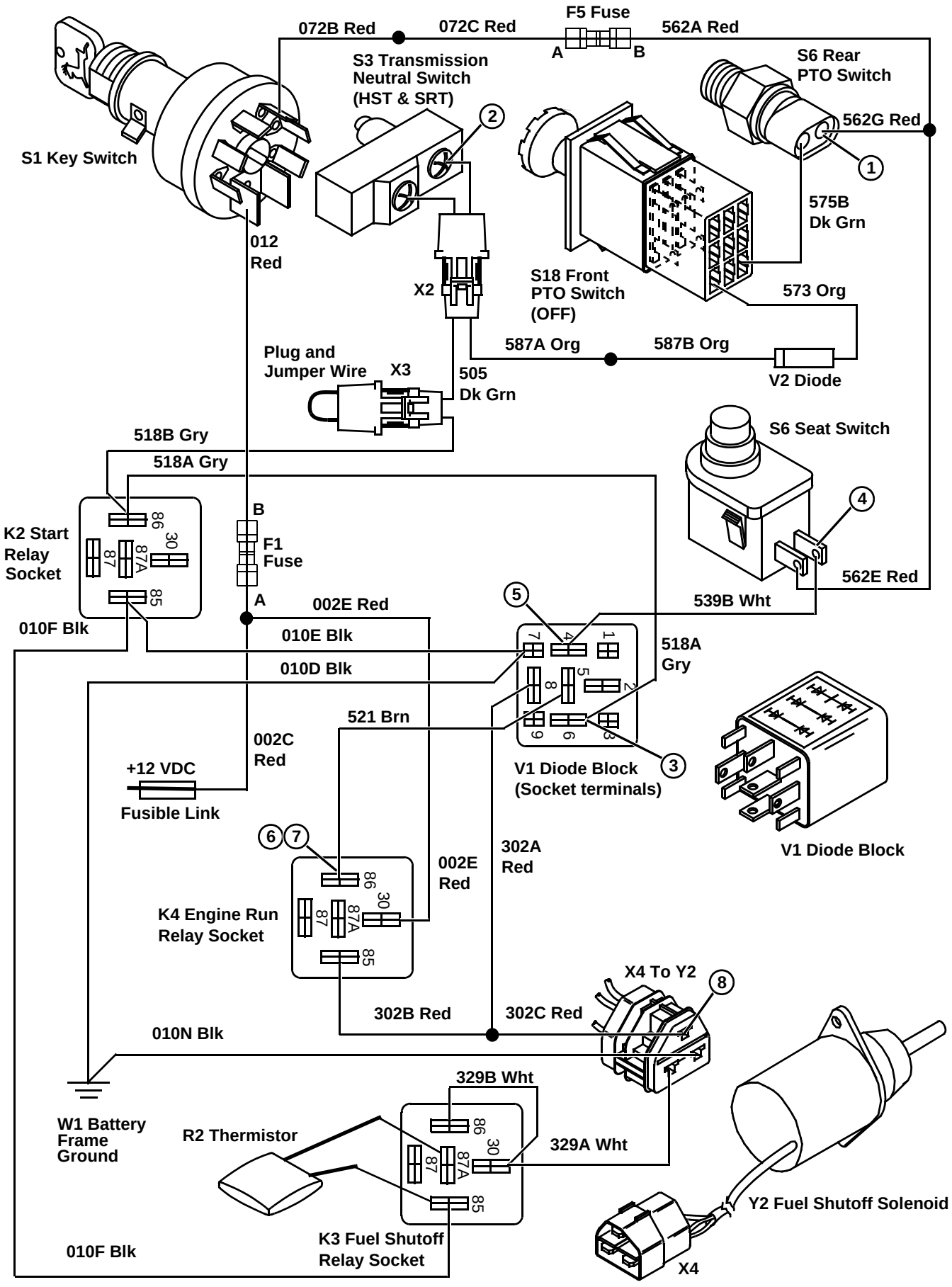
- Park brake ENGAGED
- Key switch in RUN position
- PTO switch OFF
- Transmission in GEAR
- Seat switch closed (Operator ON seat)
- Install V1 diode block; Remove K4 engine run relay

7. Engine run relay socket (terminal 86)	Battery voltage	Check diode block (terminals 4 to 5). (See “DIODE BLOCK TEST”.)

Test Conditions:

- Park brake ENGAGED
- Key switch in RUN position
- PTO(s) DISENGAGED
- X4 disconnected
- Transmission in GEAR
- Seat switch closed (Operator ON seat)
- Install K4 engine run relay

8. X4 fuel solenoid connector	Battery voltage	Check 302B and 302C Red wires and connections.


072B Red
072C Red
F5 Fuse
A
B
562A Red
S3 Transmission Neutral Switch (HST & SRT)
S6 Rear PTO Switch
562G Red
S1 Key Switch
012 Red
X2
S18 Front PTO Switch (OFF)
575B Dk Grn
573 Org
587A Org
587B Org
V2 Diode
Plug and Jumper Wire
X3
505 Dk Grn
518B Gry
518A Gry
S6 Seat Switch
562E Red
K2 Start Relay Socket
B
F1 Fuse
A
002E Red
539B Wht
010F Blk
010E Blk
010D Blk
518A Gry
521 Brn
002C Red
+12 VDC
Fusible Link
V1 Diode Block (Socket terminals)
V1 Diode Block
302A Red
002E Red
K4 Engine Run Relay Socket
X4 To Y2
302B Red
302C Red
010N Blk
329B Wht
W1 Battery Frame Ground
R2 Thermistor
329A Wht
Y2 Fuel Shutoff Solenoid
010F Blk
K3 Fuel Shutoff Relay Socket
X4

ENGINE SHUTOFF CIRCUIT OPERATION

Engine Shutoff Function:

To prevent the tractor engine from running in an unsafe condition.

Operating Conditions:

- Engine running
- Operator on seat

Engine MUST STOP if:

- PTO is ENGAGED, and
- Operator gets out of seat

or;

- Transmission is ENGAGED, and
- Operator gets out of seat

NOTE: If transmission is in NEUTRAL and the PTO is disengaged, and then the park brake is set, the operator can leave the seat and the PTO can be reengaged.

or;

- Transmission is in GEAR, and
- Operator gets out of seat

NOTE: The S3 transmission neutral switch is shown in this diagnostic section. This switch is used in conjunction with the jumper wire in the X3 connector for HST and SyncReverser tractors. For CST tractors, the jumper wire is used in the X2 connector and the S4 transmission neutral switch is used in the X3 connector.

Theory of Operation:

Fuel is supplied to the engine through the operation of the K3 fuel shutoff relay and the Y2 fuel shutoff solenoid, provided that operating conditions are met. (See "FUEL SUPPLY OPERATION").

When the operating conditions exist, and the engine is running, the engine shutoff circuit is used to maintain safe operation of the tractor. If an unsafe condition is created, the engine will stop by having the fuel supply to the engine shut off.

The fuel supply is shut off when voltage to the K4 engine run relay coil is stopped, its contacts open, and power to the Y2 fuel shutoff solenoid coils is stopped and the solenoid valve closes.

Power to the K4 engine run relay coil comes from the V1 diode block (terminal 5), and is provided to the diode block (terminals 4 or 6) through several different circuits that allow for a variety of operating conditions to exist and maintain fuel supply to the engine.

The main, and most direct, circuit provides power to the K4 engine run relay coil through the key switch, 072B and 072C Red wires, F5 fuse, 562A and 562E Red wires, S2 seat switch (operator ON seat), 539B Wht wire, V1 diode block (terminals 4 to 5), and 521 Brn wire. This circuit provides voltage to the engine run relay for normal operation of the tractor.

A second circuit provides power to the K4 engine run relay coil through the key switch, 072B and 072C Red wires, F5 fuse, 562A and 562B Red wires, rear PTO switch (OFF position), 575B Dk Grn wire, X34 (jumper wire or S5 PTO switch), 573 Org wire, V2 diode, 587B and 587A Org wires, S3 or S4 transmission neutral switch, 518B and 518A Gry wires, V1 diode block (terminals 6 to 5), and 521 Brn wire. This circuit provides voltage to the engine run relay if the PTO is DISENGAGED, and the transmission is in NEUTRAL, with or without the operator in the seat.

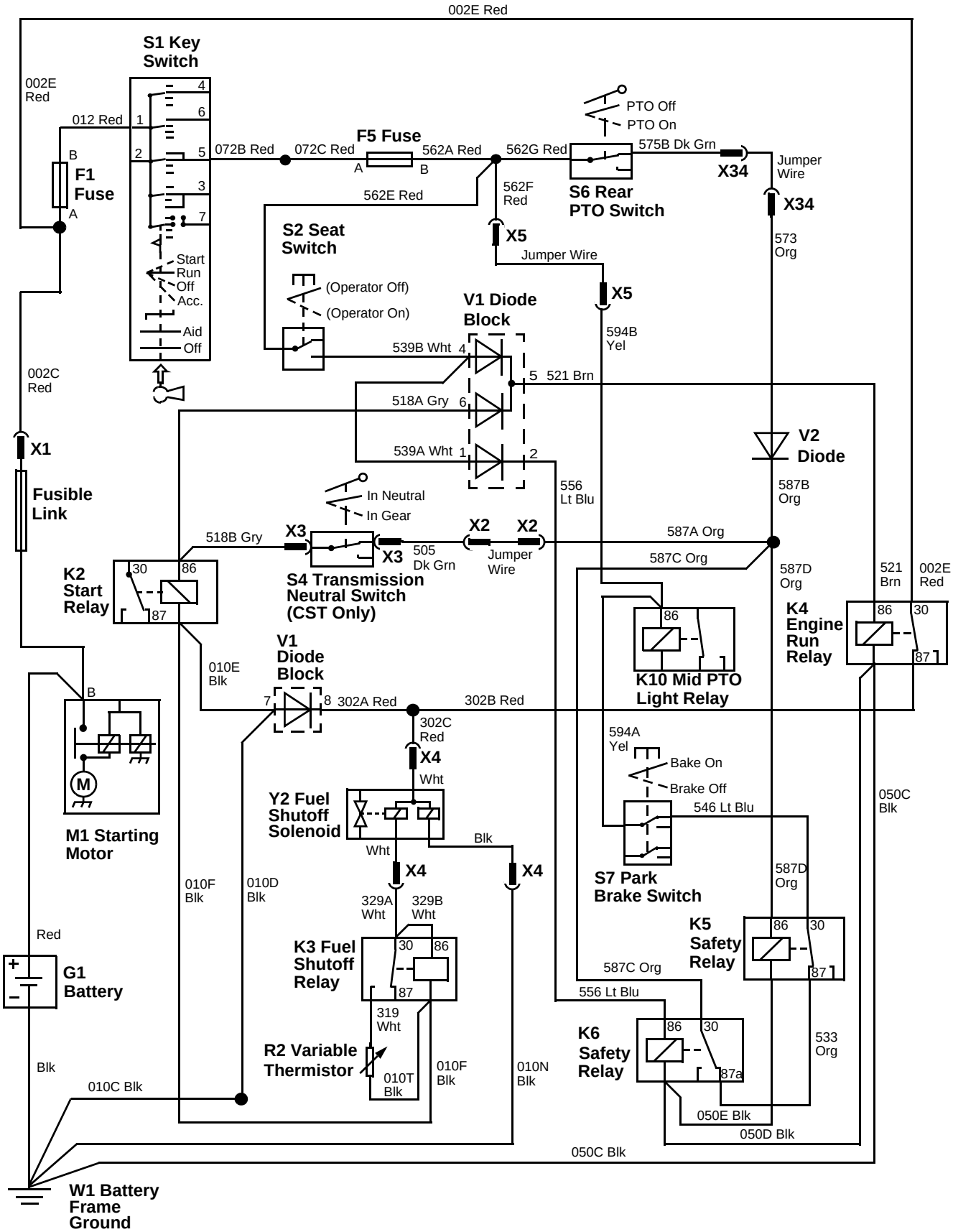
A third circuit provides power to the K4 engine run relay coil through the park brake switch and the K4 and K5 safety relays. The park brake switch and the K4 and K5 relays, in conjunction with the PTO switch, create a self-latching circuit. The PTO must be DISENGAGED, the park brake must be ENGAGED, and the operator must be OFF the seat to create the circuit. Once the latch circuit is established the PTO can be ENGAGED. The circuit will remain latched until the park brake is released or the operator is ON the seat. Power through this circuit will keep the K4 engine run relay coil energized only if the transmission is in NEUTRAL.

Power is provided to the S7 park brake switch through the key switch, 072B and 072C Red wires, F5 fuse, 562F Red wire, X5 connector and jumper wire, and 594A and 594B Yel wires. With the park brake ENGAGED, power is provided through the park brake switch and 546 Lt Blu wire to the K5 safety relay (terminal 30). Power is provided to the K5 safety relay coil (terminal 86) through the rear PTO switch (PTO DISENGAGED), 575B Dk Grn wire, X34 (jumper wire or S5 PTO switch), 573 Org wire, 575B Dk Grn wire, X34 (jumper wire or S5 PTO switch), 573 Org wire, V2 diode, and 587B and 587C Org wires.

With the K5 coil energized, and power to the K5 contact (terminal 30), power is provided through the K5 contacts and 533 Org wire to the K6 contacts (terminal 87A). The power continues through the K6 contacts, and the 587D and 587C Org wires to the K5 coil (terminal 86). The PTO can now be ENGAGED and power will remain to the K4 engine run relay through the park brake switch, latching relay circuit, and the same circuit path as provided by the PTO switch without the latching circuit.

The latching circuit will remain energized until the operator gets ON the seat and the K6 safety relay coil is energized, opening the circuit path through the K6 contacts, or; the park brake switch is DISENGAGED eliminating power to the circuit.

ENGINE SHUTOFF CIRCUIT ELECTRICAL SCHEMATIC



SE1 - STARTING	SE2 - IGNITION

ENGINE SHUTOFF CIRCUIT DIAGNOSIS

Test Conditions:

- Park brake ENGAGED
- Operator OFF seat
- PTO DISENGAGED
- Gear range lever in NEUTRAL position
- Remove V1, K2, K4, K5, and K6 from load center
- Key switch in RUN position (engine OFF)

NOTE: The S3 transmission neutral switch is shown in this diagnostic section. This switch is used in conjunction with the jumper wire in the X3 connector for tractors with a hydrostatic transmission. For tractors with a gear shift transmission the jumper wire is used in the X2 connector and the S4 transmission neutral switch is used in the X3 connector.

Test/Check Point	Normal	If Not Normal
1. K2 relay socket (terminal 86)	Battery voltage	Ensure PTO(s) is DISENGAGED and transmission is in NEUTRAL. (See "POWER CIRCUIT DIAGNOSIS").
2. V1 diode block socket (terminal 6)	Battery voltage	Check 518A Gry wire and connections.
3. K5 relay socket (terminal 86)	Battery voltage	Check 587D Org wire and connections.
4. K6 relay socket (terminal 30)	Battery voltage	Check 587C Org wire and connections.
5. Park brake switch	Battery voltage	(See "POWER CIRCUIT DIAGNOSIS").
6. Park brake switch	Battery voltage	Test switch (See "PARK BRAKE SWITCH TEST").
7. K5 relay socket (terminal 30)	Battery voltage	Check 546 Lt Blu wire and connections.
8. Seat switch	Battery voltage	Check 562E Red wire and connections.

Test Conditions:

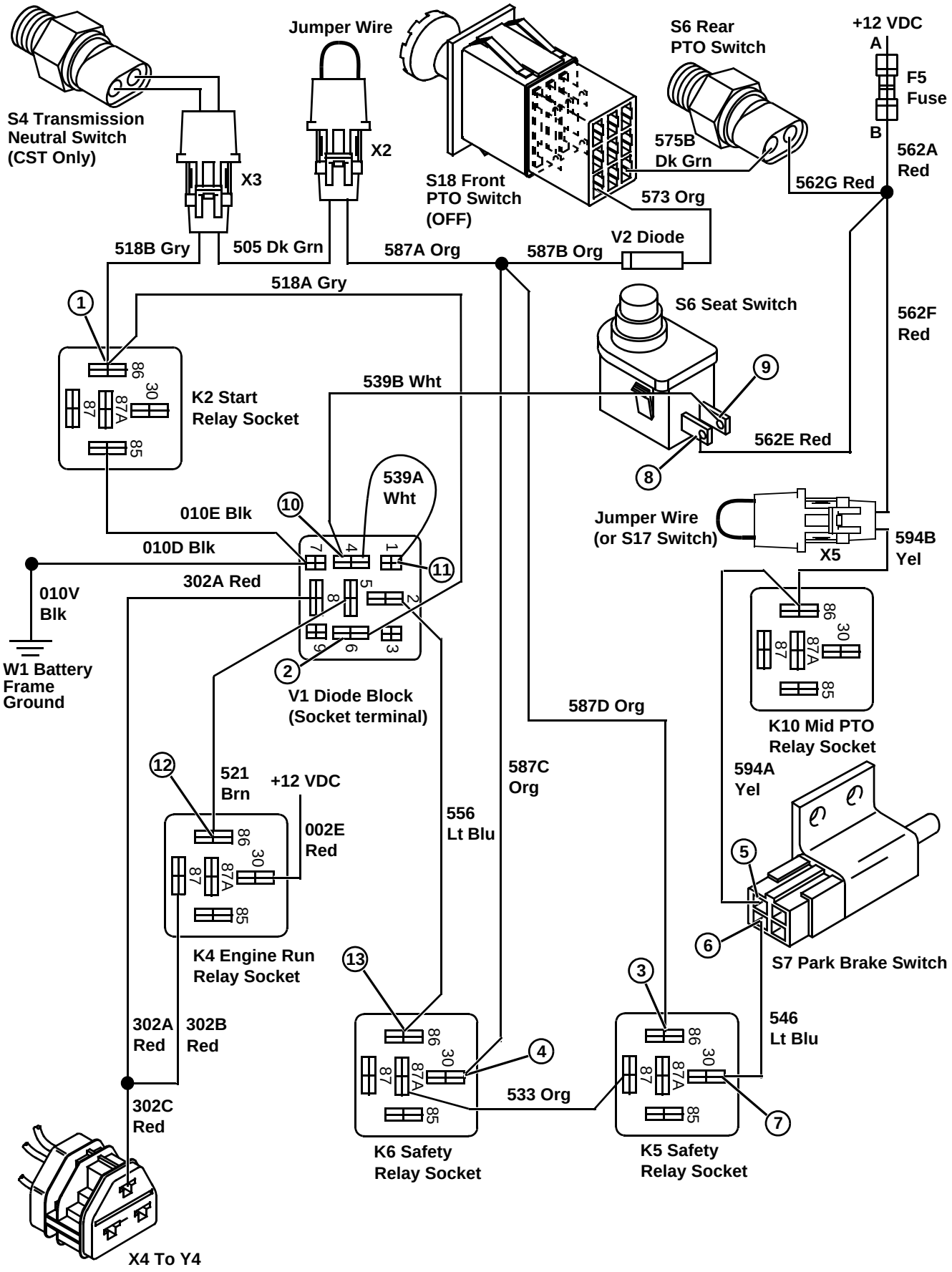
- Park brake ENGAGED
- PTO DISENGAGED
- Push and hold seat switch plunger into OPERATOR ON position
- Transmission in NEUTRAL position
- Key switch in RUN position (engine OFF)

9. Seat switch	Battery voltage	Test seat switch (See "SEAT SWITCH TEST").Replace seat switch.
10. V1 diode block socket (terminal 4)	Battery voltage	Check 539B Wht wire and connections.
11. V1 diode block socket (terminal 1)	Battery voltage	Check 539A Wht jumper wire and connections.

Test Conditions:

- Park brake ENGAGED
- Operator ON seat
- PTO DISENGAGED
- Transmission in NEUTRAL position
- Install V1 diode block in load center
- Key switch in RUN position (engine OFF)

12. K4 relay socket (terminal 86)	Battery voltage	Test diode block (See "DIODE BLOCK TEST"). Check 521 Brn wire and connections.
13. K6 relay socket (terminal 86)	Battery voltage	Test diode block. Check 556 Lt Blu wire and connections.


S4 Transmission Neutral Switch (CST Only)
X3
Jumper Wire
X2
S18 Front PTO Switch (OFF)
S6 Rear PTO Switch
575B Dk Grn
+12 VDC
A
F5 Fuse
B
562A Red
562G Red
573 Org
518B Gry
505 Dk Grn
587A Org
587B Org
V2 Diode
518A Gry
S6 Seat Switch
562F Red
539B Wht
562E Red
K2 Start Relay Socket
539A Wht
010E Blk
010D Blk
Jumper Wire (or S17 Switch)
X5
594B Yel
010V Blk
302A Red
W1 Battery Frame Ground
V1 Diode Block (Socket terminal)
587D Org
K10 Mid PTO Relay Socket
521 Brn
+12 VDC
002E Red
556 Lt Blu
587C Org
594A Yel
K4 Engine Run Relay Socket
S7 Park Brake Switch
302A Red
302B Red
546 Lt Blu
533 Org
302C Red
K6 Safety Relay Socket
K5 Safety Relay Socket
X4 To Y4

Test/Check Point	Normal	If Not Normal

Test Conditions:
- Park brake ENGAGED
- Operator OFF seat
- PTO DISENGAGED
- Transmission in NEUTRAL position
- Install V1 diode block in load center
- Key switch in RUN position (engine OFF)

14. K4 relay socket (terminal 86)	Battery voltage	Test diode block (See "DIODE BLOCK TEST"). Check 521 Brn wire and connections.

Test Conditions:
- Park brake ENGAGED
- Operator ON seat
- PTO DISENGAGED
- Transmission in NEUTRAL position
- Install K6 safety relay in load center
- Key switch in RUN position (engine OFF)

15. K5 relay socket (terminal 87)	Battery voltage	Test K6 relay (See "RELAY TEST"). Check 533 Org wire and connections.

Test Conditions:
- Park brake ENGAGED
- Operator OFF seat
- PTO DISENGAGED
- Transmission in NEUTRAL position
- Install K5 safety relay in load center
- Key switch in RUN position (engine OFF)

Test Conditions:
- After the above conditions are set:
- Place PTO shift lever in position to ENGAGE PTO

16. K4 relay socket (terminal 86)	Battery voltage	Check ground circuit of relays. See next step.

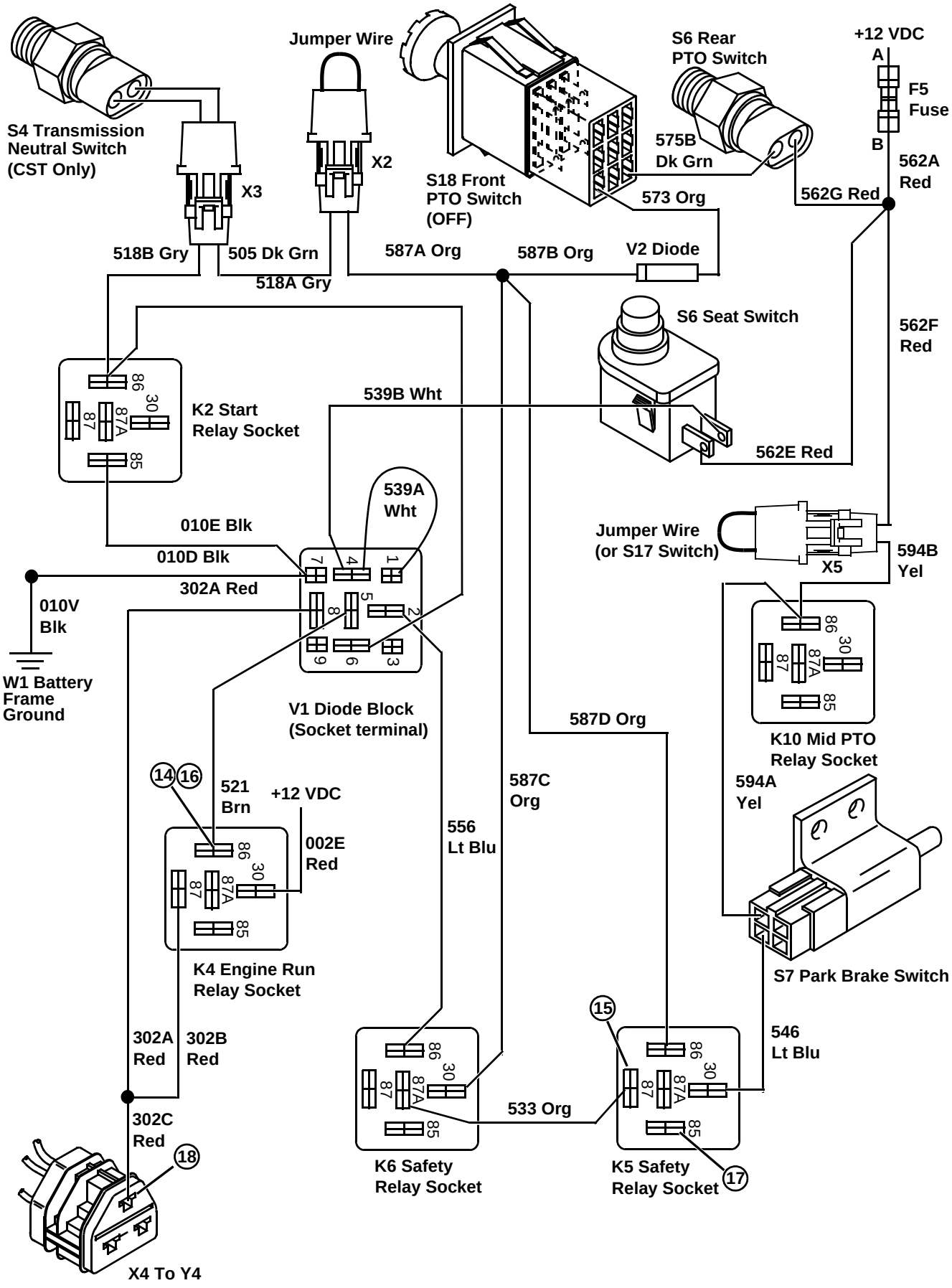
Test Conditions:
- Park brake ENGAGED
- Operator OFF seat
- PTO DISENGAGED
- Gear range lever in NEUTRAL position
- Key switch in OFF position (engine OFF)
- Remove K5 relay

17. K5 relay socket (terminal 85)	Continuity to frame ground (0.5 ohms or less)	Check 050E, 050D, and 050C Blk wires and connections.

Test Conditions:
- Park brake ENGAGED
- Operator OFF seat
- PTO DISENGAGED
- Gear range lever in NEUTRAL position
- Install K5 safety relay in load center
- Key switch in RUN position (engine OFF)

Test Conditions:
- After the above conditions are set:
- Place PTO shift lever in position to ENGAGE PTO
- Check for voltage at K4 relay socket (terminal 86); RELEASE park brake

18. X4 connector to fuel shutoff solenoid	NO voltage after park brake is RELEASED	Test K4 relay (See "RELAY TEST"). Replace relay as needed. (See "POWER CIRCUIT DIAGNOSIS").


S4 Transmission Neutral Switch (CST Only)
X3
Jumper Wire
X2
S18 Front PTO Switch (OFF)
S6 Rear PTO Switch
575B Dk Grn
573 Org
+12 VDC
A
F5 Fuse
B
562A Red
562G Red
518B Gry
505 Dk Grn
518A Gry
587A Org
587B Org
V2 Diode
S6 Seat Switch
562F Red
562E Red
539B Wht
K2 Start Relay Socket
539A Wht
010E Blk
010D Blk
302A Red
010V Blk
W1 Battery Frame Ground
V1 Diode Block (Socket terminal)
Jumper Wire (or S17 Switch)
X5
594B Yel
K10 Mid PTO Relay Socket
587D Org
594A Yel
S7 Park Brake Switch
14
16
521 Brn
+12 VDC
002E Red
556 Lt Blu
587C Org
K4 Engine Run Relay Socket
15
546 Lt Blu
302A Red
302B Red
533 Org
302C Red
18
K6 Safety Relay Socket
K5 Safety Relay Socket
17
X4 To Y4

CHARGING CIRCUIT OPERATION

FUNCTION:

To maintain battery voltage between 12.4 and 13.2 volts.

OPERATING CONDITIONS:

The key switch must be in the RUN position with the engine running for the charging system to operate.

SYSTEM OPERATION:

The charging system consists of the G2 alternator with an integrated voltage regulator/rectifier. Charging output is controlled by a regulator/rectifier. The status of the charge rate is indicated by the H4 discharge light.

With the key switch in the RUN position, battery sensing circuit current flows from battery positive terminal to the starting motor terminal, fusible link, X1, 002C Red wire, F1 fuse, 012 Red wire, S1 key switch, 072B and 072D Red wires to the alternator voltage regulator/rectifier. The battery sensing circuit allows the voltage regulator/rectifier to monitor battery voltage.

A rotating permanent magnet in the alternator induces AC current in the alternator stator coils. The AC current flows to the voltage regulator/rectifier. The voltage regulator/rectifier converts AC current to DC current needed to charge the battery.

If battery voltage is low, the regulator/rectifier allows DC current to flow to the battery to charge it through the battery charging circuit (002A Red). When the battery is fully charged, the voltage regulator/rectifier stops current flow to the battery.

If the alternator output current falls below system usage or is insufficient to maintain a preset voltage, the voltage regulator/rectifier provides current to turn on the discharge light through the 334 Yel wire, X7 connector, and the control panel circuit board runs.

The alternator is grounded through the mounting hardware to the engine.

If the voltage regulator is grounded to the alternator cover, the alternator produces unregulated amperage. (See "UNREGULATED AMPERAGE TEST")

TACHOMETER CIRCUIT OPERATION

FUNCTION:

To indicate engine rpm to the operator.

OPERATING CONDITIONS:

The key switch must be in the RUN position with the engine running for the tachometer to operate.

SYSTEM OPERATION:

Pulsed current flows from the "P" terminal of the alternator to the control panel (X6 connector, terminal F) through the 325 Dk Grn wire.

HOURMETER CIRCUIT OPERATION

FUNCTION:

To indicate engine hours of use to the operator.

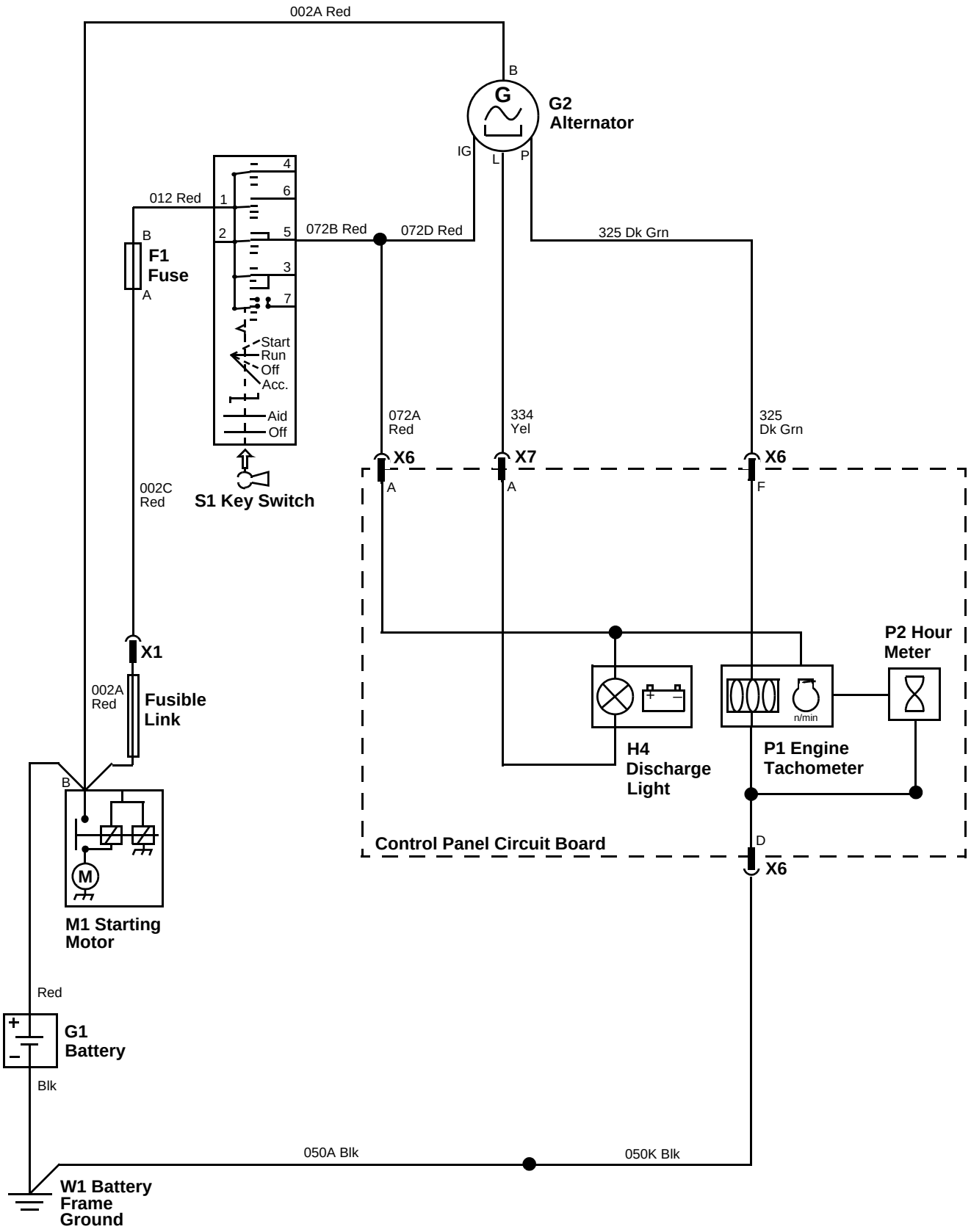
OPERATING CONDITIONS:

The key switch must be in the RUN position with the engine running for the hourmeter to operate.

SYSTEM OPERATION:

The hourmeter is integrated into the control panel and does not have any external wiring. The hourmeter operates only when the engine is running. The hourmeter uses the engine tachometer circuit for power. If the tachometer is not functioning, the hourmeter will not work. See "CHARGING CIRCUIT DIAGNOSIS" for information on tachometer and hourmeter diagnosis.

CHARGING CIRCUIT ELECTRICAL SCHEMATIC



SE1 - STARTING	SE3 - CHARGING	SE5 - INSTRUMENTATION

CHARGING CIRCUIT DIAGNOSIS

Test Conditions:

- Key switch in OFF position
- Park brake ENGAGED
- Gear range lever in NEUTRAL position
- PTO DISENGAGED

Test/Check Point	Normal	If Not Normal
1. Battery positive terminal	Battery voltage (12.4 - 13.2 volts)	Test battery. (See "BATTERY TEST")
2. Starting motor "B" terminal	Battery voltage	Check battery and starting motor cable connections.
3. Alternator "B" terminal	Battery voltage	Check battery negative cable, alternator ground, connections, and engine ground connections.

Test Conditions:

- Engine OFF
- Park brake ENGAGED
- Alternator connector removed from alternator
- Key switch in RUN position

4. Alternator connector (072D Red wire terminal)	Battery voltage	Check 072D and 072B Red wires and connections (See "POWER CIRCUIT DIAGNOSIS").

Test Conditions:

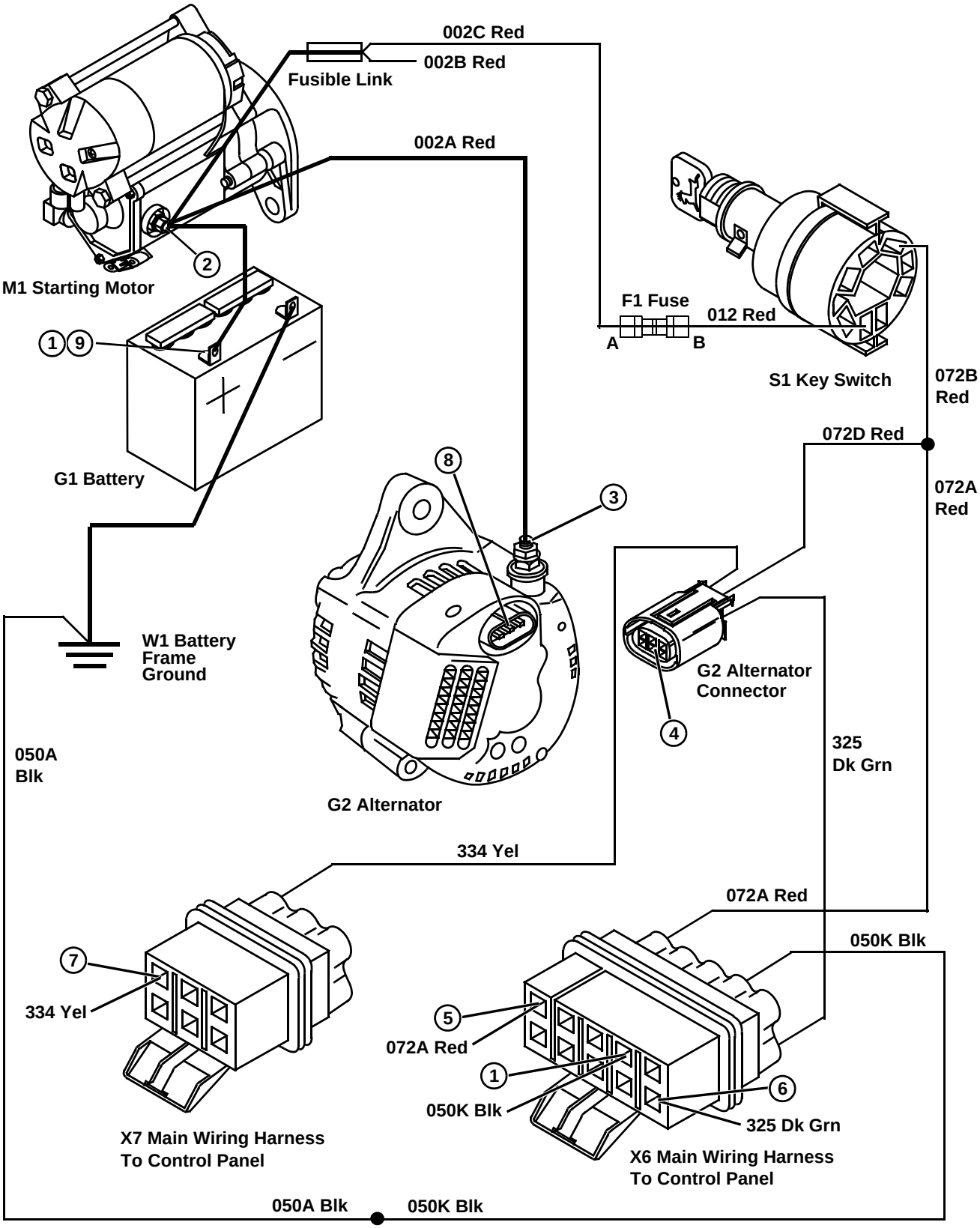
- Key switch in RUN position
- Engine OFF
- Park brake ENGAGED
- Alternator connector connected
- X6 and X7 connectors to control panel disconnected

5. X6 connector (terminal A)	Battery voltage	Check 072A and 072B Red wires and connections.
6. X6 connector (terminal F)	0.04 VDC	Check 325 Dk Grn wire and connections.
7. X7 connector (terminal A)	0.45 VDC	Check 334 Yel wire and connections.

Test Conditions:

- Park brake ENGAGED
- Transmission in NEUTRAL
- PTO DISENGAGED
- Engine RUNNING

8. Alternator	Minimum 12.2 to 13.8 volts	(See "REGULATED VOLTAGE AND AMPERAGE TESTS"). Replace voltage regulator/rectifier.
9. Battery	Voltage above normal battery voltage.	Check for excessive load on electrical system.


002C Red
002B Red
Fusible Link
002A Red
M1 Starting Motor
2
1
9
G1 Battery
F1 Fuse
012 Red
A
B
S1 Key Switch
072B Red
072D Red
072A Red
8
3
W1 Battery Frame Ground
G2 Alternator
G2 Alternator Connector
4
050A Blk
325 Dk Grn
334 Yel
072A Red
050K Blk
7
334 Yel
5
072A Red
1
050K Blk
6
325 Dk Grn
X7 Main Wiring Harness To Control Panel
X6 Main Wiring Harness To Control Panel
050A Blk
050K Blk

ENGINE OIL PRESSURE LIGHT

Function:

To alert operator of low engine oil pressure.

Operating Condition:

The key switch must be in RUN or START position.

Theory of Operation:

With the engine OFF and key in RUN position, engine oil pressure will be below **49 kPa (7.1 psi)**. The oil pressure switch will be in the normally closed position. The closed position completes a circuit path to ground and illuminates the H7 light. This informs the operator that the light is functional.

The light goes out when the engine oil pressure is at or above **49 kPa (7.1 psi)**, opens the B2 engine oil pressure switch, and removes the ground circuit from the engine oil pressure light.

ENGINE COOLANT TEMPERATURE GAUGE

Function:

Inform the operator of engine and coolant operating temperature.

Operating Condition:

The key switch must be in RUN or START position.

Theory of Operation:

The engine coolant temperature sensor is a variable resistor**,** providing a ground circuit path for the temperature gauge. As the engine coolant heats, the resistance decreases. The temperature gauge circuit is part of the tractor control panel.
The engine coolant temperature sensor resistance is approximately **40 - 700 ohms**.

FUEL GAUGE

Function:

Inform the operator of the fuel level in the fuel tank.

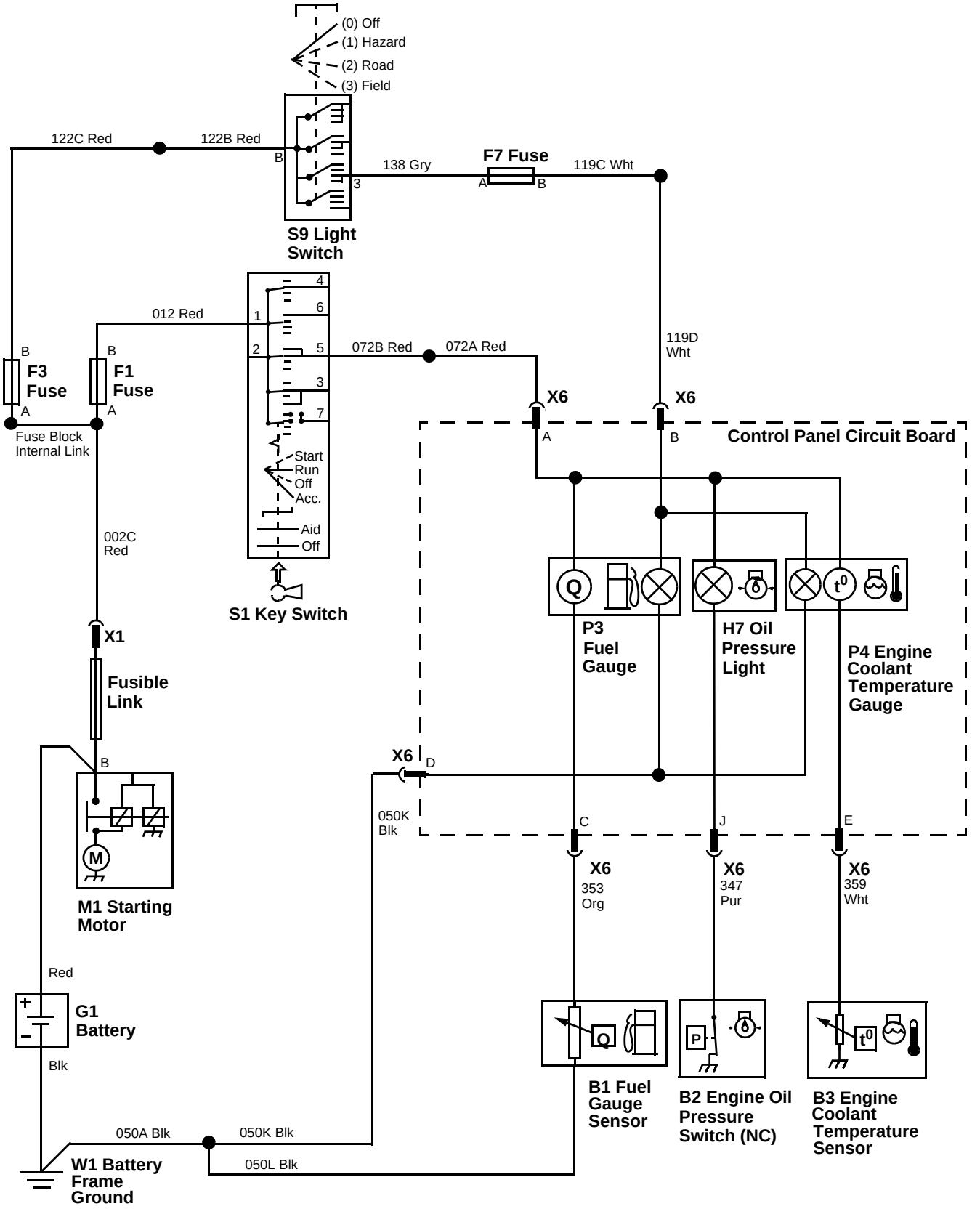
Operating Condition:

The key switch must be in RUN or START position.

Theory of Operation:

The fuel level in the fuel tank is measured by the B1 fuel gauge sensor. The sensor is a variable resistor. The resistance is set by movement of a mechanical linkage connected to a float in the fuel tank. The **5 to 110 ohm** variable resistance creates a variable voltage difference across the P1 fuel gauge. The voltage difference ranges from approximately **5.72 VDC** (fuel tank FULL) to approximately **0.87 VDC** (fuel tank EMPTY).

CONTROL PANEL GAUGES ELECTRICAL SCHEMATIC



SE2 - IGNITION	SE5 - INSTRUMENTATION

CONTROL PANEL GAUGES DIAGNOSIS

Test Conditions:

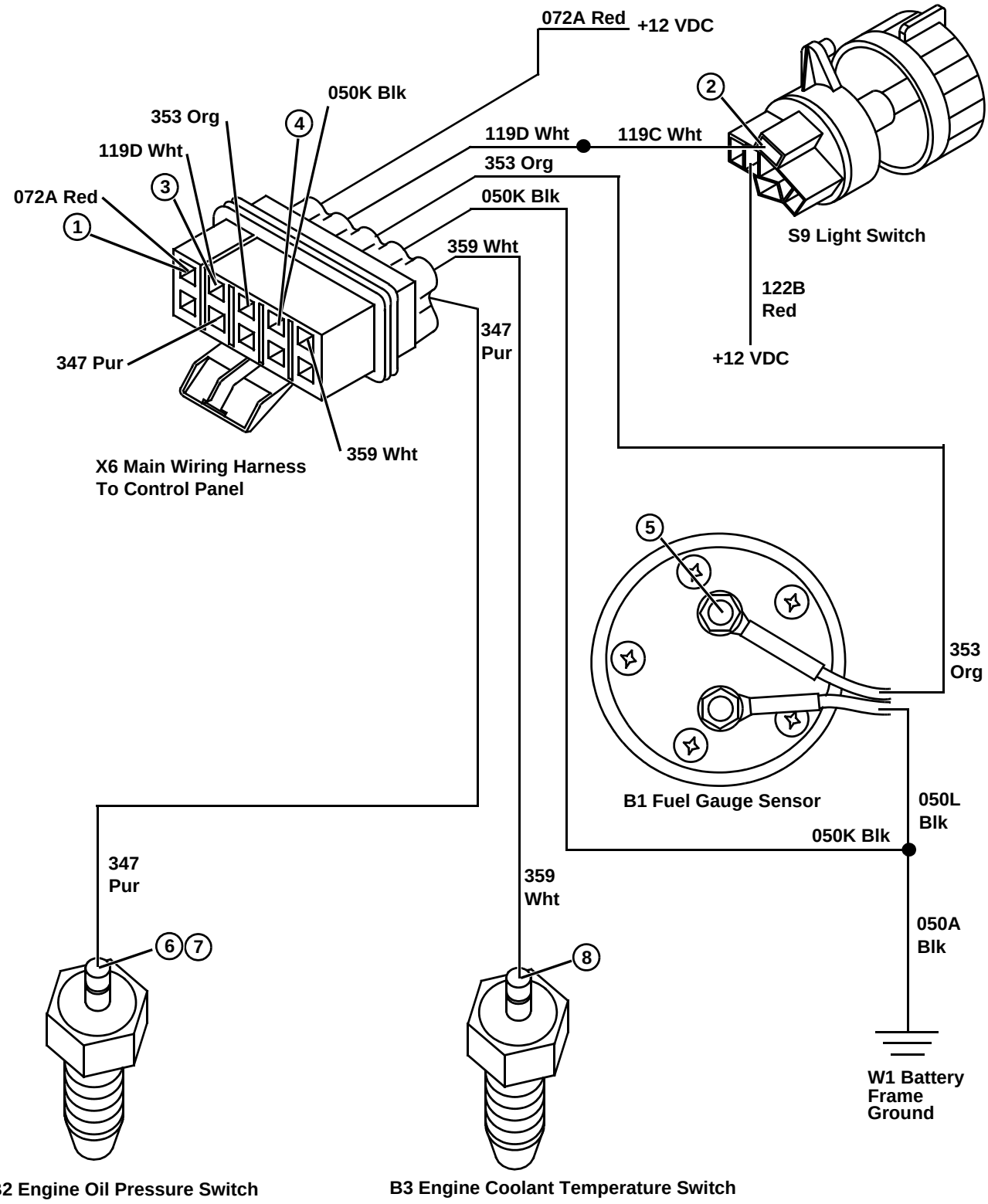
- X6 connector to control panel disconnected
- Key switch in RUN position, engine OFF
- PTO in NEUTRAL
- Transmission in NEUTRAL
- Park brake ON
- Light switch in ROAD or FIELD position

Test/Check Point	Normal	If Not Normal
1. X6 connector (terminal A)	Battery voltage	(See "POWER CIRCUIT DIAGNOSIS")
2. Light switch	Battery voltage	Check F3 fuse. Test light switch (See "LIGHT SWITCH TEST").
3. X6 connector (terminal B)	Battery voltage	Check 119C and 119D Wht wires and connections.
4. X6 connector (terminal D)	Less than 0.1 ohms resistance to ground	Check 050K and 050A Blk wires and connections.

Test Conditions:

- Transmission in NEUTRAL
- PTO in NEUTRAL
- Park brake ON
- X6 connected to control panel
- Key switch in RUN position, engine OFF
- Light switch in OFF position

5. Fuel gauge sensor	Tank full – approximately 0.1 volts DC Tank empty – approximately 5.0 volts DC	Check 353 Org wire and connections. Check battery negative cable, 050L and 050A Blk wires and connections. Test fuel sensor (See "FUEL GAUGE SENSOR TEST"). Use a jumper wire to connect 353 Org wire to battery frame ground. Fuel gauge should move to maximum position. Gauge does not move. - Replace control panel.
6. Engine oil pressure switch	Less than 0.1 volts DC	Check 347 Pur wire and connections.Test switch (See "ENGINE OIL PRESSURE SWITCH TEST"). Replace switch as needed.
7. Engine oil pressure switch (347 Pur wire lead disconnected)	Less than 0.1 ohms resistance to ground	Check engine ground. If engine ground OK: Replace switch.
8. Engine coolant temperature sensor	Continuity to ground through sensor – resistance depends on engine temperature (40 - 700 ohms). Sensor threads not corroded.	Disconnect temperature sensor lead. Use a jumper wire to connect 359 Wht wire to ground. Temperature gauge should move to maximum temperature position. Gauge does not move. - Check 359 Wht wire and connections. Replace control panel. Gauge moves. - Replace sensor.


072A Red
+12 VDC
050K Blk
353 Org
4
119D Wht
119D Wht
119C Wht
2
3
353 Org
072A Red
050K Blk
1
359 Wht
S9 Light Switch
122B
Red
347
Pur
+12 VDC
347 Pur
359 Wht
X6 Main Wiring Harness
To Control Panel
5
353
Org
B1 Fuel Gauge Sensor
050L
Blk
050K Blk
347
Pur
359
Wht
050A
Blk
6
7
8
W1 Battery
Frame
Ground
B2 Engine Oil Pressure Switch
B3 Engine Coolant Temperature Switch

REAR PTO OPERATION

REAR PTO SWITCH AND LIGHT

Function:

Switch: To control the PTO light and act as part of the ignition safety circuit. (See "ENGINE SHUTOFF CIRCUIT OPERATION").

Light: To alert operator of rear PTO being ENGAGED.

Operating Condition:

The PTO shifter must be placed in ENGAGED position.

NOTE: If the Mid PTO option is not installed in the tractor, a jumper wire is installed in the X5 connector which replaces the S17 mid PTO switch. If the 2-Speed PTO is not installed in the tractor, a jumper wire is installed in the X15 connector (574A Yel to 777 Pur) which replaces the S14 and S15 PTO switches. If the Front PTO option is not installed in the tractor, a jumper wire is installed in the X34 connector (575B Dk Grn to 573 Org) to allow ignition and operation of the engine.

Theory of Operation:

With the key in START or RUN position, battery voltage is provided to the S6 rear PTO switch through the F5 fuse and 562A and 562G Red wires. Battery voltage is also provided to the K9 rear PTO light relay (terminal 30).

When the rear PTO is DISENGAGED, voltage is provided to the K9 rear PTO relay coil (terminal 86) through the rear PTO switch contacts and 575A Dk Grn wire. With voltage provided to the K9 coil, the coil energizes and opens the relay contacts. The open contacts prevent current flow to the rear PTO indicator light.

Power is also provided through the rear PTO switch (PTO DISENGAGED) to the engine cranking circuit, (See "CRANKING CIRCUIT OPERATION") and engine safety shut-off circuit (See "ENGINE SHUTOFF CIRCUIT OPERATION") through the 575B Dk Grn wire and X34 connector.

When the PTO is ENGAGED, the S6 rear PTO switch contacts open, the K9 relay coil is deenergized, and the relay contacts close. Voltage is provided through the relay contacts, 574B and 574A Yel wires, X15 connector and jumper wire, 777 Pur wire and X7 connector to the control panel circuit board illuminating the H10 PTO indicator light. A ground circuit path for the control panel circuit board is provided though the X6 connector (terminal D), and 050K and 050A Blk wires.

2-SPEED PTO LIGHTS

Function:

To alert operator of rear PTO being ENGAGED, and which speed range is selected.

Operating Condition:

The rear PTO must be ENGAGED, and the rear PTO range selector must be placed in either the 540 rpm range or the 750 rpm range.

Theory of Operation (Early Models):

With the key in START or RUN position and the rear PTO ENGAGED, battery voltage is provided to the X15 connector through the F5 fuse, 562A and 562B Red wires, K9 rear PTO light relay contacts, and 574B and 574A Yel wires. (See "REAR PTO SWITCH AND LIGHT" Theory of Operation.)

The W7 2-speed PTO wiring harness provides voltage to each of the PTO speed range switches (S14 - 540 rpm switch and S15 - 750 rpm switch).

When the rear PTO range selector is placed in the 540 rpm position, the S14 540 rpm PTO switch is closed, and provides a current path through the switch, X15 connector, 777 Pur wire, and X7 connector (terminal B) to the control panel circuit board. A circuit board run provides voltage to the H10 540 PTO indicator light.

When the rear PTO range selector is placed in the 750 rpm position, the S15 750 rpm PTO switch is closed, and provides a current path through the switch, X15 connector, 757 Pur wire, and X7 connector (terminal F) to the control panel circuit board. A circuit board run provides voltage to the H11 750 PTO indicator light.

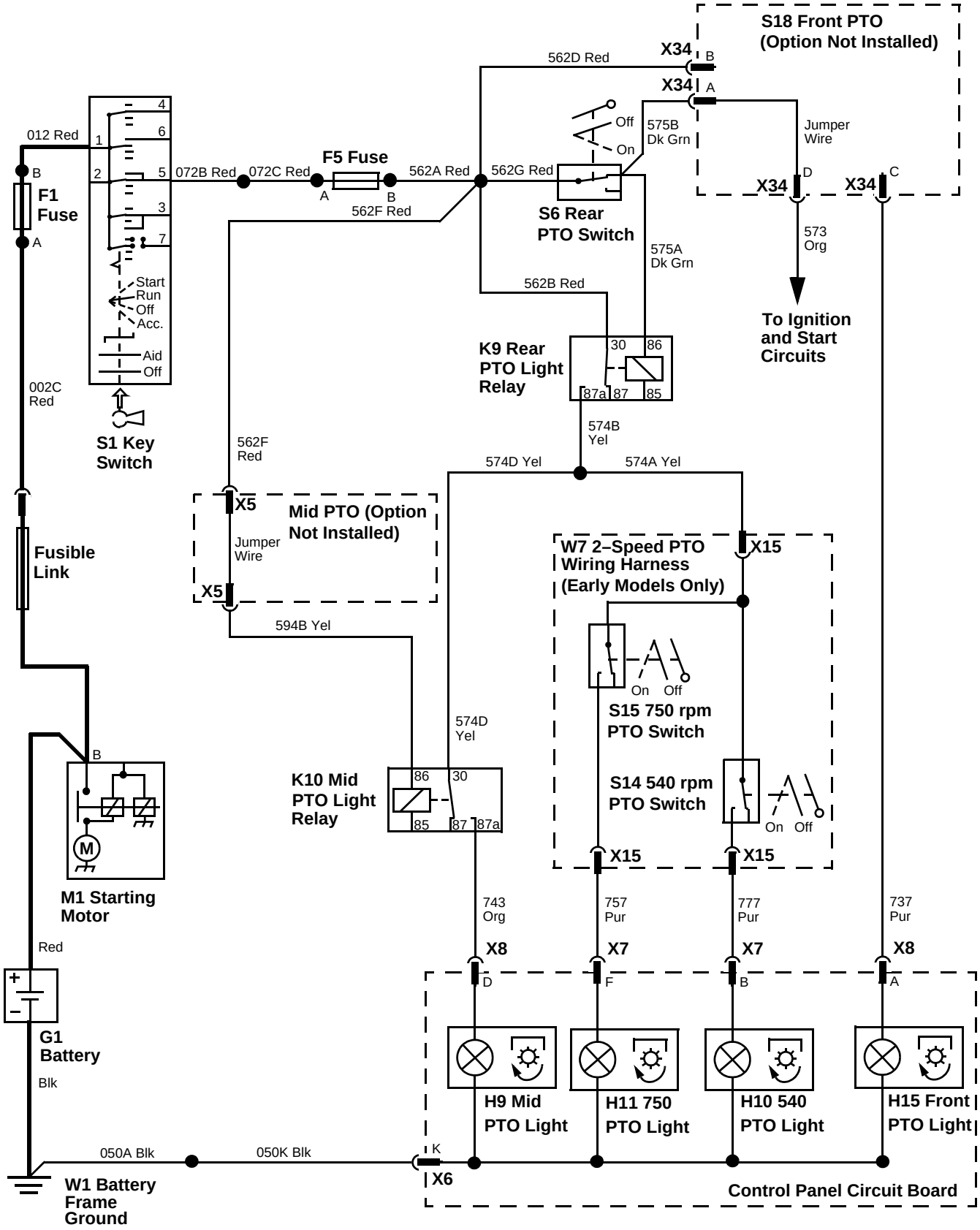
Theory of Operation (Later Models):

With the key in START or RUN position and the rear PTO ENGAGED, battery voltage is provided to the X36 and X37 connectors through the F5 fuse, 562A and 562B Red wires, K9 rear PTO light relay contacts, 574B, 574A and 574EYel wires.

When the rear PTO range selector is placed in the 540 rpm position, the S14 540 rpm PTO switch is closed, and provides a current path through the switch, X36 connector, 777 Pur wire, and X7 connector (terminal B) to the control panel circuit board. A circuit board run provides voltage to the H10 540 PTO indicator light.

When the rear PTO range selector is placed in the 750 rpm position, the S15 750 rpm PTO switch is closed, and provides a current path through the switch, X37 connector, 757 Pur wire, and X7 connector (terminal F) to the control panel circuit board. A circuit board run provides voltage to the H11 750 PTO indicator light.

REAR PTO ELECTRICAL SCHEMATIC



SE1 - STARTING	SE5 - INSTRUMENTATION

REAR PTO ELECTRICAL CIRCUIT DIAGNOSIS

Test Conditions:

- Key switch in RUN position, engine OFF
- Rear PTO DISENGAGED
- Transmission in NEUTRAL
- K9 relay removed from socket
- S5 rear PTO switch disconnected from wiring harness
- Park brake ENGAGED

Test/Check Point	Normal	If Not Normal
1. S6 rear PTO switch connector	Battery voltage	Check F5 fuse. Check 562A and 562G Red wires and connections.
2. K9 Rear PTO relay socket (terminal 30)	Battery voltage	Check F5 fuse. Check 562A and 562B Red wires and connections.

Test Conditions:

- Key switch in RUN position, engine OFF
- Transmission in NEUTRAL
- S5 rear PTO switch connected to main wiring harness
- Rear PTO DISENGAGED
- Park Brake ENGAGED
- K9 relay removed from socket

3. K9 Rear PTO relay socket (terminal 86)	Battery voltage	Ensure rear PTO is DISENGAGED. Test S6 switch (See "REAR AND MID PTO SWITCH TEST"). Replace as needed. Check 575A Dk Grn wire and connections.

Test Conditions: (Continued from previous step)

- Rear PTO ENGAGED

4. K9 Rear PTO relay socket (terminal 86)	0.0 VDC	Ensure rear PTO is ENGAGED. Test S6 switch. (See "REAR AND MID PTO SWITCH TEST"). Replace as needed.

Test Conditions:

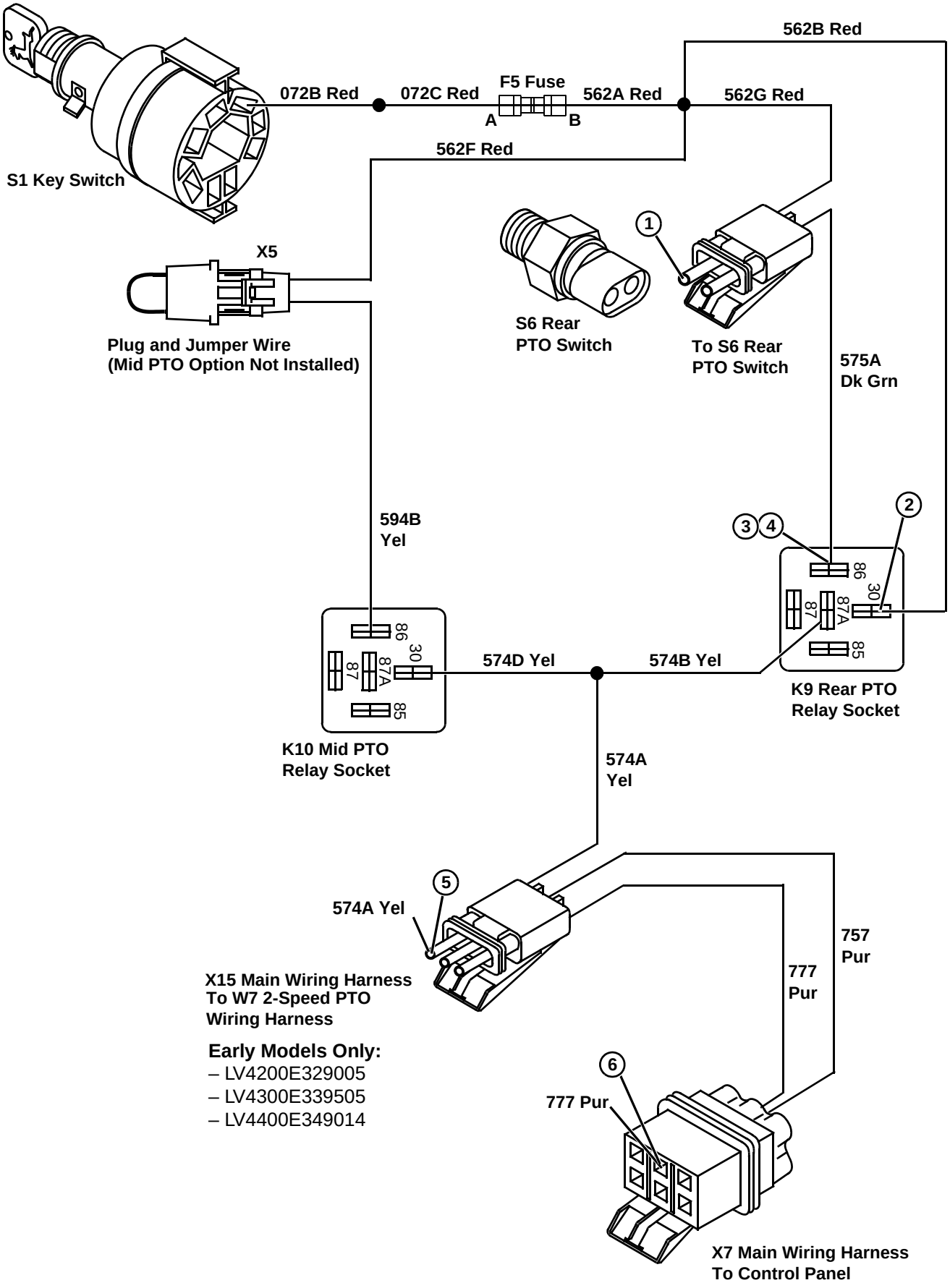
- Key switch in RUN position, engine OFF
- Transmission in NEUTRAL
- K9 rear PTO light relay installed in socket
- Rear PTO ENGAGED
- Park Brake ENGAGED
- X15 disconnected

5. X15 connector to W7 wiring harness	Battery voltage	Check K9 relay (See "RELAY TEST"). Check 574B and 574AYel wires, X15 connector.

Test Conditions:

- Key switch in RUN position, engine OFF
- Transmission in NEUTRAL
- Disconnect X7 to control panel circuit board
- Rear PTO ENGAGED
- Park Brake ENGAGED
- X15 connected

6. X7 connector to control panel circuit board	Battery voltage	Check X15 connector, W7 wiring harness, and 777 Pur wire and connections. (See "2 SPEED PTO DIAGNOSIS EARLY MODELS").


562B Red
072B Red
072C Red
F5 Fuse
A
B
562A Red
562G Red
562F Red
S1 Key Switch
X5
Plug and Jumper Wire
(Mid PTO Option Not Installed)
S6 Rear
PTO Switch
To S6 Rear
PTO Switch
575A
Dk Grn
594B
Yel
86
30
87
87A
85
574D Yel
574B Yel
K10 Mid PTO
Relay Socket
K9 Rear PTO
Relay Socket
574A
Yel
574A Yel
757
Pur
777
Pur
X15 Main Wiring Harness
To W7 2-Speed PTO
Wiring Harness
Early Models Only:
– LV4200E329005
– LV4300E339505
– LV4400E349014
777 Pur
X7 Main Wiring Harness
To Control Panel

2-SPEED PTO DIAGNOSIS (Early Models)

Test Conditions:

- Key switch in RUN position, engine OFF
- Rear PTO ENGAGED
- X15 disconnected
- Transmission in NEUTRAL
- Park brake OFF

Test/Check Point	Normal	If Not Normal
1. X15 connector to W7 2-speed PTO wiring harness	Battery voltage	(See "REAR PTO ELECTRICAL CIRCUIT DIAGNOSIS").

Test Conditions:

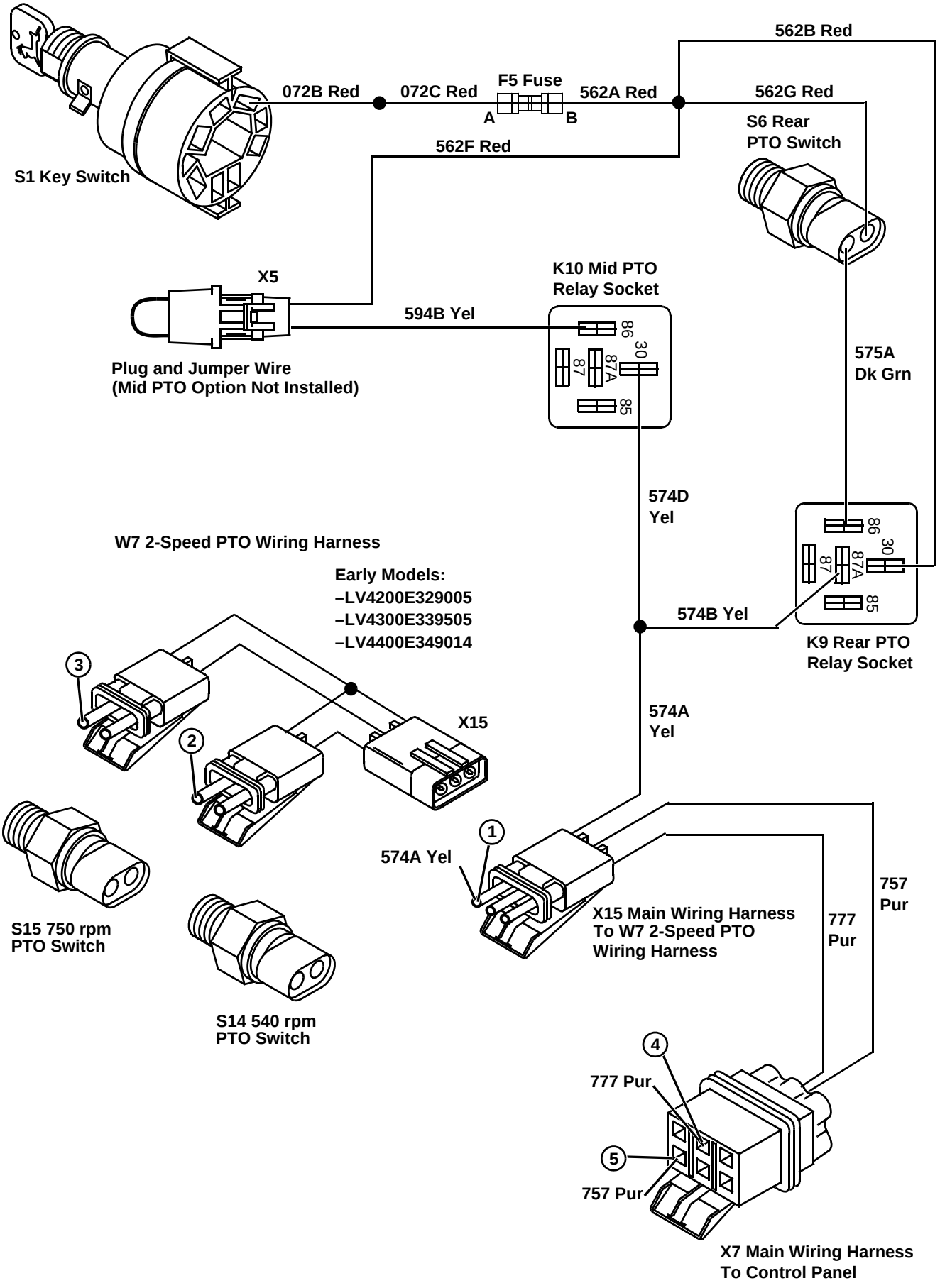
- Key switch in RUN position, engine OFF
- X15 to W7 wiring harness connected
- W7 wiring harness to S14 and S15 disconnected
- Rear PTO ENGAGED
- Park Brake ENGAGED
- Transmission in NEUTRAL

2. W7 wiring harness connector to S14 540 rpm PTO switch	Battery voltage	Check W7 wiring harness wires and connections.
3. W7 wiring harness connector to S15 750 rpm PTO switch	Battery voltage	Check W7 wiring harness wires and connections.

Test Conditions:

- Key switch in RUN position, engine OFF
- X15 to W7 wiring harness connected
- W7 wiring harness to S14 and S15 connected
- 2-speed PTO selector lever placed in 540 rpm position
- Rear PTO ENGAGED
- Park Brake ENGAGED
- Transmission in NEUTRAL
- X7 to control panel disconnected

4. X7 (777 pur wire)	Battery voltage	Check 777 Pur wire and connections.Test S14 540 rpm switch (See "2– SPEED PTO SWITCH TEST"). Replace switch as needed.
5. X7 (757 pur wire)	Battery voltage	Check 757 Pur wire and connections.Test S15 750 rpm switch (See "2– SPEED PTO SWITCH TEST"). Replace switch as needed.


562B Red
072B Red
072C Red
F5 Fuse
A
B
562A Red
562G Red
S6 Rear
PTO Switch
562F Red
S1 Key Switch
X5
K10 Mid PTO
Relay Socket
594B Yel
86
30
87
87A
85
575A
Dk Grn
Plug and Jumper Wire
(Mid PTO Option Not Installed)
574D
Yel
W7 2-Speed PTO Wiring Harness
Early Models:
–LV4200E329005
–LV4300E339505
–LV4400E349014
574B Yel
K9 Rear PTO
Relay Socket
3
2
X15
574A
Yel
1
574A Yel
S15 750 rpm
PTO Switch
X15 Main Wiring Harness
To W7 2-Speed PTO
Wiring Harness
757
Pur
777
Pur
S14 540 rpm
PTO Switch
4
777 Pur
5
757 Pur
X7 Main Wiring Harness
To Control Panel

2-SPEED PTO DIAGNOSIS (Later Models)

Test Conditions:

- Key switch in RUN position, engine OFF
- Rear PTO ENGAGED
- X36 disconnected
- X37 disconnected
- Transmission in NEUTRAL
- Park brake OFF

Test/Check Point	Normal	If Not Normal
1. X36 connector to S14	Battery voltage	Check 574B and 574EYel wires and connections (See "REAR PTO ELECTRICAL CIRCUIT DIAGNOSIS").
2. X37 connector to S15	Battery voltage	Check 574B and 574AYel wires and connections.

Test Conditions:

- Key switch in RUN position, engine OFF
- X36 and X37connected
- W7 wiring harness to S14 and S15 disconnected
- Rear PTO ENGAGED
- Park Brake ENGAGED
- Transmission in NEUTRAL

3. W7 wiring harness connector to S14 540 rpm PTO switch	Battery voltage	Check W7 wiring harness wires and connections.
4. W7 wiring harness connector to S15 750 rpm PTO switch	Battery voltage	Check W7 wiring harness wires and connections.

Test Conditions:

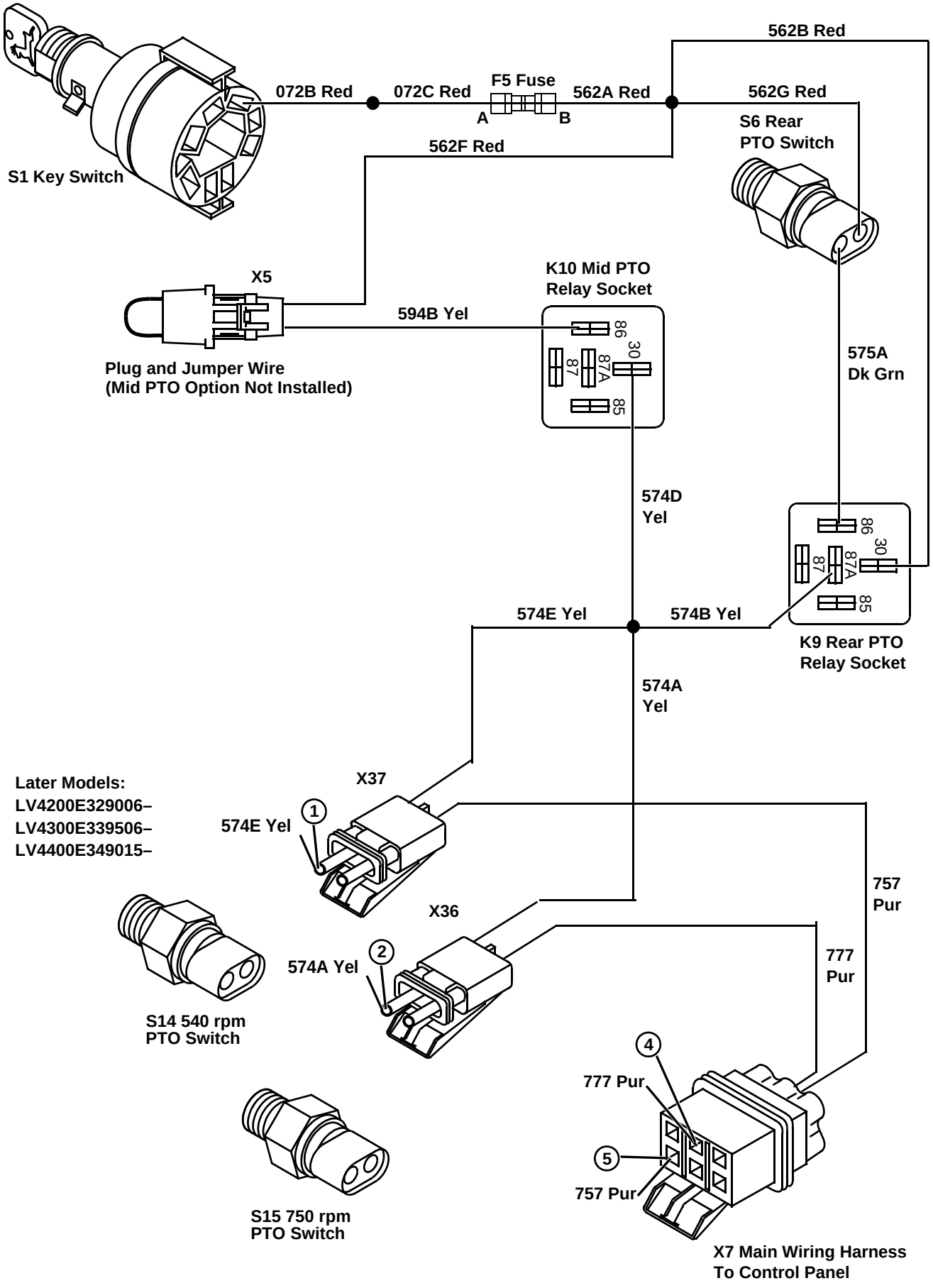
- Key switch in RUN position, engine OFF
- X36 and X37 connected to PTO switches
- 2-speed PTO selector lever placed in 540 rpm position
- X7 to control panel disconnected
- Rear PTO ENGAGED
- Park Brake ENGAGED
- Transmission in NEUTRAL

5. X7 (777 pur wire)	Battery voltage	Check 777 Pur wire and connections.Test S14 540 rpm switch (See "2–SPEED PTO SWITCH TEST"). Replace switch as needed.

Test Conditions:

- Key switch in RUN position, engine OFF
- X36 and X37 connected to PTO switches
- 2-speed PTO selector lever placed in 750 rpm position
- X7 to control panel disconnected
- Rear PTO ENGAGED
- Park Brake ENGAGED
- Transmission in NEUTRAL

6. X7 (757 pur wire)	Battery voltage	Check 757 Pur wire and connections.Test S15 750 rpm switch (See "2–SPEED PTO SWITCH TEST"). Replace switch as needed.


562B Red
072B Red
072C Red
F5 Fuse
A
B
562A Red
562G Red
S6 Rear
PTO Switch
562F Red
S1 Key Switch
X5
K10 Mid PTO
Relay Socket
594B Yel
86
30
87
87A
85
575A
Dk Grn
Plug and Jumper Wire
(Mid PTO Option Not Installed)
574D
Yel
574E Yel
574B Yel
K9 Rear PTO
Relay Socket
574A
Yel
Later Models:
LV4200E329006–
LV4300E339506–
LV4400E349015–
X37
574E Yel
1
757
Pur
X36
574A Yel
2
777
Pur
S14 540 rpm
PTO Switch
4
777 Pur
5
757 Pur
S15 750 rpm
PTO Switch
X7 Main Wiring Harness
To Control Panel

MID & FRONT PTO OPERATION

MID PTO LIGHT

Function:

To alert operator of mid PTO being ENGAGED.

Operating Condition:

The rear PTO and the mid PTO must be ENGAGED.

Theory of Operation:

With the key in START or RUN position, battery voltage is provided to the S6 rear PTO switch through the F5 fuse and 562A and 562G Red wires. Voltage is also provided to the X5 connector and S17 mid PTO switch through the F5 fuse and 562A and 562F Red wires, and the K9 rear PTO light relay (terminal 30) through the 562A and 562B Red wires.

When the rear PTO is ENGAGED, the S6 rear PTO switch contacts open, the K9 relay coil is deenergized, and the relay contacts close. Voltage is provided through the relay contacts, 574B and 574D Yel wires to the K10 mid PTO light relay contacts (terminal 30).

When the mid PTO relay coil is energized, the relay contacts are open and voltage at the relay contacts (terminal 30) is not passed through the contacts.

When the mid PTO is ENGAGED, the S17 mid PTO switch contacts are opened, and voltage to the K10 mid PTO relay coil is removed from the coil. The mid PTO light relay contacts close, and voltage is provided through the contacts to the 743 Org wire and X8 connector (terminal D). A circuit board run provides voltage to the H9 mid PTO indicator light.

NOTE: Both the K9 rear PTO light relay coil and the K10 mid PTO light relay coil have to be DEENERGIZED to allow a circuit path from the F5 fuse to the H9 mid PTO light.

FRONT PTO SWITCH, SOLENOID AND LIGHT

Function:

Switch: To control the front PTO light and PTO solenoid, and act as part of the ignition safety circuit. (See "ENGINE SHUTOFF CIRCUIT OPERATION").

Light: To alert operator of front PTO being ENGAGED.

Operating Condition:

The rear PTO must be ENGAGED and the front PTO switch placed in the ON position.

Theory of Operation:

The front PTO is electrically operated, and can not be operated if the rear PTO is ENGAGED.

With the key in START or RUN position, battery voltage is provided to the S6 rear PTO switch through the F5 fuse and 562A and 562G Red wires. Voltage is also provided to the X34 connector and S18 front PTO switch through the F5 fuse and 562A and 562D Red wires

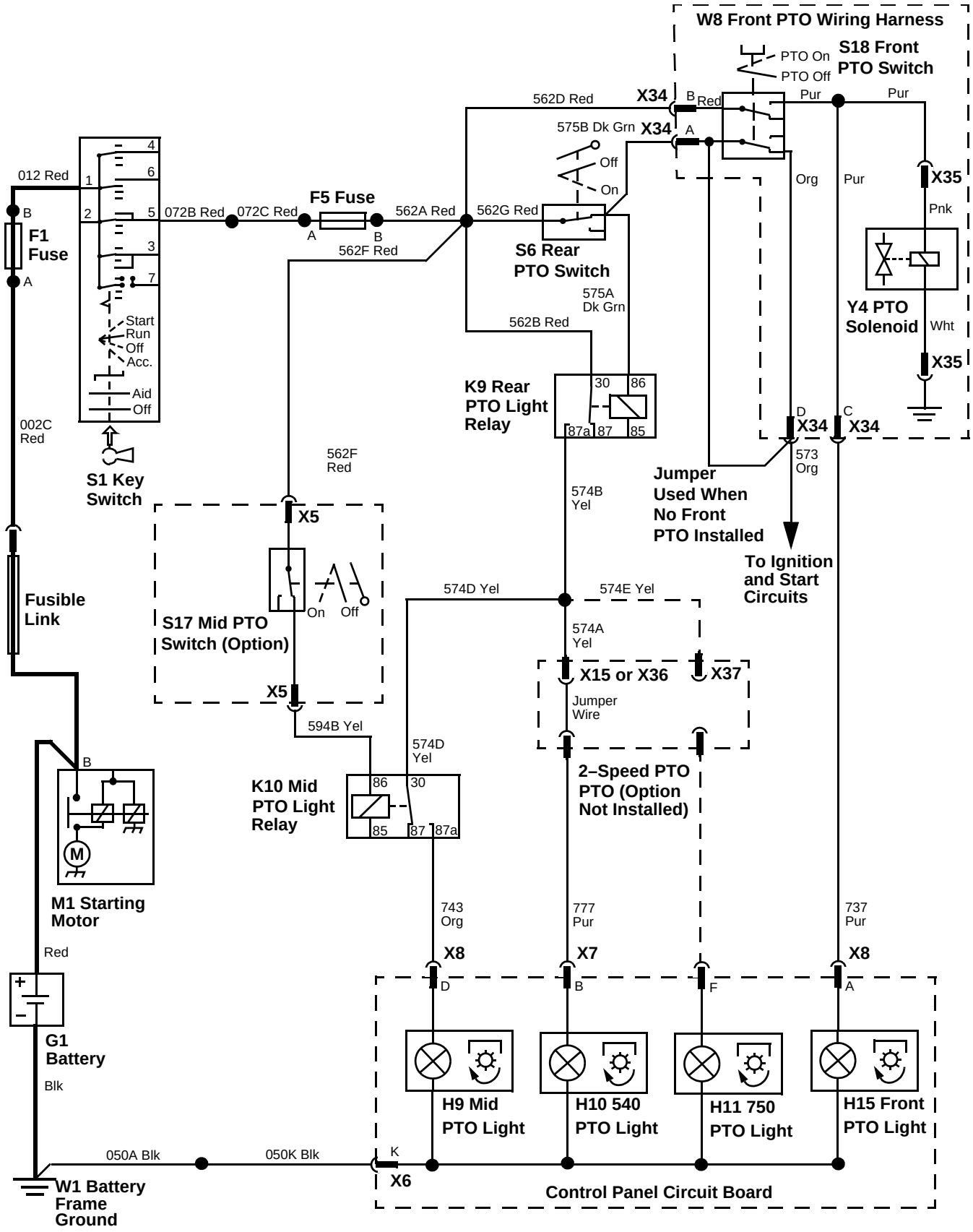
With the rear PTO DISENGAGED, voltage is provided through the rear PTO switch contacts to the X34 connector and S18 front PTO switch through the 575B Dk Grn wire.

With the rear PTO DISENGAGED and the S18 front PTO switch in the OFF position, voltage is provided to the engine cranking circuit, (See "CRANKING CIRCUIT OPERATION").and engine safety shut-off circuit (See "ENGINE SHUTOFF CIRCUIT OPERATION"). through the 562G Red wire, rear PTO switch, 575B Dk Grn wire, X34, front PTO switch, X34, and 573 Org wire.

When the front PTO switch is placed in the ON position (rear PTO DISENGAGED), voltage is supplied through the front PTO switch and front PTO wiring harness to the Y4 PTO solenoid. Voltage is also supplied through the front PTO wiring harness, 737 Pur wire, X8 connector (terminal A) and control panel circuit board to the H15 front PTO light.

When the tractor is not equipped with the front PTO option, a jumper is installed into the X34 connector, which connects the 575B Dk Grn wire to the 573 Org ignition start wire. This allows the tractor to start when the rear PTO switch is in the OFF position.

MID & FRONT PTO ELECTRICAL SCHEMATIC



SE1 - STARTING	SE5 - INSTRUMENTATION

MID AND FRONT PTO DIAGNOSIS

Test Conditions:

- Key switch in RUN position, engine OFF
- Rear PTO DISENGAGED
- Mid and Front PTOs DISENGAGED
- X34 to W8 front PTO wiring harness disconnected
- Transmission in NEUTRAL, Park brake ENGAGED
- K9 and relay removed from socket
- X5 to S17 mid PTO switch disconnected
- X8 to control panel disconnected

Test/Check Point	Normal	If Not Normal
1. K9 Rear PTO socket (terminal 86)	Battery voltage	Check F5 fuse. Ensure rear PTO is DISENGAGED. Test S6 switch (See "REAR AND MID PTO SWITCH TEST"). Check 562A and 562F Red wires, and 575A Dk Grn wire and connections.
2. K9 Rear PTO socket (terminal 30)	Battery voltage	Check 562B Red wire and connections.
3. X5 (562G Red wire)	Battery voltage	Check 562F Red wire and connections.
4. X34 (562D Red wire)	Battery voltage	Check 562D Red wire and connections.

Test Conditions:

- Key switch in RUN position, engine OFF
- Transmission in NEUTRAL, Park Brake ENGAGED
- X5 to S17 mid PTO switch connected
- K10 relay removed from socket
- All PTOs DISENGAGED
- PTO switch in OFF position
- K9 relay installed in socket

5. K10 Mid PTO relay socket (terminal 30)	Battery voltage	Ensure rear PTO is DISENGAGED. Test rear PTO relay (See "RELAY TEST"). Check 594B and 574DYel wires and connections.
6. K10 Mid PTO relay socket (terminal 86)	Battery voltage	Ensure mid PTO is DISENGAGED. Test S17 switch. Check 594B Yel wire and connections.

Test Conditions:

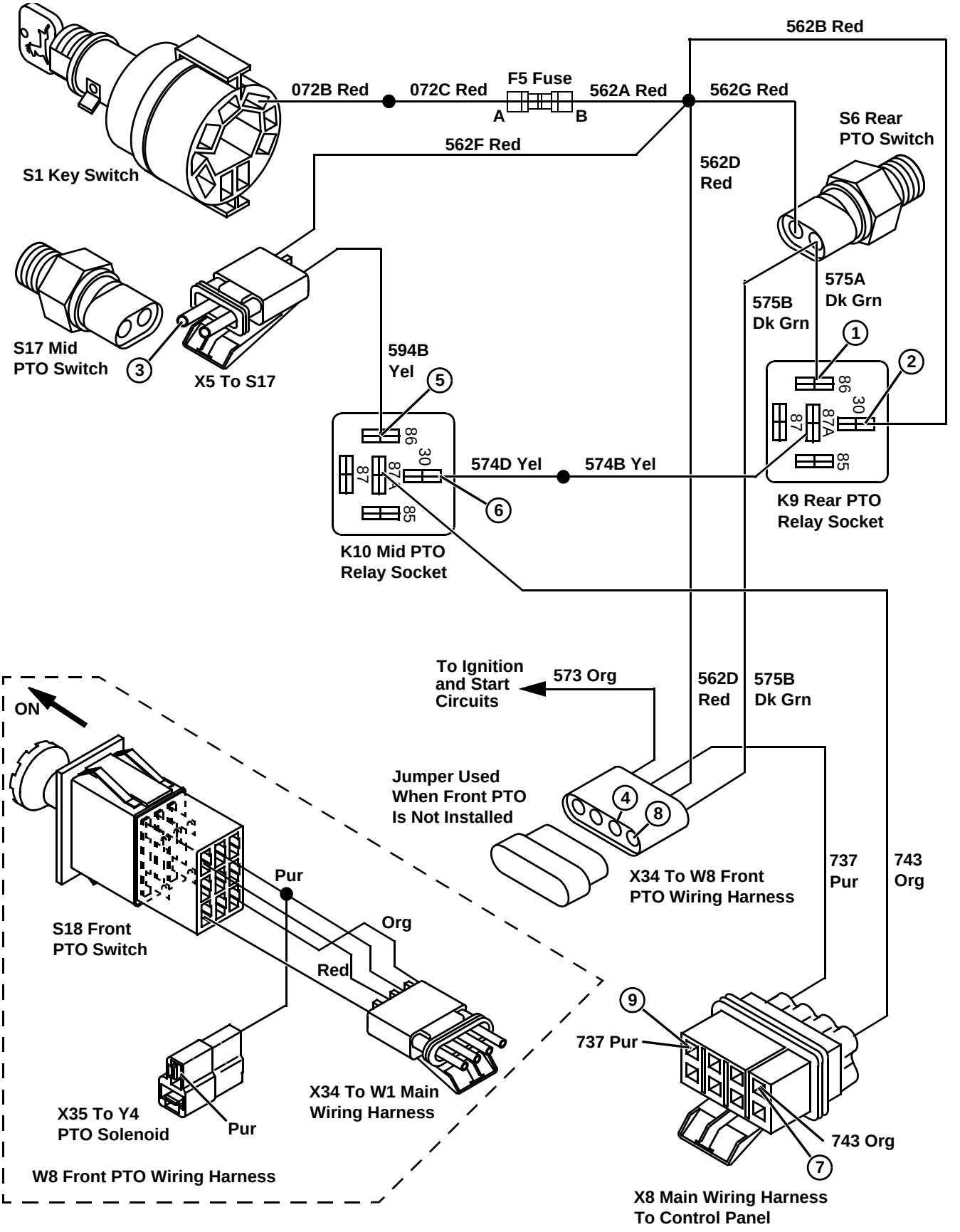
- Key switch in RUN position, engine OFF
- Transmission in NEUTRAL, Park Brake ENGAGED
- X34 connector to W8 wiring harness disconnected
- Mid PTO ENGAGED
- K10 mid PTO relay installed

7. X8 (743 Org wire)	Battery voltage	Test mid PTO relay. Replace relay as needed. Check 743 Org wire and connections.
8. X34 (575B Dk Grn wire)	Battery voltage	Check 575B Dk Grn wire and connections.

Test Conditions:

- Key switch in RUN position, engine OFF
- Transmission in NEUTRAL, Park Brake ENGAGED
- X34 to W8 wiring harness connected
- Rear PTO switch in ON position

9. X8 (737 Pur wire)	Battery voltage	Test front PTO switch. (See "FRONT PTO SWITCH TEST"). Check 737 Pur wire and connections. Check W8 wiring harness wires and connections.


562B Red
072B Red
072C Red
F5 Fuse
A
B
562A Red
562G Red
S6 Rear
PTO Switch
562F Red
562D
Red
S1 Key Switch
575A
Dk Grn
575B
Dk Grn
S17 Mid
PTO Switch
3
X5 To S17
594B
Yel
5
1
2
86
30
87
87A
85
574D Yel
574B Yel
6
K10 Mid PTO
Relay Socket
K9 Rear PTO
Relay Socket
To Ignition
and Start
Circuits
573 Org
562D
Red
575B
Dk Grn
ON
Jumper Used
When Front PTO
Is Not Installed
4
8
737
Pur
743
Org
X34 To W8 Front
PTO Wiring Harness
Pur
S18 Front
PTO Switch
Org
Red
9
737 Pur
X34 To W1 Main
Wiring Harness
X35 To Y4
PTO Solenoid
Pur
743 Org
7
W8 Front PTO Wiring Harness
X8 Main Wiring Harness
To Control Panel

LIGHT SWITCH OPERATION

Function:

Provides power to the headlights, tail lights, hazard lights, work lights and panel lights, dependent upon the position the light switch is placed in.

Operating Conditions:

Light switch must be in either HAZARD, ROAD or FIELD position.

Theory of Operation:

Unswitched power to the light switch is provided through the load center F3 fuse, 122C and 122B Red wires. (See "POWER CUICUIT DIAGNOSIS").

Light Switch in Hazard Position:

In the HAZARD position, power is provided to the LH and RH position lights (front and rear), and the license plate light.

In the HAZARD position, power is provided from the light switch (terminal 2) through the 103A and 103C Org wires to the F8 fuse, and 103A and 103B Org wires to the F9 fuse.

From the F8 fuse, power is provided through the 118A and 118E Gry wires to the license plate light; the 118A and 118C Gry wires to the LH front position light; the 118A and 118D Gry wires to the RH rear position light, and through the 118A and 118B Gry wires to the X13 trailer connector (terminal B).

From the F9 fuse, power is provided through the 128A and 128B Gry wires to the X13 trailer connector (terminal D); the 128A and 128C Gry wires to the RH front position light, and through the 128A and 128D Gry wires to the LH rear position light.

Light Switch in Road Position:

In the ROAD position, power is provided from the light switch (terminal 2) through the same circuits as the light switch is in the HAZARD position.

In addition, power is provided to the LH and RH headlights, and the control panel fuel and temperature gauge lights.

Power is provided from the light switch (terminal 3) though the 138 Gry wire to the F7 fuse. The F7 fuse provides voltage to the LH headlight through the 119C and 119B Wht wires, and the RH headlight through the 119C and 119A Wht wires. Power is also provided to the control panel gauge lights through the 119C and 119D Wht wires, X6 connector (B terminal) and the control panel circuit board.

Light Switch in Field Position:

In the FIELD position, power is removed from the position lights and license plate light (terminal 2).

Power is provided to the headlights and control panel gauge lights (terminal 3).

Power is provided to the RH and LH work lights (terminal 4).

Power is provided from the light switch (terminal 4), through the 143 Org wire to the F6 fuse. The F6 fuse provides power to the RH work light through the 147A and 147D Pur wires, and to the LH work light through the 147A and 147B Pur wires.

BRAKE LIGHTS OPERATION

Function:

Provides power to the brake lights.

Operating Conditions:

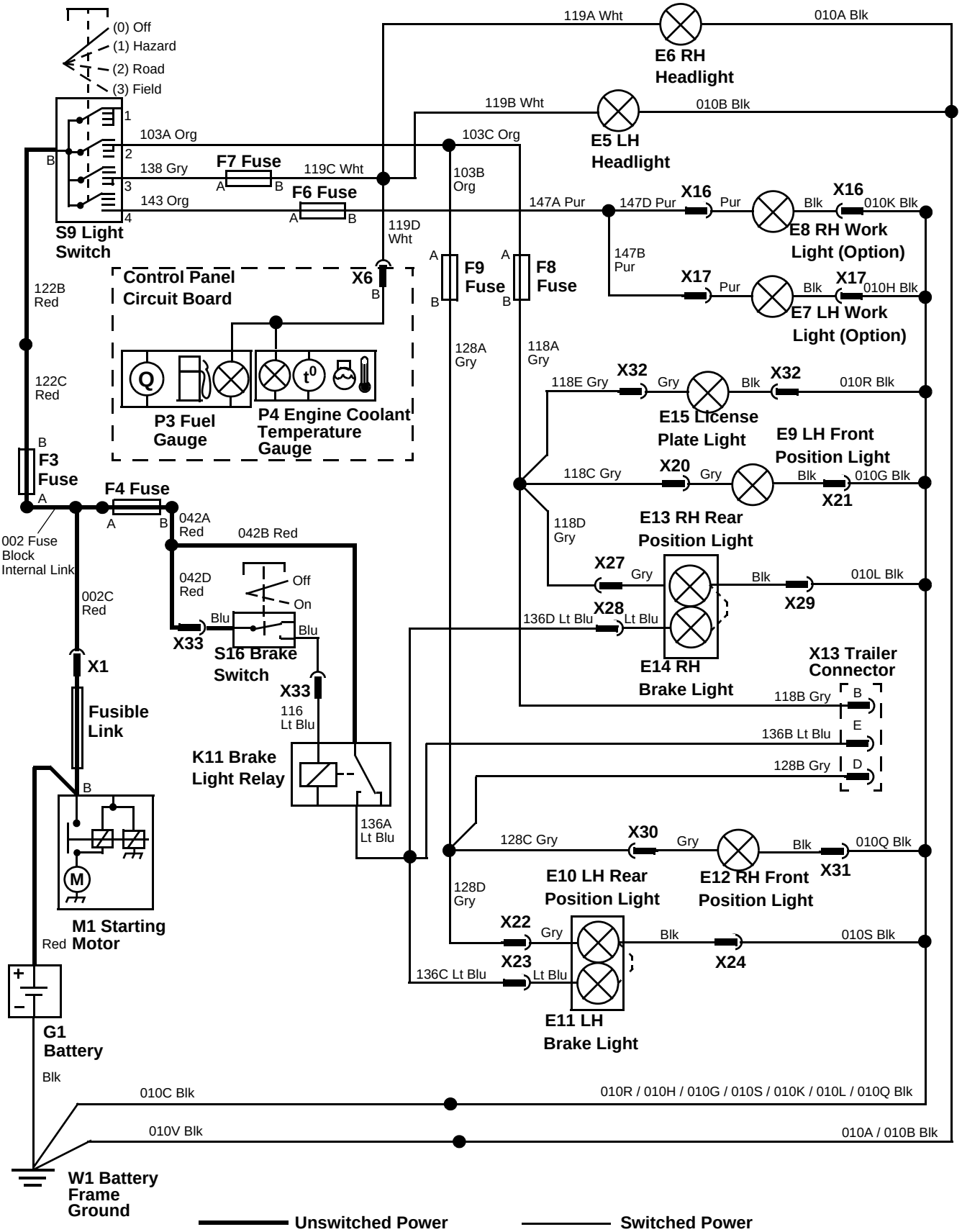
The brake pedal must be depressed.

Theory of Operation:

Unswitched power is provided to the S16 brake switch through the F4 fuse, 042A and 042D Red wires, and to the K11 brake light relay (terminal 30) through the F4 fuse, 042A and 042B Red wires.

When the brake pedal is depressed, the brake switch closes. The closed brake switch contacts provide power to the brake light relay coil (terminal 86). When the brake light relay coil is energized, the relay contacts close. The closed contacts provide a current path to the RH brake light through the 136A and 136D Lt Blu wires, the LH brake light through the 136A and 136C Lt Blue wires; and, the X13 trailer connector (terminal E) though the 136A and 136B Lt Blue wires.

LIGHT SWITCH ELECTRICAL SCHEMATIC



SE1 - STARTING	SE6 - LIGHTS

TURN SIGNAL SWITCH OPERATION

Turn Signal Switch Function:

Provides intermittent power (from K12 flasher) to either the LH front and rear turn/hazard lights, or the RH front and rear turn/hazard lights. Also provides intermittent power to the control panel turn indicator lights.

Operating Conditions:

Key switch in the ON position, hazard switch in the OFF position, and turn signal switch in either LEFT or RIGHT position.

Theory of Operation:

Unswitched power is provided to the hazard switch (terminal 30) through the F4 fuse, 042A and 042C Red wires. Switched power is provided from the key switch (terminal 5) through the 072B and 072E Red wires to the hazard switch (terminal 15).

With the hazard switch in the OFF position, the switched power is provided through the hazard switch (terminal 15 to terminal 49) and 102 Red wire to the K12 flasher (terminal 49).

The internal circuits of the K12 flasher provide an intermittent output (terminal 49a) if a circuit path is provided through a load component to the battery frame ground. The flasher unit in the turn signal switch is not used in this application. Placing the turn signal switch in either the RIGHT or LEFT position provides a circuit path through a load component (turn/hazard lights) to ground.

Right Turn Signal Theory of Operation:

With the turn signal switch in the RIGHT position, and the hazard switch in the OFF position, voltage from the K12 flasher (terminal 49a) enters the turn signal switch (terminal 4) through the 127D and 127B Pur wires. The turn signal switch completes a current path through the switch contacts (terminal 4 to terminal 5). From the turn signal switch (terminal 5), voltage is provided to the RH front turn/hazard light through the 115A and 115D Dk Grn wires, the RH rear turn/hazard light through the 115A and 115C Dk Grn wires, the X13 trailer connector (terminal A) through the 115A and 115E Dk Grn wires, the control panel RH turn light through the 115A and 115B Dk Grn wires, and the hazard switch (terminal R) through the 115A and 115F Dk Grn wires.

Each of the turn/hazard lights has a ground connection to the battery frame ground. When power is supplied to the turn/hazard lights, a complete circuit path is formed. When the circuit is formed, the internal circuits in the K12 flasher provide an intermittent voltage output. This intermittent voltage is provided to the turn/hazard lights through the circuit paths described above.

Left Turn Signal Theory of Operation:

With the turn signal switch in the LEFT position, and the hazard switch in the OFF position, voltage from the K12 flasher (terminal 49a) enters the turn signal switch (terminal 3) through the 127D and 127A Pur wires. The turn signal switch completes a current path through the switch contacts (terminal 3 to terminal 6). From the turn signal switch (terminal 6), voltage is provided to the LH front turn/hazard light through the 125A and 125D Dk Grn wires, the LH rear turn/hazard light through the 125A and 125C Dk Grn wires, the X13 trailer connector (terminal C) through the 125A and 125E Dk Grn wires, the control panel LH turn light through the 125A and 125B Dk Grn wires, and the hazard switch (terminal L) through the 125A and 125F Dk Grn wires.

Each of the turn/hazard lights has a ground connection to the battery frame ground. When power is supplied to the turn/hazard lights, a complete circuit path is formed. When the circuit is formed, the internal circuits in the K12 flasher provide an intermittent voltage output. This intermittent voltage is provided to the turn/hazard lights through the circuit paths described above.

HAZARD SWITCH OPERATION

Hazard Switch Function:

Provides intermittent power (from K12 flasher) to all of the turn/hazard lights.

Operating Conditions:

Hazard switch in ON position.

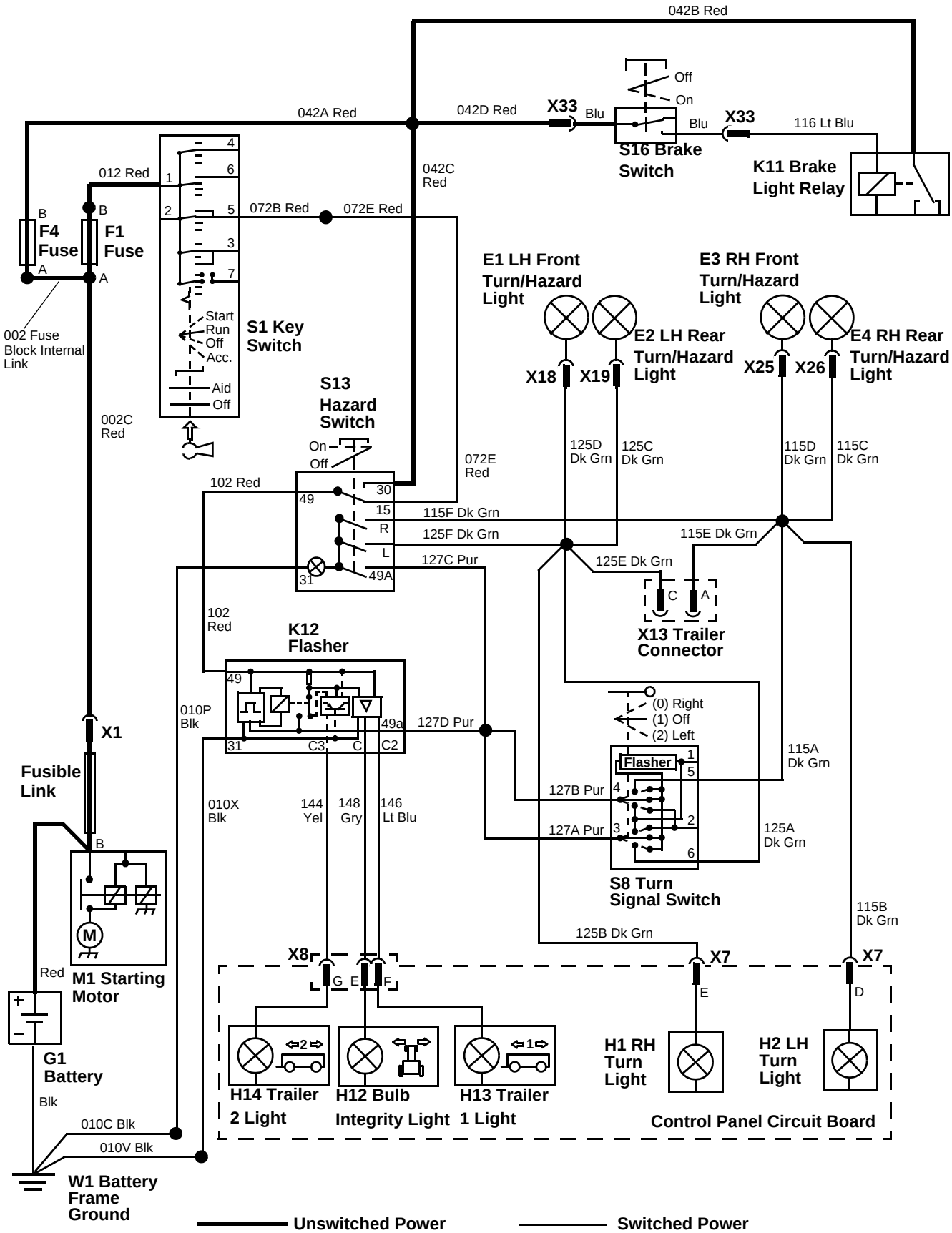
Theory of Operation:

With the hazard switch in the ON position, unswitched power is provided through the hazard switch (terminal 30 to terminal 49) and 102 Red wire to the K12 flasher (terminal 49). The internal circuits of the K12 flasher provide an intermittent output (terminal 49a) if a circuit path is provided through a load component to the battery frame ground.

The circuit path is created when the K12 flasher output power is provided through the 127D and 127C Pur wires to the hazard switch input (terminal 49a). The contacts in the hazard switch (terminal 49a to terminals R and L) complete the circuit path to all of the turn/hazard lights through the 115 Dk Grn and 125 Dk Grn wires to the LH front and rear turn/hazard lights, the RH front and rear turn/hazard lights, the X13 trailer connector (terminals C and A) and both of the control panel turn indicator lights.

The hazard switch has an internal indicator light that is provided with intermittent power from the K12 flasher.

TURN/HAZARD LIGHTS ELECTRICAL SCHEMATIC



SE1 - STARTING	SE6 - LIGHTS

LIGHTS DIAGNOSIS

Test Conditions:

- Key switch in OFF position
- Engine OFF
- Light switch in ROAD position
- X6 connector to control panel disconnected

Test/Check Point	Normal	If Not Normal
1. Light switch	Battery voltage	Check F3 fuse. (See "POWER CIRCUIT DIAGNOSIS").
2. Light switch	Battery voltage	Test light switch. (See "LIGHT SWITCH TEST").
3. F7 fuse	Battery voltage	Check F7 fuse. Check 138 Gry wire and connections.
4. RH headlight	Battery voltage	Check 119A and 119C Wht wires and connections.
5. LH headlight	Battery voltage	Check 119A and 119B Wht wires and connections.
6. X6 control panel connector (terminal B)	Battery voltage	Check 119A and 119D Wht wires and connections.

Test Conditions:

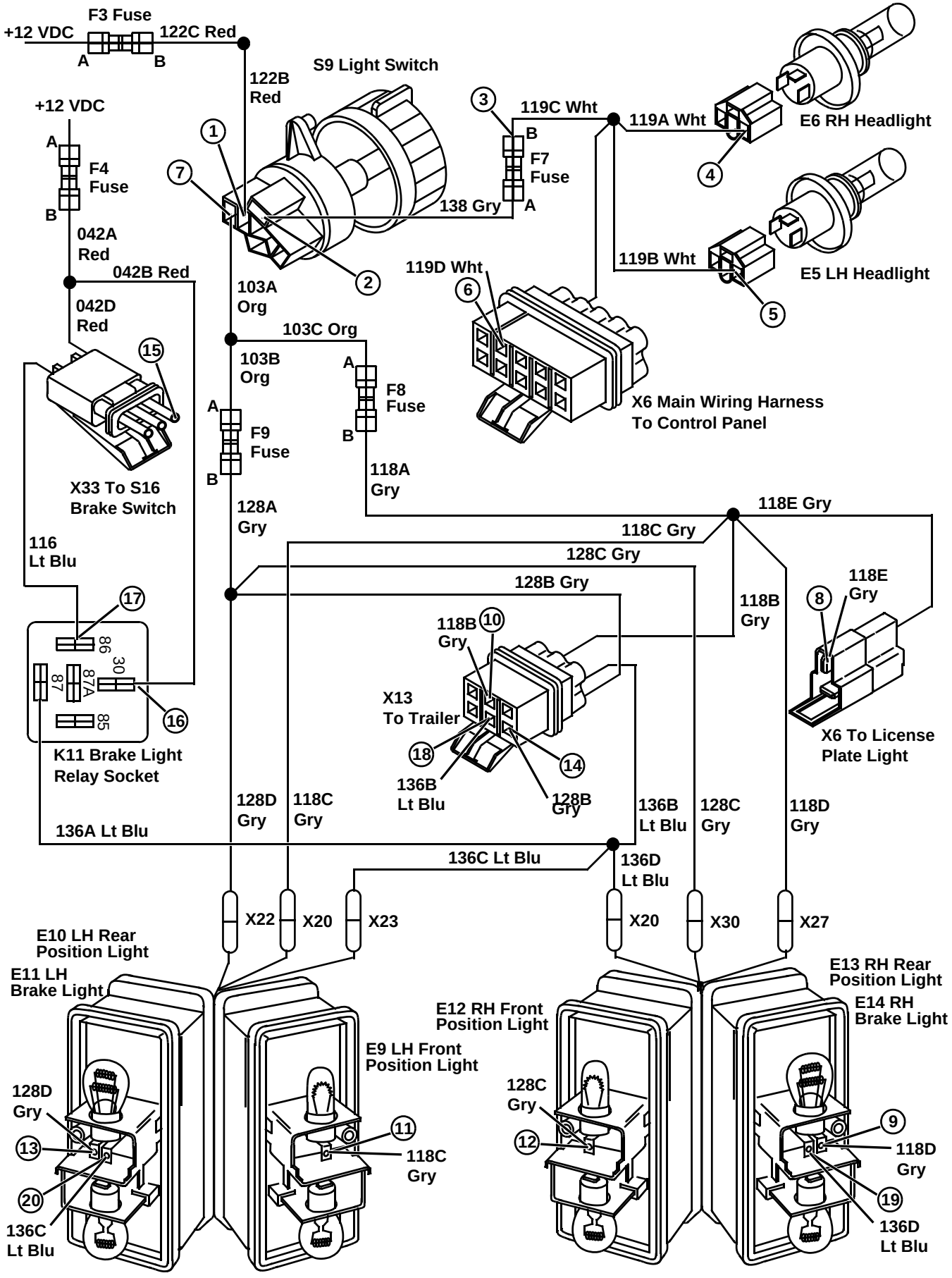
- Key switch in OFF position
- Engine OFF
- Light switch in HAZARD position
- X6 to control panel connected

7. Light switch	Battery voltage	Test light switch. (See "LIGHT SWITCH TEST").
8. X6 to license plate light	Battery voltage	Check F8 fuse. Check 103A and 103C Org wires and connections. Check 118A and 118E Gry wires and connections.
9. RH rear position light	Battery voltage	Check 118D Gry wire and connections. Check X27 connector and Gry wire.
10. X13 (terminal B)	Battery voltage	Check 118B Gry wire and connections.
11. LH front position light	Battery voltage	Check 118C Gry wire and connections. Check X20 connector and Gry wire.
12. RH front position light	Battery voltage	Check F9 fuse. Check 128A and 128C Gry wires and connections. Check X30 connector and Gry wire.
13. LH rear position light	Battery voltage	Check 128D Gry wire and connections. Check X22 connector and Gry wire.
14. X13 (terminal D)	Battery voltage	Check 128B Gry wire and connections.

Test Conditions:

- Key switch in OFF position
- Engine OFF
- Light switch in OFF position
- X33 to S16 brake switch disconnected
- K11 brake light relay removed from socket

15. X33 connector	Battery voltage	Check F4 fuse. (See "POWER CIRCUIT DIAGNOSIS").


F3 Fuse
+12 VDC
122C Red
A
B
S9 Light Switch
122B Red
+12 VDC
A
F4 Fuse
B
042A Red
042B Red
042D Red
1
2
3
7
138 Gry
119C Wht
B
F7 Fuse
A
119A Wht
E6 RH Headlight
4
119B Wht
E5 LH Headlight
5
119D Wht
6
X6 Main Wiring Harness To Control Panel
103A Org
103C Org
103B Org
A
F8 Fuse
B
A
F9 Fuse
B
118A Gry
15
X33 To S16 Brake Switch
128A Gry
118E Gry
118C Gry
128C Gry
128B Gry
116 Lt Blu
17
86
30
87
87A
85
16
K11 Brake Light Relay Socket
118B Gry
10
X13 To Trailer
18
14
136B Lt Blu
128B Gry
118B Gry
8
118E Gry
X6 To License Plate Light
128D Gry
118C Gry
136A Lt Blu
136B Lt Blu
128C Gry
118D Gry
136C Lt Blu
136D Lt Blu
X22
X20
X23
X20
X30
X27
E10 LH Rear Position Light
E11 LH Brake Light
E9 LH Front Position Light
E12 RH Front Position Light
E13 RH Rear Position Light
E14 RH Brake Light
128D Gry
13
20
136C Lt Blu
11
118C Gry
128C Gry
12
9
118D Gry
19
136D Lt Blu

Test/Check Point	Normal	If Not Normal
16. Brake light relay socket (terminal 30)	Battery voltage	Check F4 fuse. Check 042A and 042B Red wires and connections.

Test Conditions:

- Key switch in OFF position
- Engine OFF
- Light switch in OFF position
- X33 to S16 brake switch connected
- Depress brake pedal, or: Manually close and hold S16 brake switch

17. Brake light relay socket (terminal 86)	Battery voltage	Ensure brake is depressed.Test brake switch (See "BRAKE SWITCH TEST"). Check 116 Lt Blu wire and connections.

Test Conditions:

- Key switch in OFF position
- Engine OFF
- Light switch in OFF position
- Brake light relay installed in socket
- Depress brake pedal, or: Manually close and hold S16 brake switch

18. X13 (terminal E)	Battery voltage	Ensure brake is depressed. Check 136A and 136B Lt Blu wires and connections. Test brake light relay. (See "RELAY TEST"). Replace as needed.
19. RH brake light	Battery voltage	Check 136D Lt Blu wire and connections. Check X20 connector.
20. LH brake light	Battery voltage	Check 136C Lt Blu wire and connections. Check X23 connector.

Test Conditions:

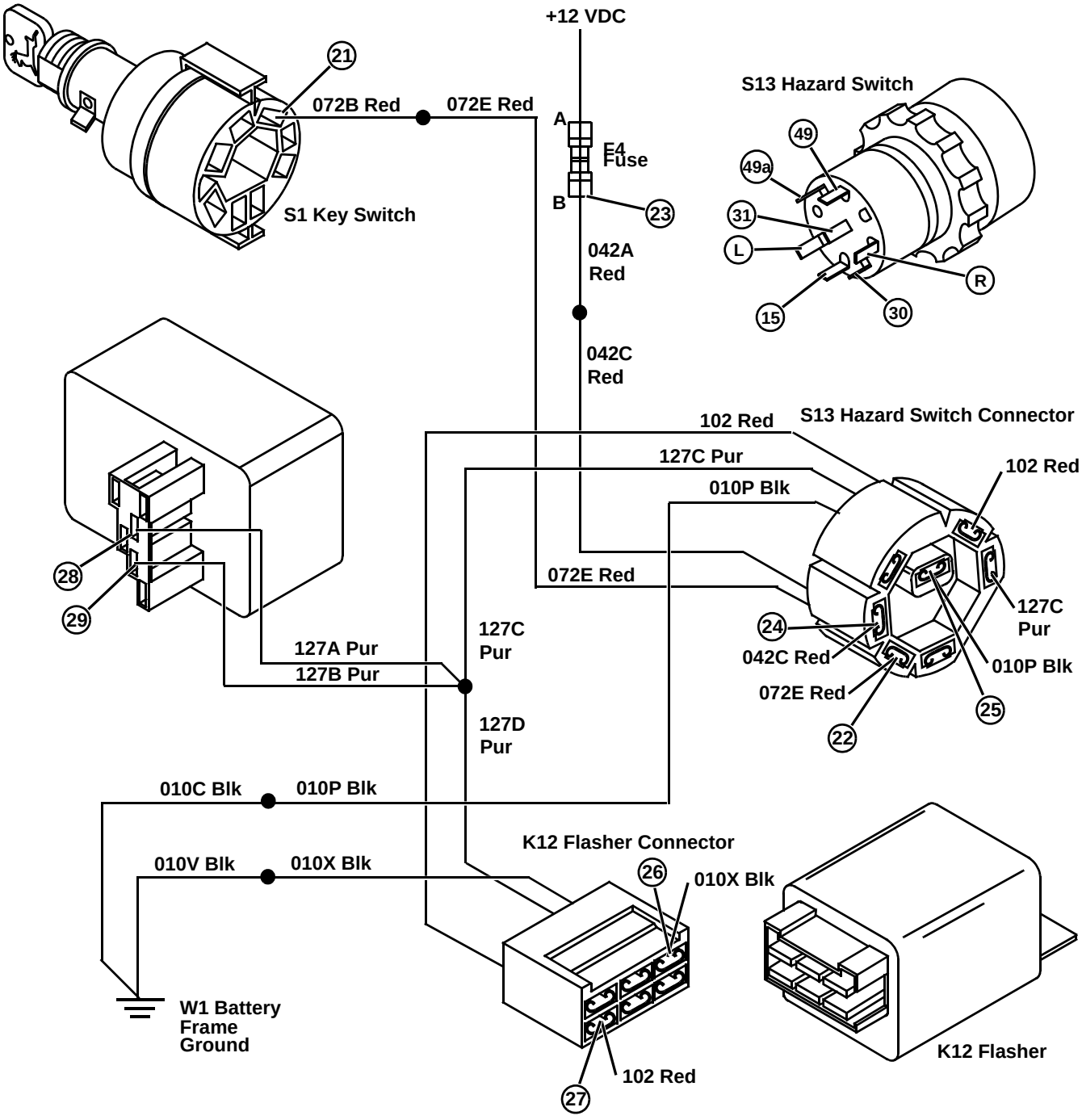
- Key switch in ON position
- Engine OFF
- Light switch in OFF position
- Turn signal switch in OFF position
- K12 flasher disconnected from wiring harness
- Hazard switch disconnected from wiring harness

21. Key switch (terminal 5)	Battery voltage	Test switch. (See "KEY SWITCH TEST"). Replace as needed.
22. Hazard switch connector	Battery voltage	Check 072B and 072E Red wires and connections.
23. F4 fuse	Battery voltage	Replace F4 fuse.
24. Hazard switch connector	Battery voltage	Check 042A and 042C Red wires and connections.
25. Hazard switch connector	Continuity to ground (0.2 ohms or less)	Check 010P and 010C Blk wires and connections.

Test Conditions:

- Key switch in ON position
- Engine OFF
- Turn signal switch in OFF position
- Hazard switch connected to wiring harness
- Hazard switch in OFF position

26. K12 flasher connector	Continuity to ground (0.2 ohms or less)	Check 010X and 010V Blk wire and connections.
27. K12 flasher connector	Battery voltage	Check 102 Red wire and connections.


+12 VDC
21
072B Red
072E Red
A
F4
Fuse
B
23
S1 Key Switch
042A
Red
042C
Red
S13 Hazard Switch
49
49a
31
L
R
15
30
102 Red
S13 Hazard Switch Connector
127C Pur
010P Blk
102 Red
072E Red
28
29
127A Pur
127B Pur
127C
Pur
127D
Pur
24
042C Red
072E Red
22
127C
Pur
010P Blk
25
010C Blk
010P Blk
010V Blk
010X Blk
K12 Flasher Connector
26
010X Blk
W1 Battery
Frame
Ground
27
102 Red
K12 Flasher

Test/Check Point	Normal	If Not Normal

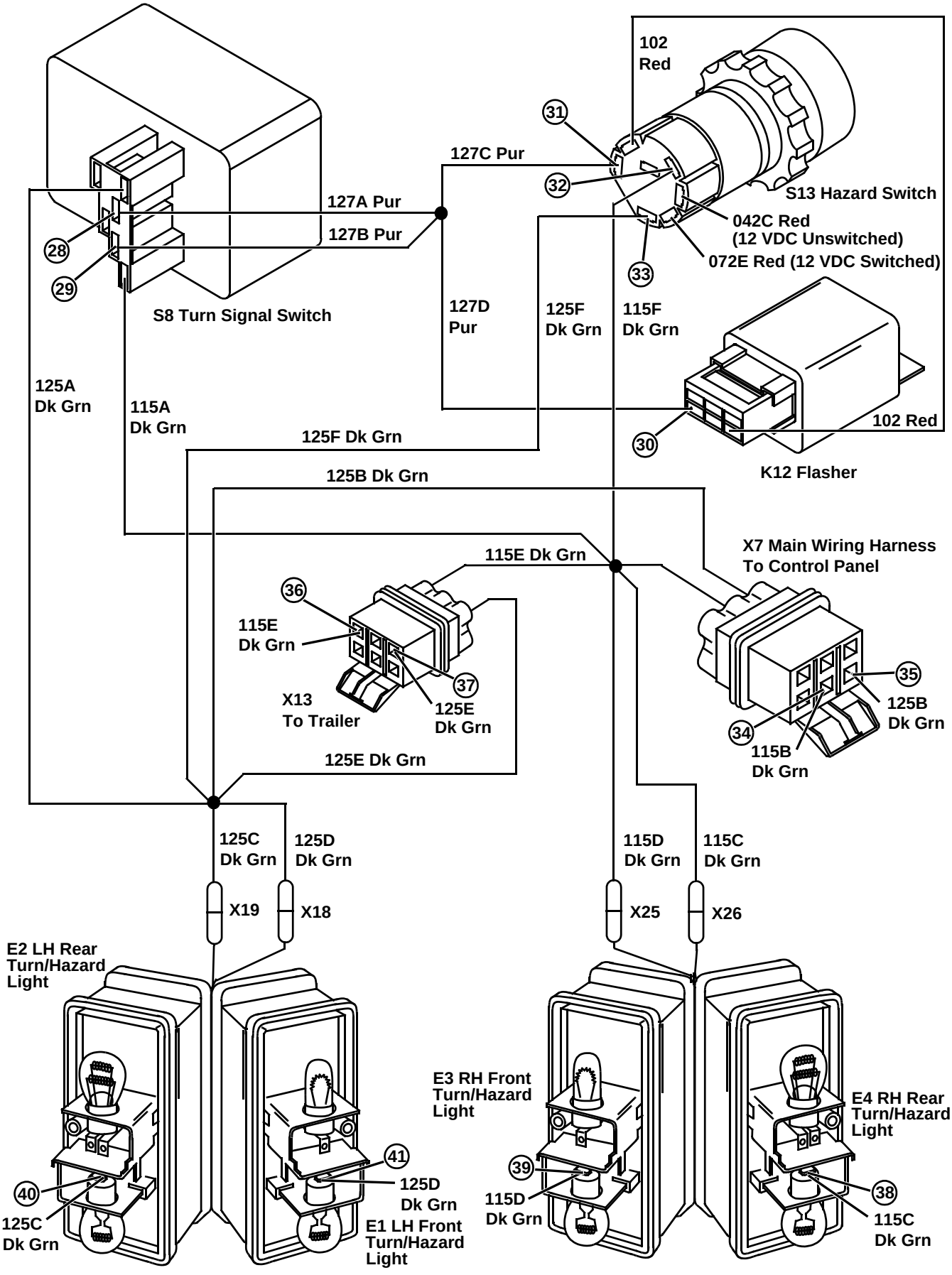
Test Conditions:
- Key switch in ON position
- Engine OFF
- Hazard switch in OFF position
- Turn signal switch in OFF position
- K12 flasher connected to wiring harness

28. Turn signal switch (terminal 3)	7.5 to 8.0 VDC	Check 127D and 127A Pur wires and connections. Ensure voltage to flasher and flasher ground connection - see steps 26 and 27. Replace flasher unit.
29. Turn signal switch (terminal 4)	7.5 to 8.0 VDC	Check 127D and 127B Pur wires and connections. See previous step.

Test Conditions:
- Key switch in OFF position
- Engine OFF
- Light switch in OFF position
- Hazard switch in ON position
- X7 connector disconnected from control panel

NOTE: Intermittent voltage to the turn/hazard lights, trailer connector, and control panel indicator lights is provided through the hazard switch when the hazard switch is in the ON position (Steps 30 to 41). Intermittent voltage to the LH or R. H. turn hazard lights, trailer connector, and control panel indicator light(s) is provided through the turn signal switch when the switch is placed in either the LH or RH position and the hazard switch is in the OFF position (Steps 42 to 45).

30. K12 flasher connector	Intermittent battery voltage	Test hazard switch. (See "HAZARD SWITCH TEST"). Replace switch as needed.
31. Hazard switch	Intermittent battery voltage	Test hazard switch. See previous step.
32. Hazard switch	Intermittent battery voltage	Test hazard switch. See previous step.
33. Hazard switch	Intermittent battery voltage	Check 127D and 127C Pur wire and connections.
34. X7 control panel connector (terminal D)	Intermittent battery voltage	Check 115F and 115B Dk Grn wires and connections.
35. X7 control panel connector (terminal E)	Intermittent battery voltage	Check 125F and 125B Dk Grn wires and connections.
36. X13 trailer connector (terminal A)	Intermittent battery voltage	Check 115F and 115E Dk Grn wires and connections.
37. X13 trailer connector (terminal C)	Intermittent battery voltage	Check 125F and 125E Dk Grn wires and connections.
38. RH rear turn/hazard light	Intermittent battery voltage	Check 115F and 115C Dk Grn wires, X26 connector and connections.
39. RH front turn/hazard light	Intermittent battery voltage	Check 115F and 115D Dk Grn wires, X25 connector and connections.
40. LH rear turn/hazard light	Intermittent battery voltage	Check 125F and 125C Dk Grn wires, X19 connector and connections.
41. LH front turn/hazard light	Intermittent battery voltage	Check 125F and 125D Dk Grn wires, X18 connector and connections.


102
Red
31
127C Pur
32
S13 Hazard Switch
042C Red
(12 VDC Unswitched)
072E Red (12 VDC Switched)
33
127A Pur
127B Pur
28
29
S8 Turn Signal Switch
127D
Pur
125F
Dk Grn
115F
Dk Grn
125A
Dk Grn
115A
Dk Grn
102 Red
30
K12 Flasher
125F Dk Grn
125B Dk Grn
115E Dk Grn
X7 Main Wiring Harness
To Control Panel
36
115E
Dk Grn
37
X13
To Trailer
125E
Dk Grn
35
125B
Dk Grn
34
115B
Dk Grn
125E Dk Grn
125C
Dk Grn
125D
Dk Grn
115D
Dk Grn
115C
Dk Grn
X19
X18
X25
X26
E2 LH Rear
Turn/Hazard
Light
E3 RH Front
Turn/Hazard
Light
E4 RH Rear
Turn/Hazard
Light
41
40
125D
Dk Grn
125C
Dk Grn
E1 LH Front
Turn/Hazard
Light
39
38
115D
Dk Grn
115C
Dk Grn

Test/Check Point	Normal	If Not Normal

Test Conditions:

- Key switch in ON position
- Engine OFF
- Light switch in OFF position
- Turn signal switch in RIGHT turn position
- Hazard switch in OFF position
- X7 connector disconnected from control panel

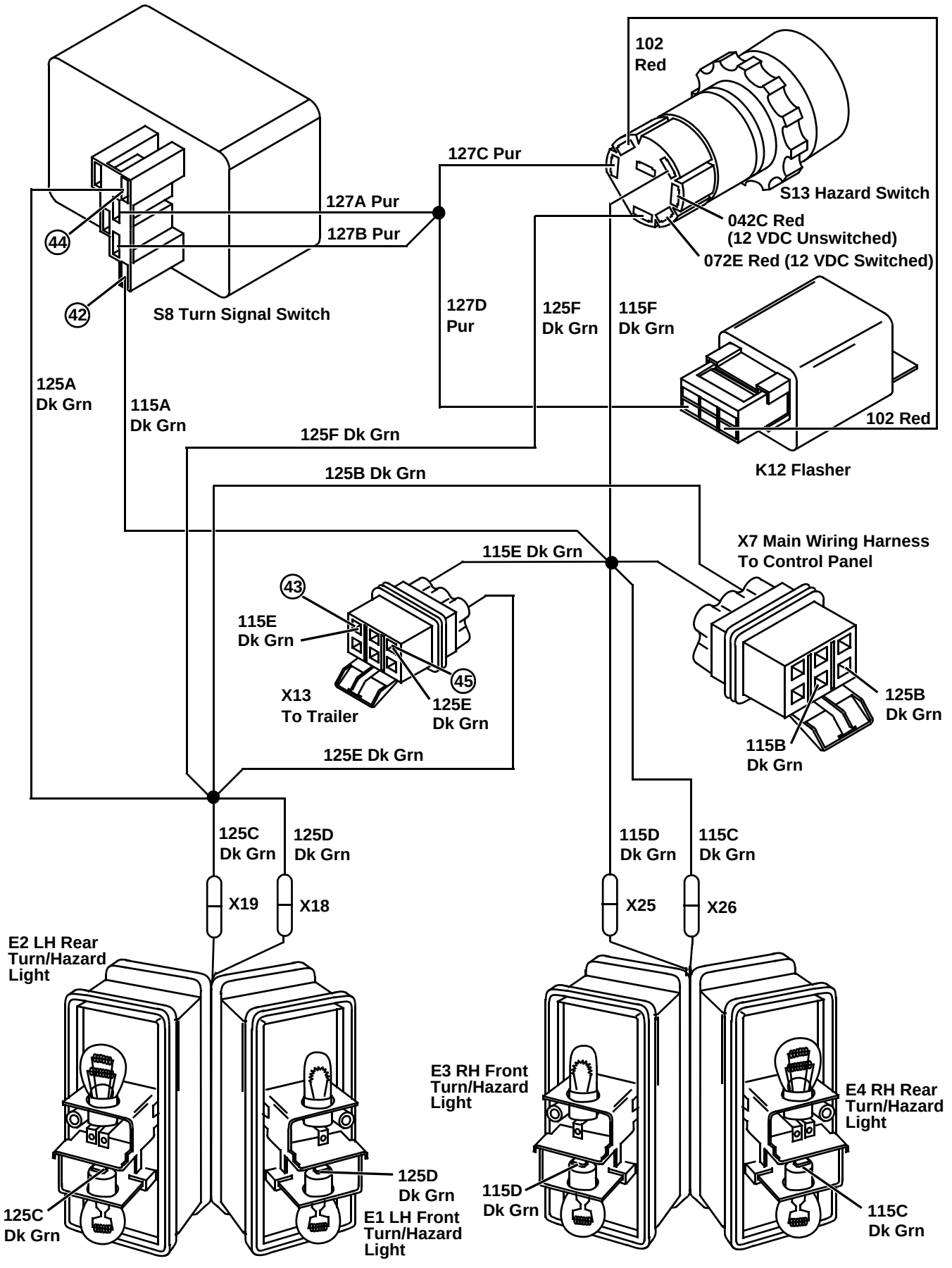
NOTE: The following steps to test the turn signal circuits DO NOT cover testing of each component. If a component is not covered in the diagnosis, refer to hazard switch test steps 38 to 41.

42. Turn signal switch	Intermittent battery voltage	Test turn signal switch (See "TURN SIGNAL SWITCH TEST"). Replace switch as needed.
43. X13 connector	Intermittent battery voltage	Check 115A and 115E Dk Grn wires and connections.

Test Conditions:

- Key switch in ON position
- Engine OFF
- Light switch in OFF position
- Turn signal switch in LEFT turn position
- Hazard switch in OFF position
- X7 connector disconnected from control panel

44. Turn signal switch	Intermittent battery voltage	Test turn signal switch (See "TURN SIGNAL SWITCH TEST"). Replace switch as needed.
45. X13 connector	Intermittent battery voltage	Check 125A and 125E Dk Grn wires and connections.


102
Red
127C Pur
S13 Hazard Switch
127A Pur
127B Pur
042C Red
(12 VDC Unswitched)
072E Red (12 VDC Switched)
44
42
S8 Turn Signal Switch
127D
Pur
125F
Dk Grn
115F
Dk Grn
125A
Dk Grn
115A
Dk Grn
102 Red
125F Dk Grn
K12 Flasher
125B Dk Grn
X7 Main Wiring Harness
To Control Panel
115E Dk Grn
43
115E
Dk Grn
45
X13
To Trailer
125E
Dk Grn
125B
Dk Grn
115B
Dk Grn
125E Dk Grn
125C
Dk Grn
125D
Dk Grn
115D
Dk Grn
115C
Dk Grn
X19
X18
X25
X26
E2 LH Rear
Turn/Hazard
Light
E3 RH Front
Turn/Hazard
Light
E4 RH Rear
Turn/Hazard
Light
125D
Dk Grn
125C
Dk Grn
E1 LH Front
Turn/Hazard
Light
115D
Dk Grn
115C
Dk Grn

CRUISE CONTROL

Cruise Control Function:

Provides an electro-mechanical means to control the forward speed of the tractor.

Operating Conditions:

- Key switch in RUN position
- Brake not depressed
- Cruise control switch momentarily in ENGAGE position, and then released to the ON position.

The cruise control will remain ENGAGED until the brake is depressed; the key switch is turned to the OFF position; or, the cruise control switch is placed into the OFF position.

Theory of Operation:

When the Y3 cruise control electromagnet is energized, the forward pedal is held in whatever position it is in when the magnet is energized. The cruise control magnet is energized through the cruise control relay contacts. The brake switch provides a latching circuit for the cruise control relay. When the brake pedal is depressed, the normally open brake switch contacts open and the latching circuit is removed. With the latching circuit removed, the cruise control relay contacts open, and the cruise control magnet is deenergized - releasing the forward pedal.

Power for the cruise control circuit is provided to the X9 connector, from the key switch (terminal 4), through the 209 Wht wire.

Power is provided from the X9 connector to the cruise control switch through the W4 wiring harness Wht wire, and X10 connector. The cruise control switch is a double pole switch with OFF, ON, and momentary ENGAGE positions.

When the cruise control switch is placed in the momentary ENGAGE position, power is provided through the switch, X10 connector, W4 wiring harness Gry wire, X9 connector, and 238 Gry wire to the K8 cruise control relay (terminal 86). With power provided, the relay coil energizes and the contacts (terminal 30 and terminal 87) close. At the same time (cruise control switch placed in the momentary ENGAGE position), power is provided through the X10 connector, W4 wiring harness Pur wire, X9 connector, and 247 Pur wire to the K8 cruise control relay contacts (terminal 87).

With the contacts closed, power is provided through the relay contacts (terminals 87 and 30) to the cruise control indicator light through the 264B Yel wire, X6 connector (terminal G), and control panel circuit board.

Latching Circuit:

Power is also provided from the cruise control relay (terminal 30) to the S11 brake switch and Y3 cruise control magnet through the 264A Yel wire, X9 connector, W4 wiring harness Yel wires, and X11 connector and X12 connector respectively.

When power is provided to the cruise control magnet, it is energized and creates a magnetic field that holds the forward pedal in a locked position.

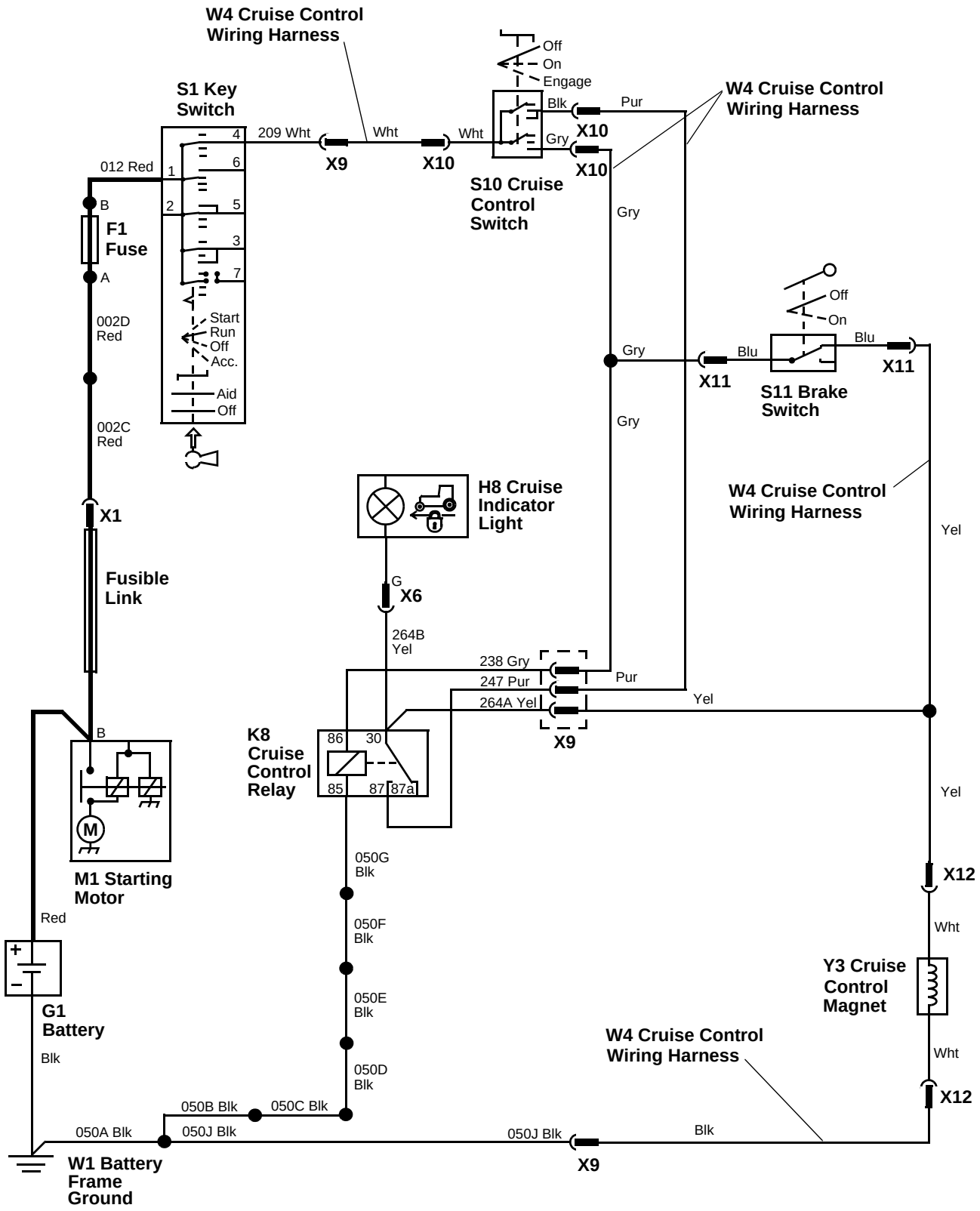
When power is provided to the S11 brake switch, and the brake switch contacts are closed (brake NOT depressed), power is provided through the X11 connector, W4 wiring harness Gry wires, X9 connector and 238 Gry wire to the cruise control relay (terminal 86). This circuit latches the cruise control relay by keeping the cruise control relay coil energized.

The latching circuit keeps the cruise control relay coil energized until the brake pedal is depressed. When the pedal is depressed, the S11 brake switch contacts open and power is removed from the cruise control relay coil.

When the cruise control relay coil is deenergized, the relay contacts open, and power provided to the cruise control indicator light and the cruise control magnet is removed. Without power, the cruise control magnet releases the forward pedal.

Placing the cruise control switch into the OFF position stops power to the cruise control relay coil and contacts.

CRUISE CONTROL ELECTRICAL SCHEMATIC



SE1 - STARTING	SE4 - ACCESORIES	SE5 - INSTRUMENTATION

CRUISE CONTROL DIAGNOSIS

Test Conditions:

- Key switch in RUN position, engine OFF
- PTO in NEUTRAL
- Transmission in NEUTRAL
- Park brake ENGAGED
- Remove K8 cruise control relay
- Disconnect X9 connector

Test/Check Point	Normal	If Not Normal
46. Key switch	Battery voltage	Test key switch (See "KEY SWITCH TEST"). Replace switch as needed.
47. X9 connector (terminal A)	Battery voltage	Check 209 Wht wire and connections.

Test Conditions:

- Reconnect X9 connector
- Disconnect X10, X11 and X12 connectors

48. X10 connector (Wht wire terminal)	Battery voltage	Check X9 connector, Wht wire and connections, and X10 connector.

Test Conditions:

- Reconnect X10 connector to cruise control switch
- Place and hold cruise control switch in ENGAGE position

49. K8 relay socket (terminal 86)	Battery voltage	Ensure cruise control switch is in ENGAGE position. Test switch. (See "CRUISE CONTROL SWITCH TEST"). Check X10 connector, Gry wire, X9 connector, and 238 Gry wires and connections.
50. K8 relay socket (terminal 87)	Battery voltage	Test cruise control switch. Check X10 connector, Pur wire, X9 connector, and 247 Pur wires and connections.
51. X11 connector (Gry wire)	Battery voltage	Check Gry wire and connections.

Test Conditions:

- Place cruise control switch in ON position

52. K8 relay socket (terminal 30)	Battery voltage	Test cruise control switch.

Test Conditions:

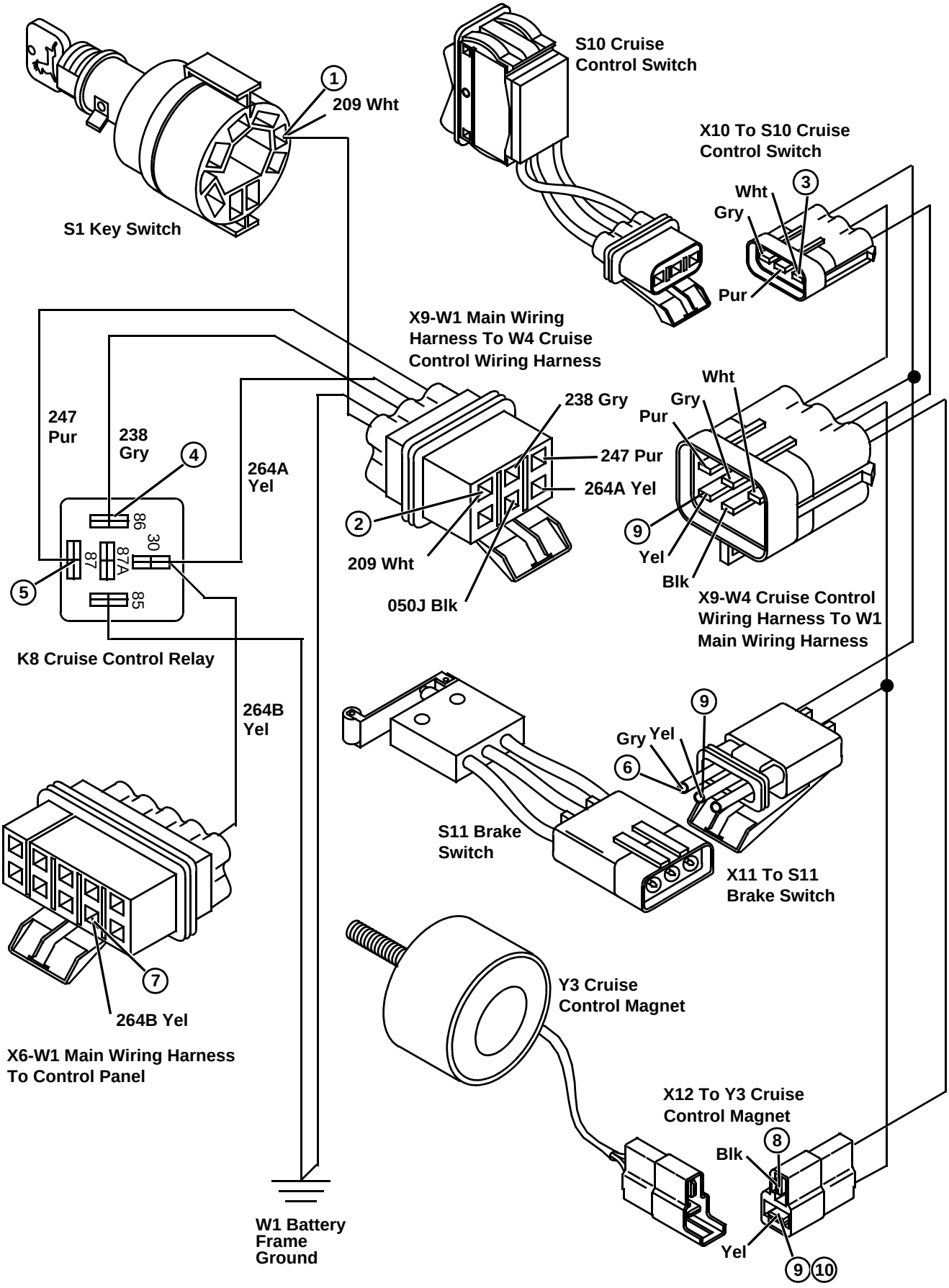
- Place key switch in OFF position

53. X12 to frame ground (Blk wire)	Less than 0.1 ohms resistance	Check Blk wire, X9 connector, and 050J and 050A Blk wires and connections.
54. X9 to X11 to X12 (Yel wires)	Less than 0.1 ohms resistance	Check Yel wires and connections.

Test Conditions:

- Reconnect X11 connector
- Key switch in ON position (Engine OFF)
- Cruise control switch in ON position
- Brake pedal NOT depressed

55. X12 connector (Yel wire)	Battery voltage	Test brake switch. (See "BRAKE SWITCH TEST").


1
209 Wht
S1 Key Switch
S10 Cruise
Control Switch
X10 To S10 Cruise
Control Switch
Wht
Gry
3
Pur
X9-W1 Main Wiring
Harness To W4 Cruise
Control Wiring Harness
247
Pur
238
Gry
4
264A
Yel
238 Gry
247 Pur
264A Yel
2
209 Wht
050J Blk
Wht
Gry
Pur
9
Yel
Blk
X9-W4 Cruise Control
Wiring Harness To W1
Main Wiring Harness
86
30
87
87A
85
5
K8 Cruise Control Relay
264B
Yel
9
Gry
Yel
6
S11 Brake
Switch
X11 To S11
Brake Switch
7
264B Yel
X6-W1 Main Wiring Harness
To Control Panel
Y3 Cruise
Control Magnet
X12 To Y3 Cruise
Control Magnet
Blk
8
Yel
9
10
W1 Battery
Frame
Ground

EUROPEAN CAB ELECTRICAL SECTION

The European road-homologated tractors fitted with operator's cabs have a main wiring harness that is specific to tractors fitted with cabs. The cab harness is the same for the 4500 and 4600 European models, and meet EEC Machinery Directives.

The cab tractors have most of the same electrical circuits as found on the standard European tractors. The differences to the main tractor harness are as follows:

• The addition of an ignition circuit to trigger the cab power relays (located in the cab overhead console).

• The removal of the work lamp circuits from the main tractor harness. (The work lamps are controlled by cab mounted switches.)

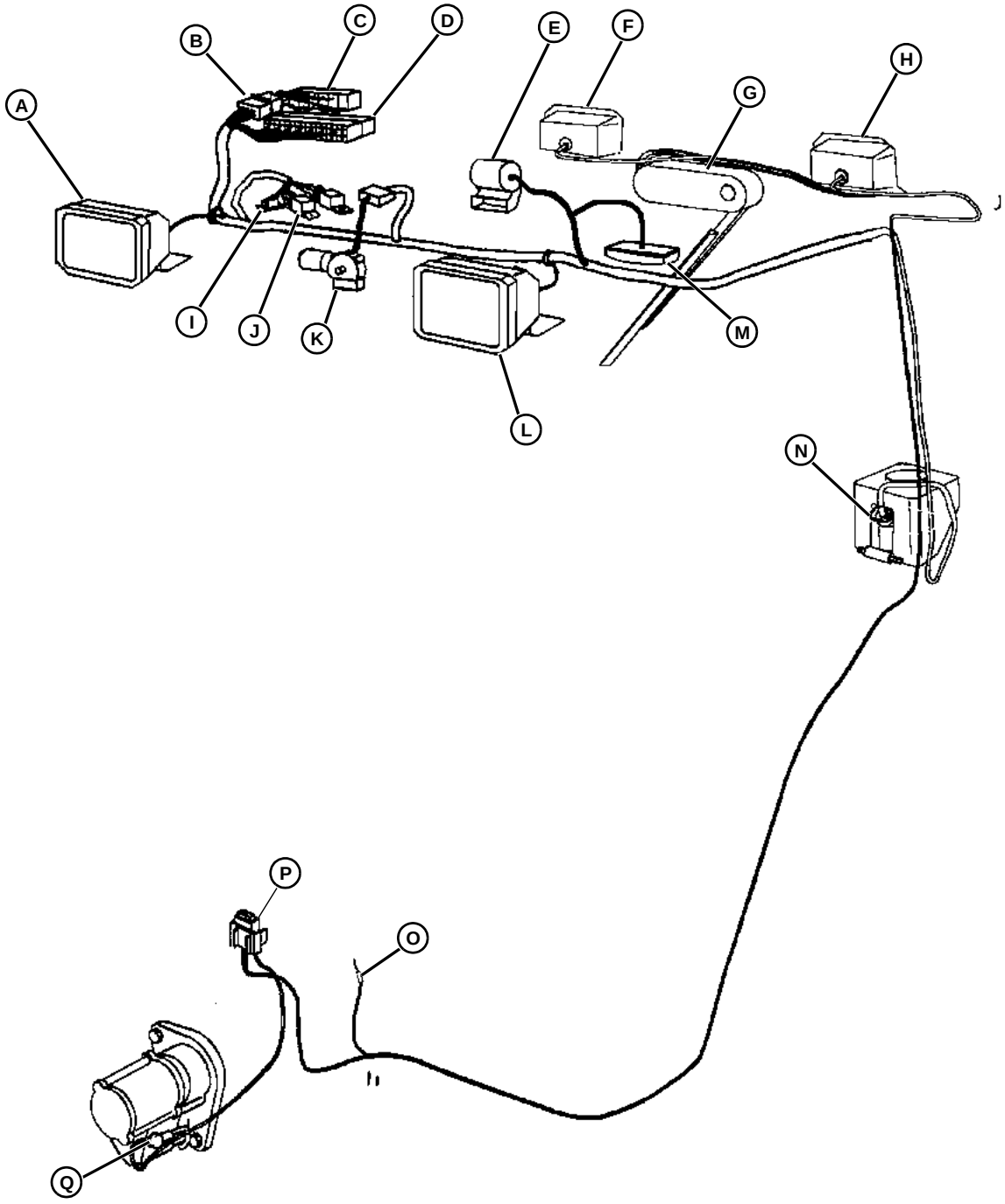
All power for the cab is taken from the battery terminal on the starting motor. A large 60 amp plug-in fuse is located on the left side engine shroud, and protects all the cab power circuits. Smaller plug-in fuses located in the cab overhead console protect individual cab circuits.

The front and rear turn signals, licence plate lamp, and trailer connector, are powered through the main tractor harness, the same as for the European tractor. Schematics and diagnosis for these circuits start on page 4-91.

Most cab electrical repairs can be diagnosed by lowering the cab overhead console, and accessing the component control switches, relays, and fuses. Repairs to harnesses for rear turn signals, licence plate lamp, trailer connector, rear work lamp, and beacon, can be accessed under padding behind operator's seat.

Only major damage to cab harness would require lifting cab up from tractor to perform repairs. (See Miscellaneous Section for Cab Removal)

COMPONENT LOCATION – CAB ELECTRICAL



A. Right Front Work Lamp
B. X2 Connector
C. Cab Fuse Panel
D. Cab Switch Panel
E. Fan Blower Motor
F. Right Rear Work Lamp
G. Rear Wiper Motor
H. Left Rear Work Lamp
I. Washer Pump Control Module
J. Cab Power Relays
K. Front Wiper Motor
L. Left Front Work Lamp
M. Dome Lamp
N. Washer Pump Motor
O. Cab X2 Connector
P. Cab Main Fuse
Q. Starter Battery Terminal

CAB SCHEMATIC AND WIRING HARNESS LEGEND

A1—Radio
B5—Left Radio Speaker
B6—Right Radio Speaker
E16—Dome Lamp
E17—Cab Front Work Lamps
E18—Cab Rear Work Lamps
E19—Cab Warning Beacon Lamp
E20—Left Front Cab Turn/Hazard Lamp
E21—Right Front Cab Turn/Hazard Lamp
E22—Left Rear Cab Turn/Hazard Lamp
E23—Right Rear Cab Turn/Hazard Lamp
E24—Cab License Plate Lamp
F10—Main Cab Fuse - 60 Amp
F11—Cab Fuse #1 - 15 Amp - Wiper/Washer
F12—Cab Fuse #2 - 4 Amp - Radio & Dome Lamp
F13—Cab Fuse #3 - 10 Amp - Fan Blower
F14—Cab Fuse #4 - 30 Amp - Work Lamps
F15—Cab Fuse #5 - Beacon
F16—Cab Fuse #6 - Unused
G1—Battery
K13—Cab Power Relay, Front
K14—Cab Power Relay, Rear
K15—Washer Pump Control Module
M1—Starting Motor
M2—Cab Fan Blower Motor
M3—Rear Wiper Motor
M4—Washer Pump Motor
M5—Front Wiper Motor
S1—Key Switch
S17—Cab Fan Blower Switch
S18—Cab Front Work Lamp Switch
S19—Cab Rear Work Lamp Switch
S20—Cab Warning Beacon Switch
S21—Rear Wiper/Washer Switch
S22—Front Wiper/Washer Switch
W1—Battery Frame Ground
W2—Cab Frame Ground

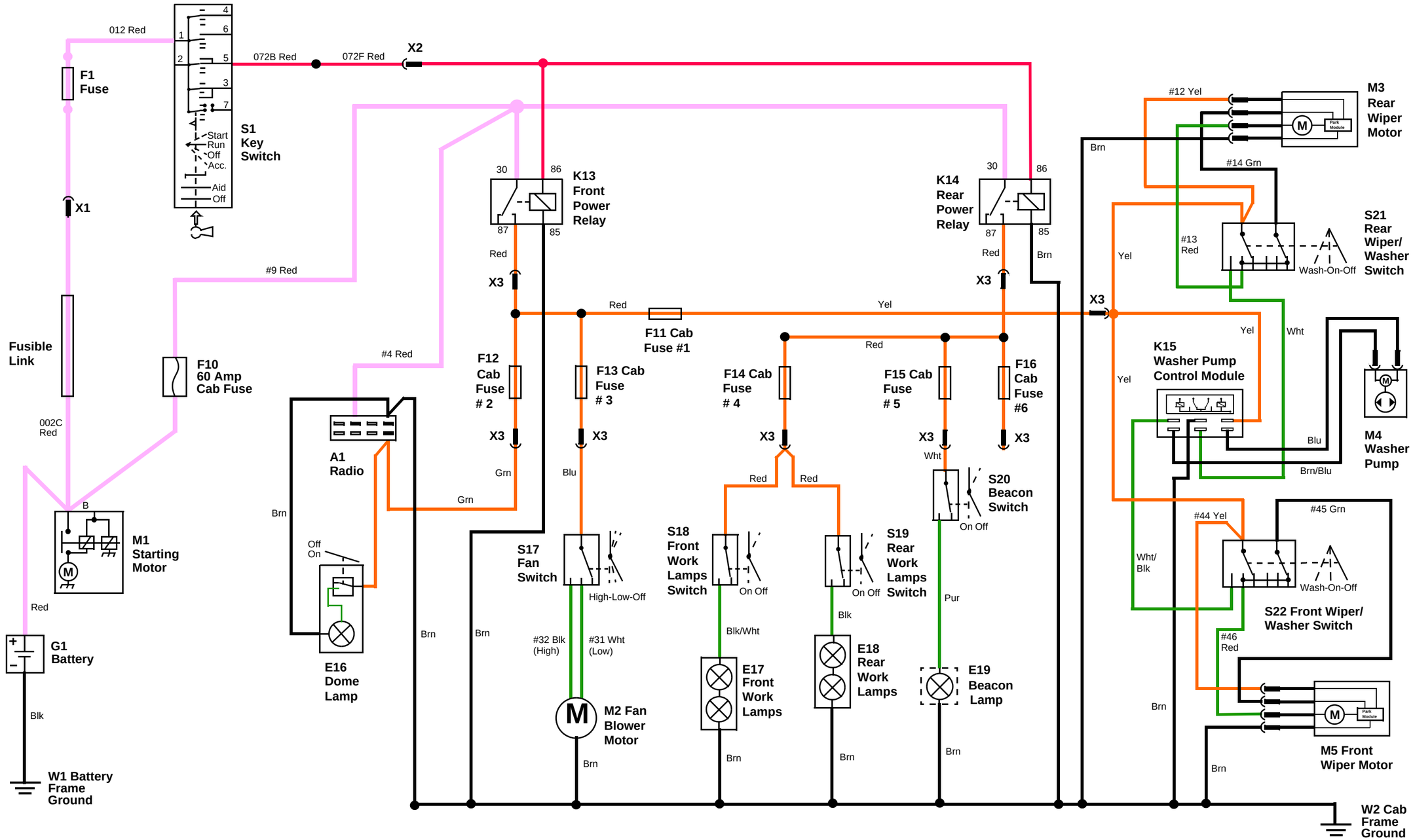
CAB WIRING HARNESS CONNECTORS:

X1—W1 Tractor Main Harness–Fusible Link to Fuse #1
X2—W1 Tractor Main Harness to W9 Cab Main Harness Ignition Signal
X3—W9 Cab Main Harness to Cab Fuse Panel

WIRING HARNESSES:

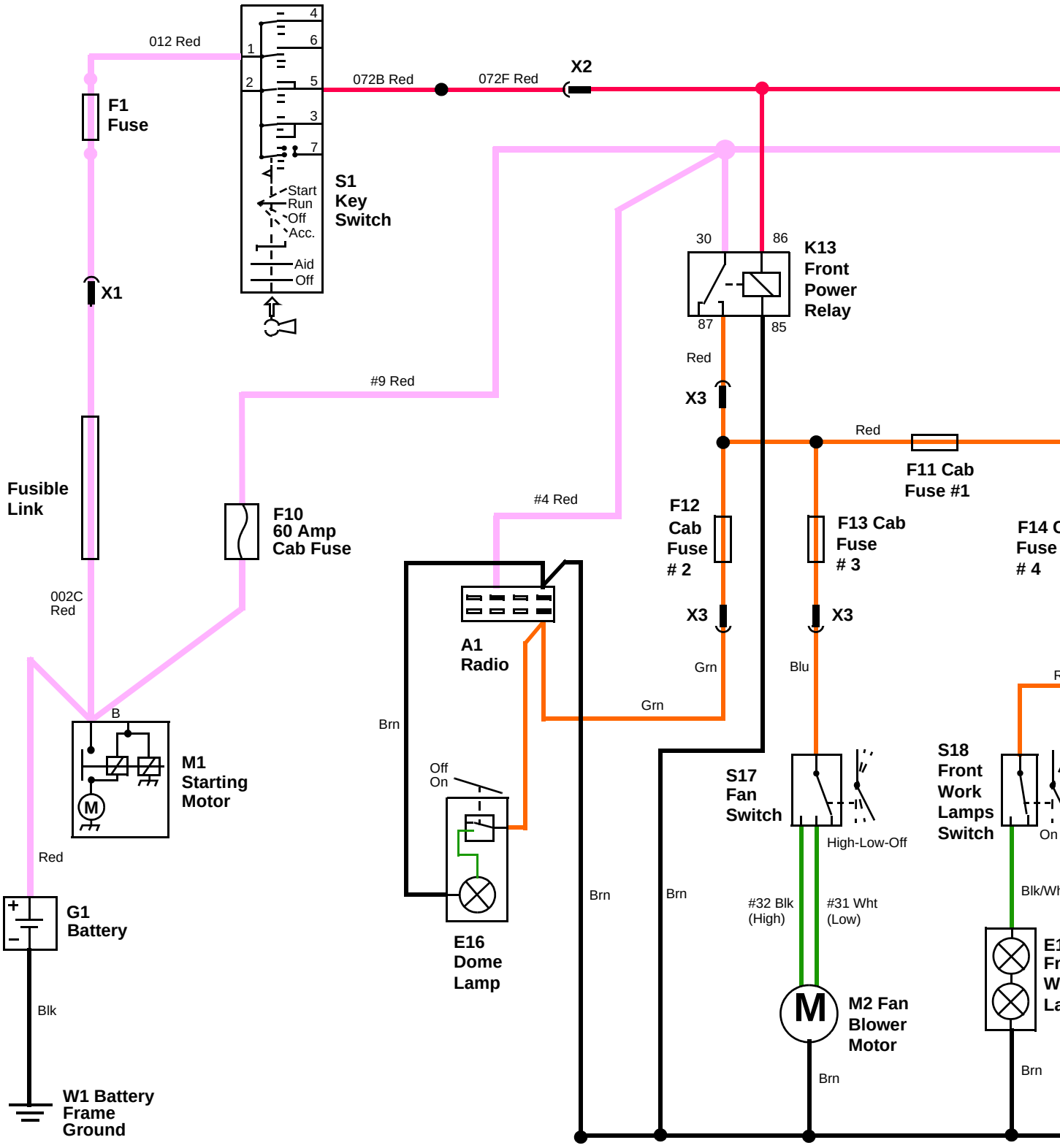
W9—Cab Main Harness
W10—Cab Left RearTurn Signal Harness
W11—Cab Right Rear Turn Signal Harness

CAB ELECTRICAL SCHEMATIC

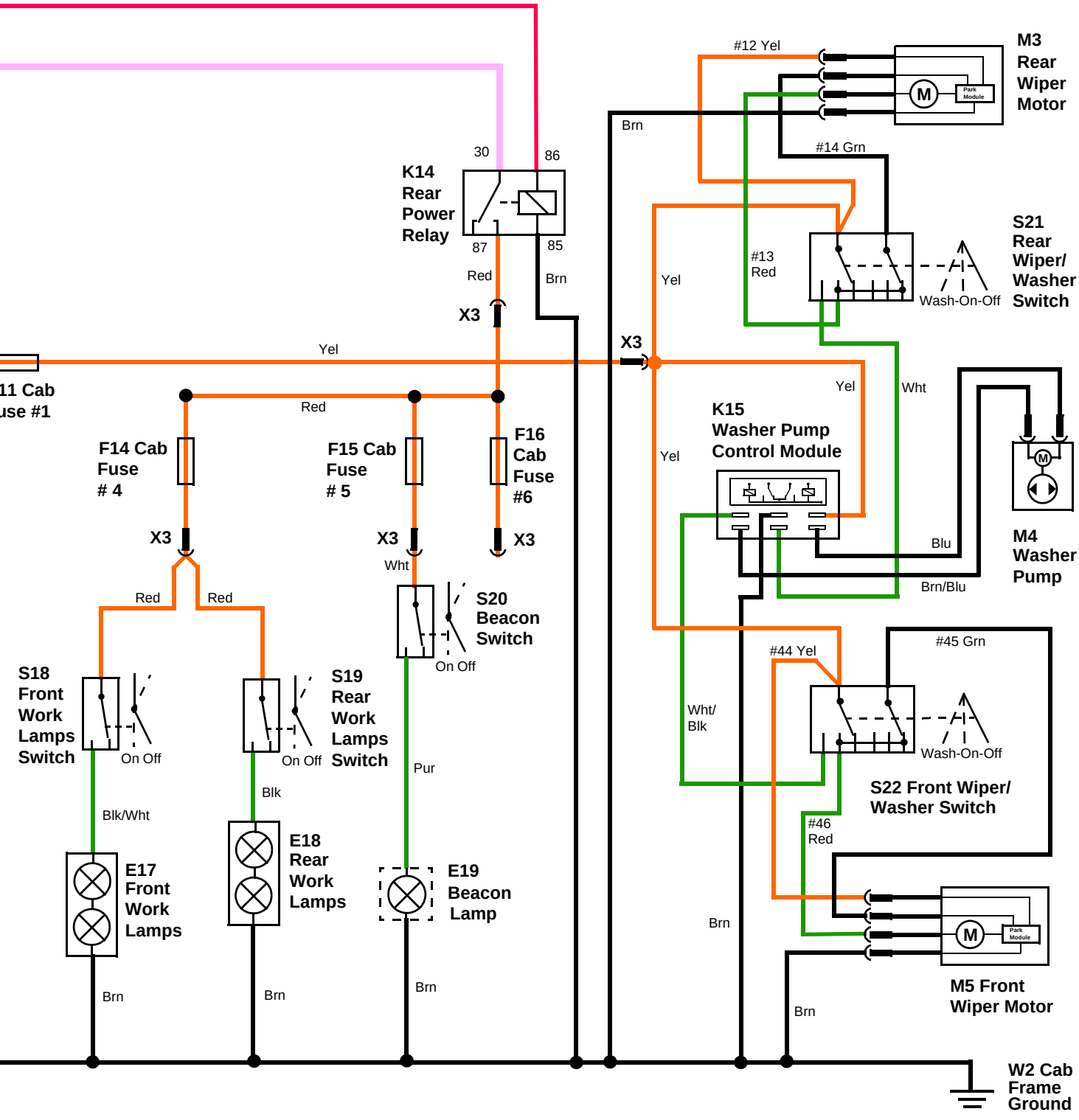


SE1 - TRACTOR	SE2 - CAB

CAB ELECTRICAL SCHEMATIC

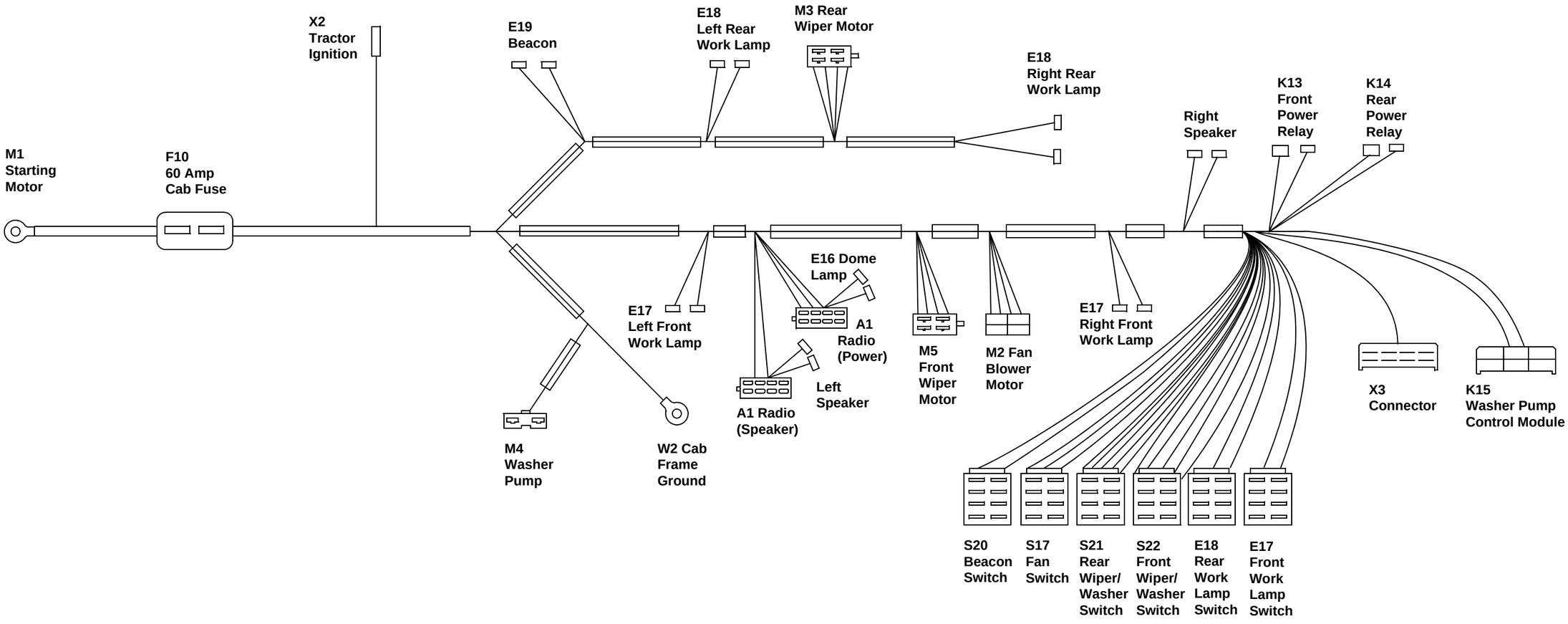


SE1 - TRACTOR	

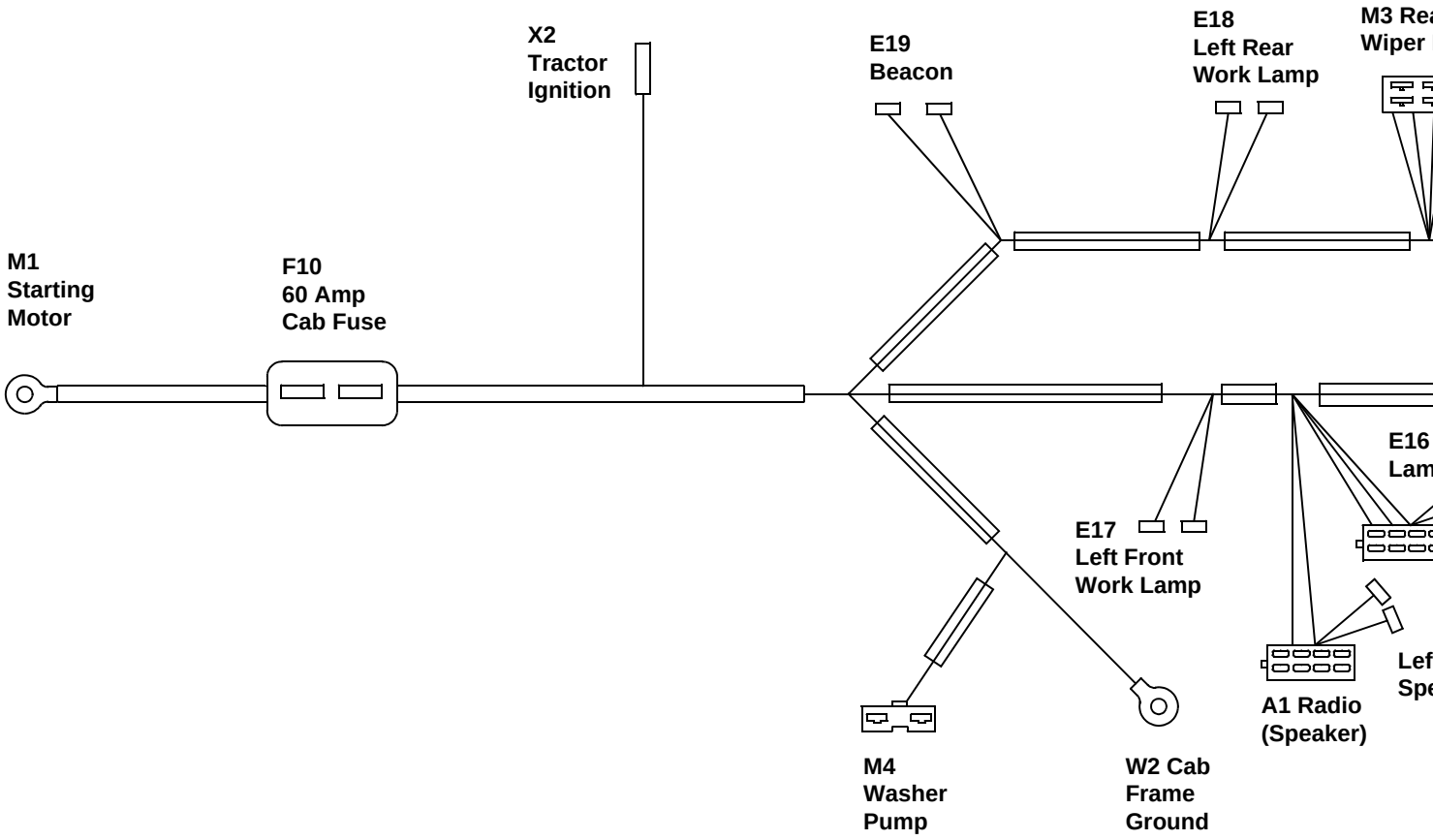

#12 Yel
M3
Rear
Wiper
Motor
Brn
#14 Grn
30
86
K14
Rear
Power
Relay
87
85
Red
Brn
X3
Yel
X3
#13
Red
Yel
S21
Rear
Wiper/
Washer
Switch
Wash-On-Off
11 Cab
use #1
Yel
Red
F14 Cab
Fuse
4
F15 Cab
Fuse
5
F16
Cab
Fuse
#6
K15
Washer Pump
Control Module
Yel
Wht
X3
X3
X3
Wht
Blu
M4
Washer
Pump
Brn/Blu
Red
Red
S20
Beacon
Switch
On Off
#44 Yel
#45 Grn
S18
Front
Work
Lamps
Switch
On Off
S19
Rear
Work
Lamps
Switch
On Off
Wht/
Blk
Wash-On-Off
S22 Front Wiper/
Washer Switch
Pur
Blk
#46
Red
Blk/Wht
E18
Rear
Work
Lamps
E19
Beacon
Lamp
Brn
M5 Front
Wiper Motor
E17
Front
Work
Lamps
Brn
Brn
Brn
Brn
W2 Cab
Frame
Ground
Secondary Switched Power
Device Control Power

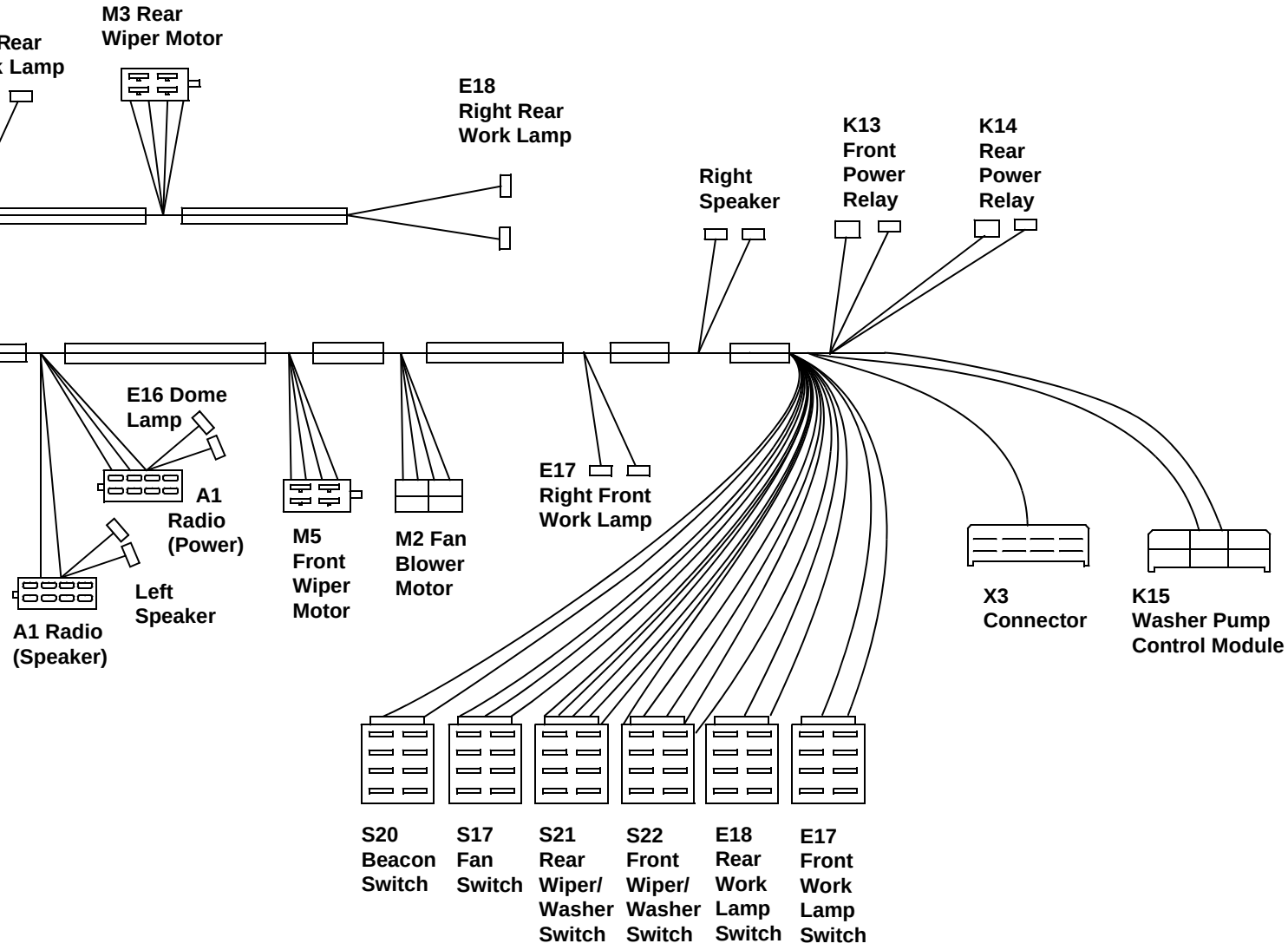
SE2 - CAB

CAB WIRING HARNESS

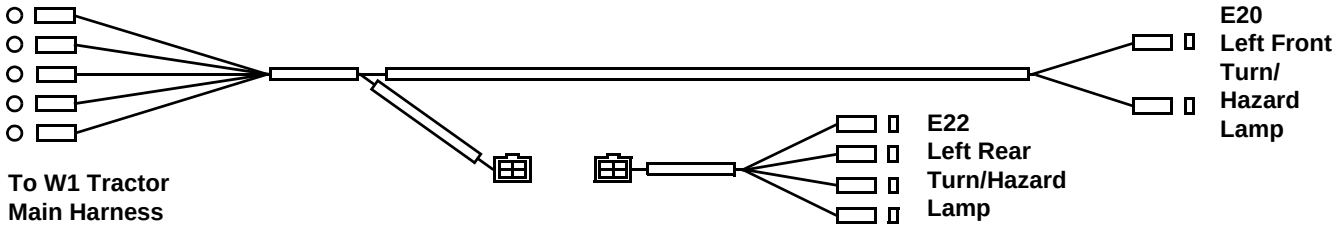


CAB WIRING HARNESS

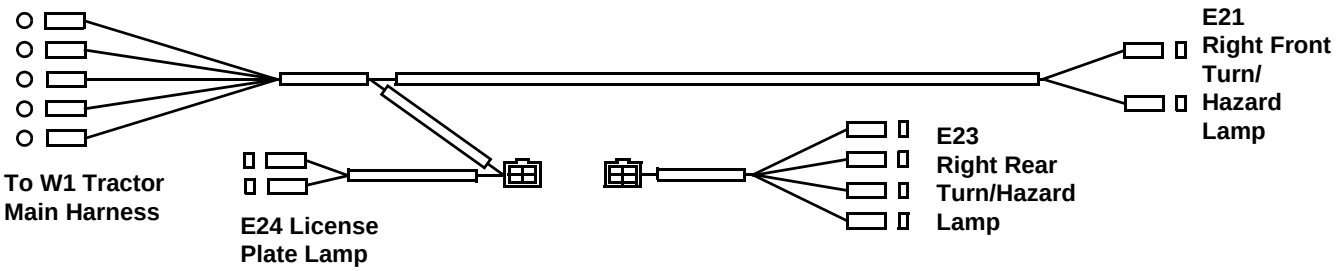



Rear
k Lamp
M3 Rear
Wiper Motor
E18
Right Rear
Work Lamp
Right
Speaker
K13
Front
Power
Relay
K14
Rear
Power
Relay
E16 Dome
Lamp
A1
Radio
(Power)
Left
Speaker
A1 Radio
(Speaker)
M5
Front
Wiper
Motor
M2 Fan
Blower
Motor
E17
Right Front
Work Lamp
X3
Connector
K15
Washer Pump
Control Module
S20
Beacon
Switch
S17
Fan
Switch
S21
Rear
Wiper/
Washer
Switch
S22
Front
Wiper/
Washer
Switch
E18
Rear
Work
Lamp
Switch
E17
Front
Work
Lamp
Switch

W10 CAB LEFT TURN SIGNAL WIRING HARNESS



W11 CAB RIGHT TURN SIGNAL WIRING HARNESS



CAB ELECTRICAL TROUBLESHOOTING

Problem or Symptom / Check or Solution	No cab power. All cab circuits dead.	Cab turn signals not operating.	Cab license plate lamp has no power.	Cab work lamps not operating.	Cab fan blower motor not operating.	No power at wipers and washers.	No power at radio and dome lamp.	Washer pump not operating.	Cab trailer connector not powered.
Check cab main 60 amp fuse.	●								
Check cab power relays are energized when ignition is on.	●								
See “Light Switch Operation” in European Electrical Section.		●	●						
Check F14 cab fuse #4.				●					
Check F13 cab fuse #3.					●				
Check F11 cab fuse #1.						●			
Check cab frame ground behind operator’s seat.	●								
Check F12 cab fuse #2.							●		
Check pump washer module.								●	
See “W7 Trailer Connector Wiring Harness” in European Electrical Section.									●

THEORY AND DIAGNOSIS

CAB POWER CIRCUIT OPERATION

NOTE: See cab electrical schematic for reference while reading this page.

Function:

Provides power to the cab components whenever the battery is connected.

The unswitched power is direct to the cab from the tractor battery.

The switched power is controlled by the tractor ignition circuit, and is only powered when key switch is in RUN, START, or AID positions. It energizes the cab power relays, closing the contacts and allowing current to flow to the cab fuse panel.

The secondary switched power is the current from the cab power relays, through the cab fuse panel, and into the cab switches.

The device control power is the current from a switch to a specific device, which will activate a device directly, or will control a relay which controls a device. It is the power directly controlled by the operator to turn something on or off.

Unswitched Power:

Battery voltage must be present at the following components with the key switch in the OFF position:

- Battery Positive Terminal
- Starting Motor Terminal B
- Cab Main 60 Amp Fuse
- F1 Tractor Ignition Fuse
- Key Switch Terminal 1
- Cab Power Relays
- Cab Radio Connector

If battery power is not available at the above points, refer back to the “Power Circuit Operation” section of the European Electrical section for theory and diagnosis of tractor power circuits.

Switched Power:

When the key switch is moved to the ON position, control current is sent to the cab via the 072F Red ignition circuit, which pulls in the K13 Front and K14 Rear Power Relays in the overhead console of the cab. The 072F circuit is specific to cab tractors, and is taken from the 072 ignition node shown on the main European tractor schematic.

Secondary Switched Power:

With the cab power relays pulled in and closed, cab power can flow from the F10 60 amp cab fuse, (located in the left-rear engine compartment), through the cab relays, to the cab fuse panel.

The K13 front power relay controls the power for cab fuses 1–3, (radio, dome lamp, wiper/washers, and blower fan)

The K14 rear power relay controls power for cab fuses 4–6, (work lamps, and optional safety beacon).

If fuses are good, power flows to the cab switch panel, radio power connector, dome lamp, and washer pump control module.

Device Control Power:

Individual switches on the cab switch panel route power to the specific electrical devices. All circuits are grounded at cab frame ground, behind operator’s seat.

The washer pump is energized by the washer pump control module, located in the cab overhead console. It’s operation is covered separately in this section.

CAB POWER CIRCUIT DIAGNOSIS

Test Conditions:

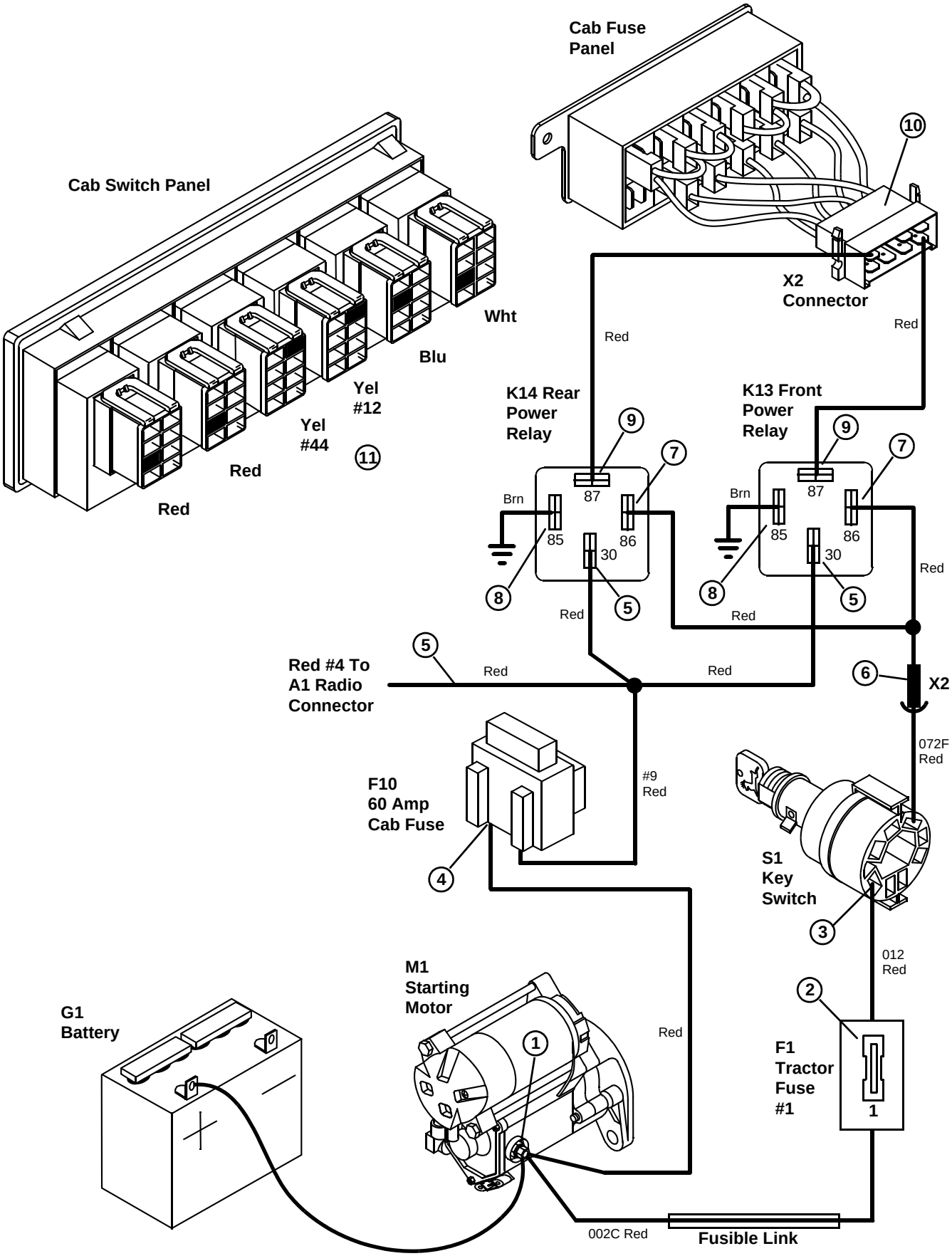
- Key switch in OFF position
- Park brake ENGAGED
- Transmission in NEUTRAL
- PTO DISENGAGED

Test/Check Point	Normal	If Not Normal
1. Starting motor battery (B) terminal	12.4 - 13.2 VDC	Check cable to battery. Test battery.
2. Tractor fuse panel—F1 fuse.	12.4 - 13.2 VDC	Check fusible link, 002C Red wire and connections.
3. Key switch 012 Red wire.	12.4 - 13.2 VDC	Check F1 fuse, 012 Red wire and connections.
4. 60 amp cab main fuse.	12.4 - 13.2 VDC	Check Red wire and connections between cab main fuse and starting motor B terminal.
5. #9 Red wire at terminal #30 of cab power relays. #4 Red wire at cab radio connector.	12.4 - 13.2 VDC	Check #9 Red wire from cab main fuse in engine compartment to cab overhead console.

Test Conditions:

- Key switch in ON position
- Park brake ENGAGED
- Transmission in NEUTRAL
- PTO DISENGAGED

Test/Check Point	Normal	If Not Normal
6. X2 connector of 072F circuit behind tractor fuse panel.	12.4 - 13.2 VDC	See “Power Circuit Diagnosis” in European Electrical section.
7. #86 terminal (red wire) of front and rear cab power relays.	12.4 - 13.2 VDC	Check Red Ignition Wire from tractor X2 connector to cab overhead console.
8. #85 terminal (brn wire) of front and rear cab power relays.	Continuity to cab frame ground located behind operator’s seat.	Repair cab frame ground wire.
9. Cab power relays	12.4 - 13.2 VDC at relay terminals 30 (red), 86 (red), and 87 (red).	If power is at terminal 30 and 86, but not at 87, relay is burned out. Replace relay.
10. All fuses in cab fuseblock	12.4 - 13.2 VDC	If no power on any side of any fuse: Check red wires between power relays and cab fuse panel. If power on only one side of a fuse: Replace fuse. If only power to three fuses (1-3 or 4-6): One power relay is defective.
11. Cab switches in overhead console.	12.4 - 13.2 VDC at back of switch panel at wire terminals and cavities marked at right.	Check wires from cab fuse panel to cab switch panel through X3 connector.


Cab Fuse Panel
10
X2 Connector
Red
Cab Switch Panel
Wht
Blu
Yel #12
Yel #44
11
Red
Red
K14 Rear Power Relay
K13 Front Power Relay
9
7
87
Brn
85
86
30
8
5
Red
Red #4 To A1 Radio Connector
6
X2
072F Red
F10 60 Amp Cab Fuse
#9 Red
4
S1 Key Switch
3
012 Red
2
F1 Tractor Fuse #1
1
G1 Battery
M1 Starting Motor
1
002C Red
Fusible Link

CAB WIPER DIAGNOSIS

Test Conditions:

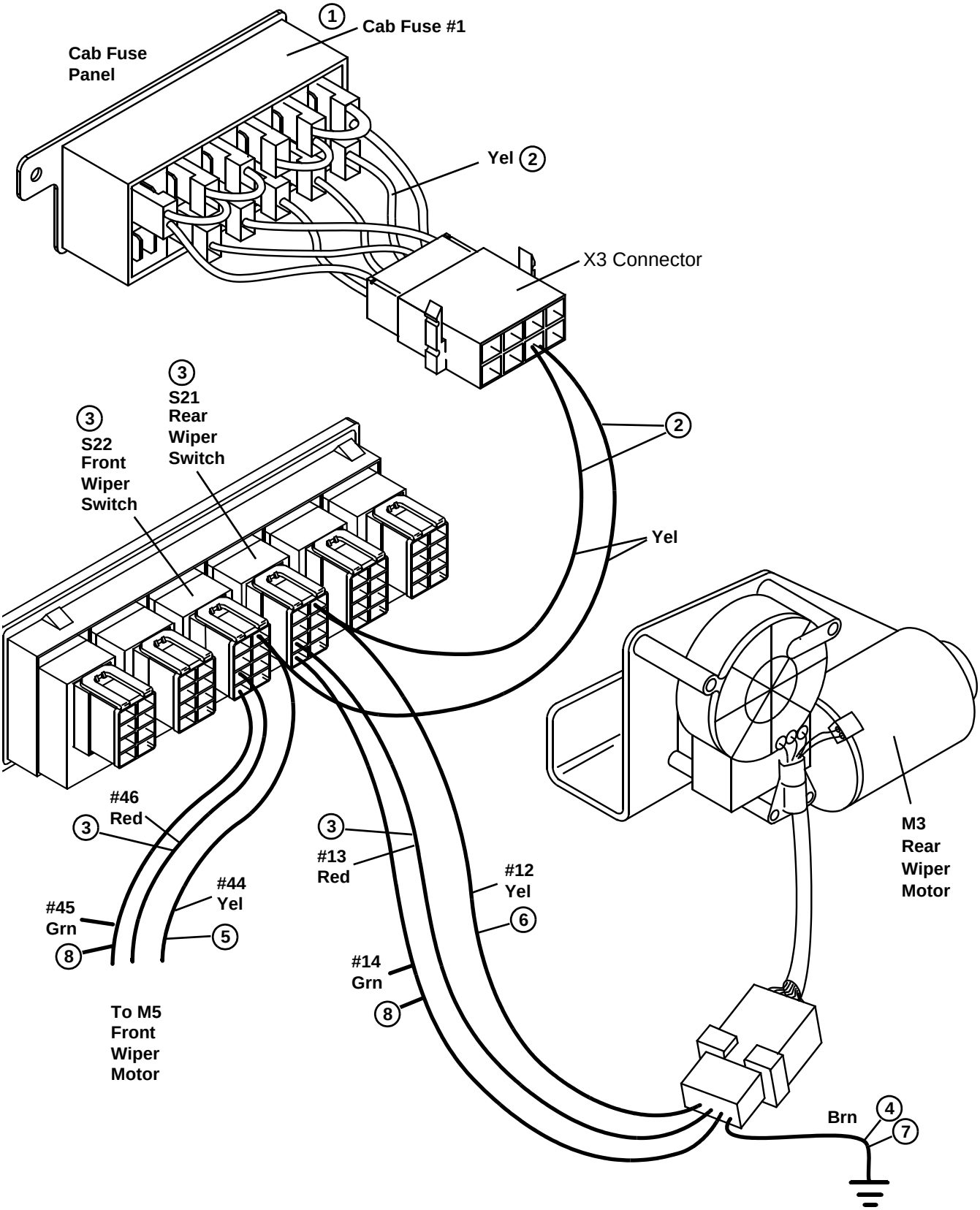
- Engine OFF
- Key switch in RUN position
- Transmission in NEUTRAL
- PTO DISENGAGED
- Park Brake ENGAGED

WIPER MOTOR CIRCUIT DIAGNOSIS

Test/Check Point	Normal	If Not Normal
1. F11 cab fuse #1	12.4 - 13.2 VDC on both sides of fuse.	No power on 1 side of fuse: Replace fuse. No power on both side of fuse: See ”Cab Power Circuit Diagnosis” section
2. Yel wire from cab fuse panel, through X3 connector, to front and rear wiper switches.	12.4 - 13.2 VDC	Repair Cab fuse panel, X3 connector terminals, or Yel wire to front and rear wiper switches.
3. Wiper switch to ON (middle) position.	12.4 - 13.2 VDC at red wire on back of wiper switch (front or rear), and to wiper motor.	No power at back of switch: replace switch. No power at wiper motor: repair red wire.
Turn wiper switch back to OFF position before performing step 4.		
4. Brn wire at wiper motor.	Continuity to ground. If normal, replace wiper motor.	Repair Brn ground wire to wiper motor.

WIPER MOTOR PARK CIRCUIT DIAGNOSIS

Test/Check Point	Normal	If Not Normal
Perform steps 1–4 above to check power circuit before performing with step 5. Turn key switch to ON position before performing step 5.		
5. #44 Yel wire from front wiper switch to front wiper motor.	12.4 - 13.2 VDC	Repair #44 wire.
6. #12 Yel wire from rear wiper switch to rear wiper motor.	12.4 - 13.2 VDC	Repair #12 wire.
7. Brn wire at wiper motor.	Continuity to ground.	Repair Brn ground wire.
8. Grn wire from wiper motor to wiper switch. (One Grn wire for each wiper.)	12.4 - 13.2 VDC when wiper arm is not in parked position. Circuit remains powered after switch is moved to OFF position, until arm is parked. 0 VDC when arm is parked.	No voltage: (Wiper will not park) Replace wiper motor. Constant voltage (Wiper will not stop) Replace wiper motor.

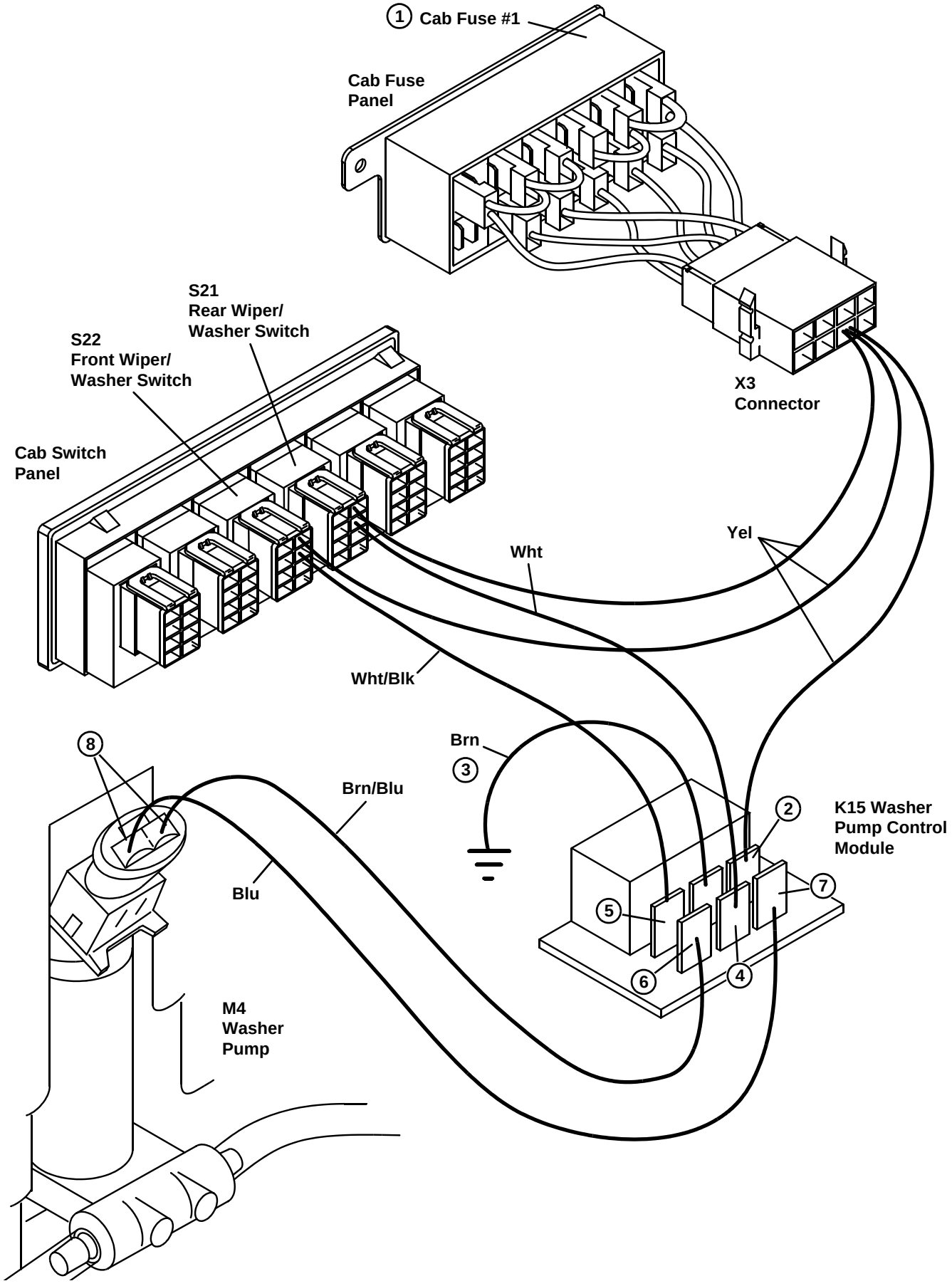

1
Cab Fuse #1
Cab Fuse Panel
Yel 2
X3 Connector
3
S21 Rear Wiper Switch
3
S22 Front Wiper Switch
2
Yel
#46 Red
3
#45 Grn
8
#44 Yel
5
To M5 Front Wiper Motor
3
#13 Red
#12 Yel
6
#14 Grn
8
M3 Rear Wiper Motor
Brn
4
7

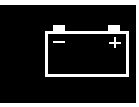
CAB WASHER PUMP DIAGNOSIS

Test Conditions:

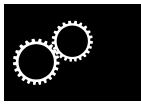
- Engine OFF
- Key switch in RUN position
- Transmission in NEUTRAL
- PTO DISENGAGED
- Park Brake ENGAGED

Test/Check Point	Normal	If Not Normal
1. F11 cab fuse #1	12.4 - 13.2 VDC	No power on both sides of fuse: See ”Cab Power Circuit Diagnosis” section. No power on one side of fuse: Replace fuse.
2. Yel wire at washer pump control module.	12.4 - 13.2 VDC	Repair Yel wire from cab fuse panel, through X3 connector, to pump control module.
3. Brn wire at washer pump control module.	Continuity to ground.	Repair Brn ground wire.
4. Wht wire at washer pump control module.	12.4 - 13.2 VDC when rear washer switch is depressed.	Repair Wht wire from rear washer switch to pump control module.
5. Wht/Blk wire at washer pump control module.	12.4 - 13.2 VDC when front washer switch is depressed.	Repair Wht/Blk wire from rear washer switch to pump control module.
6. Brn/Blu wire at washer pump control module.	12.4 - 13.2 VDC when key switch is ON, except when front washer switch is depressed.	Replace washer pump control module.
7. Blu wire at washer pump control module	12.4 - 13.2 VDC when key switch is ON, except when rear washer switch is depressed.	Replace washer pump control module.
8. Brn/Blu and Blu wires at washer pump.	Both wires should have 12.4 - 13.2 VDC when checked between wire and ground. When rear washer switch is pushed, Blu wire becomes ground and pump operates. When front washer switch is pushed, Brn/Blu wire becomes ground, and pump reverses.	If not operating, remove wiring harness and test pump with a 12 volt battery. If pump works, repair wires between pump and control module. If pump does not run, replace pump.


1 Cab Fuse #1
Cab Fuse Panel
S21 Rear Wiper/ Washer Switch
S22 Front Wiper/ Washer Switch
Cab Switch Panel
X3 Connector
Yel
Wht
Wht/Blk
Brn
3
8
Brn/Blu
Blu
2
K15 Washer Pump Control Module
7
5
6
4
M4 Washer Pump



CONTENTS



SPECIFICATIONS

GENERAL SPECIFICATIONS

Type	9x3 SST Collar Shift
Number of Speeds	9 Forward, 3 Reverse
Hydraulic Reservoir Capacity	24 L (6.3 gal)
Clutch Pedal Free Play	20 mm (0.780 in.)

REPAIR SPECIFICATIONS

TORQUE SPECIFICATIONS

SCV Port Tube Hydraulic Line Nuts	40 - 57 N•m (30 - 43 lb-ft)
Gear Housing to Transmission Housing Cap Screws	126 - 154 N•m (95 - 115 lb-ft)
Front Clutch Cover To Housing (Tunnel) Cap Screws	23 - 29 N•m (17 - 22 lb-ft)
Clutch Hub to Transmission Shaft	135 N•m (100 lb-ft)

SPECIAL OR ESSENTIAL TOOLS

Part Number	Part Name
JT07335-1,2,3	Splitting Stands and Brackets
JDG1259	Clutch Shimming Fixture
JDG 1262	Detent Ball Tool

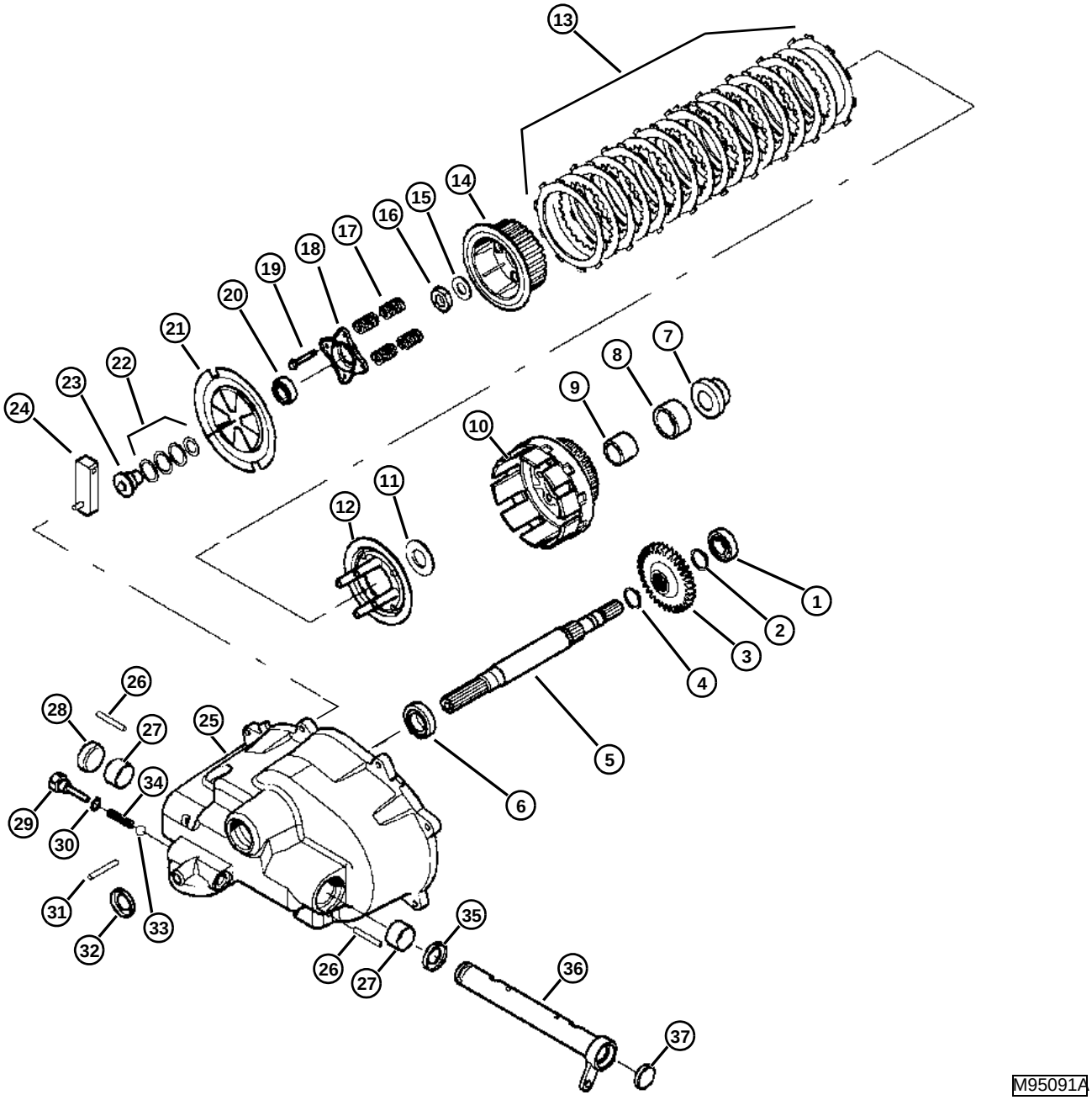
NOTE: Order tools according to information given in the U.S. SERVICE-GARD™ Catalog or in the European Microfiche Tool Catalog (MTC).

OTHER MATERIALS

Number U.S./Canadian	Name	Use
TY6305	John Deere Clean and Cure Primer	Clean form in place gasket surfaces.
TY16021	John Deere Form in Place Gasket	Between axle and differential housings, transmission tunnel etc.
TY6333	Moly High Temperature EP Grease	
TY22034	John Deere SuperLube®	
TY9370 (#242 LOCTITE®)	Thread Lock and Sealer (Medium Strength)	On dowel pins and certain cap screws.

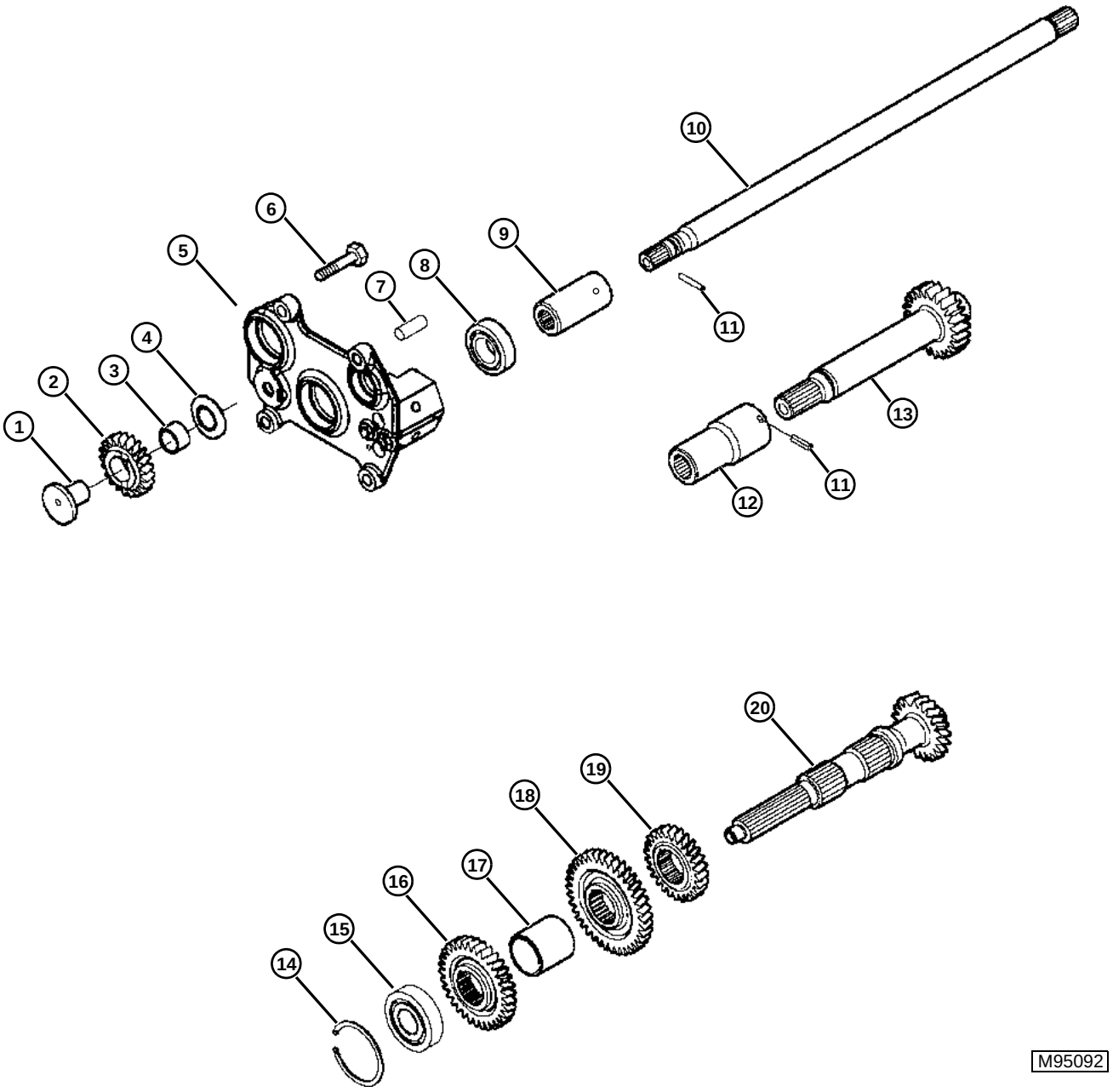
COMPONENT LOCATION

4200 – CLUTCH (CST AND SST)



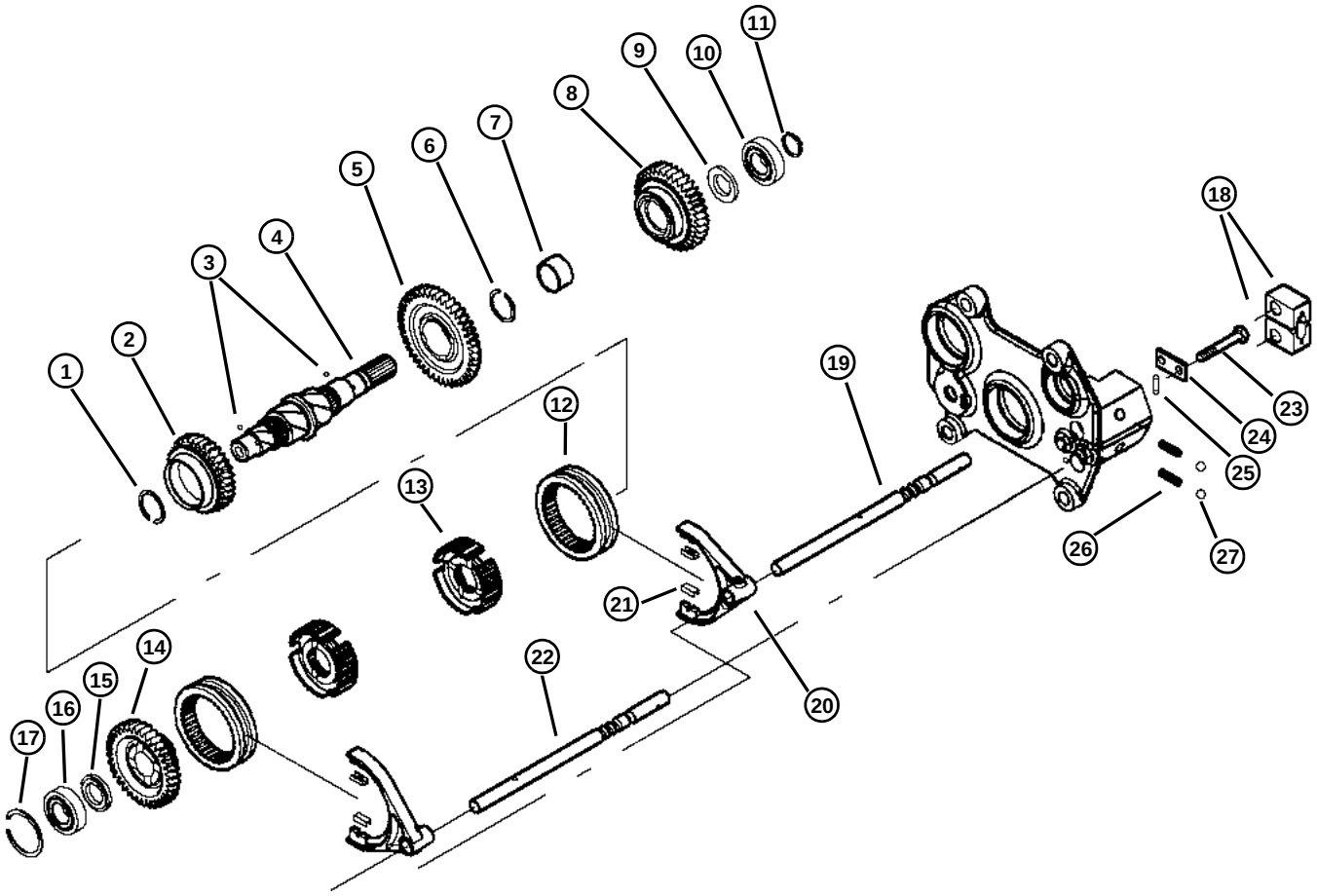
1. Ball Bearing
2. Snap Ring
3. Gear
4. Snap Ring
5. Input Shaft
6. Ball Bearing
7. Spacer
8. Bearing
9. Bearing Race
10. Clutch Basket
11. Washer
12. Piston
13. Clutch Plates
14. Hub
15. Washer
16. Nut
17. Spring (4)
18. Plate
19. Cap Screw (4 used)
20. Bearing
21. Snubber
22. Shims
23. Pin
24. Lift Arm
25. Clutch Cover
26. Pin
27. Bearing
28. Cap
29. Cap Screw
30. Cap
31. Pin
32. Seal
33. Ball
34. Spring
35. Seal
36. Shaft
37. Plug

4200 – PINION SHAFT AND COUNTER SHAFT (CST and SST)



1. Shaft	6. Cap Screw	11. Spring Pin (2 used)	16. Gear (33T)
2. Gear	7. Dowel Pin (2 used)	12. Sleeve	17. Spacer
3. Bearing	8. Bearing	13. Pinion Shaft (24T)	18. Gear (38T)
4. Thrust Washer	9. Coupler	14. Snap Ring	19. Gear (26T)
5. Bearing Housing	10. Shaft	15. Ball Bearing (2 used)	20. Countershaft

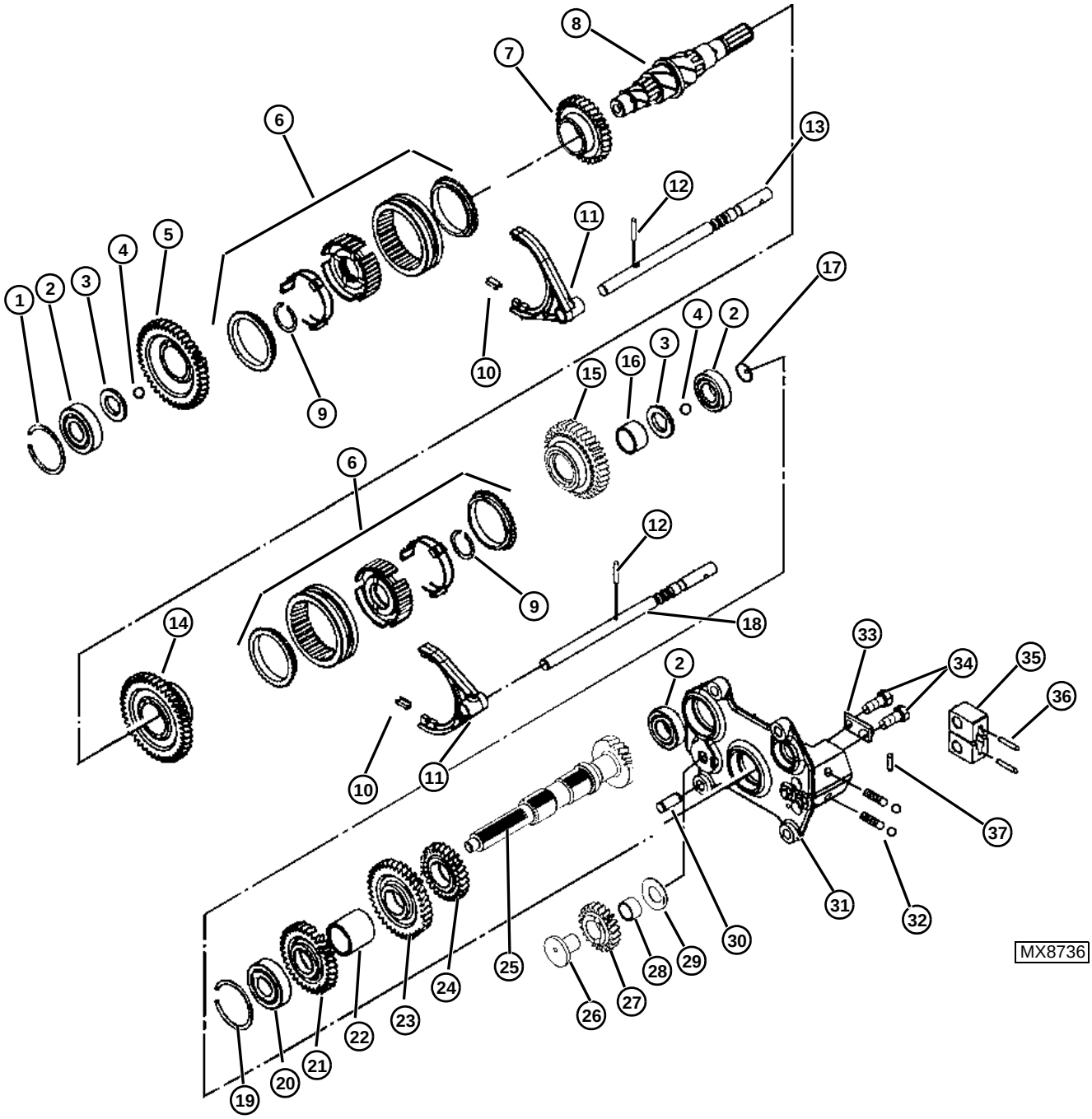
4200 – 3 SPEED TRANSMISSION (CST)



M95287A

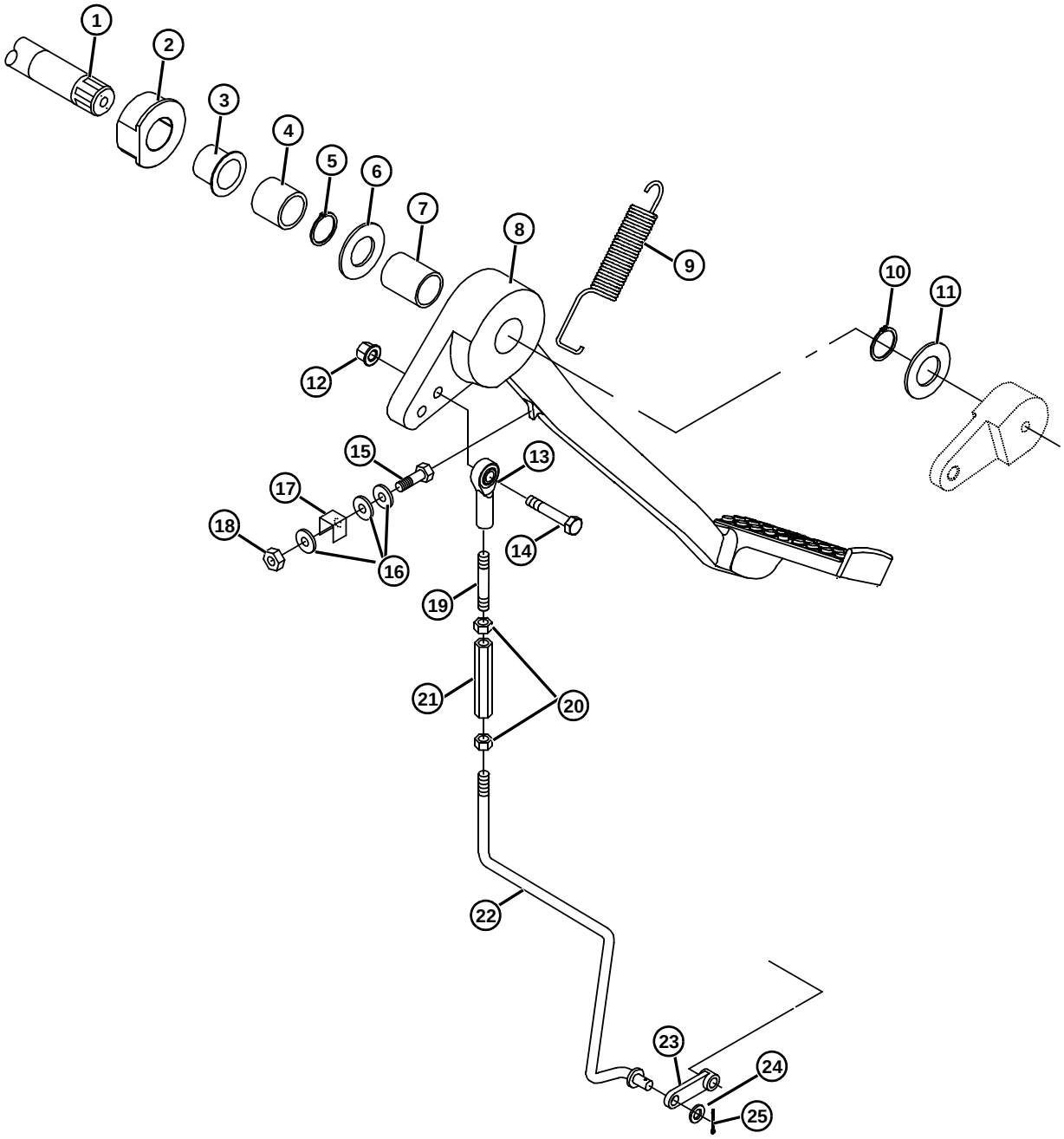
1. Snap Ring	8. Gear	15. Thrust Washer	22. Rail
2. Gear	9. Thrust Washer	16. Ball Bearing	23. Cap Screw (2)
3. Ball (2 used)	10. Ball Bearing	17. Snap Ring	24. Plate
4. Shaft	11. Snap Ring	18. Gate (2 used)	25. Pin
5. Gear	12. Collar (2)	19. Rail	26. Spring (2)
6. Snap Ring	13. Hub (2)	20. Fork (2 used)	27. Ball (2)
7. Bearing	14. Gear	21. Insert (4 used)	28.

4200 – 3 SPEED SYNCRO TRANSMISSION (SST)



1. Snap Ring
2. Ball Bearing
3. Thrust Washer (2)
4. Ball (2)
5. Gear
6. Synchronizer Assy
7. Gear
8. Shaft
9. Snap Ring
10. Insert (4 used)
11. Fork (2)
12. Pin (2)
13. Rail
14. Gear
15. Gear
16. Bearing
17. Snap Ring
18. Rail
19. Snap Ring
20. Ball Bearing
21. Gear
22. Spacer
23. Gear
24. Gear
25. Shaft
26. Shaft
27. Gear
28. Bearing
29. Thrust Washer
30. Dowel Pin
31. Bearing Housing
32. Ball & Spring (2)
33. Plate
34. Cap Screw (2)
35. Gate (2)
36. Pin (2)
37. Pin
38.
39.
40.

CLUTCH PEDAL AND LINKAGE

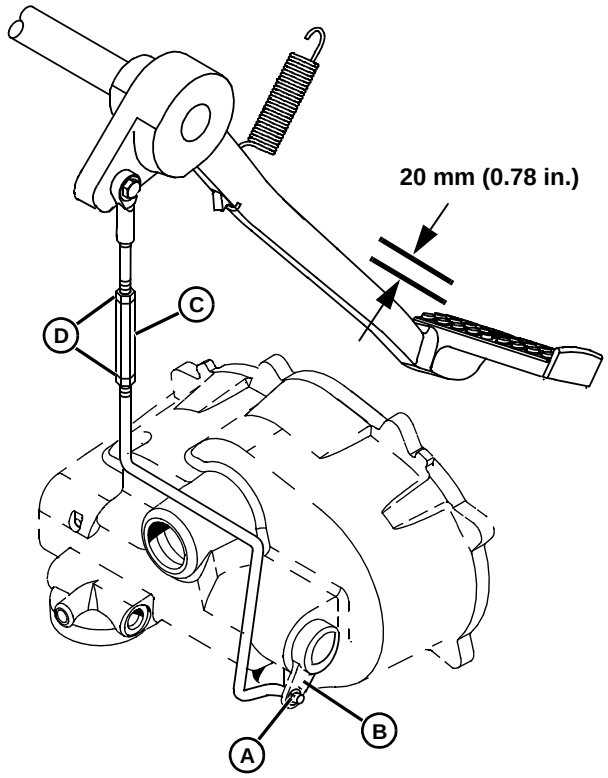


1. Shaft
2. Bearing
3. Bushing
4. Spacer
5. Snap Ring
6. Thrust Washer
7. Bushing
8. Pedal
9. Clutch Spring
10. Snap Ring
11. Thrust Washer
12. Lock Nut
13. Spherical Rod End
14. Cap Screw
15. Cap Screw (Stop)
16. Washer
17. Bracket
18. Lock Nut
19. Rod
20. Nut
21. Turnbuckle
22. Rod
23. Lever
24. Washer
25. Cotter Pin

TESTS AND ADJUSTMENTS

CLUTCH ADJUSTMENT

Procedure:



1. If the linkage or pedal have been removed or disturbed, complete all steps. If the linkage has not been removed or disturbed, complete only steps three, seven, and eight.
2. Remove cotter pin (A) and disconnect the clutch rod from the clutch arm (B).
3. Hold turnbuckle (C) on the clutch linkage and loosen lock nuts (D).
4. Move the clutch lever up until the clutch shaft contacts the clutch lift lever (no freeplay).
5. Hold the clutch lever at this position and adjust the turnbuckle until the linkage will enter the clutch arm hole.
6. Install the clutch rod, washer and cotter pin.
7. Adjust the turnbuckle until the clutch pedal has **20 mm (0.780 in.)** free travel, measured at center of clutch pedal face.
8. Hold the turnbuckle and tighten the lock nuts.

REPAIR

TRACTOR SPLITTING (FRONT)

*NOTE: It is **not** necessary to remove the bell housing from the engine unless engine is being removed. Split the tractor between the tunnel and bell housing as outlined in the story below.*

Prepare the Tractor:

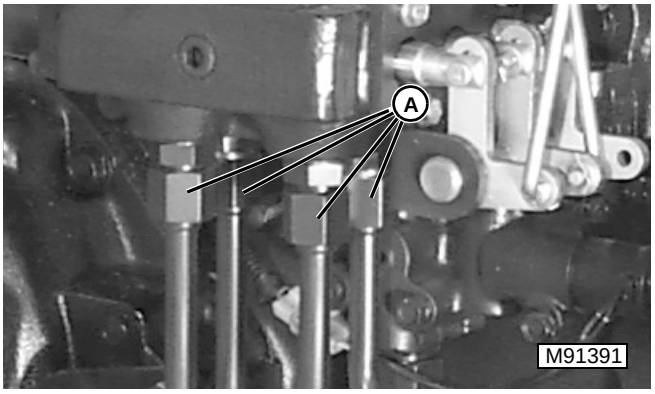
1. Remove any mid or front attachments and mid or front PTO shaft.
2. Park tractor on a level surface. Engage park brake, shut off engine.
3. Disconnect battery negative terminal.
4. Remove floor mat.
5. Remove operator's platform. (See "OPERATORS PLATFORM" in Miscellaneous section.)
6. Remove LH and RH closeout panels.
7. Remove seat and seat platform. (See "SEAT AND SEAT SUPPORT" in Miscellaneous section.)
8. Remove fenders. (See "REAR FENDERS" in Miscellaneous section.)
9. Cycle all hydraulic controls to relieve system pressure.

⚠ CAUTION

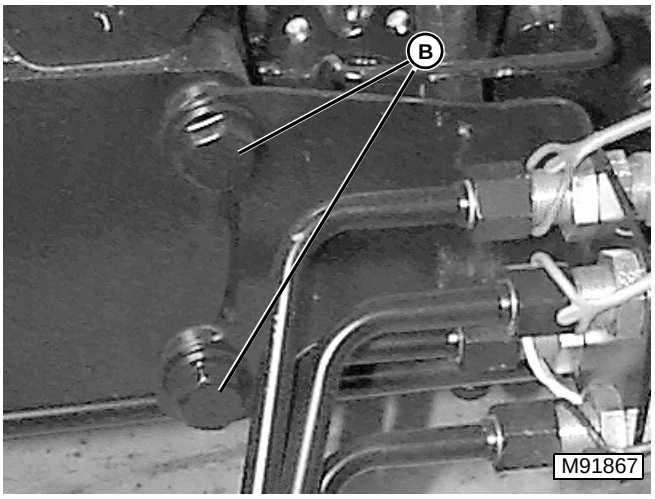
To avoid injury from escaping hydraulic oil under pressure, relieve the pressure in the system by stopping the engine and operating all hydraulic control valves.

NOTE: Hydraulic reservoir contains approximately 24L (6.3 gal) of oil. Have a suitable container ready to catch drain oil.

10. Drain hydraulic reservoir.
11. If tractor is equipped with an SCV, raise RH rear of tractor and support on suitable stands.
12. Remove RH rear wheel and tire.



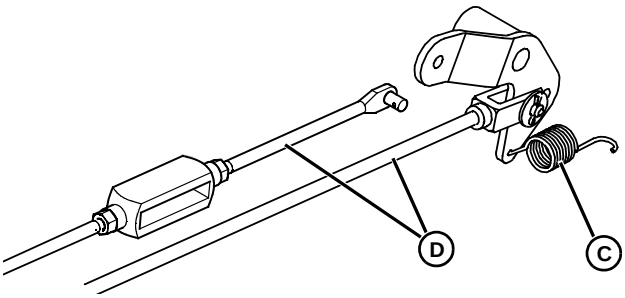
• Disconnect four work port tubes (A) from SCV.

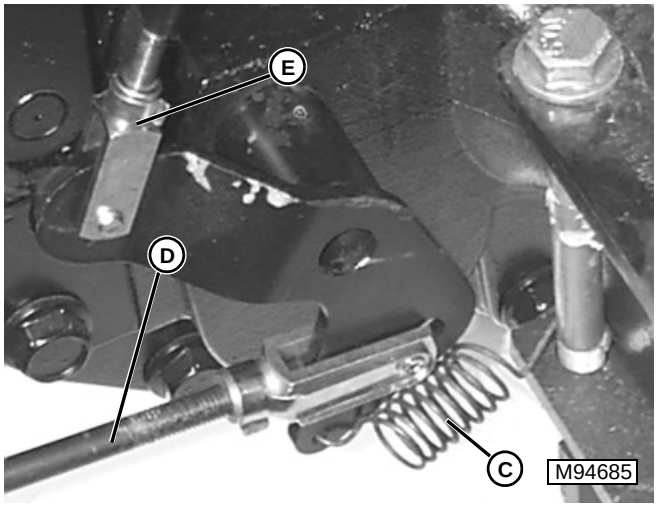


• Remove two cap screws (B) and two spacers that attach tube support bracket to frame. Remove tube support bracket and tubes as an assembly.

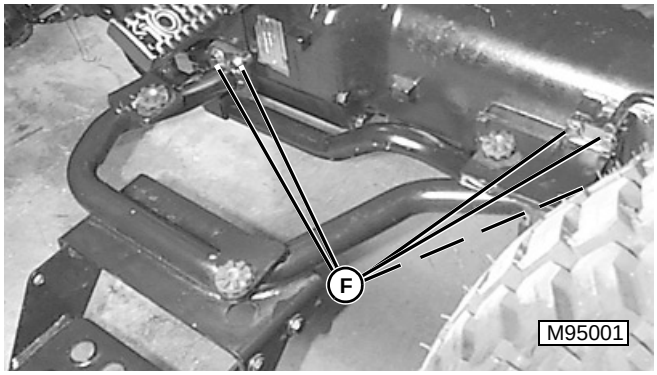
• Install RH rear wheel and tire.

13. Locate and disconnect all electrical connectors attaching wiring harness to switches and lights on rear half of tractor. Unfasten wiring harness from cable clips and move harness away from rear half of tractor.

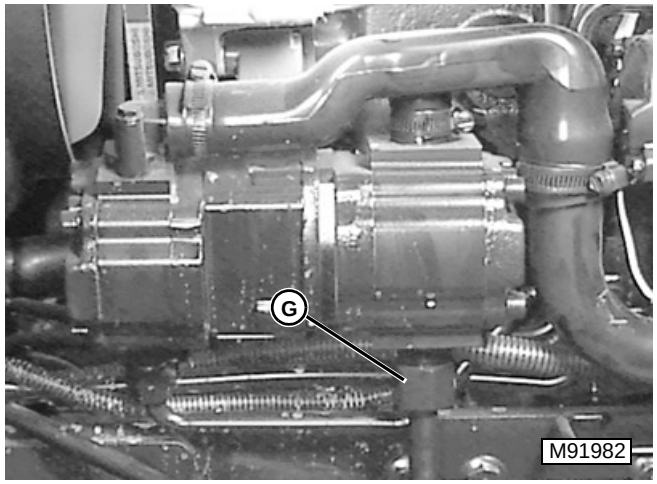




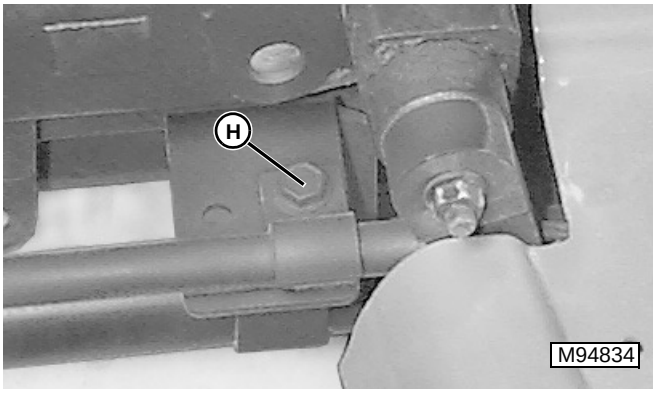
14. Disconnect brake return spring (C) from brake lever. Remove spring.
15. Disconnect lower brake rod (D) from brake lever.
16. **Side Mount Parking Brake Only:** Disconnect park brake rod (E) from brake lever.



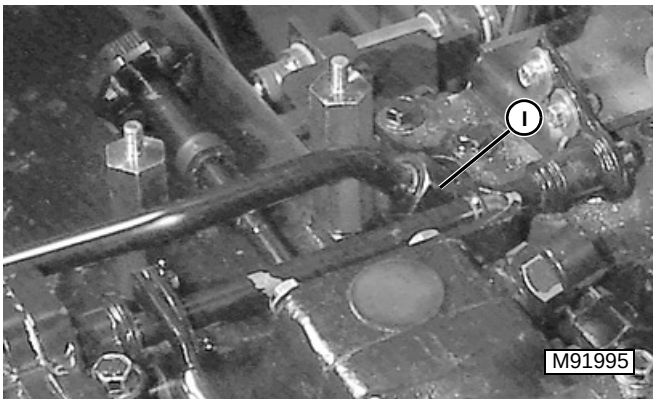
17. Remove five cap screws (F) and LH operator's platform support.



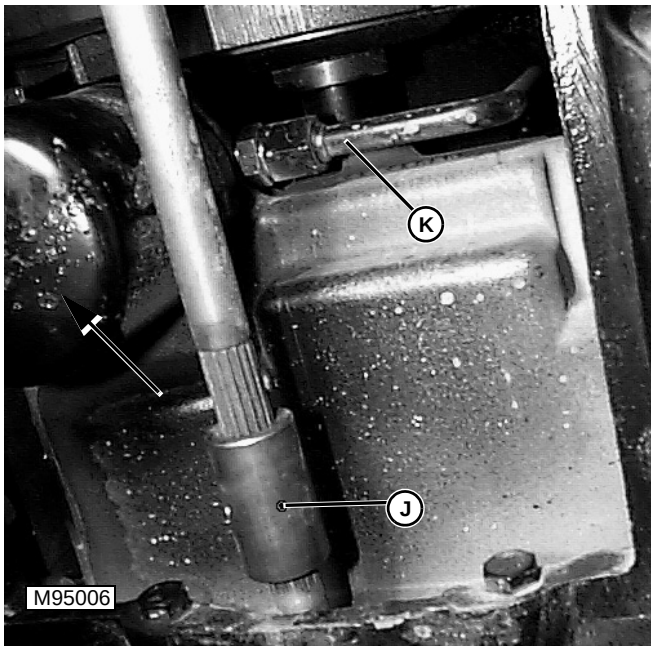
18. Disconnect hydraulic pressure tube (G) at rear gear pump.



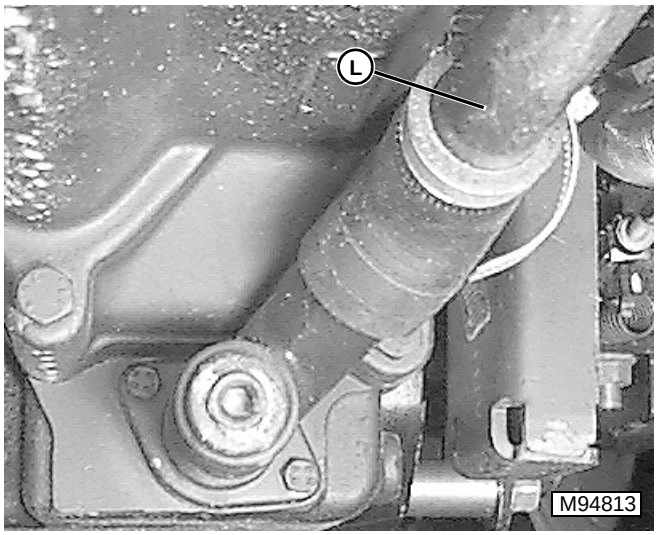
19. Remove cap screw (H) and hydraulic pressure tube clamp.



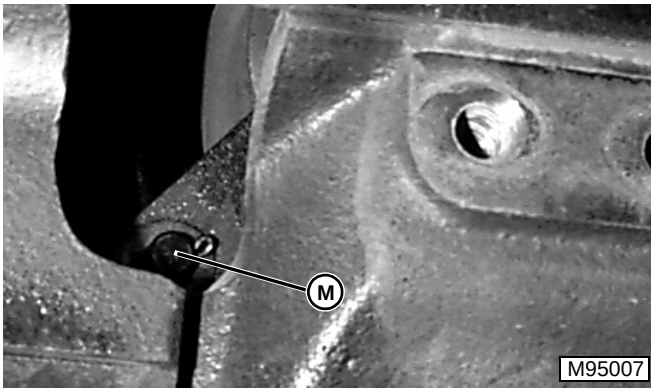
20. Disconnect hydraulic supply tube (I) at SCV or manifold block. Remove tube.



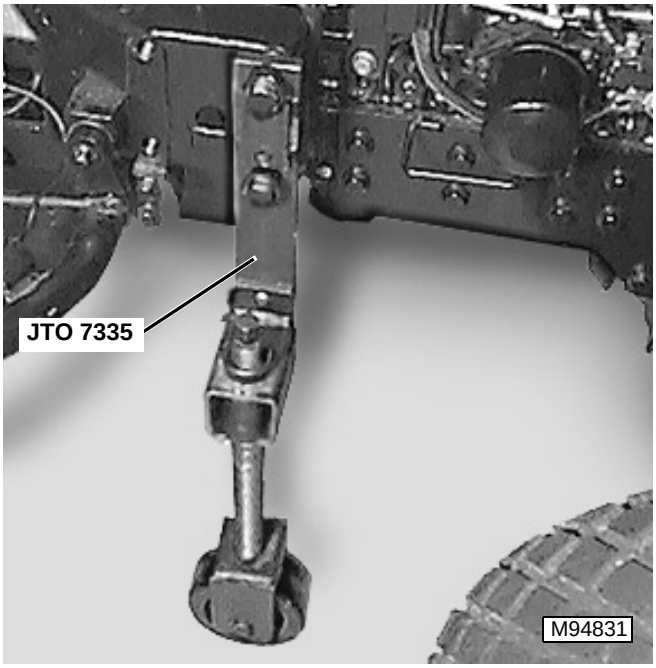
21. If equipped: Remove 4-WD drive shaft and couplers by removing spring pin (J) and sliding coupler onto shaft until clear of stub shaft. Repeat at other end of drive shaft.
22. Remove oil filter.
23. Disconnect oil tube (K) from clutch housing/filter.



24. Loosen hose clamp and disconnect suction tube (L) from manifold.



25. Remove cotter pin and washer, and disconnect linkage rod (M) from clutch lever.



NOTE: When attaching JTO 7335 splitting stands to tunnel section, use the supplied right angle brackets, and attach to holes in underside of tunnel section.

26. Using suitable cap screws, attach four JTO 7335 splitting stands to tractor sections. Adjust splitting stands so that wheels contact the floor, and are parallel to the tractor wheels.
27. Remove nine cap screws connecting tunnel to flywheel housing. Note length and locations of cap screws when removing.

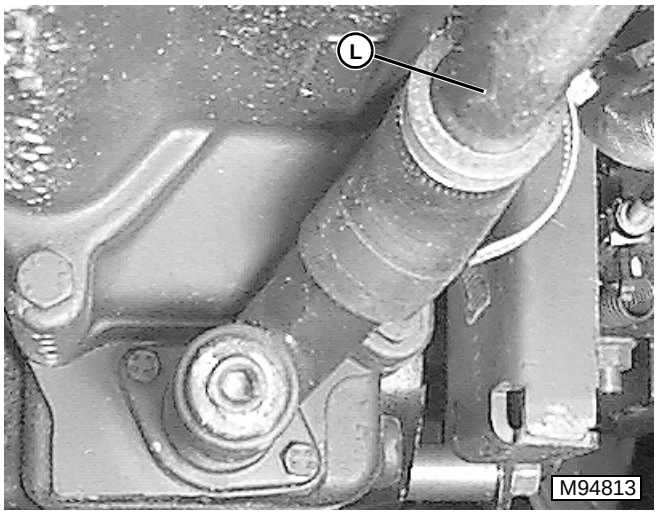
IMPORTANT: Check for, and disconnect any additional accessory wires or hydraulic tubes connecting rear half to front half before splitting tractor.

28. Release park brake and place gear shift in NEUTRAL.
29. Gently pry around edges of flanges to separate tractor halves.
30. Roll tractor halves apart.

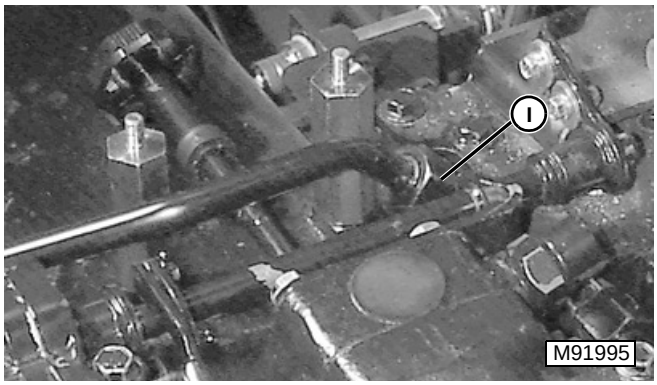
Assemble Tractor Sections:

NOTE: Splines on all drive shafts and couplers must be aligned before tractor sections are bolted together.

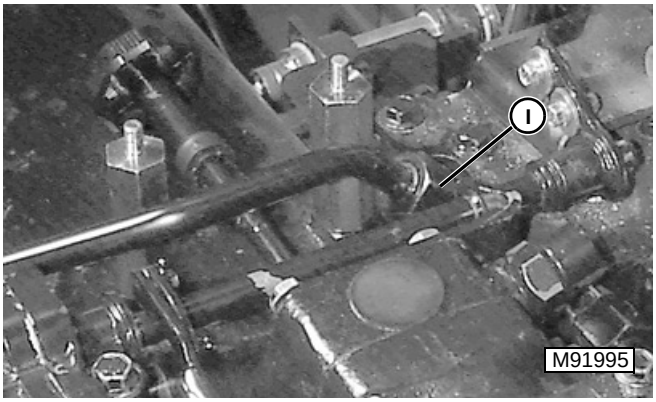
1. Align splines on transmission drive shaft and engine flywheel.
2. Move tractor sections together and retain with nine cap screws. Tighten cap screws to **126 - 154 N•m (95 - 115 lb-ft)**.
3. Remove cap screws retaining splitting stands to tractor sections. Remove splitting stands.



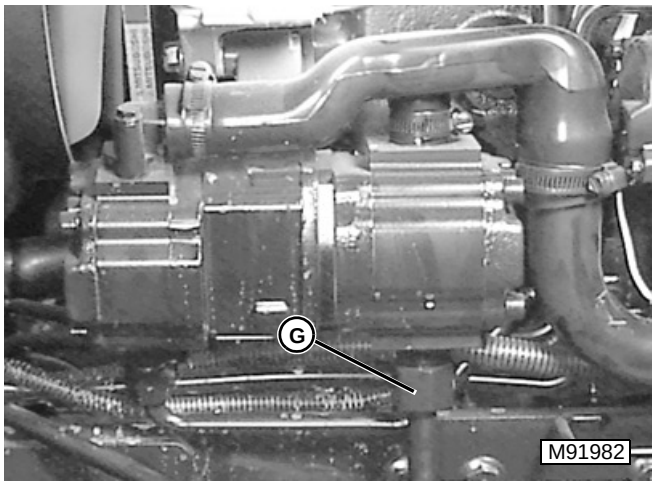
4. Connect suction tube (L) to manifold. Tighten hose clamp.



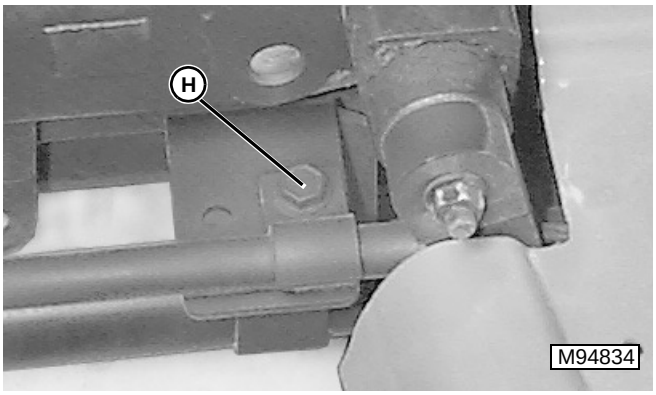
5. Install hydraulic supply tube (L) to tractor. Connect hydraulic supply tube to SCV or manifold block. Tighten tube nut to **55 - 79 N•m (40 - 59 lb-ft)**.



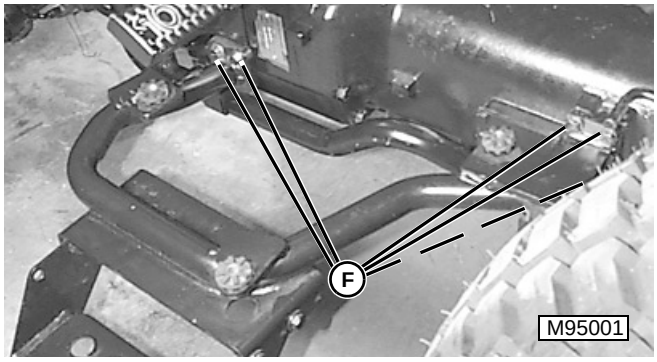
6. Install hydraulic supply tube to tractor. Connect hydraulic supply tube (I) to SCV or manifold block. Tighten tube nut to **55 - 79 N•m (40 - 59 lb-ft)**.



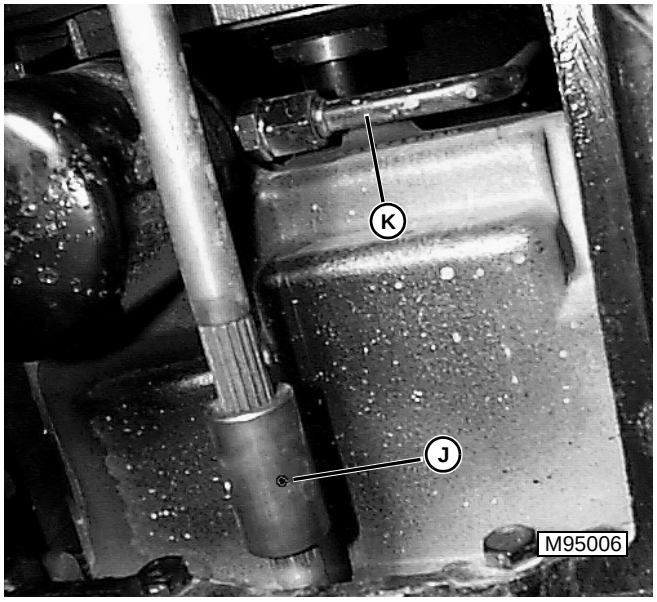
7. Connect hydraulic pressure tube (G) to rear gear pump. Tighten tube nut to **55 - 79 N•m (40 - 59 lb-ft)**.



8. Install cap screw (H) and hydraulic pressure tube clamp.

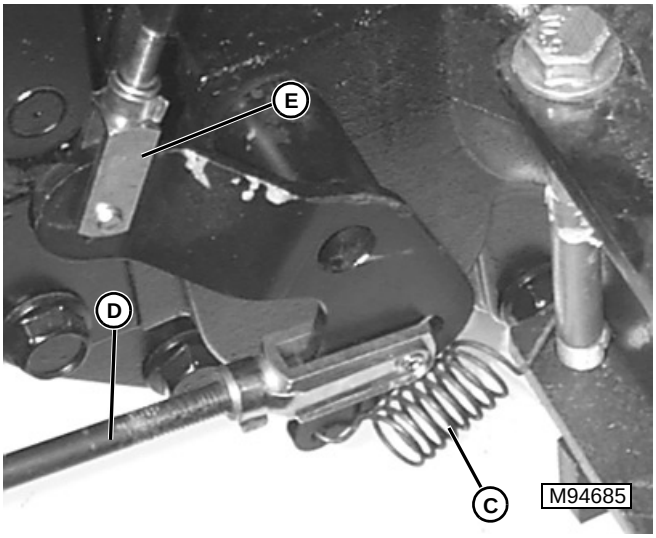


9. Install LH operator's platform support. Retain with five cap screws (F).

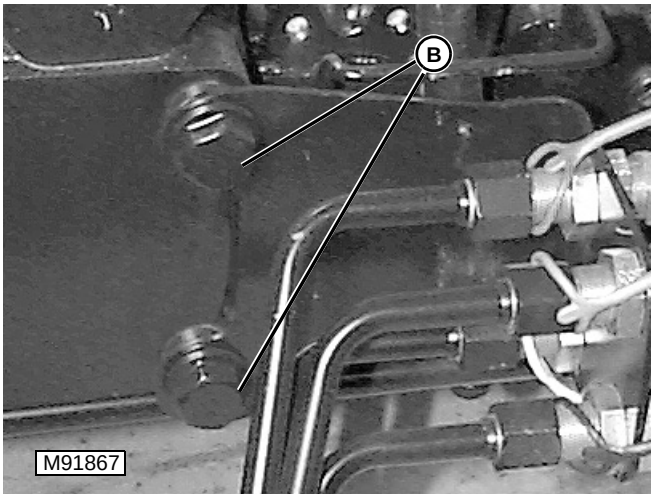


10. Connect oil tube to clutch cover on transmission. Tighten to **40 - 57 N•m (30 - 43 lb-ft)**.
11. Install a new hydraulic oil filter.

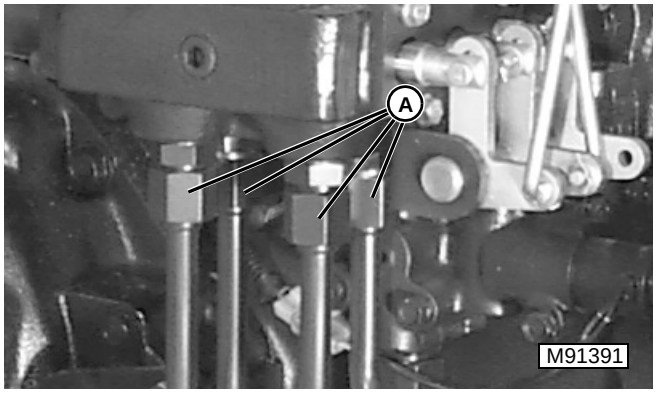
12. If equipped, install 4-WD drive shaft and couplers. Slide couplers onto shafts, and retain with spring pins (J).



13. Attach lower brake rod (D) to brake lever. Retain with pin, or pin, cotter pin, and washer.
14. **Side Mount Parking Brake Only:** Attach park brake rod (E) to brake lever. Retain with clip pin.
15. Install brake return spring (C) to brake lever and ROPS cap screw.
16. Route wiring harness through cable clips. Locate and connect all electrical connectors attaching wiring harness to switches and lights on rear half of tractor.



17. If tractor is equipped with an SCV, install SCV tube support bracket and tubes as an assembly. Install two cap screws (B) and two spacers to attach tube support bracket to frame.
18. Raise RH rear of tractor and support on suitable stands. Remove RH rear wheel and tire.

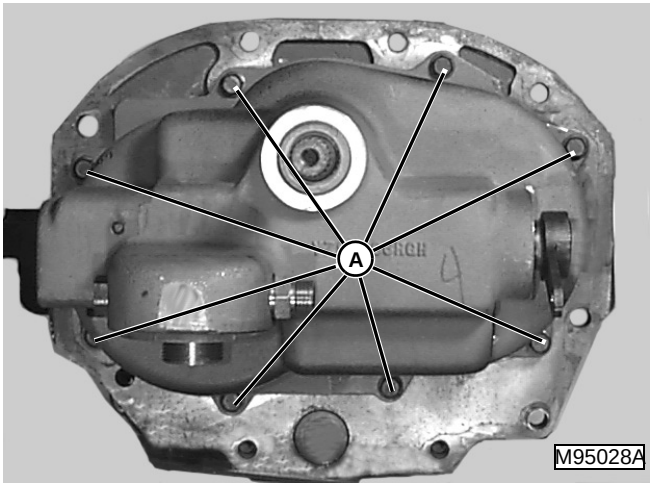


19. Connect four work port tubes (A) to SCV. Tighten tube nuts to **40 - 57 N•m (30 - 43 lb-ft)**.
20. Connect battery negative (–) terminal.
21. Install fenders. (See "REAR FENDERS" in Miscellaneous section).
22. Install kick plate. (See "KICK PLATE" in Miscellaneous section).
23. Install seat and seat platform. (See "SEAT AND SEAT SUPPORT" in Miscellaneous section).
24. Install LH and RH closeout panels.
25. Install operator's platform. (See "OPERATOR'S PLATFORM" in the Miscellaneous section).
26. Install floor mat.
27. Refill hydraulic oil reservoir to proper level.
28. Bleed air from hydraulic system. (See "HYDRAULIC SYSTEM BLEED PROCEDURE" in Hydraulics section).

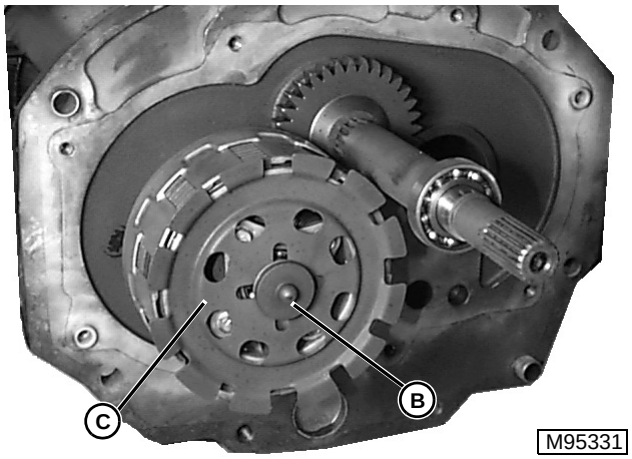
COLLAR SHIFT (CST) TRACTION CLUTCH REMOVAL

Procedure:

1. Perform tractor split between flywheel housing and tunnel housing. (See "TRACTOR SPLITTING FRONT").

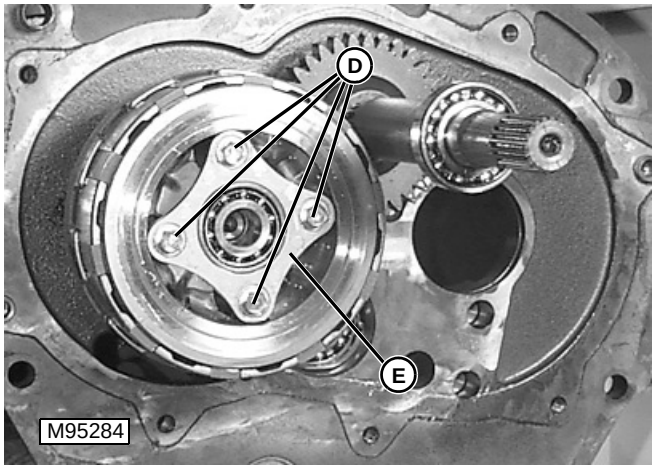


2. Remove eight cap screws securing clutch cover to tunnel housing.
3. Remove clutch cover.

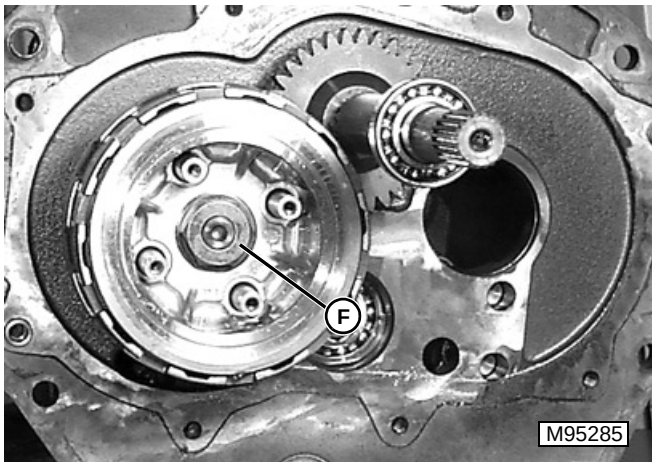


4. Remove clutch lifter pin (B) and clutch snubber (C).

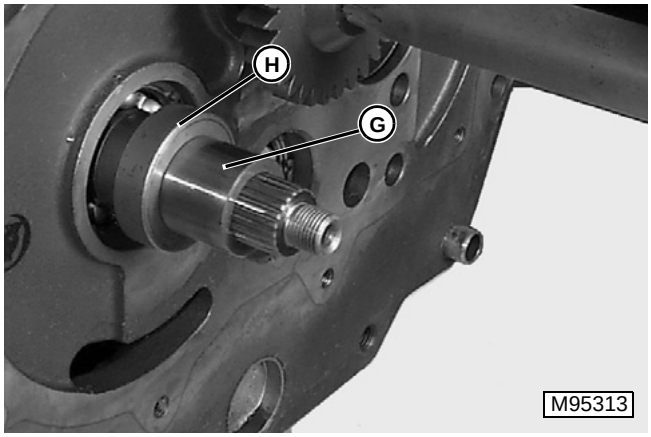
NOTE: There are shims on both sides of the clutch snubber. Retain all shims for possible use during reassembly.



5. Alternately loosen clutch spring plate retaining cap screws (D) in small increments and remove plate (E).



6. Remove clutch retaining nut (F) and slide clutch off of shaft.



7. Remove bearing race (G) and spacer (H).

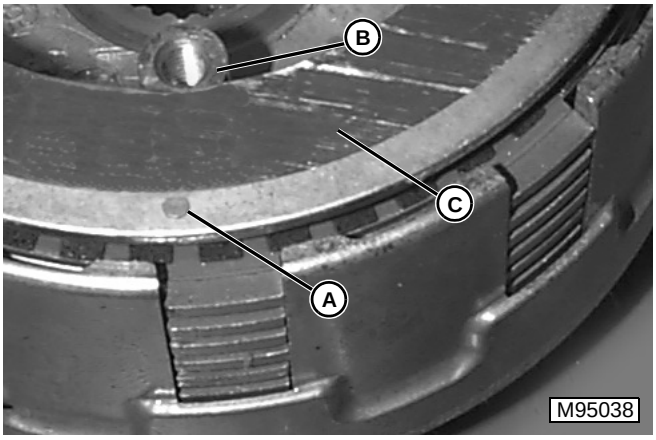
8. Inspect parts for wear or damage replace as needed.

COLLAR SHIFT (CST) TRACTION CLUTCH DISASSEMBLY

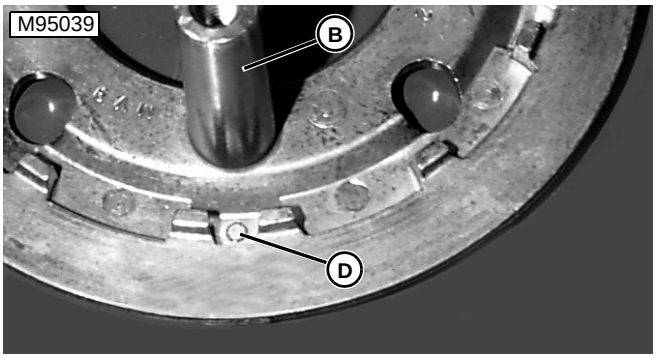
Special or Required Tools:

- Calipers
- Bearing Drivers

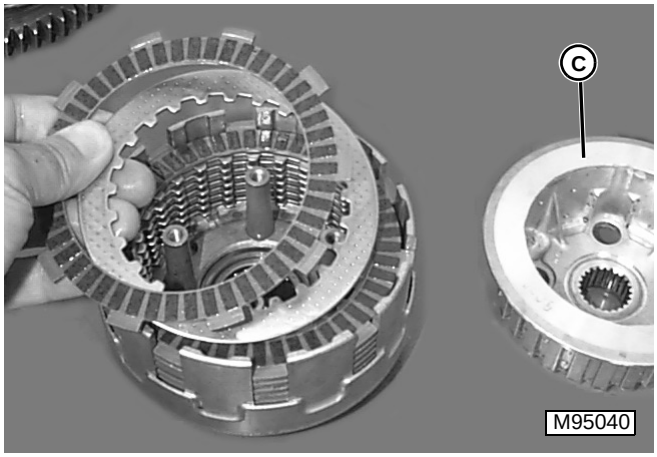
Procedure:



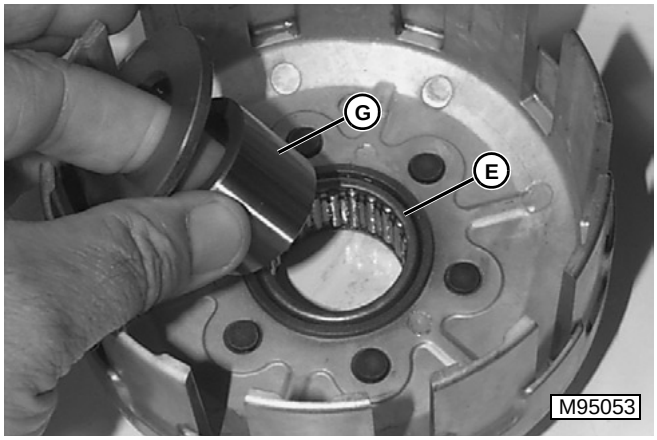
NOTE: The clutch piston and hub may only be assembled one way to operate properly. There are small assembly marks (A) on them, but you may find it helpful to mark the piston post (B) and hub (C) with a marking pen.



1. Mark piston post (B) and piston (D) with permanent marking pen for reassembly.



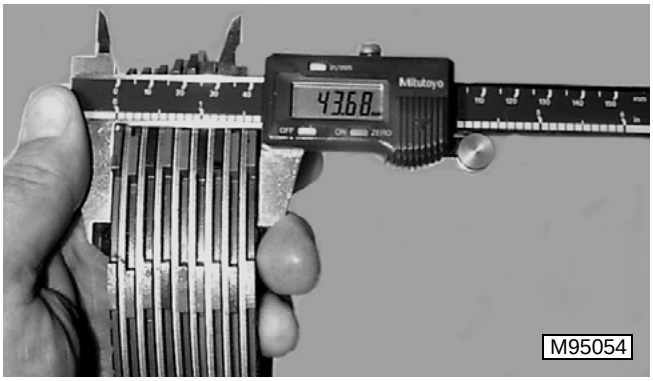
2. Remove hub and clutch plates from basket.



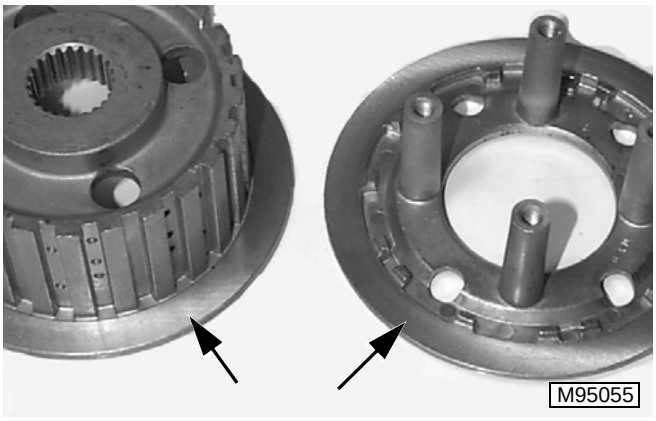
3. Inspect needle bearing (E), race (G), and thrust washer for wear or damage.

NOTE: If bearing is being replaced, replace race and thrust washer also.

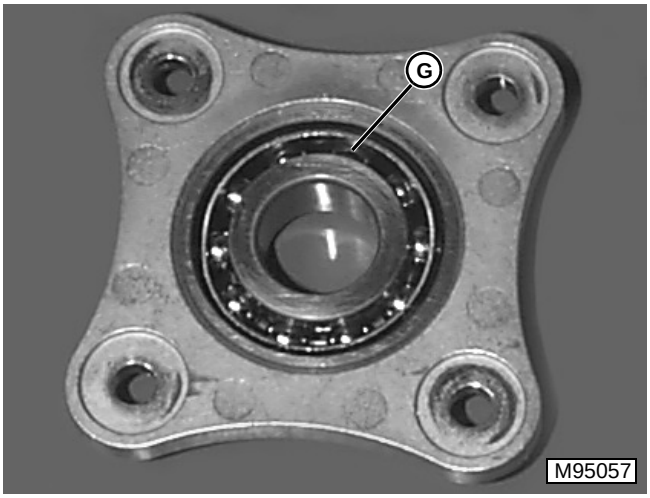
4. If replacement of bearing is necessary, drive bearing out with appropriate bearing driver. When installing new bearing, drive only on the side that the numbers are stamped on. Drive bearing in until it is slightly below flush on both sides.



5. Measure thickness of entire clutch plate pack. Minimum thickness: **42.3 mm (1.66 in.) If clutch pack measures less than minimum specification, replace clutch pack.**



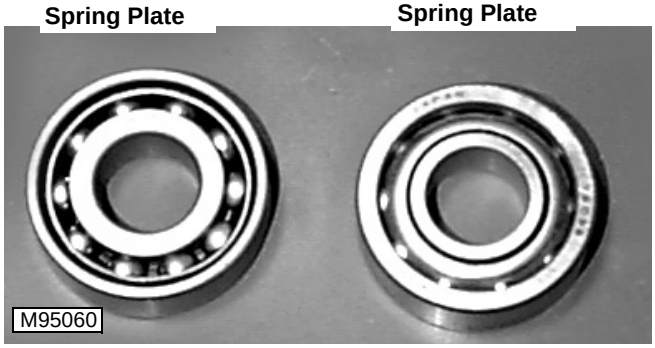
6. Inspect friction areas of hub and piston for wear. Replace parts as needed.



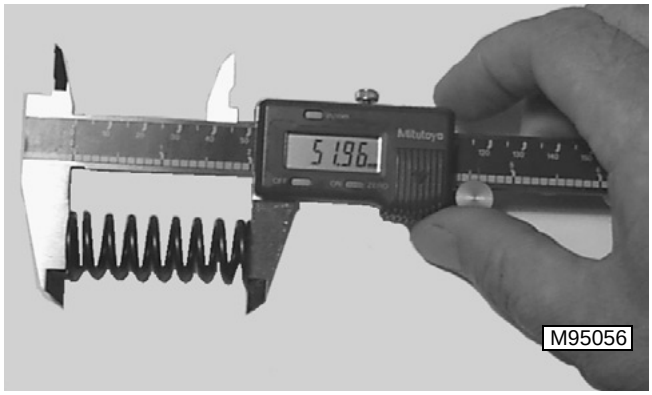
IMPORTANT: DO NOT spin bearings using compressed air. Damage to bearing balls, cage and races could result.

7. Clean spring plate bearing (G) in suitable solvent. Dry with compressed air.
8. Inspect bearing for discolored or burned balls and/or races. Check balls and races for spalling or cracking. Roll bearing by hand to check for rough turning or excessive looseness or play between balls and races. Replace bearing as required.

Front Towards Flat Side of Spring Plate **Back Towards Raised Side of Spring Plate**



IMPORTANT: Bearing is designed for side loads and must be installed in the proper direction as shown.



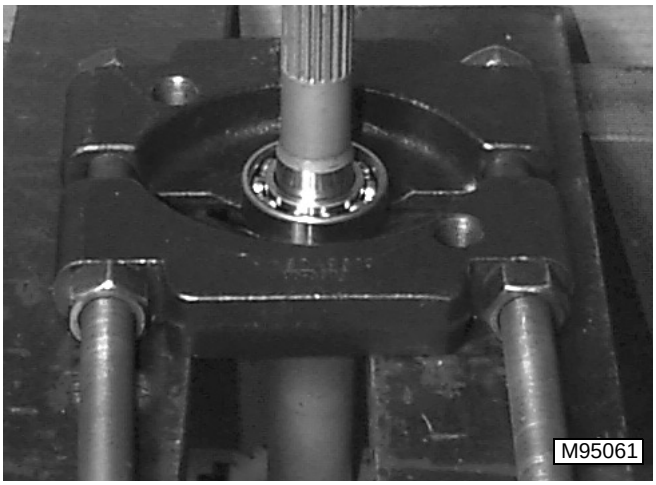
9. Measure no load length of each spring. If spring length is less than **51.3 mm (2.02 in.)**, replace spring.

INPUT SHAFT DISASSEMBLY

Special or Required Tools:

- Bearing Puller

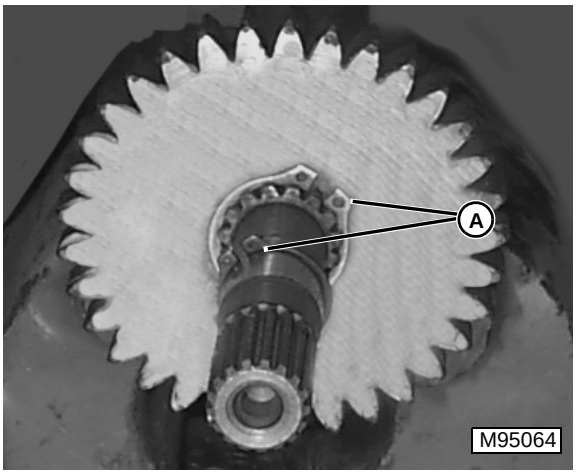
Procedure:



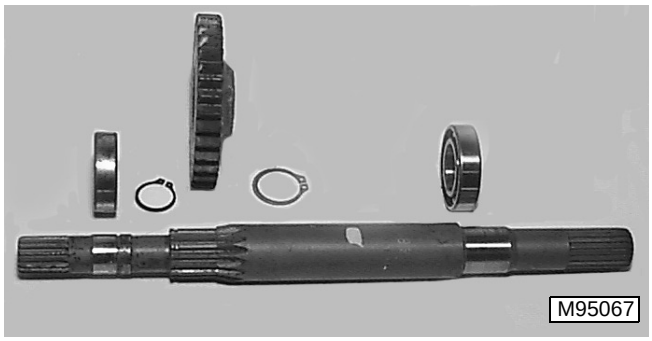
1. Using a bearing puller and press, remove bearings.

IMPORTANT: DO NOT spin bearings using compressed air. Damage to bearing balls, cage and races could result.

2. Clean bearings in suitable solvent. Dry with compressed air.
3. Inspect bearings for discolored or burned ball and/or races. Check balls and races for spalling or cracking. Roll bearing by hand to check for rough turning or excessive looseness or play between balls and races. Replace bearings as required.



4. Remove snap rings (A) and slide gear from shaft.



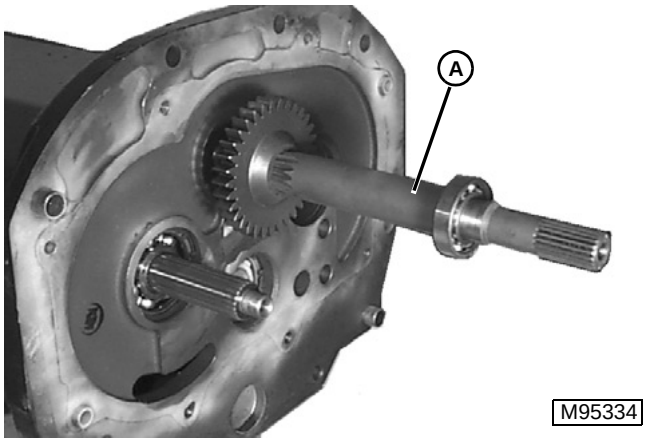
5. Inspect gear teeth for damage. Inspect splines and bearing areas of shaft for wear or damage.Replace parts as required.

TRACTION CLUTCH INSTALLATION (CST or SST)

NOTE: Gasket surfaces must be absolutely clean down to bare metal for form-in-place gasket to work properly. Scrape old material off with a sharp gasket scraper and then use a chemical gasket remover to clean mounting surfaces.

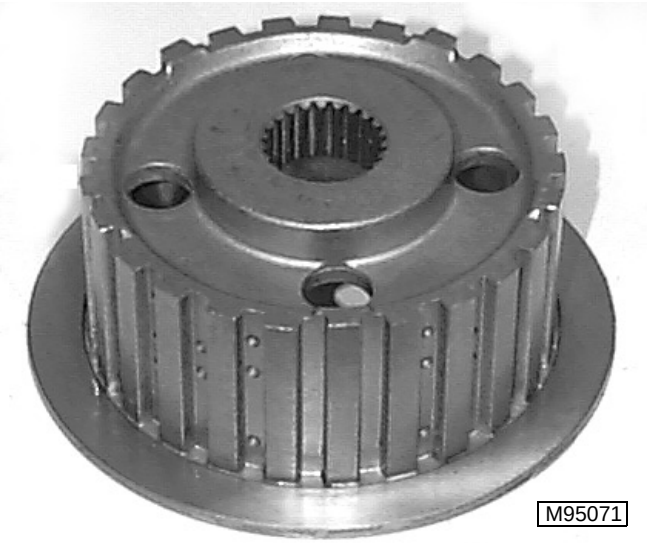
Procedure:

1. Remove any old gasket material from clutch cover and transmission housing tunnel.

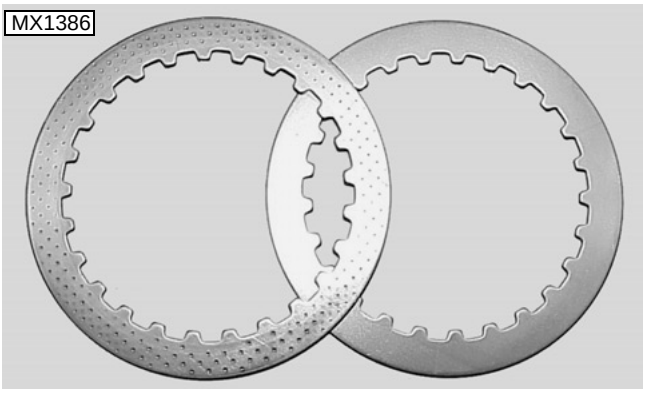


2. If input shaft (A) was removed, slide input shaft into transmission tunnel. Turn input shaft and make sure input shaft is properly engaged in PTO shaft splined collar.

Clutch Assembly:


M95071

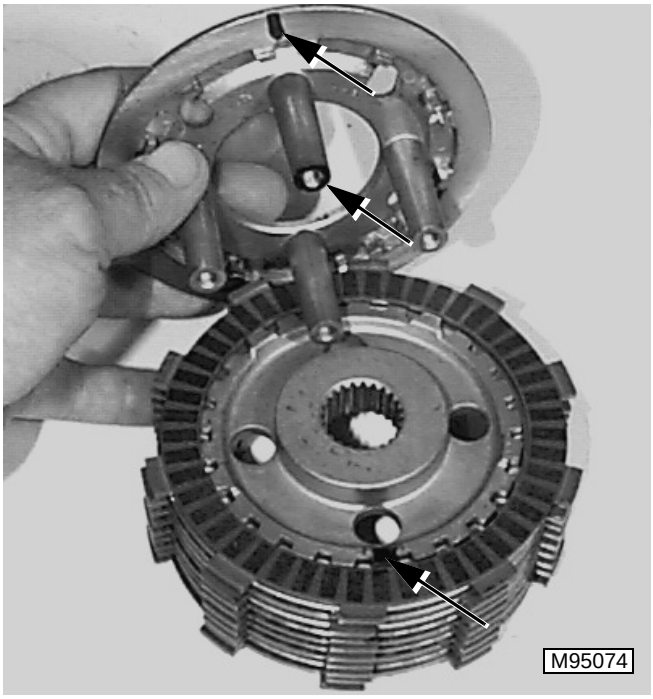
1. Lay hub assembly on workbench with splined hub facing up.


MX1386

NOTE: There are two styles of metal clutch plates. The old style on the left has dimples on the surface. The new "wavy plate" style on the right has a smooth surface. Do not mix the two styles together.

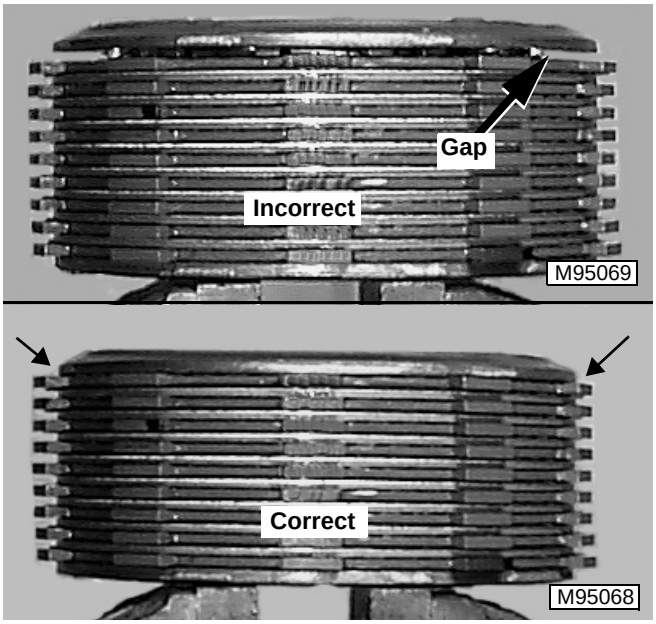

M95072

2. Install a clutch friction disc, then metal plate, then disk, then plate etc.
3. Line up tabs on clutch discs.

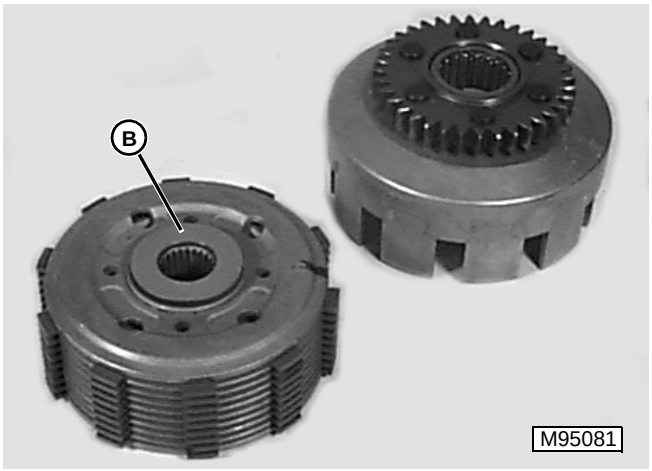

M95074

4. Line up assembly marks and put piston on hub assembly.

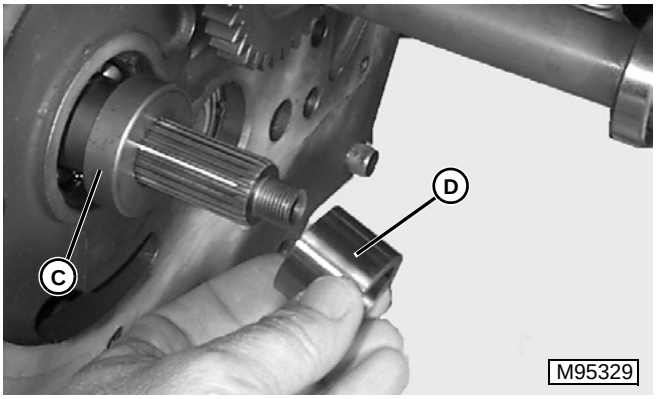
NOTE: The clutch piston and hub may only be assembled one way to operate properly. Make sure assembly marks are lined up.



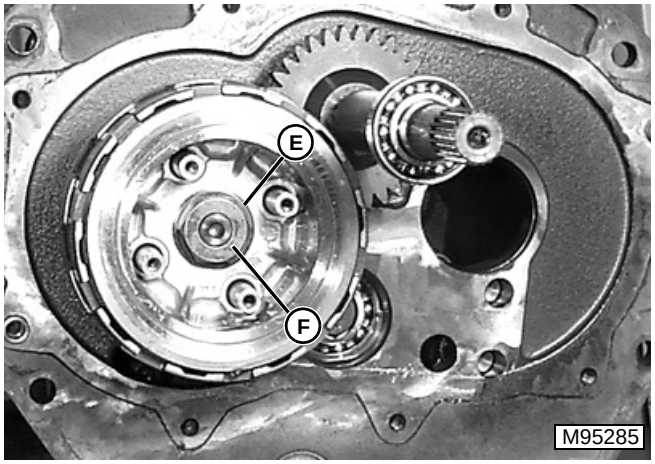
5. Verify proper assembly by making sure piston contacts clutch plates.



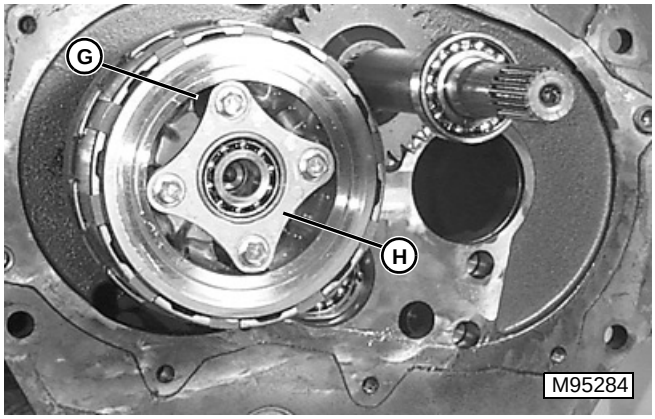
6. Place thrust washer (B) on clutch.
7. Slide clutch basket down over clutch assembly.



8. Slide spacer (C) and bearing race (D) onto clutch shaft.



9. Make sure the thrust washer is properly positioned in the clutch assembly. While applying pressure to the clutch parts to keep the thrust washer in place, slide clutch on shaft.
10. Install belleville washer (E) with side marked "OUT" toward outside.
11. Install nut (F), flat side out, and tighten to **135 N•m (100 lb-ft).**



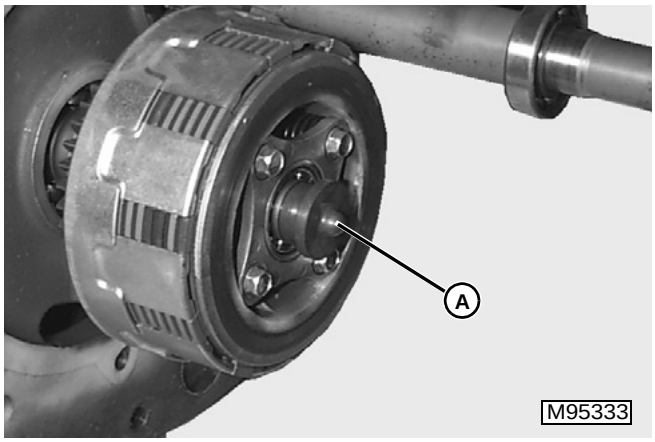
12. Install a spring (G) on each of the four posts and then spring retainer (H) on the clutch. Secure spring retainer with four cap screws and tighten cap screws to **11 N•m (98 lb-in.)**.

CLUTCH SHIMMING PROCEDURE

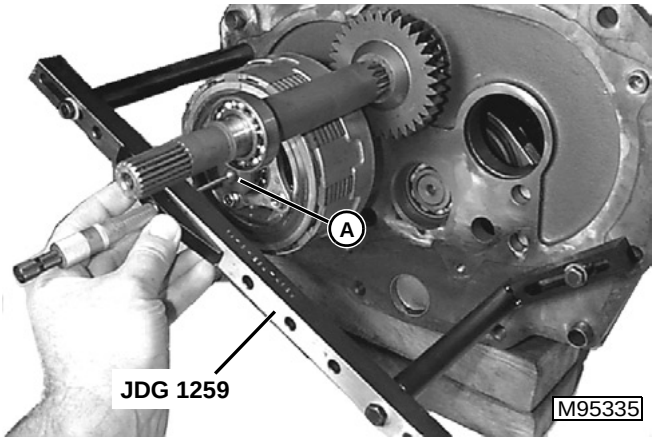
Measure Clutch:

Tool Required:

- JDG 1259 Clutch Shim Fixture



1. Install lifter pin (A) without any shims or the clutch snubber.
2. Seat the clutch back toward the transmission by tapping the assembly lightly with a soft mallet.



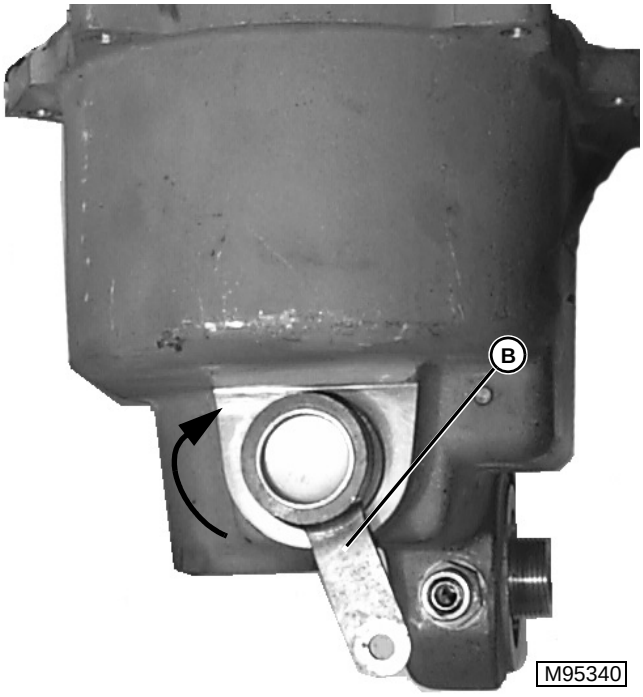
3. Install **JDG 1259** over the lifter pin of the clutch. The overall height of the fixture must be known before installation. The **JDG 1259** is **177.8 mm (7.00 in)** high.
4. Measure from the top of the fixture to the top of the lifter pin and record the measurement.
5. Subtract this number from the height of the fixture.This is dimension "A".
6. Write this measurement on the clutch with a marking pen.

Measure Clutch Housing:

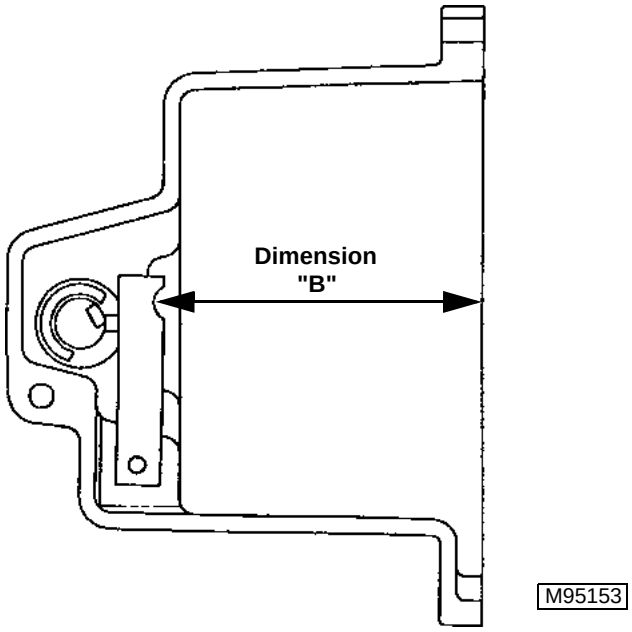
Tool Required:

- JDG 1259 Clutch Shim Fixture

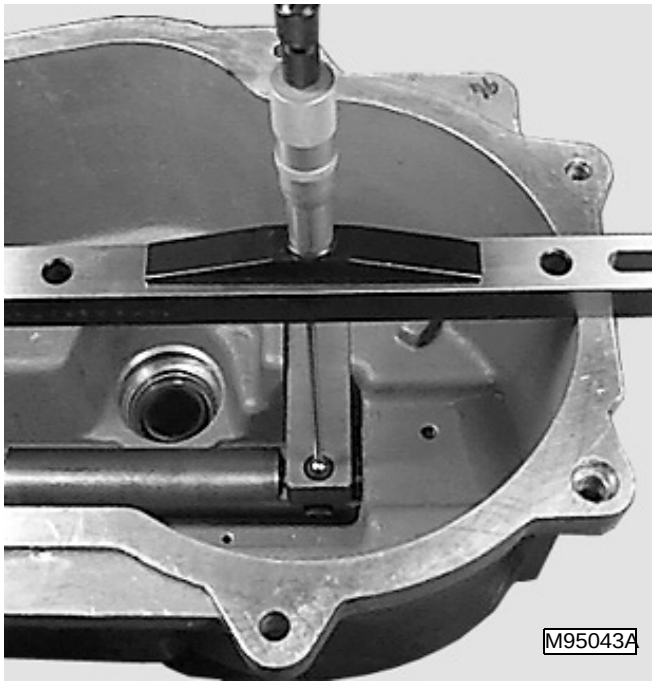
1. Position clutch cover assembly with opening up.



2. Turn clutch pedal control lever clockwise to the disengaged position (B). Lifter lever will be in the raised position when the clutch pedal control lever is in the correct position.



3. Measure dimension "B" from the bottom of the pocket in each lifter lever to the face of the housing.



- Place a **9.5 mm (0.375 in.)** diameter ball in the lifter lever pocket.
- Place the **17.78 mm (0.700 in.)** thick bar across the housing.
- Measure from the top of the bar to the top of the ball in the lifter lever pocket. Record measurement. Add the size of the ball **9.5 mm (0.375 in.)** and subtract the size of the bar **17.78 mm (0.700 in.)** to recorded measurement. Add 3mm (0.118 in.). This is dimension "B".

Determining Correct Amount of Shims:

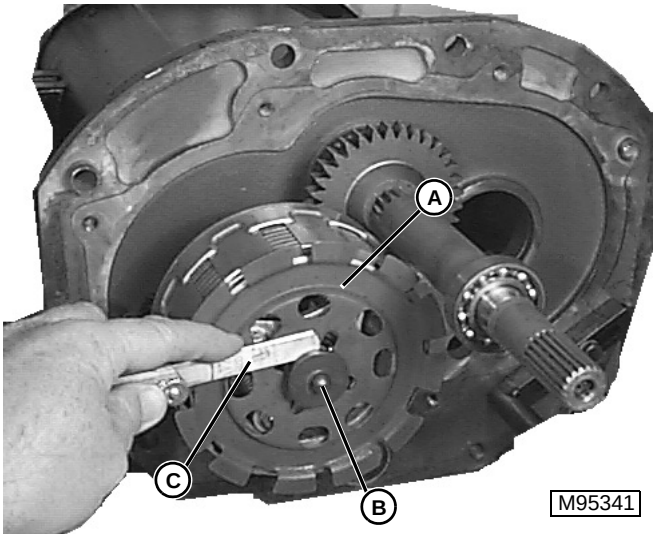
1. Subtract dimension "A" from dimension "B" to determine value "C" which can be zero or greater.
2. If "C" is zero, assemble without shims.
3. If "C" is greater than zero, add shims equal to dimension "C" **+ 0.3/- 0.0mm (+0.012 /- 0.000 in.)** between the lifter pin and the bearing.

Example:	**mm:**	**Inch:**
JDG 1259 Fixture*	177.80	7.000
Fixture To Pin Measurement	–51.31	–2.021
Dimension "A"	126.49	4.979
Clutch Cover Measurement	132.98	5.234
Ball Size	+9.50	+0.375
Bar Size (JDG 1259 Fixture*)	–17.78	–0.700
Add	+3.00	+0.118
Dimension "B"	127.70	5.027
Dimension "B"	127.70	5.027
Minus Dimension "A"	–126.49	–4.979
Dimension "A" - Dimension "B"	1.21	0.048
Value C (Min. Shim Thickness)	1.21	0.048
Shim Tolerance	+0.3 –0.00	+ 0.012 –0.000
Value C (Max. Shim Thickness)	1.51	0.060
*If any other fixture is used, do not use this value		

4. Install shims on lifter pin.

SNUBBER SHIMMING PROCEDURE

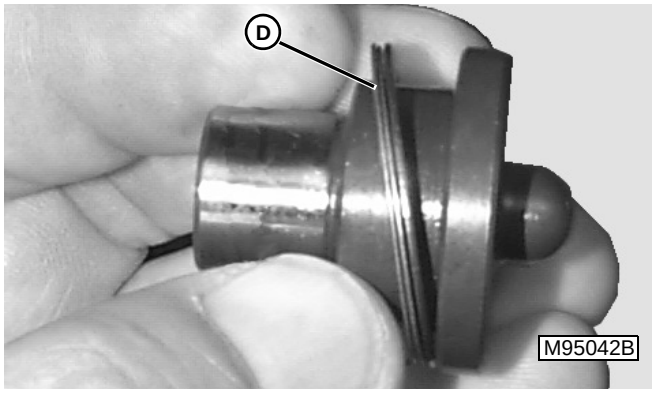
NOTE: The drive clutch must be properly shimmed before shimming the snubber.



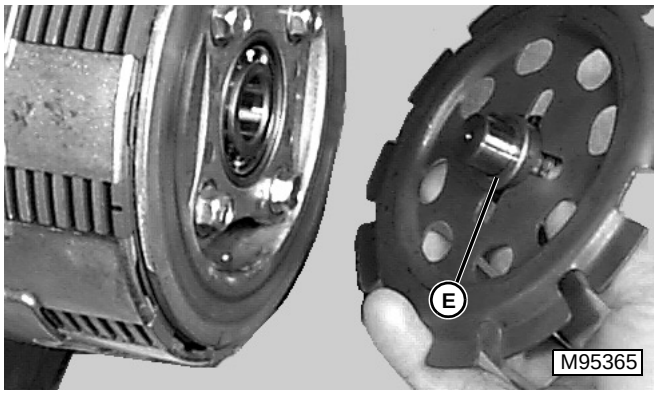
1. Install clutch shims (determined from previous procedure), snubber (A) **without** snubber shims, and lifter pin (B).
2. Hold snubber and lifter pin firmly against front of clutch and measure the gap between the snubber fingers and lifter pin shoulder with a feeler gauge (C).

NOTE: The gap should not be less than 1.14 mm (0.045 in.) or more than 1.40 mm (0.055 in).

3. Subtract **1.27 mm (0.050 in.)** from measurement in previous step. This is the thickness of shim pack to be used between the front surface of clutch snubber and bottom surface of lifter pin shoulder.
4. Measure shims to be installed individually, do not measure with the shims stacked together.



5. Install snubber shims (D) to the lifter pin.

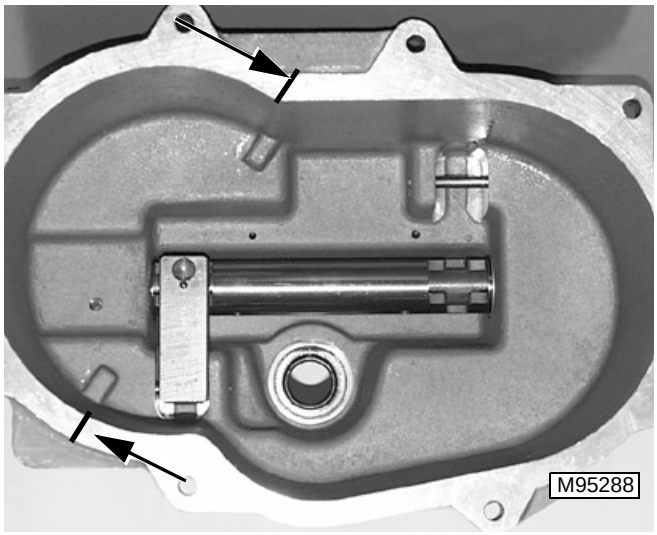


6. Install clutch shims (E) on the lifter pin and slide lifter pin and snubber into clutch bearing.

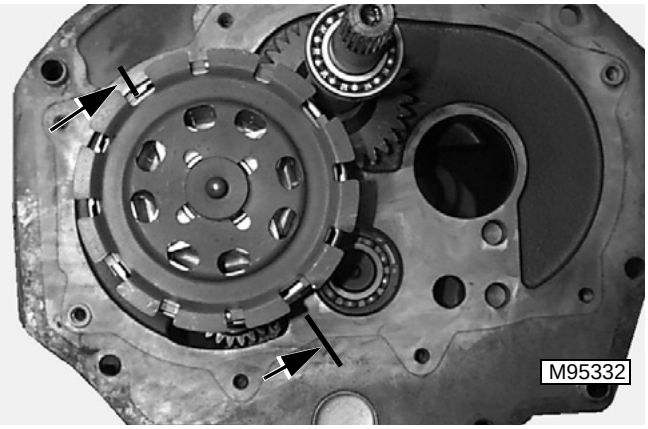
Installing Clutch Cover

IMPORTANT: Mating surfaces must be completely clean of gasket material. Use a single edged razor blade and gasket removing compound to clean surfaces to bare metal.

1. Clean form in place gasket material from mating surface with a gasket scraper or single sided razor blade and gasket removing compound.
2. Install new input shaft oil seal.



3. Mark position of snubber locating tabs on clutch housing.

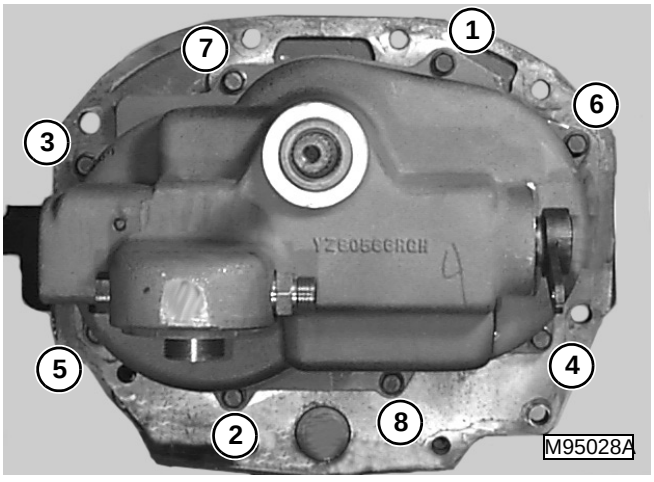


4. Hold clutch cover on center tunnel housing and place marks where clutch housing is marked.

NOTE: Four of the slots on the snubber are larger than the others. The larger slots must be lined up with the tabs on the clutch housing.

5. Line up larger slots on clutch snubber with marks on center section.
6. Place a 1/16 in. uniform bead of TY16021 John Deere Form-in-Place Gasket around the mating surface of the clutch cover.

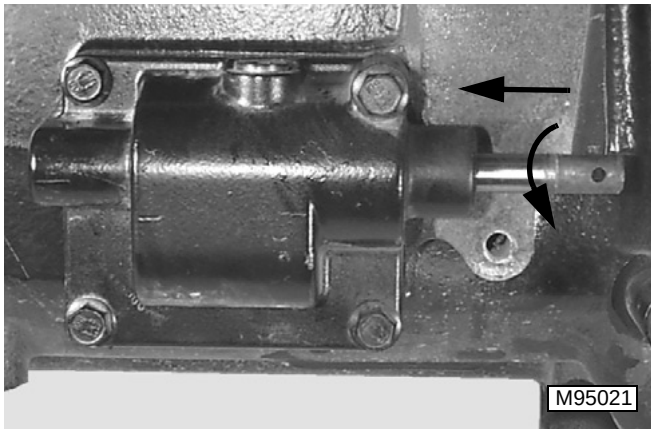
IMPORTANT: Clutch cover must come up against hollow dowels on each side, before cap screws are installed, or the snubber is not positioned correctly. Check position of snubber slots and re-align as needed.



7. Install clutch cover, and tighten cap screws to **28 N•m (20 lb-ft)** in sequence shown**.**

Snubber Check Procedure: (Optional: Check if transmission is removed from differential housing,)

NOTE: Check should be made with transmission in horizontal position.



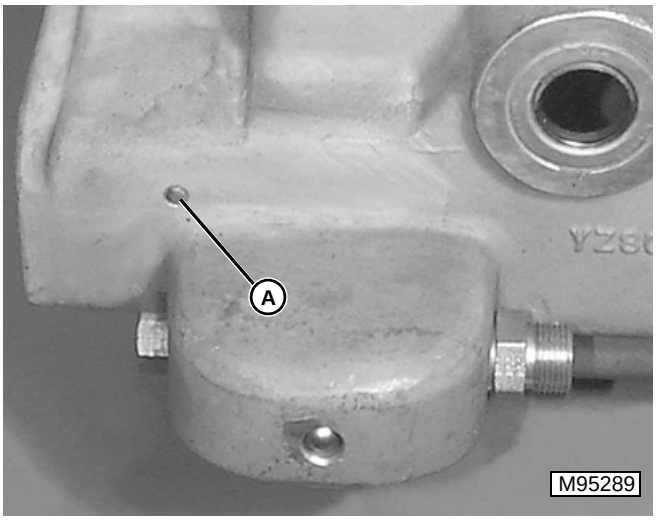
NOTE: Check must be made with transmission in 2nd gear. If shifter is not on the unit, turn shift rod counterclockwise and push in, or if shift rod and cover are not on trans, top fork rod should be in forward position.

1. Place transmission in 2nd gear.
2. Attach a dial or pointer type torque wrench to output shaft of transmission.
3. Engage clutch and rotate the output shaft at approximately 10 rpm. Observe torque while rotating shaft. Torque should be approximately **9.5 N•m (84 lb-in.).** Record reading.
4. Fully disengage the clutch, thus applying the snubber, and repeat step three. Record the observed torque.
5. Subtract the reading from step three from the reading from step four. The results must be greater than **5.4 N•m (48 lb-in.)** but not exceed **8.1 N•m (72 lb-in.).**
6. If the results are not within this range, re-shim the snubber accordingly. That is, add shims to increase torque, or remove shims to decrease torque.

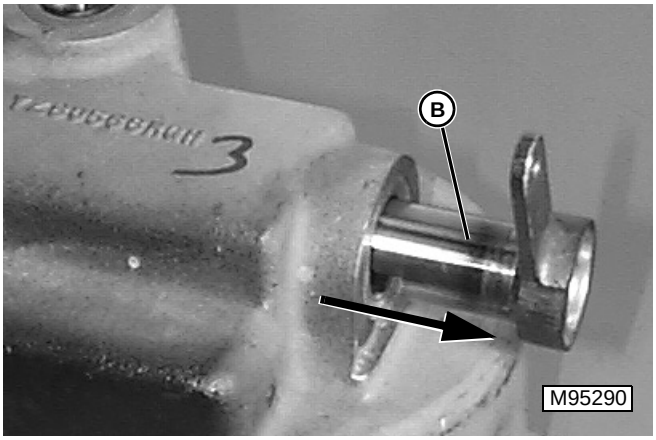
CLUTCH SHAFT REMOVAL AND INSTALLATION

Removal:

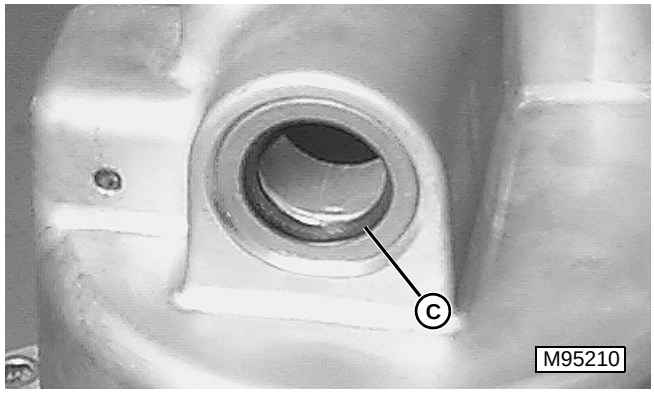
1. Split tractor between flywheel housing and tunnel (See "TRACTOR SPLITTING FRONT").
2. Remove six cap screws and clutch housing (See "COLLAR SHIFT AND SYNC SHIFT TRACTION CLUTCH REMOVAL").



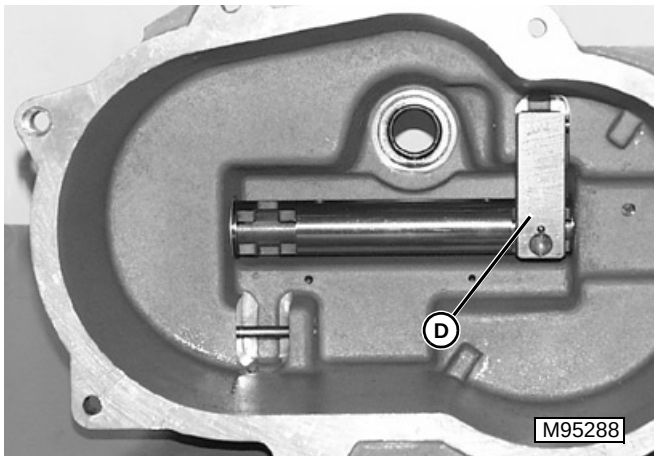
3. Remove pin (A) from clutch housing.



4. Remove clutch shaft (B) from housing.



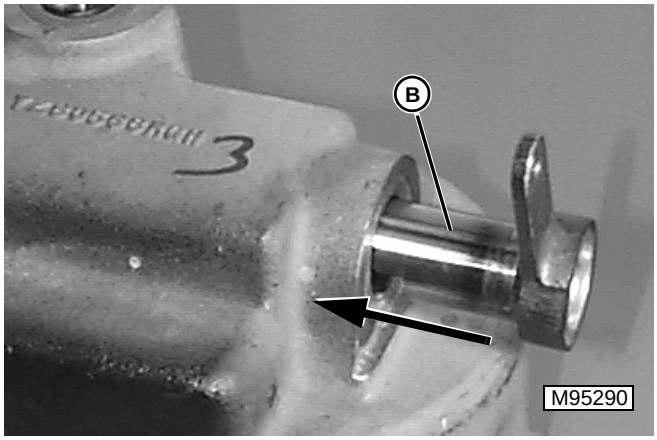
5. Remove shift shaft seal (C) in housing.



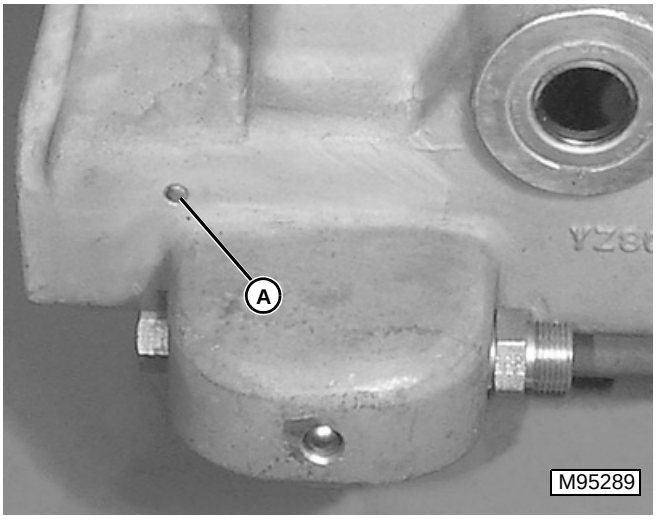
6. Inspect lift lever (D) for wear or damage. Replace if needed.

Installation:

1. Install a new shift shaft seal in housing.



2. Install clutch shaft into housing.
3. Align clutch shaft properly to allow installation of retaining pin.

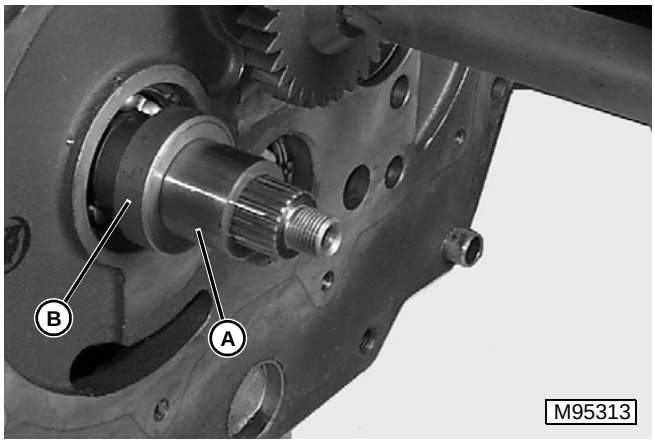


4. Install clutch shaft retaining pin (A) into clutch housing.

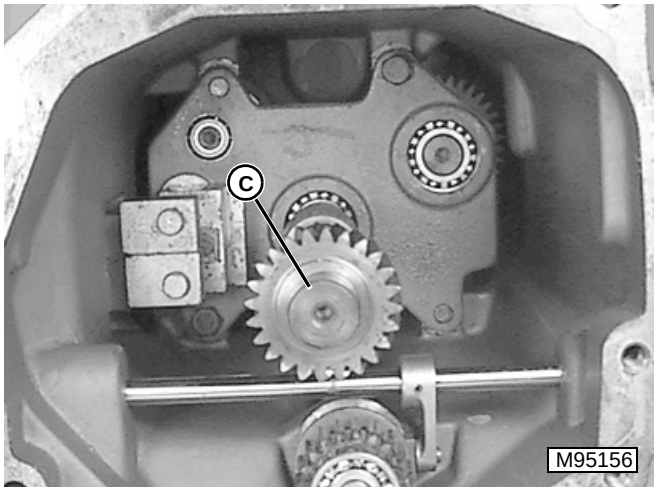
3-SPEED TRANSMISSION REMOVAL

Procedure:

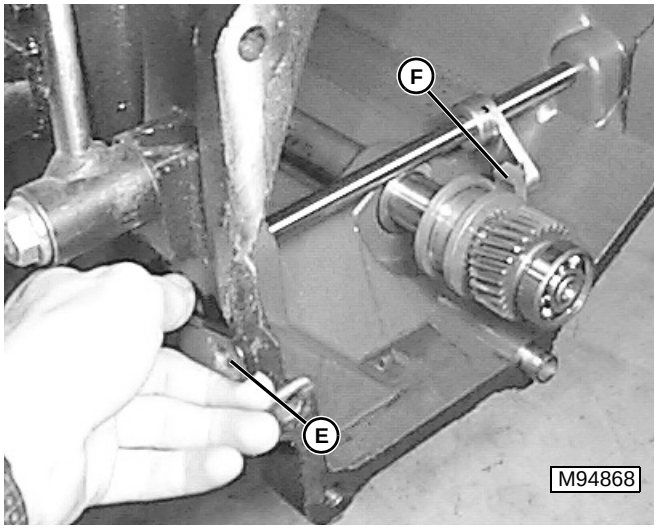
1. Split tractor between the tunnel and the differential housing. (See "TRACTOR SPLITTING REAR" in the Final Power Train section).
2. Remove tunnel from the flywheel housing. (See "TRACTOR SPLITTING FRONT").
3. Remove traction clutch. (See "COLLAR SHIFT AND SYNC SHIFT TRACTION CLUTCH REMOVAL").



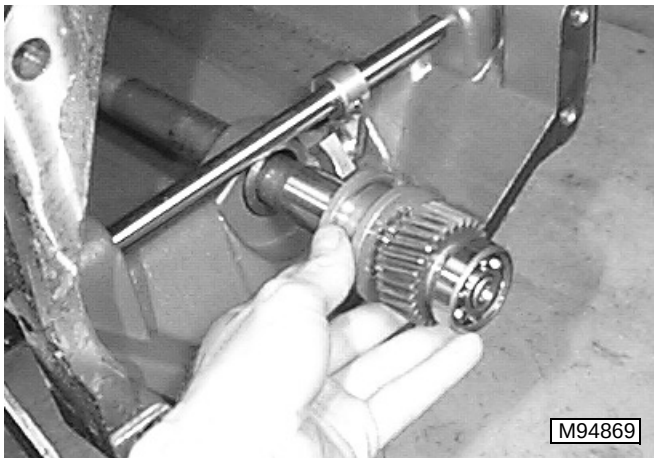
4. Remove bearing race (A) and spacer (B) from shaft.



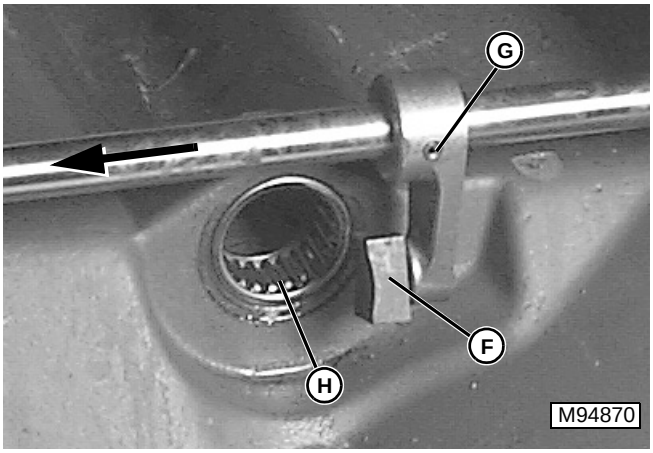
5. If not already done, remove drive shaft (C).



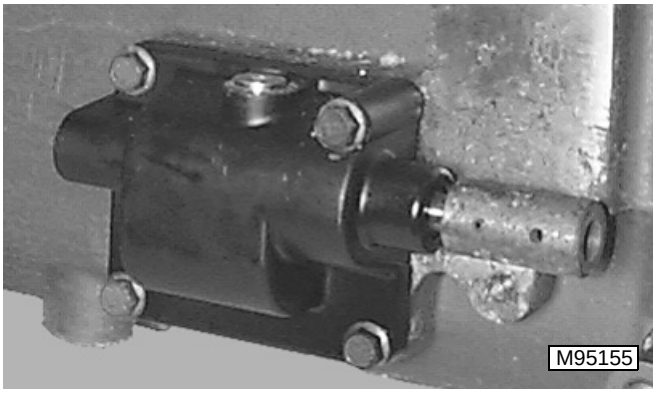
6. If equipped, rotate 4-WD shift lever (E) until shoe (F) clears shift collar.



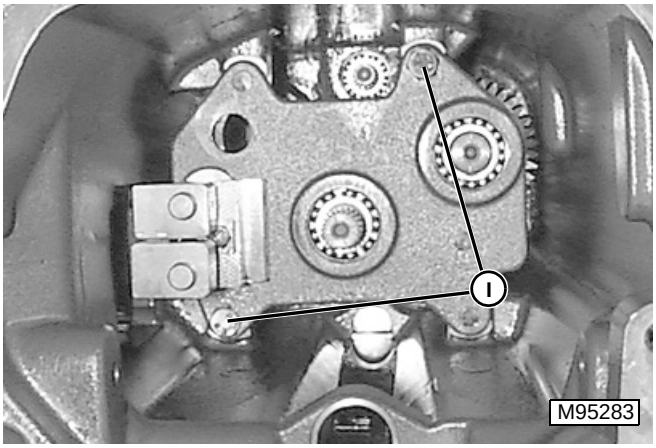
7. Remove shaft, gear, and shift collar as an assembly.



8. Remove spring pin (G) and slide shift shaft out of tunnel.
9. Inspect bearing (H) for wear or damage. Replace if necessary.
10. Inspect shoe (F) for wear or damage. Replace if necessary.

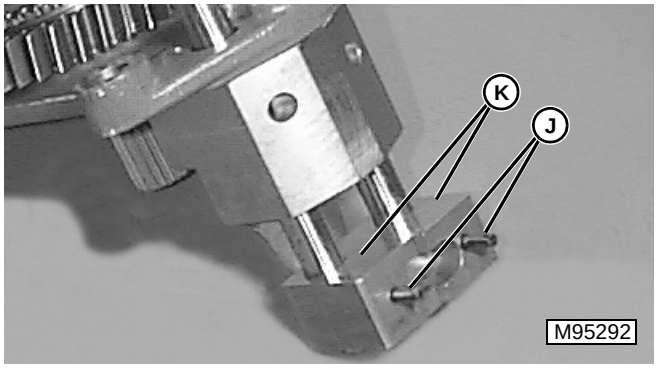


11. On LH side of tunnel, remove four cap screws and shifter assembly.

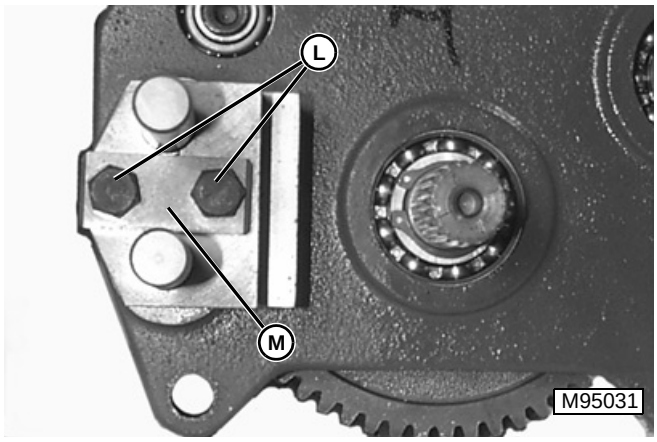


12. Remove two cap screws (I) and three speed transmission.

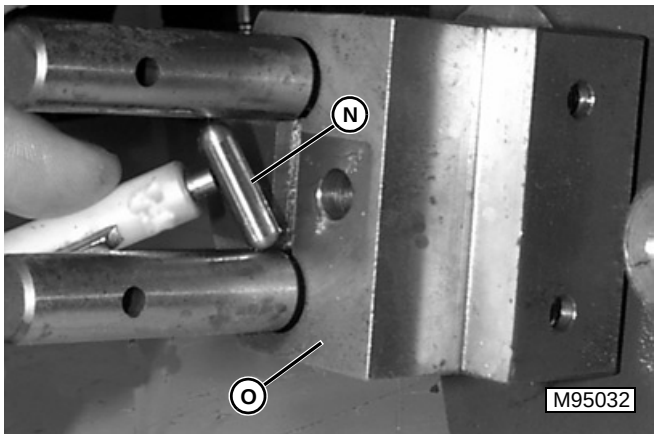
3-SPEED TRANSMISSION DISASSEMBLY



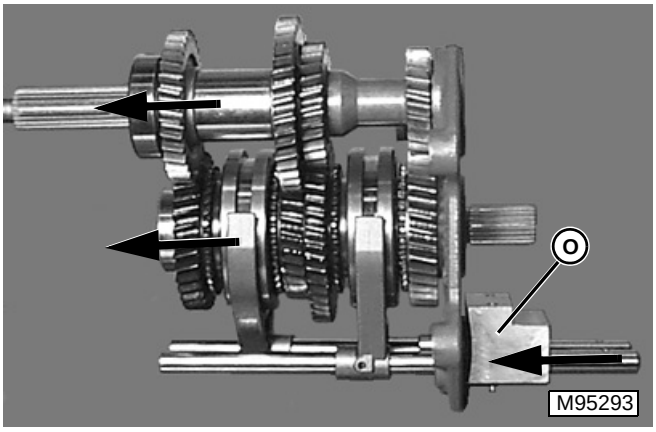
13. Remove two spring pins (J) and two shift gate blocks (K).



14. Remove two cap screws (L) and cover plate (M).

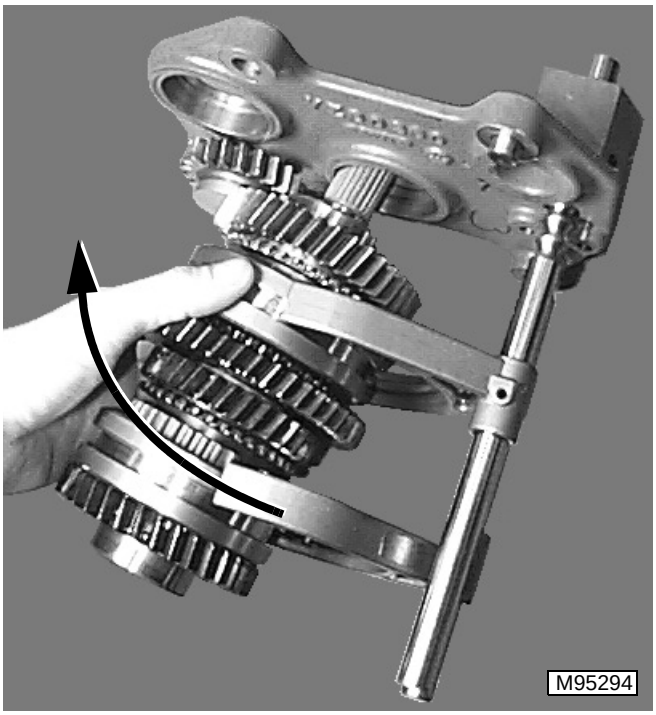


15. Remove interlock pin (N).

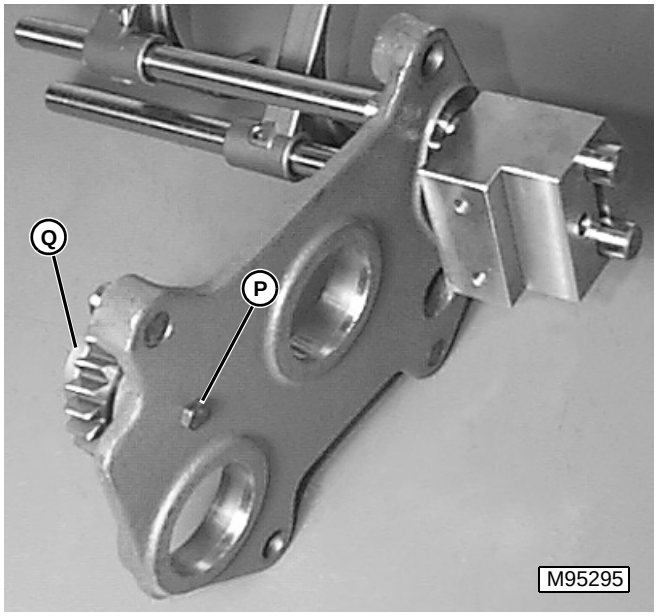


NOTE: Do not push shift rods too far into guide block (O). Guide block contains two detent balls and springs which may be lost.

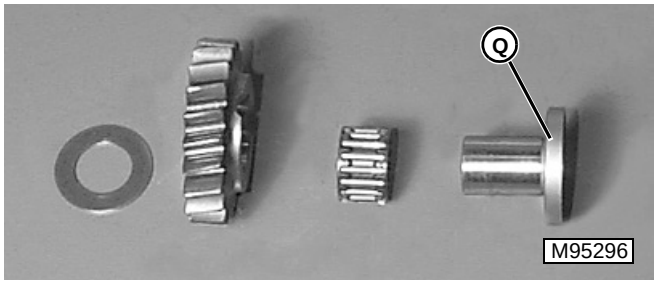
16. Using a plastic mallet, drive both shift rods toward gears and shafts. Tap on end of output shaft to loosen shafts and gears, and remove reverse shaft and pinion shaft from bearing plate.



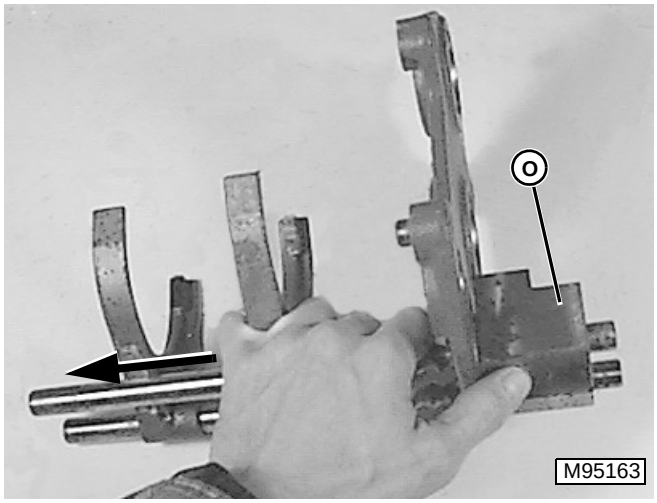
17. Rotate assembly away from shift forks, and remove.



18. Remove cap screw (P) and idler shaft (Q) assembly.

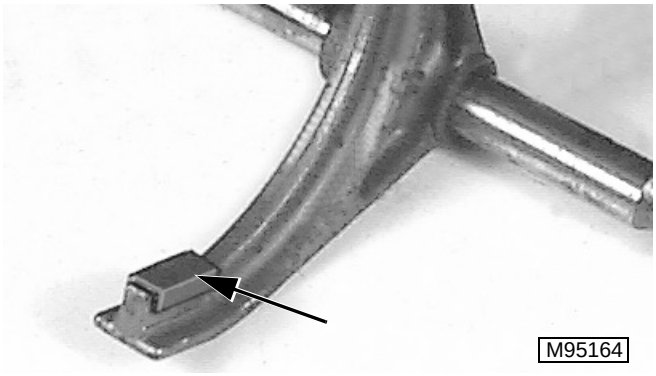


19. Remove thrust washer, gear, and bearing from shaft. Inspect parts for wear or damage. Replace as needed.

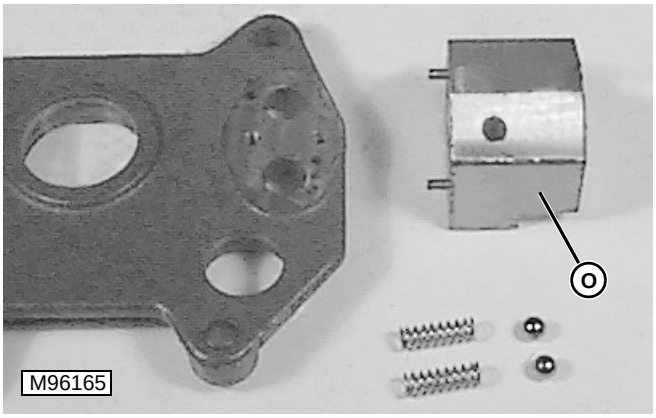


NOTE: Use care when removing shift rods from guide block (O). Guide block contains two detent balls and springs which may be lost.

20. Remove two shift rods and forks from guide block.

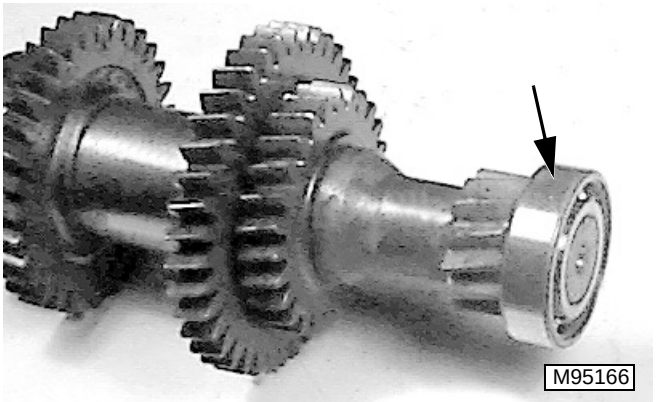


21. Inspect shift fork inserts for wear or damage. Replace if necessary.

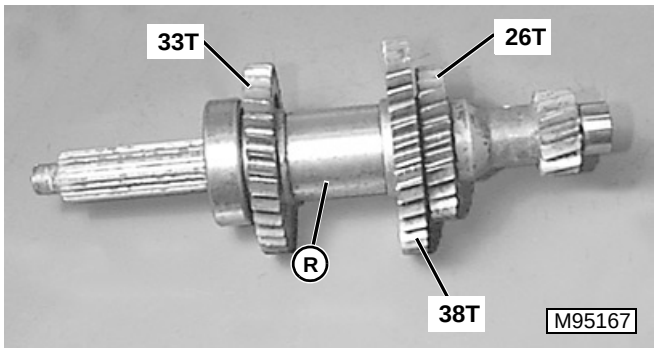


22. Remove two detent balls and springs from guide block (O). Inspect parts for wear or damage. Replace parts as needed.

Pinion Shaft Disassembly:



1. Using a suitable puller, or press, remove bearing from end of pinion shaft.
2. Inspect bearing for wear or damage. Replace if needed.



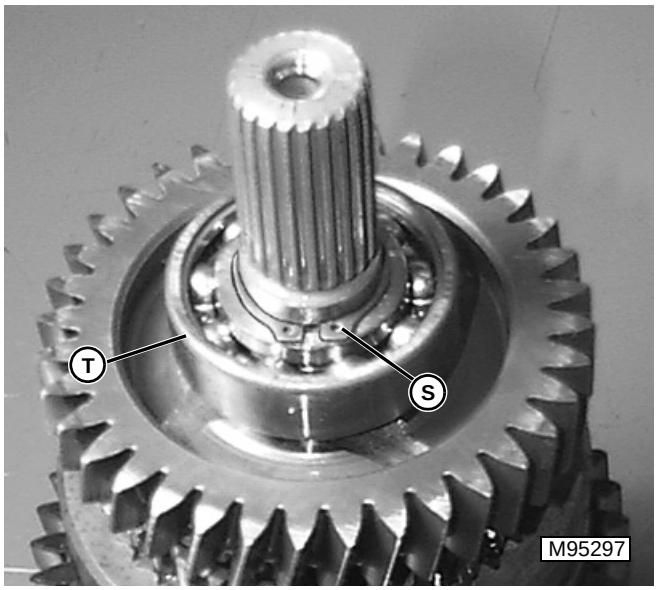
3. Using a suitable puller, or press, remove bearing, 33 tooth gear, spacer (R), 38 tooth gear, and 26 tooth gear from pinion shaft.

Pinion Shaft Assembly:

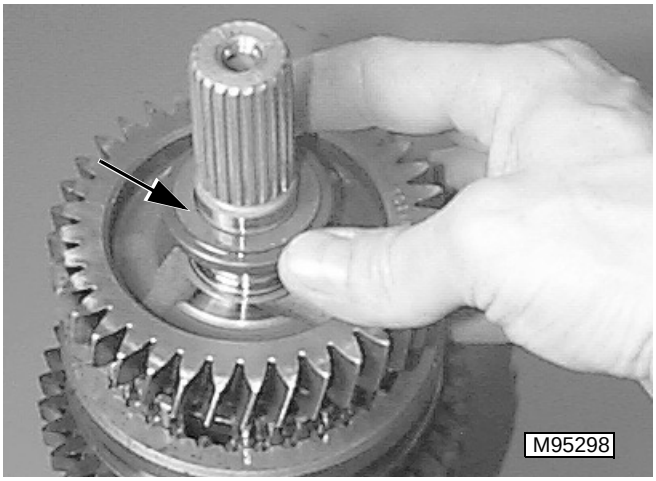
Assembly is the reverse of disassembly.

- Lubricate parts liberally with hydraulic oil before assembling.
- Install 38 tooth gear with larger flange facing toward spacer.

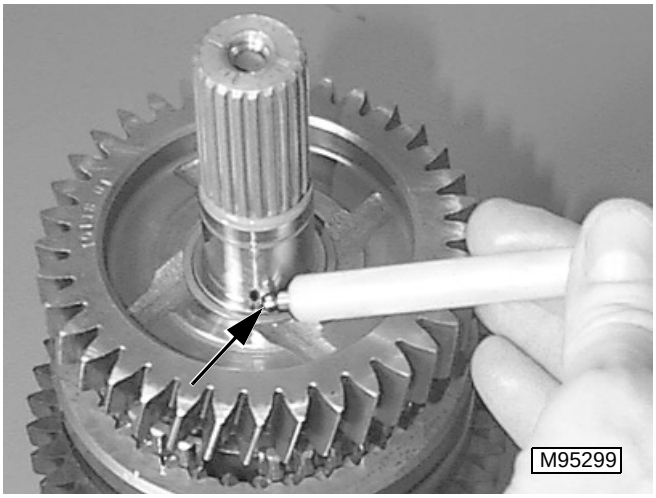
Output Shaft Disassembly:



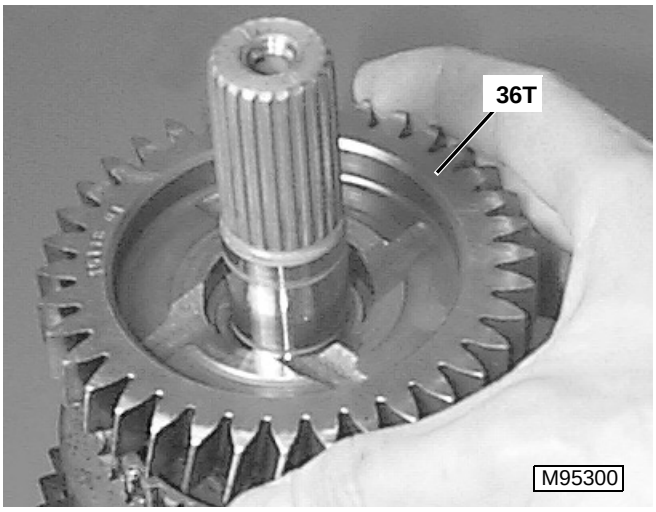
1. Remove snap ring (S).
2. Using a suitable puller or press, remove bearing (T) from end of shaft.



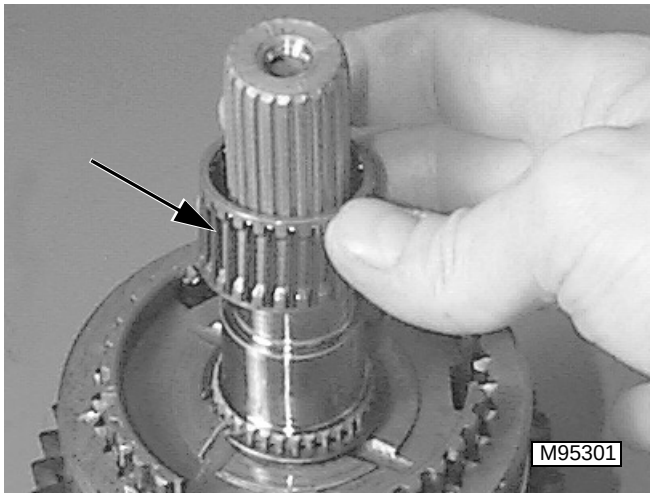
3. Remove thrust washer.



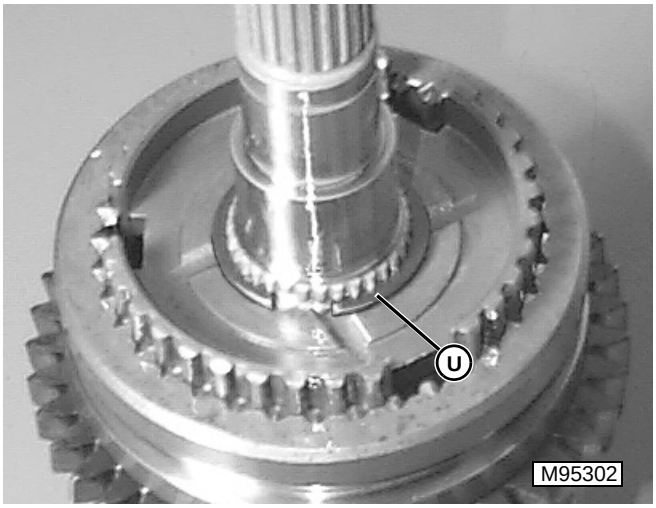
4. Remove ball from hole in shaft.



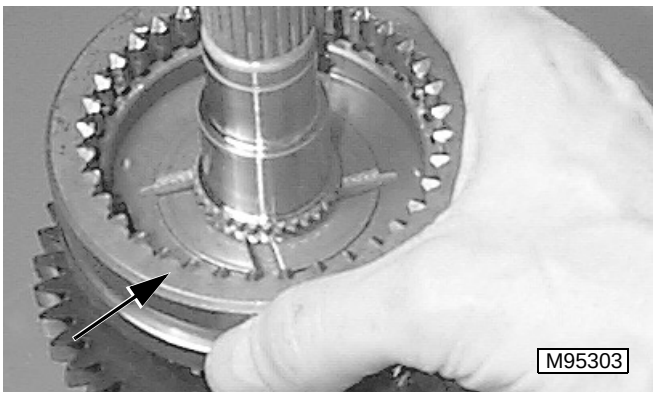
5. Remove 36 tooth gear.



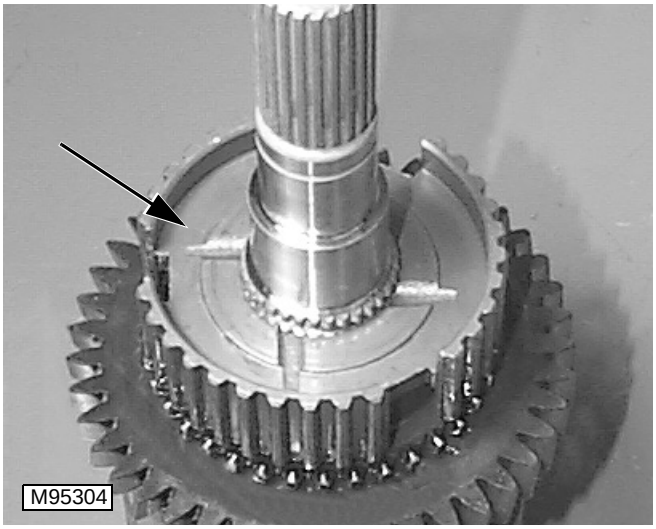
6. Remove roller bearing.



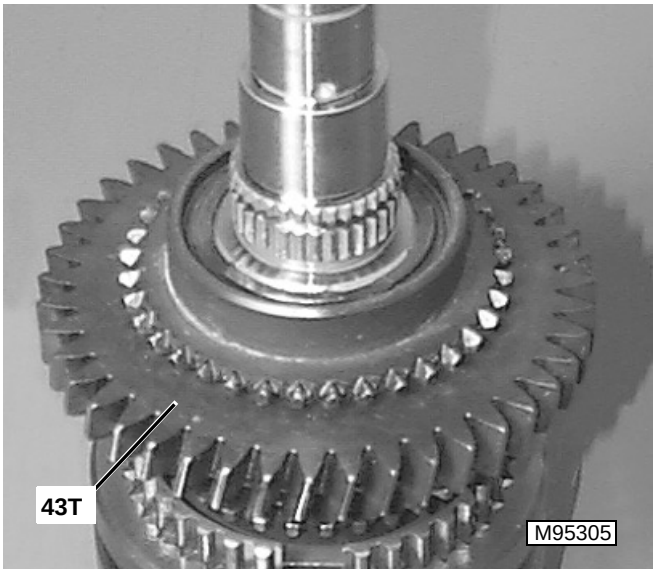
7. Remove snap ring (U).



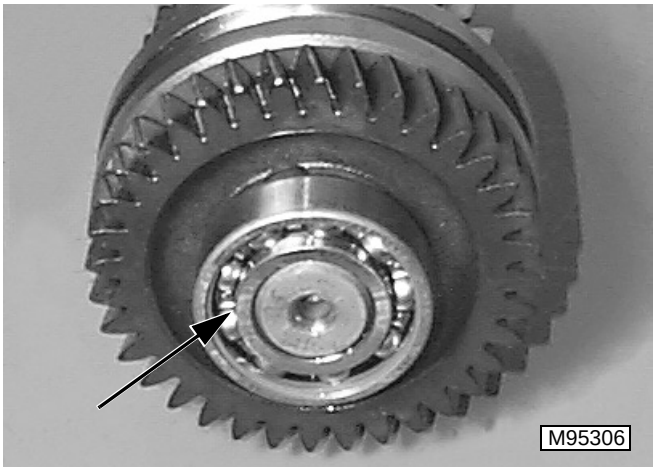
8. Remove shift collar.



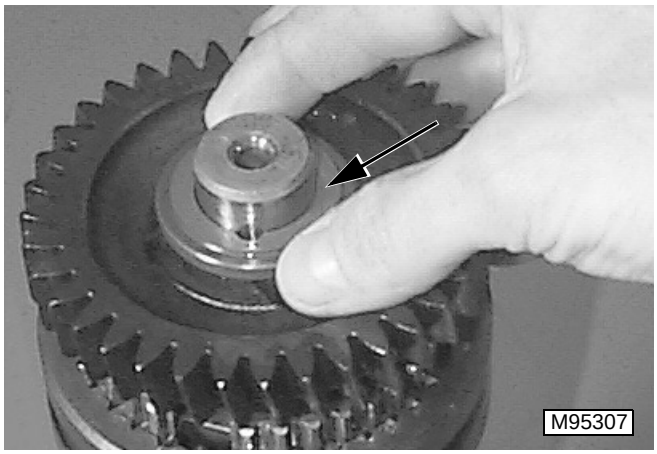
9. Remove shift collar hub.



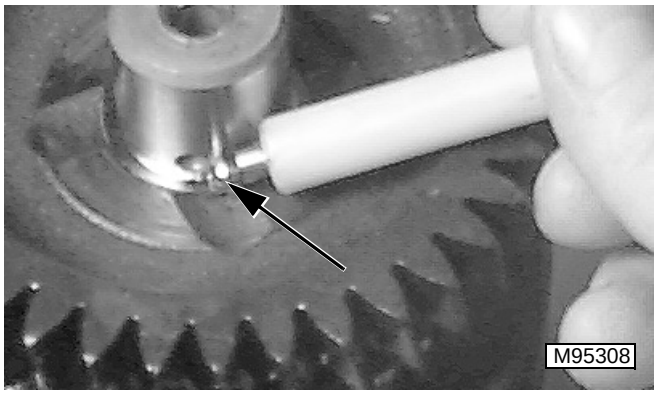
10. Remove 43 tooth gear.



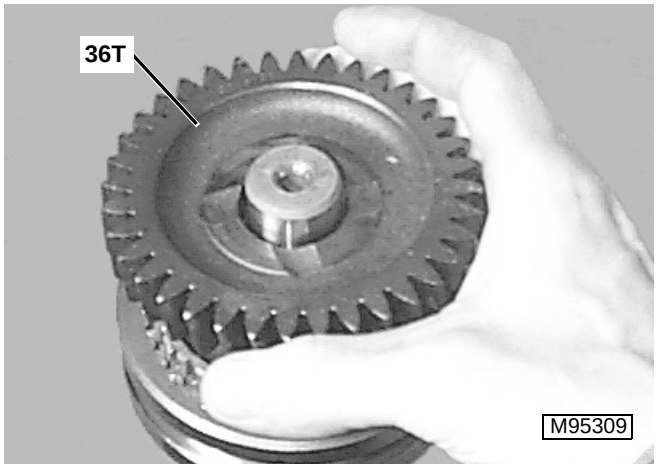
11. Remove bearing from other end of shaft.



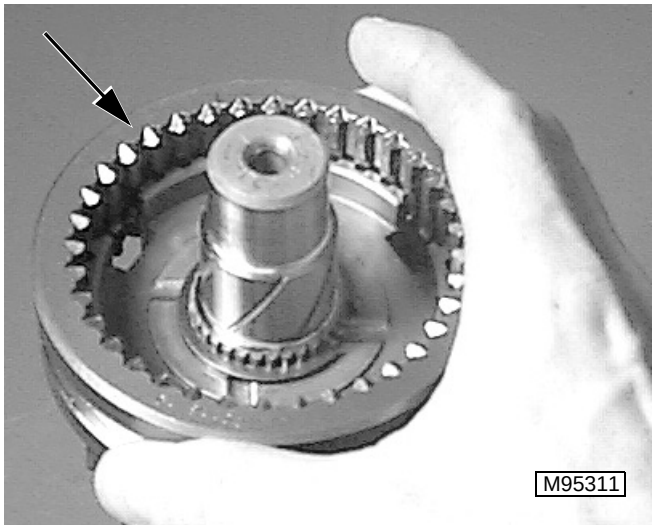
12. Remove thrust washer.



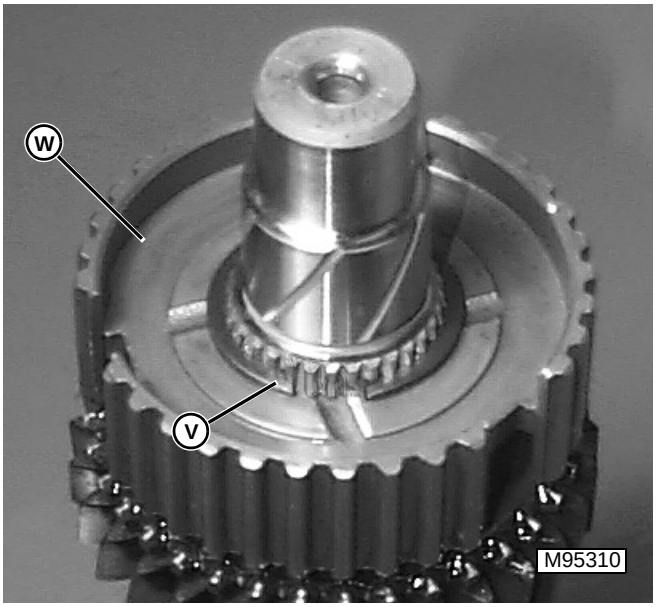
13. Remove ball.



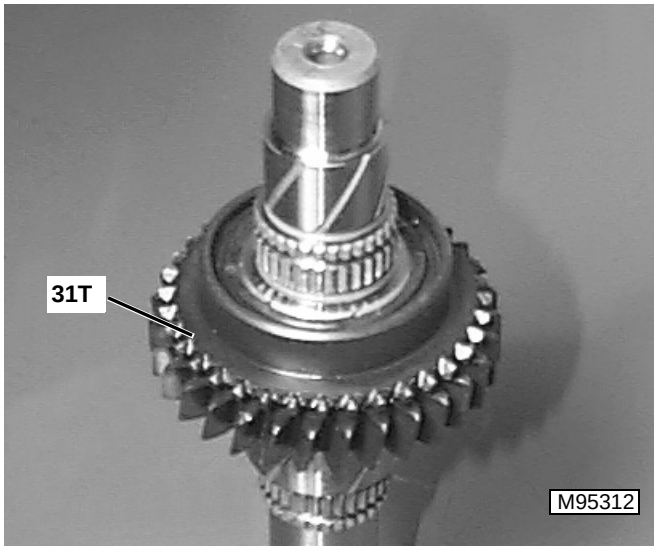
14. Remove 36 tooth gear.



15. Remove shift collar.



16. Remove snap ring (V).
17. Remove shift collar hub (W).

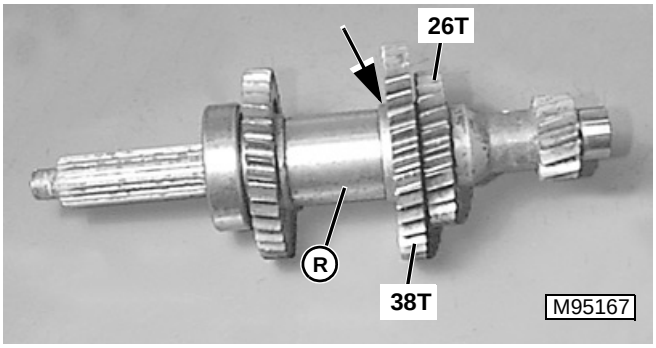


18. Remove 31 tooth gear.

3-SPEED (CST) TRANSMISSION ASSEMBLY/INSTALLATION

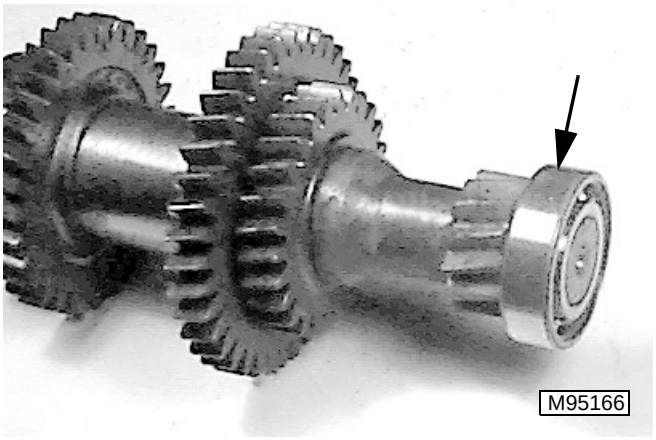
Pinion Shaft Assembly:

IMPORTANT: Lubricate parts liberally with hydraulic oil before assembling.



NOTE: Install 38 tooth gear with larger flange facing toward spacer (R).

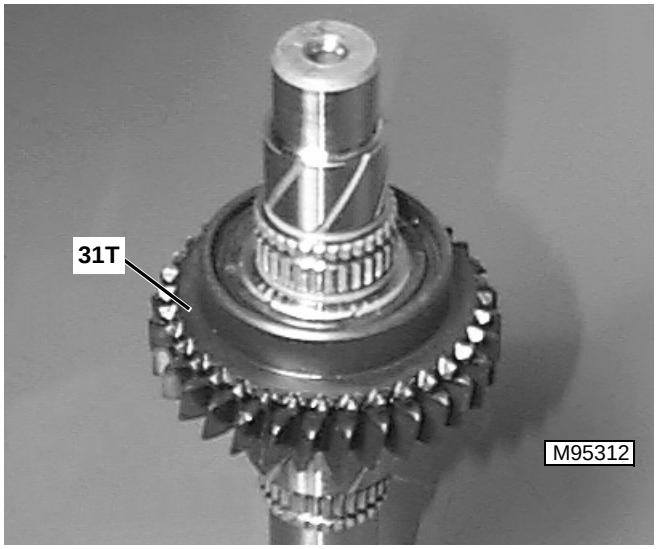
1. Using a press, install 26 tooth gear, 38 tooth gear, spacer (R), 33 tooth gear, and bearing to pinion shaft.



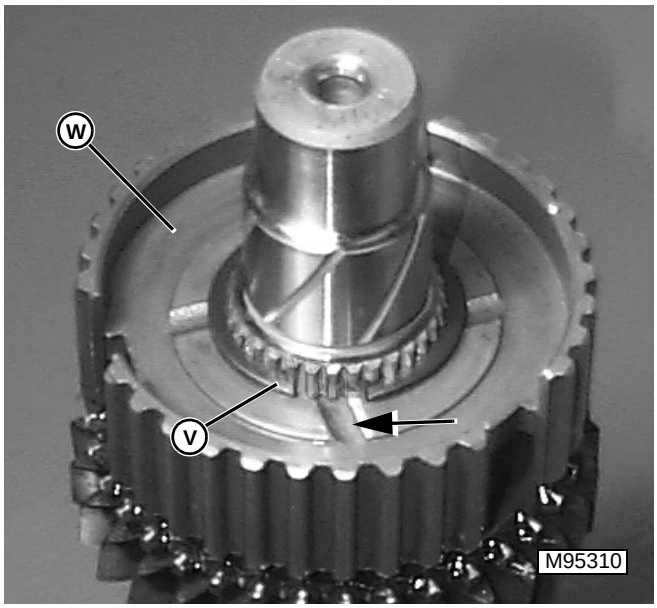
2. Using a press, install bearing onto end of pinion shaft.

Output Shaft Assembly:

IMPORTANT: Lubricate all parts liberally with clean hydraulic oil during assembly.

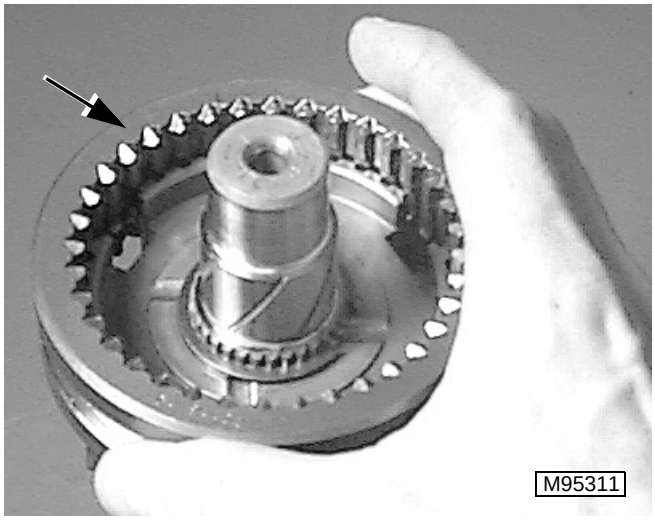


1. Install 31 tooth gear onto output shaft.

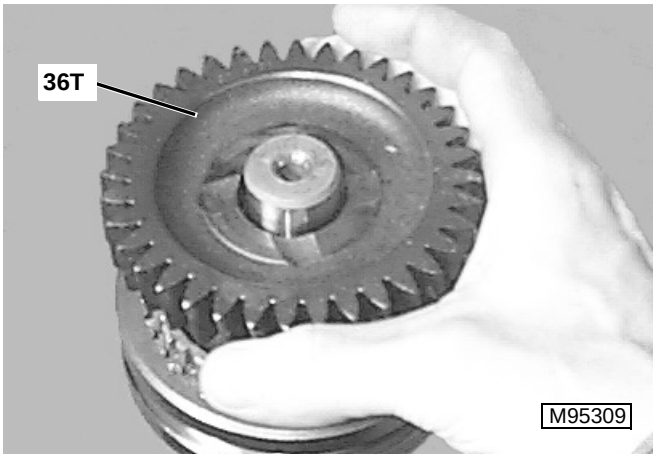


IMPORTANT: Shift collar hub should be placed on shaft with four oil grooves facing up.

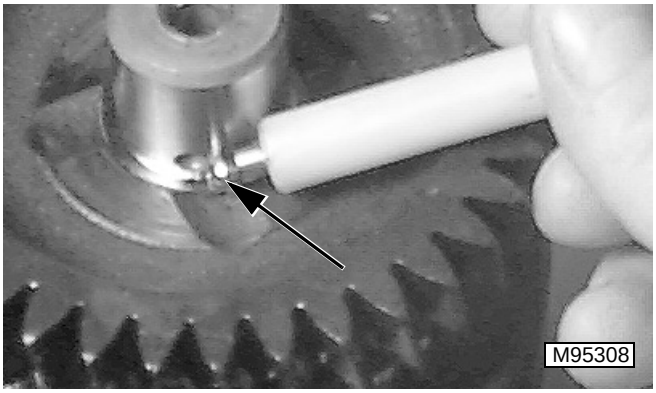
2. Install shift collar hub (W), and retain with snap ring (V).



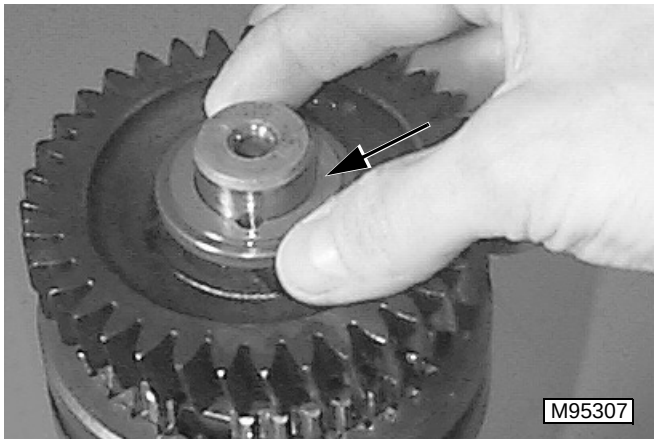
3. Install shift collar.



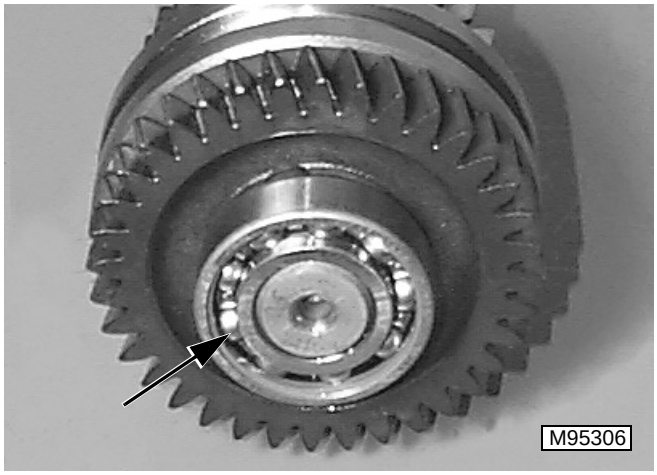
4. Install 36 tooth gear.



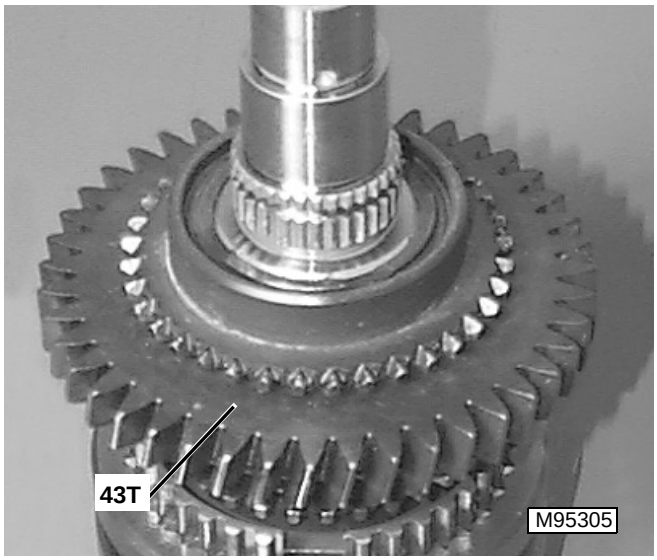
5. Install ball into hole in shaft.



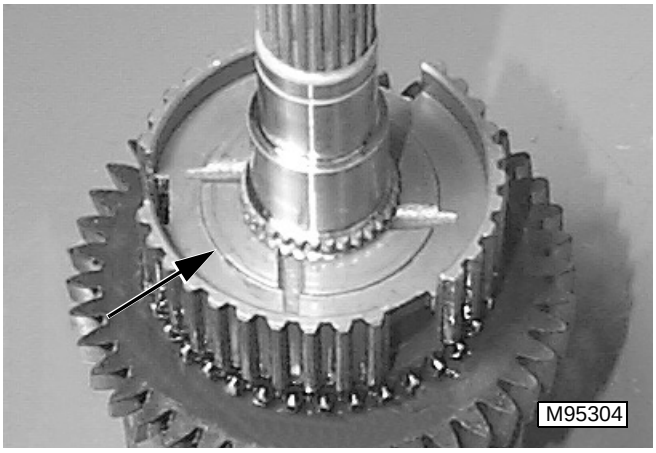
6. Install thrust washer.



7. Using a press, or suitable bearing driver and a soft-faced mallet, install bearing to end of shaft.

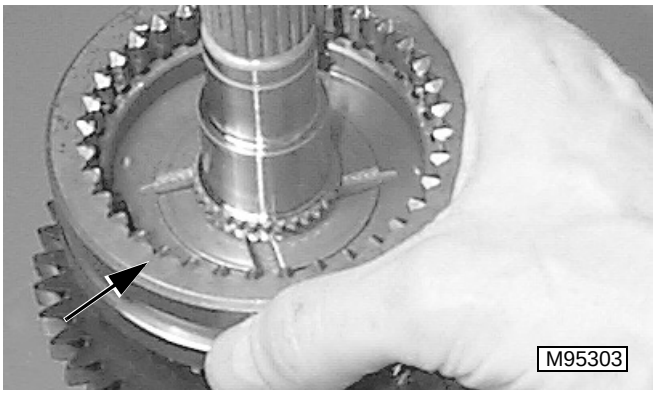


8. On other end of shaft, install 43 tooth gear.

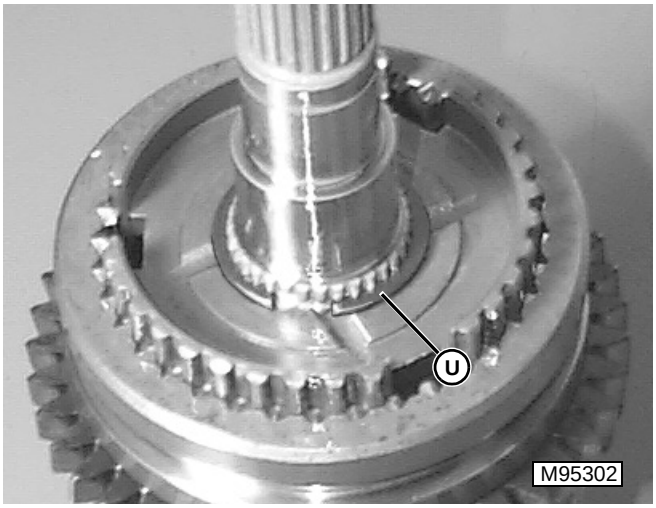


IMPORTANT: Shift collar hub should be placed on shaft with four oil grooves facing up.

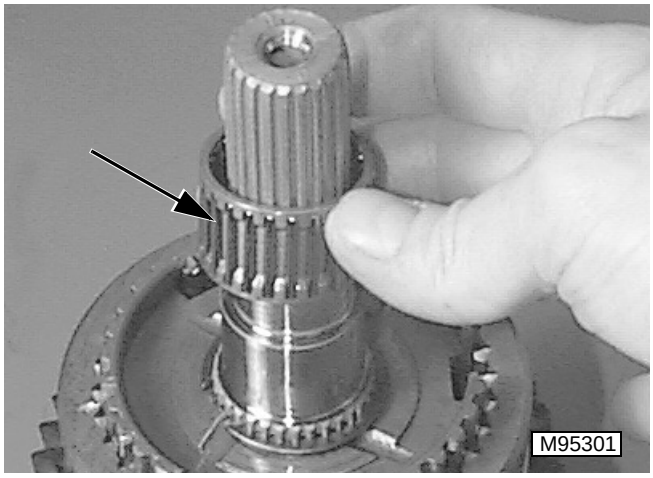
9. Install shift collar hub.



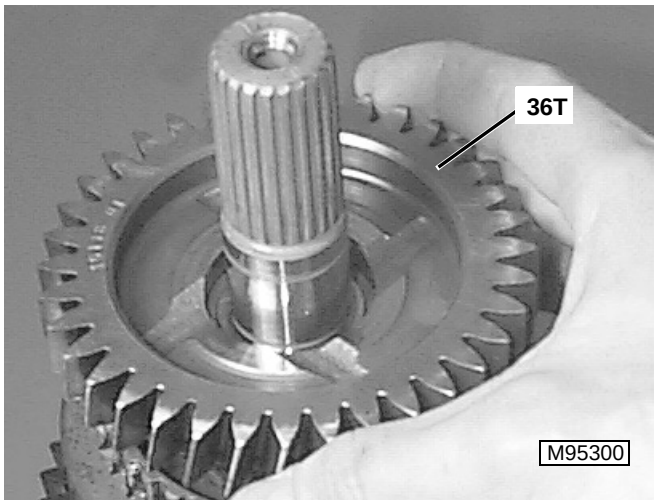
10. Install shift collar.



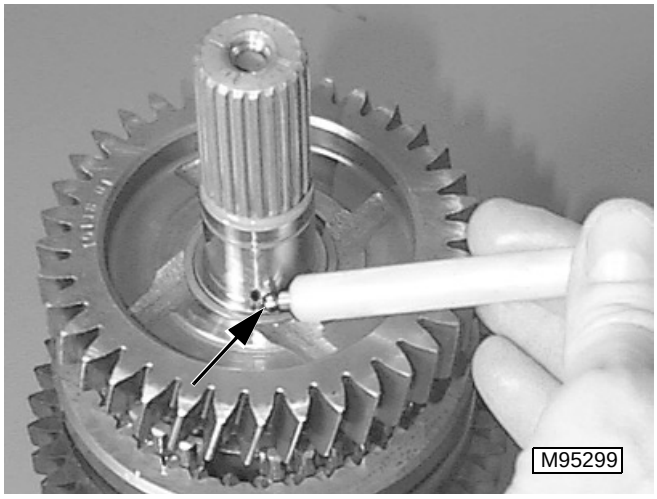
11. Install snap ring (U).



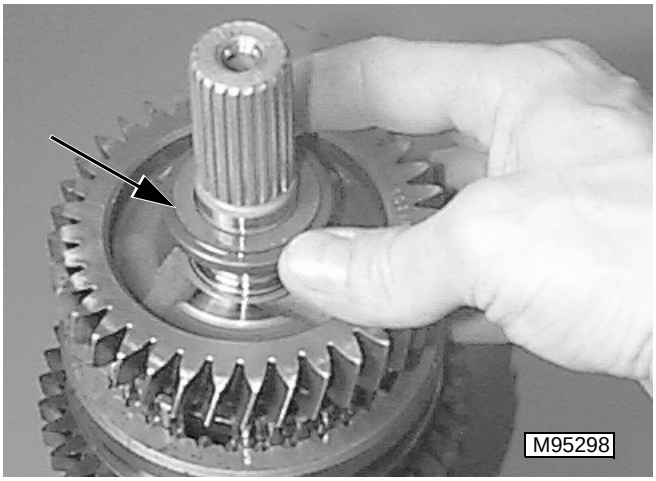
12. Install roller bearing.



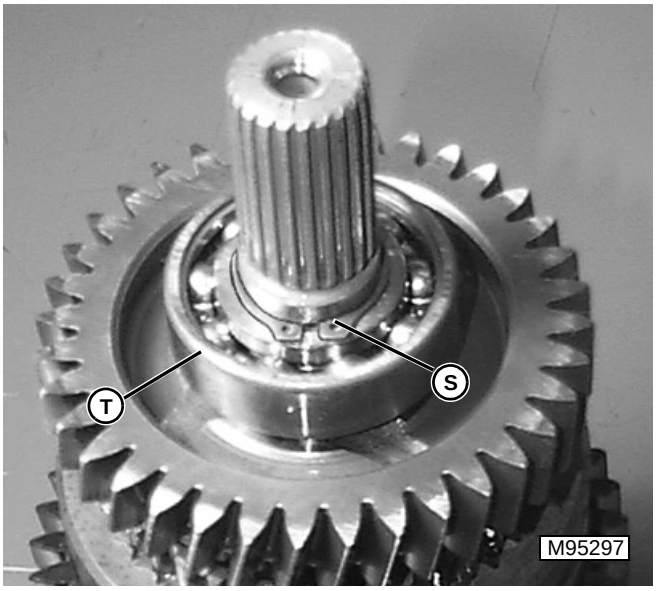
13. Install 36 tooth gear.



14. Install ball into hole in shaft.

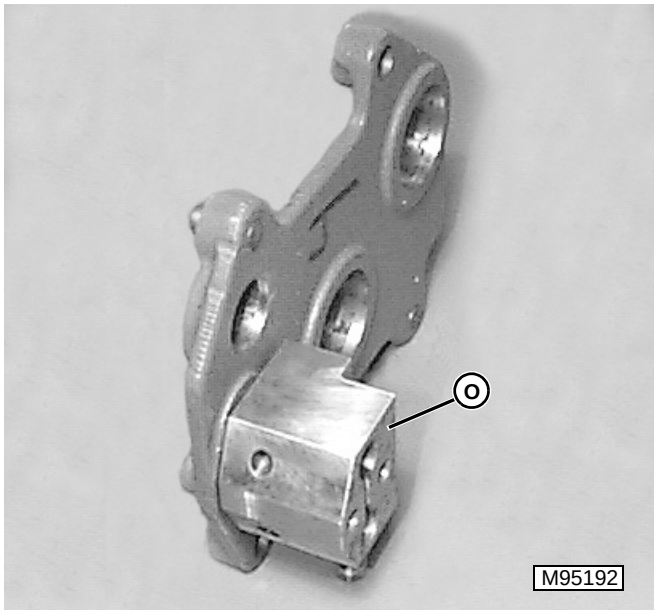


15. Install thrust washer.



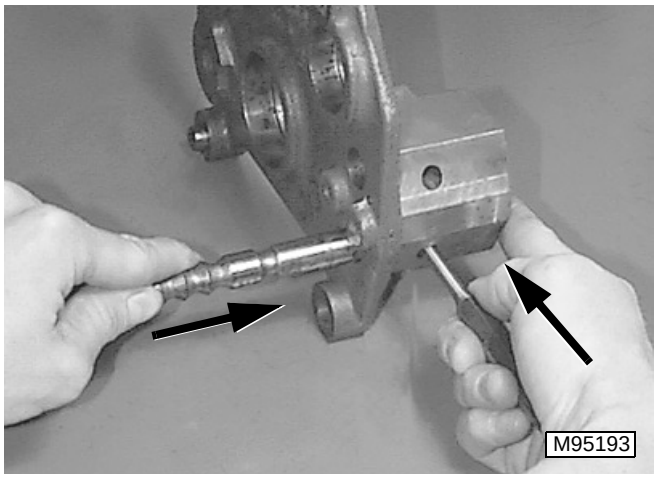
16. Using a press, or a suitable driver and a soft-faced mallet, install bearing (T) onto end of shaft. Retain with snap ring (S).

Assembly:

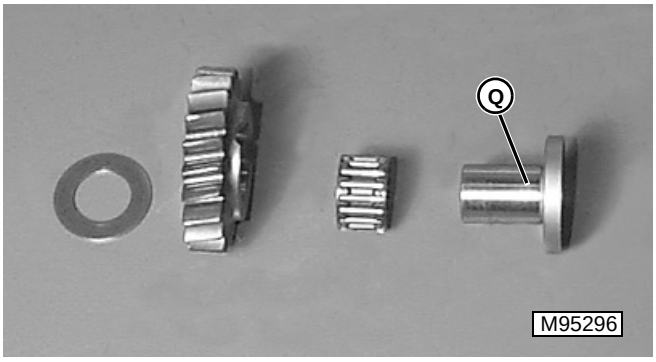


1. Install guide block (O) to bearing plate. Do not install cap screws at this time.

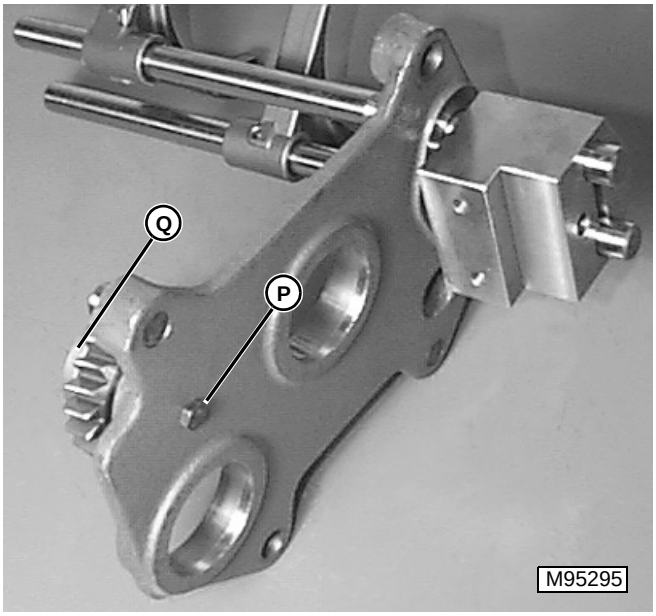
NOTE: New style bearing plates and guide blocks are a one piece casting and step one above is not necessary.



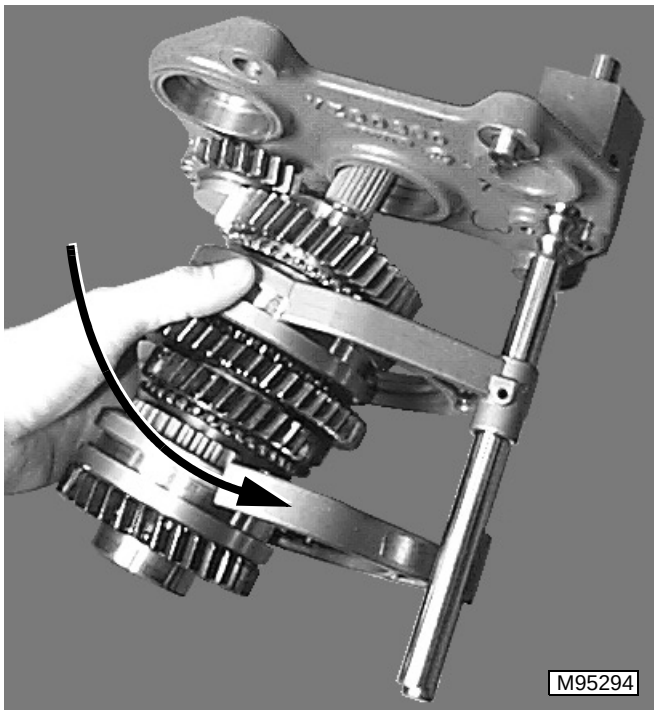
2. Install one spring and detent ball into guide block. Using a pin punch, compress the spring and hold ball while installing shift rod and fork assembly. Be sure shift rod and fork assembly is installed into correct hole.
3. Repeat for second shift rod and fork / detent ball and spring.



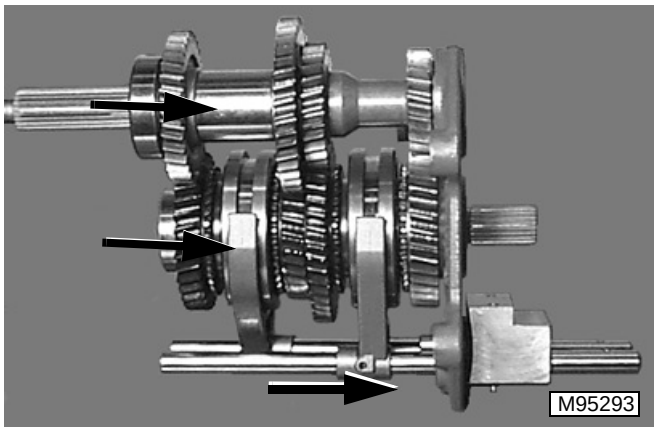
4. Install bearing, gear, and thrust washer onto idler shaft (Q).



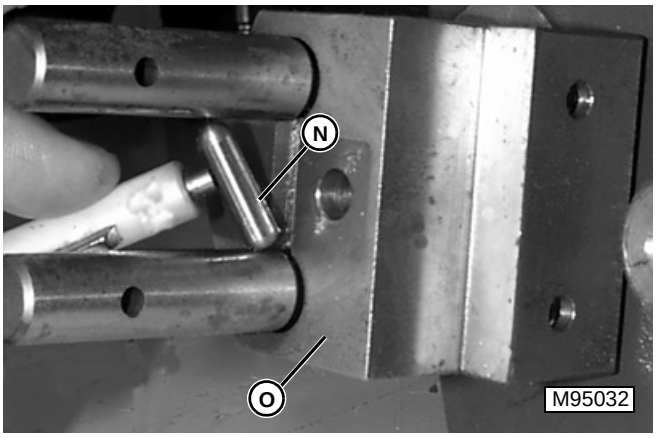
5. Install idler shaft (Q) to bearing plate. Retain with cap screw (P).
6. Rotate shift rods to correct positions.



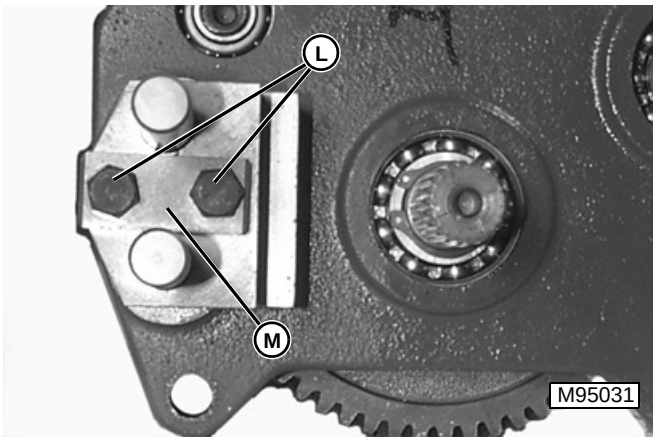
7. Install output shaft into bearing plate, and rotate to install onto shift forks.



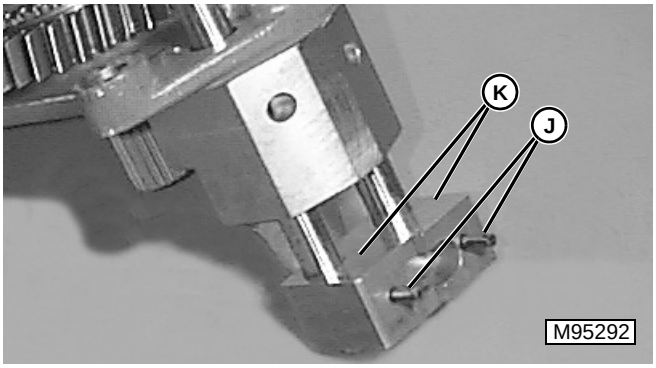
8. Install pinion shaft, and output shaft into bearing plate. Using a plastic mallet, tap shafts, gears, and two shift rods into bearing plate.



9. Properly align shift rods, and install interlock pin (N) into guide block (O).

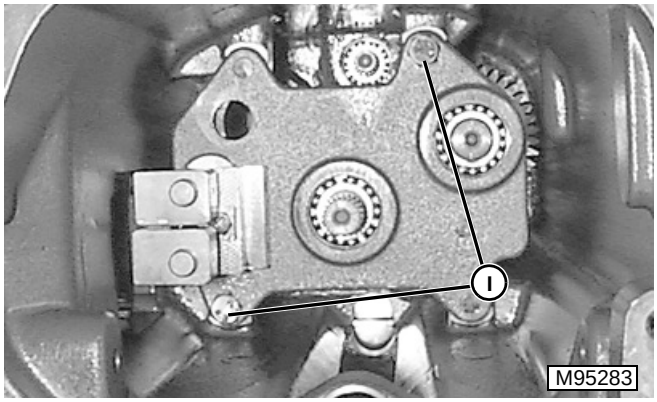


10. Install cover plate (M) and retain with two cap screws (L).



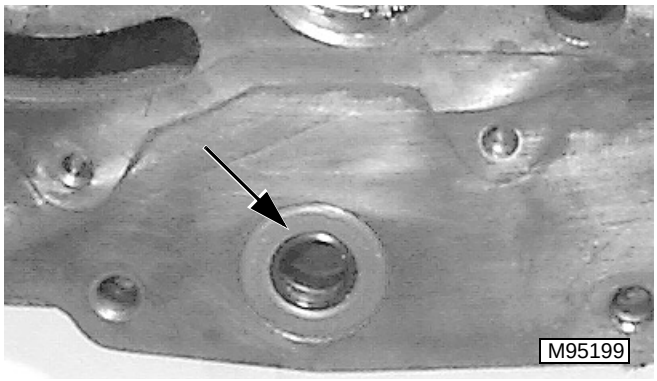
11. Install two shift gate blocks (K). Retain with two spring pins (J).

Installation:

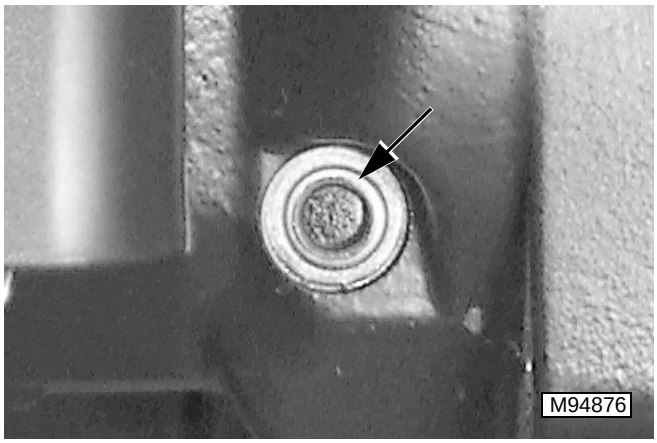


1. Align two bearings and two shift rods with holes in tunnel. Install transmission into housing and retain with two cap screws (I).

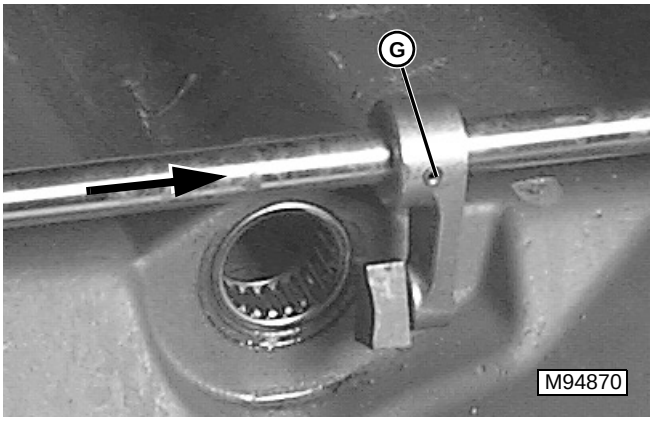
IMPORTANT: Replace O-rings and seals. Used O-rings and seals will leak.



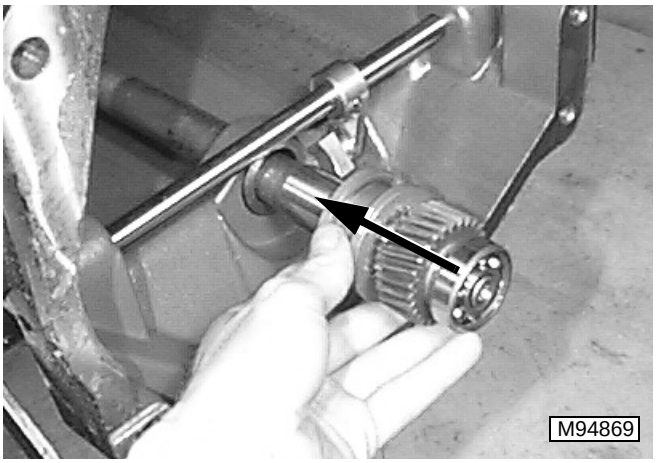
2. Install a new 4-WD drive shaft seal at front of tunnel.



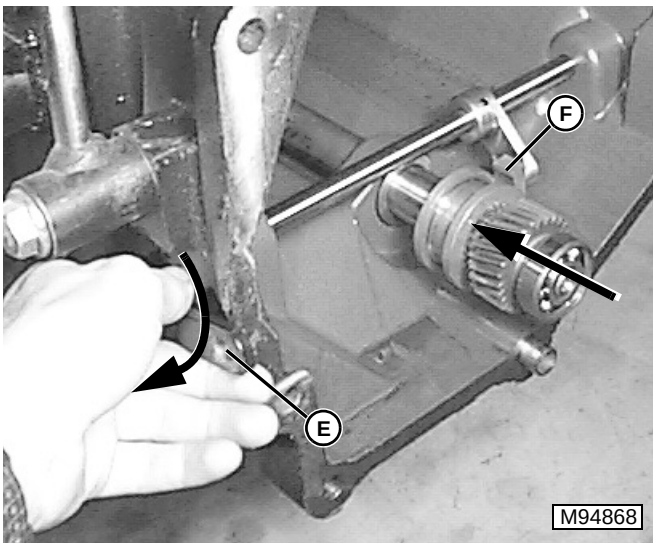
3. Install a new 4-WD shift shaft seal into tunnel.



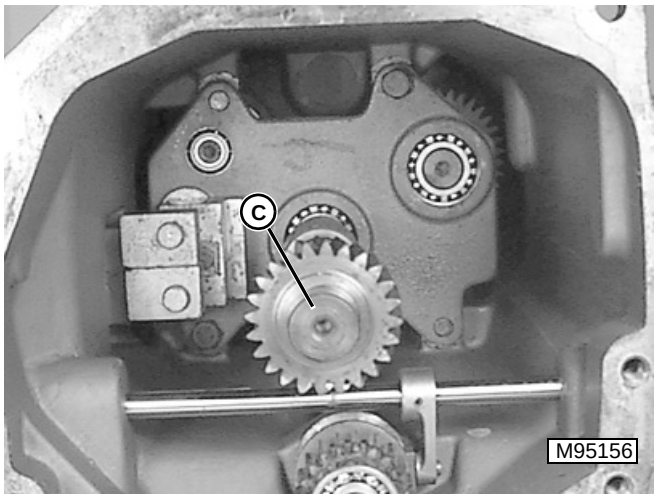
4. Slide 4-WD shift shaft into tunnel and through shift arm. Retain shift arm to shaft with spring pin (G).



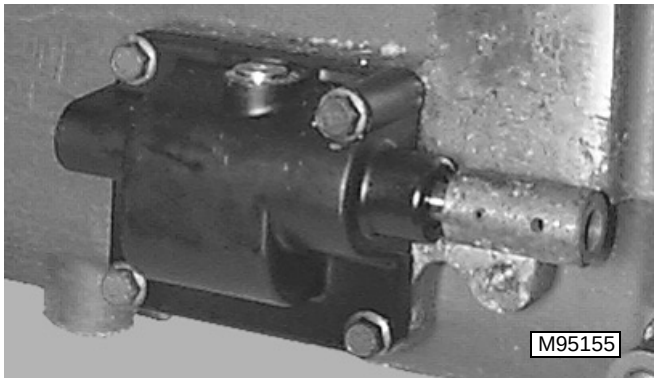
5. Insert 4-WD drive shaft assembly into tunnel.



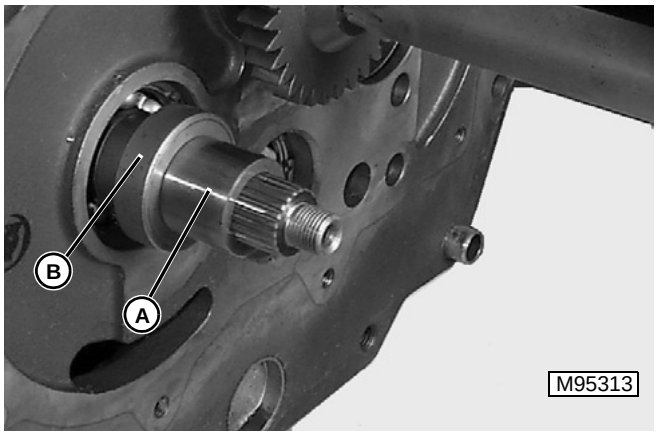
6. Engage shoe (F) to shift collar and rotate 4-WD shift lever (E) to draw 4-WD shaft into place.



7. Install drive shaft (C).



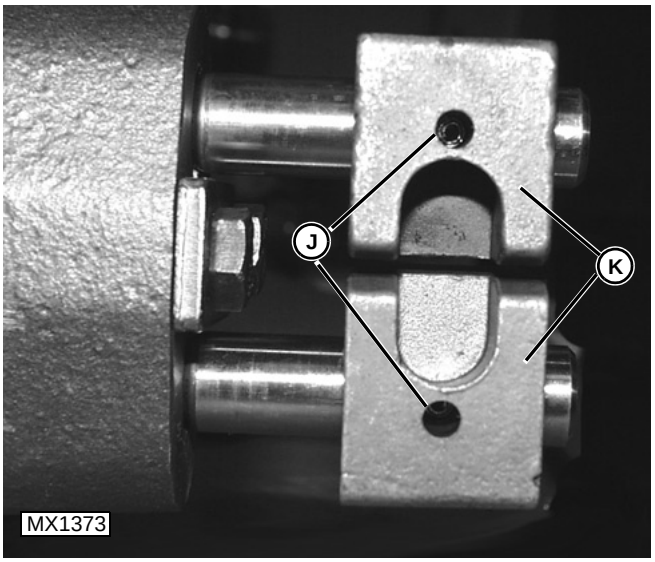
8. On LH side of tunnel, install shifter assembly and retain with four cap screws.



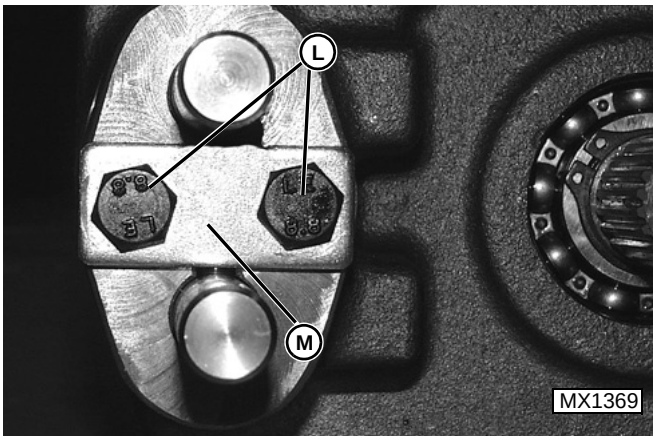
9. Install spacer (B) and bearing race (A) to input shaft.
10. Install clutch. (See "COLLAR SHIFT AND SYNC SHIFT TRACTION CLUTCH INSTALLATION").

11. Assemble tractor tunnel and differential housing sections. (See "TRACTOR SPLITTING REAR" in the Final Power Train section.)
12. Assemble tractor flywheel housing and tunnel sections. (See "TRACTOR SPLITTING FRONT").

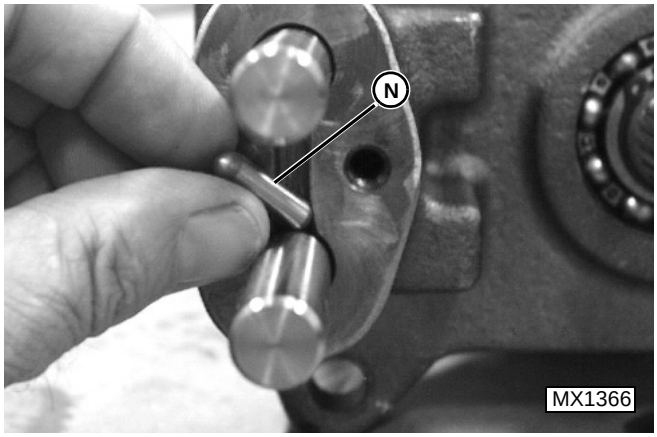
3 SPEED SYNCHRONIZED TRANSMISSION DISASSEMBLY



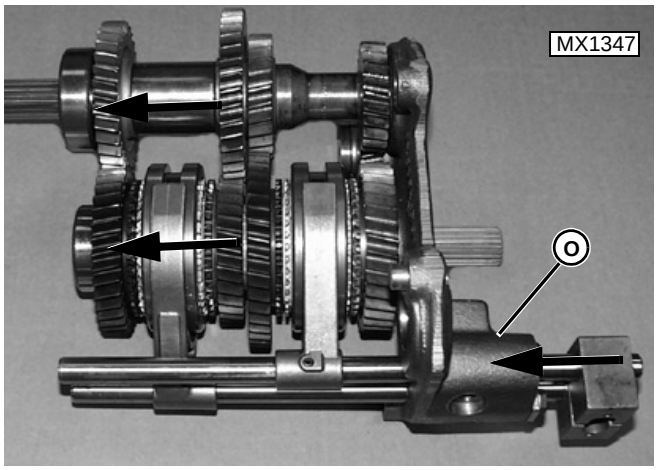
1. Remove two spring pins (J) and two shift gate blocks (K).



2. Remove two cap screws (L) and cover plate (M).

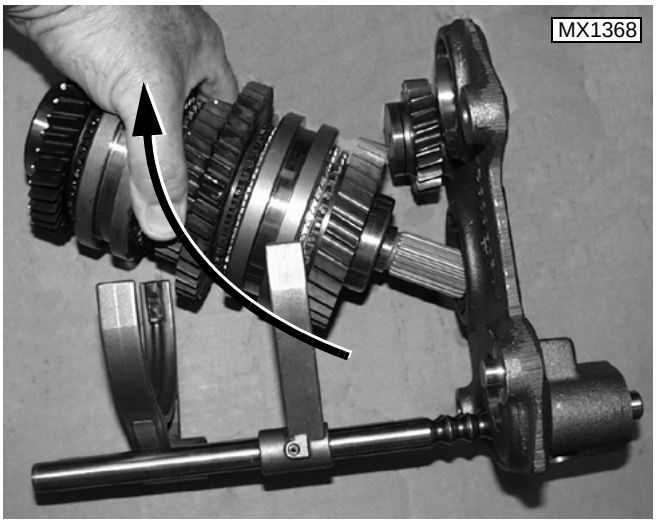


3. Remove interlock pin (N).

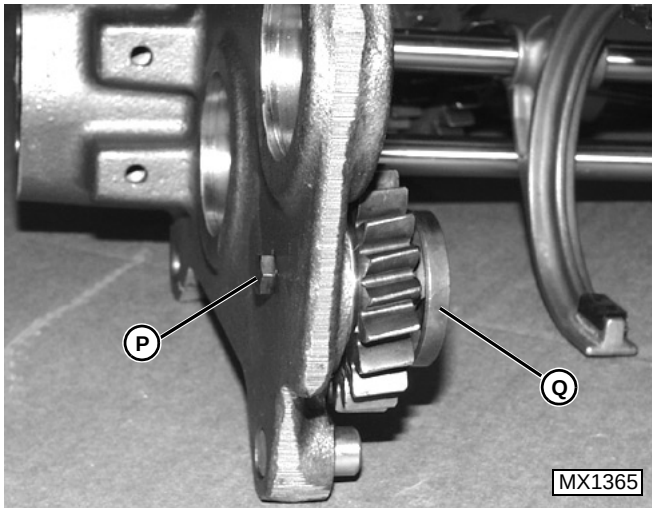


NOTE: Do not push shift rods too far into shift rod housing (O). Housing contains two detent balls and springs which may be lost.

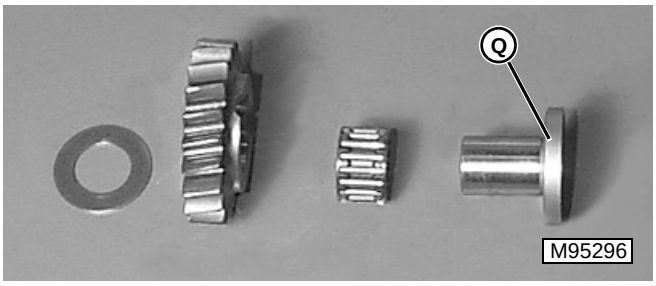
4. Using a plastic mallet, drive both shift rods toward gears and shafts. Tap on end of output shaft to loosen shafts and gears, and remove reverse shaft and pinion shaft from bearing plate.



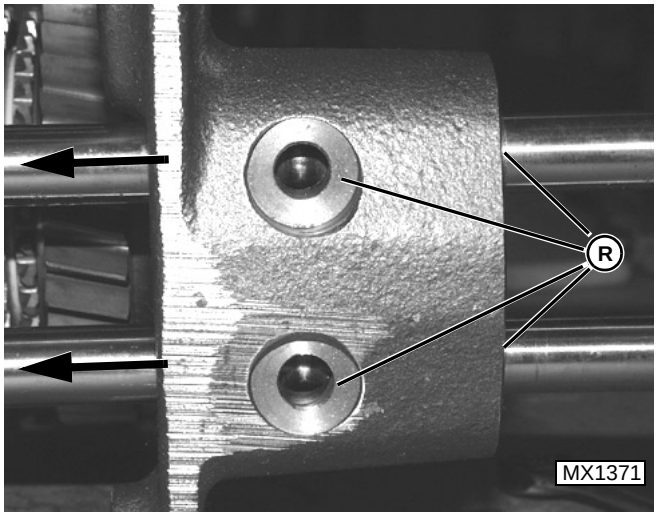
5. Rotate assembly away from shift forks, and remove.



6. Remove cap screw (P) and idler shaft and gear assembly (Q).

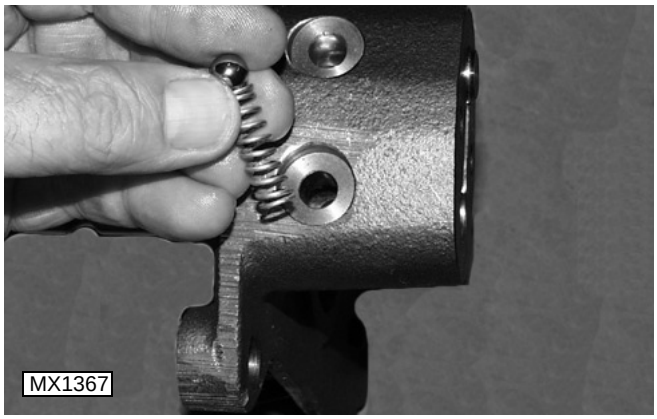


7. Remove thrust washer, gear, and bearing from shaft. Inspect parts for wear or damage. Replace as needed.

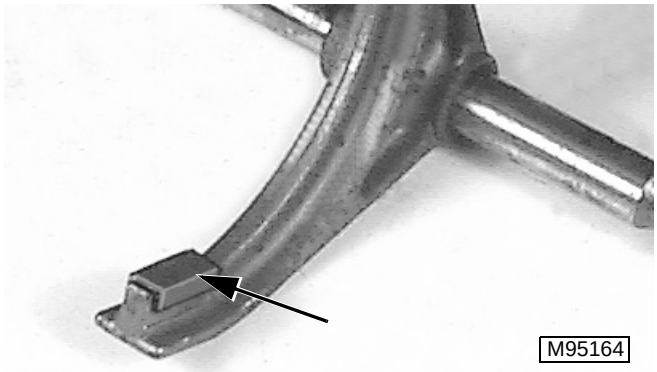


NOTE: Use care when removing shift rods from shift rod housing. Cover holes (R) in guide block to avoid loosing detent balls and springs.

8. Remove two shift rods and forks from guide block.

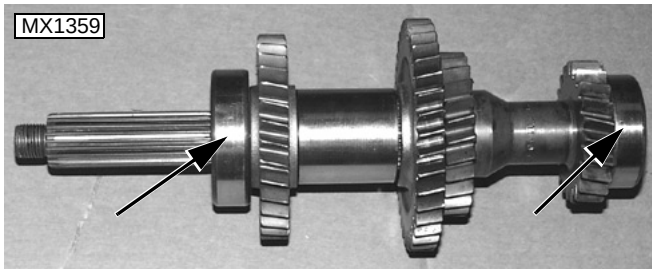


9. Remove two detent balls and springs from shift rod housing (O). Inspect parts for wear or damage. Replace parts as needed.

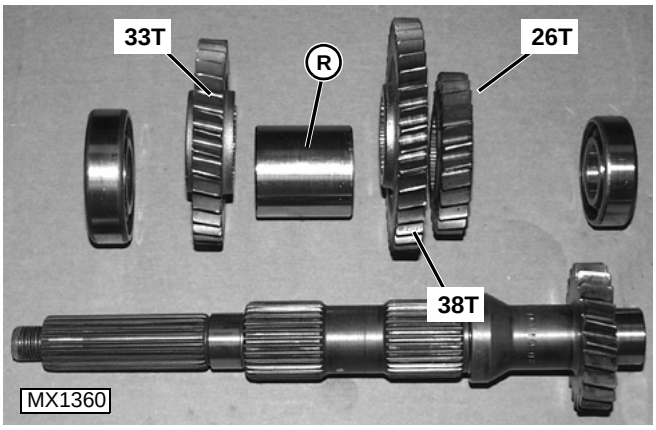


10. Inspect shift fork inserts for wear or damage. Replace if necessary.

Pinion Shaft Disassembly:



1. Using a suitable puller, or press, remove bearings from pinion shaft.
2. Inspect bearings for wear or damage. Replace if needed.

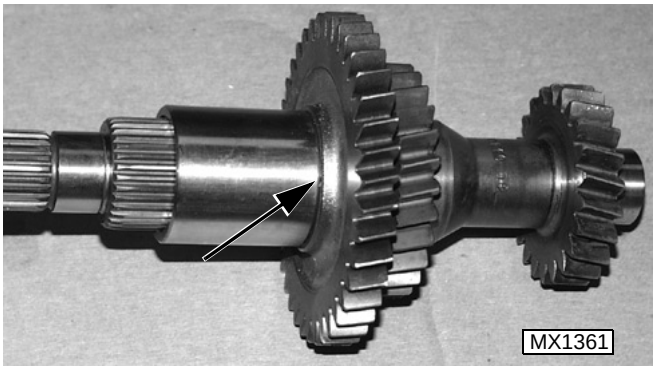


3. Slide 33 tooth gear, spacer (R), 38 tooth gear, and 26 tooth gear from pinion shaft.

Pinion Shaft Assembly:

Assembly is the reverse of disassembly.

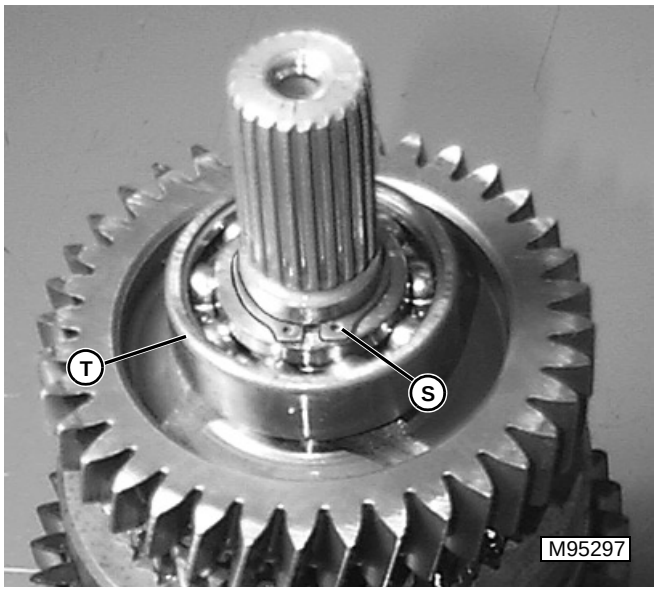
- Lubricate parts liberally with hydraulic oil before assembling.



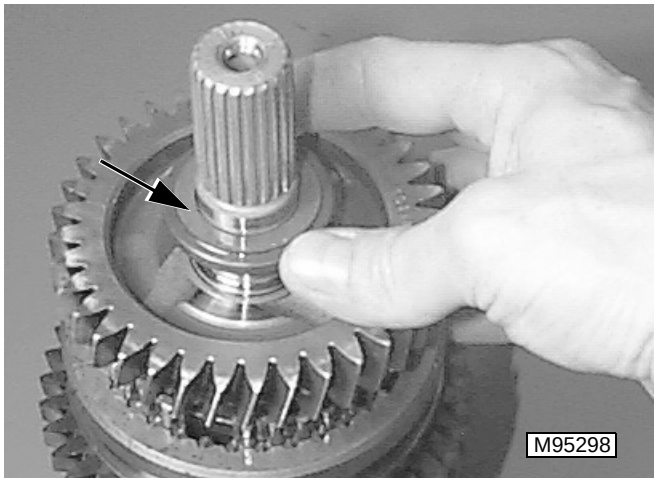
- Install 38 tooth gear with raised side of hub facing toward spacer as shown.

1. Install 26 tooth gear, 38 tooth gear, spacer (R), and 33 tooth gear. Press bearings onto pinion shaft.

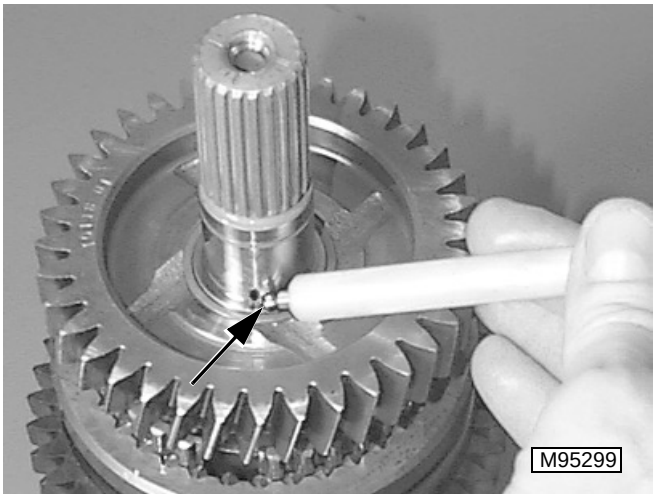
Output Shaft Disassembly:



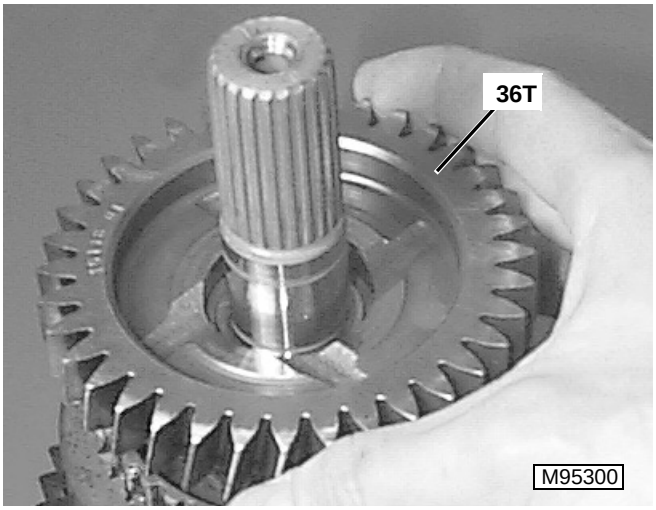
1. Remove snap ring (S).
2. Using a suitable puller or press, remove bearing (T) from end of shaft.



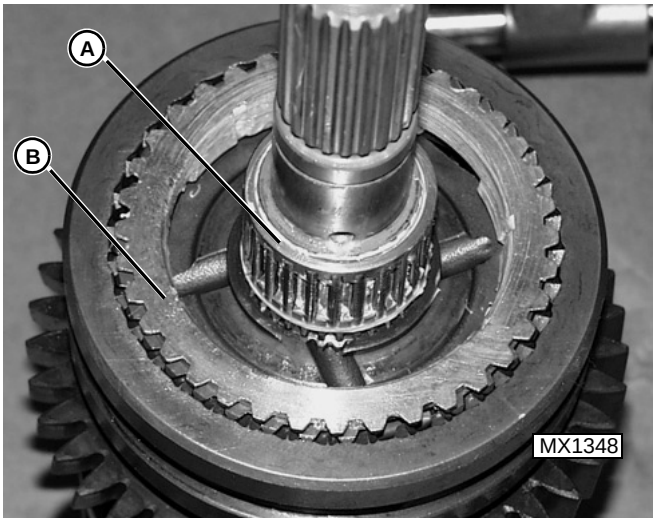
3. Remove thrust washer.



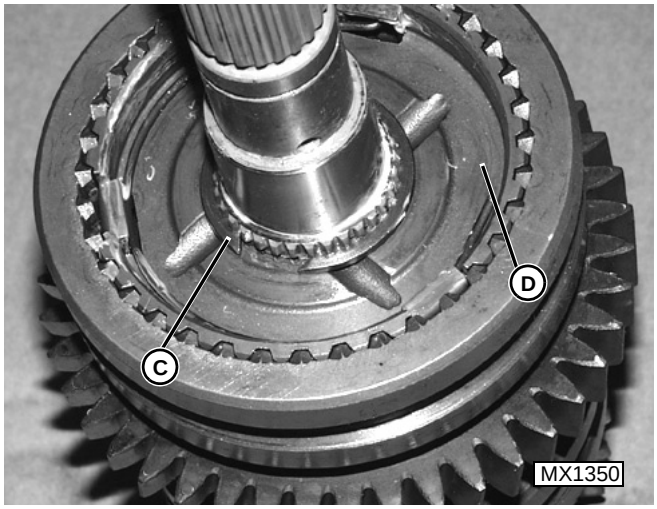
4. Remove ball from hole in shaft.



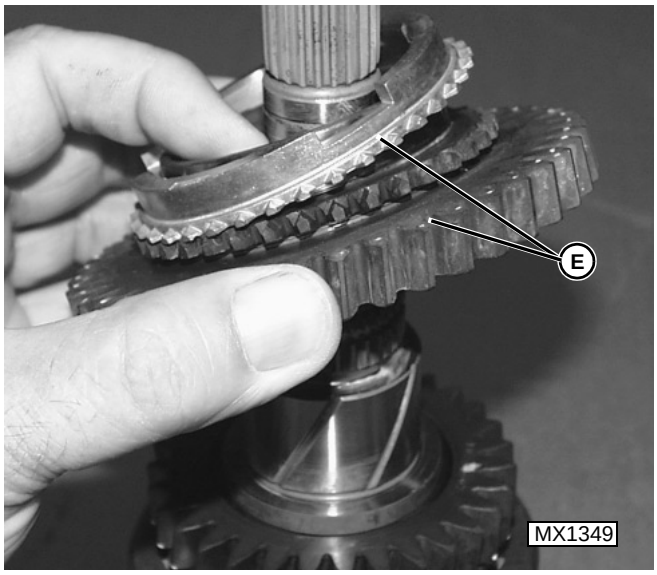
5. Remove 36 tooth gear.



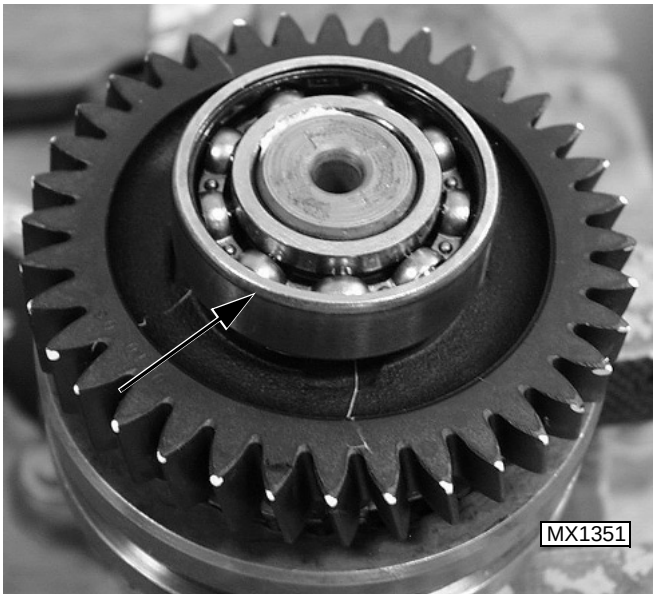
6. Remove bearing (A) and brass synchronizer ring (B).



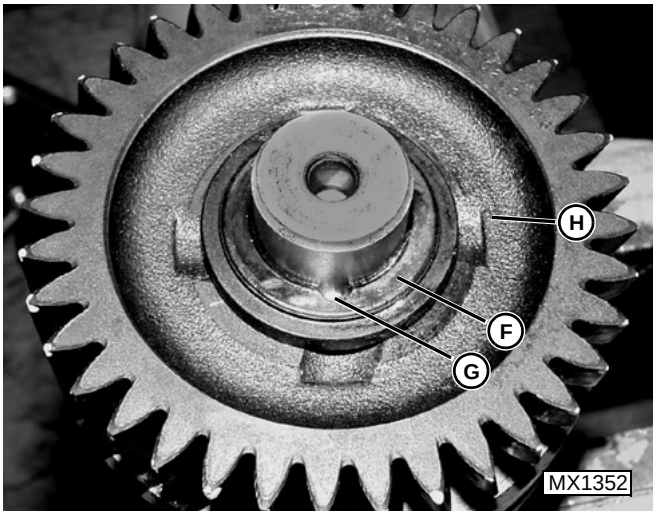
7. Remove snap ring (C) and synchronizer assembly (D).



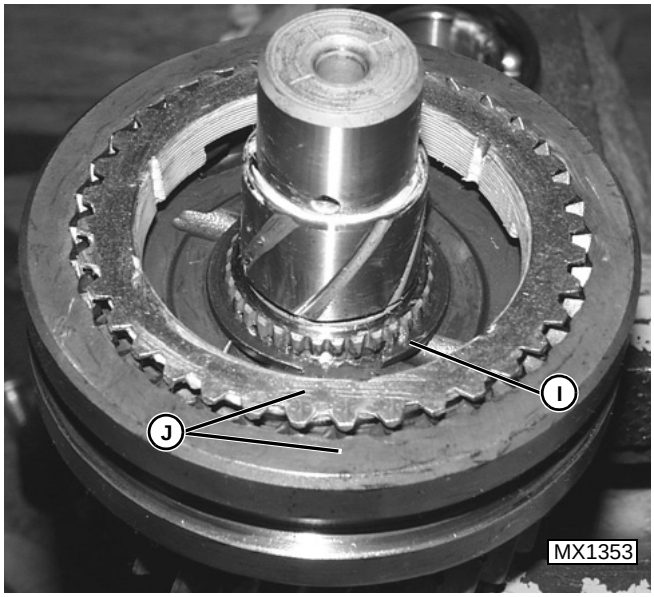
8. Remove 43 tooth gear and brass synchronizer ring (E).



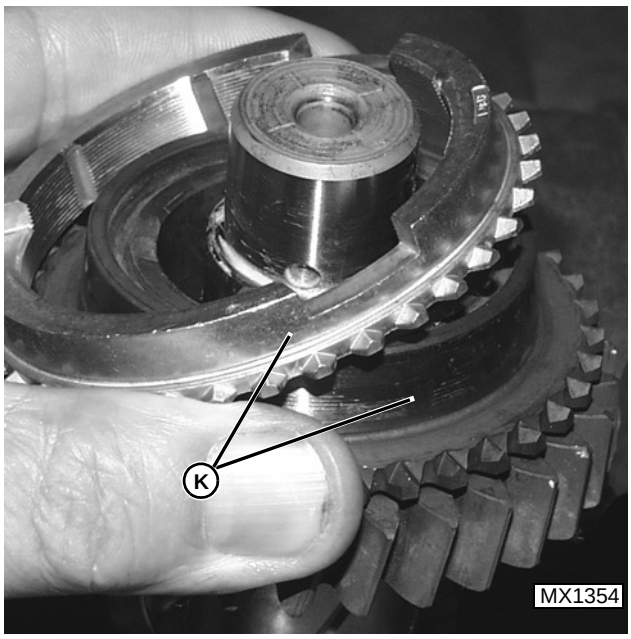
9. Remove bearing from other end of shaft.



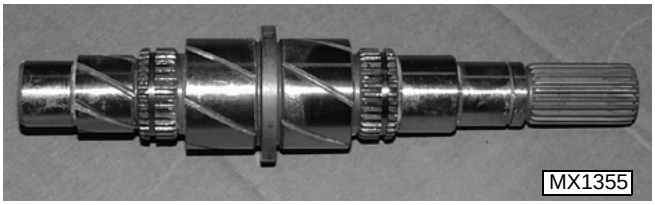
10. Remove thrust washer (F), ball (G), and gear (H).



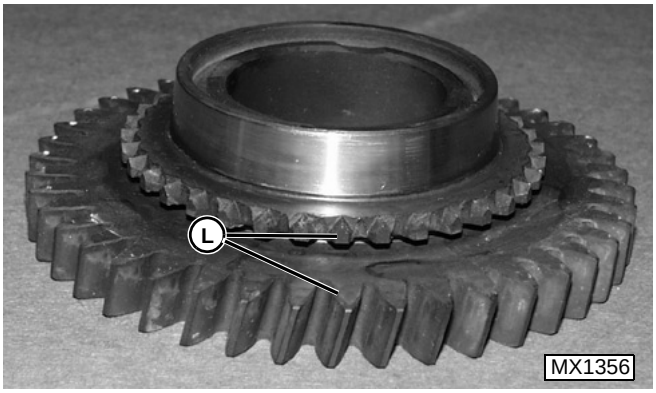
11. Remove snap ring (I) and synchronizer assembly (J).



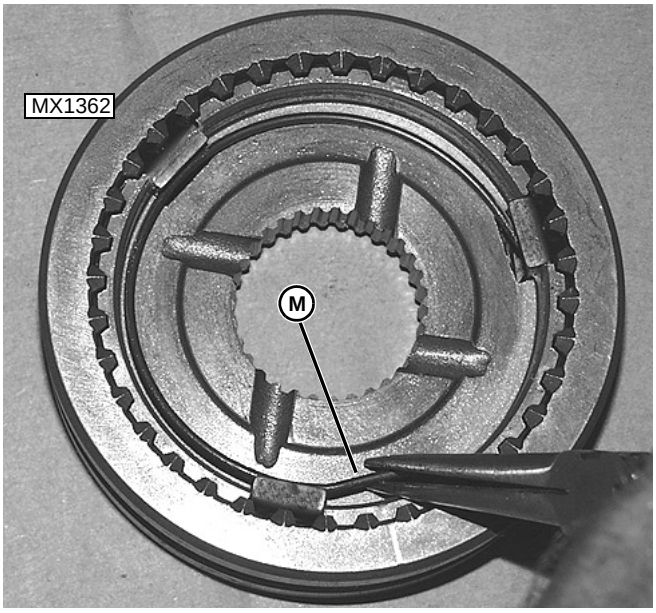
12. Remove gear and brass synchronizer ring (K).



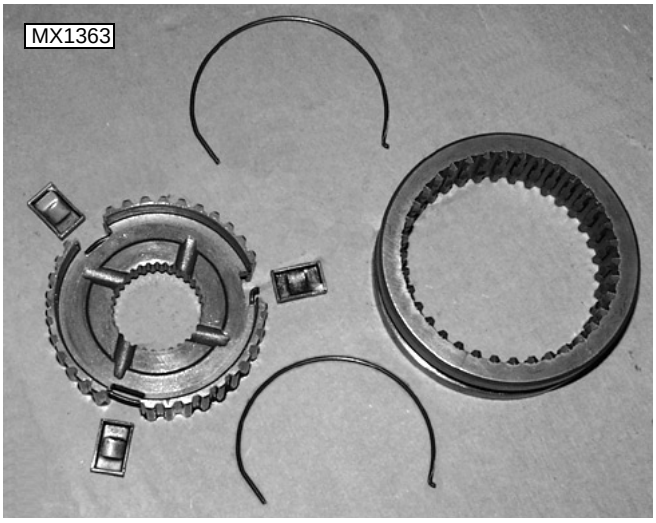
13. Inspect shaft for wear or damage on all machined areas. Check all splines. Replace shaft if needed.



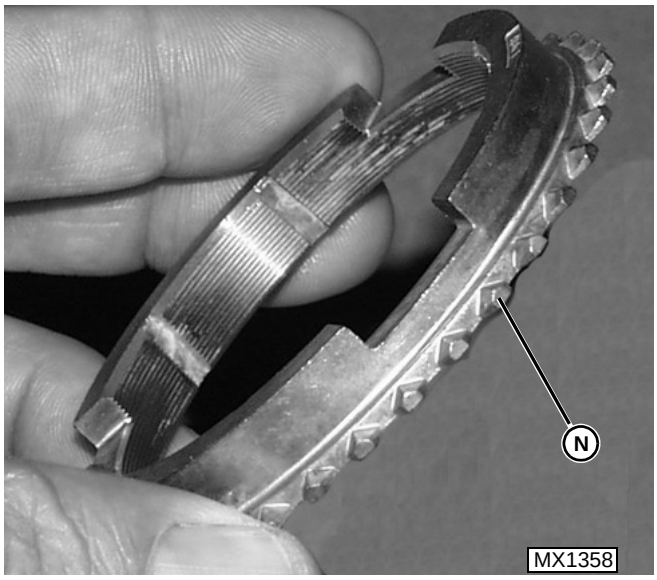
14. Check gear teeth (L) for wear, chips, or breaks. Replace as needed.



15. Remove two retainer springs (M) from synchronizer assembly.

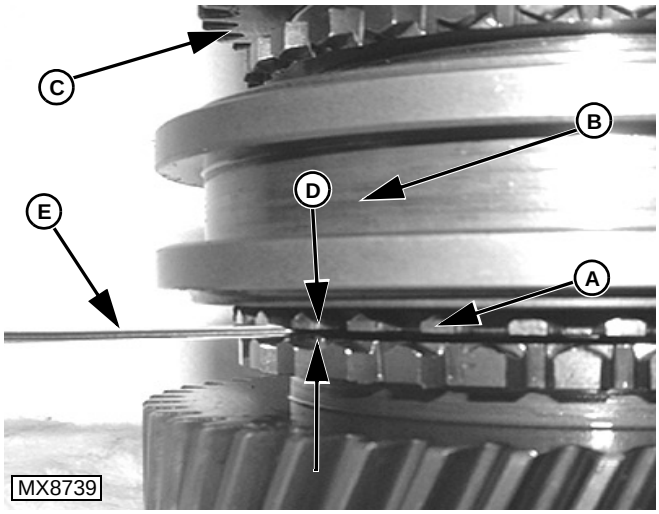


16. Check all synchronizer parts for wear or damage.



17. Check brass synchronizer ring for worn or missing teeth (N) .

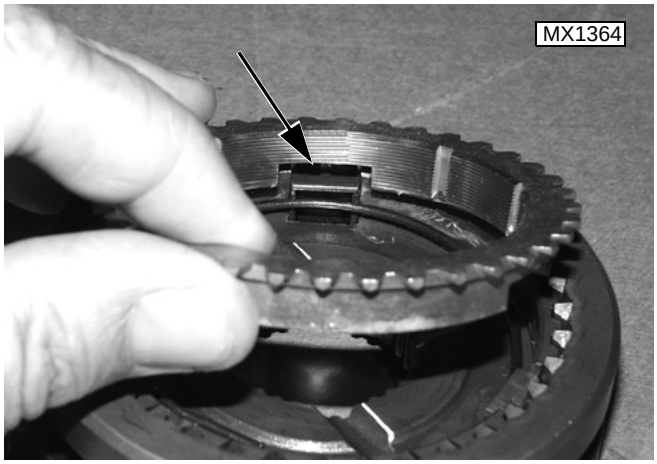
Synchronizer Wear Measurement Procedure:



1. Mark the synchronizer rings and synchronizers for location on the shaft. It is important that each synchronizer ring be measured against the gear it was assembled to.
2. Position gear on a stable surface with the synchronizer cone up. Install the corresponding synchronizer ring (A) and synchronizer (B) to the

gear. Place the opposite gear (C) on top of the synchronizer for added weight to stabilize the synchronizer ring during measurements.

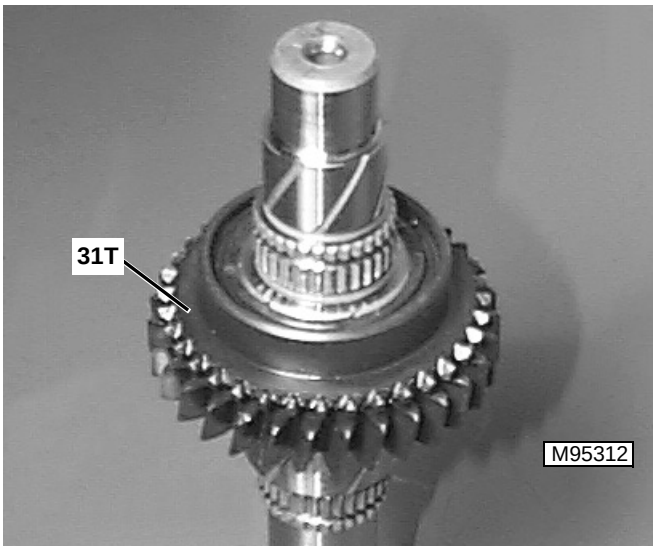
3. Measure the gap between the gear and the synchronizer ring (D) with a feeler gage (E) at 3 positions around the ring approximately 120 degrees apart. The three measurements must be within **0.18mm (0.007 in.)** of each other. If the measurements do not meet this criteria, reposition the synchronizer ring on the gear. Repeat measurements and repositioning until the **0.18mm (0.007 in.)** criteria is met.
4. The synchronizer ring gap is the average of the final measurements at the three positions. Replace synchronizer if clutching teeth are worn or the gap is less than **0.25mm (0.010 in.)**



NOTE: Synchronizer assembly and brass synchronizer rings are not serviced individually. If any parts are needed, entire assembly must be replaced.

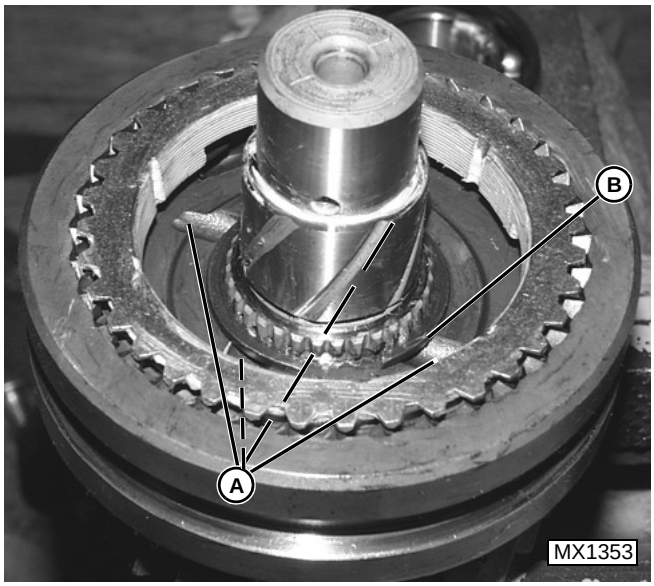
Output Shaft Assembly:

IMPORTANT: Lubricate all parts liberally with clean hydraulic oil during assembly.



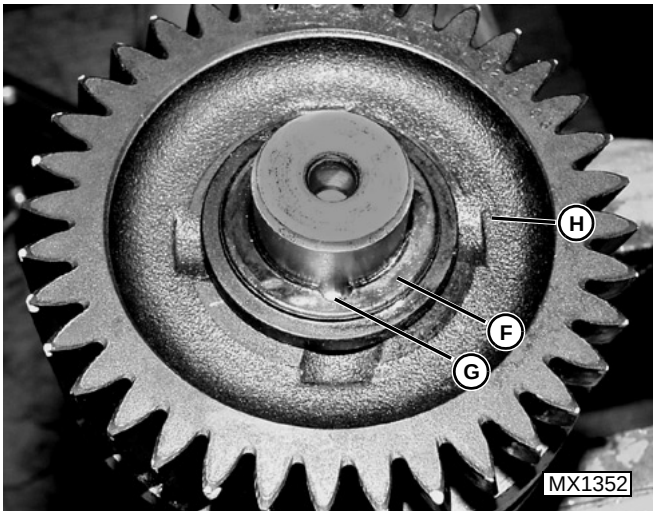
1. Install 31 tooth gear onto output shaft.

2. Make sure slots are aligned with detent blocks when installing brass ring to synchronizer assembly.

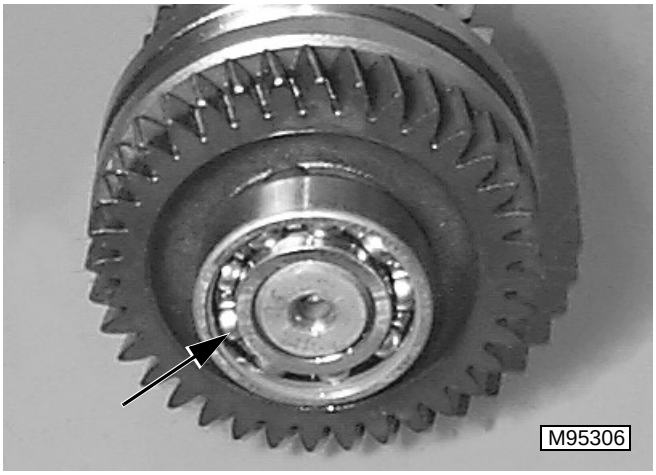


IMPORTANT: Synchronizer assembly should be placed on shaft with four oil grooves facing up.

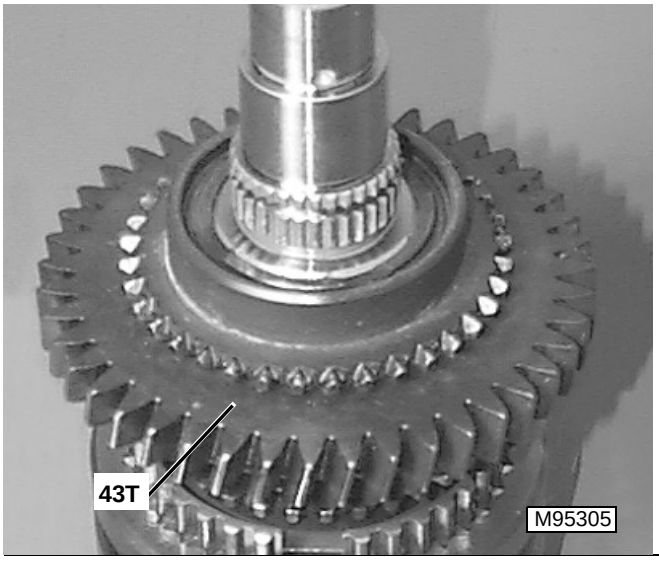
3. Install synchronizer assembly with oil grooves (A) facing up, and retain with snap ring (B).



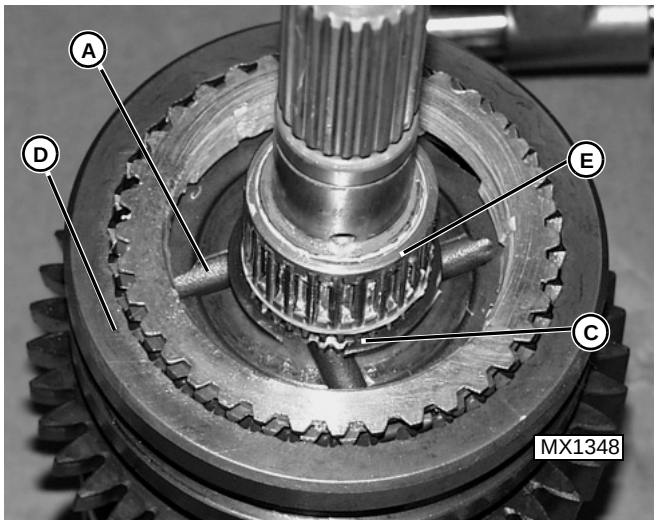
4. Install 36 tooth gear (H), and ball (G). Install thrust washer (F) with wider side toward gear.



5. Using a press, or suitable bearing driver and a soft-faced mallet, install bearing to end of shaft.

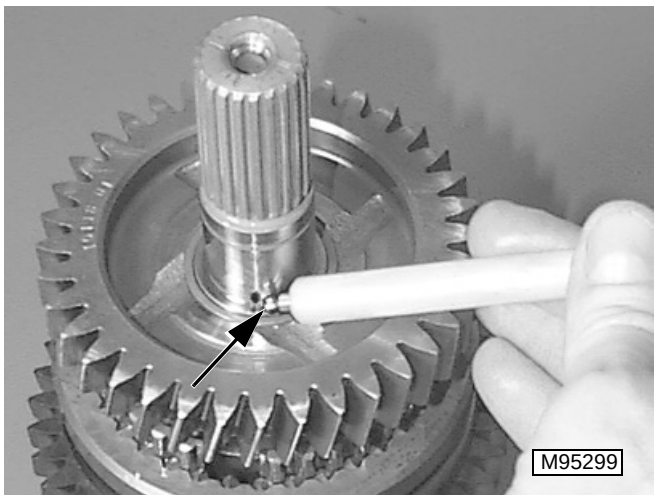


6. On other end of shaft, install 43 tooth gear.

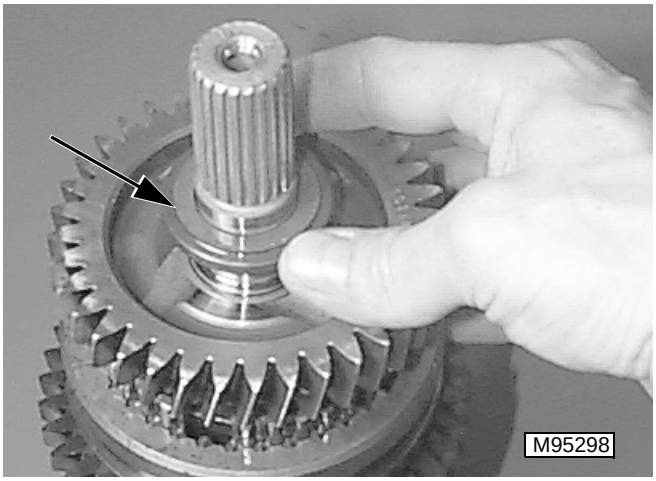


IMPORTANT: Synchronizer should be placed on shaft with four oil grooves (A) facing up.

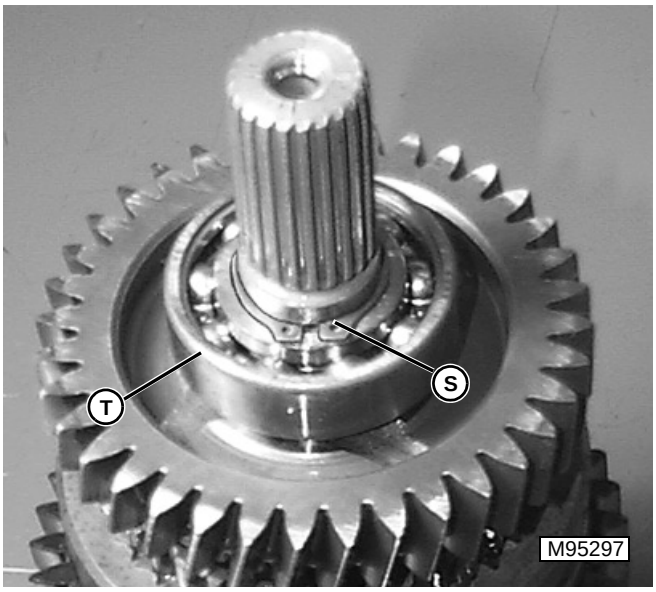
7. Install synchronizer assembly (D), snap ring (C), and bearing (E).



8. Install 36 tooth gear and install ball into hole in shaft.

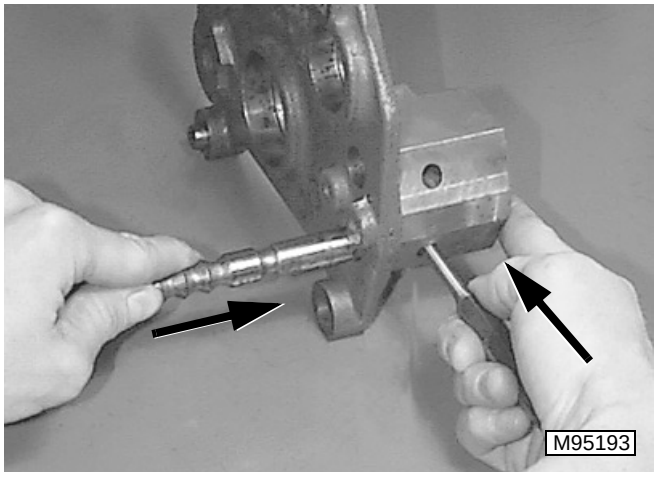


9. Install thrust washer.

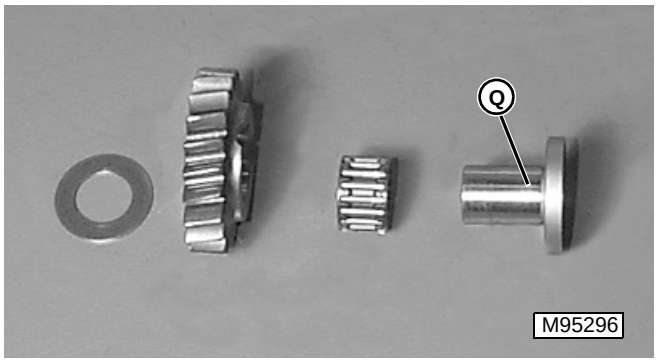


10. Using a press, or a suitable driver and a soft-faced mallet, install bearing (T) onto end of shaft. Retain with snap ring (S).

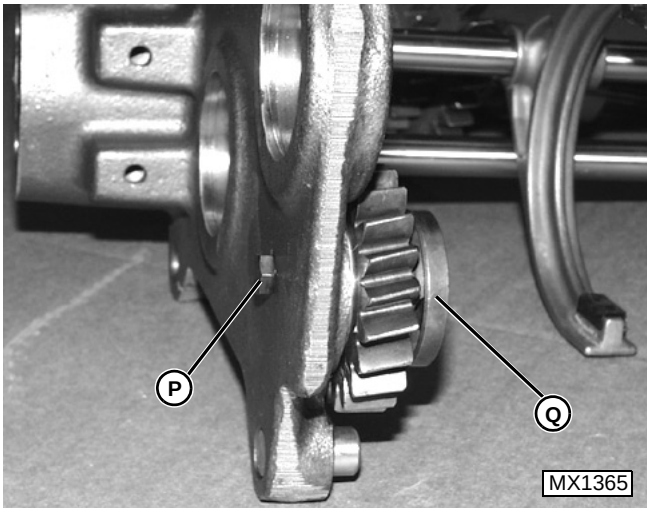
Assembly:



1. Hold the ball and spring in with a punch and install the shift rod assembly.
2. Repeat for second shift rod.

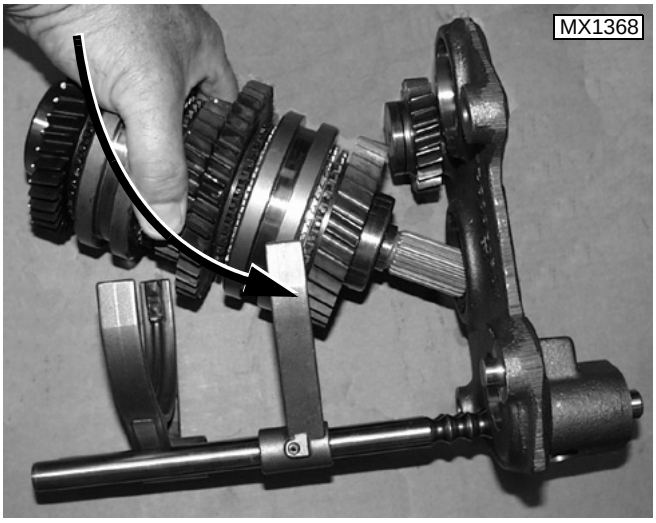


3. Install bearing, gear, and thrust washer onto idler shaft (Q).

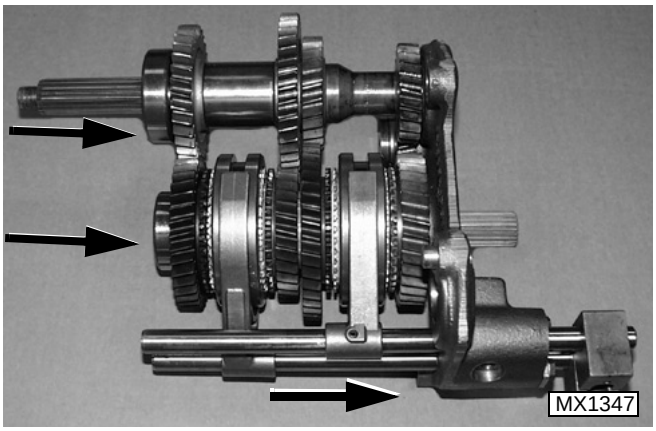


4. Install idler shaft (Q) to bearing plate. Retain with cap screw (P).

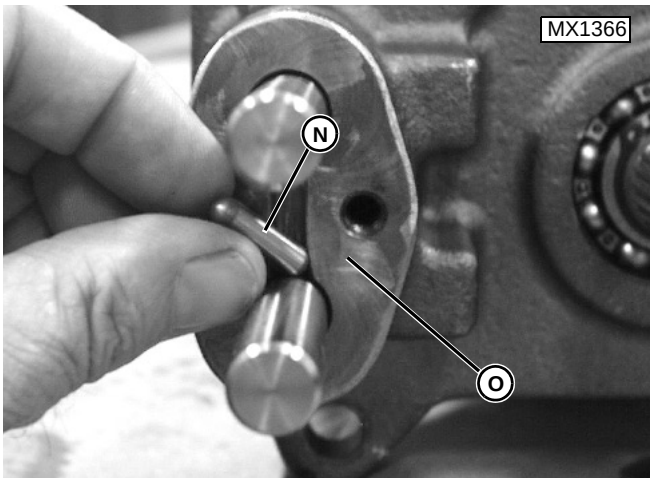
5. Rotate shift rods to correct positions.



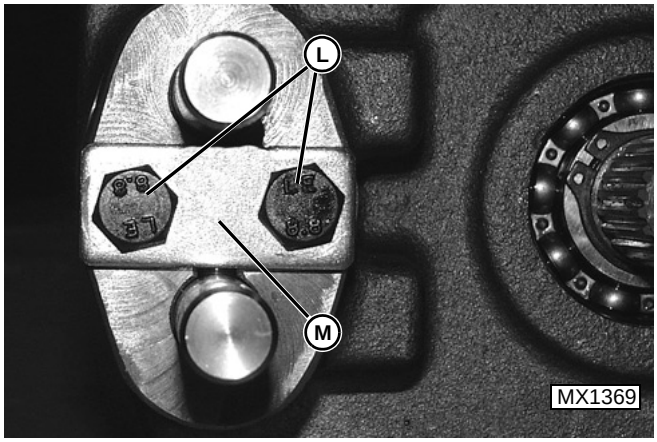
6. Install output shaft into bearing plate and shift forks.



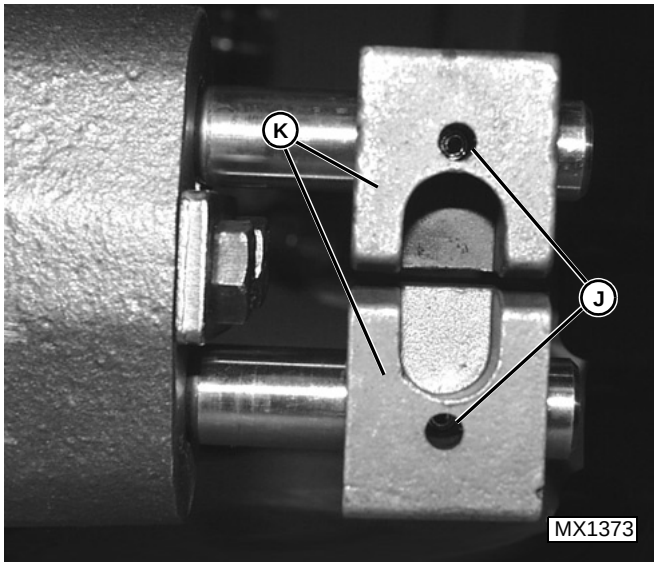
7. Install pinion shaft, and output shaft into bearing plate. Using a plastic mallet, tap shafts, gears, and two shift rods into bearing plate.



8. Properly align shift rods, and install interlock pin (N) into shaft housing (O).

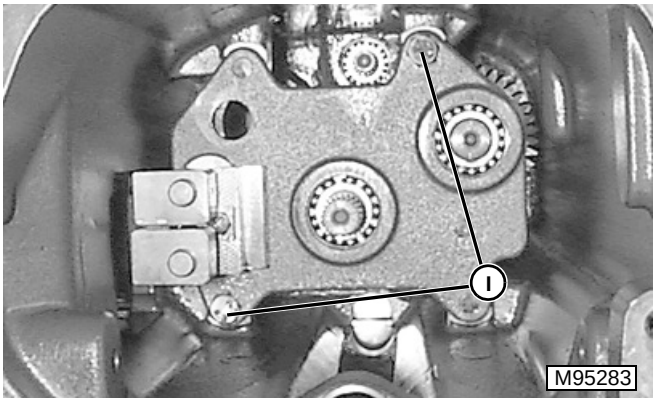


9. Install cover plate (M) and retain with two cap screws (L).



10. Install two shift gate blocks (K). Retain with two spring pins (J).

Installation:



1. Align two bearings and two shift rods with holes in tunnel. Install transmission into housing and retain with two cap screws (I).

CONTENTS

SPECIFICATIONS

General

Hydraulic Reservoir Capacity . . . . . 26 L (6.8 gal)
Pump or Motor Roller Bearing (From Back Plate to Top Surface of Bearing) . . . . . 2.3 mm ± 0.2 mm (0.090 in. ± 0.010 in.)
Roller Bearing in Motor Housing (Recess From Top of Counterbore) . . . . . 2.0 mm ± 0.3 mm (0.078 in. ± 0.015 in.)
Spring Pin in Back Plate (From Back Plate to Top Surface of Pin) . . . 4.4 mm (0.017 in.)

HYDROSTATIC PUMP

Manufacturer . . . . . EATON
Type . . . . . Piston Pump
Model 77122RAA
Displacement (variable) (maximum/rev) . . . . . 40.6 cm^3/rev (2.48 in^3/rev)
Displacement (engine at 2700 rpm) . . . . . 109.7 L/min (28.99 gpm)
Pressure Relief Valve Setting . . . . . 41368 kPa (6000 psi)
Charge Pressure . . . . . 690 - 1034 kPa (100 - 150 psi)

HYDROSTATIC MOTOR

Manufacturer . . . . . EATON
Type . . . . . Fixed Displacement Axial Piston Motor
Displacement (fixed) . . . . . 40.6 cm^3/rev (2.48 cu in./rev)

TORQUE SPECIFICATIONS

Pump To Back Plate Mounting Cap Screws . . . . . 53 - 57 N•m (39 - 42 lb-ft)
Motor To Back Plate Mounting Cap Screws . . . . . 10 - 14 N•m (87 - 123 lb-in.)
Forward and Reverse Pressure Relief Valve . . . . . 135 - 149 N•m (100 - 110 lb-ft)
Charge Pressure Relief Valve . . . . . 37 - 41 N•m (27 - 30 lb-ft)
Charge Pressure Diagnostic Port Plug . . . . . 13 - 16 N•m (115 - 142 lb-in.)
Pump Side Passage Plugs on Back Plate . . . . . 13 - 16 N•m (115 - 142 lb-in.)
Motor Side Passage Plug on Back Plate . . . . . 28 - 33 N•m (21 - 24 lb-ft)
Transmission To Tunnel Mounting Screws . . . . . 126 - 154 N•m (95 - 115 lb-ft)
Tunnel To Flywheel Housing . . . . . 126 - 154 N•m (95 - 115 lb-ft)
Tunnel To Differential Housing . . . . . 126 - 154 N•m (95 - 115 lb-ft)
SCV Pressure Tube to Pump . . . . . 55 - 79 N•m (40 - 59 lb-ft)
SCV Pressure Tube to SCV . . . . . 55 - 79 N•m (40 - 59 lb-ft)
SCV Work Port Tubes to SCV . . . . . 40 - 57 N•m (30 - 43 lb-ft)
Charge Pressure Tubes to Transmission Adapters . . . . . 55 - 79 N•m (40 - 59 lb-ft)
Cam Plate Bearing Caps Cap Screws . . . . . 37 - 42 N•m (27 - 31 lb-ft)
Tunnel Section to Differential Housing Cap Screws . . . . . 126 - 154 N•m (95 - 115 lb-ft)
Tunnel Section to Clutch Housing Cap Screws . . . . . 126 - 154 N•m (95 - 115 lb-ft)

SPECIAL OR ESSENTIAL TOOLS

NOTE: Order tools according to information given in the U.S. SERVICE-GARD™ Catalog or in the European Microfiche Tool Catalog (MTC).

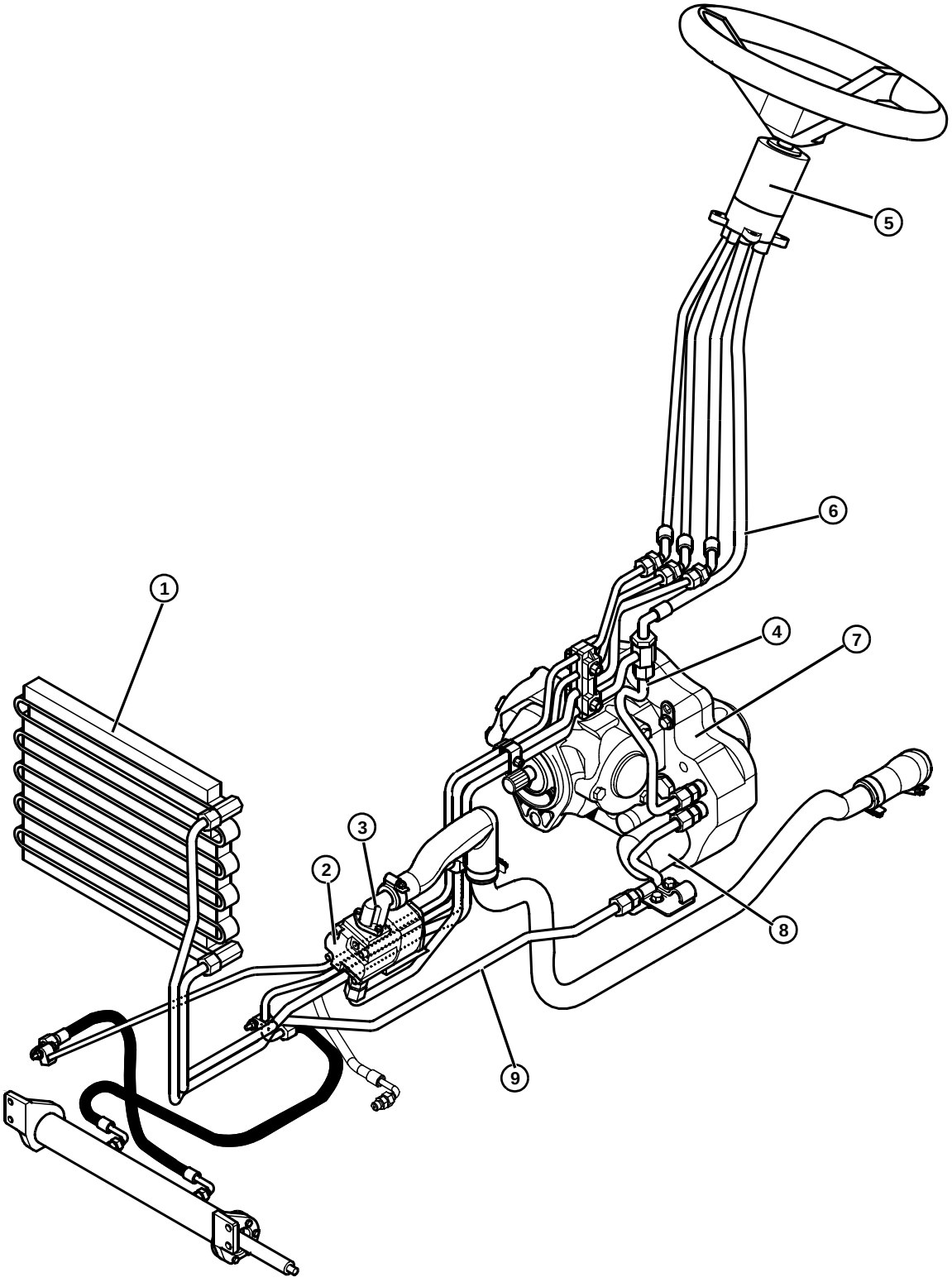
Part Number	Part Name
JT07335-1,2,3	Splitting Stands and Brackets
JT03344	2,000 kPa (300 psi) Gauge
JT03362	68947 kPa (10,000 psi) Gauge
JT03364	Hose With Quick Coupler
JTO3017	Hose With Quick Coupler
JT03240	7/16-20 M 37° X 7/16-20 M 37° Elbow
JT03264	Quick Coupler F X 7/16-20 F 37° Adaptor
JT05480	Quick Coupler M X M14-1.5 ORB Adaptor

OTHER MATERIALS

Number U.S.A./Canadian	Name	Use
Petroleum Grease	John Deere Clean and Cure Primer	Pump and Motor Reassembly
TY16021	John Deere High Flex Form-In-Place Gasket	Hydrostatic Transmission to Tunnel Seal
TY15934	John Deere General Purpose Gasket Dressing	Sealing Gaskets and Hoses
UN6419	JD Plus 4®, TurfGard®, HyGard® Transmission/Hydraulic Oil	Pump and Motor Reassembly

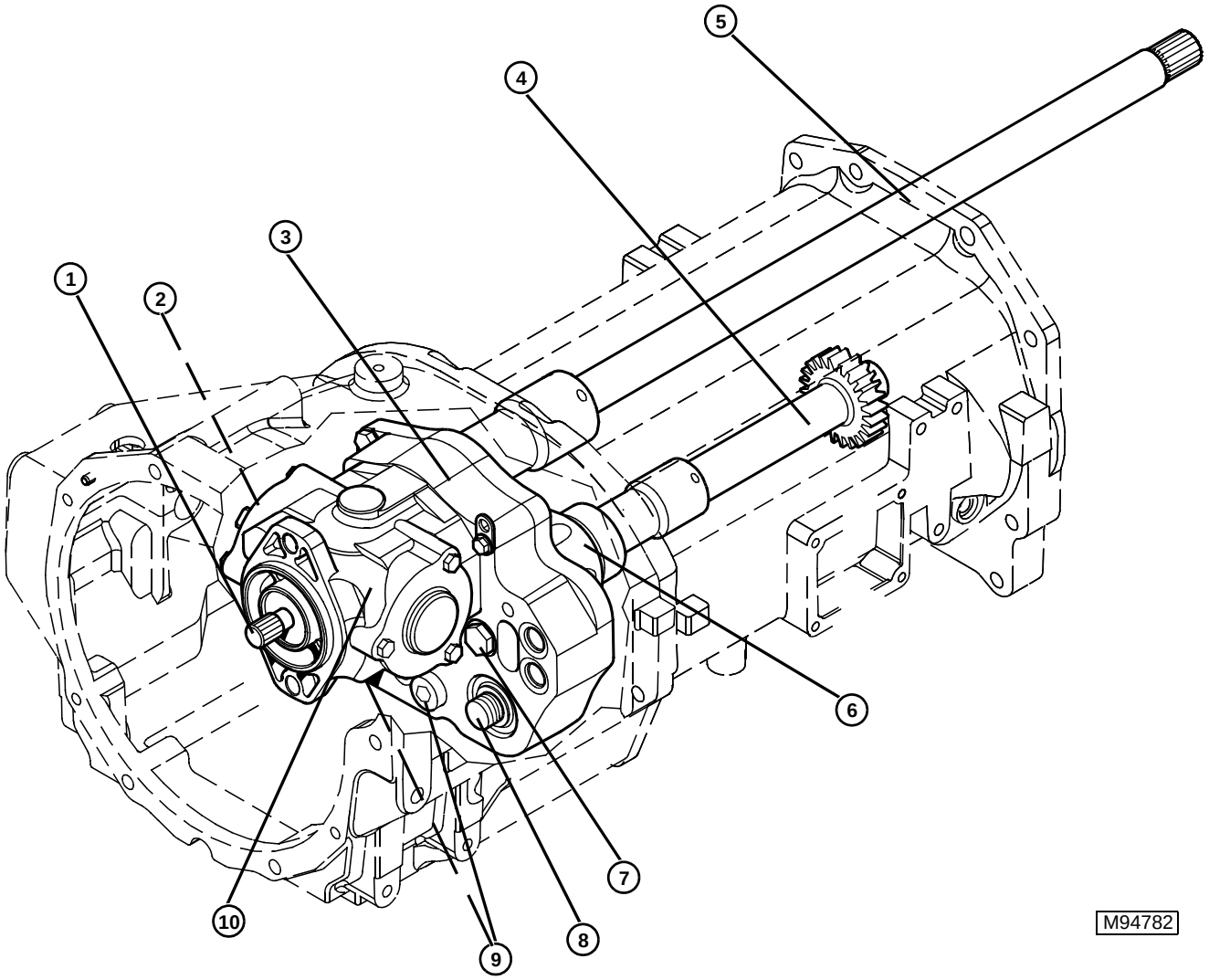
COMPONENT LOCATION

HYDRAULIC HOSES AND LINES



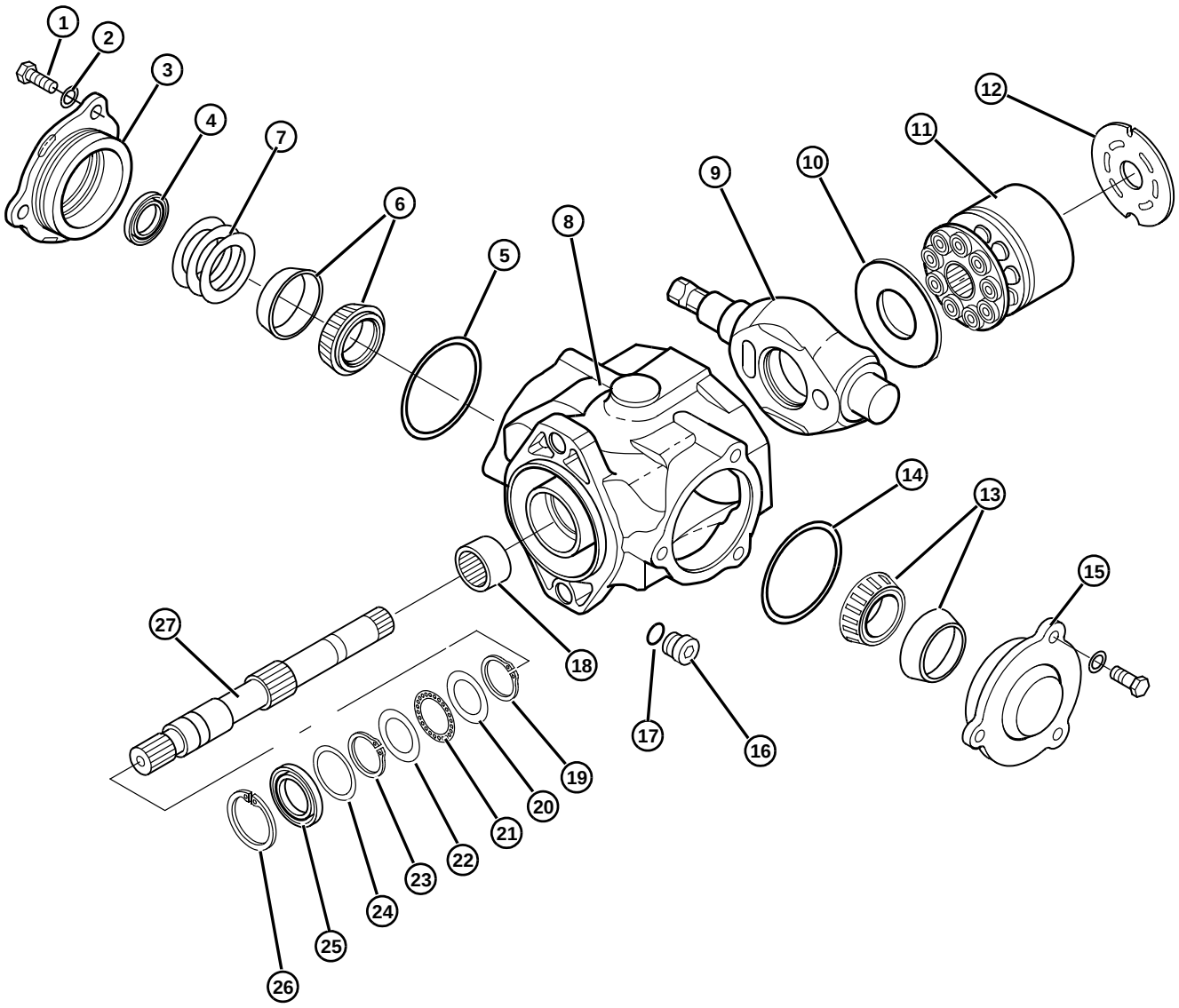
1. Hydraulic Oil Cooler
2. Front Gear Pump
3. Suction Tube Elbow (Oil Supply)
4. Steering (Charge Pressure) Supply Line
5. Steering Control Unit (SCU)
6. Steering Return Line
7. Hydrostatic Unit
8. Oil Filter
9. Cooler Return Line

HYDROSTATIC TRANSMISSION



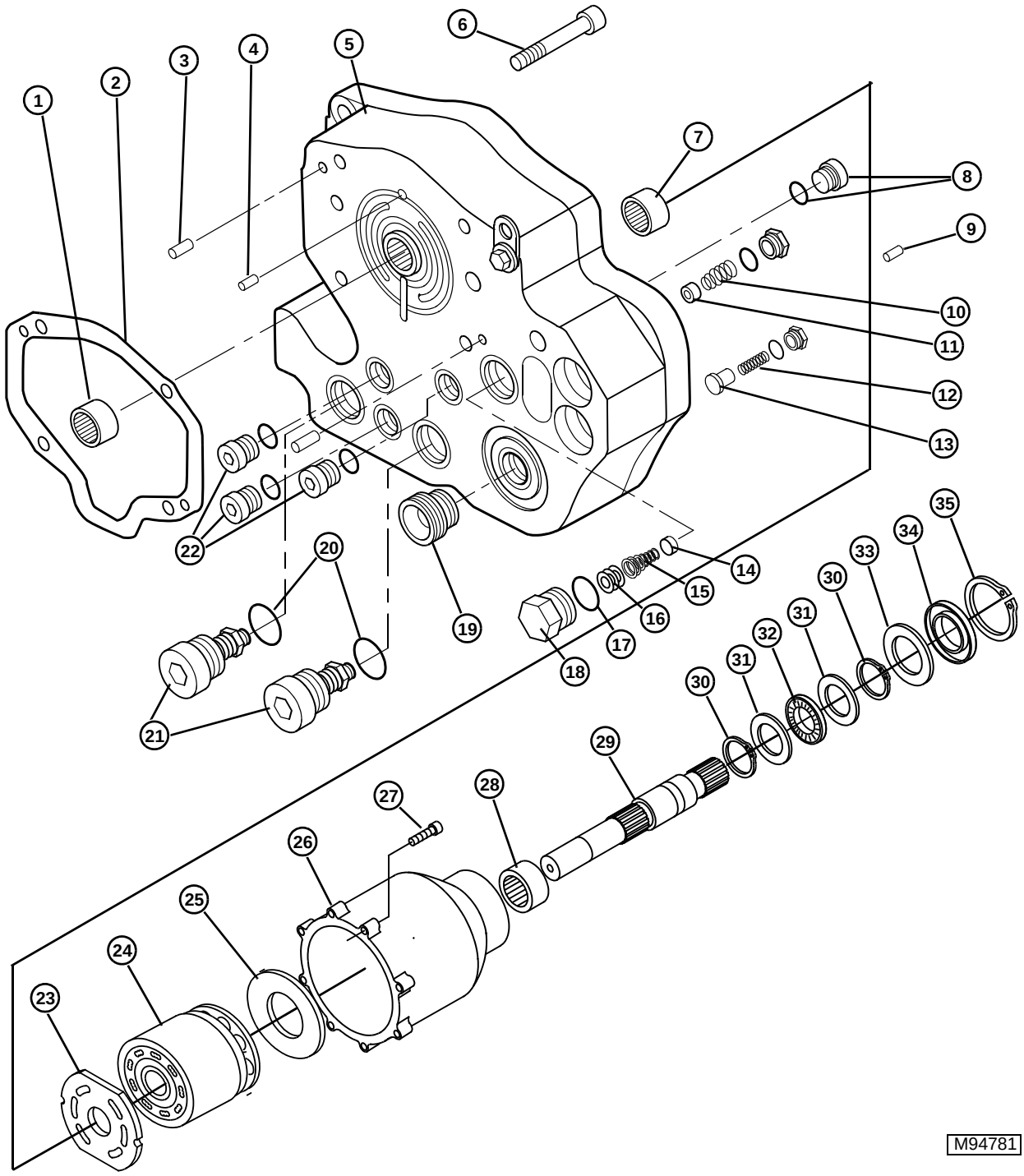
1. Input Shaft From Engine
2. Control Lever
3. Backplate
4. Drive Shaft to Transmission
5. Drive Shaft, PTO Clutch
6. Hydrostatic Motor
7. Charge Pressure Relief Valve
8. Oil Filter Mount
9. For.& Rev. Relief Valves
10. Hydrostatic Pump

TRANSMISSION MAIN PUMP CASE



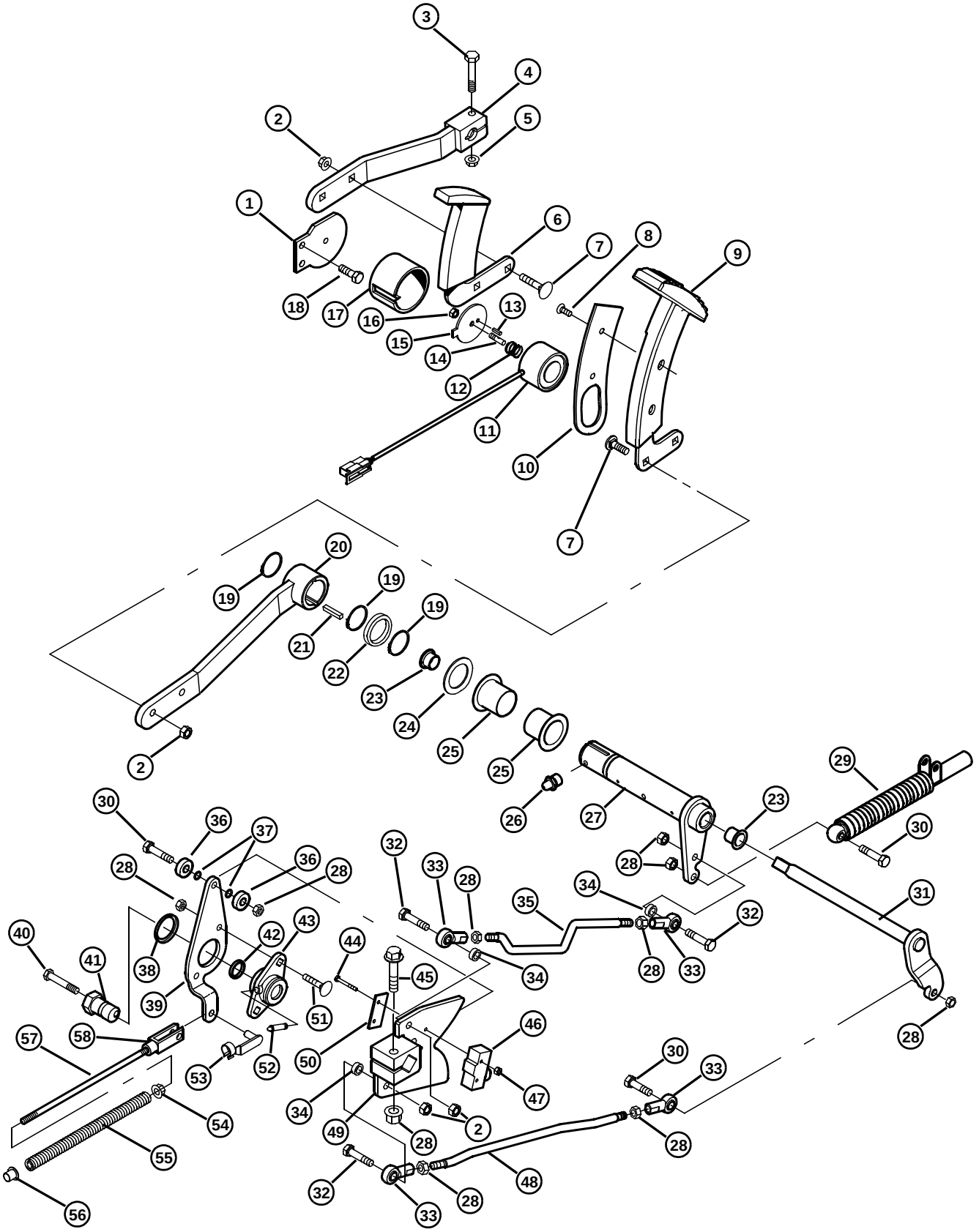
1. Cap Screws (6)
2. Washers (6)
3. Cover
4. Seal
5. O-ring
6. Bearing and Cone
7. Shims
8. Housing
9. Cam Plate
10. Cam Washer
11. Rotating Assembly
12. Valve Plate
13. Bearing and Cone
14. O-ring
15. Cover
16. Plug
17. O-ring
18. Bearing
19. Snap Ring
20. Thrust Washer
21. Thrust Bearing
22. Thrust Washer
23. Snap Ring
24. Seal Washer
25. Seal
26. Snap Ring
27. Shaft

TRANSMISSION BACK PLATE AND MOTOR



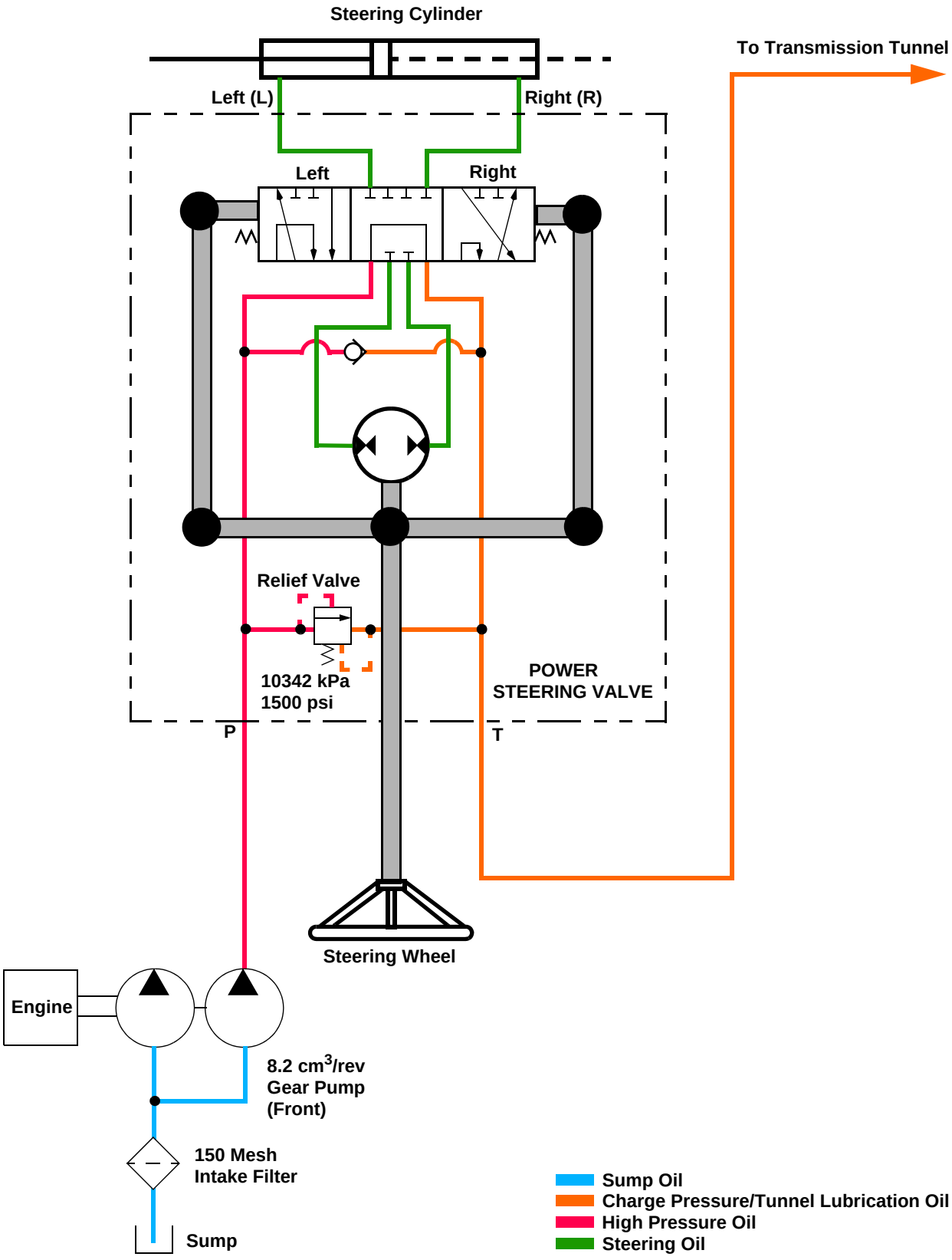
1. Bearing
2. Gasket
3. Pin
4. Pin
5. Backplate
6. Cap Screw
7. Bearing
8. Plug and O-Ring
9. Pin
10. Spring
11. Poppet
12. Spring
13. Plunger
14. Poppet
15. Spring
16. Shims
17. O-Ring
18. Plug
19. Filter Head
20. O-Rings
21. Relief Valves, Forward and Reverse
22. Plugs
23. Valve Plate
24. Rotating Assembly
25. Cam Washer
26. Motor Housing
27. Cap Screw
28. Bearing
29. Shaft
30. Snap Ring (2)
31. Thrust Washer (2)
32. Thrust Bearing
33. Seal Washer
34. Seal
35. Snap Ring

HYDROSTATIC CONTROL LINKAGE

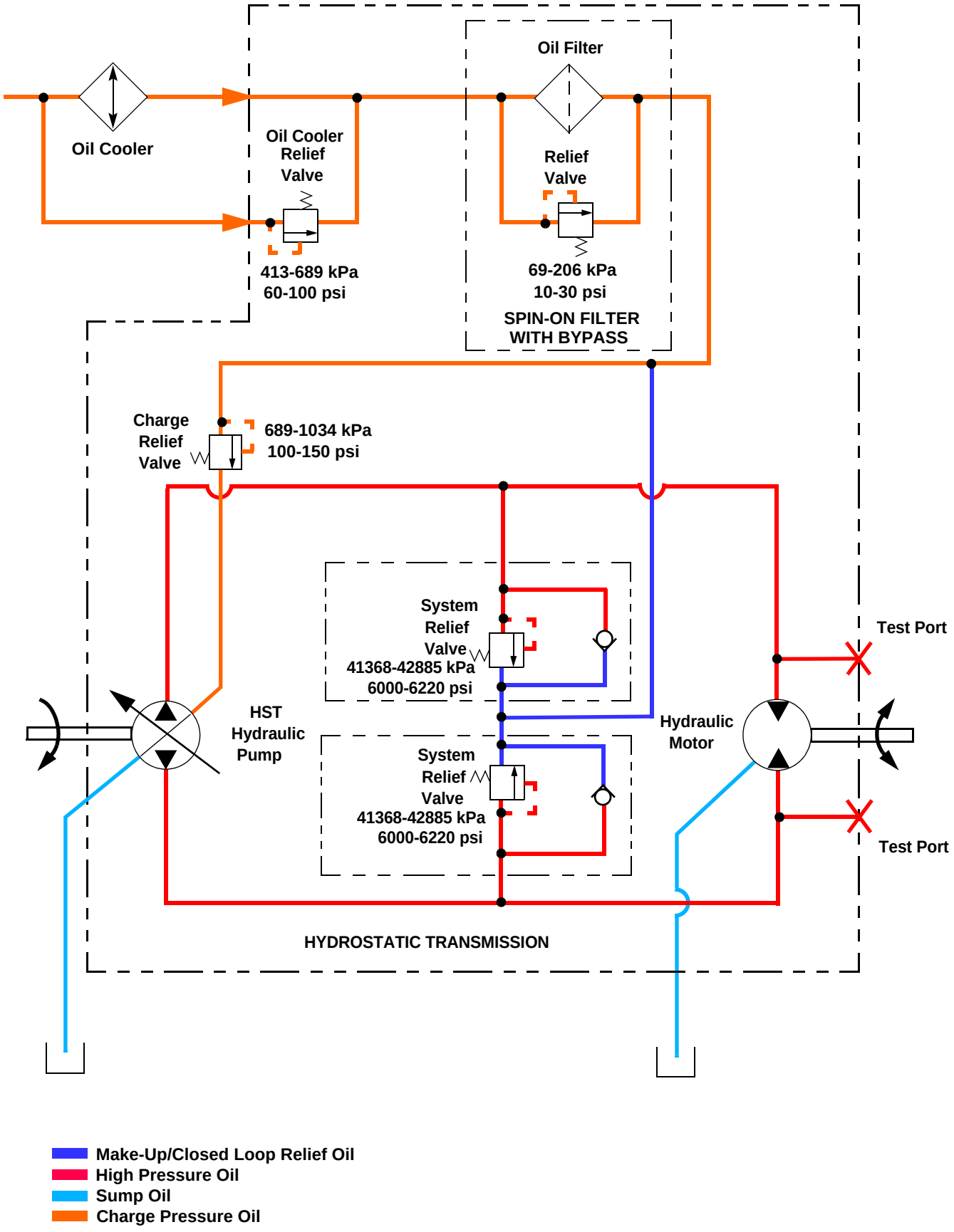


1. Bracket
2. Lock Nut
3. Cap Screw
4. Lever, Reverse
5. Nut
6. Pedal, Reverse
7. Carriage Bolt
8. Screw
9. Pedal
10. Plate
11. Magnet
12. Spring
13. Pin
14. Stud
15. Guide
16. Nut
17. Housing
18. Cap Screw
19. Snap Ring
20. Lever
21. Key
22. Spacer
23. Bushing
24. Washer
25. Bushing
26. Lubrication Fitting
27. Lever, Forward
28. Nut
29. Dampener
30. Cap Screw
31. Shaft, Reverse
32. Cap Screw
33. Ball Joint
34. Spacer
35. Rod, Forward
36. Ball Bearing
37. Washer
38. Cap
39. Lever, Neutral Control
40. Cap Screw
41. Eccentric
42. Seal
43. Pivot
44. Screw
45. Cap Screw
46. Switch, Neutral
47. Nut
48. Rod, Reverse
49. Lever, Speed Control
50. Strap
51. Carriage Bolt
52. Lubrication Fitting
53. Pin
54. Flange Nut
55. Spring
56. Bushing
57. Rod
58. Clevis

HYDROSTATIC SYSTEM SCHEMATIC



HYDROSTATIC SYSTEM SCHEMATIC (continued)



TROUBLESHOOTING

Problem or Symptom / Check or Solution	Wheels on machine will not rotate	Noisy pump or motor	Sluggish response to changes in speed	Low power	Wheels rotate in one direction only	Tractor Moves Without Pressing Forward or Reverse Pedals	Tractor Does Not Move When Forward or Reverse Pedal are Pressed
Check flex plate coupling between engine and pump	●						
Hydraulic level low in transaxle	●		●	●			
Low charge pressure *(see Tests and Adjustments Section)*	●		●	●			
Main drive pressure relief valve stuck open *(see Tests & Adjustments Section)*		●	●	●	●		
Air in system *(See "HYDRAULIC SYSTEM BLEED PROCEDURE".)*		●	●	●			
Hydrostatic motor output pressure too low *(see Tests and Adjustments Section)*			●	●			
Internal pump or motor damage or excessive wear	●	●	●	●			
Parking brake engaged or malfunctioning	●	●					
Pump centering mechanism not properly adjusted			●		●	●	
Gearbox malfunction *(see Gear Power Train Section)*	●						
Servo valve malfunctioning	●		●		●		
Pedal Neutral Position Not Properly Adjusted						●	
Hydrostatic Control Linkage Worn or Damaged			●		●	●	●

DIAGNOSTICS

Test Conditions:

- Operator in seat
- Key switch in RUN position

Test/Check Point	Normal	If Not Normal
1. Control pedals.	Pedals should move freely.	Check linkage from pedals to pump.

Test Conditions:

- Start engine and run at slow idle.

Test/Check Point	Normal	If Not Normal
2. Directional pedals are in neutral position.	Machine should not creep forward or backward.	Adjust centering of pump control pedals.
3. Move forward or reverse pedal slowly from neutral to maximum travel speed position.	Machine should accelerate smoothly forward or backwards.	Check fluid reservoir for proper fluid level. Check hydraulic tubing, and connections for leaks. Perform system flow and pressure checks to verify proper operation of charge pump and hydrostatic pump.
4. Control pedal in full forward position.	Machine should move forward.	Check pedals and forward/reverse linkage for damage. Check forward drive pressure relief valve.
5. Control pedal in full reverse position.	Machine should move backward.	Check pedals and forward/reverse linkage for damage. Check reverse drive pressure relief valve.

THEORY OF OPERATION

HYDROSTATIC SYSTEM

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, forward or reverse, by foot pedal operation.

Principles of Operation:

The hydrostatic system is a closed loop fluid power system that consists of a charge pump on the left front side of the engine, and an EATON piston pump/motor assembly, which is driven by a flexible coupler attached to the flywheel.

- **Hydrostatic Pump**

The hydrostatic pump (A) is an axial piston, variable displacement piston pump. It is mounted directly to the front of the tunnel. The input shaft (B) splines are driven by the flexible coupler attached to the engine flywheel.

Fluid flow is controlled by changing the angle of the cam plate (C). This angle is controlled by the operator through a mechanical linkage. Moving the respective directional pedal will move the position of the cam plate.

Moving the cam plate off center changes the distance the pistons (D) travel inside the piston bore of the rotating assembly. The direction that the cam plate is rotated from center determines the direction of fluid flow (forward or reverse). The number of degrees the cam plate is deflected, determines how much fluid will be displaced (speed).

The hydrostatic pump provides hydraulic fluid to the hydrostatic motor through the back plate (E). Hydraulic fluid in the power train circulates in a closed loop. Fluid leaves the hydrostatic pump and flows through the hydrostatic motor and is returned to the hydrostatic pump, not the reservoir. Fluid that leaves this closed loop circuit, such as case drain, is replenished by fluid from the charge pump. Fluid may also be dumped from the high pressure side of the loop to the low pressure side if the tractor encounters a heavy load or stalls out. This happens through the high pressure relief valves (F).

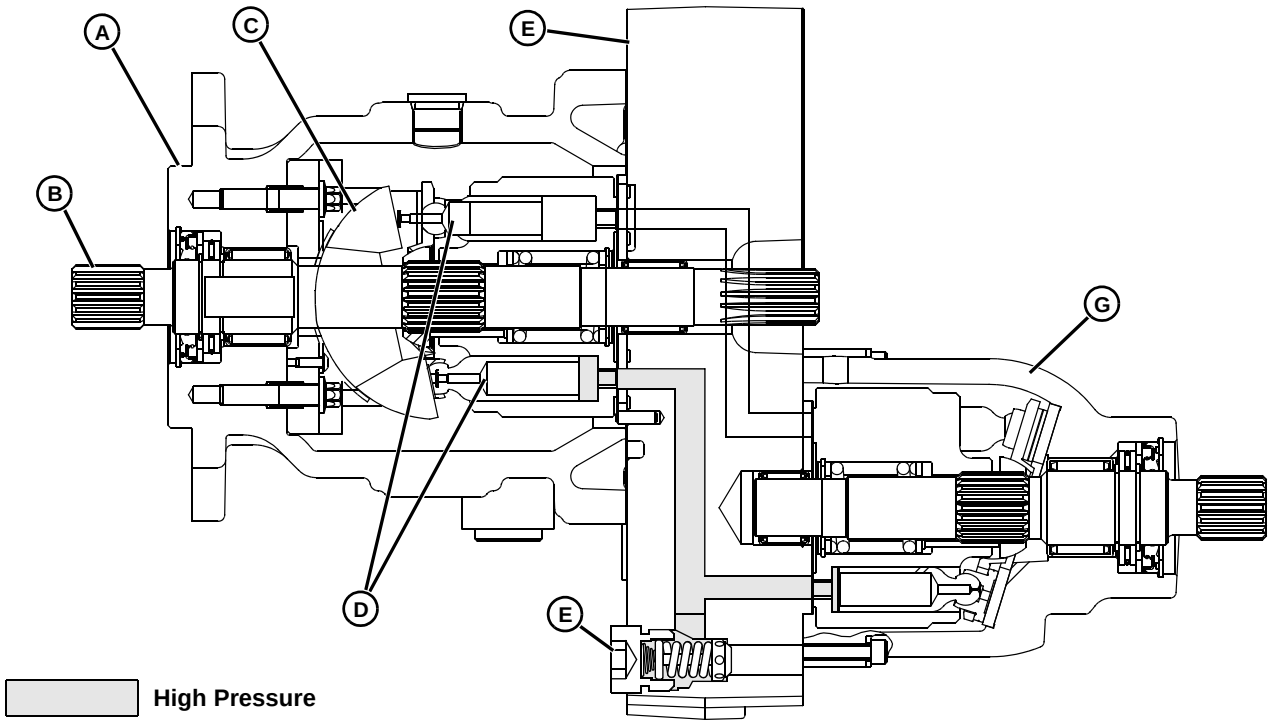
- **Charge Pump**

The charge pump is a gear type positive displacement pump mounted to the left front side of the engine.

This pump provides pressurized fluid to the SCU (Steering Control Unit). Return oil from the SCU is routed through the filter mounted to the front of the back plate, and then into the hydrostatic pump to provide replacement fluid to the closed loop of the hydrostatic transmission.

- **Hydrostatic Motor**

The hydrostatic motor (G) is a high torque axial piston motor. The motor is located on the rear of the back plate. The hydrostatic motor drives the input shaft for a three speed range gear transmission which transfers power to the wheels. *(See Final Drive Section.)*



TESTS AND ADJUSTMENTS

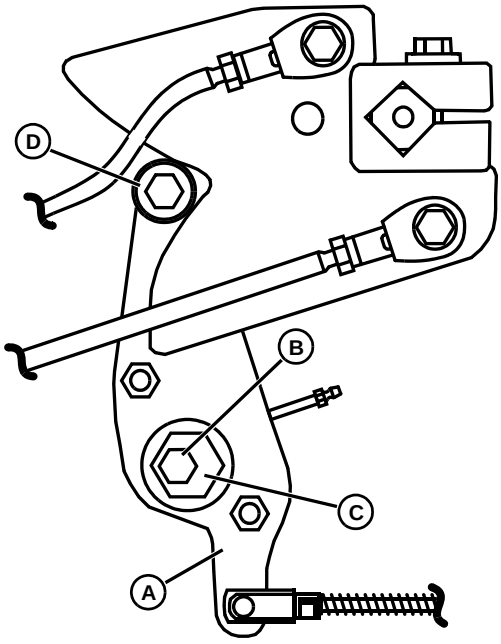
HYDROSTATIC PEDAL AND NEUTRAL ADJUSTMENT

Reason:

To ensure that tractor does not move unless forward or reverse pedal is depressed.

Procedure:

1. Operate the hydrostatic control pedals. They should return by themselves to the neutral position. If pedals do not operate properly, check pedals and linkage for damage or wear.
2. Start engine and run at low idle.
3. Place range shift lever in LOW gear. Gradually increase engine speed to full throttle.Tractor should not move. If tractor moves, note direction, and adjust neutral return lever (A) as follows:



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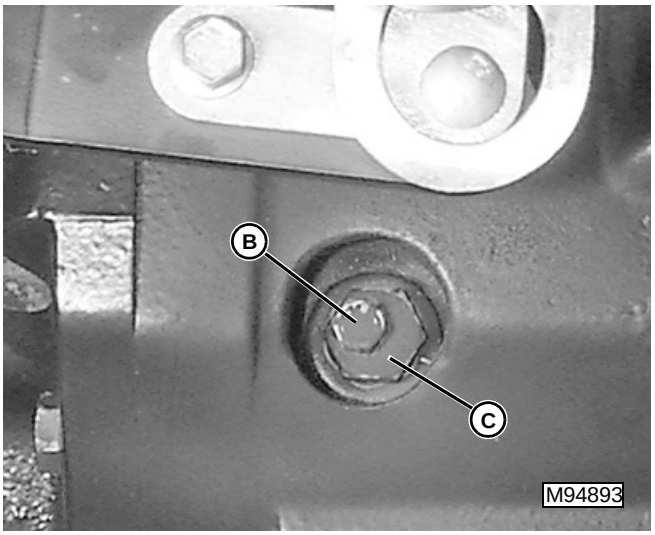
CAUTION

Severe injury or death can result if engine is not shut off when performing neutral adjustment.

4. Shut engine OFF. Engage park brake.



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5. On the right side of the tractor, below the forward and reverse control pedals, locate the locking cap screw (B) and eccentric (C). The eccentric must be turned to perform the neutral adjustment.
6. Loosen the locking cap (B) screw that holds the eccentric (C) to the transmission.
7. Using a wrench, rotate the eccentric to move the roller (D) *down* to eliminate reverse, or up to eliminate forward movement or "creep".
8. Tighten the locking cap screw.
9. Start engine and run at low idle.
10. Place range shift lever in LOW gear. Gradually increase engine speed to full throttle.Tractor should not move. If tractor moves, repeat steps 4 through 10 until movement is eliminated.

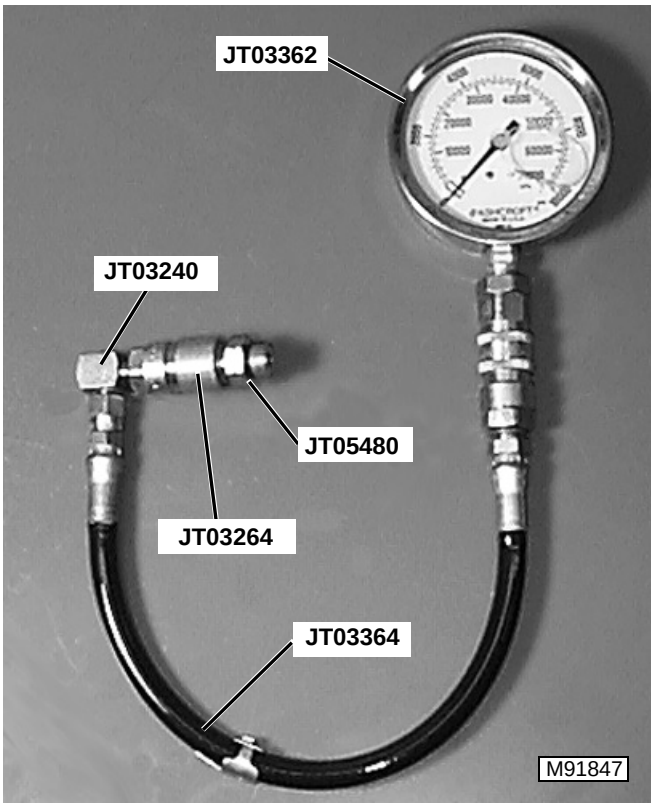
HYDROSTATIC PUMP PRESSURE TEST

Reason:

To ensure that internal parts of hydrostatic pump are not worn excessively, and the relief valves are operating properly.

Equipment:

- JT03362 - 10,000 psi Gauge
- JT03364 - Hose With Quick Coupler
- JT03240 - 7/16-20 M 37° X 7/16-20 M 37° Elbow
- JT03264 - Quick Coupler F X 7/16-20 F 37° Adaptor
- JT05480 - Quick Coupler M X M14-1.5 ORB Adapter



IMPORTANT: Make sure that the hydraulic fluid is visible in sight glass. Insufficient hydraulic fluid could cause system to run dry and damage pump and motor.

IMPORTANT: Do not allow valves to relieve for more than 10 seconds or hydraulic oil may overheat.

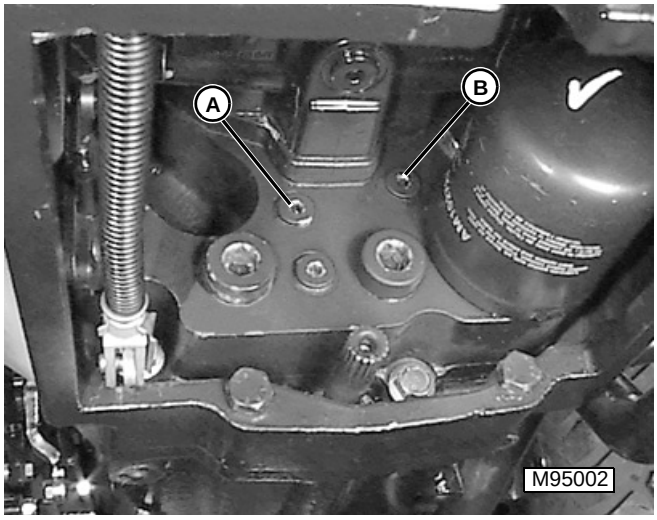
Procedure:

1. Park tractor on a level surface.
2. Turn key switch to OFF position.
3. Make sure 4-WD lever is in unlocked 2-WD position.

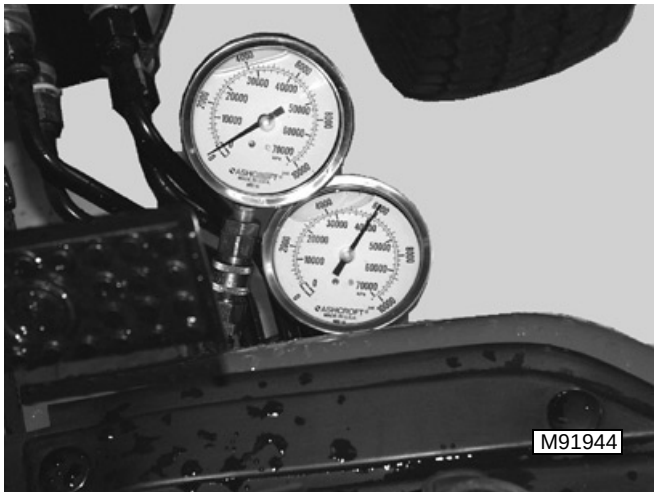
CAUTION

AVOID SUDDEN TRACTOR MOVEMENT. Tractor could move suddenly causing severe injury or damage to equipment during test procedure. Perform test in open area. Keep all personnel away from front or rear of tractor.

4. Start engine and run until hydraulic oil is warm.
5. Stop engine.
6. Cycle all controls to relieve any pressure that may be in the hydraulic system.



7. Locate forward test port (A) and reverse test port (B) on hydrostatic transmission inside tunnel opening.
8. Remove test port plugs.
9. Install one JT05480 male quick coupler into each test port.
10. Attach JT03362 gauge and hose assembly as shown to each test port adaptor.



11. Position gauges so they can be read from operator's seat.
12. Perform test from operator's seat. Make sure park brake is engaged and press right and left brake pedals. Place range transmission shift lever in "C" (high) position. Start engine and run at full throttle.

CAUTION

If brakes fail to prevent wheels from turning, STOP TEST IMMEDIATELY. Repair or adjust brakes as necessary before resuming test. *(See Brake Section.)*

13. Slowly depress forward directional pedal and observe gauge. Gauge should slowly rise to approximately **41368 kPa ± 1378 kPa (6000 psi ± 200 psi)** and relief valve will open with an audible squealing noise.
14. Repeat same procedure with reverse pedal.

Specifications:

- Pump pressure should reach approximately **41368 kPa ± 1378 kPa (6000 psi ± 200 psi)** in either direction and then relieve.

Results:

- If pressure will not reach **41368 kPa Maximum (6000 psi Maximum)** in either direction, check charge pressure. (See "CHARGE PUMP PRESSURE TEST").
- If charge pressure is good and hydrostatic pump pressure will not get up to relief pressure hydrostatic pump is worn or damaged.
- If pressure reaches **41368 kPa (6000 psi)** in one direction and not the other, one of the relief valves is defective or the seat is leaking.

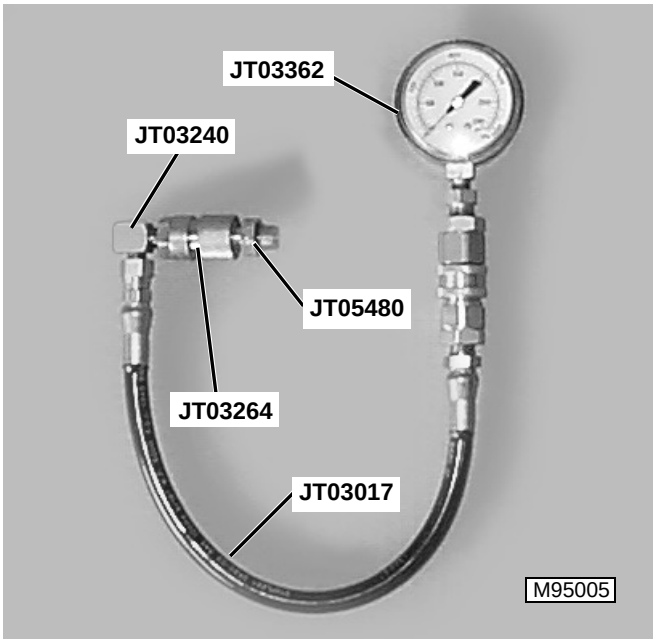
CHARGE PUMP PRESSURE TEST

Reason:

To ensure that charge pump is operating at specified pressure to supply oil to hydrostatic pump.

Equipment:

- JT03344 - 2,000 kPa (300 psi) Gauge
- JT03017 - Hose With Quick Coupler
- JT03240 - 7/16-20 M 37° X 7/16-20 M 37° Elbow
- JT03264 - Quick Coupler F X 7/16-20 F 37° Adaptor
- JT05480 - Quick Coupler M X M14-1.5 ORB Adaptor

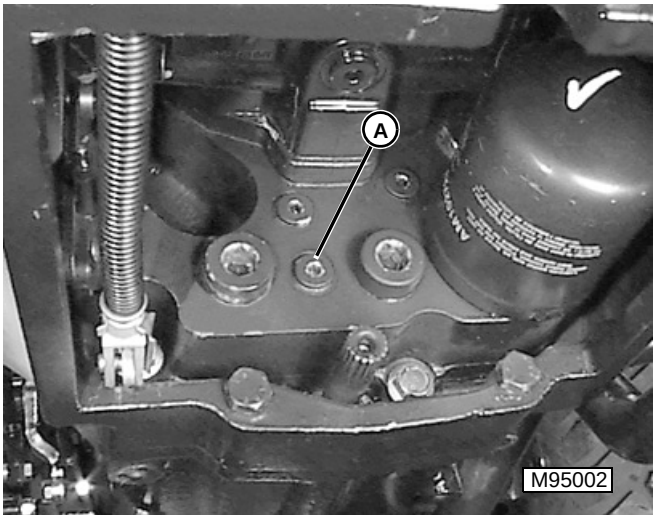


Procedure:

1. Park tractor on a level surface and set park brake.
2. Turn key switch to OFF position.
3. Shift transmission to NEUTRAL.

IMPORTANT: Make sure to relieve system pressure before loosening any system lines or hoses.

4. Cycle all controls to relieve any pressure that may be in the hydraulic system.



NOTE: 4-WD shaft removed for clarity.

5. Underneath the tractor, at the front of the tunnel, locate the hydrostatic transmission. Remove the plug in the charge pressure test port (A).
6. Assemble test equipment as shown and install to test port.
7. Start engine and run at high idle.
8. Check pressure reading on gauge.

Specifications:

Charge Pressure . . . .690 - 1034 kPa (100 - 150 psi)

Results:

- Charge pressure should reach **690 - 1034 kPa (100 - 150 psi).**
- If pressure reading of **690 - 1034 kPa (100 - 150 psi)** cannot be obtained, the mesh inlet filter may be restricted, the suction line may be restricted or leaking air, or front hydraulic pump may be defective.

HYDRAULIC SYSTEM BLEED PROCEDURE

Reason:

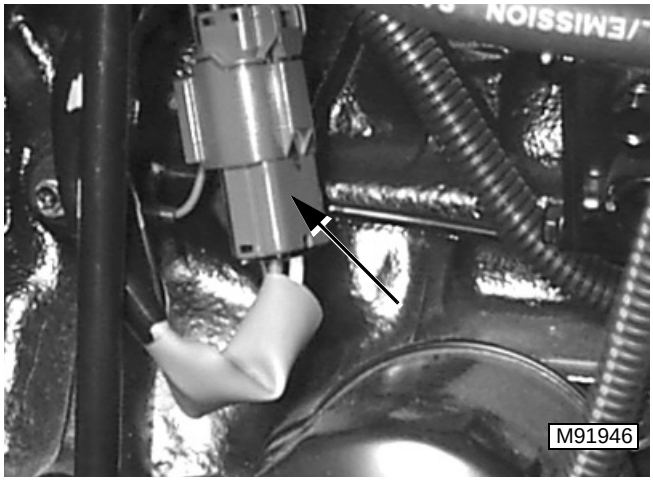
To remove air trapped in the hydraulic system which will prevent proper operation.

Procedure:

IMPORTANT: If contamination is found in hydraulic system filter or inside reservoir, flush entire hydraulic system.

NOTE: Fill the hydraulic oil filter with new oil before installing.

1. Install a new hydraulic oil filter.
2. Fill the transaxle with specified JDM J20D (preferred) or J20C oil to the proper level in sight glass.



3. Disconnect electrical connector to fuel shutoff solenoid.
4. Turn the key to START and hold for 10 seconds. Turn the key to OFF.
5. Reconnect wires to fuel shutoff solenoid.
6. Raise tractor front end and support on suitable stands.
7. Start the engine and run at low idle.

IMPORTANT: If steering fails to respond, or pump pressure is not being delivered to steering control unit (SCU), shut engine off and check to see that steering hoses are connected to the correct SCU ports.

8. Slowly turn the steering wheel left and right until wheels turn smoothly indicating that any trapped air has been bled back to the reservoir.

IMPORTANT: If rockshaft fails to react to lift control lever movement, shut engine off and check hose clamps on suction tube elbow and manifold to ensure that they are properly tightened.

9. Operate rockshaft several times until it operates smoothly.
10. Stop the engine and check the hydraulic reservoir oil level. Fill as needed. Check all line connections for leaks; tighten if necessary.
11. Lower the tractor to the ground.
12. Drive tractor in forward and reverse several times until transmission operates smoothly.

REPAIR

TRACTOR SPLITTING (FRONT)

*NOTE: It is **not** necessary to remove the flywheel housing from the engine unless engine is being removed. Split the tractor between the tunnel and flywheel housing as outlined in the story below.*

Prepare the Tractor:

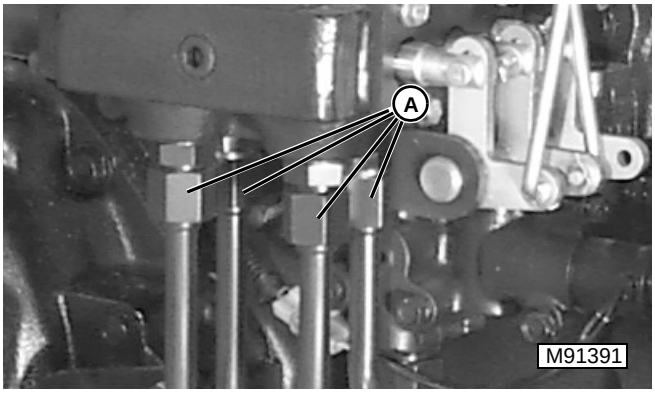
1. Remove any mid or front attachments and mid or front PTO shaft.
2. Park tractor on a level surface. Engage park brake, shut off engine.
3. Disconnect battery negative terminal.
4. Remove floor mat.
5. Remove operator's platform. (See "OPERATOR'S PLATFORM" in Miscellaneous section.)
6. Remove LH and RH closeout panels.
7. Remove seat and seat platform. (See "SEAT AND SEAT SUPPORT" in Miscellaneous section.)
8. Remove fenders. (See "REAR FENDERS" in Miscellaneous section.)
9. Cycle all hydraulic controls to relieve system pressure.

⚠ CAUTION

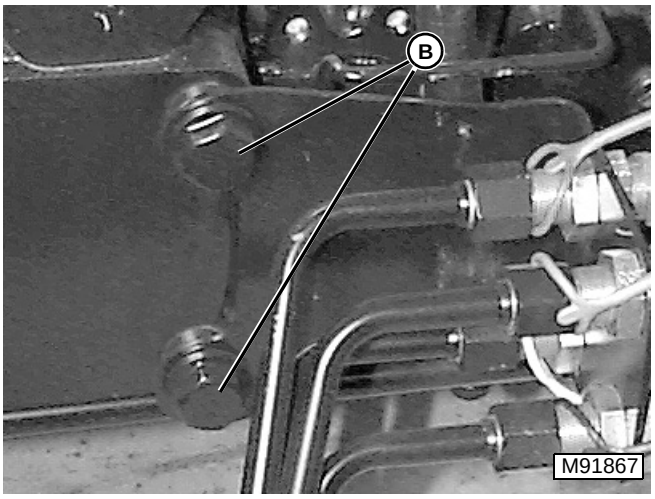
CAUTION: To avoid injury from escaping hydraulic oil under pressure, relieve the pressure in the system by stopping the engine and operating all hydraulic control valves.

NOTE: Hydraulic reservoir contains approximately 26 L (6.8 gal) of oil. Have a suitable container ready to catch drain oil.

10. Drain hydraulic reservoir.
11. If tractor is equipped with an SCV:
    - Raise RH rear of tractor and support on suitable stands.
    - Remove RH rear wheel and tire.

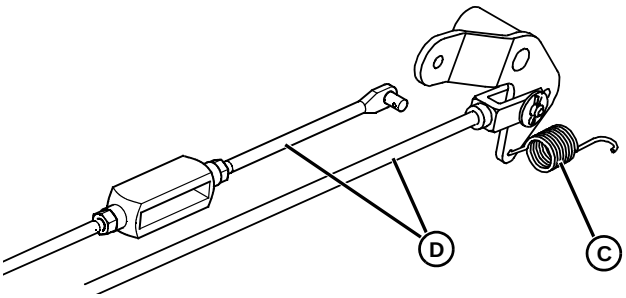


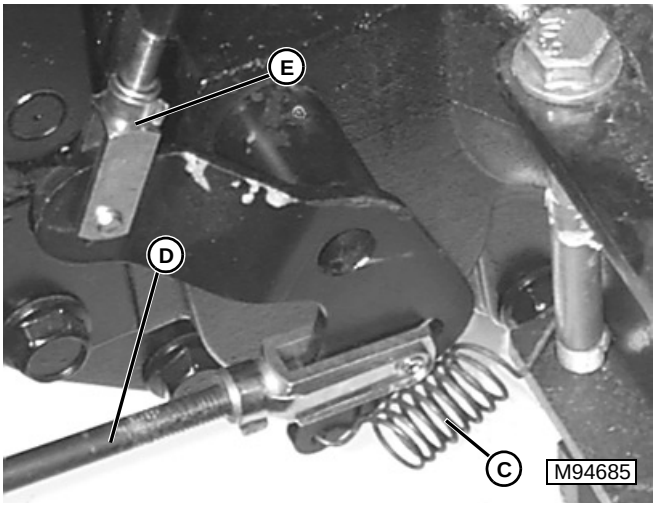
- Disconnect four work port tubes (A) from SCV.



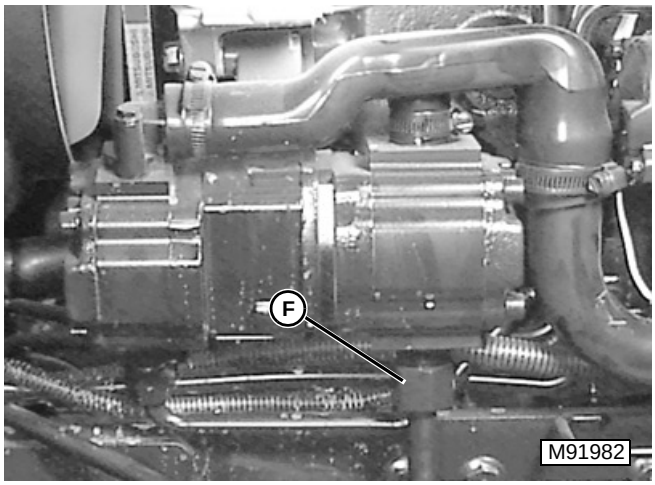
- Remove two cap screws (B) and two spacers that attach tube support bracket to frame. Remove tube support bracket and tubes as an assembly.
- Install RH rear wheel and tire.

12. Locate and disconnect all electrical connectors attaching wiring harness to switches and lights on rear half of tractor. Unfasten wiring harness from cable clips and move harness away from rear half of tractor.

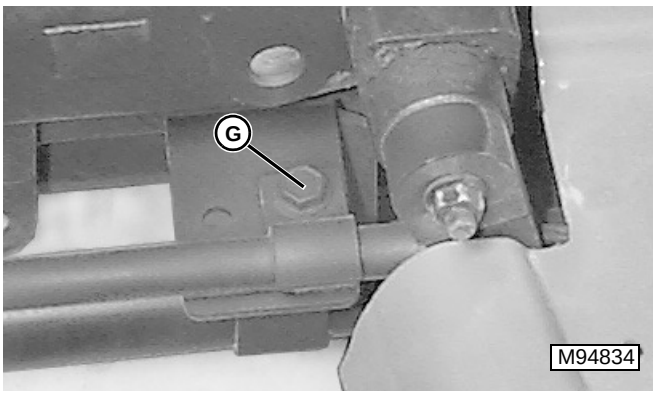




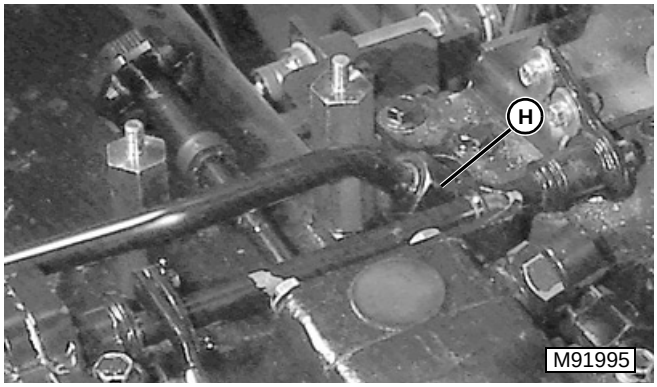
13. Disconnect brake return spring (C) from brake lever. Remove spring.
14. Disconnect lower brake rod (D) from brake lever.
15. **Side Mount Parking Brake Only:** Disconnect park brake rod (E) from brake lever.



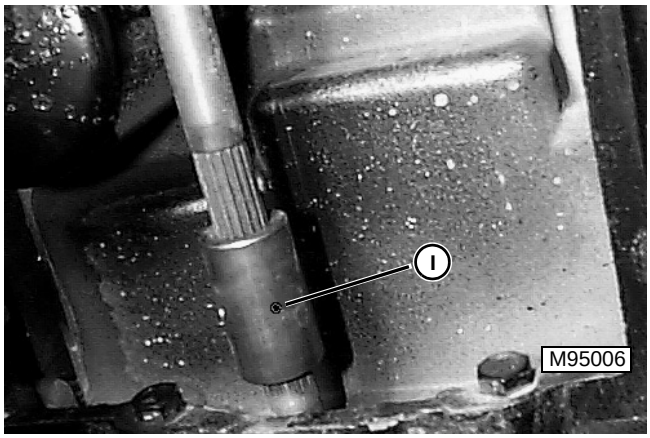
16. Disconnect hydraulic pressure tube (F) at rear gear pump.



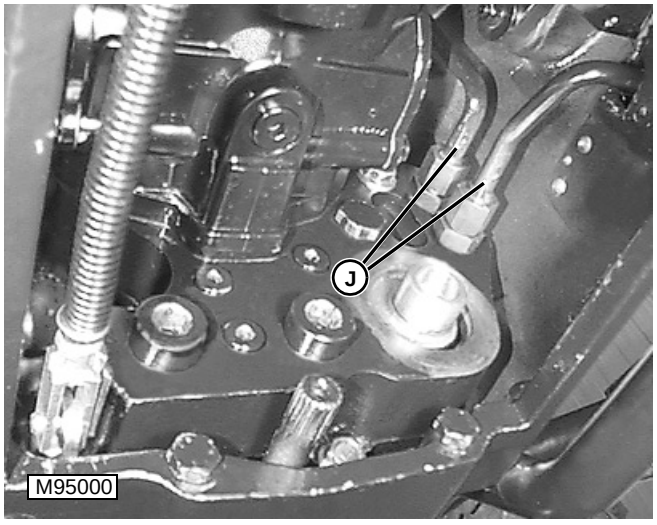
17. Remove cap screw (G) and hydraulic pressure tube clamp.



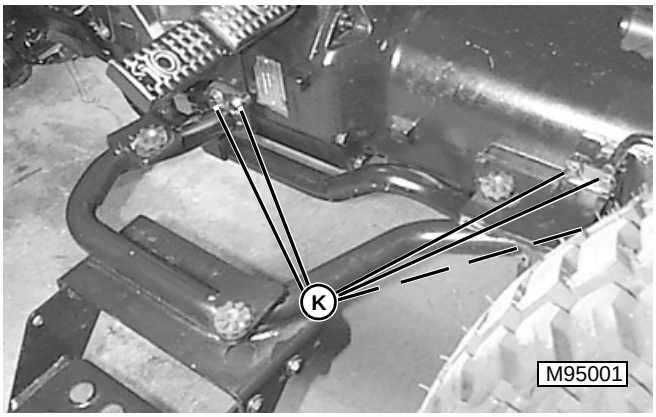
18. Disconnect hydraulic supply tube (H) at SCV or manifold block. Remove tube.



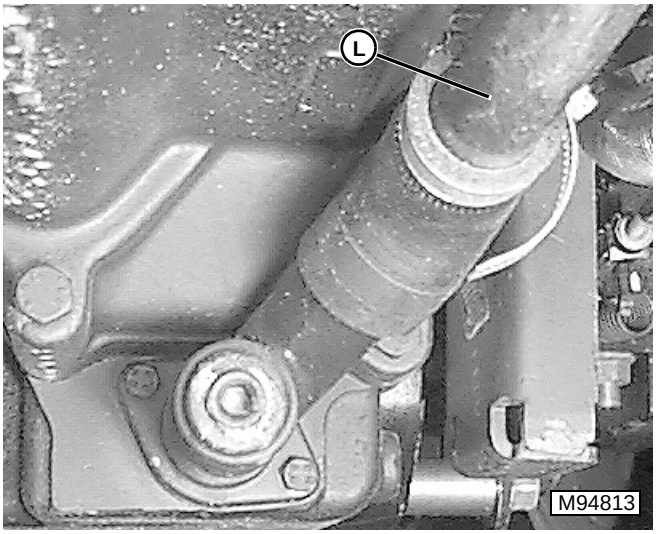
19. If equipped: Remove 4-WD drive shaft and couplers by removing spring pin (I) and sliding coupler onto shaft until clear of stub shaft. Repeat at other end of drive shaft.
20. Remove hydraulic oil filter.



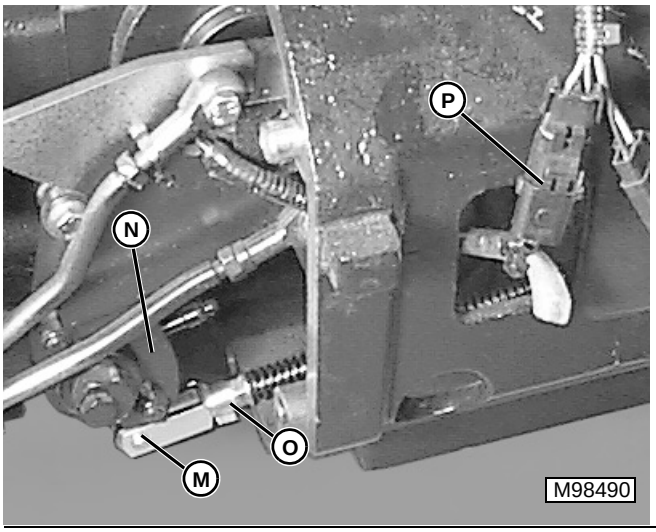
21. Disconnect two hydrostatic charge pressure tubes (J) from hydrostatic transmission.



22. Remove five cap screws (K) and LH operator's platform support.

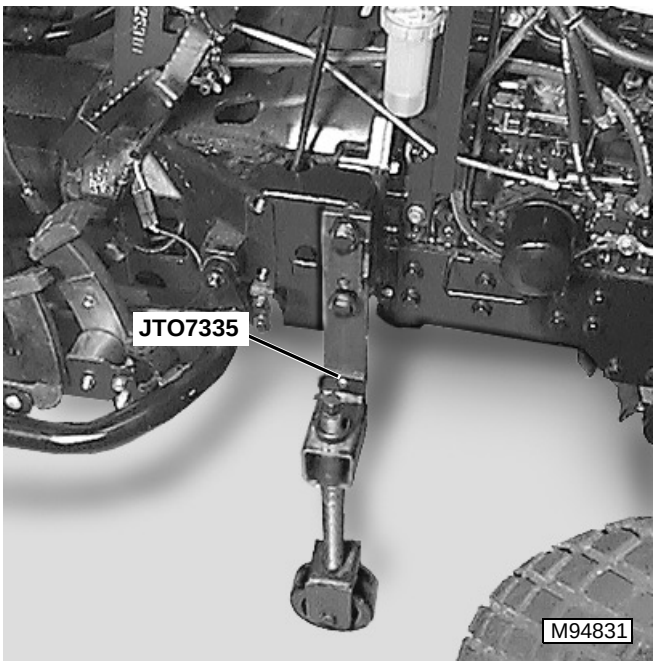


23. Loosen hose clamp and disconnect suction tube (L) from manifold.



NOTE: Tractor shown split for clarity.

24. Remove clip pin (M) and disconnect clevis from hydrostatic control linkage (N). Remove neutral return spring, rod (O), and clevis as an assembly.
25. Disconnect neutral switch connector (P).



NOTE: When attaching JTO7335 splitting stands to tunnel section, use the supplied right angle brackets, and attach to holes in underside of tunnel section.

26. Using suitable cap screws, attach four JTO7335 splitting stands to tractor sections. Adjust splitting stands so that wheels contact the floor, and are parallel to the tractor wheels.

NOTE: It is not necessary to remove top center cap screw on tunnel section when splitting tractor. It retains hydrostatic transmission to tunnel section.

27. Remove nine cap screws connecting tunnel to flywheel housing. Note length and locations of cap screws when removing.

IMPORTANT: Check for, and disconnect any additional accessory wires or hydraulic tubes connecting rear half to front half before splitting tractor.

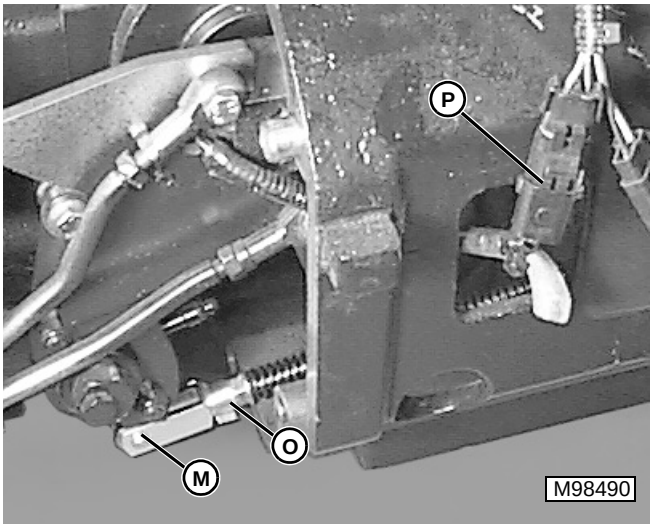
28. Release park brake and place gear shift in NEUTRAL.

29. Gently pry around edges of flanges to separate tractor halves.
30. Roll tractor halves apart.

Assemble Tractor Sections:

NOTE: Splines on all drive shafts and couplers must be aligned before tractor sections are bolted together.

1. Align splines on hydrostatic transmission drive shaft and engine flywheel.
2. Move tractor sections together and retain with nine cap screws. Tighten cap screws to **126 - 154 N•m (95 - 115 lb-ft)**.
3. Remove cap screws retaining splitting stands to tractor sections. Remove splitting stands.

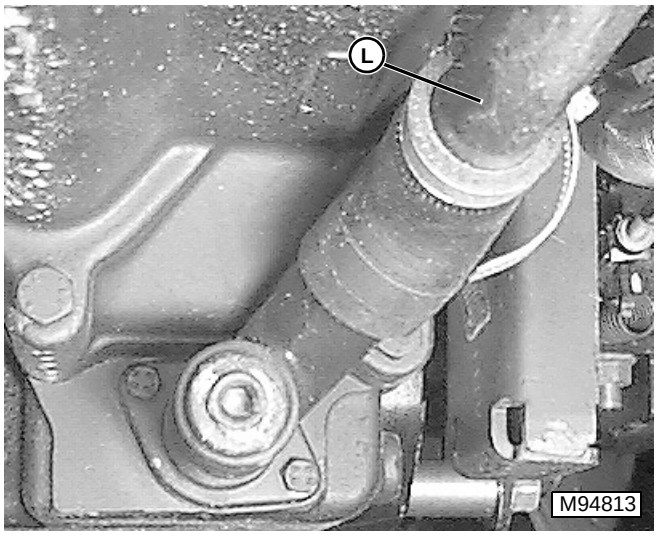


NOTE: Tractor shown split for clarity.

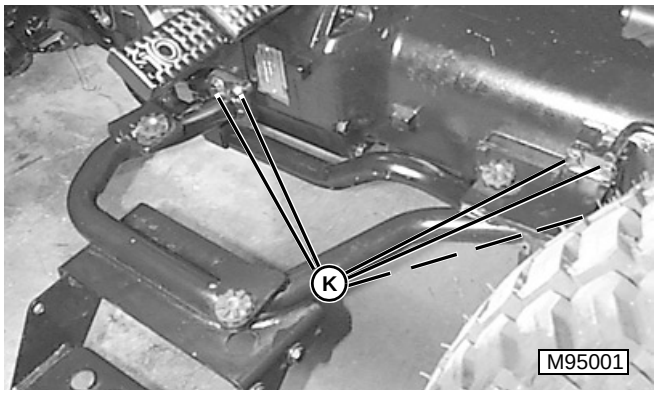
⚠ CAUTION

Tensioned spring. Wear eye protection and gloves when disconnecting spring to reduce the risk of personal injury.

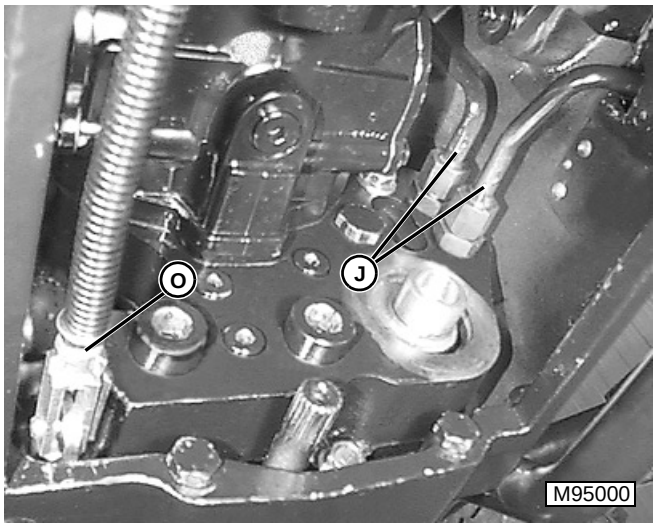
4. Install neutral return spring, rod (O), and clevis as an assembly. Attach clevis to hydrostatic control linkage and retain with clip pin (M).
5. Connect neutral switch connector (P).



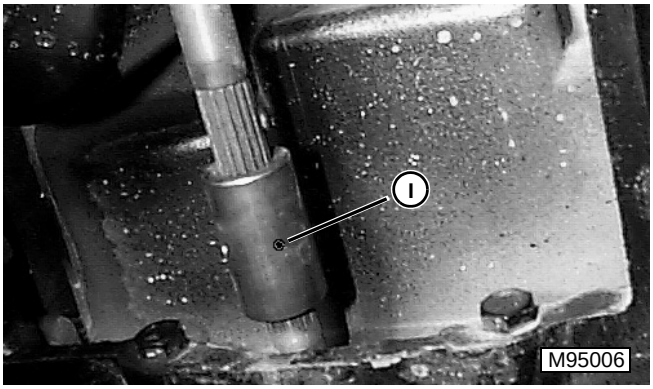
6. Connect suction tube (L) to manifold. Tighten hose clamp.



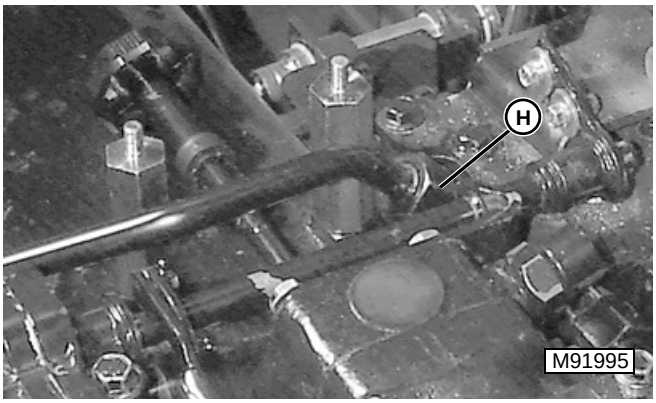
7. Install LH operator's platform support. Retain with five cap screws (K).



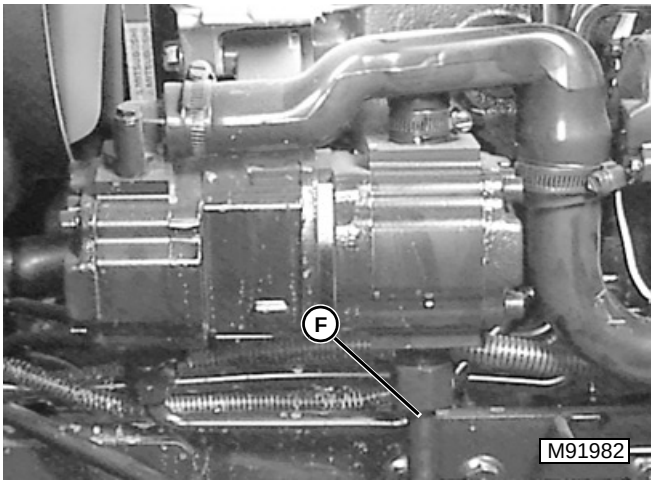
8. Connect two hydrostatic charge pressure tubes (J) to hydrostatic transmission. Tighten to **40 - 57 N•m (30 - 43 lb-ft)**. Check opposite ends of both tubes to make sure they are tight.
9. Install a new hydraulic oil filter.



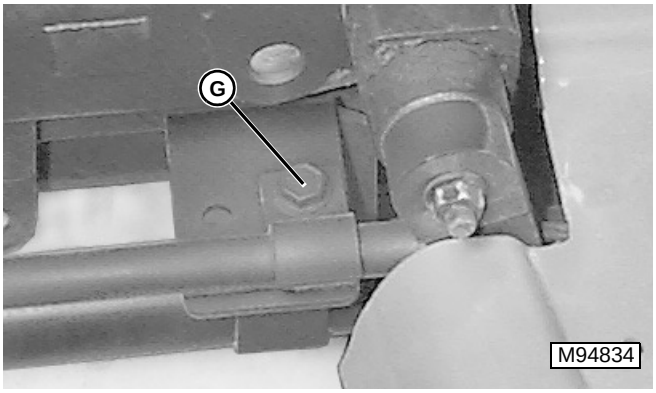
10. If equipped, install 4-WD drive shaft and couplers. Slide couplers onto shafts, and retain with spring pin (I).



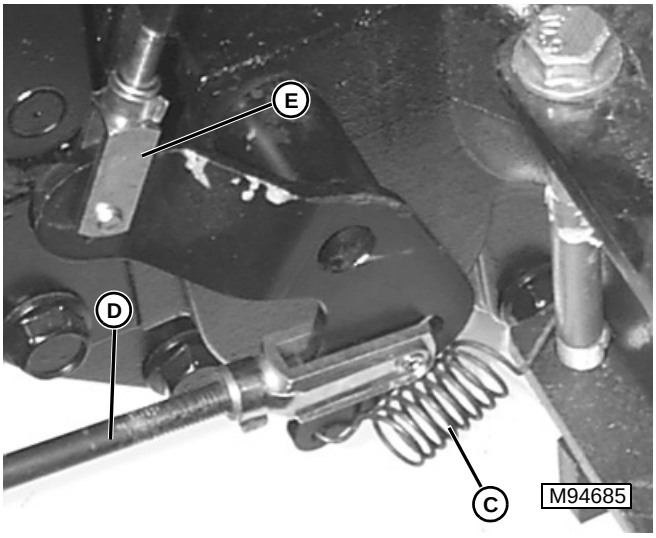
11. Install hydraulic supply tube (H) to tractor. Connect hydraulic supply tube to SCV or manifold block. Tighten tube nut to **55 - 79 N•m (40 - 59 lb-ft)**.



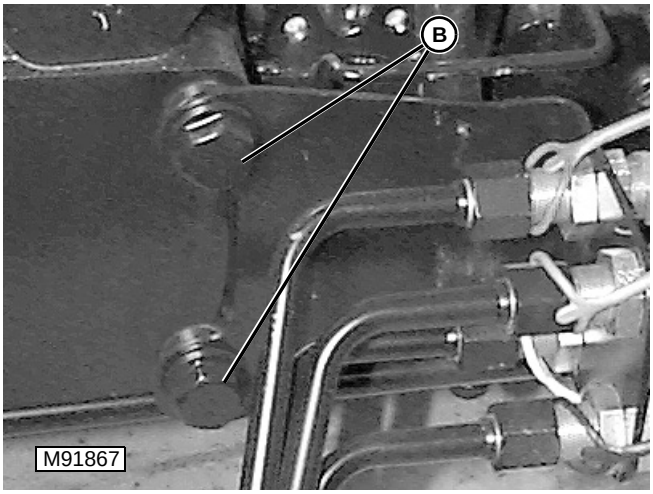
12. Connect hydraulic pressure tube (F) to rear gear pump. Tighten tube nut to **55 - 79 N•m (40 - 59 lb-ft)**.



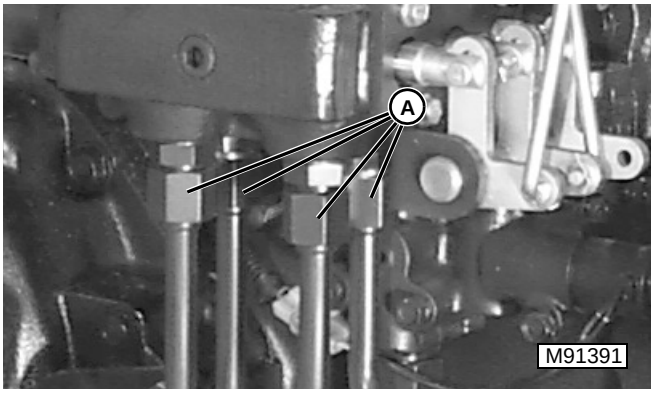
13. Install cap screw (G) and hydraulic pressure tube clamp.



14. Attach lower brake rod (D) to brake lever. Retain with pin, or pin, cotter pin, and washer.
15. **Side Mount Parking Brake Only:** Attach park brake rod (E) to brake lever. Retain with clip pin.
16. Install brake return spring (C) to brake lever and ROPS cap screw.
17. Route wiring harness through cable clips. Locate and connect all electrical connectors attaching wiring harness to switches and lights on rear half of tractor.



18. If tractor is equipped with an SCV, install SCV tube support bracket and tubes as an assembly. Install two spacers and cap screws (B) to attach tube support bracket to frame.
19. Raise RH rear of tractor and support on suitable stands. Remove RH rear wheel and tire.



20. Connect four work port tubes (A) to SCV. Tighten tube nuts to **40 - 57 N•m (30 - 43 lb-ft)**.
21. Connect battery negative (–) terminal.
22. Install fenders. (See "REAR FENDERS" in Miscellaneous section.)
23. Install kick plate. (See "KICK PLATE" in Miscellaneous Section.)
24. Install seat and seat platform. (See "SEAT AND SEAT SUPPORT" in Miscellaneous section.)
25. Install LH and RH closeout panels.
26. Install operator's platform. (See "OPERATOR'S PLATFORM" in Miscellaneous section.)
27. Install floor mat.
28. Refill hydraulic oil reservoir to proper level.
29. Bleed air from hydraulic system. (See "HYDRAULIC SYSTEM BLEED PROCEDURE").

HYDROSTATIC TRANSMISSION REMOVAL & INSTALLATION

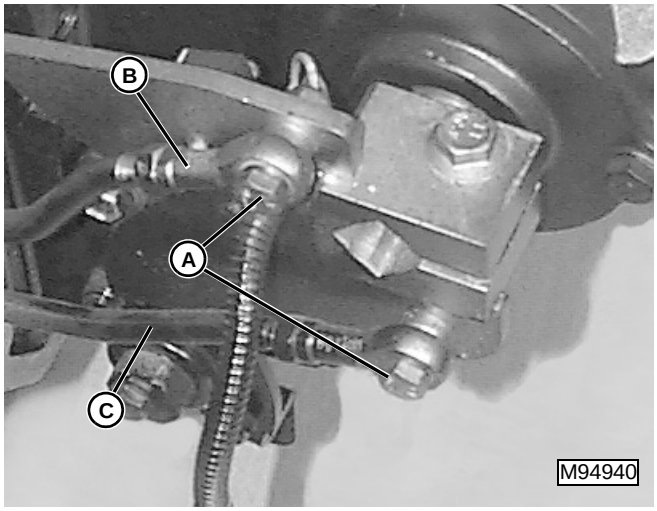
Removal:

1. Park tractor on level surface. Stop engine and release hydraulic pressure by operating all controls.

⚠ CAUTION

Avoid injury from escaping hydraulic oil under pressure. Relieve system pressure by stopping engine and operating all hydraulic controls.

2. Separate tractor engine and tunnel sections. (See "TRACTOR SPLITTING FRONT").



3. Remove two cap screws (A), spacers, and lock nuts, and disconnect transmission forward (B) and reverse (C) control rods.

⚠ CAUTION

Hydrostatic transmission weighs approximately 34 kg (75 lb). Attach a suitable lifting device to transmission before removing cap screws.

NOTE: One cap screw is removed from the top of the tunnel section, from the outside.

4. Remove five cap screws attaching transmission to tunnel section. Note length and location of cap screws when removing.

NOTE: Oil may drain from the pump and motor unit after it is removed. Have a suitable container ready to catch excess oil.

5. Gently pry around edges of flanges to break sealant. Remove transmission.

NOTE: Drive shaft may come out with transmission. If removed with transmission, remove from transmission, and install into tunnel and range transmission.

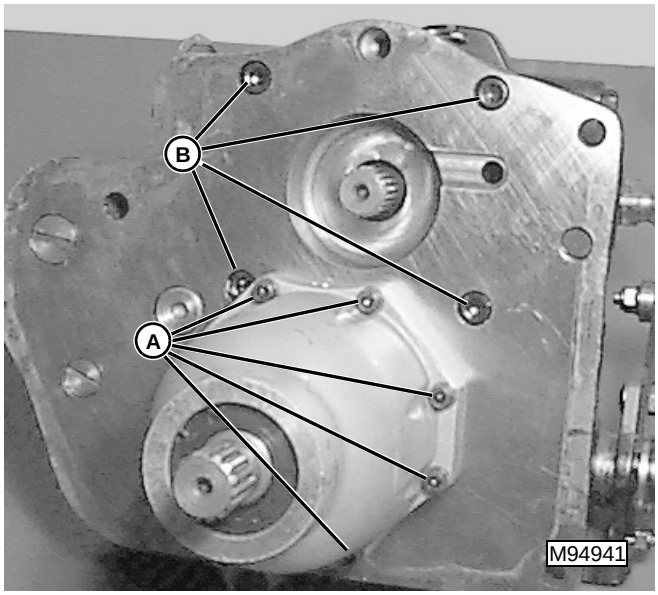
Installation:

Installation is the reverse of removal.

- Clean flanges of transmission and tunnel before applying sealant.
- Apply TY16021 sealant to flanges of transmission where it contacts the tunnel.
- Tighten cap screws attaching transmission to tunnel to **126 - 154 N•m (95 - 115 lb-ft)**.

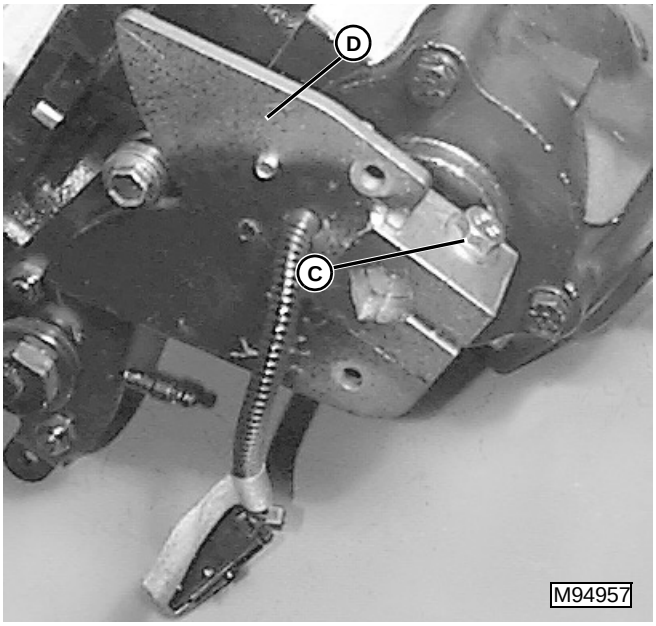
IMPORTANT: If neutral adjustment locking cap screw was loosened, neutral adjustment procedure must be performed. See "HYDROSTATIC PEDAL AND NEUTRAL ADJUSTMENT".

HYDROSTATIC TRANSMISSION DISASSEMBLY

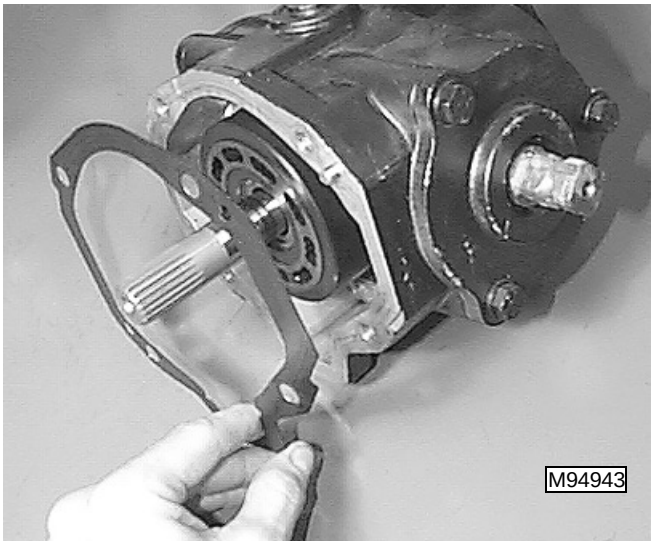


IMPORTANT: The pump body and motor body are aluminum and can be easily damaged by steel tools. Be careful to not damage machined surfaces. Do not use screwdriver or other sharp objects to pry pump or motor body from back plate.

1. Remove eight socket head cap screws (A) securing the hydrostatic motor to the back plate.Tap the motor housing with a plastic mallet to loosen it from the valve plate. Keep the assembly level or tip output end down to keep the rotating assembly from sliding off of shaft. Pull the motor housing, shaft, and rotating assembly away from back plate.
2. Remove four socket head cap screws (B) securing the pump to the back plate. Remove pump.

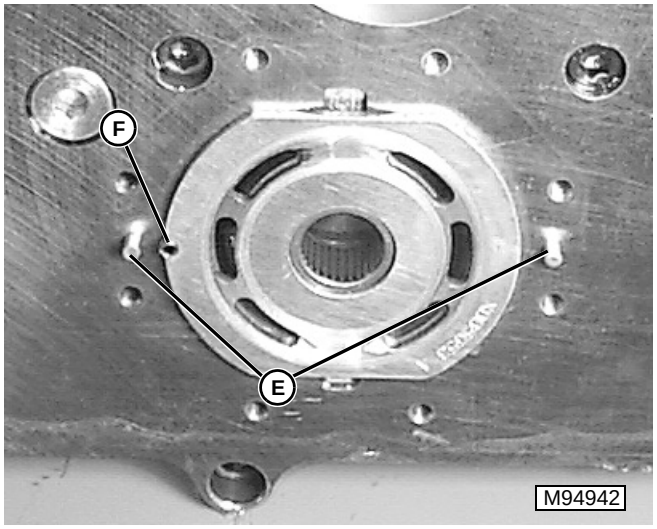


3. Remove cap screw (C) and nut. Remove speed control lever (D) and neutral switch as an assembly.



4. Remove gasket from pump assembly.

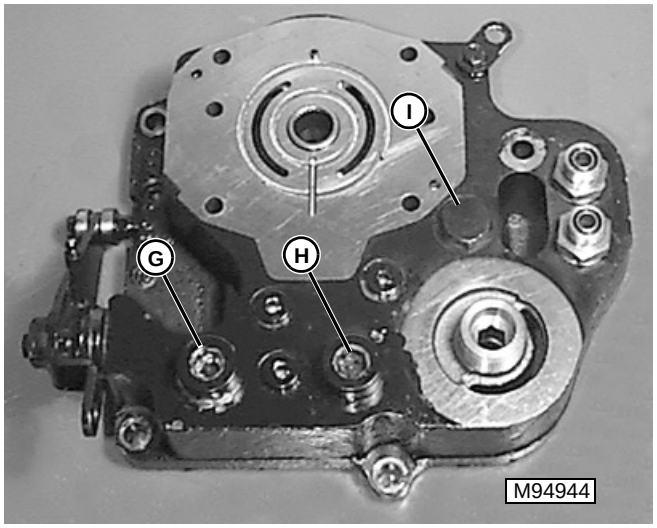
Back Plate Disassembly:



NOTE: Pump and motor valve plates are very similar in appearance, but are not interchangeable. Note shape of valve plates when removing. Valve plates are not fastened to back plate, but may adhere slightly because of oil between the machined surfaces.

5. Remove valve plates from the back plate.
6. Remove two dowel pins (E).

NOTE: Unless spring pin (F) used to locate valve plate is damaged or loose, do not remove. If replacement is necessary, use care not to scratch the machined surfaces of the back plate.



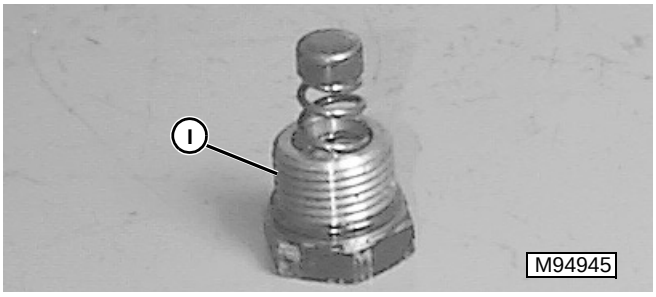
7. Mark the forward (G) and reverse (H) relief valves and their ports to ensure they go into the correct holes during assembly. Remove the relief valves from the back plate. Clean the relief valves in a suitable solvent, and check for damaged springs or seats.


M89652

NOTE: The relief valves are dual purpose valves. Each valve contains two springs. A weak spring (check valve when other circuit is in use) and a strong spring (6000 psi relief valve). Valves cannot be adjusted, and there are no serviceable parts inside. If any malfunction is suspected, replace the relief valve.

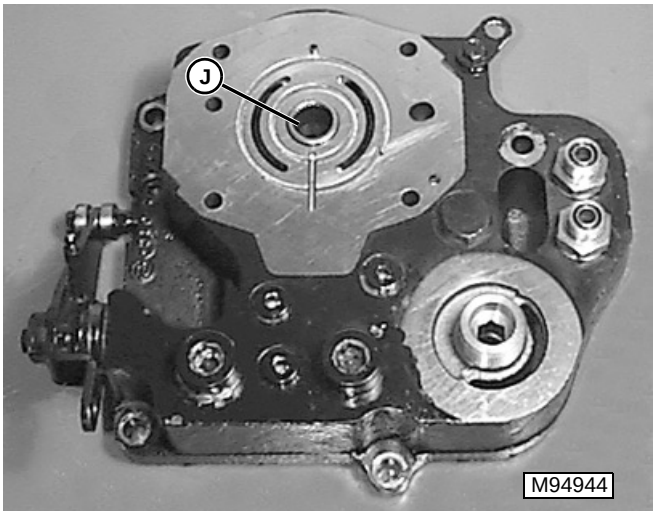
8. Examine the relief valve faces, and the seats in the back plate. The faces of the check valve and the seats in the back plate should be free of burrs and defects.

IMPORTANT: Damage to pump may occur if charge pressure relief valve and cooler bypass valve springs are accidentally swapped. Keep valves and springs separated or label them to prevent mix-up.



M94945

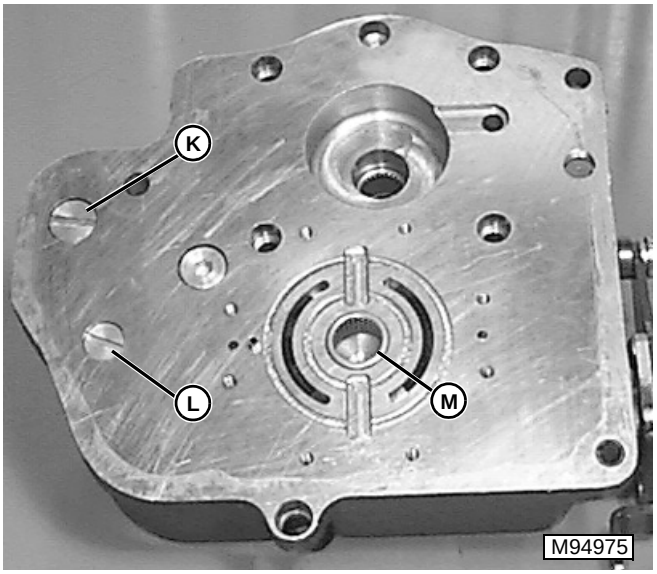
9. Remove the charge pressure relief valve (I) and check for damage or debris in spring or seating areas. Clean or replace parts as required.



M94944

IMPORTANT: To avoid damage to needle bearings when removing or installing, press only against side of bearing with lettering.
When removing bearings from the back plate, be extremely careful to not damage machined surfaces.

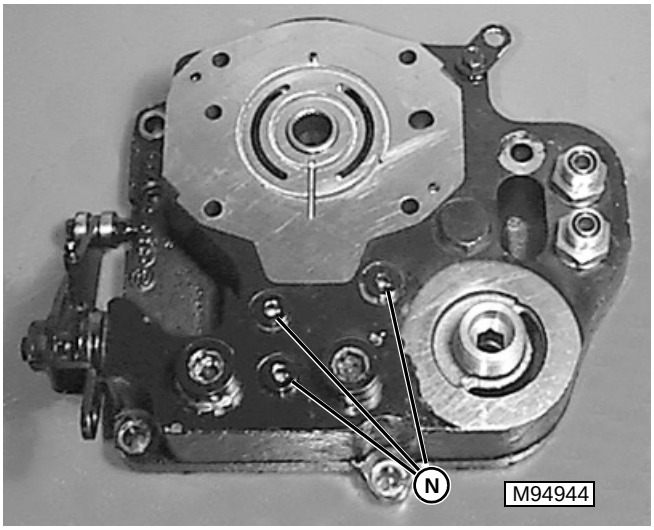
10. Inspect pump side needle bearing (J). Bearing should spin freely, and needles should not fall out of bearing cage. If replacement is necessary, press bearing out from the motor side of the housing.



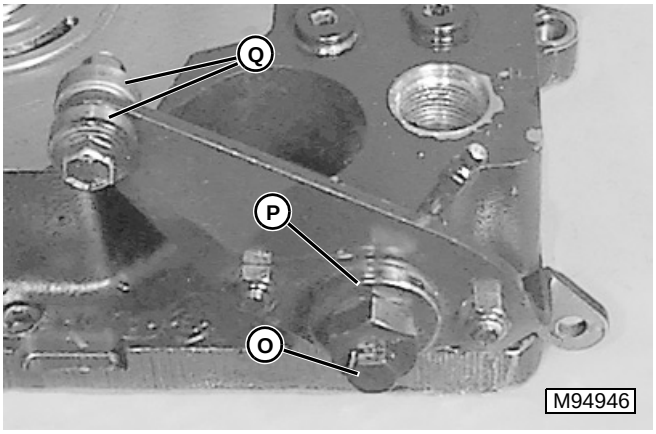
M94975

11. On the motor side of the back plate, remove the cooler bypass valve (K) and check for damage or debris in spring or seating areas. Clean or replace parts as required.

12. Remove the filter bypass valve (L) and check for damage or debris in spring or seating areas. Clean or replace parts as required.
13. Inspect the motor side needle bearing (M). Bearing should spin freely, and needles should not fall out of bearing cage. If replacement is necessary, remove using a suitable blind hole puller.



14. Remove three plugs (N) from pump side, and one plug from motor side of back plate, and clean out oil passages using a suitable solvent and compressed air.



NOTE: If neutral adjustment cap screw (O) is loosened, neutral adjustment procedure must be performed. See "HYDROSTATIC PEDAL AND NEUTRAL ADJUSTMENT".

15. Inspect pivot (P) and cam followers (Q) on neutral return lever for smooth operation. Replace parts as needed.

Back Plate Assembly:

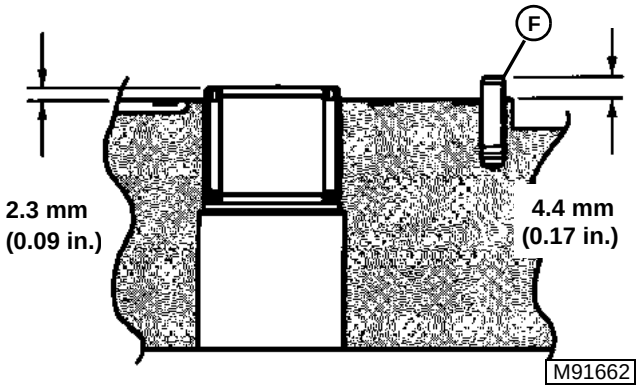
1. On motor side of the back plate, install the filter bypass valve. Tighten to **16 - 20 N•m (12 - 15 lb-ft)**.

NOTE: Cooler bypass valve spring and charge relief valve spring could accidentally be mixed up. Charge relief valve spring is thicker.

2. Install the cooler bypass valve. Tighten to **28 - 33 N•m (21 - 24 lb-ft)**.

IMPORTANT: Old O-rings, gaskets, and seals will leak. Always install new O-rings, gaskets, and seals during assembly.

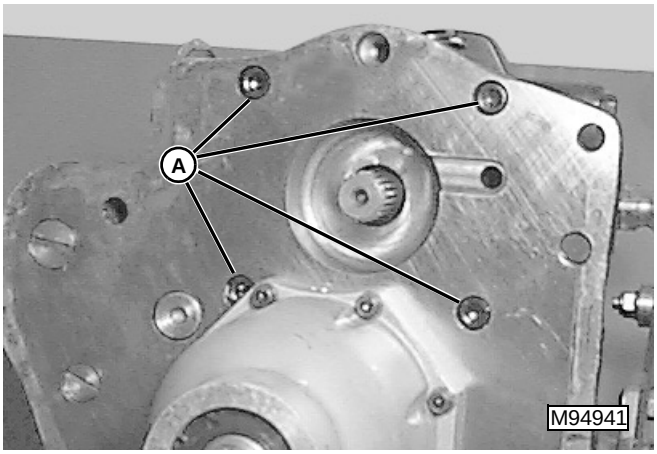
3. Install new O-ring to plug. Install plug. Tighten plug to **28 - 33 N•m (21 - 24 lb-ft)**.
4. On pump side of back plate, install new O-rings to three plugs. Install plugs. Tighten to **13 - 16 N•m (115 - 142 lb-in.)**.
5. Install forward and reverse relief valves in ports marked at disassembly. Tighten to **135 - 149 N•m (100 - 110 lb-ft)**.
6. Install charge pressure relief valve. Tighten to **37 - 41 N•m (27 - 30 lb-ft)**.
7. Install two dowel pins.



8. If the bearings were removed from the back plate, press new ones into position using a suitable bearing driver. The numbers on the bearing should face the **outside** of the back plate. Press the bearing in until **2.3 mm ± 0.2 mm (0.090 in. ± 0.010 in.)** of the race remains above the surface of the back plate.
9. If removed, install the spring pin (F) that is used to position the valve plate. Allow the pin to protrude from the back plate approximately **4.4 mm (0.17 in.)**.

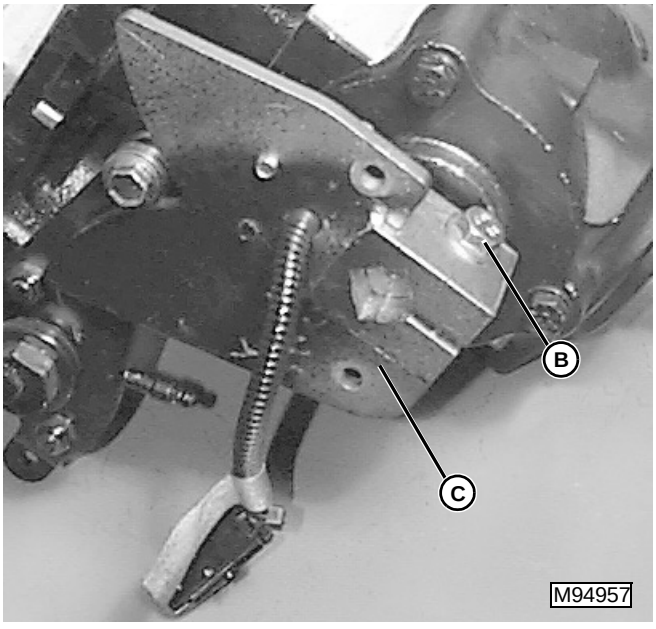
HYDROSTATIC PUMP DISASSEMBLY

Procedure:

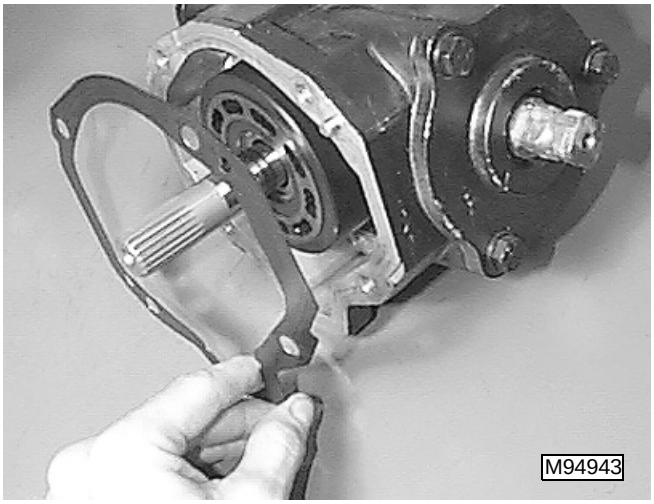


IMPORTANT: The pump body is aluminum and can be easily damaged by steel tools. Be careful to not damage machined surfaces. Do not use screwdriver or other sharp objects to pry pump body from back plate.

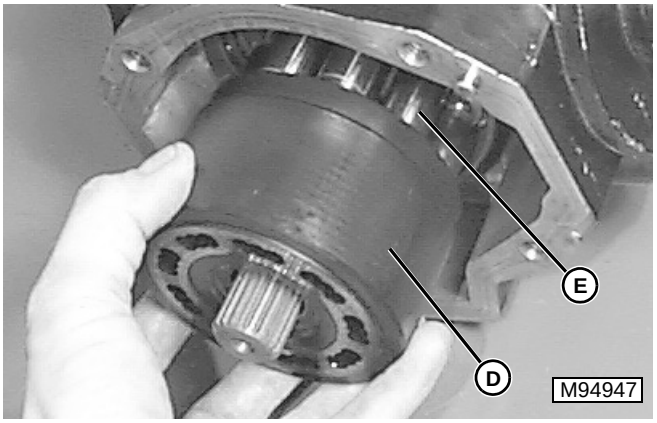
1. If not already done, remove four socket head cap screws (A) securing the pump to the back plate. Tap pump body with a plastic mallet to remove pump.



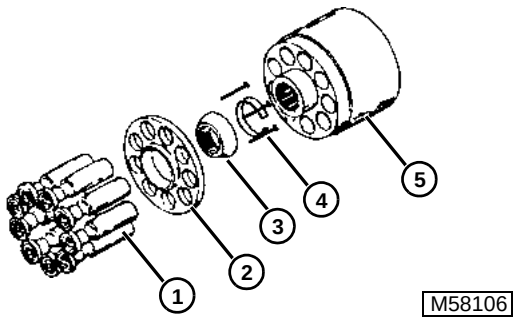
2. Remove cap screw (B) and nut. Remove speed control lever (C) and neutral switch as an assembly.



3. Remove gasket from pump assembly.



4. Remove the rotating assembly (D) from the housing.
5. If the pistons (E) did not come out with the piston block, remove the pistons along with the spider and pivot.



1. Pistons
2. Spider
3. Pivot
4. Pins and Retainer
5. Piston Block

Piston Block Disassembly:

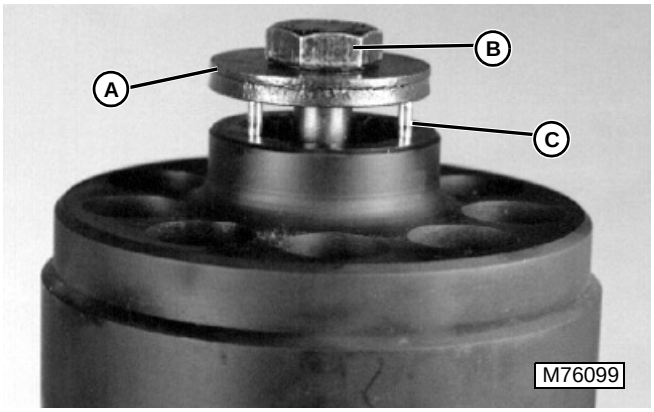
NOTE: Disassembling the piston block assembly is not necessary unless the spring or pins are damaged.

⚠ CAUTION

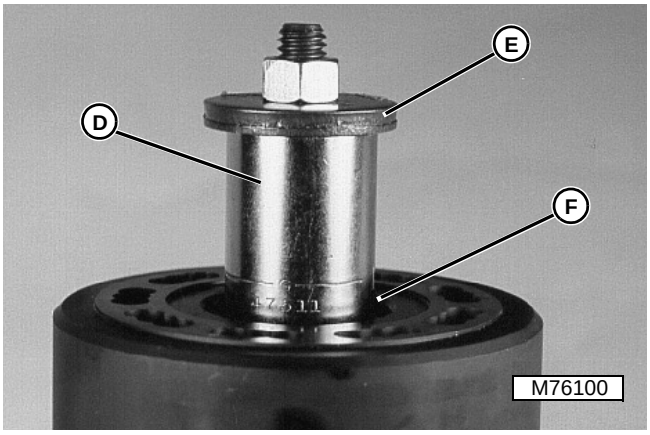
The spring inside the piston block is compressed and should not be removed without compressing the spring first. Use the following procedure to remove the spring safely.

The following parts will be needed to disassemble the piston block:

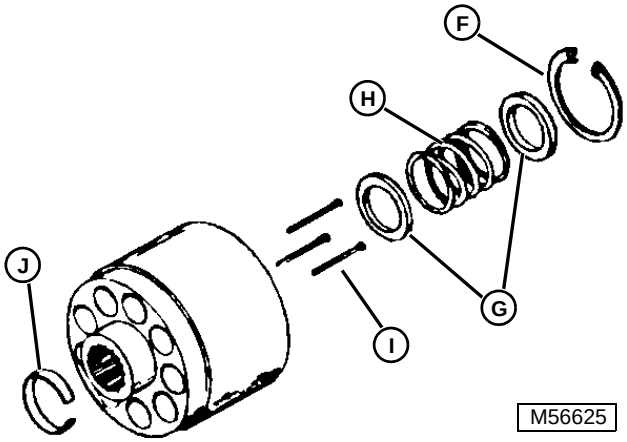
2 ea. . . . . 3/8 ID x 1-1/4 in. OD flat washers
1 ea. . . . . 3/8 x 5 in. N.C. cap screw
1 ea. . . . . 3/8 in. N.C. nut
1 ea. . . . . 1/2 in. drive socket with 1-1/8 in. OD



1. Place a flat washer (A) over the 3/8 x 5 in. cap screw (B). Install cap screw through spline end of piston block so that the washer rests on the three pins (C).



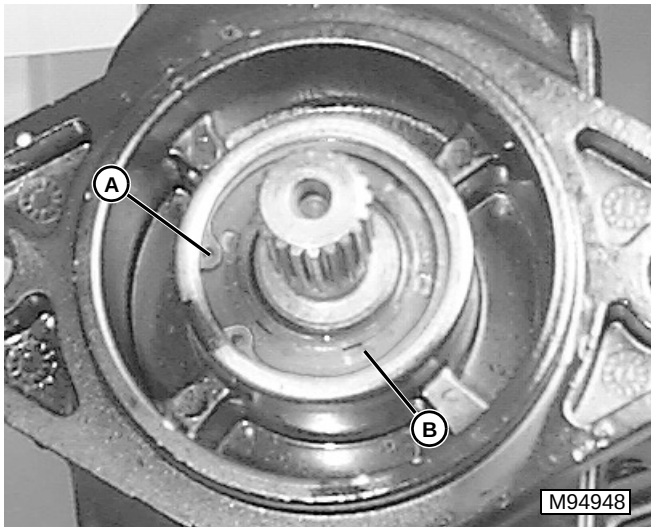
2. Place the socket (D), then a washer (E) over the threaded end of the cap screw.
3. Screw on nut and slightly compress the spring inside the piston block.
4. Using snap ring pliers, remove the internal retaining ring (F).
5. Carefully back off nut until spring tension is relieved.
6. Remove the nut, washer, and cap screw.



7. Remove washers (G), spring (H), pins (I), and pin retainer (J).
8. Inspect parts for wear or damage. Replace if needed.

Assembly is the reverse of disassembly.

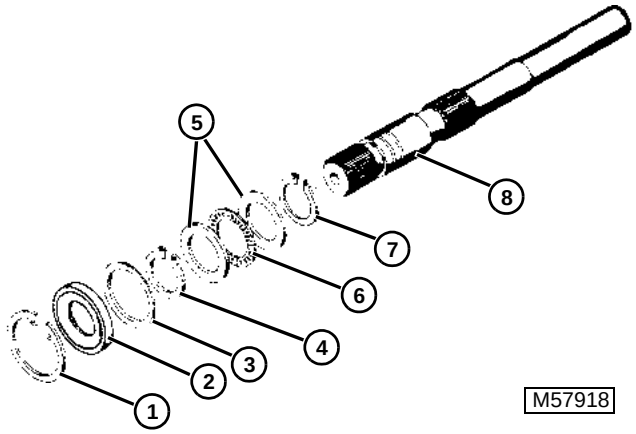
Shaft Removal and Disassembly:



1. Remove the internal snap ring (A) retaining the seal (B).

NOTE: Use care when pressing shaft out of housing to prevent shaft from falling to floor and being damaged.

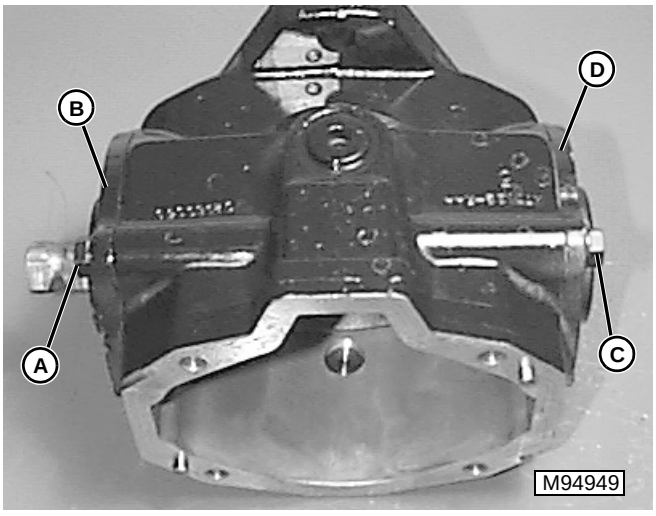
2. Press the shaft out of the housing from the back plate side until the seal releases from the bore.



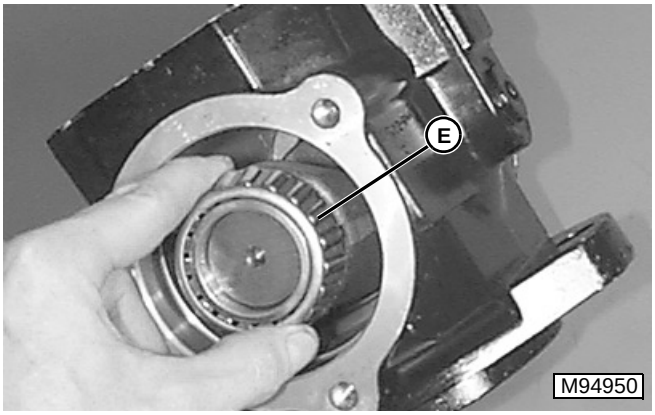
1. Internal Snap Ring
2. Seal
3. Washer
4. External Snap Ring
5. Thrust Washer
6. Thrust Bearing
7. External Snap Ring
8. Main Shaft

3. Remove the seal (2) and washer (3).
4. Remove the snap ring (4) from the shaft. Remove thrust washers (5) and thrust bearing (6).

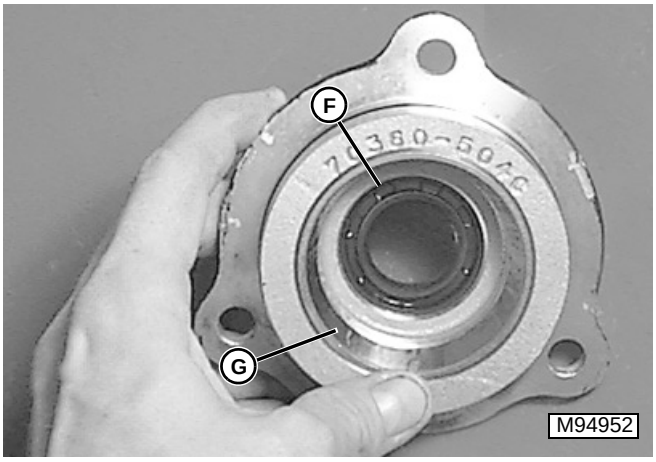
Control Disassembly:



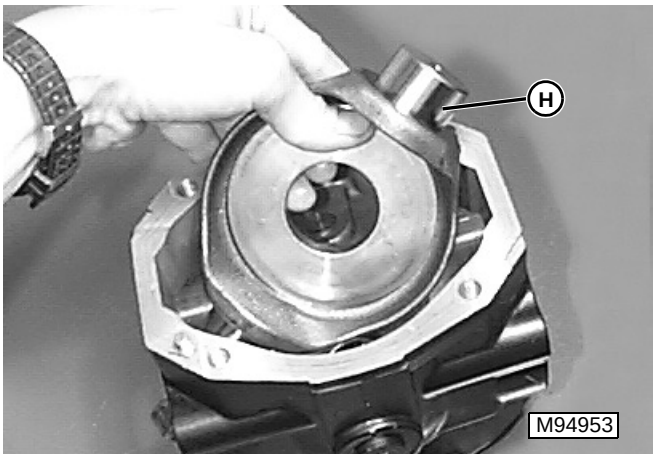
1. Remove three cap screws (A) and shaft end cap (B).
2. Remove three cap screws (C) and plain end cap (D).



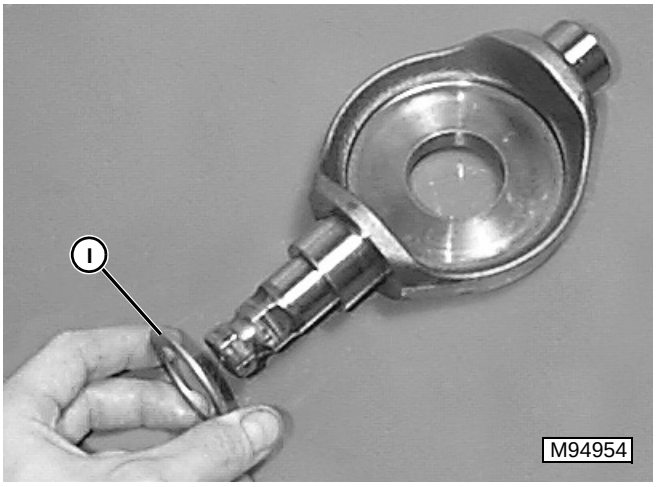
3. Remove bearing cones (E) from both ends of the control shaft. Inspect bearing cones for smooth operation, wear, or damage. Replace parts as needed.



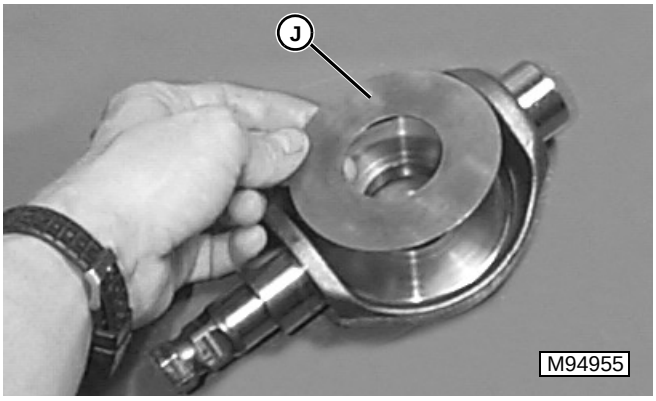
4. Replace seal (F) in shaft end cover.
5. Inspect bearing cups (G) for wear or damage. Replace bearings as needed.



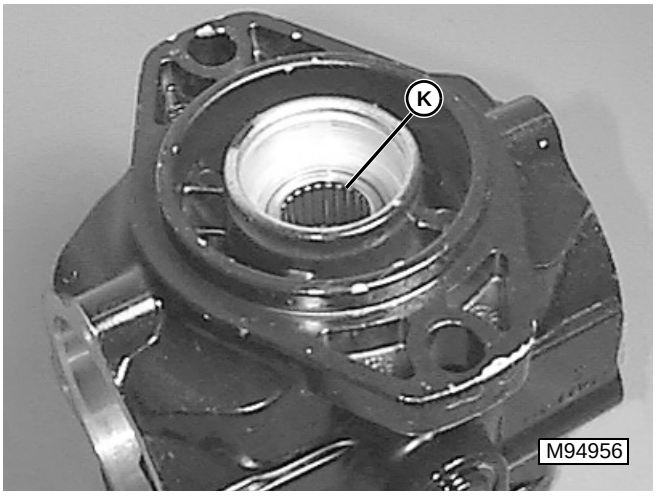
6. Remove cam plate assembly (H) from housing.



7. Remove shim (I).

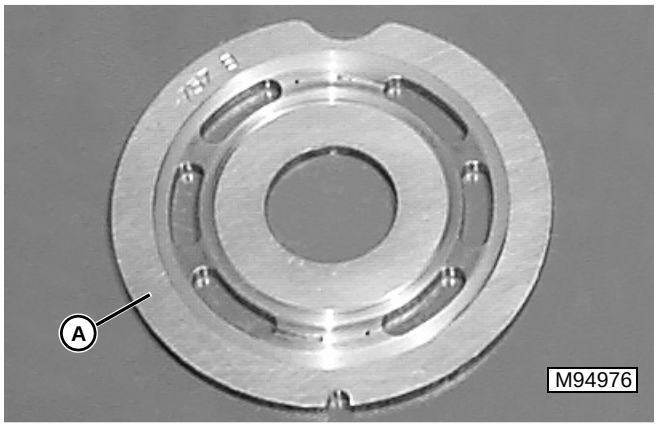


8. Remove thrust plate (J).

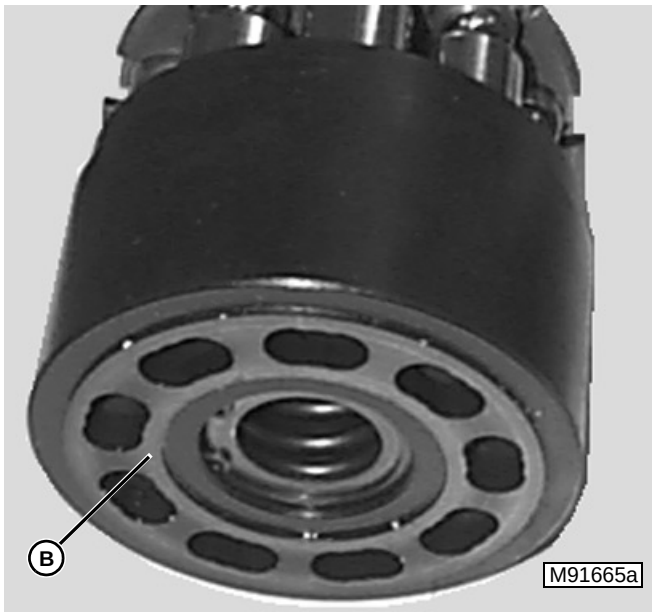


9. Inspect needle bearing (K) in housing. If the needles remain in the cage and spin freely, there is no need to replace them. If replacement is necessary, bearings may be removed with a bearing driver.

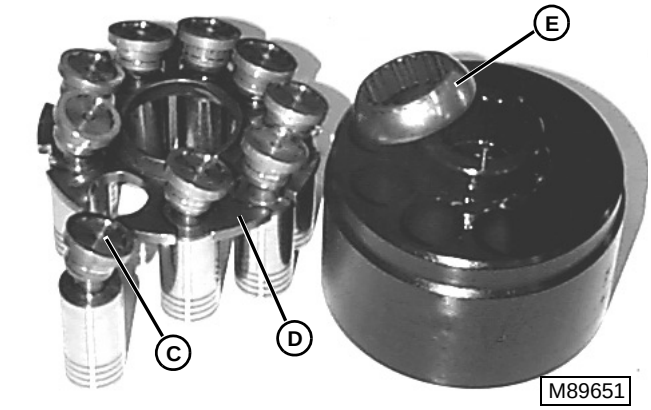
HYDROSTATIC PUMP INSPECTION



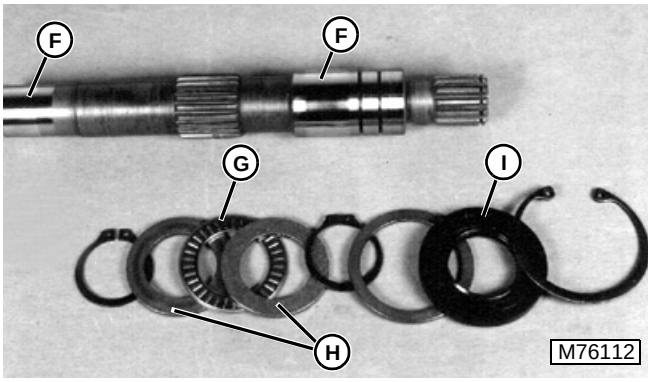
1. Inspect the bronze side of the valve plate (A) for wear. Replace the valve plate if any wear, scoring, or scratches exist.



2. Inspect the piston block surface (B) that makes contact with the valve plate. This surface should be smooth and free of deep scratches.
3. Check the piston movement in the block bore. If the pistons are sticky in the bore, examine the bore for scoring or contamination.



4. Inspect the outside of the pistons. Replace if scored or worn.
5. Inspect the shoes. Replace if loose on the ball end of the pistons, or if shoe face area (C) is worn or damaged.
6. Inspect the spider (D). Replace if worn in the area where it contacts the pivot (E).
7. Inspect the pivot. Replace if worn or damaged.
8. Examine the machined surfaces of the back plate. Replace if scored or damaged.



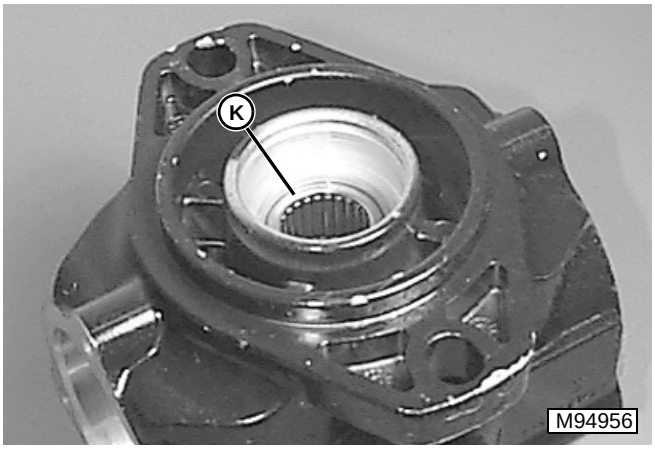
9. Inspect the shaft for damage on the bearing surfaces (F) or in the splined areas.
10. Inspect thrust bearing (G) and thrust washers (H) for wear.
11. Inspect the servo piston for scratches and wear.
12. Replace seal (I). Replace worn or damaged parts as required.

HYDROSTATIC PUMP ASSEMBLY

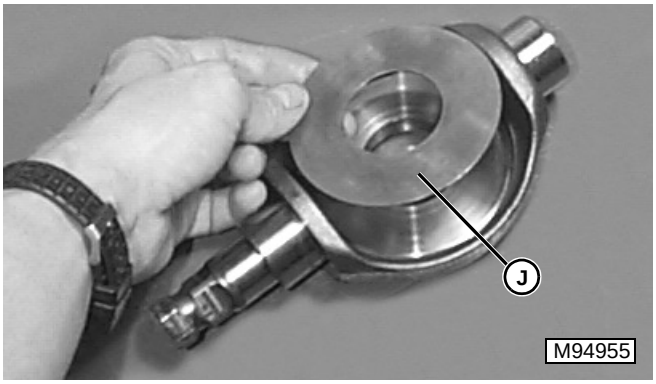
1. Clean all parts in a suitable solvent and dry with lint free rag.

IMPORTANT: Due to extremely tight tolerances and finish of internal surfaces it is very important to maintain absolute cleanliness during pump assembly. Coat all internal surfaces with clean 10W30 motor oil when assembling.

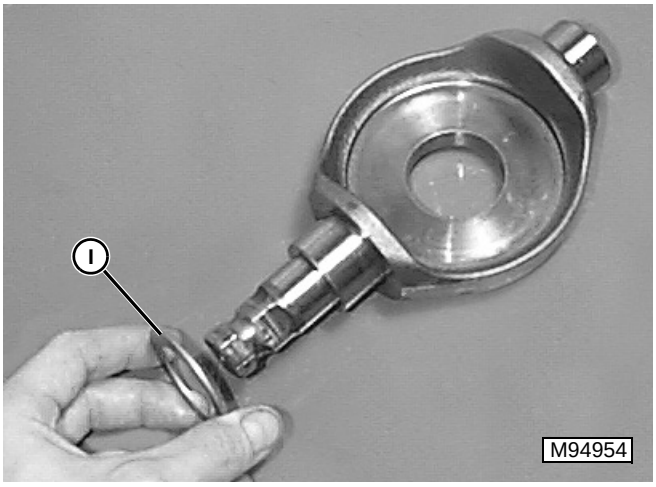
Housing and Shaft Assembly:



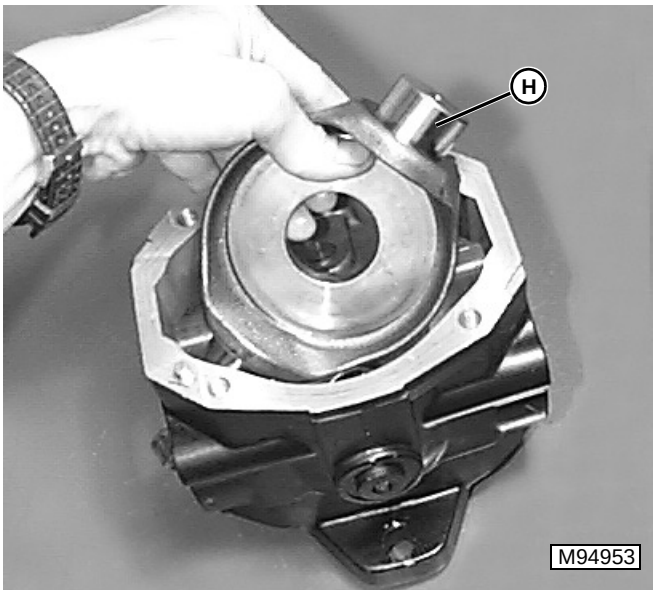
1. If the needle bearing (K) was removed from the housing, the new one can be pressed from the outside inward until the bearing race is recessed in the bore approximately **2.0 mm ± 0.3 mm (0.078 in. ± 0.15 in.)**. Be sure that the numbers on the bearing race are facing to the *outside* of the housing.



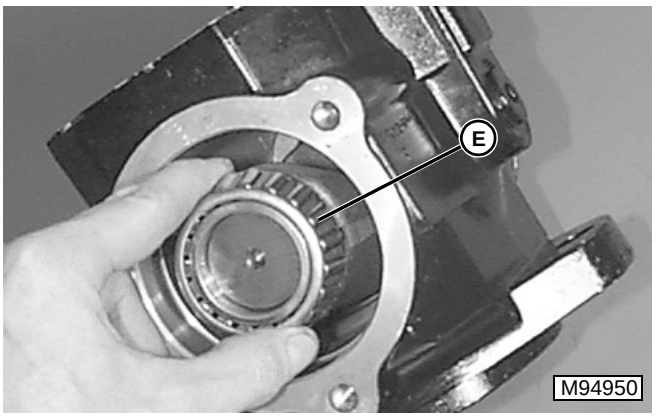
2. Apply a small amount of grease to back of thrust plate (J) and install thrust plate into cam plate.



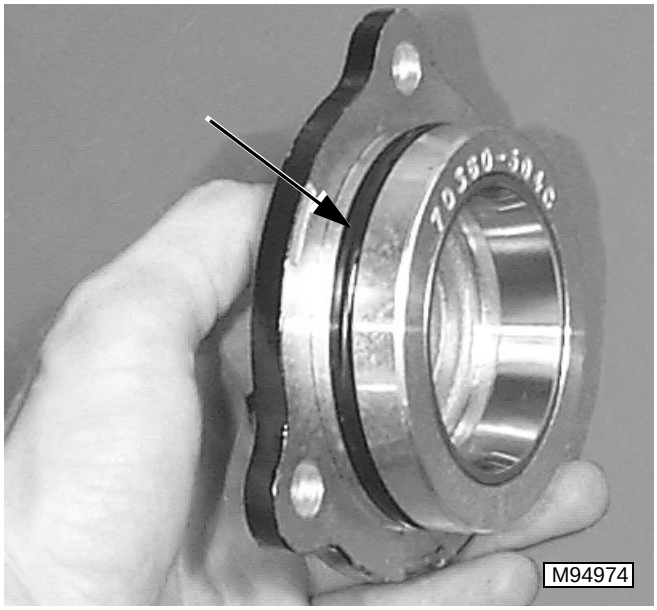
3. Install shim (I).



4. Install cam plate assembly (H) into housing.

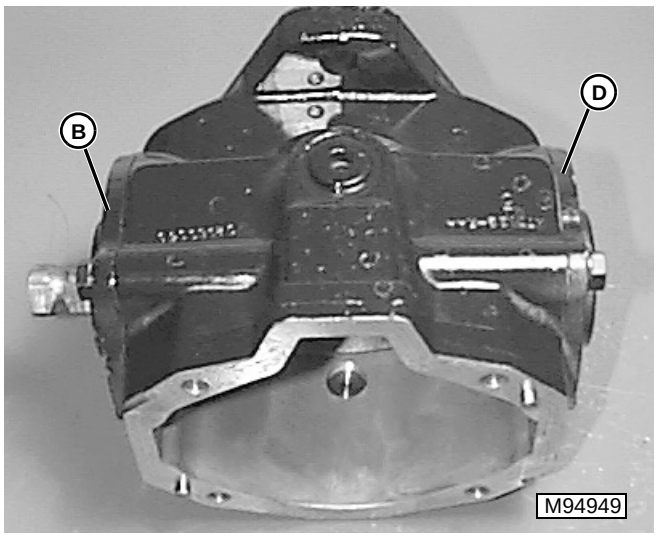


5. Install bearing cones (E) to both ends of the control shaft.



IMPORTANT: Old O-rings, gaskets, and seals will leak. Always install new O-rings, gaskets, and seals during assembly.

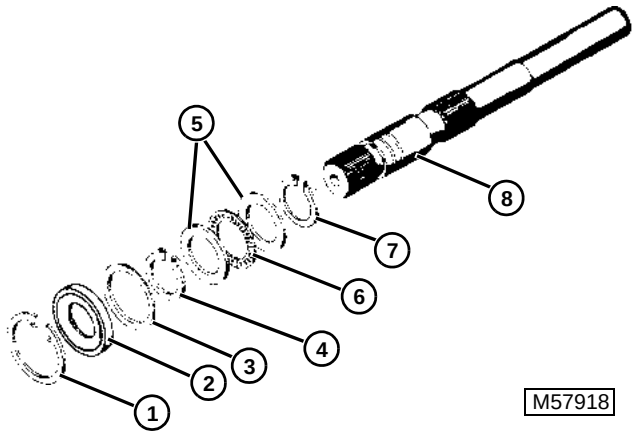
6. Install new O-rings on shaft end cap and plain end cap.



7. Install plain end (D) and shaft end (B) caps. Retain with cap screws.
8. Rotate control shaft and feel for smooth operation. Check for end play. If there is end play, remove shaft end cap and increase shim thickness until there is no end play.

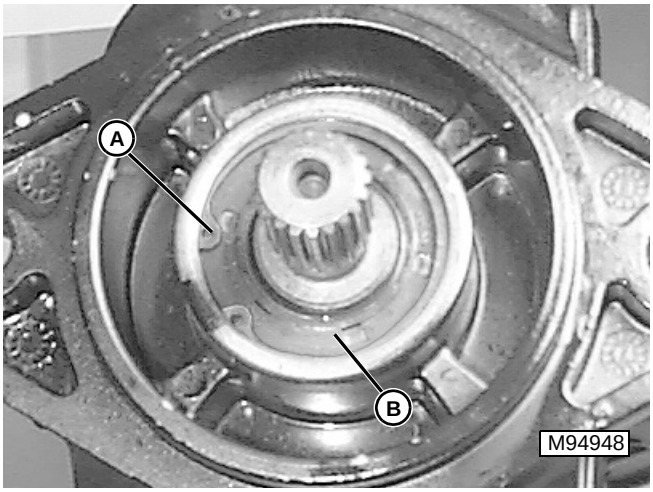
NOTE: Control shaft turning force measurement is taken while shaft is turning. Amount of force required to begin turning shaft is higher.

9. Using a suitable torque wrench, measure the amount of force required to turn the control shaft. While the shaft is turning, the amount of turning force should be **25 ± 5 lb-in.** Increase, or decrease the amount of shim on the shaft end of the cam plate until the force required is within the specification.



1. Internal Snap Ring
2. Seal
3. Washer
4. External Snap Ring
5. Thrust Washer
6. Thrust Bearing
7. External Snap Ring
8. Main Shaft

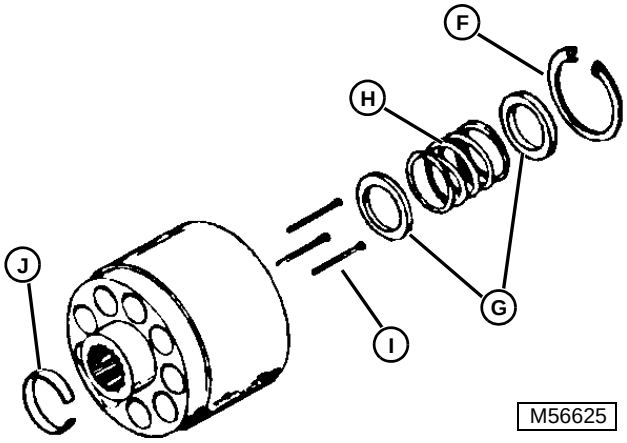
10. Install the external snap ring (7), thrust washer (5), and thrust bearing (6) on the shaft. Install the outside thrust washer (5) and external snap ring (4).
11. Install the washer (3) and a new (2) seal onto the shaft.



12. Install the shaft assembly into the housing. Using the appropriate size socket, or a clean piece of pipe, tap the shaft seal (B) into the bore in the housing until the seal is below the retaining ring groove. Secure shaft into housing with internal snap ring (A).

Rotating Assembly Installation:

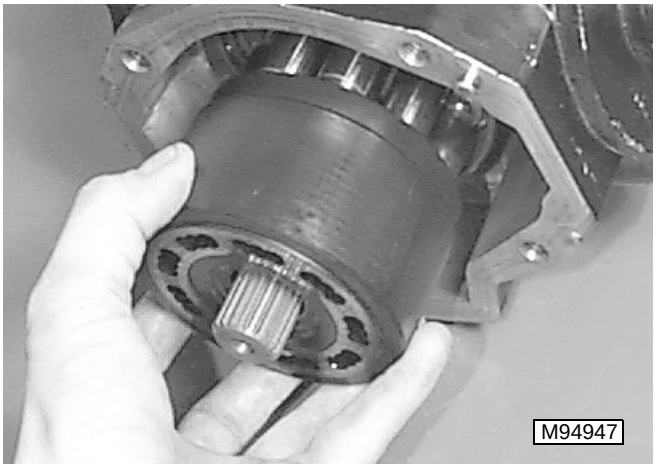
1. If the piston block assembly was disassembled complete the following. If not, skip to step 10.



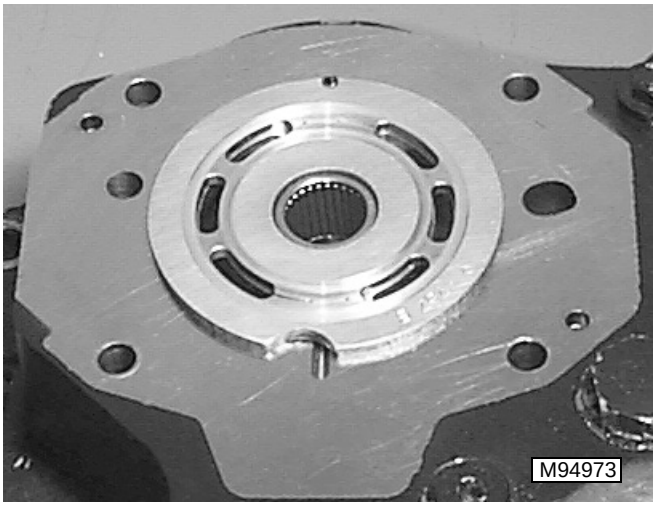
2. Install the three pins (I) in oversize grooves in spline end of piston block with the heads facing inside of the block.
3. Install the pin retainer (J).
4. Install the washers (G) and spring (H).
5. Using same tools used to compress spring during disassembly of block, install washer, spring, second washer, cap screw and nut in the piston block.
6. Compress spring.
7. Install retaining ring (F).
8. Remove spring compression tools from the piston block.

9. Place an appropriate size socket in the hole in the piston block to keep the pivot (E) in place while installing the pistons. Slide the pivot down so that the flat side rests on the top of the three pins.
10. With the pistons in place in the spider, lower the pistons into the piston block.

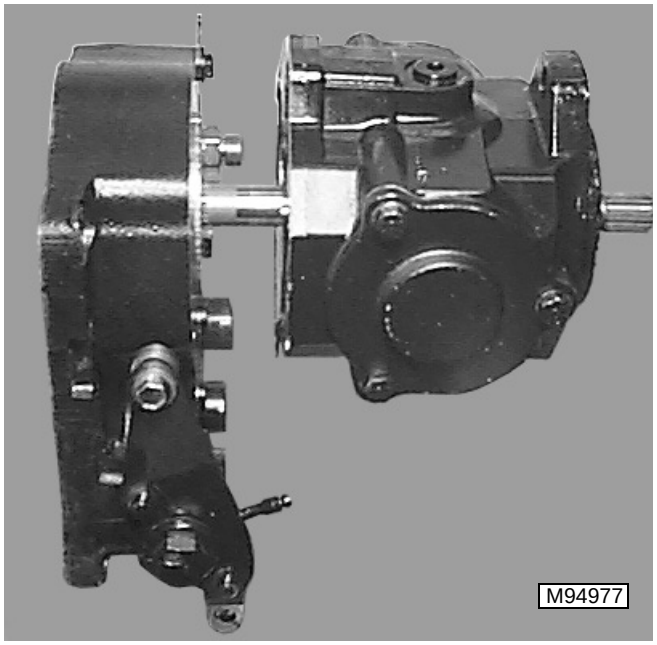
NOTE: It is not necessary to put the pistons in the original position. Any piston can be installed in any hole.



11. Tilt the pump housing so that the open end is facing slightly downward.
12. Slide the rotating assembly up the shaft until it meshes with the splines on the shaft.

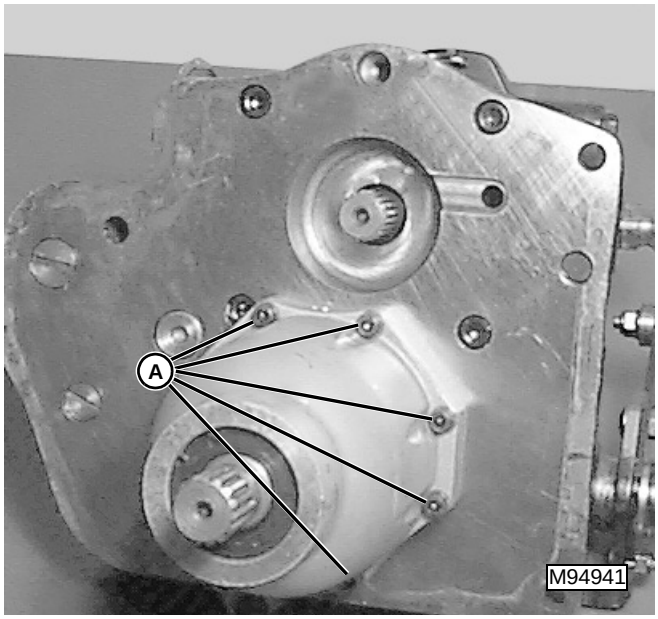


13. Apply a small amount of grease to the steel side of the valve plate to hold it in place during pump installation.
14. Install pump valve plate on back plate.
15. Place a new gasket on the pump.



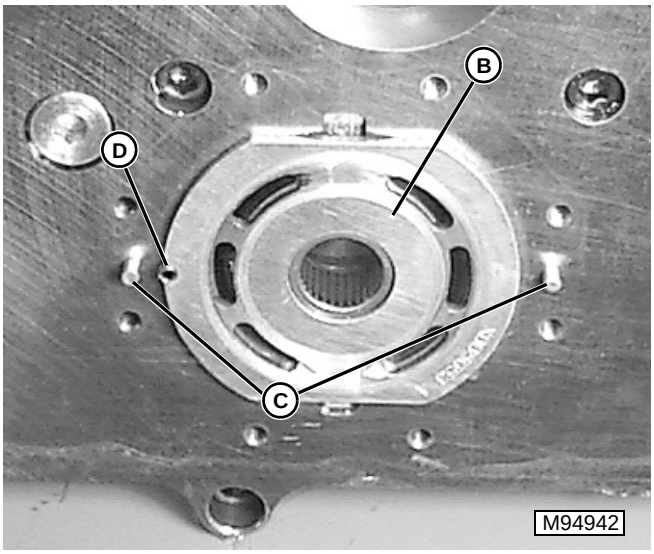
16. Install the pump assembly onto the back plate assembly. Make sure valve plate and gasket stay in position. Tighten the socket head cap screws to **53 - 57 N•m (39 - 42 lb-ft)**.

HYDROSTATIC MOTOR DISASSEMBLY



IMPORTANT: The motor body is aluminum and can be easily damaged by steel tools. Be careful to not damage machined surfaces. Do not use screwdriver or other sharp objects to pry motor body from back plate.

1. If not already done, remove motor from back plate. Remove eight socket head cap screws (A) securing the motor to the back plate. Tap the motor housing with a plastic mallet to loosen it from the valve plate. Keep the assembly level or tip output end down to keep the rotating assembly from sliding off of shaft. Pull the motor housing, shaft, and rotating assembly away from back plate.

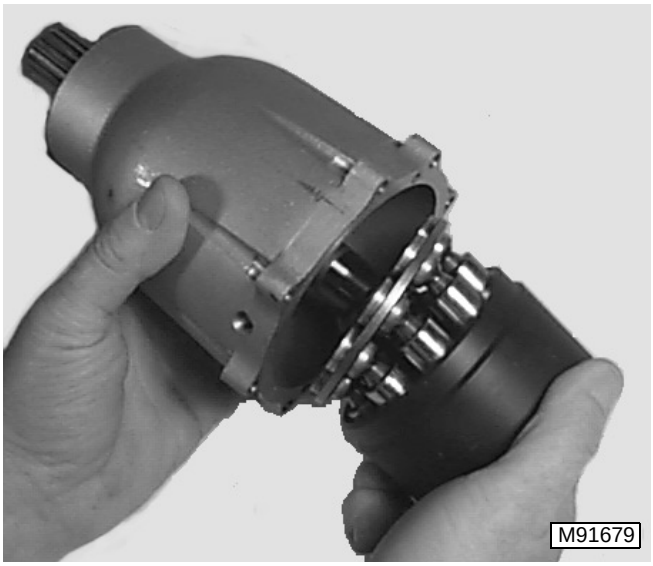


NOTE: Pump and motor valve plates are very similar in appearance, but are not interchangeable. Note shape of valve plates when removing. Valve plates are not fastened to back plate, but may adhere slightly because of oil between the machined surfaces.

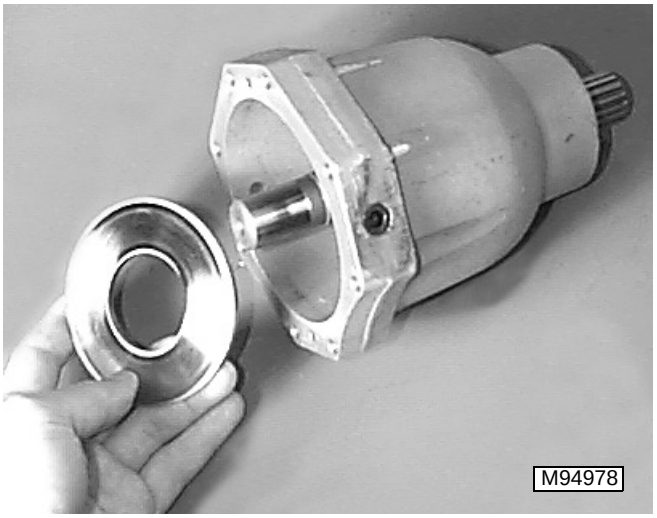
2. Remove valve plate (B) from the back plate.
3. Remove two dowel pins (C).

NOTE: Unless spring pin (D) used to locate valve plate is damaged or loose, do not remove. If replacement is necessary, use care not to scratch the machined surfaces of the back plate.

Rotating Unit Removal and Disassembly:

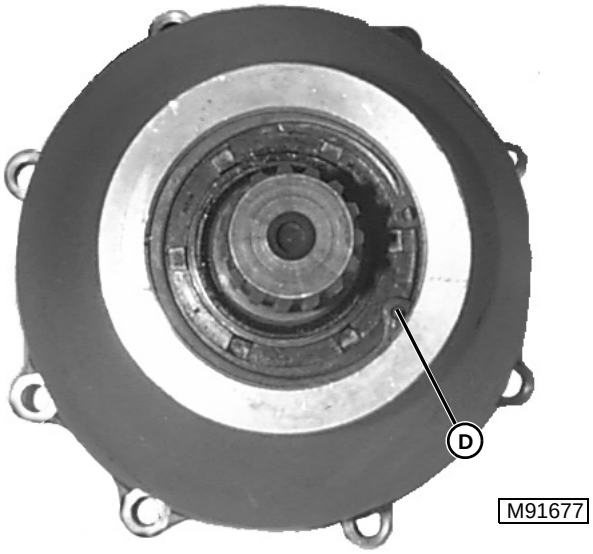


1. Invert the motor and remove the rotating assembly from the housing.
2. If the pistons did not come out with piston block, remove the pistons along with the spider and pivot.

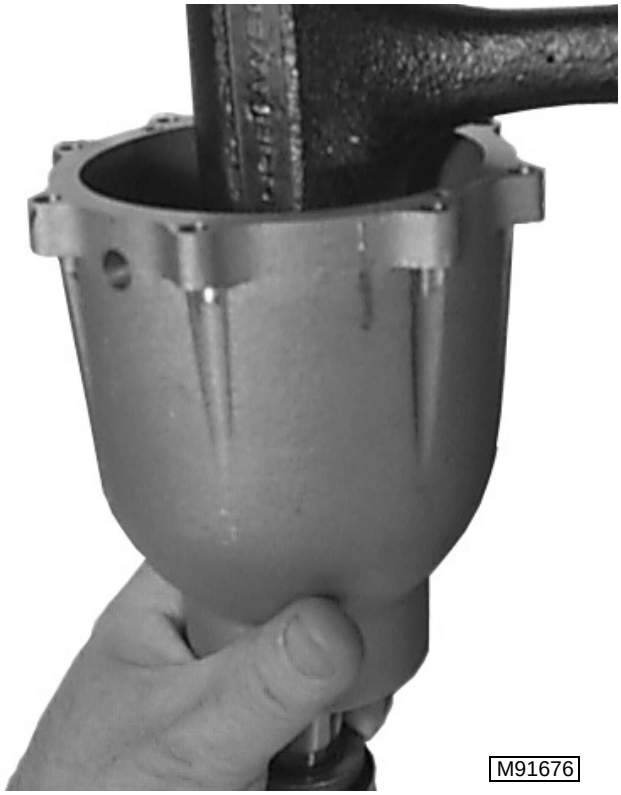


3. Remove cam washer from back of motor housing.

Shaft Removal and Disassembly:

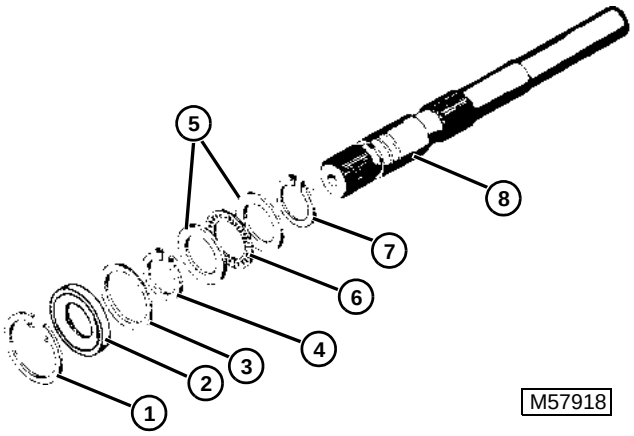


1. Remove the internal snap ring (D) retaining the seal.



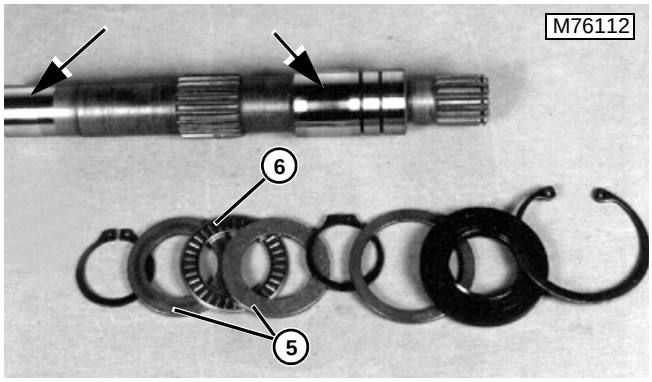
2. Gently tap the shaft with a plastic hammer as shown until the seal releases from the housing.

NOTE: Use care when removing shaft from housing to prevent shaft from falling to floor and being damaged.



1. Internal Snap Ring
2. Seal
3. Washer
4. External Snap Ring
5. Thrust Washer
6. Thrust Bearing
7. External Snap Ring
8. Main Shaft

3. Remove the seal (2) and washer (3).
4. Remove the retaining ring (4) from the shaft. Remove thrust washers (5) and thrust bearing (6).

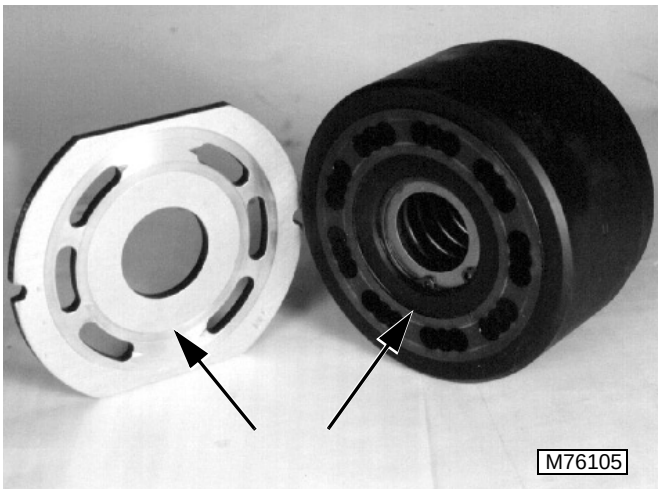


5. Inspect the shaft for damage in the bearing and spline area.
6. Inspect the thrust bearing (6) and washers (5) for wear.

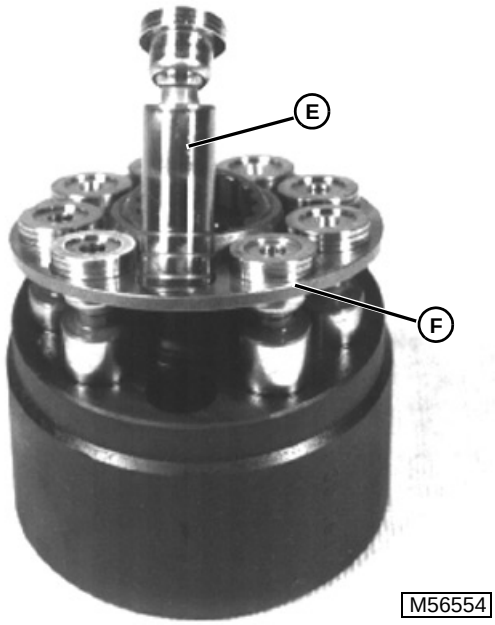
Hydrostatic Motor Inspection:

1. Inspect the needle bearings in the back plate and the motor housing. If the needles remain in the cage and spin freely, there is no need to replace them.
2. If the needle bearing in the motor housing needs to be replaced, it can be pressed out with the appropriate size bearing driver. If the bearing in the back plate must be replaced it must be pulled out with a slide hammer or blind hole puller.

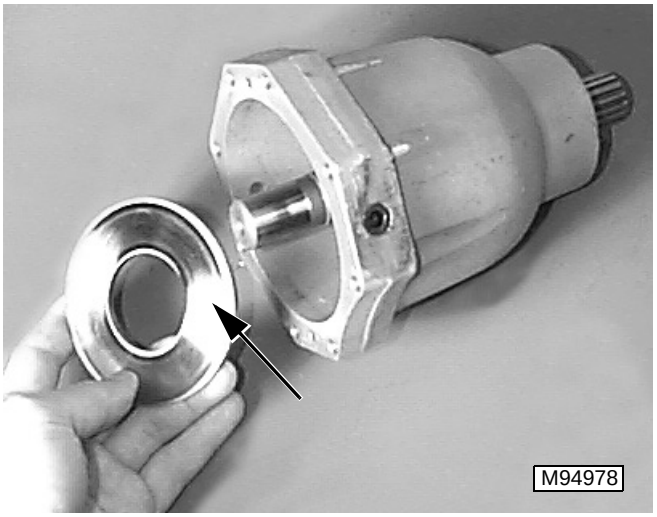
IMPORTANT: When removing bearing from back plate, be extremely careful to not damage machined surfaces.



3. Inspect the bronze side of the valve plate for wear. Replace the valve plate if any wear, scoring, or scratches exist.
4. Inspect the piston block surface that makes contact with the valve plate. This surface should be smooth and free of deep scratches.
5. Check the piston movement in the piston block bore. If the pistons are sticky in the bores examine the bores for scoring or contamination.



6. Remove the pistons (E) and spider (F) assembly.
7. Examine the outside of the pistons for finish condition. They should not show wear or deep scratches.
8. Inspect the piston shoes for a snug fit on the ball end of the pistons. Check the face of the shoes for a flat smooth surface.
9. Examine the spider for wear in the pivot area.
10. Examine the pivot to ensure smoothness and no signs of wear.



11. Inspect the cam washer shoe surface. It should be free of scratches and wear marks.

IMPORTANT: Piston face damage can be caused by towing unit, dry start-up, or loss of charge pressure.

Piston Block Disassembly:

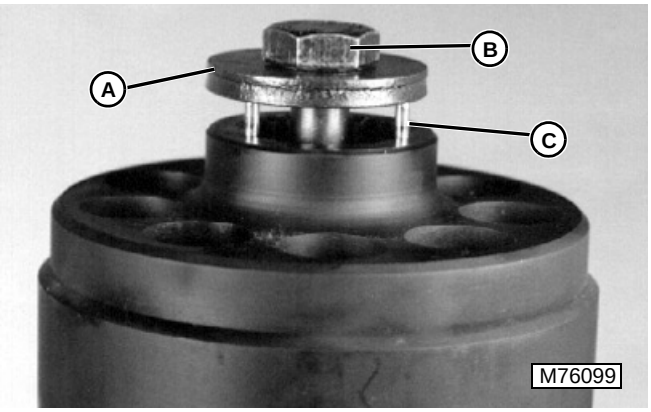
NOTE: Disassembling the piston block assembly is not necessary unless the spring or pins are damaged.

⚠ CAUTION

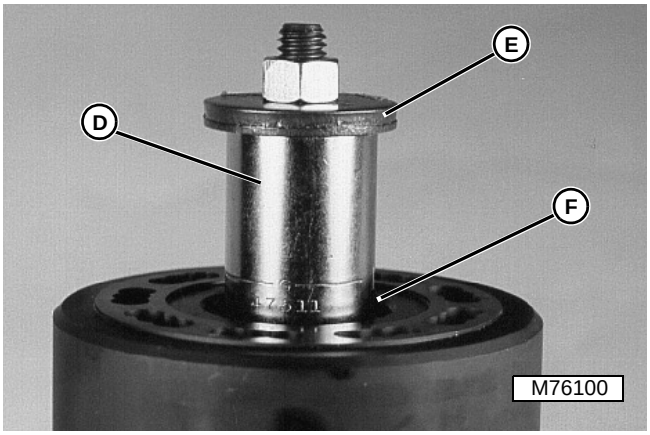
The spring inside the piston block is compressed and should not be removed without compressing the spring first. Use the following procedure to remove the spring safely.

The following parts will be needed to disassemble the piston block:

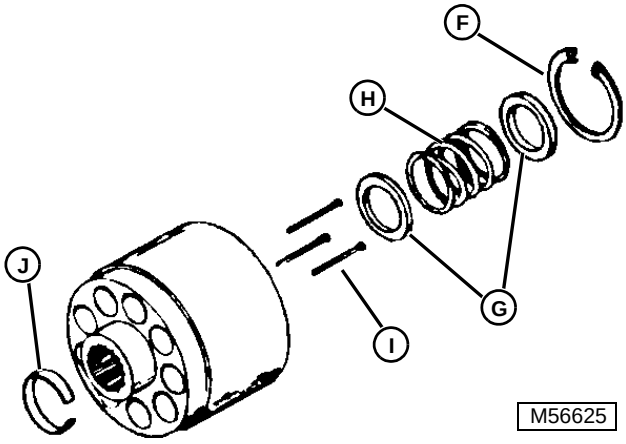
2 ea. . . . . .3/8 ID x 1-1/4 in. OD flat washers
1 ea. . . . . .3/8 x 5 in. N.C. cap screw
1 ea. . . . . .3/8 in. N.C. nut
1 ea. . . . . .1/2 in. drive socket with 1-1/8 in. OD



12. Place a flat washer (A) over the 3/8 x 5 in. cap screw (B). Install cap screw through spline end of piston block so that the washer rests on the three pins (C).



13. Place the socket (D), then a washer (E) over the threaded end of the cap screw.
14. Screw on nut and slightly compress the spring inside the piston block.
15. Using snap ring pliers, remove the internal retaining ring (F).
16. Carefully back off nut until spring tension is relieved.
17. Remove the nut, washer, and cap screw.



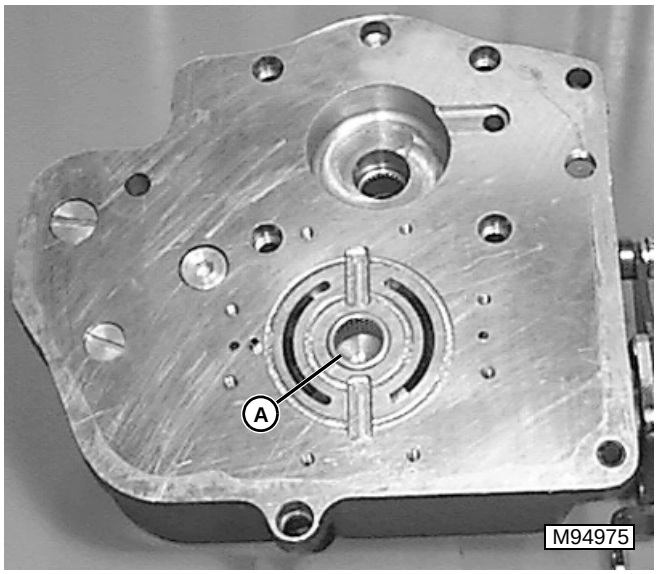
18. Remove washers (G), spring (H), pins (I), and pin retainer (J).
19. Inspect the spring inside the piston block for damage. Inspect pins for straightness.

HYDROSTATIC MOTOR ASSEMBLY

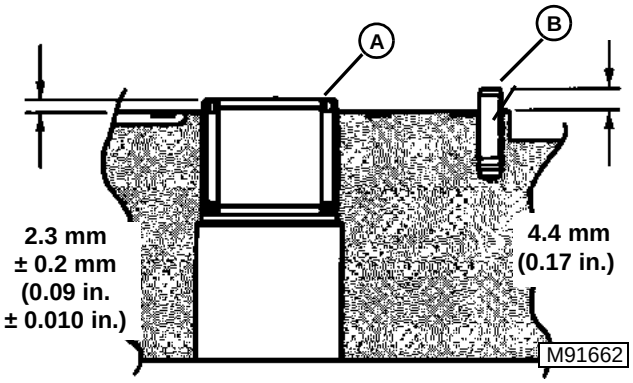
IMPORTANT: Due to extremely tight tolerances, and finish of internal surfaces, it is very important to maintain absolute cleanliness during the assembly of the motor. Coat all internal surfaces with clean 10W30 motor oil when assembling.

Main Shaft Bearing Installation:

NOTE: All needle bearings are pressed in with numbers facing out.

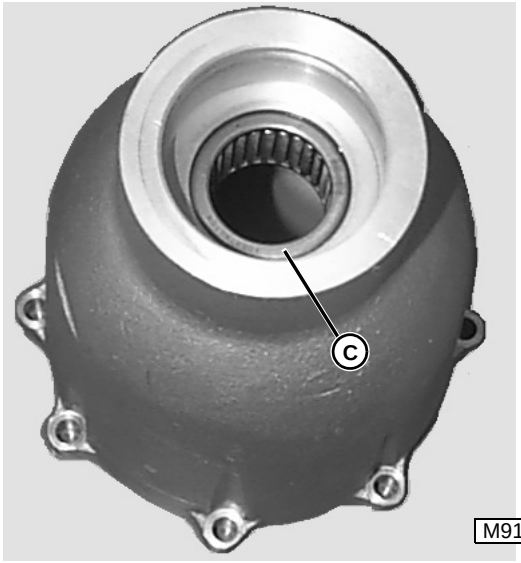


1. If the needle bearing (A) was removed from the back plate, a new one can be pressed in, numbers up, using the correct size bearing driver. The back plate bearing should be pressed in until **2.3 mm ± 0.2 mm (0.090 in. ± 0.010 in.)** is left above the bore.

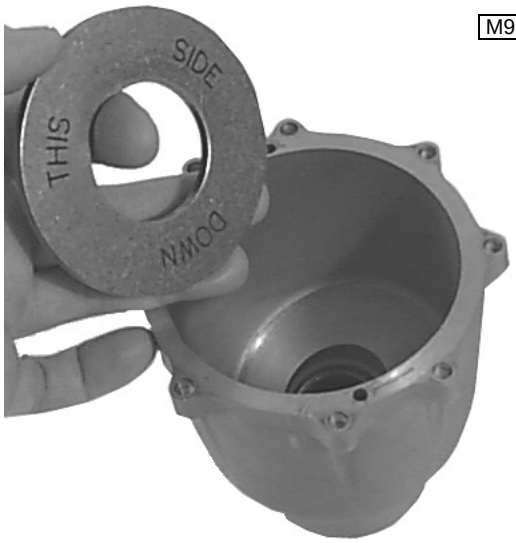


2. If spring pin (B) that is used to position the valve plate was removed or damaged, install a new one. Allow the pin to protrude from the back plate approximately **4.4 mm (0.17 in.)**.

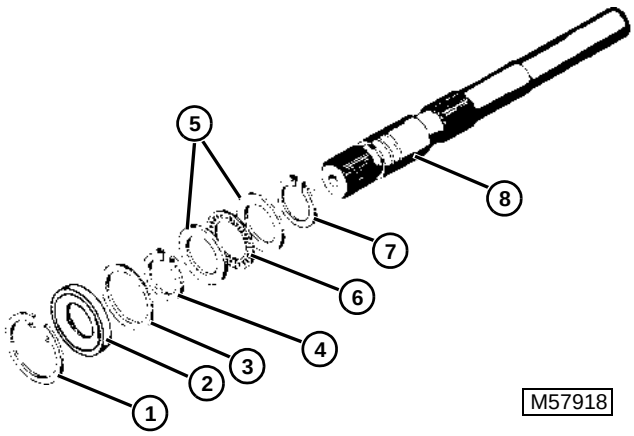
Cam Plate and Shaft Installation:



3. The housing bearing (C) should be pressed on the numbered side, from the outside of the housing inward, until the numbered end is recessed **2.0 mm ± 0.3 mm (0.078 in. ± 0.015 in.)** in the housing bore.



4. Apply some grease to the "THIS SIDE DOWN" side of the cam washer before installing into motor housing so it will stay in place while installing rotating assembly.

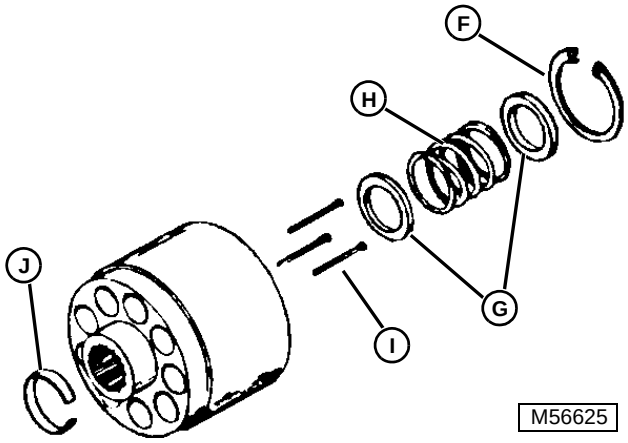


1. Internal Snap Ring	5. Thrust Washer
2. Seal	6. Thrust Bearing
3. Washer	7. External Snap Ring
4. External Snap Ring	8. Main Shaft

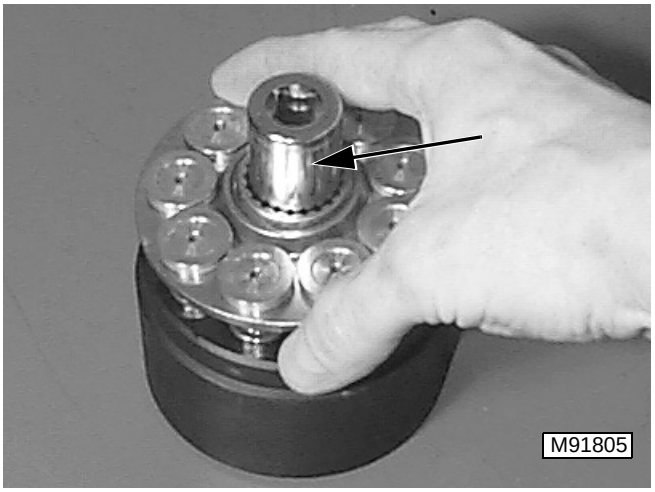
5. Install the inside snap ring (7), thrust washer (5), and thrust bearing (6) on shaft. Install the outside thrust washer and snap ring (4).
6. Install the shaft into the housing. Install the washer (3) and the new shaft seal (2). Secure them with the retaining ring (1).

Rotating Unit Assembly and Installation:

1. If the piston block assembly was disassembled complete the following. If not, skip to step 10.

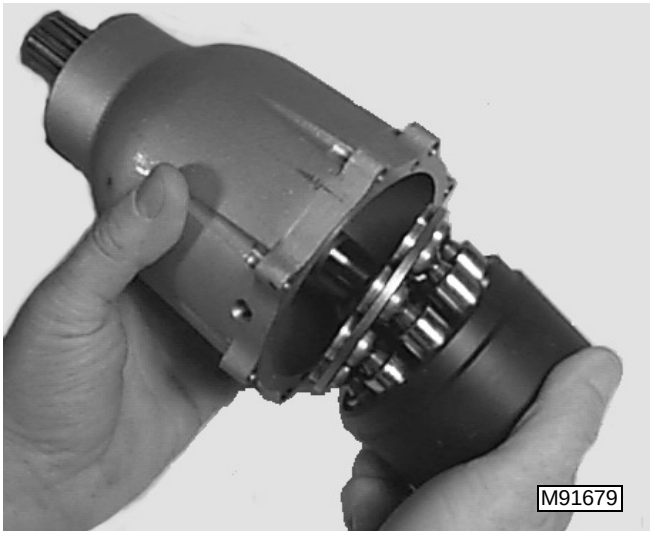


2. Install the three pins (I) in oversize grooves in spline end of piston block with the heads facing inside of the block.
3. Install the pin retainer (J).
4. Install the washers (G) and spring (H).
5. Using same tools used to compress spring during disassembly of block install washer, spring, second washer, cap screw and nut in the piston block.
6. Compress spring.
7. Install retaining ring (F).
8. Remove spring compression tools from the piston block.

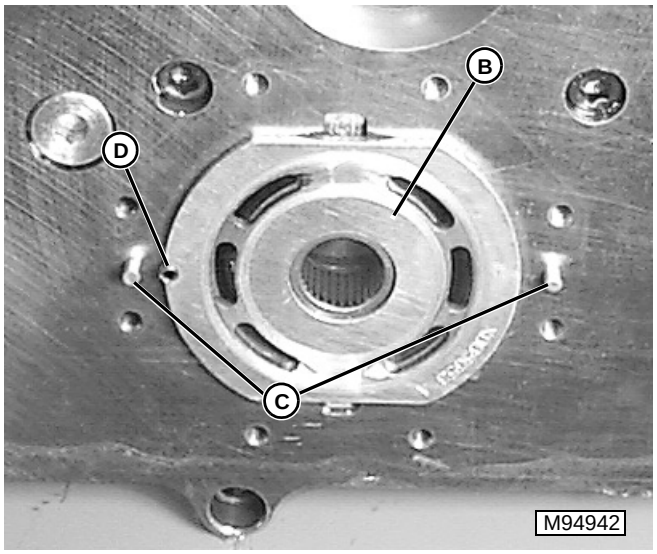


9. Place an appropriate size socket in the hole in the piston block to keep the pivot in place while installing the pistons. Slide the pivot down so that the flat side rests on the top of the three pins.
10. With the pistons in place in the spider, lower the pistons into the piston block.

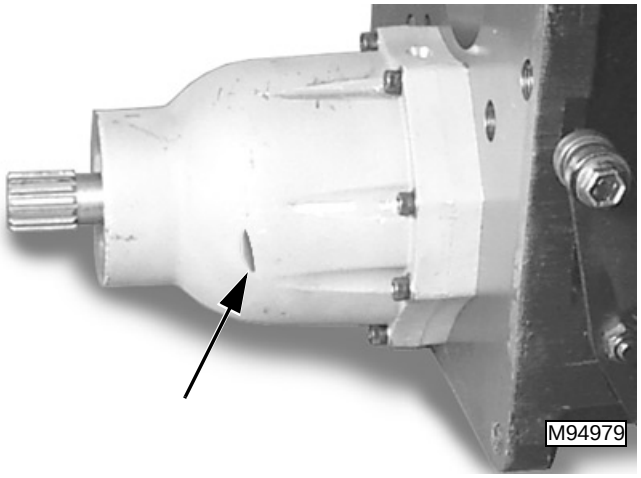
NOTE: It is not necessary to put the pistons in the original position. Any piston can be installed in any hole.



11. Tilt the motor housing so that the open end is facing slightly downward.
12. Slide the rotating unit up the shaft until it meshes with the splines on the shaft.



13. If removed, install the spring pin (D) in the back plate used to retain the valve plate. Allow the pin to protrude from the back plate approximately **4.4 mm (0.17 in.)**.
14. If removed, install two dowel pins (C).
15. Apply a small amount of grease to the steel side of valve plate (B) to hold it in place for installation. Place the valve plate in position on the back plate with steel side against back plate.

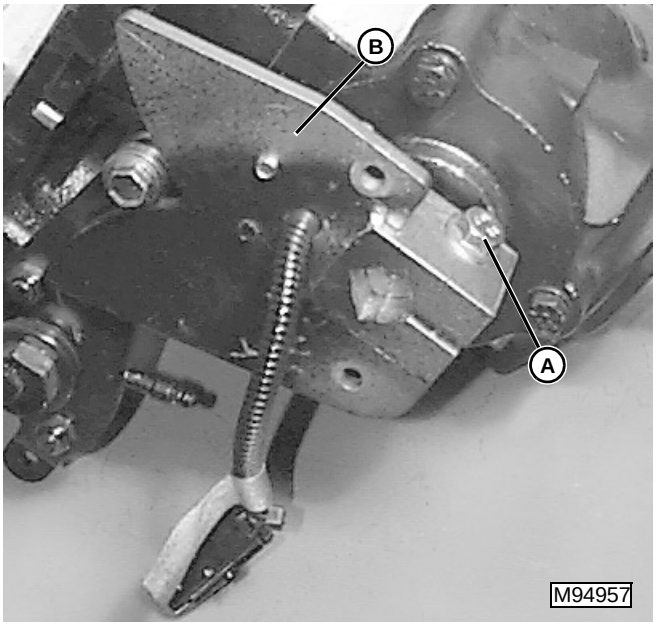


IMPORTANT: Install motor housing with cam plate slope marking as shown. If installed incorrectly the tractor will go *backwards* when forward pedal is depressed.

16. Install the motor assembly onto the back plate assembly with the cam plate marking as shown. Make sure that the valve plate and cam washer stay in position.

IMPORTANT: Damage to pump may occur if retaining cap screws are not tightened evenly, and in a criss-crossing pattern to keep pump mounting flange and back plate parallel.

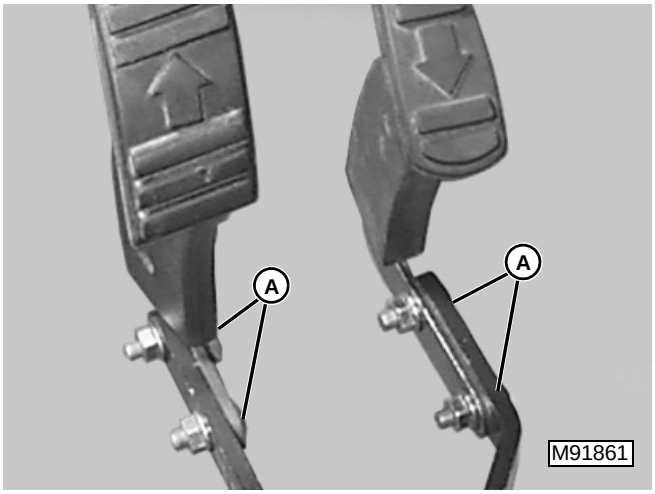
17. Install eight socket head cap screws to retain motor to back plate. Tighten evenly in a criss-crossing pattern so that pump mounting flange and back plate remain parallel. Tighten to **10 - 14 N•m (87 - 123 lb-in.)**.



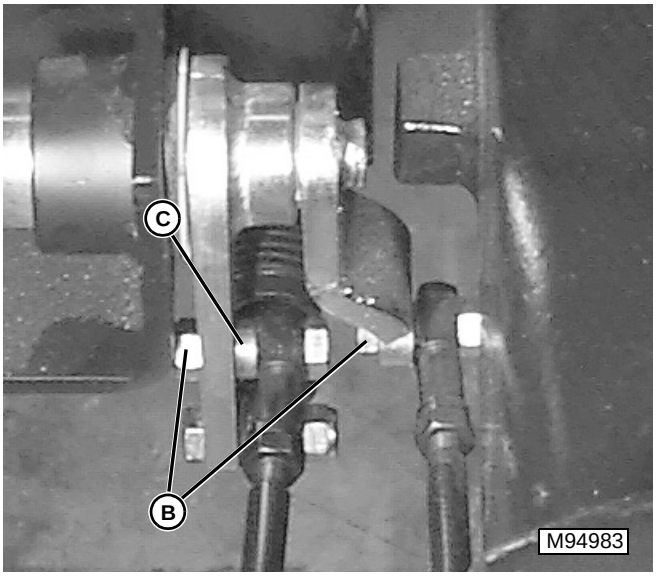
18. Install speed control lever (B) and neutral switch as an assembly. Retain with cap screw (A) and nut.

CONTROL LINKAGE REMOVAL & INSTALLATION

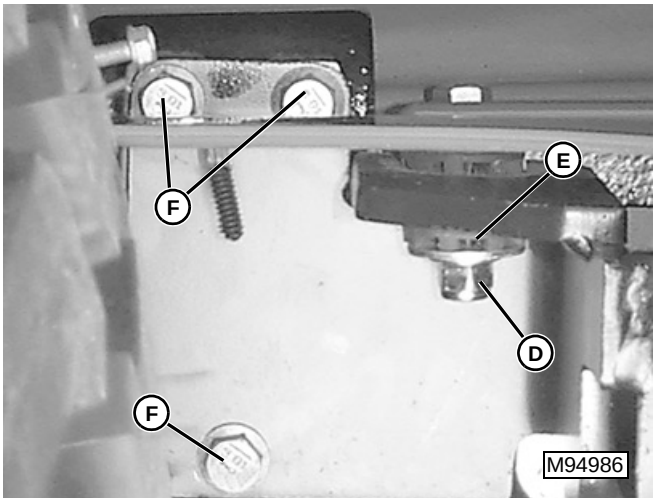
Removal:



1. Remove four nuts and carriage bolts (A) securing forward pedal to pedal arm and reverse pedal to pedal arm. Remove pedals.



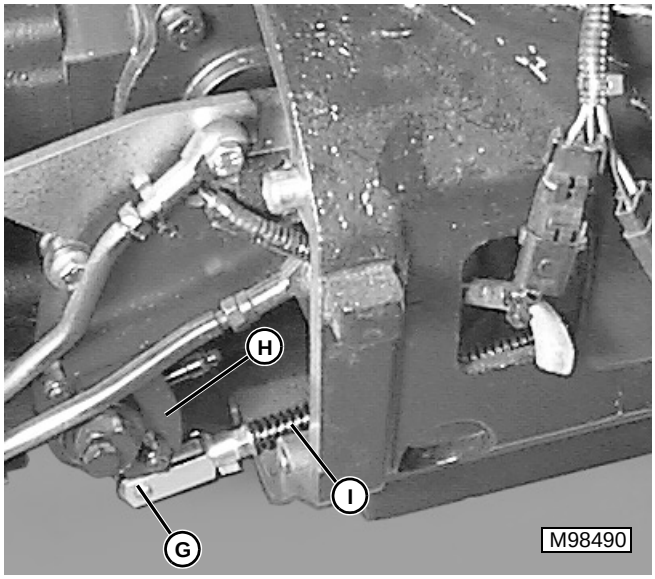
2. Remove two cap screws (B), lock nuts, and spacer (C), and disconnect control rods from pedal assembly.



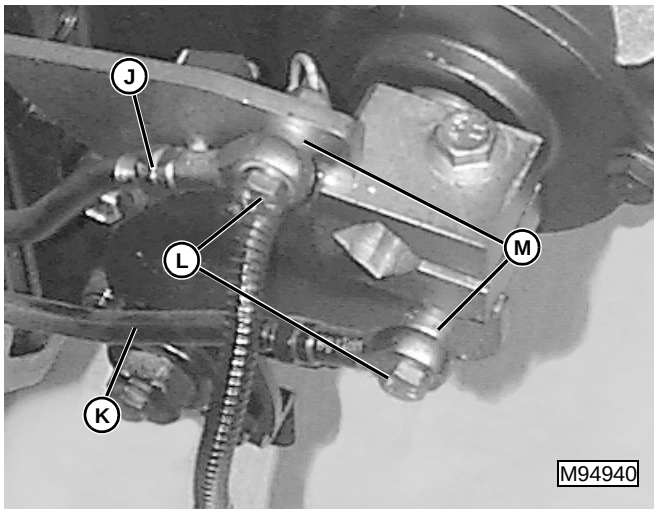
3. Remove lock nut (D), washer, and lower half of rubber isolator (E) securing operator's platform to bracket.
4. Support operator platform bracket and pedal assembly, and remove three cap screws (F) that secure bracket to tunnel.
5. Lower pedal assembly and bracket as a unit, and remove from cap screw on operator's platform.
6. Inspect components for wear or damage. Replace as needed.

NOTE: The following procedures describe the removal of control linkage located inside the flywheel housing.

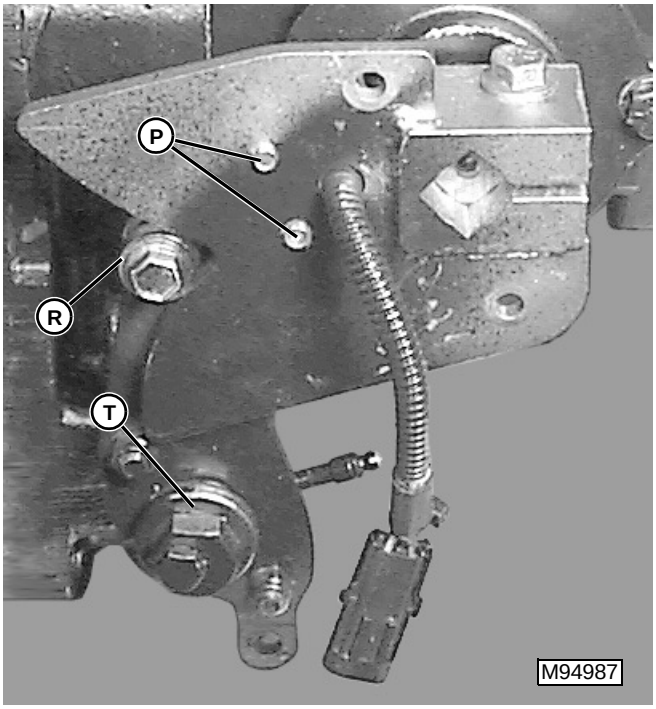
7. Split tractor between tunnel and clutch housing. (See "TRACTOR SPLITTING FRONT").

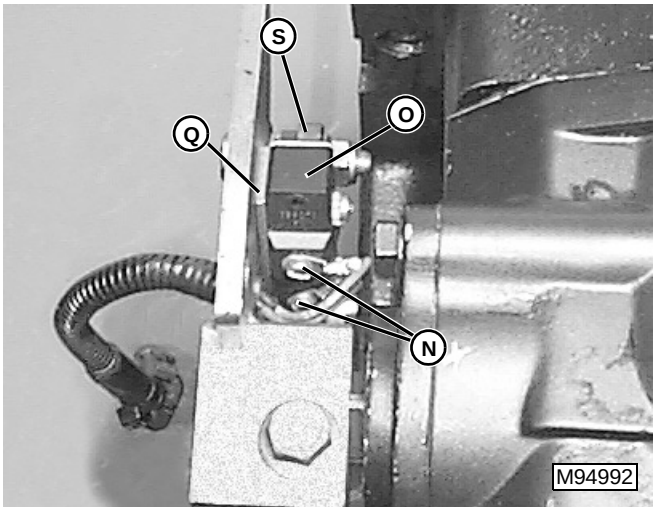


8. If not already done, remove clip pin (G) and disconnect clevis from neutral return lever (H). Remove clevis, rod (I), and neutral return spring as an assembly.



9. Mark transmission forward (J) and reverse (K) rods for correct location and orientation when assembling. Remove two cap screws (L), two spacers (M), and two lock nuts. Remove transmission forward and reverse control rods.





10. Remove two screws (N) and disconnect wiring harness from neutral switch (O).
11. Remove two cap screws (P), lock nuts, and spacer (Q), and remove neutral switch.
12. Inspect cam follower (R), neutral switch roller (S), and neutral return lever pivot (T) for smooth operation. Lubricate or replace parts as needed.

Assembly:

Assembly is the reverse of disassembly.

- Inspect all components for wear, damage, and smooth operation. Replace as needed.
- Install new nylon lock nuts where removed. Old lock nuts may become loose over time.

CONTENTS

SPECIFICATIONS

GENERAL SPECIFICATIONS

Hydraulic Reservoir Capacity . . . . . 24 L (6.3 gal)

REPAIR SPECIFICATIONS

SyncReverser Clutches

SyncReverser Clutch Pack (Minimum Thickness) . . . . . 42.34 mm (1.66 in.)
Clutch Spring (minimum free length) . . . . . 51.3 mm (2.02 in.)

TORQUE SPECIFICATIONS

SCV Port Tube Hydraulic Line Nuts . . . . . 40 - 57 N•m (30 - 43 lb-ft)
Gear Case To Gear Case Cap Screws . . . . . 126 - 154 N•m (95 - 115 lb-ft)
Front Clutch Cover To Housing (Tunnel) Cap Screws . . . . . 23-29 N•m (17 - 22 lb-ft)
Clutch Hub to Transmission Shaft . . . . . 135 N•m (100 lb-ft)

SPECIAL OR ESSENTIAL TOOLS

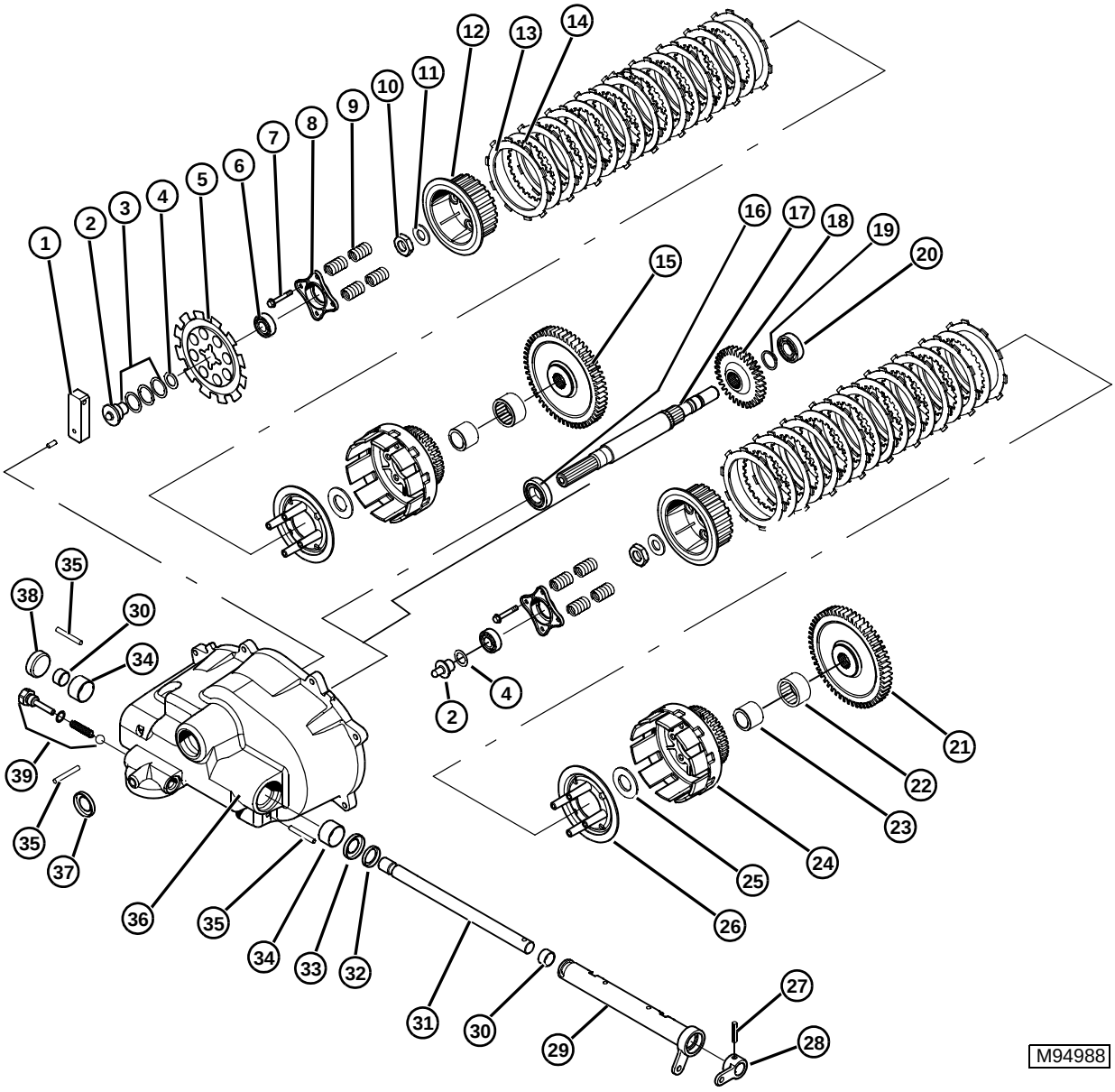
Part Number	Part Name
JDG 1259	Clutch Shimming Fixture
JTO 7335-1,2,3	Splitting Stands and Brackets

NOTE: Order tools according to information given in the U.S. SERVICE-GARD™ Catalog or in the European Microfiche Tool Catalog (MTC).

OTHER MATERIALS

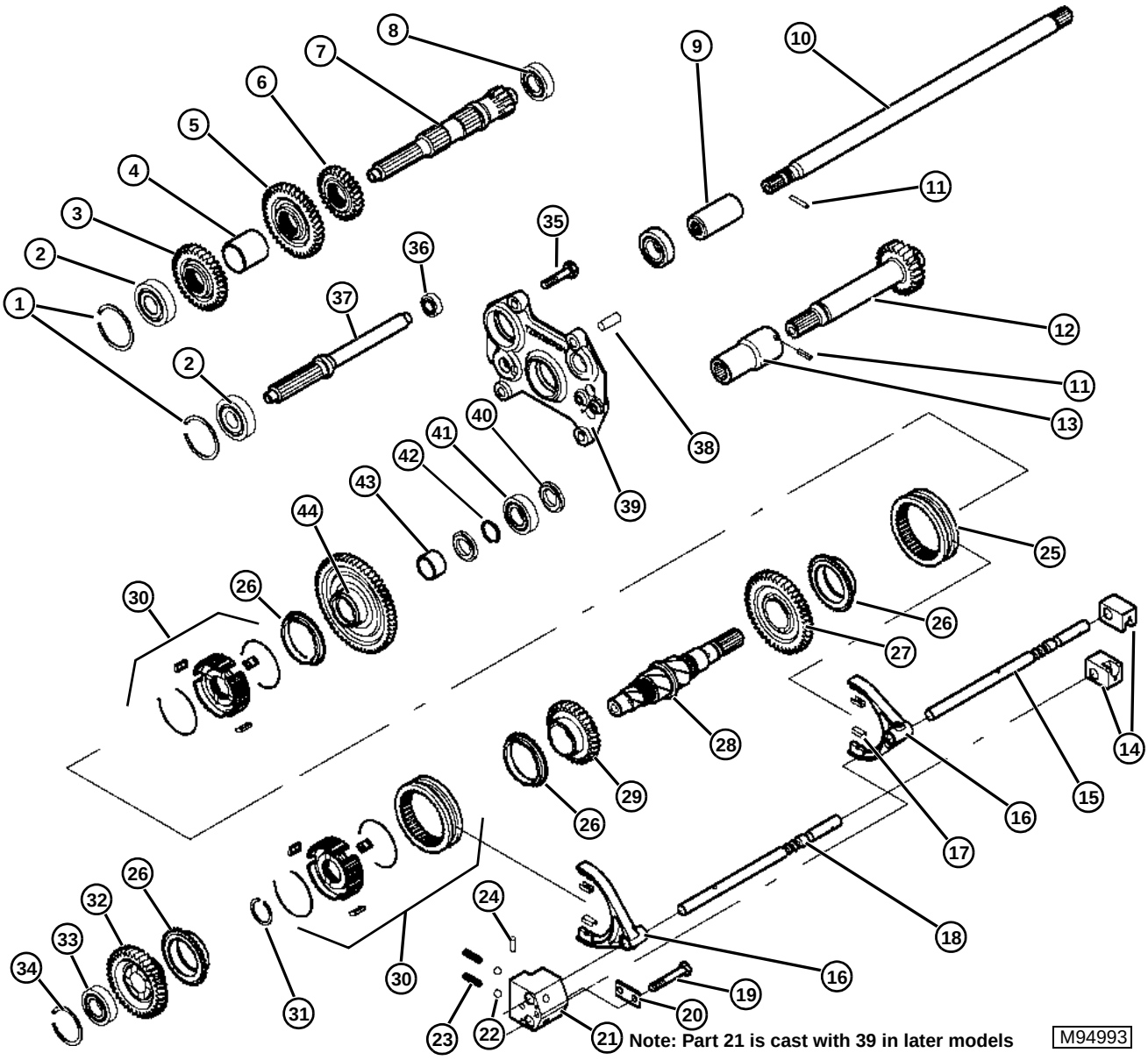
Number U.S./Canadian	Name	Use
TY6305	John Deere Clean and Cure Primer	Clean mating surfaces, helps speed curing.
TY16021	John Deere Form in Place Gasket	Between axle and differential housings, transmission tunnel etc.
TY9370 (#242 LOCTITE®)	Thread Lock and Sealer (Medium Strength)	On dowel pins and certain cap screws.

4300 / 4400 – CLUTCHES AND COVER



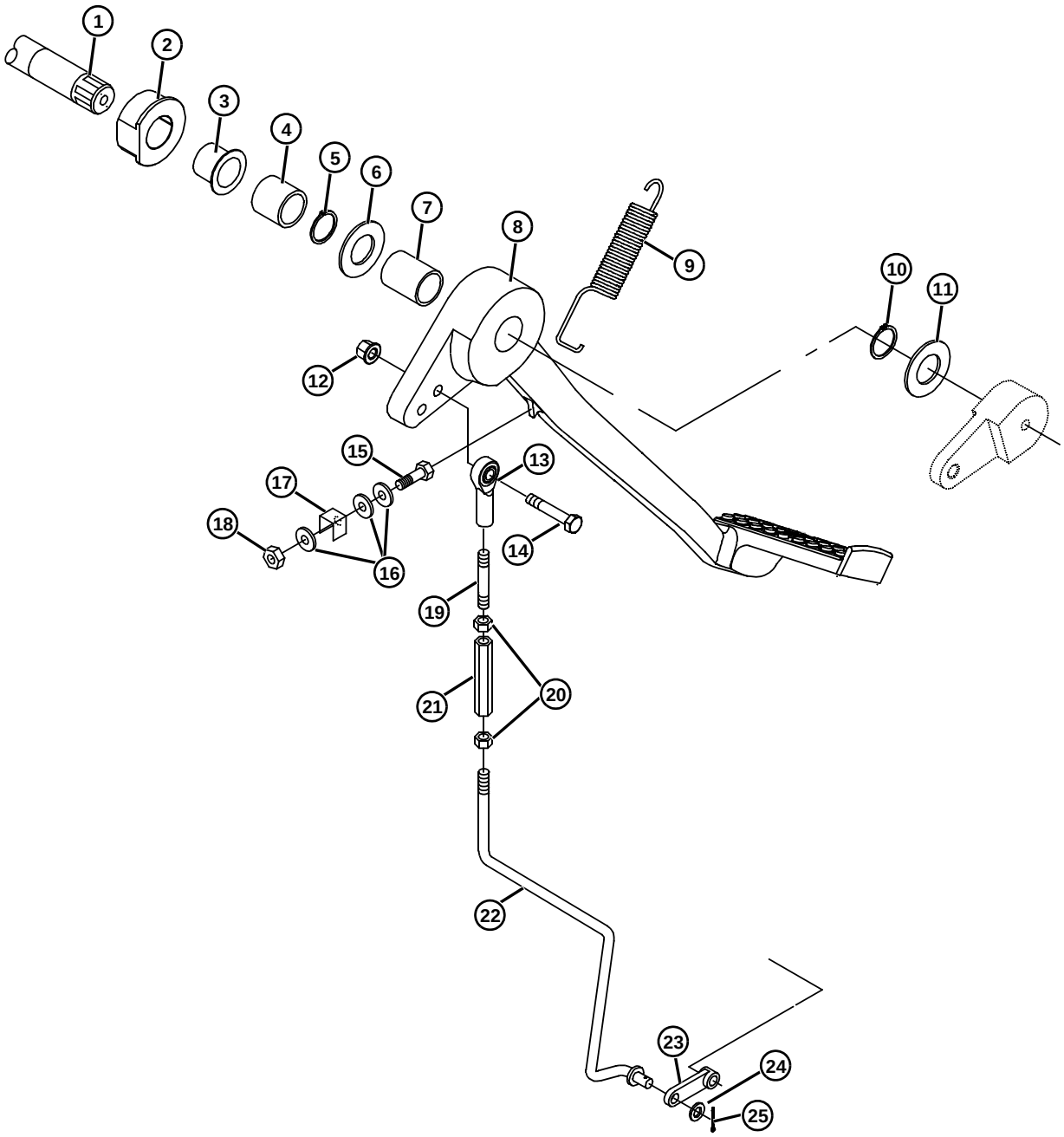
1. Lift Lever
2. Lifter Pin
3. Shim(s) Clutch Snubber
4. Shim(s) Clutch Adj.
5. Clutch Snubber
6. Bearing
7. Cap Screw
8. Plate
9. Spring(8)
10. Nut (2)
11. Washer (2)
12. Hub (2)
13. Clutch Plates (18)
14. Clutch Plates (16)
15. Gear
16. Bearing
17. Shaft
18. Gear
19. Snap Ring
20. Bearing
21. Gear
22. Bearing
23. Race
24. Basket
25. Washer
26. Piston
27. Spring Pin
28. Lever
29. Shaft
30. Bearing
31. Shaft
32. Seal
33. Seal
34. Bearing
35. Dowel Pin
36. Clutch Cover
37. Seal
38. Cap
39. Filter Bypass Valve Assembly

4300 / 4400 – 4 SPEED TRANSMISSION



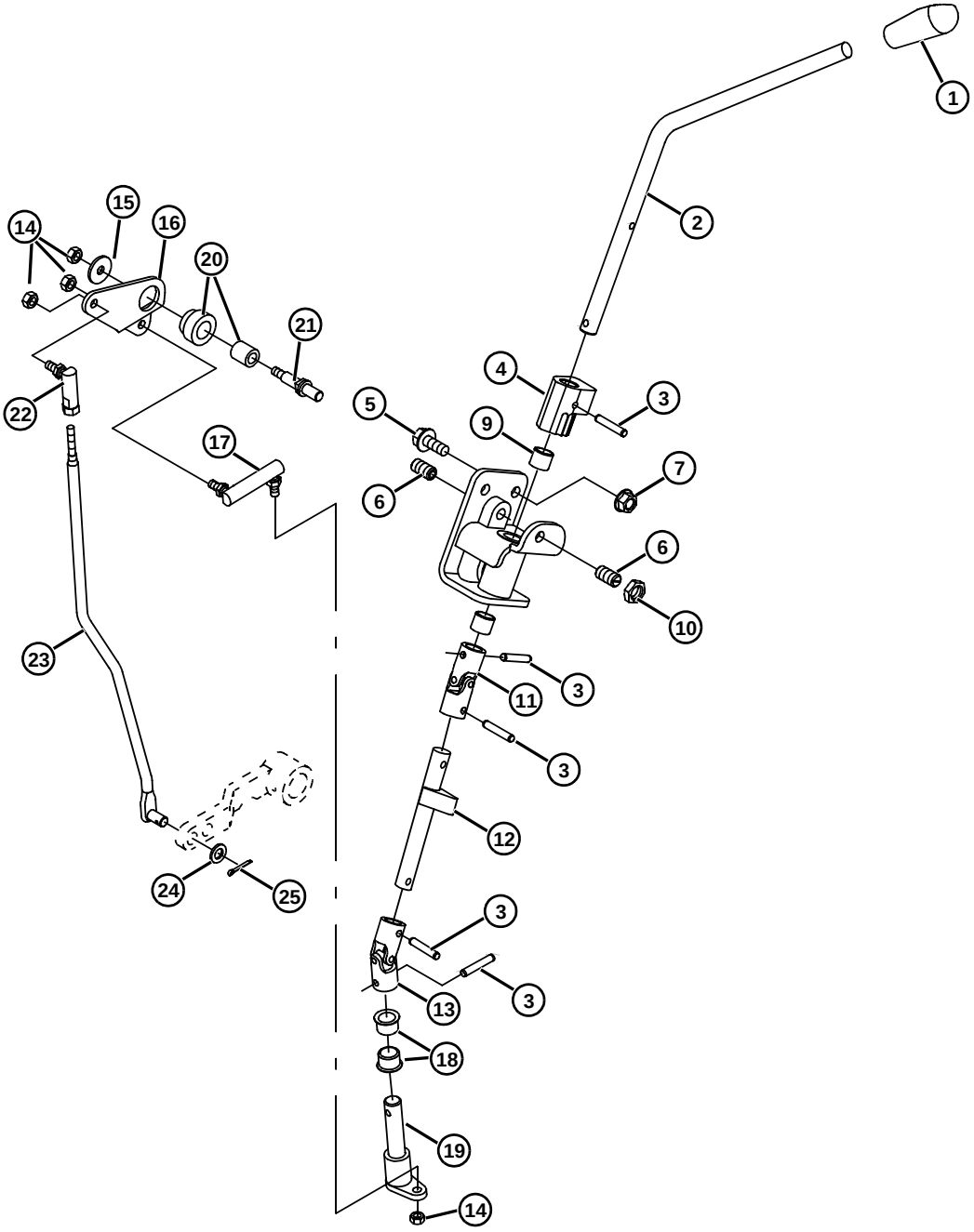
1. Snap Rings	10. Shaft	19. Cap Screw	28. Shaft	37. Shaft
2. Bearing	11. Pin	20. Plate	29. Gear	38. Dowel Pin
3. Gear	12. Pinion Shaft	21. Support	30. Synchronizer	39. Support
4. Spacer	13. Sleeve	22. Spring (2)	31. Snap ring	40. Snap Ring
5. Gear	14. Gate	23. Ball	32. Gear	41. Ball Bearing
6. Gear	15. Rail	24. Pin	33. Ball Bearing	42. Snap Ring
7. Shaft	16. Fork	25. Sleeve	34. Snap Ring	43. Bearing
8. Bearing	17. Insert	26. Ring	35. Cap Screw	44. Gear
9. Coupler	18. Rail	27. Gear	36. Ball Bearing	

CLUTCH PEDAL AND LINKAGE



1. Shaft
2. Bearing
3. Bushing
4. Spacer
5. Snap Ring
6. Thrust Washer
7. Bushing
8. Pedal
9. Clutch Spring
10. Snap Ring
11. Thrust Washer
12. Lock Nut
13. Spherical Rod End
14. Cap Screw
15. Cap Screw (Stop)
16. Washer
17. Bracket
18. Lock Nut
19. Rod
20. Nut
21. Turnbuckle
22. Rod
23. Lever
24. Washer
25. Cotter Pin

SHIFT LEVER AND LINKAGE



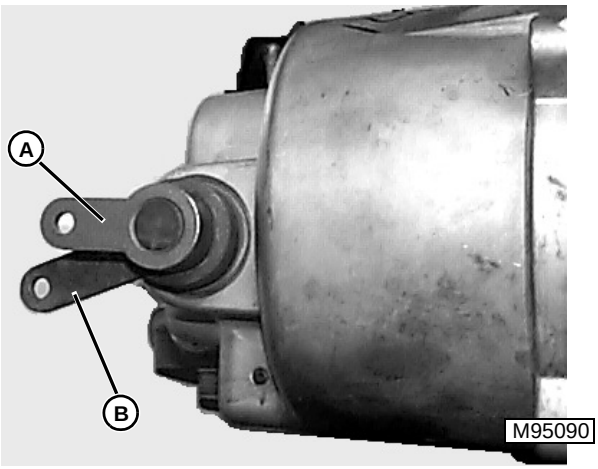
1. Knob
2. Lever, Control
3. Pin, Spring
4. Lever
5. Screw
6. Plunger
7. Nut, Flange
8. Support
9. Bearing
10. Nut
11. Joint, Universal
12. Cam
13. Joint, Universal
14. Nut, Lock
15. Washer
16. Bellcrank
17. Link
18. Bushing
19. Shaft
20. Bushing
21. Bolt
22. Ball Joint
23. Rod
24. Washer
25. Pin, Cotter

THEORY OF OPERATION

SRT OPERATION

Function:

The SRT transmission consists of two clutches rotating in opposite directions, and clutch shafts that provide a mechanical means to select the forward or reverse clutch.

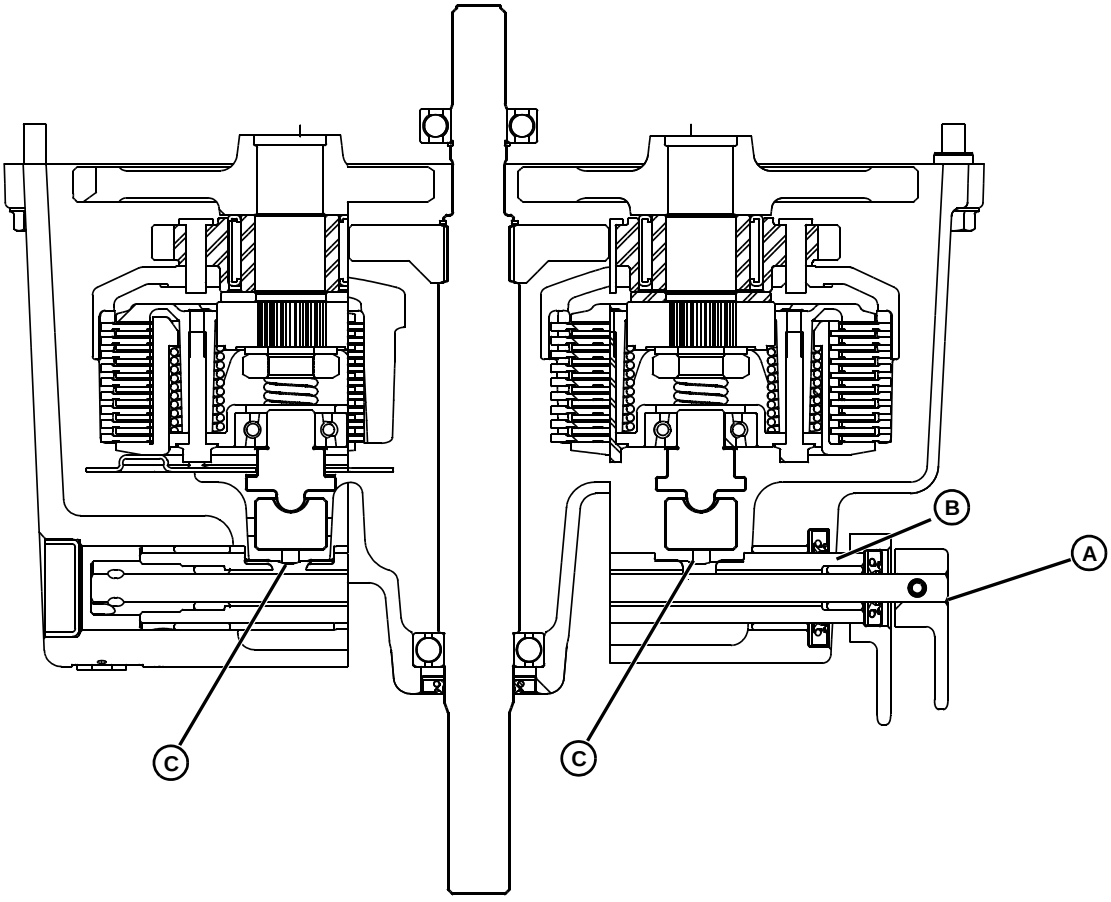


The clutches are wet type, and are lubricated and cooled by a stream of pressurized oil directed at the inside of the clutch from holes in the clutch cover.

The power is directed into the 4 speed transmission by the clutch that is selected with the forward / reverse selector shaft (A). The selector shaft has a hole for each lifter lever pin (C), that aligns with one of the pins when the forward or reverse position is selected. When the clutch shaft (B) is turned to the engaged position the pin can drop into hole in the selector shaft, and that clutch will engage. If a hole is not aligned with the pin, the pin rests on the shaft, and the clutch cannot engage. The holes are arranged so that only one clutch can engage at a time and neither clutch can engage the neutral position.

Major Components:

- Clutch Pedal / Linkage
- Clutch Shaft
- Direction Selector Shaft
- Forward / Reverse Clutches



4 SPEED TRANSMISSION OPERATION

Function:

To transfer power from the directional clutches to the range transmission at various speeds controlled by the operator.

Theory of Operation:

When the SRT transmission is engaged in either forward or reverse, there is rotation of the input shaft (A) going into the transmission. There are four gears on the shaft.

There are four corresponding gears on the driven shaft (B) that are constantly meshed to the four gears on the input shaft. The four gears on the driven shaft turn independently from the driven shaft. Two synchromesh collars (C) are splined to the driven shaft (B) and can be shifted individually forward or backward to engage the one of the gears to the driven shaft.

The driven shaft transfers power to the range transmission.

TESTS AND ADJUSTMENTS

SRT CLUTCH LINKAGE ADJUSTMENT

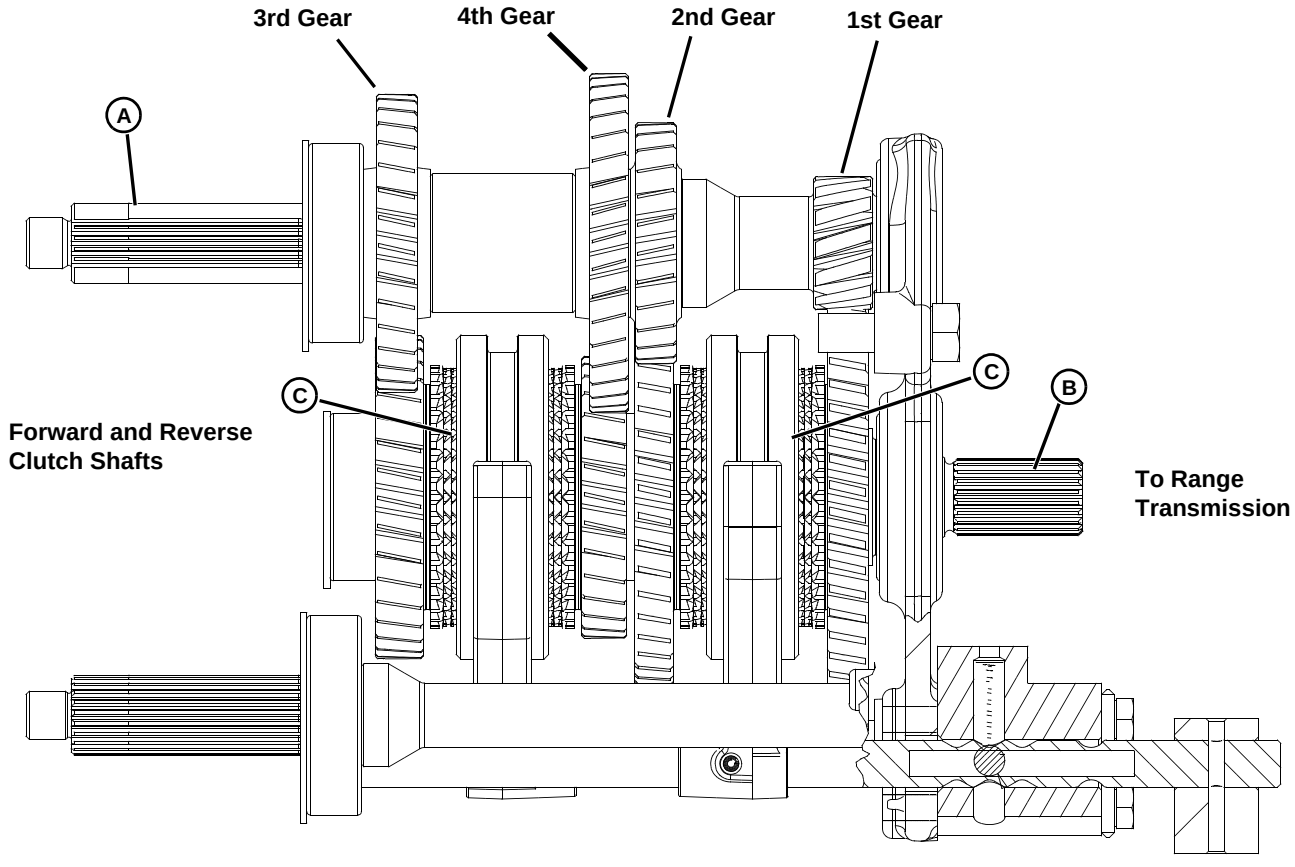
Reason:

To ensure that forward and reverse clutches engage fully, and to prevent clutch slippage and overheating.

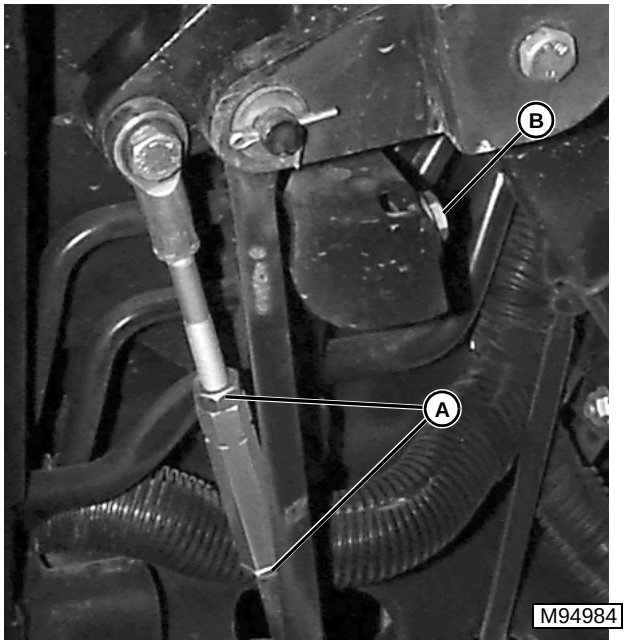
NOTE: Both clutches are operated off of the same shaft and may not wear at equal rates. The procedure below must be followed to properly adjust pedal free travel.

Procedure:

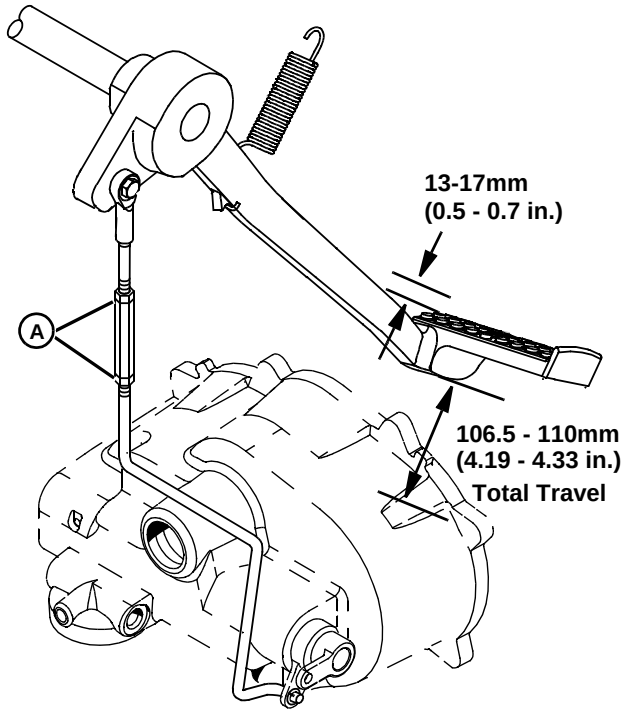
1. Remove LH engine side panel.
2. Depress clutch pedal and position forward/reverse lever in forward position. Release pedal.
3. Measure clutch pedal free travel and record reading.
4. Depress clutch pedal and position forward/reverse lever in reverse position. Release pedal.
5. Measure clutch pedal free travel and record reading.



6. Place the directional lever in the position it was in where the **least** free travel was measured.



7. Free travel should be **13 - 17mm (0.5 - 0.7 in.)** If not in specification loosen lock nuts (A) on turnbuckle and adjust turnbuckle until **13 - 17mm (0.5 - 0.7 in.)** is obtained. Hold turnbuckle and tighten lock nuts.
8. Adjust clutch pedal stop (B) until clutch pedal has **106.5 - 110 mm (4.19 - 4.33 in.)** of movement.
9. Depress clutch pedal and position forward/reverse lever in opposite position. Release pedal. Measure free travel in clutch pedal. Free travel should be less than **25 mm (1.0 in.).** If not in specification clutches are worn and must be inspected or replaced and re-shimmed. (See **"CLUTCH SHIMMING PROCEDURE" on page 22** and **"SNUBBER SHIMMING PROCEDURE" on page 25**.)



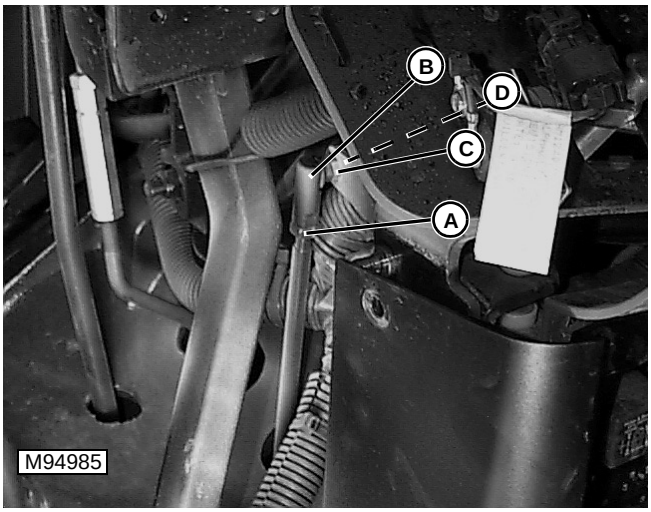
SRT SHIFT LINKAGE ADJUSTMENT

Reason:

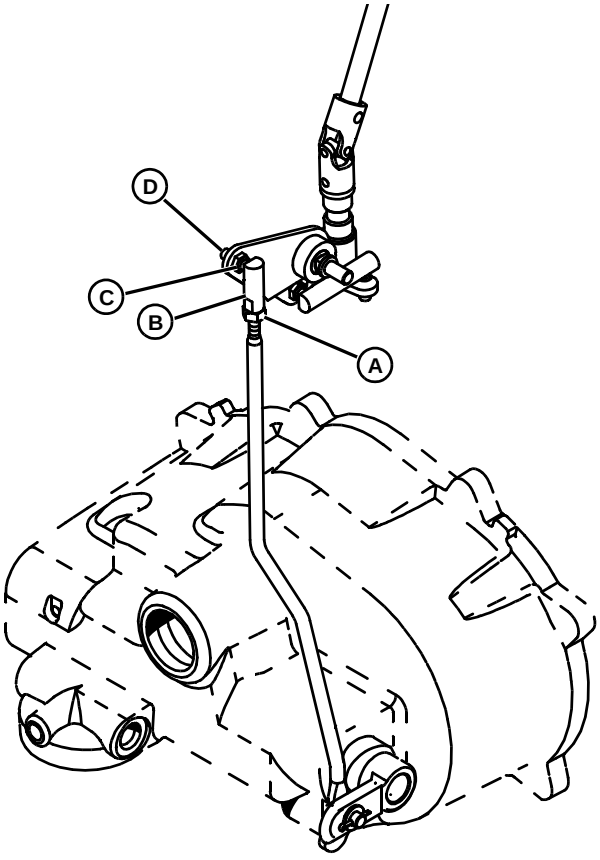
To ensure that forward and reverse clutches engage properly and that neutral is in the proper position on the lever and safety switches.

Procedure:

1. Remove LH engine side panel.
2. Remove LH cowl panel.
3. Place SRT shift lever in center (neutral) position. Make sure the neutral safety switch is depressed.
4. Loosen nut (A) locking ball joint (B) to rod.



5. Loosen lock nut (C) on shift rod and remove nut (D) securing ball joint to bellcrank.
6. Depress clutch pedal and ensure shift arm of SRT is in center (NEUTRAL) position. You should be able to feel the detent ball hold the shaft in the neutral position.



7. Place the forward/reverse shifter in neutral position. Make sure neutral switch is depressed.
8. Adjust ball joint (B) on shift rod up or down until it aligns with hole in bellcrank and secure with nut (D). Tighten locking nut (C).
9. Make sure the neutral safety switch is still depressed, if not re-adjust linkage.
10. Securely hold ball joint and tighten locking nut (A).

REPAIR

TRACTOR SPLITTING (FRONT)

*NOTE: It is **not** necessary to remove the flywheel housing from the engine unless engine is being removed. Split the tractor between the tunnel and flywheel housing as outlined in the story below.*

Prepare the Tractor:

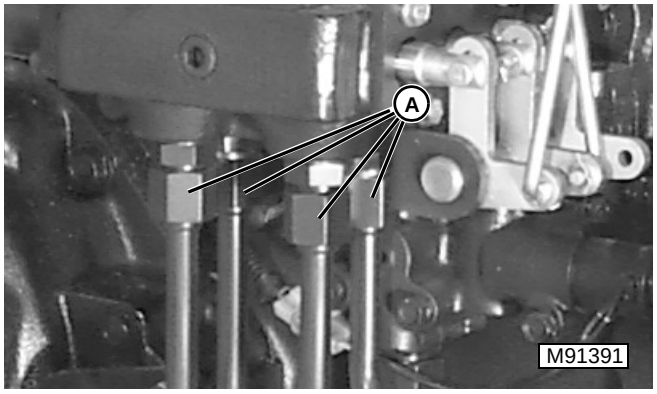
1. Remove any mid or front attachments and mid or front PTO shaft.
2. Park tractor on a level surface. Engage park brake, shut off engine.
3. Disconnect battery negative (–) terminal.
4. Remove floor mat.
5. Remove operator's platform. (See "OPERATOR'S PLATFORM" on page8 in Miscellaneous Section.)
6. Remove LH and RH closeout panels.
7. Remove seat and seat platform. (See "SEAT AND SEAT SUPPORT" on page5 in Miscellaneous Section.)
8. Remove fenders. (See "REAR FENDERS" on page 6 in Miscellaneous Section.)
9. Cycle all hydraulic controls to relieve system pressure.

⚠ CAUTION

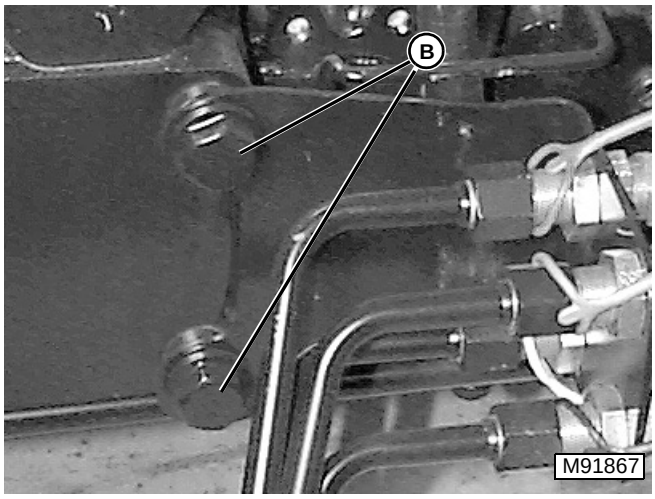
CAUTION: To avoid injury from escaping hydraulic oil under pressure, relieve the pressure in the system by stopping the engine and operating all hydraulic control valves.

NOTE: Hydraulic reservoir contains approximately 24 L (6.3 gal) of oil. Have a suitable container ready to catch drain oil.

10. Drain hydraulic reservoir.
11. If tractor is equipped with an SCV:
    - Raise RH rear of tractor and support on suitable stands.
    - Remove RH rear wheel and tire.

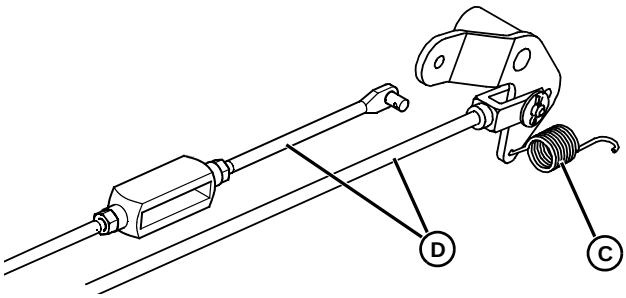


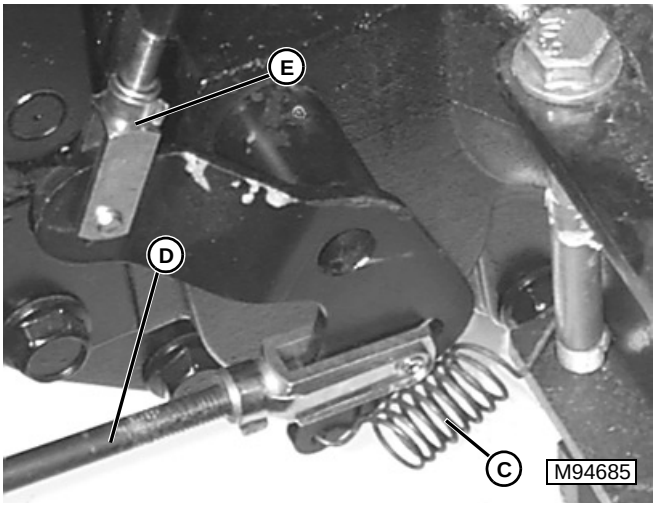
- Disconnect four work port tubes (A) from SCV.



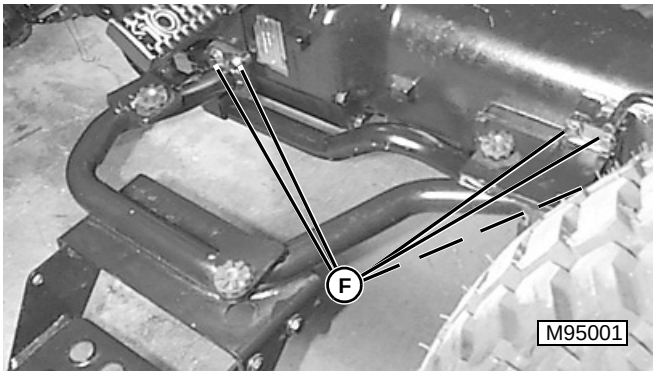
- Remove two cap screws (B) and two spacers that attach tube support bracket to frame. Remove tube support bracket and tubes as an assembly.
- Install RH rear wheel and tire.

12. Locate and disconnect all electrical connectors attaching wiring harness to switches and lights on rear half of tractor. Unfasten wiring harness from cable clips and move harness away from rear half of tractor.

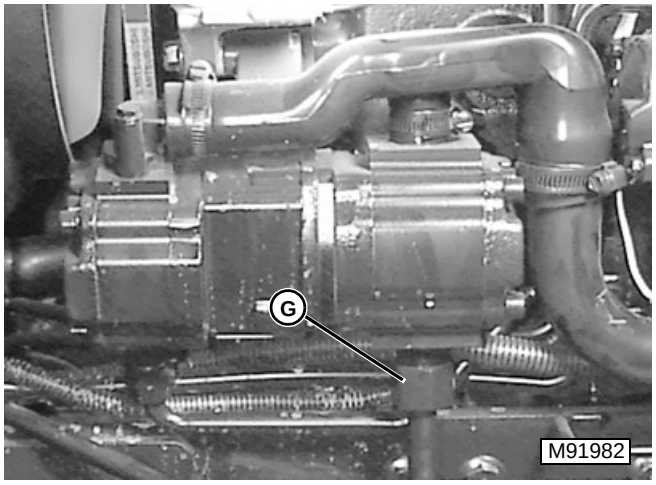




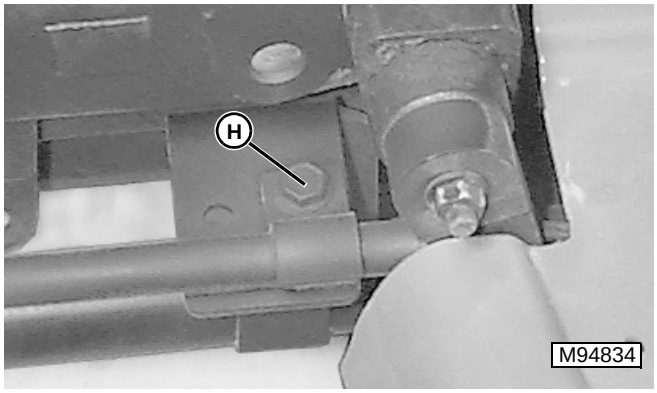
13. Disconnect brake return spring (C) from brake lever. Remove spring.
14. Disconnect lower brake rod (D) from brake lever.
15. **Side Mount Parking Brake Only:** Disconnect park brake rod (E) from brake lever.



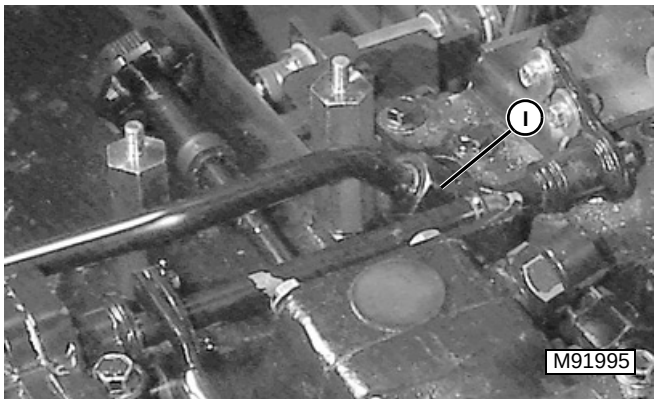
16. Remove five cap screws (F) and LH operator's platform support.



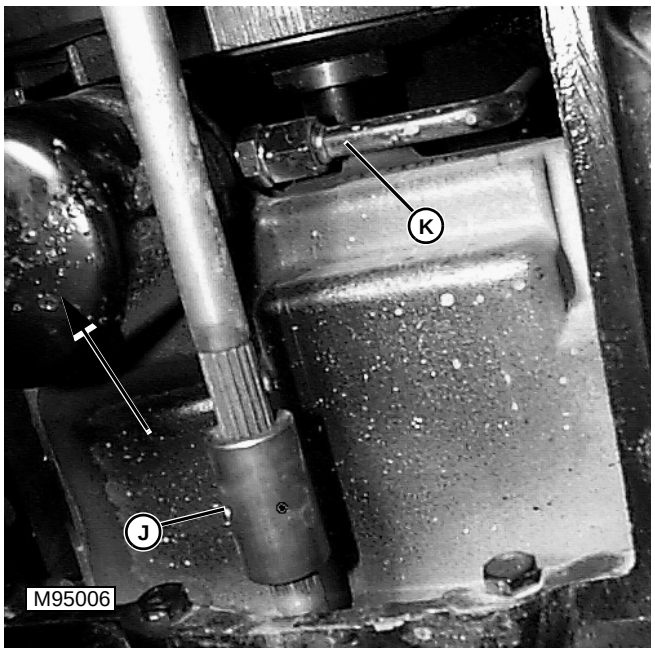
17. Disconnect hydraulic pressure tube (G) at rear gear pump.



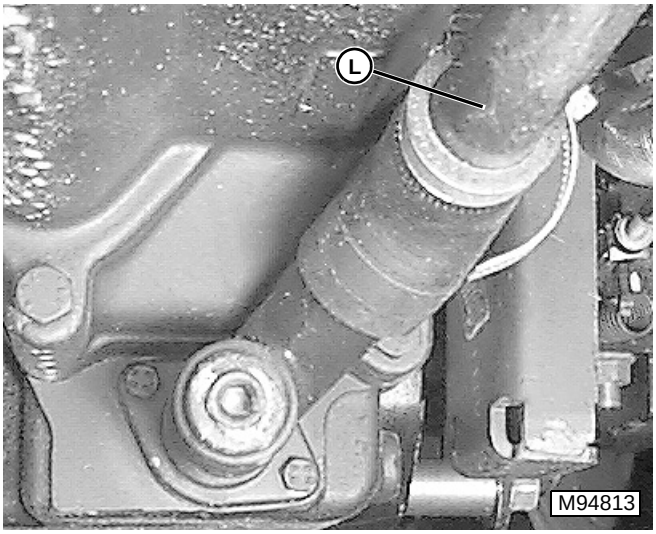
18. Remove cap screw (H) and hydraulic pressure tube clamp.



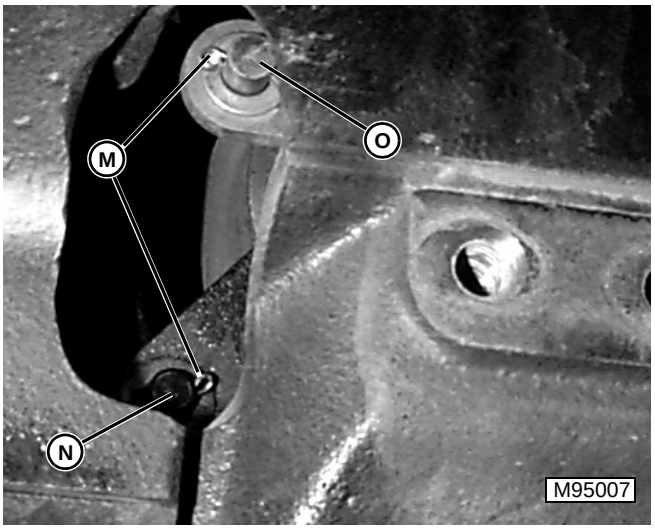
19. Disconnect hydraulic supply tube (I) at SCV or manifold block. Remove tube.



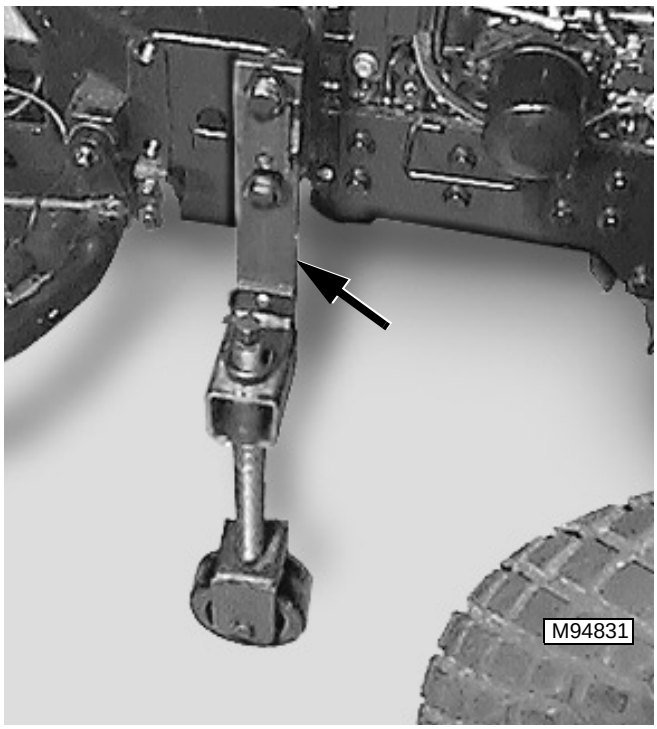
20. If equipped: Remove MFWD drive shaft and couplers by removing spring pin (J) and sliding coupler onto shaft until clear of stub shaft. Repeat at other end of drive shaft.
21. Remove oil filter.
22. Disconnect oil tube (K) from clutch housing/filter.



23. Loosen hose clamp and disconnect suction tube (L) from manifold.



24. Remove cotter pins (M) and disconnect linkage rods from clutch lever (N) and forward/reverse lever (O).



NOTE: When attaching JTO 7335 splitting stands to tunnel section, use the supplied right angle brackets, and attach to holes in underside of tunnel section.

25. Using suitable cap screws, attach four JTO 7335 splitting stands to tractor sections. Adjust splitting stands so that wheels contact the floor, and are parallel to the tractor wheels.
26. Remove nine cap screws connecting tunnel to flywheel housing. Note length and locations of cap screws when removing.

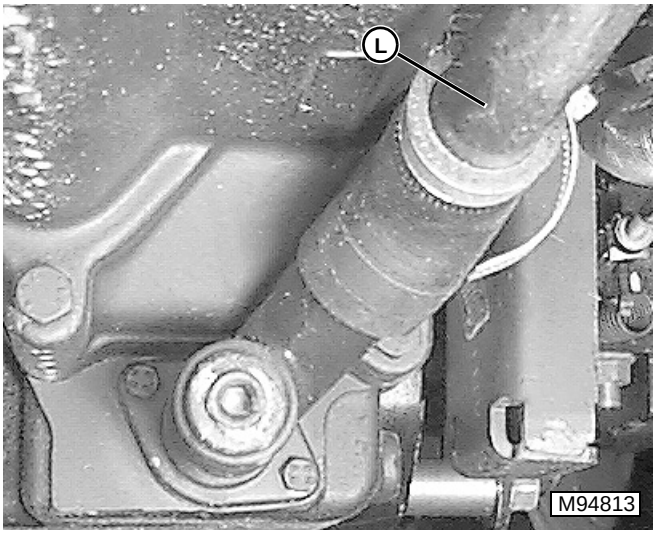
IMPORTANT: Check for, and disconnect any additional accessory wires or hydraulic tubes connecting rear half to front half before splitting tractor.

27. Release park brake and place gear shift in NEUTRAL.
28. Gently pry around edges of flanges to separate tractor halves.
29. Roll tractor halves apart.

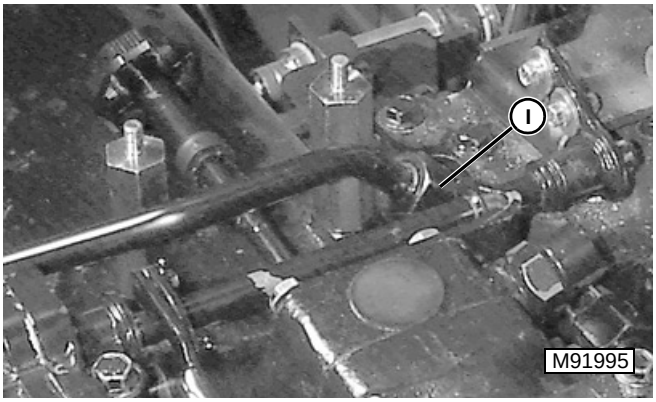
Assemble Tractor Sections:

NOTE: Splines on all drive shafts and couplers must be aligned before tractor sections are bolted together.

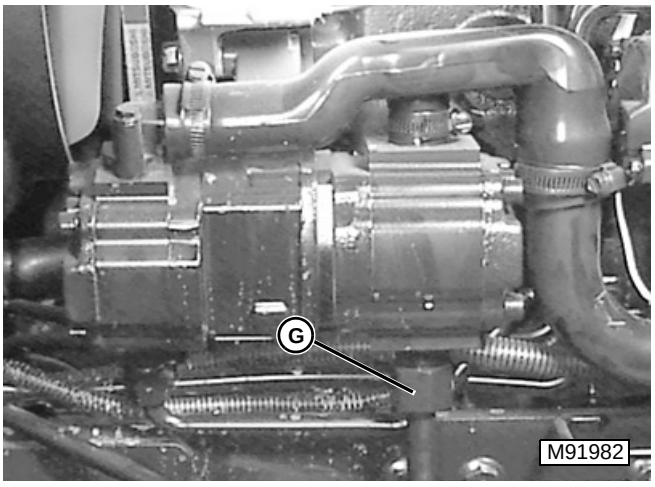
1. Align splines on transmission drive shaft and engine flywheel.
2. Move tractor sections together and retain with nine cap screws. Tighten cap screws to **126 - 154 N•m (95 - 115 lb-ft)**.
3. Remove cap screws retaining splitting stands to tractor sections. Remove splitting stands.



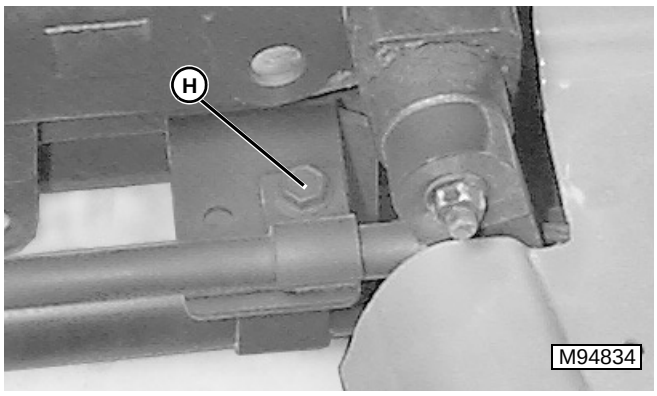
4. Connect suction tube (L) to manifold. Tighten hose clamp.



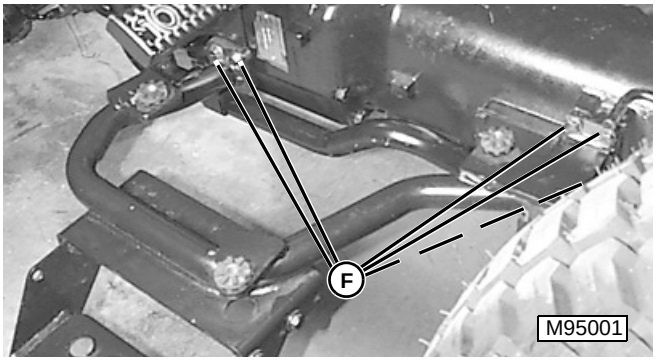
5. Install hydraulic supply tube to tractor. Connect hydraulic supply tube (I) to SCV or manifold block. Tighten tube nut to **55 - 79 N•m (40 - 59 lb-ft)**.



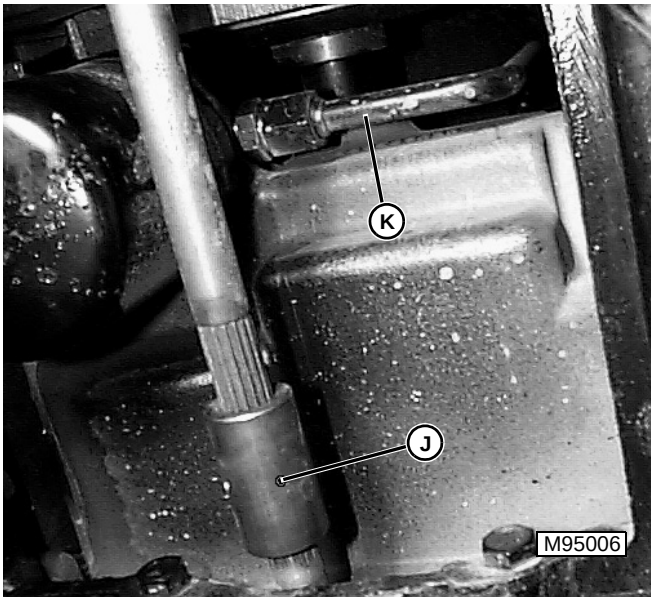
6. Connect hydraulic pressure tube (G) to rear gear pump. Tighten tube nut to **55 - 79 N•m (40 - 59 lb-ft)**.



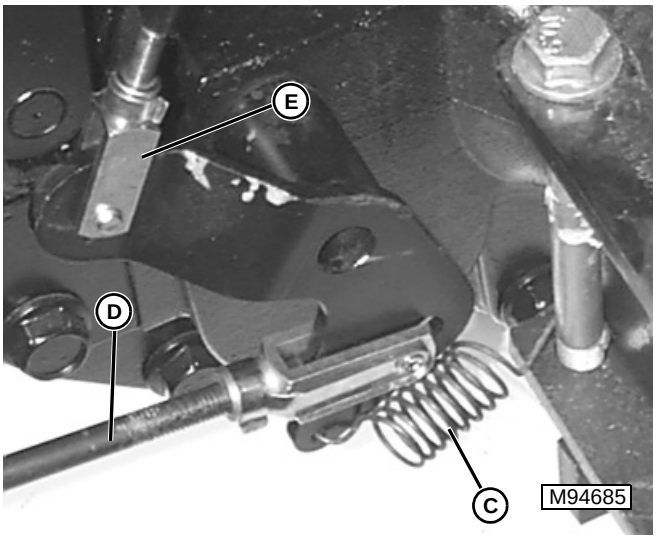
7. Install cap screw (H) and hydraulic pressure tube clamp.



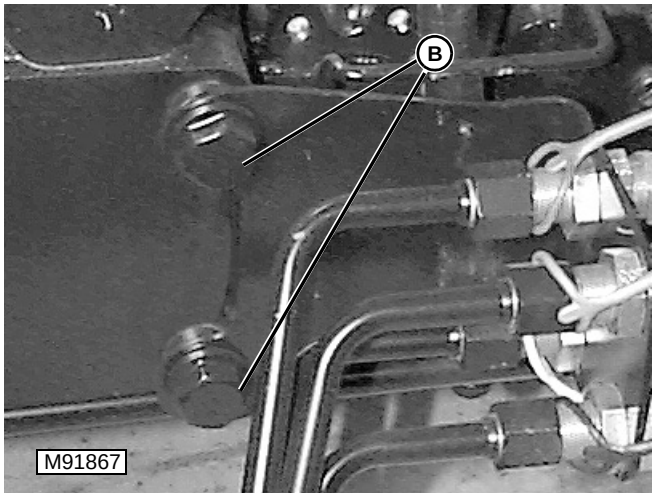
8. Install LH operator's platform support. Retain with five cap screws (F).



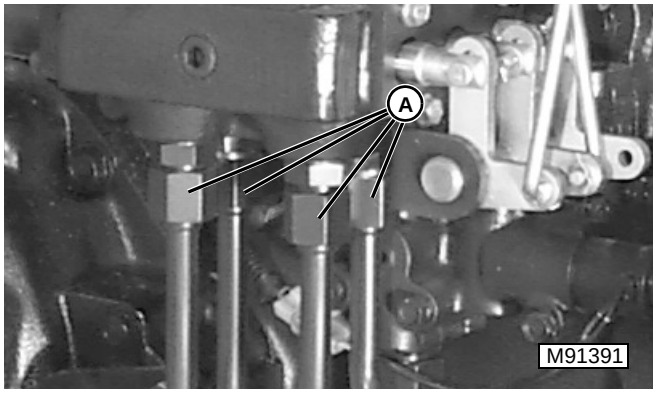
9. Connect oil tube to clutch cover on transmission. Tighten to **40 - 57 N•m (30 - 43 lb-ft)**.
10. Install a new hydraulic oil filter.
11. If equipped, install MFWD drive shaft and couplers. Slide couplers onto shafts, and retain with spring pins (J).



12. Attach lower brake rod (D) to brake lever. Retain with pin, or pin, cotter pin, and washer.
13. **Side Mount Parking Brake Only:** Attach park brake rod (E) to brake lever. Retain with clip pin.
14. Install brake return spring (C) to brake lever and ROPS cap screw.
15. Route wiring harness through cable clips. Locate and connect all electrical connectors attaching wiring harness to switches and lights on rear half of tractor.



16. If tractor is equipped with an SCV, install SCV tube support bracket and tubes as an assembly. Install two cap screws (B) and two spacers to attach tube support bracket to frame.
17. Raise RH rear of tractor and support on suitable stands. Remove RH rear wheel and tire.

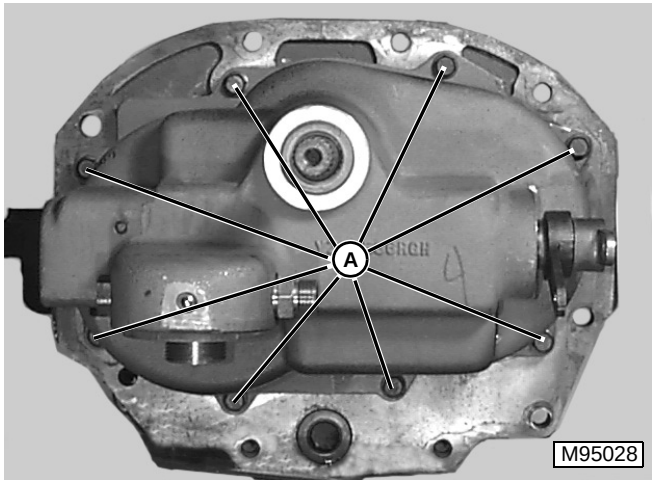


18. Connect four work port tubes (A) to SCV. Tighten tube nuts to **40 - 57 N•m (30 - 43 lb-ft)**.
19. Connect battery negative (–) terminal.
20. Install fenders. (See “REAR FENDERS” on page 6 in Miscellaneous section.)
21. Install kick plate. (See “KICK PLATE” on page 8 in Miscellaneous section.)
22. Install seat and seat platform. (See “SEAT AND SEAT SUPPORT” on page5 in Miscellaneous section.)
23. Install LH and RH closeout panels.
24. Install operator’s platform. (See “OPERATOR’S PLATFORM” on page8 in the Miscellaneous section.)
25. Install floor mat.
26. Refill hydraulic oil reservoir to proper level.
27. Bleed air from hydraulic system. (See “HYDRAULIC SYSTEM BLEED PROCEDURE” on page 25 in the Hydraulics section.)

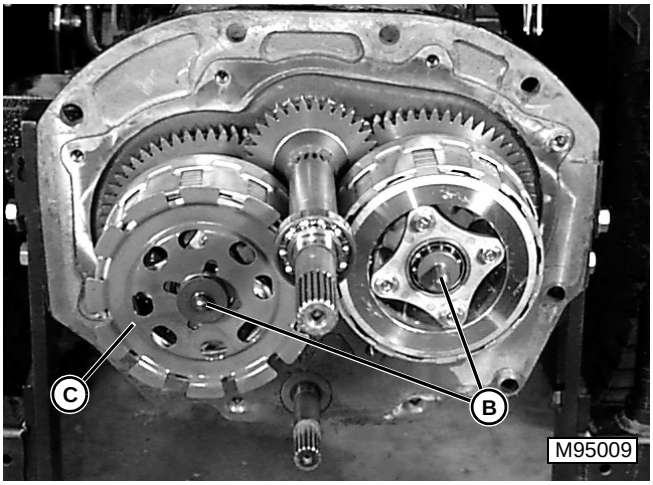
SYNCREVERSER TRACTION CLUTCH REMOVAL

Procedure:

1. Perform tractor split between flywheel housing and tunnel housing. (See “TRACTOR SPLITTING (FRONT)” on page12.)

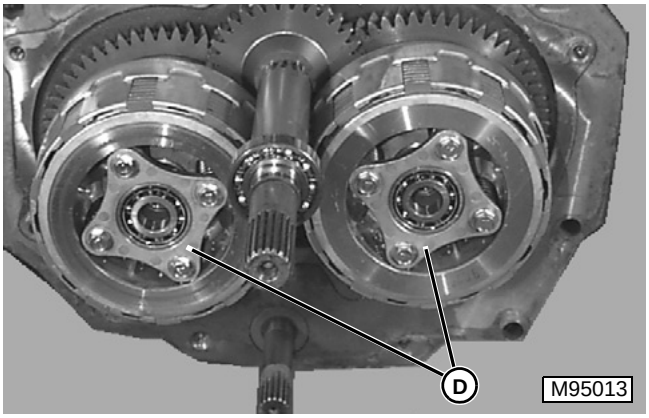


2. Remove eight cap screws securing clutch cover to tunnel housing.
3. Remove clutch cover.

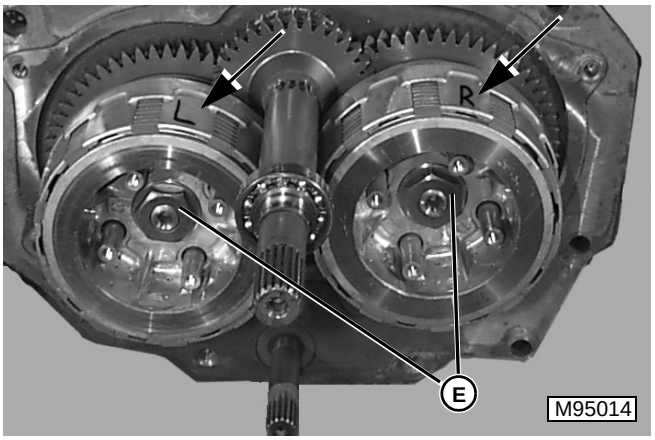


4. Remove clutch lifter pins (B) and clutch snubber (C).

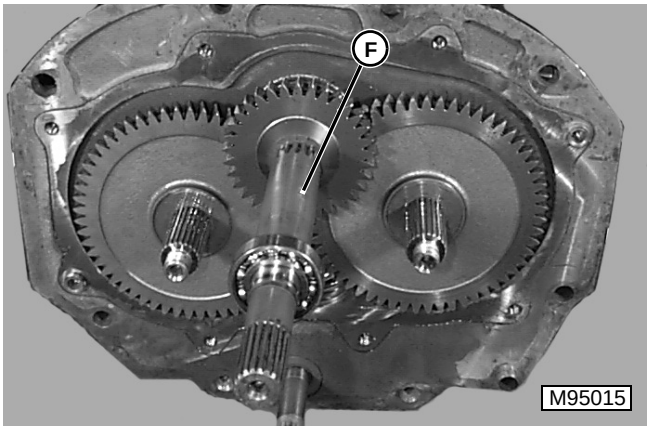
IMPORTANT: There are shims on both sides of the clutch snubber and behind the head of the lifter pin on the other clutch. Note location and retain all shims for possible use during reassembly.



5. Alternately loosen eight retaining cap screws in small increments and remove spring retainer plates (D).



6. Mark clutches so they can be installed in their original position.
7. Remove clutch retaining nuts (E) and slide clutches off of shafts.



8. Mark clutch gears for reassembly.
9. Simultaneously slide gears off of shafts and remove input shaft (F).

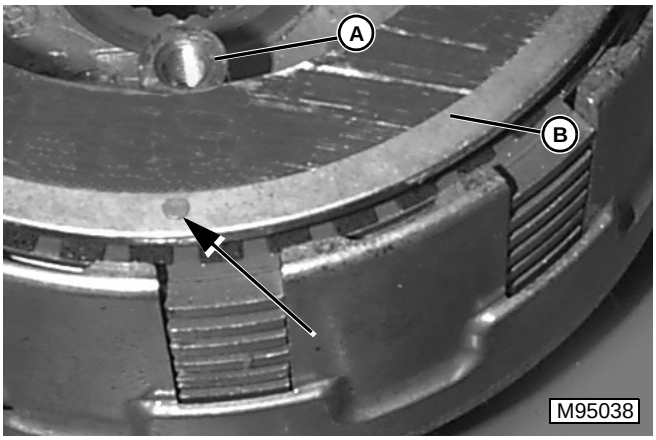
NOTE: The PTO shaft may or may not come out with the input shaft. It is easier to install with the clutch gears removed. Just place it back on the input shaft splines and guide it in, making sure it engages into PTO clutch.

SYNCREVERSER TRACTION CLUTCH DISASSEMBLY

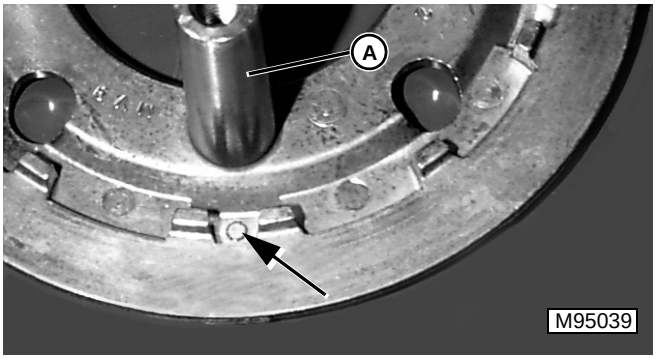
Special or Required Tools:

- Calipers
- Bearing Drivers

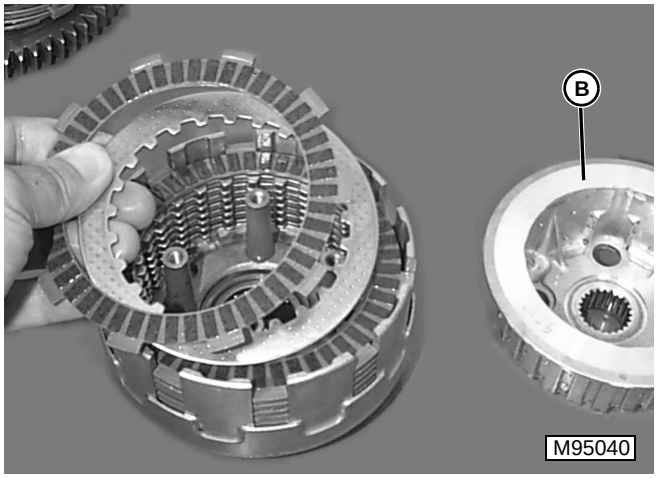
Procedure:



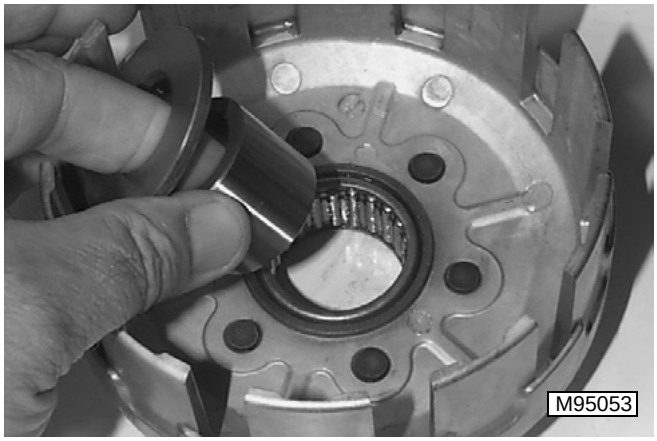
NOTE: The clutch piston and hub may only be assembled one way to operate properly. There are small assembly marks on them, but you may find it helpful to mark the piston post (A) and hub with a marking pen.



1. Mark piston post and piston with permanent marking pen for reassembly.



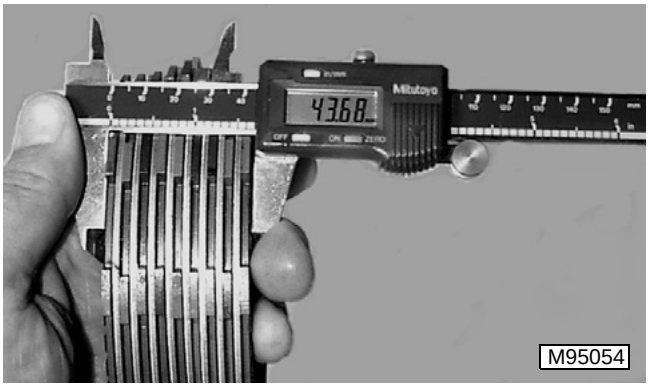
2. Remove hub (B) and clutch plates from basket.



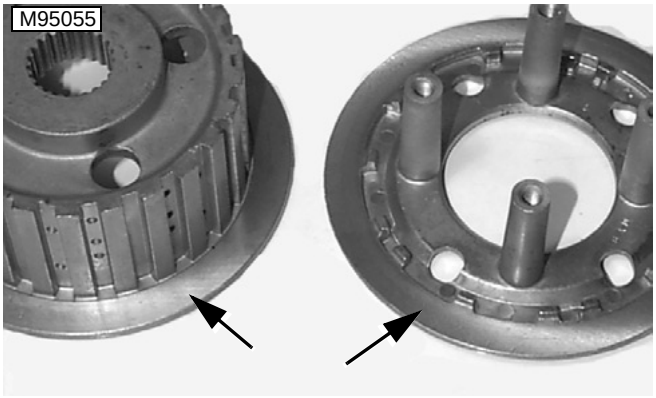
3. Inspect needle bearing, race, and thrust washer for wear or damage.

NOTE: If bearing is being replaced, replace race and thrust washer also.

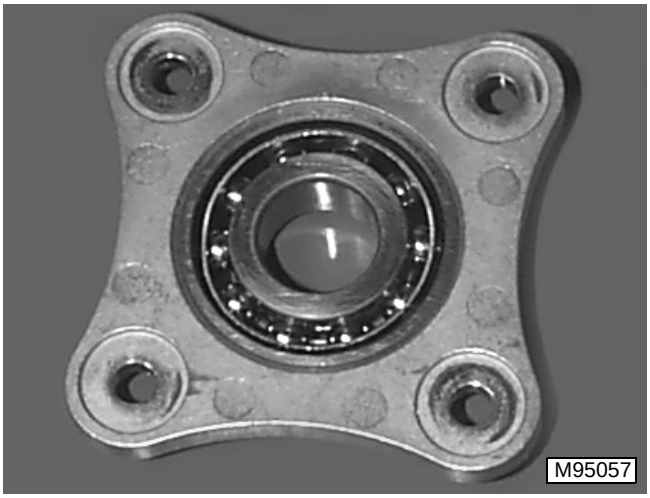
4. If replacement of bearing is necessary, drive bearing out with appropriate bearing driver. When installing new bearing, drive only on the side that the numbers are stamped on. Drive bearing in until it is slightly below flush on both sides.



5. Measure thickness of entire clutch plate pack. Minimum thickness: **42.34 mm (1.66 in.)** Replace clutch pack if below minimum thickness.

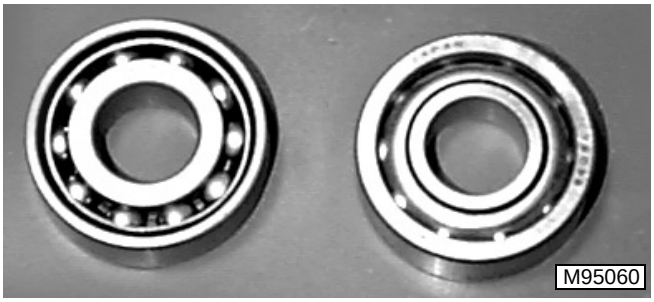


6. Inspect friction areas of hub and piston for wear. Replace parts as needed.



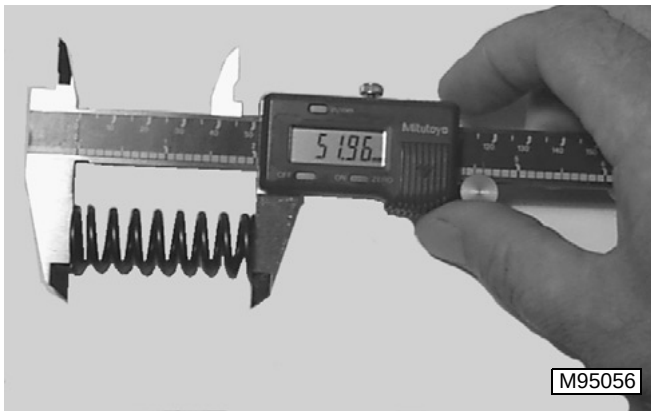
IMPORTANT: DO NOT spin bearings using compressed air. Damage to bearing balls, cage and races could result.

7. Clean spring retainer plate bearings in suitable solvent. Dry with compressed air.
8. Inspect both bearings for discolored or burned balls and/or races. Check balls and races for spalling or cracking. Roll bearing by hand to check for rough turning or excessive looseness or play between balls and races. Replace bearings as required.



Front Towards Flat Side of Spring Plate **Back Towards Raised Side of Spring Plate**

NOTE: Bearings are designed for side loads and must be installed in the proper direction as shown.



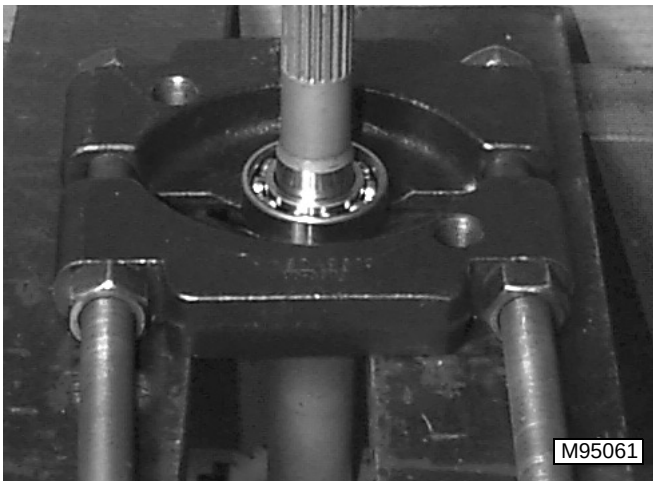
9. Measure no load length of each spring. If spring length is less than **51.3 mm (2.02 in.),** replace spring.

INPUT SHAFT DISASSEMBLY

Special or Required Tools:

- Bearing Puller

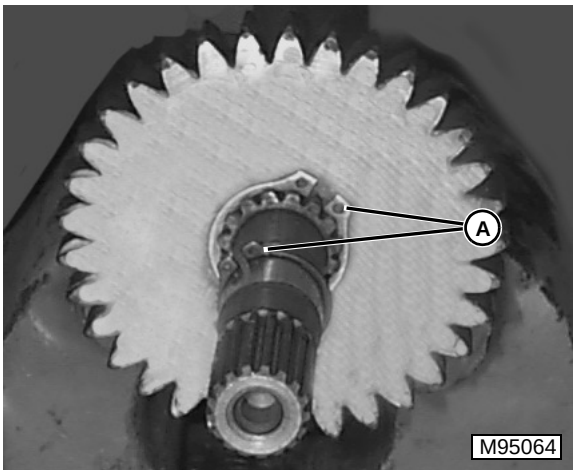
Procedure:



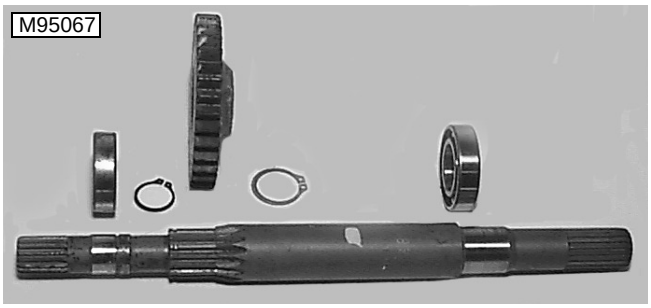
1. Using a bearing puller and press, remove bearings.

IMPORTANT: DO NOT spin bearings using compressed air. Damage to bearing balls, cage and races could result.

2. Clean bearings in suitable solvent. Dry with compressed air.
3. Inspect both bearings for discolored or burned ball and/or races. Check balls and races for spalling or cracking. Roll bearing by hand to check for rough turning or excessive looseness or play between balls and races. Replace bearings as required.



4. Remove snap rings (A) and slide gear from shaft.



5. Inspect gear teeth for damage. Inspect splines and bearing areas of shaft for wear or damage. Replace parts as required.

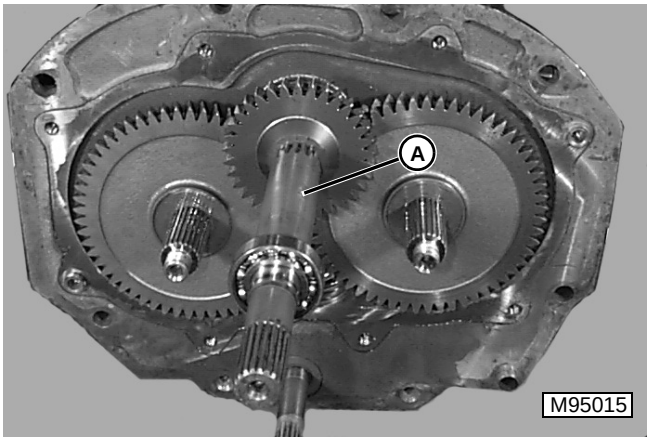
SYNCREVERSER TRACTION CLUTCH INSTALLATION

NOTE: Gasket surfaces must be absolutely clean down to bare metal for form-in-place gasket to work properly. Scrape old material off with a sharp gasket scraper and then use a chemical gasket remover to clean mounting surfaces.

Procedure:

1. Remove any old gasket material from clutch cover and transmission housing tunnel.
2. Assemble input shaft if not already assembled.

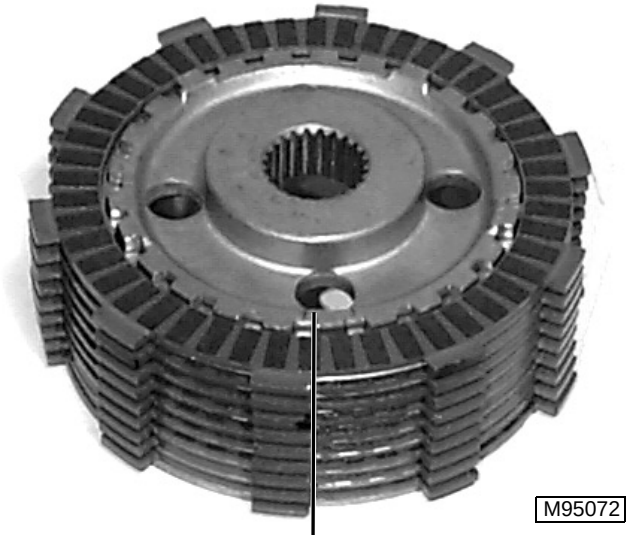
NOTE: Make sure PTO shaft is properly installed into PTO clutch splines.



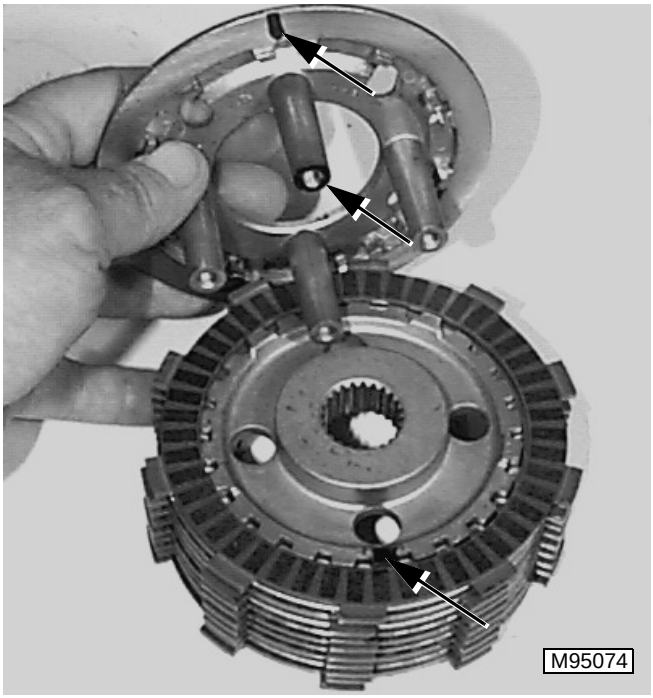
3. Simultaneously slide gears onto shafts and input shaft into transmission. Raised side of gear hubs go toward bearings. Turn input shaft (A) and make sure PTO shaft is properly installed.

Clutch Assembly:

4. Lay hub assembly on workbench with splined hub facing up.

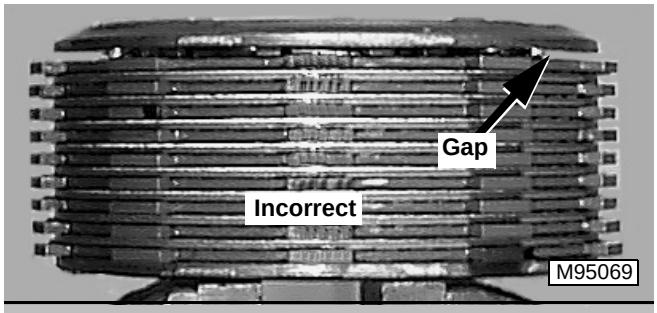


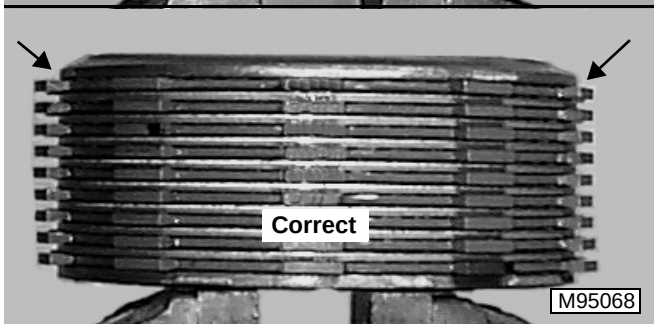
5. Install a clutch friction disc, then metal plate, then disk, then plate etc.
6. Line up tabs on clutch discs.



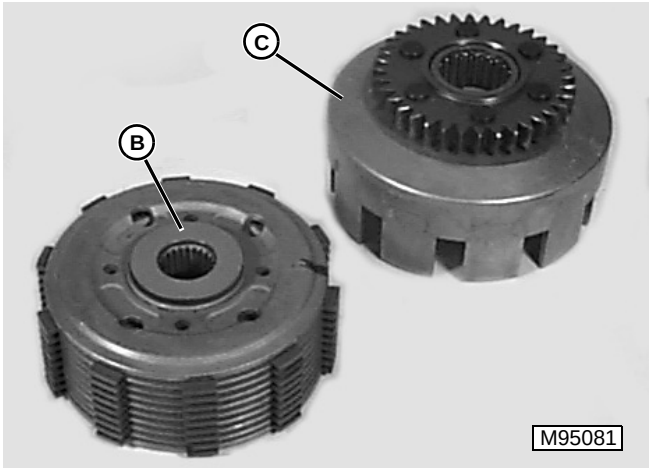
7. Line up assembly marks and put piston on hub assembly.

NOTE: The clutch piston and hub may only be assembled one way to operate properly. Make sure assembly marks are lined up.

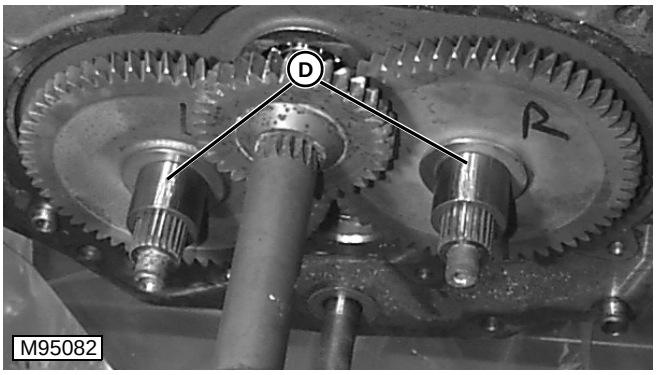




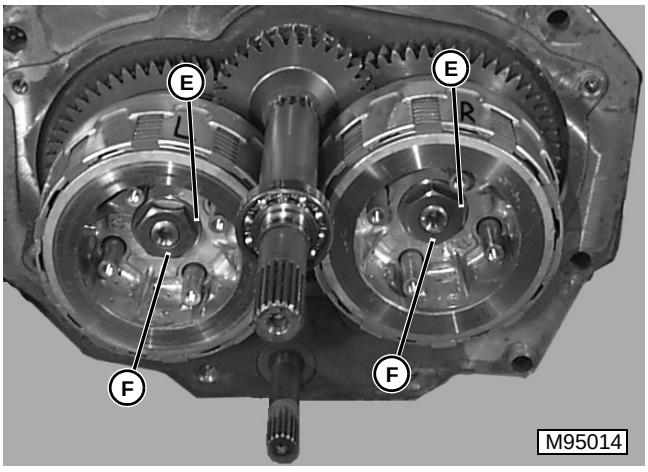
8. Verify proper assembly by making sure piston contacts clutch plates.



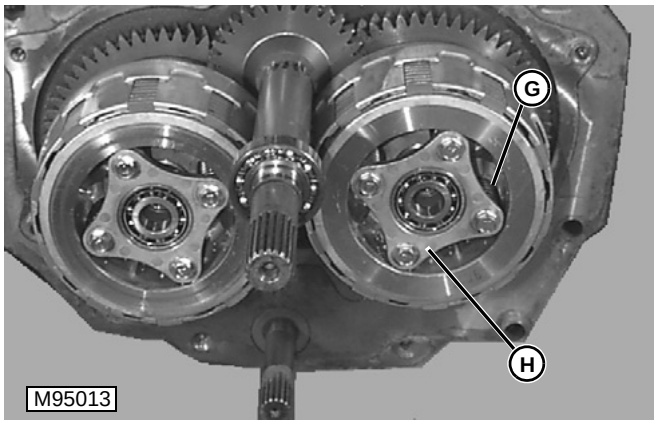
9. Place thrust washer (B) on clutch.
10. Slide clutch basket (C) down over clutch assembly.



11. Slide bearing races (D) onto clutch shafts.



12. Make sure the thrust washer is properly positioned in the clutch assembly. While applying pressure to the clutch parts to keep the thrust washer in place, slide clutches on shafts.
13. Install belleville washer (E) with side marked "out" toward outside.
14. Install nuts (F), flat side out, and tighten to **135 N•m (100 lb-ft).**



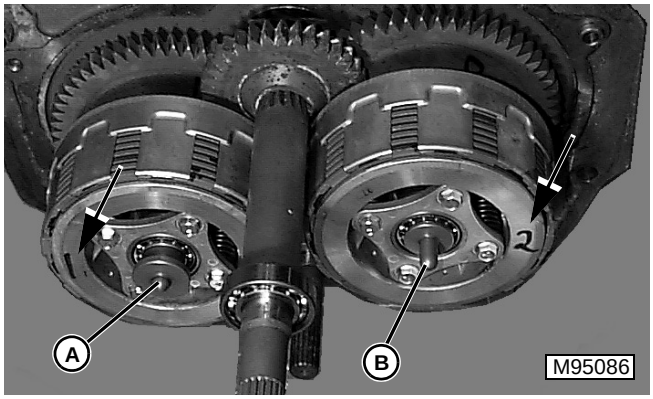
15. Install a spring (G) on each of the eight posts and then a spring retainer plate (H) on each clutch. Tighten cap screws to **11 N•m (98 lb-in.)**

CLUTCH SHIMMING PROCEDURE

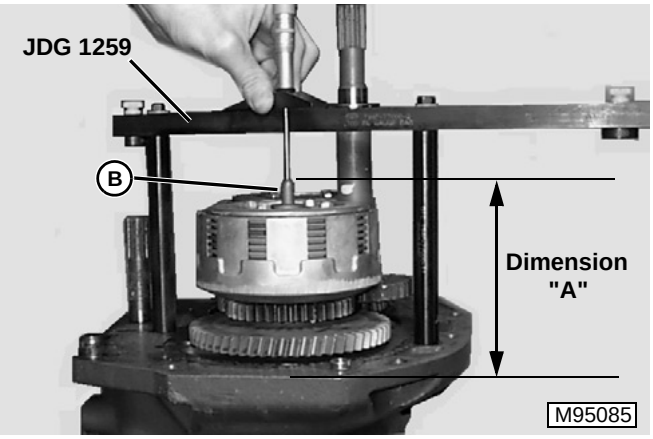
Measure Clutches:

Tool:

- JDG 1259 Clutch Shimming Fixture



1. Mark the clutches "1" and "2" with a marking pen.
2. Install lifter pins (A and B) as shown without any shims or the clutch snubber under (A).
3. Seat the clutches back toward the transmission by tapping each assembly lightly with a soft mallet.

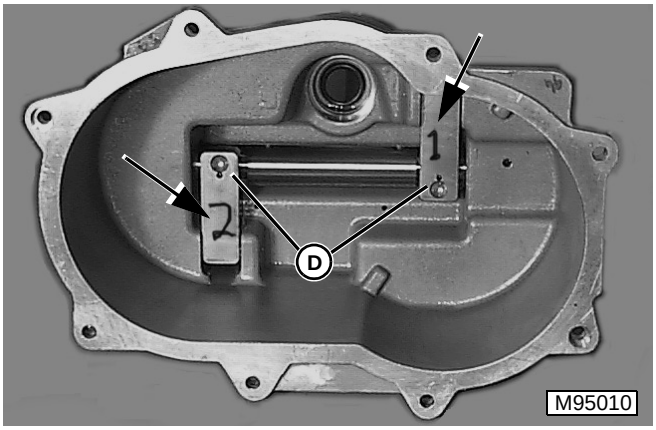


4. Install **JDG 1259 Clutch Shimming Fixture** over the lifter pin (B) of the clutch. The overall height of the fixture must be known before installation. The **JDG 1259** is **177.8 mm (7.00 in.)** high.
5. Measure from the top of the fixture to the top of the lifter pin with a depth micrometer or calipers and record the measurement.
6. Subtract this number from the height of the fixture.
7. Record number and repeat steps four through six for the other clutch. These are dimensions "A".
8. Write the measurement for each clutch on the clutch with a marking pen.

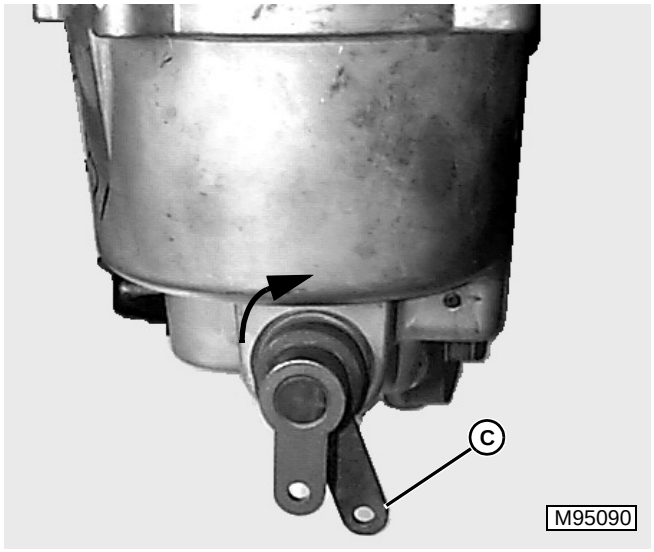
Measure Clutch Housing:

Tool:

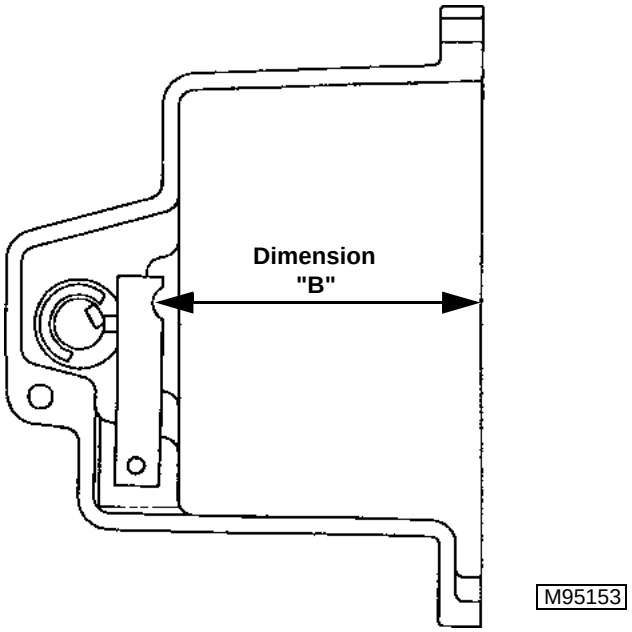
- JDG 1259



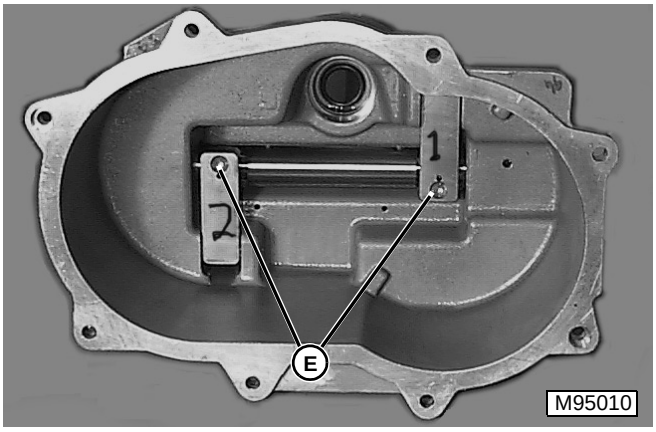
1. Position clutch cover assembly with opening up.
2. Identify and mark the location of clutch "1" and "2" as shown.



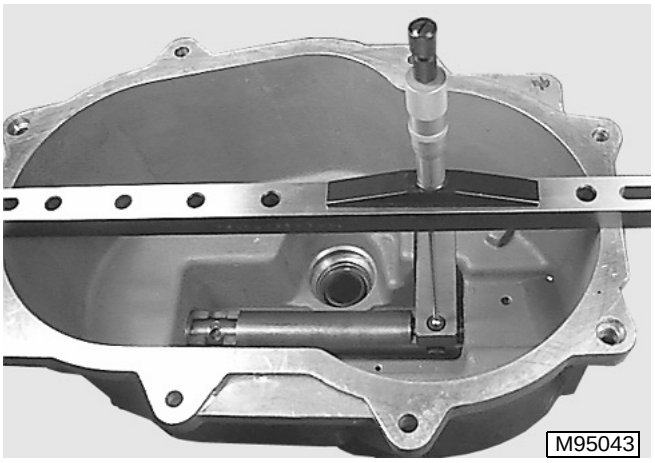
3. Turn clutch pedal control lever (C) clockwise to the disengaged position. Both lifter levers (D) in figure M95010 above will be in the raised position when the clutch pedal control lever is in the disengaged position.



4. Measure dimension "B" from the bottom of the pocket in each lifter lever to the face of the housing.



- Place a **9.53 mm (0.375 in.)** diameter ball in the pocket (E) of each lifter lever.



- Place the **17.78 mm (0.700 in.)** thick bar across the housing.
- Measure from the top of the bar to the top of the ball in each lifter lever pocket. Record measurement. Add the size of the ball **9.5 mm (0.375 in.)** and subtract the size of the bar **17.78 mm (0.700 in.)** to recorded measurement. This will be dimension "B", write this sum on each lifter lever.

Determining Correct Amount of Shims:

NOTE: Calculate each clutch separately.

1. Subtract dimension "A" from dimension "B" to determine value "C" which can be zero or greater.
2. If "C" is zero, assemble without shims.
3. If "C" is greater than zero, add shims equal to dimension "C" **+ 0.3/- 0.0mm (+0.012 /- 0.000 in.)** between the lifter pin and the bearing.

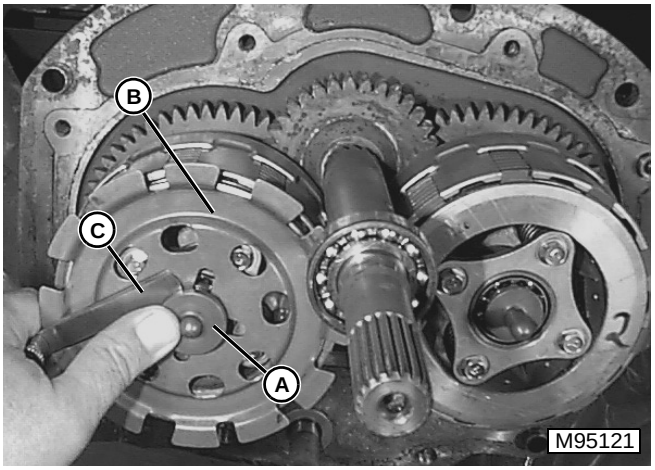
*NOTE: Due to shim sizes of **0.25mm (0.010 in.) 0.50mm (0.20 in.) and 1.0mm (0.039 in.**) it may not be possible to shim to an equal value of "C". The goal is to have the shim pack as close to dimension "C" as possible without being less than "C" and not exceed "C" by more than **0.3 mm (0.012 in.).***

Example:	**mm:**	**Inch:**
JDG 1259 Fixture*	177.80	7.000
Fixture To Pin Measurement	–51.31	–2.021
Dimension "A"	126.49	4.979
Clutch Cover Measurement	132.98	5.234
Ball Size	+9.50	+0.375
Bar Size (JDG 1259 Fixture*)	–17.78	–0.700
Add	+3.00	+0.118
Dimension "B"	127.70	5.027
Dimension "B"	127.70	5.027
Minus Dimension "A"	–126.49	–4.979
Dimension "A" - Dimension "B"	1.21	0.048
Value C (Min. Shim Thickness)	1.21	0.048
Shim Tolerance	+0.3 –0.00	+0.012 –0.000
Value C (Max. Shim Thickness)	1.51	0.060
*If any other fixture is used, do not use this value		

4. Install shims on lifter pins.

SNUBBER SHIMMING PROCEDURE

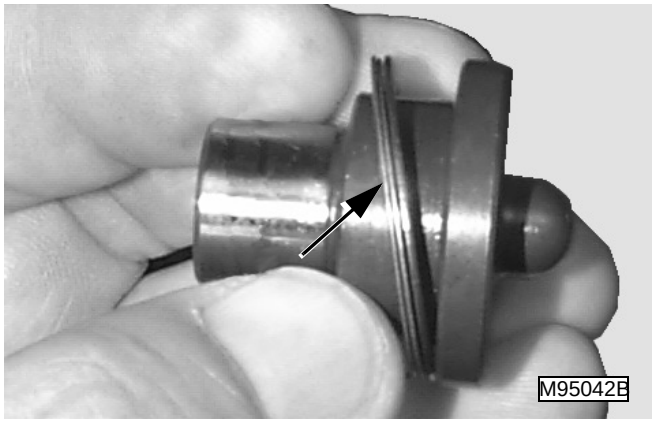
NOTE: The drive clutch must be properly shimmed before shimming the snubber.



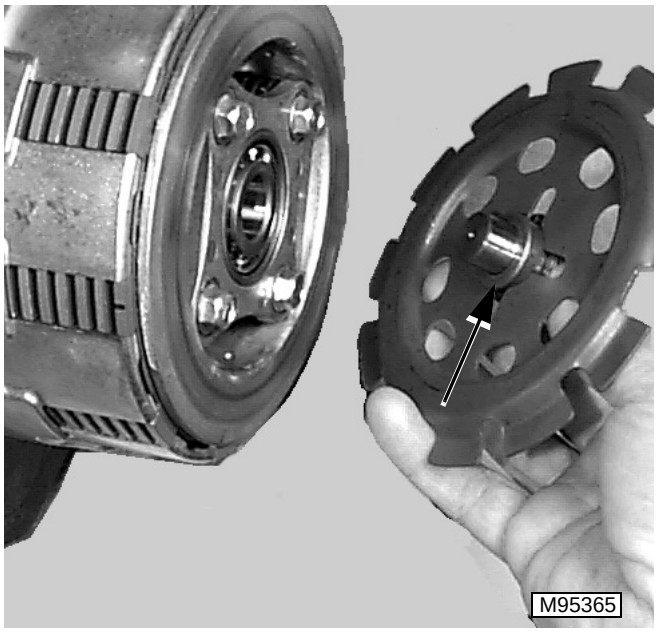
1. Install clutch shims (determined from previous procedure), lifter pin (A), and snubber (B) **without** snubber shims.
2. Hold snubber and lifter pin firmly against front of clutch and measure the gap between the snubber fingers and lifter pin shoulder with a feeler gauge (C).

NOTE: The gap should not be less than 1.40 mm (0.055 in.) or more than 1.65 mm (0.065 in).

3. Subtract **1.5 mm (0.059 in.)** from measurement in previous step. This is the minimum thickness of shim pack to be used between the front surface of clutch snubber and bottom surface of lifter pin shoulder.
4. Measure shims to be installed individually, do not measure with the shims stacked together.



5. Install snubber shims to the lifter pin.

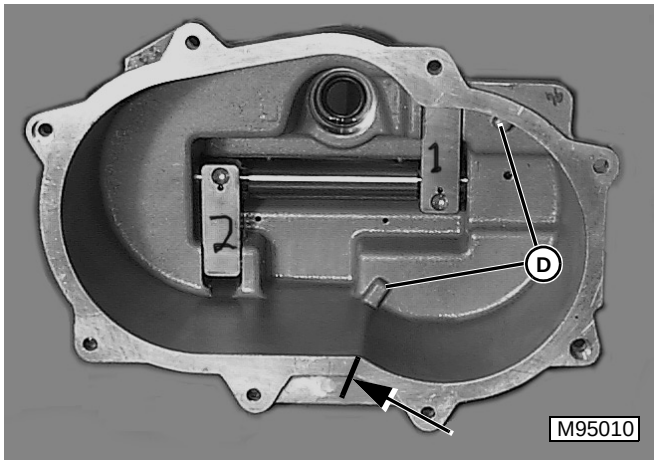


6. Insert lifter pin through the snubber.
7. Install clutch shims on the lifter pin and slide lifter pin and snubber into clutch bearing.

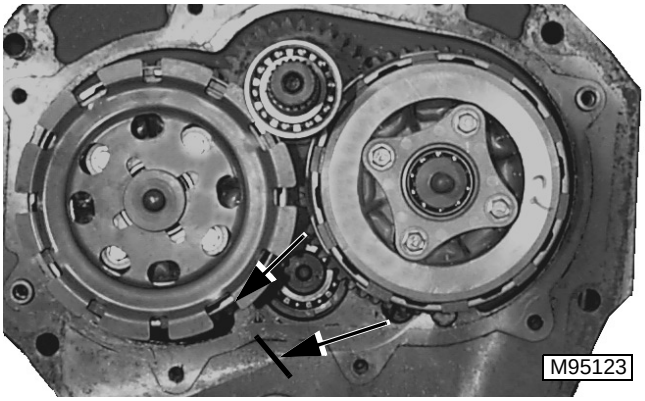
Installing Clutch Cover:

IMPORTANT: Mating surfaces must be completely clean of gasket material. Use a single edged razor blade and gasket removing compound to clean surfaces to bare metal.

1. Clean form in place gasket material from mating surface with a gasket scraper or single sided razor blade and gasket removing compound.
2. Install new input shaft oil seal.



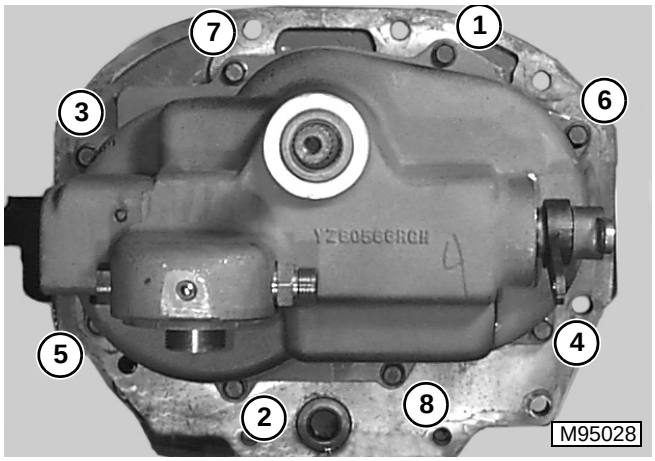
3. Mark position of snubber locating tab (D) on clutch housing.



NOTE: Four of the slots on the snubber are larger than the others. The larger slots must be lined up with the tabs on the clutch housing.

4. Hold clutch cover on center tunnel housing and place a mark on the center tunnel housing that aligns with the mark on the clutch housing.
5. Line up larger slots on clutch snubber with marks on center tunnel housing.
6. Place a 1/16 in. uniform bead of TY16021 John Deere Form- in- Place Gasket around the mating surface of the clutch cover.
7. Position forward reverse shaft so that pin for number two lifter arm drops into hole. Apply force to shift shaft so that lifter arm will be held in position and not fall away from shaft while installing clutch cover.

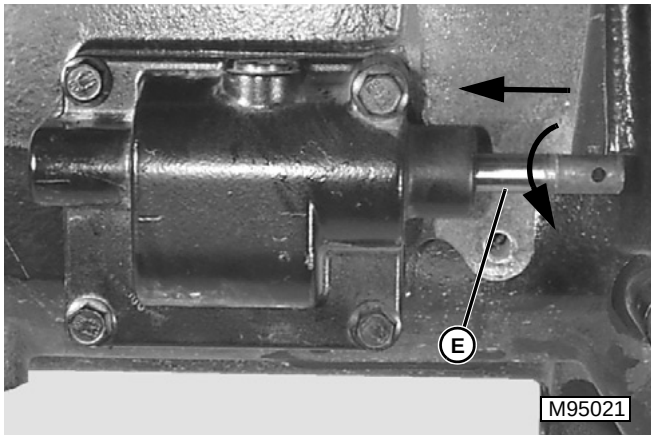
IMPORTANT: Clutch cover must come up against hollow dowels on each side or the snubber is not positioned correctly. Check position of snubber slots and re-align as needed.



8. Install clutch cover and tighten cap screws to **28 N•m (20 lb-ft)** in sequence shown.

Snubber Check Procedure: (Optional: Check if transmission is removed from differential housing.)

NOTE: Check should be made with transmission in horizontal position.



NOTE: Check must be made with transmission in 2nd gear. If shifter is not on the unit, turn shift rod (E) counterclockwise and push in, or if shift rod and cover are not on trans, top fork rod should be in forward position.

1. Place transmission in 2nd gear.
2. Attach a dial or pointer type torque wrench to output shaft of transmission.
3. Engage forward clutch and rotate the output shaft at approximately 10 rpm. Observe torque while rotating shaft. Torque should be approximately **9.5 N•m (84 lb-in.).** Record reading.
4. Fully disengage the clutch, thus applying the snubber, and repeat step three. Record the observed torque.
5. Subtract the reading from step three from the reading from step four. The results must be greater than **5.4 N•m (48 lb-in.)** but not exceed **8.1 N•m (72 lb-in.).**
6. If the results are not within this range, re-shim the snubber accordingly. That is, add shims to increase torque, or remove shims to decrease torque.

Clutch Shimming Bench Test (SRT Models):

1. Select a suitable handle for clutch lever (adjustable wrench). Rotate clutch lever upward to stop. Place speed section and range section in high gear. Rotate sync shuttle lever upward 30 degrees from horizontal (neutral detent) to the forward drive

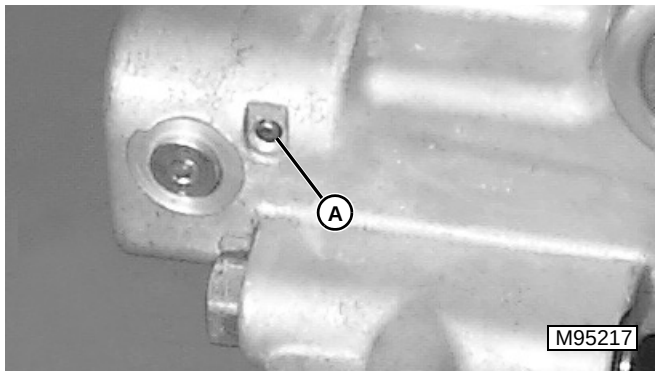
position. Release clutch lever back to the engaged position. Use a locking pliers to rotate the input shaft clockwise-- the axles should rotate forward.

2. Rotate clutch lever up to stop. Rotate sync shuttle lever downward 30 degrees below horizontal (neutral position) to the reverse drive position. Release clutch lever back to the engaged position. Rotate input shaft clockwise-- the axles should rotate in reverse.
3. Rotate clutch lever up to stop. Rotate sync shuttle lever upward to horizontal (Neutral Detent). You should be able to feel a slight detent in this position. Release clutch lever to engage position.

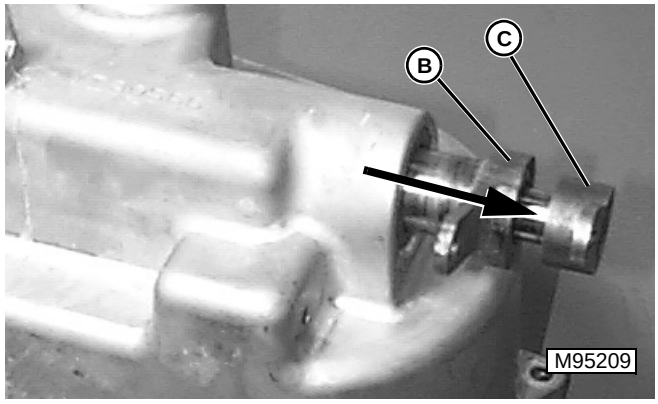
CLUTCH AND FORWARD/REVERSE SHAFTS

Removal:

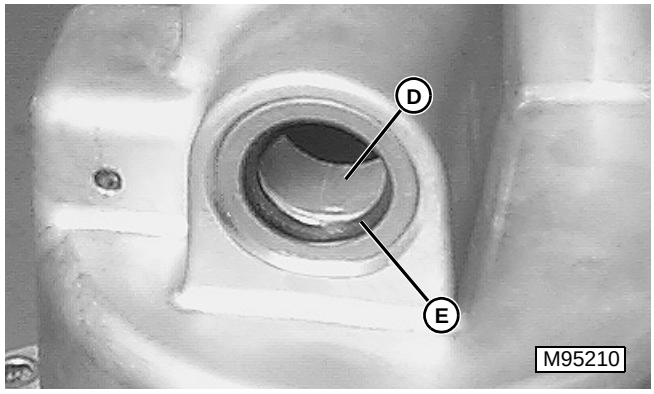
1. Split tractor between flywheel housing and tunnel (See “TRACTOR SPLITTING (FRONT)” on page 12.)
2. Remove six cap screws and clutch housing (See “SYNC REVERSER TRACTION CLUTCH REMOVAL” on page18.)



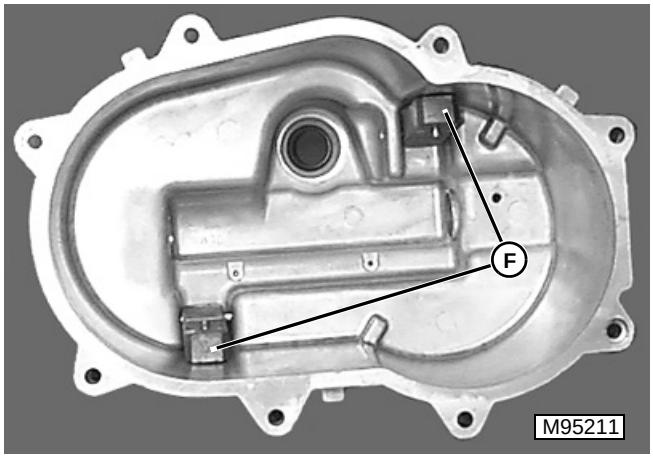
3. Remove pin (A) from clutch housing.



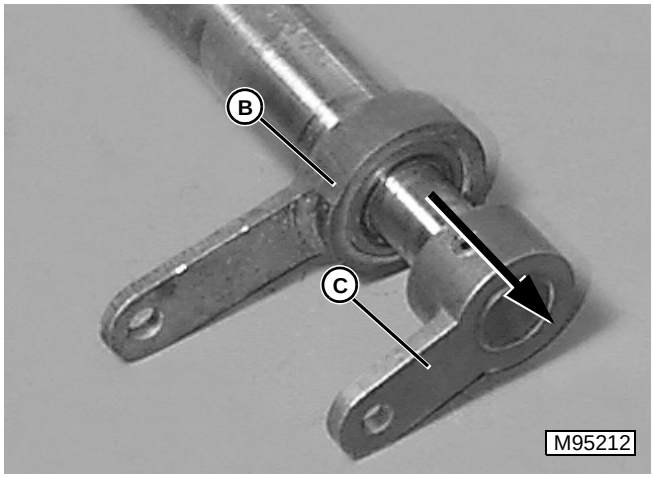
4. Remove clutch shaft (B) and forward / reverse shaft (C) from housing.



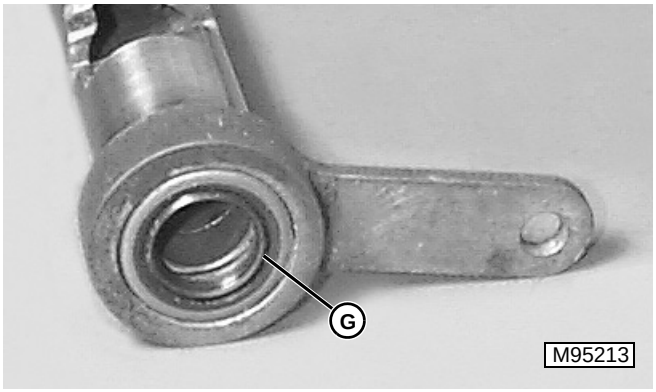
5. Inspect two shift shaft bushings (D) in housing for wear or damage. Replace if needed.
6. Replace shift shaft seal (E) in housing.



7. Inspect lift levers (F) for wear or damage. Replace if needed.



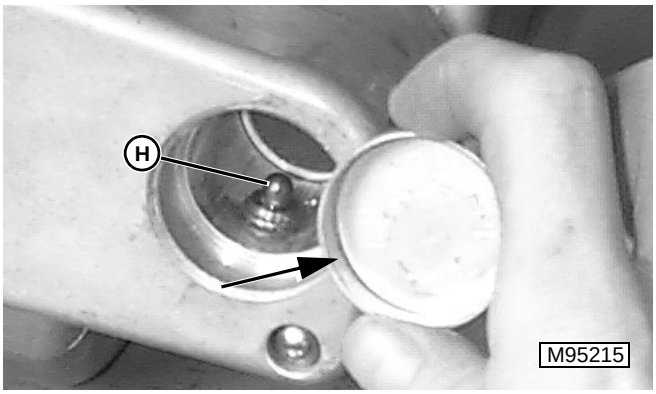
8. Remove forward / reverse shaft (C) from clutch shaft (B).



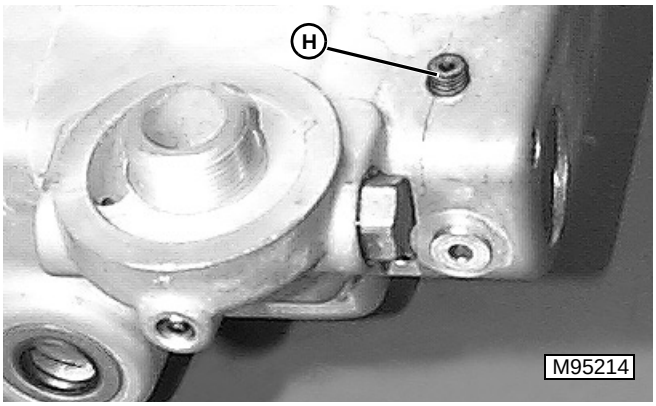
9. Replace seal (G) in end of clutch shaft.

Detent Pin Removal and Installation:

IMPORTANT: Do not remove detent pin unless replacement is needed. Detent pin cannot be removed without damaging threads on pin assembly. If removed, pin must be replaced.

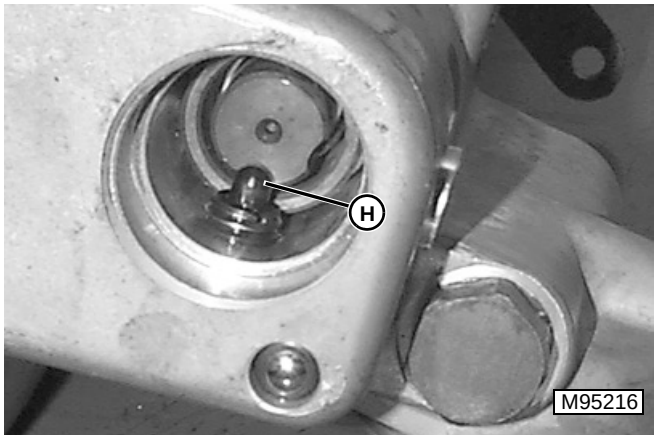


1. To inspect detent pin, use a mallet and a suitable drift to drive out expansion plug. Inspect detent pin for wear or damage. Check for proper operation.

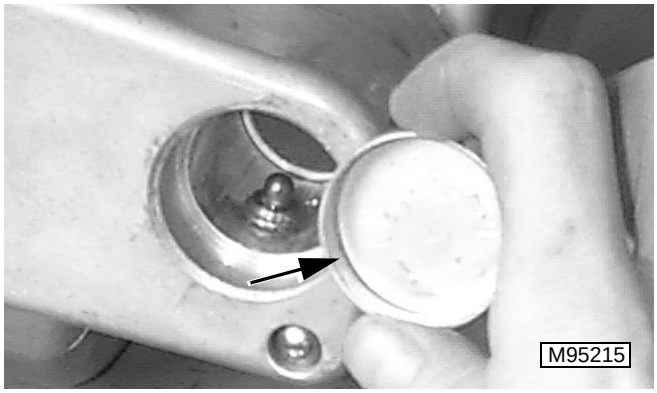


NOTE: Detent pin was coated with thread locking sealant during assembly at the factory.

1. Using a locking pliers or pipe wrench, grip detent pin by threads and remove.

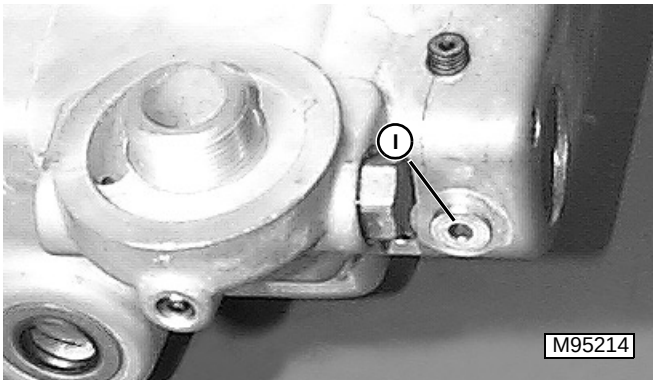


2. Coat threads of new detent pin (H) with TY9370 thread locking compound and install into housing.
3. Compress detent pin and install clutch and forward / reverse shafts into housing.
4. Adjust depth of pin until forward / reverse shaft has proper detent feel without binding.

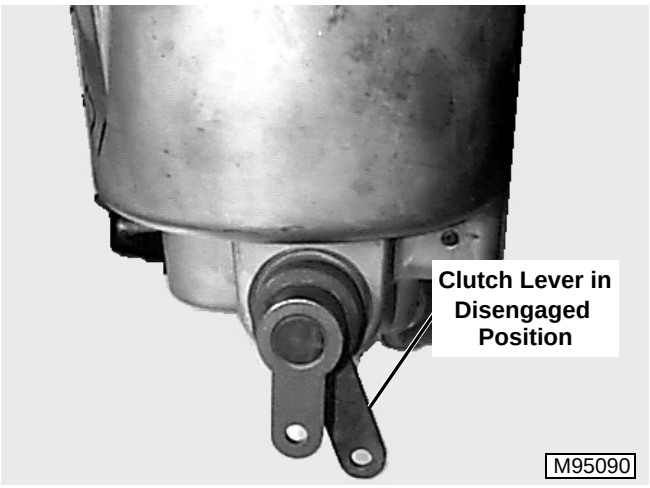


5. Install a new expansion plug.

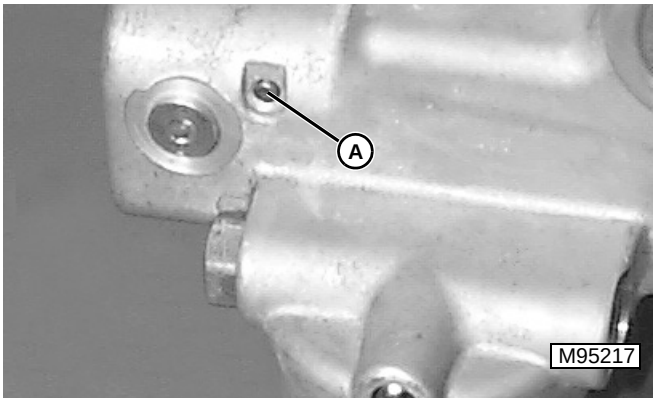
Installation:



1. Remove plug (I).
2. Using a screwdriver, depress detent pin, and install clutch and forward / reverse shafts into housing.
3. Install plug.



4. Position clutch control lever to the disengaged position.

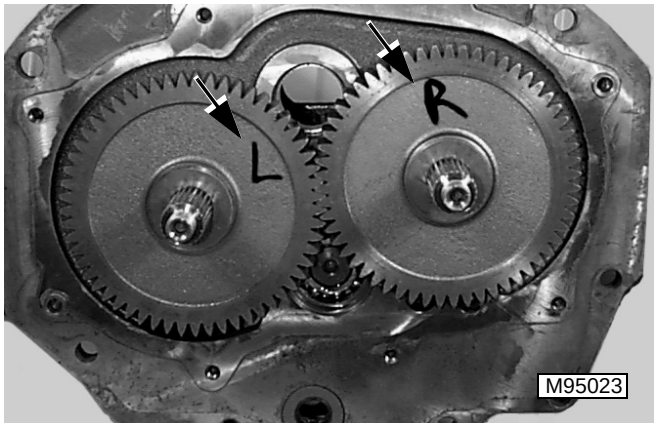


5. Align clutch and forward / reverse shafts so that retainer pin can be installed without damage to shafts. Install retainer pin.

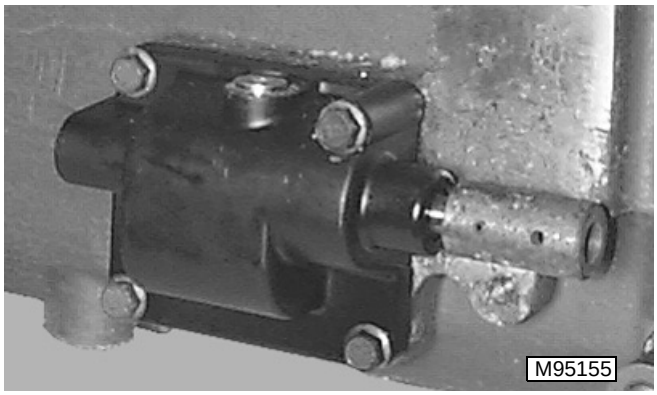
4-SPEED TRANSMISSION REMOVAL

Procedure:

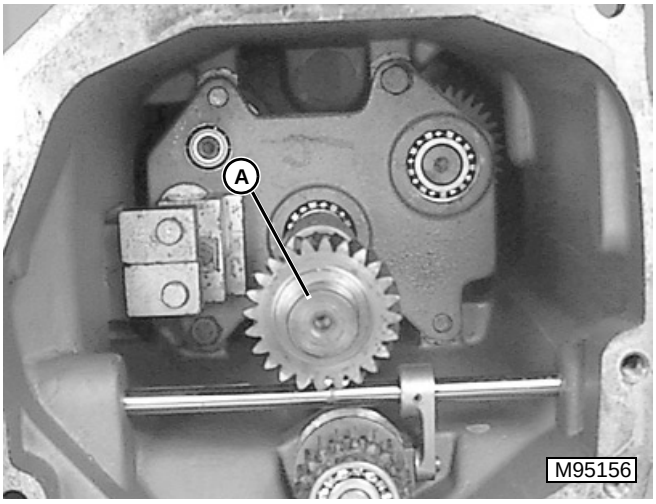
1. Split tractor between flywheel housing and tunnel. (See “TRACTOR SPLITTING (FRONT)” on page 12.)
2. Split tractor between tunnel and differential housing. (See “TRACTOR SPLITTING (REAR)” on page 32 in the Final Drive Power Train section.)
3. Remove forward and reverse clutches. (See “SYNCREVERSER TRACTION CLUTCH REMOVAL” on page17.)



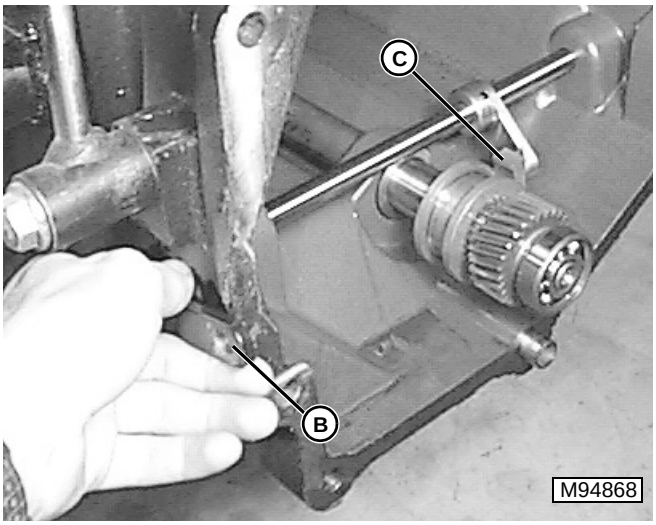
4. Label gears for correct orientation during re-assembly. Remove gears.



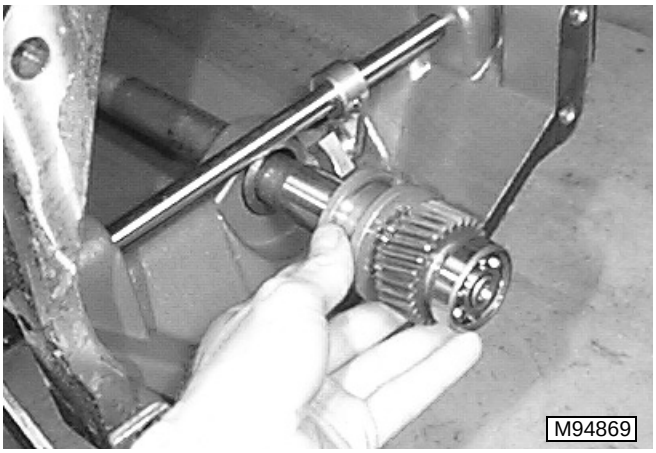
5. On LH side of tunnel, remove four cap screws and shifter assembly.



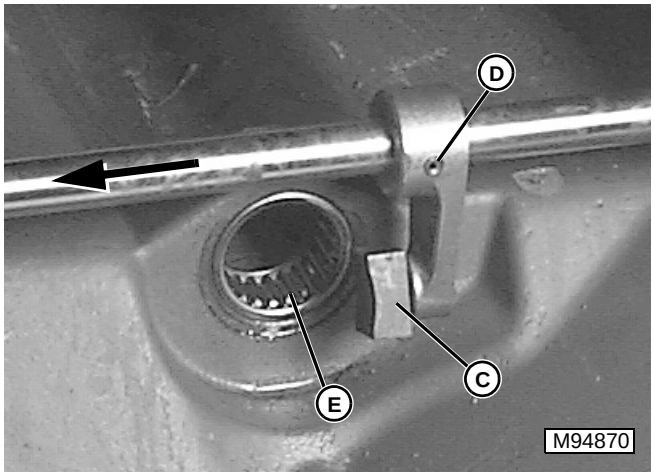
6. Remove drive shaft (A).



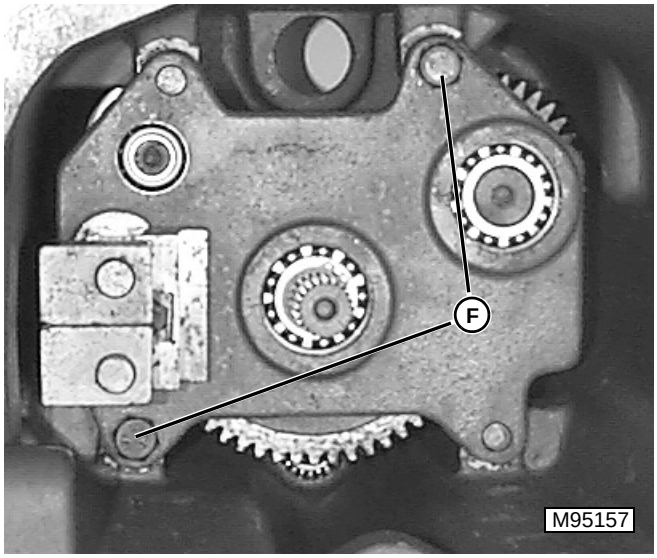
7. Rotate MFWD shift lever (B) until shoe (C) clears shift collar.



8. Remove shaft, gear, and shift collar as an assembly.

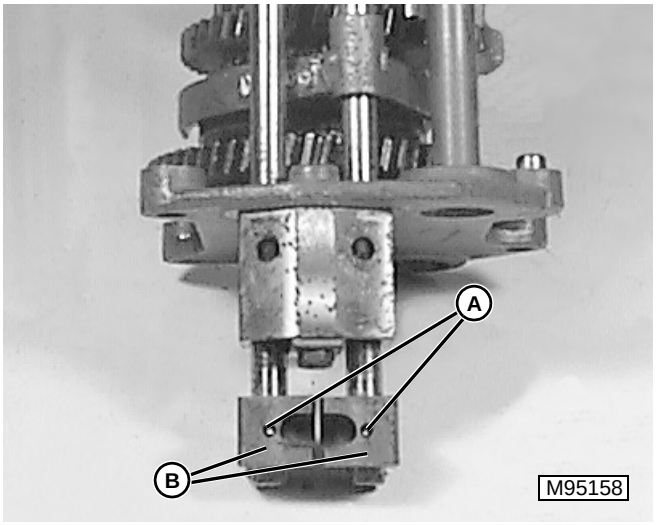


9. Remove spring pin (D) and slide shift shaft out of tunnel.
10. Inspect bearing (E) for wear or damage. Replace if necessary.
11. Inspect shoe (C) for wear or damage. Replace if necessary.

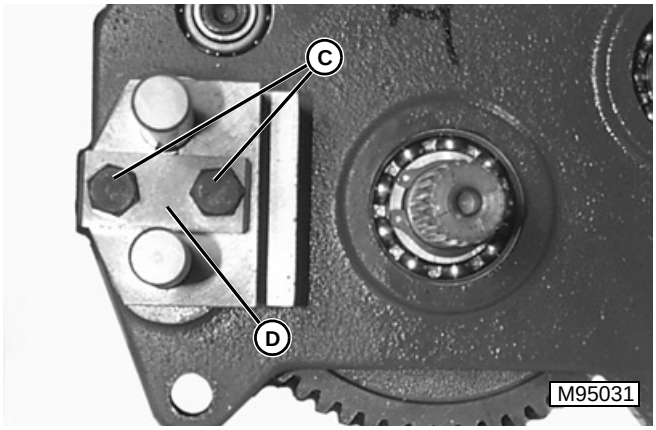


12. Remove two cap screws (F) and 4-speed transmission assembly.

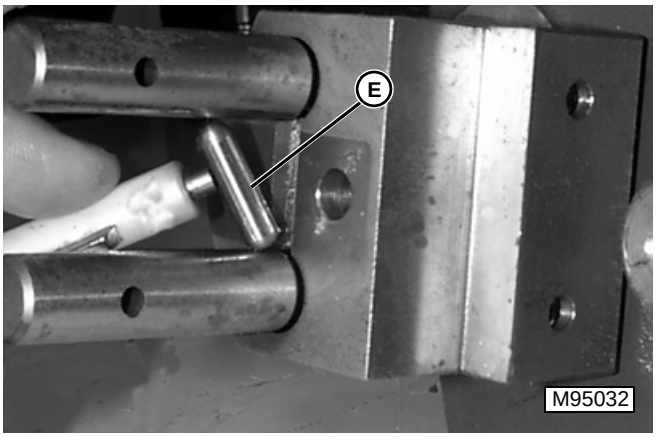
4-SPEED TRANSMISSION DISASSEMBLY



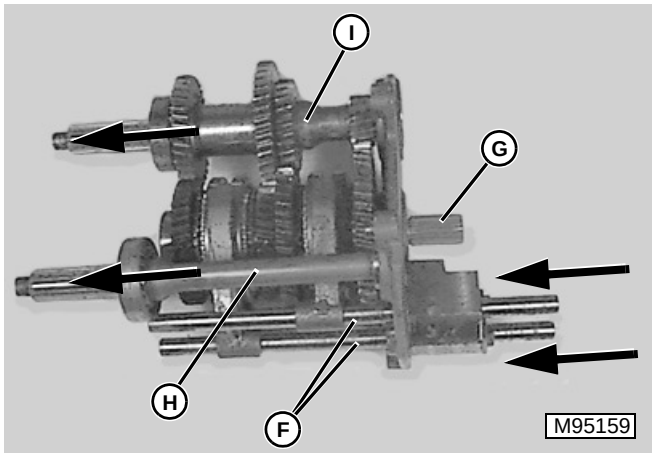
1. Remove two spring pins (A) and shift gate blocks (B).



2. Remove two cap screws (C) and cover plate (D).

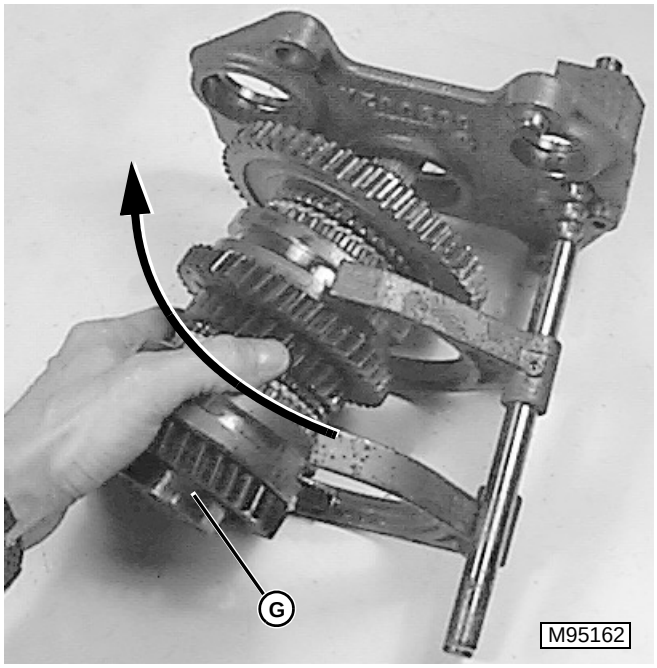


3. Remove interlock pin (E).

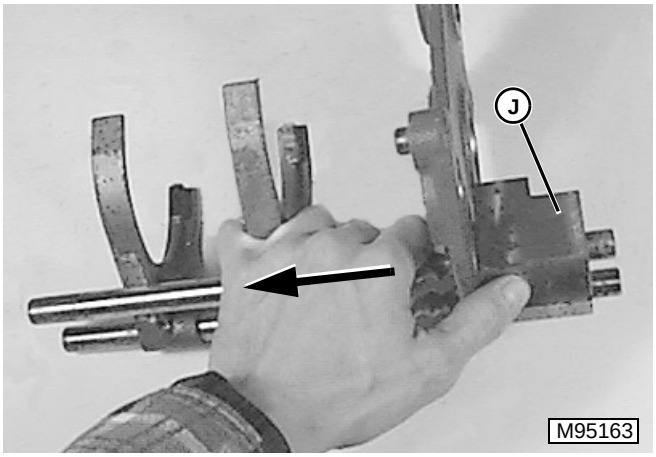


NOTE: Do not push shift rods too far into guide block. Guide block contains two detent balls and springs which may be lost.

4. Using a plastic mallet, drive both shift rods (F) toward gears and shafts.Tap on end of output shaft (G) to loosen shafts and gears, and remove reverse shaft (H) and pinion shaft (I) from bearing plate.

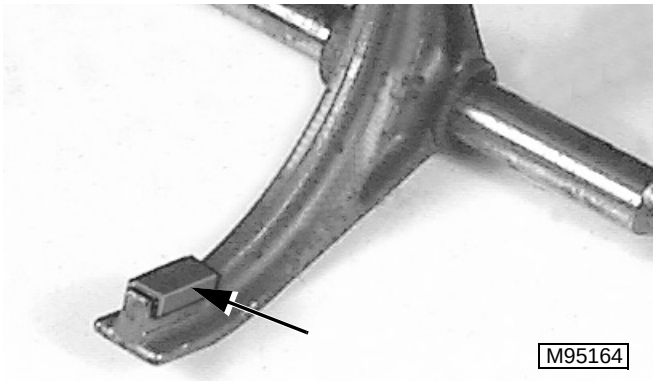


5. Rotate output shaft (G) away from shift forks, and remove.

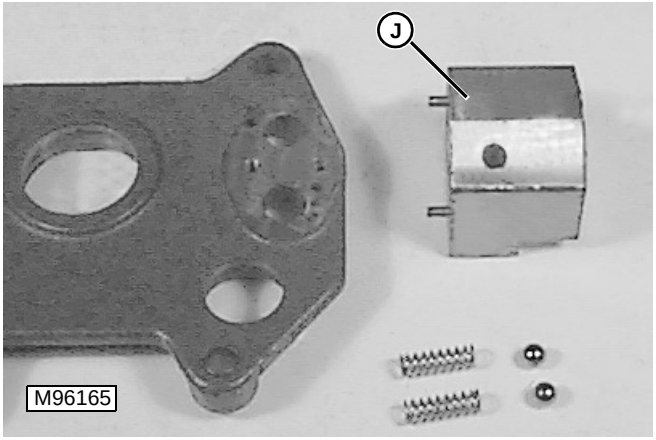


NOTE: Use care when removing shift rods from guide block (J). Guide block contains two detent balls and springs which may be lost.

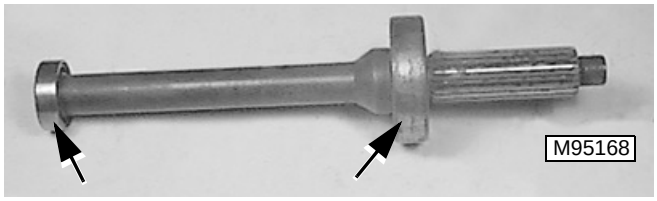
6. Remove two shift rods and forks from guide block.



7. Inspect shift fork inserts for wear or damage. Replace if necessary.

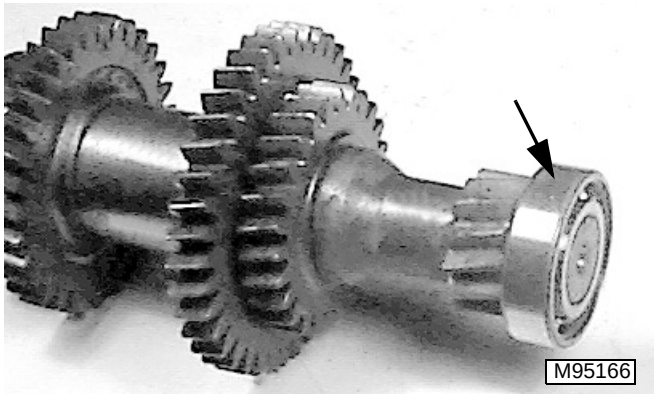


8. Remove two detent balls and springs from guide block (J). Inspect parts for wear or damage. Replace parts as needed.

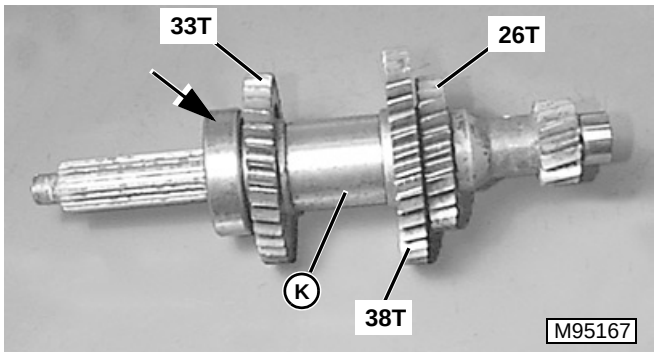


9. Inspect bearings on reverse shaft for wear or damage. To replace, use a suitable bearing puller or press.

Pinion Shaft Disassembly:



1. Using a suitable puller, or press, remove bearing from end of pinion shaft.
2. Inspect bearing for wear or damage. Replace if needed.



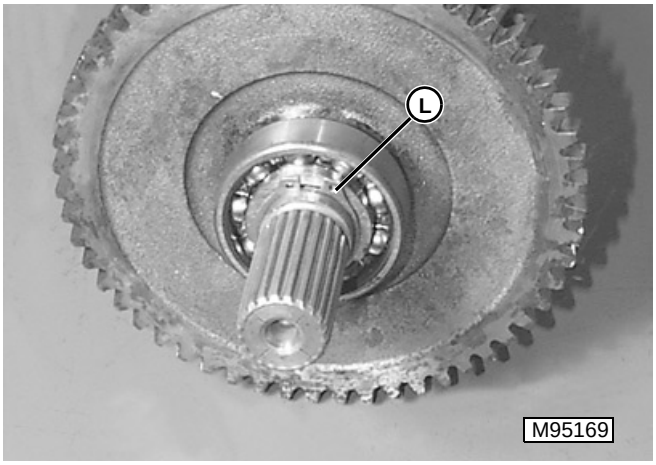
3. Using a suitable puller, or press, remove bearing, 33 tooth gear, spacer (K), 38 tooth gear, and 26 tooth gear from pinion shaft.

Pinion Shaft Assembly:

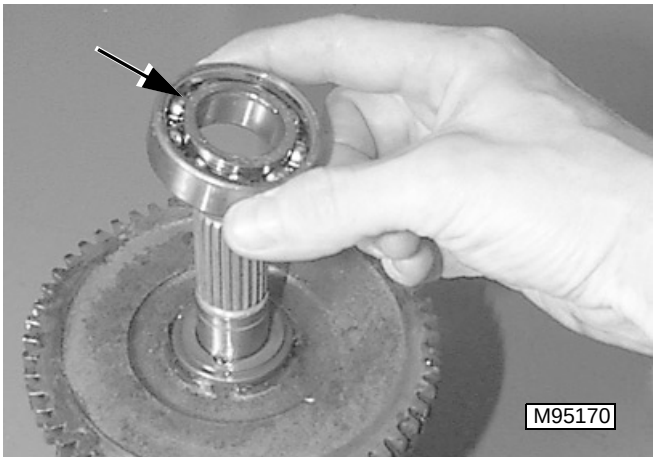
Assembly is the reverse of disassembly.

- Lubricate parts liberally with hydraulic oil before assembling.
- Install 38 tooth gear with larger flange facing toward spacer.

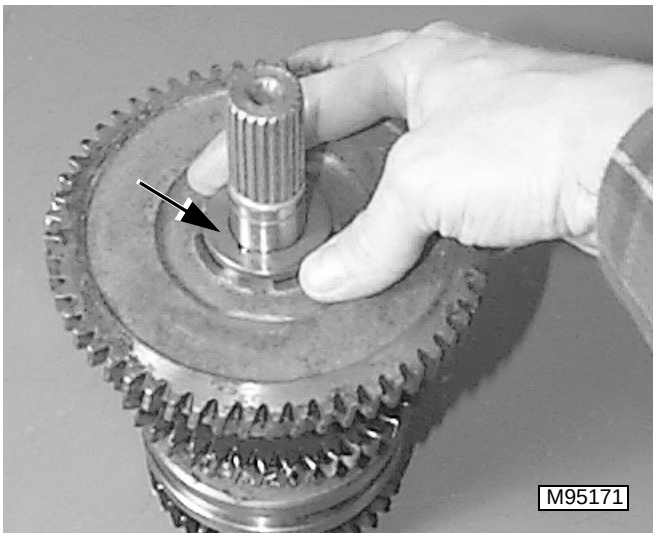
Output Shaft Disassembly:



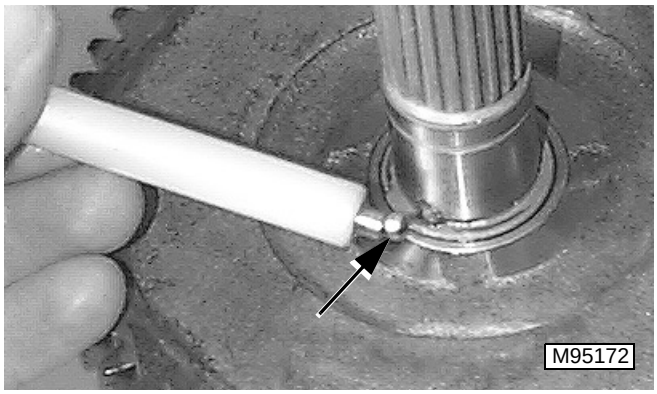
1. Remove snap ring (L).



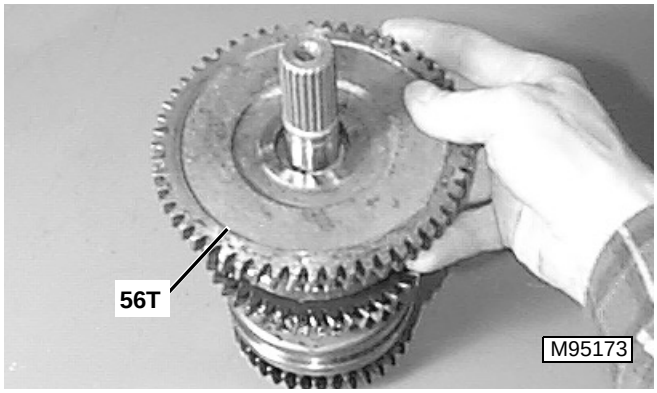
2. Using a suitable puller or press, remove bearing from end of shaft.



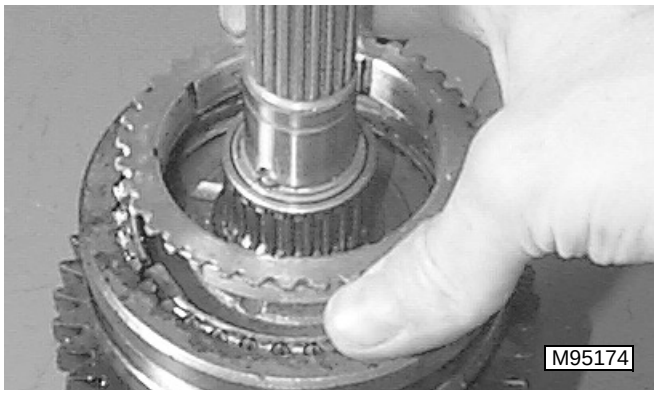
3. Remove thrust washer.



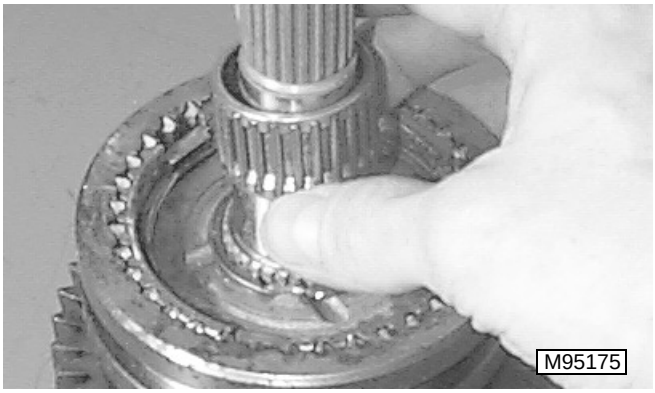
4. Remove ball from hole in shaft.



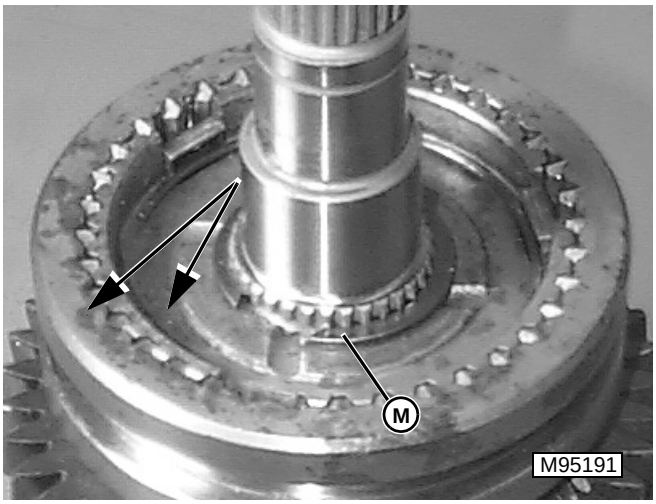
5. Remove 56 tooth gear.



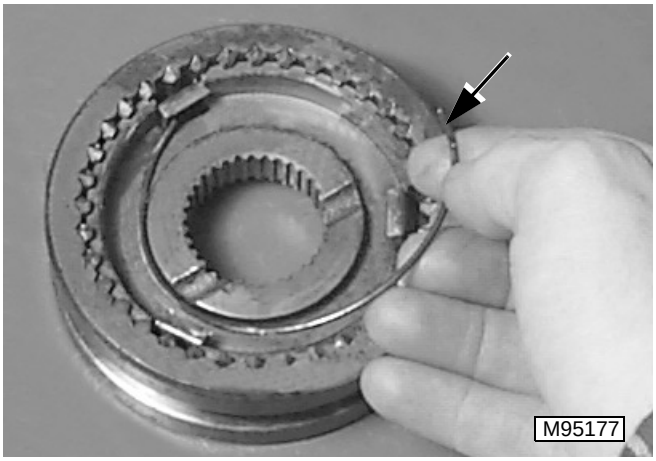
6. Remove synchronizer ring.



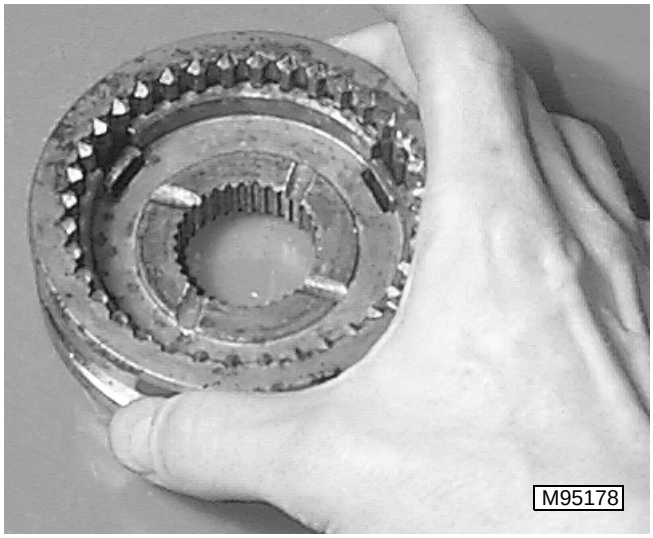
7. Remove roller bearing.



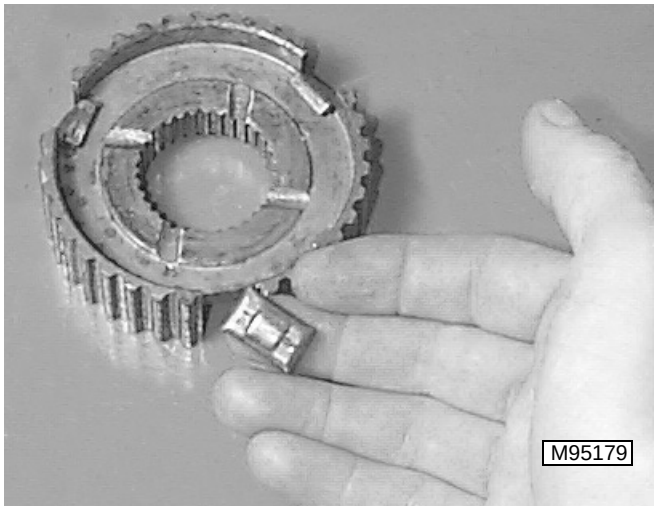
8. Remove snap ring (M) and shift collar assembly.



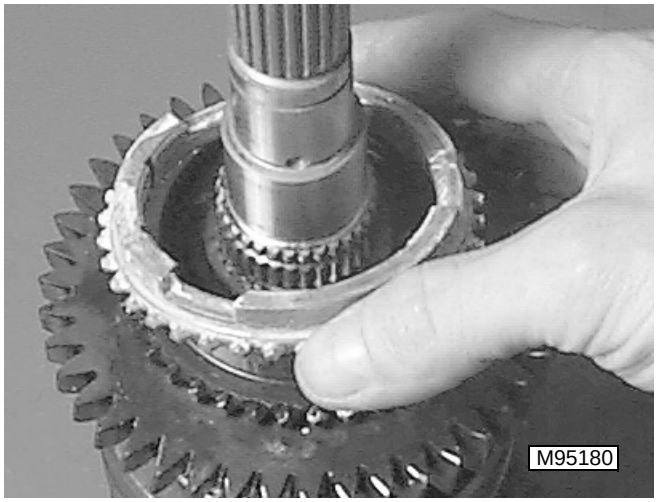
9. Remove spring from each side of shift collar.



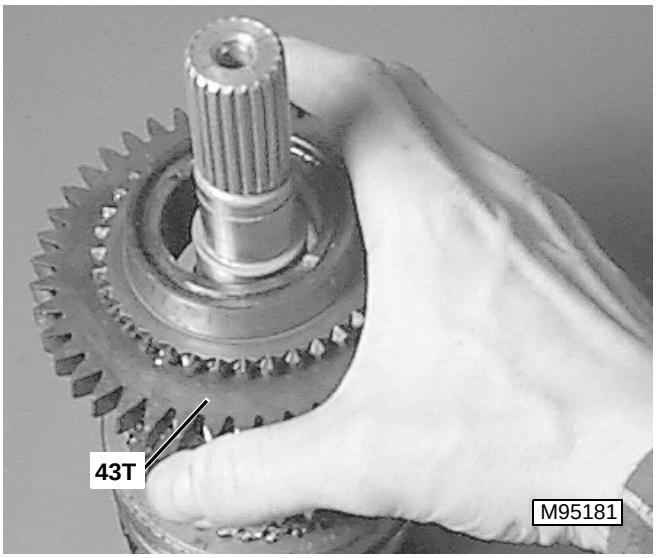
10. Remove shift collar from hub.



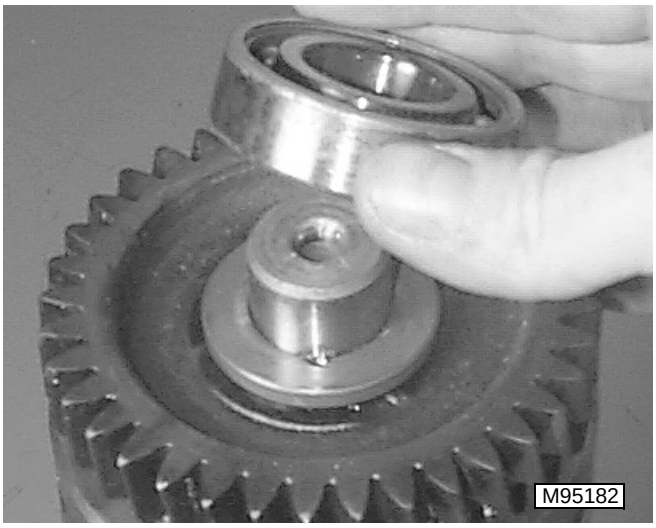
11. Remove three inserts.



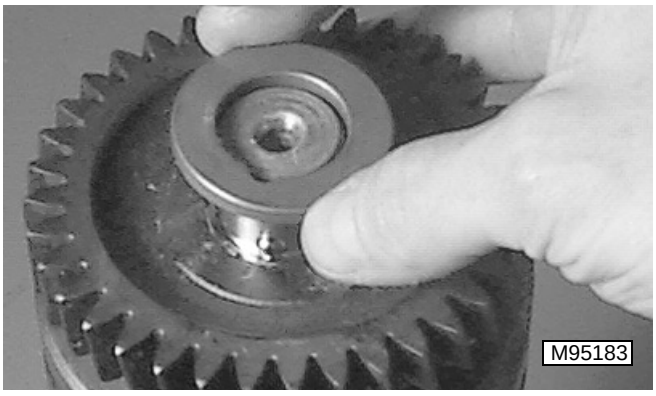
12. Remove synchronizer ring.



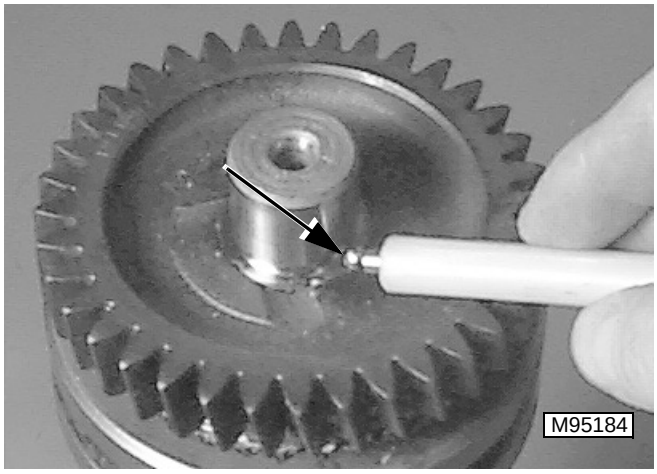
13. Remove 43 tooth gear.



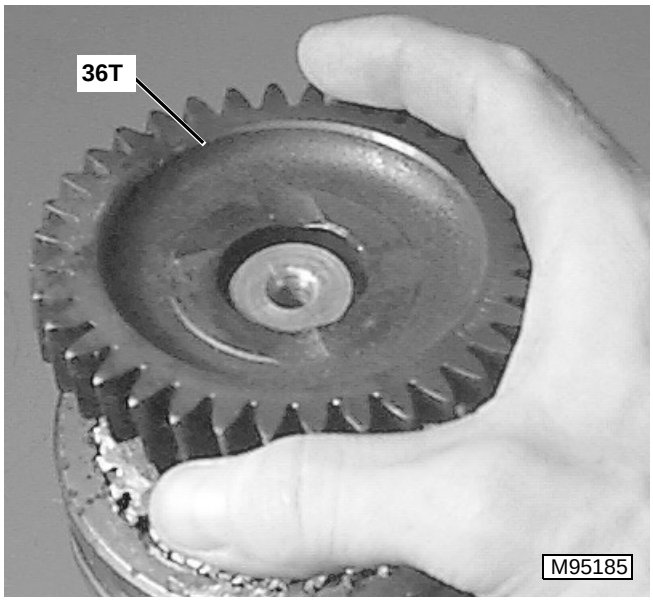
14. From opposite end of shaft, remove bearing.



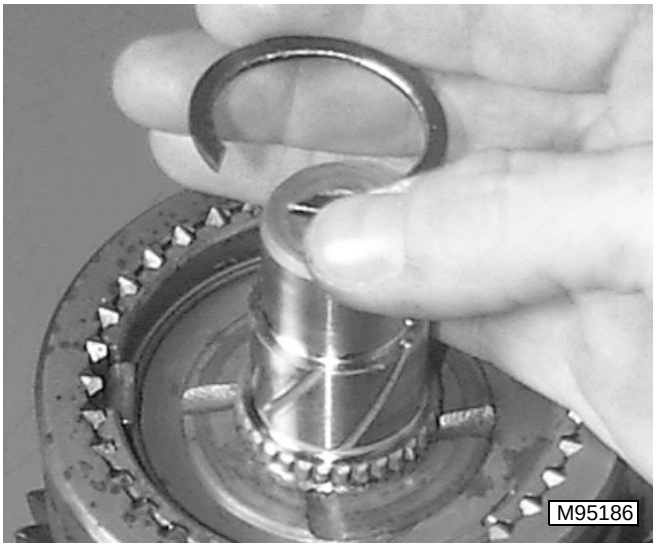
15. Remove thrust washer.



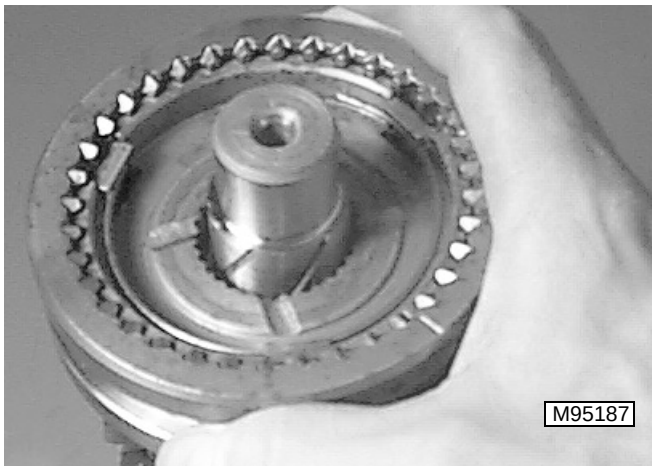
16. Remove ball.



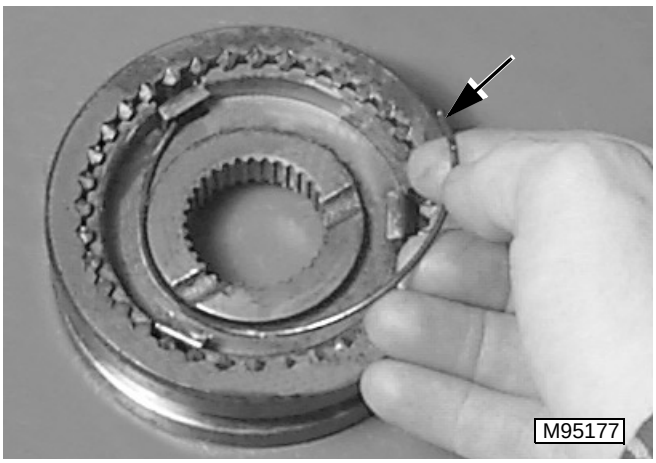
17. Remove 36 tooth gear.



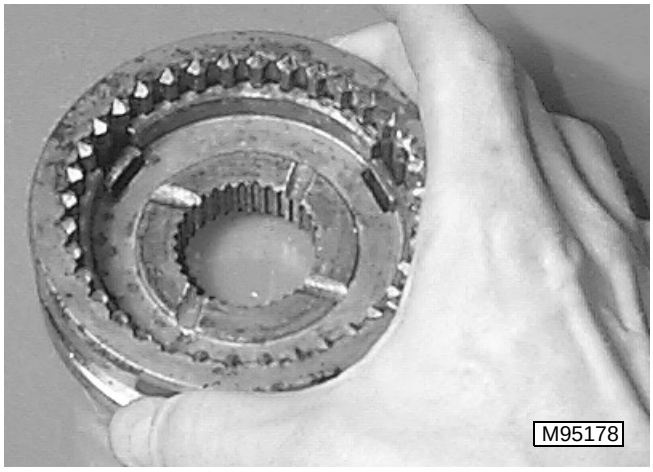
18. Remove snap ring.



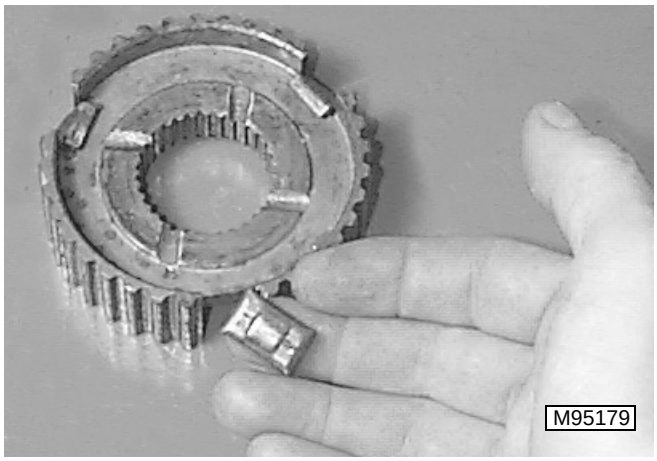
19. Remove shift collar.



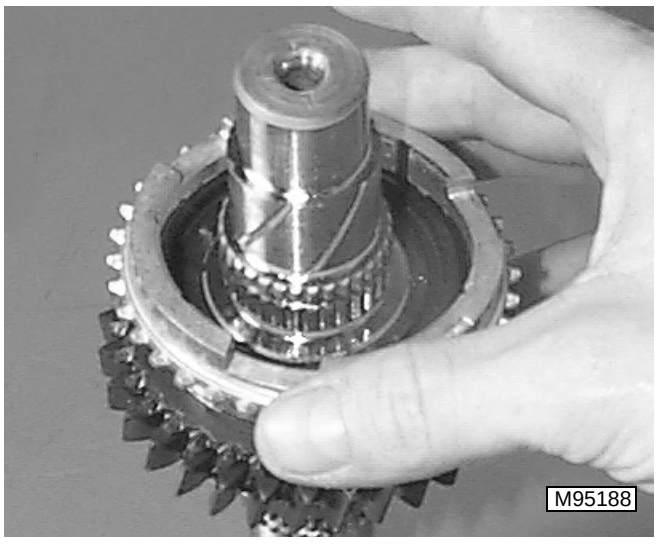
20. Remove one spring from each side of shift collar.



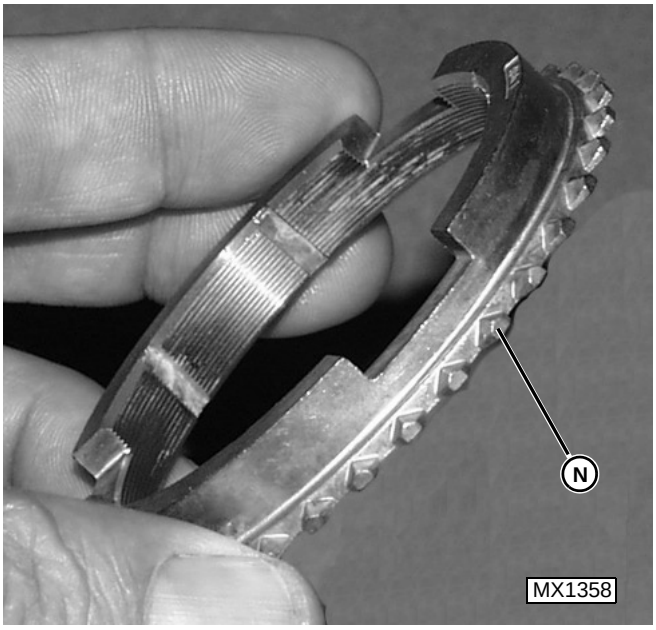
21. Remove shift collar from hub.



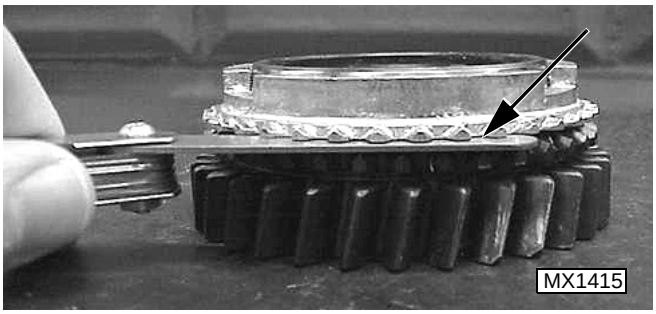
22. Remove three inserts.



23. Remove synchronizer ring.Check all synchronizer parts for wear or damage.

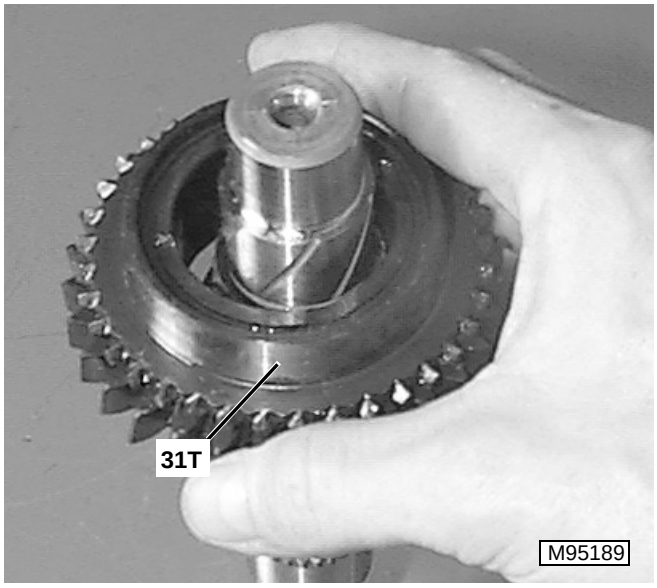


24. Check brass synchronizer ring for worn or missing teeth (N) .



25. To measure synchronizer wear, lay brass ring on gear and measure gap between gear and brass ring with a feeler gauge. If gap is less than 0.25 mm (0.010 in.), replace synchronizer assembly.

NOTE: Synchronizer assembly and brass synchronizer rings are not serviced individually. If any parts are needed, entire assembly must be replaced.

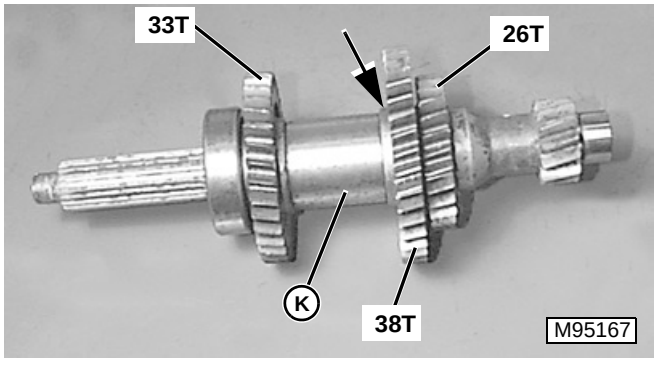


26. Remove 31 tooth gear.
27. Visually inspect all parts for wear, cracks or discoloration.

4-SPEED TRANSMISSION ASSEMBLY

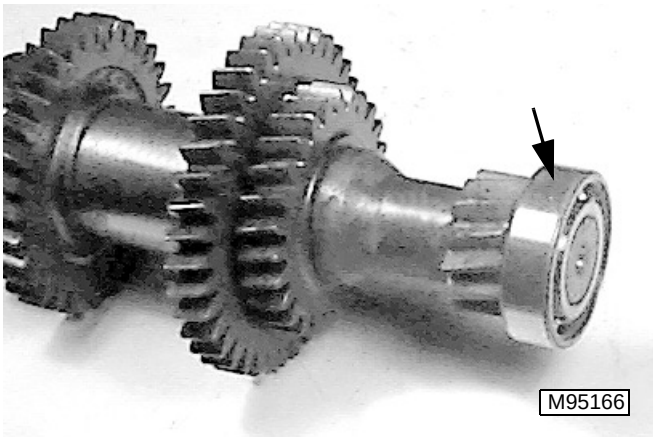
Pinion Shaft Assembly:

IMPORTANT: Lubricate parts liberally with hydraulic oil before assembling.



NOTE: Install 38 tooth gear with larger flange facing toward spacer.

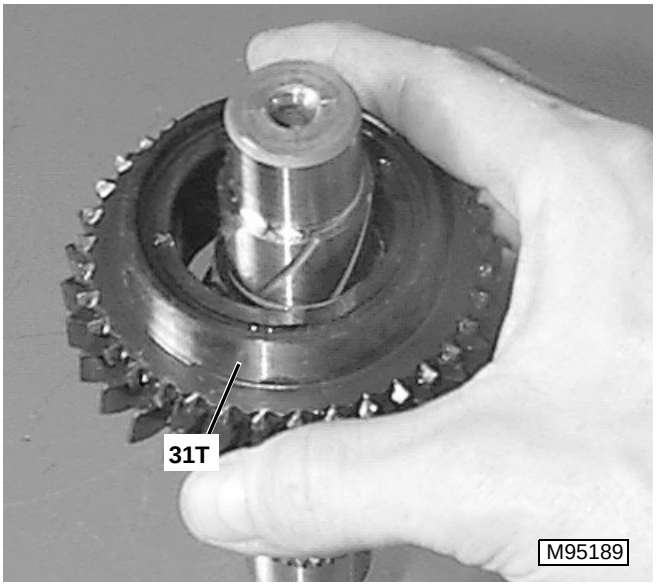
1. Using a press, install 26 tooth gear, 38 tooth gear, spacer (K), 33 tooth gear, and bearing to pinion shaft.



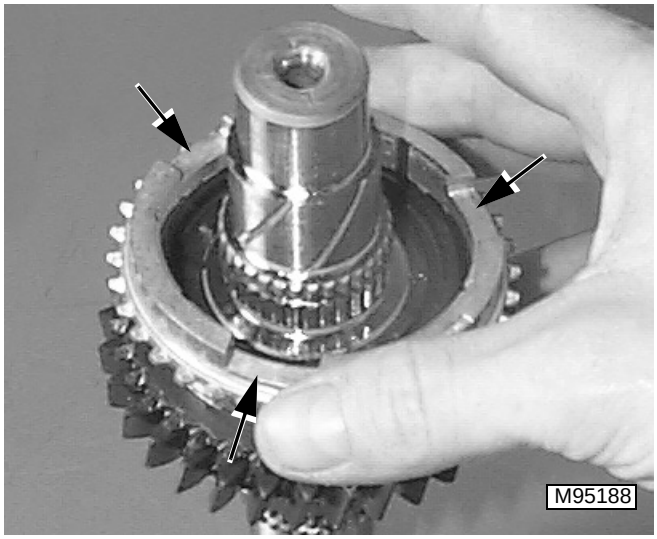
2. Using a press, install bearing onto end of pinion shaft.

Output Shaft Assembly:

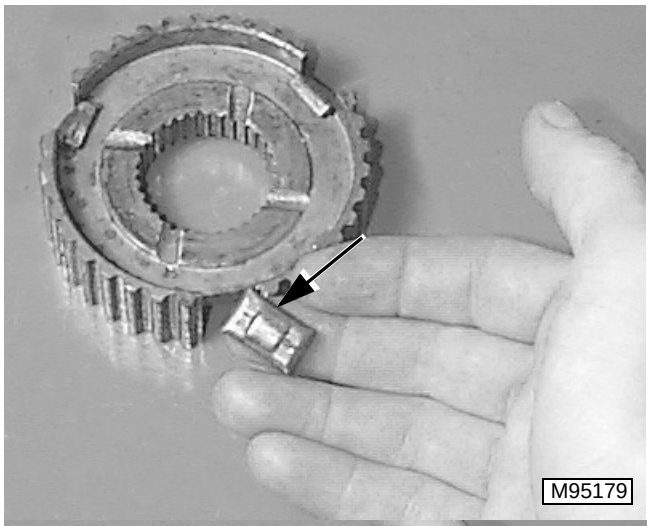
IMPORTANT: Lubricate all parts liberally with clean hydraulic oil during assembly.

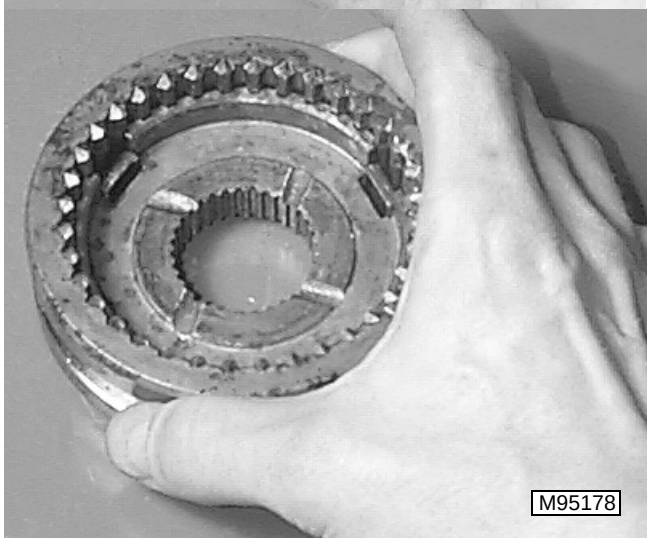


1. Install 31 tooth gear.

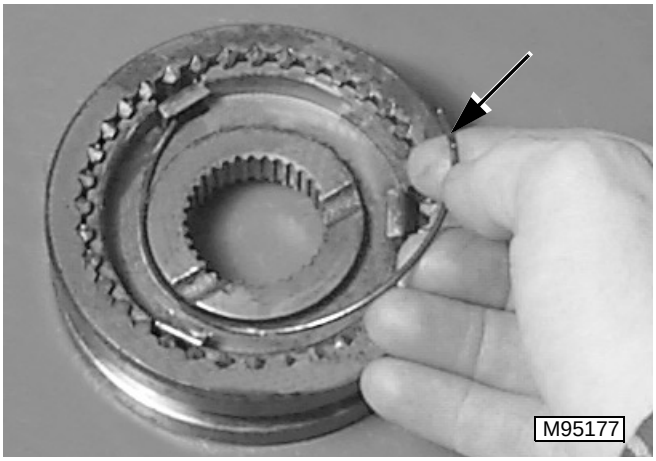


2. Install synchronizer ring with notches facing up.

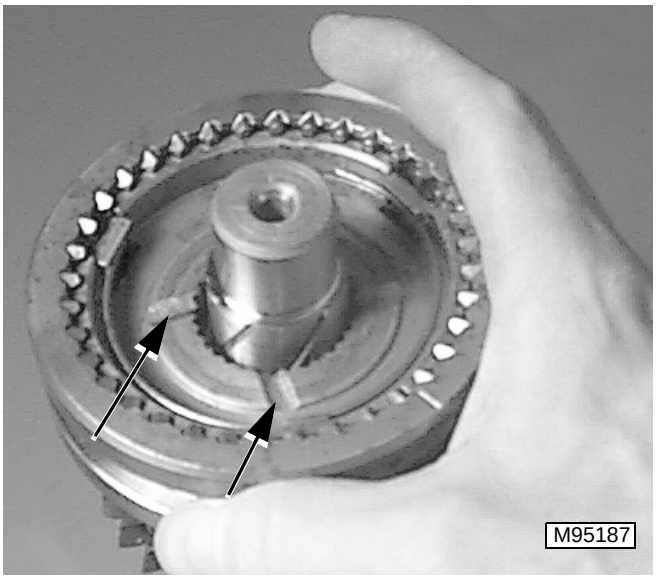




3. Install three inserts onto shift collar hub, and into shift collar.

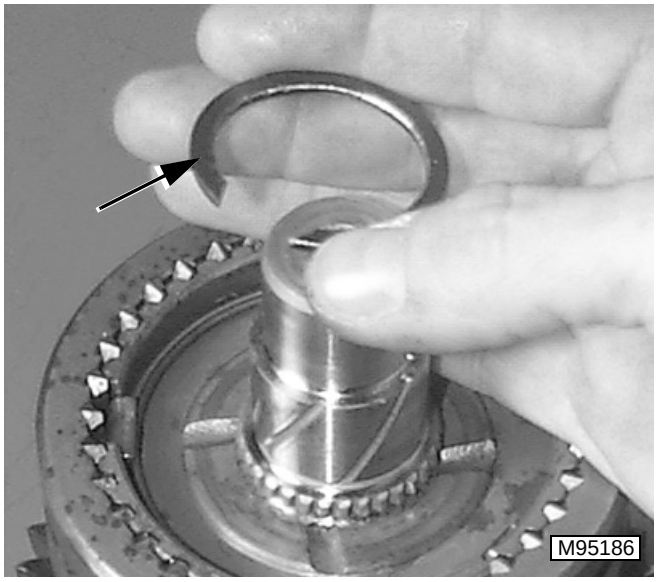


4. Install two springs to retain detent inserts in shift collar.

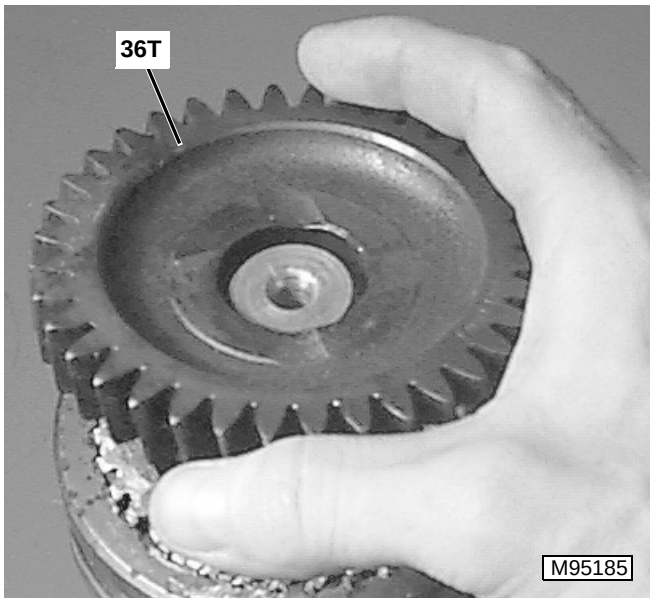


NOTE: When installing shift collar onto shaft, be sure inserts on shift collar align properly with slots in synchromesh ring and four oil grooves on shift collar face out.

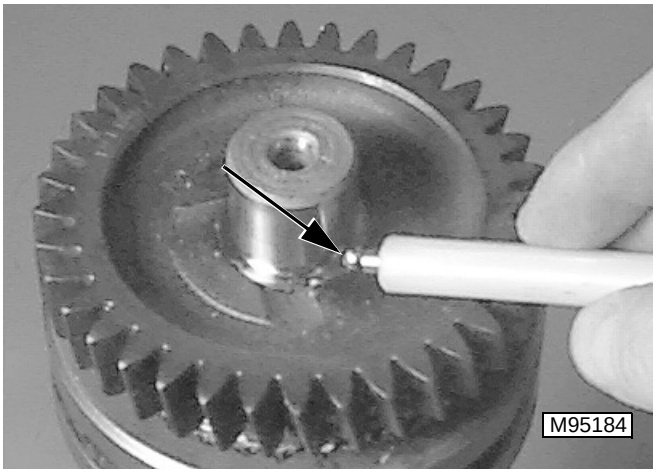
5. Install assembled shift collar onto output shaft.



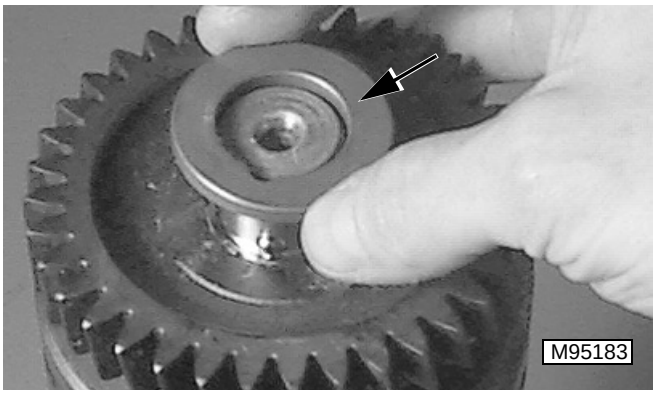
6. Retain shift collar to shaft with snap ring.



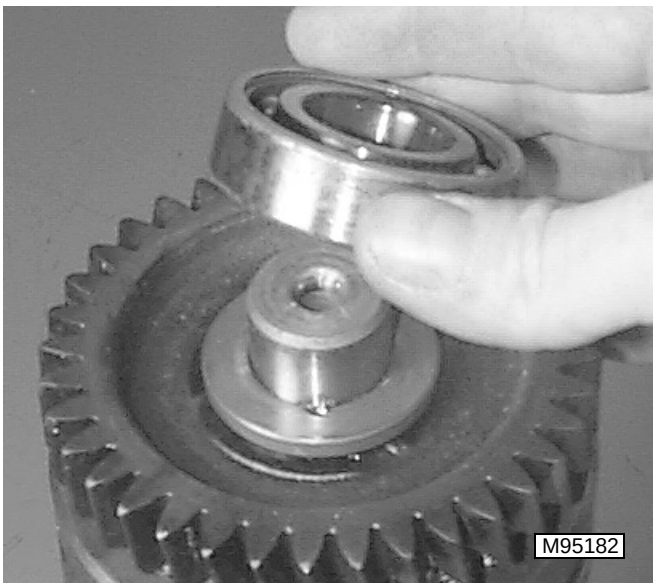
7. Install 36 tooth gear.



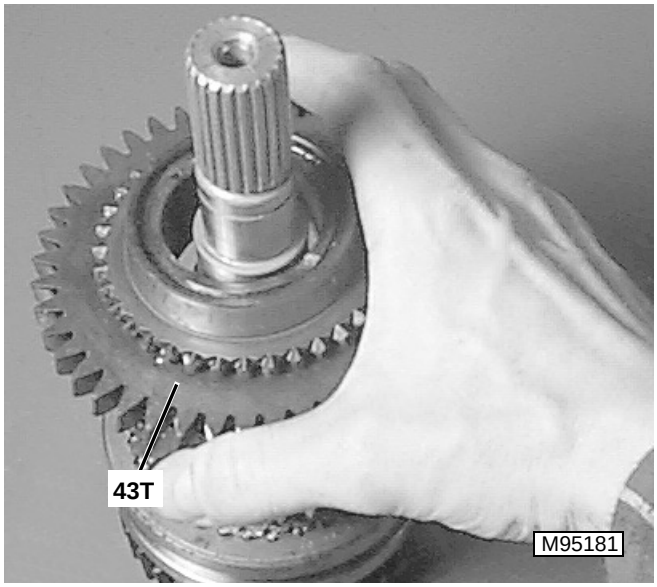
8. Install ball into hole in shaft.



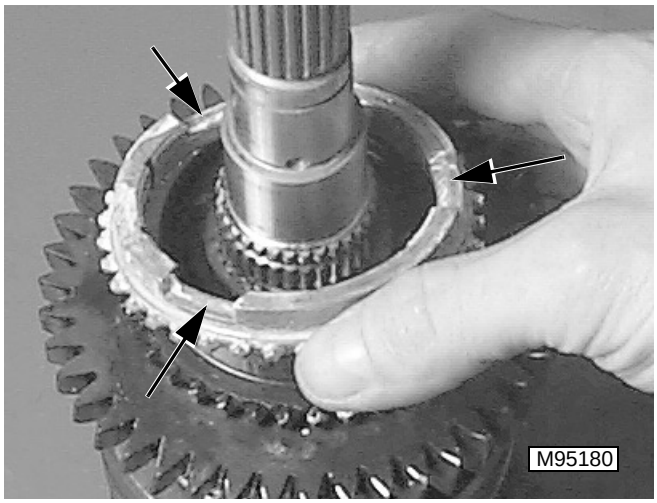
9. Retain ball with thrust washer.



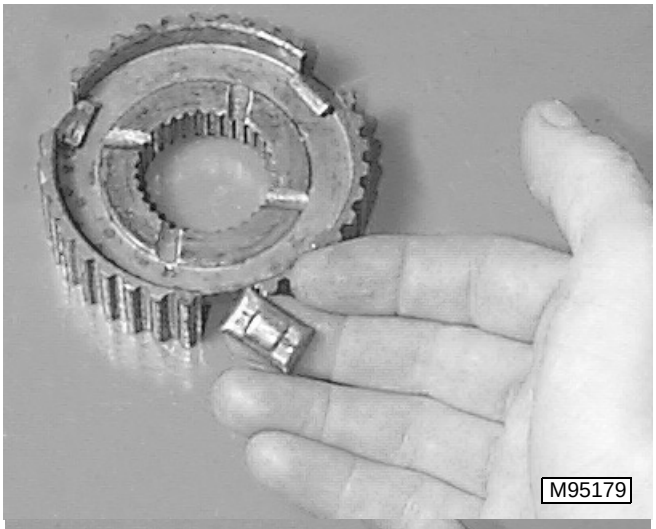
10. Dip bearing in hydraulic oil. Using a press, install bearing onto end of shaft.

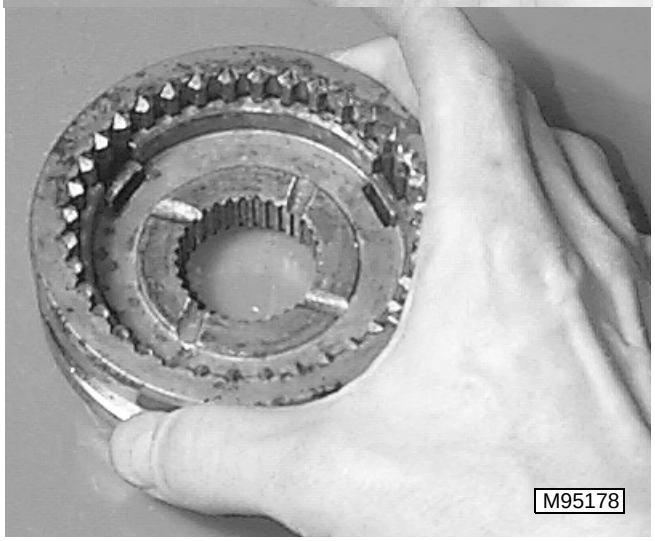


11. On opposite end of shaft, install 43 tooth gear.

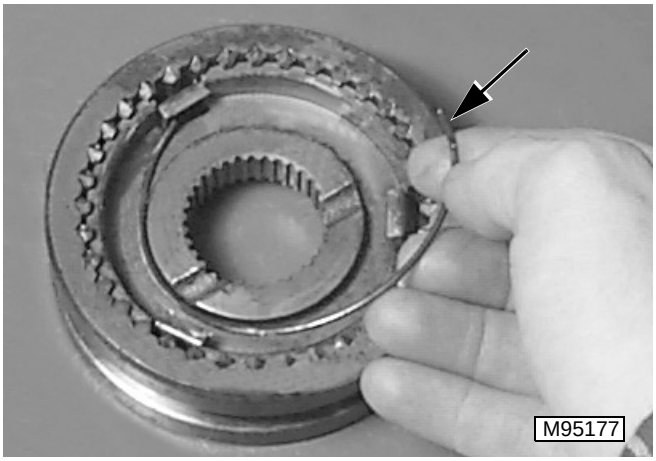


12. Install synchronizer ring onto gear with slots facing up.

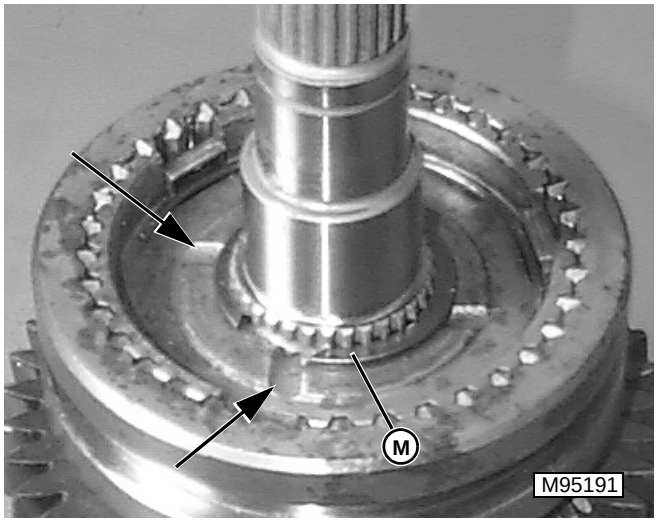




13. Install three inserts onto shift collar hub. Install hub and inserts into shift collar.

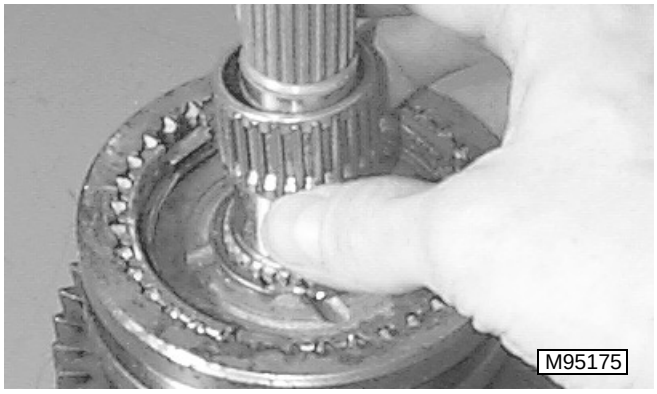


14. Install two springs to retain detent inserts in shift collar.

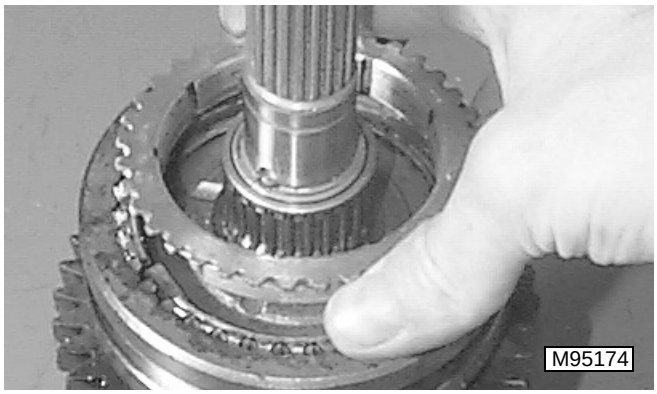


NOTE: When installing shift collar onto shaft, be sure inserts on shift collar align properly with slots in synchromesh ring and four oil grooves on shift collar face out.

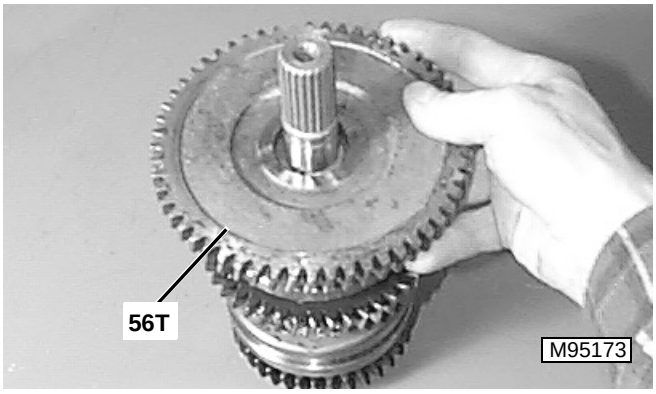
15. Install assembled shift collar onto shaft, and retain with snap ring (M).



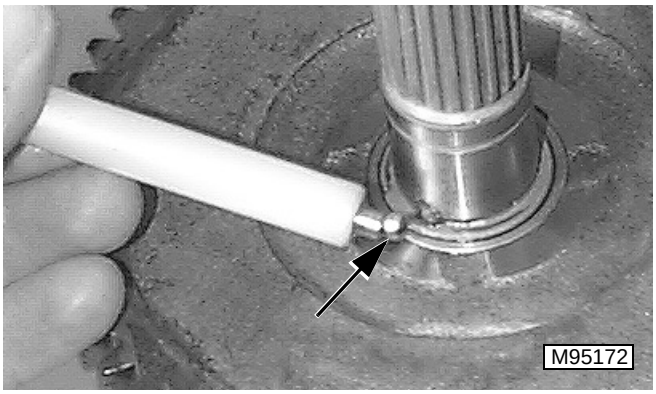
16. Install roller bearing.



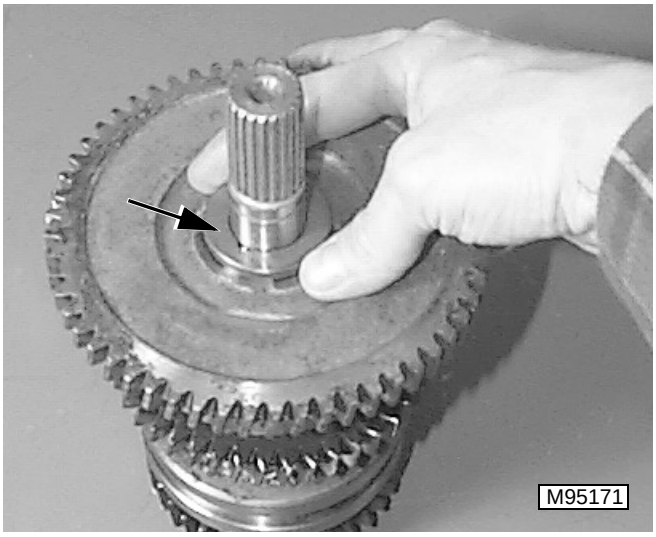
17. Install shift collar.



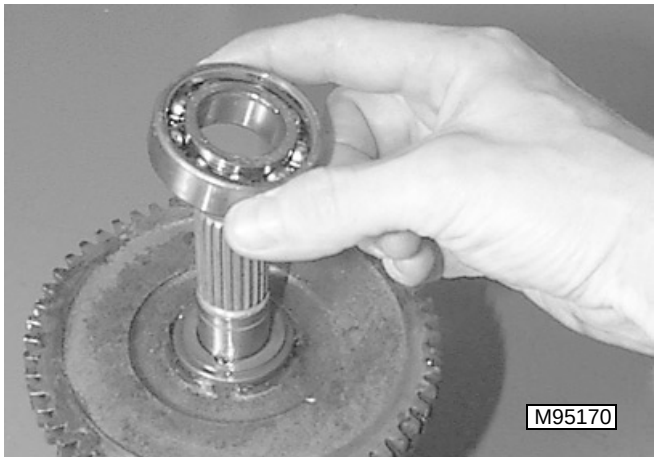
18. Install 56 tooth gear.



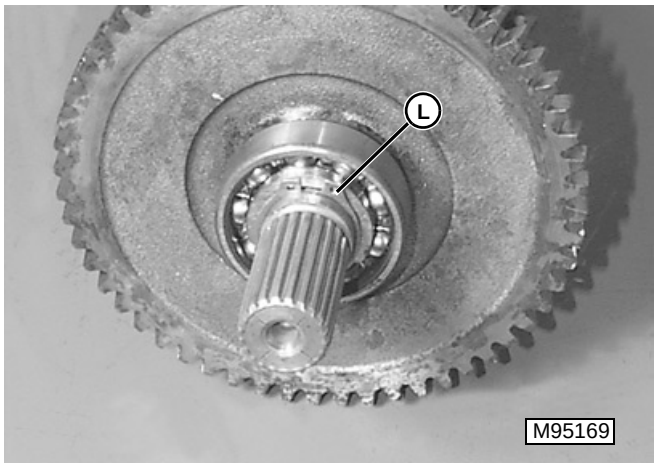
19. Install ball into hole in shaft.



20. Retain ball with thrust washer.

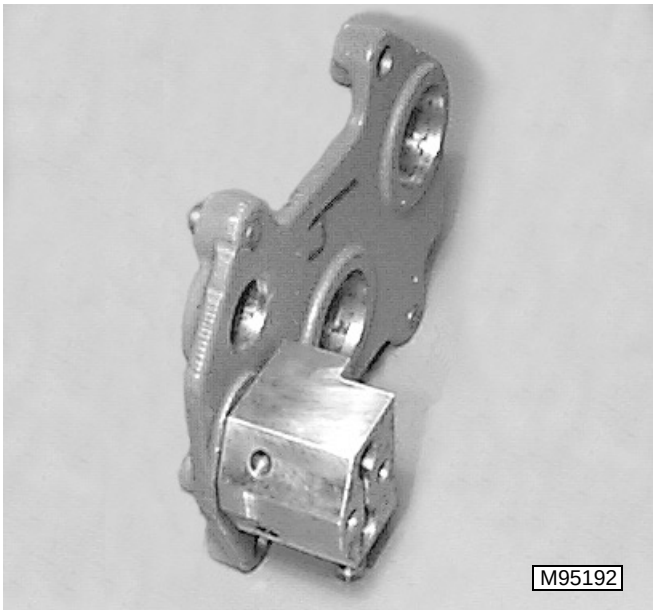


21. Dip bearing in hydraulic oil. Using a press, install bearing onto end of shaft.

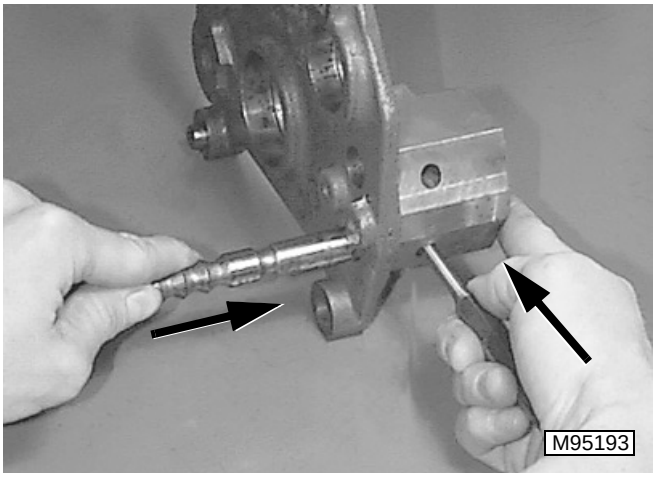


22. Install snap ring (L).
23. Check gears on output shaft. All three gears should rotate on shaft.

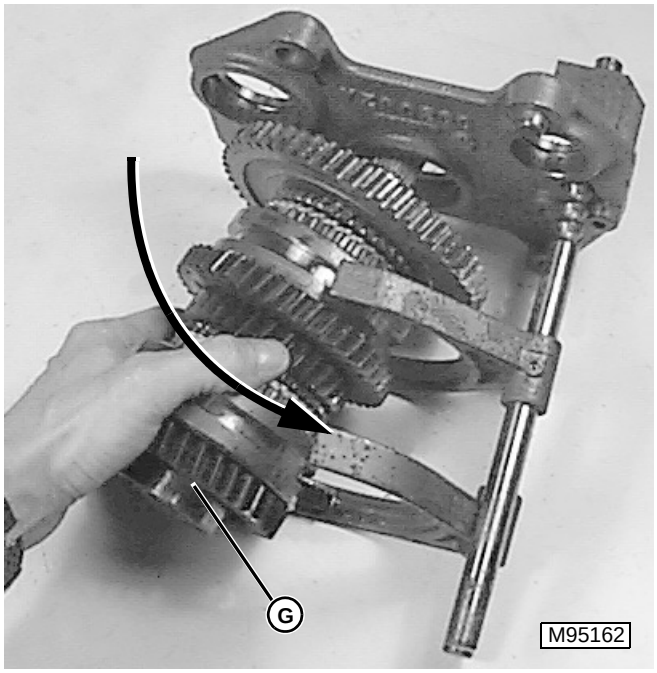
Gear and Shifter Assembly:



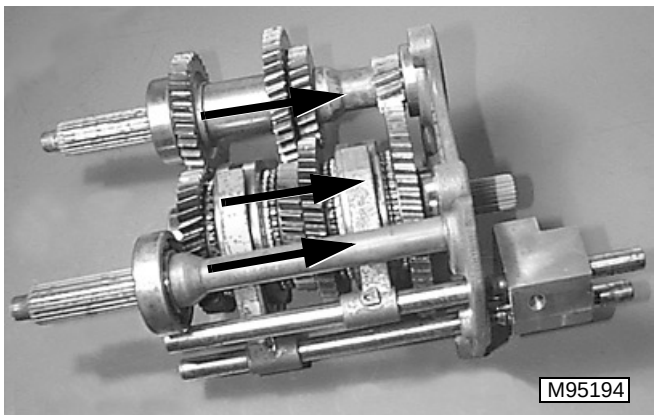
1. Install guide block to bearing plate. Do not install cap screws at this time.



2. Install one spring and detent ball into guide block. Using a pin punch, compress the spring and hold ball while installing shift rod and fork assembly. Be sure shift rod and fork assembly is installed into correct hole.
3. Repeat for second shift rod and fork / detent ball and spring.

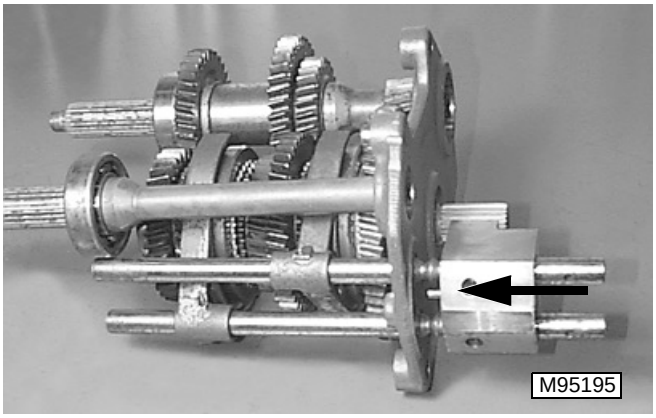


4. Install output shaft / gears assembly (G) onto shift forks.

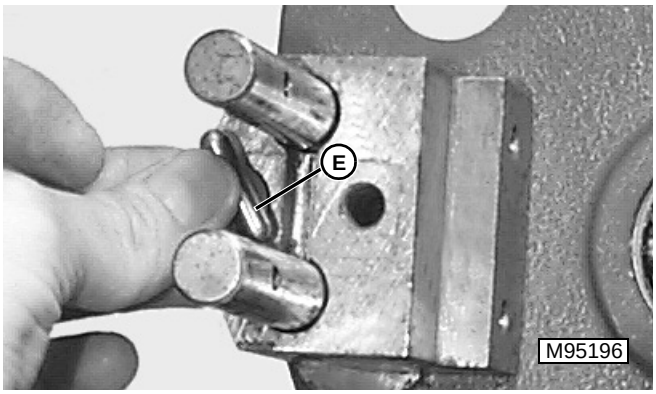


5. Install pinion shaft onto output shaft. Install reverse shaft, pinion shaft, and output shaft into bearing plate at the same time using a plastic mallet.

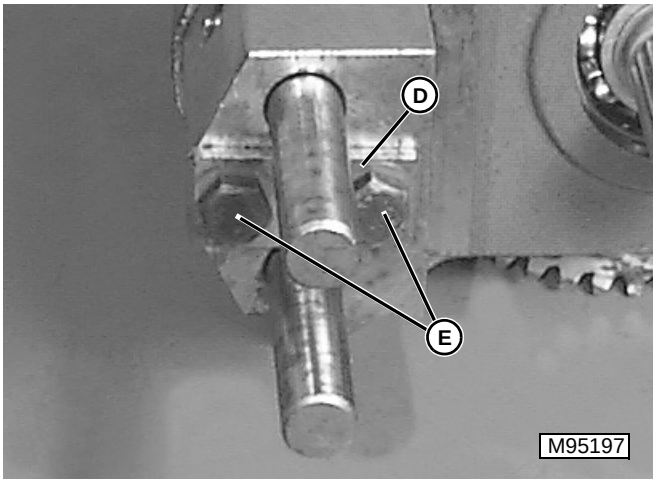
NOTE: Guide block will pull away from bearing plate when installing shafts and gears.



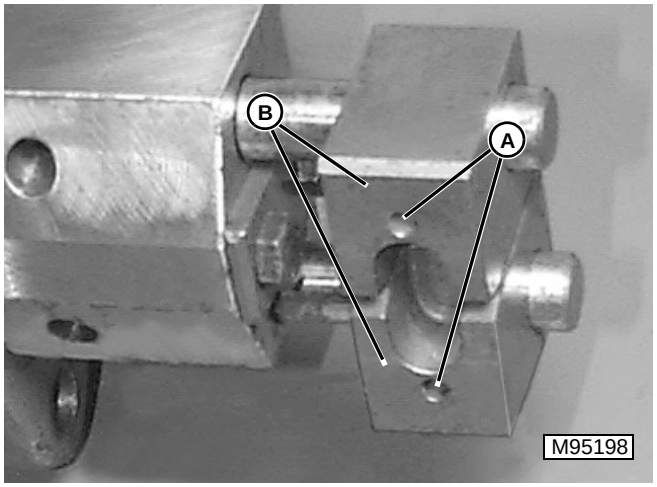
6. Slide guide block on shift rods and install to bearing plate.



7. Move shift rods / forks to center (Neutral) position and install interlock pin (E).

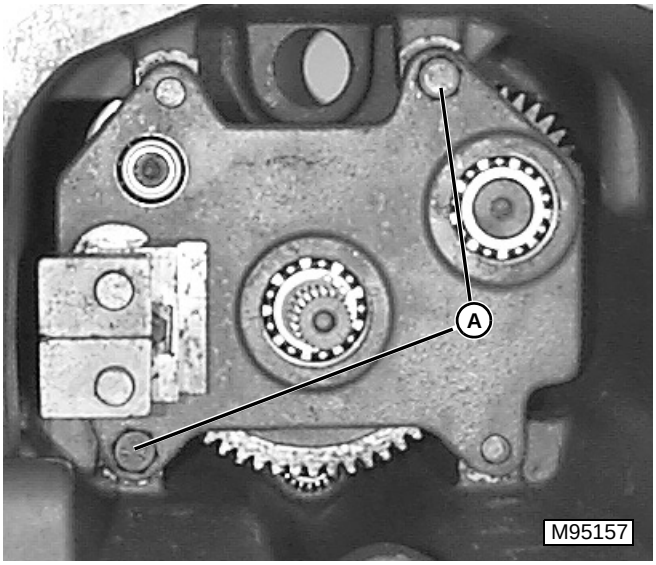


8. Install retainer plate (D). Retain with two cap screws (C).



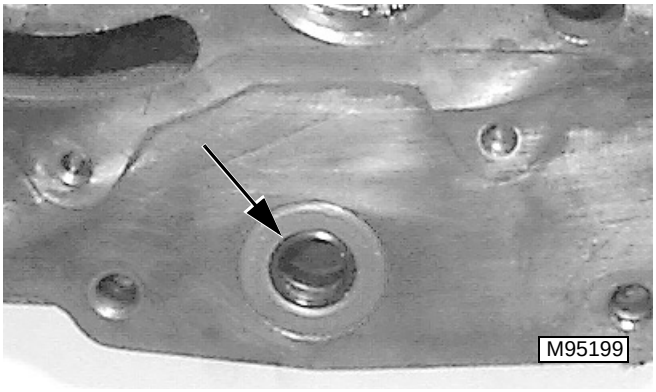
9. Install two gate blocks (B) onto rods. Retain with spring pins (A).
10. Test transmission operation by moving the shift forks and rotating the output and pinion shafts to ensure that all four speeds of the transmission operate smoothly and correctly.

4-SPEED TRANSMISSION INSTALLATION

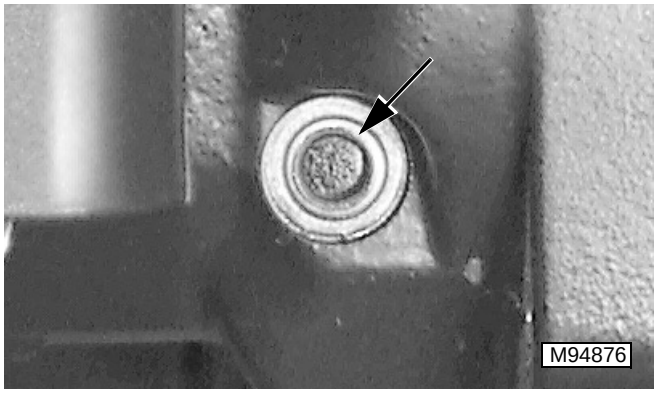


11. Align three bearings and two shift rods with holes in tunnel. Install transmission into housing and retain with two cap screws (A).

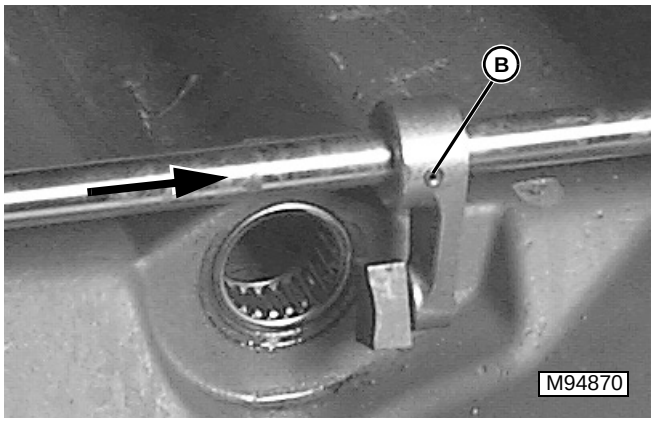
IMPORTANT: Replace O-rings and seals. Used O-rings and seals will leak.



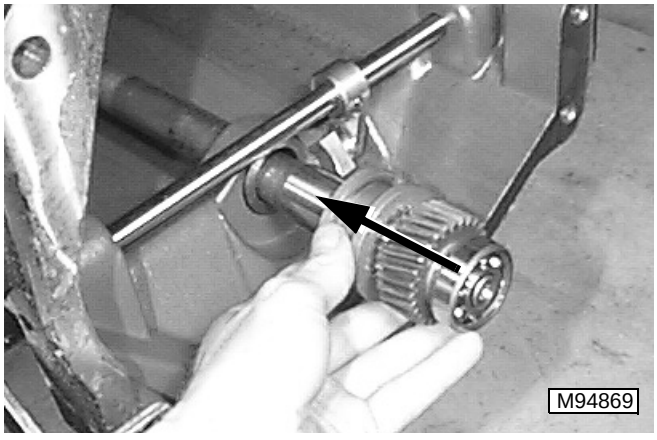
12. Install a new MFWD drive shaft seal at front of tunnel.



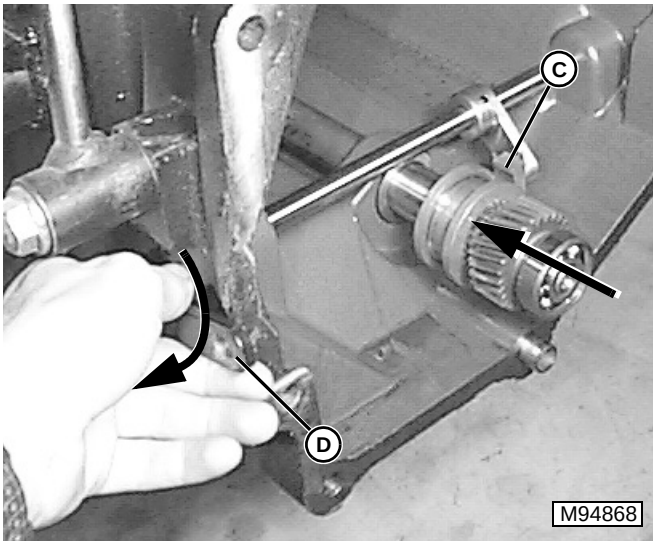
13. Install a new MFWD shift shaft seal into tunnel.



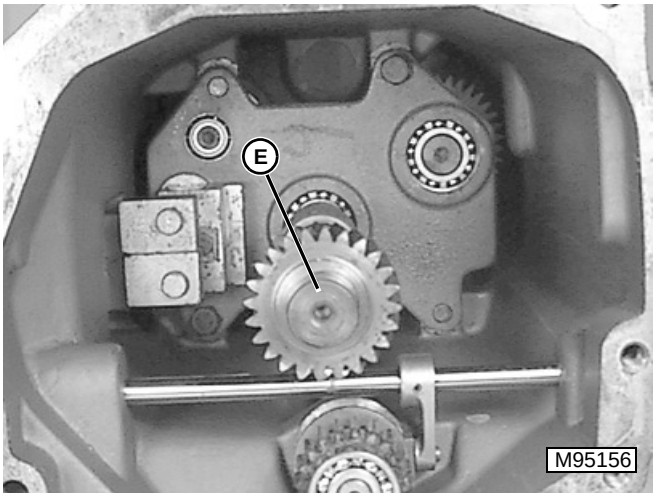
14. Slide shift shaft into tunnel and through shift arm. Retain shift arm to shaft with spring pin (B).



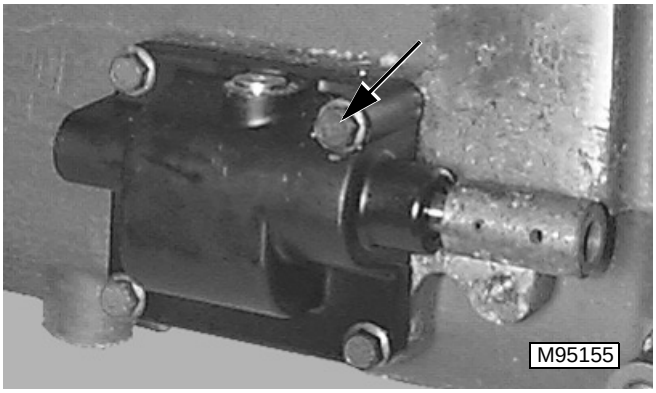
15. Insert MFWD drive shaft assembly into tunnel.



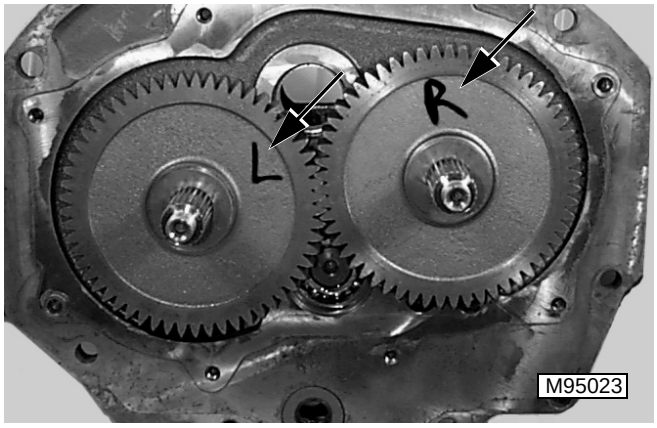
16. Engage shoe (C) to shift collar and rotate MFWD shift lever (D) to draw MFWD shaft into place.



17. Install drive shaft (E).



18. Apply TY16021 John Deere Form In Place Gasket to shifter assembly mounting surface. Make sure shifter pin is positioned correctly in shift gates. Install shifter assembly and retain with four cap screws.



19. Install gears to forward and reverse shafts in positions marked prior to disassembly.
20. Install forward and reverse clutches. (See “SYNCREVERSER TRACTION CLUTCH INSTALLATION” on page20.)
21. Assemble tractor tunnel and differential housing sections. (See “TRACTOR SPLITTING (REAR)” on page32 in the Final Drive PowerTrain section.)
22. Assemble tractor flywheel housing and tunnel sections. (See “TRACTOR SPLITTING (FRONT)” on page12.)

CONTENTS

Page

Page

SPECIFICATIONS

GENERAL SPECIFICATIONS

Transaxle Oil:

Type . . . . . John Deere J20D
Capacity (CST, SST and SRT Tractors) . . . . . 24.0 L (6.3 gal)
Capacity (HST Tractors) . . . . . 26.0 L (6.8 gal)

PTO Speeds (At 2700 Engine rpm)

Rear PTO . . . . . 540 rpm
Front PTO . . . . . 2100 rpm

MFWD Oil:

Type . . . . . John Deere J20D
Capacity . . . . . 7 L (7.4 qt)

REPAIR SPECIFICATIONS

PTO Clutch/Brake Specifications:

Minimum Clutch Pack Thickness . . . . . 41.4 mm (1.632 in.)
Minimum Brake Pack Thickness . . . . . 11.53 mm (0.454 in.)

Pinion and Ring Gear Specifications:

Differential Ring Gear Backlash . . . . . 0.10 - 0.30 mm (0.004 - 0.012 in.)

Front Wheel Alignment:

Toe In Measurement . . . . . 0 - 3 mm (0.0 - 0.12 in.)
Inclination . . . . . 13°
Swing . . . . . 10°

Steering Angle:

Inward . . . . . 54°
Outward . . . . . 62°

TORQUE SPECIFICATIONS

PTO Cover Cap Screws . . . . . .40 N•m (30 lb-ft)
Final Drive toTransmission Housing Cap Screws . . . . . 305 N•m (225 lb-ft)
Ring Gear Cap Screws . . . . . .68 N•m (50 lb-ft)
Pinion Shaft Lock Nut (Lower and Upper) . . . . . .136 N•m (100 lb-ft)
Mid PTO Housing to Transmission Housing . . . . . 36 - 44 N•m (27 - 33 lb-ft))

Front Axle MFWD

(Loctite® Number If Required)

Front Wheel Cap Screws . . . . . .118 - 147 N•m (87 - 108 lb-ft)
Final Drive Cover Cap Screw . . . . . .30 - 38 N•m (22 - 28 lb-ft)
Differential Carrier to MFWD Housing Cap Screw (262) . . . . .61 - 68 N•m (45 - 50 lb-ft)
Drive Shaft Boot Clamps . . . . . Snug Only
Tie Rod Nut . . . . . 115 - 129 N•m (85- 95 lb-ft)
Tie Rod Socket (262) . . . . . .115 - 129 N•m (85 - 95 lb-ft)
Differential Ring Gear Cap Screws . . . . . .68 N•m (50 lb-ft)
Differential Bearing Retainer Cap Screws . . . . . .54 - 68 N•m (40 - 50 lb-ft)
Pinion Retaining Nut. . . . . .163 - 176 N•m (120 - 130 lb-ft)
MFWD Housing to Spindle Housing Cap Screw (262) . . .286 - 316 N•m (211 - 233 lb-ft)

SPECIAL OR ESSENTIAL TOOLS

Part Number	Part Name
JT07335-1,2,3	Splitting Stands and Brackets
JDG 1260	Range Transmission Detent Ball Installer

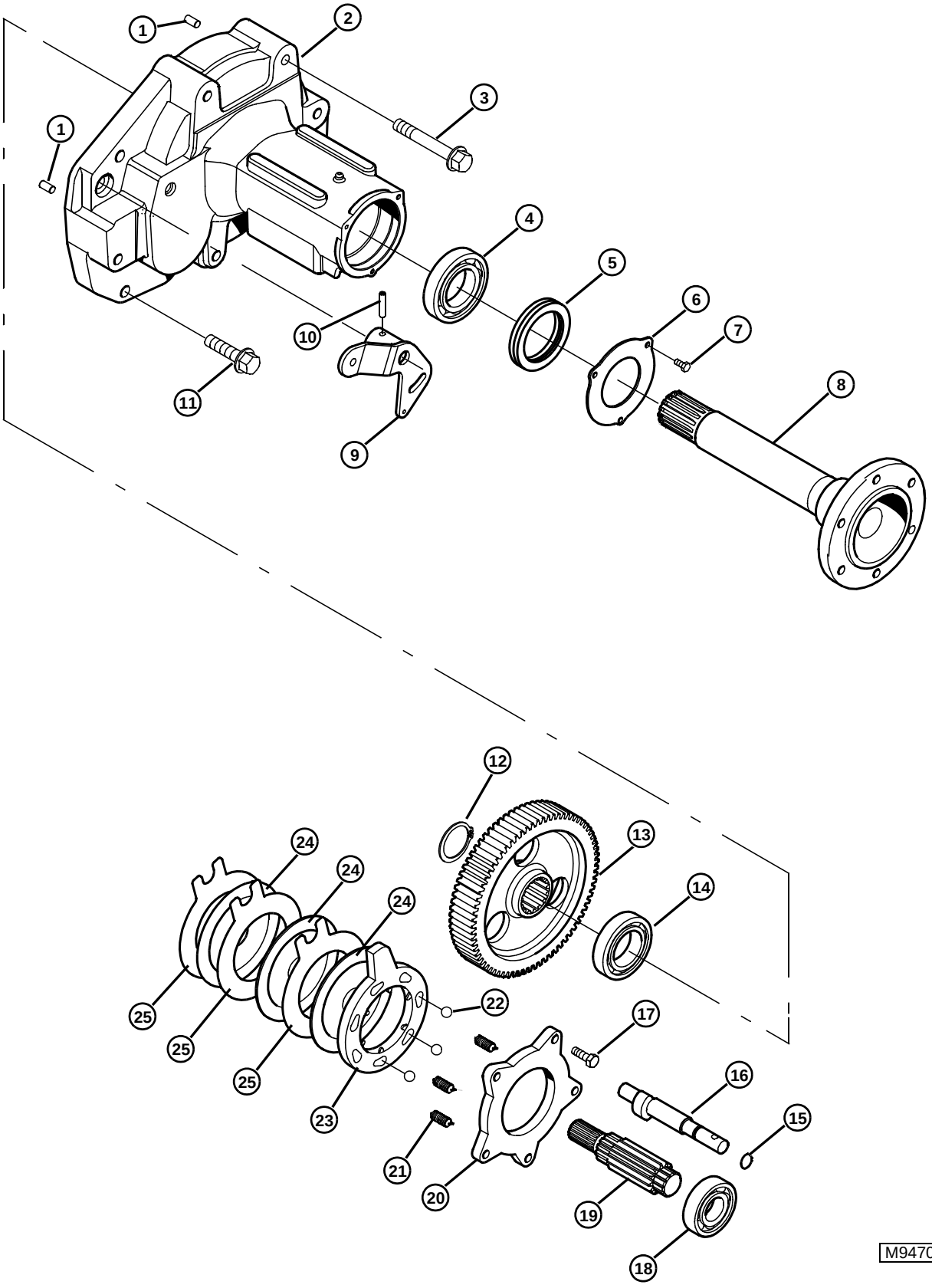
NOTE: Order tools according to information given in the U.S. SERVICE-GARD™ Catalog or in the European Microfiche Tool Catalog (MTC).

OTHER MATERIALS

Number U.S./Canadian	Name	Use
TY6305	John Deere Clean and Cure Primer	Cleans parts and speeds cure of sealant.
TY15130 / TY15934	John Deere Sealant	Seals transaxle and final drive case halves.
TY6333	Moly High Temperature EP Grease	
TY22034	John Deere SuperLube ®	
TY9370 / TY9477 (#242 LOCTITE®)	Thread Lock and Sealer (Medium Strength)	
TY6304 (#515 LOCTITE®)	Loctite Sealant	Seals the final drive housings to the transmission housing, and front axle final drive cover to the final drive housing. Also applied to the outer surface of the wheel seals.
#262 LOCTITE®	Loctite Thread Lock and Sealer (High Strength)	Apply to front axle spindle housing cap screws and to the MFWD housing cap screws.
T43514 (#277 LOCTITE®)	Loctite Thread Lock and Sealer (High Strength)	Apply to threads of pinion shaft retaining pin and to threads of ring gear retaining cap screws.
TY15941 (#620 LOCTITE®)	Loctite Retaining Compound (High Strength)	Seals front axle final drive housing cap.
TY16021	John Deere High Flex Form-In-Place Gasket	Sealing Flange Assemblies
TY15934	John Deere General Purpose Gasket Dressing	Sealing Gaskets and Hoses

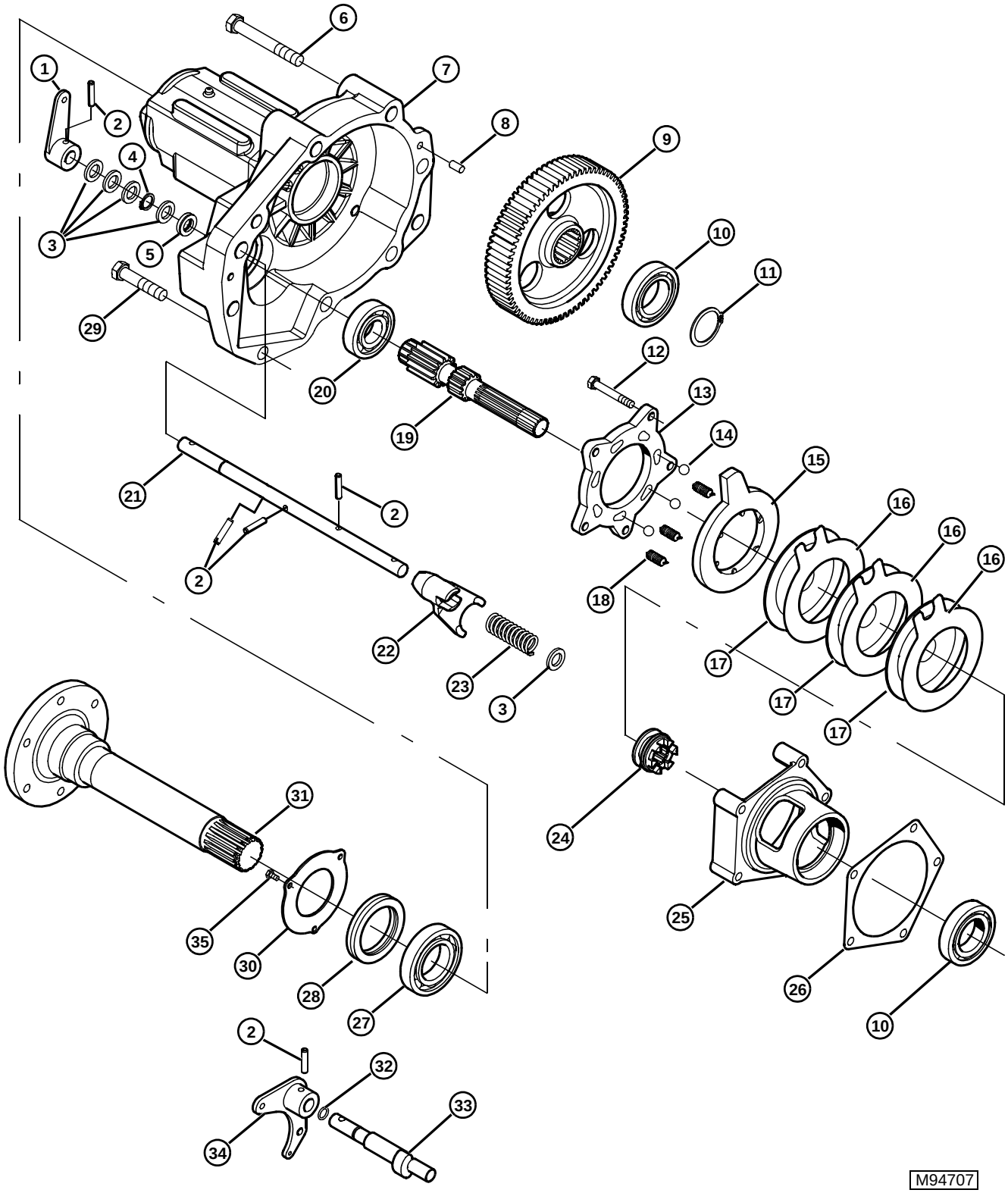
COMPONENT LOCATION

AXLE SHAFT AND BRAKE - LEFT



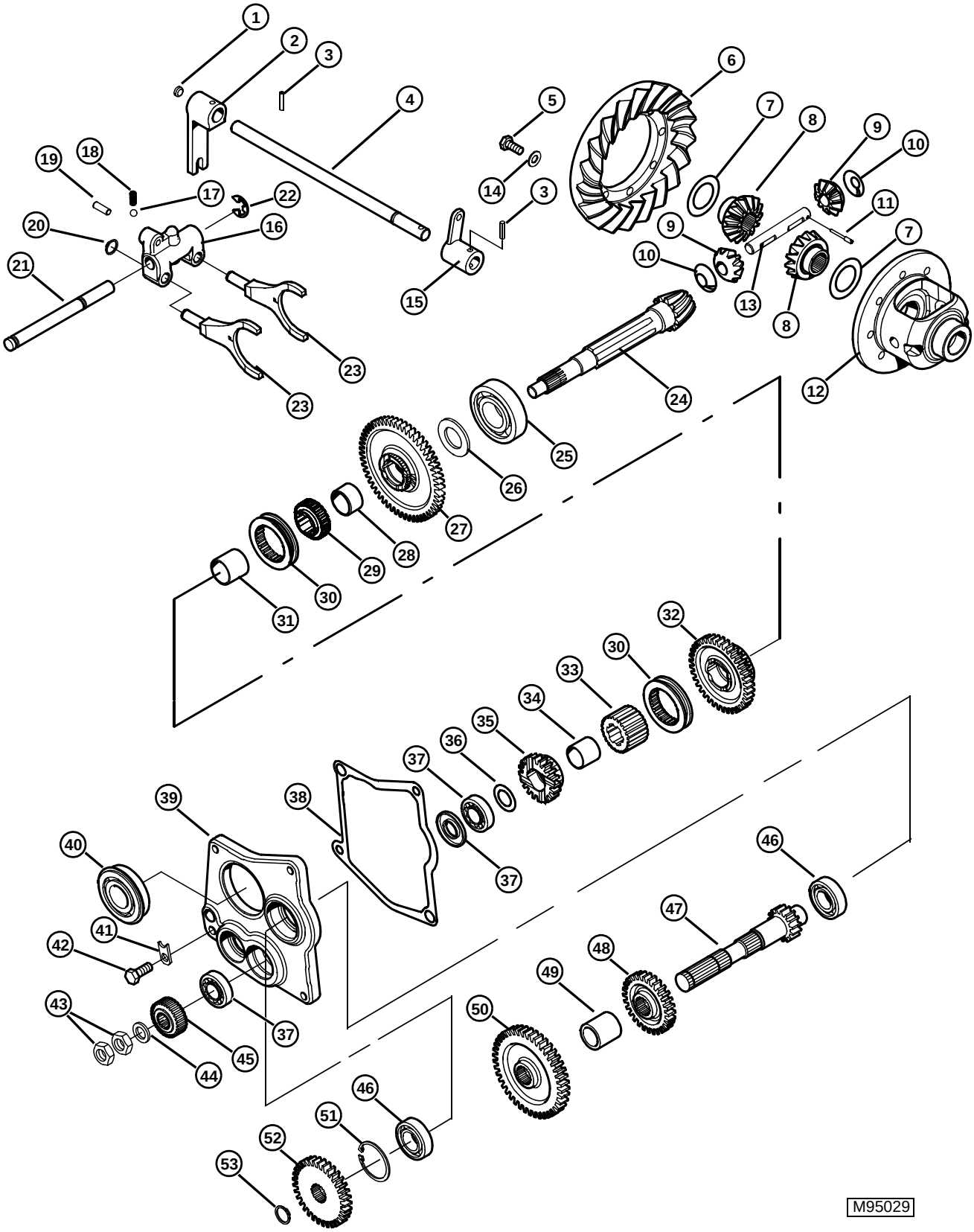
1. Dowel Pin
2. Housing
3. Cap Screw (6 Used)
4. Bearing
5. Seal
6. Bearing Retainer
7. Cap Screw (3 used)
8. Axle Shaft
9. Brake Arm
10. Spring Pin
11. Cap Screw (2 Used)
12. Snap Ring
13. Gear (73T)
14. Bearing
15. O-Ring
16. Brake Shaft
17. Cap Screw (5 Used)
18. Bearing
19. Pinion Shaft
20. Retainer Plate
21. Spring (3 Used)
22. Balls (5 or 7 Used)
23. Actuator Plate
24. Friction Disk
25. Brake Plate

AXLE SHAFT AND BRAKE - RIGHT



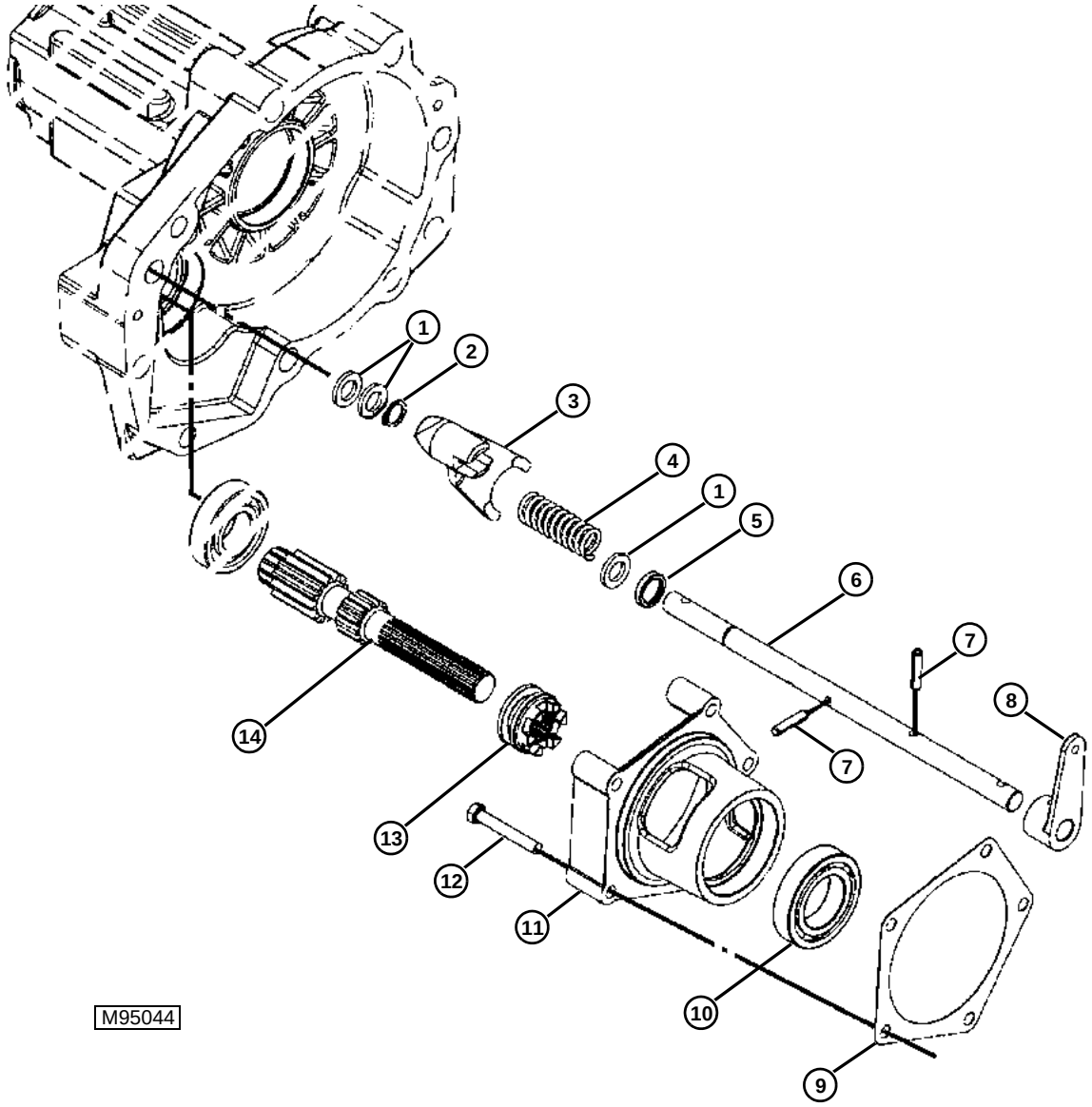
1. Differential Lock Arm
2. Spring Pin
3. Washer
4. Snap Ring
5. Seal
6. Cap Screw (5 Used)
7. Housing
8. Dowel Pin
9. Gear (73T)
10. Bearing
11. Snap Ring
12. Cap Screw
13. Retainer Plate
14. Balls (5 or 7 Used)
15. Actuator Plate
16. Brake Plate
17. Friction Disk
18. Springs (3 Used)
19. Pinion Shaft
20. Bearing
21. Differential Lock Shaft
22. Shift Fork
23. Spring
24. Shift Collar
25. Housing
26. Shim
27. Bearing
28. Seal
29. Cap Screw (2 used)
30. Bearing Retainer
31. Axle Shaft
32. O-Ring
33. Brake Shaft
34. Brake Arm
35. Cap Screw (3 Used)

RANGE SHIFT TRANSMISSION



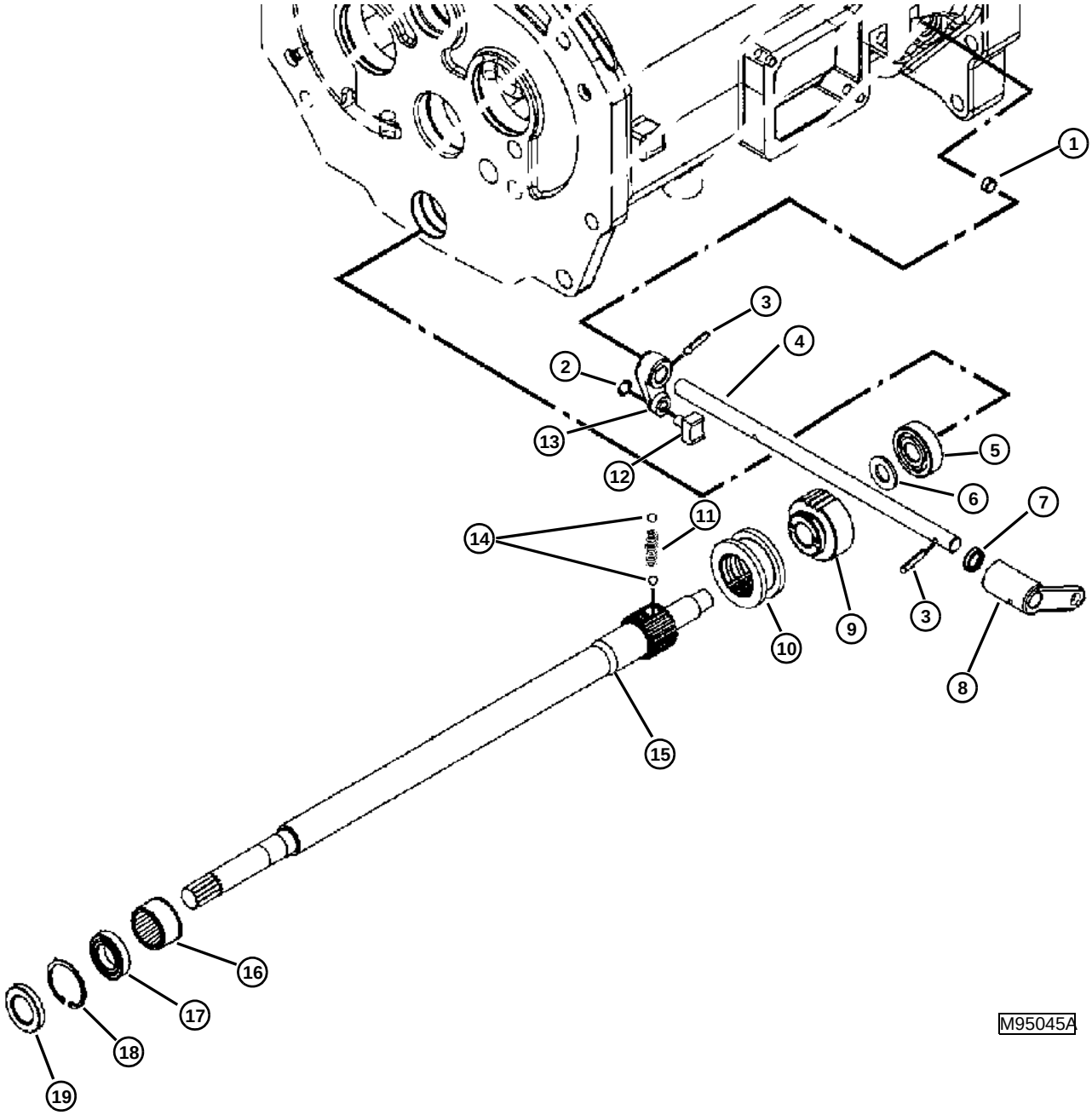
1. Cap
2. Lever
3. Spring Pin
4. Shaft
5. Cap Screw (8 Used)
6. Ring Gear
7. Thrust Washer
8. Gear
9. Gear
10. Thrust Washer
11. Screw
12. Differential Carrier
13. Cross Shaft
14. Washer (8 Used)
15. Lever
16. Shift Block
17. Detent Ball
18. Spring
19. Pin
20. Snap Ring (2 Used)
21. Detent Shaft
22. E-Clip
23. Shift Fork
24. Pinion
25. Bearing
26. Spacer
27. Gear, 50 Tooth
28. Sleeve
29. Splined Sleeve
30. Shift Collar
31. Spacer
32. Gear, 36 Tooth
33. Splined Sleeve
34. Spacer
35. Gear, 20 Tooth
36. Spacer
37. Bearing Assembly
38. Gasket
39. Bearing Plate
40. Bearing
41. Retainer
42. Cap Screw (4 Used)
43. Nut
44. Washer
45. Gear, 23 or 25 Tooth (MFWD)
46. Bearing
47. Shaft With Gear, 14 Tooth
48. Gear, 28 Tooth
49. Spacer
50. Gear, 44 Tooth
51. Snap Ring
52. Gear, 34 Tooth
53. Snap Ring

DIFFERENTIAL LOCK



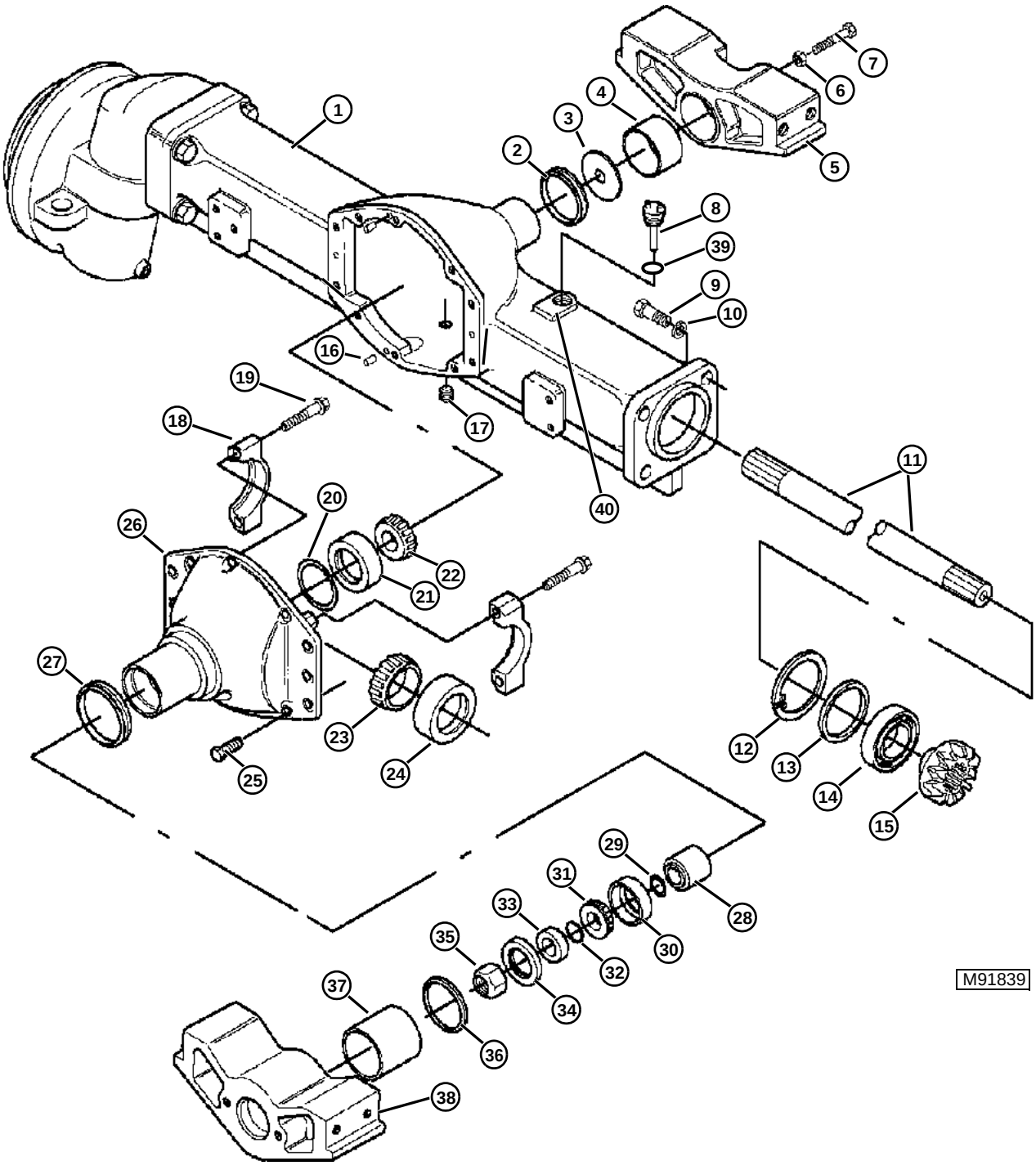
1. Washer
2. Snap Ring
3. Shift Fork
4. Spring
5. Seal
6. Shaft
7. Spring Pin (3 Used)
8. Lever
9. Shim
10. Bearing
11. Housing
12. Cap Screw (5 Used)
13. Shift Collar
14. Shaft

DRIVE SHAFT (FOR MFWD)



1. Plug	6. Washer	11. Spring	16. Bearing
2. Snap Ring	7. Seal	12. Shoe	17. Bearing
3. Spring Pin	8. Lever	13. Lever	18. Snap Ring
4. Shaft	9. Gear, 25 or 27 Tooth	14. Ball	19. Seal
5. Bearing	10. Collar, Shift	15. Shaft	

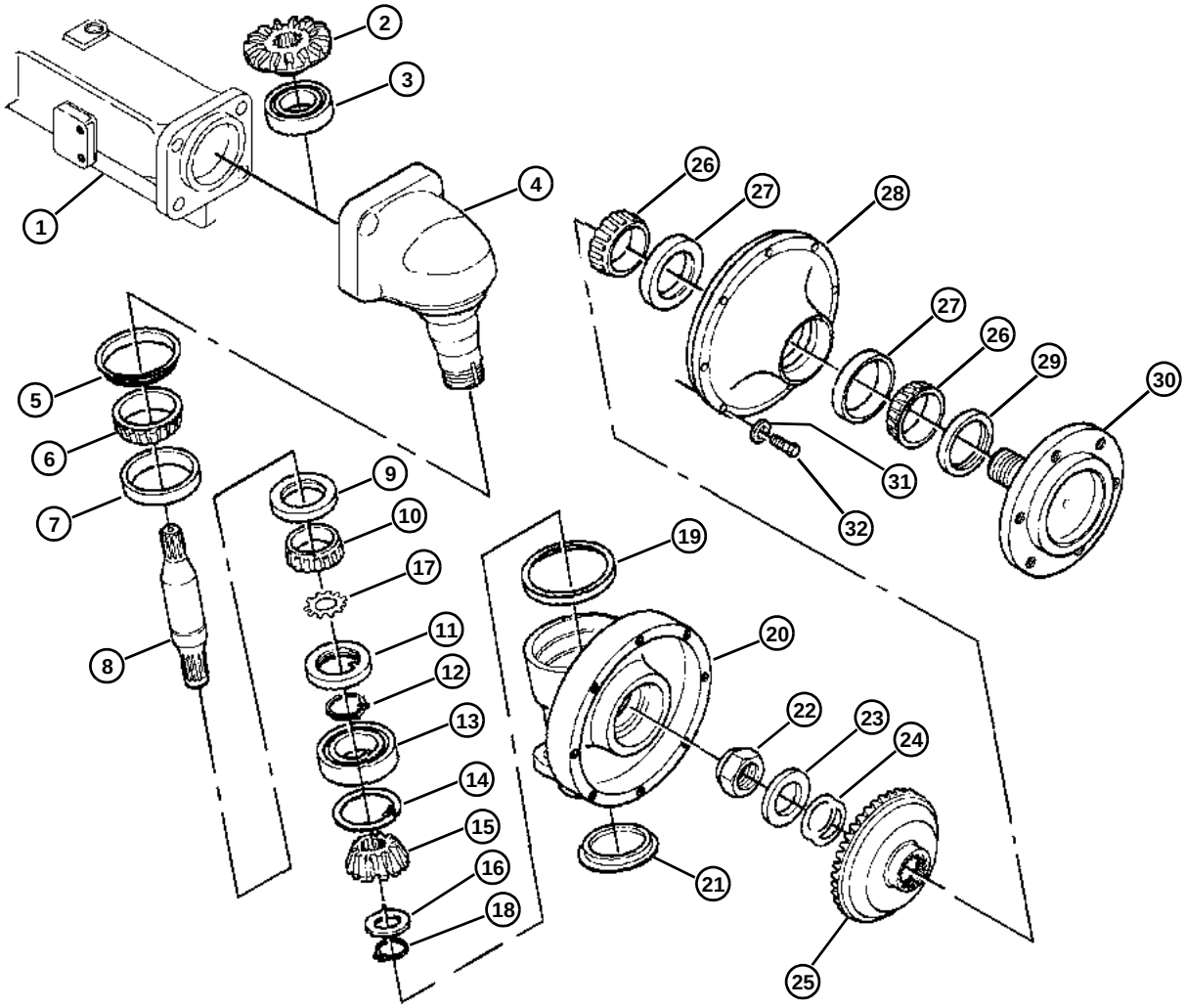
MFWD AXLE COMPONENT LOCATION



1. Axle Housing
2. Seal
3. Washer
4. Bushing
5. Axle Support
6. Nut
7. Cap Screw
8. Dip Stick/Filler Cap
9. Cap Screw(8)
10. Lock Washer (8)
11. Axle Shaft
12. Snap Ring (2)
13. Shim(s) (A/R)
14. Ball Bearing (2)
15. Bevel Gear (12T)
16. Dowel Pin (2)
17. Drain Plug
18. Bearing Retainer (2)
19. Cap Screw (4)
20. Shim(s) (A/R)
21. Bearing Cup
22. Bearing Cone
23. Bearing Cone (2)
24. Bearing Cup (2)
25. Cap Screw (12 used on A20BZ103-1, S20BZ105-1, S20BZ109-1 10 used on S20BZ107-1
26. Differential Housing
27. Seal
28. Spacer
29. Shim(s) (A/R)
30. Bearing Cup
31. Bearing Cone
32. O-ring
33. Spacer
34. Seal
35. Nut
36. Bushing
37. Bushing (All except S20BZ107-1 Axle)
38. Axle Support
39. O-Ring (All except S20BZ107-1 Axle)
40. Axle ID Number

NOTE: The axles are identified by numbers that are stamped into the housing on the dip stick pad (40). Always use the axle number when ordering parts.

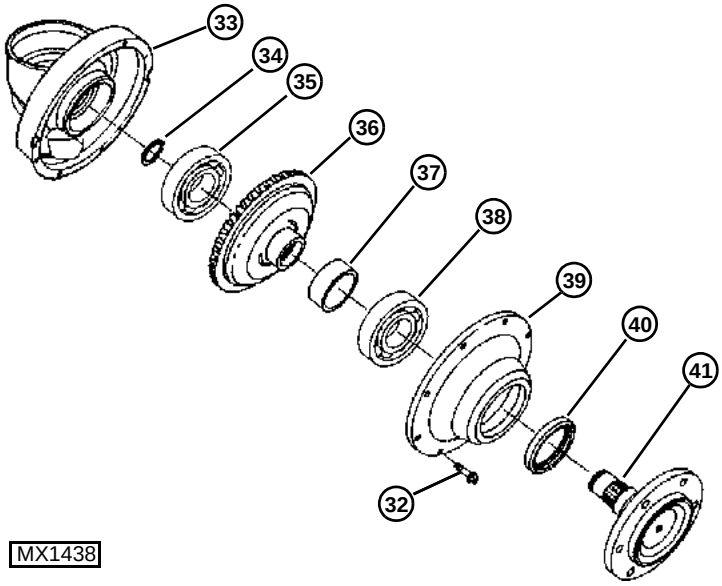
MFWD FINAL DRIVE COMPONENT LOCATION



M91837

NOTE: Use drawing above (M91937) for axles with final drives that use a nut to hold the hub shaft , numbered A20BZ103-1, S20BZ105-1.

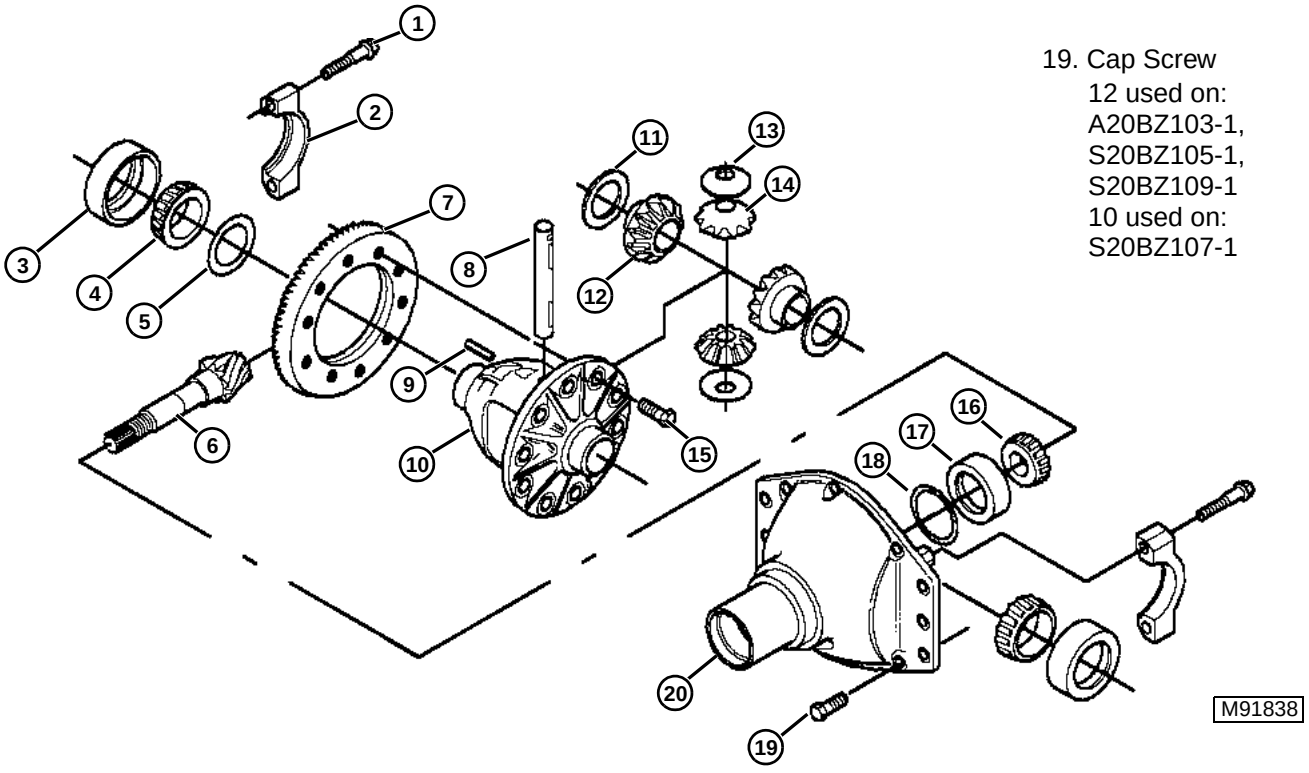
Use the drawing to right (MX1438) for axles with final drives that use a snap ring to hold the hub shaft, numbered S20BZ107-1, S20BZ109-1.



MX1438

1. Axle Housing
2. Bevel Gear (15T)
3. Ball Bearing
4. Spindle Housing
5. Seal
6. Bearing Cone
7. Bearing Cup
8. Spindle Shaft
9. Bearing Cup
10. Bearing Cone
11. Nut
12. Snap Ring
13. Ball Bearing
14. Snap Ring
15. Bevel Gear (12T)
16. Shim(s) (A/R)
17. Lock Washer
18. Snap Ring
19. Seal
20. Final Drive Housing
21. Cap
22. Spindle Nut
23. Washer
24. Shim(s) (A/R)
25. Bevel Gear (41T)
26. Bearing Cone (2)
27. Bearing Cup (2)
28. Outer Drive Cover
29. Seal
30. Hub Shaft
31. Washer (8)
32. Cap Screw (8)
33. Knuckle
34. Snap Ring
35. Ball Bearing
36. Gear
37. Spacer
38. Ball Bearing
39. Cover
40. Seal
41. Hub Shaft

MFWD DIFFERENTIAL COMPONENT LOCATION

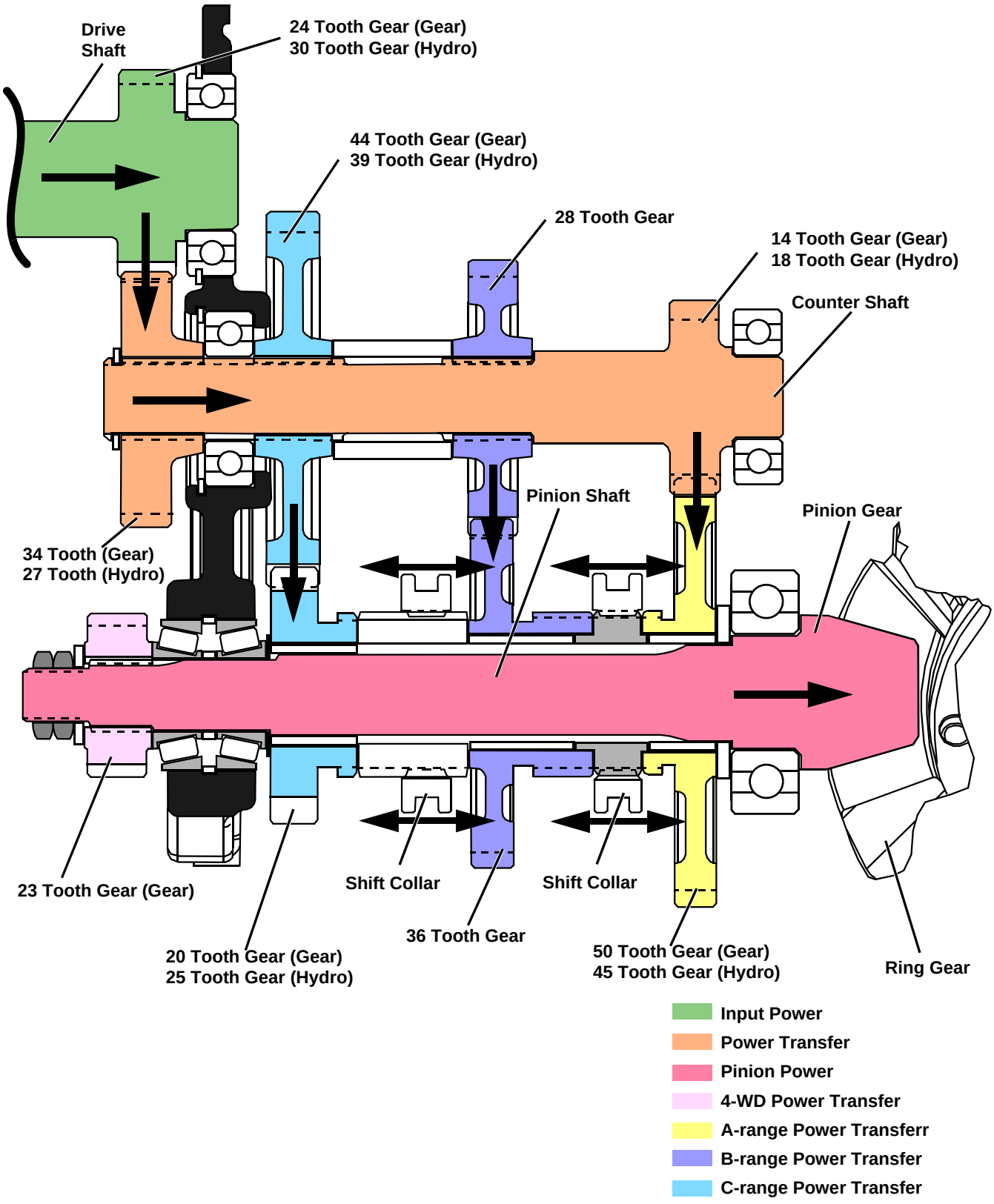


19. Cap Screw
12 used on:
A20BZ103-1,
S20BZ105-1,
S20BZ109-1
10 used on:
S20BZ107-1

1. Cap Screw (4)
2. Bearing Retainer (2)
3. Bearing Cup (2)
4. Bearing Cone (2)
5. Shim(s) (A/R)
6. Pinion (11T)
7. Ring Gear (41T)
8. Pinion Shaft
9. Pin
10. Differential Case
11. Thrust Washer (2)
12. Bevel Gear (2)
13. Washer (2)
14. Pinion Bevel Gear (2)
15. Cap Screw (10)
16. Bearing Cone
17. Bearing Cup
18. Shim(s) (A/R)
19. Cap Screw
20. Differential Housing

THEORY OF OPERATION

POWER TRANSMISSION — RANGE TRANSMISSION



Function:

The range transmission provides a means for transferring engine power to the differential pinion gear at three different gear ratios.

Theory (Gear):

Power is provided to the range shift transmission through the drive shaft which is splined to the output shaft of the collar shift, SST or SRT transmission. The 24 tooth gear is in constant mesh with the 34 tooth gear. The 34 tooth gear is splined to the counter shaft. Power is transmitted through the 24 tooth gear to the 34 tooth gear, and to the counter shaft. In order for power to be transferred to the pinion shaft, the operator must select a range; A, B, or C.

A-range:

The counter shaft is a shaft and 14 tooth gear machined as a single part. This 14 tooth gear is in constant mesh with the 50 tooth gear on the pinon shaft. The 50 tooth gear rotates freely on the pinion shaft. When the operator selects A range, the two shift collars are moved by a mechanical linkage to the rearmost position. The front shift collar does not engage a gear. The rear shift collar engages the cogs of the 50 tooth gear, linking the gear to the splined collar below the shift collar, transmitting power from the counter shaft, through the 14 tooth gear, 50 tooth gear, shift collar, splined collar, and into the pinion shaft, and finally to the pinion gear.

B-range:

The 28 tooth gear is splined to the counter shaft, and is in constant mesh with the 36 tooth gear on the pinion shaft. The 36 tooth gear rotates freely on the pinion shaft. When the operator selects B range, the two shift collars are moved by a mechanical linkage slightly forward. The front shift collar does not engage a gear. The rear shift collar engages the cogs of the 36 tooth gear, linking the gear to the splined collar below the shift collar, transmitting power from the counter shaft, through the 28 tooth gear, 36 tooth gear, shift collar, splined collar, and into the pinion shaft, and finally to the pinion gear.

C-range:

The 44 tooth gear is splined to the counter shaft, and is in constant mesh with the 20 tooth gear on the pinion shaft. The 20 tooth gear rotates freely on the pinion shaft. When the operator selects C range, the two shift collars are moved by a mechanical linkage to the far forward position. The rear shift collar slides completely onto the 36 tooth gear cogs, and does not engage the splined collar below it. The front shift collar engages the cogs of the 20 tooth gear, linking the gear to the splined collar below the shift collar, transmitting power from the counter shaft, through the 44 tooth gear, 20 tooth gear, shift collar, splined collar, and into the pinion shaft, and finally to the pinion gear.

Theory (Hydro):

Power is provided to the range shift transmission through the drive shaft which is splined to the motor shaft of the hydrostatic transmission. The 30 tooth gear is in constant mesh with the 27 tooth gear. The 27 tooth gear is splined to the counter shaft. Power is transmitted through the 30 tooth gear to the 27 tooth gear, and to the counter shaft. In order for power to be transferred to the pinion shaft, the operator must select a range; low, medium, or high.

A-range:

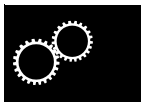
The counter shaft is a shaft and 18 tooth gear machined as a single part. This 18 tooth gear is in constant mesh with the 45 tooth gear on the pinon shaft. The 45 tooth gear rotates freely on the pinion shaft. When the operator selects low range, the two shift collars are moved by a mechanical linkage to the rearmost position. The front shift collar does not engage a gear. The rear shift collar engages the cogs of the 45 tooth gear, linking the gear to the splined collar below the shift collar, transmitting power from the counter shaft, through the 18 tooth gear, 45 tooth gear, shift collar, splined collar, and into the pinion shaft, and finally to the pinion gear.

B-range:

The 28 tooth gear is splined to the counter shaft, and is in constant mesh with the 36 tooth gear on the pinion shaft. The 36 tooth gear rotates freely on the pinion shaft. When the operator selects medium range, the two shift collars are moved by a mechanical linkage slightly forward. The front shift collar does not engage a gear. The rear shift collar engages the cogs of the 36 tooth gear, linking the gear to the splined collar below the shift collar, transmitting power from the counter shaft, through the 28 tooth gear, 36 tooth gear, shift collar, splined collar, and into the pinion shaft, and finally to the pinion gear.

C-range:

The 39 tooth gear is splined to the counter shaft, and is in constant mesh with the 25 tooth gear on the pinion shaft. The 25 tooth gear rotates freely on the pinion shaft. When the operator selects high range, the two shift collars are moved by a mechanical linkage to the far forward position. The rear shift collar slides completely onto the 36 tooth gear cogs, and does not engage the splined collar below it. The front shift collar engages the cogs of the 25 tooth gear, linking the gear to the splined collar below the shift collar, transmitting power from the counter shaft, through the 39 tooth gear, 25 tooth gear, shift collar, splined collar, and into the pinion shaft, and finally to the pinion gear.



TROUBLESHOOTING CHART

Problem or Symptom / Check or Solution	Range Transmission Will Not Engage	Range Transmission Will Not Stay Engaged	Range Transmission Noisy In Neutral	Range Transmission Noisy In Gear	One Gear Will Not Engage	Differential Noisy	MFWD Noisy	MFWD Will Not Engage	MFWD Will Not Stay Engaged
Cogs On Gear or Shift Collar Damaged or Worn/ No Longer Serviceable	●	●			●				
Drive Shaft Gear or Counter Shaft Gear Worn/ No Longer Serviceable	●		●	●					
Low/Medium/High Gears Worn/ No Longer Serviceable	●		●	●					
Detent Ball Spring Broken		●							
Shift Linkage Worn or Damaged	●	●							
Bearings On Pinion Shaft/Counter Shaft Worn or Damaged			●	●					
Pinion and Ring Gear Worn or Damaged				●		●			
Front Differential or Final Drive Worn or Damaged							●		
MFWD Shift Linkage Worn or Damaged								●	●
Cogs On MFWD Shift Collar or Gear Damaged or Worn/ No Longer Serviceable								●	●

DIAGNOSIS

Test/Check Point	Normal	If Not Normal
A. Range Shift Lever	Smooth operation, engages gear.	Lubricate linkage. Replace damaged parts.
B. Rear Wheels	Smooth, quiet operation in forward or reverse motion, wheels do not scrub when turning.	Check differential locking lever disengages when not depressed. Replace damaged parts in differential.
C. Differential Locking Lever	Smooth operation, engages differential lock.	Lubricate linkage. Replace damaged parts.
D. Front Wheels (MFWD)	Smooth, quiet operation in forward or reverse motion, wheels do not scrub excessively when turning.	Replace damaged parts in front differential.
E. MFWD Lever	Smooth operation, engages MFWD.	Lubricate linkage or replace damaged parts.

TESTS & ADJUSTMENTS

DIFFERENTIAL BACKLASH ADJUSTMENT

Reason:

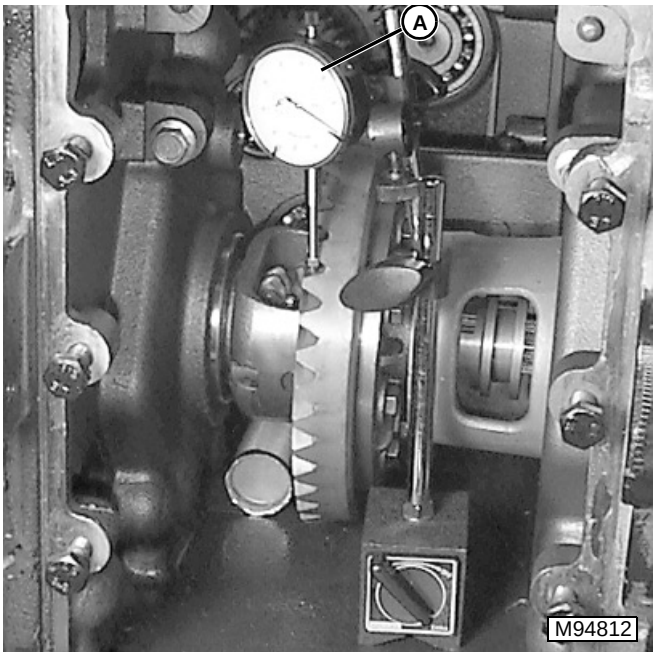
To place the differential ring gear in proper relationship with the differential input pinion shaft.

IMPORTANT: Always check and adjust backlash after pinion shaft adjustment has been made. (See "ADJUST PINION DEPTH"). Do not adjust backlash unless the ring gear was replaced or the amount of shims are in question.

Procedure:

1. While slowly rotating the differential housing carrier, use a soft faced mallet to lightly tap the face of the ring gear to move it and the carrier toward the right side of the tractor.

NOTE: This is to ensure that the carrier and bearings are properly seated.



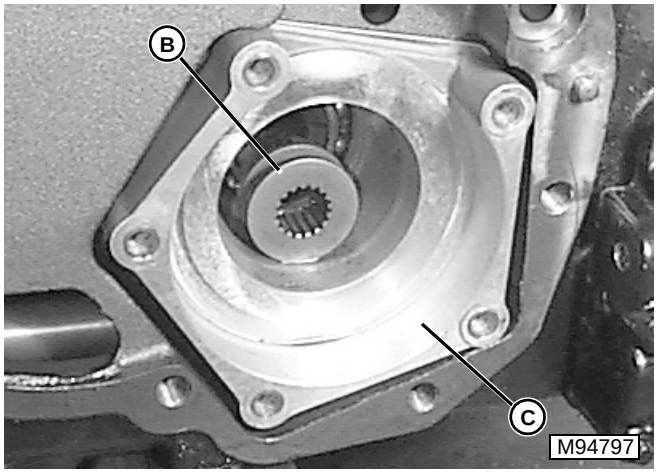
2. Attach dial indicator (A) to the transmission housing.
3. Locate the contact point of the dial indicator toward the outer part of the ring gear tooth and as close to 90° to the tooth as possible.
4. While holding the differential pinion shaft stationary at the pinion, rotate the ring gear and note the backlash reading on the dial indicator.
5. Rotate ring gear 1/2 turn, and recheck backlash.

Specification:

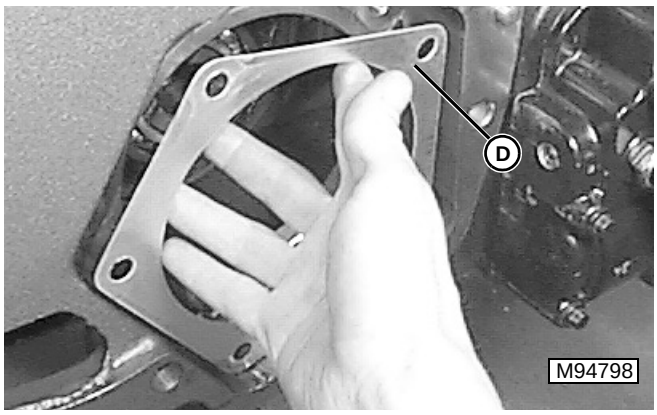
Backlash . . . . . 0.10 - 0.30 mm (0.004 - 0.012 in.)

To Adjust Backlash:

1. If not already removed, remove right hand final drive (See "FINAL DRIVE REMOVAL").
2. Remove brake disks and plates (See "BRAKE DISASSEMBLY AND INSPECTION" in Brake section).
3. Remove differential lock fork (See "DIFFERENTIAL LOCK REMOVAL AND INSTALLATION").



4. If not already done, remove differential lock collar (B).
5. Remove RH brake/differential lock collar housing (C).



6. Remove shim(s) (D) located behind bearing housing to decrease backlash, or add shim(s) to increase backlash.

NOTE: For each 0.001" of shim added, backlash will increase approximately 0.0007".
Shims are available in 0.07 mm (0.003 in.), 0.13 mm (0.005 in.), and 0.25 mm (0.010 in.) and 0.5 mm (0.020 in.) thicknesses.

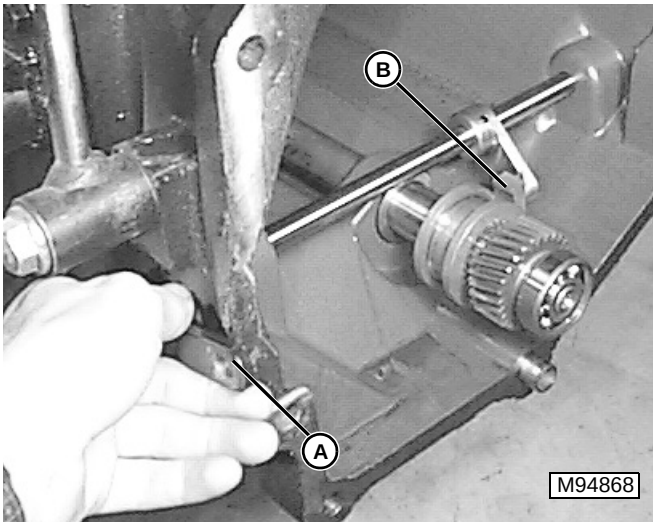
7. Install differential carrier and recheck backlash after removing or installing shims.

REPAIR

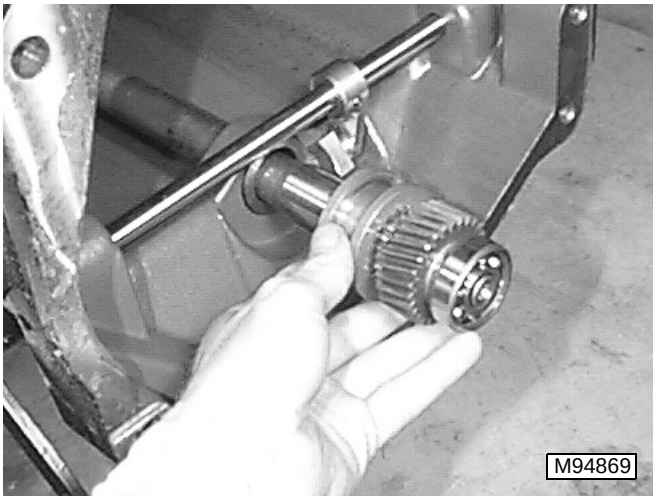
MFWD OUTPUT SHAFT REMOVAL AND INSTALLATION

Removal:

1. Split tractor at rear of tunnel. (See "DIFFERENTIAL LOCK REMOVAL/INSTALLATION").

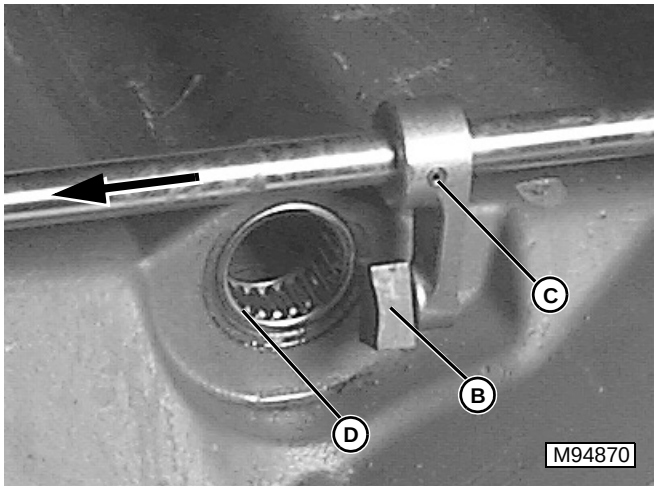


2. Rotate shift lever (A) until shoe (B) clears shift collar.



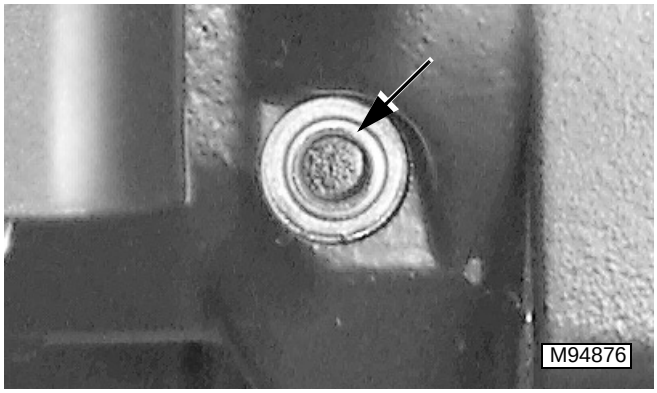
3. Remove shaft, gear, and shift collar as an assembly.

Remove Shift Shaft:



4. Remove spring pin (C) and slide shift shaft out of tunnel.
5. Inspect bearing (D) for wear or damage. Replace if necessary.
6. Inspect shoe (B) for wear or damage. Replace if necessary.

IMPORTANT: Old O-rings, gaskets, and seals will leak. When servicing, always install new O-rings, gaskets, and seals.



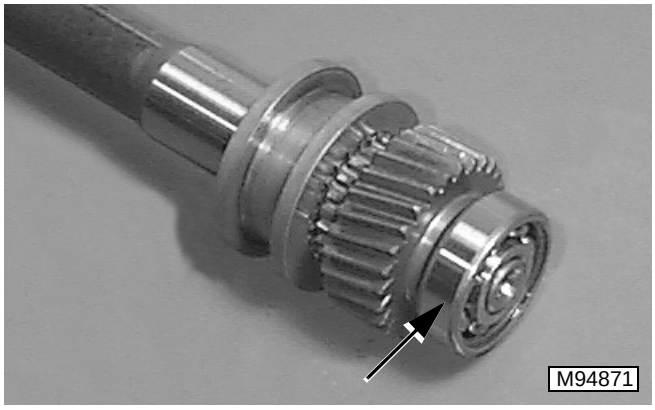
7. Replace shift shaft seal.

Installation:

Installation is the reverse of removal.

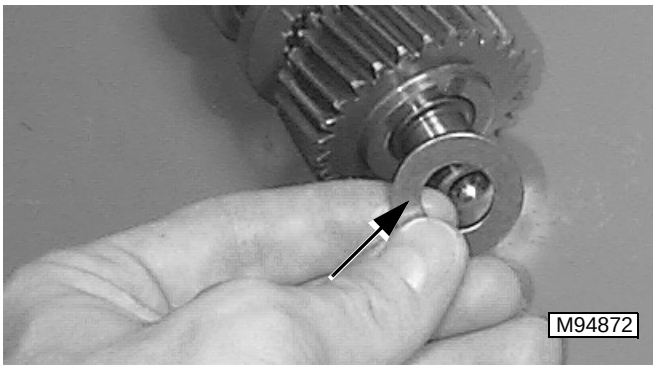
- Install a new shift shaft seal before installing shift shaft.

Disassemble MFWD Drive Shaft:

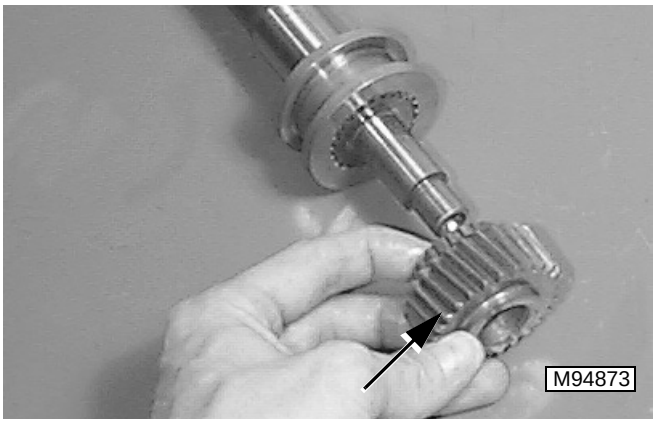


1. Using a suitable puller, remove bearing from end of shaft. Inspect bearing for smooth operation, damage, or wear. Replace as necessary.

IMPORTANT: DO NOT spin bearing using compressed air. Damage to bearing balls, cage, and races could result.

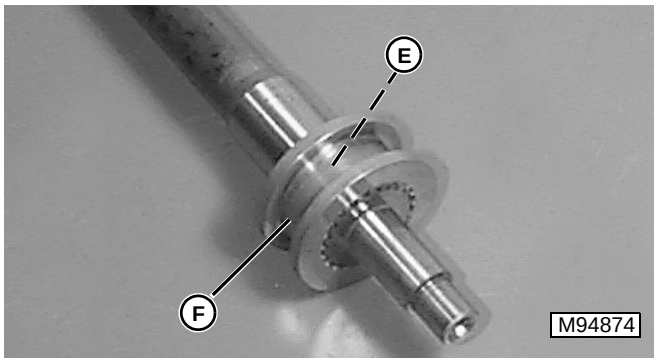


2. Remove washer.

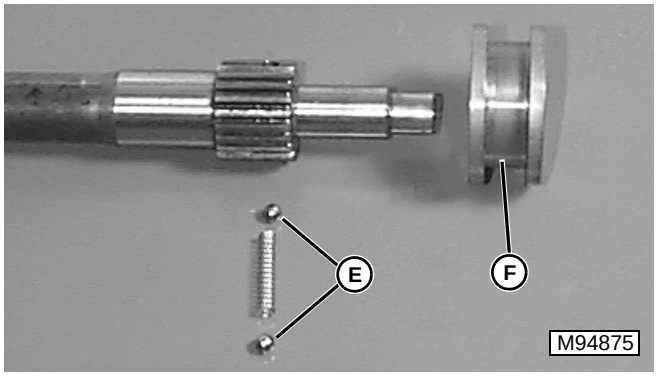


3. Remove gear.

NOTE: Shift collar retains two steel balls under spring pressure. Use care when removing collar to prevent balls from being lost.



4. Wrap shaft in a shop towel to prevent balls (E) from being lost. Remove shift collar (F).



5. Remove two steel balls and spring from shaft.

Assemble MFWD Drive Shaft:

Assembly is the reverse of disassembly.

- Install two steel balls and spring to shaft using a suitable hose clamp to compress spring and hold balls in place while shift collar is being installed.

Front Seal and Bearing Replacement:

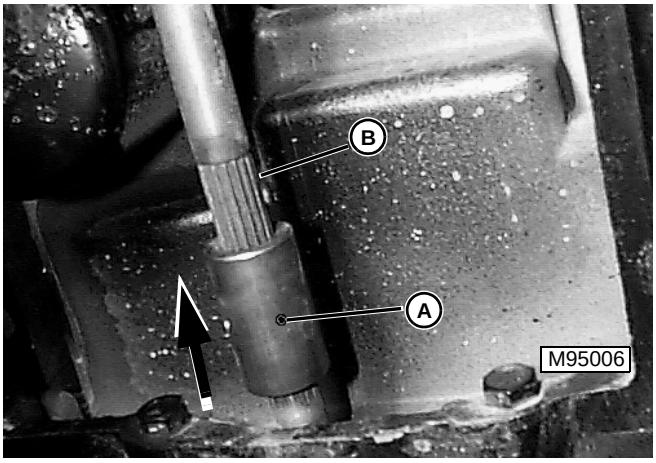
1. Split tractor between bell housing and tunnel sections. (See "TRACTOR SPLITTING FRONT") in the Hydrostatic Power Train section for HST tractors; "TRACTOR SPLITTING FRONT" in the Gear Power Train section for CST or SST tractors; or "TRACTOR SPLITTING FRONT" in the SyncReverser Power Train section for SRT tractors.)
2. Using a suitable tool, remove seal from tunnel and end of shaft.
3. Remove snap ring retaining bearing. Remove bearing. Inspect bearing for damage or wear. Replace if needed.
4. Install bearing.

IMPORTANT: Old O-rings, gaskets, and seals will leak. When servicing, always install new O-rings, gaskets, and seals.

5. Using a suitable driver, install a new seal.

MFWD DRIVE SHAFT REMOVAL AND INSTALLATION

Removal:



1. Remove the spring pins (A) from the drive shaft splined couplers (front and rear).
2. Support the drive shaft and slide the splined couplers on to the drive shaft splines (B). Remove drive shaft from the tractor.

Installation:

Installation is the reverse of removal.

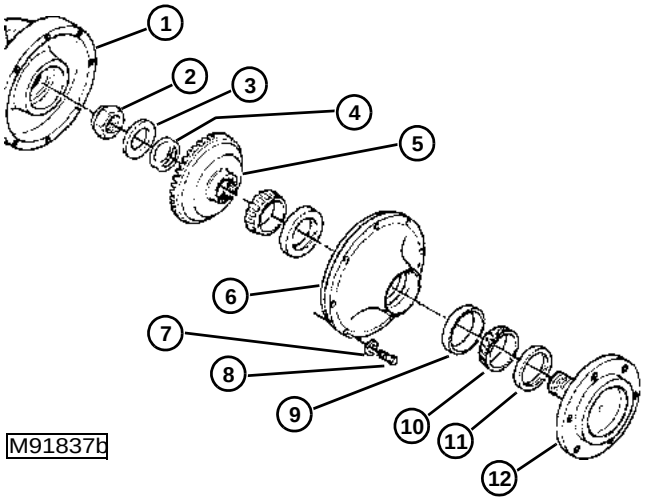
MFWD FINAL DRIVE COVER REMOVAL & INSPECTION

TAPERED BEARINGS (Axles Marked A20BZ103-1, S20BZ105-1)

NOTE: The axles are identified by numbers that are stamped into the housing on the dip stick pad.

1. Drain the differential and the final drive housing being serviced.
2. Raise and support the final drive being serviced.
3. Remove the wheel and tire from the final drive.
4. Remove eight cap screws and washers. Separate the final drive cover and hub shaft from the final drive housing.

NOTE: The final drive cover is sealed to the final drive housing. It may be necessary to pry the cover from the housing using the two reliefs on the sides of the cover.



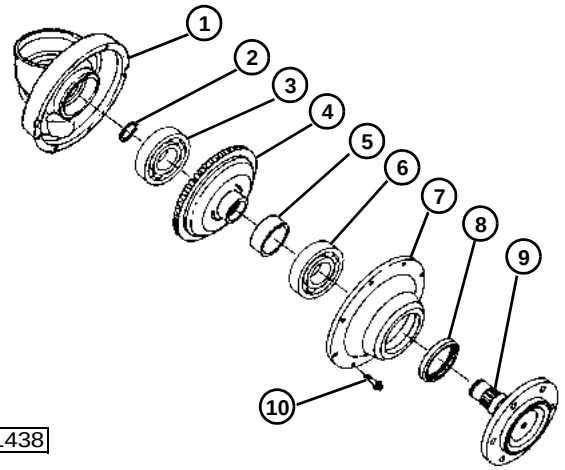
1. Final Drive Housing	7. Washer (8)
2. Retaining Nut	8. Cap Screw (8)
3. Washer	9. Bearing Cup (2)
4. Shim(s)	10. Bearing Cone (2)
5. Bevel Gear (41T)	11. Seal
6. Final Drive Cover	12. Hub Shaft

5. Secure the wheel end of the hub shaft. Remove and discard the retaining nut.
6. Press the hub shaft from the final drive cover, bearings, and bevel gear.
7. Disassemble the remaining components from the final drive cover assembly.
8. Clean and inspect all parts. Replace any unserviceable components.

BALL BEARINGS (Axles Marked S20BZ107-1, S20BZ109-1)

NOTE: The axles are identified by numbers that are stamped into the housing on the dip stick pad.

1. The first four steps are the same as the units with tapered bearings.
2. Secure the wheel end of the hub shaft. Remove the snap ring.



MX1438

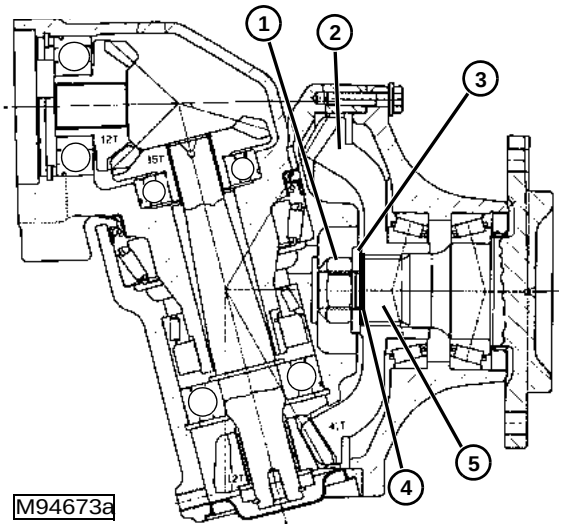
1. Final Drive Housing
2. Snap Ring
3. Ball Bearing
4. Bevel Gear (41T)
5. Spacer
6. Ball Bearing
7. Final Drive Cover
8. Seal
9. Hub Shaft
10. Cap Screw (8)

3. Press the hub shaft from the final drive cover, bearings, and bevel gear.
4. Clean and inspect all parts. Replace any unserviceable components.

MFWD FINAL DRIVE COVER INSTALLATION

TAPERED BEARINGS

1. Install the outer hub bearing cup to the bearing cone.
2. Coat the outer surface of a new hub seal with John Deere Sealant TY6304. Replace the hub seal.
3. Install the hub shaft to the bearing cones, bevel gear, and final drive cover.
4. To adjust the bearings:
   - Apply 1200 lbs axial load on the web of the bevel gear, while rolling and oscillating the bearings. This insures proper seating of the bearing.
   - With the load applied, measure the dimension between the gear face and the end of the hub shaft.
   - Select the same thickness shim as the measured dimension, and install the shim(s) to the shaft.



M94673a

1. Nut
2. Bevel Gear (41T)
3. Washer
4. Shim
5. Hub shaft

   - Assemble the washer and old nut to the hub shaft. Tighten the nut to **447 - 488 N•m (330 - 360 lb-ft).**
   - Verify that the rolling torque of the cover is **1.4 - 4.1 N•m (15 - 35 lb-in.).**
   - If the rolling torque is not correct, repeat the previous steps.
   - If the rolling torque is correct, apply LOCTITE 262 to the threads, and assemble the washer and new nut to the hub shaft. Tighten the nut to **447 - 488 N•m (330 - 360 lb-ft).**

IMPORTANT: The retaining nut on the hub shaft is a special "torque prevailing" nut. ALWAYS replace this nut - DO NOT reuse.
NEVER tighten a torque prevailing nut with an impact wrench.
ALWAYS use a torque wrench to correctly tighten torque prevailing nuts.

5. Apply John Deere Sealant TY6304 to the mating surface of the final drive cover. Install the final drive cover to the final drive housing. Tighten the cap screws to **30 - 38 N•m (22 - 28 lb-ft).**

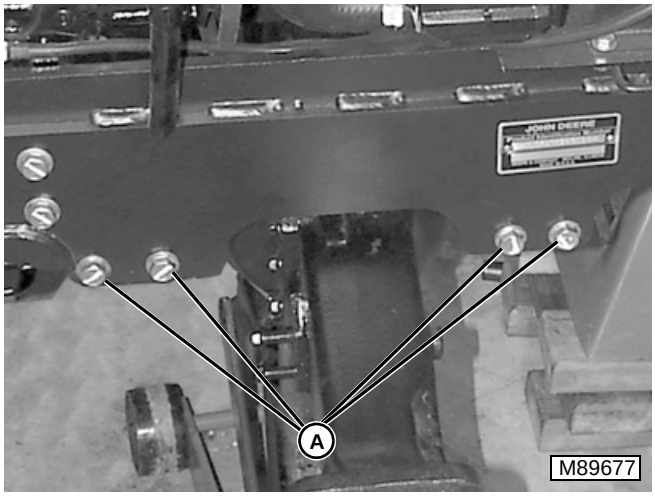
BALL BEARINGS

1. Coat the outer surface of a new hub seal with John Deere Sealant TY6304. Replace the hub seal.
2. Install the hub shaft through the seal and cover.

3. Place the ball bearing, spacer, bevel gear, and ball bearing on the hub shaft. Secure with snap ring.
4. Apply John Deere Sealant TY6304 to the mating surface of the final drive cover. Install the final drive cover to the final drive housing. Tighten the cap screws to **30 - 38 N•m (22 - 28 lb-ft).**

MFWD REMOVAL

1. Remove the differential drive shaft.
2. Label and remove the power steering hoses from the steering cylinder.
3. Raise the front of the tractor. Support the frame.
4. Support the MFWD with a floor jack.



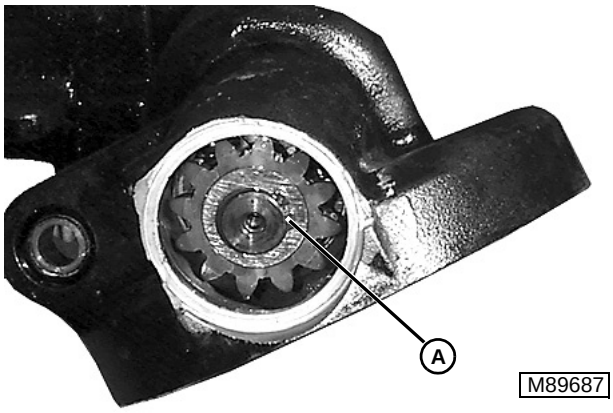
5. Remove the axle support mounting cap screws (A).

6. Lower the axle from the frame with a floor jack. Set the axle on a workbench or blocks to disassemble.
7. Inspect the axle pivots for wear or damage.

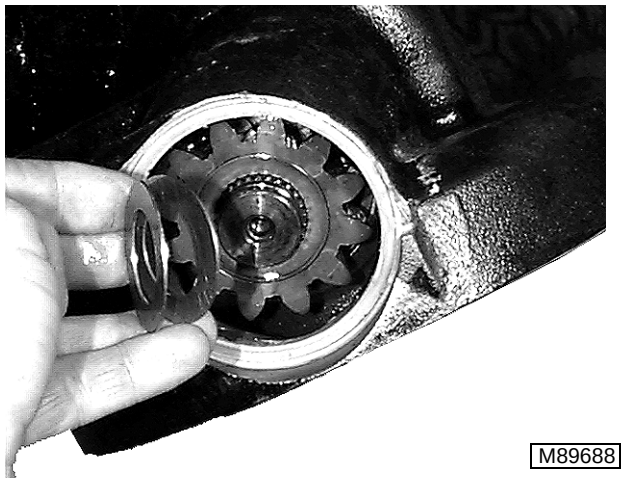
MFWD SPINDLE SHAFT

Removal and Disassembly:

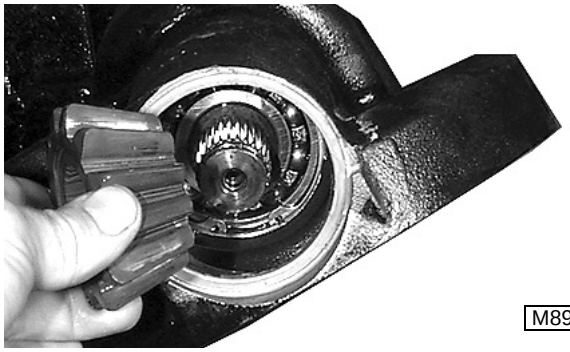
1. Carefully remove the spindle cap from the housing.



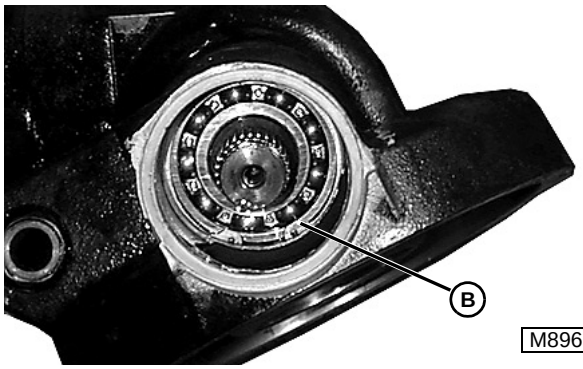
2. Remove the snap ring (A) from the spindle shaft.



3. Remove the shim(s), and lower bevel gear (12T) from the spindle shaft. Save any shim(s) from between the spacer and the lower bevel gear.

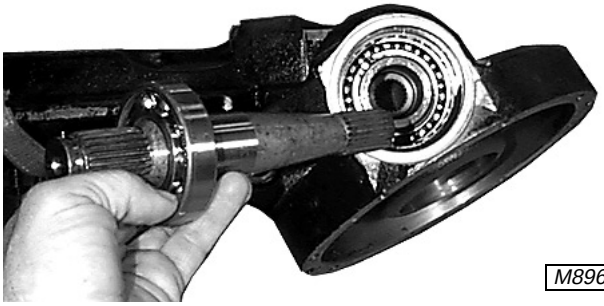

M89689

4. Remove the lower bevel gear from the spindle shaft.



M89690

5. Remove the snap ring (B) from the spindle housing.


M89691

6. Remove the spindle shaft and bearing from the spindle housing.
7. Remove the snap ring and bearing from the spindle shaft. Inspect all parts, and replace components as necessary.

Assembly and Installation:

1. Install the bearing and snap ring to the spindle shaft.
2. Install the spindle shaft assembly to the final drive housing.
3. Install the internal snap ring to the final drive housing.
4. Install the lower bevel gear (12T), shim(s), and the snap ring to the spindle shaft.
5. Install the final drive cover to the final drive housing.
6. To set the backlash of the lower final drive, shim the lower bevel gear to **0.64 - 0.76 mm (0.025 - 0.030 in.)** of end play to achieve **0.13 - 0.18 mm 0.005 - 0.007** backlash.
7. Apply John Deere TY15941 retaining compound to the final drive housing cap, and install the cap.

MFWD FINAL DRIVE HOUSING

Disassembly:

1. Remove the final drive cover. (See "MFWD FINAL DRIVE COVER REMOVAL AND INSPECTION").
2. Remove the final drive spindle shaft. (See "MFWD SPINDLE SHAFT").
3. Remove and discard the retaining nut from the final drive housing.
4. Remove the final drive housing from the spindle housing, and put the final drive housing in a vise.
5. Remove the bearing cups and bearing cones from the spindle housing and from the final drive housing.
6. Clean and inspect all components. Replace any unserviceable components.

Assembly:

1. Replace the final drive housing seal.
2. Install the bearing cups and cones to the housing.
3. Install a new bearing retaining nut to the final drive housing. To correctly install the nut:
   - Hand start the nut until it comes in contact with the bearing.
   - Apply **18 - 23 Kg (40 - 50 lbs)** compressive force to the socket, while tightening the nut to **108.5 N•m (80 lb-ft)** of torque. Oscillate the final drive housing several times to seat the bearing.
   - Loosen the nut one half turn **(180°).**

IMPORTANT: Retighten the nut to 20 - 27 N•m (15 - 20 lb-ft). The retaining nut securing the bearing to the spindle housing is a torque prevailing nut. ALWAYS replace this nut- DO NOT reuse. NEVER tighten a torque prevailing nut with an impact wrench. ALWAYS use a torque wrench to correctly tighten torque prevailing nuts.

4. Install the spindle shaft. (See "Assembly and Installation").
5. Install the final drive cover. ((See "MFWD FINAL DRIVE COVER INSTALLATION").

MFWD SPINDLE HOUSING

Removal and Disassembly:

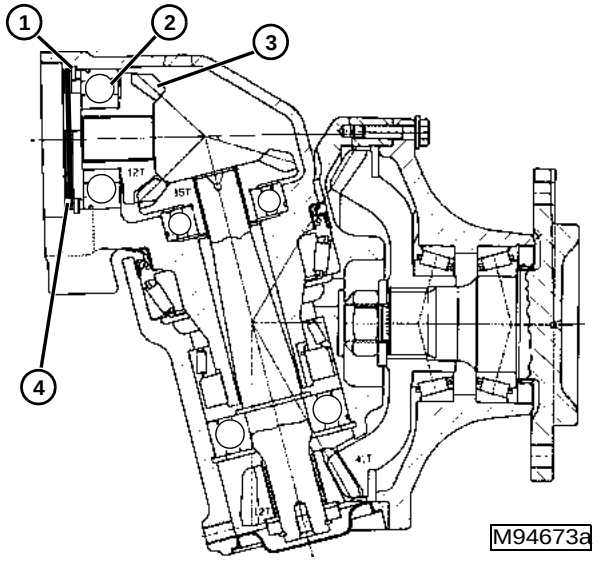
1. Remove the final drive housing. (See "MFWD FINAL DRIVE COVER REMOVAL AND INSPECTION").
2. Remove four cap screws fastening the spindle housing to the MFWD housing.
3. Remove the internal snap ring from the spindle housing.
4. Remove the bearing and axle gear (12T) assembly from the spindle housing.
5. Remove the bearing and upper bevel gear (15T) assembly from the spindle housing.
6. If necessary press the bearings from the gears.

NOTE: The bearings are pressed onto the gears, and are slip fits into the housing.

7. Clean and inspect all parts. Replace any unserviceable parts.

Assembly and Installation:

1. Install the bearing and upper bevel gear (15T) assembly to the spindle housing.
2. Install the bearing and axle gear (12T) assembly to the spindle housing.
3. Install the internal snap ring to the spindle housing.
4. Set the backlash of the axle gear:
   - Measure the distance between the bearing and the snap ring at several locations.



1. Shim
2. Bearing
3. Axle Gear (12T)
4. Snap Ring

   - Shim the bearing and axle gear to **0.15 - 0.28 mm (0.006 - 0.011 in.)** of end play, to achieve **0.10 - 0.20 mm (0.004 - 0.008 in.)** backlash.
5. Apply John Deere TY6304 sealant to the mating surfaces of the MFWD housing and the spindle housing.
6. Install the spindle housing to the MFWD housing:
   - Apply Loctite® 262 to the threads, and install four cap screws fastening the spindle housing to the MFWD housing.
   - Tighten the cap screws to **286 - 316 N•m (211 - 233 lb-ft).**
7. Install the final drive housing. (See "ASSEMBLY").

MFWD DIFFERENTIAL

Removal and Disassembly:

1. Remove both final drive housings from the MFWD. (See "MFWD FINAL DRIVE COVER").
2. Remove both axle shafts from the MFWD housing.
3. Remove the MFWD drive shaft. (See "MFWD DRIVE SHAFT REMOVAL AND INSTALLATION).
4. Remove twelve cap screws fastening the differential cover to the MFWD housing.
5. Remove the differential cover and differential case from the MFWD housing.
6. Remove the cap screws for the bearing caps.
7. Remove the differential case from the differential cover.
8. Remove ten cap screws. Remove the ring gear from the differential case.

NOTE: The differential case and internal parts comes as an assembly. If any damage is apparent there is no need to disassemble the case, the whole assembly must be replaced.

9. If internal damage is suspected disassemble the differential case assembly and inspect all parts.

NOTE: Remove the differential case bearings only if necessary. Make sure shims between the bearings and the differential case are retained and marked as to which side they were on so they may be installed to their original position.

10. Clean and inspect all parts and check parts for wear. Replace any unserviceable parts.
11. Remove the pinion nut. Do not discard the nut at this time.
12. Remove the differential pinion from the differential cover.

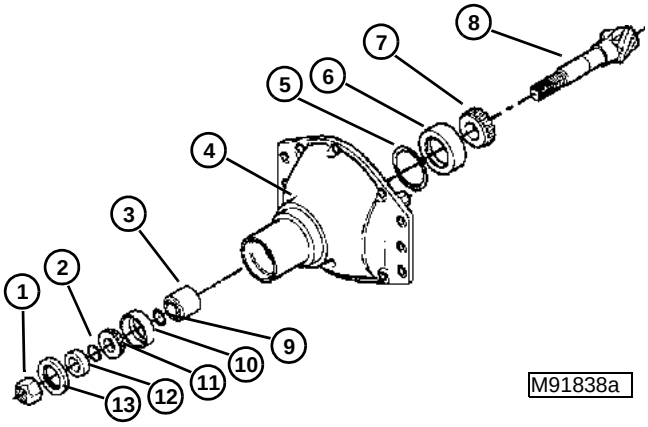
IMPORTANT: The pinion retaining nut is a special "torque prevailing" nut. ALWAYS replace this nut DO NOT reuse.
NEVER tighten a torque prevailing nut with an impact wrench.
ALWAYS use a torque wrench to correctly tighten torque prevailing nuts.

13. Disassemble the pinion shaft assembly.

NOTE: The ring gear and pinion gear are serviced as an assembly. If either the ring gear or pinion has wear or damage both must be replaced.

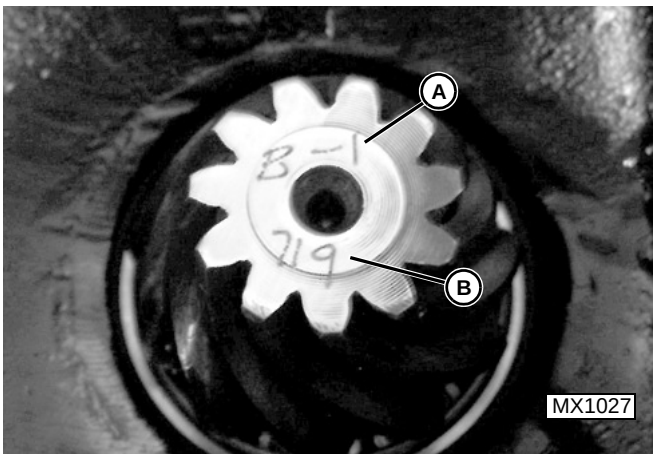
14. Clean and inspect all parts and check parts for wear. Replace any unserviceable parts.

Assembly and Installation:

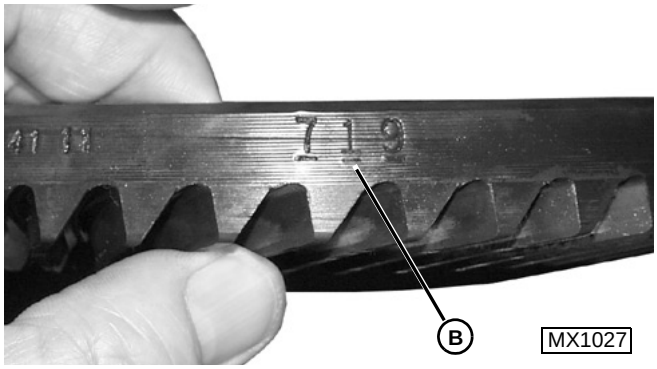


1. Nut
2. O-ring
3. Spacer
4. Cover
5. Inner Shim
6. Bearing Cup
7. Bearing Cone
8. Pinion
9. Outer Shim
10. Bearing Cup
11. Bearing Cone
12. Spacer
13. Seal

1. Assemble the bearing cone (7) to the pinion (8).
   - The inner shim(s) (5) are under the bearing cup (6) and set the pinion height. If the original pinion is being used, use the original shims, or install new shims the same thickness as the original shims.

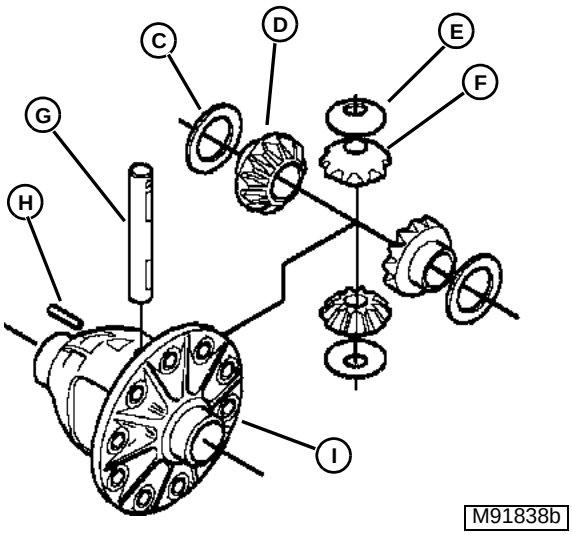


   - If the pinion is being replaced, notice the **(+)** or **(–)** number (A) on the end of the pinion gear. This indicates the best running position of each particular gear set in thousandths of an inch. If the number on the new set is not the same as the number on the one being replaced, adjust the height by adding or removing inner shim(s) (5) from the original shim pack according to the dimension etched in the head of the pinion.
   - Example: If the old pinion reads **+2** and the new pinion is marked **–1**, add **0.003 in.** shims to the original shim pack.



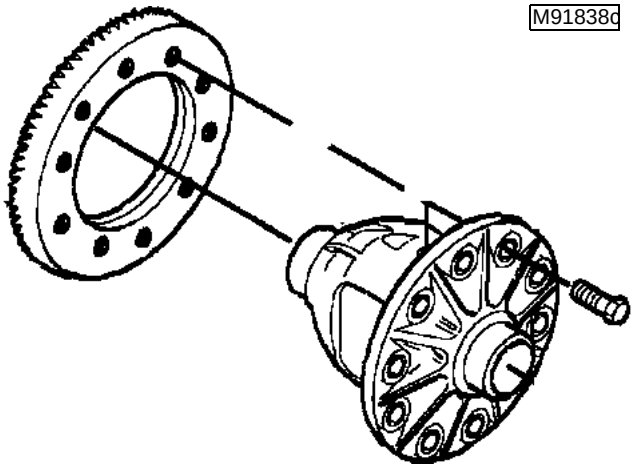
NOTE: Number (B) on pinion and ring gear indicate matched set.

2. Assemble the inner bearing cup (6) and any shims (5) in the differential cover.
3. Install the pinion (8) in the differential cover:
   - Place the pinion in the cover, and install the spacer (3), outer shim (9), bearing cone (11), O-ring (2), seal (13), spacer (12), and the old nut (1).
4. Tighten the old pinion nut to **258 - 285 N•m (190 - 210 lb-ft),** and check the rotation of the pinion:
   - It should require **0.8 - 1.4 N•m (7 - 12 lb-in.)** of torque to rotate on the pinion.
   - If the pinion does not turn within specification, adjust the shim pack. Add shims if torque is too high, remove shims if torque is too low.
   - When the pinion is shimmed correctly replace the old pinion retaining nut with a new pinion retaining nut. Tighten the new nut to **258 - 285 N•m (190 - 210 lb-ft),** and recheck the rotation of the pinion.

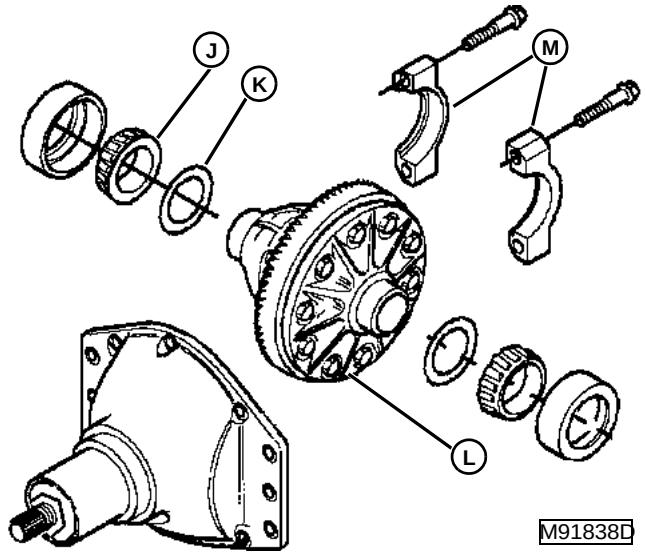


NOTE: The differential case and all parts shown above are serviced as an assembly only.

5. Install the washers (C) to the side gears (D) and install side gears into differential case (I).
6. Install concave washers (E) onto pinion gears (F). Install pinion gears to side gears and turn gears to align with hole in differential case. Install shaft (G) and secure with roll pin (H).



7. Install the ring gear to the differential case. Tighten the ring gear bolts to **79 - 88 N•m (58 - 65 lb-ft).**



NOTE: There may be several shims on each side of differential case.

8. If bearings (J) were removed, place original shims (K) or new shims equaling the same thickness, on the same side of the differential assembly (L) they were removed from. Install new bearings on the differential assembly.
9. Install the bearing caps (M). Tighten the cap screws for the bearing caps to **54 - 68 N•m (40 - 50 lb-ft).**
   - The bearing shim(s) (K), control the differential gear backlash and the preload of the bearings. If the original differential case, bearings, and gear set are being used, install the original shims, or new shims totalling the original thickness.
   - If the differential case bearings or gear set are being replaced, set the bearing preload and gear backlash by adding or removing shim(s) between the ring gear side bearing and differential case.
   - Shim the bearings to a preload of **0.03 - 0.08 mm (0.001- 0.004 in.).**
10. Install the differential case assembly to the differential cover. Check gear backlash with a dial indicator.
    - Gear backlash is adjusted by changing the shim pack thickness on the ring gear side bearing. Removing shims increases backlash, adding shims decreases backlash.

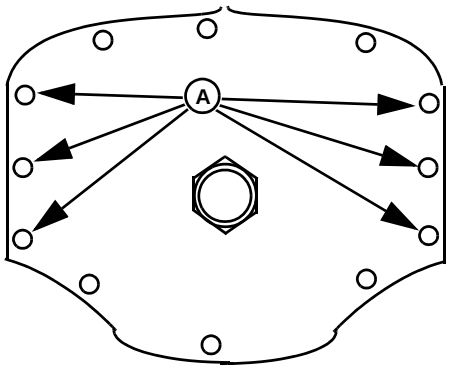
IMPORTANT: Whatever shim thickness is added to one side of the differential case must be removed from the other side. Or whatever shims are removed from one side must be added to the other to keep bearing preload from changing.

11. Adjust backlash to specification.

Specification:

Backlash . . . . . 0.03 - 0.08 mm (0.001 - 0.004 in.)

12. Apply John Deere Sealant TY6304 to the differential cover.



13. Install the differential cover to the MFWD housing.
14. Apply John Deere TY9370 thread lock and sealer to the six screws (4 on S20BZ107-1 axles) (A) on the outside of the differential cover. Tighten the cap screws to specification.

Specification:

Differential Cover Bolts . . 61 - 68 N•m (45 - 50 lb-ft).

TRACTOR SPLITTING (REAR)

Prepare the Tractor:

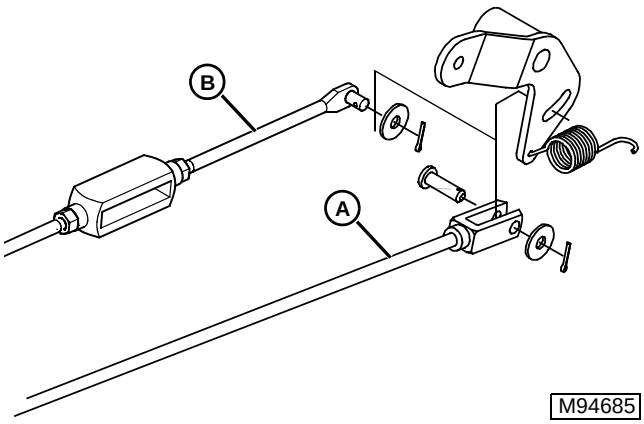
1. Remove any mid or front attachments and mid or front PTO shaft.
2. Park tractor on a level surface and set park brake.
3. Remove seat and seat support. (See "SEAT AND SEAT SUPPORT" in Miscellaneous section).
4. Remove kick plate. (See "KICK PLATE" in Miscellaneous section.)
5. Remove operator's platform. (See "OPERATOR'S PLATFORM" in Miscellaneous section).
6. Remove fenders. (See "REAR FENDERS" in Miscellaneous section).
7. Remove LH and RH closeout panels. (See "SEAT CLOSEOUT PANELS" in Miscellaneous section.)
8. Disconnect the battery negative terminal.
9. Cycle all hydraulic controls to relieve system pressure.

CAUTION

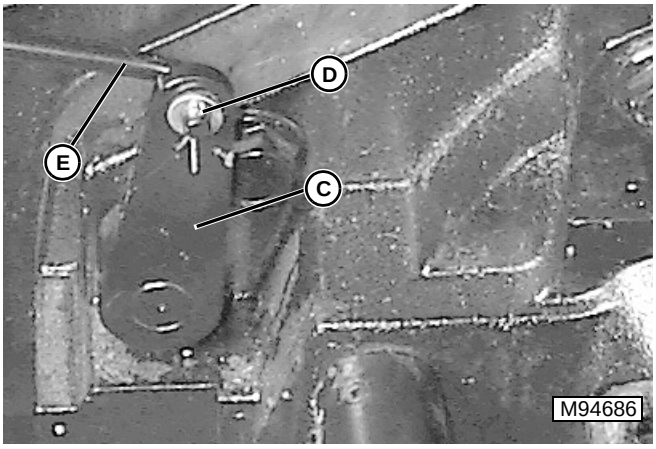
CAUTION: To avoid injury from escaping hydraulic oil under pressure, relieve the pressure in the system by stopping the engine and operating all hydraulic control valves.

NOTE: Hydraulic reservoir contains approximately 26 L (6.8 gal) of oil. Have a suitable container ready to catch drain oil.

10. Drain hydraulic reservoir.
11. Locate and disconnect all electrical connectors attaching wiring harness to switches and lights on rear half of tractor. Unfasten wiring harness from cable clips and move harness away from rear half of tractor.



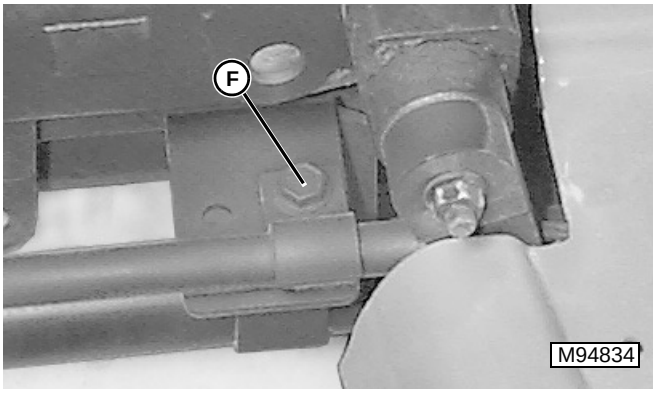
12. Disconnect lower brake rods at rear brake levers.
    - (A) Straight Rod and Clevis Style
    - (B) Turnbuckle Rod and Pin Style



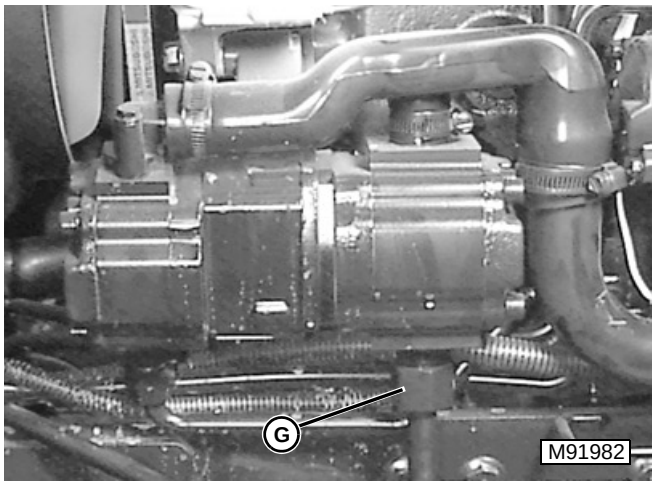
(Hydrostatic Model Shown)

NOTE: On hydrostatic models, differential lock lever (C) is located on the LH side of the tractor. On gear models, it is located on the RH side.

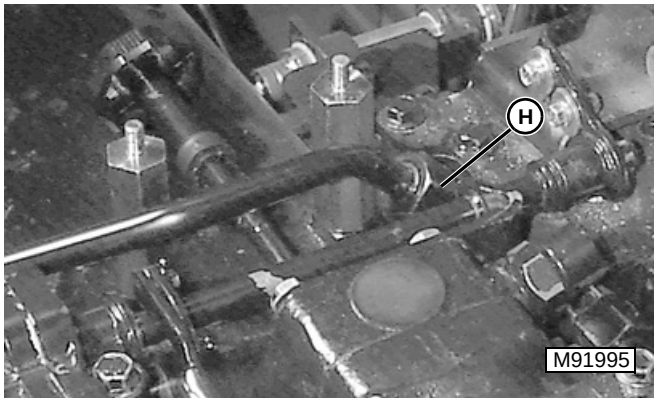
13. Remove cotter pin (D) and washer, and disconnect differential lock rod (E) from lever. Move rod aside.



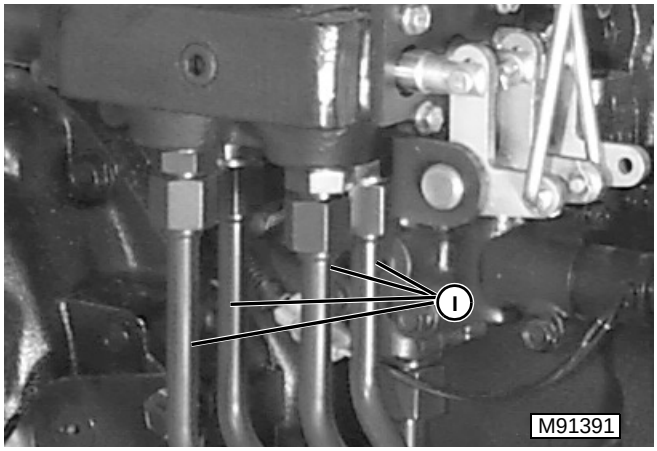
14. Remove cap screw (F) and SCV pressure tube clamp.



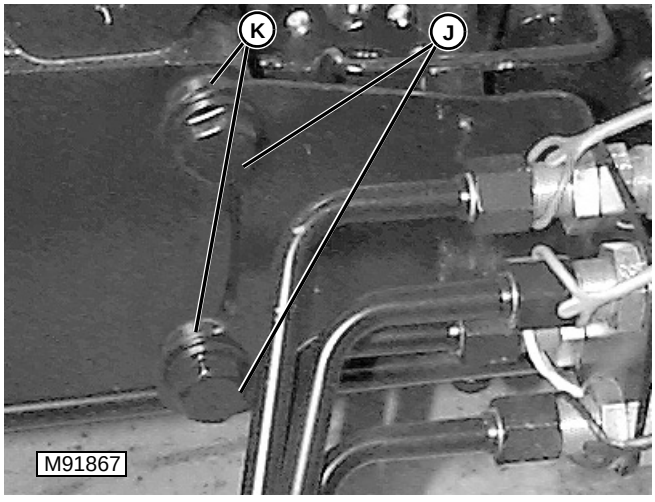
15. Disconnect pressure tube (G) at rear gear pump.



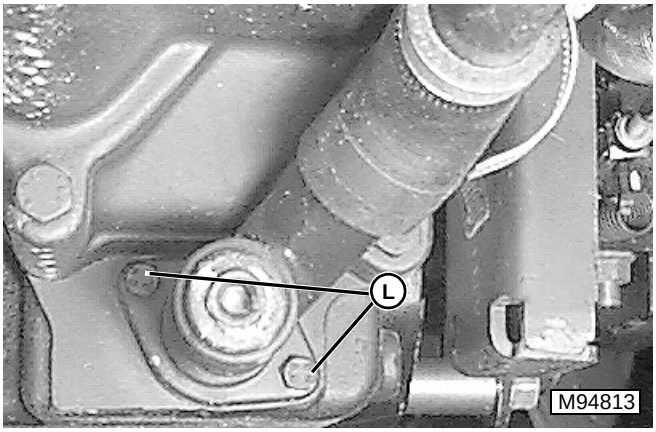
16. Disconnect hydraulic pressure tube (H) at SCV (Selective Control Valve) or manifold block, and move tube aside.



17. If equipped, disconnect SCV work port tubes (I) at SCV.



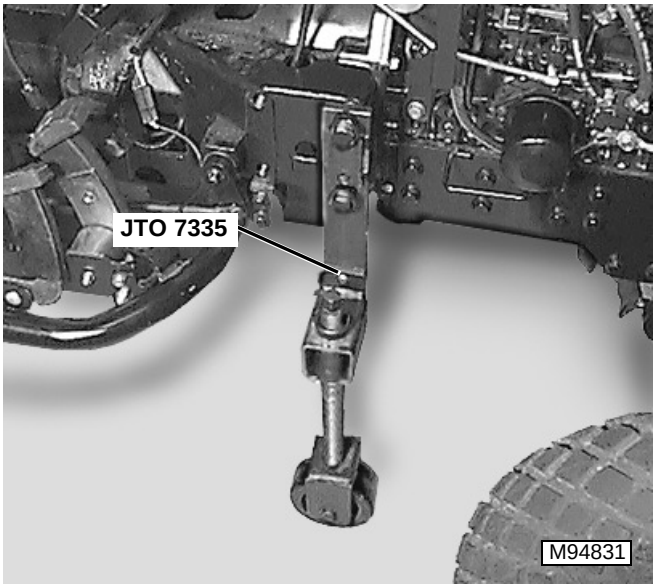
18. Remove two cap screws (J) and two spacers (K) that attach tube support bracket to frame. Remove tube support bracket and tubes as an assembly.



19. Remove two cap screws (L) and disconnect suction tube manifold from differential housing.

IMPORTANT: Check for, and disconnect any additional accessory wires or hydraulic tubes connecting rear half to front half before splitting tractor.

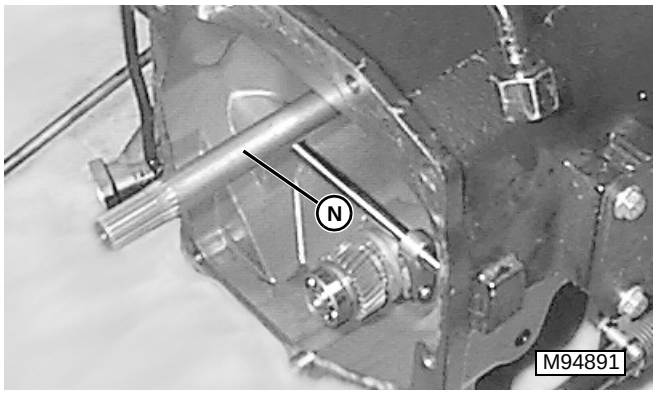
Splitting the Tractor:



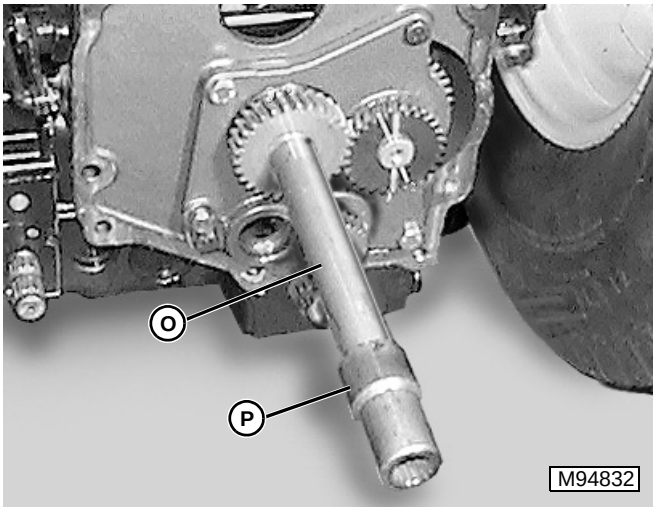
1. Using four suitable cap screws, secure two JTO 7335 splitting stands to the tunnel, or engine section of the tractor. Adjust splitting stands so that wheels contact the floor, and are parallel to the tractor wheels.
2. Using suitable stands or an overhead crane, support the differential housing of the tractor to prevent it from tipping.

3. Remove all cap screws (M) attaching tunnel section to differential housing. Note length and locations of cap screws when removing.
4. Gently pry around edges to separate tractor halves.
5. Roll engine and tunnel section away from differential housing.

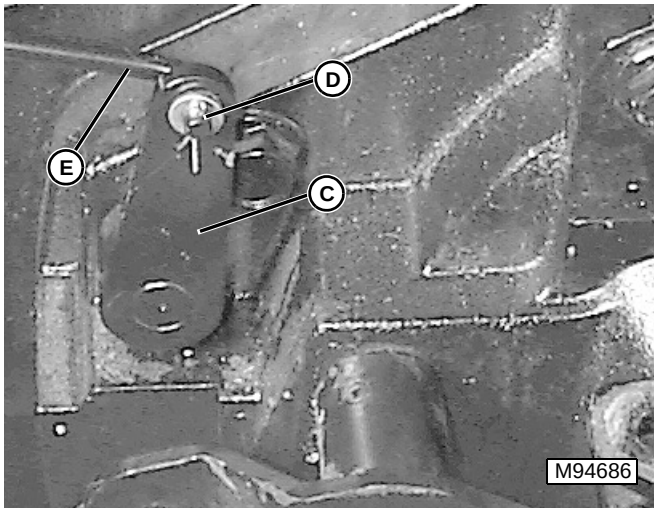
Assemble Tractor Halves:



1. If removed, install PTO drive shaft (N) to tunnel (front) section of tractor.



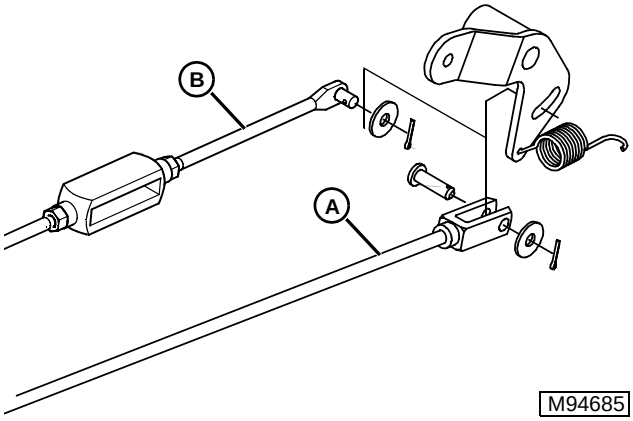
2. Install drive shaft (O) and coupler (P) to tunnel (front) section of tractor.
3. Clean mating surfaces of tunnel and differential housing to remove old sealant.
4. Apply a bead of sealant to flanges of one of the tractor sections.
5. Roll front section of tractor to rear section.
6. Align tractor halves:
   - Adjust splitting stands as required to align shafts, locator bushings, and cap screw holes.
   - Engage rear PTO.
   - Using a suitable wire hook, lift and support the PTO drive shaft while applying light pressure to the tractor halves until PTO shaft engages splines on clutch/brake coupler. If necessary, rotate PTO stub shaft at rear of tractor to align splines on shaft with coupler.
   - If necessary, use a suitable wire hook to raise drive shaft slightly to align gear teeth and shaft end with gears and bearing in bearing plate.
7. Move tractor sections together and retain with cap screws in locations as noted during disassembly. Tighten cap screws to **126 - 154 N•m (95 - 115 lb-ft)**.
8. Remove splitting stands.



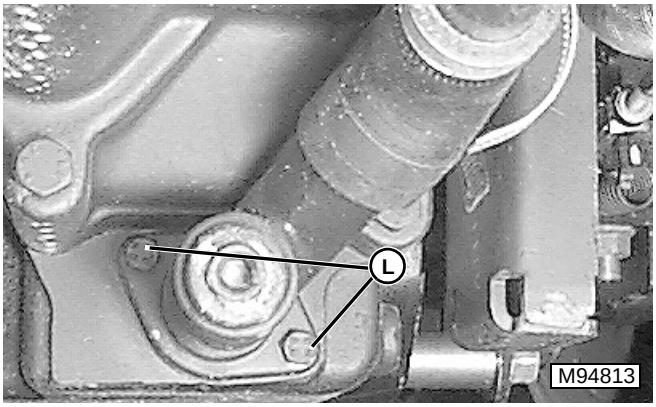
(Hydrostatic Model Shown)

NOTE: On hydrostatic models, differential lock lever is located on the LH side of the tractor. On gear models, it is located on the RH side.

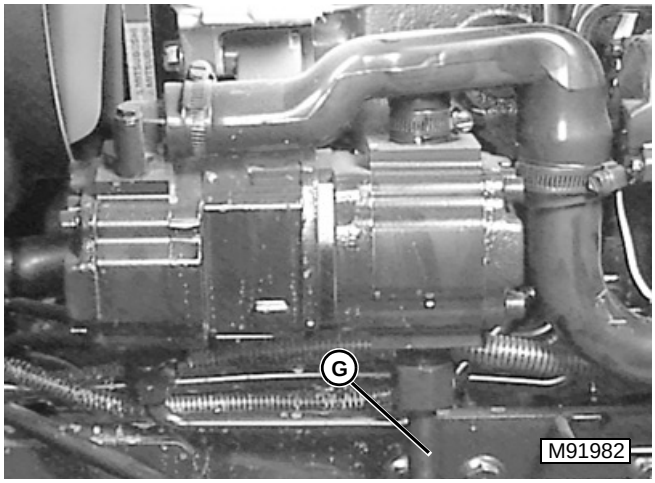
9. Reconnect differential lock rod (E) to lever (C). Install washer and a new cotter pin (D).



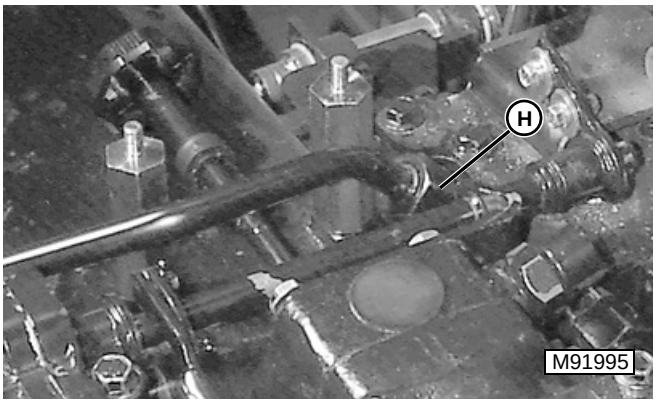
10. Reconnect lower brake rods at rear brake levers.
    - (A) Straight Rod and Clevis Style - Insert pin through clevis and brake lever, and secure with washer and cotter pin.
    - (B) Turnbuckle Rod and Pin Style - Insert end of rod through brake lever and secure with washer and cotter pin.



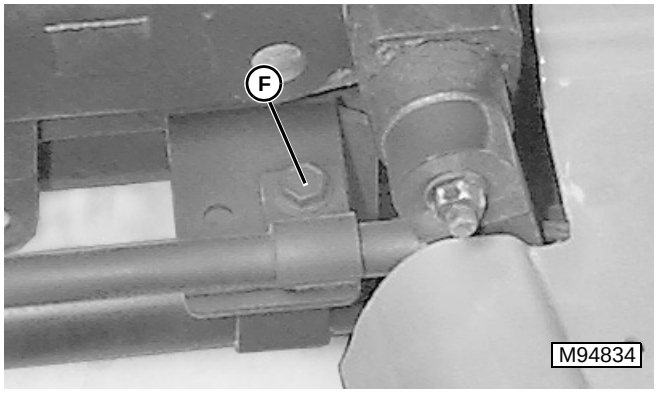
11. Install a new gasket, and attach suction tube manifold to differential housing. Retain with two cap screws (L).



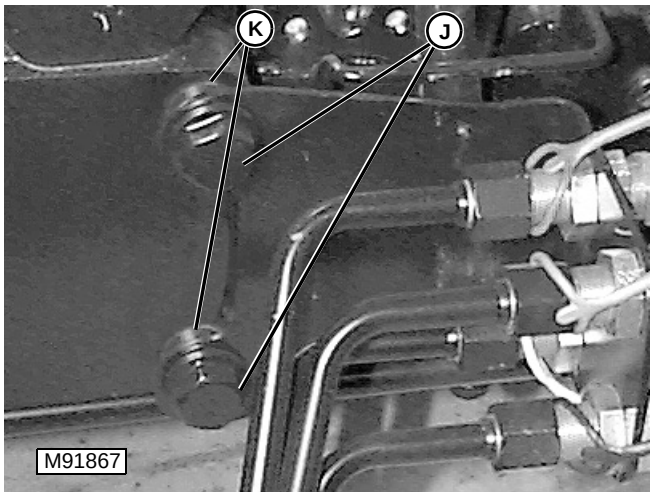
12. Attach SCV pressure tube to rear gear pump. Tighten tube nut (G) to **55 - 79 N•m (40 - 59 lb-ft)**.



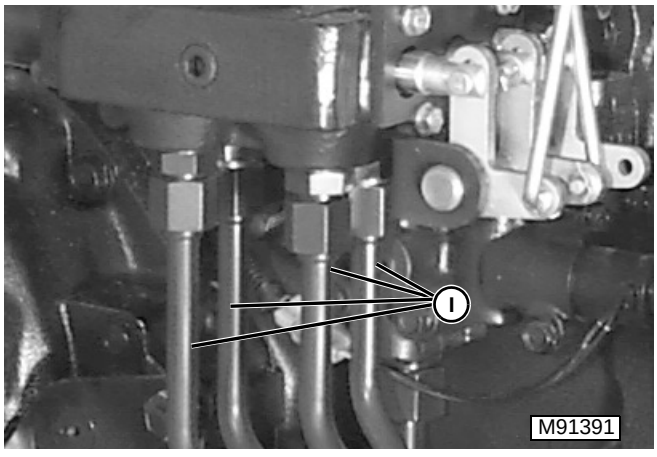
13. Attach SCV pressure tube to SCV. Tighten tube nut (H) to **55 - 79 N•m (40 - 59 lb-ft)**.



14. Install tube clamp to SCV pressure tube. Retain with cap screw (F).



15. Install tube support bracket and tubes as an assembly. Install two spacers (K) and two cap screws (J) that attach tube support bracket to frame.



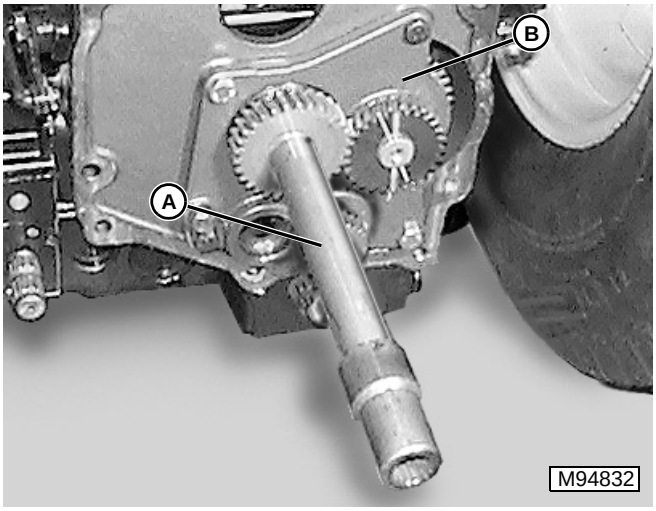
16. Connect SCV work port tubes (I) to SCV. Tighten tube nuts to **40 - 57 N•m (30 - 43 lb-ft)**.
17. Route wiring harness to rear of tractor. Connect electrical connectors as marked at disassembly.

18. Install operator's platform. (See "OPERATORS PLATFORM" in Miscellaneous section).
19. Install kick plate. (See "KICK PLATE" in Miscellaneous section.)
20. Install seat support. (See "SEAT AND SEAT SUPPORT" in Miscellaneous section.)
21. Install seat.
22. Install fenders. (See "REAR FENDERS" in Miscellaneous section.)
23. Install LH and RH closeout panels. (See "SEAT CLOSE OUT PANELS" in Miscellaneous section.)
24. Connect the battery negative terminal.
25. Refill hydraulic oil reservoir to proper level.
26. Bleed air from hydraulic system. (See "HYDRAULIC SYSTEM BLEED PROCEDURE" in Hydraulic section.)

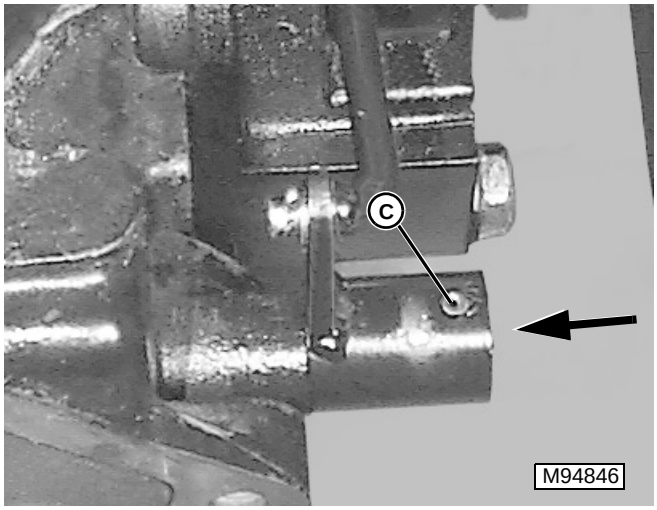
RANGE TRANSMISSION REMOVAL AND INSTALLATION

Removal:

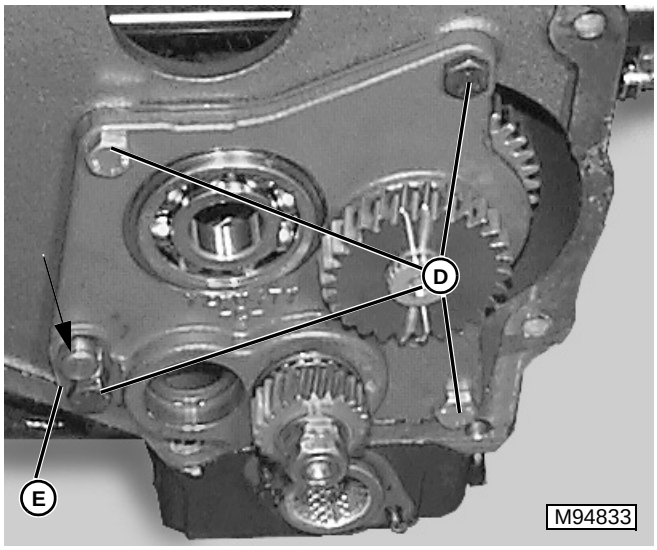
1. Split tractor at rear of tunnel. (See "TRACTOR SPLITTING REAR".)



2. Remove drive shaft (A) and coupler from bearing plate (B) as an assembly.



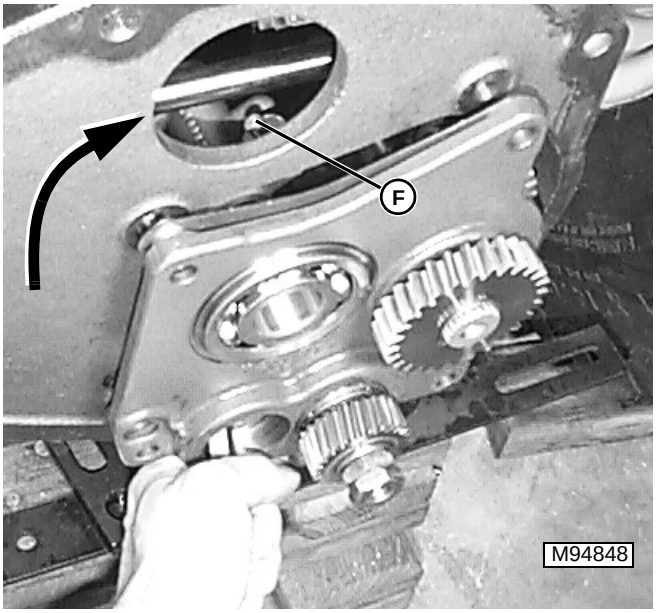
3. Remove spring pin (C) from shift lever arm. Push shift shaft into case as far as it will go.



4. Remove four cap screws (D) from bearing plate. Remove detent shaft locking plate (E) and pull out detent shaft (arrow).

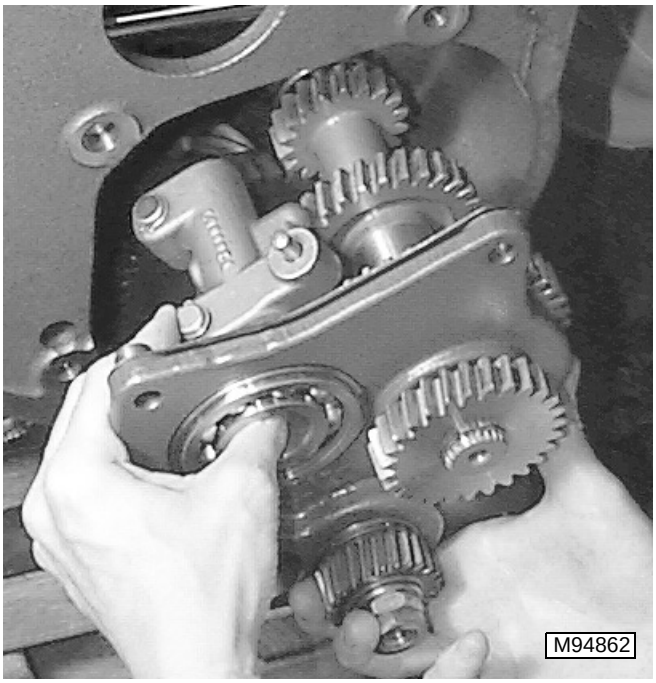
NOTE: Ball and spring for shift detent will fall into differential housing.

5. Pry around edges of cover to loosen shafts and bearings. Do not attempt to remove at this time.



6. Using a suitable pin punch or screwdriver, rotate shift fork assembly (F) on shift collars to clear housing during removal.

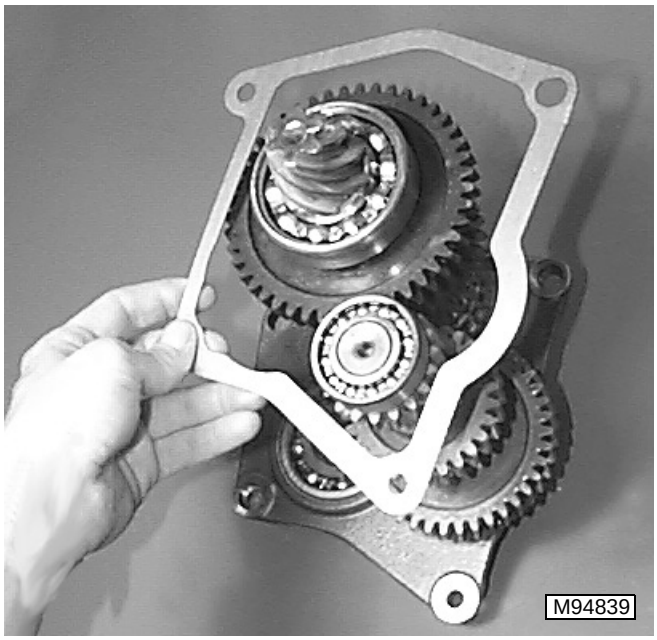
NOTE: This will not work on all tractors. If you are unable to rotate the assembly from the lever, you must remove the rockshaft assembly to gain access to the spring pin which retains the lever to the shaft. After removing the spring pin you can rotate the shifter block to allow transmission removal from the housing.



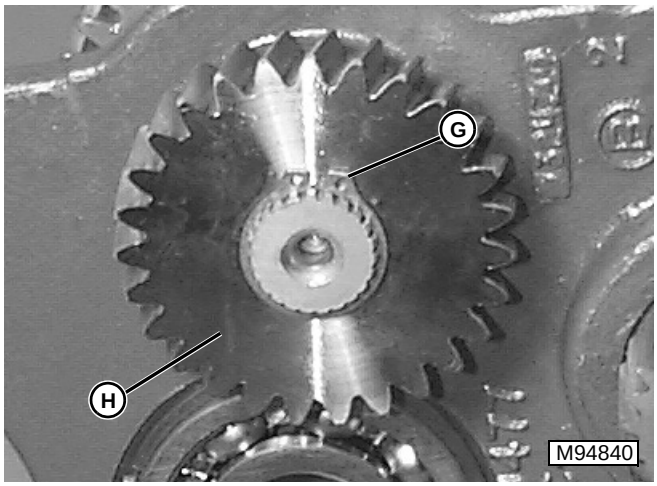
7. Remove range transmission with shift forks as an assembly.

8. Retrieve ball and spring from differential case.

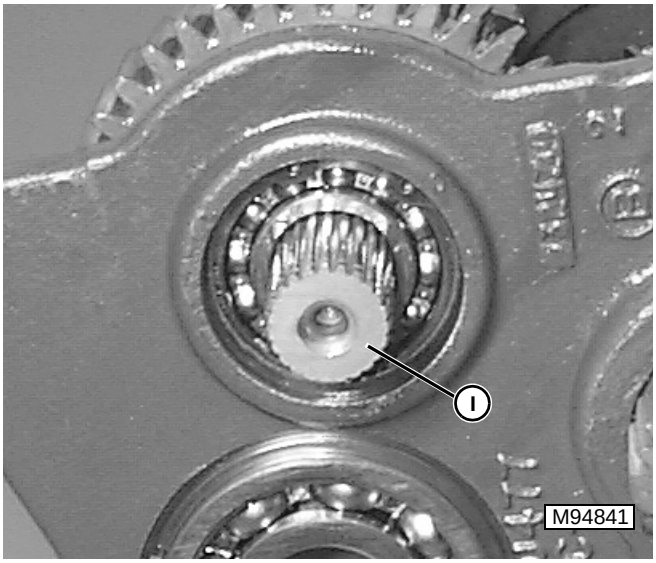
Disassembly:



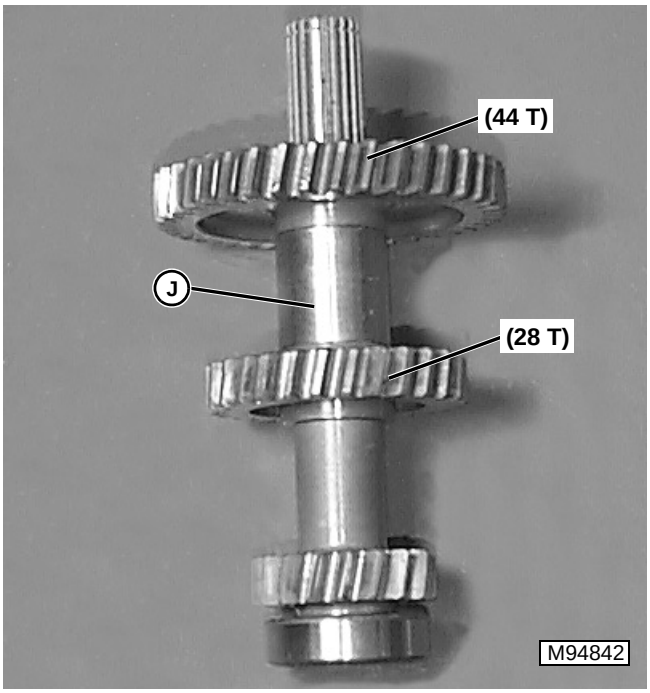
1. Remove shim pack from transmission cover and gears.



2. Remove snap ring (G) from end of counter shaft. Remove 34 tooth gear (H).



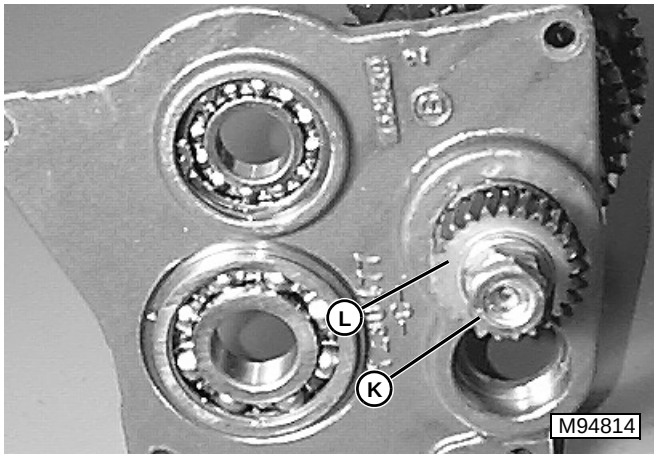
3. Using a press or plastic mallet, remove counter shaft (I) and gears from bearing plate as an assembly.



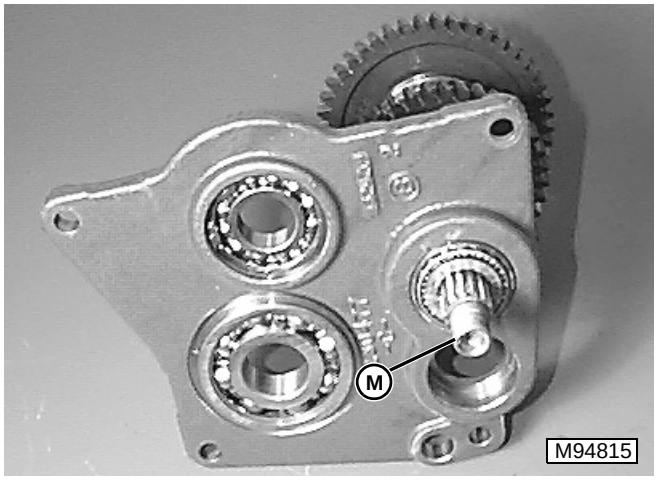
4. Remove 44 tooth gear, spacer (J), and 28 tooth gear from counter shaft.
5. Using a suitable puller or press, remove bearing. Inspect bearing for smooth operation, wear, or damage. Replace as necessary.

IMPORTANT: DO NOT spin bearing using compressed air. Damage to bearing balls, cage, and races could result.

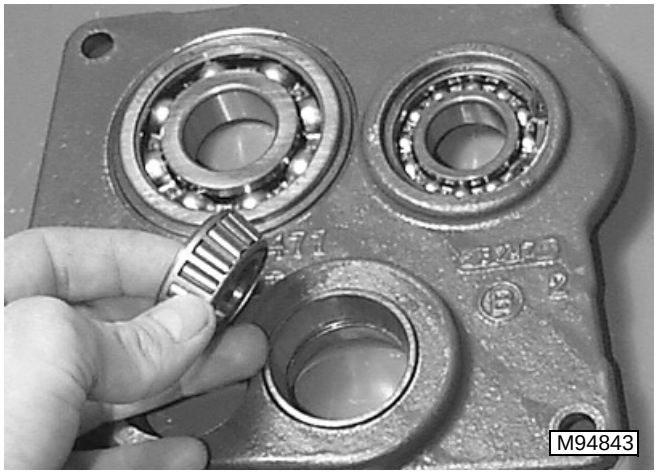
Differential Pinion Shaft Removal & Disassembly:



1. Remove two nuts (K) and washer from end of pinion shaft. Remove 23 or 25 tooth gear (L).

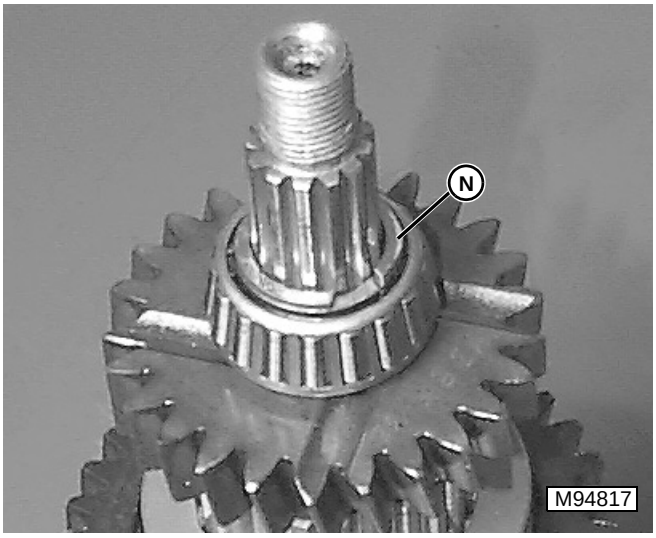


2. Using a press or a plastic mallet, remove pinion shaft (M) from outer bearing cone and bearing plate.

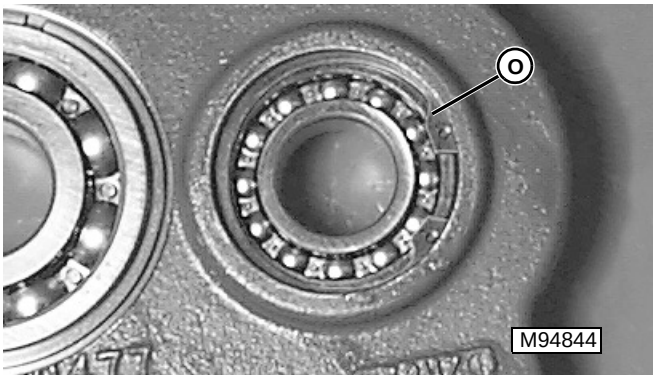


3. Inspect outer bearing for smooth operation, wear, or damage. Replace as necessary.

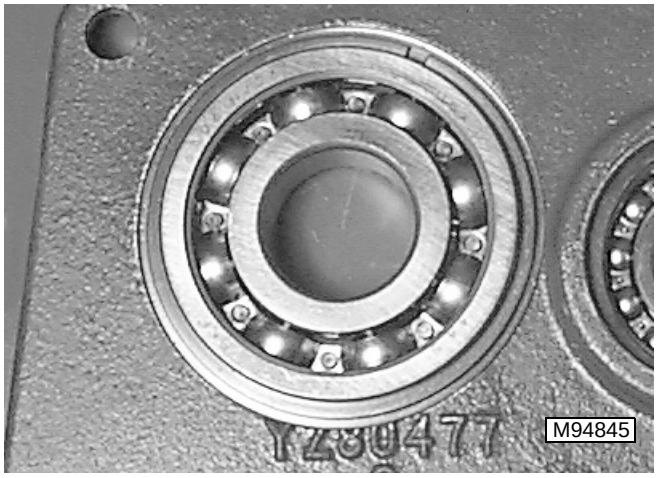
IMPORTANT: DO NOT spin bearings using compressed air. Damage to bearing balls, cage, and races could result.



4. Remove spacer washer (N) from pinion shaft. Inspect inner bearing for smooth operation, wear, or damage. Replace as necessary.

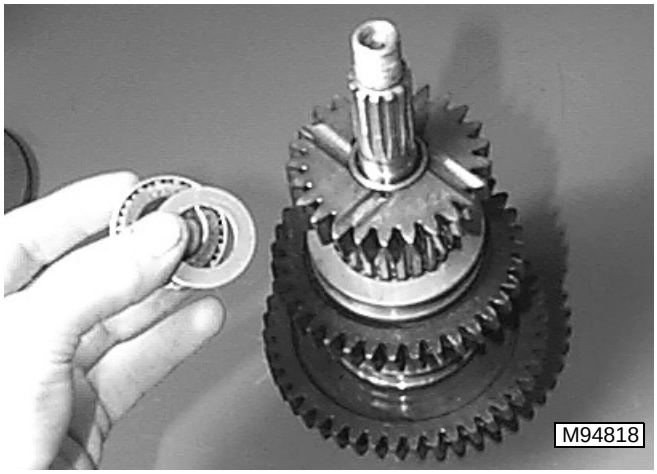


5. Remove snap ring (O) and counter shaft bearing from bearing plate. Inspect bearing for smooth operation, wear, or damage. Replace as necessary.

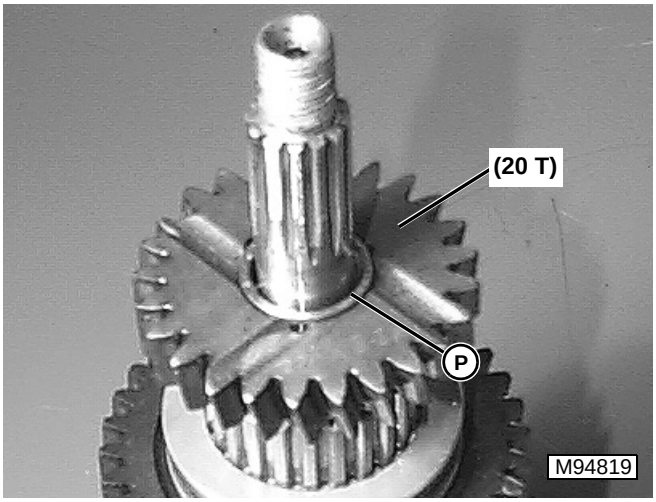


NOTE: It is not necessary to remove snap ring from bearing to remove bearing from bearing plate. Snap ring locates bearing to proper depth.

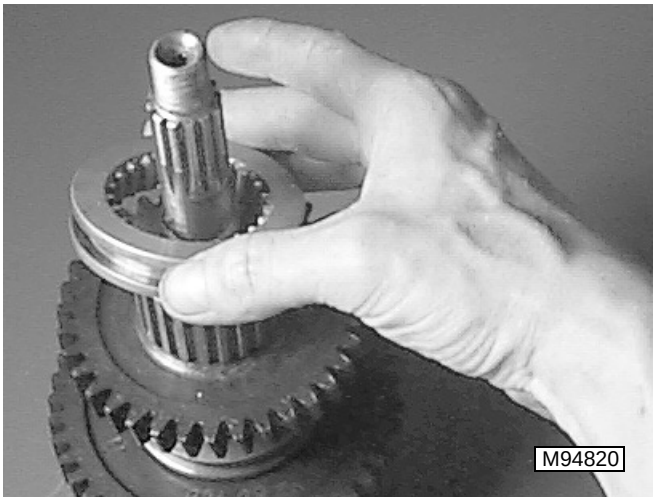
6. Using a suitable bearing driver and plastic mallet or press, remove drive shaft bearing from bearing plate. Inspect bearing for smooth operation, wear, or damage. Replace as necessary.



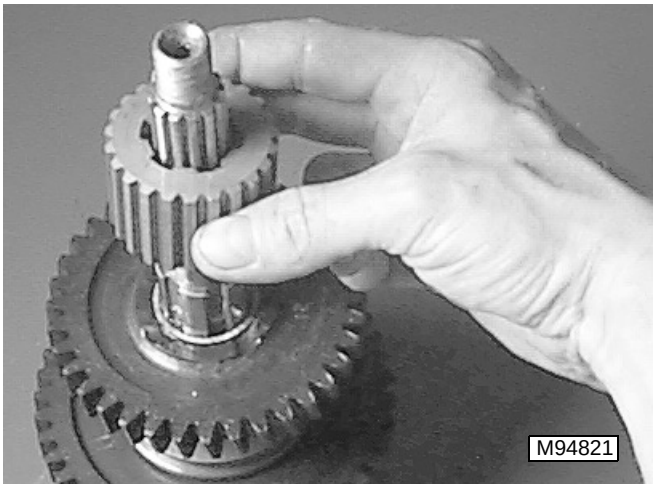
7. Using a suitable puller or press, remove inner bearing cone and spacer from pinion shaft.



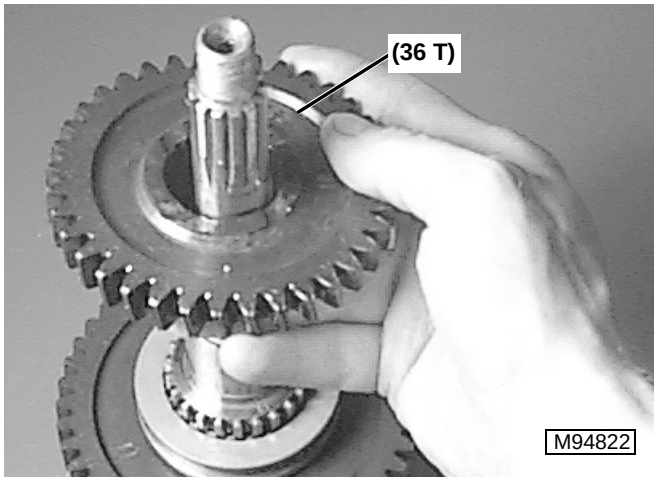
8. Remove 20 tooth gear and bushing (P).



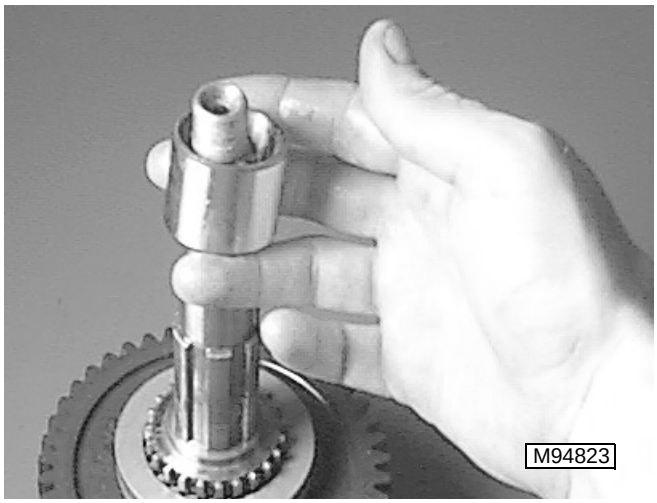
9. Remove shift collar.



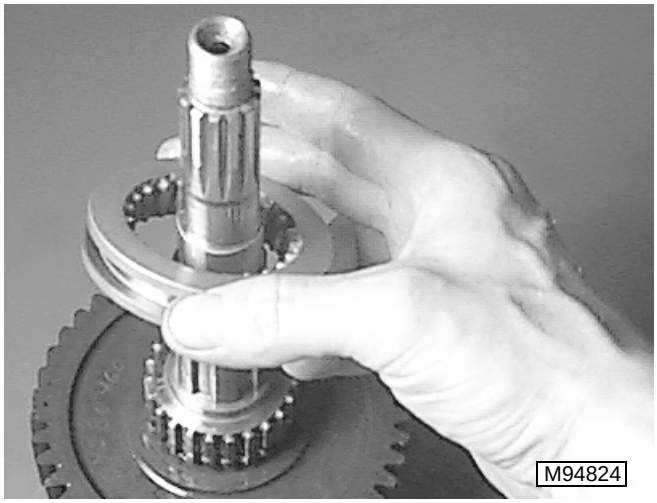
10. Remove splined sleeve.



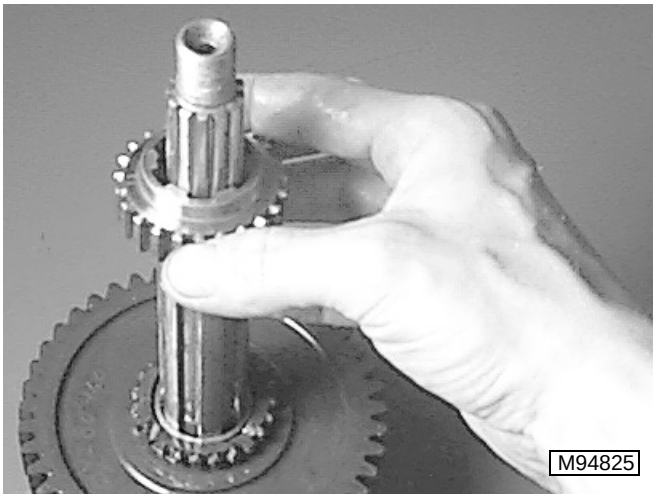
11. Remove 36 tooth gear.



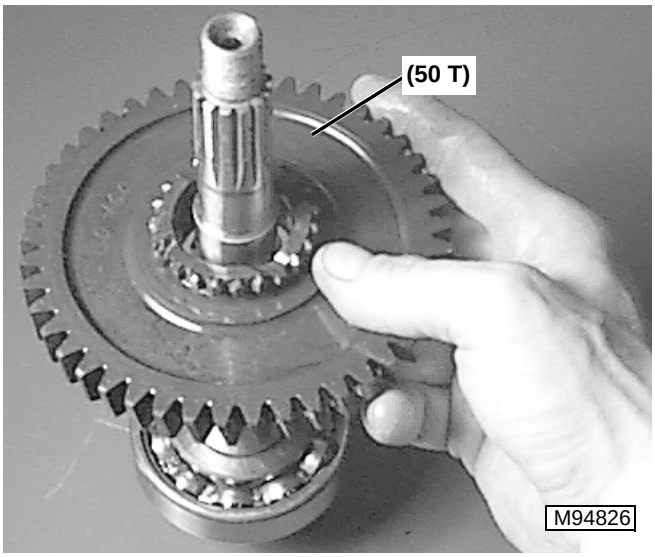
12. Remove bushing.



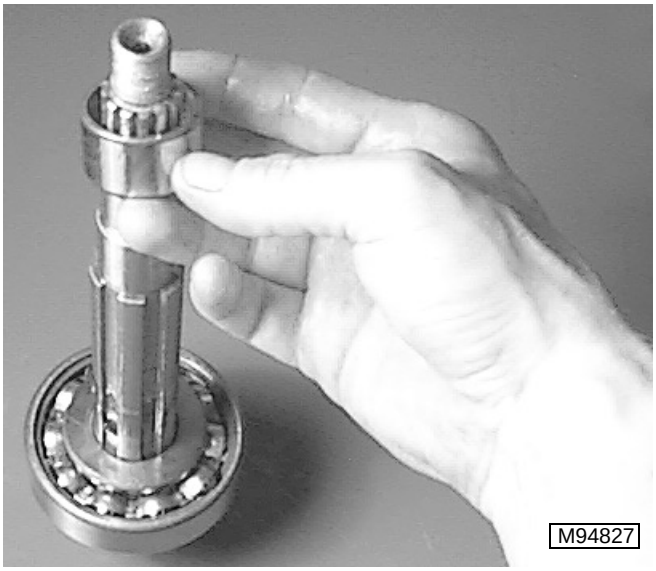
13. Remove shift collar.



14. Remove splined sleeve.



15. Remove 50 tooth gear.



16. Remove bushing.

17. Remove spacer.

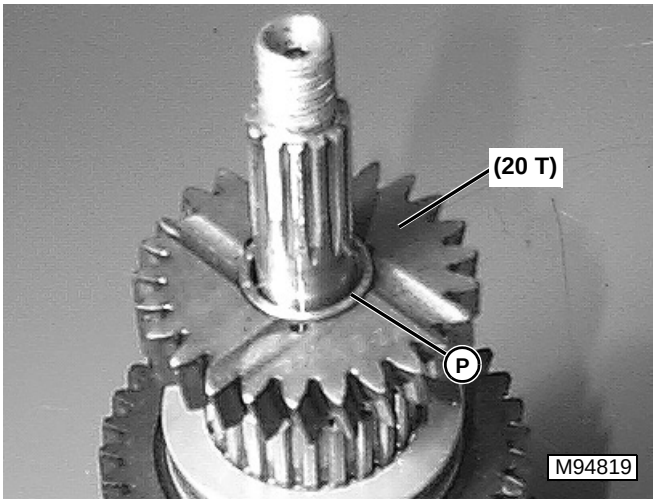
18. Using a suitable puller or press, remove bearing from pinion shaft. Inspect bearing for smooth operation, wear, or damage. Replace as necessary.

IMPORTANT: DO NOT spin bearing using compressed air. Damage to bearing balls, cage, and races could result.

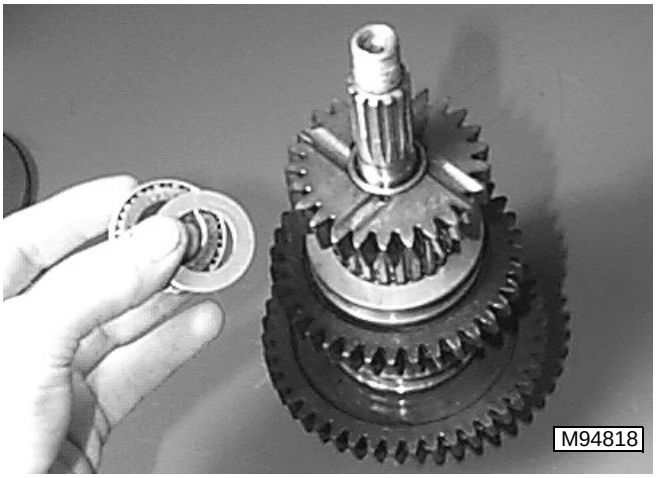
Assembly:

1. Inspect all parts to ensure that they are in good condition. Replace as necessary. Dip press-fit parts in hydraulic oil before assembling.
2. Press bearing onto pinion shaft.
3. Install spacer.

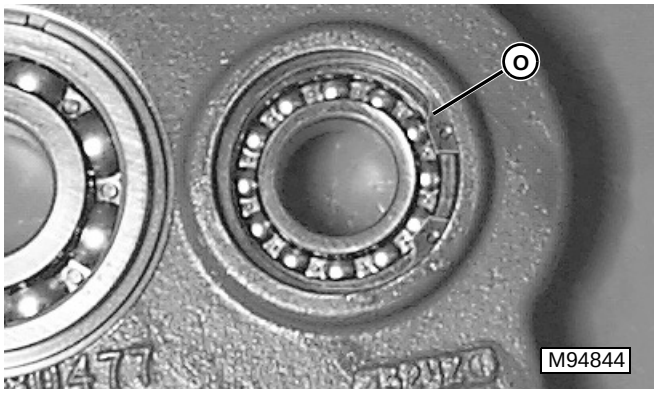
4. Install bushing.
5. Install 50 tooth gear.
6. Install splined sleeve.
7. Install shift collar.
8. Install bushing.
9. Install 36 tooth gear.
10. Install splined sleeve.
11. Install shift collar.



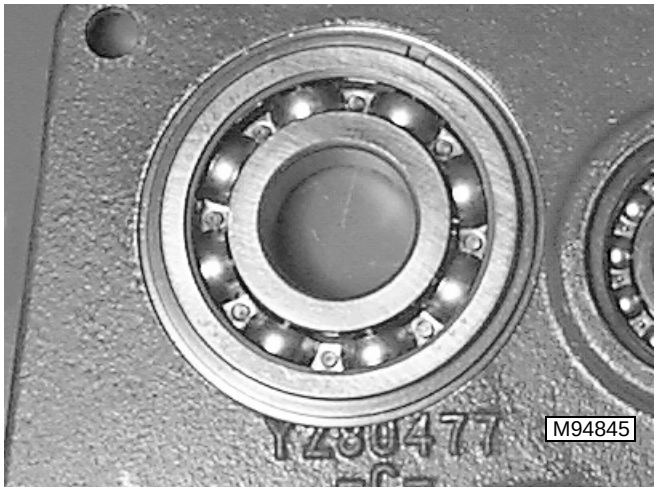
12. Install bushing (P), and 20 tooth gear.



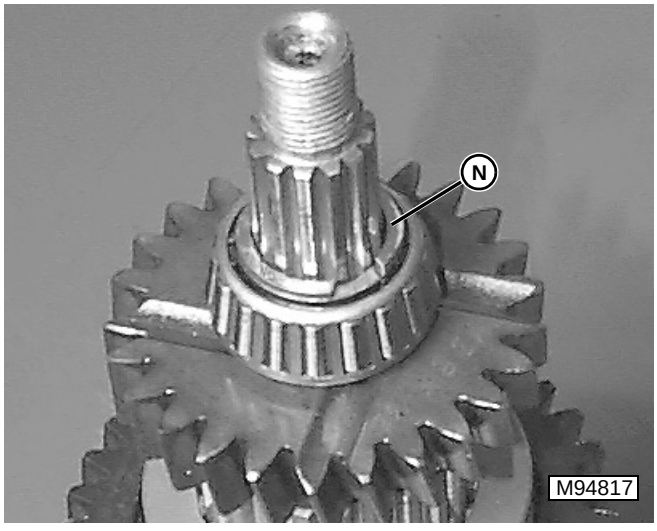
13. Install spacer on top of gear.
14. Using a suitable bearing driver or press, install bearing onto shaft with the flat side towards the spacer.



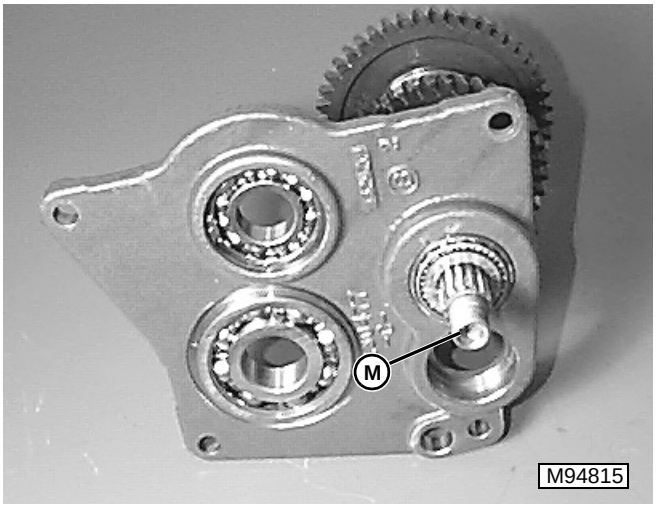
15. If removed, install counter shaft bearing into bearing plate. Retain with snap ring (O).



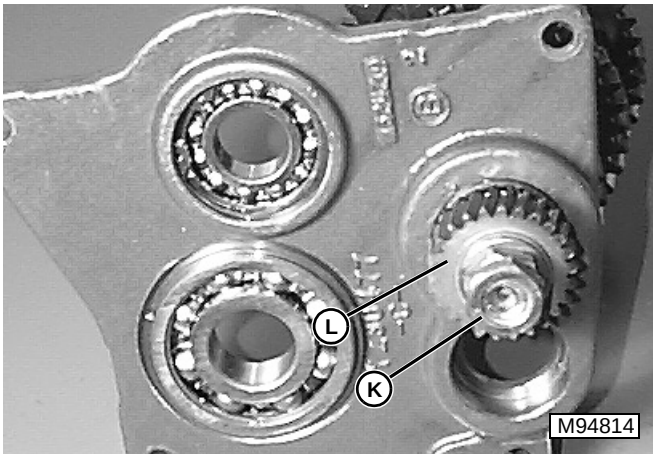
16. If removed, install drive shaft bearing into bearing plate as shown using a press.



17. Install spacer washer (N) on top of bearing cone.



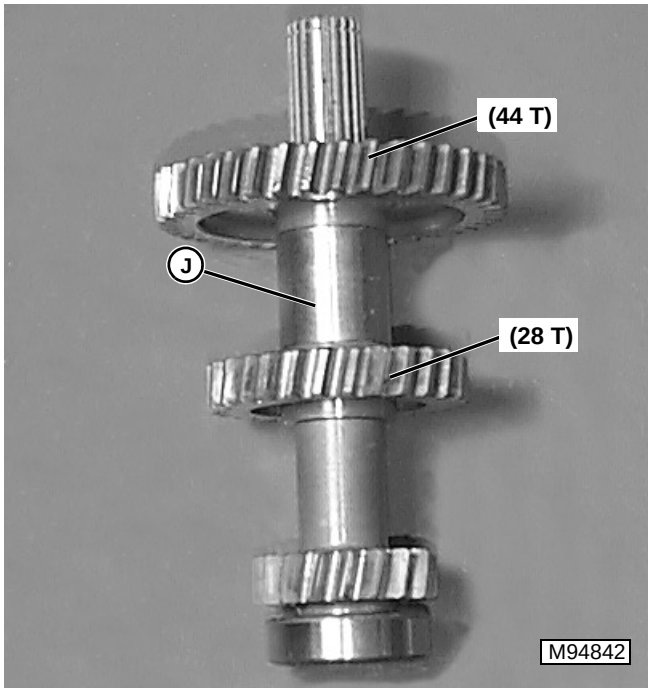
18. Install pinion shaft (M) with gears through bearing plate and outer bearing cone. Press or drive outer bearing cone onto shaft until it contacts the spacer washer.



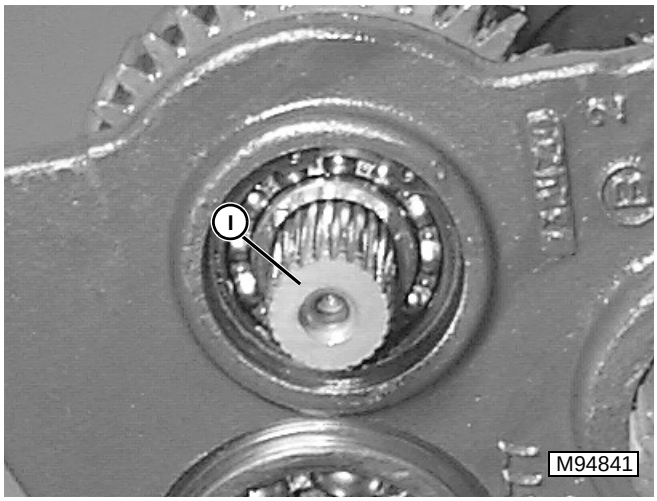
19. Install 23 or 25 tooth gear (L).

NOTE: Apply Loctite® to inner and outer nuts when installing.

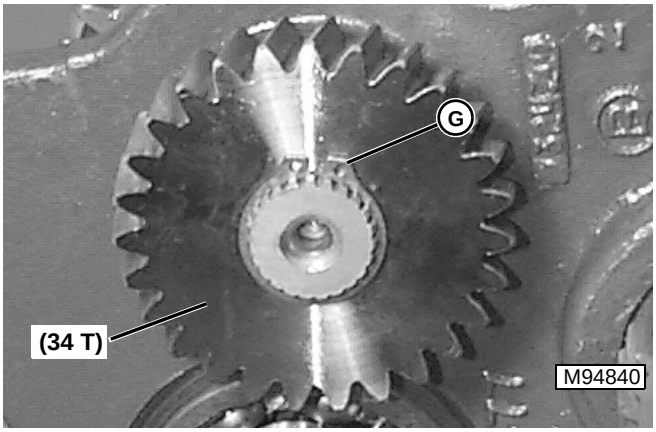
20. Install washer and inner nut. Tighten nut to **136 N•m (100 lb-ft).** Rotate the pinion shaft back and forth to seat bearing while tightening.
21. Install outer nut (K). Tighten nut to **136 N•m (100 lb-ft).**



22. Press bearing onto end of counter shaft. Install 28 tooth gear, spacer (J), and 44 tooth gear onto shaft.



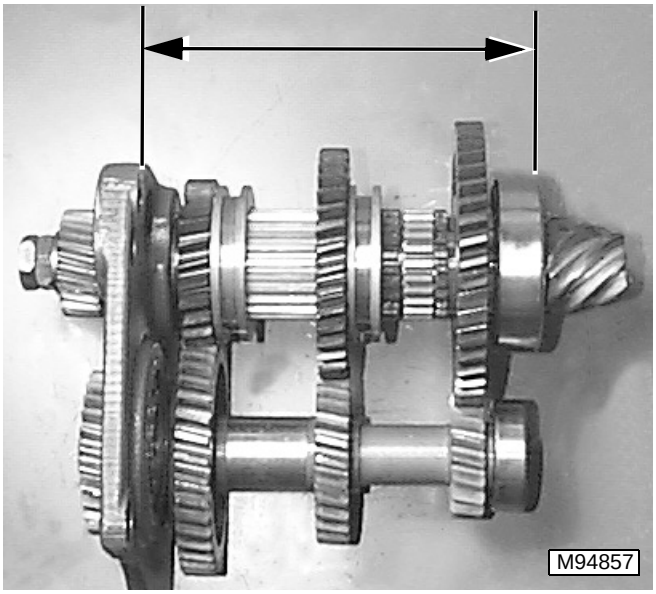
23. Using a press, or plastic mallet, install counter shaft (I) into bearing and bearing plate.



24. Install 34 tooth gear onto end of shaft. Retain with snap ring (G).

Adjust Pinion Depth:

NOTE: Adjust pinion depth only if ring gear and pinion were replaced. If ring and pinion were not replaced, use same shim pack, or same number of shims as were removed at disassembly.

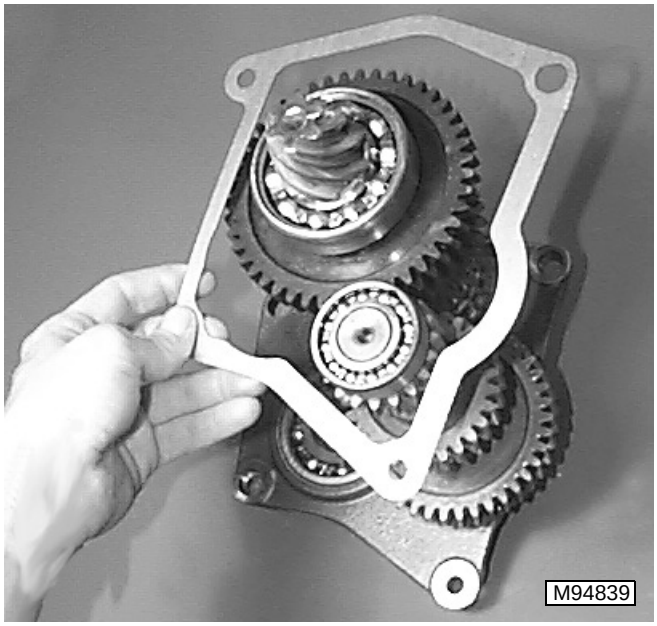


1. Measure from the mounting face of the bearing plate to the rear of the bearing on the pinion shaft. Calculate the amount of shims required to bring this dimension within specification, and make up the appropriate shim pack.

NOTE: Shims are 0.25 mm (0.010 in.) each.

Specification:

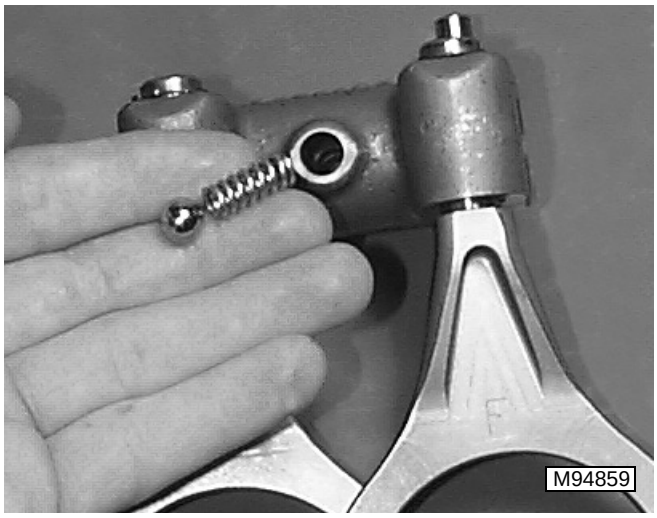
Pinion Depth. 168.58 - 168.84 mm (6.637 - 6.647 in.)



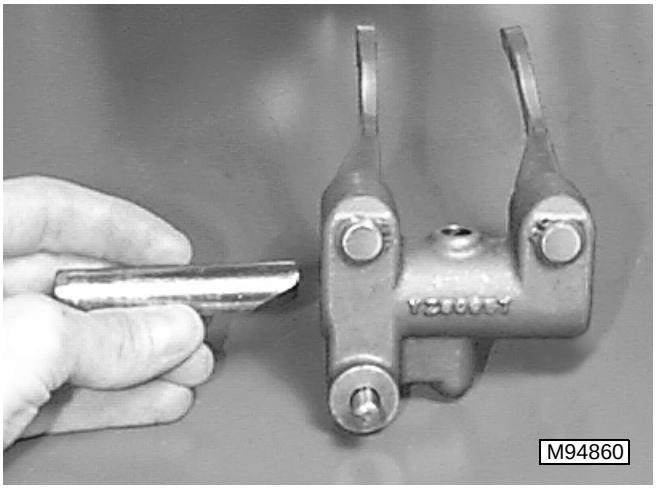
2. Install the shim pack onto the bearing plate, and check measurement from bearing face to shim pack to be sure that it is within specification.

Installation:

NOTE: Complete shift fork assembly if shift fork was disassembled.

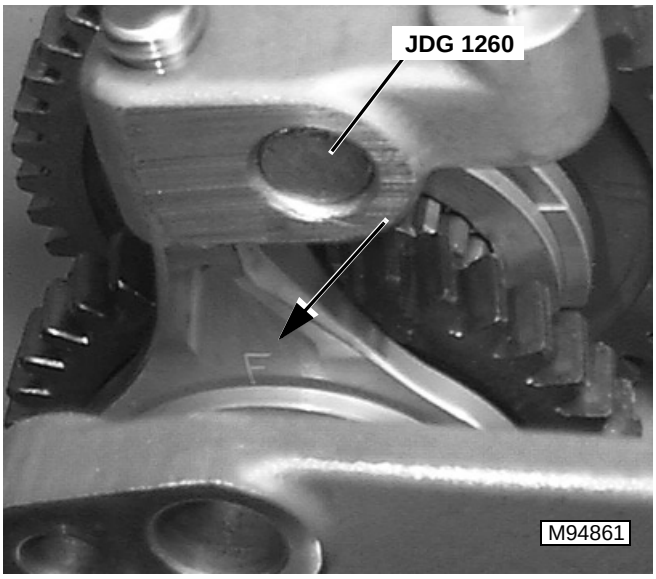


1. Install detent ball and spring into shift fork assembly.

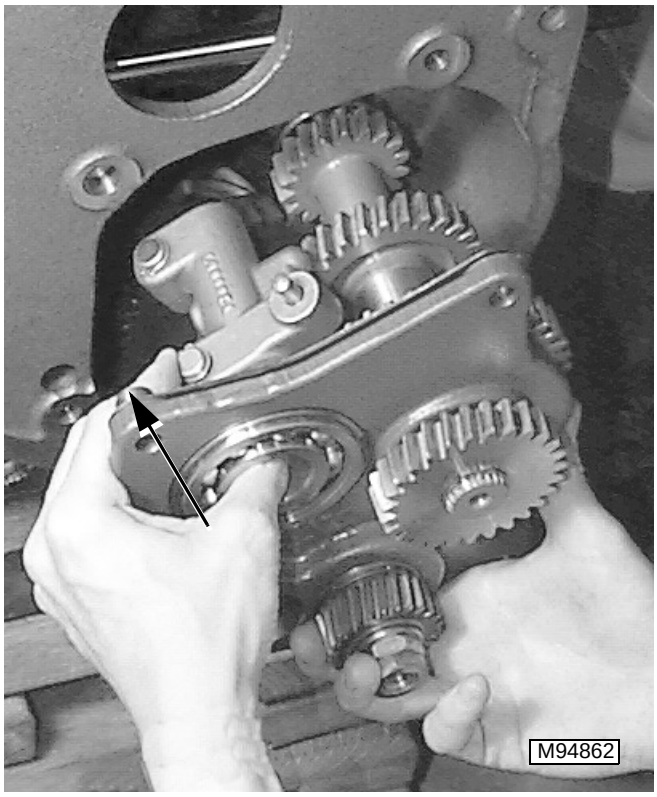


2. Insert JDG 1260 detent ball tool into shift fork to retain ball and spring during installation.

IMPORTANT: Shift forks are each marked with an "F". This marking should face bearing plate (front of tractor).



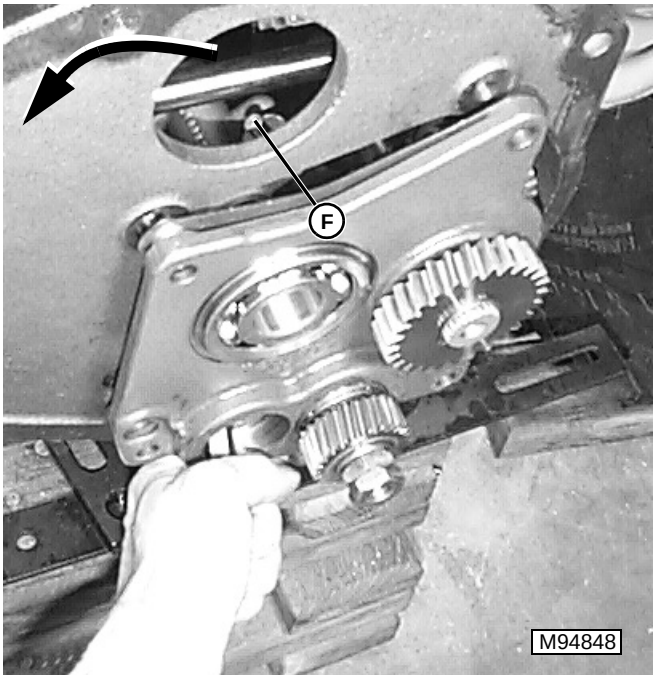
3. Install shift fork assembly to shift collars on range transmission.



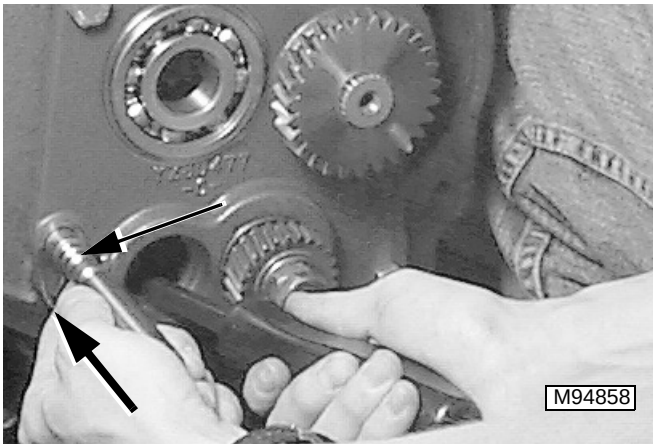
4. Remove guide bushings from differential housing and install to bearing plate to hold shim pack in place during installation.
5. While holding shift fork assembly in place, install range transmission to differential housing. If necessary, use detent shaft and cap screws to help with alignment. Check to make sure counter shaft bearing is properly aligned with bore at rear of differential housing while installing.
6. Using a plastic mallet, tap on end of pinion shaft to seat bearing in differential housing bore.

IMPORTANT: Damage to bearings or transmission may result if pinion bearing and counter shaft bearing are not properly aligned when tightening four cap screws retaining transmission to differential housing.

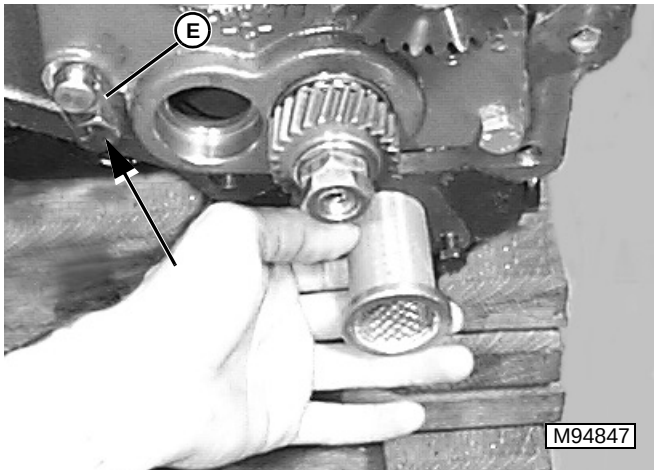
7. Carefully tighten four cap screws evenly to draw the assembly into place.



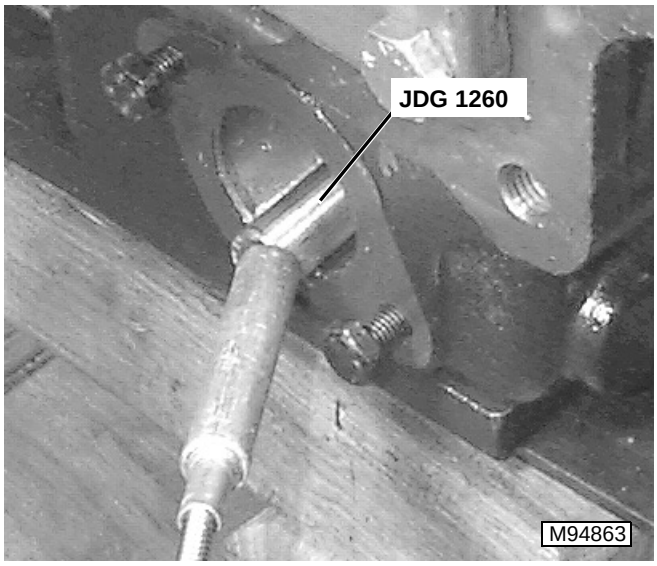
8. Rotate shift fork assembly (F) into place. Be sure shift fork pin engages slot in shift lever inside case.



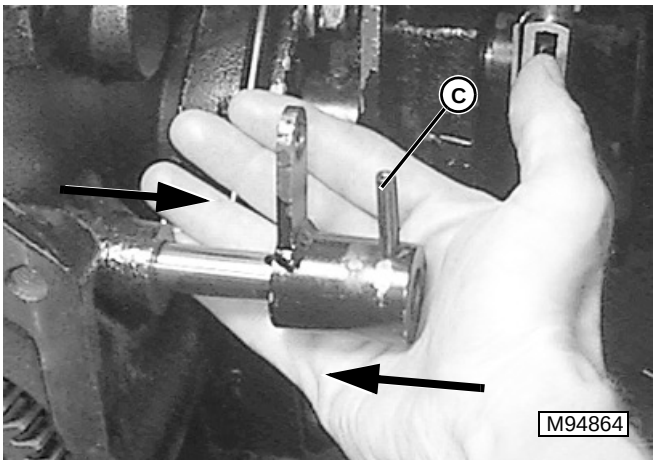
9. Insert detent shaft into hole in cover. Align shift fork assembly through MFWD bearing hole and push detent shaft through shift fork and into rear of differential housing. Detent shaft tool JDG 1260 will drop into bottom of differential housing.



10. Remove lower left cap screw, and install detent shaft retainer plate. Install cap screw. Do not tighten cap screws at this time.
11. Remove suction filter from bottom of differential housing.



12. Using a magnetic pickup or similar tool, retrieve JDG 1260 detent ball tool from differential housing.



13. Pull shift shaft out, and install shift lever arm. Install spring pin (C). Check shift lever for proper operation.
14. Remove lower left cap screw and install detent shaft retainer plate (E). Install cap screw.
15. Tighten four cap screws retaining range transmission to **50 - 60 N•m (36 - 44 lb-ft)**.
16. Adjust differential backlash. (See "DIFFERENTIAL BACKLASH ADJUSTMENT").
17. Assemble tractor halves. (See "TRACTOR SPLITTING REAR").

FINAL DRIVE REMOVAL

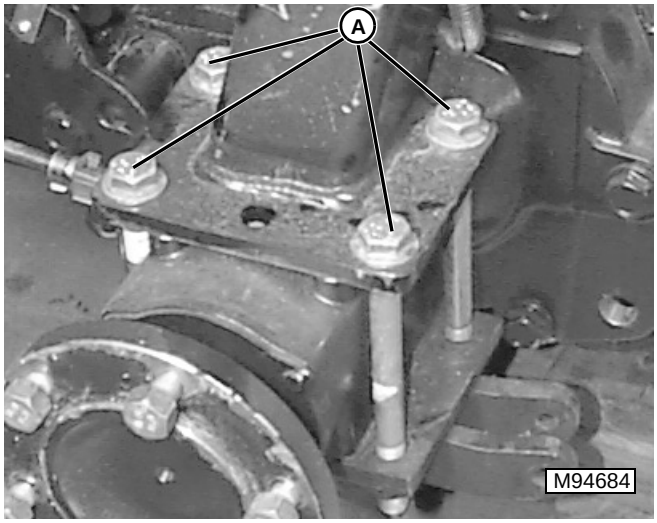
Left Hand Final Drive Removal:

NOTE: Hydrostatic model tractor has differential locking lever located on left hand final drive housing.

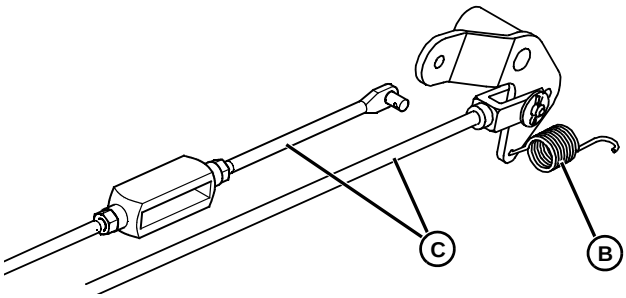
⚠ CAUTION

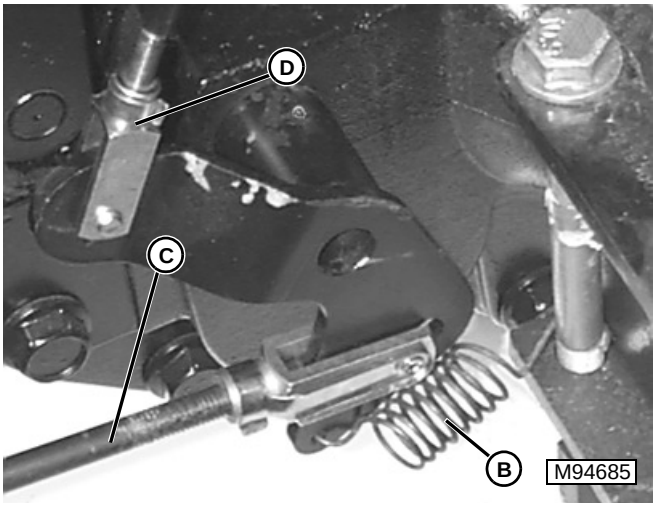
Unexpected tractor movement. Front axle pivot will allow tractor to tilt. Make sure tunnel and opposite final drive are adequately supported before removing final drive.

1. Raise rear of tractor and support on suitable stands.
2. Remove draft arms and adjustable sway bars. (See "THREE POINT HITCH" in Miscellaneous section.)
3. Remove wheel and tire.

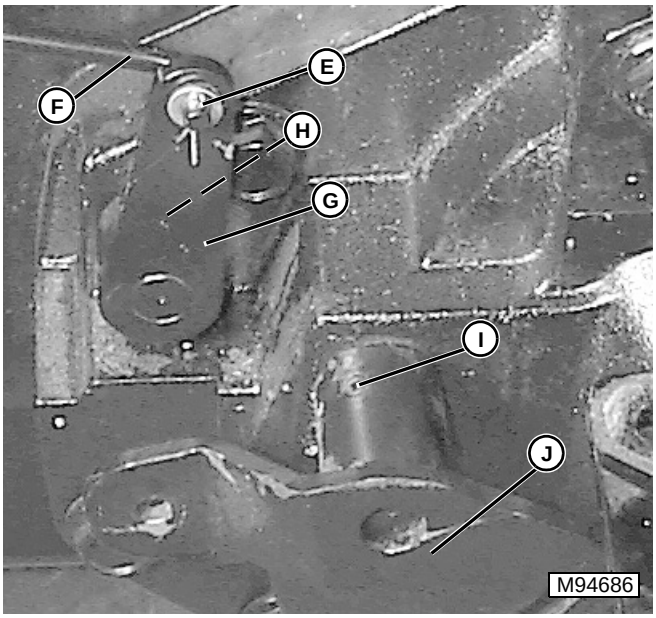


4. Remove four cap screws (A) and nuts retaining ROPS to final drive housing. If necessary, support ROPS using an overhead crane. Remove lower support plate.





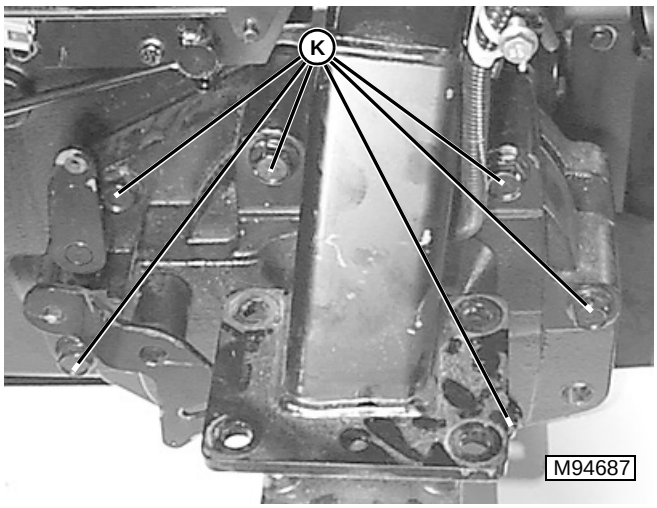
5. Disconnect brake return spring (B) from brake lever. Remove spring.
6. Disconnect lower brake rod (C) from brake lever.
7. **Side Mount Parking Brake Only:** Disconnect park brake rod (D) from brake lever.



8. (HST Model) Remove cotter pin (E) and washer and disconnect differential lock rod (F) from differential lock lever (G).
9. (HST Model) Remove roll pin (H) and differential lock lever from shaft.
10. Remove roll pin (I) and brake lever (J) from shaft.

⚠ CAUTION

Final drive/axle housings weigh approximately 34 kg (75 lbs.) each. If necessary, use a suitable lifting device or get assistance before removing cap screws securing final drive to transmission housing.



11. Remove eight cap screws (K) securing final drive to transmission housing.
12. Gently pry around edges of cover and remove final drive from transmission housing.

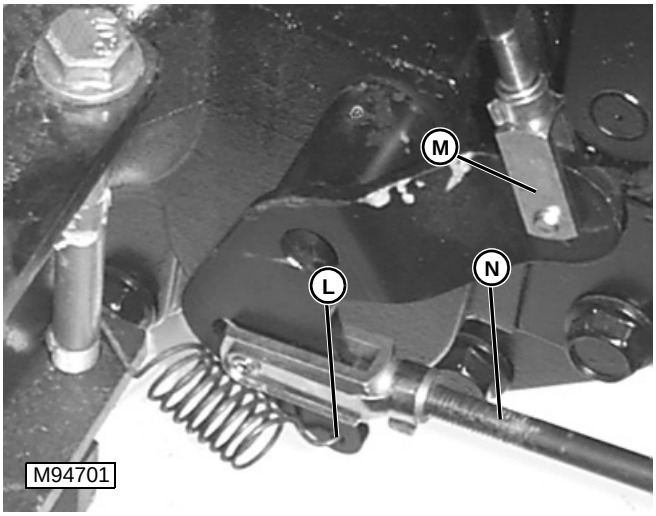
Right Hand Final Drive Removal:

NOTE: Gear tractors have differential locking lever located on right hand final drive housing.

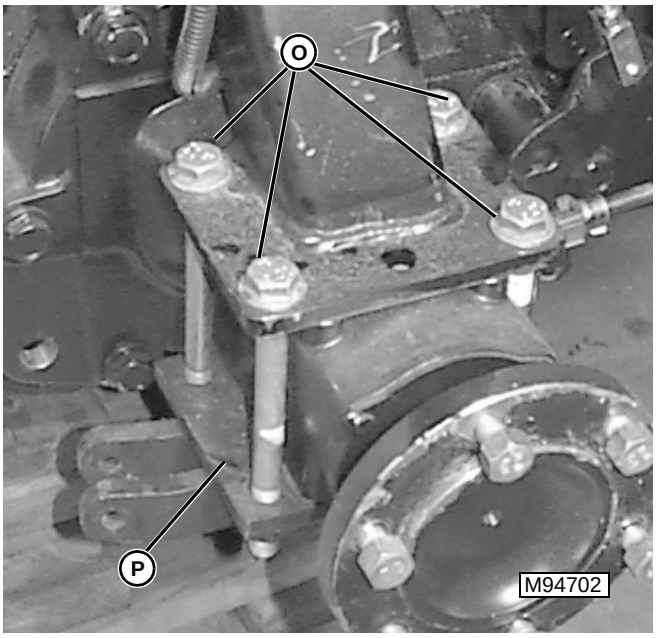
⚠ CAUTION

Avoid unexpected tractor movement. Front axle pivot will allow tractor to tilt. Make sure tunnel and opposite final drive are adequately supported before removing final drive.

1. Raise rear of tractor and support on suitable stands.
2. Remove draft arms and adjustable sway bars. (See "THREE POINT HITCH" in Miscellaneous section.)
3. Remove wheel and tire.



4. Disconnect brake return spring (L) from brake lever. Remove spring.
5. **Side Mount Parking Brake Only:** Disconnect park brake rod (M) from brake lever.
6. Disconnect lower brake rod (N) from brake lever.

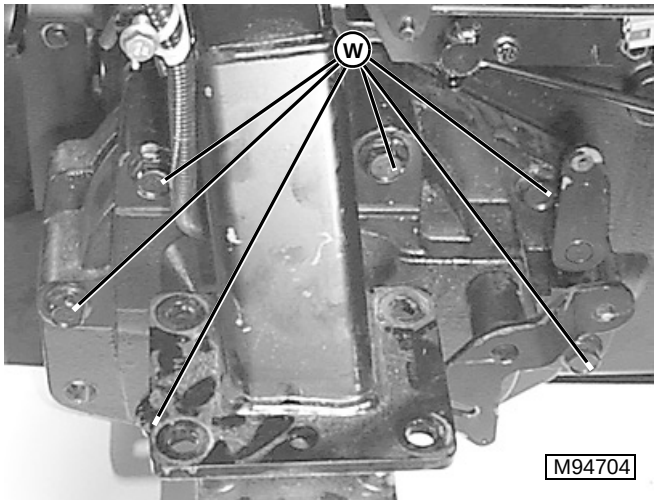


7. Remove four cap screws (O) and nuts retaining ROPS to final drive housing. If necessary, support ROPS using an overhead crane. Remove lower support plate (P).

8. (CST Model) Remove cotter pin (Q) and washer and disconnect differential lock rod (R) from differential lock lever (S).
9. (CST Model) Remove roll pin (T) and differential lock lever from shaft.
10. Remove roll pin (U) and brake lever (V) from shaft.

⚠ CAUTION

Final drive/axle housings weigh approximately 34 kg (75 lbs.) each. If necessary, use a suitable lifting device or get assistance before removing cap screws securing final drive to transmission housing.



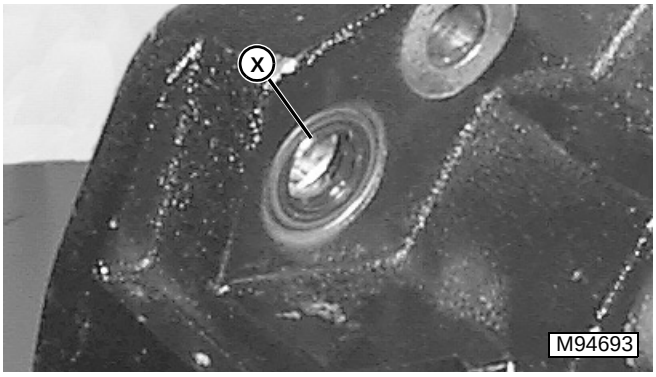
11. Remove eight cap screws (W) securing final drive to transmission housing.
12. Gently pry around edges of cover and remove final drive from transmission housing.

FINAL DRIVE INSTALLATION

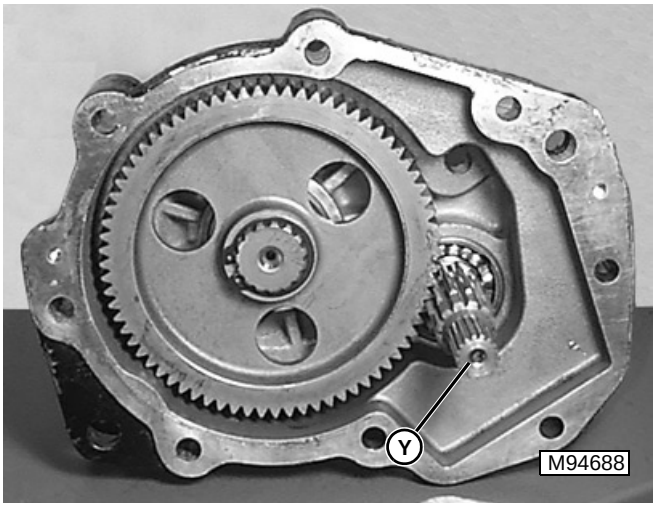
Left Hand Final Drive Installation:

CAUTION

Final drive/axle housings weigh approximately 34 kg (75 lbs.) each. If necessary, use a suitable lifting device or get assistance before removing cap screws securing final drive to transmission housing.

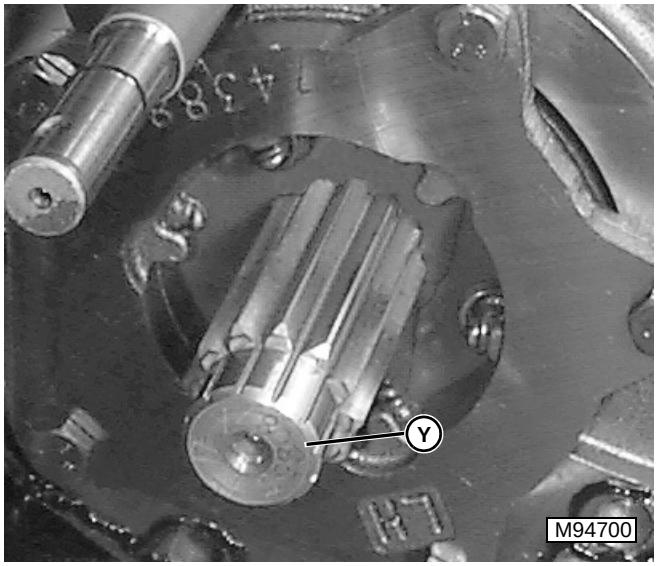


1. Install a new differential lock shaft seal (X) into final drive housing.



2. Remove pinion shaft (Y) from final drive assembly.

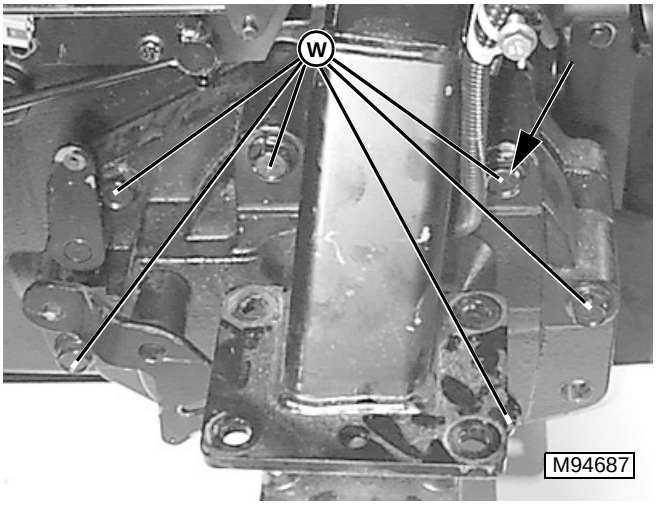
IMPORTANT: Be sure that pinion shaft bottoms out in brake plates and disks before installing final drive assembly. Damage to final drive, brake parts, and differential may result from improper installation.



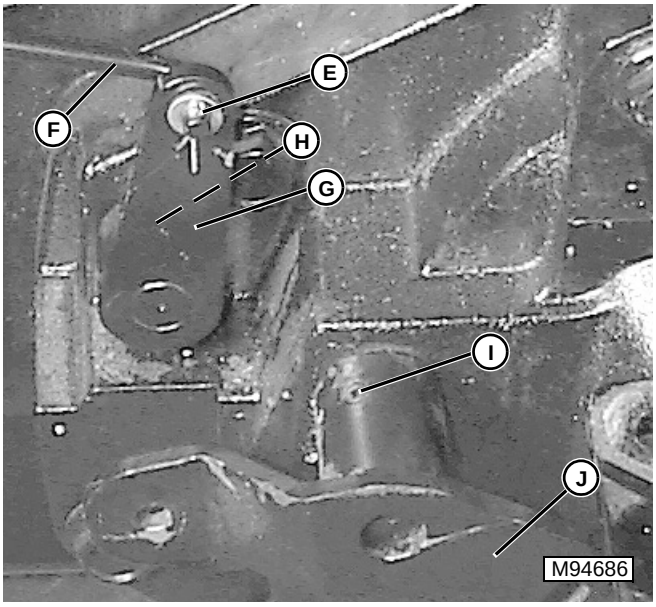
3. Install pinion shaft (Y) through brake plates and disks, and into differential carrier.
4. Make sure mating surfaces of final drive and transmission housing are clean and dry. Apply a bead of LOCTITE™ 515 sealant to the flanges of the final drive housing.

CAUTION

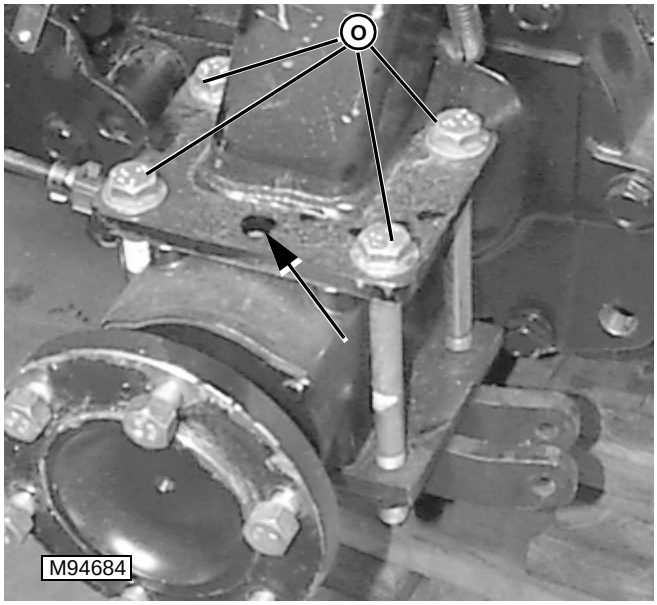
Final drive/axle housings weigh approximately 34 kg (75 lbs.) each. If necessary, use a suitable lifting device or get assistance before removing cap screws securing final drive to transmission housing.



5. Install final drive onto transmission housing and retain with eight cap screws (W). Apply Loctite® 515 to indicated (arrow) cap screw. Tighten cap screws to **305 N•m (225 lb-ft)**.



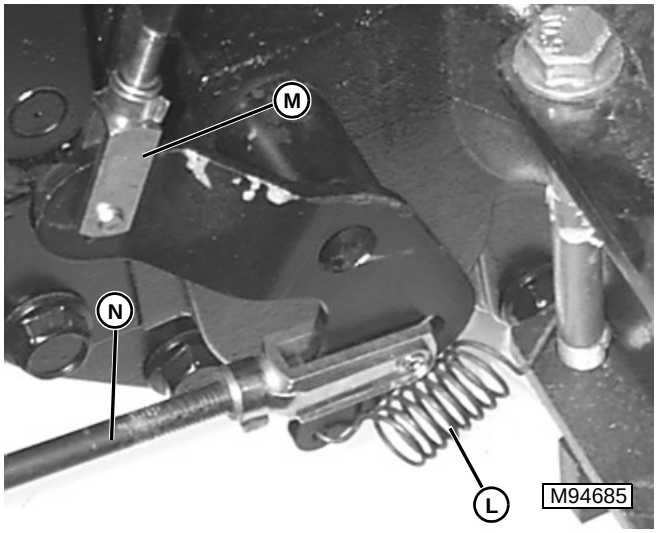
6. (HST Model) Install differential lock lever (G) onto shaft. Retain with roll pin (H).
7. (HST Model) Attach differential lock rod (F) to differential lock lever. Retain with cotter pin (E) and washer.
8. Install brake lever (J) onto brake shaft. Retain with roll pin (I).



9. Align ROPS base plate with pin (arrow) on final drive housing. Install lower support plate and retain with four cap screws (O) and nuts. Tighten cap screws and nuts to specification.

Torque Specification:

Cap Screws and Nuts . . . . . 305 N•m (225 lb-ft).



10. Attach lower brake rod (N) to brake lever. Retain with pin, or pin, cotter pin, and washer.
11. **Side Mount Parking Brake Only:** Attach park brake rod (M) to brake lever. Retain with clip pin.
12. Install brake return spring (L) to brake lever and ROPS cap screw.

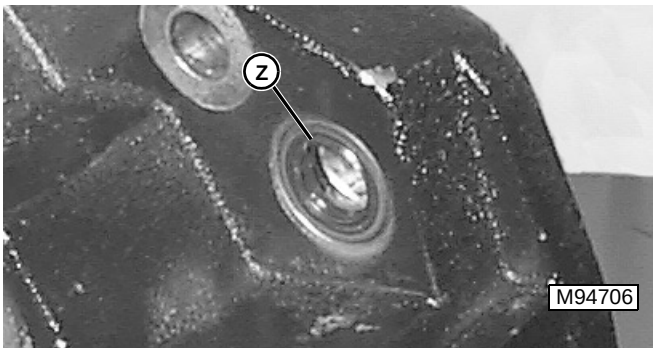
Right Hand Final Drive Installation:

⚠ CAUTION

Final drive/axle housings weigh approximately 34 kg (75 lbs.) each. If necessary, use a suitable lifting device or get assistance before removing cap screws securing final drive to transmission housing.

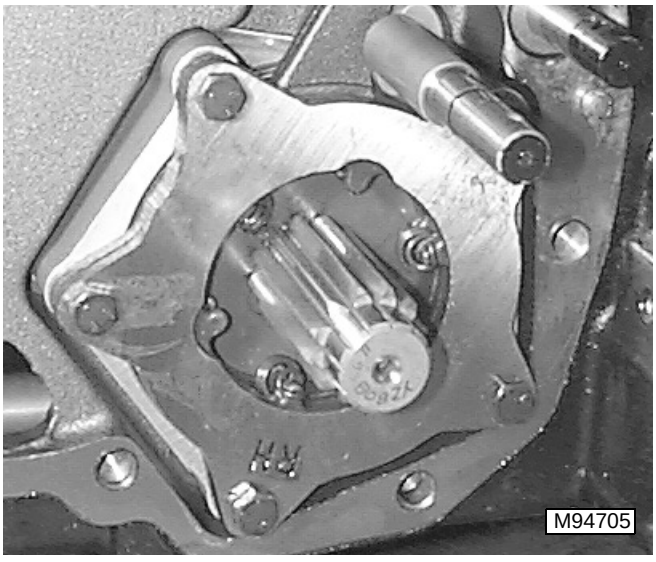
⚠ CAUTION

Final drive/axle housings weigh approximately 34 kg (75 lbs.) each. If necessary, use a suitable lifting device or get assistance before removing cap screws securing final drive to transmission housing.

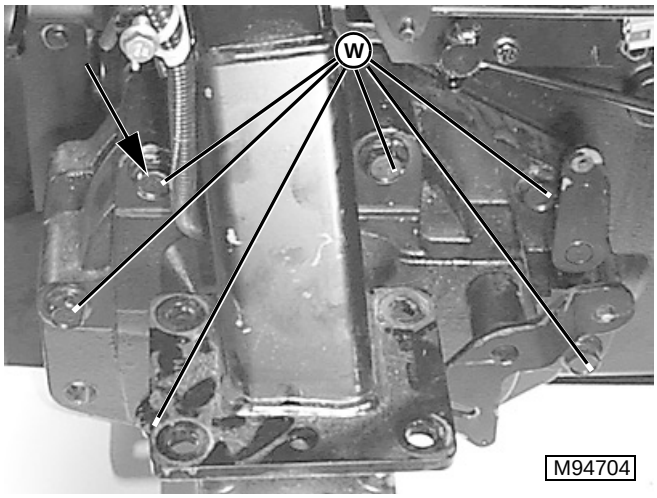


1. Install a new differential lock shaft seal (Z) into final drive housing.

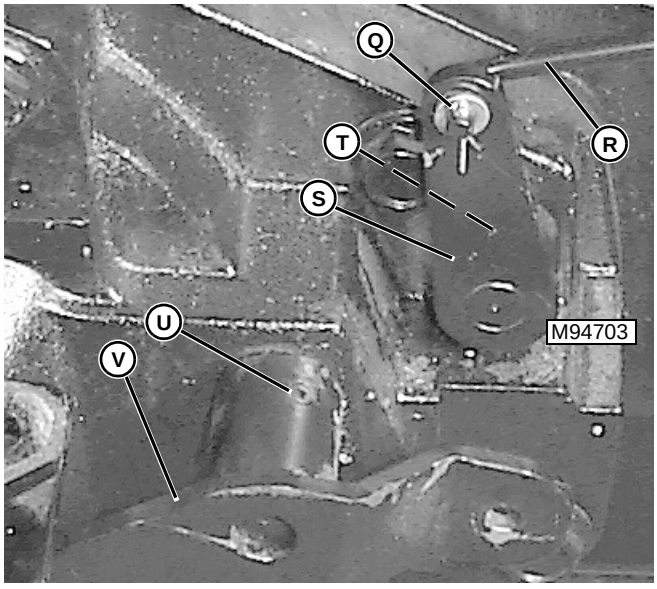
IMPORTANT: Be sure that pinion shaft bottoms out in brake plates and disks before installing final drive assembly. Damage to final drive, brake parts, and differential may result from improper installation.



2. Install pinion shaft through brake plates, disks, and differential lock collar, and into differential carrier.
3. Make sure mating surfaces of final drive and transmission housing are clean and dry. Apply a bead of LOCTITE® 515 sealant to the flanges of the final drive housing.

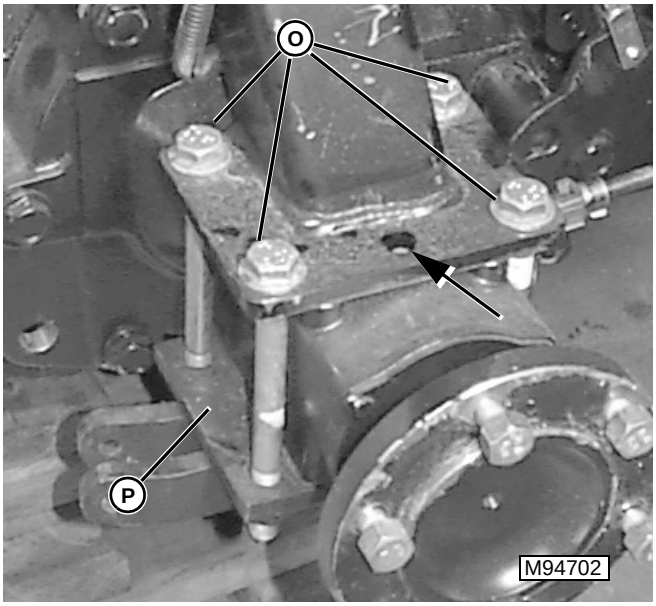


4. Install final drive onto transmission housing and retain with eight cap screws (W). Apply Loctite® 515 to indicated (arrow) cap screw. Tighten cap screws to **305 N•m (225 lb-ft)**.

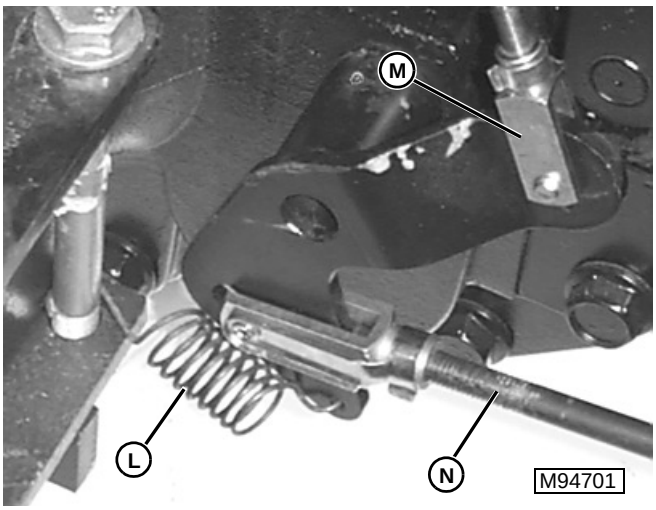


5. (CST Model) Install differential lock lever (S) onto shaft. Retain with roll pin (T).
6. (CST Model) Attach differential lock rod (R) to differential lock lever. Retain with cotter pin (Q) and washer.

7. Install brake lever (V) onto brake shaft. Retain with roll pin (U).



8. Align ROPS base plate with pin on final drive housing. Install lower support plate (P) and retain with four cap screws (O) and nuts. Tighten to **305 N•m (225 lb-ft)**.

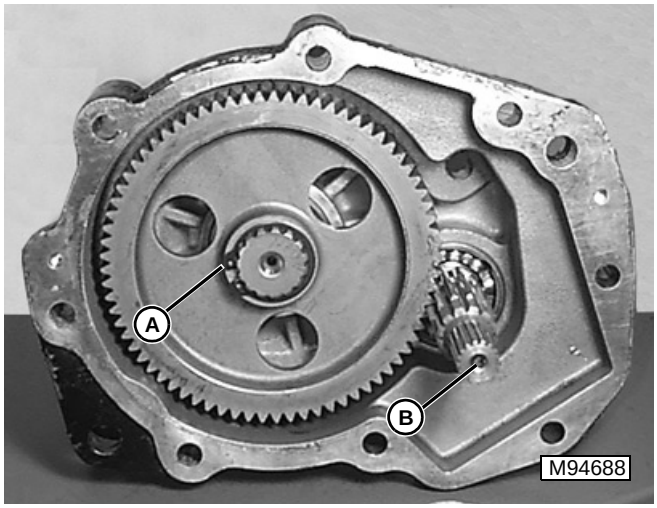


9. Attach lower brake rod (N) to brake lever. Retain with clevis pin or pin, cotter pin, and washer.
10. **Side Mount Parking Brake Only:** Attach park brake rod (M) to brake lever. Retain with clip pin.
11. Install brake return spring (L) to brake lever and ROPS cap screw.

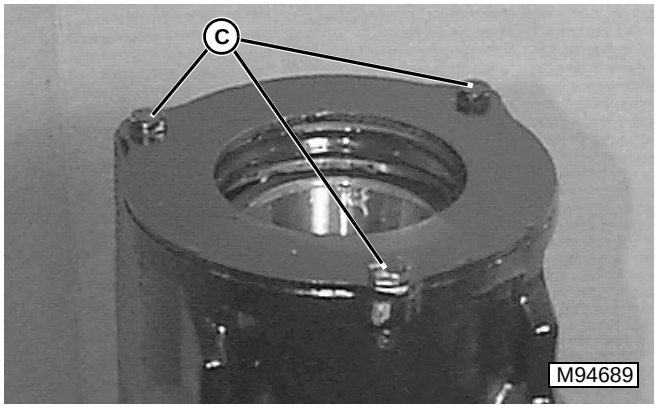
FINAL DRIVE DISASSEMBLY, INSPECTION & ASSEMBLY

NOTE: Hydrostatic model left hand final drive is shown in the following story. Right hand drive disassembly, inspection and assembly is basically the same.

1. Remove final drive to be serviced from the machine. (See FINAL DRIVE REMOVAL).

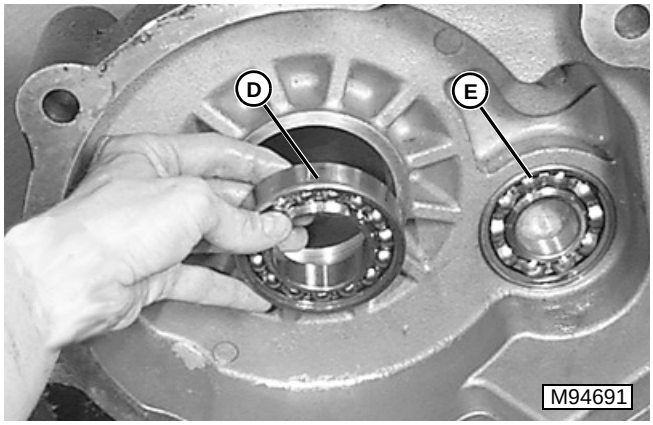


2. Remove snap ring (A) retaining gear to axle shaft. Remove gear.
3. Remove pinion shaft (B) from bearing.
4. Using a press, remove axle shaft from final drive housing.

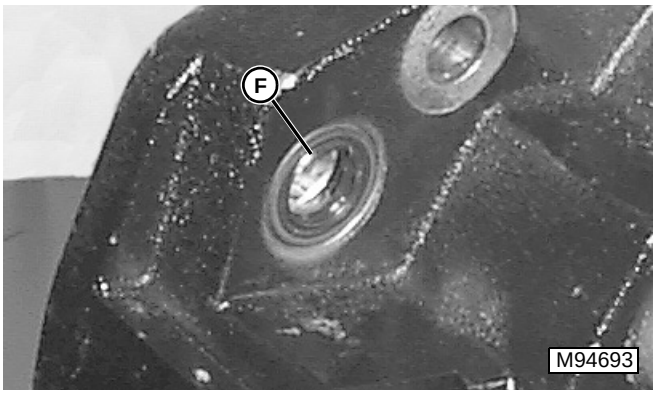


5. Remove three cap screws (C) and seal retainer plate.

6. Remove seal and outer axle bearing. Inspect bearings for smooth operation, excessive wear, or damage. Replace as required.



7. Remove inner axle shaft bearing (D). Inspect bearing for wear or damage. Replace if necessary.
8. Using a suitable puller, remove pinion shaft bearing (E). Inspect bearing for smooth operation, excessive wear, or damage. Replace as required.



9. Remove differential lock shaft seal (F).

Assembly:

Parts are assembled in the reverse order of disassembly.

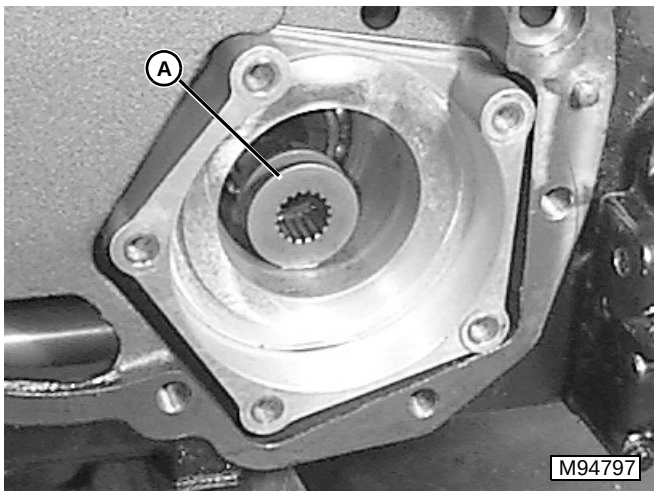
IMPORTANT: Replace O-rings and seals. Used O-rings and seals will leak.

- Lubricate bearings with transmission oil before installing into housing.

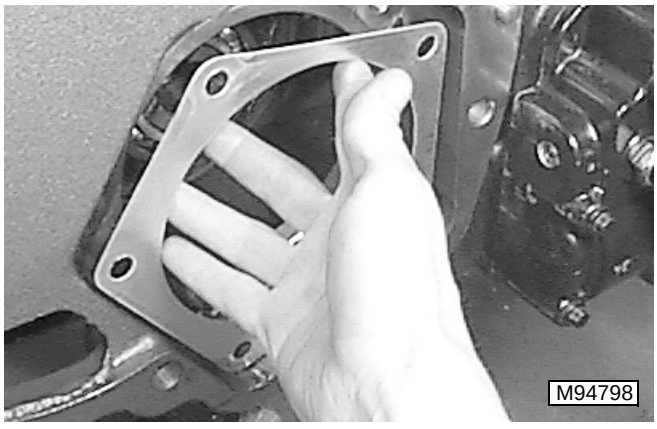
DIFFERENTIAL

Removal:

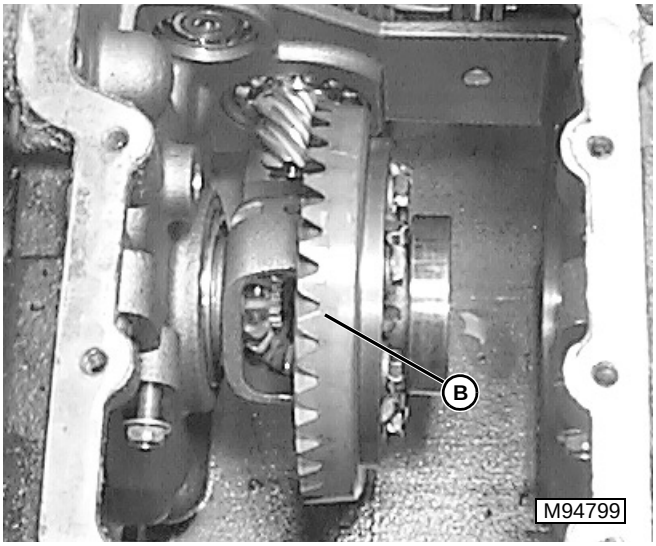
1. Remove right hand final drive. (See "FINAL DRIVE REMOVAL").
2. Remove brake assembly. (See “BRAKE DISASSEMBLY AND INSPECTION” on page 19 of the Brakes section.)
3. Remove differential lock fork. (See "DIFFERENTIAL LOCK REMOVAL AND INSTALLATION").



4. If not already done, remove differential lock collar (A).
5. Remove RH brake/differential lock collar housing.

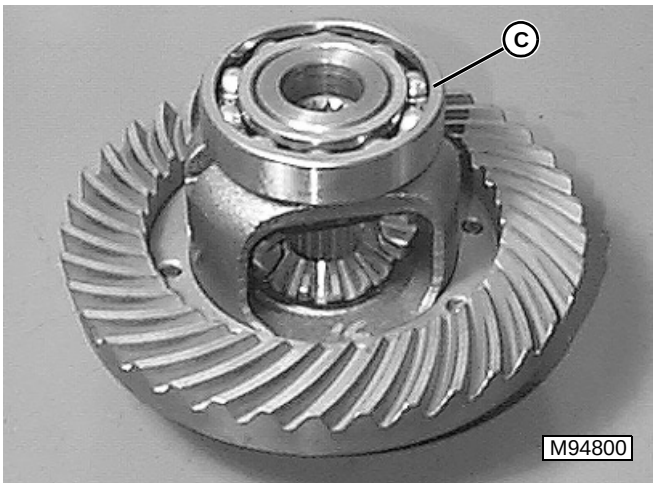


6. Remove shims.



7. Remove differential carrier (B) from left pinion shaft and transmission housing.

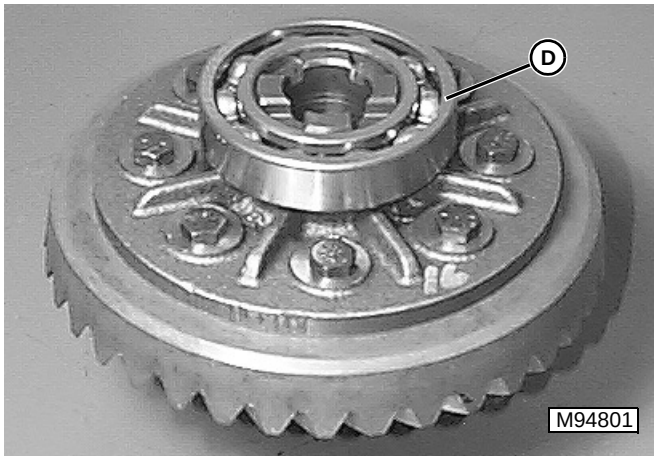
Disassembly:



1. Remove bearing (C) from differential.

IMPORTANT: DO NOT spin bearing using compressed air. Damage to bearing balls, cage, and races could result.

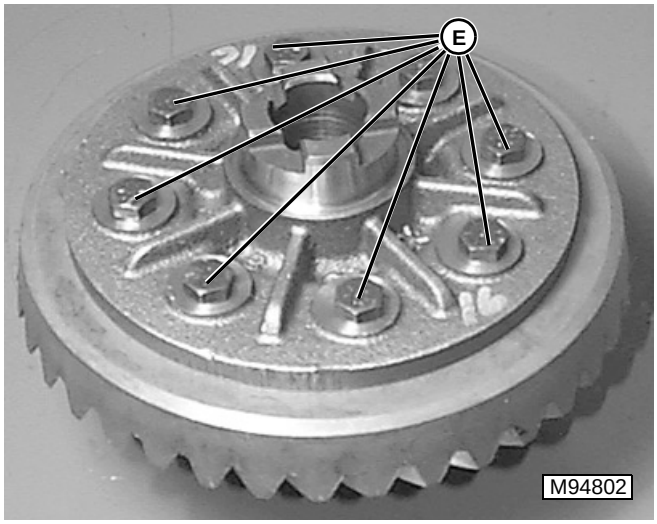
2. Inspect bearing for smooth operation, wear, or damage. Replace if necessary.



3. Remove bearing (D).

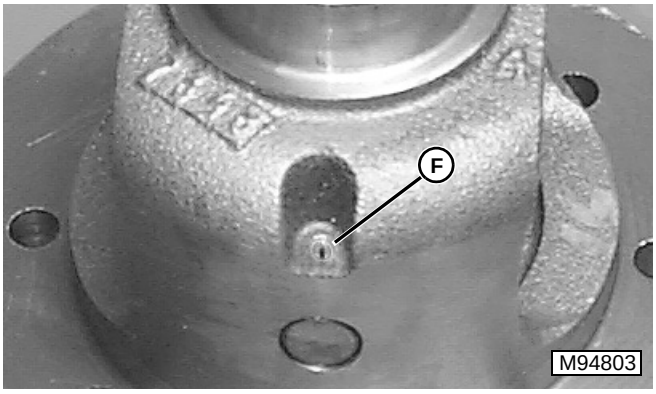
IMPORTANT: DO NOT spin bearing using compressed air. Damage to bearing balls, cage, and races could result.

4. Inspect bearing for smooth operation, wear, or damage. Replace if necessary.

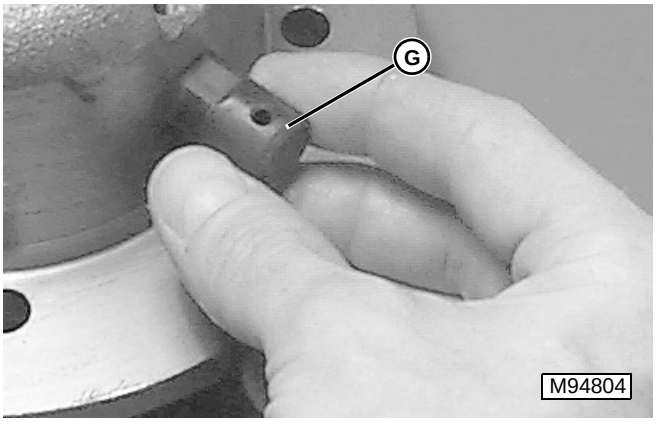


NOTE: Cap screws retaining ring gear to differential housing are held in place with LOCTITE®

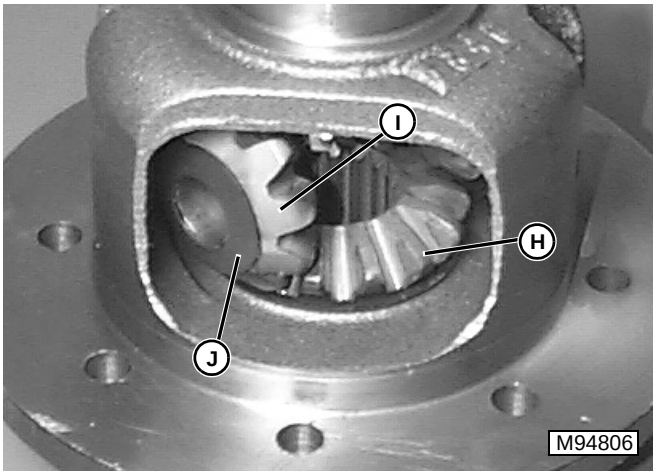
5. Remove eight cap screws (E).
6. Using a plastic mallet, separate ring gear from differential housing.



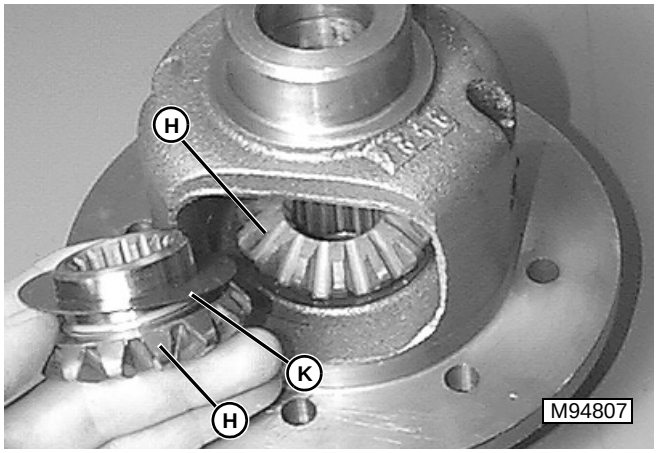
7. Locate pinion shaft retaining pin (F). Heat retaining pin and differential carrier to melt thread locking adhesive. Remove pin.



8. Remove pinion shaft (G) from differential housing.



9. Rotate bevel gears (H) and remove differential pinion gears (I) and cupped pinion washers (J) from differential housing.



10. Remove two bevel gears (H) and two thrust washers (K) from differential housing.
11. Clean all components in a suitable solvent.
12. Inspect all parts for wear or damage. Replace as required.

Assembly:

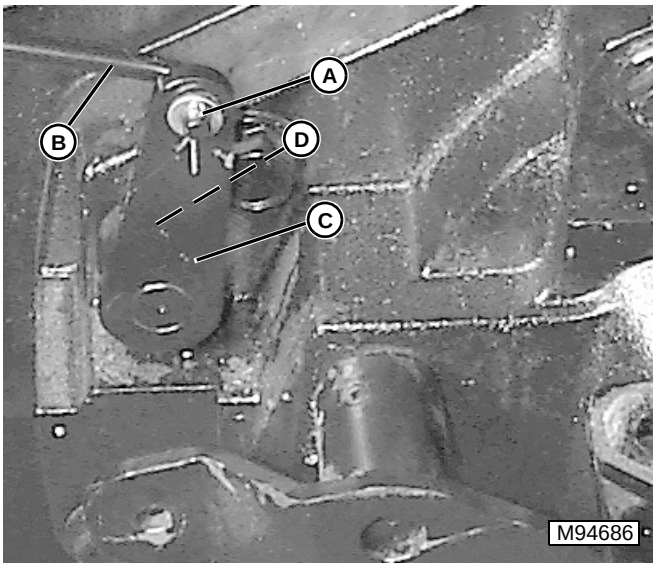
Assembly of the differential is the reverse of disassembly.

- Apply LOCTITE® 277 to threads of pinion shaft retaining pin.
- Apply LOCTITE® 277 to threads of ring gear retaining cap screws.
- Tighten 10 mm ring gear retaining cap screws to **68 N•m (50 lb-ft).**
- Adjust backlash of differential. (See "DIFFERENTIAL BACKLASH ADJUSTMENT").

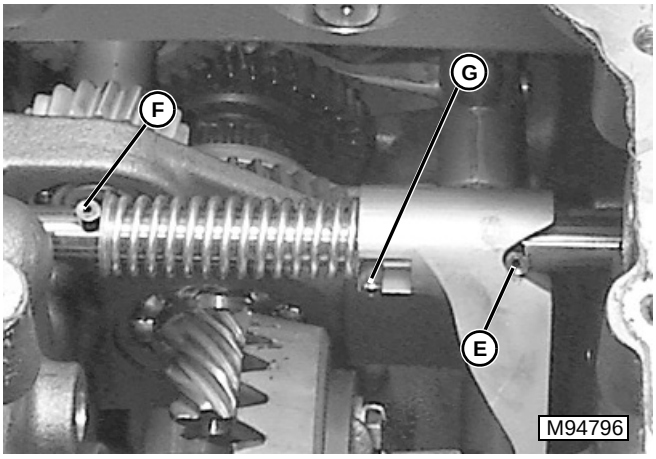
DIFFERENTIAL LOCK REMOVAL AND INSTALLATION

Removal:

1. Remove rockshaft assembly. (See "ROCKSHAFT ASSEMBLY") in Hydraulic section.)
2. Remove RH final drive assembly. (See "FINAL DRIVE REMOVAL").



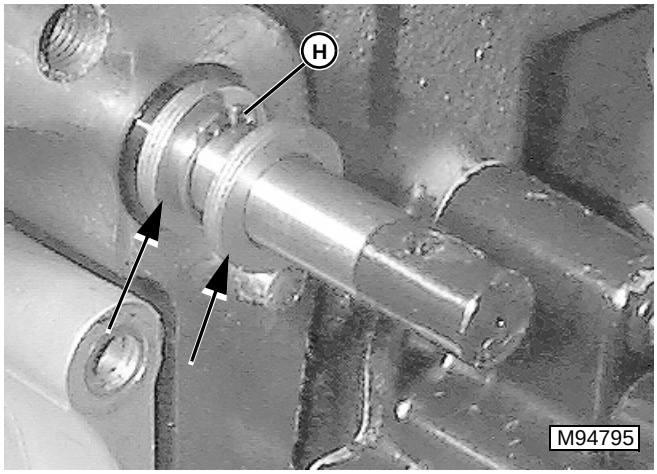
3. (HST Model) Remove cotter pin (A) and washer and disconnect differential lock rod (B) from differential lock lever (C).
4. (HST Model) Remove roll pin (D) and differential lock lever from shaft.
5. Remove rear PTO shafts and gears. (See REAR PTO SHAFTS AND GEARS REMOVAL AND INSTALLATION").
6. Remove PTO clutch/brake assembly. (See "PTO CLUTCH AND BRAKE REMOVAL AND INSTALLATION").



7. Remove roll pin (E) from RH side of shift fork.

NOTE: Spring is under tension.

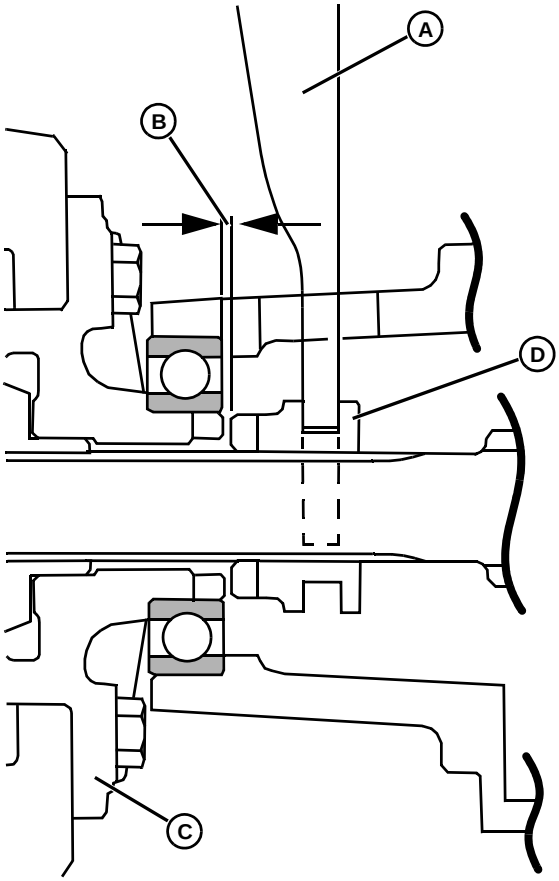
8. Remove roll pin (F) from LH side of spring.
9. Remove remaining roll pin (G) between spring and shift fork.



IMPORTANT: Note the number of shims and their location on either side of snap ring (H) to aid in reassembly.

10. Slide shaft to right, and remove from differential housing.
11. Remove washer, spring, and shift fork from center of differential housing. Remove shift collar from RH side of differential housing.

Installation:

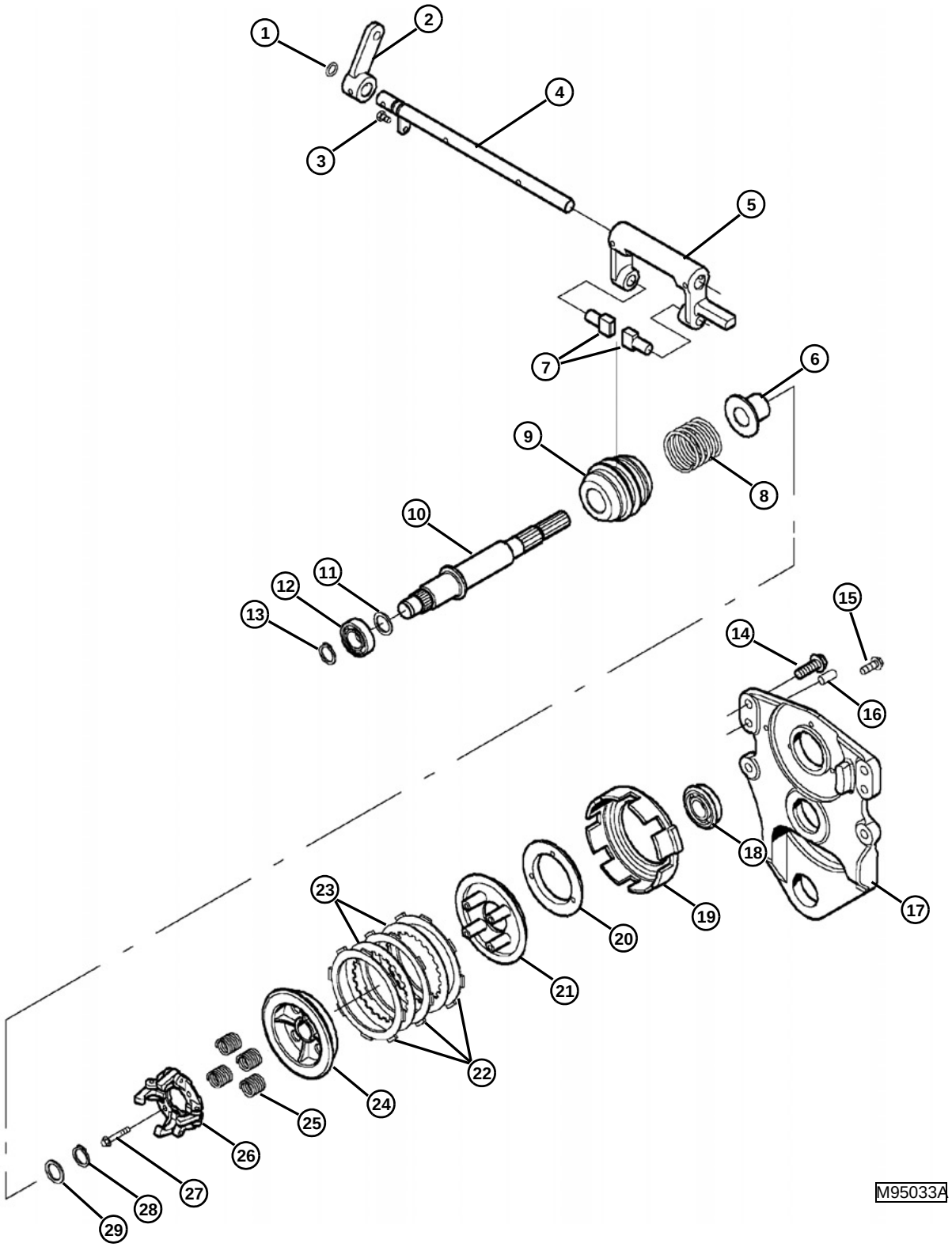


Installation of the differential lock fork is the reverse of removal.

NOTE: When installing shims, adjust shift fork (A) so that there is approximately 0.51 - 2.0 mm (0.020 - 0.080 in.) (B) of space between the differential carrier (C) and the shift collar (D).

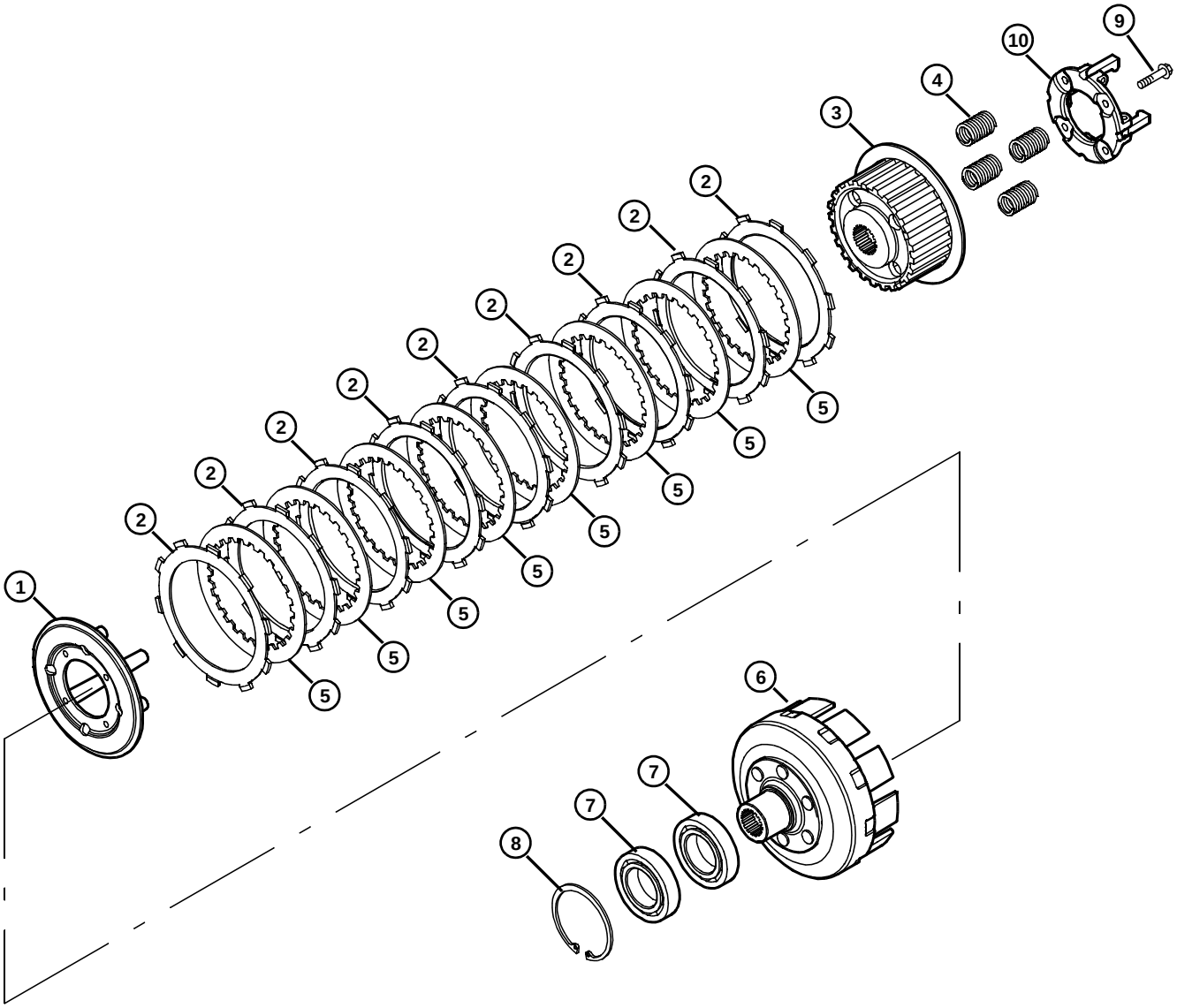
PTO COMPONENT LOCATION

PTO BRAKE



1. O-Ring
2. Lever
3. Cap Screw
4. Shaft
5. Shift Fork
6. Sleeve
7. Shoe
8. Spring
9. Collar
10. Shaft
11. Washer
12. Bearing
13. Snap Ring
14. Snap Ring
15. Cap Screw
16. Dowel Pin
17. Bearing Plate
18. Bearing
19. Basket
20. Retainer
21. Piston
22. Disk, Friction
23. Plate, Separator
24. Hub
25. Spring (4)
26. Lifter Assembly
27. Cap Screw
28. Snap Ring
29. Washer
30.

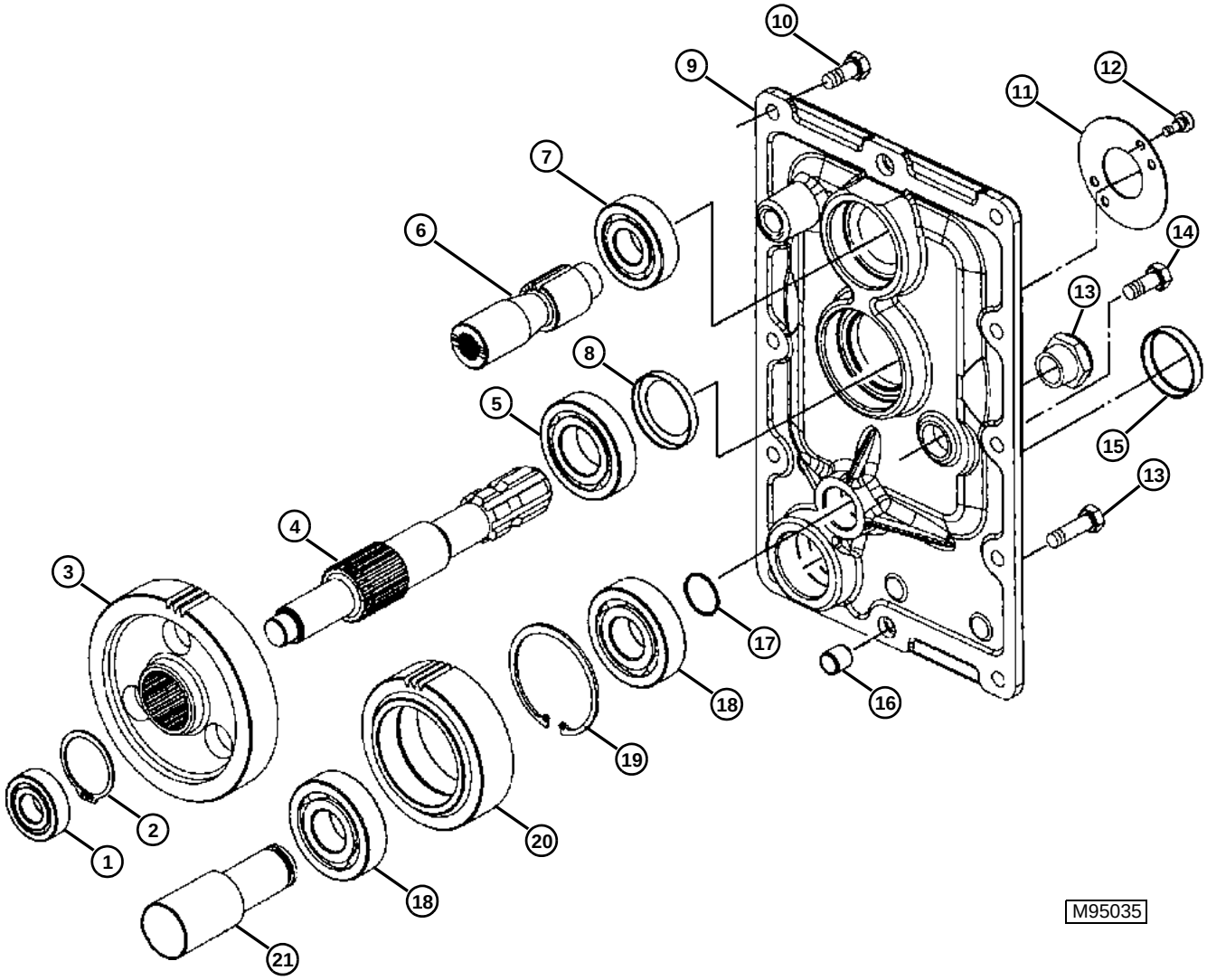
PTO CLUTCH



M95034

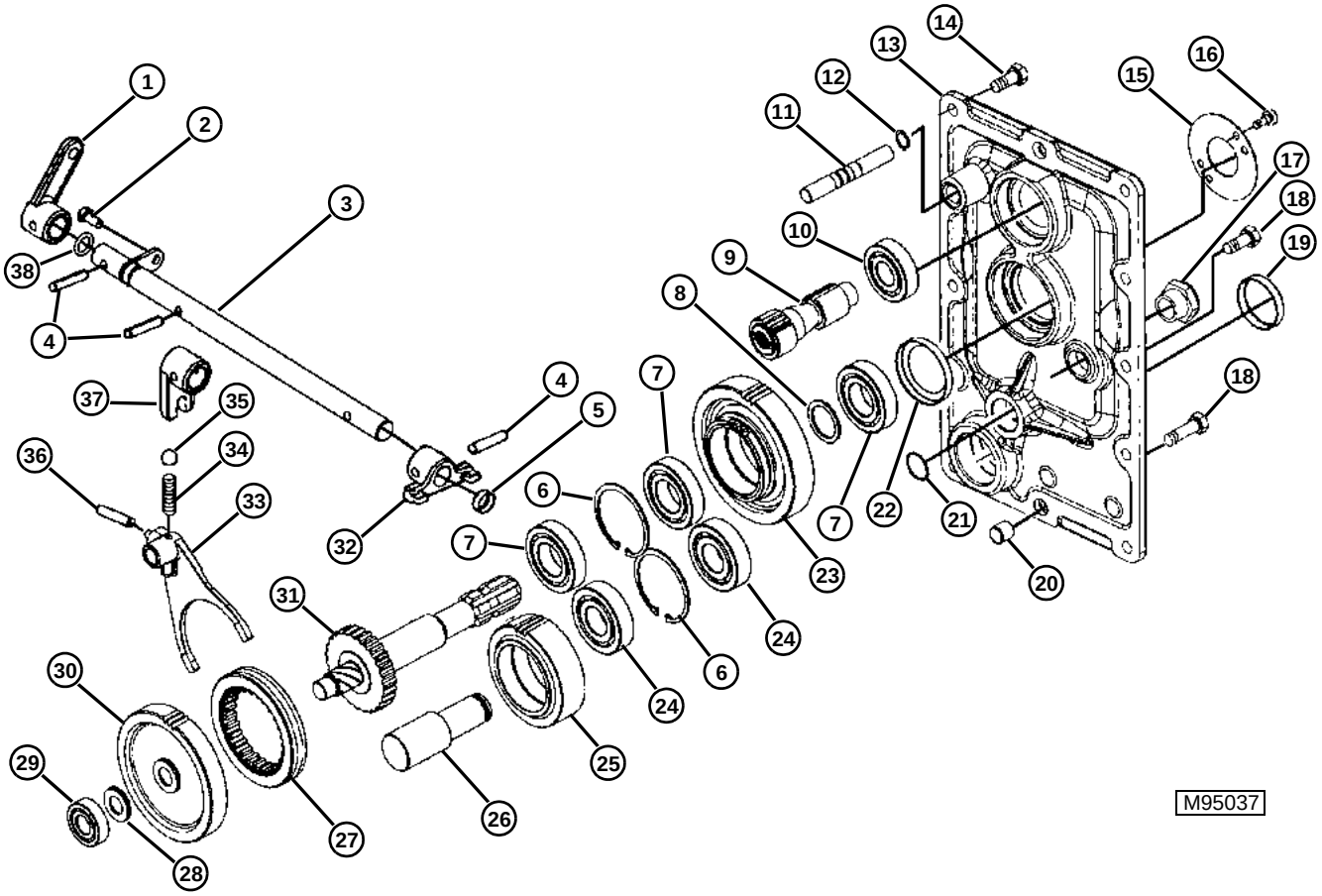
1. Retainer
2. Disk, Friction
3. Hub
4. Spring
5. Plate, separator
6. Housing
7. Bearing
8. Snap Ring
9. Cap Screw
10. Lever Assembly

REAR PTO



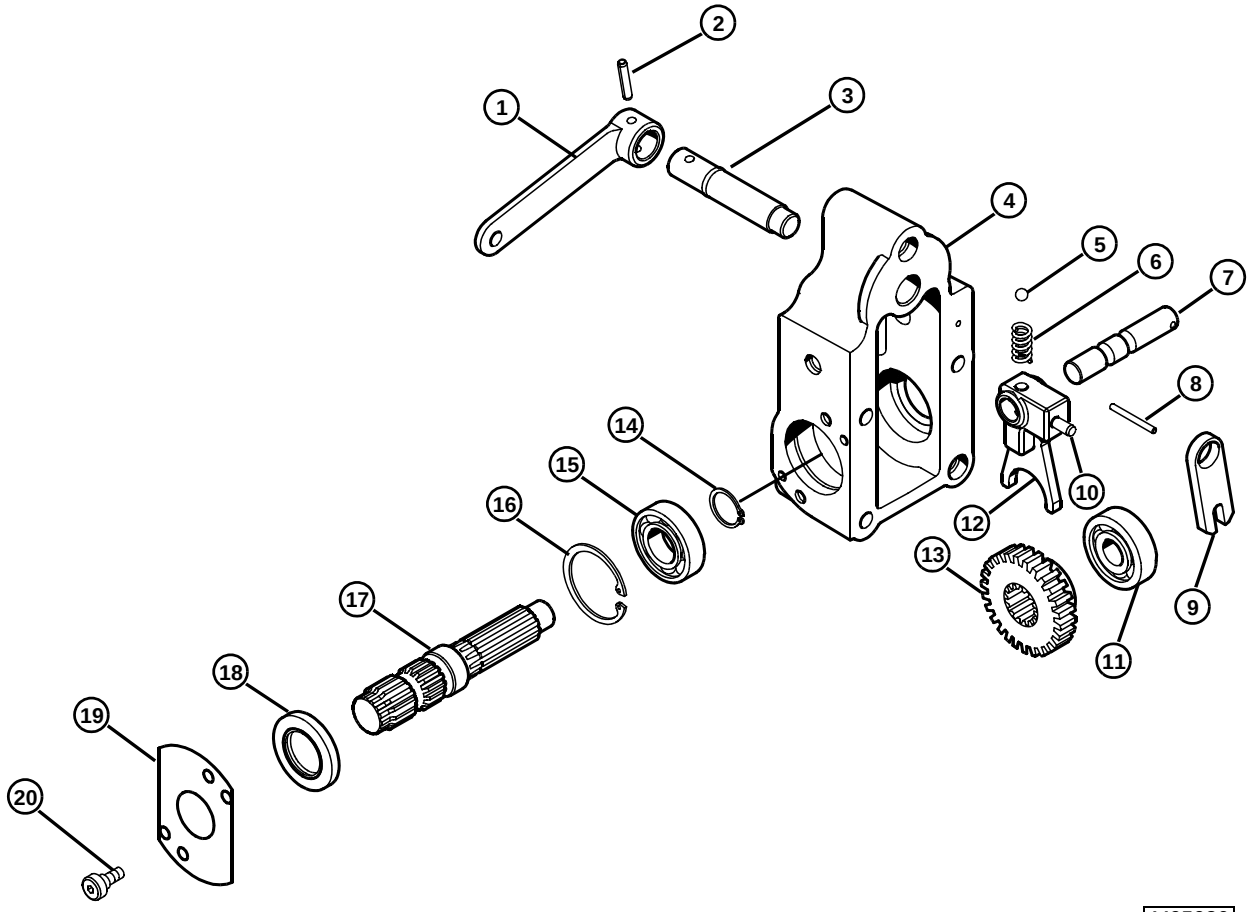
1. Bearing
2. Snap Ring
3. Gear, 70 Tooth
4. Shaft
5. Bearing
6. Shaft W/Gear, 14 Tooth
7. Bearing
8. Seal
9. Cover
10. Cap Screw
11. Retainer
12. Screw
13. Sight Glass
14. Cap Screw
15. Plug
16. Bushing
17. O-Ring
18. Bearing
19. Snap Ring
20. Gear, 51 Tooth
21. Idler Shaft

2-SPEED PTO (EUROPEAN ONLY)



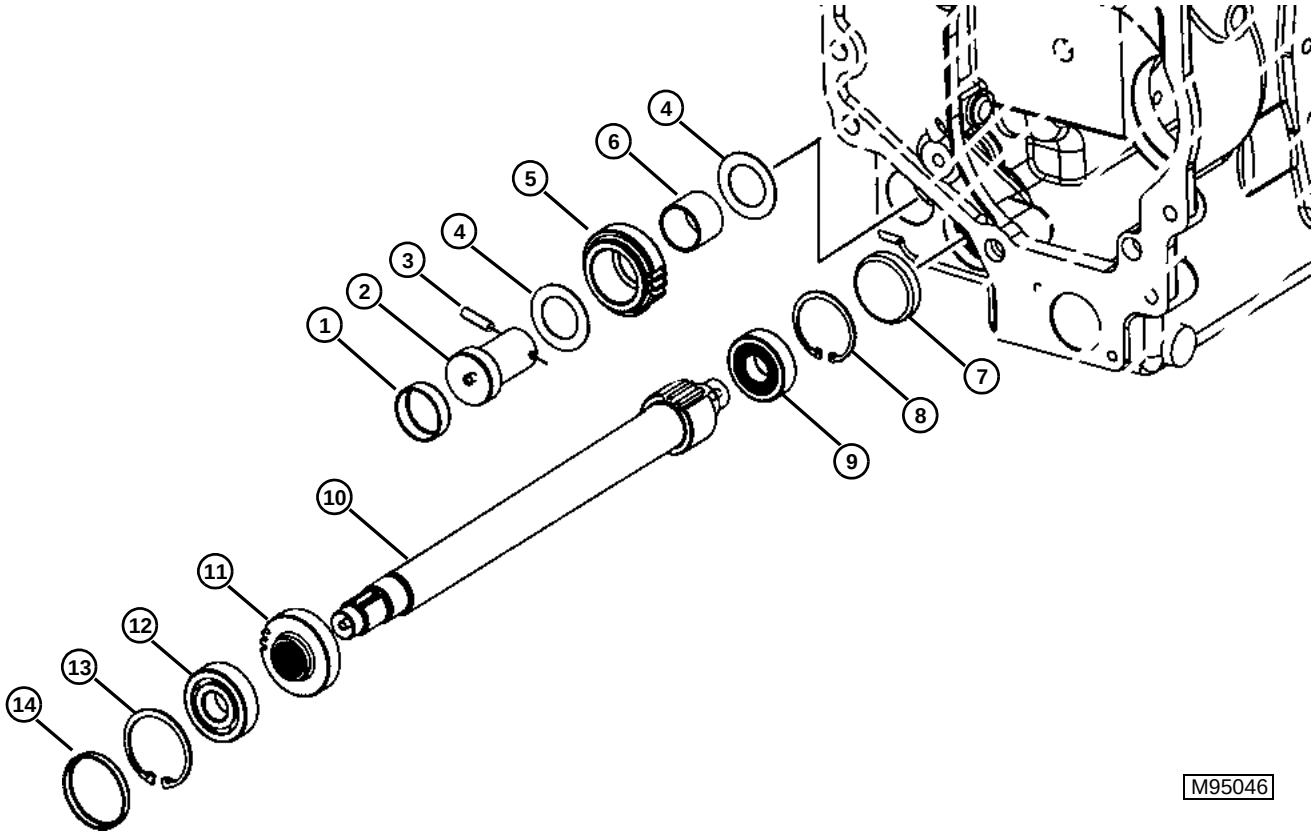
1. Lever	11. Shaft	21. O-Ring	31. Shaft
2. Cap Screw	12. O-Ring	22. Seal	32. Lever
3. Shaft	13. Cover	23. Gear, 69 Tooth	33. Shift Fork
4. Spring Pin	14. Cap Screw	24. Bearing	34. Spring
5. Cap	15. Retainer	25. Gear, 51 Tooth	35. Ball
6. Snap Ring	16. Screw	26. Pinion Shaft	36. Dowel Pin
7. Bearing	17. Sight Glass	27. Shift Collar	37. Lever
8. Thrust Washer	18. Cap Screw	28. Thrust Washer	38. O-Ring
9. Pinion Shaft	19. Plug	29. Bearing	
10. Bearing	20. Bushing	30. Gear, 65 Tooth	

MID PTO



1. Lever
2. Spring Pin
3. Shaft
4. Housing
5. Ball
6. Spring
7. Shaft
8. Pin
9. Lever
10. Pin
11. Bearing
12. Shift Fork
13. Gear, 25 Tooth
14. Snap Ring
15. Bearing
16. Snap Ring
17. Shaft
18. Seal
19. Retainer
20. Screw

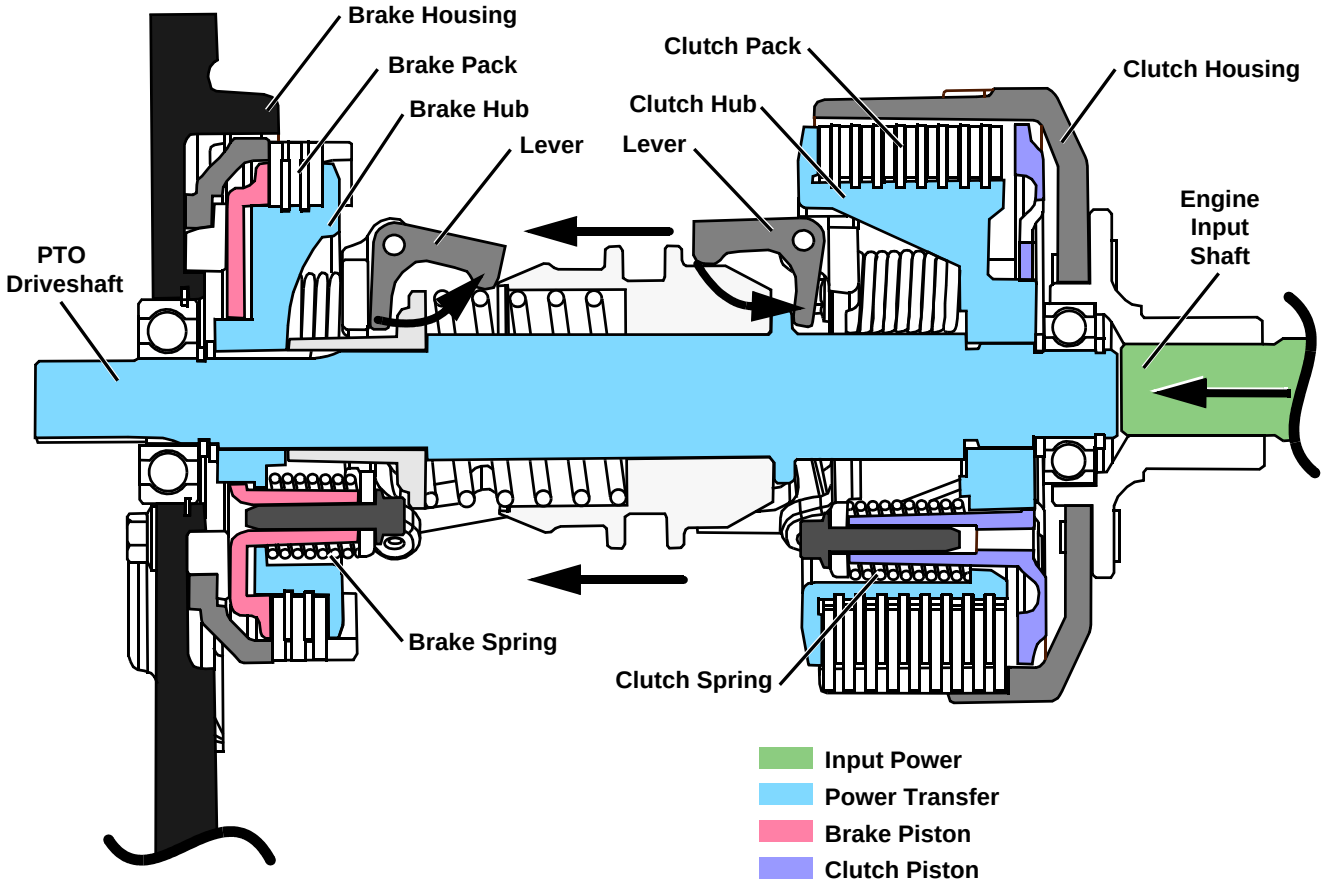
MID PTO DRIVE SHAFT



1. Cap	5. Gear, 25 Tooth	9. Bearing	13. Snap Ring
2. Shaft	6. Sleeve	10. Shaft W/18 Tooth Gear	14. Plug
3. Spring Pin	7. Plug	11. Gear, 27 Tooth	
4. Thrust Washer	8. Snap Ring	12. Bearing	

PTO THEORY OF OPERATION

POWER TRANSMISSION – PTO CLUTCH AND BRAKE



Function:

The PTO clutch provides a means for disengaging the PTO output shaft from the engine. The PTO brake is provided to positively stop the rotation of the PTO system when the PTO clutch is disengaged. The PTO clutch and PTO brake work simultaneously. Both mid and rear PTOs are affected by the operation of the PTO clutch and PTO brake.

Theory:

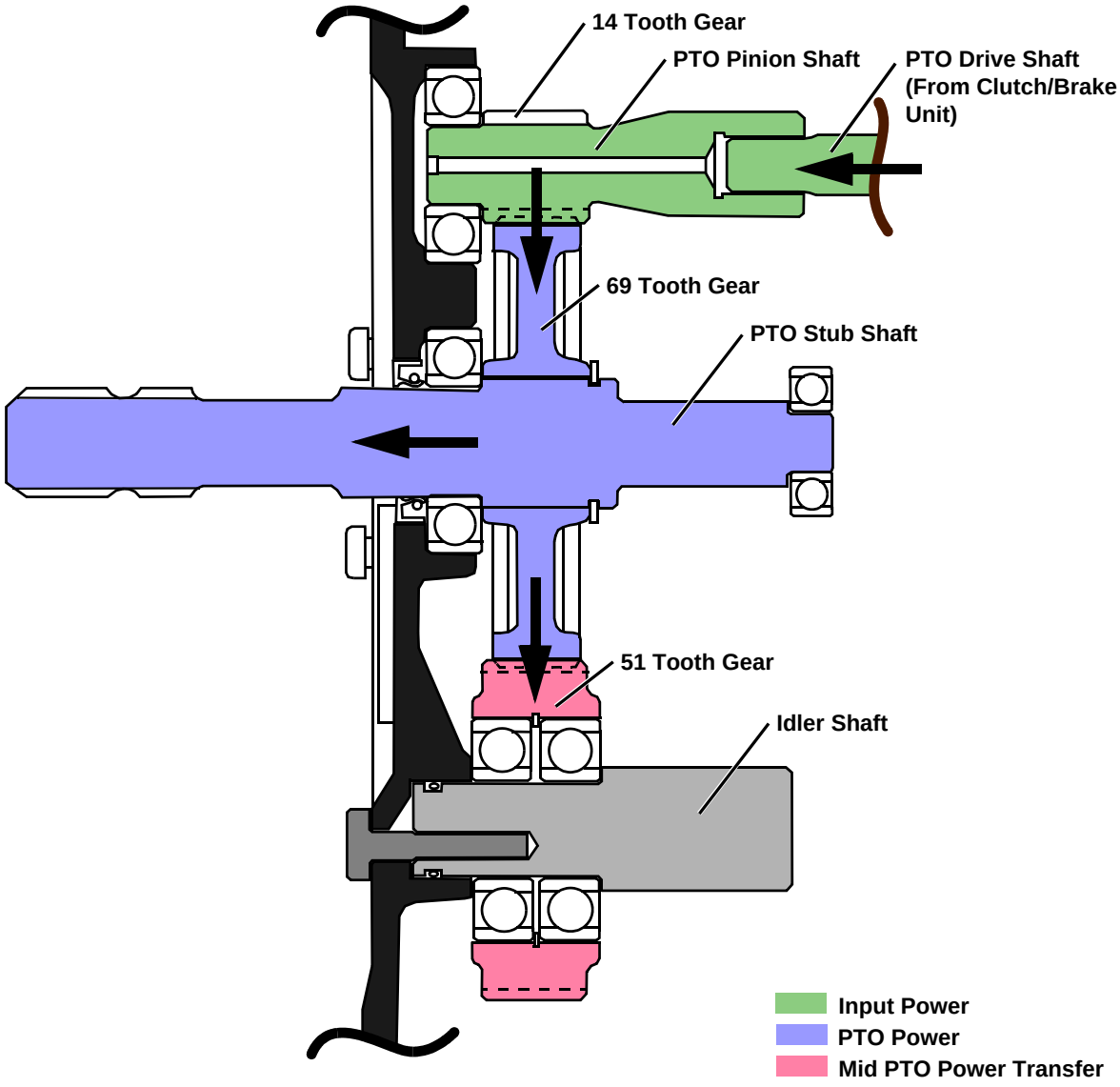
The PTO clutch and PTO brake are engaged or disengaged by the operator through a mechanical linkage which moves a shift collar.

The PTO brake is a spring loaded multi-plate wet brake and is normally engaged, preventing the PTO clutch shaft from rotating. The PTO clutch is a multi-plate wet clutch and is normally disengaged.

When the PTO lever is moved to the forward (engaged) position, the shift collar is moved to the rearward position. This turns the levers on the PTO brake, compressing the brake springs. This releases spring pressure on the brake piston and brake pack, and disengages the brake. At the same time, the levers on the clutch are released, allowing the springs in the clutch to expand, pressing the clutch piston against the clutch pack, and engaging the PTO clutch. Pressure applied to the clutch pack locks the plates (splined to the clutch hub), to the friction disks (locked to the clutch housing). Power is transferred from the input shaft to the clutch housing, through the clutch plates and disks, to the clutch hub, and finally to the PTO drive shaft.

A locking tab on the outside of the brake housing allows the PTO drive shaft to rotate approximately 330°, which, in turn allows the PTO stub shaft to rotate approximately 65° to aid in aligning the splines of an attachment driveshaft during hook-up.

POWER TRANSMISSION – REAR PTO



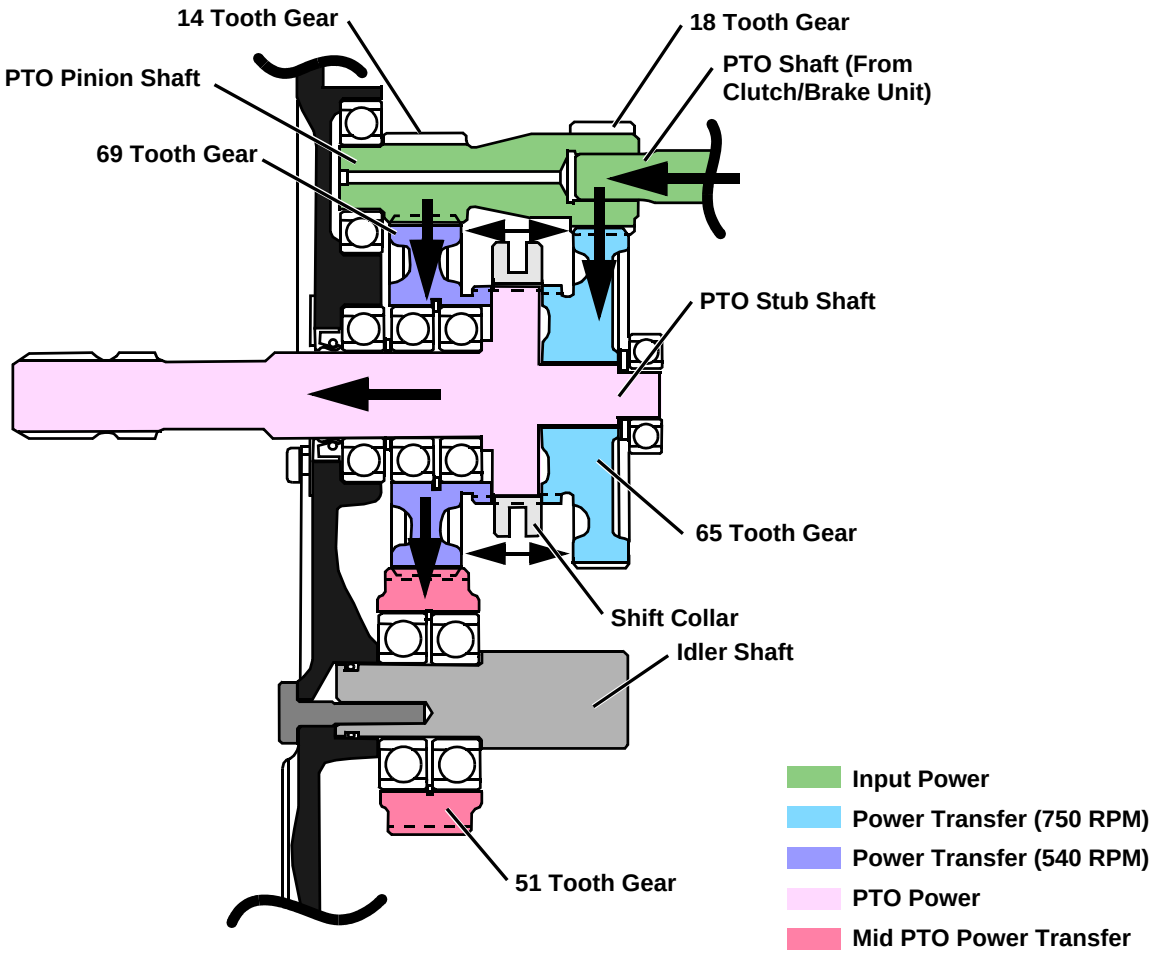
Function:

The rear PTO provides a means for transferring engine power to rear mounted attachments.

Theory:

Power is provided to the PTO gear power train through PTO clutch and PTO drive shaft. Power is not transferred until the operator engages the PTO lever (See “POWER TRANSMISSION — PTO CLUTCH AND BRAKE”.) The PTO driveshaft turns in a counter-clockwise direction and is coupled directly to the PTO pinion shaft. The PTO pinion shaft is a shaft and 14 tooth gear machined as a single part. This 14 tooth gear is in constant mesh with the 70 tooth gear which is splined to the PTO stub shaft, and rotates in a clockwise direction. The rear PTO always turns clockwise when looking at the end of the PTO shaft from the rear of the tractor. The rear PTO runs independently of the tractor forward or rearward motion, or rate of travel. Speed of the PTO is dependent on engne RPM. The rear PTO is limited to 580 RPM at maximum engine speed.

POWER TRANSMISSION – 2 -SPEED PTO (EUROPEAN ONLY)



Function:

The rear PTO provides a means for transferring engine power to rear mounted attachments.

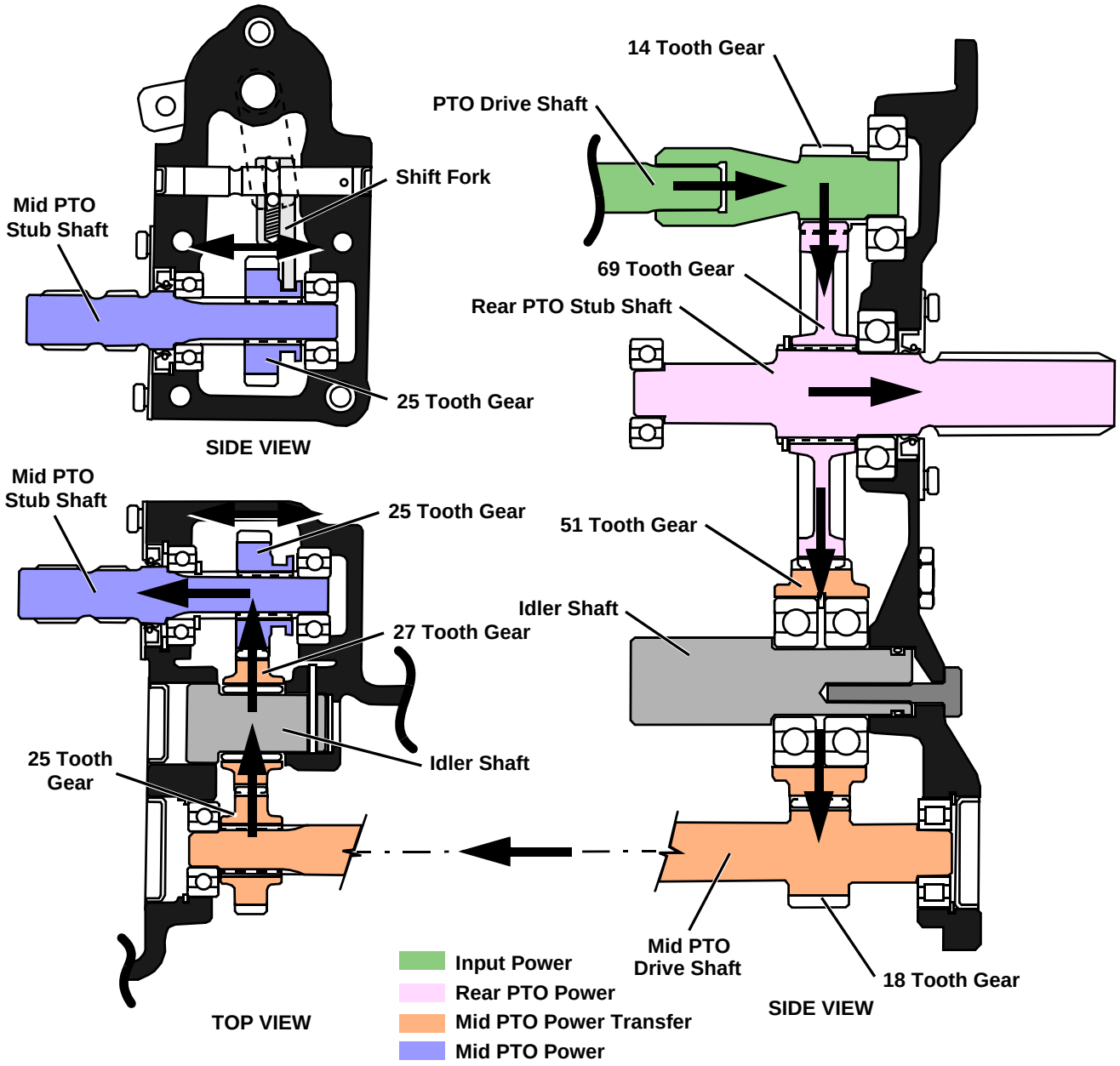
Theory:

Power is provided to the PTO gear power train through PTO clutch and PTO drive shaft. Power is not transferred until the operator engages the PTO lever (See “POWER TRANSMISSION – PTO CLUTCH AND BRAKE”.) The PTO driveshaft turns in a counter-clockwise direction and is coupled directly to the PTO pinion shaft. The PTO pinion shaft is a shaft with a 14 tooth, and 18 tooth gear machined as a single part. The 14 tooth gear is in constant mesh with the 69 tooth gear. The 18 tooth gear is in constant mesh with the 65 tooth gear. Both the 65 and 69 tooth gears rotate freely on the PTO stub shaft. Power is not transferred to the PTO stub shaft until the shift collar is moved to engage one of the two gears.

When the operator moves the PTO speed control lever from the center (neutral) position to the HIGH or LOW position, it moves the shift collar through a mechanical linkage. The shift collar couples the PTO stub shaft to the 65 or 69 tooth gear, transferring power from the pinion shaft, through the gear to the shift collar, and to the stub shaft.

The rear PTO always turns clockwise when looking at the end of the PTO shaft from the rear of the tractor. The rear PTO runs independently of the tractor forward or rearward motion, or rate of travel. Speed of the PTO is dependent on engne RPM. The rear PTO is limited to 580 RPM at maximum engine speed (low speed) and 800 RPM (high speed).

POWER TRANSMISSION – MID PTO



Function:

The mid PTO provides a means for transferring engine power to mid mount attachments such as a mower deck. It also provides a means for engaging and disengaging engine power to the mid PTO stub shaft.

Theory:

Power is provided to the mid PTO through the 70 tooth gear which is splined to the rear PTO shaft and rotates in a clockwise direction. (See "POWER TRANSMISSION – REAR PTO".) Power is not transferred until the operator engages PTO lever. (See "POWER TRANSMISSION – PTO CLUTCH AND BRAKE".) A 51 tooth gear is in constant mesh with the 70 tooth gear, and is in constant mesh with the 18 tooth gear on the mid PTO drive shaft. The mid PTO drive shaft rotates in a clockwise direction. Power is transmitted through the mid PTO drive shaft to the 25 tooth gear, which is splined to the drive shaft, and is in constant mesh with the 27 tooth gear. The 27 tooth gear is splined to the PTO stub shaft and rotates in a clockwise direction.

When the operator selects the mid PTO; a shift fork moves the 25 tooth gear, which is splined to the PTO stub shaft, to the rear-most position, engaging the teeth of the 27 tooth gear, and allowing power to be transmitted from the 27 tooth gear, through the 25 tooth gear, and to the mid PTO stub shaft.

PTO TROUBLESHOOTING CHART

Problem or Symptom / Check or Solution	Rear PTO does not engage	Rear PTO will not stay engaged	Mid PTO does not engage	Mid PTO does not stay engaged	2 speed PTO will not engage	2 speed PTO will not stay engaged	PTO slips	PTO noisy	PTO does not stop quickly enough after it is disengaged
PTO clutch worn/ no longer serviceable	●						●		
PTO brake worn/ no longer serviceable									●
Cogs on gear or shift collar worn/ no longer serviceable	●	●	●	●	●	●			
Gears worn/ no longer serviceable	●		●		●			●	
Detent ball spring broken		●				●			
Shift linkage worn or damaged	●		●		●				

PTO DIAGNOSIS

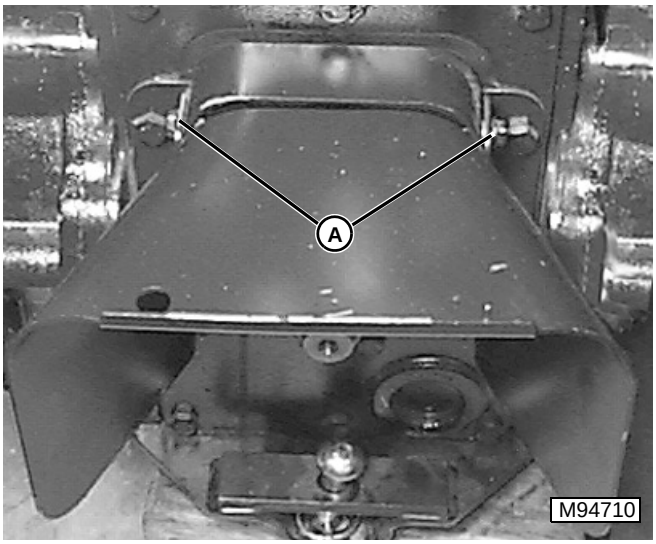
Test/Check Point	Normal	If Not Normal
A. PTO Lever	Smooth operation, engages PTO.	Lubricate linkage. Replace damaged parts.
B. Mid PTO Lever	Smooth operation, engages PTO.	Lubricate linkage. Replace damaged parts.
C. 2-Speed PTO Lever	Smooth operation, engages PTO.	Lubricate linkage. Replace damaged parts.
D. Linkage	Not bent or binding.	Lubricate linkage or replace damaged parts.

PTO REPAIR

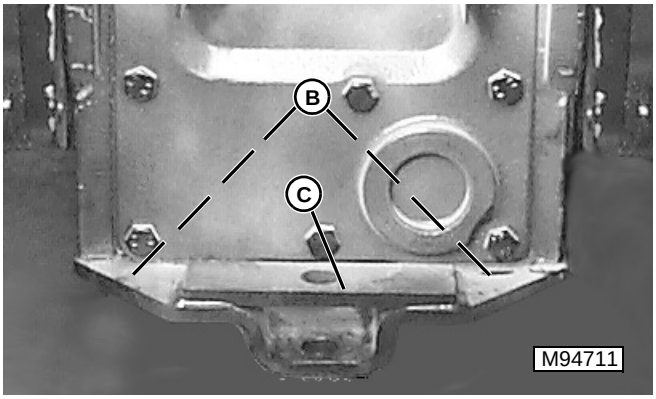
REAR PTO SHAFTS AND GEARS REMOVAL AND INSTALLATION

Removal:

1. Park tractor on a level surface, shut off engine, and set park brake.
2. If necessary, remove center lift link, draft arms, and adjustable draft links.



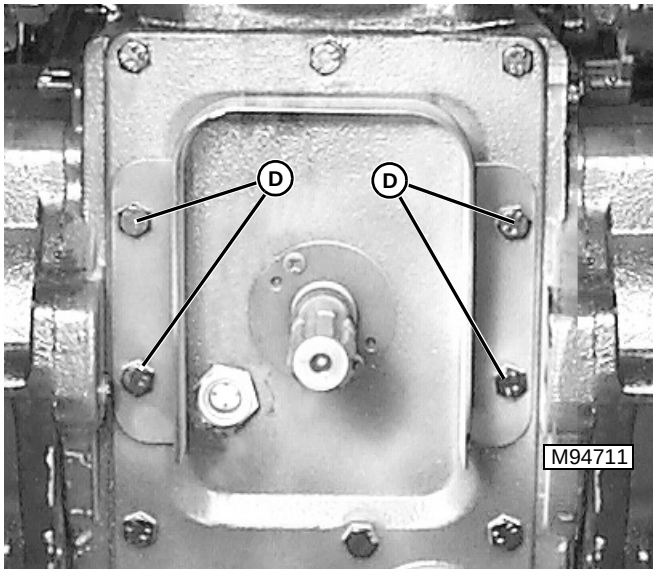
3. Remove two cap screws (A), spacers, nuts, and rear PTO shield assembly.



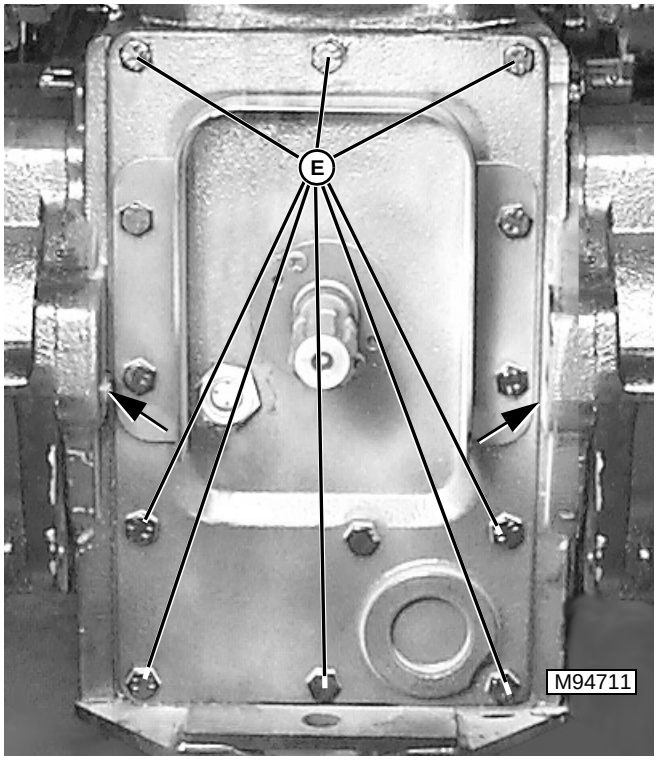
4. Remove two cap screws (B) and rear draw bar bracket (C).

*NOTE: Capacity of the hydraulic system is approximately **26 liters (6.8 gal) for HST models; or 24 liters (6.3 gal) for CST, SST and SRT models**.*

5. Drain hydraulic oil from reservoir.



6. Remove four cap screws (D) and rear PTO shield support bracket.



NOTE: Top center and bottom center cap screws in rear cover are longer.

7. Remove eight cap screws (E).
8. If necessary, loosen two rearmost cap screws attaching final drive housings to differential housing (arrows).
9. Gently pry around edges of cover to break sealant. Wobble shaft and pull at the same time to remove rear cover, shafts and gears as a unit.

NOTE: If equipped, mid PTO shaft may come out of differential housing with rear cover, or may fall into differential housing.

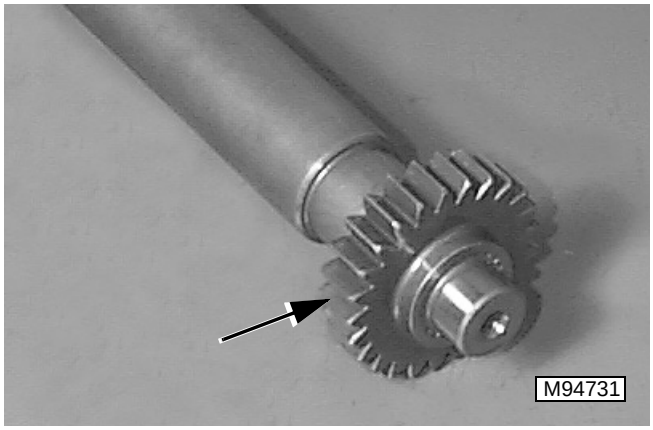
Installation:

Installation is the reverse of removal.

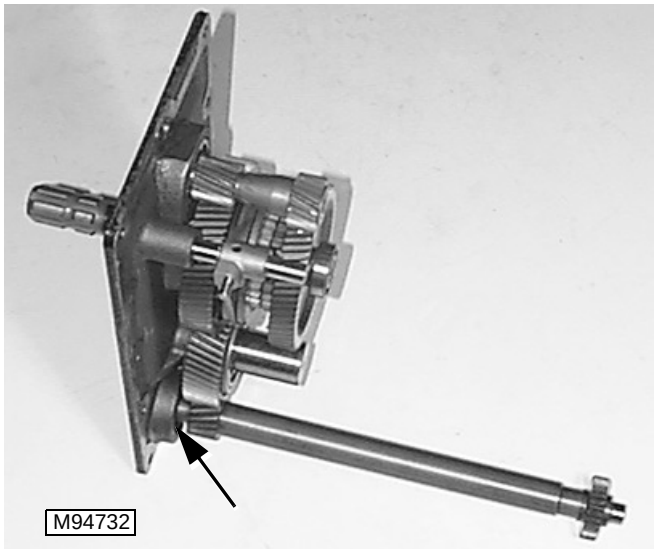
IMPORTANT: Replace all O-rings, gaskets, and seals. Used or damaged O-rings, gaskets and seals will leak.

- Thoroughly clean mating surfaces of rear cover and transmission housing to remove all traces of old gasket material.
- If tractor is equipped with two speed PTO, place shift arm in forward position when installing. Make sure shift fork pin engages shift arm yoke.
- Lay a bead of TY16021 Sealant on flange surfaces of differential housing.
- Two longer cap screws are placed in the top center and bottom center holes.
- If tractor is equipped with a mid PTO, follow steps outlined below.
- Tighten cap screws retaining rear cover to **40 N•m (30 lb-ft).**

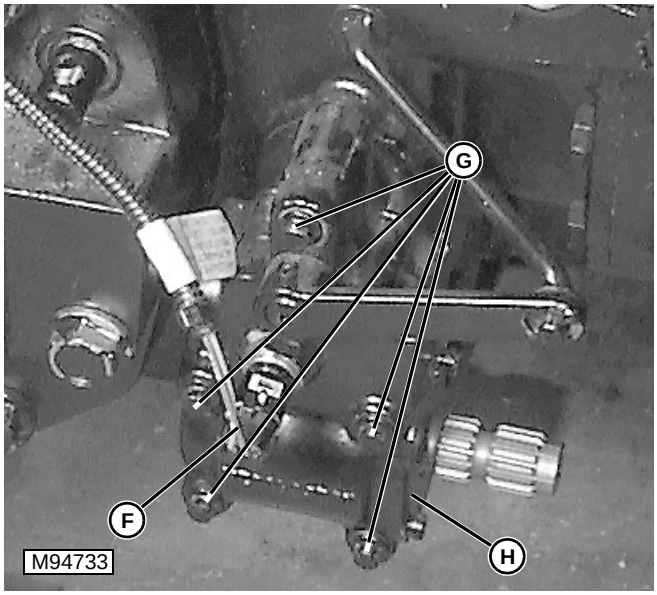
Mid PTO equipped tractors:



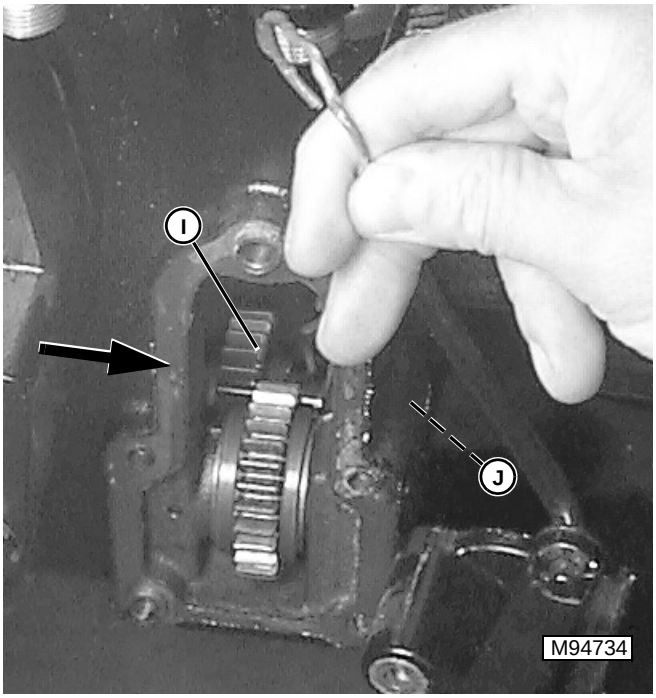
1. Remove mid PTO shaft from bottom of differential housing. When shaft is removed, gear may fall into differential housing. Retrieve gear and install on front end of shaft.



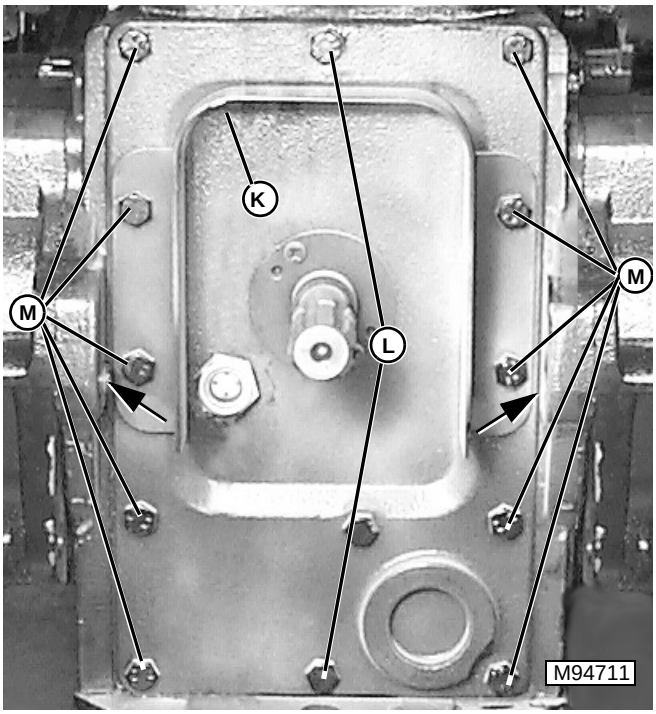
2. Install shaft and gear into roller bearing in rear cover.



3. If equipped, disconnect wiring harness connector (F) from mid PTO switch.
4. Remove five cap screws (G) and mid PTO gear box (H) from right side of differential housing.
5. Install cover with shafts and gears as an assembly into differential housing. Do not install cap screws at this time.



6. Slide gear (I) on mid PTO shaft forward slightly to make sure it will mesh with gear in differential housing.
7. Using a piece of stiff wire formed into a hook or other suitable tool, lift mid PTO shaft slightly to align end of shaft with bearing (J) in front of differential housing. Install cover with shafts and gears into differential housing. If equipped with a 2-speed PTO, check to make sure that shift fork engages shift lever and linkage.

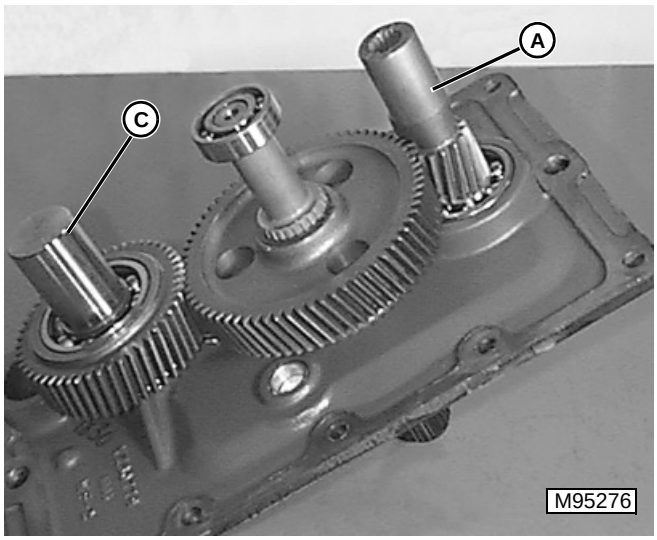


8. Install PTO guard support (K) and ten cap screws (M). Install the two longer cap screws (L) in the location shown. Tighten all cap screws to **40 N•m (30 lb-ft).**
9. If loosened, tighten two rearmost cap screws attaching final drive housings to differential housing (arrows).
10. Clean mating surfaces of mid PTO gear case and differential housing.
11. Lay a bead of TY16021 Sealant on flange surfaces of differential housing.
12. Install mid PTO gear case to differential housing, and retain with five cap screws. Tighten cap screws to **55 N•m (40 lb-ft).**
13. If equipped, connect mid PTO wiring harness.

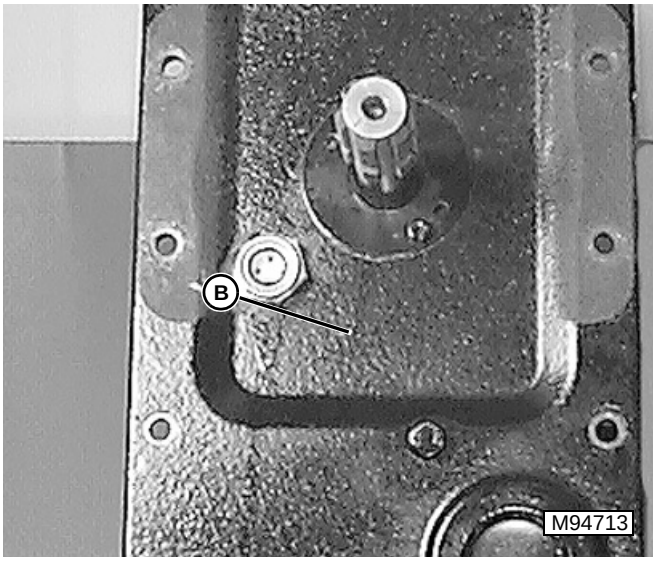
REAR PTO SHAFTS & GEARS DISASSEMBLY AND ASSEMBLY

NOTE: For 2-speed PTO disassembly procedure, (See 2 SPEED PTO SHAFTS AND GEARS DISASSEMBLY.)

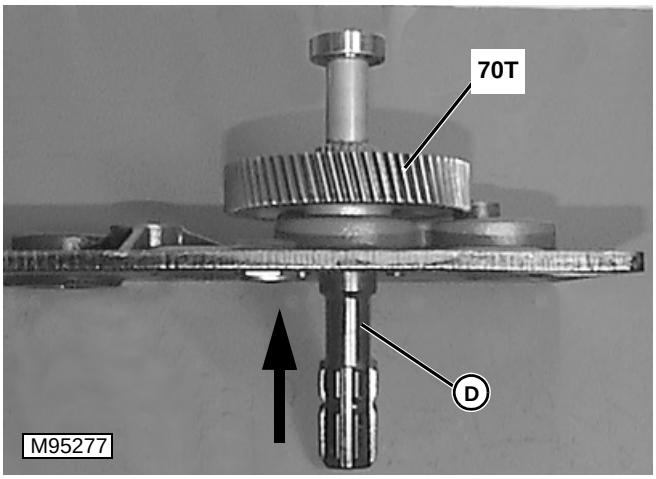
1. Remove rear PTO drive shaft and gears as an assembly. (See "REAR PTO SHAFTS AND GEARS REMOVAL AND INSTALLATION").



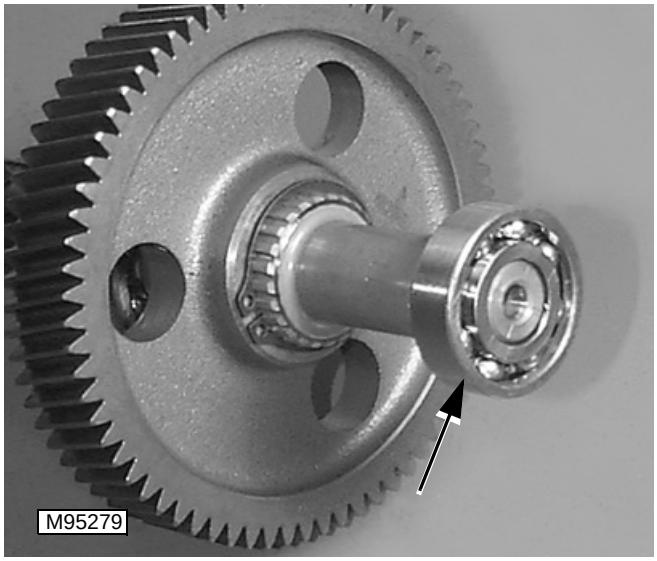
2. Remove pinion shaft (A).



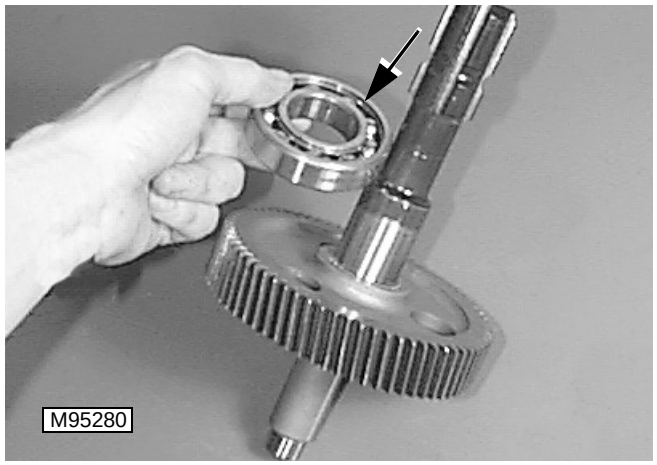
3. Remove cap screw (B) from cover that retains the idler shaft (C). Remove idler shaft, 51 tooth gear, and bearings as an assembly.



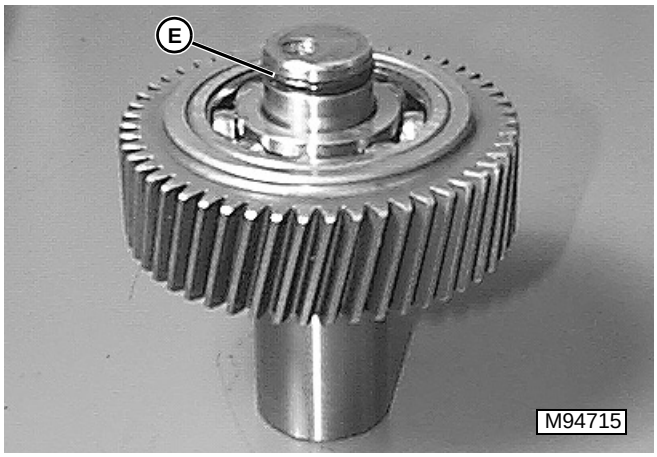
4. Using a plastic mallet, remove output shaft (D), 70 tooth gear, and bearings from rear cover.



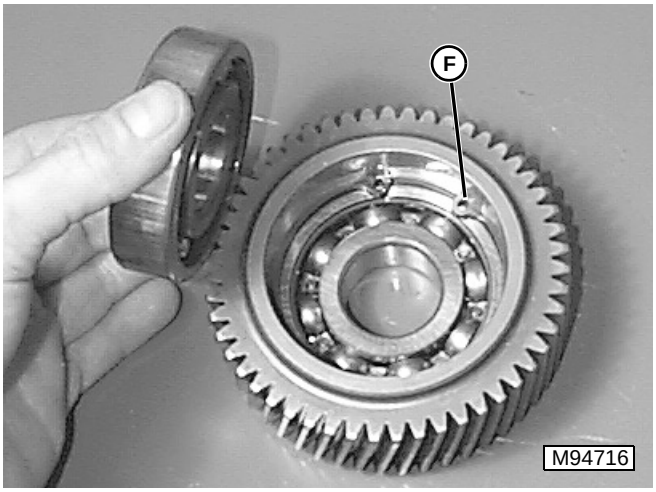
5. Inspect inner output shaft bearing for smooth operation, wear or damage. Replace if needed.
6. Inspect 70 tooth gear for wear or damage. Replace if needed.



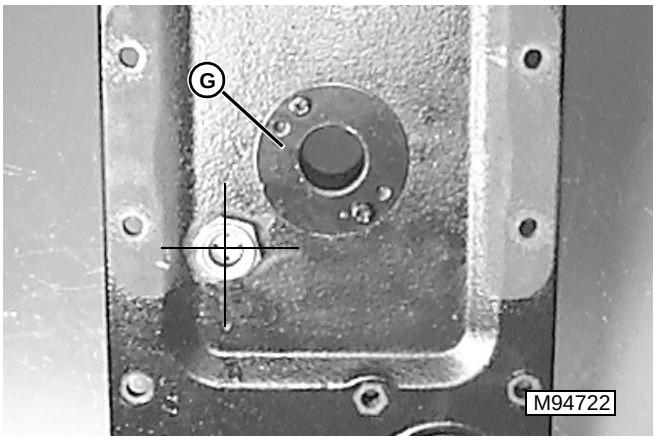
7. Inspect outer output shaft bearing for smooth operation, wear or damage. Replace if needed.



8. Remove O-ring (E) from end of idler shaft. Remove gear.

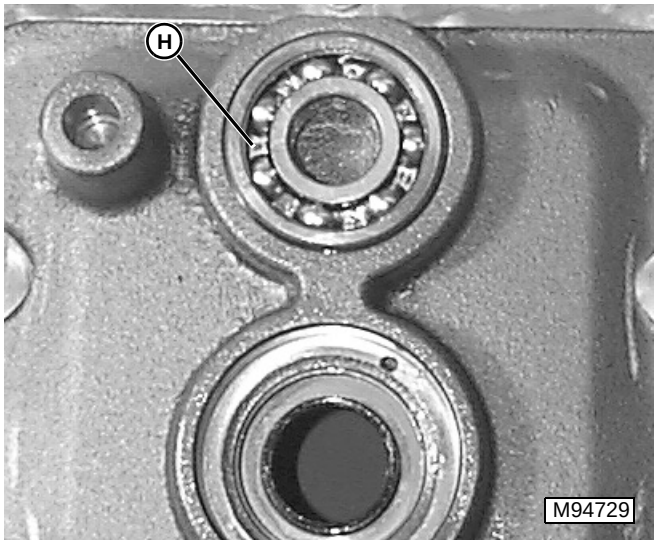


9. Remove bearings from gear. If necessary, remove snap ring (F). Inspect bearings for smooth operation, wear or damage. Replace if needed.



10. Remove two screws and seal retainer (G).
11. Using a suitable seal driver, remove seal.

IMPORTANT: If sight glass is removed, it must be installed so that the holes are vertical and horizontal (see alignment lines in photo above).



12. Inspect pinion shaft bearing (H) in cover for smooth operation, wear or damage. Replace if needed.

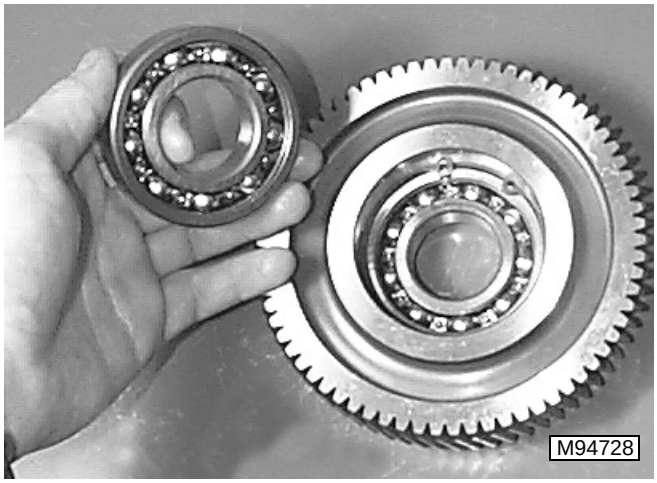
Assembly:

IMPORTANT: DO NOT spin bearing using compressed air. Damage to bearing balls, cage, and races could result.

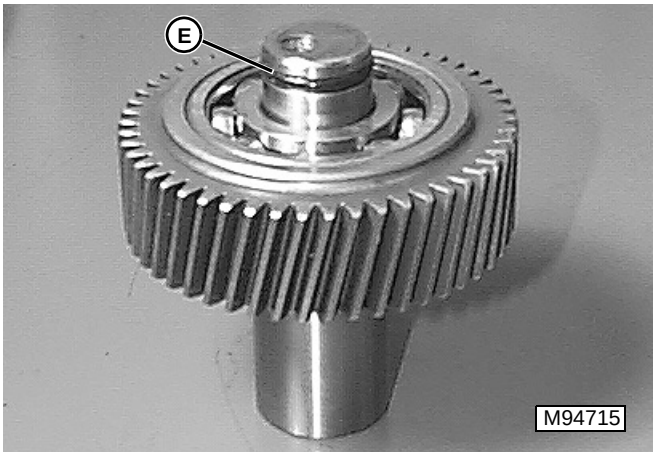
NOTE: Before beginning assembly, be sure that all components are clean, and in good condition.

IMPORTANT: Use liberal amounts of transmission oil to lubricate components as they are assembled. DO NOT use grease or other heavy lubricants unless they are specifically called for.

1. Clean mating surface of rear cover to remove old gasket material.



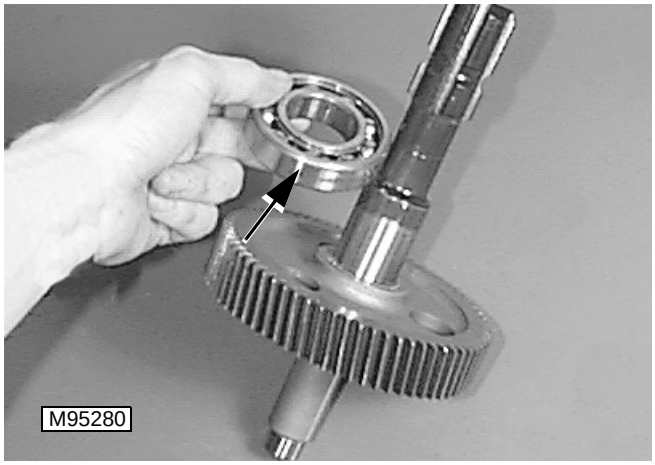
1. Install bearings and snap ring into 51 tooth gear.

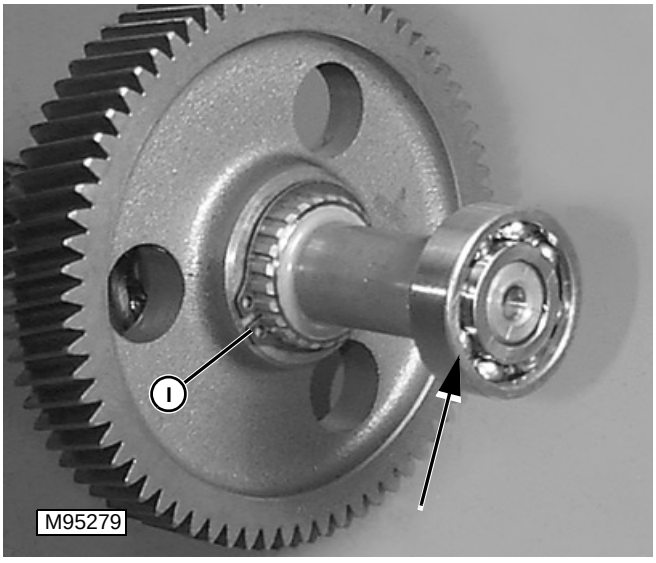


2. Install idler gear onto idler shaft.

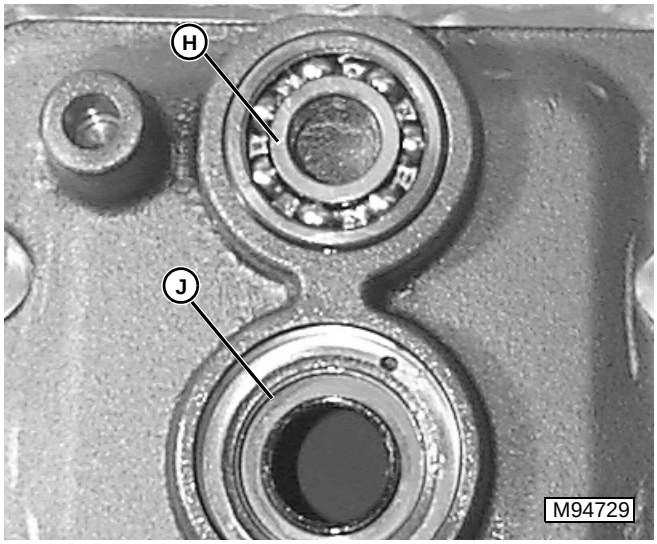
IMPORTANT: Replace all O-rings, gaskets, and seals. Used or damaged O-rings, gaskets, and seals will leak.

3. Install a new O-ring (E) onto idler shaft.

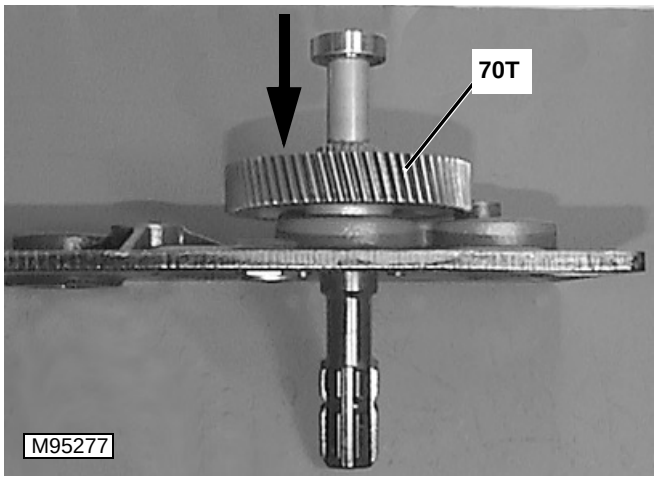




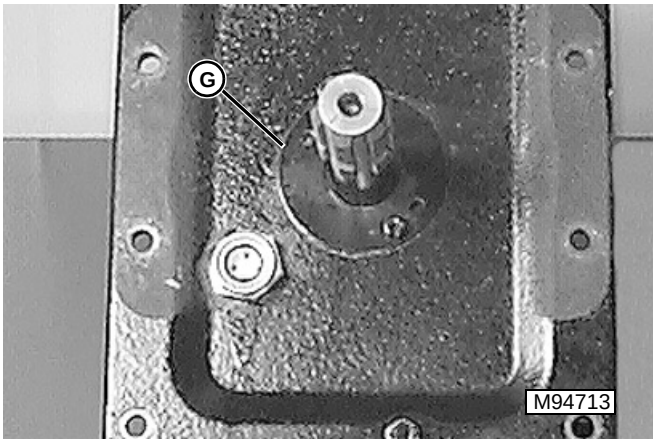
4. If removed, install snap ring (I) onto output shaft. Install 70 tooth gear against snap ring.
5. Install inner and outer bearings.



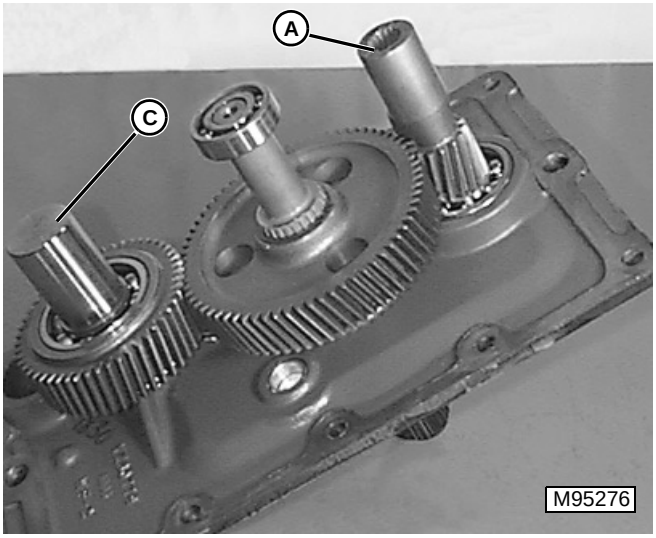
6. If removed, install pinion shaft bearing (H) into cover.
7. Using a suitable driver, install a new PTO shaft seal (J) in cover.



8. Install output shaft, gear and bearings into cover as an assembly. Use care to avoid damaging shaft seal.



9. Install seal retainer (G) and secure with two cap screws.



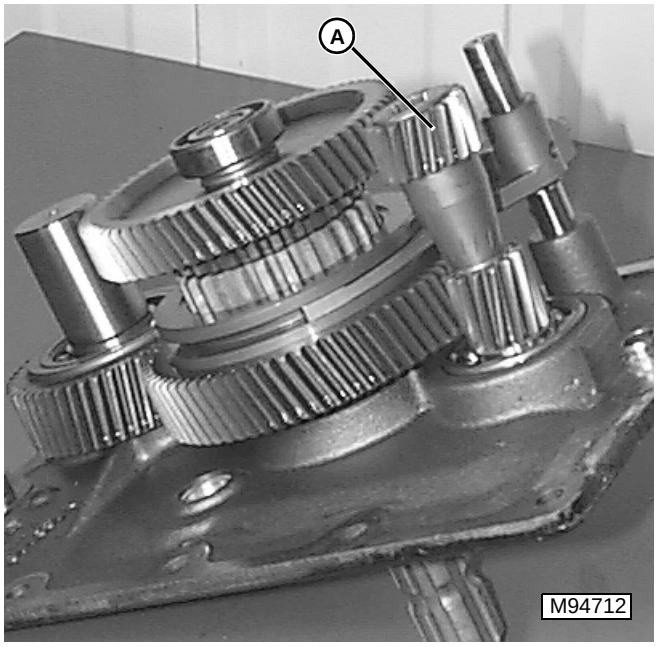
10. Install idler shaft (C) and gear into cover. Retain with cap screw.
11. Install pinion shaft (A) into cover.

NOTE: Check shafts to ensure that they are properly installed in cover; if bearings are not fully seated in cover, cover may break when PTO is installed onto transmission housing and attaching cap screws are tightened.

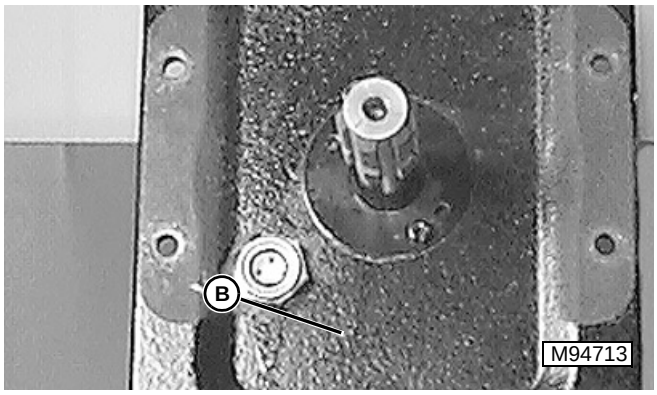
2-SPEED PTO SHAFTS AND GEARS DISASSEMBLY

NOTE: The following procedure is for a tractor equipped with a mid-PTO. Tractors not equipped with a mid-PTO are similar.

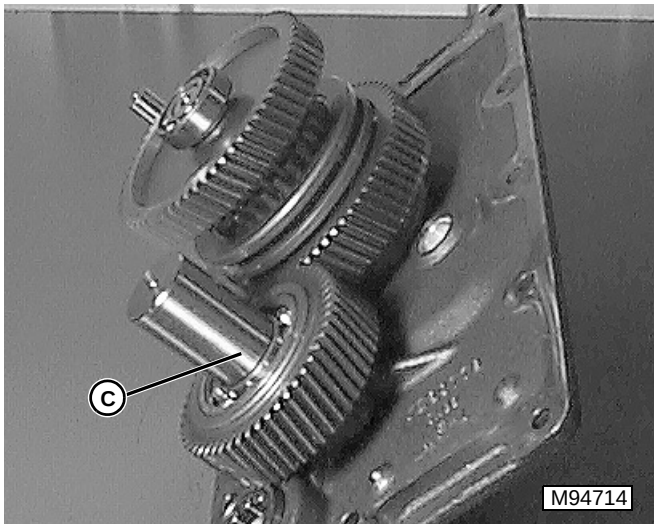
1. Remove rear PTO drive shaft and gears as an assembly. ((See "REAR PTO SHAFTS AND GEARS REMOVAL AND INSTALLATION").



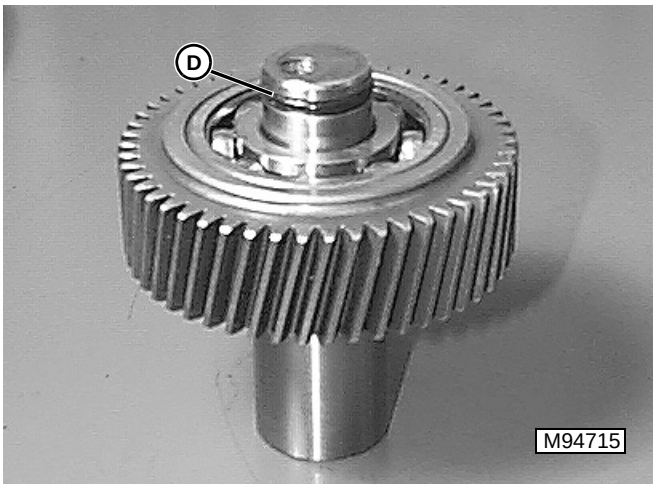
2. Remove pinion shaft.



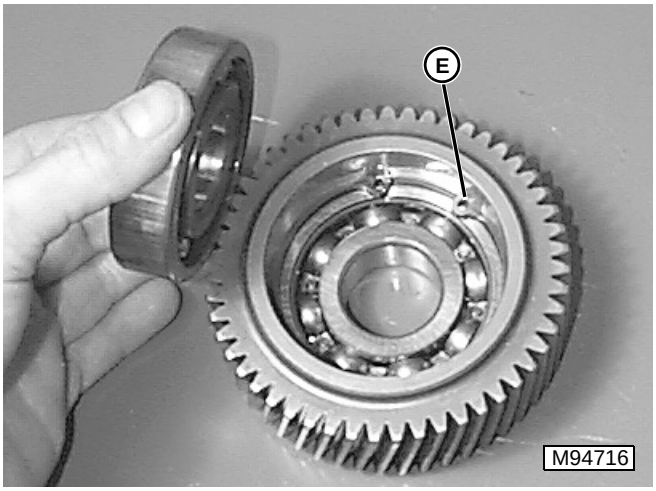
3. Remove cap screw (B) from cover that retains the idler shaft.



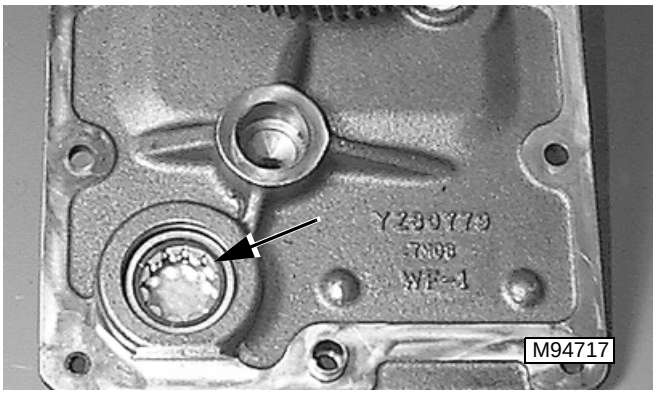
4. Remove idler shaft (C) and gear as an assembly.



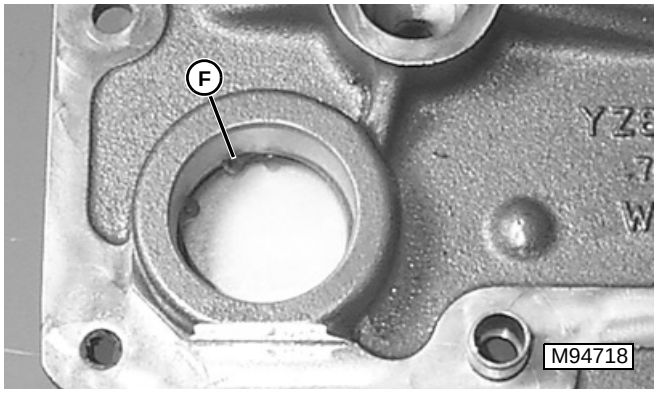
5. Remove O-ring (D) from end of idler shaft. Remove gear.



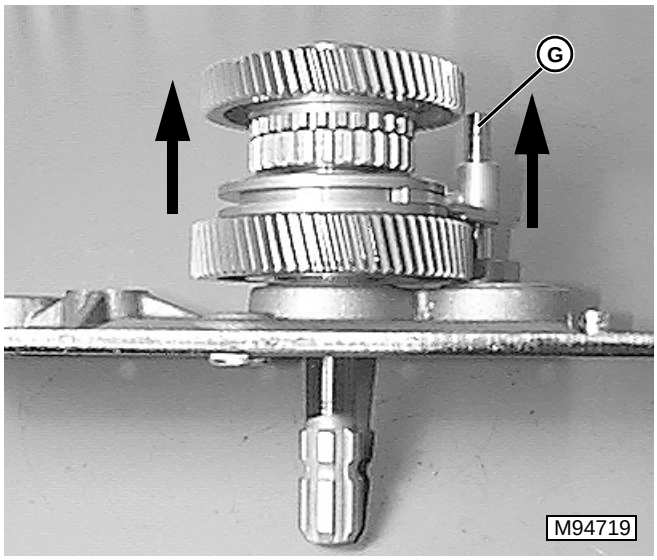
6. Remove bearings from gear. If necessary, remove snap ring (E). Inspect bearings for smooth operation, wear or damage. Replace if needed.



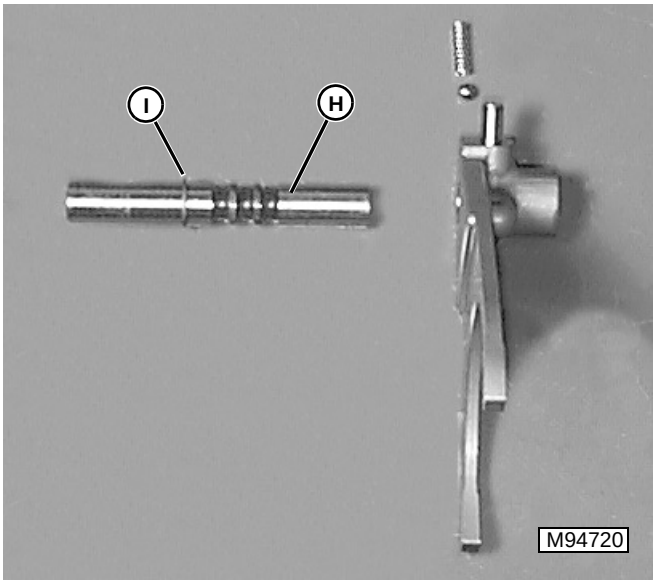
7. (Mid PTO Equipped Tractors) Remove roller bearing from bottom hole in cover. Inspect bearing for smooth operation, wear, or damage. Replace as necessary.



8. If necessary, remove snap ring (F) from hole in cover.

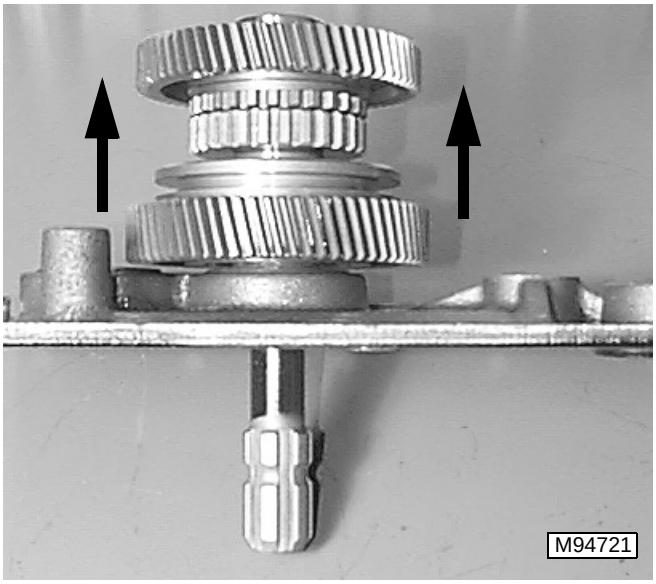


9. Slide shift collar up and remove 2-speed shift fork and shaft (G) from cover.

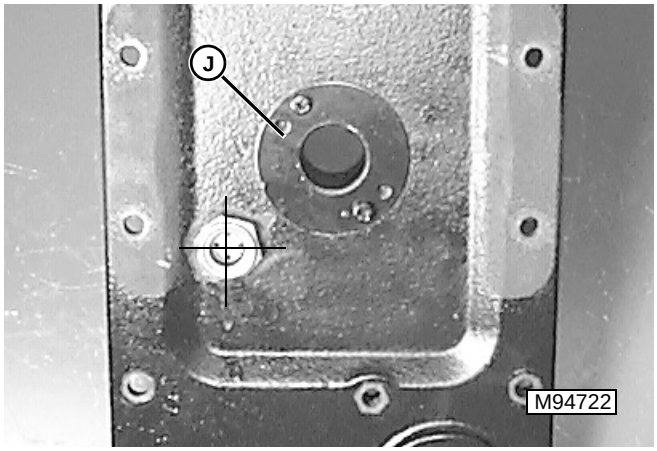


NOTE: Ball and spring in shift fork may jump and be lost. Use care when removing shift shaft from fork.

10. Remove shift shaft (H), ball, and spring from shift fork. If necessary, remove snap ring (I).

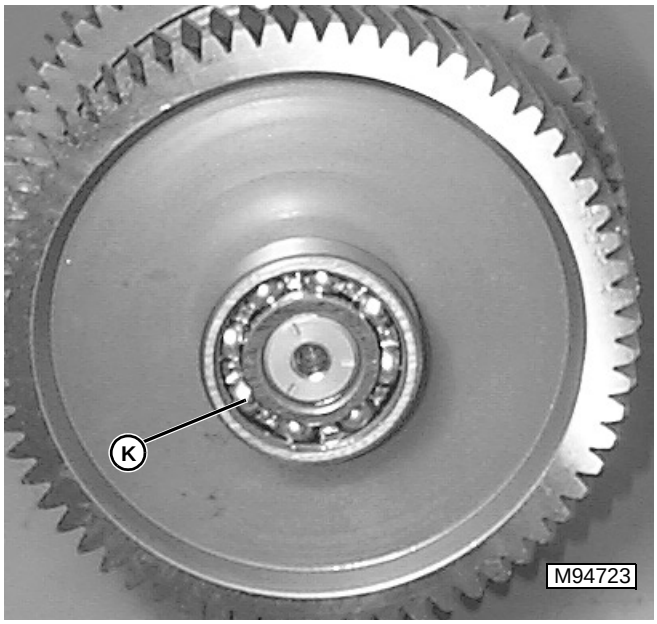


11. Using a plastic mallet, remove PTO stub shaft and gears from cover as an assembly.

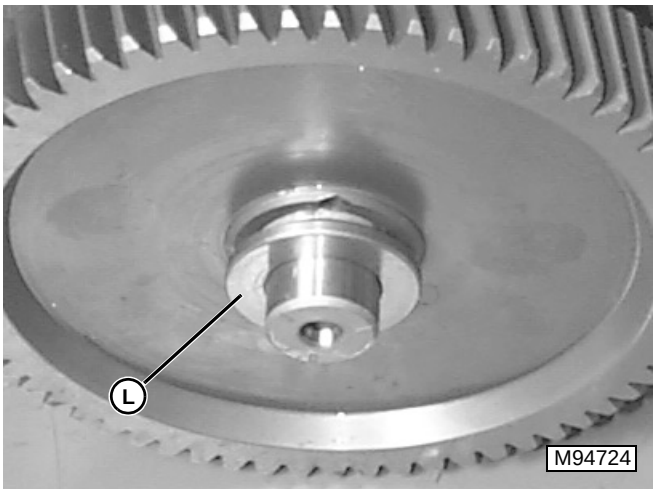


12. Remove two screws and seal retainer (J).
13. Using a suitable seal driver, remove seal.

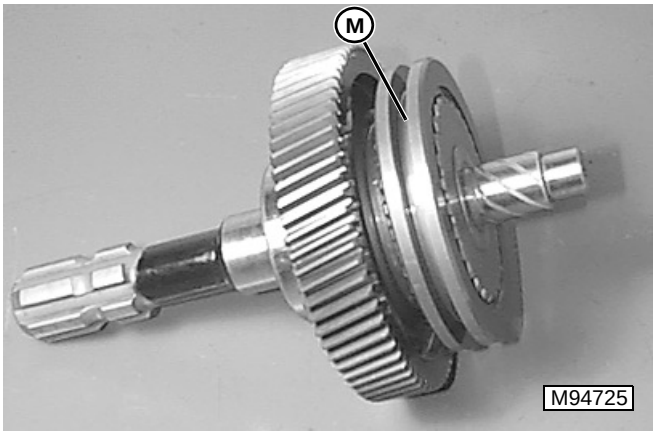
NOTE: If sight glass is removed, it must be installed so that the holes are vertical and horizontal (see photo).



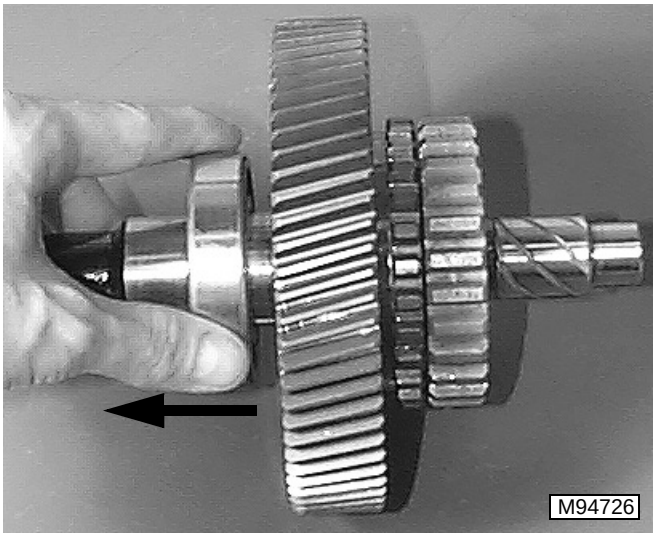
14. Using a suitable puller, remove bearing (K) from end of PTO shaft. Inspect bearings for smooth operation, wear or damage. Replace as necessary.



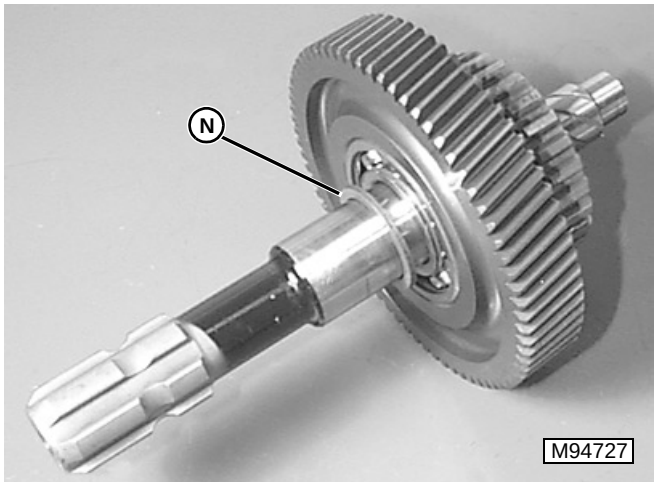
15. Remove washer (L) and gear from shaft.



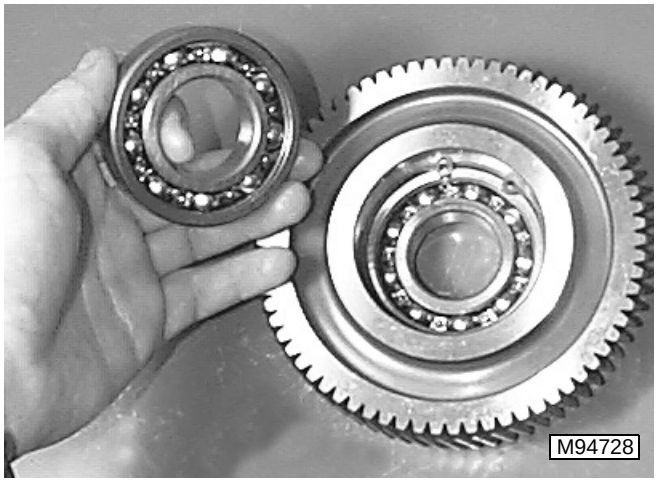
16. Remove shift collar (M).



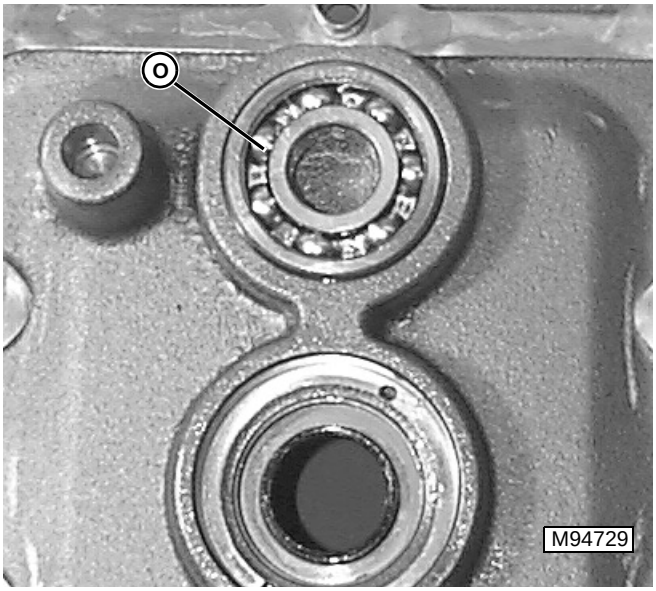
17. Remove bearing from drive end of shaft. If necessary, clean surface of shaft to remove paint for easier bearing removal. Inspect bearing for smooth operation, wear or damage. Replace as necessary.



18. Remove washer (N). Remove large gear and bearings as an assembly.

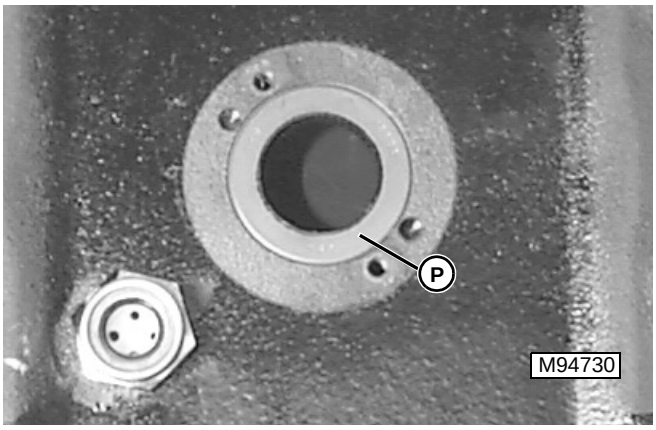


19. Remove bearings from gear. Inspect bearings for smooth operation, wear or damage. Replace as necessary.

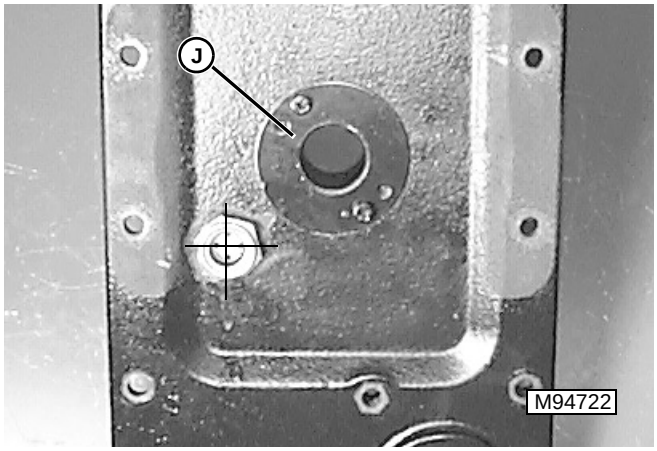


20. Remove pinion shaft bearing (O) from cover. Inspect bearing for smooth operation, wear or damage. Replace if needed.

2-SPEED PTO SHAFTS AND GEARS ASSEMBLY



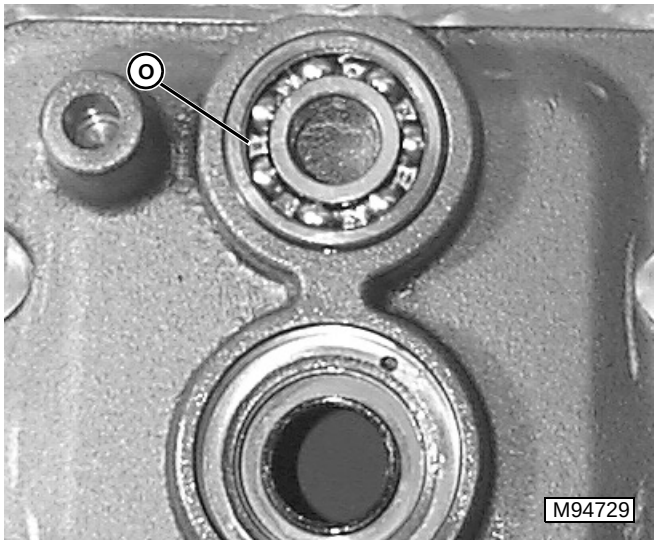
1. Using a suitable driver, install a new PTO stub shaft seal (P) into rear cover until flush with outer surface.



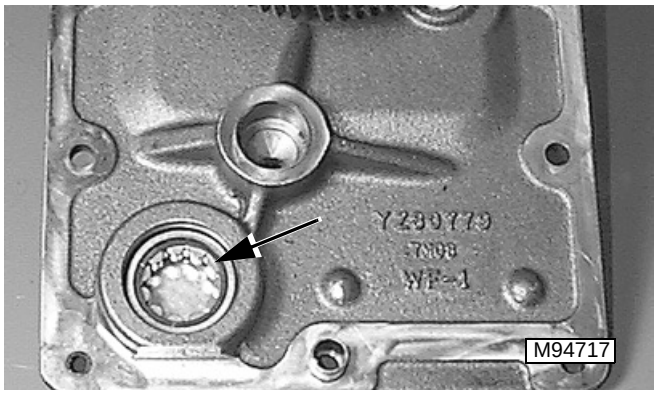
2. Install seal retainer plate (J) to rear cover, secure with two screws.

*NOTE: If sight glass is removed, it **must** be installed so that the holes are vertical and horizontal (see photo).*

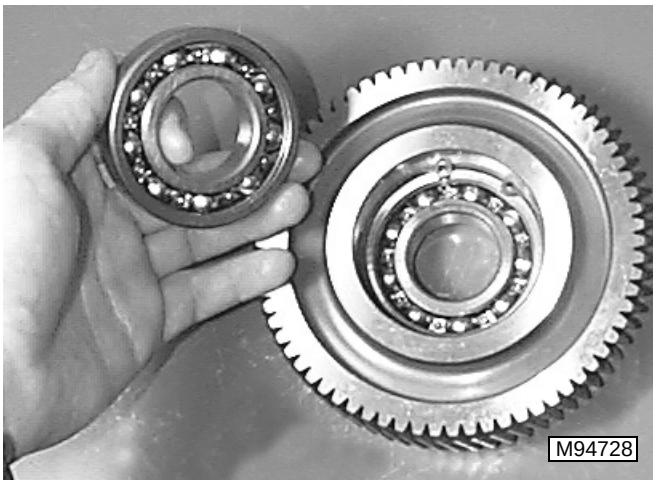
3. If removed, install sight glass into rear cover.



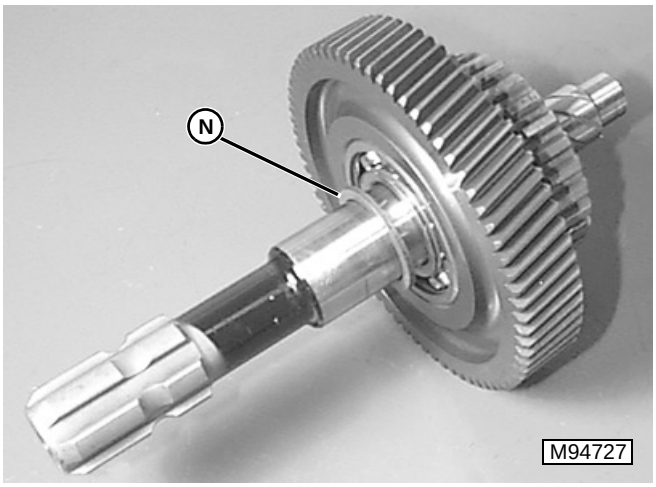
4. Install pinion shaft bearing (O) into rear cover.



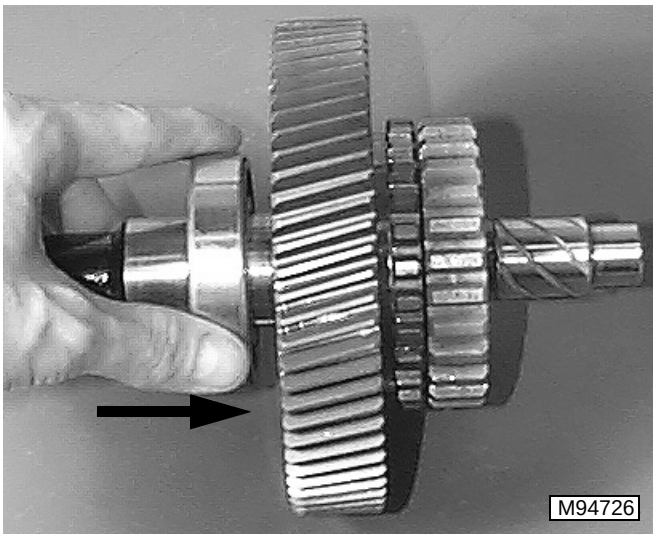
5. If equipped, install mid-pto roller bearing into rear cover.



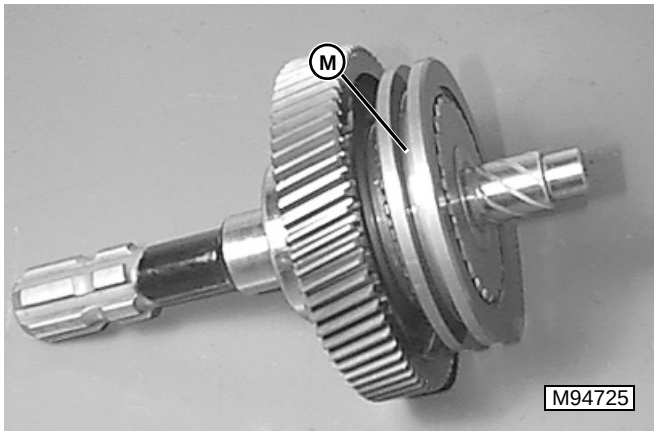
6. Install bearings and snap ring into 69 tooth gear.



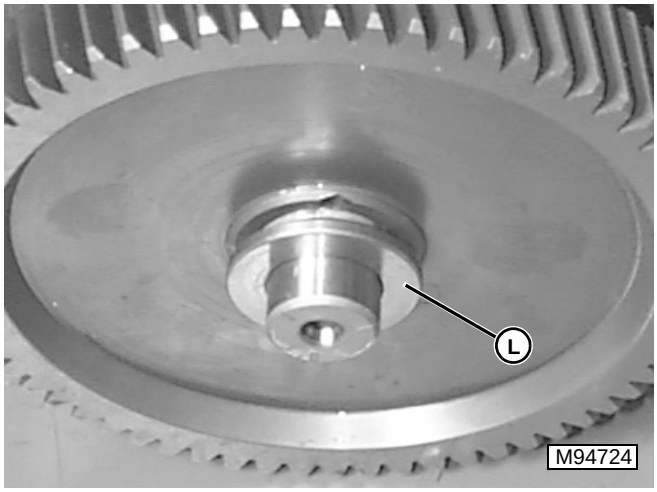
7. Install 69 tooth gear and washer (N) onto stub shaft.



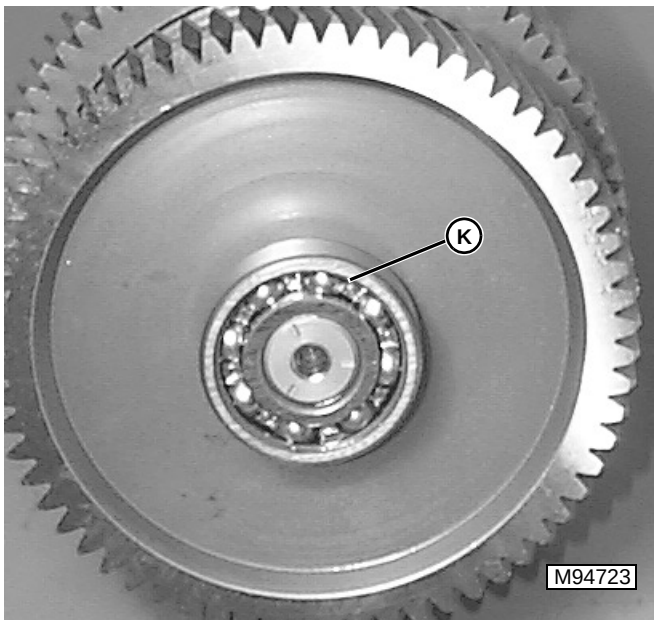
8. Install bearing.



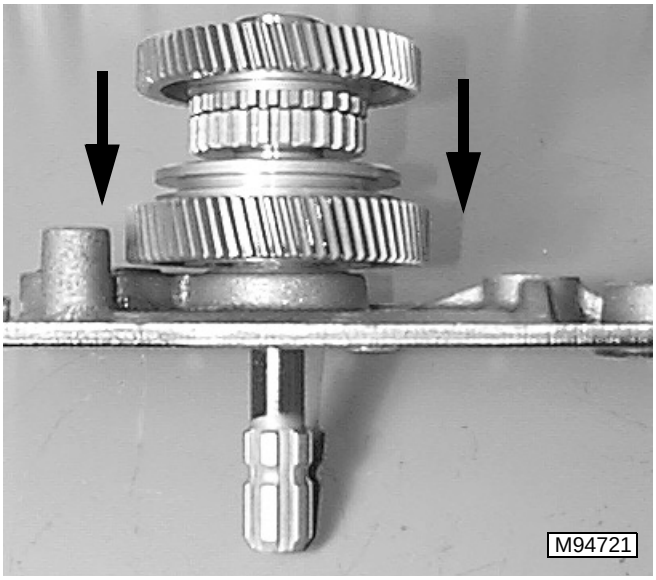
9. Install shift collar (M) onto 69 tooth gear.



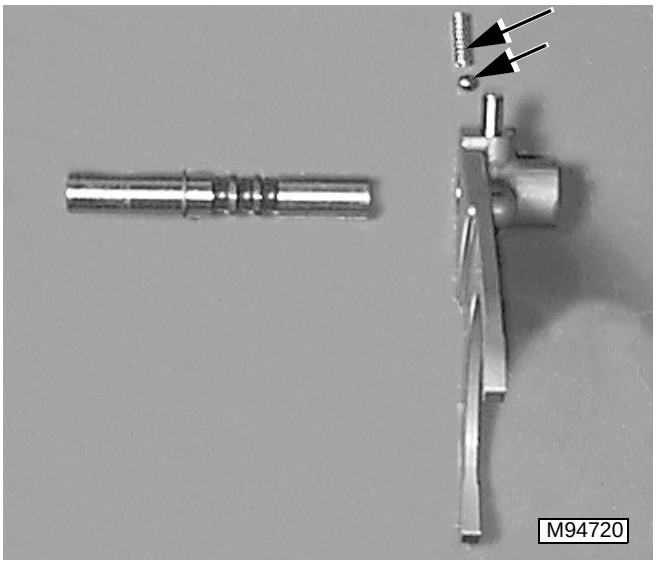
10. Install 65 tooth gear and washer (L) onto stub shaft.



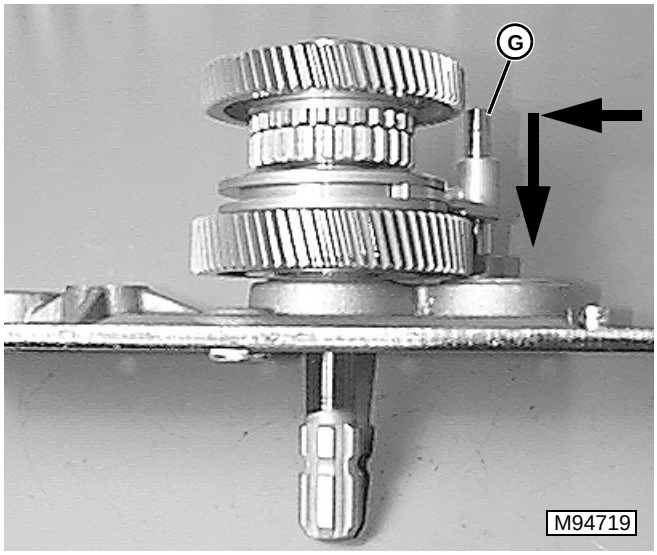
11. Install bearing (K) onto end of stub shaft.



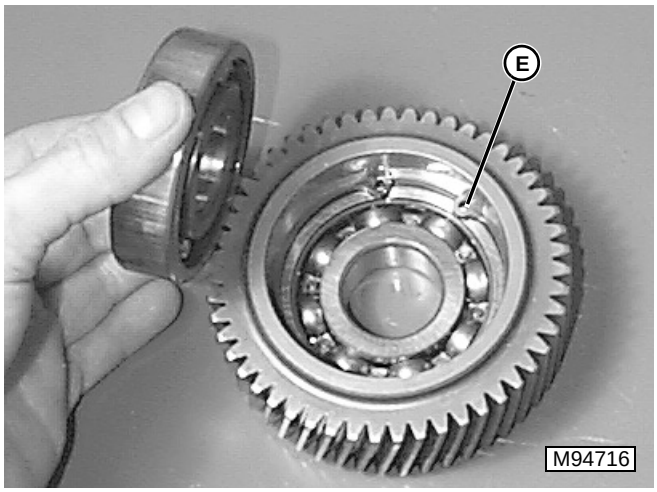
12. Install stub shaft and gears into rear cover.



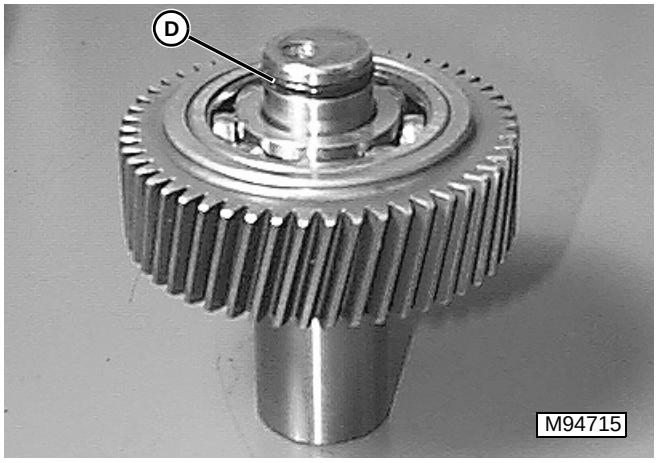
13. Assemble shift shaft, ball, and spring into shift fork.



14. Slide shift collar up, and slide shift fork into groove on collar. Install shift fork and shaft (G) as an assembly into rear cover.

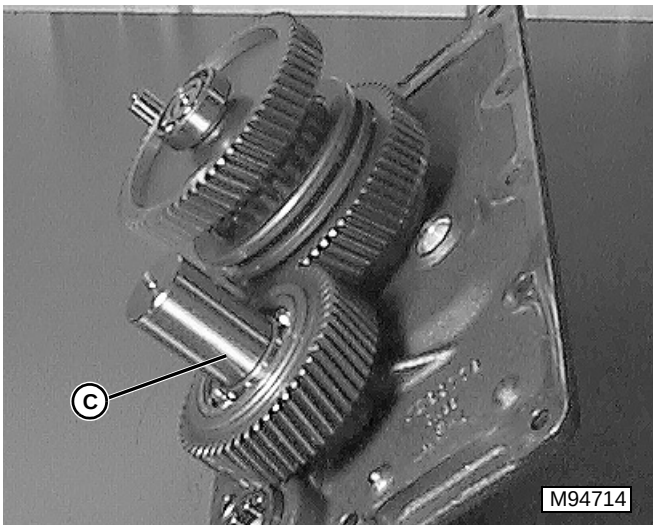


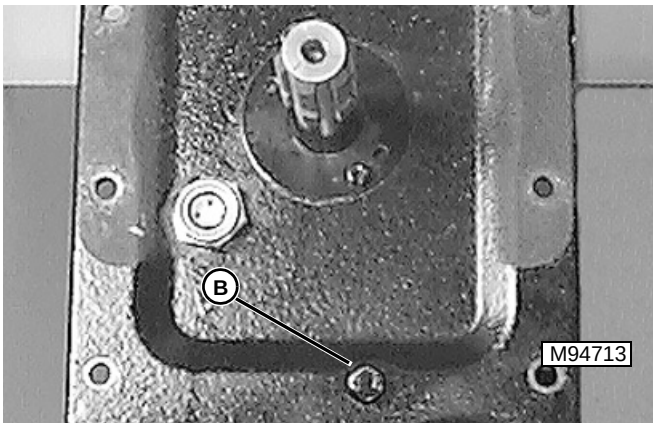
15. Install bearings and snap ring (E) into idler gear.



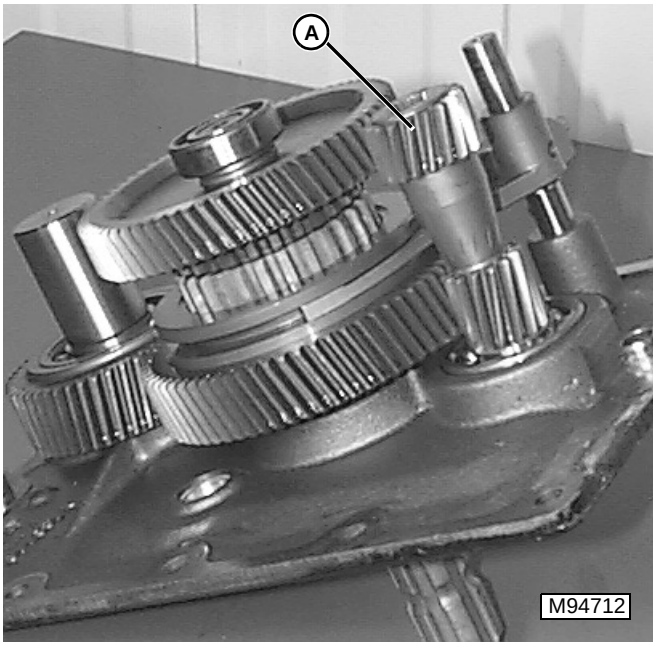
16. Install idler gear onto idler shaft.

17. Install a new O-ring (D) onto idler shaft.





18. Install idler shaft (C) with gear into rear cover. Retain with cap screw (B). Tighten cap screw to **55 N•m (40 lb-ft)**.

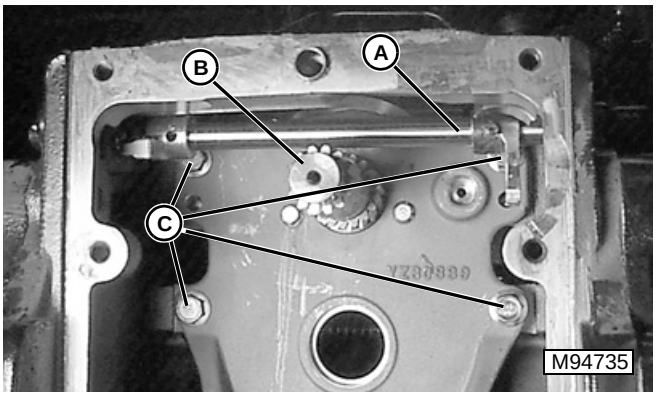


19. Install pinion shaft (A) into rear cover.
20. Install drive shaft and gears to tractor. ((See "REAR PTO SHAFTS AND GEARS REMOVAL AND INSTALLATION").

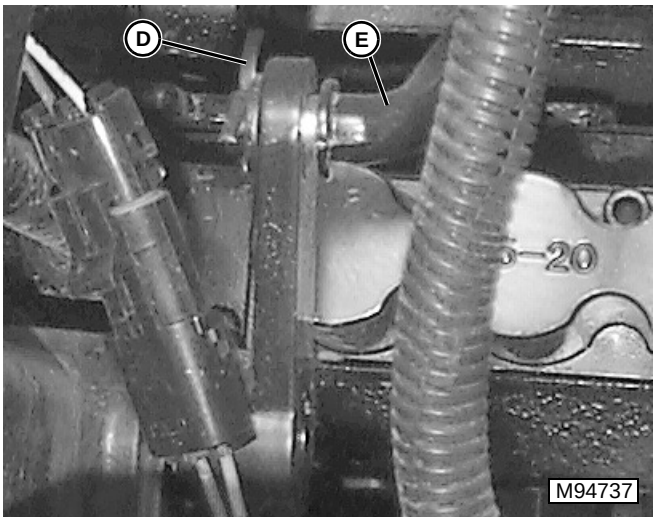
PTO CLUTCH AND BRAKE REMOVAL AND INSTALLATION

Removal:

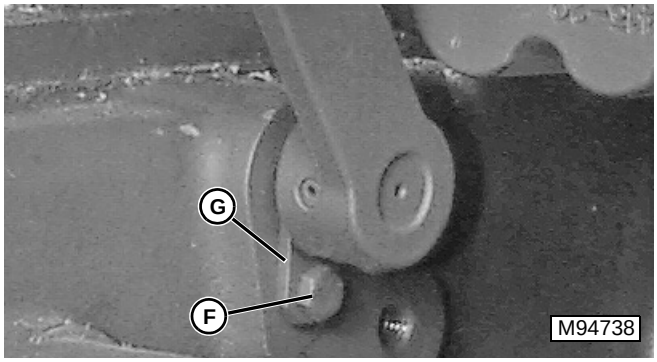
1. Remove rear PTO drive shaft and gears. ((See "REAR PTO SHAFTS AND GEARS REMOVAL AND INSTALLATION").



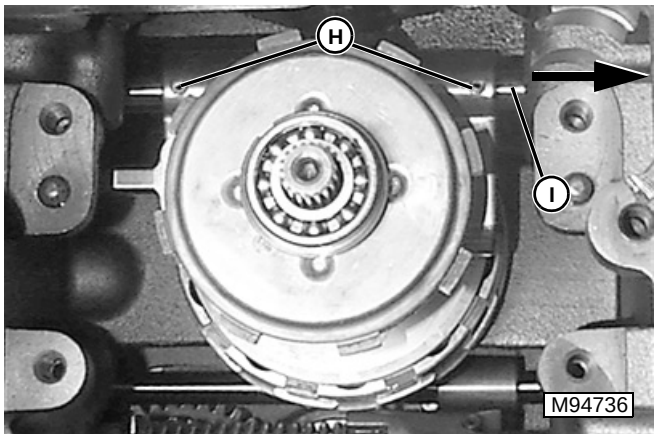
2. If equipped, remove 2-speed PTO shift shaft (A).
3. If not already done, remove PTO stub shaft (B).
4. Remove four cap screws (C) and bearing plate.



5. Remove cotter pin (D) and washer, and disconnect PTO control rod (E) from lever at differential housing.

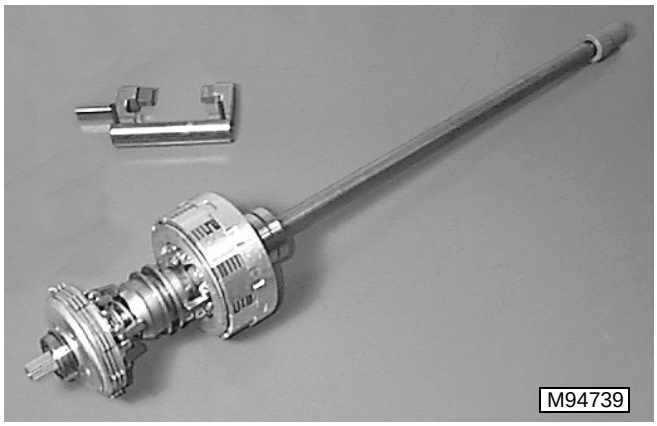


6. Remove cap screw (F) and locking plate (G).

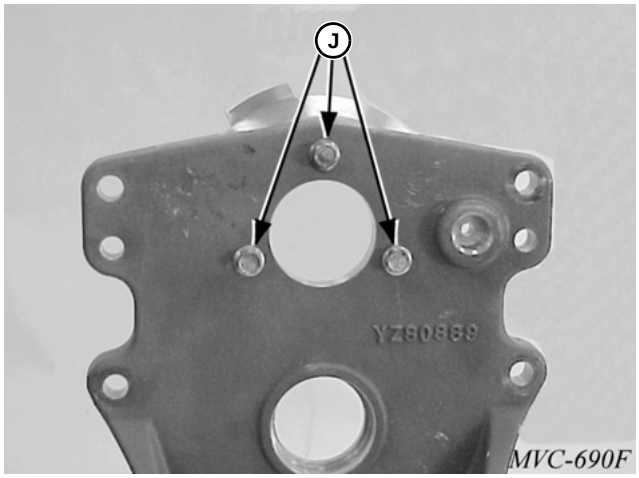


7. Remove two spring pins (H) retaining shift fork to shaft (I).
8. Slide shaft out of case until clear of shift fork.

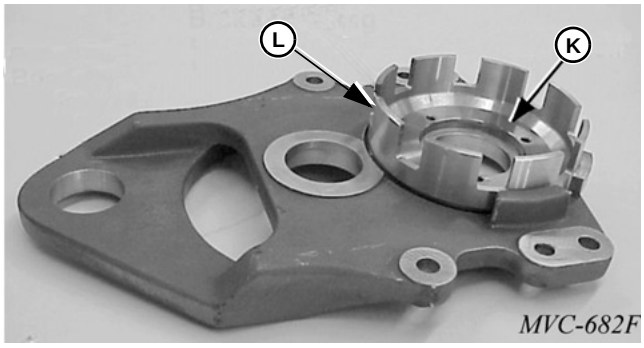
NOTE: PTO drive shaft may or may not come out of tunnel with clutch/brake unit.



9. Remove PTO clutch/brake assembly and shift fork as a unit.



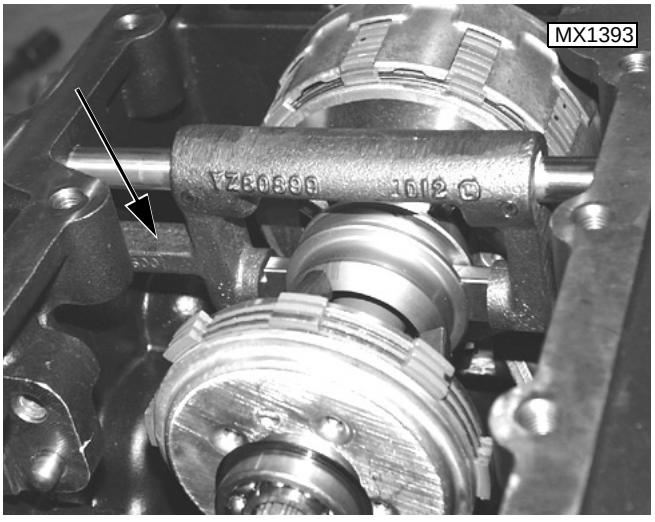
10. If PTO brake basket needs replacement, remove three cap screws (J) from bearing plate.



11. Remove retainer (K) and brake basket (L).

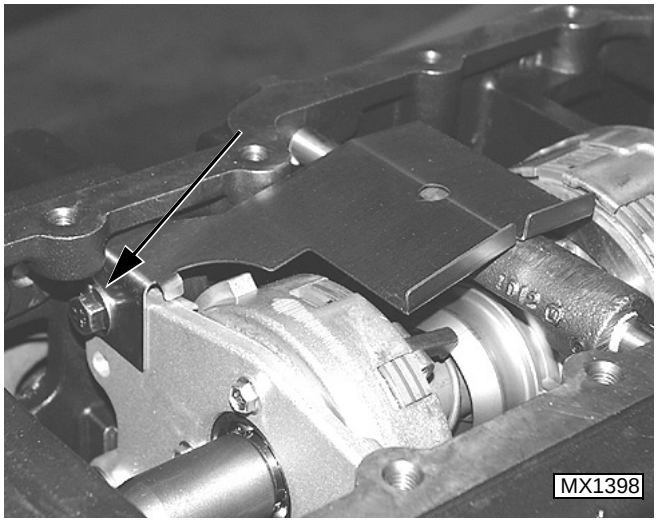
Installation:

Installation is the reverse of removal.



12. Install clutch shift fork with leg for safety switch on left side as shown.

NOTE: When installing bearing plate onto clutch/brake assembly, it may be necessary to align brake plate tabs to allow housing to be properly installed on brake pack.



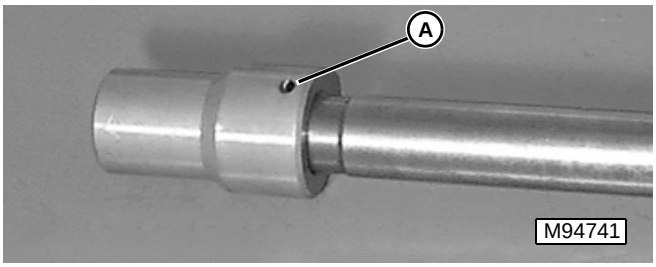
13. Install oil deflector as shown, securing with upper left cap screw. Tighten cap screws retaining bearing plate to specification.

Specification:

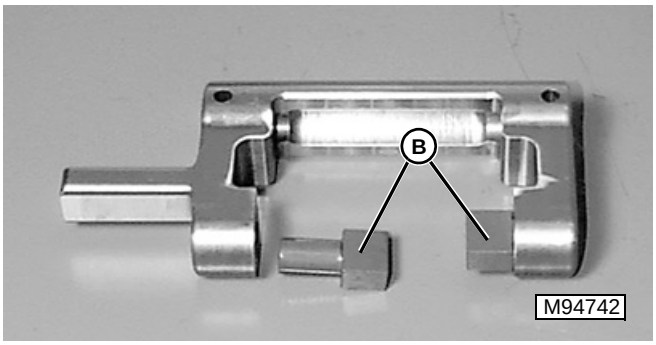
Bearing Plate Cap Screws . . . . . 80 N•m (60 lb-ft).

PTO CLUTCH AND BRAKE DISASSEMBLY AND ASSEMBLY

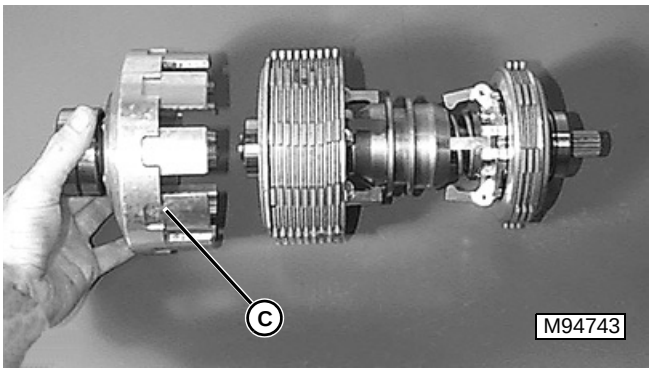
Procedure:



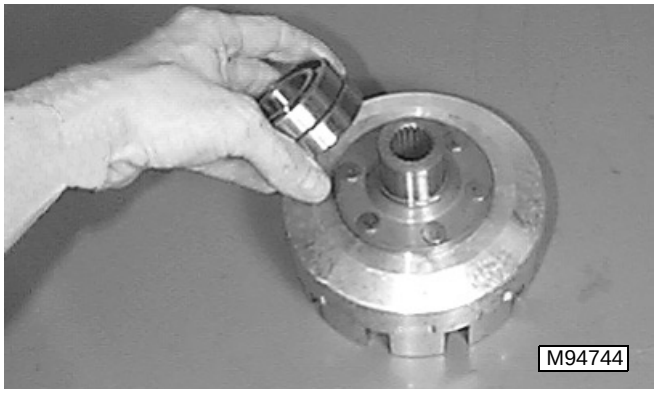
1. Remove shaft and coupler from clutch/brake assembly.
2. If necessary, remove spring pin (A) and splined coupler from end of shaft.



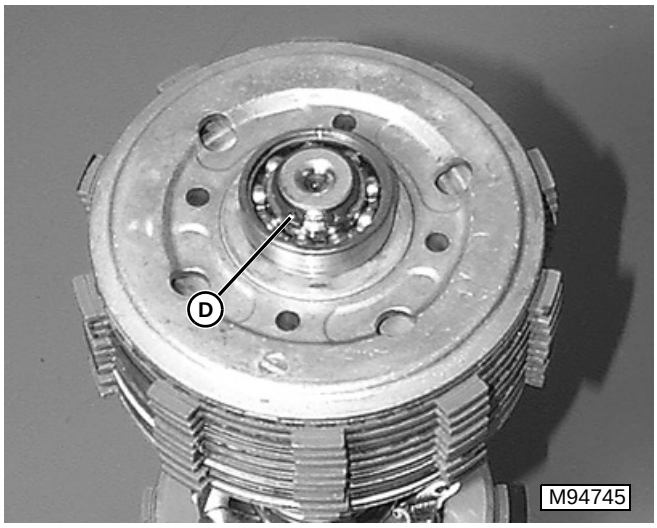
3. Remove shift pins (B) and check pins with a magnet. If the magnet sticks to the pins they are the old style steel pins and should be replaced with new aluminum/bronze pins.



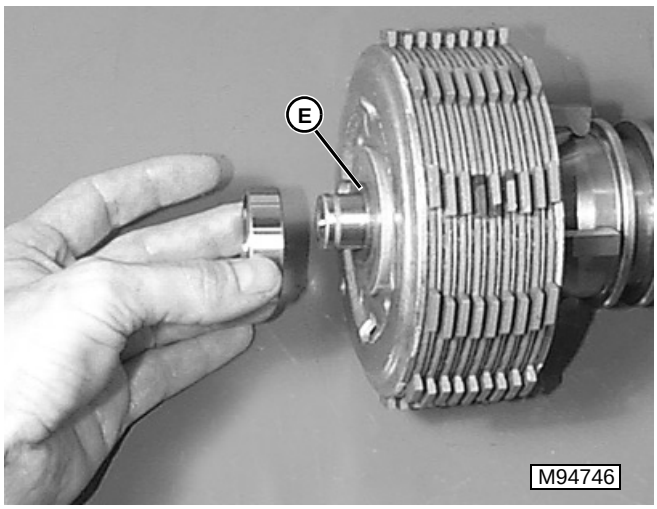
4. Remove clutch housing (C) from clutch/brake assembly.



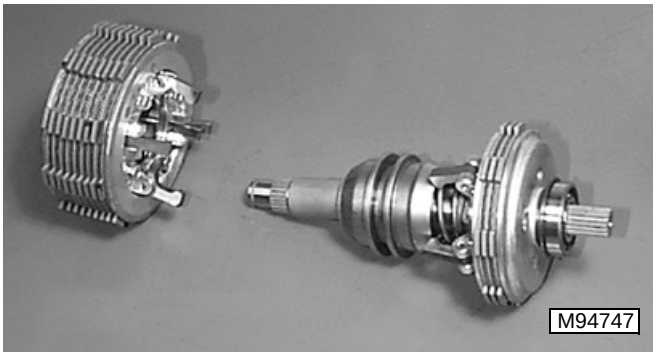
5. Using a suitable puller, remove two bearings from clutch housing.



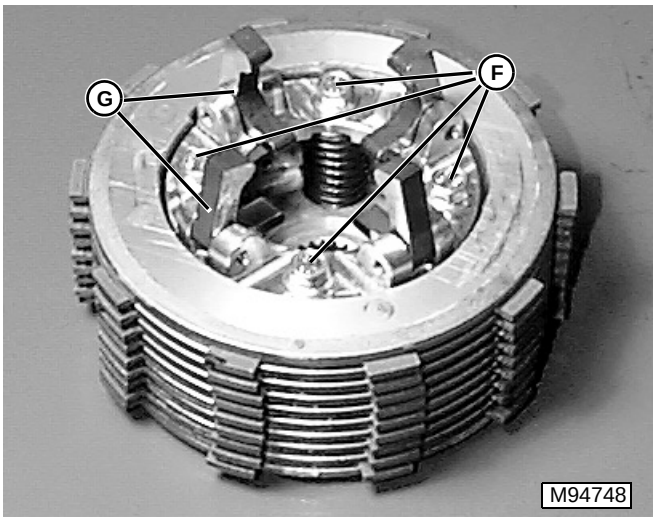
6. Remove snap ring (D) from end of shaft.



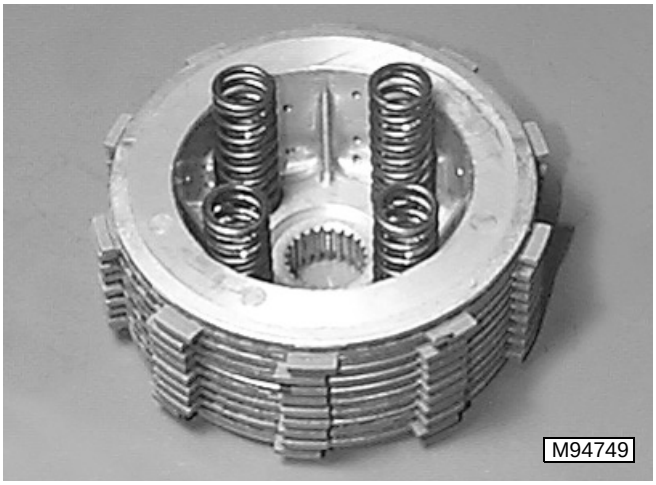
7. Using a suitable puller, remove bearing.
8. Remove washer (E).



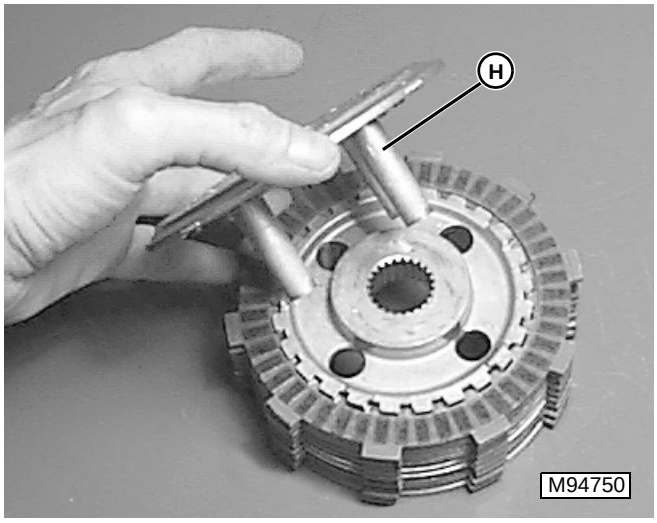
9. Remove clutch assembly from shaft.



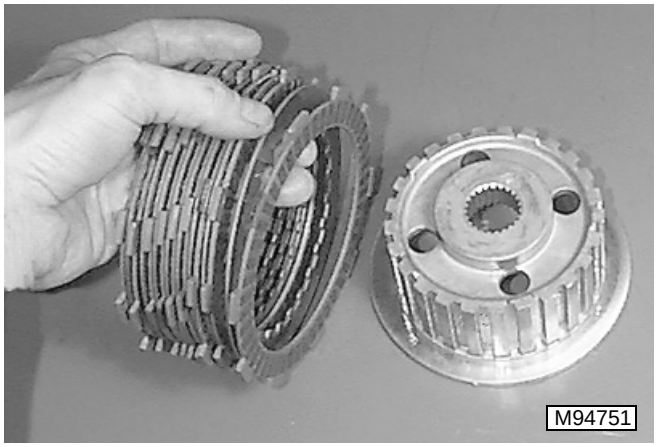
10. Remove four cap screws (F) retaining clutch lifter.
11. Inspect levers (G) for smooth operation, damage, or wear. If necessary, replace clutch lifter.



12. Remove four springs.



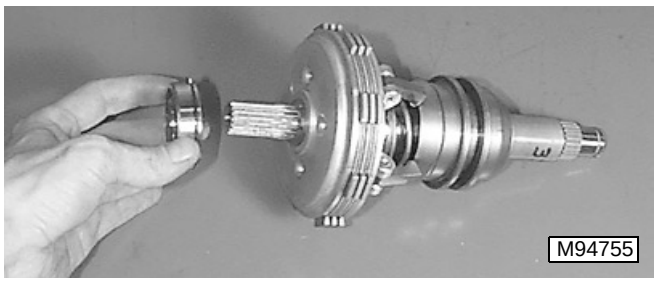
13. Turn clutch over, and remove piston (H) from hub.



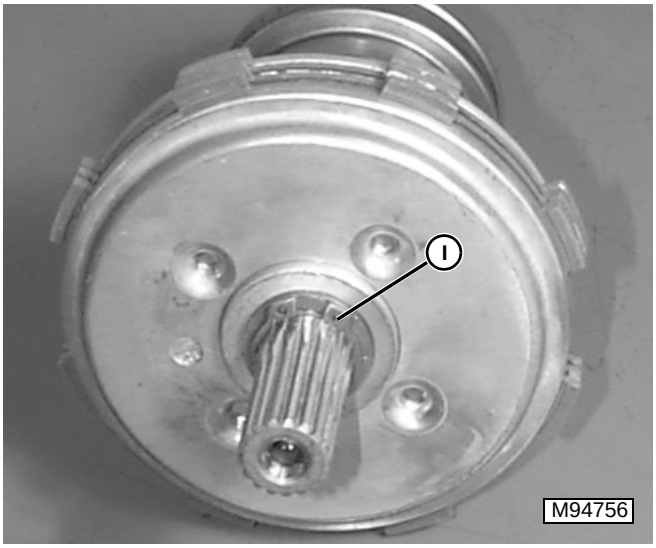
14. Remove friction disks and separator plates from hub.
15. Inspect disks and friction plates for wear, discoloration, scoring or warping. Measure clutch pack thickness. If clutch pack does not meet minimum specification, replace pack as a unit.

Specification (Minimum):

Clutch Pack. . . . . 41.4 mm (1.632 in.)

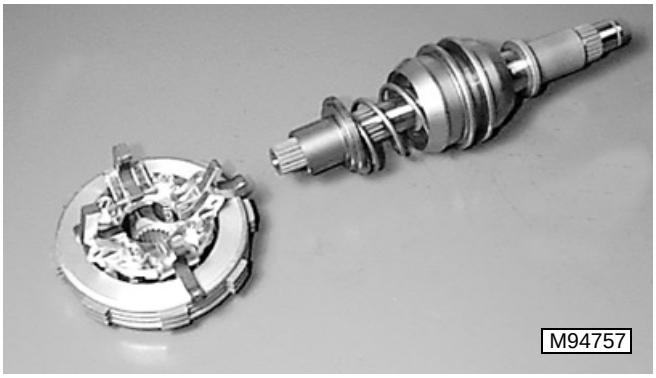


16. Using a suitable puller, remove bearing from brake end of shaft.

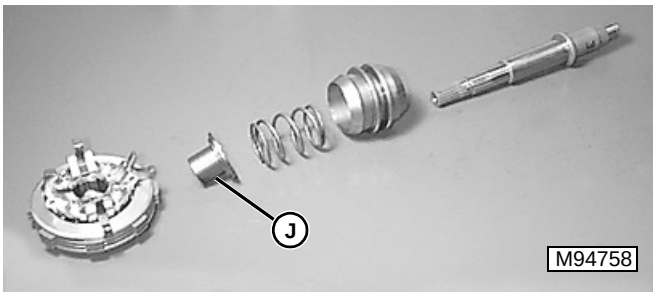


NOTE: Shift collar spring is slightly compressed. If snap ring is hard to remove, push down on brake to compress spring slightly before removing snap ring.

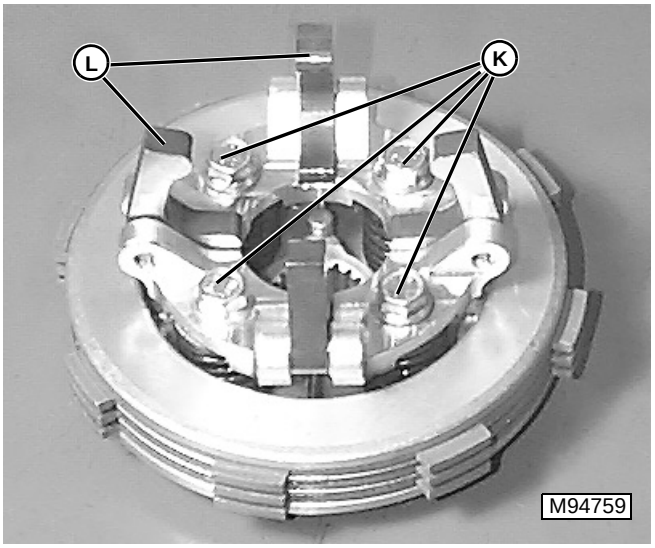
17. Remove snap ring (I) retaining brake to shaft.
18. Remove washer.



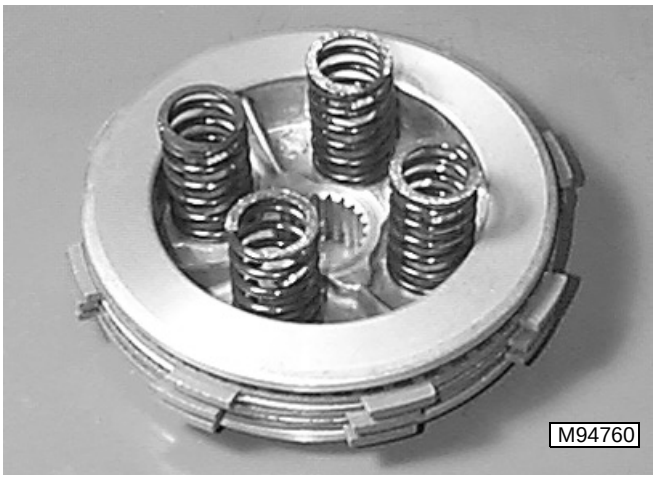
19. Remove brake assembly from shaft.



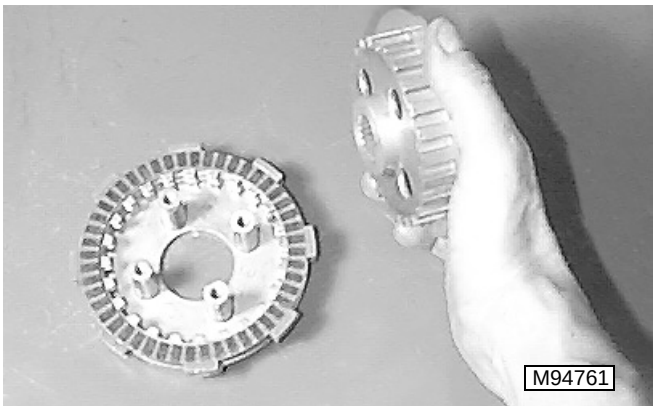
20. Remove spring retainer (J), spring, and shift collar.



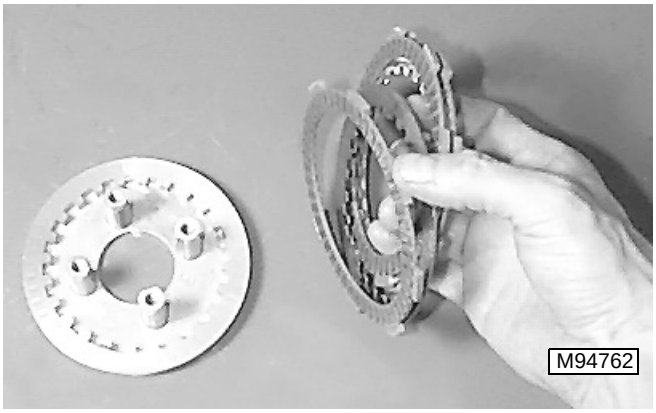
21. Remove four cap screws (K) retaining brake lifter to brake assembly. Remove brake lifter.
22. Inspect levers (L) for smooth operation, damage, or wear. If necessary, replace brake lifter assembly.



23. Remove four springs.



24. Remove hub.



25. Remove separator plates and friction disks.
26. Inspect separator plates and friction disks for wear, discoloration, scoring or warping. Measure plate and disk thickness. If plates or disks do not meet minimum thickness specification, replace brake plate pack as a unit.

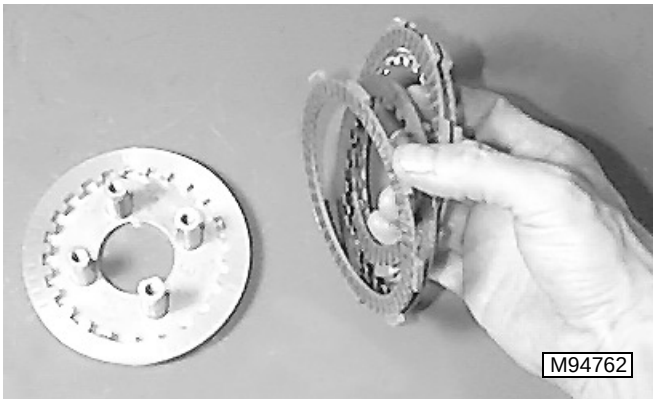
Specification (Minimum):

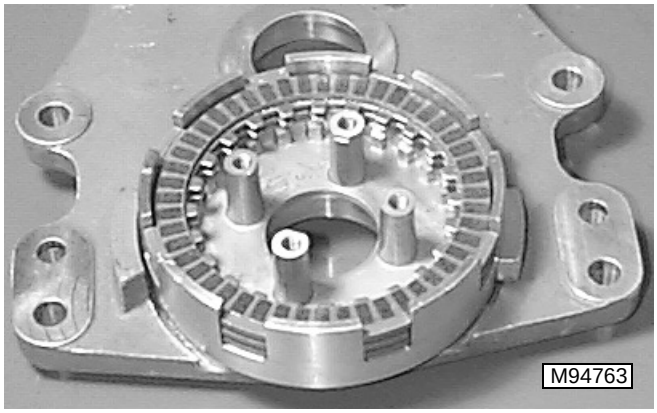
Brake Pack . . . . . 11.53 mm (0.454 in.)

Assembly:

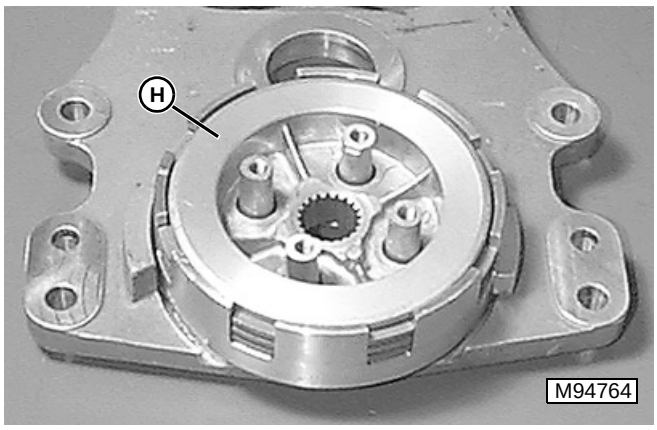
NOTE: Friction disks in brake pack have external tabs. Separator plates have internal splines.

IMPORTANT: Soak clutch and brake disks in hydraulic oil for one (1) hour before assembling clutch or brake packs. Failure to complete this step will result in premature clutch failure.

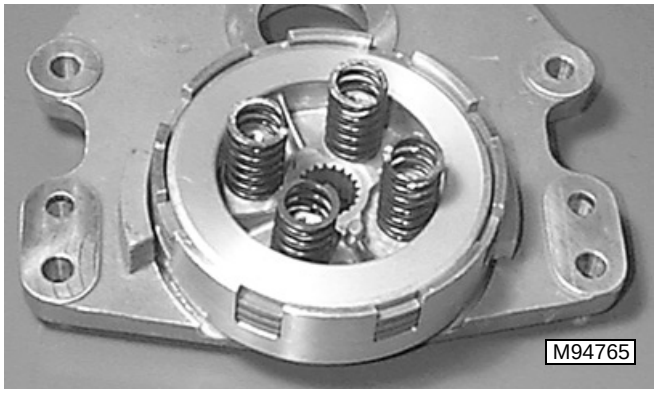




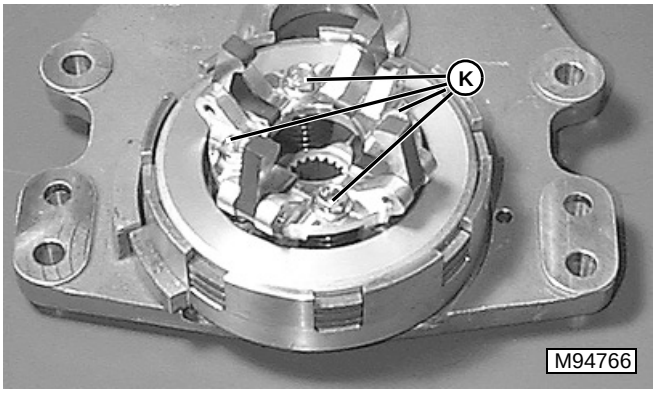
1. Install piston into brake housing, and assemble brake pack starting with a friction disk, followed by a separator plate, followed by a disk, plate, disk.



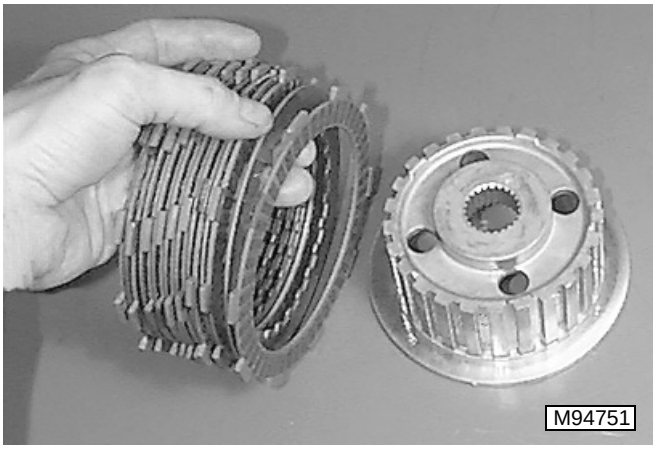
2. Install hub (H) into brake disks and plates.



3. Install four springs.

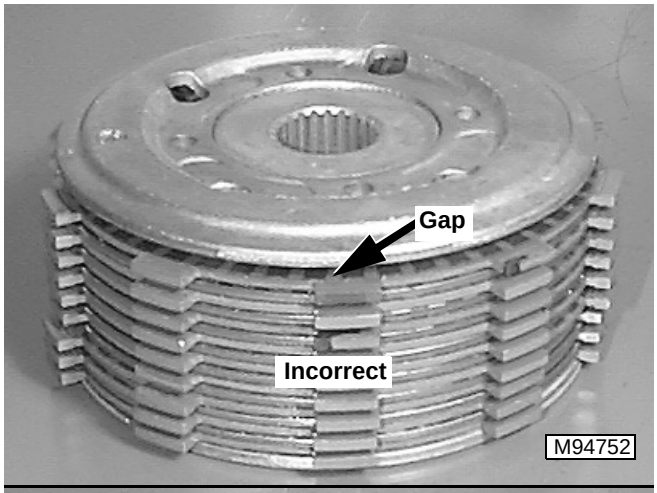


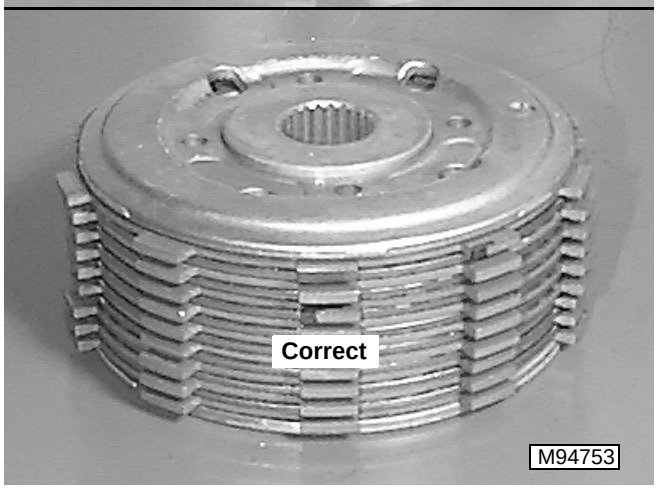
4. Install brake lifter. Retain with four cap screws (K). Tighten cap screws to **13 N•m (115 lb-in.)**.



NOTE: Friction disks in clutch pack have external tabs. Separator plates have internal splines.

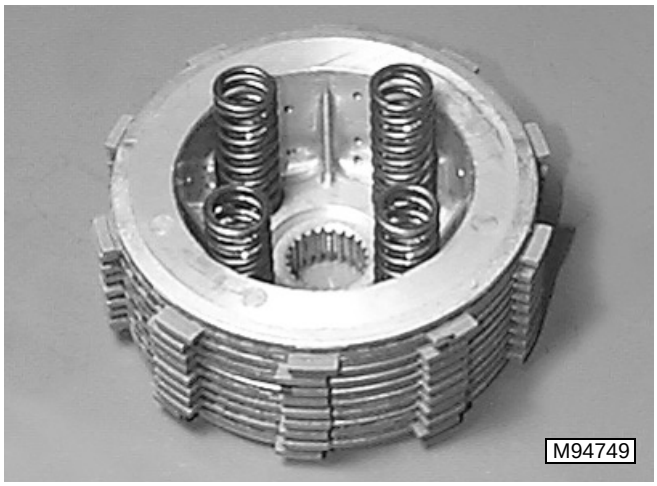
5. Install a friction disk onto hub, followed by a separator plate, disk, plate, disk, etc., until all nine disks, and eight plates are in place on hub.



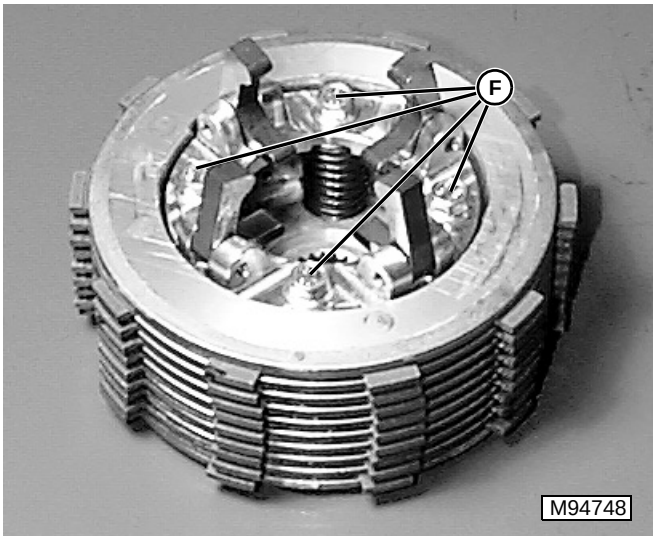


NOTE: Piston should be installed so that it rests on brake plates and disks (see photo).

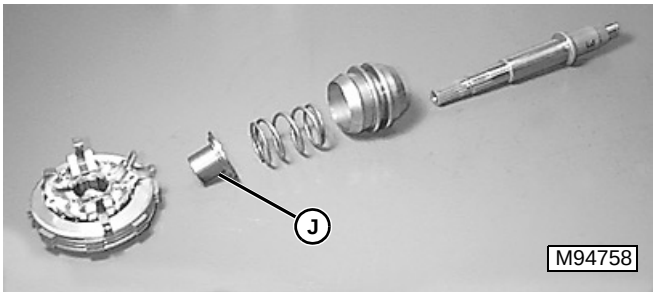
6. Install piston to hub, plates, and disks.



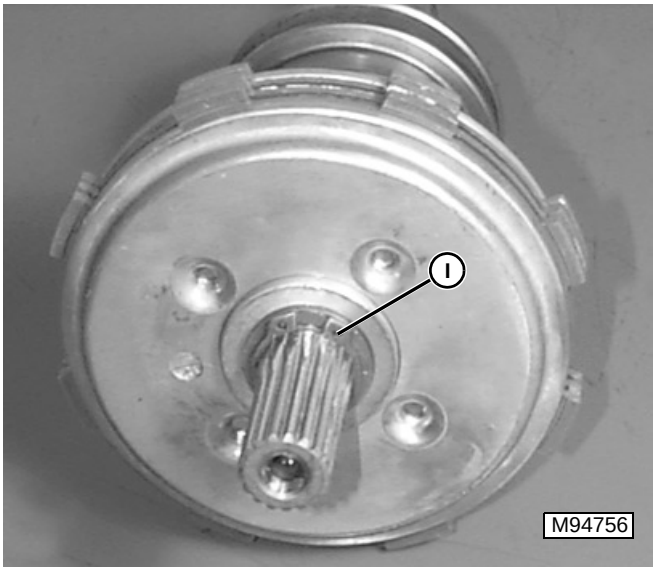
7. Turn clutch assembly over, and install four springs.



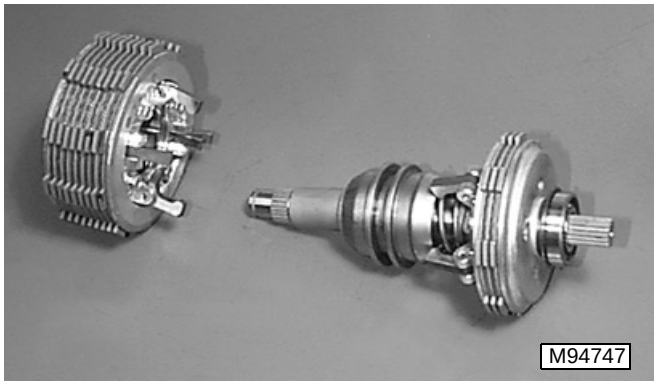
8. Install clutch lifter, and retain with four cap screws (F). Tighten cap screws to **13 N•m (115 lb-in.)**.



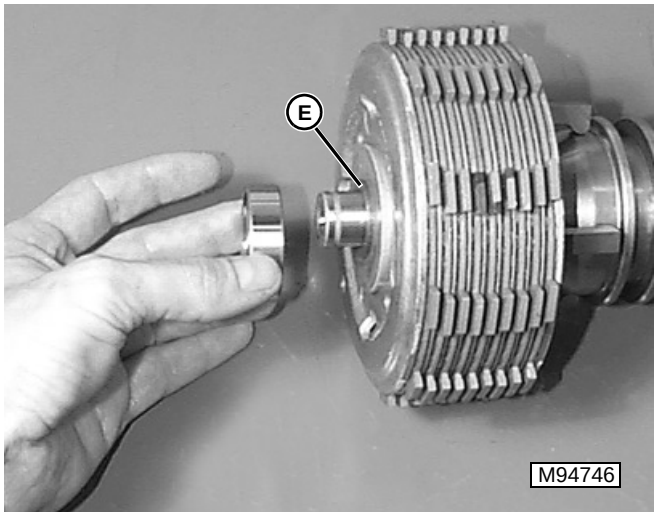
9. Assemble shift collar, spring, spring retainer (J), and brake assembly onto shaft.



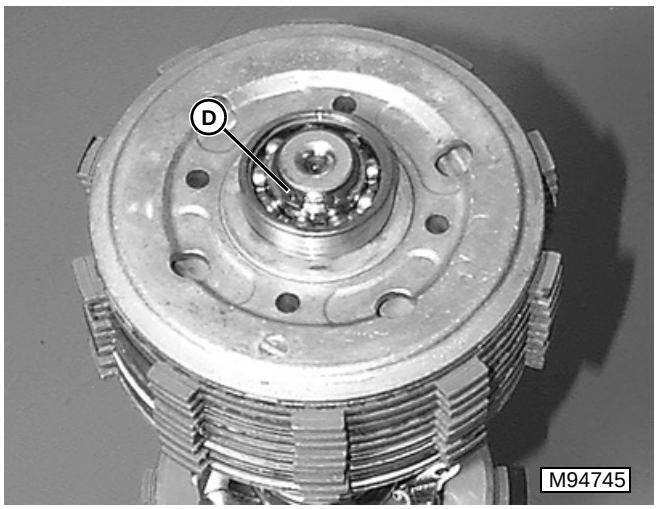
10. Install washer.
11. Push down on brake assembly to compress spring, and install snap ring (I).



12. Install clutch assembly onto shaft.

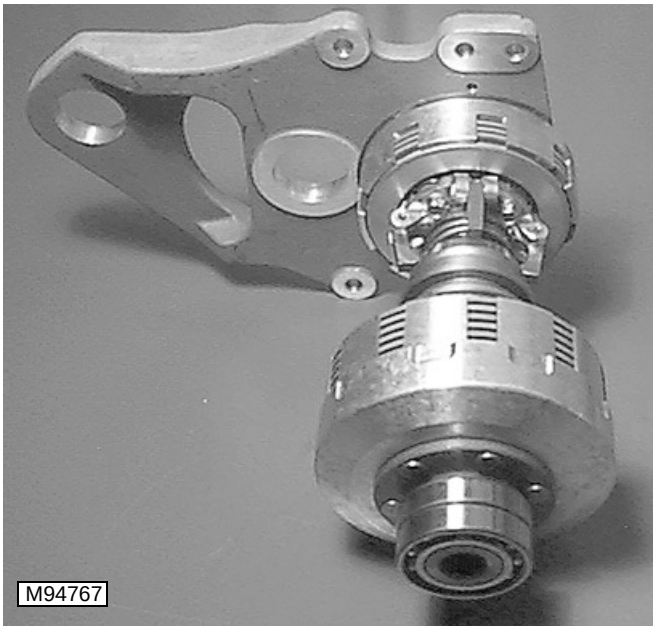


13. Install washer and bearing onto shaft. Using a suitable seal driver or press, press the bearing onto the shaft until the snap ring groove is visible above the bearing.



14. Install snap ring (D).

NOTE: It may be necessary to align disk splines to allow brake housing to be properly installed.

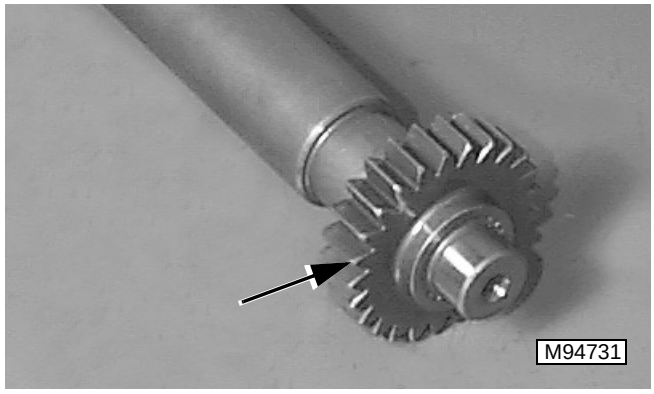


15. Install brake pack of clutch/brake assembly into brake housing on bearing plate to ensure that tabs on friction disks are properly aligned.
16. Remove clutch/brake assembly from bearing plate.
17. If removed, install splined coupling to PTO shaft. Retain with spring pin.
18. Install PTO shaft and coupler to clutch/brake assembly.
19. Install PTO clutch/brake assembly. (See "PTO CLUTCH AND BRAKE REMOVAL AND INSTALLATION".)

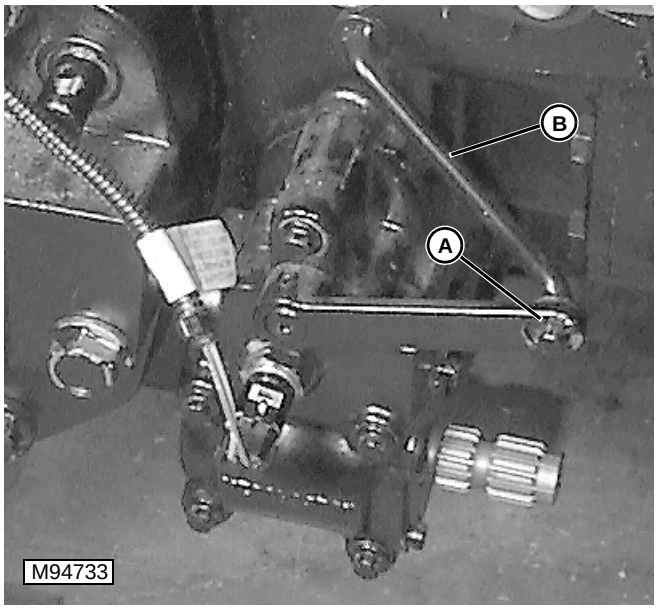
MID PTO REMOVAL AND INSTALLATION

Removal:

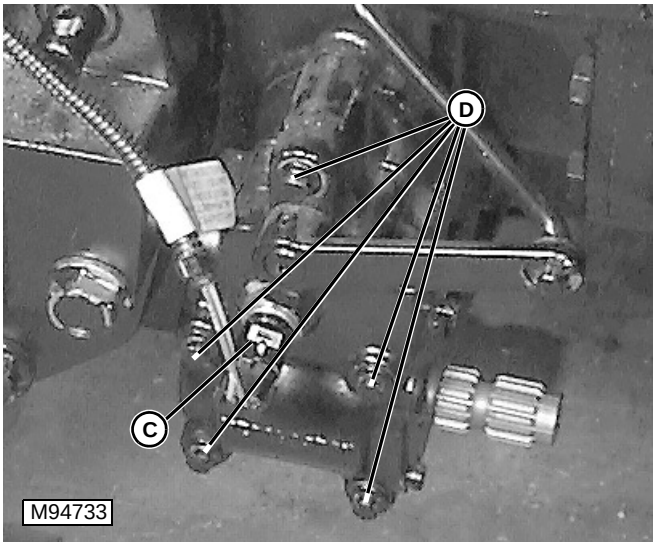
1. Remove rear cover, and rear PTO shafts and gears. (See "REAR PTO SHAFTS AND GEARS REMOVAL AND INSTALLATION").



2. Remove mid PTO shaft from bottom of differential housing. When shaft is removed, gear may fall into differential housing. Retrieve gear.

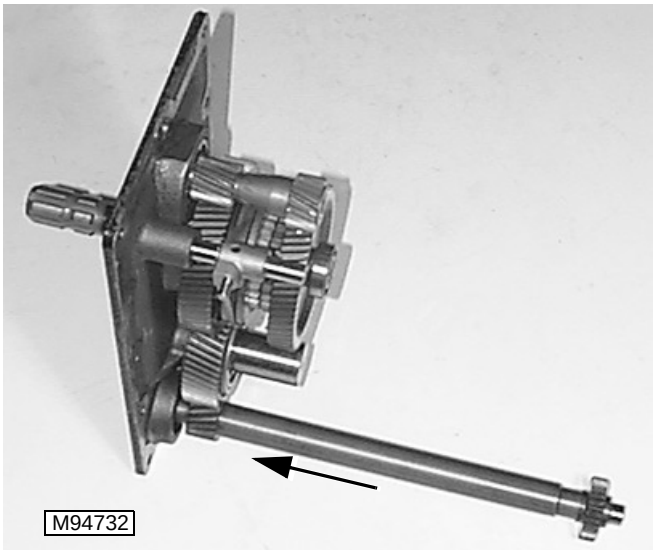


3. Remove cotter pin (A), and disconnect mid PTO rod (B).



4. If equipped, disconnect wiring harness from mid PTO switch (C).
5. Remove five cap screws (D) and mid PTO gear box from right side of differential housing.

Installation:



1. Install shaft and gear into roller bearing in rear cover.
2. Install cover with shafts and gears as an assembly into differential housing. Do not install cap screws at this time.

Installation is the reverse of removal.

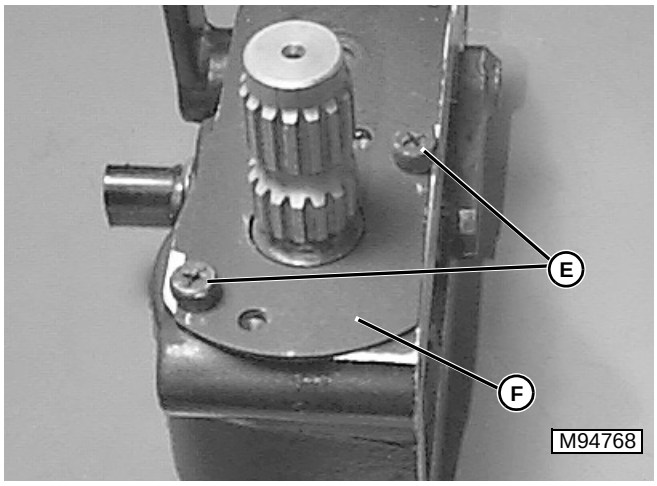
- Tighten five cap screws securing mid PTO housing to differential housing to **36 - 44 N•m (27 - 33 lb-ft)**.

NOTE: Replace O-rings. Old O-rings will leak.

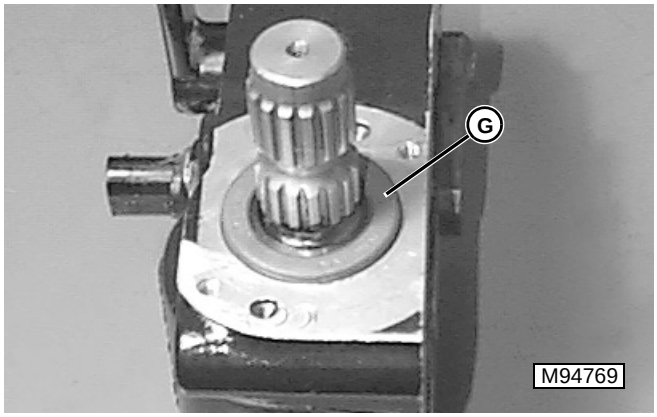
MID PTO DISASSEMBLY AND ASSEMBLY

Disassembly:

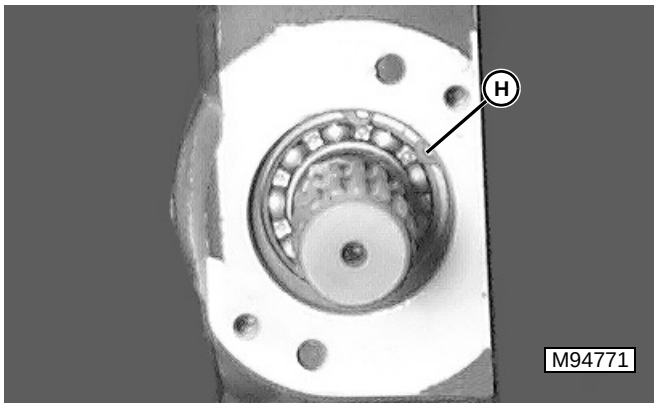
1. Remove mid PTO housing. (See "MID PTO REMOVAL AND INSTALLATION").



2. Remove two screws (E) and seal retainer (F).

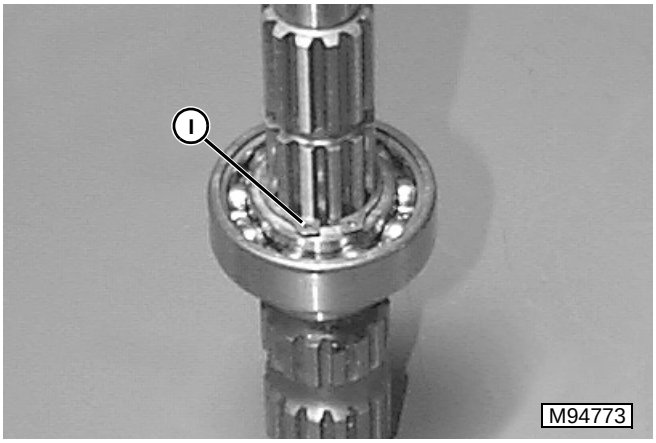


3. Remove seal (G) from output shaft.

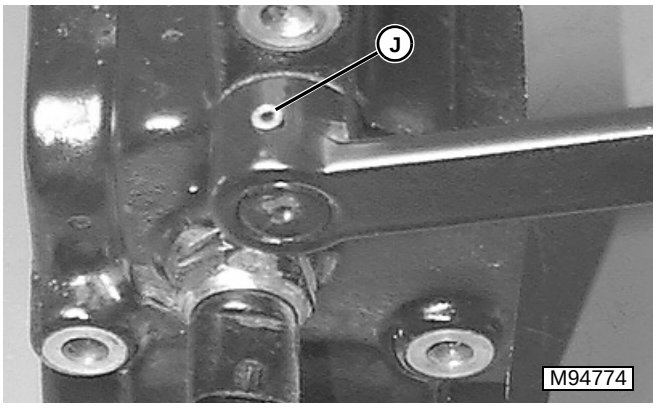


4. Remove snap ring (H) from groove in mid PTO case.

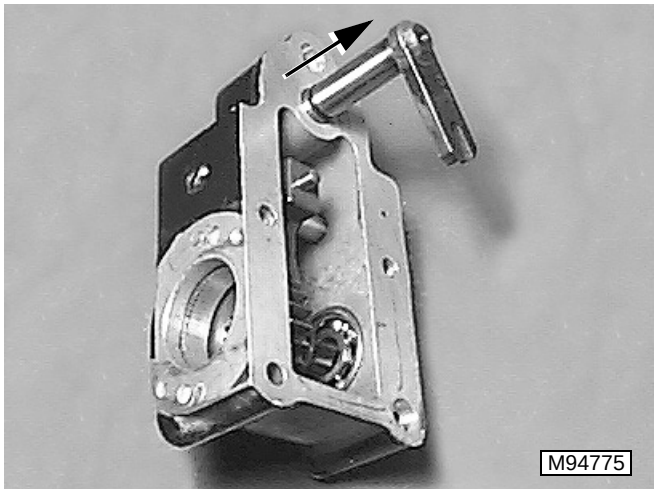
5. Remove shaft and bearing from case as an assembly.



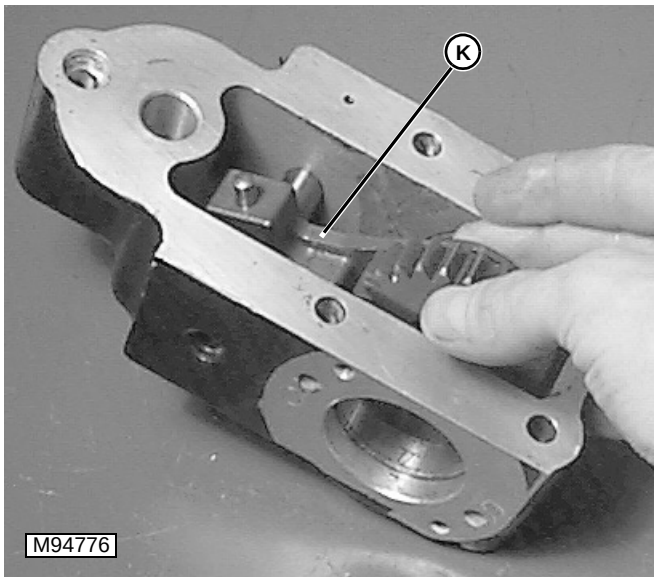
6. Remove snap ring (I) retaining bearing to shaft.
7. Using a suitable puller or press, remove bearing from shaft. Inspect bearing for smooth operation, wear or damage. Replace if necessary.



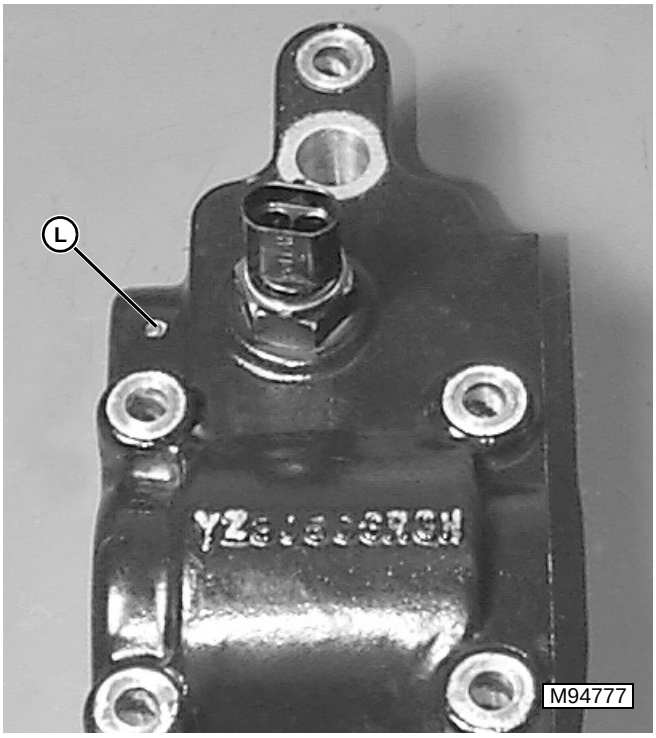
8. Remove spring pin (J) from shift lever. Remove shift lever.



9. Remove inner shift arm and shaft.

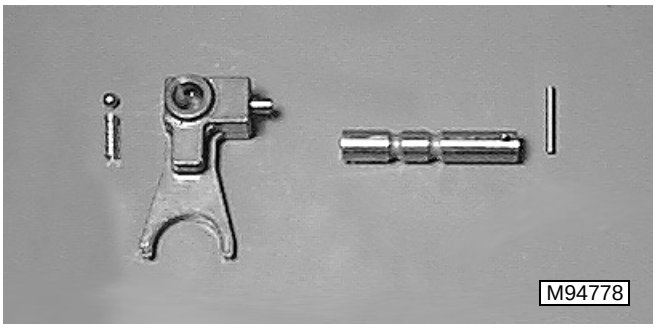


10. Tilt shift fork (K), and remove gear.

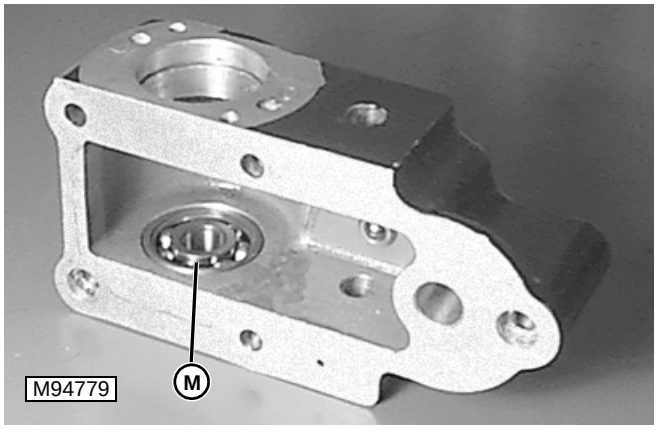


11. Using a pin punch, remove pin (L) that holds detent shaft in case.

NOTE: Shift fork retains a steel ball under spring pressure. Use care to prevent ball from being lost.



12. Using a large pin punch, remove detent shaft and two expansion plugs from housing. Remove shift fork, steel ball, and spring.

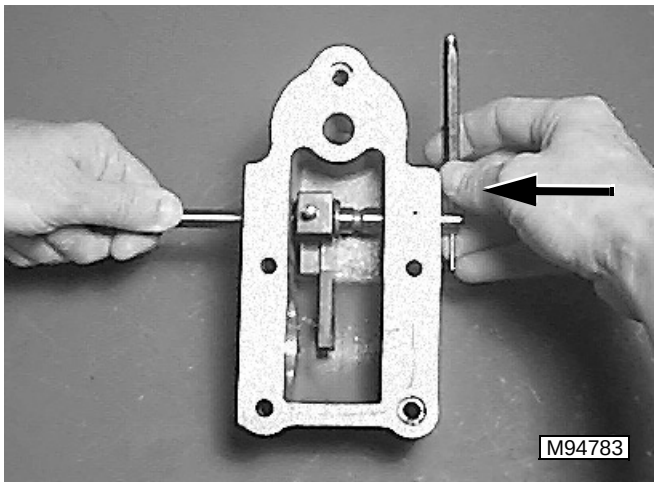


13. Using a suitable puller, remove inner bearing (M) from case. Inspect bearing for smooth operation, wear or damage. Replace if necessary.

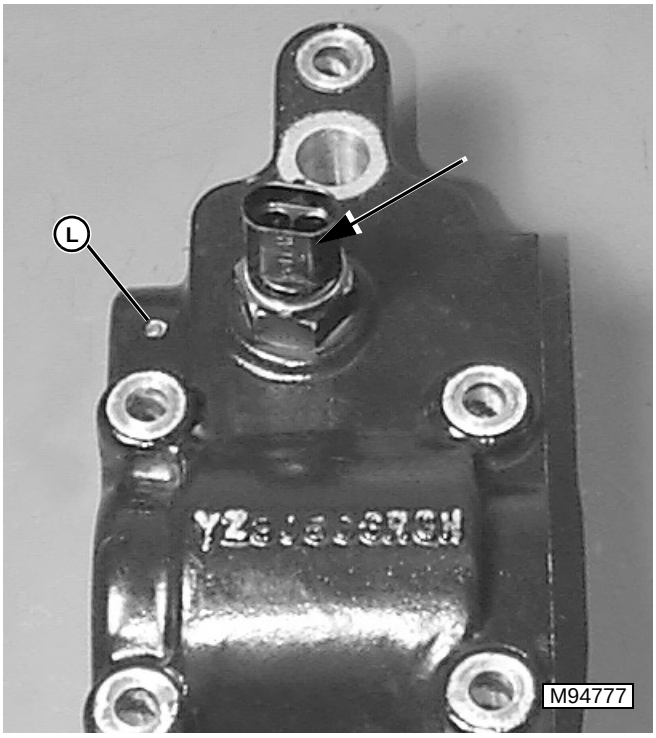
Assembly:

NOTE: Liberally lubricate all press-fit parts with hydraulic oil to aid assembly.

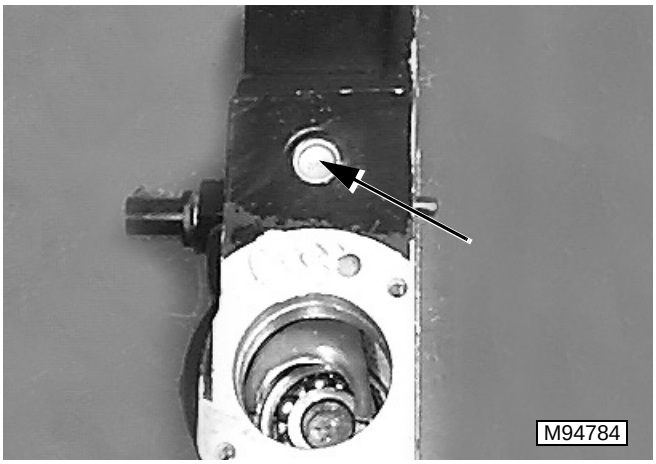
1. Install inner bearing (M) into case. If necessary, use a suitable driver and plastic mallet.



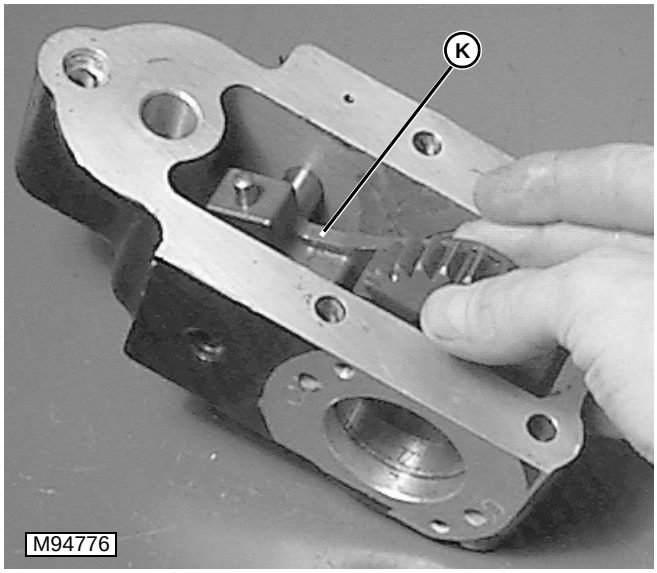
2. Apply general purpose grease to ball and spring to aid in assembly.
3. Install ball and spring into shift fork.
4. Install detent shaft into mid PTO case and shift fork:
   - Using a pin punch or other suitable tool, push down on ball to compress spring.
   - Install detent shaft into mid PTO case and shift fork.



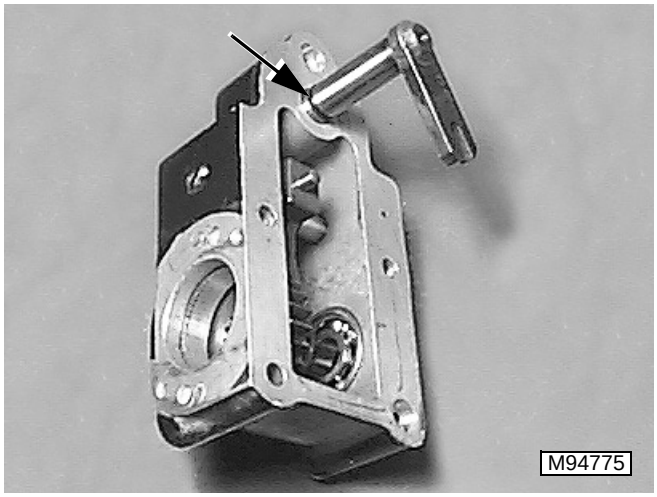
5. Install pin (L) that holds detent shaft in case.
6. If removed, install mid PTO switch.



7. Install a new expansion plug into case at each end of detent shaft.

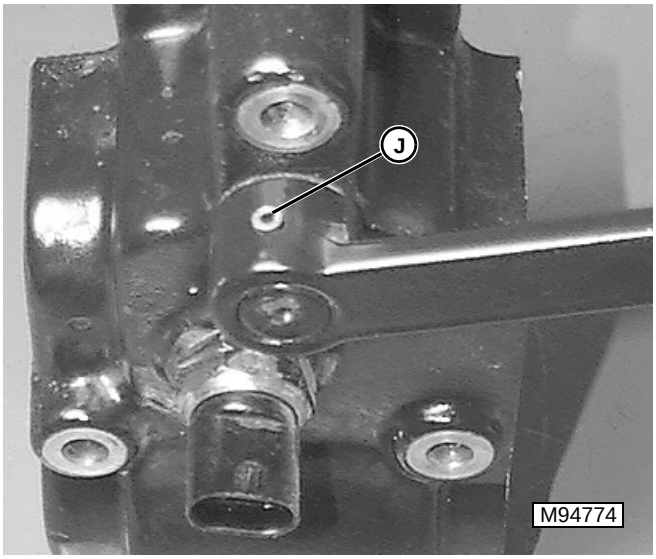


8. Install gear onto shift fork (K).

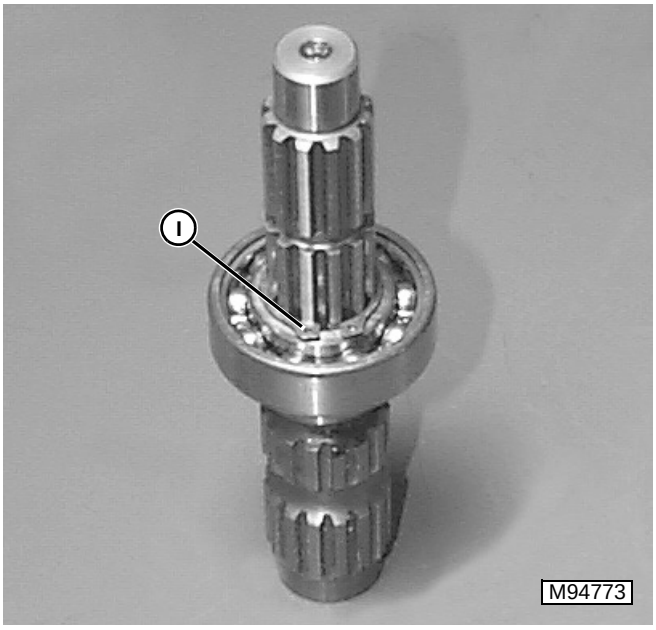


NOTE: Replace seals and O-rings. Old seals and O-rings will leak.

9. Install a new O-ring onto shift arm. Install shift arm into case.

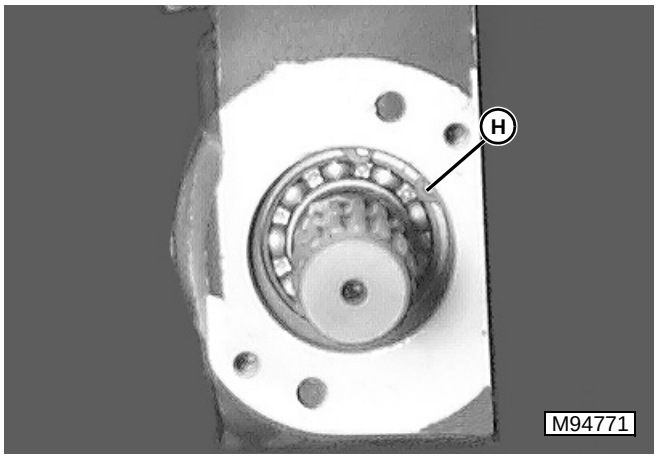


10. Install shift lever onto shaft and retain with spring pin (J).

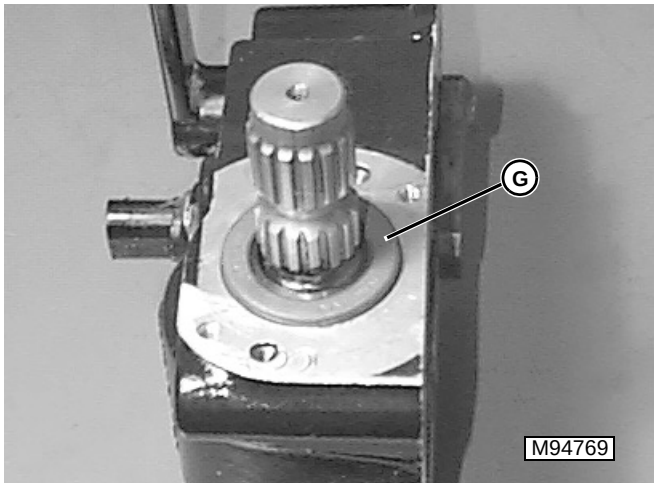


11. Using a press, install bearing onto shaft. Retain with snap ring (I).

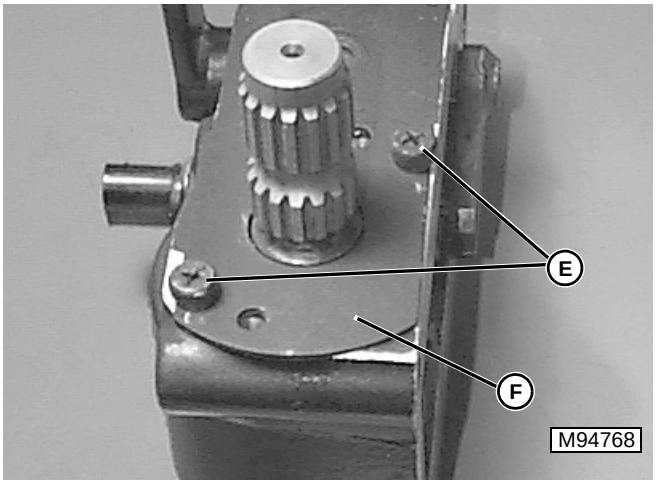
12. Install shaft and bearing into case and drive gear.



13. Install snap ring (H) to retain shaft to case.



14. Using a suitable driver, install a new seal (G).
15. Install mid PTO assembly. (See "MID PTO REMOVAL AND INSTALLATION").



16. Install seal retainer (F) and secure with two screws (E).

CONTENTS

SPECIFICATIONS

Steering:

Steering Wheel OD . . . . . 356 mm (14.0 in.)

Front Steering Angle: Maximum Inward . . . . . 54°

Front Steering Angle: Maximum Outward . . . . . 62°

Maximum Rotation of Steering Wheel - Steering at Maximum Right or Left and Constant Torque Applied to Steering Wheel . . . . . 5 rpm

Toe-In . . . . . 0 - 3 mm (0 - 0.125 in.)

Lubrication Interval:

Tie Rod Ends, Front Axle Pivot Pin (Normal Conditions) . . . . . Every 50 hours

Tie Rod Ends, Front Axle Pivot Pin (Dusty Conditions). . . . . Every 10 hours

TORQUE SPECIFICATIONS

Steering Wheel Nut. . . . . 39 - 49 N•m (29 - 36 lb-ft)

Wheel Mounting Bolts:
- Front and Rear Wheel Mounting Bolts . . . . . 98 N•m (72 lb-ft)
- Front wheels (Model 4200 Equipped With 4.0 x 15 F2 Ribbed Tires) 68 N•m (50 lb-ft)
- Front Wheels (Model 4300 Equipped With 5.0 x 15 F2 Ribbed Tires) 68 N•m (50 lb-ft)

Steering Cylinder Hose Ends
- Hose to Cylinder Adaptor . . . . . 17 - 24 N•m (150 - 212 lb-in.)
- Tube Nut to Hose at Cylinder . . . . . 33 - 47 N•m (24 - 34 lb-ft)

SCU Hose Ends
- Cylinder Tube to Hose at SCU . . . . . 33 - 47 N•m (24 - 34 lb-ft)
- Pressure or Return Tube to Hose at SCU. . . . . 40 - 58 N•m (30 - 42 lb-ft)
- Steering Cylinder Hose to Adaptor Fitting on SCU . . . . 17 - 24 N•m (150 - 212 lb-in.)
- Pressure or Return Hose to Adaptor Fitting on SCU . . . . . 33 - 47 N•m (24 - 34 lb-ft)

SCU to Tractor Cap Screws . . . . . 30 - 38 N•m (22 - 28 lb-ft)

Adaptor Fittings to SCU Ports . . . . . 14 - 16 N•m (124 - 142 lb-in.)

Tie Rod to Spindle Arm Nut (2-WD) . . . . . 115 - 129 N•m (85 - 95 lb-ft)

Tie Rod to Spindle Arm Nut (4-WD) . . . . . 115 - 129 N•m (85 - 95 lb-ft)

Tie Rod to Steering Cylinder Rod . . . . . 115 - 129 N•m (85 - 95 lb-ft)

Steering Cylinder (Dual End):

Steering Cylinder to Mounting Bracket . . . . . 25-31 N•m (18-22 lb-ft)

LH Bracket to Front Axle . . . . . 115-122 N•m (85-90 lb-ft)

Steering Hoses . . . . . 26-37 N•m (19-27 lb-ft)

Ball Joint to Cylinder Rod . . . . . 115-129 N•m (85-95 lb-ft)

Steering Cylinder (Single End):

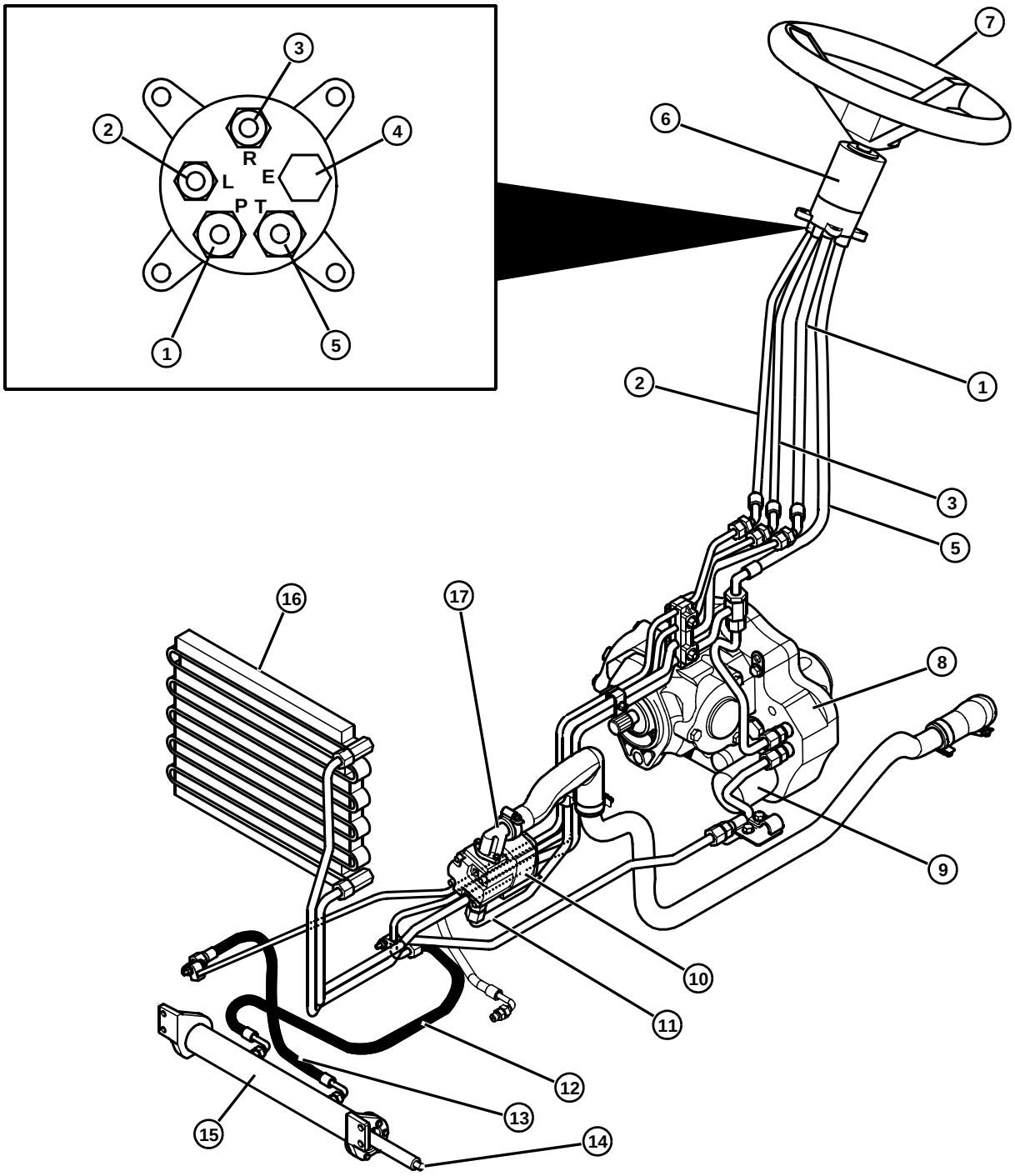
Cylinder to Spindle Arm Castle Nuts. . . . . 115-129 N•m (85-95 lb-ft)

Hose Ends. . . . . 26-37 N•m (19-27 lb-ft)

Steering Cylinder to Mounting Bracket Cap Screws . . . . . 31 - 38 N•m (22 - 28 lb-ft)

Steering Cylinder Bracket to
- Front Axle Cap Screws and Nuts . . . . . 126 - 154 N•m (94 - 115 lb-ft)

STEERING COMPONENT LOCATION



1. Pressure Hose
2. Left Turn Hose
3. Right Turn Hose
4. Plug
5. Return Hose (Tank)
6. Steering Control Unit (SCU)
7. Steering Wheel
8. Hydrostatic Transmission
9. Cartridge Filter
10. Engine Mounted Hydraulic Pump
11. Pressure Line (to SCU)
12. Right Turn Hose
13. Left Turn Hose
14. Rod End (To Tie Rod)
15. Steering Cylinder
16. Hydraulic Oil Cooler
17. Suction Tube Elbow (Reservoir to Pump)

THEORY OF OPERATION

All Models:

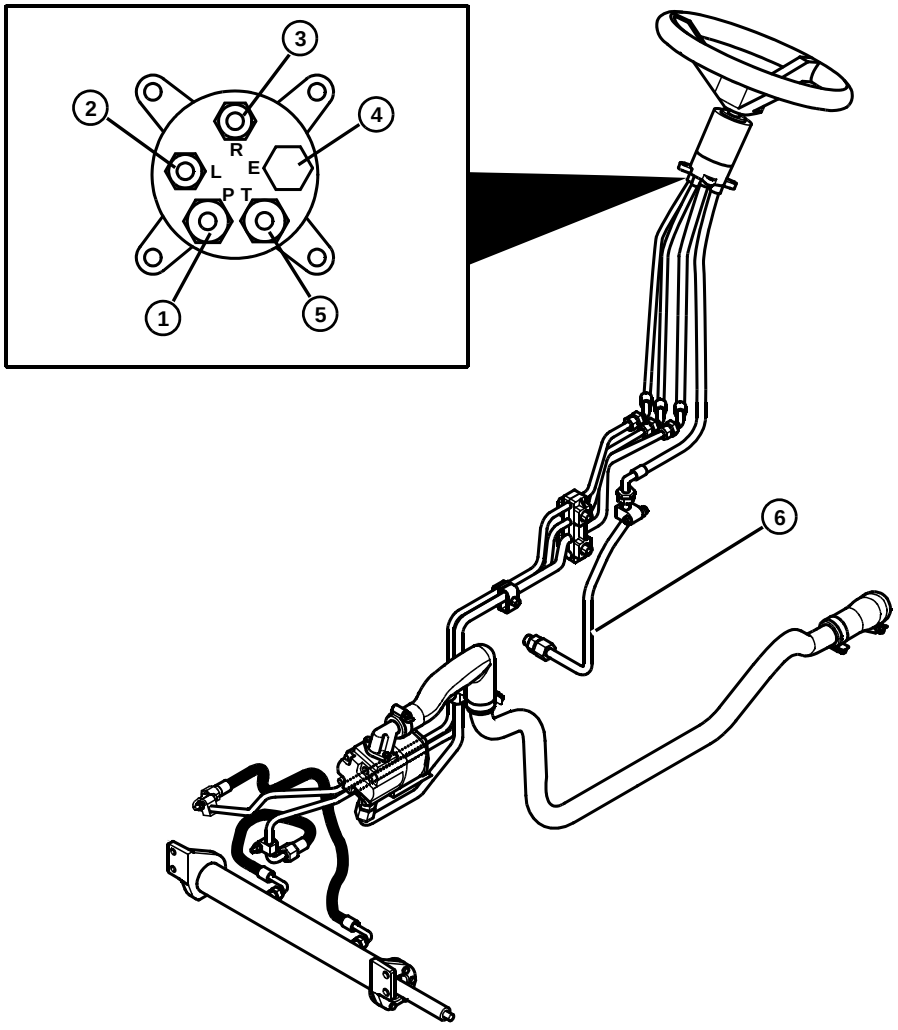
The front hydraulic pump supplies hydraulic pressure to the steering control unit (SCU). The SCU utilizes an open center control valve to operate the steering cylinder. When the steering wheel is turned, the SCU directs hydraulic pressure to the appropriate steering cylinder hose, pushing the steering cylinder ram, which pivots the front spindles and wheels. The SCU has no relief valve. The SCU and steering cylinder are not rebuildable, and must be replaced as complete units.

Hydrostatic Model:

Excess oil from the SCU passes through a tee fitting on the left side of the tractor, in front of the fuse panel. Oil travels either to the oil cooler, mounted in the front of the tractor, or directly to the hydrostatic unit. Oil entering the hydrostatic unit passes through a cartridge filter. The hydrostatic unit is a combination motor and pump, and operates as a closed loop. Most of the hydraulic oil delivered to this unit passes by the charge pressure relief valve, and returns to the reservoir. A small amount of oil flows through the hydrostatic unit, providing internal lubrication, then returns to the reservoir.

Gear or SyncReverser Model

Excess oil from the SCU passes through the filter and returns to the reservoir.



Gear or SyncReverser Transmissions Without Oil Cooler

1. Pressure Hose
2. Left Turn Hose
3. Right Turn Hose
4. Plug
5. Return Hose (Tank)
6. CST or SRT To Reservoir

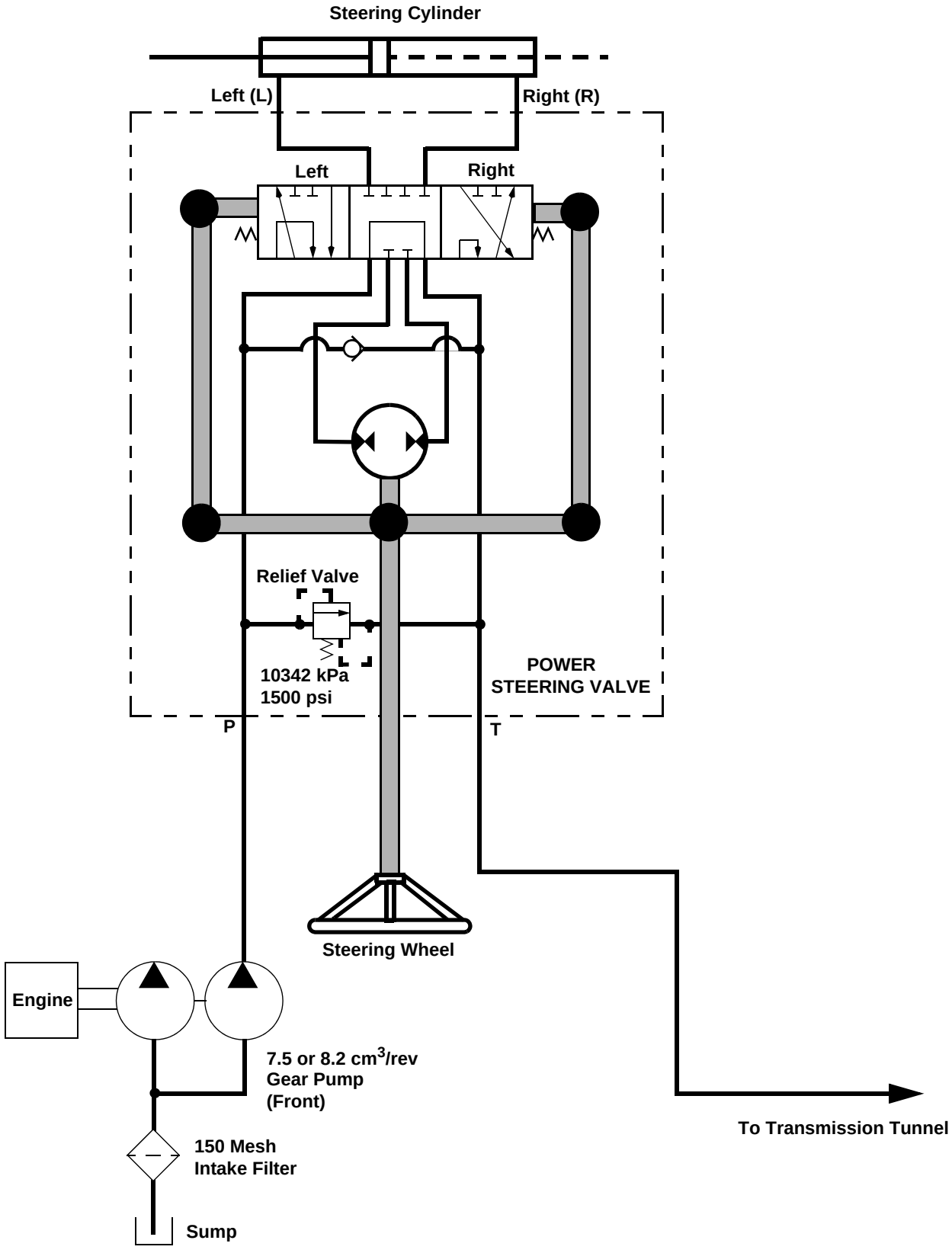
TROUBLESHOOTING CHART

Problem or Symptom / Check or Solution	Steering pulls in one direction	Steering wanders	Steering shimmies or vibrates	Wheel bearing noise	Steers hard left, right or both	Steering locks in hard left or right turns	Steering wheel pulls upward	Steering wheel tilt does not lock	Steering wheel spins freely	Noise during turns or over rough terrain	Steering wheel turns, but wheels do not	Front wheels "plow" loose soil to sides
Spindles and/or spindle bearings worn or not lubricated sufficiently	●	●	●	●	●	●				●		
Tie rod ends loose, or worn	●	●	●		●	●				●		
Toe-in incorrect	●				●							●
Steering control unit mounting loose		●					●		●	●		
Wheel bearings worn or lost lubrication	●	●	●	●	●					●		
Wheel bearing retaining nut loose	●		●	●								
Tire out-of-round, size incorrect or air pressure incorrect	●	●	●		●							
Steering wheel and/or shaft splines worn or stripped		●			●				●			
Steering wheel nut loose, stripped, or missing		●					●		●			
Steering cylinder rod (tie rod) bent or damaged	●				●	●					●	
Front axle pivot weak or unstable	●	●	●							●		
SCU leaking internally		●			●						●	
Steering cylinder leaking internally		●			●						●	
Tilt steering locking mechanism worn or damaged								●				

DIAGNOSIS

Test/Check Point	Normal	If Not Normal
1. Rims	Runout not excessive.	Replace rims.
	Wheel bolts tight.	Tighten to specification.
2. Tires	Runout not excessive.	Remount or replace tires.
	Tires properly inflated.	Inflate tires to proper pressure.
3. Wheel bearings	Wheels rotate freely without rough spots.	Replace bearings.
4. Pinion shaft and hub shaft	Assemblies tight and turn smoothly.	Tighten or replace assemblies.
5. Final drive housing	Fastened securely.	Tighten fasteners to specification.
6. Front axle mounting pivot	Pivot bushing not worn or binding.	Replace bushing.
7. Tie rod	Castle nuts tight.	Tighten castle nuts install cotter pin.
	Tie rod (steering cylinder rod) straight, toe-in correct.	Replace worn or damaged steering cylinder, adjust toe-in.
8. Steering cylinder	Assembly fastened securely.	Tighten cylinder.
	Operates from stop-to-stop smoothly with little effort, not leaking.	Replace cylinder.
9. Steering control unit	Fastened securely to frame.	Fasten securely.
	Not leaking.	Tighten fittings, replace SCU.
10. Steering wheel	Installed properly, nut torqued to specification.	Install and tighten properly.
	No cracks or breaks.	Replace as necessary.

STEERING SYSTEM SCHEMATIC



TESTS AND ADJUSTMENTS

STEERING SYSTEM TEST

Reason:

To check steering control unit and steering cylinder operation and check for internal leakage.

Tools:

- Torque wrench
- Caps for hydraulic lines

Procedure:

1. Run the tractor until the hydraulic fluid is at operating temperature.
2. Turn the steering wheel to the full right position. Apply constant torque to the steering wheel retaining nut, and count the steering wheel rotations in one minute.
3. Repeat the procedure turning the steering wheel to the full left position.
4. Stop engine.

Results:

- If the rotation in left or right hand direction exceeded **five rotations in one minute**, the steering system has internal leakage. To determine whether it's the SCU or cylinder that is leaking, proceed as follows:

Procedure:

1. Label and remove both left and right hydraulic hoses at the steering cylinder.
2. Cap the ends of both hoses.
3. Repeat the SCU test.

Results:

- If the rotation speed is now *below* five rotations in one minute, replace the steering cylinder.
- If the rotation speed remains above five rotations in one minute, replace the SCU.

TOE-IN ADJUSTMENT 4-WD (EARLY 4-WD)

Reason:

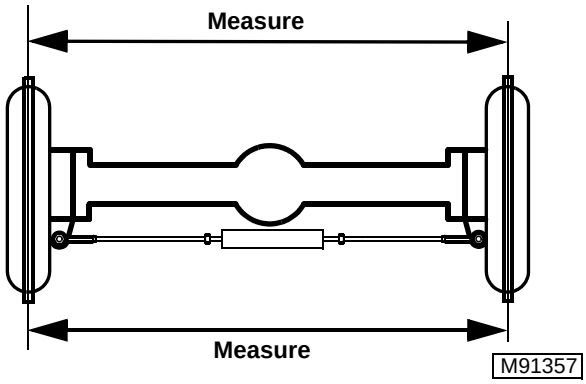
To ensure proper wheel tracking when turning, and to prevent tire scrub and premature tire wear.

Tools:

- Wrenches
- Tape Measure
- Tire scribing tool

Procedure:

*NOTE: If both tie rod ends were removed, screw-in the rod end until the distance from the lock nut to the end of the threads is approximately **22 mm (.875 in)**. Tighten the lock nuts.*

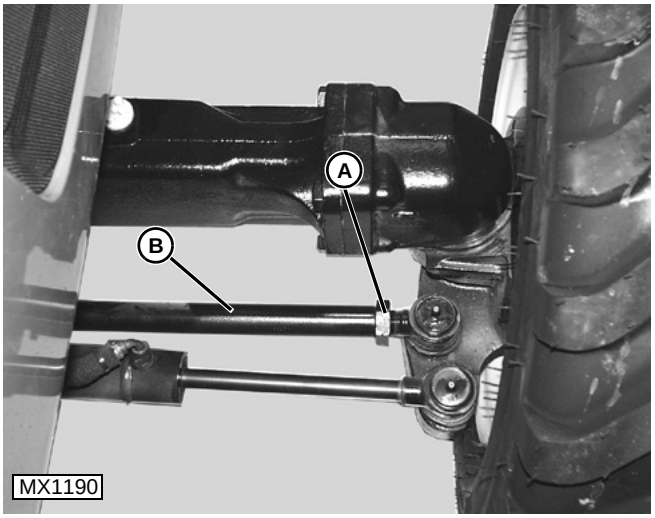


1. Jack up front axle so tires are off of floor.
2. Rotate tire by hand and scribe a line near the center of each of the front tires.
3. Measure and record the distance between the lines at the front and the rear of the tire at about axle height. The front measurement should be **0-3 mm (0-0.125 in.)** less than the rear measurement.
4. If measurement is not correct, loosen jam nuts on tie rod ends and turn the threaded portion of the rod end using a wrench to increase or decrease the amount of toe until the measured dimension is within specifications.
5. Tighten the jam nuts.

Specification:

Toe In . . . . . **0-3 mm (0-0.125 in.)**

(LATE 4-WD)



NOTE: Make sure wheels are pointing straight ahead.

1. Jack up front axle so tires are off of floor.
2. Rotate tire by hand and scribe a line near the center of each of the front tires.
3. Measure and record the distance between the lines at the front and the rear of the tire at about axle height. The front measurement should be **0-3 mm (0-0.125 in.)** less than the rear measurement.

NOTE: One of the tie rod ends and jam nut has left hand threads.

4. If measurement is not correct, loosen jam nuts (A) on both ends of tie rod and turn the tie rod (B) using a wrench to increase or decrease the amount of toe until the measured dimension is within specifications.
5. Tighten the jam nuts.

Specification:

Toe In . . . . . 0-3 mm (0-0.125 in.)

TOE-IN ADJUSTMENT (2-WD)

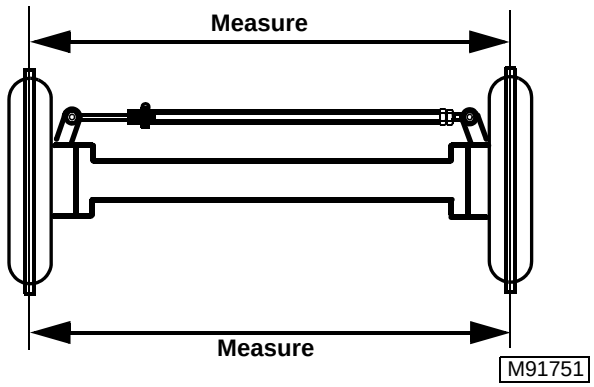
Reason:

To ensure proper wheel tracking when turning, and to prevent tire scrub and premature tire wear.

Tools:

- Wrenches
- Tape Measure
- Pliers

Procedure:



1. Jack up front axle so tires are off of floor.
2. Rotate tire by hand and scribe a line near the center of each of the front tires.
3. Measure and record the distance between the lines at the front and the rear of the tire at about axle height. Measurement at front of tire should be slightly less than measurement at rear (toed in).
4. Compare measurement to specifications, and adjust tie rod to increase or decrease the amount of toe until the dimension is within specifications.
5. Tighten the lock nut.

Specification:

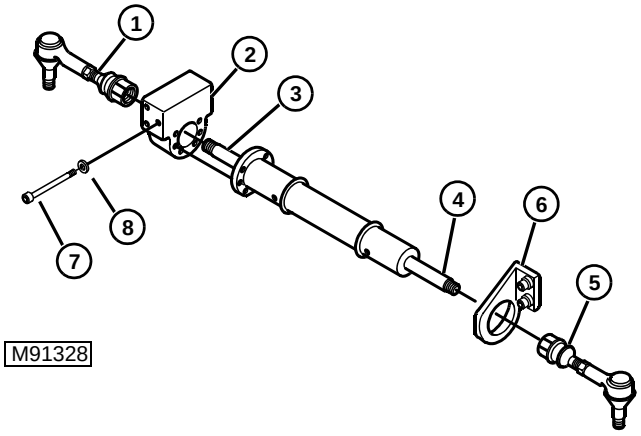
Toe In . . . . . 0-3 mm (0-0.125 in.).

REPAIR

STEERING CYLINDER

(DUAL CYLINDER ENDS - 4-WD)

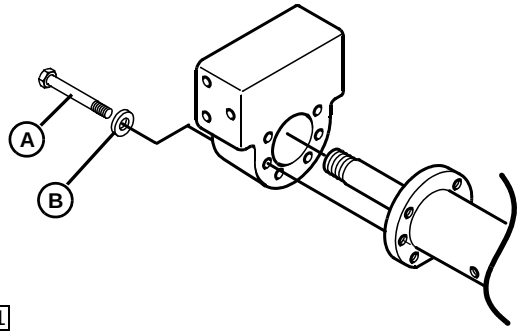
1. Label and remove both steering hoses from the steering cylinder.



M91328

1. Tie Rod	5. Tie Rod
2. LH Bracket	6. RH Bracket
3. Cylinder Rod	7. Cap Screw
4. Cylinder Rod	8. Lock Washer

2. Place a wrench on each of the tie rods on the ends of the cylinder rod, and turn to remove one side.
3. Place a wrench on the flats, or a suitable tool through the hole in the end of the cylinder rod where the ball joint was removed to prevent the cylinder rod from turning.
4. Place a wrench on the remaining ball joint, and remove.
5. Remove three cap screws and lock washers on LH bracket attaching steering cylinder and bracket to front axle. Move steering cylinder to left to remove from RH bracket. Remove cylinder.



M91331

6. Remove six cap screws (A) and lock washers (B) attaching LH bracket to steering cylinder and remove attaching bracket from cylinder.
7. Inspect the steering cylinder for leaks, cracks, rod straightness and smooth operation.

NOTE: The steering cylinder has no serviceable components. If the cylinder leaks or does not meet specifications, the unit must be replaced.

Installation:

1. Install the LH mounting bracket onto the steering cylinder and secure with 6 cap screws. Tighten to specification.
2. Install the steering cylinder into RH bracket, and secure LH bracket to the front axle with two cap screws.Tighten to specification.
3. Connect the steering hoses to the cylinder and Tighten to specification.
4. Attach ball joints to steering cylinder rod and tighten to specification.
5. Bleed the hydraulic system if required.
6. Adjust toe-in. (See “TOE IN ADJUSTMENT”).

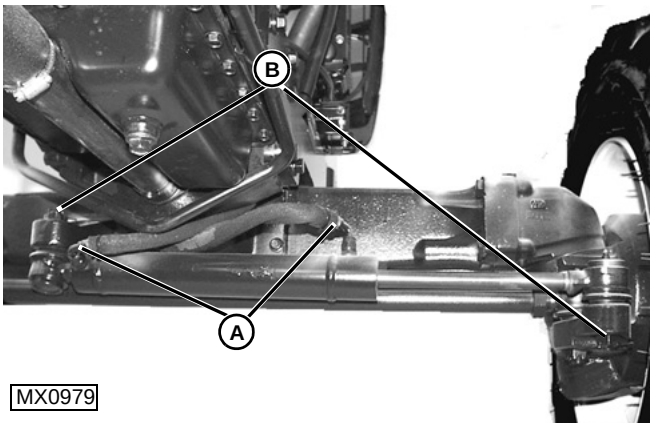
Specification:

Steering Cylinder to Mounting Bracket . . . . . .25-31 N•m (18-22 lb-ft)
LH Bracket to Front Axle . .115-122 N•m (85-90 lb-ft)
Steering Hoses . . . . . .26-37 N•m (19-27 lb-ft)
Ball Joint to Cylinder Rod .115-129 N•m (85-95 lb-ft)

STEERING CYLINDER

(SINGLE CYLINDER END - 4-WD)

Removal:



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NOTE: Cylinder ball end studs are tapered. Use a tie rod end removal tool to avoid damaging threads if cylinder is to be re used.

1. Mark hoses (A) and disconnect from cylinder.
2. Remove cotter pins and castle nuts (B).
3. Remove cylinder.

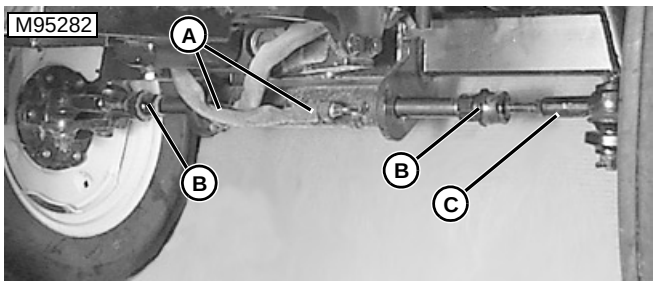
Installation:

1. Inspect rubber boots on ends of cylinder. Replace boots if necessary.
2. Install cylinder and tighten castle nuts to specification. If slots in castle nut do not line up with cotter pin hole, continue tightening nut until next slot lines up.
3. Connect hoses to cylinder.

Specification:

Castle Nuts . . . . . .115-129 N•m (85-95 lb-ft)
Hose Ends . . . . . .26-37 N•m (19-27 lb-ft)

STEERING CYLINDER REMOVAL (2-WD)



1. Label and disconnect both steering hoses (A) from the steering cylinder.
2. Place a wrench on each of the tie rods (C) on the ends of the cylinder rod (B), and turn to remove one side.
3. Place a wrench on the flats, or a suitable tool through the hole in the end of the cylinder rod where the tie rod was removed to prevent the cylinder rod from turning.
4. Place a wrench on the remaining tie rod, and remove.
5. Remove three cap screws, lock washers, and nuts attaching steering cylinder and LH bracket to front axle. Move steering cylinder to left to remove from RH bracket. Remove cylinder.

STEERING CYLINDER INSTALLATION (2-WD)

1. Install the steering cylinder into RH bracket, and secure LH bracket to the front axle with three cap screws, lock washers, and nuts. Tighten cap screws to **126 - 154 N•m (94 - 115 lb-ft)**.
2. Attach cylinder end to spindle arm. Secure with castle nut. Tighten to **115 - 129 N•m (85 - 95 lb-ft)**. Install cotter pin to secure nut.
3. Connect steering hoses to fittings on cylinder. Tighten connectors to **17 - 24 N•m (150 - 212 lb-in.)**.
4. Adjust toe-in. (See “TOE IN ADJUSTMENT 2WD”)

STEERING WHEEL REMOVAL AND INSTALLATION

Removal:

1. Remove steering wheel center cap .
2. Remove lock nut.
3. Remove steering wheel. If necessary, use a suitable puller.

Installation:

NOTE: Lubricate the steering shaft splines with general purpose grease before installing steering wheel to allow easy removal.

1. Remove white center cap plastic retaining ring from steering wheel.
2. Install steering wheel and retain with nut. Tighten steering wheel nut to specification.
3. Install plastic retaining ring to steering wheel center cap.
4. Install center cap and retaining ring to steering wheel.

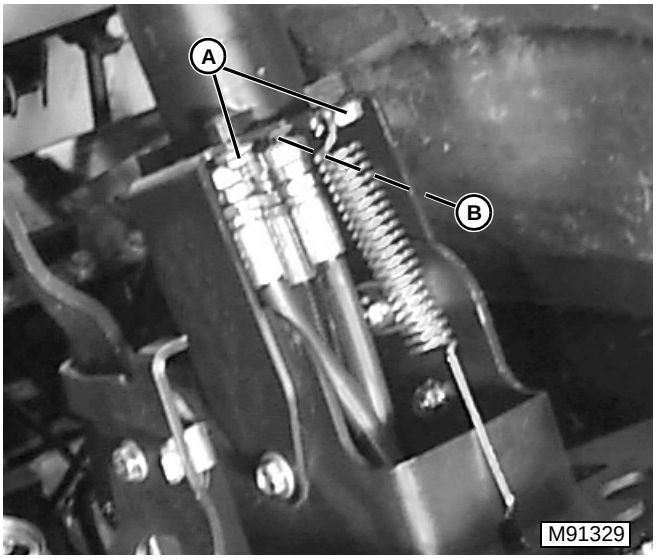
Specification:

Steering Wheel Nut . . . . . 39-49 N•m (29-36 lb-ft).

STEERING CONTROL UNIT (SCU) REMOVAL AND INSTALLATION

Removal:

1. Remove the steering wheel.
2. Remove the control panel. (See “CONTROL PANEL” in miscellaneous section.).
3. Remove the control panel lower shroud.



4. Label and remove the hydraulic hoses.
5. Remove four cap screws (A) and star washers. Remove the SCU from the tractor.
6. If necessary, remove adapter fittings (B) from the SCU.

NOTE: The SCU has no serviceable components. If the SCU does not meet specifications, the unit must be replaced.

Installation:

1. If adapter fittings were removed, inspect O-rings in adapter fittings for cracks or damage. Replace if required.
2. Install adapter fittings to the SCU ports. Tighten to specification.

NOTE: Unevenly or improperly torquing cap screws attaching SCU to tractor can result in distortion of the valve body, and premature failure of the SCU.

3. Install the SCU to the tractor. Fasten with four cap screws and star washers. Tighten to specification.
4. Install the hydraulic hoses to the adapter fittings. Tighten cylinder hoses to specification. Tighten pressure and return hoses to specification.
5. Install the control panel lower shroud.
6. Install the control panel.
7. Install the steering wheel.
8. Fill the hydraulic system to the proper level; bleed the system if required.

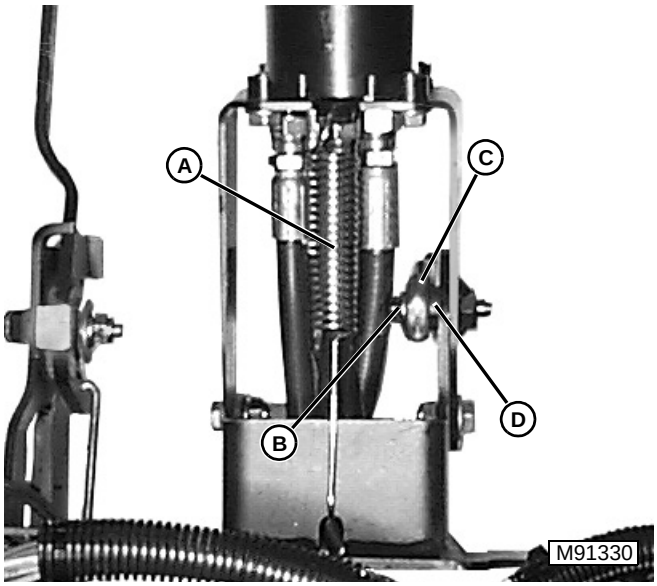
Specification:

SCU Adapter Fittings . . . 14-19 N•m (124-168 lb-in.).
SCU Mounting Cap Screws . 30-38 N•m (22-28 lb-ft).
Small Hoses To SCU . . . 19-27 N•m (168-240 lb-in.).
Large hoses To SCU . . . . . 40-57 N•m (30-42 lb-ft).

TILT STEERING MECHANISM REMOVAL AND INSTALLATION

Removal:

1. Remove steering wheel. (See “STEERING WHEEL REMOVAL AND INSTALLATION”).
2. Remove control panel. (See “CONTROL PANEL” in miscellaneous section.).
3. Remove control panel lower shroud.



4. Disconnect tilt return spring (A) from tilt column.
5. Lift up on the tilt locking lever to release lock.
6. Hold tilt locking lever and remove lock nut (B). Remove tilt locking lever (C).

NOTE: Locking screw (D) has left-hand thread into steering column.

7. Remove locking screw.

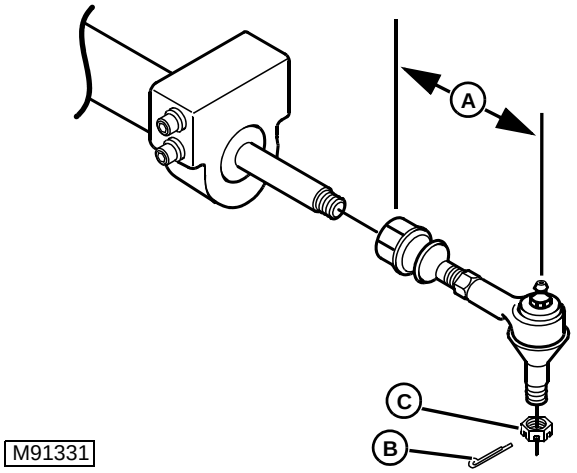
Installation:

1. Install locking screw to steering column. Tighten enough to lock column in place.
2. Install tilt locking lever into position on locking screw splines.
3. Test locking mechanism to be sure that steering column will lock in position securely, and tilt locking lever will not interfere with lower control panel shroud. Adjust if required.
4. Install lock nut and tighten.

TIE ROD REMOVAL AND INSTALLATION (EARLY 4-WD)

Removal:

1. Measure distance (A) from lubrication fitting on tie rod end to end of ball joint nut on steering cylinder rod. Record measurement.
2. Place a wrench on each of the nuts on the ends of the tie rods, and turn to remove one side.
3. If necessary, place a wrench on the flats or a suitable tool in the hole in the end of the cylinder rod where the tie rod was removed to prevent the cylinder rod from turning. Place a wrench on the remaining tie rod nut, and remove tie rod.



M91331

4. Remove cotter pin (B).
5. Remove castle nut (C).
6. Using a ball-joint separator, separate tie rod from spindle arm.
7. Remove tie rod.

Installation:

1. If installing ball joint previously used, inspect boot for damage. If necessary, replace tie rod.
2. If installing a new tie rod, loosen locking nut, and adjust tie rod until measurement from lubrication fitting to end of ball joint nut equals that recorded before removal. Tighten locking nut.
3. Attach tie rod to cylinder rod and torque to specification.
4. Attach tie rod to spindle arm.
5. Install castle nut and torque to specification.

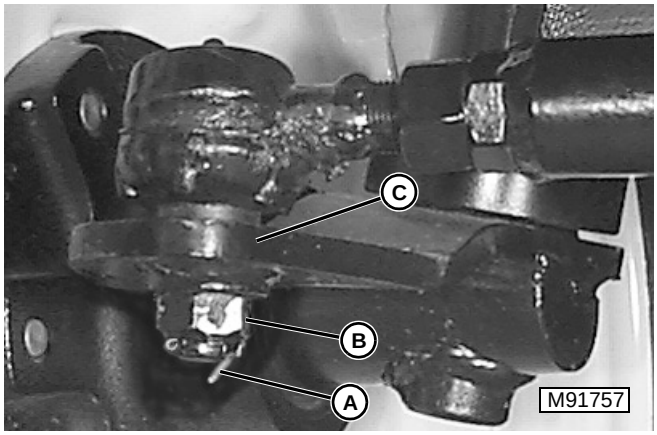
Specification:

Tie Rod End To Cylinder 115 - 129 N•m (85 - 95 lb-ft)
Castle Nut . . . . . .115 - 129 N•m (85 - 95 lb-ft)

6. Install a new cotter pin.
7. Lubricate tie rod end using general purpose grease. Follow lubrication procedure outlined in the maintenance section of the operator's manual.
8. Adjust toe-in. (See "TOE IN ADJUSTMENT 4WD").

TIE ROD REMOVAL AND INSTALLATION (2-WD)

Removal:



M91757

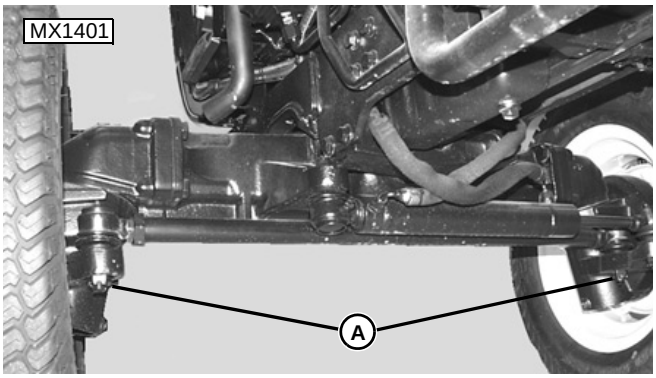
1. Remove cotter pin (A) and castle nut (B) from each rod end attaching tie rod to spindle arm.
2. Using a ball joint separator, disconnect ball joint end from spindle arm (C). Remove tie rod.

Installation:

1. If installing ball joint previously used, inspect boot. If boot is damaged, or in poor condition, replace tie rod end.
2. Insert threaded end of ball joint into hole in spindle arm.
3. Install castle nut to rod end.
4. Tighten castle nut to **115 - 129 N•m (85 - 95 lb-ft)**.
5. Install cotter pin.
6. Lubricate tie rod end using general purpose grease. Follow lubrication procedure outlined in the maintenance section of the operator's manual.

7. Adjust toe-in. (See “TOE IN ADJUSTMENT 2WD”).

TIE ROD REMOVAL AND INSTALLATION (LATE 4-WD)



1. Remove cotter pins from castle nuts (A) and remove castle nuts.
2. Using a tie rod end separator, remove tie rod ends from spindles.

NOTE: If removing tie rod ends, one of the tie rod ends and jam nut has left hand threads.

Installation:

1. Inspect tie rod end boots. If necessary, replace boots.
2. Insert tie rod ends into holes in spindle arms.
3. Install two castle nuts to rod ends.
4. Tighten castle nuts (A) to specification.
5. Install the cotter pins. If slots in castle nuts don’t align with holes after torquing, tighten nuts until next slot aligns.
6. Lubricate tie rod ends using general purpose grease. Follow lubrication procedure outlined in the maintenance section of the operator’s manual.
7. Adjust toe-in. See toe in adjustment in this section.

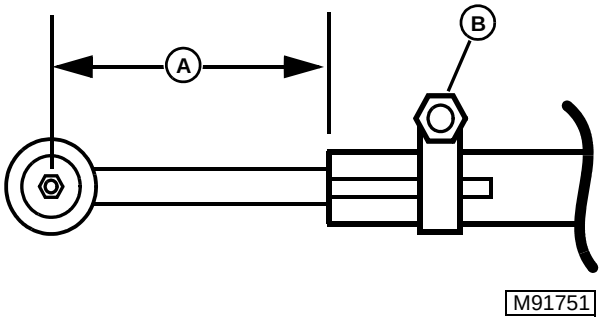
Specification:

Castle Nuts . . . . . 75-108 N•m (55-80 lb-ft).

TIE ROD DISASSEMBLY AND ASSEMBLY (2-WD)

Disassembly:

1. Remove ball joint boots from ball joints and clean parts thoroughly using a suitable solvent.



2. Measure length (A) of tie rod from clamped tube end to lubrication fitting on rod end. Record measurement.
3. Loosen cap screw and nut (B) on tie rod clamp.
4. Remove rod end from tie rod tube.
5. Loosen locking nut on adjustable rod end.
6. Unscrew adjustable rod end from tie rod.
7. Inspect ball joints for damage, wear, and smooth operation. Replace if necessary.

Assembly:

1. If installing ball joint previously used, inspect boot. If necessary, replace tie rod end.
2. If removed, thread locking nut onto adjustable tie rod end.
3. Install threaded rod end into tie rod so that approximately half the threads are showing.
4. Install plain rod end into tie rod. Measure from end of tie rod tube to lubrication fitting on tie rod end. Install so that dimension is same as that recorded before disassembly. Tighten clamp to retain rod end in tie rod tube.
5. Adjust toe-in. See toe in adjustment in this section.

CONTENTS

Page

SPECIFICATIONS

Brakes:

Brake Type	Wet Multiple Disk
Brake Pedal Stroke	63 - 76 mm (2.5 - 3.0 in.)
Pedal Free Play	27 - 35 mm (1.06 - 1.38 in.)
Total Brake Actuation	50 - 64 mm (2.0 - 2.5 in.)
Pedal Differential	2 mm (0.08 in.) or Less
Friction Disk and Plate Pack Thickness (Minimum)	16.51 mm (0.650 in.)

Transaxle Oil:

Type	John Deere J20D
Capacity (Hydrostatic)	26.0 L (6.8 gal)
Capacity (Gear)	24.0 L (6.3 gal)

Torque Specifications:

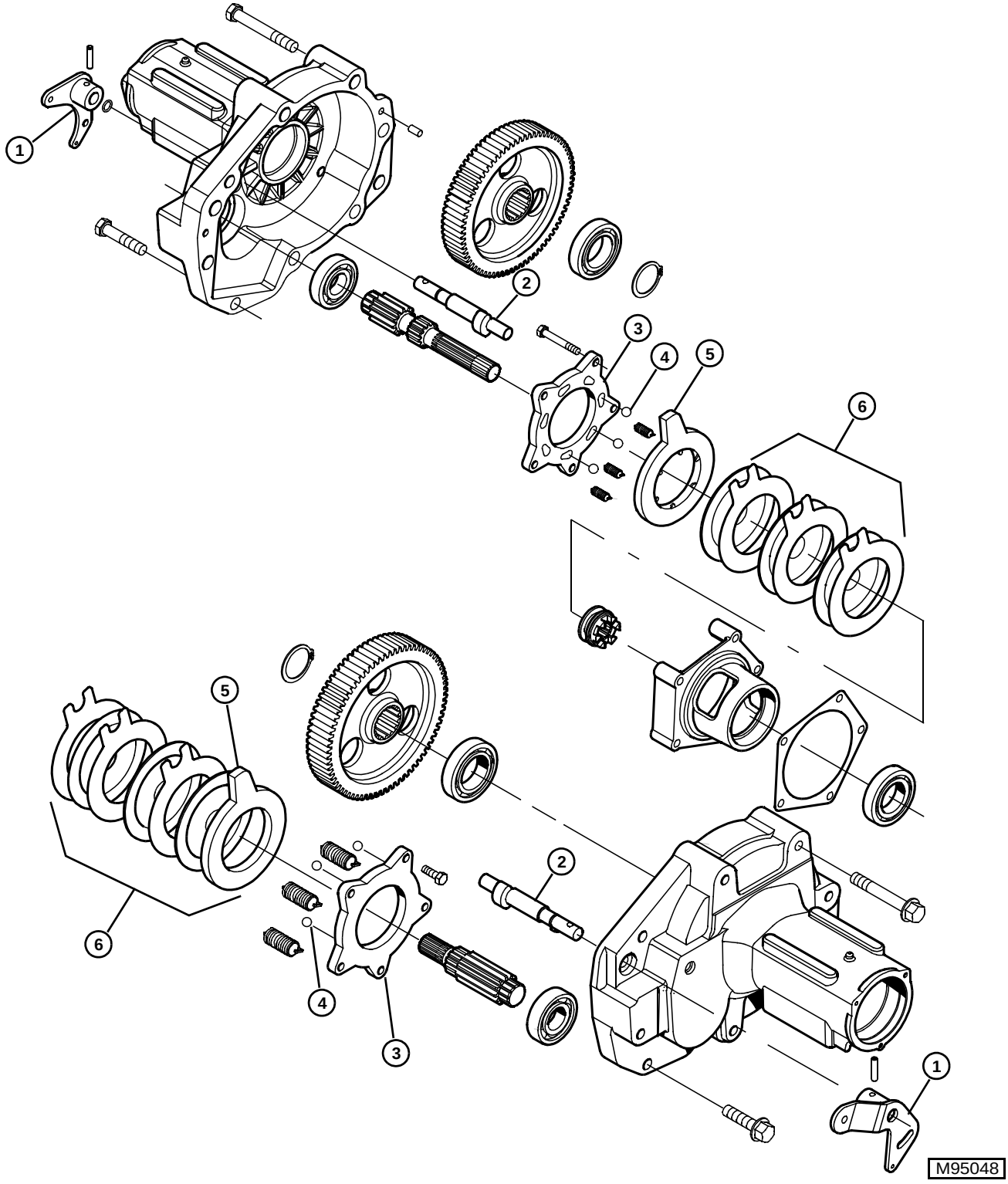
Wheel Mounting Bolts:	
Front and Rear Wheel Mounting Bolts	98 N•m (72 lb-ft)
Front wheels (Model 4200 Equipped With 4.0 x 15 F2 Ribbed Tires)	68 N•m (50 lb-ft)
Front Wheels (Model 4300 Equipped With 5.0 x 15 F2 Ribbed Tires)	68 N•m (50 lb-ft)
Master Brake Link Jam Nut	65 - 71 N•m (48 - 52 lb-ft)
Set Screw On Master Brake Pedal (To Shaft)	20 - 25 N•m (177 - 221 lb-in.)
Clutch Rod Cap Screw	36 - 44 N•m (27 - 33 lb-ft)
LH Brake Lever Cap Screw (CST & SRT Only)	36 - 44 N•m (27 - 33 lb-ft)

Additional Materials:

Thread Sealant (General Purpose)	TY9370 6 ml (0.2 oz)
Sealant (For Flanges)	TY16021 50 ml (1.7 oz)

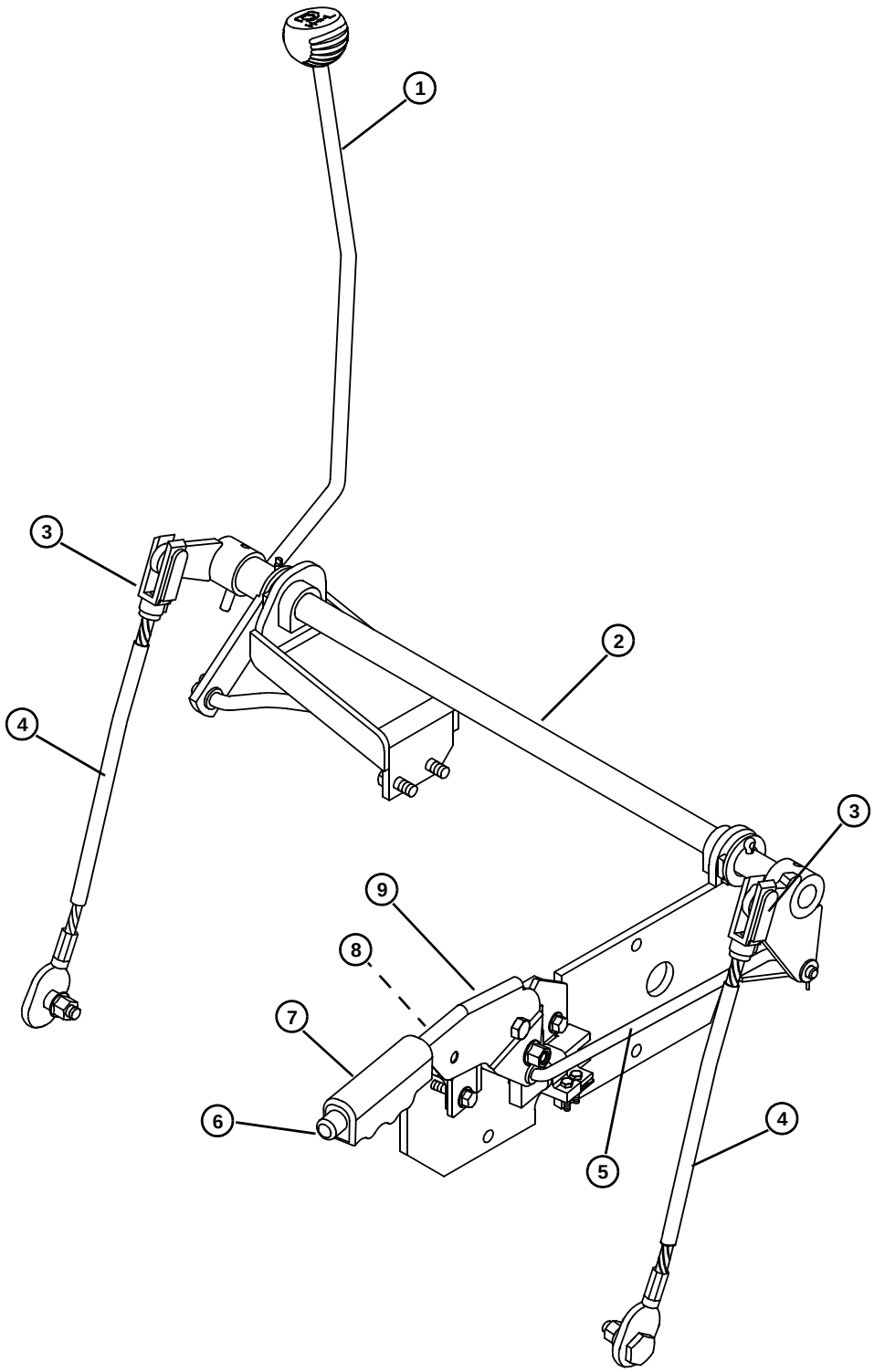
COMPONENT LOCATION

BRAKE HOUSING



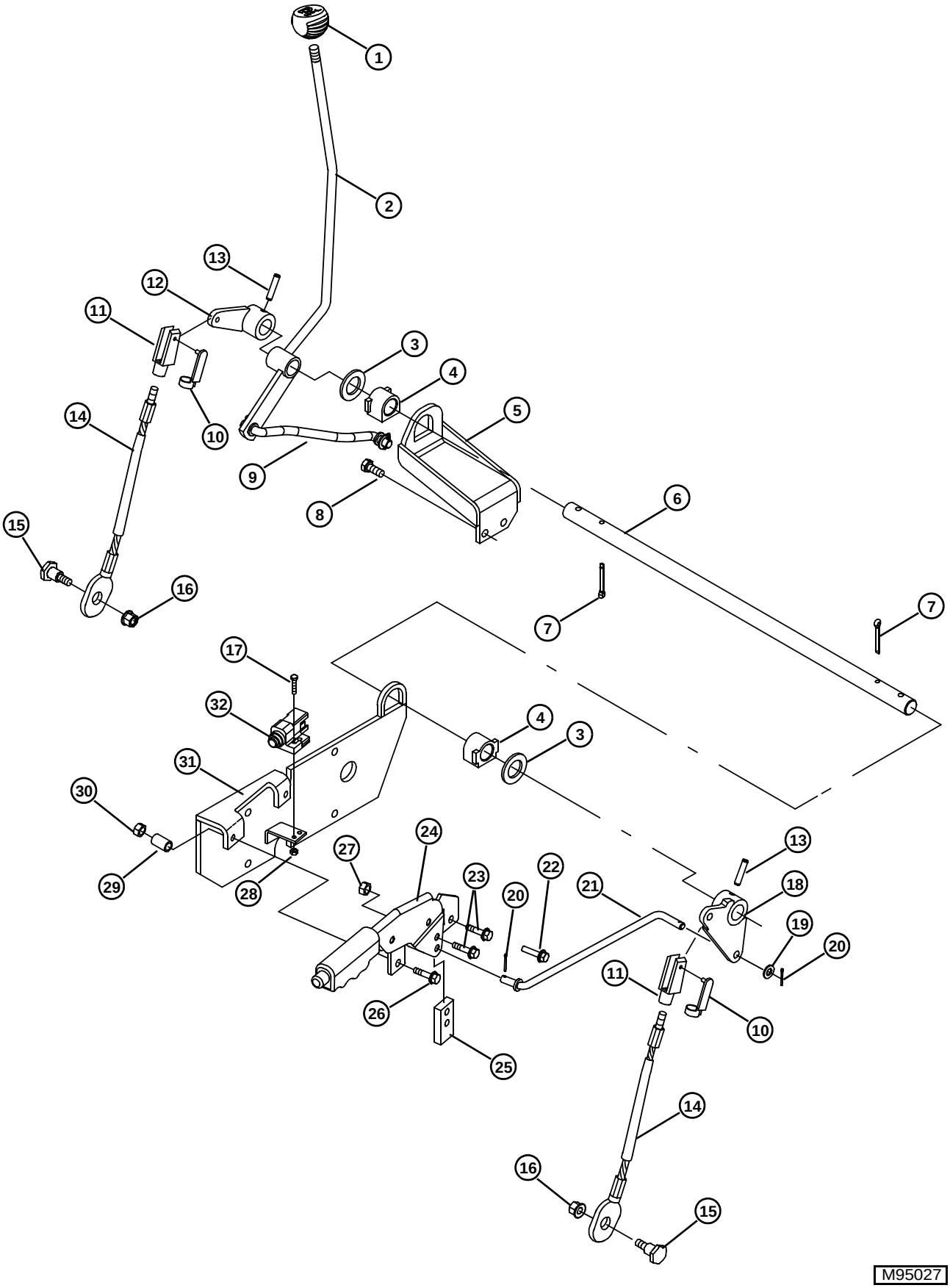
1. Brake Arm
2. Brake Cam
3. Brake Retainer Plate
4. Balls (7 used)
5. Actuator Plate
6. Friction Disks and Plates

PARKING BRAKE - SIDE MOUNT



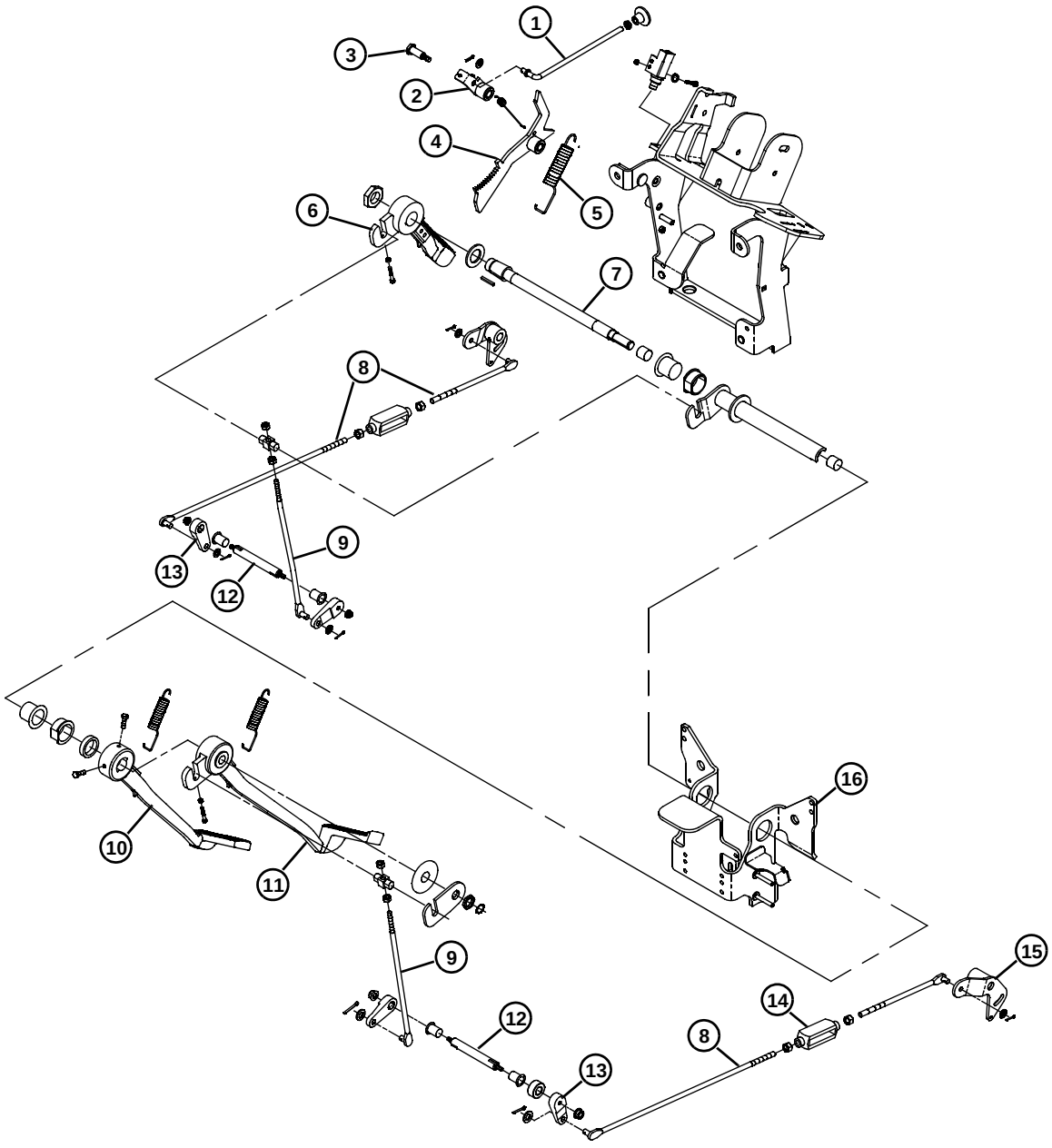
1. 2 Speed PTO Lever (European)
2. Brake Shaft Assembly
3. Clevis
4. Park Brake Cable
5. Link
6. Release Button
7. Handle
8. Ratchet
9. Brake Lever

PARKING BRAKE - SIDE MOUNT



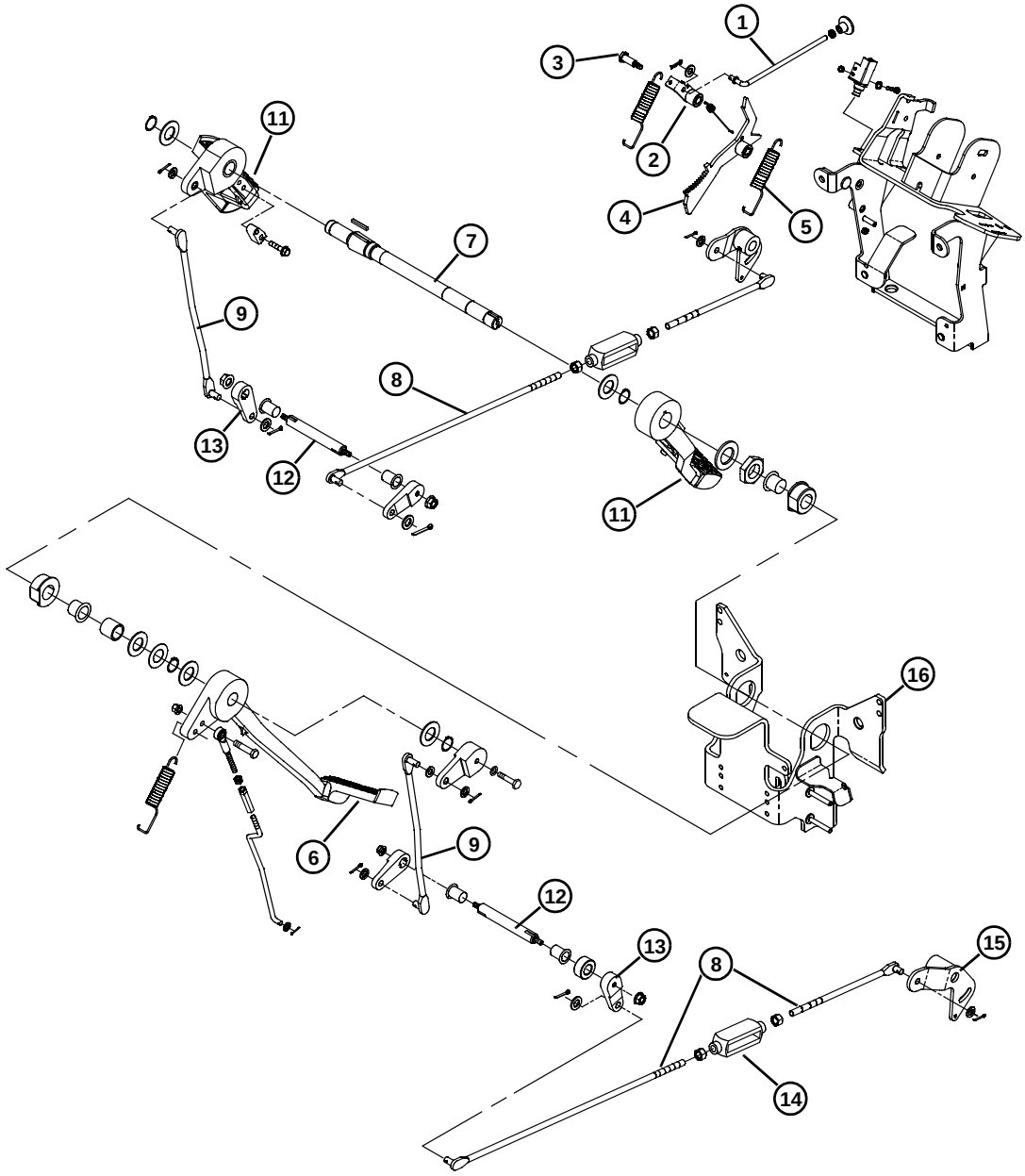
10. Knob, 2 Speed PTO (Europe)
11. Lever, 2 Speed PTO (Europe)
12. Washer
13. Bearing
14. Bracket
15. Shaft
16. Cotter Pin
17. Cap Screw
18. Link
19. Pin, Clevis
20. Clevis
21. Arm
22. Spring Pin
23. Cable
24. Shoulder Bolt
25. Lock Nut
26. Cap Screw
27. Arm
28. Washer
29. Cotter Pin
30. Link
31. Cap Screw
32. Cap Screw
33. Handbrake Lever
34. Strap
35. Cap Screw
36. Nut
37. Nut
38. Spacer
39. Nut
40. Bracket
41. Switch

PARKING BRAKE - CONSOLE MOUNT (HST)



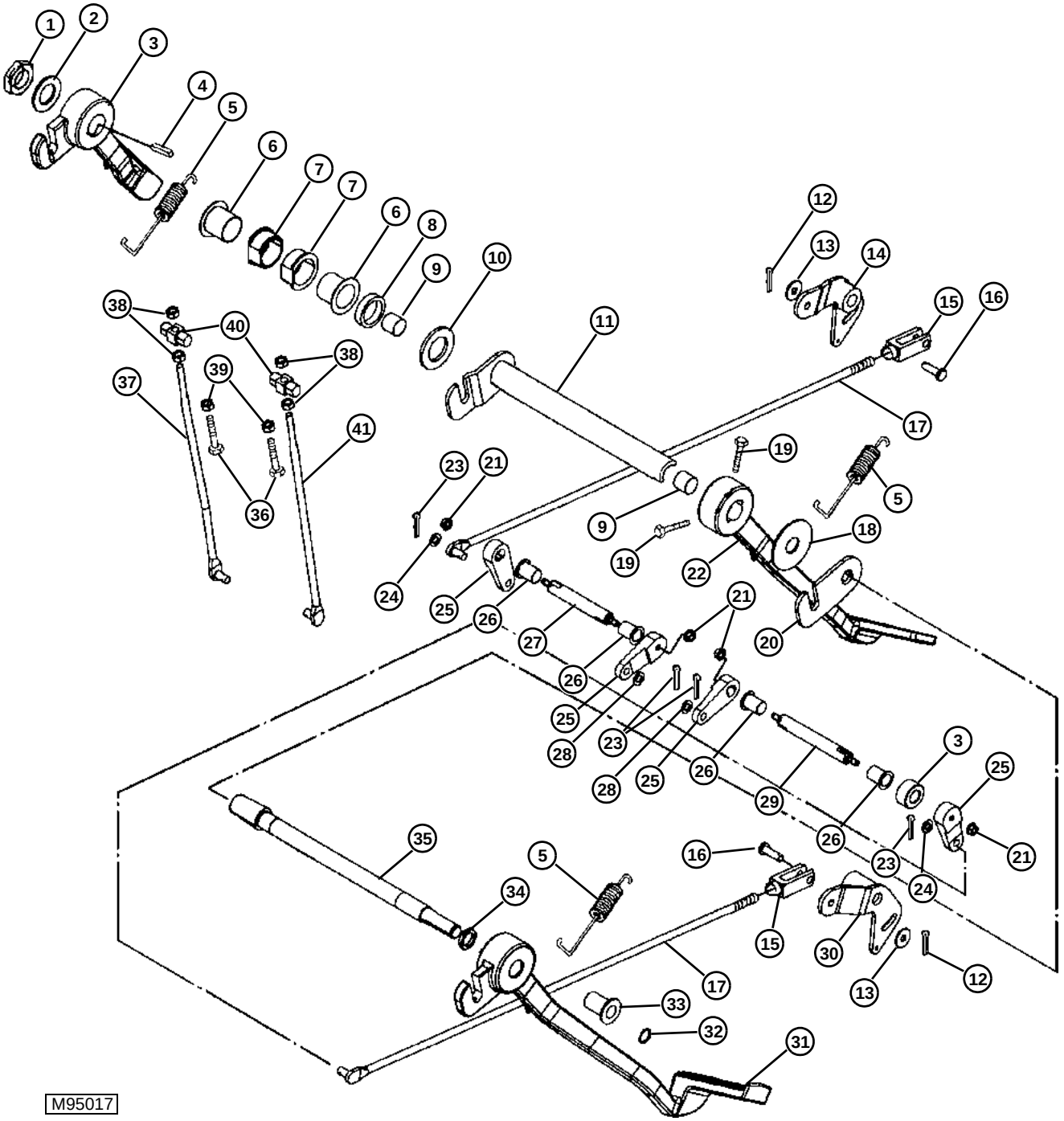
1. Park Brake Linkage
2. Cam Lever
3. Pivot Bolt
4. Engagement Lever
5. Extension Spring
6. Pedal, HST
7. Shaft, Brake
8. Lower Brake Rod
9. Upper Brake Rod
10. Pedal, Brake
11. Pedal, Brake
12. Shaft
13. Lever
14. Turnbuckle
15. Brake Lever
16. Support

PARKING BRAKE - CONSOLE MOUNT (CST - SST - SRT)



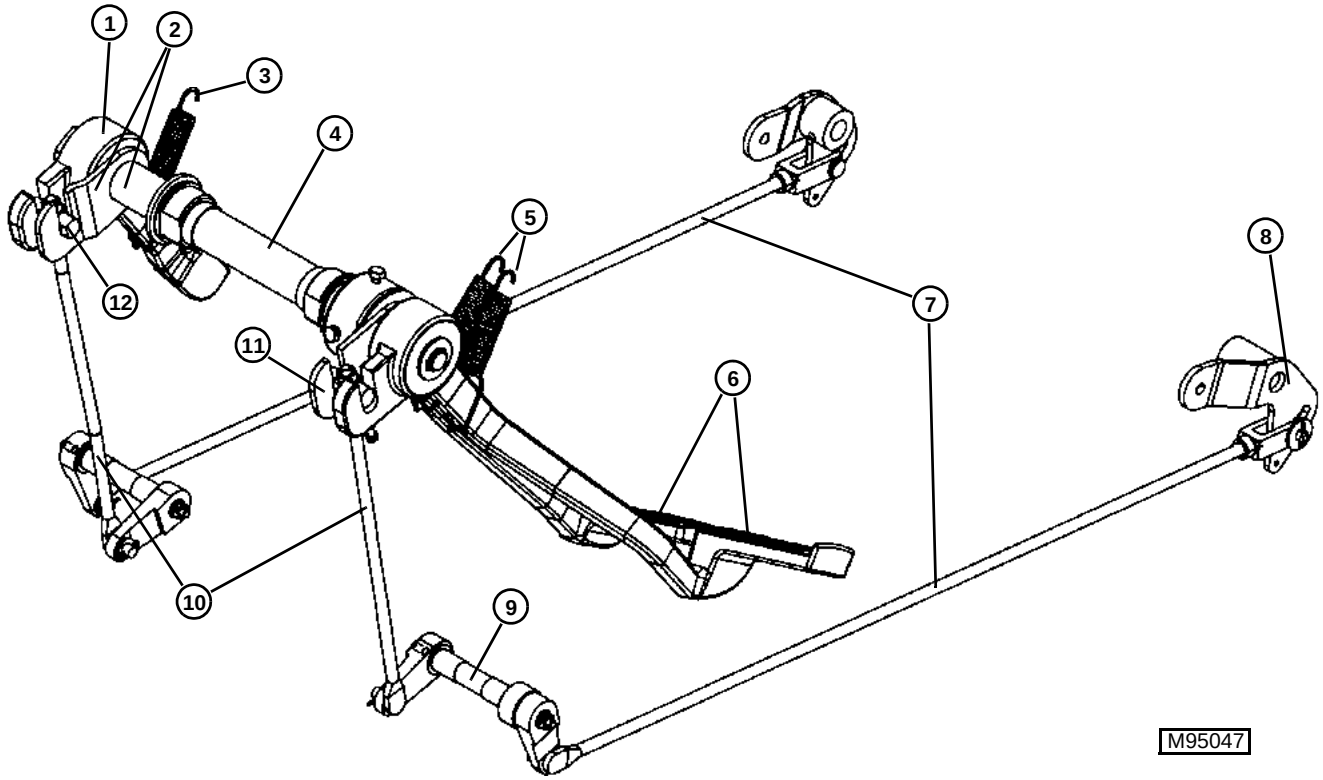
1. Park Brake Linkage
2. Cam Lever
3. Pivot Bolt
4. Engagement Lever
5. Extension Spring
6. Pedal, Clutch
7. Shaft, Brake
8. Lower Brake Rod
9. Upper Brake Rod
10. Pedal, Brake
11. Pedal, Brake
12. Shaft
13. Lever
14. Turnbuckle
15. Brake Lever
16. Support

BRAKE PEDALS AND LINKAGE – HST



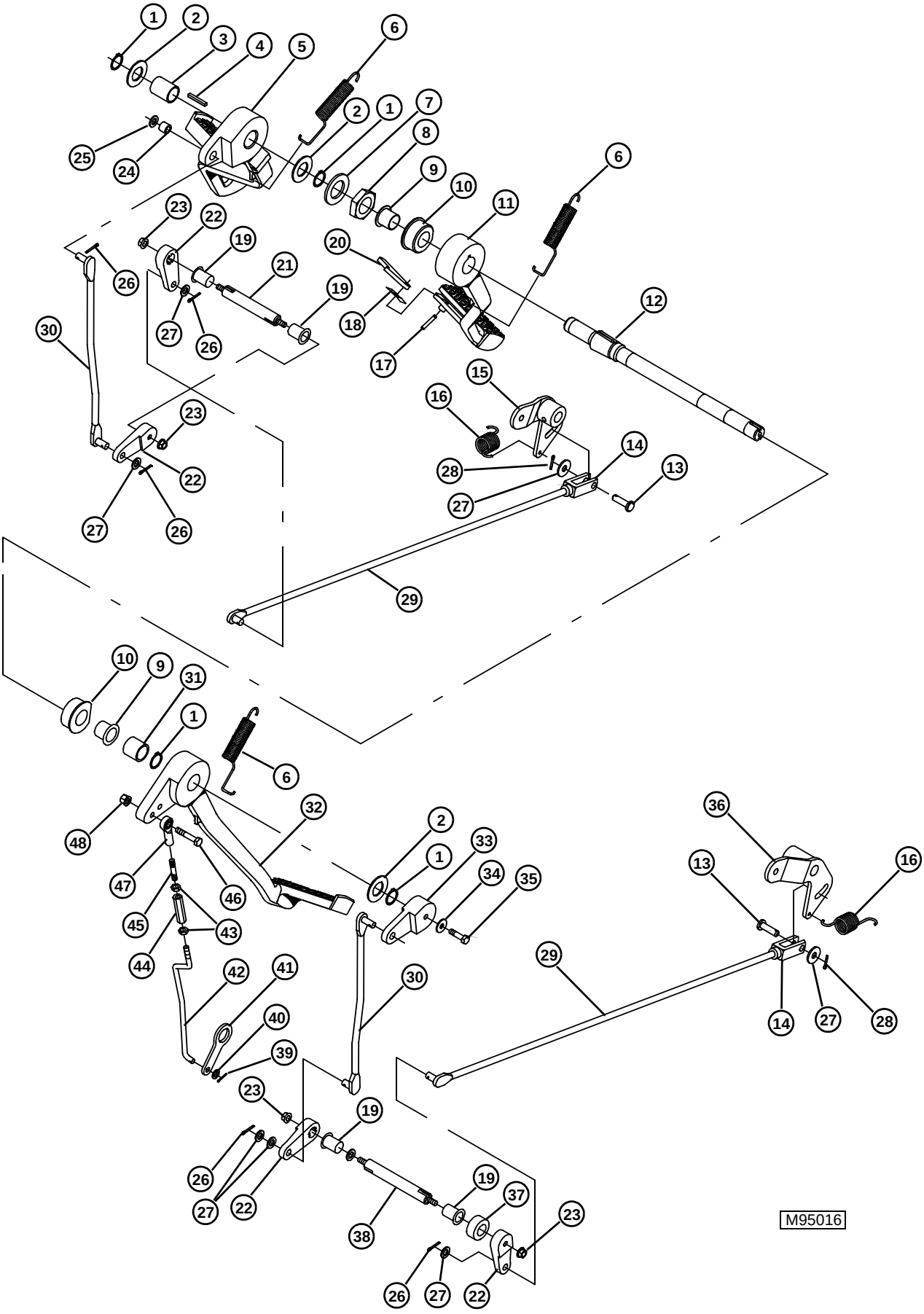
1. Nut
2. Washer
3. Pedal, Master
4. Key
5. Spring
6. Bushing
7. Bushing
8. Spacer
9. Sleeve
10. Washer
11. Tube
12. Cotter Pin
13. Washer
14. Lever
15. Clevis
16. Pin
17. Rod, Lower
18. Washer
19. Cap Screw
20. Lever
21. Nut
22. Pedal, RH
23. Cotter Pin
24. Washer
25. Lever
26. Bushing
27. Shaft
28. Washer
29. Shaft
30. Brake Arm
31. Pedal, LH
32. Snap Ring
33. Bushing
34. Nut
35. Shaft
36. Cap Screw
37. Rod, RH Upper
38. Nut
39. Nut
40. T-Pin
41. Rod, LH Upper

BRAKE PEDALS AND LINKAGE – HST



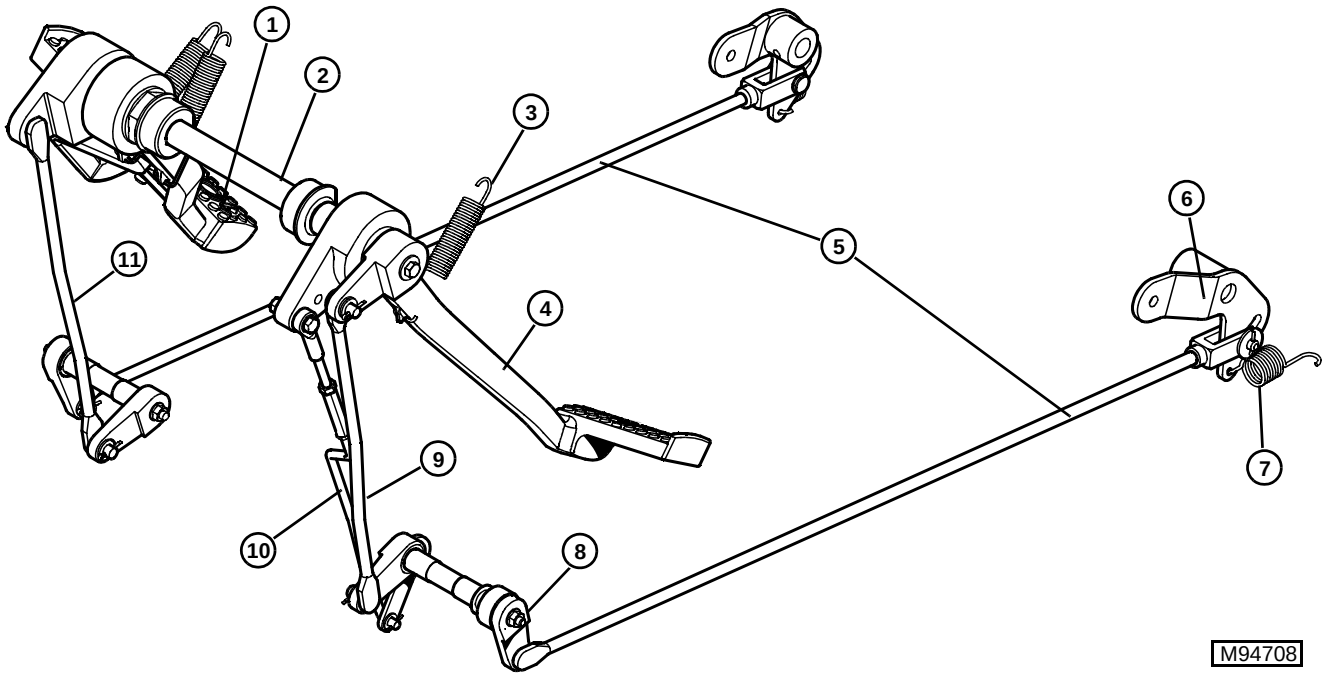
1. Master Brake Pedal
2. Right Brake Tube and Link
3. Brake Return Spring
4. Brake Pedal Pivot Shaft Assembly
5. Brake Return Spring
6. Brake Pedals
7. Lower Brake Rods
8. Brake Arm
9. Bellcrank
10. Upper Brake Rods
11. Master Brake Link
12. T-Pin

BRAKE PEDALS AND LINKAGE – CST AND SRT



1. Snap Ring
2. Washer
3. Bushing
4. Key
5. Pedal, RH Brake
6. Spring
7. Washer
8. Nut
9. Bushing
10. Bushing
11. Pedal, LH Brake
12. Shaft
13. Pin
14. Clevis
15. Arm, RH Brake
16. Spring
17. Spring Pin
18. Leaf Spring
19. Bushing
20. Arm, Pedal Locking
21. Shaft
22. Lever
23. Nut
24. Bushing
25. Washer
26. Cotter Pin
27. Washer
28. Cotter Pin
29. Rod, Lower
30. Rod, Upper
31. Spacer
32. Pedal, Clutch
33. Lever
34. Washer
35. Cap Screw
36. Arm, LH Brake
37. Spacer
38. Shaft
39. Cotter Pin
40. Washer
41. Lever
42. Rod, Clutch
43. Nut
44. Turnbuckle
45. Stud
46. Cap Screw
47. Rod End
48. Nut

BRAKE PEDALS AND LINKAGE – CST AND SRT



1. Brake Pedal
2. Brake Pedal Pivot Shaft
3. Brake Pedal Return Spring
4. Clutch Pedal
5. Lower Brake Rod
6. Brake Arm
7. Brake Return Spring
8. Bellcrank
9. Upper Brake Rod
10. Clutch rod
11. Upper Brake Rod

BRAKE THEORY OF OPERATION

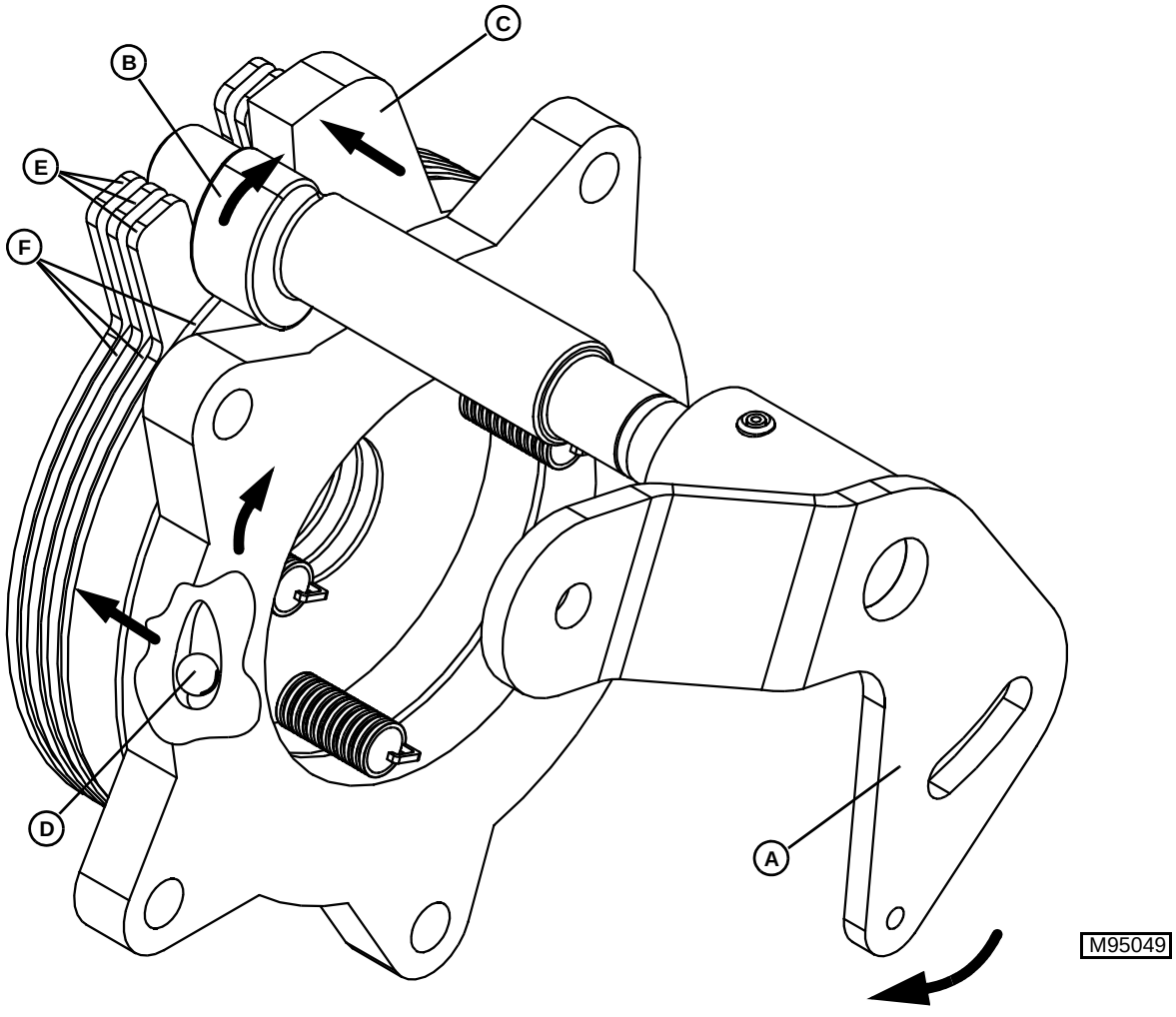
The mechanical wet disk brakes operate on each rear wheel of the tractor. The brakes are engaged by the operator applying pressure to the brake pedals. When pressure is applied to a brake pedal, the pedal pulls the front brake rod up. The brake rod pulls on the bellcrank which pivots, pulling on the lower brake rod. The lower brake rod pulls on the brake lever (A) on the final drive housing.

Inside the housing, the cam (B) on the brake lever pushes against a tab (C) on the brake actuator. The brake actuator is rotated, moving angled ramps against captive steel balls (D). As the actuator rotates, the balls and ramps force the actuator against the friction disks (E) and plates (F), and in turn the differential housing. The friction plates are held in position by the cam which rests in a U-shaped slot. The friction disks are splined to the axle shaft. The friction between the friction disks and the friction plate/differential housing slows or stops the rear drive wheels.

Removing pressure from the pedal allows the brake arm return spring and brake pedal return spring to pull the pedal back to the original position, releasing the brakes. On the hydrostatic model, an interlock between the links on the pedal shaft assembly allows the master brake pedal to brake both sides simultaneously.

The side mount parking brake uses cables extending from the park brake shaft assembly down to the brake levers on the final drive case, and is engaged with the park brake lever. It operates independently of the brake pedals. The parking brake lever is pulled up, pulling the link which turns the park brake shaft. On the park brake shaft are two cam arms which pull the park brake cables. The park brake cables pull the brake levers (A) on the final drive case. The park brake is locked in position by a ratchet on the park brake lever. The brake disks are held in position until the park brake release button is pushed, and the park brake lever is pushed down.

The dash mount parking brake mechanically latches the brake foot pedal in position after it is pressed down by the operator. Its operation is dependent on use of the brake pedal.



TROUBLESHOOTING CHART

Problem or Symptom / Check or Solution	Steering pulls in one direction	Brakes drag (tractor will not move) or slow to release	Brakes not effective	Excessive pedal travel	Noise during braking	Oil leaking from final drive case at brake arm
Brakes improperly adjusted	●	●	●	●		
Brakes worn/ no longer serviceable	●		●	●	●	
Brake return spring weak/ damaged/ missing		●				
Brake linkage damaged/ binding	●	●	●			
Brake lever cam and/ or actuator worn			●	●	●	
Actuator/ balls/ housing worn or damaged			●	●	●	
Brake friction/ stationary plates worn or damaged	●		●	●	●	
Replace brake arm seal						●

DIAGNOSIS

Test/Check Point	Normal	If Not Normal
1. Pedals	Smooth operation	Grease pedal shaft assembly/ linkage. Inspect for damage.
	Free play **27 - 35 mm (1.06 - 1.38 in.)** Total brake pedal travel **63 - 76 mm (2.5 - 3.0 in.**) Pedal differential **2 mm (0.08 in.)** or less	Adjust to specification.
2. Friction material	Friction disk not excessively worn	Replace parts as required.
3. Linkage	Not bent or binding	Adjust to specification, replace damaged parts.
4. Actuator and housing	Smooth operation, not worn	Replace worn parts.
5. Steel balls	Not pitted or scored	Replace worn parts.
6. Park brake lever	Smooth operation, not binding	Adjust to specifications, replace damaged parts.

TESTS AND ADJUSTMENTS

BRAKE PEDAL ADJUSTMENT

NOTE: (Hydrostatic Model) The locking nuts located on the upper brake rod T-pins at the brake pedal assembly should not be used as an adjustment point. All adjustment should be performed at the rear of the tractor on the lower brake rod clevises attached to the transmission brake arms.

Reason:

To set the brake linkage free play to allow full pedal movement and full application of the brake disks on the rear axle shafts. The brakes are adjusted using adjustable clevises to lengthen or shorten the brake rods.

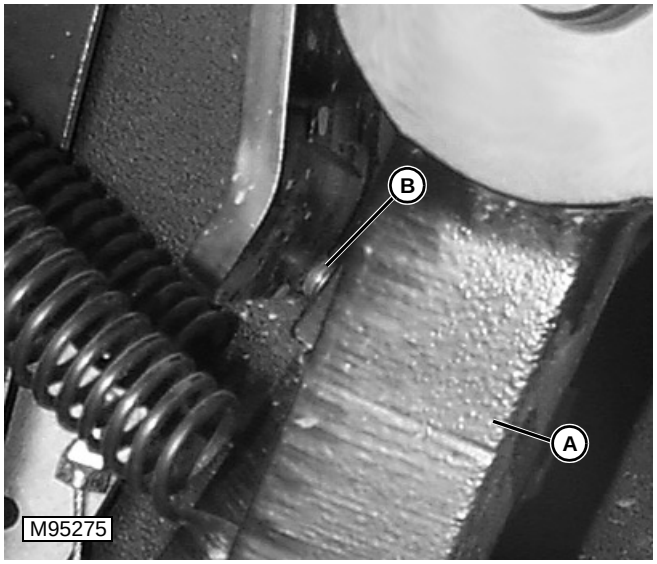
Tools:

- Ruler
- Pliers

Procedure:

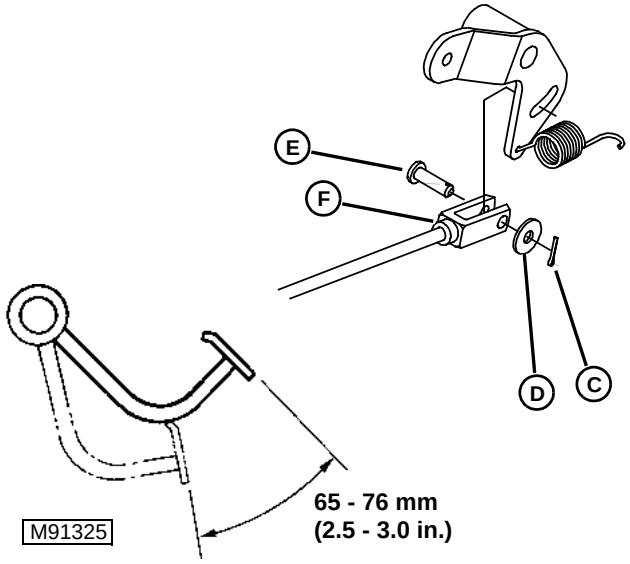
Tractors were manufactured with two different types of brake adjusters. Choose the procedure that is appropriate for your model.

Clevis-Type Adjusters:



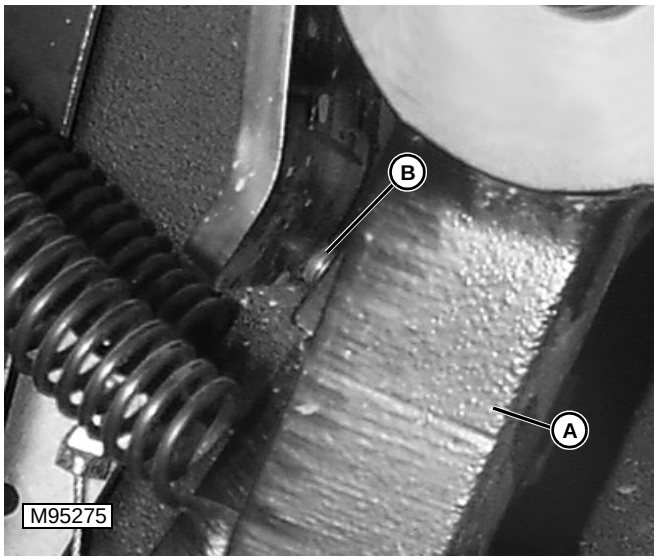
1. (CST or SRT Models) Check brake pedals (A) to ensure that they are at the same height. Adjust as required using set screws (B) on brake pedal.

NOTE: Adjuster screws may not be factory installed. If necessary, install an 8 X 20 mm set screw into pedal. Apply TY9370 thread sealant to lock screw in place.



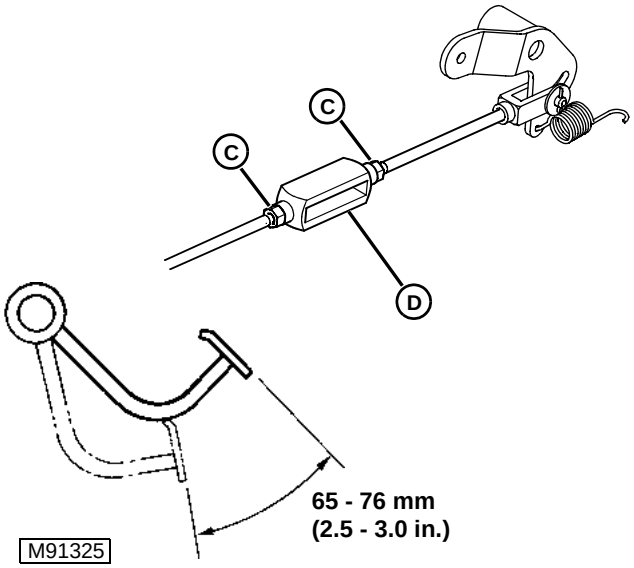
2. Remove cotter pin (C), washer (D), and clevis pin (E) to disconnect clevis (F) from transmission brake arm.
3. Turn clevis on rod to adjust free play.
4. Adjust the LH and RH clevis until the pedal free play is **27 - 35 mm (1.06 - 1.37 in.)**, and the total brake pedal stroke is **63 - 76 mm (2.5 - 3.0 in.)**.
5. The difference between left and right side pedal free play (pedal differential) should be less than **2 mm (0.08 in)**.

Turnbuckle-Type Adjusters:



1. (CST or SRT Models) Check brake pedals (A) to ensure that they are at the same height. Adjust as required using set screws (B) on brake pedal.

NOTE: Adjuster screws may not be factory installed. If necessary, install an 8 X 20 mm set screw into pedal. Apply TY9370 thread sealant to lock screw in place.



2. Loosen locking nuts (C) on lower brake rod turnbuckle (D).
3. Turn turnbuckle on rod to adjust free play.
4. Adjust the LH and RH turnbuckle until the pedal free play is **27 - 35 mm (1.06 - 1.37 in.**), and the total brake pedal stroke is **63 - 76 mm (2.5 - 3.0 in.)**.
5. The difference between left and right side pedal free play (pedal differential) should be less than **2 mm (0.08 in)**.

Results:

If the brakes are adjusted correctly:

- The wheel brakes will begin engagement when the pedals are depressed **27 - 35 mm (1.06 - 1.37 in.**).

PARKING BRAKE ADJUSTMENT - SIDE MOUNT

1. To adjust the parking brake:
   - Remove the clevis pin attaching the park brake cable to the park brake shaft (RH) or brake lever on the final drive housing (LH).
   - Loosen the locking nut which locks the clevis to the cable.
   - Turn the clevis.
2. Adjust clevis on the left brake so that the park brake begins to engage with 3 clicks of park brake lever travel. The park brake should be fully engaged at 4 or 5 clicks. Reattach clevis.
3. Remove right brake clevis pin, and repeat procedure on right brake. Reattach clevises.

IMPORTANT: Improper park brake adjustment can cause excessive heat and wear on brakes. Be sure brakes disengage fully when the park brake lever is released.

4. Release the park brake, and check to ensure that the tractor rolls freely with the park brake disengaged.

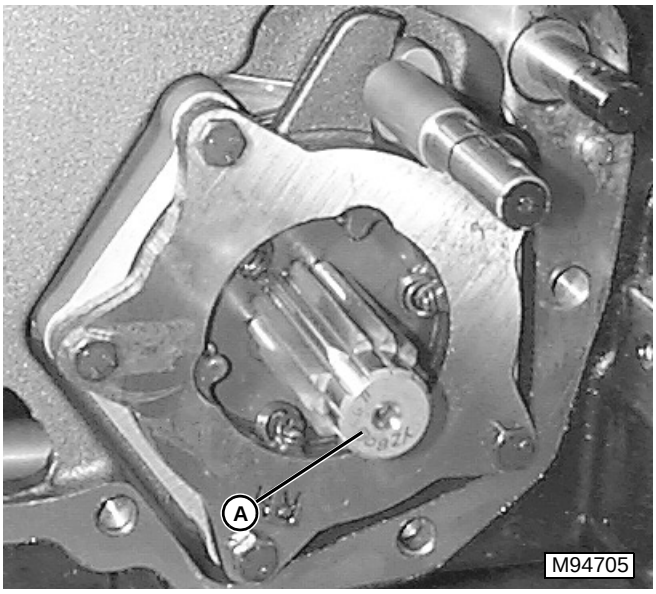
PARKING BRAKE ADJUSTMENT - CONSOLE MOUNT

The parking brake operation with the console mounted on off knob is dependent on the brake pedal adjustment. Proper adjustment of the brake pedal linkage ensures proper operation of the parking brake. (See “BRAKE PEDAL ADJUSTMENT”).

REPAIR

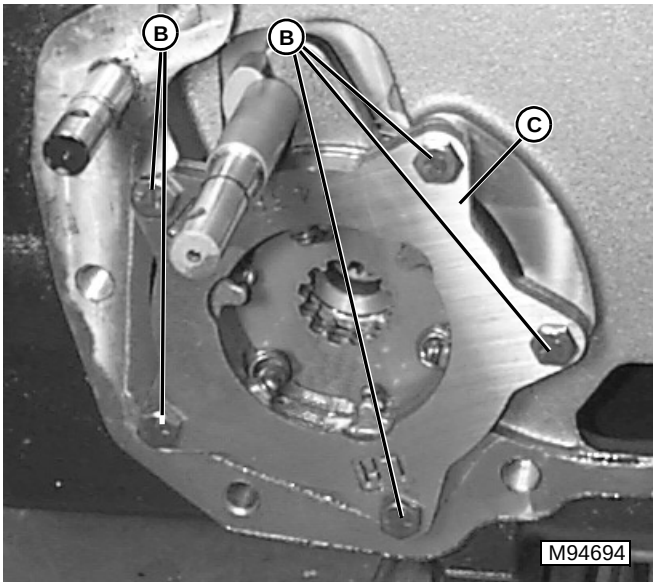
BRAKE DISASSEMBLY AND INSPECTION

1. Remove the final drive from the tractor. (See “FINAL DRIVE REMOVAL” in Final Drive PowerTrain section.)

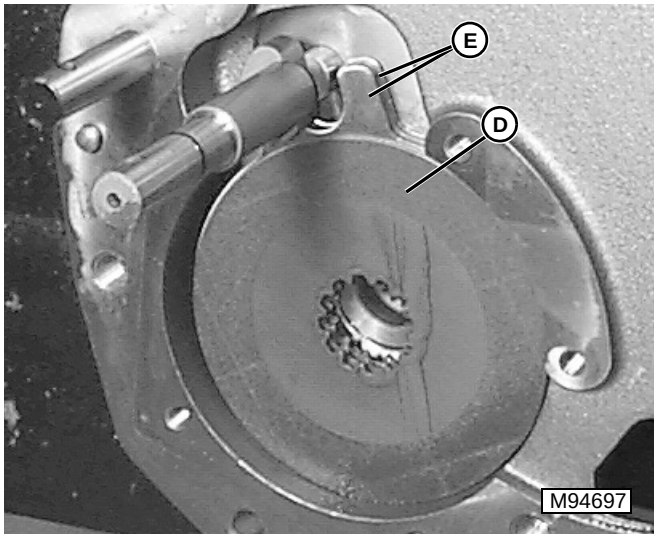


2. (RH Only) Remove pinion shaft (A) from transmission housing.

IMPORTANT: Brake plates and disks may fall out when actuator is removed. Use care to prevent damage to disks and plates.



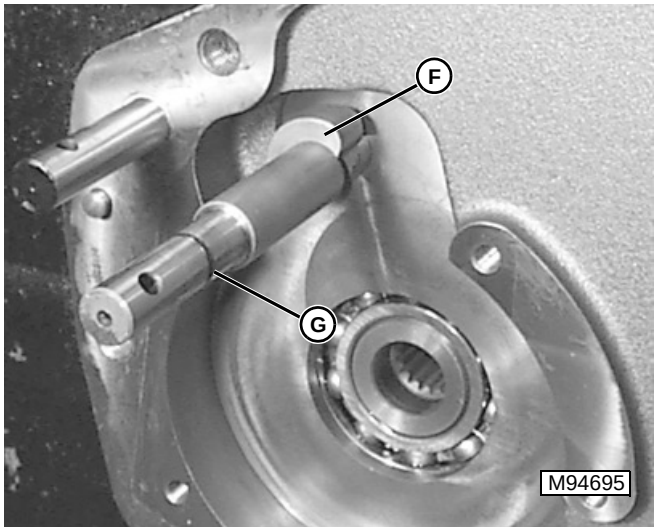
3. Remove five cap screws (B) and actuator assembly (C).



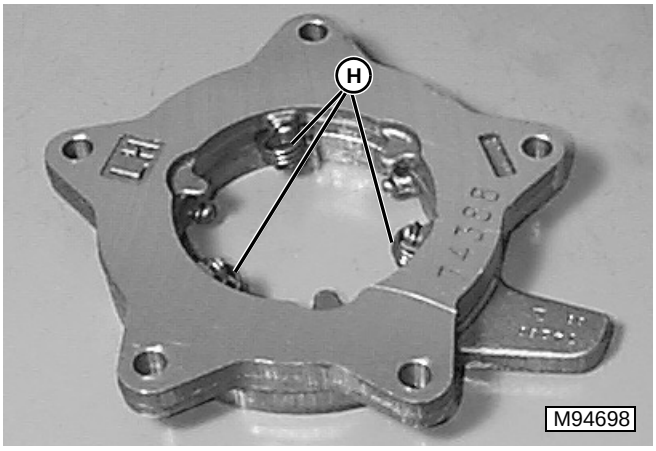
4. Remove friction disks (D) and plates (E).
5. Measure plate and disk pack thickness.

Specification:

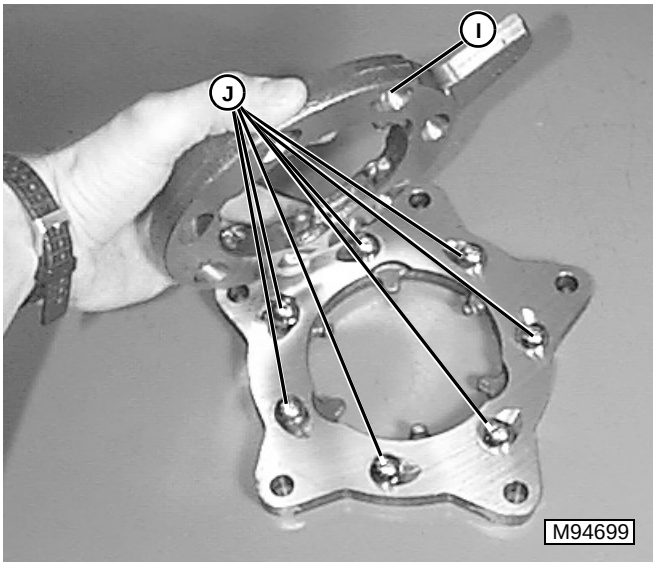
Friction Disk and Plate Pack Thickness (Minimum). . . . . 16.51 mm (0.650 in.)



6. Remove cam shaft (F).
7. Replace O-ring (G).



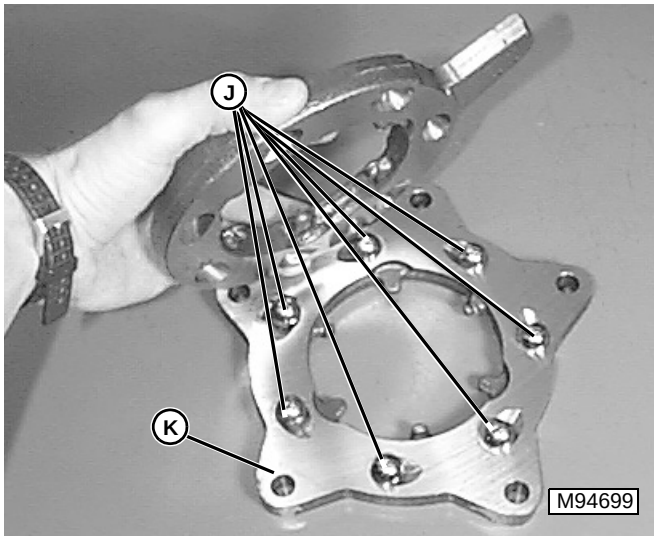
8. Lay actuator assembly on bench and remove three springs (H).



9. Remove actuator plate (I) and seven steel balls (J).
10. Inspect all parts for wear or damage. Replace any worn or damaged components.

BRAKE ASSEMBLY

IMPORTANT: If installing new friction disks, soak friction disks in hydraulic oil for 1 hour before assembling.

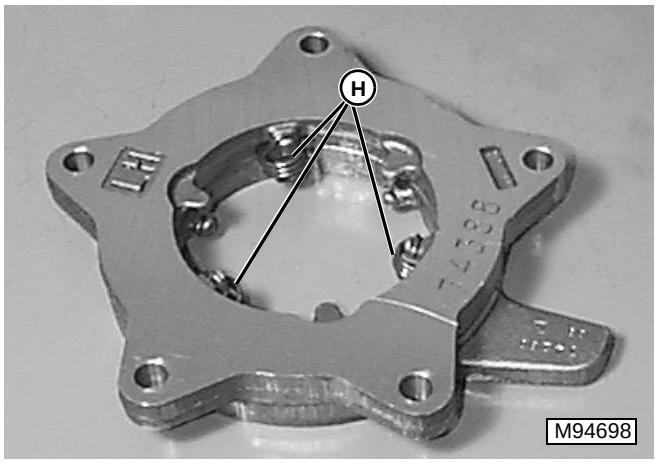


NOTE: Be certain the steel balls locate into the ramps of the actuator.

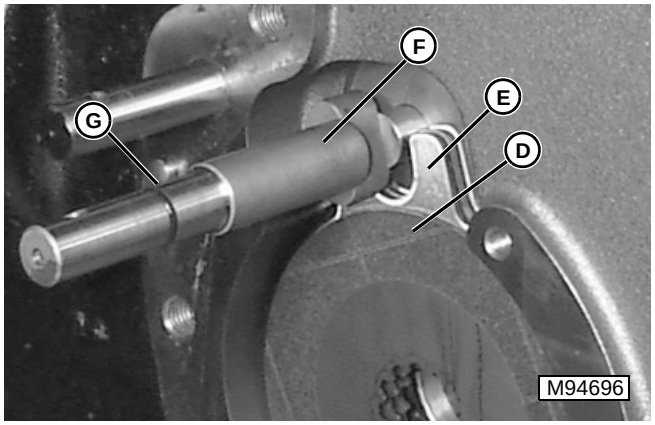
1. Dip the steel balls (J) in transmission oil. Install steel balls into brake retainer plate (K).

NOTE: Actuator plate will only fit onto steel balls and retainer plate one way. Align actuator plate and retainer plate so that spring tangs line up.

2. Install actuator plate onto steel balls and retainer plate.

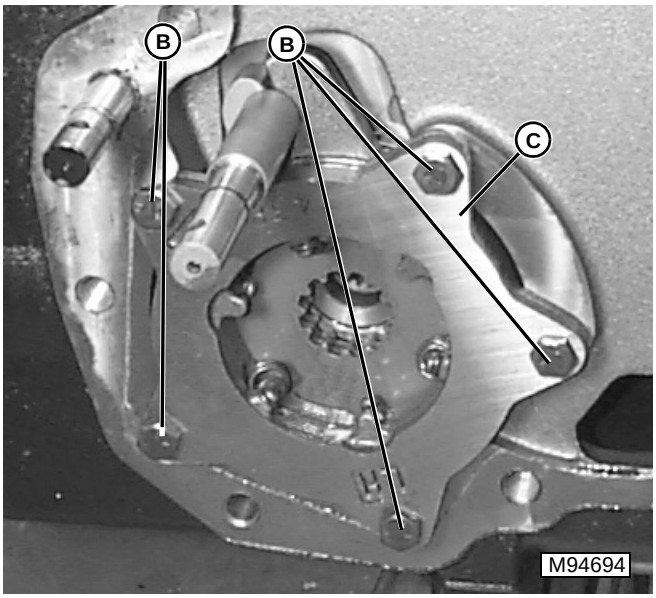


3. Install three springs (H) onto spring tangs.



IMPORTANT: If installing new friction disks, soak friction disks in hydraulic oil for one hour before assembling.

4. Dip the friction plates and the friction disks in transmission oil. Install a brake plate (E) into final drive housing, followed by a disk (D), plate, disk, plate, disk.
5. Install a new O-ring (G) onto brake cam shaft (F), and install cam shaft into final drive housing.



6. Dip brake actuator (C) in hydraulic oil and install into final drive housing. Retain with five cap screws (B). Tighten cap screws to **43 N•m (32 lb-ft)**.
7. Install the final drive housing to the transaxle. (See “FINAL DRIVE INSTALLATION” in Final Drive Power Train section.)

BRAKE PEDAL REMOVAL AND INSTALLATION - HST

Removal:

1. Remove cowl panels. (See “COWL PANEL” in Miscellaneous section.)

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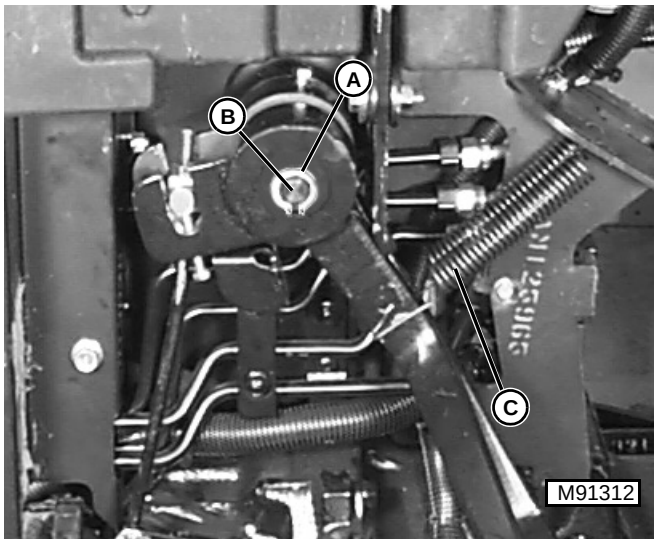
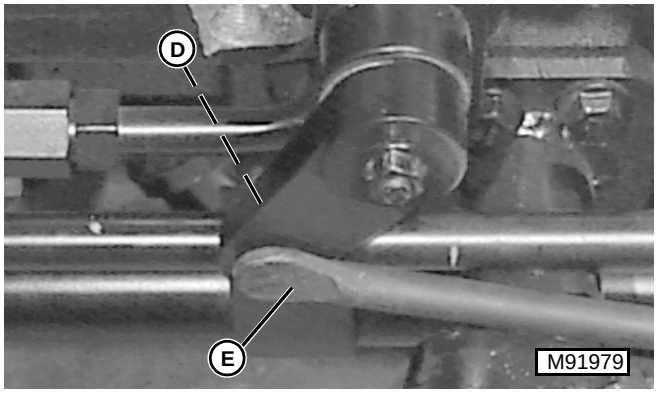


2. Remove snap ring (A) from end of brake pedal pivot shaft (B).

CAUTION

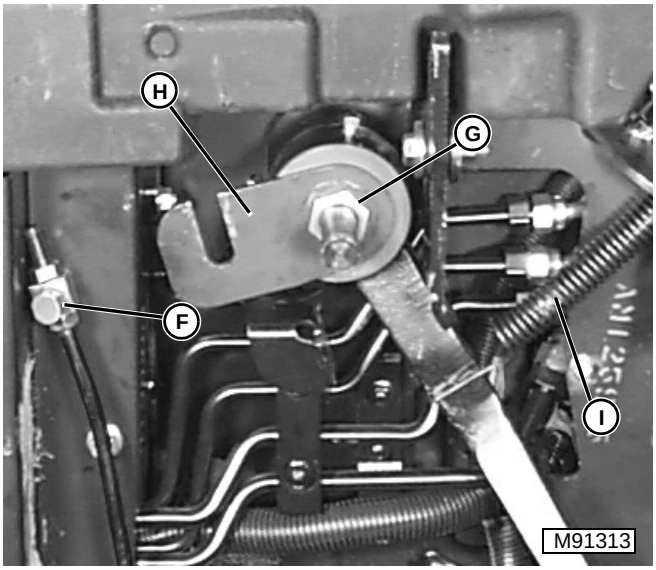
Brake return spring is under high tension. Wear safety glasses and gloves when removing or installing spring from pedal.

3. Disconnect brake return spring (C) from left brake pedal.
4. Remove left brake pedal.



5. Remove cotter pin (D) and washer, and disconnect lower brake rod (E) from bellcrank.

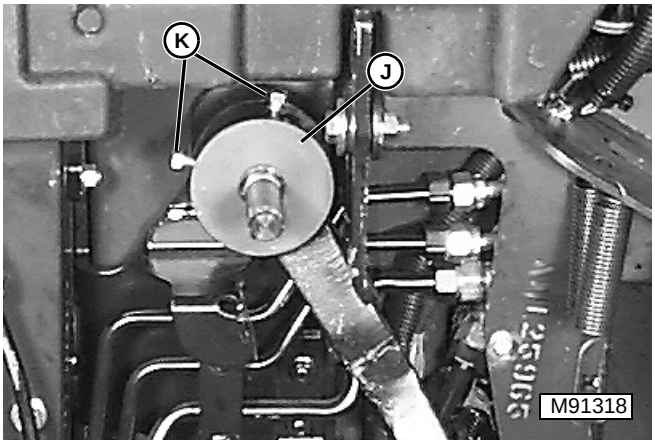
6. Turn bellcrank and move upper brake rod and T-pin (F) away from brake lever.



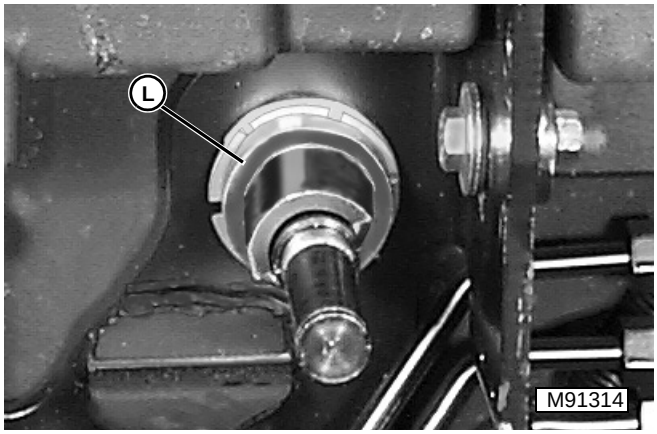
7. Remove jam nut (G) on brake pedal pivot shaft.

NOTE: T-pin location on brake rod is set at the factory. If the T-pin must be replaced, measure and note location before removing. Install newT-pin so that it is in the same location.

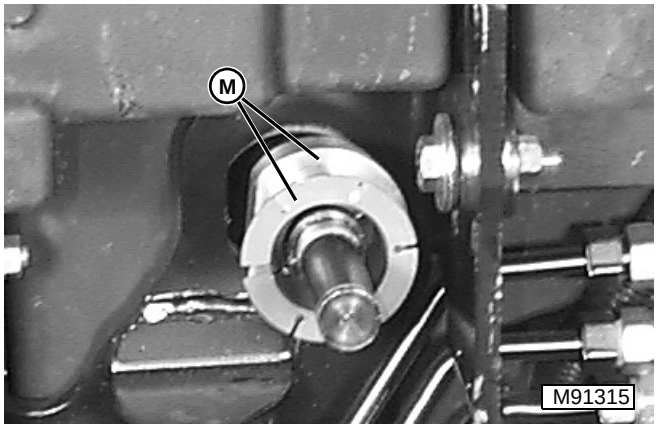
8. Move left brake rod and T-pin clear of brake shaft assembly.
9. Remove master brake link (H).
10. Disconnect brake return spring (I) from right brake pedal.



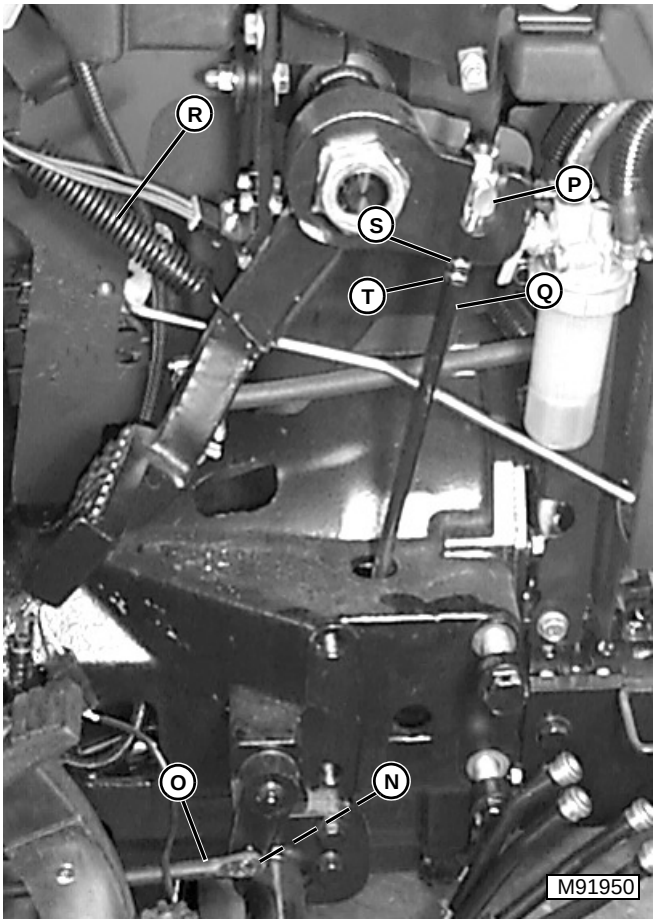
11. Remove washer (J).
12. Loosen two set screws (K) on right brake pedal.
13. Remove right brake pedal.



14. Remove bushing (L).



15. Remove two flanged bushings (M).



16. On RH side of tractor, remove cotter pin (N) and washer and disconnect front of lower brake rod (O) from bellcrank. Move T-pin (P) and upper brake rod (Q) away from brake pedals.
17. Disconnect master brake return spring (R) from brake pedal.
18. Remove master brake pedal and brake pedal shaft from tractor as an assembly.
19. Inspect all parts for wear or damage. Replace any worn or damaged components.

NOTE: If lubrication fitting on RH side of brake pedal assembly is removed or replaced, DO NOT over tighten. Lubrication fitting will bind against master brake shaft. Test by depressing RH brake pedal with brake return springs in place; watch for master brake pedal movement. If master brake pedal moves when RH brake pedal is depressed, lubrication fitting is too tight.

Installation:

Installation is the reverse of removal.

NOTE: T-pin location on brake rod is set at the factory. If the T-pin must be replaced, measure and note location before removing. Install new T-pin so that it is in the same location.

1. Install the pedal shaft assembly into tractor frame and attach the master brake pedal return spring.
2. On RH side of tractor, connect upper brake rod (Q) and T-pin (R) to brake pedal assembly.
3. Connect lower brake rod (O) to bellcrank, and retain with washer and cotter pin (N).
4. Loosen the locking nut (S) and tighten the adjuster cap screw (T) on the master brake pedal so that the T-pin (P) is evenly supported by the RH brake link and the adjuster bolt. The T-pin should be level.
5. On LH side of tractor, install two flanged bushings (M), plain bushing (L) and RH brake pedal.

⚠ CAUTION

Brake return spring is under high tension. Wear safety glasses and gloves when removing or installing spring from pedal.

6. Attach RH brake return spring (I).
7. Install washer (J), master brake link (H) and jam nut (G). Tighten jam nut to **65 - 71 N•m (48 - 52 lb-ft)**.
8. Tighten two set screws (K) on RH brake pedal to **20 - 25 N•m (177 - 221 lb-in.)**.
9. Move LH brake T-pin (F) and upper brake rod into position on master brake link (H).
10. Install LH brake pedal. Retain with snap ring (A).
11. Attach LH brake pedal return spring (C).
12. Attach lower brake rod (E) to bellcrank and retain with washer and cotter pin (D).
13. Loosen the locking nut and tighten the adjuster cap screw on the LH brake pedal so that the T-pin is evenly supported by the master brake link and the adjuster bolt. The T-pin should be level.

NOTE: If the parking brake has been removed, complete the parking brake installation and adjustment before adjusting the service brakes.

14. Adjust the brakes. (See “BRAKE PEDAL ADJUSTMENT”).

BRAKE PEDAL REMOVAL AND INSTALLATION - CST AND SRT

Removal:

1. Remove side panels.

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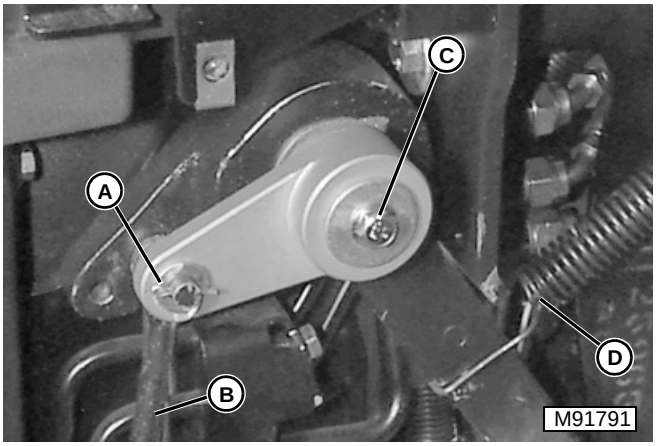
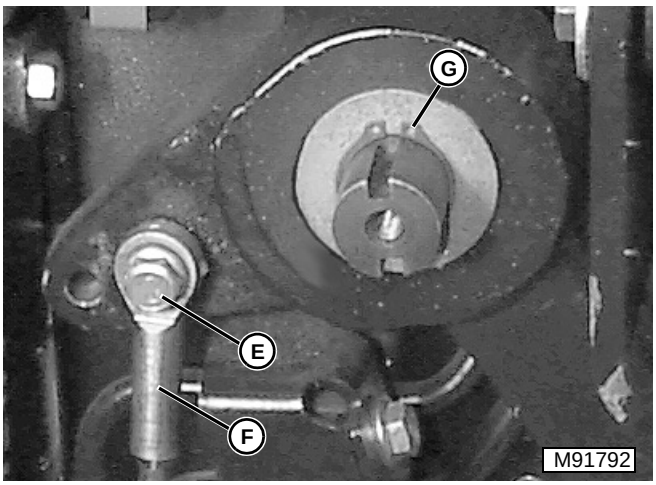


2. Remove cotter pin (A) and washer from end of brake rod.
3. Disconnect brake rod (B) from brake lever.
4. Remove cap screw (C) and washer from end of brake pedal pivot shaft.
5. Remove brake lever from end of brake pedal pivot shaft.

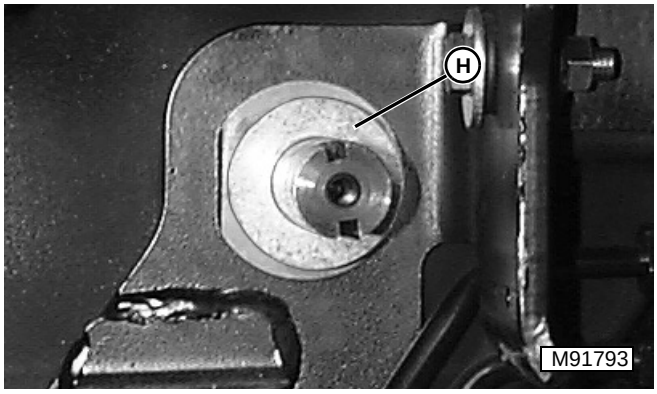
⚠ CAUTION

Clutch return spring is under high tension. Wear safety glasses and gloves when removing or installing spring from pedal.

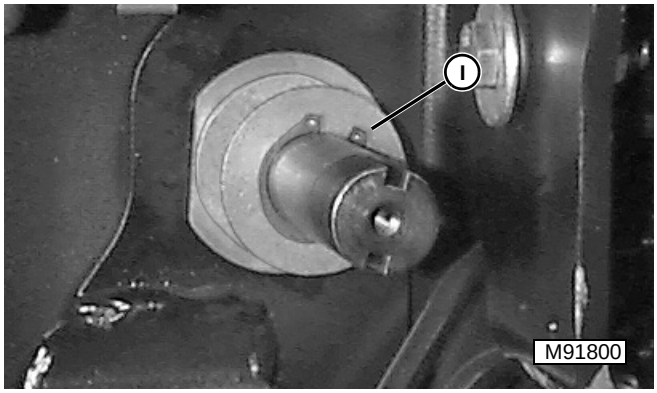
6. Disconnect clutch return spring (D) from clutch pedal.



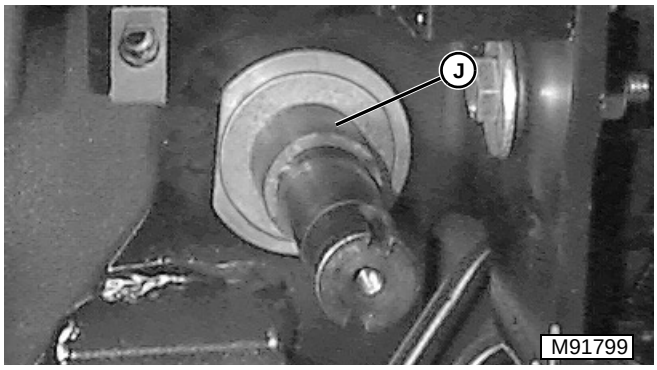
7. Remove cap screw (E) and nut holding clutch rod end (F) to clutch pedal. Disconnect clutch rod and set aside.
8. Remove snap ring (G) and washer.
9. Remove clutch pedal.



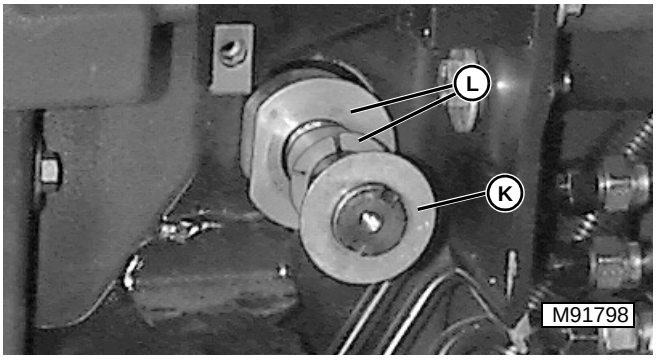
10. Remove washer (H).



11. Remove snap ring (I) and washer.



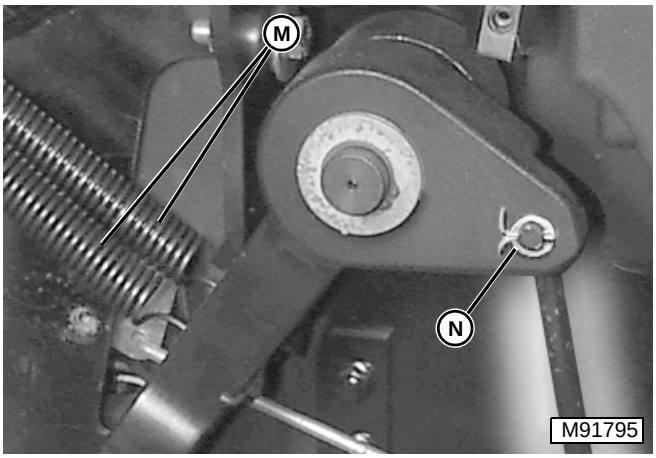
12. Remove spacer (J).



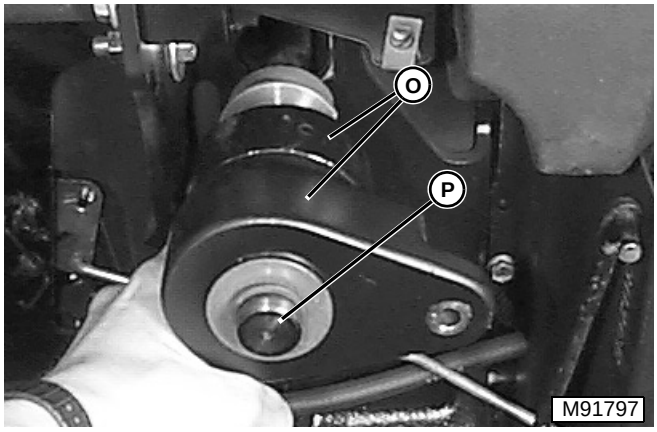
13. Remove washer (K) and two flanged bushings (L).

⚠ CAUTION

Brake return spring is under high tension. Wear safety glasses and gloves when removing or installing spring from pedal.



14. On right side of tractor, disconnect brake return springs (M) from left and right brake pedals.
15. Remove cotter pin (N) and washer from RH brake rod.
16. Disconnect RH brake rod from brake pedal.



17. Remove two brake pedals (O) and pedal shaft (P) from right side of tractor as an assembly.
18. Inspect all parts for wear or damage. Replace any worn or damaged components.

Installation:

Installation is the reverse of removal.

⚠ CAUTION

Clutch and brake return springs are under high tension. Wear safety glasses and gloves when removing or installing springs from pedals.

1. Install the pedal shaft assembly into tractor frame and attach the two brake pedal return springs (M).
2. Attach RH brake rod to the brake pedal. Retain with washer and cotter pin (N).
3. On LH side of tractor, install two flanged bushings (L), washer (K), spacer (J), and clutch pedal. Retain with washer and snap ring (I).
4. Attach clutch rod (F) to clutch pedal and retain with cap screw (E) and nut. Tighten nut to **36 - 44 N•m (27 - 33 lb-ft)**.
5. Install LH brake lever. Retain with cap screw (C) and washer. Tighten cap screw to **36 - 44 N•m (27 - 33 lb-ft).**
6. Attach LH brake rod (B) to brake lever. Retain with washer and cotter pin (A).
7. Attach clutch pedal return spring (D).

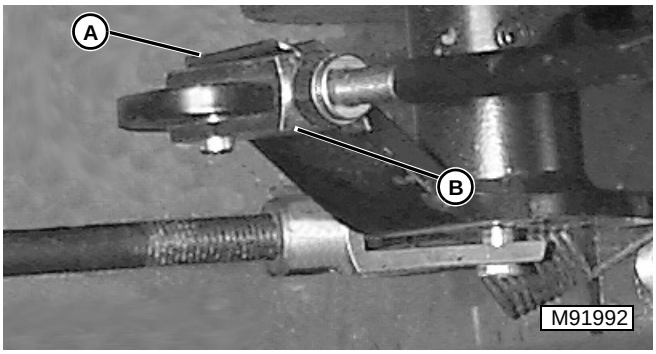
NOTE: If the parking brake has been removed, complete the parking brake installation and adjustment before adjusting the service brakes.

8. Adjust the brakes. ((See “BRAKE PEDAL ADJUSTMENT”).)

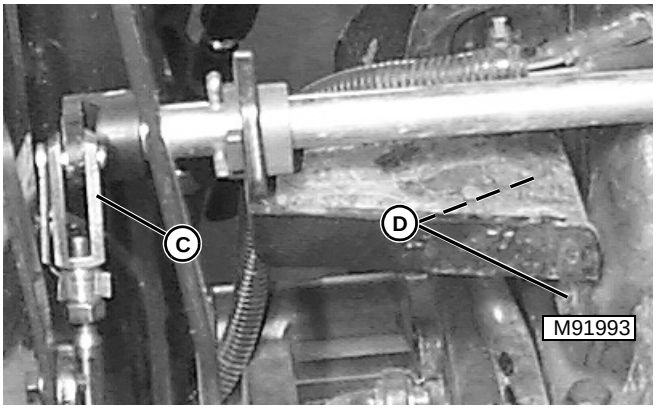
PARKING BRAKE LINKAGE REMOVAL AND INSTALLATION

Side Mount Parking Brake:

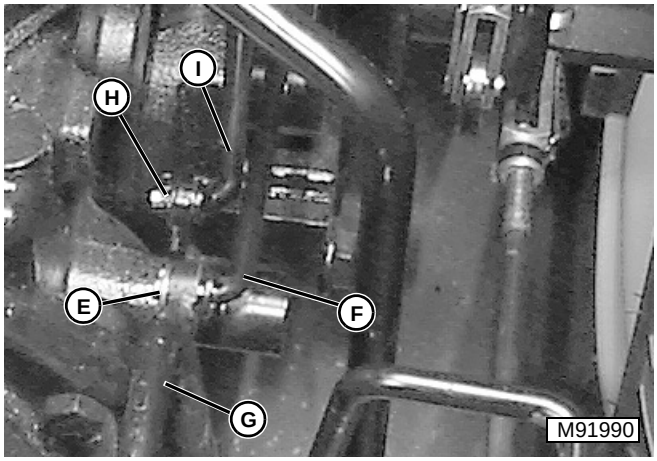
1. Remove seat. (See “SEAT AND SEAT SUPPORT” in Miscellaneous section.)
2. Remove five cap screws and LH closeout panel.
3. Remove five cap screws and RH closeout panel.
4. Raise RH rear of tractor and support on a suitable stand.
5. Remove RH rear wheel and tire.
6. Remove RH fender. (See “REAR FENDERS” in Miscellaneous section.)
7. Unplug wiring harness connector from park brake switch.
8. If equipped, remove cotter pin and washer and disconnect two-speed PTO rod at final drive housing.



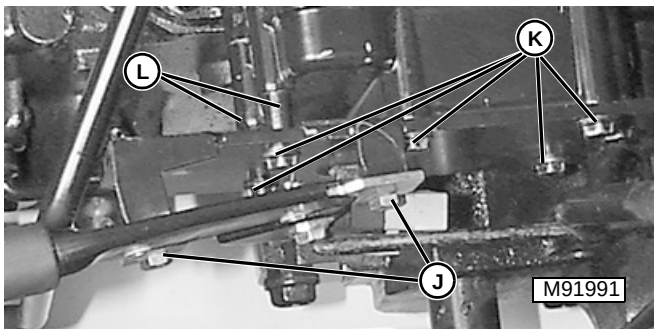
9. Remove spring locking pin (A) and disconnect LH park brake clevis (B) from brake arm on final drive housing.



10. Remove spring locking pin and disconnect RH park brake clevis (C) from brake arm on park brake shaft.
11. Remove two cap screws (D) attaching park brake shaft pivot bracket to rockshaft housing.



12. On LH side of tractor, remove cotter pin (E) and washer, and disconnect differential lock rod (F) from pedal (G).
13. Remove cotter pin (H) and washer, and disconnect range shift lever rod (I) from shift arm at final drive housing.



14. On LH side of tractor, remove two cap screws (J) that attach park brake lever to bracket.
15. Remove five cap screws (K) and two spacers (L) that attach park brake assembly to rockshaft valve cover. Remove park brake lever and linkage as an assembly.
16. Inspect all parts for wear and damage. Replace as required.

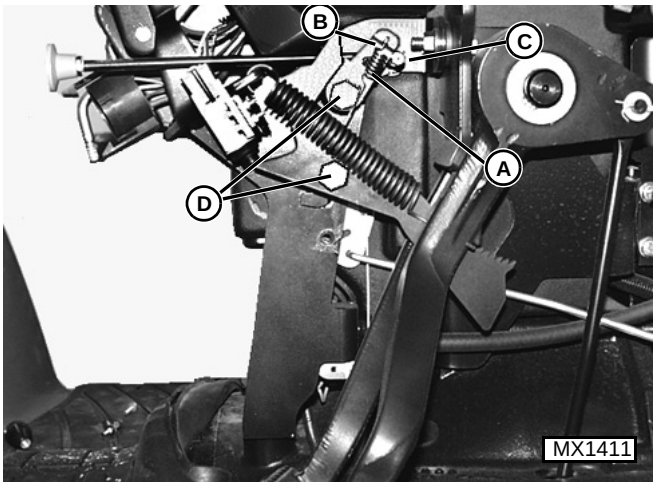
Installation:

Installation is the reverse of removal.

- After installing, adjust park brake. (See “PARKING BRAKE ADJUSTMENT - SIDE MOUNT”).

Dash Mount Parking Brake:

1. Remove RH upper cowl panel. (See “COWL PANEL” in MISCELLANEOUS section.)



2. Disconnect return spring (A) from bracket (B).
3. Remove cotter pin (C) and washer from parking brake actuator rod. Remove rod.
4. Remove bolts (D) and nuts securing bracket and pivot lever.
5. Remove bracket and lever.
6. Inspect all parts for wear or damage. Pay particular attention to engagement teeth on lever. Replace parts as required.

Installation is the reverse of removal.

CONTENTS

Page

SPECIFICATIONS

HYDRAULIC SPECIFICATIONS

Hydraulic Oil:

Type . . . . . John Deere J20D
Capacity (CST and SRT Tractors) . . . . . 24.0 L (6.3 gal)
Capacity (HST Tractors) . . . . . 26.0 L (6.8 gal)

	4200	4300	4400
Measurements at:	Engine 2600 rpm	Engine 2600 rpm	Engine 2600 rpm
Type	Open System	Open System	Open System
Working Pressure	14650 kPa (2125 psi)	17235 kPa (2500 psi)	17235 kPa (2500 psi)
Pump	Gear Type	Gear Type	Gear Type
Front Pump Capacity	19.3 L/min (5.1 gpm) 8.2 cm^3/rev	19.3 L/min (5.1 gpm) 8.2 cm^3/rev	19.3 L/min (5.1 gpm) 8.2 cm^3/rev
Rear Pump Capacity	27.6 L/min (7.3 gpm) 11.9 cm^3/rev	31.4 L/min (8.3 gpm) 13.5 cm^3/rev	31.4 L/min (8.3 gpm) 13.5 cm^3/rev
Rockshaft Lift Cycle Time	2-1/2 to 3 sec.	2-1/2 to 3 sec.	2-1/2 to 3 sec.
Rockshaft Drop Cycle Time	2-1/2 to 3 sec.	2-1/2 to 3 sec.	2-1/2 to 3 sec.
Maximum Lift Arm Drop in 5 Minutes With Rate of Drop/Stop Valve Closed	51 mm (2 in.)	51 mm (2 in.)	51 mm (2 in.)
Maximum Lift Arm Raise Height (Measured from top of left PTO shield to center of pin in end of lift arm.)	350 ± 3 mm (13.8 ± 0.12 in.)	350 ± 3 mm (13.8 ± 0.12 in.)	350 ± 3 mm (13.8 ± 0.12 in.)

REPAIR SPECIFICATIONS

Rockshaft Specifications:

Splined Sleeve Minimum OD. . . . . 46.5 mm (1.832 in.)
Bushing Maximum ID . . . . . 44.2 mm (1.738 in.)

Lift Arms:

Lift Arm Raise Angle . . . . . 50°
Lift Arm Lower Angle . . . . . 20°
Total Lift Arm Range . . . . . 70°
Maximum Variance Between Lift Arms . . . . . 5°

Gear Pump:

Shaft Bushing Maximum ID	19.15 mm (0.754 in.)
Shaft Bearing Surface Minimum OD	18.95 mm (0.746 in.)
Bushing Minimum Thickness - Steering (Front)	13.57 mm (0.534 in.)
Bushing Minimum Thickness - Implement (Rear)	19.02 mm (0.749 in.)
Drive/Idler Gear Minimum Thickness	
Front Pump (Steering)	9.43 mm (0.371 in.)
4200 Rear Pump (Implement)	14.99 mm (0.590 in.)
4300/4400 Rear Pump (Implement)	17.63 mm (0.694 in.)

TORQUE SPECIFICATIONS

J-Tube Nuts (SCV or Manifold Block to Rockshaft)	81 - 89 N•m (60 - 67 lb-ft)
SCV Tube to Quick Disconnect Coupler	51 - 57 N•m (38 - 42 lb-ft)
SCV Work Port Tubes to Adaptor Fittings	51 - 57 N•m (38 - 42 lb-ft)
Manifold Block, or SCV Valve to Tunnel Cap Screws	63 N•m (47 lb-ft)
Adapter Fitting to Pump (Front Pump)	21 N•m (180 lb-in.)
Pump to SCU Tube Nut (Front Gear Pump)	50 N•m (37 lb-ft)
Suction Tube Elbow Cap Screws (Front Gear Pump)	9 N•m (84 lb-in.)
Adapter Fitting to Pump (Rear Gear Pump)	28 N•m (21 lb-ft)
Pump to SCV Tube Nuts (Rear Gear Pump)	69 N•m (51 lb-ft)
Pump to Mounting Plate Cap Screws (Front or Rear Gear Pump)	22 N•m (192 lb-in.)
Pump Cover Cap Screws - M8	28 N•m (240 lb-in.)
Pump Cover Cap Screws - M10	55 N•m (40 lb-ft)
Rockshaft Cap Screws (10.9)	80 N•m (60 lb-ft)
Rockshaft Cap Screws (8.8)	55 N•m (40 lb-ft)
Rockshaft Cylinder Head Cap Screws	80 N•m (60 lb-ft)
Lift Arm to Splined Shaft Cap Screws	68 N•m (50 lb-ft)
Rockshaft Valve to Rockshaft Housing Cap Screws	47 N•m (35 lb-ft)

SCV Torque Specifications:

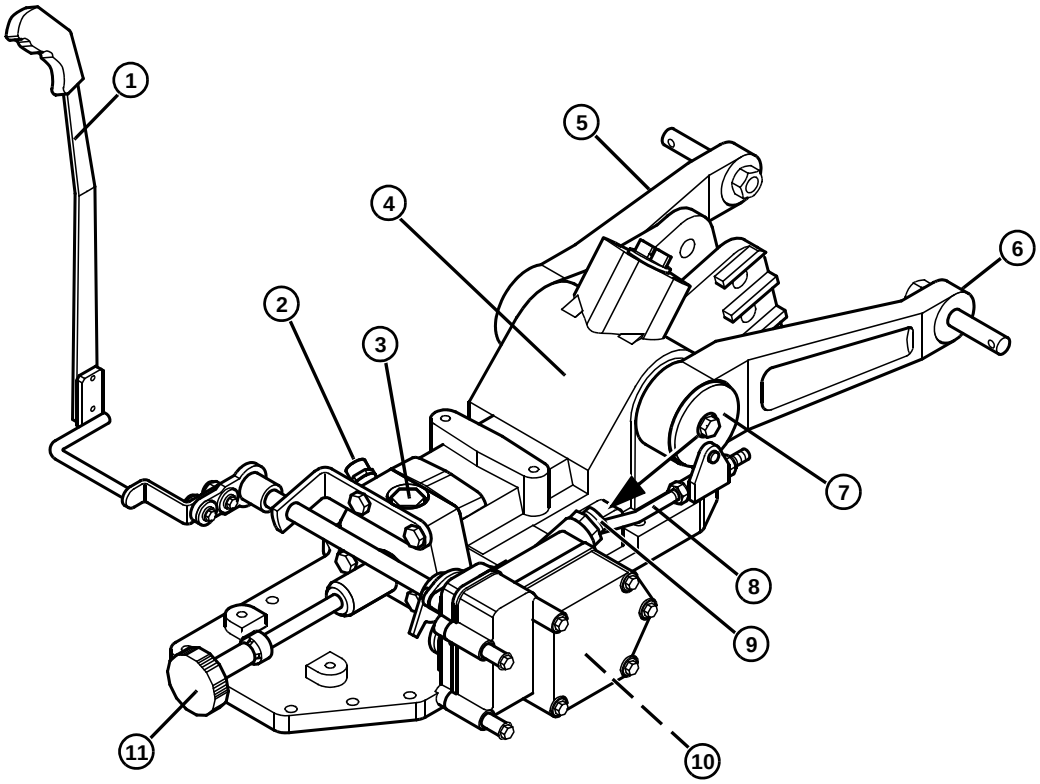
Cover Socket Head Cap Screws	19 N•m (168 lb-in.)
Valve Spring Retainer Plugs	15 N•m (133 lb-in.)
Load Check Valves	24 N•m (212 lb-in.)
Relief Valve	50 N•m (37 lb-ft)
Lever Assembly Cap Screws	40 N•m (30 lb-ft)

OTHER MATERIALS

Number U.S.A./Canadian	Name	Use
TY6305	John Deere Clean and Cure Primer	
TY16021	John Deere High Flex Form-In-Place Gasket	Sealing Flange Assemblies
TY15934	John Deere General Purpose Gasket Dressing	Sealing Gaskets and Hoses
UN6419	JDM J20D HyGard® Oil	Transmission/Hydraulic Oil

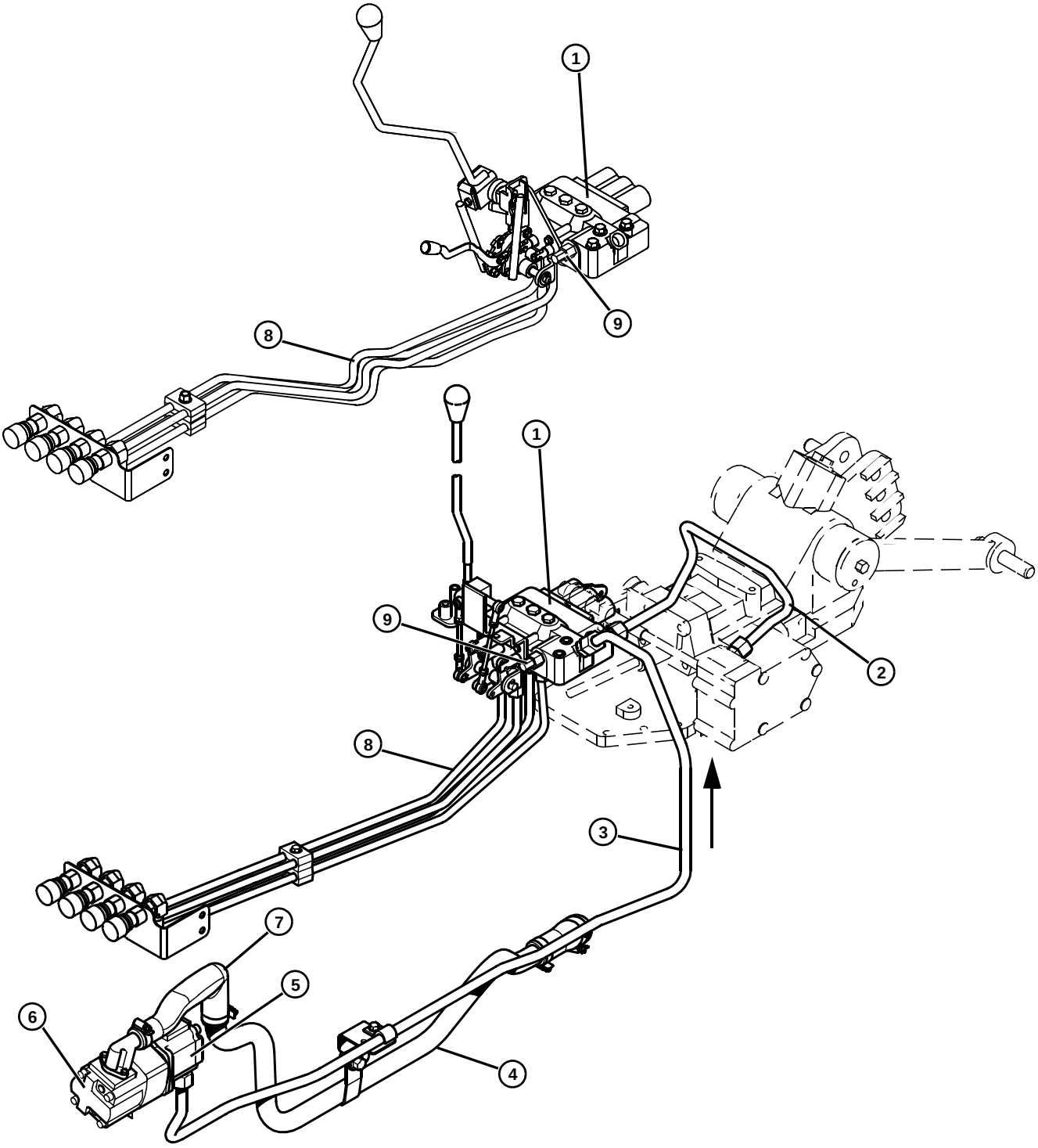
COMPONENT LOCATION

ROCKSHAFT COMPONENT LOCATION



1. Lift Control Lever
2. Rockshaft Relief Valve
3. Check Valve
4. Rockshaft Housing
5. RH Lift Arm
6. LH Lift Arm
7. Cam Plate
8. Lift Arm Position Feedback Rod
9. Rockshaft Inlet
10. Lift Control Lever
11. Rate of Drop/Stop Valve

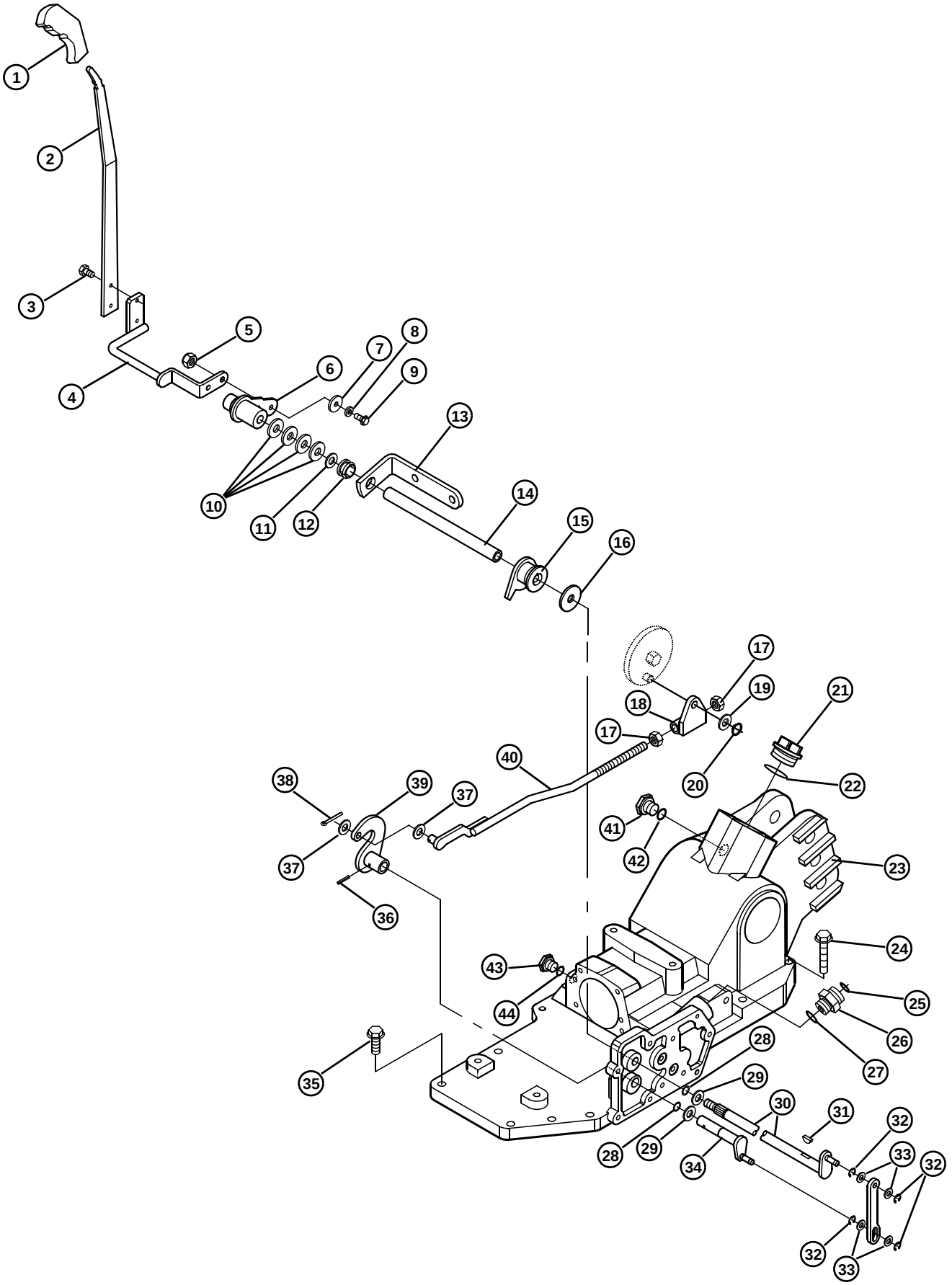
HYDRAULIC SYSTEM COMPONENT LOCATION



NOTE: Top view shows new SCV shift controls and hydraulic tubing configuration. See “SELECTIVE CONTROL VALVE DISASSEMBLY, INSPECTION, & ASSEMBLY” on page47.

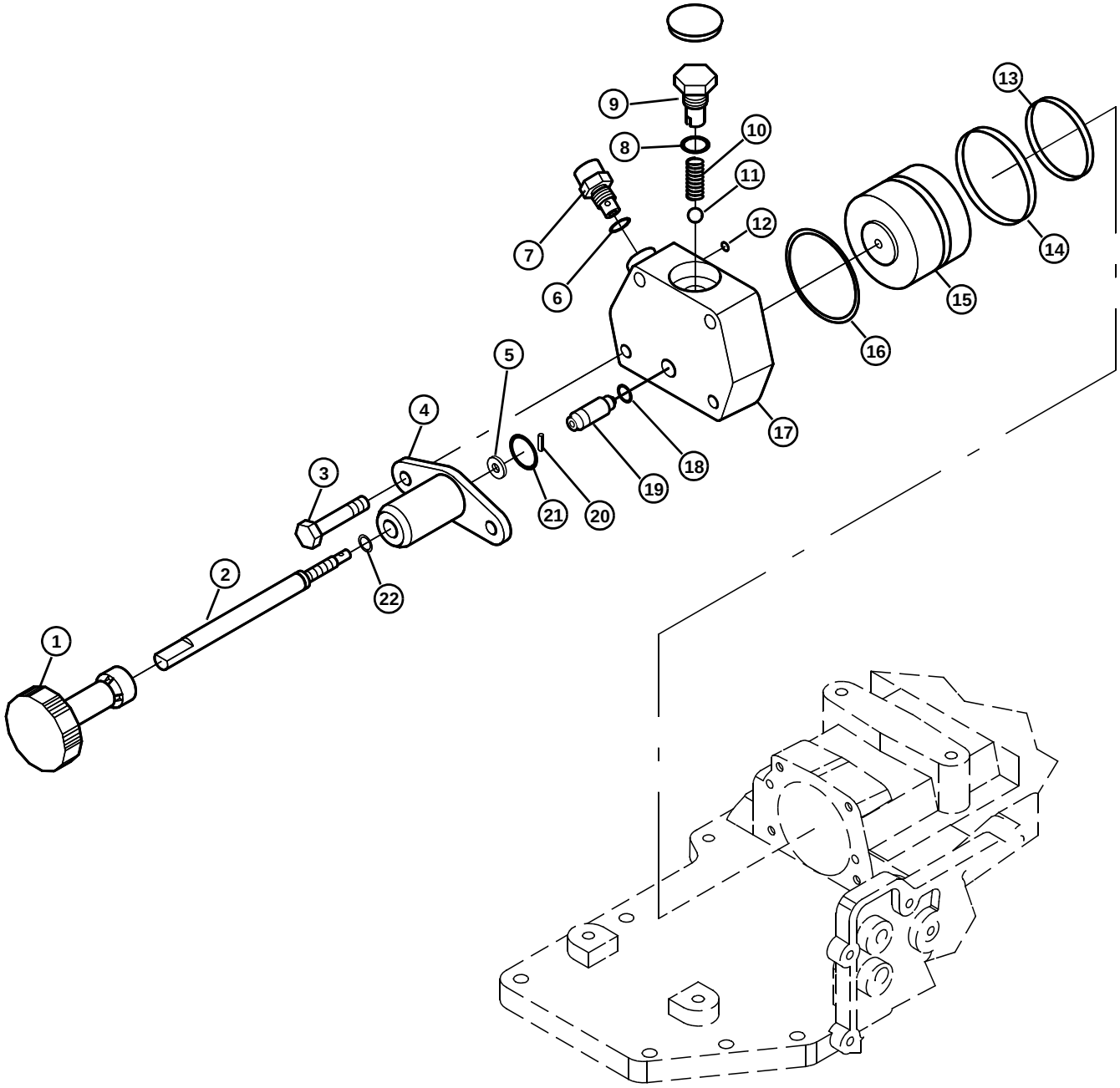
1. Selective Control Valve (SCV)
2. Rockshaft Pressure Tube
3. Pressure Tube
4. Suction Tube
5. Rear Pump (Implement)
6. Front Pump (Steering)
7. Suction Manifold
8. Work Port Tubes
9. System Relief Valve

ROCKSHAFT PLUNGER ASSEMBLY AND CONTROL LEVER



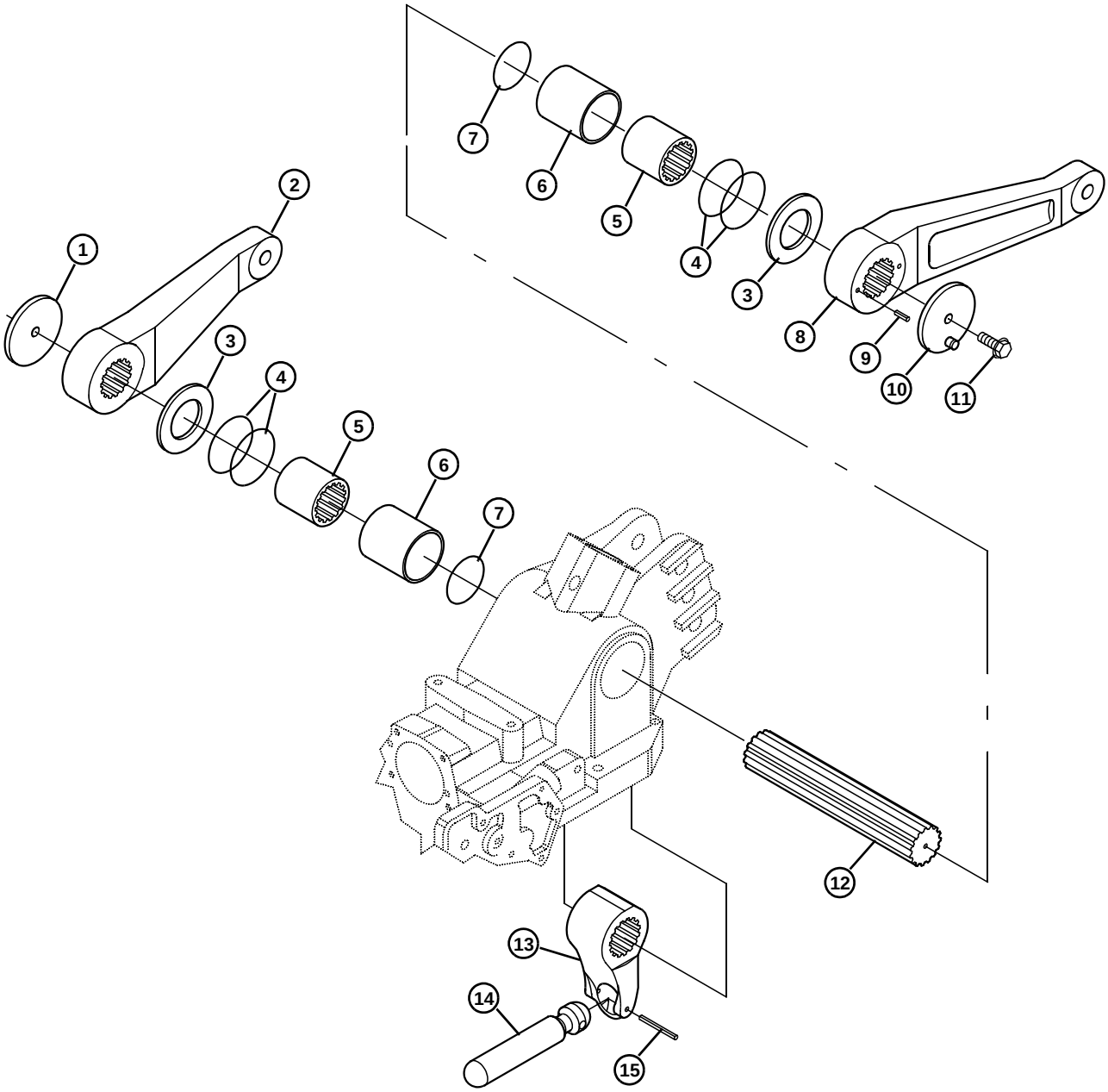
1. Knob
2. Lever
3. Cap Screw
4. Extension
5. Nut
6. Control Arm
7. Washer
8. Washer
9. Cap Screw
10. Belleville Washer
11. Washer
12. Bushing
13. Bracket
14. Tube
15. Limiter
16. Friction Washer
17. Nut
18. Link
19. Washer
20. Snap Ring
21. Plug
22. O-Ring
23. Housing
24. Cap Screw
25. O-Ring
26. Adapter Fitting
27. O-Ring
28. O-Ring
29. Washer
30. Control Shaft
31. Key
32. Snap Ring
33. Washer
34. Link
35. Cap Screw
36. Spring Pin
37. Washer
38. Cotter Pin
39. Feedback Arm
40. Feedback Rod
41. Plug
42. O-Ring
43. Plug
44. O-Ring

ROCKSHAFT PISTON, RATE OF DROP VALVE, AND RELIEF VALVES



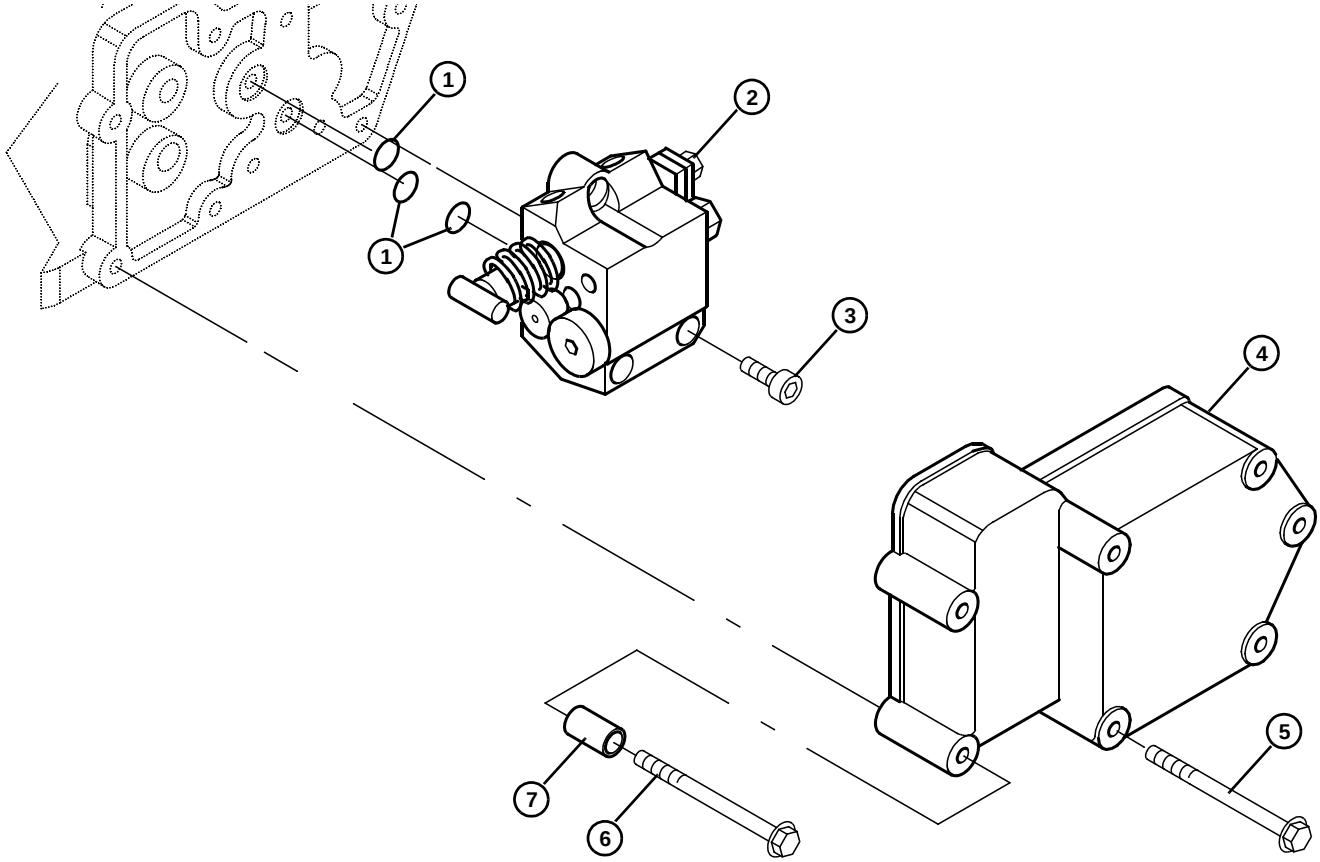
1. Knob
2. Shaft
3. Cap Screw
4. Stem
5. Washer
6. O-Ring
7. Relief Valve
8. O-Ring
9. Plug
10. Spring
11. Ball
12. O-Ring
13. Piston Ring (Inner)
14. Piston Ring (Outer)
15. Piston
16. O-Ring
17. Cover
18. O-Ring
19. Spool
20. Spring Pin
21. O-Ring
22. O-Ring

LIFT ARMS



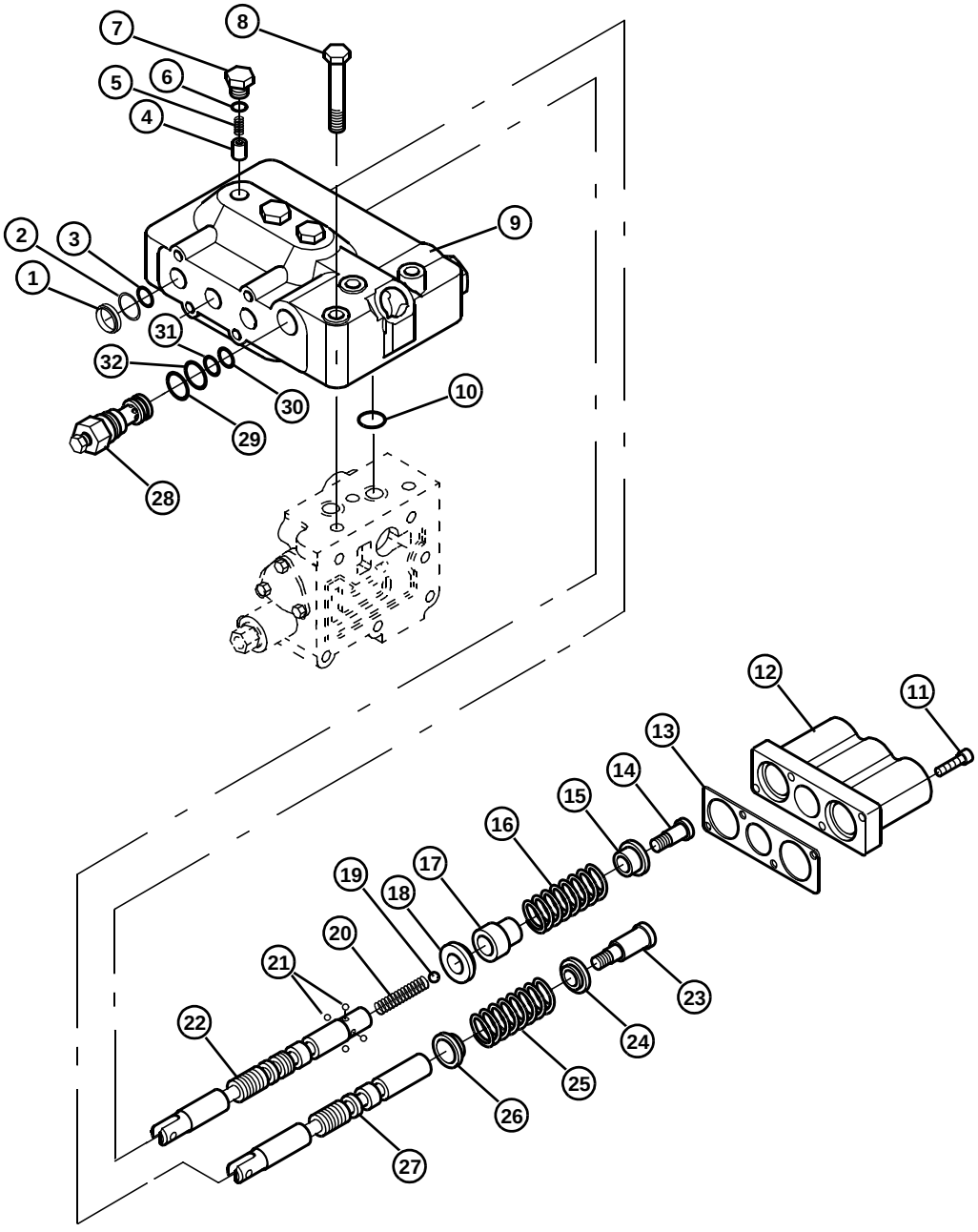
1. Washer
2. Lift Arm
3. Washer
4. O-Ring
5. Splined Sleeve
6. Bushing
7. O-Ring
8. Lift Arm
9. Spring Pin
10. Cam Plate
11. Cap Screw
12. Splined Cross Shaft
13. Lever Arm
14. Piston Rod
15. Spring Pin

ROCKSHAFT CONTROL VALVE



1. O-Ring
2. Control Valve
3. Socket Head Cap Screw
4. Cover
5. Cap Screw
6. Cap Screw
7. Spacer

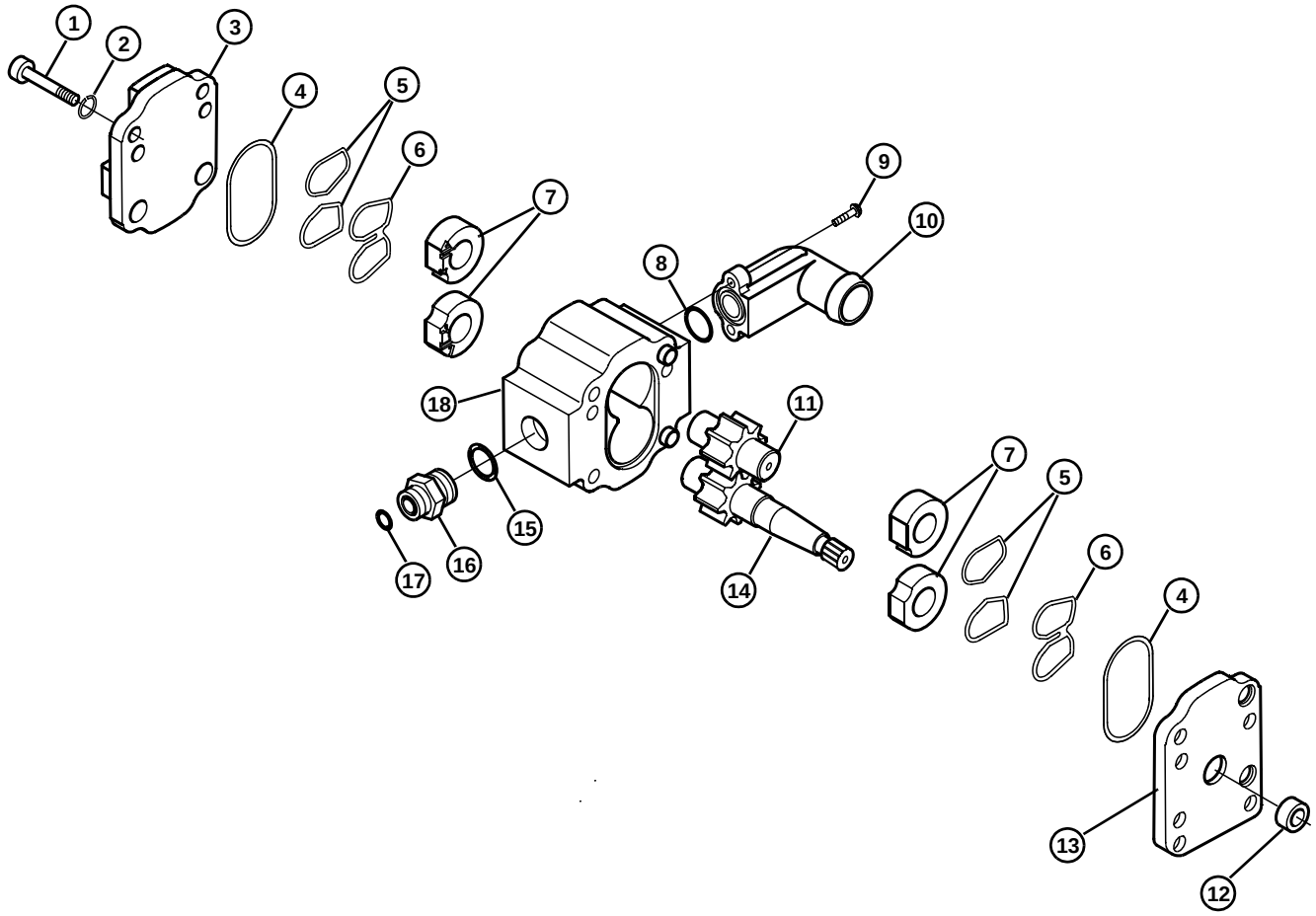
SCV VALVE COMPONENT LOCATION



1. Seal	9. Valve Body	17. Detent Cap	25. Spring
2. Backing Washer	10. O-Ring	18. Spring Retainer	26. Spacer
3. O-Ring	11. Cap Screw	19. Ball	27. Spool
4. Valve Body	12. End Cap	20. Spring	28. Relief Valve
5. Spring	13. Gasket	21. Ball (4 used)	29. O-Ring
6. O-Ring	14. Plug	22. Spool	30. Backing Washer
7. Plug, Check Valve	15. Spring Retainer	23. Plug	31. O-Ring
8. Cap Screw	16. Spring	24. Spring Retainer	32. Backing Washer

HYDRAULIC PUMP COMPONENT LOCATION

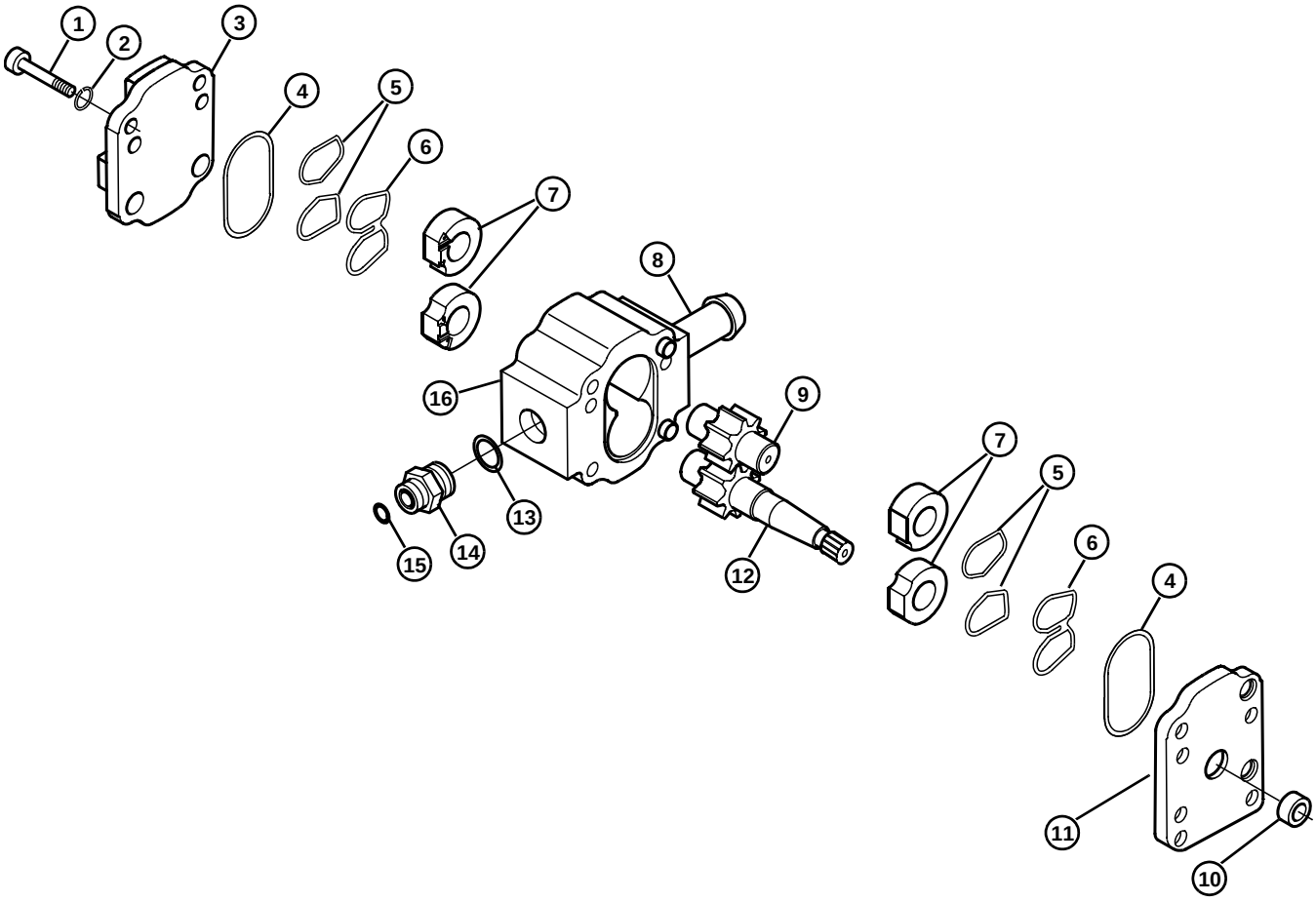
STEERING AND HYDROSTATIC CHARGE PRESSURE (FRONT)



1. Cap Screw
2. Lock Washer
3. Cover
4. O-Ring
5. Backing Rings
6. Formed O-Ring
7. Bushings
8. O-Ring
9. Cap Screw
10. Suction Tube Elbow
11. Idler Gear
12. Seal
13. Cover
14. Drive Gear
15. O-Ring
16. Adaptor Fitting
17. O-Ring
18. Pump Body

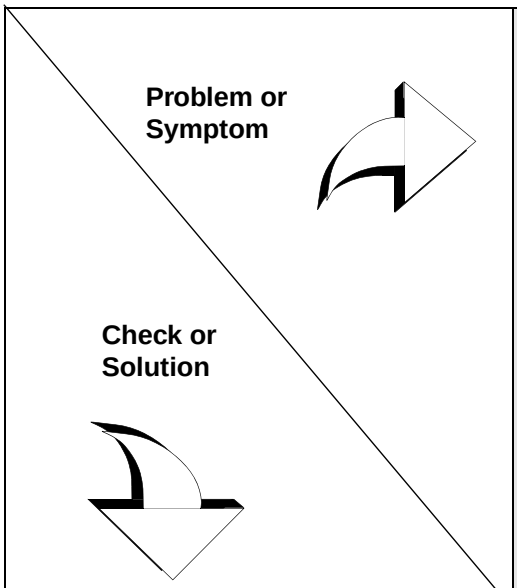
HYDRAULIC PUMP COMPONENT LOCATION

SCV, PTO, AND ROCKSHAFT WORKING PRESSURE (REAR)



1. Cap Screw
2. Lock Washer
3. Cover
4. O-Ring
5. Backing Rings
6. Formed O-Ring
7. Bushings
8. Suction Tube
9. Idler Gear
10. Seal
11. Cover
12. Drive Gear
13. O-Ring
14. Adaptor Fitting
15. O-Ring
16. Housing

TROUBLESHOOTING CHART

Problem or Symptom / Check or Solution 	Rockshaft Will Not Raise	Rockshaft Will Not Lower	Rockshaft Does Not Maintain Position	Rockshaft Does Not Operate Smoothly	Draft Arms Do Not Raise To Full Height	SCV Attachment Does Not Operate	SCV Attachment Does Not Operate Smoothly	PTO Does Not Operate	PTO Slips or Loses Power	PTO Stops Too Slowly	Raising Lift Arms Engages Relief Valve
Rockshaft Control Valve Faulty	●	●	●	●	●						
Rockshaft Rate of Drop/Stop Valve Improperly Adjusted or Faulty	●	●									
Lift Control Lever Friction Improperly Adjusted (See "ROCKSHAFT DISASSEMBLY AND ASSEMBLY")			●								
Rear Gear Pump Faulty	●			●		●	●		●	●	
SCV Faulty						●	●				
PTO Valve Faulty								●	●	●	
Rockshaft Position Feedback Linkage Improperly Adjusted (See "ROCKSHAFT POSITION FEEDBACK LINKAGE ADJUSTMENT")					●						●

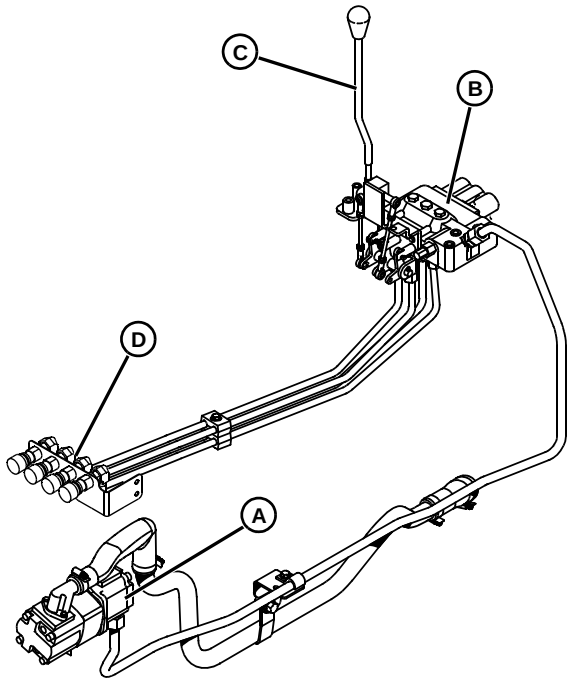
THEORY OF OPERATION

HYDRAULICS (GENERAL)

Function:

The hydraulic system provides the following:

- A means of raising and lowering equipment attached to the three point hitch.
- A means of operating equipment attached to the work ports of the selective control valve (SCV) (if equipped).
- Pressure to lubricate the forward and reverse clutches (SyncReverser™ transmission model).
- Hydrostatic transmission charge pressure (HST Model).
- Pressure to operate the power steering system.



HYDRAULICS (SCV) (OPTIONAL)

Function:

The selective control valve (SCV) provides a means of operating equipment attached to the work ports of the valve via the quick-disconnect fittings attached to the mounting plate on the tractor frame.

Theory:

The SCV system consists of a gear pump (A), and a 1 spool or 3 spool cartridge type valve (B).

Operation:

An 11.9 cm^3/rev (4200) or 13.5 cm^3/rev (4300/4400) per revolution dual gear pump (rear pump) is mounted on the left side of the engine and is gear driven off the engine camshaft.

Oil is drawn from the transaxle sump through a 150 mesh screen by the gear pump. Oil is pumped, under pressure, into the SCV.

The SCV consists of a 1 spool or 3 spool directional control valve operated by a control lever (C) mounted to the right side of the operator's seat. An optional auxiliary control lever for operating the third spool of the 3 spool SCV may also be located on the right hand fender.

When the SCV control lever is moved, mechanical linkage moves the valve spool, opening the valve and allowing oil to flow to one of the work ports. Tubes attached to the work ports route oil pressure to quick-disconnect fittings (D) to which the attachment is connected. Oil flows through these fittings into the connecting hoses of the attachment, operating the attachment. A mechanical locking device is attached to the valve control lever to prevent lever movement when the attachment is not in use.

HYDRAULICS (ROCKSHAFT)

Function:

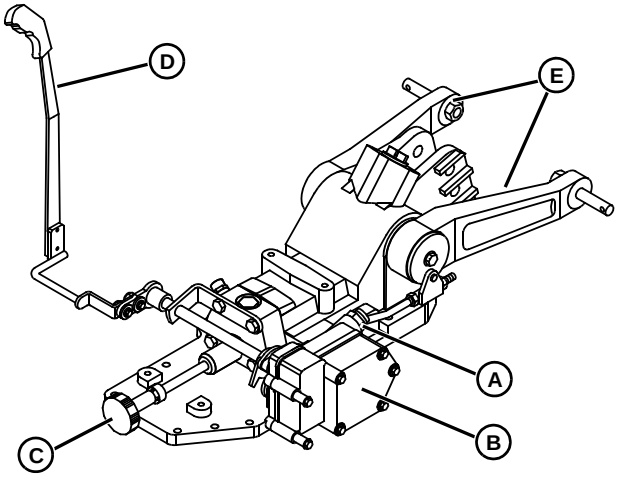
The rockshaft provides a means of raising and lowering equipment attached to the three point hitch.
It also provides a means of setting specific operating depths for tillage equipment.

Theory:

The rockshaft hydraulic system consists a gear pump, a system pressure relief valve located inside the SCV or the manifold block (if equipped), a directional control valve, (under the cover on the left side of the rockshaft housing) and a lift cylinder, connected to two lift arms through the rockshaft.

Operation:

An 11.9 cm^3/rev (4200) or 13.5 cm^3/rev (4300/4400) per revolution dual gear pump (rear pump) is mounted on the left side of the engine and is gear driven off the engine camshaft.
Oil is drawn from the transaxle sump through a 150 mesh screen by the gear pump. Oil is pumped, under pressure, to the SCV (if equipped) or manifold block and into the inlet port (A) of the rockshaft. System pressure is controlled by an adjustable system pressure relief valve mounted in the SCV or manifold block. The system pressure relief valve vents back to the transmission sump through the rockshaft housing. Oil then passes through the rockshaft housing to the rockshaft control valve.



The rockshaft control valve is located under a cover (B) on the left side of the rockshaft housing. The rockshaft housing contains an operator adjustable rate of drop/stop control valve (C), lift cylinder, high pressure relief valve, and a safety pressure relief valve.

Rockshaft functions; up, down, and depth are controlled by the operator using the rockshaft control lever (D), mounted to the right of the operator seat. Moving the lift control lever to the full back position will operate the spool in the rockshaft control valve allowing oil to flow into the cylinder. This in turn rotates the rockshaft and raises the lift arms (E) to their full up position. Moving the lift control lever to the full forward position will operate the spool in the rockshaft control valve allowing oil to flow out of the cylinder. This in turn rotates the rockshaft and lowers the lift arms to their full down position.
A movable mechanical stop is provided on the lift control lever mechanism to allow the operator to limit the movement of the lift control lever. This allows the operator to repeatedly set the range of movement of the lift arms thus controlling the height at which any attachments operate.

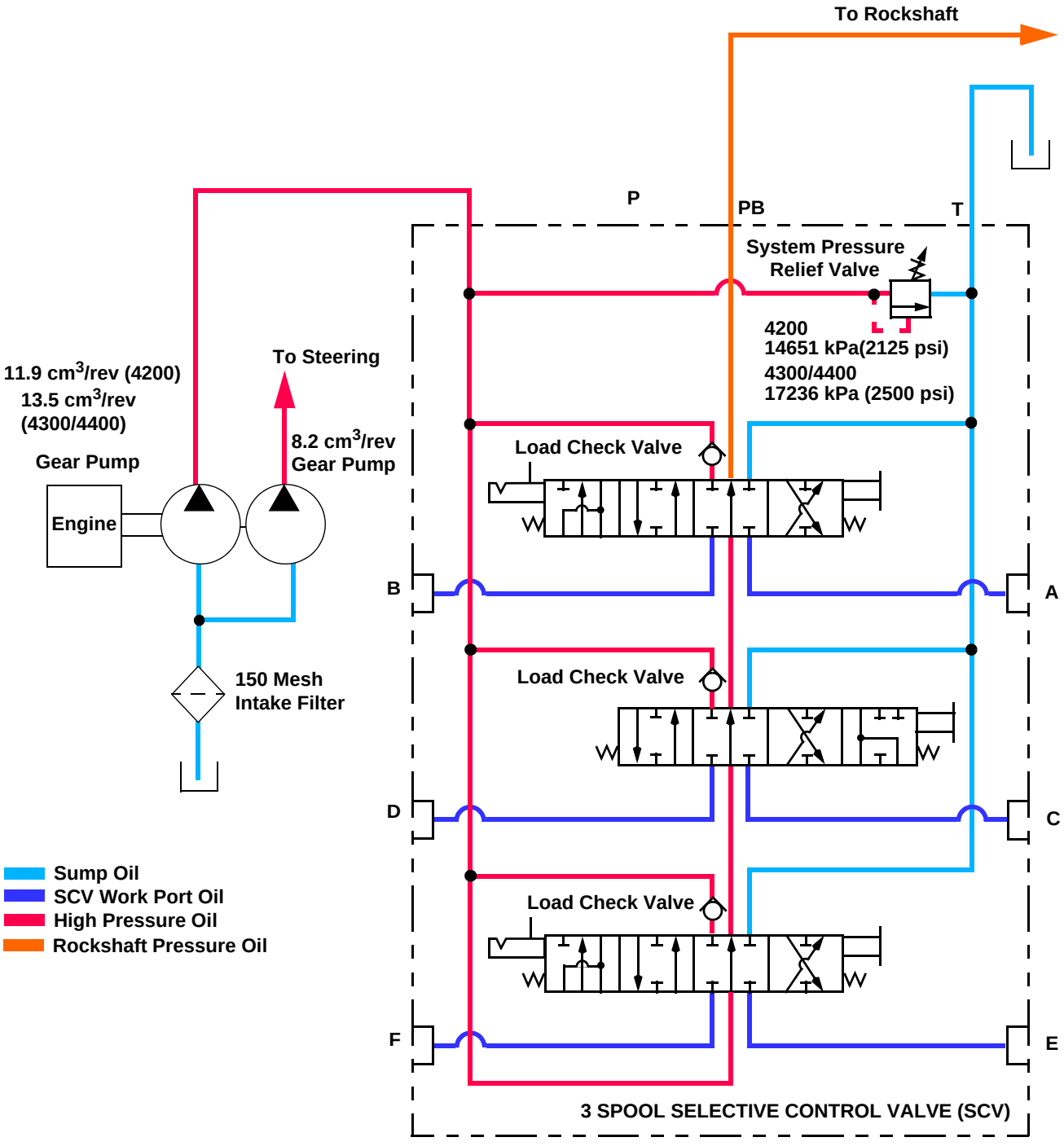
DIAGNOSISDIAGNOSIS

Test Conditions:

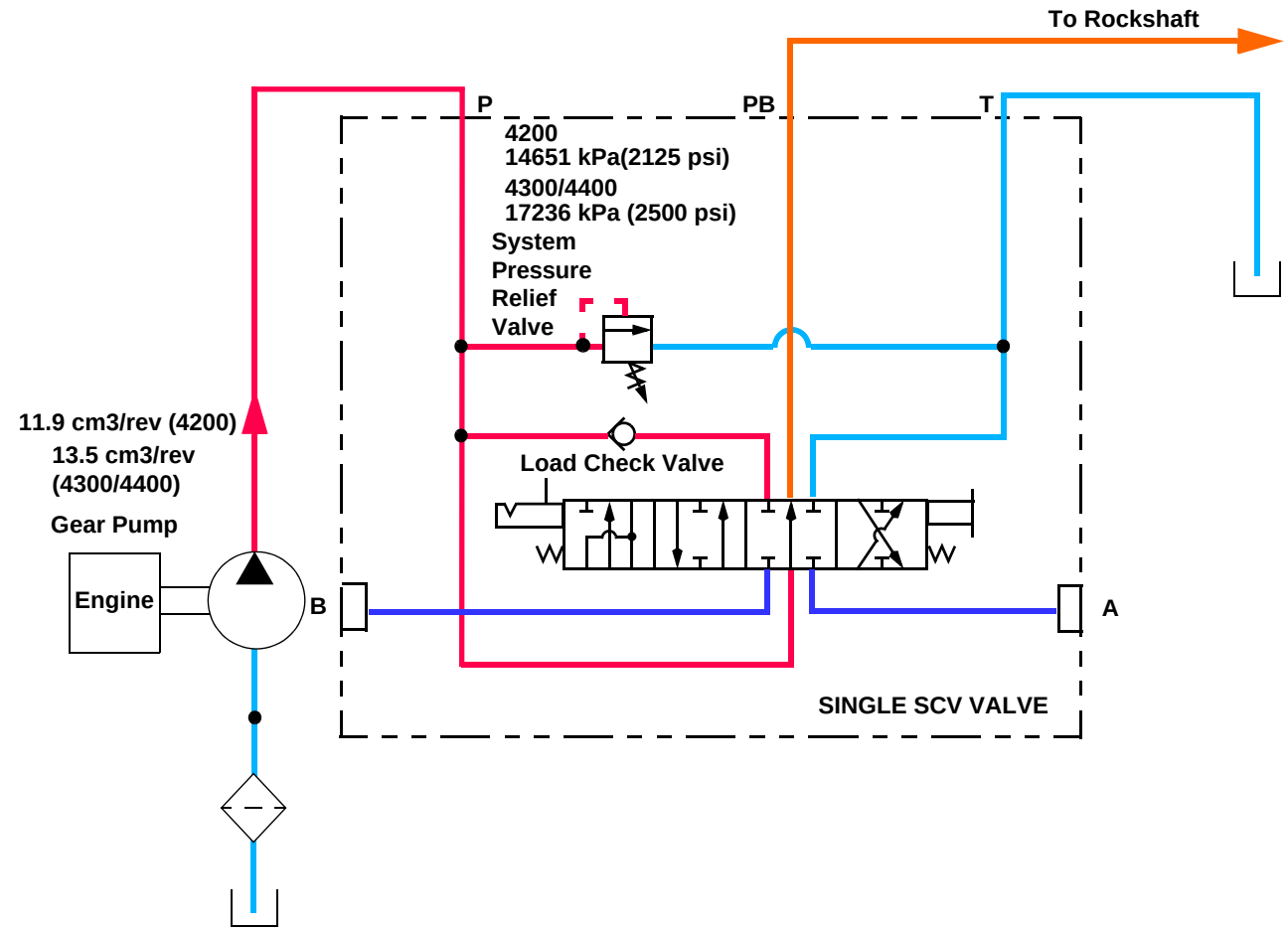
- Tractor sitting on level ground outdoors in an area clear of obstructions.
- Hydraulic oil in reservoir at proper level.
- Speed range selector in "NEUTRAL".
- Park brake engaged.
- Engine running at high idle (2920 ± 25 rpm).
- Sufficient weight on lift arms to allow self-lowering.
- Rockshaft rate of drop/stop valve fully open.

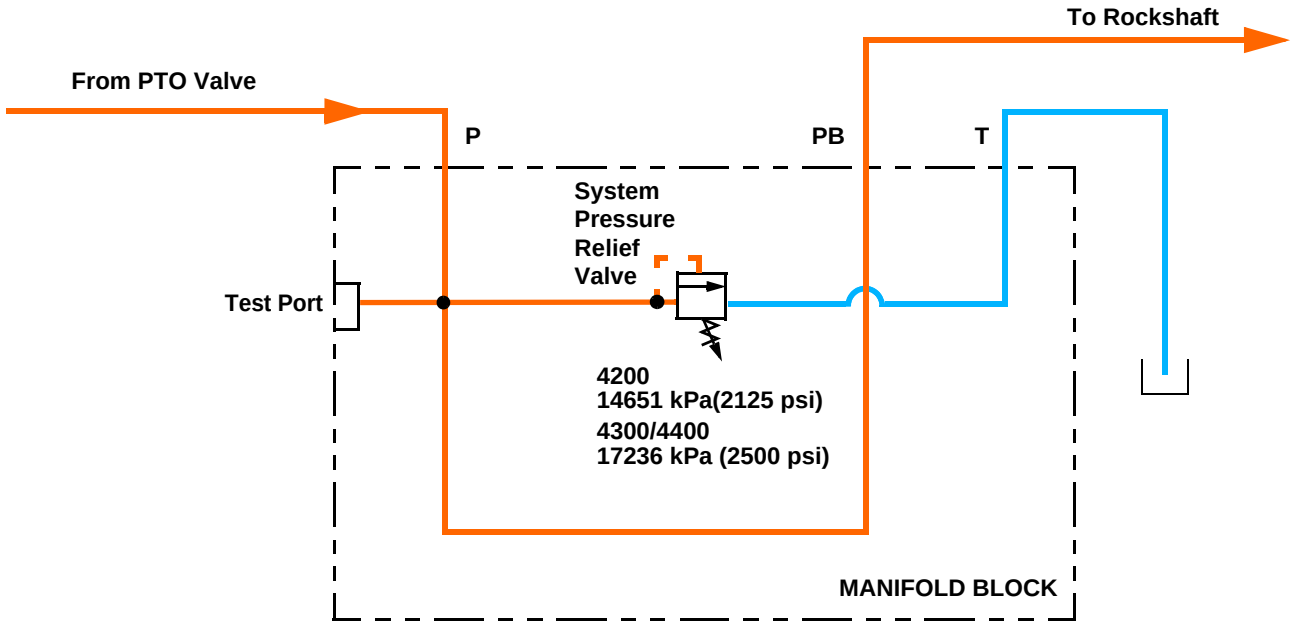
Test/Check Point	Normal	If Not Normal
1. Move rockshaft lift control to full raise (rearward) position.	Lift arms raise to full lift height.	Perform Rockshaft Position Feedback Adjustment. (See "ROCKSHAFT POSITION FEEDBACK LINKAGE ADJUSTMENT")
2. Move rockshaft lift control to full lower (forward) position.	Lift arms lower to full down position.	Open rockshaft rate of drop/stop valve fully. Make sure draft sensing control lever (if equipped) is in the full forward position. Perform Rockshaft Position Feedback Adjustment. (See "ROCKSHAFT POSITION FEEDBACK LINKAGE ADJUSTMENT")

3 SPOOL SCV HYDRAULIC SCHEMATIC



1 SPOOL SCV AND MANIFOLD BLOCK HYDRAULIC SCHEMATIC

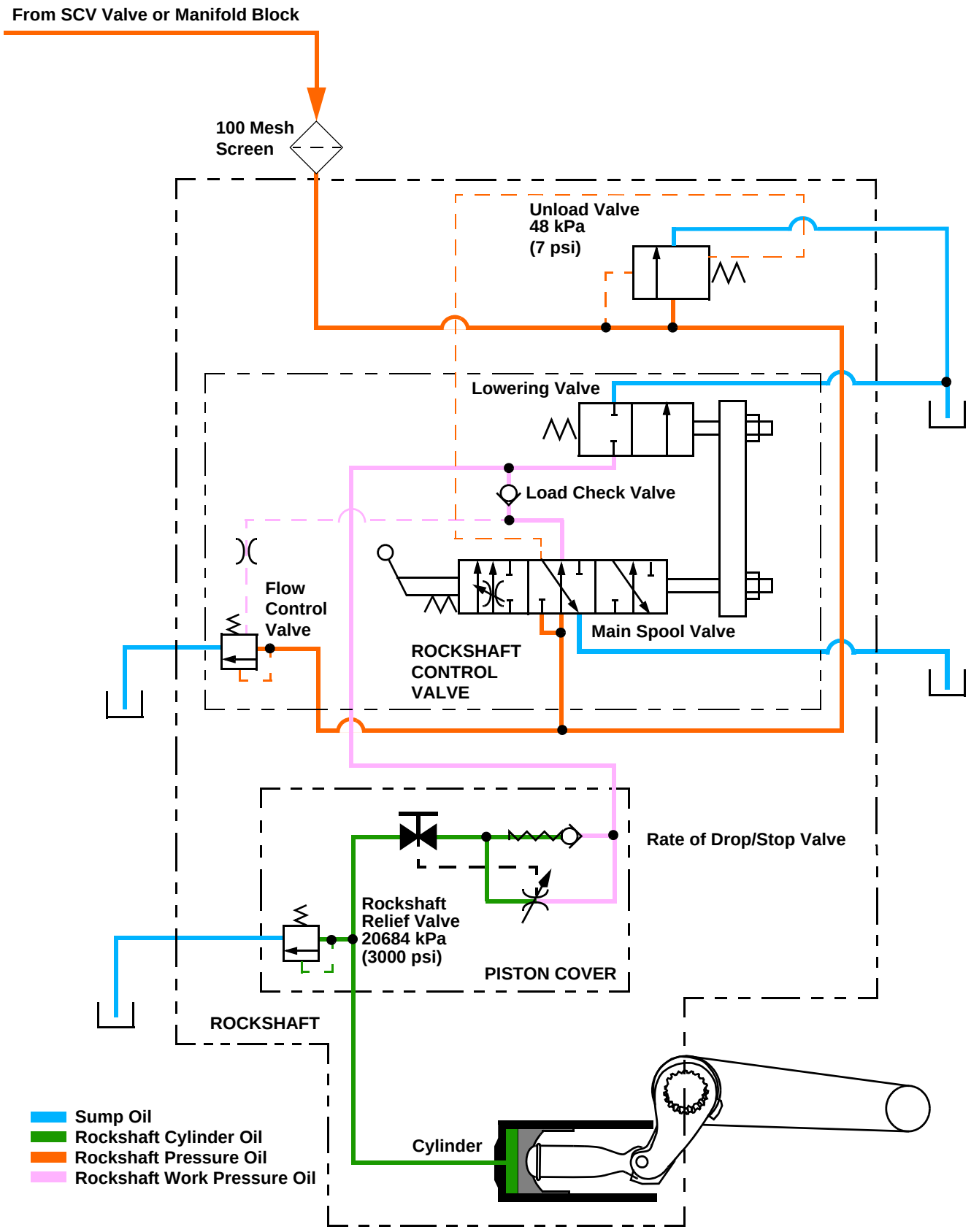




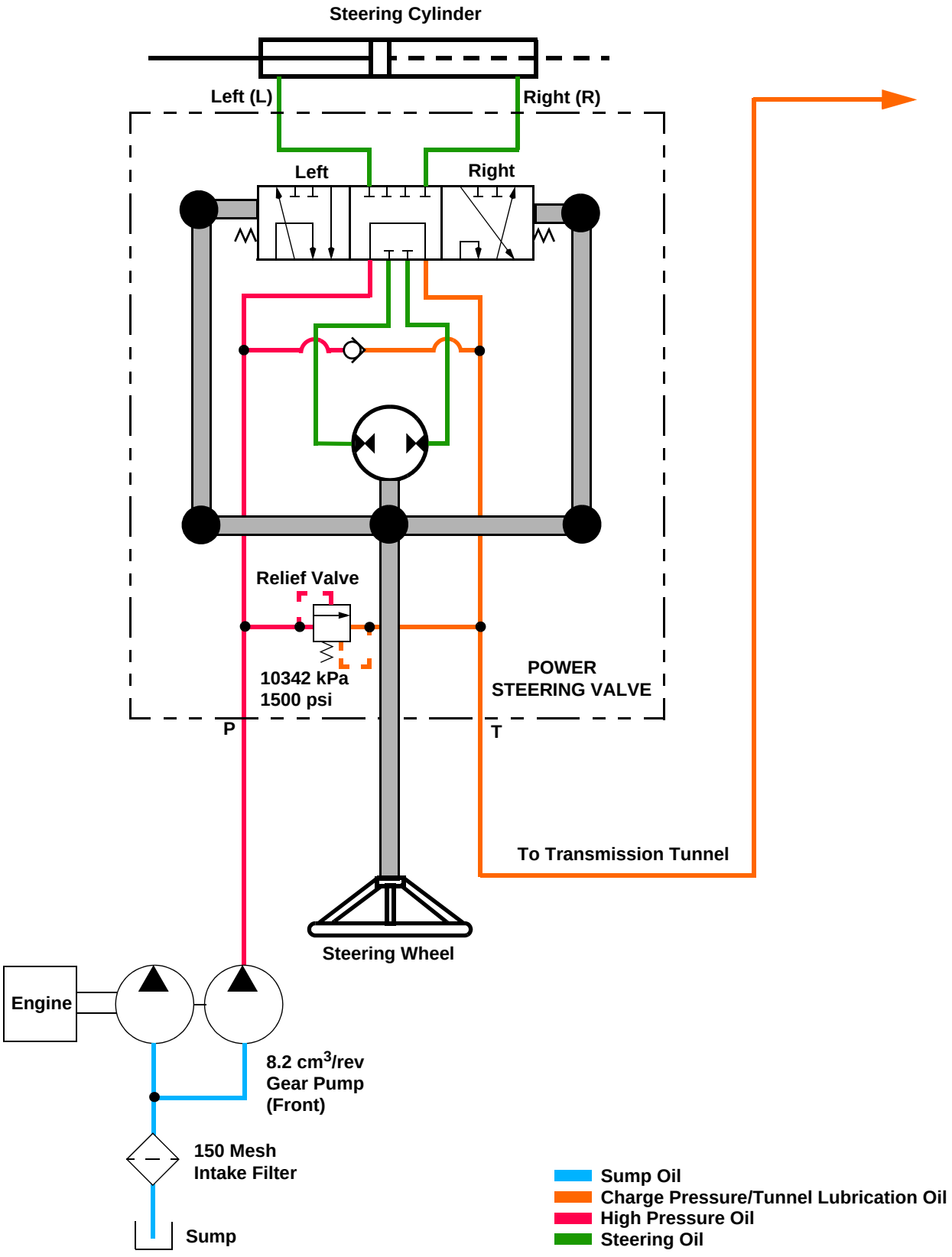
Sump Oil
SCV Work Port Oil
Rockshaft Pressure Oil

NOTE: The manifold block can be replaced by either the 1 spool selective control valve or the 3 spool selective control valve

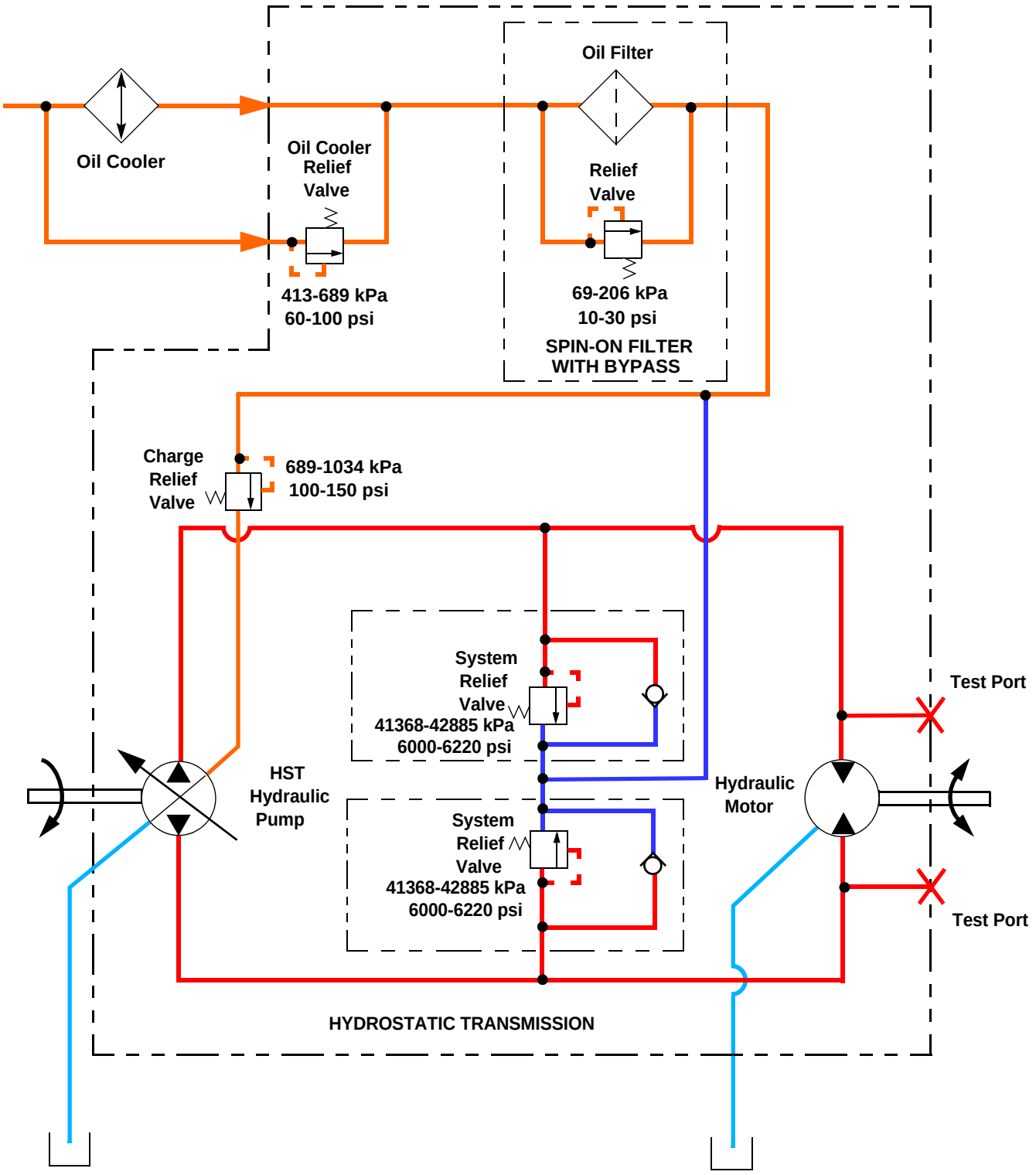
ROCKSHAFT HYDRAULIC SCHEMATIC



STEERING SCHEMATIC



HYDROSTATIC (HST) TRANSMISSION SCHEMATIC



TESTS AND ADJUSTMENTS

HYDRAULIC SYSTEM BLEED PROCEDURE

Reason:

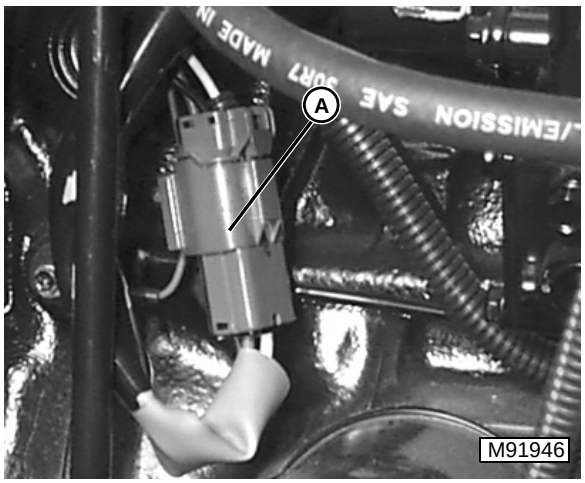
To remove air trapped in the hydraulic system which will prevent proper operation.

Procedure:

IMPORTANT: If contamination is found in hydraulic system filter or inside reservoir, flush entire hydraulic system.

NOTE: Fill the new hydraulic oil filter with new oil before installing.

1. Install a new hydraulic oil filter.
2. Fill the transaxle with specified JDM J20D (preferred) or J20C oil to the proper level on dipstick.



3. Disconnect connector (A) to fuel shutoff solenoid.
4. Turn the key to START and hold for 10 seconds. Turn the key to OFF.
5. Reconnect wires to fuel shutoff solenoid.
6. Raise tractor front end and support on suitable stands.
7. Start the engine and run at low idle.

IMPORTANT: If steering fails to respond, or pump pressure is not being delivered to steering control unit (SCU), shut engine off and check to see that steering hoses are connected to the correct SCU ports.

8. Slowly turn the steering wheel left and right until wheels turn smoothly indicating that any trapped air has been bled back to the reservoir.

IMPORTANT: If rockshaft fails to react to lift control lever movement, shut engine off and check hose clamps on suction tube elbow and manifold to ensure that they are properly tightened.

9. Operate rockshaft several times until it operates smoothly.
10. Stop the engine and check the hydraulic reservoir oil level. Fill as needed. Check all line connections for leaks; tighten if necessary.
11. Lower the tractor to the ground.
12. (HST Model) Drive tractor in forward and reverse several times until transmission operates smoothly.

RATE OF DROP/STOP VALVE ADJUSTMENT

Reason:

To ensure that lift arms lower rear attachment completely and lower it at a safe rate of speed.

Equipment:

- BW13586 Ballast Box

Procedure:

1. Park tractor on a level surface and set park brake.
2. Shift transmission to "neutral".
3. Install BW13586 ballast box, or approximately 227 kg (500 lb), on the three point hitch.
4. Start engine and run at fast idle (2500-2700 rpm).
5. Put lift control lever in full UP position.
6. Raise weight as high as it will go.
7. **Close** rate of drop/stop valve.
8. Put lift control lever in full DOWN position.
9. **Open** rate of drop stop valve 1-1/2 to 2 turns.
10. Time duration of drop cycle from full up to full down.

Specifications:

Rockshaft Drop Time . . . . . 2-1/2 to 3 seconds

Results:

If the weight lowers slower than specified time, open rockshaft rate of drop/stop valve until specification is met. If weight drop time will not meet specification, the

rate of drop/stop valve may be clogged or faulty, or the rockshaft control valve may be faulty. (See "ROCKSHAFT DISASSEMBLY AND ASSEMBLY").

LIFT ARMS ADJUSTMENT

Reason:

To ensure that lift arms are operating through the correct range of motion.

Procedure:

1. Park tractor on a level surface and set park brake.
2. Shift transmission to NEUTRAL.
3. Start engine and use hydraulics to rotate rockshaft to full UP position.
4. Using angle gage, check lift arms against specifications. If not correct, remove lift arm and reset. (See "ROCKSHAFT DISASSEMBLY AND ASSEMBLY").
5. Compare angle of second lift arm with first, they should be within **5°** of each other. If not, reset lift arms on splines and/or replace rockshaft. (See "ROCKSHAFT DISASSEMBLY AND ASSEMBLY").

Specifications:

Lift Arm Raise Angle . . . . . .50°
Lift Arm Lower Angle. . . . . .20°
Total Lift Arm Range . . . . . .70°
Maximum Variance Between Lift Arms . . . . . .5°

SYSTEM PRESSURE/FLOW TEST

Reason:

To ensure that hydraulic pump pressure and flow are maintained at sufficient levels for rockshaft and SCV attachment operation, and to determine if hydraulic pump is worn.

Equipment:

- JT05689 - Adapter Fitting (1-1/16-12 M 37° X 1-14 F ORFS) (2 Required)
- JT03012 - Adapter Fitting (3/4 F NPT X 1-1/16-12 F 37° Sw) (2 Required)
- JT05984 - In-Line Flow Meter With Pressure Gauge
- JT03377 - Hose (3/4 M NPT X 3/4 M NPT X 10') (2 Required)

Procedure:

1. Park tractor on a level surface and set park brake.
2. Shift transmission to NEUTRAL.

IMPORTANT: Make sure to relieve system pressure before loosening any system lines or hoses.

3. Cycle all controls to relieve any pressure that may be in the hydraulic system.
4. Remove hydraulic tube between rear pump and SCV valve.
5. Connect test equipment between rear pump and PTO valve. Open valve on flow meter fully.
6. Start engine and run at high idle (2500-2700 rpm).

⚠ CAUTION

Do not close valve on flow meter fully. Pump pressure may exceed working pressure of hose.

7. Slowly close valve on flow meter until working pressure is reached. Record flow reading on gauge.

Specifications (Minimum):

System Pressure (4200). . . . . 14651 kPa (2125 psi)
System Pressure (4300-4400) . 17236 kPa (2500 psi)
System Flow (4200) . . . . . 27.66 L/min (7.3 gpm)
System Flow (4300-4400). . . . 31.4 L/min (8.3 gpm)

Results:

- **Pressure too Low:** If system pressure reading cannot be reached, mesh filter may be restricted. Suction line may be restricted or leaking air. Pump may be worn. (See "GEAR PUMP DISASSEMBLY AND INSPECTION").
- **Flow too low:** Mesh filter may be restricted. Suction line may be restricted or leaking air. Pump may be worn. (See "GEAR PUMP DISASSEMBLY AND INSPECTION").

SYSTEM PRESSURE ADJUSTMENT

NOTE: On tractors equipped with a manifold block in place of an SCV, system pressure is set at the factory, and should not require adjustment.

Reason:

To adjust hydraulic pressure so that system pressure is maintained at correct levels to perform work without causing damage to the hydraulic system.

Equipment:

- JT05689 - Adapter Fitting (1-1/16-12 M 37° X 1-14 F ORFS) (2 Required)
- JT03012 - Adapter Fitting (3/4 F NPT X 1-1/16-12 F 37° Sw) (2 Required)
- JT05984 - In-Line Flow Meter With Pressure Gauge
- JT03377 - Hose (3/4 M NPT X 3/4 M NPT X 10') (2 Required)

Procedure:

1. Park tractor on a level surface and set park brake.
2. Shift transmission to NEUTRAL.

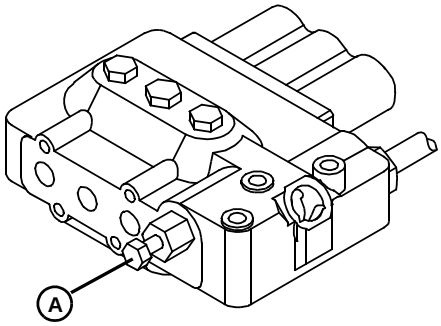
IMPORTANT: Make sure to relieve system pressure before loosening any system lines or hoses.

3. Cycle all controls to relieve any pressure that may be in the hydraulic system.
4. Remove hydraulic tube between rear pump and SCV valve.
5. Connect test equipment between rear pump and SCV valve. Open valve on flow meter fully.
6. Start engine and run at high idle (2500-2700 rpm).
7. Move SCV control lever to open SCV valve to a closed work port (dead head).
8. Check pressure reading on gauge.

Specifications:

System Pressure (4200) . . . . . 14651 kPa (2125 psi)
System Pressure (4300, 4400) 17237 kPa (2500 psi)

Results:



- **Pressure too low:** Turn system pressure relief valve (A) clockwise until pressure reading is within specification.

NOTE: If system pressure will not meet specification, pump may be worn. Perform system pressure/flow test (See "SYSTEM PRESSURE FLOW TEST").

- **Pressure too high:** Turn system pressure relief valve counter-clockwise until pressure reading is within specification.

STEERING PRESSURE ADJUSTMENT

Reason:

To ensure that steering pump pressure is maintained at correct level for steering without causing damage to the system, and to determine if hydraulic pump is worn.

Equipment:

- JT03375 - Adapter Fitting (7/16-20 M 37° X 9/16-18 M ORFS)
- JT03117 - 0-14000 kPa (0-2000 psi) Pressure Gauge
- JT03017 Hose w/Quick Disconnect Fitting

Procedure:

1. Park tractor on a level surface and set park brake.
2. Shift transmission to NEUTRAL.

IMPORTANT: Make sure to relieve system pressure before loosening any system lines or hoses.

3. Cycle all controls to relieve any pressure that may be in the hydraulic system.

4. Remove hydraulic hose on left side of steering cylinder.
5. Attach gauge to left steering hose.

NOTE: Turning steering wheel to the right will cause hydraulic oil to leak out of disconnected cylinder port. Turn wheel only to left when performing test.

6. Start engine and run at high idle **(2500-2700 rpm)**.
7. Turn steering wheel to the left. While turning wheel, check pressure reading on gauge.

Specifications:

Pressure . . . . . .10342 kPa ± 10% (1500 psi ± 10%)

Results:

- **No pressure:** Steering hoses may be incorrectly connected to the SCU. Check hose connections.
- **Pressure too low:** Relief valve in SCU may be stuck open or defective; perform steering system test, (See "STEERING SYSTEM TEST" in Steering section), or gear pump may be worn; disassemble and inspect pump. (See "GEAR PUMP DISASSEMBLY AND INSPECTION").
- **Pressure too high:** Relief valve in SCU may be clogged or defective.

ROCKSHAFT LIFT CYCLE TEST

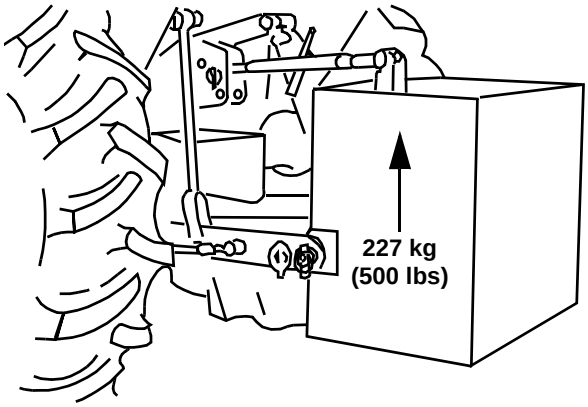
Reason:

To ensure that hydraulic system is functioning correctly and capable of lifting rated load.

Equipment:

- BW13586 Ballast Box

Procedure:



1. Park tractor on a level surface and set park brake.
2. Shift transmission to NEUTRAL.
3. Install BW13586 ballast box, or approximately 227 kg (500 lb), on the three point hitch.
4. Open rate of drop/stop valve completely.
5. Start engine and run at fast idle (2500-2700 rpm).
6. Move lift control lever to full UP position.
7. Time duration of lift cycle from full down to full up.

Specifications

Rockshaft Lift Time . . . . . .2-1/2 to 3 sec.

Results:

If the weight raises slower than specified there may be internal leakage in the lift cylinder or rockshaft control valve.

ROCKSHAFT LEAKAGE TEST

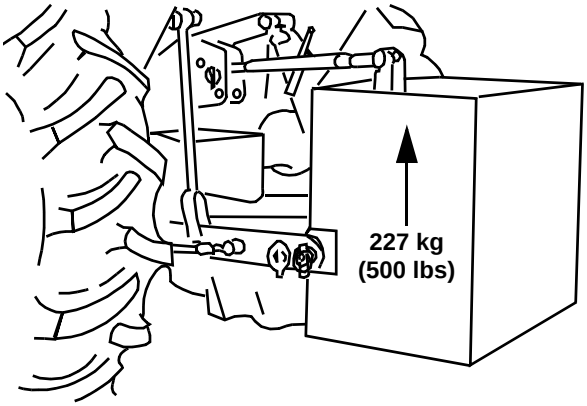
Reason:

To ensure that hydraulic system is functioning correctly and capable of lifting rated load.

Equipment:

- BW13586 Ballast Box

Procedure:



1. Park tractor on a level surface and set park brake.
2. Shift transmission to "neutral".
3. Install BW13586 ballast box, or approximately 227 kg (500 lb), on the three point hitch.
4. Start engine and run at fast idle (2500-2700 rpm).
5. Put lift control lever in full UP position.
6. Raise weight as high as it will go.
7. **Close** rate of drop/stop valve.
8. Shut off engine.
9. Measure distance weight drops in five minutes.
10. Restart engine, **open** rate of drop/stop valve fully and raise weight to full UP position.
11. Shut off engine.
12. Measure distance weight drops in five minutes.

Specifications

Maximum Drop in Five Minutes . . . . . 51 mm (2 in.)

Results:

If the weight drops farther than specified distance with the stop/drop valve **closed** (first test) there may be leakage in the cylinder, relief valve or drop/stop valve. If the weight drops **farther** with the drop/stop valve **open** (second test) than it did in the first test, there may be leakage in the rockshaft control valve.

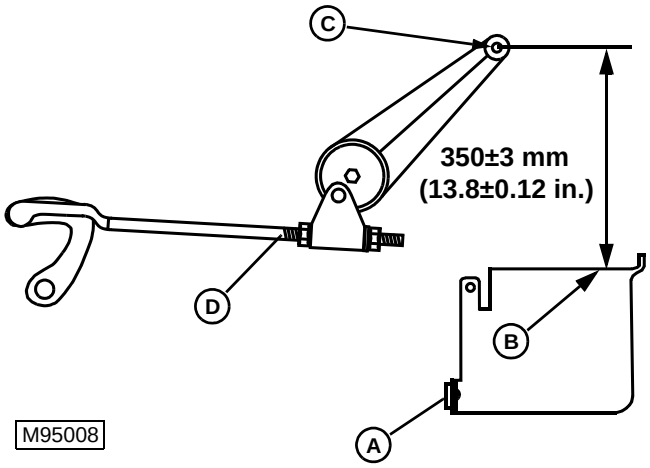
ROCKSHAFT POSITION FEEDBACK LINKAGE ADJUSTMENT

Reason:

To ensure that draft arms raise to maximum lift height without engaging relief valve.

Procedure:

1. Position tractor on a level surface and set park brake.
2. Shift transmission to NEUTRAL.
3. Position lift control lever in the full forward (down) position and provide enough weight on lift arms to allow self lowering.
4. Start engine.
5. Move lift control lever to full raise position (back).



NOTE: Make sure the PTO shield is in place, and is in good condition before performing adjustment. Make sure rubber bumper (A) is in place on PTO shield.

6. Using a tape measure, measure from the top of the PTO shield (B) to the center of the pin (C) in end of lift arm. Lift arm should raise to **350±3 mm (13.8±0.12 in.)** as shown, without engaging the relief valve. Check that there is **25.4 mm (1 in.)** of slack above the vertical height.
7. If specification is not met, lengthen the lift arm position feedback rod (D) to increase, or shorten to reduce the maximum height until within specification. The relief valve should not engage.

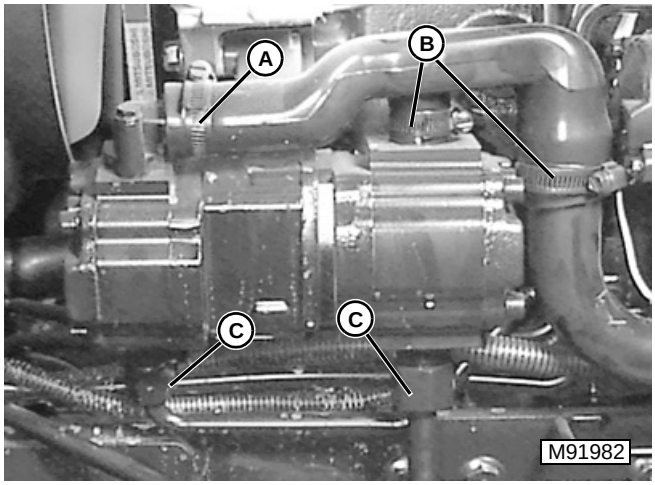
REPAIR

HYDRAULIC GEAR PUMP REMOVAL & INSTALLATION

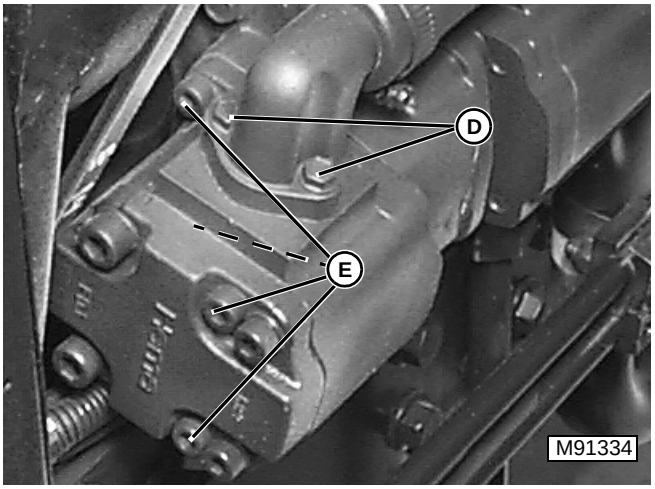
The hydraulic pumps are the same on both hydrostatic and gear drive tractors. The only difference in the removal and installation of the two is in the specific routing of the individual pressure hoses/tubes.
The two gear pumps are identical in design, but each uses different suction tube attaching methods, and they have different displacements.

Removal:

1. Remove engine side panels.
2. (Front Pump Only) If necessary, remove exhaust pipe from muffler.



3. Loosen hose clamp (A) on suction tube manifold.
4. Disconnect suction tube manifold from pump.
5. (Rear Pump Only) Loosen two remaining hose clamps (B) on suction tube manifold. Remove manifold.
6. Disconnect pressure tube (C) from fitting on bottom of pump.



7. Remove two long and two short socket head cap screws (E) securing pump to engine drive housing.
8. Remove pump.
9. If necessary, remove fitting from pressure side of pump body.
10. (Front Pump Only) If necessary, remove two cap screws (F) and suction tube elbow.

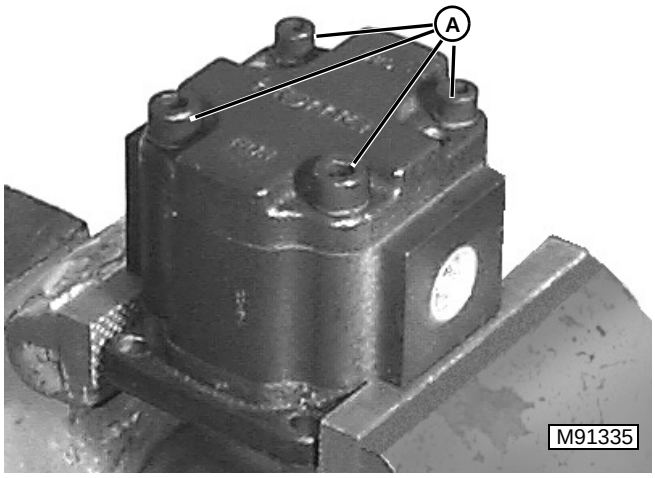
Installation:

IMPORTANT: Replace all O-rings, gaskets, and seals. Used or damaged O-rings, gaskets and seals will leak.

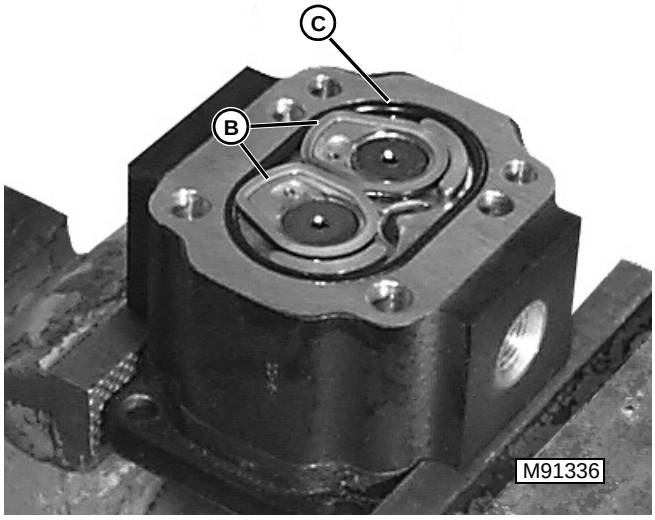
1. Install new O-rings on both ends of adapter fitting and secure to pumpbody. Tighten front pump adapter fitting to **21 N•m (180 lb-in.)**. Tighten rear pump adapter fitting to **28 N•m (21 lb-ft).**
2. (Front Pump Only) Install new O-ring on suction tube elbow, and secure to pump with two cap screws. Tighten to **9 N•m (84 lb-in.)**.
3. Install new gasket on front cover where pump attaches to engine drive housing.
4. Align splines on pump input shaft with splines on engine drive. Insert pump into engine housing.
5. Secure pump with four socket head cap screws. Tighten to **22 N•m (192 lb-in.)**.
6. Attach pressure tube to adapter fitting. Tighten tube nut on front pump to **50 N•m (37 lb-ft)**. Tighten tube nut on rear pump to **69 N•m (51 lb-ft)**.
7. Inspect suction tube manifold for damage or cracking. Replace if necessary.
8. Attach suction tube manifold to pump. Secure with hose clamps.

GEAR PUMP DISASSEMBLY & INSPECTION

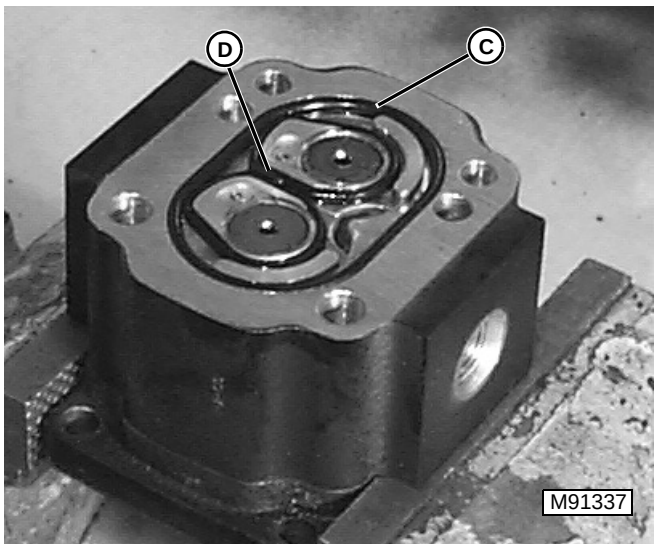
1. Remove pump from engine. (See "HYDRAULIC GEAR PUMP REMOVAL AND INSTALLATION").



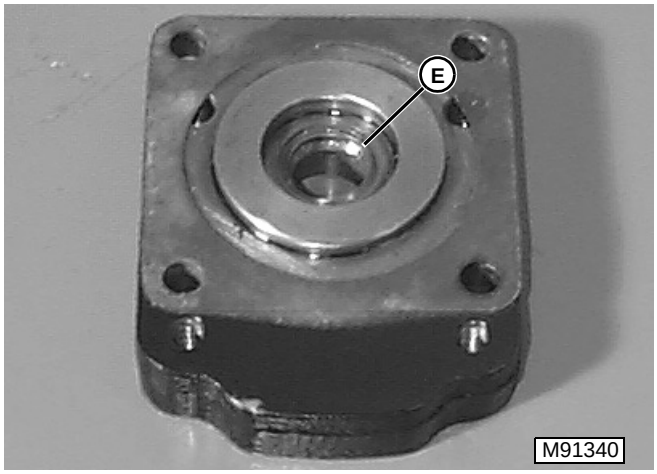
2. Remove two large and two small socket head cap screws (A) and lock washers securing pump cover to pumpbody.
3. Remove pump cover.
4. Inspect pump cover for wear or damage. If necessary, replace pump.



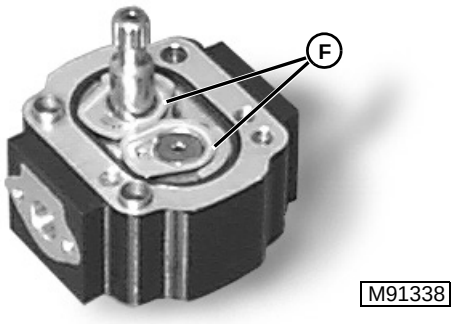
5. Remove two backing washers (A).



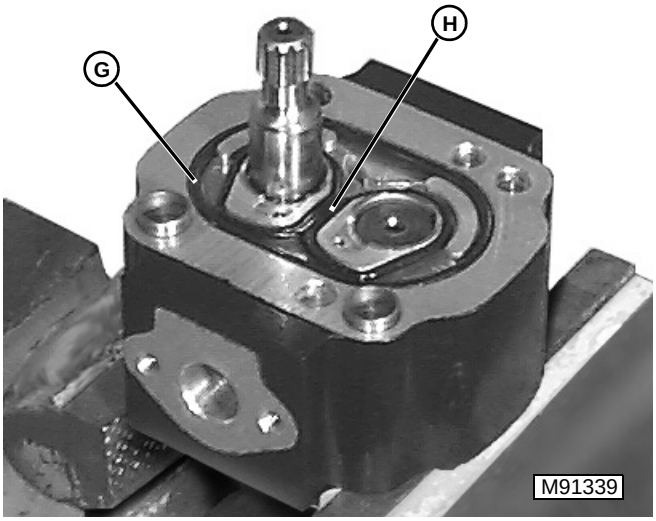
6. Remove O-ring (C) and formed O-ring gaskets (D).
7. Remove front cover.
8. Inspect front cover for scoring, wear, or damage. If necessary, replace pump.



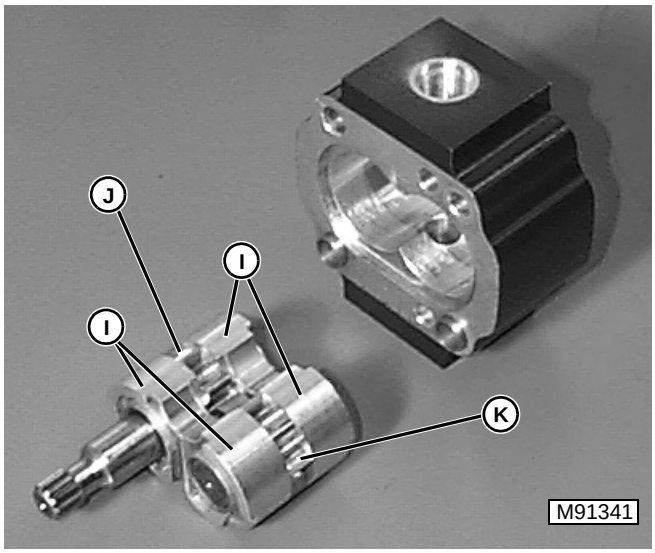
9. Inspect front cover shaft seal (E) for cracks, wear, or damage. If necessary, replace seal.



10. Remove two backing washers (F).



11. Remove O-ring (G) and formed O-ring gaskets (H).



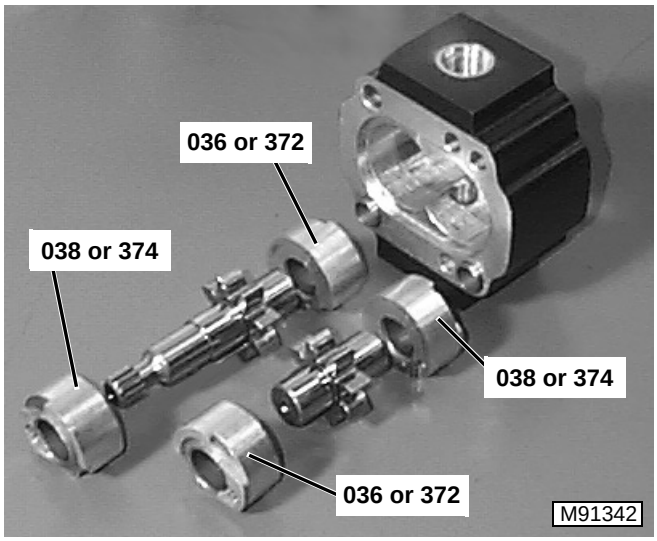
NOTE: Markings on pump bushings varies depending on pump capacity. Markings may vary from what is shown on art.

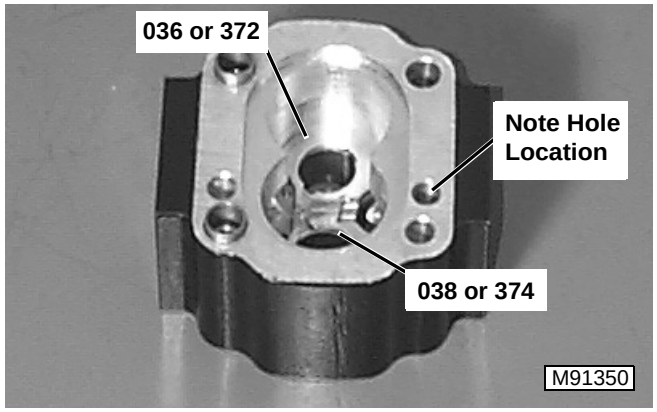
12. Note the location and markings on four bushings (I) to ensure correct orientation at assembly.
13. Remove four bushings, drive gear (J), and idler gear (K) from pump as an assembly.
14. Remove bushings from gears.
15. Inspect gears and bushing faces for scoring, excessive scratching, or damage. If necessary, replace pump.
16. Inspect input gear shaft splines. If damaged, replace pump.
17. Measure gear shaft bearing surfaces. If not within specifications, replace pump.
18. Inspect inside of bushings for scoring or excessive scratching. Measure bearing surfaces. Replace bushings if damaged or not within specifications.
19. Inspect pump body internal surfaces for scoring or excessive scratching. Replace pump if damaged.

Specifications:

Shaft Bushing Maximum ID	**19.15 mm (0.754 in.)**
Shaft Bearing Surface:	
Minimum OD	**18.95 mm (0.746 in.)**
Bushing Minimum Thickness - Steering (Front)	**13.57 mm (0.534 in.)**
Bushing Minimum Thickness - Implement (Rear)	**19.02 mm (0.749 in.)**
Drive/Idler Gear Minimum Thickness:	
Front Pump (Steering)	**9.43 mm (0.371 in.)**
4200 Rear Pump (Implement)	**14.99 mm (0.590 in.)**
4300/4400 Rear Pump (Implement)	**17.63 mm (0.694 in.)**

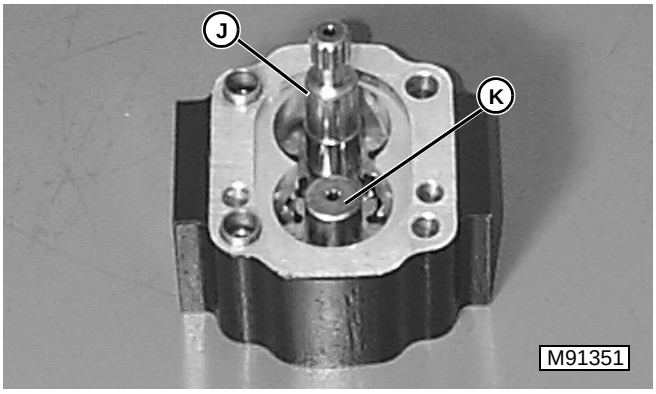
GEAR PUMP ASSEMBLY



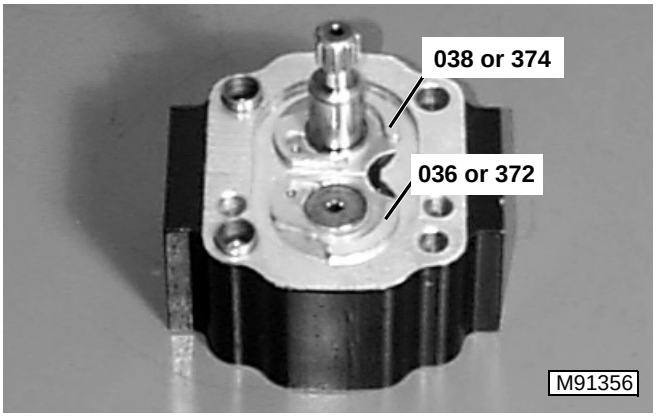


1. Lay pump body on a clean, flat surface, and install back bushings into bore as shown. Push bushings to bottom of bore.

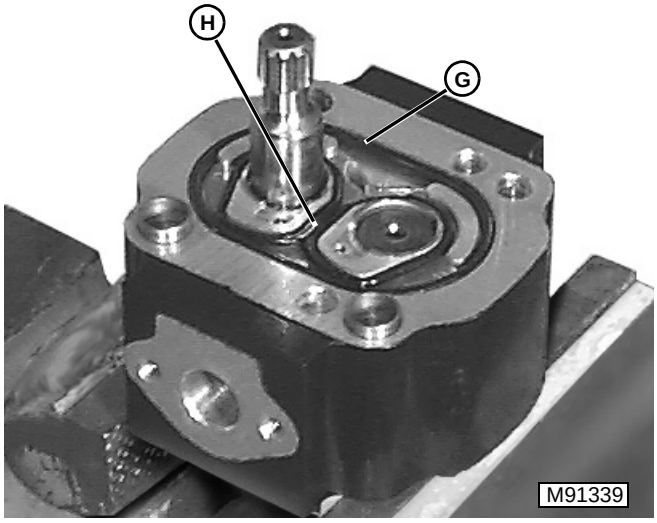
NOTE: Idler gear is symmetrical and can be placed in pump body either end first.



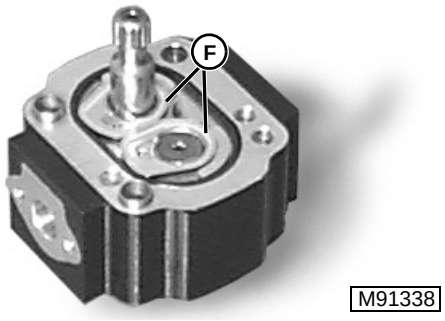
2. Install drive gear (J) and idler gear (K) into pump body and bushings.



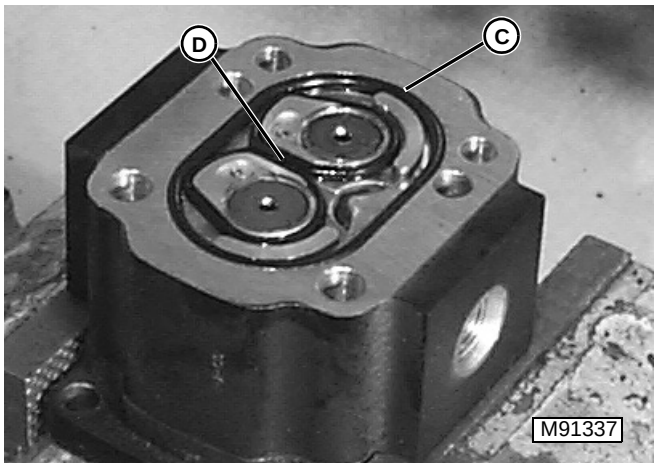
3. Install front bushings into pump body and onto drive gear and idler gear shafts.



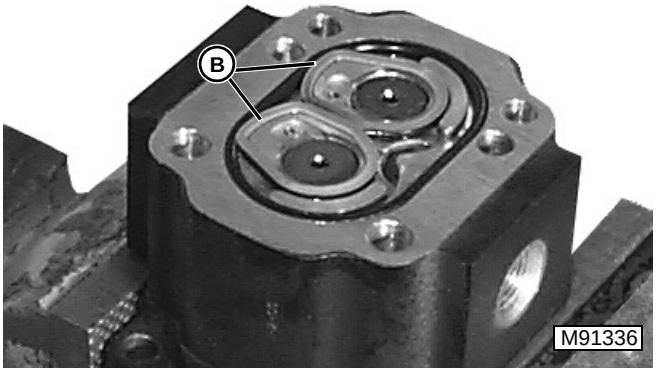
4. Install O-ring (G) and formed O-ring gaskets (H).



5. Install two backing washers (F).
6. If not already done, install new shaft seal in front cover using a suitable driver.
7. Install front cover over drive gear shaft and onto pump body.



8. Turn pump over, and install O-ring (D) and formed O-ring gaskets (D).

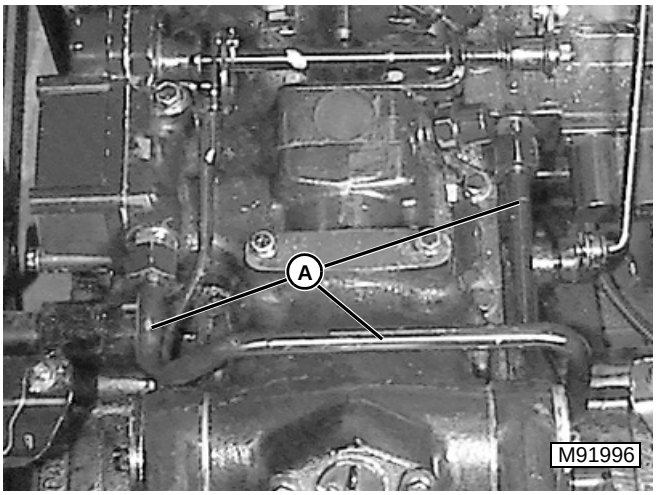


9. Install two backing washers (B).
10. Install rear cover and secure with two small (M8), and two large (M10) socket head cap screws. Tighten M8 cap screws to **28 N•m (240 lb-in.),** and M10 cap screws to **55 N•m (40 lb-ft).**
11. Install pump. (See "HYDRAULIC GEAR PUMP REMOVAL AND INSTALLATION").

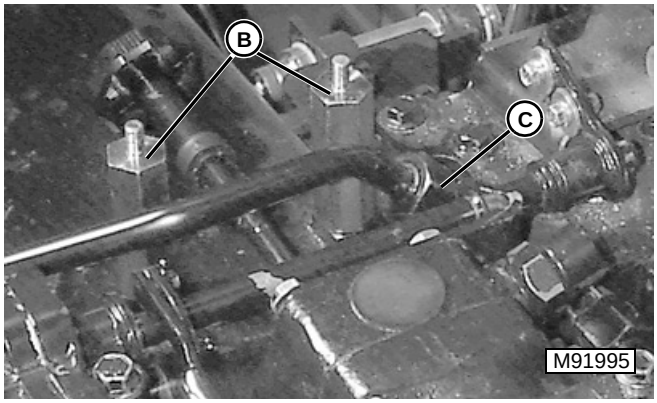
ROCKSHAFT ASSEMBLY

Removal:

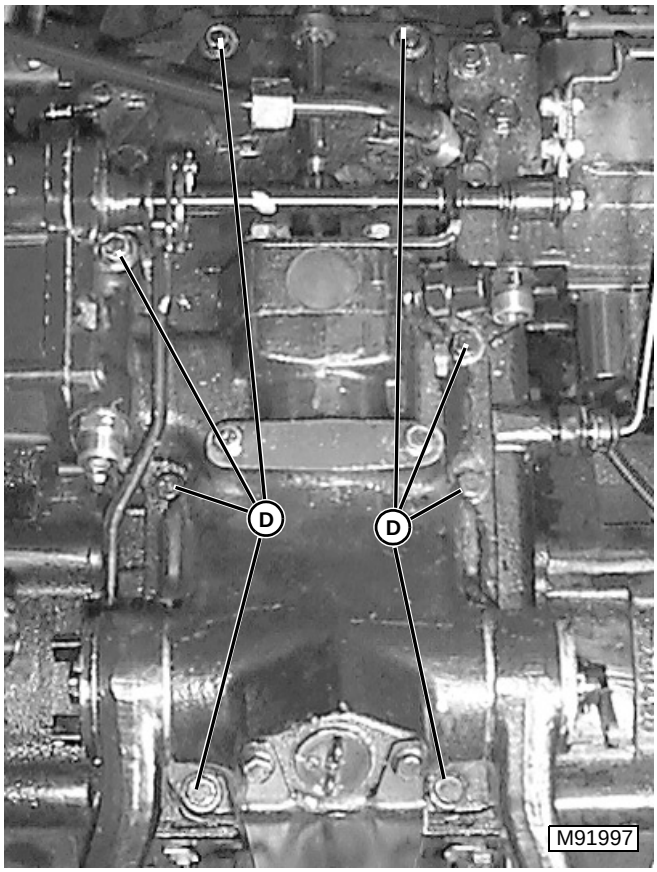
1. Remove seat and seat support. (See "SEAT AND SEAT SUPPORT" in Miscellaneous section.)
2. Remove seat close out panels. (See "SEAT CLOSE OUT PANELS" in Miscellaneous section.)
3. Remove kick plate. (See "KICK PLATE" in Miscellaneous section.)
4. Remove three point hitch. (See "THREE POINT HITCH" in Miscellaneous section.)
5. Remove park brake lever and linkage. (See "PARKING BRAKE LINKAGE REMOVAL AND INSTALLATION" in Brakes section.)
6. Disconnect lighting wiring harness on RH side of tractor where wiring harness enters ROPS.
7. Move wiring harness clear of rockshaft housing.



8. Remove rockshaft hydraulic pressure tube (A).



9. Remove two seat standoffs (B).
10. Disconnect SCV (if equipped) or manifold block pressure tube (C).



11. Remove twelve cap screws (D) securing rockshaft housing to transmission. Gently pry up around edge of rockshaft cover to loosen.

⚠ CAUTION

The approximate weight of the rockshaft assembly is 39 kg (85 lb). Do not attempt to remove rockshaft assembly without an assistant or overhead crane.

12. Remove rockshaft housing from final drive housing.

Installation:

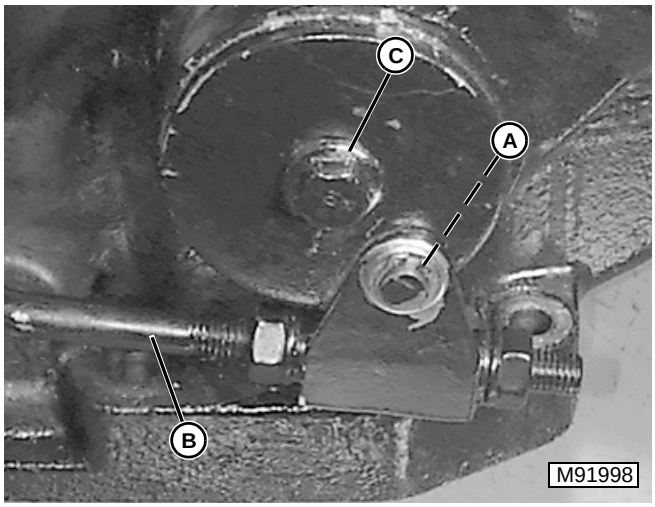
NOTE: Installation is reverse of removal.

- Clean sealing surfaces of rockshaft and final drive housing. Install a new bead of sealant (TY16021) on transaxle rockshaft mounting surface.
- If lift arms have been removed they must be reset. (See "LIFT ARMS ADJUSTMENT").
- Tighten 8.8 grade cap screws to **55 N•m (40 lb-ft).**
- Tighten 10.9 grade cap screws to **80 N•m (60 lb-ft).**

ROCKSHAFT LIFT ARMS

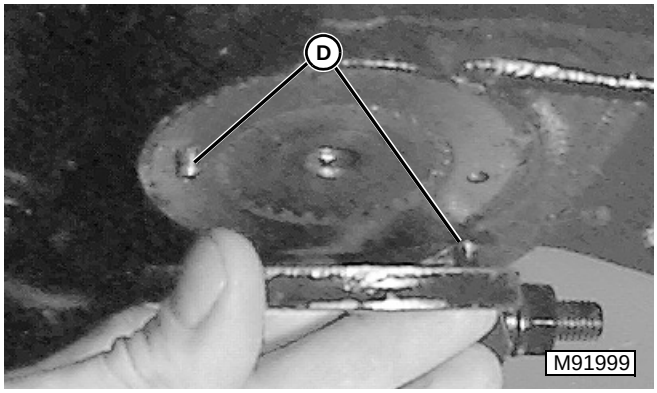
Removal:

NOTE: Lift arms may be removed with rockshaft assembly installed in tractor. DO NOT remove splined cross shaft unless rockshaft is first removed from tractor. Internal components will fall into transmission if splined cross shaft is removed while rockshaft is attached to transmission.

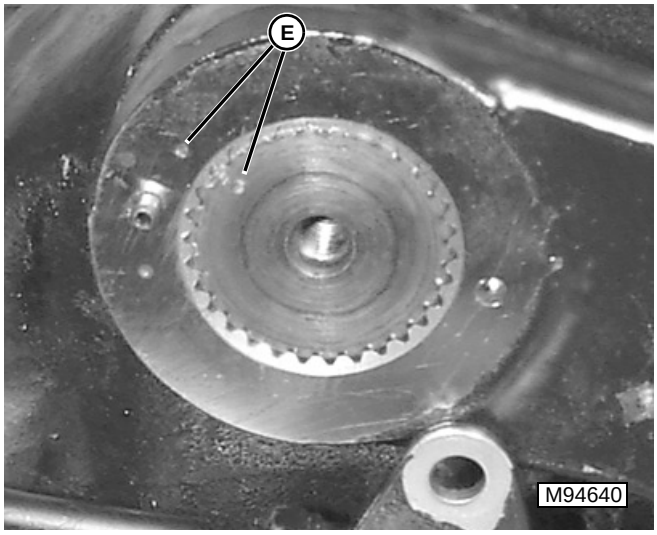


1. Remove snap ring (A) and washer from end of cam plate pin. Disconnect position feedback rod (B).
2. Remove cap screw (C) from end of rockshaft.

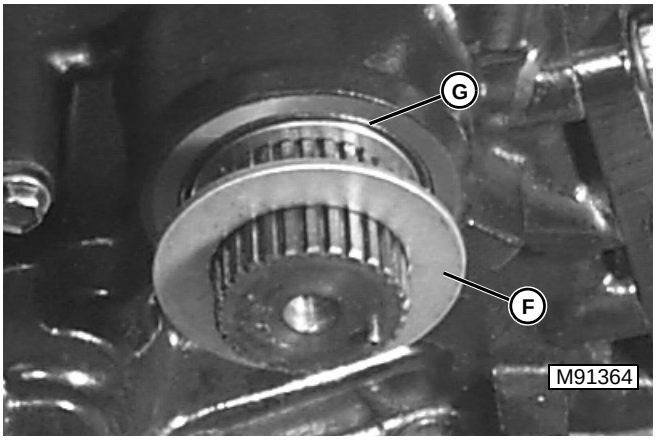
NOTE: Two spring pins (D) retain cam plate to rockshaft.



3. Remove cam plate.



4. If not already done, use center punch to mark (E) splined cross shaft and lift arm.
5. Remove lift arm from splined cross shaft.

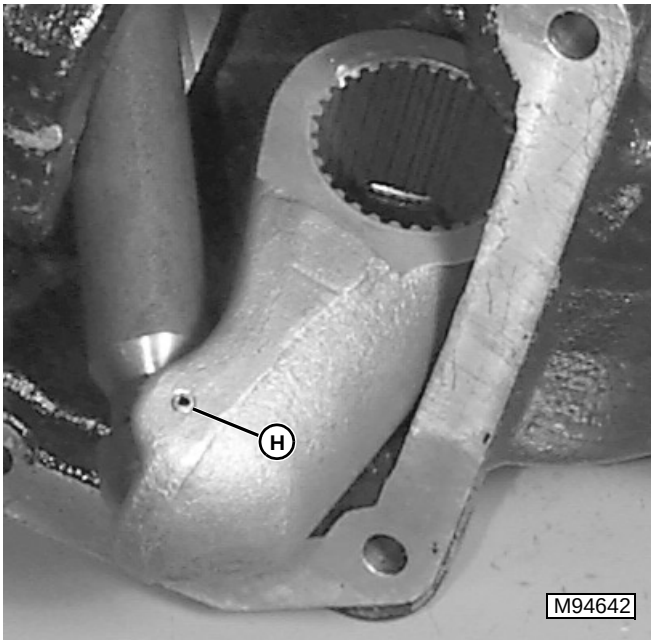


6. Remove washer (F) from splined cross shaft.
7. Remove outer O-ring (G) from groove in housing.

NOTE: DO NOT remove splined cross shaft unless rockshaft is first removed from vehicle. Internal components will fall into transmission if splined cross shaft is removed while rockshaft is on transmission.
If rockshaft assembly is still installed on transmission, remove right lift arm only.

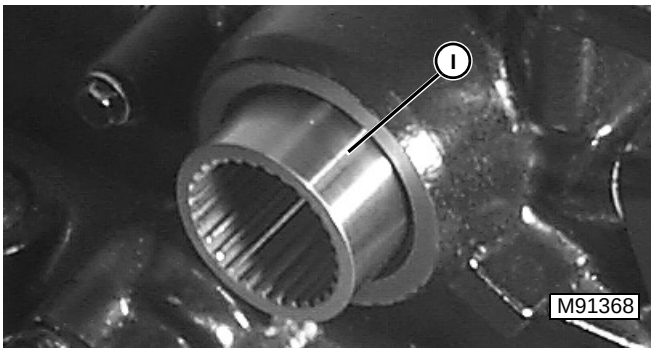
8. Remove right side lift arm and splined cross shaft from housing as a unit.

NOTE: If right side lift arm must be removed from splined cross shaft, use center punch to mark shaft and lift arm for alignment.



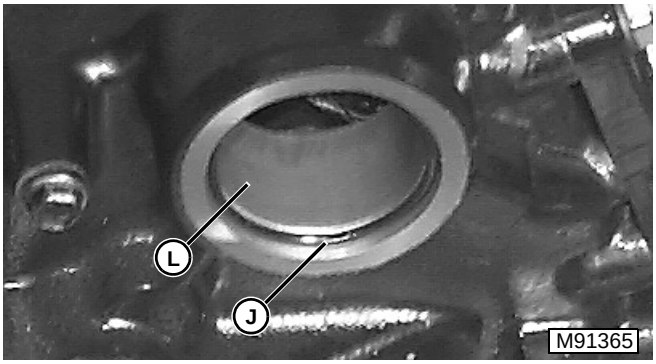
9. If necessary, remove spring pin (H) and separate rockshaft lever arm and piston rod. Remove lever arm and piston rod from rockshaft housing.

NOTE: Inner O-ring may come out of bore with splined sleeve when removed.

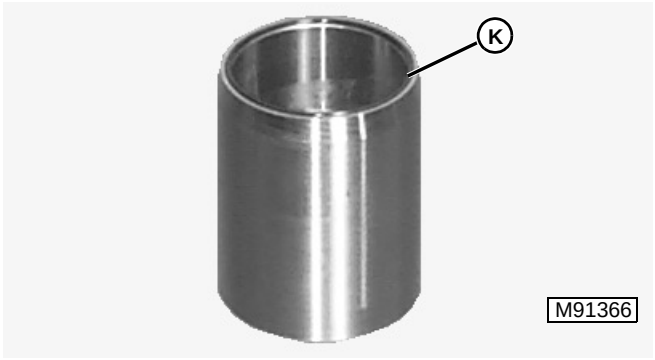


10. Remove two splined sleeves (I) from housing.

NOTE: Beveled ends of the splined sleeves should face inward.
There is an O-ring in ID of beveled end of splined sleeve.



11. Remove inner O-ring (J) from bore of rockshaft housing.



12. Remove O-rings (K) from bevelled end of splined sleeves.
13. Inspect splines on ID of splined sleeves for damage. Inspect OD for grooves or excessive wear. Replace as required.
14. Measure OD of splined sleeves. If not in specification, replace.
15. Measure ID of bushing (L) in housing. If not in specification, replace.

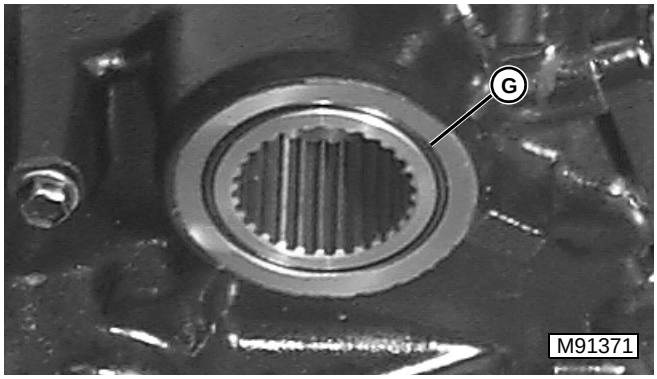
Specifications:

Splined Sleeve Minimum OD. . . 46.5 mm (1.832 in.)
Bushing Maximum ID. . . . . 44.2 mm (1.738 in.)

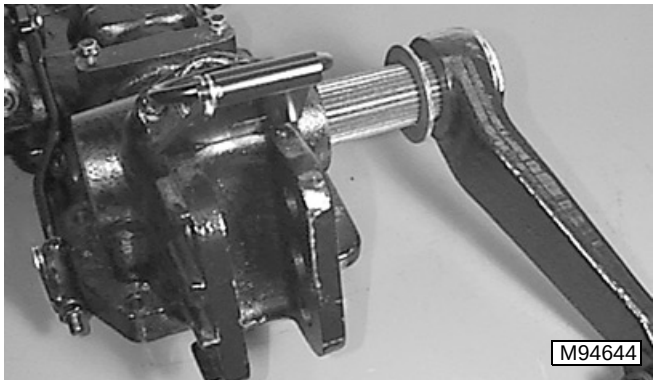
Installation:

IMPORTANT: Replace all O-rings and seals. Used or damaged O-rings and seals will leak.

1. If required, use a piloted bushing driver to install new bushings (L) into rockshaft housing.
2. Install two new inner O-rings (J) into rockshaft housing against bushings.
3. Install new O-rings (K) into bevelled end of two splined sleeves.
4. Install right side splined sleeve into rockshaft housing with bevel to the inside.



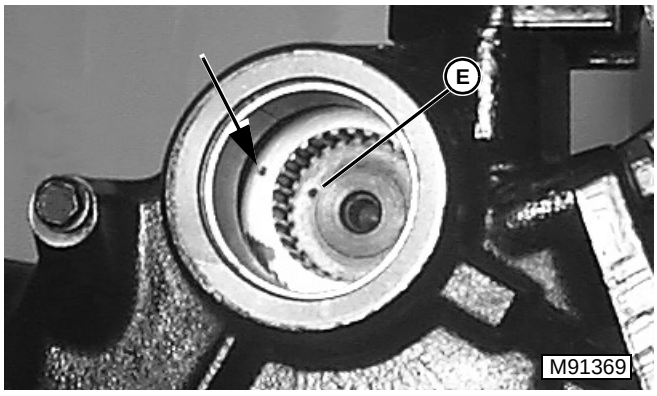
5. Install new outer O-ring (G) into groove between splined sleeve and rockshaft housing.
6. Align punch marks and assemble right side lift arm to splined cross shaft. Secure with large washer, and cap screw.



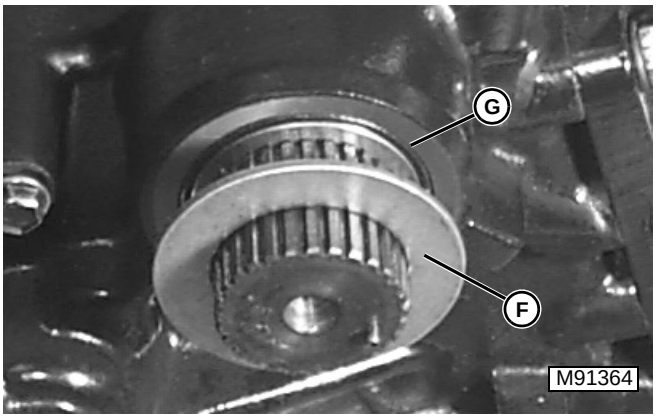
7. Install washer onto rockshaft against right side lift arm.

NOTE: Install shaft carefully to prevent splined cross shaft from knocking O-ring out of groove in bevelled end of splined sleeve.

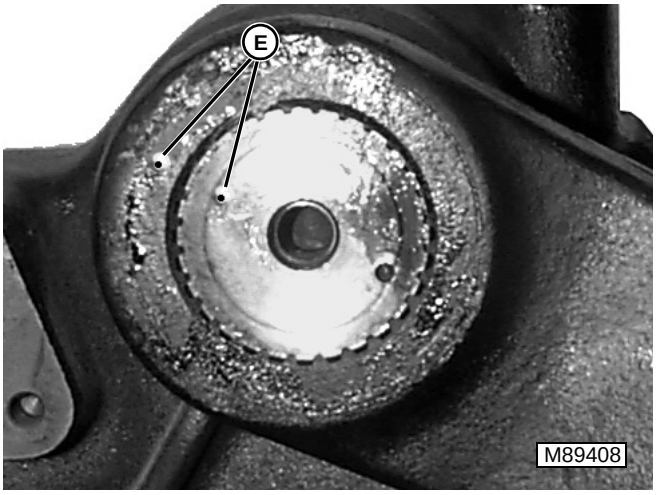
8. Install right side lift arm and rockshaft into right splined sleeve in rockshaft housing.



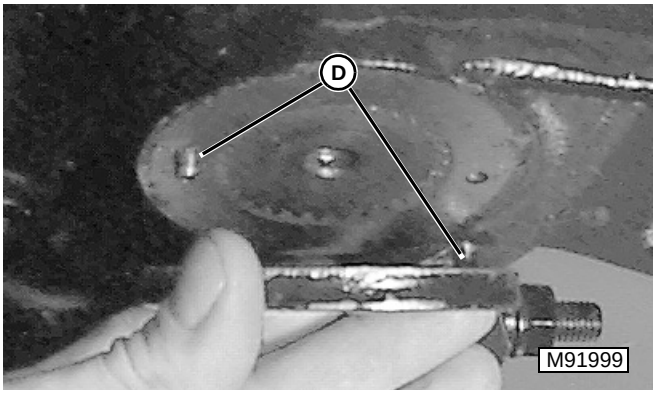
9. Align punch marks on splined cross shaft and rockshaft lever arm and install cross shaft through lever arm and into housing.
10. Install left side splined bushing into rockshaft housing and onto splined cross shaft.
11. Install outer O-ring (G) into groove between splined sleeve and rockshaft housing.



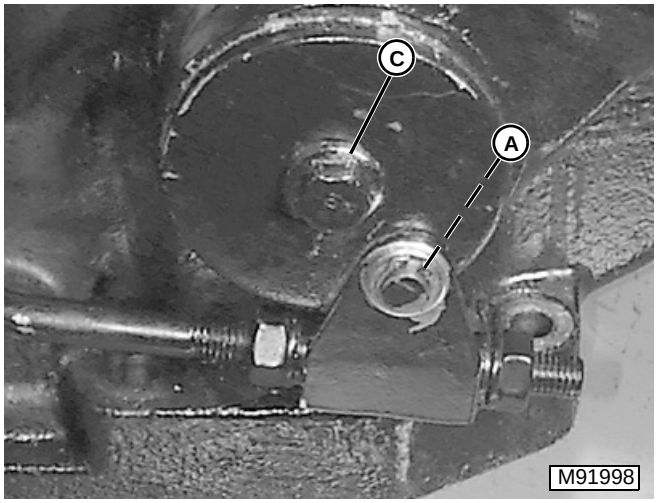
12. Install washer (F) onto splined cross shaft.



13. Align punch marks (E) on lift arm and splined cross shaft, and install left side lift arm onto shaft.



14. Replace spring pins in lift arm or cam plate if damaged.



15. Install cam plate and retain with cap screw (C).
16. Attach position feedback rod and retain with washer and snap ring (A).

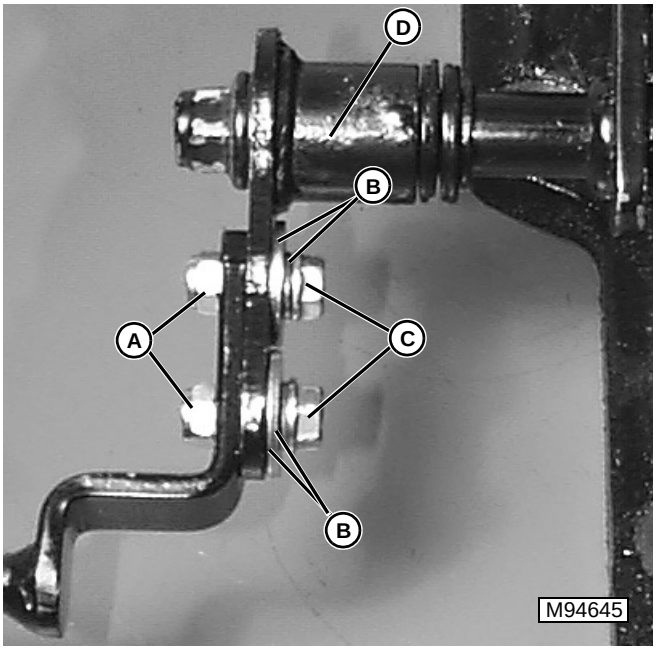
NOTE: Whenever the rockshaft feedback mechanism has been disturbed, be sure to adjust Rockshaft Position Feedback Linkage. (See "ROCKSHAFT POSITION FEEDBACK LINKAGE ADJUSTMENT").

Specifications:

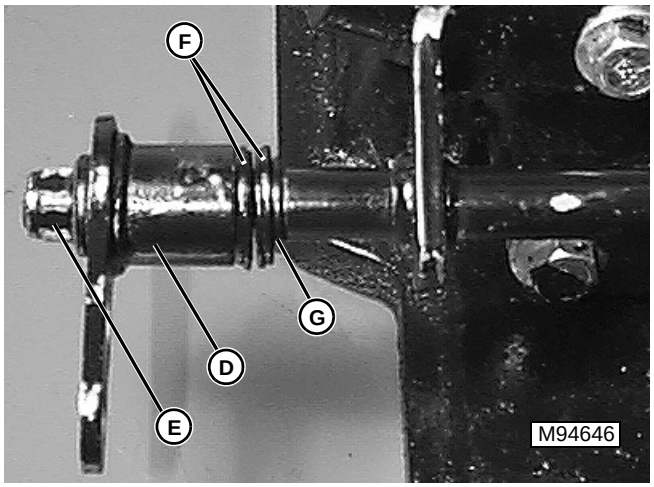
Lift Arm Raise Angle (Above Horizontal). . . . . .50°
Lift Arm Lower Angle (Below Horizontal) . . . . . .20°
Total Lift Arm Range . . . . . .70°
Maximum Variance Between Lift Arms . . . . . .5°

ROCKSHAFT DISASSEMBLY AND ASSEMBLY

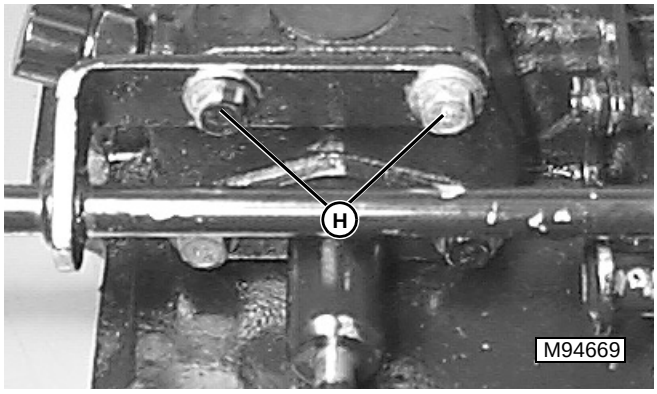
Disassembly:



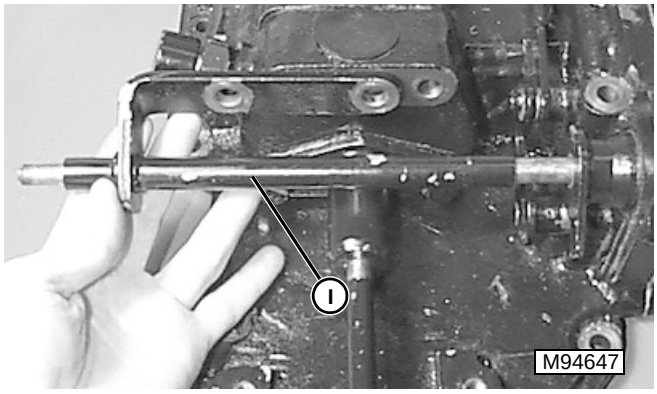
1. Remove two lock nuts (A), four washers (B) and two cap screws (C) that retain control lever to lever arm (D). Remove control lever.



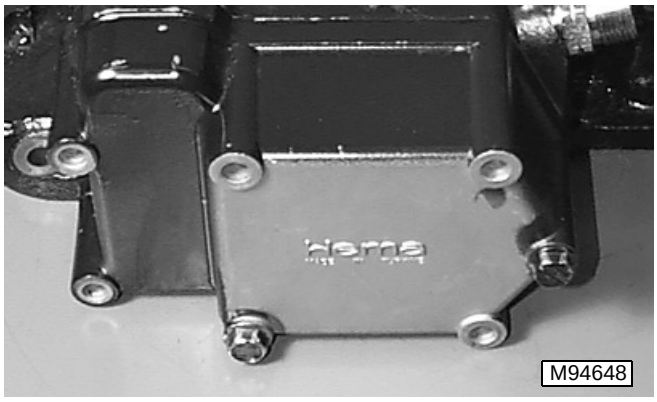
2. Remove lock nut (E), lever arm(D), four belleville washers(F), and one flat washer (G).



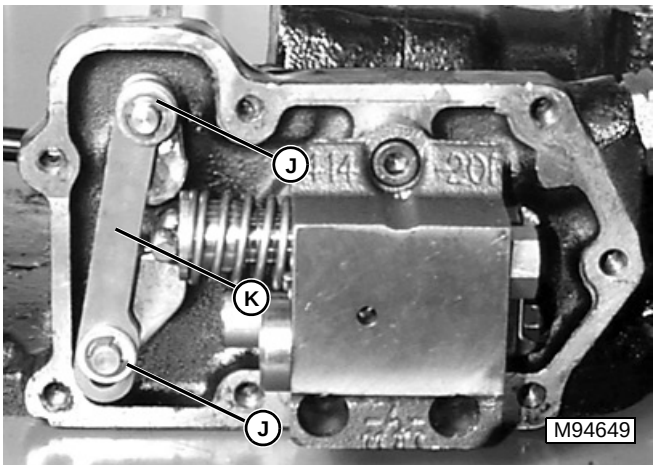
3. Remove two cap screws (H).



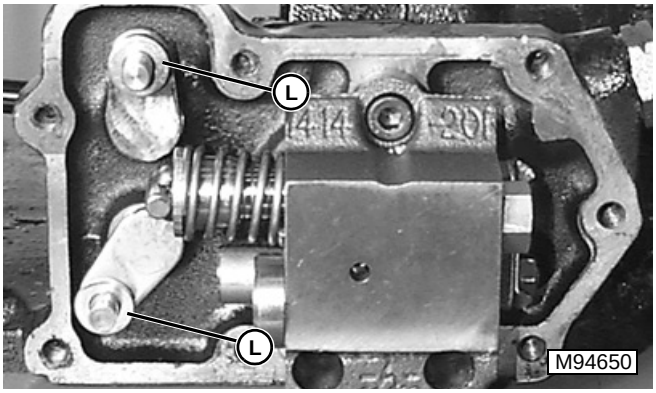
4. Remove shaft support tube (I).



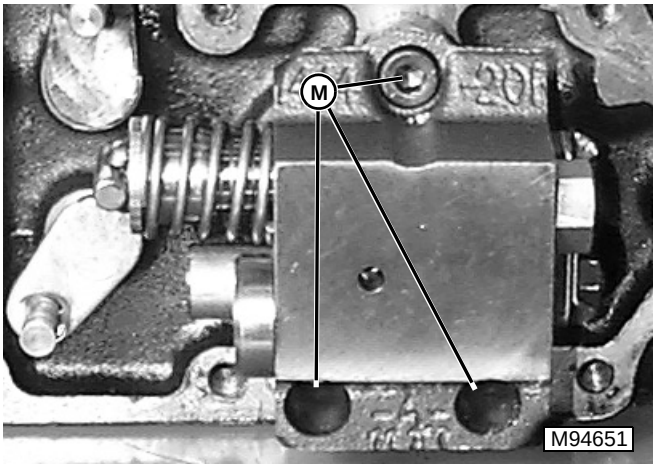
5. Remove two remaining cap screws and rockshaft valve cover.



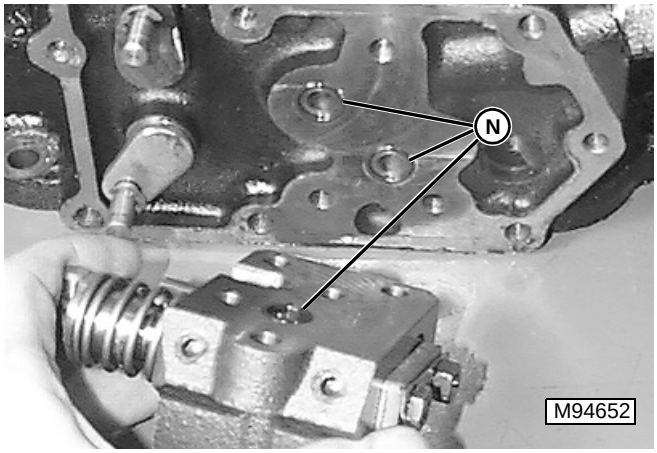
6. Remove two snap rings (J), two flat washers, and link (K).



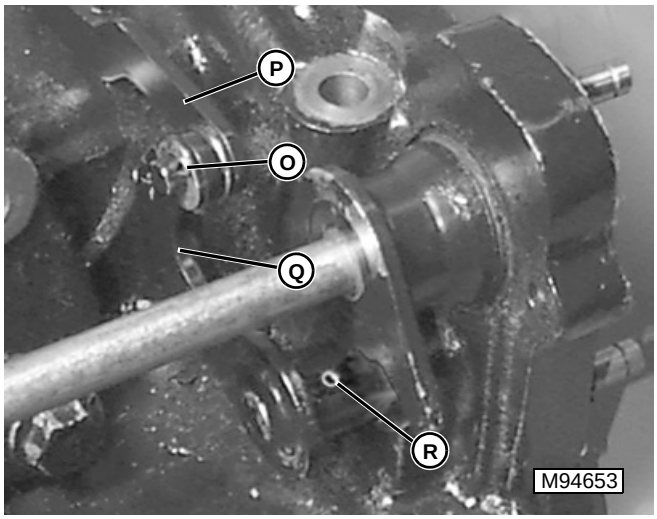
7. Remove two washers (L).



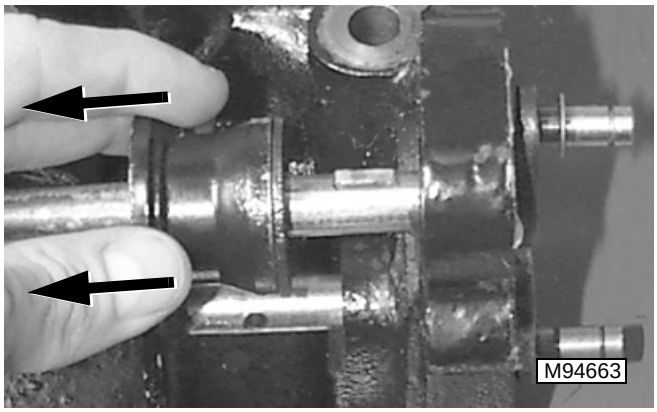
8. Remove three socket head cap screws (M) and rockshaft control valve.



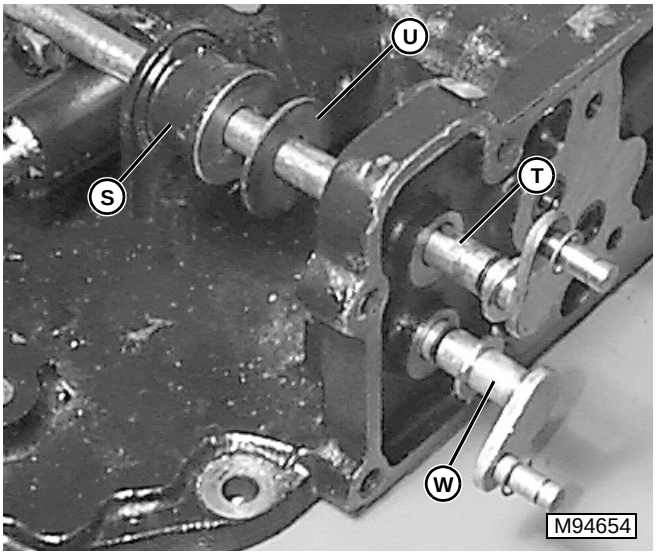
9. Replace three O-rings (N).



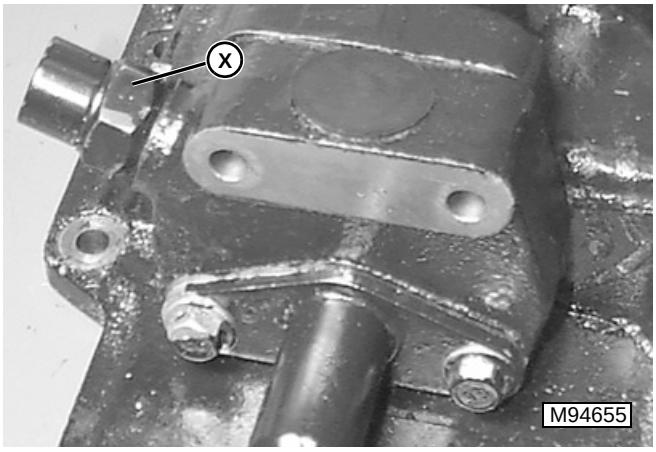
10. Remove cotter pin (O) and washer, and disconnect position feedback rod (P) from feedback lever (Q).
11. Remove spring pin (R), and feedback lever.



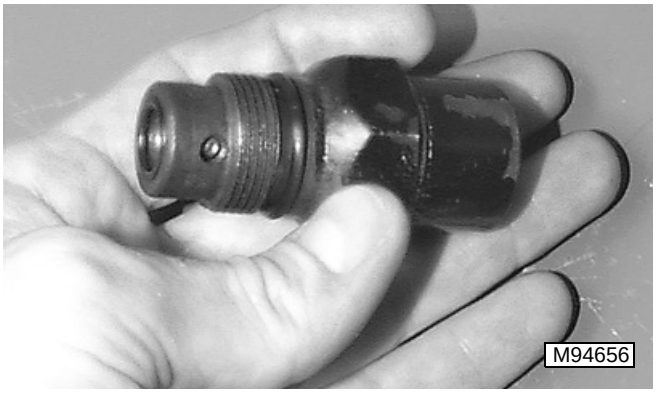
12. Slide limiter (S) away from rockshaft housing. Remove woodruff key.



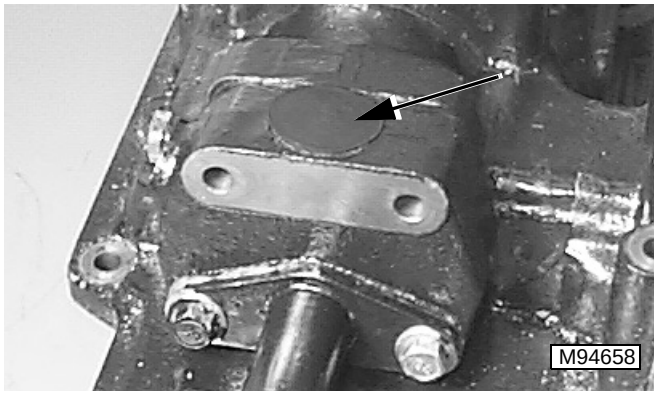
13. Remove lift control shaft (T) from rockshaft housing. Remove limiter (S) and rubber washer (U).
14. Remove position feedback shaft (W) from housing.
15. Replace O-rings on lift control and position feedback shafts.



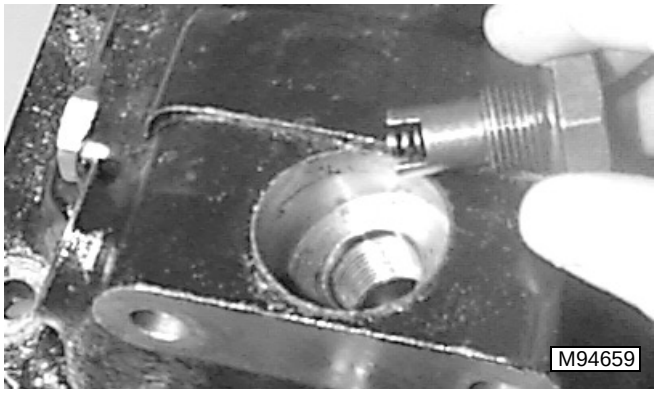
16. Remove relief valve (X).



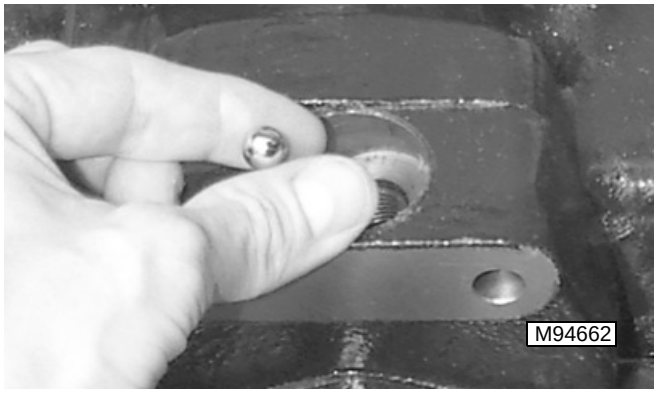
17. Replace two O-rings in relief valve.



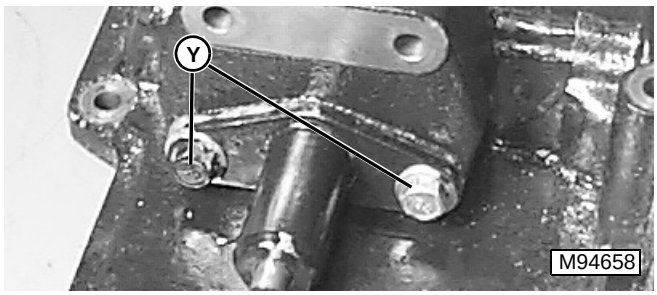
18. Remove plastic cap on top of cylinder head.



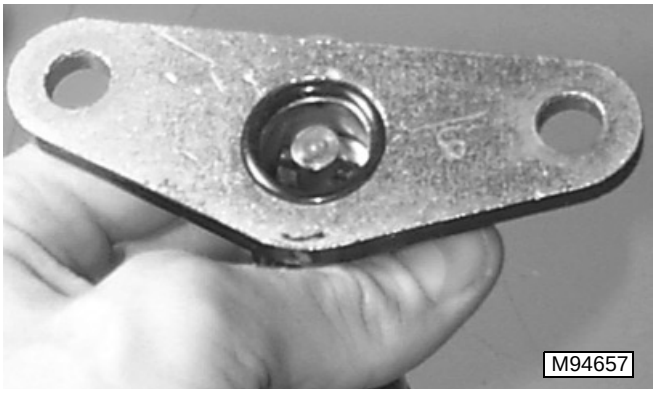
19. Remove plug and spring.



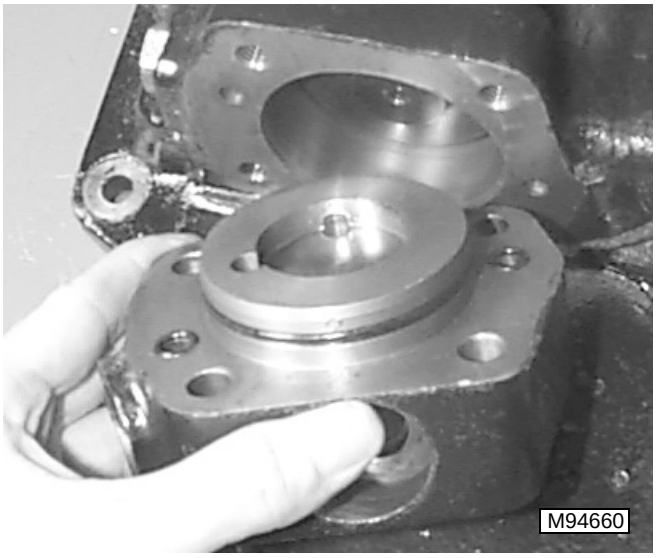
20. Remove ball.



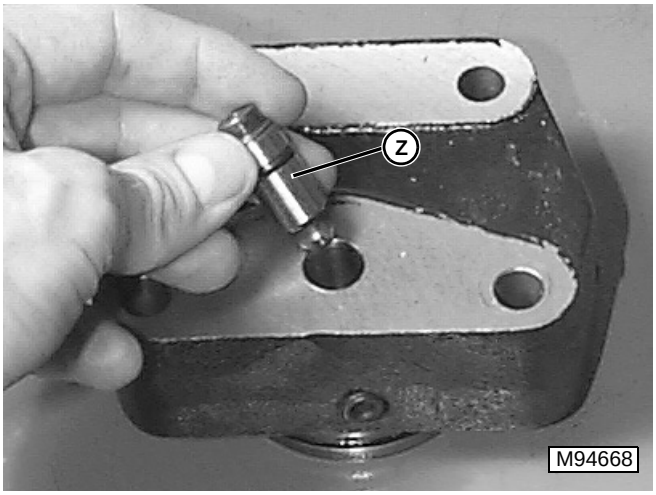
21. Remove two cap screws (Y) and rate of drop/stop valve stem.



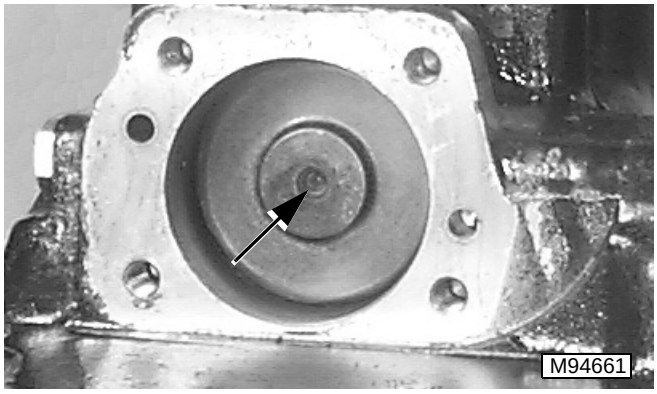
22. Replace O-ring in end of valve stem.



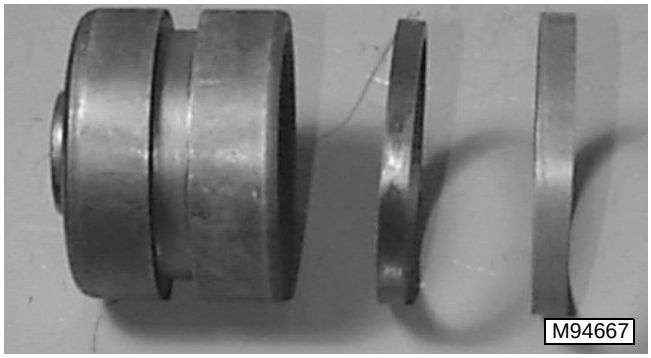
23. Remove cylinder head. Replace O-rings in cylinder head.



24. Remove rate of drop/stop valve spool (Z). Replace O-ring on spool.



25. Place a suitable bolt in threaded hole in end of piston. Remove piston.



26. Replace inner and outer piston rings.

Assembly:

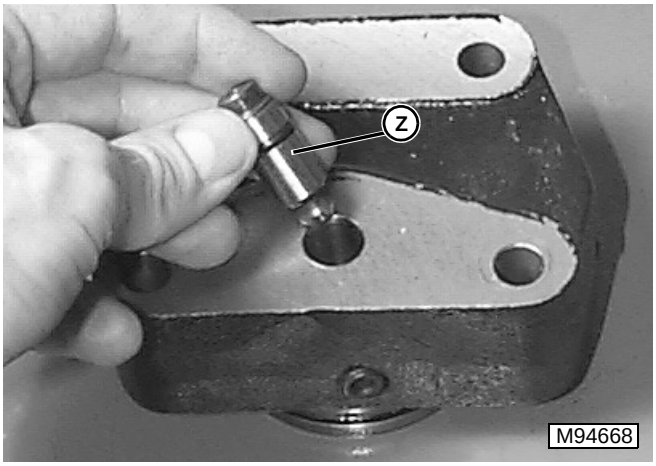
IMPORTANT: Replace all O-rings and seals. Used or damaged O-rings and seals will leak.

NOTE: When assembling, DO NOT lubricate belleville washers or lift control lever friction surfaces.

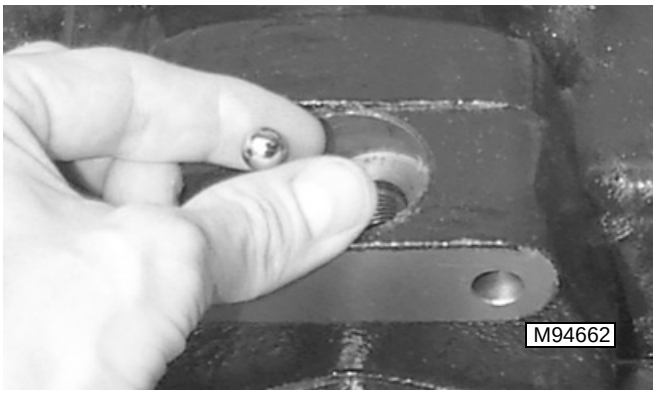
1. Install a new inner and outer piston rings.

IMPORTANT: Use care when installing piston into cylinder bore to prevent damage to piston rings. Be sure piston rings are centered in cylinder bore and properly seated in piston ring groove during installation.

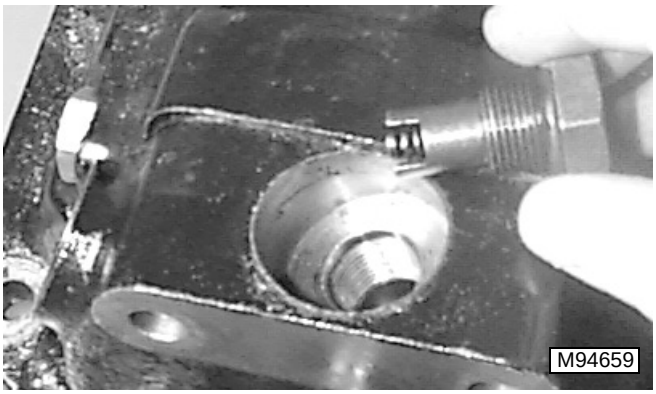
2. Lubricate piston and rings liberally with hydraulic oil. Using a plastic mallet, install piston into cylinder bore.
3. Install new O-rings into cylinder head.
4. Install cylinder head into cylinder bore. Retain with two lower cap screws. Tighten cap screws to **80 N•m (60 lb-ft)**.



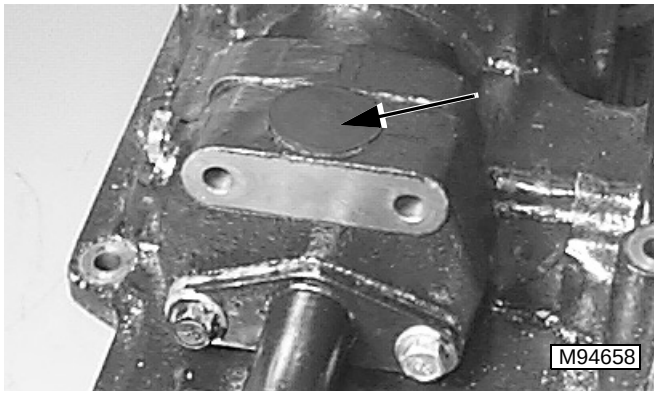
5. Install a new O-ring onto rate of drop/stop valve spool (Z). Install rate of drop/stop valve spool into bore in cylinder head.
6. Install a new O-ring into end of rate of drop/stop valve stem. Install rate of drop/stop valve stem onto cylinder head and retain with two cap screws.



7. Install ball.

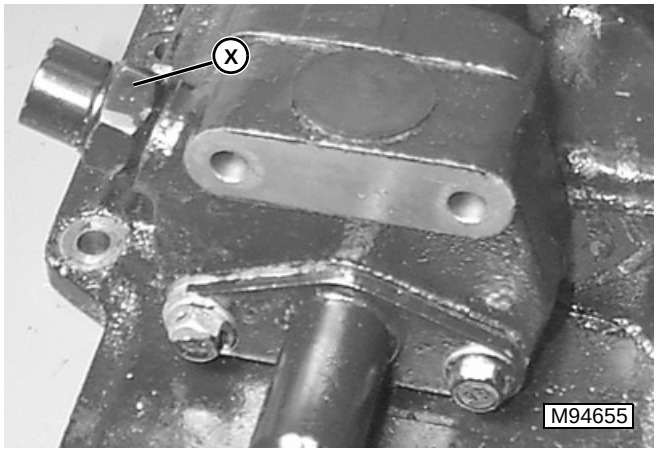


8. Install plug and spring.

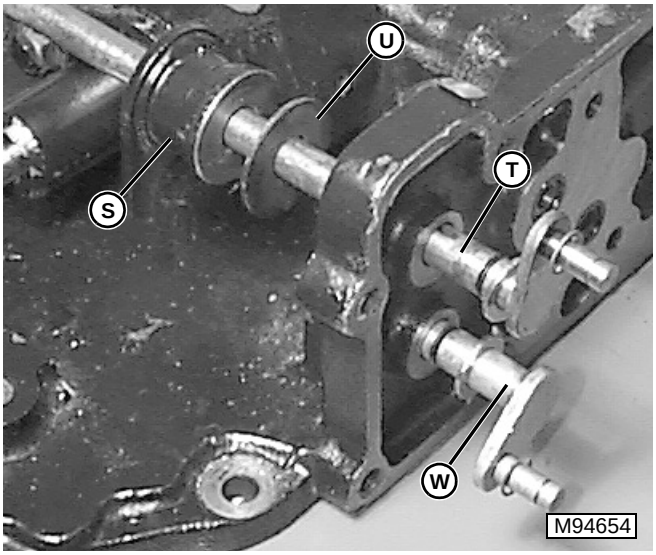


9. Install plastic cap on top of cylinder head.

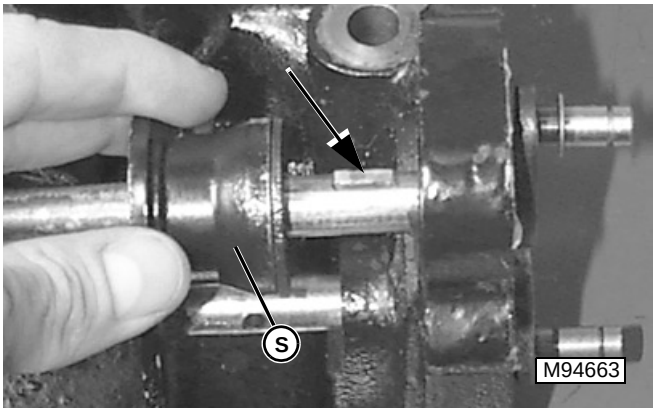
10. Install two new O-rings in relief valve.



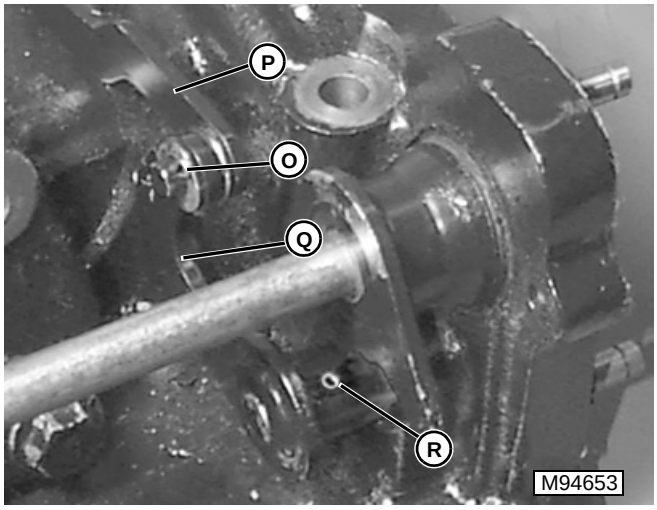
11. Install relief valve (X). Tighten to **50 N•m (37 lb-ft)**.



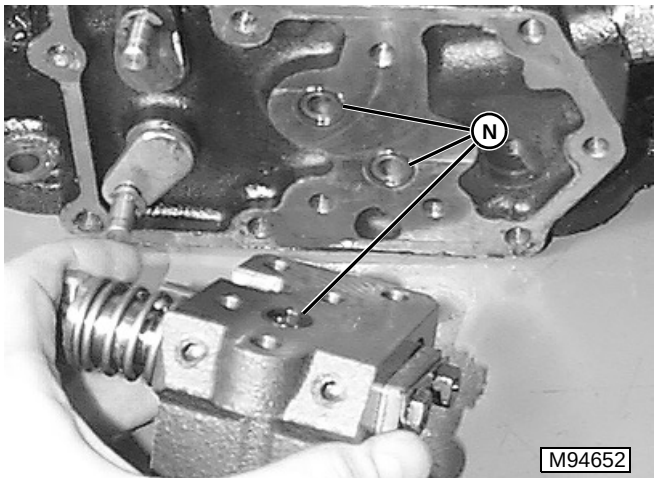
12. If removed, install washers onto lift control (T) and position feedback (W) shafts.
13. If removed, install snap rings onto lift control and position feedback shafts.
14. Install new O-rings onto lift control and position feedback shafts.
15. Install lift control shaft into rockshaft housing. Install rubber washer (U) and limiter (S) onto shaft.
16. Install position feedback shaft into housing.



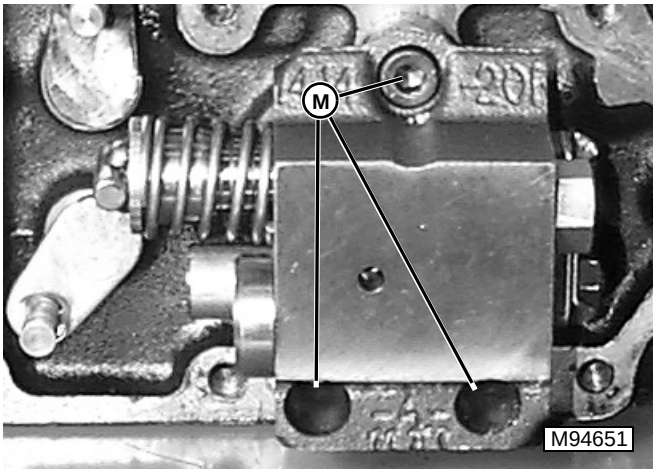
17. Install woodruff key into shaft. Slide limiter over woodruff key and against rockshaft housing.



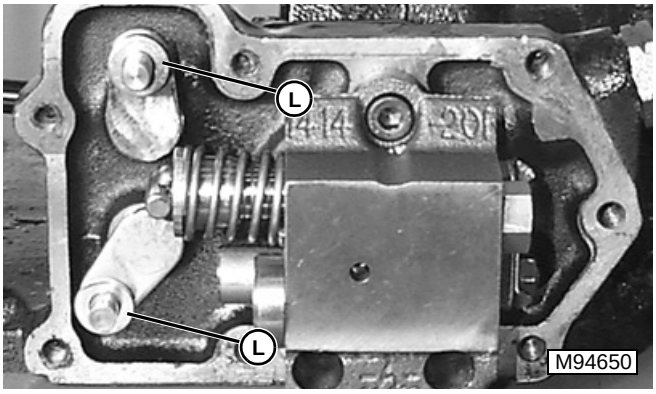
18. Install feedback lever (Q) onto feedback shaft. Retain with spring pin (R).
19. Connect position feedback rod (P) to position feedback lever. Retain with washer and cotter pin (O).



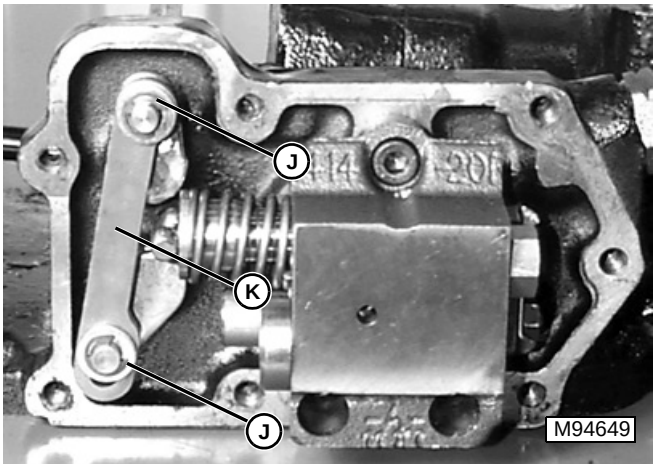
20. Install new O-rings (N) into rockshaft control valve and rockshaft housing at rockshaft valve mounting surface.



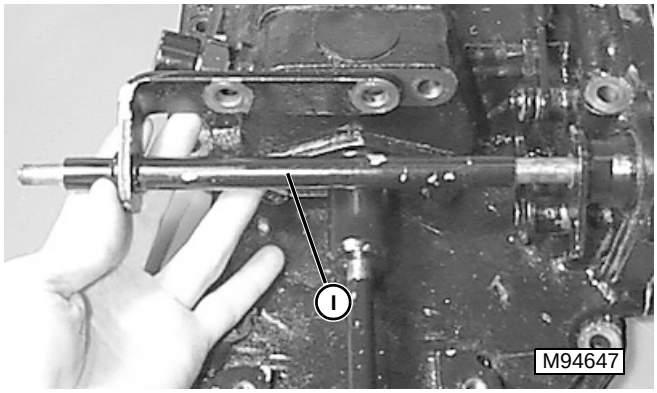
21. Install rockshaft control valve and retain with three socket head cap screws (M). Tighten cap screws to **47 N•m (35 lb-ft)**.



22. Install two washers (L).



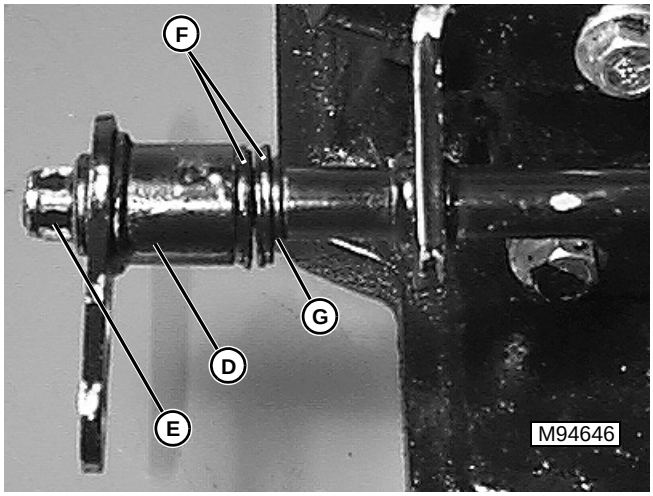
23. Install link (K). Retain with two flat washers, and two snap rings (J).



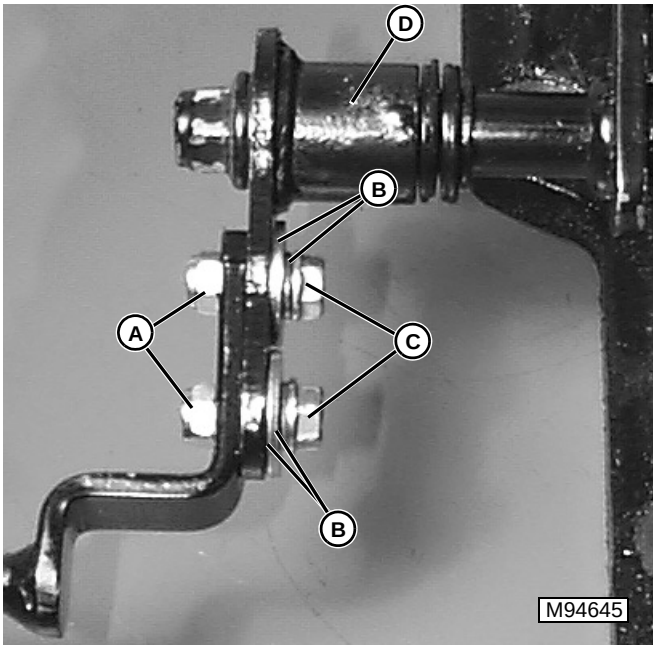
24. Install shaft support tube (I) onto lift control shaft and retain with two cap screws. Tighten cap screws to **80 N•m (60 lb-ft)**.

IMPORTANT: Make sure that Belleville washers are correctly installed with cupped sides of each pair of washers facing each other.

NOTE: Lever arm should be installed so that when the lever if in the full forward (down) position, the lever arm is parallel to the ground.



25. Install washer (G), four belleville washers (F), and lever arm (D) to shaft. Retain with lock nut (E).



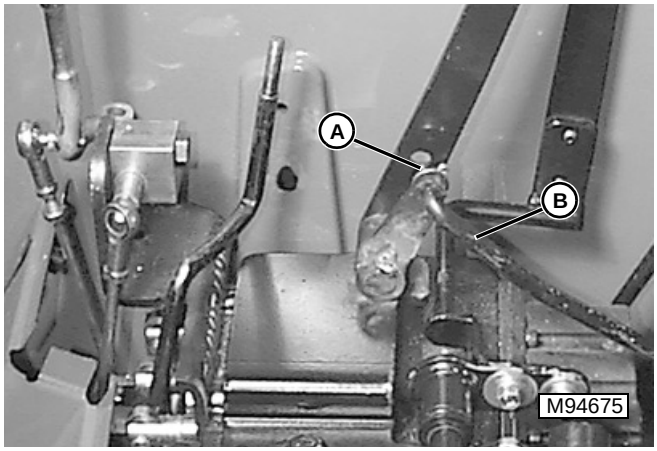
26. Install control lever to lever arm. Retain with two cap screws (C), four washers (B), and two lock nuts (A).

SELECTIVE CONTROL VALVE REMOVAL AND INSTALLATION

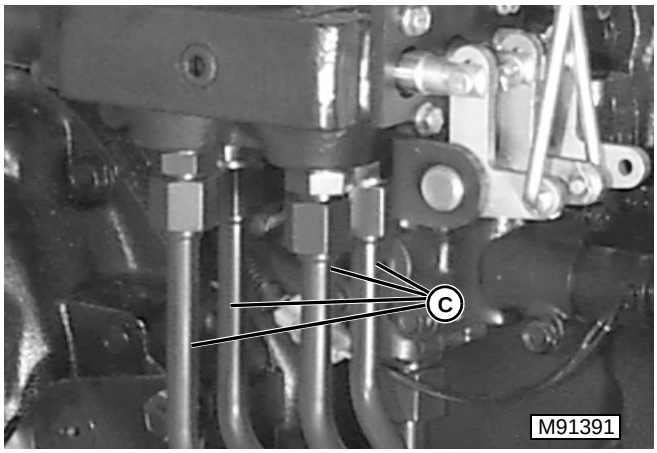
NOTE: Tractor may be equipped with a manifold block instead of an SCV. Removal and installation of this block is basically the same as that of the SCV.

Removal:

1. Remove seat and seat support. (See "SEAT AND SEAT SUPPORT") in Miscellaneous section.)
2. Disconnect electrical connector from hazard light switch.
3. If equipped, remove mid PTO control knob.
4. Remove SCV control knob, rockshaft control knob, and PTO control knob.
5. Remove 5 cap screws and right closeout panel from SCV and rockshaft lift control levers.
6. Remove gear shift knob. Remove four cap screws and left closeout panel from gear shift levers.
7. Remove two cap screws securing closeout panel at front of seat to kick plate. Remove closeout panel.
8. Under fenders, locate front cap screw that secures fenders to seat support angle. Remove two cap screws and seat support angle.

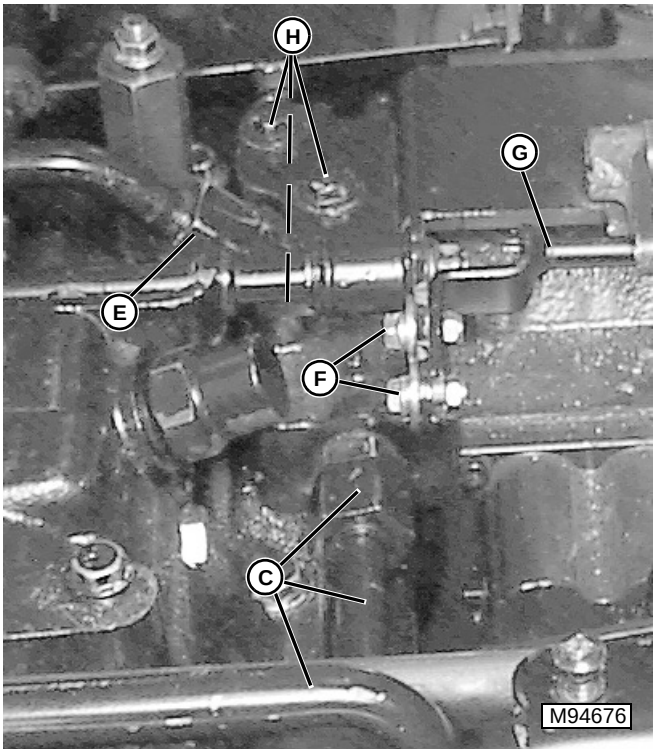


9. Remove cotter pin (A) and washer securing PTO link (B) to PTO lever. Move link clear of SCV.



NOTE: Wheel, tire, and fender removed for clarity.

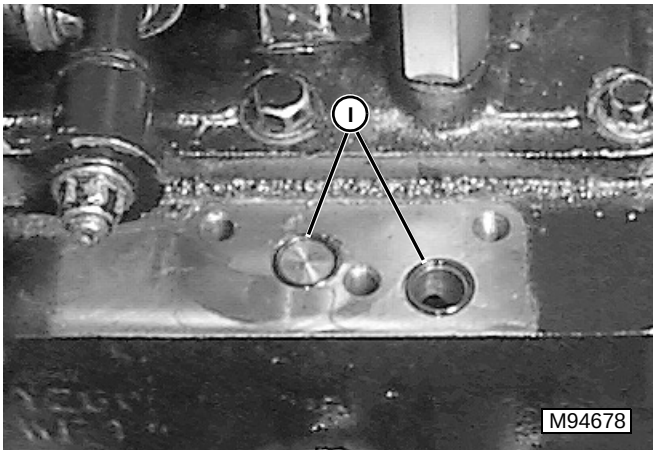
10. Disconnect four tubes (C) from bottom of SCV.



11. Remove J-shaped tube (D) from SCV to rockshaft housing.
12. Disconnect SCV pressure tube (E).
13. Remove two cap screws (F), two lock nuts, and four washers. Remove rockshaft control lever (G).

NOTE: On tractors equipped with mid PTO, it may be necessary to remove mid PTO control shaft before SCV can be removed.

14. Remove three cap screws (H) securing SCV and PTO lever bracket to final drive housing. Remove PTO lever bracket and SCV.



15. Replace two O-rings (I) between final drive housing and SCV.

Installation:

IMPORTANT: Replace all O-rings and seals. Used or damaged O-rings and seals will leak.

Installation is the reverse of removal.

- Tighten ends of J-shaped tube to **81 - 89 N•m (60 - 67 lb-ft).**
- Tighten SCV work port tube ends to **51 - 57 N•m (38 - 42 lb-ft).**

SELECTIVE CONTROL VALVE DISASSEMBLY, INSPECTION, & ASSEMBLY

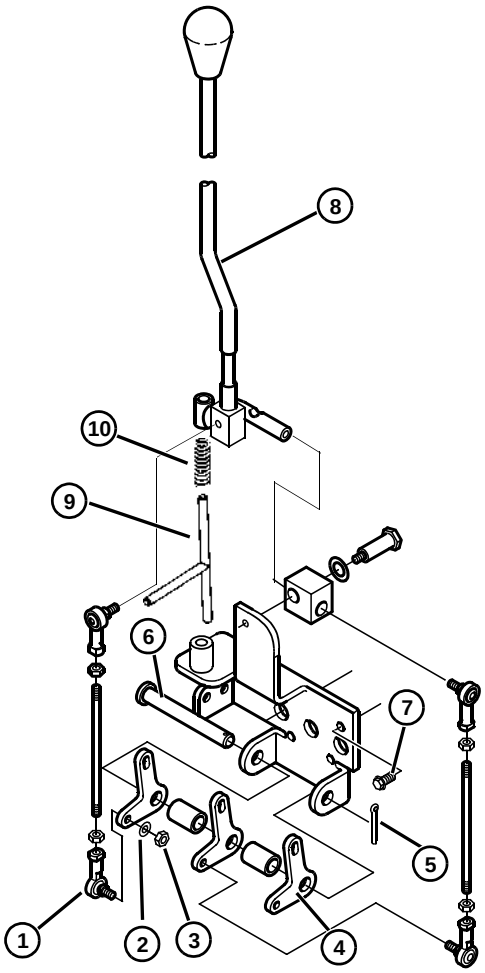
Disassembly, Inspection, and Assembly

NOTE: Some internal components of SCV are NOT serviceable. If SCV internal components are excessively worn or damaged, check for availability of kits.

1. Remove control valve shift linkage.

NOTE: SCV control linkage may be either a single lock model or a multi-lock model.

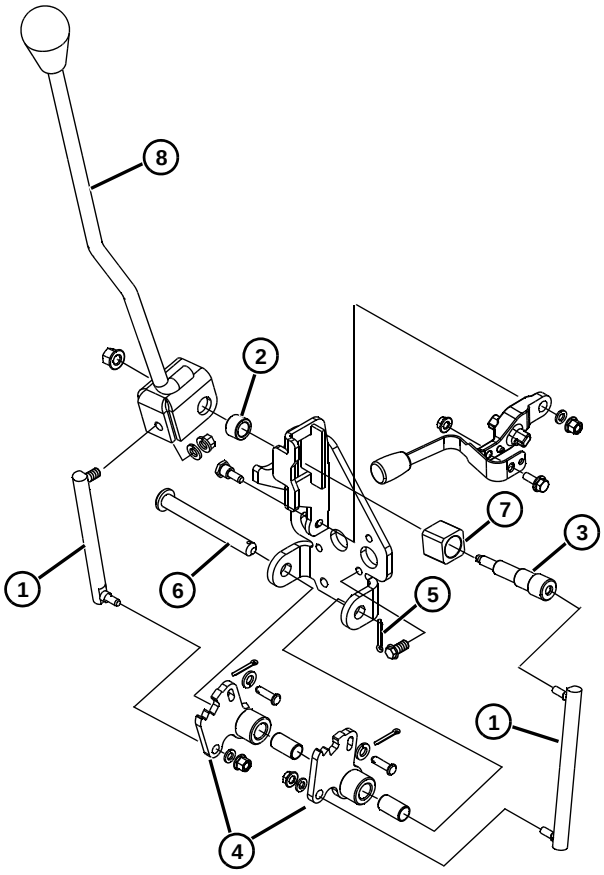
Single Lock Control Removal:



1. Ball Joints
2. Washer
3. Nut
4. Bellcrank
5. Cotter Pin
6. Pin
7. Cap Screw
8. Lever
9. Lock Lever
10. Spring

1. Remove nuts and washers securing ball joints to bellcranks.
2. Remove four cap screws retaining lever assembly to valve body. Remove lever assembly.

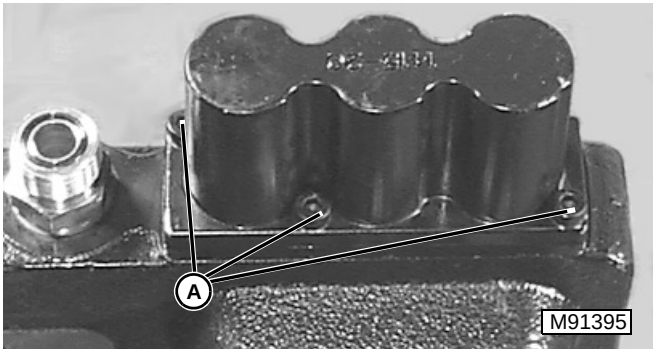
Multi-Lock Control Removal:



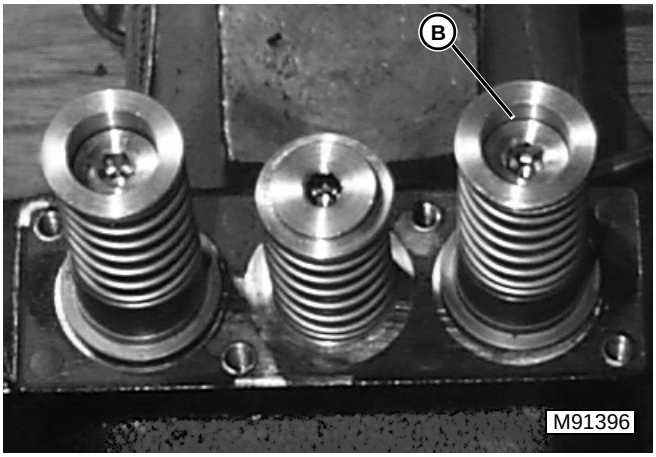
1. Link Rod
2. Spacer
3. Pin
4. Bellcrank
5. Cotter Pin
6. Pin
7. Guide Bar
8. Lever

1. Remove nuts and washers securing link rods to bellcranks.
2. Remove four cap screws retaining lever assembly to valve body. Remove lever assembly.

SCV Disassembly:

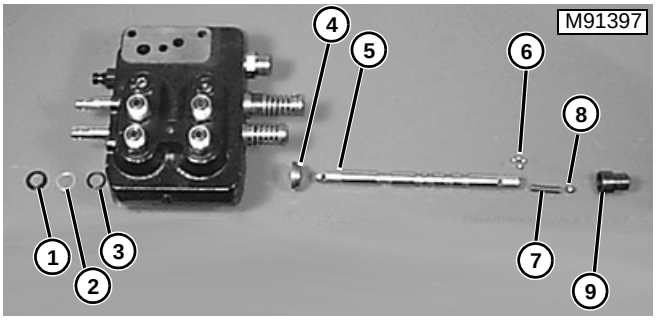


1. Remove four socket head cap screws (A) on end cover. Remove end cover. Replace end cover gasket.



NOTE: Valve spools are similar. Center valve section does NOT contain a detent assembly.

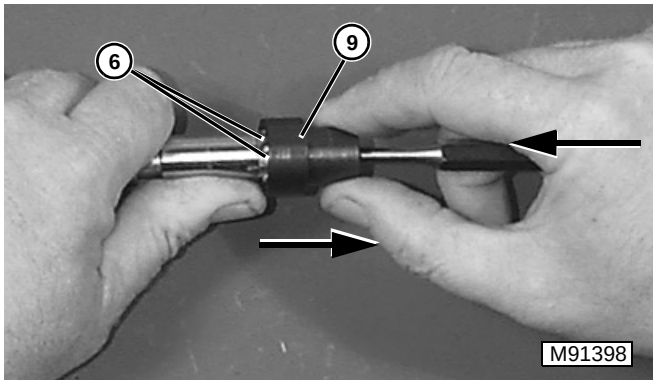
2. Hold spring slightly compressed and remove spring retainer plug (B) and valve spring retainer. Remove spring.



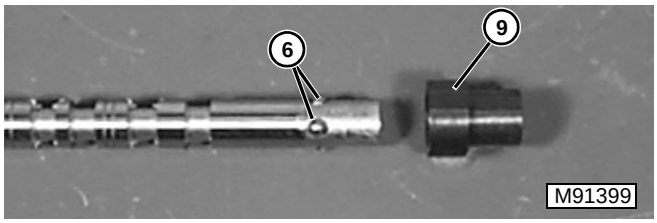
1. Seal
2. Washer
3. O-ring
4. Spacer
5. Spool
6. Small Balls
7. Spring
8. Ball
9. Detent Cap

NOTE: Use care when removing valve spool and detent assembly from valve body. Detent cap may come off, and balls may fall out and be lost. Push valve spool out from lever side to remove.

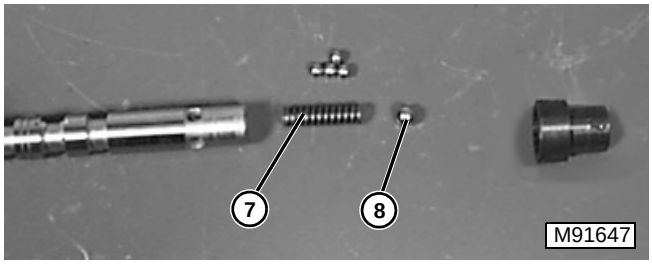
3. Slide spool with detent assembly out of valve body.
4. Inspect spool and valve body for signs of wear or damage. If worn or damaged, replace entire selective control valve assembly.
5. Remove spacer from spool.
6. Remove seal, backing washer, and O-ring from valve body. Replace O-ring and seal.



7. Remove detent cap (9) by inserting a suitable pin punch into the threaded hole and pressing inward to release spring tension on balls (6). Slide detent cap off end of spool.



8. Remove detent cap.
9. Remove four small balls.

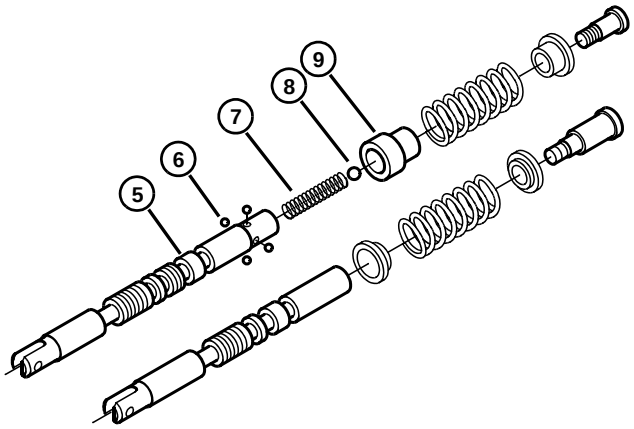


10. Remove larger ball (8), and spring (7).

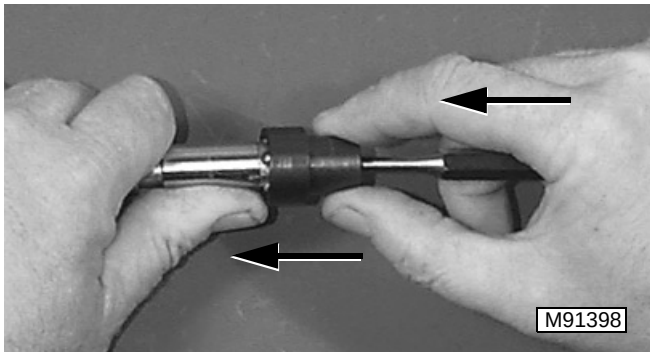
Valve Spools Assembly:

IMPORTANT: Replace all O-rings and seals. Used or damaged O-rings and seals will leak.

1. Install spring and ball into end of valve spool.



2. Apply a small amount of general purpose grease into the holes for the small balls (6) on the valve spool.
3. Insert four small balls into holes in valve spool.
4. Slide detent cap (9) over end of valve spool. *Do not slide over balls at this time.*



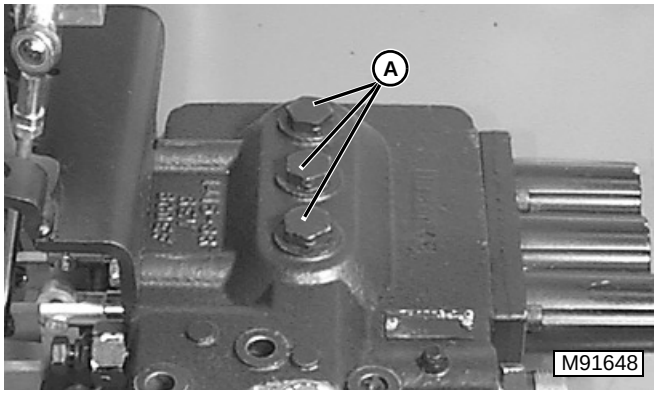
5. Using a suitable pin punch, press on the ball in the end of the spool to slightly compress the spring. Slide detent cap over four small balls.

NOTE: When properly installed, the four small balls will retain the larger ball, and maintain spring pressure on the larger ball.

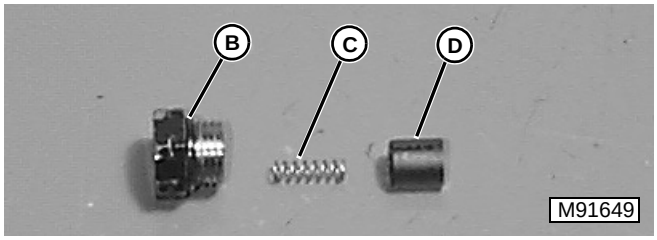
6. Install spacer onto spool.
7. slide spool into valve body.
8. Install O-ring, backing washer, and seal into valve body.
9. Install spring, spring retainer, and valve spring retainer plug. Tighten plug to **15 N•m (133 lb-in.)**.
10. Install end cover. Retain with four socket head cap screws. Tighten cap screws to **19 N•m (14.5 lb-ft)**.
11. Install lever assembly. Retain with four cap screws. Tighten cap screws to **40 N•m (30 lb-ft)**.

Load Check Valves:

Removal:



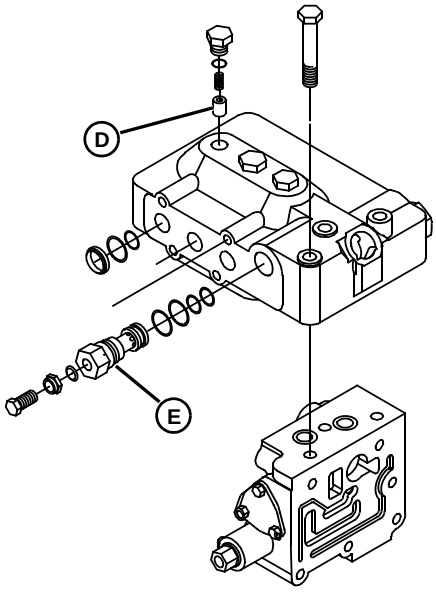
1. Remove valves (A).



2. Replace O-ring (B).
3. Inspect spring (C) and valve poppet (D) for wear or damage. Replace if necessary.

Installation:

Installation is the reverse of removal.

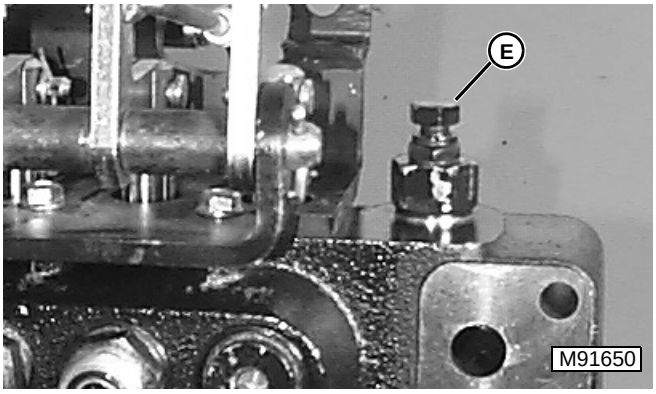


IMPORTANT: Replace all O-rings and seals. Used or damaged O-rings and seals will leak.

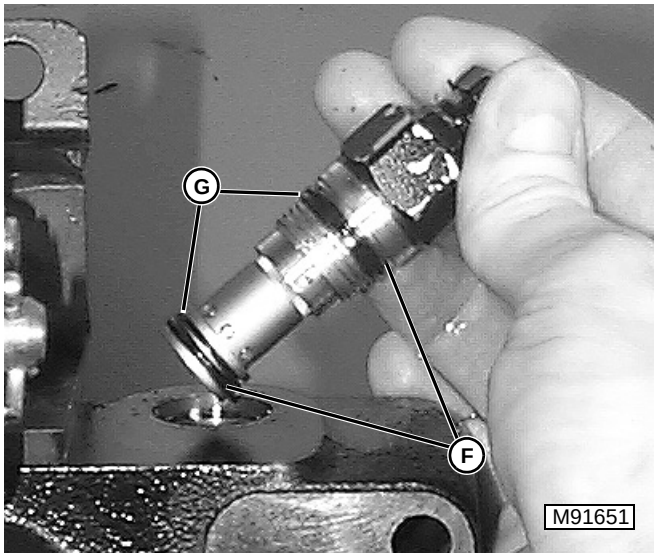
- Tighten check valve to **24 N•m (18 lb-ft)**.

Relief Valve:

Removal:



1. Remove valve (E).



2. Replace O-rings (F) and backing washers (G).
3. Inspect valve for wear or damage. Replace if necessary.

Installation:

Installation is the reverse of removal.

IMPORTANT: Replace all O-rings and seals. Used or damaged O-rings and seals will leak.

- Tighten relief valve to **50 N•m (37 lb-ft)**.

NOTE: If replacement of relief valve was necessary, or if relief valve setting was changed, perform SCV pressure relief valve adjustment. (See "SYSTEM PRESSURE ADJUSTMENT").

CONTENTS

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SPECIFICATIONS

TORQUE SPECIFICATIONS

Wheel Mounting Bolts:
- Front and Rear Wheel Mounting Bolts . . . . . 122 N•m (90 lb-ft)
- Front wheels (Model 4200 Equipped With 4.0 x 15 F2 Ribbed Tires) 68 N•m (50 lb-ft)
- Front Wheels (Model 4300 Equipped With 5.0 x 15 F2 Ribbed Tires) 68 N•m (50 lb-ft)

Wheel Disc-to-Rim Mounting Bolts . . . . . 122 N•m (90 lb-ft)

Steering Wheel Nut . . . . . 39 - 49 N•m (29 - 36 lb-ft)

Center Link Bracket Cap Screws. . . . . 150 N•m (110 lb-ft)

Center Link Spring Holder . . . . . 95 N•m (70 lb-ft)

ROPS Attaching Hardware . . . . . 340 N•m (250 lb-ft)

FRONT PTO SPECIFICATIONS

Drive Shaft Greasing Interval . . . . . 25 Hours

Gear Box Oil Change Interval . . . . . 500 Hours

Front PTO Speed (At 2700 Engine RPM) . . . . . 2100 rpm

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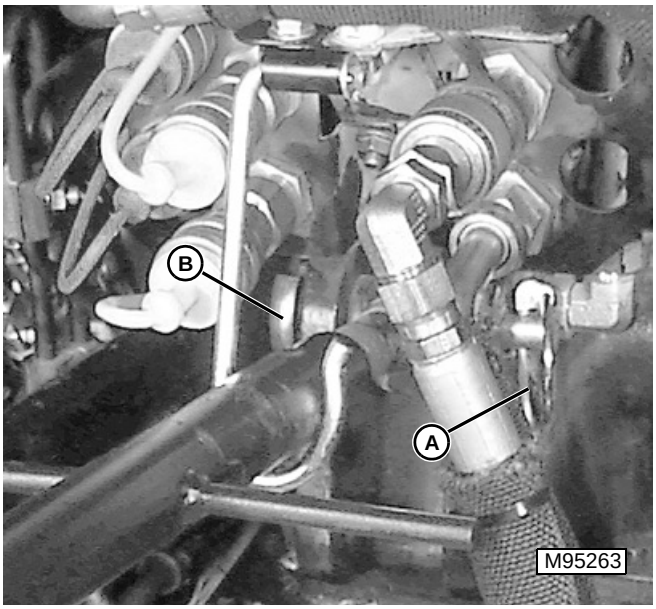
REPAIR

THREE POINT HITCH

Center Lift Link Removal:

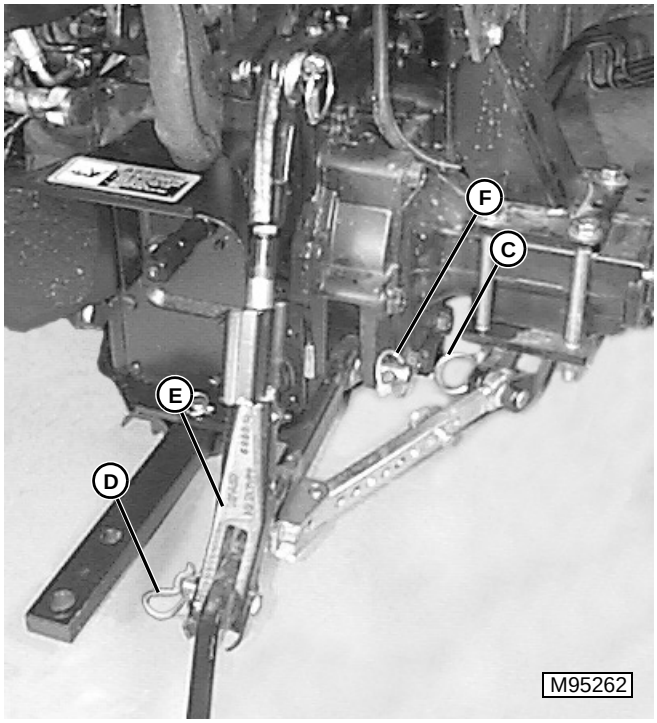


1. Disconnect center lift link from storage hook.
2. Remove lynch pin (A) from hitch pin attaching center lift link to bracket on rockshaft.
3. Support center lift link and remove hitch pin (B). Remove center lift link.

Installation:

Installation is the reverse of removal.

Draft Arm & Adjustable Sway Bar Removal:



1. Remove spring clip (C) from clevis pin on front of adjustable sway bar. Remove clevis pin.
2. Remove spring pin (D) from hitch pin on bottom of adjustable lift link (E).
3. Support draft arm and adjustable sway bar and remove hitch pin and two retainers.
4. Remove lynch pin (F) from anchor pin at front of draft arm.
5. Remove adjustable sway bar and draft arm.

Installation:

Installation is the reverse of removal.

Adjustable (RH) and Fixed (LH) Lift Link Removal:

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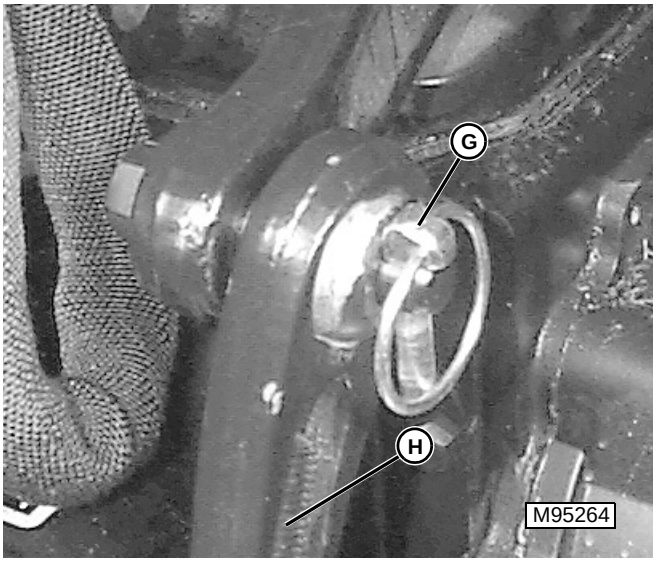


1. Remove lynch pin (G) from rockshaft at top of lift link (H).
2. Remove lift link.

Installation:

Installation is the reverse of removal.

SEAT AND SEAT SUPPORT

Removal:

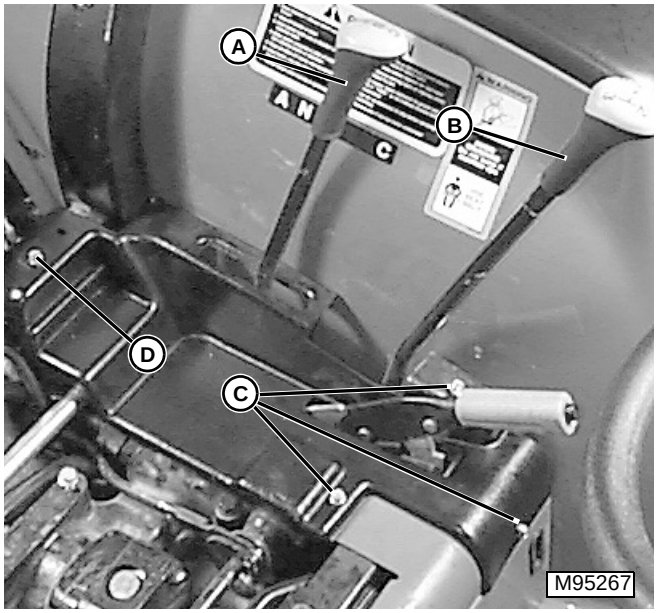
1. Disconnect seat switch electrical connector.
2. Remove two cap screws at rear of seat support attaching seat support to tractor frame.
3. Remove two nuts at front of seat support attaching seat support to operators platform and standoffs.
4. Remove seat and seat support from tractor as an assembly.

Installation:

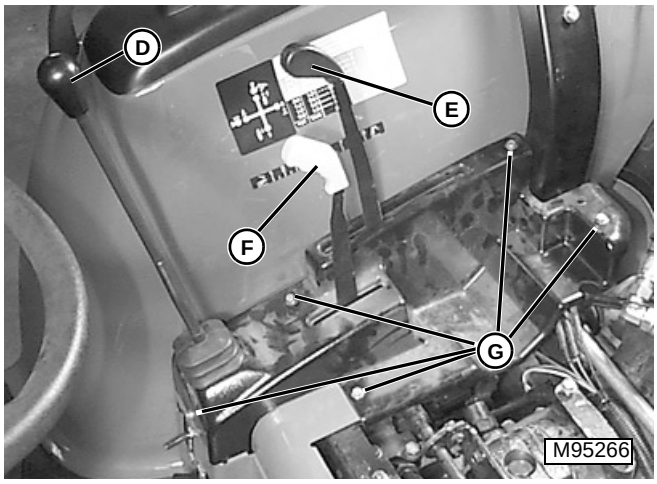
Installation is the reverse of removal.

SEAT CLOSE OUT PANELS

Removal:



1. Remove cap on range shift knob (A) to left of seat. Remove cap screw and knob.
2. (Collar Shift or SyncReverser Tractor) Repeat step 1 and remove gear shift knob (B).
3. If equipped, unscrew and remove 4-WD T-handle knob.
4. Remove cap screws (C) securing shift lever gate and remove gate.



5. Unscrew SCV control knob (D) and remove.
6. Remove rockshaft control knob (E).
7. Remove PTO control knob (F).
8. Remove cap screws (G) securing SCV/rockshaft control lever gate and remove gate.
9. Remove seat. (See "SEAT AND SEAT SUPPORT").

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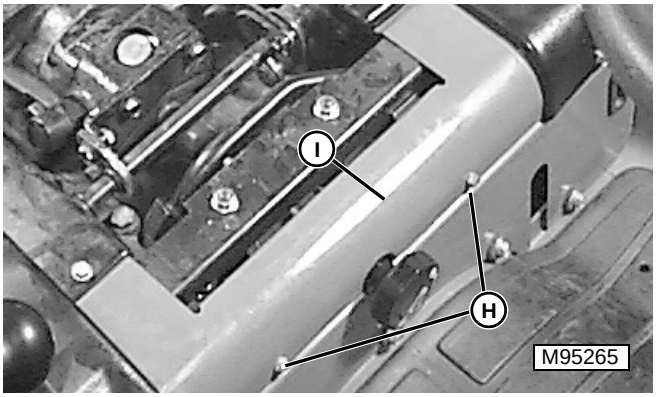


10. Remove two cap screws (H) and seat closeout panel (I).

Installation:

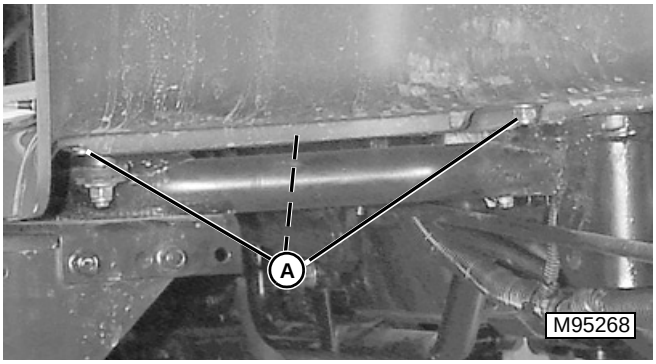
Installation is the reverse of removal.

NOTE: If removed, install rear wheel fenders before installing seat platform.

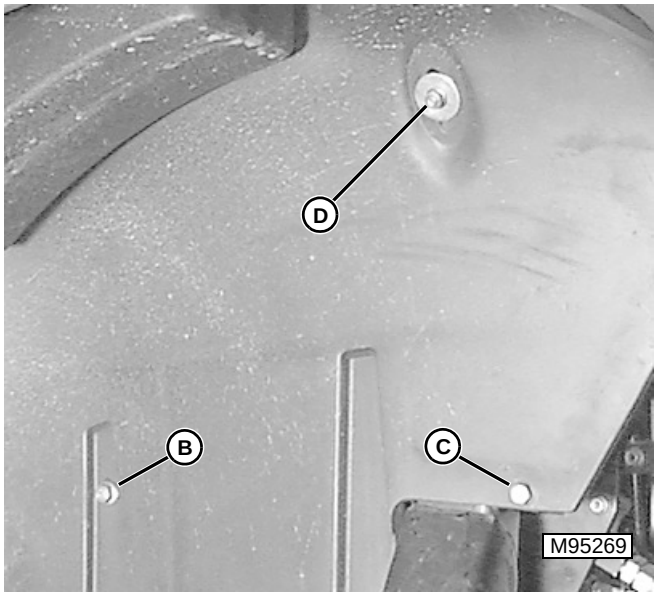
REAR FENDERS

NOTE: The following procedure is for either LH or RH fender.
If tractor is equipped with an auxiliary SCV, disconnect two control cables at valve before removing RH fender.

Removal:



1. Remove three lock nuts (A) and carriage bolts securing fender to operator's platform.



2. Remove front cap screw (B) securing fender to seat support angle.
3. Remove cap screw (C) securing fender to ROPS.

IMPORTANT: It may be necessary for an assistant to support the fender when removing the cap screws securing it to the ROPS.

4. Support fender and remove nut (D) and washer securing fender to ROPS. Remove fender.

Installation:

Installation is the reverse of removal.

ROLL OVER PROTECTIVE STRUCTURE (ROPS)

Removal:

1. Remove rear wheels and tires. (See "REAR WHEELS").
2. Remove seat and seat support. (See "SEAT AND SEAT SUPPORT").
3. Remove rear fenders. (See "REAR FENDERS").
4. Remove seat close out panels. (See "SEAT CLOSE OUT PANELS").
5. Disconnect wiring harness electrical connectors from wiring inside roll bar (warning light connectors, work light connectors, tail light connectors).

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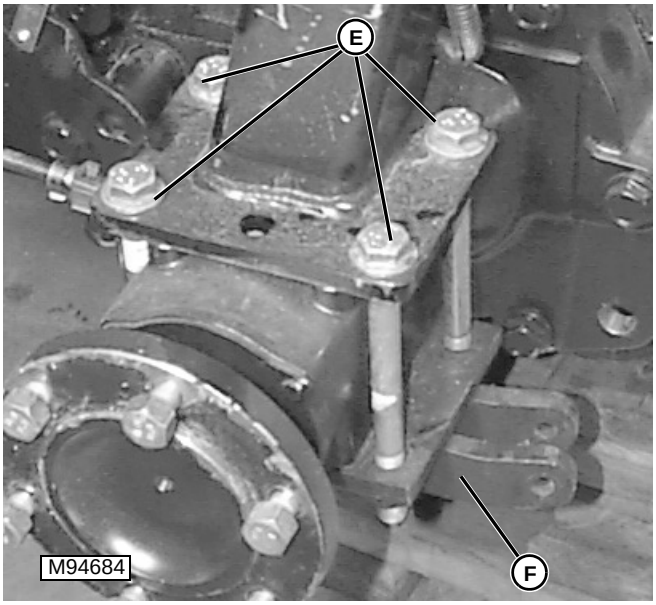
⚠ CAUTION

The approximate weight of the ROPS is 57 kg (125 lb). Do not attempt to remove ROPS without an assistant or overhead crane.



6. If equipped, remove cap screw and nut securing ROPS to auxiliary SCV bracket.
7. Remove four cap screws (E) and nuts securing ROPS to support plates (F) on underside of rear axle.
8. Lift ROPS to clear tractor, and remove.

Installation:

Installation is the reverse of removal.

- Tighten hardware to specifications:

Torque Specifications:

ROPS Mounting Cap Screws to Nuts . . . . . .340 N•m (250 lb-ft)

FRONT WHEELS

Removal:

1. Loosen lug nuts slightly before raising tractor front axle.
2. Raise front of tractor and lower onto support stands so that tractor is supported by front axle.

NOTE: If the front wheels are being removed to perform work on the front axles, lower tractor onto suitable stands that will support the tractor by the frame.

3. Remove lug bolts and wheel.

Installation:

1. Install wheel onto axle, insert lug bolts and lightly tighten bolts.
2. Raise front of tractor, remove support stands and lower tractor to floor.
3. Tighten lug bolts to following specification:

Specifications:

Lug Bolt Torque . . . . . .122 N•m (90 lb-ft)
4200 with 4.0x15 F2 Ribbed Tires. . 68 N•m (50 lb-ft)
4300 with 5.0x15 F2 Ribbed Tires. . 68 N•m (50 lb-ft)

REAR WHEELS

IMPORTANT: If both rear wheels are to be removed, support the tractor frame in a manner that will prevent the frame from pivoting on the front axle.

Removal:

1. Loosen lug bolts slightly before raising tractor rear axle.
2. Raise rear of tractor and lower onto support stands so that tractor is supported by rear axle.

NOTE: If the rear wheels are being removed to perform work on the rear axles, lower tractor onto suitable stands that will support the tractor frame.

3. Remove lug bolts and wheel.

Installation:

1. Install wheel onto axle, insert lug bolts and lightly tighten bolts.
2. Raise rear of tractor, remove support stands and lower tractor to floor.
3. Tighten lug bolts to **88 - 108 N•m (65 - 80 lb-ft)**.

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FLOOR MAT

Removal:

1. Remove fuse panel cover. (See "FUSE PANEL COVER").
2. Remove all plastic rivets holding rubber mat to floor plate.

IMPORTANT: (HST Model) Use care when removing floor mat from forward and reverse pedals. It may be necessary to remove pedal pads to prevent damage to floor mat.

3. Lift and remove floor mat.

Installation:

Installation is the reverse of removal.

SIDE PANELS

Removal:

1. Raise hood and support with hood prop latch.
2. Pull out side panel lock clips and turn to release top of panel.
3. Tilt top of side panel out. Lift and remove panel from tractor.

Installation:

1. Position the two tabs on the bottom of the side panel on the wire loops welded to the tractor frame.
2. Lower the side panel into position, making sure the panel lock clips are in the correct position to go through the slots in the top of the side panels.
3. Tilt panel into position and onto lock clips. Pull and turn lock clips to lock panel to tractor. Fold lock clips flat.
4. Close and latch the hood.

KICK PLATE

Removal:

1. Remove rate of drop knob from control shaft at front edge of seat.
2. Remove seat and seat support. (See "SEAT AND SEAT SUPPORT").
3. Remove seat close out panels. (See "SEAT CLOSE OUT PANELS").
4. Remove 5 cap screws through isolators attaching kick plate to operator's platform. Remove kick plate.

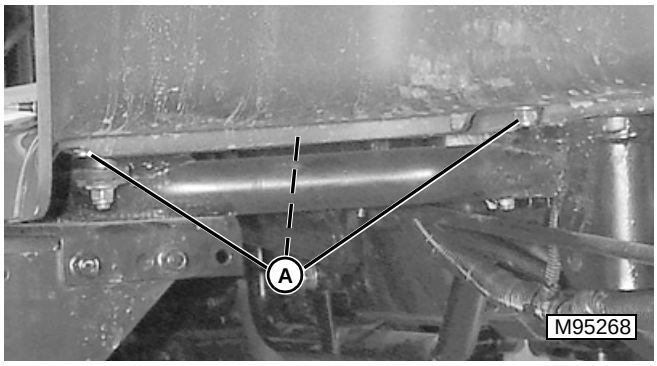
Installation:

Installation is the reverse of removal.

OPERATOR'S PLATFORM

Removal:

1. Remove fuse panel cover (See "FUSE PANEL COVER").
2. Remove floor mat. (See "FLOOR MAT").
3. Remove kick plate (See "KICK PLATE").



NOTE: Wheel and tire removed for clarity.

4. Remove six lock nuts (A) and carriage bolts securing operator's platform to fenders.
5. (HST Model) Remove two nuts and carriage bolts securing forward pedal. Remove pedal. Repeat for reverse pedal.
6. Remove six cap screws, lock nuts, and washers from rubber isolators attaching platform to frame.
7. If equipped, remove cotter pin and washer, and disconnect differential lock rod from pedal. Move pedal toward rear of tractor to clear operator's platform.
8. Lift operator's platform slightly, and slide rearward. Remove operator's platform. Inspect rubber isolators for cracks and deterioration. Replace as necessary.

Installation:

Installation is the reverse of removal.

M

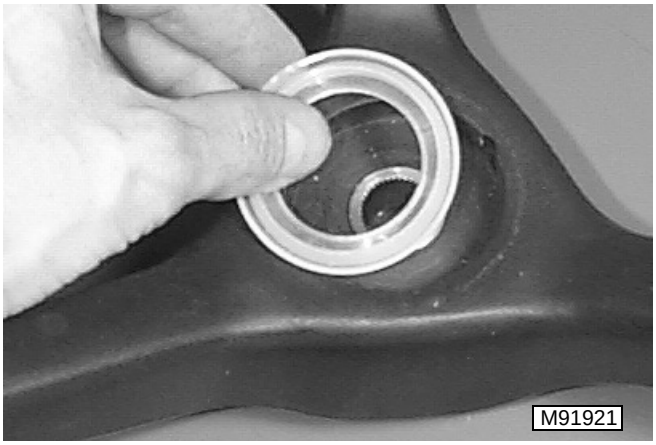
STEERING WHEEL

Removal:

1. Remove steering wheel center cap.
2. Remove lock nut.
3. Remove steering wheel. If necessary, use a suitable puller.

Installation:

NOTE: Lubricate the steering shaft splines with general purpose grease before installing steering wheel.



1. Remove center cap retaining ring from steering wheel.
2. Install steering wheel and retain with nut. Tighten steering wheel nut to **39-49 N•m (29-36 lb-ft)**.
3. Install plastic retaining ring to steering wheel center cap.
4. Install center cap and retaining ring to steering wheel.

CONTROL PANEL

Removal:

1. Disconnect negative (–) battery cable.
2. Remove steering wheel. (See "STEERING WHEEL").
3. Remove throttle control knob.
4. Remove screws securing control panel; lift off the panel.
5. Disconnect all wiring harness connectors to control panel.
6. Remove control panel.

Installation:

Installation is the reverse of removal.

FUSE PANEL COVER

Removal:

1. Remove two cap screws from RH and LH side top edge of cover.
2. Open fuse panel door. Remove two cap screws from top edge of cover inside door.
3. Tilt top of cover towards seat.
4. Lift and remove cover.

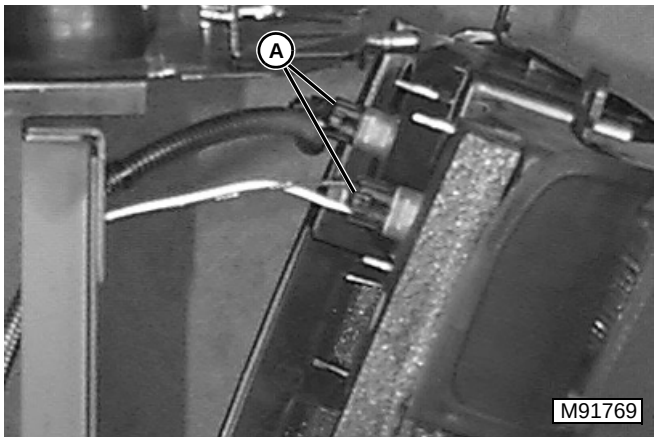
Installation:

Installation is the reverse of removal.

GRILLE

Removal:

1. Open hood and support on hood prop latch.
2. Remove side panels. (See "SIDEPANELS").
3. Pull out 2 panel lock clips at top of grille, and turn to release top of grille.



4. Tilt top of grille forward and disconnect the headlight connectors (A).
5. Lift and remove grille from tractor.

Installation:

1. Slide the bottom of the grille under the battery tray. Insert the locating tabs on the bottom of the grille into the wire loops welded to the tractor frame.
2. Connect the headlights.
3. Tilt grille into position and onto lock clips. Pull and turn lock clips to lock grille to tractor. Fold lock clips flat.
4. Install side panels. (See "SIDE PANELS").
5. Lower the hood.

M

BATTERY

Removal:

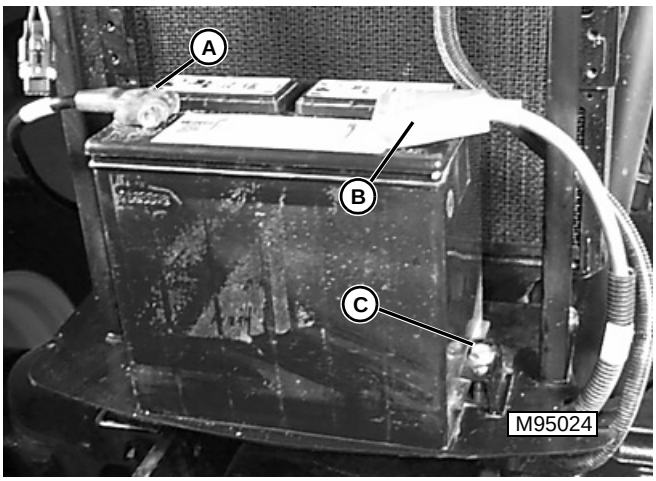
⚠ CAUTION

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

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.

- **Antidotes:**
- **External: Flush with clear water for at least 15 minutes. Call a Physician Immediately.**
- **Internal: Drink large quantities of milk or water. Follow with Milk of Magnesia or Vegetable Oil. Call a Physician Immediately.**
- **Eyes: Force eye open and flush with clear water for at least 15 minutes. Call a Physician Immediately.**
- **Neutralize all Acid spills with a solution of 1 part baking soda to 5 parts water.**

1. Remove grille. (See "GRILLE").



2. Disconnect negative (–) battery cable (A).
3. Disconnect positive (+) battery cable (B).
4. Loosen two cap screws (C) and battery hold downs.
5. Remove battery.

Installation:

1. Clean both battery terminals before installation.
2. Check for proper battery fluid level.
3. Install battery and secure with battery hold down clamps.
4. Connect positive (+) battery terminal clamp. Tighten positive battery clamp bolt securely.
5. Connect negative (–) battery terminal clamp. Tighten negative battery clamp bolt securely.

KEY SWITCH PANEL

Removal:

1. Remove steering wheel tilt locking lever knob.
2. Disconnect battery negative (–) cable.
3. Remove fuse panel cover. (See "FUSE PANEL COVER").
4. Remove two screws attaching key switch panel to console. Slide key switch panel down and away from console.
5. Disconnect key switch electrical connector and remove panel.

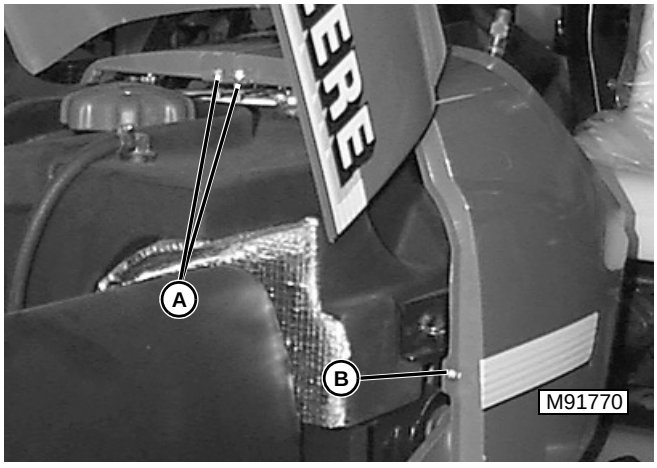
Installation:

Installation is the reverse of removal.

COWL PANEL

Removal:

1. Remove side panels. (See "SIDEPANELS").
1. Remove steering wheel (SEE "STEERING WHEEL").
2. Remove control panel. (See "CONTROL PANEL").
3. Remove fuse panel cover. (See "FUSE PANEL COVER").
4. Remove key switch panel. (See "KEY SWITCH PANEL").
5. Raise hood and support with hood prop latch.



6. Remove cap screw under rear of hood at top front of cowl panel.
7. Support panel and remove cap screw (B) from side of panel at bottom. Remove shroud panel.
8. Repeat for other side.

Installation:

Installation is the reverse of removal.

ENGINE HOOD

Removal:

1. Open hood and support on hood prop latch.

NOTE: An assistant may be required to support hood during removal.

2. Remove four cap screws and nuts attaching hood to LH and RH hinges.
3. Remove hood.

Installation:

Installation is the reverse of removal.

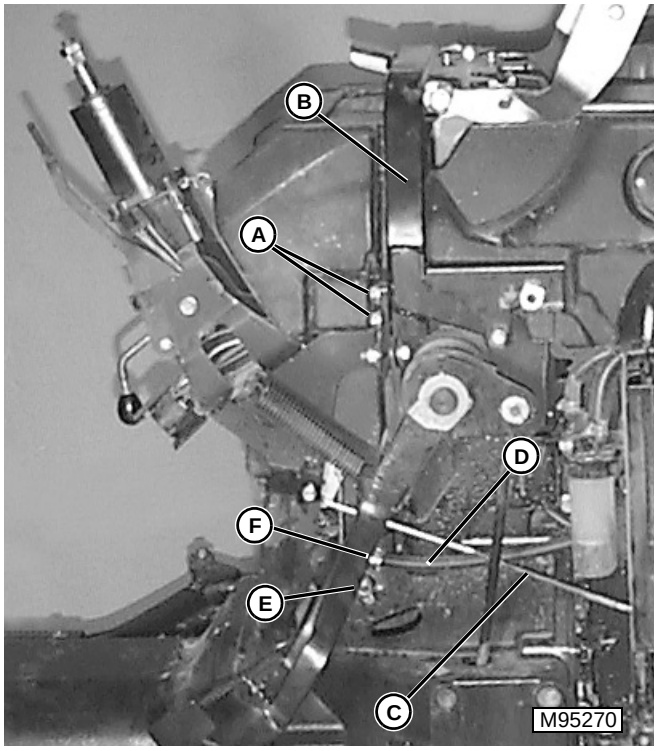
FUEL TANK

Removal:

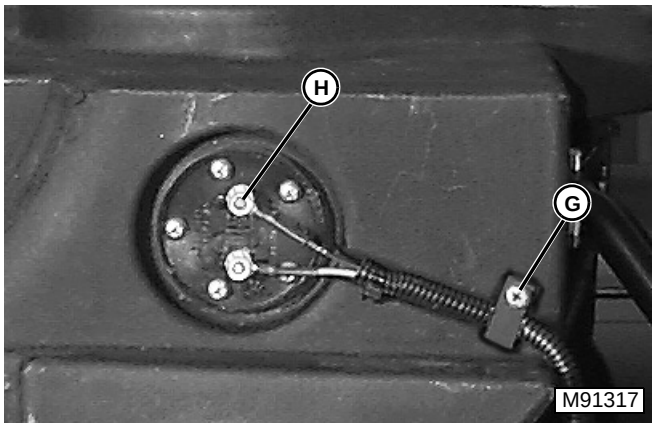
⚠ CAUTION

Diesel fuel is flammable! Extinguish all open flames before working on fuel system. Do not smoke.

1. Park tractor on level surface, shut engine off, engage park brake.
2. Allow tractor and engine to cool before attempting to service fuel system.
3. Remove engine side panels.
4. Remove steering wheel. (See "STEERING WHEEL").
5. Remove control panel. (See CONTROL PANEL").
6. Remove key switch panel (See "KEY SWITCH PANEL").
7. Remove cowl panels. (See "COWL PANEL").
8. Remove hood. (See "ENGINE HOOD").
9. Remove brake pedal shaft. (See "BRAKE PEDAL REMOVAL AND INSTALLATION" in Brake section.)

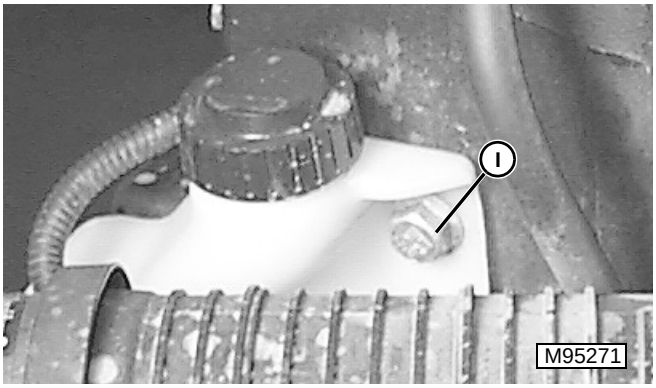


10. Remove four cap screws (A) and hood support frame (B).
11. Disconnect throttle link (C) at engine by pulling rod outward.
12. Drain fuel from tank into a suitable container.
13. Label and remove fuel lines from fuel tank.
14. Remove fuel overflow drain hose (D).
15. Remove drain cock (E) and fuel hose elbow (F) from fuel tank.

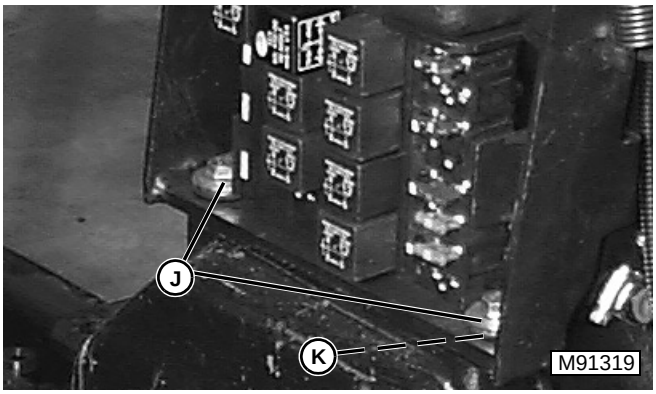


16. Loosen screw (G) on clamp holding fuel gauge sender wiring harness to fuel tank.Turn clamp to release harness.
17. Remove two nuts (H) and lock washers connecting wires to fuel gauge sender. Remove wires.

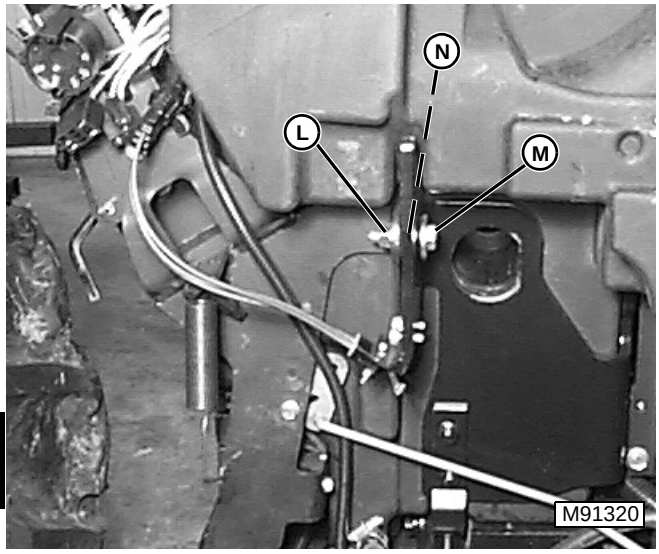
M



18. If necessary, drain coolant overflow tank and disconnect hose from radiator to tank.
19. Remove cap screw (I) and coolant overflow tank.



20. Remove two cap screws (J) , washers and rubber isolators (K) securing bottom of steering support to frame.



21. Remove two nuts (L), four washers, and two cap screws (M) from rubber isolators (N) that secure top of steering support to frame.

NOTE: An assistant may be required to tilt steering support while removing fuel tank.

22. Tilt steering support toward rear of tractor and remove tank from frame.

Installation:

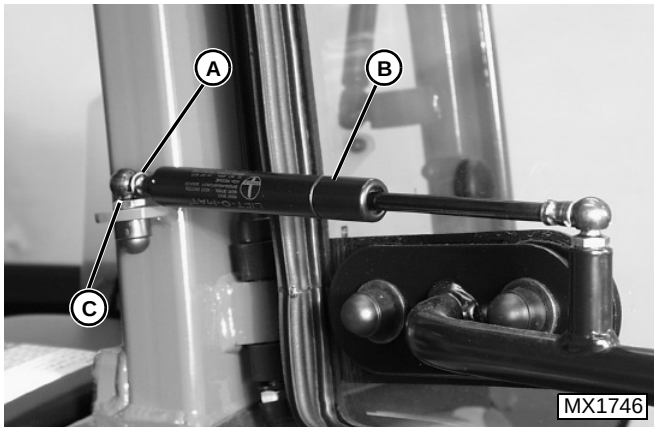
Installation is the reverse of removal.

CAB REPAIR

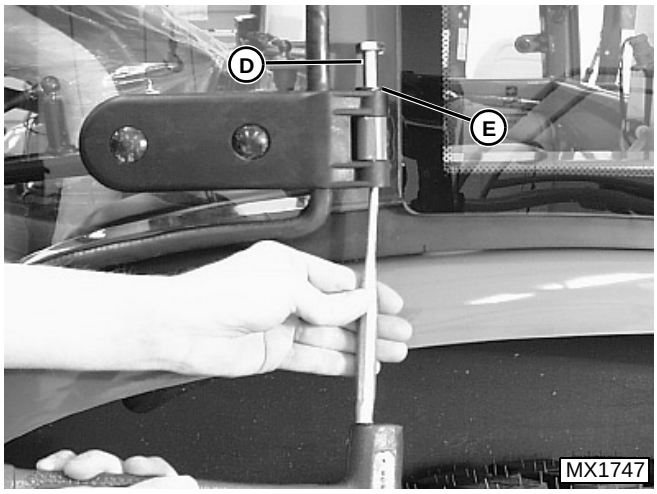
CAB DOOR

Removal:

1. Open cab door.



2. Remove clip (A) from damper (B). Disconnect damper from ball joint (C).
3. Close and latch door.
4. Remove plastic caps from door hinge bolts.
5. Remove hex nut and flat washer from threaded end of each hinge bolt.



M

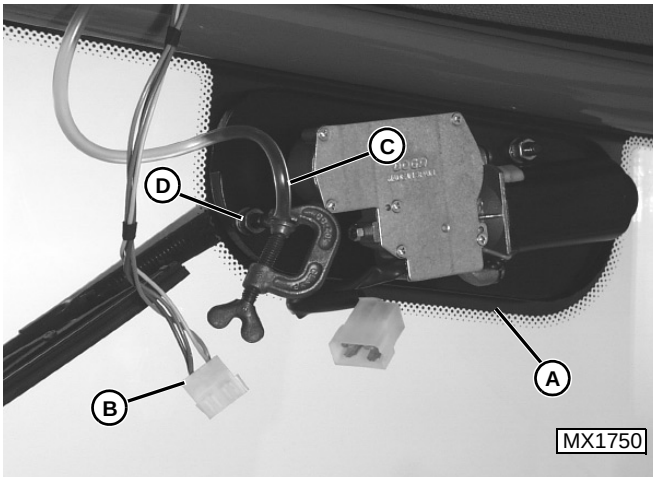
6. Tap hinge bolt (D) with pin punch to remove bolt and flat washer (E). Repeat at other hinge.
7. Hold door securely and unlatch to remove.

Installation:

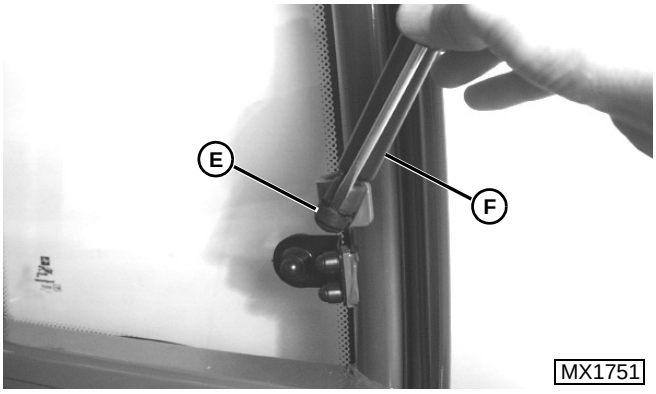
Installation is the reverse of removal. Latch door closed and align hinges before installing hinge bolts. Do not tighten hinge bolts very tight or door will not swing correctly.

CAB REAR

Removal:



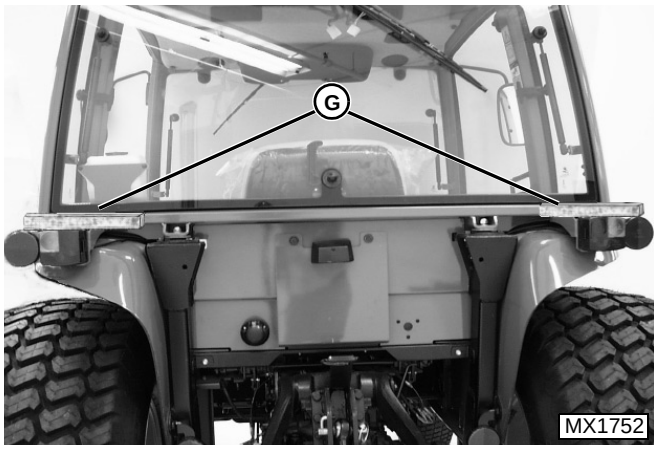
1. Pry carefully with a screwdriver to unsnap and remove cover from rear wiper motor assembly (A).
2. Disconnect wiring harness connector (B).
3. Plug end of washer fluid hose (C).
4. Disconnect hose from spray nipple (D).
5. Open rear window.



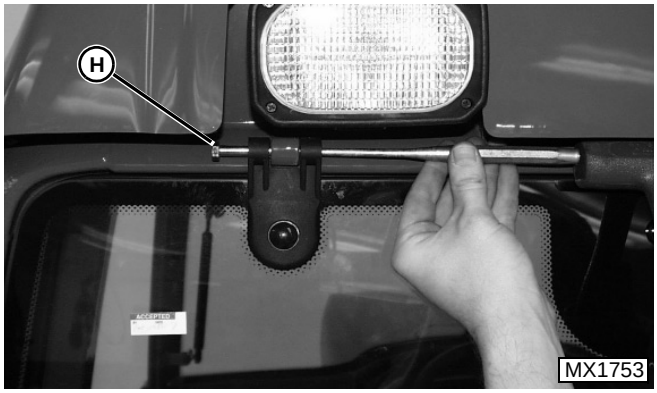
CAUTION

To avoid injury, have an assistant hold window up while disconnecting dampers.

6. Insert tip of flat head screwdriver behind clip (E) and disconnect damper (F). Repeat for other damper.
7. Close rear window.



8. Support rear window on wooden blocks (G).
9. Remove plastic caps from rear window hinge bolts.
10. Remove hex nut and flat washer from threaded end of each hinge bolt.



11. Tap hinge bolt (H) with pin punch to remove bolt. Repeat at other hinge.
12. Remove rear window from cab.

Installation:

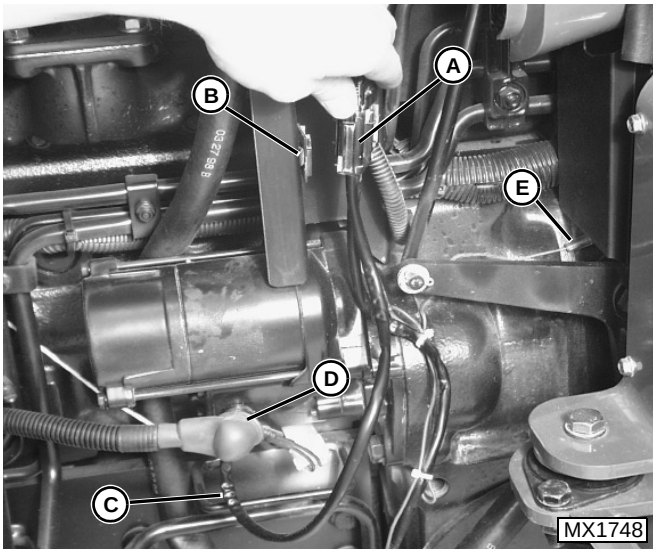
1. Installation is the reverse order of removal. Use an assistant to help hold glass in place while aligning hinges. Do not tighten hinge bolts very tight or glass will not swing easily.
2. Snap end of dampener back onto post.

M

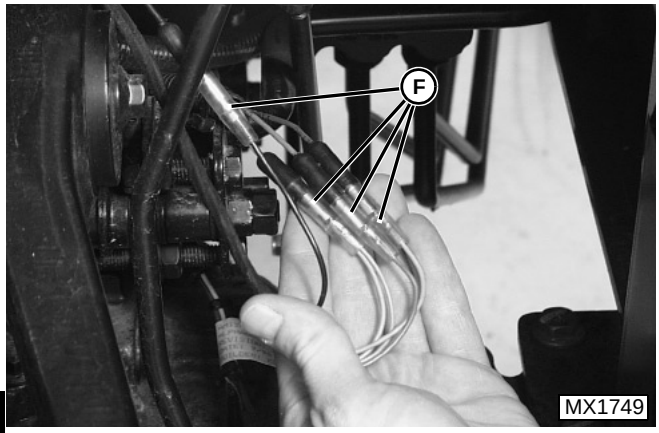
CAB

Cab Removal:

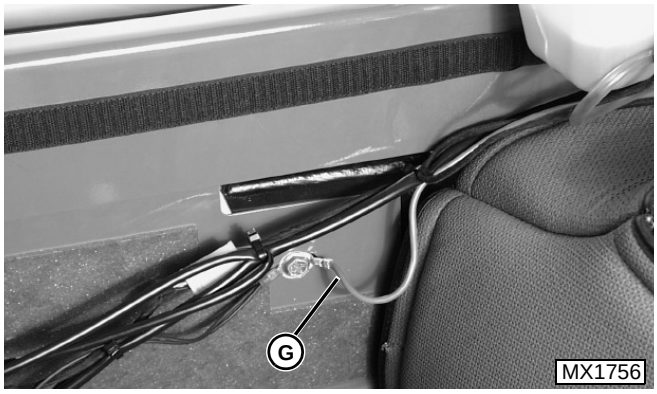
1. Disconnect negative cable from battery.
2. Drain engine coolant from radiator.
3. Remove cab door panels.
4. Remove cab floor mat and all upholstery liners except those covering the fender deck.
5. Remove engine side panels. (See “SIDE PANELS, REMOVAL & INSTALLATION”).



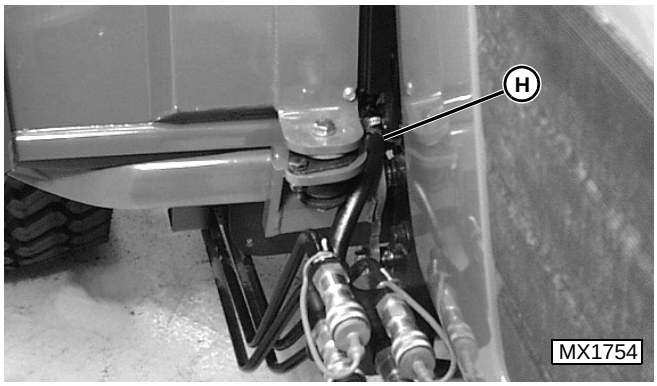
6. Release 60 amp fuse holder (A) from mounting clip (B) using tip of flat head screwdriver.
7. Remove power lead (C) from starter motor terminal (D).
8. Disconnect Red wire bullet connector (E).



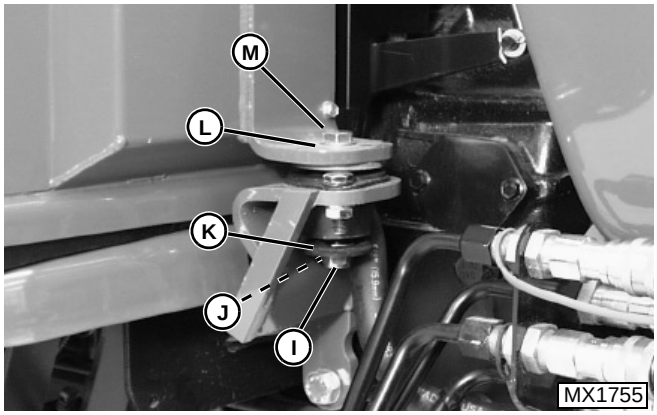
9. Label and disconnect eight bullet connectors (F) under rear of cab (four at each side of rockshaft).



10. Disconnect brn ground wire (G) from panel behind cab seat. Cut all tie straps as needed to free the ground wire for cab removal.

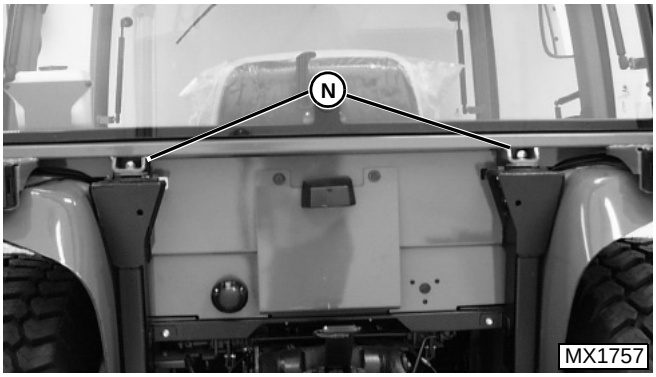


11. Disconnect heater hose (H) at R.H. and L.H. sides of tractor. Plug or cap the hoses.

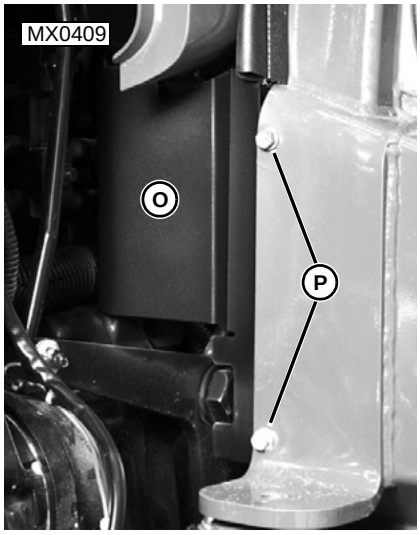


12. Remove the following hardware from the two front cab mounts:
    - Lock Nut (I)
    - Flat Washer (J)
    - Rubber Washer (K)
    - Flat Washer (L)
    - Hex Bolt (M)

M



13. Repeat for rear cab mounts (N).



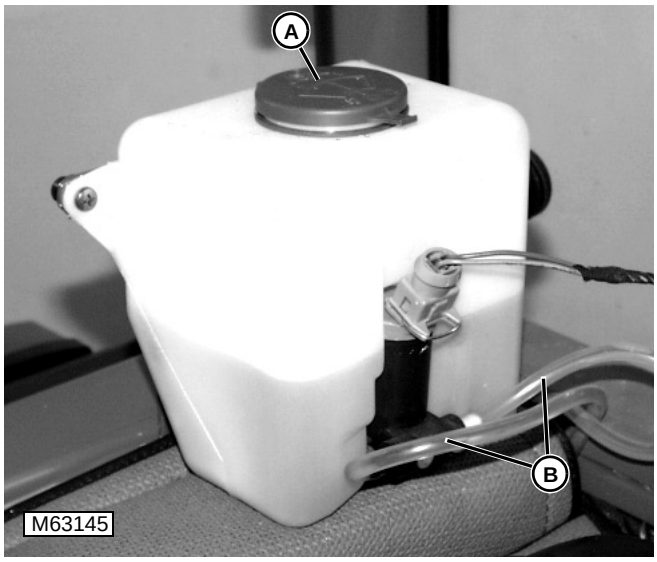
14. Remove front splash plate (O) from front of cab by removing cap screws (P) and lock nuts from cab frame. Repeat for other side of cab.

NOTE: Cab must be lifted with a hoist capable of raising cab high enough for front of cab to clear tractor fenders, (if removing from the rear), or for front of cab to clear engine cover, (if removing from the front.)
Have suitable stands ready to support the rear of the cab (after it is removed) to prevent the tail lamps from contacting the ground.

15. The cab is now free to be lifted using a overhead crane. Route lifting straps through main frame of cab, avoiding the fiberglass roof and overhead console. Wrap straps around corners of frame to prevent straps from sliding, and allowing cab to shift while being lifted.
Alternatively, a large fork truck may be used to lift the cab by putting the forks through the rear window opening. Span a 4x4 beam across the door frames inside the cab to prevent tips of forks from contacting overhead console. Cab must be lifted high enough for the front bottom corners of cab to clear tractor fenders.

WINDSHIELD WASHER REPAIR

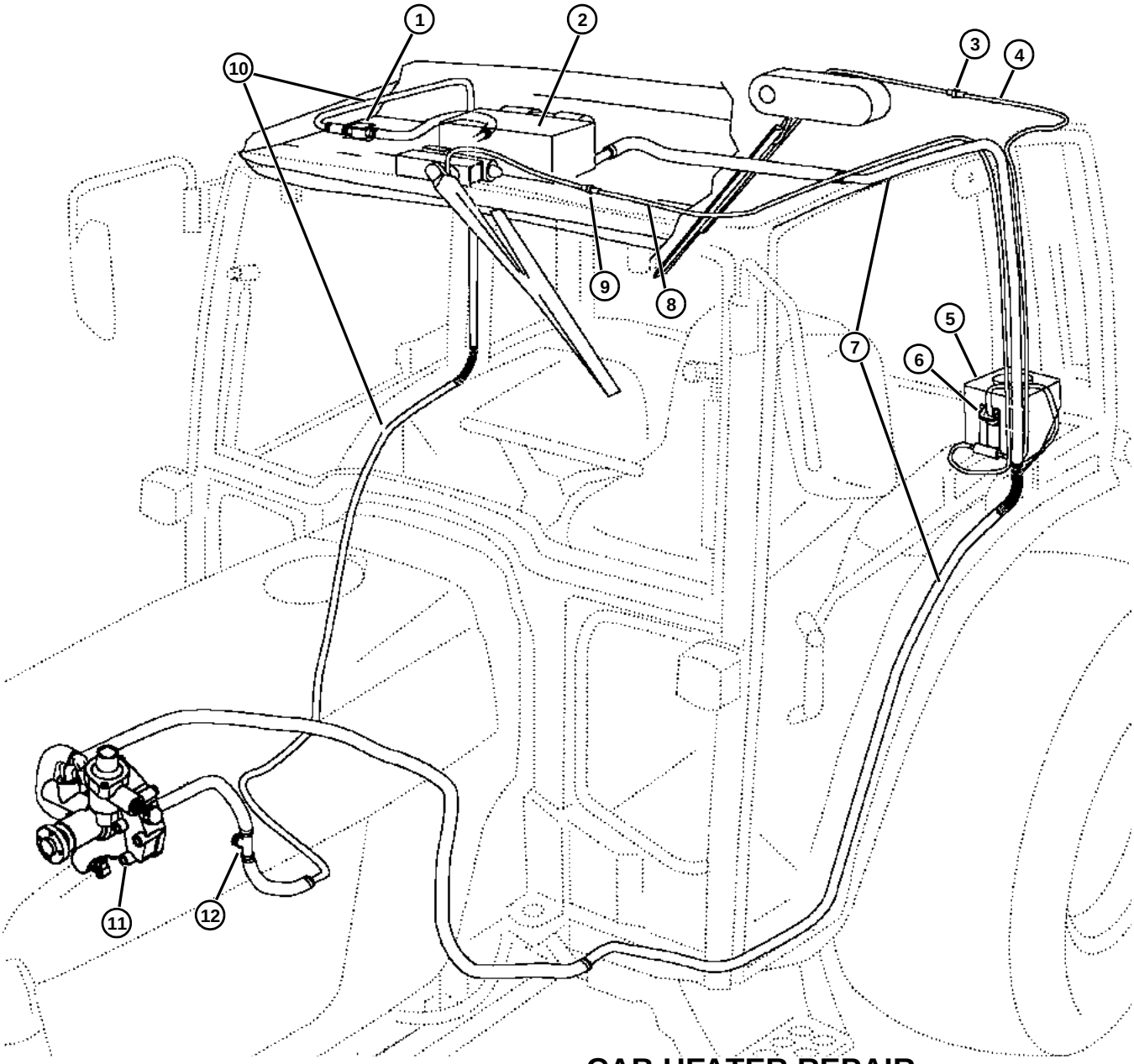
NOTE: for diagnosis of windshield washer pump electrical problems.
See drawing on next page to identify windshield washer components and water line routing through cab frame.



If front or rear washer is not working, check the following items:

- Check vent hole on reservoir cap is clear (A), and that reservoir is full of clean, unfrozen, windshield washer fluid. Listen for pump operation.
- Check that front or rear spray nozzles are not clogged by removing washer hose from nozzle and operating front or rear washer switches. Clean the clogged nozzle with a pin and compressed air.
- If no fluid is discharged from washer hose when pump is operated, be sure check-valve is installed correctly on water line. An arrow on check-valve body indicates direction of flow. (Front check valve is located in roof overhang above windshield. Rear check valve is located inside cab under padding above rear window.) Remove check valve and operate front or rear washer switch to check for fluid flow.
- Check for fluid flow from pump by removing fluid lines (B) from pump ports and operating front or rear washer switches. If no pump output, remove reservoir and flush with clean water until clear.
- If fluid lines are clogged, try to clear with compressed air. Look for pinched line at front or rear washer nozzles. If front fluid line is clogged, cab must be lifted up from tractor to route a new line up cab door post frame. ()

CAB WATER LINE LOCATIONS



1. Heater Control Valve
2. Heater Core
3. Rear Washer Check Valve
4. Rear Washer Fluid Hose
5. Washer Reservoir
6. Washer Pump
7. Cab Heater Water Return Hose/Tube
8. Front Washer Fluid Hose
9. Front Washer Check Valve
10. Cab Heater Water Supply Hose/Tube
11. Water Pump
12. Heater Hose Drain Valve

CAB HEATER REPAIR

NOTE: For blower motor electrical diagnosis, see of Electrical Section.

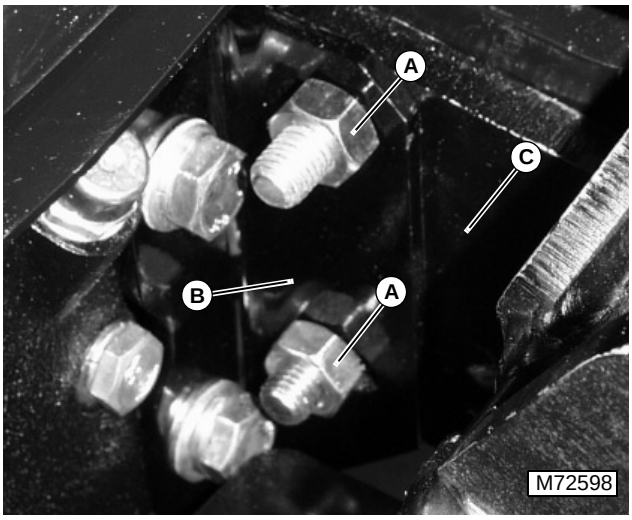
1. Drain cooling system at drain valve (L) on right rear of engine compartment.
2. Lower cab overhead console to access heater control valve (1), heater core (2), and blower motor.
3. Water lines running inside of cab frame are steel tubing, with rubber hose and clamps at joints, and require cab to be lifted from tractor to service.
4. Route hose in overhead console to prevent it from kinking when overhead console is raised to install.

M

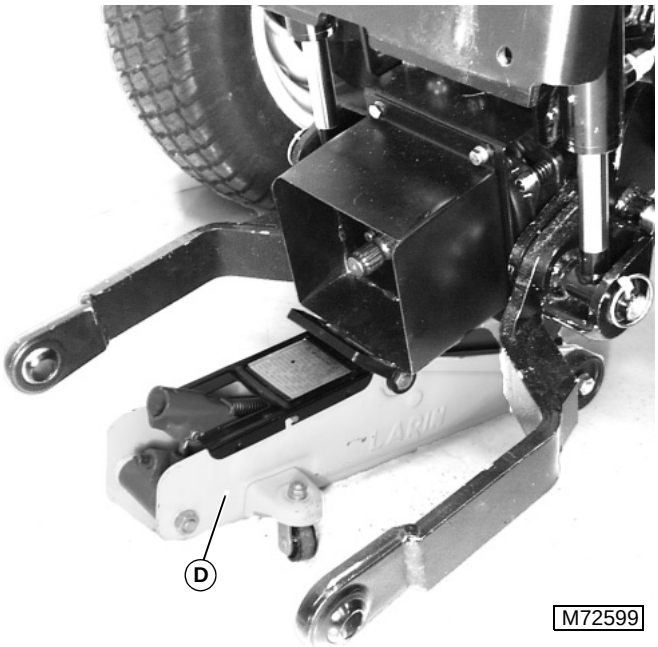
FRONT PTO

PTO GEARBOX REMOVAL

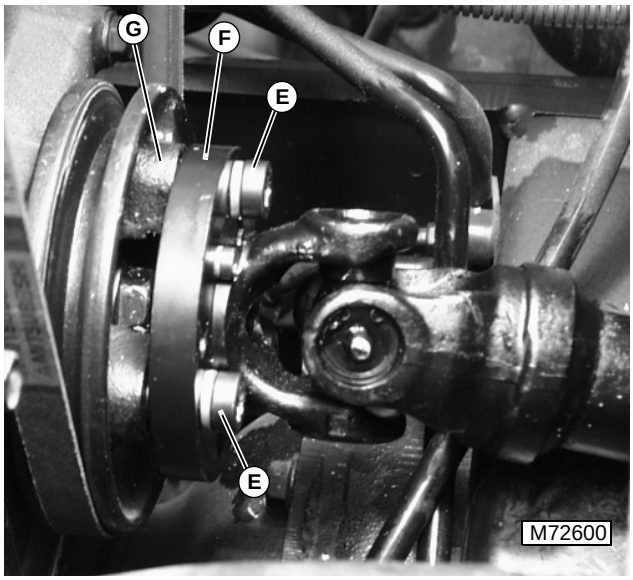
1. Open engine cover and latch open. Remove engine side shields.
2. Unlatch front grille fasteners. Disconnect headlamp wiring harness and remove front grille from tractor.
3. Disconnect negative battery cable.
4. Disconnect electrical lead to Front PTO clutch, and tie PTO harness back to tractor frame where it can not become entangled with implements or front axle.



5. Remove four lock nuts (A) from upper and lower front mounting cap screws holding Front PTO mounting brackets (B) to tractor frame (C).



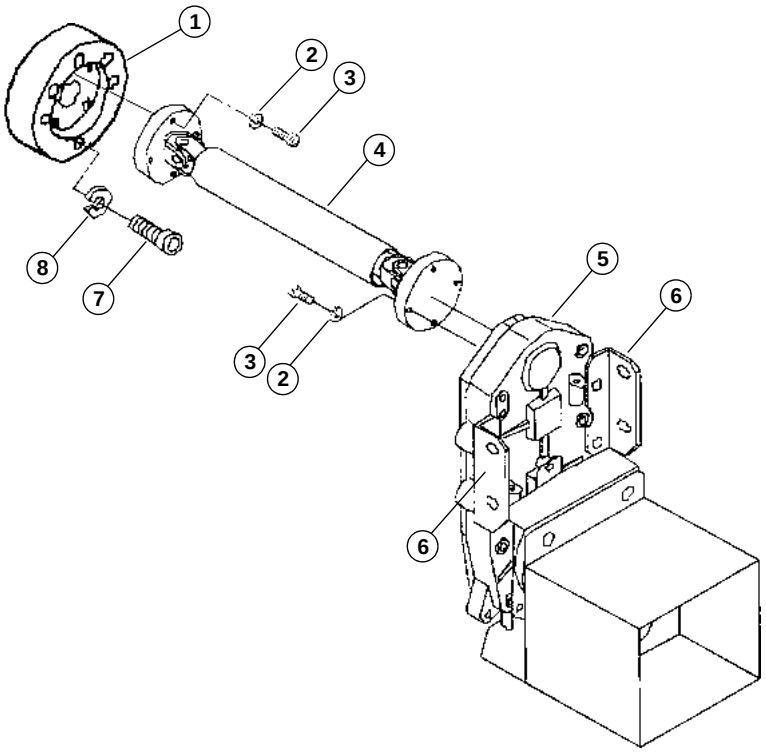
6. Support Front PTO housing from bottom with floor jack (D), and remove four mounting cap screws.
7. Lower PTO housing down out of tractor frame while rotating top of PTO housing forward to separate front and rear halves of PTO drive shaft.



8. Remove M10x35 allen head cap screws and lock washers (E), holding PTO drive shaft flange (F) to engine crankshaft pulley (G).

M

PTO INSTALLATION KIT PARTS



Item	Qty.	Description
1	1	Adapter Flange
2	8	Lock Washer
3	8	Cap Screw–M5x12
4	1	Driveshaft
5	1	PTO Gearbox
6	2	Mounting Bracket
7	3	Cap Screw–M10x25
8	3	Lock Washer–M10

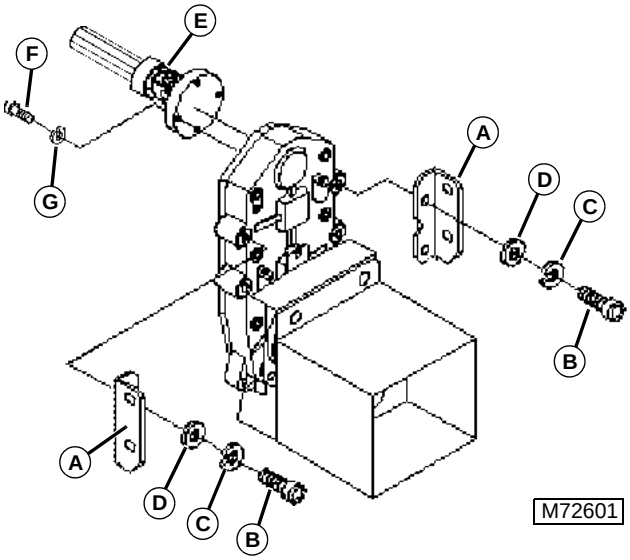
M

PTO GEARBOX INSTALLATION

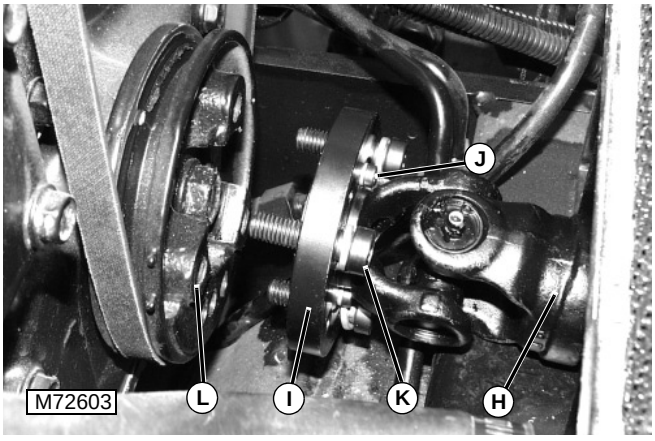
Procedure:

NOTE: PTO Gearbox is not filled with oil at the factory, and must be filled before operating for the first time.

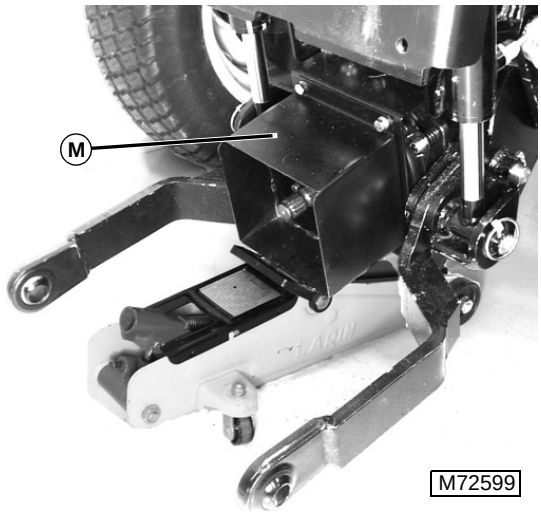
1. Park tractor. Raise engine cover and latch open. Remove engine side covers. Unlatch front grille, disconnect headlamp electrical connectors and remove front grille from tractor.
2. Disconnect negative battery cable.



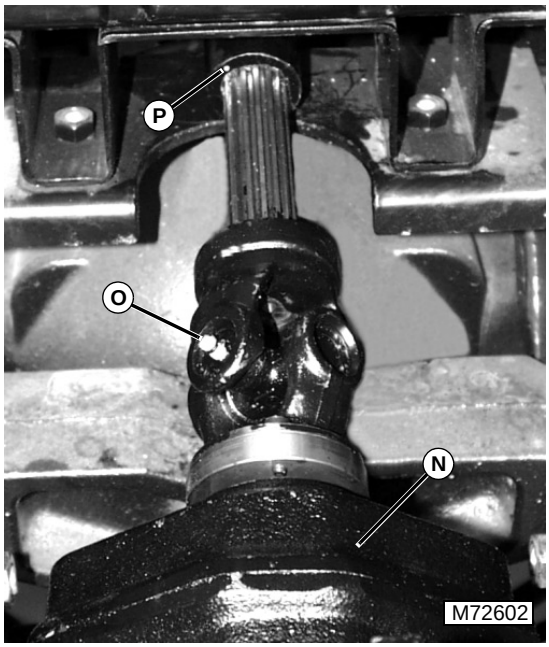
3. Install mounting brackets (A) onto PTO gearbox housing using four M12x40 cap screws (B), lock washers (C), and flat washers (D).
4. Fill PTO gearbox at dipstick tube with 80W-90 gear oil.
5. Install front half of PTO drive shaft (E) onto gearbox input flange using four M5x12 allen head cap screws (F) and lock washers (G).



6. Assemble rear half of PTO shaft (H) to adapter flange (I) using four M5x12 allen head cap screws and lock washers (J).
7. Install M10x25 allen head cap screws and lock washers (K) into adapter flange (I) to match bolt pattern on engine crankshaft pulley (L). (Three cap screws are used on models 4300 & 4400; four are used on model 4200.)
8. Slide rear half of PTO shaft into tractor frame (under radiator) as shown. Do not attach drive shaft to engine crankshaft pulley at this time.



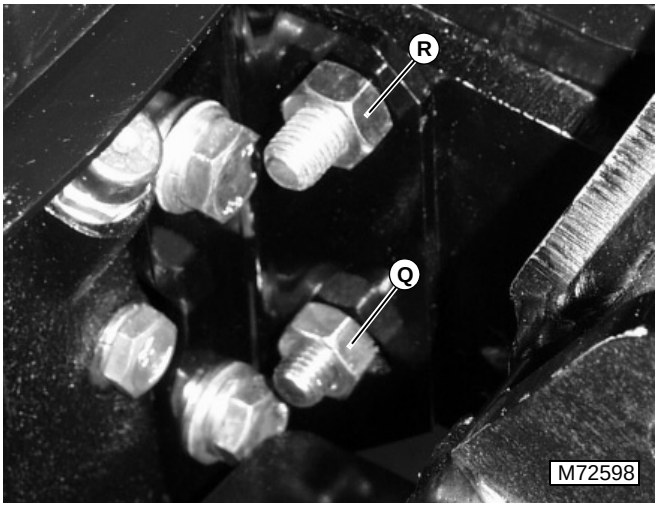
9. Place PTO gearbox housing (M) onto a small floor jack and roll under front of Front Hitch Kit.



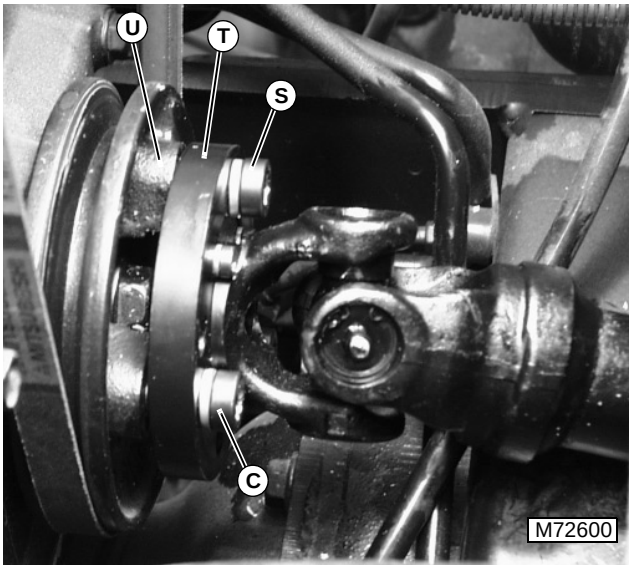
10. Begin to lift the PTO gearbox (N) up into tractor frame with floor jack, while directing the splines of the two halves of the PTO drive shaft together. Align the grease fitting (O) on the front half, with

M

the alignment mark (P) on the face of the rear half. Join splines together while lifting PTO gearbox up into tractor frame.

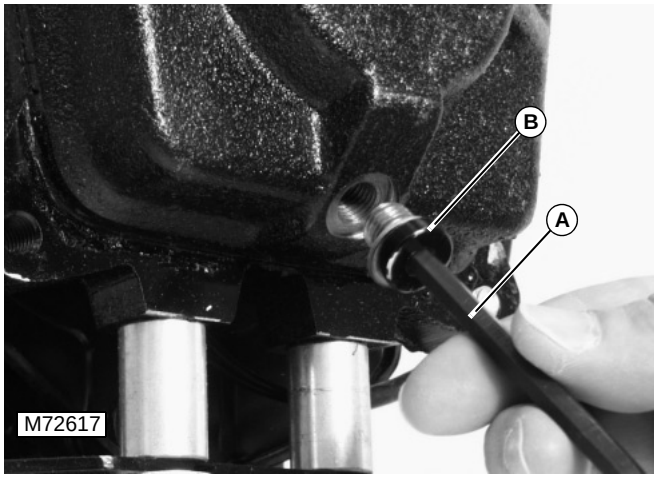


11. Install one M12x65 cap screw (Q) through bottom-front mounting hole on left and right side of tractor. Secure with lock washers and hex nuts.
12. Install one M12x60 cap screw (R) through top-front mounting hole on left and right side of tractor. Secure with lock washers and hex nuts.
13. Tighten all eight cap screws to 95 N•m (70 lb-ft).



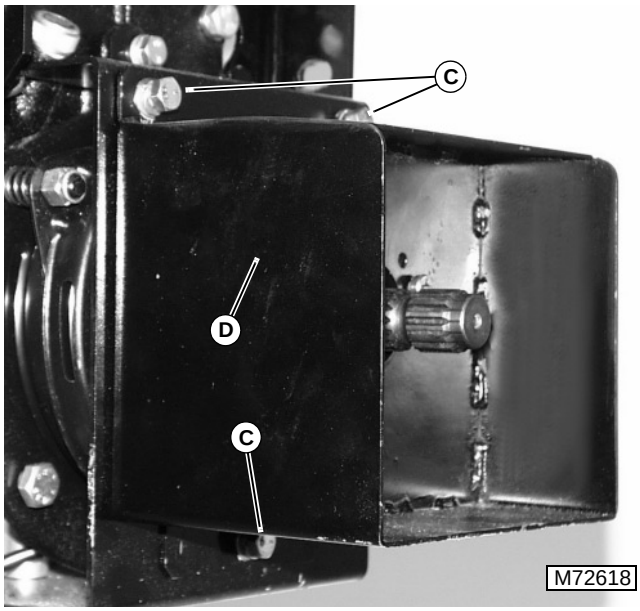
14. Install three M10x35 allen head cap screws and lock washers (S) through PTO drive shaft flange (T) and into engine crankshaft pulley (U).

PTO GEARBOX DISASSEMBLY



1. Using a drain pan and a 8 mm allen wrench (A), drain gear oil by removing drain plug (B) on bottom of PTO gearbox.

PTO Clutch Removal:



2. Remove three cap screws (C) holding PTO shaft shield (D) to clutch shield. Remove shield from gearbox.

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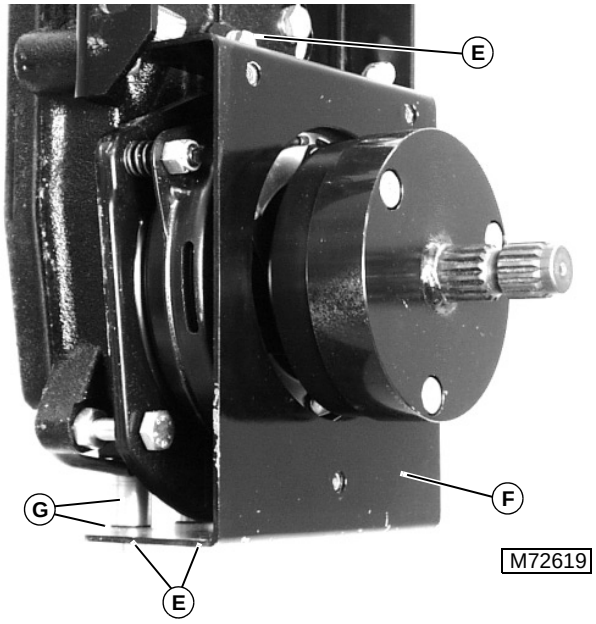
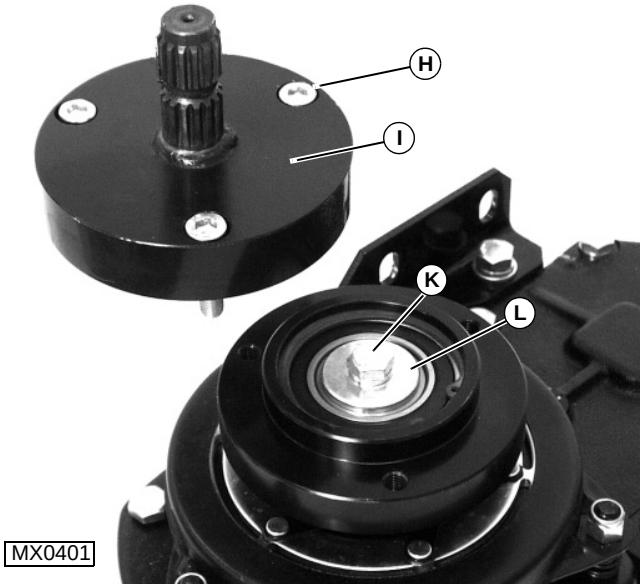
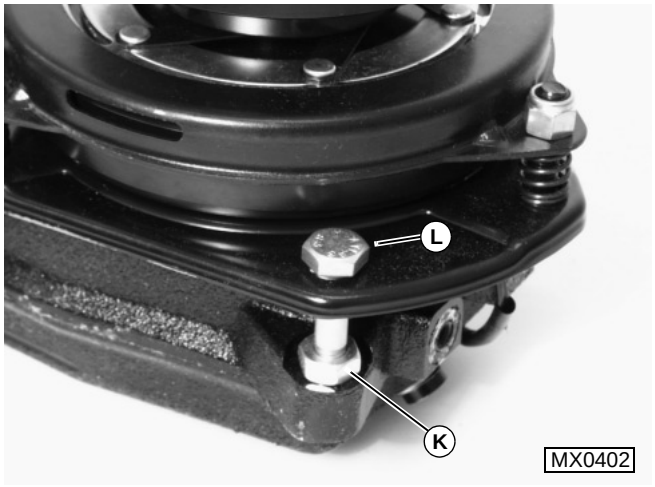


3. Remove three cap screws (E) holding clutch shield (F) to gearbox housing. Remove clutch shield, washers and spacers (G).

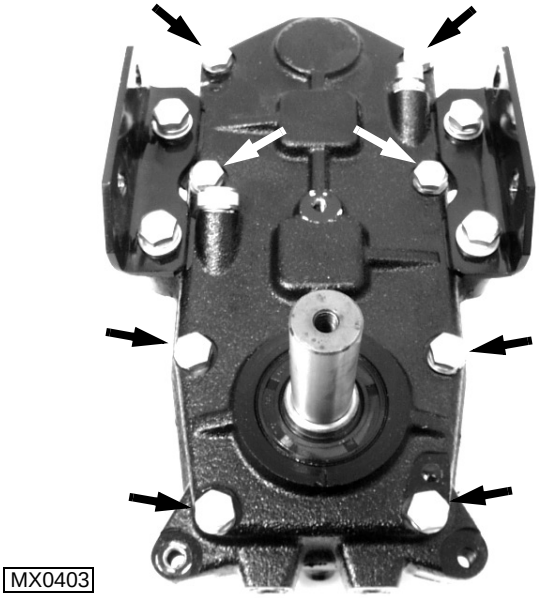


4. Remove three allen head cap screws (H) from PTO spline shaft flange (I). Remove spline shaft flange by tapping on side of flange with a soft-faced hammer to break it free from electromechanical clutch (EMC) (J).
5. Using a strap wrench to hold outside of EMC from turning, remove cap screw (K) and flat washer (L) from center of EMC.



6. Loosen lock-nut (K) on EMC anti-rotation cap screw (L). Remove cap screw from gearbox housing.
7. Pull EMC off of gearbox input shaft.

Splitting Gearbox Case:



1. Loosen each of the eight gearbox housing cap screws 4 turns.

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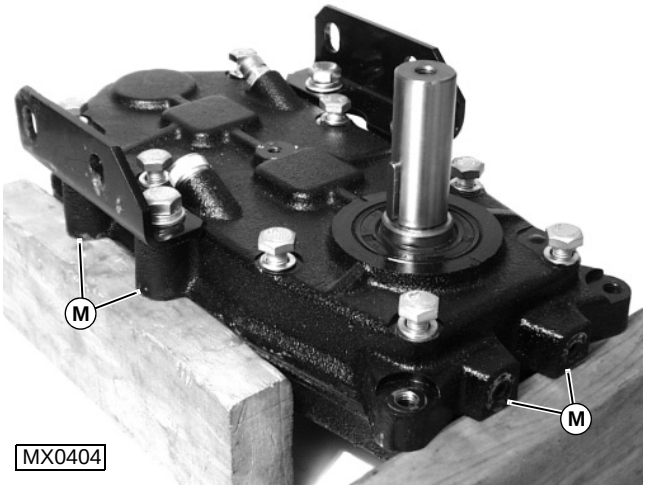
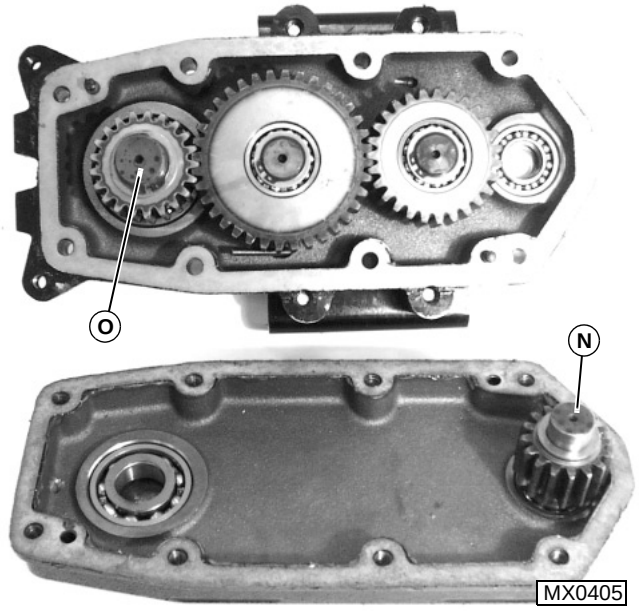


MX0404

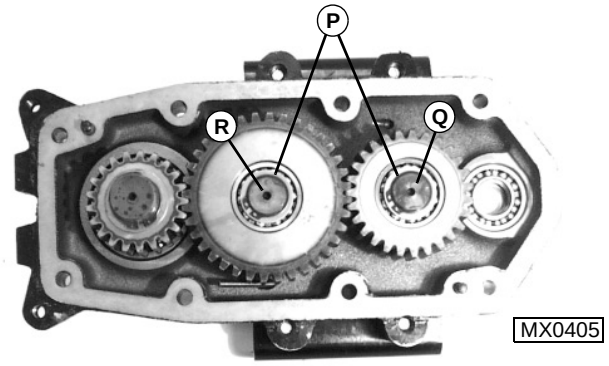
2. Place wooden blocks under cast ears (M) of gearbox so that rear half of gearbox housing is free to drop down onto bench.
3. Tap on heads of cap screws to break gasket seal between halves of gearbox. Loosen cap screws and separate gearbox halves. If gearbox did not separate completely, use a punch or drift in bottom of holes that cap screws were removed from; Do not pry gearbox apart at sealing surface.

Removing Gears:



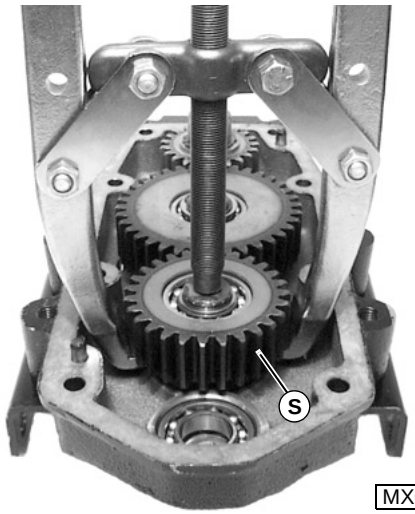
MX0405

1. Note that there are shims on the input shaft (N) and on output shaft (O). These may be on the shafts, or stuck to the bearings. Do not allow these to be lost. Count, label, and set shims aside.
2. Clean gearbox of old gasket material and oil.



MX0405

3. Remove retaining rings (P) from first reduction shaft (Q), and second reduction shaft (R).
4. Remove, count, and label shims under retaining rings on each reduction shaft.
5. Mark the face of the first and second reduction gears with a felt tip marker to insure they will be installed in the same direction as removed.



MX0412

6. Use a puller to remove the first reduction gear (S) from it's shaft.
7. Remove, count, and label the shims under the first reduction gear.

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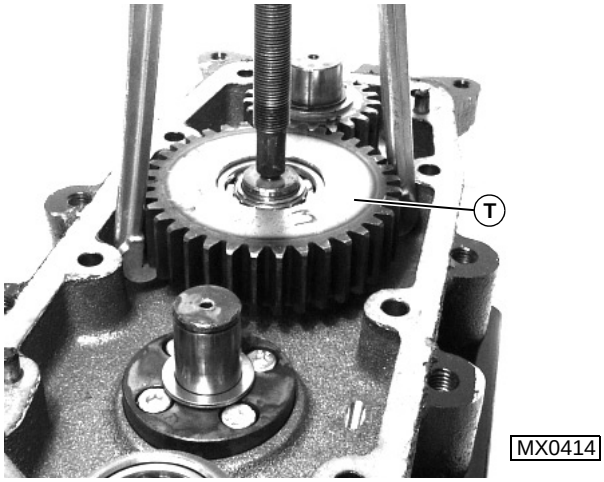
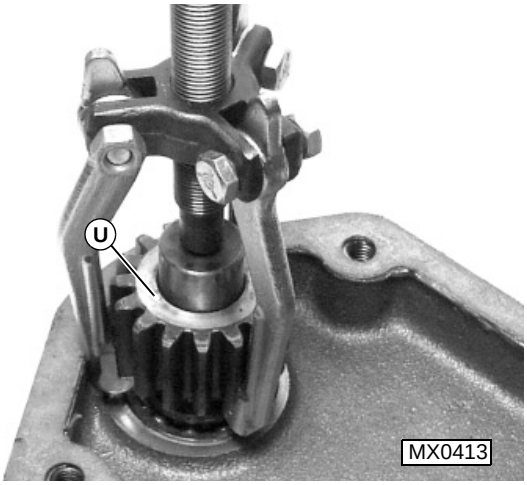
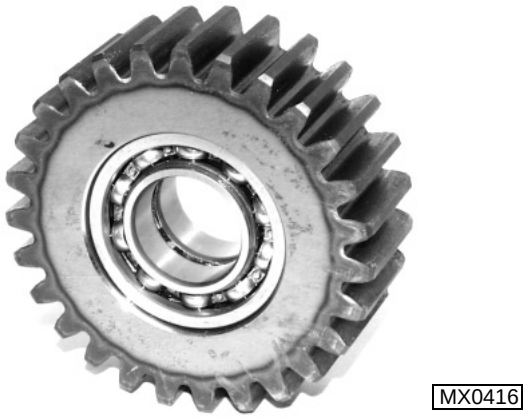
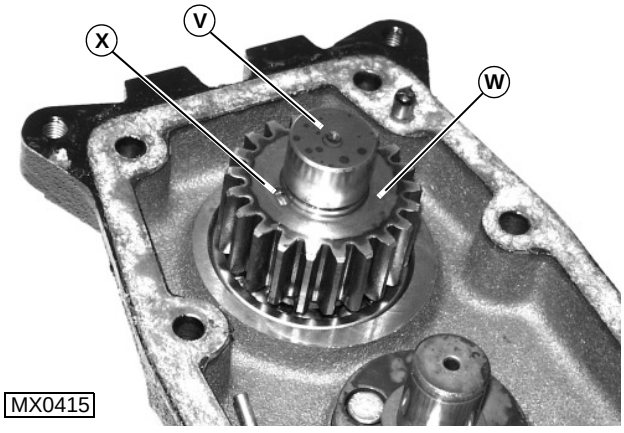




8. Use a puller to remove the second reduction gear (T) from it's shaft.
9. Remove, count, and label the shims under the second reduction gear.



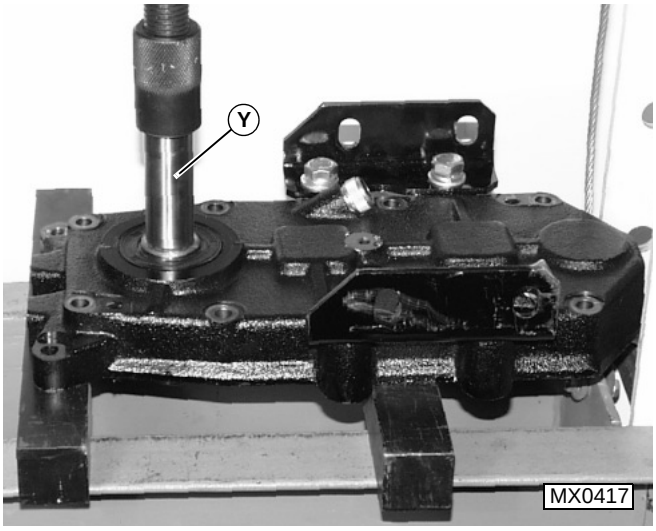
10. Roller bearings inside of reduction gears are pressed in against an internal snap ring, which is not accessible and will not allow bearings to be pressed out. If roller bearings need replacement, cut inner race of one of the bearings with an air chisel, and remove inner race, ball cage, and ball bearings. This will allow access to internal snap ring, allowing it to be removed.
11. Press out remaining bearing and outer race on a arbor press.
12. Remove retaining ring and shims from input shaft. Count, label, and set shims aside.
13. Mark the face of the input shaft gear (U) with a felt tip marker to insure it will be installed in the same direction as it was removed.
14. Use a puller to remove input shaft gear, being careful not to catch hooks of puller on shims under input gear. Do not use arbor press to press output shaft from gear, or damage to shims will result.
15. Remove key from key slot on input shaft by holding key with locking pliers and tapping on pliers until key is pulled free from slot.
16. Remove, count, and label shims under input shaft gear.
17. Tap on input shaft with a soft faced hammer to remove shaft from bearing and seal.
18. Input shaft seal can only be removed from the outside of the gear case. Pry out seal using a large screwdriver under edge of seal.
19. Input shaft bearing can only be removed by pressing bearing towards inside of gear case. Use an arbor press to remove bearing from case.



20. Remove external snap ring and shims from output shaft (V). Count, label, and set shims aside.

M

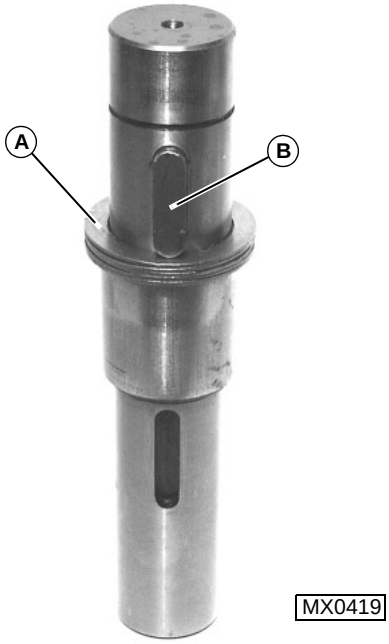
21. Mark the face of the output shaft gear (W) with a felt tip marker to insure it will be installed in the same direction as it was removed.
22. Use a puller to remove output shaft gear, being careful not to catch hooks of puller on shims under output gear.
23. Remove key (X) from keyway on output shaft by holding key with locking pliers and tapping on pliers until key is pulled free from slot.
24. Remove, count, and label shims from input shaft.



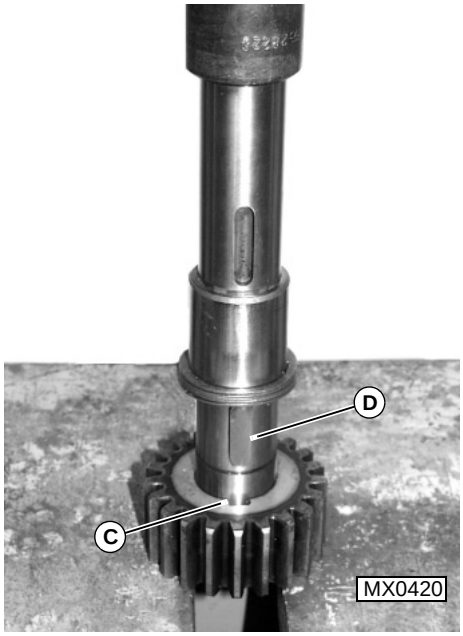
25. Remove key (Y) from keyway on outside of output shaft by holding key with locking pliers and tapping on pliers until key is pulled free from slot.
26. Place the PTO gearbox in an arbor press to drive out the output shaft and bearing from the gearbox housing.
27. Use the arbor press to remove the output shaft bearing from the shaft.

PTO GEARBOX ASSEMBLY

Output Shaft Assembly And Installation:



1. Assemble five shims (A) onto output shaft. Install key (B) into keyway on shaft.



2. Place output shaft gear (21T) into arbor press with assembly mark facing down, and keyway (C) facing forward.
3. Align key on output shaft (D) with keyway on gear, and press shaft into gear until shims bottom out against gear face.

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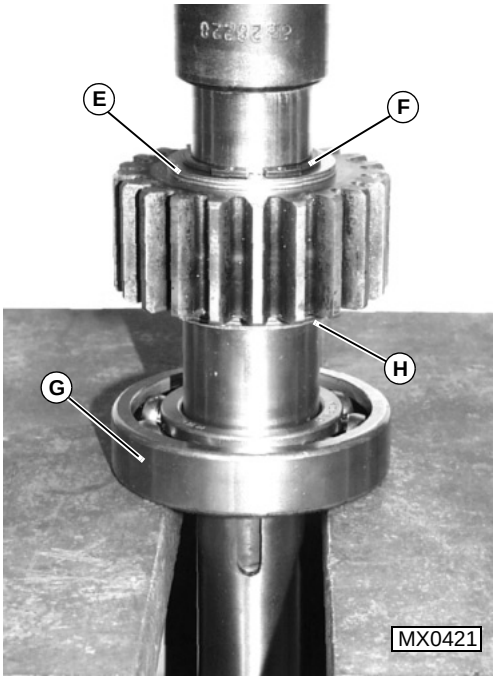
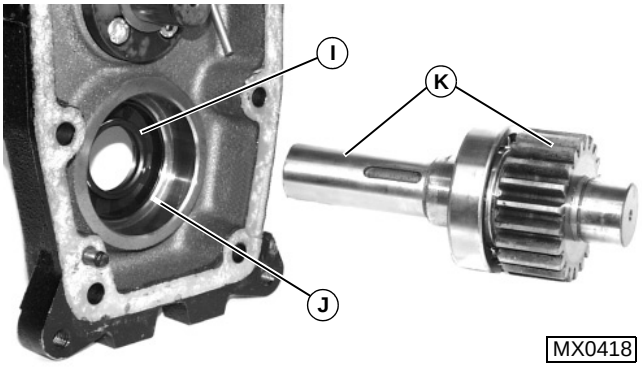
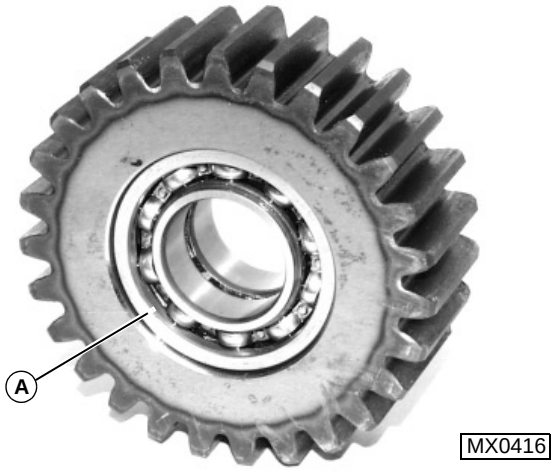


4. Install three shims (E) onto output shaft and secure with external snap ring (F).
5. Place bearing (G) onto arbor press with inner race supported. Press output shaft into bearing until bearing contacts shims (H).

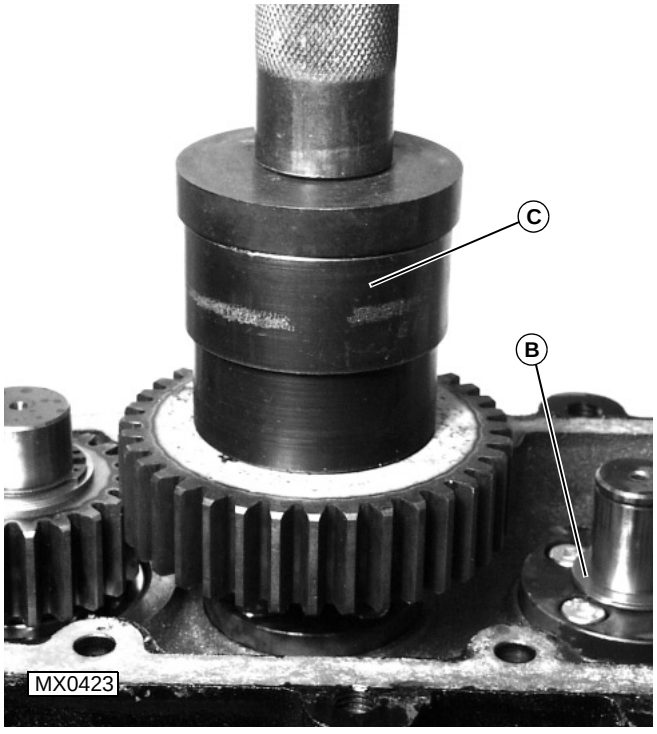


6. Install new seal (I) into front half of gear case, pressing seal down until it contacts machined flange face (J).
7. Install output shaft assembly (K) into front half of gear case, pressing bearing into case with arbor press until bearing is seated on machined flange face (J).

Intermediate Gear Assembly And Installation



1. If bearings (A) were removed from first or second intermediate gears, install internal snap ring in groove in center of gear, and press a new bearing in from each side of the gear until bearings contact snap ring.



2. Place two shims (B) on each intermediate gear shaft. Press gear onto shaft using a large diameter driver (C) and an arbor press. Repeat for other intermediate gear.

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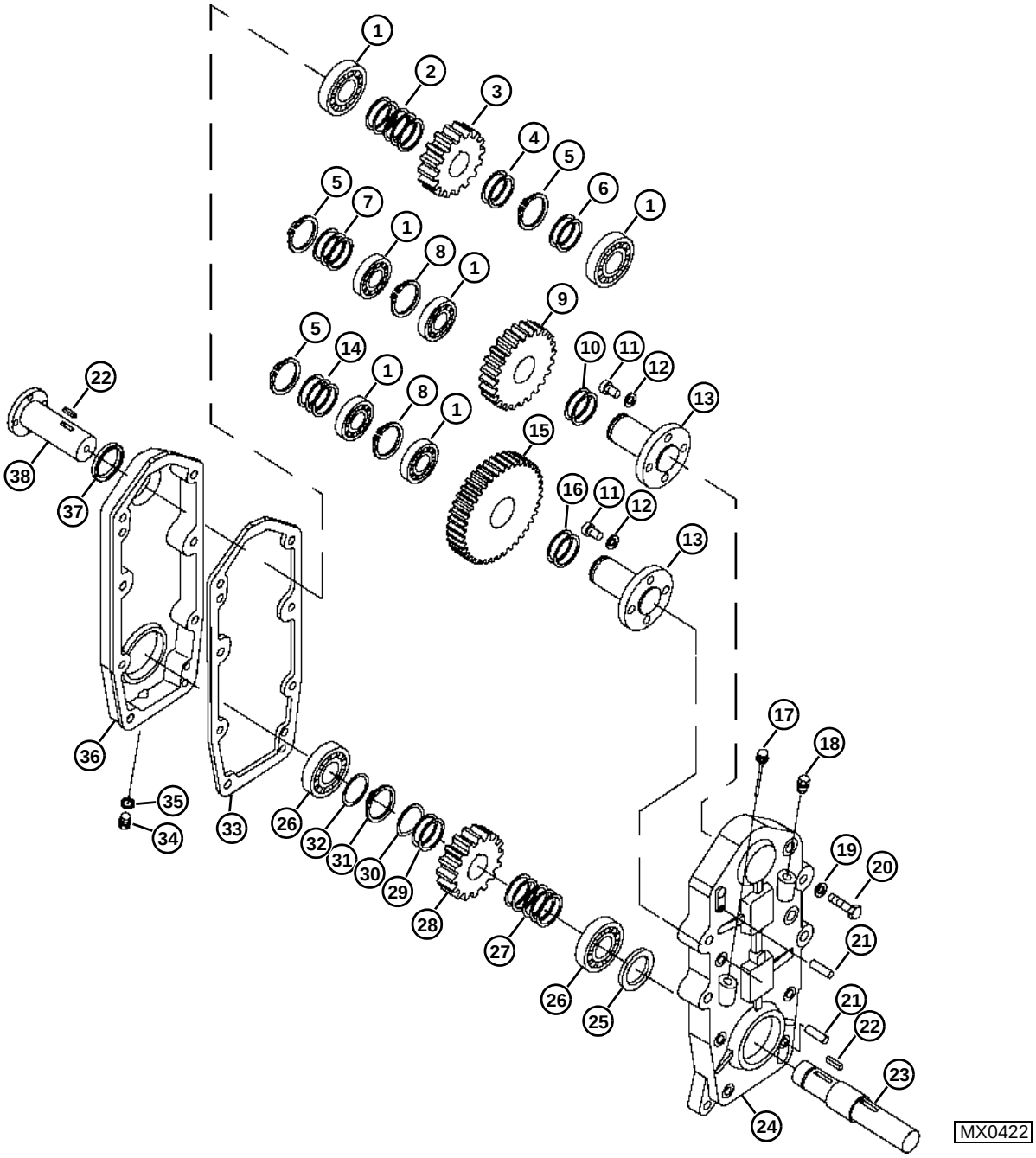
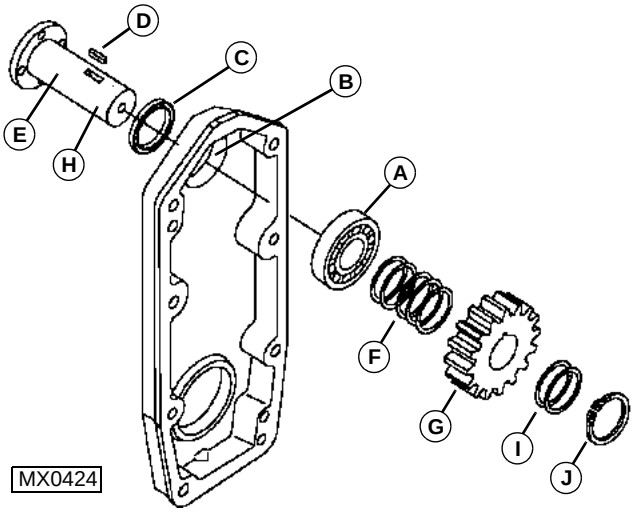


1. Ball Bearing (6)
2. Shim–M25x35x1 (5)
3. Input Shaft Gear–16T
4. Shim–M25x35x1 (2)
5. Snap Ring–M25 (3)
6. Shim–M25x35x1 (2)
7. Shim–M25x35x1 (3)
8. Snap Ring–M47 (2)
9. 1st Reduction Gear–27T
10. Shim–M25x35x1 (2)
11. Cap Screw–M8x16 (8)
12. Lock Washer–M8 (8)
13. Axle Stub (2)
14. Shim–M25x35x1 (3)
15. 2nd Reduction Gear–36T
16. Shim–M25x35x1 (2)
17. Dipstick (1)
18. Vent (1)
19. Lock Washer–M10 (8)
20. Cap Screw–M10x55 (8)
21. Dowel Pin–M8x50 (2)
22. Key–M8x7x28 (2)
23. Output Shaft (1)
24. Gear Case–Front (1)
25. Seal–Output Shaft (1)
26. Ball Bearing (2)
27. Shim–M30x42x1 (5)
28. Output Shaft Gear–21T
29. Shim–M30x42x1 (2)
30. Shim–M30x42x0.5 (1)
31. Snap Ring–M30
32. Shim–M30x42x1 (1)
33. Gasket (1)
34. Drain Plug (1)
35. Seal Washer (1)
36. Gear Case–Rear (1)
37. Seal–Input Shaft (1)
38. Input Shaft (1)

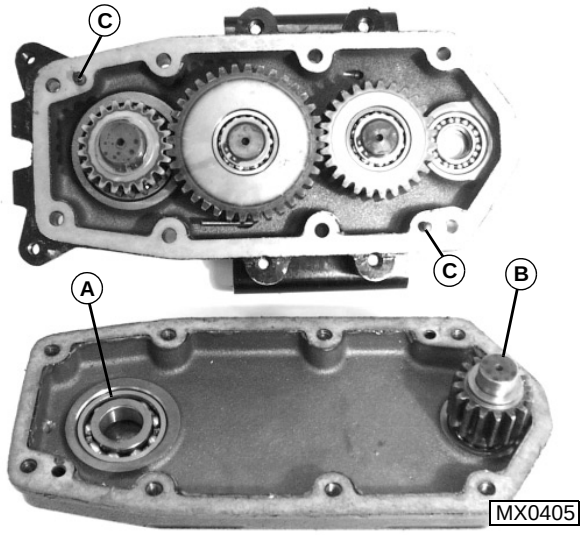
M

Input Shaft Installation:



1. Install input shaft bearing (A) to inside of gear case. Press bearing in until seated on machined flange (B) in bore of case.
2. Install input shaft seal (C) from outside of gear case, pressing in until seated flush with outside of case.
3. Remove input shaft key (D) (if installed) from input shaft (E).
4. Install input shaft through seal and bearing, tapping lightly with a soft faced hammer.
5. Install five M25x35x1 shims (F) onto end of input shaft.
6. Install M8x7x28 key (D) into key on input shaft.
7. Press input shaft gear (G) onto shaft using arbor press. Press gear onto input shaft until groove (H) on shaft is exposed enough to install two M25x35x1 shims (I), and snap ring (J) on shaft.
8. After shims and snap ring are installed on shaft, press input shaft back out of gear case until shims (I & F) are compressed between snap ring & bearing (J & A). This will cause the input shaft to extend out of the gear case to it's maximum length.

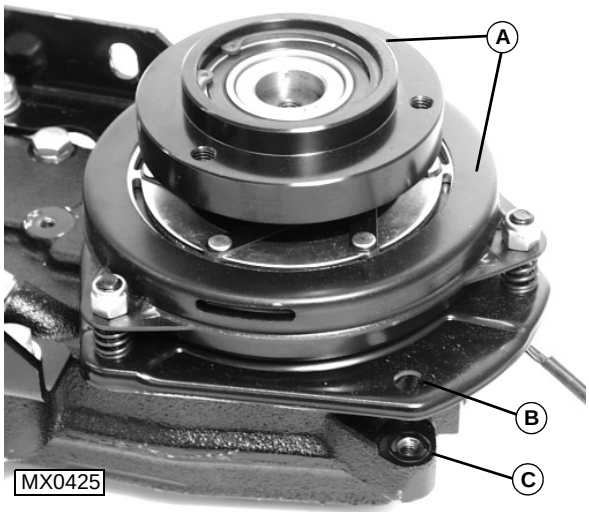
Gear Case Assembly:



1. Clean both front and rear gear case halves and install new gasket.
2. Install one shim on output shaft bearing (A), and two shims on input shaft (B).
3. Place front half of gear case on top of rear half, aligning pins (C) with holes on rear case.Tap on gear case
4. Install eight M10x55 cap screws and lock washers and torque to 55 N•m (40 lb-ft), drawing gear case halves together.

PTO Clutch Installation:

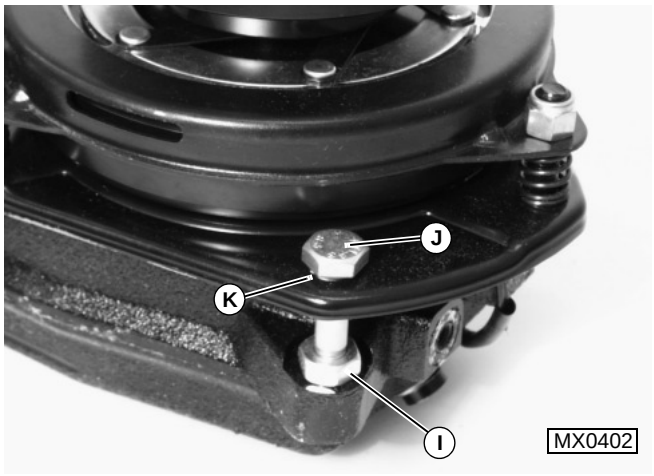
1. Install key into keyway on output shaft.



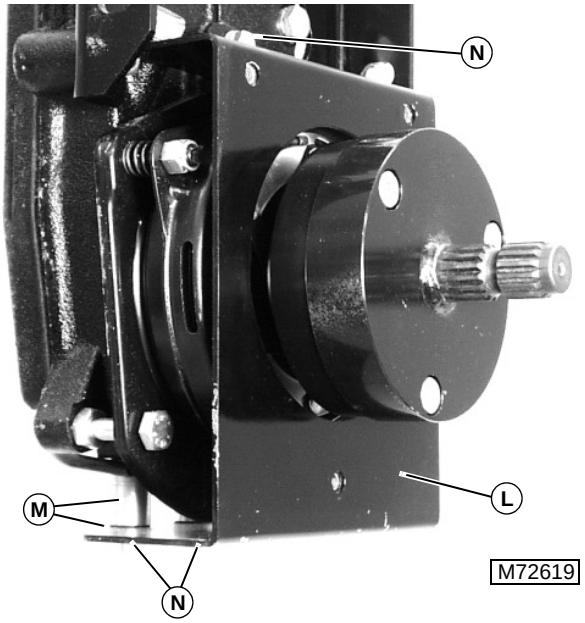
2. Install EMC clutch (A) onto output shaft, lining up key in shaft with keyway in clutch housing.
3. Align hole in PTO clutch (B) with tapped hole in gear case (C).

M

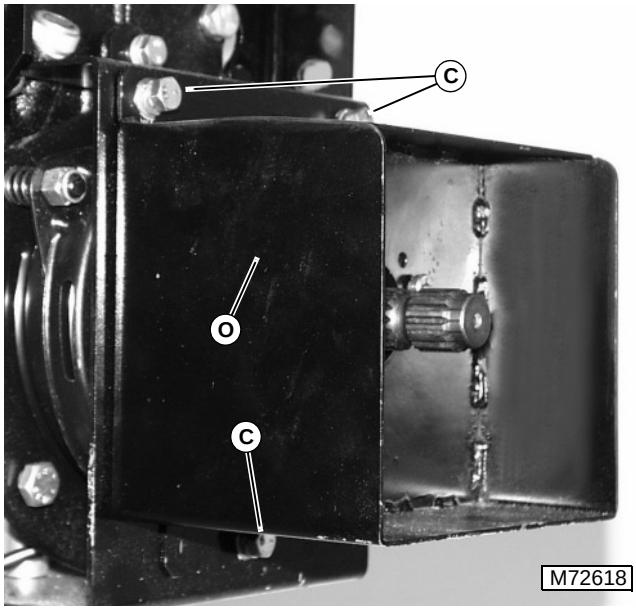
4. Install M10x40 cap screw (D), M10 flat washer, and lock washer (E) into output shaft. Hold input shaft flange of gear box in soft faced vice while tightening cap screw on output shaft.
5. Install PTO spline shaft flange (F) onto EMC clutch, lining up cap screws (G) with holes in clutch (H). Tighten cap screws evenly until flange is drawn down onto step of clutch.



6. Place M10 hex nut (I) on threaded hole in case. Screw M10x55 cap screw (J) through clutch flange, hex nut, and into threads of gear case until there is a 2–5 mm gap between head of screw and clutch bracket (K). Tighten hex nut (I).



7. Install clutch shield (L) over EMC clutch. Install two spacers (M) and three M8 cap screws (N).



8. Install PTO shaft shield (O) to clutch shield. Secure with three cap screws (P), lock washers and flat washers.

M

Numerics

A

B

C

D

E

F

G

H

S

T

V

W