3325 and 3365 Professional Turf Mower

For complete service information also see:

Yanmar Engine Repair CTM3

John Deere Horicon Works
TM1427 (30MAR93)
LITHO IN U.S.A.
ENGLISH

Introduction

FOREWORD

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

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

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

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

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

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

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

TM,1427A1,IFC -19-30MAR93

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

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Group 15—Diagnosis, Tests & Adjustments
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GENERAL INFORMATION

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HANDLE FLUIDS SAFELY—AVOID FIRES

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

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

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

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



TS227 -UN-23AUG88

DX,FLAME -19-04JUN90

PREVENT BATTERY EXPLOSIONS

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

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

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



TS204 -UN-23AUG88

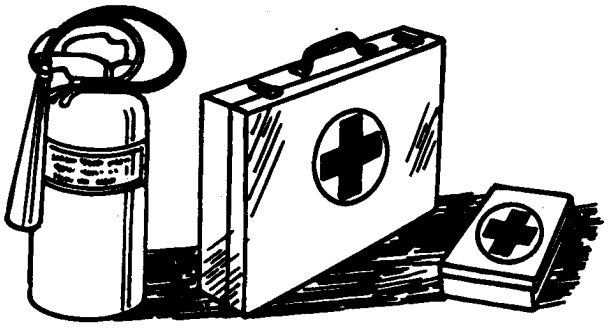
DX,SPARKS -19-03MAR93

PREPARE FOR EMERGENCIES

Be prepared if a fire starts.

Keep a first aid kit and fire extinguisher handy.

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



TS291 -UN-23AUG88

DX,FIRE2 -19-03MAR93

PREVENT ACID BURNS

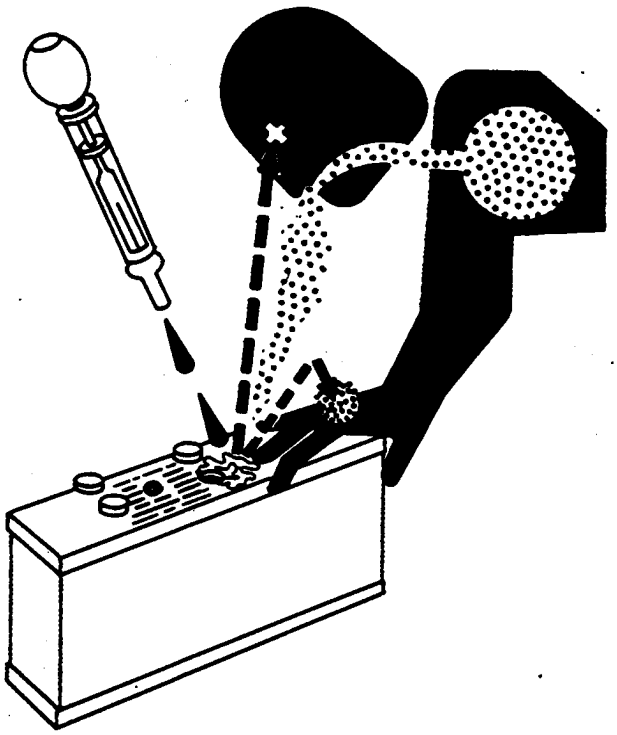
10
05
2

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

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

If you spill acid on yourself:
1. Flush your skin with water.
2. Apply baking soda or lime to help neutralize the acid.
3. Flush your eyes with water for 10—15 minutes. 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.



TS203 -UN-23AUG88

DX,POISON -19-04JUN90

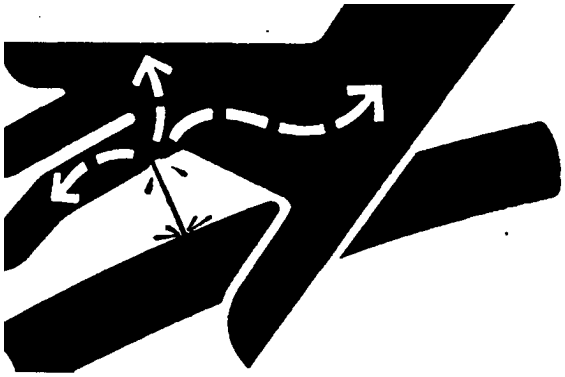
AVOID HIGH-PRESSURE FLUIDS

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

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

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

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



X9811 -UN-23AUG88

DX,FLUID -19-03MAR93

AVOID INJURY FROM ROTATING BLADES

Keep hands and feet away while machine is running. Shut off power to service, lubricate or unlatch cutting units.

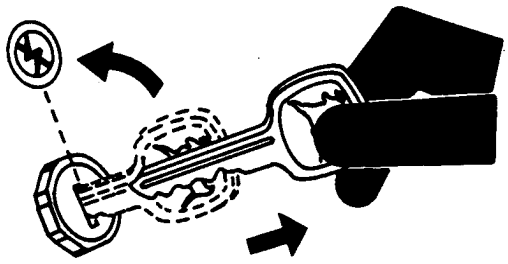


E30096 -UN-21SEP88

2E6,1005G,1C -19-25MAY90

PARK MACHINE SAFELY

Before working on the machine:
- Lower all equipment to the ground.
- Stop the engine and remove the key.
- Disconnect the battery ground strap.
- Hang a “DO NOT OPERATE” tag in operator station.



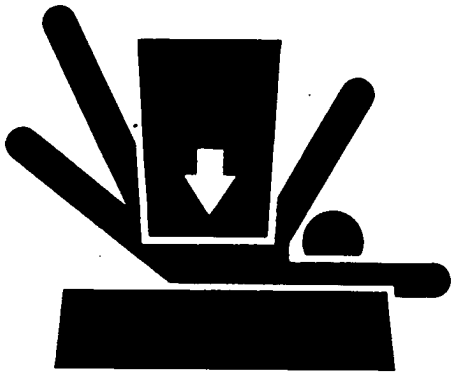
TS230 -UN-24MAY89

DX,PARK -19-04JUN90

SUPPORT MACHINE PROPERLY

Always lower the attachment or implement to the ground before you work on the machine. 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.



TS229 -UN-23AUG88

DX,LOWER -19-04JUN90

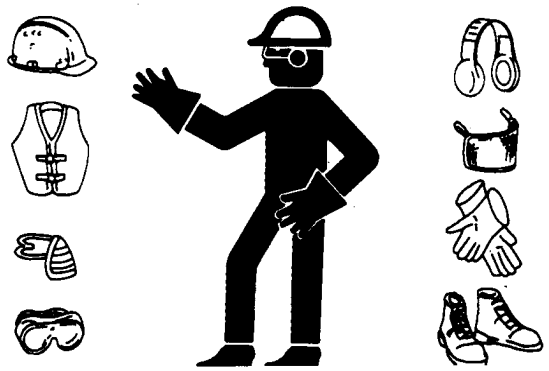
WEAR PROTECTIVE CLOTHING

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

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

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

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

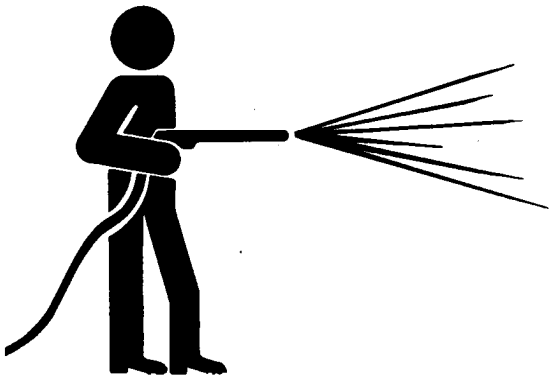


TS206 -UN-23AUG88

DX,WEAR -19-10SEP90

WORK IN CLEAN AREA

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



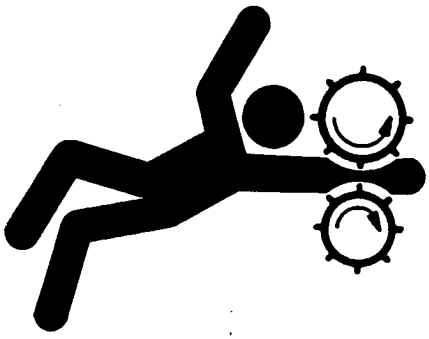
T6642EJ -UN-18OCT88

DX,CLEAN -19-04JUN90

SERVICE MACHINES SAFELY

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

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



TS228 -UN-23AUG88

DX,LOOSE -19-04JUN90

WORK IN VENTILATED AREA

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

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

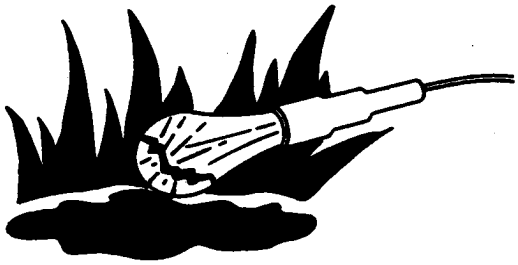


TS220 -UN-23AUG88

DX,AIR -19-04JUN90

ILLUMINATE WORK AREA SAFELY

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

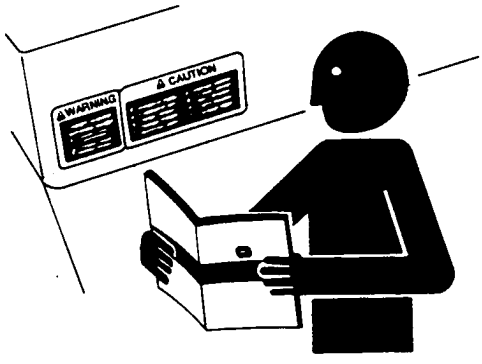


TS223 -UN-23AUG88

DX,LIGHT -19-04JUN90

REPLACE SAFETY SIGNS

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



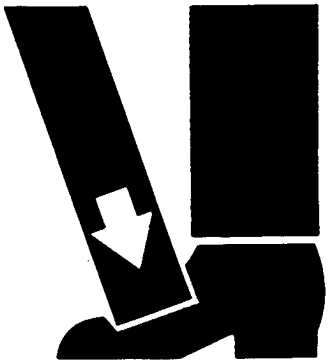
TS201 -UN-23AUG88

DX,SIGNS1 -19-04JUN90

USE PROPER LIFTING EQUIPMENT

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

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



TS226 -UN-23AUG88

DX,LIFT -19-04JUN90

REMOVE PAINT BEFORE WELDING OR HEATING

Avoid potentially toxic fumes and dust.

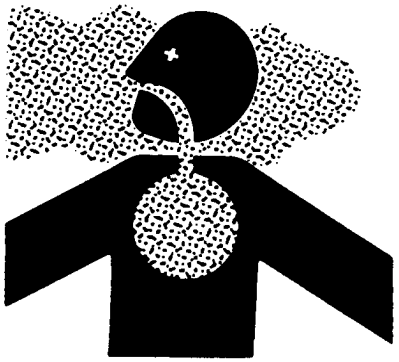
Hazardous fumes can be generated when paint is heated by welding, soldering, or using a torch.

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.



TS220 -UN-23AUG88

DX,PAINT -19-03MAR93

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.



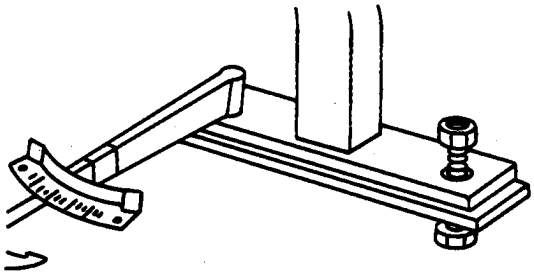
TS953 -UN-15MAY90

DX,TORCH -19-03MAR93

KEEP ROPS INSTALLED PROPERLY

Make certain all parts are reinstalled correctly if the roll-over protective structure (ROPS) is loosened or removed for any reason. Tighten mounting bolts to proper torque.

The protection offered by ROPS will be impaired if ROPS is subjected to structural damage, is involved in an overturn incident, or is in any way altered by welding, bending, drilling, or cutting. A damaged ROPS should be replaced, not reused.



TS212 -UN-23AUG88

DX,ROPS3 -19-03MAR93

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.



TS952 -UN-12APR90

DX,TIRECP -19-24AUG90

PRACTICE SAFE MAINTENANCE

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05
8

Understand service procedure before doing work. Keep area clean and dry.

Never lubricate, service, or adjust machine while it is moving. Keep hands, feet , and clothing from power-driven parts. Disengage all power and operate controls to relieve pressure. Lower equipment to the ground. Stop the engine. Remove the key. Allow machine to cool.

Securely support any machine elements that must be raised for service work.

Keep all parts in good condition and properly installed. Fix damage immediately. Replace worn or broken parts. Remove any buildup of grease, oil, or debris.

Disconnect battery ground cable (-) before making adjustments on electrical systems or welding on machine.



TS218 -UN-23AUG88

DX,SERV -19-03MAR93

USE PROPER TOOLS

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

Use power tools only to loosen threaded parts and fasteners.

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

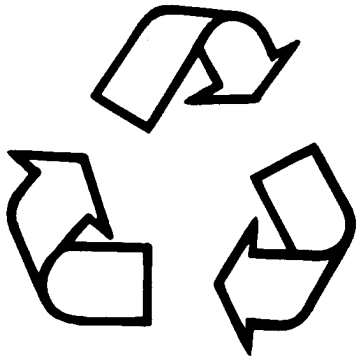
Use only service parts meeting John Deere specifications.



TS779 -UN-08NOV89

DX,REPAIR -19-04JUN90

DISPOSE OF WASTE PROPERLY



TS1133 -UN-26NOV90

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

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

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

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

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

DX,DRAIN -19-03MAR93

LIVE WITH SAFETY

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



TS231 -19-07OCT88

DX,LIVE -19-25SEP92

3325 AND 3365 SPECIFICATIONS

ENGINE	
Make	Yanmar
Type	Diesel
Model	4TN82—RJE
Horsepower at 2700 rpm	28 kW (38 hp)
Number of Cylinders	4
Displacement	1.8 L (110.2 cu in.)
Bore and Stroke	82 x 86 mm (3.23 x 3.39)
Fast Idle	2800 rpm
Slow Idle	1000 rpm
Start Aid	Air Heater
Cooling System	Liquid Cooled
Air Cleaner	Replaceable Dry Type w/Safety Element
Engine Shutoff	Key Switch
FUEL SYSTEM	
Type	Direct Injection
Fuel Delivery	Electric Fuel Pump
ELECTRICAL SYSTEM	
Type	12 Volt
Battery Size	BCI Group 24 F 550 Cold Cranking Amps
Alternator	40 Amps
System Polarity	Negative Ground
Starter	12 Volt Electric w/Solenoid
Instrumentation	Hour Meter, Fuel Gauge & 11 Function Indicators (Stop Engine, Service Alert, Engine Oil Pressure, Engine Coolant Temperature, Water in Fuel, Hydraulic Oil Temperature, Hydrostatic Oil Temperature, Engine Air Heater, Parking Brake, Engine Alternator Volts, Engine Air Restriction)

MX,1010HV,A1 -19-30NOV92

SPECIFICATIONS—CONTINUED

POWER TRAIN

Type	25 Series Sundstrand w/Kansaki Transaxle
Control (Foot)	2 Pedal

Travel Speeds:

Forward (Transport)	0—18.7 km/h (0—11.7 mph)
Reverse	0—9.7 km/h (0—6 mph)
Mowing	0—10.8 km/h (0—7.2 mph)

STEERING/BRAKES

Steering	Hydrostatic Power
Brakes	Mechanical Wet Disk

HYDRAULIC SYSTEM

Dual Hydraulic Pump Flow at 2800 rpm	37.8 L/min (10 gpm) per section
Reel Relief Valve	20684 kPa (207 bar) (3000 psi)
Wing Lift and Rockshaft Relief Valves	14617 kPa (146 bar) (2120 psi)
Filter Bypass Relief Valve	138—207 kPa (1.4—2.1 bar) (20—30 psi)

HYDROSTATIC SYSTEM

Charge Pump Flow at 2800 rpm	12.1 L/min (3.2 gpm) minimum
Charge Pump Relief Valve	965—1379 kPa (9.6—13.8 bar) (140—200 psi)
Main Relief Valve	41369—44816 kPa (414—448 bar) (6000—6500 psi)
Filter Bypass Relief Valve	138—207 kPa (1.4—2.1 bar) (20—30 psi)
Cooler Bypass Relief Valve	552—896 kPa (5.5—9.0 bar) (80—130 psi)
Transaxle Pump Flow at 2800 rpm	31.8 L/min (8.4 gpm)
Steering Relief Valve	10497 + 500—0 kPa (105 + 5 - 0 bar) (1522.5 + 72.5 - 0 psi)

CAPACITIES

Fuel Tank	75 L (20 gal)
Engine Crankcase	5.7 L (6.0 qt) with Filter
Engine Cooling System	6.6 L (7 qt)
Hydraulic System	26.5 L (7 gal)
Hydrostatic Transaxle System	18.9 L (5 gal)
Cutting Unit Gear Case	0.4 L (0.8 pt)

MX,1010HV,A2 -19-30NOV92

SPECIFICATIONS—CONTINUED

TIRES
Size:
- Front . . . . . 33 x 12.5—15
- Rear . . . . . 23 x 10.5—12

Maximum Inflation:
- Front (Mowers Up) . . . . . 68 kPa (0.7 bar) (9.9 psi)
- Front (Mowers Down) . . . . . 67 kPa (0.67 bar) (9.7 psi)
- Rear . . . . . 62 kPa (0.6 bar) (9.0 psi)

OVERALL DIMENSIONS:
Wheelbase . . . . . 162.5 cm (64 in.)
Tread Width . . . . . 142 cm (56 in.)
Machine Width (Mowers down) . . . . . 368 cm (145 in.)
Machine Width (Mowers up) . . . . . 226 cm (89 in.)
Turning Radius . . . . . 152 cm (60 in.)
Working Weight . . . . . 1619 kg (3570 lb)

MOWER
Mower Lift . . . . . Single Lift Lever w/Auxiliary Switches for Wing Mowers
Number of Reels 5
Overall Cutting Width . . . . . 3.5 m (138 in.)

Reel Speed (3325) . . . . . 1300 rpm
Bed Knife Adjustment . . . . . Reel to Bed Knife
Height of Cut Range . . . . . 10 to 76 mm (0.375 to 3.0 in.)
Number of Blades . . . . . 6 standard; 8 or 10 optional

CUTTING RATIOS

Ground Speed:		**7 km/h (4.5 mph)**	**8 km/h (5.0 mph)**	**9 km/h (5.5 mph)**	**10 km/h (6.0 mph)**	**11 km/h (6.5 mph)**	**11.6 km/h (7.2 mph)**
NO. of BLADES	**MODEL**						
6 Blades	**3325**	**17.4 mm (0.71 in.)**	**19.8 mm (0.79 in.)**	**22.3 mm (0.86 in.)**	**24.8 mm (0.94 in.)**	**27.3 mm (1.02 in.)**	**28.8 mm (1.13 in.)**
	3365	**16.0 mm (0.63 in.)**	**18.0 mm (0.71 in.)**	**20.0 mm (0.78 in.)**	**22.0 mm (0.85 in.)**	**23.0 mm (0.92 in.)**	**26.0 mm (1.02 in.)**
8 Blades	**3325**	**13.0 mm (0.53 in.)**	**14.9 mm (0.59 in.)**	**16.7 mm (0.65 in.)**	**18.6 mm (0.71 in.)**	**20.5 mm (0.77 in.)**	**21.6 mm (0.85 in.)**
	3365	**12.0 mm (0.47 in.)**	**13.0 mm (0.51 in.)**	**15.0 mm (0.59 in.)**	**16.0 mm (0.63 in.)**	**18.0 mm (0.71 in.)**	**19.0 mm (0.75 in.)**
10 Blades	**3325**	**10.4 mm (0.42 in.)**	**11.9 mm (0.47 in.)**	**13.4 mm (0.52 in.)**	**14.9 mm (0.57 in.)**	**16.4 mm (0.61 in.)**	**17.3 mm (0.68 in.)**
	3365	**10.0 mm (.38 in.)**	**11.0 mm (0.42 in.)**	**12.0 mm (0.47 in.)**	**13.0 mm (0.51 in.)**	**14.0 mm (0.55 in.)**	**15.0 mm (0.59 in.)**

MX,1010HV,A3 -19-30NOV92

REPAIR SPECIFICATIONS

NOTE: For repair specification of the engine, use CTM3, 3TN and 4TN Series Yanmar Diesel Engines.

For repair specification of reel mower cutting units, use TM1528, Reel Mower Cutting Units.

Item	Measurement	Specification
SECTION 20—ENGINE REPAIR		
ENGINE:		
Mounting Bracket-to-Frame Cap Screws and Nuts	Torque	44—54 N·m (33—40 lb-ft)
Mounting Bracket-to-Engine Cap Screws (16 used)	Torque	90 N·m (66 lb-ft)
COOLING SYSTEM:		
Coolant Level Below Bottom of Filler Neck	Distance	13—25 mm (0.5—1.0 in.)
Radiator-to-Frame Cap Screws	Torque	31—37 N·m (270—330 lb-in.)
SECTION 30—FUEL AND AIR REPAIR		
For all injection pump, nozzle and governor repair—Use CTM3.		
SECTION 40—ELECTRICAL SYSTEM		
For starter and alternator repair—use CTM3.		
SECTION 50—POWER TRAIN REPAIR		
DRIVE SHAFT:		
Drive Shaft-to-Isolator Cap Screws and Nuts	Torque	49 N·m (36 lb-ft)
Isolator-to-Flywheel Cap Screws	Torque	49 N·m (36 lb-ft)
Engine Mount-to-Frame Cap Screws	Torque	44—54 N·m (33—40 lb-ft)
Drive Shaft Coupler Cap Screws	Torque	60 N·m (45 lb-ft)
CHARGE PUMP:		
Seal	Depth Below Surface	1.5—2.5 mm (0.056—0.096 in.)
Charge Pump-to-Transmission Cap Screws	Torque	37—50 N·m (27—37 lb-ft)

MX,1015HV,A2 -19-30NOV92

REPAIR SPECIFICATIONS—CONTINUED

Item	Measurement	Specification
SECTION 50—POWER TRAIN REPAIR—CONTINUED		
HYDROSTATIC TRANSMISSION:		
Swash Plate End Covers Cap Screws	Torque	8—9 N·m (72—84 lb-in.)
Center Section Needle Bearings	Depth above surface of housing	3 mm (7/64 in.)
Center Section-to-Housing Cap Screws	Torque	44—55 N·m (33—41 lb-ft)
Gear to Output Shaft Cap Screw	Torque	54 N·m (40 lb-ft)
Transmission-to-Transaxle Cap Screws	Torque	142 N·m (105 lb-ft)
Neutral Centering Spring		
S.N. —840000	Approx Length	133 mm (5.25 in.)
S.N. 840001—	Approx Length	203 mm (8.00 in.)
HYDROSTATIC OIL COOLER:		
Oil Cooler Fittings	Torque	34 N·m (25 lb-ft)
TRANSAXLE:		
PTO Clutch		
Separator Plate-to-Cylinder	Maximum distance	4.7 mm (0.185 in.)
Top Plate	Minimum thickness	2.9 mm (0.114 in.)
Clutch Disk	Minimum thickness	1.9 mm (0.075 in.)
Separator Plate	Minimum thickness	1.0 mm (0.039 in.)
Piston Return Spring	Minimum free length	29 mm (1.14 in.)
	Minimum working load	17.5 mm at 540 N (0.689 in. at 121 lb)
Differential		
Bearing Retainer Cap Screws	Torque	26 N·m (19 lb-ft)
Rear Cover Assembly		
M12 Cap Screws	Torque	90 N·m (66 lb-ft)
M10 Cap Screws	Torque	50 N·m (37 lb-ft)
M8 Cap Screws	Torque	26 N·m (19 lb-ft)
Differential Ring Gear	Backlash	0.15—0.21 mm (0.006—0.008 in.)
Differential Carrier-to-Case Cap Screws	Torque	26 N·m (19 lb-ft)
Front Cover Cap Screws		
M12 Cap Screw	Torque	90 N·m (66 lb-ft)
M10 Cap Screw	Torque	50 N·m (37 lb-ft)
PTO Valve Cover Cap Screws	Torque	26 N·m (19 lb-ft)
Support-to-Transaxle Cap Screws	Torque	80 N·m (59 lb-ft)
ROPS-to-Frame Cap Screws and Nuts	Torque	130 N·m (96 lb-ft)
Frame-to-Transaxle Cap Screws	Torque	175 N·m (129 lb-ft)
Cross Brace-to-Frame Cap Screws and Nuts (3365)	Torque	175 N·m (129 lb-ft)

MX,1015HV,A3 -19-30NOV92

REPAIR SPECIFICATIONS—CONTINUED

Item	Measurement	Specification
SECTION 50—POWER TRAIN REPAIR—CONTINUED		
Front Wheel Lug Bolts	Torque	115 N·m (85 lb-ft)
Oil Cooler-to-Transmission Hose Connections	Torque	49 N·m (36 lb-ft)
Wing Lift-to-Flow Control Valve Hose Connection	Torque	49 N·m (36 lb-ft)
Steering Valve-to-Flow Control Valve Hose Connection	Torque	49 N·m (36 lb-ft)
Steering Valve-to-PTO Valve Hose Connection	Torque	49 N·m (36 lb-ft)
Hydraulic Pump-to-Transaxle Cap Screws	Torque	54 N·m (40 lb-ft)
Cutting Unit Supply Line-to-Hydraulic Pump Connections	Torque	102 N·m (75 lb-ft)
Suction Tube-to-Hydraulic Pump Flange Cap Screws	Torque	37 N·m (27 lb-ft)
Lift Link-to-Rockshaft Arm Cap Screws and Nuts	Torque	163 N·m (120 lb-ft)
FINAL DRIVES:		
Seal Housing-to-Axle Housing Cap Screws (Axle S.N. —000755)	Torque	25 N·m (18 lb-ft)
Ring Gear Cap Screws	Torque	26 N·m (230 lb-in.)
Final Drive-to-Differential Housing Cap Screws	Torque	52 N·m (38 lb-ft)
CONTROL LINKAGE:		
Neutral Centering Lever Bushing (S.N. 840001—)	Minimum diameter	19.088 ± 0.025 mm (0.7515 ± 0.001 in.)

MX,1015HV,A4 -19-30NOV92

REPAIR SPECIFICATIONS—CONTINUED

Item	Measurement	Specification
SECTION 60—STEERING AND BRAKE REPAIR		
STEERING VALVE:		
Rotor to Stator Clearance	Maximum clearance	0.08 mm (0.003 in.)
Top of Steering Tube to Bushing	Dimension	2.5 mm (0.1 in.)
Metering Assembly Screws	Torque	1.4 ± 0.1 N·m (12 ± 1 lb-in.)
Commutator Ring and Drive Plate TIR	Maximum allowable TIR	0.13 mm (0.005 in.)
Port Cover Nuts	Torque	30 N·m (266 lb-in.)
Check Ball Plug	Torque	14 N·m (124 lb-in.)
Steering Wheel Nut	Torque	15 N·m (11 lb-ft)
Relief Valve	Pressure	10497 + 500 - 0 kPa (1522.5 + 72.5 - 0 psi)
BRAKES:		
Brake Disk	Thickness (new)	4.6—4.8 mm (0.181—0.189 in.)
	Minimum thickness	4.4 mm (0.173 in.)
Brake Disk Spline-to-Shaft	Backlash (new)	0.13—0.31 mm (.005—.012 in.)
	Maximum backlash	1.2 mm (0.047 in.)
Brake Linkage Rod	Approximate length (includes clevis)	557 mm (21.9 in.)
Brake Plate	Thickness (new)	2.5—2.7 mm (0.098—0.106 in.)
	Minimum thickness	2.3 mm (0.090 in.)
	Warpage (new)	0.15 mm (0.006 in.)
	Maximum warpage	0.3 mm (0.012 in.)
STEERING AXLE:		
Steering Cylinder-to-Spindle Nut	Torque	75 N·m (55 lb-ft)
Tie Rod-to-Spindle Nut	Torque	53 N·m (39 lb-ft)
Toe-in Adjustment	Length less at front than at rear of rear tires	6 mm (1/4 in.)
Tie Rod Nut	Torque	118 N·m (87 lb-ft)
Pivot Pin Nut	Torque	509 N·m (375 lb-ft)
Axle Pivot End Play	Approximate clearance	1 mm (0.040 in.)

MX,1015HV,A5 -19-30NOV92

REPAIR SPECIFICATIONS—CONTINUED

Item	Measurement	Specification
SECTION 70—HYDRAULIC REPAIR		
HYDRAULIC PUMPS:		
Transaxle Pump-to-Differential Housing Cap Screws	Torque	47 N·m (35 lb-ft)
Lift Link-to-Rockshaft Arm Cap Screw	Torque	163 N·m (120 lb-ft)
Transaxle Pump Cover Socket Head Screws	Torque	47 N·m (35 lb-ft)
Hydraulic Pump Socket Head Screws	Torque	47 N·m (35 lb-ft)
Hydraulic Pump Mounting Cap Screws	Torque	54 N·m (40 lb-ft)
Hydraulic Pump Tube Nuts	Torque	102 N·m (75 lb-ft)
REEL CONTROL VALVE:		
Tie Rod Nuts	Torque	18.6 N·m (165 lb-in.)
WING LIFT VALVE:		
Tie Rod Nuts	Torque	13 N·m (115 lb-in.)
FLOW CONTROL VALVE:		
Priority Flow Divider Spool Plug	Torque	98 N·m (72 lb-ft)
Proportional Flow Divider Spool Plug	Torque	44 N·m (33 lb-ft)
Relief Spools Seat Retainers	Torque	29 N·m (22 lb-ft)
Relief Spools Plugs	Torque	98 N·m (72 lb-ft)
Socket Head Mounting Screws	Torque	17 N·m (150 lb-in.)
WEIGHT TRANSFER:		
Solenoid Nut	Torque	5.5—8 N·m (48—72 lb-in.)
Cylinder Piston	Torque	47 N·m (35 lb-ft)
ROCKSHAFT ASSEMBLY:		
Rockshaft Valve		
Control Valve Spool Bolt Torque	Torque	10 N·m (88 lb-in.)
Control Valve-to-Rockshaft Cap Screw	Torque	24 N·m (18 lb-ft)
Control Valve Cover-to-Rockshaft Cap Screws	Torque	27 N·m (20 lb-ft)
Rockshaft Upper Lever Tension	Force	11.3—13.6 Kg (25—30 lb)
Rockshaft Piston Cover		
Piston Cover-to-Rockshaft	Torque	88 N·m (65 lb-ft)
Check Relief Valve Spring	Free length	27.7 mm (1.09 in.)
	Compressed length	18 mm at 10N (0.71 in. at 2 lb)
Check Relief Valve Plug	Torque	34 N·m (25 lb-ft)
Stop Valve Spring	Free length	36 mm (1.4 in.)
	Compressed length	14 mm at 59N (0.55 in. at 13 lb)
Stop Bolt Assembly-to-Piston Cover Socket Head Screws	Torque	25 N·m (18 lb-ft)
Overload Relief Valve Spring	Free length	44 mm (1.73 in.)
	Compressed length	38 mm at 170 N (1.50 in. at 38 lb)

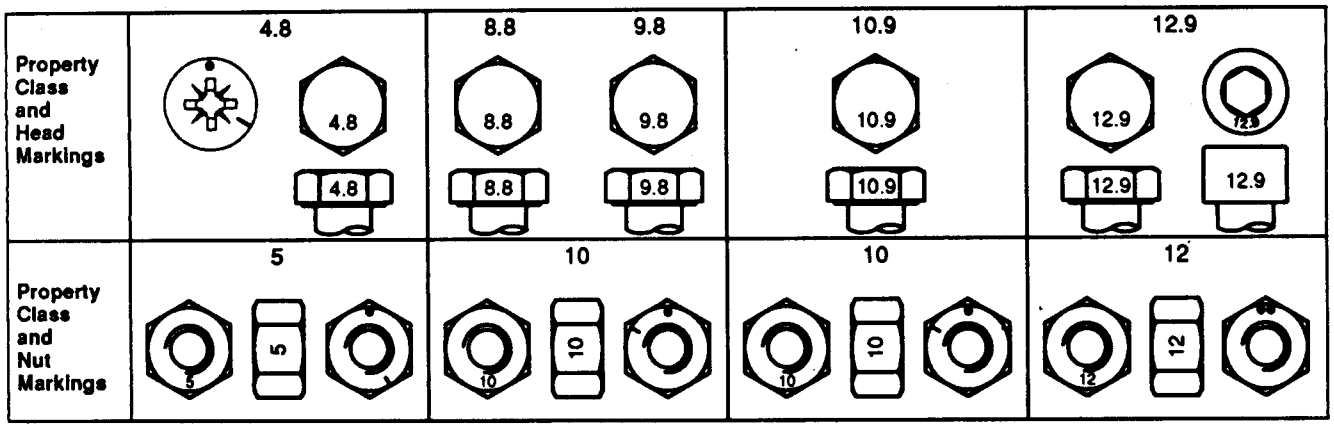
MX,1015HV,A6 -19-30MAR93

REPAIR SPECIFICATIONS—CONTINUED

Item	Measurement	Specification
SECTION 70—HYDRAULIC REPAIR—CONTINUED		
Rockshaft Piston Cover—Continued		
Safety Relief Valve Retainer	Torque	27 N·m (20 lb-ft)
Safety Relief Valve Plug	Torque	78 N·m (58 lb-ft)
Rockshaft Piston		
Rockshaft Cylinder	ID	60.00—60.046 mm (2.362—2.364 in.)
Rockshaft Piston	OD	59.94—59.97 mm (2.360—2.361 in.)
Piston-to-Cylinder Wear Clearance	Maximum clearance	0.3 mm (0.012 in.)
Rockshaft Housing		
Rockshaft Sleeve	OD	44.950—44.975 mm (1.769—1.770 in.)
Sleeve-to-Bushing Clearance	Maximum clearance	0.4 mm (0.016 in.)
Rockshaft Bushing	ID	45.000—45.039 mm (1.771—1.773 in.)
Lift Arm-to-Rockshaft Bolts	Torque	52 N·m (38 lb-ft)
Rockshaft-to-Transmission Cap Screws	Torque	52 N·m (38 lb-ft)
Lift Linkage-to-Lift Arms Cap Screws and Nuts	Torque	163 N·m (120 lb-ft)
CUTTING UNIT MOTOR:		
3325 Reel Motor-to-Cutting Unit Cap Screws	Torque	16 N·m (142 lb-in.)
Motor Cap Screws	Torque	47 N·m (35 lb-ft)
Motor Gear Nut	Torque	54 N·m (40 lb-ft)
SECTION 80—MISCELLANEOUS REPAIR		
3325 Reel Motor-to-Cutting Unit Cap Screws	Torque	16 N·m (142 lb-in.)

MX,1015HV,A7 -19-30MAR93

METRIC BOLT AND CAP SCREW TORQUE VALUES



-19-04MAR91

TS1163

Size	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]	
	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	4.8	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	190
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 values if a different torque value or tightening procedure is given for a specific application. Torque values listed are for general use only. Check tightness of fasteners periodically.

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

Fasteners should be replaced with the same or higher property class. If higher property class fasteners are used, these should only be tightened to the strength of the original.

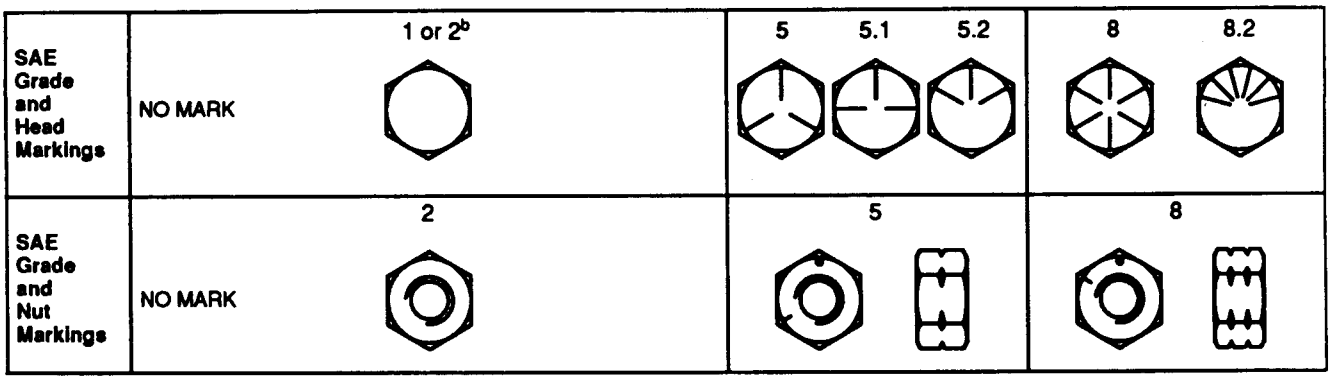
Make sure fasteners threads are clean and that you properly start thread engagement. This will prevent them from failing when tightening.

Tighten plastic insert or crimped steel-type lock nuts to approximately 50 percent of the dry torque shown in the chart, applied to the nut, not to 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 without any lubrication.

DX,TORQ2 -19-16APR92

UNIFIED INCH BOLT AND CAP SCREW TORQUE VALUES



-19-04MAR91
TS1162

Size	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]	
	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 values if a different torque value or tightening procedure is given for a specific application. Torque values listed are for general use only. Check tightness of fasteners periodically.

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

Fasteners should be replaced with the same or higher grade. If higher grade fasteners are used, these should only be tightened to the strength of the original.

Make sure fasteners threads are clean and that you properly start thread engagement. This will prevent them from failing when tightening.

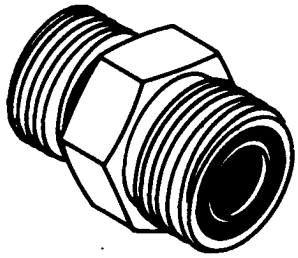
Tighten plastic insert or crimped steel-type lock nuts to approximately 50 percent of the dry torque shown in the chart, applied to the nut, not to the bolt head. Tighten toothed or serrated-type lock nuts to the full torque value.

[a] "Lubricated" means coated with a lubricant such as engine oil, or fasteners with phosphate and oil coatings. "Dry" means plain or zinc plated 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.

DX,TORQ1 -19-15MAR91

O-RING FACE SEAL FITTINGS SERVICE RECOMMENDATIONS



T6243AD -UN-18OCT88

1. Inspect the fitting sealing surfaces. They must be free of dirt or defects.

2. Inspect the O-ring. It must be free of damage or defects.

3. Lubricate O-rings and install into groove using petroleum jelly to hold in place.

4. Push O-ring into the groove with plenty of petroleum jelly so O-ring is not displaced during assembly.

5. Index angle fittings and tighten by hand 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.

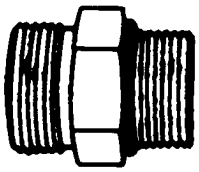
O-RING FACE SEAL FITTING TORQUE

Nominal Tube O.D.			Thread Size	Swivel Nut Torque		Bulkhead Nut Torque	
mm	in.	Dash Size	in.	Nm	lb-ft	Nm	lb-ft
6.35	0.250	-4	9/16-18	16	12	5.0	3.5
9.52	0.375	-6	11/16-16	24	18	9.0	6.5
12.70	0.500	-8	13/16-16	50	37	17.0	12.5
15.88	0.625	-10	1-14	69	51	17.0	12.5
19.05	0.750	-12	1 3/16-12	102	75	17.0	12.5
22.22	0.875	-14	1 3/16-12	102	75	17.0	12.5
25.40	1.000	-16	1 7/16-12	142	105	17.0	12.5
31.75	1.250	-20	1 11/16-12	190	140	17.0	12.5
38.10	1.500	-24	2-12	217	160	17.0	12.5

NOTE: Torque tolerance is +15 -20%.

EX,2243,1010,9 -19-08MAR91

O-RING BOSS FITTINGS SERVICE RECOMMENDATIONS



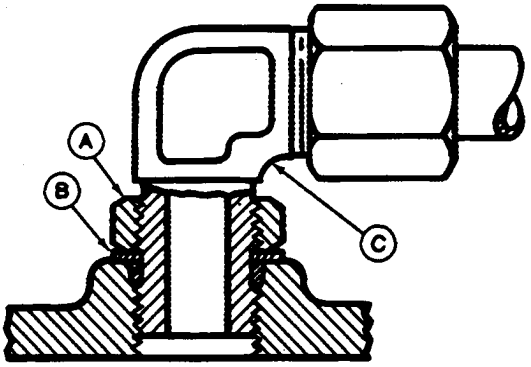
T6243AE -UN-18OCT88

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.

Occasionally a lower durometer O-ring will seat against a rough seat. If neither of these solutions work, the component must be replaced.

2. Put hydraulic oil, petroleum jelly or soap on the O-ring. Put a thimble over the threads to protect O-ring from nicks. Slide O-ring over the thimble and into the turned down section of fitting.

For angle fittings (C), loosen special nut (A) and push special washer (B) against threads so O-ring can be installed into the turned down section of fitting.



T6520AB -UN-18OCT88

3. 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.

4. To position angle fittings, turn the fitting counterclockwise a maximum of one turn.

5. 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 (1)

Thread Size	Torque[1] N·m	(lb-ft)	Number of Flats[2]
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

[1]Torque tolerance is ± 10 percent.

[2]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.

EX,2243,1010,8 -19-08MAR91

FUEL

CAUTION: Handle fuel carefully. If the engine is running, do not fill the fuel tank. If engine is hot, let engine cool several minutes before you add fuel. Do not smoke while you fill the fuel tank or service the fuel system. Fill fuel tank only to bottom of filler neck.

Fuel tank cap is vented. Use only a vented cap.



E30097 -UN-11DEC89

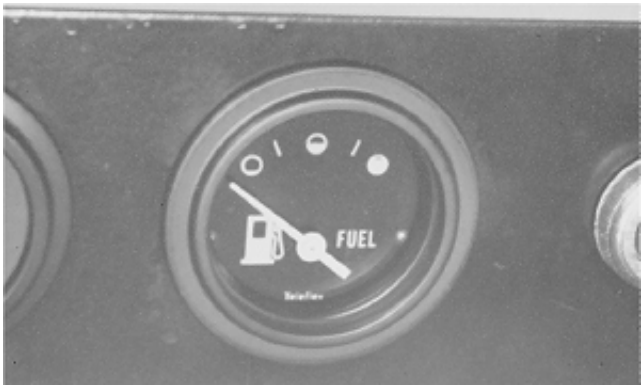
2E6,1025G,1 -19-25MAY90

Check fuel gauge regularly.

Fuel tank capacity is 75.7 L (20 gal).

Fill fuel tank at end of each day's operation.

If engine runs out of fuel:
—Fill fuel tank.
—Bleed fuel system.



M38945 -UN-29AUG88

2E6,1025G,2 -19-25MAY90

FUEL SPECIFICATIONS

Use ONLY clean, high-quality fuel.

Use Grade No. 2-D fuel at temperatures above 4˚C (40˚F).

Use Grade No. 1-D fuel at temperatures below 4˚C (40˚F).

Use Grade No. 1-D fuel for all air temperatures at altitudes above 1 500 m (5000 ft).

IMPORTANT: Use fuel with less than 1.0 percent sulfur. If possible, use fuel with less than 0.5 percent sulfur. If fuel sulfur content exceeds 0.5 percent, change engine oil and filter every 100 hours.

For maximum filter life, sediment and water should not be more than 0.10 percent.

The octane number should be 40 minimum. If you operate your machine where air temperatures are normally low or where altitudes are high, you may need fuel with a higher cetane number.

Cloud Point—For cold weather operation, cloud point should be 6˚C (10˚F) below lowest normal air temperature.

2E6,1025G,3 -19-25MAY90

FUEL STORAGE

NOTE: Diesel fuels stored for a long time may form gum and plug filters.

Keep fuel in a clean container in a protected area. Water and sediment must be removed before fuel gets to the engine. Do not use de-icers to remove water from fuel. Do not depend on fuel filters to remove water.

If possible, install a water separator at the storage tank outlet. (See your John Deere dealer for this part).

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

Store fuel drum on its side with plug up.

M21,FLQ,B -19-02APR85

DO NOT USE GALVANIZED CONTAINERS

IMPORTANT: Diesel fuel stored in galvanized containers reacts with zinc coating on 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.

DO NOT USE a galvanized container to store diesel fuel.

Store fuel in:
—plastic containers.
—aluminum containers.
—specially coated steel containers made for diesel fuel.

DO NOT USE brass-coated containers: brass is an alloy of copper and zinc.

M21,FLQ,B1 -19-02AUG85

ENGINE OIL

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

The following oil is preferred:

• John Deere TORQ-GARD SUPREME PLUS-50™

The following oils are also recommended:

• John Deere TORQ-GARD SUPREME®
• John Deere UNI-GARD™

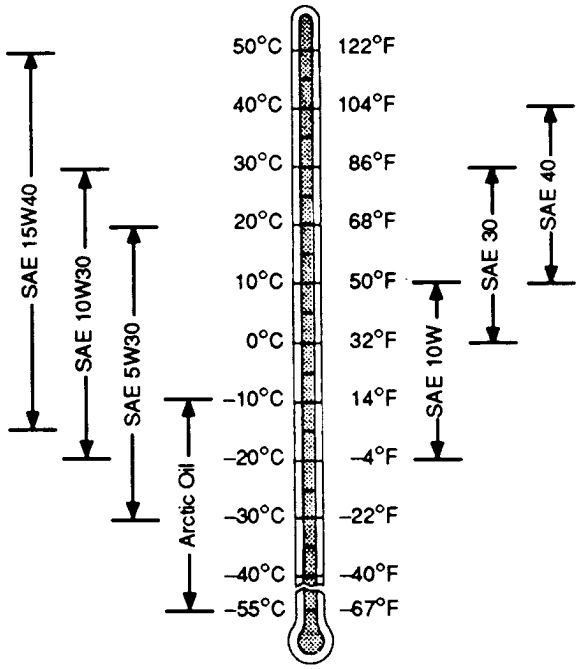
Other oils may be used if they meet one of the following:

• API Service Classification CE
• API Service Classification CD
• CCMC Specification D5
• CCMC Specification D4

If John Deere TORQ-GARD SUPREME PLUS-50 engine oil and a John Deere oil filter are used, the oil and filter service interval may be extended by 50 hours.

If diesel fuel exceeding 0.5% sulfur content is used, reduce the service interval for engine oil and filter by 50%.

Oils meeting Military Specification MIL-L-46167B may be used as arctic oils.



DX,ENOIL -19-03MAR93

ENGINE COOLANT

10
20
4

John Deere Low Silicate Antifreeze is recommended.

Also recommended is low silicate antifreeze formulated to GM6038M or equivalent.

Other antifreezes that may be used:
• Ethylene-glycol type.
• Those containing not more than 0.1 percent anhydrous metasilicate.
• Those meeting General Motors Performance Specification GM1899M

IMPORTANT: Some types of ethylene-glycol antifreeze are intended for automotive use. These products are often labeled for use in aluminum engines and usually contain more than 0.1 percent of anhydrous metasilicate.

Check container label or consult with antifreeze supplier before using.

Mix 50-67 percent low silicate antifreeze with 33-50 percent distilled or deionized water.

Low silicate antifreeze provides:
• Adequate heat transfer.
• Corrosion-resistant environment within the cooling system.
• Compatibility with cooling system hose and seal material.
• Protection during cold and hot weather operations.

Certain geographical areas may require special antifreeze or coolant practices. If you have any questions, consult your authorized servicing dealer to obtain the latest information and recommendations.

DX,COOL -19-04JUN90

TRANSMISSION AND HYDRAULIC OIL

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

The following oils are preferred:

- John Deere HY-GARD®
- John Deere Low Viscosity HY-GARD®

The following oil is also recommended:

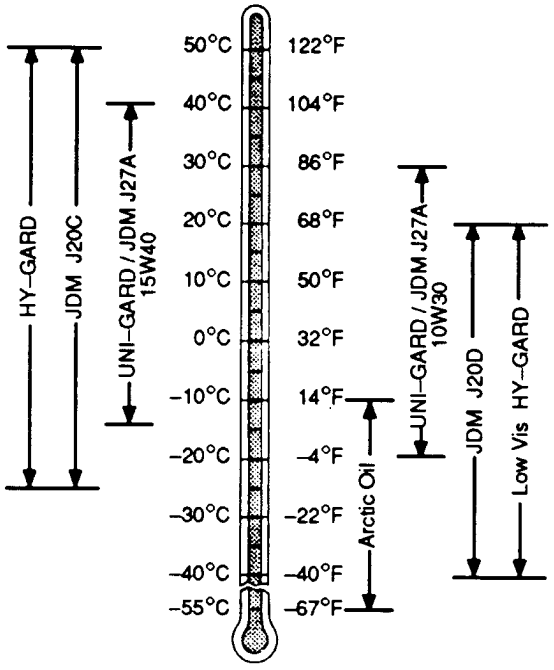
- John Deere UNI-GARD™

Other oils may be used if they meet one of the following:

- John Deere Standard JDM J20C
- John Deere Standard JDM J20D
- John Deere Standard JDM J27A

IMPORTANT: Do not use engine oil for this application.

Oils meeting Military Specification MIL-L-46167B may be used as arctic oils.



TS1413 -UN-29MAY92

DX,ANTI -19-03MAR93

GREASE

Use grease based on the expected air temperature range during the service interval.

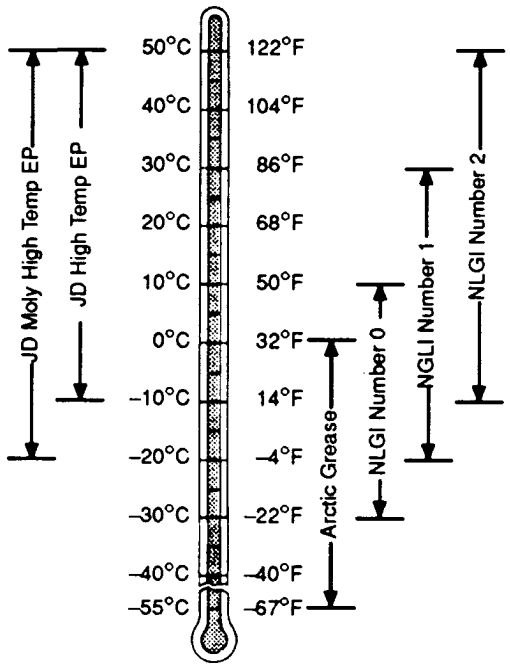
The following greases are preferred:

- John Deere MOLY HIGH TEMPERATURE EP GREASE
- John Deere HIGH TEMPERATURE EP GREASE
- John Deere GREASE-GARD™

Other greases may be used if they meet one of the following:

- SAE Multipurpose EP Grease with a maximum of 5% molybdenum disulfide
- SAE Multipurpose EP Grease

Greases meeting Military Specification MIL-G-10924F may be used as arctic grease.



DX,GREA1 -19-03MAR93

ALTERNATIVE AND SYNTHETIC LUBRICANTS

Conditions in certain geographical areas may require lubricant recommendations different from those printed in this operator's manual. Some John Deere lubricants may not be available in your location. Consult your John Deere dealer to obtain information and recommendations.

Synthetic lubricants may be used if they meet the performance requirements as shown in this operator's manual.

DX,ALTER -19-03MAR93

LUBRICANT STORAGE

Your equipment can operate at top efficiency only if clean lubricants are used.

Use clean containers to handle all lubricants.

Whenever possible, store lubricants and containers in an area protected from dust, moisture, and other contamination. Store containers on their side to avoid water and dirt accumulation.

DX,LUBST -19-03MAR93

SERIAL NUMBERS

When working on machines or components that are covered by warranty, it is IMPORTANT that you include the Product Identification Number and the component serial number on the warranty claim form.

The location of component serial number plates is shown below.

2E6,1030G,1 -19-25MAY90

PRODUCT IDENTIFICATION NUMBER

Located on left side of the frame, just below fuel tank.

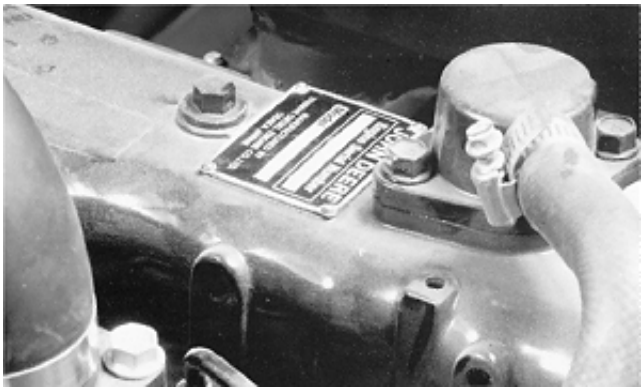


E30083 -UN-11DEC89

2E6,1030G,2 -19-30NOV92

ENGINE SERIAL NUMBER

Located on engine valve cover.

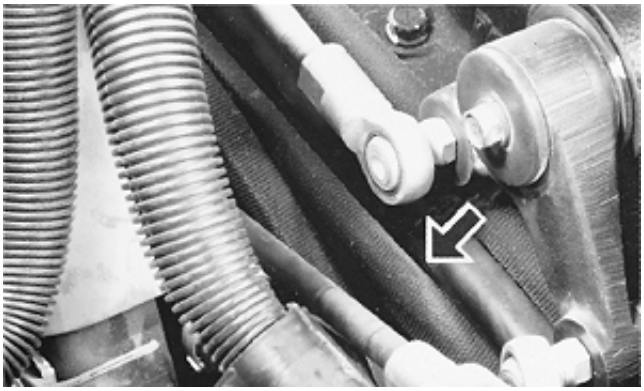


E30084 -UN-11DEC89

2E6,1030G,3 -19-30NOV92

TRANSAXLE SERIAL NUMBER

Located on flat surface of transaxle case, below right rockshaft lift arm.



E30085 -UN-11DEC89

2E6,1030G,4 -19-30NOV92

TRANSMISSION SERIAL NUMBER

3325
- Located on plate attached to right side of transmission.

3365
- Located on top, left side of transmission.

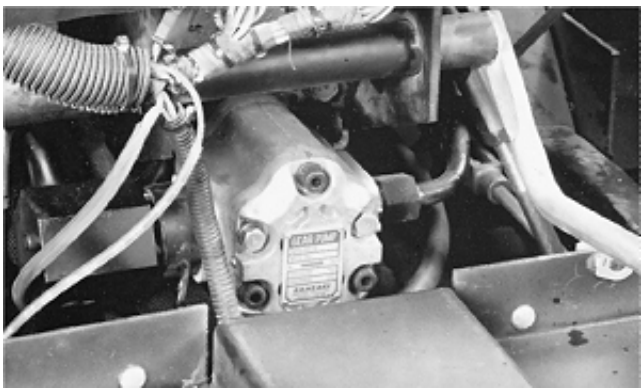


E30086 -UN-11DEC89

2E6,1030G,5 -19-30NOV92

TRANSAXLE PUMP SERIAL NUMBER

Located on pump end cover.

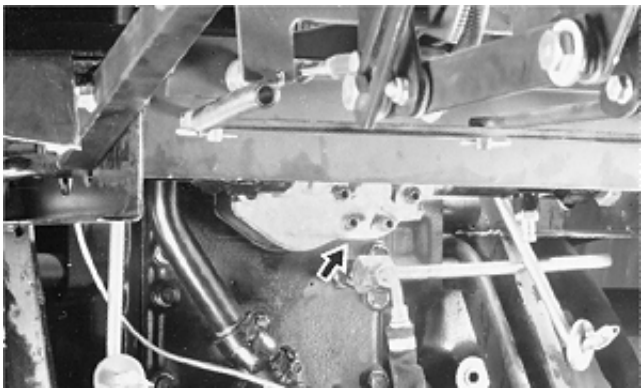


E30087 -UN-11DEC89

2E6,1030G,6 -19-30NOV92

DUAL HYDRAULIC PUMP SERIAL NUMBER

Located on bottom of pump housing.



E30088 -UN-11DEC89

2E6,1030G,7 -19-30NOV92

Section 20
ENGINE REPAIR

Contents

Page

Group 05—Engine Removal and Installation
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Other Material 20-05-1
Specifications 20-05-1
Remove Engine 20-05-2

Group 10—Muffler
Remove Muffler 20-10-1
Install Muffler 20-10-1

Group 15—Cooling System
Specifications 20-15-1
Radiator
Remove and Inspect 20-15-1
Install 20-15-2

4TN SERIES YANMAR ENGINE REPAIR—USE CTM-3

For complete repair information the component technical manual (CTM) is also required.

Use the component manual in conjunction with this machine manual.



TS225 -UN-17JAN89

2E6,2005G,1A -19-25MAY90

SERVICE EQUIPMENT AND TOOLS

NOTE: Order tools from the U.S. SERVICEGARD™ Catalog or from the European Microfiche Tool Catalog (MTC). Some tools may be available from a local supplier.

Name	Use
Load-Positioning Sling	To remove and install engine.
Repair Stand	To hold engine during disassembly and assembly.

M21,2005X,A -19-27JUN86

OTHER MATERIAL

Number	Name	Use
PT469	John Deere NEVER-SEEZ®	To lubricate spring dampener spline.

NEVER-SEEZ is a trademark of the Never-Seez Corp.

2E6,2005G,1B -19-25MAY90

SPECIFICATIONS

Item	Measurement	Specification
Engine Mounting Bracket-to-Frame Cap Screws (4 used)	Torque	44—54 N·m (33—40 lb-ft)
Mounting Bracket-to-Engine Cap Screws (16 used)	Torque	90 N·m (66 lb-ft)
Coolant level below bottom of filler neck	Distance	13—25 mm (0.5—1.0 in.)

MX,2005HV,A1A -19-30NOV92

REMOVE ENGINE

1. Remove hood.

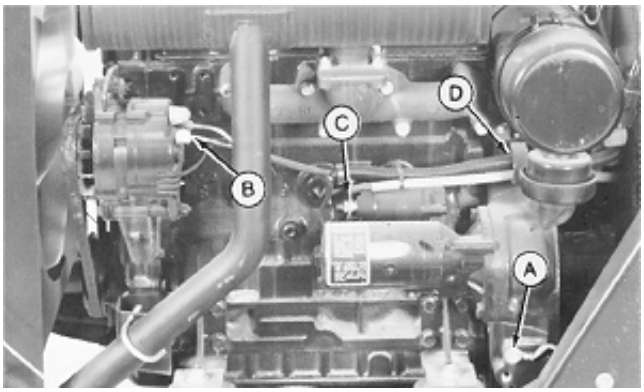
2. Remove radiator. (See Group 10 in this section.)

3. Disconnect ground wire (A) from battery and engine.

4. Disconnect wires from alternator (B) and starter (C). Label wires for proper assembly.

5. Remove strap (D) on 3325 units only.

6. Remove muffler. (See Section 20, Group 10.)



-UN-22MAY90
E34148

A—Ground Wire
B—Alternator
C—Starter
D—Strap (3325 only)

MX,2005HV,A1 -19-30NOV92

7. Remove coolant temperature sensor lead (A).

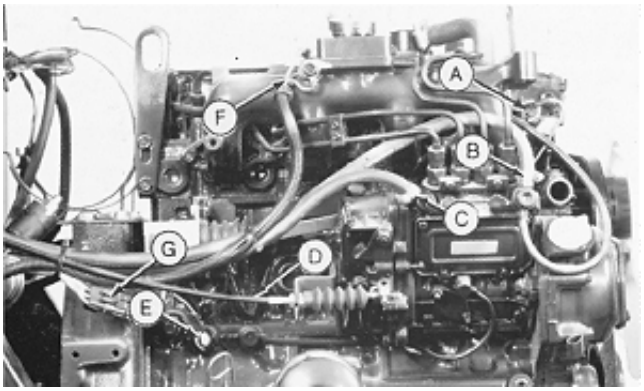
8. Remove fuel return hose (B) and fuel supply hose (C). Plug hose ends and pump fittings.

9. Remove throttle cable (D).

10. Remove oil pressure sensor lead (E).

11. Remove engine air preheat leads (F).

12. Unplug fuel shut-off solenoid connector (G).



-UN-11DEC89
E30007

Air cleaner removed for clarity

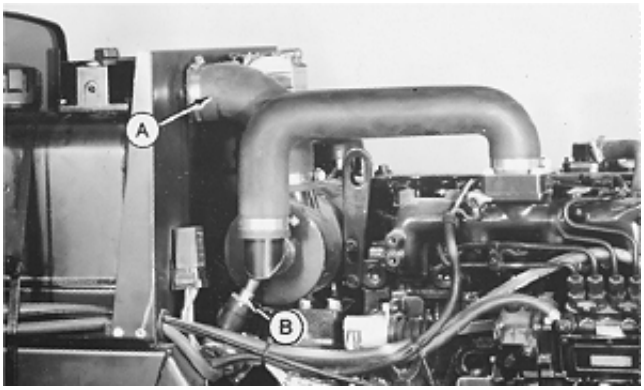
A—Coolant Temperature Sensor Lead
B—Fuel Return Hose
C—Fuel Supply Hose
D—Throttle Cable
E—Oil Pressure Sensor Lead
F—Engine Air Preheat Leads
G—Fuel Shut-Off Solenoid Connector

2E6,2005G,2 -19-25MAY90

13. Disconnect inlet hose (A):

- For 3325, disconnect hose from engine compartment wall.
- For 3365, disconnect hose from air cleaner housing.

14. Disconnect wire from air restriction switch (B).

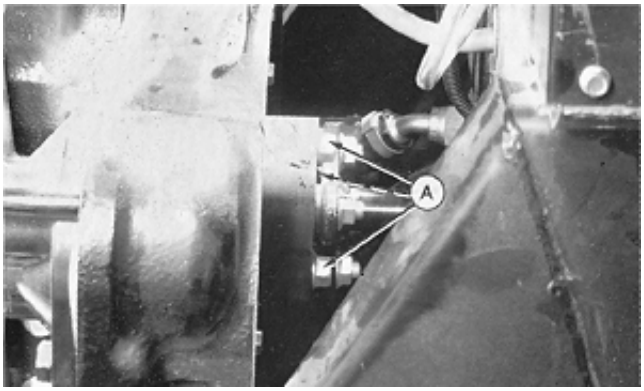


Model 3325 Shown

MX,2005HV,A2 -19-30NOV92

15. Hold drive shaft in position with large screwdriver through universal joint.

16. Remove three cap screws (A) securing drive shaft isolator to flywheel.



Air cleaner bracket removed for clarity

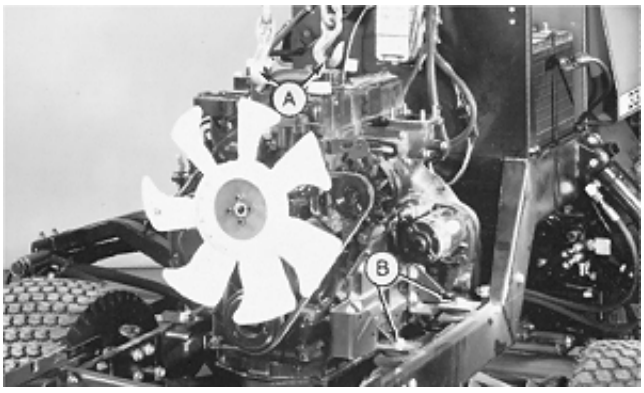
2E6,2005G,4 -19-24APR91

N **CAUTION: The approximate weight of engine is 191 kg (420 lb).**

17. Connect load positioning sling to engine lifting eyes (A).

18. Remove four engine mounting cap screws (B), two from each side.

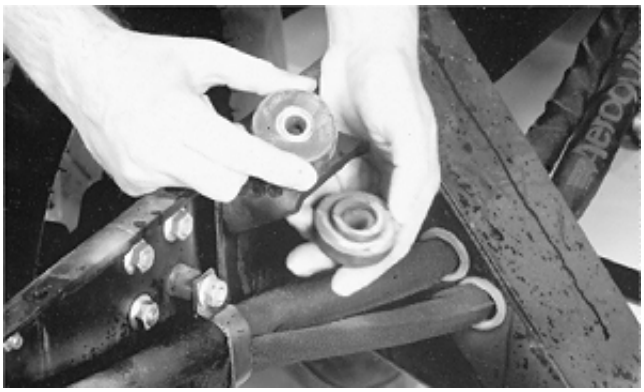
19. Slowly remove engine with hoist. Use care to avoid damage to external components.



MX,2005HV,A2B -19-30NOV92

INSPECT ENGINE MOUNTS

Remove engine mounts. Inspect for damage or excessive wear; replace as necessary.



2E6,2005G,6 -19-25MAY90

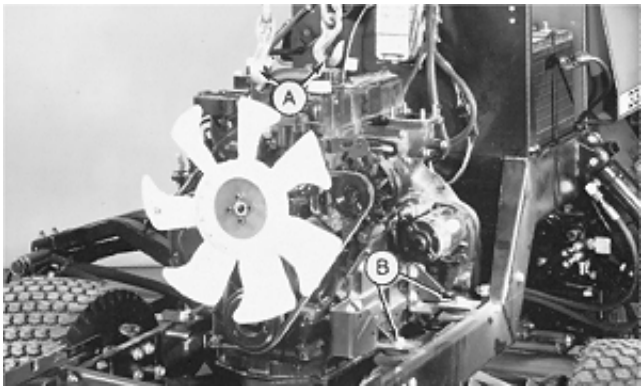
INSTALL ENGINE

1. Install engine mounts. Tighten cap screws to 90 N·m (66 lb-ft).

2. Lower engine onto mounts. Align flywheel with drive shaft isolator.

3. Install four engine mounting cap screws (B), washers and nuts, two on each side. Tighten nuts.

4. Remove load positioning sling.

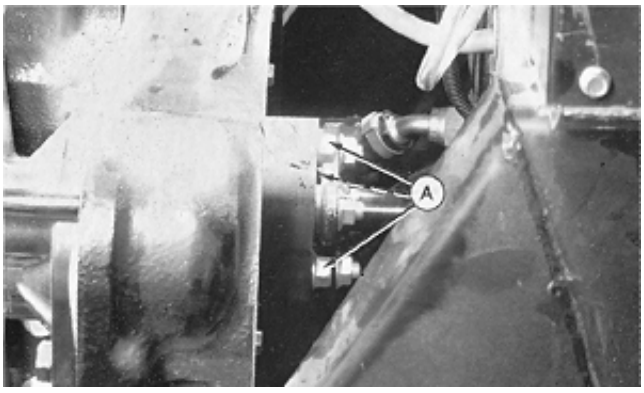


2E6,2005G,7 -19-24APR91

5. Hold drive shaft in position with large screwdriver through universal joint.

6. Secure drive shaft isolator to flywheel with three cap screws (A). Tighten cap screws.

Air cleaner bracket removed for clarity

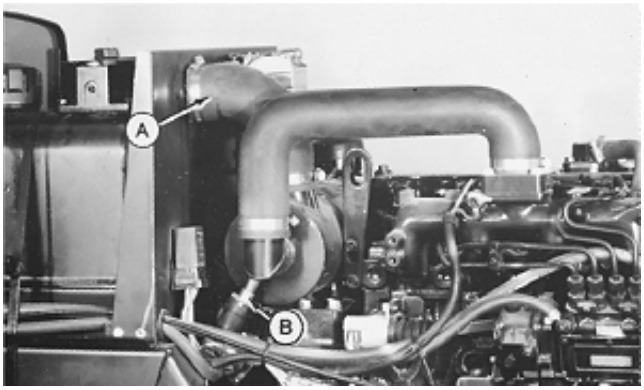


2E6,2005G,8 -19-24APR91

7. Connect wire to air restriction switch (B).

8. Connect inlet hose (A).

   - For 3325, connect hose to engine compartment wall.
   - For 3365, connect hose to air cleaner housing.



-UN-12DEC90
E35657

Model 3325 Shown

MX,2005HV,A3 -19-30NOV92

9. Attach fuel shut-off solenoid connector (G).

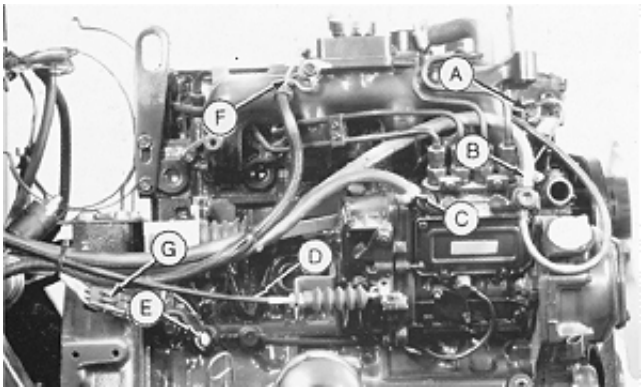
10. Attach engine air preheat leads (F).

11. Attach oil pressure sensor lead (E).

12. Install throttle cable (D).

13. Install fuel return hose (B) and fuel supply hose (C).

14. Attach coolant temperature sensor lead (A).



-UN-11DEC89
E30007

Air cleaner removed for clarity

A—Coolant Temperature Sensor Lead
B—Fuel Return Hose
C—Fuel Supply Hose
D—Throttle Cable
E—Oil Pressure Sensor
F—Engine Air Preheat Leads
G—Fuel Shut-Off Solenoid Connector

2E6,2005G,10 -19-24APR91

15. Install muffler. (See Group 10 in this section.)

16. Attach wires to alternator (B) and starter (C).

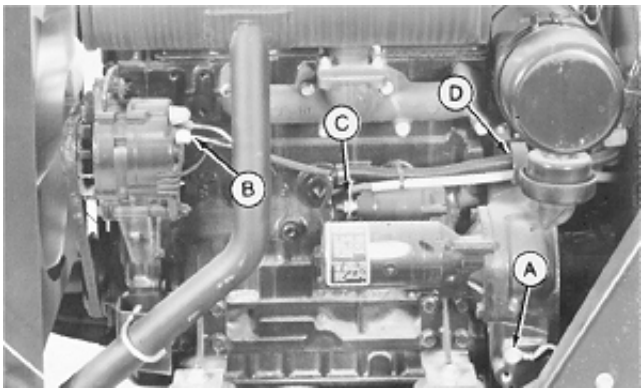
17. Connect ground wire from battery and from engine block (A).

20 05 6

18. On model 3325, install strap (D). Clamp strap around wire harness and starter cable.

19. Install radiator. (See Group 10 in this section.)

20. Install hood.



A—Ground Wire
B—Alternator
C—Starter
D—Strap (3325 only)

MX,2005HV,A4 -19-30NOV92

REMOVE MUFFLER

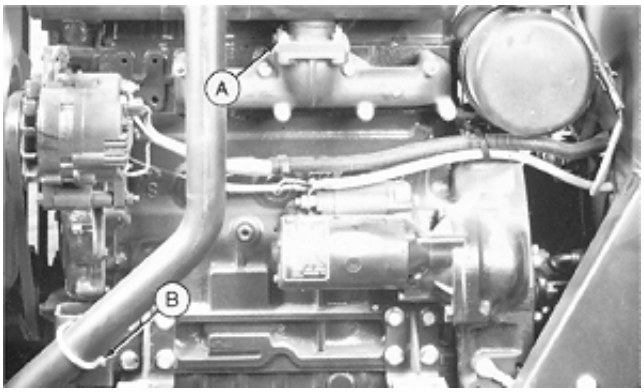
1. Remove four nuts and washers (A) on exhaust manifold.

2. For models (S.N. —880000), remove two nuts and U-clamp from bracket (B).

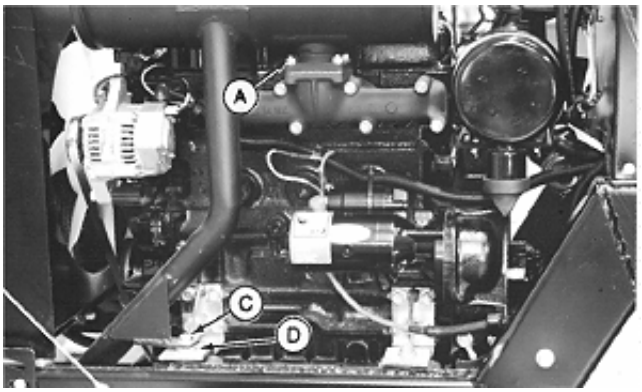
For models (S.N. 880001—), remove motor mount cap screw (C), washer and nut.

3. Lift up and forward to remove muffler.

A—Nut and Washer (4 used)
B—Bracket
C—Cap Screw, Washer and Nut
D—Washer (3 used)



S.N. —880000



S.N. 880001—

MX,2010HV,A1 -19-30NOV92

INSTALL MUFFLER

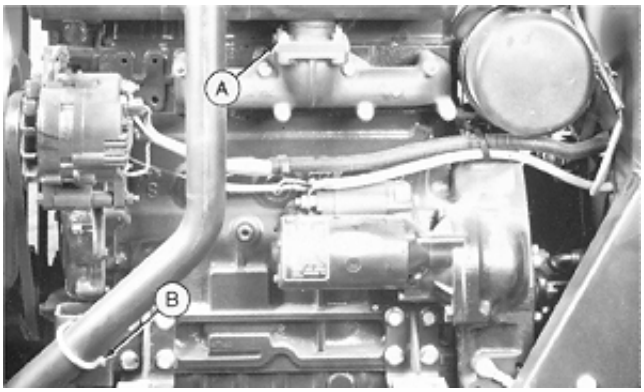
1. Install new gasket and attach muffler to exhaust manifold. Install and tighten four nuts (A).

2. For models (S.N. 880001—), put washers (D) under bracket of exhaust pipe.

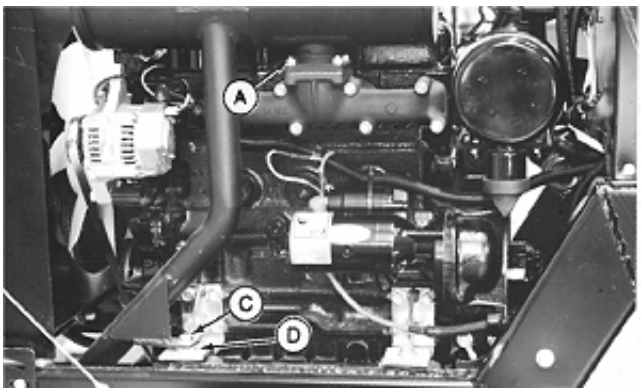
3. For models (S.N. —880000), attach U-clamp and nuts to bracket (B). Tighten nuts.

For models (S.N. 880001—), install motor mount cap screw (C), washer and nut. Tighten to 44—54 N·m (33—40 lb-ft),

A—Nut and Washer (4 used)
B—Bracket
C—Cap Screw, Washer and Nut
D—Washer (3 used)



S.N. —880000



S.N. 880001—

MX,2010HV,A2 -19-30NOV92

SPECIFICATIONS

Item	Measurement	Specification
Radiator		
Attaching cap screw	Torque	31—37 N·m (270—330 lb-in.)
Cooling System		
Coolant level below bottom of filler neck	Distance	13—25 mm (0.5—1.0 in.)

EX,3325,2010,3 -19-30NOV92

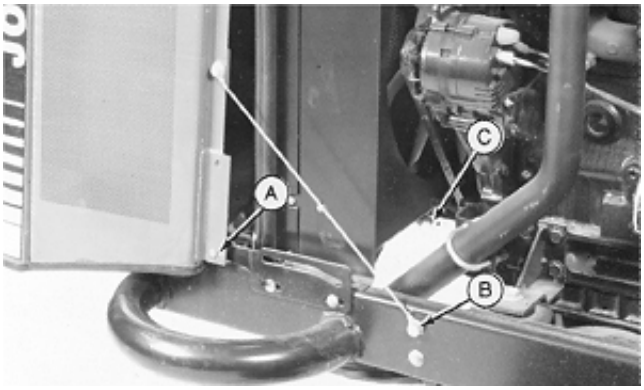
REMOVE AND INSPECT RADIATOR

NOTE: Two people are required to remove hood.

1. With hood lowered, remove pin (A) and cap screw and nut (B) from both sides to remove hood.

2. Install tubing on drain valve (C). Drain radiator.

NOTE: Some radiators may have different location for drain petcock.



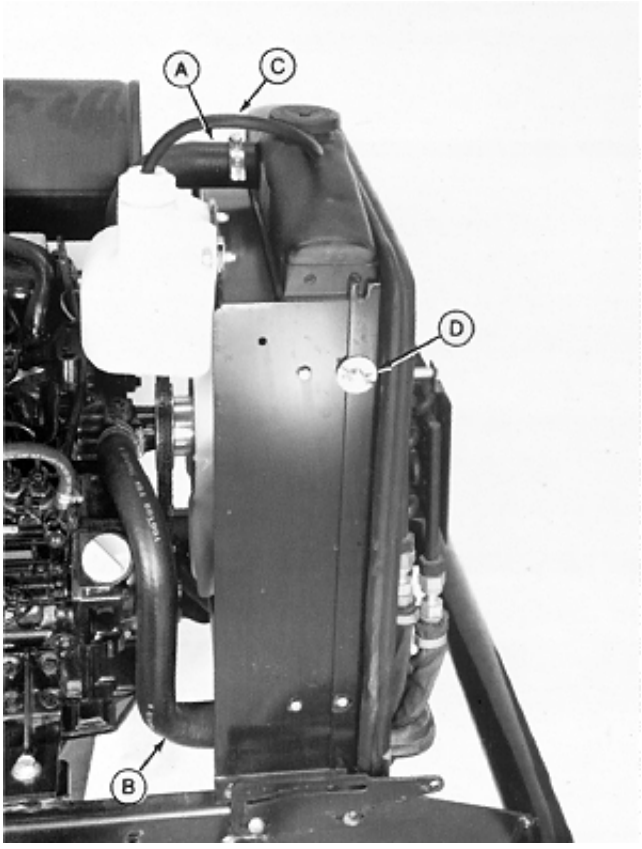
E34149 -UN-22MAY90

EX,3325TM,CG680-19-24APR91

3. Remove hoses (A—C).

4. Remove winged screw and washer (D) from both sides of radiator shroud and tilt oil cooler bracket back.

A—Upper Radiator Hose
B—Lower Radiator Hose
C—Radiator Overflow Hose
D—Winged Screw and Washer



E35449 -UN-18OCT90

EX,3325,20191 -19-22OCT90

5. Remove three cap screws (A) from both sides. Remove radiator.

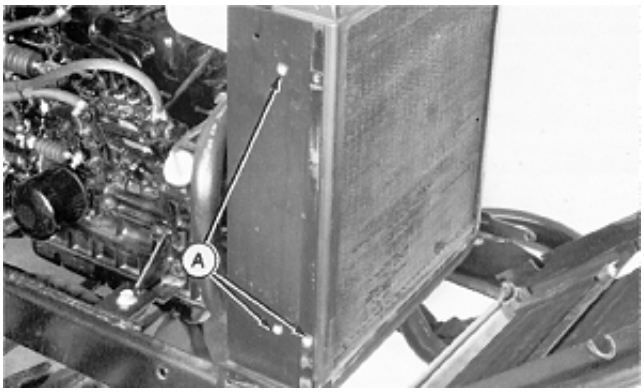
6. Check radiator for debris lodged in the cores. Clean radiator with compressed air or a clean brush. Do not bend fins.

20
15
2

7. Inspect radiator for bent fins, cracks or damaged seams. Repair as necessary.

8. Test radiator and radiator cap.

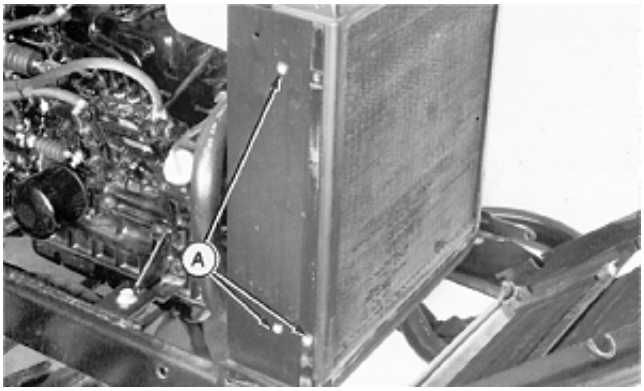
9. Inspect fan and fan belt for damage; replace or adjust as necessary. (See Section 220, Group 15.)



MX,2015HV,A1 -19-30NOV92

INSTALL RADIATOR

1. Install radiator with three cap screws (A) on both sides.



EX,3325TM,CG676-19-24APR91

2. Install hoses (A—C). Close drain valve and fill radiator.

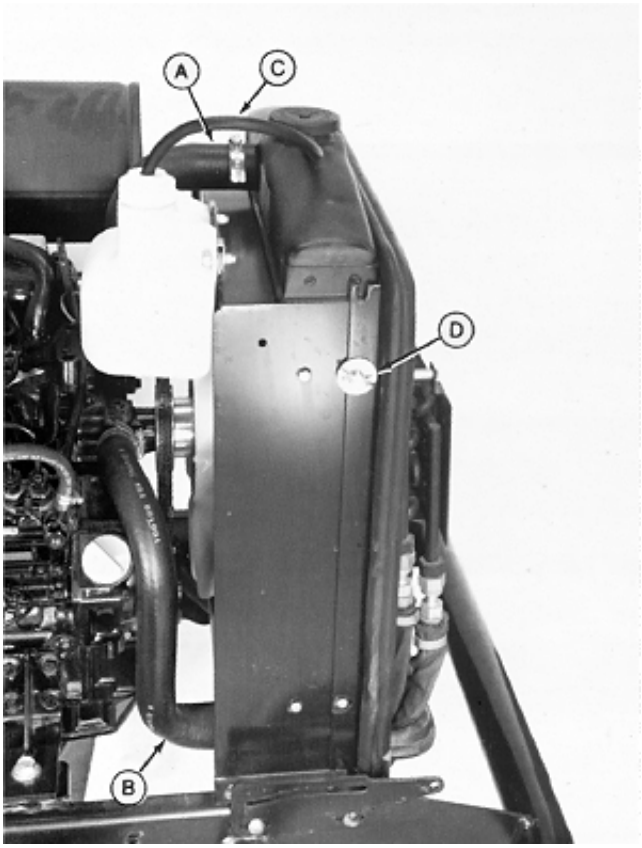
3. Move oil cooler into position and secure with winged screw and washer (D).

NOTE: Two people are required to install hood.

4. Start engine. Check operation.

5. Install hood.

A—Upper Radiator Hose
B—Lower Radiator Hose
C—Radiator Over Flow Hose
D—Winged Screw and Washer



E35449 -UN-18OCT90

EX,3325,2010,2 -19-24APR91

Section 30
FUEL AND AIR REPAIR

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INJECTION PUMP, NOZZLE AND GOVERNOR REPAIR—USE CTM3

For complete repair information, the component technical manual (CTM) is also required.

Use the component manual in conjunction with this machine manual.

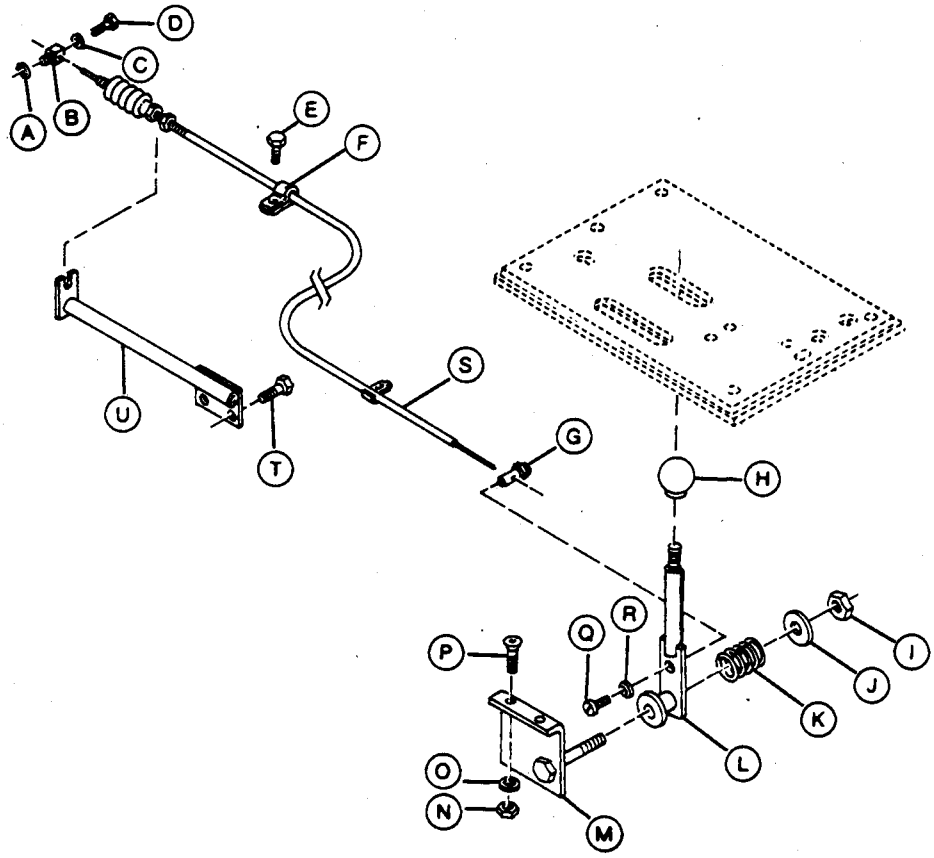


TS225 -UN-17JAN89

MX,3005HV,A1 -19-30NOV92

30
05
1

INSPECT THROTTLE CONTROL LINKAGE



E30036 -UN-21SEP88

A—Retaining Ring
B—Wire Clamp
C—Hex Nut
D—Bolt, 4 x 12 mm
E—Screw
F—Clamp
G—Clamp
H—Knob
I—Nut
J—Speed Control Disk
K—Spring
L—Throttle Lever
M—Throttle Bracket
N—Locknut
O—Washer
P—Screw
Q—Screw
R—Washer
S—Throttle Cable
T—Screw
U—Bracket

1. Inspect throttle cable for kinks, breaks and worn-through casing; replace as necessary.

2. Inspect bushings and connectors for wear and free movement, replace as necessary.

3. Adjust throttle cable length. (See Section 220, Group 15.)

4. Adjust slow and fast idle. (See Section 220, Group 15.)

MX,3005HV,A2 -19-30NOV92

REPLACE FUEL TRANSFER PUMP

1. Disconnect wire connector (A).

2. Disconnect fuel inlet and outlet hoses (B).

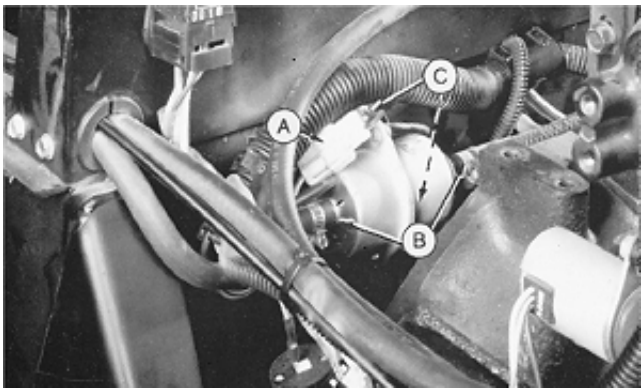
3. Remove two nuts (C). Remove pump.

4. Install replacement pump. Install nuts.

5. Connect fuel inlet and outlet hoses.

6. Connect wire connector.

7. Bleed fuel system. (Refer to Bleed Fuel Supply System in this group.)



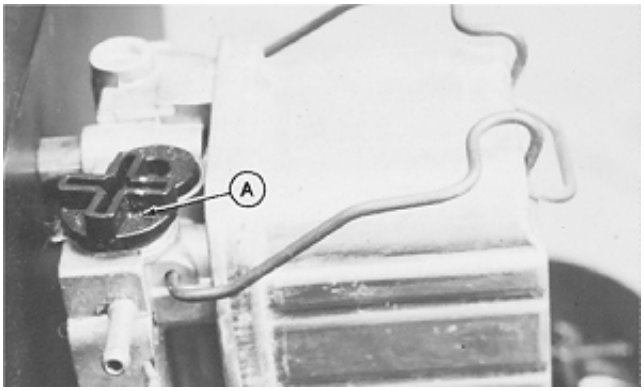
E30013 -UN-11DEC89

MX,3005HV,A3 -19-30NOV92

REPLACE FUEL FILTER/WATER SEPARATOR ASSEMBLY

CAUTION: Fuel is very flammable. Keep flames and sparks away from fuel. Do not smoke when working on fuel system.

1. Turn air vent plug (A) counterclockwise to open vent.

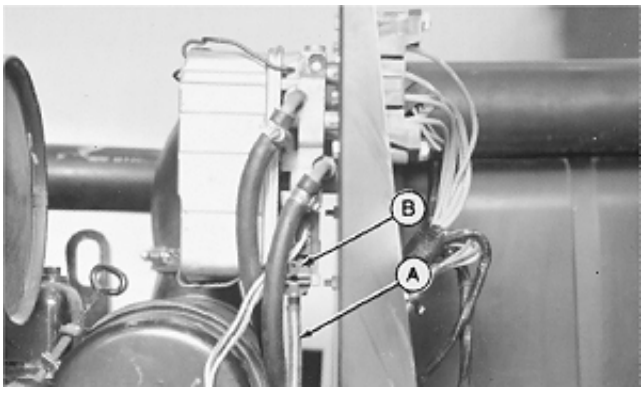


E29625 -UN-12SEP88

MX,3005HV,A4 -19-30NOV92

2. Connect a drain hose (A) to drain tube.

3. Turn drain plug (B) counterclockwise. Drain all fuel from water separator into a container.



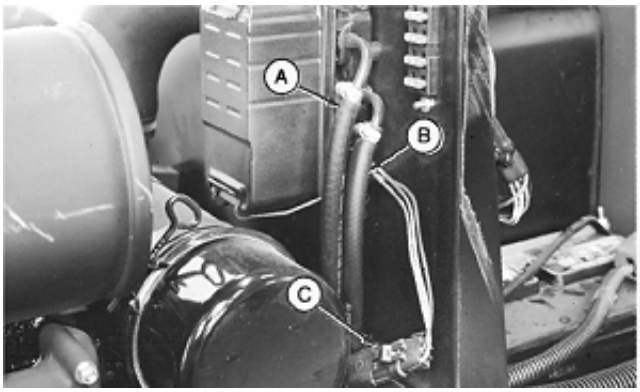
E34367 -UN-20AUG90

MX,3005HV,A5 -19-30NOV92

4. Tag and disconnect fuel lines (A and B).

5. Disconnect wiring connector (C).

A—Transfer Pump-to-Filter Separator Hose
B—Filter Separator-to-Injection Pump Hose
C—Connector



M81280A -UN-03NOV92

MX,3005HV,A6 -19-30NOV92

6. Loosen relay mounting screws (A and B).

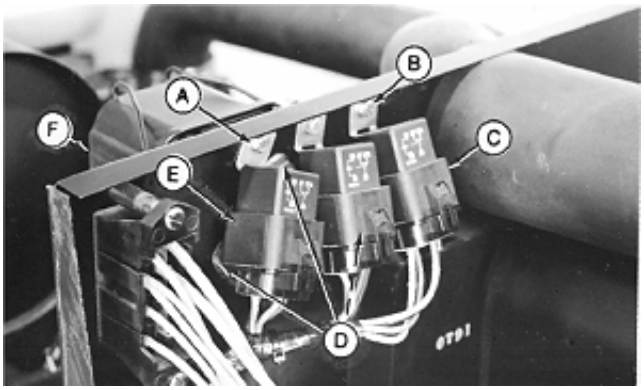
7. Push relays (C and E) to the side to access cap screws (D).

8. Remove cap screws (D) and spacers to remove fuel filter/water separator assembly (F).

9. Install new separator assembly. Install spacers and cap screws (D).

10. Tighten relay mounting screws and nuts.

A—Relay Mounting Screw
B—Relay Mounting Screw
C—Relay
D—Cap Screws
E—Relay
F—Fuel Filter/Water Separator



M81281A -UN-03NOV92

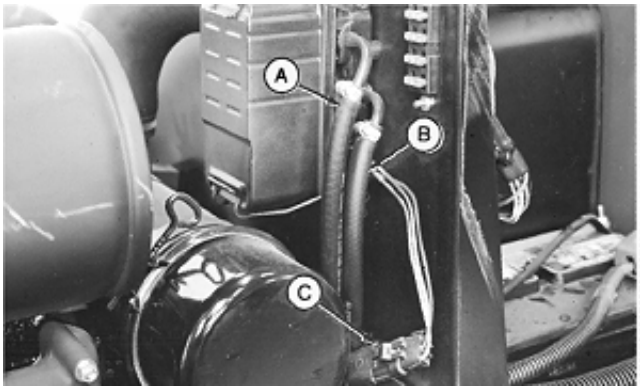
MX,3005HV,A7 -19-30NOV92

11. Connect fuel lines (A and B).

12. Connect wiring connector (C).

13. Bleed fuel system. (Refer to Bleed Fuel Supply System in this group.)

A—Transfer Pump-to-Filter Separator Hose
B—Filter Separator-to-Injection Pump Hose
C—Connector



M81280A -UN-03NOV92

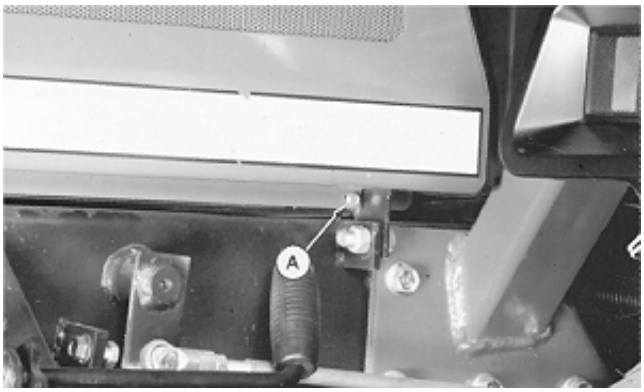
MX,3005HV,A8 -19-30NOV92

REMOVE FUEL TANK

1. Open hood.

NOTE: Two persons are required to remove fuel tank cover.

2. Remove four cap screws (A). Remove fuel tank cover.



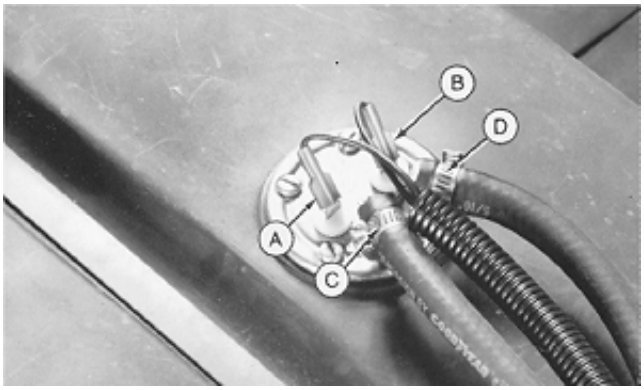
MX,3005HV,A9 -19-30NOV92

NOTE: Tag fuel lines and wires for proper assembly.

3. Disconnect ground wire (A) and fuel sender wire (B).

4. Disconnect return hose (C) and fuel supply line (D).

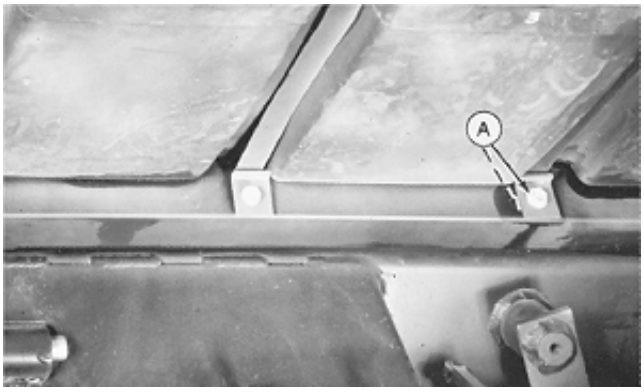
A—Ground Wire
B—Fuel Sender Wire
C—Return Hose
D—Fuel Supply Line



MX,3005HV,A10 -19-30NOV92

5. Remove four cap screws and nuts (A). Remove hold-down straps.

6. Remove fuel tank.

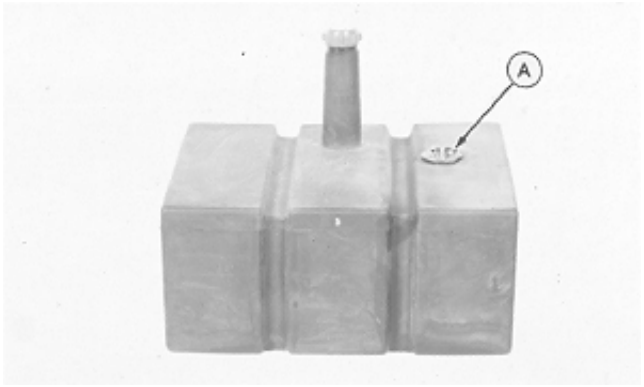


MX,3005HV,A11 -19-30NOV92

INSPECT FUEL TANK

1. Inspect fuel tank for cracks or damage. Replace if necessary.

2. Check fuel gauge sending unit (A) and fuel line fittings for leaks. Seal or replace as necessary.



MX,3005HV,A12 -19-30NOV92

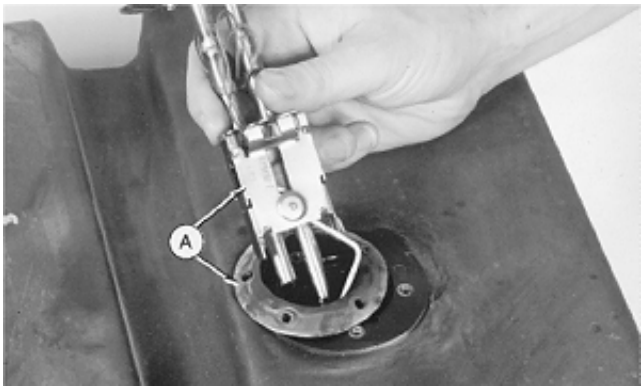
REPLACE FUEL GAUGE SENDING UNIT

1. Remove five screws (A).



EX,3325TM,CG652-19-30NOV92

2. Remove fuel gauge sending unit and gasket (A).



2E6,3010G,11 -19-24APR91

3. Install new fuel gauge sending unit and gasket.

4. Install and tighten five screws (A).

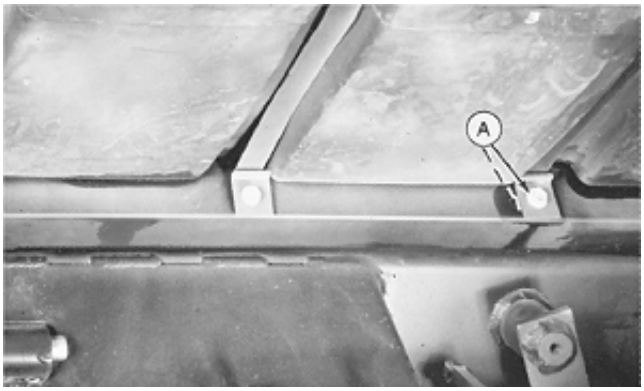


EX,3325TM,CG650-19-24APR91

INSTALL FUEL TANK

1. Position tank on support.

2. Install the hold-down straps and tighten four cap screws and nuts (A).



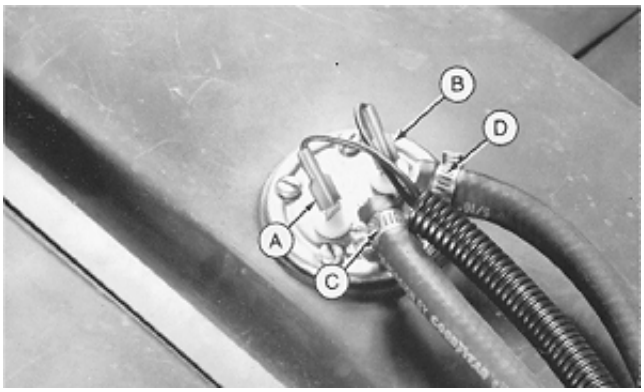
MX,3005HV,A13 -19-30NOV92

3. Connect return hose (C) and fuel supply line (D) to proper fittings.

4. Connect ground wire (A) and fuel sender wire (B) to proper terminals.

5. Fill fuel tank. Check for leaks.

A—Ground Wire
B—Fuel Sender Wire
C—Return Hose
D—Fuel Supply Line



E30017 -UN-11DEC89

MX,3005HV,A14 -19-30NOV92

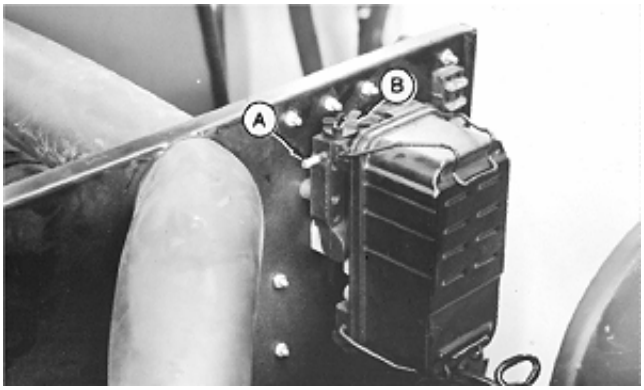
BLEED FUEL SUPPLY SYSTEM

1.Install a clear drain hose to air vent (A).

2. Turn air vent valve (B) counterclockwise to open air vent.

3. Turn key switch to ON position. DO NOT start engine.

Fuel transfer pump will operate and fuel will begin to flow. Close air vent when a continuous stream of fuel flows out of vent.



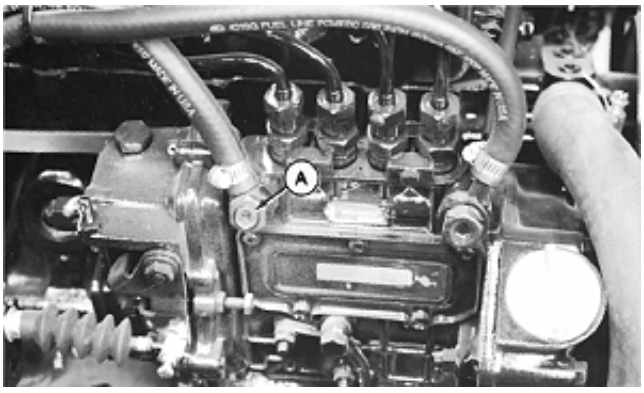
M81355 -UN-03NOV92

MX,3005HV,A15 -19-30NOV92

4. Loosen bleed screw (A).

5. Close bleed screw when a continuous stream of fuel flows from bleed screw.

6. Turn key switch to OFF position.



M81297 -UN-03NOV92

MX,3005HV,A16 -19-30NOV92

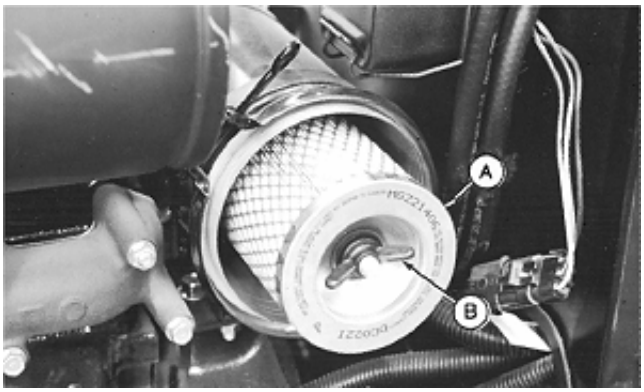
REMOVE, INSPECT AND INSTALL AIR CLEANER ELEMENTS

1. Remove air cleaner cover.

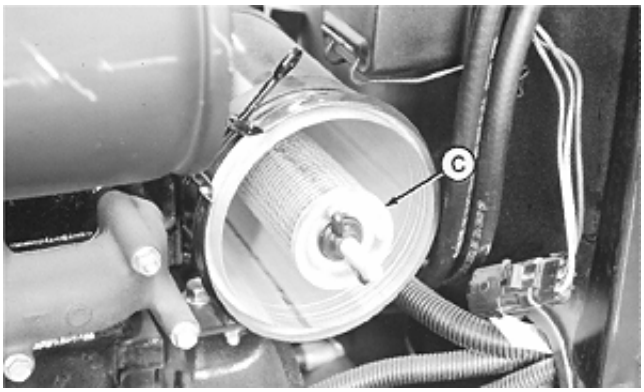
2. Remove wing nut (B) to remove primary element (A).

IMPORTANT: Remove secondary safety element ONLY if it is to be replaced. Do not attempt to clean secondary element. Install new element immediately to prevent dust from entering air intake system. Dust can damage internal engine components.

3. Remove secondary safety element (C). Replace as necessary.



M81356 -UN-03NOV92



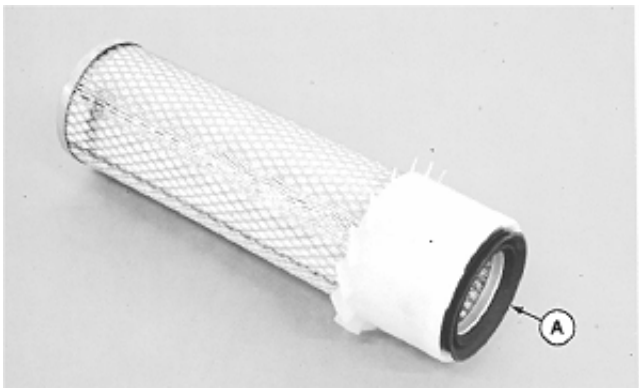
M81357 -UN-03NOV92

MX,3010HV,A1 -19-30NOV92

4. Pat primary element with the palm of your hand. DO NOT hit the element against a hard surface.

5. If this does not remove dust, use compressed air less than 690 kPa (6.9 bar) (100 psi). Direct air up and down the pleats, blowing from the inside to the outside. Be careful not to damage the element.

6. Inspect the element and gasket for damage. Throw away an element that has the smallest break. Install a new element if gasket (A) is broken or missing.



M81358 -UN-03NOV92

IMPORTANT: DO NOT wash element in fuel oil, oil, gasoline, or solvent. DO NOT use compressed air to remove water from an element.

7. Add John Deere R36757 Filter Element Cleaner or an equivalent non-sudsing detergent to water. Move the element up and down in this solution to loosen dirt.

8. Flush with clean water. Use water pressure less than 280 kPa (2.80 bar) (40 psi).

IMPORTANT: Air dry element for 24 to 36 hours before installing.

9. Shake the element to remove water. Do not install element in the machine until it is dry.

10. Clean the inside of air cleaner housing and unloader valve with a damp cloth.

11. Install primary element.

12. Install cover.

MX,3010HV,A2 -19-30NOV92

REMOVE AND INSTALL AIR CLEANER ASSEMBLY

1. Disconnect hoses (A and B) from air cleaner assembly.

2. Disconnect wire from air restriction switch (C).

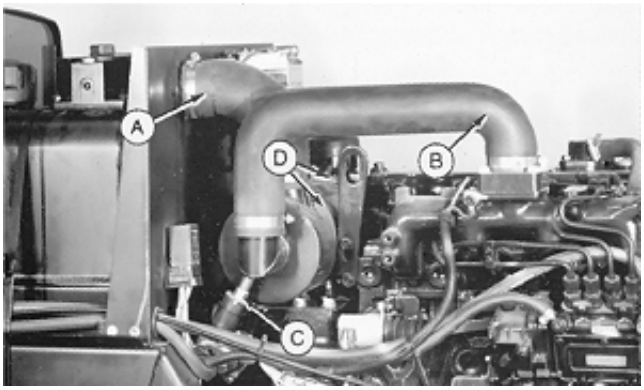
3. Remove machine screw and nut from two straps (D). Open straps to remove air cleaner assembly.

4. Make repairs as necessary.

5. Install air cleaner assembly. Install two straps.

6. Connect wire.

7. Connect hoses.



E30006 -UN-11DEC89

A—Inlet Hose
B—Intake Hose
C—Air Restriction Switch
D—Strap (2 used)

MX,3010HV,A3 -19-30NOV92

Section 40
ELECTRICAL REPAIR

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REMOVE AND INSTALL BATTERY

CAUTION: Battery gas can explode. Keep sparks and flames away from battery. Use a flashlight to check battery electrolyte level.

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

Always disconnect negative (—) (ground) cable first and connect it last.



TS204 -UN-23AUG88

1. Disconnect negative (—) cable (A).

2. Open cover (B). Disconnect positive (+) cable (D). Remove cover.

3. Remove hold-down bracket (C).

4. Remove battery.

5. Install battery.

IMPORTANT: Do not overtighten hold-down bracket (C). Damage to battery may result.

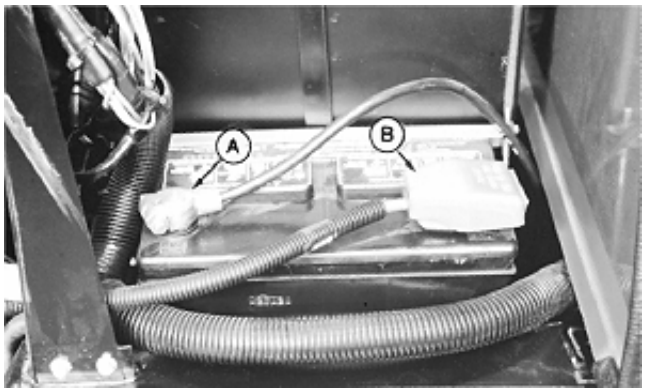
6. Install hold-down bracket.

NOTE: Clean battery posts and cable clamps before connecting cables to battery.

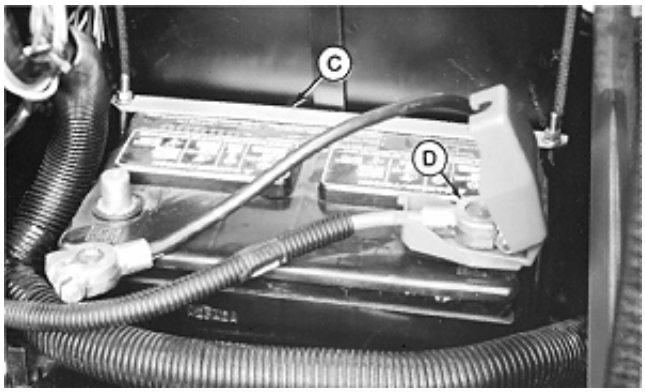
7. Put cover on the positive (+) battery terminal. Connect positive (+) cable to battery.

8. Connect negative (—) cable to battery.

9. Apply multi-purpose grease on battery terminals to prevent corrosion.



M81283A -UN-03NOV92



M81284A -UN-03NOV92

A—Negative (—) Cable
B—Cover
C—Hold-down Bracket
D—Positive (+) Cable

MX,4005HV,A1 -19-30NOV92

REPLACE BATTERY CABLES

1. Lift left side of fuel tank. Install support rod.

CAUTION: Battery gas can explode. Keep sparks and flames away from battery.

Always disconnect negative (—) (ground) cable first and connect it last.

2. Disconnect negative (—) (ground) cable (D) from battery.

3. Remove cap screw (F). Remove cable (D).

4. Open cover (E). Disconnect positive (+) cable (C) from battery.

5. Remove nut (A) from starter solenoid.

6. Straighten retaining strap (B) and remove cable (C).

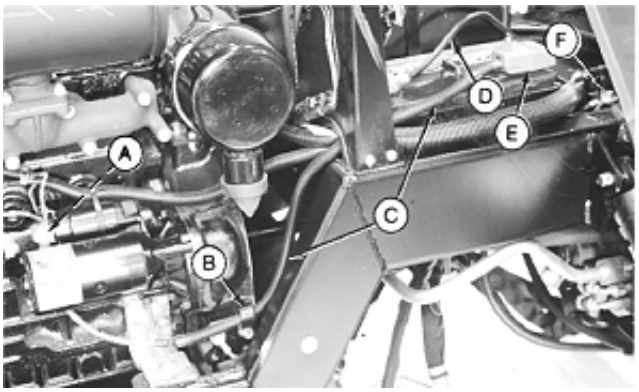
NOTE: Clean battery posts and cable clamps before connecting cables to battery.

7. Install positive (+) cable as shown. Attach cable to starter solenoid.

8. Install negative (—) (ground) cable. Attach cable to machine frame using cap screw.

9. Apply multi-purpose grease on battery terminals to prevent corrosion.

10. Lower fuel tank.



M81285A -UN-03NOV92

A—Nut
B—Retaining Strap
C—Positive (+) Cable
D—Negative (—) Cable
E—Cover
F—Cap Screw

MX,4005HV,A2 -19-30NOV92

STARTER AND ALTERNATOR REPAIR—USE CTM3

For complete repair information, the component technical manual (CTM) is also required.

Use the component manual in conjunction with this machine manual.



TS225 -UN-17JAN89

MX,4010HV,A1 -19-30NOV92

OTHER MATERIAL

Number	Name	Use
TY9375	John Deere Pipe Sealant with TEFLON®	Apply to water temperature switch threads. Apply to engine oil pressure switch threads.

TEFLON is a registered trademark of the Du Pont Company.

MX,4010HV,A2 -19-30NOV92

REMOVE AND INSTALL STARTER

N **CAUTION: Hood is heavy. Handle weight safely. Raise and lower the hood carefully to avoid pinching hands.**

1. Open hood.

2. Disconnect negative (—) cable from battery.

3. Disconnect wires (A) and cable (D) from starter solenoid (E).

4. Remove tie strap (B).

5. Remove cap screws (C).

6. Remove starter.

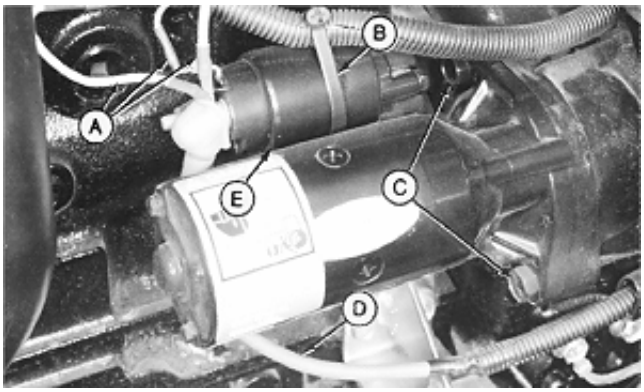
7. Install starter. Install cap screws (C).

8. Connect wires (A) and cable (D) to starter solenoid (E).

9. Install new tie strap.

10. Connect negative (—) cable to battery.

11. Close hood.



M81286A -UN-03NOV92

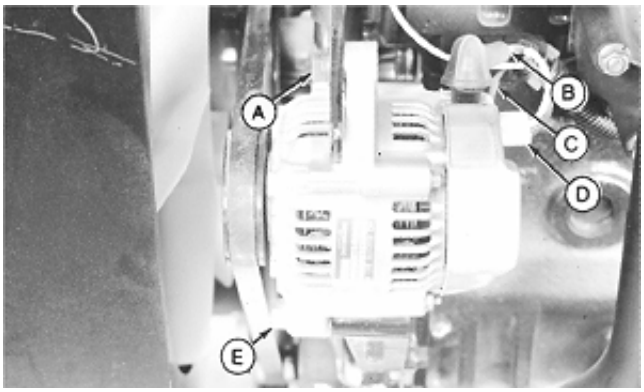
A—Wires
B—Tie Strap
C—Cap Screws
D—Positive (+) Battery Cable
E—Starter Solenoid

MX,4010HV,A3 -19-30NOV92

REMOVE AND INSTALL ALTERNATOR

CAUTION: Hood is heavy. Handle weight safely. Raise and lower the hood carefully to avoid pinching hands.

1. Open hood.
2. Disconnect negative (—) cable from battery.
3. Disconnect wires (B and C).
4. Disconnect connector (D).
5. Loosen cap screws (A and E).
6. Pivot alternator towards engine. Remove fan belt from alternator sheave.
7. Remove cap screws (A and E) to remove alternator.
8. Install alternator. Install cap screws (A and E) (Do not tighten.).
9. Connect wiring connector (D).
10. Connect wires (B and C).
11. Connect negative (—) cable to battery.
12. Install fan belt on alternator sheave.
13. Adjust fan belt. (See Section 220, Group 15.)



M81287A -UN-03NOV92

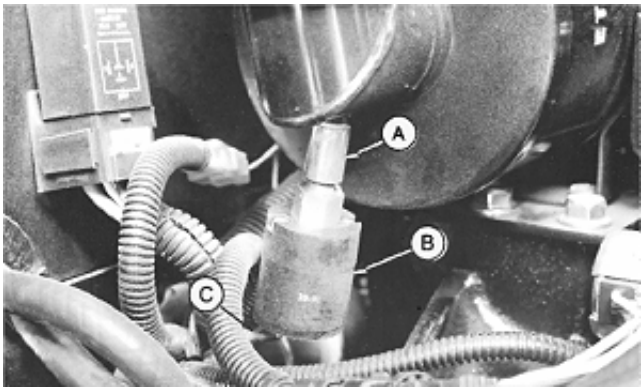
A—Cap Screw
B—Power Wire
C—Ground Wire
D—Connector
E—Cap Screw

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10
3

MX,4010HV,A4 -19-30NOV92

REPLACE AIR RESTRICTION SWITCH

1. Disconnect wire (C).
2. Remove air restriction switch (B) from fitting (A).
3. Install air restriction switch.
4. Connect wire.

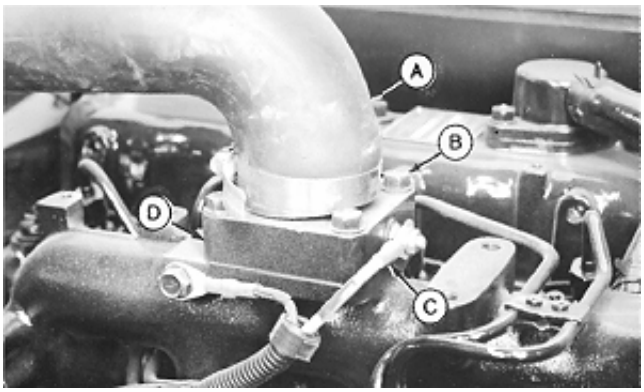


M81294 -UN-03NOV92

MX,4010HV,A5 -19-30NOV92

REPLACE ENGINE AIR HEATER

1. Disconnect air intake hose (A).
2. Disconnect wire (C).
3. Remove four cap screws (B) to remove heater (D).
4. Replace gasket as necessary.
5. Install heater and cap screws.
6. Connect wire and hose.



M81295 -UN-03NOV92

A—Intake Hose
B—Cap Screw (4 used)
C—Wire
D—Air Heater

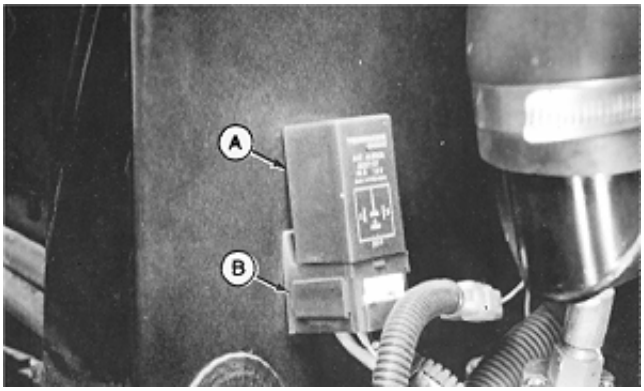
MX,4010HV,A6 -19-30NOV92

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4

REPLACE AIR HEATER CONTROLLER

NOTE: Air heater controller (A) is a socket type. Remove controller by pulling relay from base (B).

1. Remove air heater controller (A).
2. Install controller.



M81296 -UN-03NOV92

MX,4010HV,A7 -19-30NOV92

REPLACE FUEL SHUT-OFF SOLENOID

1. Remove tie strap (H) to disconnect wiring connector (A).

2. Remove spring clip (D).

3. Remove two cap screws (C) to remove solenoid assembly (B).

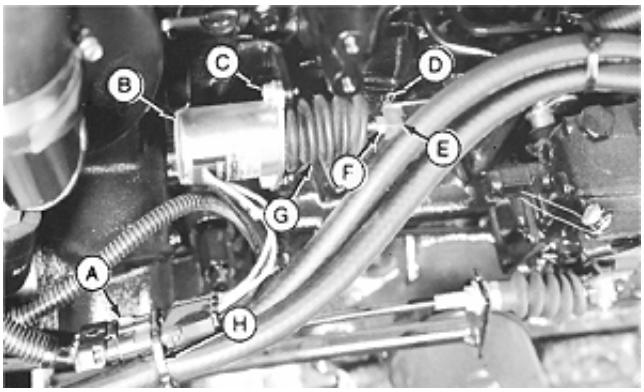
4. Remove parts (E—G) as necessary.

5. Install parts (E—G) on new solenoid.

6. Install solenoid assembly and cap screws.

7. Connect wire connector. Attach connector to the fuel lines with a tie strap.

8. Adjust fuel shut-off solenoid. (Refer to Section 220, Group 15.)



M81293 -UN-03NOV92

A—Wiring Connector
B—Solenoid
C—Cap Screw (2 used)
D—Spring Clip
E—Pivot Block
F—Nut
G—Boot
H—Tie Strap

MX,4010HV,A8 -19-30NOV92

REPLACE WATER TEMPERATURE SWITCH

1. Drain coolant until coolant level is below water temperature switch (A).

2. Disconnect wire (B).

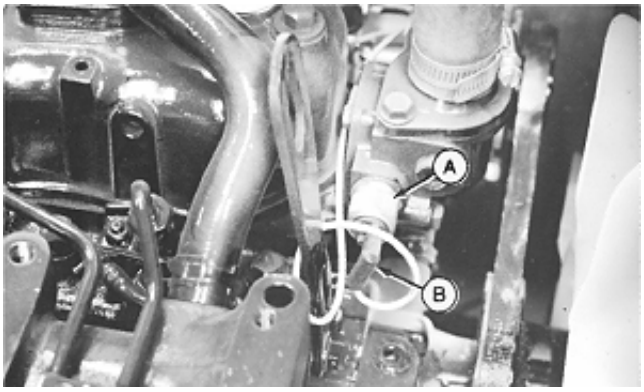
3. Remove water temperature switch.

4. Apply pipe thread sealant with TEFLON to threads of new switch.

5. Install switch.

6. Connect wire.

7. Add specified coolant as necessary. (Refer to Section 10, Group 20.)



M81298 -UN-03NOV92

MX,4010HV,A9 -19-30NOV92

REPLACE OIL PRESSURE SWITCH

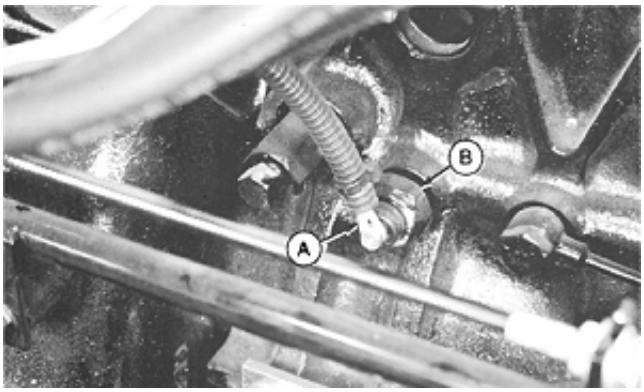
1. Disconnect wire (A).

2. Remove oil pressure switch (B).

3. Apply pipe thread sealant with TEFLON to threads of new switch.

4. Install switch.

5. Connect wire.



M81299 -UN-03NOV92

MX,4010HV,A10 -19-30NOV92

REMOVE AND INSTALL DISPLAY CONSOLE PANEL

1. Remove tie strap (D) under right fender.

2. Remove eight screws (A) from console panel (B).

3. While lifting console panel, push wire harness (C) up through the fender grommet.

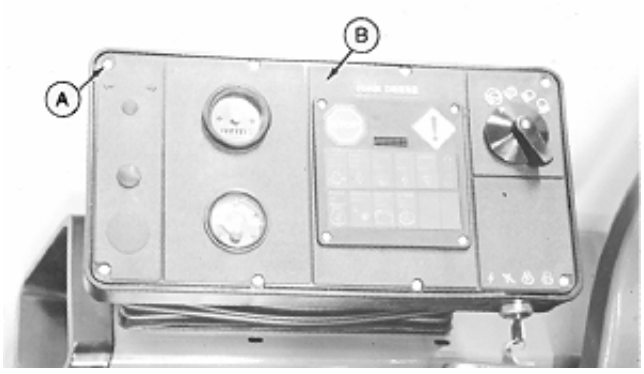
4. Make repairs as necessary.

IMPORTANT: Approximately 13 mm (0.5 in.) of the harness split conduit should be above the fender grommet. This will provide enough slack to attach harness (C) to fender support (E).

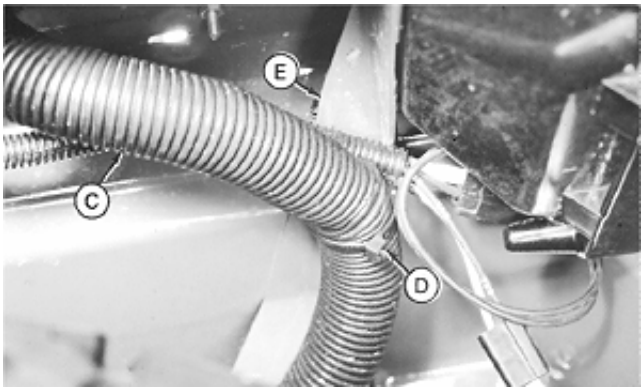
5. Pull wire harness (C) down through the fender grommet to install console panel (B). Install eight screws (A).

6. Attach harness to fender support (E) with tie strap (D).

A—Screw (8 used)
B—Console Panel
C—Display Console Harness
D—Tie Strap
E—Fender Support



M81320 -UN-03NOV92



M81321 -UN-03NOV92

MX,4010HV,A11 -19-30NOV92

REPLACE FUEL GAUGE

1. Remove display console panel. (See procedure in this group.)

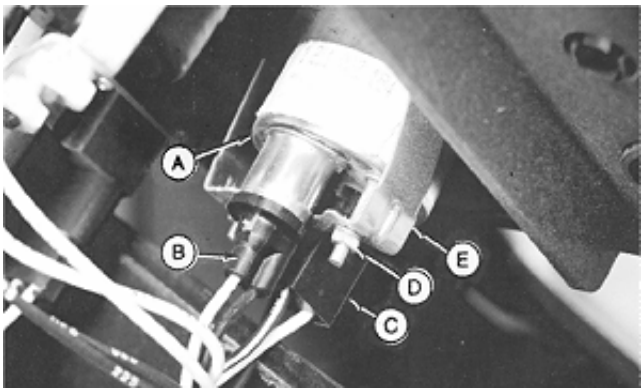
2. Disconnect lamp socket (B) and wiring connector (C).

3. Remove two nuts and washers (D) and strap (E). Remove fuel gauge (A).

4. Install new fuel gauge, strap, washers and nuts.

5. Connect wiring connector. Connect lamp socket.

6. Install display console panel. (See procedure in this group.)



M81322 -UN-03NOV92

A—Fuel Gauge
B—Lamp Socket
C—Wiring Connector
D—Nut and Washer (2 used)
E—Strap

MX,4010HV,A12 -19-30NOV92

40 10 7

REPLACE HOURMETER

1. Remove display console panel. (See procedure in this group.)

2. Disconnect wires (C and D).

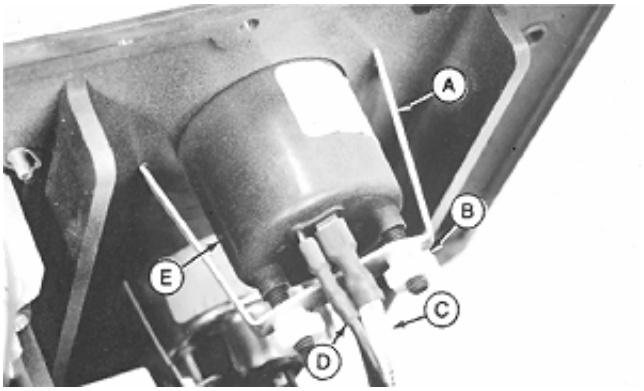
3. Remove two nuts (B) and strap (A) to remove hourmeter (E).

4. Install new hourmeter, strap and two nuts.

5. Connect wires (C and D):

WIRE COLORS	TERMINAL
Yellow (C)	Positive (+)
Black (D)	Negative (—)

6. Install display console panel. (See procedure in this group.)



M81323 -UN-03NOV92

A—Strap
B—Nuts (2 used)
C—Yellow Wires
D—Black Wires
E—Hourmeter

MX,4010HV,A13 -19-30NOV92

REPLACE KEY SWITCH

1. Disconnect battery negative (—) cable.

2. Remove nut (A).



MX,4010HV,A14 -19-30NOV92

3. Remove display console panel. (See procedure in this group.)

4. Separate grounding ring (B) from key switch (A).

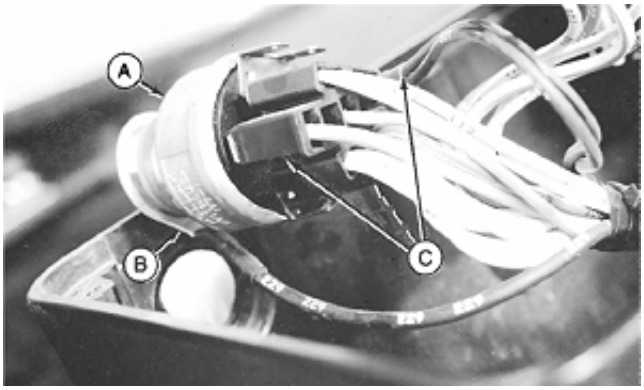
5. Disconnect wiring connectors (C) to remove key switch.

6. Connect wiring connectors to new key switch.

7. Install grounding ring on switch body and install switch. Install nut.

8. Install display console panel. (See procedure in this group.)

9. Connect battery negative (—) cable.

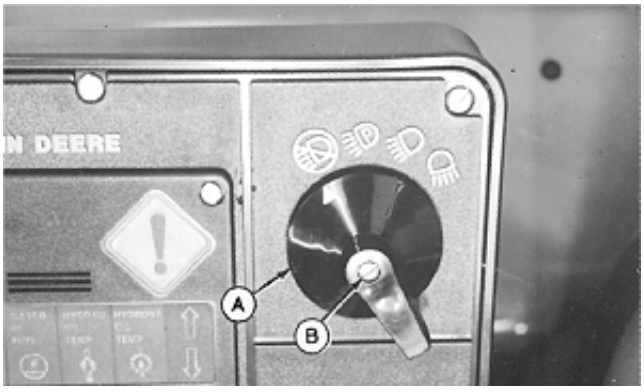


MX,4010HV,A15 -19-30NOV92

REPLACE LIGHT SWITCH

1. Disconnect battery negative (—) cable.

2. Remove screw (B) to remove knob (A).



MX,4010HV,A16 -19-30NOV92

3. Remove display console panel. (See procedure in this group.)

4. Disconnect wiring connector (A).

5. Remove nut (B) to remove light switch (C).

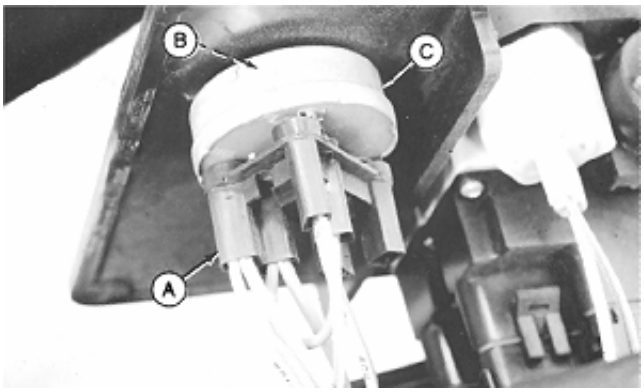
6. Align pin on switch body with slot in console panel. Install switch and nut.

7. Connect wiring connector.

8. Install display console panel. (See procedure in this group.)

9. Install knob and screw.

10. Connect battery negative (—) cable.

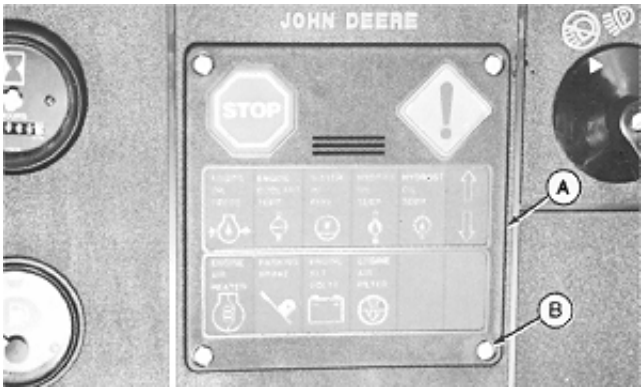


-UN-03NOV92
M81327

MX,4010HV,A17 -19-30NOV92

REMOVE AND INSTALL DISPLAY MODULE

1. Remove four screw (B) from display module (A).



-UN-03NOV92
M81328

MX,4010HV,A18 -19-30NOV92

2. Remove display console panel. (See procedure in this group.)

3. Disconnect lamp sockets (A and B).

4. Disconnect wiring connectors (C—G).

5. Remove display module.

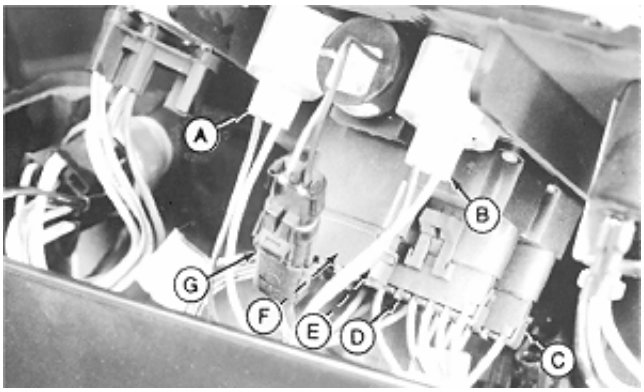
6. Service or replace as necessary.

7. Install display module and screws.

8. Connect wiring connectors (C—G).

9. Connect lamp sockets (A and B).

10. Install display console panel. (See procedure in this group.)



-UN-03NOV92
M81329

A—Warning Lamp Socket (Wire Nos. 114, 511)
B—STOP Lamp Socket (Wire Nos. 119, 513)
C—Wiring Connector (Bottom Right)
D—Wiring Connector (Top Right)
E—Wiring Connector (Bottom Center)
F—Wiring Connector (Top Left)
G—Wiring Connector (Alarm)

MX,4010HV,A19 -19-30NOV92

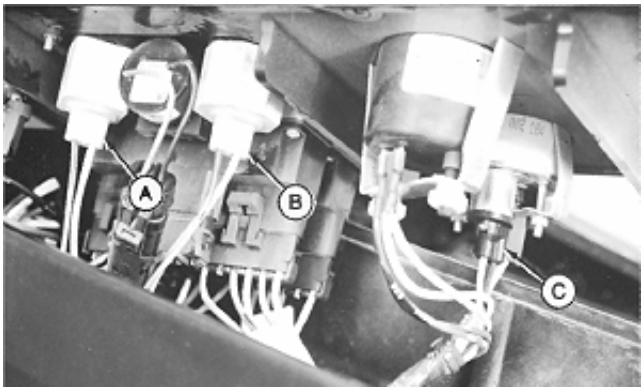
REPLACE STOP, WARNING, AND FUEL GAUGE LAMPS

1. Remove display console panel. (See procedure in this group.)

2. Disconnect lamp sockets (A—C). Replace lamps as necessary.

3. Connect lamp sockets.

4. Install display console panel. (See procedure in this group.)



-UN-03NOV92
M81330

A—Warning Lamp Socket
B—STOP Lamp Socket
C—Fuel Gauge Light Socket

MX,4010HV,A20 -19-30NOV92

REPLACE DISPLAY MODULE INDICATOR LAMPS

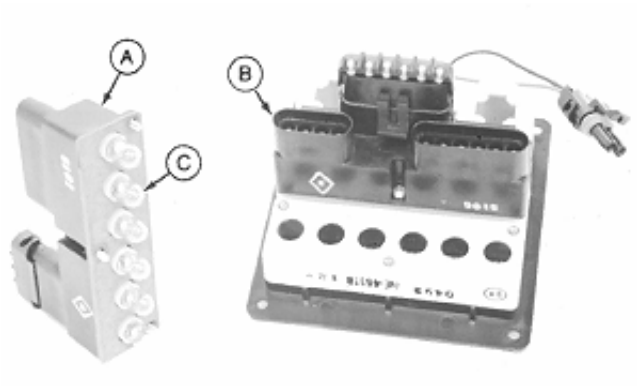
1. Remove display module. (See procedure in this group.)

2. Remove modules (A and B) as necessary.

3. Replace lamps (C) as necessary.

4. Install modules (A and B).

5. Install display module. (See procedure in this group.)



-UN-03NOV92
M81331

A—Lower Display Module
B—Upper Display Module
C—Lamps (12 used)

MX,4010HV,A21 -19-30NOV92

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10
11

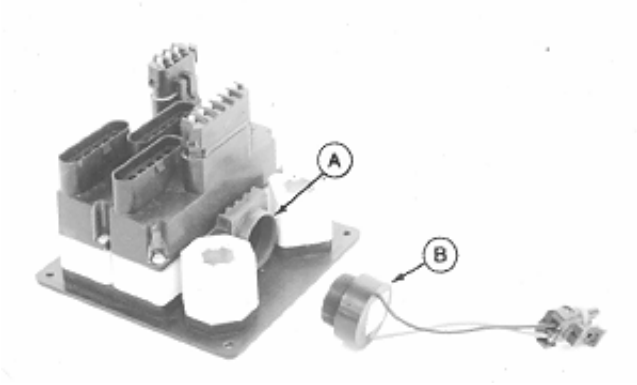
REPLACE ALARM

1. Remove display module. (See procedure in this group.)

2. Turn alarm (B) counterclockwise to remove alarm from receptacle (A).

3. Install new alarm.

4. Install display module. (See procedure in this group.)



-UN-03NOV92
M81334

MX,4010HV,A22 -19-30NOV92

REPLACE HEADLIGHT

1. Remove three screws (A), to remove headlight assembly (B).



-UN-03NOV92
M81332

MX,4010HV,A23 -19-30NOV92

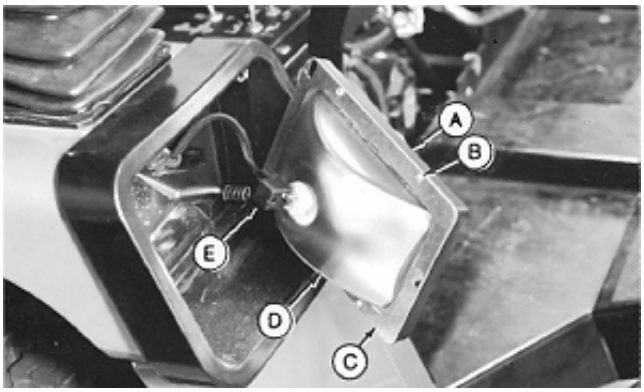
2. Disconnect wiring connector (E).

3. Remove four screws (B). Pull plate (C) and bezel (A) from headlight (D).

4. Assembly plate and bezel on new headlight. Fasten with four screws.

5. Connect wiring connector.

A—Bezel
B—Screw (4 used)
C—Plate
D—Headlight
E—Wiring Connector



-UN-03NOV92
M81333

MX,4010HV,A24 -19-30NOV92

6. Install headlight assembly (B) and fasten with three screws (A).

7. Adjust headlight by turning screws (A) as necessary.



-UN-03NOV92
M81332

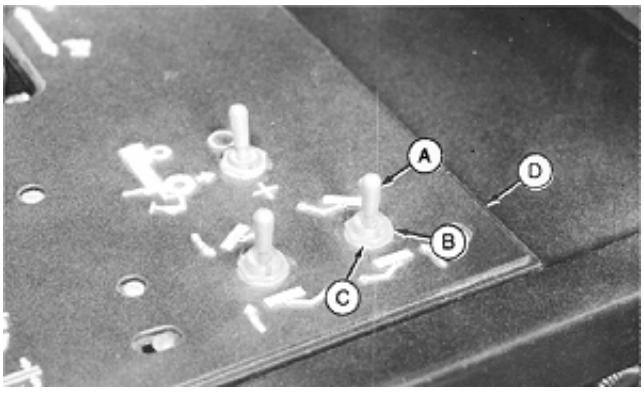
MX,4010HV,A25 -19-30NOV92

REPLACE WING TOGGLE SWITCHES

1. Remove kick panel.

2. Remove nut (B) and washer (C). Push switch down through switch panel (D).

A—Toggle Switch
B—Nut
C—Washer
D—Switch Panel



-UN-03NOV92
M81335

MX,4010HV,A26 -19-30NOV92

NOTE: Early units used modular plugs instead of screw terminals.

3. Tag and disconnect wires (A).

4. Install jumper strap (B) on new switch if necessary.

5. Connect wires:

LEFT WING TOGGLE SWITCH

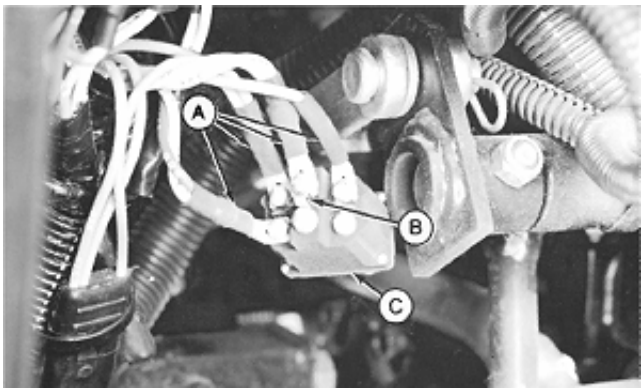
WIRE	TERMINAL
427 (YEL)/428 (PUR)	1
Jumper Strap	2—5
None	3
418A (GRY)/419 (LT BLU)	4
122/123 (YEL)	5
422 (PNK)	6

RIGHT WING TOGGLE SWITCH

WIRE	TERMINAL
128/427 (YEL)	1
Jumper Strap	2—5
None	3
411 (GRN)/412A (BLK)	4
113/122 (YEL)	5
408 (RED)	6

6. Align slot in threaded portion of switch with tab in mounting hole. Install switch.

7. Install kick panel.



M81336 -UN-03NOV92

A—Wires
B—Jumper Strap
C—Toggle Switch

MX,4010HV,A27 -19-30NOV92

REPLACE WEIGHT TRANSFER SWITCH

1. Remove kick panel.

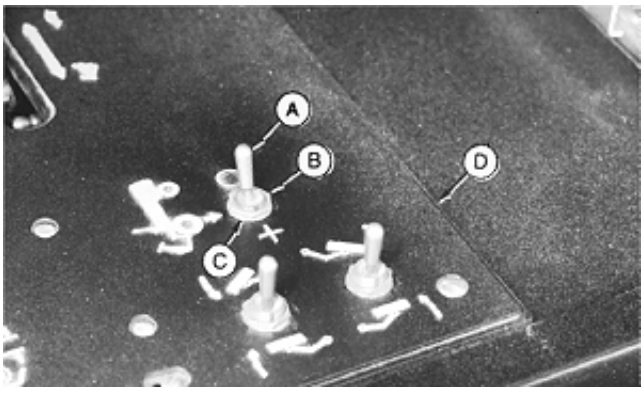
2. Remove nut (B) and washer (C). Push weight transfer switch (A) down through switch panel (D).

3. Disconnect wires.

4. Connect wires to new switch.

5. Align slot in threaded portion of switch with tab in mounting hole. Install switch.

6. Install kick panel.



M81337 -UN-03NOV92

A—Weight Transfer Switch
B—Nut
C—Washer
D—Switch Panel

MX,4010HV,A28 -19-30NOV92

REPLACE BACKLAP SWITCH

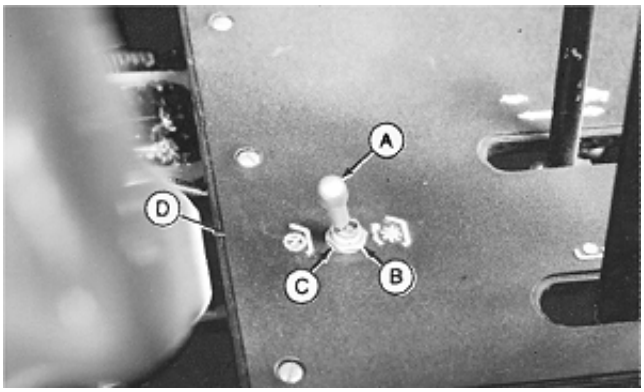
1. Remove nut (B) and washer (C). Push backlap switch (A) down through switch panel (D).

2. Disconnect wires.

3. Connect wires to new switch.

4. Align slot in threaded portion of switch with tab in mounting hole. Install switch.

A—Backlap Switch
B—Nut
C—Washer
D—Switch Panel



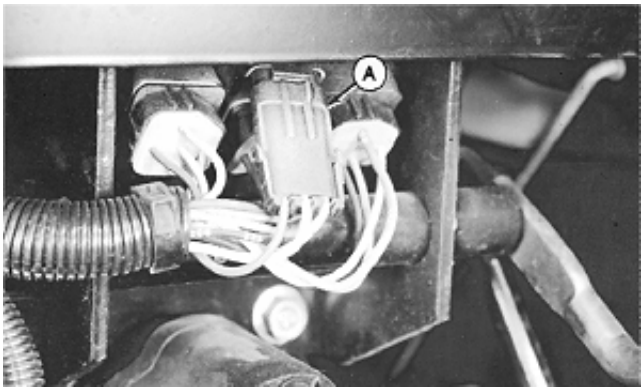
-UN-03NOV92
M81339

MX,4010HV,A30 -19-30NOV92

REPLACE SEAT SWITCH

1. Remove kick panel.

2. Disconnect wiring connector (A).



-UN-03NOV92
M81341

MX,4010HV,A32 -19-30NOV92

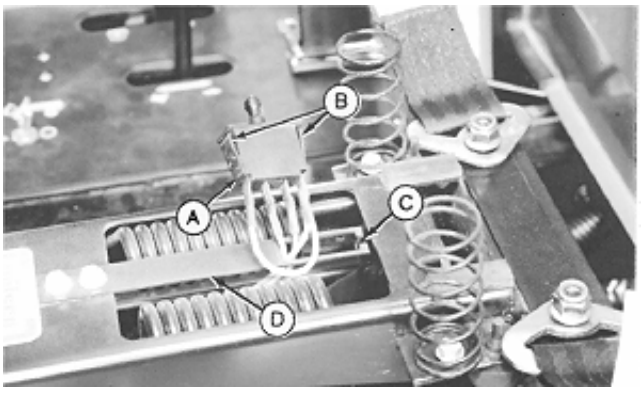
3. Press tabs (B) to remove seat switch (A) from bracket (D). Slide wires through slot (C) to remove switch from seat assembly.

4. Install switch.

5. Connect wiring connector.

6. Install kick panel.

A—Seat Switch
B—Tabs
C—Slot
D—Bracket



-UN-03NOV92
M81342

MX,4010HV,A33 -19-30NOV92

REPLACE MOW MICROSWITCH

1. Remove kick panel.

2. Remove two screws (D) and retaining strap (E) to remove mow microswitch (C) from switch panel.

3. Disconnect wires from mow switch.

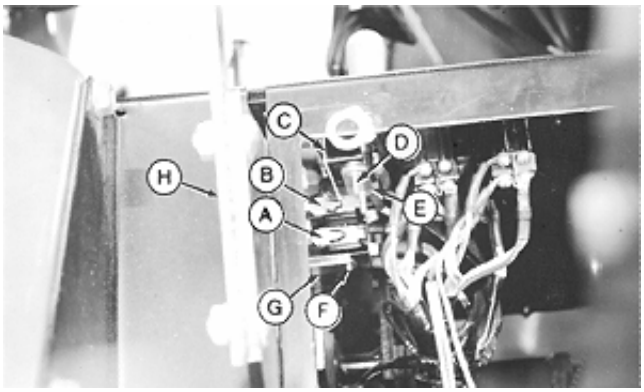
4. Connect wires to new microswitch:

WIRE	TERMINAL
125/127 (YEL)	COM
423 (WHT)	NO

5. Pull cutting units control lever (H) forward.

6. Install microswitch with lever towards front and roller towards the right side. Install retaining strap and two screws.

7. Adjust mow microswitch. (Refer to Adjust Mow Microswitch in Section 240, Group 15.)



M81343 -UN-03NOV92

A—Right Wing Lift Microswitch
B—Left Wing Lift Microswitch
C—Mow Microswitch
D—Screw (2 used)
E—Retaining Strap
F—Screw (2 used)
G—Retaining Strap
H—Cutting Units Control Lever

MX,4010HV,A34 -19-30NOV92

REPLACE WING LIFT MICROSWITCHES

1. Remove kick panel.

2. Remove two screws (F) and retaining strap (G) to remove wing lift microswitches (A and B) from switch panel.

3. Disconnect wires from microswitch.

4. Connect wires:

LEFT WING LIFT MICROSWITCH

WIRE	TERMINAL
123/124 (YEL)	COM
420 (DK BLU)/421 (PNK)	NO

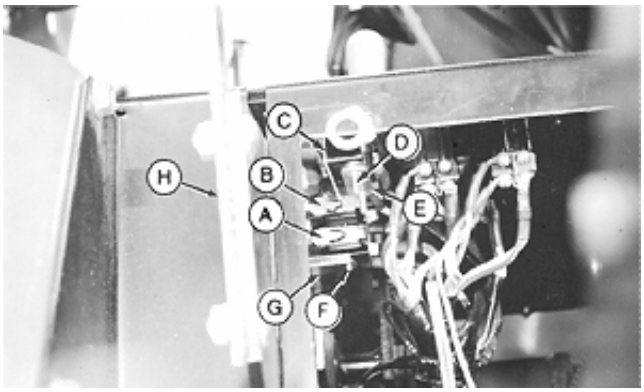
RIGHT WING LIFT MICROSWITCH

WIRE	TERMINAL
124/125 (YEL)	COM
409 (RED)/410 (DK GRN)	NO

5. Pull cutting units control lever (H) forward.

6. Install microswitches with levers towards the front and roller towards the right side. Install retaining strap and two screws.

7. Adjust microswitch levers. (Refer to Adjust Wing Lift Microswitches in Section 240, Group 15.)



M81343 -UN-03NOV92

A—Right Wing Lift Microswitch
B—Left Wing Lift Microswitch
C—Mow Microswitch
D—Screw (2 used)
E—Retaining Strap
F—Screw (2 used)
G—Retaining Strap
H—Cutting Units Control Lever

MX,4010HV,A37 -19-30NOV92

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10
16

REPLACE BRAKE MICROSWITCHES

NOTE: Brake microswitches are located underneath the floorboard, directly below the steering column.

1. Disconnect wires (A).

2. Remove two screws (E) and retaining strap (B). Remove microswitches (C and D).

3. Assemble parts (B—E). Install microswitches with levers towards the front and rollers downward.

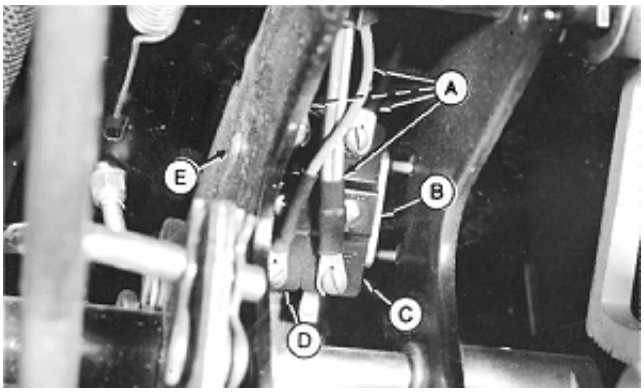
4. Connect wires:

BRAKE MICROSWITCH (D)

WIRE NO.	TERMINAL
228B	COM
512	NC

BRAKE MICROSWITCH (C)

WIRE NO.	TERMINAL
304	COM
305/306	NC



M81290 -UN-03NOV92

A—Wires
B—Retaining Strap
C—Microswitch
D—Microswitch
E—Screw (2 used)

MX,4010HV,A40 -19-30NOV92

REPLACE NEUTRAL START MICROSWITCHES

1. Lift left side of fuel tank. Install support rod.

2. Disconnect wires (A).

3. Remove screws (B) and retaining strap (E) to remove microswitches (C and D).

4. Install new microswitches.

5. Connect wires to microswitch (D):

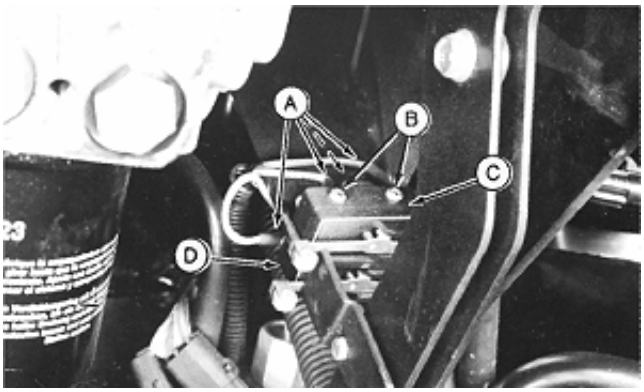
WIRE	TERMINAL
308 (PUR/WHT)	COM
307 (PUR/WHT)	NO

40
10
18

6. Connect wires to microswitch (C):

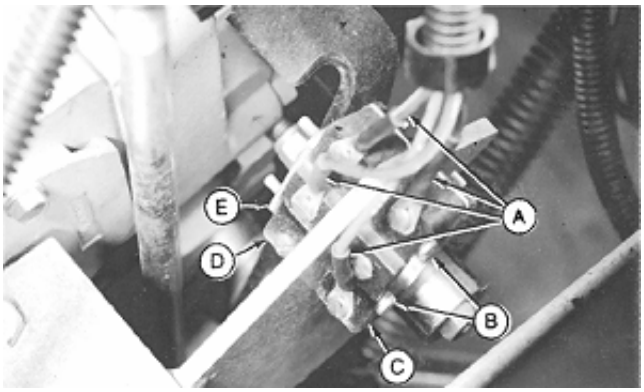
WIRE	TERMINAL
512 (BLK/RED)	COM
516 (RED)	NC

7. Adjust microswitches. (Refer to Adjust Neutral Start Switches in Section 240, Group 15.)



M81406 -UN-10DEC92

Serial No. —840000



M81346 -UN-03NOV92

Serial No. 840001—

A—Wires
B—Screws
C—Microswitch
D—Microswitch
E—Retaining Strap

MX,4010HV,A41 -19-30NOV92

REPLACE MERCURY SWITCH

NOTE: Mercury switches (A) are located on the outer reel wing arms (B).

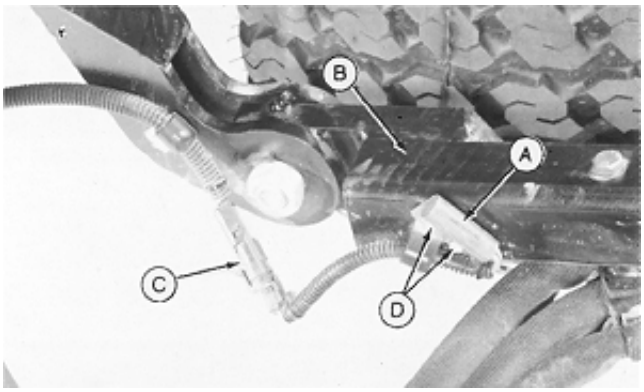
1. Disconnect wiring connector (C).

2. Remove two cap screws (D) to remove mercury switch (A).

IMPORTANT: Make sure wire harness end of switch is down. Mowing system will not operate correctly if switch is installed upside down.

3. Install mercury switch with wiring pointing downward.

4. Connect wiring connector (C). Make sure it is securely connected.



E34117 -UN-22MAY90

A—Mercury Switch
B—Reel Wing
C—Connector
D—Cap Screws

MX,4010HV,A42 -19-30NOV92

REPLACE PTO CLUTCH SWITCH

1. Lower all cutting units to ground.

2. Remove kick panel.

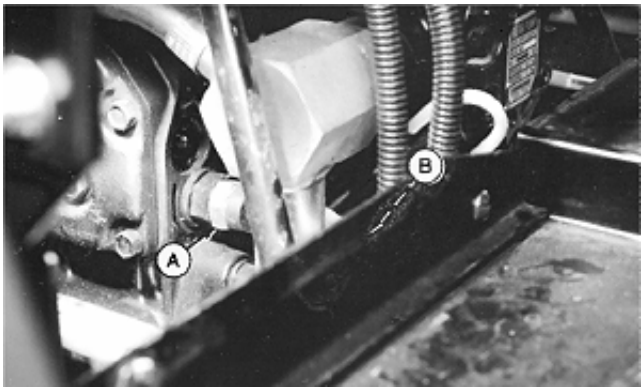
3. Disconnect wiring connector (B).

4. Remove switch (A).

5. Apply pipe sealant with TEFLON to threads of switch. Install new switch.

6. Connect wiring connector (B).

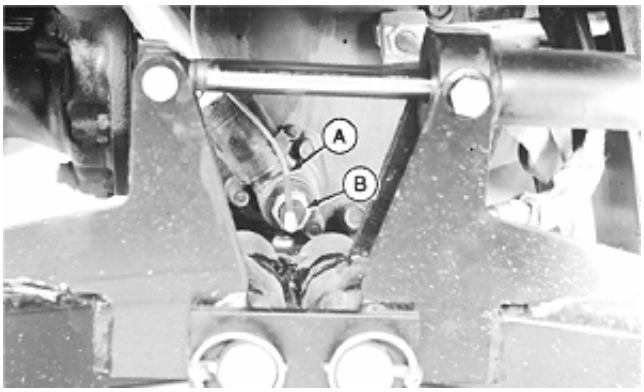
7. Install kick panel.



M81291 -UN-03NOV92

MX,4010HV,A43 -19-30NOV92

REPLACE HYDROSTATIC OIL TEMPERATURE SWITCH



1. Lower front mowers to ground.

NOTE: Approximate oil capacity of transaxle is 18.9 L (5 gal).

2. Drain transaxle oil. (See procedure in Section 50, Group 10.)

3. Disconnect wire (A).

4. Remove switch (B).

5. Apply pipe sealant with TEFLON to threads of switch. Install switch.

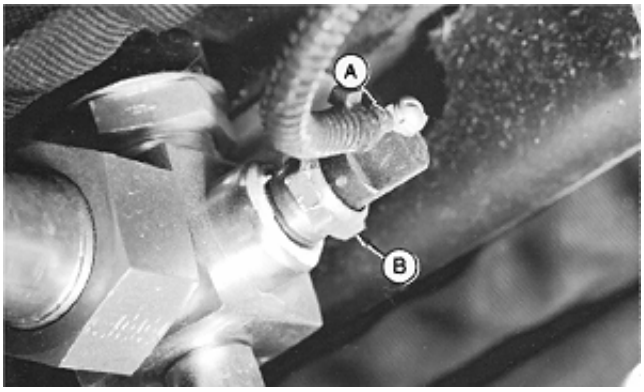
40 10 20

6. Connect wire.

7. Fill transaxle with specified transmission/hydraulic oil. (Refer to Section 10, Group 20.)

MX,4010HV,A44 -19-30NOV92

REPLACE HYDRAULIC OIL TEMPERATURE SWITCH



NOTE: The hydraulic oil temperature switch is located below the hydraulic oil reservoir, just above center cutting unit.

The approximate capacity of hydraulic oil reservoir is 26.5 L (7 gal).

1. Drain hydraulic oil reservoir.

2. Disconnect wire (A).

3. Remove switch (B).

4. Apply pipe sealant with TEFLON to threads of switch. Install switch.

5. Connect wire.

6. Fill reservoir with specified hydraulic oil. (Refer to Section 10, Group 20.)

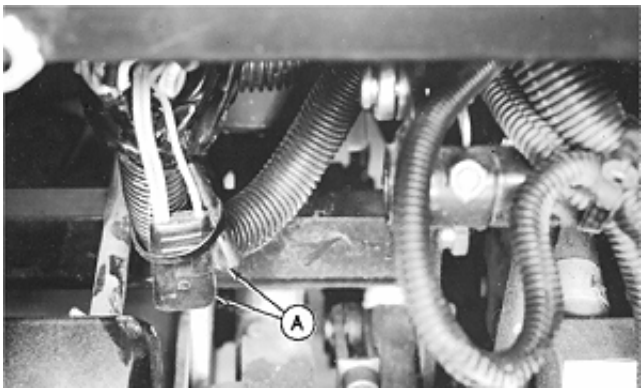
MX,4010HV,A45 -19-30NOV92

REPLACE WING AND SEAT RELAY DIODES

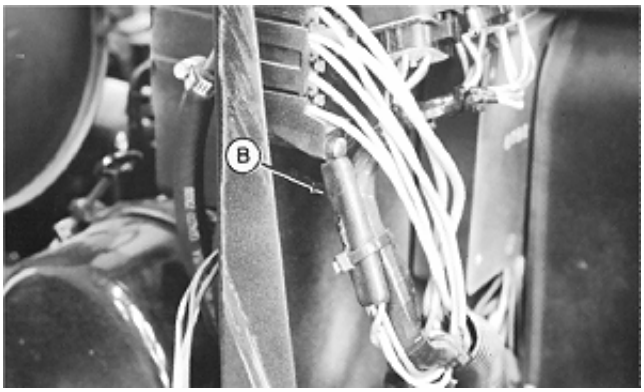
NOTE: The wing diodes are located under the switch panel. The seat relay diode is located below the fuse block on front side of firewall.

Remove and replace diodes as necessary.

A—Left and Right Wing Diodes
B—Seat Relay Diode



-UN-03NOV92
M81348

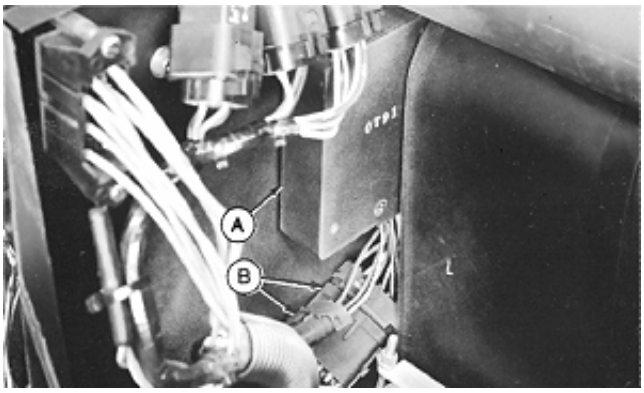


-UN-03NOV92
M81354

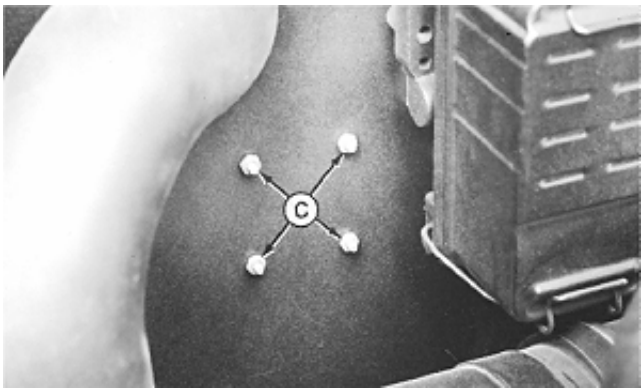
MX,4010HV,A46 -19-30NOV92

REPLACE CONTROL MODULE

1. Disconnect two connectors (B).
2. Remove nuts (C) to remove control module (A).
3. Install control module.
4. Connect wiring connectors.



-UN-03NOV92
M81350

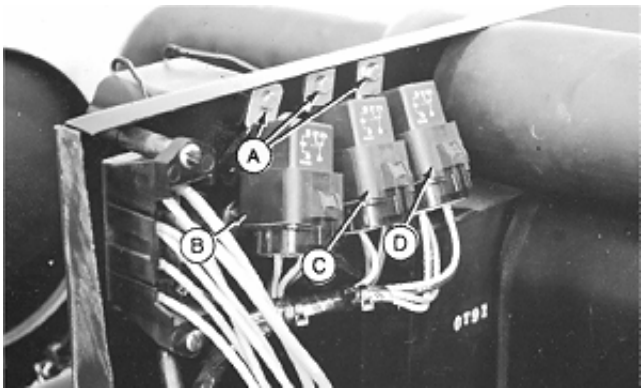


-UN-03NOV92
M81349

MX,4010HV,A47 -19-30NOV92

REPLACE START-ENABLE, NEUTRAL START AND SEAT RELAY

1. Remove nuts and cap screws (A).
2. Disconnect wiring connectors to remove relays (B—D).
3. Replace relays as necessary.
4. Connect wiring connectors.
5. Install relays, cap screws and nuts.



M81288 -UN-03NOV92

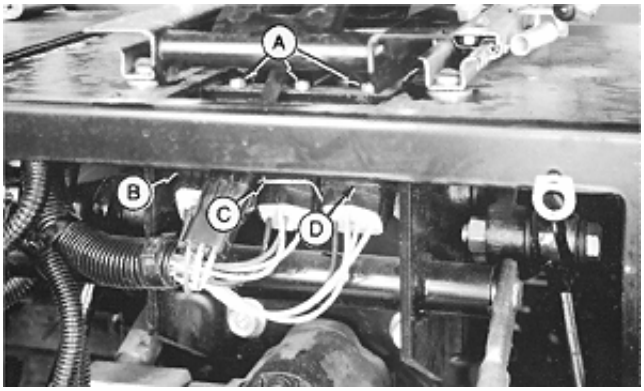
A—Nuts and Cap Screws
B—Neutral Start Relay
C—Start-Enable Relay (3365 only)
D—Seat Relay

40 10 22

MX,4010HV,A48 -19-30NOV92

REPLACE MOW AND WING RELAYS

1. Remove kick panel.
2. Remove cap screw and nuts (A).
3. Disconnect wiring connectors to remove relays (B—D).
4. Replace relays as necessary.
5. Connect wiring connectors.
6. Install relays, cap screws and nuts.
7. Install kick panel.



M81289 -UN-03NOV92

A—Screw and Nuts
B—Left Wing Relay
C—Right Wing Relay
D—Mow Relay

MX,4010HV,A49 -19-30NOV92

REPLACE WEIGHT TRANSFER SOLENOID

1. Lower left wing to ground.

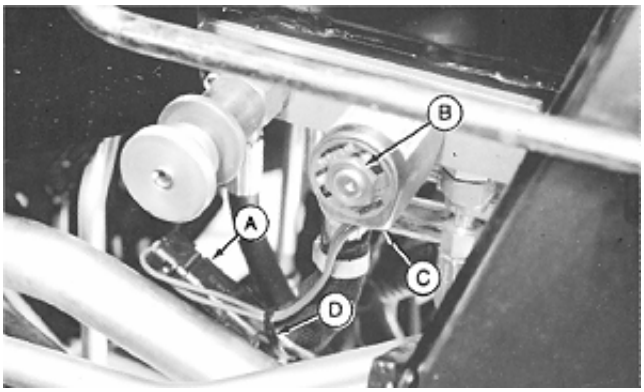
2. Remove tie strap (D). Disconnect wiring connector (A).

3. Remove nut (B) to remove weight transfer solenoid (C).

4. Install new solenoid. Install nut.

5. Connect wiring connector. Install new tie strap.

A—Connector
B—Nut
C—Solenoid
D—Tie Strap



-UN-03NOV92
M81351

MX,4010HV,A50 -19-30NOV92

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10
23

REPLACE MOW SOLENOIDS

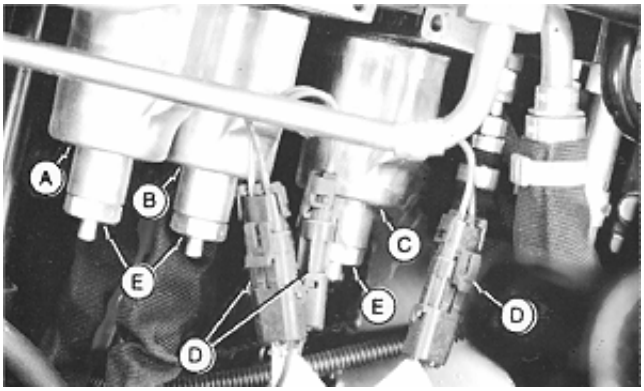
1. Tag and disconnect wiring connectors (D).

2. Remove nuts (E). Remove and replace solenoids (A—C) as necessary.

3. Install solenoids and nuts.

4. Connect wiring connectors:

WIRE NOS./COLORS CONNECTOR	SOLENOID
414/220 ORG/BLK	C
424/218 BRN/BLK	B
425/216 GRY/BLK	A



-UN-03NOV92
M81352

Bottom View

A—Left Wing Mow Solenoid
B—Right Wing Mow Solenoid
C—Front and Center Mow Solenoid
D—Connectors
E—Nut and Sleeve

MX,4010HV,A51 -19-30NOV92

REPLACE WING LIFT AND LOWER SOLENOIDS

1. Tag and disconnect wiring connectors (B).

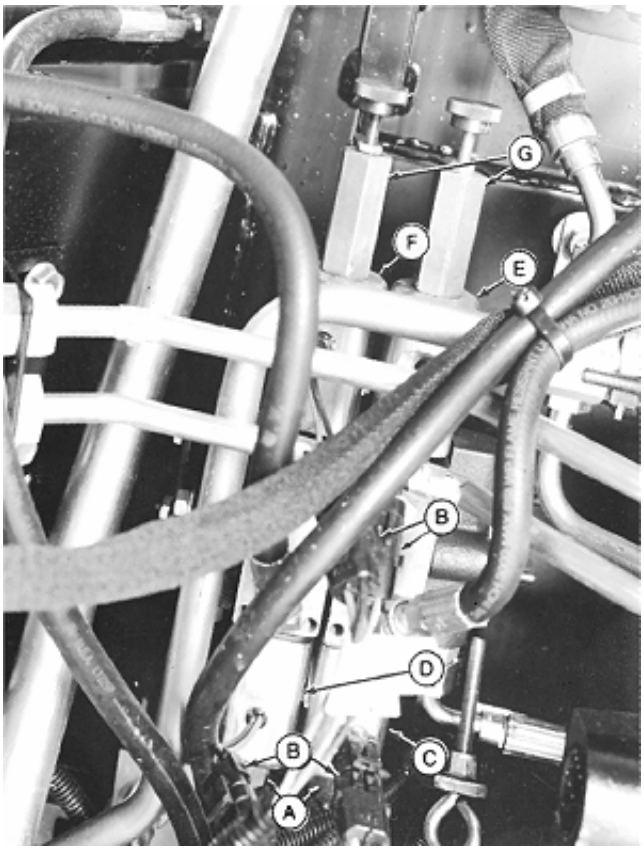
2. Remove nuts (A and G). Remove and replace solenoids (C—F) as necessary.

3. Install solenoids and nuts.

4. Connect wiring connectors:

WIRE NOS./COLORS CONNECTOR	SOLENOID
411/217 LT GRN/BLK	C
419/215 LT BLU/BLK	D
410/219 DK GRN/BLK	E
420/213 DK BLU/BLK	F

A—Nut (2 used)
B—Connectors
C—Right Wing Lower Solenoid
D—Left Wing Lower Solenoid
E—Right Wing Lift Solenoid
F—Left Wing Lift Solenoid
G—Adjuster Assembly (2 used)



M81353 -UN-03NOV92

MX,4010HV,A52 -19-30NOV92

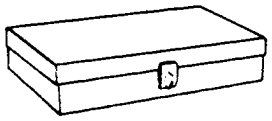
SPECIAL OR ESSENTIAL TOOLS

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

DX,TOOLS -19-05JUN91

TS446 -UN-22JUN89

Electrical Repair Tool Kit JDG155



Repair and installation of wires into electrical connectors.

DX,JDG155 -19-05JUN90

SERVICE PARTS KITS

The following kits are available through your parts catalog:

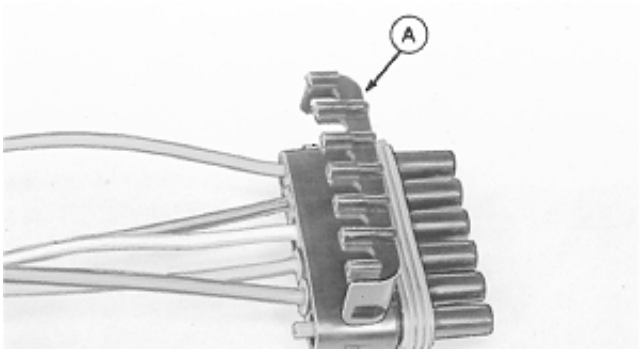
- RE11154 Electrical Connector and Wire Service Kit.

DX,ECONN,AE -19-04JUN90

REPLACE WEATHER PACK™ CONNECTOR

IMPORTANT: Identify wire color locations with connector terminal letters.

1. Open connector body (A).

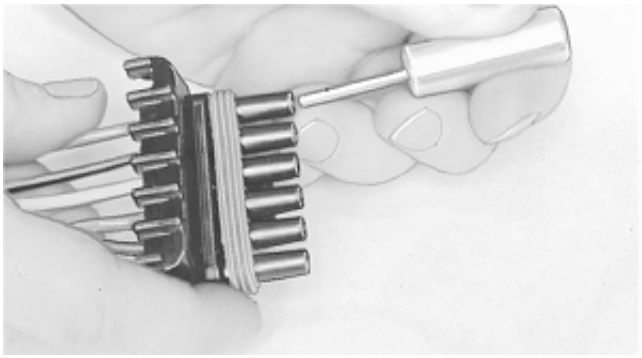


TS0127 -UN-23AUG88

WEATHER PACK is a trademark of PACKARD ELECTRIC

DX,ECONN,O -19-04JUN90

2. Insert JDG364 Extraction Tool over terminal contact in connector body.

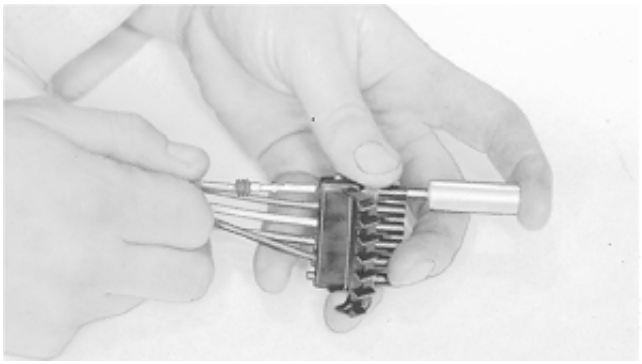


TS0128 -UN-23AUG88

DX,ECONN,P -19-04JUN90

3. Hold extractor tool fully seated and pull wire from connector body.

NOTE: If terminal cannot be removed, insert wire or nail through extractor tool handle and push terminal contact from connector.



TS0129 -UN-23AUG88

DX,ECONN,Q -19-04JUN90

IMPORTANT: Carefully spread contact lances to assure good seating on connector body.

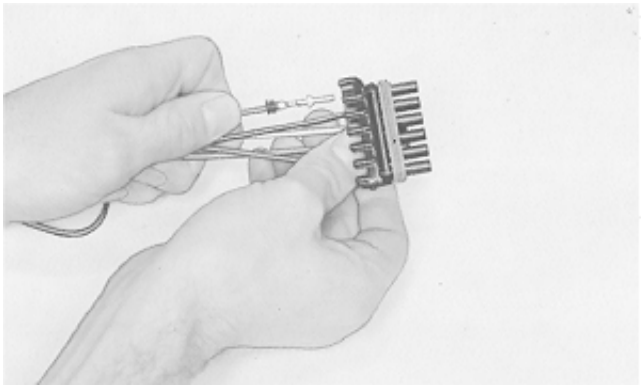
NOTE: Connector bodies are "keyed" for proper contact mating. Be sure contacts are in proper alignment.

4. Push contact into new connector body until fully seated.

5. Pull on wire slightly to be certain contact is locked in place.

6. Transfer remaining wires to correct terminal in new connector.

7. Close connector body.

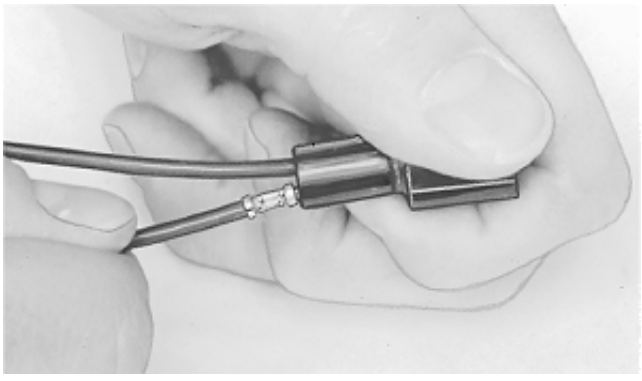


TS0130 -UN-23AUG88

DX,ECONN,R -19-04JUN90

REPLACE SURE-SEAL™ CONNECTOR WITH WEATHER PACK CONNECTOR

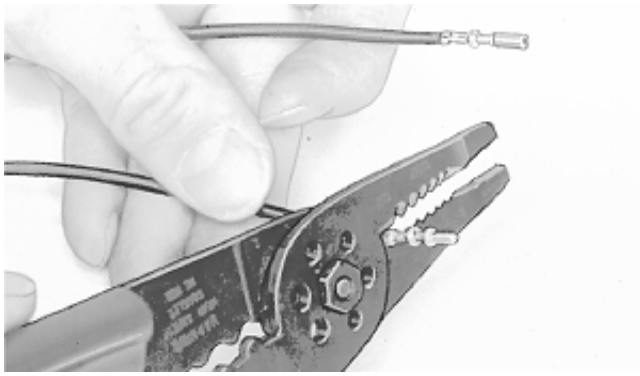
1. Pull wire to remove contact from SURE-SEAL connector.



TS0131 -UN-23AUG88

DX,ECONN,S -19-04JUN90

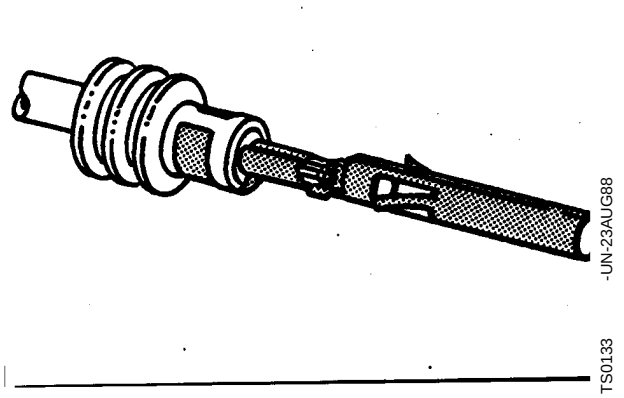
2. Use JDG145 Universal Electrical Plier to remove wire as close as possible to contact.



DX,ECONN,T -19-04JUN90

IMPORTANT: SURE-SEAL and WEATHER PACK connector bodies are “keyed” for proper contact mating. Be sure contacts are in proper alignment. SURE-SEAL connectors are keyed 1, 2, 3. WEATHER PACK connectors are keyed A, B, C. “A” matches 1, “B” matches 2 and “C” matches 3. See component replacement stories for any exceptions on connector codes.

3. Install WEATHER PACK contact on wire. (See install WEATHER PACK Contact in this section.)

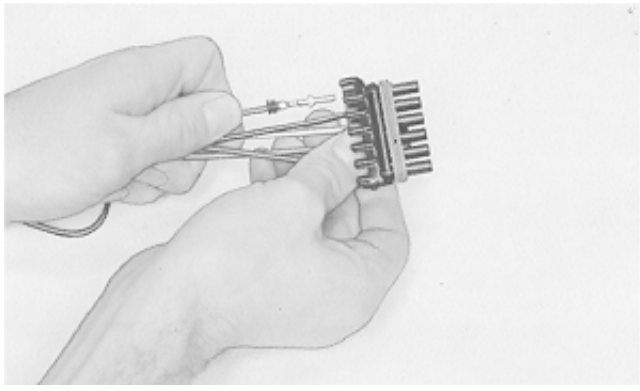


DX,ECONN,U -19-04JUN90

4. Push contact into WEATHER PACK connector body until fully seated.

5. Pull on wire slightly to be certain contact is locked in place.

6. Close connector body.



DX,ECONN,V -19-04JUN90

INSTALL WEATHER PACK CONTACT

NOTE: Cable seals are color coded for three sizes of wire:

a) Green - 18 to 20 gauge wire
b) Gray - 14 to 16 gauge wire
c) Blue - 10 to 12 gauge wire

1. Slip correct size cable seal on wire.

2. Strip insulation from wire to expose 6 mm (1/4 in.) and align cable seal with edge of insulation.



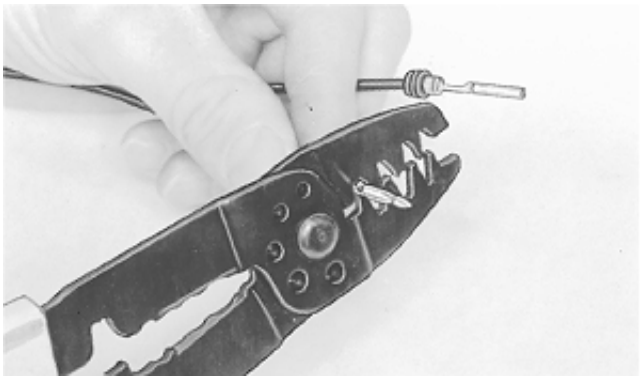
TS0136 -UN-23AUG88

DX,ECONN,AA -19-04JUN90

NOTE: Contacts have numbered identification for two sizes of wire:

a) #15 for 14 to 16 gauge wire
b) #19 for 18 to 20 gauge wire

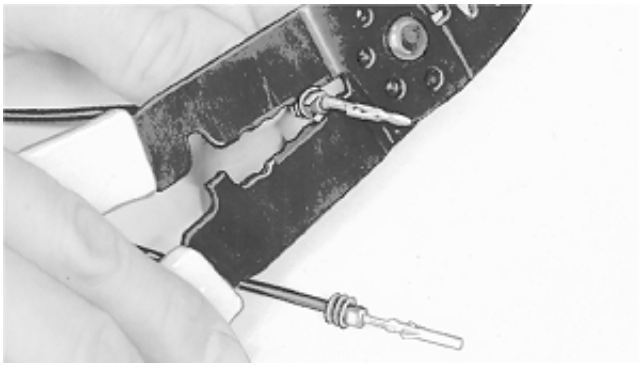
3. Place proper size contact on wire and use JDG144 Terminal Applicator to crimp contact in place with a “W” type crimp.



TS0137 -UN-23AUG88

DX,ECONN,AB -19-04JUN90

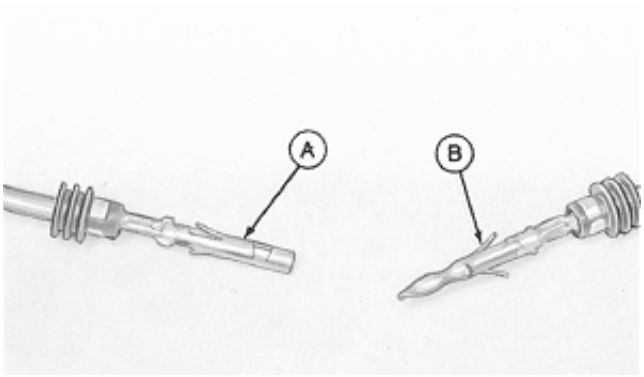
4. Use JDG144 Terminal Applicator to secure cable seal to contact as shown.



TS0138 -UN-23AUG88

DX,ECONN,AC -19-04JUN90

IMPORTANT: Proper contact installation for "sleeve" (A) and "pin" (B) is shown.

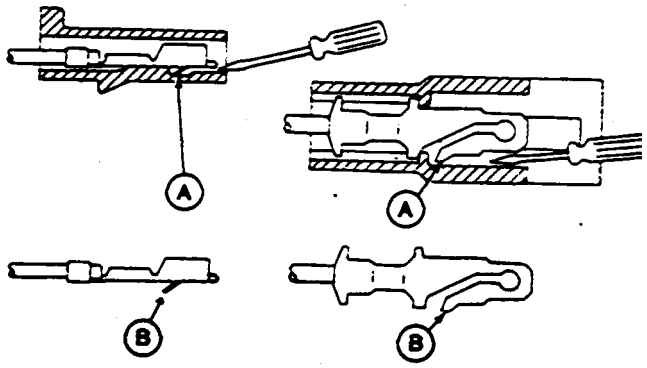


DX,ECONN,AD -19-04JUN90

REMOVE CONNECTOR BODY FROM BLADE TERMINALS

1. Use a small screw driver to depress locking tang (A) on terminal. Slide connector body off.

2. Be sure to bend locking tang back to its original position (B) before installing connector body.



DX,ECONN,V1 -19-04JUN90

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15
5

REPLACE WIRING HARNESS

1—Left Wing Mercury Switch
2—Transmission Neutral Switches
3—Weight Transfer Valve Solenoid
4—Left Work Light
5—Left Headlight
6—Transmission Temperature Switch
7—Brake Switches
8—Mow Relay
9—Right Wing Relay
10—Left Wing Relay
11—Seat Switch
12—Left Wing Diode
13—Right Wing Diode
14—Left Wing Switch
15—Right Wing Switch
16—Mow Switch
17—Right Wing Switch
18—Left Wing Switch
19—Optional Weight Transfer Switch
20—PTO Clutch Switch
21—Backlap Switch
22—Right Headlight
23—Instrument Panel
24—Right Work Light
25—Right Wing Mercury Switch
26—Center Reels Control Solenoid
27—Right Reel Control Solenoid
28—Left Wheel Control Solenoid
29—Fuse Block
30—Neutral Start Relay
31—Seat Relay
32—Water-in-Fuel Sensor
33—Ground Connection
34—Battery
35—Engine Air Heater Controller
36—Fuel Transfer Pump
37—Seat Relay Diode
38—TDC Module
39—Fuel Lever Sensor
40—Alternator
41—Starter/Solenoid
42—Air Restriction Switch
43—Water Temperature Sensor
44—Engine Air Heater
45—Oil Pressure Switch
46—Fuel Shut-Off Solenoid
47—Hydraulic Oil Temperature Switch
48—Right Wing Lift Solenoid
49—Left Wing Lift Solenoid
50—Left Wing Lower Solenoid
51—Right Wing Lower Solenoid
52—Start-Enable Relay (3365 only)

40
15
6

1. Open hood. Lift left side of fuel tank and install support rod.

2. Disconnect negative (—) battery cable.

3. Cut all tie straps.

4. Remove all hold-down clamps.

5. Disconnect wiring connectors and leads from components (1—52).

6. Remove fuse block (29) and engine air heater controller socket (35) from firewall.

7. Remove and replace wiring harness.

8. Install wiring harness.

9. Install fuse block and engine air heater controller socket.

10. Connect wiring connectors and leads to components (1—52).

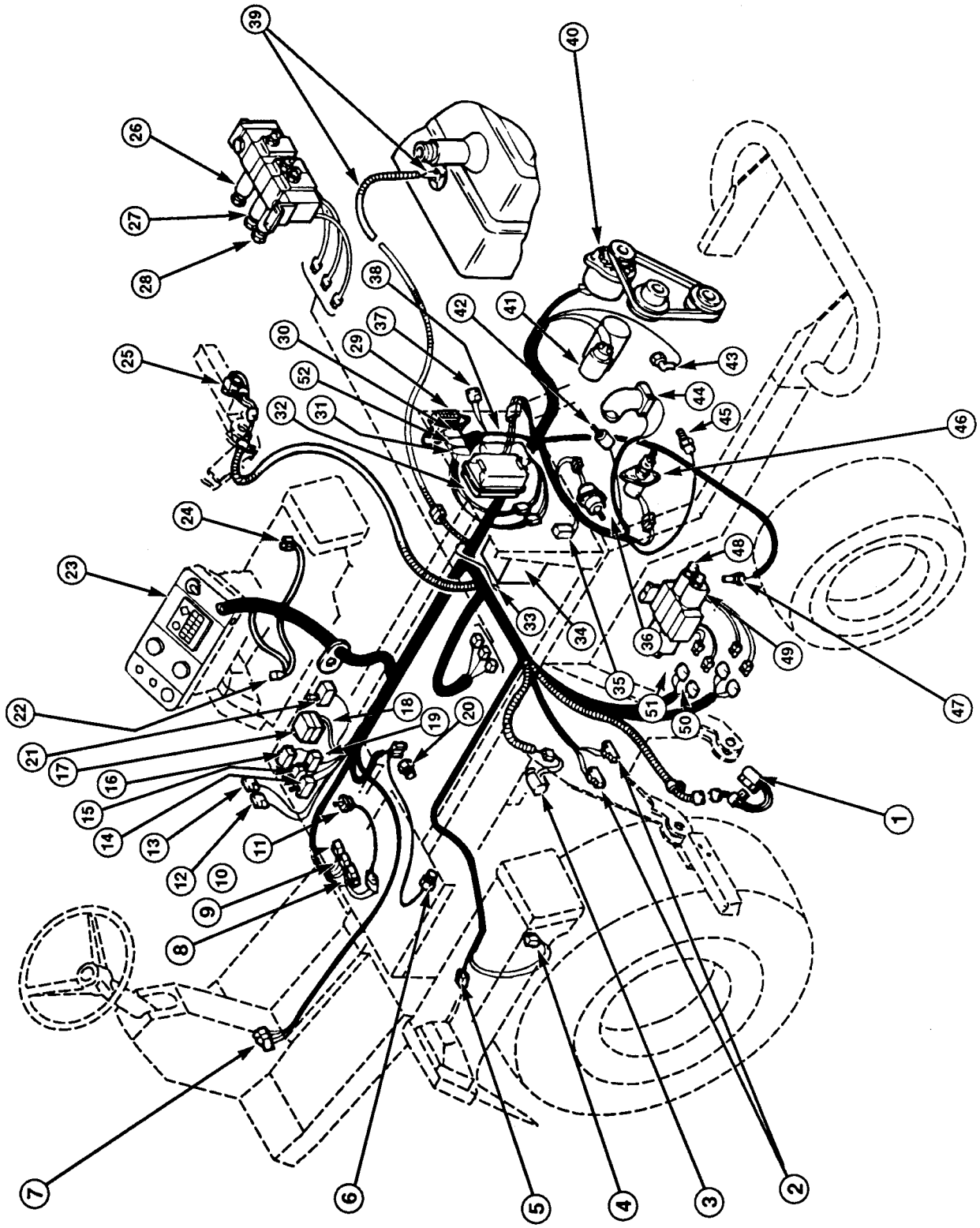
11. Install hold-down clamps.

12. Install new tie straps as necessary.

13. Connect negative (—) battery cable.

14. Lower fuel tank and close hood.

MX,4015HV,A1 -19-30NOV92



M81359AE -UN-10DEC92

MX,4015HV,A2 -19-30NOV92

Section 50
POWER TRAIN REPAIR

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50

SERVICE EQUIPMENT AND TOOLS

NOTE: Order tools from the U.S. SERVICEGARD™ Catalog or from the European Microfiche Tool Catalog (MTC). Some tools may be available from a local supplier.

Name	Use
Bushing, Bearing, and Seal Driver Set	To service bearings and seals.
2-Jaw Puller	To remove bearings.
Bearing Puller Attachment	To remove bearings.
Press	To service bearings.
Bench Fixture	To service transmission.

MX,5005HV,A1A -19-30NOV92

SPECIFICATIONS

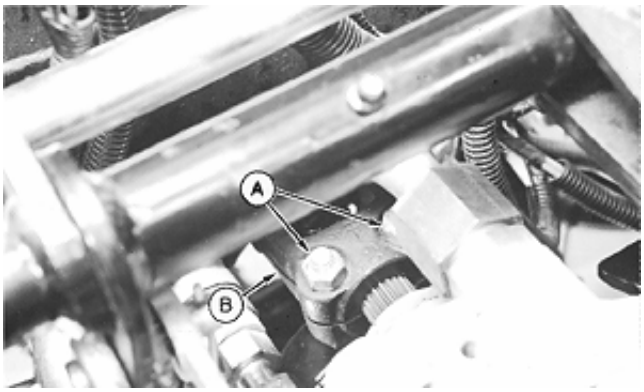
Item	Measurement	Specification
DRIVESHAFT:		
Drive Shaft-to-Isolator Cap Screws and Nuts	Torque	49 N·m (36 lb-ft).
Isolator-to-Flywheel Cap Screws	Torque	49 N·m (36 lb-ft)
Engine Mount-to-Frame Cap Screws	Torque	44—54 N·m (33—40 lb-ft)
Drive Shaft Coupler Cap Screws and Nuts	Torque	60 N·m (45 lb-ft)
CHARGE PUMP:		
Seal	Depth below surface	1.5—2.5 mm (0.056—0.096 in.)
Charge Pump-to-Transmission Cap Screws	Torque	37—50 N·m (27—37 lb-ft)
HYDROSTATIC TRANSMISSION:		
Swash Plate End Caps Cap Screws	Torque	8—9 N·m (72—84 lb-in.)
Center Section Needle Bearings	Depth above surface of housing	3 mm (7/64 in.) Above the Surface of Housing
Center Section-to-Housing Cap Screws	Torque	44—55 N·m (33—41 lb-ft)
Gear to Output Shaft Cap Screw	Torque	54 N·m (40 lb-ft)
Transmission-to-Transaxle Cap Screws	Torque	142 N·m (105 in.)
Neutral Return Spring		
S.N. —840000	Length	133 mm (5.25 in.)
S.N. 840001—	Length	203 mm (8.00 in.)
HYDROSTATIC OIL COOLER:		
Oil Cooler Fittings	Torque	34 N·m (25 lb-ft)

MX,5005HV,A1 -19-30NOV92

REMOVE DRIVE SHAFT

1. Open hood. Raise left side of fuel tank and install support rod.

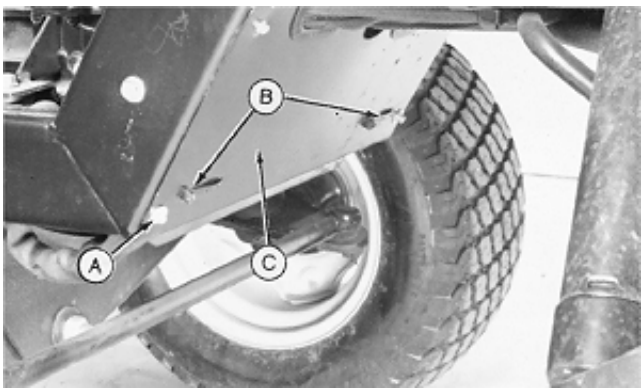
2. Loosen two cap screws and nuts (A) on drive shaft coupler (B).



M81420 -UN-12NOV92

MX,5005HV,A2 -19-30NOV92

3. Remove four cap screws (A) and two tie straps (B) to remove cover (C).



E34129 -UN-22MAY90

MX,5005HV,A3 -19-30NOV92

4. For 3325: Remove tie strap (A) around hydraulic reservoir.

NOTE: The approximate capacity of hydraulic oil reservoir is 26.5 L (7 gal).

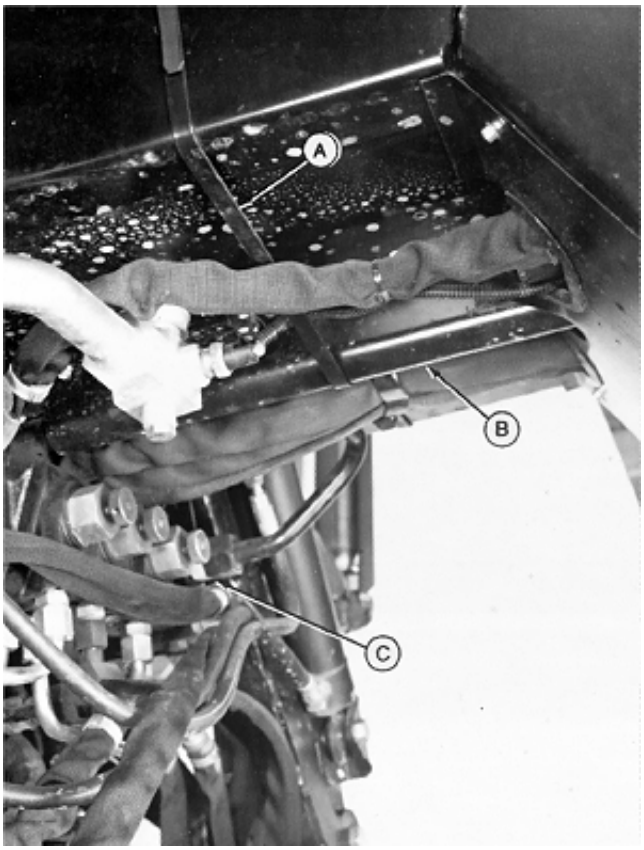
5. For 3365:

- Remove plug (E) to drain hydraulic reservoir.
- Remove return line (D).

6. Remove two cap screws to remove drive shaft shield (B).

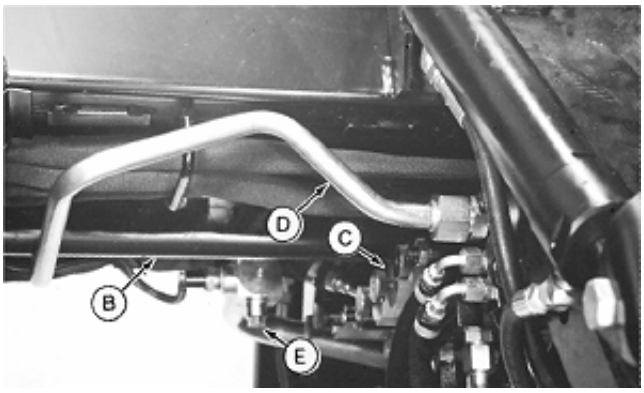
7. Loosen mounting cap screws of reel control valve (C).

A—Tie Strap
B—Drive Shaft Shield
C—Reel Control valve
D—Return Line
E—Plug



E35451 -UN-18OCT90

Model 3325



M81421 -UN-12NOV92

Model 3365

MX,5005HV,A4 -19-30NOV92

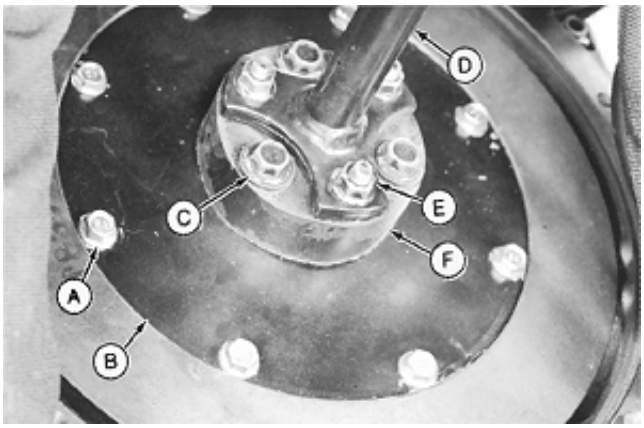
8. Remove three cap screws (C).

9. Slide drive shaft (D) forward. Remove three nuts (E). Remove isolator (F).

10. For 3365:

- Remove eight cap screws (A) to remove plate (B).
- If necessary, loosen four engine mount cap screws. Push engine rearward to remove isolator and plate.

11. Remove drive shaft.



M81422 -UN-12NOV92

A—Cap Screw (8 used)
B—Plate
C—Cap Screw (3 used)
D—Drive Shaft
E—Nut (3 used)
F—Isolator

MX,5005HV,A5 -19-30NOV92

INSTALL DRIVE SHAFT

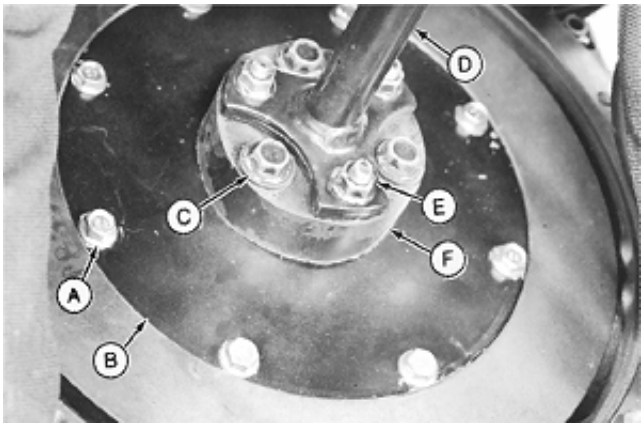
1. Slide coupler end of drive shaft onto transmission input shaft.

2. For 3365, install plate (B). Fasten with eight cap screws (A).

3. Align drive shaft flange holes with the non-raised holes in isolator (B). Install isolator to drive shaft with the three shorter cap screws and nuts (E). Tighten cap screws and nuts to 49 N·m (36 lb-ft).

4. Attach the isolator/drive shaft assembly to flywheel with the three longer cap screws (C). Tighten cap screws to 49 N·m (36 lb-ft).

5. For 3365, if engine mount cap screws were loosened, tighten cap screws to 44—54 N·m (33—40 lb-ft).



M81422 -UN-12NOV92

A—Cap Screw (8 used)
B—Plate
C—Long Cap Screw (3 used)
D—Drive Shaft
E—Nut (3 used)
F—Isolator

MX,5005HV,A6 -19-30NOV92

6. Tighten mounting cap screws of reel control valve (C).

7. Install drive shaft shield (B) using two cap screws.

8. For 3325:

   • Install tie strap (A) around reservoir and drive shaft shield.

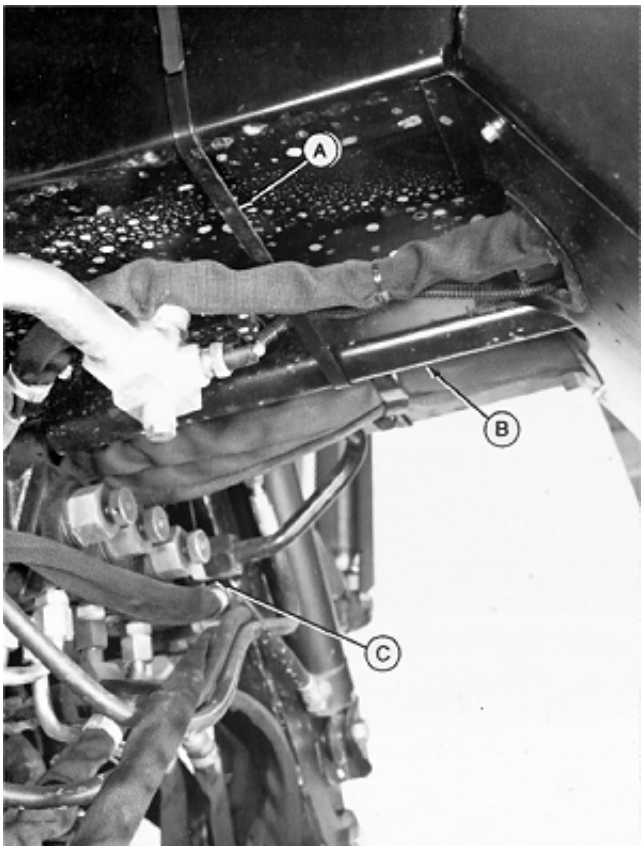
9. For 3365:

   • Install plug (E).

   • Install return line (D).

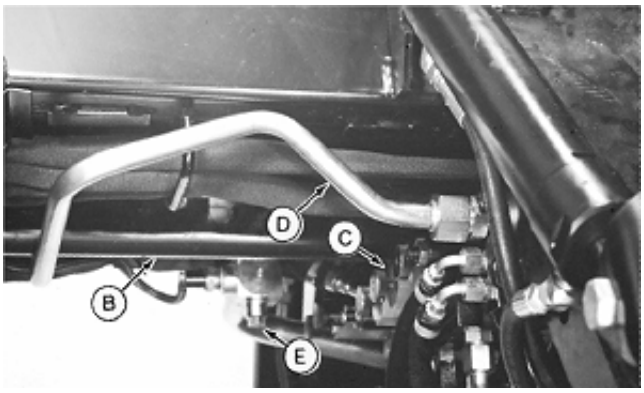
   • Fill reservoir with specified hydraulic oil. (See Section 10, Group 20.)

A—Tie Strap
B—Drive Shaft Shield
C—Reel Control Valve
D—Return Line
E—Plug



E35451 -UN-18OCT90

Model 3325



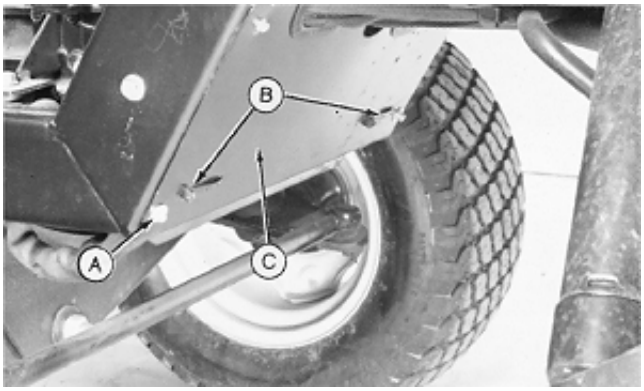
M81421 -UN-12NOV92

Model 3365

MX,5005HV,A7 -19-30NOV92

10. Install shield (C). Fasten with four cap screws (A).

11. Fasten hydraulic lines to shield using two tie straps (B).

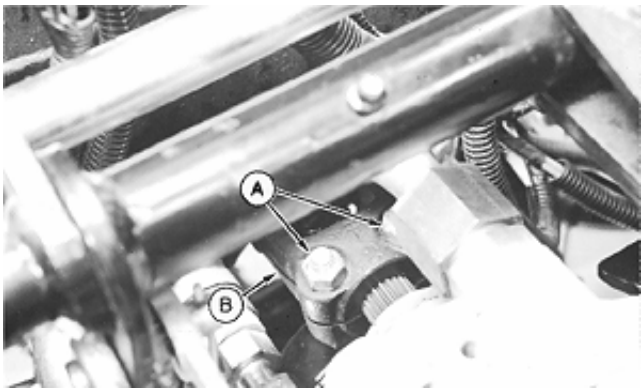


E34129 -UN-22MAY90

MX,5005HV,A8 -19-30NOV92

12. Tighten cap screws and nuts (A) on coupler (B) to 60 N·m (45 lb-ft).

13. Lower fuel tank and close hood.



M81420 -UN-12NOV92

MX,5005HV,A9 -19-30NOV92

REPAIR CHARGE PUMP

1. Drain transaxle oil. (See procedure in Group 10.)

2. Remove drive shaft. (See procedure in this group.)

3. Remove cap screws (B).

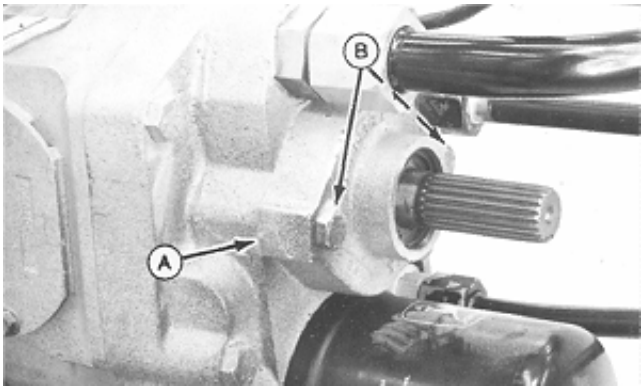
IMPORTANT: Pin (C) may fall from input shaft when pump is removed from transmission. Do not lose pin.

NOTE: Hydraulic lines removed for clarity of photograph.

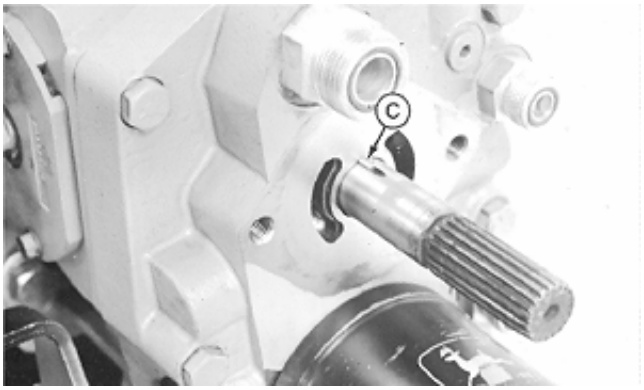
4. Carefully remove charge pump (A) from transmission so not to lose pin (C).

5. Inspect pin and input shaft for damage or wear. Replace if necessary.

A—Charge Pump
B—Cap Screws
C—Pin



M42372 -UN-20FEB92



M81315 -UN-12NOV92

MX,5005HV,A10 -19-30NOV92

6. Disassemble parts (A—F).

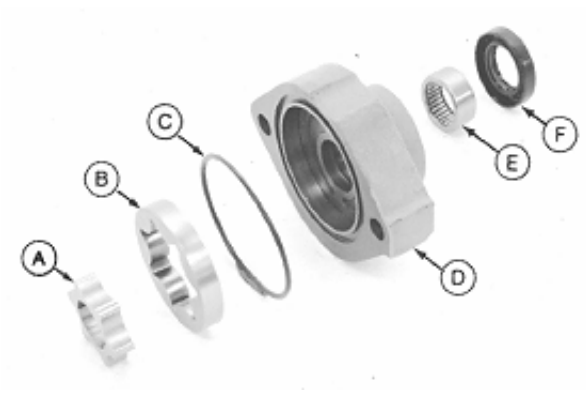
7. Clean and dry all parts. Machined surfaces must be clean and smooth.

8. Inspect all parts for wear or damage. Replace parts as necessary.

9. Inspect machined surfaces of charge pump and transmission center section for severe scoring. If scored, replace charge pump and center section.

10. Apply clean transmission oil on all internal parts.

11. Assemble parts (A—F). Install seal (F) with open end towards pump. Seal should be 1.5—2.5 mm (0.056—0.096 in.) below housing surface.



M81316 -UN-12NOV92

A—Gerotor Inner Gear
B—Gerotor Ring Gear
C—O-Ring
D—Housing
E—Needle Bearing
F—Seal

MX,5005HV,A11 -19-30NOV92

12. Apply petroleum jelly to pin (C) and input shaft keyway to hold pin in place during installation of charge pump.

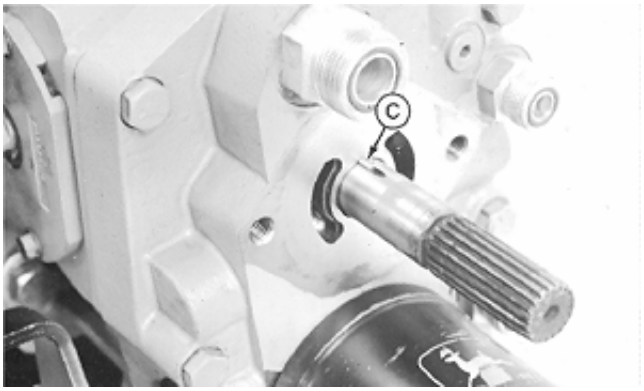
13. Make sure pump O-ring is seated in its groove.

IMPORTANT: Pump must be installed with flat (A) of housing to left side of machine. Pump will not draw oil if installed with flat on the right.

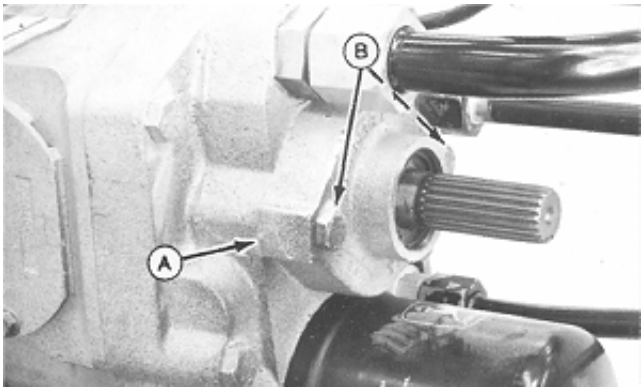
14. Install charge pump on transmission with flat surface (A) on left side. Tighten cap screws (B) to 37—50 N·m (27—37 lb-ft).

15. Install drive shaft. (See procedure in this group.)

16. Fill transaxle with specified hydraulic oil. (See Section 10, Group 20.)



M81315 -UN-12NOV92



M42372 -UN-20FEB92

A—Flat Surface
B—Cap Screws
C—Pin

MX,5005HV,A12 -19-30NOV92

CAUTION: Avoid injury from rotating blades. Keep hands and feet away from cutting units while machine is operating.

4. Move backlapping switch (A) to “N” (neutral position) for backlapping. Set throttle lever (B) to low idle.

5. Engage PTO.

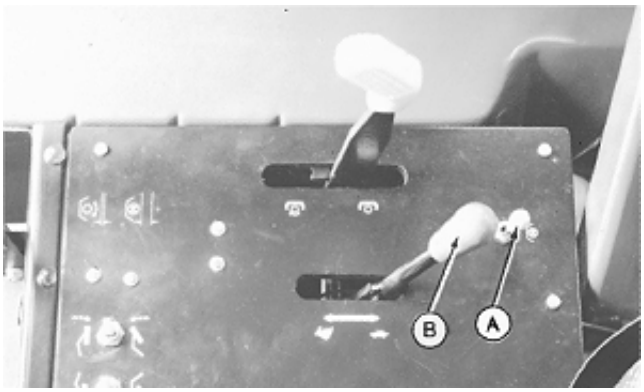
IMPORTANT: Reels must be turning backwards slowly enough so grinding compound will not be thrown off during backlapping.

NOTE: Cutting units may be backlapped separately. The left thumbscrew controls the left cutting unit. The center thumbscrew controls the right cutting unit. The right thumbscrew controls the three remaining units.

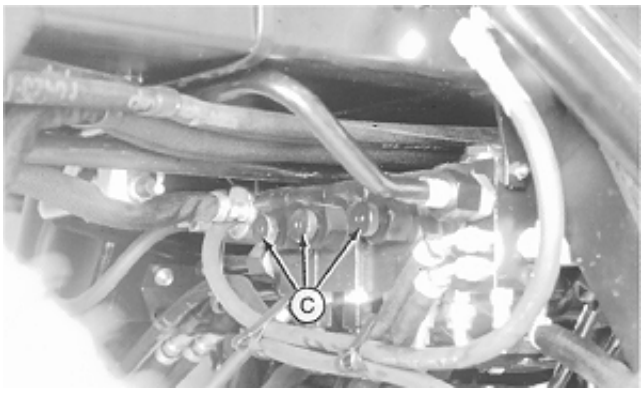
6. Turn thumbscrews (C) inward (clockwise) to turn reels in reverse direction and adjust reel speed. Thumbscrews are located on right side, behind fuel tank, and below battery.

7. Use a long-handed brush to carefully apply reel backlapping compound, uniformly, from one end of the reel to the other. Apply compound again starting from the opposite end. Allow unit to continue rotating backwards until reel is quiet.

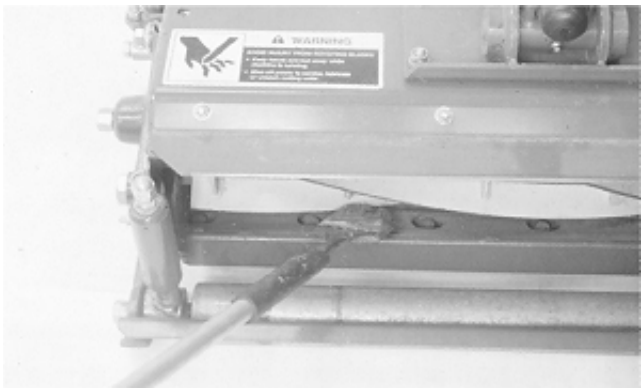
8. Periodically disengage PTO lever and shut engine off to visually check blade appearance.



-UN-16SEP88 E29644



-UN-16SEP88 E29574



-UN-12SEP88 E32250

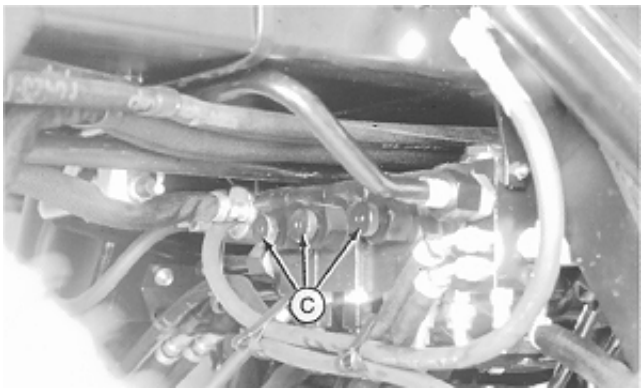
MX,5005HV,A13 -19-30NOV92

11. Disengage PTO lever and shut off engine. Turn thumbscrews (C) fully counterclockwise.

IMPORTANT: Do not operate units in the forward direction until reel sharpening compound is washed from the unit. Unless compound is removed thoroughly, the reels can be dulled by the compound.

12. With the reel stopped, use water to thoroughly wash off all reel sharpening compound.

13. Check reel-to-bed knife clearance. Adjust clearance if necessary.



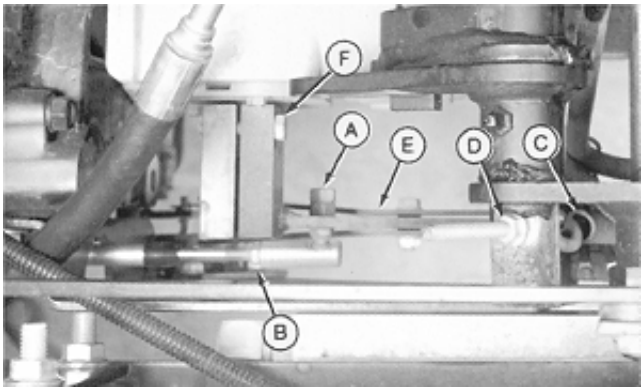
E29574 -UN-16SEP88

MX,5005HV,A14 -19-30NOV92

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05
10

7. Remove neutral centering assembly and linkage, S.N. —840000:

- Remove two nuts (A) to disconnect forward/reverse cable (B).
- Release tension on spring (C).
- Disconnect spring and swing roller assembly (E) down.
- Remove two cap screws and washer to remove neutral centering support from transaxle case.
- Remove cap screw (F) to remove cam.



E35454 -UN-18OCT90

A—Nut (2 used)
B—Forward/Reverse Cable
C—Return Spring
D—Nut (2 used)
E—Cam Roller Assembly
F—Cap Screw

MX,5005HV,A15 -19-30NOV92

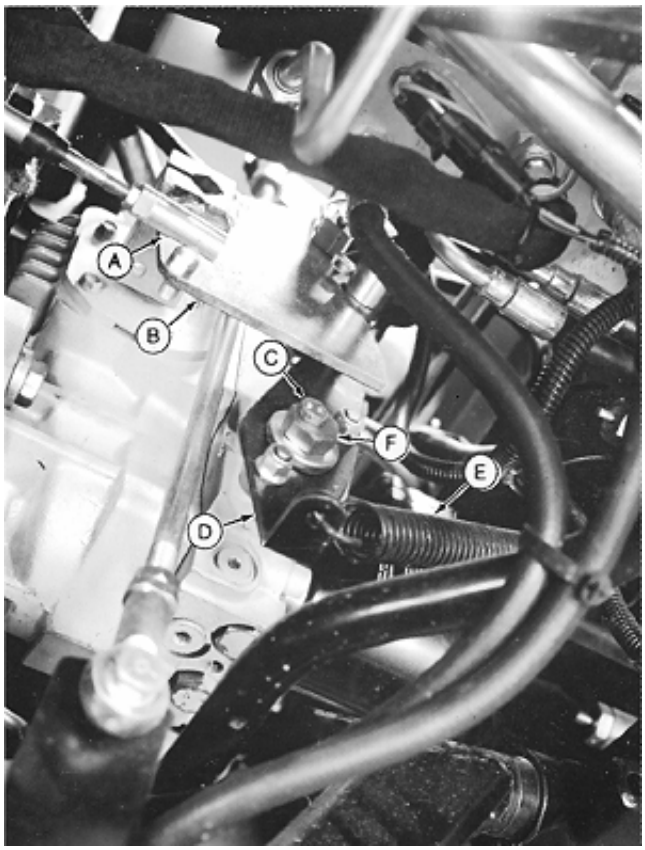
8. Remove neutral centering assembly and linkage, S.N. 840001— :

- Disconnect forward/reverse cable (A) from cam (B).
- Release spring tension to remove spring (E).

NOTE: See Section 50, Group 20 for repair of transmission control linkage.

- Remove cam (B). Lay cam, with attached microswitches, on machine frame.
- Remove cap screw (C) to remove eccentric (F) and lever (D).

A—Forward/Reverse Cable
B—Cam
C—Cap Screw
D—Neutral Centering Lever
E—Return Spring
F—Eccentric

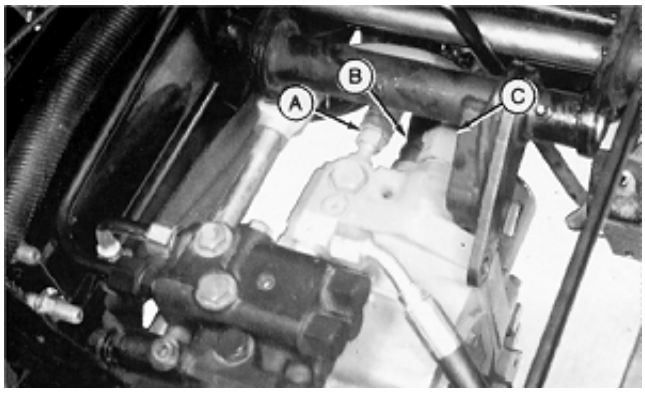


M81314 -UN-12NOV92

MX,5005HV,A16 -19-30NOV92

9. Tag and disconnect two hydraulic hoses (A and B). Close all openings with caps and plugs to prevent dirt from entering the hydraulic system.

10. Remove suction line (C) by disconnecting line from transaxle, transaxle pump and hydrostatic transmission.



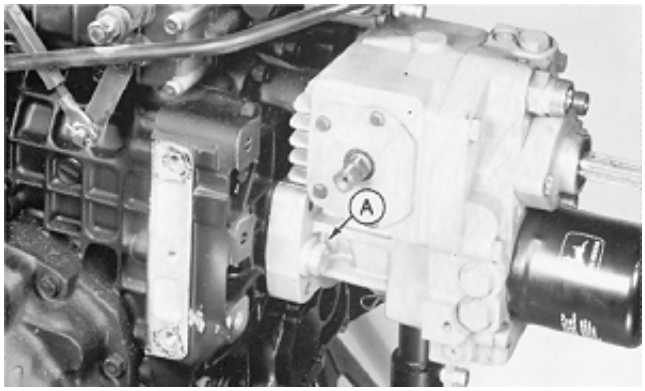
E35455 -UN-18OCT90

MX,5005HV,A17 -19-30NOV92

NOTE: Transaxle removed for clarity of photograph.

11. Attach sling and hoist to transmission.

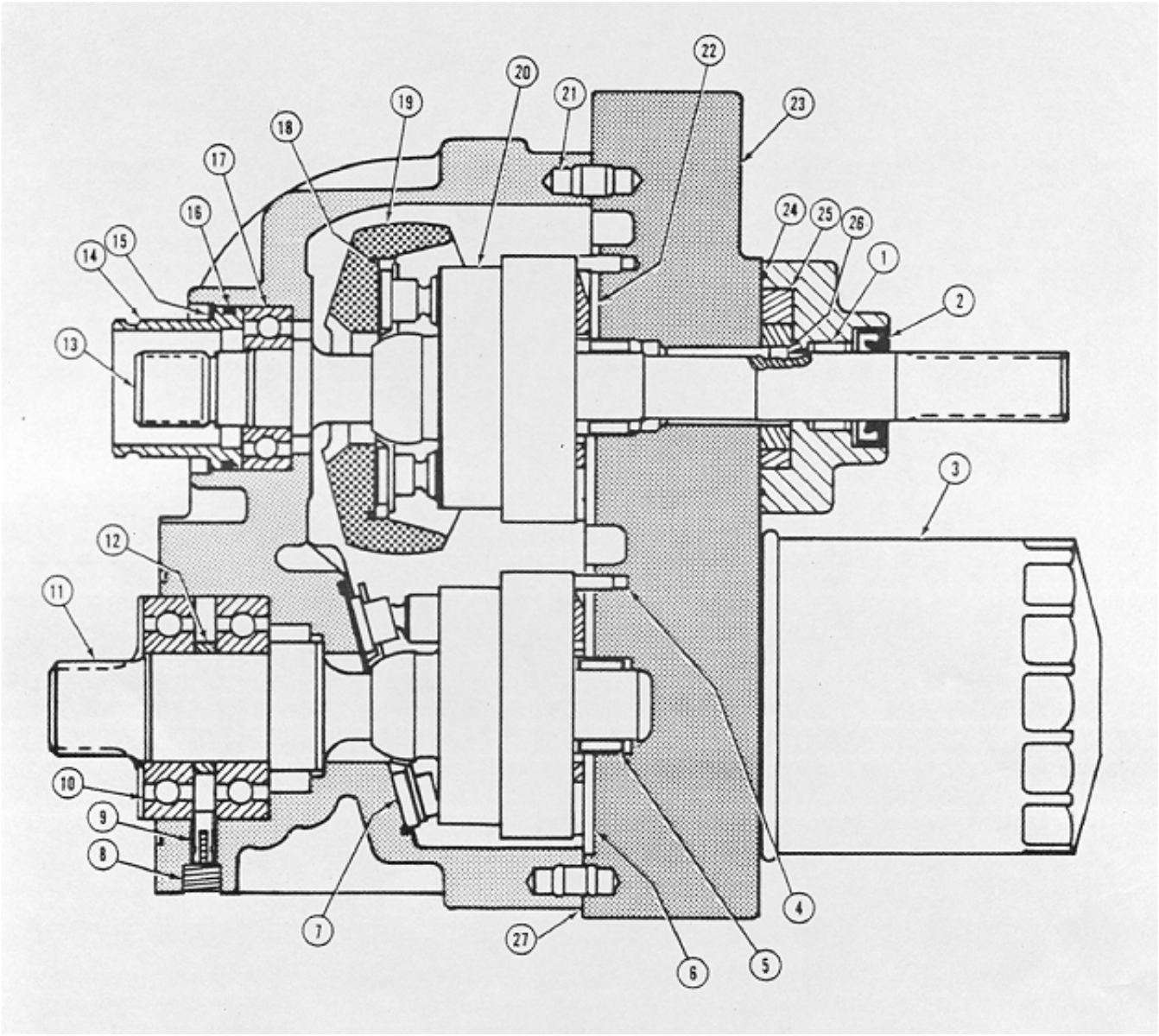
12. Remove cap screw and washer (A) from each side to remove hydrostatic transmission.



E30079 -UN-11DEC89

MX,5005HV,A18 -19-30NOV92

CROSS SECTION OF TRANSMISSION



1—Needle Bearing
2—Seal
3—Oil Filter
4—Pin (2 Used)
5—Bearing (2 Used)
6—Valve Plate
7—Thrust Plate
8—Pipe Plug
9—Pin
10—Bearing (2 Used)
11—Motor Shaft
12—Collar
13—Pump Shaft
14—Seal Guide
15—Ring
16—O-Ring
17—Bearing
18—Thrust Plate
19—Swash Plate
20—Cylinder Block Assembly (2 Used)
21—Pin (2 Used)
22—Valve Plate
23—Transmission Case (Center Section)
24—O-Ring
25—Gerotor (Gear Set)
26—Pin
27—Gasket

2E6,5005G,14A -19-30NOV92

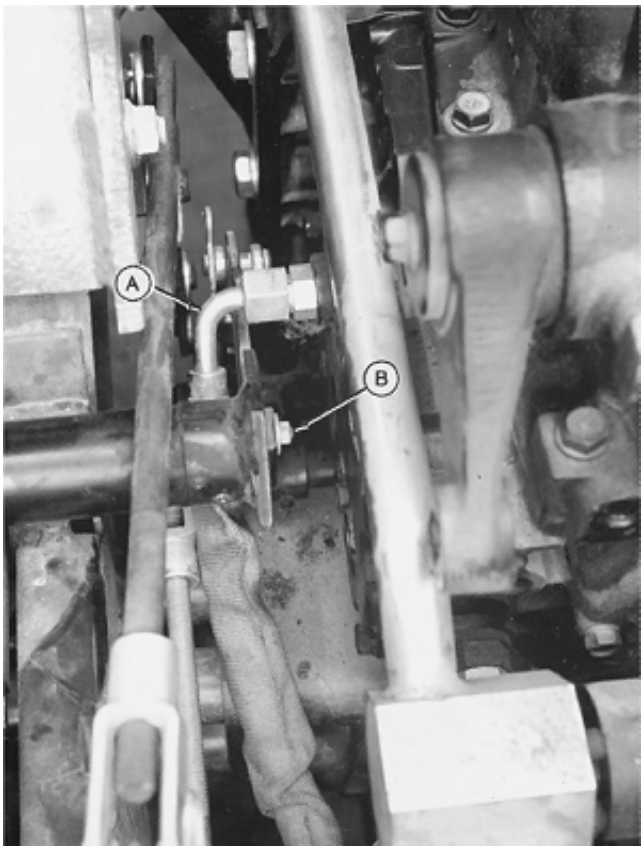
30. Tag and disconnect hydraulic hose (A).

31. Remove shoulder cap screw, nut and washer(s) (B) to disconnect PTO valve lever.

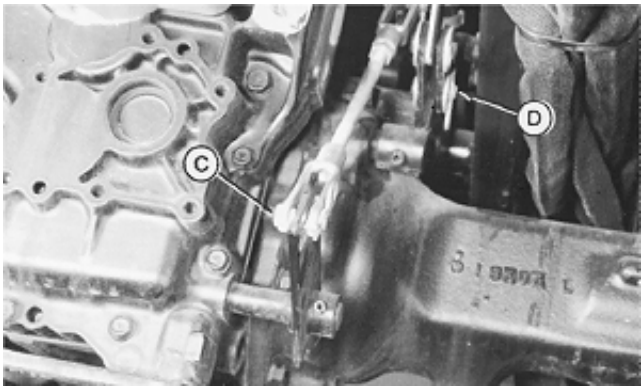
32. Remove spring locking pin and pin (D) to disconnect differential lock linkage.

33. For S.N. —840000 only: Remove spring locking pin and pin (C) to disconnect PTO lever lock linkage.

A—Steering Valve (Port T)-to-PTO Valve
B—Cap Screw, Nut, and Washers
C—PTO Linkage Pin
D—Differential Lock Linkage Pin



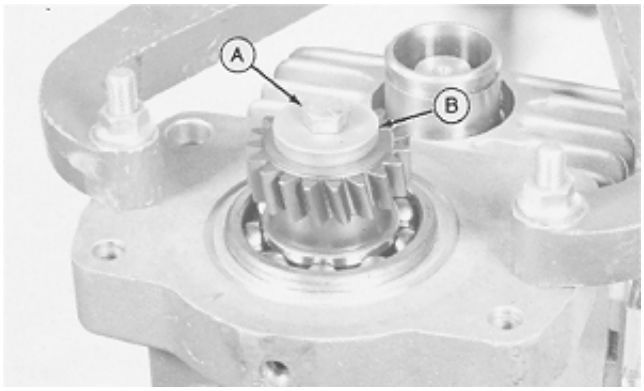
E35699 -UN-09JAN91



E35446 -UN-09JAN91

MX,5010HV,A19 -19-30NOV92

5. Remove cap screw (A), washer (B), and output shaft drive gear.



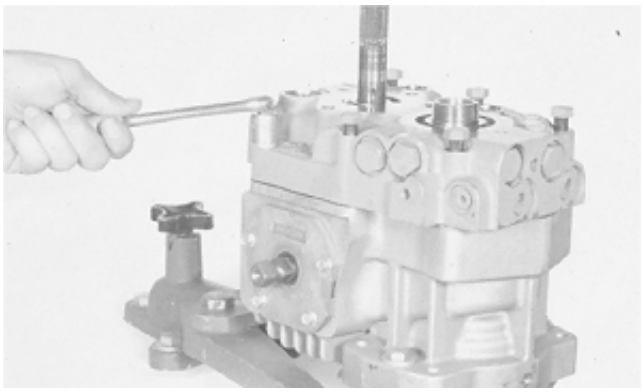
M43814 -UN-31AUG88

M21,5005W,23 -19-25MAY90

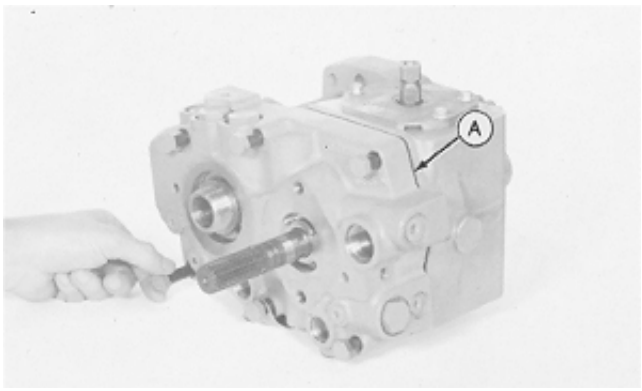
IMPORTANT: Do not allow internal parts to fall when removing center section.

6. Loosen six cap screws (do not remove). Remove transmission from bench fixture.

7. Lay transmission on its right side as shown. Remove six cap screws, center section and gasket (A).



M43815 -UN-31AUG88



M43816 -UN-31AUG88

MX,5005HV,A20 -19-30NOV92

IMPORTANT: DO NOT allow internal parts to fall free when removing center section.

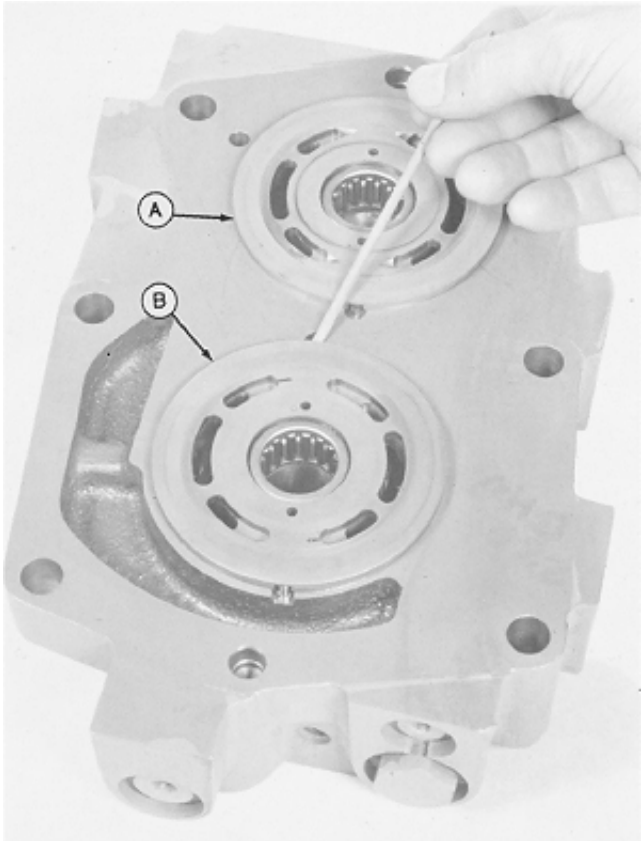
DO NOT mix pump and motor components, they are NOT interchangeable.

DO NOT nick or scratch lapped or machined surfaces of the center section, valve plates, or cylinder blocks and pistons.

8. Remove valve plates (A and B). If it is necessary to pry valve plates loose from center section, use a wooden dowel and pry only at dowel pin grooves.

If valve plates do not come off with center section, remove valve plates from cylinder block assemblies.

It may be necessary to apply diesel fuel between valve plate and cylinder block to cut oil film.

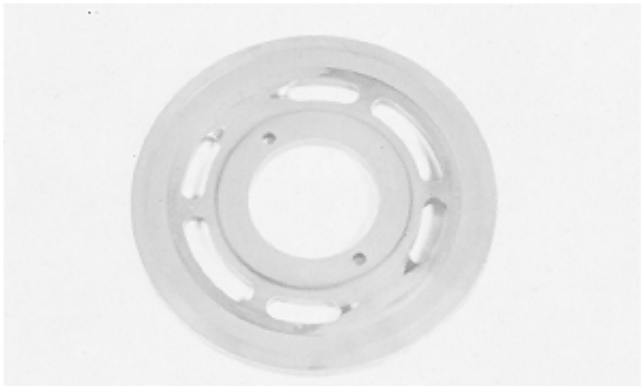


M43817 -UN-31AUG88

MX,5005HV,A21 -19-30NOV92

NOTE: Valve plates should be flat, free of all nicks, burrs, scratches and erosion around the ports. The bronze metal should not show scoring (fine scratches or grooves cut into the plate), smearing or discoloration.

9. Inspect valve plates. Replace plates when scratches can be detected by feel, fingernail or lead pencil.

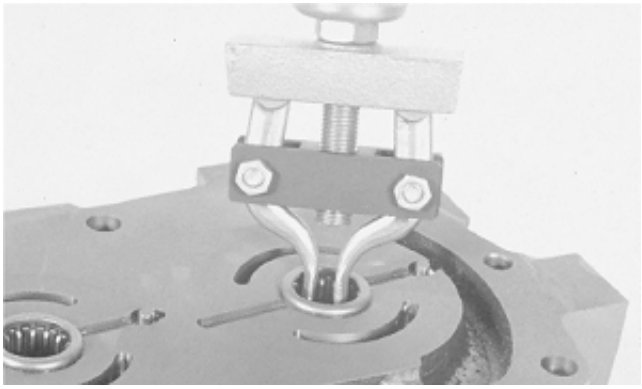


M43818 -UN-31AUG88

MX,5005HV,A22 -19-30NOV92

10. Inspect both bearings in center section. Replace if necessary. Remove bearing using a 2-jaw puller and a slide hammer.

11. For disassembly of center section, see Remove And Install Checks And Relief Valves in this group.



M43819 -UN-31AUG88

MX,5005HV,A23 -19-30NOV92

IMPORTANT: Do not nick or scratch lapped surface of cylinder blocks.

Piston-to-bore relationship should be maintained; keep pump and motor components separate, they are not interchangeable.

12. Remove motor and pump cylinder blocks.



M43820 -UN-31AUG88

M21,5005W,28 -19-24APR91

IMPORTANT: DO NOT interchange pistons between motor and pump cylinder blocks. Pistons and cylinder blocks are matched and must NOT be interchanged.

13. Inspect cylinder block assemblies:

- Lift piston retainer and pistons from cylinder block.
- Check for free movement of pistons in cylinder bores as you remove them.
- If any dragging is detected, replace entire cylinder block assembly.

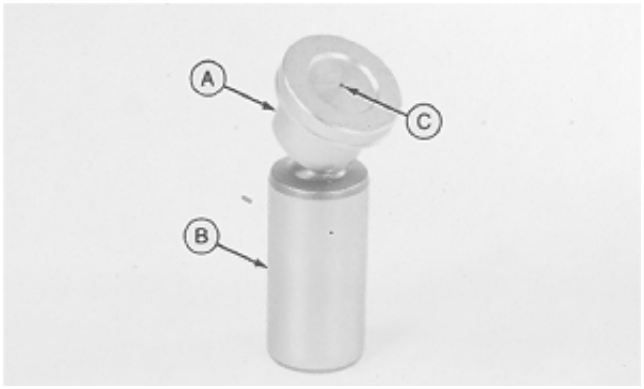


M36111 -UN-29AUG88

MX,5005HV,A24 -19-30NOV92

14. Remove and inspect all pistons:

- Check barrel (B) for scoring, discoloration, or any signs of separation of slippers.
- Check slipper (A) for scoring, smearing, rolled edges and a full 360° free rotation on barrel.
- Check lubrication hole (C) for blockage. Clean with compressed air.
- Replace entire cylinder block assembly if any component of the piston is damaged.

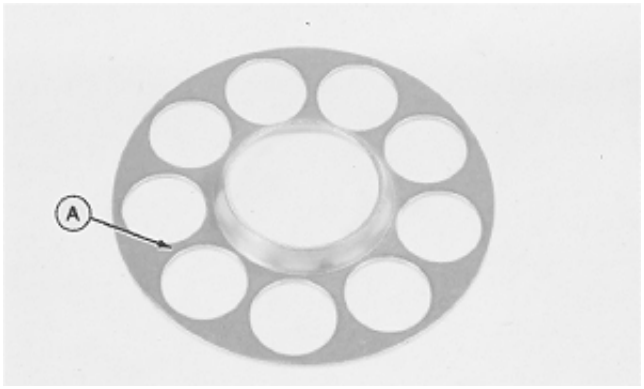


M36112 -UN-29AUG88

MX,5005HV,A25 -19-30NOV92

15. Remove and inspect both piston retainers:

- Check retainer for flatness, nicks, burrs and discoloration.
- Check for scoring, at location (A), where the piston slipper contacts the retainer.
- Replace the entire cylinder block assembly if any part of the piston retainer is damaged.

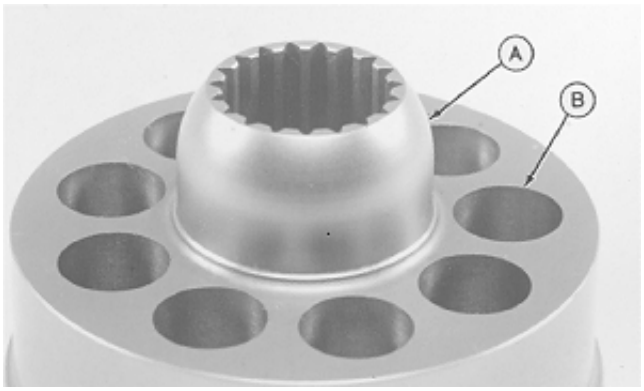


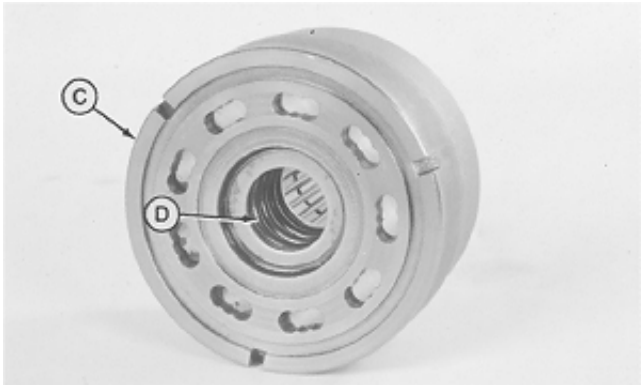
MX,5005HV,A26 -19-30NOV92

16. Inspect both cylinder blocks:

- Check ball guide area (A) for scoring, wear and damage.
- Check nine cylinder bores (B) for burrs and scoring.
- Check lapped surface (C) for wear and damage.
- Check spring assembly (D) for damage and free axle movement.
- Replace the entire cylinder block assembly if any part of the cylinder block is damaged.

A—Ball Guide Area
B—Cylinder Bore
C—Lapped Surface
D—Spring Assembly





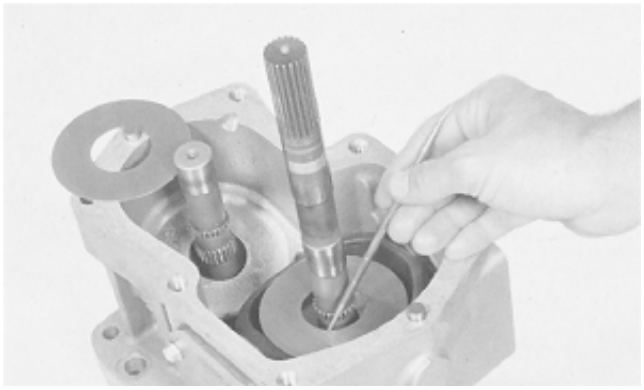
MX,5005HV,A27 -19-30NOV92

IMPORTANT: Do not scratch machined surfaces of thrust plates or swash plates.

17. Remove pump and motor thrust plates using a brass O-ring pick.

18. Inspect thrust plates:

- Check plates for scoring and smeared plated material.
- Replace thrust plates if scoring or smearing is detected.



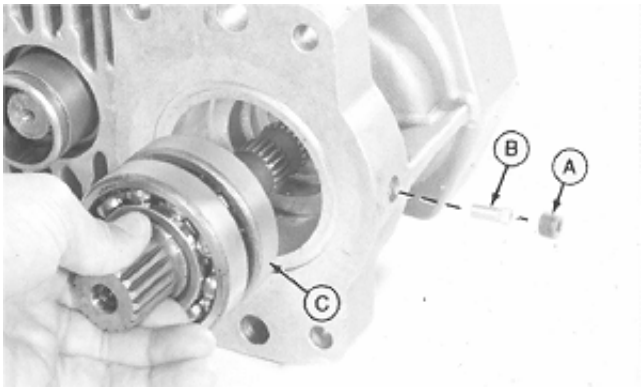
M43821 -UN-31AUG88

MX,5005HV,A28 -19-30NOV92

19. Remove set screw (A).

20. Thread a #8-32 x 1 UNC-2B cap screw into bearing retaining pin (B). Use a slide hammer puller on the head of the cap screw to remove retaining pin (B).

21. Remove motor shaft assembly (C).



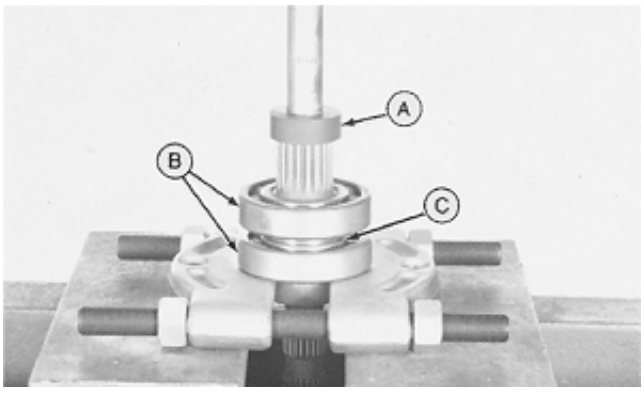
M43822 -UN-29MAY91

MX,5005HV,A29 -19-30NOV92

22. Inspect bearings, replace as necessary.

IMPORTANT: Hold shaft from underneath while removing bearing to prevent it from falling onto the floor and possibly damaging the shaft.

23. Remove bearings (B) and collar (C) using a 1 in. driver disk (A), knife-edge puller, and a press.

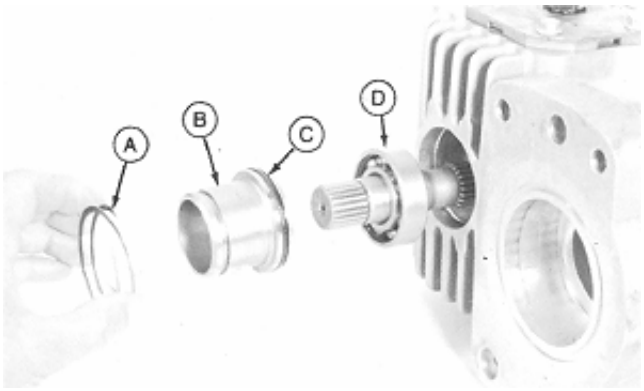


M43823 -UN-31AUG88

MX,5005HV,A30 -19-30NOV92

24. Remove retaining ring (A), seal guide (B), O-ring (C), and pump shaft assembly (D).

A—Retaining Ring
B—Seal Guide
C—O-Ring
D—Pump Shaft Assembly



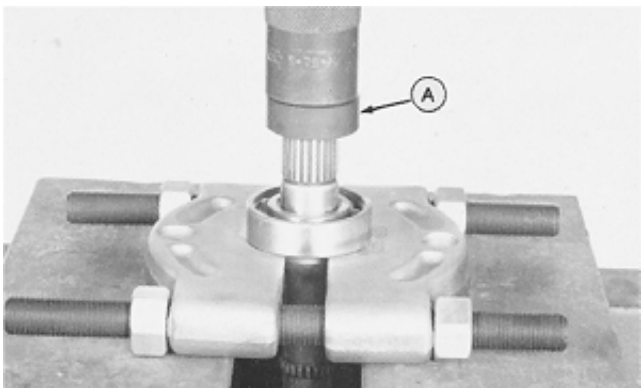
-UN-29MAY91
M43824

MX,5005HV,A31 -19-30NOV92

25. Inspect bearing, replace as necessary.

IMPORTANT: Hold shaft from underneath while removing bearing to prevent it from falling onto the floor and possibly damaging the shaft.

26. Remove bearing using a 1 in. driver disk (A), knife-edge puller, and a press.



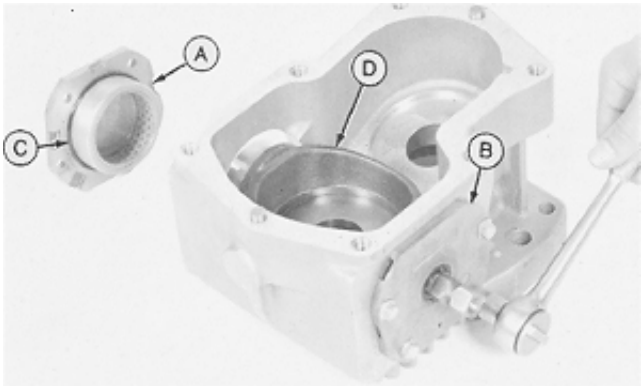
-UN-31AUG88
M43825

MX,5005HV,A32 -19-30NOV92

27. Remove cap screws to remove end caps (A and B):

- Inspect bushings; if bushings are worn or damaged, replace the end cap. Remove O-ring (C).
- Inspect control shaft seal, replace as necessary.

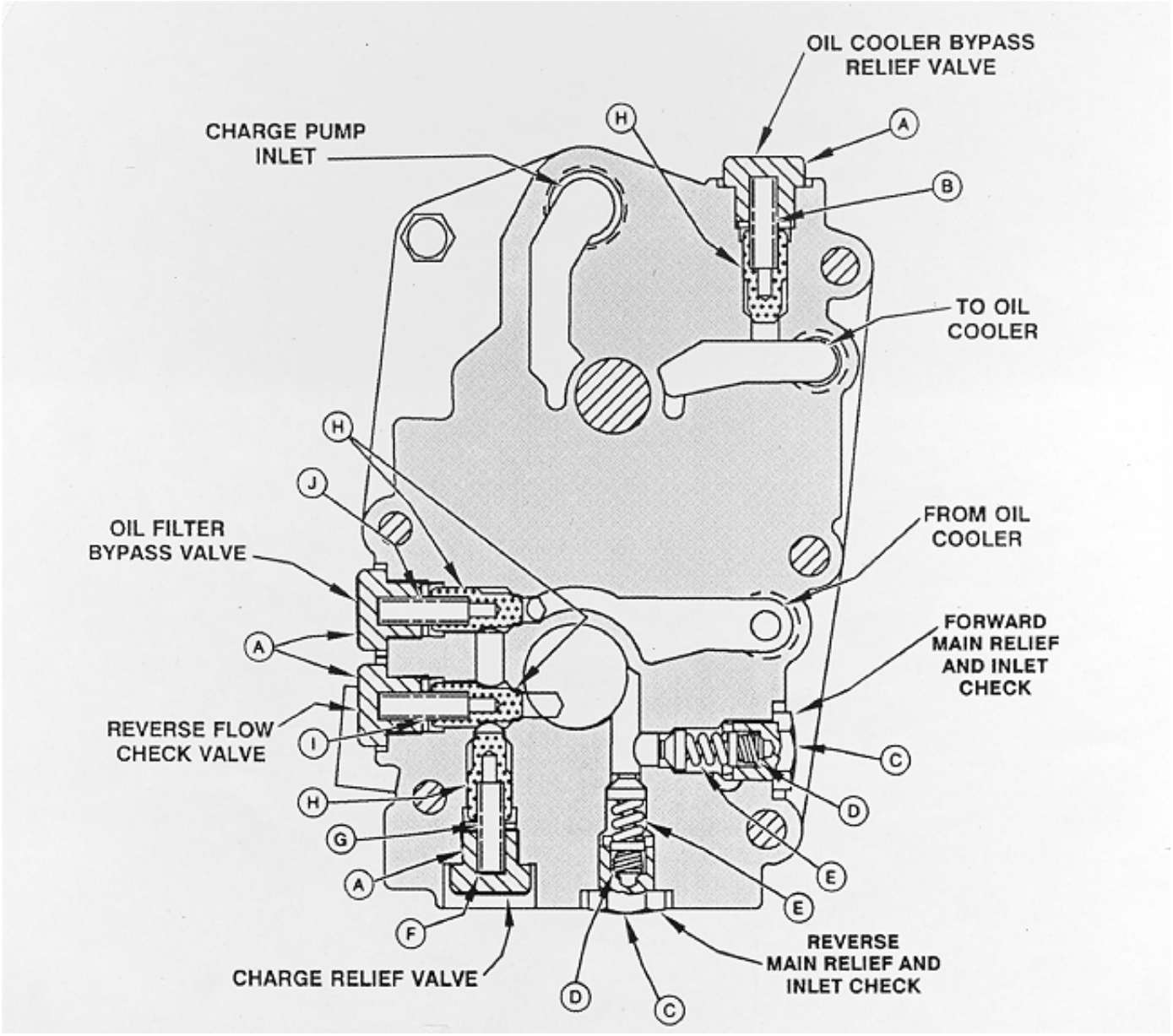
28. Remove swash plate (D).



-UN-31AUG88
M43826

MX,5005HV,A33 -19-30NOV92

REMOVE AND INSTALL CHECKS AND RELIEF VALVES



A—Plug (4 used)
B—Spring
C—Plug (2 used)
D—Spring (2 used)
E—Relief Valve Assembly
F—Shim (as required)
G—Spring
H—Valve (4 used)
I—Spring
J—Spring

IMPORTANT: All springs, shims, and valves must be returned to the same port it was removed from.

Remove charge relief valve; remove plug, shims if equipped, spring, and valve.

Remove the remaining valves as required. Inspect valves and seats for damage. Valves must slide freely in bore.

Apply clean transmission oil on all internal parts when assembling relief valves and check valves. Check for correct operation after assembly and installation.

Adjust relief valves. (See Section 250, Group 10.)

MX,5005HV,A34 -19-30NOV92

ASSEMBLE HYDROSTATIC TRANSMISSION

1. Clean and dry all parts.

2. Use new O-rings, seals, and gaskets when assembling the transmission.

3. Before assembly, apply clean transmission oil on all internal parts.

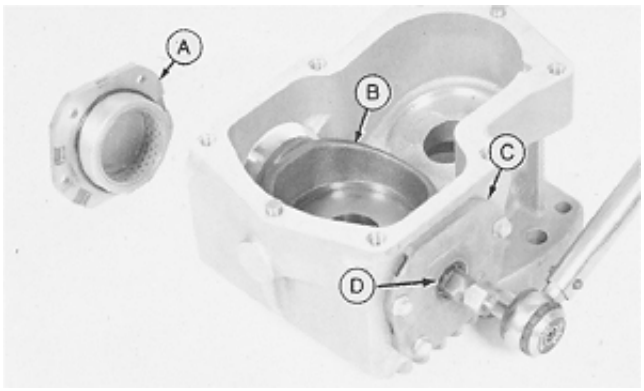
4. Install swashplate (B).

5. Install seal (D) with spring side toward the inside of transmission.

IMPORTANT: Do not damage seal when installing end cap over the control shaft. Replace end cap (A) when plastic wears through into the bronze backing.

6. Carefully install end cap (C) over control shaft. Install cap screws.

7. Install end cap (A) and cap screws. Tighten all cap screws to 8-9 N·m (72-84 lb-in).

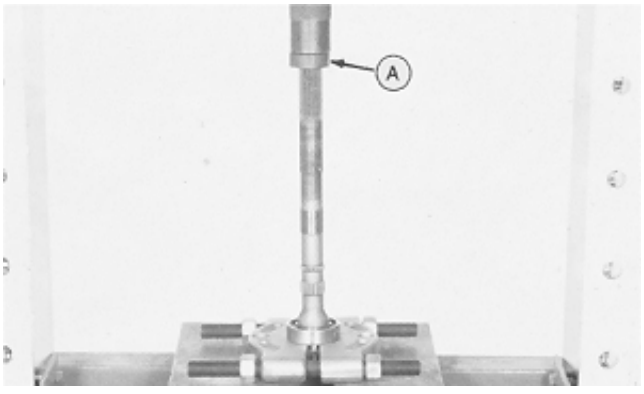


M43827 -UN-31AUG88

A—End Cap
B—Swashplate
C—End Cap
D—Seal

MX,5005HV,A34A -19-30NOV92

8. Use a 1 in. driver disk (A), knife-edge puller, and a press to push pump shaft into bearing until it contacts the shaft shoulder.

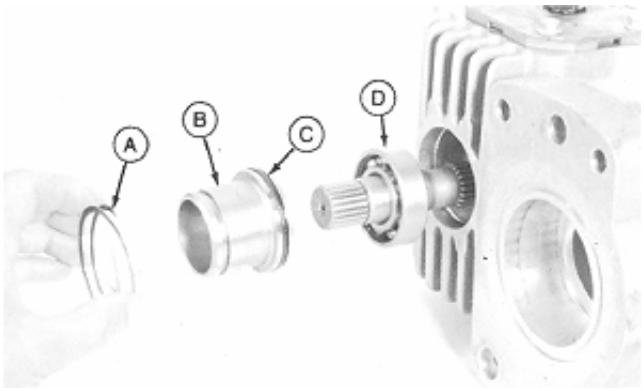


M43828 -UN-31AUG88

MX,HU,5005,43 -19-31OCT91

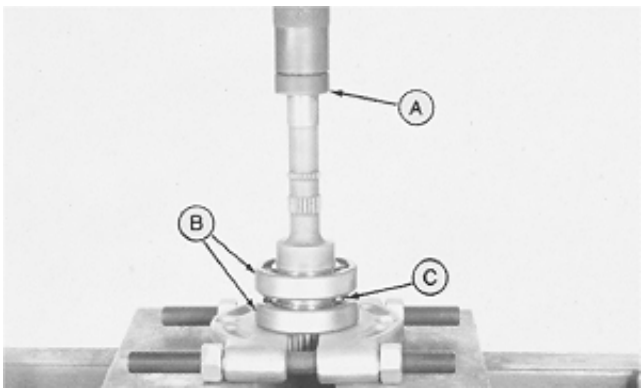
9. Install pump shaft assembly (D), O-ring (C), seal guide (B), and snap ring (A).

A—Snap Ring
B—Seal Guide
C—O-Ring
D—Pump Shaft Assembly



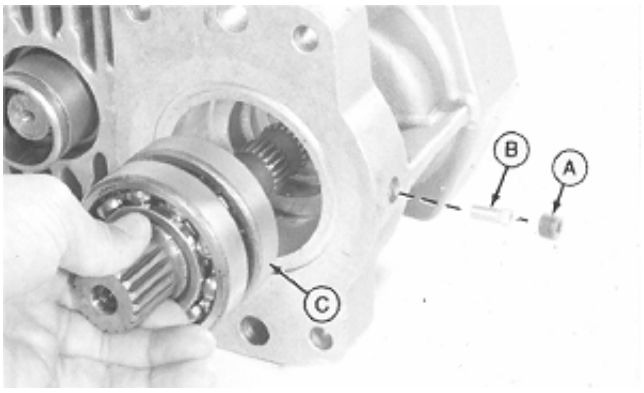
MX,HU,5005,44 -19-31OCT91

10. Install bearings (B) and collar (C) onto the motor shaft using a driver disk (A), knife-edge puller and a press. Install bearings tight against the shaft shoulder.



MX,5005HV,A35 -19-30NOV92

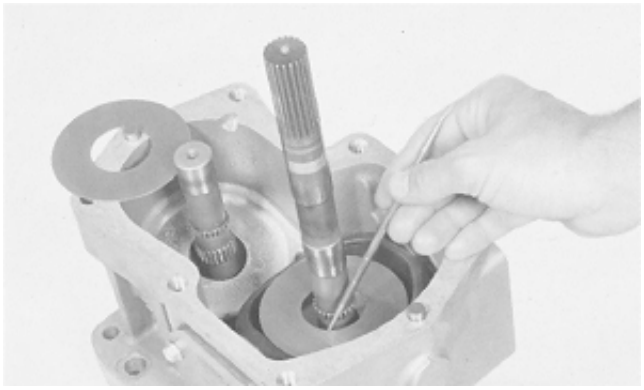
11. Install motor shaft assembly (C), retaining pin (B), and set screw (A). Tighten set screw.



MX,5005HV,A35A -19-30NOV92

IMPORTANT: Do not nick or scratch lapped surface of cylinder blocks. Piston-to-bore relationship need not be maintained.

Do not scratch machined surfaces of thrust plates or swashplates. Initial production transmission cases were machined for 1.02 mm (.040 in) larger motor thrust plates than pump thrust plates. A running change to equal-diameter thrust plates for both the motor and the pump has been made. Do not try to install the new (smaller diameter) motor thrust plates in earlier model transmission cases with the wider motor machined bore.



12. Install pump and motor thrust plates.

MX,HU,5005,47 -19-31OCT91

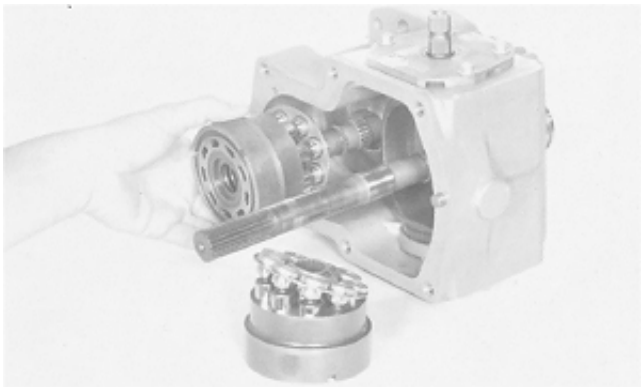
13. Install pistons and piston retainer.

Lift piston retainer and piston from cylinder block. Check for free movement of pistons in cylinder block before installing in housing.



MX,HU,5005,48 -19-31OCT91

14. Install pump and motor cylinder blocks.



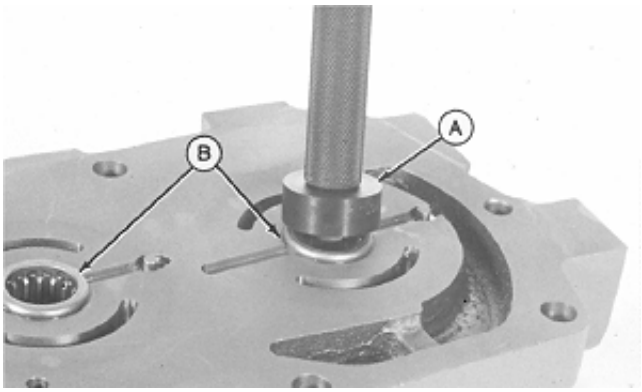
MX,HU,5005,49 -19-31OCT91

IMPORTANT: Do not nick or scratch lapped or machined surfaces of the center section, valve plates or cylinder block.

Keep pump and motor components separate. They are not interchangeable.

15. Use a 1-5/16 in. driver disk (A) to install two needle bearings (B). Drive bearings into center section housing until they are approximately 3 mm (7/64 in.) above the surface of the housing.

16. Assemble center section. (See Remove and Install Checks and Relief Valves in this group.)



-UN-29MAY91
M43830

MX,5005HV,A36 -19-30NOV92

17. Put clean hydrostatic oil on valve plates and machined surface of center section housing.

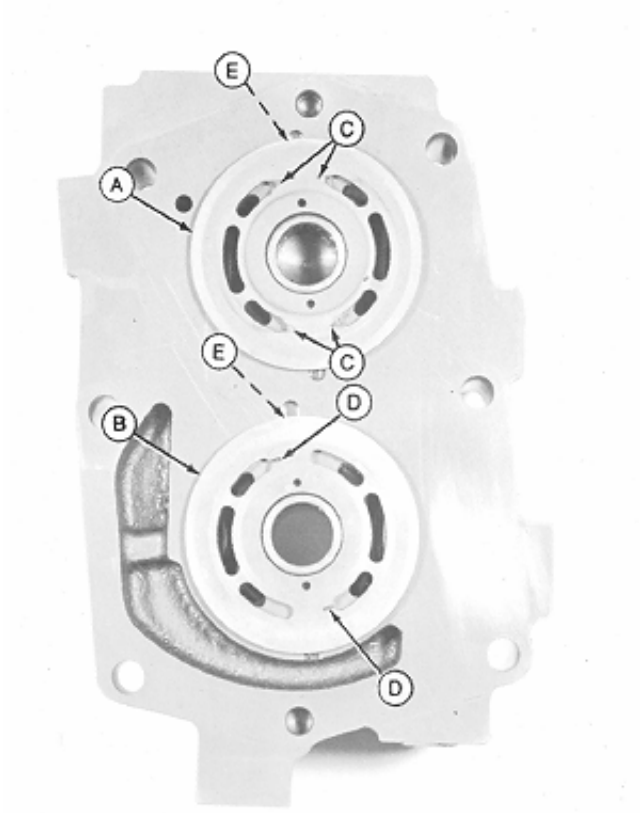
50
05
24

IMPORTANT: PUMP VALVE PLATE has TWO slotted ports (D).

MOTOR VALVE PLATE has FOUR slotted ports (C).

18. Install pump valve plate (B) and motor valve plate (A) over the protruding bearings and align slots on back sides of plates with pins (E) in housing.

A—Motor Valve Plate
B—Pump Valve Plate
C—Slotted Ports (Motor)
D—Slotted Ports (Pump)
E—Center Section Pins



-UN-29MAY91
M43831

MX,5005HV,A36B -19-30NOV92

IMPORTANT: Use extreme care when assembling the center section, valve plates and cylinder block to avoid dropping, nicking, or scratching lapped surfaces.

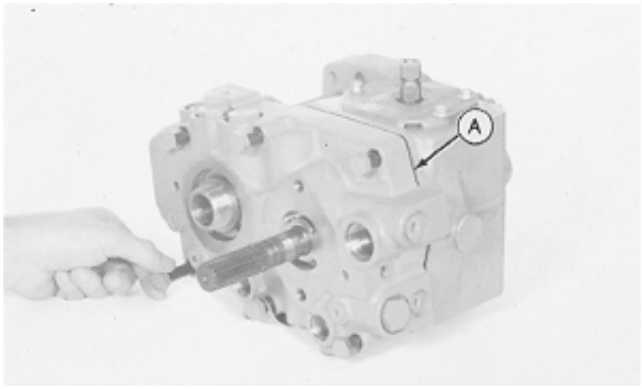
19. Install center section and gasket (A) on housing and install six cap screws. Tighten cap screws evenly in a crossing pattern until they are snug—DO NOT tighten them at this time.

NOTE: Center section will seem springy, this is because the springs inside the cylinder blocks are being compressed.

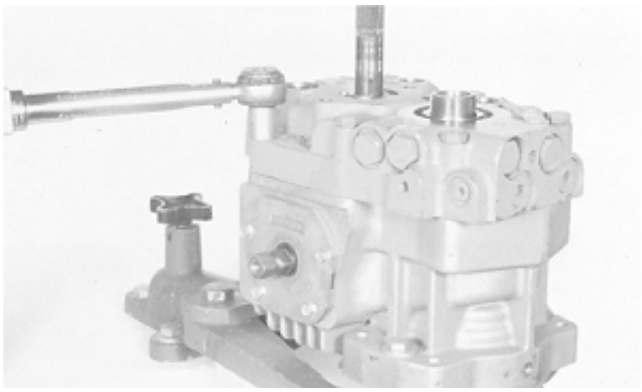
20. Install transmission upright in bench fixture.

IMPORTANT: Check for proper internal assembly by slowly rotating pump, motor and control shaft while tightening cap screws.

21. Tighten cap screws to 44—55 N·m (33—41 lb-ft), also in a crossing pattern.



-UN-31AUG88
M43816



-UN-31AUG88
M43842

MX,5005HV,A36A -19-30NOV92

22. Install new filter (B).

23. Install charge pump (A). (See Remove and Install Charge Pump procedure in this group.)



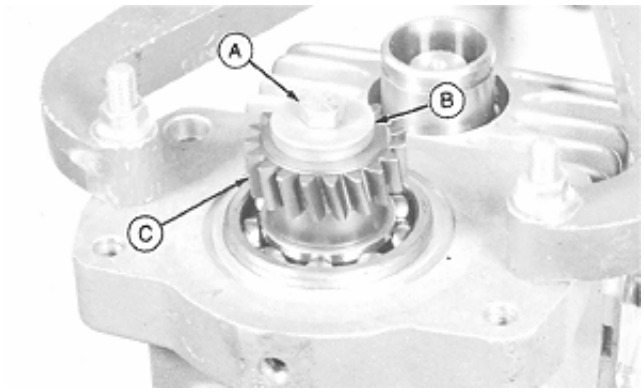
-UN-31AUG88
M43813

MX,5005HV,A37 -19-30NOV92

24. Install output drive gear (C) (19 teeth) on motor output shaft.

25. Install washer (B) and cap screw (A).

26. Tighten cap screw to 54 N·m (40 lb-ft).



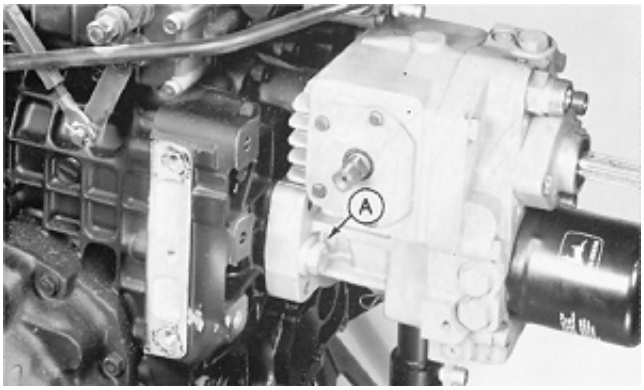
-UN-29MAY91
M43814

MX,5005HV,A38 -19-30NOV92

INSTALL HYDROSTATIC TRANSMISSION

IMPORTANT: Insure splined coupling is installed on top transaxle shaft before installing transmission.

1. Install hydrostatic transmission using two cap screws and washers (A). Tighten to 142 N·m (105 lb-ft).

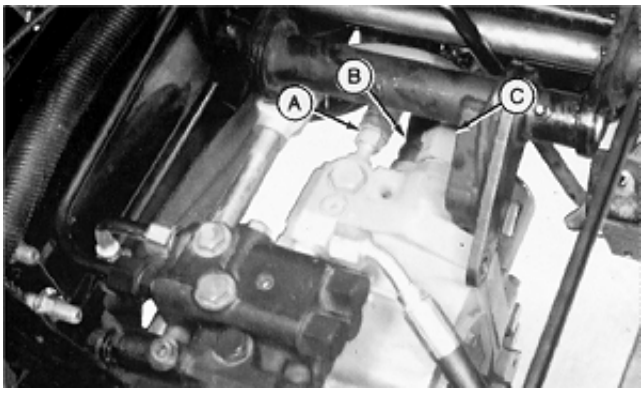


-UN-11DEC89
E30079

2E6,5005G,15 -19-30NOV92

2. Install suction line (C). Connect to transaxle, transaxle pump, and hydrostatic transmission.

3. Connect two hydraulic lines (A and B).

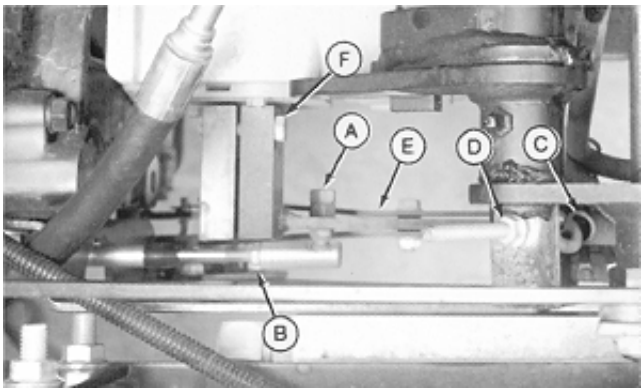


-UN-18OCT90
E35455

EX,3325,5005,10-19-24APR91

4. Install neutral centering assembly and linkage, S.N. —840000:

- Install cam and tighten cap screw (F).
- Install neutral centering support to transaxle case using two cap screws and washers.
- Lift roller assembly (E) into position and connect return spring (C).
- Tighten nut (D) until return spring length is approximately 133 mm (5.2 in.). Tighten lock nut.
- Connect forward/reverse cable (B) using nuts (A).



E35454 -UN-18OCT90

A—Nut (2 used)
B—Forward/Reverse Cable
C—Return Spring
D—Nut (2 used)
E—Cam Roller Assembly
F—Cap Screw

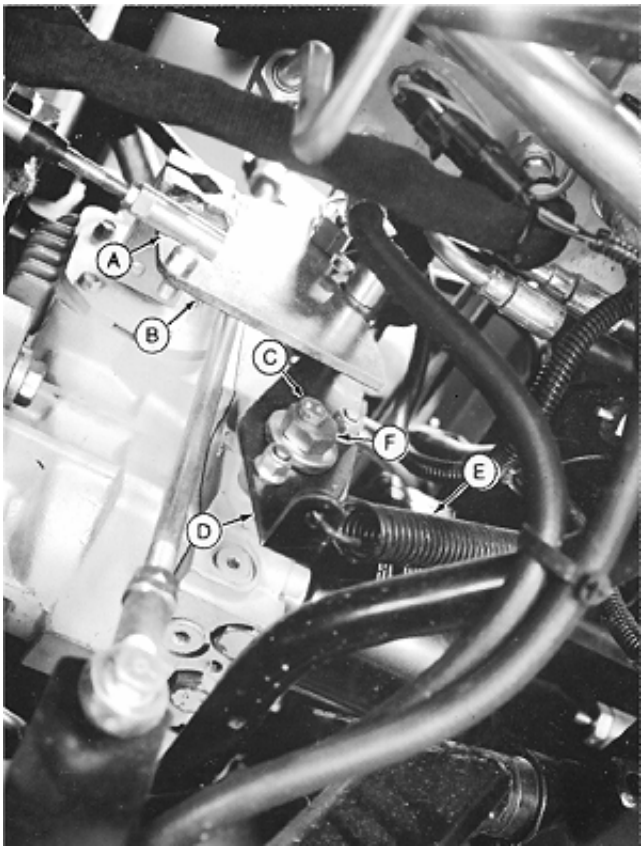
50 05 27

MX,5005HV,A39 -19-30NOV92

5. Install neutral centering assembly and linkage, S.N. 840001— :

- Install neutral centering lever (D) and eccentric (F). Fasten with cap screw (C).
- Install cam (B).
- Install spring (E). Adjust spring length to approximately 203 mm (8.0 in.), hook-to-hook.
- Connect forward/reverse cable (A) to cam.

A—Forward/Reverse Cable
B—Cam
C—Cap Screw
D—Neutral Centering Lever
E—Return Spring
F—Eccentric



M81314 -UN-12NOV92

MX,5005HV,A40 -19-30NOV92

6. Install drive shaft. (See procedure in this group.)

7. Connect center lift arm to transaxle bracket using pin (A) and spring locking pin.



MX,5005HV,A41 -19-30NOV92

8. Lift center lift arm to connect rod using cap screw (A) washer, and nut.

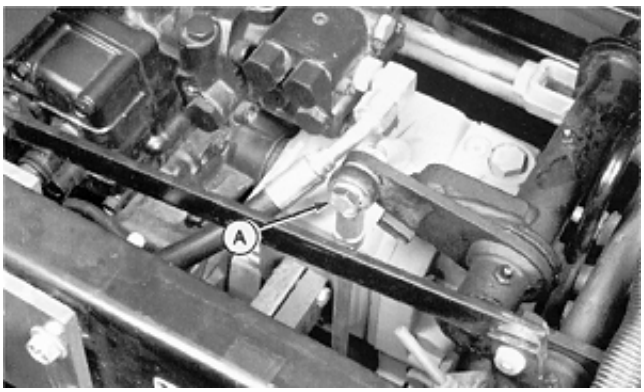
9. Adjust transmission neutral. (See procedure in Section 250, Group 15.)

10. Lower fuel tank and close hood.

11. Install rear center cutting unit. (See Section 80, Group 05.)

12. Fill transaxle with specified hydraulic oil. (See Section 10, Group 20.)

13. Bleed hydraulic/hydrostatic systems. (See procedure in Group 10.)



MX,5005HV,A42 -19-30NOV92

REMOVE AND INSTALL HYDROSTATIC OIL COOLER

1. Drain transaxle oil. (See procedure in Group 10.)

N **CAUTION: Engine hood is heavy. Use lifting equipment during hood removal to prevent personal injury and machine damage.**

2. Remove engine hood.

3. Tag and disconnect hydraulic lines (B and C).

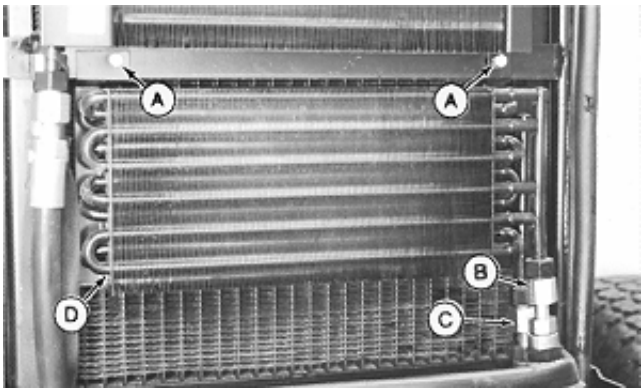
4. Remove cap screws (A) and nuts to remove oil cooler (D).

5. Install oil cooler.

6. Connect hydraulic lines. Tighten fittings to 34 N·m (25 lb-ft).

7. Install hood.

8. Fill transaxle with specified hydraulic oil. (See Section 10, Group 20.)



M81405 -UN-12NOV92

A—Cap Screw (2 used)
B—Oil Cooler-to-Lower Transmission Port Hose
C—Upper Transmission Port-to-Oil Cooler Hose
D—Hydrostatic Oil Cooler

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MX,5005HV,A43 -19-30NOV92

SPECIAL OR ESSENTIAL TOOLS

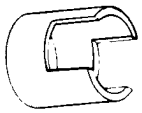
NOTE: Order tools according to information given in the U.S. SERVICE-GARD™ Catalog or in the European Microfiche Tool Catalog (MTC).

DX,TOOLS -19-05JUN91

M81455 -UN-12NOV92

Clutch Piston Compressor JDG561

Remove PTO clutch snap ring and spring.

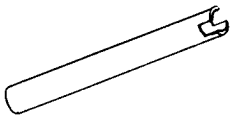


JDG561 -19-30NOV92

M81456 -UN-12NOV92

Snap Ring Compressor JDG562

Remove and install snap ring on differential lock shaft.

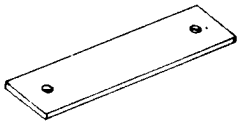


JDG562 -19-30NOV92

M81457 -UN-12NOV92

Magnetic Base Gauge Holder JDG563

Use as a mounting surface for magnetic base of dial indicator holder.



JDG563 -19-30NOV92

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SERVICE EQUIPMENT AND TOOLS

NOTE: Order tools from the U.S. SERVICEGARD™ Catalog or from the European Microfiche Tool Catalog (MTC). Some tools may be available from a local supplier.

Name	Use
Bushing, Bearing and Seal Driver Set	To service bearings and seal.
Press	To service bearings.
Knife-Edge Puller	To remove bearings.
Magnet Extraction Tool	To remove inside portion of PTO valve.
6 mm Cap Screw	To remove rear portion of PTO valve.
8 mm Cap Screws	To remove differential carrier.
Floor Jack Stands	To support transaxle.
Overhead Hoist	To lift and move mower frame away from transaxle.

MX,5010HV,A1 -19-30NOV92

OTHER MATERIAL

Number	Name	Use
TY6305	John Deere LOCTITE® Clean and Cure Primer	Clean threads.
T43512	John Deere LOCTITE® Thread Lock and Sealer (Medium Strength)	Retain differential cap screws.
		Retain front weight transfer cylinder shoulder cap screws
TY9375	John Deere LOCTITE® Pipe Sealant with TEFLON®	Apply to threads of hydrostatic temperature switch.

LOCTITE is a trademark of the Loctite Corp.

TEFLON is a trademark of the DuPont Corp.

MX,5010HV,A2 -19-30NOV92

SPECIFICATIONS

Item	Measurement	Specification
PTO Clutch		
Separator Plate-to-Cylinder	Maximum distance	4.7 mm (0.185 in.)
Top Plate	Minimum thickness	2.9 mm (0.114 in.)
Clutch Disk	Minimum thickness	1.9 mm (0.075 in.)
Separator Plate	Minimum thickness	1.0 mm (0.039 in.)
Piston Return Spring	Minimum free length	29 mm (1.14 in.)
	Minimum working load	17.5 mm at 540 N (0.689 in. at 121 lb)
Differential Shaft		
Bearing Retainer Cap Screws	Torque	26 N·m (19 lb-ft)
Rear Cover Assembly		
M12 Cap Screws	Torque	90 N·m (66 lb-ft)
M10 Cap Screws	Torque	50 N·m (37 lb-ft)
M8 Cap Screws	Torque	26 N·m (19 lb-ft)
Differential Ring Gear	Backlash	0.15—0.21 mm (0.006—0.008 in.)
Differential Carrier-to-Case Cap Screws	Torque	26 N·m (19 lb-ft)
Front Cover Cap Screws		
M12 Cap Screws	Torque	90 N·m (66 lb-ft)
M10 Cap Screws	Torque	50 N·m (37 lb-ft)
PTO Valve Cover Cap Screws	Torque	26 N·m (19 lb-ft)
Support-to-Transaxle Cap Screws	Torque	80 N·m (59 lb-ft)
ROPS-to-Frame Cap Screws and Nuts	Torque	130 N·m (96 lb-ft)
Frame-to-Transaxle Cap Screws	Torque	175 N·m (129 lb-ft)
Cross Brace-to-Frame Cap Screws and Nuts (3365)	Torque	175 N·m (129 lb-ft)

Continued on next page

Item	Measurement	Specification
Front Wheel Lug Bolts	Torque	115 N·m (85 lb-ft)
Oil Cooler-to-Transmission Hose Connections	Torque	49 N·m (36 lb-ft)
Wing Lift-to-Flow Control Valve Hose Connection	Torque	49 N·m (36 lb-ft)
Steering Valve-to-Flow Control Valve Hose Connection	Torque	49 N·m (36 lb-ft)
Steering Valve-to-PTO Valve Hose Connection	Torque	49 N·m (36 lb-ft)
Hydraulic Pump-to-Transaxle Cap Screws	Torque	54 N·m (40 lb-ft)
Cutting Unit Supply Line-to-Hydraulic Pump Connections	Torque	102 N·m (75 lb-ft)
Suction Tube-to-Hydraulic Pump Flange Cap Screws	Torque	37 N·m (27 lb-ft)
Lift Link-to-Rockshaft Arm Cap Screws and Nuts	Torque	163 N·m (120 lb-ft)

MX,5010HV,A3 -19-30NOV92

DRAIN TRANSAXLE OIL

1. Park mower on a level surface.

2. Run engine a few minutes to warm oil.

3. Stop engine.

NOTE: Approximate capacity of transaxle is 18.9 L (5 gal).

4. Remove drain plug (A) to drain oil.



E34130 -UN-22MAY90

MX,5010HV,A4 -19-30NOV92

REMOVE TRANSAXLE

1. Remove all five cutting units. (See Section 80, Group 05.) Put front two reel motors on steps and attach using rope or wire.

2. Raise all lift arms.

3. Drain oil from transaxle. (See procedure in this group.)

4. Drain oil from hydraulic reservoir by removing plug from bottom of suction fitting.

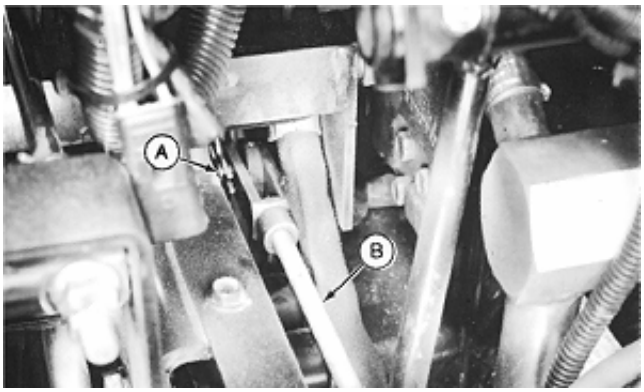
5. Remove seat platform (A). (See Section 80, Group 10.)



M81429 -UN-12NOV92

MX,5010HV,A5 -19-30NOV92

6. Remove pin (A) to disconnect brake linkage rod (B) on each side of transaxle.

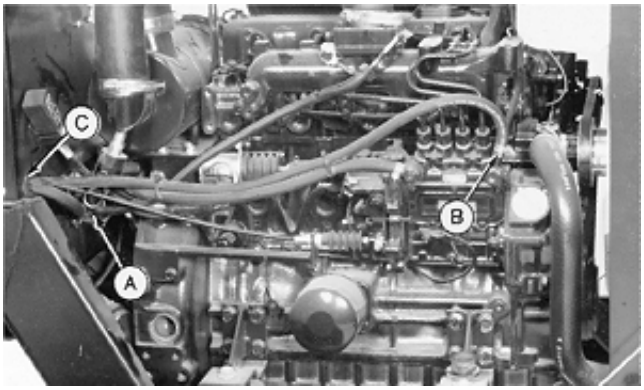


MX,5010HV,A6 -19-30NOV92

IMPORTANT: Fuel may siphon from lines. Close all fuel lines and ports after disconnecting.

7. Disconnect fuel supply line (A) from fuel pump and fuel return line (B) from injector pump.

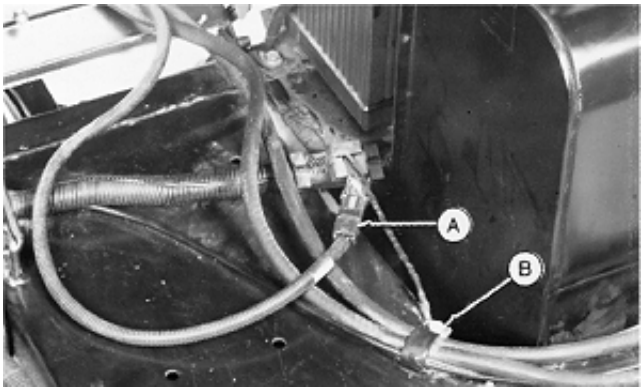
Cut two tie straps from fuel return line. Pull hoses through grommet (C).



MX,5010HV,A7 -19-30NOV92

8. Disconnect wiring connector (A).

9. Loosen cap screw (B). Pull fuel lines through strap.

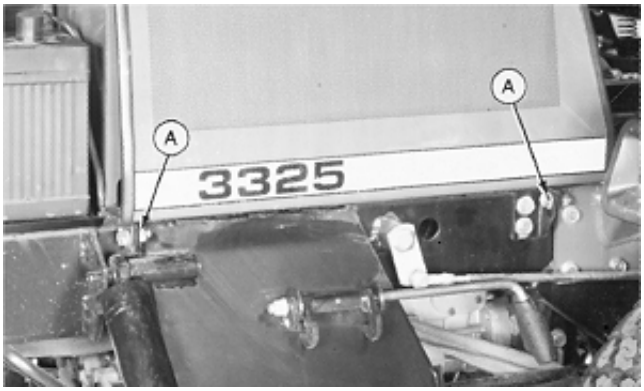


MX,5010HV,A8 -19-30NOV92

NOTE: Two persons are required to remove fuel tank.

10. Lower fuel tank. Remove two cap screws (A). Remove fuel tank.

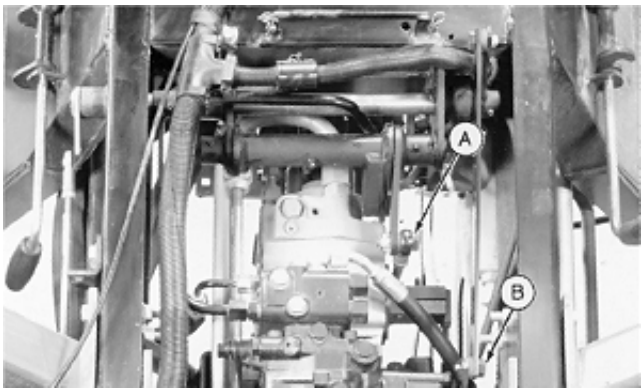
11. Remove drive shaft. (See Section 50, Group 05.)



MX,5010HV,A9 -19-30NOV92

12. Support center lift arm. Remove cap screw (A), nut and washer.

13. Remove shoulder bolt (B) and rubber washer.



MX,5010HV,A10 -19-30NOV92

NOTE: Step 14 is only required if the unit is equipped with weight transfer.

14. Remove upper pin (A), cap screw and nut (B) on center lift arm. Position center cutting unit weight transfer cylinder to the left side of the machine. Be careful not to damage hoses.

MX,5010HV,A11 -19-30NOV92

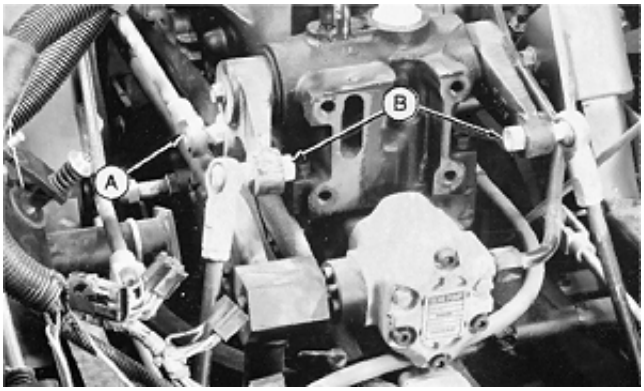
15. Remove pin (A) to remove center lift arm.



MX,5010HV,A12 -19-30NOV92

16. Remove cotter pin to remove pin (A).

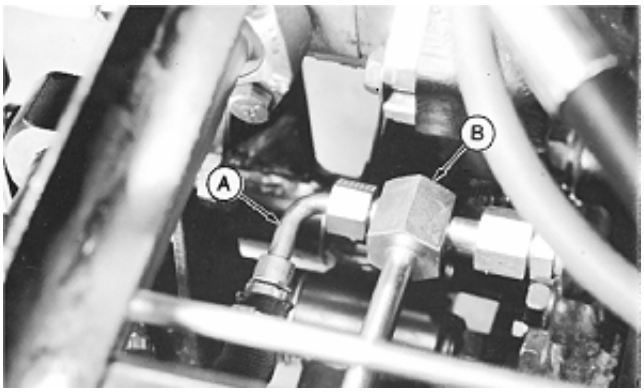
17. Support each front lift arm. Remove cap screws, nuts (B), and washers to disconnect lift links from rockshaft arms.



MX,5010HV,A13 -19-30NOV92

18. If equipped, disconnect weight transfer cylinder hose (A) from front, left side of transaxle.

19. Remove steel return line (B).



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M81427

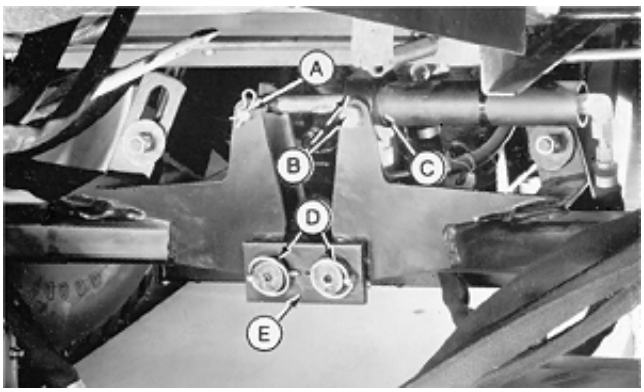
MX,5010HV,A14 -19-30NOV92

NOTE: Steps 20 and 21 are required only if the weight transfer option is installed on the unit.

20. Remove spring locking pin (A), pin and spacer.

21. Remove two shoulder cap screws (B). Remove weight transfer cylinder (C) and locate to left side of machine.

22. Remove two quick lock pins (D) and plate (E). Pull both front lift arms forward to remove from machine.



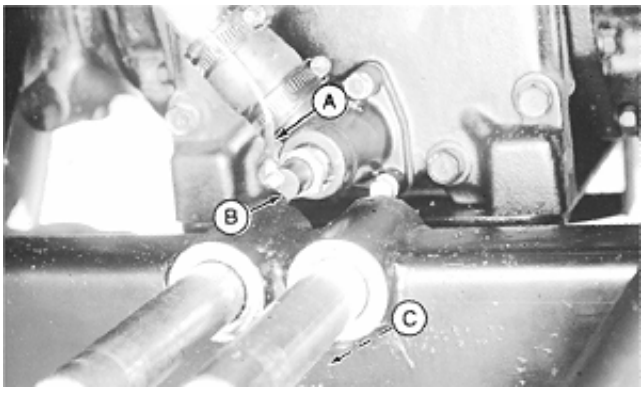
-UN-18OCT90
E35445

A—Spring Locking Pin
B—Shoulder Cap Screw
C—Weight Transfer Cylinder
D—Quick Lock Pin
E—Plate

MX,5010HV,A15 -19-30NOV92

23. Disconnect wire (A). Remove hydrostatic temperature switch (B).

24. Remove nut and clamp (C) that fastens reel hoses to bottom of transaxle. Move hoses and lift arms to front and right side of transaxle.



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M81428

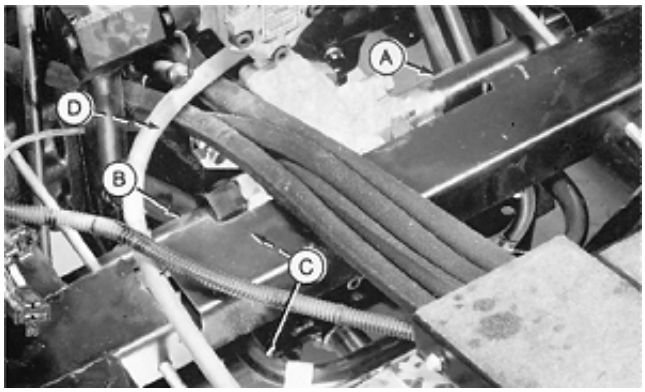
MX,5010HV,A16 -19-30NOV92

25. Disconnect suction line (A) and supply line (B) from lower hydraulic pump.

26. Remove supply line (C).

27. Disconnect PTO switch (D).

A—Hydraulic Pump Suction Line
B—Cutting Units Control Valve Supply Line
C—Wing Cutting Units Control Valve Supply Line
D—PTO Switch



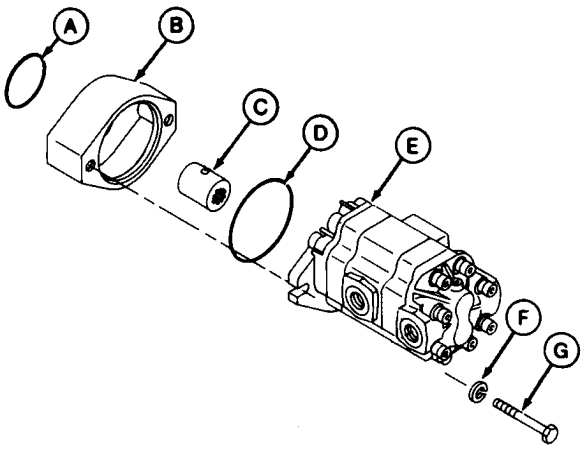
-UN-18OCT90
E34139

MX,5010HV,A17 -19-30NOV92

28. Remove cap screws (G) and washers (F). Pull pump (E) forward and down to remove pump.

29. Remove pump coupling (C), spacer (B), and O-rings (A and D).

A—O-Ring
B—Spacer
C—Splined Coupling
D—O-Ring
E—Hydraulic Pump
F—Washer (2 used)
G—Cap Screw (2 used)



-UN-22JAN91
E35466

MX,5010HV,A18 -19-30NOV92

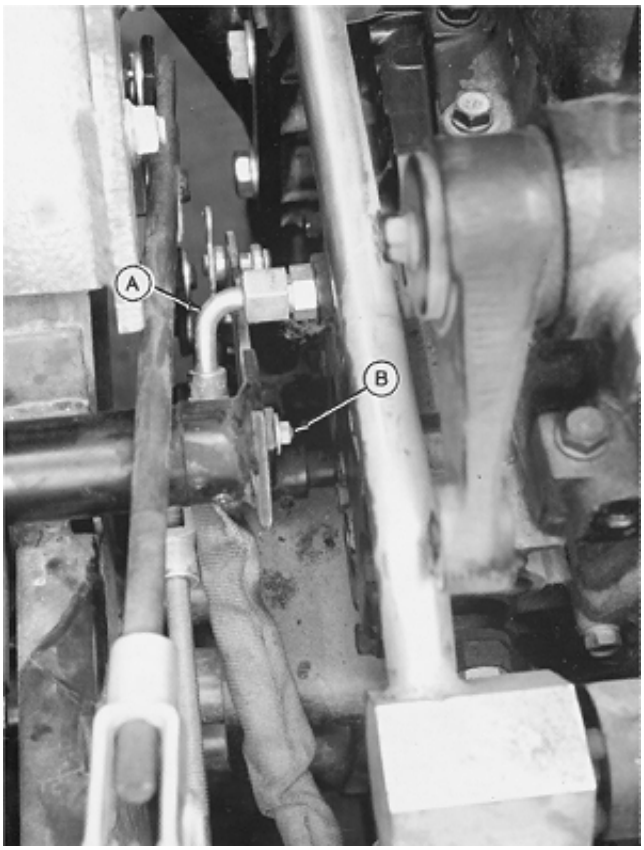
30. Tag and disconnect hydraulic hose (A).

31. Remove shoulder cap screw, nut and washer(s) (B) to disconnect PTO valve lever.

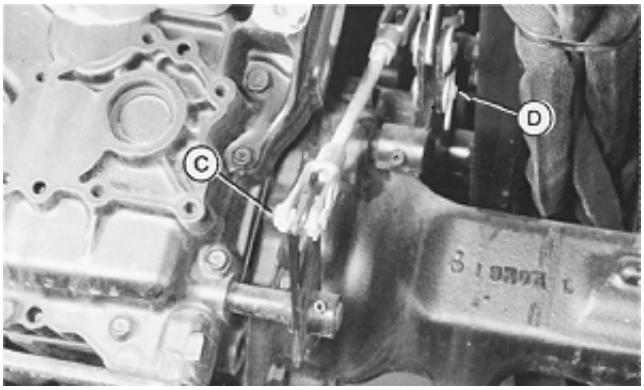
32. Remove spring locking pin and pin (D) to disconnect differential lock linkage.

33. For S.N. —840000 only: Remove spring locking pin and pin (C) to disconnect PTO lever lock linkage.

A—Steering Valve (Port T)-to-PTO Valve
B—Cap Screw, Nut, and Washers
C—PTO Linkage Pin
D—Differential Lock Linkage Pin



E35699 -UN-09JAN91



E35446 -UN-09JAN91

MX,5010HV,A19 -19-30NOV92

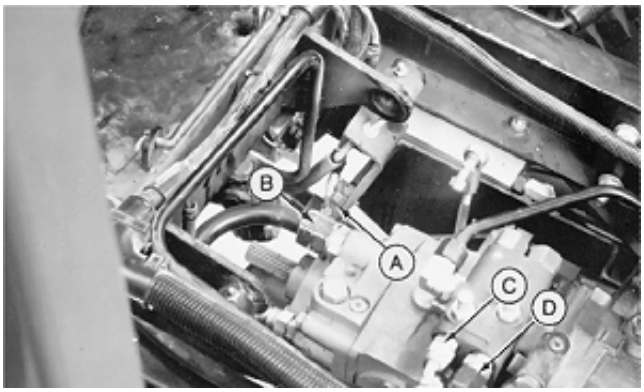
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NOTE: Hydrostatic suction line (B) should not be disconnected.

34. Tag and disconnect power steering line (C) and wing lift line (D) from the flow control valve.

35. For S.N. —840000, tag and disconnect neutral start switch (A) wire leads or remove switches.

A—Neutral Start Switch
B—Hydrostatic Suction Line
C—Steering Valve (Port P)-to-Flow Control Valve Hose
D—Wing Lift Control Valve-to-Flow Control Valve Hose



E30064 -UN-11DEC89

MX,5010HV,A20 -19-30NOV92

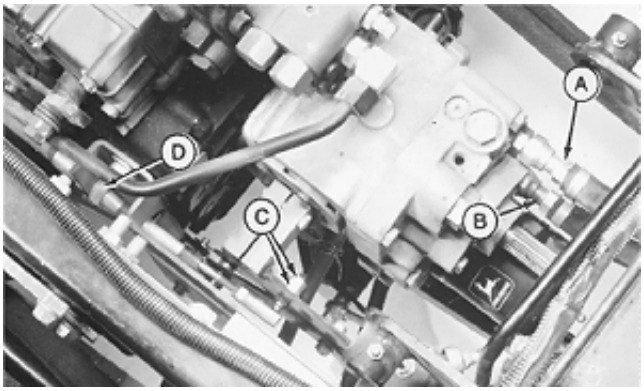
36. Tag and disconnect oil cooler hoses (A and B) from transmission.

37. Disconnect forward/reverse cable from neutral return cam.

38. For S.N. 840001— , remove neutral return cam from transmission. Locate cam with neutral start switches attached, off to one side.

39. Loosen nuts (D) to disconnect forward/reverse cable from mounting bracket.

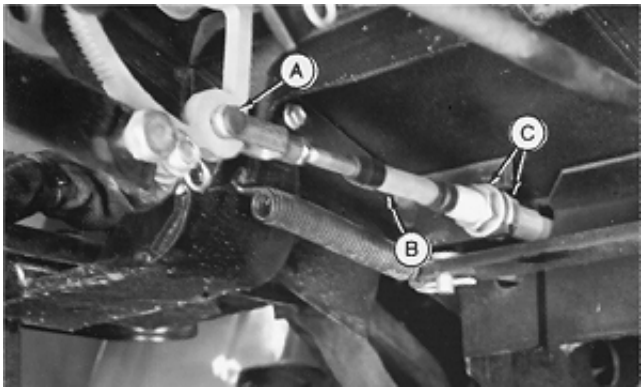
A—Transmission-to-Oil Cooler Hose
B—Oil Cooler-to-Transmission Hose
C—Nut
Serial No. —840000 (2 used)
Serial No. 840001— (1 used)
D—Nut (2 used)



E34141 -UN-28JAN91

MX,5010HV,A21 -19-30NOV92

40. Remove pin (A). Loosen nuts (C) and pull travel cable forward through frame until cable is away from transaxle.



E35698 -UN-09JAN91

MX,5010HV,A22 -19-30NOV92

CAUTION: The approximate weight of machine is 1633 kg (3600 lb).

41. Attach chain or lifting strap around front of main frame wing on each side. Make sure chain or strap lengths are even for proper lifting balance.

42. Install a wood block between frame and rear axle on both sides of mower. Block rear wheels and remove slack from chain.

43. Close hood. Raise front of mower off ground.

44. Install jack stands under each axle housing and under transmission to support transaxle. Lower mower onto the jack stands.

45. Remove front wheels.



-UN-21SEP88
E30075



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E35710

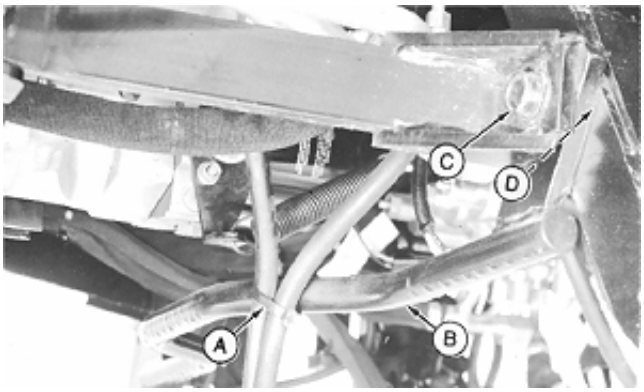
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MX,5010HV,A23 -19-30NOV92

46. For 3365 units:

- Remove tie strap (A), if mower is equipped with weight transfer option.
- Remove two cap screws (C) and nuts (D) to remove cross brace (B).

A—Tie Strap
B—Cross Brace
C—Cap Screw (2 used)
D—Nut (2 used)



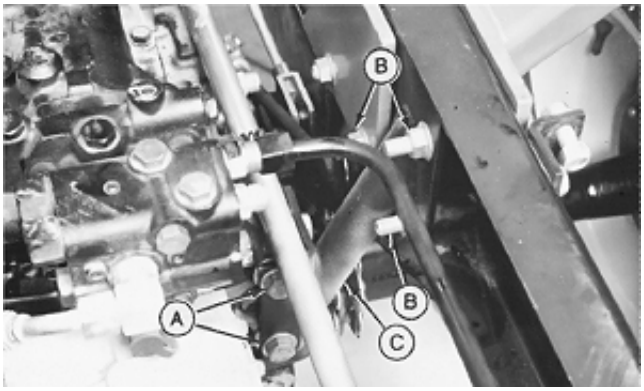
-UN-12NOV92
M81423

MX,5010HV,A24 -19-30NOV92

47. Remove four cap screws and washers (A) from transaxle.

IMPORTANT: If necessary, loosen remaining cap screw and nut fastening right side of ROPS to the mower frame to remove support. DO NOT remove remaining cap screw and nut.

48. Remove three cap screws and nuts (B) to remove rear transaxle support (C).



-UN-09JAN91
E35701

MX,5010HV,A25 -19-30NOV92

49. For 3325 units, remove three cap screws (A) from each side of mower.

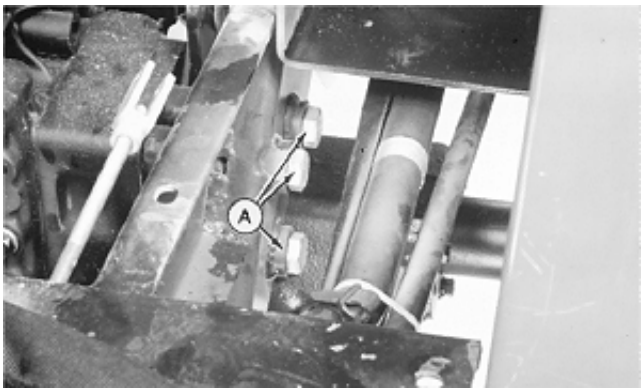
For 3365 units, remove cap screws, washers and nuts (B—F) from each side of mower.

IMPORTANT: Check for clearance over pump at front of transaxle.

50. Slowly raise frame. Check for proper clearance all around transaxle as frame is raised.

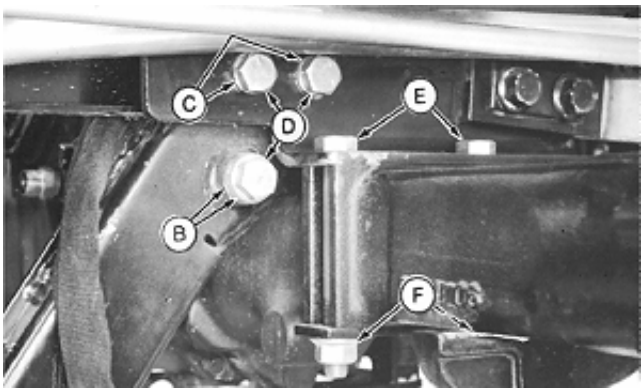
Once mower frame clears top of transaxle, remove chocks from rear wheels and roll mower frame clear of transaxle. Lower frame onto jack stands.

A—Cap Screw (3 used)
B—Thick Washer (2 used)
C—Lock Washer (2 used)
D—Cap Screw (3 used)
E—Cap Screw (2 used)
F—Nut (2 used)



E30073 -UN-21SEP88

Model 3325

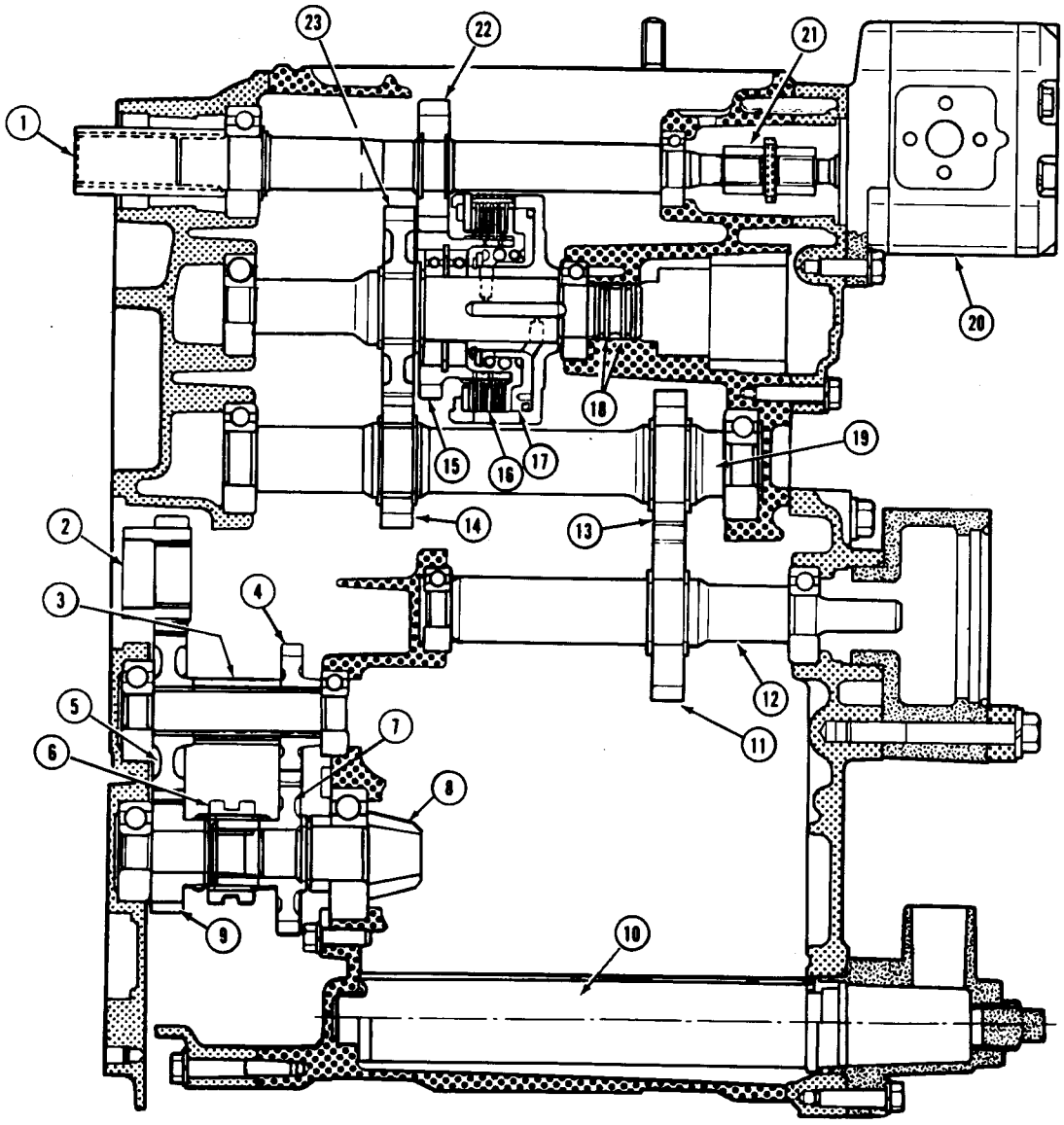


M81424 -UN-12NOV92

Model 3365

MX,5010HV,A26 -19-30NOV92

CROSS SECTION OF TRANSAXLE



M81301 -UN-12NOV92

1—Transaxle Main Shaft
2—Transaxle Input Drive Gear
3—High/Low Reduction/Speed Shaft
4—Low Range Reduction Gear
5—High Range Reduction Gear
6—High/Low Shift Collar
7—Low Range Input Gear
8—Differential Drive Shaft with Pinion Gear
9—High Range Input Gear
10—Transaxle Suction Screen
11—PTO Output Gear
12—PTO Drive Shaft
13—PTO Transfer Gear
14—PTO Reduction Gear
15—PTO Clutch Drive Gear
16—PTO Clutch Pack (Disk and Plates)
17—PTO Clutch Piston
18—Clutch Shaft Sealing Rings
19—PTO Reduction Shaft
20—Transaxle Pump
21—Transaxle Pump Coupler
22—PTO Main Input Shaft Drive Gear
23—Clutch Shaft PTO Drive Gear

MX,5010HV,A26E -19-30NOV92

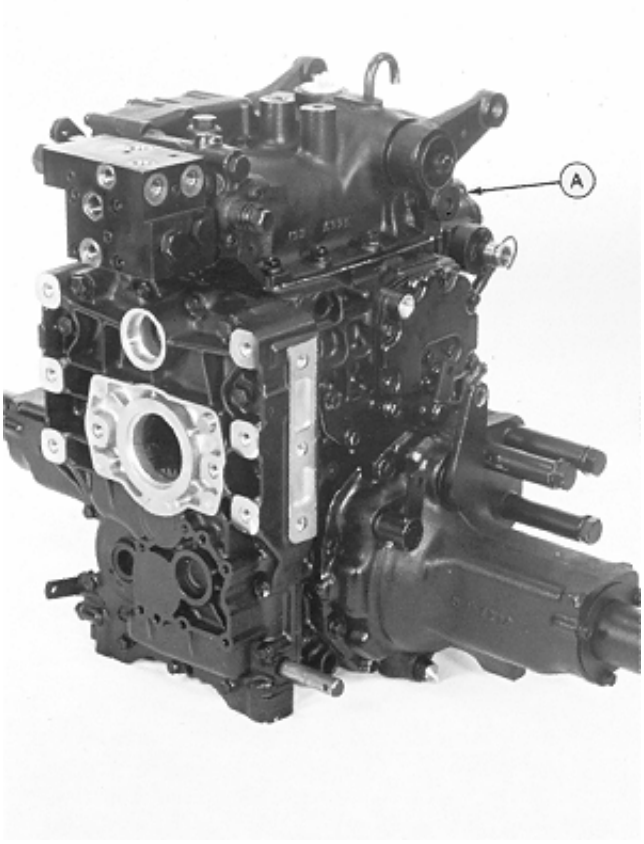
DISASSEMBLE TRANSAXLE

1. Remove hydrostatic transmission. (Refer to Section 50, Group 05.)

2. Remove transaxle pump. (See Section 70, Group 05.)

3. Remove rockshaft assembly (A). (See Section 70, Group 25.)

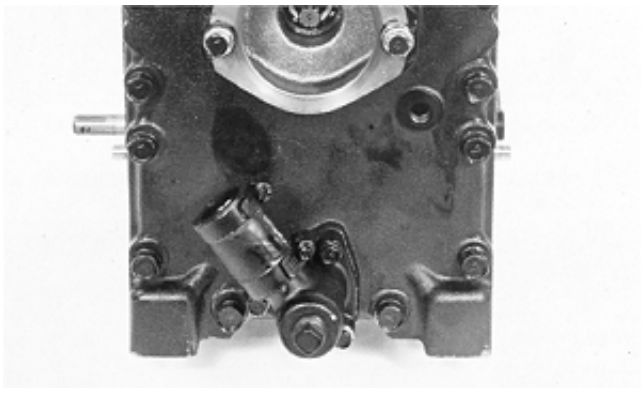
4. Remove final drives. (Refer to procedure in Group 15.)



E30143 -UN-11DEC89

2E6,5010G,31,1 -19-30NOV92

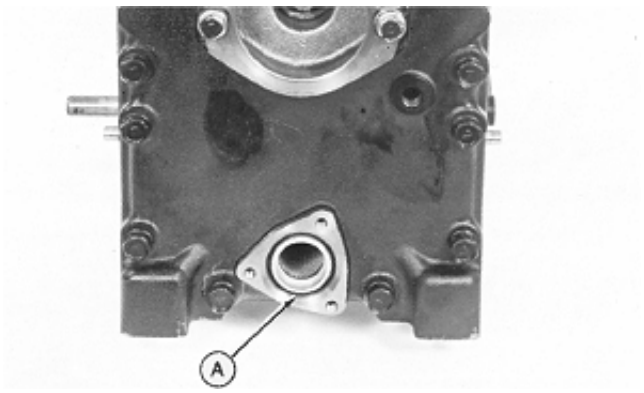
5. Remove filter screen housing.



E30145 -UN-11DEC89

2E6,5010G,31,2 -19-24APR91

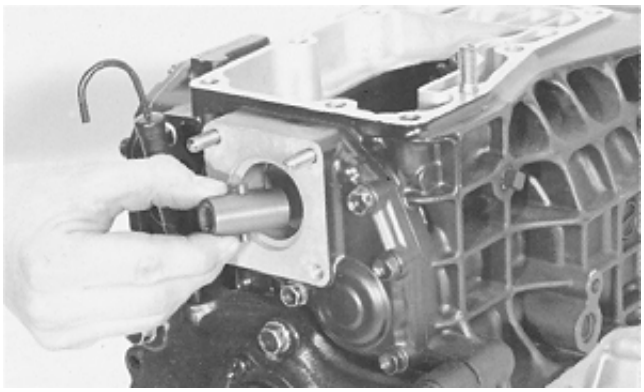
6. Pull out suction strainer and O-ring (A).



E30146 -UN-11DEC89

2E6,5010G,31,3 -19-24APR91

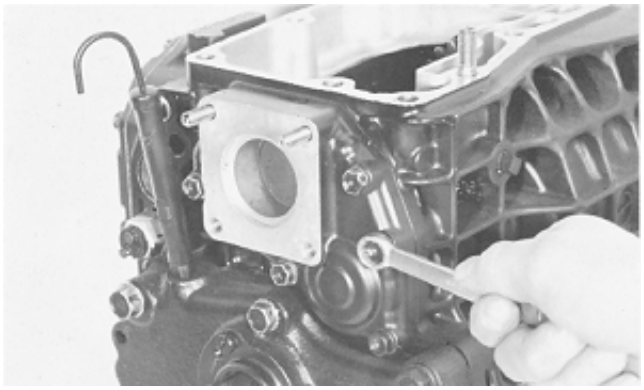
7. Remove transaxle pump drive coupling.



-UN-08SEP88
M37721

2E6,5010G,31,5 -19-24APR91

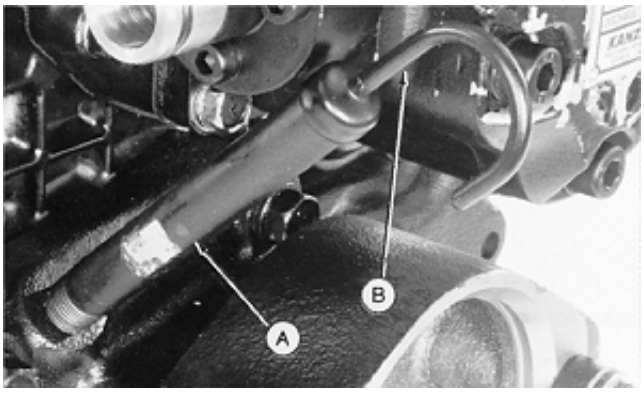
8. Remove the five cap screws to remove cover.



-UN-08SEP88
M37722

2E6,5010G,31,6 -19-24APR91

9. If necessary, remove oil level gauge (B) and pipe (A).

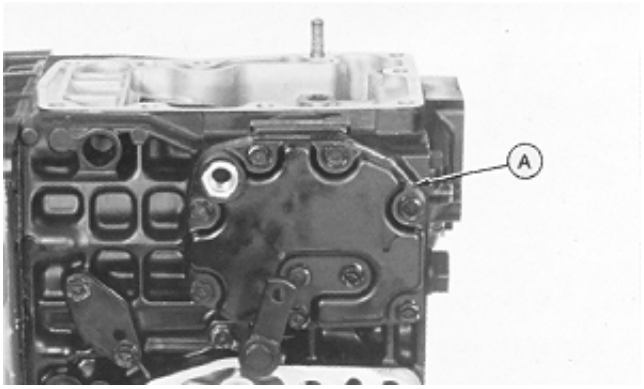


-UN-11DEC89
E30173

EX,3325,5010,2 -19-24APR91

REMOVE AND INSPECT PTO VALVES

1. Remove nine cap screws to remove side cover (A) and gasket.

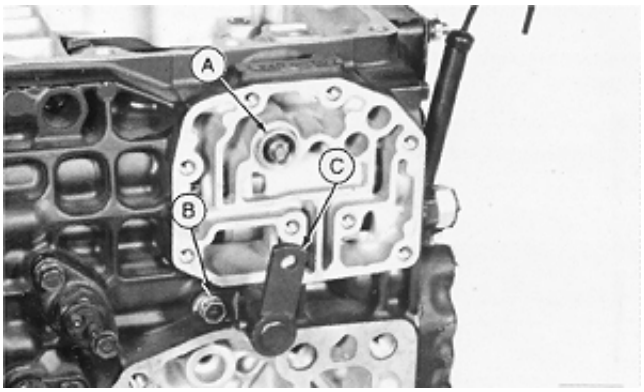


-UN-11DEC89
E30148

2E6,5010G,31,6A-19-30NOV92

2. Remove lube relief valve assembly (A).

3. Remove cap screw, washer, and retaining plate (B). Slide shift arm (C) shaft into the housing.



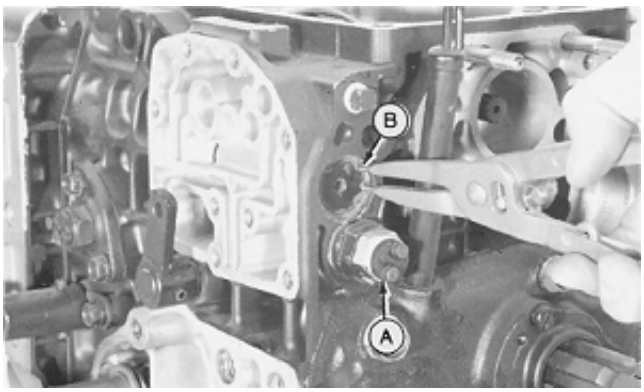
-UN-08JUN90
E34077

M21,5010W,36 -19-24APR91

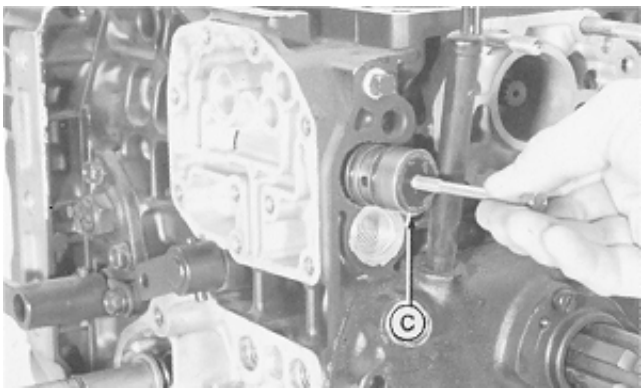
4. Remove PTO switch and holder (A). Pull out control valve spool assembly.

5. Remove snap ring (B).

6. Remove stop (C) of PTO clutch delay relief valve using a 6 mm screw. Pull out remaining parts of valve using a magnet.



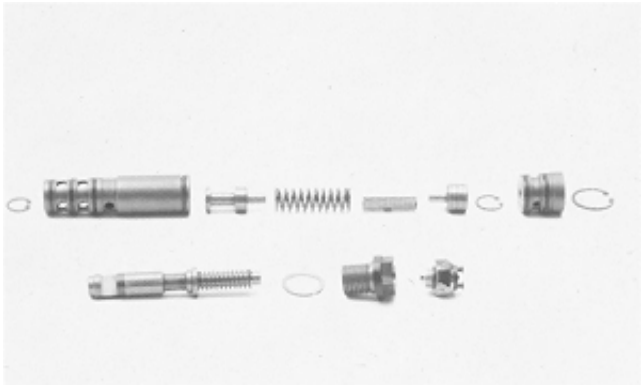
-UN-29AUG88
M37728



-UN-29AUG88
M37729

2E6,5010W,37 -19-24APR91

7. Disassemble upper and lower valve assemblies as necessary. Inspect and replace parts as required.



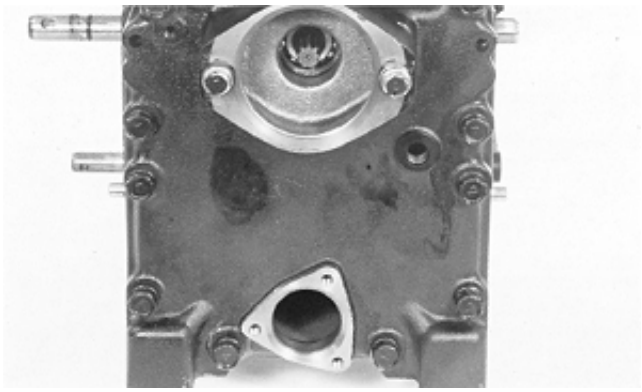
-UN-29AUG88
M37730

M21,5010W,38 -19-24APR91

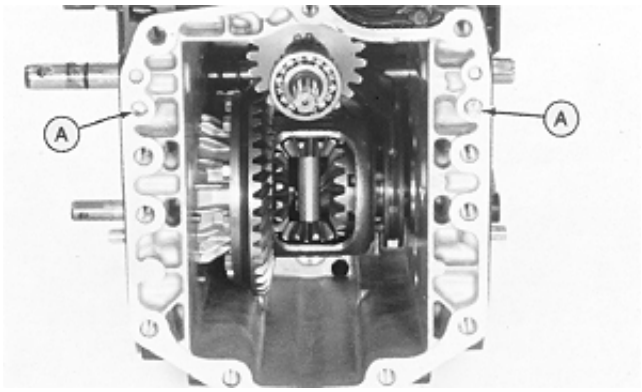
REMOVE FRONT COVER AND PTO DRIVE SHAFT

1. Remove front case cover and two pins (A).

2. Remove front PTO shaft assembly. Inspect and repair shaft as required.



E30149 -UN-11DEC89

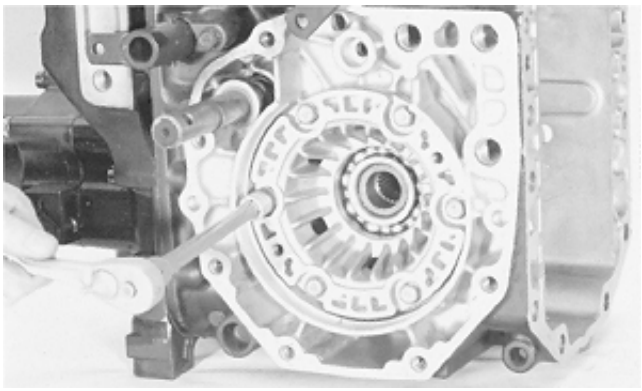


E30150 -UN-11DEC89

MX,5010HV,A26D -19-30NOV92

REMOVE AND INSPECT DIFFERENTIAL ASSEMBLY

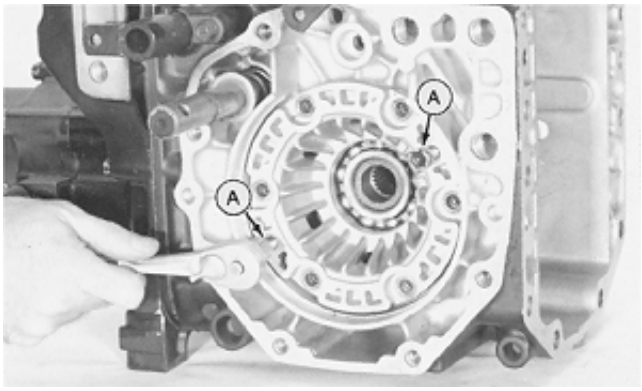
1. Remove six cap screws from differential carrier on right side.



M37735 -UN-29AUG88

2E6,5010G,31,7B-19-30NOV92

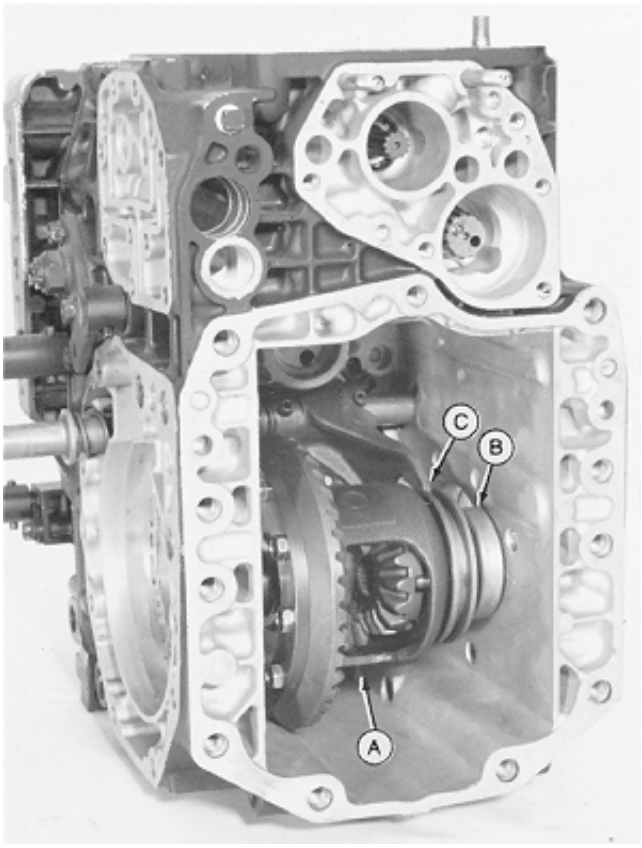
2. Remove differential carrier from transaxle case using two 8 mm screws (A) to jack carrier from case.



M37736 -UN-29AUG88

EX,3325,5010,3 -19-24APR91

3. Slide differential assembly to the side so bearing (B) and differential lock shift fork (C) clear. Remove differential assembly (A).



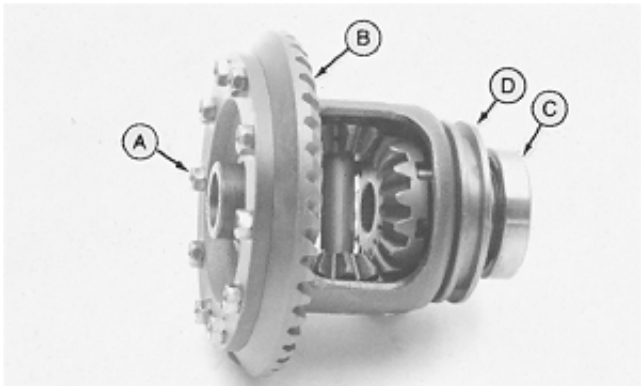
M37737 -UN-29AUG88

M21,5010W,44 -19-24APR91

4. Remove ten cap screws (A) to remove ring gear (B).

5. Remove bearing (C) using a knife edge bearing puller. Remove shift collar (D).

A—Cap Screws
B—Ring Gear
C—Bearing
D—Differential Lock Shift Collar



M37738 -UN-29AUG88

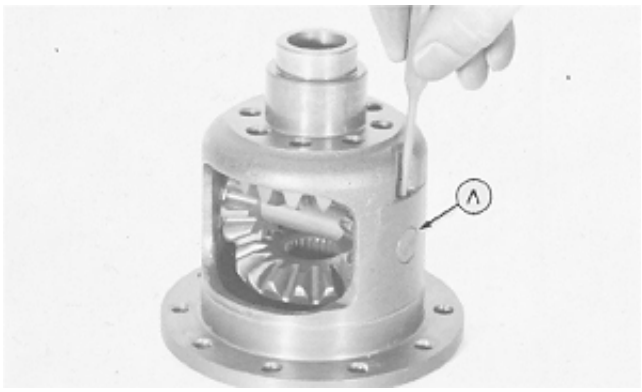
M21,5010W,45 -19-24APR91

6. Drive spring pin through cross shaft (A). Disassemble pinion gears and washers.

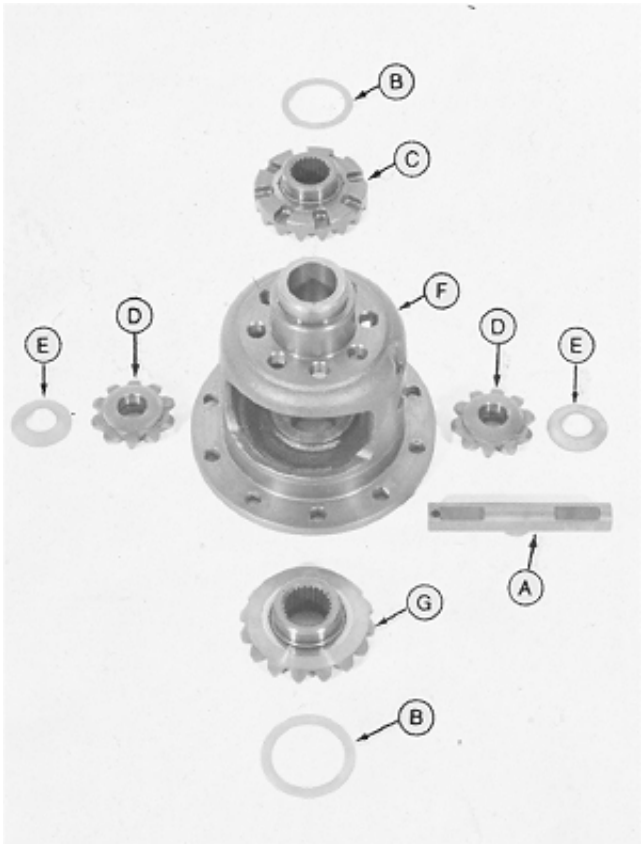
7. Inspect pinion gears for wear or damage.

8. Assemble pinions (C) and (G) using flat thrust washers (B).

A—Pinion Shaft
B—Flat Thrust washer
C—Lock Pinion
D—Pinion
E—Bevel Thrust Washer
F—Differential Carrier
G—Pinion



M37739 -UN-29AUG88



M37740 -UN-29AUG88

M21,5010W,46 -19-24APR91

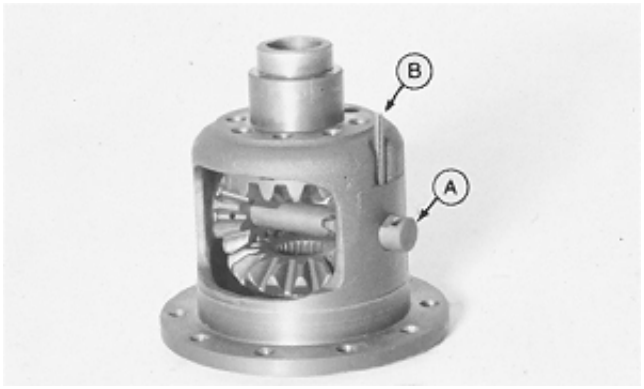
9. Install pinions (A) and bevel thrust washers (B).



M37741 -UN-29MAY91

M21,5010W,47A -19-30NOV92

10. Install pinion cross shaft (A). Drive spring pin (B) into hole in cross shaft.

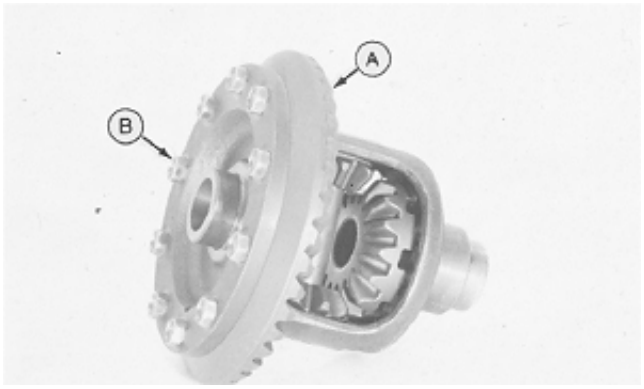


M21,5010W,48 -19-25MAY90

11. Clean threads of cap screws and threaded ring gear with clean and cure primer.

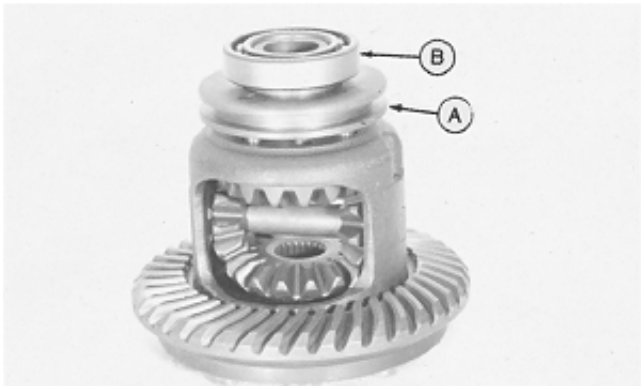
12. Apply medium strength thread lock and sealer to the cap screw threads.

13. Install the ten cap screws. Tighten to 26 N·m (19 lb-ft).



M21,5010W,49 -19-25MAY90

14. Install shift collar (A) and bearing (B).

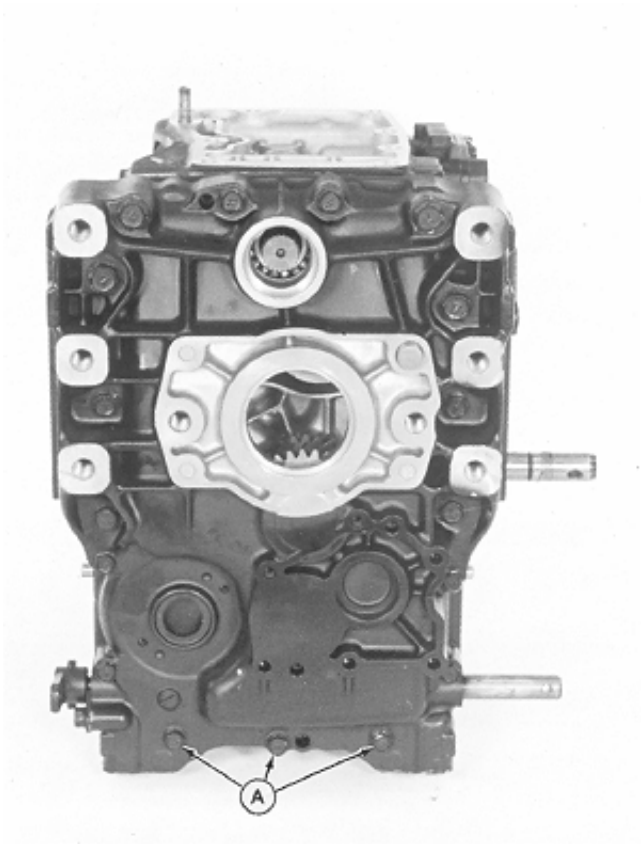


M21,5010W,50 -19-24APR91

REMOVE REAR COVER, PTO CLUTCH ASSEMBLY AND SHAFTS

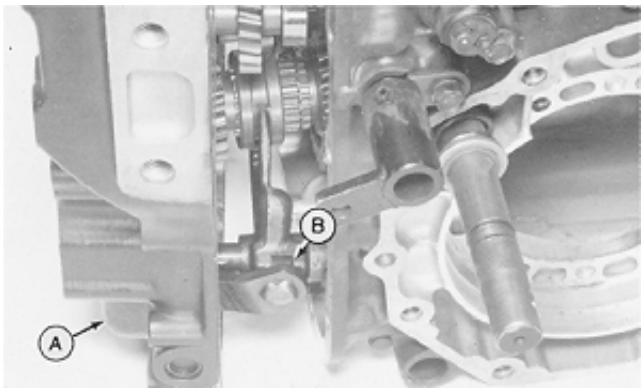
NOTE: Three different size cap screws are used.

1. Remove 17 cap screws (A) from rear transaxle case cover.



MX,5010HV,A26C -19-30NOV92

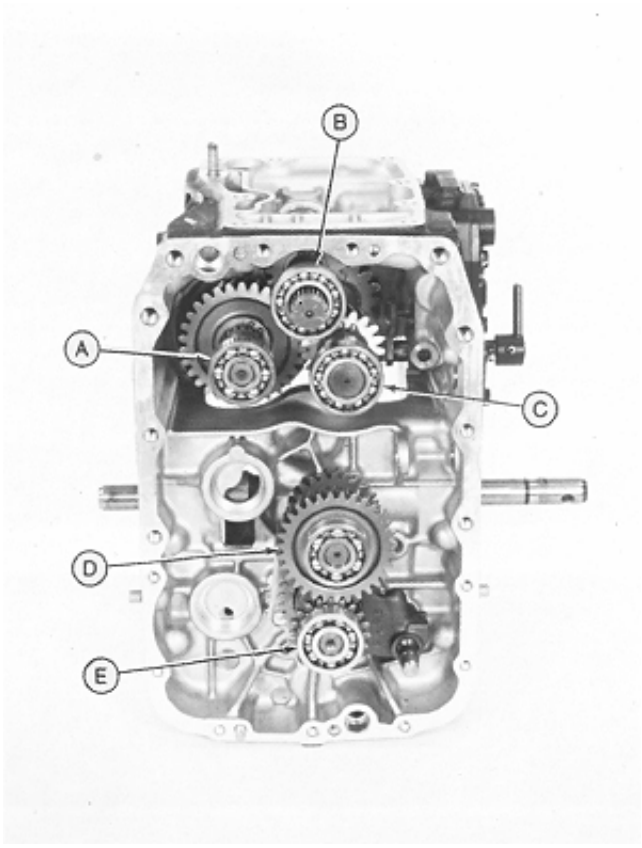
2. Remove rear cover (A). Rotate shaft fork (B) to clear the shift shaft. Allow the shaft fork to remain with the transaxle assembly.



2E6,5010G,31,7D-19-24APR91

3. Identify gear and shaft assemblies before doing any disassembly. All shafts are shown with the rear case bearings attached. The bearings may remain with the case cover as cover is removed.

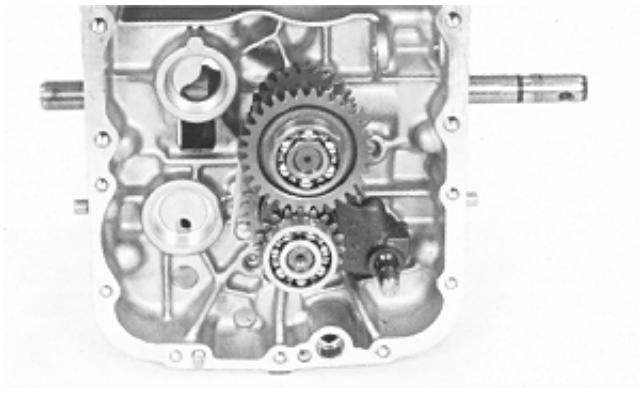
A—PTO Clutch Shaft
B—PTO Main Shaft
C—PTO Reduction Shaft
D—Reduction Shaft
E—Differential Drive Shaft



E30152 -UN-11DEC89

EX,1427TM,CG560-19-24APR91

4. Remove the reduction shaft, gears, and front and rear bearings.

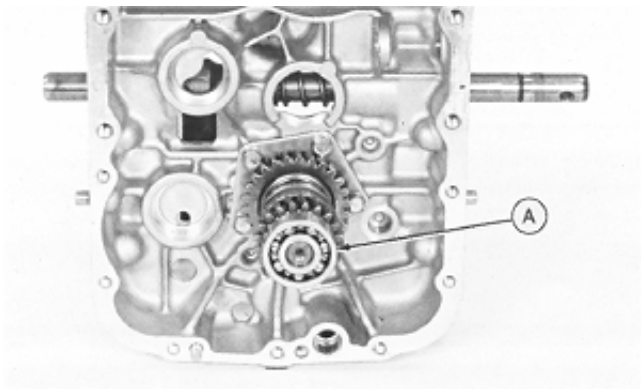


E30153 -UN-11DEC89

EX,3325TM,CG558-19-24APR91

5. Pull bearing (A) from shaft using a knife-edge puller.

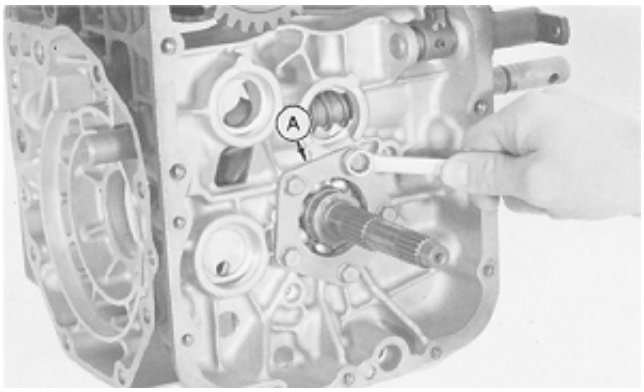
6. Disassemble differential drive shaft. Remove all gears, washers, and snap rings. Keep the parts in order as they are removed.



E30174 -UN-11DEC89

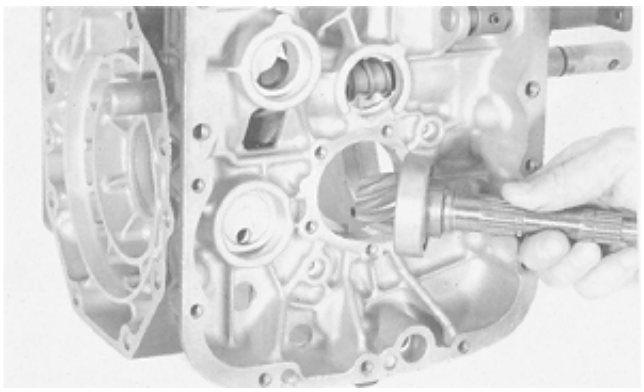
EX,3325TM,CG556-19-24APR91

7. Remove five cap screws and retaining bracket (A).



EX,3325TM,CG554-19-25MAY90

8. Remove differential drive shaft with bearing.

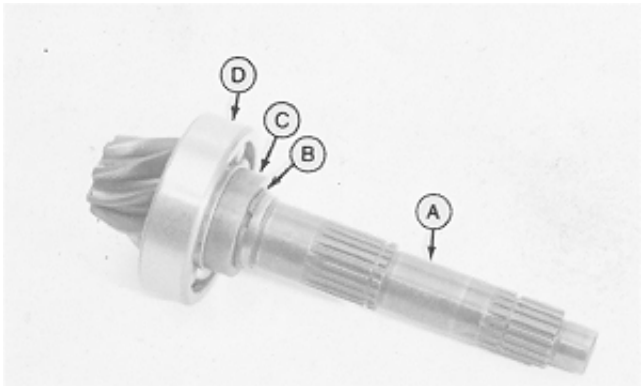


EX,3325TM,CG552-19-25MAY90

9. Inspect drive shaft (A) and bearing (D). Disassemble shaft if required.

10. Remove snap ring (B) and collar (C). Press bearing off shaft.

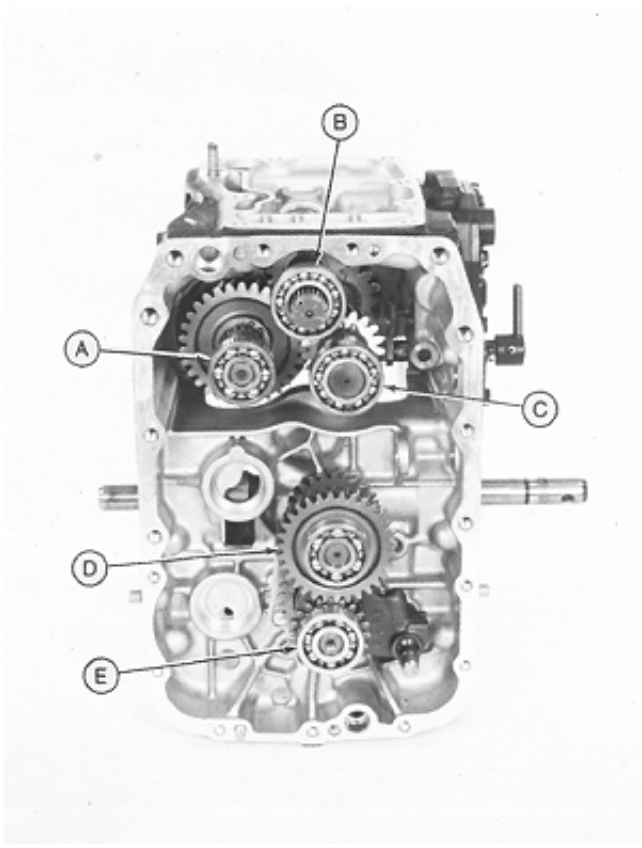
A—Drive Shaft
B—Snap Ring
C—Collar
D—Bearing



EX,3325TM,CG550-19-25MAY90

11. Remove PTO clutch shaft (A), PTO main shaft (B) and PTO reduction shaft (C) all at the same time.

A—PTO Clutch Shaft
B—PTO Main Shaft
C—PTO Reduction Shaft
D—Reduction Shaft
E—Differential Drive Shaft



E30152 -UN-11DEC89

EX,3325TM,CG551-19-30MAR93

REPAIR PTO REDUCTION SHAFT

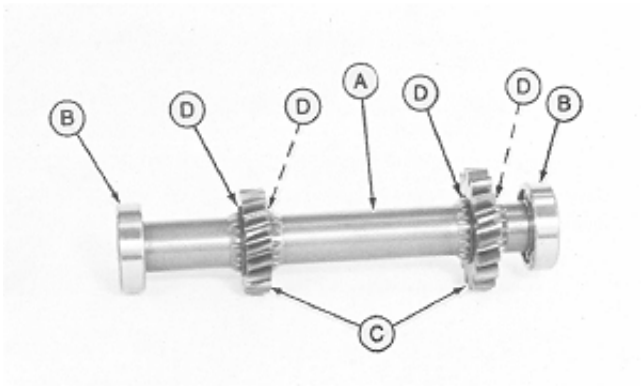
1. Inspect PTO reduction shaft (A), bearings (B), and gears (C).

2. Disassemble shaft as necessary. Pull bearings off shaft using a knife-edge puller. Replace snap rings (D) as required.

3. Assemble gears (C) to shaft using snap rings (D).

4. Install bearings (B) on shaft.

A—PTO Reduction Shaft
B—Bearing (2 Used)
C—Gears
D—Snap Ring (4 Used)



E30154 -UN-11DEC89

EX,3325TM,CG548-19-30NOV92

REPAIR PTO MAIN SHAFT

1. Inspect PTO shaft (A), 20-tooth gear (B), and bearings (C) and (D).

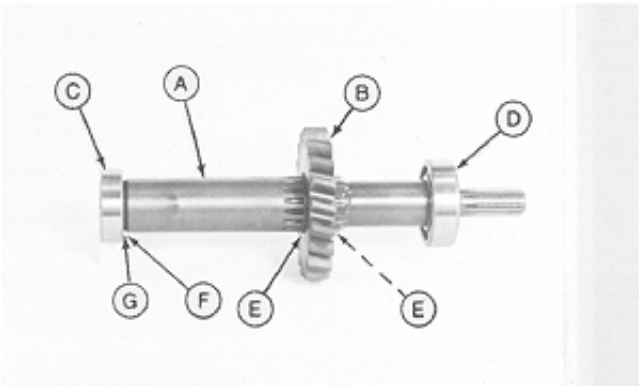
2. Disassemble and repair as required. Remove bearings (C) and (D) from shaft using a knife-edge puller.

3. Inspect and replace snap rings (E and F) as required.

4. Assemble gear (B) to shaft with two snap rings (E).

5. Assemble snap rings (F) to shaft with washer (G) and small bearing (C).

6. Install large bearing (D).



E30155 -UN-11DEC89

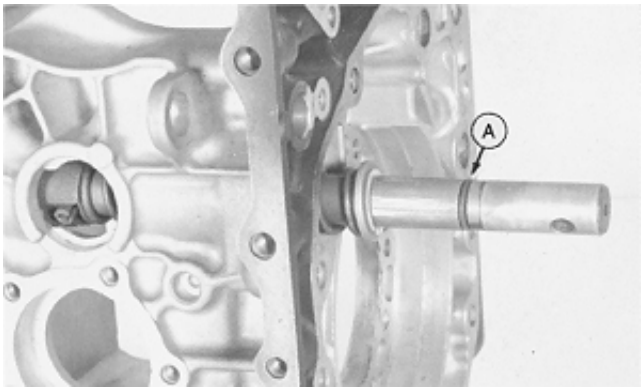
A—Main PTO Shaft
B—Gear
C—Small Bearing
D—Large Bearing
E—Snap Ring (2 Used)
F—Snap Ring
G—Flat Washer

2E6,5010G,31,16-19-30NOV92

REPAIR DIFFERENTIAL LOCK SHIFT SHAFT

50
10
26

1. Remove and discard O-ring (A).



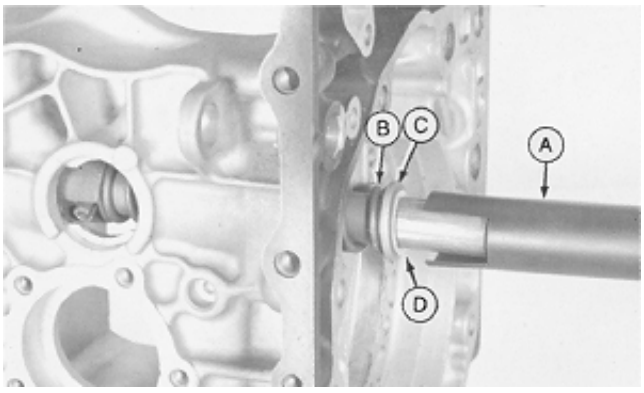
M37935 -UN-29AUG88

M21,5010W,80 -19-30NOV92

2. Compress spring (B) by pushing against washer (C) with JDG562 Snap Ring Compressor (A).

3. Remove snap ring (D) and spring (B).

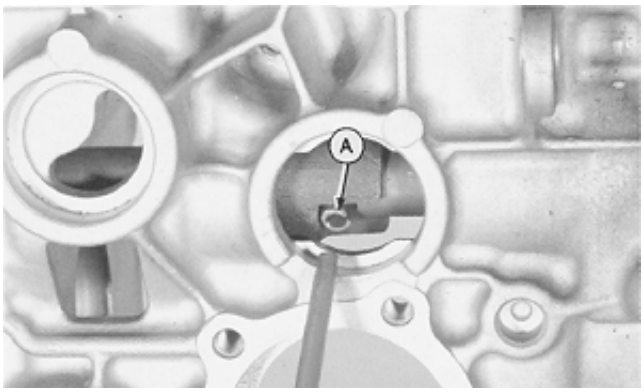
A—JDG562 Snap Ring Compressor
B—Spring
C—Washer
D—Snap Ring



M37936 -UN-29AUG88

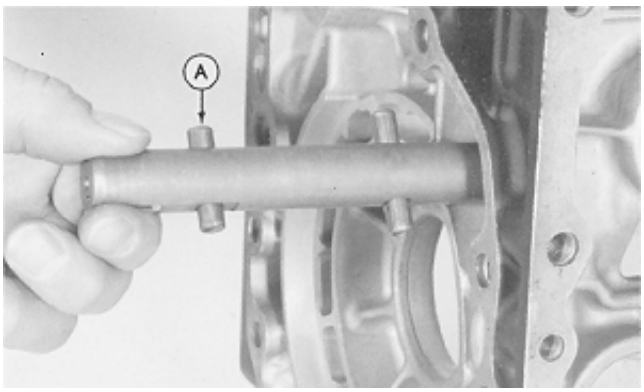
MX,5010HV,A26A -19-30NOV92

4. Remove spring pin (A) from center of shaft.



M21,5010W,82 -19-25MAY90

5. Remove shifter shaft from the side of the case. Inspect spring pin (A) for wear or damage.



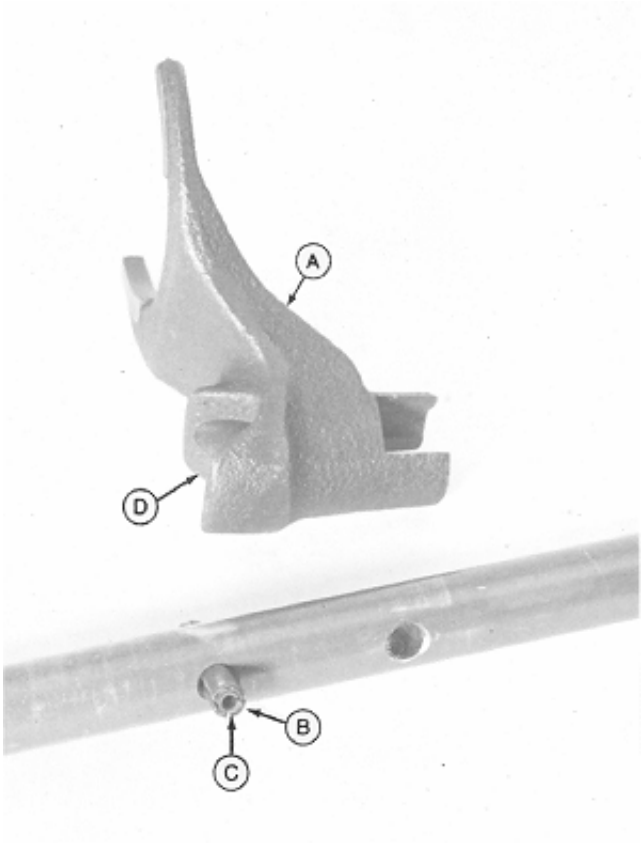
M21,5010W,83 -19-25MAY90

6. Inspect shift fork (A). Replace fork if it shows signs of wear.

7. Inspect spring pins (B) and (C). Replace if required.

8. Install large outside spring pin (B) with open side away from notch (D) in shifter fork. Install small spring pin (C) inside large spring pin. Install small spring pin with open side opposite the large spring pin's open side.

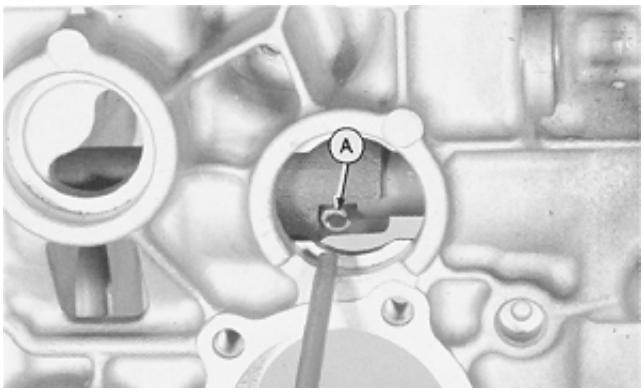
A—Shifter Fork
B—Large Spring Pin
C—Small Spring Pin
D—Notch



M21,5010W,84A -19-30NOV92

9. Install shifter shaft in case, through shift fork.

10. Install spring pin (A) with shift fork in position.



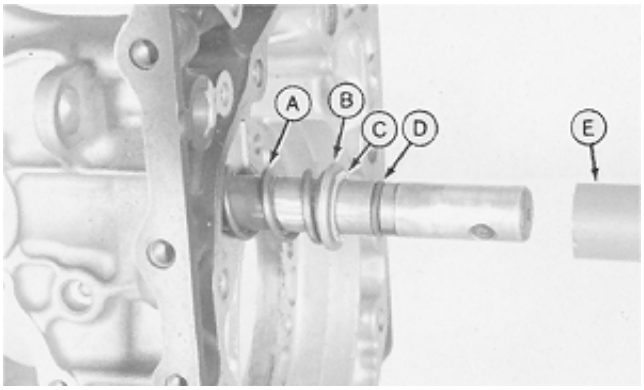
M21,5010W,85 -19-25MAY90

11. Install spring (A) and flat washer (B) on the shaft.

12. Install snap ring (C). Push snap ring into groove on shaft using JDG562 Snap Ring Compressor (E).

13. Install O-ring (D).

A—Spring
B—Flat Washer
C—Snap Ring
D—O-Ring
E—JDG562 Snap Ring Compressor



MX,5010HV,A26B -19-30NOV92

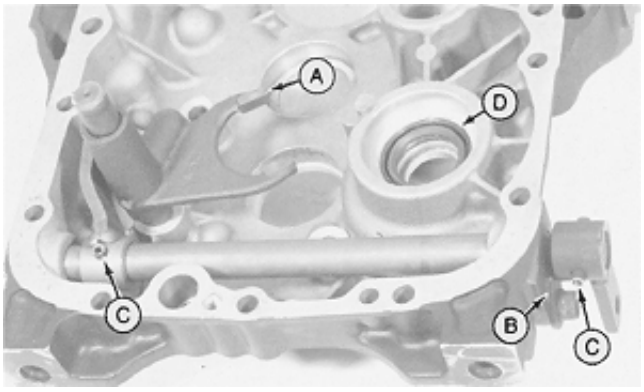
REPAIR RANGE SHIFT SHAFT

1. Inspect range shift fork (A) for wear. Remove if required.

2. Remove retaining plate (B) and two spring pins (C) to disassemble shaft.

3. Replace mid PTO shaft oil seal (D).

A—Shift Fork
B—Plate
C—Spring Pin (2 used)
D—Oil Seal



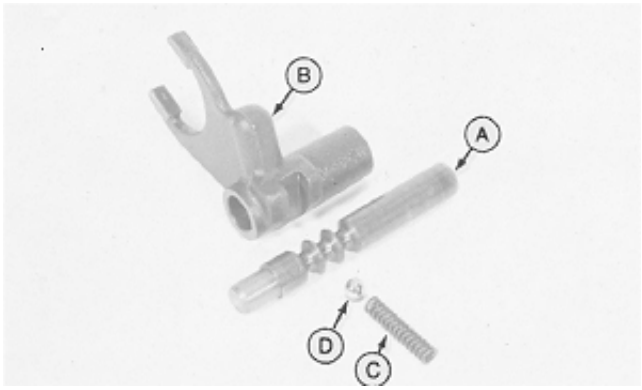
M21,5010W,87 -19-30NOV92

4. Remove and inspect fork shaft (A) and shift fork (B). Replace spring (C) and ball (D) if required.

5. Assemble shaft and shift fork with spring and ball.

6. Assemble shift arms to shift shaft. Install shaft into rear case cover.

A—Fork Shaft
B—Fork Shaft
C—Spring
D—Ball



-UN-29AUG88
M37965

2E6,5010G,17A -19-25MAY90

DISASSEMBLE AND INSPECT PTO CLUTCH ASSEMBLY

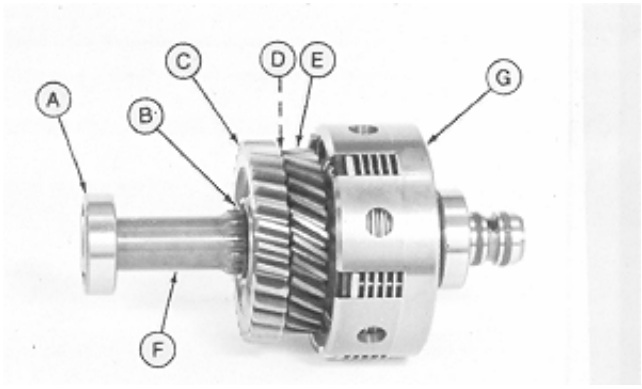
1. Remove bearing (A) using a knife-edge puller and a press.

2. Remove snap ring (B) and 20-tooth gear (C).

3. Remove snap ring (D).

4. Remove clutch gear (E).

5. Remove shaft (F) from PTO cylinder (G).



-UN-11DEC89
E30156

A—Bearing
B—Snap Ring
C—Gear, 30-Tooth
D—Snap Ring
E—Clutch Gear
F—Clutch Shaft
G—PTO Cylinder

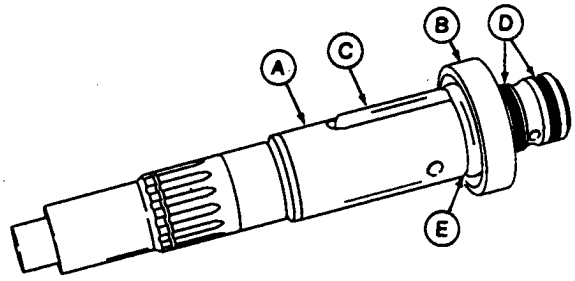
MX,5010HV,A27 -19-30NOV92

6. Remove parts (B—E) from clutch shaft (A). Remove bearing (B) using a knife-edge puller and a press.

7. Inspect all parts for wear or damage. Replace as necessary.

8. Replace two seal rings (D).

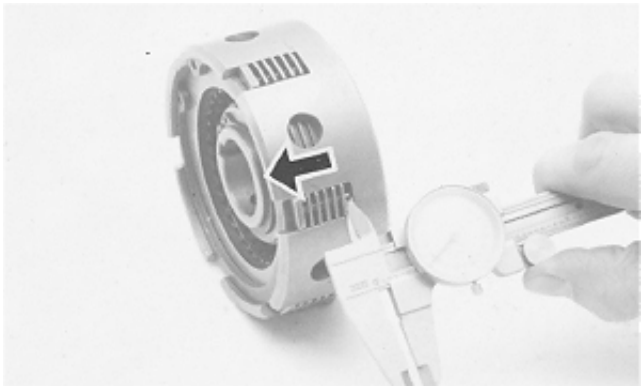
A—Clutch Shaft
B—Bearing
C—Key
D—Seal Rings (2 used)
E—Washer



-UN-21SEP88
E30194

MX,5010HV,A28 -19-30NOV92

9. Hold all the clutch disks together then measure the space between the bottom separator plate and the PTO cylinder. If space measures 4.7 mm (0.185 in.) or more, replace all the clutch disks.



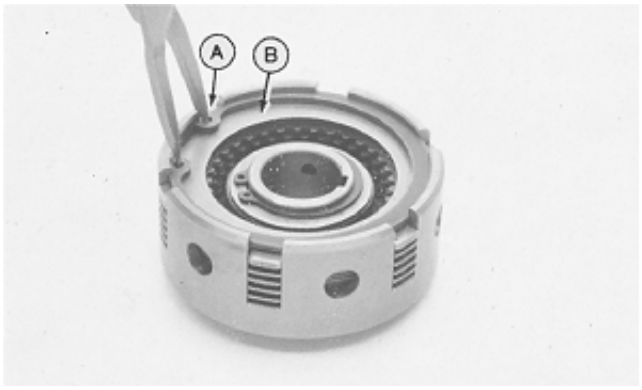
MX,5010HV,A29 -19-30NOV92

10. Remove large snap ring (A). Lift top plate (B) off clutch assembly.

Measure thickness of the top plate. A minimum thickness is required and the plate must be flat.

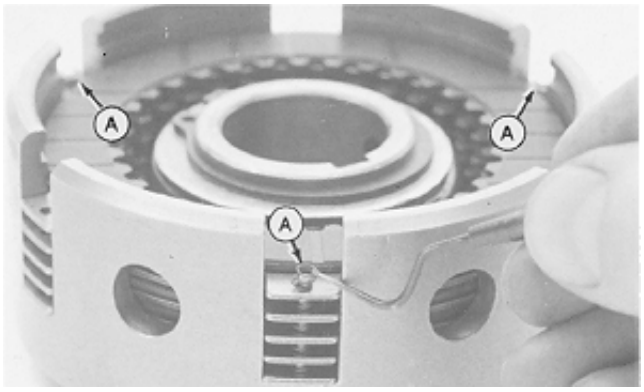
MINIMUM THICKNESS SPECIFICATION

Clutch Top Plate . . . . . 2.9 mm (0.114 in.)



MX,5010HV,A30 -19-30NOV92

11. Remove 15 small springs (A) as the disks are removed. The springs are located on three sides of the clutch assembly.



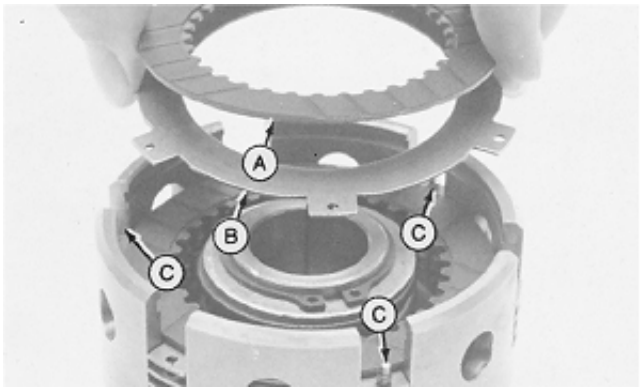
MX,5010HV,A31 -19-30NOV92

12. Remove five separator plates (B) and five clutch disks (A). Remove three pins (C).

Measure clutch disks and separator plates for minimum thickness requirement. The separator plates must be flat.

MINIMUM THICKNESS SPECIFICATION

Clutch Disk . . . . . 1.9 mm (0.075 in.)
Separator Plate . . . . . 1.0 mm (0.039 in.)

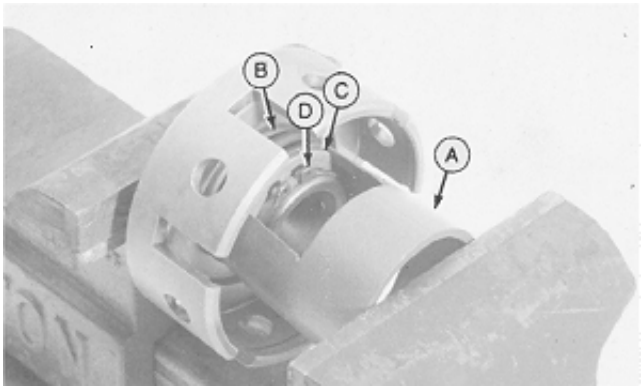


MX,5010HV,A32 -19-30NOV92

13. Remove spring (B):

- Position JDG561 Clutch Piston Compressor against flat washer (C) as shown. Install assembly in a vise.
- Compress spring (B) to remove snap ring (D).
- Slowly open vise jaws to remove spring (B).

A—JDG561 Clutch Piston Compressor
B—Spring
C—Flat Washers
D—Snap Ring



-UN-29AUG88
M37951

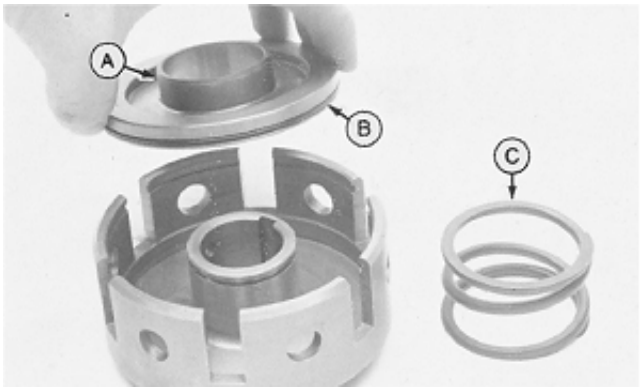
MX,5010HV,A33 -19-30NOV92

14. Remove piston (A). Replace piston if scratched or nicked. Remove O-ring (B).

15. Check free length of piston return spring (C), replace as necessary.

PISTON RETURN SPRING SPECIFICATION

Minimum Free Length	29 mm (1.14 in.)
Minimum Working Load	17.5 mm at 540 N (0.689 in. at 121 lb.)



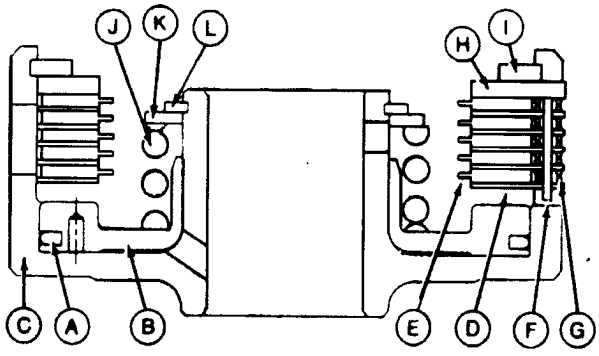
-UN-29AUG88
M37952

MX,5010HV,A34 -19-30NOV92

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31

PTO CLUTCH CROSS SECTION

A—O-Ring
B—Clutch Piston
C—Clutch Cylinder
D—Plate (5 used)
E—Clutch Disk (5 used)
F—Pin (3 used)
G—Spring (15 used)
H—Plate
I—Snap Ring
J—Spring
K—Washer
L—Snap Ring



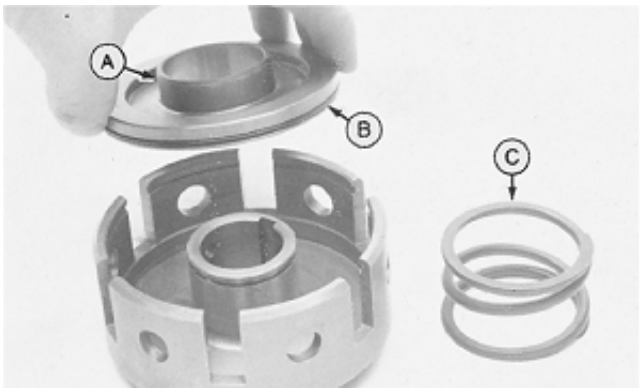
-UN-08JUL91
M43096

M21,5010W,101 -19-30NOV92

ASSEMBLE PTO CLUTCH

1. Install new O-ring (B). Lubricate piston (A) and O-ring and install.

2. Put piston return spring (C) on top of piston.



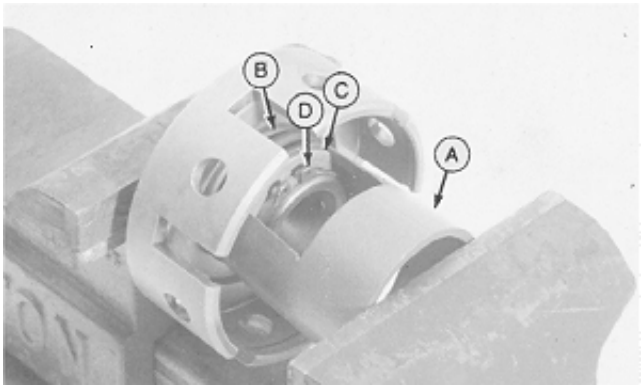
M37952 -UN-29AUG88

MX,HU,5010,105 -19-30NOV92

3. Install spring (B):

- Position JDG561 Clutch Piston Compressor (A) against flat washer (C). Install assembly in a vice.
- Compress spring (B) to install snap ring (D).
- Remove assembly from vise.

A—JDG561 Clutch Piston Compressor
B—Spring
C—Flat Washers
D—Snap Rings

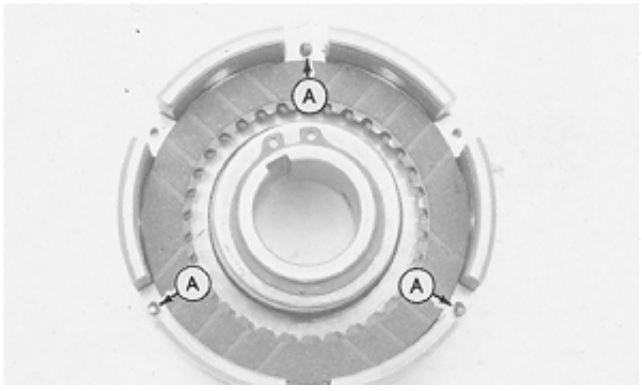


M37951 -UN-29AUG88

MX,5010HV,A35 -19-30NOV92

4. Assemble clutch disks and separator plates:

- Install one of the thin separator plates into the bottom of the slots in the wall of the clutch cylinder.
- Install the three pins (A).
- Install one spring one each pin as each clutch disk and separator plate is installed alternately.

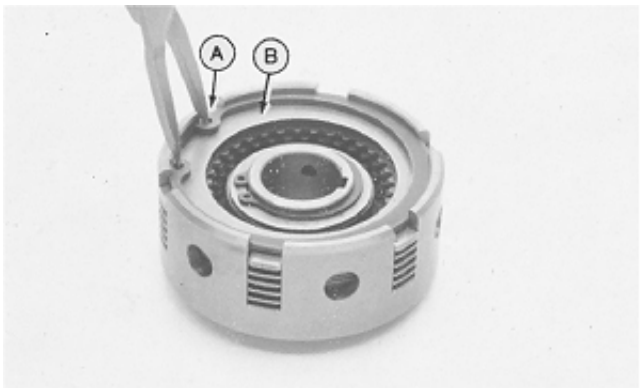


M37953 -UN-29AUG88

MX,5010HV,A36 -19-30NOV92

5. Install the top plate (B) and snap ring (A).

IMPORTANT: Position the snap ring so that the open portion is against one of the sides of the piston.

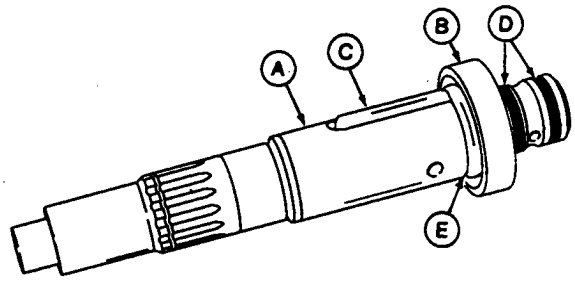


M37948 -UN-29AUG88

MX,5010HV,A37 -19-30NOV92

6. Assemble the clutch shaft (A). Put washer (E) on the shaft, install bearing (B), and key (C). Install two new seals (D).

A—Clutch Shaft
B—Bearing
C—Key
D—Seals (2 used)
E—Washer



E30194 -UN-21SEP88

MX,5010HV,A38 -19-30NOV92

7. Install shaft (F) into PTO cylinder (G). Install clutch gear assembly (E) on shaft and into splines of clutch disks. Rotate clutch gear until all clutch plates line up.

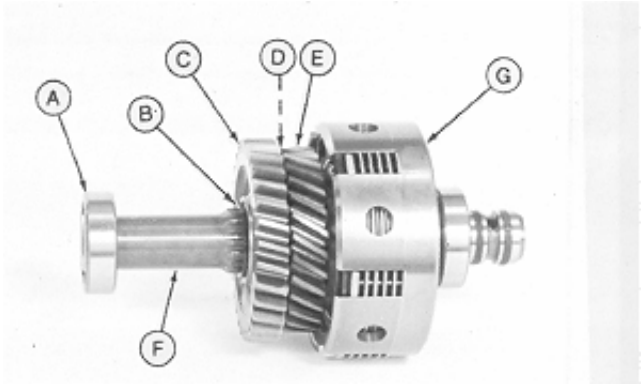
8. Install snap ring (D).

9. Install gear (C) and snap ring (B).

10. Install bearing (A).

The PTO clutch assembly is complete and ready for installation in the transaxle case.

A—Bearing
B—Snap Ring
C—Gear
D—Snap Ring
E—Clutch Gear
F—Clutch Shaft
G—PTO Cylinder



E30156 -UN-11DEC89

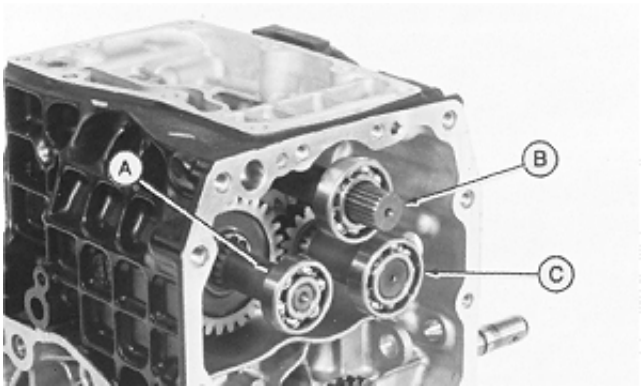
MX,5010HV,A39 -19-30NOV92

INSTALL PTO CLUTCH AND PTO SHAFTS

1. Put PTO clutch assembly (A) in position, but do not install.

2. Put PTO main shaft (B) and then PTO reduction shaft (C) in position.

3. Install all shafts and PTO clutch assembly.



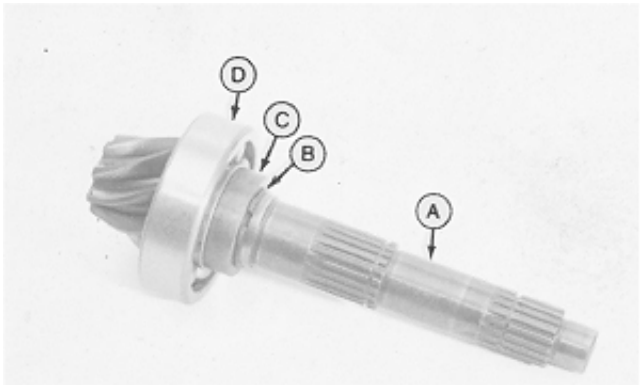
E30142 -UN-11DEC89

EX,3325TM,CG540-19-30NOV92

INSTALL DIFFERENTIAL DRIVE SHAFT

1. Assemble differential drive shaft bearing (D), collar (C), and snap ring (B) on shaft (A).

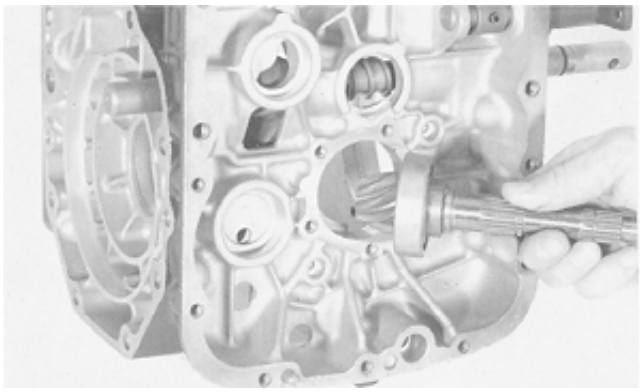
A—Drive Shaft
B—Snap Ring
C—Collar
D—Bearing



M37955 -UN-29AUG88

M21,5010W,111 -19-30NOV92

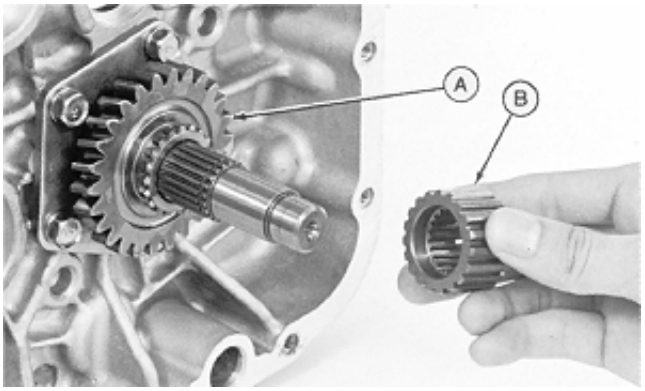
2. Install drive shaft into case.



M37868 -UN-29AUG88

M21,5010W,112 -19-25MAY90

5. Install grooved washer with grooves towards gear (A). Install gear (A), collar (B), and snap ring.



E30157 -UN-11DEC89

2E6,5010G,18B -19-24APR91

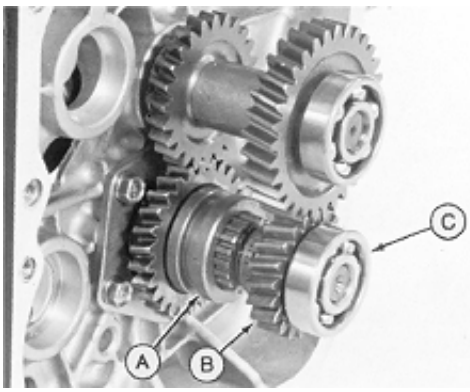
6. Install the reduction shaft assembly.



E30158 -UN-11DEC89

2E6,5010G,18C -19-25MAY90

7. Install collar (A), washer, gear (B), washer, and bearing (C).



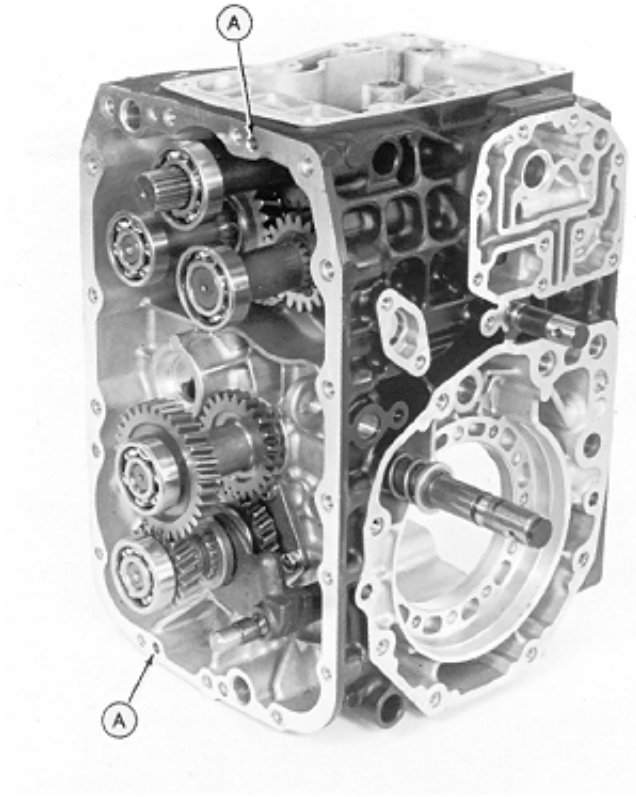
E30159 -UN-11DEC89

2E6,5010G,18D -19-25MAY90

INSTALL REAR COVER ASSEMBLY

1. Install two dowel pins (A) in transaxle case.

2. Install all five outside bearings on shaft assemblies if not previously installed. Lubricate the outside surface of the bearings.

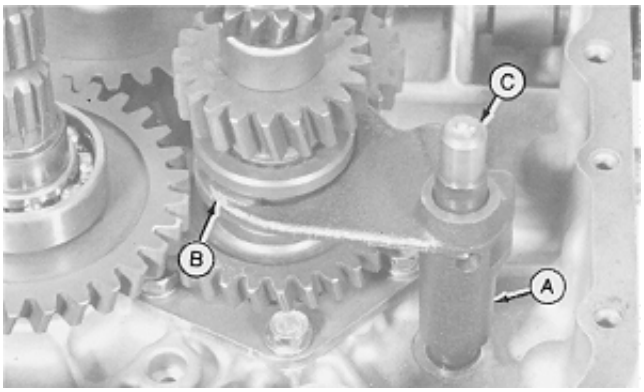


E30160 -UN-11DEC89

2E6,5010G,31,19-19-30NOV92

3. Install range shift fork assembly (A) in transaxle case. Install fork in shift collar (B) of drive shaft assembly.

4. Lubricate end of shaft (C) with oil.

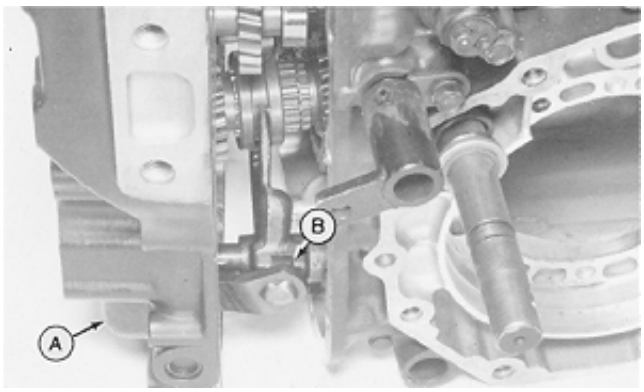


M21,5010W,119 -19-25MAY90

5. Install new rear cover gasket.

6. Install rear cover assembly (A) to transaxle assembly. Check alignment of all six bearings and two shift shafts.

7. Install shift linkage (B) as cover is installed.

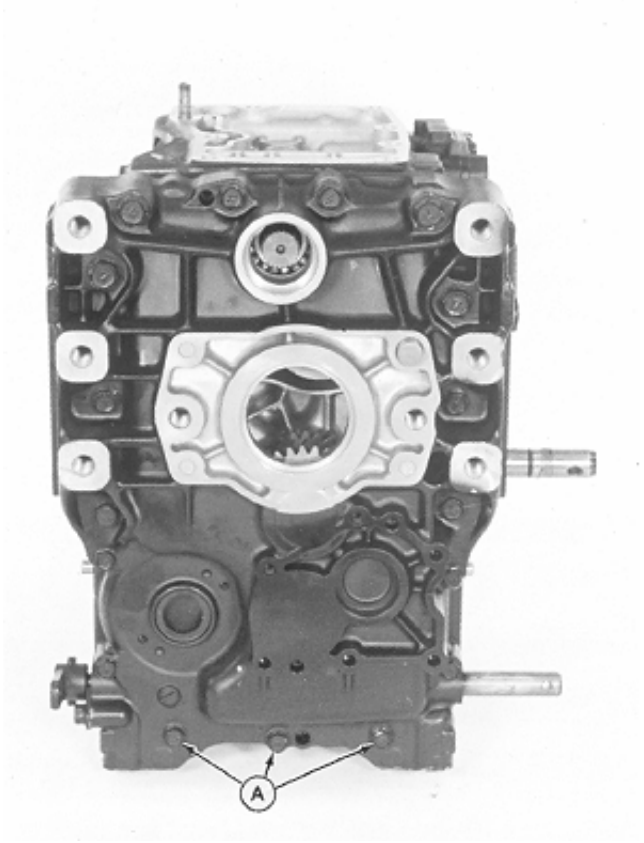


EX,3325TM,CG538-19-25MAY90

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10
36

8. Tighten four M12, six M10, and seven M8 cap screws.

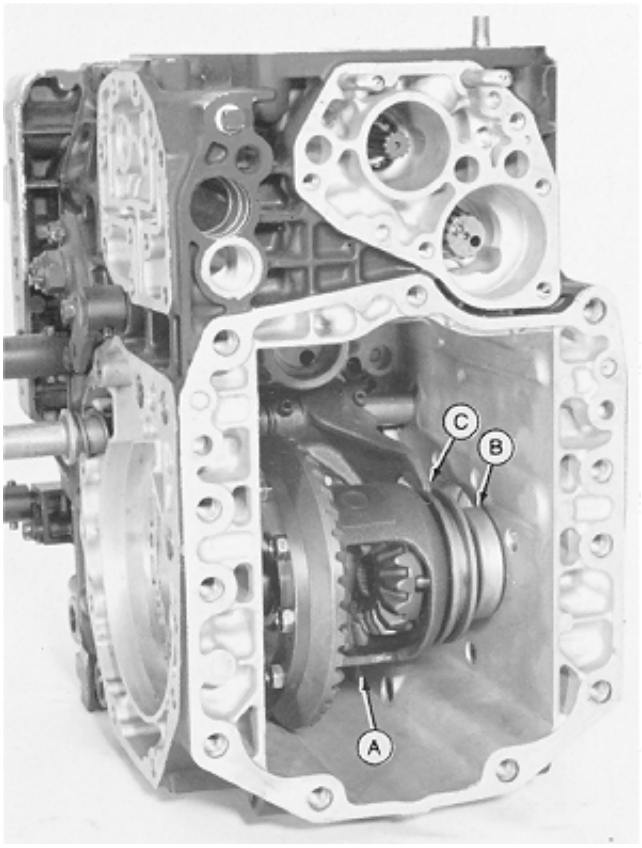
CAP SCREWS	TORQUE SPECIFICATION
M12	90 N·m (66 lb-ft)
M10	50 N·m (37 lb-ft)
M8	26 N·m (19 lb-ft)



EX,3325TM,CG536-19-25MAY90

ADJUST DIFFERENTIAL BACKLASH

1. Install differential assembly (A) in transaxle housing. Put a film of grease or oil on surface of bearing (B). Align shift fork (C) with collar.



M37737 -UN-29AUG88

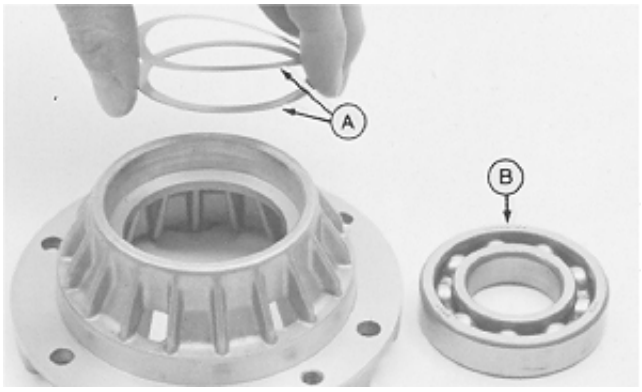
M21,59010W,124 -19-30NOV92

2. Install the same number of shims (A) into carrier assembly as were removed.

3. Install bearing (B) into carrier.

Shim Pack Sizes

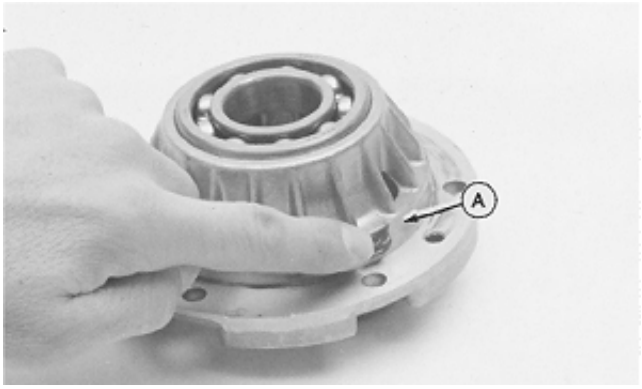
0.1 mm
0.3 mm
0.5 mm



M37969 -UN-29AUG88

M21,5010W,125 -19-25MAY90

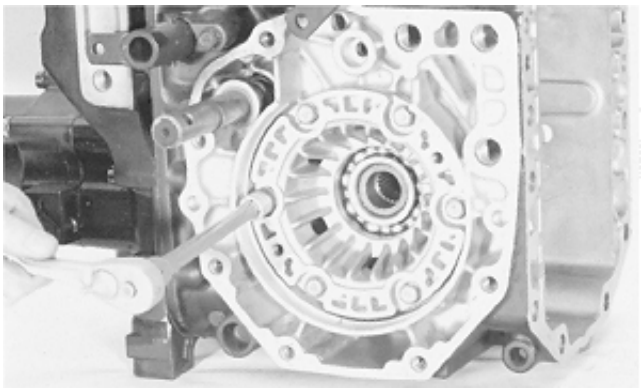
4. Add a coat of grease to the outside surface (A) of the carrier.



M37970 -UN-29AUG88

M21,5010W,126 -19-25MAY90

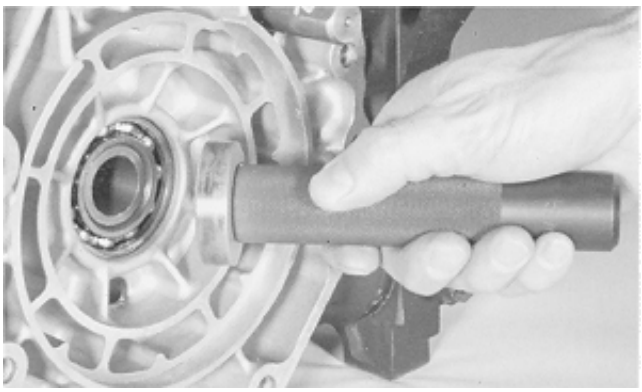
5. Install carrier and tighten all six cap screws to 26 N·m (19 lb-ft).



M21,5010W,127 -19-24APR91

6. Push bearing and differential assembly to the right using a driver disk. Differential assembly must be tight up against right side carrier and shims before backlash is checked.

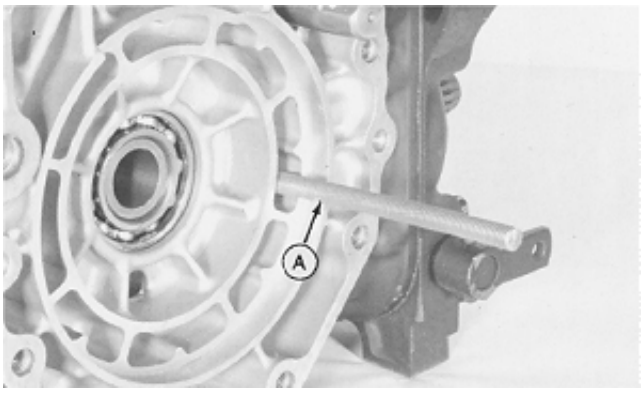
Tap bearing lightly.



EX,3325,5010,5 -19-24APR91

7. Put a rod (A) through the left side carrier and into the differential pinion gear.

Use the rod to block rotation of the pinion gear while the backlash measurement is performed.



EX,3325,5010,6 -19-24APR91

8. Install JDG563 Magnetic Base Gauge Holder (A) across the transaxle case. Mount the indicator's magnetic base (B) on the gauge holder. Position a deflection type gauge (C) against one of the ring gear teeth (D).

9. Hold rod (E) firmly against the pinion gear while moving the ring gear back and forth. Total ring gear backlash movement must measure 0.15—0.21 mm (0.006—0.008 in.).

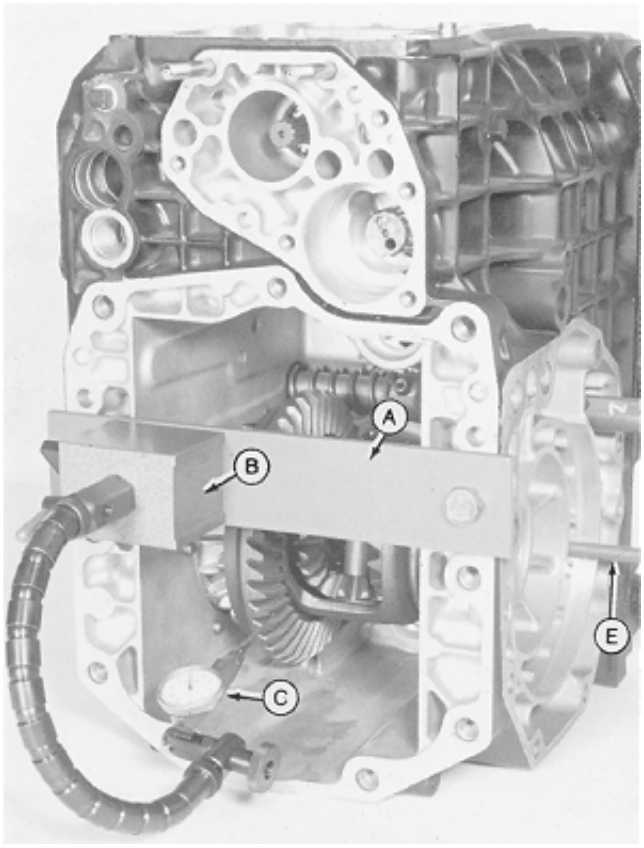
10. If proper backlash is not obtained, disassemble carrier and add or subtract shims. Repeat procedure to measure backlash.

11. Tighten six right side carrier cap screws to 26 N·m (19 lb-ft).

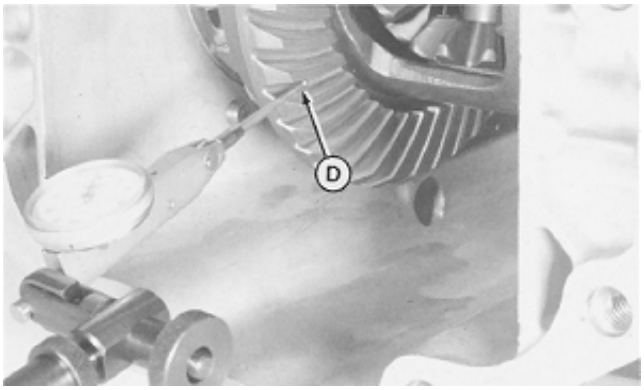
BACKLASH SPECIFICATION

Ring Gear . . . . . 0.15—0.21 mm (0.006—0.008 in.)

A—JDG563 Magnetic Base Gauge Holder
B—Magnetic Base
C—Deflection Gauge
D—Ring Gear
E—Rod



M37973 -UN-29AUG88



M37974 -UN-29AUG88

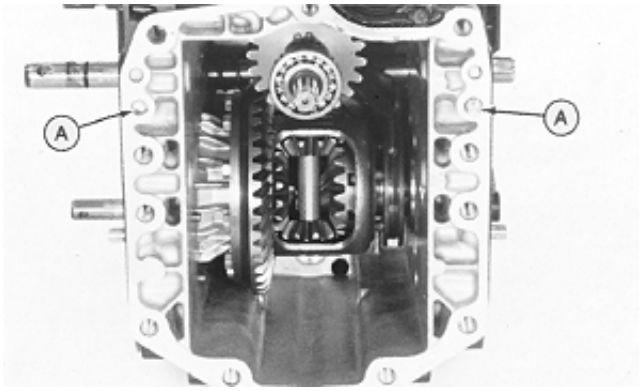
MX,5010HV,A40 -19-30NOV92

INSTALL PTO DRIVE SHAFT AND FRONT COVER

1. Assemble front PTO shaft if repair was necessary.

2. Install PTO shaft.

3. Install two pins (A) in the case.



E30150 -UN-11DEC89

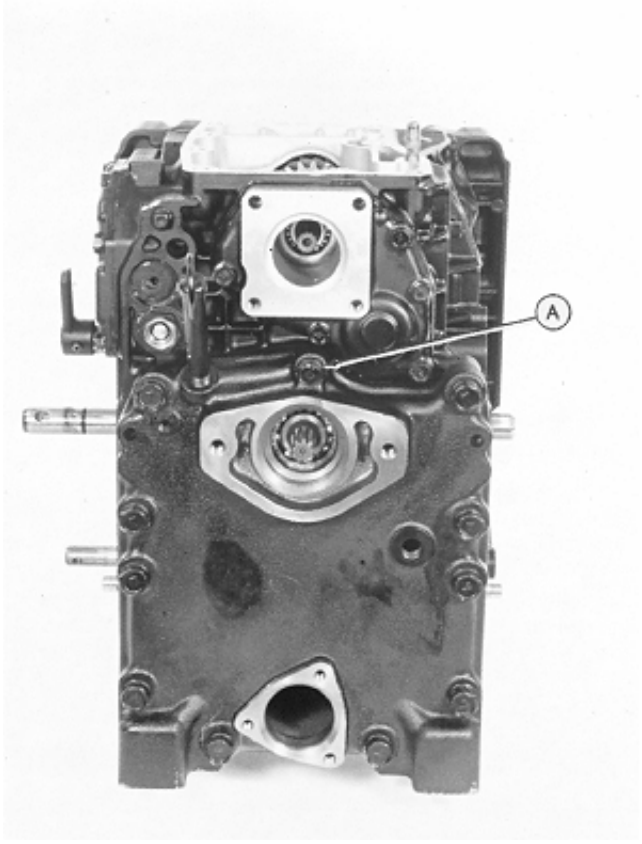
MX,5010HV,A40A -19-30NOV92

4. Install a new gasket.

5. Align PTO bearing with front cover.

6. Install cover with ten M12 cap screws and one M10 cap screw (A). Tighten to specifications.

REAR COVER	TORQUE SPECIFICATION
M12 Cap Screws	90 N·m (66 lb-ft)
M10 Cap Screws	50 N·m (37 lb-ft)



2E6,5010G,31,24-19-25MAY90

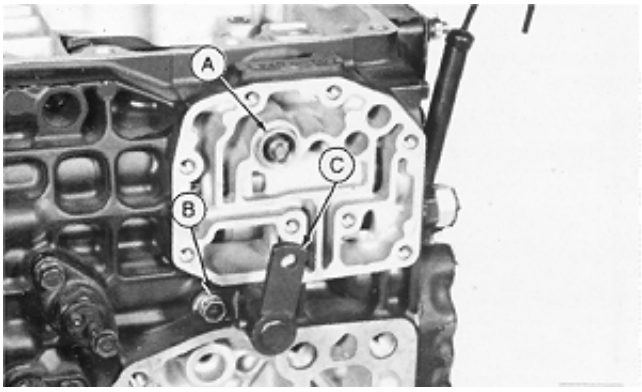
50
10
40

INSTALL PTO VALVES

1. Install upper and lower valve assemblies.

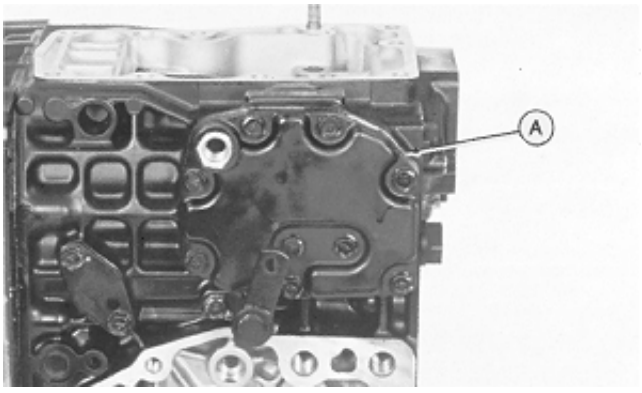
2. Engage PTO shift lever (C) in valve. Install retaining plate (B) and tighten cap screw.

3. Install lube relief valve assembly (A).



M21,5010W,133 -19-30NOV92

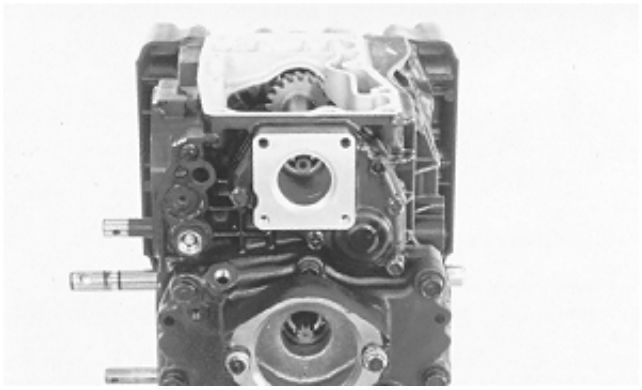
4. Install cover (A). Tighten ten cap screws to 26 N·m (19 lb-ft).



2E6,5010G,3124A-19-25MAY90

INSTALL PTO COVER

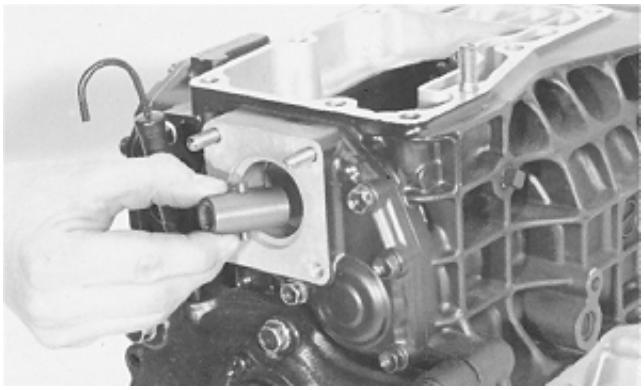
1. Install pins.
2. Install sleeve and O-rings.
3. Install new gasket.
4. Fasten cover with five cap screws.



2E6,5010G,31,25-19-30NOV92

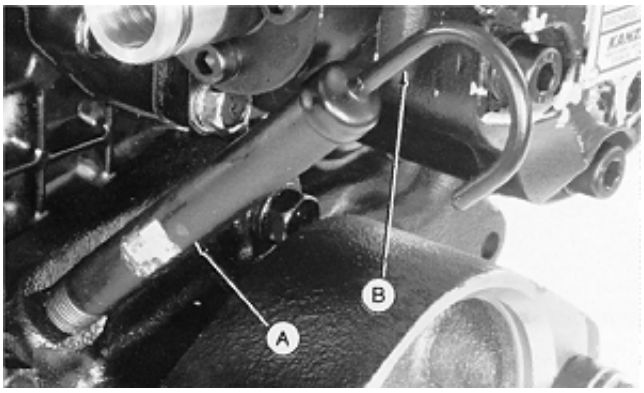
ASSEMBLE TRANSAXLE

1. Install transaxle pump drive coupling. The coupling fits in either direction.



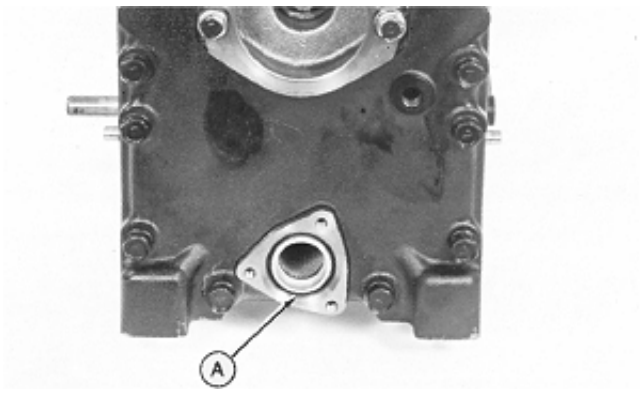
M21,5010W,138 -19-30NOV92

2. Install pipe (A), if removed.
3. Insert oil level gauge (B).



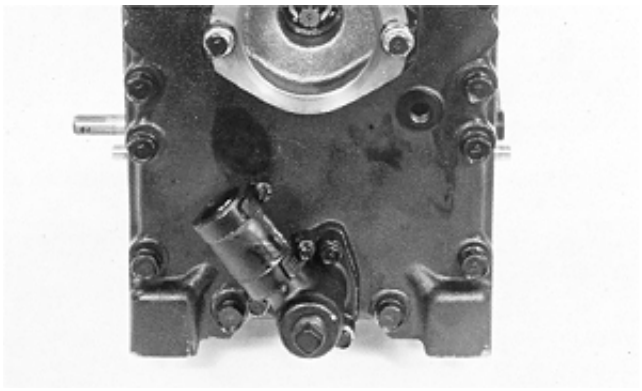
EX,3325TM,CG532-19-24APR91

4. Install oil suction screen. Install new O-ring (A).



EX,3325TM,G532 -19-24APR91

5. Install screen housing with three cap screws.



E30145 -UN-11DEC89

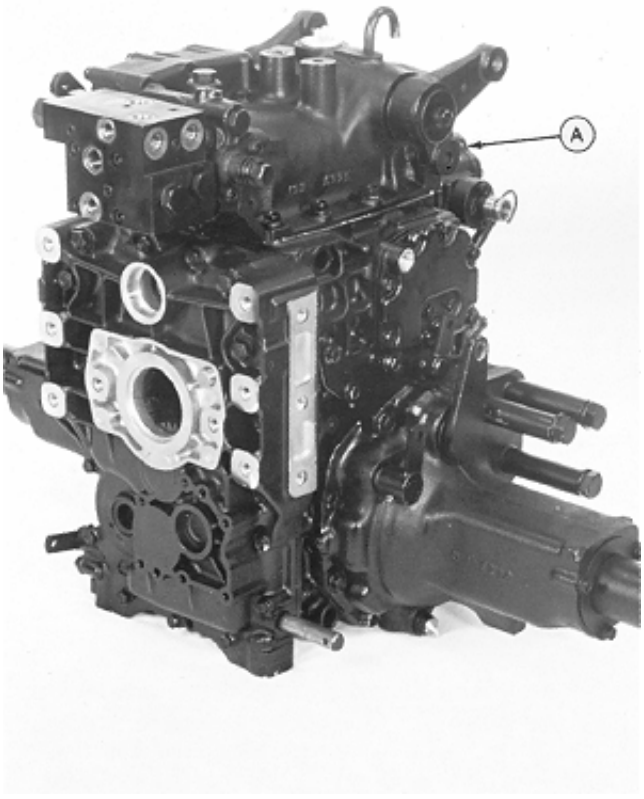
EX,3325TM,CG528-19-24APR91

6. Install rockshaft assembly (A). (See Section 70, Group 25.)

7. Install transaxle pump. (See Section 70, Group 05.)

8. Install hydrostatic transmission and suction tube. (Refer to procedure in Group 05.)

9. Install final drives. (Refer to procedure in Group 15.)



E30143 -UN-11DEC89

MX,5010HV,A41 -19-30NOV92

INSTALL TRANSAXLE

1. Position transaxle on jack stands. Support rear of transmission with hydraulic floor jack or jack stand.

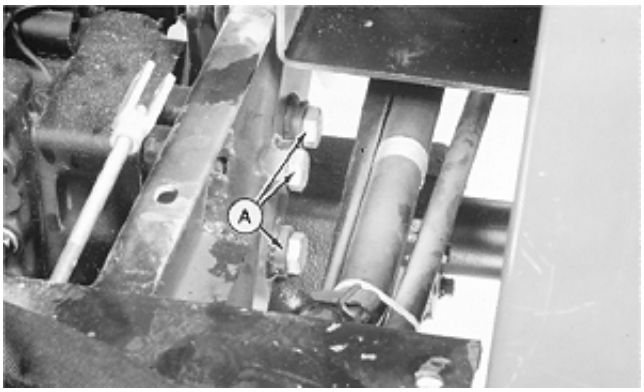
2. Roll mower frame over transaxle.

3. Slowly lower frame. Check for clearance all around as frame is lowered.

4. For 3325 units, install three cap screws (A) on each side of mower. Do not tighten at this time.

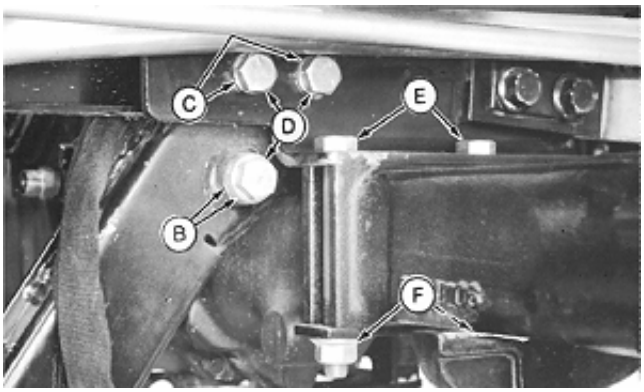
5. For 3365 units, install cap screws, washers and nuts (B—F) on each side of mower. Do not tighten at this time.

A—Cap Screw (3 used)
B—Thick Washer (2 used)
C—Lock Washer (2 used)
D—Cap Screw (3 used)
E—Cap Screw (2 used)
F—Nut (2 used)



E30073 -UN-21SEP88

Model 3325



M81424 -UN-12NOV92

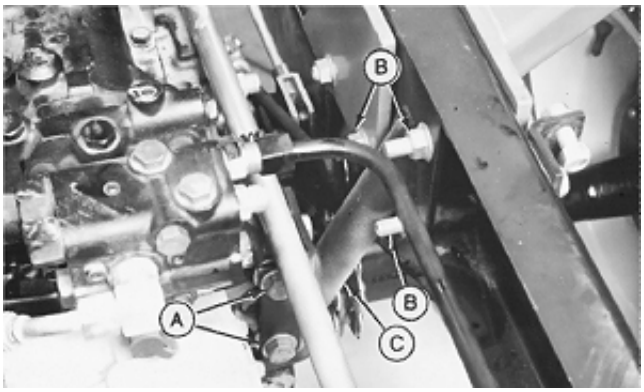
Model 3365

MX,5010HV,A42 -19-30NOV92

6. Install rear transaxle support (C) and three ROPS cap screws and nuts (B). Do not tighten at this time.

7. Adjust position of transaxle using a floor jack to install four cap screws and washers (A). Tighten cap screws to 80 N·m (59 lb-ft).

8. Tighten all ROPS cap screws and nuts to 130 N·m (96 lb-ft). Tighten all frame-to-transaxle cap screws and nuts to 175 N·m (129 lb-ft).



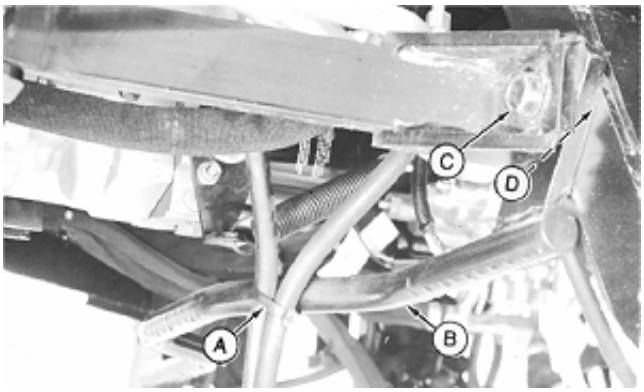
E35701 -UN-09JAN91

MX,5010HV,A43 -19-30NOV92

9. For 3365 units:

- Install cross brace (B). Tighten cap screws and nuts to 175 N·m (129 lb-ft).
- If equipped, fasten weight transfer hoses to cross brace with new tie strap (A).

A—Tie Strap
B—Cross Brace
C—Cap Screw (2 used)
D—Nut (2 used)



-UN-12NOV92
M81423

MX,5010HV,A44 -19-30NOV92

10. Install front wheels. Tighten lug bolts (A) to 115 N·m (85 lb-ft).

11. Remove jack stands and hydraulic floor jack. Lower machine to ground.



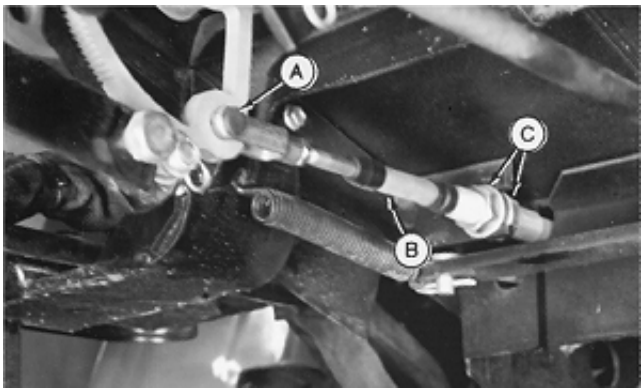
-UN-29AUG88
M39584

MX,5010HV,A45 -19-30NOV92

12. Pull forward/reverse cable rearward through notch in frame. Put cable under transaxle pump and back towards transmission arm.

13. Install forward/reverse cable in slot in frame with nuts and washers (C) on each side. Tighten nuts.

14. Connect cable to cruise control pivot using pin (A). Install spring locking pin.



E35698 -UN-09JAN91

MX,5010HV,A46 -19-30NOV92

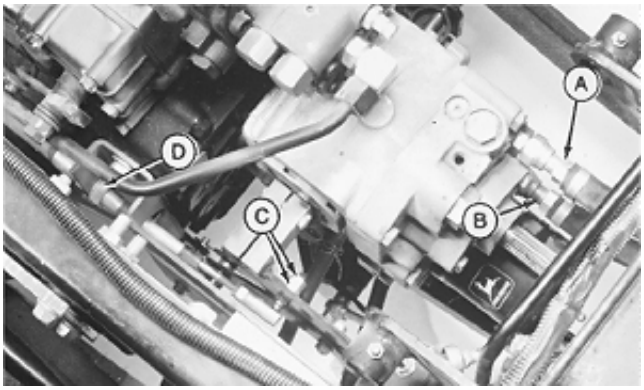
15. Connect hoses (A and B). Tighten to 49 N·m (36 lb-ft).

16. For S.N. 840001— , install neutral return cam.

17. Install forward/reverse cable on mounting bracket and tighten jam nut (D).

18. Connect forward/reverse cable to neutral return cam using nut (C).

A—Transmission-to-Oil Cooler Hose
B—Oil Cooler-to-Transmission Hose
C—Nut
Serial No. —840000 (2 used)
Serial No. 840001— (1 used)
D—Nut (2 used)



E34141 -UN-28JAN91

S.N. —840000 Shown

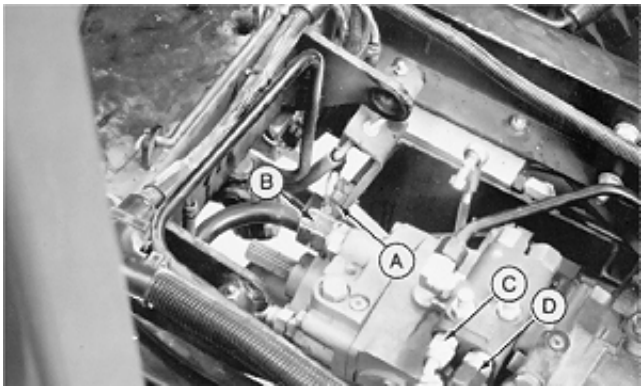
MX,5010HV,A47 -19-30NOV92

NOTE: Suction tube (B) is installed when hydrostatic transmission is assembled to transaxle.

19. Connect wing lift line (D) and power steering hose (C). Tighten connections to 49 N·m (36 lb-ft).

20. For S.N. —840000, connect hydrostatic transmission neutral start switch (A) wire leads or install switches.

A—Neutral Start Switch
B—Hydrostatic Pump Suction Tube
C—Power Steering Valve Hose
D—Wing Lift Valve Hose



E30064 -UN-11DEC89

MX,5010HV,A48 -19-30NOV92

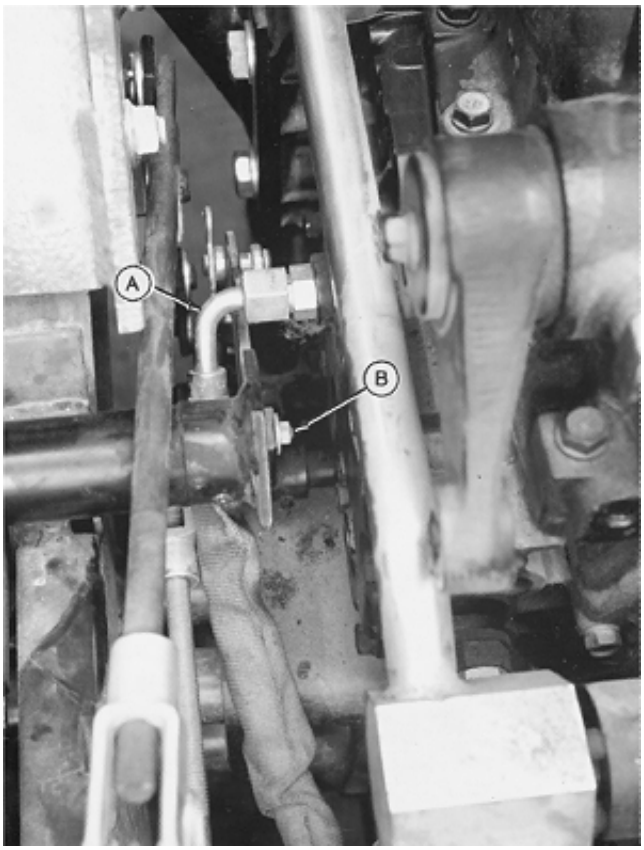
21. Connect hose (A). Tighten to 49 N·m (36 lb-ft).

22. Connect PTO lever to transaxle valve lever using shoulder cap screw, washers and nut (B).

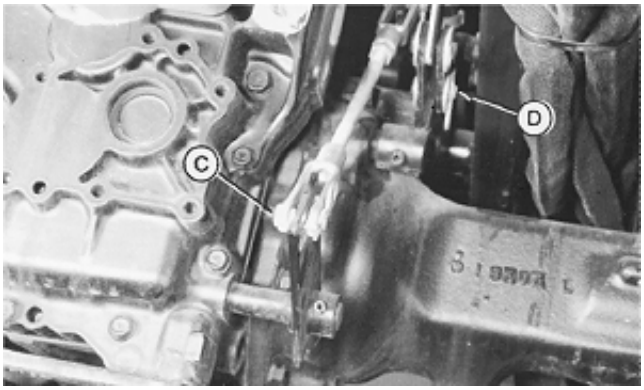
23. Connect differential lock linkage using pin (D) and spring locking pin.

24. S.N. —840000 only: Connect PTO lever lock linkage using pin (C) and spring locking pin.

A—Steering Valve Port T-to-PTO Clutch Hose
B—Cap Screw, Washers, and Nut
C—PTO Linkage Pin
D—Differential Lock Linkage Pin



E35699 -UN-09JAN91



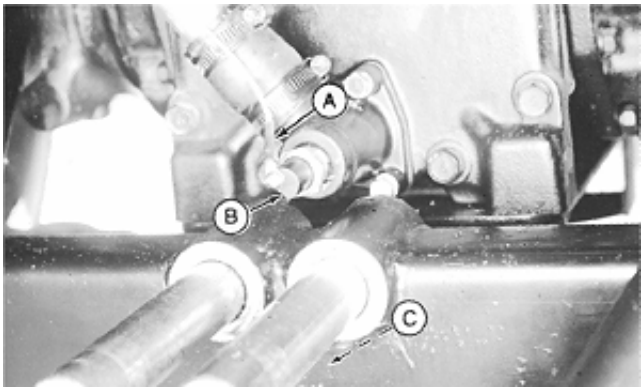
E35446 -UN-09JAN91

MX,5010HV,A49 -19-30NOV92

25. Move reel hoses into position under frame. Install nut and clamp (C).

26. Apply pipe sealant with TEFLON to threads of hydrostatic temperature switch (B). Install switch.

27. Connect wire (A) to switch.



M81428 -UN-12NOV92

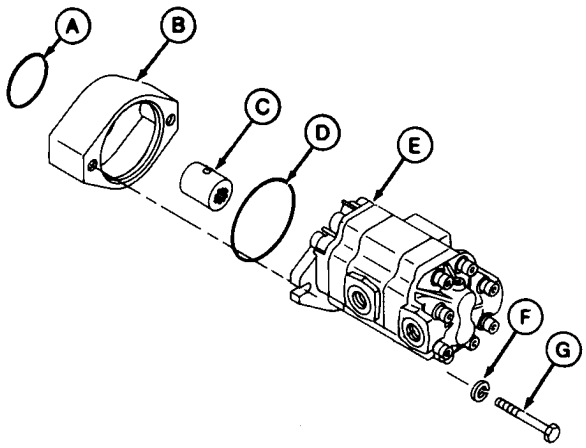
MX,5010HV,A50 -19-30NOV92

28. Install pump coupling (C), O-rings (A and D) and spacer (B).

NOTE: Forward/reverse cable should be routed between transaxle pump and hydraulic pump.

29. Install pump (E) and cap screws (G) and washers (F). Tighten cap screws to 54 N·m (40 lb-ft).

A—O-Ring
B—Spacer
C—Splined Coupling
D—O-Ring
E—Hydraulic Pump
F—Washer (2 used)
G—Cap Screw (2 used)



-UN-22JAN91
E35466

MX,5010HV,A51 -19-30NOV92

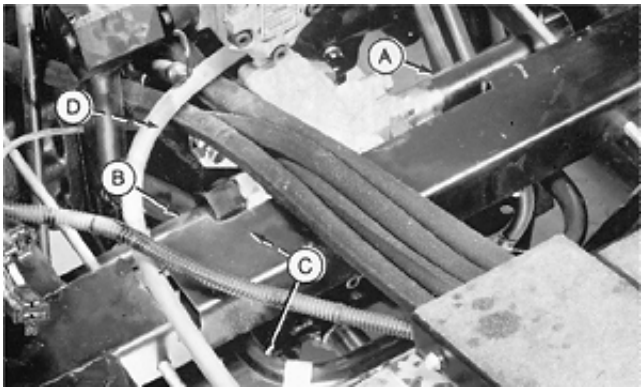
30. Connect wire harness to PTO switch (D).

31. Connect supply line (B) to the pump. Tighten tube nut to 102 N·m (75 lb-ft).

32. Connect supply line (C) to bulkhead on left side of frame and to pump. Tighten tube nuts to 102 N·m (75 lb-ft).

33. Connect suction tube (A) to the pump. Tighten flange cap screws to 37 N·m (27 lb-ft).

A—Hydraulic Pump Suction Tube
B—Center Cutting Units Control Valve Supply Line
C—Wing Cutting Units Control Valve Supply Line
D—PTO Switch



-UN-18OCT90
E34139

MX,5010HV,A52 -19-30NOV92

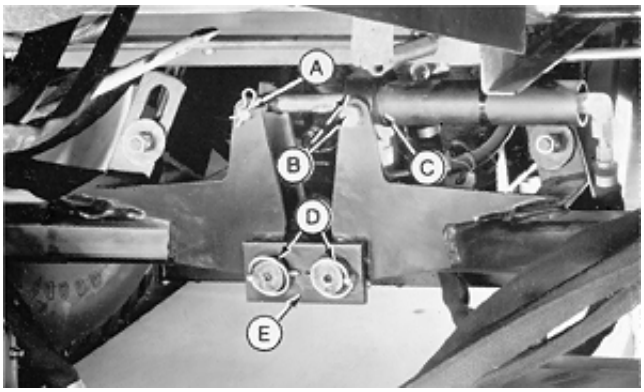
34. Install front lift arms on mower.

35. Install plate (E) and quick lock pins (D).

NOTE: Steps 36 and 37 are required only if the unit is equipped with weight transfer.

36. Apply thread lock and sealer (medium strength) on threads of two shoulder cap screws (B). Move weight transfer cylinder (C) into position and install the shoulder cap screws.

37. Install spacer, pin and spring locking pin (A).



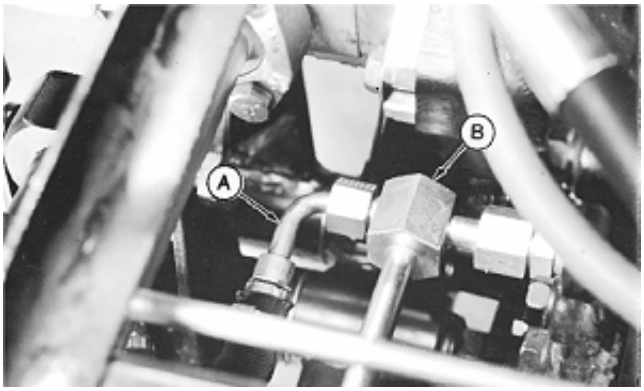
E35445 -UN-18OCT90

A—Spring Locking Pin
B—Cap Screws
C—Weight Transfer Cylinder
D—Quick Lock Pin
E—Plate

MX,5010HV,A53 -19-30NOV92

38. Install steel return line (B) to front left side of transaxle.

39. Connect weight transfer cylinder hose (A), if equipped.

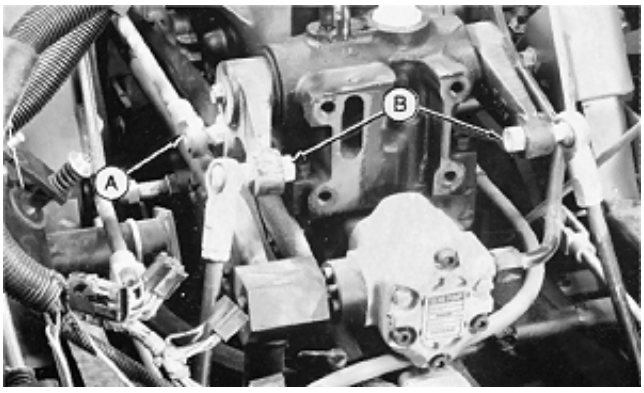


M81427 -UN-12NOV92

MX,5010HV,A54 -19-30NOV92

40. Lift and support each front lift arm. Connect lift links to rockshaft arm with cap screws and nuts (B). Tighten to 163 N·m (120 lb-ft).

41. Connect center lift arm lift linkage to rockshaft arm with pin (A). Install cotter pin.



E34137 -UN-22MAY90

MX,5010HV,A55 -19-30NOV92

42. Raise center lift arm into position under transaxle. Install pin (A) and spring locking pin.

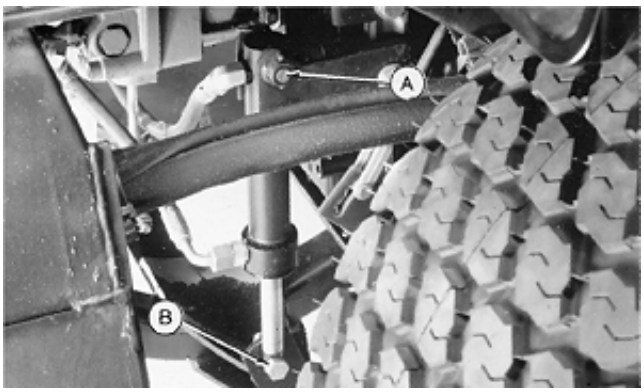


MX,5010HV,A56 -19-30NOV92

NOTE: Steps 43 and 44 are only required if the unit is equipped with weight transfer.

43. Connect the center cutting unit weight transfer cylinder to transaxle bracket using pin (A). Install cotter pin.

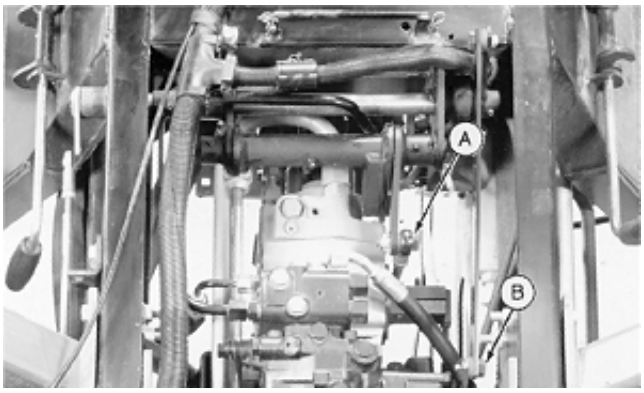
44. Lift center lift arm and install cap screw and nut (B).



MX,5010HV,A57 -19-30NOV92

45. Lift and support center lift arm. Connect lift link using cap screw (A), nut and washer.

46. Connect linkage strap to rockshaft control valve arm using shoulder cap screw (B) and rubber washer.



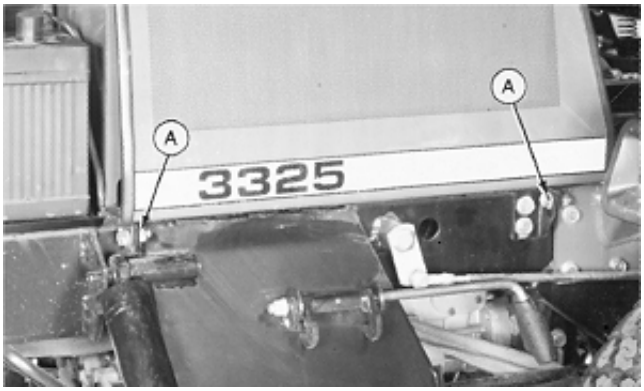
MX,5010HV,A58 -19-30NOV92

47. Install drive shaft. (See Section 50, Group 05.)

IMPORTANT: Fuel may siphon from lines. Make sure fuel lines are plugged before installing fuel tank.

NOTE: Two persons are required to install fuel tank.

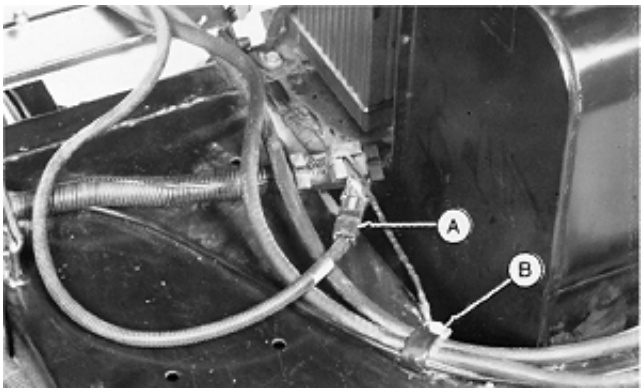
48. Install fuel tank on mower. Install two cap screws (A).



MX,5010HV,A59 -19-30NOV92

49. Push fuel lines through strap on left side of frame. Tighten cap screw (B).

50. Connect wiring connector (A).

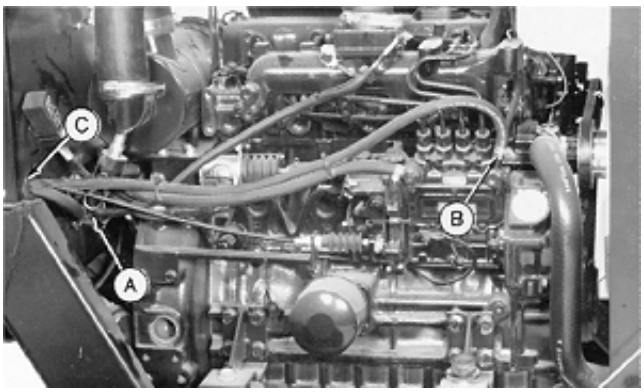


-UN-22MAY90
E34133

MX,5010HV,A60 -19-30NOV92

51. Push hoses through grommet (C).

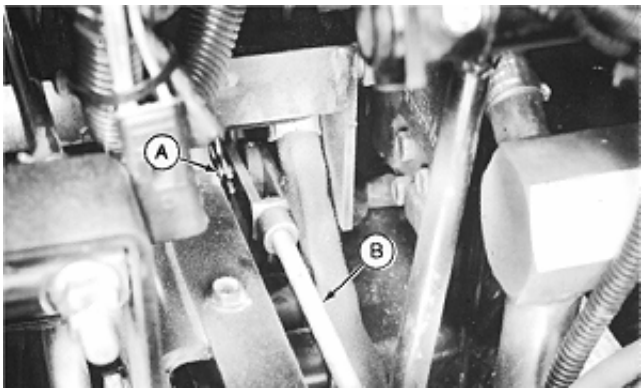
52. Connect fuel supply line (A) to fuel pump and fuel return line (B) to injector pump. Install tie straps.



-UN-22MAY90
E34134

MX,5010HV,A61 -19-30NOV92

53. Connect brake linkage rod (B) to brake actuator arm on each side using pin (A). Install cotter pin.



-UN-12NOV92
M81426

MX,5010HV,A62 -19-30NOV92

54. Fill transaxle with specified transmission/hydraulic oil. (See Section 10, Group 20.)

55. Install seat platform (A). (See Section 80, Group 10.)

56. Fill hydraulic oil reservoir with specified hydraulic oil. (See Section 10, Group 20.)

57. Bleed hydraulic/hydrostatic system. (Refer to procedure in this group.)

58. Adjust forward/reverse cable and transmission neutral. (See Section 250, Group 15.)



M81429 -UN-12NOV92

MX,5010HV,A63 -19-30NOV92

BLEED HYDRAULIC/HYDROSTATIC SYSTEM

After servicing the hydraulic/hydrostatic system, follow this bleeding procedure to assure that air is purged from the hydraulic system.

1. Check transaxle and hydraulic reservoir oil levels. Fill systems as necessary with specified oil. (See Section 10, Group 20.)

2. Start engine and idle it for 10 minutes.

3. Run engine at high idle for one minute.

4. Turn steering wheel full left and hold for 5 seconds.

5. Turn steering wheel to straight forward for 10 seconds.

6. Turn steering wheel full right and hold for 5 seconds.

7. Return steering wheel to straight forward. Travel vehicle forward about 25 feet then make two hard left turns.

8. Then make two hard right turns.

9. Travel vehicle in reverse for 10 feet.

10. Cycle all hydraulic functions 3 times.

11. Shut engine off and inspect hydraulic components for leaks.

12. Check transaxle and hydraulic reservoir oil levels. Add oil as necessary.

MX,5010HV,A64 -19-30NOV92

SERVICE EQUIPMENT AND TOOLS

NOTE: Order tools from the U.S. SERVICEGARD™ Catalog or from the European Microfiche Tool Catalog (MTC). Some tools may be available from a local supplier.

Name	Use
Bushing, Bearing and Seal Driver Set	To service bearings and seal.
Press	To service bearings.

M21,5010W,1 -19-25MAY90

OTHER MATERIAL

Number	Name	Use
T43511	John Deere LOCTITE® Clean and Cure Primer	Clean threads.
T43512	John Deere LOCTITE® Thread Lock and Sealer (Medium Strength)	Retain differential cap screws.

LOCTITE is a trademark of the Loctite Corp.

M21,5010W,5 -19-30NOV92

SPECIFICATIONS

Item	Measurement	Specification
Seal Housing-to-Axle Housing Cap Screws (Axle S.N. —000755)	Torque	25 N·m (18 lb-ft)
Ring Gear Cap Screws	Torque	26 N·m (230 lb-in.)
Final Drive-to-Differential Housing Cap Screws	Torque	52 N·m (38 lb-ft)

MX,5015HV,A1 -19-30NOV92

REMOVE FINAL DRIVE

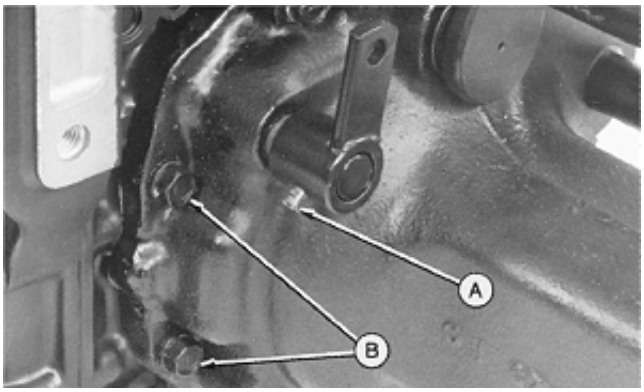
1. Remove transaxle. (See Section 50, Group 10.)

2. Remove spring pin (A) on right side only to remove differential lock lever.

CAUTION: Final drive assembly is heavy. Use a lifting device to support assembly while removing the final drive.

3. Remove six remaining cap screws (B).

4. Remove final drive assembly.



E30144 -UN-15DEC89

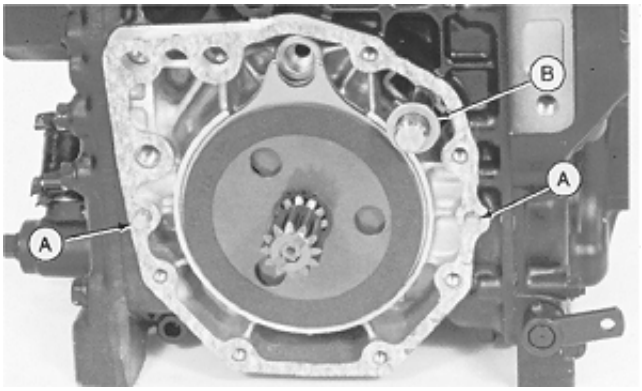
2E6,5010G,31,1A-19-30NOV92

5. Remove dowels (A), if necessary.

6. Pull final drive pinion shaft, two plates, and two brake disks from transaxle.

7. Repeat steps 3—6 for left final drive assembly.

8. Use care so not to lose washer (B) on left side of differential lock shaft.



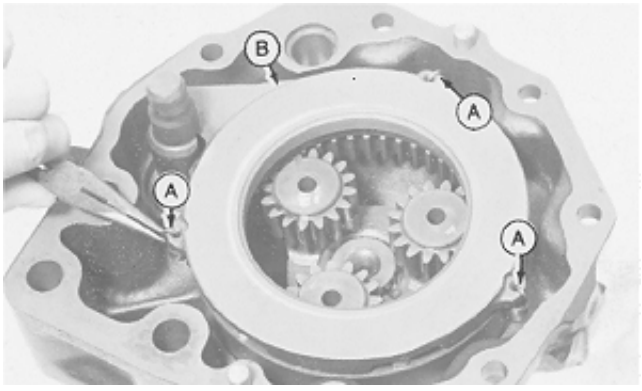
E30166 -UN-11DEC89

MX,5015HV,A2 -19-30NOV92

DISASSEMBLE FINAL DRIVE

NOTE: Disassembly procedure is shown for a left final drive. The right side is similar, but some parts are not interchangeable, left to right. Do not mix left and right side parts.

1. Remove three springs (A).



M37977 -UN-29AUG88

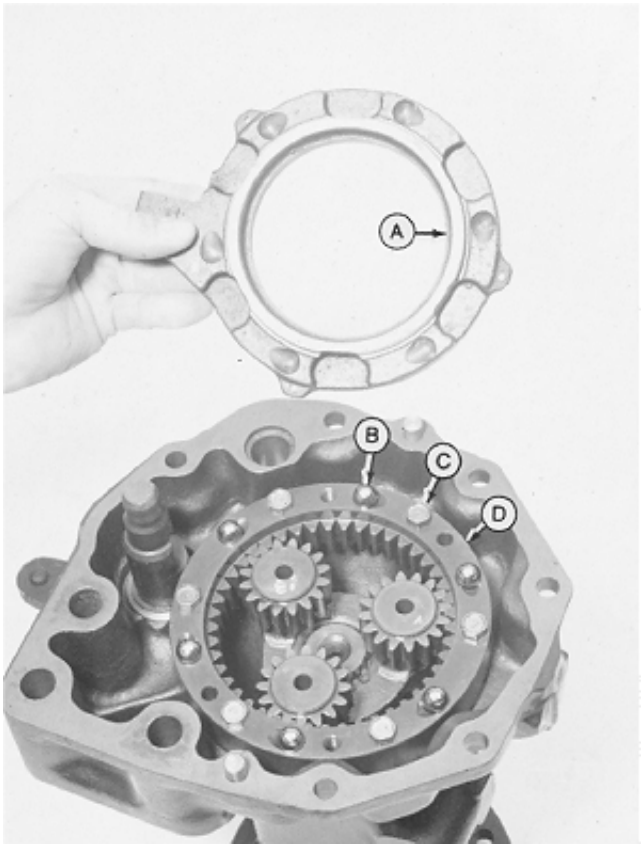
M21,5015W,5 -19-25MAY90

2. Remove actuator plate (A).

3. Remove six steel balls (B).

4. Remove six cap screws (C), then remove ring gear (D).

A—Actuator Plate
B—Steel Ball (6 Used)
C—Cap Screw (6 Used)
D—Ring Gear

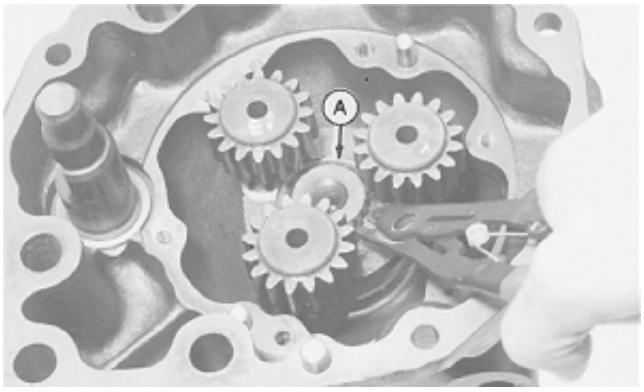


M37978 -UN-29AUG88

M21,5015W,6 -19-25MAY90

5. Remove snap ring (A).

6. Remove planet pinion assembly.



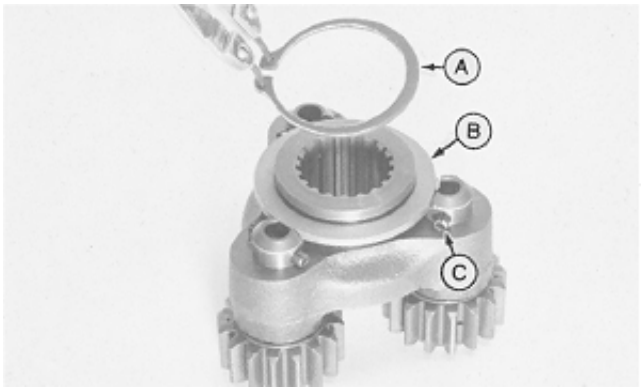
M37979 -UN-29AUG88

M21,5015W,7 -19-25MAY90

REPAIR AXLE PINION ASSEMBLY

1. Remove snap ring (A) and ring (B).

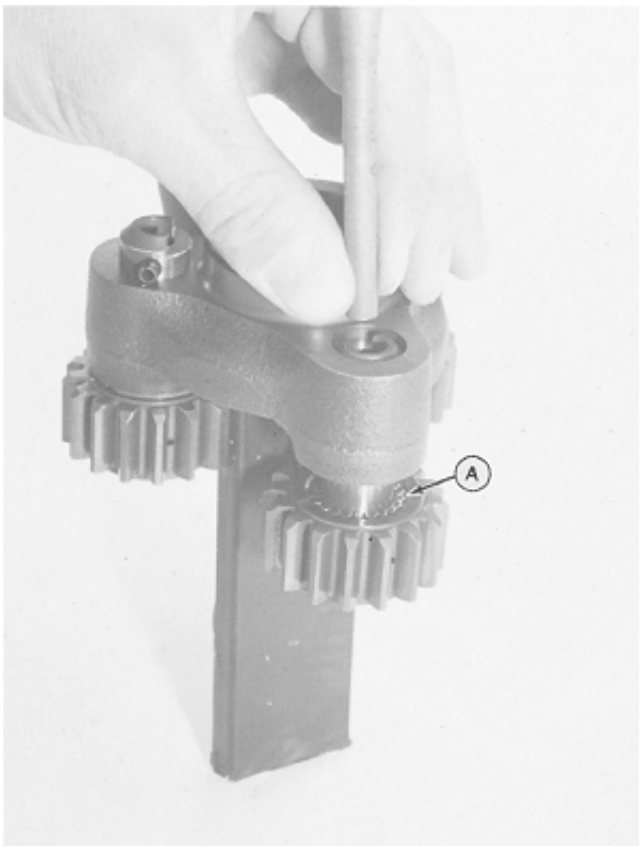
2. Drive out three roll pins (C).



M37993 -UN-29AUG88

M21,5015W,8 -19-24APR91

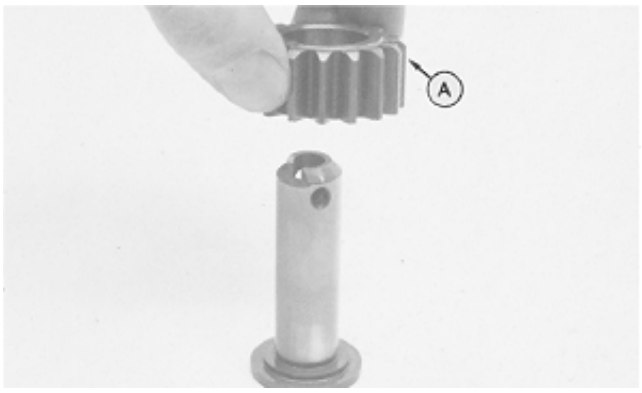
3. Drive or press the three pinion shafts out of the carrier. Take care not to lose the 22 needle bearings (A) in each pinion.



M37994 -UN-29AUG88

M21,5015W,9 -19-25MAY90

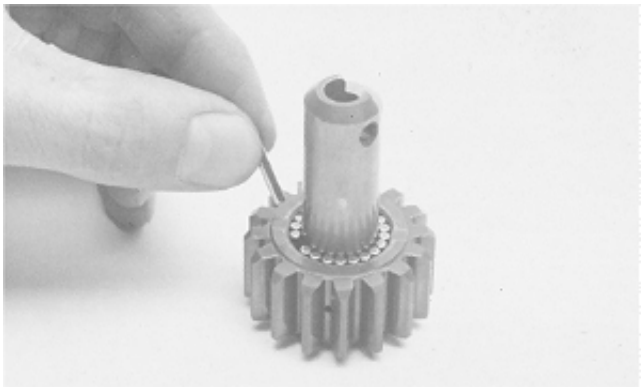
4. Assemble gear on shaft with bevel (A) edge up.



M37995 -UN-29AUG88

M21,5015W,10 -19-25MAY90

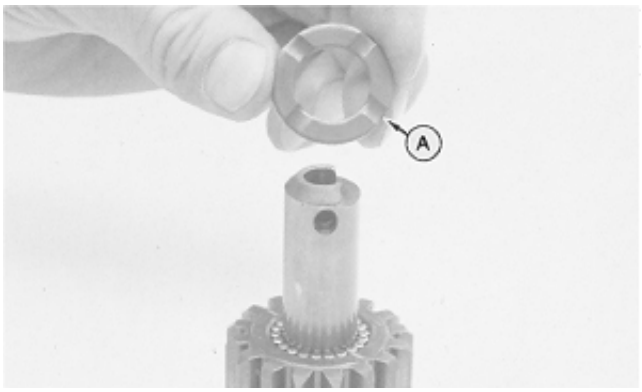
5. Install 22 needle bearings in each gear.



E35659 -UN-12DEC90

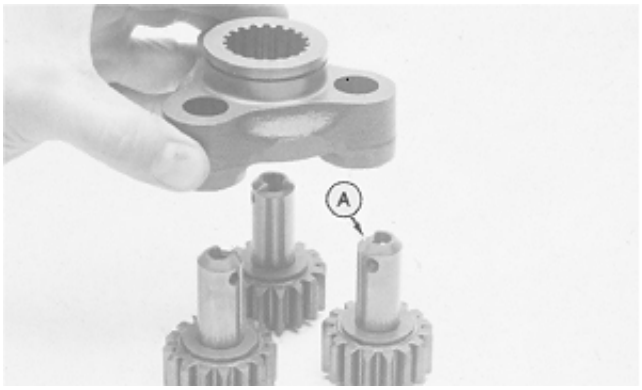
M21,5015W,11 -19-24APR91

6. Install washer (A) with groove side against gear.



M21,5015W,12 -19-25MAY90

7. Install pinion shafts to the carrier. The notch (A) on each shaft must be on the inside of the carrier. Press the pinion shafts into the carrier one at a time.

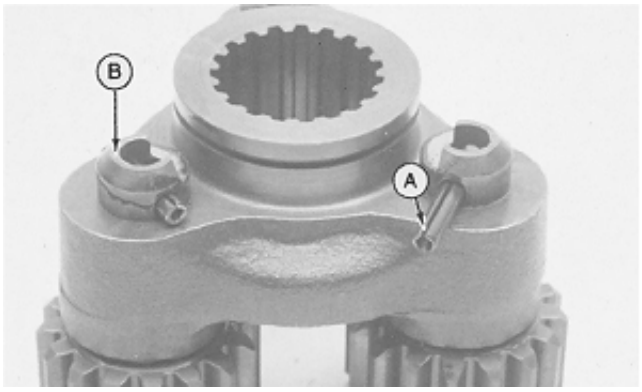


M21,5015W,13 -19-25MAY90

8. Drive roll pins into the shafts. The open side of the pin (A) must be up.

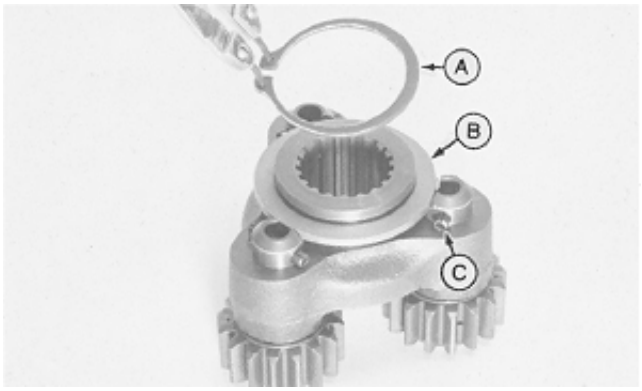
9. Tap the top of each pinion shaft (B) so the roll pin rests on the carrier.

10. Check pinion to see that it turns freely.



M21,5015W,14 -19-25MAY90

11. Install ring (B) and snap ring (A).



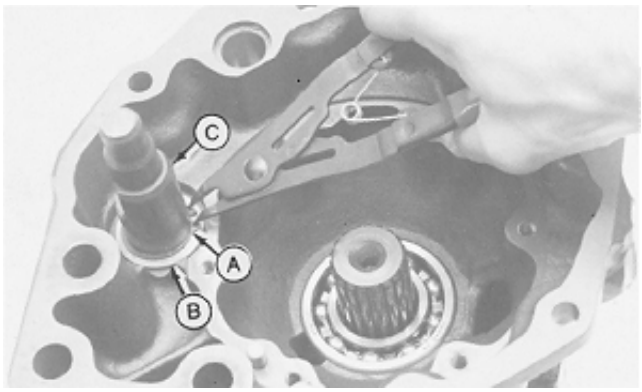
M21,5015W,16 -19-25MAY90

DISASSEMBLE AND INSPECT AXLE HOUSING ASSEMBLY

1. Remove snap ring (A) from brake camshaft (C).

IMPORTANT: Do not mix left and right side brake camshafts, camshafts are not interchangeable.

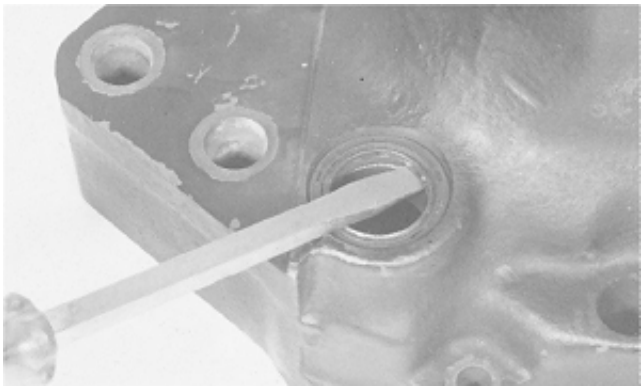
2. Push shaft out of housing and remove flat washer (B).



-UN-29AUG88
M37980

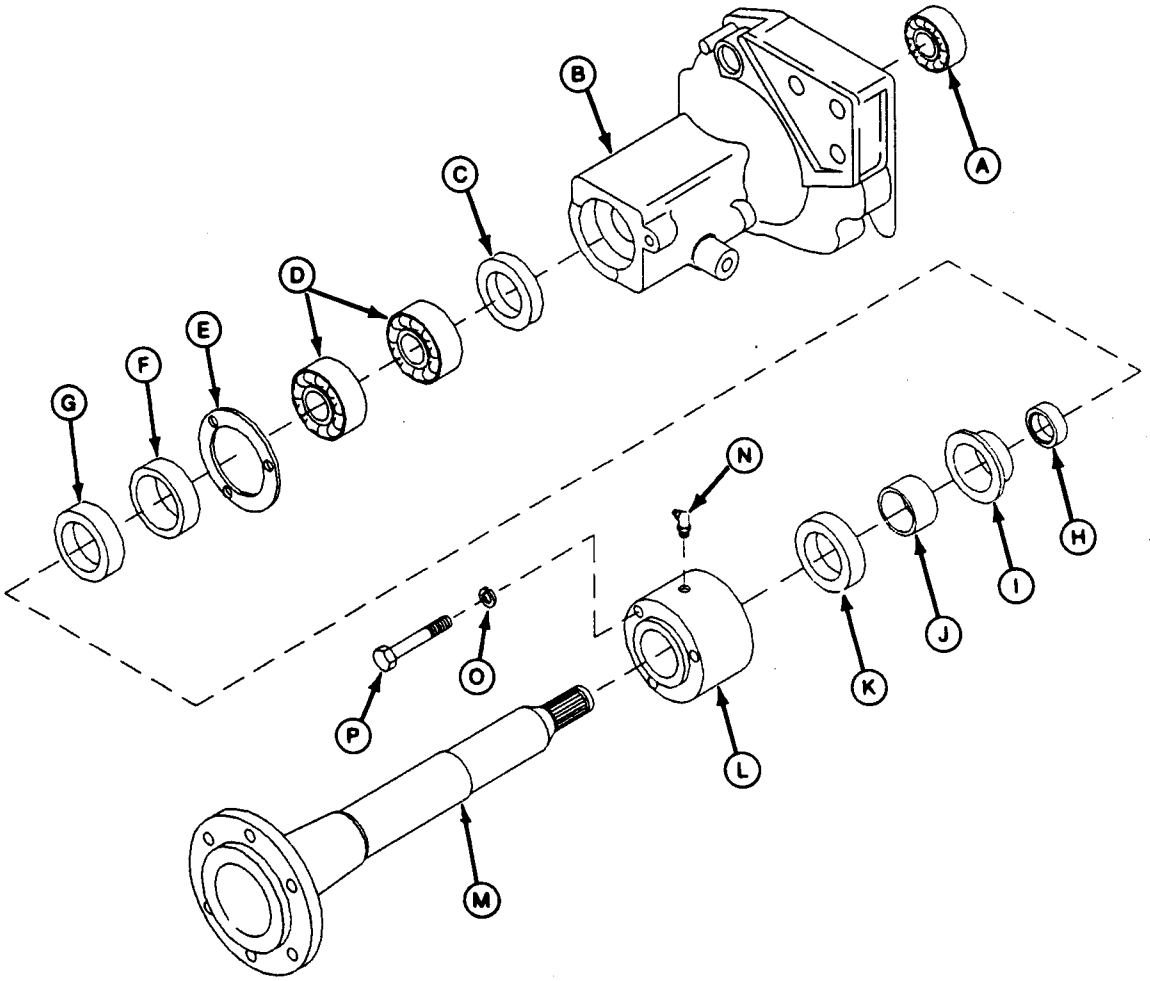
MX,5015HV,A3 -19-30NOV92

3. Remove brake camshaft seal (A). Use care not to damage housing bore.



-UN-29AUG88
M37992

MX,5015HV,A4 -19-30NOV92



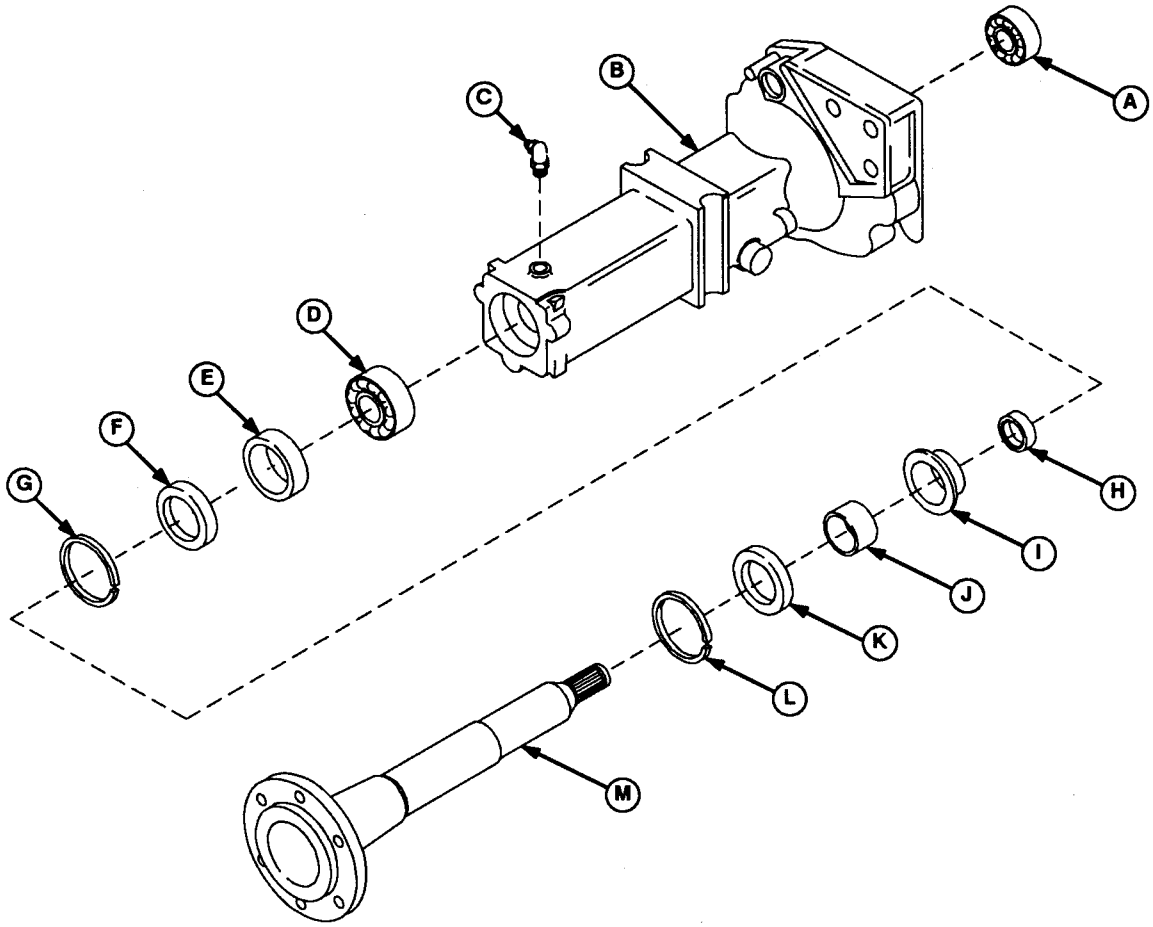
E35788 -UN-27FEB91

A—Inner Ball Bearing
B—Axle Housing
C—Inner Spacer
D—Outer Ball Bearing (2 used)
E—Gasket
F—Outer Collar
G—Inner Seal
H—Inner Collar
I—Inner Wear Sleeve
J—Outer Wear Sleeve
K—Outer Seal
L—Seal Housing
M—Axle Shaft
N—Lube Fitting
O—Lock Washer (3 used)
P—Cap Screw (3 used)

4. Axle S.N. —000755:

- Remove three cap screws (P) and washers (O).
- Use a soft-faced or lead hammer to loosen axle shaft (M) from housing (B). Hit shaft on splined end.
- Carefully remove axle shaft from housing. Remove bearings (D) and spacer (C) from axle housing.
- Remove bearing (A). Use a bearing puller if necessary.
- Remove outer collar (F) and seal (G) from seal housing (L).
- Remove inner collar (H), inner wear sleeve (I) and outer wear sleeve (J). If necessary, use a knife-edge bearing puller.
- Remove gasket (E), and seal housing (L) from axle shaft.
- Remove seal (K) from seal housing.
- Inspect all parts for wear or damage. Replace parts as necessary.

MX,5015HV,A6 -19-30NOV92



M81430AE -UN-12NOV92

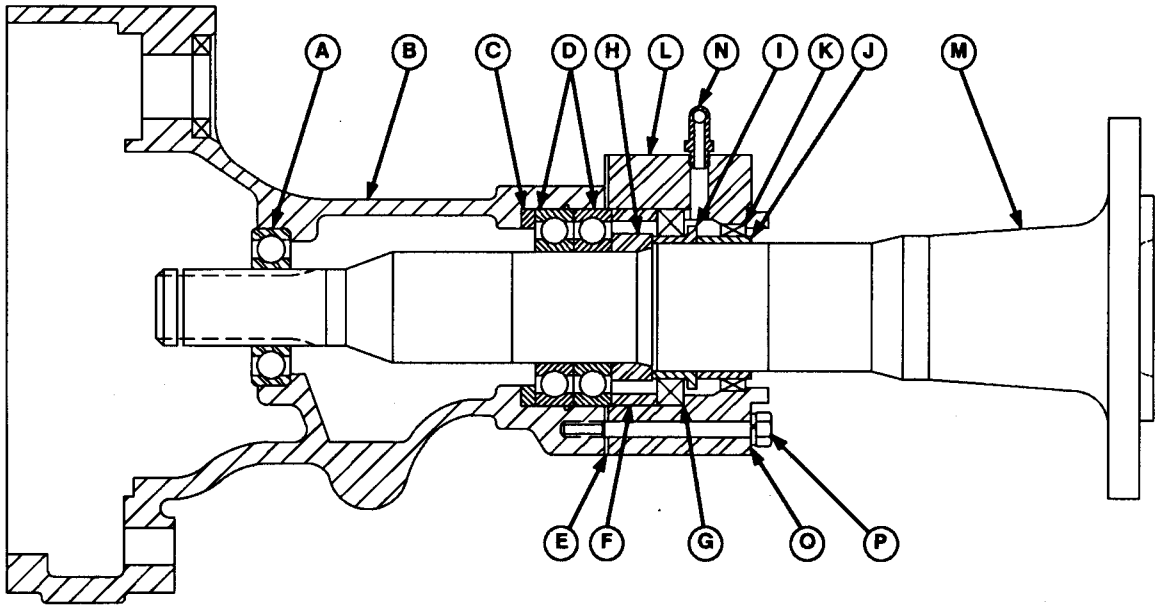
A—Inner Ball Bearing
B—Axle Housing
C—Lube Fitting
D—Outer Ball Bearing
E—Outer Collar
F—Inner Seal
G—Retaining Ring
H—Inner Collar
I—Inner Wear Sleeve
J—Outer Wear Sleeve
K—Outer Seal
L—Retaining Ring
M—Axle Shaft

5. Axle S.N. 000756— :

- Remove retaining ring (L) from groove in end of axle housing (M).
- Use a soft-faced or lead hammer to loosen axle shaft (M) from housing (B). Hit shaft on splined end.
- Carefully remove axle shaft (M) from housing. Parts (H—L) will stay with axle shaft as shaft is removed. Seal (K) may not come out with shaft assembly.
- Remove parts (H—L) from axle shaft. If necessary, use a knife edge puller.
- If seal remains in the housing, pry seal out using a large screwdriver.
- Remove retaining ring (G) to remove seal (F), outer collar (E) and bearing (D) from axle housing.
- Remove bearing (A) from axle housing. Use a bearing puller if necessary.
- Inspect all parts for wear or damage. Replace parts as necessary.

MX,5015HV,A5 -19-30NOV92

ASSEMBLE AXLE HOUSING



E35814 -UN-12NOV92

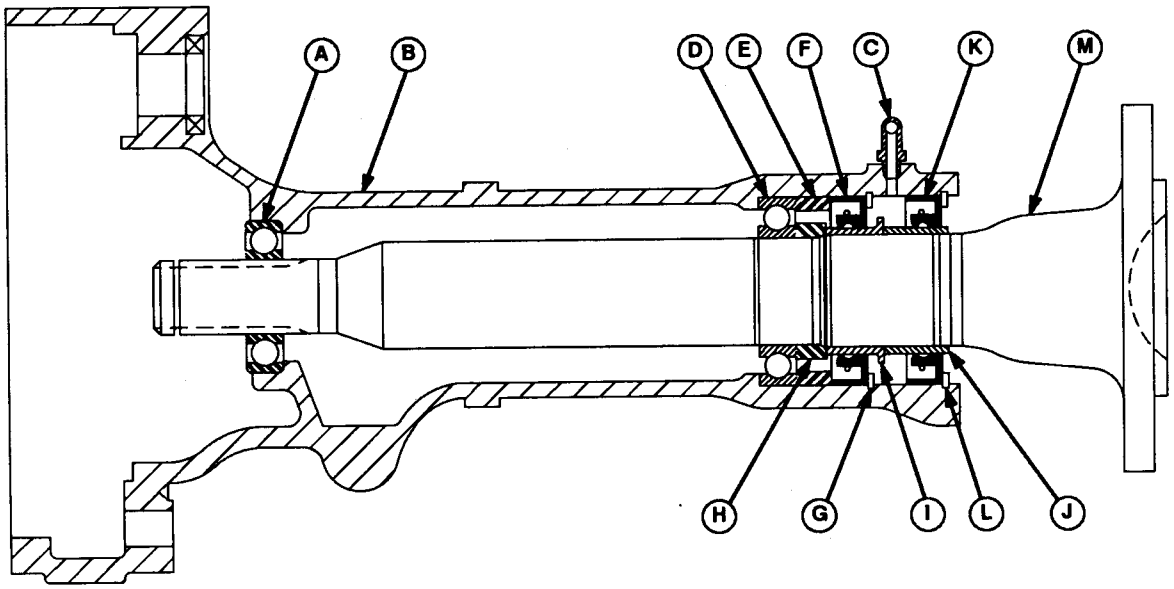
A—Inner Ball Bearing
B—Axle Housing
C—Inner Spacer
D—Outer Ball Bearing (2 used)
E—Gasket
F—Outer Collar
G—Inner Seal
H—Inner Collar
I—Inner Wear Sleeve
J—Outer Wear Sleeve
K—Outer Seal
L—Seal Housing
M—Axle Shaft
N—Lube Fitting
O—Lock Washer (3 used)
P—Cap Screw (3 used)

NOTE: Apply clean transmission/hydraulic oil to all internal parts during assembly.

1. Axle S.N. —000755:

- Install seal (K) to bottom of bore in seal housing (L).
- Stand axle shaft (M) in the vertical position. Carefully slide seal housing onto shaft, so not to damage seal.
- Install outer wear sleeve (J) on axle shaft. Install inner wear sleeve (I) with flanged end towards outer sleeve. Install inner collar (H) with inner chamfer towards wear sleeve. Use a piece of pipe to push collar and two sleeves all at once onto the axle shaft, until collar bottoms against shoulder of axle shaft.
- Position final drive end of axle housing (B) on the floor. Install inner spacer (C) and two bearing (D).
- Carefully lift seal housing (L) so not to damage seal (K) into approximate position on axle shaft. Install seal (G), outer collar (F) and gasket (E).
- Slowly lower axle shaft assembly into axle housing. Make sure lube fitting (N) is to the top of the axle housing. Install lock washers (O) and cap screws (P). Tighten cap screws to 25 N·m (18 lb-ft).

MX,5015HV,A7 -19-30NOV92



M81431AE -UN-12NOV92

50
15
10

A—Inner Ball Bearing
B—Axle Housing
C—Lube Fitting
D—Outer Ball Bearing
E—Outer Collar
F—Inner Seal
G—Retaining Ring
H—Inner Collar
I—Inner Wear Sleeve
J—Outer Wear Sleeve
K—Outer Seal
L—Retaining Ring
M—Axle Shaft

NOTE: Apply clean transmission/hydraulic oil to all internal parts during assembly.

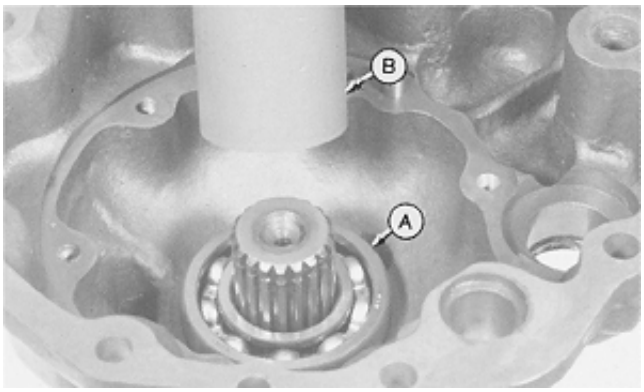
2. Axle S.N. 000756— :

- Slide retaining ring (L), then outer seal (K), onto axle shaft (M). Lip of seal must be towards final drive end of axle.
- Install outer wear sleeve (J) onto shaft. Install inner wear sleeve (I) with flanged end towards outer sleeve. Install inner collar (H) with chamfer towards wear sleeve. Push collar and sleeves onto axle until collar is tight against shoulder of axle shaft.
- Position final drive end of axle housing (B) on the floor. Install outer bearing (D), then outer collar (E) into axle housing. Install inner seal (F) with seal lip toward final drive end of housing. Install retaining ring (G).
- Slowly lower axle shaft assembly into the axle housing. Press outer seal (K) into position. Install retaining ring (L).

MX,5015HV,A8 -19-30NOV92

3. Turn axle housing so axle flange is on the floor. Install bearing (A). Push bearing into place using a piece of pipe (B) with an inside diameter of 40 mm (1-9/16 in.). Pipe must contact on inner race only.

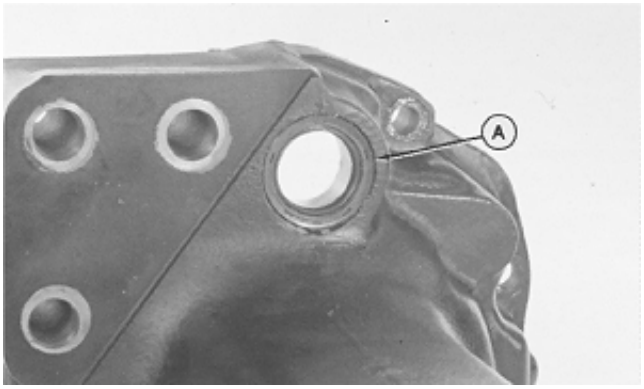
A—Inner Ball Bearing
B—Pipe



M37991 -UN-29AUG88

MX,5015HV,A9 -19-30NOV92

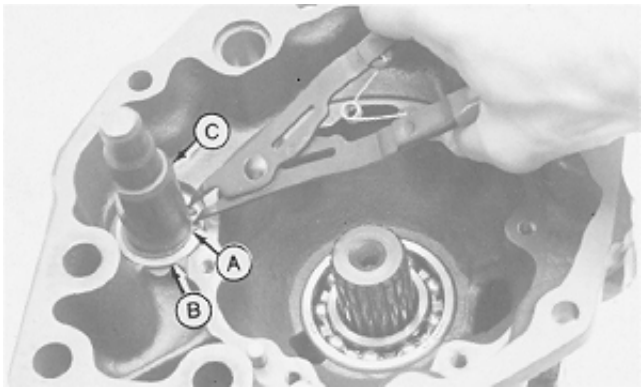
4. Install camshaft seal (A) to bottom of bore.



E35714 -UN-09JAN91

MX,5015HV,A10 -19-30NOV92

5. Install brake camshaft (C). Fasten it with washer (B) and snap ring (A).

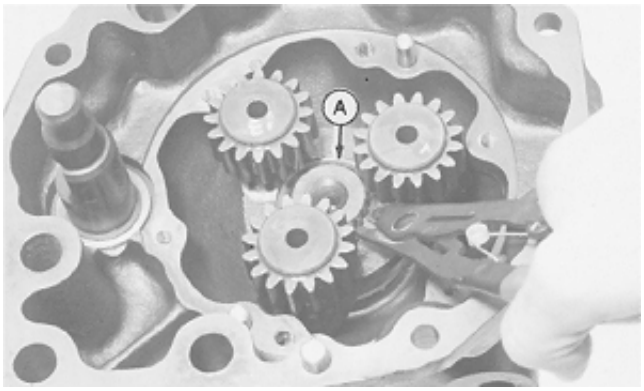


M37980 -UN-29AUG88

MX,5015HV,A11 -19-30NOV92

ASSEMBLE FINAL DRIVE

1. Install planet pinion assembly. Fasten planetary with snap ring (A).



M37979 -UN-29AUG88

EX,3325,5015,1 -19-30NOV92

2. Clean the threads of all six ring gear mounting cap screws and tapped holes of axle housing using clean and cure primer.

NOTE: Spring mounting holes or bottom of ring gear are not symmetrical with dowel pins. Be sure ring gear is turned so that spring mounting hole is away from brake camshaft.

3. Install ring gear (D) on dowel pins.

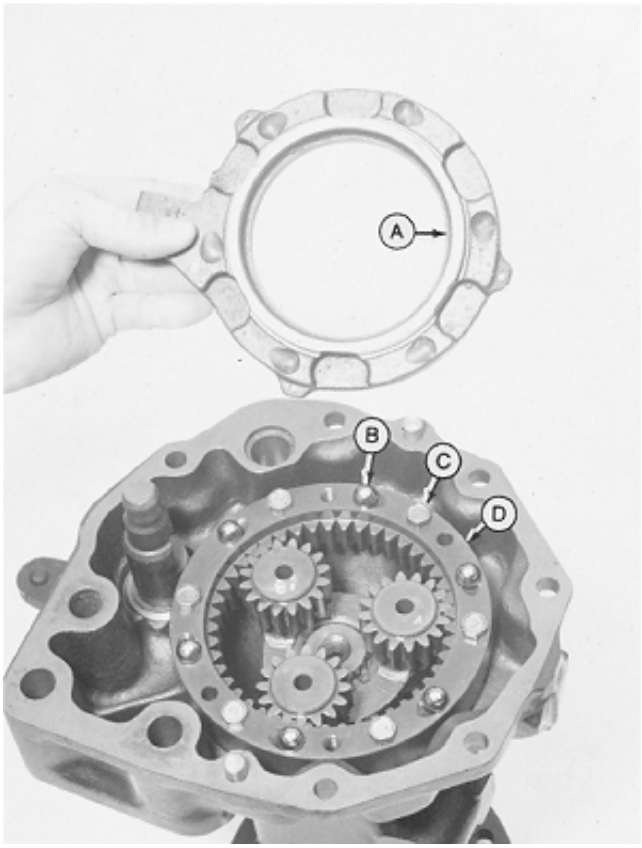
4. Apply thread lock and sealer (medium strength) on threads of cap screws.

5. Install and tighten six cap screws (C) to 26 N·m (230 lb-in.).

6. Install and apply grease to six balls (B).

7. Put actuator plate (A) in place.

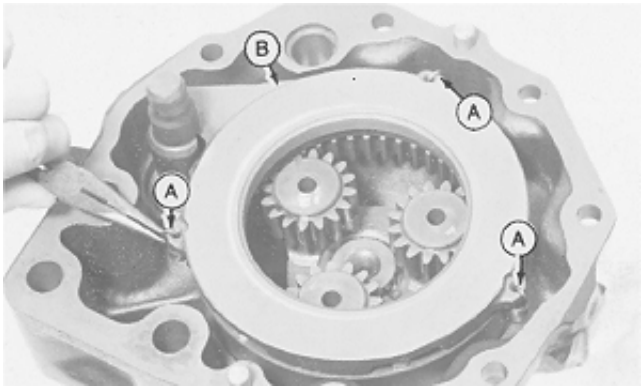
A—Actuator Plate
B—Steel Ball (6)
C—Cap Screw (6)
D—Ring Gear



M37978 -UN-29AUG88

EX,3325,5015,2 -19-24APR91

8. Install three springs (A) to hold actuator plate (B). Attach short hook of each spring to ring gear.



M37977 -UN-29AUG88

MX,5015HV,A12 -19-30NOV92

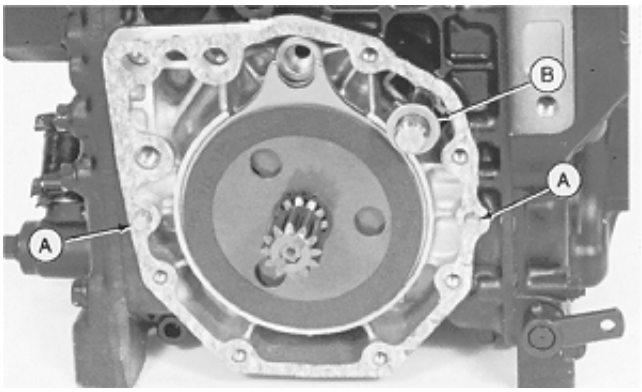
INSTALL FINAL DRIVE

1. Install the final drive pinion shaft with two brake plates and two brake disks alternately on differential housing.

2. Align the brake plate notches with the brake camshaft hole.

3. Install washer (B) on differential lock shaft (left side only).

4. Install dowels (A) and a new gasket on transaxle.



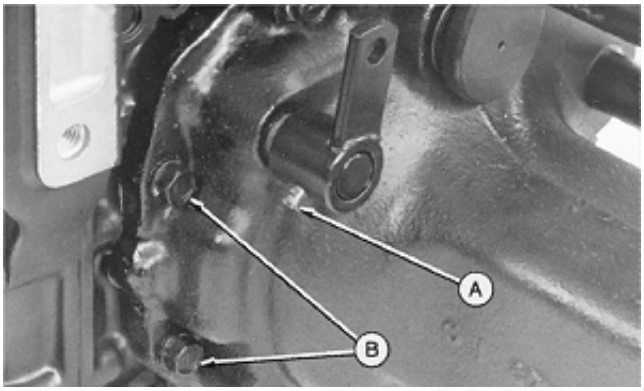
MX,5015HV,A13 -19-30NOV92

5. Align brake camshaft with notches on brake plates and install final drive assembly.

6. Fasten final drive with six cap screws (B). Tighten cap screws to 52 N·m (38 lb-ft).

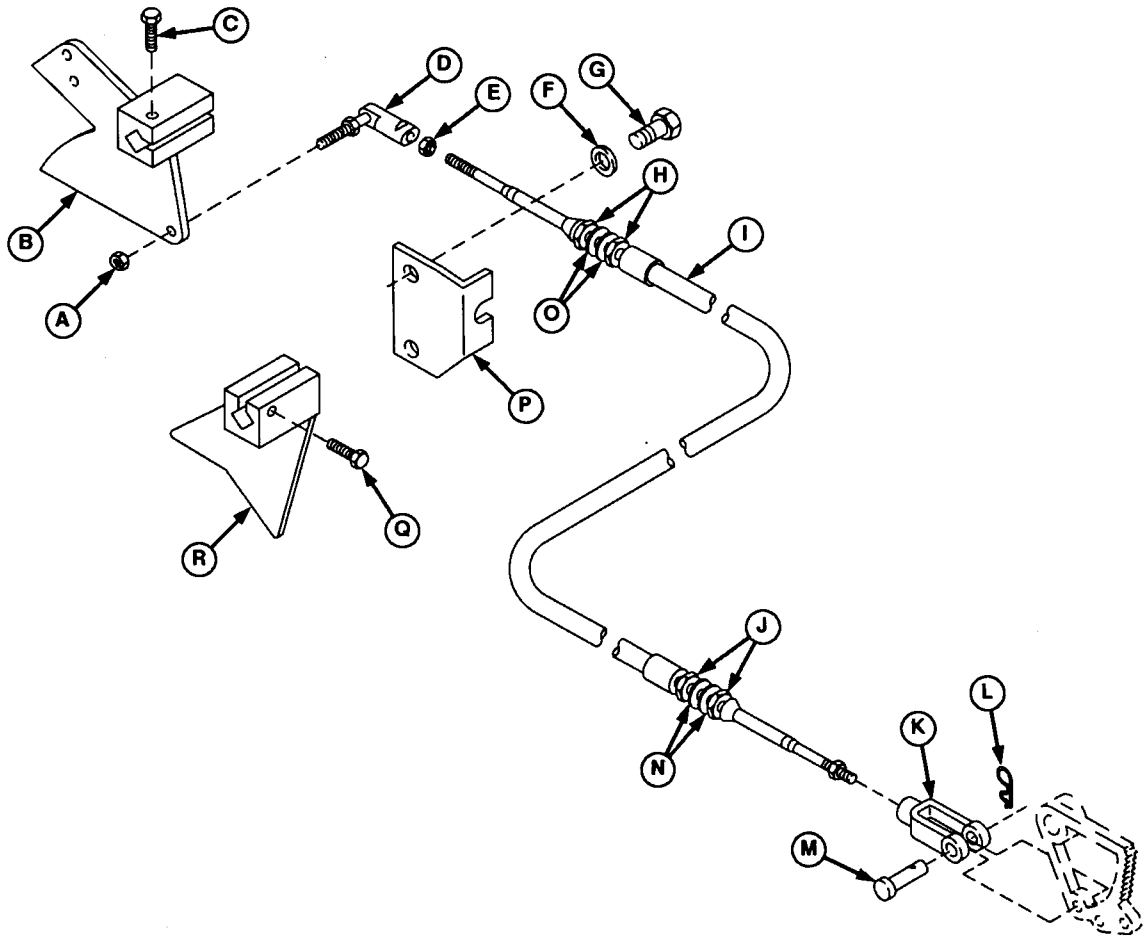
7. Install differential lock lever (right side only). Fasten it with a spring pin (A).

8. Install transaxle. (Refer to Section 50, Group 10.)



MX,5015HV,A14 -19-30NOV92

REPLACE FORWARD/REVERSE CABLE



M81432AE -UN-17NOV92

A—Lock Nut (S.N. 840001—) Nut (S.N. —840000) (2 used)
B—Neutral Return Cam (S.N. 840001—)
C—Cap Screw
D—Ball Joint
E—Nut
F—Washer
G—Cap Screw
H—Nut (2 used)
I—Forward/Reverse Cable
J—Nuts (2 used)
K—Yoke
L—Spring Locking Pin
M—Pin
N—Washer (2 used)
O—Washer (2 used)
P—Bracket
Q—Cap Screw
R—Neutral Return Cam (S.N. —840000)

1. Remove cable:

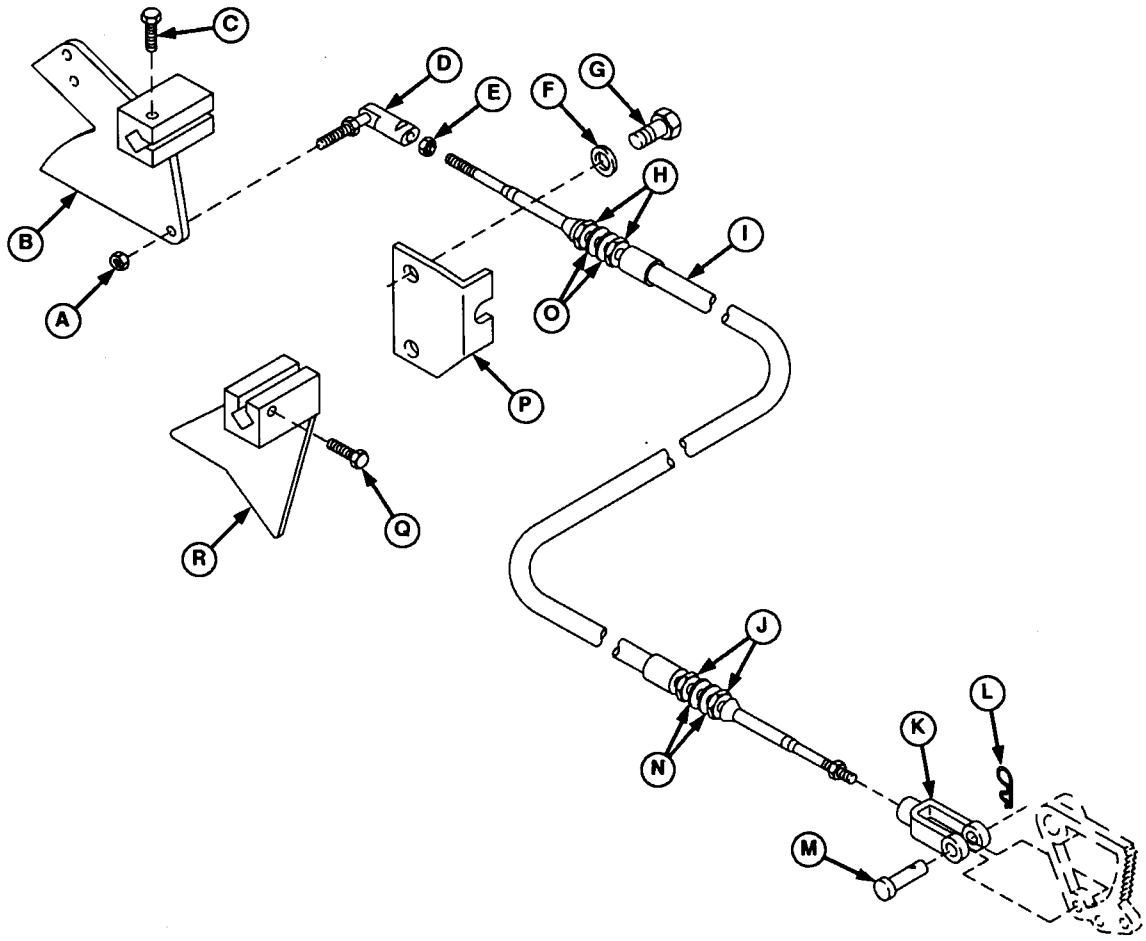
- Disconnect ball joint (D) from neutral return cam (B) (S.N. 840001—) or (R) (S.N. —840000).
- Disconnect yoke (K) from cruise control pivot arm.
- Loosen nuts (H and J). Remove cable assembly from machine by pulling cable forward through notch in frame.
- Remove ball joint and yoke from cable ends.

2. Inspect parts for wear or damage. Replace as necessary.

3. Install yoke and ball joint on new cable.

4. Inspect neutral return cam for wear or damage. Replace as necessary.

MX,5020HV,A1 -19-30NOV92



M81432AE -UN-17NOV92

A—Lock Nut (S.N. 840001—) Nut (S.N. —840000) (2 used)
B—Neutral Return Cam (S.N. 840001—)
C—Cap Screw
D—Ball Joint
E—Nut
F—Washer
G—Cap Screw
H—Nut (2 used)
I—Forward/Reverse Cable
J—Nuts (2 used)
K—Yoke
L—Spring Locking Pin
M—Pin
N—Washer (2 used)
O—Washer (2 used)
P—Bracket
Q—Cap Screw
R—Neutral Return Cam (S.N. —840000)

5. Install cable:

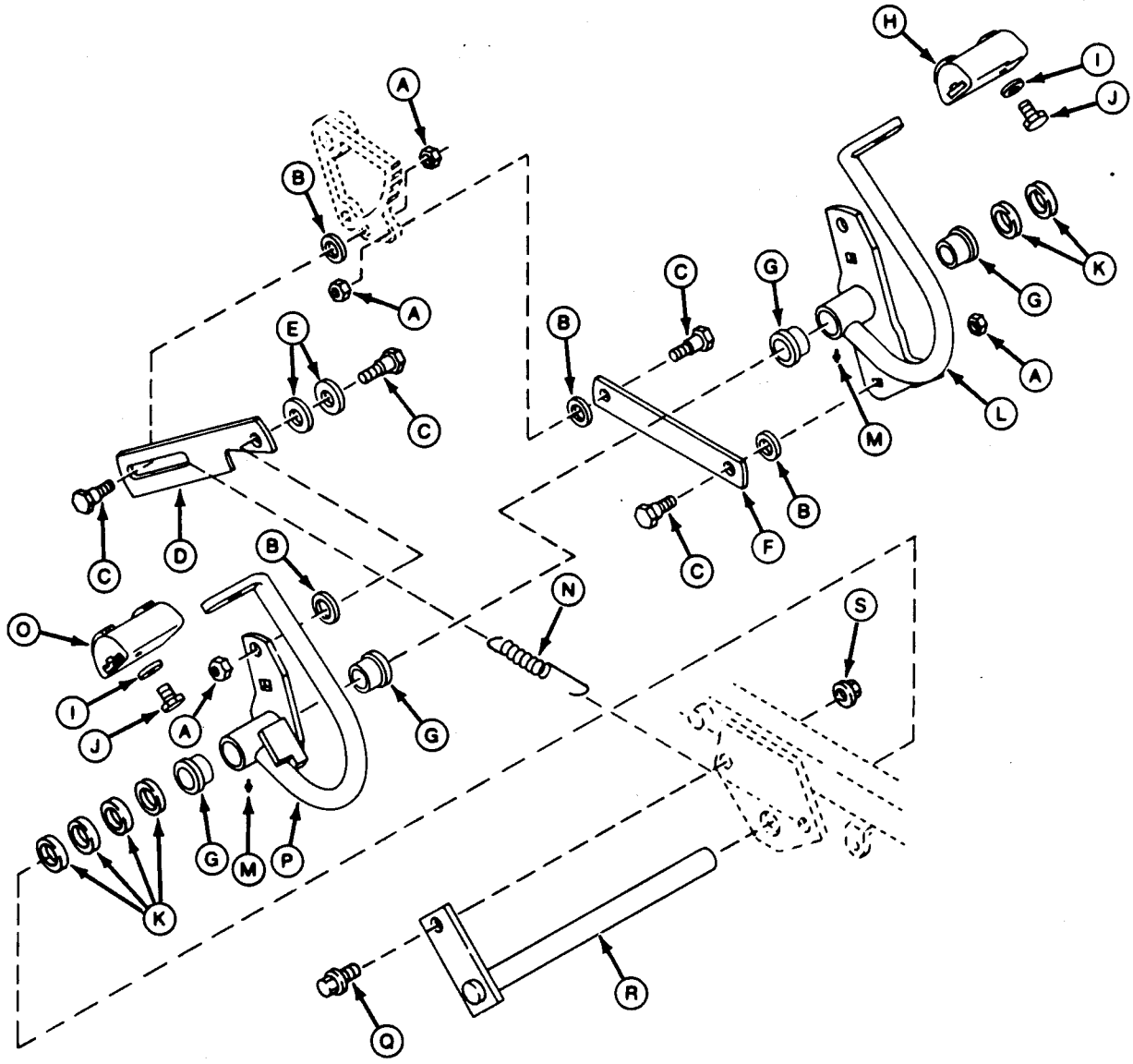
- Pull cable rearward through notch in frame. Route cable under transaxle pump and back towards transmission.
- Insert cable into slot in frame with nuts (J) and washers (N) on each side. Tighten nuts.
- Connect yoke (K) to cruise control pivot arm.
- Insert cable into slot in bracket (P) with nuts (H) and washers (O) on each side. Tighten nuts.
- Connect ball joint (D) to neutral centering cam.

6. Adjust pedal position. (See procedure in Section 250, Group 15.)

If necessary, adjust transmission for neutral.

MX,5020HV,A1A -19-30NOV92

INSPECT AND REPAIR FORWARD/REVERSE PEDALS



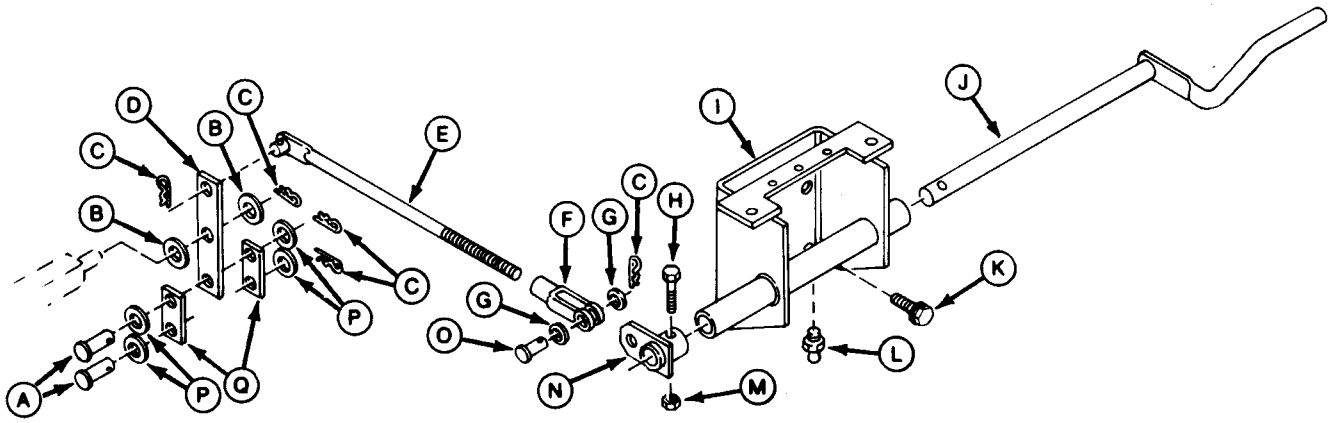
A—Lock Nut (4 used)
B—Washer (4 used)
C—Shoulder Bolt (4 used)
D—Link
E—Washer (2 used)
F—Strap
G—Bushing (4 used)
H—Pad
I—Washer (2 used)
J—Cap Screw (2 used)
K—Washer (6 used)
L—Pedal (Forward)
M—Lube Fitting
N—Spring
O—Pad
P—Pedal (Reverse)
Q—Cap Screw
R—Pin
S—Nut

1. Inspect parts for wear or damage. Replace as necessary.

2. Adjust pedal position. (See procedure in Section 250, Group 15.)

MX,5020HV,A3 -19-30NOV92

INSPECT AND REPAIR DIFFERENTIAL LOCK LINKAGE



M81434 -UN-17NOV92

A—Pin (2 used)
B—Washer (2 used)
C—Spring Locking Pin (5 used)
D—Strap
E—Rod
F—Yoke
G—Washer (2 used)
H—Cap Screw
I—Support
J—Pedal
K—Cap Screw (4 used)
L—Lube Fitting
M—Lock Nut
N—Arm
O—Pin
P—Washer (4 used)
Q—Strap (2 used)

50 20 4

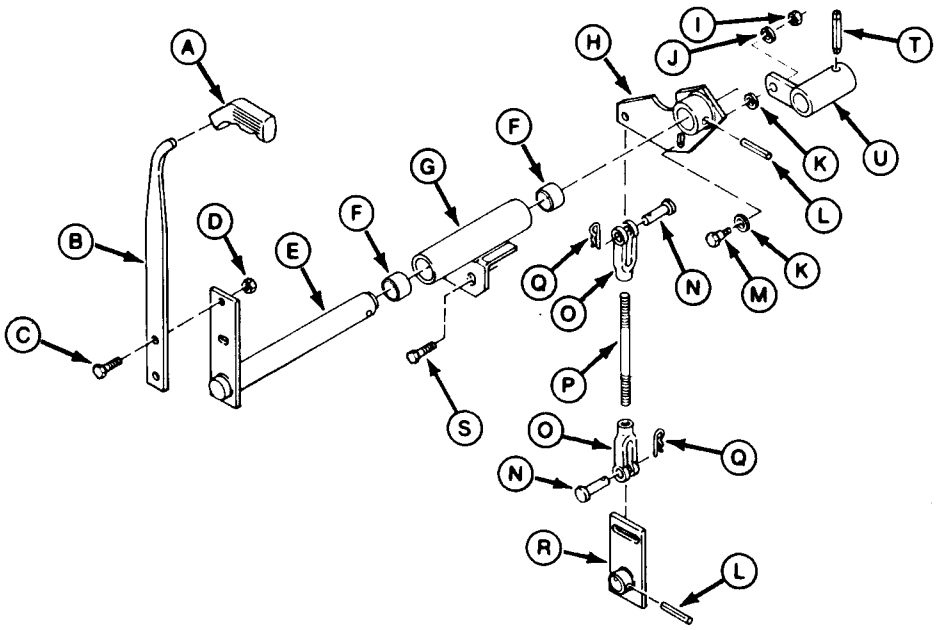
1. Remove kick panel.

2. Inspect parts for wear or damage. Replace as necessary.

3. Adjust differential lock pedal. (See procedure in Section 250, Group 15.)

MX,5020HV,A4 -19-30NOV92

INSPECT AND REPAIR PTO LEVER AND LINKAGE—S.N. —840000



M81435 -UN-17NOV92

A—Grip
B—Lever
C—Cap Screw (2 used)
D—Flange Nut (2 used)
E—Shaft w/Lever
F—Bushing (2 used)
G—Support
H—Arm
I—Lock Nut
J—Washer
K—Washer
L—Spring Pin
M—Shoulder Bolt
N—Pin (2 used)
O—Yoke (2 used)
P—Stud
Q—Spring Locking Pin
R—Arm
S—Cap Screw (2 used)
T—Spring Pin
U—Arm

1. Remove kick panel.

2. Inspect parts for wear or damage. Replace as necessary.

3. Adjust PTO lever. (See procedure in Section 250, Group 15.)

4. Adjust PTO lever interlock. (See procedure in Section 250, Group 15.)

MX,5020HV,A5 -19-30NOV92

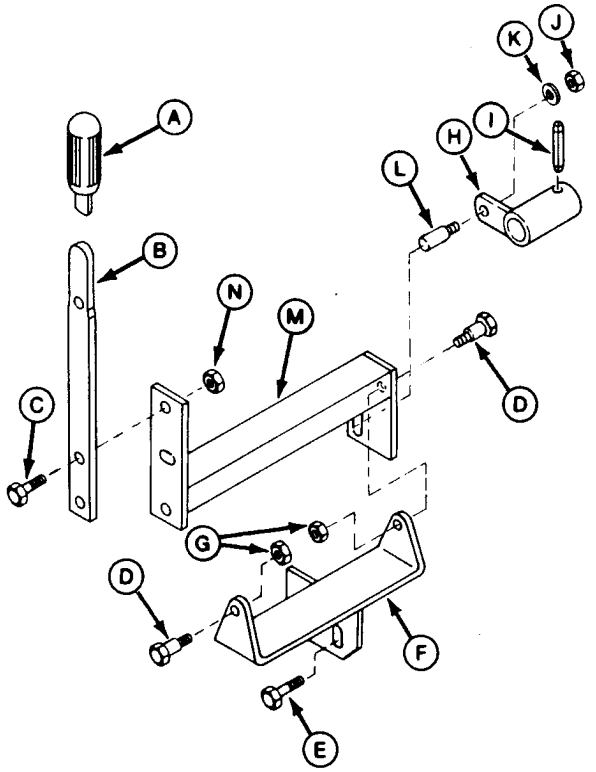
INSPECT AND REPAIR PTO LEVER AND LINKAGE—S.N. 840001—

1. Remove kick panel.

2. Inspect parts for wear or damage. Replace as necessary.

3. Adjust PTO lever. (See procedure in Section 250, Group 15.)

A—Knob
B—Lever
C—Cap Screw (2 used)
D—Shoulder Bolt (2 used)
E—Cap Screw (2 used)
F—Support
G—Lock Nut (2 used)
H—Arm
I—Spring Pin
J—Lock Nut
K—Washer
L—Stud
M—Arm
N—Flange Nut (2 used)



M81436 -UN-17NOV92

MX,5020HV,A6 -19-30NOV92

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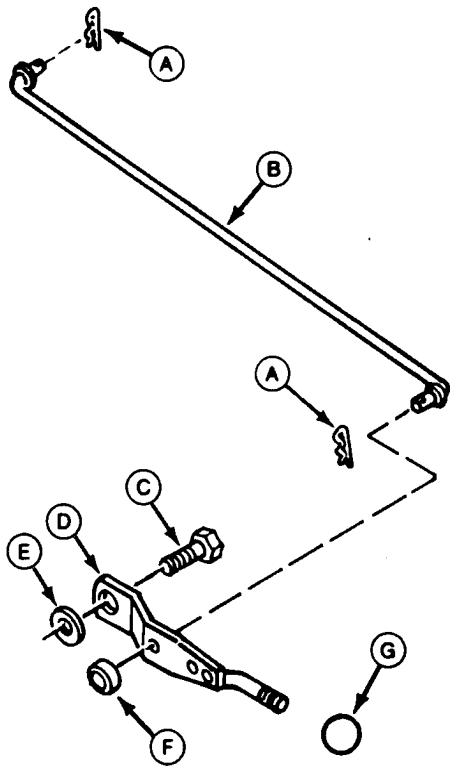
INSPECT AND REPAIR TWO-SPEED AXLE LEVER AND LINKAGE

1. Remove kick panel and top left access panel.

2. Inspect parts for wear or damage. Replace as necessary.

3. Adjust two-speed axle lever. (See procedure in Section 250, Group 15.)

A—Spring Locking Pin (2 used)
B—Link
C—Cap Screw
D—Lever
E—Washer
F—Washer
G—Knob



M81437 -UN-17NOV92

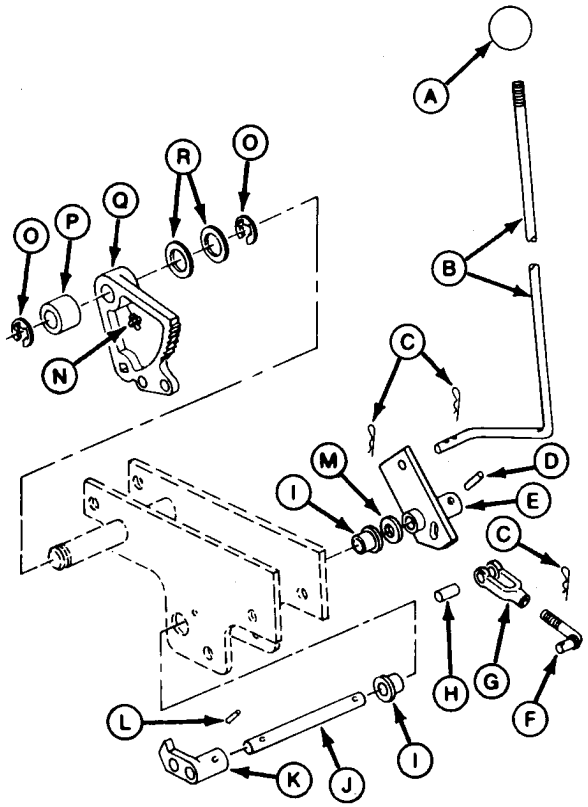
MX,5020HV,A7 -19-30NOV92

INSPECT AND REPAIR CRUISE CONTROL LINKAGE

1. Inspect parts for wear or damage. Replace as necessary.

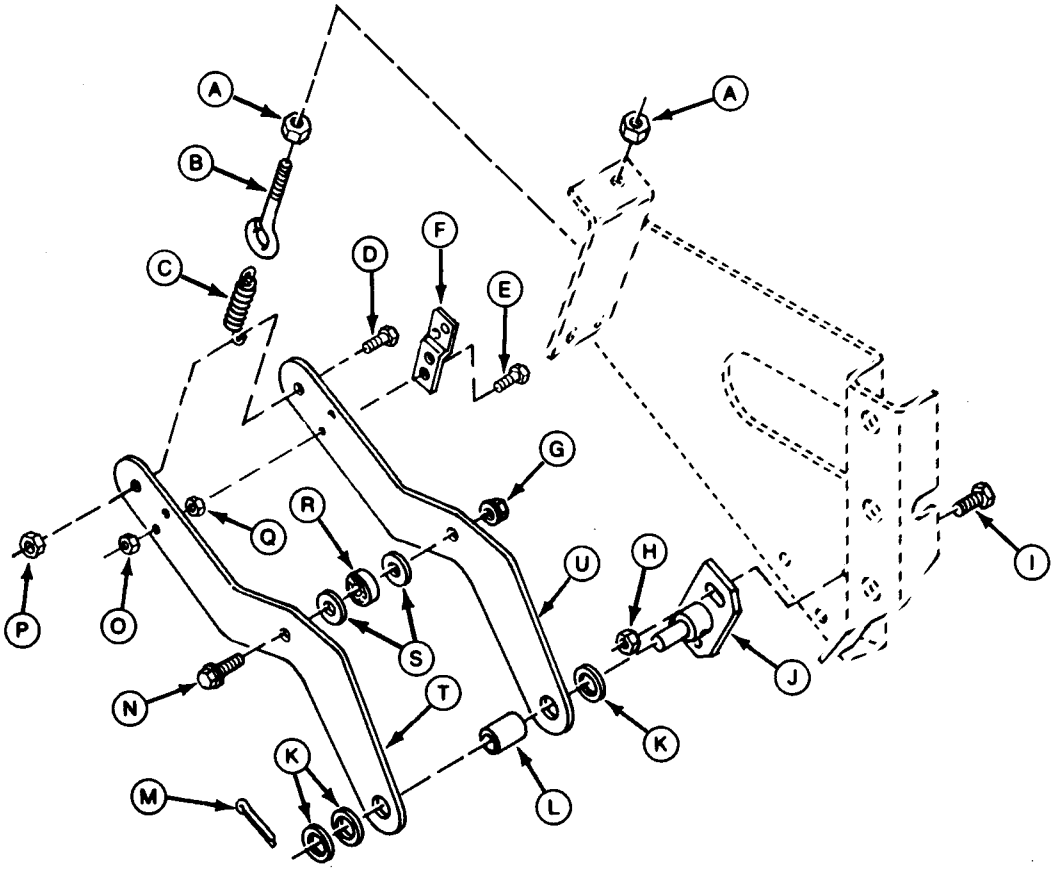
2. Adjust cruise control lock. (See procedure in Section 250, Group 15.)

A—Knob
B—Lever
C—Spring Locking Pin (3 used)
D—Spring Pin
E—Arm
F—Link
G—Yoke
H—Pin
I—Bushing (2 used)
J—Shaft
K—Pawl
L—Spring Pin
M—Washer
N—Lube Fitting
O—Retaining Ring (2 used)
P—Bushing
Q—Pivot
R—Washer (2 used)



MX,5020HV,A8 -19-30NOV92

INSPECT AND REPAIR NEUTRAL CENTERING ASSEMBLY—S.N. —840000



M81439 -UN-17NOV92

A—Nut (2 used)
B—Eyebolt
C—Spring
D—Cap Screw
E—Cap Screw (2 used)
F—Support
G—Nut
H—Nut (2 used)
I—Cap Screw (2 used)
J—Support
K—Washer (3 used)
L—Bushing
M—Cotter Pin
N—Cap Screw
O—Lock Nut
P—Lock Nut
Q—Nut
R—Ball Bearing
S—Washer (2 used)
T—Arm
U—Arm

1. Inspect parts for wear or damage. Replace as necessary.

2. Adjust length of spring (C) to approximately 133 mm (5.2 in.).

3. Adjust neutral start microswitches. (See procedure in Section 240, Group 15.)

MX,5020HV,A9 -19-30NOV92

INSPECT AND REPAIR NEUTRAL CENTERING LEVER—S.N. 840001—

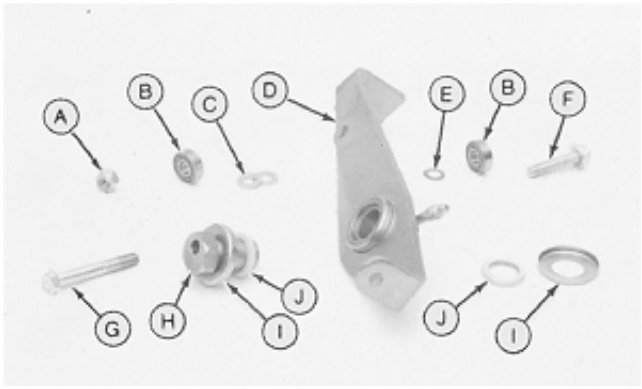
1. Release spring tension on neutral centering lever.

2. Inspect parts for wear or damage. Replace as necessary.

3. If installing new bushing, make sure hole in bushing aligns with lube fitting hole in lever.

Ream inside of bushing to 19.063—19.113 mm (0.7505—0.7525 in.) diameter.

4. Adjust length of neutral return spring to approximately 216 mm (8.5 in.), hook-to-hook.



M43679 -UN-31AUG88

A—Lock Nut
B—Roller (2 used)
C—Washer (2 used)
D—Neutral Centering Lever
E—Thin Washer
F—Short Cap Screw
G—Long Cap Screw
H—Eccentric Pivot
I—Seal Cover (2 used)
J—Felt Seal (2 used)

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MX,5020HV,A10 -19-30NOV92

Section 60
STEERING AND BRAKE REPAIR

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SERVICE EQUIPMENT AND TOOLS

NOTE: Order tools from your SERVICE-GARD™ catalog. Some tools may be available from a local supplier.

Name	Use
Feeler Gauge	Measure rotor-to-stator clearance
13-Ton Puller Set	Remove steering tube bushing
Bushing, Bearing and Seal Driver Set	Install steering tube bushing
0.18 mm (0.007 in.) Shim Stock	Align Commutator ring with drive plate

M21,6005R,1 -19-01MAR90

FABRICATED TOOLS

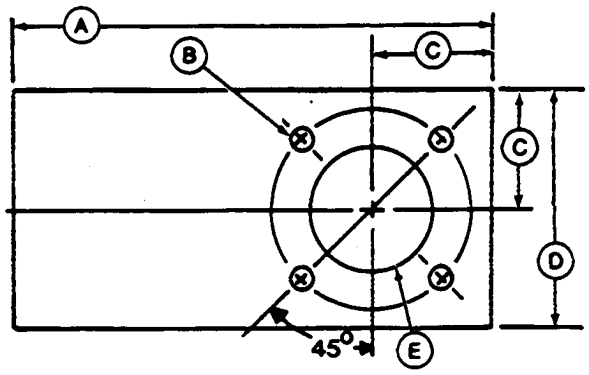
STEERING VALVE FIXTURE

Steering valve fixture is used to hold steering valve.

Material required: One piece of 5 x 102 x 203 mm (3/16 x 4 x 8 in.) 1020 mild steel flat stock.

Holes (B) are equally spaced on an 83 mm (3-1/4 in.) diameter circle.

A—203 mm (8.0 in.)
B—9.5 mm (3/8 in.)
C—51 mm (2.0 in.)
D—102 mm (4.0 in.)
E—51 mm (2.0 in.) Diameter Hole



M36877 -UN-28APR89

EX,2243,6005,2 -19-08MAR91

OTHER MATERIAL

Number	Name	Use
T43511	John Deere LOCTITE® Clean and Cure Primer	Clean Threads
TY9369	John Deere LOCTITE Thread Lock and Sealer (Low Strength)	Retain metering assembly screws

LOCTITE is a trademark of the Loctite Corp.

M21,6005R,3 -19-01MAR90

SPECIFICATIONS

Item	Measurement	Specification
Rotor-to-stator clearance	Maximum allowable clearance	0.08 mm (0.003 in.)
Steering tube to bushing	Top of tube to bushing	2.5 mm (.01 in.)
Metering assembly screws	Torque	1.4 N·m (12 lb-in.)
Commutator ring and drive plate TIR	Maximum allowable TIR	0.13 mm (0.005 in.)
Port cover nuts	Torque	30 N·m (266 lb-in.)
Check Ball Plug	Torque	14 N·m (124 lb-in.)
Steering wheel nut	Torque	15 N·m (11 lb-ft)
Relief Valve	Pressure	10497 + 500 - 0 kPa (1522.5 + 72.5 - 0 psi)

EX,3325TM,CG480-19-24APR91

REMOVE STEERING VALVE

1. Park mower safely.

2. Turn steering wheel back and forth several times and move hydraulic control lever back and forth several times to relieve hydraulic pressure from the system.

3. Remove steering wheel cap and nut (A).

IMPORTANT: DO NOT hammer on end of steering shaft or damage to steering valve or shaft will occur.

4. Lift steering wheel off shaft.



M81373 -UN-03NOV92

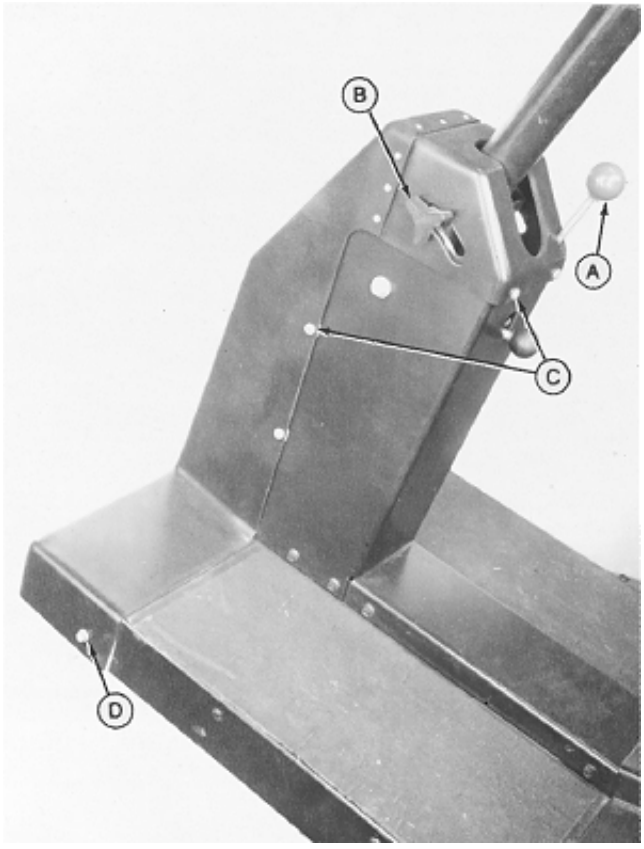
MX,6005HV,A1 -19-30NOV92

5. Remove cruise control knob (A).

6. Remove steering wheel tilt knobs, lock washers, and bolts (B).

7. Remove six cap screws (C) and two cap screws (D). Lift off cover.

A—Cruise Control Knob
B—Steering Wheel Tilt Knob
C—Screw (6 used)
D—Cap Screw (2 used)



E35458 -UN-12DEC90

MX,6005HV,A2 -19-30NOV92

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05
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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.

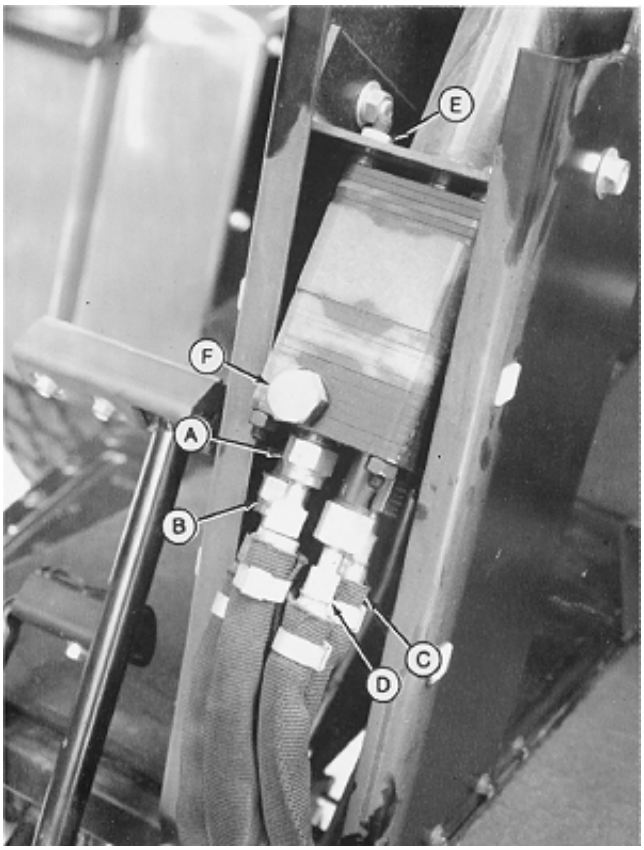
IMPORTANT: Crimped hose clamps are not reusable. Replace with a 5/8 in. adjustable clamp.

8. Disconnect four hydraulic lines (A—D). Close all openings with caps and plugs to keep dirt out of the hydraulic system. Tag each line and fitting for identification when installing.

NOTE: To aid in installation, note that relief valve plug (F) is toward front of machine.

9. Remove four nuts (E) to remove steering valve.

A—Pressure Line From Priority Valve
B—Return Line
C—Head End Line of Steering Cylinder
D—Rod End Line of Steering Cylinder
E—Nut (4 used)
F—Relief Valve Plug



E35459 -UN-12DEC90

MX,6005HV,A2A -19-30NOV92

60 05 4

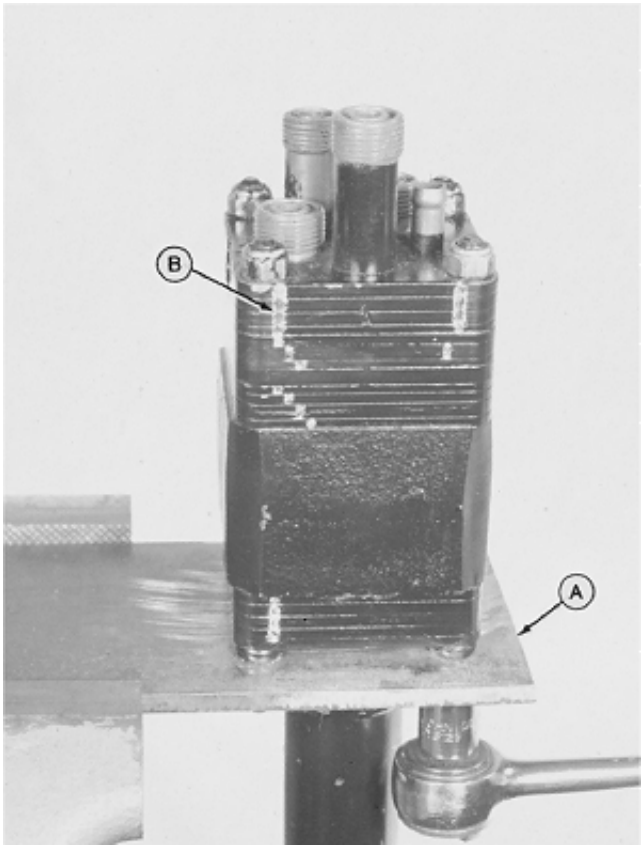
DISASSEMBLE CONTROL VALVE SECTION

IMPORTANT: Do not hold steering valve in a vise during disassembly. Steering valve can be damaged. Disassemble steering valve in a clean work area.

1. Install power steering valve, with steering column down, in steering valve fixture (A). Fasten valve to fixture using four 5/16-24 UNF nuts.

NOTE: Check position of alignment grooves (B) in valve body to aid in assembly.

2. Loosen relief valve plug one turn.



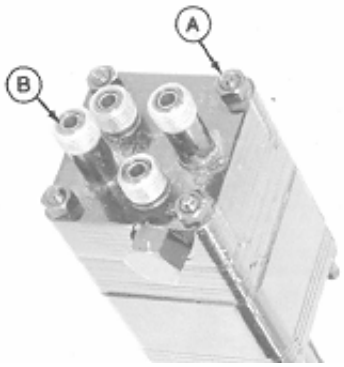
M36831 -UN-29AUG88

2E6,6005G,4A -19-24APR91

IMPORTANT: Do not damage fittings during nut removal. Do not nick or scratch the machined surfaces of the steering valve.

3. Remove nuts (A) to remove port cover assembly (four plates bonded together).

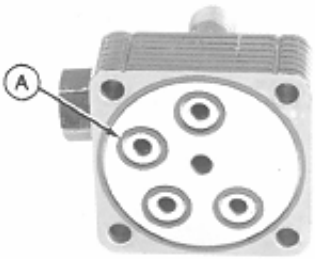
4. Replace O-rings (B).



M47344 -UN-27FEB92

MX,6005HV,A3 -19-30NOV92

5. Remove seal ring and four O-rings (A).

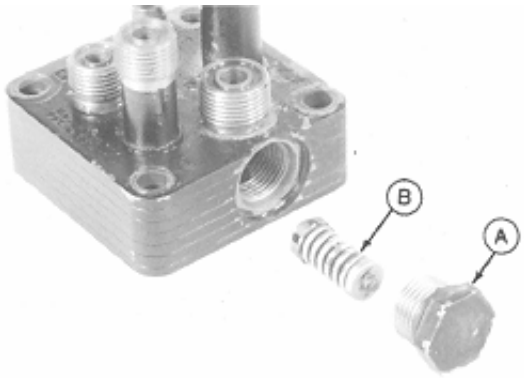


M47345 -UN-27FEB92

MX,6005HV,A4 -19-30NOV92

6. Remove plug (A) and relief valve assembly (B).

7. Inspect port cover for scratches on machined surfaces or damage to fittings. Replace cover if damaged.



M47356 -UN-27FEB92

MX,6005HV,A5 -19-30NOV92

NOTE: Port manifold has three springs which may come loose during disassembly.

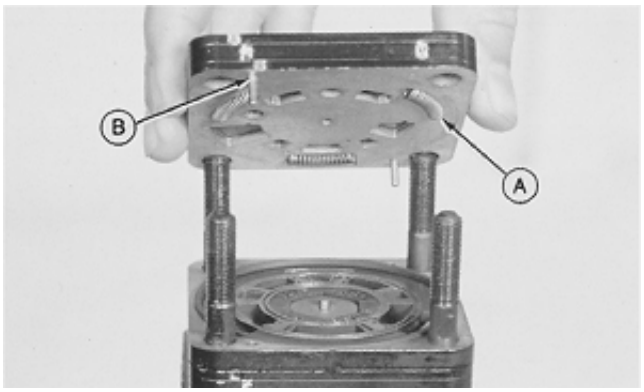
8. Carefully remove port manifold (three plates bonded together).

IMPORTANT: Do not interchange springs. The steering valve has two sets of springs. Keep springs with respective manifold.

9. Remove three springs (A).

NOTE: If one spring is damaged, all six springs in valve must be replaced.

10. Inspect springs and pins (B) for distortion, wear, or damage.

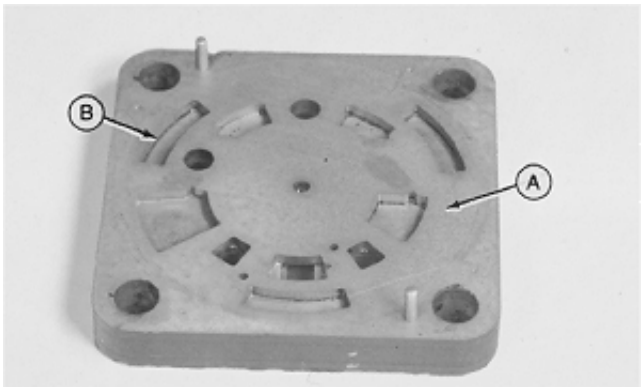


-UN-29AUG88
M36836

MX,6005HV,A6 -19-30NOV92

11. Inspect port manifold machined surfaces (A) for scratches or scoring. A polished pattern from the rotation of the valve plate and hex drive assembly is normal. All edges (B) must be sharp, free of nicks and burrs.

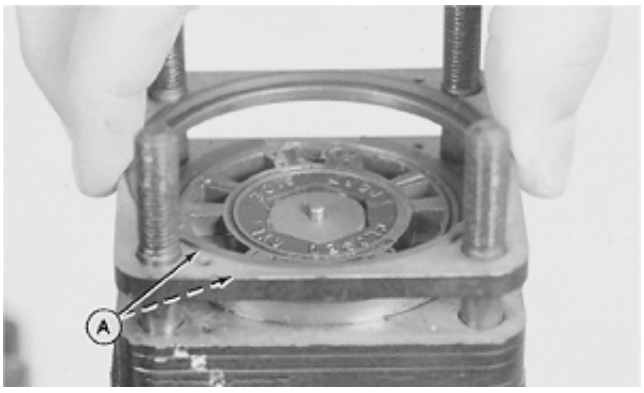
NOTE: Scoring is indicated by fine scratches or grooves cut into the manifold. When these scratches can be detected by feel with finger nail or lead pencil, the manifold should be replaced.



-UN-29AUG88
M36837

MX,6005HV,A7 -19-30NOV92

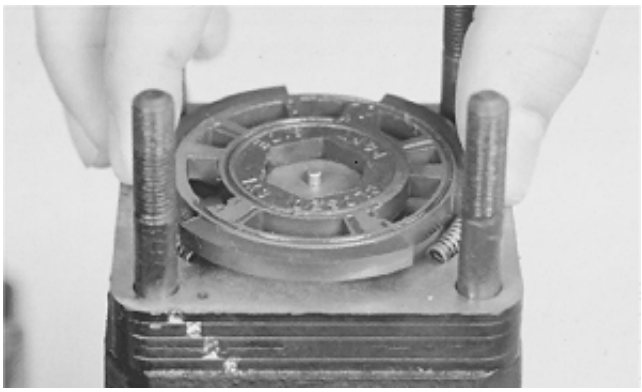
12. Remove the valve ring and two seal rings (A). Check valve ring for nicks and scoring. If the valve ring is damaged, it must be replaced.



-UN-29AUG88
M36838

MX,6005HV,A8 -19-30NOV92

13. Remove valve plate. Inspect the slots and ground surfaces for nicks or wear. If the valve plate is scored or the edges are not sharp, the valve plate and valve ring both must be replaced.

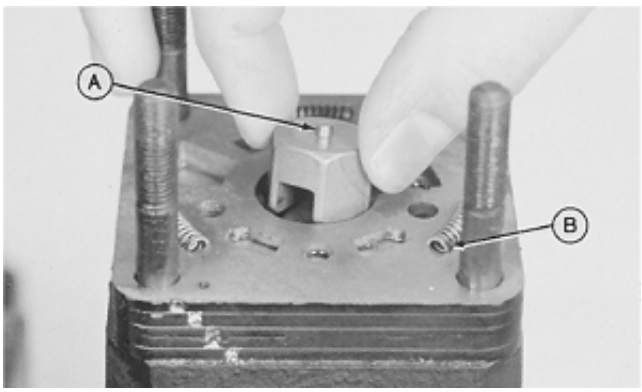


MX,6005HV,A9 -19-30NOV92

14. Remove and inspect hex drive assembly. Check sides and slot for wear, grooves, or scoring. Pin (A) should be tight and show no wear or damage.

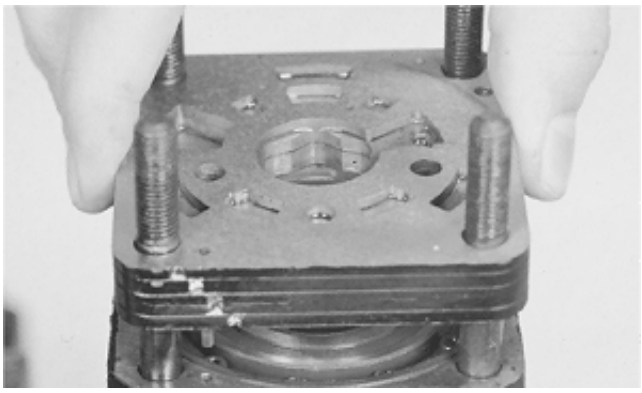
15. Remove three springs (B).

16. Inspect springs for broken coils, wear, or damage.



MX,6005HV,A10 -19-30NOV92

17. Remove the isolation manifold (four plates bonded together). Check manifold surface, holes and edges for nicks, or unusual wear. A polished pattern from the rotation of the valve plate and commutator cover is normal.

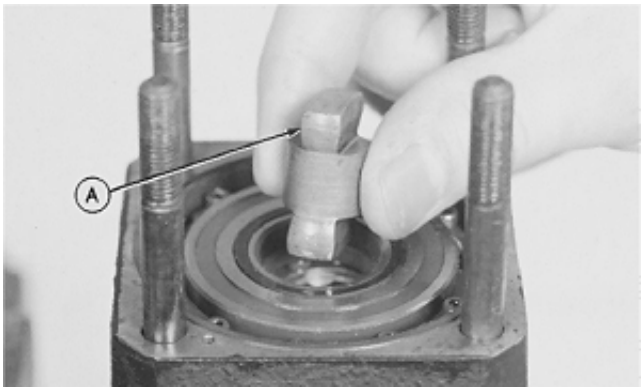


MX,6005HV,A11 -19-30NOV92

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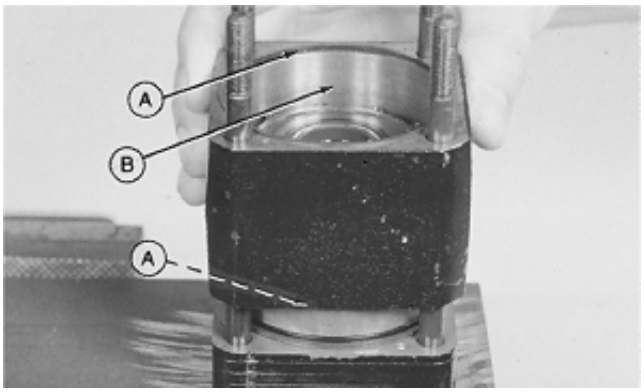
DISASSEMBLE METERING SECTION

1. Remove drive link. Check the four crowned surfaces (A) for wear or scoring.



EX1,6005R,22 -19-24APR91

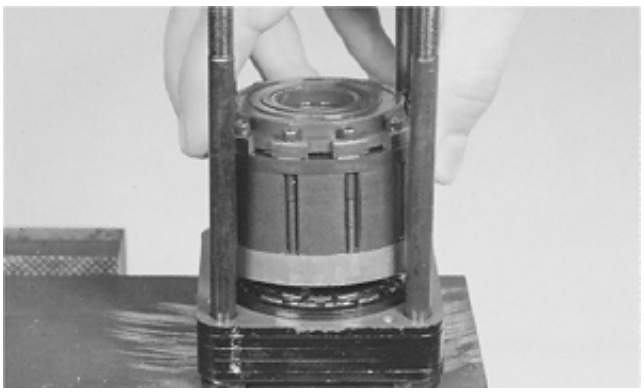
2. Remove metering ring and upper and lower seals (A). If the bore (B) is scored, the metering ring must be replaced.



EX1,6005R,23 -19-29MAY90

IMPORTANT: Do not clamp metering assembly in a vise.

3. Remove metering assembly. Put assembly on a clean surface.

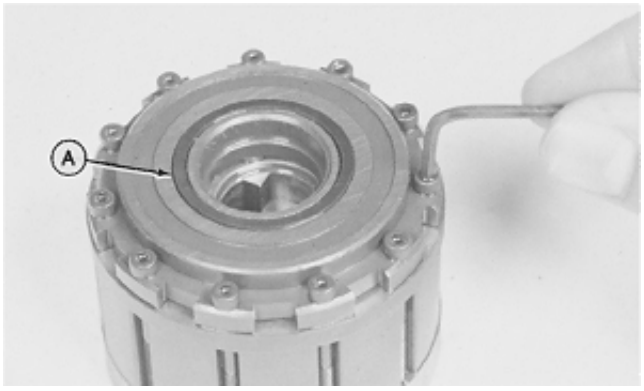


EX1,6005R,24 -19-29MAY90

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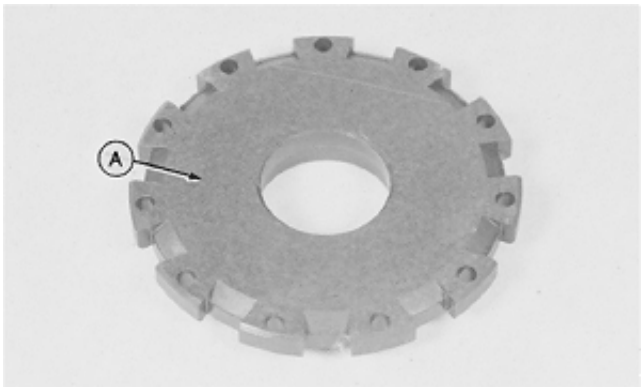
4. Remove commutator seal (A).

5. Remove 11 screws to remove commutator cover. Inspect screws for damage and replace if necessary.



EX1,6005R,25 -19-29MAY90

6. Check commutator cover machined surface (A) for nicks, burrs, scoring, or unusual wear. A polished pattern due to rotation of the commutator is normal.

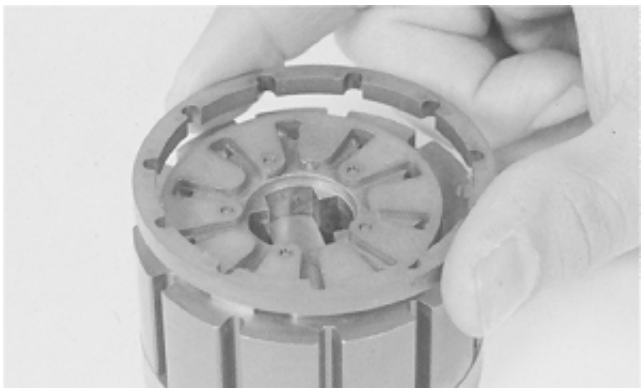


EX1,6005R,26 -19-29MAY90

IMPORTANT: Handle commutator ring with care; it is easily broken.

7. Remove commutator ring and inspect for wear, burrs, cracks, or scoring.

NOTE: The commutator ring and commutator are a matched set. If either is worn or damaged, both must be replaced.



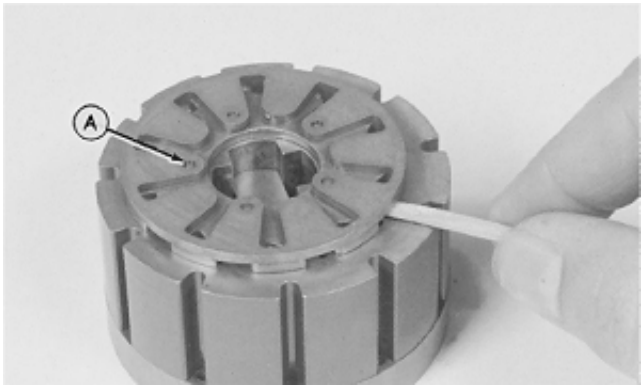
EX1,6005R,27 -19-29MAY90

IMPORTANT: DO NOT use a screwdriver to remove commutator. Commutator can be damaged.

8. Remove commutator and five pins (A) using a wood dowel or equivalent.

NOTE: The commutator is made up of two plates bonded together. It is a permanent assembly and cannot be disassembled.

9. Check commutator machined surface, holes and edges for nicks. Edges must be sharp.

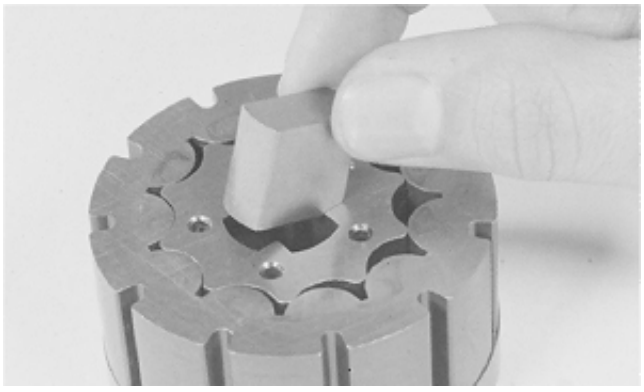


EX1,6005R,28 -19-29MAY90

10. Remove drive link spacer. Check spacer for grooves, wear, or damage.

11. The rotor should rotate and orbit freely within the stator. Check commutator side of stator face for grooves or scoring.

NOTE: Stator and rotor are a matched set. If either is worn or damaged, both must be replaced.



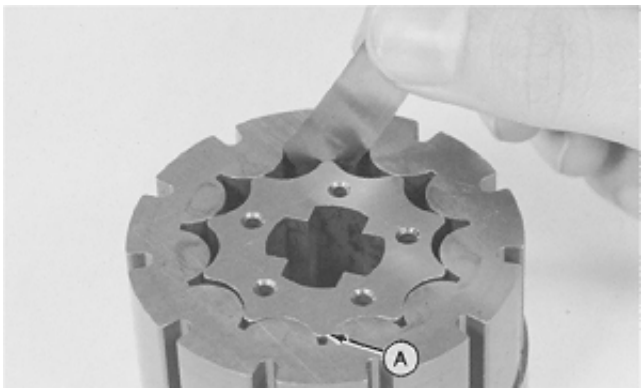
EX1,6005R,29 -19-29MAY90

12. Measure rotor-to-stator clearance. Center rotor lobe (A) between stator lobes and check clearance directly opposite lobe (A).

ROTOR-TO-STATOR SPECIFICATIONS

Maximum allowable clearance . . . . . 0.08 mm (0.003 in.)

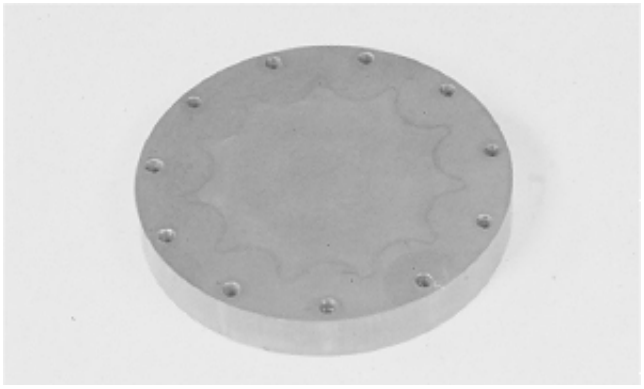
If rotor clearance exceeds 0.08 mm (0.003 in.), replace rotor and stator.



EX1,6005R,30 -19-15JUN90

13. Lift the rotor and stator from the drive plate. Check the drive plate side of the rotor assembly for nicks, grooves, or scoring.

A spiral pattern due to rotor movement is normal.

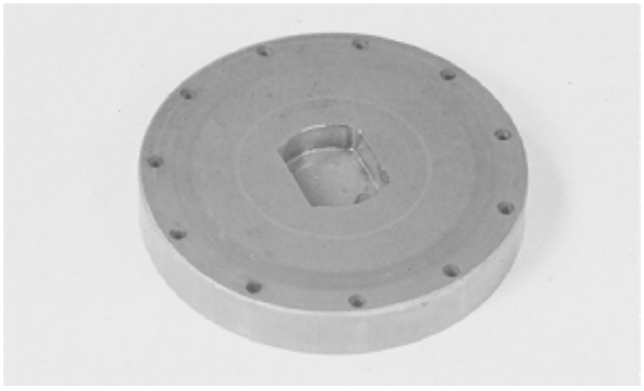


EX1,6005R,31 -19-29MAY90

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14. The thrust bearing side of the plate should also show a normal wear pattern without grooves, flaking, or dents.

15. The flat sides of the input shaft hole should not be grooved or worn.



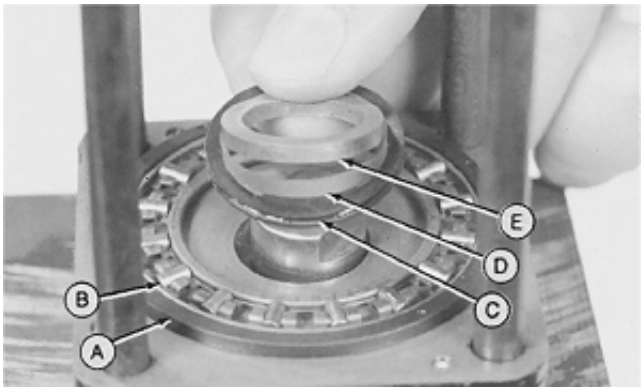
EX1,6005R,32 -19-29MAY90

16. Remove parts (A—E).

Inspect bearing for broken or missing rollers, metal flakes, or dents.

Check seal spacer and bearing spacer for wear or damage.

A—Thrust Bearing Spacer
B—Thrust Bearing
C—Face Seal
D—Back-Up Ring
E—Seal Spacer



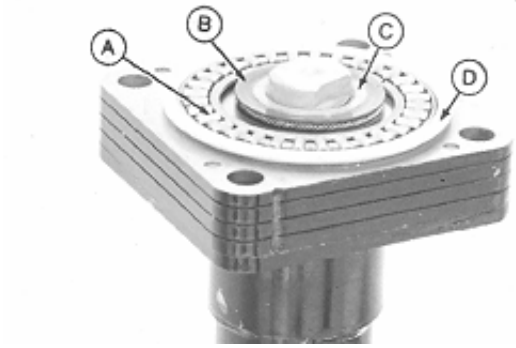
EX1,6005R,33 -19-29MAY90

16. Remove parts (A-D).

Inspect bearing for metal flakes, pitting, or dents.

Check seal spacer and bearing spacer for wear or damage.

A—Thrust Bearing
B—Seal
C—Back-Up-Ring
D—Bearing Spacer

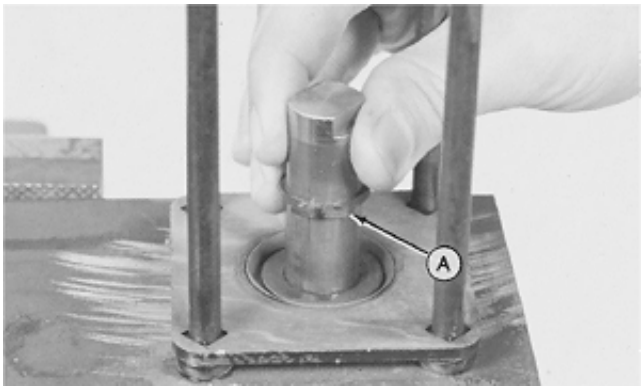


M47347 -UN-03MAR92

MX,GU,6005,30 -19-26MAR92

2. Remove steering shaft and snap ring (A).

3. Inspect steering, shaft serrations, threads, and flats for grooves, wear, or damage.

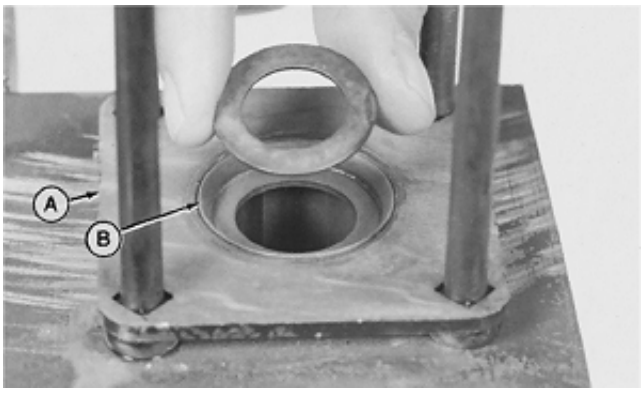


M36855 -UN-29AUG88

EX1,6005R,35 -19-29MAY90

4. Remove washer and steering tube (A).

NOTE: Steering tube and retaining plate (B) are a matched set. It either part is worn or damaged, both must be replaced.



M36856 -UN-29AUG88

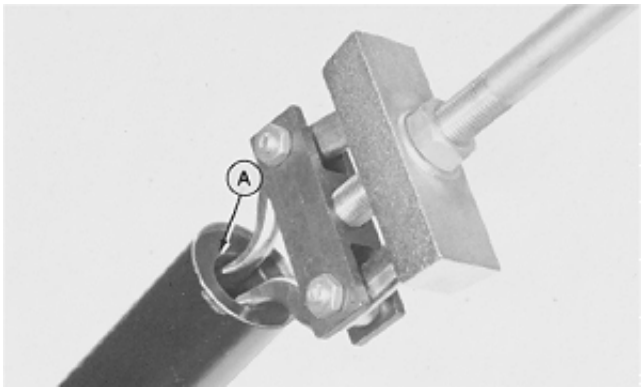
EX1,6005R,36 -19-29MAY90

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IMPORTANT: Hold steering tube in a soft-jaw vise. Be careful not to crush steering tube.

5. Inspect bushing (A) for wear or damage. If bushing replacement is necessary, straighten crimped area of steering tube using a punch.

6. Remove bushing using a 2-jaw puller and slide hammer.

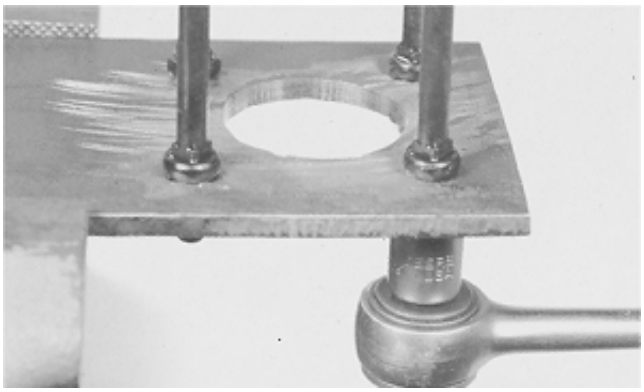


M36857 -UN-29AUG88

EX1,6005R,37 -19-29MAY90

7. Remove nuts holding the four bolts to the fixture, and remove the bolts.

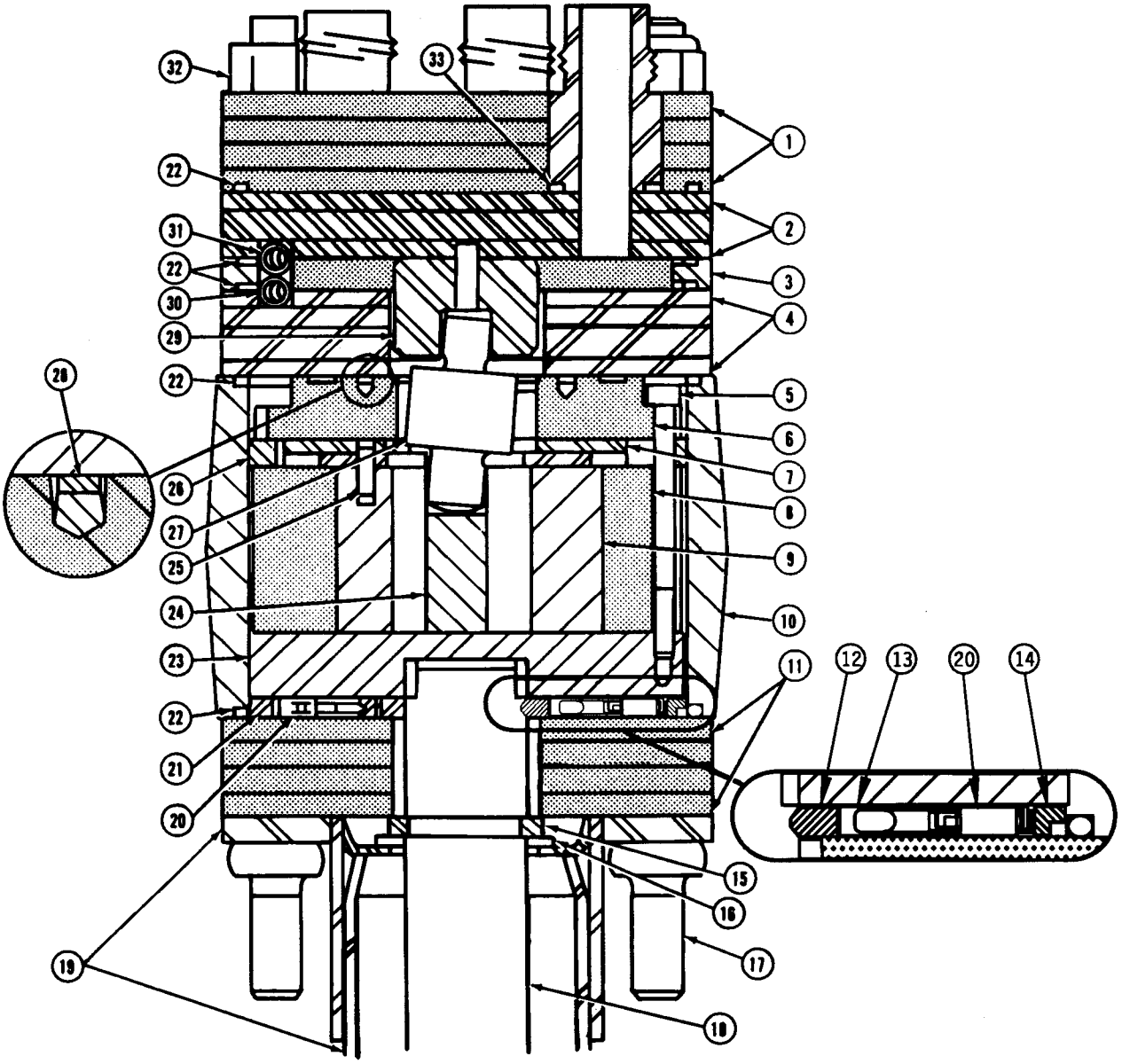
Check bolt threads for wear or damage.



M36858 -UN-29AUG88

EX1,6005R,38 -19-29MAY90

CROSS-SECTION VIEW—STEERING VALVE



1—Port Cover
2—Port Manifold
3—Valve Assembly
4—Isolation Manifold
5—Cap Screw (11 used)
6—Commutator Cover
7—Commutator
8—Stator
9—Rotor
10—Metering Ring
11—Upper Cover Plate
12—Seal Spacer
13—Seal
14—Bearing Spacer
15—Snap Ring
16—Washer
17—Bolt (4 used)
18—Steering Shaft
19—Steering Tube
20—Thrust Bearing
21—Trust Bearing Spacer
22—Seal Ring (5 used)
23—Drive Plate
24—Drive Link Spacer
25—Alignment Pin (9 used)
26—Commutator Ring
27—Drive Link
28—Commutator Seal
29—Hex Drive Assembly
30—Spring (3 used)
31—Spring (3 used)
32—Nut (4 used)
33—O-Ring (5 used)

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-UN-03MAR92

M47348

MX,GU,6005,36 -19-30NOV92

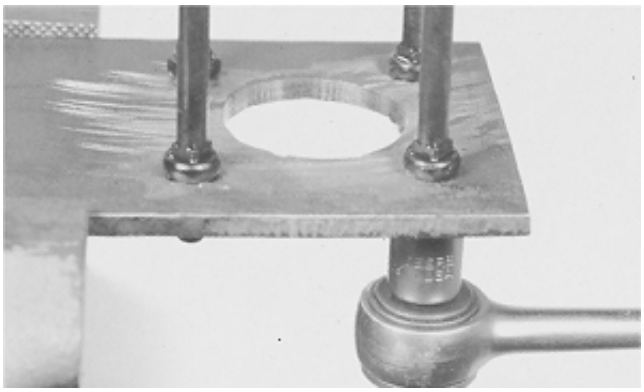
ASSEMBLE STEERING TUBE SECTION

1. Thoroughly clean and dry all parts.

2. Use a seal kit when assembling the steering valve.

3. Put clean hydrostatic oil on internal parts as they are assembled.

4. Install four bolts, with short threaded end down, in fixture. Install nuts.

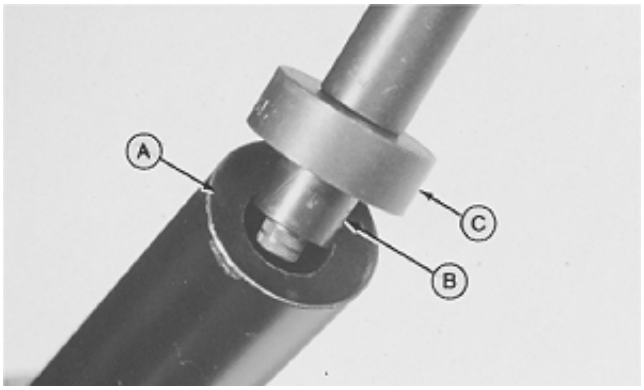


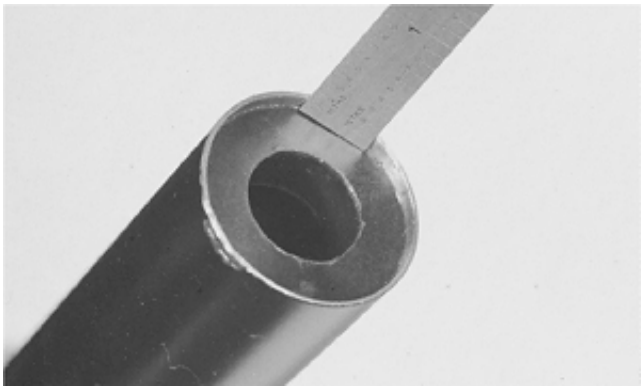
MX,6005HV,A12 -19-30NOV92

5. Install bearing (A) with recesses away from driver using a 3/4 in. driver disk (B) and a 1-3/8 in. driver disk (C). Push bushing down until it is 2.5 mm (0.1 in.) below top of steering tube.

6. Slightly bend the end of the steering tube over the bushing using a punch.

7. Apply clean multi-purpose grease on the inside of bushing.



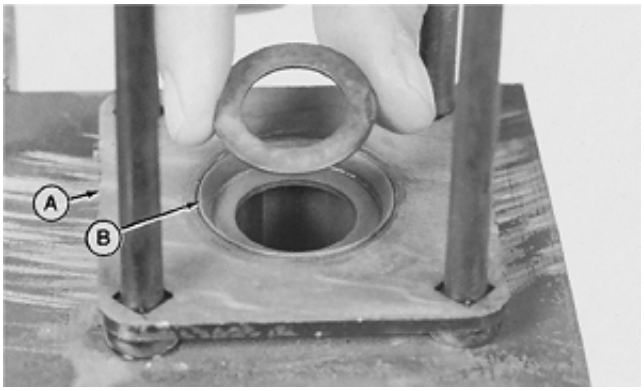


EX,6005R,41 -19-29MAY90

8. Install steering tube (A) on bolts. Be sure the square holes in the steering tube are seated on the square shoulders of the bolts.

9. Apply clean multi-purpose grease on retainer plate (B) and washer.

10. Install washer.

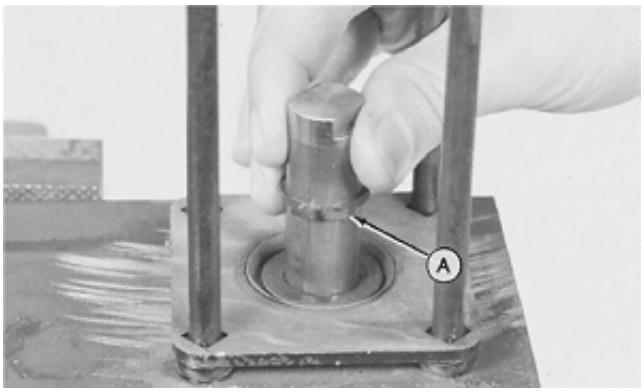


EX1,6005R,42 -19-29MAY90

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11. Install snap ring (A) on steering shaft.

12. Install steering shaft with threaded end down into steering tube.

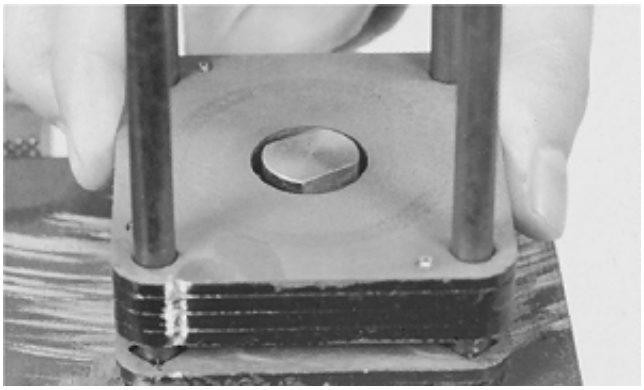


M36855 -UN-29AUG88

EX1,6005R,43 -19-29MAY90

IMPORTANT: Alignment grooves must be on only one side of steering valve for proper valve operation.

13. Install upper cover plate over four bolts with the highly polished surface up.



M36854 -UN-29AUG88

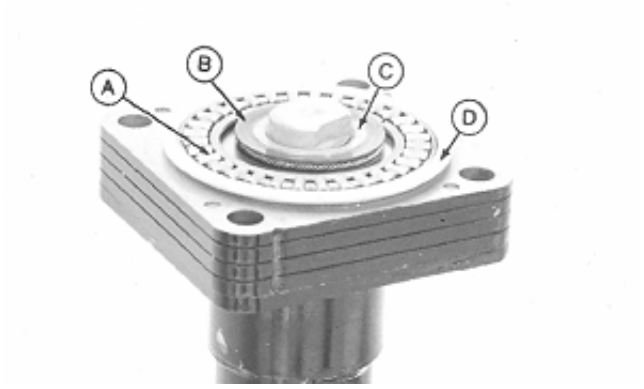
EX1,6005R,44 -19-29MAY90

ASSEMBLE METERING SECTION

1. Apply clean multi-purpose grease on the face of the upper cover plate, top and bottom of seal, steering shaft end, and thrust bearing.

2. Install parts (A-D).

A—Thrust Bearing
B—Seal
C—Back-Up Ring
D—Bearing Spacer



M47347 -UN-03MAR92

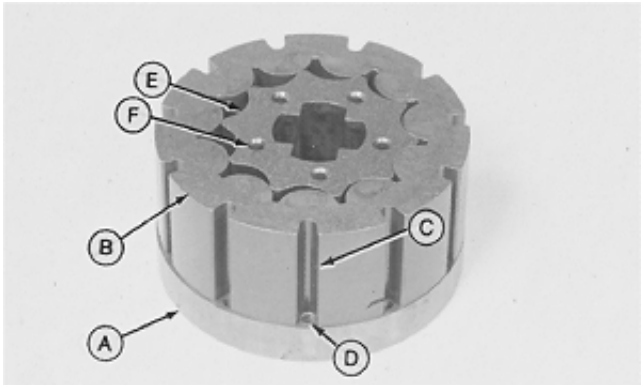
MX,GU,6005,45 -19-26MAR92

3. Put drive plate (A) on a clean surface with slot downward.

4. Install and turn stator (B) until the stator slots (C) are aligned with drive plate holes (D).

5. Install rotor (E) with five pin holes (F) up.

A—Drive Plate
B—Stator
C—Stator Slots
D—Drive Plate Holes
E—Rotor
F—Pin Holes

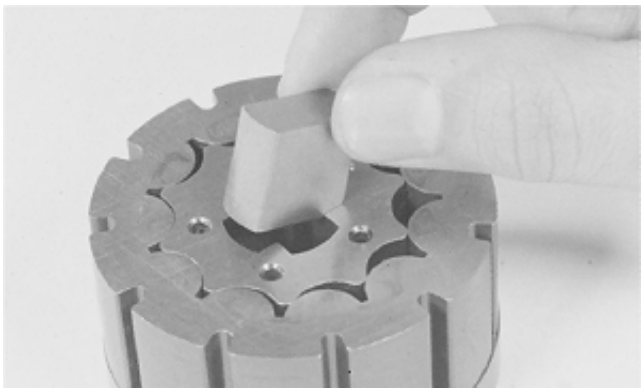


M36861 -UN-29AUG88

EX1,6005R,46 -19-29MAY90

6. Apply multi-purpose grease on spacer.

7. Install spacer in rotor drive slot.



M36849 -UN-29AUG88

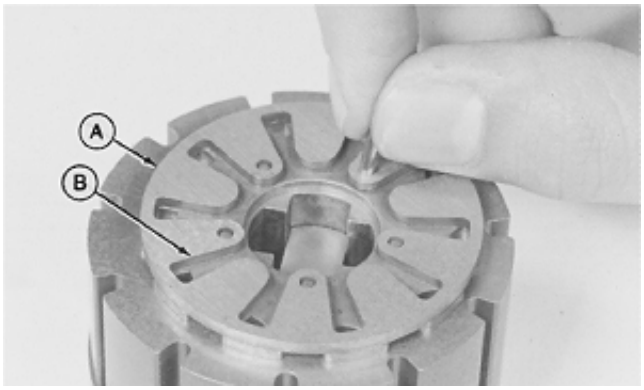
EX1,6005R,47 -19-29MAY90

8. Install commutator (A) with long grooves (B) upward, on rotor.

IMPORTANT: Pins must be installed below the surface of the commutator to prevent commutator cover damage.

9. Align commutator holes with rotor holes and install five pins.

10. Put a few drops of clean hydrostatic oil into each groove of the commutator.



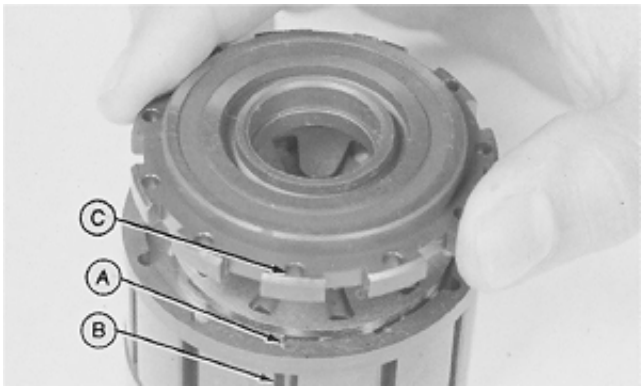
M36862 -UN-29AUG88

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EX1,6005R,48 -19-29MAY90

11. Align commutator ring slots (A) with stator slots (B) and install commutator ring.

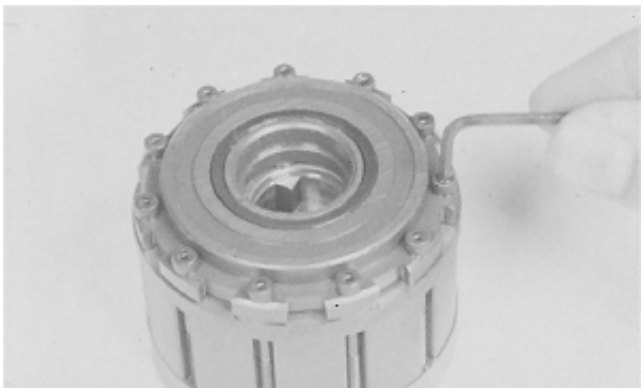
12. Align commutator cover holes (C) with commutator ring slots. Install commutator cover with flat surface toward commutator.



M36863 -UN-29AUG88

EX1,6005R,49 -19-29MAY90

13. Clean screw threads using clean and cure primer. Apply thread lock and sealer (low strength) on screw threads. Install 11 screws into metering assembly. DO NOT tighten screws at this time.

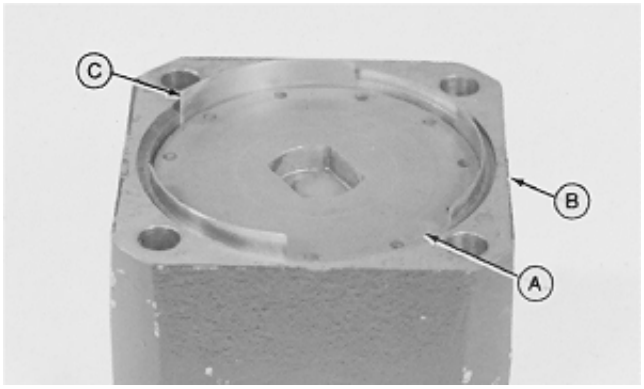


EX1,6005R,50 -19-29MAY90

IMPORTANT: The following procedure must be used to minimize an out-of-round condition between commutator ring and drive plate. The commutator ring is self-centering when the drive plate is shimmed.

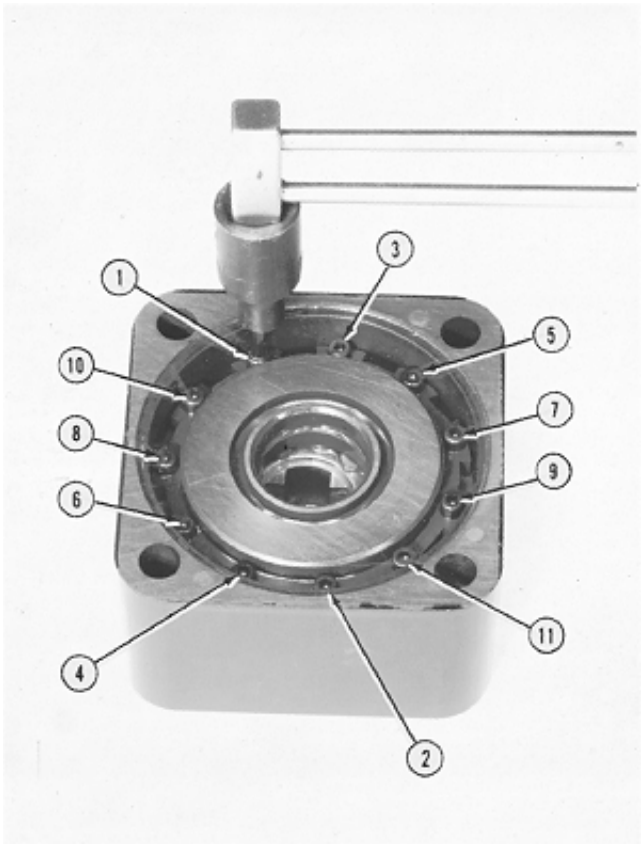
14. Install metering assembly, with drive plate (A) up into metering ring (B).

15. Make six pieces of 0.18 mm (0.007 in.) shim stock (C), approximately 13 mm (0.5 in.) wide x 38 mm (1.5 in.) long. Install two shims each between drive plate and metering ring 120˚ apart.



EX1,6005R,51 -19-29MAY90

16. Turn metering ring over on a flat surface and push metering assembly down. Tighten 11 screws in several steps and in the sequence shown to 1.4 ± 0.1 N·m (12 ± 1 lb-in.).

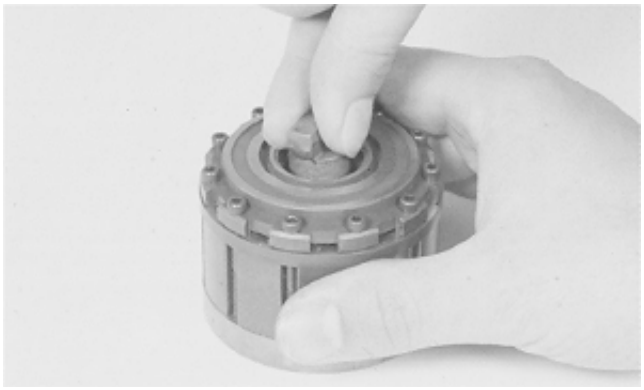


EX,3325,4C -19-29MAY90

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17. Install LARGE end of drive link into the slot in the rotor. Hold the drive link and rotate the metering assembly by hand. The rotor should turn freely inside the stator.

If they bind or do not move, disassemble and inspect to find the cause. Repeat steps 3—17.

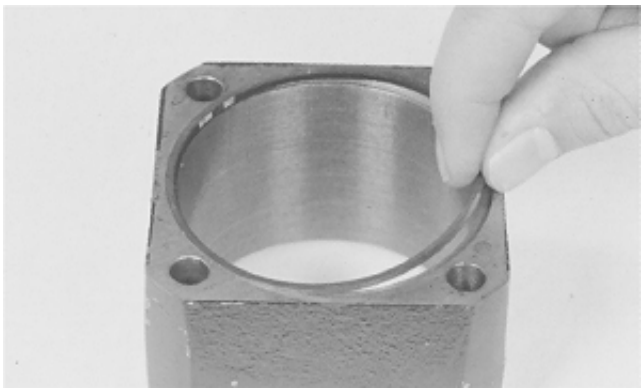


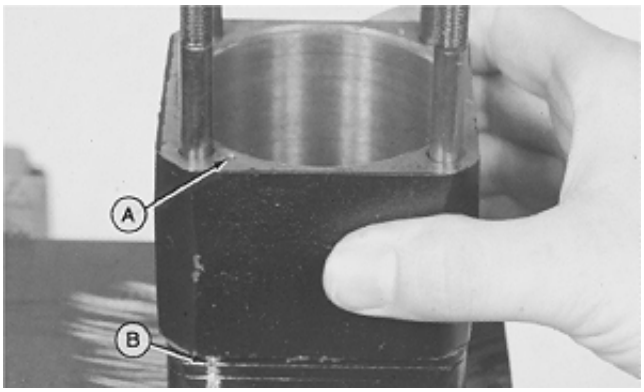
EX,6005R,53 -19-29MAY90

18. Apply clean multi-purpose grease on seal ring. Install seal ring on metering ring end with no pin holes.

IMPORTANT: Align pin hole (A) in metering ring with groove (B) on upper cover plate so that remaining parts can be aligned correctly.

19. Install metering ring with pin holes up on bolts.

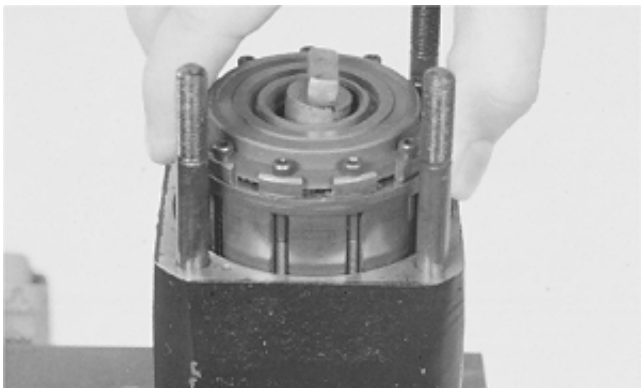




EX1,6005R,54 -19-29MAY90

20. Apply clean multi-purpose grease on drive plate surface.

21. Install metering assembly, with drive plate down into metering ring. Turn metering assembly until the steering shaft engages the drive plate hole. When properly seated, the metering assembly is below the surface of the metering ring.



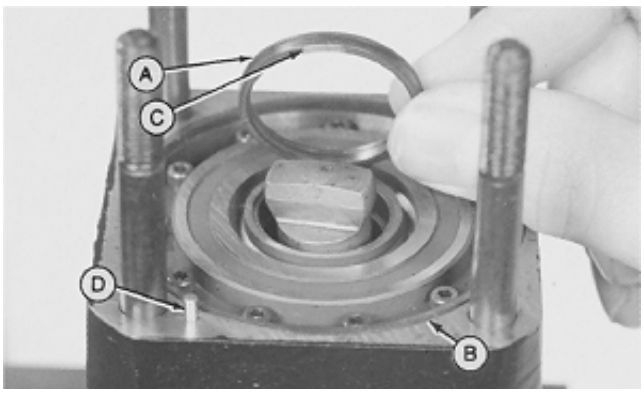
EX1,6005R,55 -19-29MAY90

22. Apply clean multi-purpose grease on commutator seal (A) and seal ring (B).

23. Install commutator seal with yellow mark (C) down into commutator cover.

24. Install seal ring and pins (D).

A—Commutator Seal
B—Seal Ring
C—Yellow Mark
D—Pin (2 used)



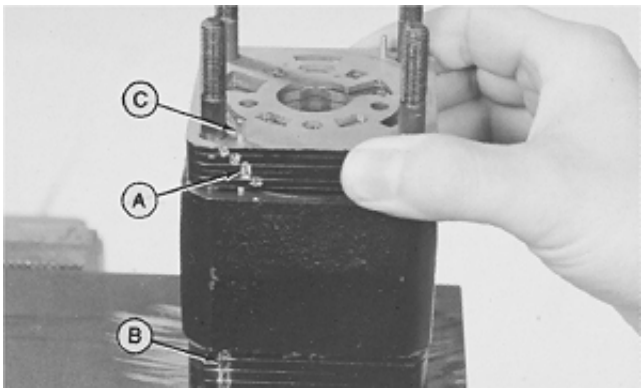
EX1,6005R,56 -19-29MAY90

ASSEMBLE CONTROL VALVE SECTION

IMPORTANT: Align grooves (A) in isolation manifold with groove (B) in upper cover plate.

1. Install isolation manifold, with recessed slots up, on metering ring.

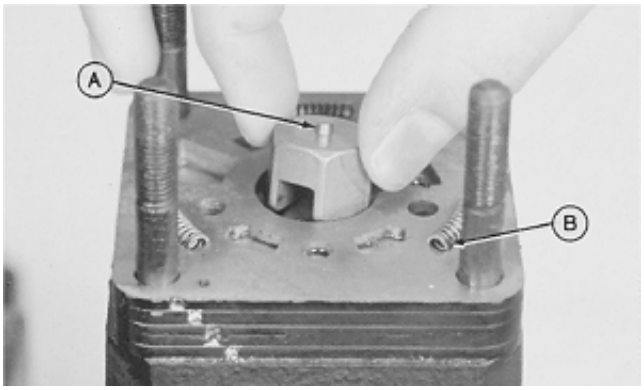
2. Install pins (C).



EX1,6005R,57 -19-24APR91

3. Install three 13 mm (1/2 in.) springs (B) in recessed slots of the isolation manifold.

4. Install hex, drive assembly, with pin (A) up, on drive link.

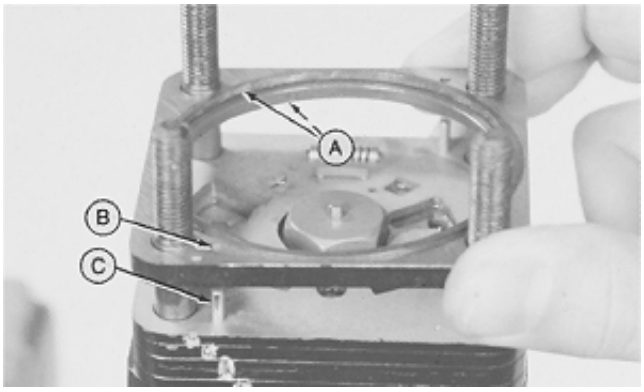


EX1,6005R,58 -19-29MAY90

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5. Apply clean multi-purpose grease on seal rings (A). Install seal rings on valve ring.

6. Align valve ring holes (B) with pins (C) to install valve ring.

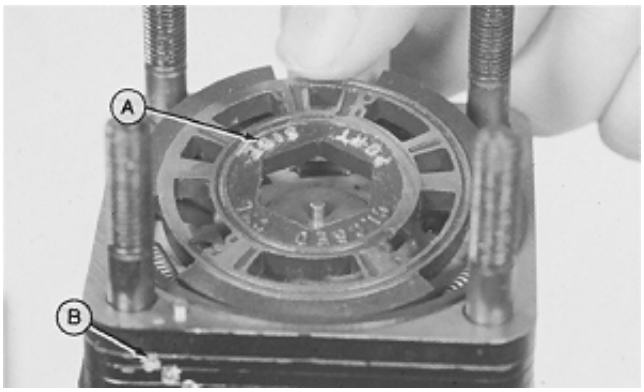


EX1,6005R,59 -19-29MAY90

IMPORTANT: Valve plate must be installed with "PORT SIDE" (A) directly opposite (12 o'clock position) from alignment grooves (B) for proper operation. Valve plate spring slots and springs must be aligned to prevent spring damage when installing port manifold.

7. Install valve plate, with "PORT SIDE" up, on isolation manifold. Turn valve plate to make sure springs are centered in valve plate spring slots.

8. Apply clean hydraulic oil on valve plate.



M36872 -UN-29AUG88

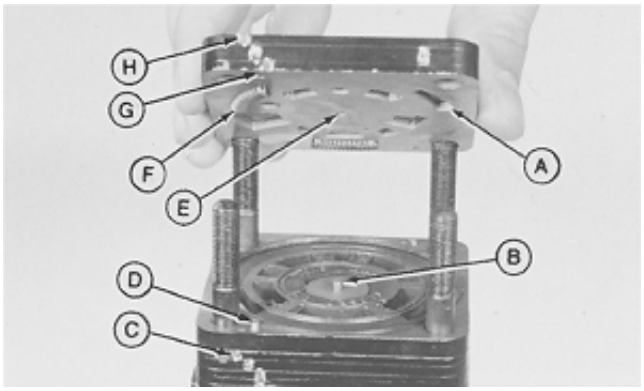
EX1,6005R,60 -19-29MAY90

9. Install three 19 mm (3/4 in.) springs (F) in recessed slots (A) of the port manifold.

IMPORTANT: Align grooves (H) in port manifold with grooves (C) in isolation manifold. Be careful not to damage springs while installing port manifold.

10. Install port manifold with springs toward valve plate. Be sure pins (D) engage alignment holes (G) in port manifold. Be sure hex drive assembly pin (B) engages center hole (E) in port manifold.

A—Recessed Slots
B—Hex Drive Assembly Pin
C—Isolation Manifold Grooves
D—Pin (2 Used)
E—Port Manifold Center Hole
F—19 mm (3/4 in.) Spring (3 Used)
G—Port Manifold Alignment Hole (2 Used)
H—Port Manifold Grooves



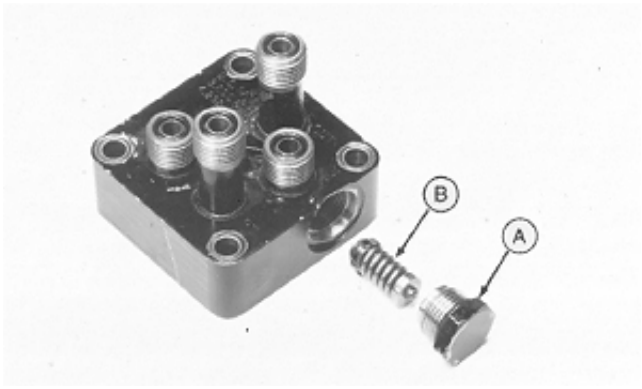
M36873 -UN-29AUG88

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EX1,6005R,61 -19-29MAY90

NOTE: Relief valve is preset at 10497 kPa (1522.5 psi) and is not adjustable.

11. Install relief valve assembly (B) and plug (A). Tighten plug.



E30195 -UN-30NOV89

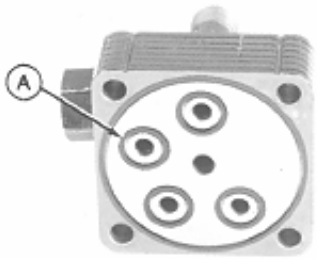
MX,6005HV,A13A -19-30NOV92

12. Apply clean multi-purpose grease on four O-rings (A) and seal ring (B). Install O-rings and seal ring in port cover.

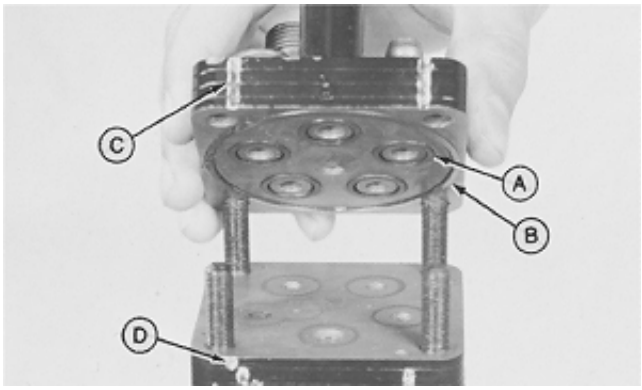
IMPORTANT: Align grooves (C) in port cover with grooves (D) in port manifold.

13. Install port cover with seals toward port manifold.

A—O-Rings (4 used)
B—Seal Ring
C—Port Cover Alignment Grooves
D—Port Manifold Alignment Grooves



M47345 -UN-27FEB92



M36874 -UN-29AUG88

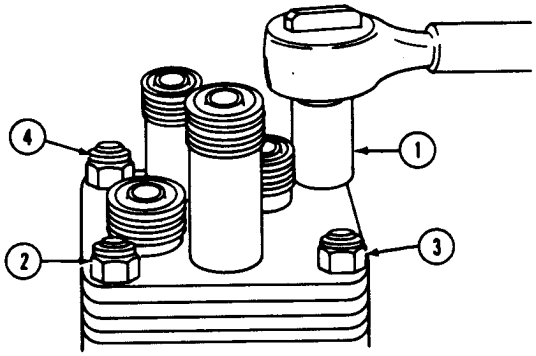
MX,6005HV,A14 -19-30NOV92

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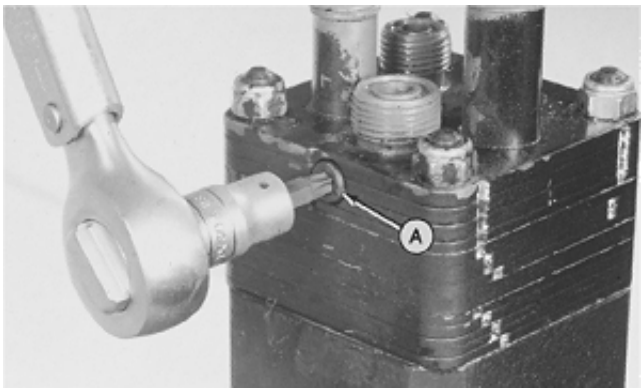
14. Install and tighten four nuts in the sequence shown. Tighten in several steps to 30 ± 3 N·m (266 ± 27 lb-in.).

15. Install manual steer check ball and plug. Tighten plug (A) to 14 ± 3 N·m (124 ± 27 lb-in.).

16. Remove nuts to remove steering valve from fixture.



E34187 -UN-05JUN90



M36876 -UN-29AUG88

EX,3325TM,G476 -19-04JUN90

INSTALL STEERING VALVE

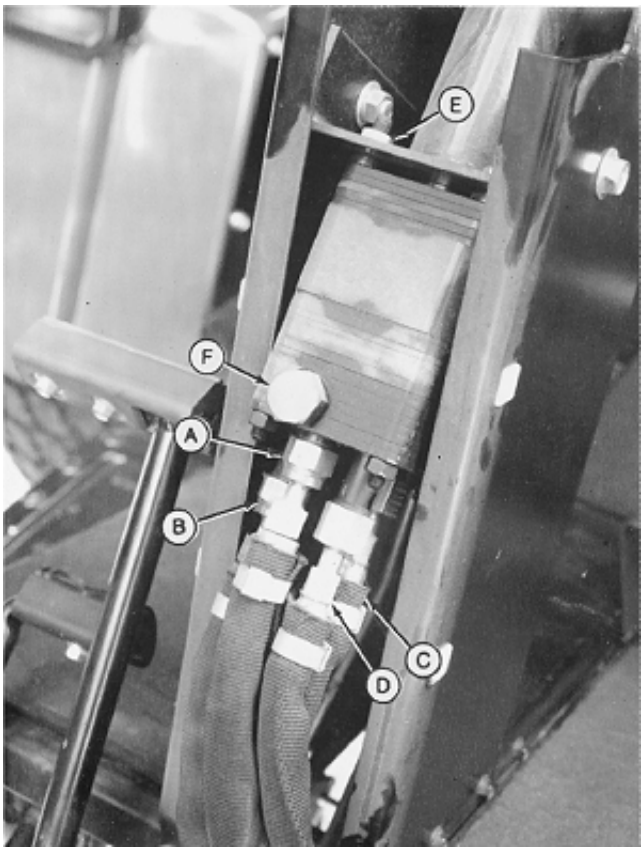
IMPORTANT: Steering valve must be installed with relief valve plug (F) toward front of machine. Hydraulic lines must be connected to the correct fittings.

1. Install new steering valve with relief valve plug (F) towards front of machine. Fasten with four nuts (E).

NOTE: Crimp-type hose clamps are not reusable. Replace with a 5/8 in. adjustable clamp.

2. Connect four hydraulic lines (A—D). Use a crowsfoot wrench to tighten.

A—Line to Rod End of Steering Cylinder
B—Line to Head End of Steering Cylinder
C—Pressure Line from Priority Valve
D—Return Line
E—Nut (4 used)
F—Relief Valve Plug



E35459 -UN-12DEC90

MX,6005HV,A16 -19-30NOV92

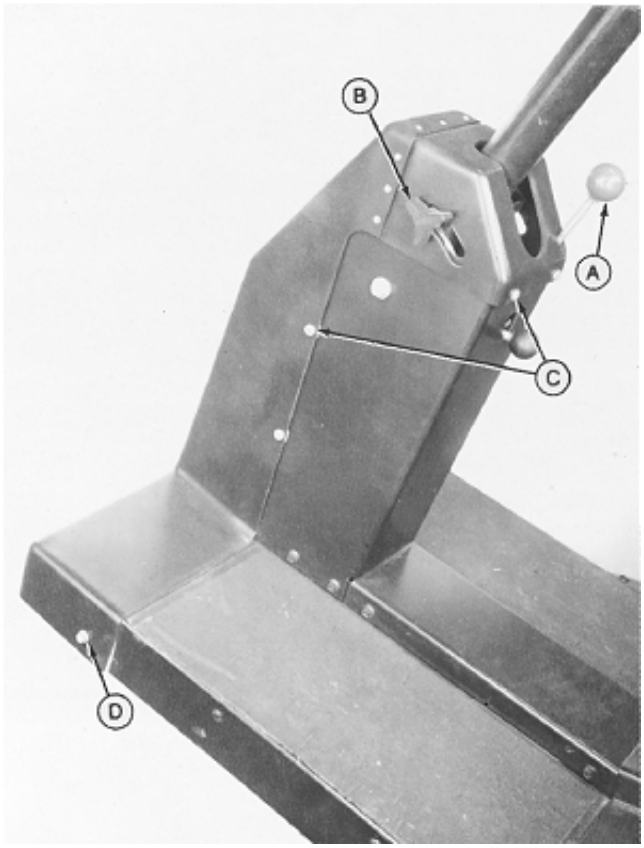
60 05 23

3. Install cover, six screws (C) and two cap screws (D).

4. Install bolts, lock washers, and knobs (B).

5. Install cruise control knob (A).

A—Cruise Control Knob
B—Steering Wheel Tilt Knob
C—Screw (6 used)
D—Cap Screw (2 used)



E35458 -UN-12DEC90

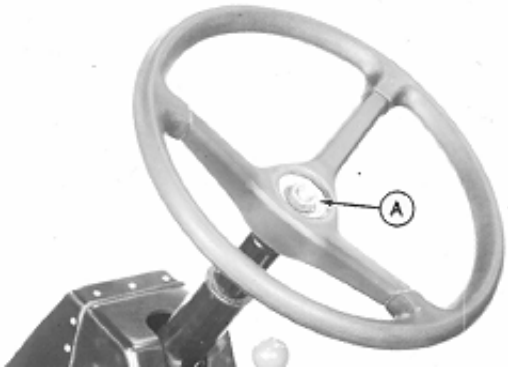
MX,6005HV,A17 -19-30NOV92

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24

6. Install steering wheel. Install and tighten nut (A) to 13—16 N·m (10—12 lb-ft).

7. Install steering wheel cap.

8. Bleed the steering system. (See procedure in this group.)



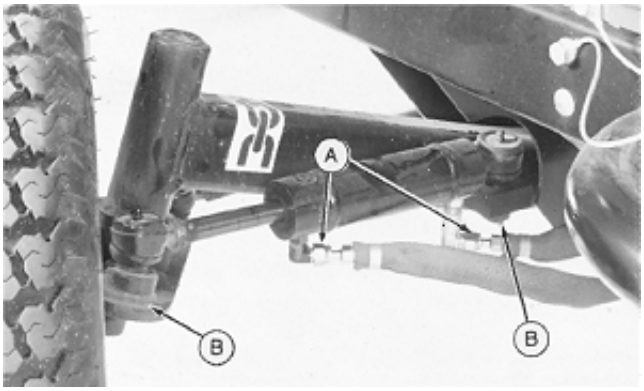
M81373 -UN-03NOV92

MX,6005HV,A18 -19-30NOV92

REMOVE STEERING CYLINDER

1. Tag and disconnect hydraulic hoses (A). Close all openings with caps and plugs to prevent dirt from entering the hydraulic system.

2. Remove cotter pin and nut (B) from each end of cylinder. Remove cylinder.



E34123 -UN-22MAY90

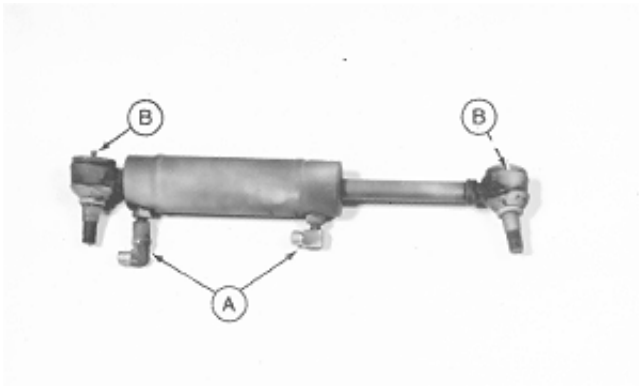
MX,6005HV,A18A -19-30NOV92

STEERING CYLINDER REPAIR

1. Check fittings (A) for leaks. Replace O-rings.

2. Replace grease fittings (B) if worn.

3. If cylinder leaks anywhere besides at fittings (A), replace cylinder. If necessary, replace O-rings at fittings (A).



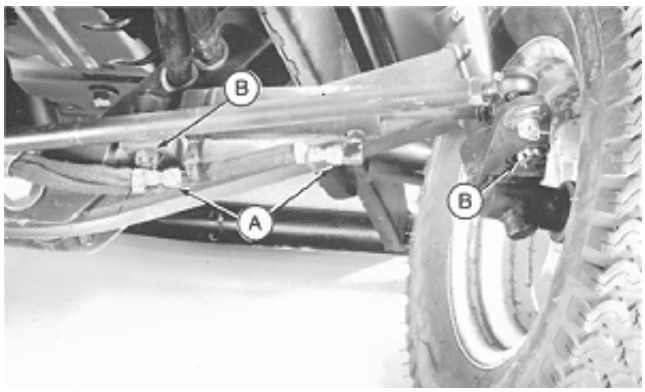
E30125 -UN-11DEC89

MX,6005HV,A18B -19-30NOV92

INSTALL STEERING CYLINDER

1. Install cotter pin and nut (B) on each end of cylinder.

2. Connect hydraulic hoses (A).



E30120 -UN-11DEC89

MX,6005HV,A18C -19-30NOV92

BLEED STEERING SYSTEM

After installing a repaired or replacement steering part, follow this procedure to assure that air is purged from the steering system.

1. Start engine and idle it for 5 minutes.

2. Run engine at high idle for one minute.

3. Turn steering wheel full left and hold for 5 seconds.

4. Turn steering wheel to straight forward and hold for 10 seconds.

5. Turn steering wheel full right and hold for 5 seconds.

6. Return steering wheel to straight forward. Travel vehicle forward about 20 feet and then make two hard left turns.

7. Then make two hard right turns.

8. Shut engine off and inspect steering hydraulic components for leaks.

9. Fill transaxle as necessary with John Deere hydrostatic oil.

MX,6005HV,A19 -19-30NOV92

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OTHER MATERIAL

Number	Name	Use
PT569	John Deere NEVER-SEEZ® Lubricant	Lubricate pedal pin.

NEVER-SEEZ is a trademark of the Emhart Chemical Group.

MX,6010HV,A1 -19-30NOV92

SPECIFICATIONS

Item	Measurement	Specification
Brake Disk	Minimum thickness	4.4 mm (0.173 in.)
Brake Disk Spline-To-Shaft	Maximum backlash	1.2 mm (0.047 in.)
Brake Linkage Rod	Approximate Length (include clevis)	557 mm (21.9 in.)
Brake Plate	Minimum thickness	2.3 mm (0.090 in.)
	Maximum warpage	0.3 mm (0.012 in.)
Brake Return Springs	Relaxed Length	Approximately 89 mm (3.5 in.)

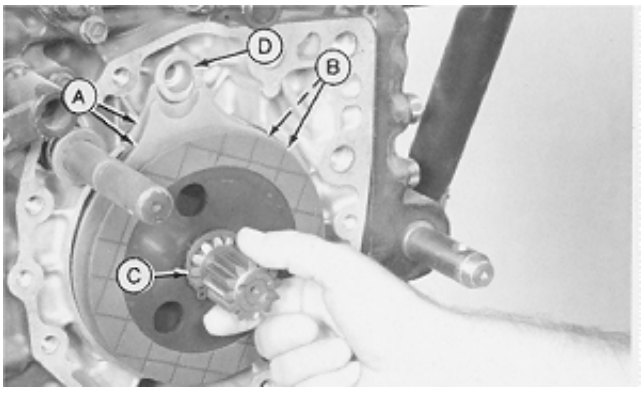
MX,6010HV,A2 -19-30NOV92

INSPECT BRAKES

1. Remove final drive axles. (See Remove Final Drives in Section 50, Group 15.)

2. Remove shaft (C), brake disks (B), and plates (A).

A—Brake Plate (2)
B—Brake Disk (2)
C—Final Drive Pinion Shaft
D—Brake Camshaft Hole



-UN-31AUG88
M43589

MX,6010HV,A3 -19-30NOV92

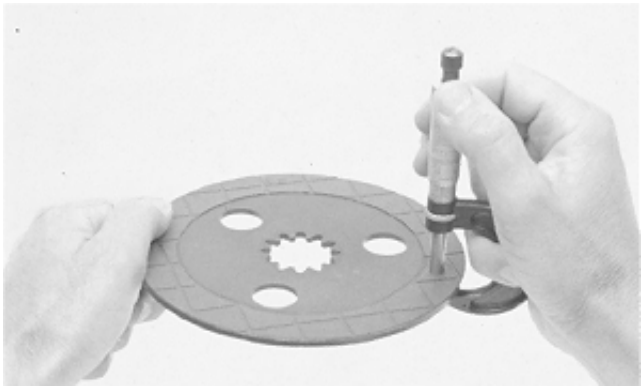
3. Measure brake disks.

BRAKE DISK SPECIFICATION

Thickness New . . . . . 4.6—4.8 mm (0.181—0.189 in.)
Minimum . . . . . 4.4 mm (0.173 in.)

Spline Backlash New . . . . . 0.13—0.31 mm (.005—.012 in.)
Maximum . . . . . 1.2 mm (0.047 in.)

Replace brake disks if out of specification.



-UN-31AUG88
M43766

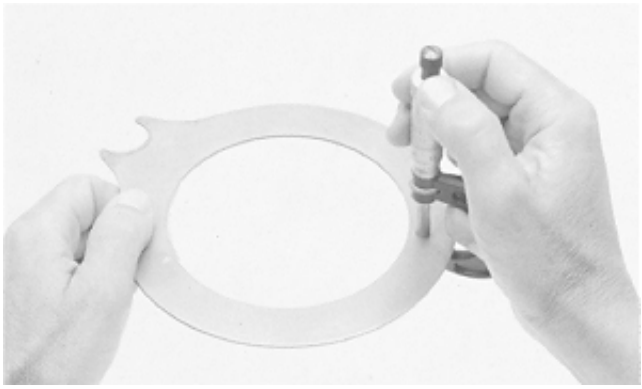
MX,6010GU,2 -19-26MAR92

BRAKE PLATE SPECIFICATION

Thickness New . . . . . 2.5—2.7 mm (0.098—0.106 in.)
Minimum . . . . . 2.3 mm (0.090 in.)

Warpage New . . . . . 0.15 mm (0.006 in.)
Maximum . . . . . 0.3 mm (0.012 in.)

4. Replace brake plate if out of specification or if surface is scored or grooved.



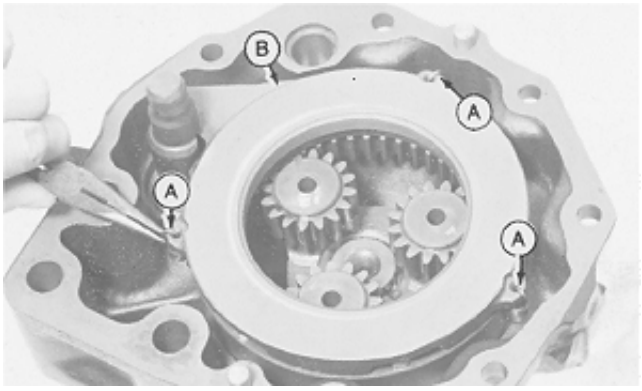
-UN-31AUG88
M43767

MX,6010GU,3 -19-26MAR92

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5. Remove three springs (A). Replace all three if any are broken or stretched.

6. Inspect actuator plate (B) for scoring or roughness. Use 400 grit emery paper to smooth the brake face if necessary.

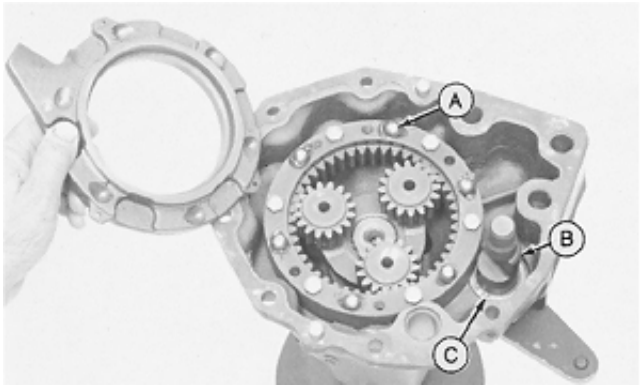


-UN-29AUG88
M37977

MX,6010GU,4 -19-26MAR92

7. Inspect six steel balls (A) for damage. Replace any that are damaged.

8. Inspect brake camshaft (B) for wear or damage. To remove camshaft, remove snap ring (C) and washer.



-UN-31AUG88
M43768

MX,6010GU,5 -19-26MAR92

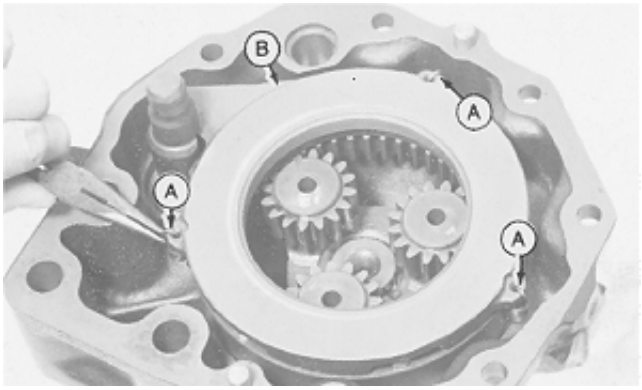
9. Clean all parts. Install camshaft, washer, and snap ring.

10. Install and apply grease to six steel balls.

11. Put actuator plate (B) in place. Fasten it with three springs (A). Put shorter hook of springs on ring gear.

12. Install new gasket. Be sure two guide pins are in place.

13. Install final drive axles. (See Install Final Drives—Section 50, Group 15.)



M37977 -UN-29AUG88

MX,6010GU,6 -19-26MAR92

REMOVE BRAKE PEDAL

1. Make sure park brake lever is disengaged.

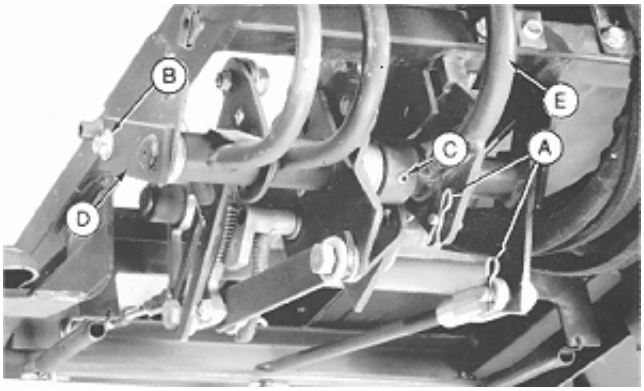
2. Remove steering column cover and right front floor panel.

3. Remove two spring locking pins (A) and cap screw (B).

4. Loosen set screw (C).

IMPORTANT: As pedal pin is removed, note position and quantity of washers on pin. Washers are used to align pedals and must be installed in same position as removed.

5. Carefully pull out pedal pin (D) far enough to remove brake pedal (E). Note quantity and position of washers as pin is removed.



E30105 -UN-11DEC89

A—Spring Locking Pin
B—Cap Screw
C—Set Screw
D—Pedal Pin
E—Brake Pedal

EX,3325TM,CG470-19-24APR91

INSTALL BRAKE PEDAL

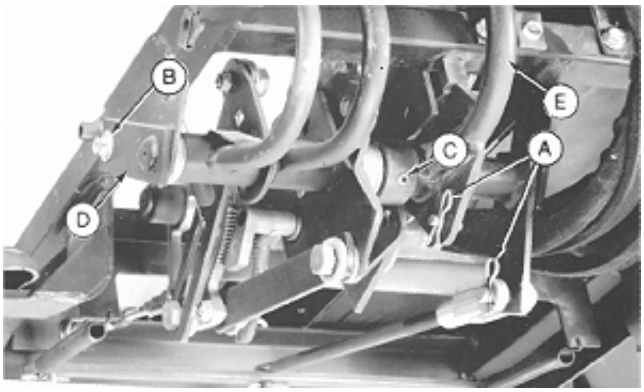
IMPORTANT: Install washers into same position as removed to align pedals properly.

1. Apply NEVER-SEEZ lubricant or equivalent to pedal pin (D).

2. Position brake pedal (E) and any washers used. Slide pedal pin (D) into place and install cap screw (B).

3. Connect rods and install spring locking pins (A).

4. Slightly tighten set screw (C).



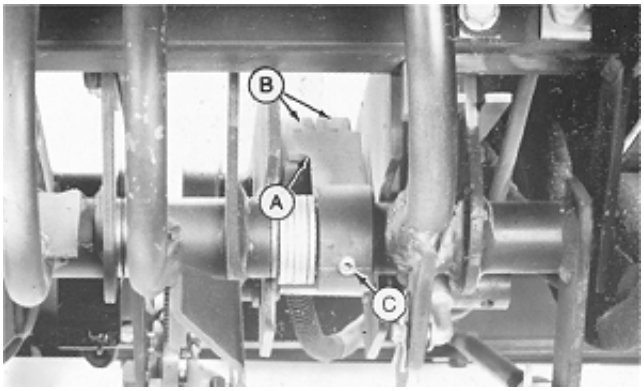
E30105 -UN-11DEC89

A—Spring Locking Pins
B—Cap Screw
C—Set Screw
D—Pedal Pin
E—Brake Pedal

MX,6010HV,A4 -19-30NOV92

5. With the brake pedal all the way up, align switch lever (A) so lever is tight against electrical switches (B).

6. Tighten set screw (C).

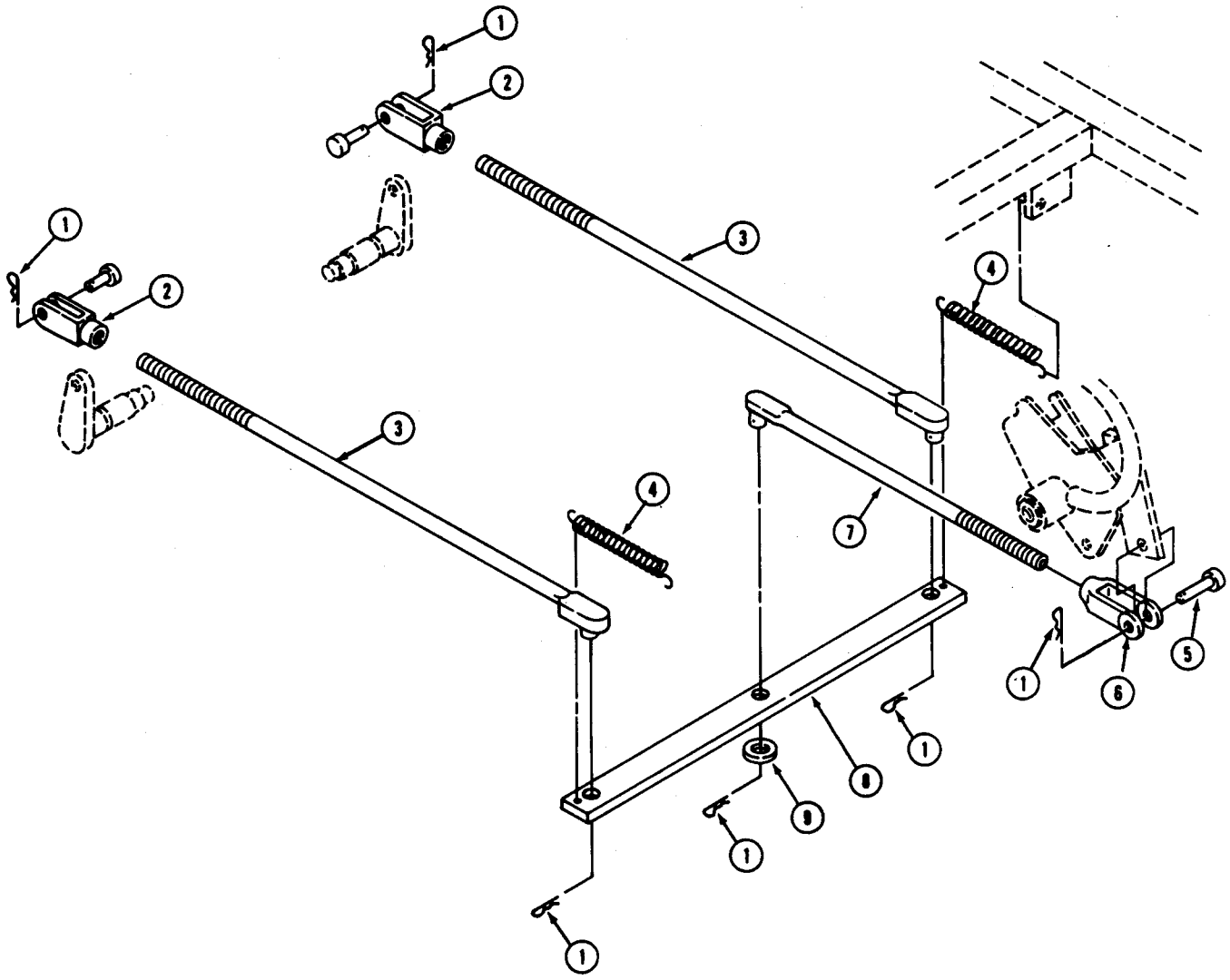


E30106 -UN-21SEP88

MX,6010HV,A5 -19-30NOV92

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4

BRAKE LINKAGE EXPLODED VIEW



1—Spring Locking Pin
2—Yoke
3—Brake Rod
4—Return Spring
5—Pin
6—Yoke
7—Brake Rod
8—Strap
9—Washer

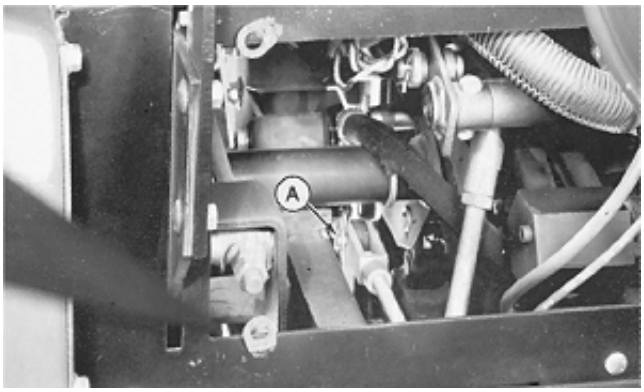
Approximate relaxed length of return springs (4) is 89 mm (3.5 in.). Replace springs that are longer than specification.

MX,6010HV,A6 -19-30NOV92

REMOVE BRAKE LINKAGE

1. Remove front access panel.

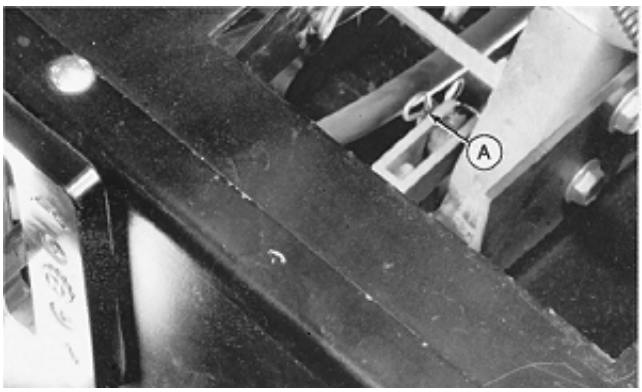
2. Remove spring locking pin and pin (A) on right side of transaxle.



EX,3325TM,CG466-19-24APR91

3. Remove top access panel.

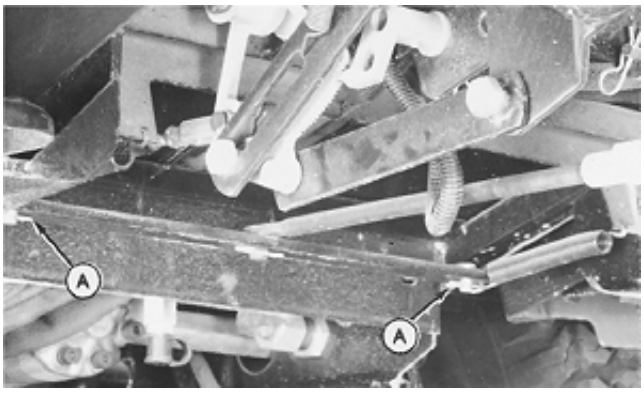
4. Remove spring locking pin and pin (A).



EX,3325TM,CG464-19-25MAY90

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6

5. Remove spring locking pins (A). Remove clevis from right and left brake rods and pull brake rods forward to remove rods.

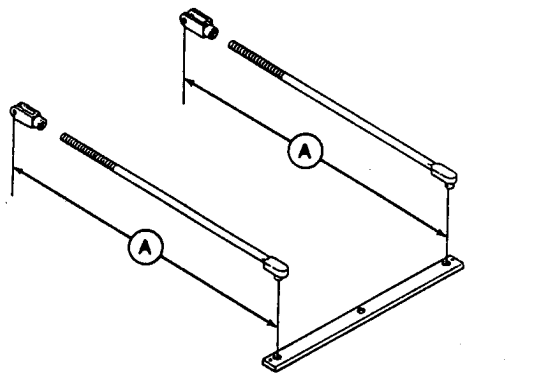


EX,3325,6010,1 -19-24APR91

INSTALL BRAKE LINKAGE

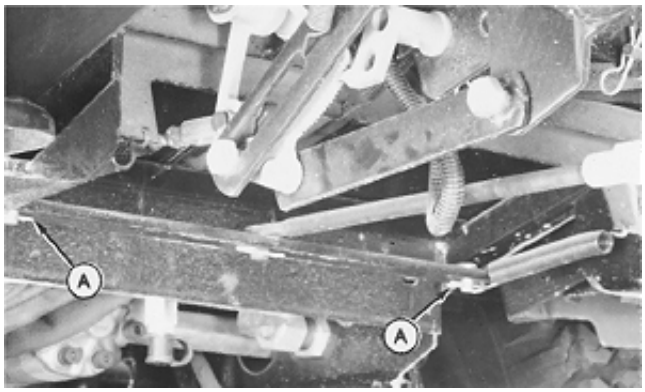
1. Install right and left brake rods in mower.

2. Install clevis on each brake rod. Adjust right and left brake rods to length (A) of 557 mm (21.9 in.).



EX,3325,6010,2 -19-24APR91

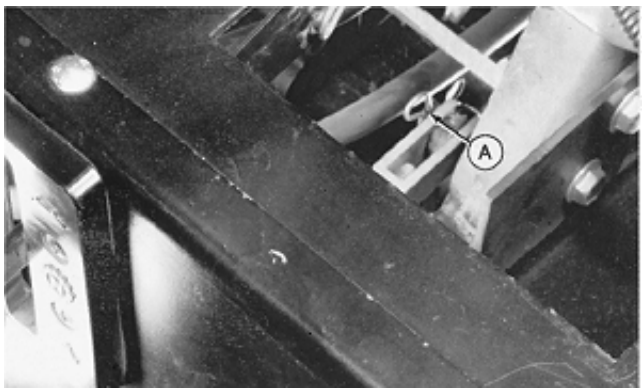
3. Install spring locking pins (A).



EX,3325,6010,3 -19-24APR91

4. Install pin and spring locking pin (A).

5. Install top access panel.

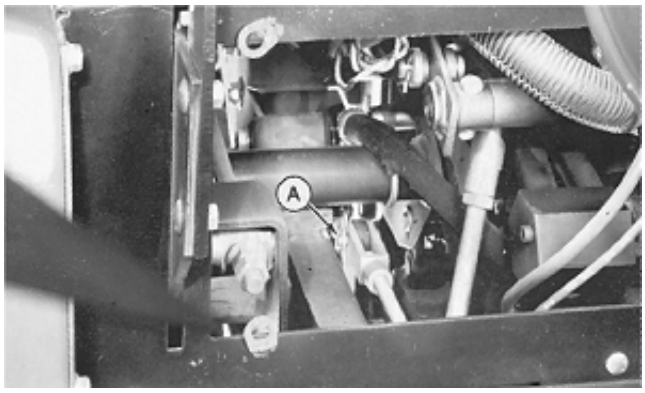


EX,3325TM,CG462-19-24APR91

6. Install pin and spring locking pin (A) on right side of transaxle.

7. Install front access panel.

8. Adjust brakes. (See procedure in this group.)



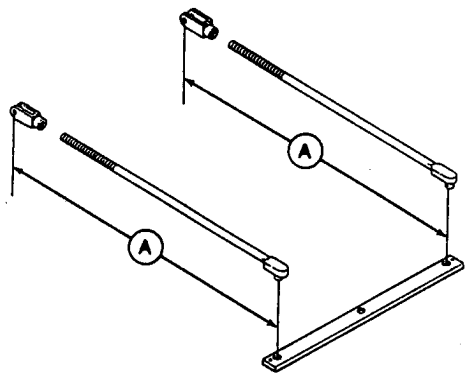
EX,3325TM,CG460-19-24APR91

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ADJUST BRAKES

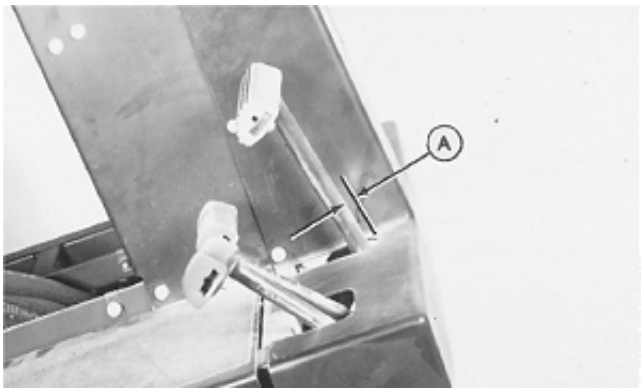
NOTE: There are two rods, one under each side floor panel.

1. The right brake and left rod lengths should be adjusted initially and equally to 557 mm (21.9 in.) (A).



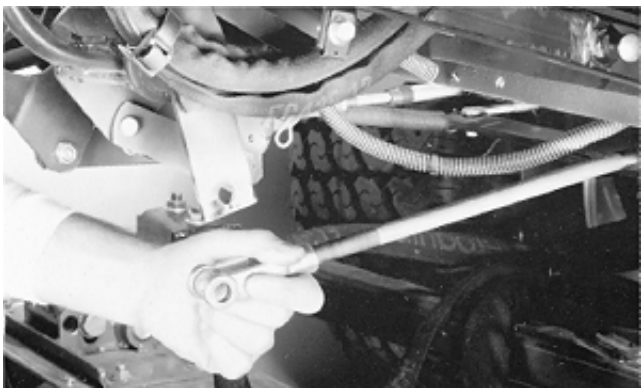
EX,3325TM,CG458-19-30NOV92

2. When brake pedal is fully depressed, there should be 6 mm (1/4 in.) clearance (A) between pedal rod and front edge of slot in cover.



2E6,6010G,12 -19-30NOV92

3. If not, disconnect rod and turn connector to achieve the 6 mm (1/4 in.) clearance. Reconnect the rod.



2E6,6010G,13 -19-30NOV92

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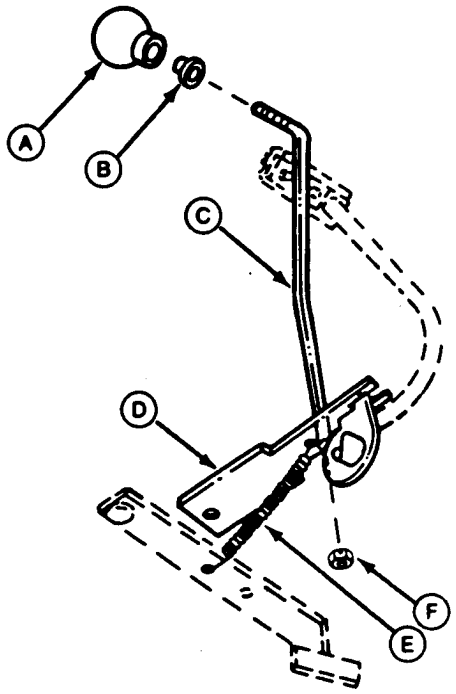
INSPECT AND REPAIR PARK BRAKE LINKAGE

1. Remove parts (A—F).

2. Inspect all parts for wear or damage. Replace as necessary.

3. Install park brake linkage:

- Put park brake lock knob in the disengaged position.
- Install adjustment nut (F) until pawl (D) will engage brake pedal ratchet and hold brake pedal engaged.
- Tighten nut until brake pedal releases.
- Engage and disengage brake pedal and park brake linkage several times to check for proper operation.



M54216 -UN-06SEP90

A—Knob
B—Weld Nut
C—Rod
D—Pawl
E—Spring
F—Adjustment Nut

MX,6010HV,A7 -19-30NOV92

ESSENTIAL TOOLS

NOTE: Order tools from the U.S. SERVICEGARD™ Catalog or from the European Microfiche Tool Catalog (MTC). Some tools may be available from a local supplier.

Number	Name	Use
JTO 1732	Blind Hole Puller	Remove spindle shaft bushing.

M21,6010W,1 -19-24APR91

SERVICE EQUIPMENT AND TOOLS

NOTE: Order tools from the U.S. SERVICEGARD™ Catalog or from the European Microfiche Tool Catalog (MTC). Some tools may be available from a local supplier.

Name	Use
Feeler Gauge	Measure axle end-play.
Bushing, Bearing, and Seal Drive Set	Service spindle bushing and race.
2-Jaw Puller	Remove spindle race
Press	Service wheel bearings and races.

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1

M21,6010W,2 -19-24APR91

OTHER MATERIAL

Number	Name	Use
	John Deere Moly Hi Temp Extreme Pressure (EP) Grease	Lubricate wheel bearings, and spindles.

2E6,6015G,0 -19-24APR91

SPECIFICATIONS

Item	Measurement	Specification
Steering cylinder-to-spindle nut	Torque	75 N·m (55 lb-ft)
Tie rod-to-spindle nut	Torque	53 N·m (39 lb-ft)
Toe-in adjustment	Length	6 mm (1/4 in.) less in front than in rear of rear tire.
Tie rod nut	Torque	118 N·m (87 lb-ft)
Pivot pin nut	Torque	509 N·m (375 lb-ft)
Axle pivot end play	Approximate clearance	1 mm (0.040 in.)

M21,60102,3 -19-24APR91

REMOVE AND INSPECT WHEEL BEARINGS

1. Raise mower, remove wheel and hub cap.

2. Remove cotter pin and castellated nut.

3. Slide washer, bearing, and wheel hub off shaft.

4. Inspect bearing and shaft for excessive wear or damage. Replace as necessary.

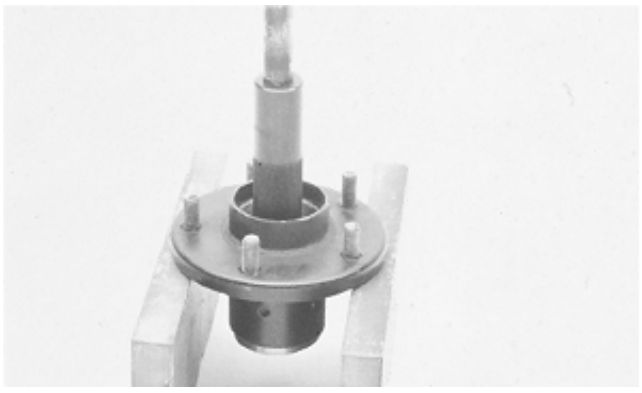


E30094 -UN-11DEC89

2E6,6015G,15 -19-24APR91

5. Remove inner bearing and seal. Use a 1-13/16 in. driver disk.

6. Inspect bearing for excessive wear or damage. Replace as necessary.

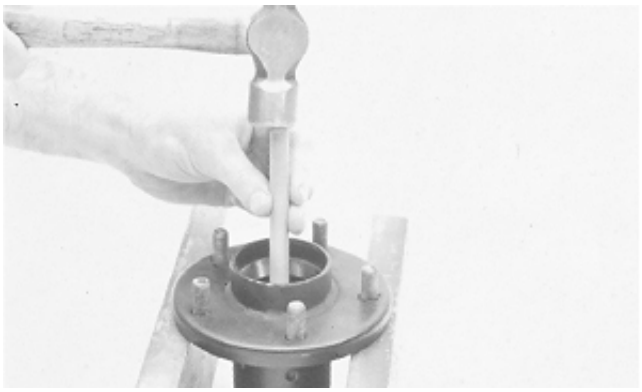


M43558 -UN-31AUG88

2E6,6015G,16 -19-25MAY90

7. Inspect races for excessive wear or damage. Replace as necessary.

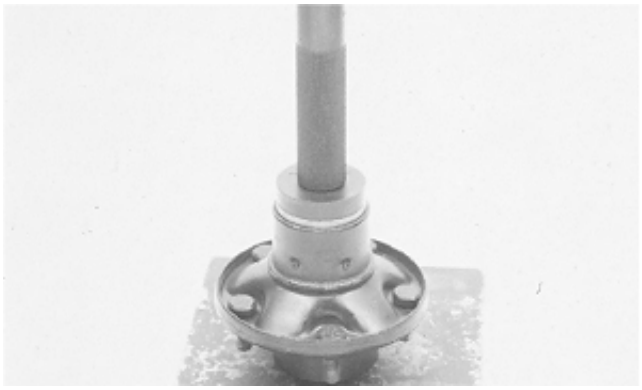
8. To remove inner or outer race use a soft drift.



2E6,6015G,17 -19-25MAY90

INSTALL WHEEL BEARINGS

1. Use a 2-5/16 in. driver disk to install inner or outer race. Drive race in until it bottoms in hub bore.

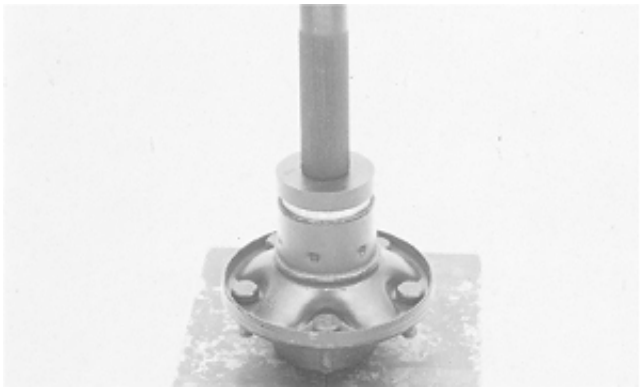


2E6,6015G,18 -19-24APR91

2. Pack inner bearing with Moly Hi Temp extreme pressure (EP) grease and install a hub.

3. Install new seal flush with hub surface. Use a 2-9/16 in. driver disk.

4. Fill hub cavity with multi-purpose grease.



EX,3325TM,CG454-19-25MAY90

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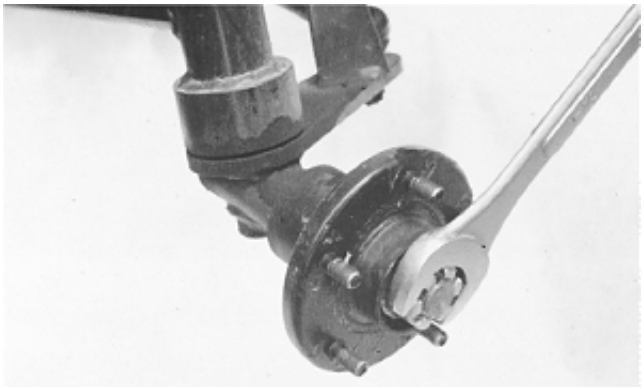
5. Pack outer bearing with multi-purpose grease.

6. Install hub, bearing, and washer on spindle.

7. Install and tighten nut until a slight drag is felt when hub is turned. Back nut off 1/4 turn or just enough to install cotter pin.

8. Install cotter pin and hub cap.

9. Install and tighten wheel.



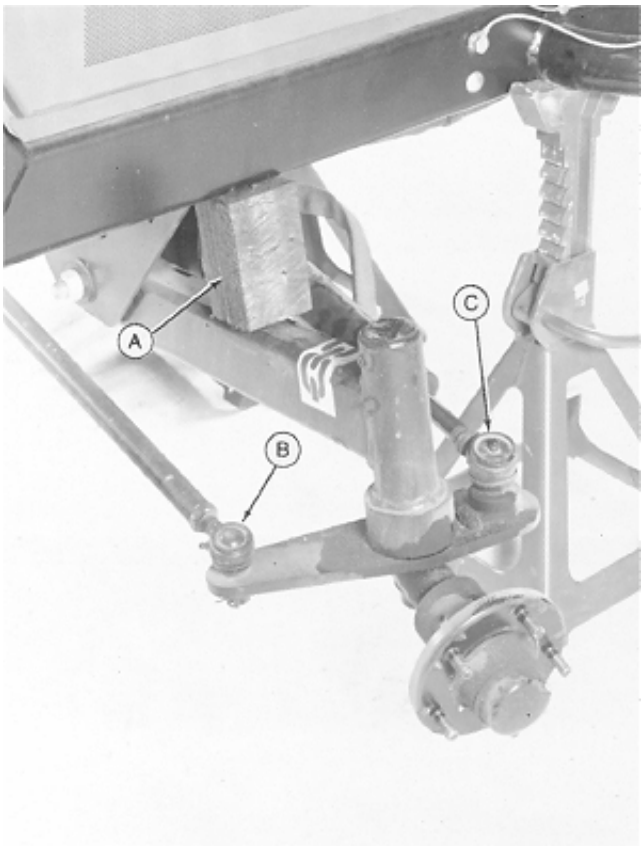
EX,3325TM,CG452-19-24APR91

REMOVE SPINDLE SHAFT AND HUB

1. Raise mower and remove wheel.

2. Push axle all the way down and install wood block (A).

3. Disconnect tie rod end (B) and steering cylinder end (C).



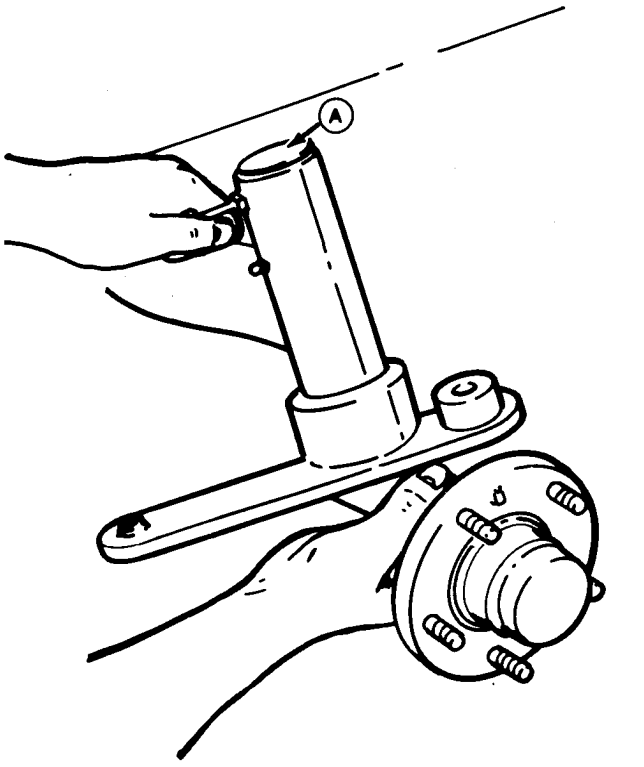
2E6,6015G,7 -19-24APR91

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4. Remove cap (A).

5. Remove set screw and lower shaft and hub from axle.

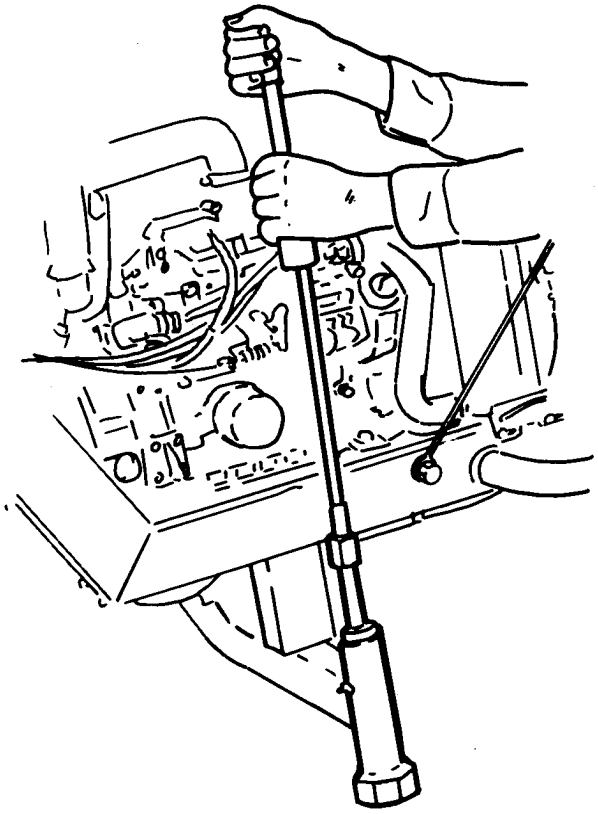
6. Inspect spindle shaft and bushing for excessive wear or damage. Replace as necessary.



2E6,6015G,8 -19-24APR91

REPLACE SPINDLE SHAFT BUSHING

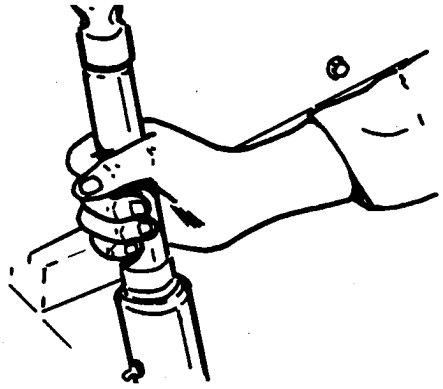
1. Remove bushing. Use 1-1/4—1-1/2 in. blind hole puller (JTO 1732) and slide hammer as shown.



E35462 -UN-12DEC90

2E6,6015G,9 -19-24APR91

2. Install new bushing until it bottoms on shoulder in housing. Use 1-1/4 and 1-7/16 in. driver disk.



E30091 -UN-21SEP88

2E6,6015G,10 -19-25MAY90

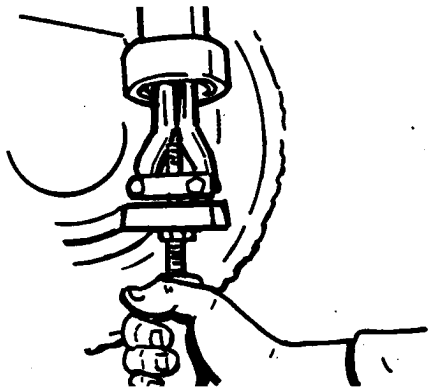
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REPLACE SPINDLE SHAFT BEARING

1. Remove grease seal and bearing.

2. Inspect bearing and race for excessive wear or damage. Replace as necessary.

3. Use a 2-jaw puller with slide hammer to remove race.



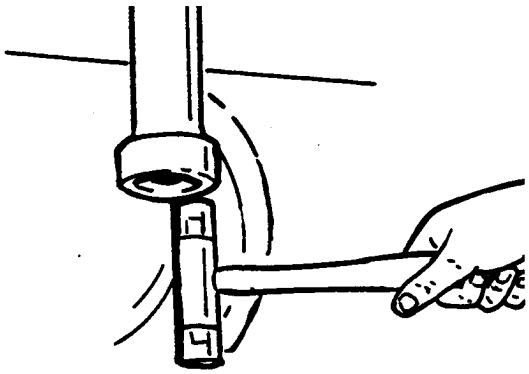
E30092 -UN-21SEP88

2E6,6015G,11 -19-24APR91

4. Install new race until it bottoms on shoulder in housing. Use a 2-1/4 in. driver disk.

5. Pack bearing with multi-purpose grease.

6. Install bearing and new seal. Be sure sealing flange faces down.

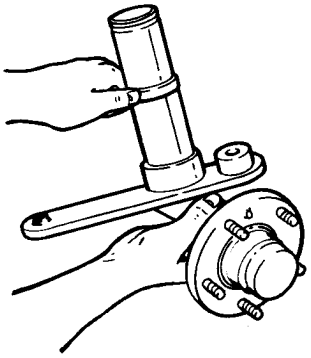


E30093 -UN-21SEP88

2E6,6015G,12 -19-25MAY90

INSTALL SPINDLE SHAFT AND HUB

1. Install thrust washer with outside chamfer up.



E35464 -UN-12DEC90

2E6,6015G,13 -19-24APR91

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6

2. Lubricate spindle shaft with a light film of multi-purpose grease. Slide shaft into spindle housing.

3. Install set screw (D) until it contacts spindle shaft machine groove. Back off set screw 1/4 turn. Tighten nut.

4. Install housing cap.

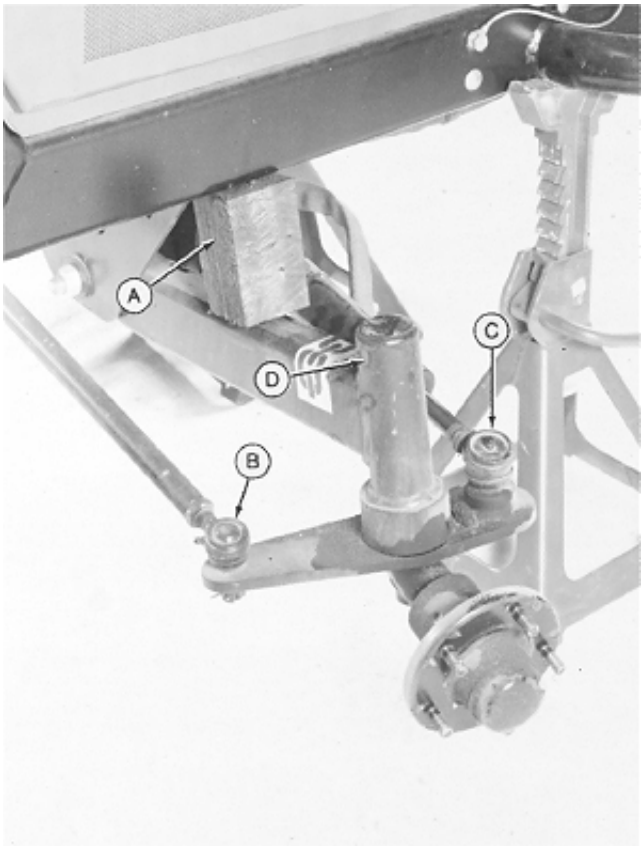
5. Connect steering cylinder end (C). Tighten slotted nut to 75 N·m (55 lb-ft). Install cotter pin.

6. Connect tie rod end (B). Tighten slotted nut to 53 N·m (39 lb-ft). Install cotter pin.

7. Lubricate spindle grease fitting with Moly Hi Temp extreme pressure (EP) grease.

8. Remove wood block (A).

9. Install and tighten wheel.

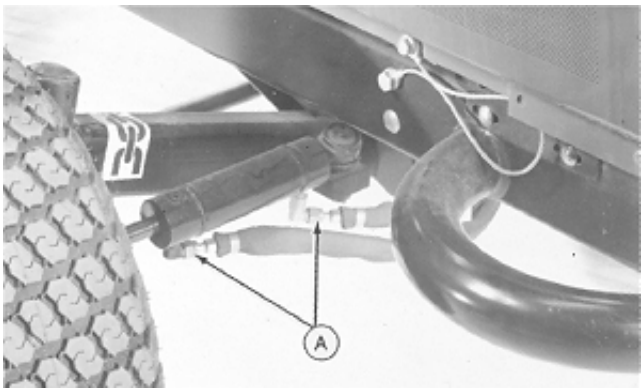


E34196 -UN-05JUN90

EX,3325TM,CG456-19-25MAY90

REMOVE REAR AXLE

1. Disconnect steering lines (A).

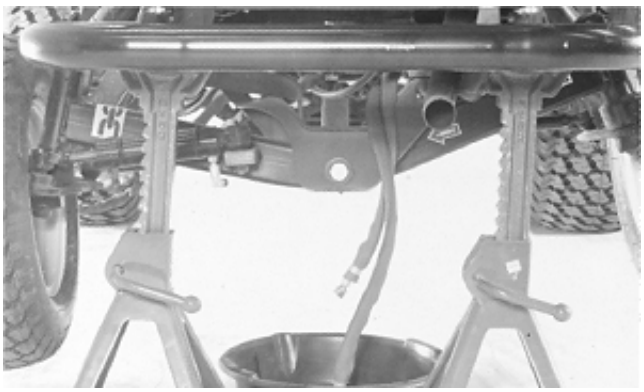


2E6,6015G,1 -19-24APR91

3. Raise rear of machine and support frame behind the axle.

4. Remove rear wheels.

5. Support axle with floor jack.



2E6,6015G,2 -19-24APR91

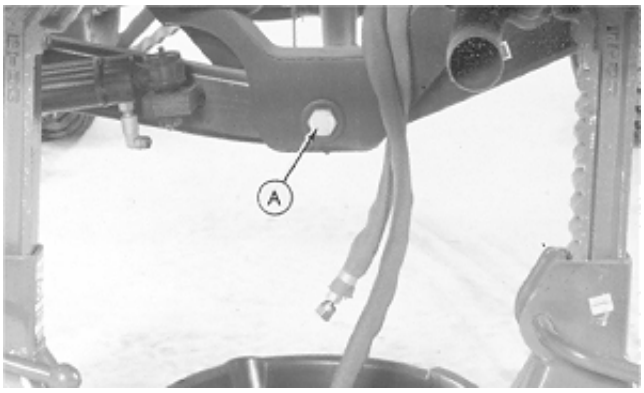
6. Remove steering line clamp from axle.

7. Remove nut from pivot pin (A).

8. Remove pivot pin, shims and thrust washers.

9. Lower axle out of frame.

10. Inspect axle, pivot pin and bushing for excessive wear or damage. Replace as necessary.



MX,6015HV,A1 -19-30NOV92

INSTALL REAR AXLE

1. Raise axle into frame. Install bushing, shims, pivot pin and thrust washers.

2. Install nut on pivot pin. Tighten to 509 N·m (375 lb-ft).

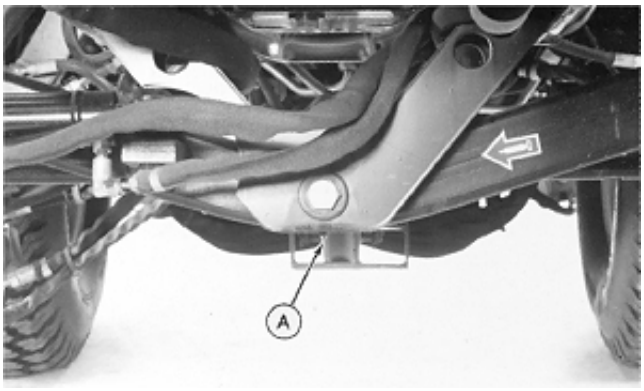
3. Check rear axle end play. Adjust as necessary. (See procedure in this group.)

4. Install and tighten rear wheels.

5. Raise mower and remove support stands.

6. Lubricate axle pivot (A) with extreme pressure (EP) grease.

7. Connect steering lines.



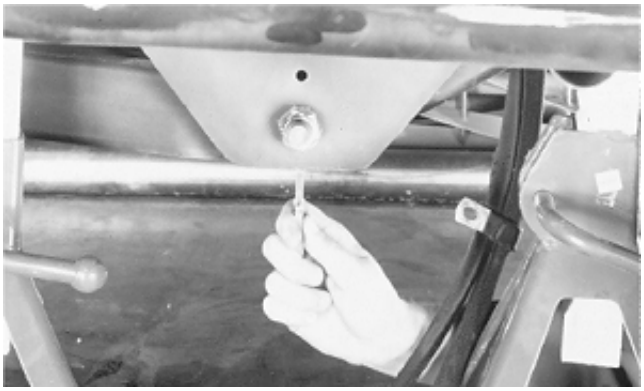
E34193 -UN-05JUN90

MX,6015HV,A2 -19-30NOV92

CHECK AND ADJUST REAR AXLE END PLAY

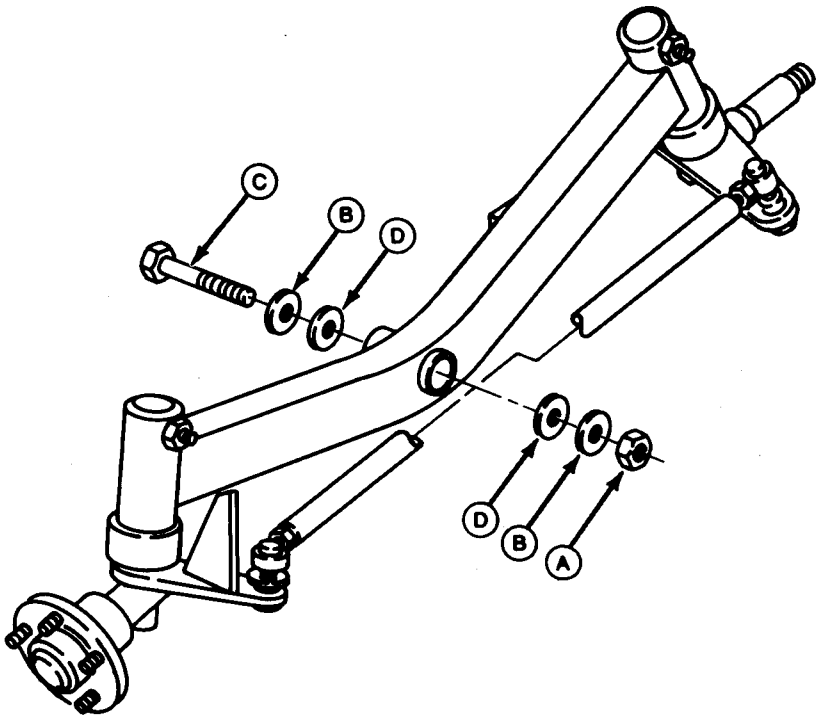
1. Raise rear of mower and push axle assembly fully towards the rear.

2. Measure the clearance between the front side of the rear axle and the mower frame. Clearance must be approximately 1 mm (0.040 in.).



E30045 -UN-11DEC89

MX,6015HV,A2A -19-30NOV92



E35460 -UN-12DEC90

3. If clearance is less than specification:
   - •Support axle using a floor jack and remove pivot nut (A), washers (B), and cap screw (C).
   - •Remove shims (D) as necessary, to obtain specified clearance.
   - •Install pivot cap screw, washers, and nut.
   - •Tighten nut to 509 N·m (375 lb-ft).

4. If clearance is greater than specification:
   - •Support axle using a floor jack and remove pivot nut (A), washers (B), and cap screw (C).
   - •Add shims (D) as necessary to obtain specified clearance.
   - •Install pivot cap screw, washers, and nut.
   - •Tighten nut to 509 N·m (375 lb-ft).

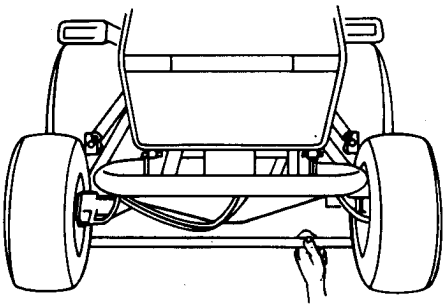
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EX,3325,6015,2 -19-24APR91

ADJUST STEERING TOE-IN

1. Position wheels so they are pointing straight ahead.

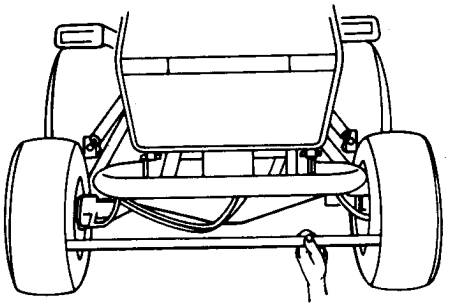
2. Measure distance between the front inner edges of the tires.



E34155 -UN-22MAY90

2E6,6015G,21 -19-24APR91

3. Measure rear distance between tires. When properly adjusted, rear distance should be 6 mm (1/4 in.) greater than front distance.



E34156 -UN-22MAY90

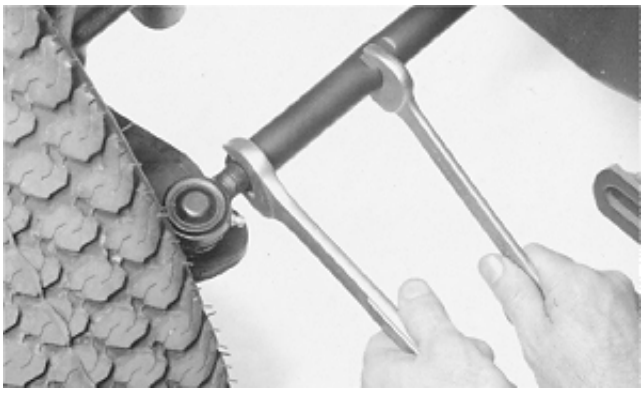
2E6,6015G,22 -19-25MAY90

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4. Loosen tie rod nuts and adjust tie rod to lengthen or shorten distance.

IMPORTANT: Make sure there is free movement of ball joints after tightening.

5. Tighten tie rod nuts to 118 N·m (87 lb-ft).



M43592 -UN-31AUG88

2E6,6015G,23 -19-25MAY90

Section 70
HYDRAULIC REPAIR

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SPECIFICATIONS

Item	Measurement	Specification
Transaxle Pump-to-Differential Housing Cap Screws	Torque	47 N·m (35 lb-ft)
Lift link-to-rockshaft arm cap screw	Torque	163 N·m (120 lb-ft)
Transaxle Pump Cover Socket Head Screws	Torque	47 N·m (35 lb-ft)
Lower Hydraulic Pump Socket Head Screws	Torque	47 N·m (35 lb-ft)
Hydraulic pump mounting cap screws	Torque	54 N·m (40 lb-ft)
Hydraulic pump tube nuts	Torque	102 N·m (75 lb-ft)
Suction Line Adapter-to-Differential Housing Cap Screws	Torque	26 N·m (230 lb-in.)

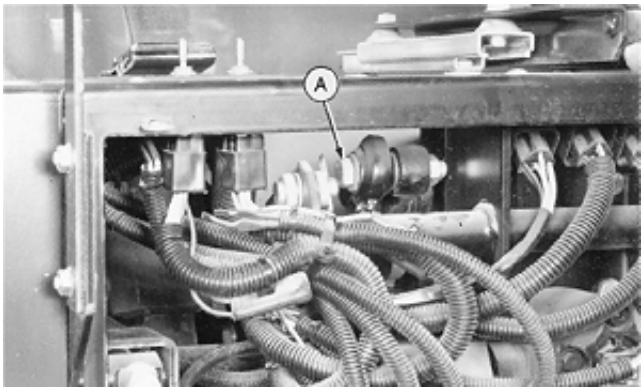
EX,3325,7005,3 -19-30NOV92

REMOVE TRANSAXLE PUMP

1. Drain oil from transaxle. (See procedure in Section 50, Group 10.)

2. Remove front kick and floor panels.

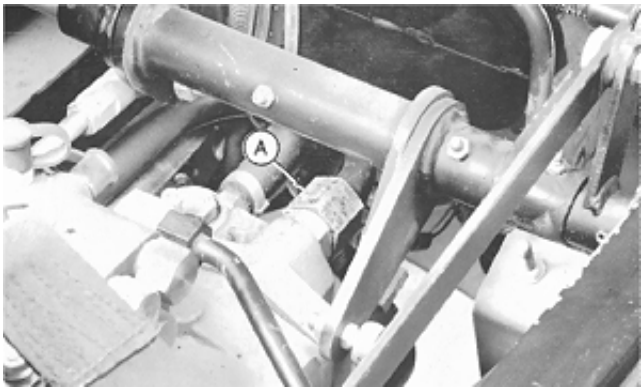
3. Lower cutting units to the ground. Remove cap screw (A) to disconnect right lift linkage from right rockshaft arm.



-UN-22MAY90
E34120

MX,7005HV,A1 -19-30NOV92

4. Lift left side of fuel tank and install support rod. Disconnect charge pump suction tube (A) from transmission.

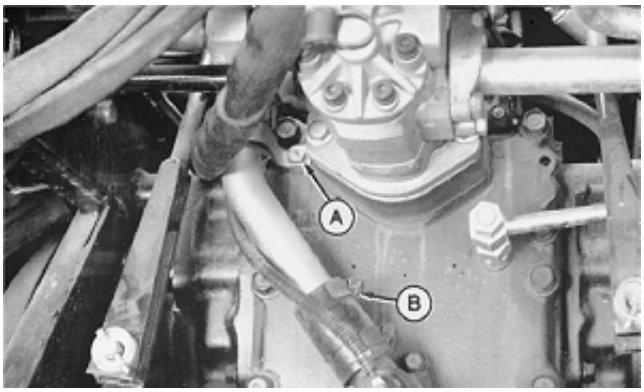


-UN-11DEC89
E30116

MX,7005HV,A1A -19-30NOV92

5. Remove cap screw (A) securing suction tube clamp to transaxle.

6. Loosen upper hose clamp (B).



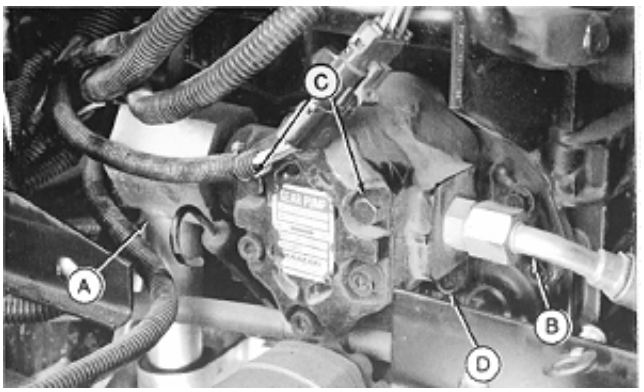
EX,3325TM,CG440-19-24APR91

7. Pull suction tube (A) from transaxle pump.

8. Disconnect flow control valve pressure line (B).

9. Remove two long cap screws (C) and two cap screws (D). Remove transaxle pump.

A—Suction Tube
B—Flow Control Valve Pressure Line
C—Long Cap Screw
D—Cap Screw



MX,7005HV,A1B -19-30NOV92

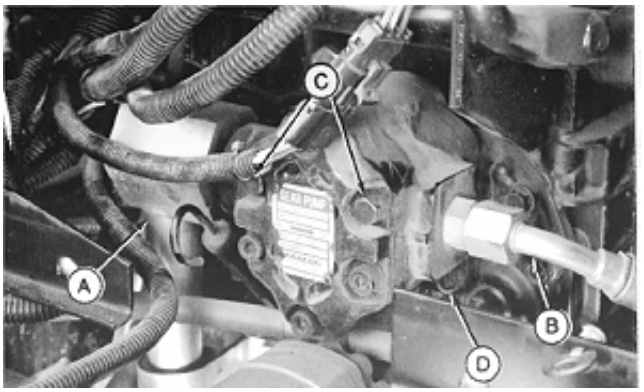
INSTALL TRANSAXLE PUMP

1. Install gasket and pump on transaxle. Install cap screws (C and D). Tighten to 47 N·m (35 lb-ft).

2. Connect flow control valve pressure line (B).

3. Apply petroleum jelly to O-ring of pump inlet fitting. Push suction tube (A) on fitting.

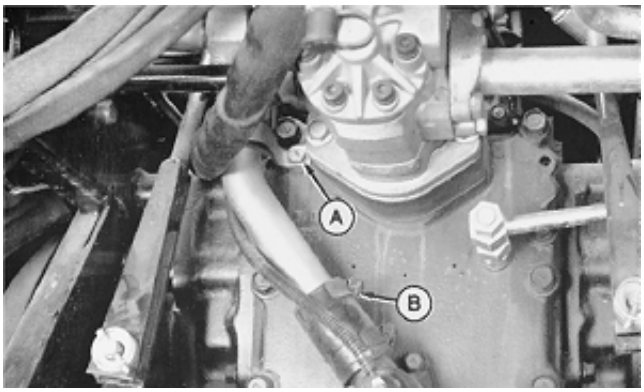
A—Suction Tube
B—Flow Control Valve Pressure Line
C—Long Cap Screw
D—Cap Screw



MX,7005HV,A1C -19-30NOV92

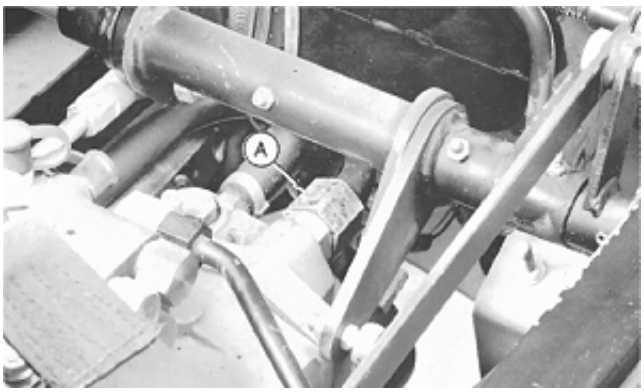
4. Connect suction tube to hose and tighten clamp (B).

5. Install and tighten cap screw (A) to fasten suction tube clamp to transaxle.



EX,3325,7005,2 -19-30NOV92

6. Connect suction tube (A) to transmission and lower fuel tank.



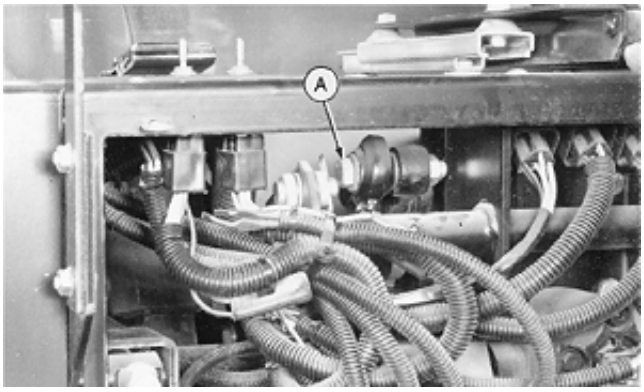
MX,7005HV,A1D -19-30NOV92

7. Lift front right lift arm to connect right lift linkage to right rockshaft arm. Install cap screw and nut (A). Tighten cap screw to 163 N·m (120 lb-ft).

8. Install floor and front kick panels.

9. Fill transaxle with specified transmission/hydraulic oil. (See Section 10, Group 20.)

10. Bleed the hydraulic system. (See procedure in Section 50, Group 05.)



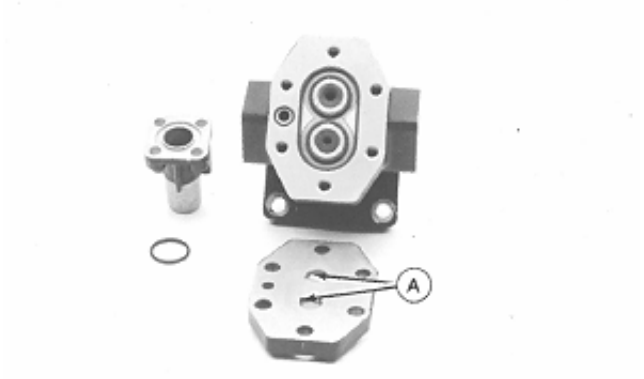
MX,7005HV,A1E -19-30NOV92

DISASSEMBLE TRANSAXLE PUMP

1. Remove inlet fitting and O-ring from pump housing.

2. Remove end cover from pump housing. Check to see that passages (A) in the cover are open and clear.

3. Remove O-ring from the end of bushings, recess in housing, and port between cover and housing.



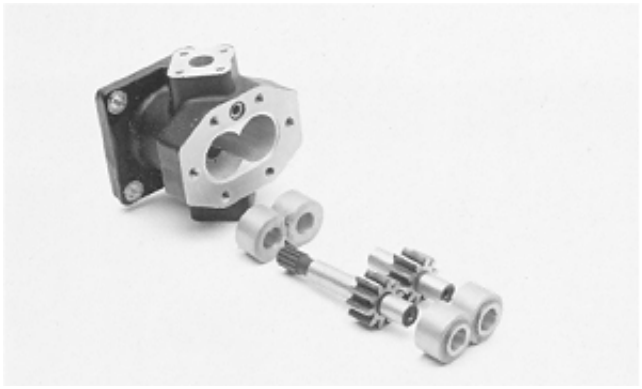
2E6,7005G,8A -19-30NOV92

4. Remove bushings and gear set from housing. Also remove O-rings from the backside of the front bushings.

5. Inspect the housing for severe wear and scoring. A small amount of wear in the gear track is normal.

6. Also inspect the shafts and inside diameters of the bushings for wear, scoring, and blue discoloration indicating overheating.

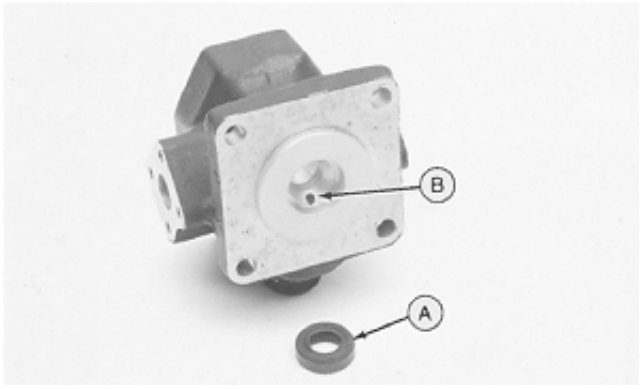
Pump body is not serviced; if damaged or worn, replace complete hydraulic pump.



M43551 -UN-31AUG88

2E6,7005G,8B -19-24APR91

7. Remove shaft seal (A) from housing. Be sure passageway (B) is clear and open.



M43552 -UN-31AUG88

M21,7005W,10 -19-25MAY90

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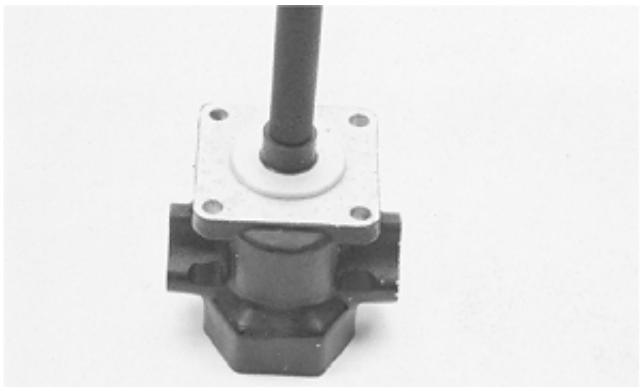
ASSEMBLE TRANSAXLE PUMP

1. Clean and dry all parts.

2. Use new O-rings and seals for reassembly.

3. Before assembly, apply clean hydraulic oil to all internal parts.

4. Install new shaft seal using a 25 mm (1 in.) diameter seal driver disk.

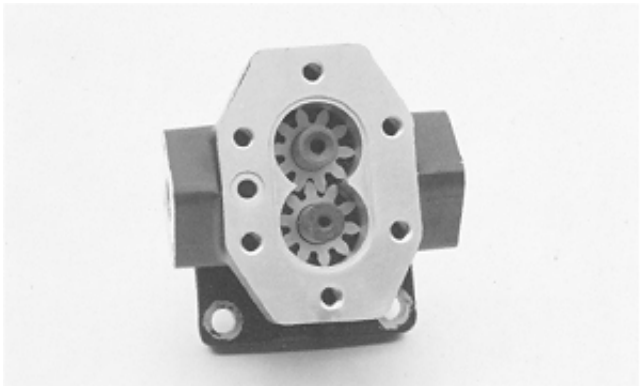


M43553 -UN-31AUG88

2E6,7005G,8C -19-30NOV92

5. Install new O-rings on each bushing. Install first set of bushings, O-ring side first, into pump housing.

6. Slide gear set into place making sure shaft seal is not damaged.



M43554 -UN-31AUG88

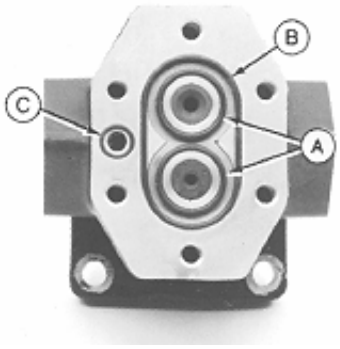
M21,7005W,12 -19-25MAY90

7. Install new O-rings on rear bushings (A) and place them in the housing, O-ring side away from the gear set.

8. Place new O-ring in the housing recess (B) and in the housing port (C).

9. Install cover. Tighten socket head screws to 47 N·m (35 lb-ft).

10. Place new O-ring on inlet fitting and install fitting on pump housing. Install and tighten four socket head screws.



M43555 -UN-23SEP91

MX,7005HV,A1F -19-30NOV92

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REMOVE LOWER HYDRAULIC PUMP

1. Drain hydraulic reservoir and transaxle. (See procedure in Section 50, Group 10.)

NOTE: Steps 2 and 3 apply only to mowers equipped with weight transfer system.

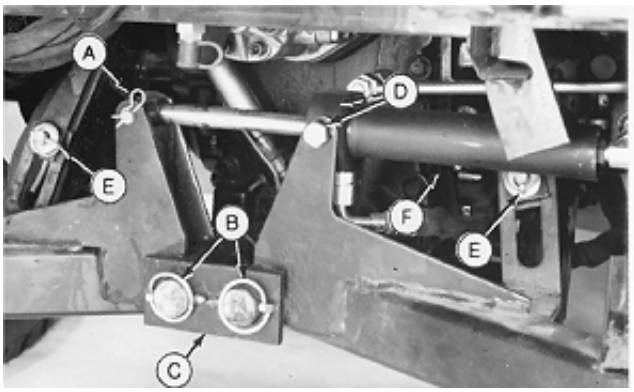
2. Remove spring locking pin (A), pin and spacer from weight transfer cylinder rod.

3. Remove two cap screws (D) on weight transfer cylinder (F). Move cylinder to the left side of the mower.

4. Remove two quick lock pins, spacers, and washers (E) from each side.

5. Remove two quick lock pins (B), plate (C) and washers.

6. Pull both cutting units and lift arms forward from pivot pins.



E35863 -UN-11MAR91

A—Spring Lock Pin
B—Quick Lock Pin
C—Plate
D—Cap Screw
E—Quick Lock Pin
F—Front Weight Transfer Cylinder

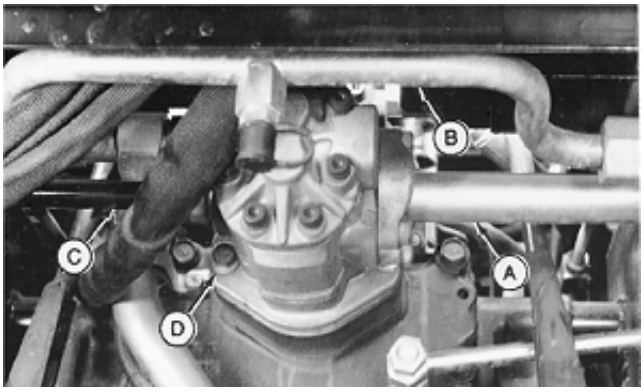
MX,7005HV,A2 -19-30NOV92

7. Remove four cap screws and washers from hydraulic pump supply tube (A). Remove flange clamp. Loosen reservoir end of tube to pull tube out of way.

8. Unfasten two tube nuts and remove supply tube (B) from pump.

9. Loosen nuts on each end of reel control valve supply tube (C). Move tube from pump.

10. Remove cap screws (D) from each side of pump. Pull pump forward and down, away from transaxle.

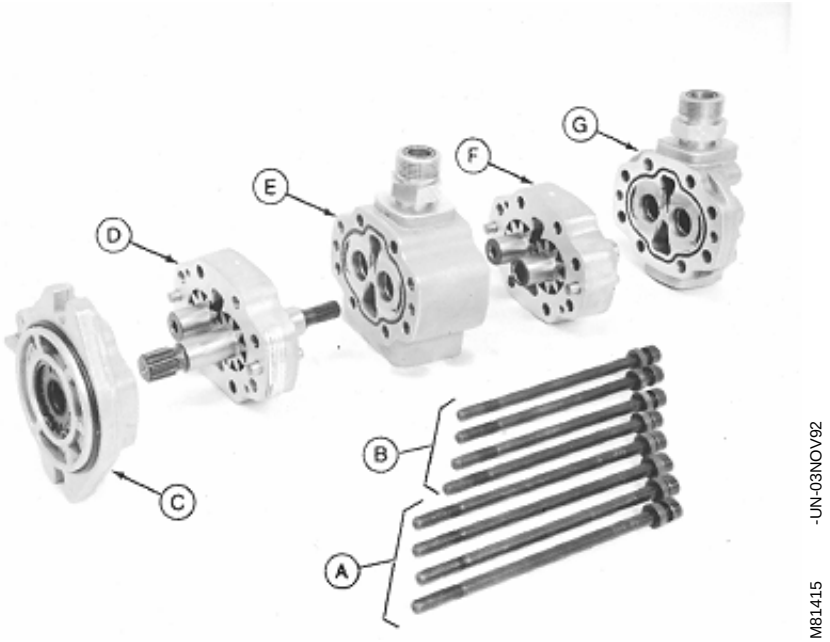


E35465 -UN-22JAN91

A—Hydraulic Pump Supply Tube
B—Reel Control Valve Left Supply Tube
C—Reel Control Valve Right Supply Tube
D—Cap Screw (2 used)

MX,7005HV,A2A -19-30NOV92

REPLACE HYDRAULIC PUMP SEALS



A—Long Socket Head Screw with Spacer (4 used)
B—Short Socket Head Screw with Spacer (4 used)
C—Mounting Flange
D—Center Cutting Units Section
E—Inlet/Outlet Section
F—Wing/Cutting Units Section
G—Cover/Outlet Section

1. Mark pump sections to aid assembly.

2. Remove eight socket head screws (A and B) with spacers.

IMPORTANT: Separate pump sections carefully. Do not allow parts to fall out. Keep individual pump components together as matched sets.

3. Carefully separate pump sections (C—G) as necessary.

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MX,7005HV,A6 -19-30NOV92

4. Remove porting plate (C), back-up seal (D), bushing seal (E) and section seals (F) from inlet/outlet section (A).

Repeat step for cover/outlet section (B). Only one section seal is used.

5. Inspect bushings in sections and gear contact surfaces for wear, damage or discoloration.

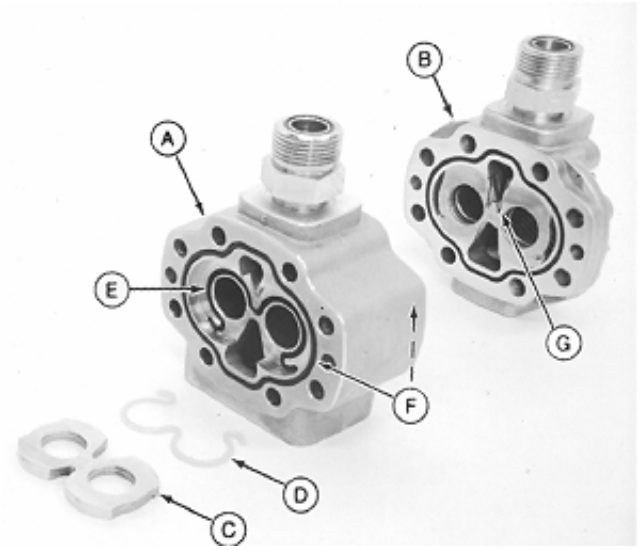
Inspect porting plate for scoring or damage.

Replace hydraulic pump if damage is found.

6. Install new bushing seal, backup seal and section seals. Be sure flat side of back-up seal is toward porting plate.

7. Install porting plate with flat side towards seals and notches (G) towards smaller outlet port.

8. Repeat steps 6 and 7 for cover/outlet section.



M81417 -UN-03NOV92

A—Inlet/Outlet Section
B—Cover/Outlet Section
C—Porting Plate
D—Back-Up Seal
E—Bushing Seal
F—Section Seal
G—Notches

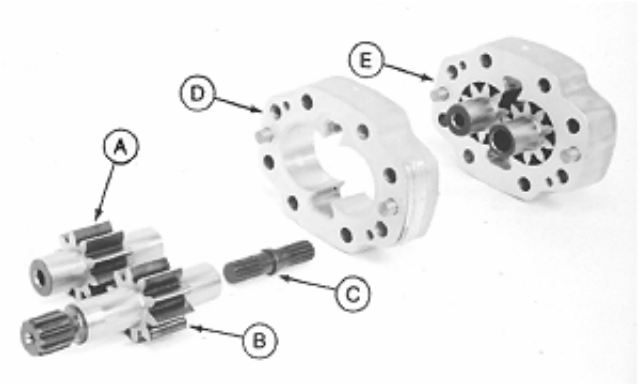
MX,7005HV,A7 -19-30NOV92

9. Put a mark across gear teeth so gears can be assembled with the same teeth meshed together. Use a lead pencil or marker. Do not damage gear surface.

10. Inspect gears, gear shafts and inner surface of pump section (D) for nicks, scoring or discoloration. If damage is found, replace hydraulic pump.

11. Repeat steps 9 and 10 for wing section (E).

12. Assemble gears and sections, making sure the longer shafts of the driven gears and wing section drive gear are towards cover/outlet end of pump.



M81416 -UN-03NOV92

A—Driven Gear
B—Drive Gear
C—Splined Coupler
D—Center Cutting Units Section
E—Wing Cutting Units Section

MX,7005HV,A8 -19-30NOV92

13. Remove parts (A—D) from mounting flange (E).

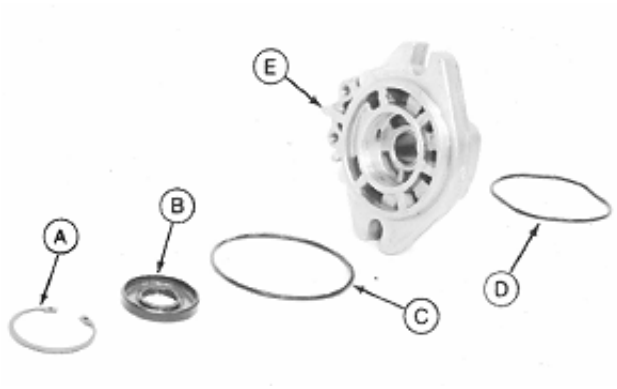
14. Inspect bushings in flange for wear, damage or discoloration.

Inspect gear contact surfaces for scoring or damage.

Replace hydraulic pump if damage is found.

15. Install new seal (B) with spring side into bore first. Push seal to bottom of bore and install snap ring.

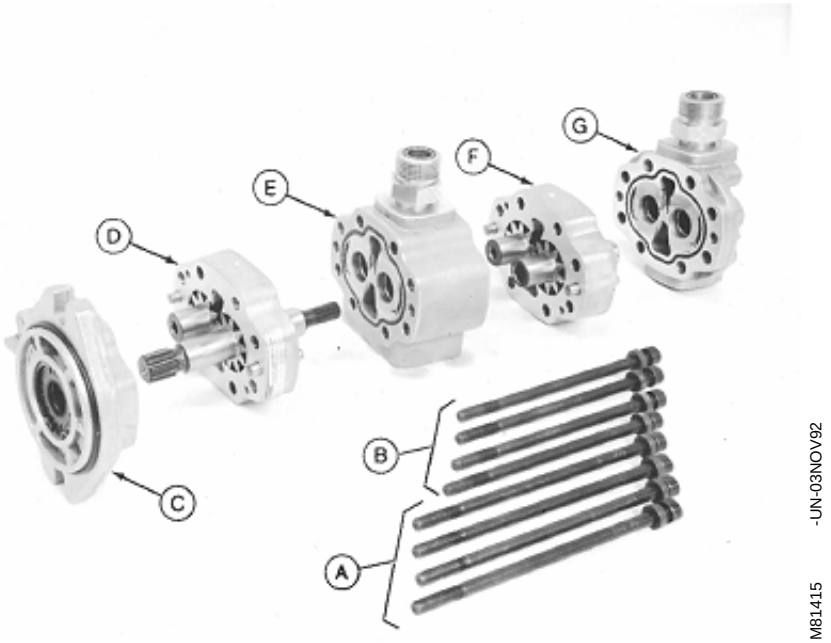
16. Install O-ring and seal.



M81418 -UN-03NOV92

A—Snap Ring
B—Shaft Seal
C—O-Ring
D—Section Seal
E—Mounting Flange

MX,7005HV,A9 -19-30NOV92



M81415 -UN-03NOV92

A—Long Socket Head Screw with Spacer (4 used)
B—Short Socket Head Screw with Spacer (4 used)
C—Mounting Flange
D—Center Cutting Units Section
E—Inlet/Outlet Section
F—Wing Cutting Units Section
G—Cover/Outlet Section

IMPORTANT: Apply clean hydraulic oil to all internal parts before assembly. Premature pump failure can result if pump is assembled dry.

17. Apply clean hydraulic oil to all internal parts.

18. Align pump sections (C—G) using mark made during disassembly.

19. Install and tighten socket head screws (A and B) to 47 N·m (35 lb-ft).

MX,7005HV,A10 -19-30NOV92

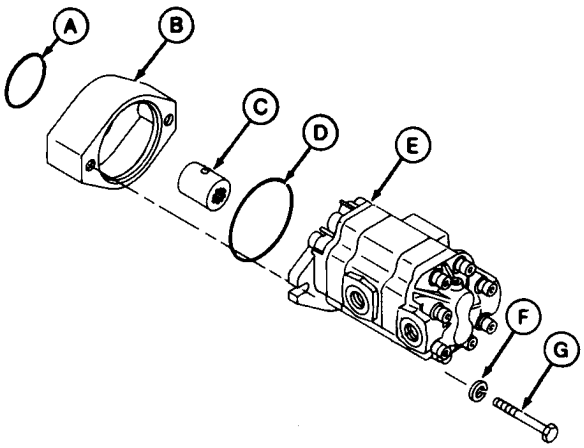
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9

INSTALL LOWER HYDRAULIC PUMP

1. Install hydraulic pump (E), making sure O-rings (A and D), spacer (B), and splined coupling (C) are in position on transaxle.

2. Install two washers (F) and cap screws (G).

A—O-Ring
B—Spacer
C—Splined Coupling
D—O-Ring
E—Hydraulic Pump
F—Washer
G—Cap Screw



E35466 -UN-22JAN91

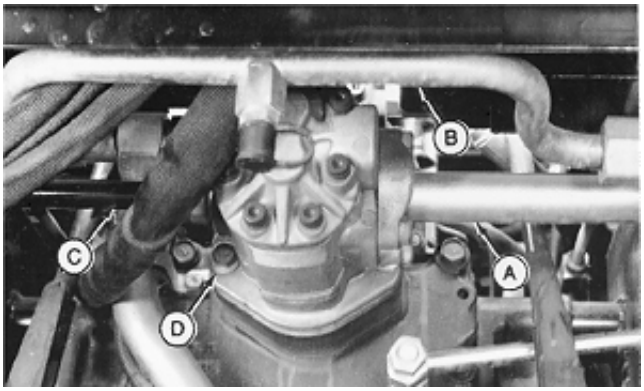
MX,7005HV,A2B -19-30NOV92

3. Tighten cap screws (D) to 54 N·m (40 lb-ft).

4. Put tubes (B and C) in position and tighten nuts on each end to 102 N·m (75 lb-ft).

5. Install tube (A) and flange clamp with four cap screws and washers.

A—Hydraulic Pump Supply Tube
B—Reel Control Valve Left Supply Tube
C—Reel Control Valve Right Supply Tube
D—Cap Screw (2 used)



E35465 -UN-22JAN91

MX,7005HV,A2C -19-30NOV92

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6. Support front weight transfer cylinder (F) and slide both cutting units and lift arms onto pivot pins.

7. Install washers, plate (C) and two quick lock pins (B).

8. Install two pins, spacers, quick locking pins and washers (E) on each side.

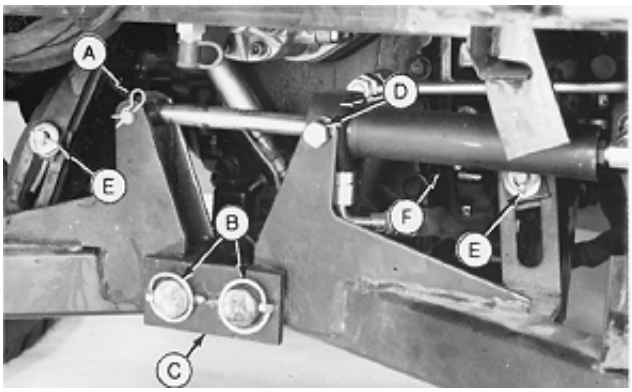
NOTE: Steps 9 and 10 apply only to mowers equipped with weight transfer system.

9. Move weight transfer cylinder (F) into position. Install and tighten two cap screws (D).

10. Install pin, spacer and spring locking pin (A) on weight transfer cylinder rod.

11. Fill transaxle and reservoir with oil.

12. Bleed the hydraulic system. (See procedure in Section 50, Group 05.)



E35863 -UN-11MAR91

A—Spring Lock Pin
B—Quick Lock Pin
C—Plate
D—Cap Screw
E—Quick Lock Pin
F—Front Weight Transfer Cylinder

EX,3325TM,CG446-19-24APR91

INSPECT SUCTION SCREEN

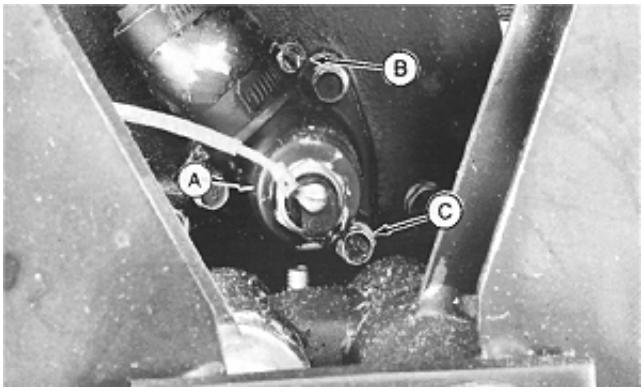
NOTE: Oil capacity of transaxle is approximately 19 L (5 gal).

1. Drain transaxle. (See procedure in Section 50, Group 10.)

2. Loosen hose clamp (B).

3. Disconnect wire from temperature switch.

4. Remove three cap screws (C) to remove suction adapter (A).



M81411 -UN-03NOV92

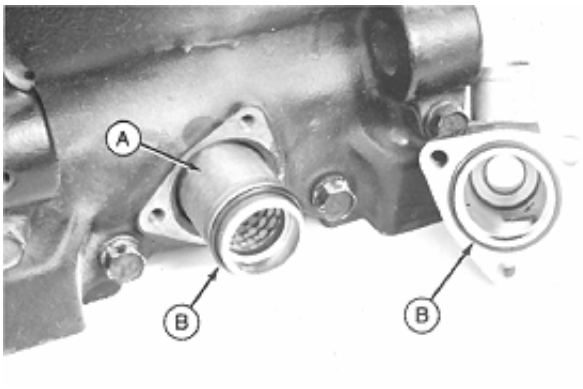
MX,7005HV,A3 -19-30NOV92

NOTE: Transaxle shown removed for clarity.

5. Remove filter screen (A). Clean screen thoroughly in solvent, blow dry with compressed air, and examine for damage. Replace if necessary.

6. Replace O-rings (B). Apply clean hydraulic oil to O-rings.

7. Install suction screen.



-UN-12FEB92
M80883

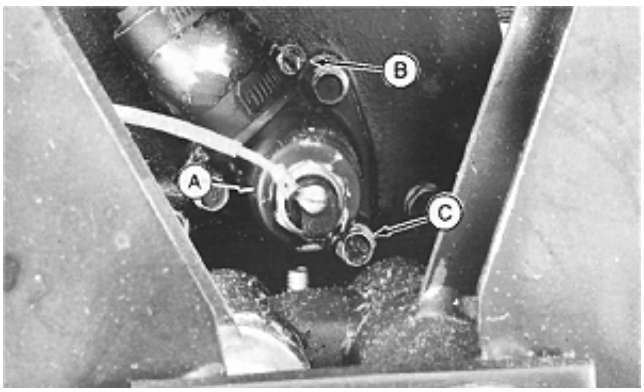
MX,7005HV,A4 -19-30NOV92

8. Install suction adapter (A). Tighten cap screws (C) to 26 N·m (230 lb-in.).

9. Tighten hose clamp (B).

10. Connect wire to switch.

11. Fill transaxle with specified transmission/hydraulic oil. (See Section 10, Group 20.)



-UN-03NOV92
M81411

MX,7005HV,A5 -19-30NOV92

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SPECIFICATIONS

Item	Measurement	Specification
Reel Control Valve Tie Rod Nuts	Torque	18.6 N·m (165 lb-in.)
Wing Lift Valve Tie Rod Nuts	Torque	13 N·m (115 lb-in.)
Flow Control Valve		
Priority Flow Divider Spool Plug	Torque	98 N·m (72 lb-ft)
Proportional Flow Divider Spool Plug	Torque	44 N·m (33 lb-ft)
Relief Spools Seat Retainers	Torque	29 N·m (22 lb-ft)
Relief Spools Plugs	Torque	98 N·m (72 lb-ft)
Socket Head Mounting Screws	Torque	17 N·m (150 lb-in.)

MX,7010HV,A1A -19-30NOV92

REMOVE AND INSTALL RELIEF VALVES

NOTE: Approximate oil capacity of reservoir is 26.5 L (7 gal).

1. Drain hydraulic reservoir.

2. Clean area around relief valves and lines.

3. If necessary, disconnect hoses (E) and (F) to access relief valve (B).

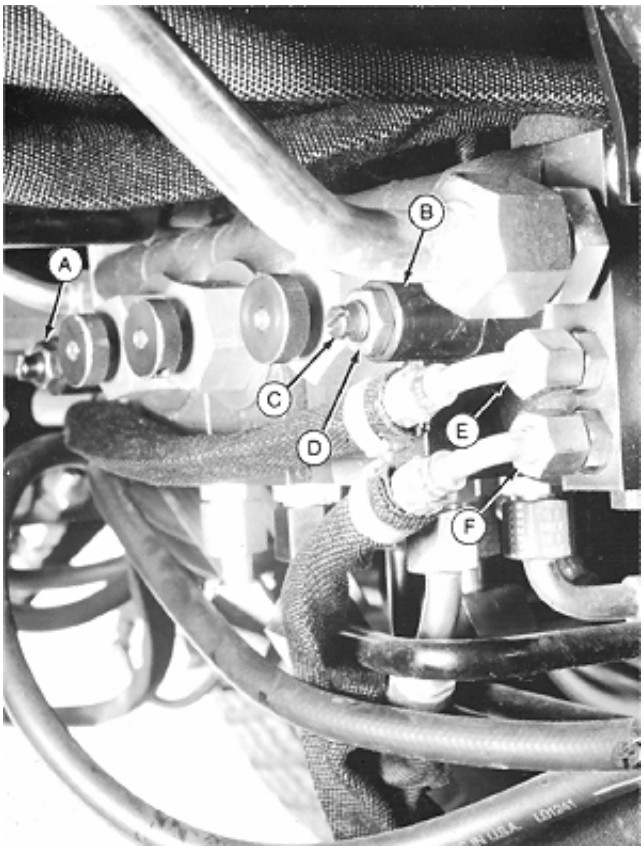
IMPORTANT: Do not interchange relief valves. Relief valves have different pressure settings.

4. Remove relief valve (A) or (B). DO NOT turn adjustment screw (C) or lock nut (D) on either relief valve.

5. Install relief valve using a new O-ring seal. Used or damaged O-rings can leak.

6. Connect hoses (E) and (F), if removed.

7. Fill reservoir with specified hydraulic oil. (See Section 10, Group 20.)



M81378 -UN-03NOV92

A—Wing Motors Relief Valve
B—Front and Center Motors Relief Valve
C—Adjustment Screw
D—Lock Nut
E—Left Wing Motor Drain Hose
F—Rear Center Motor Drain Hose

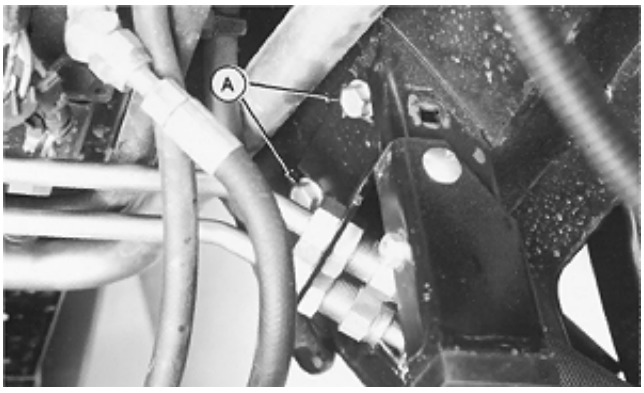
MX,7010HV,A1 -19-30NOV92

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REMOVE REEL CONTROL VALVE

1. Drain oil from hydraulic reservoir.

2. Loosen mounting bracket cap screws (A) for right and left wing motor hydraulic lines.



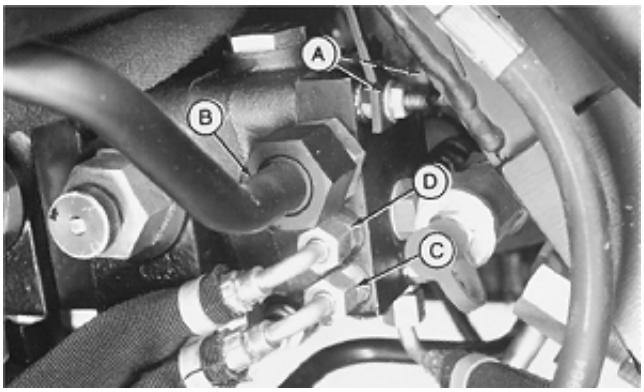
E35715 -UN-09JAN91

EX,3325,7010,6 -19-30NOV92

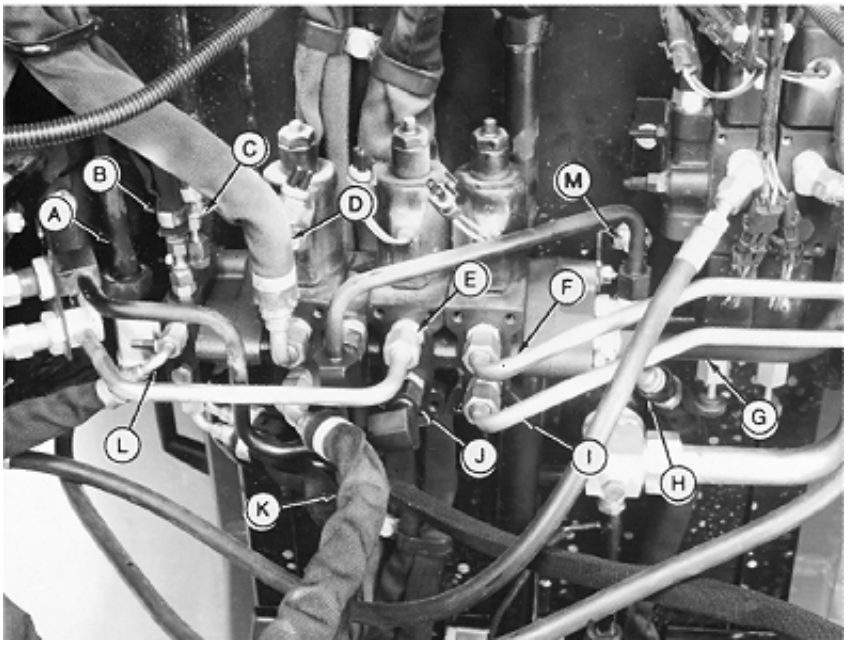
3. Remove two nuts (A).

4. Tag and disconnect hydraulic lines (B—D).

A—Mounting Nut (2 used)
B—Reel Control Valve Right Outlet Port-to-Reservoir Line
C—Rear Center Motor Drain Hose
D—Left Wing Motor Drain Hose



EX,3325,7010,7 -19-24APR91



A—Hydraulic Pump-to-Reel Control Valve Right Inlet Port Line
B—Front Left Motor Drain Hose
C—Front Right Motor Drain Hose
D—Front Center Cutting Units Valve Section to-Front Right Motor Inlet Port Hose
E—Right Wing Cutting Unit Valve Section to-Right Wing Motor Inlet Port Line
F—Left Wing Cutting Unit Valve Section to-Left Wing Motor Inlet Port Line
G—Hydraulic Pump-to-Reel Control Valve Left Inlet Port Line
H—Reel Control Valve Left Outlet Port-to-Oil Cooler Hose
I—Left Wing Motor Outlet Port-to-Left Wing Cutting Unit Valve Section Line
J—Right Wing Motor Outlet Port-to-Right Wing Cutting Unit Valve Section Line
K—Rear Center Motor Outlet Port-to-Front Center Cutting Units Valve Section Hose
L—Right Wing Motor Drain Hose
M—Cap Screw and Two Spacers (2 used)

70 10 4

5. Disconnect wing motors hydraulic lines (E, F, I, and J). Lift line mounting brackets from cap screws to move wing lines and hoses aside.

6. Tag and disconnect hydraulic lines and hoses (A—D, G, H, K, and L).

IMPORTANT: Reel control valve weighs approximately 23 kg (50 lb). Handle valve with care so not to damage or bend manual operation buttons on the solenoids.

Do not support control valve by the solenoids. Solenoids can be distorted causing the valve not to function.

7. Carefully remove two cap screws with spacers (M) to lower reel control valve from frame.

EX,3325,7010,8 -19-24APR91

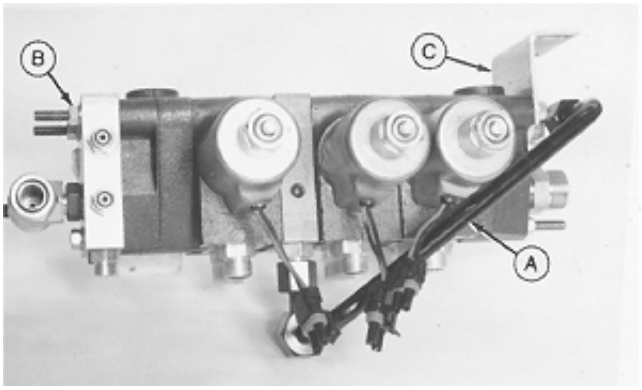
DISASSEMBLE REEL CONTROL VALVE

1. Remove hydraulic line (A).

IMPORTANT: When tie rods are removed, valve sections will separate. Identify sections for assembly in the same order.

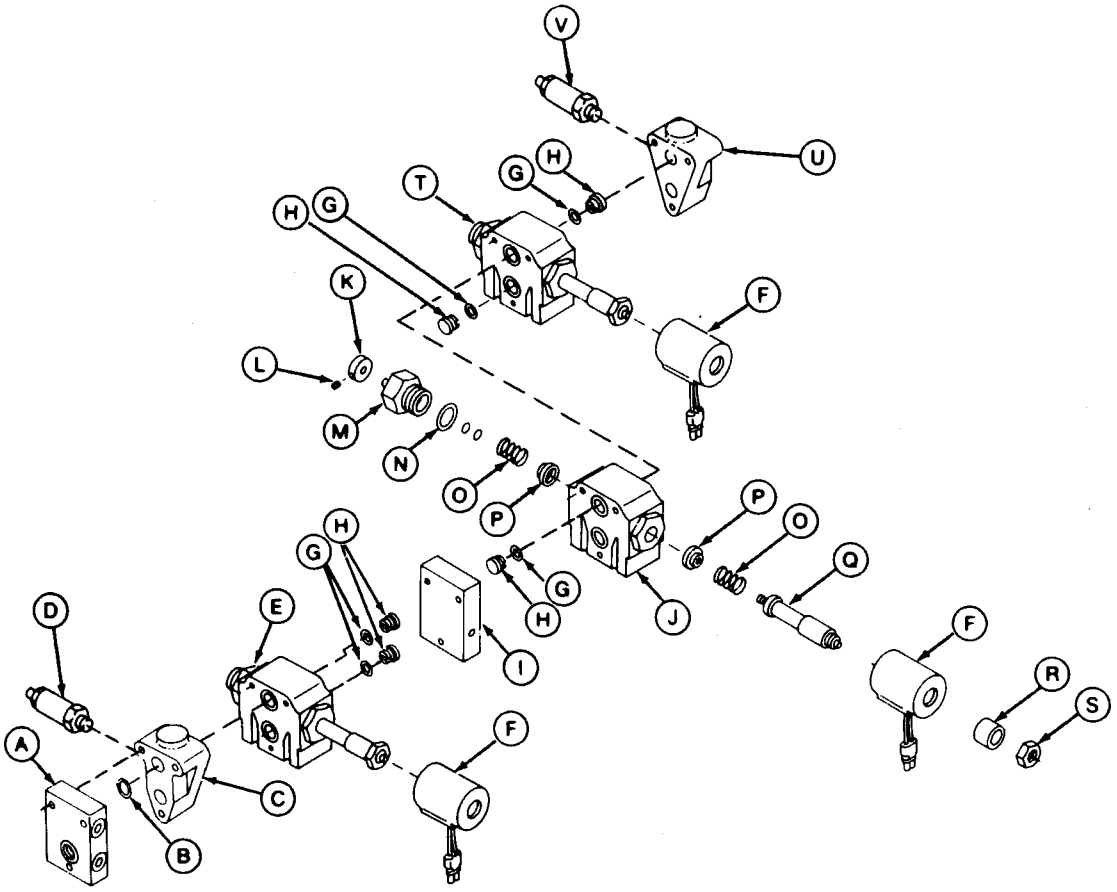
2. Tag or mark each section of valve to ensure correct position of sections at assembly.

Remove three nuts and washers (B). Carefully remove tie rods to remove bracket (C) and separate valve sections.



E35883 -UN-13MAR91

EX,3325,7010,4 -19-30NOV92



E35474 -UN-03NOV92

A—Inlet/Outlet Section
B—O-Ring
C—Front and Center Motors Relief Valve Section
D—Relief Valve Assembly
E—Front and Center Motors Control Valve Section
F—Coil (3 used)
G—O-Ring
H—Plug (5 used)
I—Outlet Section
J—Right Wing Motor Control Valve Section
K—Knob
L—Set Screw
M—Actuator Assembly
N—O-Ring
O—Spring
P—Spring Retainer
Q—Coil Plunger Assembly
R—Bushing
S—Nut
T—Left Wing Motor Control Valve Section
U—Wing Motors Relief Valve Section
V—Relief Valve Assembly

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6

IMPORTANT: Identify plug (H) locations for assembly in proper ports.

3. Carefully separate valve sections (A, D, E, J, T and U) and note shim (C) locations. Identify sections so sections can be assembled in the same position as removed.

4. Remove nut (S) and bushing (R) to remove coil (F).

5. Remove coil plunger assembly (Q). Do not drop or lose spring (O) and spring retainer (P).

IMPORTANT: Plunger assembly (Q) parts are a matched set. If any parts are damaged, replace plunger assembly.

6. Remove actuator assembly (M). Do not drop or lose spring (O) and spring retainers (P).

7. Repeat steps 4—6 for remaining sections (E and T).

8. Disassemble relief valve sections (C and U) only for cleaning or inspection. Keep all parts together as a set. Complete valve section must be replaced if worn or damaged.

MX,7010HV,A1B -19-30NOV92

INSPECT REEL CONTROL VALVE

1. Inspect valve sections for scratches and marks on mating surfaces that may affect the seal between sections.

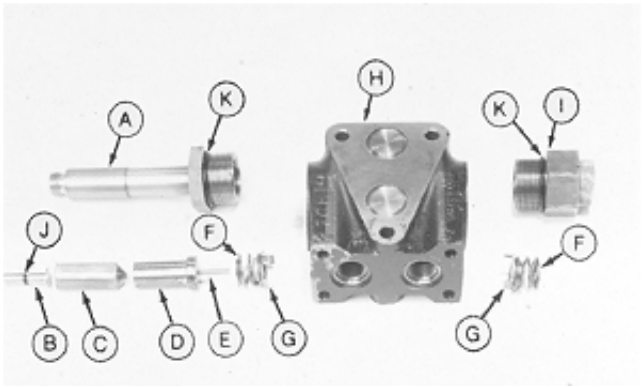
2. Inspect all seals and gaskets for tears and cracks.

3. Replace O-rings (J and K) and any damaged or worn parts.

IMPORTANT: Valve body and spool are a matched set. Spool must be installed in body the same position as removed, not turned end-for-end. If body or spool is damaged, replace parts as a set.

Coil plunger assembly is a matched set. Parts must be replaced as a set.

4. Keep valve body and spool (H) together as a set. Keep coil plunger assembly (A—E) together as a set.



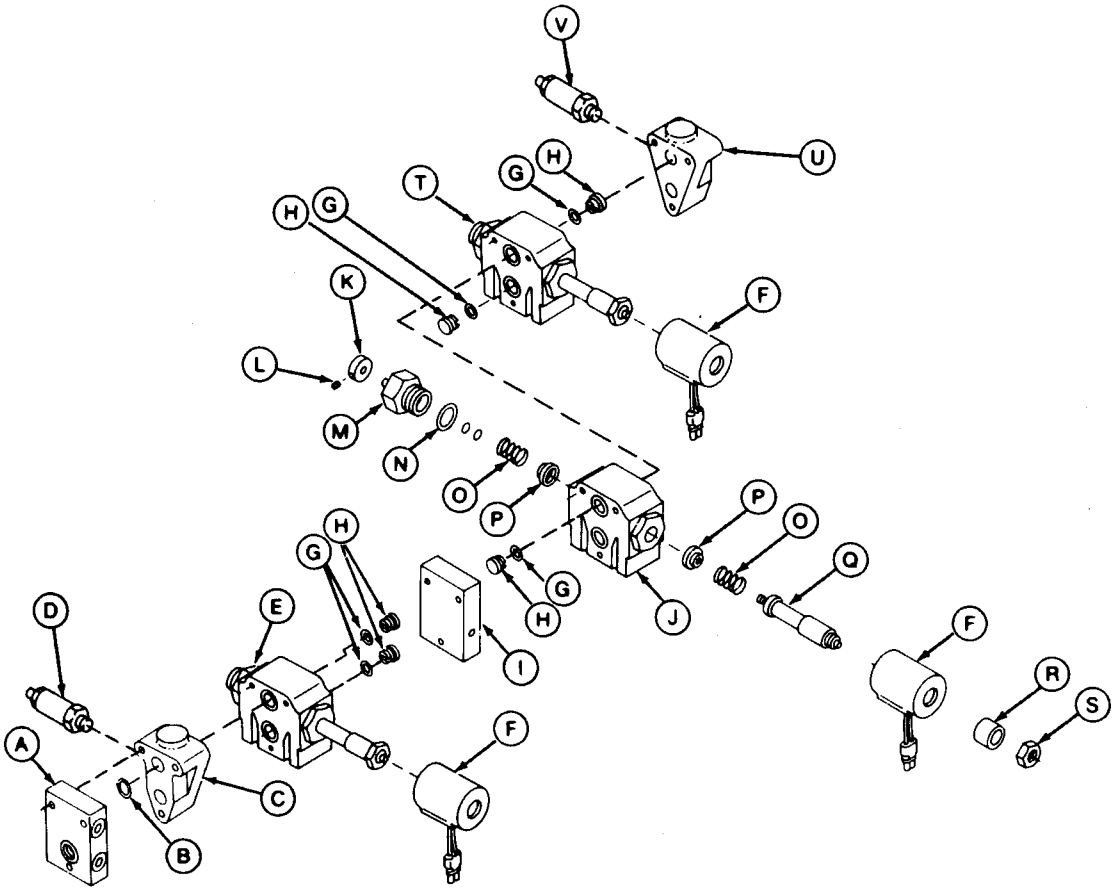
E34085 -UN-05JUN90

A—Coil Tube
B—Manual Button
C—Plunger
D—Guide
E—Pin
F—Centering Spring
G—Spring Retainer
H—Valve Body and Spool
I—Actuator Assembly
J—O-Ring
K—O-Ring

EX,3325,TMCG432-19-30NOV92

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ASSEMBLE REEL CONTROL VALVE



E35474 -UN-03NOV92

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8

A—Inlet/Outlet Section
B—O-Ring
C—Front and Center Motors Relief Valve Section
D—Relief Valve Assembly
E—Front and Center Motors Control Valve Section
F—Coil (3 used)
G—O-Ring
H—Plug (5 used)
I—Outlet Section
J—Right Wing Motor Control Valve Section
K—Knob
L—Set Screw
M—Actuator Assembly
N—O-Ring
O—Spring
P—Spring Retainer
Q—Coil Plunger Assembly
R—Bushing
S—Nut
T—Left Wing Motor Control Valve Section
U—Wing Motors Relief Valve Section
V—Relief Valve Assembly

1. Clean and dry all parts.

2. Apply clean hydraulic oil on all internal parts.

3. Assemble relief valve sections (C and U).

IMPORTANT: Install spring retainer with larger diameter into valve body first otherwise valve will not work.

4. Install spring retainer (P), spring (O) and actuator assembly (M) in valve body.

5. Install spring retainer (P), spring (O), coil plunger assembly (Q), and not in valve body.

6. Install coil (F), bushing (R), and nut (S).

7. Make sure plugs (H) and O-rings (G) are installed in the proper ports as shown.

8. Assembly valve sections (A, D, E, J, T and U) in the proper order. Make sure shims (C) and O-rings (B) are installed in same position as removed.

MX,7010HV,A2 -19-30NOV92

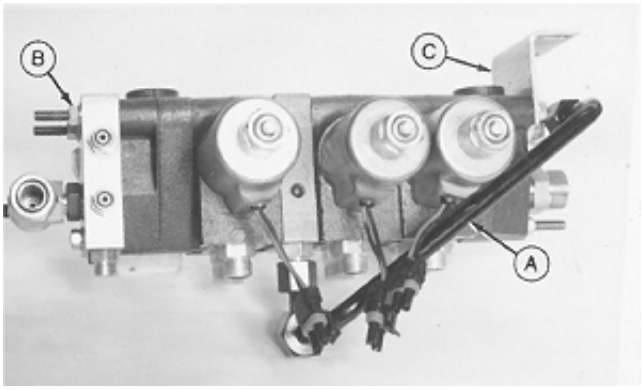
NOTE: For the top two tie rods, keep more threads exposed towards the right side. Rods are used to mount the control valve.

9. Install bracket (C) and nuts and washers (B). Tighten nuts and washers to ensure no movement of sections when tightening to final torque.

IMPORTANT: Proper tightening procedure must be followed to prevent leakage between valve sections.

10. Tighten nuts evenly to 18.6 N·m (165 lb-in.).

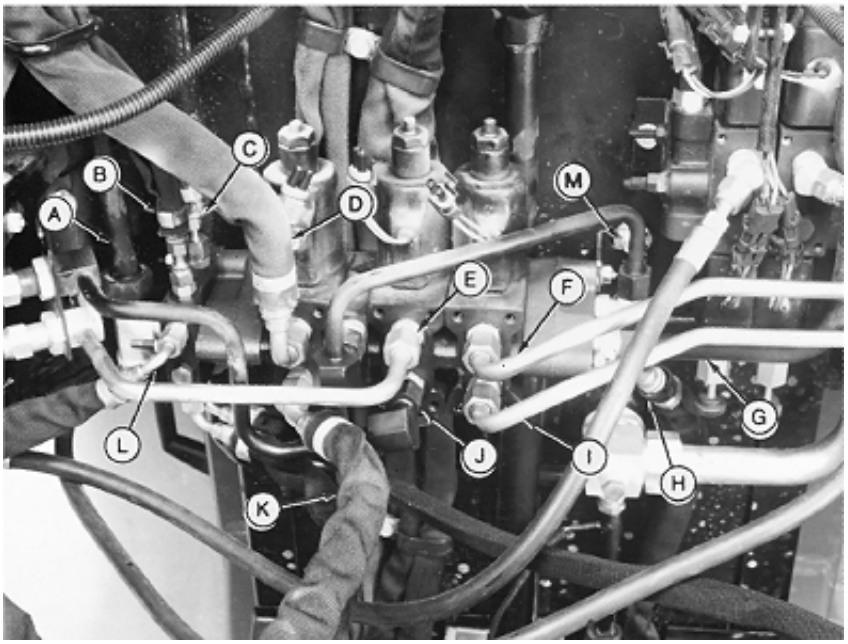
11. Install hydraulic line (A).



E35883 -UN-13MAR91

MX,7010HV,A2A -19-30NOV92

INSTALL REEL CONTROL VALVE



A—Hydraulic Pump-to-Reel Control Valve Right Inlet Port Line
B—Front Left Motor Drain Hose
C—Front Right Motor Drain Hose
D—Front Center Cutting Units Valve Section to-Front Right Motor Inlet Port Hose
E—Right Wing Cutting Unit Valve Section to-Right Wing Motor Inlet Port Line
F—Left Wing Cutting Unit Valve Section to-Left Wing Motor Inlet Port Line
G—Hydraulic Pump-to-Reel Control Valve Left Inlet Port Line
H—Reel Control Valve Left Outlet Port-to-Oil Cooler Hose
I—Left Wing Motor Outlet Port-to-Left Wing Cutting Unit Valve Section Line
J—Right Wing Motor Outlet Port-to-Right Wing Cutting Unit Valve Section Line
K—Rear Center Motor Outlet Port-to-Front Center Cutting Units Valve Section Hose
L—Right Wing Motor Drain Hose
M—Cap Screw and Two Spacers (2 used)

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IMPORTANT: Handle reel control valve with care so not to drop valve and bend or damage manual operation buttons on solenoids.

Do not support control valve assembly by the solenoids. Solenoids can be distorted causing the valve not to function.

1. Carefully lift reel control valve into position. Put threaded rods of valve into right mounting bracket. Install and tighten two cap screws with spacers (M) on left bracket. Put spacers between mower frame and right bracket.

2. Connect hydraulic lines and hoses (A—D, G, H, K, and L).

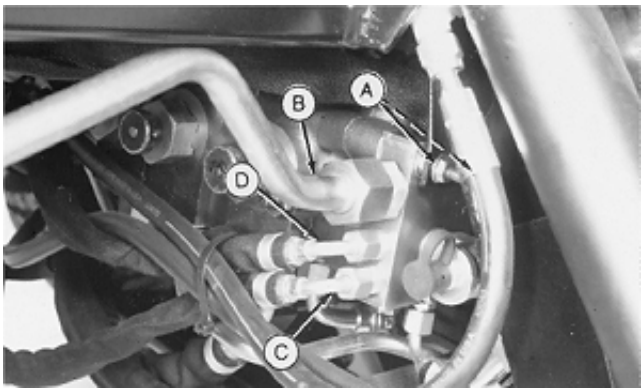
3. Put left and right wing hydraulic lines with brackets in position. Connect hydraulic lines (E, F, I, and J).

EX,3325PIP,99 -19-30NOV92

4. Install and tighten mounting nuts (A).

5. Connect lines (B—D).

A—Mounting Nut (2 used)
B—Reel Control Valve Right Outlet Port-to-Reservoir Line
C—Rear Center Motor Drain Hose
D—Left Wing Motor Drain Hose

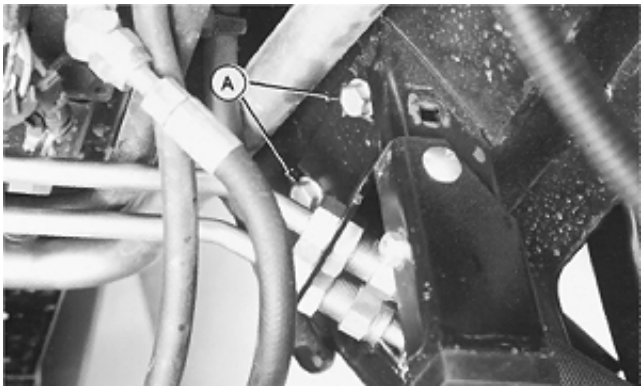


-UN-05MAR91
E35882

MX,7010HV,A2B -19-30NOV92

6. Tighten mounting bracket cap screws (A) for right and left wing motor hydraulic lines.

Left Side Shown



-UN-09JAN91
E35715

EX,3325PIP,101 -19-07MAR91

7. Fill oil reservoir with specified hydraulic oil. (See Section 10, Group 20.)

8. Operate reel motors to bleed any air out of system.

9. Check reservoir oil level. Add oil as necessary.



-UN-09DEC89
E29601

MX,7010HV,A2C -19-30NOV92

REMOVE WING LIFT VALVE

1. Make sure wing lift arms are lowered to the ground or raised and locked in position.

NOTE: Close all openings using caps and plugs to keep dirt out of the hydraulic system.

2. Tag and disconnect hoses (A) and lines (B).

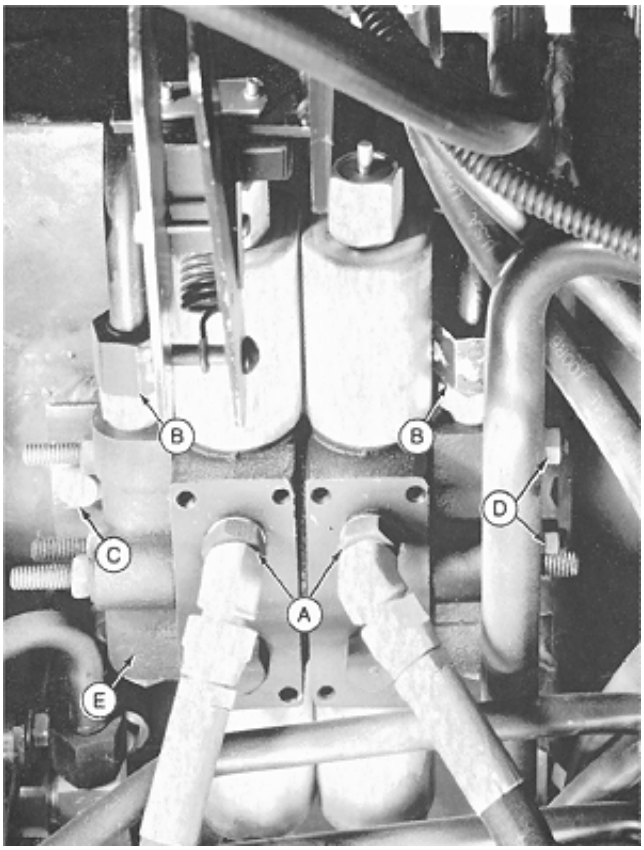
3. Tag and disconnect four electrical connectors from solenoid coils.

IMPORTANT: Handle wing lift control valve with care so not to drop valve and bend or damage manual operation buttons on solenoids.

Do not support control valve assembly by the solenoids. Solenoids can be distorted causing the valve not to function.

4. Remove cap screw (C) and two nuts (D) holding wing lift control valve (E) to main frame.

A—Cylinder Hoses
B—Lines
C—Cap screw
D—Nuts
E—Wing Lift Control Valve



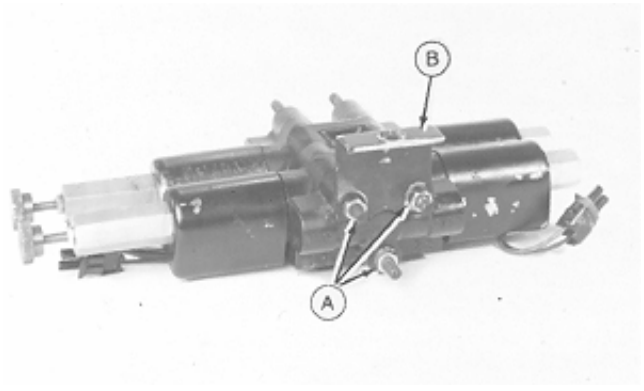
E30107 -UN-11DEC89

EX,1427TM,CG424-19-30NOV92

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12

DISASSEMBLE WING LIFT VALVE

1. Remove nuts (A) and washers to remove bracket (B).



E34181 -UN-05JUN90

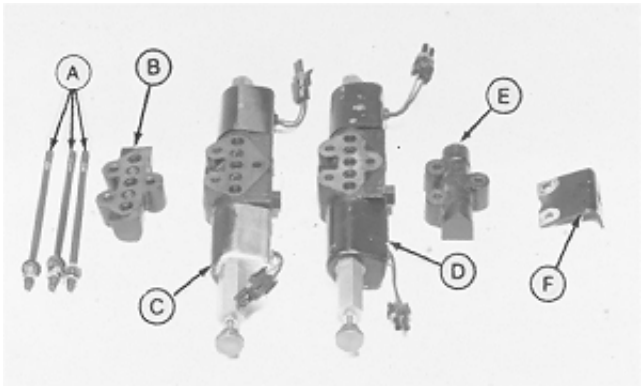
EX,3325TM,CG245-19-30NOV92

IMPORTANT: When tie rods are removed, valve sections will separate.

2. Slide tie rods (A) from control valve.

3. Carefully separate valve sections (C and D), manifolds (B and E) and bracket (F). Identify manifolds and valve sections so they can be assembled in the same position as removed.

4. Remove O-rings between sections and manifolds.



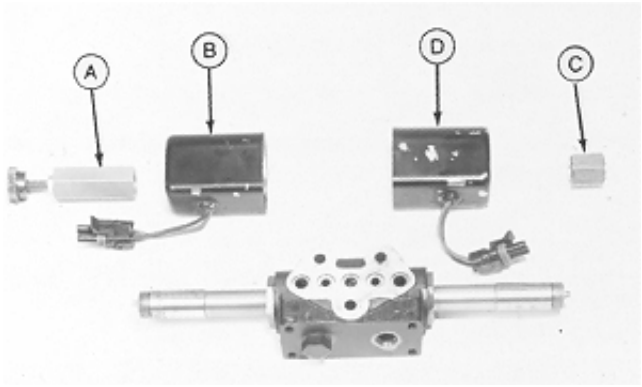
-UN-22JAN91
E34182

A—Tie Rods
B—Outlet Manifold
C—Left Wing Lift Valve Section
D—Right Wing Lift Valve Section
E—Inlet Manifold
F—Bracket

MX,7010HV,A3 -19-30NOV92

5. Remove adjuster assembly (A) to remove lift solenoid coil (B).

6. Remove nut (C) to remove lower solenoid coil (D).



-UN-05JUN90
E34183

A—Adjuster Assembly
B—Lift Solenoid Coil
C—Nut
D—Lower Solenoid Coil

MX,7010HV,A3A -19-30NOV92

7. Loosen nut to remove coil plunger assembly (C) from each end of section. Do not drop or lose spring (B) and spring retainer (A).

IMPORTANT: Coil plunger assembly parts are a matched set, if any are damaged replace plunger assembly.

8. Inspect nut and coil plunger assembly (C) for damage. Keep plunger assembly parts together as a set.

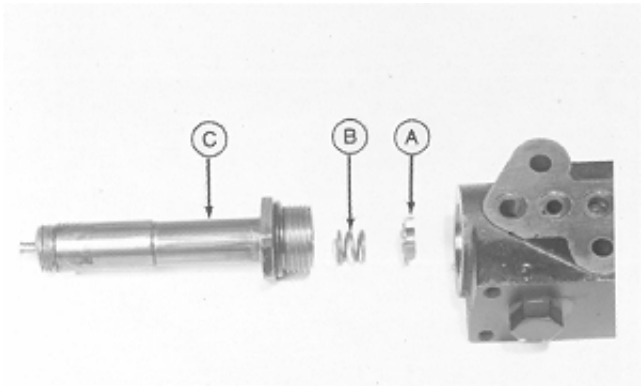
9. Inspect valve sections for scratches and marks on mating surfaces that may affect the seal between sections.

10. Inspect all seals and gaskets for tears and cracks.

11. Replace O-rings and any damaged or worn parts.

IMPORTANT: Valve body and spool are a matched set. Spool must be installed in body the same position as removed, not turned end-for-end. If body or spool is damaged, replace parts as a set.

12. Keep valve body and spool together as a set.



-UN-05JUN90
E34186

MX,7010HV,A3B -19-30NOV92

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ASSEMBLE WING LIFT VALVE

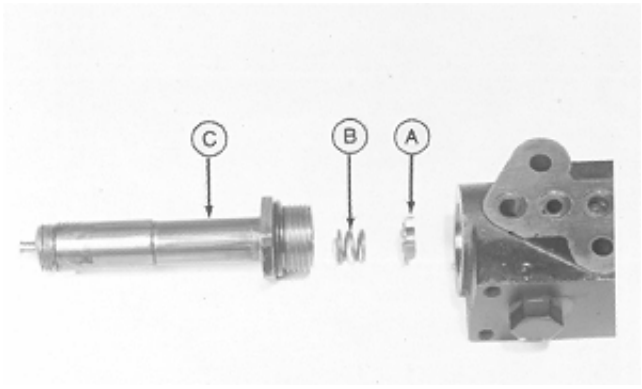
1. Clean and dry all parts.

2. Before assembling, apply clean hydraulic oil on all internal parts.

IMPORTANT: Install spring retainer (A) with cupped side into valve body first. This will ensure proper spring force for valve operation.

3. Install spring retainer (A), spring (B), new O-ring, and coil plunger assembly (C) into valve body and tighten plunger assembly.

Repeat step for other end of valve.



-UN-05JUN90
E34186

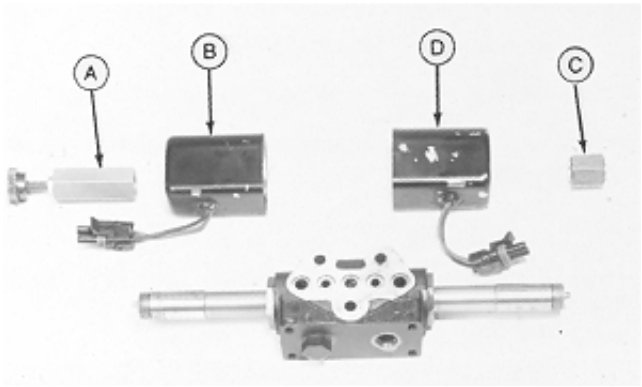
MX,7010HV,A3C -19-30NOV92

4. Install coil (B) over plunger assembly.

5. Install adjuster assembly (A) and tighten.

6. Install coil (D) and nut (C). Tighten nut.

A—Adjuster Assembly
B—Lift Solenoid Coil
C—Nut
D—Lower Solenoid Coil



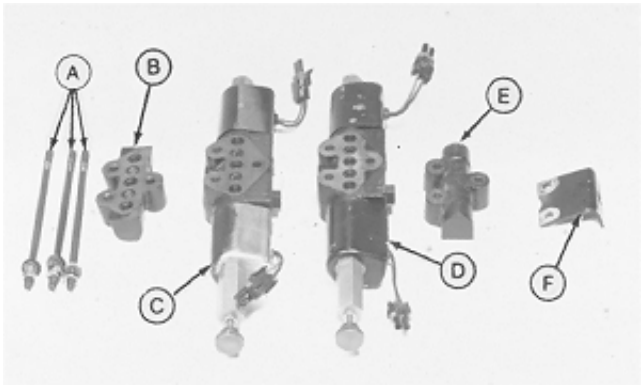
-UN-05JUN90
E34183

MX,7010HV,A3D -19-30NOV92

7. Install new O-rings between sections (C and D) and manifolds (B and E).

8. Assemble sections and manifold in same order as removed. Install tie rods (A).

A—Tie Rods
B—Outlet Manifold
C—Left Wing Lift Valve Section
D—Right Wing Lift Valve Section
E—Inlet Manifold
F—Bracket



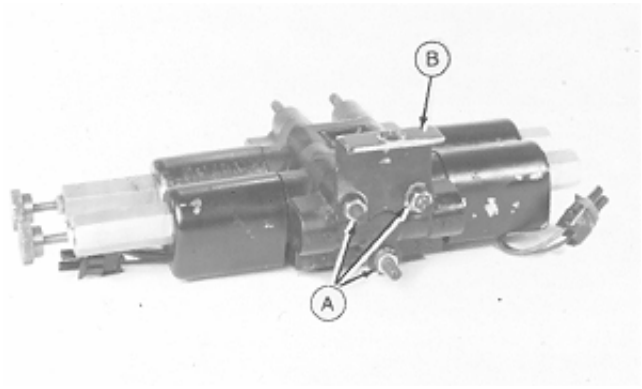
-UN-22JAN91
E34182

EX,3325,7010,3 -19-24APR91

9. Install nuts (A) and bracket (B).

IMPORTANT: Proper tightening sequence must be followed to prevent leakage between valve sections.

10. Tighten nuts in three steps:
- •Tighten nuts in equal increments to 5.6 N·m (50 lb-in.).
- •Tighten nuts in equal increments to 10.2 N·m (90 lb-in.).
- •Tighten nuts in equal increments to 13 N·m (115 lb-in.).



-UN-05JUN90
E34181

MX,7010HV,A3E -19-30NOV92

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INSTALL WING LIFT VALVE

IMPORTANT: Handle wing lift control valve with care so not to drop valve and bend or damage manual operation buttons on solenoids.

Do not support control valve assembly by the solenoids. Solenoids can be distorted causing the valve not to function.

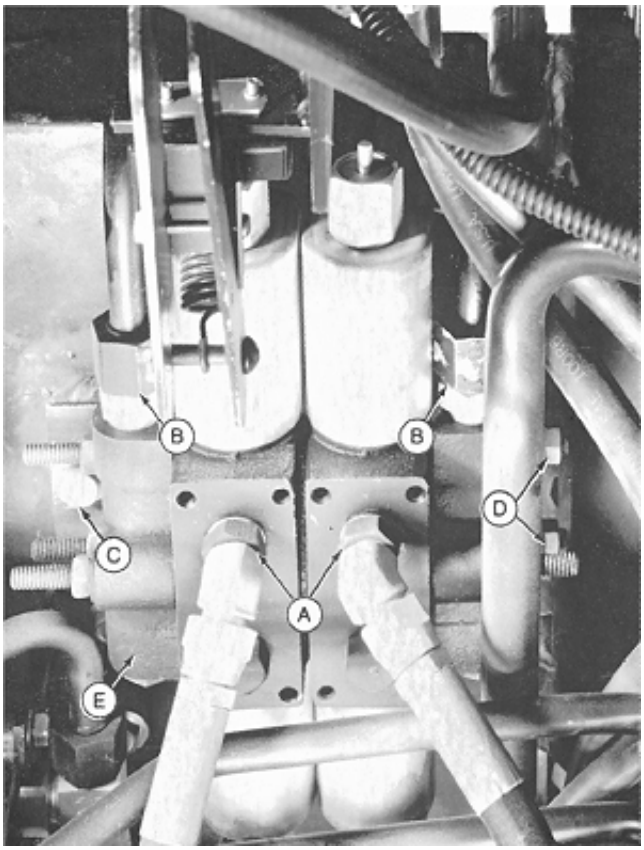
1. Position wing lift control valve (E).

2. Install cap screw (C) and nuts (D) to main frame.

3. Connect four connectors, one to each solenoid coil.

4. Connect hoses (A) and lines (B).

A—Cylinder Hoses
B—Lines
C—Cap Screw
D—Nuts
E—Wing Lift Control Valve



E30107 -UN-11DEC89

EX,3325TM,CG422-19-30NOV92

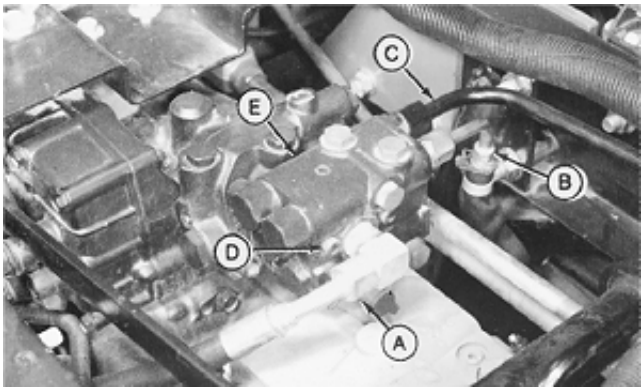
REMOVE FLOW CONTROL VALVE

1. Lift left side of fuel tank and install support rod.

2. Tag and disconnect three hydraulic lines (A—C). Close all openings using caps and plugs.

3. Remove four socket head screws (D) to remove flow control valve (E).

A—Transaxle Pump Outlet Hose
B—Steering Valve Port P Hose
C—Wing Lift Valve Inlet Port Line or Hose
D—Socket Head Screw (4 used)
E—Flow Control Valve

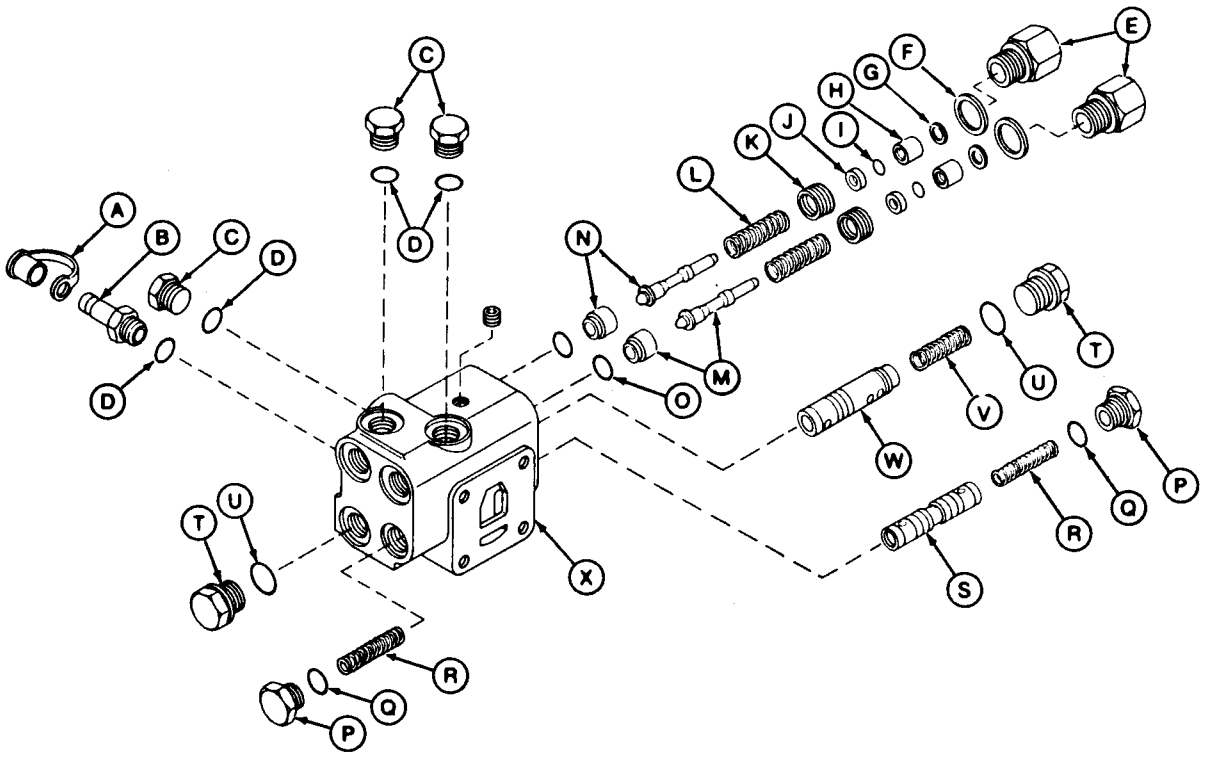


E35666 -UN-22JAN91

Serial No. —880000 Shown

MX,7010HV,A5 -19-30NOV92

REPAIR FLOW CONTROL VALVE



E35667 -UN-03NOV92

A—Cover
B—Diagnostic Receptacle
C—Plug (3 used)
D—O-Ring (4 used)
E—Plug (2 used)
F—Seal Ring (2 used)
G—Shim (2 used)
H—Bushing (2 used)
I—O-Ring (2 used)
J—Washer (2 used)
K—Seat Retainer (2 used)
L—Spring (2 used)
M—Rockshaft Relief Spool and Seat
N—Wing Lift Relief Spool and Seat
O—O-Ring (2 used)
P—Plug (2 used)
Q—O-Ring (2 used)
R—Proportional Spring (2 used)
S—Proportional Flow Divider Spool
T—Plug (2 used)
U—O-Ring (2 used)
V—Priority Spring
W—Priority Flow Divider Spool
X—Valve Body

70 10 17

Serial No. —880000

1. Remove parts (A—D) as necessary for repair.

2. Remove plugs (E) to remove wing lift and rockshaft relief valve assemblies.

3. Use a large screwdriver to remove retainers (K).

4. Inspect spool and seat (M and N), washer (J), and bushing (H) for excessive wear or damage. Replace as necessary.

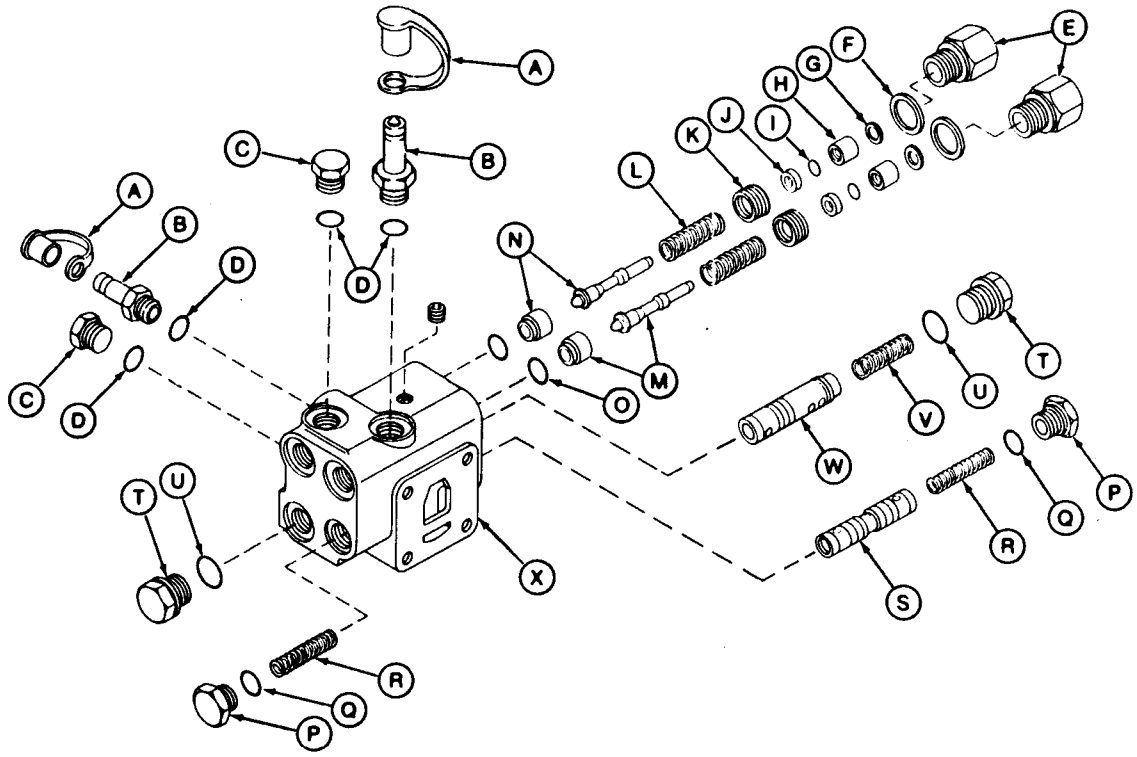
5. Inspect springs (L) and replace if necessary.

6. Remove plug (P), O-ring (Q), and spring (R) from each side of valve (X).

7. Remove spool(s). Inspect for scoring or damage, replace if necessary.

8. Inspect springs (R) and replace if necessary.

MX,7010HV,A5A -19-30NOV92



M81410 -UN-03NOV92

A—Cover (2 used)
B—Diagnostic Receptacle (2 used)
C—Plug (3 used)
D—O-Ring (4 used)
E—Plug (2 used)
F—Seal Ring (2 used)
G—Shim (2 used)
H—Bushing (2 used)
I—O-Ring (2 used)
J—Washer (2 used)
K—Seat Retainer (2 used)
L—Spring (2 used)
M—Rockshaft Relief Spool and Seat
N—Wing Lift Relief Spool and Seat
O—O-Ring (2 used)
P—Plug (2 used)
Q—O-Ring (2 used)
R—Proportional Spring (2 used)
S—Proportional Flow Divider Spool
T—Plug (2 used)
U—O-Ring (2 used)
V—Priority Spring
W—Priority Flow Divider Spool
X—Valve Body

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18

Serial No. 880001—

9. Remove plugs (T) and O-rings (U) from each side of valve.

10. Remove spring (V) and spool (W). Inspect spool for scoring or damage; replace if necessary.

11. Inspect spring (V) and replace if necessary.

12. Replace O-rings (D, I, O, Q, and U) and seal rings (F).

13. Apply clean hydraulic oil to all parts before assembly.

14. Install parts (T thru W). Make sure end of spool with two holes is toward line connection port of flow control valve.

15. Tighten plugs (T) to 98 N·m (72 lb-ft).

16. Install parts (P thru S). Tighten plugs (P) to 44 N·m (33 lb-ft).

17. Install O-rings (O), seat of the spool and seat set (M and N), and retainer (K). Tighten retainer to 29 N·m (22 lb-ft).

18. Install parts (E thru J, L, M, and N). Tighten plugs (E) to 98 N·m (72 lb-ft).

MX,7010HV,A5B -19-30NOV92

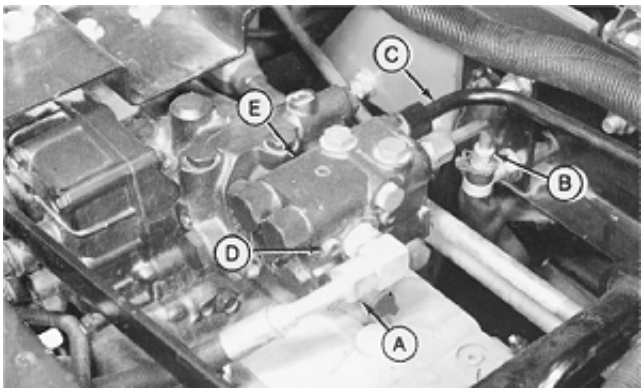
INSTALL FLOW CONTROL VALVE

1. Make sure O-ring is in position on rockshaft piston cover.

2. Install flow control valve (E) and four socket head screws (D). Tighten socket head screws in a diagonal pattern to 17 N·m (150 lb-in.).

3. Connect three hydraulic lines (A—C).

4. Lower fuel tank.



Serial No. —880000 Shown

A—Transaxle Pump Outlet Hose
B—Steering Valve Port P Hose
C—Wing Lift Valve Inlet Port Line or Hose
D—Socket Head Screw (4 used)
E—Flow Control Valve

MX,7010HV,A6 -19-30NOV92

OTHER MATERIAL

Number	Name	Use
TY6305	Clean and Cure Primer	To clean piston-to-rod threads
T43514	Plastic Gasket	To seal piston-to-rod threads
T43512	Thread Lock and Sealer (Medium Strength)	To lock front weight transfer cylinder mounting screws

MX,7015HV,A1 -19-30NOV92

SPECIFICATIONS

Item	Measurement	Specification
Weight Transfer Solenoid Nut	Torque	5.5—8 N·m (48—72 lb-in.)
Weight Transfer Cylinder Piston	Torque	47 N·m (35 lb-ft)

MX,7015HV,A2 -19-30NOV92

REMOVE AND INSTALL WEIGHT TRANSFER SOLENOID AND RELIEF VALVE

NOTE: Weight transfer valve consists of a solenoid valve and a variable relief valve mounted in the manifold block on left side of main frame.

1. Lower all cutting units to the ground.

2. Disconnect electrical connector from solenoid coil (A). Remove nut to remove coil.

3. Remove solenoid plunger (C) to remove O-rings (D and F), screen (E), and backup ring (G).

4. Remove variable relief valve (B) to remove O-rings (D and F), screen (E), and backup ring (G).

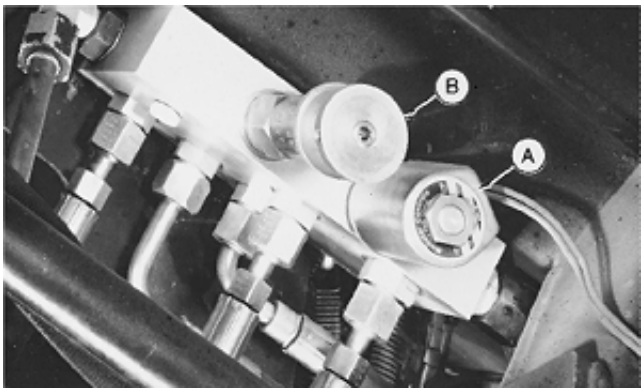
5. Install backup ring (G), O-rings (D and F) and screen (E) on relief valve and solenoid valve.

6. Install and tighten relief valve and solenoid valve.

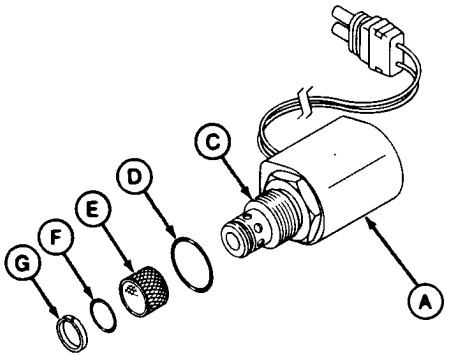
IMPORTANT: Tighten solenoid coil nut to specification. Do not over-tighten or valve can be damaged.

7. Install solenoid coil and nut. Tighten nut to 5.5—8 N·m (48—72 lb-in.). Connect electrical connector.

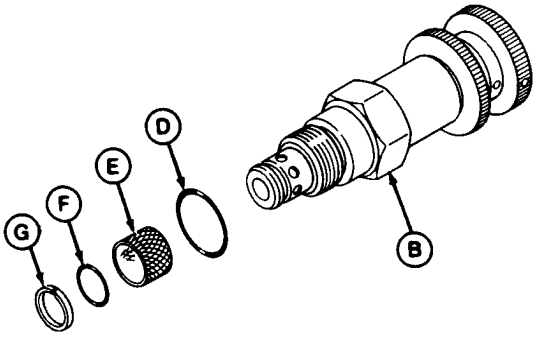
A—Solenoid Coil
B—Variable Relief Valve
C—Solenoid Plunger Assembly
D—O-Ring
E—Screen
F—O-Ring
G—Backup Ring



E34121 -UN-22JAN91



E35475 -UN-22JAN91



E35476 -UN-22JAN91

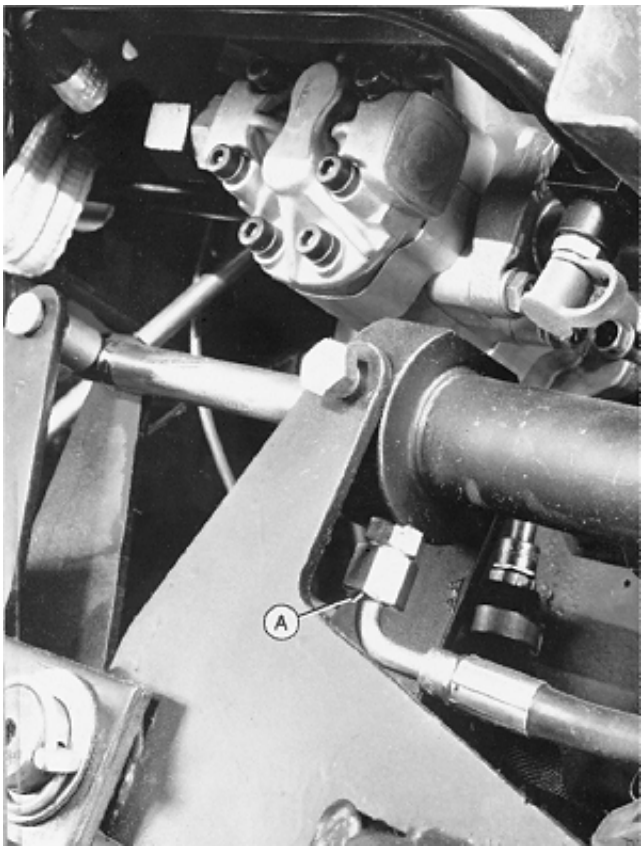
MX,7015HV,A3 -19-30NOV92

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REMOVE AND INSTALL FRONT WEIGHT TRANSFER CYLINDER

1. Lower cutting units to the ground.

2. Tag and disconnect weight transfer valve-to-cylinder hose (A). Close all openings using caps and plugs to keep dirt from entering hydraulic system.



EX,3325,7015,2 -19-30NOV92

3. Tag and disconnect cylinder-to-return hose (A).

4. Remove spring locking pin (B) to remove pin and spacer (C).

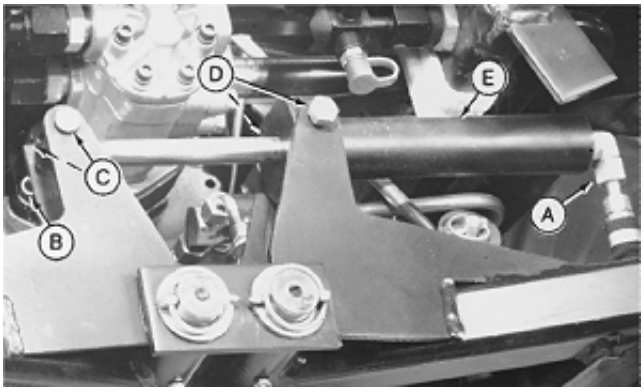
5. Remove two shoulder screws (D) to remove front weight transfer cylinder (E).

6. Repair or replace cylinder as necessary.

7. Apply thread lock and sealer (medium strength) to threads of shoulder screws. Install cylinder and two shoulder screws.

8. Install spacer and pin (C) and spring locking pin (B).

9. Connect hose (A).

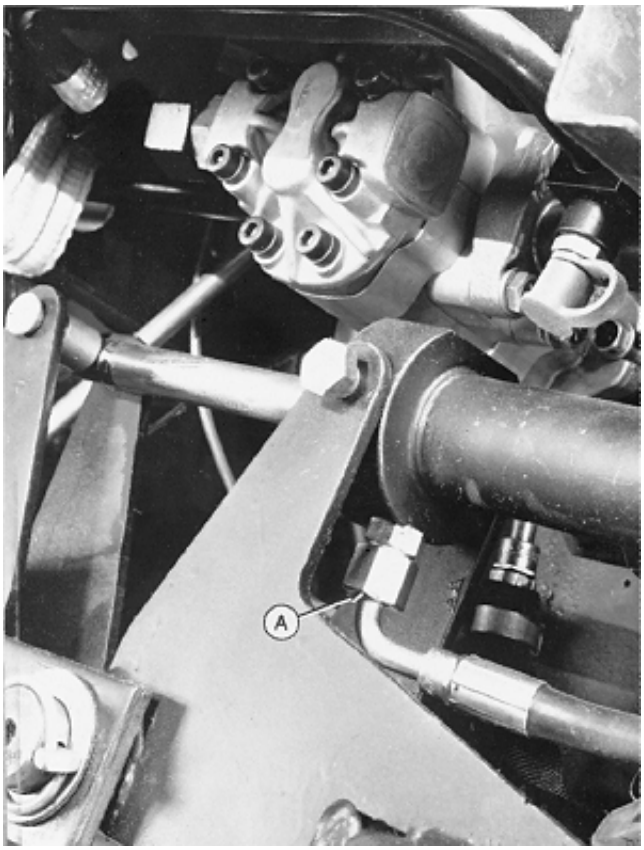


A—Hose
B—Spring Locking Pin
C—Pin and Spacer
D—Shoulder Screw
E—Front Weight Transfer Cylinder

EX,3325,7015,3 -19-24APR91

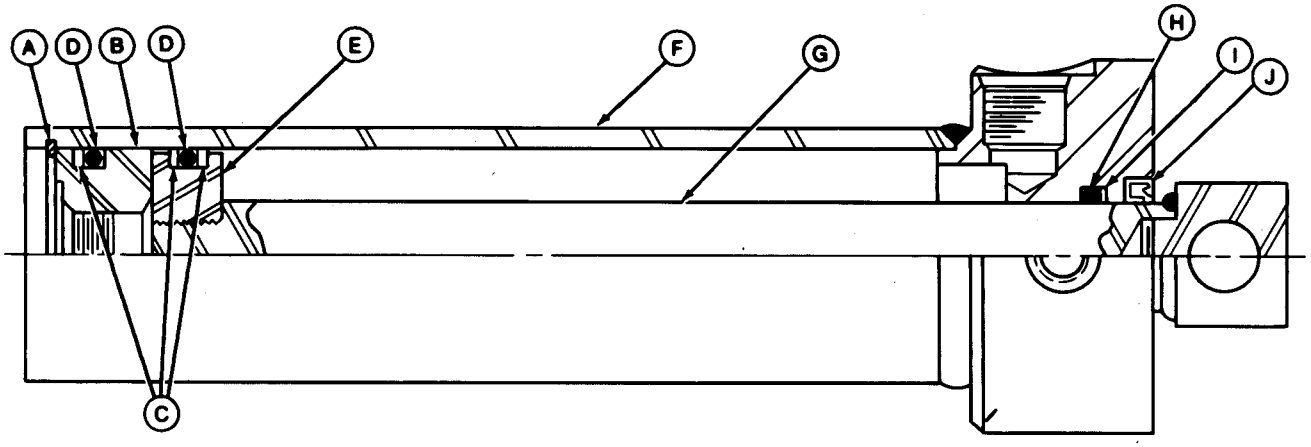
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3

10. Connect hose (A).



EX,3325,7015,4 -19-24APR91

REPAIR FRONT WEIGHT TRANSFER CYLINDER



-UN-22JAN91
E35669

A—Retaining Ring
B—Cylinder Block
C—Backup Ring (3 used)
D—O-Ring (2 used)
E—Piston
F—Cylinder Barrel
G—Rod
H—O-Ring
I—Backup Ring
J—Wiper Seal

1. Push cylinder block (B) into cylinder (F) just enough to remove retaining ring (A).

2. Remove cylinder block, backup ring (C) and O-ring (D).

3. Unthread piston (E) from rod (G) and remove rod and piston.

4. Remove remaining backup rings (C and I), O-rings (D and I) and wiper seal (J).

5. Inspect rod and barrel for scoring and damage. Replace cylinder if necessary.

6. Install new O-rings and backup rings in cylinder barrel, piston, and cylinder block.

7. Install wiper seal to bottom of bore. Apply petroleum jelly to seal lips, O-rings and backup rings.

8. Protect threaded end of rod and carefully slide rod into cylinder barrel. Use care so not to damage wiper seal lips.

9. Clean and prime threads of rod and piston using Clean and Cure Primer. Apply plastic gasket to threads.

10. Install piston assembly and tighten to 47 N·m (35 lb-ft).

11. Install cylinder block and retaining ring.

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EX,3325,7015,5 -19-30NOV92

REMOVE AND INSTALL REAR WEIGHT TRANSFER CYLINDER

1. Lower cutting units to the ground.

2. Tag and disconnect hoses (A and B) from rear weight transfer cylinder (F). Close all openings with caps and plugs to prevent dirt from entering the hydraulic system.

3. Remove cap screw (E), washer, and nut.

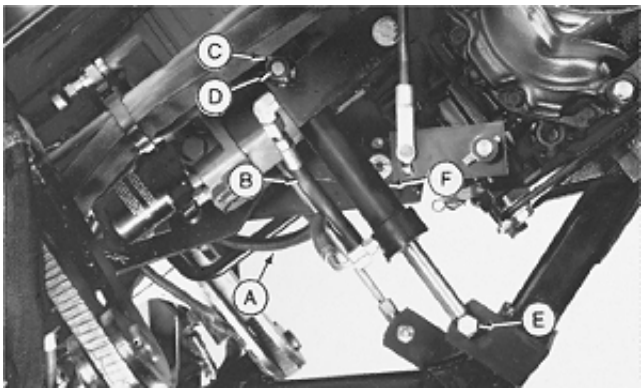
4. Remove cotter pin (C) to remove pin (D) and cylinder.

5. Repair or replace cylinder as necessary.

6. Put cylinder (F) in position and install pin (D) and cotter pin (C).

7. Install and tighten cap screw (E), washer, and nut.

8. Connect hoses (A and B).



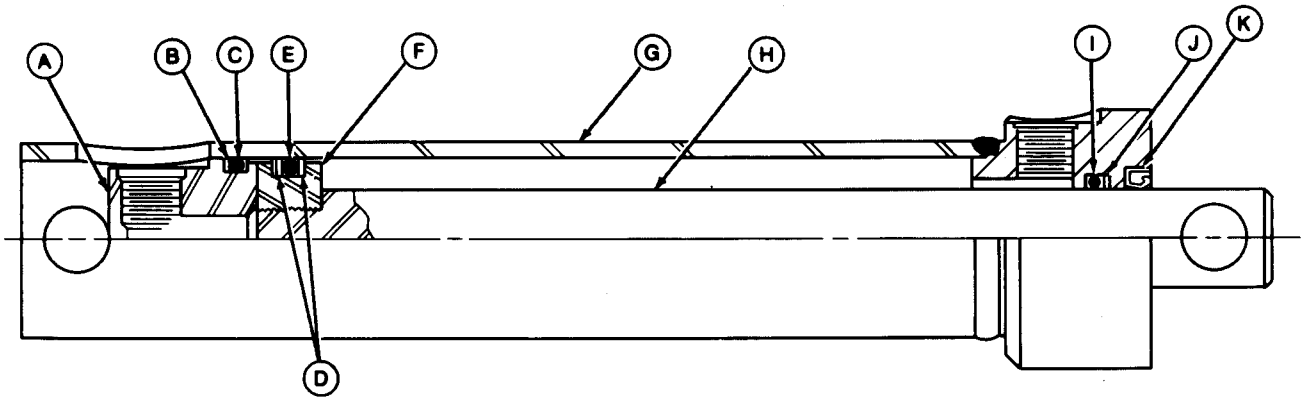
E30109 -UN-11DEC89

A—Weight Transfer Valve-to-Cylinder Hose
B—Cylinder-to-Manifold Hose
C—Cotter Pin
D—Pin
E—Cap Screw
F—Rear Weight Transfer Cylinder

EX,3325,7015,5A-19-30NOV92

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6

REPAIR REAR WEIGHT TRANSFER CYLINDER



-UN-22JAN91
E35670

A—Cylinder Block
B—Backup Ring
C—O-Ring
D—Backup Ring (2 used)
E—O-Ring
F—Piston
G—Cylinder Barrel
H—Rod
I—O-Ring
J—Backup Ring
K—Wiper Seal

1. Push rod (H) into cylinder barrel (G) to remove cylinder block (A), backup ring (B), and O-ring (C).

2. Remove piston and rod assembly. Unthread piston (F) from rod (H).

3. Remove backup rings (D) and O-rings (E) from piston.

4. Remove O-ring (I), backup ring (J) and wiper seal (K).

5. Inspect rod and barrel for scoring or damage. Replace cylinder if necessary.

6. Install new O-rings and backup rings in cylinder barrel, piston, and cylinder block.

7. Install wiper seal to bottom of bore. Apply petroleum jelly to seal lips, O-rings, and backup rings.

8. Clean and prime threads of rod end piston using Clean and Cure Primer. Apply plastic gasket to threads.

9. Install piston assembly on rod and tighten to 47 N·m (35 lb-ft).

10. Carefully slide piston and rod into cylinder barrel. Use care not to cut O-ring or backup ring.

11. Install cylinder block assembly into barrel until just past mounting hole in barrel. Use care not to cut O-ring or backup ring.

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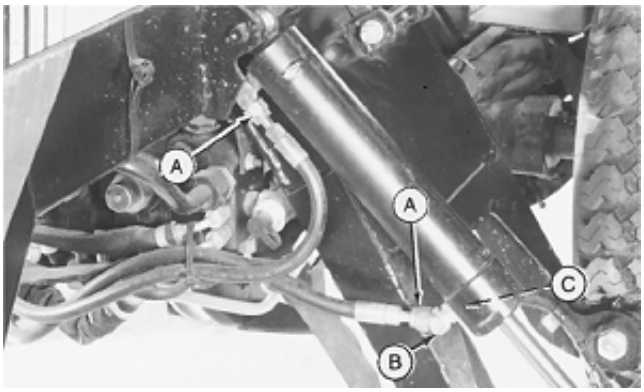
MX,7015HV,A4 -19-30NOV92

REMOVE WING LIFT CYLINDER

1. Lower wing cutting unit to the ground.

2. Tag and disconnect hydraulic hoses (A). Close all openings with caps and plugs to prevent dirt from entering the hydraulic system.

NOTE: An orifice (C) is installed in rod end port of cylinder under 45˚ elbow fitting (B).



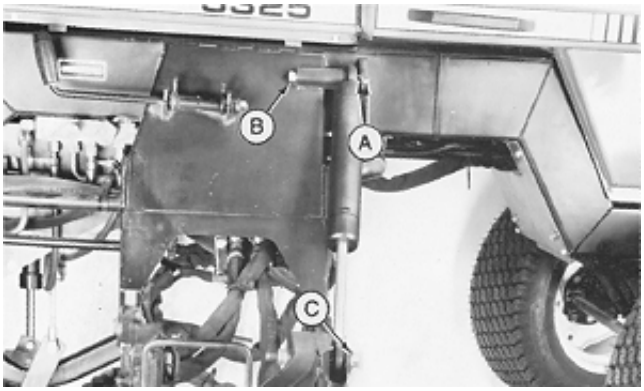
Right Side Down

EX,3325TM,CG410-19-30NOV92

3. Remove inner spring pin (A) to remove pin (B).

4. Remove cap screw (C), washer and nut to remove cylinder.

5. Repeat steps 1—4 to remove opposite lift cylinder.



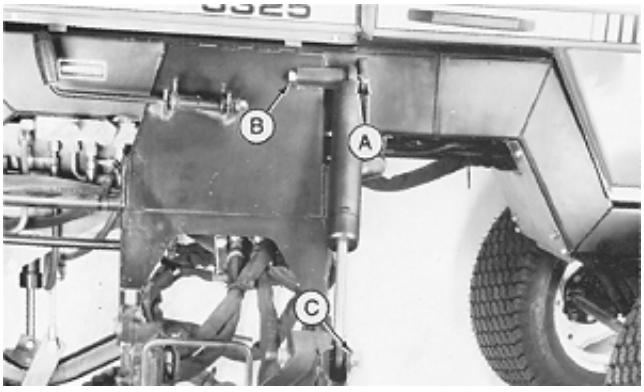
MX,7020HV,A2 -19-30NOV92

INSTALL WING LIFT CYLINDER

1. Put cylinder in position and install pin (B) and spring pin (A).

2. Install cap screw (C), washer and nut.

Be sure washer is on the front side of cylinder rod and between rod end and wing frame.



MX,7020HV,A3 -19-30NOV92

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1

NOTE: Perform steps 3 and 4 only if rod end hydraulic fitting was removed from cylinder.

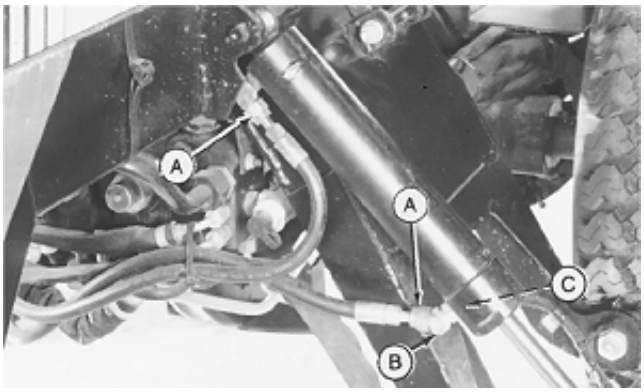
3. Install orifice (C) with large hole away from cylinder into the rod end port of the wing lift cylinder.

4. Install fitting (B). Tighten fitting finger tight. Back out fitting 1/8 to 1/4 turn. Hold fitting in position while tightening jamb nut. This will allow orifice to float in fitting without turning sideways.

IMPORTANT: Make sure hydraulic fitting on rod end of lift cylinder is positioned so fitting does not contact wing frame.

5. Connect hydraulic hoses (A). Head end of cylinder can be turned to position hose and fitting away from wing frame.

6. Repeat steps 1—5 for opposite lift cylinder.



Right Side Shown

MX,7020HV,A3A -19-30NOV92

REPAIR WING LIFT CYLINDER

1. Thoroughly clean external surfaces.

IMPORTANT: Use care not to distort or damage cylinder when putting cylinder in a vise.

2. Check bushings (B) for wear. If excessively worn, replace cylinder.

3. Clamp cylinder in vise.

4. Pry tip of lock ring (A) out using a screwdriver.

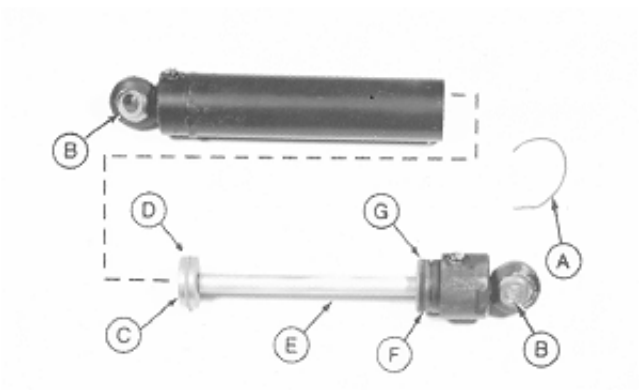
5. Hold tip of lock ring with needle nose pliers and turn rod guide with strap wrench to remove lock ring.

6. Remove piston rod (E).Check piston rod and piston (C) for scoring. If scored, replace cylinder.

7. Replace wiper seal (D), O-ring (F) and backup ring (G).

NOTE: Always use new lock ring (A) for assembly.

8. Assemble cylinder. Turn rod guide so cylinder ports are aligned.



E30126 -UN-11DEC89

A—Lock Ring
B—Bushing
C—Piston
D—Wiper Seal
E—Piston Rod
F—O-Ring
G—Back-Up Ring

MX,7020HV,A4 -19-30NOV92

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3

OTHER MATERIAL

Number	Name	Use
TY6305	Clean and Cure Primer	To clean threads
T43512	Thread Lock and Sealer (Medium Strength)	To lock rockshaft spool cap screw

MX,7025HV,A1A -19-30NOV92

SPECIFICATIONS

Item	Measurement	Specification
Rockshaft Valve		
Control Valve Spool Bolt Torque	Torque	10 N·m (88 lb-in.)
Control Valve-to-Rockshaft Cap Screw	Torque	24 N·m (18 lb-ft)
Control Valve Cover-to-Rockshaft Cap Screws	Torque	27 N·m (20 lb-ft)
Rockshaft Upper Lever Tension	Force	11.3—13.6 Kg (25—30 lb)
Rockshaft Piston Cover		
Piston Cover-to-Rockshaft	Torque	88 N·m (65 lb-ft)
Check Relief Valve Spring	Free Length	27.7 mm (1.09 in.)
	Compressed Length	18 mm at 10N (0.71 in. at 2 lb)
Check Relief Valve Plug	Torque	34 N·m (25 lb-ft)
Stop Valve Spring	Free Length	36 mm (1.4 in.)
	Compressed Length	14 mm at 59N (0.55 in. at 13 lb)
Stop Bolt Assembly-to-Piston Cover Socket Head Screws	Torque	25 N·m (18 lb-ft)
Overload Relief Valve Spring	Free Length	44 mm (1.73 in.)
	Compressed Length	38 mm at 170 N (1.50 in. at 38 lb)
Safety Relief Valve Retainer	Torque	27 N·m (20 lb-ft)
Plug	Torque	78 N·m (58 lb-ft)
Rockshaft Piston		
Rockshaft Cylinder	ID	60.00—60.046 mm (2.362—2.364 in.)
Rockshaft Piston	OD	59.94—59.97 mm (2.360—2.361 in.)

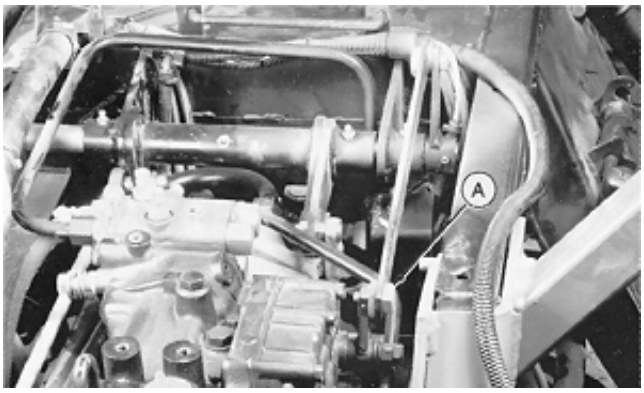
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Item	Measurement	Specification
Piston-to-Cylinder Wear Clearance	Maximum Clearance	0.3 mm (0.012 in.)
Rockshaft Housing		
Rockshaft Sleeve	OD	44.950—44.975 mm (1.769—1.770 in.)
Sleeve-to-Bushing Clearance	Maximum Clearance	0.4 mm (0.016 in.)
Rockshaft Bushing	ID	45.000—45.039 mm (1.771—1.773 in.)
Lift Arm-to-Rockshaft Bolts	Torque	52 N·m (38 lb-ft)
Rockshaft-to-Transmission Cap Screws	Torque	52 N·m (38 lb-ft)
Lift Linkage-to-Lift Arms Cap Screws and Nuts	Torque	163 N·m (120 lb-ft)

MX,7025HV,A1 -19-30NOV92

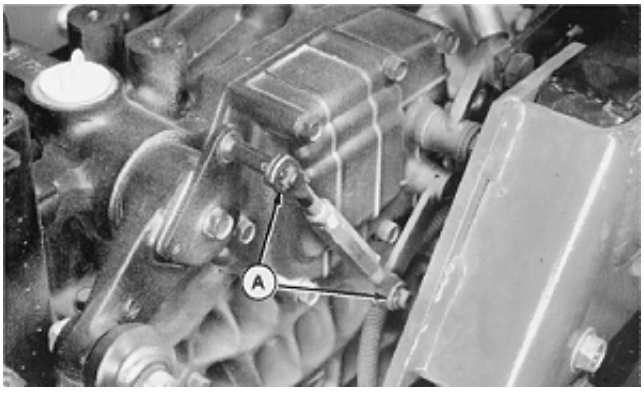
REMOVE ROCKSHAFT CONTROL VALVE

1. Remove seat assembly. (See Section 80, Group 10.)
2. Remove seat support. (See Section 80, Group 10.)
3. Remove shoulder screw (A) and washer.



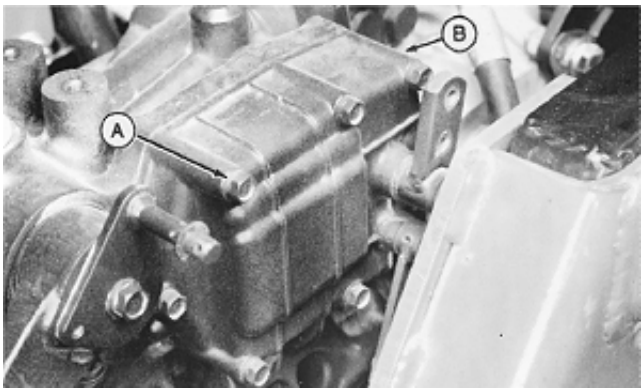
MX,7025HV,A2F -19-30NOV92

4. Remove cotter pins and washers (A) from rockshaft feedback linkage.
5. Remove valve feedback linkage.



EX,3325TM,CG398-19-24APR91

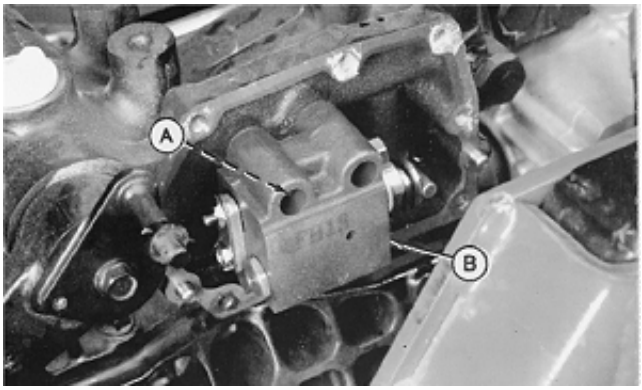
6. Remove eight cap screws (A) to remove rockshaft valve cover (B).



-UN-22JAN91
E35661

EX,3325TM,CG392-19-24APR91

7. Remove three socket head cap screws (A) to remove rockshaft valve (B).



-UN-22JAN91
E35662

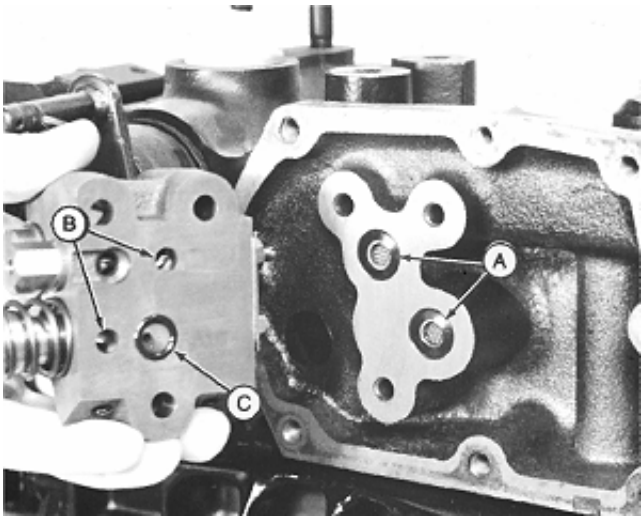
EX,3325TM,CG394-19-24APR91

NOTE: Transaxle shown removed for clarity of parts.

8. Remove rubber seal washers (A), spacers and 100 mesh screens that align with valve ports (B). Clean or replace screens and seal washers as needed.

9. Remove and discard O-ring (C).

10. Remove all gasket material from mating surfaces of rockshaft housing and valve cover.



-UN-12SEP91
M42291

MX,7025HV,A2G -19-30NOV92

DISASSEMBLE ROCKSHAFT CONTROL VALVE

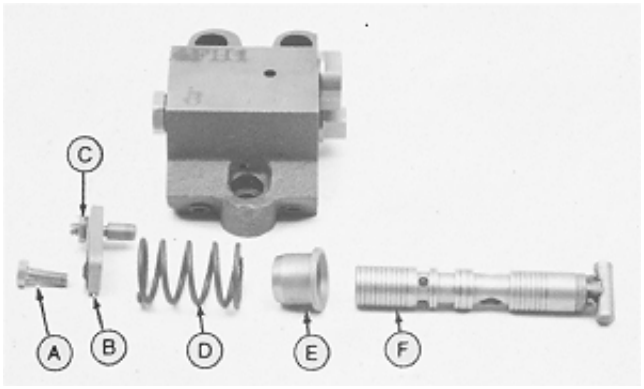
1. Bend lock tab down from bolt (A).

IMPORTANT: DO NOT remove or attempt to adjust lower valve adjusting screw (C). This is a factory adjustment.

2. Remove bolt (A), connecting plate (B) and spool assembly (D, E, and F).

NOTE: Spool and valve body are not serviced. If either is damaged, replace valve assembly.

3. Inspect spool (F) and its bore for scoring and sticking.



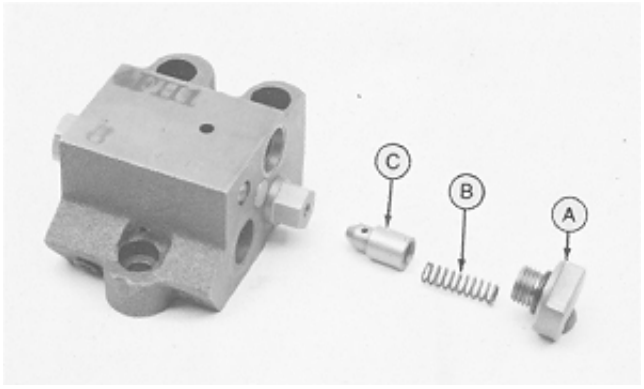
M43578 -UN-31AUG88

A—Bolt
B—Connecting Plate
C—Nut
D—Spring
E—Spring Guide
F—Spool

MX,7025HV,A2 -19-30NOV92

4. Remove load check plug and O-ring (A), spring (B) and poppet (C).

5. Inspect for damage.

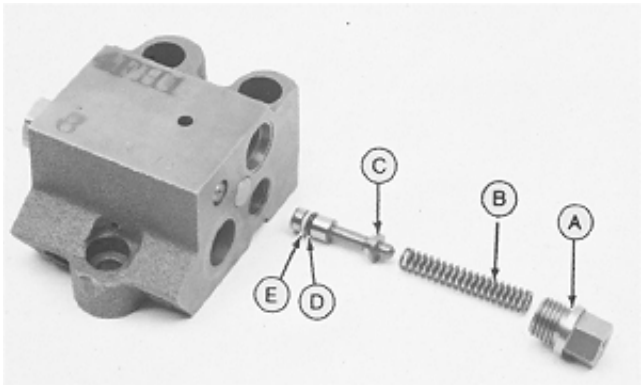


M43579 -UN-31AUG88

MX,7025HV,A2A -19-30NOV92

6. Remove mechanical check plug (A), spring (B), and spool (C). Inspect for damage.

A—Plug
B—Spring
C—Spool
D—O-Ring
E—Back-Up Ring

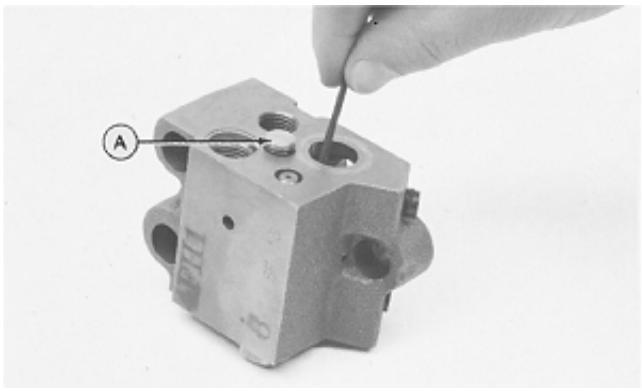


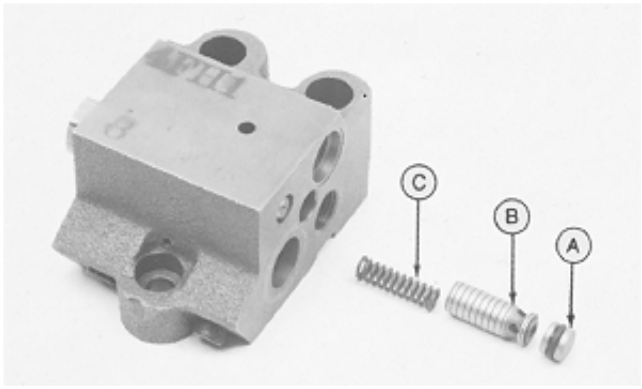
M43580 -UN-31AUG88

MX,7025HV,A2B -19-30NOV92

7. Insert short end of hex wrench through spool bore and into hole in flow control spool. Carefully pull up until plug (A) can be removed.

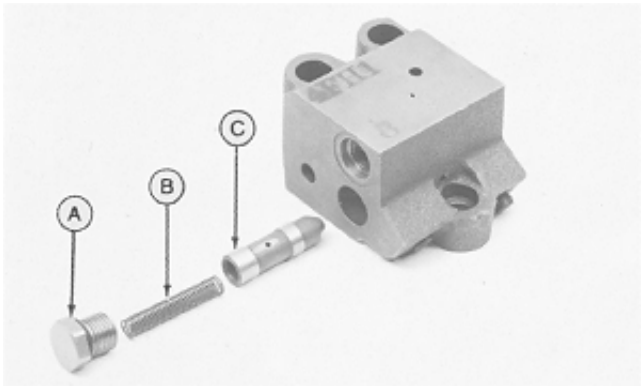
8. Remove flow control plug (A), spool (B), and spring (C). Inspect for damage.





MX,7025HV,A2C -19-30NOV92

9. Remove unloading valve plug (A), spring (B), and poppet (C). Inspect for damage.



MX,7025HV,A2D -19-30NOV92

70
25
6

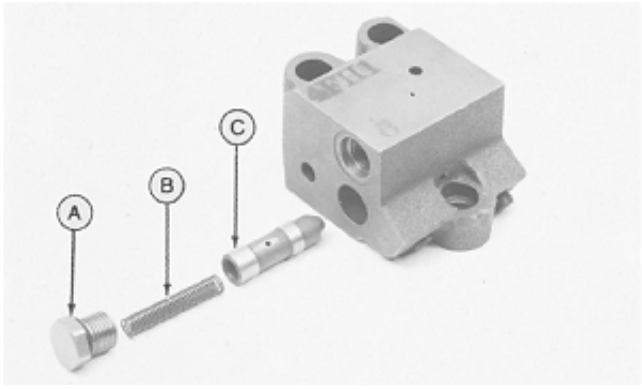
ASSEMBLE ROCKSHAFT CONTROL VALVE

1. Clean and dry all parts.

2. Before assembly, apply clean hydraulic oil on all internal parts.

3. Install new O-ring on unloading valve plug (A).

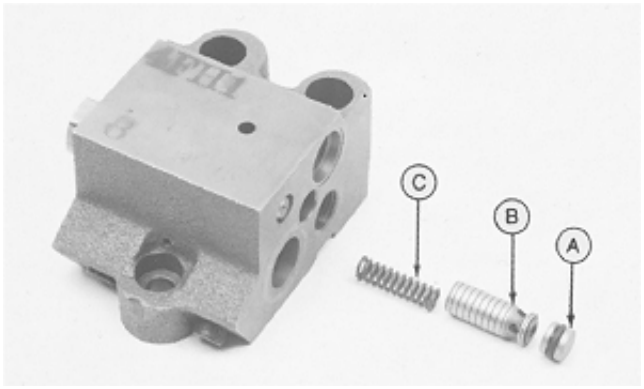
4. Assemble poppet (C), spring (B), and plug into valve and tighten.



M21,7020W,10 -19-30NOV92

5. Assemble flow control spring (C) and poppet (B).

6. Install new O-ring on plug (A) and install in valve.

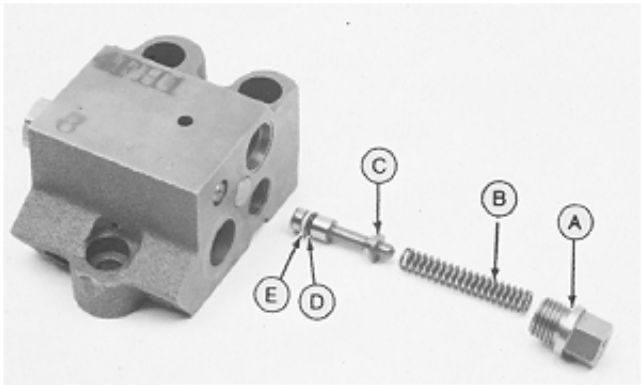


M21,7020W,11 -19-25MAY90

7. Install new back-up ring (E) and O-ring (D) on mechanical check spool (C).

8. Assemble spool (C), spring (B), and plug (A) into valve using care not to damage O-ring. Tighten plug.

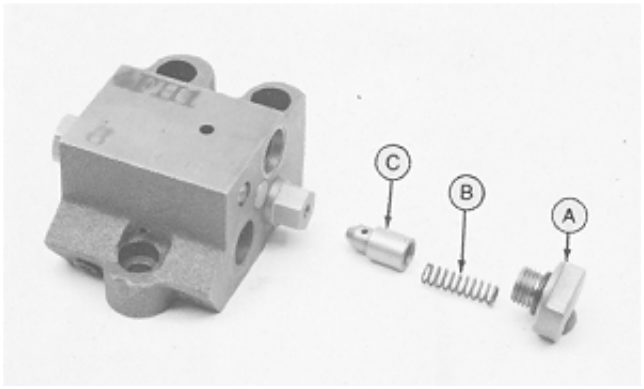
A—Plug
B—Spring
C—Spool
D—O-Ring
E—Back-up Ring



M21,7020W,12 -19-25MAY90

9. Assemble load check poppet (C) and spring (B) into valve.

10. Install new O-ring on plug (A). Install and tighten plug.



MX,7025HV,A2E -19-30NOV92

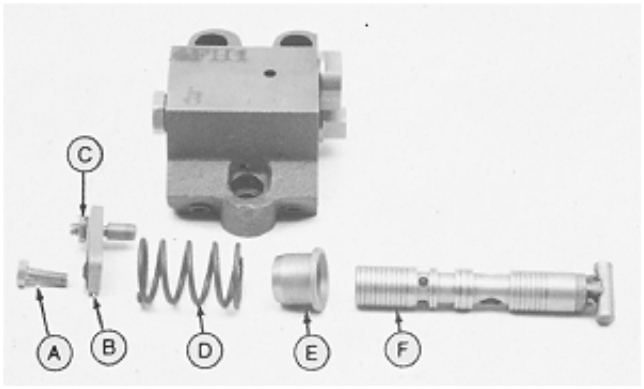
11. Assemble spring (D) and spring guide (E) onto spool (F).

12. Install spool assembly into valve body.

13. Clean the threads of bolt (A) and the internal threads of the spool with clean and cure primer.

14. Apply thread lock and sealer (medium strength) to the threads of the bolt.

15. Assemble connecting plate (B) to spool and fasten with bolt (A). Tighten bolt to 10 N·m (88 lb-in.)



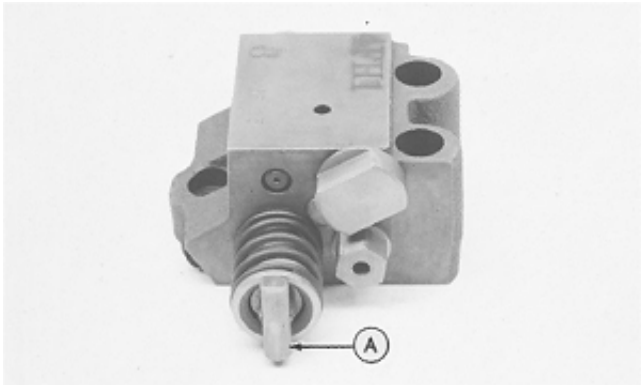
M43578 -UN-31AUG88

A—Bolt
B—Connecting Plate
C—Nut
D—Spring
E—Spring Guide
F—Spool Assembly

MX,7025HV,A3 -19-30NOV92

NOTE: Make certain cross pin (A) on end of spool is at right angles to valve mounting surface.

16. Bend locking tab up against bolt head.

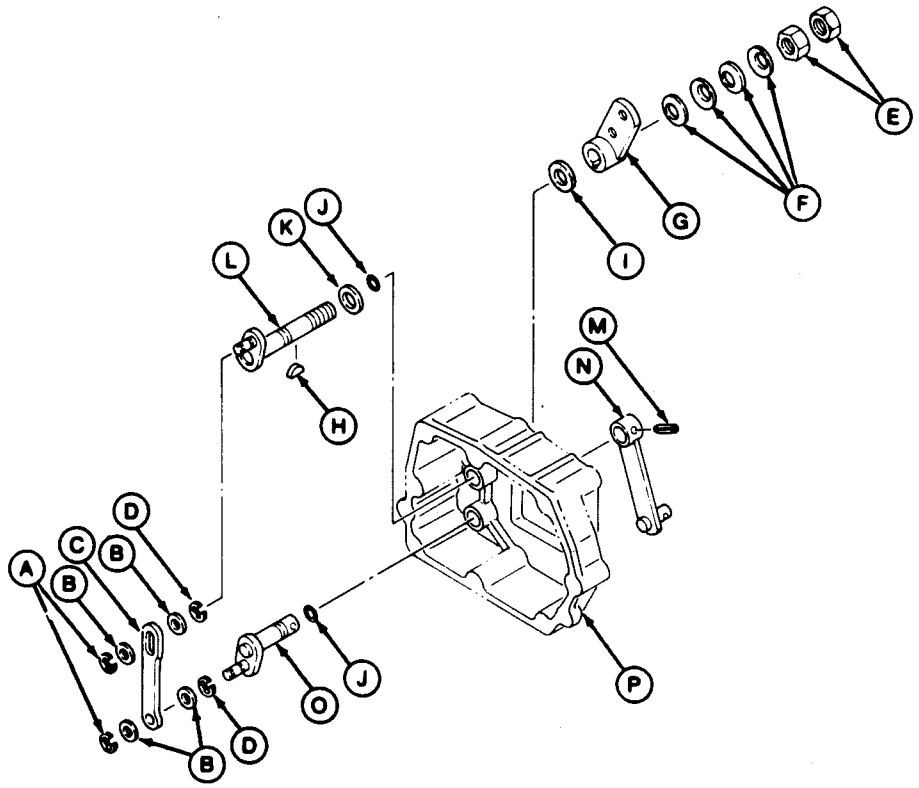


M43584 -UN-31AUG88

EX,3325,7025,11-19-24APR91

70
25
8

REPAIR ROCKSHAFT VALVE COVER



E35663 -UN-22JAN91

A—Snap Ring
B—Washer (4 used)
C—Link Bar
D—Snap Ring
E—Nut (2 used)
F—Belleville Washer (4 used)
G—Upper Arm
H—Key
I—Washer
J—O-Ring (2 used)
K—Washer
L—Upper Shaft
M—Spring Pin
N—Lower Arm
O—Lower Shaft
P—Rockshaft Valve Cover

1. Remove snap rings (A) to remove washer (B), link bar (C) and snap rings (D).

2. Remove nuts (E) to remove belleville washers (F), upper arm (G), key (H), washers (I and K), upper shaft (L) and O-ring (J).

3. Remove spring pin (M) to remove lower arm (N), lower shaft (O), and O-ring (J).

4. Apply petroleum jelly to O-rings (J). Install O-ring on lower shaft (O).

5. Install lower shaft in cover (P) and install lower arm (N) and spring pin (M).

6. Install washer (K) and O-ring (J) on upper shaft (L).

7. Install upper shaft in cover. Install washer (I), key (H) and arm (G).

8. Install belleville washers (F) in two pairs. Each pair must have the concave sides toward each other.

9. Install nuts (E). Do not tighten at this time. Nuts will be tightened when cover is installed.

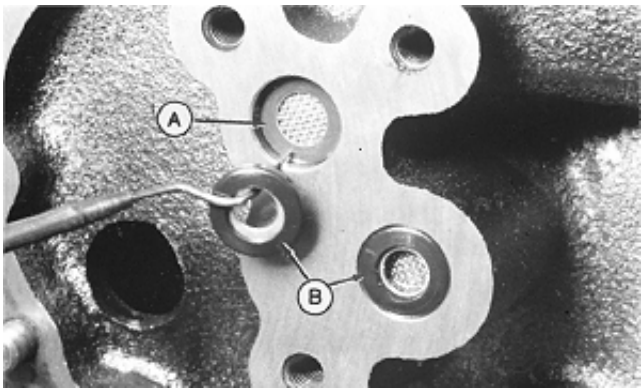
10. Install snap rings (D), washers (B), link bar (C) and snap rings (A).

MX,7025HV,A4 -19-30NOV92

INSTALL ROCKSHAFT CONTROL VALVE

1. Install 100 mesh screens (A) in recesses of rockshaft housing with wide face side of screens to the outside.

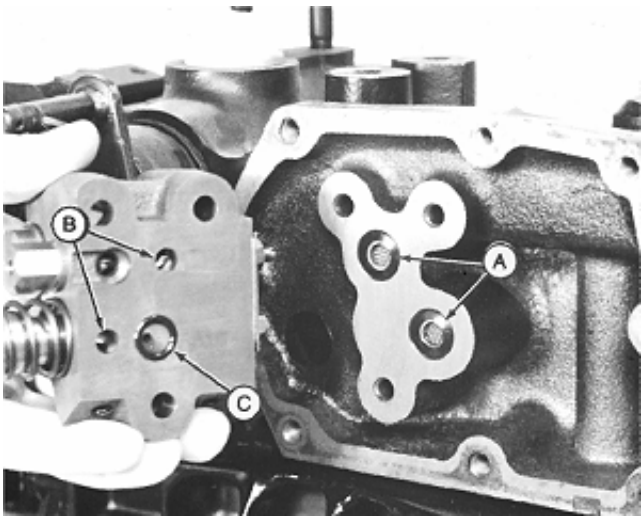
2. Install spacers and rubber seal washers (B).



MX,7025HV,A4A -19-30NOV92

3. Install new O-ring (C).

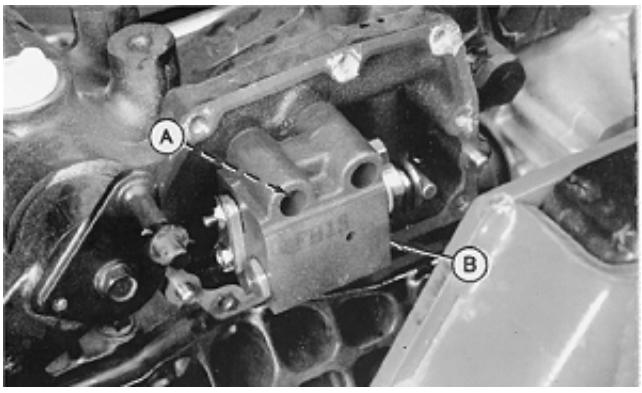
4. Align valve ports (B) with 100 mesh screens and seal washers (A).



MX,7025HV,A4B -19-30NOV92

70
25
10

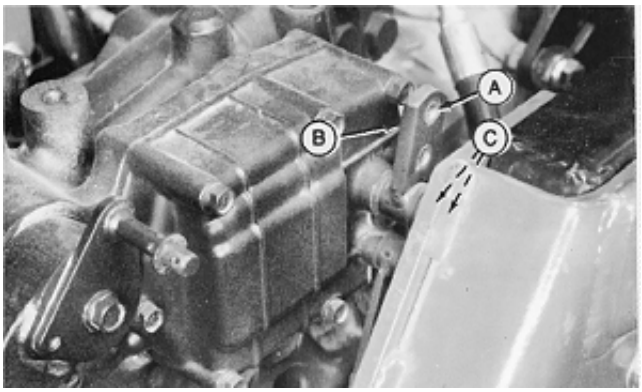
5. Install valve (B) on transaxle. Tighten three socket head cap screws (A) to 24 N·m (18 lb-ft).



MX,7025HV,A5 -19-30NOV92

6. Install cover with new gasket. Make certain internal linkage is away from valve spool. Tighten cap screws to 27 N·m (20 lb-ft).

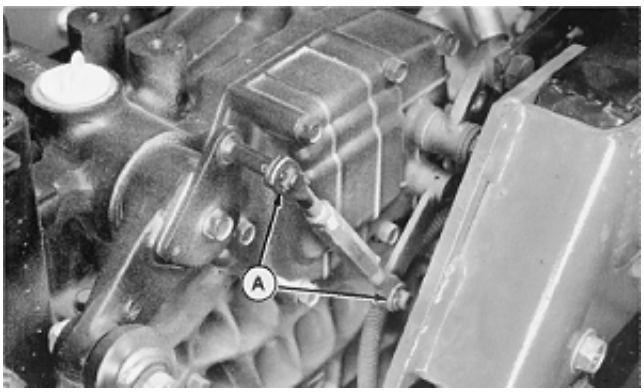
7. Adjust tension on upper lever arm (B) to 11.3 to 13.6 kg (25 to 30 lb) by tightening or loosening lever arm nuts (C). Hook a spring scale in the rockshaft lever hole (A) and check force of pull required to move lever arm (B).



-UN-22JAN91
E35664

MX,7025HV,A6 -19-30NOV92

8. Connect feedback linkage, using a washer on each side of turnbuckle and insert cotter pin (A).

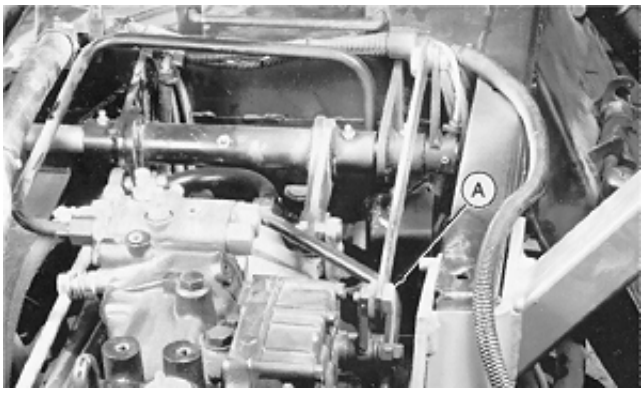


-UN-22JAN91
E35660

MX,7025HV,A7 -19-30NOV92

9. Install washer and shoulder screw (A). Tighten shoulder screw.

10. Install seat support and seat assembly. (See Section 80, Group 10.)



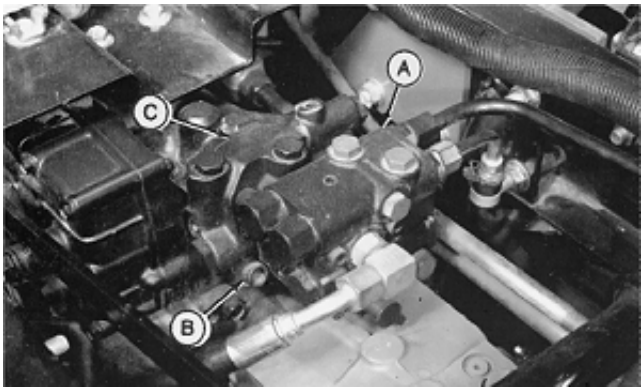
-UN-11DEC89
E30176

MX,7025HV,A8 -19-30NOV92

REMOVE ROCKSHAFT PISTON COVER

1. Remove flow control valve (A). (See Group 10 in this section.)

2. Remove four socket heads bolts (B) to remove piston cover (C).

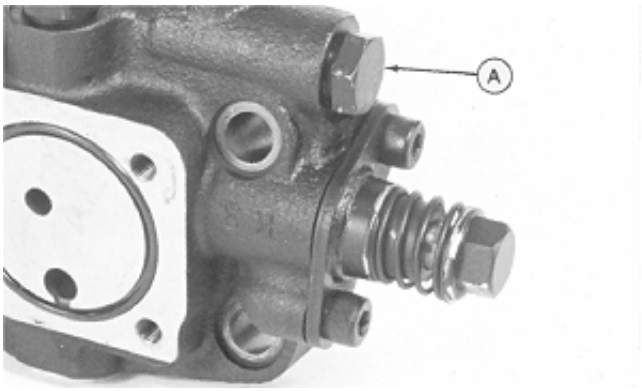


-UN-22JAN91
E35668

MX,7025HV,A9 -19-30NOV92

REPAIR LOWERING CHECK VALVE

1. Remove check relief valve plug (A). Remove valve assembly.



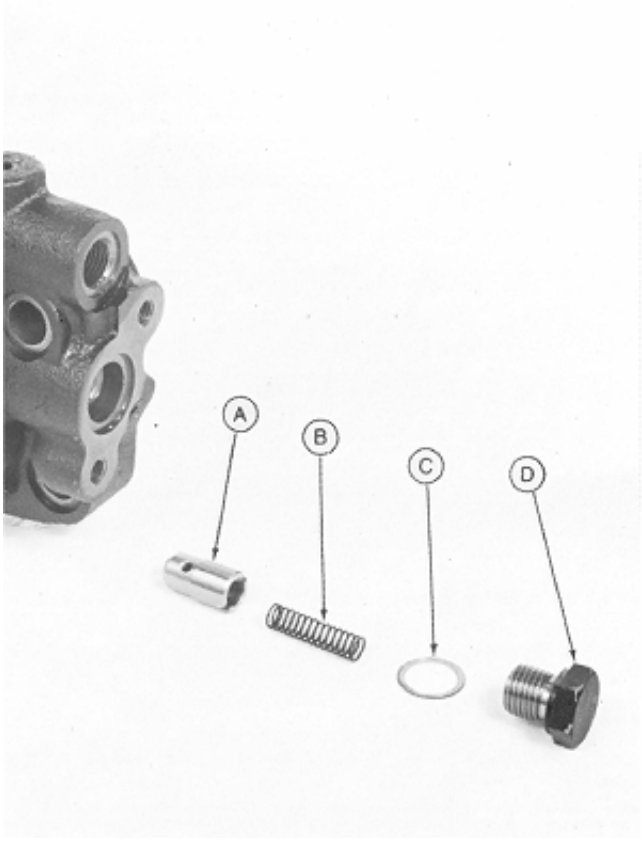
2E6,7025G,7A -19-30NOV92

2. Inspect poppet (A) for excessive wear or damage. Replace as necessary.

3. Inspect spring (B) for a free length of 27.7 mm (1.09 in.) and a compressed length of 18 mm at 10.1 N (0.71 in. at 2.27 lb).

4. Apply clean hydraulic oil to all parts. Assemble in order as shown. Tighten plug to 34 N·m (25 lb-ft).

A—Poppet
B—Spring
C—Sealing Ring
D—Plug



EX,6,7025G,7B -19-24APR91

70
25
12

REPAIR RATE-OF-DROP/STOP VALVE

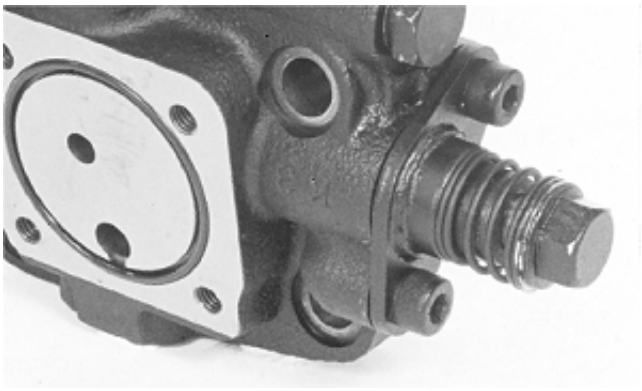
1. Remove two socket head bolts. Remove stop bolt assembly.

2. Remove stop valve (A) using an M5 cap screw.

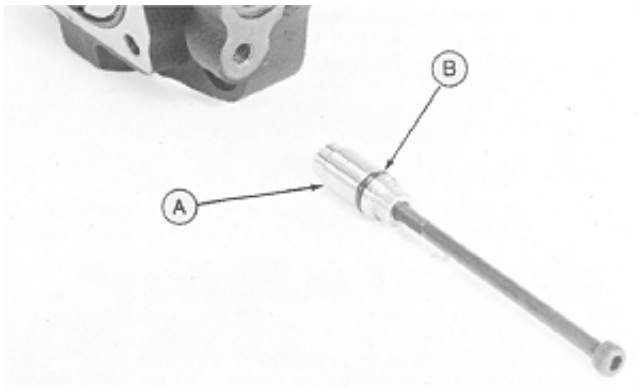
3. Inspect stop valve for excessive wear or damage. Replace as necessary.

4. Replace O-ring (B).

5. Apply clean hydraulic oil to stop valve and O-ring before assembly.



E30181 -UN-30NOV89



E30182 -UN-30NOV89

MX,7025HV,A10 -19-30NOV92

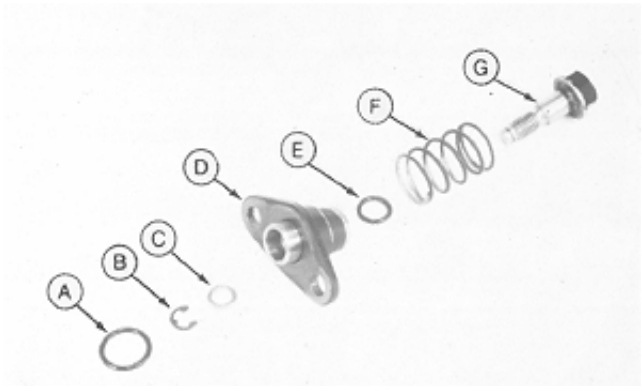
6. Disassemble stop bolt parts (A—G).

7. Inspect stop bolt assembly for excessive wear or damage.

8. Inspect spring (F) for free length of 36 mm (1.4 in.) and a compressed length of 14 mm at 59 N (0.55 in. at 13 lb).

9. Apply small amount of grease to bolt (G) threads.

10. Install stop bolt assembly on piston cover. Install and tighten two socket head screws to 25 N·m (18 lb-ft).



E30183 -UN-30NOV89

A—O-Ring
B—Retaining Ring
C—Washer
D—Body
E—O-Ring
F—Spring
G—Bolt

MX,7025HV,A11 -19-30NOV92

REPAIR SAFETY RELIEF VALVE

1. Remove safety relief valve plug (I). Remove valve assembly.

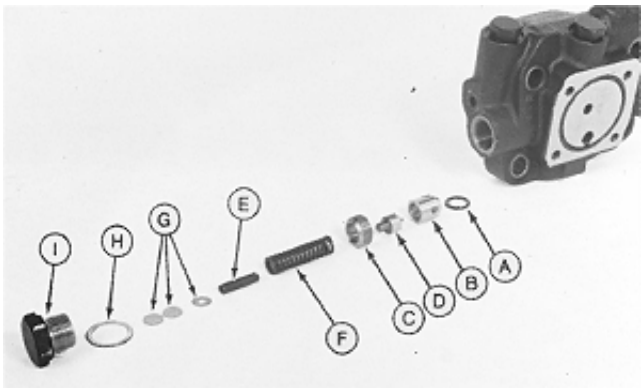
2. Use large screwdriver to remove retainer (C).

3. Inspect seat (B), poppet (D), and roll pin (E) for excessive wear or damage. Replace as necessary.

4. Inspect spring (F) for free length of 44 mm (1.73 in.) and a compressed length of 38 mm at 170 N (1.5 in. at 38.2 lb).

5. Replace O-ring (A).

6. Dip all parts in clean hydraulic oil. Assemble in order as shown. Tighten retainer (C) to 27 N·m (20 lb-ft) and plug (I) to 78 N·m (58 lb-ft).



E30184 -UN-30NOV89

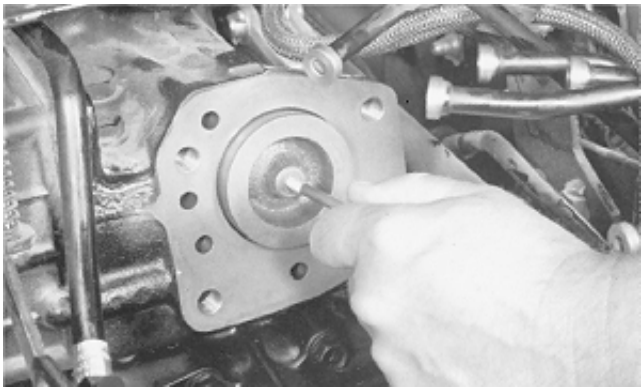
A—O-Ring
B—Valve Seat
C—Retainer
D—Poppet
E—Roll Pin
F—Spring
G—Shims
H—Sealing Ring
I—Plug

MX,7025HV,A11C -19-30NOV92

REMOVE AND INSPECT ROCKSHAFT PISTON

1. Remove rockshaft piston cover.

2. Install M6 cap screw in piston. Pull piston out.



M43499 -UN-31AUG88

2E6,7025G,12 -19-25MAY90

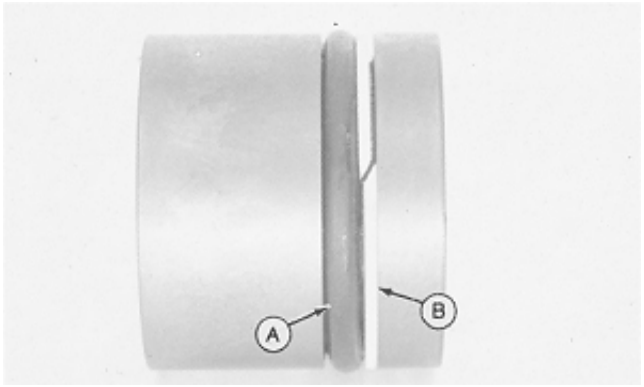
3. Inspect cylinder wall and piston for excessive scoring or damage.

Cylinder ID . . . . . 60.000—60.046 mm (2.362—2.364 in.)

Piston OD . . . . . 59.94—59.97 mm (2.360—2.361 in.)

Piston to cylinder maximum wear clearance . . . . . 0.3 mm (0.012 in.)

4. Replace O-ring (A) and backup ring (B). Be sure backup ring ends DO NOT overlap each other.

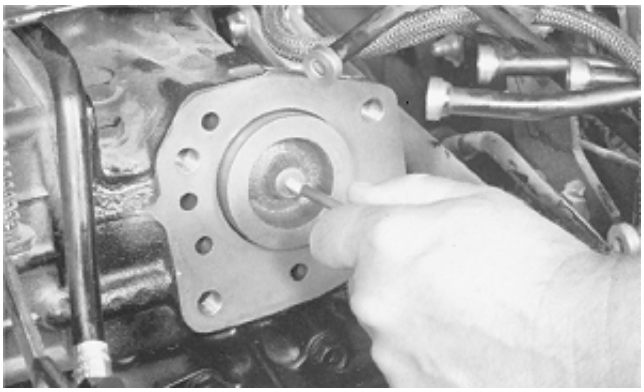


M43413 -UN-31AUG88

2E6,7025G,12A -19-25MAY90

INSTALL ROCKSHAFT PISTON

1. Apply clean hydraulic oil to piston. Install piston into rockshaft housing.



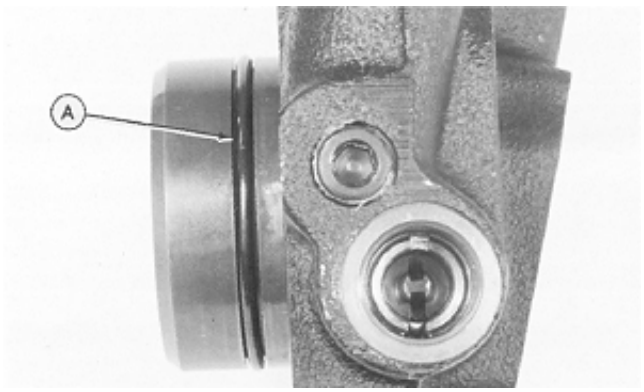
M43499 -UN-31AUG88

2E6,7025G,13 -19-30NOV92

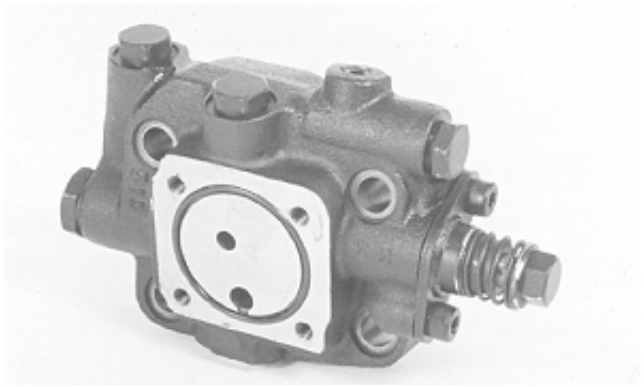
INSTALL ROCKSHAFT PISTON COVER

1. Replace all O-rings.

2. Apply clean oil to O-ring (A) before installing piston cover.



E30186 -UN-30NOV89



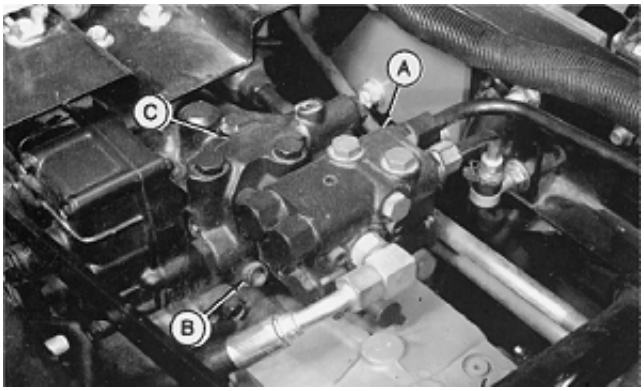
E30187 -UN-30NOV89

MX,7025HV,A9A -19-30NOV92

3. Install rockshaft piston cover (C). Fasten cover with four socket head bolts (B). Longer two bolts to the top.

4. Tighten bolts diagonally to 88 N·m (65 lb-ft).

5. Install flow control valve (A). (See Group 10 in this section.)



E35668 -UN-22JAN91

MX,7025HV,A8A -19-30NOV92

REMOVE ROCKSHAFT HOUSING

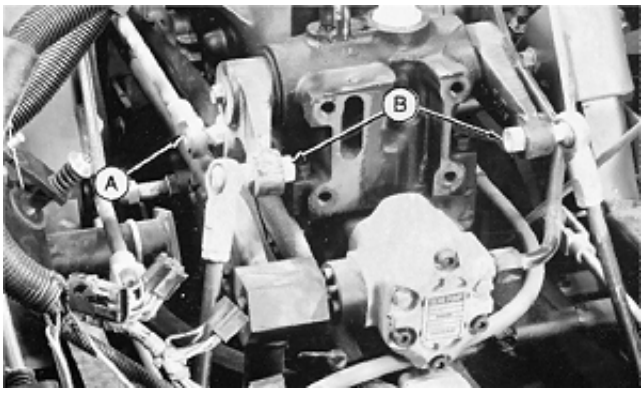
1. Lower cutting units to the ground.

2. Remove operator's seat and seat support. (See Section 80, Group 10.).



MX,7025HV,A11A -19-30NOV92

3. Disconnect linkage from rockshaft arms by removing cap screws (B), nuts, and washers and pin (A).

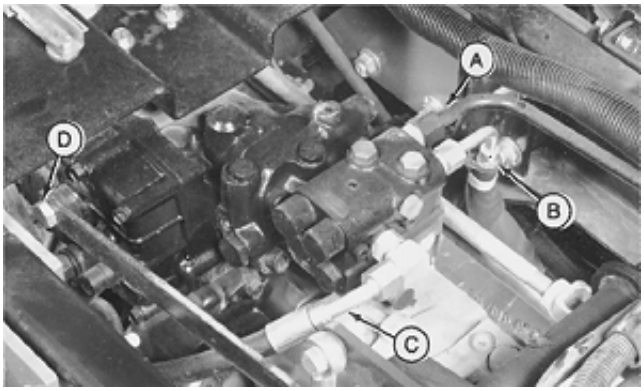


MX,7025HV,A11B -19-30NOV92

4. Tag and disconnect three lines (A—C) from flow control valve.

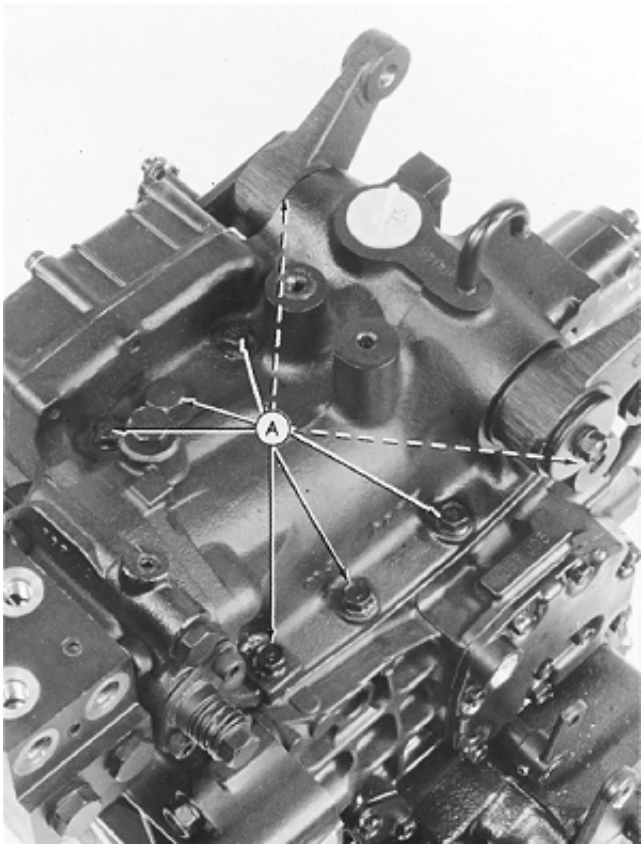
5. Disconnect rockshaft control valve linkage by removing shoulder bolt (D) and washer.

A—Wing Lift Valve Inlet Port Line or Hose
B—Steering Valve Port P Hose
C—Transaxle Pump Outlet Hose
D—Shoulder Bolt



MX,7025HV,A12 -19-30NOV92

6. Remove eight cap screws (A) and one nut with lock washers. Remove rockshaft housing.



E34127 -UN-22JAN91

MX,7025HV,A12A -19-30NOV92

DISASSEMBLE ROCKSHAFT HOUSING

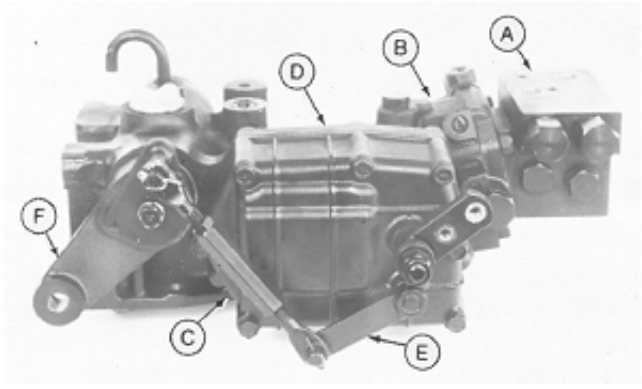
NOTE: Flow control valve shown is early production model.

1. Remove flow control valve (A), piston cover (B) and piston.

2. Remove turnbuckle (C), control valve cover (D) and control valve assembly.

3. Remove feedback arm (E) and lift arms (F).

A—Flow Control Valve
B—Piston Cover
C—Turnbuckle
D—Control Valve Cover
E—Feedback Arm
F—Lift Arms



E30189 -UN-30NOV89

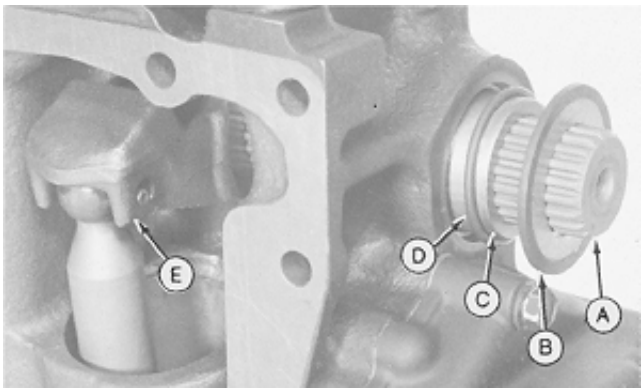
MX,7025HV,A13 -19-30NOV92

NOTE: Left splined sleeve is longer.

4. Remove seal washer (B), splined sleeve (C) with O-ring (D) from each side. Carefully remove rockshaft (A). Lift crank arm (E) from housing.

5. Remove piston. (See, procedure in this group.)

A—Rockshaft
B—Seal Washer (2 used)
C—Splined Sleeve (2 used)
D—O-Ring (2 used)
E—Crank Arm



M43415 -UN-31AUG88

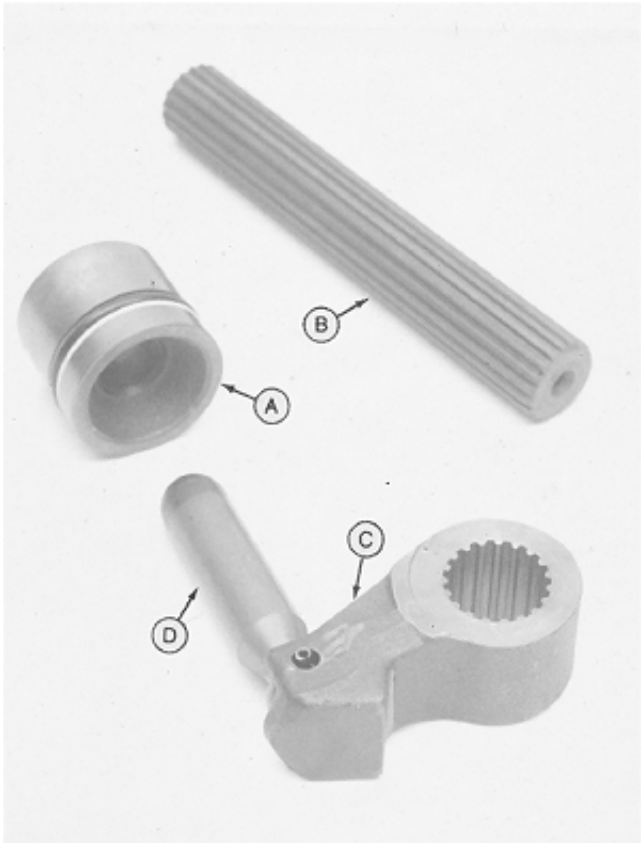
MX,7025HV,A13A -19-30NOV92

INSPECT ROCKSHAFT HOUSING AND COMPONENTS

1. Inspect piston (A) and cylinder wall. (See procedure in this group.)

2. Inspect rockshaft (B) and crank arm (C) splines for excessive wear or damage.

3. Check piston rod (D) for damage or excessive looseness in rod-to-crank connection. Replace as necessary.



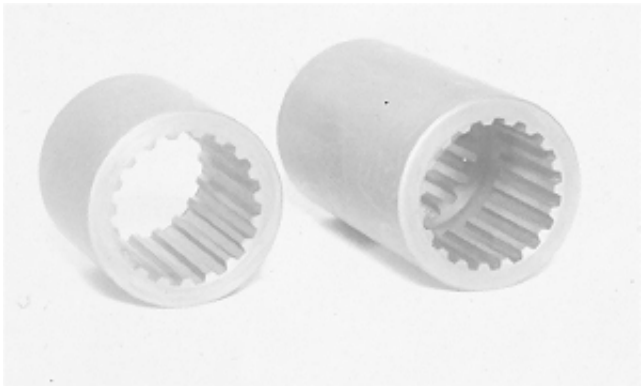
M43416 -UN-31AUG88

MX,7025HV,A14 -19-30NOV92

4. Check splines in sleeve for damage. Examine spline sleeve for wear. Replace as necessary.

Sleeve OD . . . . . 44.95—44.975 mm (1.769—1.77 in.)

Sleeve to bushing maximum
wear clearance . . . . . 0.4 mm (0.016 in.)



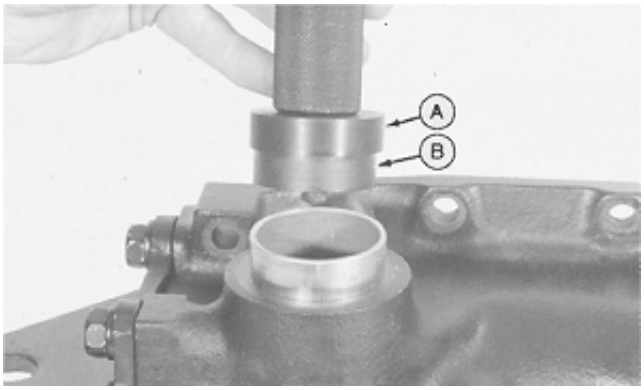
M21,7015W,20 -19-25MAY90

5. Check bushings for wear.

Bushing ID . . . . . 45.00—45.039 mm (1.771—1.773 in.)

6. Replace bushings as necessary. Press out old bushings.

7. Press new bushing into housing until outer edge of bushing is 4.2 mm (0.166) in.) below surface of bore. Use a 1-15/16 driver disk (A) and a 1-3/4 in. driver disk (B).



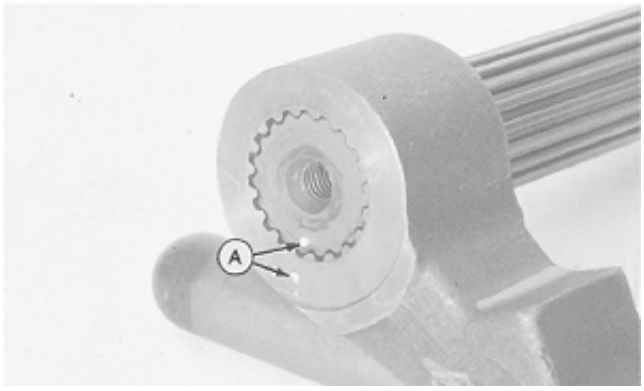
M21,7015W,21 -19-25MAY90

ASSEMBLE ROCKSHAFT HOUSING

1. Lubricate all mating parts and O-rings with clean hydraulic oil prior to assembly.

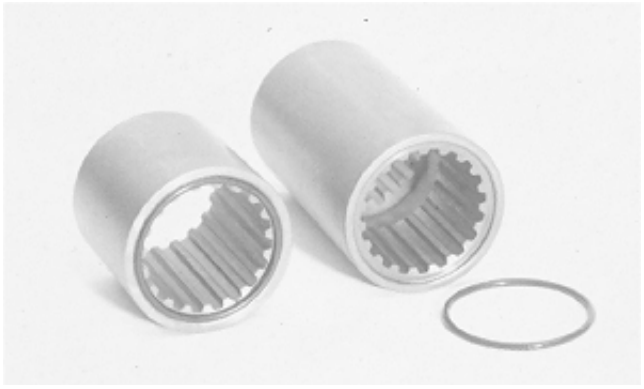
2. Install crank arm and piston rod.

3. Install rockshaft, aligning index marks (A) on crank arm and rockshaft.



M21,7015W,22 -19-25MAY90

4. Install new O-ring to crank arm end of each splined sleeve.



MX,7025HV,A14A -19-30NOV92

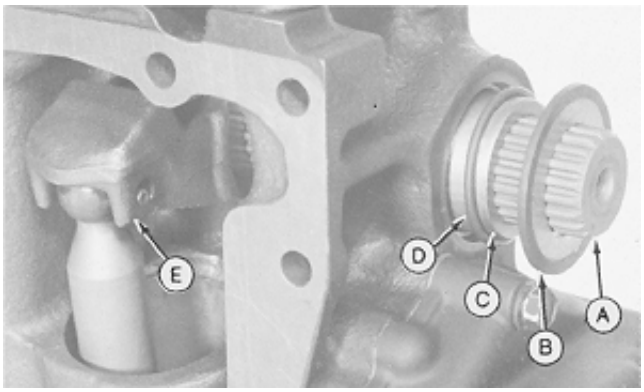
IMPORTANT: Be sure splined sleeves are installed O-ring end in first.

Longer splined sleeve is installed on left side.

5. Grease lightly and install splined sleeve (C) and O-ring (D) on each side.

6. Install seal washer (B).

A—Rockshaft
B—Seal Washer (2 used)
C—Splined Sleeve (2 used)
D—O-Ring (2 used)
E—Crank Arm



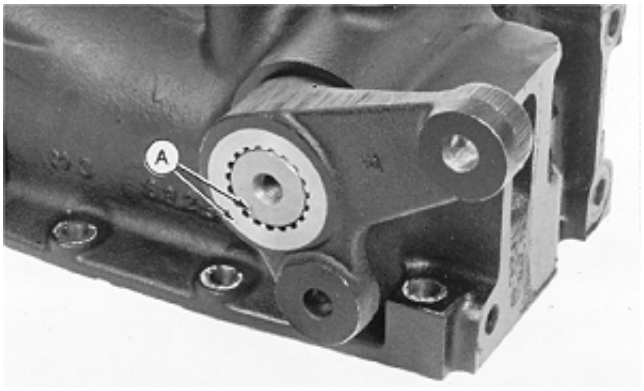
-UN-31AUG88
M43415

MX,7025HV,A14B -19-30NOV92

7. Install both lift arms to rockshaft, aligning index marks (A).

8. Install feedback arm and washer.

9. Install lift arm retaining bolts and lock washers. Slightly raise and drop lift arms. Tighten bolts to 52 N·m (38 lb-ft).



-UN-30NOV89
E30190

MX,7025HV,A14C -19-30NOV92

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10. Install control valve, using new O-rings. Tighten socket head bolts to 24 N·m (18 lb-ft).

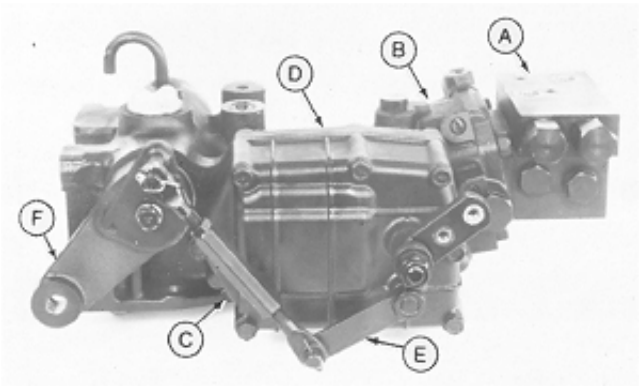
11. Install control valve cover (D), using new gasket. Install and tighten cap screws diagonally 27 N·m (20 lb-ft).

12. Install turnbuckle (C).

13. Dip piston in clean hydraulic oil, and install.

14. Install piston cover (B) using new O-rings. Apply oil to O-rings before installation. Install socket head bolts with longer bolts to the top. Tighten bolts diagonally to 88 N·m (65 lb-ft).

15. Install flow control valve (A) using new O-rings. Apply oil to O-rings before installation. Install four socket head bolts. Tighten bolts diagonally to 17 N·m (150 lb-in.)



E30189 -UN-30NOV89

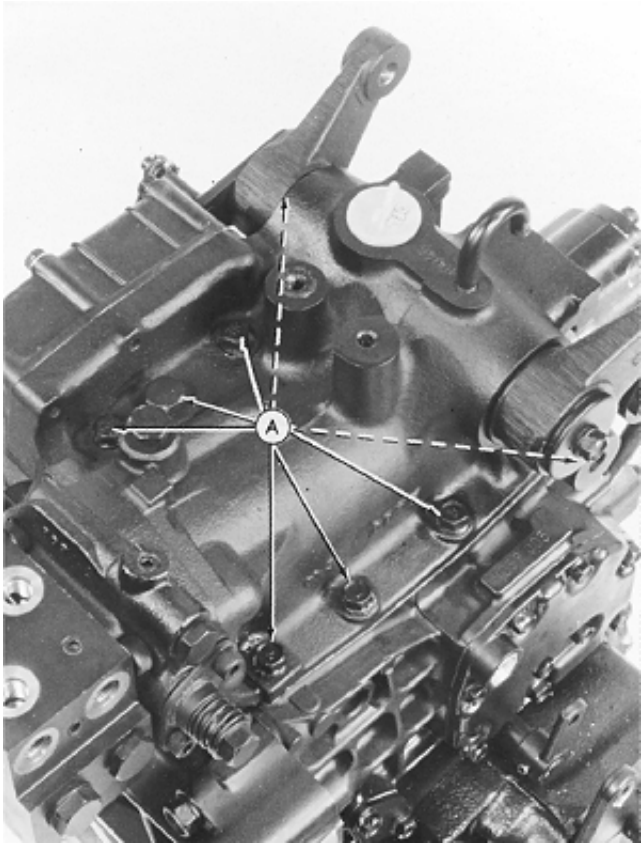
A—Flow Control Valve
B—Piston Cover
C—Turnbuckle
D—Control Valve Cover
E—Feedback Arm
F—Lift Arms

MX,7025HV,A15 -19-30NOV92

INSTALL ROCKSHAFT HOUSING

1. Replace rockshaft-to-transaxle gasket.

2. Install rockshaft housing. Install and tighten eight cap screws (A) and one nut with lock washers 52 N·m (38 lb-ft).



E34127 -UN-22JAN91

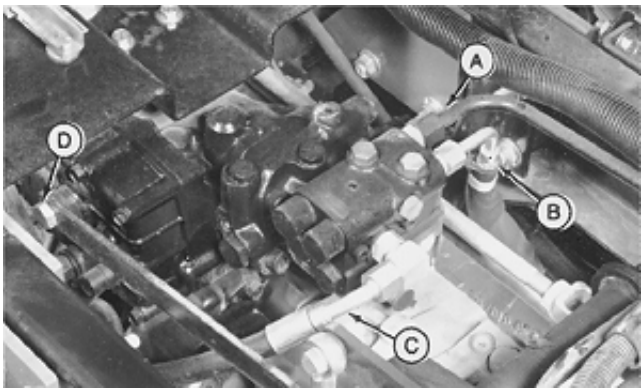
2E6,7025G,19 -19-30NOV92

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25
21

3. Connect rockshaft control valve linkage by installing shoulder bolt (D) and washer.

4. Connect three hydraulic lines (A—C).

A—Wing Lift Valve Inlet Port Line or Hose
B—Steering Valve Port P Hose
C—Transaxle Pump Outlet Hose
D—Shoulder Bolt



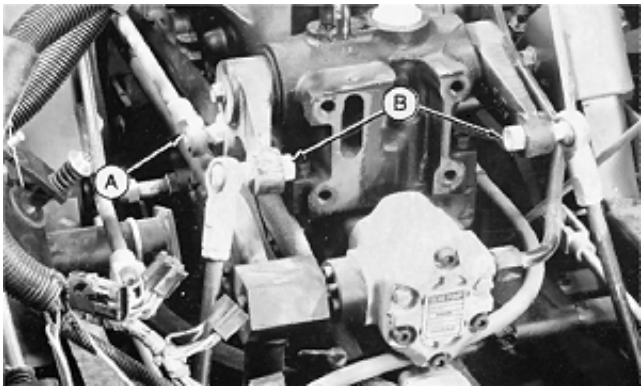
-UN-22JAN91
E34126

MX,7025HV,A15A -19-30NOV92

5. Connect rear lift linkage using pin (A) and spring locking pin.

6. Connect front lift linkage on both sides by installing cap screws (B), washers and nuts. Tighten cap screws to 163 N·m (120 lb-ft)

7. Install operator's seat and support. (See Section 80, Group 10.)



-UN-22MAY90
E34137

MX,7025HV,A15B -19-30NOV92

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OTHER MATERIAL

Number	Name	Use
AN113719	John Deere Cotton Picker Spindle Grease	Lubricant in cutting unit gearbox.

EX,3325,7030,1 -19-24APR91

SPECIFICATIONS

Item	Measurement	Specification
3325 Cutting Unit Motor Mounting Cap Screws	Torque	16 N·m (142 lb-in.)
Motor Cap Screws	Torque	47 N·m (35 lb-ft)
Motor Gear nut	Torque	54 N·m (40 lb-ft)

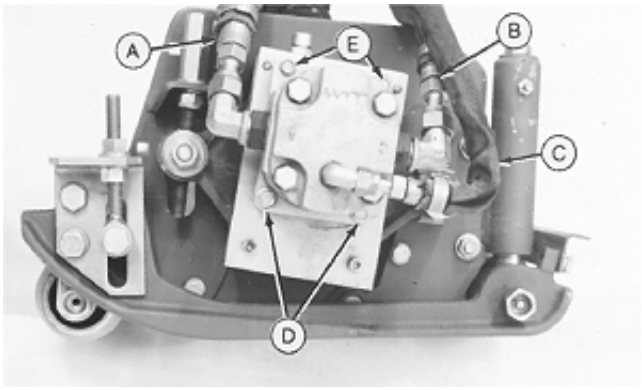
MX,7030HV,A1 -19-30NOV92

REMOVE AND INSTALL CUTTING UNIT MOTOR

1. Tag and disconnect three hoses (A—C). Close all openings using caps and plugs.

2. For 3325 units, remove four cap screws (D and E) to remove motor and gasket.

A—Inlet Hose
B—Outlet Hose
C—Motor Drain Hose
D—30 mm (1.18 in.) Cap Screw (2 used)
E—45 mm (1.77 in.) Cap Screw (2 used)

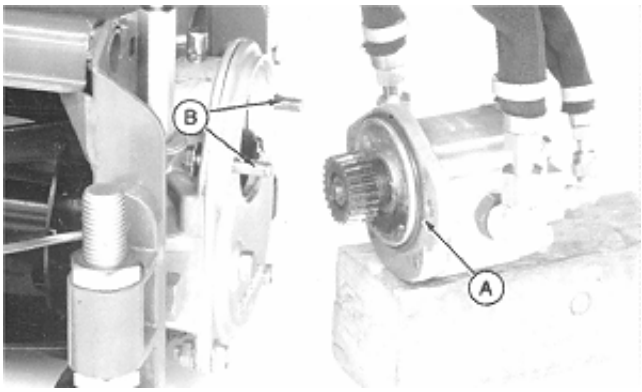


E35809 -UN-27FEB91

MX,7030HV,A2 -19-30NOV92

For 3365 units, remove lock nuts from cap screws (B).

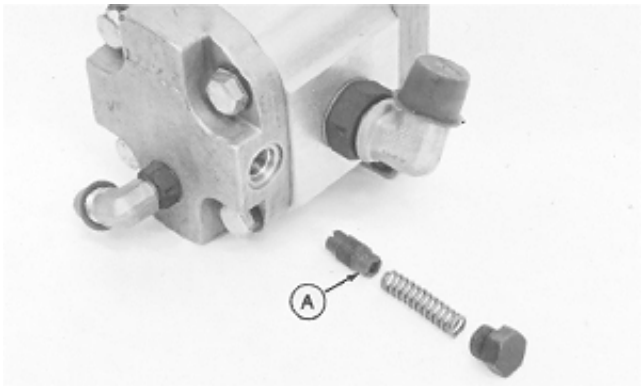
Inspect O-ring (A) for damage.



MX,7030HV,A2A -19-30NOV92

IMPORTANT: Right and left cutting unit motors are the same. To obtain proper rotation of left and right units, the motor check valve must be installed differently in the motors. Refer to Change Cutting Unit Motor Rotation in this group.

3. Make sure check valve (A) is positioned properly in motor for correct rotation of reel. (See Change Cutting Unit Motor Rotation in this group.)

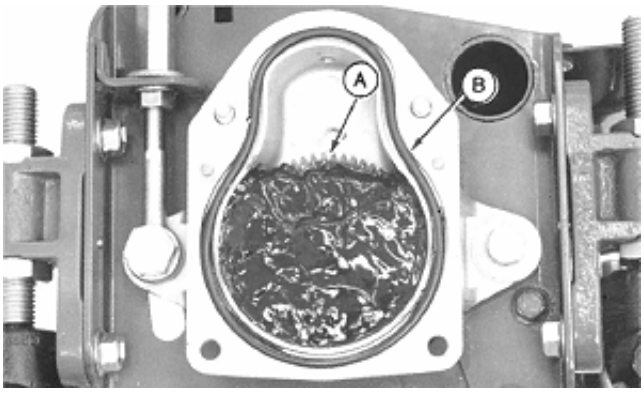


MX,7030HV,A3 -19-30NOV92

4. If necessary, pack cutting unit gear case to top of drive gear (A) with Cotton Picker Spindle Grease or multipurpose grease with NLGI Consistency Number 00.

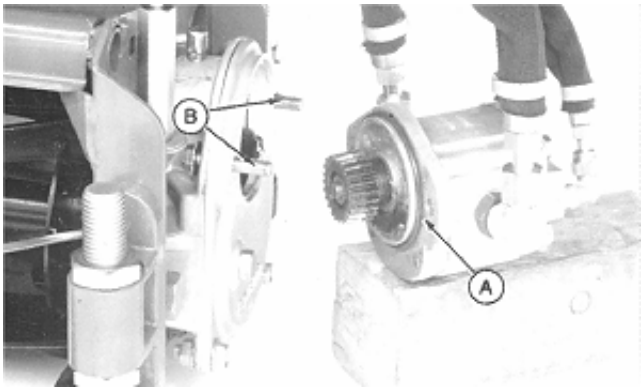
5. Install new gasket or O-ring (B) and motor.

3365 Shown



MX,7030HV,A3A -19-30NOV92

6. For 3365 units, install O-ring (A). Install and tighten lock nuts on cap screws (B).



MX,7030HV,A3B -19-30NOV92

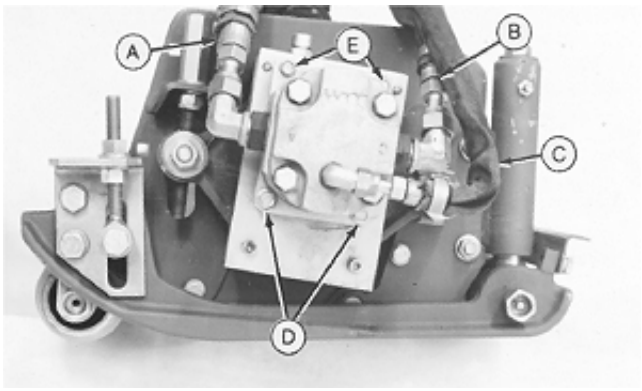
IMPORTANT: For 3325 units, be sure to put shorter cap screws (D) in the lower holes or damage to driven gear may occur.

For 3325 units, install and tighten cap screws (D and E) to 16 N·m (142 lb-in.).

NOTE: All motors are installed with the inlet port towards the front of the machine; port marked "A" for right and center units, port marked "C" for left units.

7. Connect hydraulic hoses (A—C).

A—Inlet Hose
B—Outlet Hose
C—Motor Drain Hose
D—30 mm (1.18 in.) Cap Screw (2 used)
E—45 mm (1.77 in.) Cap Screw (2 used)



-UN-27FEB91
E35809

MX,7030HV,A4 -19-30NOV92

REPLACE CUTTING UNIT MOTOR SEALS

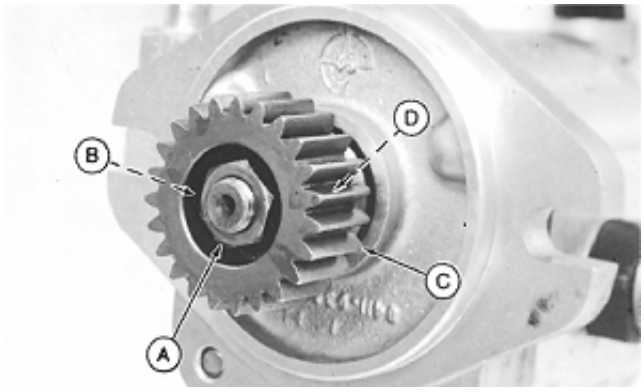
1. Remove cutting unit motor. (See procedure in this group.)

2. Remove nut (A) and lock washer (B).

IMPORTANT: DO NOT pry or hit gear to remove gear. Internal damage can be caused in the motor.

3. Remove gear (C) and key (D) using a puller.

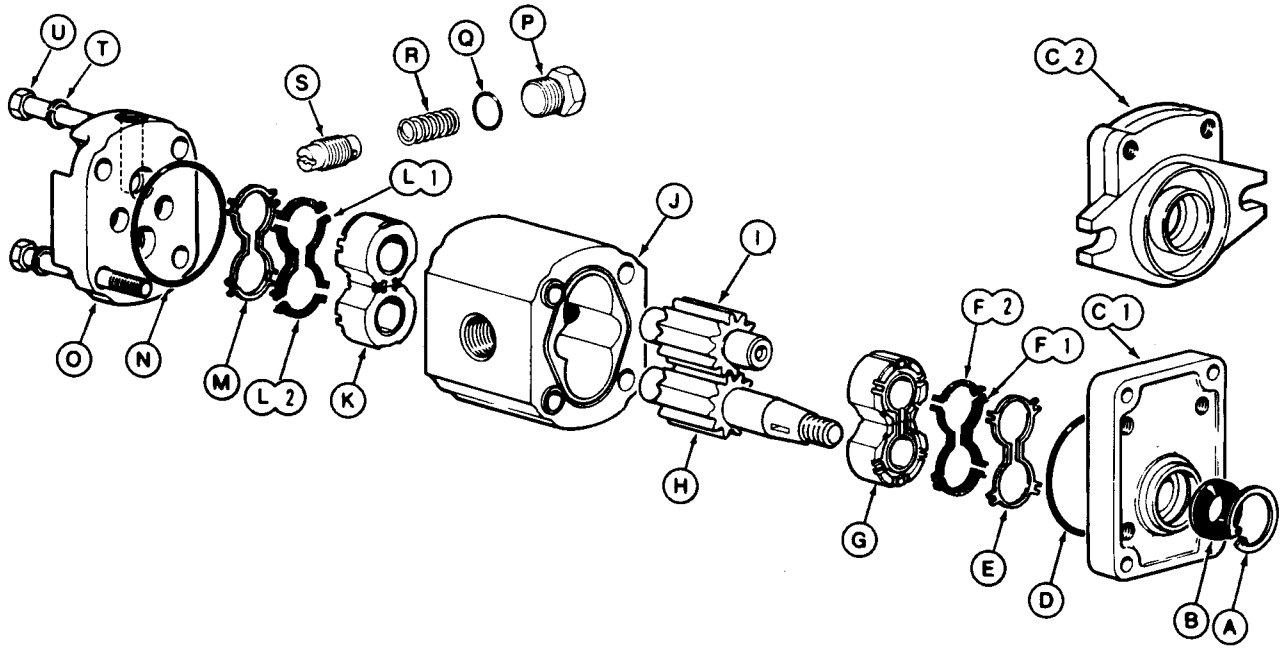
A—Nut
B—Lock Washer
C—Gear
D—Key



-UN-03NOV92
M81413

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MX,7030HV,A4A -19-30NOV92



-UN-12NOV92
M81412

A—Snap Ring
B—Shaft Seal
C1—Mounting Flange (3325 only)
C2—Mounting Flange (3365 only)
D—Flange O-Ring
E—Back-Up Seal
F1—Bushing Side Seal (2 used)
F2—Bushing End Seal (2 used)
G—Flange Bushings
H—Drive Gear
I—Driven Gear
J—Motor Body
K—Cover Bushings
L1—Bushing Side Seal (2 used)
L2—Bushing End Seal (2 used)
M—Back-Up Seal
N—Cover O-Ring
O—Cover
P—Plug
Q—O-Ring
R—Spring
S—Check Valve Cartridge
T—Lock Washer (4 used)
U—Cap Screw (4 used)

4. Put a mark across pump cover (O), body (J) and flange (C1 or C2) to aid assembly.

70
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4

5. Remove cap screws (U) and lock washers (T).

6. Lightly tap flange to separate flange from motor body.

IMPORTANT: Keep gears meshed and bearings on gear shafts. A wear pattern has been formed between the gears and bearing assemblies. To keep internal leakage to a minimum, gears and bearings must be installed in the same position as which they are removed.

7. Remove snap ring (A) and shaft seal (B).

8. Remove flange end O-ring (D), back-up seal (E) and bushing seals (F1 and F2).

9. Inspect wear surfaces of motor body, bushings and gears for scoring, nicks, gouges or discoloration. Replace motor if any parts are damaged.

MX,7030HV,A4B -19-30NOV92

10. Install new bushing seals in flange bearings. Install new back-up seal so back-up seal fits into recess of bushing seals. Flat side of back-up seal must be away from bushing seals.

11. Install new shaft seal into flange with spring side of seal into bore first. If seal bore is scored, apply Form-in-Place Gasket to outer diameter of seal before installation. Install snap ring.

12. Apply a small amount of grease to seal lips.

13. Install new O-ring (D) in motor body.

14. While protecting seal lips from sharp edges of drive shaft, install flange on motor body.

15. Repeat steps 8, 9 and 10 for cover end of motor.

16. Replace O-ring (Q). Tighten plug (P) securely.

17. Install new O-ring (N) in motor body.

18. Install cover so drain port is aligned with driven gear (I) shaft.

19. Install and tighten cap screws (U) and lock washers (T) to 47 N·m (35 lb-ft).

20. Pour clean hydraulic oil in one port. Check that drive shaft can be rotated without excessive force.

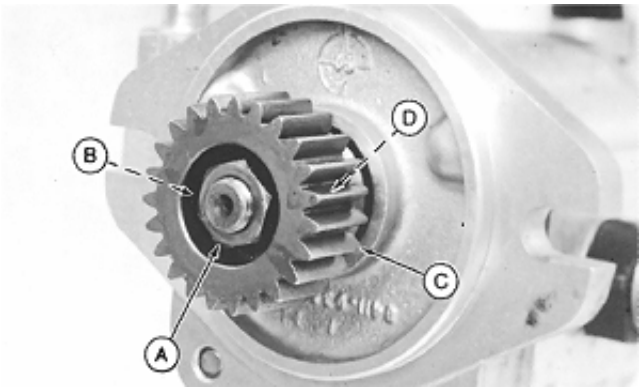
MX,7030HV,A4D -19-30NOV92

21. Install key (D), and gear (C).

22. Install lock washer (B) and nut (A). Tighten nut to 54 N·m (40 lb-ft).

23. Install cutting unit motor. (See procedure in this group.)

A—Nut
B—Lock Washer
C—Gear
D—Key



M81413 -UN-03NOV92

MX,7030HV,A4C -19-30NOV92

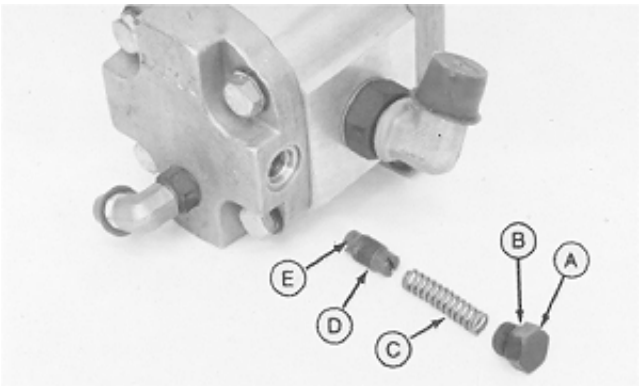
CHANGE CUTTING UNIT MOTOR ROTATION

1. Carefully remove plug (A). Inspect O-ring (B) for damage. Replace as necessary.

CAUTION: Spring behind plug is under compression. Use care when removing plug to avoid bodily injury.

2. Remove spring (C).

3. Remove check valve cartridge (D) using a screw driver.



E35783 -UN-28JAN91

A—Plug
B—O-Ring
C—Spring
D—Check Valve Cartridge
E—Pin End

MX,7030HV,A5 -19-30NOV92

NOTE: For center and right cutting units, the motor must turn counterclockwise as viewed from the motor shaft end. For left cutting units, the motor must turn clockwise.

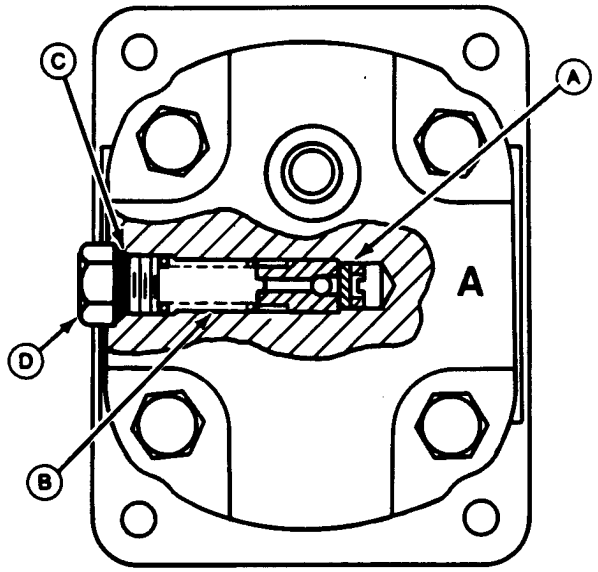
4. Install check valve cartridge in the proper position for the desired rotation:

- •Center and Right Cutting Units -Counterclockwise
  Install check valve cartridge with the pin end (A) into the port first.

- •Left Cutting Units -Clockwise
  Install check valve cartridge with the pin end (A) towards the spring.

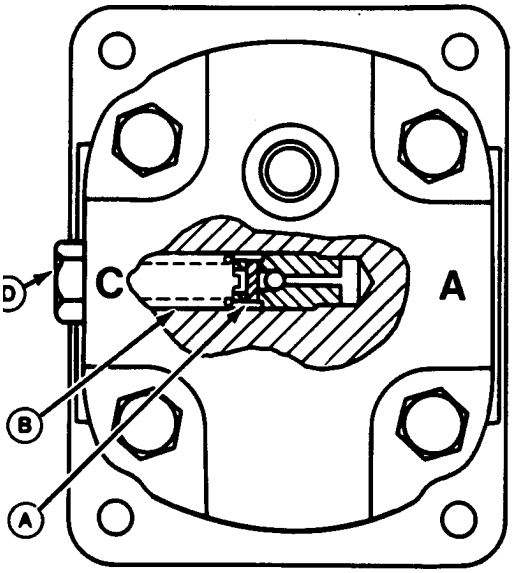
5. Tighten check valve cartridge with screwdriver.

6. Install spring (B), O-ring (C) and plug (D). Tighten plug securely.



E35779 -UN-28JAN91

Center and Right Cutting Units



E35780 -UN-28JAN91

Left Cutting Units

MX,7030HV,A6 -19-30NOV92

REMOVE AND INSTALL HYDRAULIC OIL COOLER

1. Drain hydraulic reservoir.

CAUTION: Engine hood is heavy. Use lifting equipment during hood removal to prevent personal injury and machine damage.

2. Remove engine hood.

3. Tag and disconnect hydraulic lines (A and B).

4. Remove cap screws (C) and nuts to remove oil cooler (D).

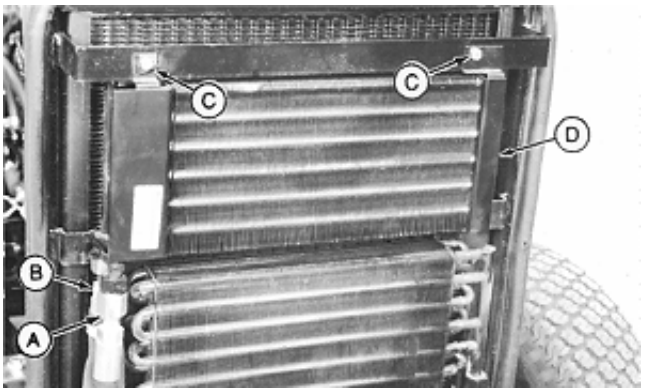
5. Inspect oil cooler for damage or leaks. Straighten damaged fins. Replace cooler if necessary.

6. Install oil cooler.

7. Connect hydraulic lines.

8. Install hood.

9. Fill reservoir with specified hydraulic oil. (See Section 10, Group 20.)



A—Oil Cooler-to-Reservoir or Oil Filter Hose
B—Motors Control Valve-to-Oil Cooler Hose
C—Cap Screw and Nut (2 used)
D—Hydraulic Oil Cooler

MX,7030HV,A7 -19-30NOV92

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Section 80
MISCELLANEOUS REPAIR

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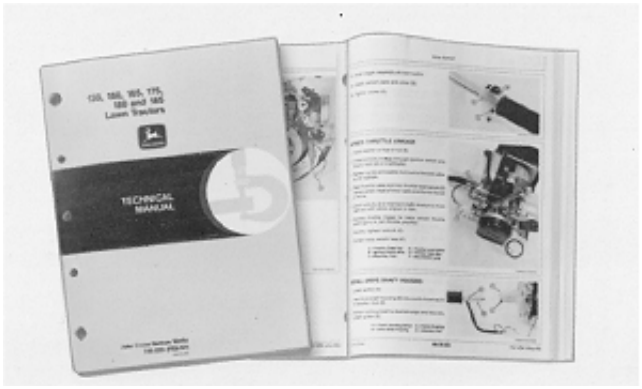
Group 05—Cutting Units
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  Install 80-10-1
Seat Platform
  Remove 80-10-2
  Install 80-10-5

CUTTING UNITS REPAIR—USE TM1528

For complete repair information, the Reel Mower Cutting Units technical manual (TM1528) is also required.

Use the manual in conjunction with this machine manual.



TS224 -UN-17JAN89

MX,8005HV,A1 -19-30NOV92

SPECIFICATIONS

Item	Measurement	Specification
3325 Reel Motor-to-Cutting Unit Cap Screws	Torque	16 N·m (142 lb-in.)

MX,8005HV,A2 -19-30NOV92

REMOVE CUTTING UNIT

CAUTION: Weight transfer switch must be in OFF "O" position when cutting units are being removed to prevent arms from raising rapidly. Turn valve fully counterclockwise to open.

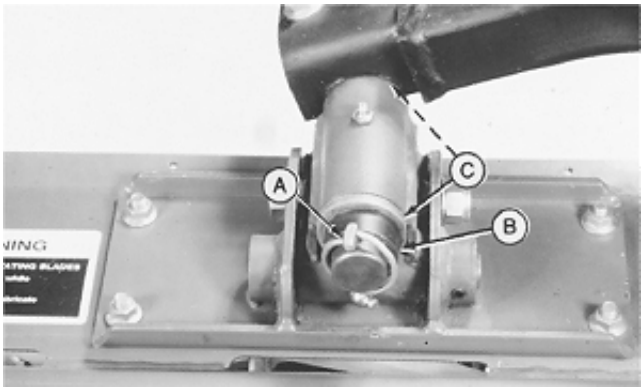
NOTE: Model 3325 shown.

1. Remove quick lock pin (A), spacer (B) and washers (C).

2. Slide cutting unit off the lift arm.

NOTE: Install parts (A—C) on pivot pin so not to lose them.

3. Mark or tag cutting unit so unit can be installed at the same location from which it was removed.



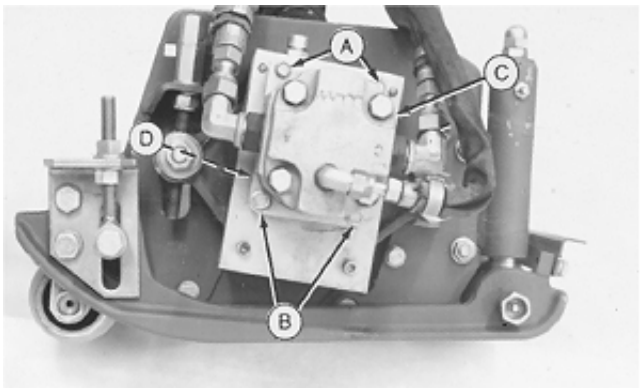
E30127 -UN-08FEB91

MX,8005HV,A3 -19-30MAR93

NOTE: Hydraulic hoses do not have to be disconnected if only the cutting unit is to be repaired.

4. For 3325, remove four cap screws (A and B) and remove motor (C) and gasket (D).

A—M6 x 45 (Long) Cap Screw (2 used)
B—M6 x 30 Cap Screw (2 used)
C—Hydraulic Motor
D—Gasket

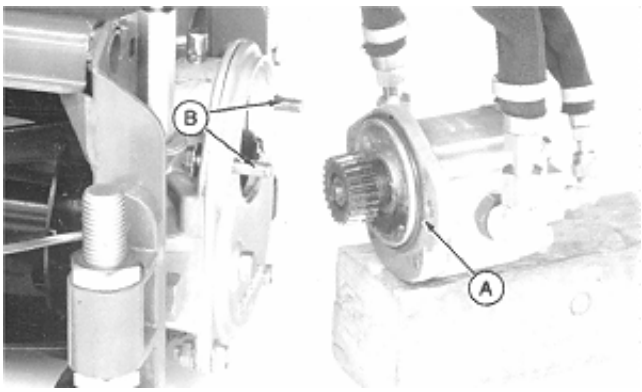


E35781 -UN-08FEB91

MX,8005HV,A4 -19-30NOV92

5. For 3365, remove two nuts and two cap screws (B) to remove motor from reel.

6. Remove O-ring (A).

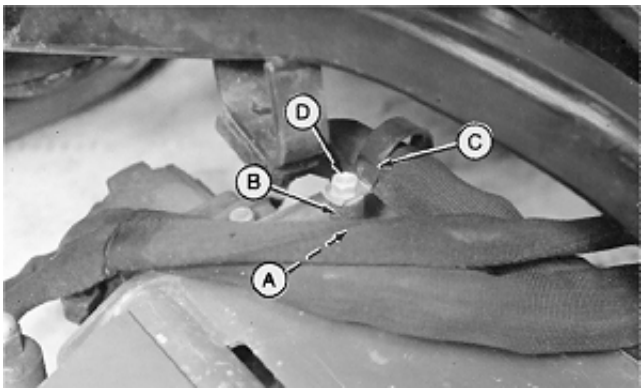


M47246 -UN-12FEB92

MX,8005HV,A5 -19-30NOV92

7. On 3325 mowers with serial no. 840001— only, remove lock nut (D), cap screw (A), bushing (B) and hose strap (C) from wing and rear center cutting units only.

A—Cap Screw
B—Bushing
C—Hose Strap
D—Lock Nut



E35375 -UN-20AUG90

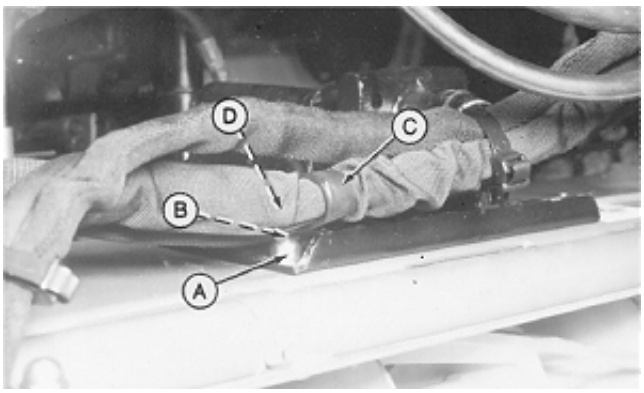
MX,8005HV,A6 -19-30NOV92

8. For 3325 rear center unit only, remove nut (D) to remove second hose strap (C). Do not loosen cap screw (B) and nut (A).

9. Pull cutting unit from machine.

10. Secure hydraulic motor to machine frame using wire or rope.

A—Nut
B—Cap Screw
C—Hose Strap
D—Nut



E32074 -UN-16SEP88

MX,8005HV,A7 -19-30NOV92

INSTALL CUTTING UNIT

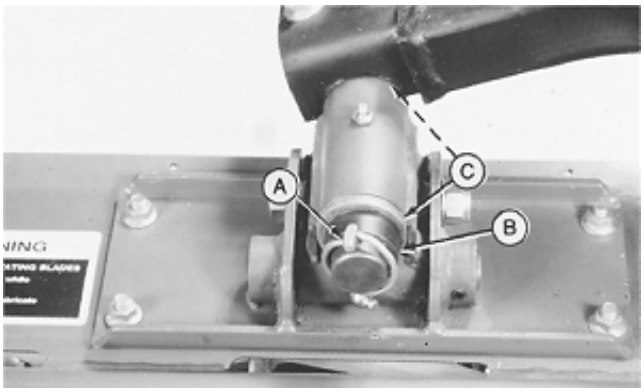
NOTE: Model 3325 shown.

1. Position cutting unit on pivot pin at the same location from which it was removed.

NOTE: Spacer (B) is used only on rear center and two front cutting units. On rear center unit, spacer is installed next to quick lock pin (A). For front units, spacer is installed first, then washers and cutting unit.

For wing units, spacer (B) is replaced with a washer. Washer is installed next to quick lock pin.

2. Install washers (C), spacer (B), and quick lock pin (A).



-UN-08FEB91
E30127

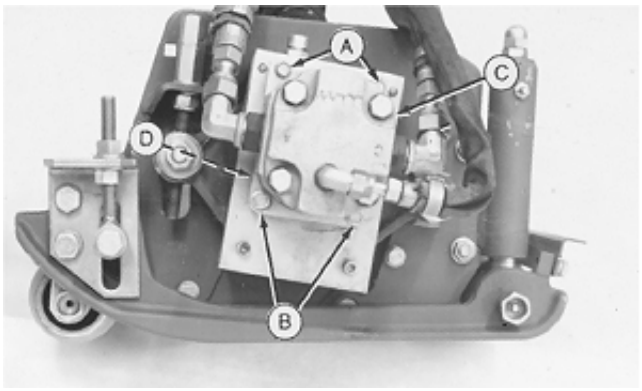
MX,8005HV,A8 -19-30NOV92

3. For 3325 install gasket (D) and motor (C) on cutting unit.

IMPORTANT: Be sure to put shorter cap screws (B) in the lower holes or damage to the driven gear may occur.

4. Install and tighten cap screws (A and B) to 16 N·m (142 lb-in.).

A—M6 x 45 (Long) Cap Screw (2 used)
B—M6 x 30 Cap Screw (2 used)
C—Hydraulic Motor
D—Gasket

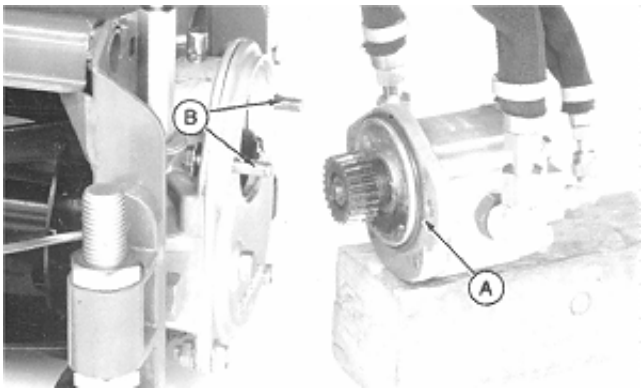


-UN-08FEB91
E35781

MX,8005HV,A9 -19-30NOV92

5. For 3365, lubricate O-ring (A) with grease and install on motor.

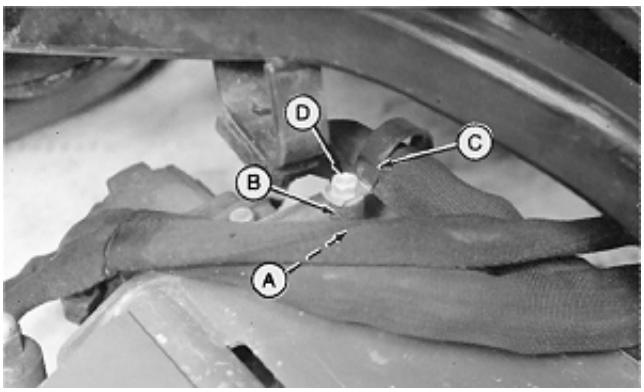
6. Install motor on cutting unit cap screws (B) using two flange nuts.



MX,8005HV,A10 -19-30NOV92

7. On 3325 mowers with serial no. 840001— only, install cap screw (A), bushing (B), hose strap (C), and lock nut (D) on wing and rear center cutting units only.

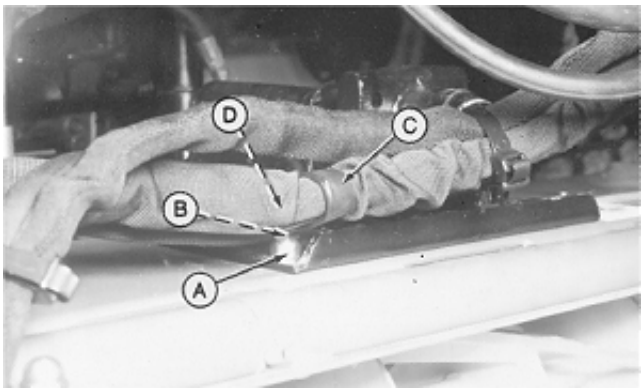
A—Cap Screw
B—Bushing
C—Hose Strap
D—Lock Nut



MX,8005HV,A11 -19-30NOV92

8. For 3325 rear center unit only, install hose strap (C) and nut (D).

A—Nut
B—Cap Screw
C—Hose Strap
D—Nut



MX,8005HV,A12 -19-30NOV92

BACKLAP CUTTING UNITS

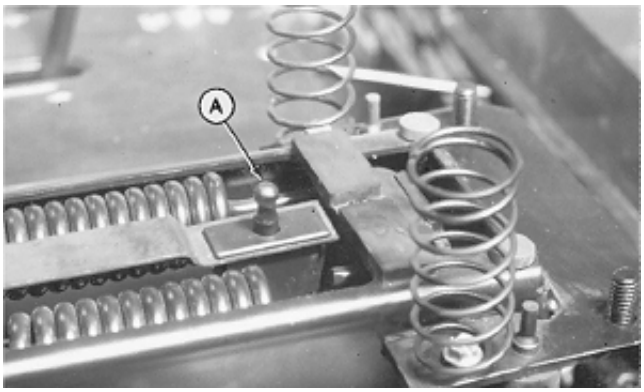
IMPORTANT: The reel-to-bed knife clearance must be adjusted before backlapping operation.

Backlapping must be done on a routine basis to prolong reel life, prevent down time, and provide sharp cutting action.

1. Set parking brake and start engine.

2. Raise seat.

3. Pull up interlock switch (A), located under seat.



E32068 -UN-16SEP88

EX,3325,8005,66-19-30NOV92

CAUTION: Avoid injury from rotating blades. Keep hands and feet away from cutting units while machine is operating.

4. Move backlapping switch (A) to “N” (neutral position) for backlapping. Set throttle lever (B) to low idle.

5. Engage PTO.

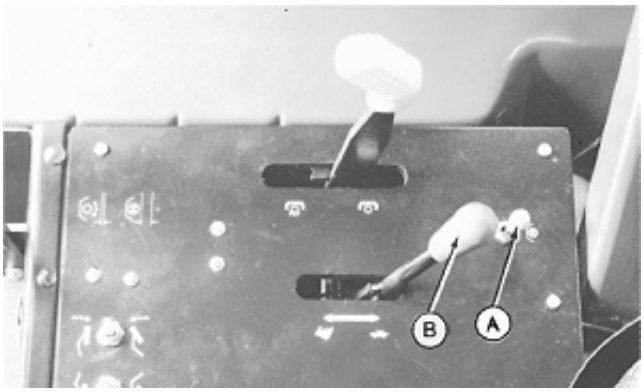
IMPORTANT: Reels must be turning backwards slowly enough so grinding compound will not be thrown off during backlapping.

NOTE: Cutting units may be backlapped separately. The left thumbscrew controls the left cutting unit. The center thumbscrew controls the right cutting unit. The right thumbscrew controls the three remaining units.

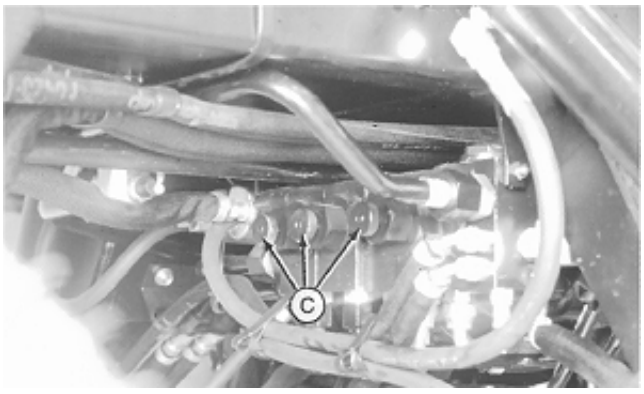
6. Turn thumbscrews (C) inward (clockwise) to turn reels in reverse direction and adjust reel speed. Thumbscrews are located on right side, behind fuel tank, and below battery.

7. Use a long-handed brush to carefully apply reel backlapping compound, uniformly, from one end of the reel to the other. Apply compound again starting from the opposite end. Allow unit to continue rotating backwards until reel is quiet.

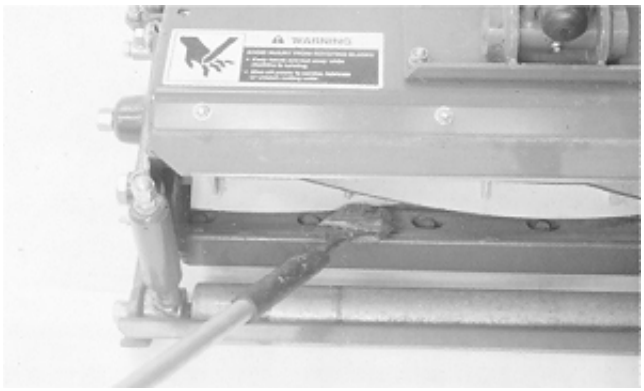
8. Periodically disengage PTO lever and shut engine off to visually check blade appearance.



E29644 -UN-16SEP88



E29574 -UN-16SEP88

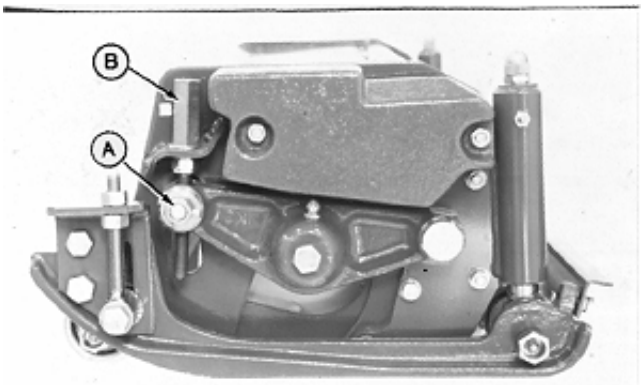

E32250 -UN-12SEP88

MX,5005HV,A13 -19-30NOV92

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9. Check reel-to-bed knife clearance. If clearance is not uniform, partially loosen adjuster shoulder bolt (A) on the end of the cutting unit with the greatest clearance. Turn adjuster bolt (B) counterclockwise 1-1/2 flats or as needed to make clearance uniform. Tighten clamp bolts (A) and lock nut.

10. Repeat steps 7, 8, and 9 until clearance appears uniform across the length of the bed knife.



E35561 -UN-24OCT90

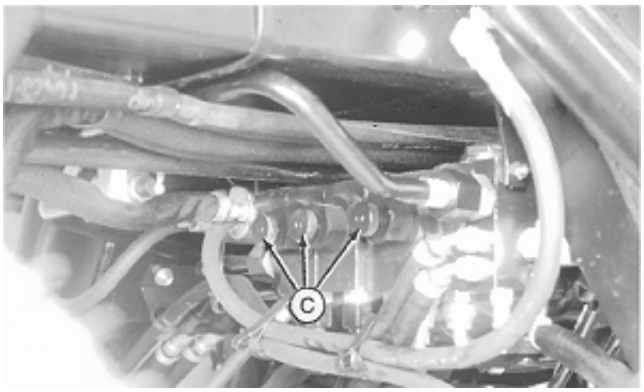
EX,3325,8005,68-19-24APR91

11. Disengage PTO lever and shut off engine. Turn thumbscrews (C) fully counterclockwise.

IMPORTANT: Do not operate units in the forward direction until reel sharpening compound is washed from the unit. Unless compound is removed thoroughly, the reels can be dulled by the compound.

12. With the reel stopped, use water to thoroughly wash off all reel sharpening compound.

13. Check reel-to-bed knife clearance. Adjust clearance if necessary.



E29574 -UN-16SEP88

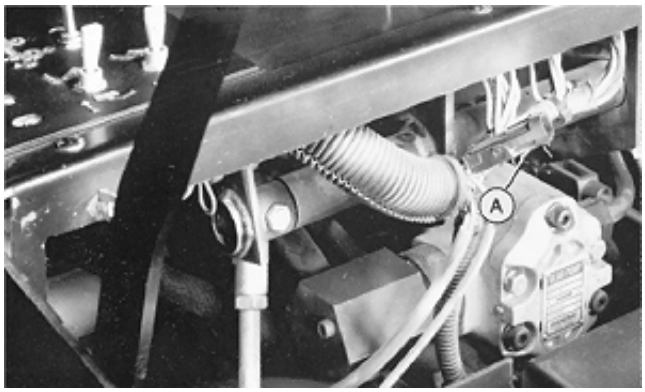
MX,5005HV,A14 -19-30NOV92

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7

REMOVE OPERATOR SEAT

1. Remove front kick panel.

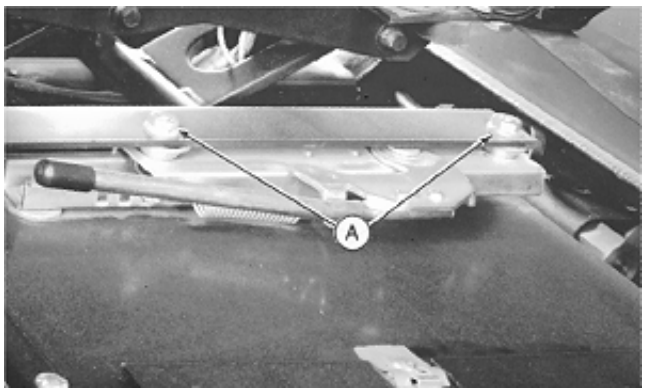
2. Disconnect seat switch (A).



2E6,8005G,1 -19-24APR91

3. Tilt seat forward and remove nuts (A) from each side.

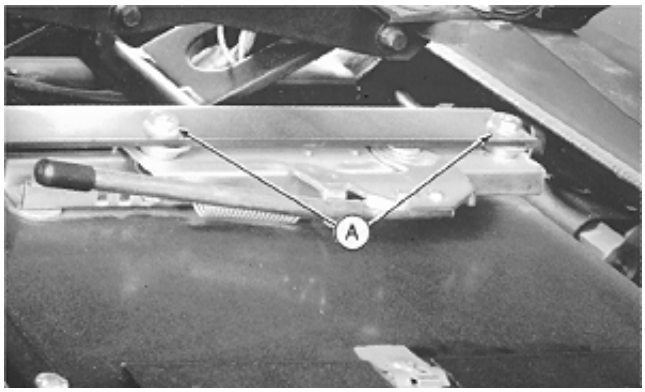
4. Remove seat assembly.



2E6,8005G,2 -19-25MAY90

INSTALL OPERATOR SEAT

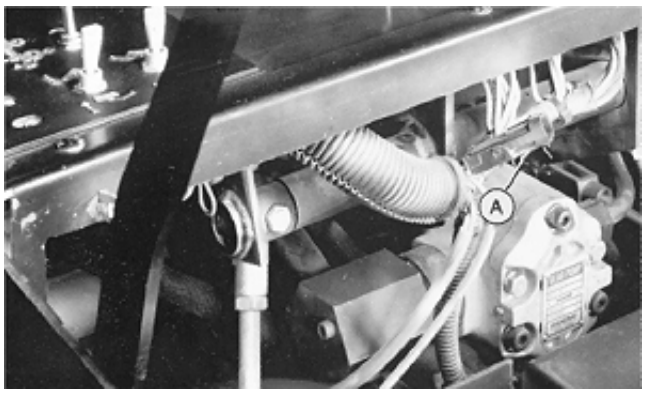
1. Position seat assembly and install nuts (A) on each side.



2E6,8005G,3 -19-24APR91

2. Connect seat switch (A).

3. Install front kick panel.

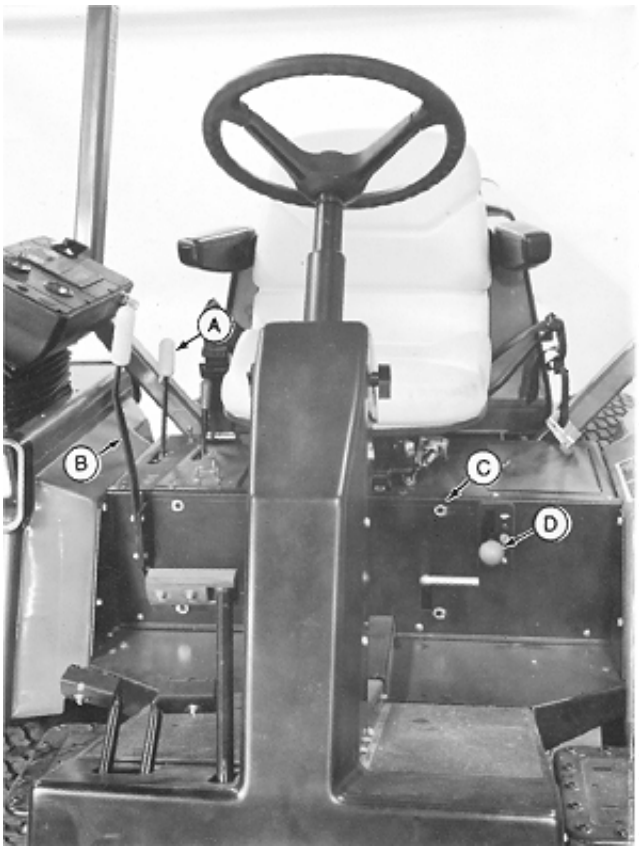


MX,8010HV,A1 -19-30NOV92

REMOVE SEAT PLATFORM

1. Remove parts (A—D).

A—PTO Lever Handle
B—Cutting Units Lift/Lower Lever
C—Kick Panel
D—Two-Speed Axle Lever Knob



M81453 -UN-12NOV92

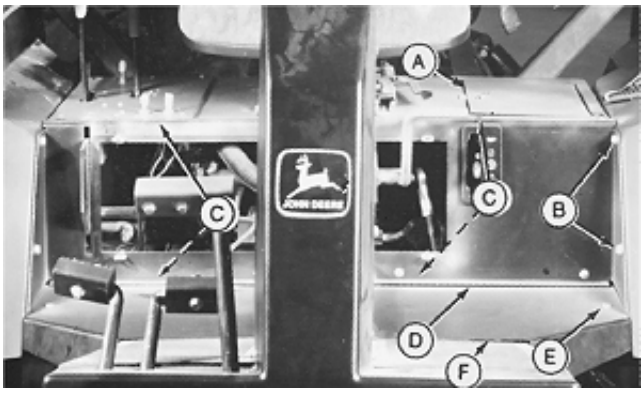
MX,8010HV,A2 -19-30NOV92

2. Remove panel (A).

3. Remove four cap screws and nuts (B), ten bolts and nuts (C), and kick panel frame (D).

4. Remove two bolts and nuts (E) to remove deck panel (F).

A—Top Left Access Panel
B—Cap Screw and Nut (4 used)
C—Bolt and Nut (10 used)
D—Kick Panel Frame
E—Bolt and Nut (2 used)
F—Deck Panel

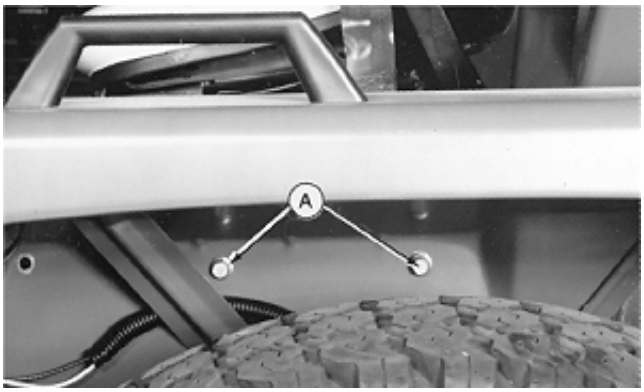


E35686 -UN-09JAN91

MX,8010HV,A3 -19-30NOV92

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2

5. Remove two cap screws and nuts (A) on each side attaching fenders to seat platform.



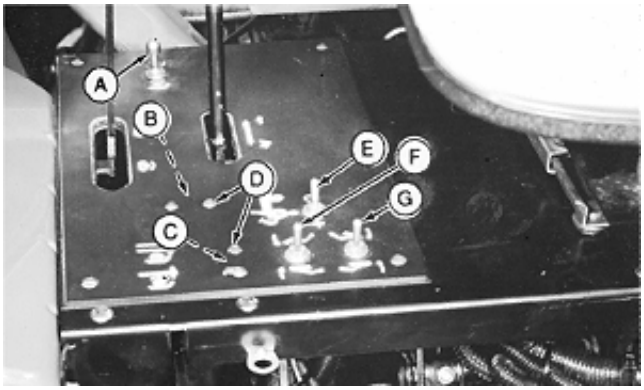
MX,8010HV,A4 -19-30NOV92

NOTE: Tag switches for ease of assembly.

Screws (D) fasten to retaining straps located under the microswitches. Hold retaining straps when removing screws to prevent straps from dropping.

6. Remove parts (A—G) from switch panel.

A—Backlap Switch
B—Left and Right Wing Lift Microswitches
C—Mow Microswitch
D—Screws (4 used)
E—Weight Transfer Switch
F—Right Wing Lift/Lower Toggle Switch
G—Left Wing Lift/Lower Toggle Switch

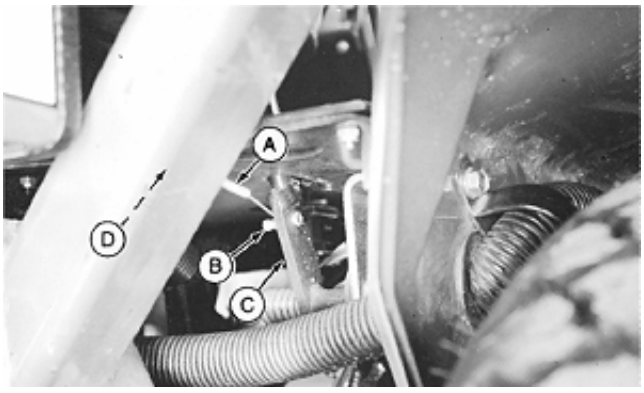


MX,8010HV,A5 -19-30NOV92

7. Disconnect cable clamp (D) from seat platform.

8. Loosen screw (B) to disconnect throttle cable (A) from throttle lever (C).

A—Throttle Cable
B—Screw
C—Throttle Lever
D—Cable Clamp



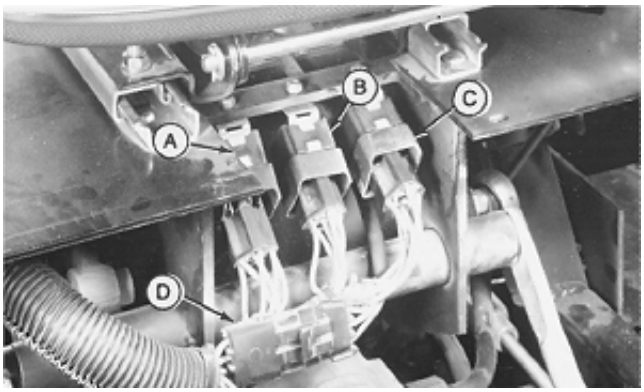
MX,8010HV,A6 -19-30NOV92

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3

NOTE: Tag connectors for ease of assembly.

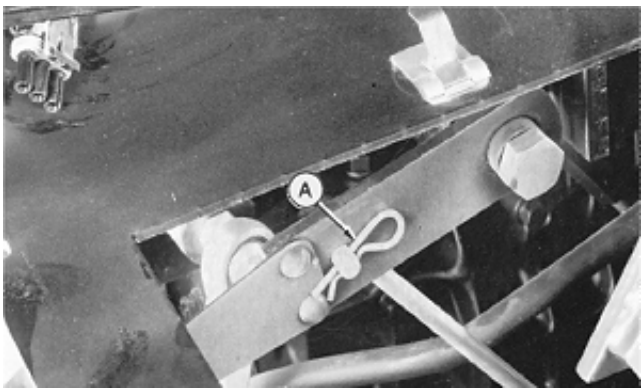
9. Tag and disconnect connectors (A—D).

A—Left Wing Mow Relay
B—Right Wing Mow Relay
C—Backlap Relay
D—Seat Switch Connector



MX,8010HV,A7 -19-30NOV92

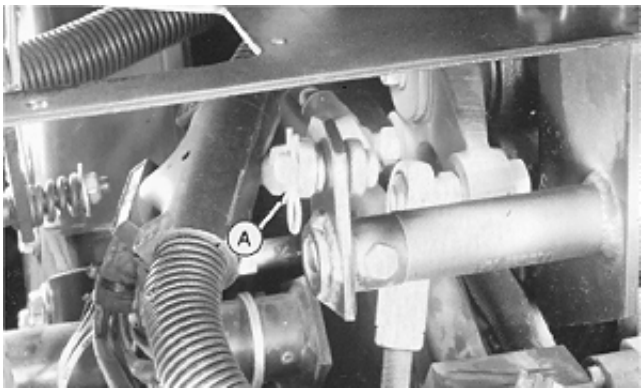
10. Remove spring locking pin (A) to disconnect two-speed axle linkage rod from lever.



MX,8010HV,A8 -19-30NOV92

11. Remove spring locking pin (A), two washers and pin to disconnect differential lock linkage.

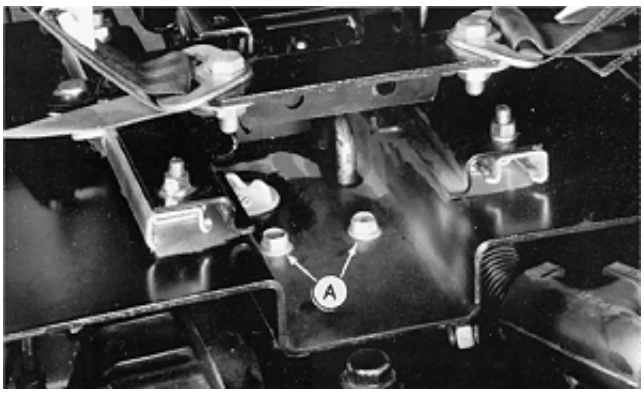
12. Cut tie strap to remove wire harness from differential lock pedal/seat support.



MX,8010HV,A9 -19-30NOV92

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4

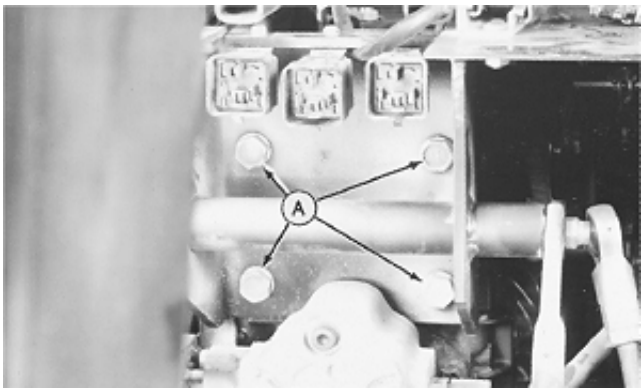
13. Remove two cap screws (A) attaching seat platform to top of transaxle.



MX,8010HV,A10 -19-30NOV92

14. Remove four cap screws (A) attaching differential lock pedal/seat support to transaxle.

15. Carefully remove seat platform assembly from machine. Use two people to ease removal of platform.

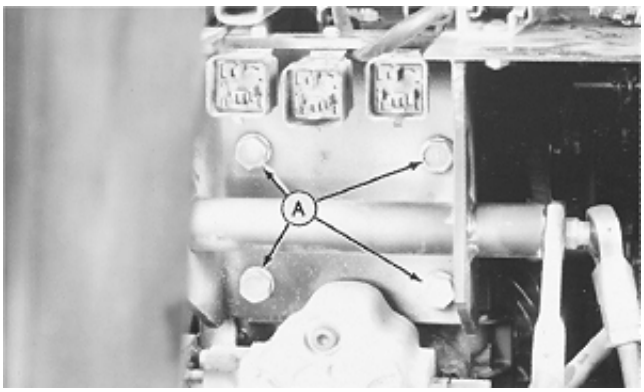


MX,8010HV,A11 -19-30NOV92

INSTALL SEAT PLATFORM

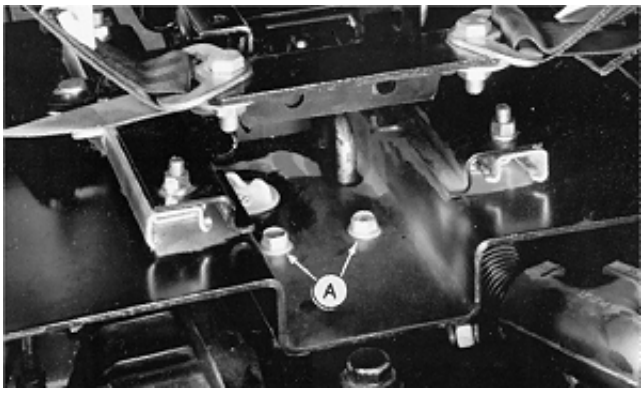
1. Carefully position seat platform assembly on top of transaxle.

2. Install four cap screws (A) to attach differential lock pedal/seat support to transaxle.



MX,8010HV,A12 -19-30NOV92

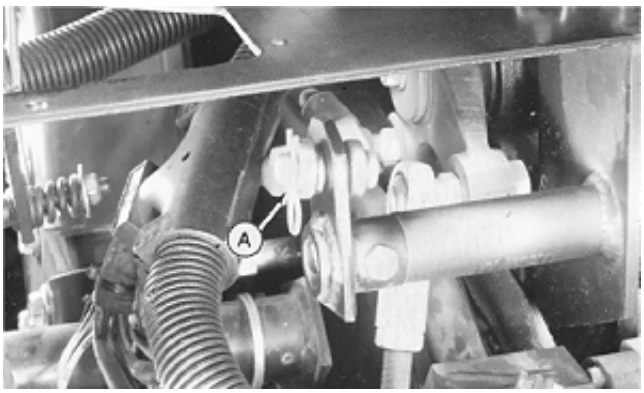
3. Install two cap screws (A), below rear of operator's seat, to attach seat platform to top of transaxle.



MX,8010HV,A13 -19-30NOV92

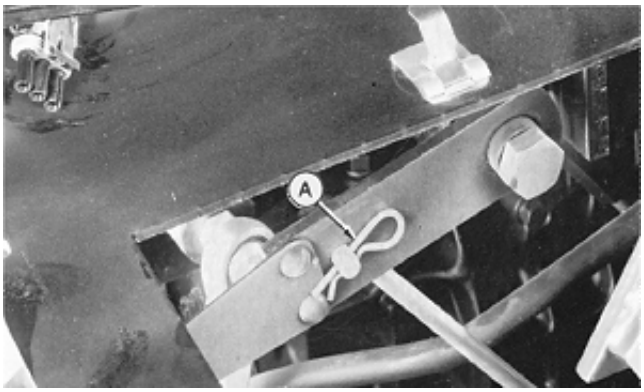
4. Install pin, two washers and spring locking pin (A) to connect differential lock linkage.

5. Install a tie strap to fasten wire harness to differential lock pedal/seat support.



MX,8010HV,A14 -19-30NOV92

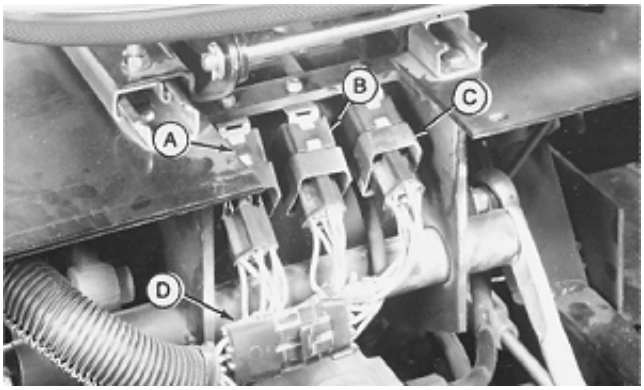
6. Connect two-speed axle linkage rod to lever. Install spring locking pin (A).



MX,8010HV,A15 -19-30NOV92

7. Connect four connectors (A—D).

A—Left Wing Mow Relay
B—Right Wing Mow Relay
C—Backlap Relay
D—Seat Switch Connector

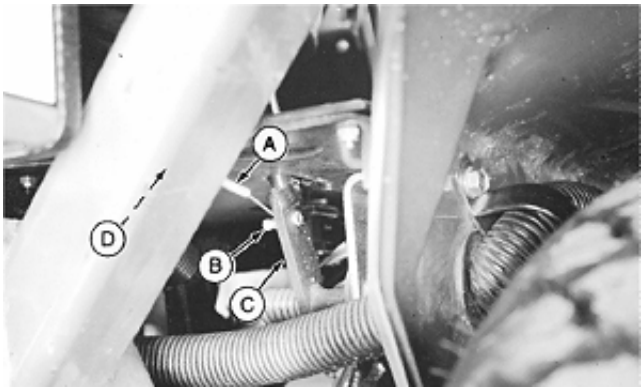


MX,8010HV,A16 -19-30NOV92

8. Insert cable wire into hole in throttle lever pin. Tighten screw (B).

9. Attach cable clamp (D) to seat platform.

A—Throttle Cable
B—Screw
C—Throttle Lever
D—Cable Clamp



MX,8010HV,A17 -19-30NOV92

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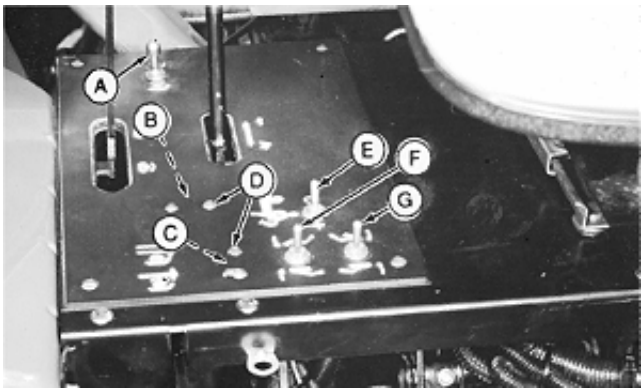
10. Install wing lift microswitches (B):

- Switch lever rollers must be towards right side of machine.
- Lever side of switches towards front of machine.

11. Install mow microswitch (C):

- Switch lever roller must be towards front of machine.
- Lever side of switch towards right side of machine.

12. Align slot in threaded portion of toggle switches (A, E—G) with tab in mounting holes in switch panel. Install toggle switches.

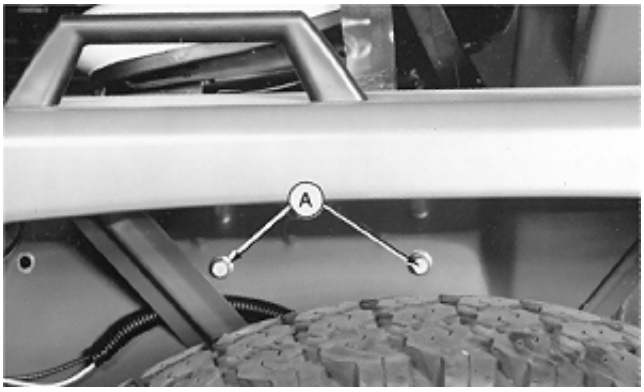


M81425 -UN-12NOV92

A—Backlap Switch
B—Left and Right Wing Lift Microswitches
C—Mow Microswitch
D—Screws (4 used)
E—Optional Weight Transfer Switch
F—Right Wing Lift/Lower Toggle Switch
G—Left Wing Lift/Lower Toggle Switch

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13. Install two cap screws and nuts (A) on each side to attach fenders to seat platform.



E30049 -UN-21SEP88

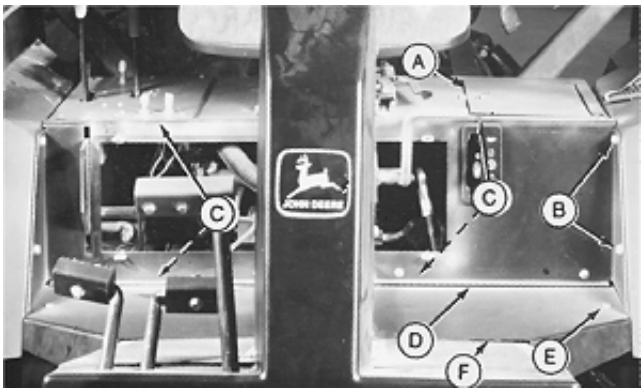
MX,8010HV,A19 -19-30NOV92

14. Install deck panel (F) using two bolts and nuts (E).

15. Install kick panel frame (D). Install and tighten ten bolts and nuts (C) and four cap screws and nuts (B).

16. Install top panel (A).

A—Top Left Access Panel
B—Cap Screw and Nut (4 used)
C—Bolt and Nut (10 used)
D—Kick Panel Frame
E—Bolt and Nut (2 used)
F—Deck Panel



-UN-09JAN91
E35686

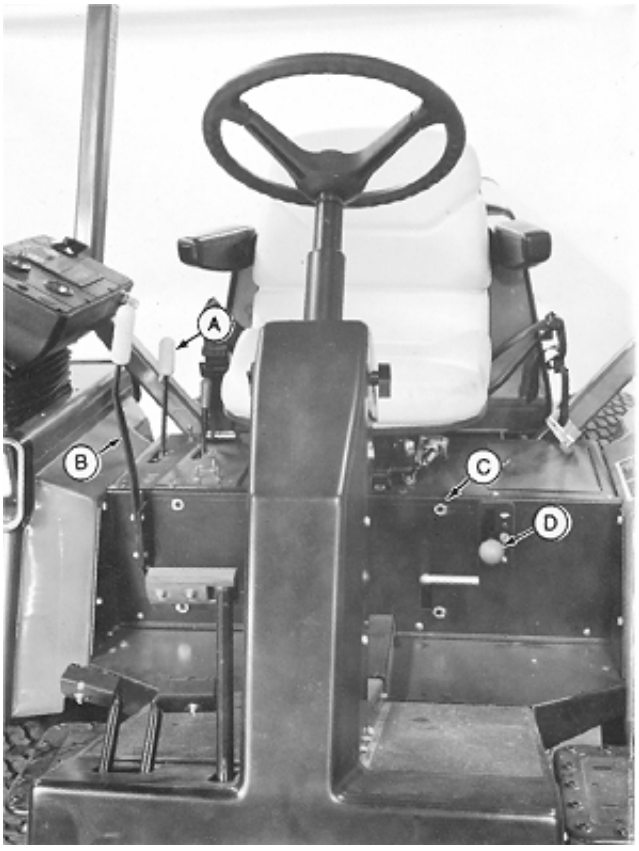
MX,8010HV,A20 -19-30NOV92

17. Adjust mow microswitch. (See procedure in Section 240, Group 15.)

18. Adjust throttle cable. (See procedure in Section 220, Group 15.)

19. Install parts (A—D).

A—PTO Lever Handle
B—Cutting Units Lift/Lower Lever
C—Kick Panel
D—Two-Speed Axle Lever Knob



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M81453

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Section 210
OPERATIONAL CHECKOUT PROCEDURE

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TEST AND ADJUSTMENT SPECIFICATIONS

ITEM	SPECIFICATION
ENGINE	
Throttle Lever Friction Adjustment	18 N (4.0 lb force)
Fuel Transfer Pump	
Minimum Flow for 30 seconds	207 mL (7 oz)
Minimum Fuel Pressure	21 kPa (0.2 bar) (3 psi)
Engine Compression	
Minimum Cranking Speed	250 rpm
Minimum Pressure	2448 kPa (24.5 Bar) (355 psi)
Maximum Difference Between Cylinders	490 kPa (4.9 bar) (71 psi)
Engine Oil Pressure	294—440 kPa (2.9—4.4 bar) (43—64 psi)
Idle Speeds	
Slow	950—1050 rpm
Fast	2800 rpm
Cooling System	
Test Pressure	69 kPa (0.7 bar) (10 psi)
Minimum Pressure after 15 Seconds	55 kPa (0.6 bar) (8 psi)
Radiator Cap	
Opening Pressure	41—55 kPa (0.4—0.6 bar) (6—8 psi)
Minimum Pressure after 15 Seconds	34 kPa (0.34 bar) (5 psi)
Engine Valve Clearance	
Intake and Exhaust	0.20 mm (0.008 in.)
Fan Belt	
Applied Force	95 N (20 lb force)
Belt Deflection	13 mm (1/2 in.)
ELECTRICAL SYSTEM	
Starter	
On engine: Current draw/rpm	300 amps at 200 rpm
On bench (No-load): Current draw/rpm	850 amps maximum at 0 rpm 110 amps minimum at 4500 rpm
Alternator/Regulator	
Current output (at max. load)	0 amps minimum at 1300 rpm
Regulated voltage	13.5—14.7 volts DC at 10 amps or less, 2800 rpm, 25˚C (77˚F)
Solenoid Valve Coils	
Wing Lift/Lower Valves	5.02 ± 0.15 ohms
Cutting Unit Valves	3.49 ± 0.10 ohms
Hydraulic and Hydrostatic	
Temperature Switches	Normally open, Contacts close at 104˚C (220˚F)
Engine Oil Pressure Switch	Normally open, Contacts close at 69 kPa (0.7 bar) (10 psi) or less
Engine Coolant Temperature Switch	Normally open, Contacts close when temperature exceeds 100˚C (212˚F)
Air Filter Restriction Switch	Normally open, Contacts close at 6.2 ± 1.2 kPa vacuum, (62 ± 12 mbar vacuum) (25 ± 5 in. water)

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POWER TRAIN
Charge Pump Relief Valve Pressure . . . . . 690—1241 kPa (6.9—12.4 bar) (100—180 psi)
Charge Pump Flow . . . . . 11.4 L/min (3.3 gpm) minimum
Transmission High Pressure Reliefs . . . . . 41370—44817 kPa (413—448 bar) (6000—6500 psi)
Clutch Lube Pressure . . . . . 21—41 kPa (0.2—0.4 bar) (3—6 psi)
PTO Clutch Engagement Pressure . . . . . 827 kPa (8.3 bar) (120 psi)
Neutral Return Spring Initial Adjustment
  3325 . . . . . 133 mm (5-1/4 in.)
  3365 . . . . . 203 mm (8 in.)
Differential Lock Pedal
  Height above foot rest when engaged . . . . . 50—60 mm (2.0—2.4 in.)

STEERING
Steering Valve Pressure Relief . . . . . 10497—10997 kPa (105—110 bar) (1522.5—1595 psi)
Steering Hydraulic Flow Rate . . . . . 6.4 L/min (1.7 gpm)
Steering System Leakage
  Maximum steering wheel rpm . . . . . 6 rpm at 6.8 N·m (60 lb-in.) torque

BRAKES
Brake Rod Length . . . . . 557 mm (21.9 in.)
Brake Pedal Clearance . . . . . 6 mm (1/4 in.)

HYDRAULIC SYSTEM
Oil Operating Temperature . . . . . 43˚C (110˚F)
Transaxle Pump Flow . . . . . 33.5 L/min (8.85 gpm)
Rockshaft
  Maximum Leakage . . . . . 2 mm (0.08 in.) drop in 1 minute
Flow Control Valve
  Rockshaft Relief Valve Pressure . . . . . 14617 kPa (146 bar) (2120 psi)
  Wing Lift Relief Pressure . . . . . 14617 kPa (146 bar) (2120 psi)
  Priority Flow to Steering . . . . . 6.4 L/min (1.69 gpm)
Hydraulic Pump Flow
  Front/Center Section . . . . . 37.8 L/min (10 gpm)
  Wing Section . . . . . 37.8 L/min (10 gpm)
Cutting Unit Motor Relief Pressure
  Front/Center Motors Relief Valve . . . . . 17237—21374 kPa (172—214 bar) (2500—3100 psi)
  Wing Motors Relief Valve . . . . . 18616—22753 kPa (186—228 bar) (2700—3300psi)
Lift System Initial Adjustments
  Horizontal Lift Rod Length . . . . . 490 mm (19.3 in.)
  Vertical Lift Rod Length . . . . . 495 mm (19.5 in.)
  Lift Lever Rod Length . . . . . 625 mm (24.6 in.)
Front Lift Arm-to-Frame Clearance . . . . . 3 mm (1/8 in.)
Center Cutting Unit-to-Stop Clearance . . . . . 3—6 mm (1/8—1/4 in.)

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05
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MX,21005HV,A1A -19-18JAN93

OPERATIONAL CHECKOUT PROCEDURES

The procedures covered in this group are used to give a quick checkout of all the systems and components on the unit. These checkouts should be run to insure proper operation after any extended storage, when the unit comes in for service, and after repairs have been made on the unit. They can also be helpful in determining the value of the unit at trade-in time. The unit should be placed on a level surface to run the checkouts. All the checkouts should be done and all of the steps of each checkout should be followed.

Each checkout lists:
- Conditions - How the unit should be set up for the checkout.
- Procedure - The specific action to be done.
- Normal - What should happen or be heard or be seen.
- If Not Normal - Where to go if other tests or adjustments are needed.

When performing the checkout, be sure to set your machine up to the test conditions listed and follow the sequence carefully. The “Normal” paragraph gives the result that should happen when performing the checkout. If the results are not normal, go to the Section and Group listed in the “If Not Normal” paragraph to determine the cause and repair the malfunction.

The photograph that accompanies each checkout procedure is included to help conduct the checkout.

MX,21010HE,1A -19-27SEP91

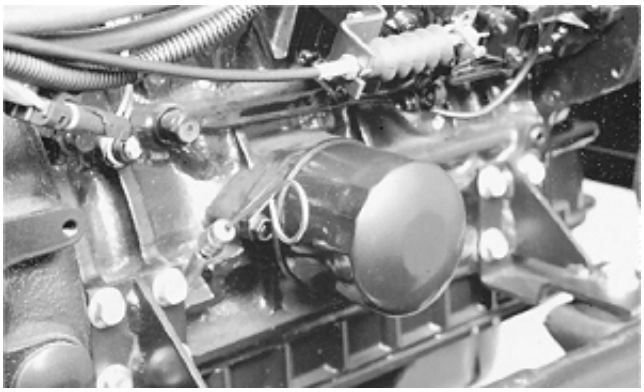
ENGINE OIL LEVEL AND CONDITION CHECK

CONDITIONS:
- Machine parked on level surface.
- Key switch in off position.
- Park brake engaged.
- Engine not run for at least 5 minutes.

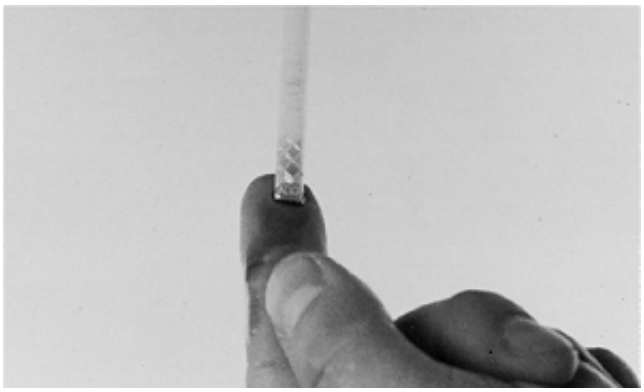
PROCEDURE:
- Clean dirt from area around dipstick opening.
- Remove and wipe off engine oil dipstick.
- Install dipstick until seated in tube.
- Remove dipstick and check level and condition of oil.

NORMAL:
- Oil level between full and add marks of dipstick.
- Oil not excessively thick or thin.
- No fuel odor in oil.
- No visible foreign material in oil.

IF NOT NORMAL:
- Add proper oil to full mark on dipstick. (Refer to Section 10, Group 20.)
- Replace contaminated oil and filter.
- Go to Section 220, Group 15 for engine diagnosis, tests and adjustments.



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M45603 -UN-06AUG90

MX,21010HV,A1 -19-18JAN93

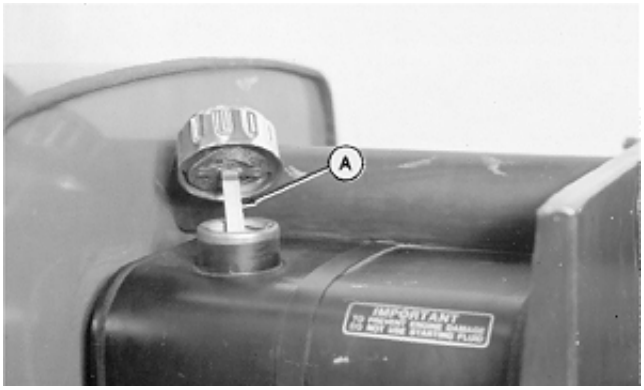
HYDRAULIC OIL LEVEL AND CONDITION CHECK

CONDITIONS:
- Machine parked on level surface.
- Key switch in off position.
- Park brake engaged.
- Mower not operated for at least 5 minutes.

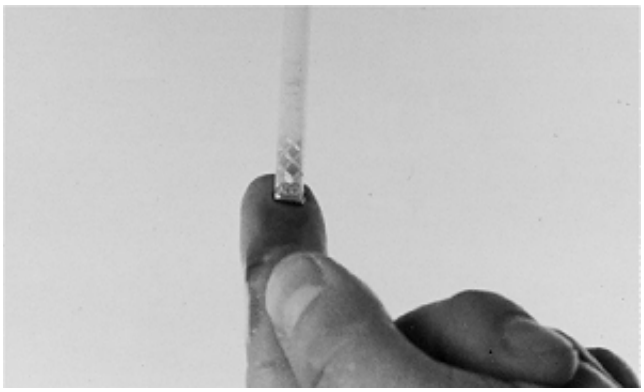
PROCEDURE:
- Clean dirt from area around reservoir cap.
- Remove cap and wipe off dipstick (A).
- Install dipstick until cap is seated.
- Remove cap and check level and condition of oil.

NORMAL:
- Oil level between F and L marks on dipstick.
- Oil not excessively thick or thin.
- No visible foreign material in oil.

IF NOT NORMAL:
- Add proper oil to F mark on dipstick. (Refer to Section 10, Group 20.)
- Replace contaminated oil and filter.
- Go to Section 270, Group 15 for hydraulic diagnosis, tests and adjustments.



E34356 -UN-20AUG90



M45603 -UN-06AUG90

MX,21010HV,A2 -19-18JAN93

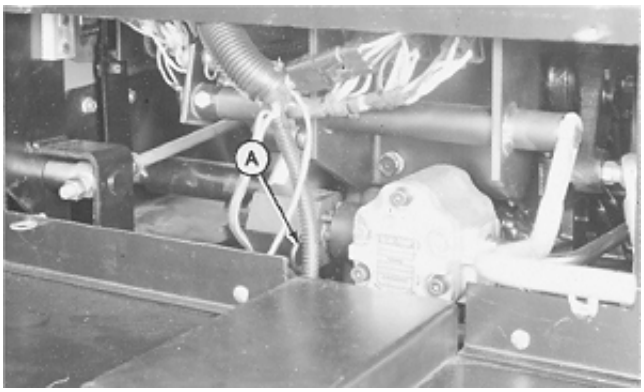
TRANSAXLE OIL LEVEL AND CONDITION CHECK

CONDITIONS:
- Machine parked on level surface.
- Key switch in off position.
- Park brake engaged.
- Transaxle oil is cold.
- Lower all cutting units to the ground.

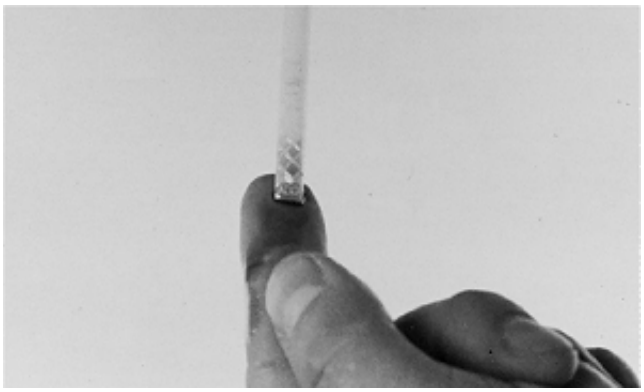
PROCEDURE:
- Clean dirt from area around dipstick (A) opening.
- Remove and wipe off dipstick.
- Install dipstick until seated in tube.
- Remove dipstick and check level and condition of oil.

NORMAL:
- Oil level between full and add marks of dipstick.
- Oil not excessively thick or thin.
- No visible foreign material in oil.

IF NOT NORMAL:
- Add proper oil to full mark on dipstick. (Refer to Section 10, Group 20.)
- Replace contaminated oil and filter.
- Go to Section 250, Group 15 for transaxle system diagnosis, tests and adjustments.



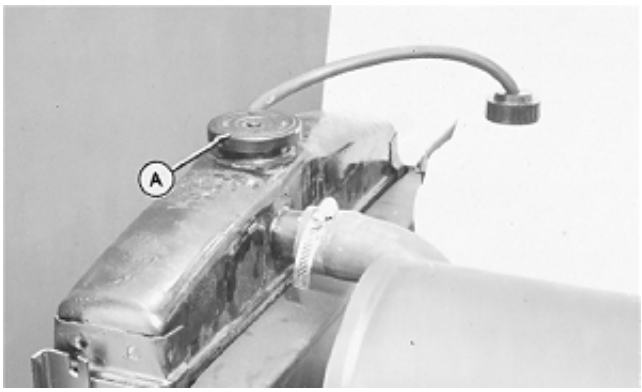
E32316 -UN-12SEP88



M45603 -UN-06AUG90

MX,21010HV,A3 -19-18JAN93

COOLANT LEVEL AND CONDITION CHECK



E29602 -UN-16SEP88

CONDITIONS:
- Key switch in off position.
- Engine is cool.

PROCEDURE:
- Observe level of coolant in radiator.
- Coolant level in overflow tank must be high enough so end of overflow tube is just in coolant solution.
- Check condition of overflow tank and tank-to-radiator hose.

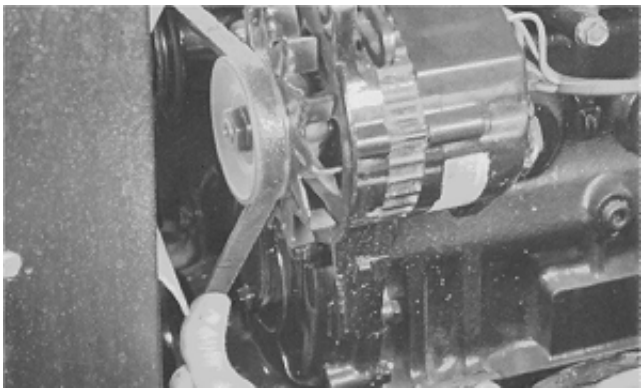
NORMAL:
- Recovery tank and hose in good condition, no holes or cracks.
- Coolant should be 13—25 mm (1/2—1 in.) below bottom of filler neck.
- Coolant clean; no oil, rust-like discoloration or foreign material in fluid.

IF NOT NORMAL:
- Replace overflow tank or hose, add coolant and check level after operation.
- Add coolant to proper level.
- Check radiator-to-tank hose and overflow tank for holes or cracks.
- Change coolant and flush cooling system.
- Go to Section 220, Group 15 for diagnosis, tests and adjustments.

MX,21010HV,A4 -19-18JAN93

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FAN AND BELT CHECK


M39412 -UN-29AUG88

CONDITIONS:
- Key switch in off position.
- Engine not run for at least 15 min.
- Park brake engaged.

PROCEDURE:
- Inspect fan and belt for damage.
- Check belt tension. (See Section 220, Group 15.)

NORMAL:
- Fan undamaged; no cracks or bent blades.
- Belt not cracked, frayed or glazed.
- Belt does not “squeel” during operation.

IF NOT NORMAL:
- Replace damaged fan or belt.
- Adjust belt tension. (Refer to Section 220, Group 15.)

MX,21010HV,A5 -19-18JAN93

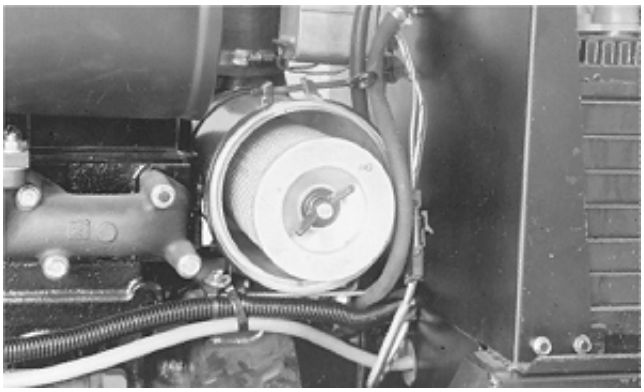
AIR INTAKE SYSTEM CHECK

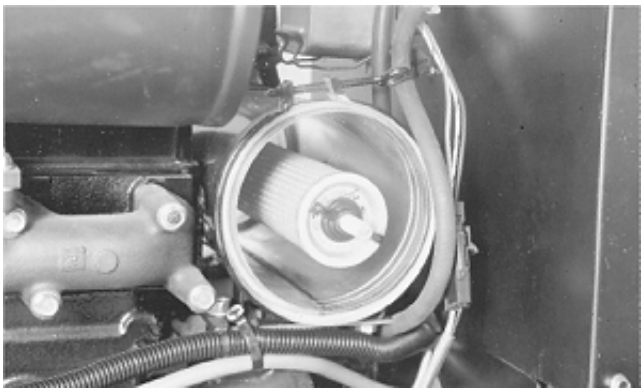
CONDITIONS:
- Key switch off.
- Park brake engaged.

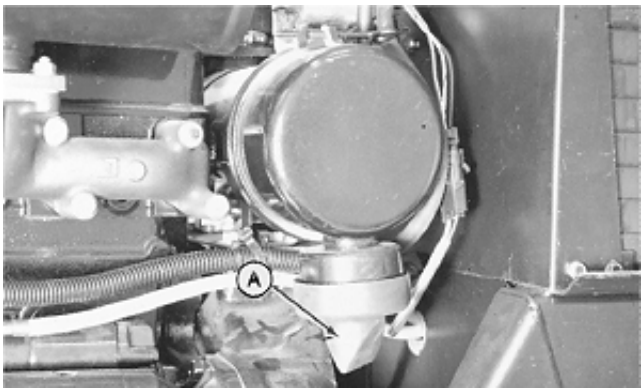
PROCEDURE:
- Observe condition of air filter elements.
- Check air intake hose condition.
- Observe ENGINE AIR FILTER restriction indicator on dash. (While engine is running.)

NORMAL:
- Air intake and elements free of debris.
- Air intake hoses in good condition. Hose clamps tight.
- Air cleaner dust valve (A) not plugged.
- Air cleaner housing sealed.
- ENGINE AIR FILTER indicator light off.

IF NOT NORMAL:
- Clean, repair or replace air filter assembly as required.
- Go to Section 220, Group 15 for diagnosis, tests and adjustments.
- Go to Section 30, Group 10 for inspection and repair.







MX,21010HV,A6 -19-18JAN93

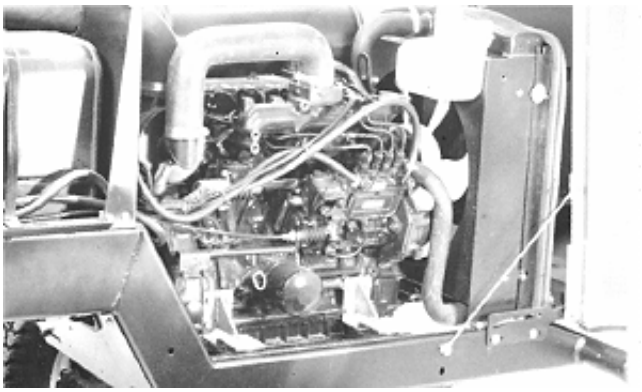
FUEL SYSTEM CHECK

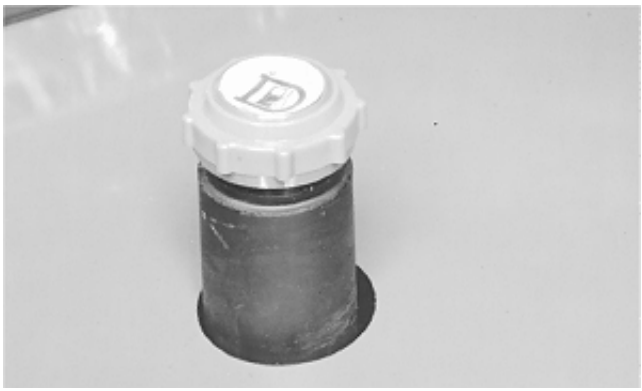
CONDITIONS:
- Key switch in ON position.
- Park brake engaged.

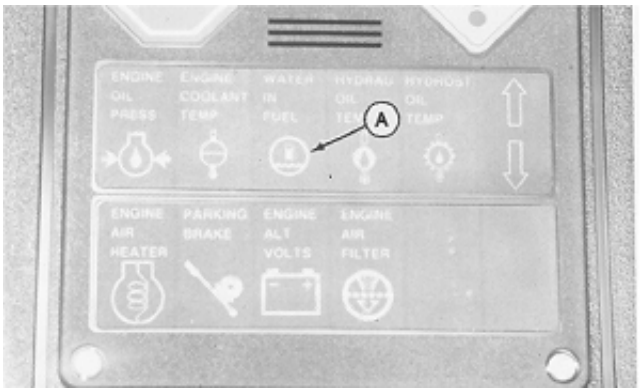
PROCEDURE:
- Observe fuel level gauge and condition of fuel.
- Check WATER-IN-FUEL indicator (A).
- Check fuel tank, lines and hoses for kinks, leaks or damage.

NORMAL:
- Fuel level OK.
- Correct type and grade of clean fuel.
- WATER-IN-FUEL indicator is not lit.
- No leaks in fuel lines.

IF NOT NORMAL:
- Add correct type and grade of clean fuel. (Refer to Section 10, Group 20.)
- Clean contaminated fuel tank, filter or lines.
- Repair or replace damaged fuel tank, filter or lines. (Refer to Section 30, Group 05 for fuel system repair.)


M47230 -UN-12FEB92


E29583 -UN-16SEP88



E32060 -UN-16SEP88

MX,21010HV,A7 -19-18JAN93

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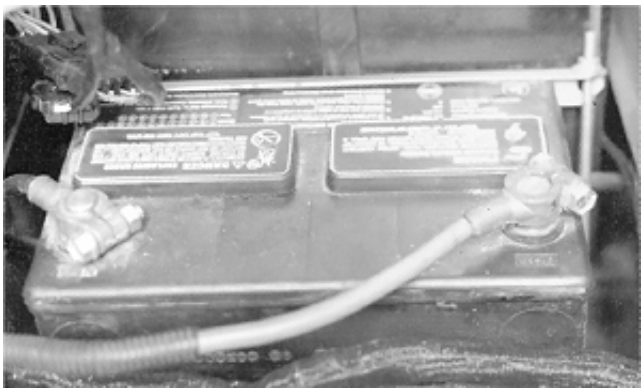
ELECTRICAL SYSTEM CHECK

CONDITIONS:
- Key switch in off position.
- Park brake engaged.

PROCEDURE:
- Check battery electrolyte level.
- Check battery cable condition.
- Check ground cable connection (A).
- Check engine ground strap (B) and connections.
- Check condition of starter and alternator connections.
- Check fuses.

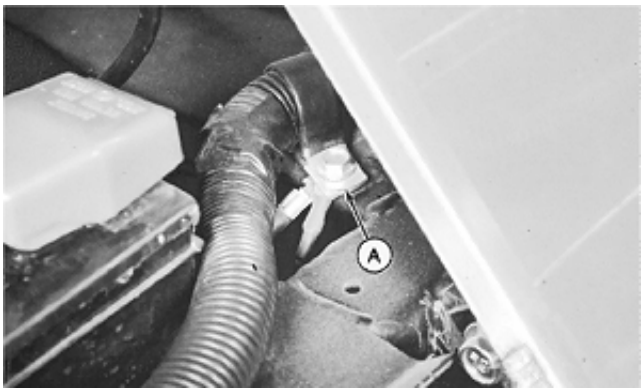
NORMAL:
- Battery electrolyte level covers battery plates.
- All electrical connections clean and tight.
- Fuses good and of correct amperage rating.

IF NOT NORMAL:
- Add distilled water to battery to bring electrolyte to proper level.
- Clean and tighten electrical connections.
- Replace fuses as required. Determine reason for blown fuses. (Refer to Section 240, Group 15 for diagnosis, tests and adjustments.)



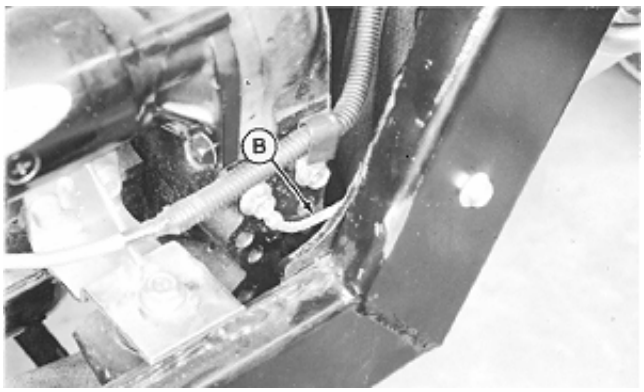
E35378 -UN-20AUG90

Battery



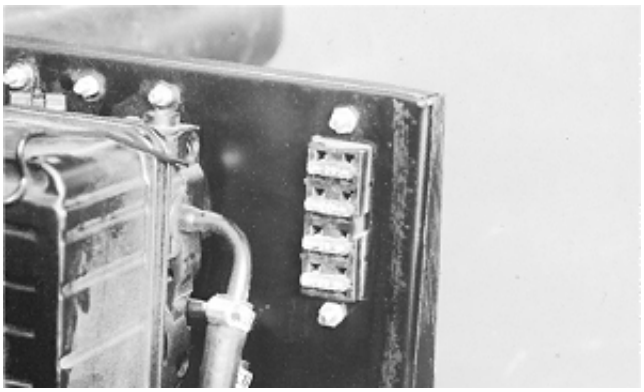
M81442 -UN-12NOV92

Ground Connection



M81447 -UN-12NOV92

Engine Ground Strap



M81441 -UN-12NOV92

Fuses

MX,21010HV,A8 -19-18JAN93

LIGHTING SYSTEM CHECK



M81444 -UN-12NOV92

CONDITIONS:
- Key switch in off position
- Park brake engaged

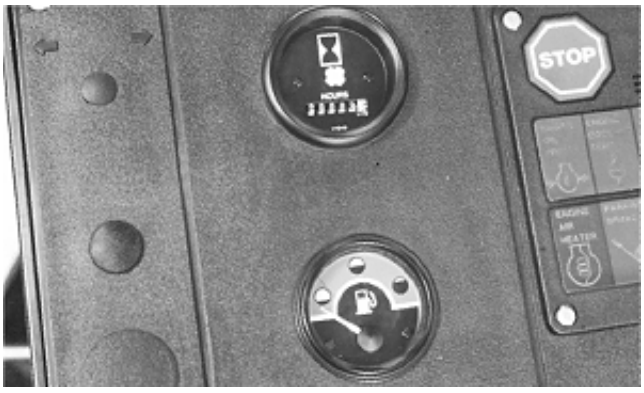
PROCEDURE:
- Turn light switch clockwise to each position.
- Turn light switch back to off position.

NORMAL:
- First position is not used.
- Second position, headlights and fuel gauge light is on.
- Third position, headlight, fuel gauge light and work lights are on, if equipped.
- Off position, all lights are off.

IF NOT NORMAL:
- Check bulbs.
- Check light circuit connectors.
- Go to Section 240, Group 15 for electrical diagnosis, tests and adjustments.

MX,21010HV,A9 -19-18JAN93

FUEL GAUGE AND HOURMETER CHECK



M81451 -UN-12NOV92

PROCEDURE:
- Turn key switch to on position.

NORMAL:
- Fuel gauge must indicate approximate amount of fuel in tank.
- Indicator in center of hourmeter must begin to rotate.

IF NOT NORMAL:
- Go to Section 240, Group 15 for electrical diagnosis, tests and adjustments.

MX,21010HV,A9A -19-18JAN93

INDICATOR LAMP AND ALARM CHECK



M81443 -UN-12NOV92

CONDITIONS:
- Park brake engage.

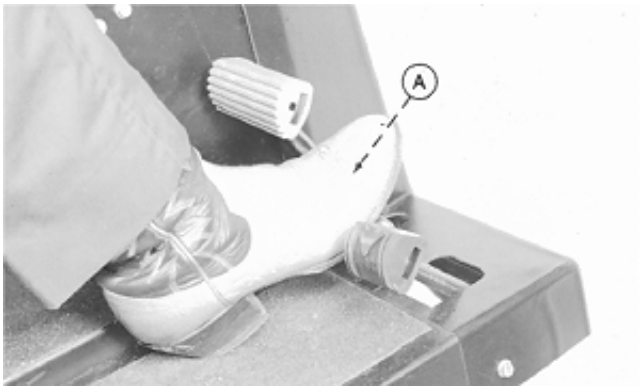
PROCEDURE:
- Turn key switch to on position.
- Turn key switch to Bulb Check position.

NORMAL:
- STOP lamp, warning lamp, and alarm are on with key switch in on position.
- 10 indicator lamps light with key in Bulb Check.

IF NOT NORMAL:
- Check lamps, alarm and wiring circuit.
- Go to Section 240, Group 15 for electrical diagnosis, tests and adjustments.
- If ENGINE OIL PRESS lamp remains on with engine running, turn engine off. Go to Section 220, Group 15 for engine diagnosis, tests and adjustments.

MX,21010HV,A10 -19-18JAN93

TRANSMISSION NEUTRAL START CHECK



E29580 -UN-16SEP88

CONDITIONS:
- PTO lever in disengaged position.
- Operator on seat.
- Forward or reverse pedal depressed.

PROCEDURE:
- Turn key switch to start position.

NORMAL:
- Starter should not crank engine.

IF NOT NORMAL:
- Go to Section 240, Group 15 for electrical diagnosis, tests and adjustments.

MX,21010HV,A11 -19-18JAN93

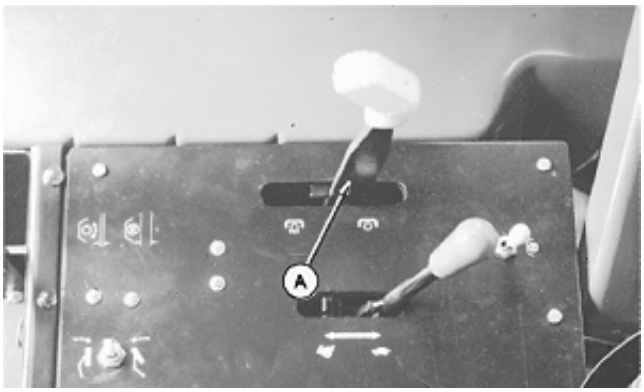
PTO NEUTRAL START CHECK

CONDITIONS:
- PTO lever (A) in engaged position.
- Travel pedals in neutral position.
- Operator on seat.

PROCEDURE:
- Turn key switch to start position.

NORMAL:
- Starter should not crank engine.

IF NOT NORMAL:
- Go to Section 240, Group 15 for electrical diagnosis, tests and adjustments.



E29564 -UN-16SEP88

MX,21010HV,A12 -19-18JAN93

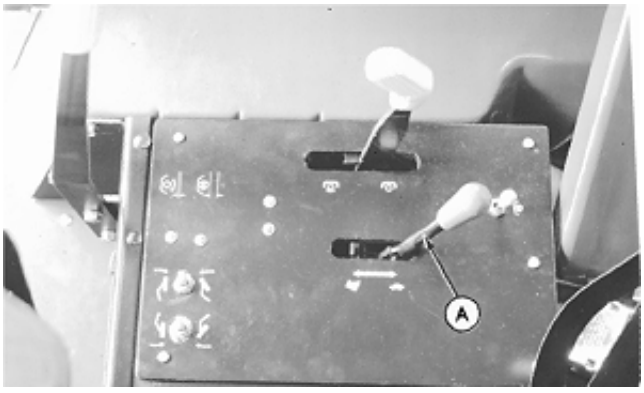
ENGINE START CHECK

CONDITIONS:
- PTO lever in disengaged position.
- Travel pedals in neutral position.
- Operator on seat.

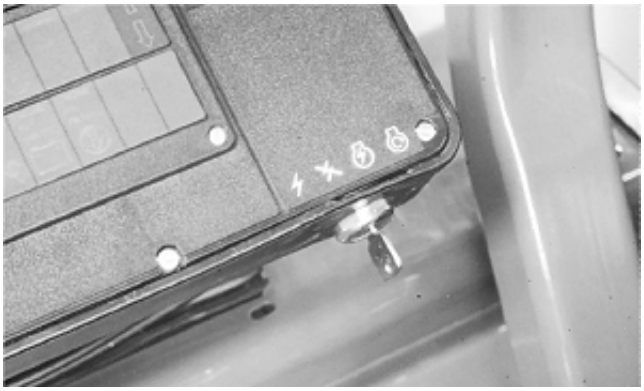
PROCEDURE:
- Push throttle lever (A) forward about one-third of travel.
- Turn key to start position.
- Release key when engine starts.

NORMAL:
- Engine starts within 20 seconds.

IF NOT NORMAL:
- Wait 2 minutes for starter to cool.
- Try to start engine again.
- Repeat start procedure two more times, if necessary.
- If starter motor does not turn, go to Section 240, Group 15 for electrical diagnosis, tests and adjustments.
- Go to Section 220, Group 15 for engine diagnosis, tests and adjustments.



E29563 -UN-16SEP88


M81445 -UN-12NOV92

MX,21010HV,A13 -19-18JAN93

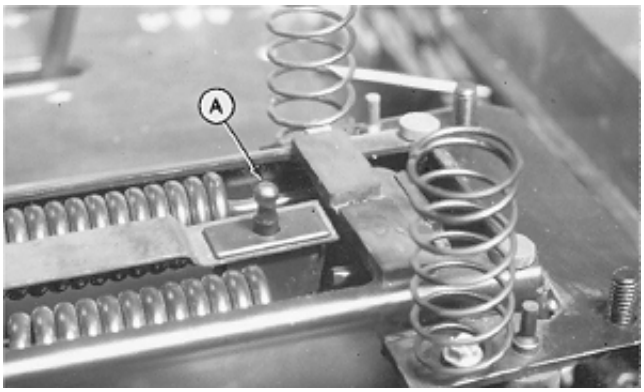
ENGINE START CHECK—OVERRIDE OPERATION

CONDITIONS:
- PTO lever in disengaged position.
- Travel pedals in neutral position.
- Parking brake engaged.

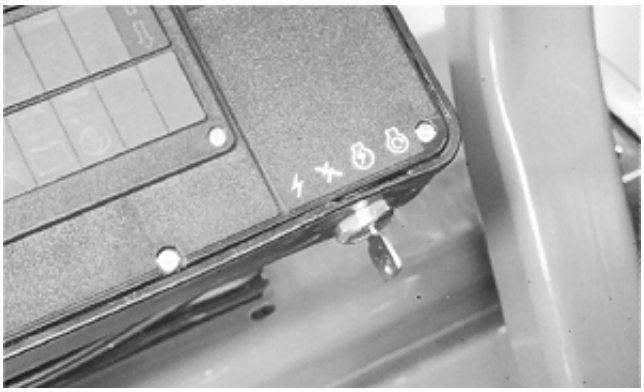
PROCEDURE:
- Lift seat and pull up seat switch button (A).
- Push throttle lever forward about one-third of travel.
- Turn key to start position.
- Release key when engine starts.

NORMAL:
- Engine starts within 20 seconds.

IF NOT NORMAL:
- Wait 2 minutes for starter to cool.
- Try to start engine again.
- Repeat start procedure two more times, if necessary.
- Go to Section 240, Group 15 for electrical diagnosis, tests and adjustments.



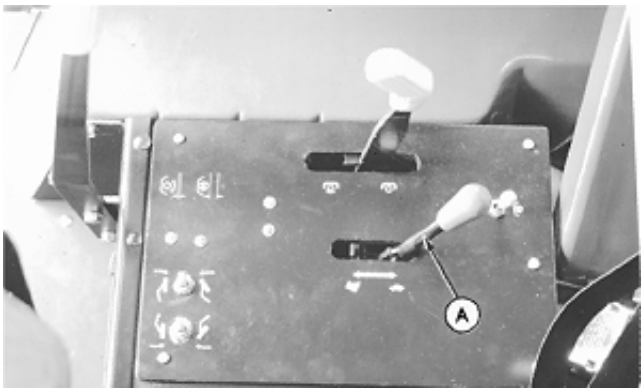
E32068 -UN-16SEP88



M81445 -UN-12NOV92

MX,21010HV,A14 -19-18JAN93

ENGINE FAST AND SLOW IDLE CHECK



CONDITIONS:
- Travel pedals in neutral position.
- Parking brake engaged.
- Operator on seat.

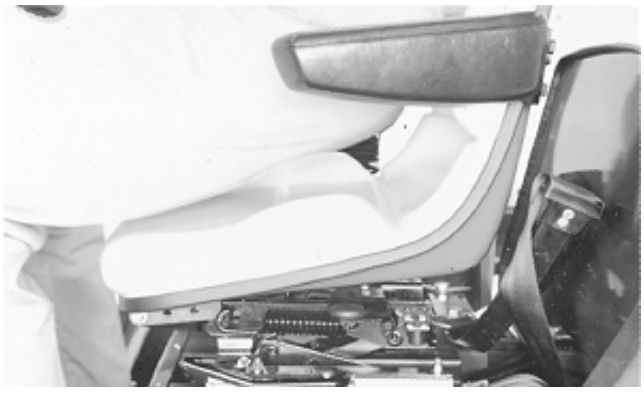
PROCEDURE:
- Start engine and warm up for several minutes between 1500 and 1900 rpm.
- Move throttle lever from slow to fast idle several times slowly and rapidly.

NORMAL:
- Engine runs smoothly at all throttle settings.
- Engine accelerates and decelerates smoothly without misfiring or stumbling.

IF NOT NORMAL:
- Go to Section 220, Group 15 for engine diagnosis, tests and adjustments.

MX,21010HV,A15 -19-18JAN93

SEAT SAFETY CHECK



CONDITIONS:
- Engine operating.
- Parking brake engaged.
- Travel pedals in neutral position.

PROCEDURE:
- Raise off seat.

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10
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NORMAL:
- Engine must stop after approximately 1/2 second.

IF NOT NORMAL:
- Go to Section 240, Group 15 for electrical diagnosis, tests and adjustments.

MX,21010HV,A16 -19-18JAN93

STEERING CHECK

CONDITIONS:
- Operator on seat.
- Travel pedals in neutral position.
- Engine running.

PROCEDURE:
- Turn steering wheel from full left to full right and back.

NORMAL:
- Tires move from stop-to-stop.
- Steering wheel moves smoothly in both directions.
- Steering wheel stops turning when released.

IF NOT NORMAL:
- Go to Section 260, Group 15 for steering diagnosis, tests and adjustments.



M81446 -UN-12NOV92

MX,21010HV,A17 -19-18JAN93

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15

SERVICE BRAKE CHECK

CONDITIONS:
- Operator on seat.
- Engine running.
- Forward or reverse pedal depressed.

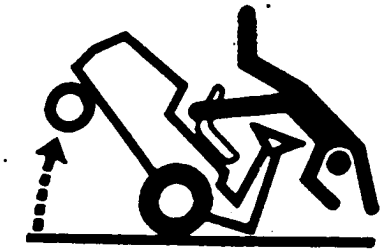
PROCEDURE:

CAUTION: Do not press brake pedal too hard initially to avoid tipping machine.

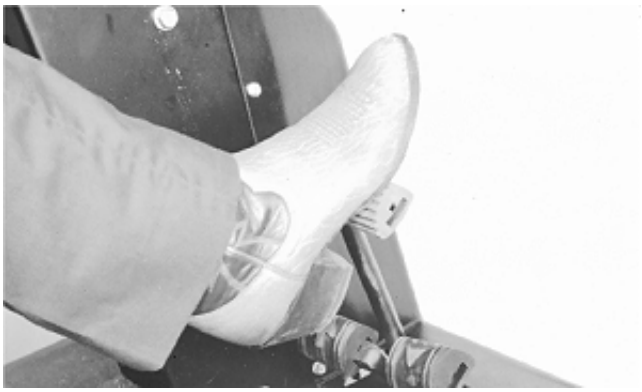
- Remove foot from travel pedal and depress brake pedal

NORMAL:
- Machine stops evenly.
- Brakes operate smoothly and quietly.

IF NOT NORMAL:
- Adjust brake linkage. (Refer to Section 260, Group 15.)
- Repair or replace parts as required. (Refer to Section 60, Group 10.)
- Go to Section 260, Group 15 for brake system diagnosis, tests and adjustments.



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MX,21010HV,A18 -19-18JAN93

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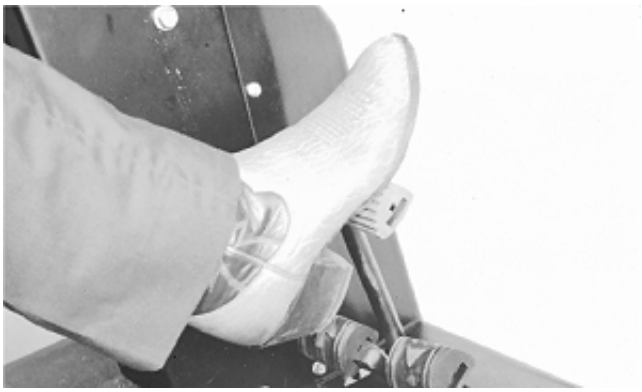
PARKING BRAKE CHECK

CONDITIONS:
- Operator on seat.
- Engine running.

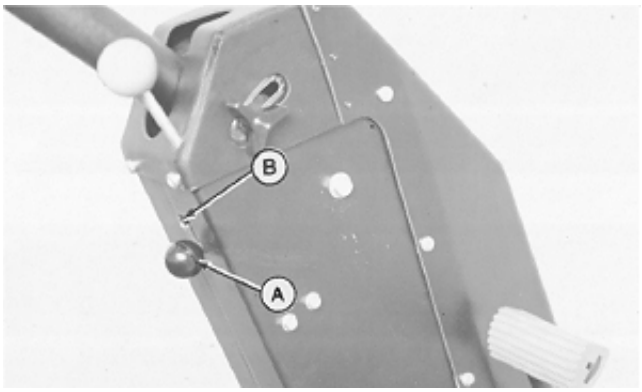
PROCEDURE:
- Depress brake pedal.
- Lower knob (A) in slot to engage parking brake.
- Slightly depress forward, then reverse travel pedals.
- Depress brake pedal and lift knob to unlock position (B).

NORMAL:
- Pedal remains in the depressed position when knob is in lowest position.
- Machine does not move when travel pedals are depressed.
- Pedal returns to upper position when parking brake is unlocked.

IF NOT NORMAL:
- Adjust parking brake. (See Section 260, Group 15.)
- Repair or replace parts as required. (Refer to Section 60, Group 10.)
- Go to Section 260, Group 15 for brake system diagnosis, tests and adjustments.



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E29582



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E32045

MX,21010HV,A19 -19-18JAN93

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TRANSMISSION FORWARD/REVERSE AND TWO SPEED CHECK

CONDITIONS:
- Operator on seat.
- Engine running.
- Parking brake disengaged.

PROCEDURE:
- Put two-speed axle shift lever (A) in slow position.
- Slowly depress forward travel pedal.
- Slowly release forward travel pedal.
- Repeat steps for reverse travel pedal.

NORMAL:
- Machine must accelerate and decelerate smoothly in both forward and reverse directions.

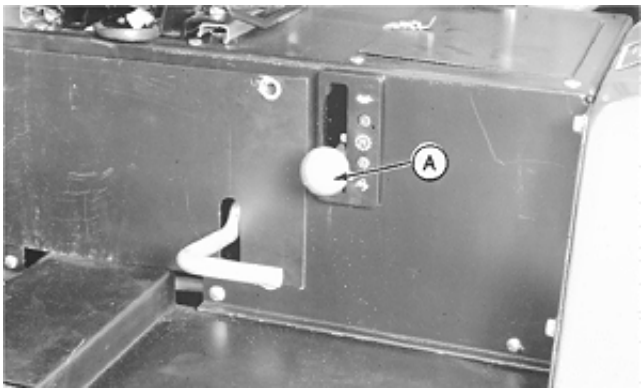
PROCEDURE:
- With machine stopped, move two-speed axle shift lever to fast position.
- Depress and release forward and reverse travel pedals slowly.

NORMAL:
- Machine must accelerate and decelerate smoothly and move approximately twice as fast as first procedure.

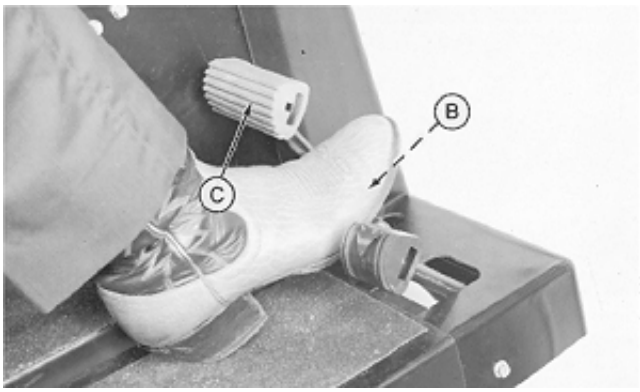
PROCEDURE:
- With machine stopped, move two-speed axle shift lever to N, neutral position.
- Depress and release both travel pedals.

NORMAL:
- Machine must not move when travel pedals are depressed.
- Machine should be able to be pushed.

IF NOT NORMAL:
- Go to Section 250, Group 15 for transmission diagnosis, tests and adjustments.



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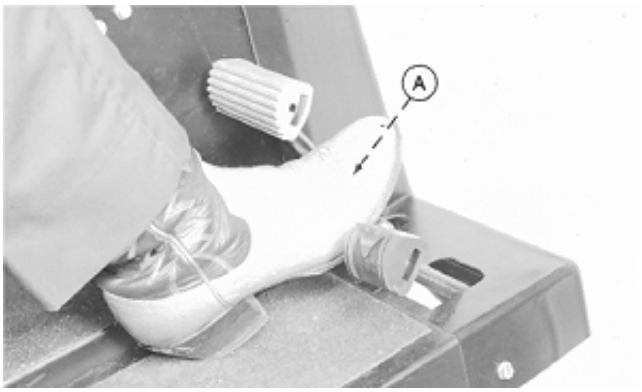


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MX,21010HV,A20 -19-18JAN93

TRANSMISSION NEUTRAL RETURN CHECK



IMPORTANT: Perform this check in a wide open area.

CONDITIONS:
- Operator on seat.
- Travel pedals in neutral position.
- Parking brake disengaged.
- PTO lever in off position.

PROCEDURE:
- Operate engine at full throttle.
- Depress forward travel pedal fully. While machine is moving, release pedal.

NORMAL:
- Machine must come to a smooth stop in approximately 10.7 m (35 ft).

NOTE: Stopping time may vary with different attachments and operator preference.

- Control pedals must return to neutral position.
- Machine must not creep in neutral.

IF NOT NORMAL:
- Go to Section 250, Group 15 for Transmission Neutral Adjustment or Return-to-Neutral Adjustment.

MX,21010HV,A21 -19-18JAN93

DIFFERENTIAL LOCK CHECK



CONDITIONS:
- Operator on seat.
- Engine running at slow idle.
- Two-speed axle lever in slow position.

PROCEDURE:
- Depress forward travel pedal.
- Depress differential pedal (A).
- Briefly turn steering wheel left or right.

NORMAL:
- Machine must try to go straight ahead when steering wheel is turned.
- Differential operates quietly.

IF NOT NORMAL:
- Go to Section 250, Group 15 for differential diagnosis, tests and adjustments.

MX,21010HV,A26 -19-18JAN93

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CRUISE CONTROL CHECK

CONDITIONS:
- Operator on seat.
- Travel pedals in neutral position.
- Parking brake disengaged.
- PTO lever in off position.

PROCEDURE:
- Drive machine forward at medium speed.
- Engage cruise control (A).

NORMAL:
- Forward travel pedal must stay in set position.
- Machine must maintain constant speed.

PROCEDURE:
- Push down on cruise control lever.

NORMAL:
- Cruise control must disengage and forward control pedal must return to neutral position.

PROCEDURE:
- Engage cruise control.
- Press forward pedal (B) and release.

NORMAL:
- Cruise control must disengage and forward control pedal must return to neutral position.

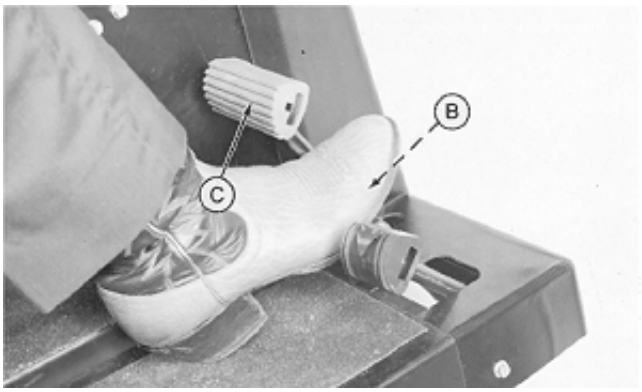
PROCEDURE:
- Engage cruise control.
- Press brake pedal.

NORMAL:
- Cruise control must disengage and forward control pedal must return to neutral position.

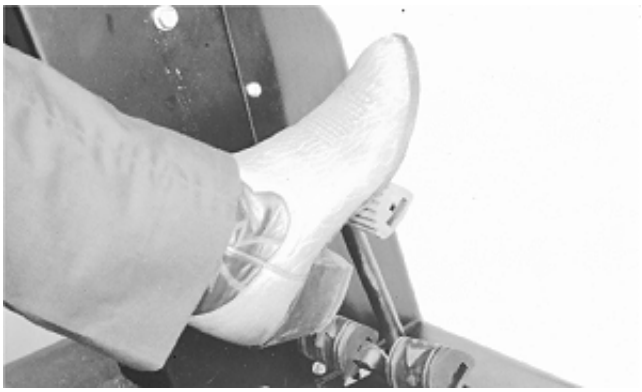
IF NOT NORMAL:
- Adjust cruise control linkage. (Refer to Section 250, Group 15.)



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E29656



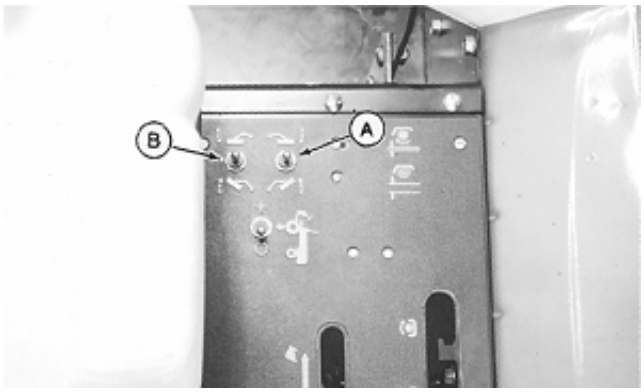
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MX,21010HV,A22 -19-18JAN93

WINGS RAISE/LOWER CHECK



CONDITIONS:
- Engine operating.
- Parking brake engaged.
- PTO lever in off position.
- Backlap switch in the reel engaged position.

PROCEDURE:
- Disengage wing transport latches.
- Move toggle switch (A) forward to lower right wing to approximately 70° then release switch.
- Repeat procedure for left wing using toggle switch (B).

NORMAL:
- Wing must lower and stop when switch is released.
- Wing must lower at a moderate speed.

PROCEDURE:
- Move toggle switch (A) forward until right wing is approximately 40° then release switch.
- Repeat procedure for left wing.

NORMAL:
- From approximately 45° and lower, wing will continue lowering until cutting unit is on the ground.

PROCEDURE:
- Move toggle switch rearward until wing raises to approximately 40°, then release switch.

NORMAL:
- From approximately 45° and lower, wing will lower until cutting unit is on the ground.

PROCEDURE:
- Move toggle switch rearward until wing is above 45°, then release switch.

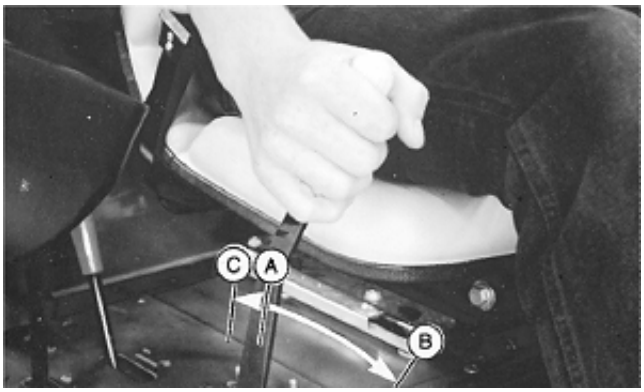
NORMAL:
- Wing will remain at position where switch was released.

IF NOT NORMAL:
- Adjust wing rate-of-drop.
- Go to Section 240, Group 15 for electrical diagnosis, tests and adjustments.
- Go to Section 270, Group 15 for hydraulic diagnosis, tests and adjustments.

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MX,21010HV,A23 -19-18JAN93

CUTTING UNITS RAISE/LOWER CHECK



CONDITIONS:
- Engine operating.
- Parking brake engaged.
- PTO lever in off position.
- Backlap switch in the reel engaged position.
- Wing units lowered to the ground.

PROCEDURE:
- Move cutting units control lever to position (B), forward most position.

NORMAL:
- Front and center cutting units will lower to the ground.

NOTE: If lever is not moved fully forward, the cutting units will only lower proportionately to the position of the lever between A and B, not completely to the ground.

PROCEDURE:
- Move cutting units lever to position A.

NORMAL:
- Only front and center cutting units will raise.

PROCEDURE:
- Move cutting units lever back to position C, against spring force, until wing cutting units lift, then release lever.

NORMAL:
- Wing units will raise until lever is released and remain at released position.

PROCEDURE:
- Move cutting units lever forward to position B.

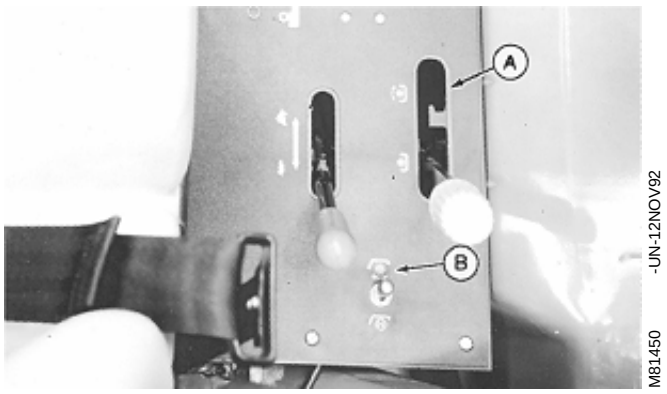
NORMAL:
- All five cutting units will lower to the ground.

- If wing cutting units are above 45° position, wings will not lower.

IF NOT NORMAL:
- Go to Section 240, Group 15 for electrical diagnosis, tests and adjustments.
- Go to Section 270, Group 15 for hydraulic diagnosis, tests and adjustments.

MX,21010HV,A24 -19-18JAN93

CUTTING UNITS/PTO OPERATION CHECK



CONDITIONS:
- Engine operating.
- Parking brake engaged.
- All cutting units in raised position.
- PTO lever in on position (A).
- Backlap switch in reel engaged position (B).

PROCEDURE:
- Move cutting units lever to forward position.

NORMAL:
- Front and center cutting units lower to the ground and begin to rotate.

PROCEDURE:
- Move cutting units lever rearward to lift cutting units.

NORMAL:
- Front and center cutting unit must raise and stop rotating.

PROCEDURE:
- Move cutting units lever to forward position.
- Use toggle switch to lower right wing.
- Use toggle switch to raise right wing.
- Repeat last two steps for left wing.

NORMAL:
- Wing must lower and cutting unit begin to rotate at approximately 45˚.
- Wing must raise and cutting unit stop rotating at approximately 45˚.

PROCEDURE:
- Lower all cutting units to the ground.
- Move PTO lever to off position and back to on position.

NORMAL:
- Cutting units must stop rotating and begin to rotate again.

PROCEDURE:
- Move cutting units lever back to lift front and center cutting units.
- Move cutting units lever back against spring force to lift wing units.

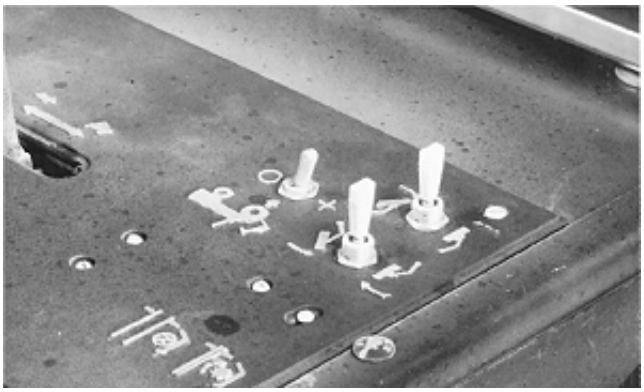
NORMAL:
- Front and center units should raise and ALL five cutting units stop rotating.
- Wing units must raise.

IF NOT NORMAL:
- Go to Section 240, Group 15 for electrical diagnosis, tests and adjustments.
- Go to Section 270, Group 15 for hydraulic diagnosis, tests and adjustments.

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MX,21010HV,A25 -19-18JAN93

WEIGHT TRANSFER VALVE CHECK


E32012 -UN-16SEP88

NOTE: Weight transfer is an option for 3325 Mowers.

CONDITIONS:
- Operator on seat.
- Travel pedals in neutral position.
- Parking brake engaged.
- PTO lever in off position.
- Weight transfer switch in “O”, off position.

PROCEDURE:
- Loosen lock ring (A) and turn knob (B) fully clockwise.
- Operate engine at fast idle.
- Lower cutting units to the ground.
- Move weight transfer switch to “+”, on position.

NORMAL:
- Cutting unit arms should rise slightly.

IF NOT NORMAL:
- Go to Section 240, Group 15 for electrical diagnosis, tests and adjustments.
- Go to Section 270, Group 15 for hydraulic diagnosis, tests and adjustments.

MX,21010HV,A27 -19-18JAN93

MISCELLANEOUS CHECKS


M34570 -UN-07SEP88

CONDITIONS:
- Key switch in off position.
- Parking brake engaged.

NORMAL:
- Tires in good condition, properly inflated.
- Seat and safety belt in good condition.
- ROPS securely fastened.
- Wheel cap screws and nuts tight.

IF NOT NORMAL:
- Replace or tighten hardware.
- Repair, replace or adjust as necessary.

MX,21010HV,A28 -19-18JAN93

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Engine Operation, Tests and Adjustments

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ENGINE COMPONENT LOCATION INFORMATION

This group contains component location drawings for the following engine system components:

- Engine Components
- Lubrication Components
- Cooling Components

Use the drawings when diagnosing an engine problem to help locate the components to be tested.

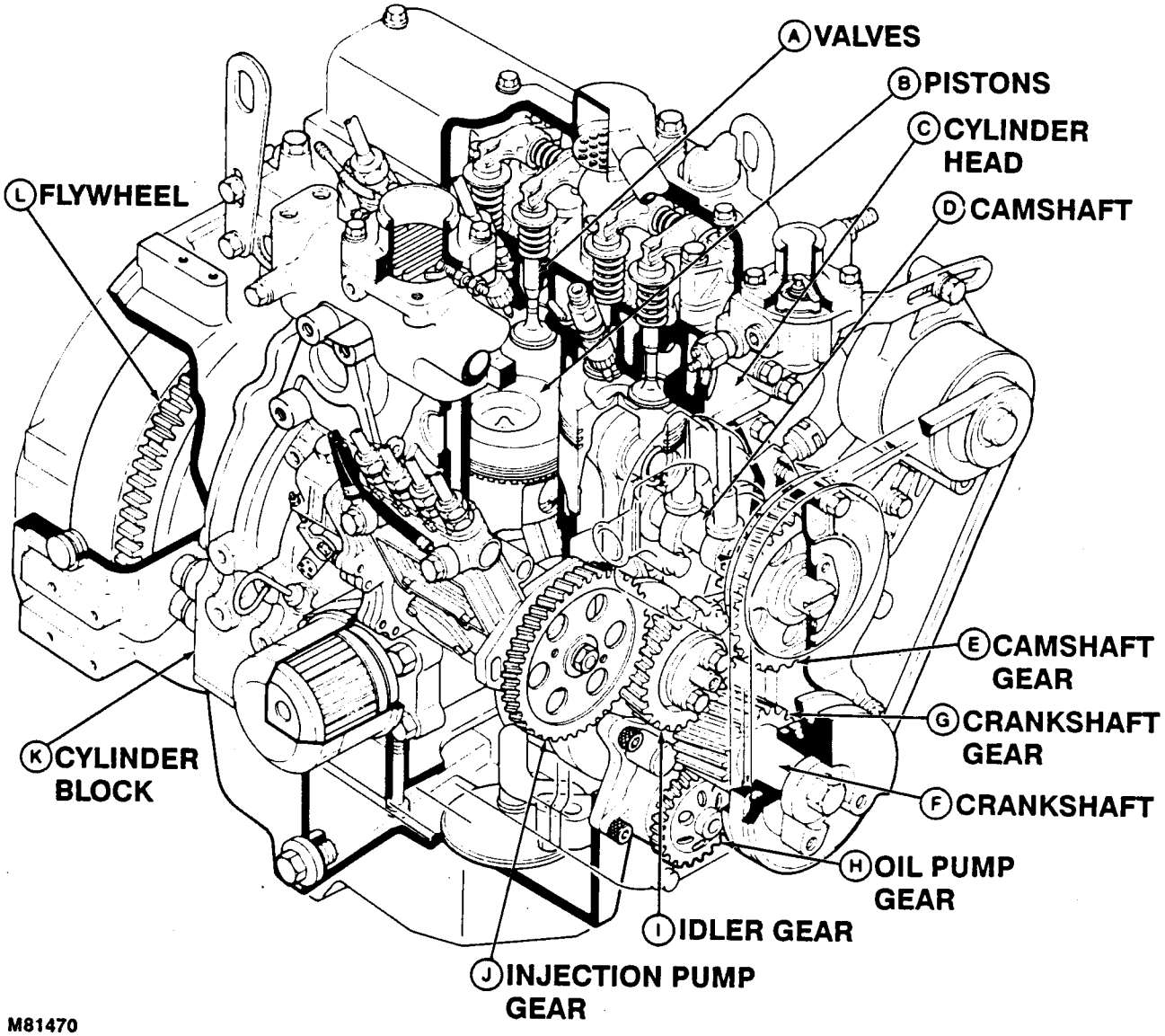
MX,22005HV,A1 -19-18JAN93

ENGINE COMPONENTS

A—Valves
B—Pistons
C—Cylinder Head
D—Camshaft
E—Camshaft Gear
F—Crankshaft
G—Crankshaft Gear
H—Oil Pump Gear
I—Idler Gear
J—Injection Pump Gear
K—Cylinder Block
L—Flywheel

Slide M81470

MX,22005HV,A2 -19-18JAN93



ENGINE COMPONENTS LOCATION

MX,22005HV,A3 -19-18JAN93

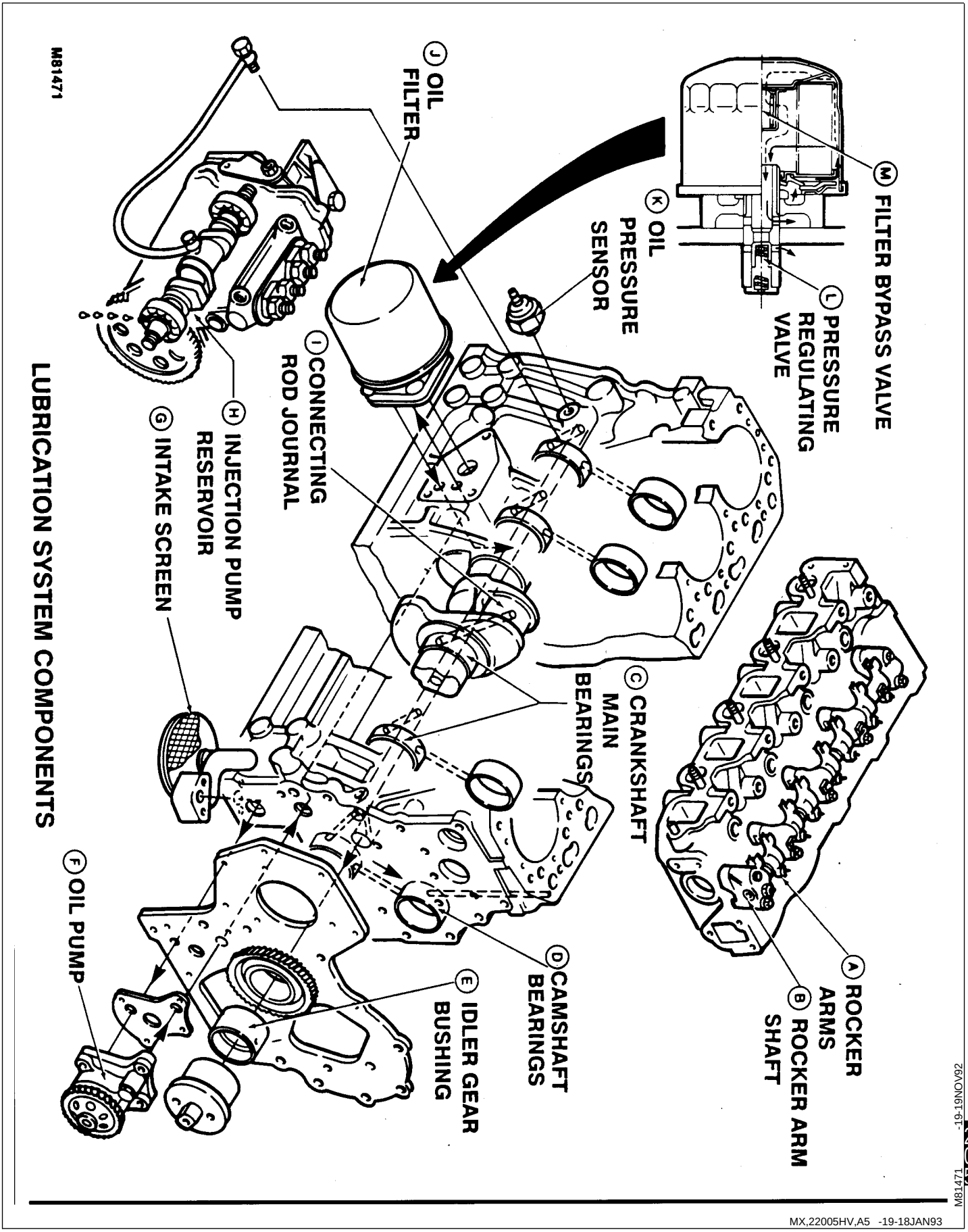
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LUBRICATION SYSTEM COMPONENTS

A—Rocker Arms
B—Rocker Arm Shaft
C—Crankshaft Main Bearing
D—Camshaft Bearings
E—Idler Gear Bushing
F—Oil Pump
G—Intake Screen
H—Injection Pump Reservoir
I—Connecting Rod Journal
J—Oil Filter
K—Oil Pressure Sensor
L—Pressure Regulating Valve
M—Filter Bypass Valve

Slide M81471

MX,22005HV,A4 -19-18JAN93



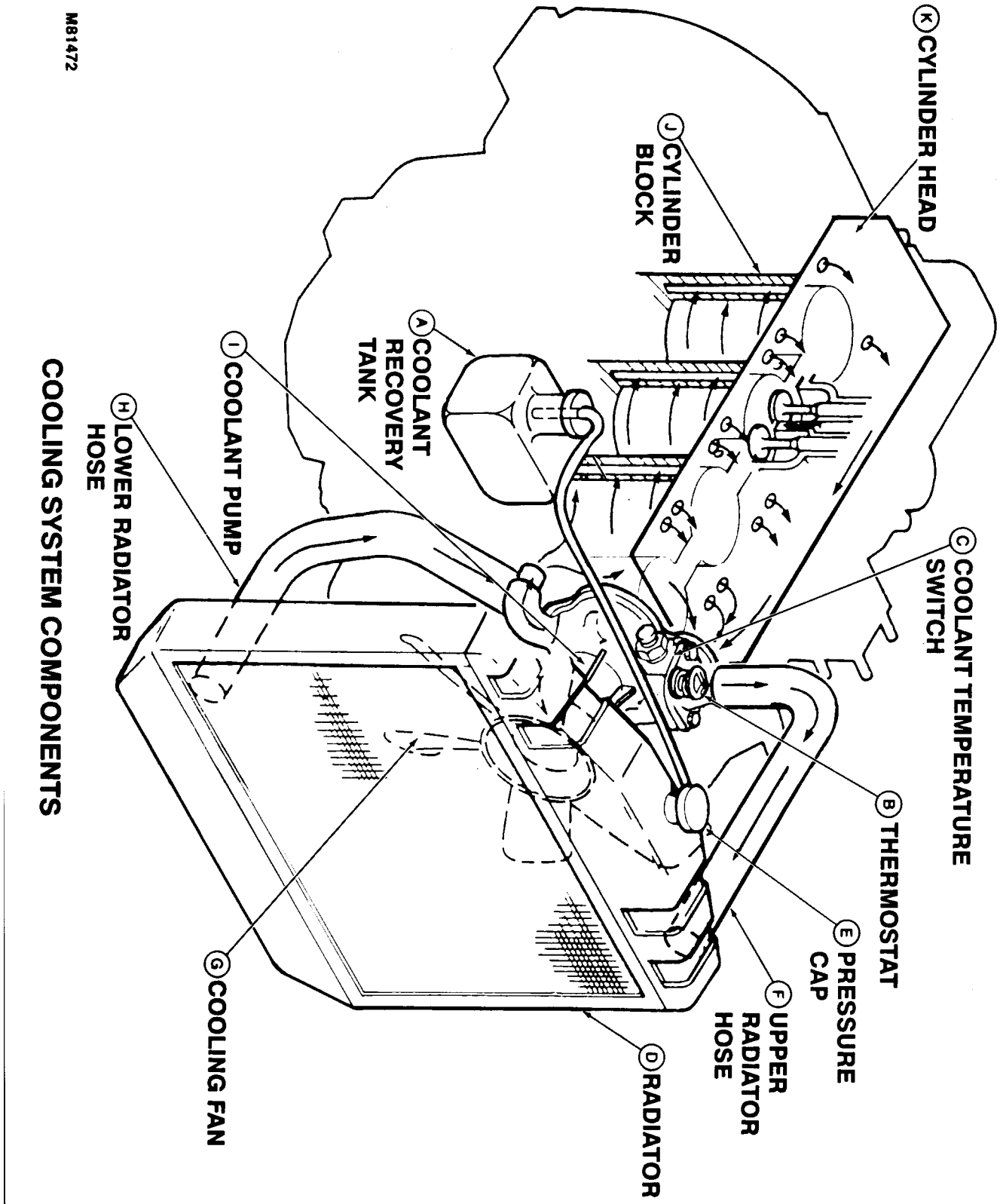
MX,22005HV,A5 -19-18JAN93

COOLING SYSTEM COMPONENTS

A—Coolant Recovery Tank
B—Thermostat
C—Coolant Temperature Switch
D—Radiator
E—Pressure Cap
F—Upper Radiator Hose
G—Cooling Fan
H—Lower Radiator Hose
I—Coolant Pump
J—Cylinder Block
K—Cylinder Head

Slide M81472

MX,22005HV,A6 -19-18JAN93



M81472 -19-19NOV92

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MX,22005HV,A7 -19-18JAN93

THEORY OF OPERATION INFORMATION

This group divides the engine system into individual components or systems by function. The story contains information on function, component identification, and theory of operation.

The following systems or components are covered:
- Crankcase Breather
- Lubrication System
- Oil Filter
- Oil Pressure Regulating Valve
- Cooling System

The slide number reference under the art is used for service training purposes to match a specific piece of technical manual art to the same slide.

MX,22010HV,A1 -19-18JAN93

CRANKCASE BREATHER OPERATION

A—Valve Cover Nut (3 used)
B—Cap
C—Plate
D—O-Ring
E—Deflector
F—Breather Tube
G—Oil Filler Cap
H—Valve Cover
I—Valve Cover O-Ring

Slide M81464

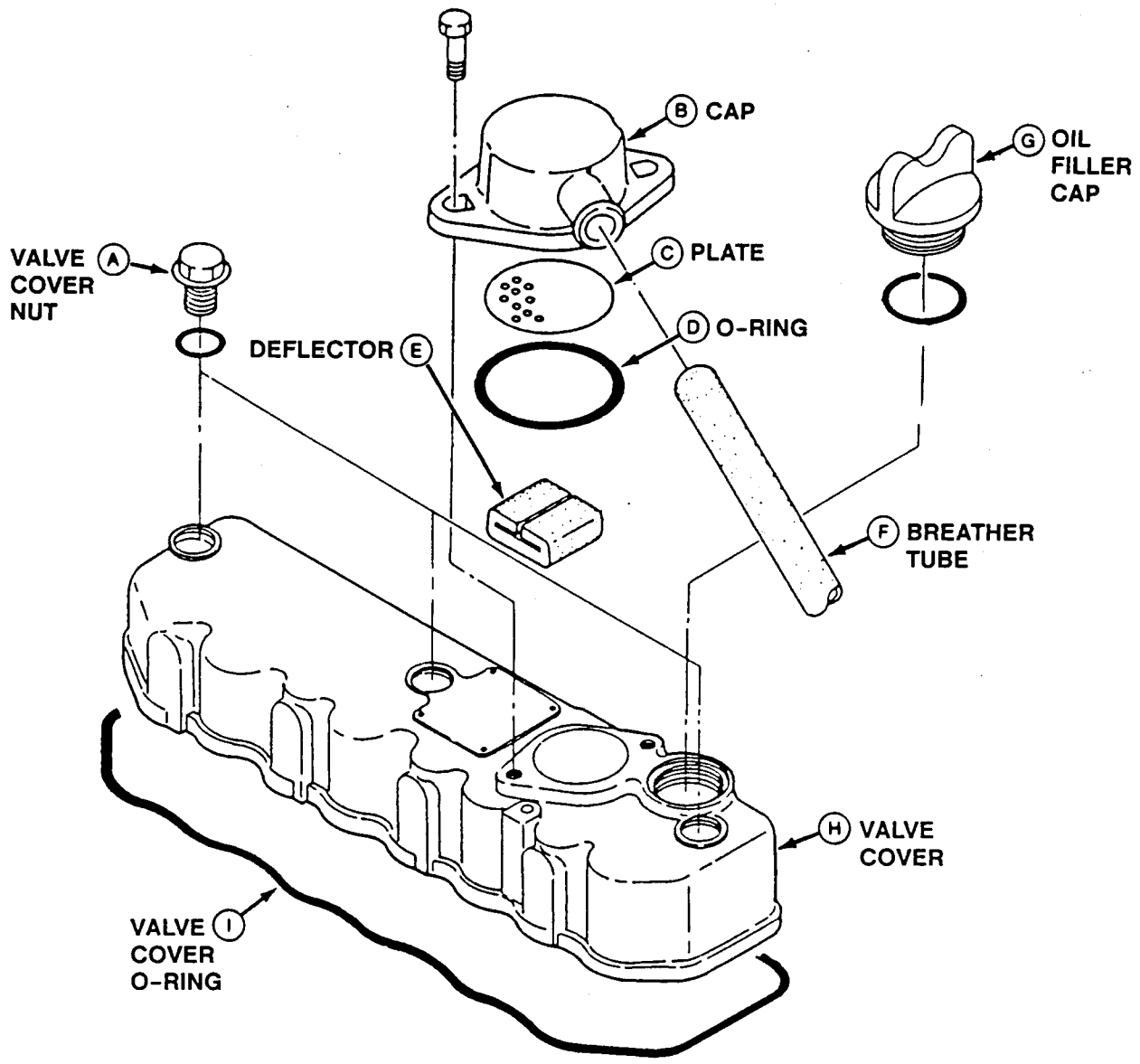
FUNCTION:
Vents crankcase fuel and water vapor out of engine without losing engine oil.

MAJOR COMPONENTS:
- Valve Cover
- Cap
- Plate
- Deflector

THEORY OF OPERATION:
During normal engine operation, unburned fuel vapors and water vapors contaminate the crankcase. These vapors are expelled by the exchange of air which is controlled by the breather. The crankcase is slightly pressurized by the leakage of compression around the pistons. The air is circulated by the movement of the pistons.

MX,22010HV,A2 -19-18JAN93

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CRANKCASE BREATHER OPERATION

MX,22010HV,A3 -19-18JAN93

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ENGINE LUBRICATION SYSTEM OPERATION

A—Rocker Arms
B—Rocker Arm Shaft
C—Crankshaft Main Bearings
D—Camshaft Bearings
E—Idler Gear Bushing
F—Oil Pump
G—Injection Pump Reservoir
H—Intake Screen
I—Connecting Rod Journal
J—Oil Filter
K—Pressure Regulating Valve
L—Oil Pressure Sensor
M—Pressure Oil
N—Pressure Free Oil

Slide MXC70910

FUNCTION:
A full pressure system lubricates engine parts with filtered oil.

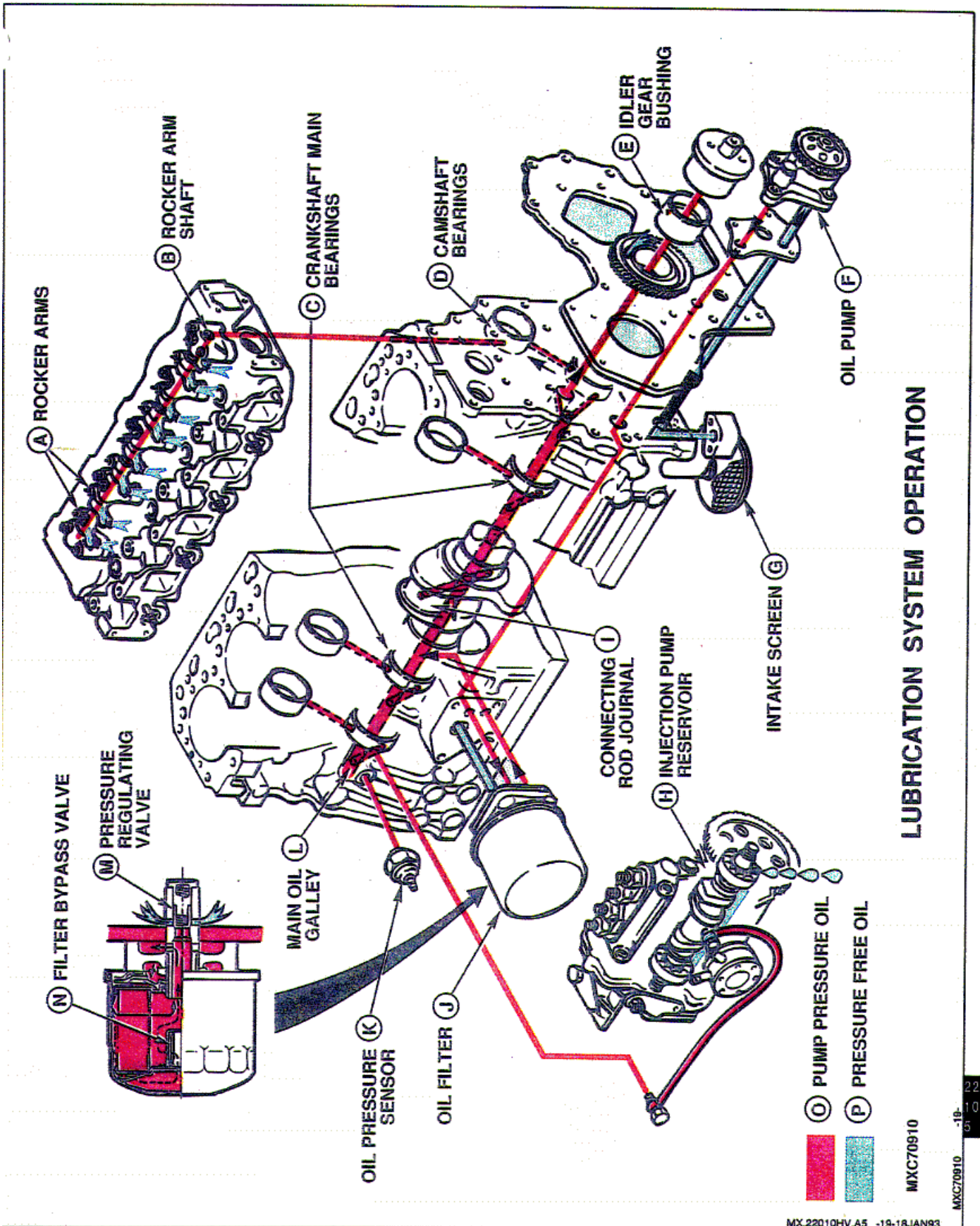
MAJOR COMPONENTS:
- Cylinder Head
- Engine Block
- Gear Case
- Rocker Arms
- Rocker Arm Shaft
- Crankshaft Main Bearings
- Camshaft Bearings
- Idler Gear Bushing
- Oil Pump
- Intake Screen
- Oil Filter
- Pressure Regulating Valve
- Oil Pressure Sensor

THEORY OF OPERATION:
A rotary type pump (F) draws oil through the sump intake screen (H), and directs it to the full-flow oil filter (J), and pressure regulating valve (K). Passages drilled in the block, head and crankshaft distribute oil to the moving parts.

An oil pressure sensor (L) activates an indicator light to alert the operator to stop the engine if oil pressure drops below 69 kPa (0.69 bar) (10 psi).

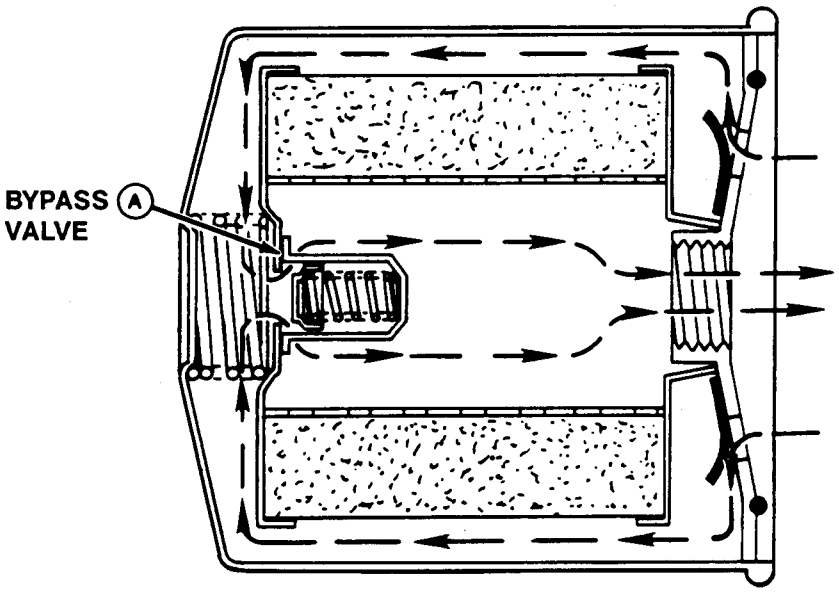
MX,22010HV,A4 -19-18JAN93

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4


LUBRICATION SYSTEM OPERATION
A ROCKER ARMS
B ROCKER ARM SHAFT
C CRANKSHAFT MAIN BEARINGS
D CAMSHAFT BEARINGS
E IDLER GEAR BUSHING
F OIL PUMP
G INTAKE SCREEN
H INJECTION PUMP RESERVOIR
I CONNECTING ROD JOURNAL
J OIL FILTER
K OIL PRESSURE SENSOR
L MAIN OIL GALLEY
M PRESSURE REGULATING VALVE
N FILTER BYPASS VALVE
O PUMP PRESSURE OIL
P PRESSURE FREE OIL
MXC70910
MX,22010HV,A5 -19-18JAN93

310393

OIL FILTER OPERATION



M53983

-19-06SEP90

M53983

OIL FILTER OPERATION

Slide M53983

FUNCTION:
Removes contaminates from the oil between oil/filter changes.

MAJOR COMPONENTS:
- Filter
- Bypass Valve

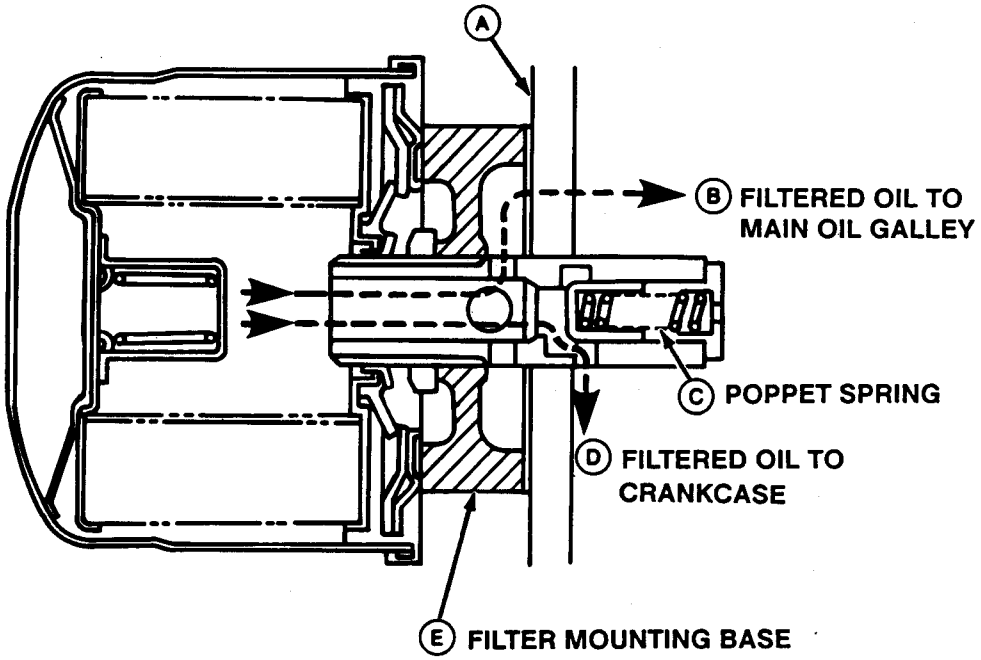
THEORY OF OPERATION:
Pressurized oil is directed from the oil pump to the oil filter. Oil flows through the filter element to the main oil galley and to the engine components.

The oil filter is equipped with a bypass valve (A). The valve ensures adequate engine lubrication if the filter is clogged or oil viscosity is too heavy to properly flow through the filter. Bypass valve opens at 96 kPa (0.96 bar) (14 psi) pressure differential.

MX,22010HV,A6 -19-18JAN93

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OIL PRESSURE REGULATING VALVE OPERATION



M53993 -19-06SEP90

M53993

OIL PRESSURE REGULATING VALVE OPERATION

A—Engine
B—Filtered Oil-to-Main Oil Galley
C—Poppet Spring
D—Filtered Oil-to-Crankcase
E—Filter Mounting Base

Slide M53993

FUNCTION:
Regulates engine oil pressure.

MAJOR COMPONENTS:
- Oil Pressure Regulating Valve

THEORY OF OPERATION:
The oil pressure regulating valve is located in the oil filter mounting base stud. Filtered oil passes through the pressure regulating valve to the main oil galley (B). If oil pressure is higher than the valve is set for, the spring (C) is overcome, opening the relief valve. When opened, a passage is opened to route oil back to the crankcase (D).

NOTE: See Section 210, Group 05, Test & Adjustment Specifications for the oil pressure regulating valve setting.

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MX,22010GU,7 -19-18JAN93

ENGINE COOLING SYSTEM OPERATION

A—Cylinder Head
B—Thermostat
C—Coolant Recovery Tank
D—Cooling Fan
E—Radiator
F—Coolant Pump
G—Coolant Hoses
H—Coolant Temperature Switch
I—Pressure Cap
J—Engine Block

Slide M81473

FUNCTION:
The coolant pump circulates coolant through the cooling system, drawing hot coolant from the engine block and circulating it through the radiator for cooling.

MAJOR COMPONENTS:
- Radiator
- Radiator Hoses
- Coolant Pump
- Cooling Fan
- Fan Belt
- Engine Block
- Cylinder Head
- Thermostat
- Coolant Temperature Switch
- Coolant Recovery Tank
- Pressure Cap

THEORY OF OPERATION:
An impeller type pump (F) draws coolant from the lower radiator tank (E) and pumps it into coolant passages in block, up through head, past thermostat (B) and temperature sensor (H), then back to the top radiator tank.

A fan mounted to coolant pump, driven by a fan belt from the engine crankshaft, draws cool air through the engine hood and radiator, discharging it across the engine.

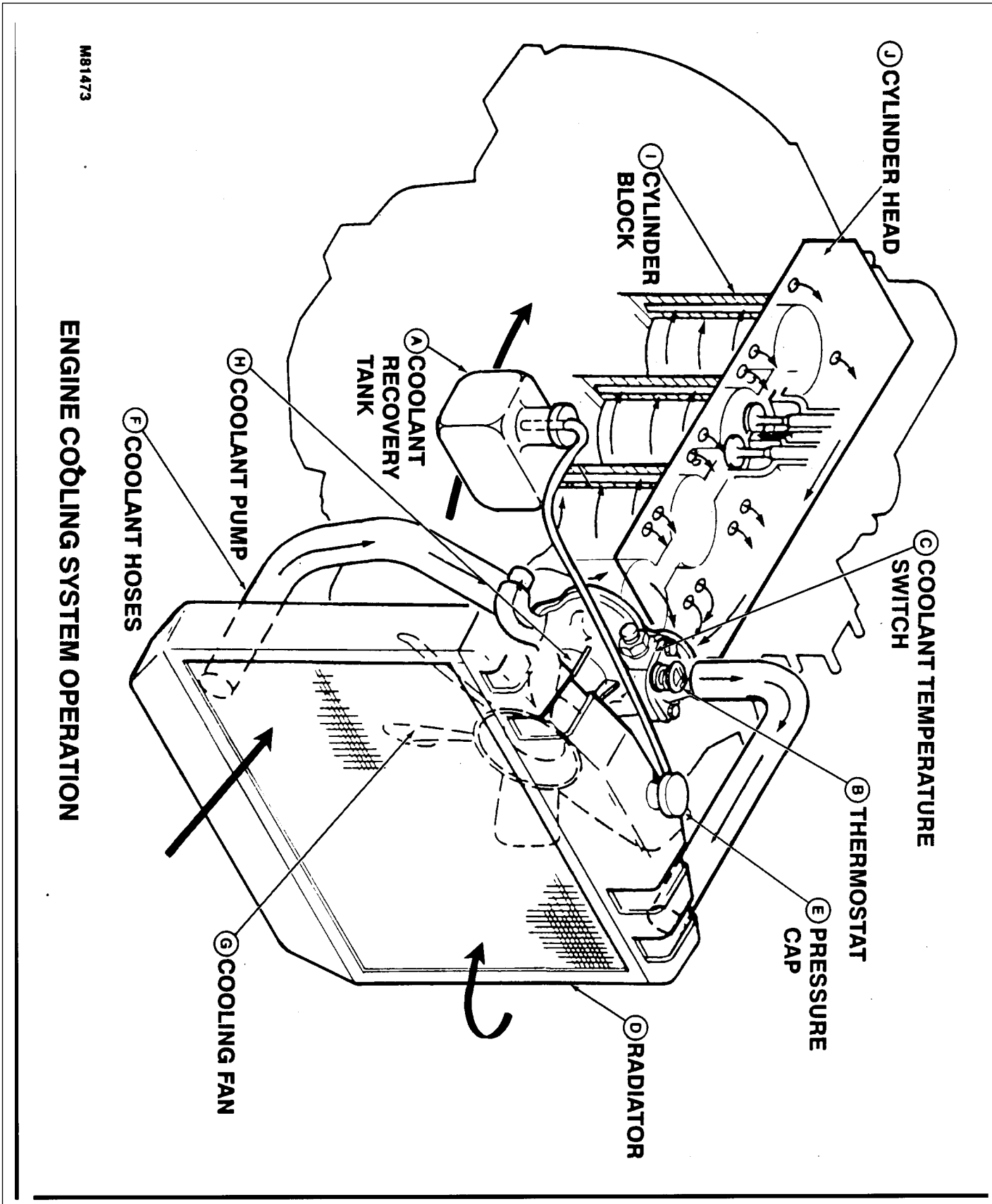
As the coolant is heated it expands. If pressure exceeds cap relief pressure, the cap (I) opens allowing coolant to overflow to coolant recovery tank (C).

NOTE: See Section 210, Group 05, Test & Adjustment Specifications for the radiator cap pressure setting.

Passages permit some coolant to bypass the thermostat (when closed) to provide more uniform warm-up engine parts.

MX,22010HV,A7 -19-18JAN93

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M81473 -19-19NOV92

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MX,22010HV,A8 -19-18JAN93

DIAGNOSTIC INFORMATION

The diagnostic information in this group is used to test components related to a specific problem. Select the appropriate symptom from the list that best matches your problem and follow the test procedures under that heading. The symptom headings are:

- Turns over but will not start or starts hard
- Runs irregularly or stalls frequently
- Runs rough
- Low power
- Exhaust smokes—black or grey
- Smokes excessive—white
- Smokes blue or uses excess oil
- Uses excess fuel
- Excess noise or vibrations
- Low oil pressure
- Coolant operating temperature incorrect
- Oil in coolant or coolant in oil

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 specification or condition that should be obtained when performing the test or check. If the results 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 this 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 arrow shows the exact point where the test is to be made.

The slide number references under the art is used for service training purposes only.

MX,22015GU,A1 -19-26MAR92

ENGINE TURNS OVER BUT WILL NOT START OR STARTS HARD

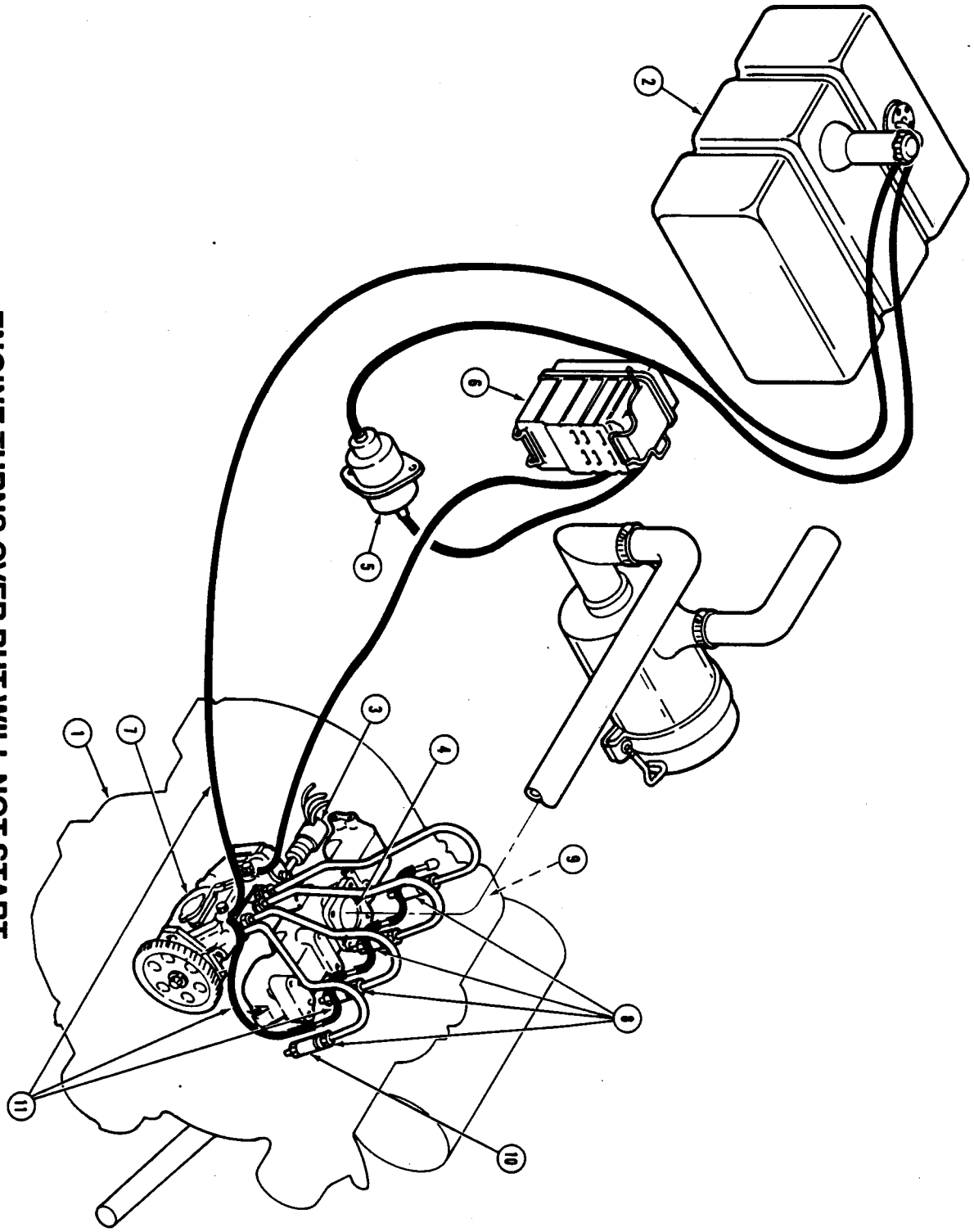
Conditions:
- Travel pedals in neutral position
- PTO off
- Throttle lever in fast idle position
- Key switch on
- Park brake engaged
- Seat switch in OVERRIDE position
- Use tests and adjustments in this group.

Test/Check Point	Normal	If Not Normal
1. Engine oil	Correct viscosity.	Drain and replace with correct viscosity.
2. Fuel tank	Diesel fuel or correct grade for ambient temperature.	Replace with correct fuel.
3. Fuel shutoff solenoid	Solenoid retracts fully.	Check for binding linkage/correct adjustment. Check electrical circuit, see Section 240.
4. Engine air heater	Heats when key switch is ON and ambient temperature is below 20˚C (68˚F).	See Engine Air Heater Test, Section 240.
5. Fuel transfer pump	Constant pressure and volume.	See Fuel Transfer Pump Test, Section 220. Replace pump.
6. Fuel/water separator	Fuel flows out outlet.	Replace element.
•Key in START position		
7. Injection pump	Delivers fuel, free of air to injectors when cranked. (lines cracked open at injectors.)	Remove and service. See CTM3. (Complete test sequence before removing pump.)
	Injection pump timing marks align.	See Injection Pump Timing Adjustment.
8. Injectors	Spray pattern OK. Cracking pressure within specification.	Test injectors. Clean, repair, adjust or replace as necessary. See CTM3.
9. Valves	Cold engine, valve clearance within specification.	Adjust valves. See Valve Clearance Adjustment.
10. Injector ports	Cylinder compression within specification.	Repair engine. See Section 20.
11. Fuel return line	Small amount of fuel flows when engine running.	Clean or replace line. Make sure line is not pinched.

MX,22015HV,A4 -19-18JAN93

M81474

ENGINE TURNS OVER BUT WILL NOT START OR STARTS HARD



-19-01DEC92

M81474

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Slide M81474

MX,22015HV,A5 -19-18JAN93

ENGINE RUNS IRREGULARLY OR STALLS FREQUENTLY

CONDITIONS:
- Travel pedals in neutral position
- PTO off
- Park brake engaged
- Seat switch in OVERRIDE position
- Throttle lever in fast idle position
- Key switch ON
- Engine operating
- Use tests and adjustments in this group.

Test Location	Normal	If Not Normal
1. Fuel tank cap	No pressure or vacuum when removed from tank.	Check cap vent.
2. Fuel tank	Diesel fuel of correct grade.	Replace with correct fuel.
3. Fuel control solenoid	Solenoid retracts fully.	Check for binding linkage/correct adjustment. Check electrical circuit, see Section 240.
4. Fuel transfer pump	Pump output within specification. Fuel flows at filter outlet.	See Fuel Transfer Pump Test. Check for clogged strainer on fuel sender pick-up line.
5. Fuel filter	No water or contamination.	Replace filter.
6. Fuel return line	Small amount of fuel flows when engine running.	Clean or replace line. Make sure line is not pinched.
7. Coolant temperature indicator	Indicator lamp not illuminated.	See Coolant Operating Temperature Incorrect.

CONDITIONS:
- Engine stopped

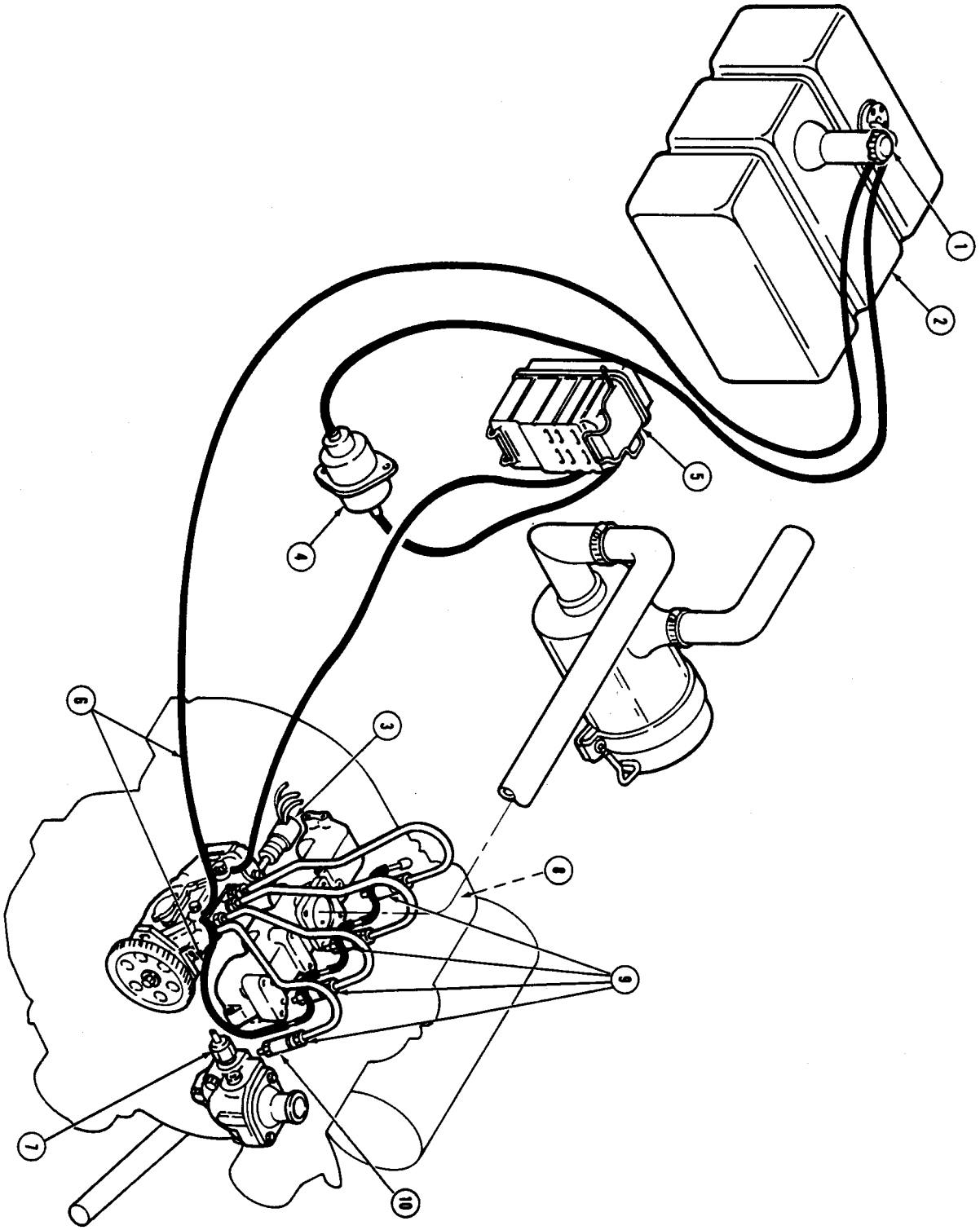
8. Valves	Cold engine. Valve clearance within specification.	Adjust valves. See Valve Clearance Adjustment.
9. Injectors	Spray pattern OK. Cracking pressure within specification.	Test injectors. Clean, repair, adjust or replace as necessary. See CTM3.
10. Injector ports	Cylinder compression within specification. Pressure difference between cylinder within specification.	Repair engine. See Section 20.

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MX,22015HV,A6 -19-18JAN93

M81475

ENGINE RUNS IRREGULARLY OR STALLS FREQUENTLY



M81475 -19-01DEC92

Slide M81475

MX,22015HV,A7 -19-18JAN93

ENGINE RUNS ROUGH

CONDITIONS:
- Travel pedals in neutral position
- PTO off
- Park brake engaged
- Seat switch in OVERRIDE position
- Throttle lever in slow idle position
- Key switch ON
- Engine operating
- Use tests and adjustments in this group

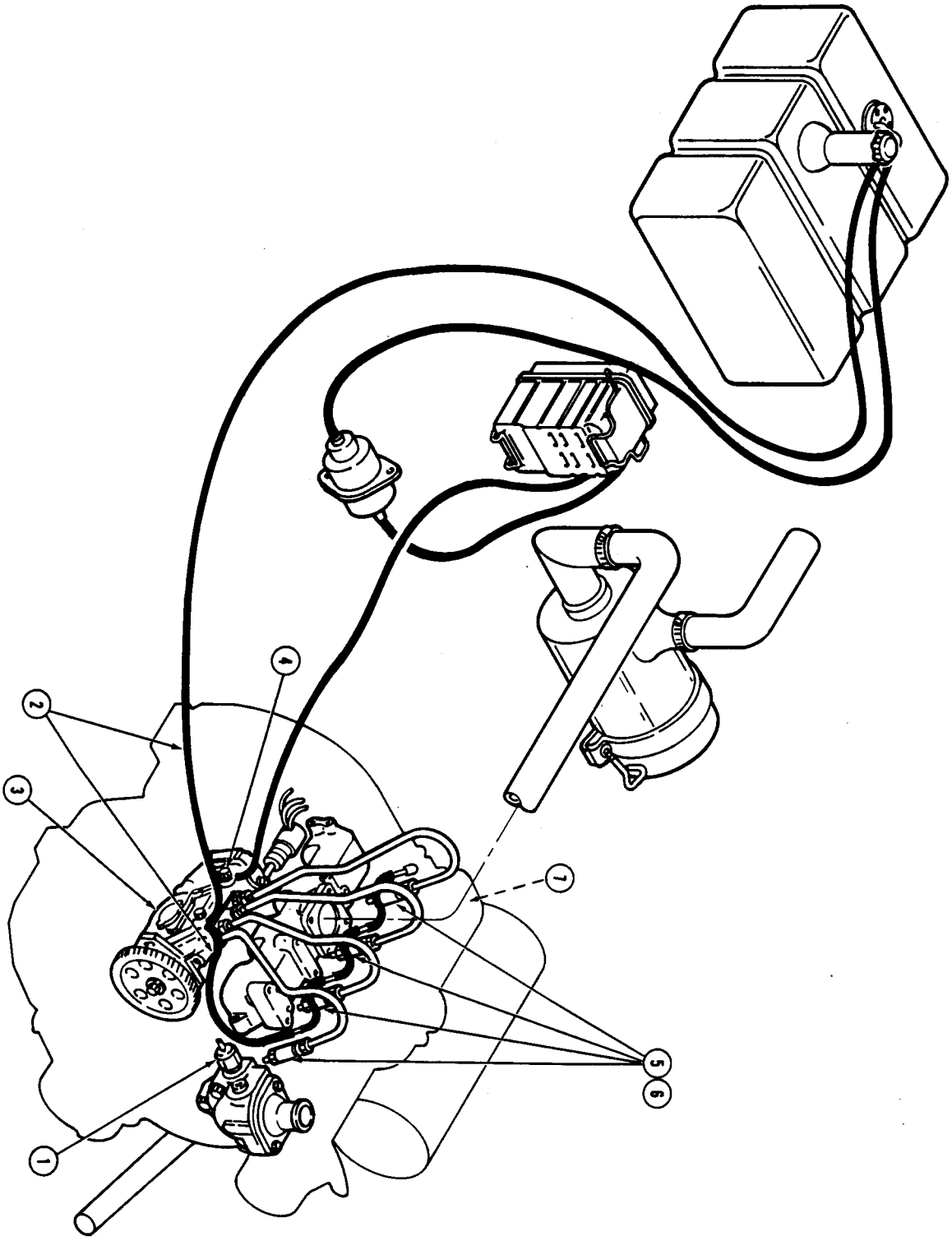
Test Location	Normal	If Not Normal
1. Coolant temperature indicator	Indicator lamp not illuminated. (Engine at normal operating temperature.)	See Coolant Operating Temperature Incorrect.
2. Fuel return line	Small amount of fuel flows when engine running.	Clean or replace line. Make sure line is not pinched.
3. Injection pump	Delivers fuel, free of air to injectors when cranked. (lines cracked open at injectors.)	Remove and service. See CTM3.
4. Injection system	Delivers adequate fuel/no air in system.	Bleed fuel system. See this group. Check fuel line connections for leaks.
CONDITIONS: • Engine stopped		
5. Injectors	Spray pattern OK. Cracking pressure within specification.	Test injectors. Clean, repair, adjust or replace as necessary. See CTM3.
6. Injector ports	Cylinder compression within specification. Pressure difference between cylinder within specification.	Repair engine. See Section 20.
7. Valves	Cold engine. Valve clearance within specification.	Adjust valves. See Valve Clearance Adjustment.

MX,22015HV,A8 -19-18JAN93

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M81476

ENGINE RUNS ROUGH



Slide M81476

-19-01DEC92

M81476

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MX,22015HV,A9 -19-18JAN93

ENGINE LOW POWER

CONDITIONS:
- Travel pedals in neutral position
- PTO off
- Park brake engaged
- Engine stopped
- Use tests and adjustments in this group.

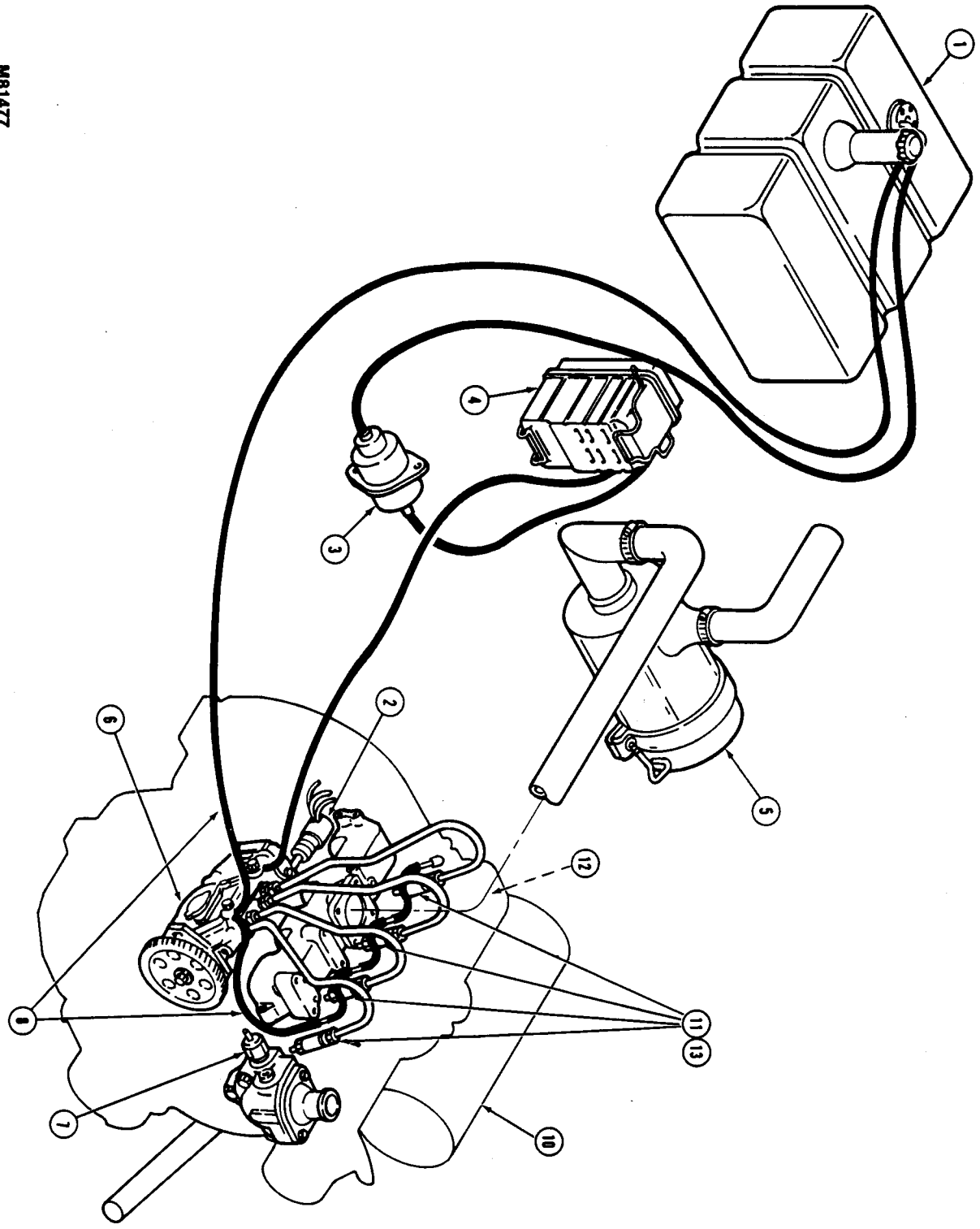
Test Location	Normal	If Not Normal
1. Fuel tank	Diesel fuel of correct grade.	Replace with correct fuel.
CONDITIONS: • Seat switch in OVERRIDE position		
2. Fuel control solenoid	Solenoid retracts fully.	Check for binding linkage/correct adjustment. Check electrical circuit, refer to Section 240.
3. Fuel transfer pump	Pump output within specification.	See Transfer Pump Test. Replace pump.
4. Fuel/water separator	Fuel flows at outlet.	Replace element.
CONDITIONS: • Engine operating at fast idle		
5. Air cleaner	No restriction/air restriction indicator not illuminated.	Clean or replace air cleaner element. Refer to Section 30.
6. Injection pump	Delivers fuel, free of air, to injectors when cranked. (lines cracked open at injectors.)	Remove and service. See CTM3.
	Engine slow idle within specification.	Adjust idle speed. See Slow Idle. Adjustment and Fast Idle Adjustment.
	Engine fast idle within specification.	
7. Coolant temperature indicator	Indicator lamp not illuminated. (Engine at normal operating temperature.)	See Coolant Operating Temperature Incorrect.
8. Fuel return line	Small amount of fuel flows when engine running.	Clean or replace line. Make sure line is not pinched.
9. Hydraulic system (not shown)	No load with all valves in neutral. (Hydraulic system not going over relief.)	Refer to Sections 250 and 270.
10. Muffler	Low restriction. (operate briefly without muffler to check.)	Replace muffler if significant improvement when operated without.

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MX,22015HV,A10 -19-18JAN93

M81477

ENGINE LOW POWER



Slide M81477

-19-01DEC92

M81477

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MX,22015HV,A11 -19-18JAN93

ENGINE LOW POWER—CONTINUED

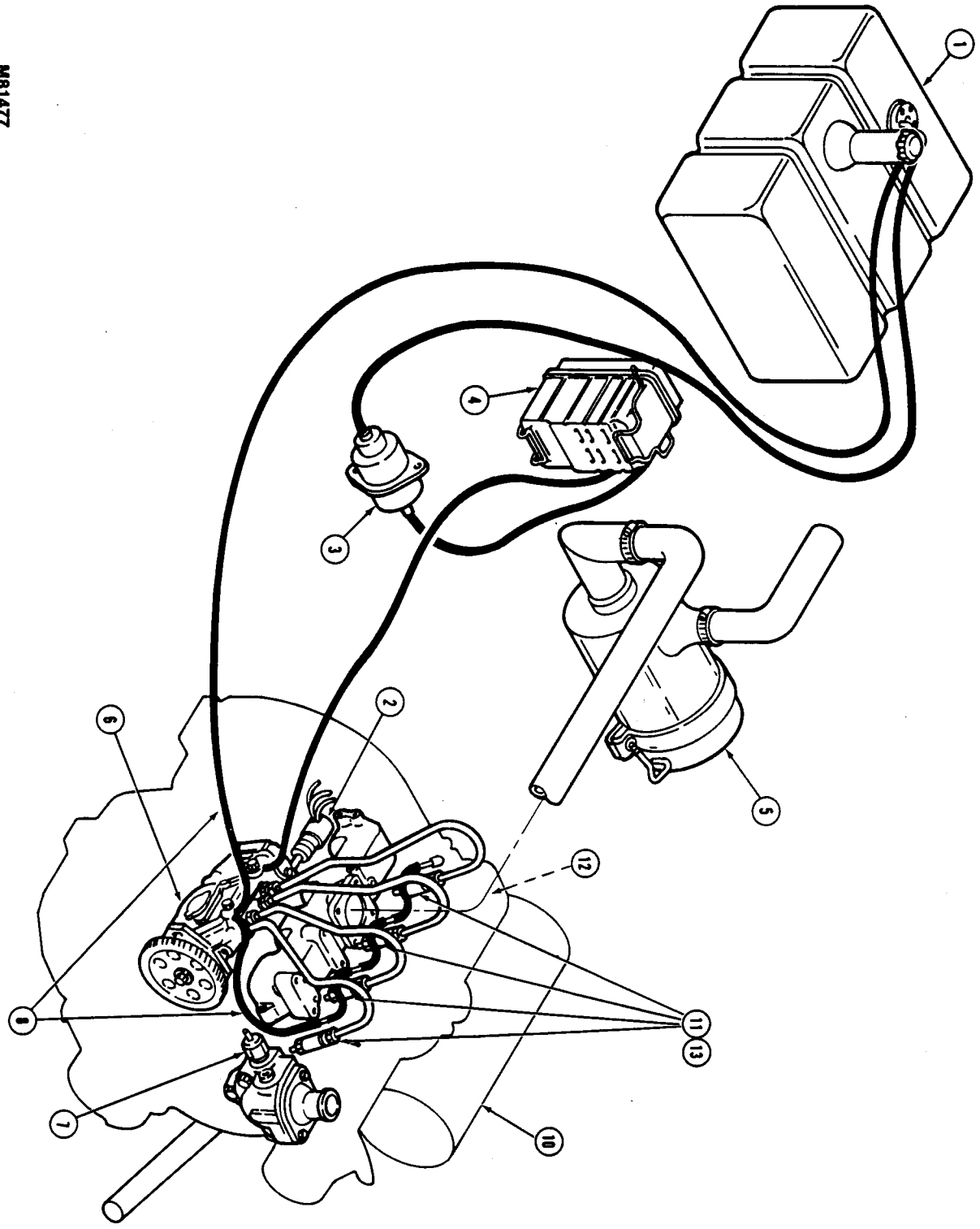
Test Location	Normal	If Not Normal
CONDITIONS: • Engine stopped		
11. Injectors	Spray pattern OK. Cracking pressure within specification.	Test injectors. Clean, repair, adjust or replace as necessary. See CTM3.
12. Valves	Cold engine. Valve clearance within specification.	Adjust valves. See Valve Clearance Adjustment.
13. Injector ports	Cylinder compression within specification. Pressure difference between cylinder within specification.	Repair engine. See Section 20.
14. Brakes (not shown)	Brake linkage not too tight. Brake disks not dragging.	Check and adjust brake and linkage. See Section 260.

MX,22015HV,A12 -19-18JAN93

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M81477

ENGINE LOW POWER



Slide M81477

-19-01DEC92

M81477

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11

MX,22015HV,A11 -19-18JAN93

ENGINE EXHAUST SMOKE—BLACK OR GREY

CONDITIONS:
- Travel pedals in neutral position
- PTO off
- Park brake engaged
- Seat switch in OVERRIDE position
- Throttle lever in fast idle position
- Key switch ON
- Engine operating
- Use tests and adjustments in this group

Test Location	Normal	If Not Normal
1. Air cleaner	No restriction/air restriction indicator reads OK.	Clean or replace air cleaner element. See Section 30.
2. Fuel tank	Diesel fuel of correct grade.	Replace with correct fuel.

CONDITIONS:
- Engine stopped

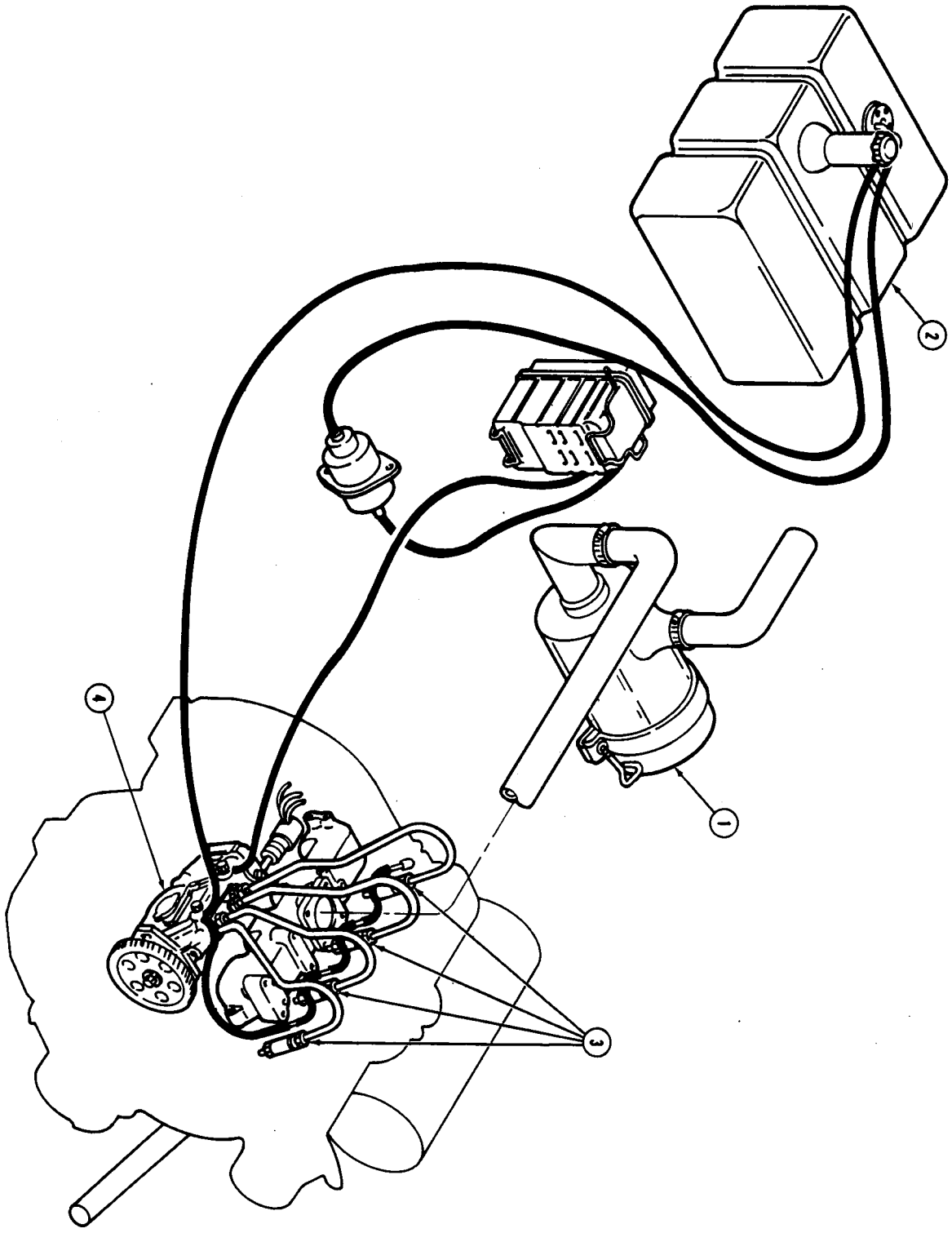
3. Injectors	Spray pattern OK. Cracking pressure within specification.	Test indicators. Clean, repair, adjust or replace as necessary. See CTM3.
4. Injection pump	Delivers correct amount of fuel for load.	See Injection Pump Timing Adjustment. Remove and service. See CTM3.

MX,22015HV,A13 -19-18JAN93

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M81478

ENGINE EXHAUST SMOKE – BLACK OR GREY



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-19-01DEC92

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MX,22015HV,A14 -19-18JAN93

ENGINE EXHAUST SMOKE—EXCESSIVE WHITE

CONDITIONS:
- Travel pedals in neutral position
- PTO off
- Park brake engaged
- Seat switch in OVERRIDE position
- Throttle lever in fast idle position
- Key switch ON
- Engine operating
- Use tests and adjustments in this group.

Test Location	Normal	If Not Normal
1. Coolant temperature indicator	Indicator lamp not illuminated. Engine at normal operating temperature.	See Coolant Operating Temperature Incorrect.
2. Engine air heater	Heats when key switch is ON and ambient temperature is below 20˚C (68˚F).	See Engine Air Heater Test, Section 240.
3. Injection pump	Proper timing marks align.	See Injection Pump Timing Adjustment.

CONDITIONS:
- Engine stopped

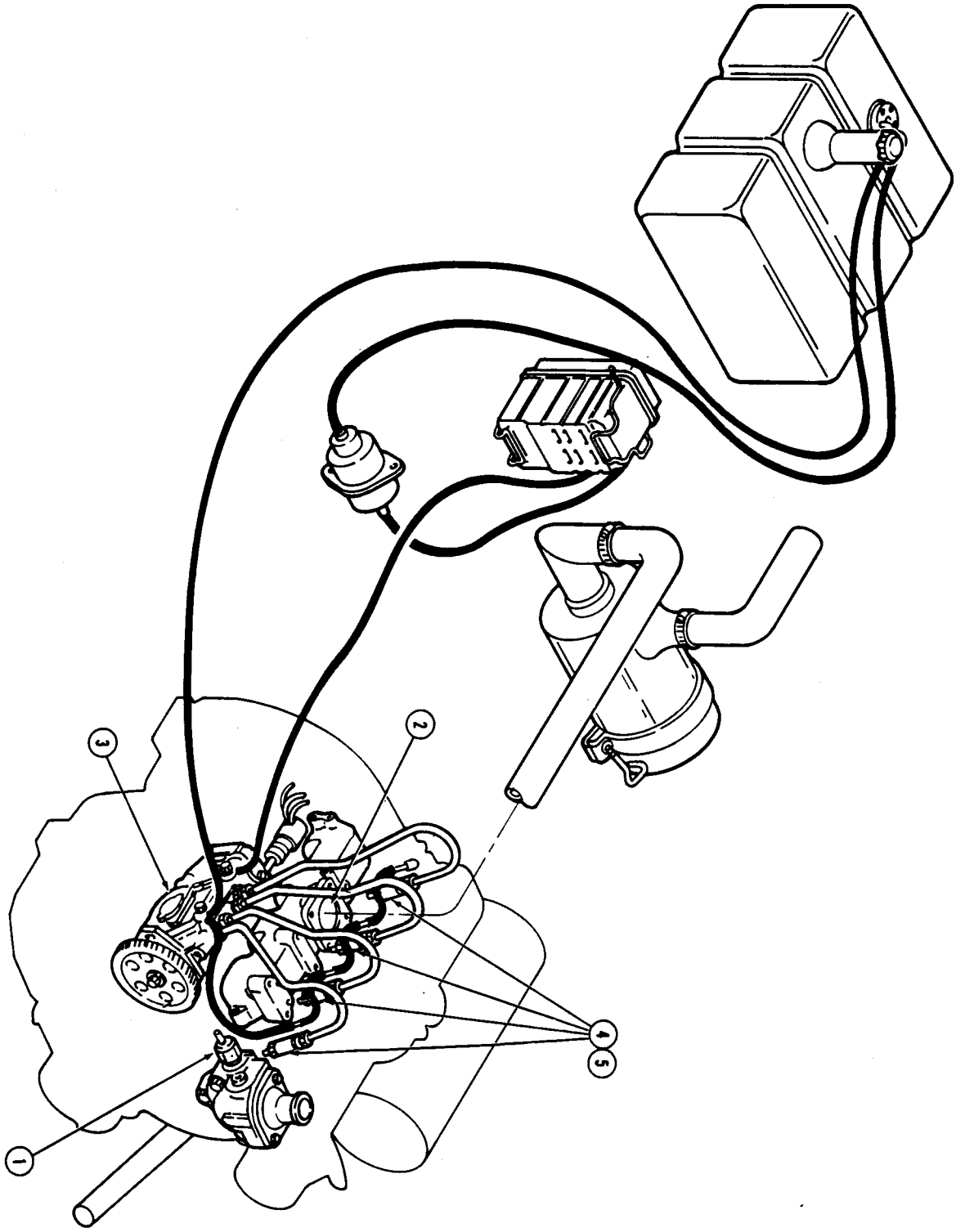
4. Injectors	Spray pattern OK. Cracking pressure within specification.	Test injectors. Clean, repair, adjust or replace as necessary. See CTM3.
5. Injector ports	Cylinder compression within specification. Pressure difference between cylinder within specification.	Repair engine. See Section 20.

MX,22015HV,A15 -19-18JAN93

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M81479

ENGINE EXHAUST SMOKE – EXCESSIVE WHITE



Slide M81479

-19-01DEC92

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MX,22015HV,A16 -19-18JAN93

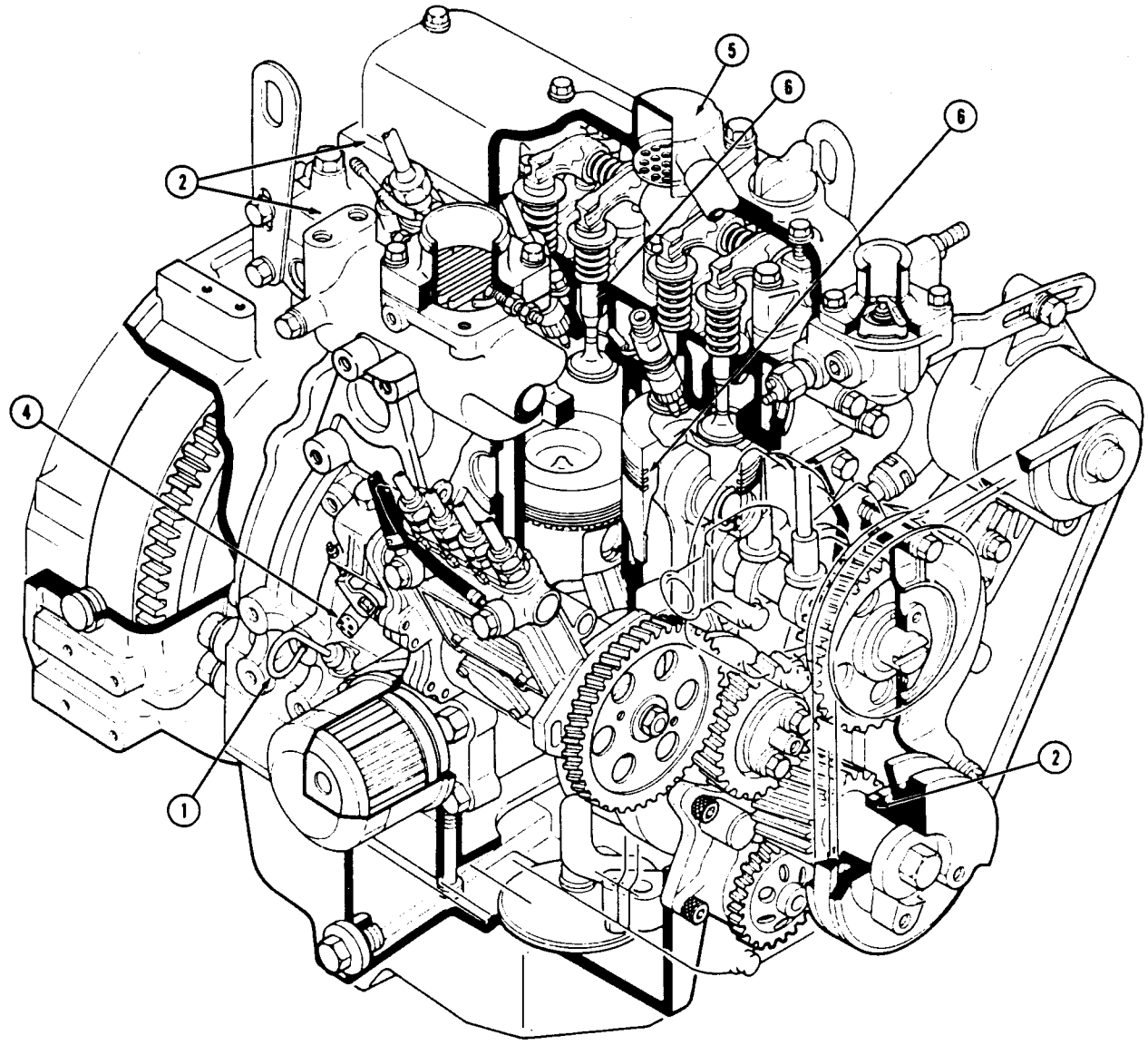
ENGINE USES EXCESSIVE OIL OR EXHAUST SMOKE—BLUE

CONDITIONS:
- Travel pedals in neutral position
- PTO off
- Park brake engaged
- Use tests and adjustments in this group.

Test Location	Normal	If Not Normal
1. Oil	Correct viscosity.	Drain and replace with correct viscosity. See Section 10, Group 20.
2. Crankcase breather	Tube and screen clean and not restricted.	Clean or replace.
3. Engine gaskets/seals	No external leaks.	Replace. See Section 20.
CONDITIONS: • Engine operating		
4. Air cleaner (not shown)	No restriction/air restriction indicator reads OK.	Clean or replace air cleaner element. See Section 30.
5. Oil pressure switch port	Oil pressure within specification.	Inspect and clean regulating valve. Replace valve if necessary. See Section 20.
6. Engine internal parts	Within wear limits. Rings not stuck Valve guide not worn.	Replace. See Section 20.

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M81480

ENGINE USES EXCESSIVE OIL OR EXHAUST SMOKE – BLUE

-19-19NOV92

M81480

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ENGINE USES EXCESSIVE FUEL

CONDITIONS:
- Travel pedals in neutral position
- PTO off
- Park brake engaged
- Seat switch in OVERRIDE position
- Throttle lever in fast idle position
- Key switch ON
- Engine running
- Use tests and adjustments in this group.

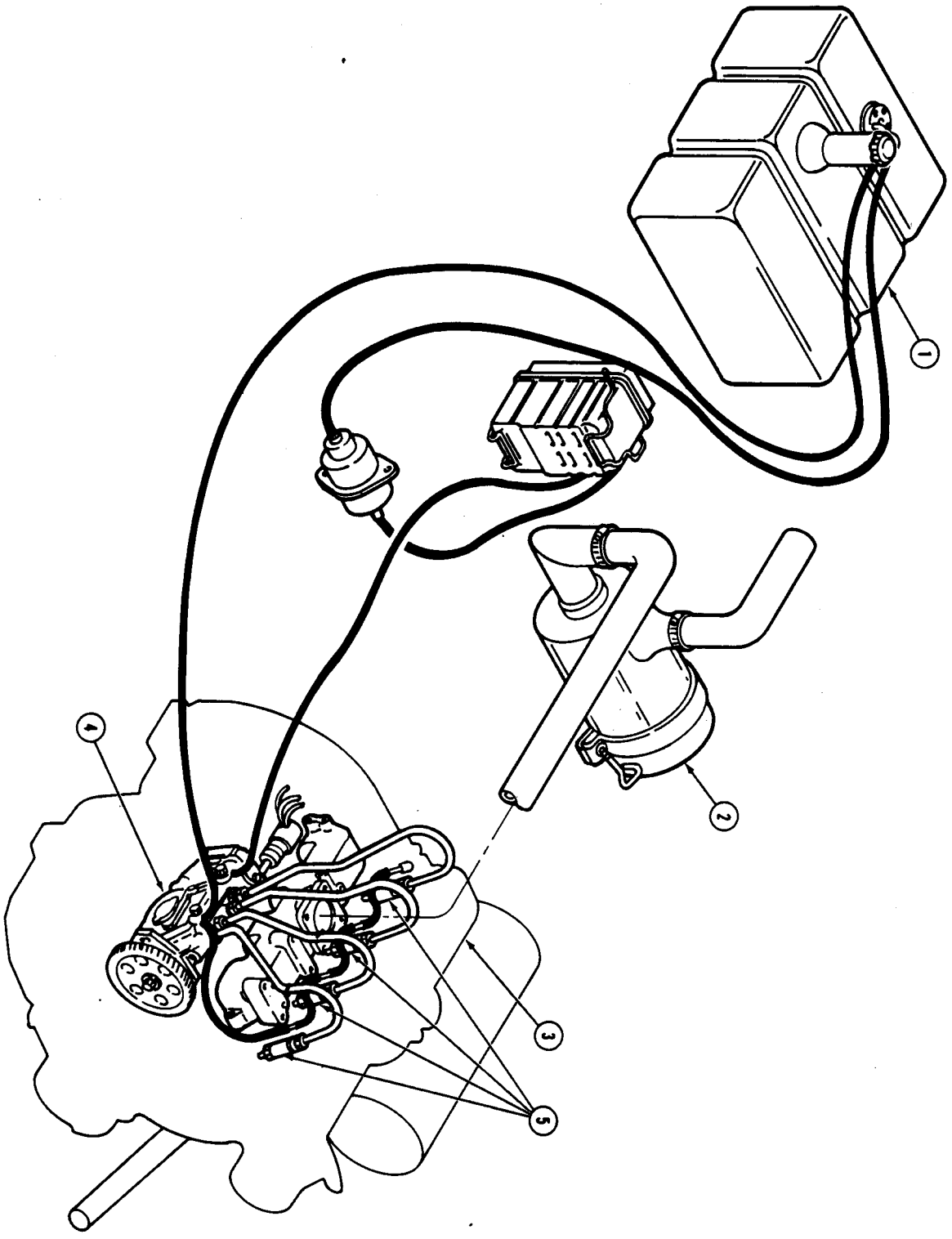
Test Location	Normal	If Not Normal
1. Fuel tank	Diesel fuel of correct grade.	Replace with correct fuel.
2. Air cleaner	No restriction/air restriction indicator reads OK.	Clean or replace air cleaner element. See Operators Manual.
3. Engine	Normal load and correct ballast No fuel leaks.	Reduce load. Check ballast. Repair leaks.
CONDITIONS: • Engine stopped		
4. Injection pump	Injection pump timing marks align.	See Injection Pump Timing Adjustment.
	Engine runs smooth under load. Engine rpm to specification.	Adjust idle speed. See Slow Idle Adjustment and Fast Idle Adjustment.
5. Injectors	Spray pattern OK. Cranking pressure within specification.	Test injectors. Clean, repair, adjust or replace as necessary. See CTM3.

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M81481

ENGINE USES EXCESSIVE FUEL



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-19-01DEC92

M81481

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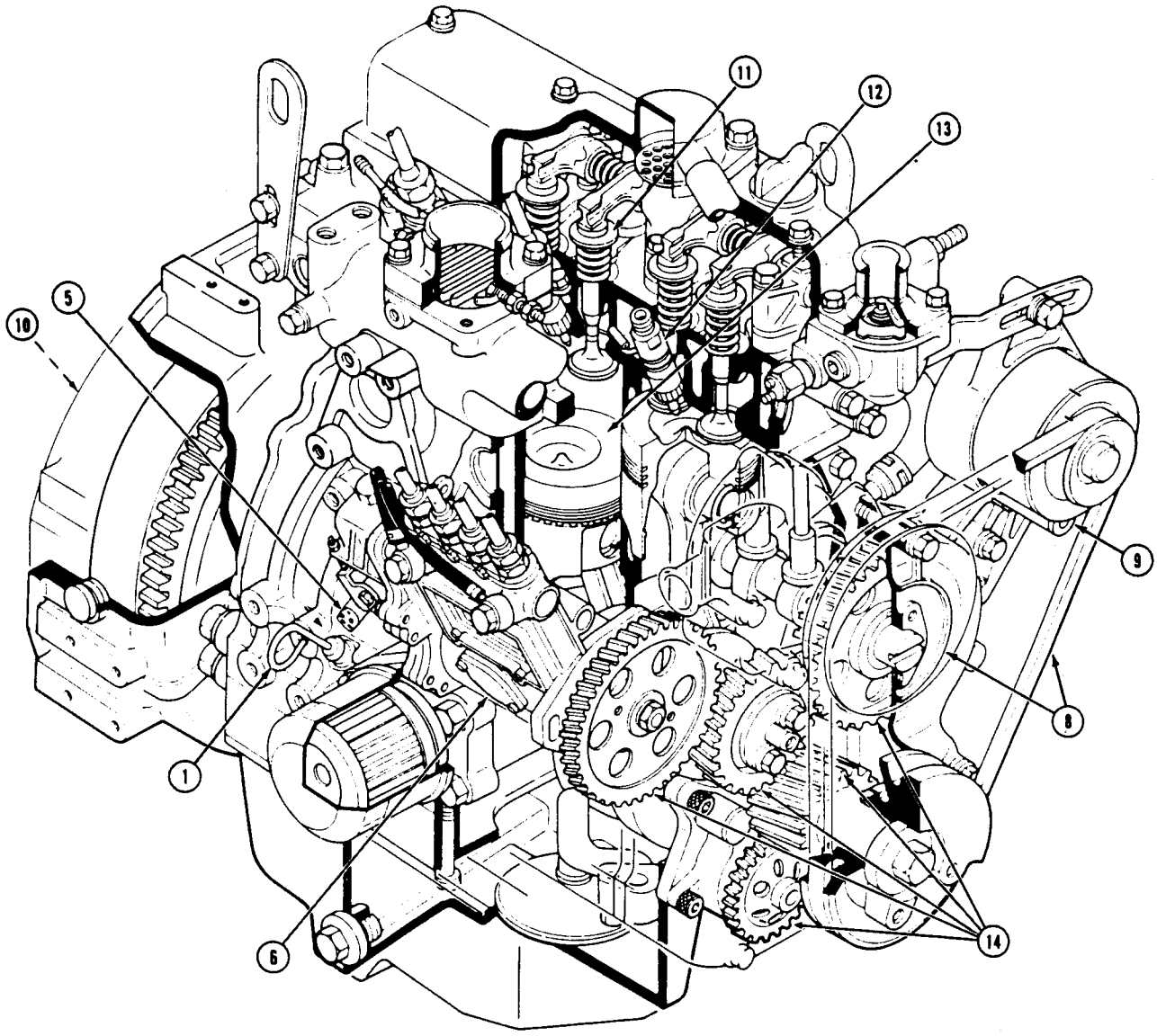
ENGINE HAS EXCESSIVE NOISE OR VIBRATIONS

CONDITIONS:
- Travel pedals in neutral position
- PTO off
- Park brake engaged
- Use tests and adjustments in this group.

Test Location	Normal	If Not Normal
1. Dipstick tube	Crankcase oil level is between marks on dipstick. Correct viscosity.	Add to correct level with correct viscosity. See “Oil In Coolant Or Coolant In Oil”. Drain and replace with correct viscosity. Refer to Section 10.
2. Muffler (not shown)	Mounting hardware tight. Not restricted.	Tighten mounting hardware. Replace if necessary.
3. Hardware	Tight.	Tighten.
4. Fan (not shown)	Blades not bent or worn.	Replace
CONDITIONS • Seat switch in OVERRIDE position • Engine operating		
5. Oil pressure sender port	Oil pressure within specification.	Inspect and clean regulating valve. Replace valve if necessary. See Section 20.
6. Injection pump	Injection pump timing marks align. Delivers fuel, free of air, to injectors when cranked (line cracked open at injectors).	See Injection Pump Timing Adjustment. Bleed the fuel system. Remove and service. See CTM3.
7. Starter (not shown)	Not contacting flywheel.	Tighten mounting cap screws. Repair starter. See Section 40.
8. Water pump belt and idler	No vibration. No noise.	Inspect or replace if necessary. See Section 20.
9. Alternator	No vibration. No noise.	Inspect or replace if necessary. See Section 40.
10. Drive shaft (not shown)	No vibration. Couplers, U-joints and connections tight.	Inspect. Repair or replace parts if necessary. See Section 50.

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M81482

ENGINE HAS EXCESSIVE NOISE OR VIBRATIONS

-19-19NOV92

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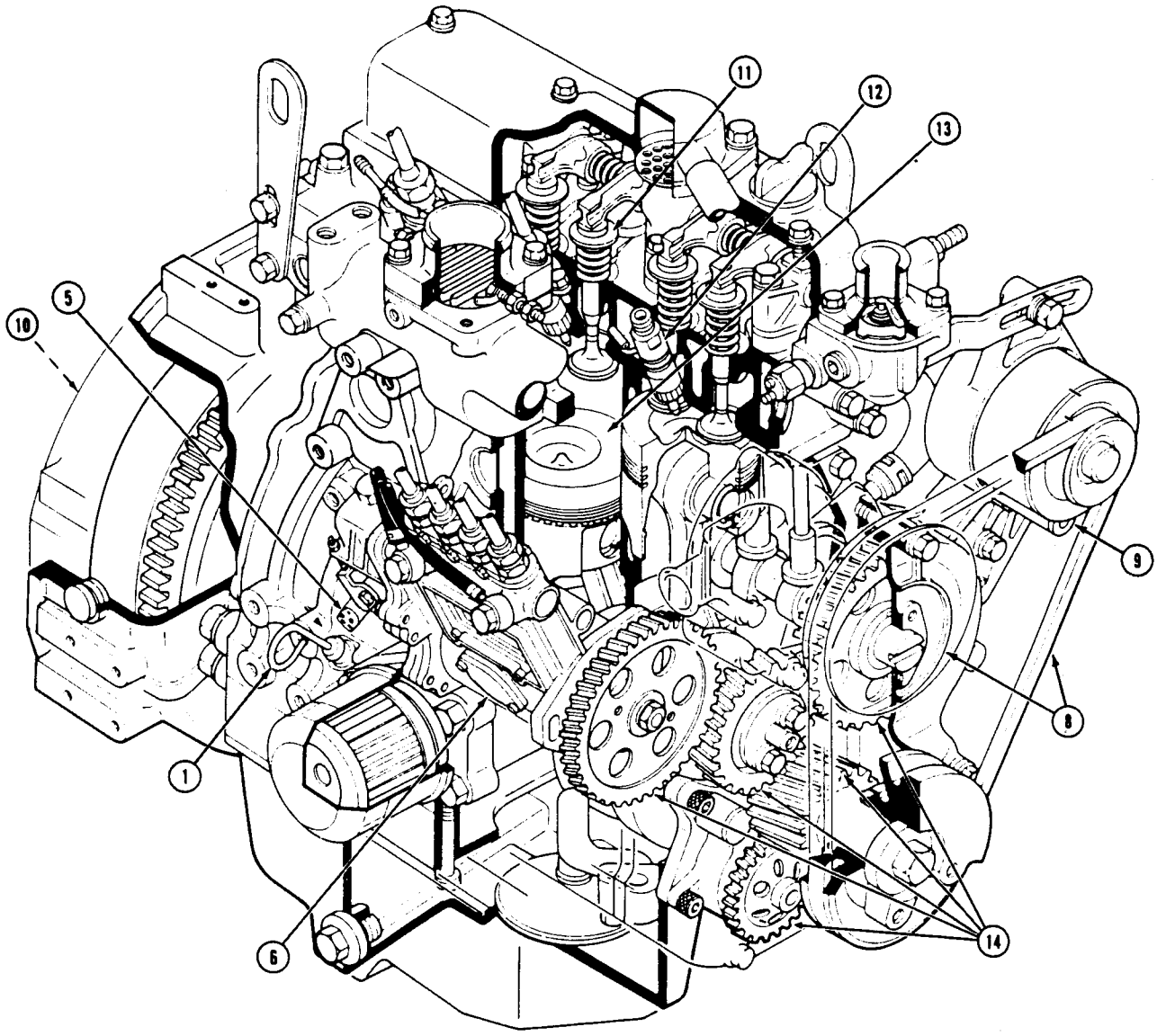
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ENGINE HAS EXCESSIVE NOISE OR VIBRATIONS—CONTINUED

Test Location	Normal	If Not Normal
11. Valves	Cold engine. Valve clearance within specification. Lifter not sticking. Push-rods not bent.	Adjust valves. See Valve Clearance Adjustment. Refer to Section 20.
12. Injectors	Spray pattern OK. Cracking pressure within specification.	Test injectors. Clean, repair, adjust or replace as necessary. See CTM3.
13. Pistons and bearings	Clearance within specifications Not scored.	Repair. Refer to Section 20.
14. Timing gears	Meshing correctly.	Replace. Refer to Section 20.

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M81482

ENGINE HAS EXCESSIVE NOISE OR VIBRATIONS

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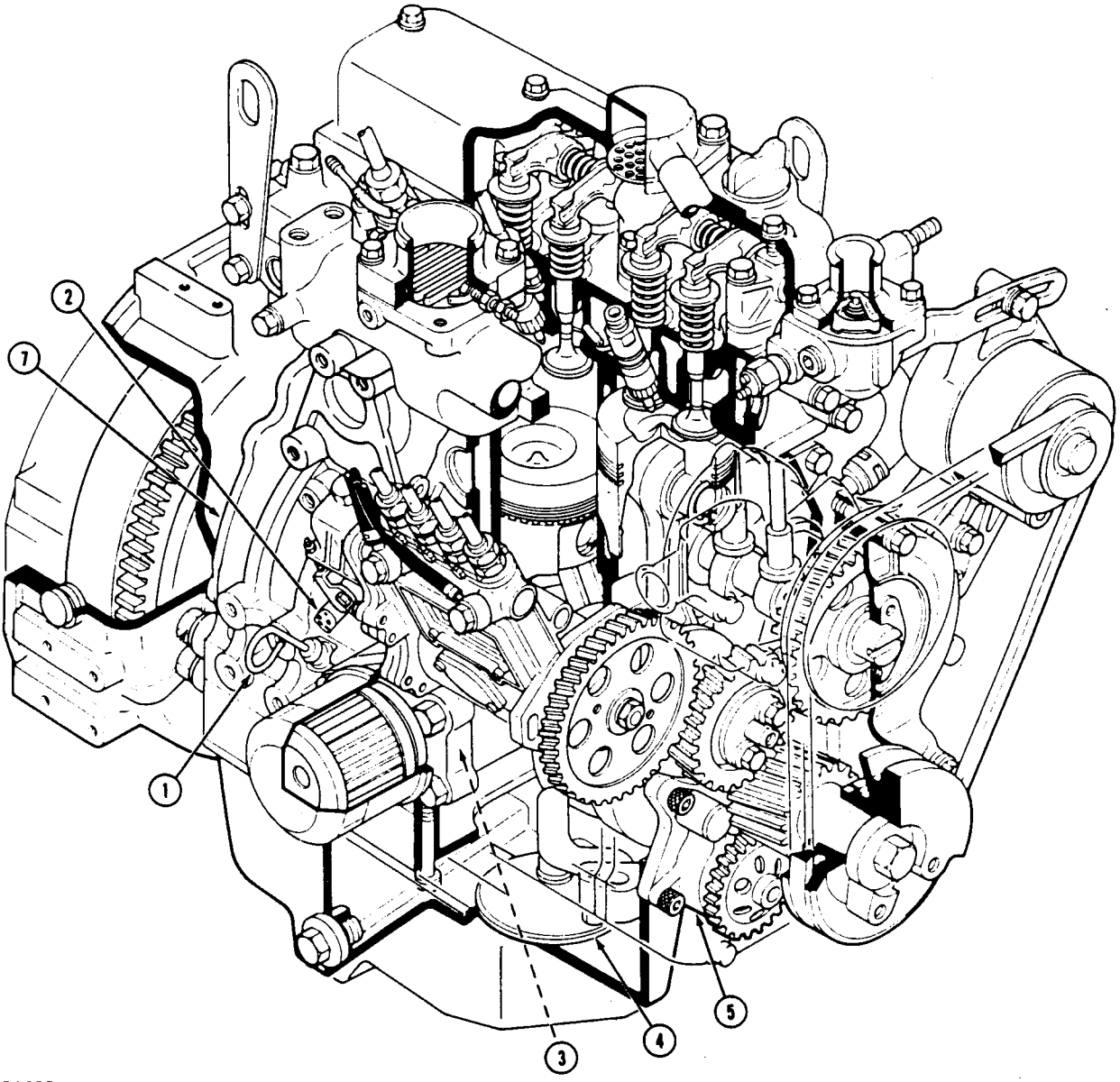
ENGINE HAS LOW OIL PRESSURE

CONDITIONS:
- Travel pedals in neutral position
- PTO off
- Park brake engaged
- Seat switch in OVERRIDE position
- Throttle lever in fast idle position
- Key switch ON
- Engine operating
- Use tests and adjustments within this group

Test Location	Normal	If Not Normal
1. Dipstick tube	Crankcase oil level is between marks on dipstick. Correct viscosity.	Add to correct level with correct viscosity. Refer to Section 10.
2. Oil pressure switch	Oil pressure within specification. Indicator lamp on at less than 69 kPa (0.7 bar) (10 psi).	Perform Oil Pressure Test in this group.
CONDITIONS: • Engine stopped		
3. Oil pressure regulating valve	Valve free in bore. Spring within specifications. Refer to Section 20.	Inspect and clean valve. Replace as necessary. Refer to Section 20.
4. Oil pump intake screen	Screen clean/no damage.	Clean or replace. Refer to Section 20.
5. Oil pump	Clearances within specifications Refer to Section 20.	Replace parts worn excessively. Refer to Section 20.
6. Bearings (not shown)	Clearance within specifications See CTM3.	Repair. See CTM3.
7. Block	Oil passages not cracked or plugged.	Replace as necessary.

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M81483

ENGINE HAS LOW OIL PRESSURE

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MX,22015HV,A25 -19-18JAN93

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ENGINE COOLANT OPERATING TEMPERATURE INCORRECT

CONDITIONS:
- Engine stopped and cool

Test Location	Normal	If Not Normal
1. Coolant recovery tank	Coolant level to bottom of overflow tube.	Fill to bottom of tube. Fill radiator to 13—25 mm (1/2—1 in.) below bottom of filler neck.
2. Fan drive belt (not shown)	Deflection within specification.	Adjust. See Fan Belt Adjustment.
3. Dipstick tube (not shown)	Crankcase oil level is between marks on dipstick.	Add to correct level with correct viscosity. See Section 10.
4. Radiator/hood screen	Free of dirt/trash.	Clean.

CONDITIONS:
- Travel pedals in neutral position
- PTO off
- Park brake engaged
- Seat switch in OVERRIDE position
- Throttle lever in fast idle position
- Key switch ON
- Engine operating
- Use tests and adjustments in this group

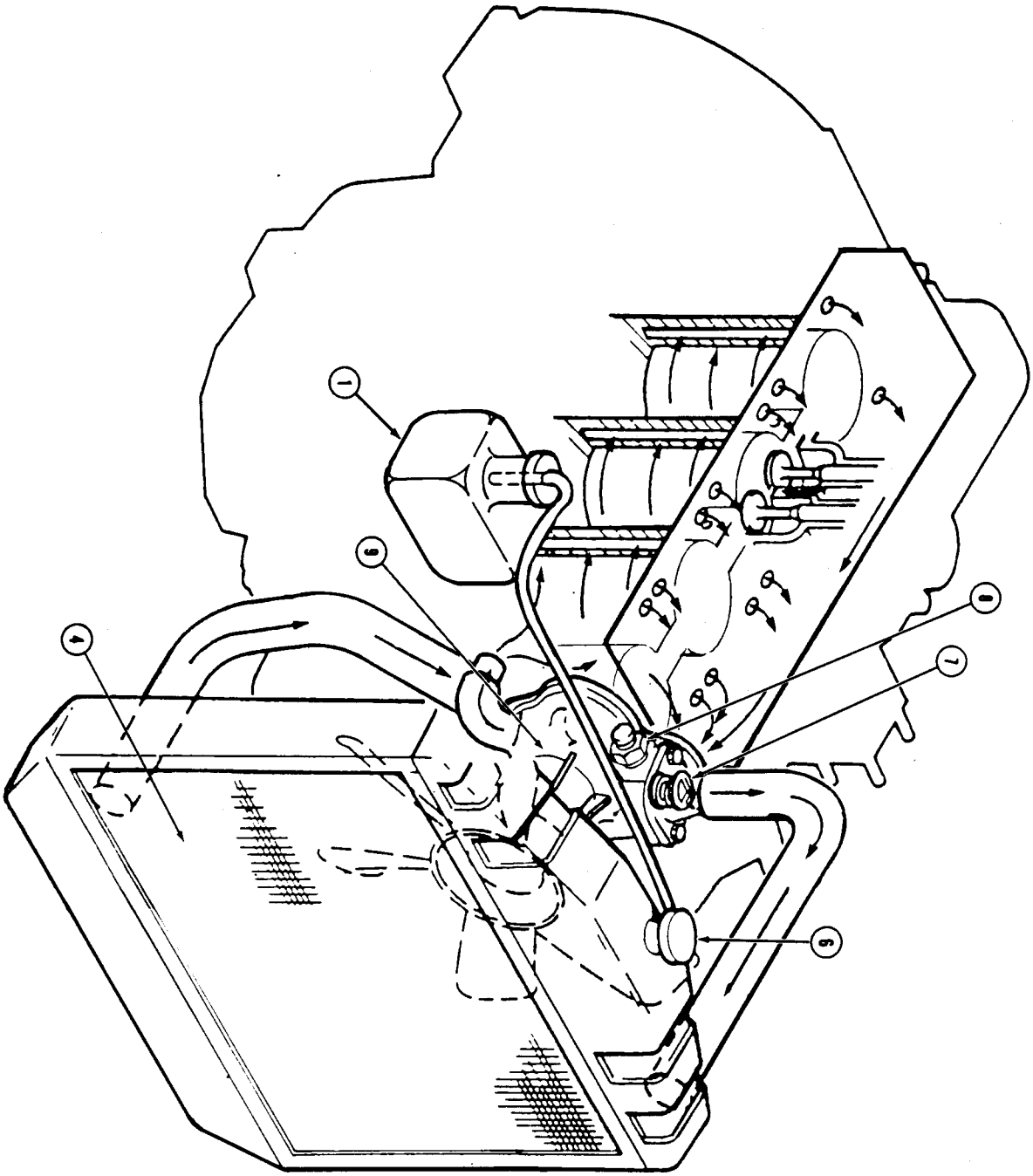
5. Load applied (not shown)	Within horsepower available.	Reduce load.
6. Radiator cap	Operating within range. Not leaking.	Replace cap.
7. Thermostat	Starts to open at 71˚C (160˚F) full open 85˚C (185˚F).	Replace.
8. Coolant temperature indicator	Indicator lamp not illuminated.	Test circuit. See Section 240.
9. Coolant pump	Clearance within specifications. No “play” in bearing/no leaks.	Repair. See CTM3.
10. Pistons (not shown)	No scoring.	Replace. See CTM3.

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M81484

ENGINE COOLANT TEMPERATURE INCORRECT



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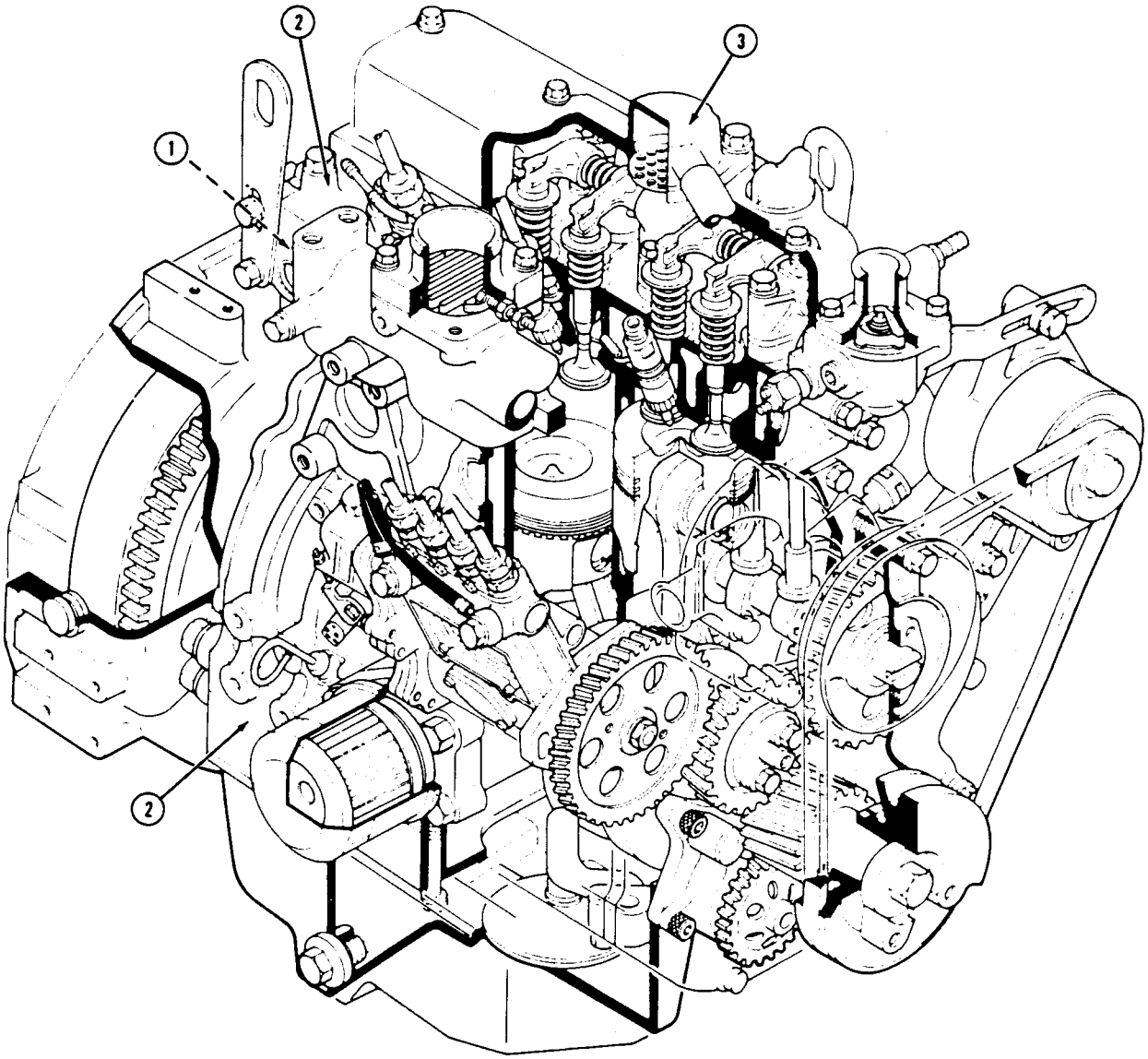
MX,22015HV,A27 -19-18JAN93

OIL IN COOLANT OR COOLANT IN OIL

Test Location	Normal	If Not Normal
1. Head gasket	Complete seal.	Replace/check head and block for flatness. See CTM3.
2. Block/head	No cracks.	Replace. See CTM3.
3. Breather	Not plugged.	Clean and check breather operation. Check for proper maintenance and oil change intervals

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M81485

OIL IN COOLANT OR COOLANT IN OIL

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RADIATOR BUBBLE TEST

REASON:
To determine if compression pressure is leaking past head gasket.

PROCEDURE:

1. Test radiator cap for correct operating pressure. (See procedure in this group.)

2. With coolant at proper level and radiator cap tight, start and run engine to bring it to operating temperature.

3. Remove overflow hose from coolant recovery tank.

4. Put end of hose in a container of water.

5. Check for bubbles coming from hose.

RESULTS:
•If bubbles are present, check cylinder head for cracks and replace head gasket. (Refer to Section 20.)



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COOLING SYSTEM TEST

REASON:
Inspect cooling system for leaks.

EQUIPMENT:
•D05104ST Cooling System Pressure Pump
•JDG692 Radiator Pressure Test Kit (Adaptors)

CONNECTIONS:
1. Remove cap and attach pressure pump and adapters to radiator.

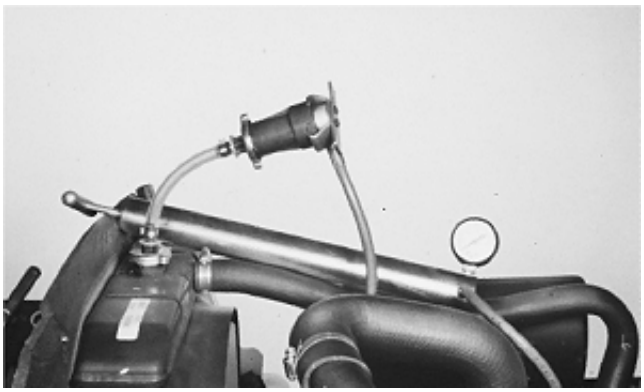
PROCEDURE:
1. Apply 68.9 kPa (0.7 bar) (10 psi) maximum pressure.

2. Check for leaks.

SPECIFICATIONS:
• Min. pressure after 15 seconds .. 55 kPa (0.6 bar) (8 psi)

RESULTS:
• Pressure should hold to specifications. If pressure decreases, check for leaks. Repair leaks or replace parts as necessary. (Refer to Section 20.)

• If pressure test still indicates leakage and all external leaks have been stopped, a blown head gasket or cracked block may be the cause. (Refer to Section 20.)



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RADIATOR CAP PRESSURE TEST

REASON:
Test radiator cap for operating in correct pressure range.

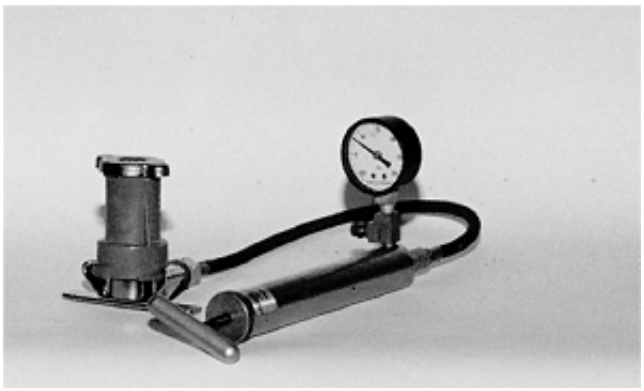
EQUIPMENT:
•D05104ST Cooling System Pressure Pump
•JDG692 Radiator Pressure Test Kit (Adaptors)

CONNECTIONS:
1. Install pressure pump and adaptor to radiator cap.

PROCEDURE:
1. Apply pressure and observe when cap relieves.

SPECIFICATIONS:
- Opening pressure .. 41—55 kPa (0.4—0.6 bar) (6—8 psi)
- Minimum pressure .. 34 kPa (0.34 bar) (5 psi)

RESULTS:
•If cap leaks, retighten and test again. Replace cap if pressure is not according to specifications.



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MX,22015HV,A32 -19-18JAN93

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FUEL TRANSFER PUMP FLOW TEST

REASON:
To determine proper fuel flow from transfer pump.

EQUIPMENT:
•Graduated container

CONNECTIONS:
1. Disconnect fuel supply hose from filter inlet and put end in a graduated container.

PROCEDURE:
1. Turn key switch to ON position for 30 seconds.

2. Compare collected fuel amount to specification.

3. Connect fuel line. It may be necessary to bleed the fuel system. (See procedure in this group.)

SPECIFICATIONS:
• Fuel temperature for test .. 15—25˚C (59—77˚F)
• Minimum fuel flow for 30 sec. .. 207 mL (7 oz)

RESULTS:
• If fuel flow at transfer pump is below minimum, check for pinched or deteriorated fuel lines between fuel tank and pump. Also check fuel tank pickup screens for possible restriction. Replace lines as necessary

• If fuel flow is still below minimum, replace transfer pump. (Refer to Section 30.)



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FUEL TRANSFER PUMP PRESSURE TEST

REASON:
To determine proper transfer pump pressure.

EQUIPMENT:
•JDG356 Fuel Pump Pressure Test Kit.

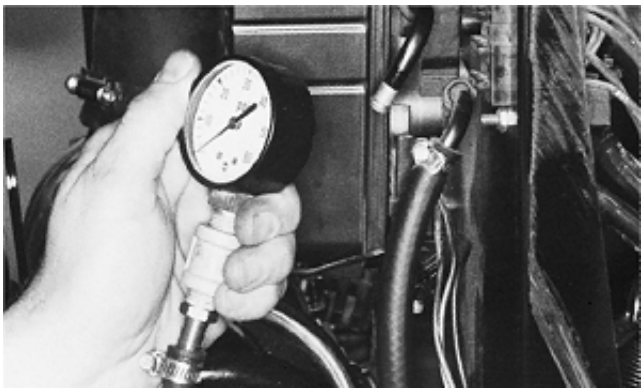
CONNECTIONS:
1. Disconnect fuel supply hose from filter inlet. Connect Fuel Pump Pressure Test Kit to hose.

PROCEDURE:
1. Turn key switch to ON position. Observe pressure reading.

2. Connect fuel line. It may be necessary to bleed the fuel system. (See procedure in this group.)

SPECIFICATIONS:
• Fuel temperature for test .. 15—25˚C (59—77˚F)
• Minimum fuel pressure .. 21 kPa (0.2 bar) (3 psi)

RESULTS:
• If pressure is below minimum, replace transfer pump. (Refer to Section 30.)



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ENGINE OIL PRESSURE TEST

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

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

CONNECTIONS:
1. Remove oil pressure sender.

NOTE: Thread is 1/8" BSP, use JT03349 Connector, hose and 0—700 kPa (0—100 psi) gauge.

2. Install JT03349 Connector (A).

3. Connect JT05577 Pressure Gauge Assembly and JT03017 Hose Assembly.

PROCEDURE:

IMPORTANT: Do not operate engine if no pressure present.

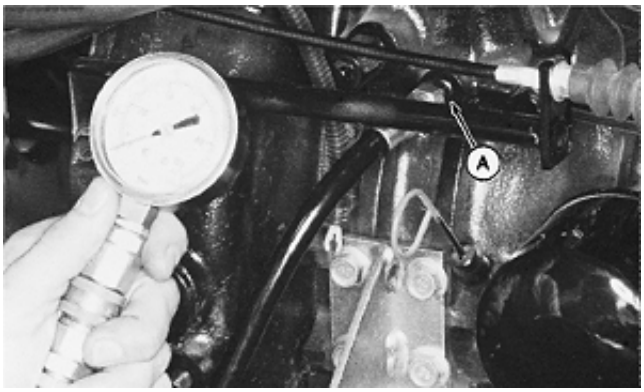
1. Start engine. If pressure reading is below 69 kPa (0.7 bar) (10 psi), STOP ENGINE.

2. Run engine approximately 5 minutes to heat oil, then check oil pressure.

SPECIFICATIONS:
- Engine Oil Pressure .. 294—440 kPa (2.9—4.4 bar) (43—64 psi)

RESULTS:
- If oil pressure is not within specifications, inspect oil pressure regulating valve for broken or worn spring, stuck or damaged valve. (Refer to Section 20.)

- If pressure does not increase, check for a worn or damaged oil pump. Also check for excessive wear of connecting rod and main bearing journals. (Refer to Section 20.)



M81461 -UN-17NOV92

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MX,22015HV,A35 -19-18JAN93

CYLINDER COMPRESSION PRESSURE TEST

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

EQUIPMENT:
- JT01682 Compression Gauge Assembly
- JDG560 Adapter

1. Remove injection nozzles.

2. Install heat protector (A) from end of injector and install on JDG560 adapter (B).

3. Install JT01682 Compression Gauge Assembly and JDG560 Adapter in injector port. Install retaining plate and tighten nuts (C) to 4.5 N·m (39 lb-in.).

PROCEDURE:
1. Disconnect fuel shut off solenoid connector.

IMPORTANT: DO NOT overheat starting motor during test.

2. Crank engine for five seconds using starter.

3. Record pressure reading for each cylinder.

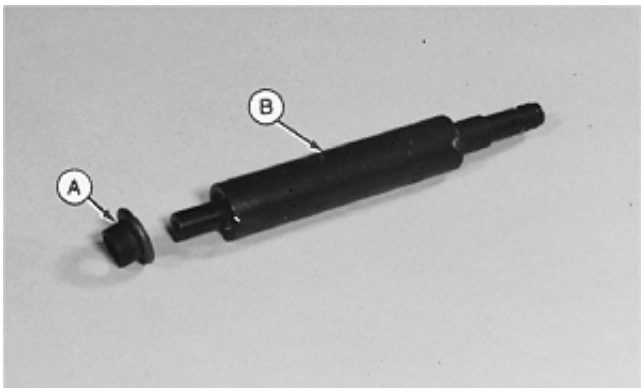
4. After test is completed, bleed the fuel system. (See procedure in this group.)

SPECIFICATIONS:
- Minimum compression .. 2448 kPa (24.5 bar) (355 psi)
- Maximum difference between cylinders .. 490 kPa (4.9 bar) (71 psi)
- Minimum cranking speed .. 250 rpm

RESULTS:
- If pressure reading is below specification, squirt clean engine oil into cylinders through injector ports and repeat test.

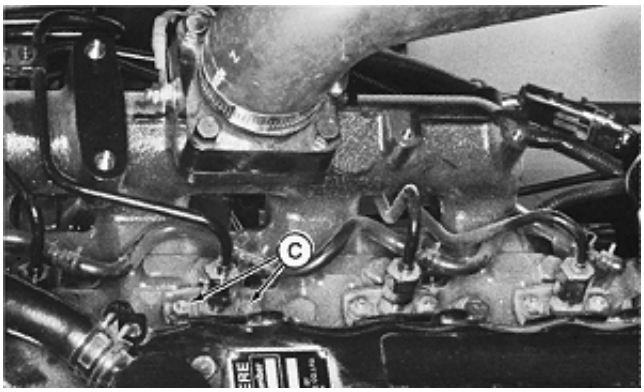
- If pressure increases significantly, check piston, rings, and cylinder walls for wear or damage. (Refer to Section 20.)

- If pressure does not increase significantly after adding oil to cylinders, check for leaking valves, valve seats or cylinder head gasket. (Refer to Section 20.)



M46947 -UN-20FEB92

Slide M46947



M81462 -UN-17NOV92

Slide M81462

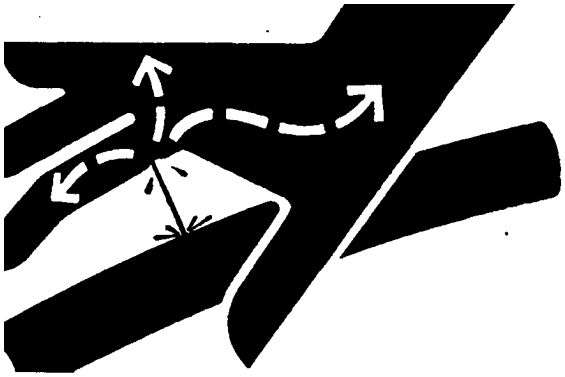
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MX,22015HV,A36 -19-18JAN93

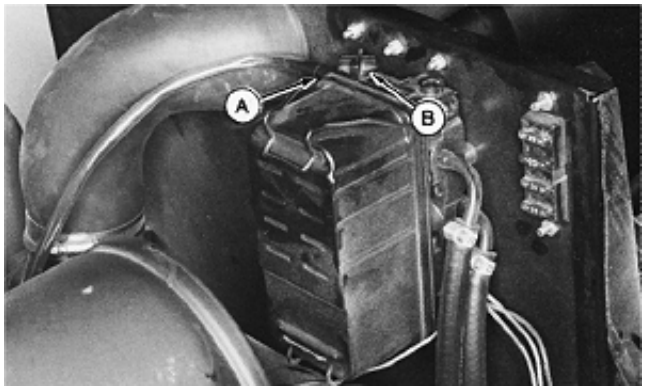
BLEED FUEL INJECTION SYSTEM

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

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

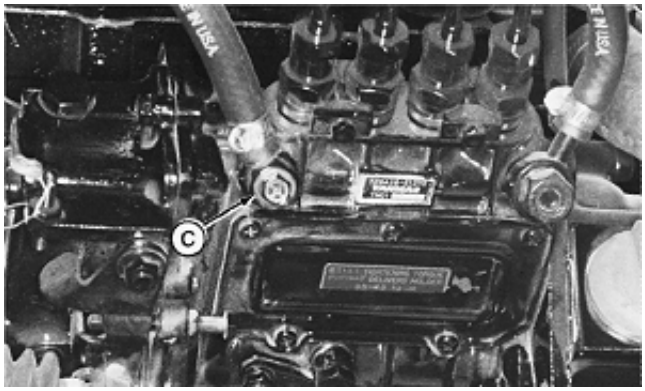


X9811 -UN-23AUG88



M81305 -UN-03NOV92

Slide M81305



M81306 -UN-03NOV92

Slide M81306

REASON:
To remove air from fuel lines anytime fuel connections have been opened for service such as changing filters or parts.

PROCEDURE:
1. Check fuel tank for adequate fuel supply.

IMPORTANT: DO NOT start engine while bleeding fuel supply lines. Injection pump can be damaged.

2. Disconnect fuel shut-off solenoid connector.

3. Attach clear tubing to vent tube (A) and turn vent screw (B) counterclockwise to open vent.

4. Turn key switch to ON position. When fuel appears at vent tube without air bubbles, close vent screw.

5. Loosen bleed screw (C). When fuel appears at screw threads without air bubbles, tighten screw.

6. Turn key switch OFF and connect fuel shut-off solenoid connector.

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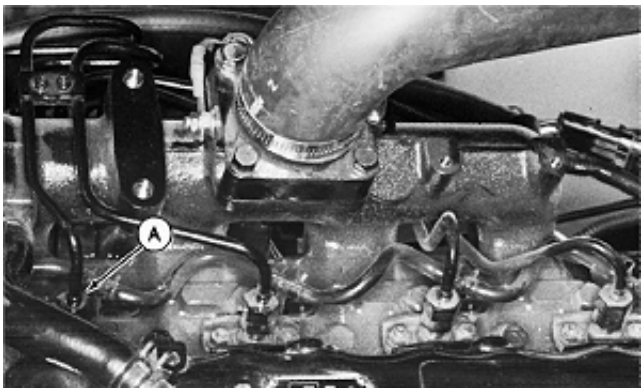
IMPORTANT: DO NOT turn pump delivery valve fittings on fuel injection pump when loosening or tightening fuel injection lines. Turning delivery valve fittings can damage pump internally.

7. Start engine.

NOTE: Cylinders are numbered 1—4, starting from the flywheel.

- If the engine runs rough, loosen fuel injection line at no. 4 injector (A). Tighten the line when fuel appears at the injector without air bubbles.

- If the engine does not start, loosen fuel injection line at no. 4 injector (A). Use starter to turn engine until fuel appears at injector without air bubbles. If necessary, repeat for remaining three injectors.



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MX,22015HV,A1A -19-18JAN93

TIME FUEL INJECTION PUMP

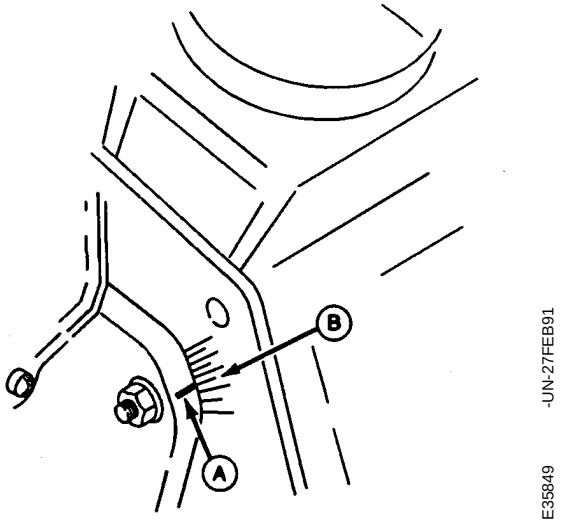
REASON:
To position injection pump for proper engine operation.

EQUIPMENT:
- JDF14 Injection Pump Adapter

PROCEDURE:

NOTE: If injection pump has been removed from engine without disturbing engine crankshaft and pump shaft, perform Step 1 only. Otherwise, perform the entire timing procedure.

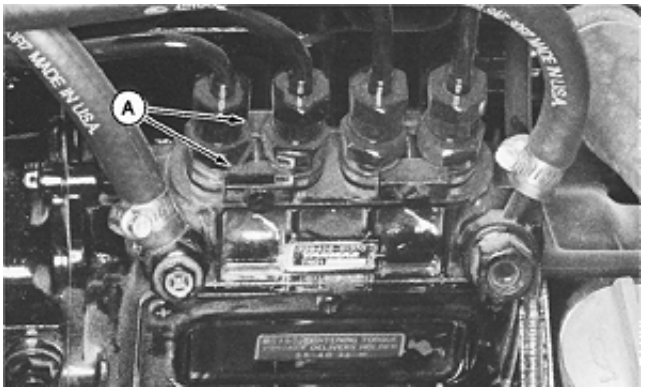
1. Align arrow or line (A) on injection pump flange with the sixth mark (B) on the timing gears plate.



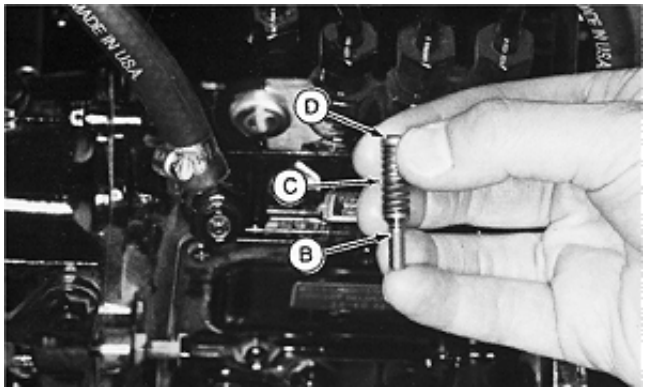
Slide E35849

MX,22015HV,A2 -19-18JAN93

TIME FUEL INJECTION PUMP—CONTINUED



Slide M81307



Slide M81308

A—Retainer **B—Delivery Valve** **C—Spring** **D—Stop**

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.

IMPORTANT: Clean the area around injection pump and lines to prevent dirt from entering the fuel injection system. Put clean diesel fuel on fingers before handling injection pump parts.

NOTE: Cylinders are numbered 1—4, starting from the flywheel end.

2. Remove cylinder no. 1 fuel injection line.

3. Loosen and remove retainers (A) to remove no. 1 delivery valve fitting from pump. Remove delivery valve (B), spring (C) and stop (D). Install and tighten delivery valve fitting.

4. Install injection pump adapter on no. 1 delivery fitting. If adapter is not available, make an adapter tool by cutting an extra fuel injection line after the first bend.

NOTE: To make sure no. 1 piston is at TDC on compression stroke, remove valve cover. If both intake and exhaust rocker arms for no. 1 cylinder are loose, piston is at TDC. If both rocker arms are not loose, turn flywheel one complete turn.

5. Remove plug from timing hole. Turn flywheel counterclockwise (as viewed from the flywheel end) until the no. 1/4 piston mark aligns with the index groove. No. 1 piston must be at top dead center (TDC) on compression stroke.

6. Put a container under adapter to collect fuel.

7. Turn key switch to ON position. DO NOT start engine. Push solenoid plunger to “hold” position.

8. Put flywheel in position so the no. 1 cylinder is at the point of fuel injection:

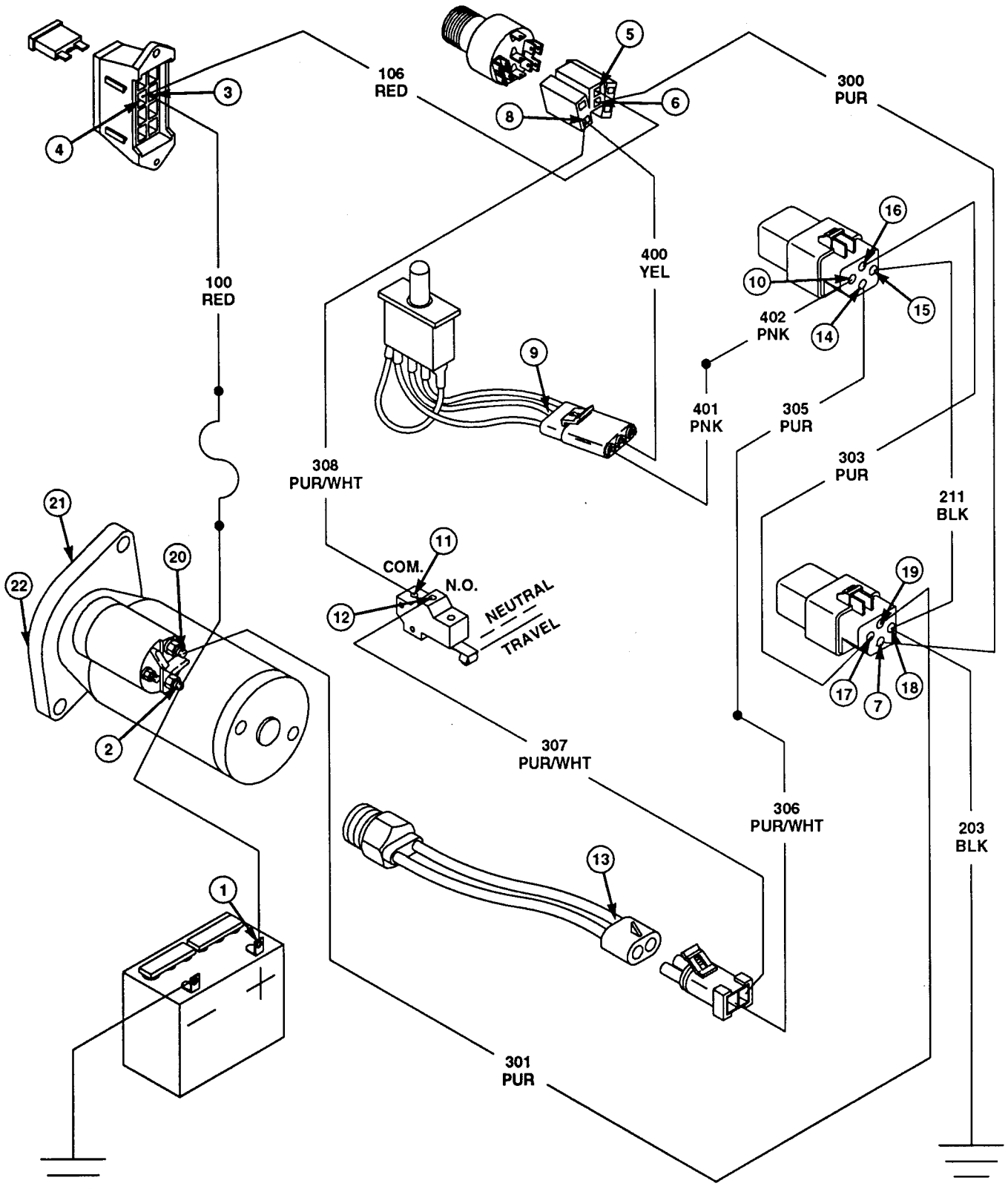
- Turn flywheel clockwise (as viewed from flywheel end) until fuel flow from adapter stops. Continue turning flywheel until fuel flows again.

IMPORTANT: If fuel flow does not stop, the no. 1 piston is on exhaust stroke instead of compression stroke. Turn flywheel one revolution counterclockwise and repeat steps 5—8.

- SLOWLY turn flywheel counterclockwise until fuel flow changes from a stream to drops and finally stops.

- Turn key switch OFF.

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CRANKING SYSTEM TEST POINTS-OPERATOR ON SEAT-3325

MX,24015HV,A3 -19-21JAN93

SLOW IDLE ADJUSTMENT

REASON:
To achieve proper slow idle rpm setting. Provides adequate rpm to keep engine operating smoothly without stalling.

EQUIPMENT:
•JT05719 Hand Held Digital Tachometer

CONNECTIONS:
1. Disconnect throttle cable.

PROCEDURE:
1. Start engine and run for 5 minutes.

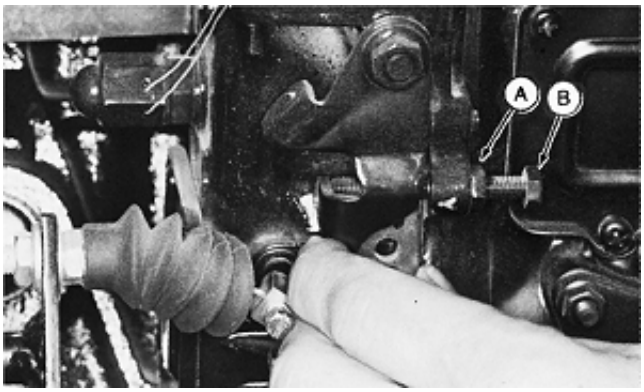
2. Make sure injection pump throttle lever is against slow idle stop screw (B).

3. Use JT05719 Hand Held Digital Tachometer to check slow idle engine speed at crankshaft pulley.

4. After slow idle speed adjustment, adjust throttle cable. (See procedure in this group.)

SPECIFICATIONS:
• Slow Idle Speed .. 1000 ± 50 rpm

RESULTS:
• If slow idle rpm is not according to specifications, loosen nut (A) and turn screw (B). After adjustment, tighten nut.



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MX,22015HV,A37 -19-18JAN93

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FAST IDLE ADJUSTMENT

REASON:
To achieve proper fast idle speed setting. This provides proper speed for PTO operation and insures that engine is operating at proper rpm's for peak performance.

EQUIPMENT:
• JT05719 Hand Held Digital Tachometer

CONNECTIONS:
1. Disconnect throttle cable.

PROCEDURE:
1. Start engine and run for 5 minutes.

2. Hold injection pump throttle lever against fast idle stop screw (B).

3. Use JT05719 Hand Held Digital Tachometer to check fast idle engine speed at crankshaft pulley.

4. After fast idle speed adjustment, adjust throttle cable. (See procedure in this group.)

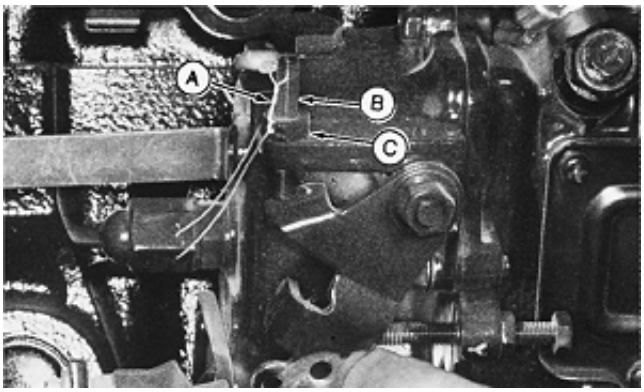
SPECIFICATIONS:
• Fast Idle Speed .. 2800 rpm

RESULTS:
NOTE: Some adjustment can be made without removing sealed wire (A). Attempt to make the adjustment before removing wire.

• If fast idle rpm is not according to specifications, loosen nut (C). Turn screw (B) until fast idle speed is correct. After adjustment, tighten nut (C).

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

• If engine still does not meet fast idle speed specifications, have pump inspected by an diesel injection service.



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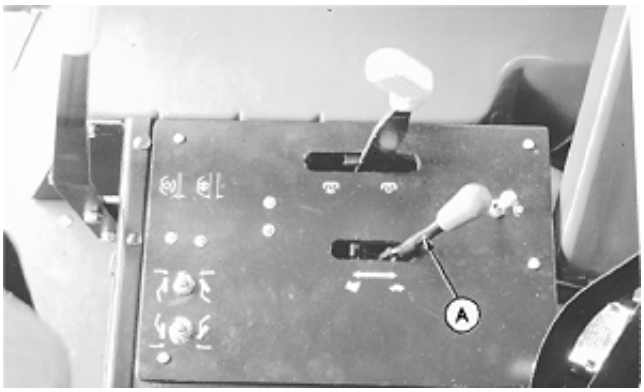
THROTTLE CABLE ADJUSTMENT

REASON:
To insure that throttle lever and cable moves governor lever fully from slow to fast idle position.

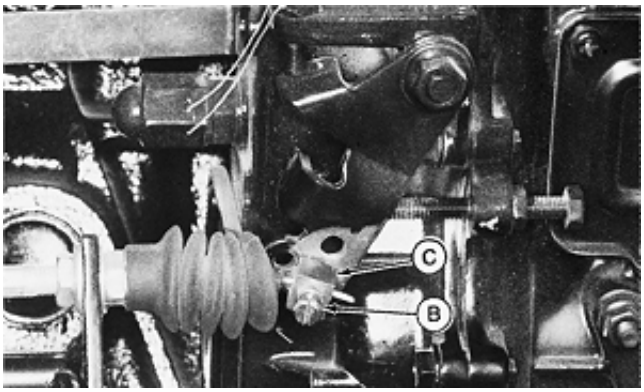
PROCEDURE:
1. Disconnect throttle cable from governor lever by loosening screw (B).

2. Move throttle lever (A) to fast idle position. Pull lever back approximately 2—3 mm (0.08—0.10 in.), measured at the switch panel.

3. Push governor lever forward against fast idle screw and install cable in pivot block (C). Tighten screw (B).



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MX,22015HV,A39 -19-18JAN93

THROTTLE LEVER ADJUSTMENT

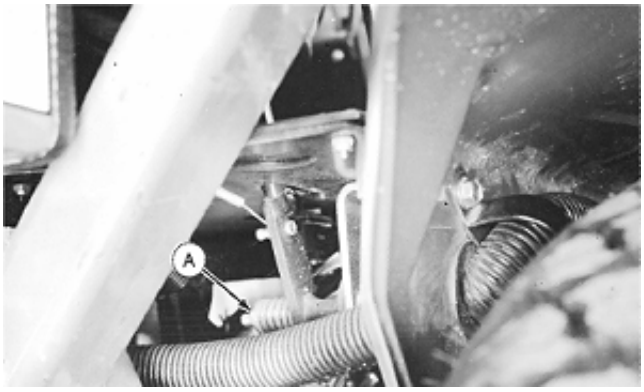
REASON:
To achieve smooth throttle lever movement with enough tension to maintain throttle setting.

CONNECTIONS:
1. Connect a spring scale near the end of the throttle lever.

PROCEDURE:
1. Tighten or loosen lock nut (A) until throttle lever movement in forward direction meets specifications.

NOTE: Make sure throttle cable is not binding or stuck.

SPECIFICATIONS:
• Force to move throttle lever .. 18 N (4 lb force)



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VALVE CLEARANCE ADJUSTMENT

NOTE: Valve clearance adjustment is made with engine cold.

REASON:
To achieve correct valve setting for proper engine operation.

PROCEDURE:

NOTE: No. 1 cylinder is closest to the flywheel. Clockwise rotation is determined by facing the flywheel.

The flywheel has three sets of timing marks with the no. 1 and no. 4 cylinders using the same set of marks.

1. Turn crankshaft clockwise until No. 1 cylinder intake valve opens.

2. Continue to turn flywheel until No. 1 timing mark (D) lines up with index groove.

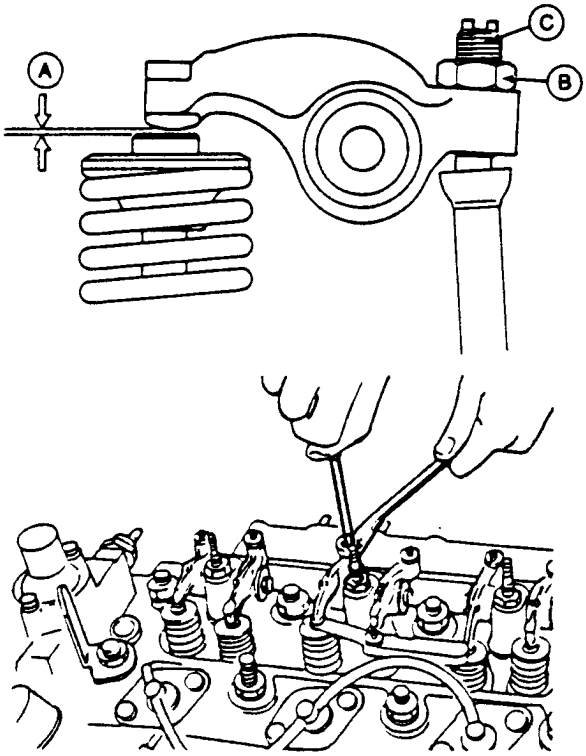
3. Measure both intake and exhaust valve clearances (A). See specifications.

4. Repeat test for No. 2—4 cylinders by turning flywheel and matching the corresponding timing marks.

SPECIFICATIONS:
• Valve Clearance .. 0.20 mm (0.008 in.)

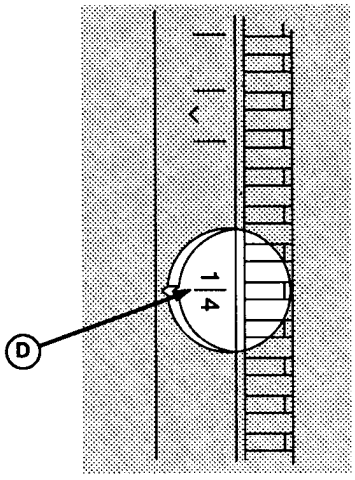
RESULTS:
• To adjust valve clearance, loosen nut (B) and turn adjusting screw (C) to correct clearance. Hold screw while tightening nut.

A—Clearance
B—Jam Nut
C—Adjusting Screw
D—Timing Mark (TDC)



M46955 -UN-03MAR92

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M81468AE -UN-17NOV92

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FAN BELT ADJUSTMENT

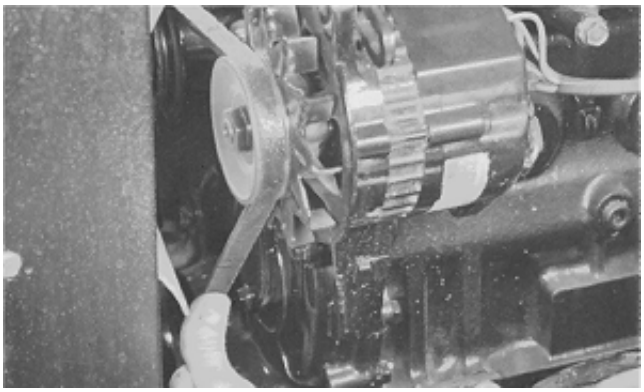
REASON:
To keep proper tension on belt to drive fan, water pump and alternator.

EQUIPMENT:
• JDST28 Belt Tension Gauge

PROCEDURE:
1. Use JDST28 Belt Tension Gauge to check belt deflection (A) between alternator pulley and crankshaft pulley. See specifications.

SPECIFICATIONS:
• Applied force .. 95 N (20 lb force)
• Deflection .. 13 mm (1/2 in.)

RESULTS:
• If deflection is not according to specifications, loosen alternator mounting strap cap screw and adjust as necessary.



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Section 230
FUEL/AIR OPERATION, TESTS AND ADJUSTMENTS

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COMPONENT LOCATION INFORMATION

This group contains component location drawings for the following fuel/air system components:

- Fuel System Components
- Air System Components

Use the drawings when diagnosing a fuel/air problem and to help locate the components to be tested.

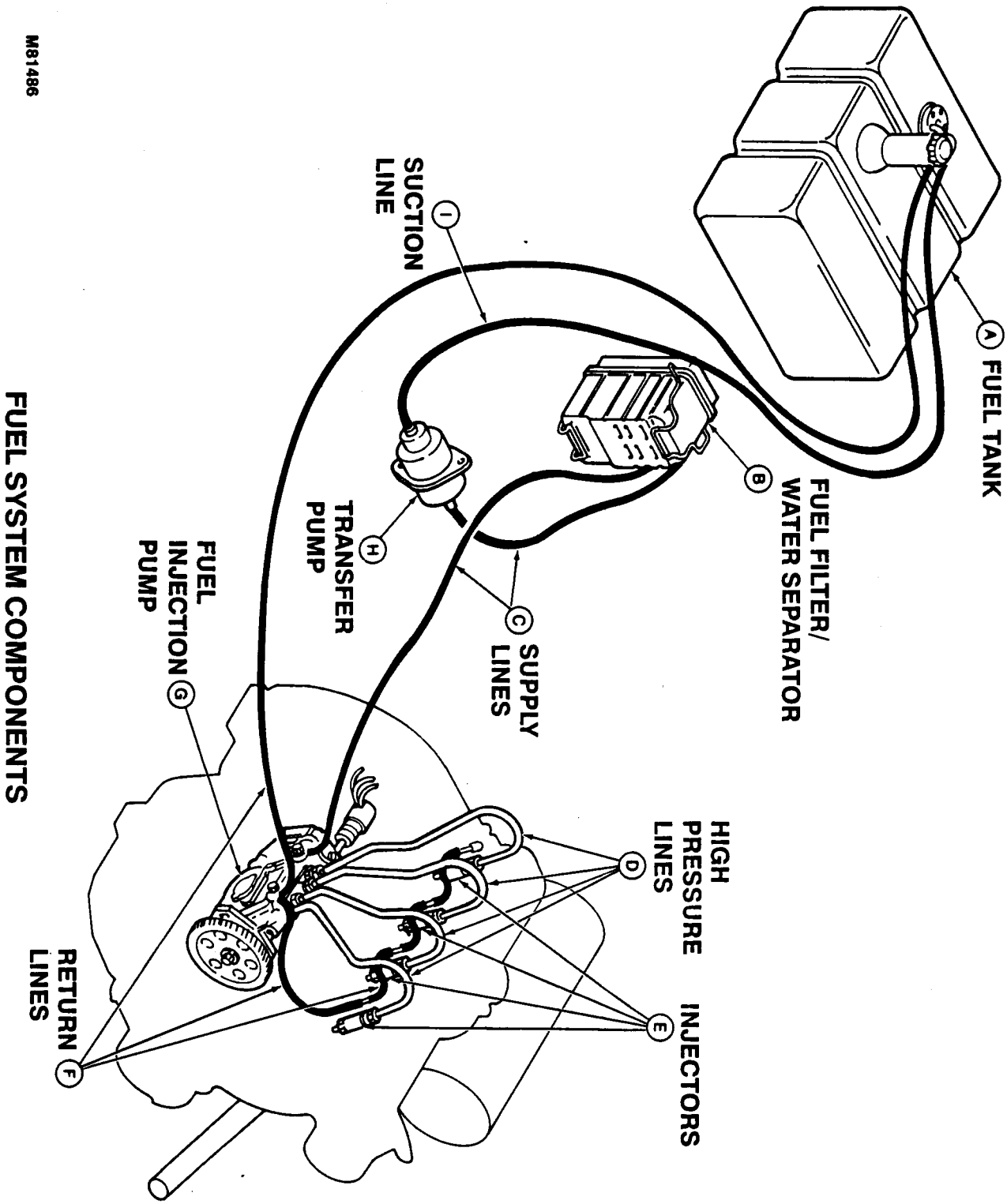
MX,23005HV,A1 -19-18JAN93

FUEL SYSTEM COMPONENTS

A—Fuel Tank
B—Water Separator
C—Supply Lines
D—High Pressure Lines
E—Injectors
F—Return Lines
G—Fuel Injection Pump
H—Transfer Pump
I—Suction Line

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MX,23005HV,A2 -19-18JAN93



MX,23005HV,A3 -19-18JAN93

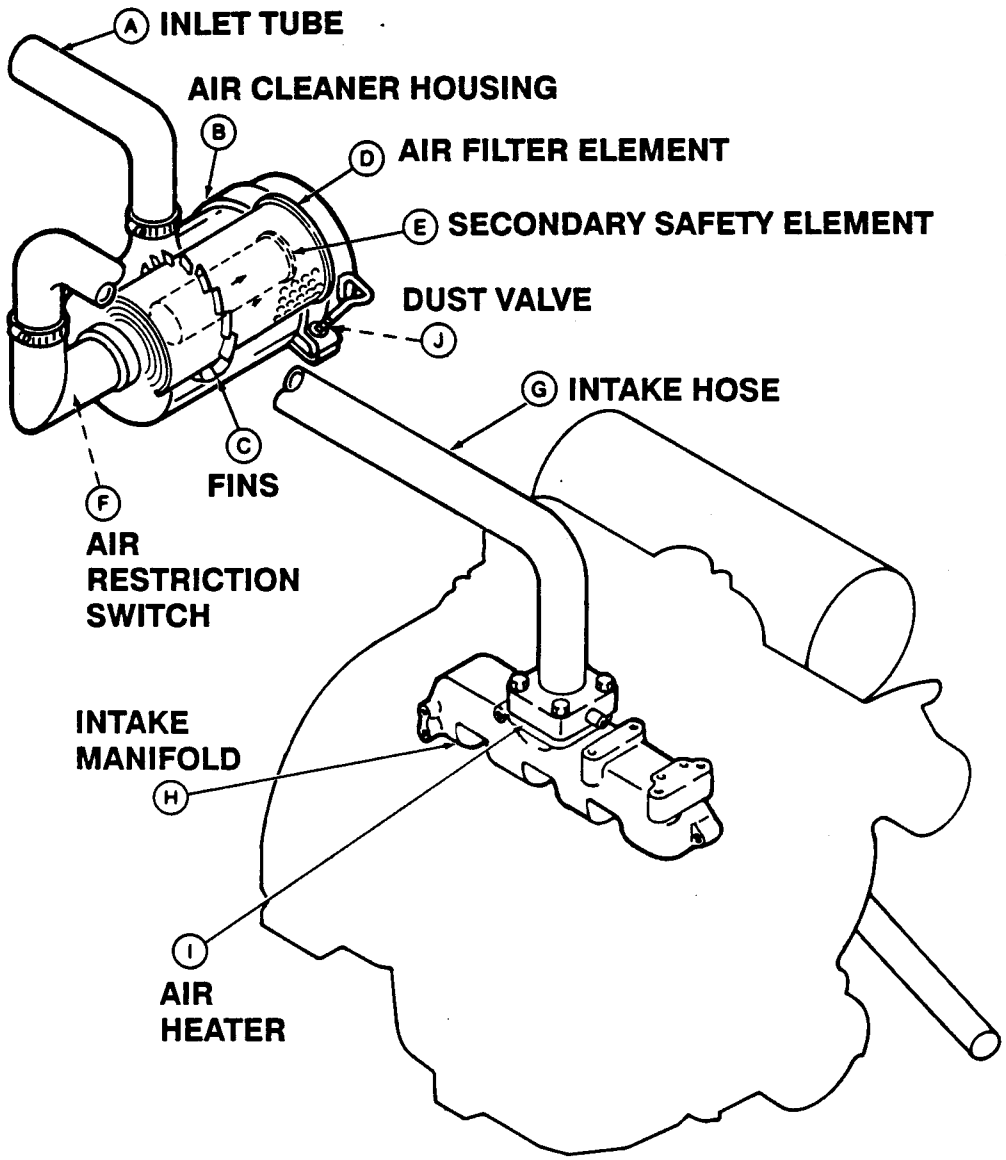
AIR SYSTEM COMPONENTS

A—Inlet Tube
B—Air Cleaner Housing
C—Fins
D—Air Filter Element
E—Secondary Safety Element
F—Air Restriction Switch
G—Intake Hose
H—Intake Manifold
I—Air Heater

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AIR SYSTEM COMPONENTS

M81488 -19-01DEC92

MX,23005HV,A5 -19-18JAN93

THEORY OF OPERATION INFORMATION

This group divides the fuel/air system into individual components or sub-systems by function. The story contains information on function, component or sub-system identification, and theory of operation.

The following systems or components are covered:
- Fuel System
- Air System

The slide number reference under the art is used for service training purposes only.

MX,23010HV,A1 -19-18JAN93

FUEL SYSTEM OPERATION

A—Fuel Tank
B—Fuel Level Sensor Assembly
C—Suction Line
D—Transfer Pump
E—Fuel Filter/Water Separator
F—Injection Pump
G—Return Lines
H—Injection Lines
I—Fuel Shutoff Solenoid
J—Injectors
K—Supply Lines

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FUNCTION:
Fuel system supplies fuel to injectors for combustion.

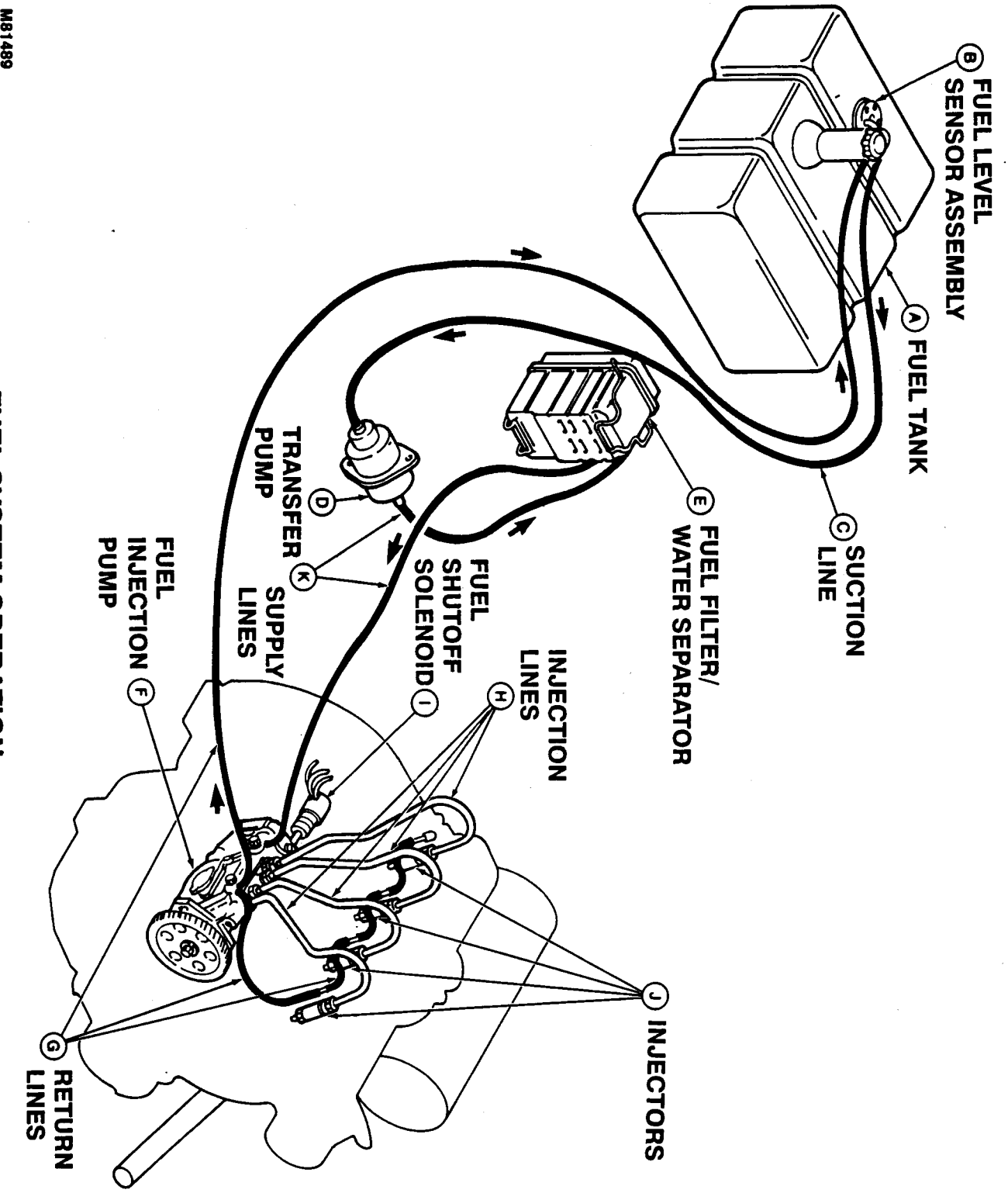
MAJOR COMPONENTS:
- Fuel Tank
- Fuel Transfer Pump
- Fuel Filter/Water Separator
- Injection Pump
- Injectors
- High Pressure Fuel Lines
- Supply Lines
- Return Lines
- Fuel Shutoff Solenoid

THEORY OF OPERATION:
The transfer pump (D) draws fuel from the fuel tank (A). The transfer pump forces fuel under low pressure through the fuel filter (E) and to the injection pump (F). Fuel not used by the injection pump circulates back to the fuel tank. The injection pump meters fuel as determined by the governor and delivers the fuel at high pressure to the injector nozzles (J).

The injector nozzle prevents flow until high pressure is reached, opening the valve, and spraying atomized fuel into the combustion chamber. Injection lines have trapped fuel whenever injection is not taking place.

Small amounts of fuel are allowed to leak past the nozzles for cooling and lubrication. This return flow is routed through return lines (G) and joins the return fuel flow from the injection pump back to the fuel tank.

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MX,23010HV,A3 -19-18JAN93

FUEL INJECTION PUMP OPERATION (BOTTOM OF STROKE)

A—Low Pressure Fuel
B—Trapped Fuel
C—Fuel Injection Line
D—Fuel Inlet Fitting
E—Inlet Orifice
F—Barrel
G—Control Rack
H—Roller Tappet
I—Camshaft
J—Control Sleeve
K—Plunge
L—Fuel Gallery
M—Valve Seat
N—Delivery Valve
O—Spring

Slide MXC48491

FUNCTION:
Injection pump supplies high pressure fuel to injectors.

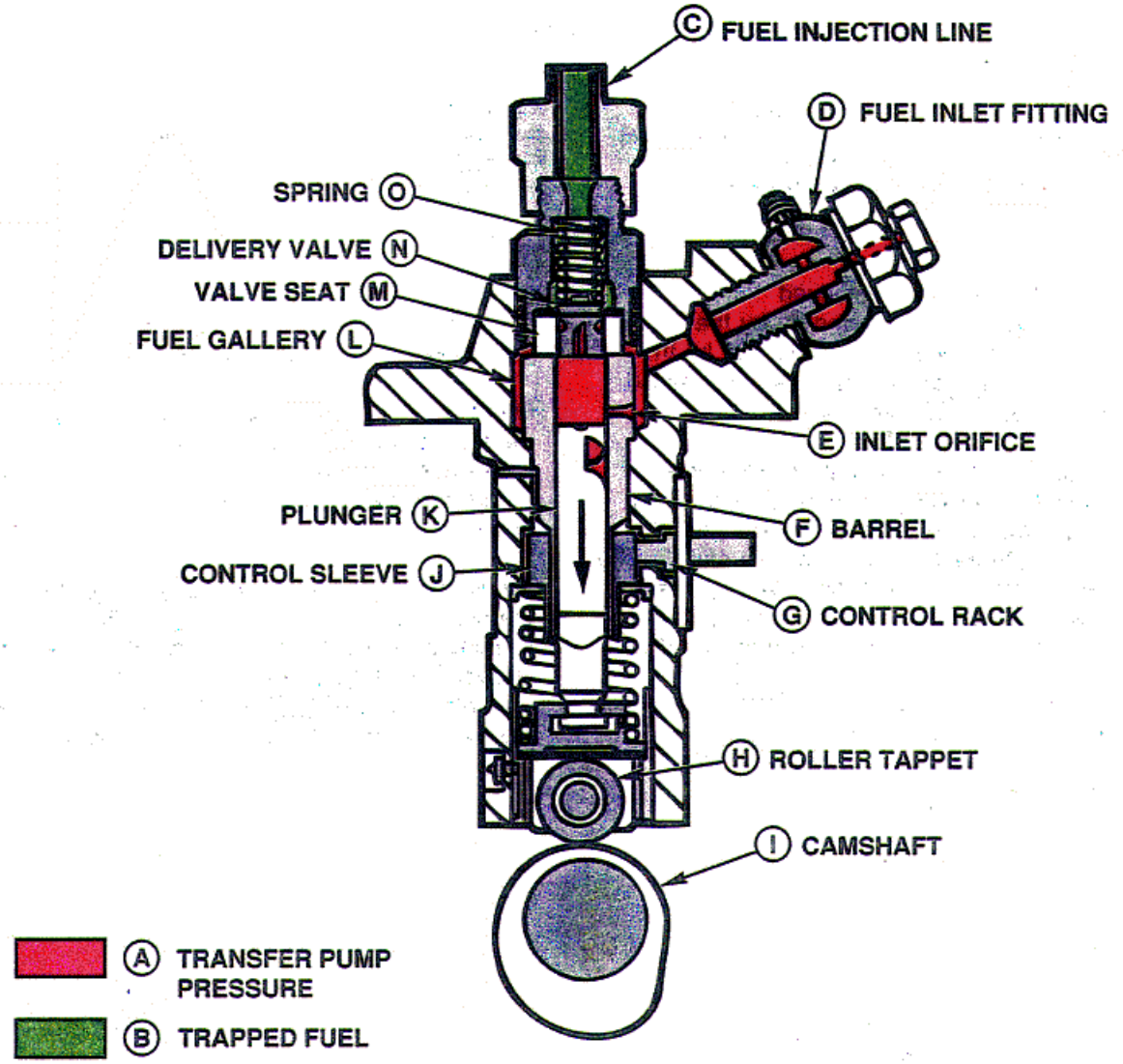
MAJOR COMPONENTS:
- Fuel Injection Lines
- Fuel Inlet Fitting
- Barrel
- Control Rack
- Roller Tappet
- Camshaft
- Control Sleeve
- Plunger
- Valve Seat
- Delivery Valve
- Spring

THEORY OF OPERATION:
The fuel injection pump is a variable-displacement, in-line plunger-type pump. It is located on the left side of the engine. The pump is driven by a camshaft (I) which turns at one-half engine speed.

When the plunger (K) is in the downward position, filtered low pressure fuel (A) from the fuel transfer pump flows through the fuel inlet fitting (D), to the fuel gallery (L). Fuel flows from the fuel gallery through the inlet orifice (E) and fills the plunger area.

Whenever the plunger is in the downward position, the delivery valve (N) is held closed against the valve seat (M), by spring pressure (O) and trapped fuel pressure (B). In this position, fuel flow to the fuel injection line (C) and nozzle is blocked.

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MXC48491

INJECTION PUMP OPERATION (Bottom of Stroke)

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MX,23010HV,A5 -19-18JAN93

INJECTION PUMP OPERATION (PUMP AT TOP OF STROKE)

A—High Pressure Fuel
B—Low Pressure Fuel
C—Fuel Injection Line
D—Fuel Inlet Fitting
E—Inlet Orifice
F—Plunger Groove (Helix)
G—Barrel
H—Control Rack
I—Roller Tappet
J—Camshaft
K—Control Sleeve
L—Plunger
M—Fuel Gallery
N—Valve Seat
O—Delivery Valve
P—Spring

Slide MXC48492

THEORY OF OPERATION—continued
When the roller tappet (I) is moved up by the camshaft (J), the inlet orifice (E) is blocked by the plunger (L). Fuel in the plunger area is compressed and forced against the delivery valve (O).

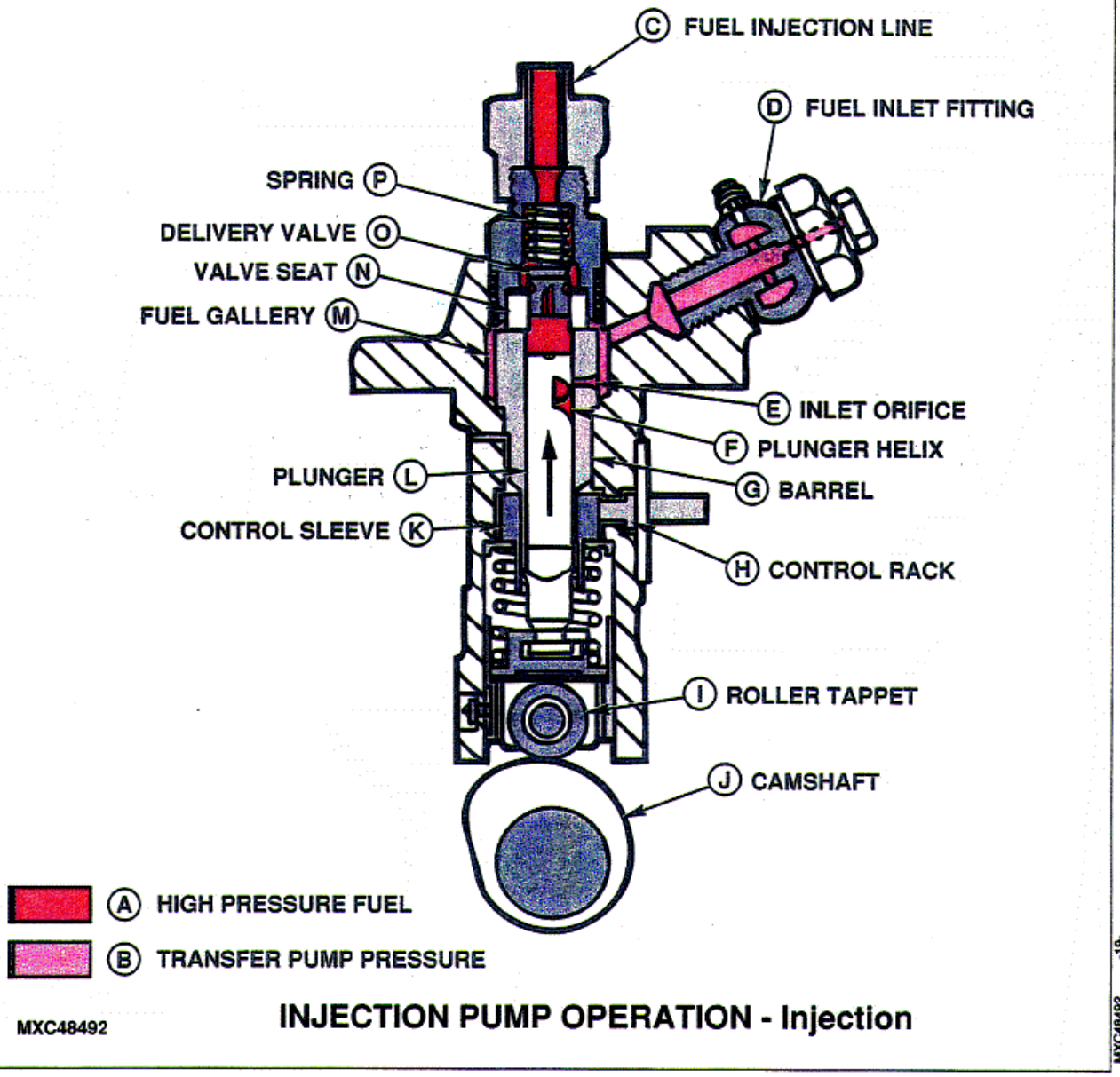
When fuel pressure is high enough to overcome spring (P), the delivery valve is lifted upward off the vale seat (N). High pressure fuel (A) flows past the delivery valve to the fuel injection line (C) and then to the fuel injection nozzle. The delivery valve is held open, only the fuel pressure in the plunger area is greater than the delivery valve spring pressure (P).

As the plunger continues moving upward, the plunger groove (F) aligns with the inlet orifice (E). The pressure in the plunger area is higher than the pressure in the fuel gallery (M). This causes fuel to flow from the plunger area, through the plunger groove and inlet orifice to the fuel gallery.

Fuel flow through the inlet orifice causes pressure in the plunger area to decrease. With pressure equal on both sides of the delivery valve, spring force closes the delivery valve and stops the fuel flow to injection nozzle.

A governor-operated control rack (H) is connected to the control sleeve (K) and plunger (L) to regulate the quantity of fuel delivery to the nozzles. The control sleeve turns the plunger and increases or decreases the amount of plunger movement before the plunger groove (F) and inlet orifice (E) are aligned.

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INJECTION PUMP OPERATION - Injection

MX,23010HV,A7 -19-18JAN93

DIRECT INJECTION NOZZLE OPERATION

A—High Pressure Fuel
B—Return Fuel
C—Return Pipe
D—Dowel Pin
E—Seat
F—Nozzle Nut
G—Nozzle Valve Seat
H—Injector Holes
I—Nozzle Body
J—Nozzle Valve
K—Retainer
L—Spring
M—Shim

Slide MXC70747

FUNCTION:
To atomize fuel into engine cylinder.

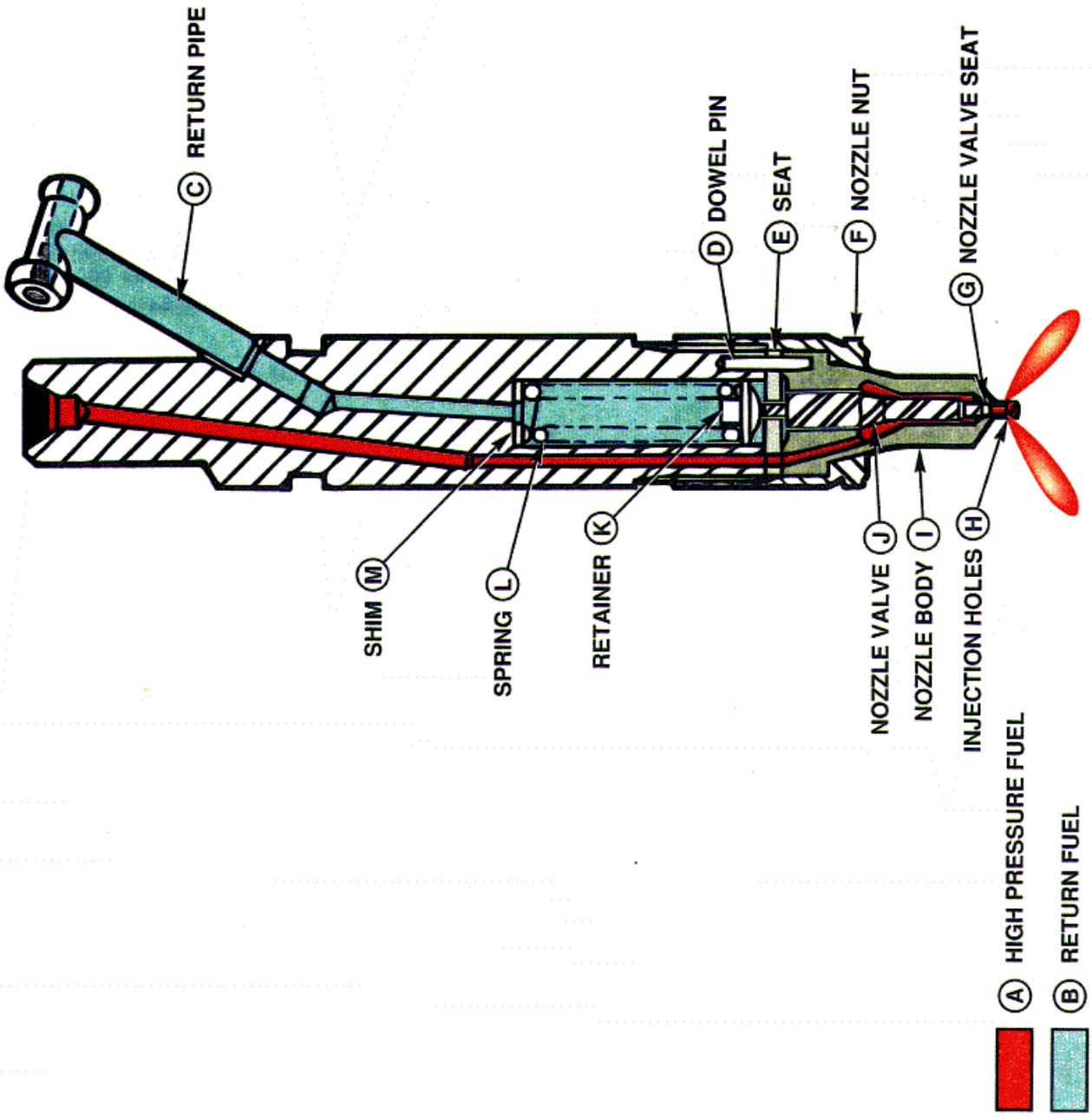
MAJOR COMPONENTS:
- Nozzle Body
- Nozzle Valve
- Spring
- Injector Holes
- Nozzle Valve Seat
- Return Pipe

THEORY OF OPERATION:
The fuel injection nozzle used in direct injection engines is a multi-hole type that sprays atomized fuel directly into the cylinder.

Fuel from injection pump flows through inlet passage to the shim adjusted nozzle valve (J). When the pressure is high enough the valve is pushed off its seat (G), injecting fuel through the holes (H).

A small amount of fuel leaks past nozzle valve to lubricate the internal components, then returns to the tank through the fuel return pipe (C).

MX,23010HV,A8 -19-18JAN93



DIRECT INJECTION NOZZLE OPERATION (Hole Type)

MXC70747 -19-

MX,23010HV,A9 -19-18JAN93

DIRECT INJECTION COMBUSTION CHAMBER

A—Piston Swirl Cup
B—Combustion Chamber
C—Intake Valve
D—Injector
E—Exhaust Valve
F—High Pressure Fuel

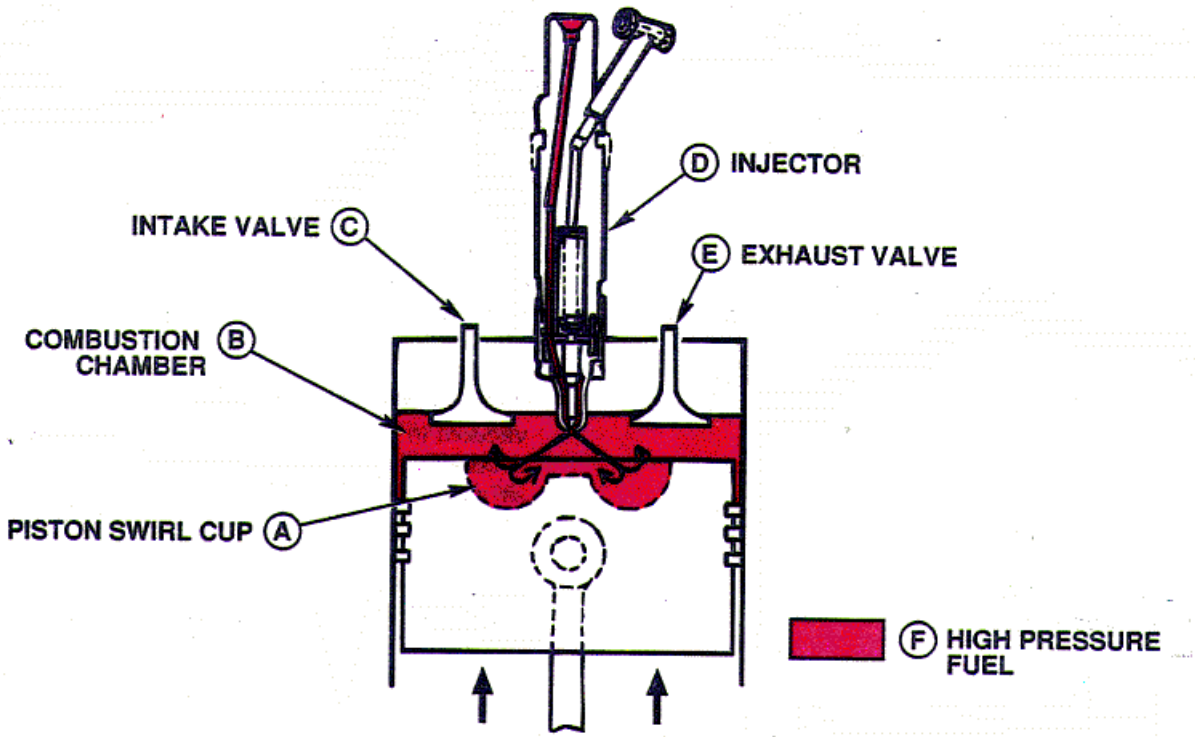
FUNCTION:
To assist in mixing fuel and air.

MAJOR COMPONENTS:
- Combustion Chamber
- Piston

THEORY OF OPERATION:
The 3325 and 3365 mower engines use the direct system of injection. The swirl chamber is formed in the head of the piston (A). As the piston travels upward on its compression stroke, the shape of the chamber causes the air to swirl as it is compressed and heated. At 17° BTDC crankshaft rotation, fuel is injected by the multi-hole injector (D). The swirling action of the air thoroughly mixes the atomized fuel and air for complete burning, as the piston travels into the power stroke.

When starting a cold engine, compression of ambient temperature air may not provide enough heat for ignition. To aid cold temperature starting an electrically operated heater element is located at the intake manifold inlet. The heater is energized when the key switch is on and the engine compartment temperature is 20°C (68°F). An air heater controller cycles the heater on and off as necessary.

MX,23010HV,A10 -19-18JAN93



MXC70749

DIRECT INJECTION COMBUSTION CHAMBER

A—Piston Swirl Cup
B—Combustion Chamber
C—Intake Valve
D—Injector
E—Exhaust Valve
F—High Pressure Fuel

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MX,23010HV,A11 -19-18JAN93

AIR INTAKE SYSTEM OPERATION

A—Inlet Tube
B—Air Cleaner Housing
C—Fins
D—Air Filter Element
E—Secondary Safety Element
F—Air Restriction Switch
G—Intake Hose
H—Intake Manifold
I—Intake Air Heater
J—Dust Valve

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FUNCTION:
Air intake system filters are needed for combustion. It also heats the intake air for aid in cold weather starting.

MAJOR COMPONENTS:
- Air Cleaner
- Air Filter Element
- Secondary Safety Element
- Air Restriction Switch
- Intake Hose
- Intake Air Heater
- Intake Manifold

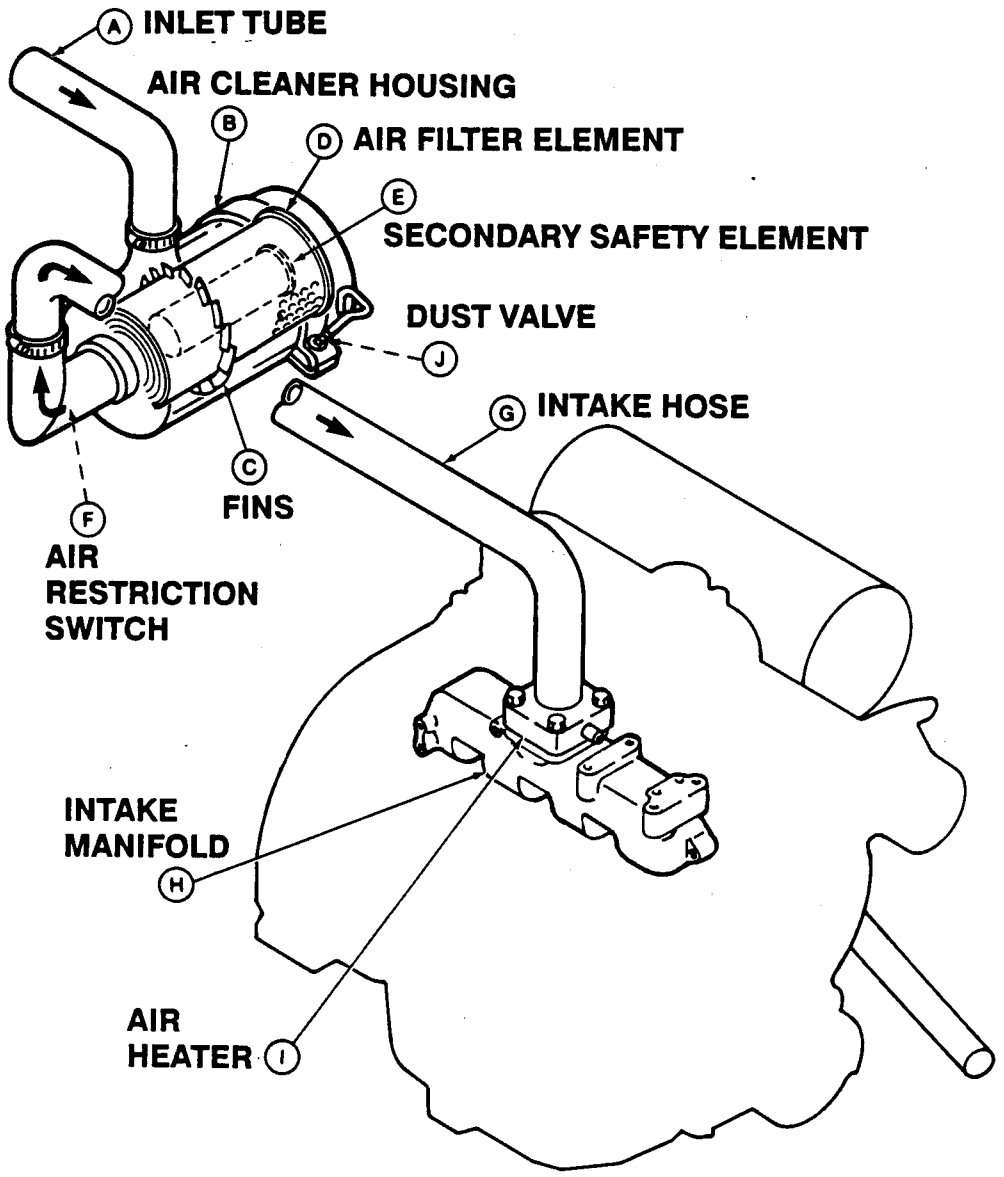
THEORY OF OPERATION:
Air enters through the inlet tube (A) and flows to air cleaner housing (B). Fins (C) placed at an angle, direct air around primary element (E) in a circular motion, throwing larger particles to the dust valve (J). Air is then directed through a secondary element (E), through intake hose (G), through the intake air heater (I), and then into the intake manifold (H).

The dust valve (J) is like a one-way valve. It closes and does not let air into the air cleaner housing. The operator can squeeze the valve to let the large filtered particles out.

An air restriction switch (F) senses the amount of vacuum in the intake system. A small amount of vacuum is always present due to some restriction of air movement through the filter elements. The vacuum increases as the filter elements become plugged. The switch closes its contacts when the vacuum reaches the set point of the switch. This lights the air filter indicator lamp. The most restriction normally occurs when the engine is operated at wide open throttle. An air intake leak will cause the air restriction switch not to function properly.

The intake air heater (I), is the cold weather starting aid. It heats the air as air passes through the hot heating element. Warm air then enters the intake manifold.

MX,23010HV,A12 -19-18JAN93



AIR INTAKE SYSTEM OPERATION

M81487 -19-01DEC92

MX,23010HV,A13 -19-18JAN93

FUEL/AIR DIAGNOSIS, TESTS AND ADJUSTMENTS

FOR THIS PRODUCT, ALL DIAGNOSIS, TESTS AND ADJUSTMENTS FOR THE FUEL/AIR SYSTEM ARE DISCUSSED IN SECTION 220 GROUP 15. THIS IS DONE SINCE MANY ENGINE COMPLAINTS CAN BE CAUSED BY THE FUEL/AIR SYSTEM AND DIAGNOSING THEM SEPARATELY IS DIFFICULT.

MX,23015HV,A1 -19-18JAN93

Section 240
ELECTRICAL OPERATION, TESTS AND ADJUSTMENTS

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COMPONENT LOCATION INFORMATION

This group contains component location drawings for the following electrical system components:

- Turf Mower
- Instrument Panel

Use the drawings when troubleshooting an electrical problem to locate the electrical components to be tested.

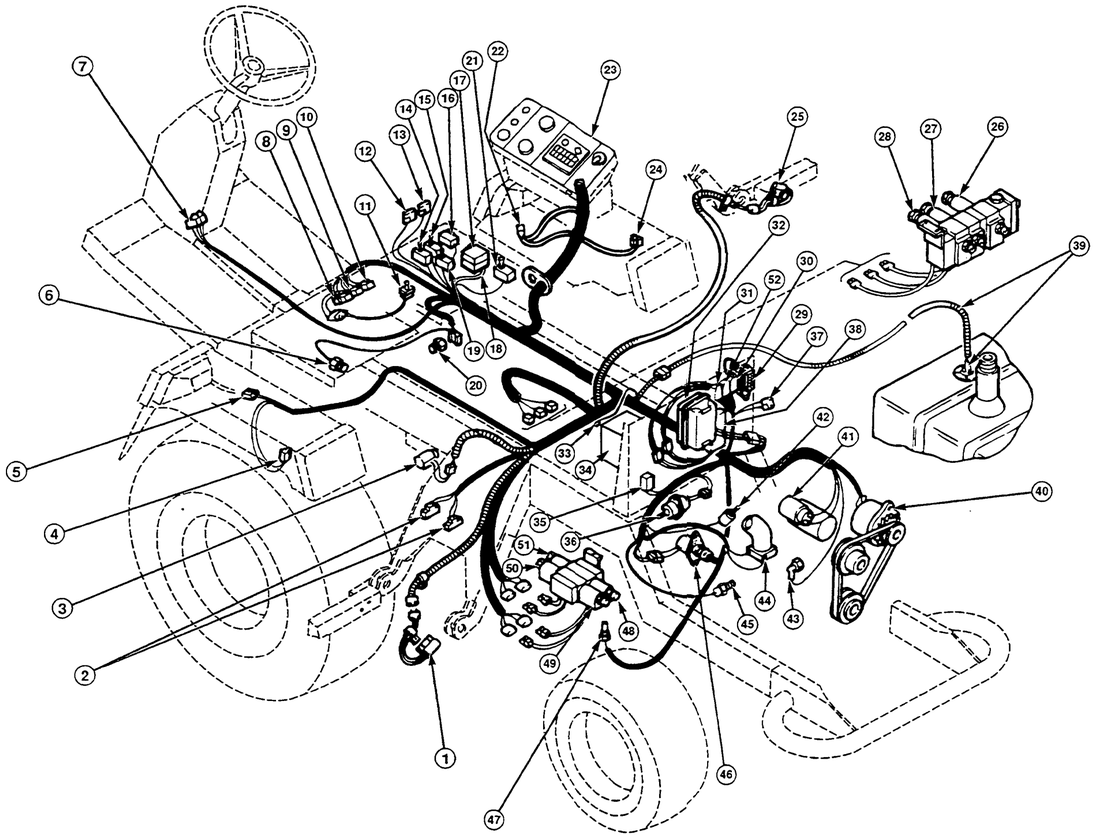
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TURF MOWER ELECTRICAL COMPONENTS LOCATION

1—Left Wing Mercury Switch
2—Transmission Neutral Switches
3—Weight Transfer Valve Solenoid
4—Left Work Light
5—Left Headlight
6—Transmission Temperature Switch
7—Brake Switches
8—Mow Relay
9—Right Wing Relay
10—Left Wing Relay
11—Seat Switch
12—Left Wing Diode
13—Right Wing Diode
14—Left Wing Switch
15—Right Wing Switch
16—Mow Switch
17—Right Wing Switch
18—Left Wing Switch
19—Optional Weight Transfer Switch
20—PTO Clutch Switch
21—Backlap Switch
22—Right Headlight
23—Instrument Panel
24—Right Work Light
25—Right Wing Mercury Switch
26—Center Reels Control Solenoid
27—Right Reel Control Solenoid
28—Left Wheel Control Solenoid
29—Fuse Block
30—Neutral Start Relay
31—Seat Relay
32—Water-in-Fuel Sensor
33—Ground Connection
34—Battery
35—Air Heater
36—Fuel Transfer Pump
37—Seat Relay Diode
38—TDC Module
39—Fuel Lever Sensor
40—Alternator
41—Starter/Solenoid
42—Air Restriction Switch
43—Water Temperature Sensor
44—Engine Air Heater
45—Oil Pressure Switch
46—Fuel Shut-Off Solenoid
47—Hydraulic Oil Temperature Switch
48—Right Wing Lift Solenoid
49—Left Wing Lift Solenoid
50—Left Wing Lower Solenoid
51—Right Wing Lower Solenoid
52—Start-Enable Relay (3365 only)

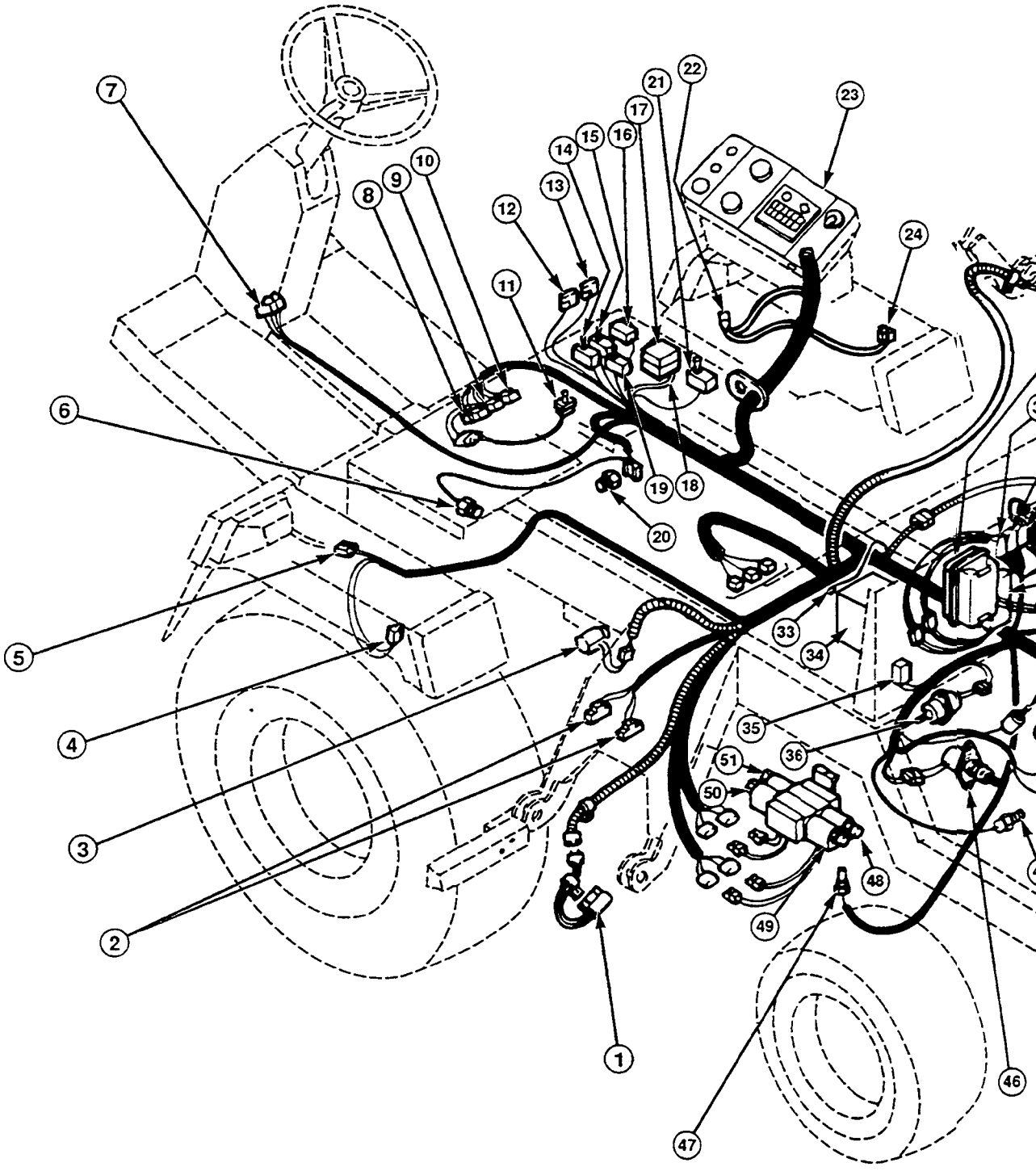
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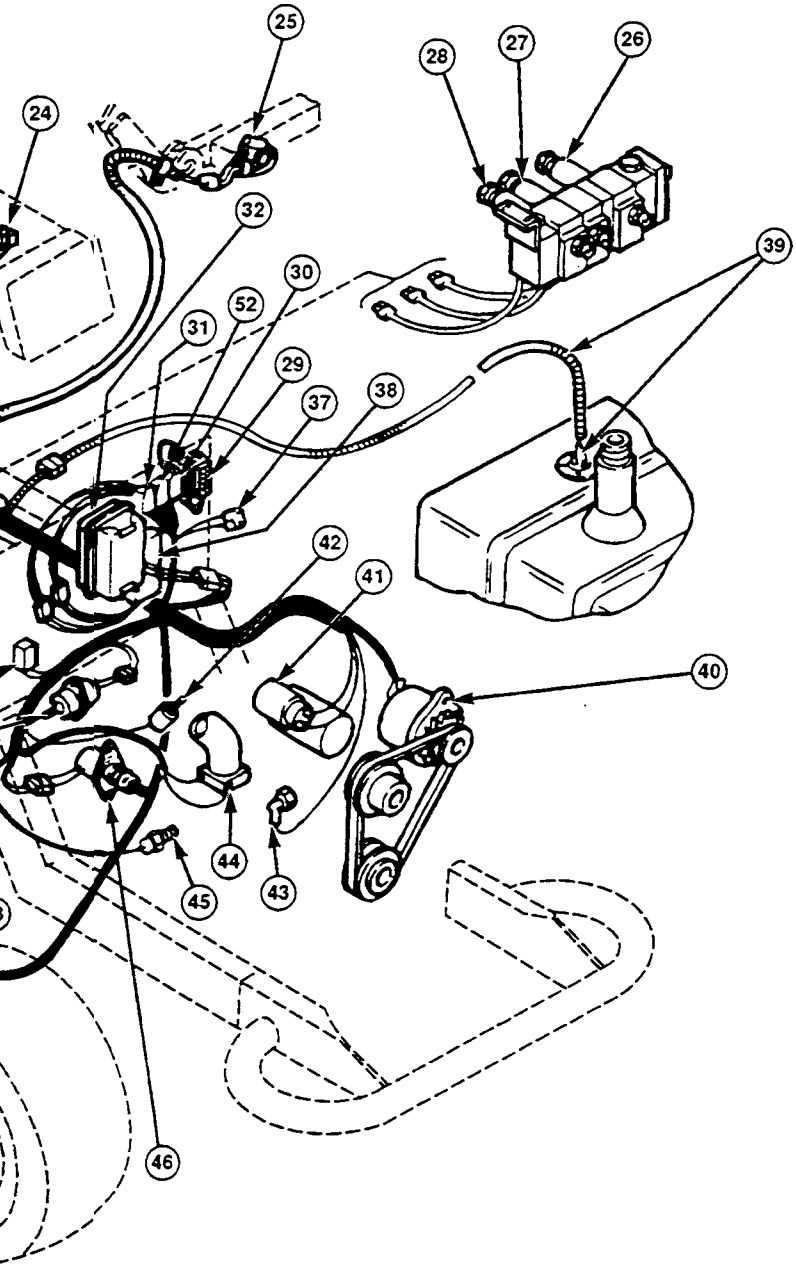
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3325/3365 PROFESSIONAL TURF MOWER ELECTRICAL COMPONENTS LOCATION



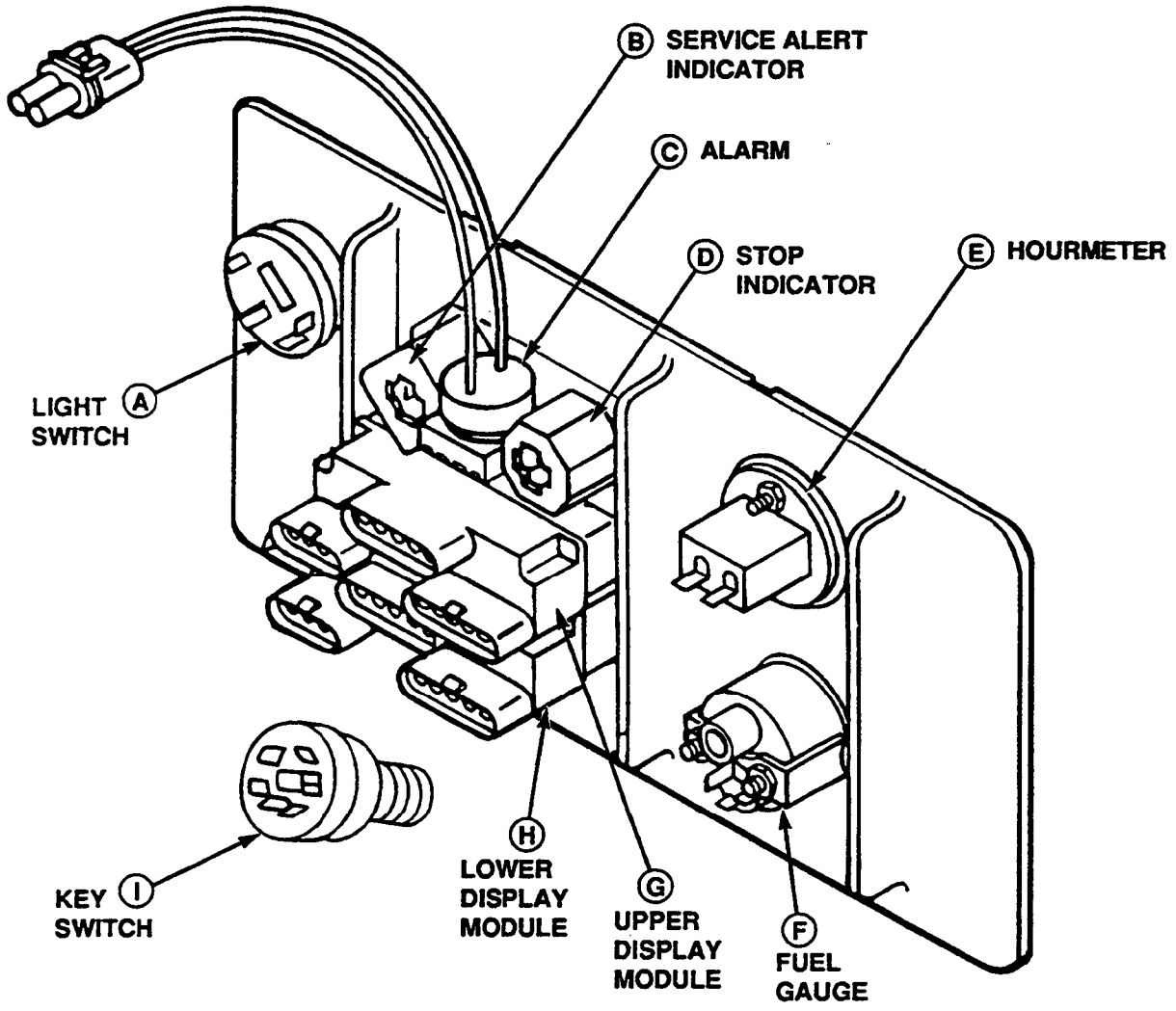
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3325/3365 PROFESSIONAL TURF MOWER ELECTRICA



ELECTRICAL COMPONENTS LOCATION

INSTRUMENT PANEL COMPONENTS LOCATION



M80943AE

M80943AE -19-

A—Light Switch
B—Service Alert Indicator
C—Alarm
D—Stop Indicator
E—Hourmeter
F—Fuel Gauge
G—Upper Display Module
H—Lower Display Module
I—Key Switch

Slide M80943AE

THEORY OF OPERATION INFORMATION

This group divides the electrical system into individual circuits by function. Each circuit has been isolated from the main wiring schematic and only shows the components that are used in that circuit. The theory of operation story explains: function of circuit, operation conditions, components used, and current flow.

The circuit schematic that accompanies each theory story is drawn in the operating condition with the battery or power circuit at the top and the ground circuit at the bottom. COLOR HIGHLIGHT IS USED TO IDENTIFY DIFFERENT SUB-CIRCUITS. THE COLOR USED IS NOT NECESSARILY THE COLOR OF THE WIRE.

The following systems or components are covered:

- Cranking System Operation
  - —Operator On Seat—3325
  - —Operator Off Seat—3325
  - —Operator On Seat—3365
  - —Operator Off Seat—3365
- Fuel Control System Operation
  - —Operator On Seat
  - —Operator Off Seat
  - —Seat Override
- Engine Air Heater System Operation
- Charging System Operation
- Warning Alarm Circuits Operation
- Service Alert Circuits Operation
- Hourmeter Operation
- Fuel Gauge Operation
- Lighting System Operation
- Cutting Units Control Operation
  - —Left Wing Raise
  - —Right Wing Raise
  - —Left Wing Lower
  - —Right Wing Lower
  - —Mow
  - —Backlap
  - —Weight Transfer

The slide number reference under the art is used for service training purposes to match the piece of technical manual art to the correct slide.

MX,24010HV,A1 -19-21OCT92

CRANKING SYSTEM OPERATION—OPERATOR ON SEAT—3325

A—Power Circuit
B—Seat Switch Circuit
C—Neutral/PTO Circuit
D—Start Solenoid Circuit
E—Ground Circuit
F—Battery
G—Fusible Link
H—20-Amp Fuse
I—Key Switch
J—Seat Switch
K—Neutral Switch
L—Neutral Start Relay
M—Starter
N—Seat Relay
O—PTO Switch

Slide MXC80948AE

FUNCTION:
To engage starter motor when starting conditions are met.

OPERATING CONDITIONS:
To engage starter motor, the following conditions must be met:
- Operator on the seat
- PTO disengaged
- Travel pedals in neutral position.

MAJOR COMPONENTS:
- Battery
- Fusible Link
- 20 Amp Fuse
- Key Switch
- Seat Switch
- Seat Relay
- Neutral Switch
- PTO Switch
- Neutral Start Relay
- Starter

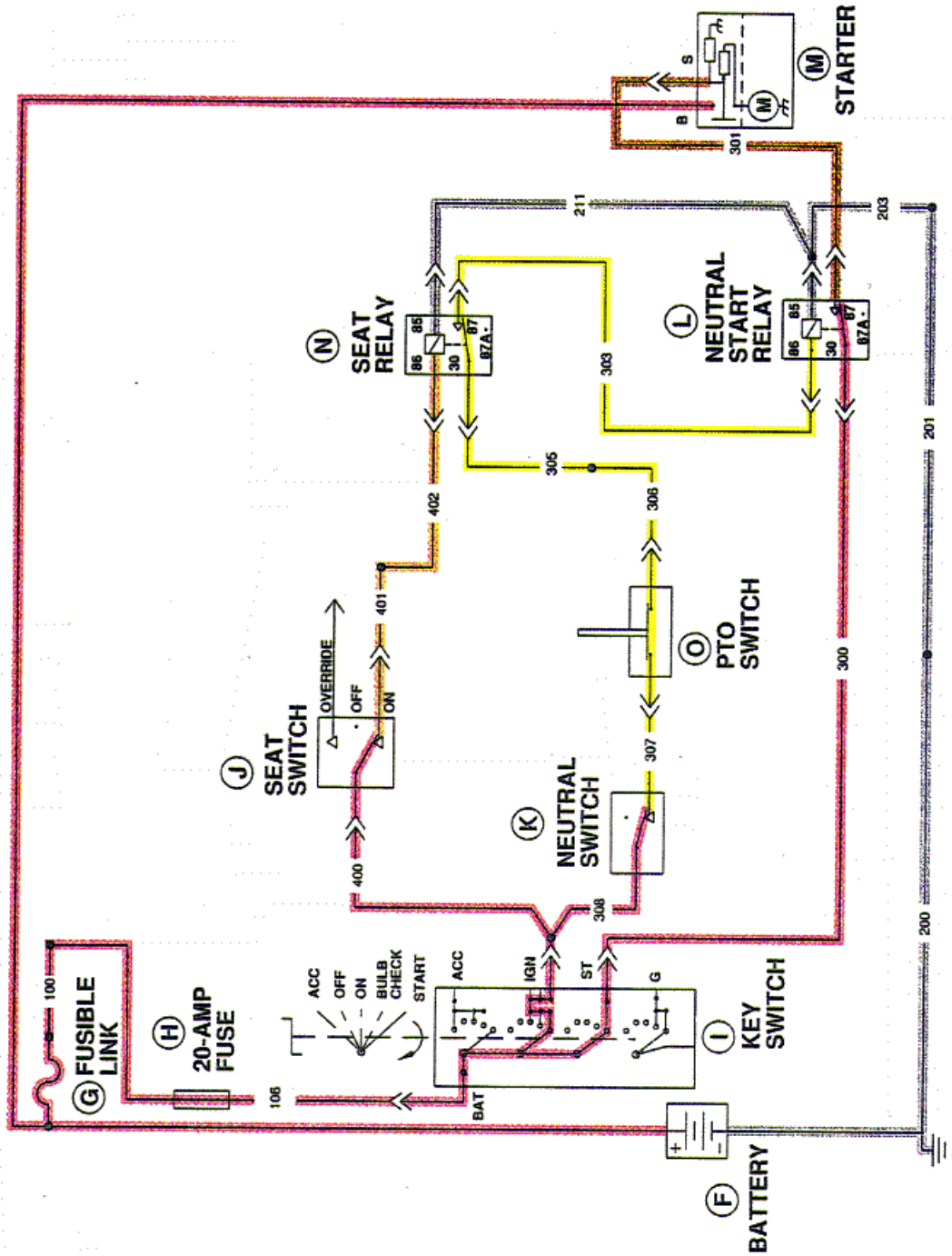
THEORY OF OPERATION:
Current flows in circuit (A) from the battery (F) to the starter (M) and key switch (I) through fusible link (G) and 20 amp fuse (H). When the key switch is in the START position, current flows to the seat switch (J) and neutral switch (K) from IGN terminal.

With operator on the seat, current in circuit (B) flows from the seat switch to the seat relay (N) coil. The energized coil makes contact between terminals 30 and 87 of seat relay.

Putting travel pedals in neutral makes contact between common and normally open terminals of neutral switch (K). In circuit (C), current flows to the PTO switch (O). When PTO is disengaged, PTO switch is closed and current continues flowing to seat relay terminal 30. The seat switch energizes the seat relay so current can continue flowing through seat relay to neutral start relay (L) coil. The energized coil makes contact between terminals 30 and 87 of neutral start relay.

Current also flows from the ST terminal of the key switch when in the START position. Current flows to terminal 30 of the neutral start relay (L). When the neutral start relay is energized, circuit (D) current flows from terminal 87 of the relay to the S terminal of the starter. The starter solenoid energizes and engages the starter.

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MX,24010HV,A12 -19-21JAN93

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CRANKING SYSTEM OPERATION—OPERATOR OFF SEAT—3325

A—Power Circuit
B—Neutral/PTO/Brake Circuit
C—Start Solenoid Circuit
D—Ground Circuit
E—Battery
F—Fusible Link
G—20-Amp Fuse
H—Key Switch
I—Neutral Switch
J—Neutral Start Relay
K—Starter
L—PTO Switch
M—Brake Switch

Slide MXC80949AE

FUNCTION:
To engage starter motor when starting conditions are met.

OPERATING CONDITIONS:
To engage starter motor, the following conditions must be met if operator is off the seat:
- Travel pedals in neutral position
- PTO disengaged
- Parking brake engaged

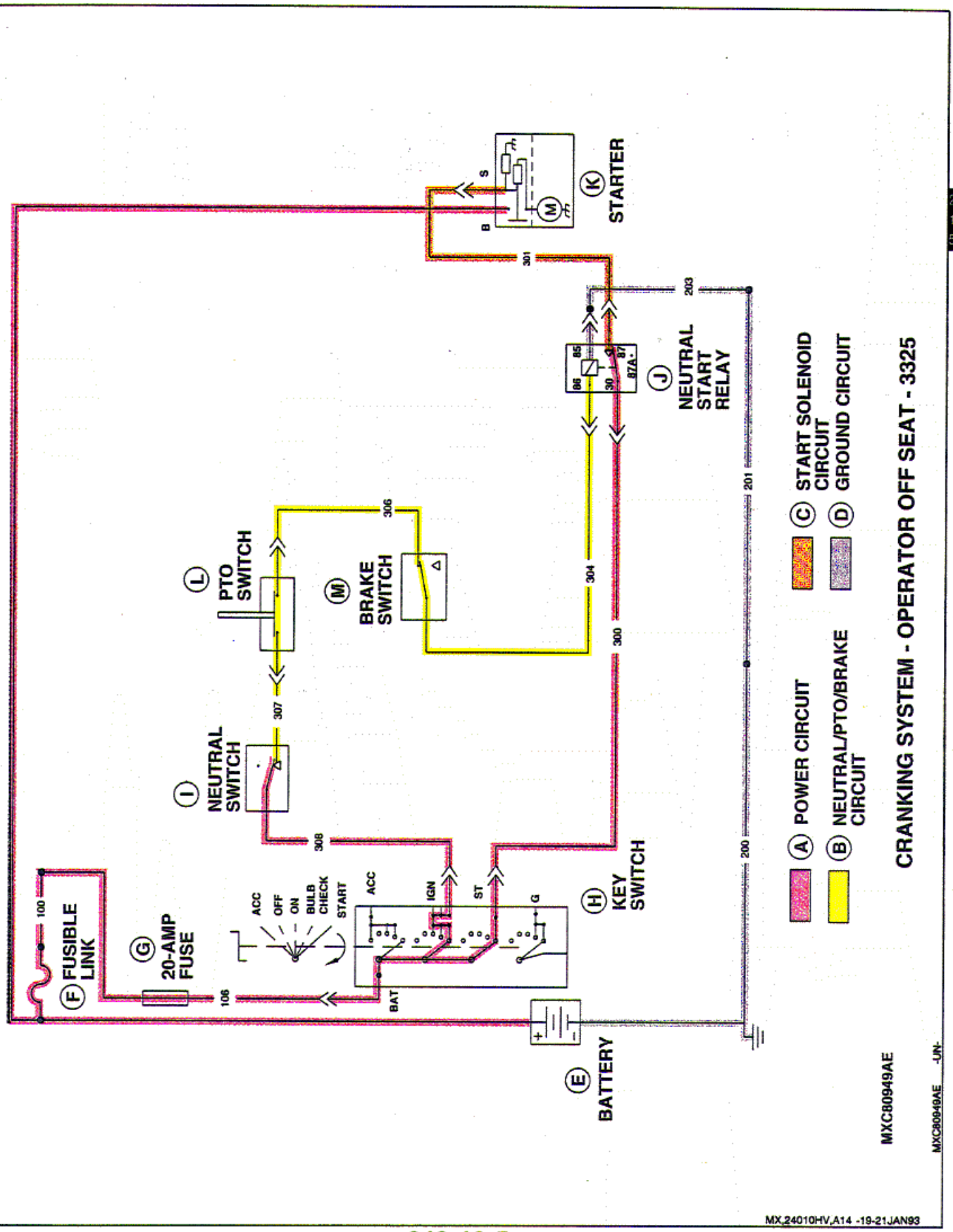
MAJOR COMPONENTS:
- Battery
- Fusible Link
- 20 Amp Fuse
- Key Switch
- Neutral Switch
- PTO Switch
- Brake Switch
- Neutral Start Relay
- Starter

THEORY OF OPERATION:
Current in circuit (A) flows from the battery (E) to the starter (K) and key switch (H) through the fusible link (F) and 20 amp fuse. When the key switch is in the START position, current flows to the neutral switch (I).

With travel pedals in neutral, current flows from common terminal to normally open terminal of neutral switch. Current in circuit (B) continues to the PTO switch (L). When PTO is disengaged, PTO switch is closed and current flows to normally closed terminal of the brake switch (M). Since brakes are engaged, current can flow to the common terminal of the brake switch and to the neutral start relay (J) coil. The energized coil connects terminals 30 and 87.

When the key switch is in the START POSITION, current flows from the ST terminal, to terminal 30 of the neutral start relay. When the neutral start relay energizes, circuit (C) current flows from terminal 87 of the relay to the S terminal of the starter. The starter solenoid energizes and engages the starter.

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MX,24010HV,A14 -19-21JAN93

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CRANKING SYSTEM OPERATION—OPERATOR ON SEAT—3365

A—Power Circuit
B—Seat Switch Circuit
C—Neutral/PTO/Brake Circuit
D—Neutral Start Circuit
E—Start—Enable Circuit
F—Ground Circuit
G—Battery
H—Fusible Link
I—20-Amp Fuse
J—Key Switch
K—Seat Switch
L—Neutral Switch
M—Neutral Start Relay
N—Start—Enable Relay
O—Starter
P—Seat Relay
Q—PTO Switch
R—Brake Switch

Slide MXC80966AE

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FUNCTION:
To engage starter motor when starting conditions are met.

OPERATING CONDITIONS:
To engage starter, the following conditions must be met:
- Operator on seat
- Travel pedals in neutral position
- PTO disengaged

MAJOR COMPONENTS:
- Battery
- Fusible Link
- 20 Amp Fuse
- Key Switch
- Seat Switch
- Seat Relay
- Neutral Switch
- PTO Switch
- Neutral Start Relay
- Start-Enable Relay
- Starter

THEORY OF OPERATION:
Current in circuit (A) flows from the battery (G) to the starter (O), start-enable relay (N) and key switch (J) through fusible link (H) and 20 amp fuse (I). When the key switch is in the START position, current flows to the seat switch (K), neutral switch (L) and terminal 86 of neutral start relay (M).

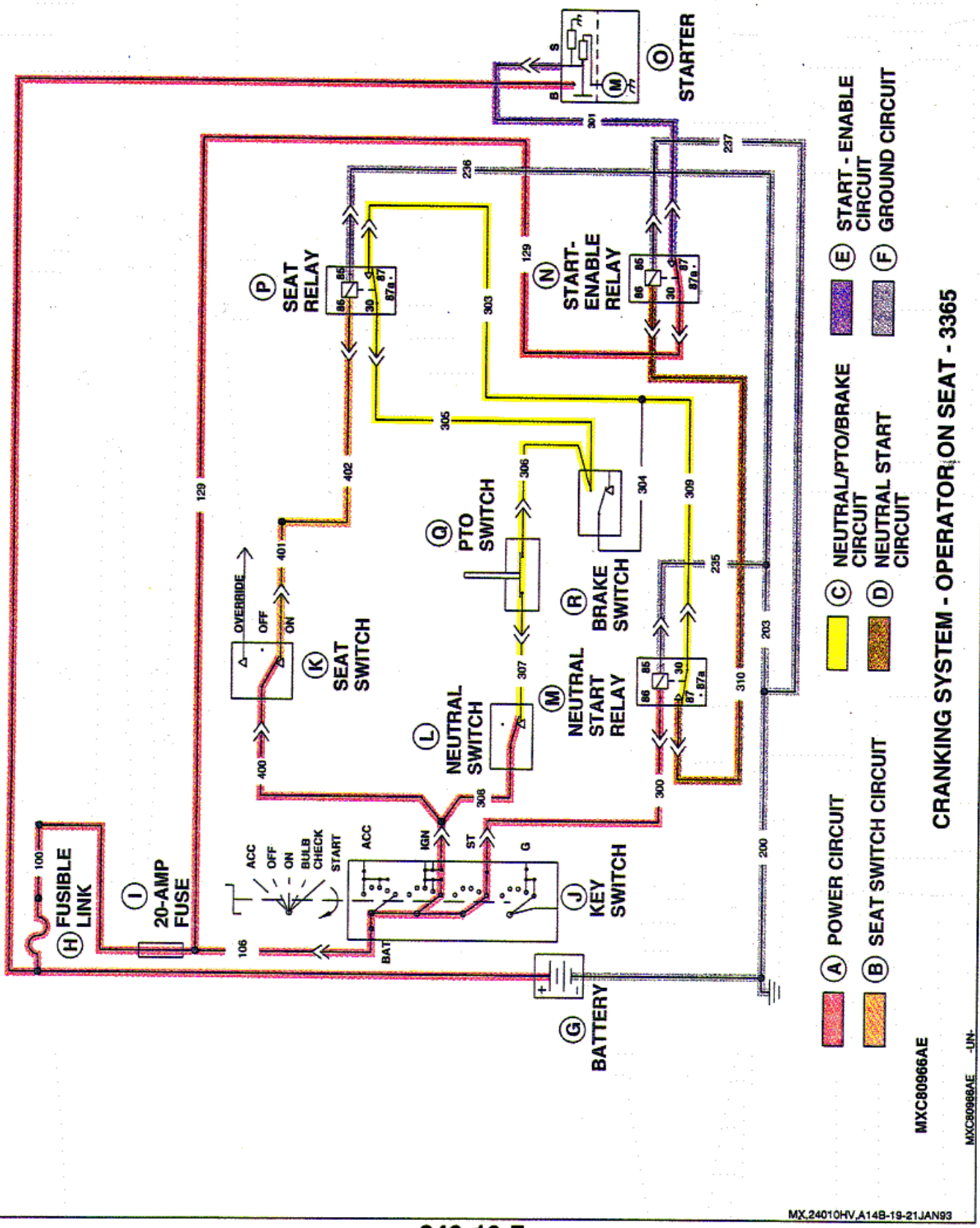
With operator on the seat, current in circuit (B) flows from the seat switch to the seat relay (P) coil. The energized coil makes contact between terminals 30 and 87 of seat relay.

Putting travel pedals in neutral makes contact between common and normally open terminals of neutral switch (L). In circuit (C), current flows to the PTO switch (Q). When PTO is disengaged, PTO switch is closed and current continues flowing to seat relay terminal 30. The seat relay energizes so current can continue flowing to neutral start relay terminal 30. The neutral start relay coil energizes by current from terminal ST of the key switch. Continuity exists between terminals 30 and 87.

Current in circuit (D) from the neutral start relay flows to the start-enable relay (N), energizing the coil. The coil makes contact between terminals 30 and 87.

The start-enable relay allows current to flow through circuit (E) to starter solenoid terminal S. This current engages starter and turns the engine.

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MX,24010HV,A14B-19-21JAN93

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CRANKING SYSTEM OPERATION—OPERATOR OFF SEAT—3365

A—Power Circuit
B—Neutral/PTO/Brake Circuit
C—Neutral Start Circuit
D—Start-Enable Circuit
E—Ground Circuit
F—Battery
G—Fusible Link
H—20-Amp Fuse
I—Key Switch
J—Seat Switch
K—Neutral Switch
L—Neutral Start Relay
M—Start-Enable Relay
N—Starter
O—Seat Relay
P—PTO Switch
Q—Brake Switch

Slide MXC80967AE

FUNCTION:
To engage starter motor when starting conditions are met.

OPERATING CONDITIONS:
To engage starter motor, the following conditions must be met if operator is off the seat:
- Travel pedals in neutral position
- PTO disengaged
- Parking brake engaged

MAJOR COMPONENTS:
- Battery
- Fusible Link
- 20 Amp Fuse
- Key Switch
- Neutral Switch
- PTO Switch
- Brake Switch
- Neutral Start Relay
- Start—Enable Relay
- Starter

THEORY OF OPERATION:
Current in circuit (A) flows from the battery (F) to the starter (N), start-enable relay (M) and key switch (I) through the fusible link (G) and 20 amp fuse (H). When the key switch is in the START position, current flows to the seat switch (J), neutral switch (K) and terminal 86 of neutral start relay (L).

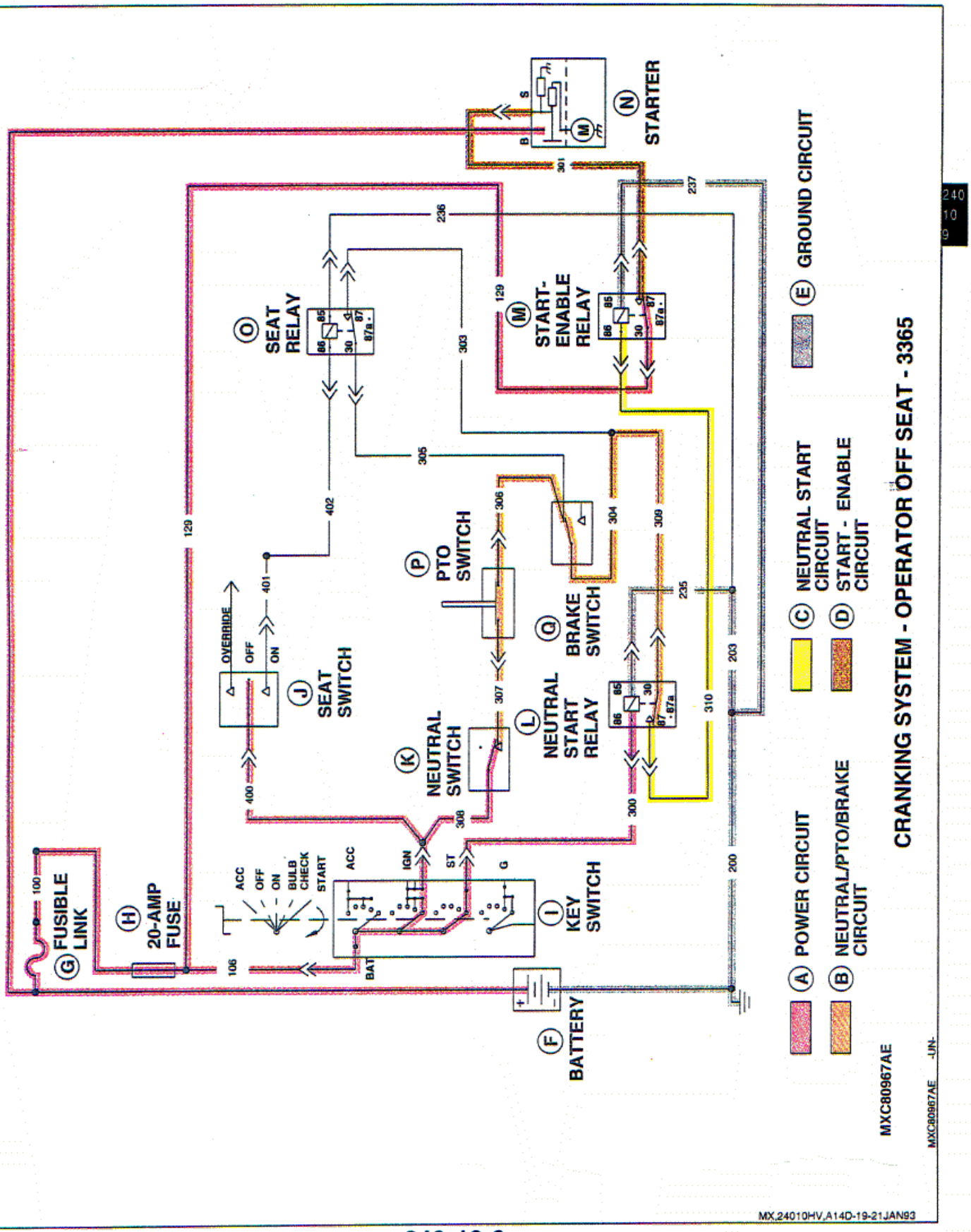
With operator off the seat, current flow stops at seat switch (J).

With travel pedals in neutral, there is continuity between common and normally open terminals of neutral switch (K) is made. In circuit (B), current flows to the PTO switch (P). When PTO is disengaged, PTO switch closes and current continues flowing to brake switch (Q). When the brakes are engaged, the common and normally closed terminals of the brake switch make contact. Current continues to flow to the neutral start relay, terminal 30.

The neutral start relay coil energizes by current flowing from terminal ST of the key switch. This current closes contacts between terminals 30 and 87. Circuit (C) current flows from neutral start relay to the start-enable relay coil, energizing the relay.

The energized start-enable relay coil closes contacts 30 and 87. Current can flow through circuit (D) to the starter solenoid terminal S engaging the starting motor.

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FUEL CONTROL SYSTEM OPERATION—OPERATOR ON SEAT

A—Power Circuit
B—Seat Switch Circuit
C—Fuel Solenoid Hold-in Circuit
D—Fuel Solenoid Pull-in Circuit
E—Ground Circuit
F—Battery
G—Fusible Link
H—20-Amp Fuse
I—Key Switch
J—Seat Switch
K—TDC (Time Delay Control) Module
L—25-Amp Fuse
M—Seat Diode
N—Hold-in Relay
O—Pull-in Relay
P—Fuel Pump
Q—Fuel Shut-off Solenoid
R—Seat Switch Time Delay
S—Seat Switch Transistor
T—Pull-in Time Delay

Slide MXC80944AE

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FUNCTION:
Controls the flow of fuel to the injection pump.

OPERATING CONDITIONS:
Before engine will start or operate, fuel must be supplied to the injection pump. Fuel control system is activated when key switch is in ON or START position and operator is on the seat.

MAJOR COMPONENTS:
- Battery
- Fusible Link
- 25 Amp Fuse
- 20 Amp Fuse
- Time Delay Control (TDC) Module
- Key Switch
- Seat Switch
- Seat Switch Diode

THEORY OF OPERATION:
Current in circuit (A) flows from the battery (F) through the fusible link (G) and 20 amp fuse (H) to the key switch (I). Current also flows through the 25 amp fuse (L) to the TDC module (K), pull-in relay (O) terminal. When the key switch is in the ON or START position, current flows from IGN terminal to the TDC module hold-in relay (N) terminal.

From key switch IGN terminal, current also flows to the seat switch (J). With the operator on the seat, the seat switch contacts close. Current in circuit (B) flows through the seat diode (M). From the diode, current flows to the IC (integrated circuit) for seat switch time delay (R) in the TDC module. The IC energizes the seat transistor (S). Current also flows to the TDC module hold-in relay (N) coil.

From the coil, current flows to the seat switch transistor. Since the IC energized the seat switch transistor, circuit (B) current can flow to ground. This energizes the hold-in relay coil, closing the relay contacts.

From the hold-in relay, current in circuit (C) flows:

- through diode to hold-in relay coil. This keeps the hold-in coil energized.

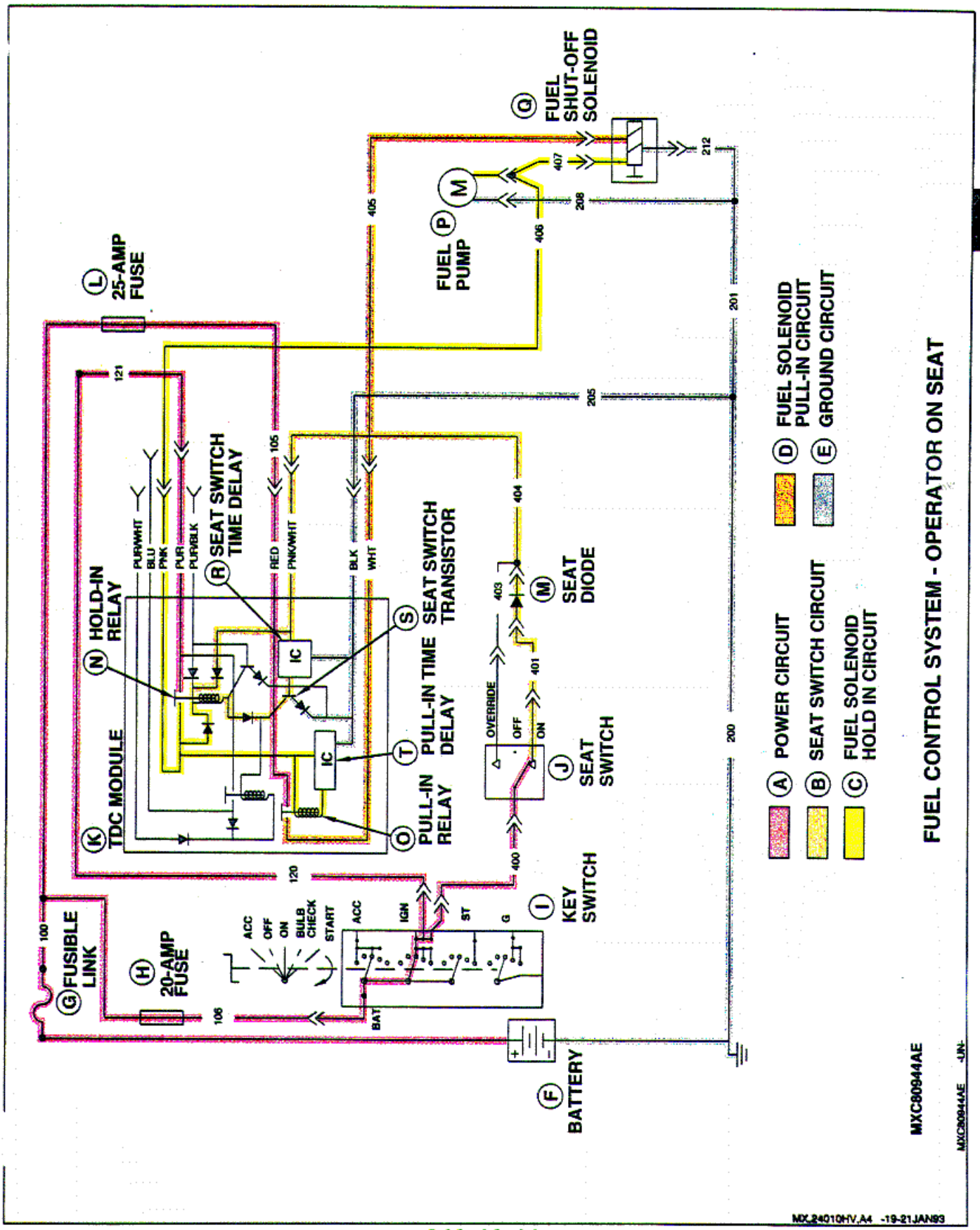
- to pull-in time delay IC (integrated circuit) (T) and pull-in relay (O) coil. The IC starts a timer and allows current to flow through the pull-in relay coil for approximately 1 second, closing the relay contacts.

- to fuel pump (P) and hold-in windings of fuel shut-off solenoid (Q). The fuel pump operates and the hold-in windings of the fuel shut-off solenoid energize.

When the pull-in relay energizes, the contacts close and allow current to the pull-in winding of the fuel shut-off solenoid. This pulls the solenoid armature in and moves injection pump linkage to ON position, allowing fuel to flow to injection pump. The hold-in winding holds the armature in after the pull-in relay de-energizes after 1 second.

If the operator rises from the seat momentarily or bounces due to rough terrain, current (B) is interrupted to the hold in relay (N) and the seat switch delay integrated circuit (R). The hold-in relay remains closed because circuit (C) current continues to flow, energizing the coil. The seat switch time delay continues to energize the seat switch only for a short time. If circuit (B) current isn't restored soon enough, the seat switch transistor de-energizes, opening the path to ground. This opens the hold-in relay and stops current flow to the fuel shut-off solenoid.

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FUEL CONTROL SYSTEM - OPERATOR ON SEAT
(A) POWER CIRCUIT
(B) SEAT SWITCH CIRCUIT
(C) FUEL SOLENOID HOLD IN CIRCUIT
(D) FUEL SOLENOID PULL-IN CIRCUIT
(E) GROUND CIRCUIT
(F) BATTERY
(G) FUSIBLE LINK
(H) 20-AMP FUSE
(I) KEY SWITCH
(J) SEAT SWITCH
(K) TDC MODULE
(L) 25-AMP FUSE
(M) SEAT DIODE
(N) HOLD-IN RELAY
(O) PULL-IN RELAY
(P) FUEL PUMP
(Q) FUEL SHUT-OFF SOLENOID
(R) SEAT SWITCH TIME DELAY
(S) SEAT SWITCH TRANSISTOR
(T) PULL-IN TIME DELAY
ACC
OFF
ON
BULB CHECK
START
IGN
ST
G
BAT
OVERRIDE
IC
PUR/WHT
BLU
PNK
PUR
PUR/BLK
RED
PNK/WHT
BLK
WHT
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FUEL CONTROL SYSTEM OPERATION—OPERATOR OFF SEAT

A—Power Circuit
B—Safety Circuit
C—Fuel Solenoid Hold-In Circuit
D—Fuel Solenoid Pull-In Circuit
E—Ground Circuit
F—Battery
G—Fusible Link
H—20 Amp Fuse
I—Key Switch
J—Neutral Switch
K—TDC Module
L—25 Amp Fuse
M—PTO Switch
N—Brake Switch
O—Safety Circuit Transistor
P—Hold-In Relay
Q—Fuel Pump
R—Fuel Shut-Off Solenoid
S—Pull-In Relay
T—Pull-In Time Delay

Slide MXC80945AE

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FUNCTION:
Regulates the flow of fuel to the injection pump.

OPERATING CONDITIONS:
Before engine will start or operate, fuel must be supplied to the injection pump. The fuel control system will activate when operator is off the seat if key switch is in ON or START position, transmission is in neutral, PTO is disengaged and park brake is engaged.

MAJOR COMPONENTS:
- Battery
- Fusible Link
- 25 Amp Fuse
- 20 Amp Fuse
- Time Delay Control (TDC) Module
- Key Switch
- Neutral Switch
- PTO Switch
- Brake Switch

THEORY OF OPERATION:
Current flows in circuit (A) from the battery (F) through the fusible link (G) and 20 amp fuse (H) to the key switch (I). Current also flows through the 25 amp fuse (L) to the TDC module (K) pull-in relay (S) terminal. When the key switch is in ON or START position, current flows from IGN terminal to the TDC module hold-in relay (P) terminal.

When the transmission is in neutral, current flows from the IGN terminal of the key switch to the neutral switch. Current in circuit (B) flows to the PTO switch. Current continues flowing through the PTO switch to the brake switch (N) when the PTO is disengaged. With the parking engaged, the normally closed terminal allows current to continue to flow to the TDC module, hold-in relay (P) coil and safety circuit transistor (O).

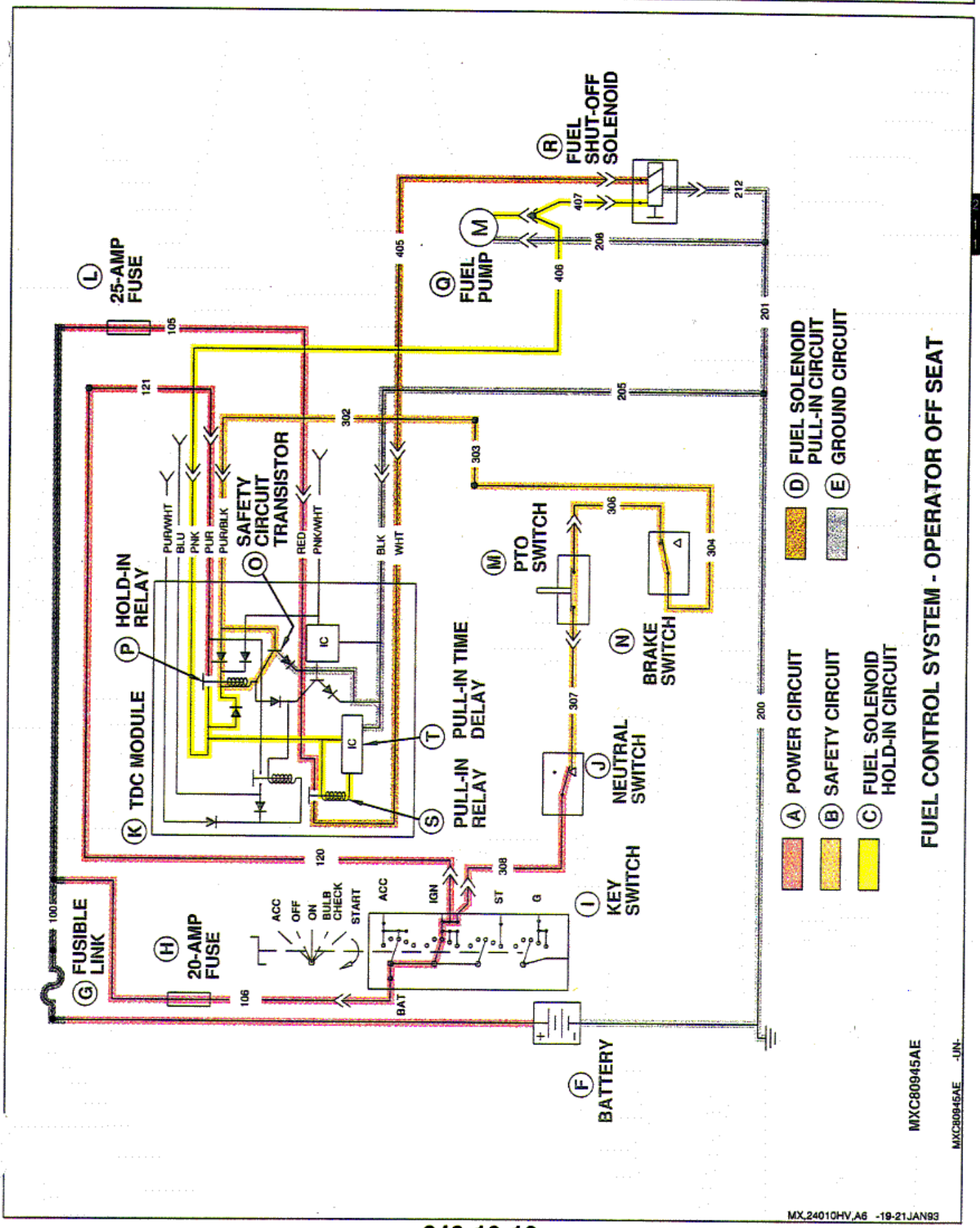
The safety circuit transistor energizes and allows current from the hold-in relay coil to flow to ground. The energized coil closes the hold-in relay contacts.

From the hold-in relay, current in circuit (C) flows:

- through diode to hold-in relay coil. This keeps the hold-in coil energized.
- to pull-in time delay IC (integrated circuit) (T) and pull-in relay (S) coil. The IC timer starts and allows current to flow through the pull-in relay coil for approximately 1 second, closing the relay contacts.
- to fuel pump (Q) and hold-in windings of fuel shut-off solenoid (R). The fuel pump operates and the hold-in windings of the fuel shut-off solenoid are energized.

When the pull-in relay energizes momentarily, the contacts close which allows current flow to the pull-in windings of the fuel shut-off solenoid. This pulls the solenoid armature in and moves injection pump linkage to ON position, allowing fuel flow to injection pump. The hold-in windings holds the armature when the pull-in relay de-energizes after 1 second.

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FUEL CONTROL SYSTEM - OPERATOR OFF SEAT
(A) POWER CIRCUIT
(B) SAFETY CIRCUIT
(C) FUEL SOLENOID HOLD-IN CIRCUIT
(D) FUEL SOLENOID PULL-IN CIRCUIT
(E) GROUND CIRCUIT
(F) BATTERY
(G) FUSIBLE LINK
(H) 20-AMP FUSE
(I) KEY SWITCH
(J) NEUTRAL SWITCH
(K) TDC MODULE
(L) 25-AMP FUSE
(M) PTO SWITCH
(N) BRAKE SWITCH
(O) SAFETY CIRCUIT TRANSISTOR
(P) HOLD-IN RELAY
(Q) FUEL PUMP
(R) FUEL SHUT-OFF SOLENOID
(S) PULL-IN RELAY
(T) PULL-IN TIME DELAY
ACC
OFF
ON
BULB CHECK
START
IGN
ST
G
BAT
IC
PUR/WHT
BLU
PNK
PUR
PUR/BLK
RED
PNK/WHT
BLK
WHT
100
105
106
120
121
200
201
205
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FUEL CONTROL SYSTEM OPERATION—SEAT OVERRIDE

A—Power Circuit
B—Override Circuit
C—Fuel Solenoid Hold-In Circuit
D—Fuel Solenoid Pull-In Circuit
E—Ground Circuit
F—Battery
G—Fusible Link
H—20-Amp Fuse
I—Key Switch
J—Seat Switch
K—TDC Module
L—25-Amp Fuse
M—Hold-In Relay
N—Fuel Pump
O—Fuel Shut-Off Solenoid
P—Seat Switch Time Delay
Q—Seat Switch Transistor
R—Pull-In Time Delay
S—Pull-In Relay
T—Seat Diode

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240
10
14

FUNCTION:
Regulates the flow of fuel to the injection pump.

OPERATING CONDITIONS:
Before the engine will start or operate, fuel must be supplied to the injection pump. The fuel control system can be overridden so PTO can be activated while operator is off the seat to service cutting units.

MAJOR COMPONENTS:
- Battery
- Fusible Link
- 25 Amp Fuse
- 20 Amp Fuse
- Time Delay Control (TDC) Module
- Key Switch
- Seat Switch

THEORY OF OPERATION:
Current in circuit (A) flows from the battery (F) through the fusible link (G) and 20 amp fuse (H) to the key switch (I). Current also flows through the 25 amp fuse (L) to the TDC module (K), pull-in relay (S) terminal. When the key switch is in ON or START position, current flows from IGN terminal to the TDC module, hold-in relay (M) terminal.

Current also flows from the key switch IGN terminal to the seat switch (J). With the seat switch pulled up to the override position, seat switch contacts close and current flows past the seat diode (T) to the TDC module. The system now functions as if the operator was on the seat.

Circuit (B) current flows to the seat switch time delay IC (integrated circuit) (P) in the TDC module. The IC energizes the seat transistor (Q). Current also flows to the TDC module hold-in relay (M) coil. From the coil, current flows to the seat switch transistor. With the seat switch transistor energized, current in circuit (B) can flow to ground. This energizes the hold-in relay coil, closing the relay contacts.

From the hold-in relay, current in circuit (C) flows:

- through diode to hold-in relay coil. This keeps the hold-in coil energized.

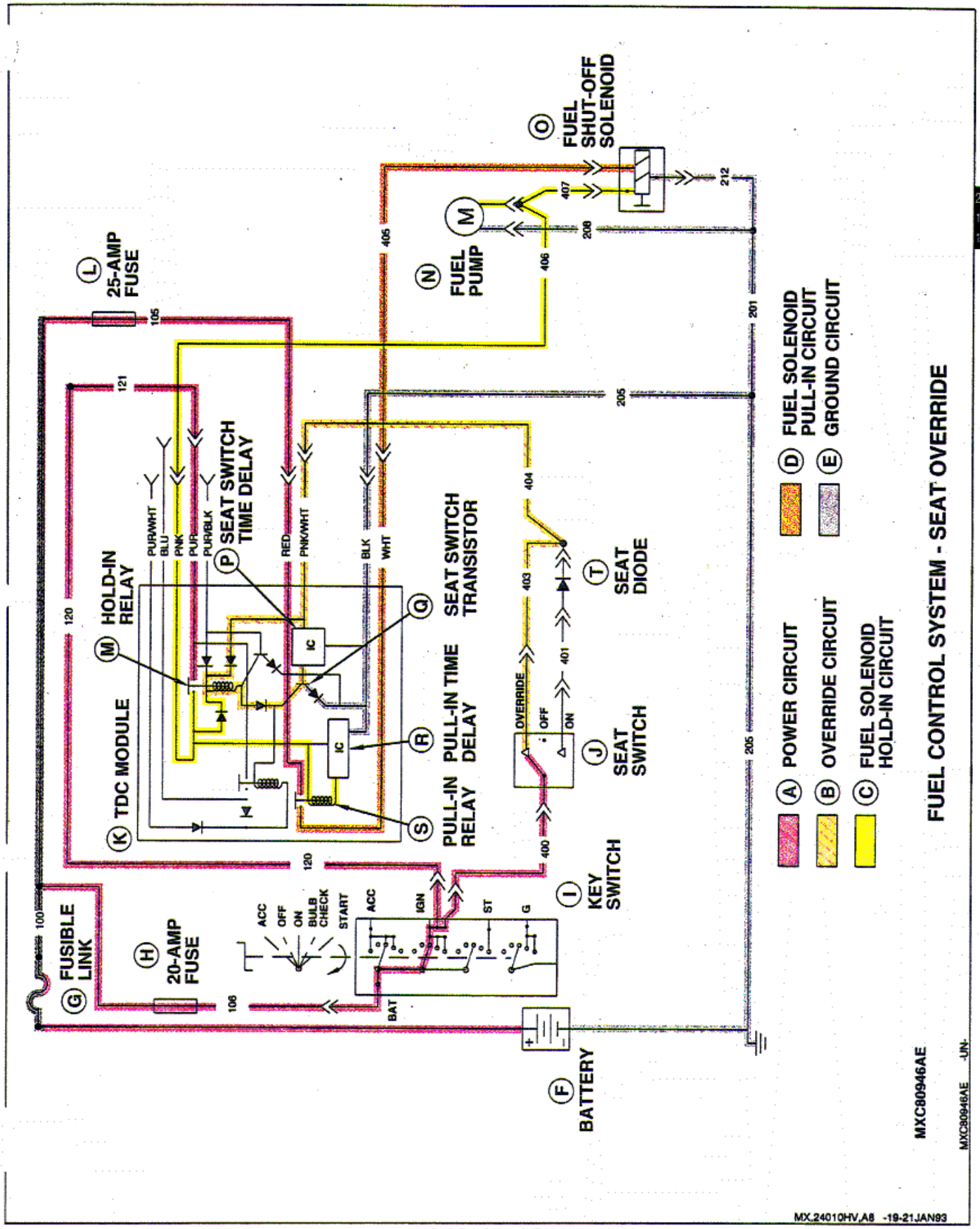
- to pull-in time delay IC (integrated circuit) (R) and pull-in relay (S) coil.

The IC timer starts and allows current to flow through the pull-in relay coil for approximately 1 second, closing the relay contacts.

Current now flows to fuel pump (N) and hold-in windings of fuel shut-off solenoid (O). The fuel pump operates and the hold-in windings of the fuel shut-off solenoid energize.

When the pull-in relay energizes, momentarily the contacts close which allows current flow to the pull-in windings of the fuel shut-off solenoid. This pulls the solenoid armature in and moves injection pump linkage to ON position, allowing fuel to flow to injection pump. The hold-in windings holds the armature after the pull-in relay de-energizes after 1 second.

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FUEL CONTROL SYSTEM - SEAT OVERRIDE
(A) POWER CIRCUIT
(B) OVERRIDE CIRCUIT
(C) FUEL SOLENOID HOLD-IN CIRCUIT
(D) FUEL SOLENOID PULL-IN CIRCUIT
(E) GROUND CIRCUIT
(F) BATTERY
(G) FUSIBLE LINK
(H) 20-AMP FUSE
(I) KEY SWITCH
(J) SEAT SWITCH
(K) TDC MODULE
(L) 25-AMP FUSE
(M) HOLD-IN RELAY
(N) FUEL PUMP
(O) FUEL SHUT-OFF SOLENOID
(P) SEAT SWITCH TIME DELAY
(Q) SEAT SWITCH TRANSISTOR
(R) PULL-IN TIME DELAY
(S) PULL-IN RELAY
(T) SEAT DIODE
ACC
OFF
ON
BULB CHECK
START
BAT
IGN
ST
G
OVERRIDE
IC
PUR/WHT
BLU
PNK
PUR
PUR/BLK
RED
PNK/WHT
BLK
WHT
100
105
106
120
121
201
205
212
400
401
403
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407
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ENGINE AIR HEATER SYSTEM OPERATION

A—Power Circuit
B—Heater Element Circuit
C—Service Alert Lamp Circuit
D—Heater Indicator Circuit
E—Ground Circuit
F—Battery
G—Fusible Link
H—20-Amp Fuse
I—Key Switch
J—Air Heater Controller
K—Lower Display Module
L—Service Alert Lamp
M—Relay Transistor
N—Thermistor
O—Light Transistor
P—Heater Element

Slide MXC80947AE

240
10
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FUNCTION:
The air heater system heats engine air to promote easier starting in cold start conditions. The system is fully automatic and does not require any operator interaction.

OPERATING CONDITIONS:
The air heater system functions only when the key switch is in the ON or START position and the engine compartment temperature is approximately 20˚C (68˚F) or lower.

MAJOR COMPONENTS:
- Battery
- Fusible Link
- 20 Amp Fuse
- Key Switch
- Air Heater Controller
- Engine Air Heater Indicator

THEORY OF OPERATION:
Current flows in circuit (A) from the battery (F) through the fusible link (G), to terminal 2 of the air heater controller (J) and to the key switch (I) through 20 amp fuse (H). When the key switch is in the ON or START position, current flows to terminal 3 of air heater controller, to lower display module (K) and to service alert lamp (L). From terminal 3, current flows to the integrated circuits, thermistor (N), and through relay coil to relay transistor (M).

Terminal 3 is connected to the ICs (integrated circuits) and thermistor (N). The thermistor varies current flow with respect to temperature. When the engine compartment temperature is approximately 20˚C (68˚F) or lower, the thermistor allows current to flow to the integrated circuits. The integrated circuits start a timer and energize the relay and light transistors (M and O). If temperature is above 20˚C (68˚F), current flow stops and transistors do not energize. Current does not flow through heater element or indicator lamps.

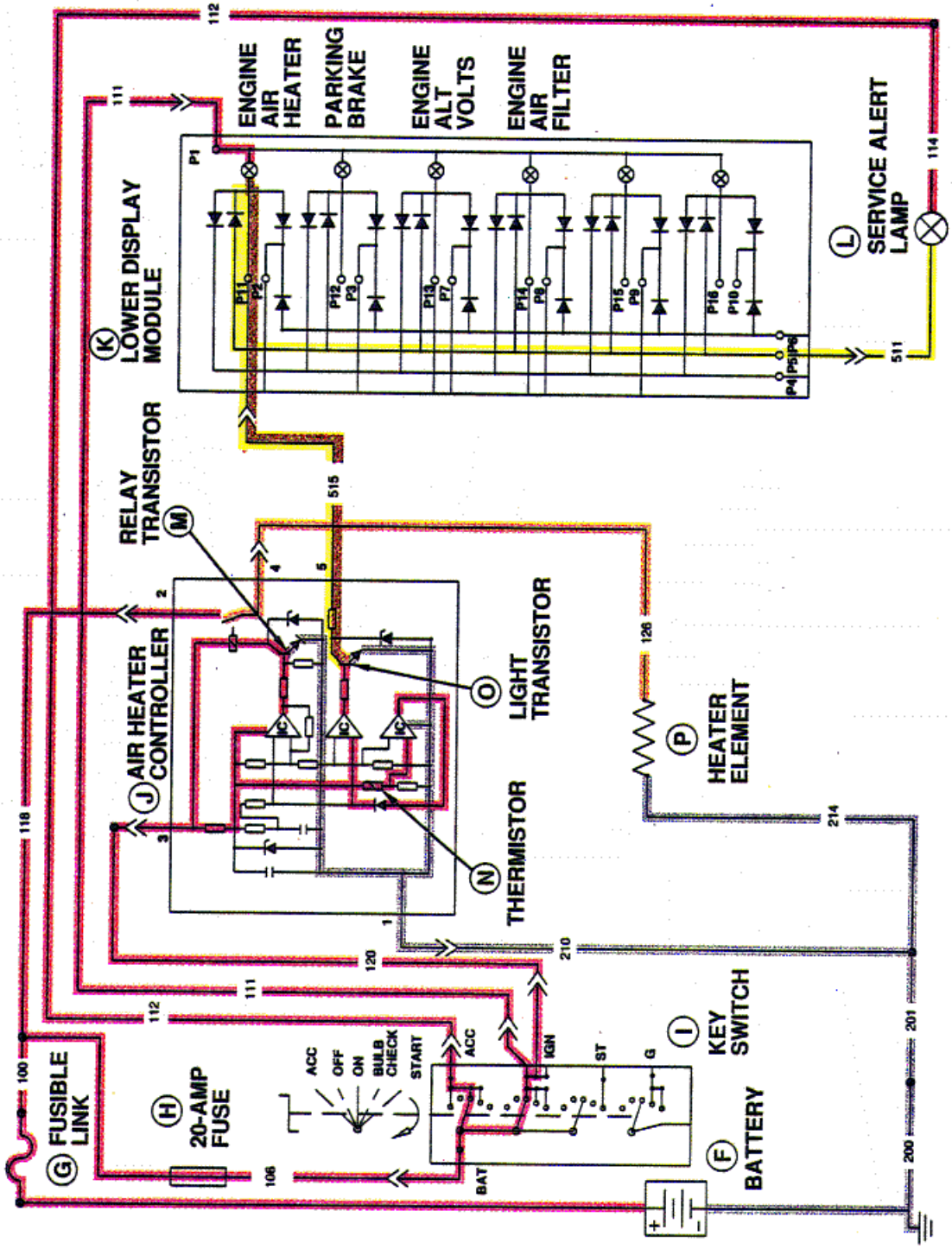
From terminal 3, current also flows to an internal relay coil. When the relay transistor (M) energizes, the transistor provides a path to ground for current through the relay. The relay contacts close and current at terminal 2 is allowed to flow to terminal 4.

Current in circuit (B) comes directly from the battery and flows from terminal 4 to the air heater element. The integrated circuit timer keeps current flowing for approximately 45 seconds. After 45 seconds, the relay transistor de-energizes stopping current flow to the element. If temperature in the engine compartment remains low, the cycle repeats.

Circuit (A) current also flows from the key switch IGN terminal to pin P1 of the lower display module. P1 is connected to engine air heater indicator bulb. In the heater indicator circuit (D), current flows through pin P11 to terminal 5 of the air heater controller. Terminal 5 is connected to the light transistor (O). When the light transistor is energized by the integrated circuits, current in the lamp circuit (D) can flow to ground. This illuminates the indicator bulb for the air heater. A timer in the integrated circuit energizes the light transistor for approximately 20 seconds. After 20 seconds, the integrated circuit stops current flow to the light transistor. This de-energizes the transistor and the current path of the indicator lamp circuit opens. The light goes out.

Current in circuit (A) is also present at the service alert lamp (L). Circuit (D) current can flow from the lamp to pin P5 of the lower display module. P5 is also connected to pin P11. The service alert lamp illuminates at the same time as the heater indicator lamp.

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CHARGING SYSTEM OPERATION

A—Power Circuit
B—Charging Circuit
C—Service Alert Lamp Circuit
D—Alternator Indicator Circuit
E—Ground Circuit
F—Battery
G—Fusible Link
H—20-Amp Fuse
I—Key Switch
J—Lower Display Module
K—Service Alert Lamp
L—Alternator

Slide MXC80950AE

FUNCTION:
To keep battery fully-charged and supply current for electrical accessories while engine is operating.

OPERATING CONDITIONS:
Key switch must be ON and engine operating.

MAJOR COMPONENTS:
- Battery
- Fusible Link
- 20 Amp Fuse
- Key Switch
- Alternator
- Lower Display Module

THEORY OF OPERATION:
Current in circuit (A) flows from the battery (F) to the fusible link (G), 20 amp fuse (H) and finally to the key switch (I). Key switch provides a current path for power circuit (A) to service alert lamp (K) and engine alternator volts indicator lamp.

When in the START or ON position, current flows through the switch to terminal IG of the internal voltage regulator. The voltage regulator monitors battery voltage through IG terminal and decreases or increases alternator output to maintain proper charging voltage. Alternator output is determined by the strength of magnetism of the rotor field coil. As the battery voltage increases or decreases, the regulator controls current flow to the field coil which in turn reduces or increases the magnetic field. When current flow in the field coil is at maximum, the alternator will produce the most current.

The alternator produces alternating current (AC) which is then rectified into direct current (DC) by the internal rectifier.

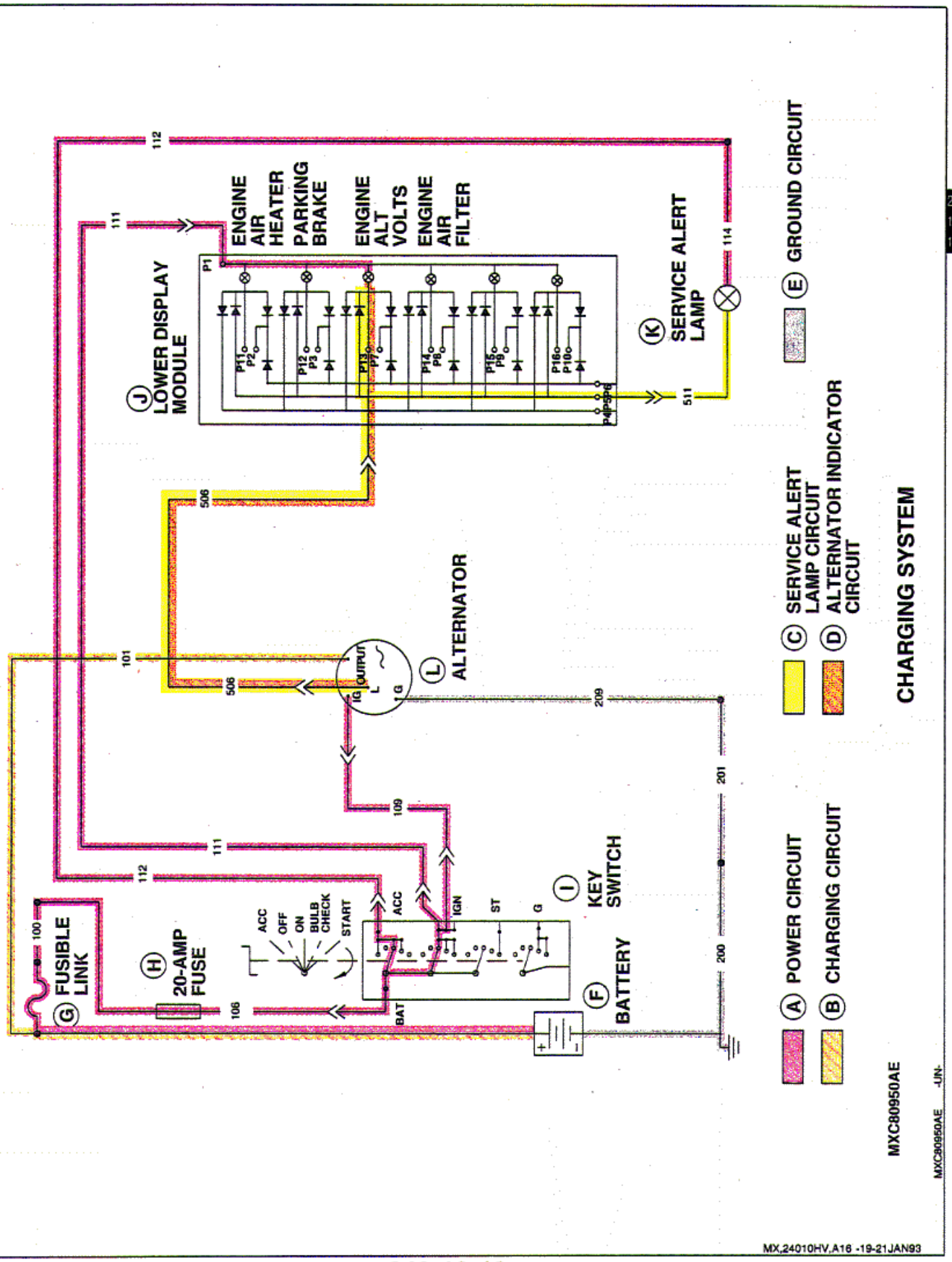
Current in charging circuit (B) flows from the alternator to a common connection point on the starter and then to the positive terminal of the battery.

Current in service alert lamp circuit (C) and indicator circuit (D) only flows when the L terminal of the alternator completes a path to ground. The lamps remain off during normal operating conditions.

When the alternator (L) produces little or no output, a transistor energizes in the regulator which completes a path to ground. This illuminates the alternator volt lamp and service alert lamp.

Ground circuit (E) provides the path to ground for internal regulator and indicator lamp.

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WARNING ALARM CIRCUITS OPERATION

A—Power Circuit
B—Alarm Circuit
C—Oil Pressure Circuit
D—Coolant Temperature Circuit
E—Water-In-Fuel Circuit
F—Hydraulic Oil Temperature Circuit
G—Hydrostatic Oil Temperature Circuit
H—Ground Circuit
I—Bulb Check Circuit
J—Battery
K—Fusible Link
L—20-Amp Fuse
M—Key Switch
N—Upper Display Module
O—Stop Lamp
P—Alarm
Q—Oil Pressure Switch
R—Coolant Temperature Switch
S—Water-In-Fuel Sensor
T—Hydraulic Oil Temperature Switch
U—Hydrostatic Oil Temperature Switch

240
10
20

Slide MXC80951AE

FUNCTION:
To alert operator when a vital system malfunctions so operator can stop the engine to prevent machine damage.

OPERATING CONDITIONS:
Key switch must be ON and the engine operating. Indicator lamps will light and alarm sound when corresponding switch closes.

MAJOR COMPONENTS:
- Battery
- Fusible Link
- 20 Amp Fuse
- Key Switch
- Upper Display Module
- Alarm
- Stop Lamp
- Oil Pressure Switch
- Coolant Switch
- Water-In-Fuel Sensor
- Hydraulic Oil Temperature Switch
- Hydrostatic Oil Temperature Switch

THEORY OF OPERATION:
Current in circuit (A) flows from the battery (J), through the fusible link (K), 20 amp fuse (L) and to the key switch (M). When the key switch is in START or ON position, current flows to upper display module (N), terminal P1 and to each indicator lamp.

When the engine is operating and all systems are functioning properly, none of the indicator lights or alarm are on. All five indicator switches are open so current has no path to ground.

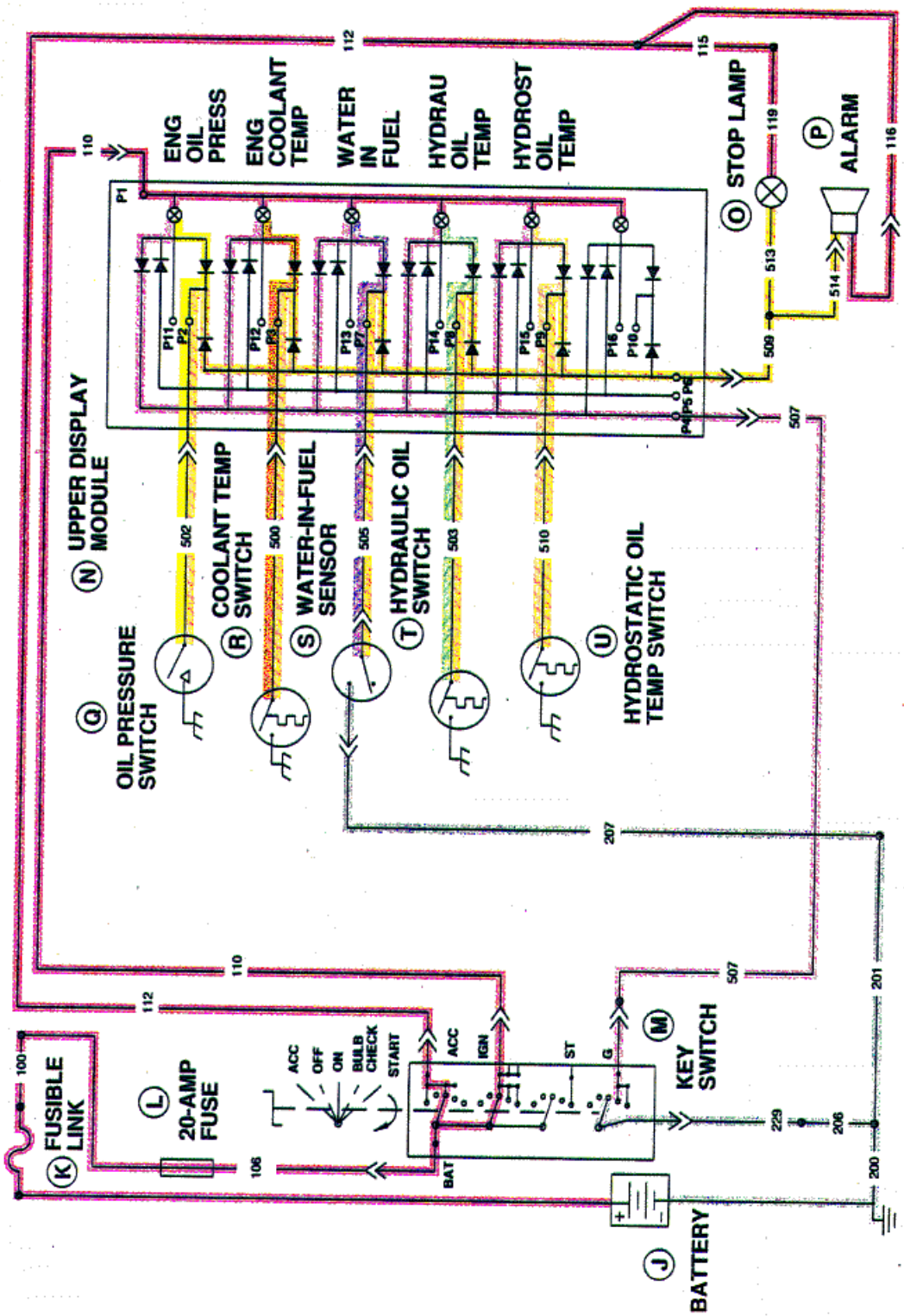
The switches close under the following conditions:
- Oil pressure switch (Q)
  —engine oil pressure falls below 69 kPa (0.7 bar) (10 psi).
- Engine coolant switch (R)
  —engine coolant temperature exceeds 100° C (212° F).
- Water-in-fuel sensor (S)
  —when water at sensor tip reaches a predetermined concentration.
- Hydraulic oil temperature switch (T)
  —hydraulic oil temperature in reservoir exceeds approximately 104° C (220° F).
- Hydrostatic oil temperature switch (U)
  —hydrostatic oil temperature in transaxle exceeds approximately 104° C (220° F).

When a switch closes, current flows in the appropriate circuit (C—G) to the indicator lamp and to ground. This illuminates the indicator lamp in the upper display module.

When any of the five warning switches (Q—U) close, current from the power circuit (A) flows from the key switch to the STOP lamp (O) and alarm (P). Current also flows in the alarm circuit (B) from the STOP lamp and alarm to pin (P6) of the upper display module. From pin (P6), current flows to the appropriate pin (P2, P3, P7, P8 or P9) and through the closed switch to ground. The STOP lamp, alarm and indicator lamp all come on at the same time.

To check the five warning alarm indicators, key switch must be in the BULB CHECK position. In this position, current in circuit (A) flows from IGN terminal of the key switch to upper display module terminal P1. Current then flows through bulb check circuit (I) from each lamp to terminal P4 and terminal (G) of the key switch. Terminal (G) provides a path to ground, allowing current to flow and illuminating all five indicator lamps.

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SERVICE ALERT CIRCUITS OPERATION

A—Power Circuit
B—Service Alert Circuit
C—Parking Brake Circuit
D—Air Restriction Circuit
E—Alarm Circuit
F—Ground Circuit
G—Bulb Check Circuit
H—Battery
I—Fusible Link
J—20 Amp Fuse
K—Key Switch
L—Lower Display Module
M—Stop Lamp
N—Alarm
O—Service Alert Lamp
P—Neutral Switch
Q—Brake Switch
R—Air Restriction Switch

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22

FUNCTION:
To alert operator that parking brake is engaged when travel and when air cleaner needs servicing.

OPERATING CONDITIONS:
Key switch must be ON and engine operating. Indicator lamps will come on when corresponding switches close. If brakes are engaged while trying to travel, alarm will sound and STOP lamp will light.

MAJOR COMPONENTS:
- Battery
- Fusible Link
- 20 Amp Fuse
- Key Switch
- Lower Display Module
- Alarm
- Stop Lamp
- Service Alert Lamp (!)
- Air Restriction Switch
- Brake Switch
- Neutral Switch

THEORY OF OPERATION:
Current in circuit (A) flows from the battery (H), through the fusible link (I), 20 amp fuse (J) and to the key switch (K). When the key switch is in START or ON position, voltage is available at lower display module (L) terminal P1 and at each indicator lamp.

For operation of air heater indicator and alternator indicator in the lower display module, refer to theory of operation of the air heater and charging system in this group.

When brakes are engaged and the transmission is in FORWARD or REVERSE, the brake and neutral switches are in normally closed position. This allows circuit (C) current to flow from the PARKING BRAKE indicator, through the switches to ground, illuminating the indicator lamp. This indicates that brakes are engaged while the machine is moving.

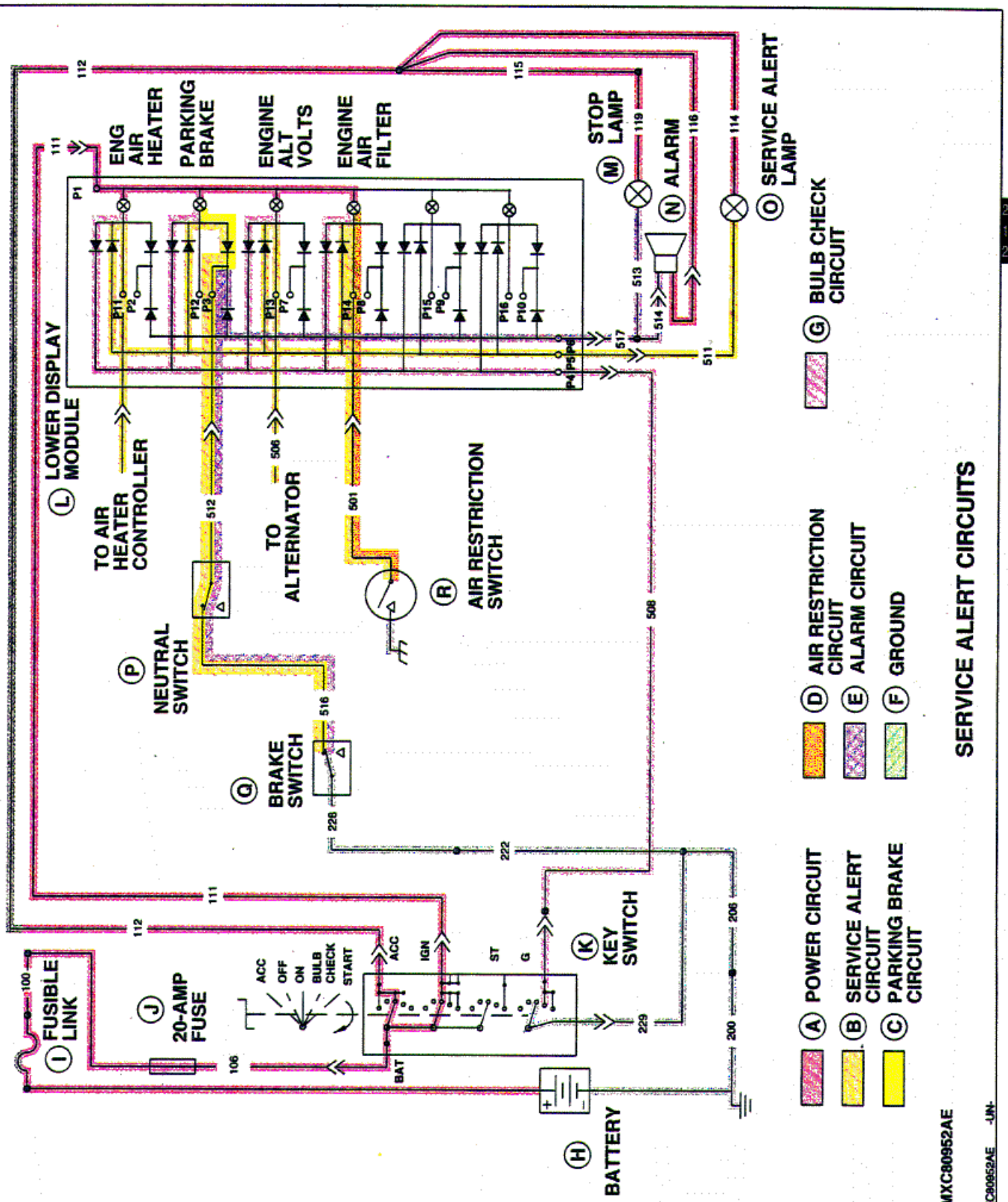
When the air restriction switch senses a large enough pressure differential, the switch closes indicating a restriction in the filter. Current in circuit (D) flows through engine air filter indicator lamp to ground, illuminating ENGINE AIR FILTER lamp.

Current from the power circuit (A) also flows from the key switch to the STOP lamp (M), alarm (N) and service alert lamp (O). When any of the four service alert circuits are grounded, current in the service alert circuit (B) flows from the service alert lamp to pin (P5) of the lower display module. From pin (P5), current flows to the appropriate pin (P3, P11, P13 or P14) to ground. This illuminates the service alert lamp and the indicator lamp at the same time.

The parking brake circuit (C) is the only service alert circuit that is also connected to the STOP lamp and alarm. When both brake and neutral switches are closed (brakes engaged, travel pedal in FORWARD or REVERSE), current flows through circuit (E) from the STOP lamp and alarm to ground. Lamp illuminates and alarm sounds.

To check the four service alert indicators, key switch must be in the BULB CHECK position. In this position, current in circuit (A) flows from IGN terminal of the key switch to the lower display module terminal P1. Current then flows through bulb check circuit (G) from each lamp to terminal P4 and to terminal G of the key switch. This terminal provides a path to ground and illuminates the four indicator lamps.

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HOURMETER OPERATION

A—Power Circuit
B—Ground Circuit
C—Battery
D—Fusible Link
E—20 Amp Fuse
F—Key Switch
G—Hourmeter

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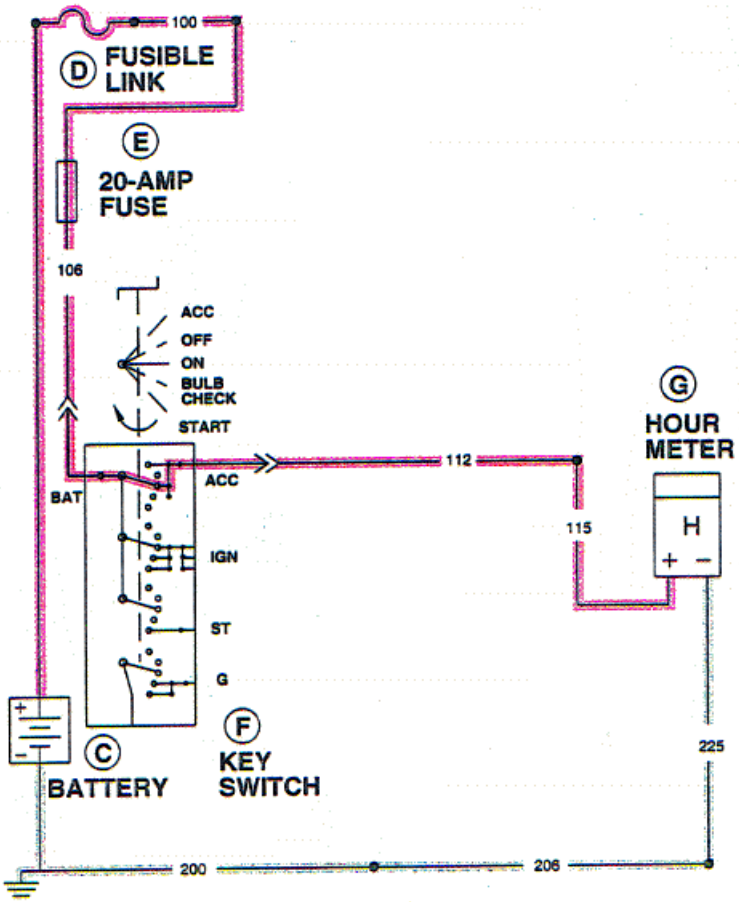
FUNCTION:
To record the number of hours the key switch is in the ON or ACC position.

OPERATING CONDITIONS:
The key switch must be in the ACC or ON position to operate the hourmeter.

MAJOR COMPONENTS:
- Battery
- Fusible Link
- 20 Amp Fuse
- Key Switch
- Hourmeter

THEORY OF OPERATION:
Current in circuit (A) flows from the battery (C), through the fusible link (D), 20 amp fuse (E) and to the key switch (F). Whenever the key switch is in ACC or ON position, current flows to the positive terminal of the hourmeter (G). The negative terminal of the hourmeter is connected directly to ground.

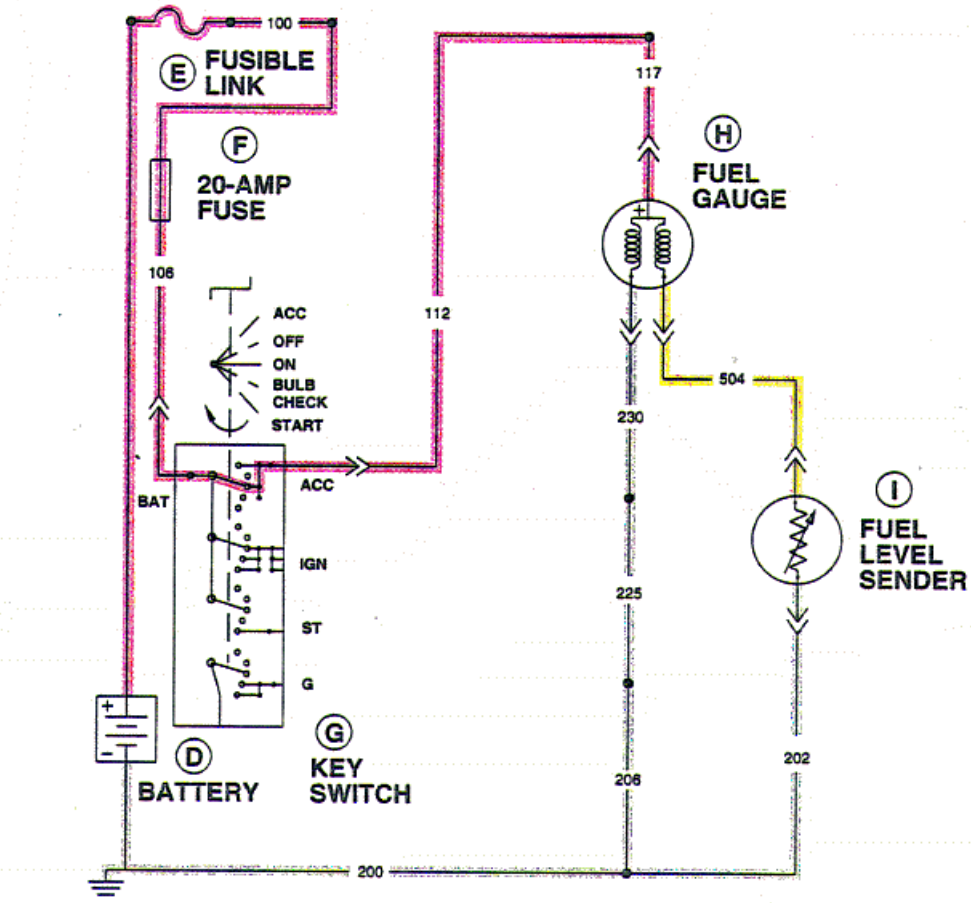
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HOURMETER

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MXC80954AE

FUEL GAUGE

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LIGHTING SYSTEM OPERATION

A—Power Circuit
B—Headlight/Gauge Light Circuit
C—Work Light Circuit
D—Ground Circuit
E—Battery
F—20 Amp Fuse
G—Light Switch
H—Right Headlight
I—Left Headlight
J—Fuel Gauge Light
K—Right Work Light
L—Left Work Light

Slide MXC80955AE

FUNCTION:
To provide illumination for operating in dark conditions.

OPERATING CONDITIONS:
The light switch is connected directly to the battery. Only the light switch must be on to operate lights.

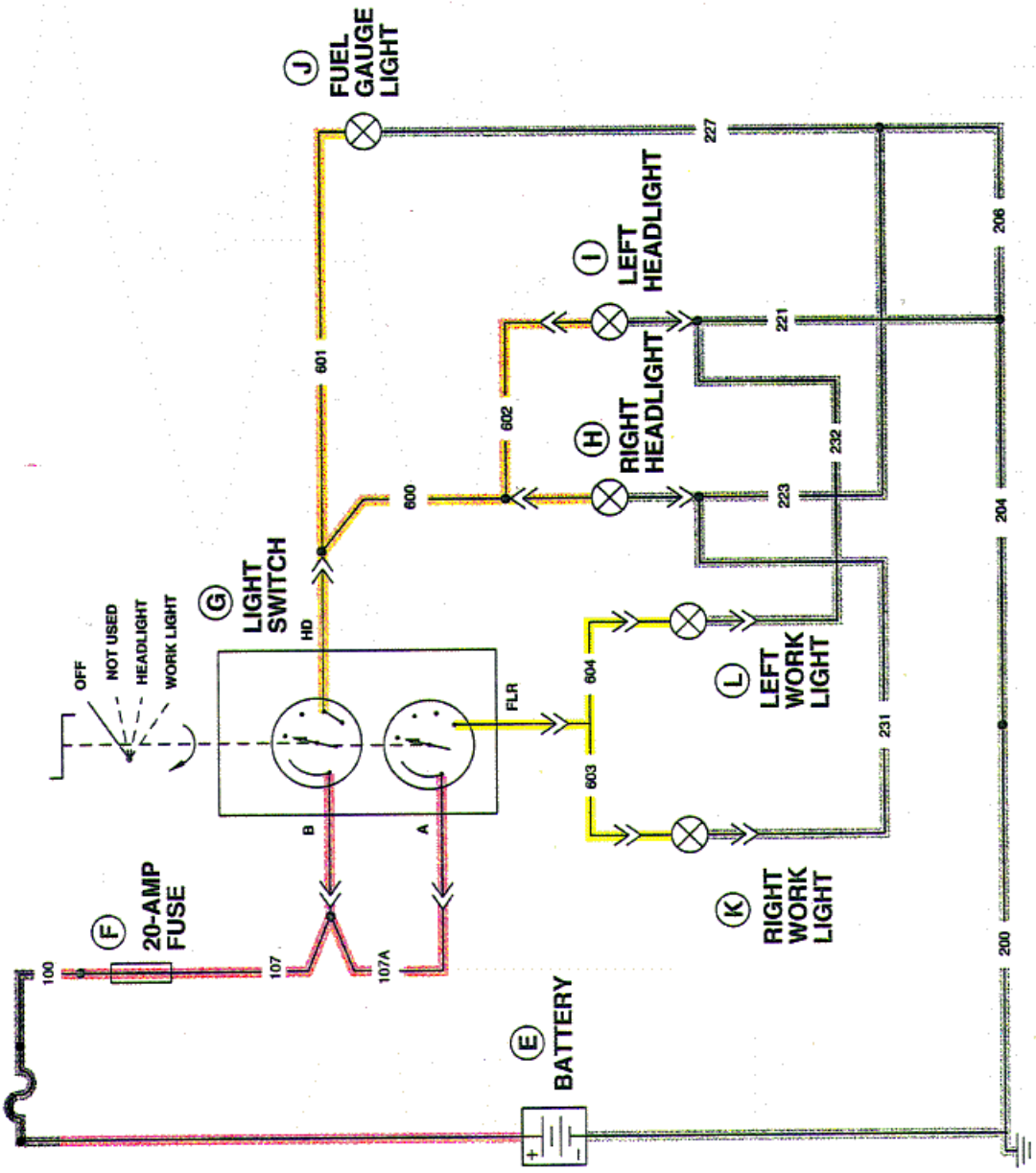
MAJOR COMPONENTS:
- Battery
- Light Switch
- Headlights
- Gauge Light
- Work Lights

THEORY OF OPERATION:
When the light switch is in the off position, there is no current flow. When the light switch is in any position other than off, power circuit (A) current flows directly from the battery (E), through 20 amp fuse (F) and to light switch (G), terminals A and B.

When the light switch is turned to the headlight position, current in circuit (B) flows from terminal B to terminal HD of the light switch. Current continues to flow to the headlights and fuel gauge lamp.

When the light switch is in the work light position, circuit (B) provides a path so current can flow to terminal HD as described above as well as from terminal A to terminal FLR in circuit (C). From terminal FLR, current flows to the work lights.

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CUTTING UNITS CONTROL OPERATION—LEFT WING RAISE

A—Power Circuit
B—Toggle Switch Circuit
C—Cutting Unit Lever Circuit
D—Ground Circuit
E—Battery
F—Fusible Link
G—20 Amp Fuse
H—Key Switch
I—Right Wing Toggle Switch
J—Left Wing Toggle Switch
K—Left Wing Lift Switch
L—Left Wing Relay
M—Right Wing Relay
N—Left Wing Lift Solenoid

Slide MXC80957AE and MXC80970AE

FUNCTION:
Raise left wing using toggle switch or cutting units lever.

OPERATING CONDITIONS:
Key switch must be in the ON or ACC position.

MAJOR COMPONENTS:
- Battery
- Fusible Link
- 20 Amp Fuse
- Key Switch
- Left Wing Toggle Switch
- Left Wing Lift Solenoid
- Left Wing Relay
- Left Wing Lift Microswitch

THEORY OF OPERATION:
Current in circuit (A) flows from the battery (E), through fusible link (F), and 20 amp fuse (G), to key switch (H). From key switch, current flows to left wing toggle switch (J) and left wing lift switch (K).

Toggle Switch Operation:
When the toggle switch is moved to the raise position, current in circuit (B) flows to the left wing relay (L) and the left wing lift solenoid. The solenoid allows the left wing to raise.

Cutting Units Lever Operation:
When the cutting units lever is pulled all the way rearward, the left wing lift switch (K) normally open terminal is closed. Current in circuit (C) is allowed to flow to the left wing lift solenoid (N), lifting the left wing.

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FUEL GAUGE OPERATION

A—Power Circuit
B—Fuel Gauge Circuit
C—Ground Circuit
D—Battery
E—Fusible Link
F—20 Amp Fuse
G—Key Switch
H—Fuel Gauge
I—Fuel Level Sender

Slide MXC80954AE

FUNCTION:
To indicate level of fuel in the fuel tank.

OPERATING CONDITIONS:
Key switch must be in ON or ACC position to operate fuel gauge.

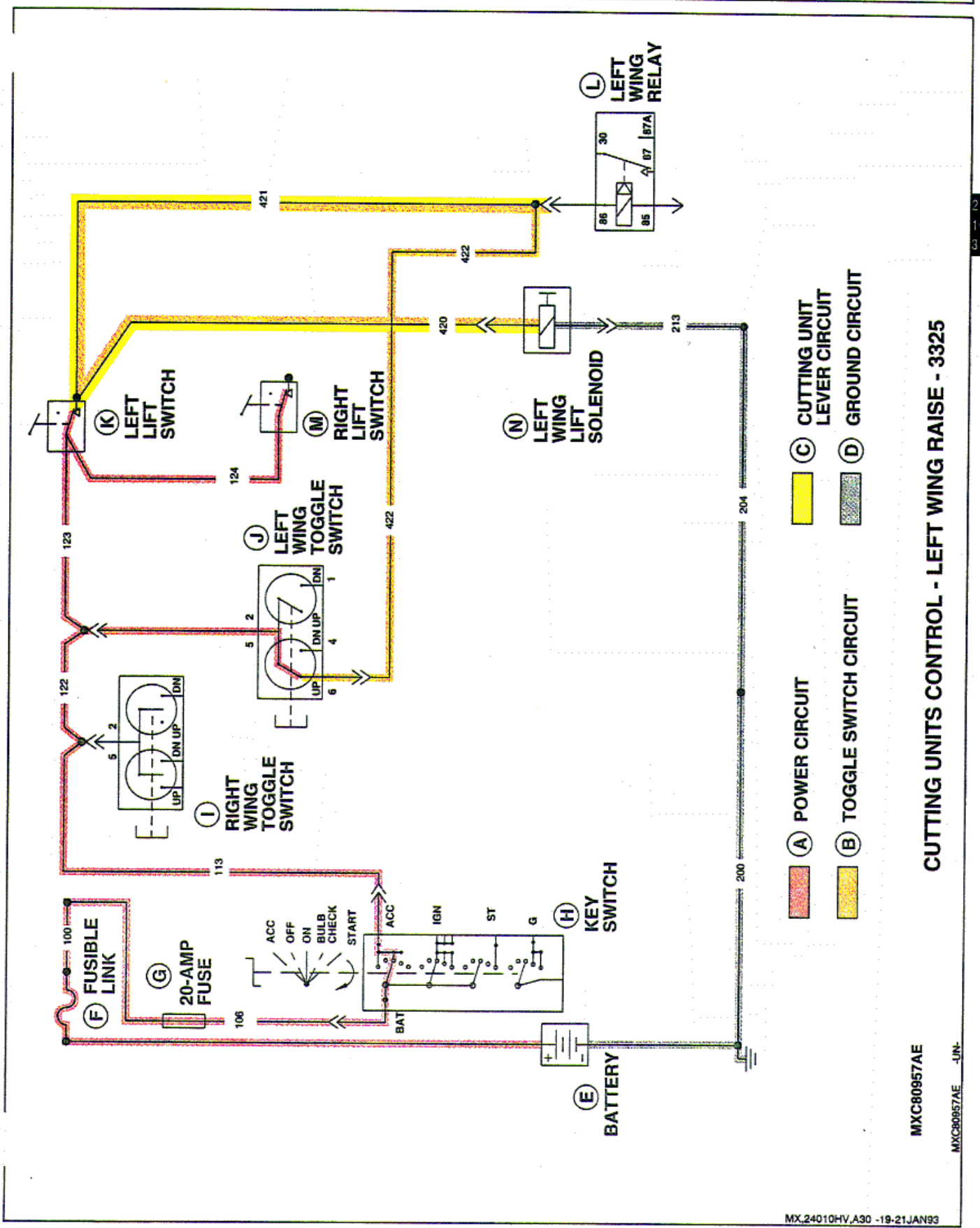
MAJOR COMPONENTS:
- Battery
- Fusible Link
- 20 Amp Fuse
- Key Switch
- Fuel Gauge
- Fuel Gauge Sender

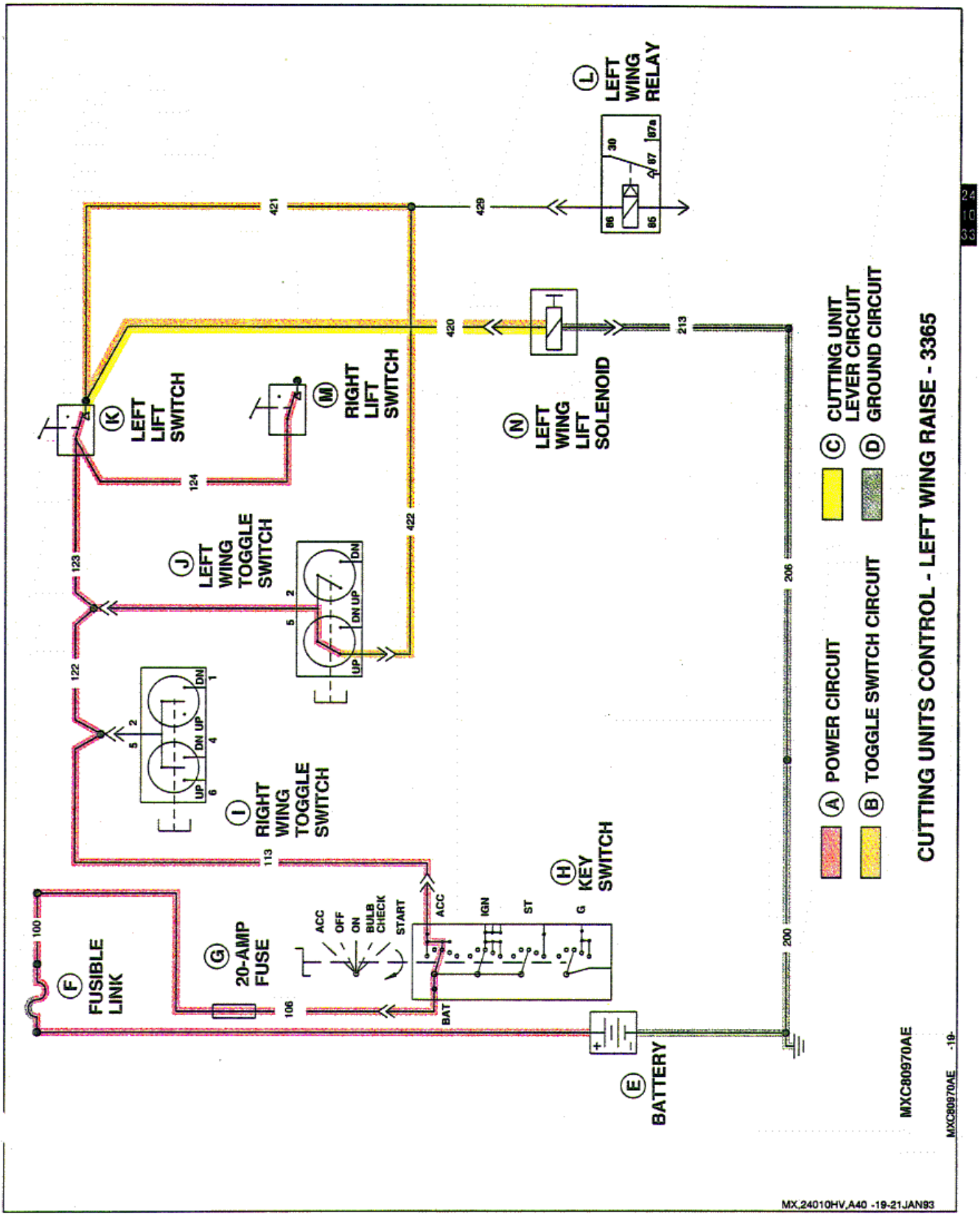
THEORY OF OPERATION:
With the key switch (G) in the ON or ACC position, current in circuit (A) flows from the battery (D) through the fusible link (E) and 20 amp fuse (F) to the key switch. From the key switch, current flows to the fuel gauge (H).

Circuit (B) current flows from the fuel gauge to the fuel level sender (I). Current flow through the sender is controlled by a variable resistor. As the sender float moves with the level of the fuel, the amount of resistance increases or decreases, varying the current flow. The gauge senses the change in current flow and displays the level of fuel in the tank by the position of the gauge needle.

Ground circuit (C) provides a path to ground for gauge and sender.

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CUTTING UNITS CONTROL - LEFT WING RAISE - 3325
(A) POWER CIRCUIT
(B) TOGGLE SWITCH CIRCUIT
(C) CUTTING UNIT LEVER CIRCUIT
(D) GROUND CIRCUIT
(E) BATTERY
(F) FUSIBLE LINK
(G) 20-AMP FUSE
(H) KEY SWITCH
(I) RIGHT WING TOGGLE SWITCH
(J) LEFT WING TOGGLE SWITCH
(K) LEFT LIFT SWITCH
(L) LEFT WING RELAY
(M) RIGHT LIFT SWITCH
(N) LEFT WING LIFT SOLENOID
ACC
OFF
ON
BULB CHECK
START
IGN
ST
G
BAT
UP
DN
DN UP
MXC80957AE


CUTTING UNITS CONTROL - LEFT WING RAISE - 3365
(A) POWER CIRCUIT
(B) TOGGLE SWITCH CIRCUIT
(C) CUTTING UNIT LEVER CIRCUIT
(D) GROUND CIRCUIT
(E) BATTERY
(F) FUSIBLE LINK
(G) 20-AMP FUSE
(H) KEY SWITCH
(I) RIGHT WING TOGGLE SWITCH
(J) LEFT WING TOGGLE SWITCH
(K) LEFT LIFT SWITCH
(L) LEFT WING RELAY
(M) RIGHT LIFT SWITCH
(N) LEFT WING LIFT SOLENOID
ACC
OFF
ON
BULB CHECK
START
BAT
IGN
ST
G
UP
DN
MXC80970AE

CUTTING UNITS CONTROL OPERATION—RIGHT WING RAISE

A—Power Circuit
B—Toggle Switch Circuit
C—Cutting Unit Lever Circuit
D—Ground Circuit
E—Battery
F—Fusible Link
G—20 Amp Fuse
H—Key Switch
I—Right Wing Toggle Switch
J—Left Wing Toggle Switch
K—Left Wing Lift Switch
L—Right Wing Relay
M—Right Wing Lift Switch
N—Right Wing Lift Solenoid

Slides MXC80969AE and MXC80971AE

FUNCTION:
Raise right wing using toggle switch or cutting units lever.

OPERATING CONDITIONS:
Key switch must be in the ON or ACC position.

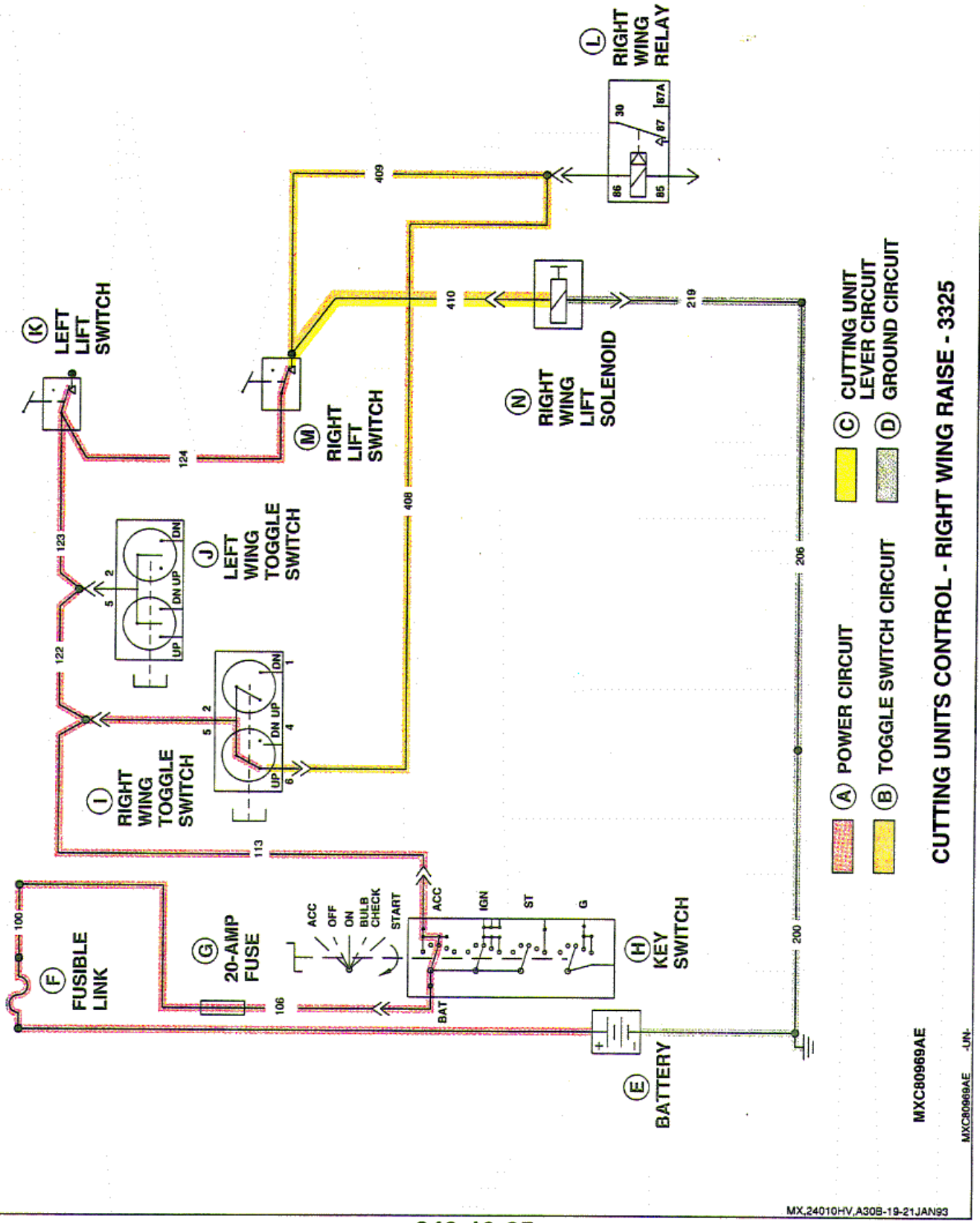
MAJOR COMPONENTS:
- Battery
- Fusible Link
- 20 Amp Fuse
- Key Switch
- Right Wing Toggle Switch
- Right Wing Lift Solenoid
- Right Wing Relay
- Right Wing Lift Microswitch

THEORY OF OPERATION:
Current in circuit (A) flows from the battery (E), through fusible link (F), and 20 amp fuse (G), to key switch (H). From key switch, current flows to right wing toggle switch (I) and right wing lift switch (M).

Toggle Switch Operation:
When the toggle switch is moved to the raise position, current in circuit (B) flows to the right wing relay (L) and the right wing lift solenoid (N). The solenoid allows the right wing to raise.

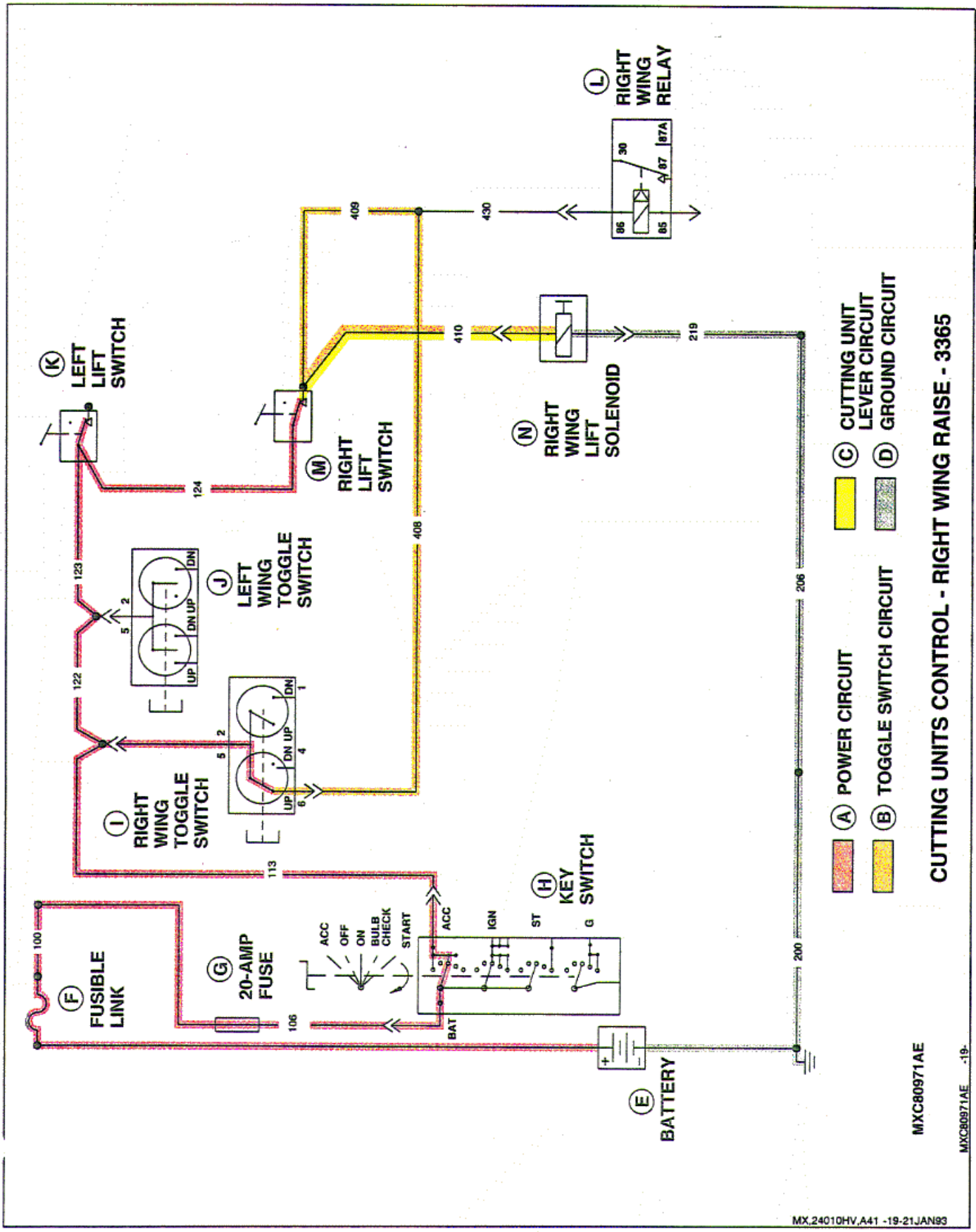
Cutting Units Lever Operation:
When the cutting units lever is pulled all the way rearward, the right wing lift switch (M) is closed to the normally open position. Current in circuit (C) is allowed to flow to the right wing lift solenoid (N), lifting the right wing.

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CUTTING UNITS CONTROL OPERATION—LEFT WING LOWER

A—Power Circuit
B—Toggle Switch Circuit
C—Cutting Unit Lever Circuit
D—Mow Relay Circuit
E—Ground Circuit
F—Battery
G—Fusible Link
H—20 Amp Fuse
I—Key Switch
J—Right Wing Toggle Switch
K—Left Wing Toggle Switch
L—Mow Switch
M—20 Amp Fuse
N—Mow Relay
O—Backlap Switch
P—Left Wing Relay
Q—Left Wing Mercury Switch
R—Left Mow Solenoid
S—Left Wing Diode
T—Left Wing Lower Solenoid

Slide MXC80956AE and MXC80972AE

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FUNCTION:
Lower left wing using toggle switch or cutting units lever.

OPERATING CONDITIONS:
Key switch must be in the ON or ACC position.
Backlap switch in disengaged position (switch closed).

MAJOR COMPONENTS:
- Battery
- Fusible Link
- 20 Amp Fuse
- Key Switch
- Left Wing Toggle Switch
- Left Wing Lower Solenoid
- Left Wing Diode
- Mow Switch
- Backlap Switch
- Mow Relay
- 20 Amp Fuse
- Left Wing Relay
- Left Wing Mercury Switch

THEORY OF OPERATION:
Current in circuit (A) flows from the battery (F), through fusible link (G), 20 amp fuse (H) and to key switch (I). Current also flows through 20 amp fuse (M) to terminal 30 of mow relay (N). When the key switch is in ON or ACC position, current flows to the wing toggle switches (J and K) and the mow switch (L).

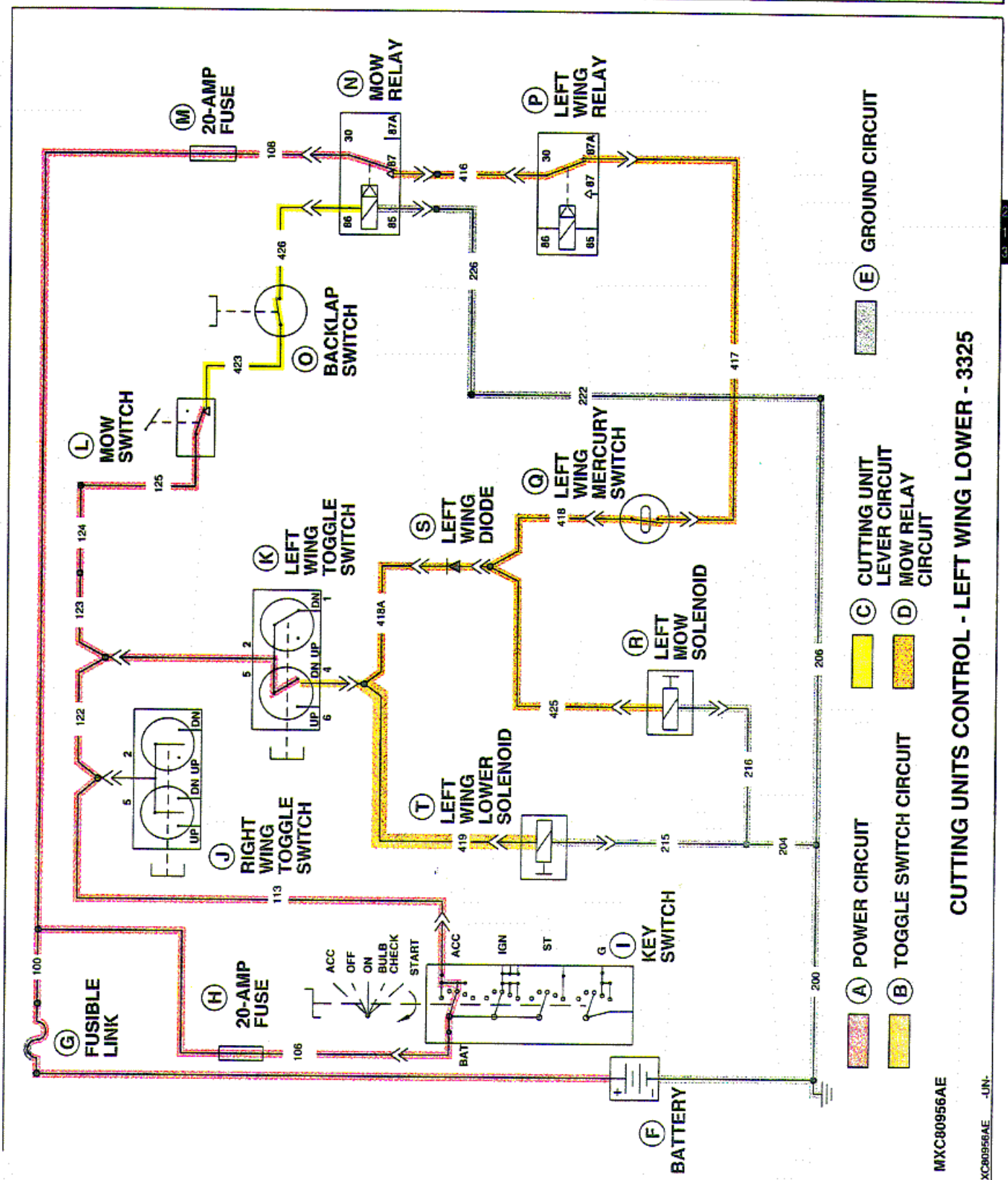
Wing cutting units can be lowered using either a toggle switch or the cutting units lever. The cutting units lever will only lower wing units when the cutting units are approximately 45° or lower, otherwise the toggle switch must be used for lowering.

Toggle Switch Operation:
When the left wing toggle switch is moved to the lower position, circuit (B) current flows from the toggle switch to the left wing lower solenoid (T). The wing lower solenoid is energized allowing hydraulic oil to flow and lowering the left wing.

Cutting Units Lever Operation:
When the cutting units lever is moved forward to lower cutting units, lever engages the mow switch and allows current in circuit (C) to flow to the backlap switch (O). Backlap switch must be closed (backlap disengaged). Current continues to flow through the backlap switch to terminal 86 of mow relay (N), energizing the relay coil which connects terminals 30 and 87 of mow relay.

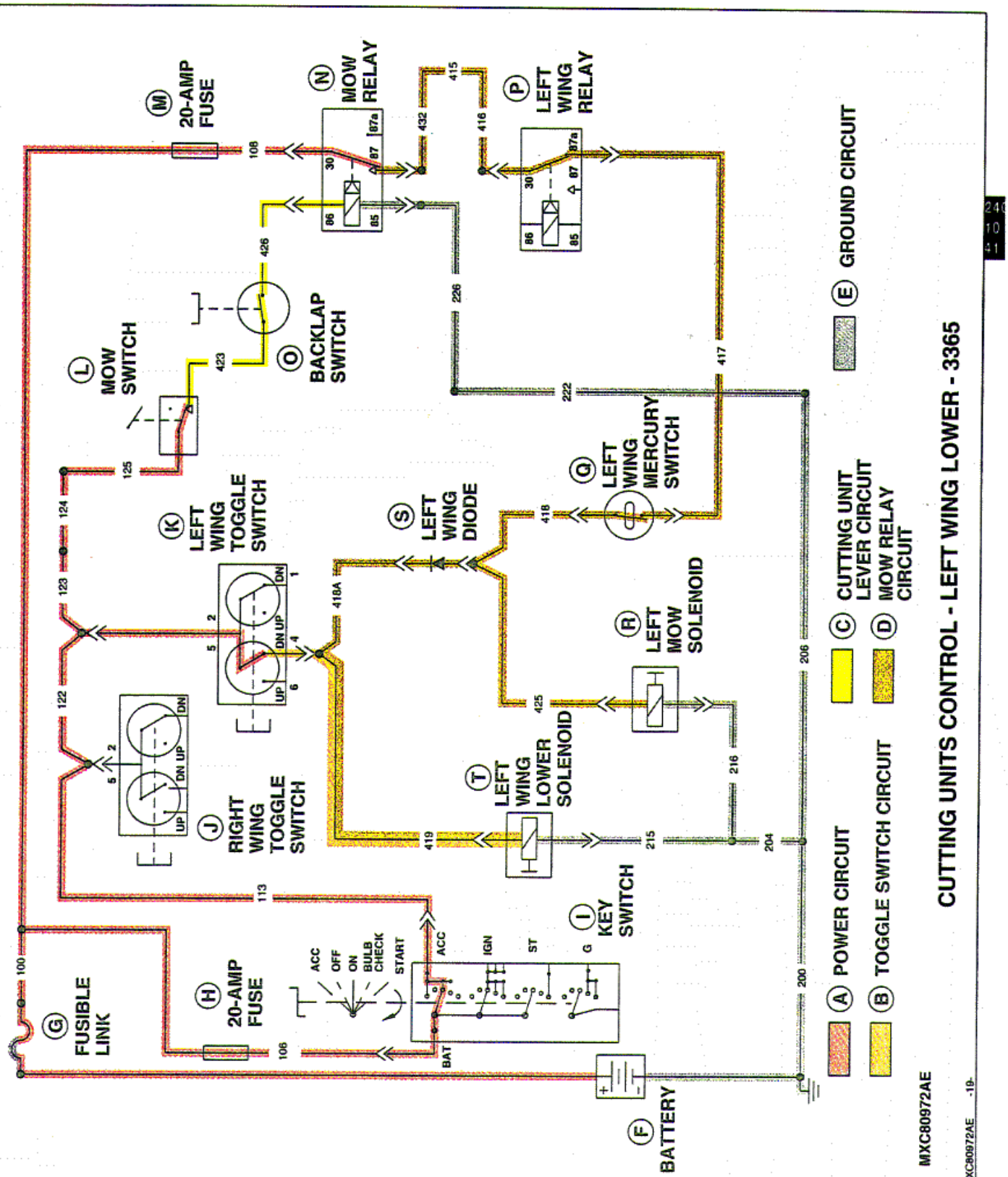
Current in circuit (D) flows from mow relay terminal 87 to the left wing relay (P) terminal 30. Current continues through the wing relay to terminal 87A and to the left wing mercury switch (Q). When the wing is low enough, the mercury switch closes, allowing current to continue. If the wing is too high, the mercury switch is open and current flow is stopped, not allowing the wing to lower. From the mercury switch, current flows through the left wing diode (S) to the left wing lower solenoid. Current also flows to the wing mow solenoid, allowing left cutting unit to operate.

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MXC80972AE -19-

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CUTTING UNITS CONTROL OPERATION—RIGHT WING LOWER

A—Power Circuit
B—Toggle Switch Circuit
C—Cutting Unit Lever Circuit
D—Mow Relay Circuit
E—Ground Circuit
F—Battery
G—Fusible Link
H—20 Amp Fuse
I—Key Switch
J—Right Wing Toggle Switch
K—Left Wing Toggle Switch
L—Mow Switch
M—20 Amp Fuse
N—Mow Relay
O—Backlap Switch
P—Right Wing Relay
Q—Right Wing Mercury Switch
R—Right Mow Solenoid
S—Right Wing Diode
T—Right Wing Lower Solenoid

Slide MXC80968AE and MXC80973AE

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FUNCTION:
Lower right wing using toggle switch or cutting units lever.

OPERATING CONDITIONS:
Key switch must be in the ON or ACC position.
Backlap switch in disengaged position (switch closed).

MAJOR COMPONENTS:
- Battery
- Fusible Link
- 20 Amp Fuse
- Key switch
- Right Wing Toggle Switch
- Right Wing Lower Solenoid
- Right Wing Diode
- Mow Switch
- Backlap Switch
- Mow Relay
- 20 Amp Fuse
- Right Wing Relay
- Right Wing Mercury Switch

THEORY OF OPERATION:
Current in circuit (A) flows from the battery (F), through fusible link (G), 20 amp fuse (H) and to key switch (I). Current also flows through 20 amp fuse (M) to terminal 30 of mow relay (N). When the key switch is in ON or ACC position, current flows to the wing toggle switches (J and K) and the mow switch (L).

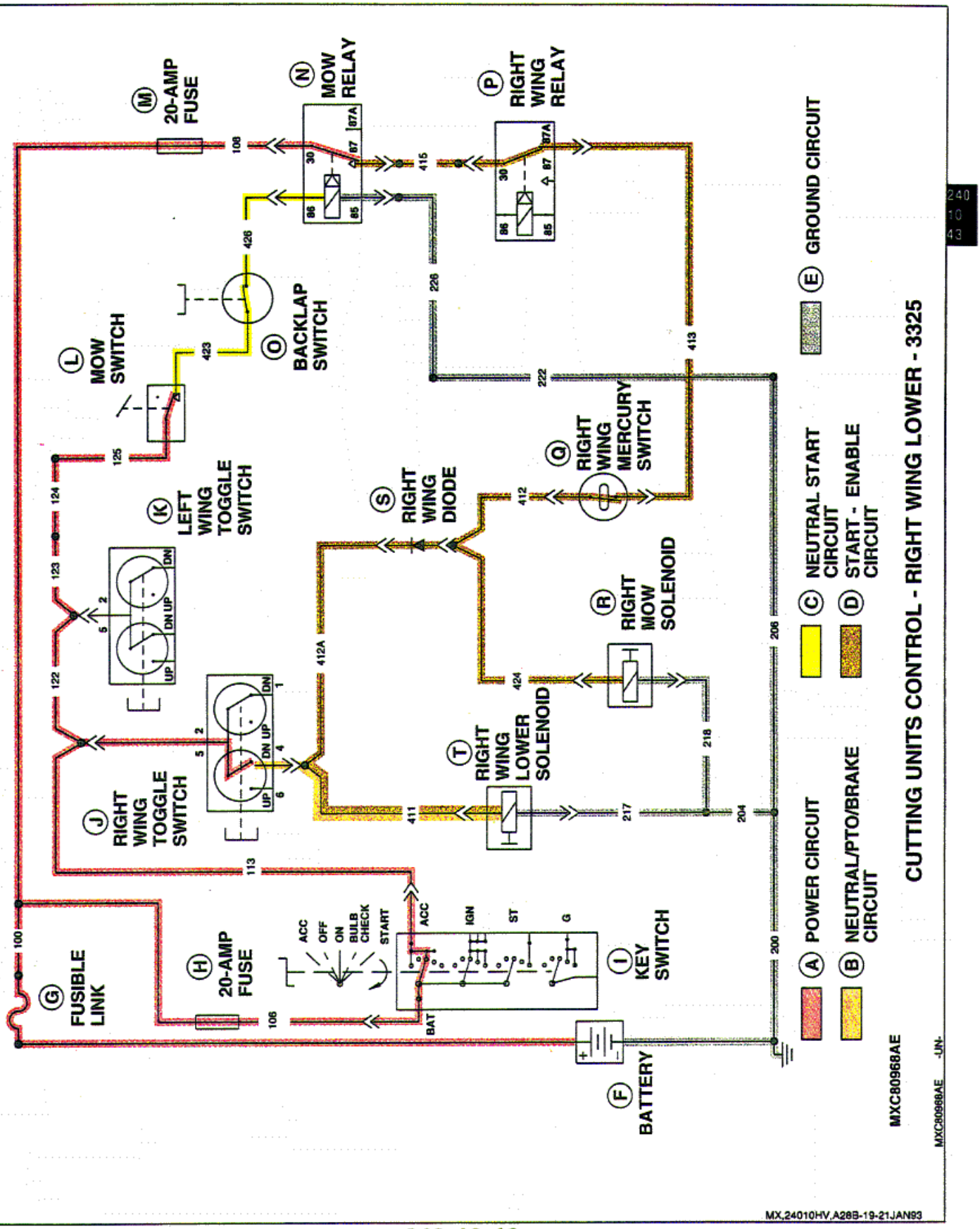
Wing cutting units can be lowered using either a toggle switch or the cutting units lever. The cutting units lever will only lower wing units when the cutting units are approximately 45° or lower, otherwise the toggle switch must be used for lowering.

Toggle Switch Operation:
When the right wing toggle switch is moved to the lower position, circuit (B) current flows from the toggle switch to the right wing lower solenoid (T). The wing lower solenoid is energized allowing hydraulic oil to flow and lowering the right wing.

Cutting Units Lever Operation:
When the cutting units lever is moved forward to lower cutting units, lever engages the mow switch and allows current in circuit (C) to flow to the backlap switch (O). Backlap switch must be closed (backlap disengaged). Current continues to flow through the backlap switch to terminal 86 of mow relay (N), energizing the relay coil which connect terminals 30 and 87 of mow relay.

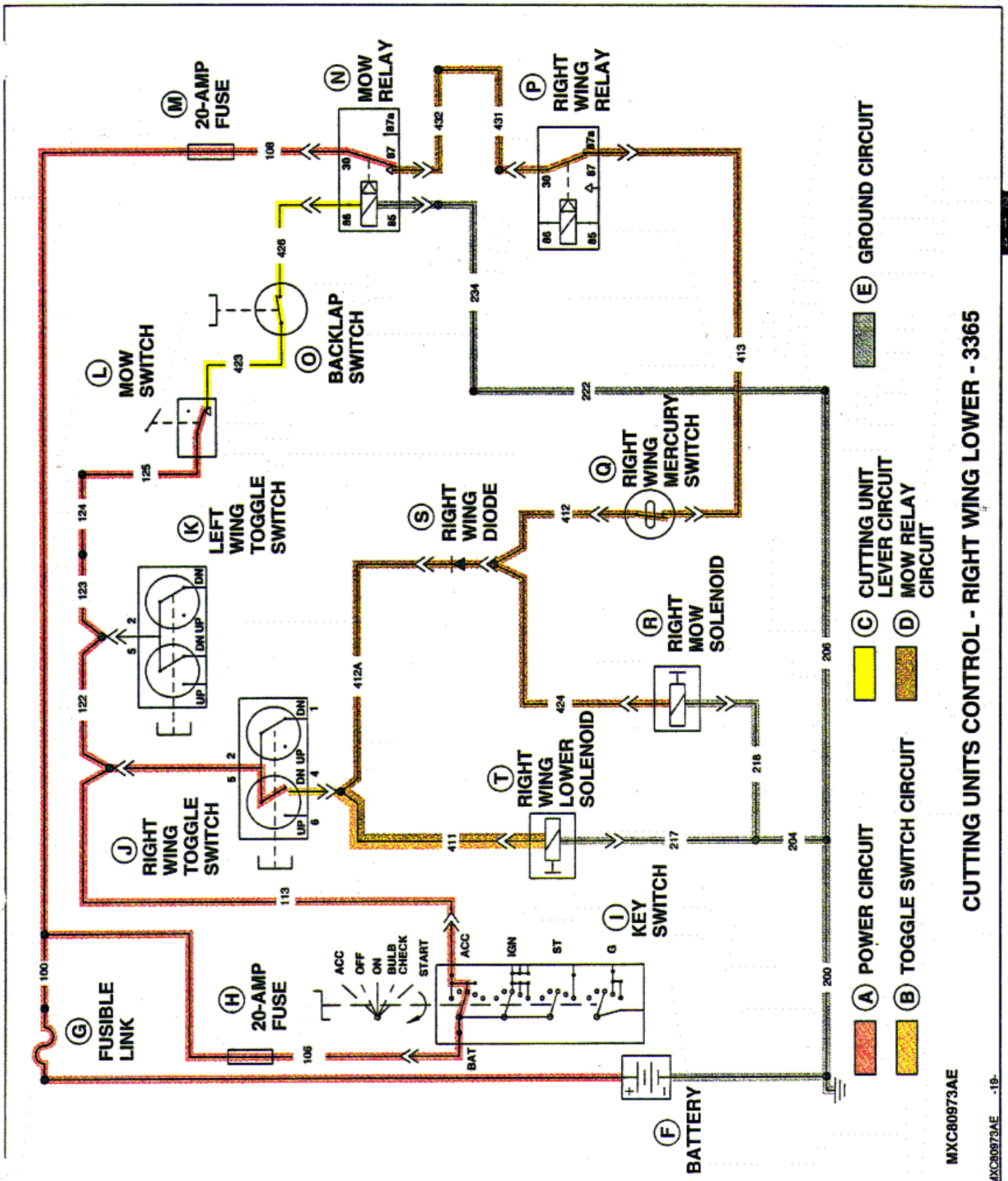
Current in circuit (D) flows from mow relay terminal 87 to the right wing relay (P) terminal 30. Current continues through the wing relay to terminal 87A and to the right wing mercury switch (Q). When the wing is low enough, the mercury switch closes, allowing current to continue. If the wing is too high, the mercury switch is open and current flow is stopped, not allowing the wing to lower. From the mercury switch, current flows through the right wing diode (S) to the right wing lower solenoid. Current also flows to the wing mow solenoid, allowing right cutting unit to operate.

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MX,24010HV,A26B-19-21JAN93

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MX,24010HV,A43 -19-21JAN93

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CUTTING UNITS CONTROL OPERATION—MOW AND BACKLAP

A—Power Circuit
B—Mow Relay Circuit
C—Left Mow Circuit
D—Right Mow Circuit
E—Ground Circuit
F—Battery
G—Fusible Link
H—20 Amp Fuse
I—Key Switch
J—Right Wing Toggle Switch
K—Left Wing Toggle Switch
L—Left Lift Switch
M—Right Lift Switch
N—Mow Switch
O—Backlap Switch
P—20 Amp Fuse
Q—Mow Relay
R—Left Wing Relay
S—Right Wing Relay
T—Center Mow Solenoid
U—Left Wing Mercury Switch
V—Left Wing Diode
W—Left Mow Solenoid
X—Right Wing Mercury Switch
Y—Right Wing Diode
Z—Right Mow Solenoid

Slides MXC80958AE and MXC80974AE

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46

FUNCTION:
To engage cutting units reels for mowing or backlapping application.

OPERATING CONDITIONS:
Key switch must be in the ON position, cutting units lever all the way forward and backlap switch in disengaged position (switch closed).

MAJOR COMPONENTS:
- Battery
- Fusible Link
- 20 Amp Fuse
- Key Switch
- Wing Toggle Switches (2)
- Lift Switches (2)
- Mow Switch
- Backlap Switch
- 20 Amp Fuse
- Mow Relay
- Wing Relays (2)
- Mow Solenoids (3)
- Wing Diodes (2)
- Mercury Switches (2)

THEORY OF OPERATION:
Current in circuit (A) flows from the battery (F), through fusible link (G), 20 amp fuse (H) to key switch (I). When the key switch is in the ON or ACC position, current continues flowing to the wing toggles switches (J and K) and to mow switch (N).

Mow Operation:
When the cutting units lever is all the way forward, the mow switch normally open terminal is closed. Current is allowed to flow through the mow switch, the closed backlap switch (O) and to the mow relay (Q) terminal 86, energizing the relay coil. Current also flows through 20 amp fuse (P) to terminal 30 of mow relay. Since the coil is energized, current at terminal 30 flows to terminal 87.

From terminal 87 of the mow relay, current in circuit (B) flows to both wing relays, (R and S) terminals 30, and to center mow solenoid (T). The center mow solenoid energizes which allows hydraulic oil to turn motor of center three cutting units.

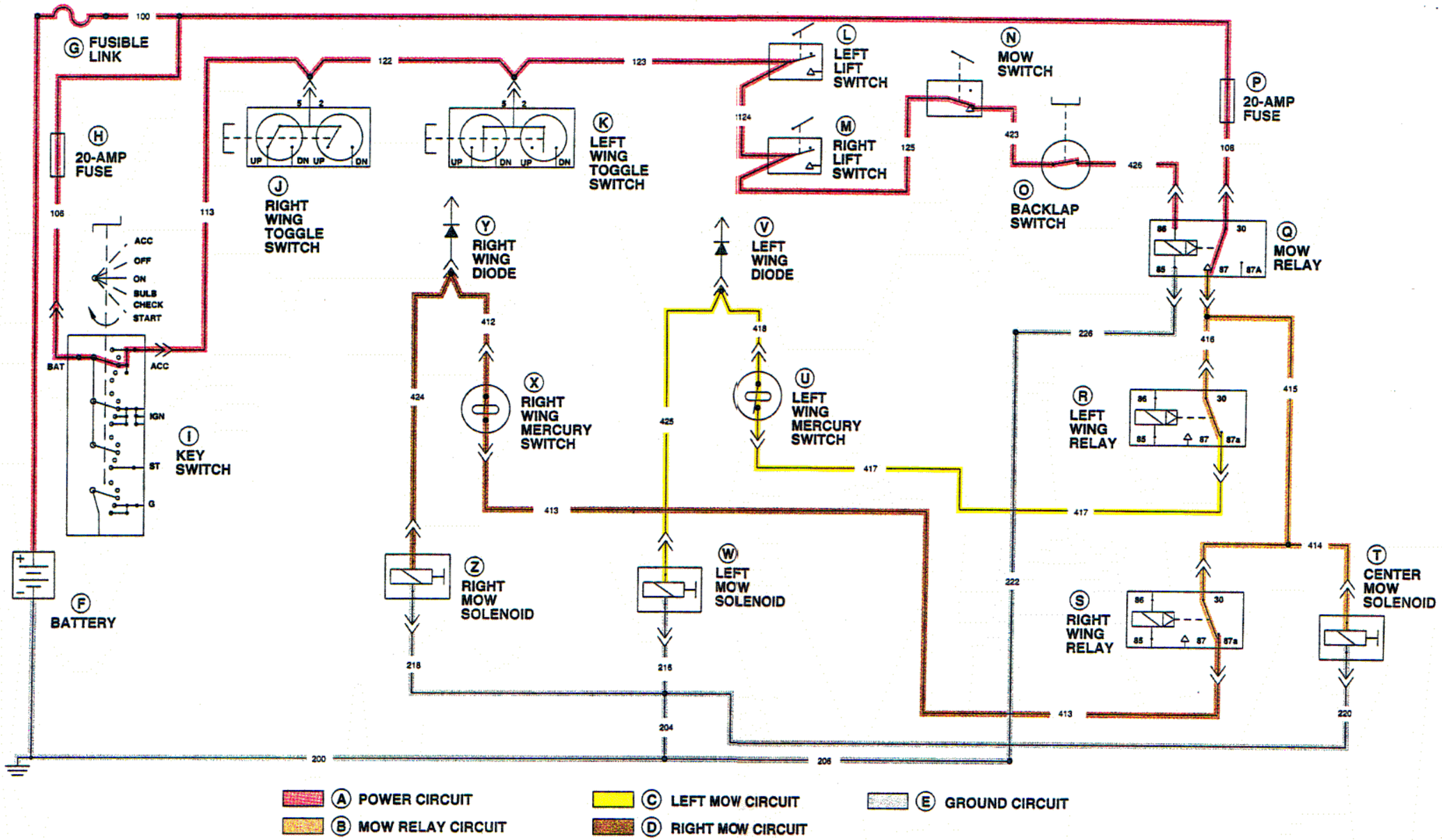
From each wing relay terminal 87A, current flows through circuits (C and/or D) to the respective wing mercury switch (U or X). If the wing is low enough, the mercury switch closes and current flow can continue to the mow solenoids (W or Z) past the wing diodes (V or Y). This allows wing cutting units motors to turn.

If the wings are not low enough to close the mercury switch, the wing toggle switches must be used to lower wings until mercury switches close.

Backlap Operation:
For the backlap operation, backlap switch (K) must be moved to the neutral, N position, This will open the switch and de-energizes the mow relay (M). When the mow relay is de-energized, current from 20-amp fuse (L) stops flowing to the center mow solenoid (P) and the wing relays (N and O).

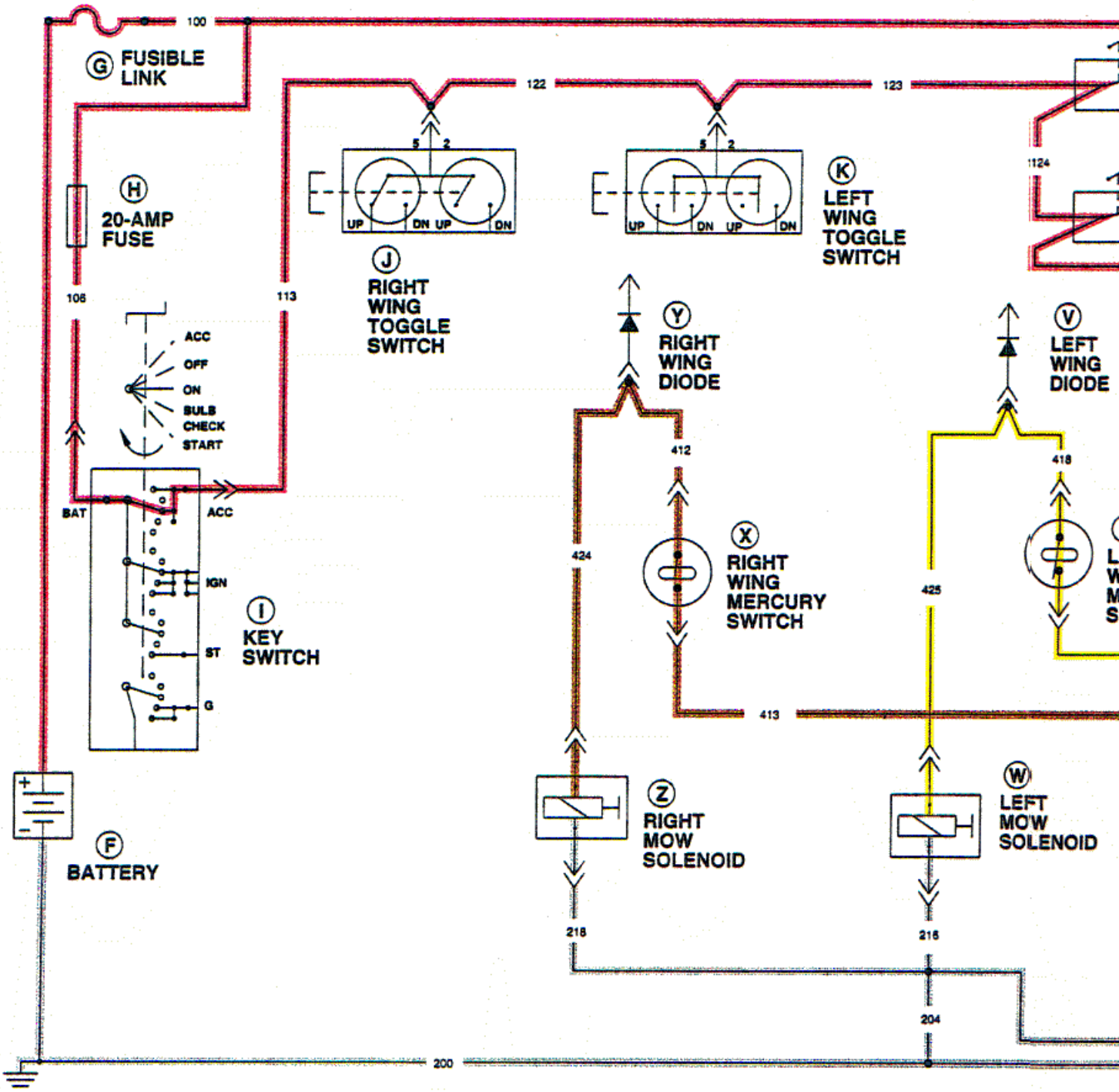
To reverse the cutting unit motors for backlapping operation, the spools in the mow hydraulic valves must be manually moved to the reverse position by turning the thumbscrews.

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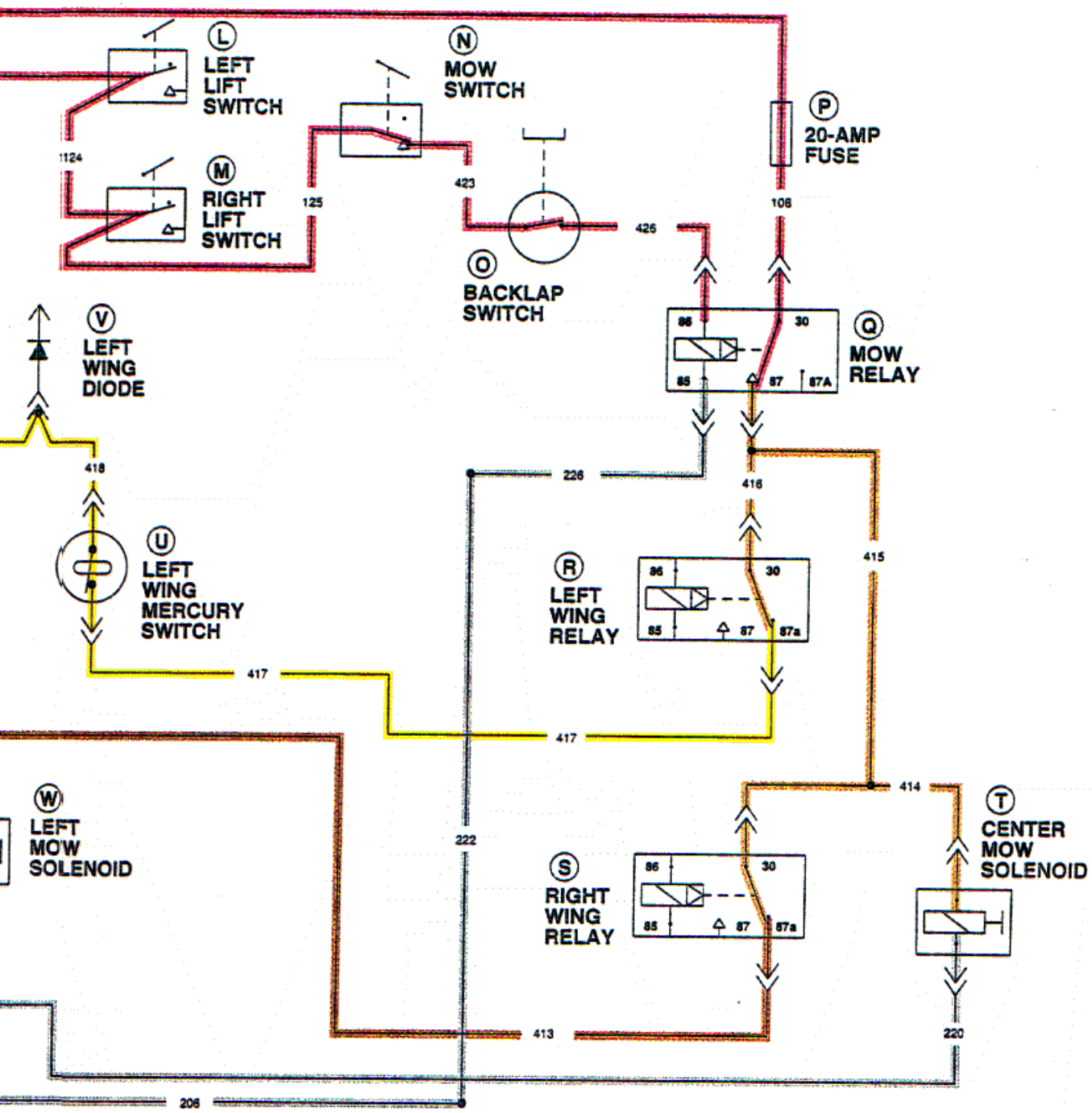
MXC80958AE

CUTTING UNITS CONTROL - MOW - 3325



MXC80958AE

CUTTING UNITS CONTROL - M

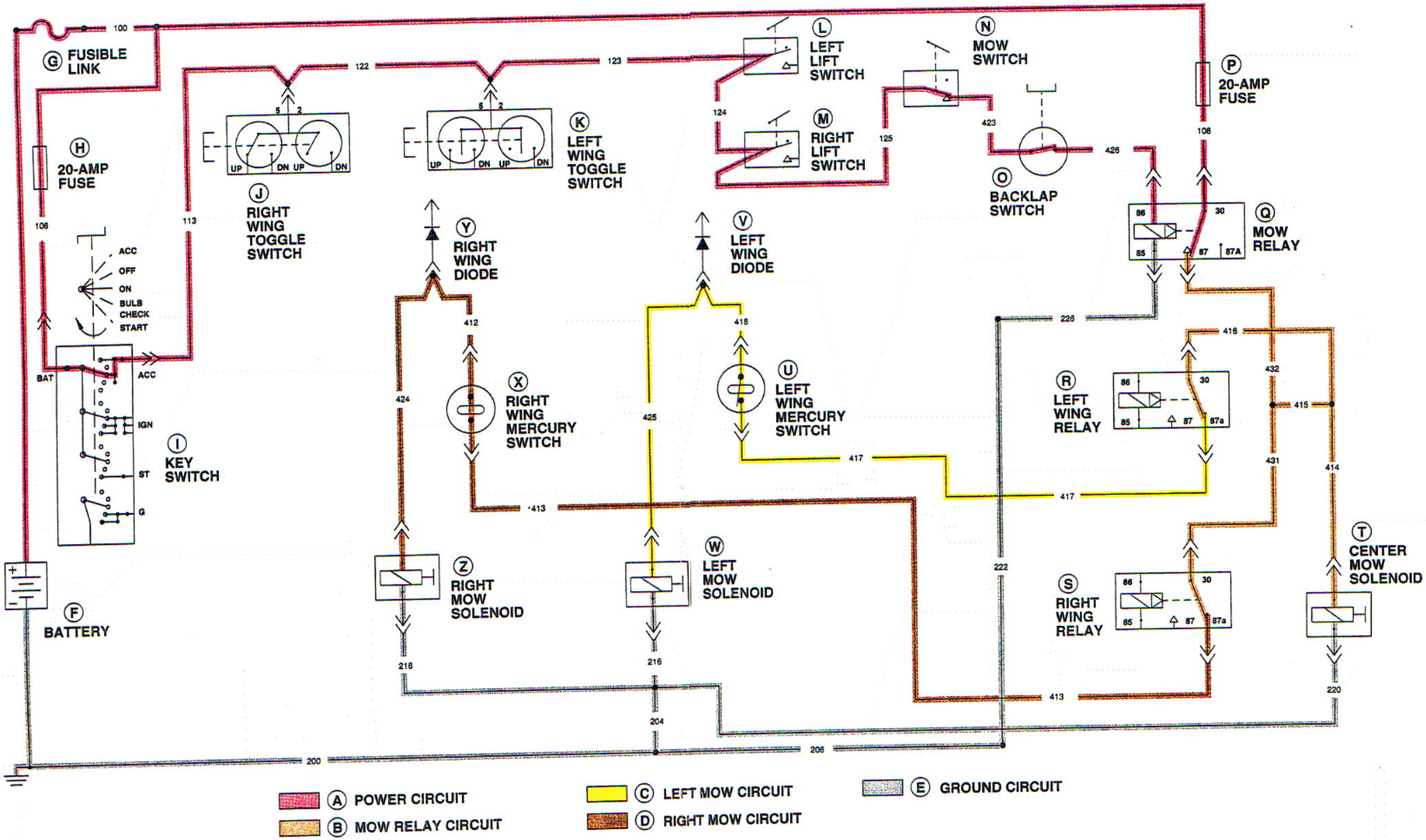


FT MOW CIRCUIT

HT MOW CIRCUIT

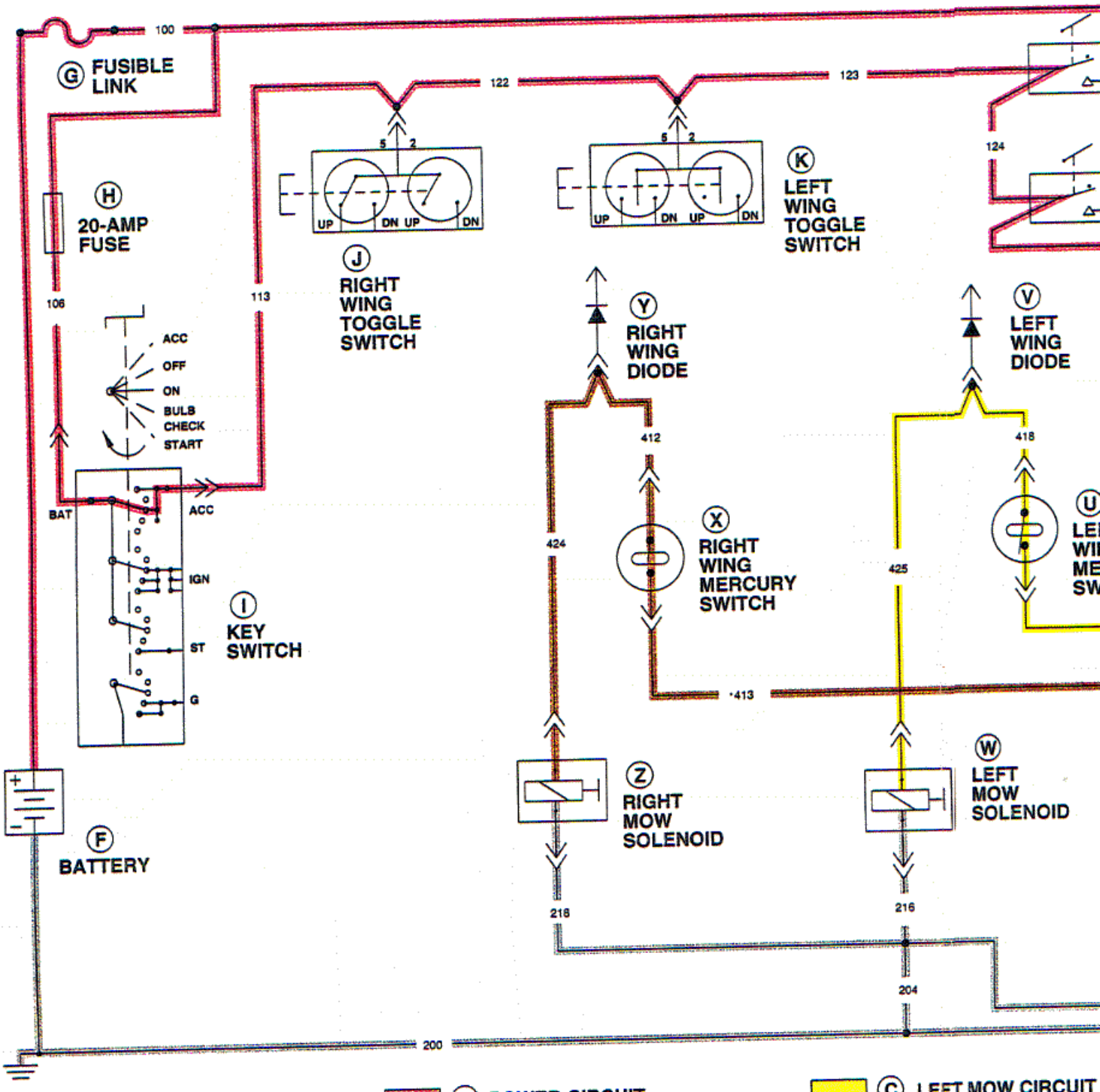
E GROUND CIRCUIT

CONTROL - MOW - 3325



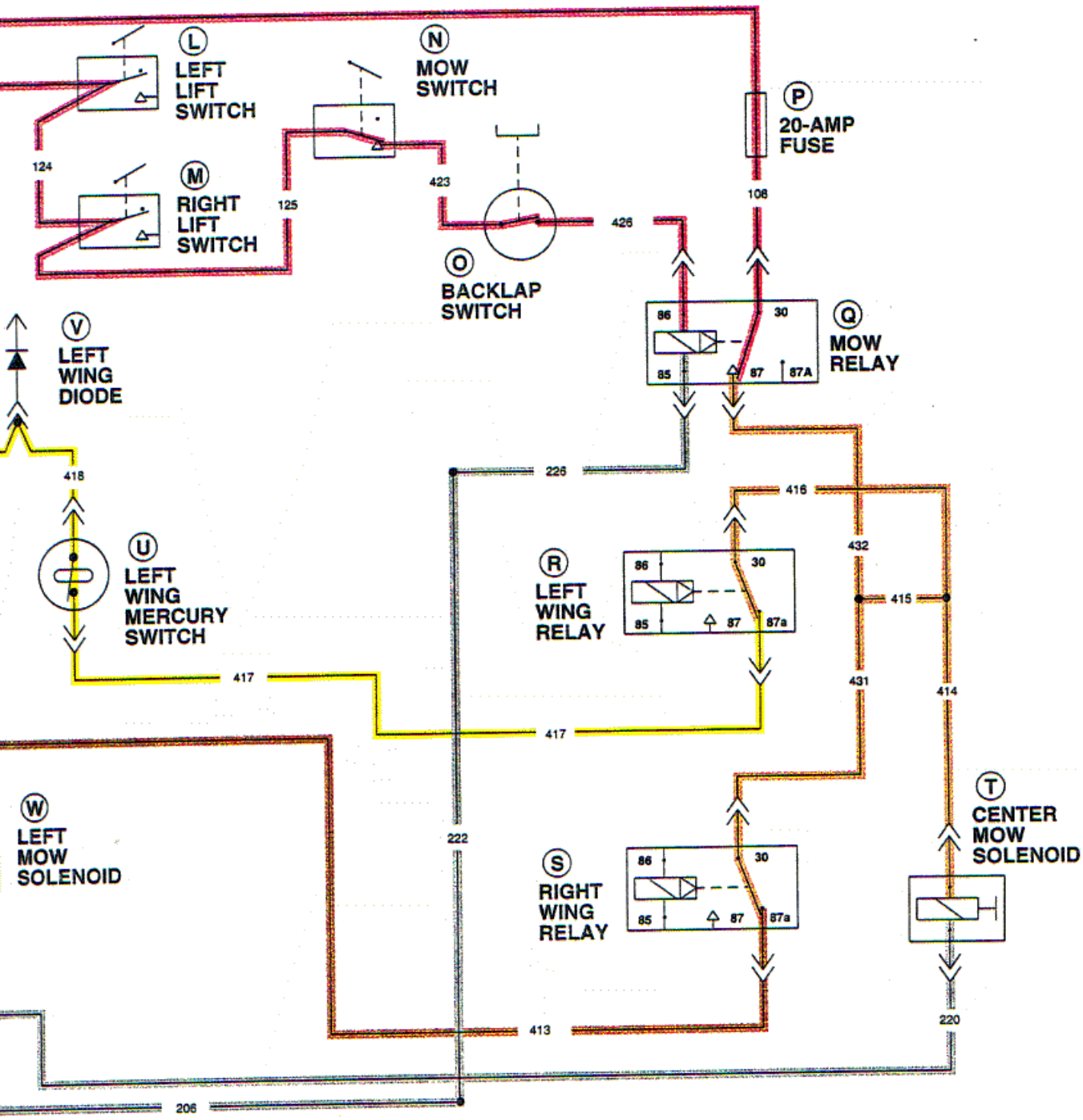
MXC80974AE

CUTTING UNITS CONTROL - MOW - 3365



MXC80974AE

CUTTING UNITS CONTROL - M



T MOW CIRCUIT

HT MOW CIRCUIT

E GROUND CIRCUIT

CONTROL - MOW - 3365

WEIGHT TRANSFER OPERATION

A—Power Circuit
B—Weight Transfer OFF Circuit
C—Weight Transfer ON—Wing Toggle Lower Circuit
D—Ground Circuit
E—Battery
F—Fusible Link
G—20 Amp Fuse
H—Key Switch
I—Right Wing Toggle Switch
J—Left Wing Toggle
K—Weight Transfer Switch
L—Weight Transfer Solenoid

Slide MXC80960AE

FUNCTION:
To permit ON/OFF control of weight transfer system.

OPERATING CONDITIONS:
To activate the weight transfer system, the switch must be in the engaged (+) position (switch open). To de-activate the weight transfer system, the switch must be in the disengaged (O) position (switch closed).

MAJOR COMPONENTS:
- Battery
- Fusible Link
- 20 Amp Fuse
- Key Switch
- Left Wing Toggle Switch
- Right Wing Toggle Switch
- Weight Transfer Switch
- Weight Transfer Solenoid

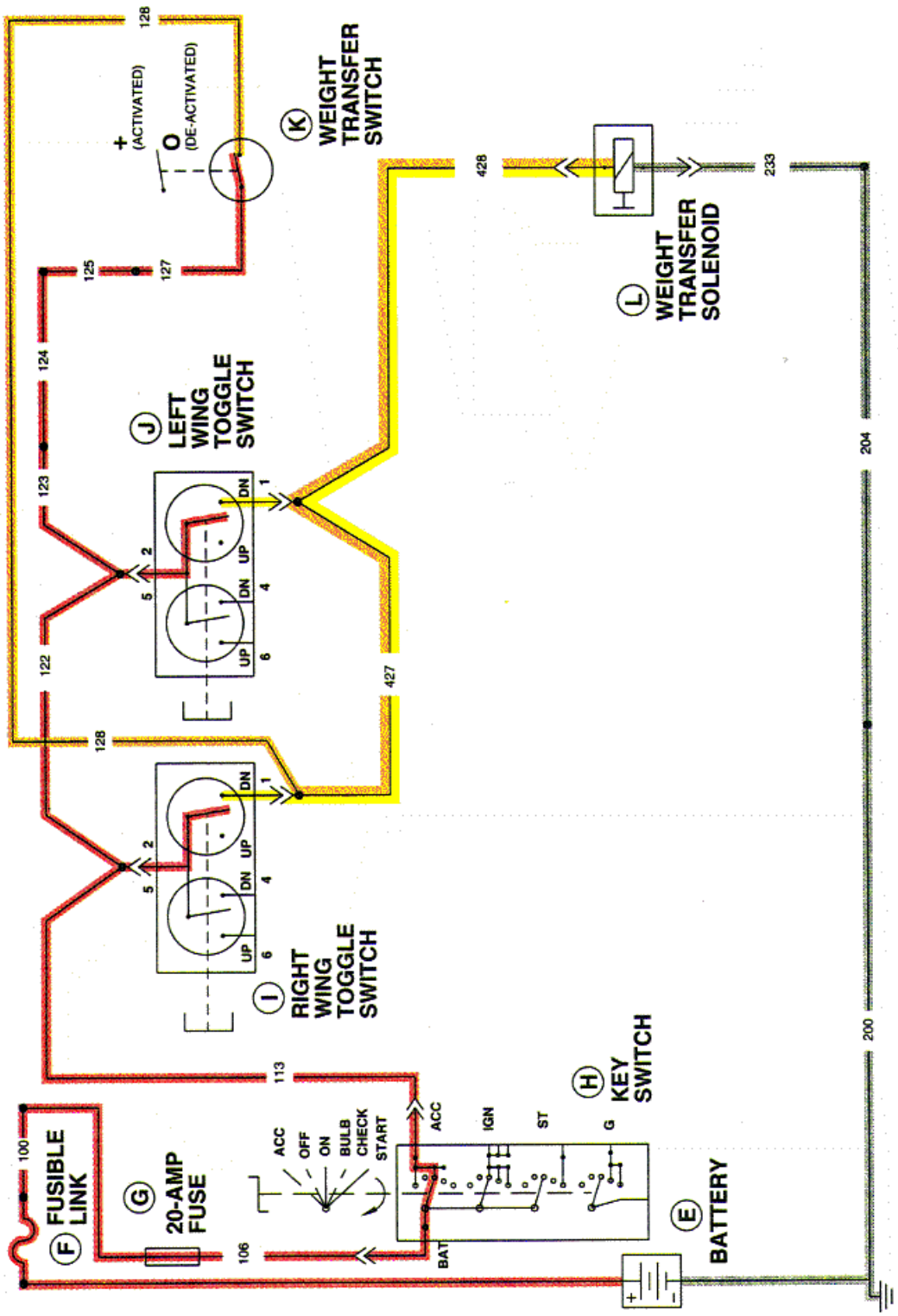
THEORY OF OPERATION:
Current in circuit (A) flows from the battery (E), through the fusible link (F), 20 amp fuse (G) and to the key switch (H). When the key switch is in the ON or ACC position, current continues flowing to the wing toggle switches (I and J) and weight transfer switch (K).

The weight transfer system is a hydraulic function. The system applies hydraulic pressure on the lift side of cylinders to maintain mower weight on the drive wheels. To de-activate the system, the switch is moved to O position, which closes the switch and allows current in circuit (B) to flow from the transfer switch (K) to the weight transfer solenoid (L). The solenoid is energized, stopping the hydraulic oil flow to the transfer cylinders.

To activate the weight transfer system, the switch is moved to + position which opens the switch. This interrupts current flow and de-energizes the weight transfer solenoid. Hydraulic oil now flows to the cylinders.

When the weight transfer system is activated (switch open) and the wing toggle switches are moved to lower the wings, weight transfer (lifting) force must be removed from wing cylinders. The toggle switches override the weight transfer system during lowering. Current is allowed to flow through circuit (C). This will energize the solenoid to de-activate the weight transfer system while the wing(s) lower. When the toggle switch is released, the solenoid is de-energized and the weight transfer system is back in operation.

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DIAGNOSTIC PROCEDURE

The diagnostics in this group are function-oriented rather than problem-oriented. Select the appropriate function that applies to the problem and follow the test procedure under that heading. The functions addressed are:

- Cranking System
  - —Operator On Seat—3325
  - —Operator Off Seat—3325
  - —Operator On Seat—3365
  - —Operator Off Seat—3365
- Fuel Control System
  - —Operator On Seat
  - —Operator Off Seat
  - —Seat Override
- Air Heater System
- Charging System
- Warning Alarm System
- Service Alert System
- Hourmeter System
- Fuel Gauge System
- Lighting System
- Cutting Units System
  - —Left Wing Raise
  - —Left Wing Lower
  - —Right Wing Raise
  - —Right Wing Lower
  - —Mow
    - —Front/Center
    - —Left
    - —Right
  - —Backlap
  - —Weight Transfer

The diagnostic procedure lists:
- •Test conditions
- •Test sequence
- •Test/check point
- •Normal reading
- •Check or test to perform if reading is not normal

When performing the test or check, be sure to follow the test conditions and sequence carefully. The “Normal” column shows the expected reading or condition. If the results of the test or check are not normal, perform the test, check or adjustment listed in the “If Not Normal” column. The detailed tests or adjustments referred to in the “If Not Normal” column are located at the end of this group.

The components used in the circuit diagrams resemble actual machine components. The key number on the diagram determines the test sequence and the arrows indicate diagnostic test points.

The number under the art refers to the slides used during service training.

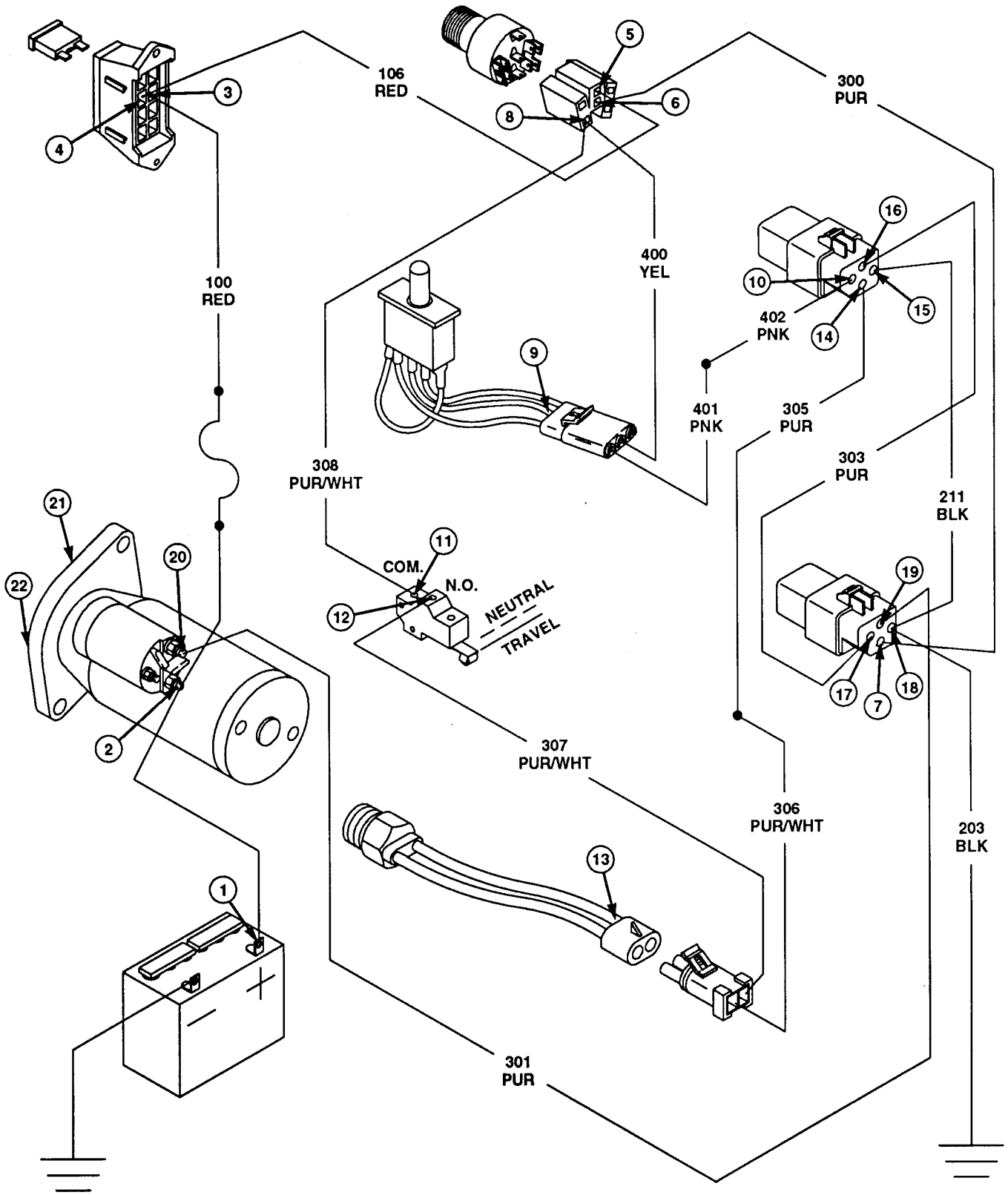
MX,24015HV,A1 -19-21JAN93

CRANKING SYSTEM TEST POINTS—OPERATOR ON SEAT—3325

CONDITIONS:
- Both travel pedals in neutral position.
- PTO disengaged.
- Key switch in start position.
- Sufficient weight on seat to close seat switch.
- Connectors fully-seated.
- Meter set to DC volts position.
- Meter positive (red) lead connected to numbered test points.
- Meter negative (black) lead connected to ground.
- Electrical tests and adjustments in this group.

Test Location	Normal	If Not Normal
1. Battery positive post	Minimum 12.4 volts.	Charge and load test battery. Replace bad battery.
2. Starter battery terminal	Battery voltage.	Check for bad connections or a break in cable between battery and starter.
3. Wire no. 100 terminal of 20-amp fuse, F3	Battery voltage.	Check for failed fusible link at starter. If fusible link is bad, determine cause and replace fusible link. Also check for bad splice or broken wire no. 100.
4. Wire no. 106 terminal of 20-amp fuse, F3	Battery voltage.	Check for a blown fuse, F3. If fuse is good, check for bad connections.
5. BAT terminal of key switch	Battery voltage.	Check for bad connections or a break in wire no. 106.
6. ST terminal of key switch	Battery voltage.	Test key switch. See procedure in this group.
7. Wire no. 300 terminal of neutral start relay connector	Battery voltage.	Check for a bad connection or a break in wire no. 300.
8. IGN terminal of key switch	Battery voltage.	Test key switch. See procedure in this group.
9. Switch side of seat switch connector, yellow wire	Battery voltage.	Check for a bad connection in the seat switch connector or a break in wire no. 400.
10. Wire no. 402 terminal of seat relay connector	Battery voltage.	Check for a bad connection in the seat switch connector or a break in wire nos. 401 and 402. Also check for a break in the splice connecting wire nos. 401 and 402. If connections are good, test seat switch. See procedure in this group.
11. COM terminal of neutral switch	Battery voltage.	Check for a bad connection or break in wire no. 308.
12. NO terminal of neutral switch	Battery voltage.	Test or adjust neutral switch. See procedure in this group.

MX,24015HV,A2 -19-21JAN93



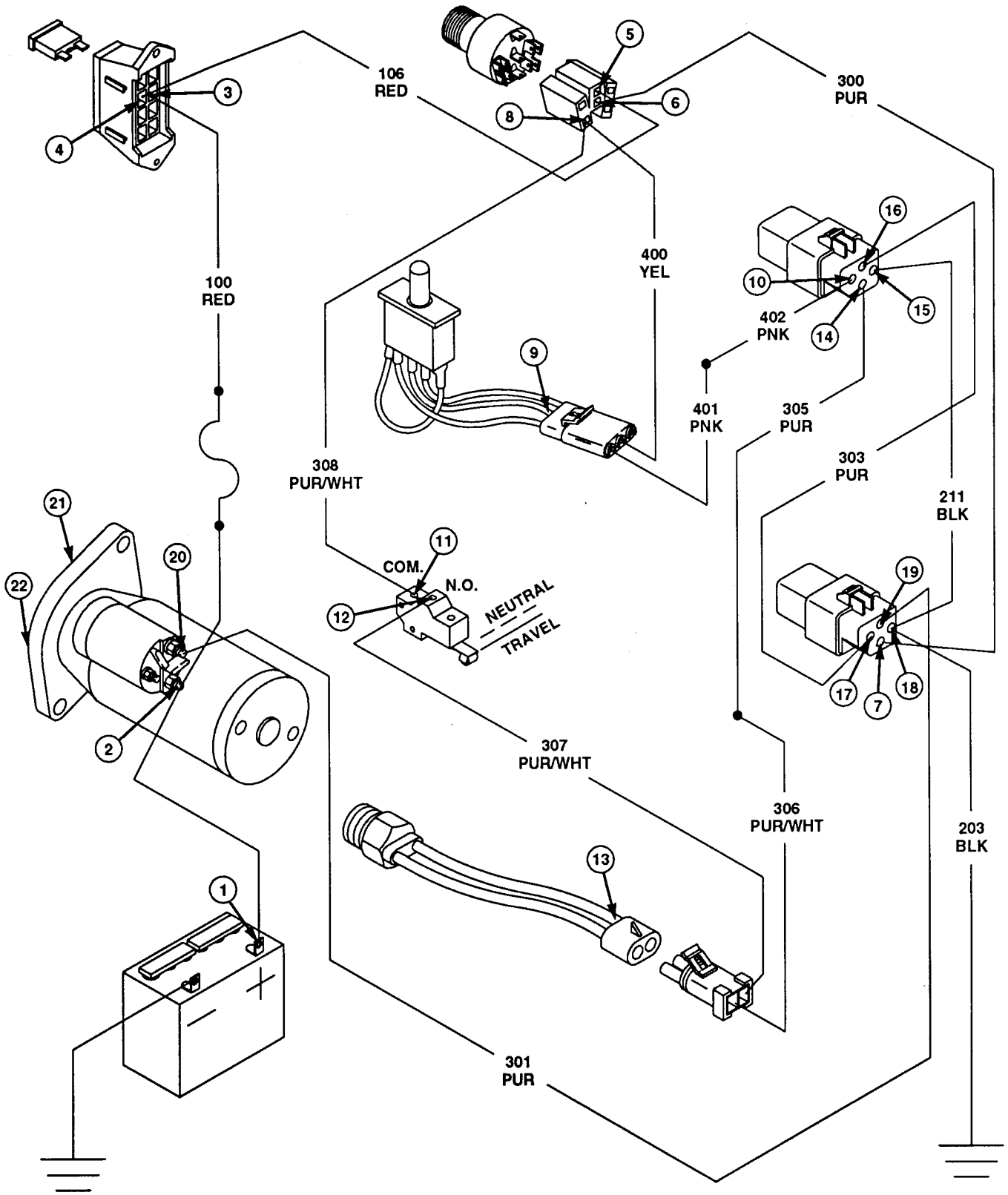
CRANKING SYSTEM TEST POINTS-OPERATOR ON SEAT-3325

MX,24015HV,A3 -19-21JAN93

CRANKING SYSTEM TEST POINTS—OPERATOR ON SEAT—3325—CONTINUED

Test Location	Normal	If Not Normal
13. Switch side of PTO switch connector	Battery voltage.	Check for a bad connection in the PTO switch connector or a break in wire no. 307.
14. Wire no. 305 terminal of seat relay connector	Battery voltage.	Check for a bad connection in the PTO switch connector or a break in the splice connecting wire nos. 305 and 306. Test PTO switch. See procedure in this group.
15. Wire no. 211 terminal of seat relay connector	Less than 0.2 volt.	Check continuity to ground of wire no. 211.
16. Wire no. 303 terminal of seat relay connector	Battery voltage.	Test seat relay. See procedure in this group.
17. Wire no. 303 terminal of neutral start relay connector	Battery voltage.	Check for a break in wire no. 303.
18. Wire no. 203/211 terminal of neutral start relay connector	Less than 0.2 volt.	Check continuity to ground of wire no. 211.
19. Wire no. 301 terminal of neutral start relay	Battery voltage.	Test neutral start relay. See procedure in this group.
20. S terminal of starter	Battery voltage.	Check for a bad connection or a break in wire no. 301.
21. Test starter amp draw/cranking rpm	Starter amp draw within specification.	Check engine for binding.
22. Remove starter and perform no-load amp/rpm tests	Starter no-load amp draw within specification.	Replace starter.

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CRANKING SYSTEM TEST POINTS-OPERATOR ON SEAT-3325

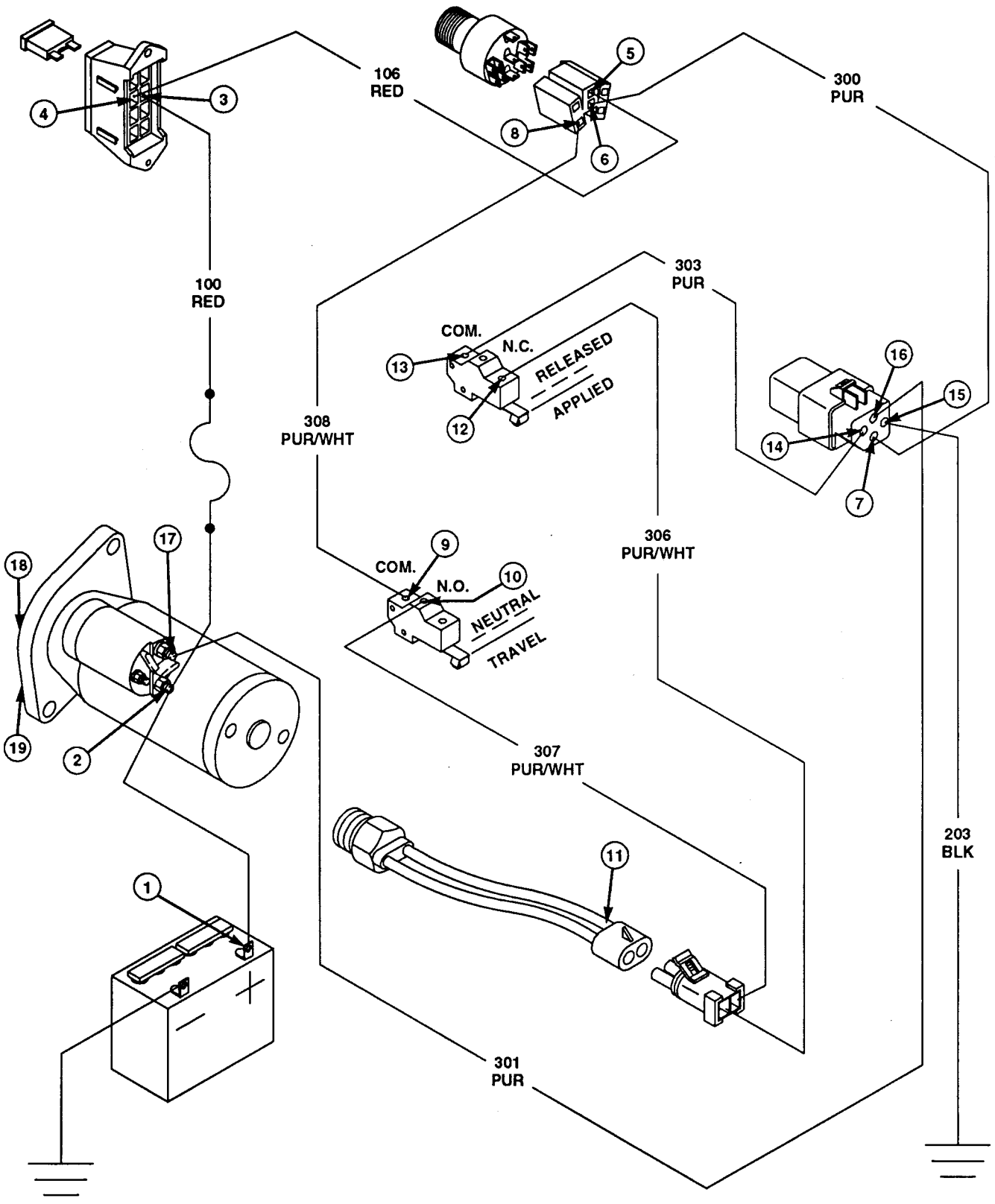
MX,24015HV,A3 -19-21JAN93

CRANKING SYSTEM TEST POINTS—OPERATOR OFF SEAT—3325

CONDITIONS:
- Both travel pedals in neutral position.
- PTO disengaged.
- No weight on seat.
- Key switch in start position.
- Parking brake applied.
- Connectors fully-seated.
- Meter set to DC volts position.
- Meter positive (red) lead connected to numbered test points.
- Meter negative (black) lead connected to ground.
- Electrical tests and adjustments in this group.

Test Location	Normal	If Not Normal
1. Battery positive post	Minimum 12.4 volts.	Charge and load test battery.
2. Starter battery terminal	Battery voltage.	Check for bad connections or a break in cable between battery and starter.
3. Wire no. 100 terminal of 20-amp fuse, F3	Battery voltage.	Check for failed fusible link at starter. If fusible link is bad, determine cause and replace fusible link. Also check for bad splice or broken wire no. 100.
4. Wire no. 106 terminal of 20-amp fuse, F3	Battery voltage.	Check for a blown fuse, F3. If fuse is good, check for a bad connection at the fuse block.
5. BAT terminal of key switch	Battery voltage.	Check for bad connections or a break in wire no. 106.
6. ST terminal of key switch	Battery voltage.	Test key switch. See procedure in this group.
7. Wire no. 300 terminal of neutral start relay connector	Battery voltage.	Check for a bad connection or a break in wire no. 300.
8. IGN terminal of key switch	Battery voltage.	Test key switch. See procedure in this group.
9. COM terminal of neutral switch	Battery voltage.	Check for a bad connection or a break in wire no. 308.
10. NO terminal of neutral switch	Battery voltage.	Test neutral switch. See procedure in this group.
11. Switch side of PTO switch connector	Battery voltage.	Check for a bad connection in the PTO switch connector or a break in wire no. 307.
12. NC terminal of brake switch	Battery voltage.	Check for a bad connection in the PTO switch connector or a break in wire no. 306. Test PTO switch. See procedure in this group.
13. COM terminal of brake switch	Battery voltage.	Test brake switch. See procedure in this group.
14. Wire no. 303 terminal of neutral start relay connector	Battery voltage.	Check for a bad connection or a break in wire no. 303.

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M81392AE

CRANKING SYSTEM TEST POINTS-OPERATOR OFF SEAT-3325

M81392AE -19-10DEC92

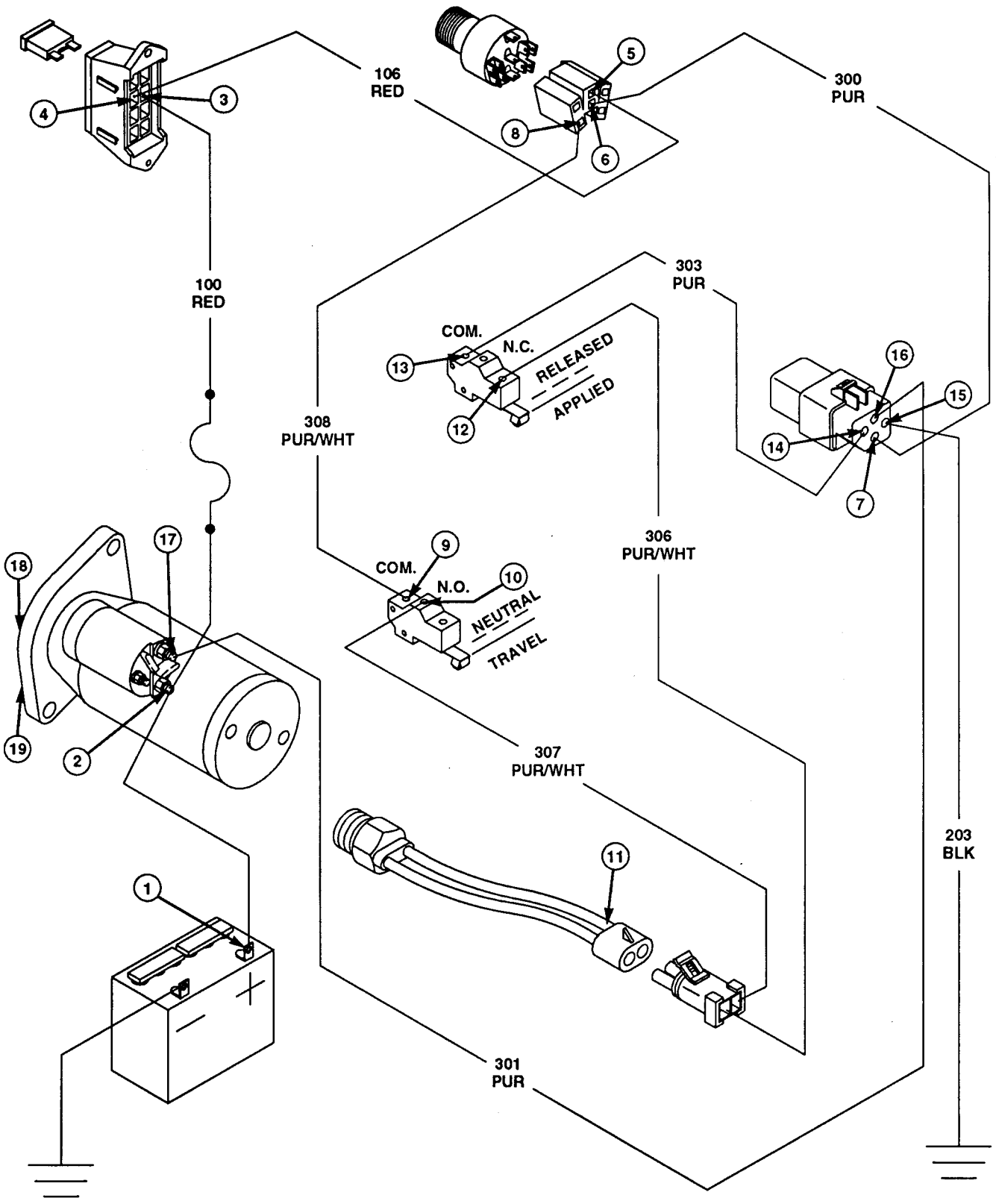
MX,24015HV,A5 -19-21JAN93

CRANKING SYSTEM TEST POINTS—OPERATOR OFF SEAT—3325—CONTINUED

Test Location	Normal	If Not Normal
15. Wire no. 203 terminal of neutral start relay connector	Less than 0.2 volt.	Check continuity to ground of wire no. 203.
16. Wire no. 301 terminal of neutral start relay connector	Battery voltage.	Test neutral start relay. See procedure in this group.
17. S terminal of starter	Battery voltage.	Check for a bad connection or a break in wire no. 301.
18. Test starter amp draw/cranking rpm	Starter amp draw within specification.	Check engine for binding.
19. Remove starter and perform no-load amp/rpm tests	Starter no-load amp draw within specification.	Replace starter.

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MX,24015HV,A5A -19-21JAN93



M81392AE

CRANKING SYSTEM TEST POINTS-OPERATOR OFF SEAT-3325

M81392AE -19-10DEC92

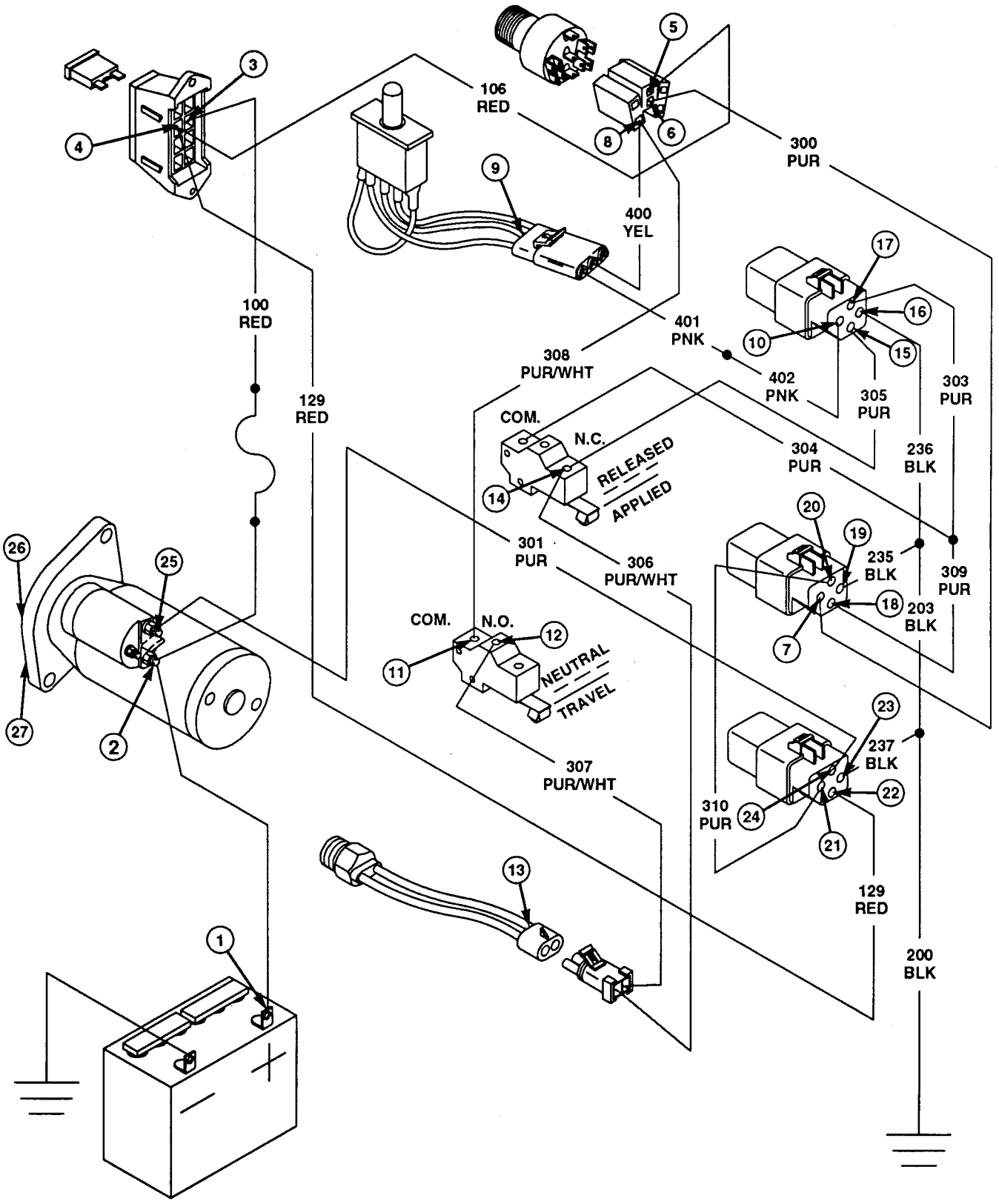
MX,24015HV,A5 -19-21JAN93

CRANKING SYSTEM TEST POINTS—OPERATOR ON SEAT—3365

CONDITIONS:
- Both travel pedals in neutral position.
- PTO disengaged.
- Key switch in start position.
- Sufficient weight on seat to close seat switch.
- Connectors fully-seated.
- Meter set to DC volts position.
- Meter positive (red) lead connected to numbered test points.
- Meter negative (black) lead connected to ground.
- Electrical tests and adjustments in this group.

Test Location	Normal	If Not Normal
1. Battery positive post	Minimum 12.4 volts.	Charge and load test battery. Replace bad battery.
2. Starter battery terminal	Battery voltage.	Check for bad connections or a break in cable between battery and starter.
3. Wire no. 100 terminal of 20-amp fuse, F3	Battery voltage.	Check for a failed fusible link at starter. If fusible link is bad, determine cause and replace fusible link. Also check for a bad splice or a break in wire no. 100.
4. Wire no. 106/129 terminal of 20-amp fuse, F3	Battery voltage.	Check for a blown fuse, F3. If fuse is good, check for bad connections.
5. BAT terminal of key switch	Battery voltage.	Check for bad connections or a break in wire no. 106.
6. ST terminal of key switch	Battery voltage.	Test key switch. See procedure in this group. Replace defective key switch.
7. Wire no. 300 terminal of neutral start relay connector	Battery voltage.	Check for a bad connection or a break in wire no. 300.
8. IGN terminal of key switch	Battery voltage.	Test key switch. See procedure in this group.
9. Switch side of seat switch connector, yellow wire	Battery voltage.	Check for a bad connection in the seat switch connector or a break in wire no. 400.
10. Wire no. 402 terminal of seat relay connector	Battery voltage.	Check for a bad connection in the seat switch connector or a break in wire nos. 401 and 402. Also check for a break in the splice connecting wire nos. 401 and 402. If connections are good, test seat switch. See procedure in this group.
11. COM terminal of neutral switch	Battery voltage.	Check for a bad connection or break in wire no. 308.
12. NO terminal of neutral switch	Battery voltage.	Test or adjust neutral switch. See procedure in this group.

MX,24015HV,A6 -19-21JAN93



CRANKING SYSTEM TEST POINTS-OPERATOR ON SEAT-3365

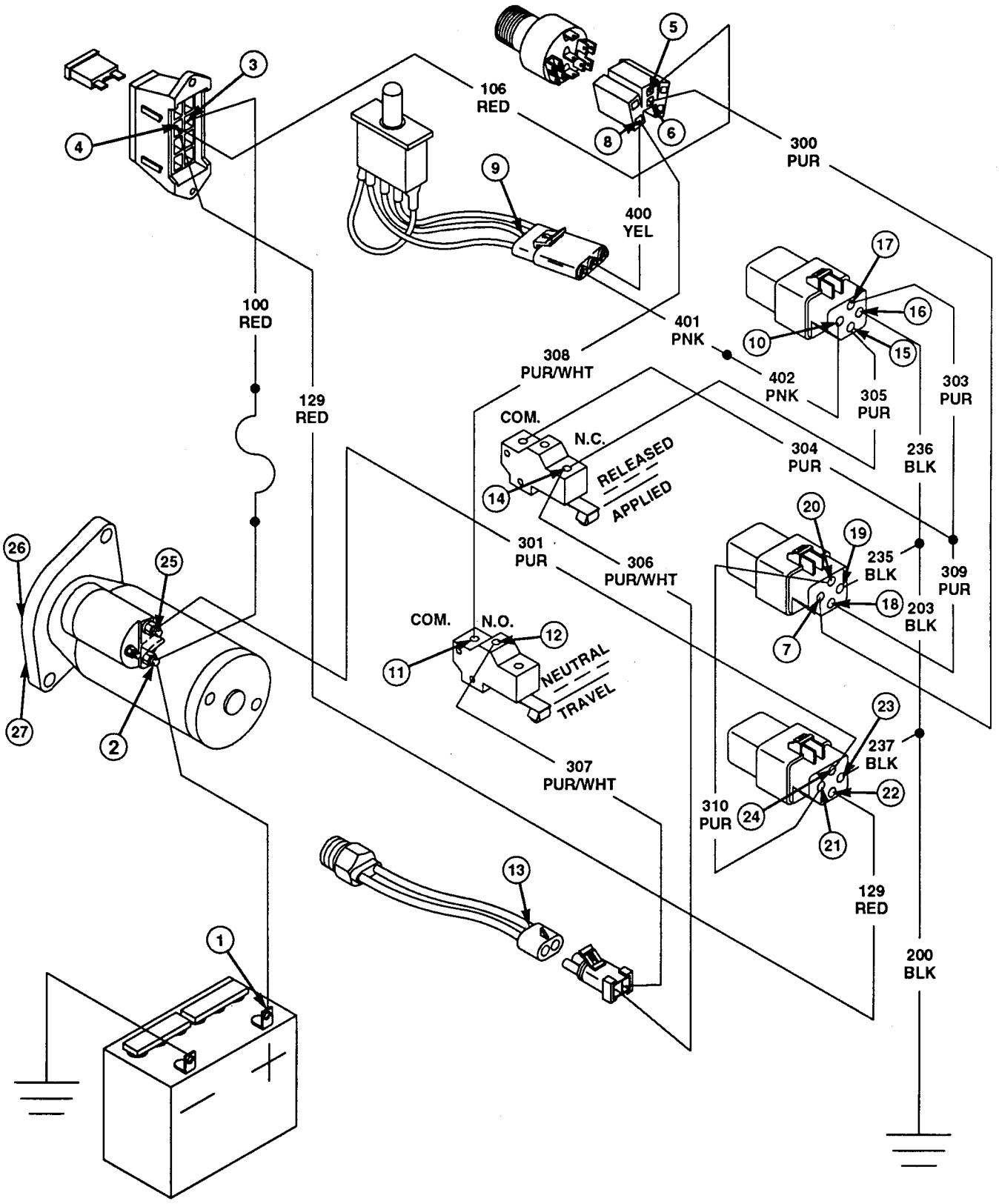
M81393AE -19-10DEC92

MX,24015HV,A7 -19-21JAN93

CRANKING SYSTEM TEST POINTS—OPERATOR ON SEAT—3365—CONTINUED

Test Location	Normal	If Not Normal
13. Switch side of PTO switch connector	Battery voltage.	Check for a bad connection in the PTO switch connector or a break in wire no. 307.
14. NC terminal of brake switch	Battery voltage.	Check for a bad connection in PTO switch connector or a break in wire no. 306. Test PTO switch. See procedure in this group.
15. Wire no. 305 terminal of seat relay connector	Battery voltage.	Check for a bad connection or break in wire no. 305.
16. Wire no. 236 terminal of seat relay connector	Less than 0.2 volt.	Check continuity to ground of wire no. 236.
17. Wire no. 303 terminal of seat relay connector	Battery voltage.	Test seat relay. See procedure in this group.
18. Wire no. 309 terminal of neutral start relay connector	Battery voltage.	Check for a bad connection or a break in the splice connecting wire nos. 303 and 309.
19. Wire no. 235 terminal of neutral start relay	Less than 0.2 volt.	Check continuity to ground of wire no. 235.
20. Wire no. 310 terminal of neutral start relay	Battery voltage.	Test neutral start relay. See procedure in this group.
21. Wire no. 310 terminal of start-enable relay	Battery voltage.	Check for a bad connection or a break in wire no. 310.
22. Wire no. 129 terminal of start-enable relay	Battery voltage.	Check for a bad connection or a break in wire no. 129.
23. Wire no. 237 terminal of start-enable relay	Less than 0.2 volt.	Check continuity of wire no. 237 to ground.
24. Wire no. 301 terminal of start-enable relay	Battery voltage.	Test start-enable relay. See procedure in this group.
25. S terminal of starter	Battery voltage.	Check for a bad connection or a break in wire no. 301.
26. Test starter amp draw/cranking rpm	Starter amp draw within specification.	Check engine for binding.
27. Remove starter and perform no-load amp/rpm tests	Starter no-load amp draw within specification.	Replace starter.

MX,24015HV,A7A -19-21JAN93



CRANKING SYSTEM TEST POINTS-OPERATOR ON SEAT-3365

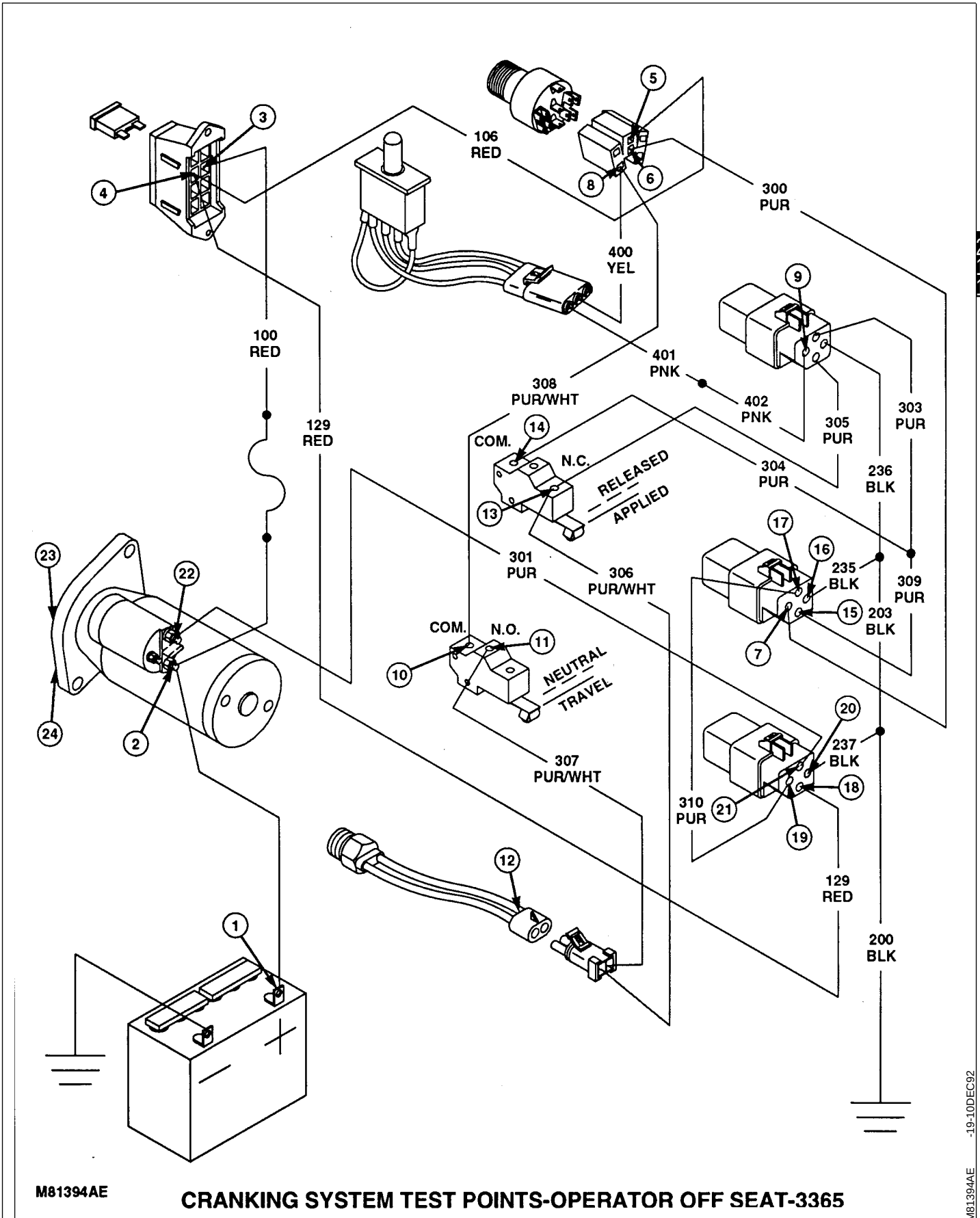
MX,24015HV,A7 -19-21JAN93

CRANKING SYSTEM TEST POINTS—OPERATOR OFF SEAT—3365

CONDITIONS:
- Both travel pedals in neutral position.
- PTO disengaged.
- No weight on seat.
- Key switch in start position.
- Parking brake applied.
- Connectors fully-seated.
- Meter set to DC volts position.
- Meter positive (red) lead connected to numbered test points.
- Meter negative (black) lead connected to ground.
- Electrical tests and adjustments in this group.

Test Location	Normal	If Not Normal
1. Battery positive post	Minimum 12.4 volts.	Charge and load test battery.
2. Starter battery terminal	Battery voltage.	Check for bad connections or a break in cable between battery and starter.
3. Wire no. 100 terminal of 20-amp fuse, F3	Battery voltage.	Check for failed fusible link at starter. If fusible link is bad, determine cause and replace fusible link. Also check for bad splice or broken wire no. 100.
4. Wire no. 106/129 terminal of 20-amp fuse, F3	Battery voltage.	Check for a blown fuse, F3. If fuse is good, check for a bad connection at the fuse block.
5. BAT terminal of key switch	Battery voltage.	Check for bad connections or a break in wire no. 106.
6. ST terminal of key switch	Battery voltage.	Test key switch. See procedure in this group.
7. Wire no. 300 terminal of connector	Battery voltage.	Check for a bad connection or a break in wire no. 300 neutral start relay between key switch and neutral start relay.
8. IGN terminal of key switch	Battery voltage.	Test key switch. See procedure in this group.
9. Wire no. 402 terminal of seat relay connector	No voltage.	Test seat switch. Also check switch plunger for sticking.
10. COM terminal of neutral switch	Battery voltage.	Check for a bad connection or a break in wire no. 308.
11. NO terminal of neutral switch	Battery voltage.	Test neutral switch. See procedure in this group.
12. Switch side of PTO switch connector	Battery voltage.	Check for a bad connection in the PTO switch connector or a break in wire no. 307.
13. NC terminal of brake switch	Battery voltage.	Check for a bad connection in the PTO switch connector or a break in wire no. 306. Test PTO switch. See procedure in this group.

MX,24015HV,A8 -19-21JAN93



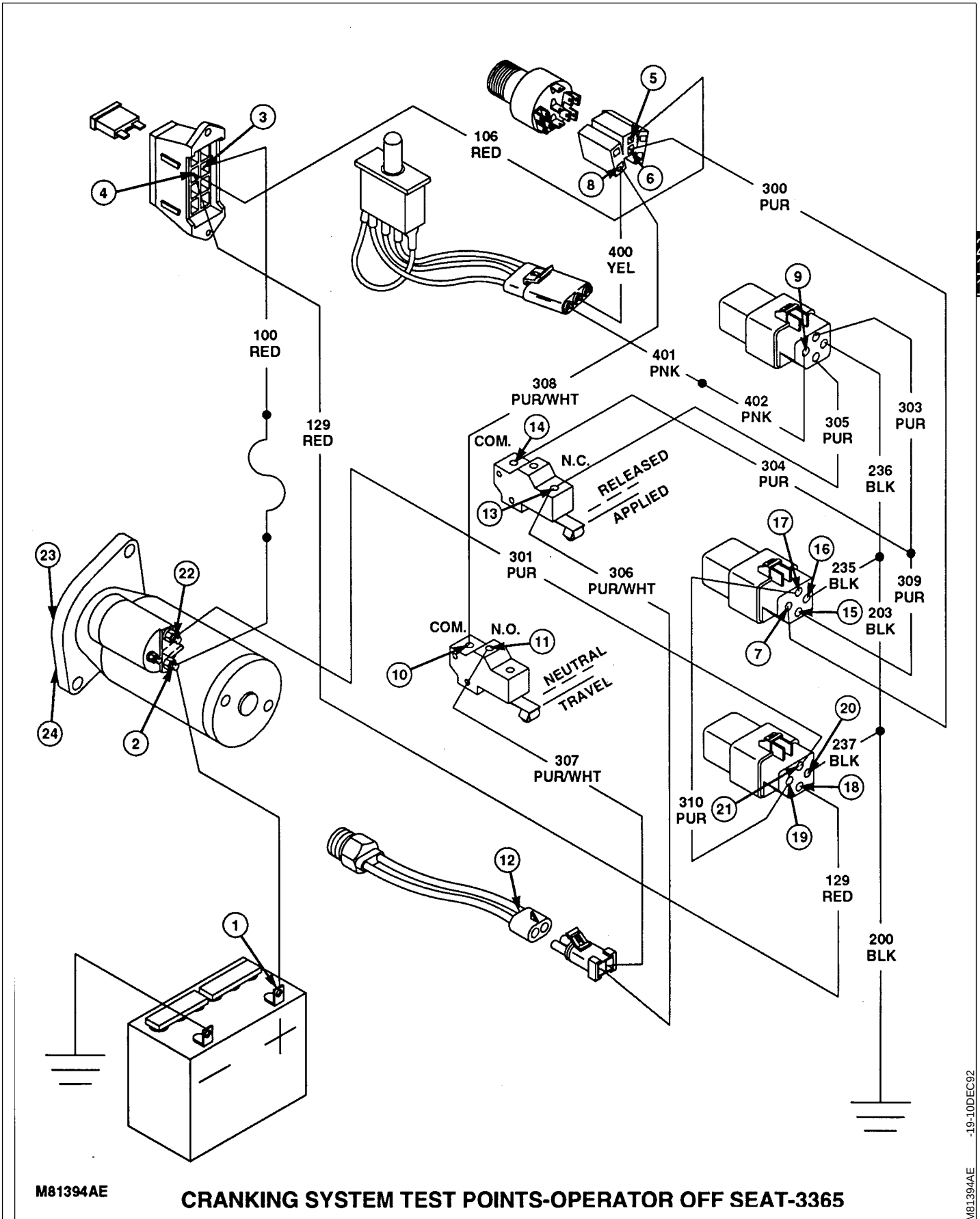
CRANKING SYSTEM TEST POINTS-OPERATOR OFF SEAT-3365

MX,24015HV,A9 -19-21JAN93

CRANKING SYSTEM TEST POINTS—OPERATOR OFF SEAT—3365—CONTINUED

Test Location	Normal	If Not Normal
14. COM terminal of brake switch	Battery voltage.	Test brake switch. See procedure in this group.
15. Wire no. 309 terminal of neutral start relay connector	Battery voltage.	Check for a break in the splice connecting wire nos. 303, 304 and 309. Also check for a break in wire nos. 304 and 309.
16. Wire no. 235 terminal of neutral start relay connector	Less than 0.2 volt.	Check continuity to ground of wire no. 235.
17. Wire no. 310 terminal of neutral start relay connector	Battery voltage.	Test neutral start relay. See procedure in this group.
18. Wire no. 129 terminal of start-enable relay connector	Battery voltage.	Check for a bad connection or a break in wire no. 129.
19. Wire no. 310 terminal of start-enable relay connector	Battery voltage.	Check for a bad connection or a break in wire no. 310.
20. Wire no. 237 terminal of start-enable relay connector	Less than 0.2 volt.	Check continuity to ground of wire no. 237.
21. Wire no. 301 terminal of start-enable relay connector	Battery voltage.	Test start-enable relay. See procedure in this group.
22. S terminal of starter	Battery voltage.	Check for a bad connection or a break in wire no. 301.
23. Test starter amp draw/cranking rpm	Starter amp draw within specification.	Check engine for binding.
24. Remove starter and perform no-load amp/rpm tests	Starter no-load amp draw within specification.	Replace starter.

MX,24015HV,A9A -19-21JAN93



CRANKING SYSTEM TEST POINTS-OPERATOR OFF SEAT-3365

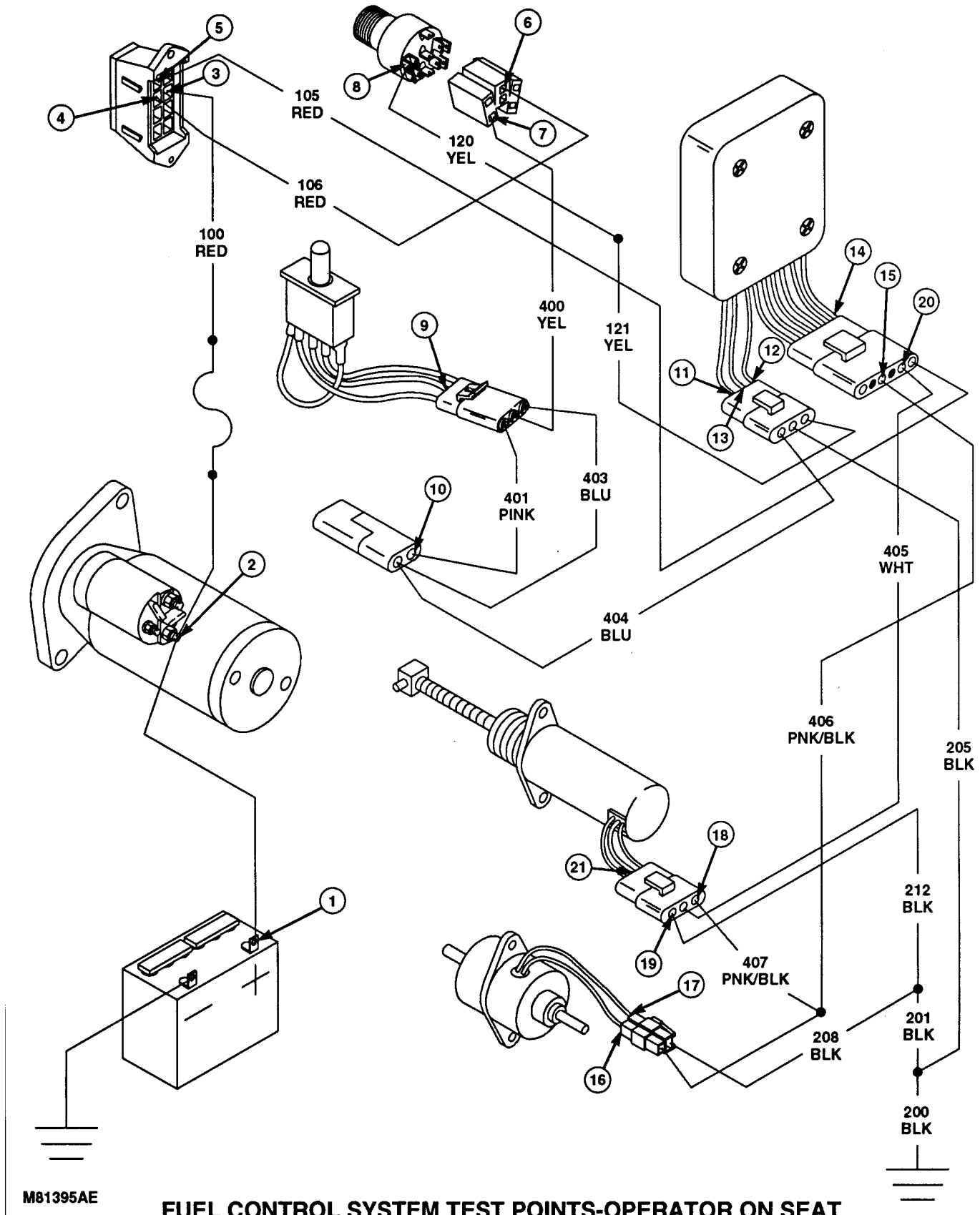
MX,24015HV,A9 -19-21JAN93

FUEL CONTROL SYSTEM TEST POINTS—OPERATOR ON SEAT

CONDITIONS:
- Both travel pedals in neutral position.
- PTO disengaged.
- Key switch in ON position.
- Sufficient weight on seat to close seat switch.
- Connectors fully-seated.
- Meter set to DC volts position.
- Meter positive (red) lead connected to numbered test points.
- Meter negative (black) lead connected to ground.
- Electrical tests and adjustments in this group.

Test Location	Normal	If Not Normal
1. Battery positive post	Minimum 12.4 volts.	Charge and load test battery.
2. Starter battery terminal	Battery voltage.	Check for bad connections or a break in cable between battery and starter.
3. Wire no. 100 terminal of 20-amp fuse, F3	Battery voltage.	Check for failed fusible link at starter. If fusible link is bad, determine cause and replace fusible link. Also check for bad splice or broken wire no. 100.
4. Wire no. 106 terminal of 20-amp fuse, F3	Battery voltage.	Check for a blown fuse, F3. If fuse is good, check for a bad connection at the fuse block.
5. Wire no. 105 terminal of 25-amp fuse, F2	Battery voltage.	Check for a blown fuse, F2. If fuse is good, check for a bad connection at the fuse block.
6. BAT terminal of key switch	Battery voltage.	Check for bad connections or a break in wire no. 106.
7. IGN terminal of key switch	Minimum 10 volts.	Test key switch. See procedure in this group.
8. Wire no. 120 terminal of key switch	Minimum 10 volts.	Test key switch. See procedure in this group.
9. Seat switch side of seat switch connector, yellow wire	Minimum 10 volts.	Check for a bad connection or a break in wire no. 400.
10. Wire no. 401 terminal of seat diode connector	Minimum 10 volts.	Check for a bad connection or a break in wire no. 401. Test seat switch. See procedure in this group.
11. Red/white wire terminal of 3-pin TDC module connector	Minimum 10 volts.	Check for a bad connection or a break in wire no. 404. Test seat diode. See procedure in this group.
12. Brown wire terminal of 3-pin TDC module connector	Minimum 10 volts.	Check for a break in the splice connecting wire nos. 120 and 121.
13. Black wire terminal of 3-pin TDC module connector	Less than 0.2 volt.	Check for continuity between wire no. 205 and ground.

MX,24015HV,A10 -19-21JAN93



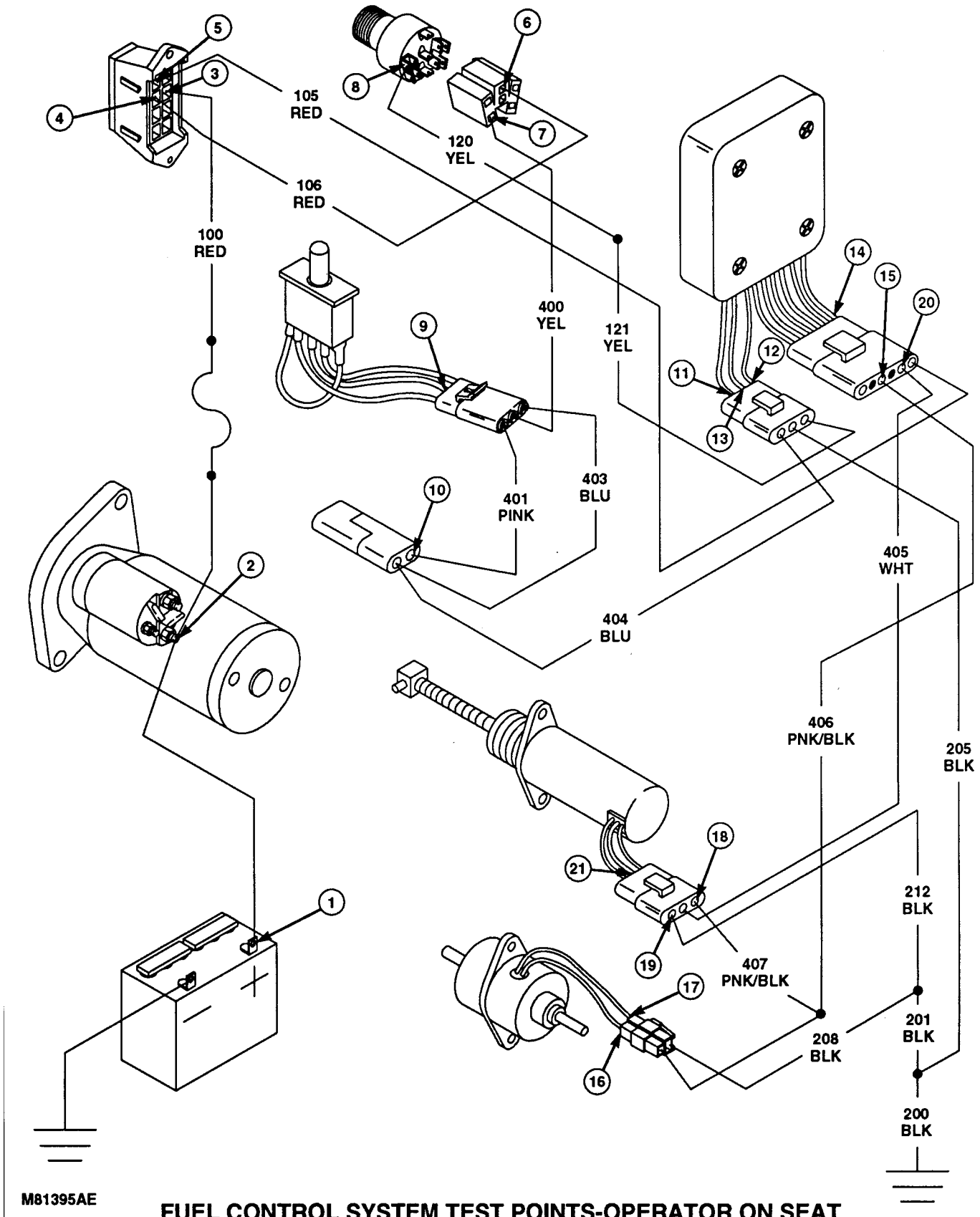
FUEL CONTROL SYSTEM TEST POINTS-OPERATOR ON SEAT

MX,24015HV,A11 -19-21JAN93

FUEL CONTROL SYSTEM TEST POINTS—OPERATOR ON SEAT—CONTINUED

Test Location	Normal	If Not Normal
14. Red wire terminal of 6-pin TDC module connector	Minimum 10 volts.	Check for a bad connection or a break in wire no. 105.
15. Wire no. 406 terminal of 6-pin TDC module connector	Minimum 10 volts.	Check for a bad connection at 6-pin TDC module connector. If connection is good, replace TDC module.
16. Black/white wire of fuel pump connector	Minimum 10 volts.	Check for a bad connection at fuel pump connector or a break in wire no. 406. Also check for a break in splice connecting wire nos. 406 and 407.
17. Black wire of fuel pump connector (fuel pump mounting screw on 3365)	Less than 0.2 volt.	On 3325, check continuity of wire no. 208 to ground. On 3365, make sure ground wire is secured to mounting screw.
18. Wire no. 407 terminal of fuel solenoid connector	Minimum 10 volts.	Check for a bad connection or a break in wire no. 407. Also check for a break in the splice connecting wire nos. 406 and 407.
19. Wire no. 212 terminal of fuel solenoid connector	Less than 0.2 volt.	Check wire no. 212 for continuity to ground.
CONDITIONS: • Turn key switch OFF, then ON with test leads connected.		
20. Wire no. 405 terminal of 6-pin TDC module connector	Minimum 9 volts for one second.	Check for a bad connection at 6-pin TDC module connector. If connections are good, replace TDC module.
21. White wire terminal of fuel solenoid connector	Minimum 9 volts for one second.	Check connections at fuel solenoid connector. If connections are good, check for a break in wire no. 405.

MX,24015HV,A11A-19-21JAN93



FUEL CONTROL SYSTEM TEST POINTS-OPERATOR ON SEAT

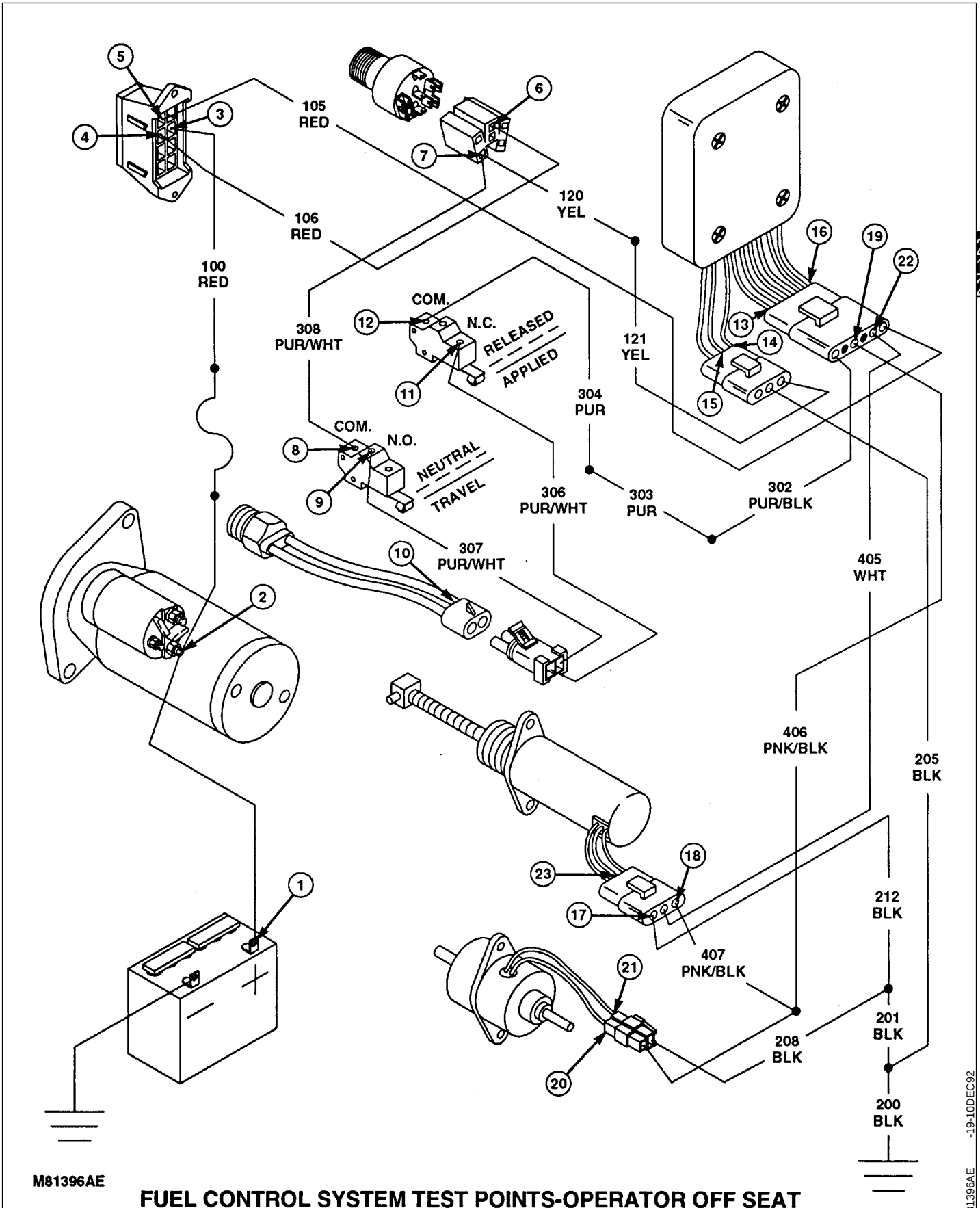
MX,24015HV,A11 -19-21JAN93

FUEL CONTROL SYSTEM TEST POINTS—OPERATOR OFF SEAT

CONDITIONS:
- Both travel pedals in neutral position.
- Parking brake engaged.
- PTO disengaged.
- Key switch in ON position.
- No weight on seat.
- Connectors fully-seated.
- Meter set to DC volts position.
- Meter positive (red) lead connected to numbered test points.
- Meter negative (black) lead connected to ground.
- Electrical tests and adjustments in this group.

Test Location	Normal	If Not Normal
1. Battery positive post	Minimum 12.4 volts.	Charge and load test battery.
2. Starter battery terminal	Battery voltage.	Check for bad connections or a break in cable between battery and starter.
3. Wire no. 100 terminal of 20-amp fuse, F3	Battery voltage.	Check for failed fusible link at starter. If fusible link is bad, determine cause and replace fusible link. Also check for bad splice or broken wire no. 100.
4. Wire no. 106 terminal of 20-amp fuse, F3	Battery voltage.	Check for a blown fuse, F3. If fuse is good, check for a bad connection at the fuse block.
5. Wire no. 105 terminal of 25-amp fuse, F2	Battery voltage.	Check for a blown fuse, F2. If fuse is good, check for a bad connection at the fuse block.
6. BAT terminal of key switch	Battery voltage.	Check for bad connections or a break in wire no. 106.
7. IGN terminal of key switch	Minimum 10 volts.	Test key switch. See procedure in this group.
8. Wire no. 308 terminal of neutral switch	Minimum 10 volts.	Check for a bad connection or a break in wire no. 308.
9. Wire no. 307 terminal of neutral switch	Minimum 10 volts.	Check for a bad connection and test switch. See procedure in this group.
10. PTO switch side of PTO switch connector	Minimum 10 volts.	Check for a bad connection or a break in wire no. 307.
11. Wire no. 306 terminal of brake switch	Minimum 10 volts.	Check for a bad connection or a break in wire no. 306. Test PTO switch. See procedure in this group.
12. Wire no. 304 terminal of brake switch	Minimum 10 volts.	Test brake switch. See procedure in this group.
13. Purple/black wire terminal of 6-pin TDC module connector	Minimum 10 volts.	Check for a bad connection or a break in the splices connecting wire nos. 302, 303 and 304.

MX,24015HV,A12 -19-21JAN93



FUEL CONTROL SYSTEM TEST POINTS-OPERATOR OFF SEAT

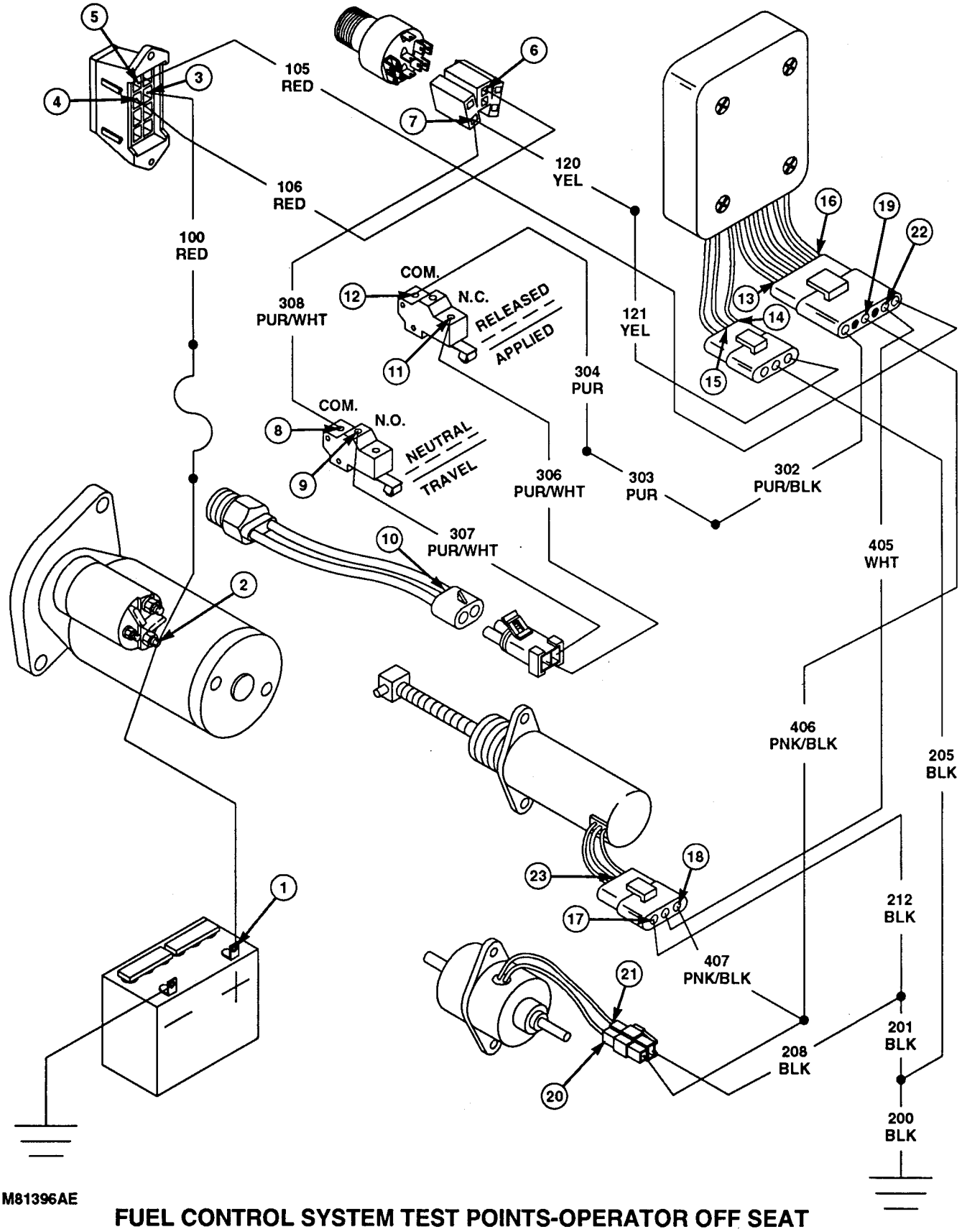
MX,24015HV,A13 -19-21JAN93

FUEL CONTROL SYSTEM TEST POINTS—OPERATOR OFF SEAT

Test Location	Normal	If Not Normal
14. Brown wire terminal of 3-pin TDC module connector	Minimum 10 volts.	Check for a break in the splice connecting wire nos. 120 and 121.
15. Black wire terminal of 3-pin TDC module connector	Less than 0.2 volt.	Check for continuity between wire no. 205 and ground.
16. Red wire terminal of 6-pin TDC module connector	Minimum 10 volts.	Check for a bad connection or a break in wire no. 105.
17. Wire no. 212 terminal of fuel solenoid connector	Less than 0.2 volt.	Check wire no. 212 for continuity to ground.
18. Wire no. 407 terminal of fuel solenoid connector	Minimum 10 volts.	Check for a bad connection or a break in wire no. 407. Also check splice connecting wire nos. 406 and 407.
19. Wire no. 406 terminal of 6-pin TDC module connector	Minimum 10 volts.	Check for a bad connection at 6-pin TDC module connector. If connection is good, replace TDC module.
20. Black/white wire of fuel pump connector	Minimum 10 volts.	Check for a bad connection at fuel pump connector or a break in wire no. 406. Also check for a break in splice connecting wire nos. 406 and 407.
21. Black wire of fuel pump connector (fuel pump mounting screw on 3365)	Less than 0.2 volt.	On 3325, check continuity of wire no. 208 to ground. On 3365, make sure ground wire is secured to mounting screw.
CONDITIONS: • Turn key switch OFF, then ON with test leads connected.		
22. Wire no. 405 terminal of 6-pin TDC module connector	Minimum 9 volts for one second.	Check for a bad connection at 6-pin TDC module connector. If connections are good, replace TDC module.
23. White wire terminal of fuel solenoid connector	Minimum 9 volts for one second.	Check for a bad connection at fuel solenoid connector. If connections are good, check for a break in wire no. 405.

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FUEL CONTROL SYSTEM TEST POINTS-OPERATOR OFF SEAT

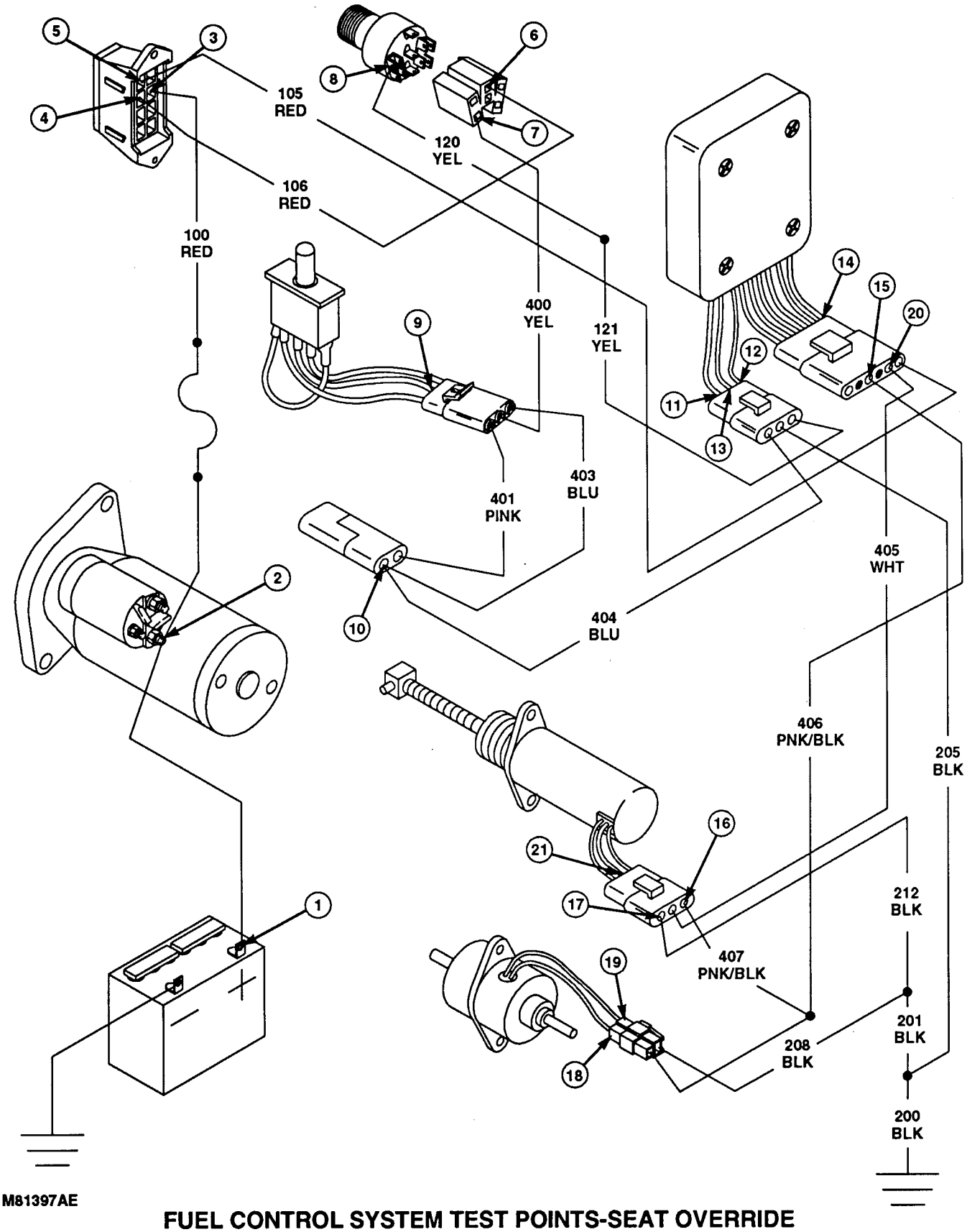
MX,24015HV,A13 -19-21JAN93

FUEL CONTROL SYSTEM TEST POINTS—SEAT OVERRIDE

CONDITIONS:
- Key switch in ON position.
- Seat switch plunger pulled up to override position.
- Connectors fully-seated.
- Meter set to DC volts position.
- Meter positive (red) lead connected to numbered test points.
- Meter negative (black) lead connected to ground.
- Electrical tests and adjustments in this group.

Test Location	Normal	If Not Normal
1. Battery positive post	Minimum 12.4 volts.	Charge and load test battery.
2. Starter battery terminal	Battery voltage.	Check for bad connections or a break in cable between battery and starter.
3. Wire no. 100 terminal of 20-amp fuse, F3	Battery voltage.	Check for failed fusible link at starter. If fusible link is bad, determine cause and replace fusible link. Also check for bad splice or broken wire no. 100.
4. Wire no. 106 terminal of 20-amp fuse, F3	Battery voltage.	Check for a blown fuse, F3. If fuse is good, check for a bad connection at the fuse block.
5. Wire no. 105 terminal of 25-amp fuse, F2	Battery voltage.	Check for a blown fuse, F2. If fuse is good, check for a bad connection at the fuse block.
6. BAT terminal of key switch	Battery voltage.	Check for bad connections or a break in wire no. 106.
7. IGN terminal of key switch	Minimum 10 volts.	Test key switch. See procedure in this group.
8. Wire no. 120 terminal of key switch	Minimum 10 volts.	Test key switch. See procedure in this group.
9. Seat switch side of seat switch connector, yellow wire	Minimum 10 volts.	Check for a bad connection or a break in wire no. 400.
10. Wire no. 404 terminal of seat diode connector	Minimum 10 volts.	Check for a bad connection or a break in wire no. 403. Test seat switch. See procedure in this group.
11. Red/white wire terminal of 3-pin TDC module connector	Minimum 10 volts.	Check for a bad connection or a break in wire no. 404.
12. Brown wire terminal of 3-pin TDC module connector	Minimum 10 volts.	Check for a break in the splice connecting wire nos. 120 and 121.
13. Black wire terminal of 3-pin TDC module connector	Less than 0.2 volt.	Check for continuity between wire no. 205 and ground.

MX,24015HV,A14 -19-21JAN93



FUEL CONTROL SYSTEM TEST POINTS-SEAT OVERRIDE

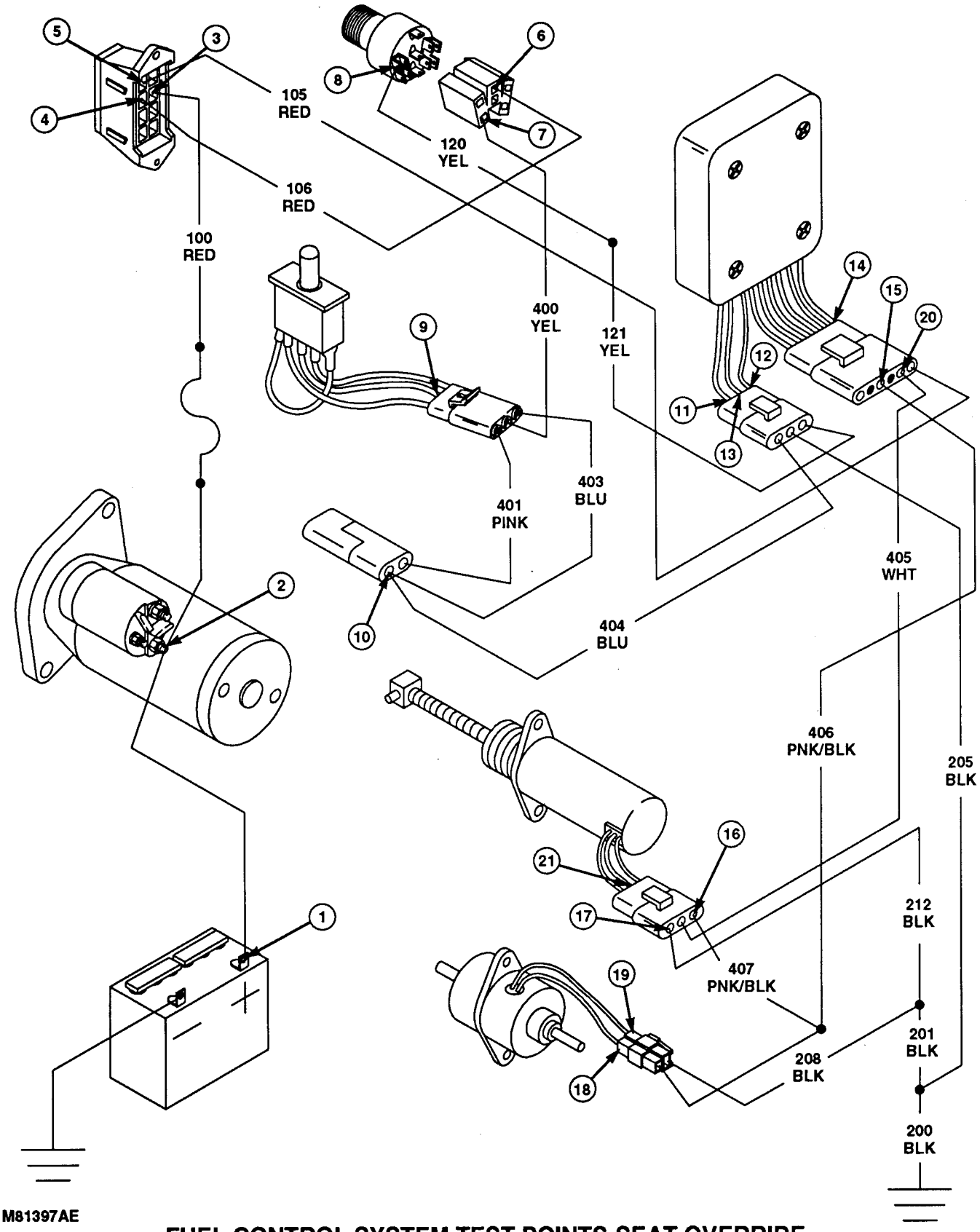
MX,24015HV,A15 -19-21JAN93

FUEL CONTROL SYSTEM TEST POINTS—SEAT OVERRIDE—CONTINUED

Test Location	Normal	If Not Normal
14. Red wire terminal of 6-pin TDC module connector	Minimum 10 volts.	Check for a bad connection or a break in wire no. 105.
15. Wire no. 406 terminal of 6-pin TDC module connector	Minimum 10 volts.	Check for a bad connection at 6-pin TDC module connector. If connection is good, replace TDC module.
16. Wire no. 407 terminal of fuel solenoid connector	Minimum 10 volts.	Check for a bad connection or a break in wire no. 407. Also check for a break in splice connecting wire nos. 406 and 407.
17. Wire no. 212 terminal of fuel solenoid connector	Less than 0.2 volt.	Check wire no. 212 for continuity to ground.
18. Black/white wire of fuel pump connector	Minimum 10 volts.	Check for a bad connection at fuel pump connector or a break in wire no. 406. Also check for a break in splice connecting wire nos. 406 and 407.
19. Black wire of fuel pump connector (fuel pump mounting screw on 3365)	Less than 0.2 volt.	On 3325, check continuity of wire no. 208 to ground. On 3365, make sure ground wire is secured to mounting screw.
CONDITIONS: • Turn key switch OFF, then ON with test leads connected.		
20. Wire no. 405 terminal of 6-pin TDC module connector	Minimum 9 volts for one second.	Check for a bad connection at 6-pin TDC module connector. If connections are good, replace TDC module.
21. White wire terminal of fuel solenoid connector	Minimum 9 volts for one second.	Check for a bad connection at fuel solenoid connector. If connections are good, check for a break in wire no. 405.

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FUEL CONTROL SYSTEM TEST POINTS-SEAT OVERRIDE

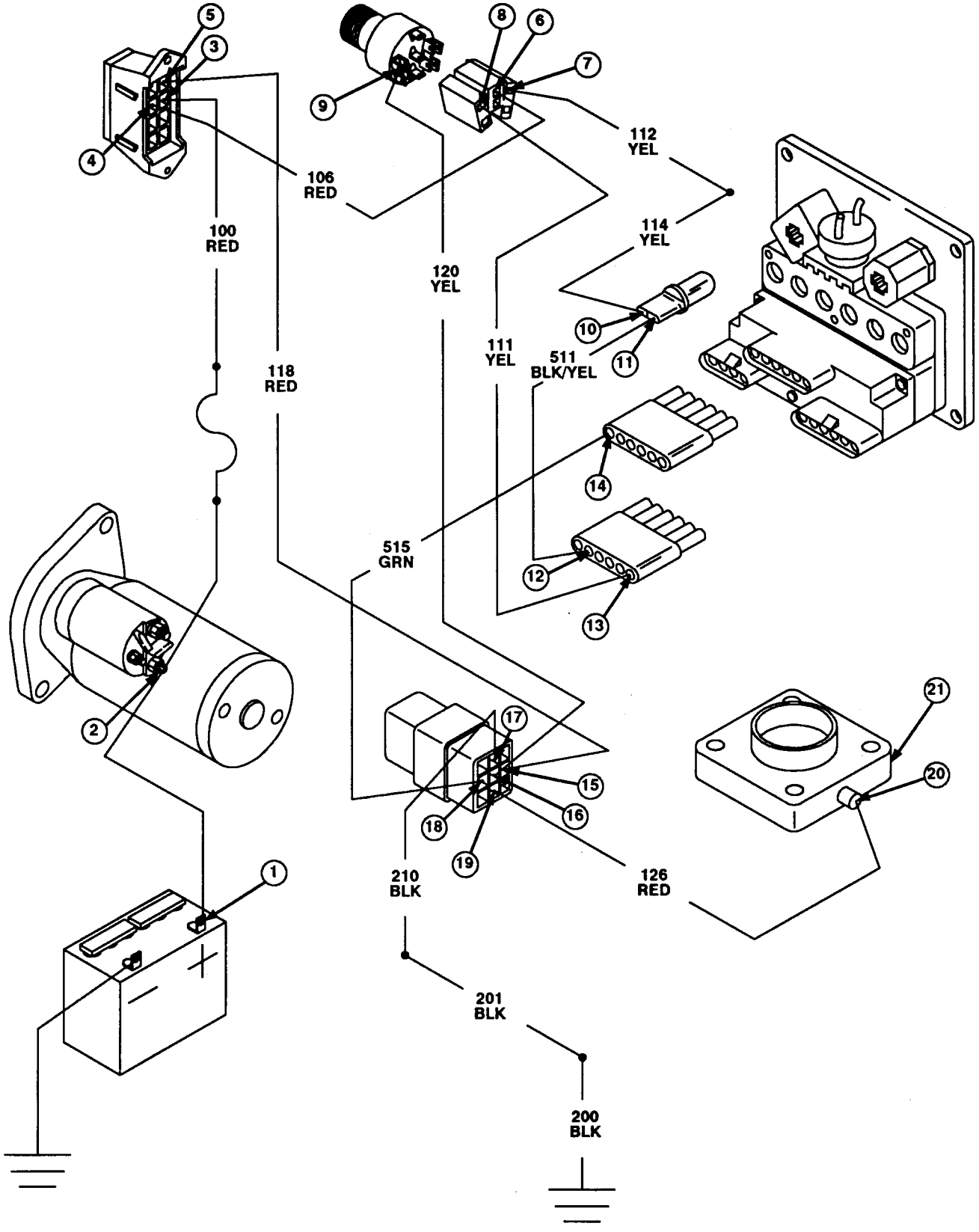
MX,24015HV,A15 -19-21JAN93

ENGINE AIR HEATER SYSTEM TEST POINTS

CONDITIONS:
- Key switch in ON position.
- Temperature surrounding air heater controller less than 20˚C (68˚F)
- Connectors fully-seated.
- Meter set to DC volts position.
- Meter positive (red) lead connected to numbered test points.
- Meter negative (black) lead connected to ground.
- Electrical tests and adjustments in this group.

Test Location	Normal	If Not Normal
1. Battery positive post	Minimum 12.4 volts.	Charge and load test battery.
2. Starter battery terminal	Battery voltage.	Check for bad connections or a break in cable between battery and starter.
3. Wire no. 100 terminal of 20-amp fuse, F3	Battery voltage.	Check for failed fusible link at starter. If fusible link is bad, determine cause and replace fusible link. Also check for bad splice or broken wire no. 100.
4. Wire no. 106 terminal of 20-amp fuse, F3	Battery voltage.	Check for a blown fuse, F3. If fuse is good, check for a bad connection at the fuse block.
5. Wire no. 118 terminal of 25-amp fuse, F2	Battery voltage.	Check for a bad connection at the fuse block.
6. BAT terminal of key switch	Battery voltage.	Check for bad connections or a break in wire no. 106.
7. Wire no. 112 terminal of key switch	Battery voltage.	Test key switch. See procedure in this group.
8. Wire no. 111 terminal of key switch	Battery voltage.	Test key switch. See procedure in this group.
9. Wire no. 120 terminal of key switch	Battery voltage.	Test key switch. See procedure in this group.
10. Wire no. 114 terminal of service alert lamp	Battery voltage.	Check for a bad connection or a break in the splice connecting wire nos. 112 and 114 .
11. Wire no. 511 terminal of service alert lamp	Less than battery voltage.	Check for a bad connection at the bulb socket or a bad bulb.
12. Wire no. 511 terminal of lower display module connector	Less than battery voltage.	Check for a bad connection or a break in wire no. 511.
13. Wire no. 111 terminal of lower display module connector	Battery voltage.	Check for a bad connection or a break in wire no. 111.

MX,24015HV,A16 -19-21JAN93



AIR HEATER SYSTEM TEST POINTS

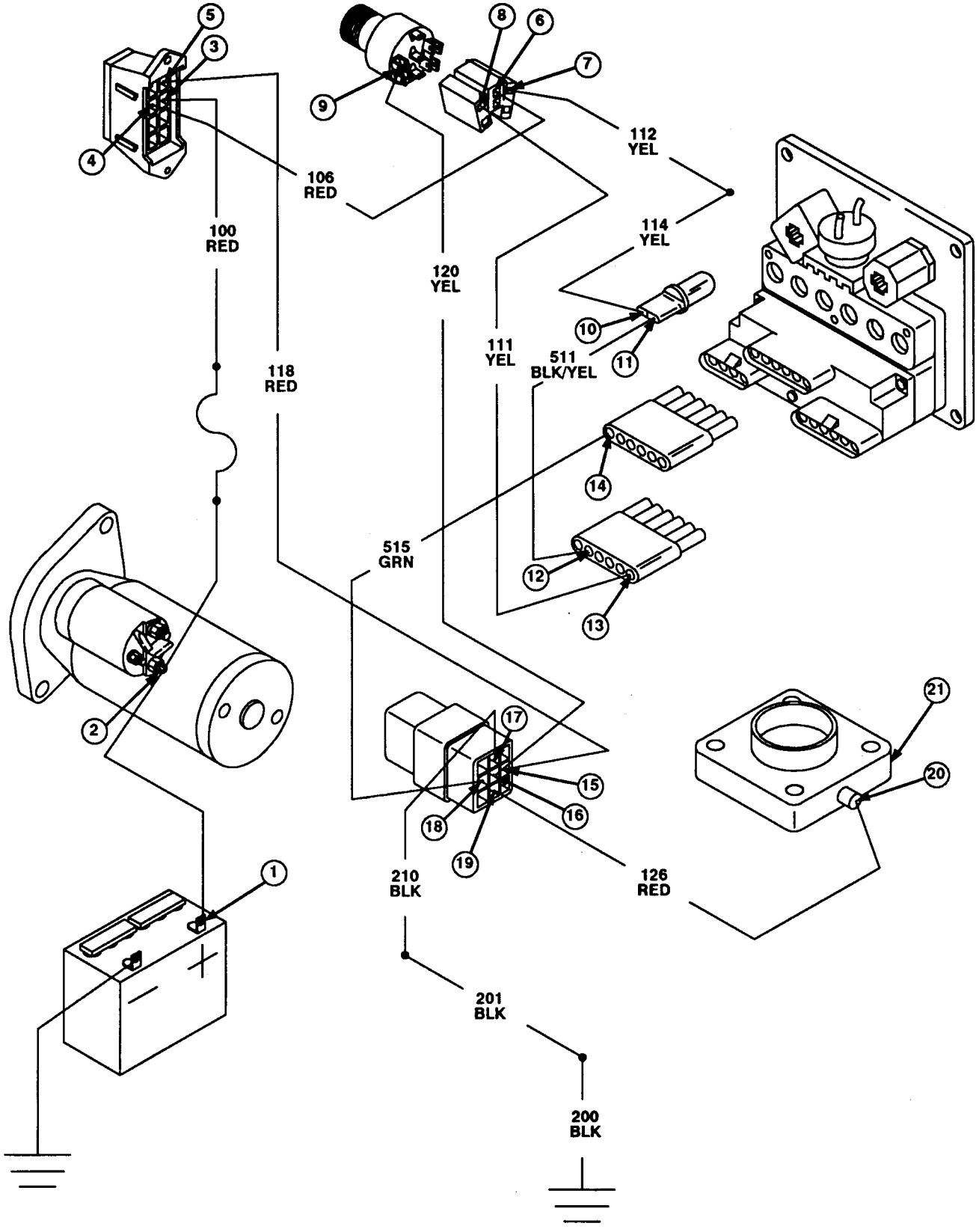
M81399AE -19-09JAN93

MX,24015HV,A17 -19-21JAN93

ENGINE AIR HEATER SYSTEM TEST POINTS—CONTINUED

Test Location	Normal	If Not Normal
14. Wire no. 515 terminal of lower display module connector	Less than 0.2 volt.	Check for a bad connection at lower display module connector or a break in wire no. 515.
15. Wire no. 118 terminal of air heater controller	Battery voltage.	Check for a bad connection or a break in wire no. 118.
16. Wire no. 120 terminal of air heater controller	Battery voltage.	Check for a bad connection or a break in wire no. 120.
17. Wire no. 210 terminal of air heater controller	Less than 0.2 volt.	Check wire no. 210 for continuity to ground. If no continuity is found, check for a break in the splices connecting wire nos. 210, 201 and 200.
18. Wire no. 515 terminal of air heater controller	Less than 0.2 volt.	Check for a bad connection at air heater controller. If connection is good, replace controller.
19. Wire no. 126 terminal of air heater controller	Battery voltage.	Replace air heater controller.
20. Wire no. 126 terminal of air heater	Battery voltage.	Check for a bad connection or a break in wire no. 126.
21. Body of air heater controller	Less than 0.2 volt.	Check for loose air heater mounting cap screws. Also make sure ground connection on intake manifold is secure. If ground is good, replace air heater.

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AIR HEATER SYSTEM TEST POINTS

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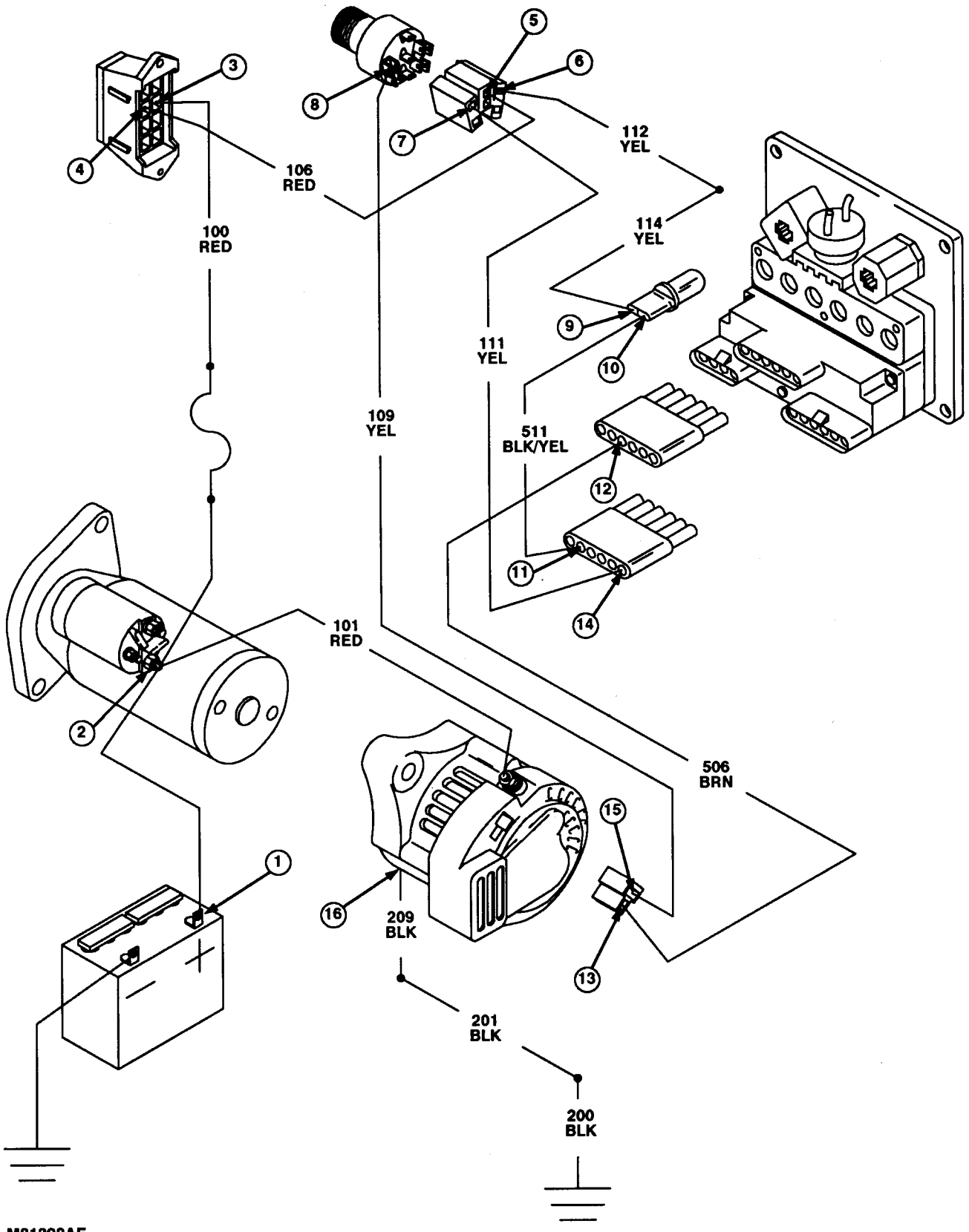
MX,24015HV,A17 -19-21JAN93

CHARGING SYSTEM TEST POINTS

CONDITIONS:
- Key switch ON; engine off.
- Connectors fully-seated.
- Meter set to DC volts position.
- Meter positive (red) lead connected to numbered test points.
- Meter negative (black) lead connected to ground.
- Electrical tests and adjustments in this group.

Test Location	Normal	If Not Normal
1. Battery positive post	Minimum 12.4 volts.	Charge and load test battery.
2. Starter battery terminal	Battery voltage.	Check for bad connections or a break in cable between battery and starter.
3. Wire no. 100 terminal of 20-amp fuse, F3	Battery voltage.	Check for failed fusible link at starter. If fusible link is bad, determine cause and replace fusible link. Also check for bad splice or broken wire no. 100.
4. Wire no. 106 terminal of 20-amp fuse, F3	Battery voltage.	Check for a blown fuse, F3. If fuse is good, check for a bad connection at the fuse block.
5. Wire no. 106 terminal of key switch	Battery voltage.	Check for bad connections or a break in wire no. 106.
6. Wire no. 112 terminal of key switch	Battery voltage.	Test key switch. See procedure in this group.
7. Wire no. 111 terminal of key switch	Battery voltage.	Test key switch. See procedure in this group.
8. Wire no. 109 terminal of key switch	Battery voltage.	Test key switch. See procedure in this group.
9. Wire no. 114 terminal of service alert lamp	Battery voltage.	Check for a bad connection or a break in splice connecting wire nos. 112 and 114.
10. Wire no. 511 terminal of service alert lamp	Less than battery voltage.	Check for a bad bulb or bad connection at bulb socket.
11. Wire no. 511 terminal of lower display module connector	Less than battery voltage.	Check for a break in wire no. 511 or bad connection at lower display module.
12. Wire no. 506 terminal of lower display module connector	Less than battery voltage.	Check for a bad connection at lower display module connector. Also check continuity of display module.
13. Wire no. 506 terminal of alternator connector	Less than battery voltage.	Check for a break in wire no. 506 or a bad connection at alternator L terminal.

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CHARGING SYSTEM TEST POINTS

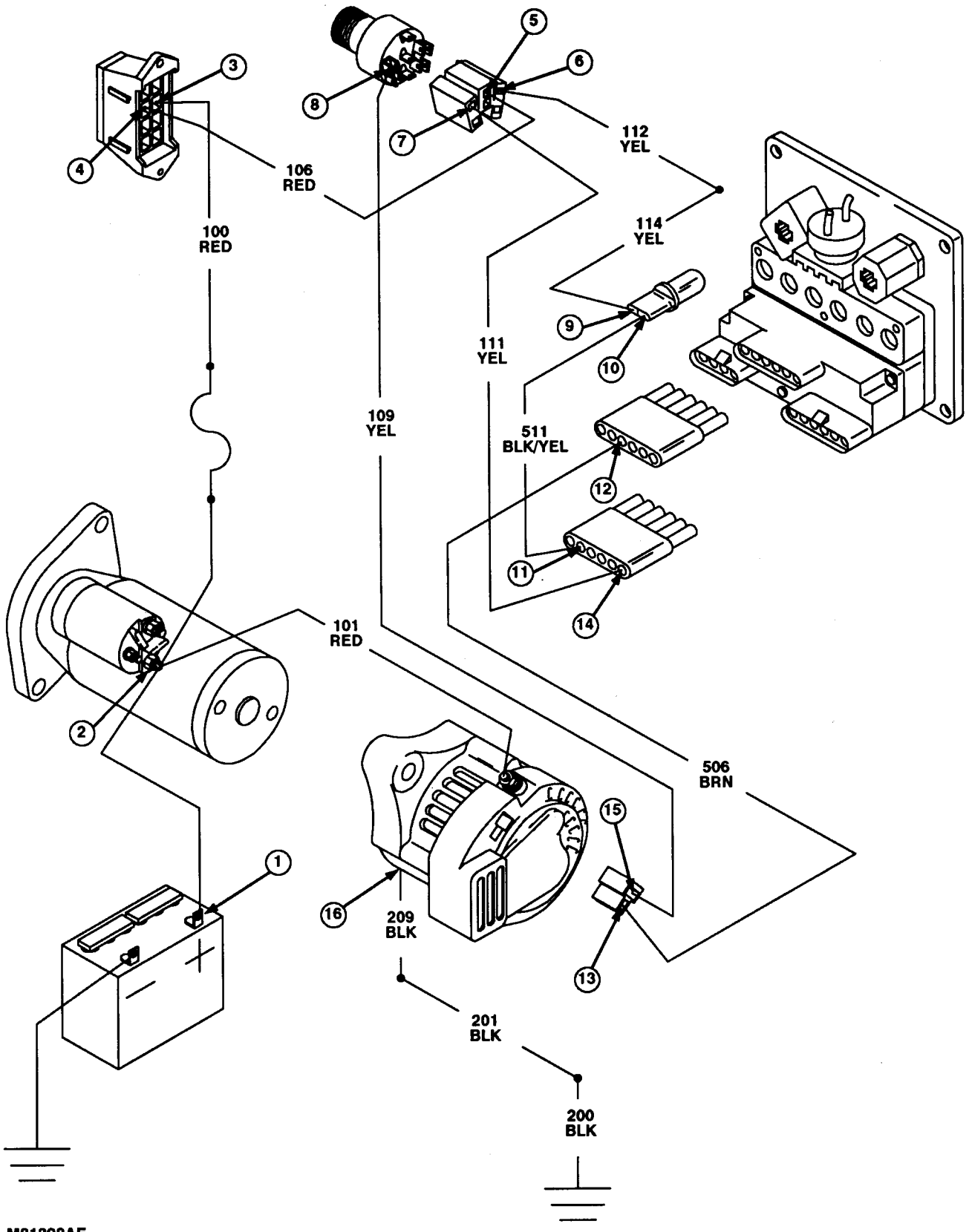
M81398AE -19-09JAN93

MX,24015HV,A19 -19-21JAN93

CHARGING SYSTEM TEST POINTS—CONTINUED

Test Location	Normal	If Not Normal
14. Wire no. 111 terminal of lower display module connector	Battery voltage.	Check for a bad connection or a break in wire no. 111.
15. Wire no. 109 terminal of alternator connector	Battery voltage.	Check for a bad connection or a break in wire no. 109.
CONDITIONS: • Start engine and operate at fast idle.		
16. Alternator ground wire	Less than 0.2 volt.	Check for a bad connection at alternator case or ground. Also check splices connecting wire nos. 200, 201 and 209.
17. Alternator output terminal	14.2—14.8 volts.	Check belt tension. Test alternator; see procedure in this group.

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CHARGING SYSTEM TEST POINTS

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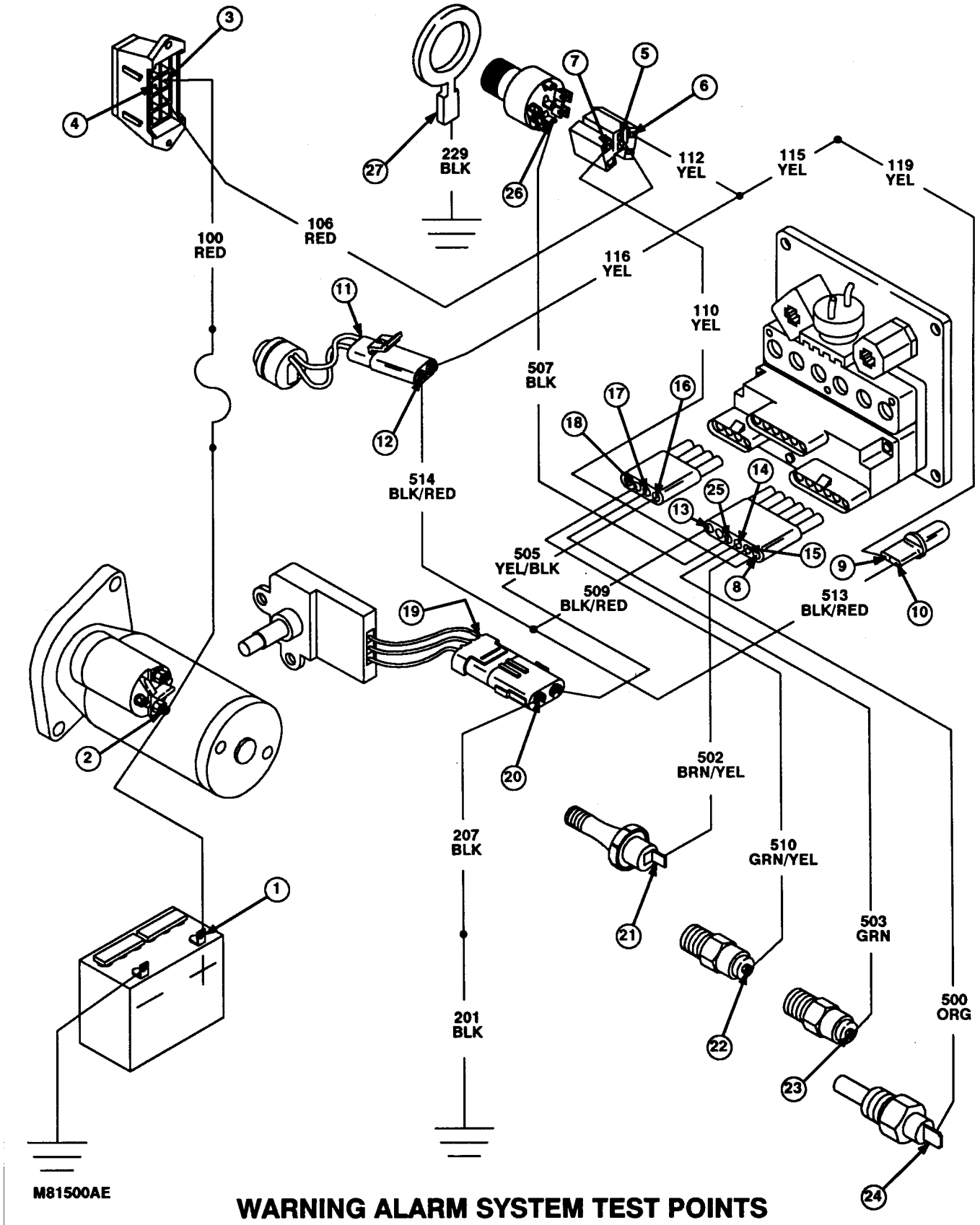
WARNING ALARM SYSTEM TEST POINTS

CONDITIONS:
- Key switch ON, engine off.
- Connectors fully-seated.
- Coolant temperature less than 100° C (212° F)
- Hydraulic oil temperature less than 104° C (220° F)
- Hydrostatic oil temperature less than 104° C (220° F)
- Connector at oil pressure switch disconnected.
- Meter set to DC volts position.
- Meter positive (red) lead connected to numbered test points.
- Meter negative (black) lead connected to ground.
- Electrical tests and adjustments in this group.

240
15
38

Test Location	Normal	If Not Normal
1. Battery positive post	Minimum 12.4 volts.	Charge and load test battery.
2. Starter battery terminal	Battery voltage.	Check for bad connections or a break in cable between battery and starter.
3. Wire no. 100 terminal of 20-amp fuse, F3	Battery voltage.	Check for failed fusible link at starter. If fusible link is bad, determine cause and replace fusible link. Also check for bad splice or broken wire no. 100.
4. Wire no. 106 terminal of 20-amp fuse, F3	Battery voltage.	Check for a blown fuse, F3. If fuse is good, check for a bad connection at the fuse block.
5. Wire no. 106 terminal of key switch	Battery voltage.	Check for bad connections or a break in wire no. 106.
6. Wire no. 112 terminal of key switch	Battery voltage.	Test key switch. See procedure in this group.
7. Wire no. 110 terminal of key switch	Battery voltage.	Test key switch. See procedure in this group.
8. Wire no. 110 terminal of upper display module connector	Battery voltage.	Check for a bad connection or a break in wire no. 110.
9. Wire no. 119 terminal of stop lamp	Battery voltage.	Check for a bad connection or a break in the splices connecting wire nos. 112, 115 and 119.
10. Wire no. 513 terminal of stop lamp	Battery voltage.	Check for a bad bulb or bad connection at bulb socket.

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WARNING ALARM SYSTEM TEST POINTS

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WARNING ALARM SYSTEM TEST POINTS—CONTINUED

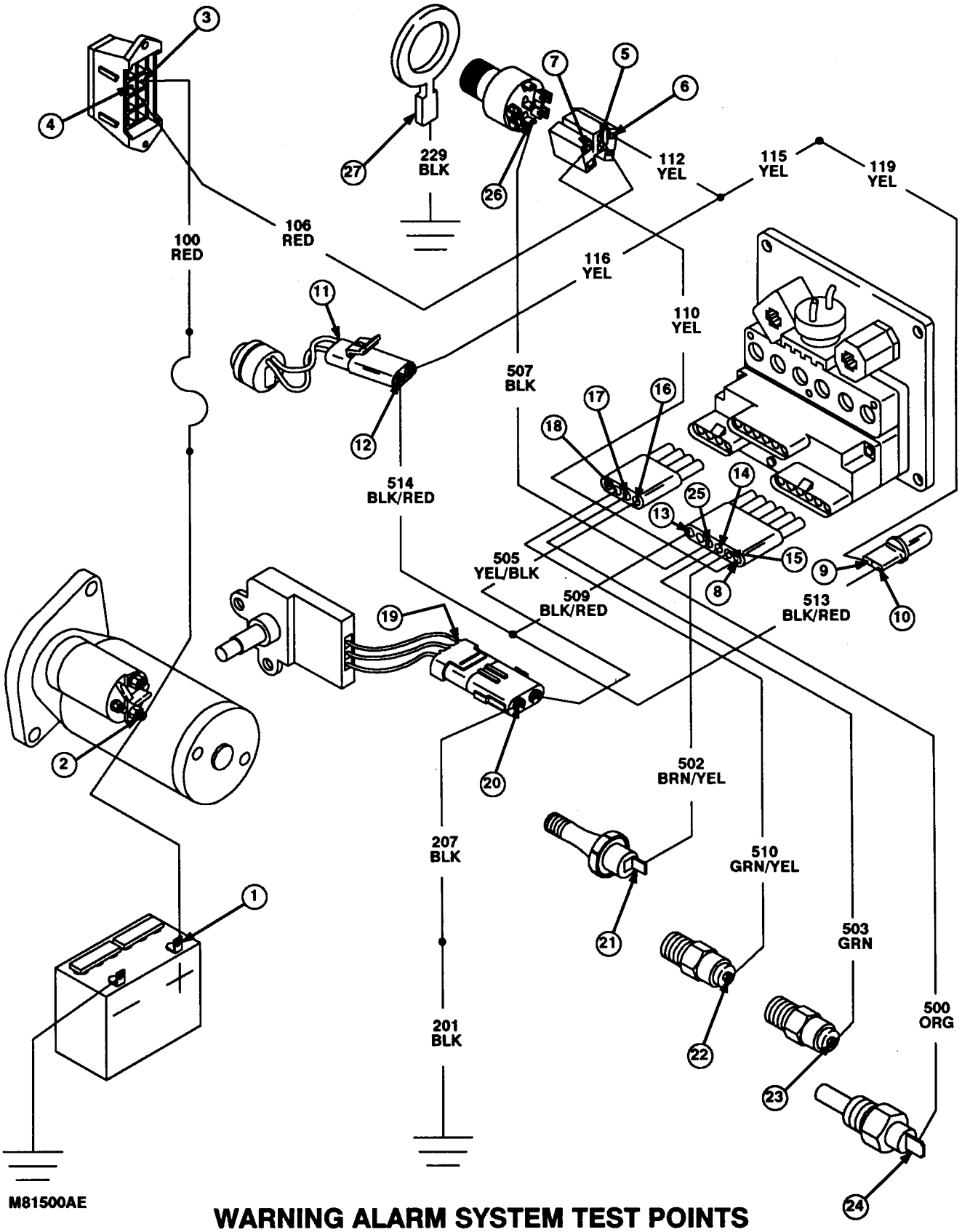
CONDITIONS:
- Wire connected to oil pressure sender.

Test Location	Normal	If Not Normal
11. Alarm side of alarm connector	Battery voltage.	Check for a bad connection or a break in the splice connecting wire nos. 112 and 116.
12. Wire no. 514 terminal of alarm connector	Less than 0.2 volt.	Check for a bad connection or a bad splice connecting wire nos. 509, 513 and 514.
13. Wire no. 509 terminal of upper display module connector	Less than 0.2 volt.	Check for a bad connection at display module.
14. Wire no. 500 terminal of upper display module connector	Battery voltage.	Check for a bad connection at display module connector.
15. Wire no. 502 terminal of upper display module connector	Battery voltage.	Check for a bad connection at display module connector.
16. Wire no. 505 terminal of upper display module connector	Battery voltage.	Check for a bad connection at display module connection.
17. Wire no. 503 terminal of upper display module connector	Battery voltage.	Check for a bad connection at display module connector.
18. Wire no. 510 terminal of upper display module connector	Battery voltage.	Check for a bad connection at display module connector.
19. Water-in-fuel sensor connector, yellow wire	Battery voltage.	Check for a bad connection or a break in wire no. 505.

CONDITIONS:
- Key switch off.
- Connector removed from water-in-fuel sensor.
- Meter set to ohms or diode test position.
- One test lead connected to ground.

20. Wire no. 207 terminal of water-in-fuel sensor connector	Continuity.	Check for a bad connection or a break in splice connecting wire nos. 201 and 207.

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WARNING ALARM SYSTEM TEST POINTS

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WARNING ALARM SYSTEM TEST POINTS—CONTINUED

CONDITIONS:
- Key switch on, engine off.
- Meter set to DC volts position.
- Wires/connectors removed from senders/sensors.

Test Location	Normal	If Not Normal
21. Wire no. 502 of oil pressure sender	Battery voltage.	Check for a bad oil pressure indicator bulb or a break in wire 502. If both test good, replace upper display module.
22. Wire no. 510 of hydrostatic oil temperature switch	Battery voltage.	Check for a bad hydrostatic oil temperature indicator bulb or a break in wire no. 510. If both test good, replace upper display module.
23. Wire no. 503 of hydraulic oil temperature switch	Battery voltage.	Check for a bad hydraulic oil temperature indicator bulb or a break in wire no. 503. If both test good, replace upper display module.
24. Wire no. 500 of coolant temperature switch	Battery voltage.	Check for a bad bulb or a break in wire no. 502. If both test good, replace upper display module.

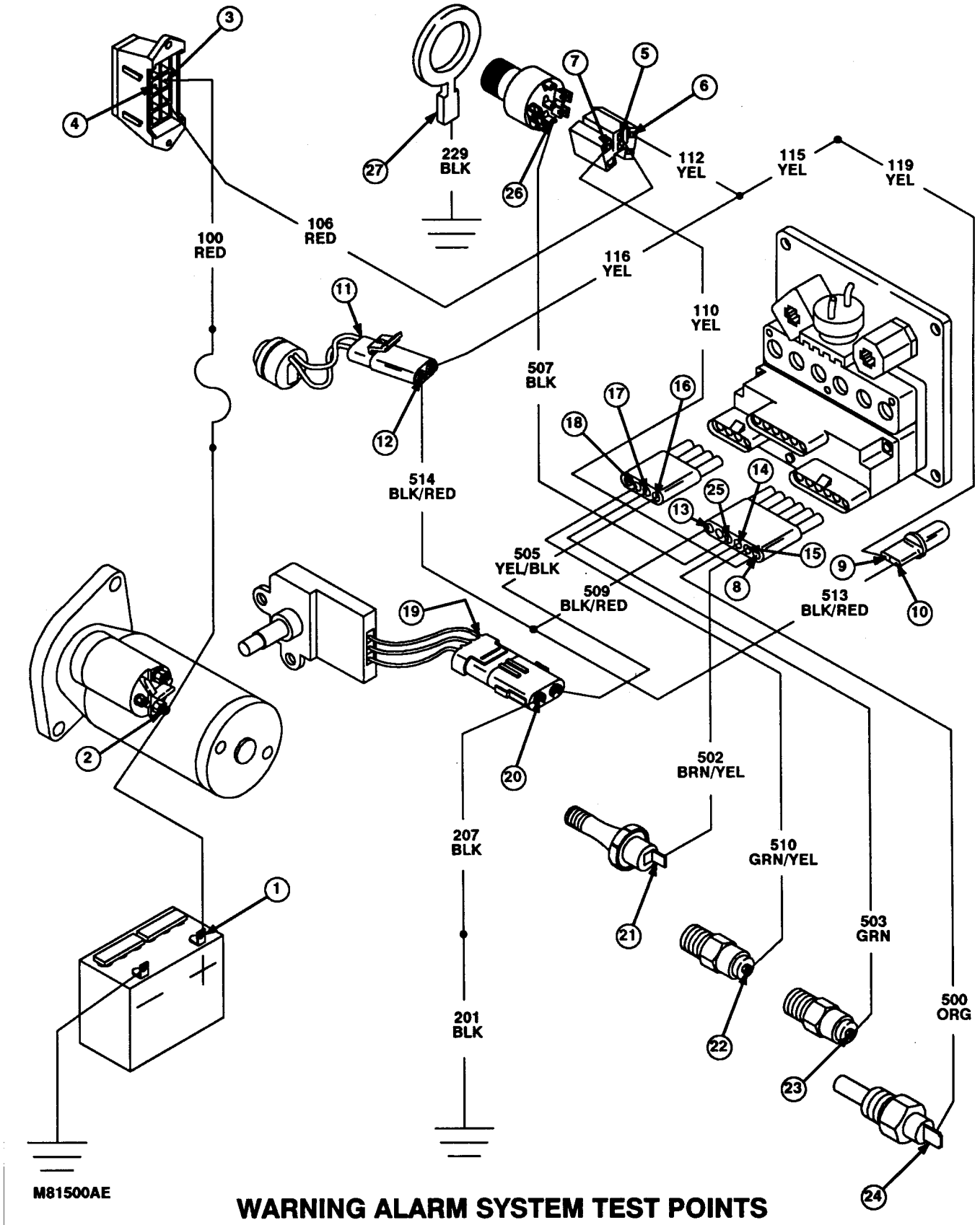
CONDITIONS:
- Jumper wire connected between ground and points indicated.

21A. Wire no. 502 of oil pressure switch	Oil and stop lamps light, alarm sounds.	Check indicator and alarm.
22A. Wire no. 510 of hydrostatic oil temperature switch	Oil and stop lamps light, alarm sounds.	Check indicator and alarm.
23A. Wire no. 503 of hydraulic oil temperature switch	Oil and stop lamps light, alarm sounds.	Check indicator and alarm.
24A. Wire no. 500 of coolant temperature switch	Temp. and stop lamps light, alarm sounds.	Check indicator and alarm.

CONDITIONS:
- Key switch in start position.
- Wire removed from S terminal at starter.

25. Wire no. 507 terminal of upper display module connector	Less than 0.2 volt.	Check for a bad connection or a break in wire no. 507.
26. Wire no. 507 terminal of key switch	Less than 0.2 volt.	Test key switch. See procedure in this group.
27. Wire no. 229 terminal of key switch ground wire	Less than 0.2 volt.	Check continuity of wire no. 129 to ground.

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WARNING ALARM SYSTEM TEST POINTS

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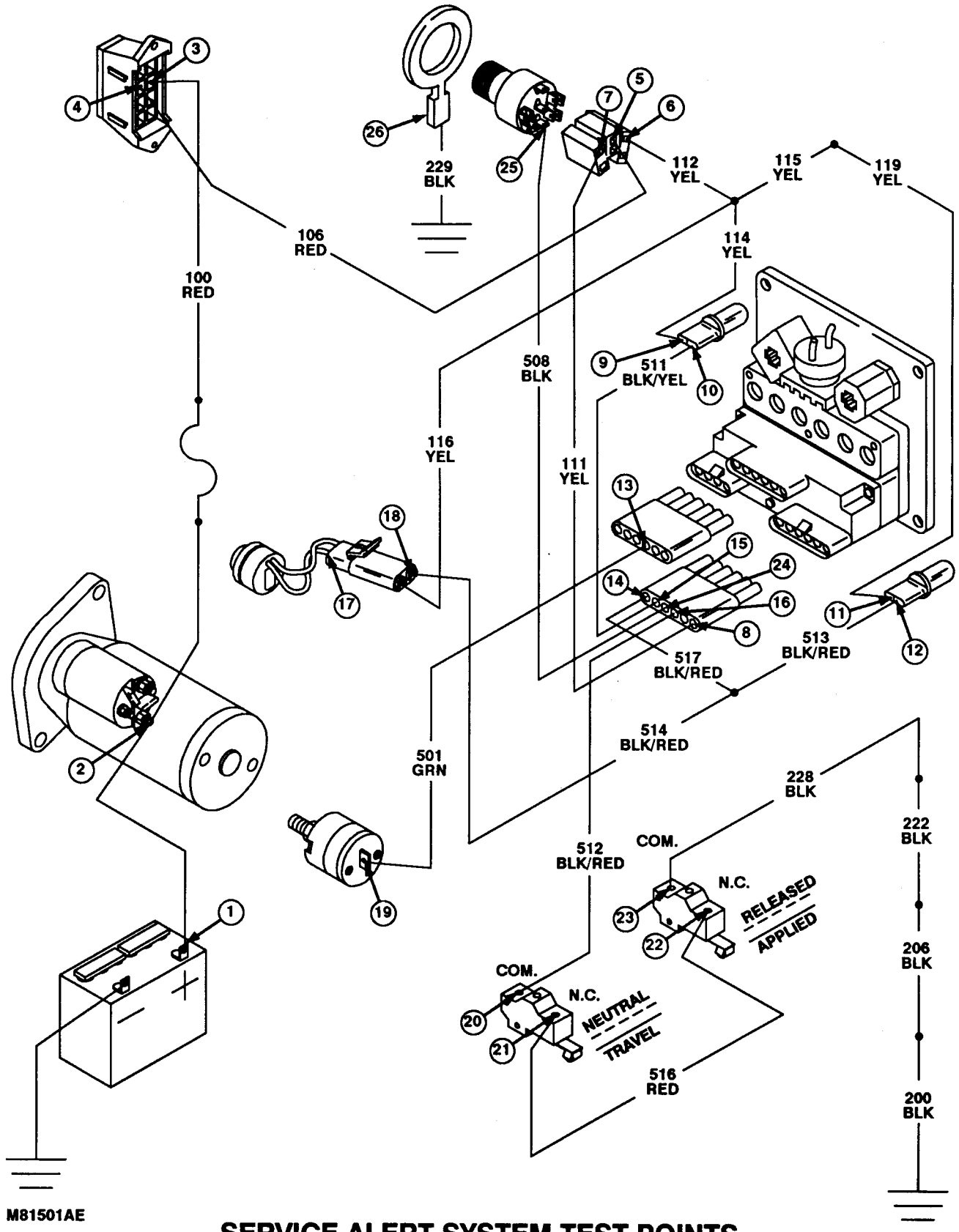
MX,24015HV,A21 -19-21JAN93

SERVICE ALERT SYSTEM TEST POINTS

CONDITIONS:
- Key switch ON, engine off.
- Two-wire alternator connector unplugged.
- Air heater controller disconnected.
- Both travel pedals in neutral.
- Parking brake disengaged.
- Meter set to DC volts position.
- Meter positive (red) lead connected to numbered test points.
- Meter negative (black) lead connected to ground.
- Electrical tests and adjustments in this group.

Test Location	Normal	If Not Normal
1. Battery positive post	Minimum 12.4 volts.	Charge and load test battery.
2. Starter battery terminal	Battery voltage.	Check for bad connections or a break in cable between battery and starter.
3. Wire no. 100 terminal of 20-amp fuse, F3	Battery voltage.	Check for failed fusible link at starter. If fusible link is bad, determine cause and replace fusible link. Also check for bad splice or broken wire no. 100.
4. Wire no. 106 terminal of 20-amp fuse, F3	Battery voltage.	Check for a blown fuse, F3. If fuse is good, check for a bad connection at the fuse block.
5. Wire no. 106 terminal of key switch	Battery voltage.	Check for bad connections or a break in wire no. 106.
6. Wire no. 112 terminal of key switch	Battery voltage.	Test key switch. See procedure in this group.
7. Wire no. 111 terminal of key switch	Battery voltage.	Test key switch. See procedure in this group.
8. Wire no. 111 terminal of lower display module connector	Battery voltage.	Check for a bad connection or a break in wire no. 111.
9. Wire no. 114 terminal of service alert lamp	Battery voltage.	Check for a bad connection or a break in the splices connecting wire nos. 112, 114, 115 and 116.
10. Wire no. 511 terminal of service alert lamp	Battery voltage.	Check for a bad bulb or bad connection at bulb socket.
11. Wire no. 119 terminal of stop lamp	Battery voltage.	Check for a break in the splices connecting wire nos. 112, 115 and 119.
12. Wire no. 513 terminal of stop lamp	Battery voltage.	Check for a bad bulb or bad connection at bulb socket.

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SERVICE ALERT SYSTEM TEST POINTS

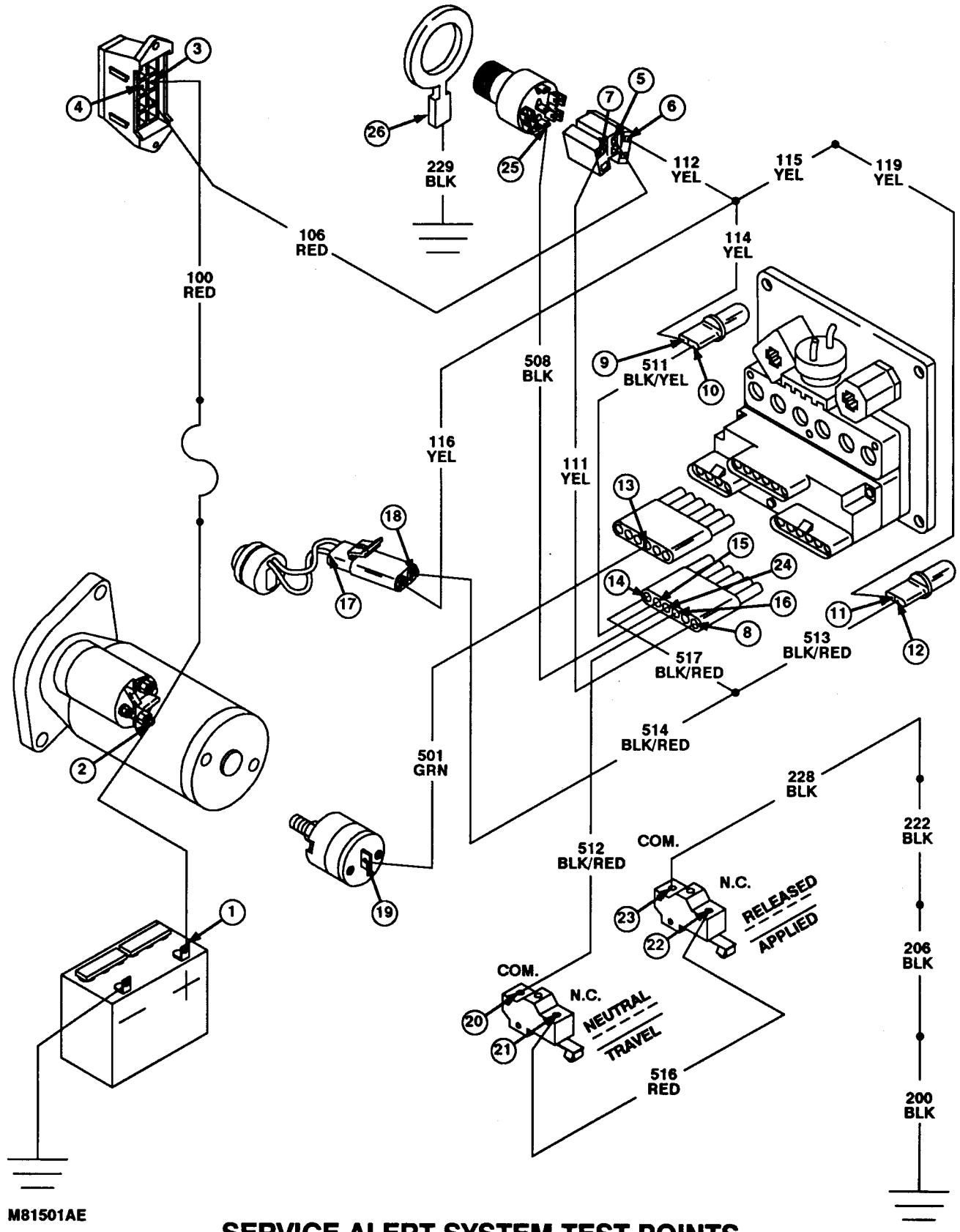
MX,24015HV,A23 -19-21JAN93

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45

SERVICE ALERT SYSTEM TEST POINTS—CONTINUED

Test Location	Normal	If Not Normal
13. Wire no. 501 terminal of lower display module connector	Battery voltage.	Check for a bad connection at display module connector.
14. Wire no. 517 terminal of lower display module connector	Battery voltage.	Check for a break in splice connecting wire nos. 513, 514 and 517.
15. Wire no. 511 terminal of lower display module connector	Battery voltage.	Check for a break in wire no. 511.
16. Wire no. 512 terminal of lower display module connector	Battery voltage.	Check for a bad connection at display module.
17. Alarm side of alarm connector	Battery voltage.	Check for a bad connection at alarm connector or a break in wire no. 116.
18. Wire no. 514 terminal of alarm connector	Battery voltage.	Check for a bad connection at alarm connector.
CONDITIONS: • Parking brake engaged. • Travel pedals in forward or reverse position.		
18A. Wire no. 514 terminal of alarm connector	Less than battery voltage.	Check for a break in splice connecting wire nos. 513, 514 and 517.
CONDITIONS: • Parking brake disengaged. • Travel pedals in neutral.		
19. Wire no. 501 terminal of air restriction switch	Battery voltage.	Check for a break in wire no. 501.
CONDITIONS: • Jumper wire connected to wire no. 501 at air restriction switch and ground.		
19A. Wire no. 501 terminal of air restriction switch	Service alert lamp lights.	Check lower display module.
CONDITIONS: • Parking brake disengaged • Travel pedals in neutral position.		
20. Wire no. 512 terminal of neutral switch	Battery voltage.	Check for a break in wire no. 512.

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SERVICE ALERT SYSTEM TEST POINTS

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SERVICE ALERT SYSTEM TEST POINTS—CONTINUED

CONDITIONS:
- Travel pedals in forward or reverse position.
- Parking brake disengaged.

Test Location	Normal	If Not Normal
21. Wire no. 516 terminal of neutral switch	Battery voltage.	Test neutral switch. See procedure in this group.
22. Wire no. 516 terminal of brake switch	Battery voltage.	Check for a break in wire no. 516.

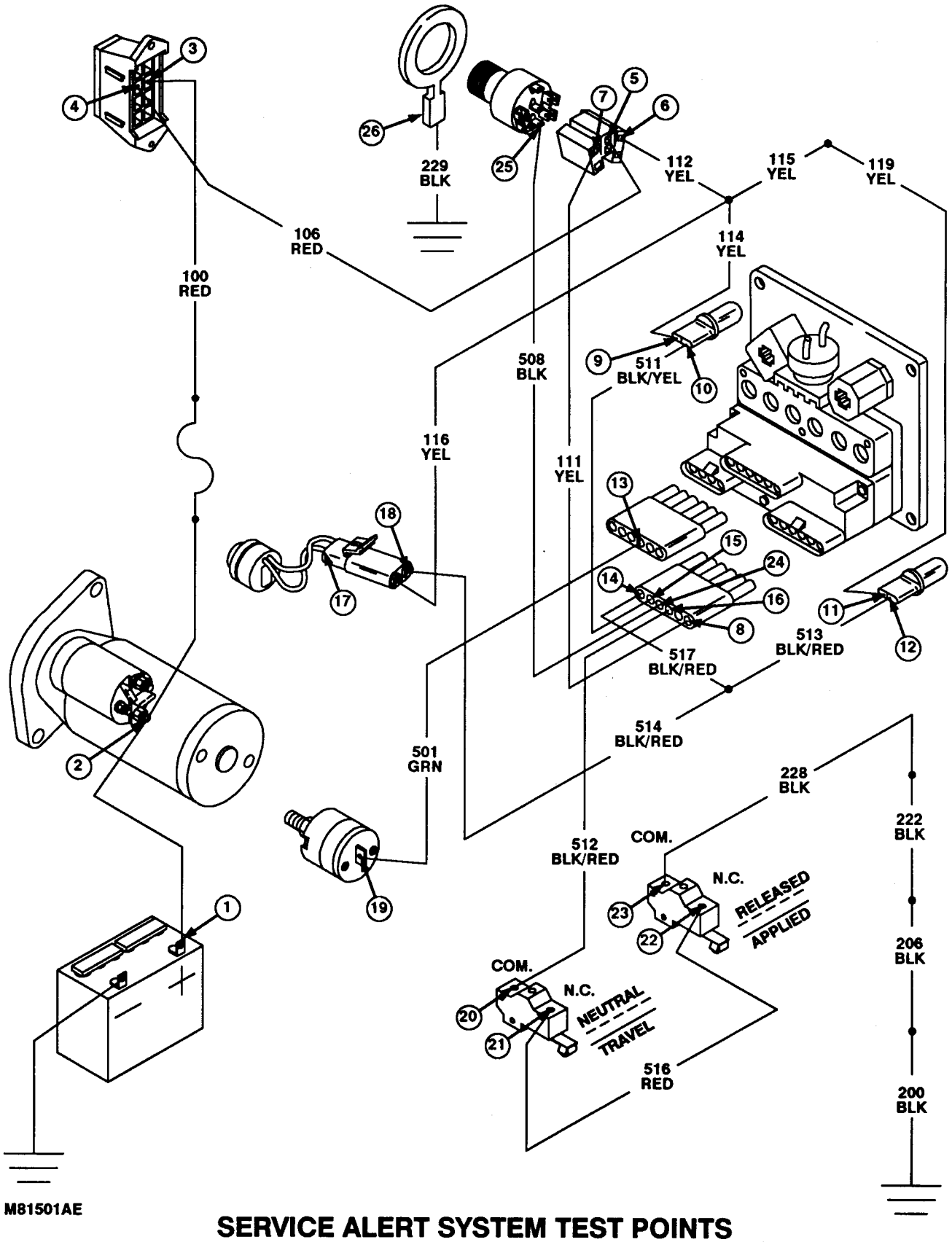
CONDITIONS:
- Travel pedals in forward or reverse position.
- Parking brake engaged.

23. Wire no. 228 terminal of brake switch	Less than 0.2 volt	Test brake switch. See procedure in this group. Check continuity of wire no. 228 to ground. Check for broken splices connecting wire nos. 200, 206, 222 and 228.

CONDITIONS:
- Key switch in bulb check position.

24. Wire no. 508 terminal of lower display module connector	Less than 0.2 volt.	Check for a bad connection at display module. Also check for a break in wire no. 508.
25. Wire no. 508 terminal of key switch	Less than 0.2 volt.	Test key switch. See procedure in this group.
26. Wire no. 229 terminal of key switch ground	Less than 0.2 volt.	Check continuity of wire no. 229 to ground.

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SERVICE ALERT SYSTEM TEST POINTS

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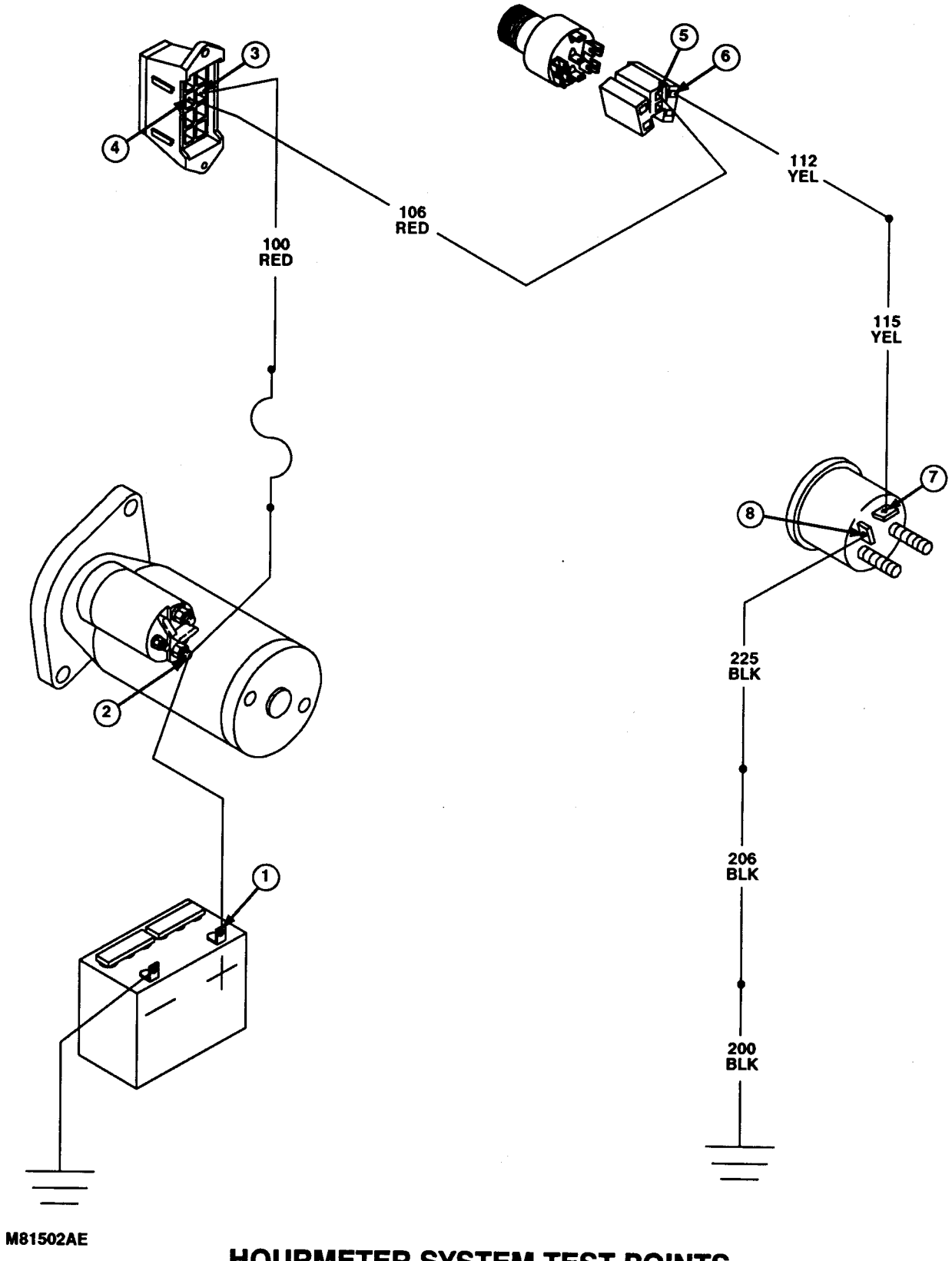
MX,24015HV,A23 -19-21JAN93

HOURMETER SYSTEM TEST POINTS

CONDITIONS:
- Key switch ON, engine off.
- Meter set to DC volts position.
- Meter positive (red) lead connected to numbered test points.
- Meter negative (black) lead connected to ground.
- Electrical tests and adjustments in this group.

Test Location	Normal	If Not Normal
1. Battery positive post	Minimum 12.4 volts.	Charge and load test battery.
2. Starter battery terminal	Battery voltage.	Check for bad connections or a break in cable between battery and starter.
3. Wire no. 100 terminal of 20-amp fuse, F3	Battery voltage.	Check for failed fusible link at starter. If fusible link is bad, determine cause and replace fusible link. Also check for bad splice or broken wire no. 100.
4. Wire no. 106 terminal of 20-amp fuse, F3	Battery voltage.	Check for a blown fuse, F3. If fuse is good, check for a bad connection at the fuse block.
5. Wire no. 106 terminal of key switch	Battery voltage.	Check for bad connections or a break in wire no. 106.
6. Wire no. 112 terminal of key switch	Battery voltage.	Test key switch. See procedure in this group.
7. Wire no. 115 terminal of hourmeter	Battery voltage.	Check for a break in the splice connecting wire nos. 112 and 115.
8. Wire no. 225 terminal of hourmeter	Less than 0.2 volt.	Check continuity to ground of wire no. 225. Also check for a break in splices connecting wire nos. 200, 206 and 225.

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HOURMETER SYSTEM TEST POINTS

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FUEL GAUGE SYSTEM TEST POINTS

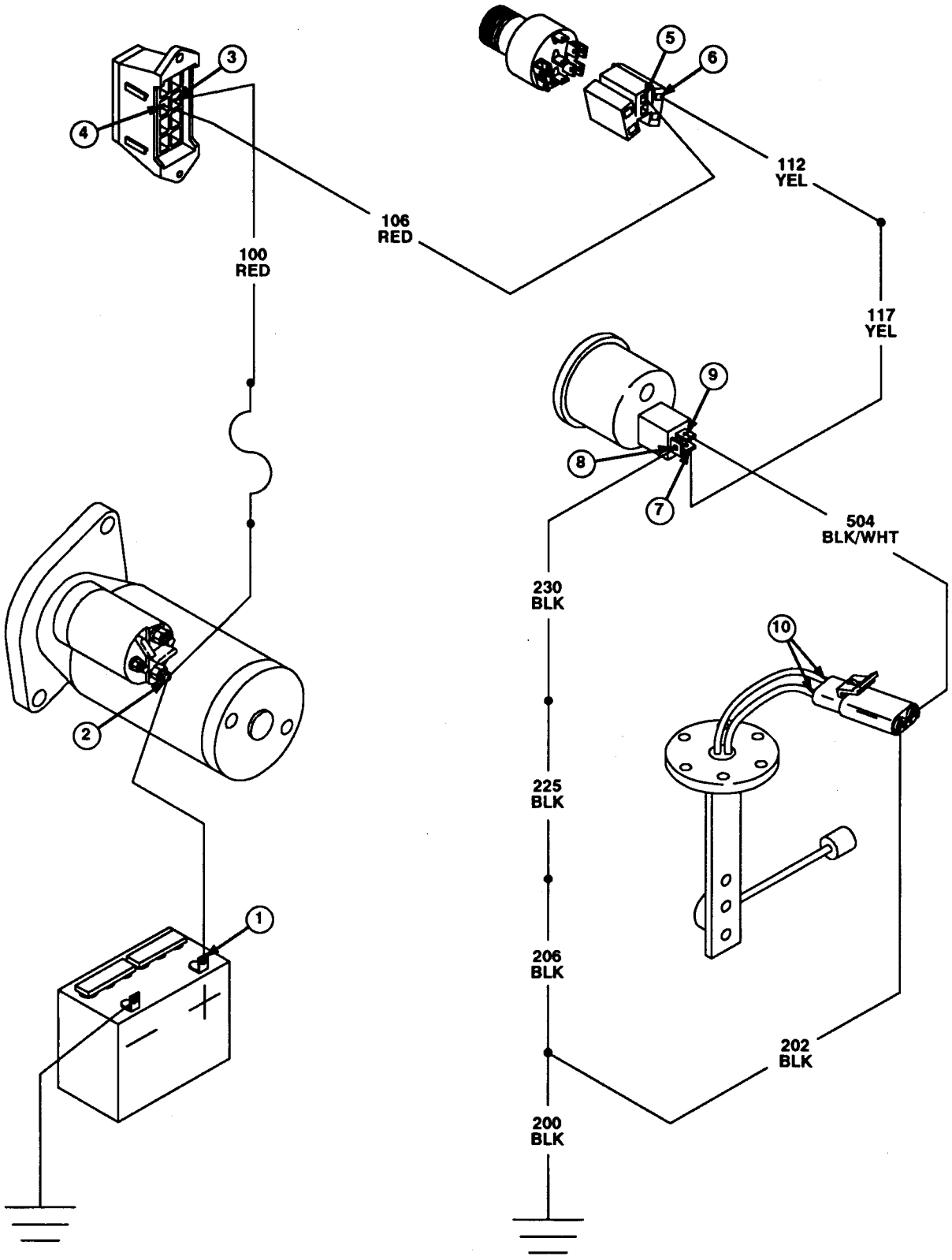
CONDITIONS:
- Key switch ON, engine off.
- Meter set to DC volts position.
- Meter positive (red) lead connected to numbered test points.
- Meter negative (black) lead connected to ground.
- Electrical tests and adjustments in this group.

Test Location	Normal	If Not Normal
1. Battery positive post	Minimum 12.4 volts.	Charge and load test battery.
2. Starter battery terminal	Battery voltage.	Check for bad connections or a break in cable between battery and starter.
3. Wire no. 100 terminal of 20-amp fuse, F3	Battery voltage.	Check for failed fusible link at starter. If fusible link is bad, determine cause and replace fusible link. Also check for bad splice or broken wire no. 100.
4. Wire no. 106 terminal of 20-amp fuse, F3	Battery voltage.	Check for a blown fuse, F3. If fuse is good, check for a bad connection at the fuse block.
5. Wire no. 106 terminal of key switch	Battery voltage.	Check for bad connections or a break in wire no. 106.
6. Wire no. 112 terminal of key switch	Battery voltage.	Test key switch. See procedure in this group.
7. Wire no. 117 terminal of fuel gauge	Battery voltage.	Check for a break in the splice connecting wire nos. 112 and 117.
8. Wire no. 230 terminal of fuel gauge	Less than 0.2 volt.	Check continuity to ground of wire no. 230. Also check for a break in splices connecting wire nos. 200, 206, 225 and 230.
9. Wire no. 504 terminal of fuel gauge	Less than battery voltage.	Check for a break in wire nos. 504 and 202. Also check splice connecting wire nos. 202 and 200.

CONDITIONS:
- Key switch in off position.
- Meter set to ohms position.
- Fuel sender connector disconnected.
- Use a long wire to raise and lower sender float.

10. Terminals of fuel sender connector	Resistance changes smoothly between 6.0—100.0 ohms as float is raised and lowered.	Replace fuel sender.

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M81503AE

FUEL GUAGE SYSTEM TEST POINTS

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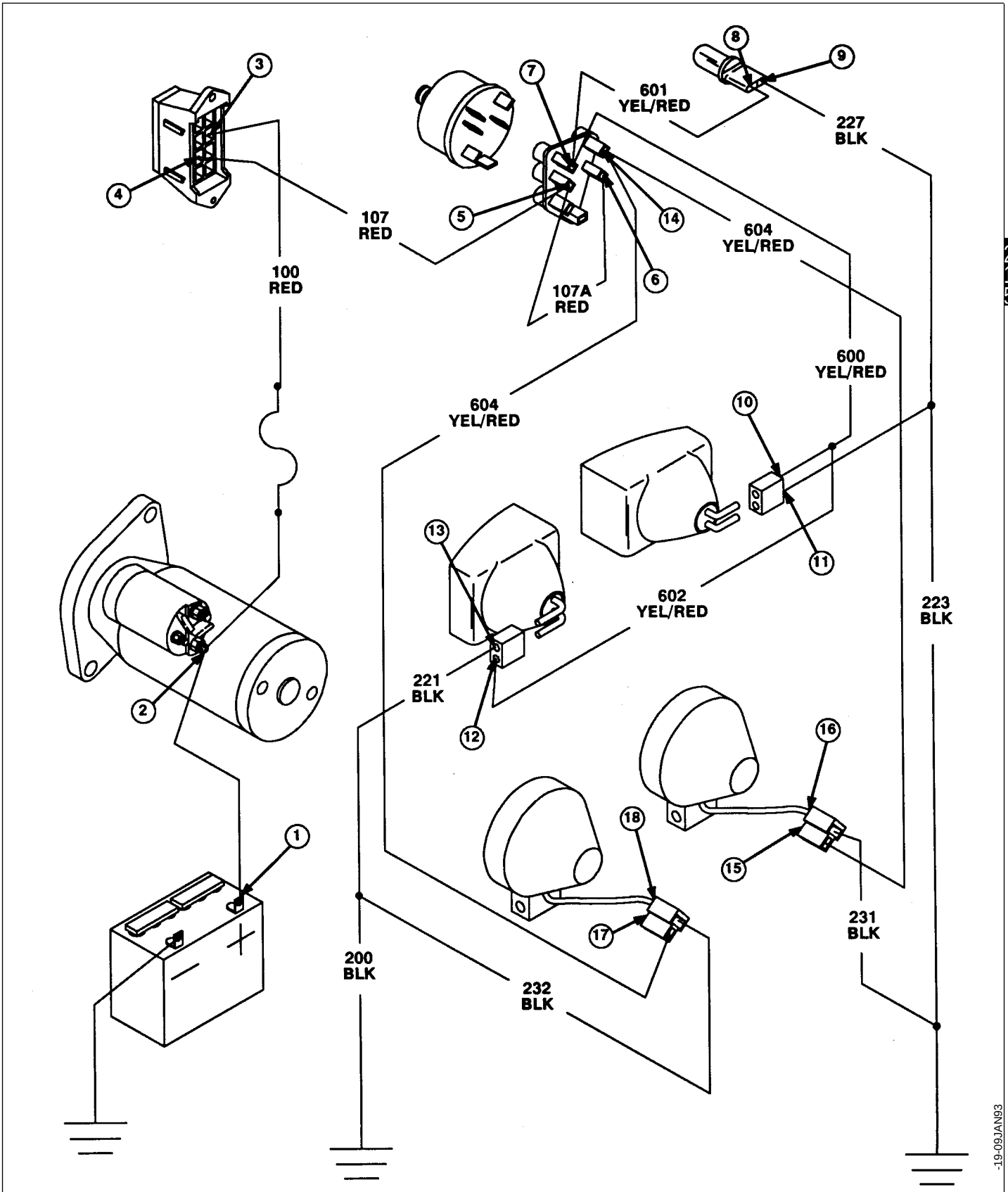
MX,24015HV,A27 -19-21JAN93

LIGHTING SYSTEM TEST POINTS

CONDITIONS:
- Headlight switch in headlight position.
- Meter set to DC volts position.
- Meter positive (red) lead connected to numbered test points.
- Meter negative (black) lead connected to ground.
- Electrical tests and adjustments in this group.

Test Location	Normal	If Not Normal
1. Battery positive post	Minimum 12.4 volts.	Charge and load test battery.
2. Starter battery terminal	Battery voltage.	Check for bad connections or a break in cable between battery and starter.
3. Wire no. 100 terminal of 20-amp fuse, F3	Battery voltage.	Check for failed fusible link at starter. If fusible link is bad, determine cause and replace fusible link. Also check for bad splice or broken wire no. 100.
4. Wire no. 107 terminal of 20-amp fuse, F4	Battery voltage.	Check for a blown fuse, F4. If fuse is good, check for a bad connection at fuse block.
5. Wire no. 107/107A terminal of headlight switch connector	Battery voltage.	Check for a bad connection or a break in wire no. 107.
6. Wire no. 107A terminal of headlight switch connector	Battery voltage.	Check for a bad connection or a break in wire no. 107A.
7. Wire no. 600/601 terminal of headlight switch connector	Battery voltage.	Test light switch. See procedure in this group.
8. Wire no. 601 terminal of fuel gauge lamp	Battery voltage.	Check for a bad connection or a break in wire no. 601.
9. Wire no. 227 terminal of fuel gauge lamp	Less than 0.2 volt.	Check continuity of wire no. 227 to ground.
10. Wire no. 602 terminal of right headlight connector	Battery voltage.	Check for a break in the splice connecting wire nos. 600 and 602.
11. Wire no 223 terminal of right headlight connector	Less than 0.2 volt.	Check continuity of wire no. 223 to ground.
12. Wire no. 602 terminal of left headlight connector	Battery voltage.	Check for a break in the splice connecting wire nos. 602 and 600.
13. Wire no. 221 terminal of left headlight connector	Less than 0.2 volt.	Check continuity of wire no. 221 to ground.

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LIGHTING SYSTEM TEST POINTS

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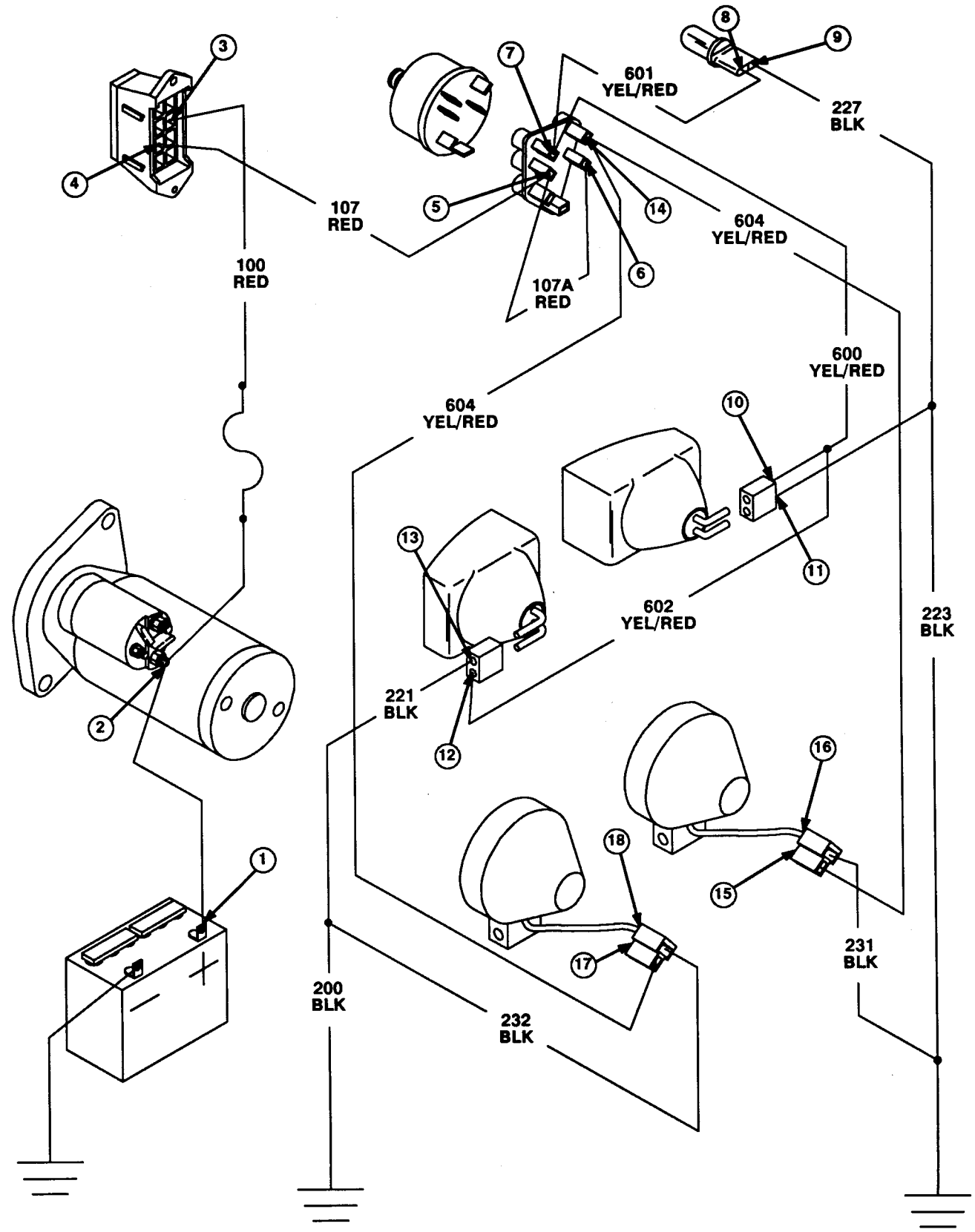
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LIGHTING SYSTEM TEST POINTS—CONTINUED

CONDITIONS:
- Headlight switch in work light position.

Test Location	Normal	If Not Normal
14. Wire no. 604 terminal of headlight switch connector	Battery voltage.	Test light switch. See procedure in this group.
15. Wire no. 604 terminal of right work light connector	Battery voltage.	Check for a bad connection or a break in wire no. 604.
16. Wire no. 231 terminal of right work light connector	Less than 0.2 volt.	Check continuity of wire no. 231 to ground.
17. Wire no. 604 terminal of left work light connector	Battery voltage.	Check for a bad connection or a break in wire no. 604.
18. Wire no. 232 terminal of left work light connector	Less than 0.2 volt.	Check continuity of wire no. 232 to ground.

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LIGHTING SYSTEM TEST POINTS

-19-09JAN93

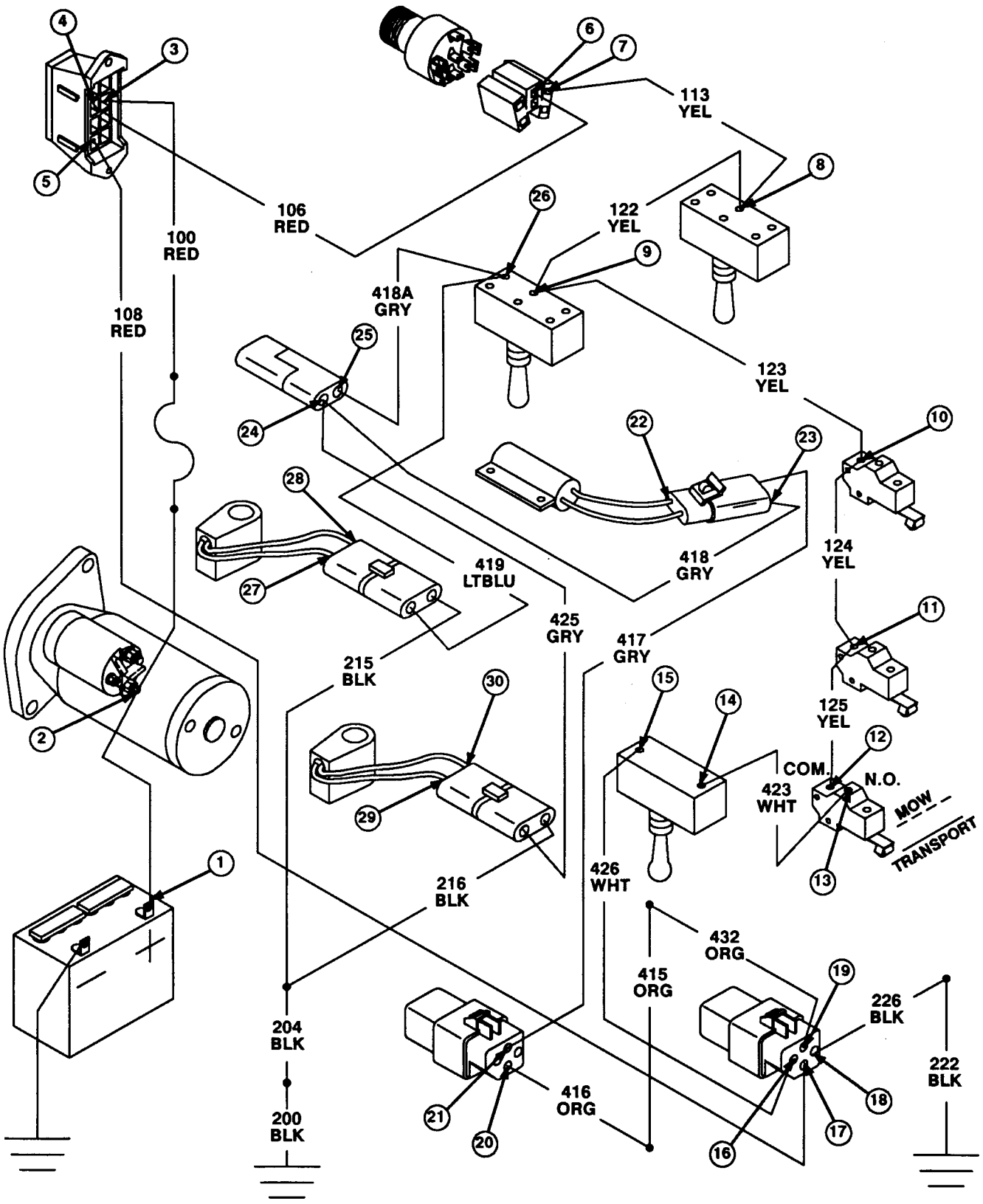
MX,24015HV,A29 -19-21JAN93

LEFT WING LOWER SYSTEM TEST POINTS

CONDITIONS:
- Key switch in ON position.
- Meter set to DC volts position.
- Left wing lowered to less than 45-degree position.
- Left wing toggle switch in off position.
- Meter positive (red) lead connected to numbered test points.
- Meter negative (black) lead connected to ground.
- Electrical tests and adjustments in this group.

Test Location	Normal	If Not Normal
1. Battery positive post	Minimum 12.4 volts.	Charge and load test battery.
2. Starter battery terminal	Battery voltage.	Check for bad connections or a break in cable between battery and starter.
3. Wire no. 100 terminal of 20-amp fuse, F3	Battery voltage.	Check for failed fusible link at starter. If fusible link is bad, determine cause and replace fusible link. Also check for bad splice or broken wire no. 100.
4. Wire no. 106 terminal of 20-amp fuse, F3	Battery voltage.	Check for a blown fuse, F3. If fuse is good, check for a bad connection at fuse block.
5. Wire no. 108 terminal of 20-amp fuse, F5	Battery voltage.	Check for a blown fuse, F5. If fuse is good, check for a bad connection at fuse block.
6. Wire no. 106 terminal of key switch connector	Battery voltage.	Check for a bad connection or a break in wire no. 106.
7. Wire no. 113 terminal of key switch connector	Battery voltage.	Test key switch. See procedure in this group.
8. Wire no. 113/122 terminal of right wing toggle switch	Battery voltage.	Check for a bad connection or a break in wire no. 113.
9. Wire no. 122/123 terminal of left wing toggle switch	Battery voltage.	Check for a bad connection or a break in wire no. 122.
10. Wire no. 123/124 terminal of left wing lift switch	Battery voltage.	Check for a bad connection or a break in wire no. 123.
11. Wire no. 124/125 terminal of right wing lift switch	Battery voltage.	Check for a bad connection or a break in wire no. 124.
12. Wire no. 125 terminal of mow switch	Battery voltage.	Check for a bad connection or a break in wire no. 125.

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LEFT WING LOWER SYSTEM TEST POINTS

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LEFT WING LOWER SYSTEM TEST POINTS—CONTINUED

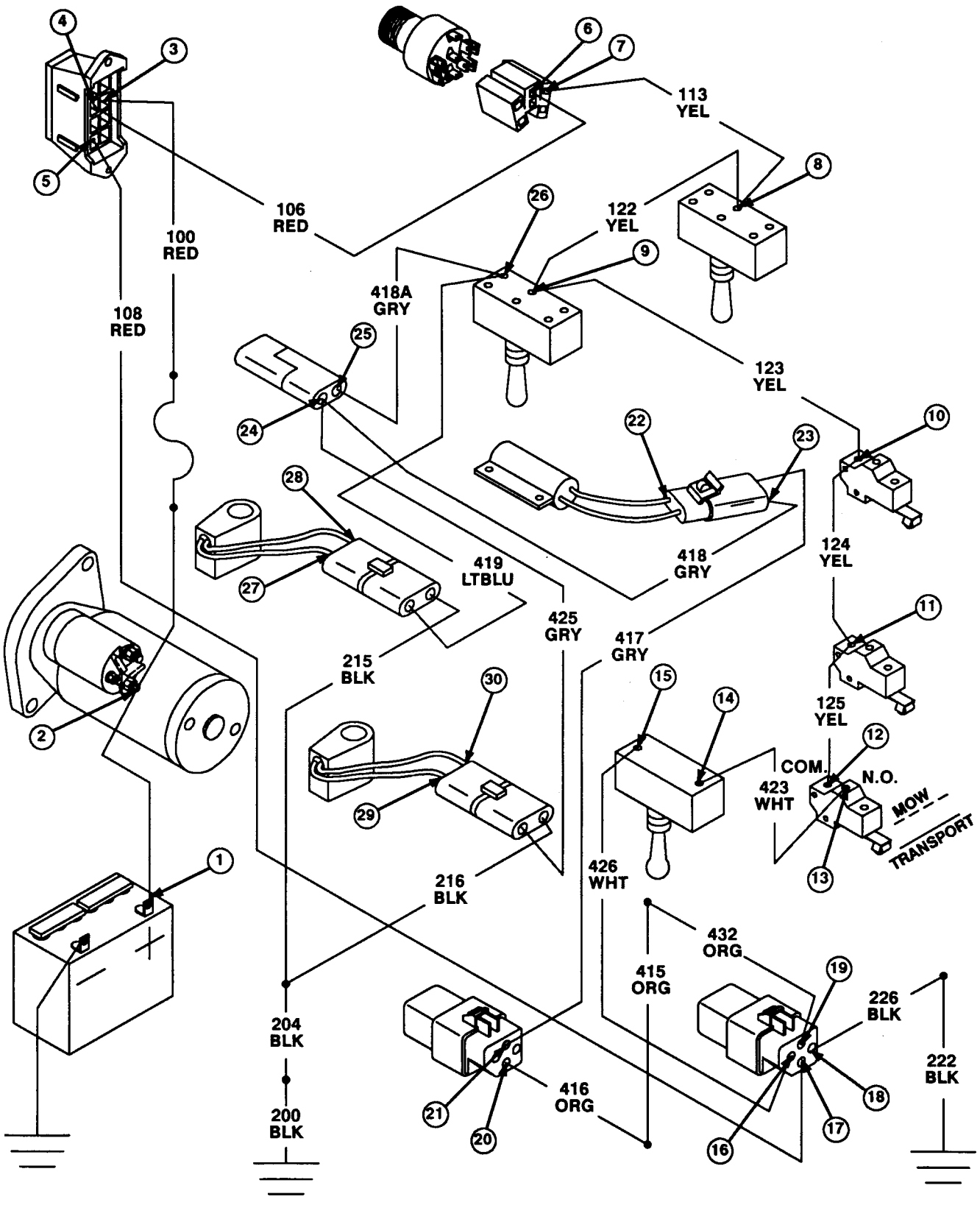
CONDITIONS:
- Cutting units lever moved forward to lower position.

Test Location	Normal	If Not Normal
13. Wire no. 423 terminal of mow switch	Battery voltage.	Test mow switch. See procedure in this group.
14. Wire no. 423 terminal of backlap switch	Battery voltage.	Check for a bad connection or a break in wire no. 423.

CONDITIONS:
- Backlap switch in disengaged position.

15. Wire no. 426 terminal of backlap switch	Battery voltage.	Test backlap switch. See procedure in this group.
16. Wire no. 426 terminal of mow relay	Battery voltage.	Check for a bad connection or a break in wire no. 426.
17. Wire no. 108 terminal of mow relay	Battery voltage.	Check for a bad connection or a break in wire no. 108.
18. Wire no. 234 terminal of mow relay (Wire no. 226 on 3325)	Less than 0.2 volt.	Check continuity of wire no. 226 to ground.
19. Wire no. 432 terminal of mow relay (Wire no. 416 on 3325)	Battery voltage.	Test relay. See procedure in this group.
20. Wire no. 416 terminal of left wing relay	Battery voltage.	On 3365, check for a break in splices connecting wire nos. 415, 416 and 432. On 3325, check for a bad connection or a break in wire no. 416.
21. Wire no. 417 terminal of left wing relay	Battery voltage.	Test relay. See procedure in this group.
22. Mercury switch side of mercury switch connector	Battery voltage.	Check for a bad connection or a break in wire no. 417.
23. Wire no. 418 terminal of mercury switch connector	Battery voltage.	Test and adjust mercury switch. See procedure in this group.
24. Wire no. 418/425 terminal of left wing diode	Battery voltage.	Check for a bad connection or a break in wire no. 418.
25. Wire no. 418A terminal of left wing diode	Battery voltage.	Test diode. See procedure in this group.

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LEFT WING LOWER SYSTEM TEST POINTS

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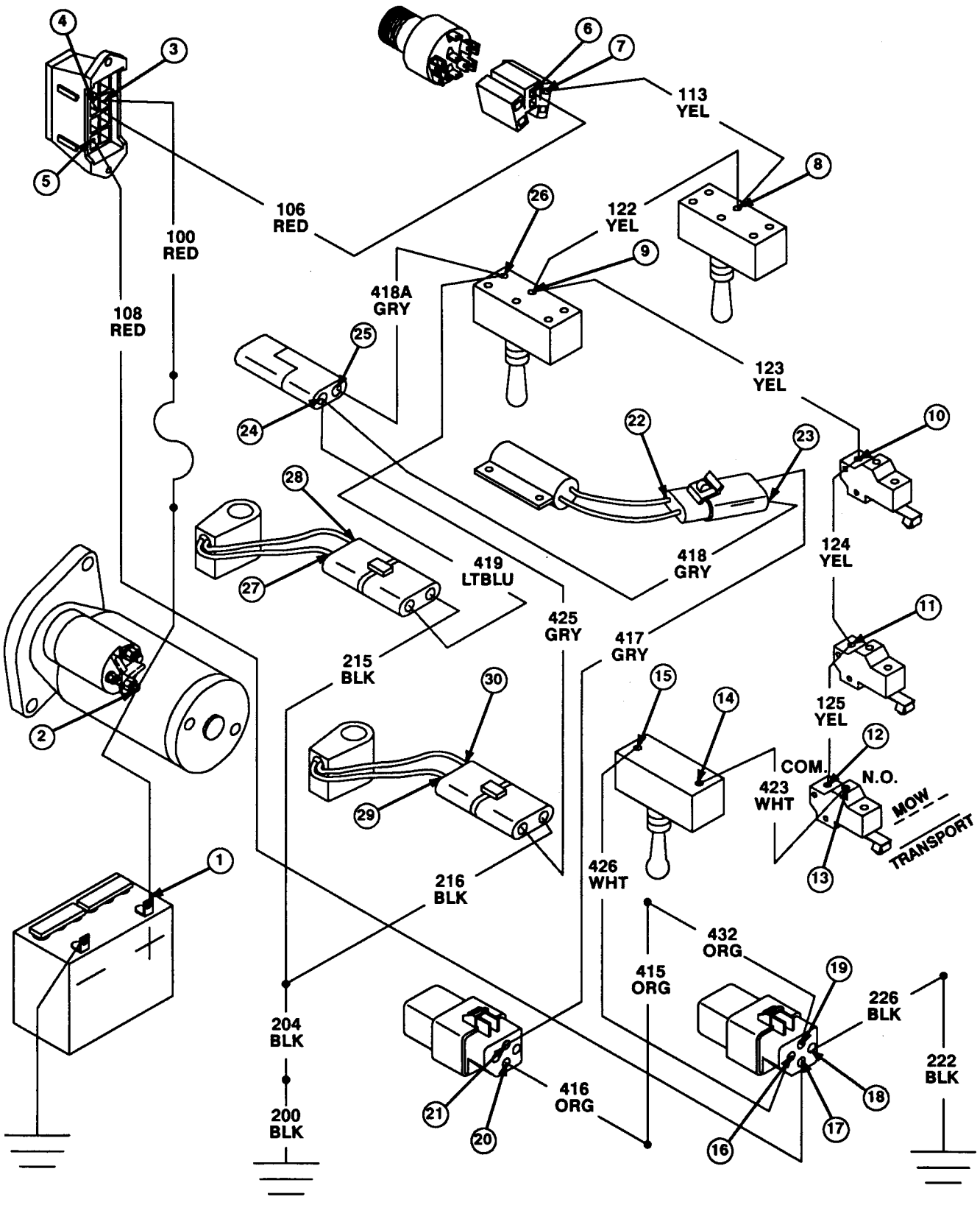
LEFT WING LOWER SYSTEM TEST POINTS—CONTINUED

CONDITIONS:
- Left wing toggle switch in lower position.

Test Location	Normal	If Not Normal
26. Wire no. 418A/419 terminal of left wing toggle switch	Battery voltage.	Test switch. See procedure in this group.
27. Solenoid side of left wing solenoid connector	Battery voltage.	Check for a break in splice connecting wire nos. 419 and 418A.
28. Solenoid side of left wing solenoid connector	Less than 0.2 volt.	Check continuity of wire no. 215 to ground.
29. Solenoid side of left mow solenoid connector	Battery voltage.	Check for a bad connection or a break in wire no. 425.
30. Solenoid side of left mow solenoid connector	Less than 0.2 volt.	Check continuity of wire no. 216 to ground.

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LEFT WING LOWER SYSTEM TEST POINTS

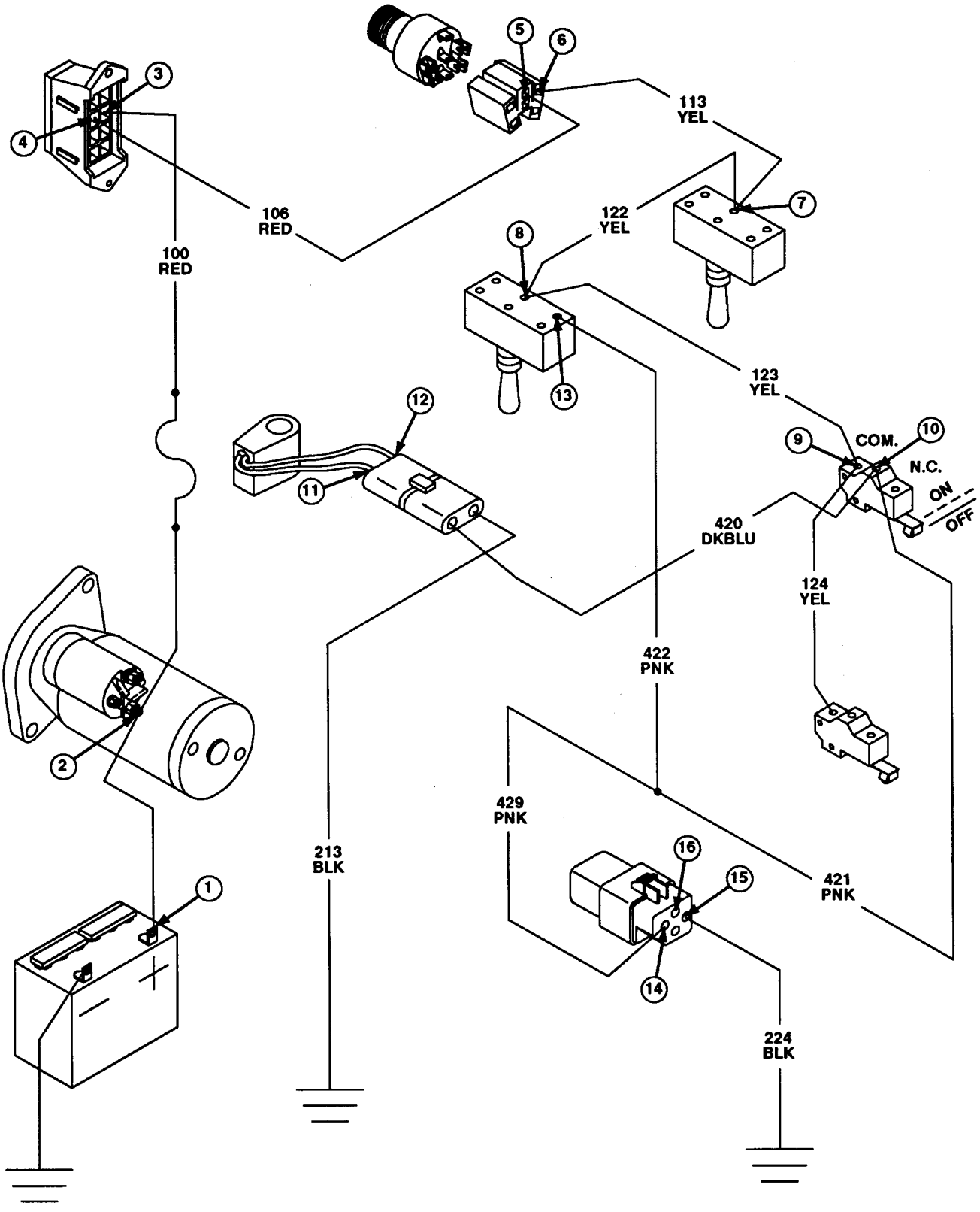
MX,24015HV,A31 -19-21JAN93

LEFT WING RAISE SYSTEM TEST POINTS

CONDITIONS:
- Key switch in ON position.
- Meter set to DC volts position.
- Left wing lowered.
- Left wing toggle switch in off position.
- Cutting units lever in rearward position.
- Meter positive (red) lead connected to numbered test points.
- Meter negative (black) lead connected to ground.
- Electrical tests and adjustments in this group.

Test Location	Normal	If Not Normal
1. Battery positive post	Minimum 12.4 volts.	Charge and load test battery.
2. Starter battery terminal	Battery voltage.	Check for bad connections or a break in cable between battery and starter.
3. Wire no. 100 terminal of 20-amp fuse, F3	Battery voltage.	Check for failed fusible link at starter. If fusible link is bad, determine cause and replace fusible link. Also check for bad splice or broken wire no. 100.
4. Wire no. 106 terminal of 20-amp fuse, F3	Battery voltage.	Check for a blown fuse, F3. If fuse is good, check for a bad connection at fuse block.
5. Wire no. 106 terminal of key switch	Battery voltage.	Check for a bad connection or a break in wire no. 106.
6. Wire no. 113 terminal of key switch connector	Battery voltage.	Test key switch. See procedure in this group.
7. Wire no. 113/122 terminal of right wing toggle switch	Battery voltage.	Check for a bad connection or a break in wire no. 113.
8. Wire no. 122/123 terminal of left wing toggle switch	Battery voltage.	Check for a bad connection or a break in wire no. 122.
9. Wire no. 123/124 terminal of left wing lift switch	Battery voltage.	Check for a bad connection or a break in wire no. 123.
10. Wire no. 420/421 terminal of left wing lift switch	Battery voltage.	Test switch. See procedure in this group.
11. Solenoid side of connector, left wing lift solenoid	Battery voltage.	Check for a bad connection or a break in wire no. 420.
12. Solenoid side of connector, left wing lift solenoid	Less than 0.2 volt.	Check continuity of wire no. 213 to ground.

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LEFT WING RAISE SYSTEM TEST POINTS

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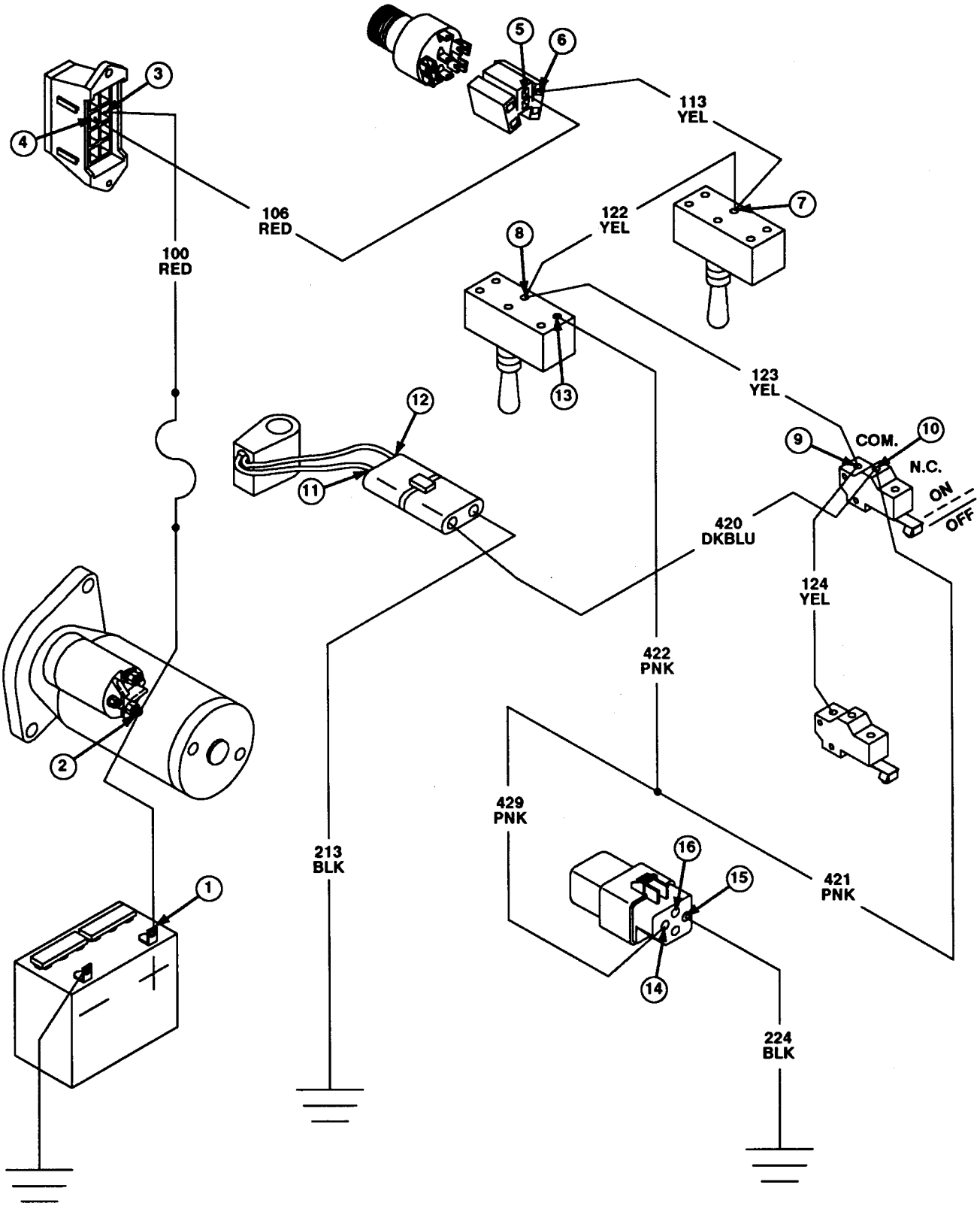
LEFT WING RAISE SYSTEM TEST POINTS—CONTINUED

CONDITIONS:
- Left wing toggle switch in raise position.

Test Location	Normal	If Not Normal
13. Wire no. 422 terminal of left wing toggle switch	Battery voltage.	Test switch. See procedure in this group.
14. Wire no. 429 terminal of left wing relay connector (Wire no. 422 on 3325)	Battery voltage.	Check for a break in splice connecting wire nos. 421, 422 and 429.
15. Wire no. 224 terminal of left wing relay connector (Wire no. 222 on 3325)	Less than 0.2 volt.	Check continuity of wire no. 224 to ground.
16. Wire no. 417 terminal of left wing relay connector	No voltage.	Replace left wing relay.

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LEFT WING RAISE SYSTEM TEST POINTS

M81507AE -19-09JAN93

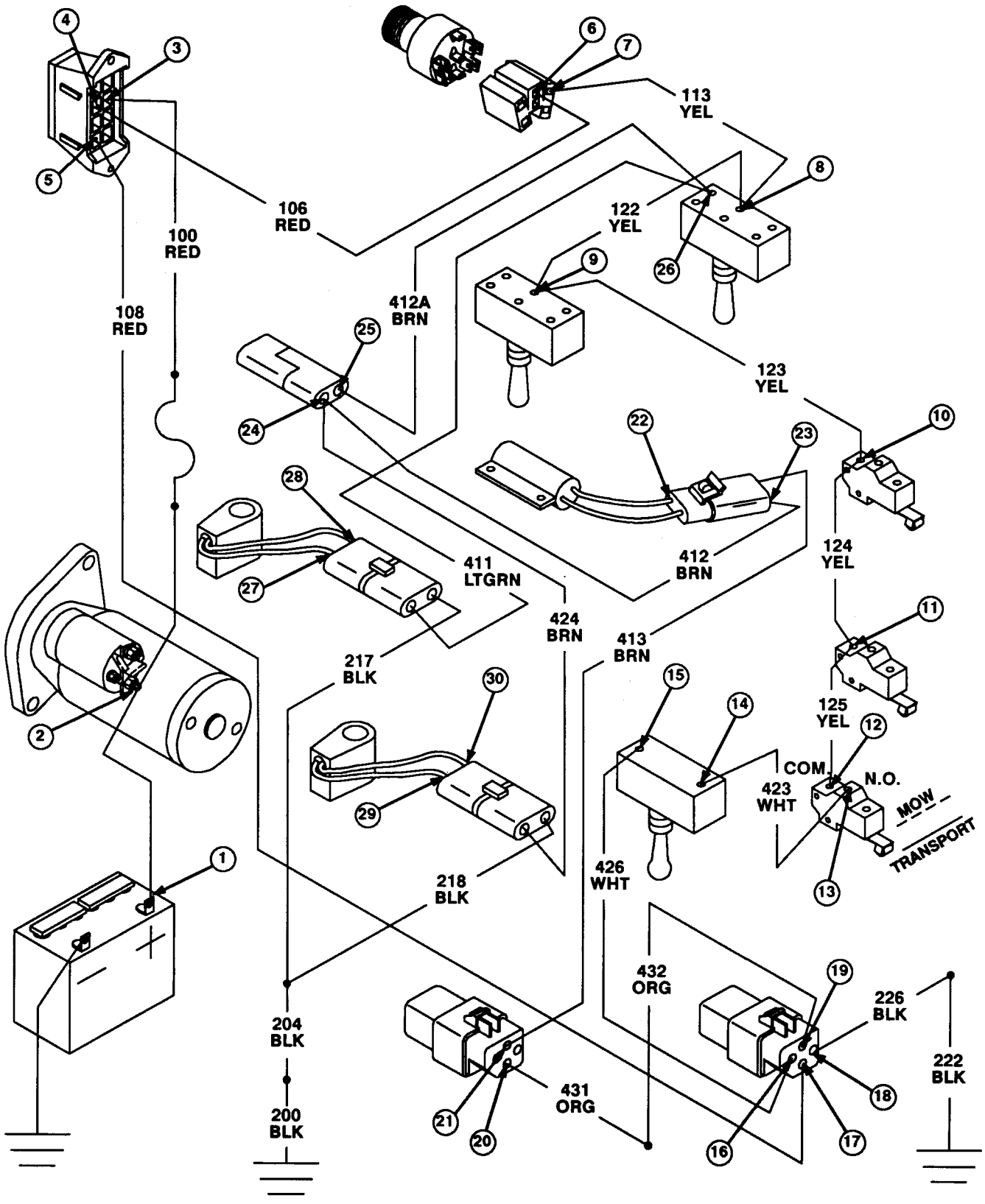
MX,24015HV,A33 -19-21JAN93

RIGHT WING LOWER SYSTEM TEST POINTS

CONDITIONS:
- Key switch in ON position.
- Meter set to DC volts position.
- Right wing lowered to less than 45-degree position.
- Right wing toggle switch in off position.
- Meter positive (red) lead connected to numbered test points.
- Meter negative (black) lead connected to ground.
- Electrical tests and adjustments in this group.

Test Location	Normal	If Not Normal
1. Battery positive post	Minimum 12.4 volts.	Charge and load test battery.
2. Starter battery terminal	Battery voltage.	Check for bad connections or a break in cable between battery and starter.
3. Wire no. 100 terminal of 20-amp fuse, F3	Battery voltage.	Check for failed fusible link at starter. If fusible link is bad, determine cause and replace fusible link. Also check for bad splice or broken wire no. 100.
4. Wire no. 106 terminal of 20-amp fuse, F3	Battery voltage.	Check for a blown fuse, F3. If fuse is good, check for a bad connection at fuse block.
5. Wire no. 108 terminal of 20-amp fuse, F5	Battery voltage.	Check for a blown fuse, F5. If fuse is good, check for a bad connection at fuse block.
6. Wire no. 106 terminal of key switch connector	Battery voltage.	Check for a bad connection or a break in wire no. 106.
7. Wire no. 113 terminal of key switch connector	Battery voltage.	Test key switch. See procedure in this group.
8. Wire no. 113/122 terminal of right wing toggle switch	Battery voltage.	Check for a bad connection or a break in wire no. 113.
9. Wire no. 122/123 terminal of left wing toggle switch	Battery voltage.	Check for a bad connection or a break in wire no. 122.
10. Wire no. 123/124 terminal of left wing lift switch	Battery voltage.	Check for a bad connection or a break in wire no. 123.
11. Wire no. 124/125 terminal of right wing lift switch	Battery voltage.	Check for a bad connection or a break in wire no. 124.
12. Wire no. 125 terminal of mow switch	Battery voltage.	Check for a bad connection or a break in wire no. 125.

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RIGHT WING LOWER SYSTEM TEST POINTS

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MX,24015HV,A35 -19-21JAN93

RIGHT WING LOWER SYSTEM TEST POINTS—CONTINUED

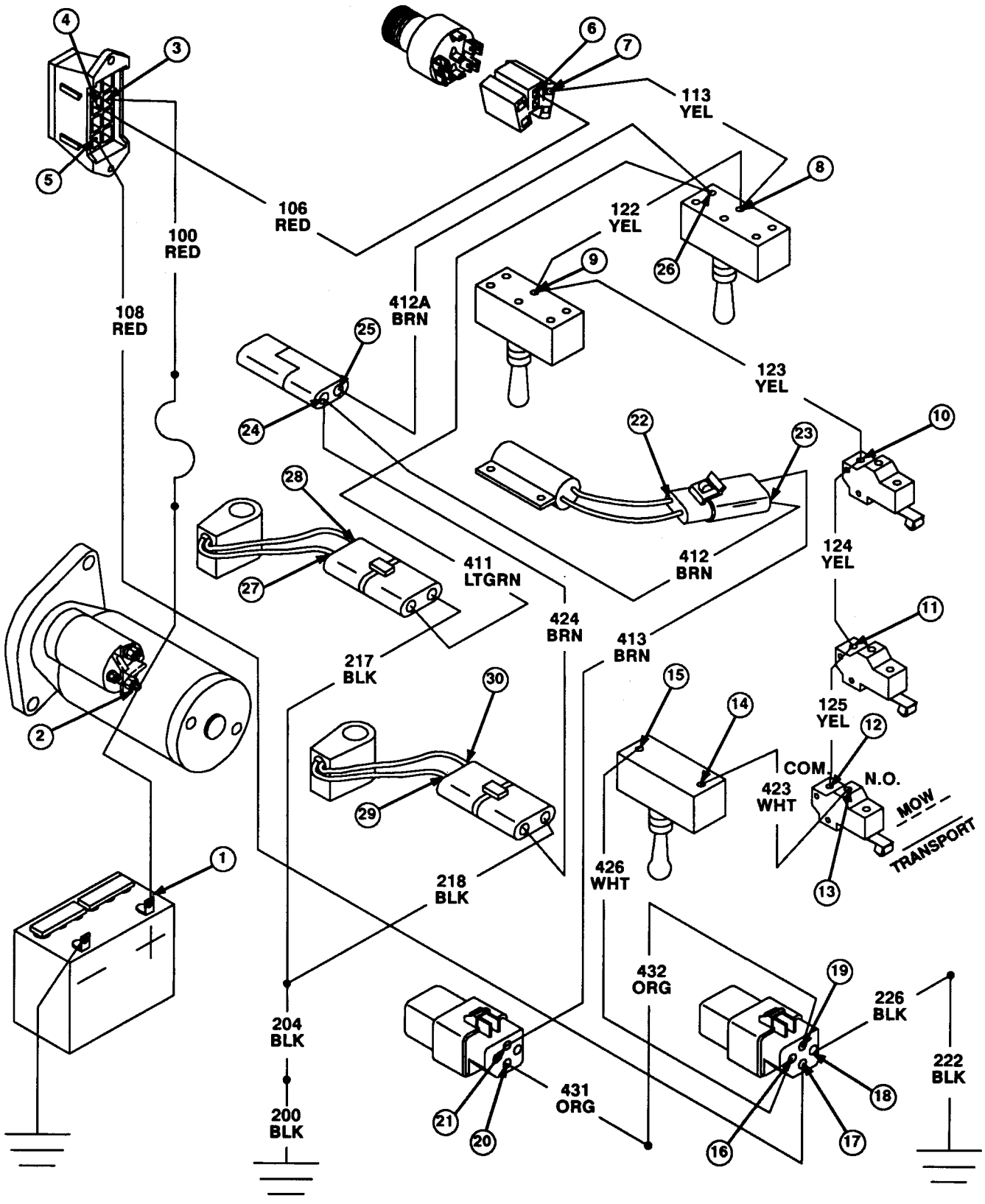
CONDITIONS:
- Cutting units lever moved forward to lower position.

Test Location	Normal	If Not Normal
13. Wire no. 423 terminal of mow switch	Battery voltage.	Test mow switch. See procedure in this group.
14. Wire no. 423 terminal of backlap switch	Battery voltage.	Check for a bad connection or a break in wire no. 423.

CONDITIONS:
- Backlap switch in disengaged position.

15. Wire no. 426 terminal of backlap switch	Battery voltage.	Test backlap switch. See procedure in this group.
16. Wire no. 426 terminal of mow relay	Battery voltage.	Check for a bad connection or a break in wire no. 426.
17. Wire no. 108 terminal of mow relay	Battery voltage.	Check for a bad connection or a break in wire no. 108.
18. Wire no. 234 terminal of mow relay (Wire no. 226 on 3325)	Less than 0.2 volt.	Check continuity of wire no. 234 to ground.
19. Wire no. 432 terminal of mow relay (Wire no. 415 on 3325)	Battery voltage.	Test relay. See procedure in this group.
20. Wire no. 431 terminal of right wing relay (415 on 3325) (Wire no. 415 on 3325)	Battery voltage.	On 3365, check for a break in splice connecting wire nos. 431 and 432. On 3325, check for a bad connection or a break in wire no. 415.
21. Wire no. 413 terminal of right wing relay	Battery voltage.	Test relay. See procedure in this group.
22. Mercury switch side of mercury switch connector	Battery voltage.	Check for a bad connection or a break in wire no. 413.
23. Wire no. 412 terminal of mercury switch connector	Battery voltage.	Test and adjust mercury switch. See procedure in this group.
24. Wire no. 412/424 terminal of right wing diode	Battery voltage.	Check for a bad connection or a break in wire no. 412.
25. Wire no. 412A terminal of right wing diode	Battery voltage.	Test diode. See procedure in this group.

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RIGHT WING LOWER SYSTEM TEST POINTS

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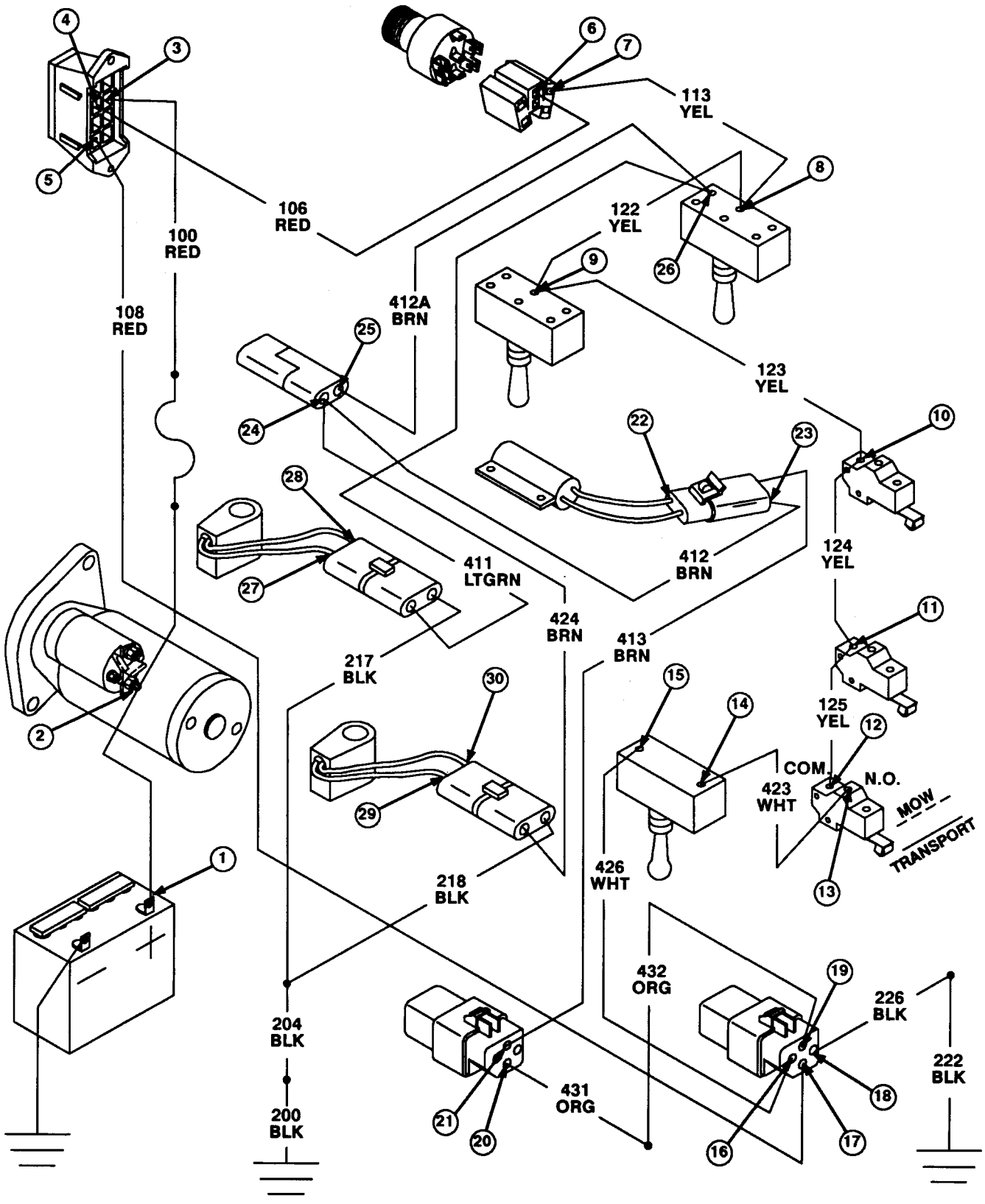
MX,24015HV,A35 -19-21JAN93

RIGHT WING LOWER SYSTEM TEST POINTS—CONTINUED

CONDITIONS:
- Right wing toggle switch in lower position.

Test Location	Normal	If Not Normal
26. Wire no. 412A/411 terminal of right wing toggle switch	Battery voltage.	Test switch. See procedure in this group.
27. Solenoid side of right wing solenoid connector	Battery voltage.	Check for a break in splice connecting wire nos. 411 and 412A.
28. Solenoid side of right wing solenoid connector	Less than 0.2 volt.	Check continuity of wire no. 215 to ground.
29. Solenoid side of right mow solenoid connector	Battery voltage.	Check for a bad connection or a break in wire no. 424.
30. Solenoid side of right mow solenoid connector	Less than 0.2 volt.	Check continuity of wire no. 218 to ground.

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RIGHT WING LOWER SYSTEM TEST POINTS

-19-09JAN93

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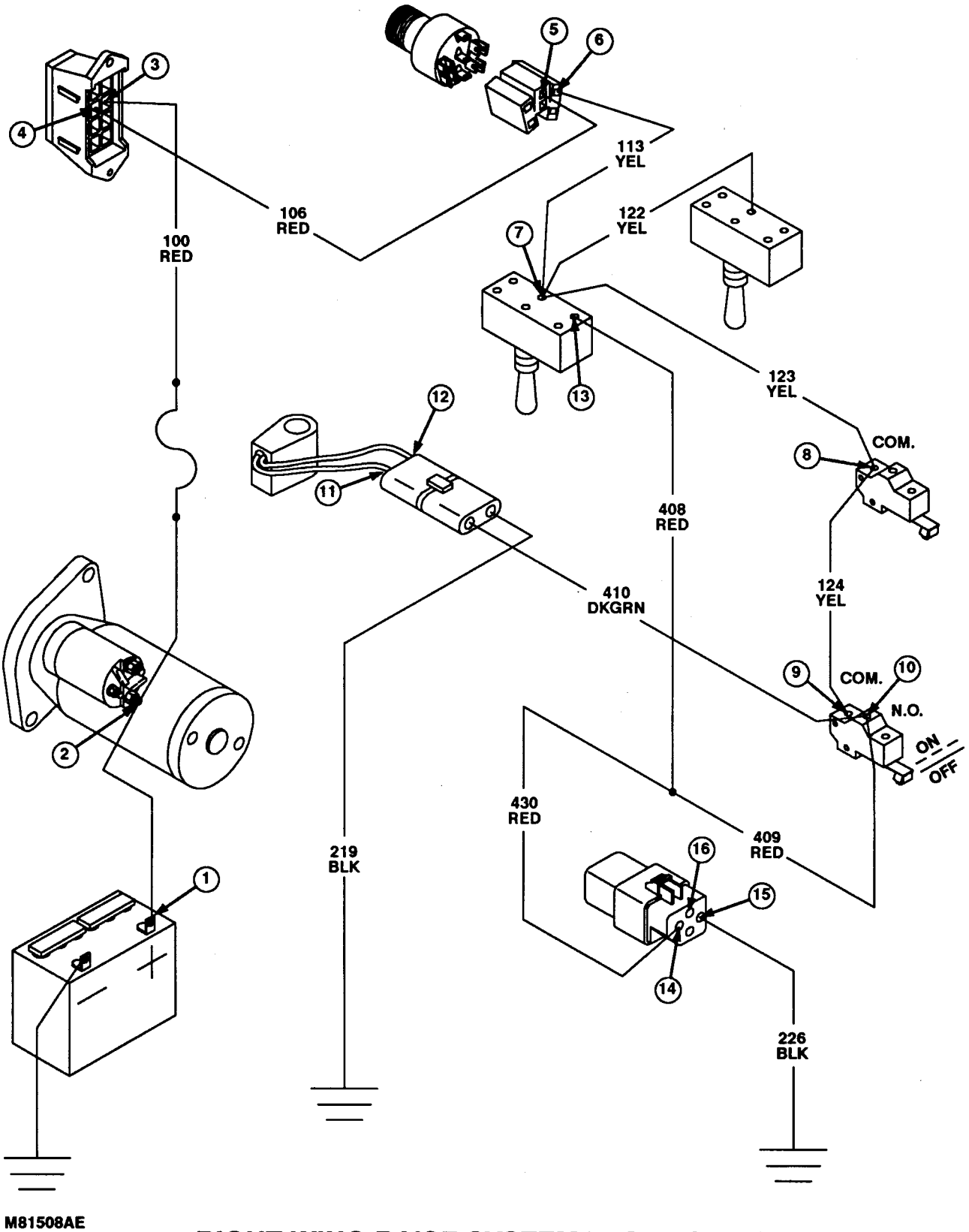
MX,24015HV,A35 -19-21JAN93

RIGHT WING RAISE SYSTEM TEST POINTS

CONDITIONS:
- Key switch in ON position.
- Meter set to DC volts position.
- Right wing lowered.
- Right wing toggle switch in off position.
- Cutting units lever in rearward position.
- Meter positive (red) lead connected to numbered test points.
- Meter negative (black) lead connected to ground.
- Electrical tests and adjustments in this group.

Test Location	Normal	If Not Normal
1. Battery positive post	Minimum 12.4 volts.	Charge and load test battery.
2. Starter battery terminal	Battery voltage.	Check for bad connections or a break in cable between battery and starter.
3. Wire no. 100 terminal of 20-amp fuse, F3	Battery voltage.	Check for failed fusible link at starter. If fusible link is bad, determine cause and replace fusible link. Also check for bad splice or broken wire no. 100.
4. Wire no. 106 terminal of 20-amp fuse, F3	Battery voltage.	Check for a blown fuse, F3. If fuse is good, check for a bad connection at fuse block.
5. Wire no. 106 terminal of key switch	Battery voltage.	Check for a bad connection or a break in wire no. 106.
6. Wire no. 113 terminal of key switch connector	Battery voltage.	Test key switch. See procedure in this group.
7. Wire no. 113/122 terminal of right wing toggle switch	Battery voltage.	Check for a bad connection or a break in wire no. 113.
8. Wire no. 123/124 terminal of left wing lift switch	Battery voltage.	Check for a bad connection or a break in wire no. 123.
9. Wire no. 124/125 terminal of right wing lift switch	Battery voltage.	Check for a bad connection or a break in wire no. 124.
10. Wire no. 409/410 terminal of right wing lift switch	Battery voltage.	Test switch. See procedure in this group.
11. Solenoid side of connector, right wing lift solenoid	Battery voltage.	Check for a bad connection or a break in wire no. 410.
12. Solenoid side of connector, right wing lift solenoid	Less than 0.2 volt.	Check continuity of wire no. 219 to ground.

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RIGHT WING RAISE SYSTEM TEST POINTS

M81508AE -19-09JAN93

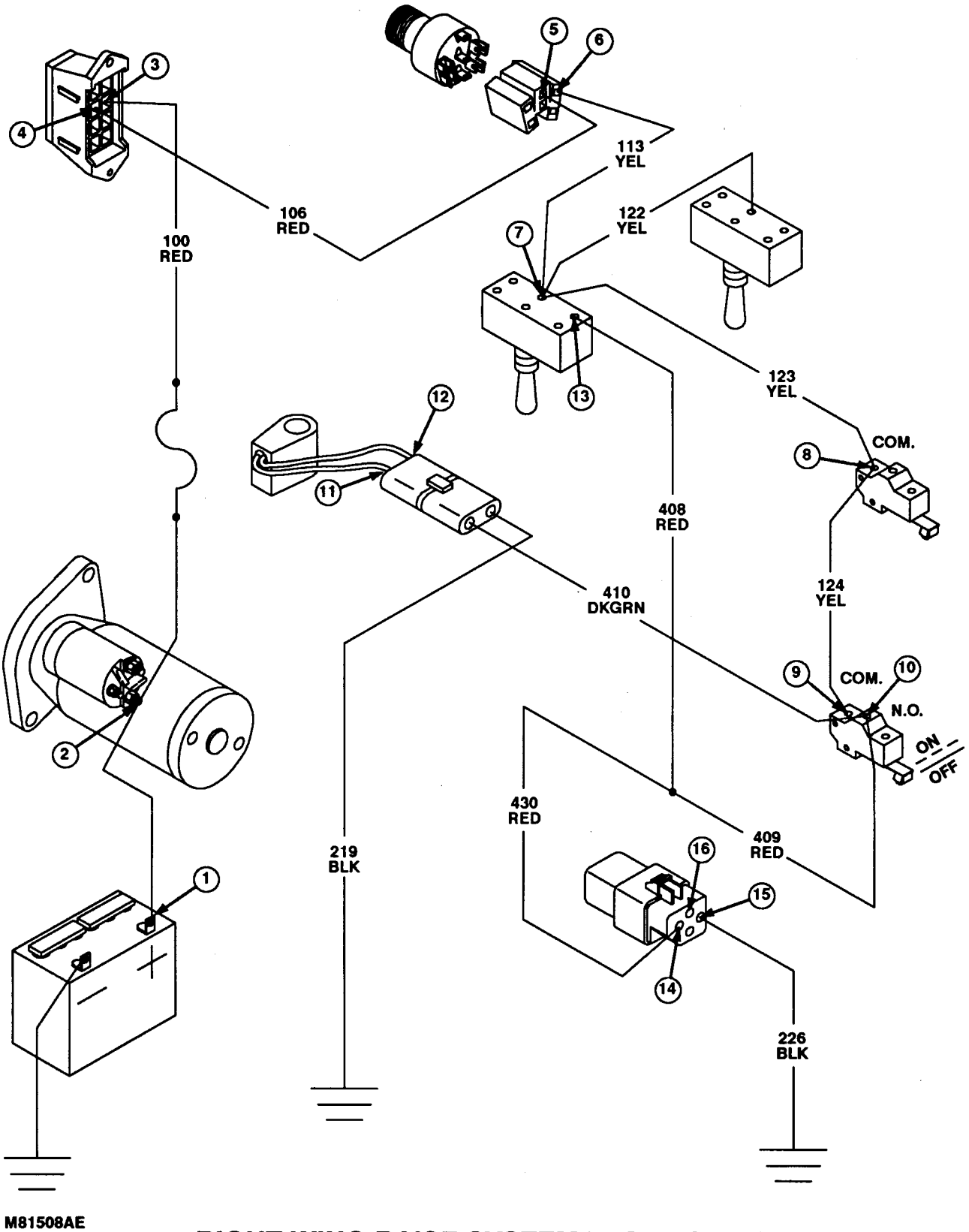
MX,24015HV,A37 -19-21JAN93

RIGHT WING RAISE SYSTEM TEST POINTS—CONTINUED

CONDITIONS:
- Right wing toggle switch in raise position.

13. Wire no. 408 terminal of right wing toggle switch	Battery voltage.	Test switch. See procedure in this group.
14. Wire no. 430 terminal of right wing relay connector	Battery voltage.	Check for a break in splice connecting wire nos. 408, 409 and 430.
15. Wire no. 226 terminal of right wing relay connector (Wire no. 224 on 3325)	Less than 0.2 volt.	Check continuity of wire no. 224 to ground.
16. Wire no. 413 terminal of right wing relay connector	No voltage.	Replace right wing relay.

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RIGHT WING RAISE SYSTEM TEST POINTS

M81508AE -19-09JAN93

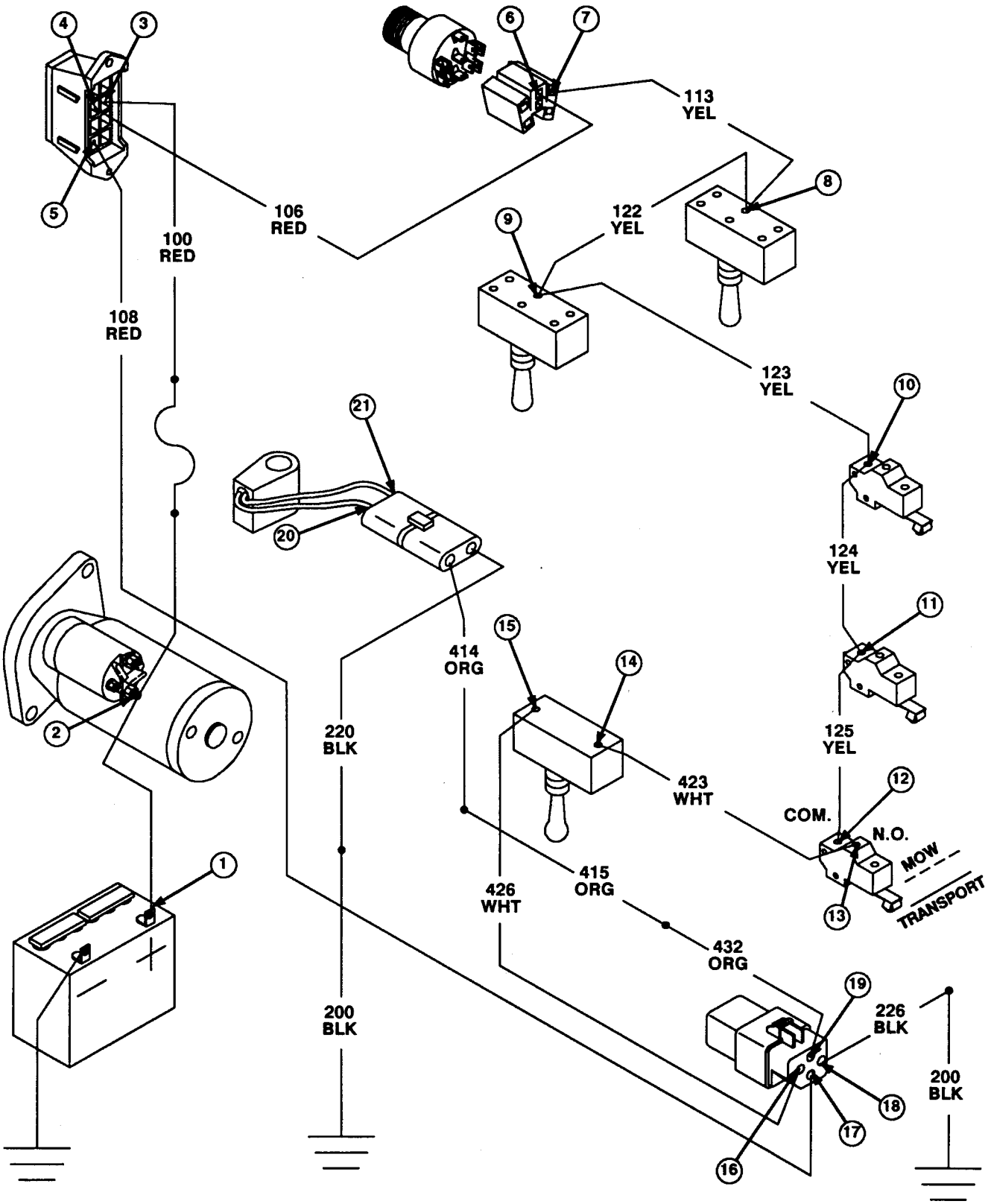
MX,24015HV,A37 -19-21JAN93

CUTTING UNITS CONTROL SYSTEM TEST POINTS—FRONT/CENTER MOW

CONDITIONS:
- Key switch in ON position.
- Meter set to DC volts position.
- Cutting units lever completely forward.
- Backlap switch in disengaged position.
- Meter positive (red) lead connected to numbered test points.
- Meter negative (black) lead connected to ground.
- Electrical tests and adjustments in this group.

Test Location	Normal	If Not Normal
1. Battery positive post	Minimum 12.4 volts.	Charge and load test battery.
2. Starter battery terminal	Battery voltage.	Check for bad connections or a break in cable between battery and starter.
3. Wire no. 100 terminal of 20-amp fuse, F3	Battery voltage.	Check for failed fusible link at starter. If fusible link is bad, determine cause and replace fusible link. Also check for bad splice or broken wire no. 100.
4. Wire no. 106 terminal of 20-amp fuse, F3	Battery voltage.	Check for a blown fuse, F3. If fuse is good, check for a bad connection at fuse block.
5. Wire no. 108 terminal of 20-amp fuse, F5	Battery voltage.	Check for a blown fuse, F5.
6. Wire no. 106 terminal of key switch connector	Battery voltage.	Check for a bad connection or a break in wire no. 106.
7. Wire no. 113 terminal of key switch connector	Battery voltage.	Test key switch. See procedure in this group.
8. Wire no. 113/122 terminal of right wing toggle switch	Battery voltage.	Check for a bad connection or a break in wire no. 113.
9. Wire no. 122/123 terminal of left wing toggle switch	Battery voltage.	Check for a bad connection or a break in wire no. 122.
10. Wire no. 123/124 terminal of left wing lift switch	Battery voltage.	Check for a bad connection or a break in wire no. 123.
11. Wire no. 124/125 terminal of right wing lift switch	Battery voltage.	Check for a bad connection or a break in wire no. 124.
12. Wire no. 125 terminal of mow switch	Battery voltage.	Check for a bad connection or a break in wire no. 125.
13. Wire no. 423 terminal of mow switch	Battery voltage.	Test switch. See procedure in this group.
14. Wire no. 423 terminal of backlap switch	Battery voltage.	Check for a bad connection or a break in wire no. 423.

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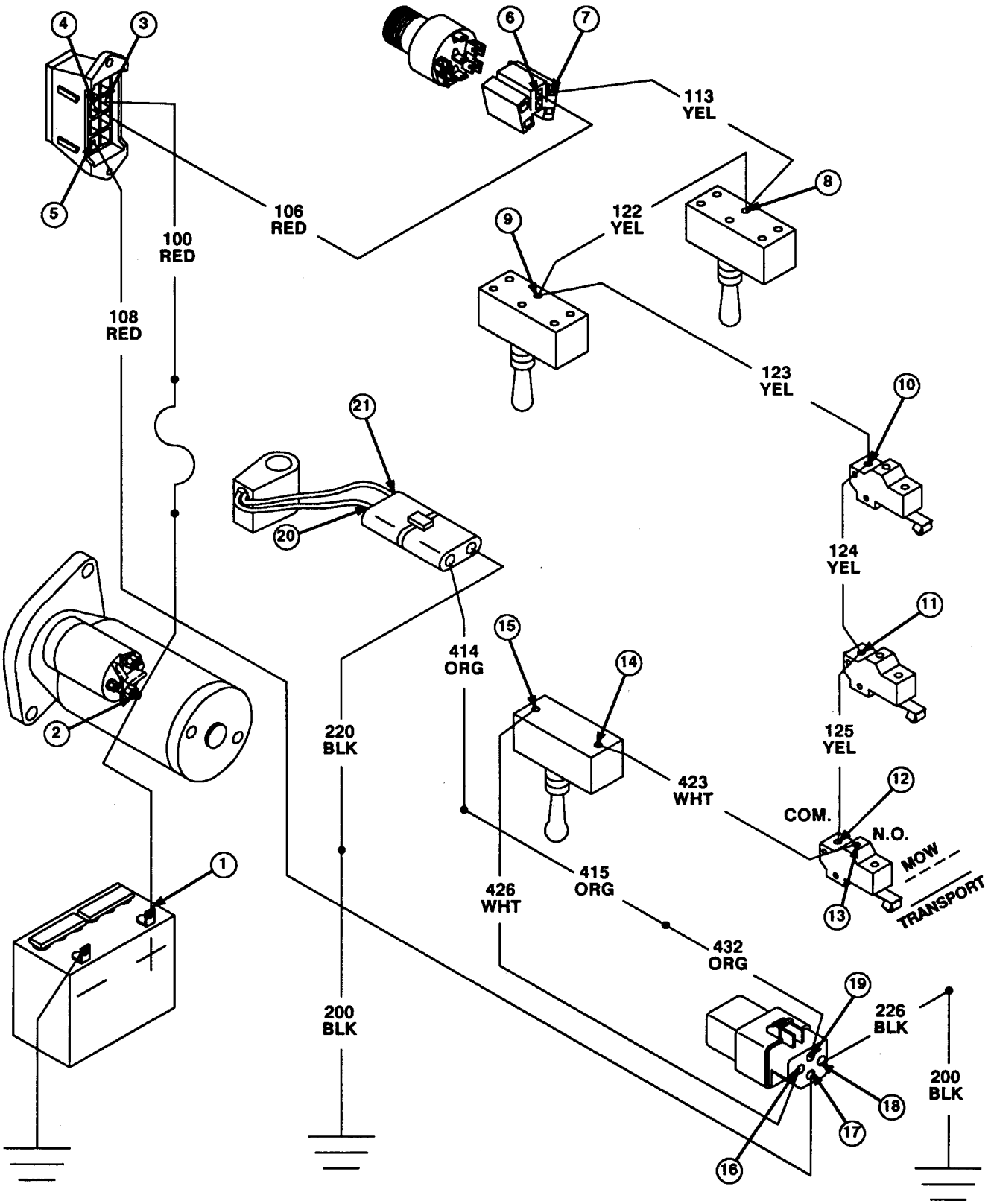
CUTTING UNITS CONTROL SYSTEM TEST POINTS FRONT/CENTER MOW

MX,24015HV,A39 -19-21JAN93

CUTTING UNITS CONTROL SYSTEM TEST POINTS—FRONT/CENTER MOW—CONTINUED

Test Location	Normal	If Not Normal
15. Wire no. 426 terminal of backlap switch	Battery voltage.	Test switch. See procedure in this group.
16. Wire no. 426 terminal of mow relay	Battery voltage.	Check for a bad connection or a break in wire no. 426.
17. Wire no. 108 terminal of mow relay	Battery voltage.	Check for a bad connection or a break in wire no. 108.
18. Wire no. 234 terminal of mow relay (Wire no. 226 on 3325)	Less than 0.2 volt.	Check continuity of wire no. 234 to ground.
19. Wire no. 432 terminal of mow relay (Wire no. 415 on 3325)	Battery voltage.	Test relay. See procedure in this group.
20. Front/center mow solenoid connector, solenoid side	Battery voltage.	On 3365, check for a break in splice connecting wire nos. 414, 415 and 432. On 3325, check for a break in splices connecting wire nos. 414, 415 and 416.
21. Front/center mow solenoid connector, solenoid side	Less than 0.2 volt.	Check continuity of wire no. 220 to ground. If continuity is good, test solenoid. See procedure in this group.

MX,24015HV,A39A-19-21JAN93



CUTTING UNITS CONTROL SYSTEM TEST POINTS FRONT/CENTER MOW

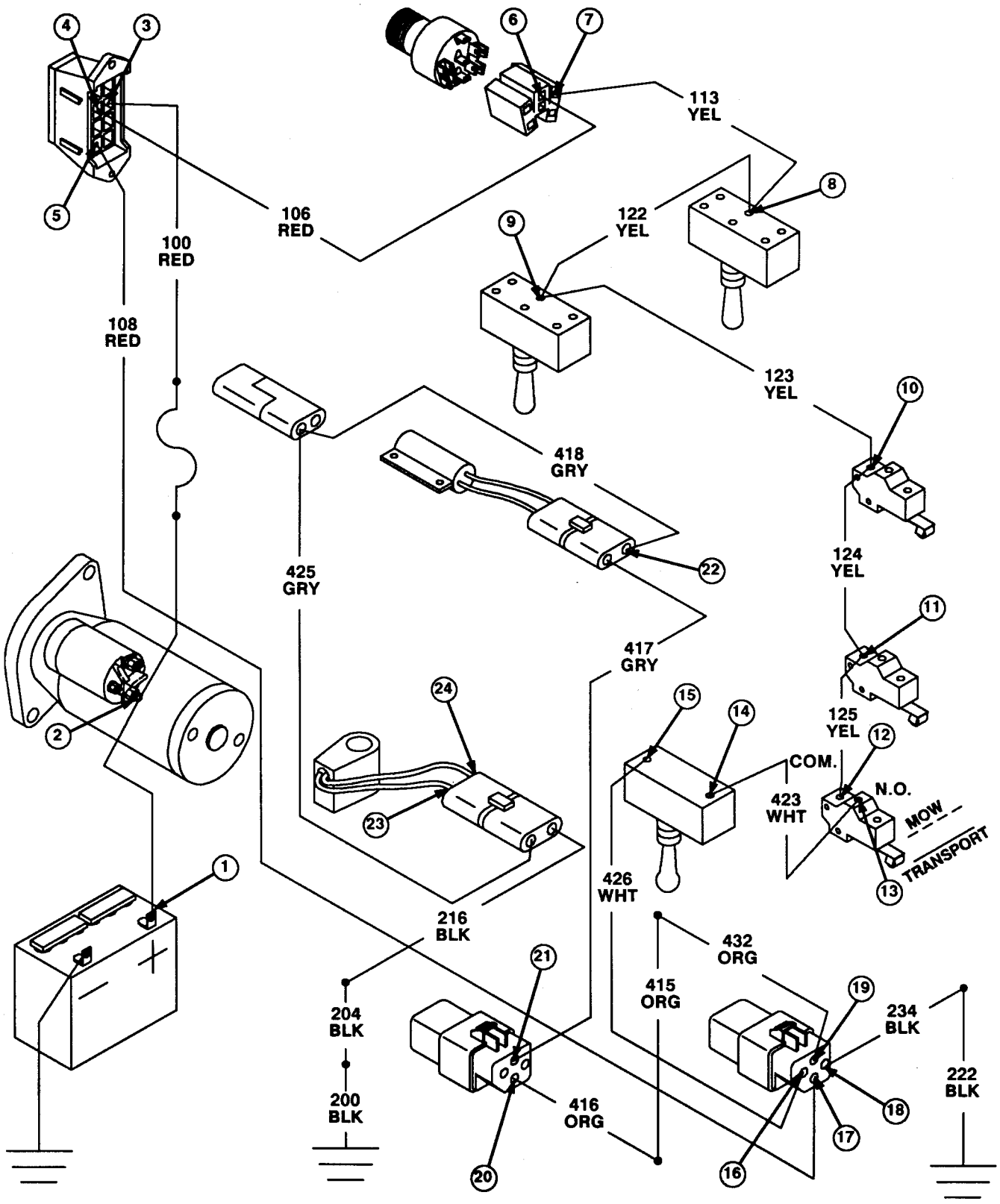
MX,24015HV,A39 -19-21JAN93

CUTTING UNITS CONTROL SYSTEM TEST POINTS—LEFT MOW

CONDITIONS:
- Key switch in ON position.
- Meter set to DC volts position.
- Cutting units lever completely forward.
- Left wing unit lowered to the ground.
- Backlap switch in disengaged position.
- Meter positive (red) lead connected to numbered test points.
- Meter negative (black) lead connected to ground.
- Electrical tests and adjustments in this group.

Test Location	Normal	If Not Normal
1. Battery positive post	Minimum 12.4 volts.	Charge and load test battery.
2. Starter battery terminal	Battery voltage.	Check for bad connections or a break in cable between battery and starter.
3. Wire no. 100 terminal of 20-amp fuse, F3	Battery voltage.	Check for failed fusible link at starter. If fusible link is bad, determine cause and replace fusible link. Also check for bad splice or broken wire no. 100.
4. Wire no. 106 terminal of 20-amp fuse, F3	Battery voltage.	Check for a blown fuse, F3. If fuse is good, check for a bad connection at fuse block.
5. Wire no. 108 terminal of 20-amp fuse, F5	Battery voltage.	Check for a blown fuse, F5.
6. Wire no. 106 terminal of key switch connector	Battery voltage.	Check for a bad connection or a break in wire no. 106.
7. Wire no. 113 terminal of key switch connector	Battery voltage.	Test key switch. See procedure in this group.
8. Wire no. 113/122 terminal of right wing toggle switch	Battery voltage.	Check for a bad connection or a break in wire no. 113.
9. Wire no. 122/123 terminal of left wing toggle switch	Battery voltage.	Check for a bad connection or a break in wire no. 122.
10. Wire no. 123/124 terminal of left wing lift switch	Battery voltage.	Check for a bad connection or a break in wire no. 123.
11. Wire no. 124/125 terminal of right wing lift switch	Battery voltage.	Check for a bad connection or a break in wire no. 124.
12. Wire no. 125 terminal of mow switch	Battery voltage.	Check for a bad connection or a break in wire no. 125.
13. Wire no. 423 terminal of mow switch	Battery voltage.	Test switch. See procedure in this group.
14. Wire no. 423 terminal of backlap switch	Battery voltage.	Check for a bad connection or a break in wire no. 423.

MX,24015HV,A40 -19-21JAN93



CUTTING UNITS CONTROL SYSTEM TEST POINTS LEFT MOW

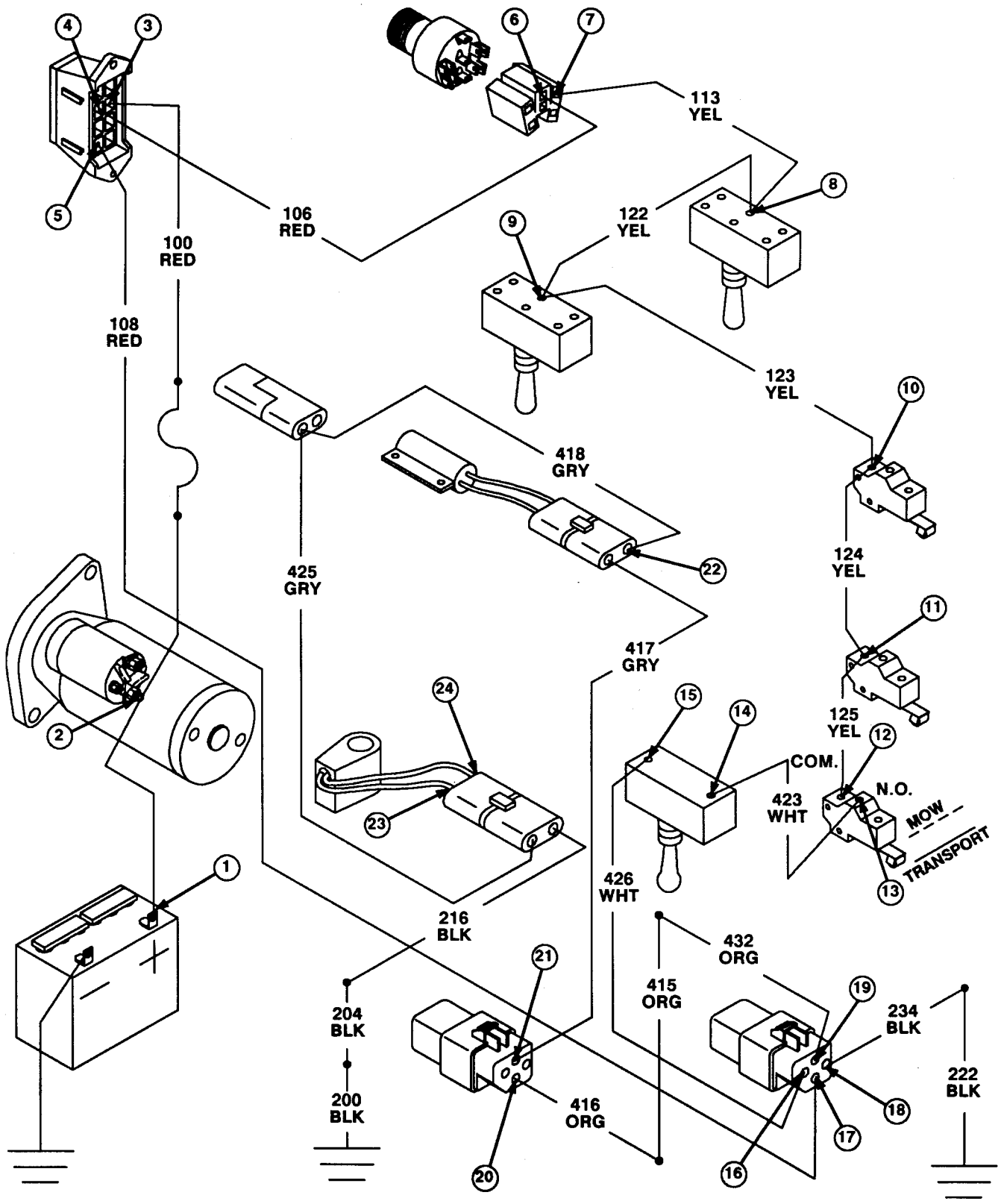
M81513AE -19-09JAN93

MX,24015HV,A41 -19-21JAN93

CUTTING UNITS CONTROL SYSTEM TEST POINTS—LEFT MOW—CONTINUED

Test Location	Normal	If Not Normal
15. Wire no. 426 terminal of backlap switch	Battery voltage.	Test switch. See procedure in this group.
16. Wire no. 426 terminal of mow relay	Battery voltage.	Check for a bad connection or a break in wire no. 426.
17. Wire no. 108 terminal of mow relay.	Battery voltage.	Check for a bad connection or a break in wire no. 108.
18. Wire no. 234 terminal of mow relay (wire no. 226 on 3325)	Less than 0.2 volt.	Check continuity of wire no. 234 to ground.
19. Wire no. 432 terminal of mow relay (wire no. 416 on 3325)	Battery voltage.	Test relay. See procedure in this group.
20. Wire no. 416 terminal of left wing relay	Battery voltage.	Check for a bad connection. Check for a broken splice or a break in wires 416, 415 or 432.
21. Wire no. 417 terminal of left wing relay	Battery voltage.	Test relay. See procedure in this group.
22. Wire no. 418 terminal of mercury switch	Battery voltage.	Test mercury switch. See procedure in this group. Check for a bad connection or a break in wire no. 417.
23. Left mow solenoid connector, solenoid side	Battery voltage.	Check for a bad connection at left mow solenoid or at left wing diode. Check for a break in wires 425 and 418.
24. Left mow solenoid connector, solenoid side	Less than 0.2 volt.	Test solenoid. See procedure in this group. Check for a bad connection. Check for a broken splice or a break in wires 216, 204 and 200.

MX,24015HV,A41A-19-21JAN93



CUTTING UNITS CONTROL SYSTEM TEST POINTS LEFT MOW

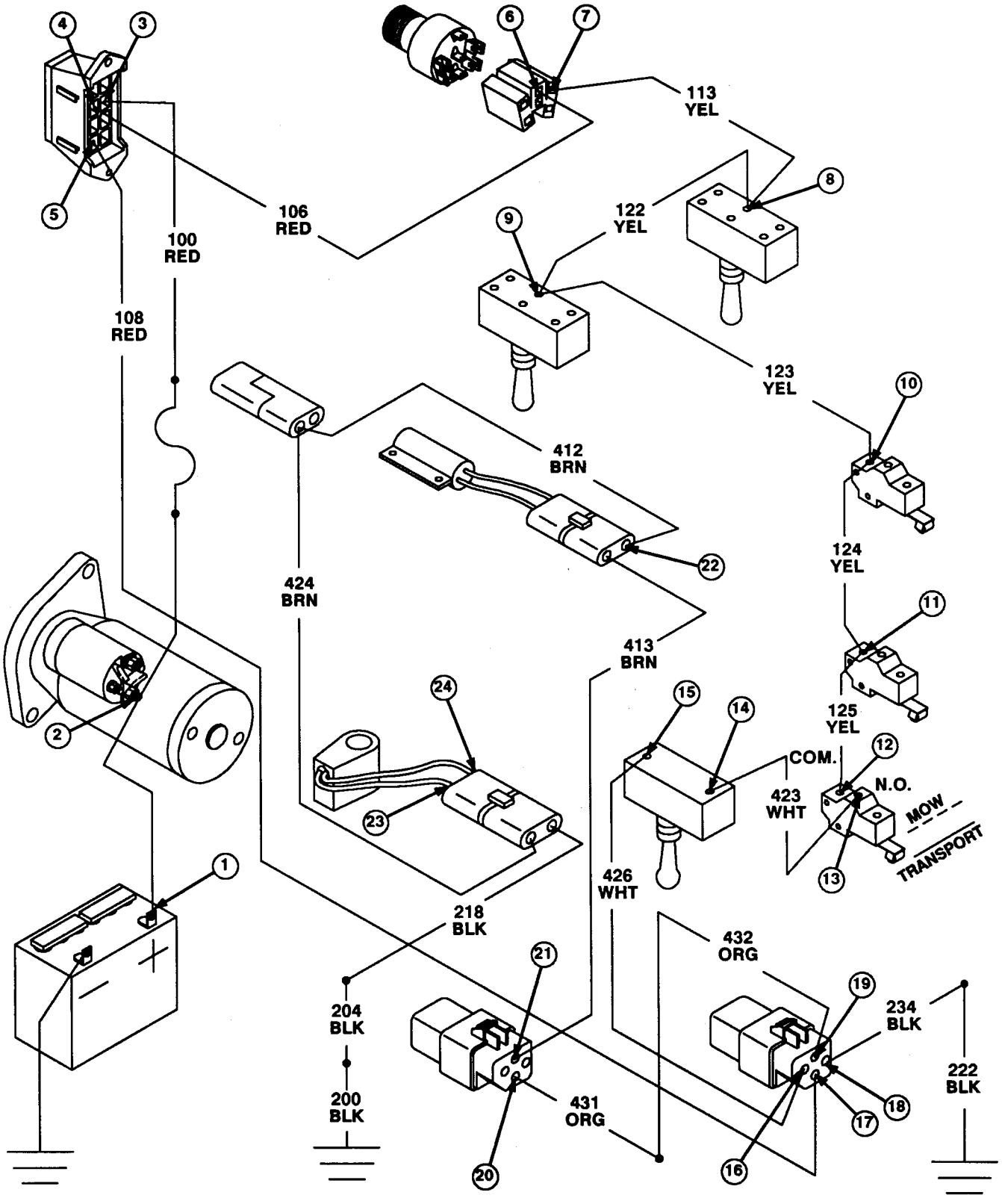
MX,24015HV,A41 -19-21JAN93

CUTTING UNITS CONTROL SYSTEM TEST POINTS—RIGHT MOW

CONDITIONS:
- Key switch in ON position.
- Meter set to DC volts position.
- Cutting units lever completely forward.
- Right wing unit lowered to the ground.
- Backlap switch in disengaged position.
- Meter positive (red) lead connected to numbered test points.
- Meter negative (black) lead connected to ground.
- Electrical tests and adjustments in this group.

Test Location	Normal	If Not Normal
1. Battery positive post	Minimum 12.4 volts.	Charge and load test battery.
2. Starter battery terminal	Battery voltage.	Check for bad connections or a break in cable between battery and starter.
3. Wire no. 100 terminal of 20-amp fuse, F3	Battery voltage.	Check for failed fusible link at starter. If fusible link is bad, determine cause and replace fusible link. Also check for bad splice or broken wire no. 100.
4. Wire no. 106 terminal of 20-amp fuse, F3	Battery voltage.	Check for a blown fuse, F3. If fuse is good, check for a bad connection at fuse block.
5. Wire no. 108 terminal of 20-amp fuse, F5	Battery voltage.	Check for a blown fuse, F5.
6. Wire no. 106 terminal of key switch connector	Battery voltage.	Check for a bad connection or a break in wire no. 106.
7. Wire no. 113 terminal of key switch connector	Battery voltage.	Test key switch. See procedure in this group.
8. Wire no. 113/122 terminal of right wing toggle switch	Battery voltage.	Check for a bad connection or a break in wire no. 113.
9. Wire no. 122/123 terminal of left wing toggle switch	Battery voltage.	Check for a bad connection or a break in wire no. 122.
10. Wire no. 123/124 terminal of left wing lift switch	Battery voltage.	Check for a bad connection or a break in wire no. 123.
11. Wire no. 124/125 terminal of right wing lift switch	Battery voltage.	Check for a bad connection or a break in wire no. 124.
12. Wire no. 125 terminal of mow switch	Battery voltage.	Check for a bad connection or a break in wire no. 125.
13. Wire no. 423 terminal of mow switch	Battery voltage.	Test switch. See procedure in this group.
14. Wire no. 423 terminal of backlap switch	Battery voltage.	Check for a bad connection or a break in wire no. 423.

MX,24015HV,A42 -19-21JAN93



CUTTING UNITS CONTROL SYSTEM TEST POINTS RIGHT MOW

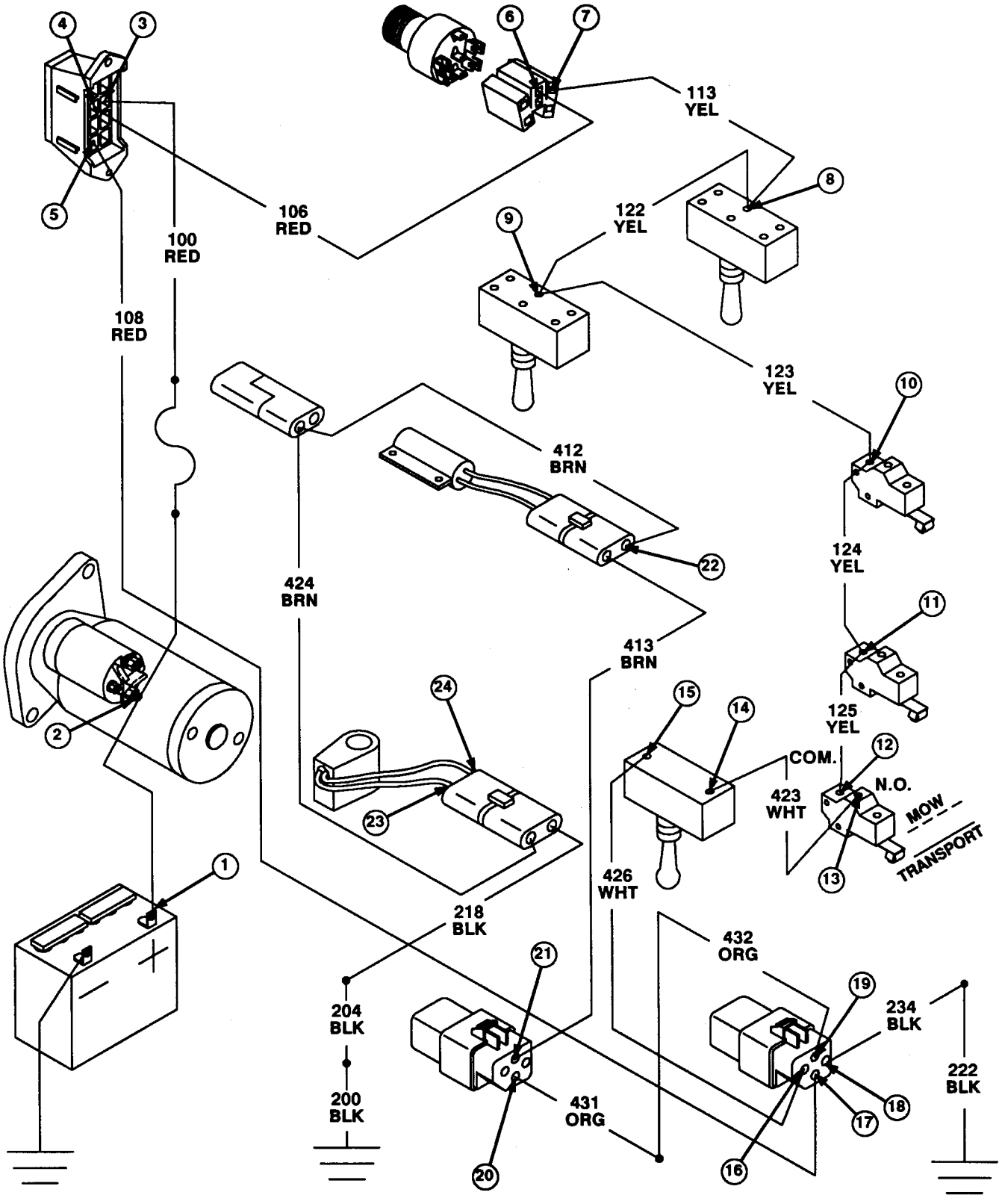
M81514AE -19-09JAN93

MX,24015HV,A43 -19-21JAN93

CUTTING UNITS CONTROL SYSTEM TEST POINTS—RIGHT MOW—CONTINUED

Test Location	Normal	If Not Normal
15. Wire no. 426 terminal of backlap switch	Battery voltage.	Test switch. See procedure in this group.
16. Wire no. 426 terminal of mow relay	Battery voltage.	Check for a bad connection or a break in wire no. 426.
17. Wire no. 108 terminal of mow relay	Battery voltage.	Check for a bad connection or a break in wire no. 108.
18. Wire no. 234 terminal of mow relay (wire no. 226 on 3325)	Less than 0.2 volt.	Check continuity of wire no. 234 to ground.
19. Wire no. 432 terminal of mow relay (wire no. 416 on 3325)	Battery voltage.	Test relay. See procedure in this group.
20. Wire no. 431 terminal of right wing relay (wire no. 415 on 3325)	Battery voltage.	Check for a bad connection. Check for a broken splice or a break in wires 431 and 432.
21. Wire no. 413 terminal of right wing relay	Battery voltage.	Test relay. See procedure in this group.
22. Wire no. 412 terminal of mercury switch	Battery voltage.	Test mercury switch. See procedure in this group. Check for a bad connection or a break in wire no. 413.
23. Right mow solenoid connector, solenoid side	Battery voltage.	Check for a bad connection at right mow solenoid or at right wing diode. Check for a break in wires 424 and 412.
24. Right mow solenoid connector, solenoid side	Less than 0.2 volt.	Test solenoid. See procedure in this group. Check for a bad connection. Check for a broken splice or a break in wires 218, 204 and 200.

MX,24015HV,A43A-19-21JAN93



CUTTING UNITS CONTROL SYSTEM TEST POINTS RIGHT MOW

M81514AE -19-09JAN93

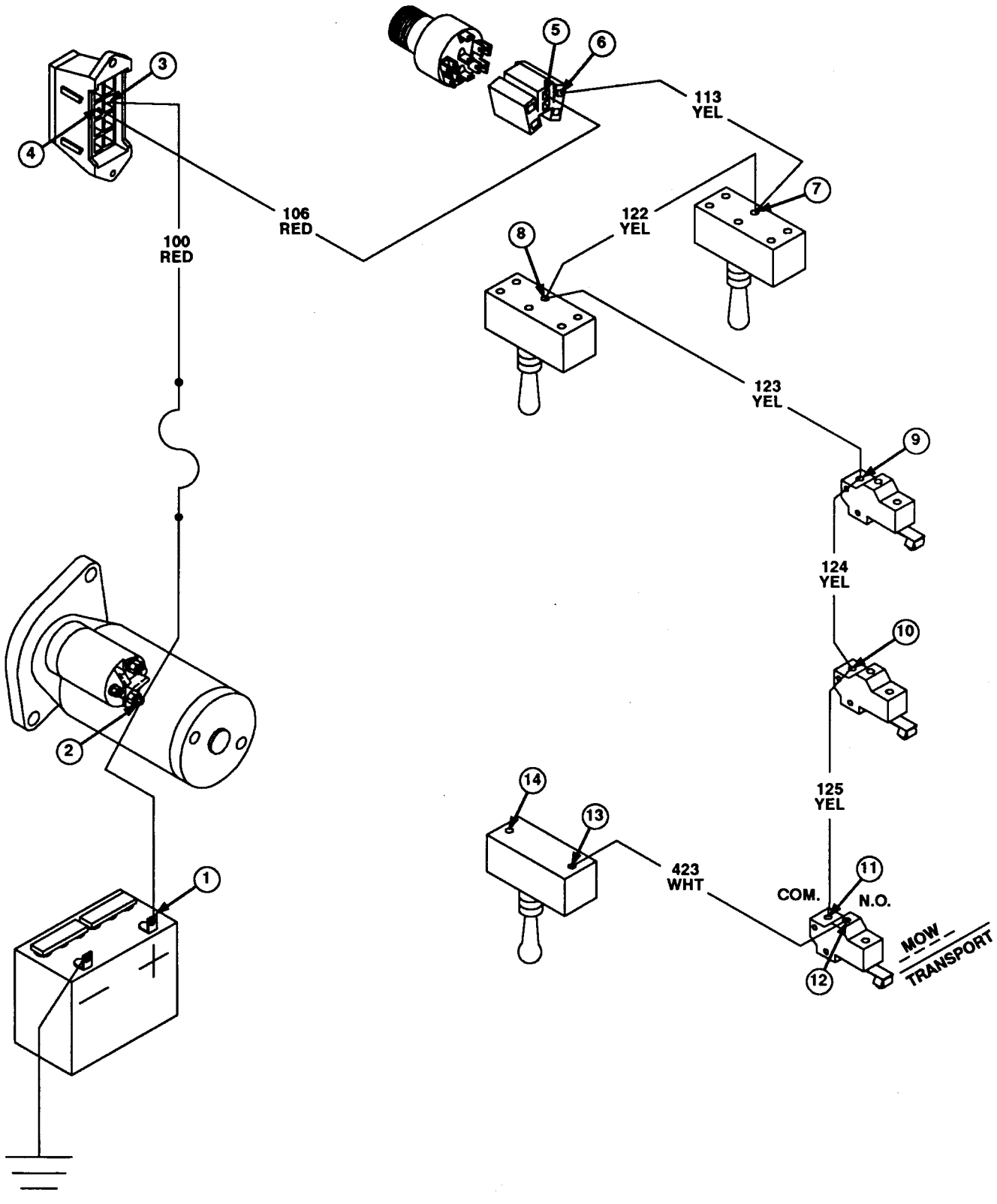
MX,24015HV,A43 -19-21JAN93

CUTTING UNITS CONTROL SYSTEM TEST POINTS—BACKLAP

CONDITIONS:
- Key switch in ON position
- Meter set to DC volts position.
- Cutting units lever completely forward.
- Backlap switch in engaged position.
- Meter positive (red) lead connected to numbered test points.
- Meter negative (black) lead connected to ground.
- Electrical tests and adjustments in this group.

Test Location	Normal	If Not Normal
1. Battery positive post	Minimum 12.4 volts.	Charge and load test battery.
2. Starter battery terminal	Battery voltage.	Check for bad connections or a break in cable between battery and starter.
3. Wire no. 100 terminal of 20-amp fuse, F3	Battery voltage.	Check for failed fusible link at starter. If fusible link is bad, determine cause and replace fusible link. Also check for bad splice or broken wire no. 100.
4. Wire no. 106 terminal of 20-amp fuse, F3	Battery voltage.	Check for a blown fuse, F3. If fuse is good, check for a bad connection at fuse block.
5. Wire no. 106 terminal of key switch connector	Battery voltage.	Check for a bad connection or a break in wire no. 106.
6. Wire no. 113 terminal of key switch connector	Battery voltage.	Test key switch. See procedure in this group.
7. Wire no. 113/122 terminal of right wing toggle switch	Battery voltage.	Check for a bad connection or a break in wire no. 113.
8. Wire no. 122/123 terminal of left wing toggle switch	Battery voltage.	Check for a bad connection or a break in wire no. 122.
9. Wire no. 123/124 terminal of left wing lift switch	Battery voltage.	Check for a bad connection or a break in wire no. 123.
10. Wire no. 124/125 terminal of right wing lift switch	Battery voltage.	Check for a bad connection or a break in wire no. 124.
11. Wire no. 125 terminal of mow switch	Battery voltage.	Check for a bad connection or a break in wire no. 125.
12. Wire no. 423 terminal of mow switch	Battery voltage.	Test switch. See procedure in this group.
13. Wire no. 423 terminal of backlap switch	Battery voltage.	Check for a bad connection or a break in wire no. 423.
14. Wire no. 426 terminal of backlap switch	Zero voltage.	Test switch. See procedure in this group.

MX,24015HV,A44 -19-21JAN93



CUTTING UNITS CONTROL SYSTEM TEST POINTS BACKLAP

M81515AE -19-09JAN93

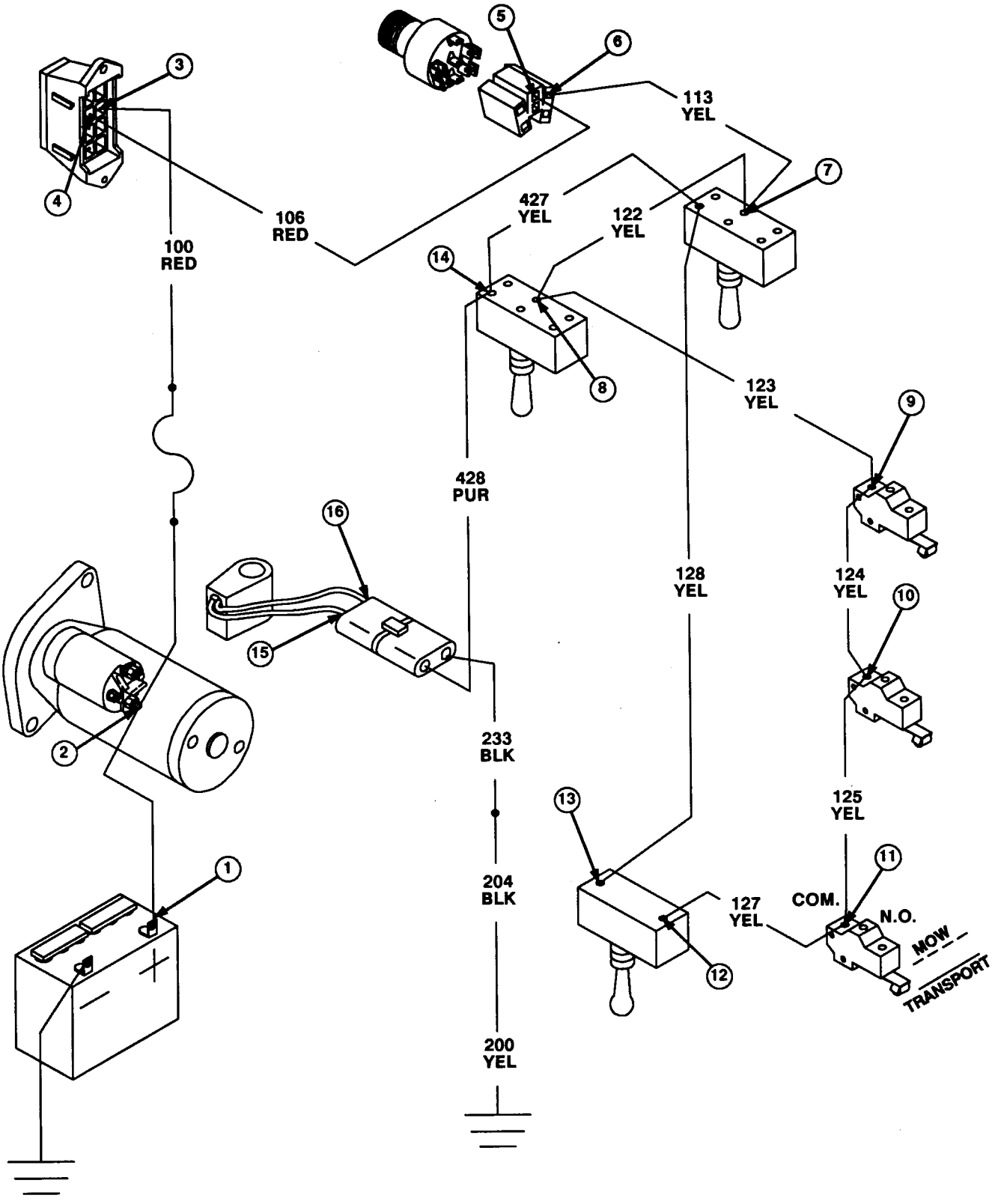
MX,24015HV,A45 -19-21JAN93

CUTTING UNITS CONTROL SYSTEM TEST POINTS—WEIGHT TRANSFER

CONDITIONS:
- Key switch in ON position.
- Meter set to DC volts position.
- Cutting units lever completely forward.
- Weight transfer switch in the off position.
- Backlap switch in disengaged position.
- Meter positive (red) lead connected to numbered test points.
- Meter negative (black) lead connected to ground.
- Electrical tests and adjustments in this group.

Test Location	Normal	If Not Normal
1. Battery positive post	Minimum 12.4 volts.	Charge and load test battery.
2. Starter battery terminal	Battery voltage.	Check for bad connections or a break in cable between battery and starter.
3. Wire no. 100 terminal of 20-amp fuse, F3	Battery voltage.	Check for failed fusible link at starter. If fusible link is bad, determine cause and replace fusible link. Also check for bad splice or broken wire no. 100.
4. Wire no. 106 terminal of 20-amp fuse, F3	Battery voltage.	Check for a blown fuse, F3. If fuse is good, check for a bad connection at fuse block.
5. Wire no. 106 terminal of key switch connector	Battery voltage.	Check for a bad connection or a break in wire no. 106.
6. Wire no. 113 terminal of key switch connector	Battery voltage.	Test key switch. See procedure in this group.
7. Wire no. 113/122 terminal of right wing toggle switch	Battery voltage.	Check for a bad connection or a break in wire no. 113.
8. Wire no. 122/123 terminal of left wing toggle switch	Battery voltage.	Check for a bad connection or a break in wire no. 122.
9. Wire no. 123/124 terminal of left wing lift switch	Battery voltage.	Check for a bad connection or a break in wire no. 123.
10. Wire no. 124/125 terminal of right wing lift switch	Battery voltage.	Check for a bad connection or a break in wire no. 124.
11. Wire no. 125/127 terminal of mow switch	Battery voltage.	Check for a bad connection or a break in wire no. 125.
12. Wire no. 127 terminal of weight transfer switch	Battery voltage.	Check for a bad connection or a break in wire no. 127.
13. Wire no. 128 terminal of weight transfer switch	Battery voltage.	Test switch. See procedure in this group.
14. Wire no. 427/428 terminal of left wing toggle switch	Battery voltage.	Check for bad connections or a break in wires 427 and 128.

MX,24015HV,A46 -19-21JAN93



CUTTING UNITS CONTROL SYSTEM TEST POINTS
WEIGHT TRANSFER

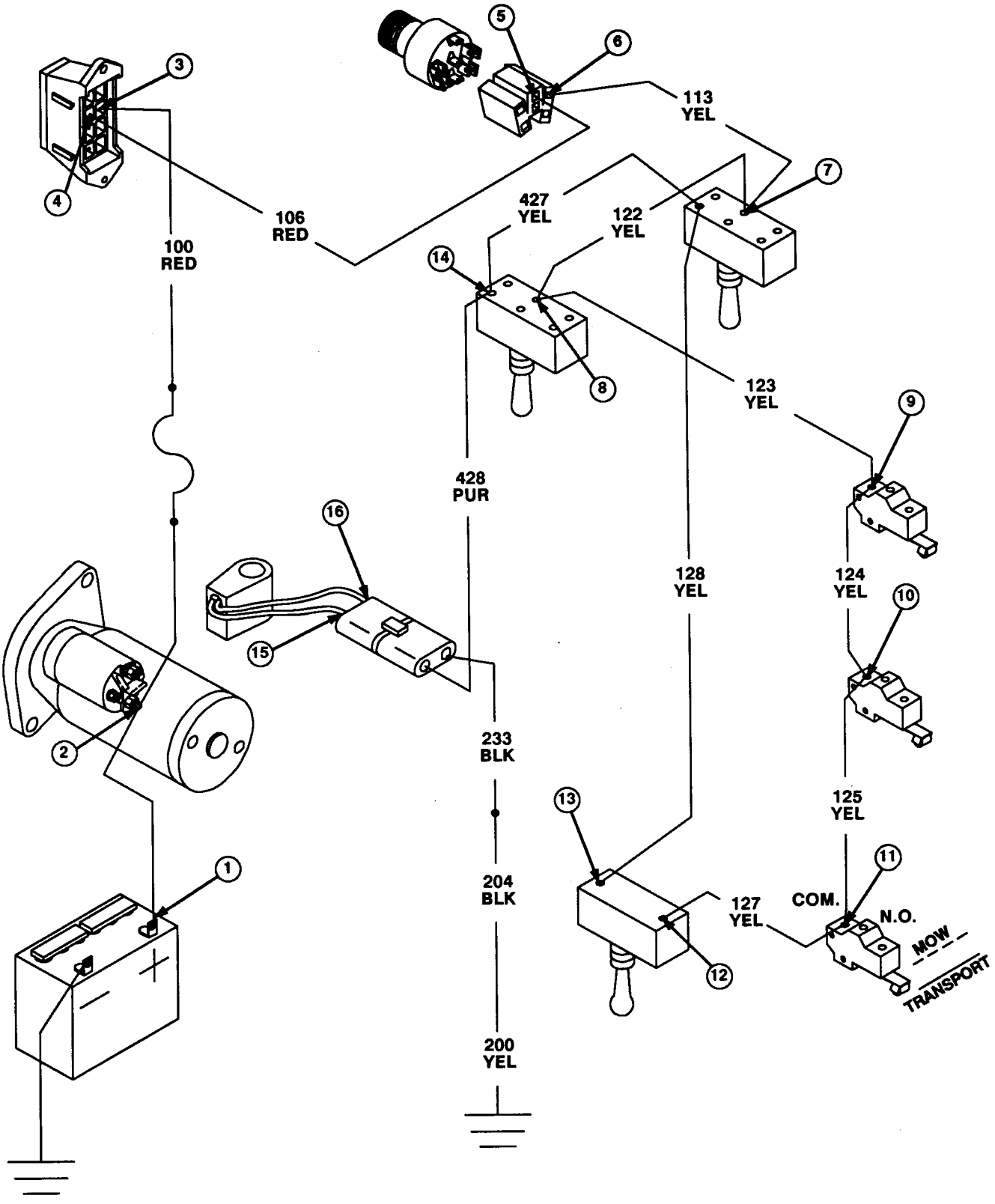
M81516AE -19-09JAN93

MX,24015HV,A47 -19-21JAN93

CUTTING UNITS CONTROL SYSTEM TEST POINTS—WEIGHT TRANSFER—CONTINUED

Test Location	Normal	If Not Normal
15. Weight transfer solenoid connector, solenoid side	Battery voltage.	Check for a bad connection or a break in wire no. 428.
16. Weight transfer solenoid connector, solenoid side	Less than 0.2 volt.	Test solenoid. See procedure in this group. Check for a broken splice or a break in wires 233, 204 and 200.

MX,24015HV,A47A-19-21JAN93



CUTTING UNITS CONTROL SYSTEM TEST POINTS WEIGHT TRANSFER

M81516AE -19-09JAN93

MX,24015HV,A47 -19-21JAN93

BATTERY VOLTAGE AND SPECIFIC GRAVITY TESTS

REASON:
To determine condition of battery.

EQUIPMENT:
- Voltmeter of JT05685 Load Tester
- Hydrometer

240
15
96

PROCEDURE:
1. Clean battery terminals and top of battery.

2. Inspect battery terminals and case for breakage or cracks.

3. 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.

4. If battery has been charged, remove surface charge by turning load knob of tester clockwise until ammeter reads 100 amps. Hold for 15 seconds then turn load knob to off.

5. Check battery voltage with voltmeter or Load Tester.

6. Check and record specific gravity of each cell with a hydrometer.

SPECIFICATIONS:
- Minimum battery voltage .. 12.4 volts
- Minimum specific gravity .. 1.225 with less than 50 point variation.

RESULTS:
- Battery voltage less than 12.4 VDC, charge battery and test again. See CHARGE BATTERY in this group.

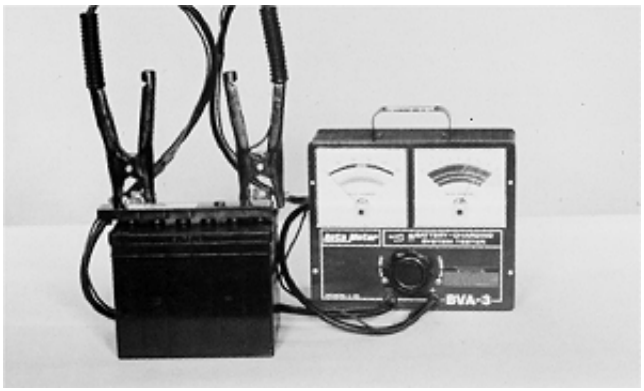
- Battery voltage more than 12.4 VDC, load test battery. See BATTERY LOAD TEST in this group.

- All cells less than 1.225 with less than 50 point variation, charge battery at 10 amp rate and test again. See CHARGE BATTERY in this group.

- All cells more than 1.225 with less than 50 point variation, load test battery. See BATTERY LOAD TEST in this group.

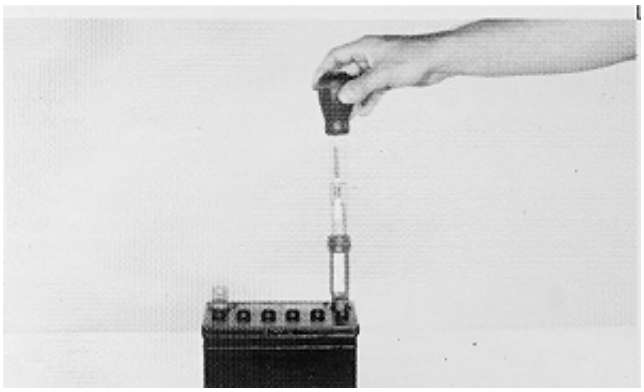
- More than 50 point variation: replace battery.

- If battery fails voltage or specific gravity test after charging, replace battery.



-UN-18SEP90
M49595

Slide M49595

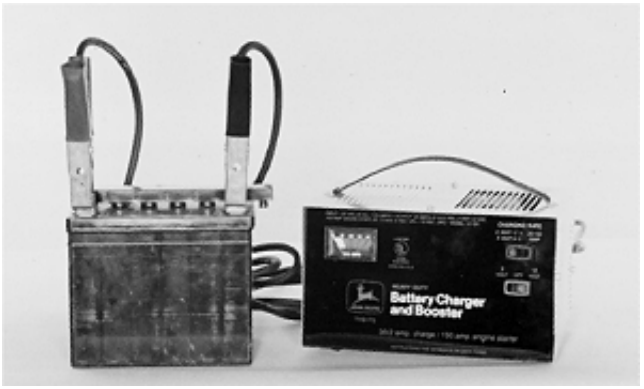


-UN-18SEP90
M49596

Slide M49596

MX,24015HV,A48 -19-21JAN93

CHARGE BATTERY



Slide M49598

REASON:
To increase battery charge after battery has been discharged.

EQUIPMENT:
• Battery charger (variable rate)

PROCEDURE:

NOTE: See BATTERY VOLTAGE AND SPECIFIC GRAVITY TESTS in this group before charging battery.

1. Connect variable rate charger to battery.

2. Start charger at slow rate. Increase charge rate one setting at a time. Check charger ammeter after 1 minute at each setting. Maintain 10 amp charge rate.

3. Check if battery is accepting a 10 amp charge after 10 minutes.

—Battery will not accept 10 amp charge after 10 minutes: replace battery.

—Battery is accepting 10 amp charge after 10 minutes, and battery did not need water: go to steps 6 and 7.

—Battery is accepting 10 amp charge after 10 minutes, but battery needed water or all cells were below 1.225: go to steps 4 and 5.

4. Set charger at 15—25 amps.

IMPORTANT: Decrease charge rate if battery gases or bubbles excessively or becomes too warm to touch.

5. Check specific gravity after 30 minutes (60 minutes for maintenance-free battery).

—More than 50 point variation between cells: replace battery.

—Less than 50 point variation between cells: go to steps 6 and 7.

NOTE: If battery was discharged at a slow or unknown rate, charge at 10—15 amps for 6—12 hours. (Maintenance-free battery: 12—24 hours.) If battery was discharged at fast rate, charge at 20—25 amps for 2—4 hours. (Maintenance-free battery: 4—8 hours.)

6. Continue charging battery until specific gravity is 1.225—1.265 points.

7. Load test battery. See BATTERY LOAD TEST in this group.

MX,24015HV,A49 -19-21JAN93

BATTERY LOAD TEST

REASON:
To determine battery's ability to withstand a load.

EQUIPMENT:
• JT05685 Load Tester

CONNECTIONS:
1. Turn load knob (A) of tester counterclockwise to off.

2. Connect tester red cable (B) to battery positive post.

3. Connect tester black cable (C) to battery negative post.

PROCEDURE:
1. Make sure battery passes voltage and specific gravity tests before load testing. See BATTERY VOLTAGE AND SPECIFIC GRAVITY TESTS in this Group.

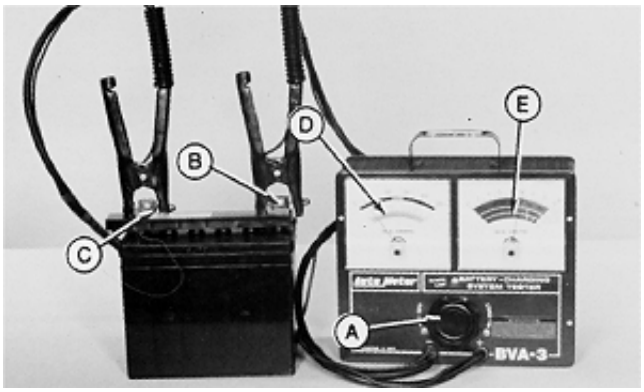
IMPORTANT: If using another battery tester without a blue, cold cranking rating scale, turn load knob until amperage is equal to HALF the battery cold cranking amperage (CCA) rating.

2. Turn load knob of tester clockwise until amperage reading (D) is equal to:
   A. Cold cranking amperage rating (blue scale).
   —OR—
   B. Three times ampere hour rating (black scale).

3. Hold for 15 seconds, note voltage reading, and turn load knob of tester to off.

SPECIFICATION:
• Minimum battery voltage under load .. 9.6 volts.

RESULTS:
• If the battery passes the test, battery is good.
• If the battery does not pass the test, replace battery.

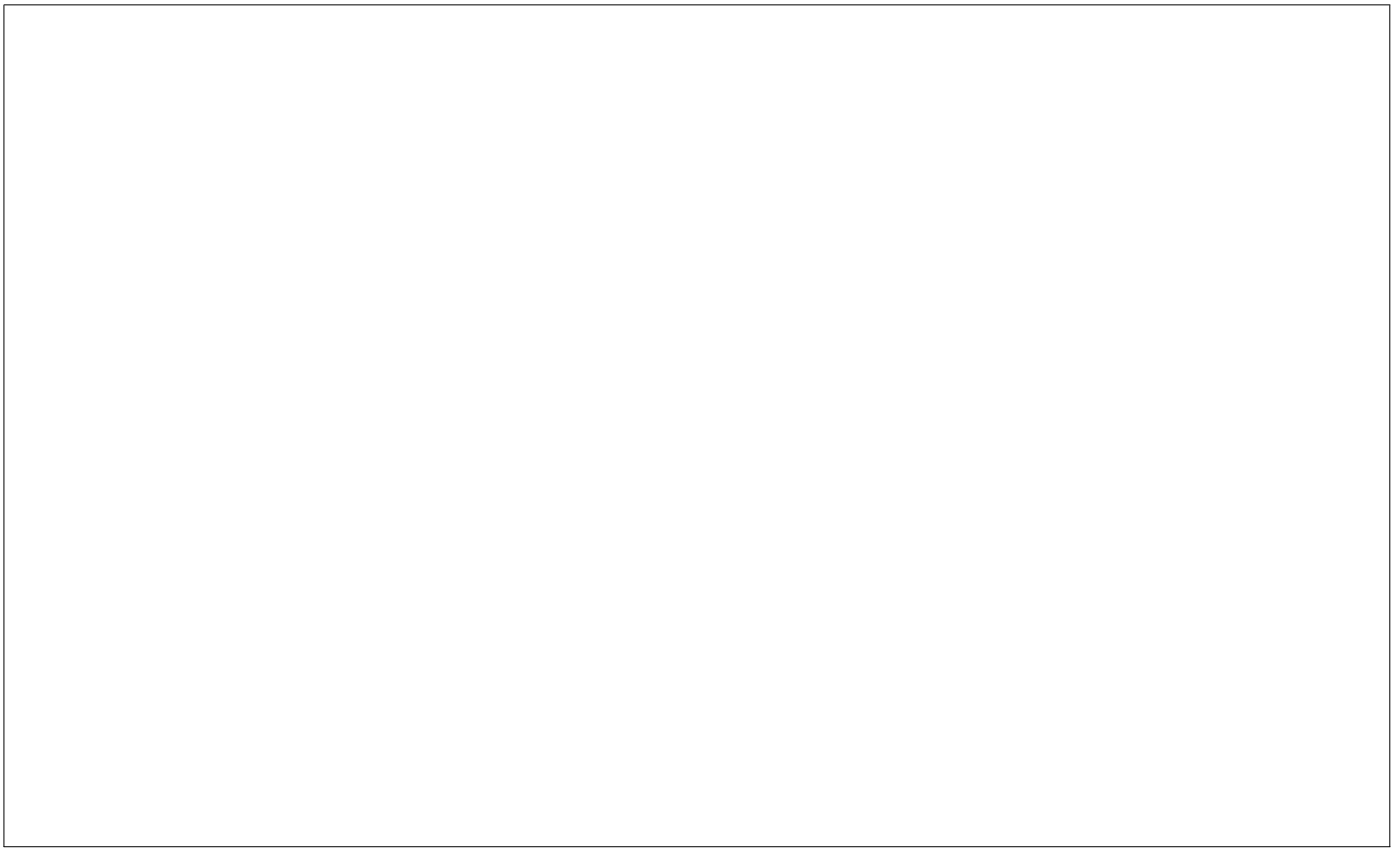


Slide M49597

A—Tester Load Knob
B—Tester Red Cable
C—Tester Black Cable
D—Amperage
E—Voltage

MX,24015HV,A50 -19-21JAN93

STARTER AMP DRAW/RPM TEST



Slide M81574

REASON:
To determine condition of starter.

EQUIPMENT:
- JT05685 Load Tester
- JT05719 Tachometer

CAUTION: Disconnect fuel shut-off solenoid wiring to prevent engine from starting.

IMPORTANT: Turn load knob fully counterclockwise before making connections.

NOTE: Engine should be at normal operating temperature when performing this test for an accurate amperage reading.

CONNECTIONS:
1. Turn load knob fully counterclockwise.

2. Connect load tester red cable to positive (+) terminal on battery.

3. Connect load tester black cable to negative (—) terminal.

4. Disconnect fuel shut-off solenoid connector.

PROCEDURE:
1. Check system ground connections. Be sure battery is fully charged.

2. Crank engine. Read and record voltage at meter.

3. Use tachometer to read and record cranking rpm.

4. Turn key switch OFF. Adjust load knob until battery voltage is the same as when engine is cranking.

5. Read and record amperage on meter.

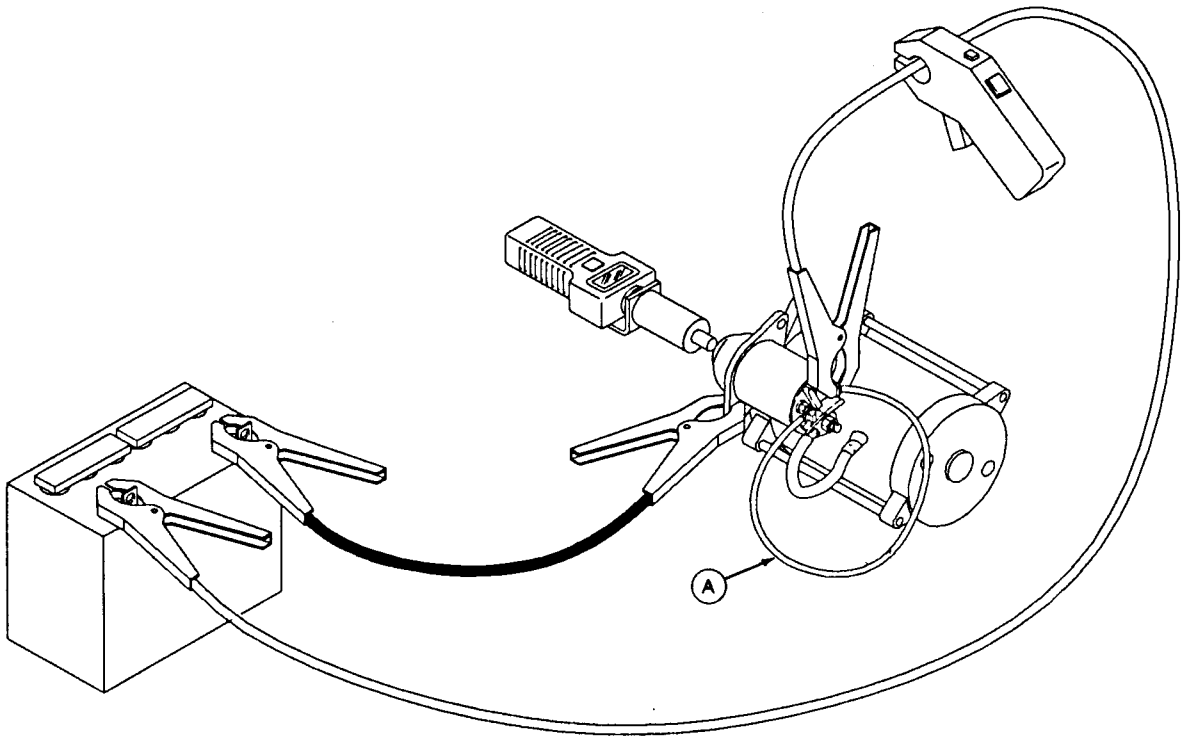
6. Turn load knob fully counterclockwise.

SPECIFICATION:
- Starter amp draw/rpm .. 300 amps at 200 rpm

RESULTS:
- If amp reading is not to specification, or to specification but RPM is low: remove starter and perform Starter No-Load Amp Draw RPM Test (See this Group).

MX,24015HV,A51 -19-21JAN93

STARTER NO-LOAD AMP DRAW/RPM TEST



LV066AE -UN-23FEB92

Slide LV066AE

REASON:
To determine condition of starter.

EQUIPMENT:
- JT05712 Current Gun
- JT05719 Tachometer

CONNECTIONS:
1. Disconnect battery negative (—) cable and remove starter from engine.

NOTE: Check that battery is fully charged to ensure accuracy of test.

2. Connect positive (+) cable to positive (battery) terminal on starter.

3. Connect negative (—) cable to starter body.

4. Connect jumper cables to battery.

5. Attach current gun to positive cable.

PROCEDURE:

IMPORTANT: Complete this test in 20 seconds or less to prevent starter damage.

1. Use jumper wire (A) to briefly connect positive (+) starter terminal to solenoid terminal “S”.

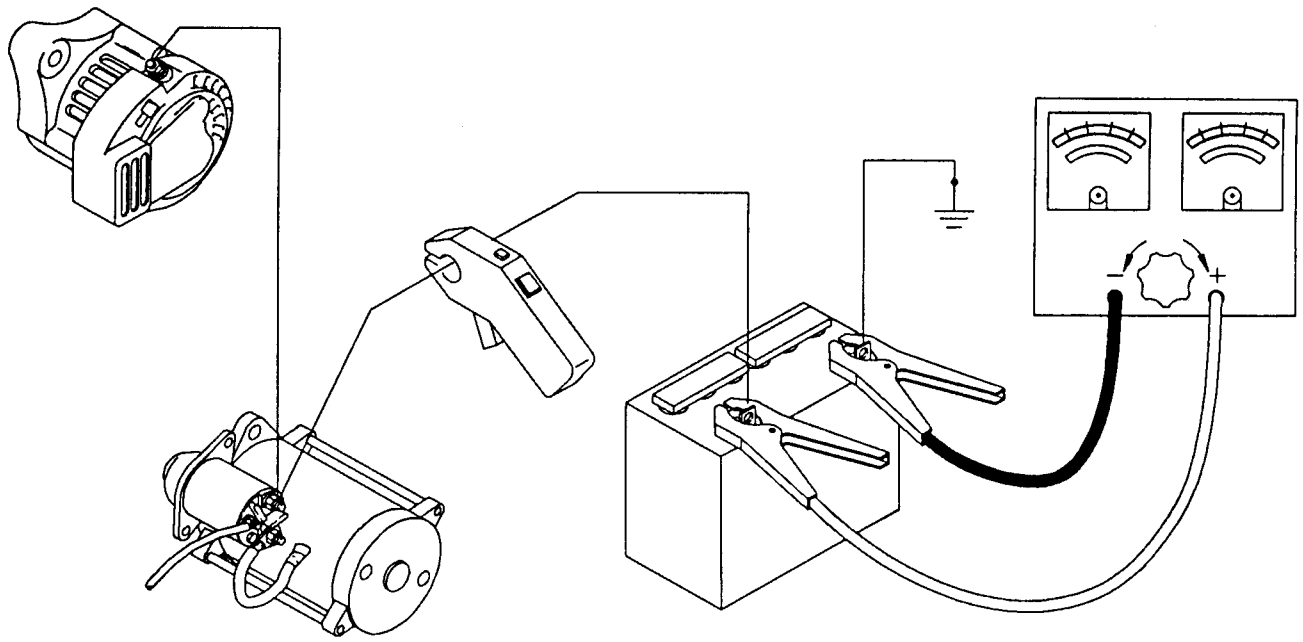
2. Read and record starter amperage and rpm.

SPECIFICATION:
- Starter no-load draw maximum .. 850 amp at 0 rpm.
- Starter no-load draw minimum .. 110 amp at 4500 rpm.

RESULTS:
If starter amps or rpm are not to specification, repair or replace starter.

MX,24015HV,A52 -19-21JAN93

ALTERNATOR/REGULATOR TEST



Slide LV064AE

REASON:
To determine condition of alternator/regulator.

EQUIPMENT:
- JT05685 Load Tester.
- JT05712 Current Gun.

CONNECTIONS:
1. Gear shift lever in P, park position.

2. Be sure battery is fully charged and all accessories are off.

3. Turn load knob (C) of battery tester (D) off (fully counterclockwise).

4. Connect red battery tester clamp (E) to positive (+) post of battery.

5. Connect black battery tester clamp (F) to negative (—) post of battery.

6. Put current gun over large red cable between alternator and starter.

PROCEDURE:
1. Start engine and run at fast idle.

IMPORTANT: Perform this test as quickly as possible to prevent damage to the electrical system components.

2. Slowly turn load knob clockwise until current gun displays maximum current output. Record reading.

IMPORTANT: Load system only as necessary to obtain maximum current output. Do not reduce system voltage any lower than 11 volts.

3. Turn load knob off (fully counterclockwise).

4. Let engine run and watch when current gun reading is 10 amps or less.

5. Read and record meter voltage.

SPECIFICATIONS:
- Current output .. Minimum 0 Amps at 1300 rpm.
- Regulated voltage .. 13.5 to 14.7 VDC at 25˚C (77˚F).

RESULTS:
If alternator current output or regulated voltage is not to specifications, replace alternator.

LV,24015HA,A53 -19-21JAN93

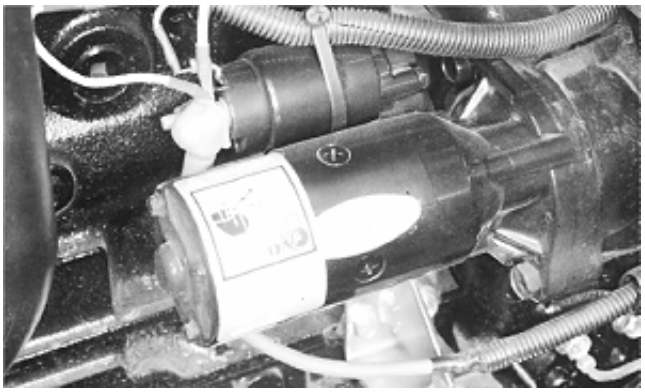
STARTER SOLENOID TEST

REASON:
To determine condition of starter solenoid.

PROCEDURE:
1. Test Starting System to ensure voltage at solenoid. (See this Group.)

2. Turn key to start and listen that solenoid engages and stays engaged.

RESULTS:
- If solenoid does not engage, chatter or click, check the ground cable near battery or replace solenoid.



Slide M81561

MX,24015HV,A54 -19-21JAN93

KEY SWITCH TEST

REASON:
To check operation of key switch.

EQUIPMENT:
- Ohmmeter or continuity tester.

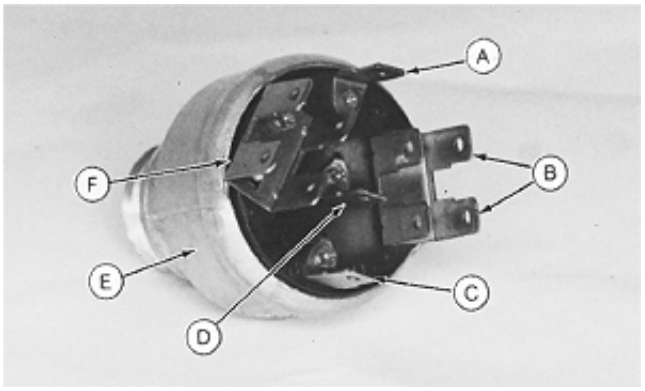
PROCEDURE:
1. Disconnect key switch connector.

2. Use ohmmeter to check continuity between switch terminals (A—G) in OFF, RUN, BULB CHECK, START and ACCESSORY positions:

KEY SWITCH CONTINUITY

Switch Position	Continuity between terminals
OFF	None
RUN	BAT-IGN-ACC
BULB CHECK	BAT-IGN and G-Case
START	BAT-ST-IGN-G
ACCESSORY	BAT-ACC

RESULTS:
- If continuity is not present between terminals listed for each switch position, replace key switch
- If continuity exists between terminals not listed for each switch position, replace switch.



Slide M81562

A—G Terminal (Ground)
B—ACC Terminal (Not Used)
C—BAT Terminal (Battery)
D—ST Terminal (Start)
E—Switch Case
F—IGN Terminal (Ignition)

MX,24015HV,A55 -19-21JAN93

NEUTRAL START, START-ENABLE, SEAT, MOW AND WING RELAYS TEST

REASON:
To check relay terminal continuity in the energized and de-energized condition.

EQUIPMENT:
- Ohmmeter or Continuity Tester
- Jumper Wire (2 used)

PROCEDURE:
1. Disconnect and remove relay.

2. Check terminal continuity using an ohmmeter or continuity tester:

- Continuity should exist between relay terminals
  —87A and 30 (A and B)
  —85 and 86 (C and D)

- No continuity between relay terminals
  —30 and 87 (B and E)

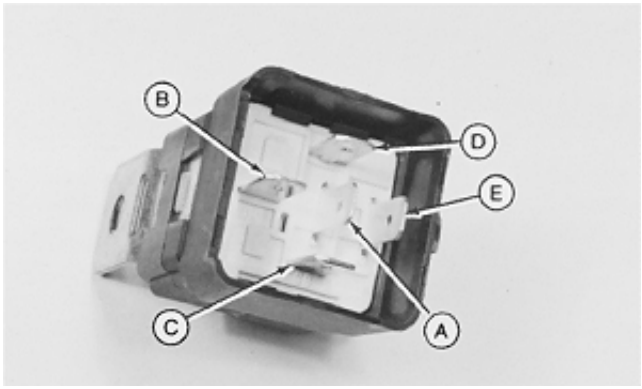
3. Connect a jumper wire from battery positive (+) terminal to relay terminal 85 (C). Connect another jumper wire from relay terminal 86 (D) to battery negative (—) terminal.

4. Check terminal continuity using an ohmmeter or continuity tester:

- Continuity should exist between relay terminals
  —30 and 87 (B and E)

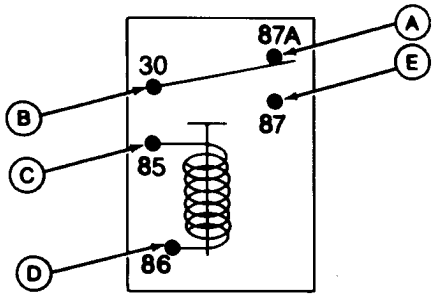
- No continuity between relay terminals
  —30 and 87A (B and A)

RESULTS:
- If continuity is not correct, replace relay.



Slide M48376

M48376 -UN-25OCT89



Slide E35622

E35622 -UN-12DEC90

MX,24015HV,A56 -19-21JAN93

FUEL SHUT-OFF SOLENOID TEST

REASON:
To determine if the fuel shut-off solenoid is operating properly.

EQUIPMENT:
- Jumper Wire (2 used)
- Ohmmeter or Continuity Tester

240
15
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OPERATION CHECK:
1. Open engine hood.

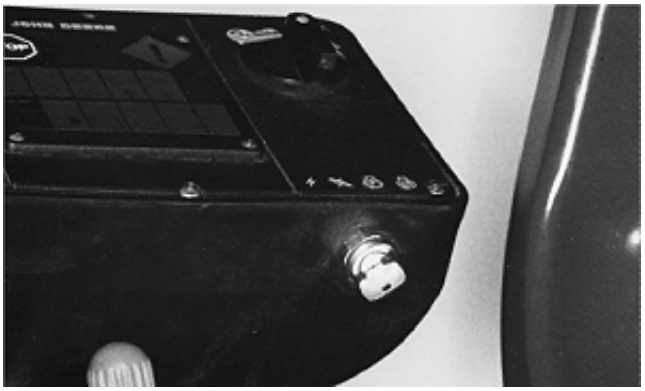
2. While on the seat, turn key switch to ON.

3. Observe fuel shut-off solenoid, then turn key switch to OFF.

RESULTS:
Fuel shut-off solenoid should click and solenoid plunger move forward, into solenoid case.

- If solenoid moves, test is complete.

- If solenoid does not move, continue with test.



Slide M81309

PULL-IN CHECK:
4. Disconnect fuel shut-off solenoid connector.

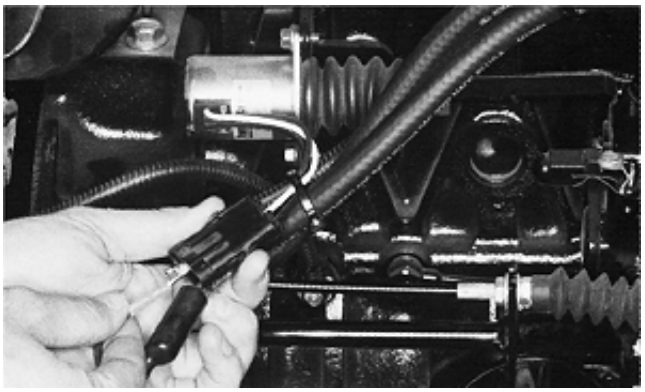
5. Use a jumper wire to connect black wire of solenoid to ground.

6. Briefly, connect white wire of solenoid directly to battery positive (+) terminal using a jumper wire.

RESULTS:
Fuel shut-off solenoid plunger should pull in.

- If plunger pulls in, pull-in windings are good. Continue test.

- If plunger does not pull in, pull-in windings are bad. Replace fuel shut-off solenoid.



Slide M81310

MX,24015HV,A57 -19-21JAN93

FUEL SHUT-OFF SOLENOID TEST—CONTINUED

HOLD-IN CHECK:
7. Disconnect jumper wire from white wire. Leave solenoid black wire connected to ground.

8. Connect jumper wire to red wire of solenoid and to battery positive (+) terminal.

9. Push solenoid plunger into solenoid case.

RESULTS:
Solenoid should hold plunger in.

- If plunger does not stay in, hold-in windings are good. Continue test.

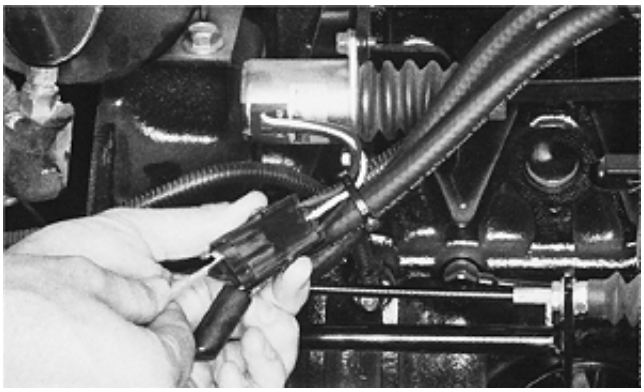
- If solenoid does not remain in case, hold-in windings are bad. Replace fuel shut-off solenoid.

GROUND CHECK:
10. Turn key switch to OFF and remove jumper wires.

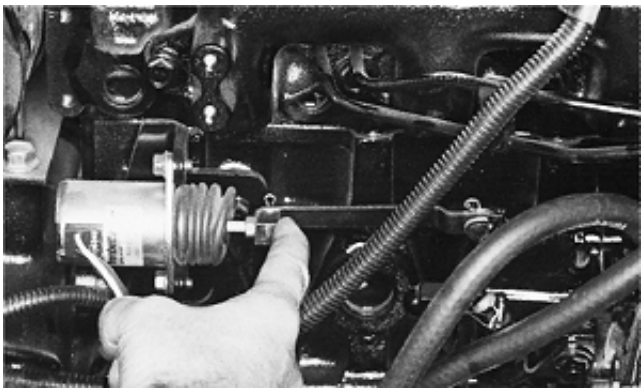
11. Check continuity of main harness black wire no. 212 from fuel shut-off solenoid connector to ground terminal on frame.

RESULTS:
- If continuity is good, test is complete. Check fuel shut-off solenoid adjustment.

- If tester does not show continuity, check chassis ground connection. Repair or replace black ground wires.



Slide M81311



Slide M81312

MX,24015HV,A58 -19-21JAN93

FUSE TEST

REASON:
To determine if fuse has failed.

EQUIPMENT:
- Ohmmeter.

CONNECTIONS:
1. Set ohmmeter to 1X ohms scale.

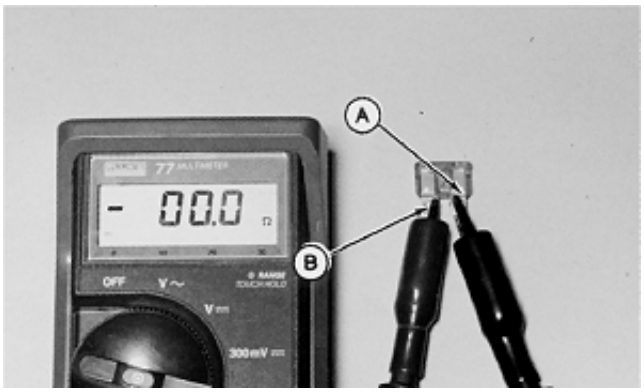
NOTE: On analog (swing needle) ohmmeters, set zero point before every test.

2. Connect one meter lead to one post (A) of fuse.

3. Connect other meter lead to other post (B) of fuse.

PROCEDURE:
1. Read meter.

RESULTS:
- If there is no continuity between posts, replace fuse.



M49586 -UN-25SEP90

Slide M49586

LV,24015HA,A48 -19-21JAN93

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MICRO SWITCH TEST

REASON:
To check micro switch operation.

EQUIPMENT:
- Ohmmeter or continuity tester.

PROCEDURE:
1. Disconnect wires from switch.

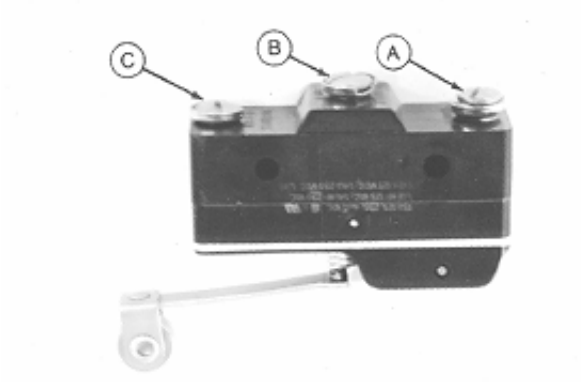
2. Check continuity between terminals (A, B and C) with the switch lever released and activated.

Terminals	Switch Lever Position	
	Released	**Activated**
A—B	Continuity	No Continuity
A—C	No Continuity	Continuity
B—C	No Continuity	No Continuity

RESULTS:
- If continuity is not correct, replace switch.

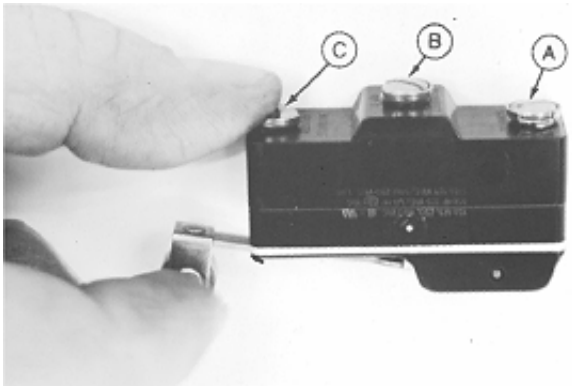
- If continuity is correct check for proper switch installation or bent switch lever.

A—Common Terminal
B—Normally Closed Terminal
C—Normally Open Terminal



E35626 -UN-06JAN92

Slide E35626



E35627 -UN-06JAN92

Slide E35627

MX,24015HV,A59 -19-21JAN93

SEAT SWITCH TEST

REASON:
To check operation of seat switch.

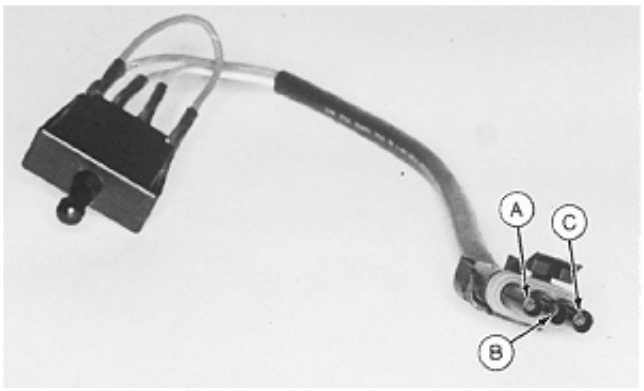
EQUIPMENT:
- Ohmmeter or continuity tester.

PROCEDURE:
1. Disconnect switch connector.

2. Check continuity between terminal A, B and C with switch button released, depressed and pulled out.

Terminals	Switch Button Position		
	Released	**Depressed**	**Pulled Out**
A—B	No Continuity	Continuity	No Continuity
A—C	No Continuity	No Continuity	No Continuity
B—C	No Continuity	No Continuity	Continuity

RESULTS:
- If continuity is not correct, replace switch.
- If continuity is correct, check for proper installation or bent switch arm.



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MX,24015HV,A60 -19-21JAN93

PTO CLUTCH SWITCH TEST

REASON:
To check PTO switch operation.

EQUIPMENT:
- Ohmmeter or continuity tester.

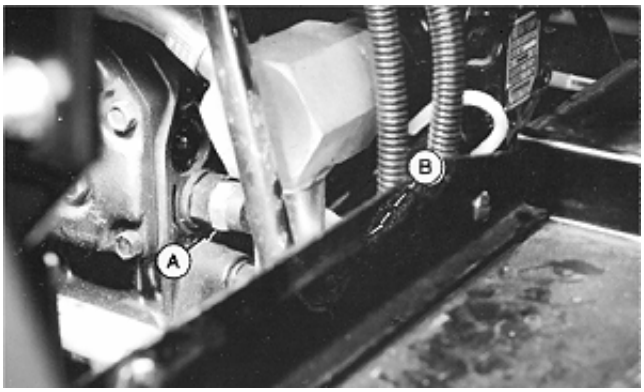
PROCEDURE:
1. Disconnect wiring connector (B) and remove switch (A).

2. Connect test equipment to switch terminals.

3. Check for continuity between terminals with the switch at rest.

4. Activate switch by pushing ball into switch. Continuity must not be present between switch terminals.

RESULTS:
- If continuity is not correct, replace switch.
- If continuity is correct, check for proper switch installation.



M81291 -UN-03NOV92

Slide M81291

MX,24015HV,A61 -19-21JAN93

WING TOGGLE SWITCH TEST

REASON:
To determine if wing toggle switch is operating properly.

EQUIPMENT:
- Ohmmeter or continuity tester.

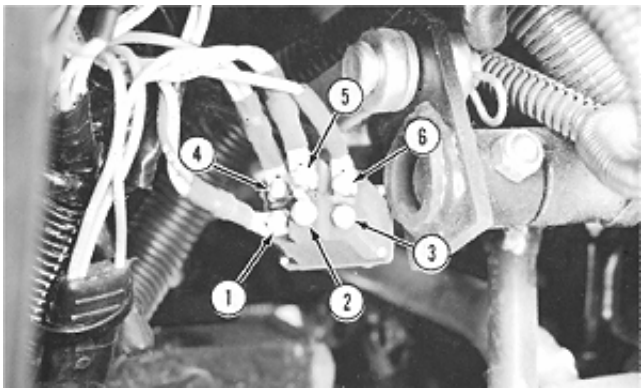
PROCEDURE:
1. Disconnect wires from wing toggle switch.

2. Check continuity between terminals (1—6) with the switch toggle in all three positions.

Wing Toggle Switch Continuity

Toggle Positions	Continuity Between Terminals
Center	2 - 5
Forward	1 - 2 - 4 - 5
Rearward	2 - 3 - 5 - 6

RESULTS:
- If continuity is not present between terminals listed for each switch position, replace key switch.
- If continuity exists between terminals not listed, replace switch.



M81568 -UN-21DEC92

Slide M81568

MX,24015HV,A62 -19-21JAN93

BACKLAP AND WEIGHT TRANSFER SWITCHES TEST

REASON:
To determine if switches are operating properly.

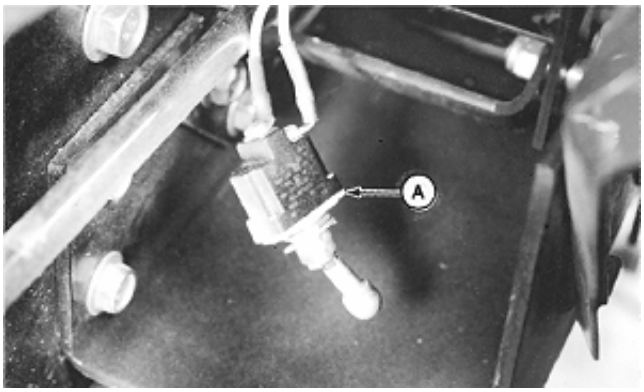
EQUIPMENT:
- Ohmmeter or continuity tester.

PROCEDURE:
1. Disconnect wires from switch (A or B).

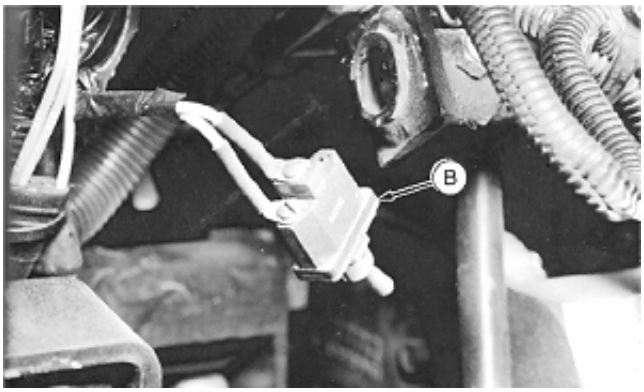
2. Connect test equipment to terminals of switch.

3. Move switch toggle back and forth.

RESULTS:
- Switches must have continuity in one position and no continuity in the other position. Replace switch if continuity is not correct.



Slide M81340



Slide M81338

MX,24015HV,A63 -19-21JAN93

MERCURY SWITCH TEST

REASON:
To determine that mercury switch functions properly.

EQUIPMENT:
- Ohmmeter or continuity tester.

PROCEDURE:
1. Remove switch from wing arm.

2. Connect test equipment to switch terminals.

3. Tilt switch end-to-end and observe tester.

RESULTS:
- Switch must show continuity when tilted one way and no continuity when tilted the other. Replace switch if continuity does not change.



MX,27015HV,A64 -19-21JAN93

WING AND SEAT DIODE TEST

REASON:
To determine if diode has failed.

EQUIPMENT:
- Diode tester, ohmmeter or continuity tester.

PROCEDURE:
1. Connect test equipment to terminals of diode.

2. Note tester reading.

3. Switch tester leads.

4. Note tester reading.

RESULTS:
- Diode must have continuity in ONE direction only. Replace diode if continuity exists both ways or not at all.



Slide M81565



Slide M81566

MX,24015HV,A65 -19-21JAN93

SOLENOID VALVE COIL TEST

REASON:
To determine condition of the solenoid valve coil.

EQUIPMENT:
- Ohmmeter

PROCEDURE:
1. Disconnect solenoid connector.

2. Check resistance between coil terminals. Resistance must be within specification.

3. Check for grounds or shorts by connecting one tester lead to coil terminal and the other lead to bare metal of the coil case. There should be no continuity between terminal and case.

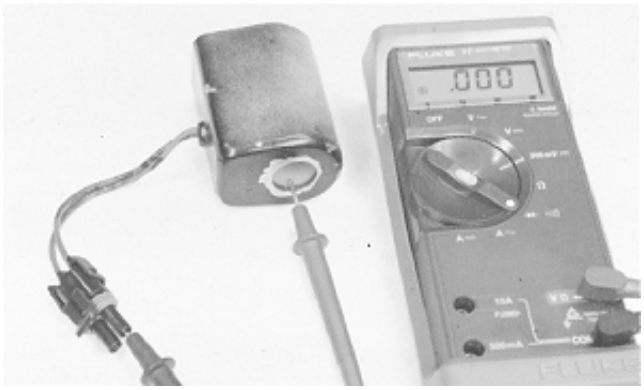
SPECIFICATIONS:
- Wing Lift/Lower Solenoids .. 5.02 ± 0.15 ohms
- Reel Control Valve Solenoids .. 3.49 ± 0.10 ohms

RESULTS:
- If resistance between terminals is not within specification, replace coil.
- If continuity exists between terminal and case, replace coil.



-UN-12DEC90
E35628

Slide E35628



-UN-12DEC90
E35629

Slide E35629

MX,24015HV,A66 -19-21JAN93

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HYDRAULIC AND HYDROSTATIC OIL TEMPERATURE SWITCH TEST

REASON:
To determine if temperature switch is operating properly.

EQUIPMENT:
- Container of heated hydraulic oil.
- Ohmmeter or continuity tester.

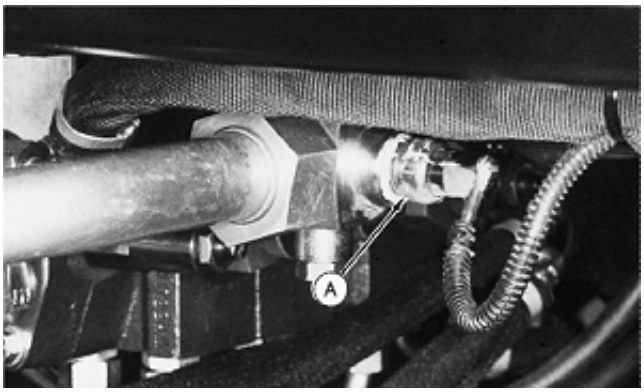
PROCEDURE:
1. Remove hydraulic (A) or hydrostatic temperature switch. See Section 40, Group 10 for procedure.

2. Check switch continuity by connecting test equipment to switch terminal and switch body.

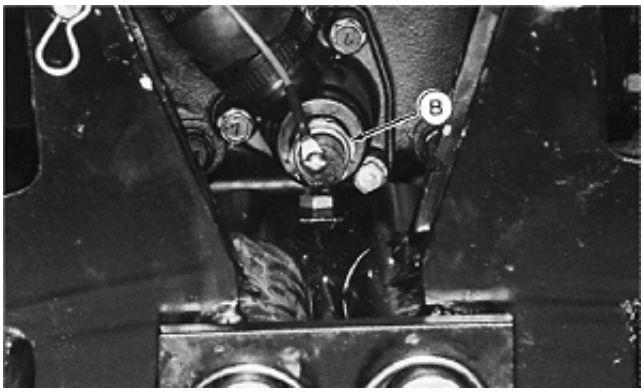
3. Heat hydraulic oil to approximately 107˚C (225˚F).

4. Put switch in heated oil for a minute, then check continuity.

RESULTS:
- Switch must not show continuity until heated to approximately 104˚C (220˚F). Replace switch if not to specification.



Slide M81571



Slide M81572

MX,24015HV,A67 -19-21JAN93

COOLANT TEMPERATURE SWITCH TEST

REASON:
To determine if temperature switch (A) is operating properly.

EQUIPMENT:
- Container of heated water.
- Ohmmeter or continuity tester.

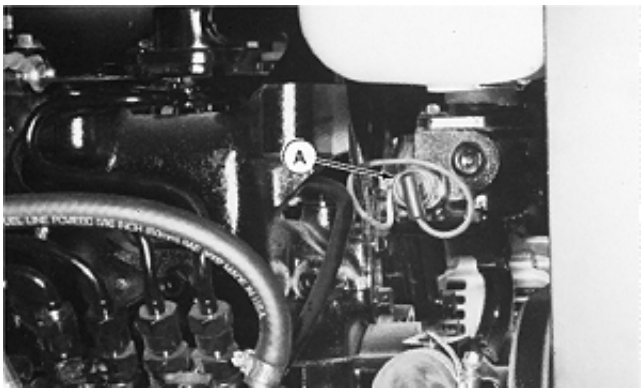
PROCEDURE:
1. Drain engine coolant until coolant level is below temperature switch.

2. Remove temperature switch.

3. Check switch continuity by connecting test equipment to switch terminal and switch body.

4. Put switch in water heated to 100˚C (212˚F) for a minute then check continuity.

RESULTS:
- Switch must not shown continuity until heated to approximately 100˚C (212˚F). Replace switch if not to specification.



M81573 -UN-21DEC92

Slide M81573

MX,24015HV,A68 -19-21JAN93

LIGHT SWITCH TEST

REASON:
To check operation of light switch.

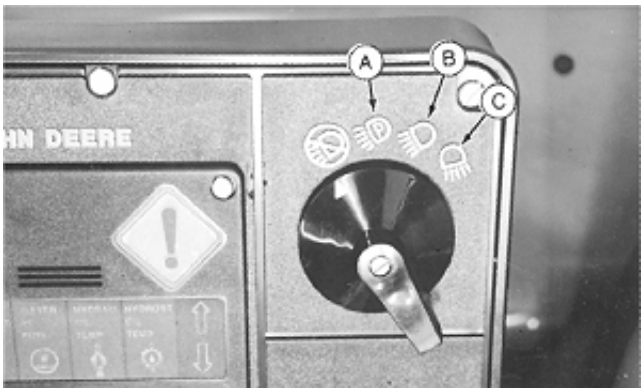
EQUIPMENT:
•Ohmmeter or continuity tester.

PROCEDURE:
1. Disconnect light switch connector.

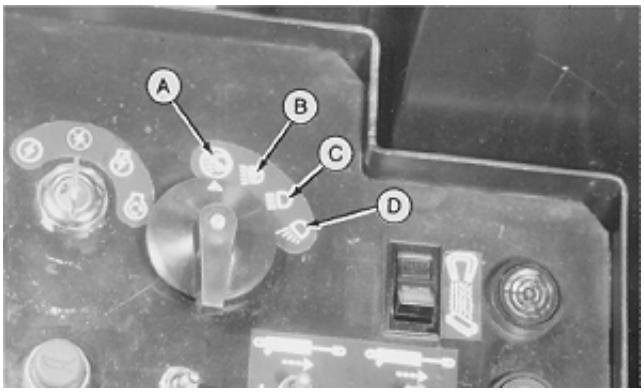
2. Check continuity between terminals as shown in table. Move switch knob to indicated position when making checks.

Switch Position	Terminals in Continuity
OFF	None
A	A - WL
B	A - TL - WL and B - HD
C	A - FLR and B - HD

RESULTS:
- If continuity is not correct, replace switch.
- If continuity is correct, check for proper wire connections.



Slide M81564



Slide E26299

LV,24015HA,A69 -19-21JAN93

ALARM TEST

REASON:
To check function of alarm (A).

EQUIPMENT:
- Jumper wire (2)
- 12 volt DC power source

PROCEDURE:

NOTE: Alarm shown removed from machine. Test can be performed while alarm is in machine console.

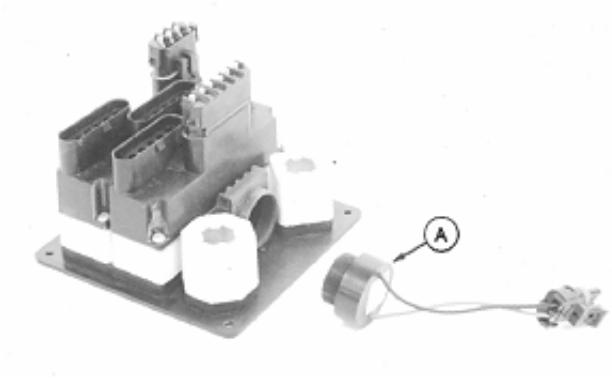
1. Remove display console panel.

2. Disconnect alarm connector.

3. Connect positive (+) power source to red wire terminal of alarm using jumper wire.

4. Connect jumper wire to negative (—) power source. Momentarily touch jumper wire to black wire terminal of alarm.

RESULTS:
- If alarm does not sound, replace alarm.
- If alarm sounds, check alarm circuit.



-UN-21DEC92
M81567

Slide M81567

MX,24015HV,A70 -19-21JAN93

BULB TEST

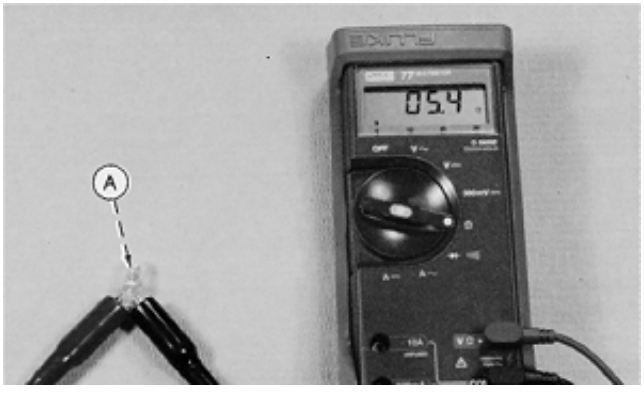
REASON:
To check condition of bulb filament.

EQUIPMENT:
- Ohmmeter

PROCEDURE:
1. Connect test equipment to bulb terminals.

2. Check meter reading for continuity.

RESULTS:
- If continuity is not present, replace bulb.
- If continuity is correct, inspect bulb socket and bulb circuit.

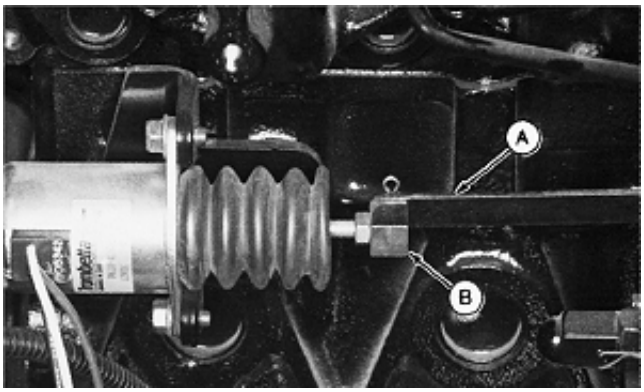


-UN-11NOV89
M48392

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MX,24015HV,A71 -19-21JAN93

ADJUST FUEL SHUT-OFF SOLENOID



M81313 -UN-03NOV92

REASON:
To adjust fuel shut-off solenoid linkage to ensure correct operation.

PROCEDURE:
1. Lift seat and pull seat switch up to override position.

2. Disconnect fuel shut-off link (A) from solenoid plunger block (B).

3. Turn key switch to ON position.

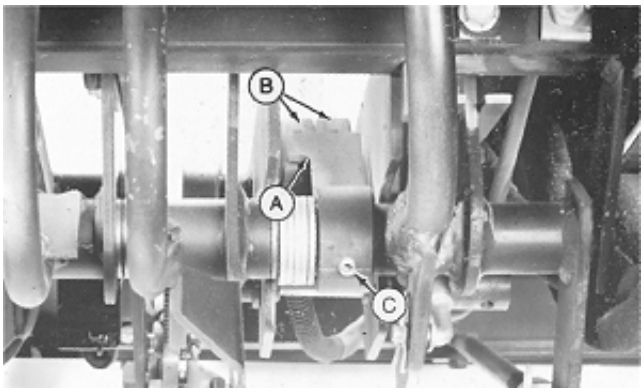
4. Adjust linkage:
   - •Pull link (A) forward until link stops.
   - •Turn block (B) until block pin aligns with hole in link.
   - •Turn block off plunger two additional turns.
   - •Connect link and tighten lock nut.

5. Turn key switch OFF.

MX,24015HV,A72 -19-21JAN93

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ADJUST BRAKE SWITCHES



E30106 -UN-21SEP88

REASON:
To adjust brake switches for proper operation.

PROCEDURE:
1. Stop engine and block drive wheels.

2. Disengage parking brake.

3. Loosen set screw (C).

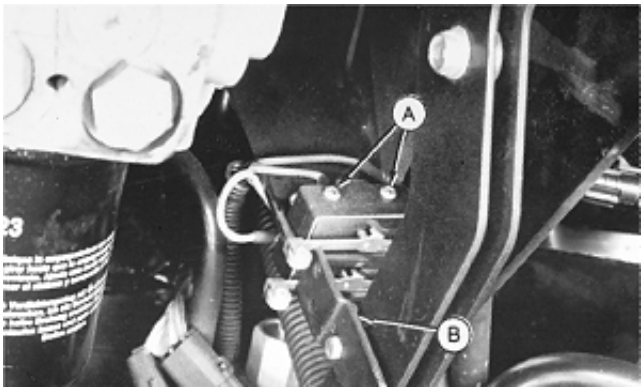
4. Move switch arm (A) so arm contacts the levers of the switches (B). Continue moving arm until switches “click” too the open position.

IMPORTANT: Make sure arm does not push against switch housings. Switches can be damaged or moved out of position.

5. Tighten set screw.

MX,24015HV,A73 -19-21JAN93

ADJUST NEUTRAL START SWITCHES (S.N. —840000)



E36052 -UN-23APR91

REASON:
To adjust neutral start switches for proper operation.

PROCEDURE:
1. Make sure transmission is in neutral position.

2. Stop engine.

3. Loosen switch mounting screws (A).

4. Move switches downward toward striker (B) until switches “click” to the open position.

IMPORTANT: Make sure striker does not push against switch housings. Switches can be damaged or moved out of position.

5. Tighten screws while holding switches in position.

MX,24015HV,A74 -19-21JAN93

ADJUST WING LIFT SWITCHES

REASON:
To lift both wings at the same time when using the cutting units lever.

PROCEDURE:

NOTE: Switch panel lifted for clarity.

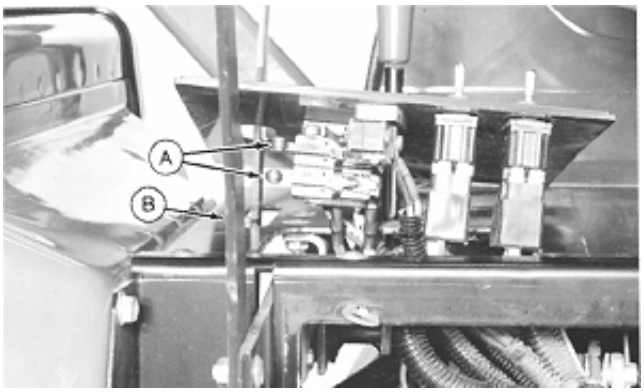
240
15
120

1. Lower all cutting units to the ground and stop engine.

2. Pull cutting units lever (B) rearward and listen for both lift switches to click.

3. Bend switch levers (A) as necessary until lift switches click at the same time.

4. Start engine and lift wings using cutting units lever. If wings do not lift at the same time, repeat procedure.



-UN-21DEC92
M81570

MX,24015HV,A75 -19-21JAN93

ADJUST MOW SWITCH

REASON:
To adjust mow switch for cutting unit engagement.

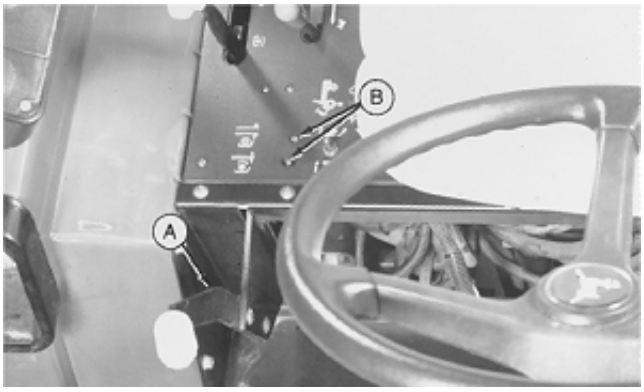
PROCEDURE:
1. Turn key switch to OFF position.

2. Move lift lever (A) fully forward.

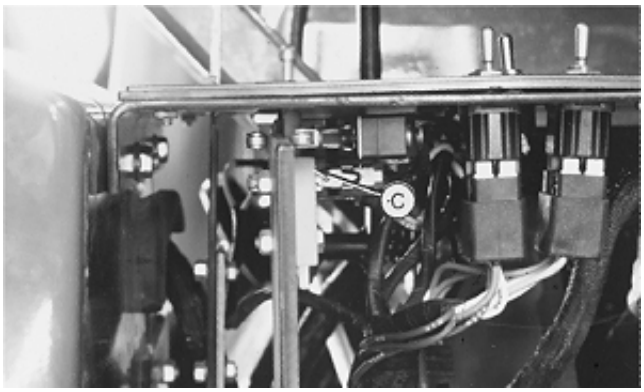
3. Loosen mow switch mounting screws (B).

4. Move front of mow switch towards ramp (C) of lift lever until switch “clicks”.

5. Tighten mounting screws.



-UN-09APR91
E36053



-UN-09APR91
E36054

MX,24015HV,A76 -19-21JAN93

SCHEMATICS INFORMATION

The wiring schematics are drawn with the power in, or battery positive circuit across the top and the ground, or battery negative, circuit across the bottom. The flow is then, as much as possible, from top to bottom through each circuit and component. All components are shown in the off position.

MX,24020HE,1 -19-27SEP91

WIRE COLOR CHART

Wiring diagrams use the following color abbreviations:

BLK	Black
BLU	Blue
BRN	Brown
CLR	Clear
DK BLU	Dark Blue
DK BRN	Dark Brown
DK GRN	Dark Green
GRN	Green
GRY	Gray
LT BLU	Light Blue
LT GRN	Light Green
LT GRY	Light Gray
ORG	Orange
PNK	Pink
PUR	Purple
RED	Red
TAN	Tan
WHT	White
YEL	Yellow

Wires with tracer stripes have the main color abbreviation followed by a slash, then the tracer color abbreviation.

MX,24010HV,A2 -19-21OCT92

ELECTRICAL SCHEMATIC SYMBOLS

LINES

1	———	WORKING (MAIN) LINES
2	- - - - - -	PILOT CONTROL LINES
3	- - - - - - - - -	DRAIN LINE
4	——▶ / ——▷	HYDRAULIC / PNEUMATIC } FLOW DIRECTION
5	or	CROSSING LINES
6		JOINING LINES
7		FLEXIBLE LINE

PUMPS

8		FIXED DISPLACEMENT
9		VARIABLE DISPLACEMENT

MOTORS

10		FIXED DISPLACEMENT
11		VARIABLE DISPLACEMENT

RESERVOIR

12		VENTED RESERVOIR
13		PRESSURIZED RESERVOIR
14		RESERVOIR RETURN - ABOVE FLUID LEVEL
15		RESERVOIR RETURN - BELOW FLUID LEVEL

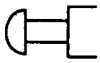
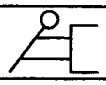
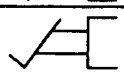
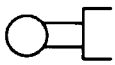
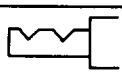
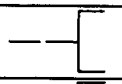
VALVES

16		CHECK VALVE
17		MANUAL ON/OFF VALVE
19		PRESSURE RELIEF VALVE
20		PRESSURE REDUCTION VALVE
21		TWO POSITION, TWO CONNECTION VALVE
22		TWO POSITION, THREE CONNECTION VALVE
23		TWO POSITION, FOUR CONNECTION VALVE
24		THREE POSITION, FOUR CONNECTION VALVE
25		TWO POSITION, FOUR CONNECTION VALVE WITH TRANSMISSION
26		THREE POSITION, FOUR CONNECTION VALVE WITH INFINITE POSITIONING
27		ADJUSTABLE FLOW CONTROL VALVE (TEMPERATURE AND PRESSURE COMPENSATED)
18		FIXED / VARIABLE } ORIFICE

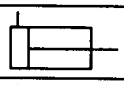
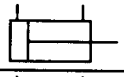
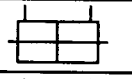
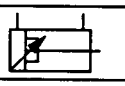
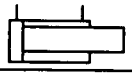
M81419AE -19-19NOV92

MX,24020HV,A1 -19-21JAN93

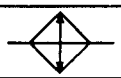
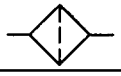
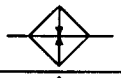
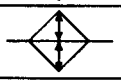
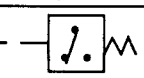
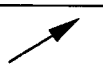
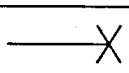
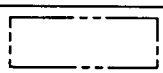
VALVE OPERATORS

28		SPRING
29		MANUAL
30		PUSH BUTTON
31		PUSH/PULL LEVER
32		PEDAL OR TREADLE
33		MECHANICAL
34		DETENTS
35		PRESSURE COMPENSATED
36		SOLENOID-SINGLE WINDING
37		REVERSING MOTOR
38		PILOT PRESSURE -REMOTE SUPPLY
39		PILOT PRESSURE -INTERNAL SUPPLY

CYLINDERS

40		SINGLE ACTING
41		DOUBLE ACTING, SINGLE ROD
42		DOUBLE ACTING, DOUBLE ROD
43		DOUBLE ACTING, ADJ. CUSHION, EXTEND ONLY
44		DOUBLE ACTING, DIFFERENTIAL PISTON

MISCELLANEOUS

45		COOLER
46		FILTER, STRAINER
47		HEATER
48		TEMPERATURE CONTROLLER
49		PRESSURE SWITCH
50		PRESSURE INDICATOR
51		TEMPERATURE INDICATOR
52		PRESSURE COMPENSATED
53		VARIABLE COMPONENT (SYMBOL THRU COMPONENT)
54		PLUG, TEST PORT, PRESSURE SUPPLY TEST
55		GAS CHARGED ACCUMULATOR
56		SPRING LOADED ACCUMULATOR
57		ELECTRIC MOTOR
58		SHAFT ROTATION (ARROW ON NEAR SIDE OF SHAFT)
59		COMPONENT OUTLINE

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MX,24020HV,A2 -19-21JAN93

COMPONENT IDENTIFICATION TABLE

Each component (electrical device) and main connector will have and identification letter assigned to it. A number is added to the letter to separate and indicate the total components within that letter group.

Identification Letter	Type	Examples
A	System, subassembly, parts group	Control units, trigger boxes, two-way radios, logic module, FNR logic module
B	Transducer for conversion of non-electrical variables to electrical and vice versa	Speed sensors, pressure sensors, pressure switches horns, sensors, pickups, limit-value sensors, pulse generators, loudspeakers, inductive pickups, probes, air-flow sensors, oil-pressure switches, temperature sensors, ignition-voltage pickups
C	Condenser, capacitor	Condensers and capacitors, general
D	Binary device, memory	Digital devices, integrated circuits, pulse counters, magnetic tape recorders
E	Various devices and equipment	Heating devices, air conditioners, light, headlights, spark plugs, ignition distributors
F	Protection device	Release mechanisms, polarity protection devices, fuses, current protection circuits
G	Power supply, generator	Batteries, generators, alternators, charging units
H	Monitor, alarm, signalling device	Audible alarms, indicator lights, turn-signal lights, brake lights, alarms, warning lights, buzzers
K	Relay	Battery relays, turn-signal relays, solenoid switches, starting relays, warning flashers
L	Inductor	Choke coils, coils, windings
M	Motor	Blower motors, fan motors, starter motors
N	Regulator, amplifier	Regulators (electronic or electromechanical), voltage stabilizers
P	Measuring instrument	Ammeter, diagnostic connectors, tachometers, fuel gauge, pressure gauges, measuring points, test points, speedometers
R	Resistor	Flame glow plugs, sheathed-element flame glow plugs, glow plugs, heating resistors, NTC resistors, PTC resistors, potentiometers, regulating resistors

TX,901505,QQ381-19-16SEP92

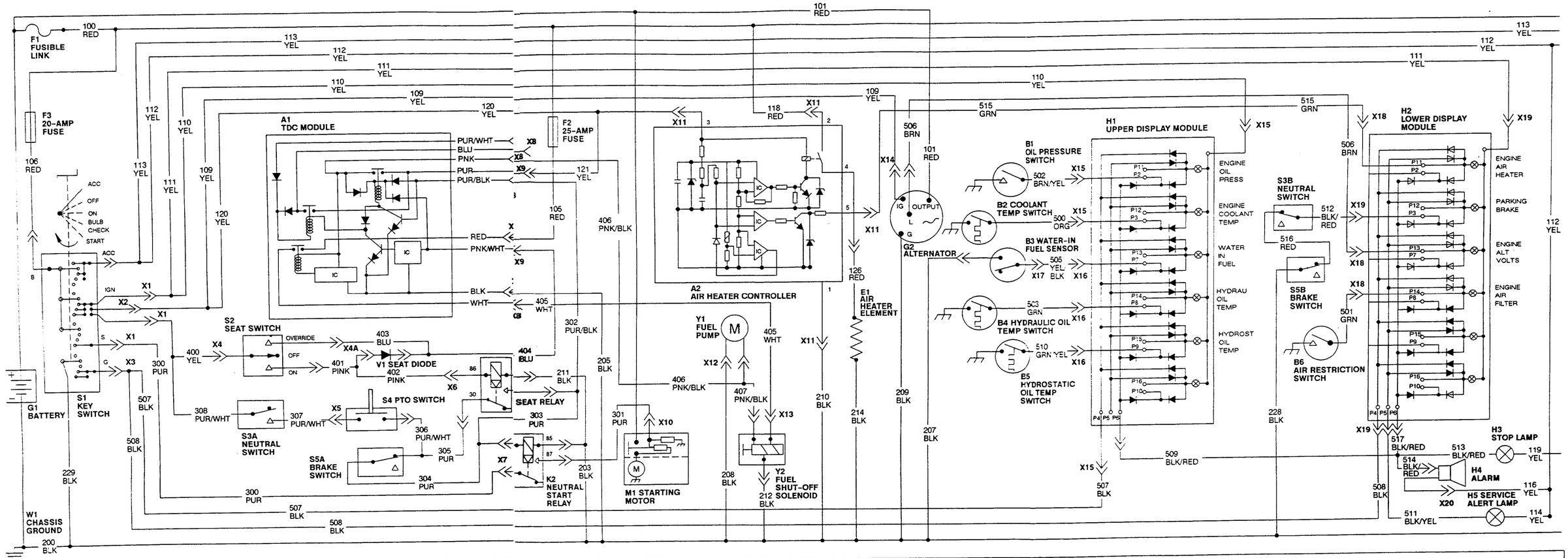
Identification Letter	Type	Examples
S	Switch	Switches and pushbuttons, general key switch, light switch, horn switch, flasher switch
T	Transformer	Ignition coil, ignition transformer
U	Modulator, converter	DC transformers
V	Semiconductor, electron tubes	Transistors, diodes, electron tubes, rectifiers, semiconductors, thyristors, zener diodes
W	Transmission path, conductor, antenna	Antennas, shielding components, shielded conductors, cable harnesses, conductors, ground conductors
X	Terminal, plug, plug and socket connection	Terminal studs, electrical connections, connectors electrical line couplers, line connectors, sockets, plugs, terminals, plug-and-socket connections
Y	Electrically actuated mechanical device	Permanent magnets, (solenoid-operated) injection valves, electromagnetic clutches and brakes, air valves, fuel pumps, solenoids, switching valves, start valves, locking systems
Z	Electrical filter	Interference suppression filters

TX,901505,QQ383-19-17DEC92

3325 ELECTRICAL SCHEMATIC

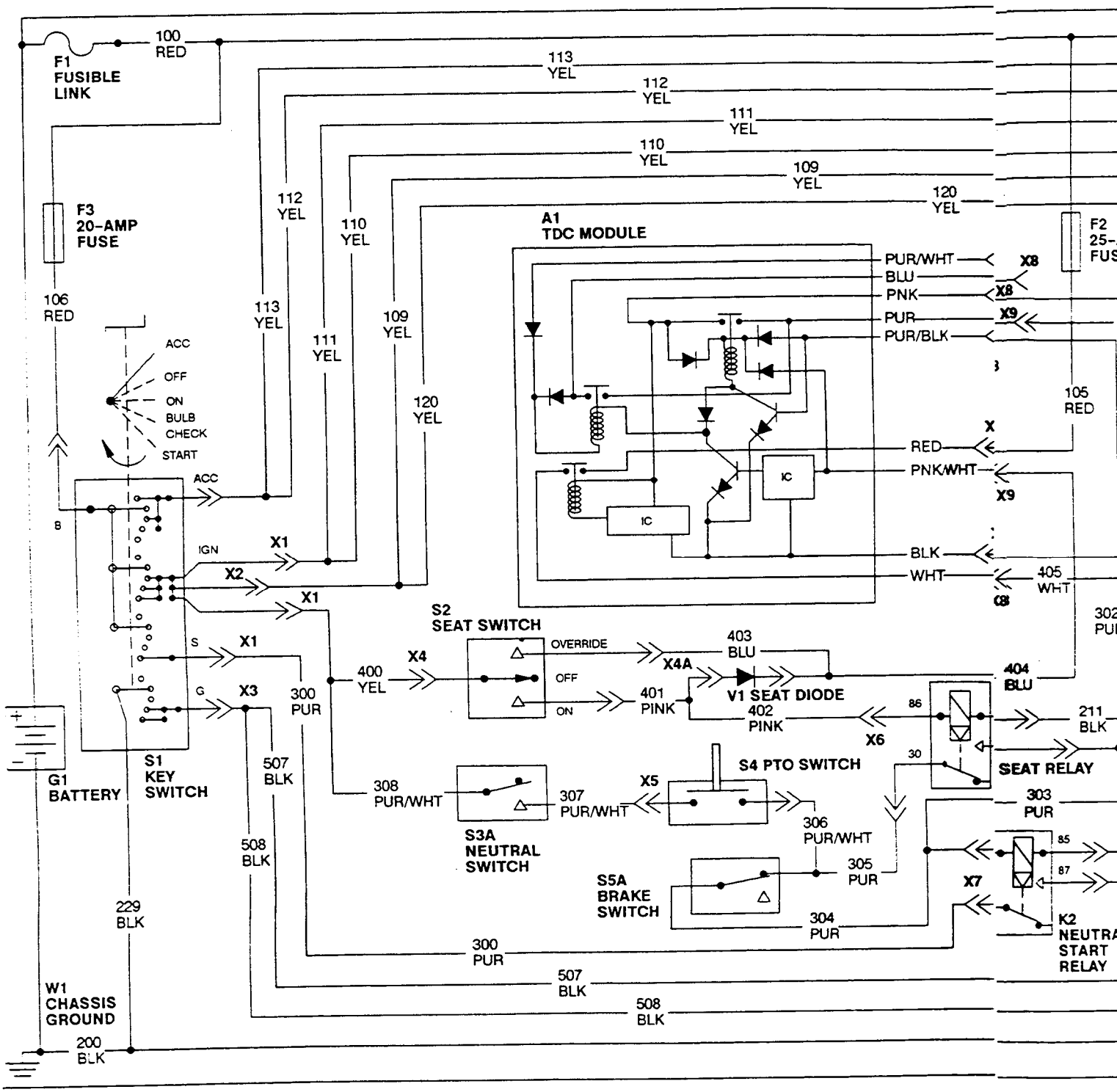
A1—TDC Module
A2—Air Heater Controller
B1—Oil Pressure Switch
B2—Coolant Temperature Switch
B3—Water-in-Fuel Sensor
B4—Hydraulic Oil Temperature Switch
B5—Hydrostatic Oil Temperature Switch
B6—Air Restriction Switch
E1—Right Work Light
E2—Left Work Light
E3—Right Headlight
E4—Left Headlight
E5—Fuel Gauge Light
F1—Fusible Link
F2—Control Module 25-Amp Fuse
F3—Key Switch Power 20-Amp Fuse
F4—Lights 20-Amp Fuse
F5—Mow 20-Amp Fuse
G1—Battery
G2—Alternator
H1—Upper Display Module
H2—Lower Display Module
H3—Stop Lamp
H4—Alarm
H5—Service Alert Lamp
K1—Seat Relay
K2—Neutral Start Relay
K3—Mow Relay
K4—Left Wing Relay
K5—right Wing Relay
M1—Starter Motor
P1—Hourmeter
P2—Fuel Gauge
P3—Fuel Level Sender
S1—Key Switch
S2—Seat Switch
S3A—Neutral Switch
S3B—Neutral Switch
S4—PTO Switch
S5A—Brake Switch
S5B—Brake Switch
S6—Light Switch
S7—Right Wing Toggle Switch
S8—Left Wing Toggle Switch
S9—Right Wing Mercury Switch
S10—Left Wing Mercury Switch
S11—A-Right Wing Lift Switch
S11—B-Left Wing Lift Switch
S12—Mow Switch
S13—Backlap Switch
S14—Weight Transfer Switch
V1—Seat Diode
V2—Right Wing Diode
V3—Left Wing Diode
W1—Chassis Ground
X1—Key Switch 6-Pin Connector
X2—Key Switch 1-Pin Connector
X3—Key Switch 1-Pin Connector
X4—Seat Switch Connector
X4A—Seat Switch Diode Connector
X5—PTO Switch Connector
X6—Seat Relay Connector
X7—Neutral Start Relay Connector
X8—TDC Module 6-Pin Connector
X9—TDC Module 3-Pin Connector
X10—Starter Solenoid Connector
X11—Air Heater Controller Connector
X12—Fuel Pump Connector
X13—Fuel Shut-Off Solenoid Connector
X14—Alternator Connector
X15—Upper Display Module 6-Pin Connector
X16—Upper Display Module 4-Pin Connector
X17—Water-IN-Fuel Connector
X18—Lower Display Module Center 6-Pin Connector
X19—Lower Display Module 6-Pin Connector
X20—Alarm Connector
X21—Hourmeter (Positive) Connector
X22—Hourmeter (Negative) Connector
X23—Fuel Gauge Connector
X24—Fuel Level Sender Connector
X25—Light Switch Connector
X26—Right Work Light Connector
X27—Left Work Light Connector
X28—Right Headlight Connector
X29—Left Headlight Connector
X30—Right Wing Toggle Switch Connector
X31—Right Wing Lower Solenoid Connector
X32—Right Wing Diode Connector
X33—Right Mow Solenoid Connector
X34—Right Wing Mercury Switch Connector
X35—Left Wing Toggle Switch Connector
X36—Left Wing Lower Solenoid Connector
X37—Left Wing Diode Connector
X38—Left Mow Solenoid Connector
X39—Left Wing Mercury Switch Connector
X40—Left Wing Lift Solenoid Connector
X41—Right Wing Lift Solenoid Connector
X42—Mow Relay Connect
X43—Left Wing Relay Connector
X44—Right Wing Relay Connector
X45—Center Mow Solenoid Connector
X46—Weight Transfer Solenoid Connector
Y1—Fuel Pump
Y2—Right Wing Lower Solenoid
Y3—Right Mow Solenoid
Y4—Left Wing Lower Solenoid
Y5—Left Mow Solenoid
Y6—Left Wing Lift Solenoid
Y7—Right Wing Lift Solenoid
Y8—Center Mow Solenoid
Y9—Weight Transfer Solenoid

MX,24020HV,A3 -19-21OCT92



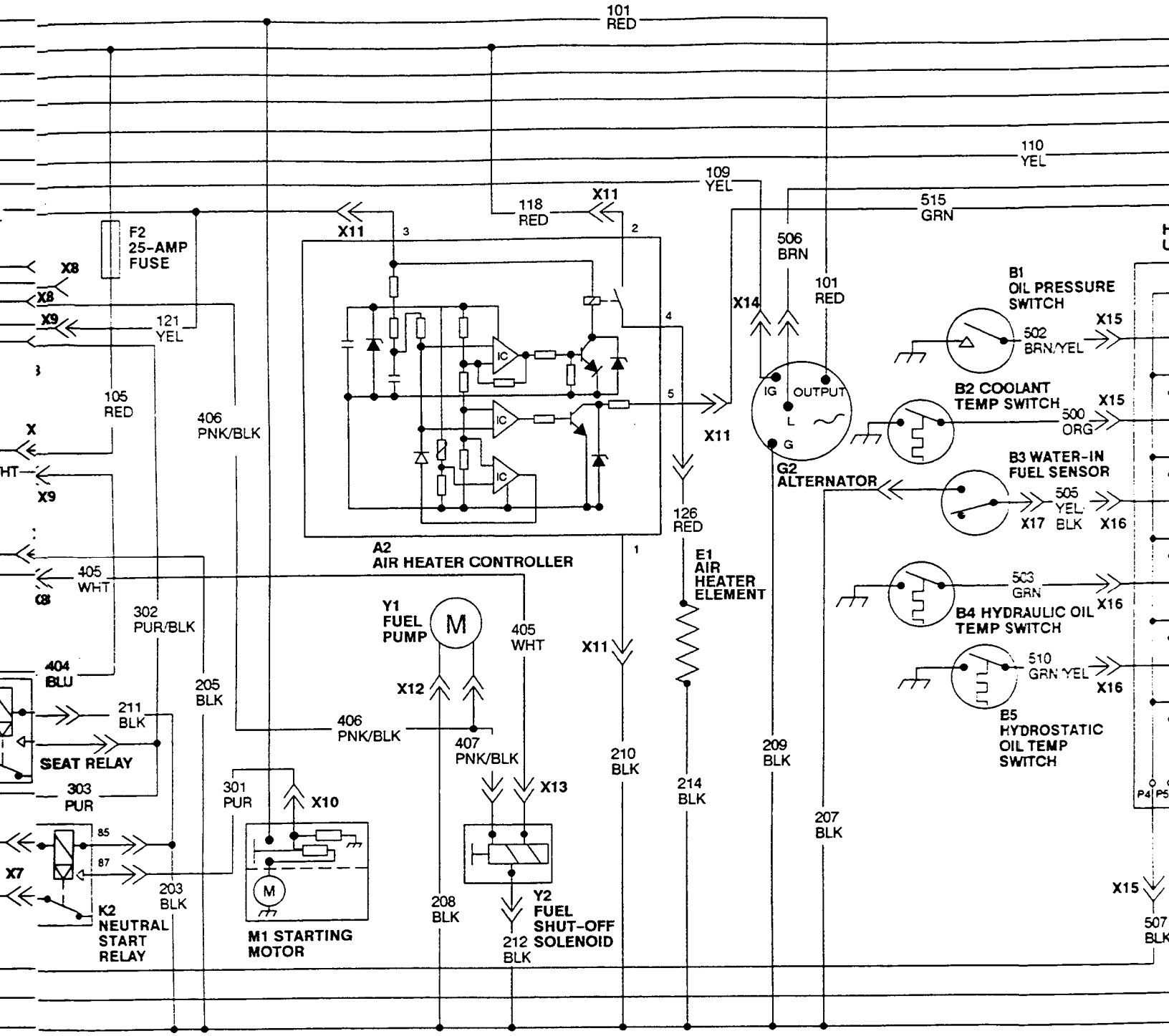
SE1 STARTING CIRCUIT | SE2 AIR HEATER CIRCUIT | SE3 CHARGING CIRCUIT | SE4 DISPLAY MODULE CIRCUIT

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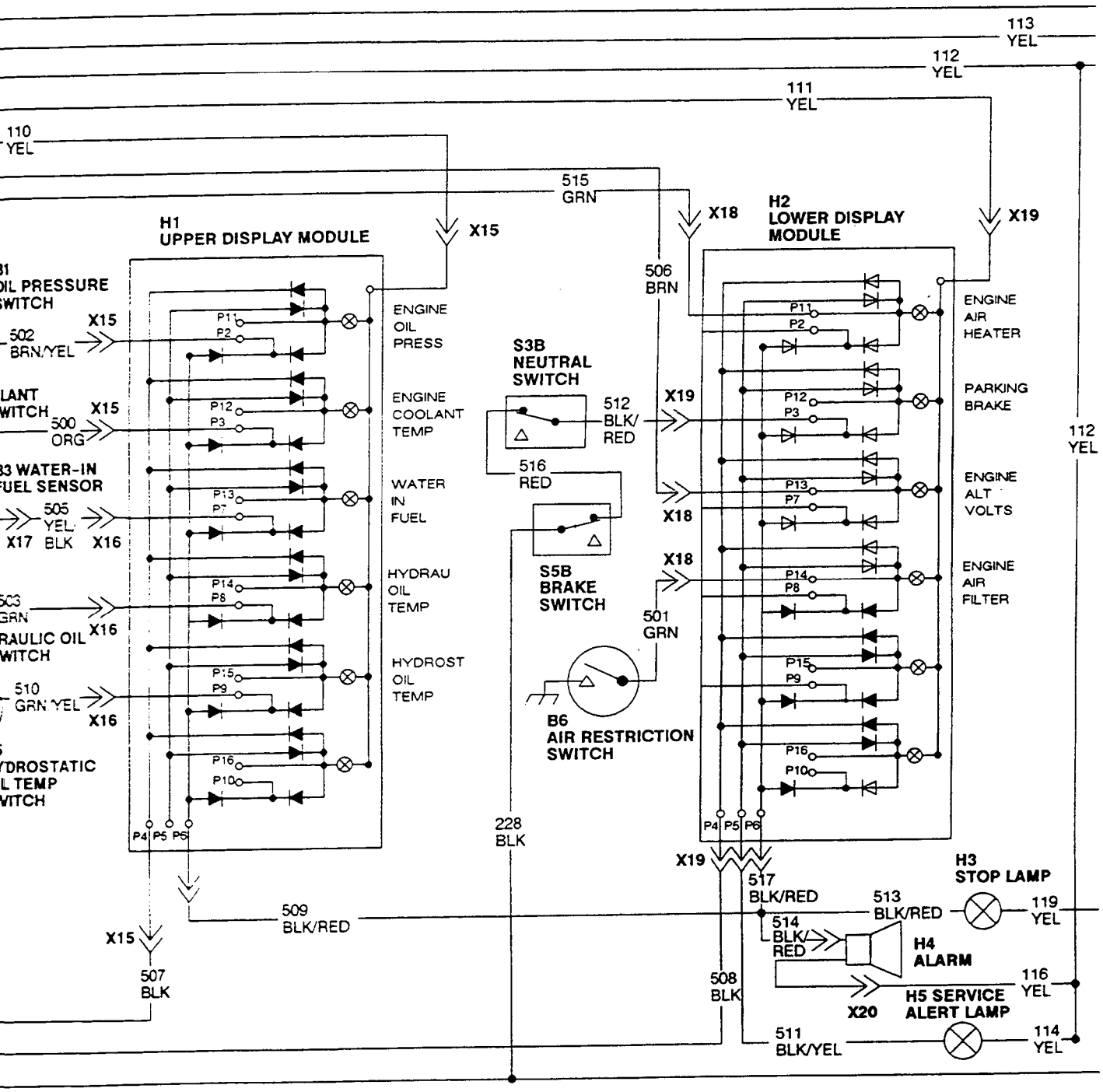


SE1 STARTING CIRCUIT

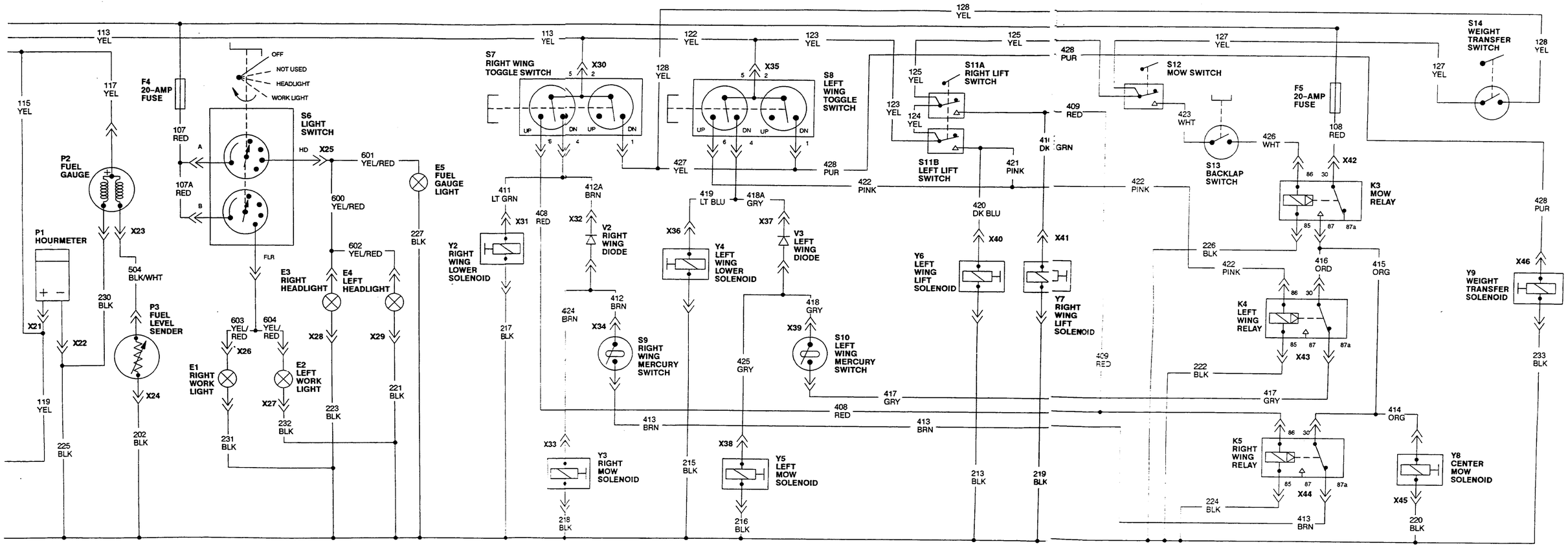
M80940AE



SE2 AIR HEATER CIRCUIT	SE3 CHARGING CIRCUIT

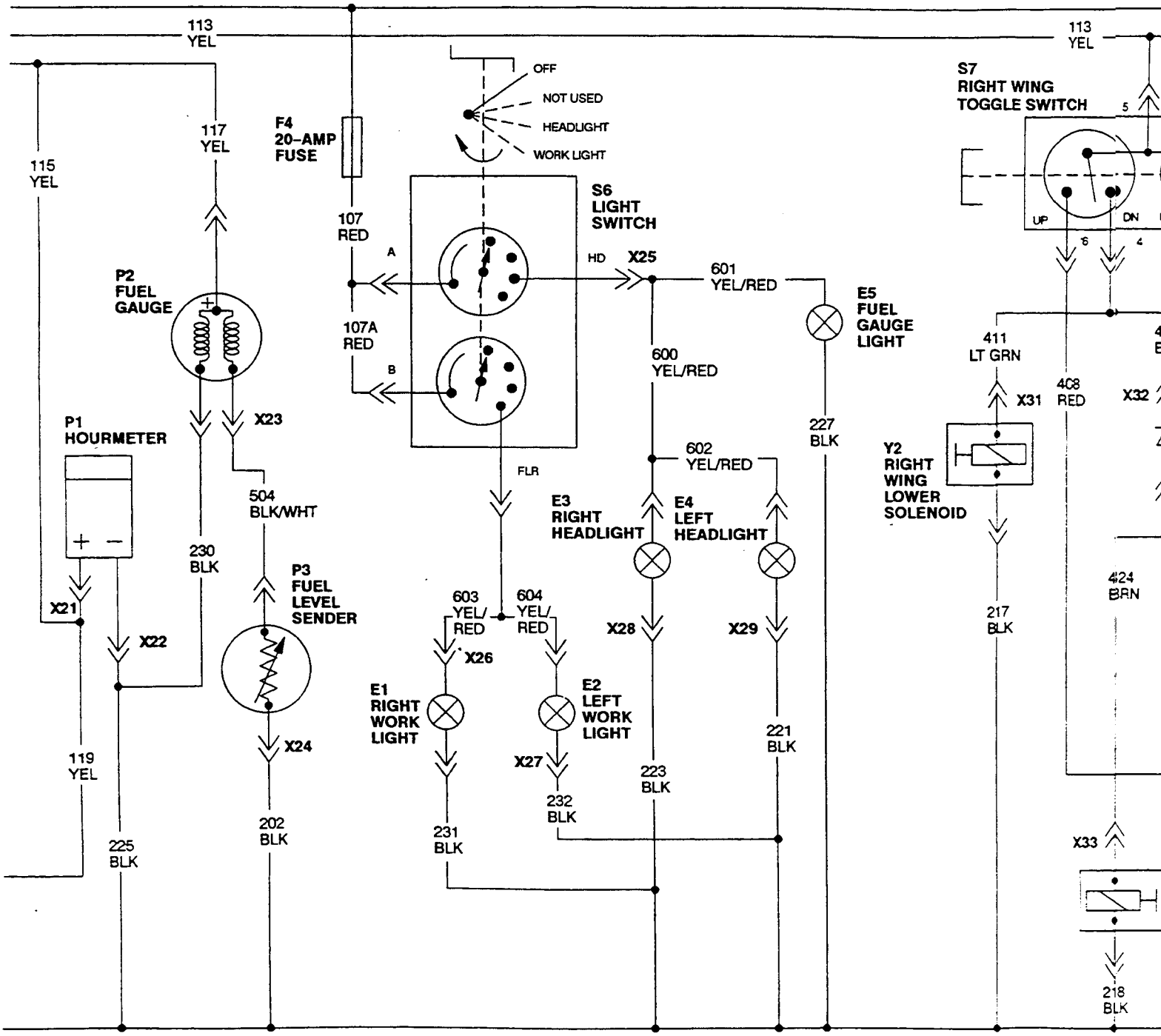


SE4 DISPLAY MODULE CIRCUIT



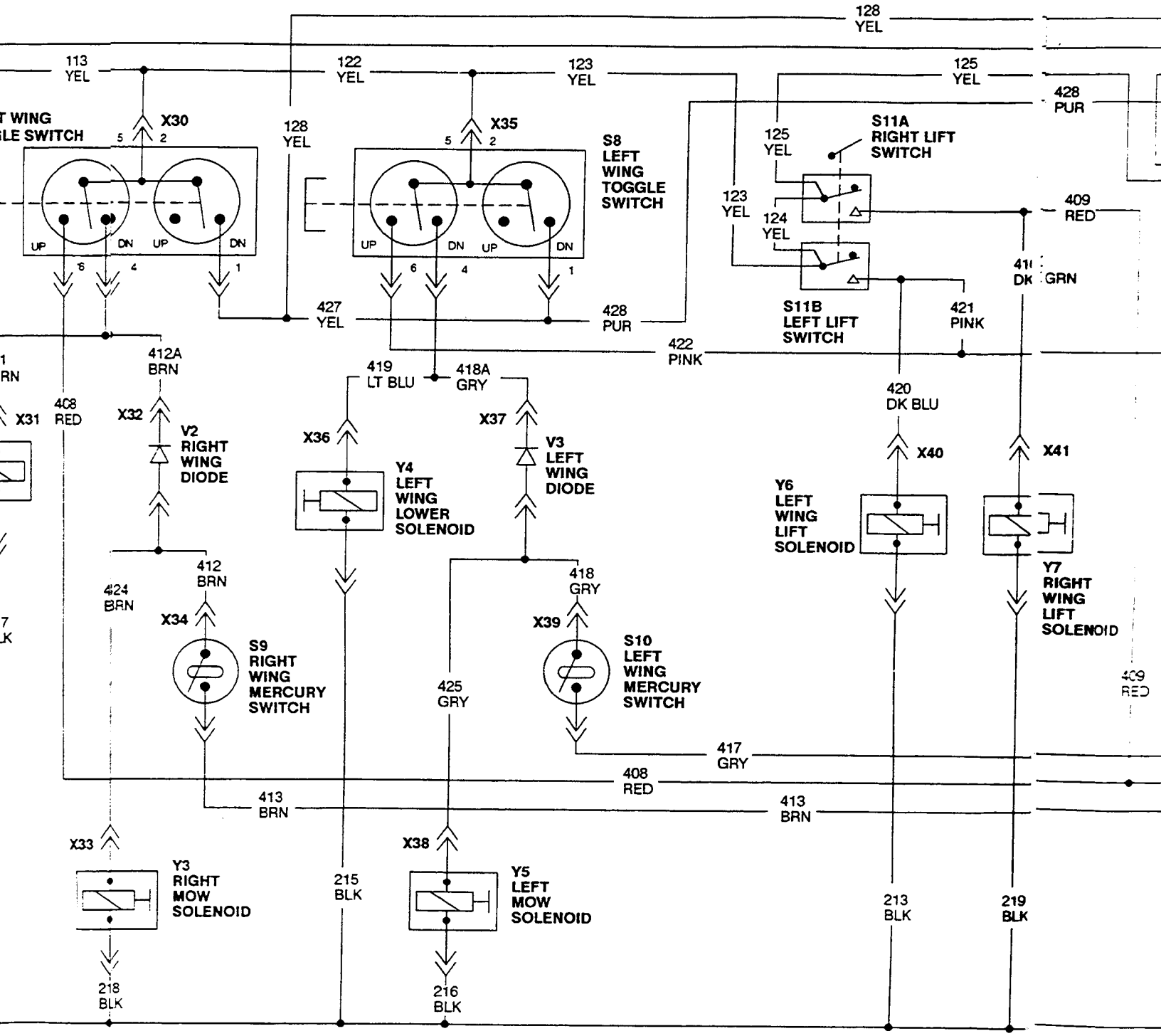
SE5 HOURMETER CIRCUIT	SE6 FUEL GAUGE CIRCUIT	SE7 LIGHTS CIRCUIT	SE8 CUTTING UNITS CONTROL CIRCUIT	SE9 WEIGHT TRANSFER CIRCUIT

M80941AE

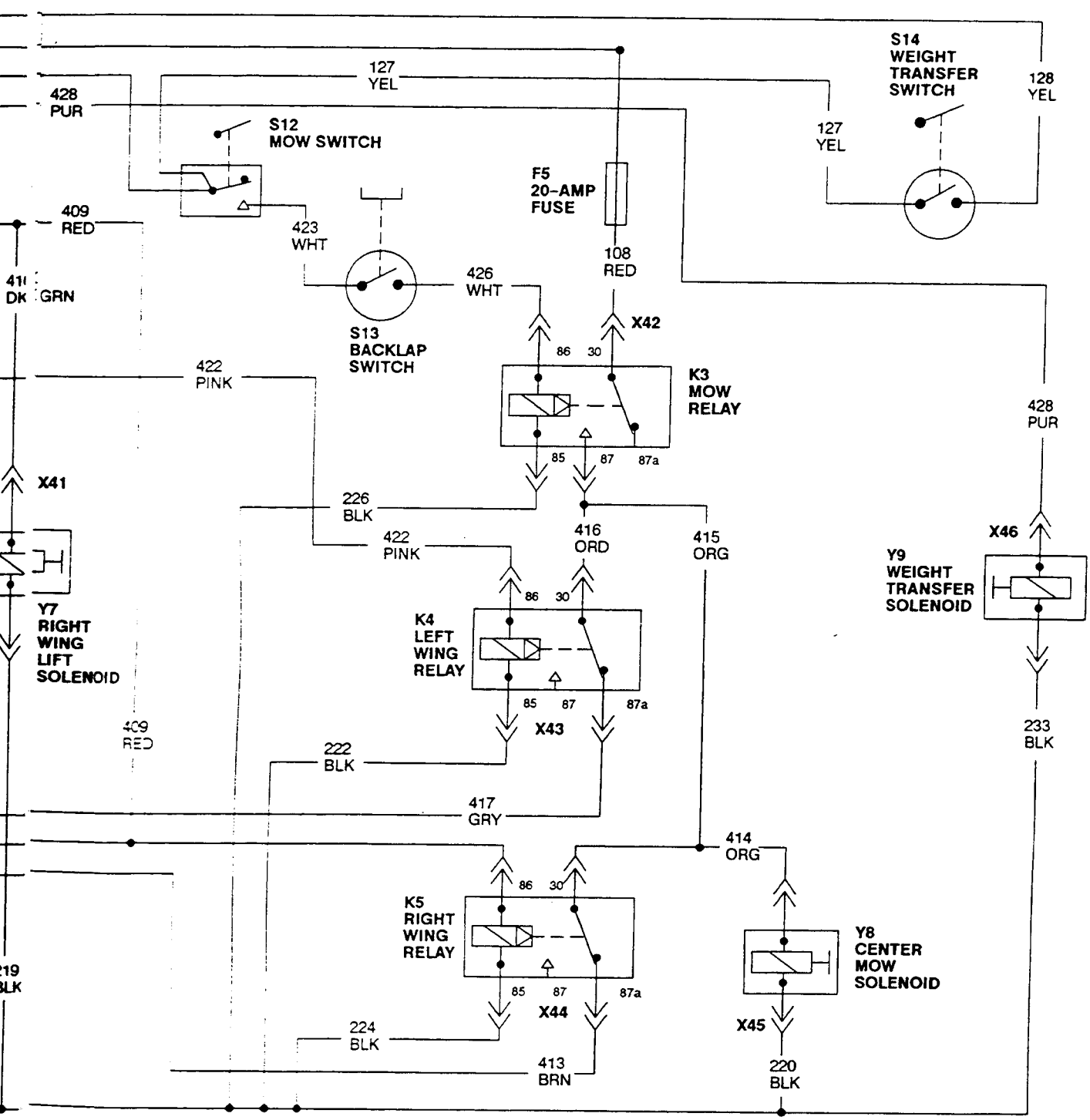


SE5 HOURMETER CIRCUIT	SE6 FUEL GAUGE CIRCUIT	SE7 LIGHTS CIRCUIT	

M80941AE



SE8 CUTTING UNITS CONTROL CIRCUIT



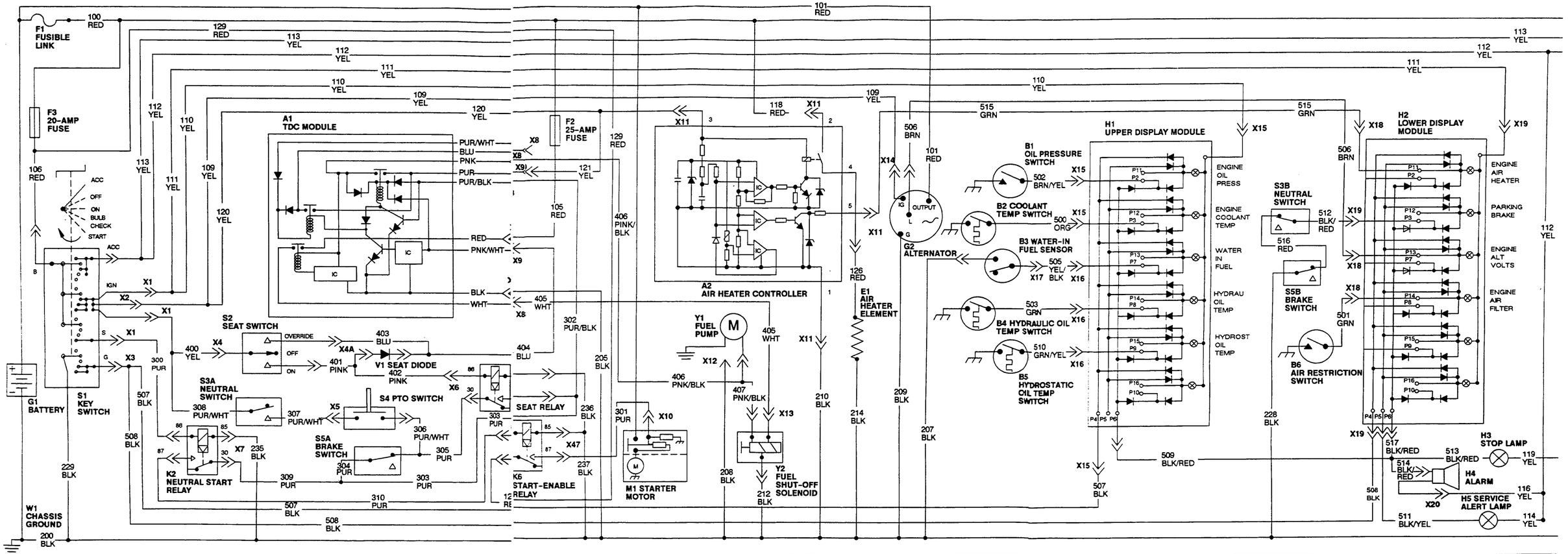
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SE9 WEIGHT TRANSFER CIRCUIT

3365 ELECTRICAL SCHEMATIC

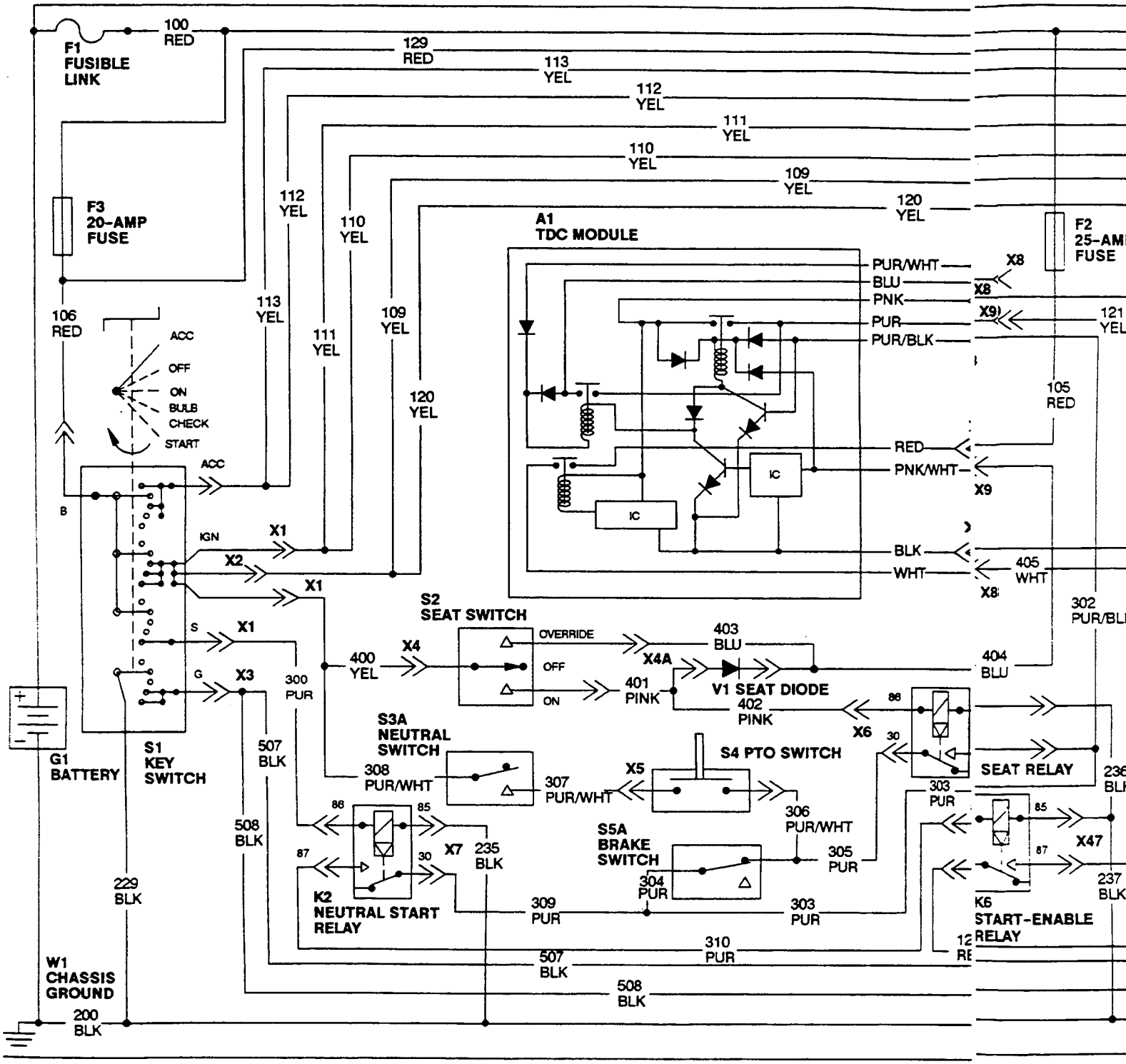
A1—TDC Module
A2—Air Heater Controller
B1—Oil Pressure Switch
B2—Coolant Temperature Switch
B3—Water-in-Fuel Sensor
B4—Hydraulic Oil Temperature Switch
B5—Hydrostatic Oil Temperature Switch
B6—Air Restriction Switch
E1—Right Work Light
E2—Left Work Light
E3—Right Headlight
E4—Left Headlight
E5—Fuel Gauge Light
F1—Fusible Link
F2—Control Module 25-Amp Fuse
F3—Key Switch Power 20-Amp Fuse
F4—Lights 20-Amp Fuse
F5—Mow 20-Amp Fuse
G1—Battery
G2—Alternator
H1—Upper Display Module
H2—Lower Display Module
H3—Stop Lamp
H4—Alarm
H5—Service Alert Lamp
K1—Seat Relay
K2—Neutral Start Relay
K3—Mow Relay
K4—Left Wing Relay
K5—Right Wing Relay
K6—Start-Enable Relay
M1—Starter Motor
P1—Hourmeter
P2—Fuel Gauge
P3—Fuel Level Sender
S1—Key Switch
S2—Seat Switch
S3A—Neutral Switch
S3B—Neutral Switch
S4—PTO Switch
S5A—Brake Switch
S5B—Brake Switch
S6—Light Switch
S7—Right Wing Toggle Switch
S8—Left Wing Toggle Switch
S9—Right Wing Mercury Switch
S10—Left Wing Mercury Switch
S11—A-Right Wing Lift Switch
S11—B-Left Wing Lift Switch
S12—Mow Switch
S13—Backlap Switch
S14—Weight Transfer Switch
V1—Seat Diode
V2—Right Wing Diode
V3—Left Wing Diode
W1—Chassis Ground
X1—Key Switch 6-Pin Connector
X2—Key Switch 1-Pin Connector
X3—Key Switch 1-Pin Connector
X4—Seat Switch Connector
X4A—Seat Switch Diode Connector
X5—PTO Switch Connector
X6—Seat Relay Connector
X7—Neutral Start Relay Connector
X8—TDC Module 6-Pin Connector
X9—TDC Module 3-Pin Connector
X10—Starter Solenoid Connector
X11—Air Heater Controller Connector
X12—Fuel Pump Connector
X13—Fuel Shut-Off Solenoid Connector
X14—Alternator Connector
X15—Upper Display Module 6-Pin Connector
X16—Upper Display Module 4-Pin Connector
X17—Water-in-Fuel Connector
X18—Lower Display Module Center 6-Pin Connector
X19—Lower Display Module 6-Pin Connector
X20—Alarm Connector
X21—Hourmeter (Positive) Connector
X22—Hourmeter (Negative) Connector
X23—Fuel Gauge Connector
X24—Fuel Level Sender Connector
X25—Light Switch Connector
X26—Right Work Light Connector
X27—Left Work Light Connector
X28—Right Headlight Connector
X29—Left Headlight Connector
X30—Right Wing Toggle Switch Connector
X31—Right Wing Lower Solenoid Connector
X32—Right Wing Diode Connector
X33—Right Mow Solenoid Connector
X34—Right Wing Mercury Switch Connector
X35—Left Wing Toggle Switch Connector
X36—Left Wing Lower Solenoid Connector
X37—Left Wing Diode Connector
X38—Left Mow Solenoid Connector
X39—Left Wing Mercury Switch Connector
X40—Left Wing Lift Solenoid Connector
X41—Right Wing Lift Solenoid Connector
X42—Mow Relay Connect
X43—Left Wing Relay Connector
X44—Right Wing Relay Connector
X45—Center Mow Solenoid Connector
X46—Weight Transfer Solenoid Connector
X47—Start-Enable Relay Connector
Y1—Fuel Pump
Y2—Right Wing Lower Solenoid
Y3—Right Mow Solenoid
Y4—Left Wing Lower Solenoid
Y5—Left Mow Solenoid
Y6—Left Wing Lift Solenoid
Y7—Right Wing Lift Solenoid
Y8—Center Mow Solenoid
Y9—Weight Transfer Solenoid

MX,24020HV,A6 -19-21OCT92



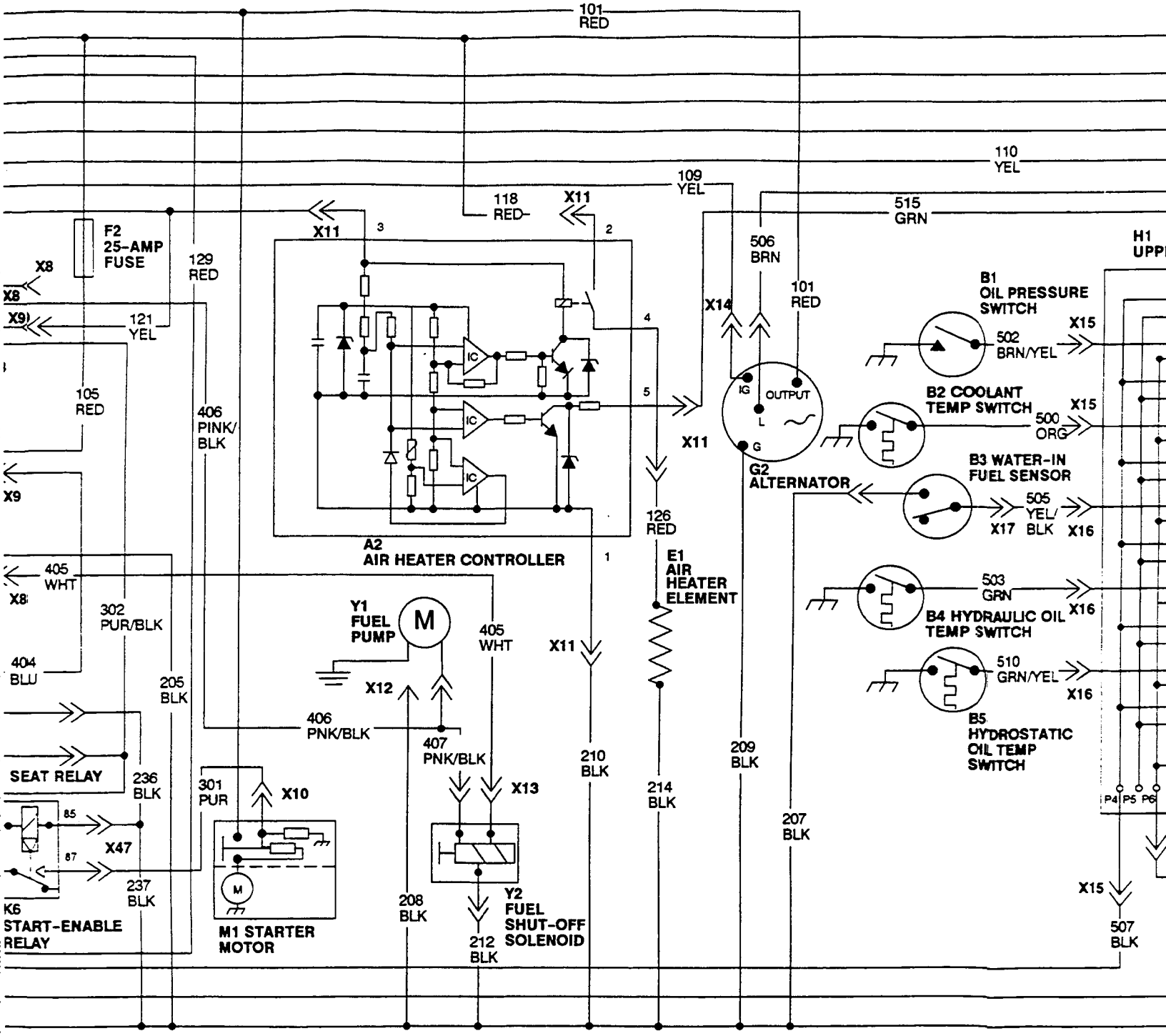
SE1 STARTING CIRCUIT | **SE2 AIR HEATER CIRCUIT** | **SE3 CHARGING CIRCUIT** | **SE4 DISPLAY MODULE CIRCUIT**

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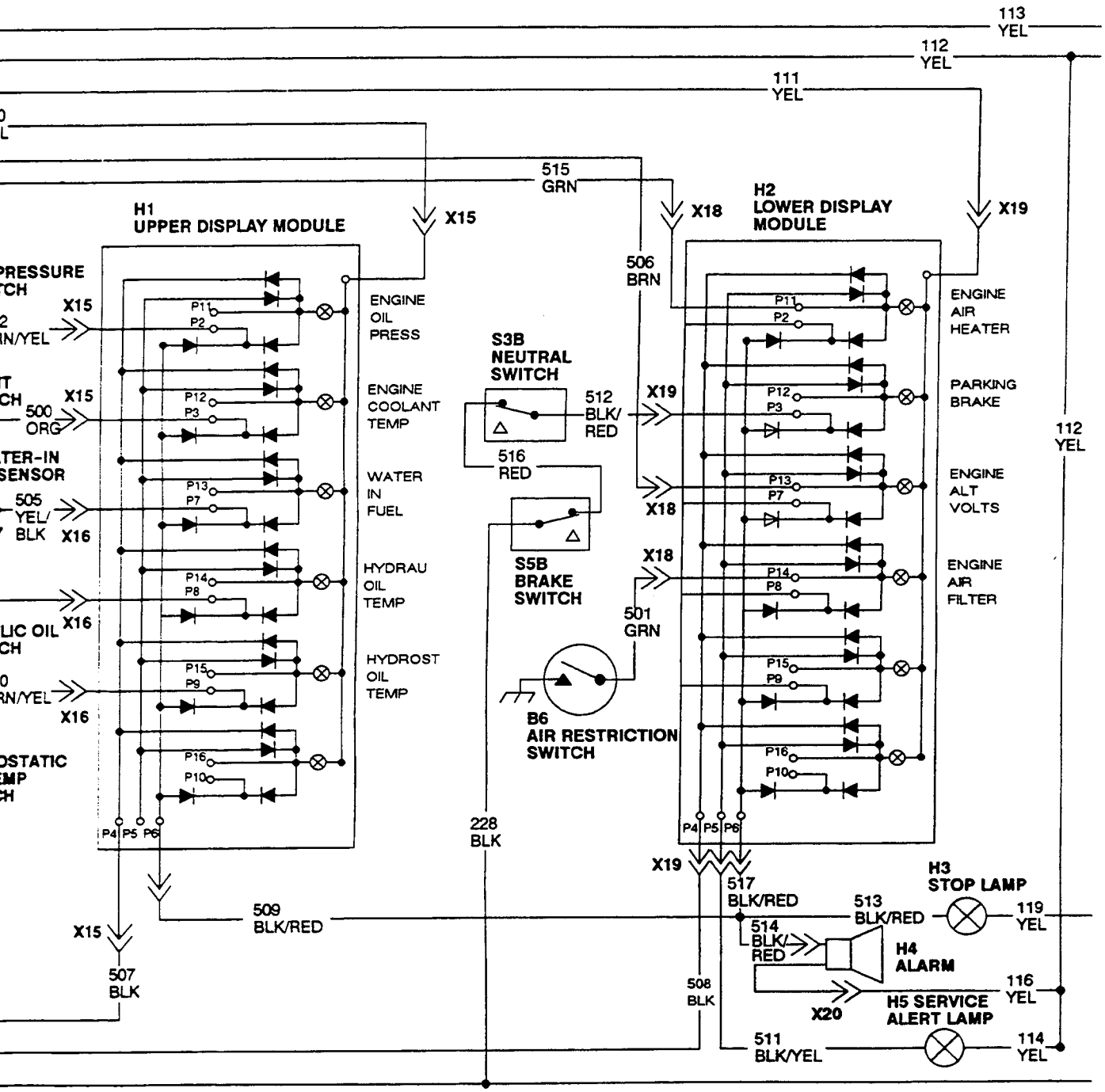


SE1 STARTING CIRCUIT

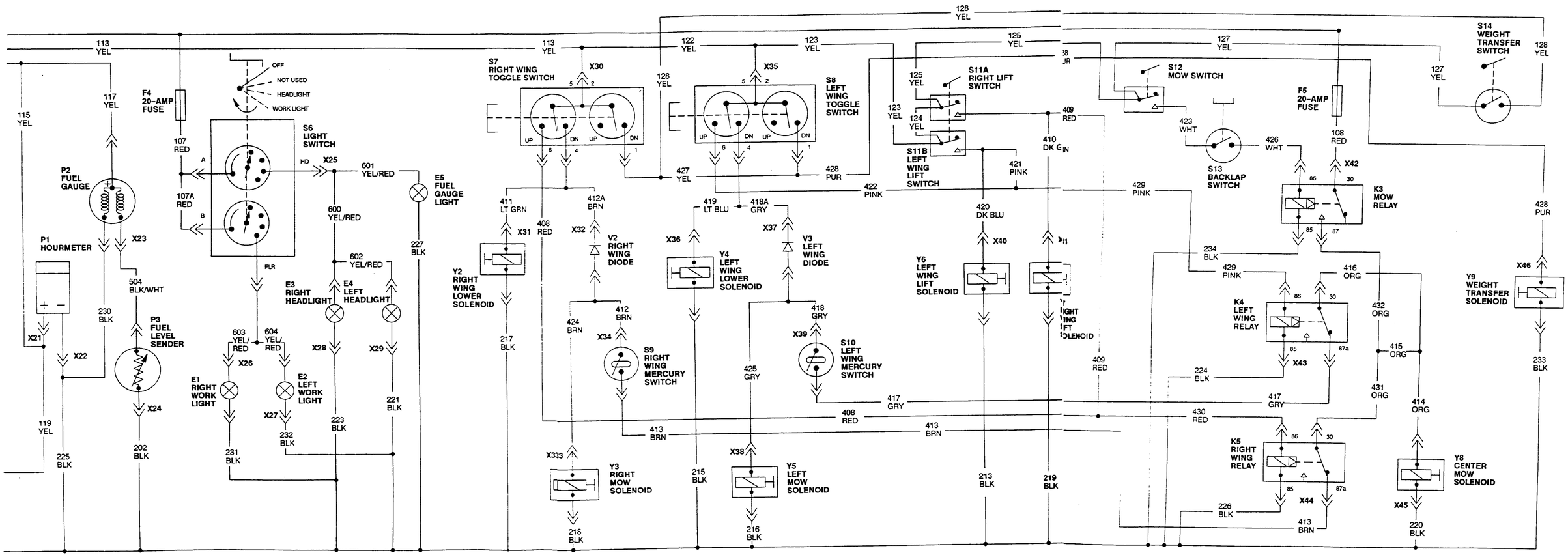
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SE2 AIR HEATER CIRCUIT	SE3 CHARGING CIRCUIT

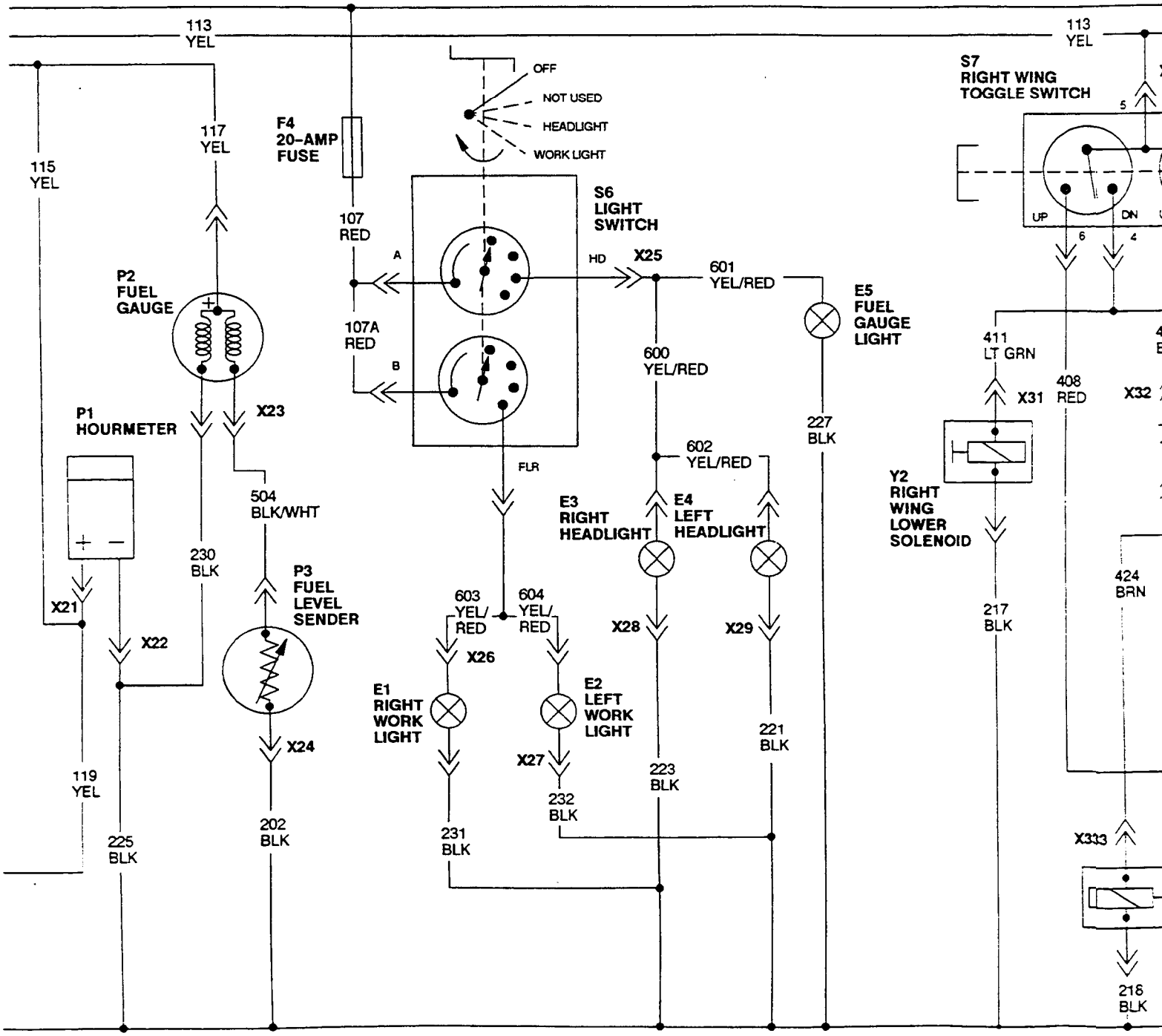


SE4 DISPLAY MODULE CIRCUIT



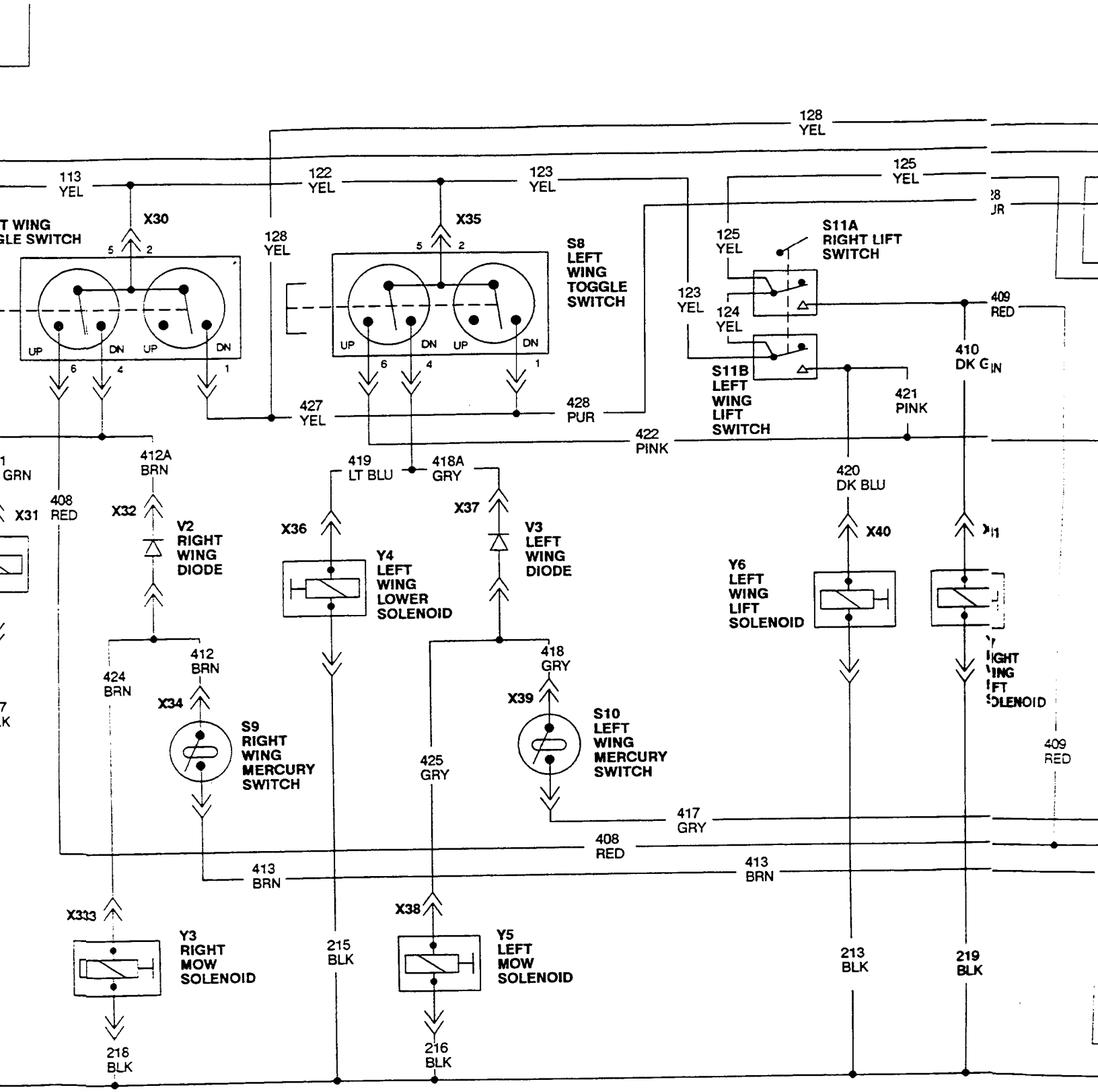
SE5 HOURMETER CIRCUIT	SE6 FUEL GAUGE CIRCUIT	SE7 LIGHTS CIRCUIT	SE8 CUTTING UNITS CONTROL CIRCUIT	SE9 WEIGHT TRANSFER CIRCUIT

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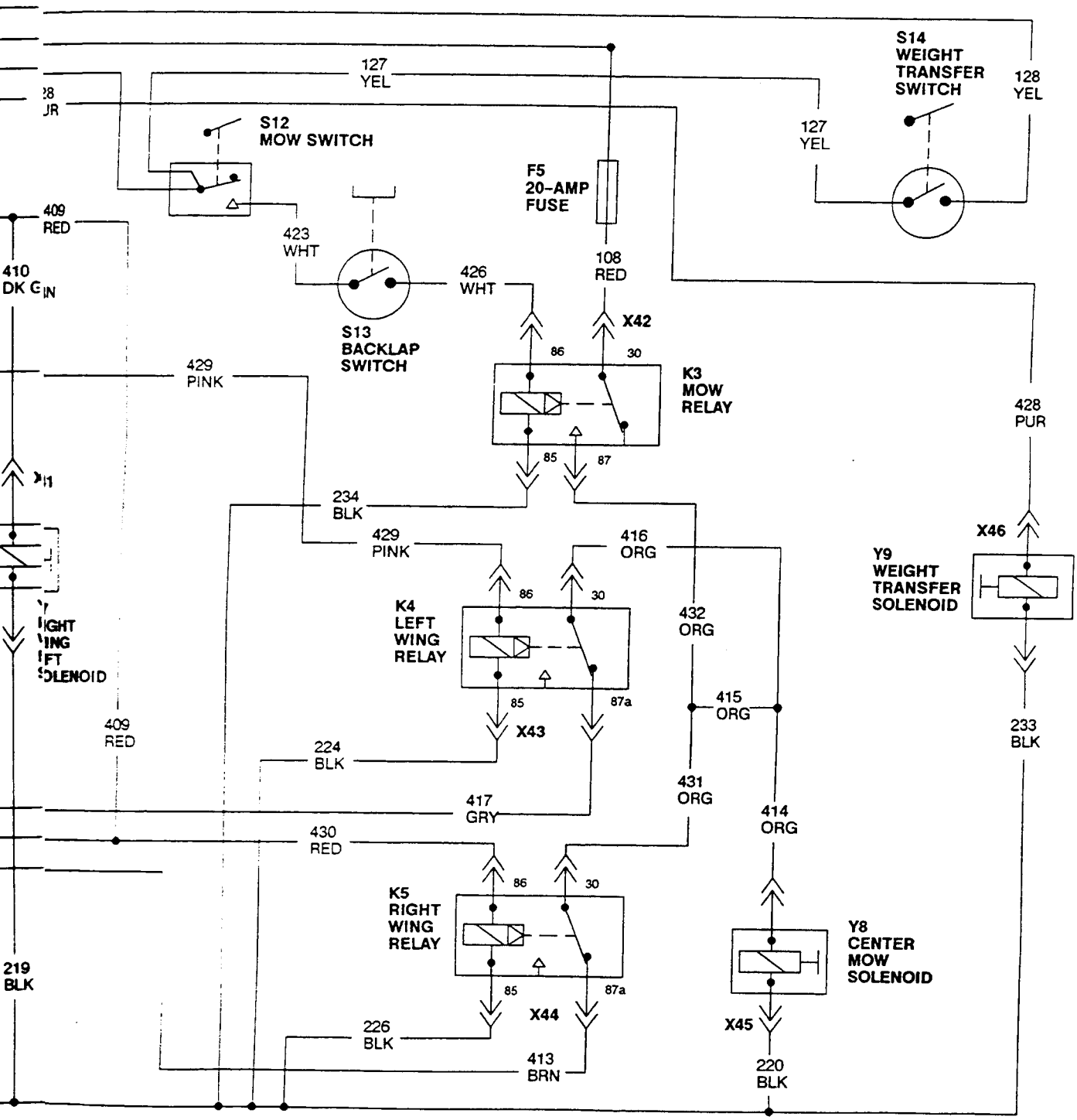


SE5 HOURMETER CIRCUIT	SE6 FUEL GAUGE CIRCUIT	SE7 LIGHTS CIRCUIT	

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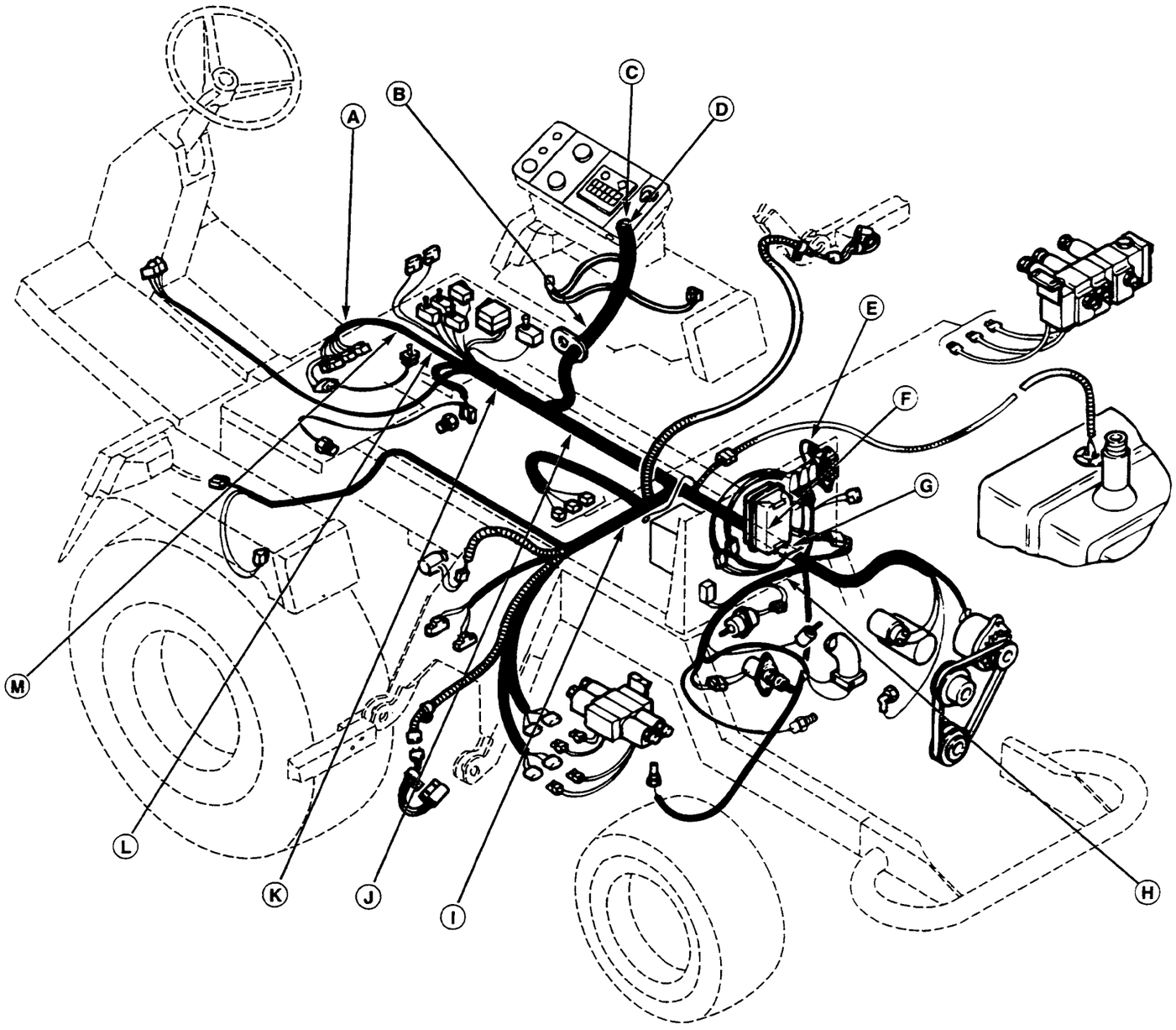


SE8 CUTTING UNITS CONTROL CIRCUIT



IRCIIT

SE9 WEIGHT TRANSFER CIRCUIT



A - Black Wires
222
224
226
228
234

B - Black Wires
206
222
223
225
227
229

C - Yellow Wires
112
114
115
116
117

D - Black/Red Wires
509
513
514
517

E - Purple Wires
302/Black
303
304
309

F - Black Wires
200
207
208
209
210
212
214

G - Black Wires
203
235
236

H - Black Wires
201
207
208
209
210
212
214

I - Black Wires
204
213
215
216
217
218
219
220
221
233

J - Orange Wires
414
415
416

K - Orange Wires
415
431
432

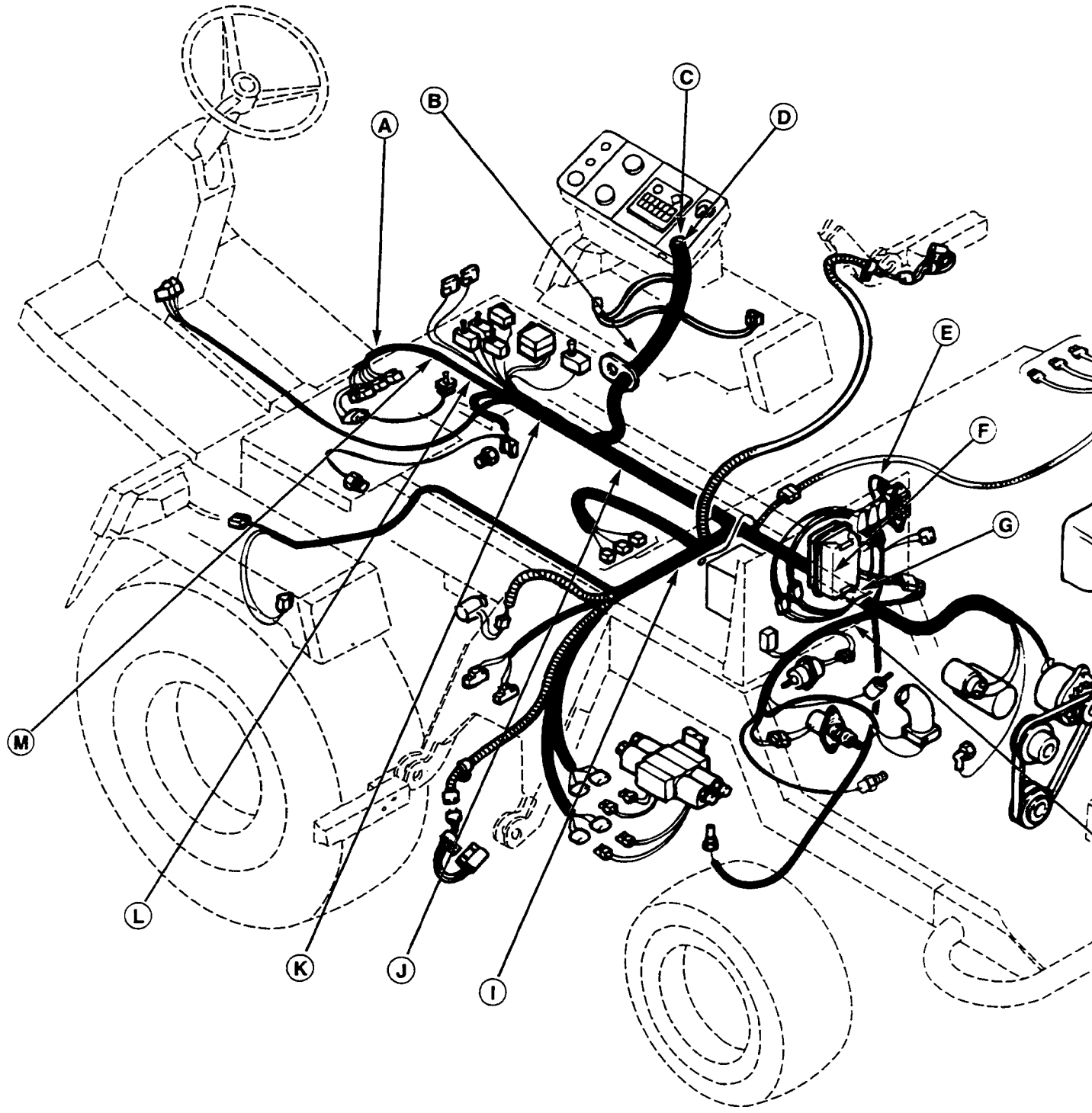
L - Red Wires
408
409
430

M - Pink Wires
421
422
429

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MAIN HARNESS SPLICE LOCATIONS

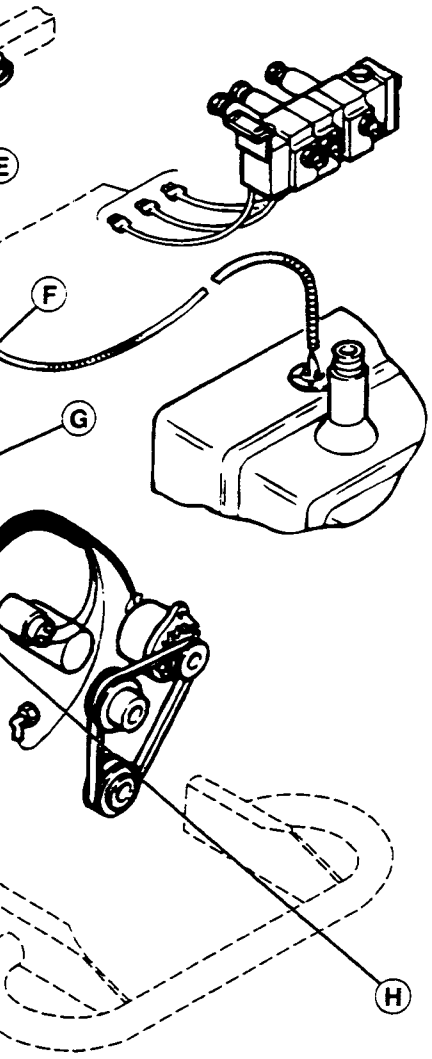
MX,24020HV,A10 -19-21JAN93



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MAIN HARNESS SPLICE LOCATION

MX,24020HV,A10 -19-21JAN93



A - Black Wires
- 222
- 224
- 226
- 228
- 234

B - Black Wires
- 206
- 222
- 223
- 225
- 227
- 229

C - Yellow Wires
- 112
- 114
- 115
- 116
- 117

D - Black/Red Wires
- 509
- 513
- 514
- 517

E - Purple Wires
- 302/Black
- 303
- 304
- 309

F - Black Wires
- 200
- 207
- 208
- 209
- 210
- 212
- 214

G - Black Wires
- 203
- 235
- 236

H - Black Wires
- 201
- 207
- 208
- 209
- 210
- 212
- 214

I - Black Wires
- 204
- 213
- 215
- 216
- 217
- 218
- 219
- 220
- 221
- 233

J - Orange Wires
- 414
- 415
- 416

K - Orange Wires
- 415
- 431
- 432

L - Red Wires
- 408
- 409
- 430

M - Pink Wires
- 421
- 422
- 429

LOCATIONS

Section 250
POWER TRAIN OPERATION, TESTS AND ADJUSTMENTS

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POWER TRAIN COMPONENT LOCATION INFORMATION

This group contains component location drawings for the following power train components:

- Hydrostatic Transmission
- Transaxle

Use the drawings to help you locate the components and familiarize yourself with the configuration of the power train system.

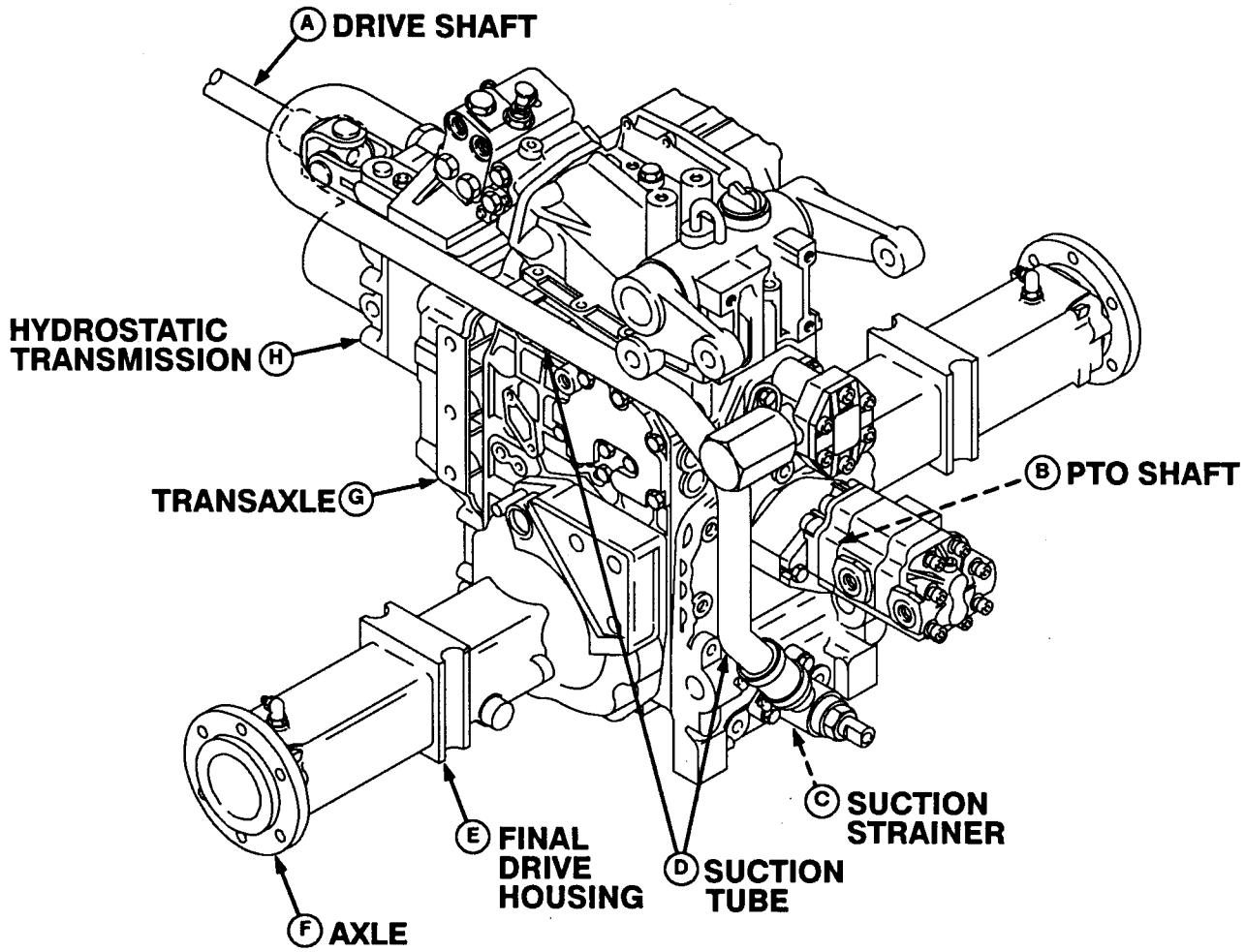
MX,25005HV,A1 -19-18JAN93

POWER TRAIN COMPONENTS

A—Drive Shaft
B—PTO Shaft
C—Suction Strainer
D—Suction Tube
E—Final Drive Housing
F—Axle
G—Transaxle
H—Hydrostatic Transmission

Slide M81522AE

MX,25005HV,A2 -19-18JAN93



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MX,25005HV,A3 -19-18JAN93

THEORY OF OPERATION INFORMATION

This group divides the power train into individual components or systems by function. The story contains information on function, component or system identification and theory of operation.

The following systems or components are covered:
- Hydrostatic Transmission
- Transaxle
- PTO Power Flow System
- PTO Engagement and Lubrication Oil Flow
- Differential Lock

The slide number reference under the art is used for service training purposes only.

MX,25010HV,A1 -19-18JAN93

HYDROSTATIC TRANSMISSION OPERATION

A—Transaxle Case
B—Suction Screen (250 mesh)
C—Suction Tube
D—Charge Pump
E—Drive Shaft
F—Hydrostatic Oil Cooler
G—Line to Oil Cooler
H—Line from Oil Cooler
I—Oil Filter
J—Hydrostatic Transmission

Slide M81523AE

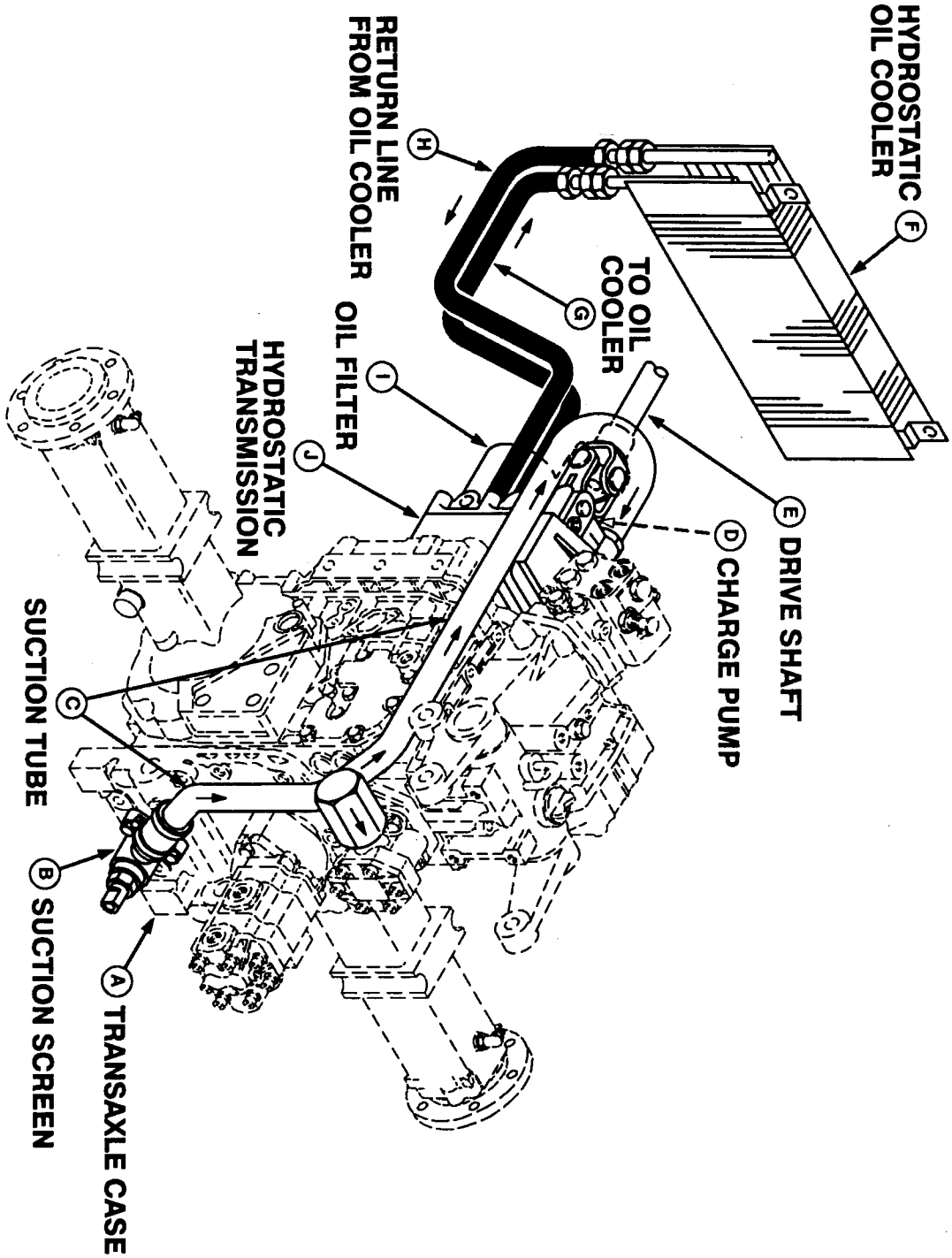
FUNCTION:
The hydrostatic transmission controls input speed, and direction to the transaxle.

THEORY OF OPERATION:
The hydrostatic charge pump (D) is driven directly off the engine driveshaft (E). Therefore, the charge pump operates whenever the engine is running. The charge pump draws hydraulic oil through a suction screen (B) on the bottom of the transaxle case (A), through a common suction tube (C) with the transaxle pump.

Oil flows to the rear of hydrostatic transmission (J), and into the charge pump.

Oil is pumped from the charge pump to the oil cooler (F) and back to the hydrostatic transmission. Oil then flows through the hydraulic oil filter (I). The cooled and filtered oil is then available for charging, lubricating, and cooling the hydrostatic pump and motor rotating groups. Lubricating oil flows through the output shaft bearing, back into the transaxle sump.

MX,25010HV,A2 -19-18JAN93



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HYDROSTATIC TRANSMISSION OPERATION

M81523AE -19-21DEC92

MX,25010HV,A3 -19-18JAN93

HYDROSTATIC TRANSMISSION OPERATION—CONTINUED

A—Pump Shaft
B—Charge Pump
C—Pump Drive Shaft Output
D—Swash Plate
E—Motor
F—Motor Output Shaft
G—Center Section

Slide M46959

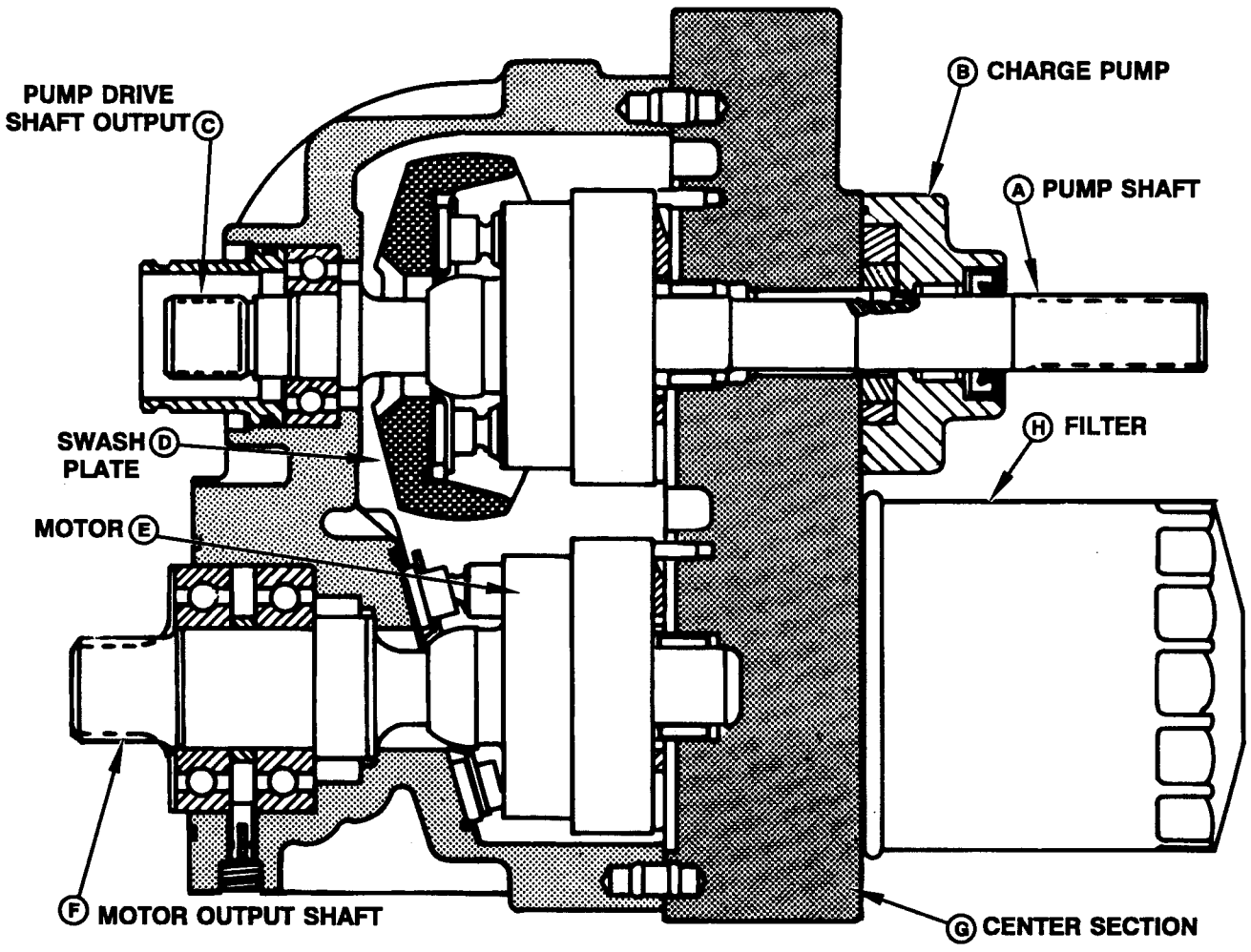
The drive shaft rotates the pump shaft (A) whenever the engine is running. The charge pump (B) and variable displacement pump will also be rotating with this shaft. The pump drive shaft output (C) exits the case and drives the top shaft of the transaxle.

When the swash plate (D) is moved, the pump begins to move hydraulic oil to the fixed displacement motor (E) and the motor begins turning the motor shaft (F). The motor shaft provides the input power to the transaxle.

The center section (G) contains most of the valves and porting that controls the operation of the hydrostatic transmission.

250
10
4

MX,25010HV,A4 -19-18JAN93



HYDROSTATIC TRANSMISSION

MX,25010GU,5 -19-26MAR92

250 10 5

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HYDROSTATIC TRANSMISSION OPERATION—CONTINUED

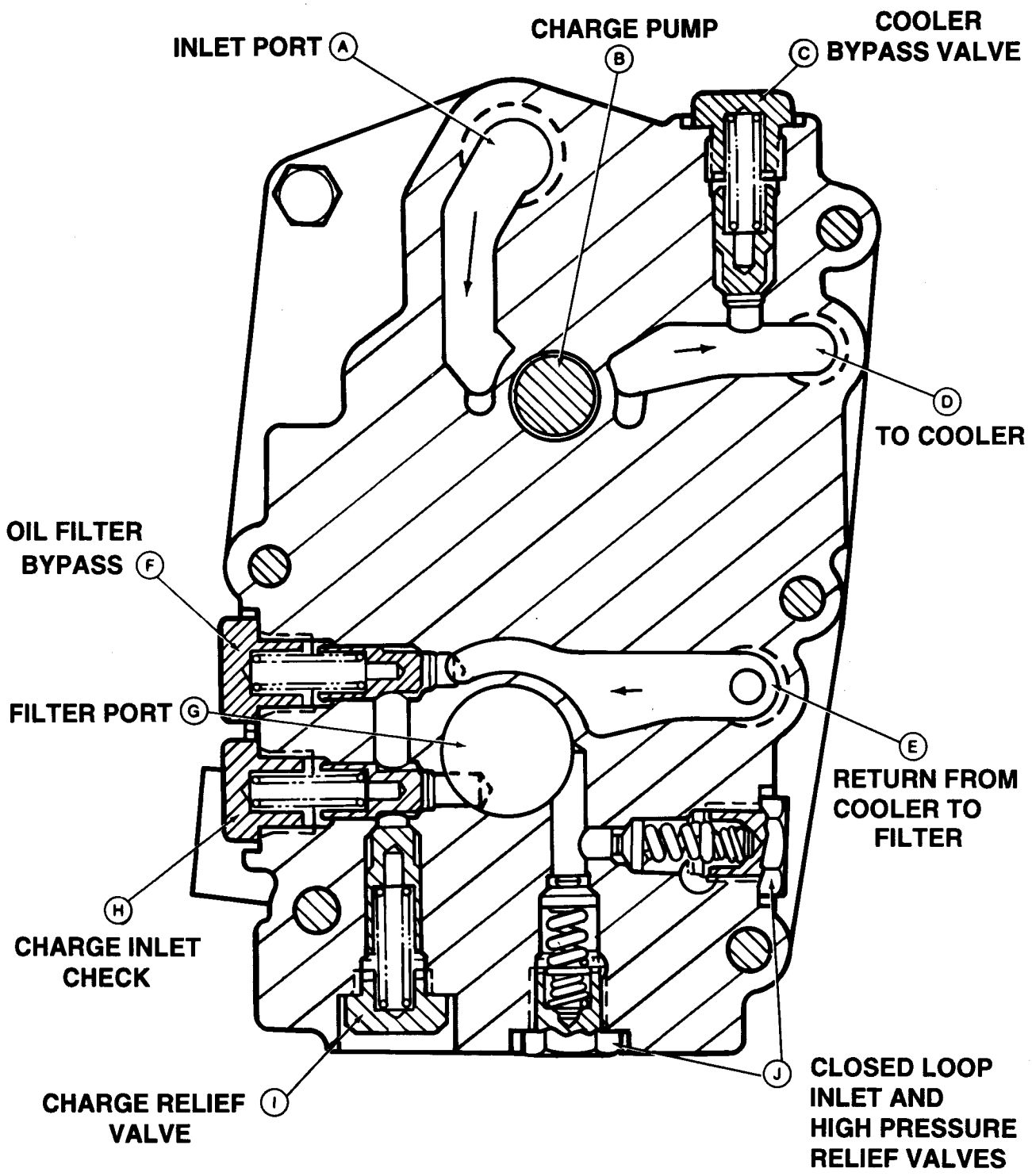
Slide M49960

TRANSMISSION CENTER SECTION
The hydrostatic center section contains the valving and porting to operate the transmission.

A-Inlet Port - from transaxle pickup screen
B-Charge Pump - (bushing area)
C-Oil Cooler Bypass Valve - protects the cooler from high pressure when hydraulic oil is cold.
D-To Cooler
E-Return From Cooler to Filter
F-Oil Filter Bypass Valve - Provides a by-pass for the oil if filter becomes plugged or if the oil is to cold to get through.

G-Filter Port
H-Charge Inlet Check - Prevent unfiltered oil from getting to the close loop circuit.
I-Charge Relief Valve - Maintains internal pressure for charging rotating groups and closed loop circuits.
J-Closed Loop Inlet Check and High Pressure Relief Valves - Inlet check valve let charge oil into low pressure side of the closed loop and keep high pressure from the closed loop back into the charge circuit. The high pressure relief valve protects the closed loop from extremely high pressure, caused by an extreme load.

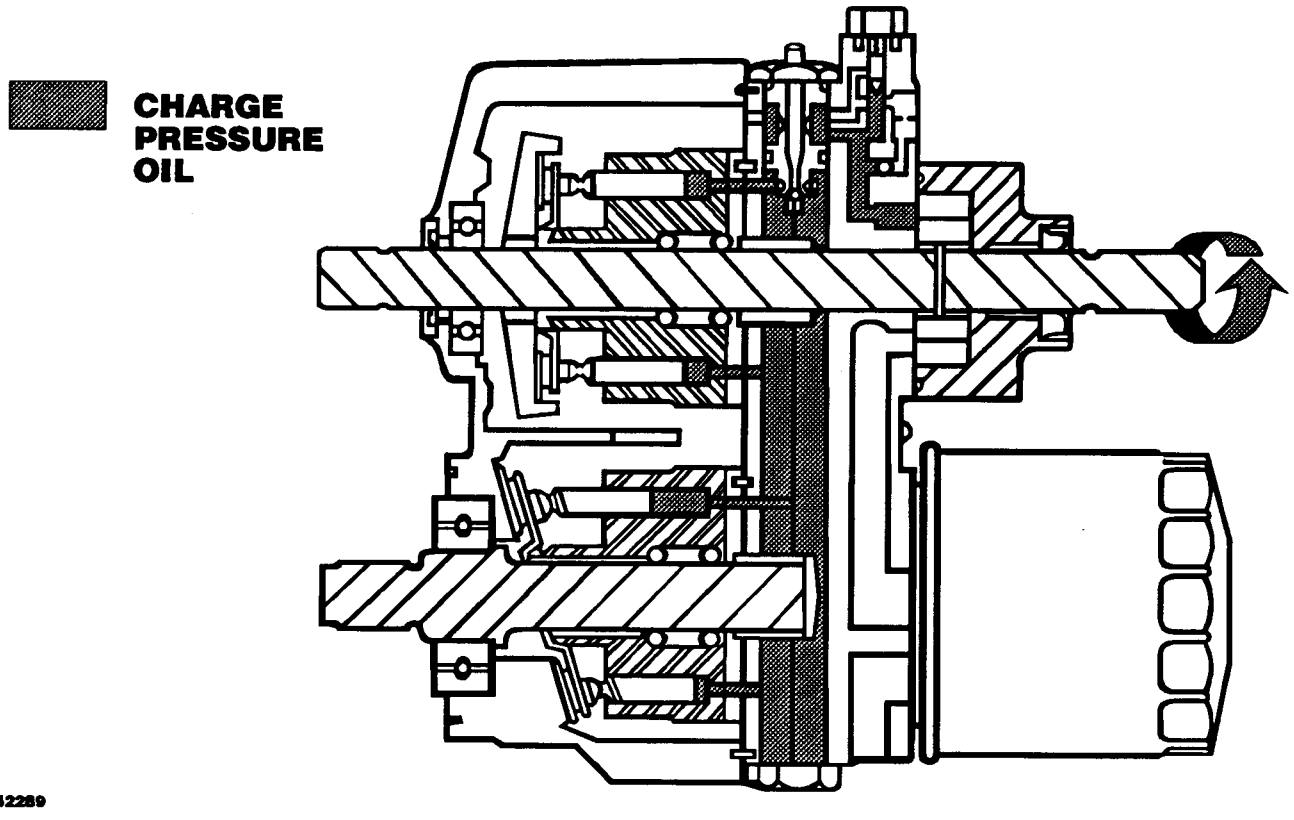
MX,25010HV,A6 -19-18JAN93



HYDROSTATIC TRANSMISSION CENTER SECTION

MX,25010GU,7 -19-26MAR92

HYDROSTATIC TRANSMISSION OPERATION—CONTINUED



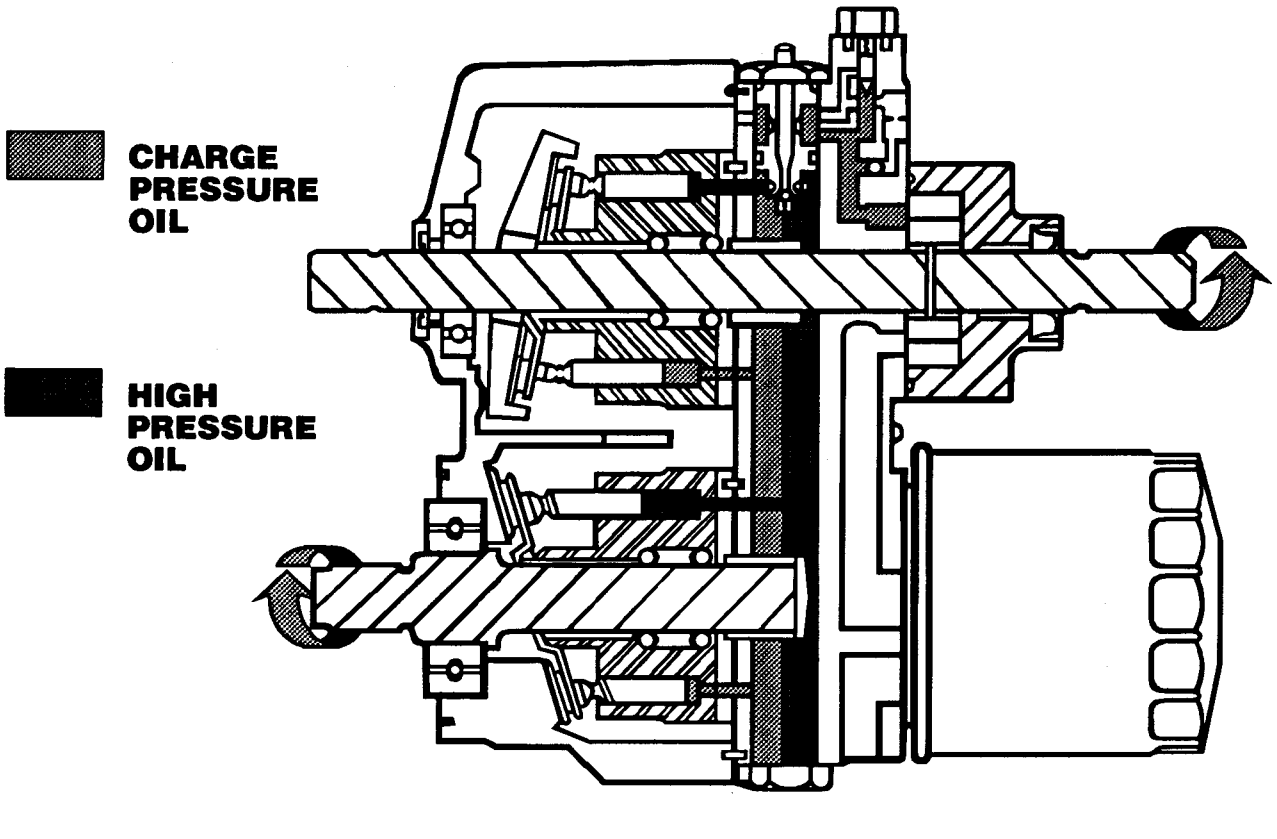
Slide M42289

NEUTRAL OPERATION

When the foot control pedals are in neutral, only the charge pump and the variable-displacement pump rotate. The swashplate is in the vertical position and the displacement of the piston cylinders of the pump is zero. Charge pressure is present in all passages and is not great enough to turn the motor.

MX,25010HV,A8 -19-18JAN93

HYDROSTATIC TRANSMISSION OPERATION—CONTINUED



-19-23SEP91
M42290

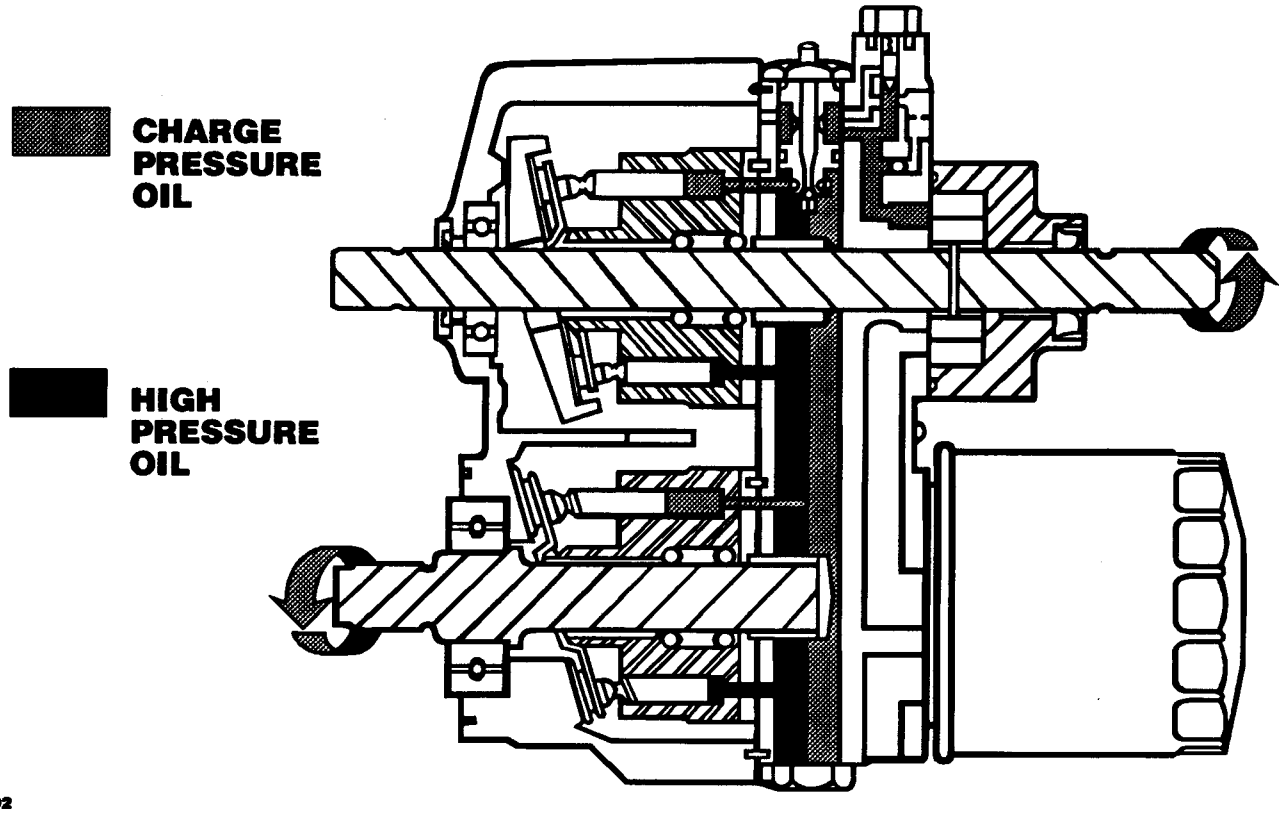
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FORWARD OPERATION

As the operator depresses the forward foot control pedal, the swashplate of the pump moves away from the vertical plane of the neutral position. A change in displacement inside the piston cylinder bores results. This change in displacement generates high-pressure oil in a closed-loop from the pump to the motor. This high-pressure oil enters the motor inlet port and pushes against the pistons, which transfer the pressure against the incline of the fixed motor swashplate, forcing the cylinder block and drive shaft of the motor to rotate. Whenever the swashplate of the pump is at an angle opposite the motor swashplate, the motor drive shaft will turn in the same direction as the pump drive shaft. Bolted to the end of the motor drive shaft is the transaxle input gear, which drives the transaxle.

MX,25010HV,A9 -19-18JAN93

HYDROSTATIC TRANSMISSION OPERATION—CONTINUED



REVERSE OPERATION

As the operator depresses the reverse foot control pedal, the swashplate of the pump moves away from the vertical plane of the neutral position. A change in displacement inside the piston cylinder bores results. This change in displacement generates high-pressure oil in a closed-loop from the pump to the motor. This high-pressure oil enters the motor inlet port and pushes against the pistons, which transfer the pressure against the incline of the fixed motor swashplate, forcing the cylinder block and drive shaft of the motor to rotate. Whenever the swashplate of the pump is toward the same angle as the motor swashplate, the motor drive shaft will turn in the opposite direction as the pump drive shaft. Bolted to the end of the motor drive shaft is the transaxle input gear, which drives the transaxle.

MX,25010HV,A10 -19-18JAN93

TRANSAXLE OPERATION

A—Transaxle/Pump Shaft
B—PTO Drive Gear
C—PTO Clutch
D—PTO Clutch Shaft
E—PTO Reduction Shaft
F—PTO Drive Shaft
G—Transaxle Input Drive Gear
H—High/Low Reduction Speed Shaft
I—High/Low Shift Collar
J—Differential Drive Shaft
K—Low Range Input Gear
L—High Range Input Gear
M—PTO Power Flow
N—Low Range Power Flow
O—High Range Power Flow

Slide M81492

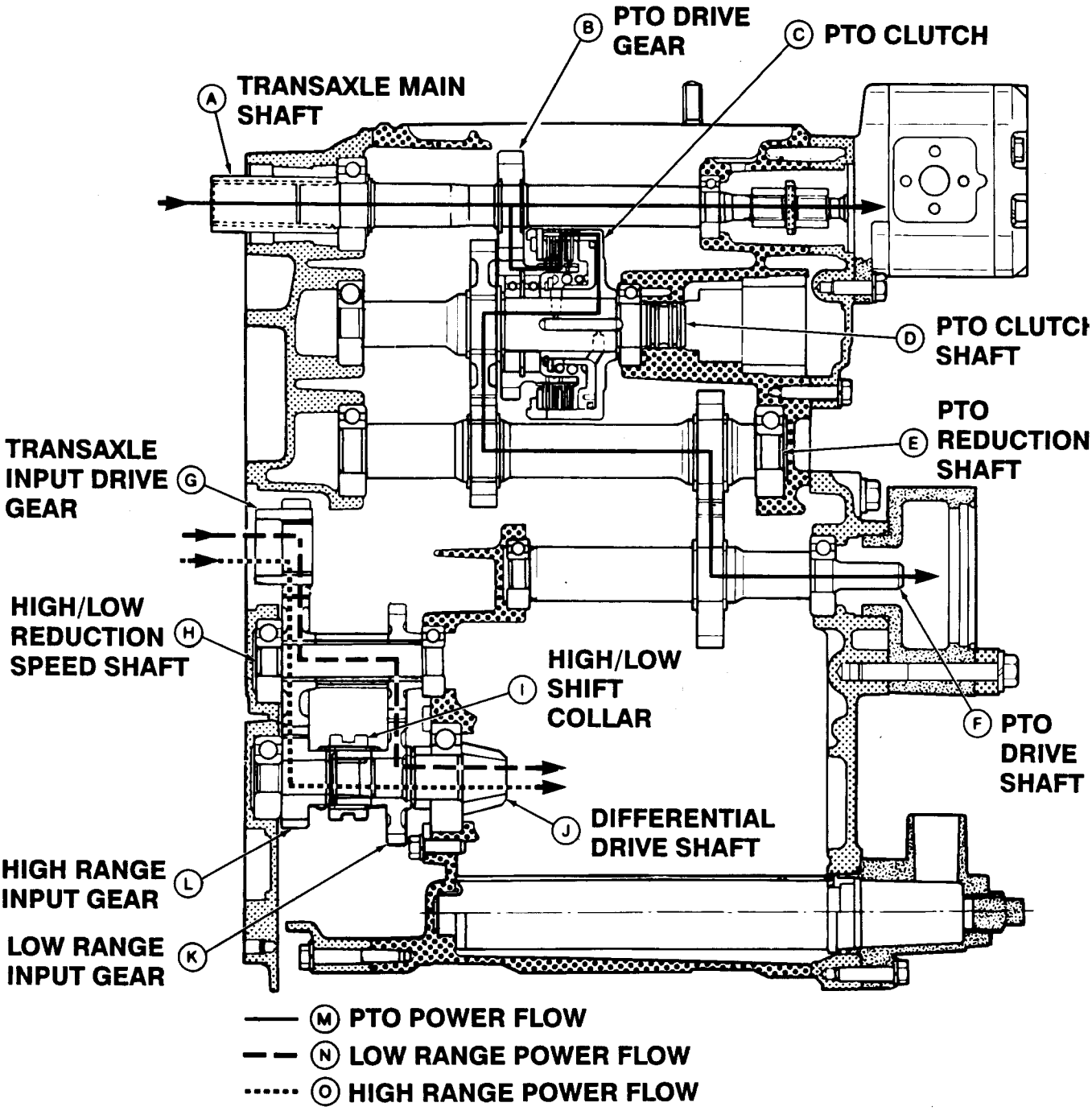
FUNCTION:
- Transfer hydrostatic transmission input to the differential and final drives.
- Provides neutral, low and high range speeds.
- Transmits and controls engine input to the PTO (two-stage hydraulic pump).

PTO POWER FLOW:
The transaxle/pump shaft is rotated by the drive shaft whenever the engine is running. This shaft drives the transaxle pump and the PTO clutch shaft.

The PTO clutch is activated by pressure oil and disengage by spring pressure. When the clutch is engaged, power is transmitted through the reduction shaft to PTO drive shaft.

TWO-SPEED AXLE POWER FLOW
Power input from the hydrostatic transmission output shaft turns the transaxle input gear (G) which turns the high/low reduction speed shaft (H). High/low shift collar can be in the center, neutral position or engage either the high or low input gears, transferring power to the differential drive shaft (K).

MX,25010HV,A11 -19-18JAN93



TRANSAXLE OPERATION

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MX,25010HV,A12 -19-18JAN93

PTO CLUTCH OPERATION

A—Inlet from Steering Valve
B—Delay Relief Valve
C—PTO Lube Pressure Test Port
D—Lube Relief Valve
E—PTO Pressure Test Port
F—Modulation Piston
G—Orifice
H—PTO Clutch Piston
I—PTO Clutch Spool Valve

Slide M81493AE

FUNCTION:
To engage and lubricate the PTO clutch when the PTO lever is activated.

MAJOR COMPONENTS:
- PTO Clutch Spool Valve
- Delay Relief Valve
- Lube Relief Valve
- PTO Clutch Piston

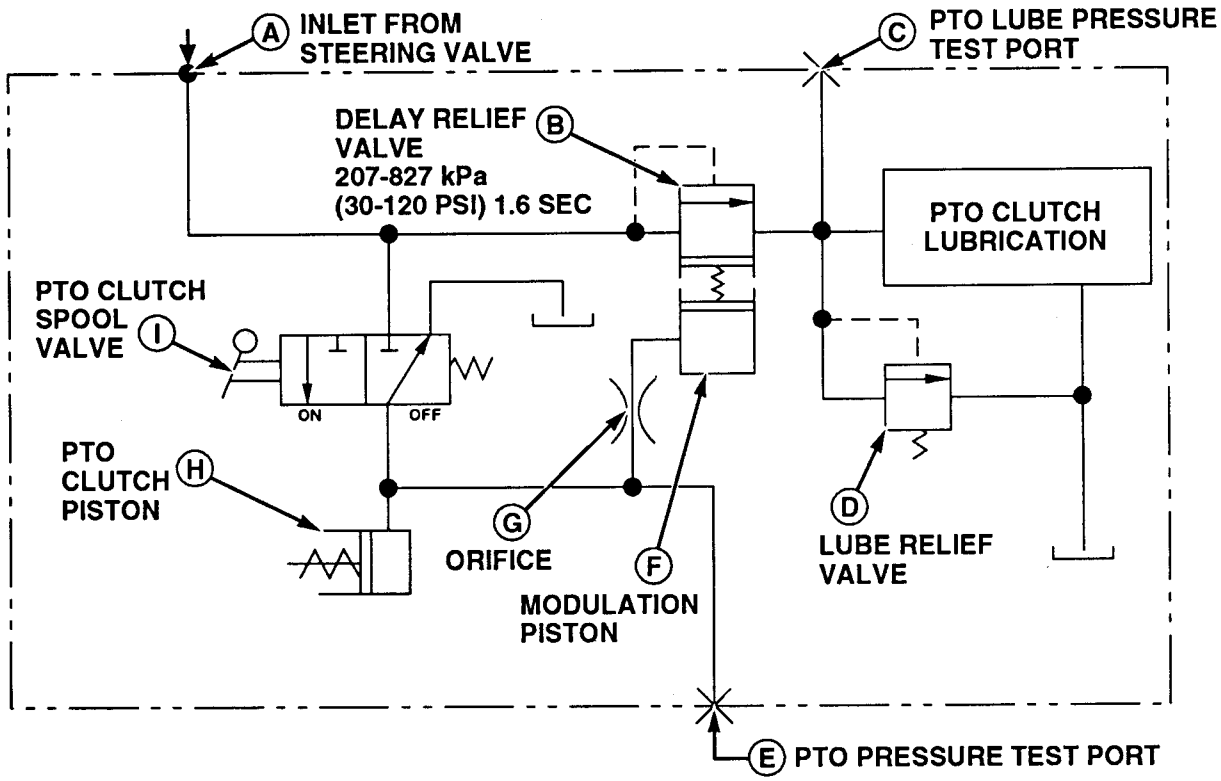
THEORY OF OPERATION:

LUBRICATION OIL FLOW
Return oil flow from the steering valve enters the PTO control valve housing at inlet (A). Oil is routed to the delay relief valve (B). If the PTO valve (I) is not activated, there is no pressure oil in the modulation piston (F) end of the delay relief valve allowing oil to flow through the delay relief valve. Pressure in the circuit remains at lube pressure, controlled by the lube relief valve (D).

Lube relief valve pressure is 21—41 kPa (0.2—0.4 bar) (3—6 psi). Lube oil flows through the lubrication passages, through a drilled passage in the PTO shaft and lubricates the PTO clutch pack discs.

ENGAGEMENT OIL FLOW:
When the PTO lever is activated (PTO ON), the lever shaft pushes the PTO clutch spool valve (I), allowing oil to flow to the orifice (G) and modulation piston. The orifice regulates the amount of oil entering the modulation piston. As oil enters the modulation piston, the oil pushes the piston against two concentric springs, which at the same time push the delay relief valve closed. This spring force increases the pressure at which the delay relief valve opens so oil pressure flowing to the PTO clutch piston increases. The two springs also act as an accumulator, allowing the oil pressure to increase at different rates, providing the modulated engagement. This modulated pressure oil is routed to the PTO clutch piston (H) to engage the clutch.

MX,25010HV,A13 -19-18JAN93



PTO CLUTCH OPERATION

MX,25010HV,A14 -19-18JAN93

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10
14

DIFFERENTIAL AND DIFFERENTIAL LOCK OPERATION

A—Input Pinion
B—Ring Gear
C—Bevel Pinion
D—Side Gear
E—Carrier
F—Differential Lock Shift Collar and Pins
G—Pinion Shaft
H—Final Drive Pinions
I—Axle
J—Differential Lock Pin

Slide M81494

FUNCTION:
The differential distributes engine power evenly to each axle. Each axle is free to rotate at different speeds for cornering. When the differential lock is engaged, it locks the axle to the carrier providing equal power flow to both wheels.

MAJOR COMPONENTS:
- Pinion Gear
- Ring Gear
- Differential Carrier
- Differential Lock Shift Collar and Pin
- Final Drive Pinions
- Axles

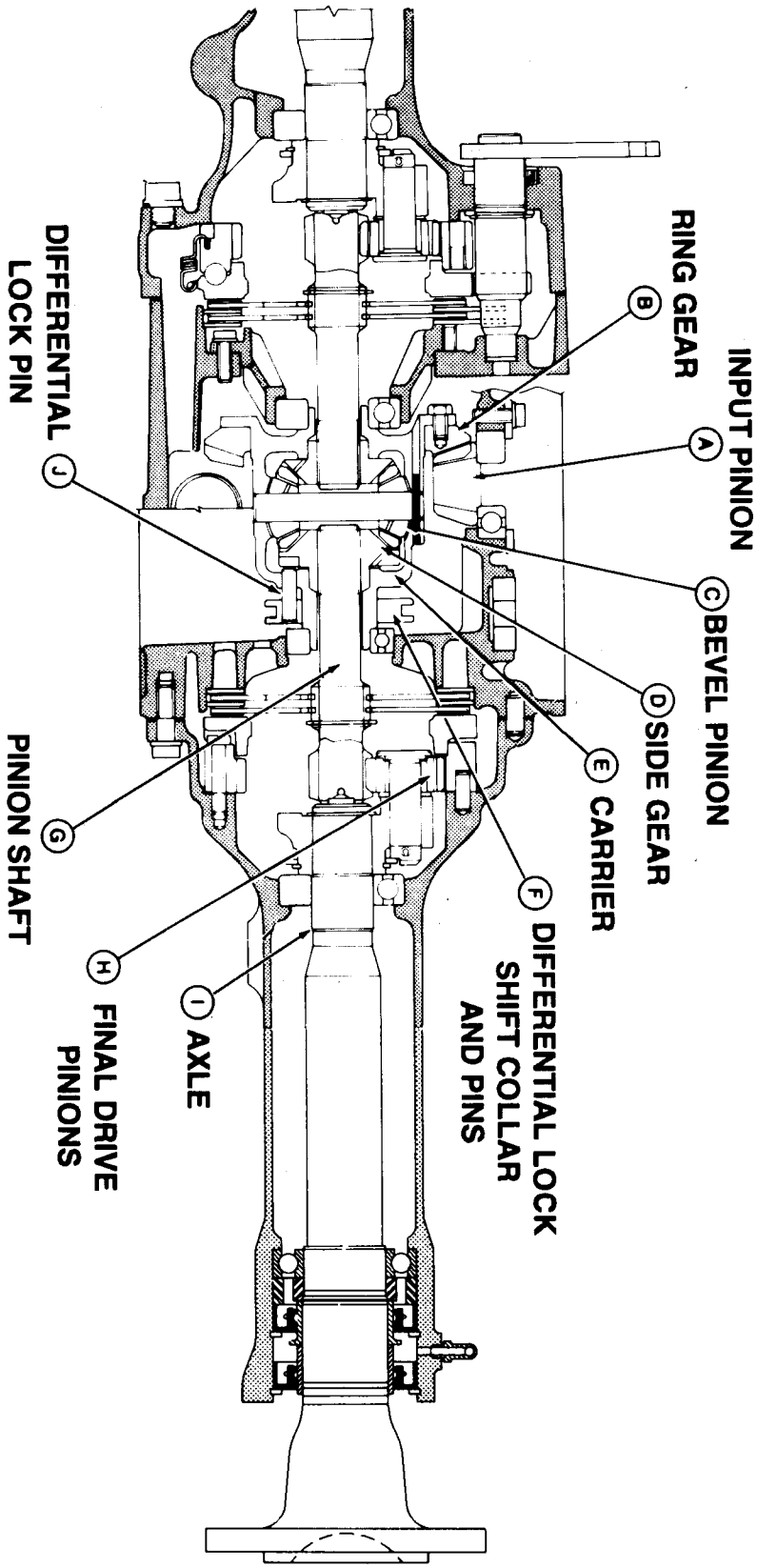
THEORY OF OPERATION:
When the forward or reverse travel pedal is depressed, power is transmitted from the hydrostatic transmission to the drive shaft input pinion (A). The input pinion rotates the ring gear (B) and carrier (E). When the vehicle is moving straight ahead, the carrier transmits the power directly to both pinion shafts (G), through the final drive pinions (H) and out through the axles (I). If turning, or if one wheel spins, the bevel pinions allow the axles to rotate independently. Power flow is transmitted to the axle with the least amount of resistance to rotation.

When the operator engages the differential lock, the shift collar and lock pins (F) lock the axle and side gear (D) to the carrier (E), locking both axles together. Now power is directed equally to both wheels. This prevents the loss of traction to the slipping wheel.

MX,25010HV,A15 -19-18JAN93

M81494

DIFFERENTIAL AND DIFFERENTIAL LOCK



M81494 -19-04JAN93

MX,25010HV,A16 -19-18JAN93

POWER TRAIN CONTROLS AND LINKAGE

A—Forward Travel Pedal
B—Reverse Travel Pedal
C—Forward Link
D—Reverse Link
E—Cruise Control Pivot
F—Forward/Reverse Cable
G—Neutral Return Spring
H—Neutral Return Adjustment Bolt
I—Neutral Return Roller
J—Neutral Return Cam
K—Differential Lock Pedal
L—Two-Speed Shift Lever

Slide M81495AE

FUNCTION:
- Positions the hydrostatic transmission swash plate into forward, reverse and neutral. Provides a smooth return to neutral when pedals are released.
- Control transaxle range selection.
- Control differential lock

THEORY OF OPERATION:
By pushing either forward speed pedal (A) or the reverse speed pedal (B), the forward/reverse cable (F) pushes or pulls the neutral return cam (J). The cam is attached to the hydrostatic transmission control shaft which moves the pump swash plate. As the neutral return cam moves, the return roller (I) moves up and down the ramps of the return cam.

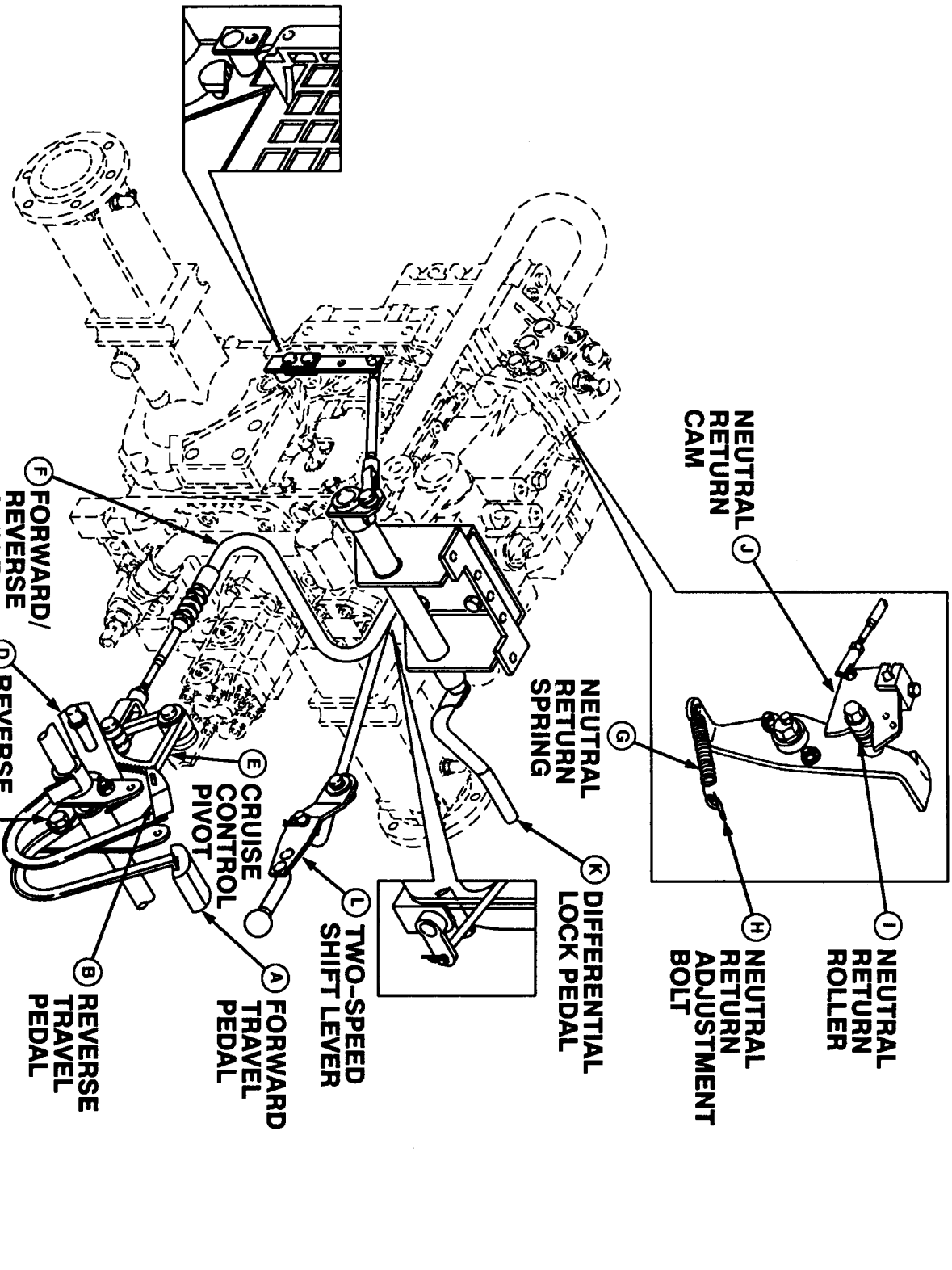
The return spring (G) forces the roller back into the vee, bringing the control linkage back to the neutral position when the pedals are released. The speed of the return-to-neutral can be adjusted by the return adjustment bolt. The more tension on the spring, the faster the return.

The two-speed shift lever (L) controls the shift collar to select high or low range inside the transmission case. (See Transaxle operation.)

The differential lock pedal (K) controls the differential lock collar on the differential carrier. (See Differential and Differential Lock Operation.)

MX,25010HV,A17 -19-18JAN93

POWER TRAIN CONTROLS AND LINKAGE



MX,25010HV,A18 -19-18JAN93

DIAGNOSTIC INFORMATION

The diagnostic information is grouped under the following headings:

- Lack of Drive in One Direction
- Lack of Drive in Both Directions
- Low Power—Wheels Stall Too Easily
- Mower Will Not Reach Full Speed
- Hydrostatic System Operating Too Hot

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 Nor Normal” column to repair the malfunction. The detailed tests or adjustments referred to the “If Not Normal” column are located at the end of this 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 arrow points to the exact point the test is to be made.

The slide number references under the art is used for service training purposes only.

MX,25015HV,A20 -19-18JAN93

LACK OF DRIVE IN ONE DIRECTION

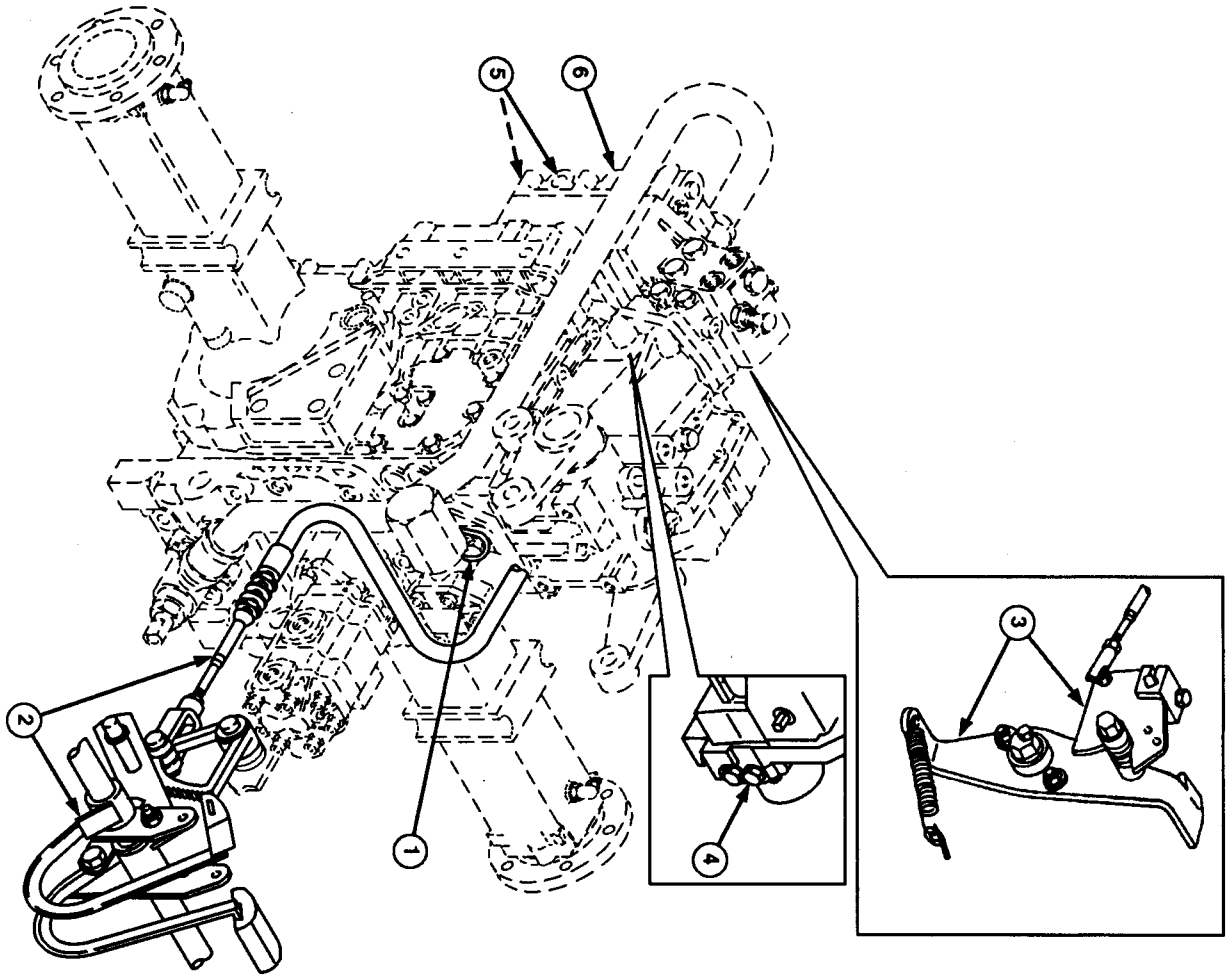
CONDITIONS:
- Transmission in neutral.
- PTO off
- Engine stopped
- Use tests and adjustments in this group.

Test/Check Point	Normal	If Not Normal
1. Transaxle dipstick	Proper oil level and viscosity. No transmission/transaxle leaks.	Add or change hydrostatic oil and filter. Repair any leaks.
2. Travel pedals and cable	Cable moves freely in both directions. No pinching or binding. Linkage is not loose.	Repair or replace travel cable. Adjust transmission neutral and travel pedals.
3. Neutral return linkage	Allows neutral return cam to return to neutral position.	Adjust neutral return spring. Repair or replace linkage. Adjust transmission neutral.
4. Reverse flow (inlet) check valve	Check valve is free of obstruction and any damage to spring, valve, or valve seat.	Repair or replace parts as necessary. See Section 50.
5. Forward or reverse main relief and inlet check valves	Transmission high pressure relief valves within specification. See test procedure in this group.	Inspect for damaged valve seat, valve, or spring. Replace cartridge. See Section 50.
6. Transmission	Charge pump flow within specification.	Repair charge pump. Repair transmission. Inspect for wear and internal leakage. See Section 50.

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M81496AE

LACK OF DRIVE IN ONE DIRECTION



M81496AE -19-21DEC92

Slide M81496AE

MX,25015HV,A22 -19-18JAN93

LACK OF DRIVE IN BOTH DIRECTIONS

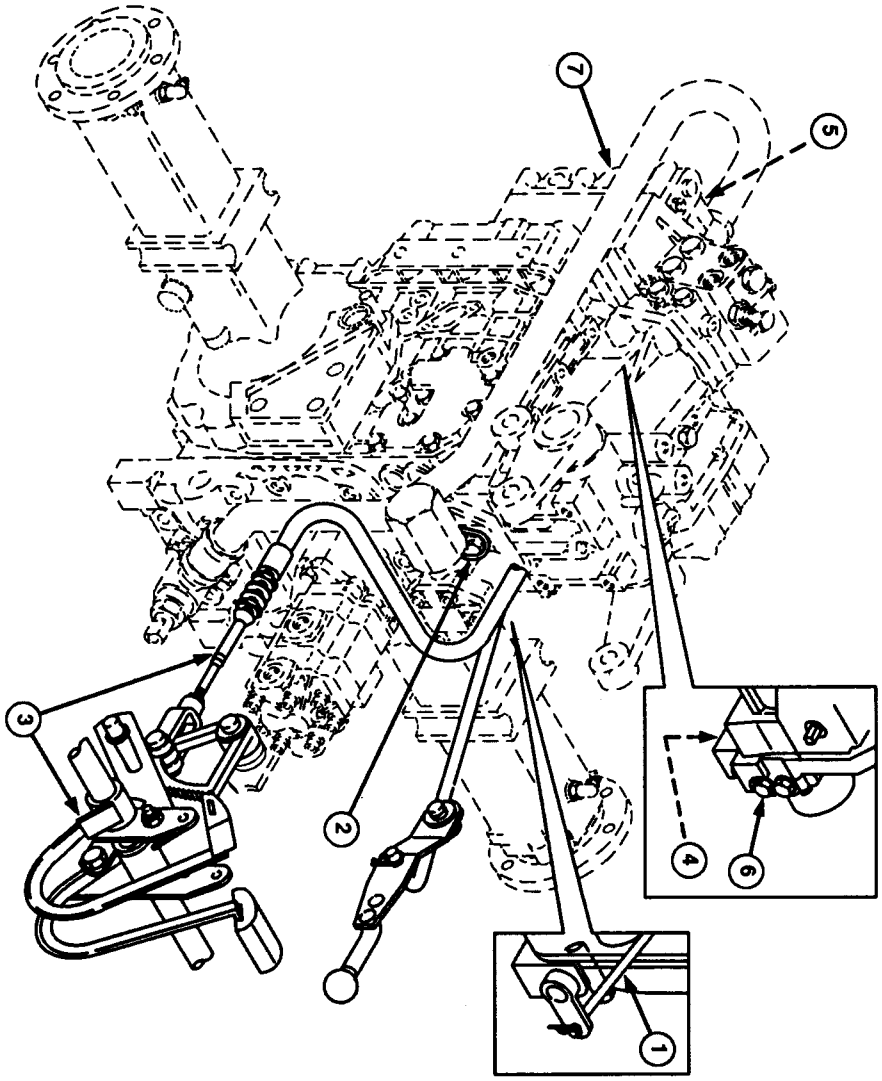
CONDITIONS:
- Transmission in neutral
- PTO off
- Engine stopped
- Use tests and adjustments in this group.

Test/Check Point	Normal	If Not Normal
1. Two-speed shift lever	In fast or slow position.	Move lever into position. Check and adjust linkage.
2. Transaxle dipstick	Proper oil level and viscosity.	Add or change hydrostatic oil and filter.
	No transmission/transaxle leaks.	Repair any leaks.
3. Travel pedals and cable	Cable moves freely in both directions. No pinching or binding.	Repair or replace travel cable.
	Linkage is not loose.	Adjust transmission neutral and travel pedals.
4. Charge pump relief valve	Charge pump relief valve pressure is within specification.	Inspect charge pump relief valve for stuck or damaged condition.
		Adjust charge pressure relief valve. See this group.
		Repair transmission. See Section 50.
5. Charge pump	Charge pump flow is within specification.	Inspect transaxle suction screen and supply line for obstruction or air leaks.
		Repair or replace charge pump. See Section 50.
6. Reverse flow (inlet) check valve	Check valve is free of obstruction and any damage to spring, valve or valve seat.	Repair or replace parts as necessary. See Section 50.
7. Transmission	Internal components free of excessive wear or damage.	Repair transmission. See Section 50.

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LACK OF DRIVE IN BOTH DIRECTIONS



M81497AE -19-04JAN93

Slide M81497AE

MX,25015HV,A24 -19-18JAN93

LOW POWER—WHEELS STALL TOO EASILY

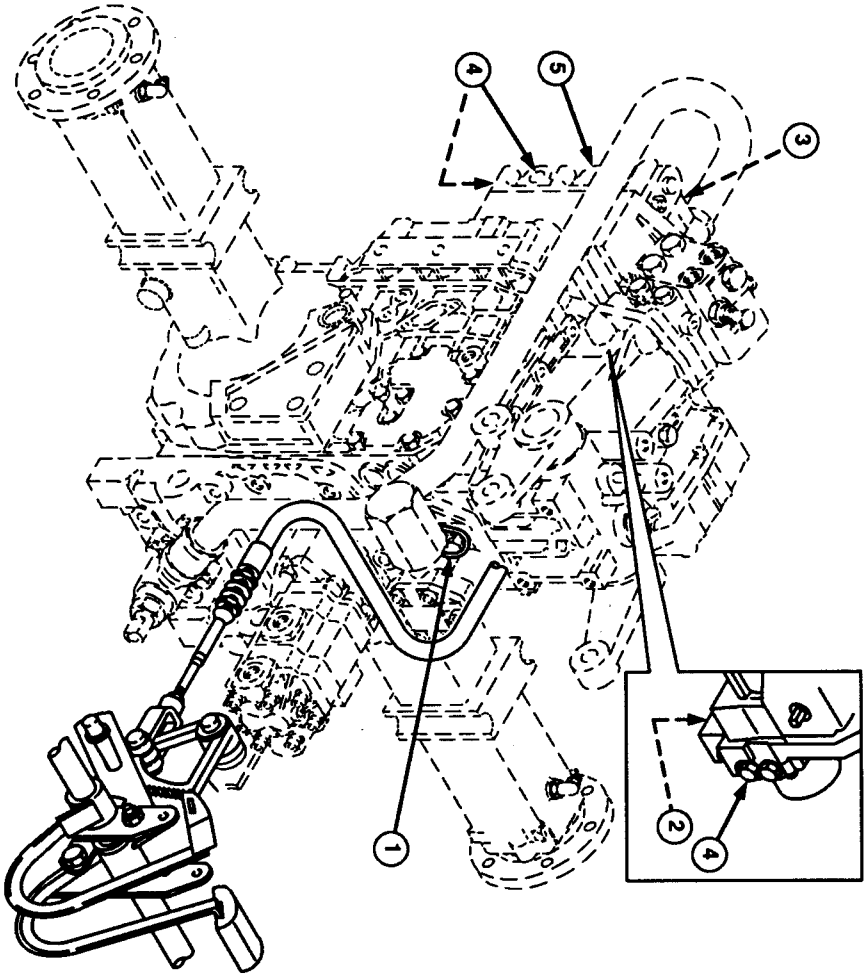
CONDITIONS:
- Transmission in neutral
- PTO off
- Engine stopped
- Use tests and adjustments in this group.

Test/Check Point	Normal	If Not Normal
1. Transaxle dipstick	Proper oil level and viscosity.	Add or change hydrostatic oil and filter.
	No transmission/transaxle leaks.	Repair any leaks.
2. Charge pump relief valve	Charge pump relief valve pressure is within specification.	Inspect charge pump relief valve for stuck or damaged condition. Adjust charge pressure relief valve. See this group. Repair transmission. See Section 50.
3. Charge pump	Charge pump flow is within specification.	Inspect transaxle suction screen and supply line for obstruction or air leaks. Repair or replace charge pump. See Section 50.
4. Forward or reverse main relief and inlet check valves	Transmission high pressure relief valves within specification. See test procedure in this group.	Inspect for damaged valve seat, valve seat, valve or spring. Replace cartridge. See Section 50.
5. Transmission	Internal components free of excessive wear or damage.	Repair transmission. See Section 50.

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M81498AE

LOW POWER – WHEELS STALL TO EASILY



Slide M81498AE

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MX,25015HV,A26 -19-18JAN93

MOWER WILL NOT REACH FULL SPEED

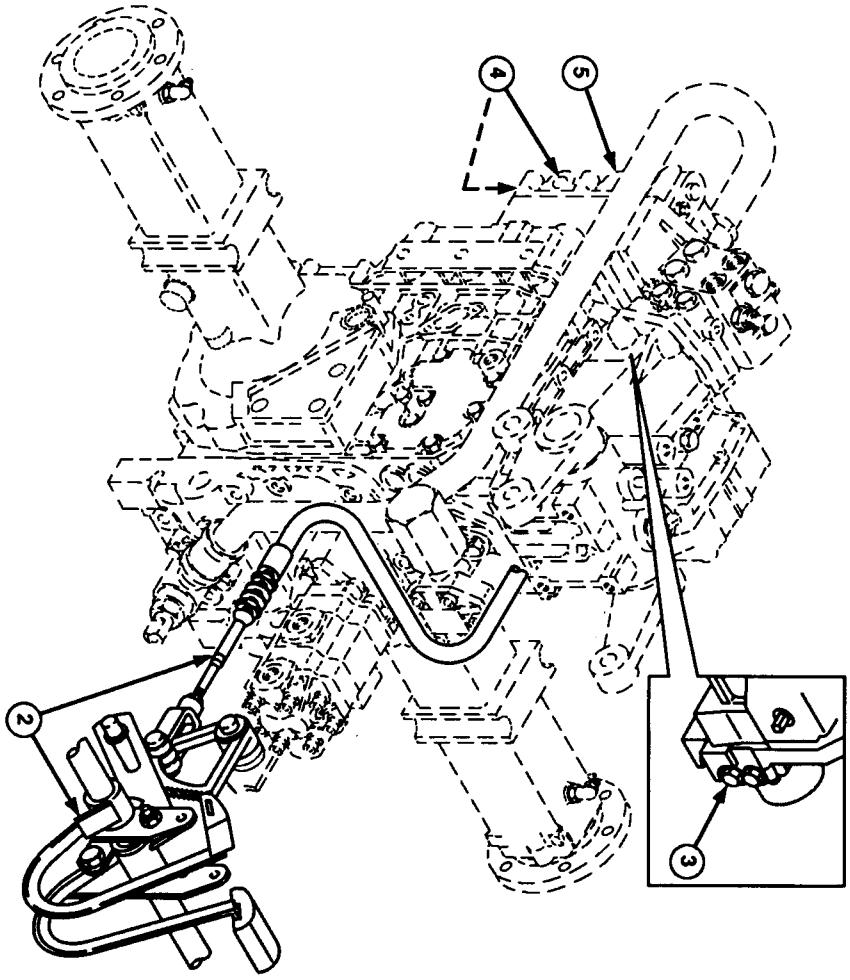
CONDITIONS:
- Transmission in neutral
- PTO off
- Engine stopped
- Use tests and adjustments in Section 220 and this group.

Test/Check Point	Normal	If Not Normal
1. Throttle linkage (not shown)	Engine fast idle speed is within specification.	Inspect throttle linkage for wear or pinched condition. Adjust fast idle speed. See Section 220.
2. Travel pedals and cable	Cable moves freely in both directions. No pinching or binding. Linkage is not loose.	Repair or replace travel cable. Adjust travel pedals. See this group.
3. Reverse flow (inlet) check valve	Check valve is free of obstruction and any damage to spring, valve or valve seat.	Repair or replace parts as necessary. See Section 50.
4. Forward or reverse main relief and inlet check valves.	Transmission high pressure relief valves within specification. See test procedure in this group.	Inspect for damaged valve seat, valve, or spring. Replace cartridge. See Section 50.
5. Transmission	Internal components free of excessive wear or damage.	Repair transmission. See Section 50.

MX,25015HV,A27 -19-18JAN93

M81499AE

MOWER WILL NOT REACH FULL SPEED



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M81499AE -19-21DEC92

MX,25015HV,A28 -19-18JAN93

HYDROSTATIC SYSTEM OPERATING TOO HOT

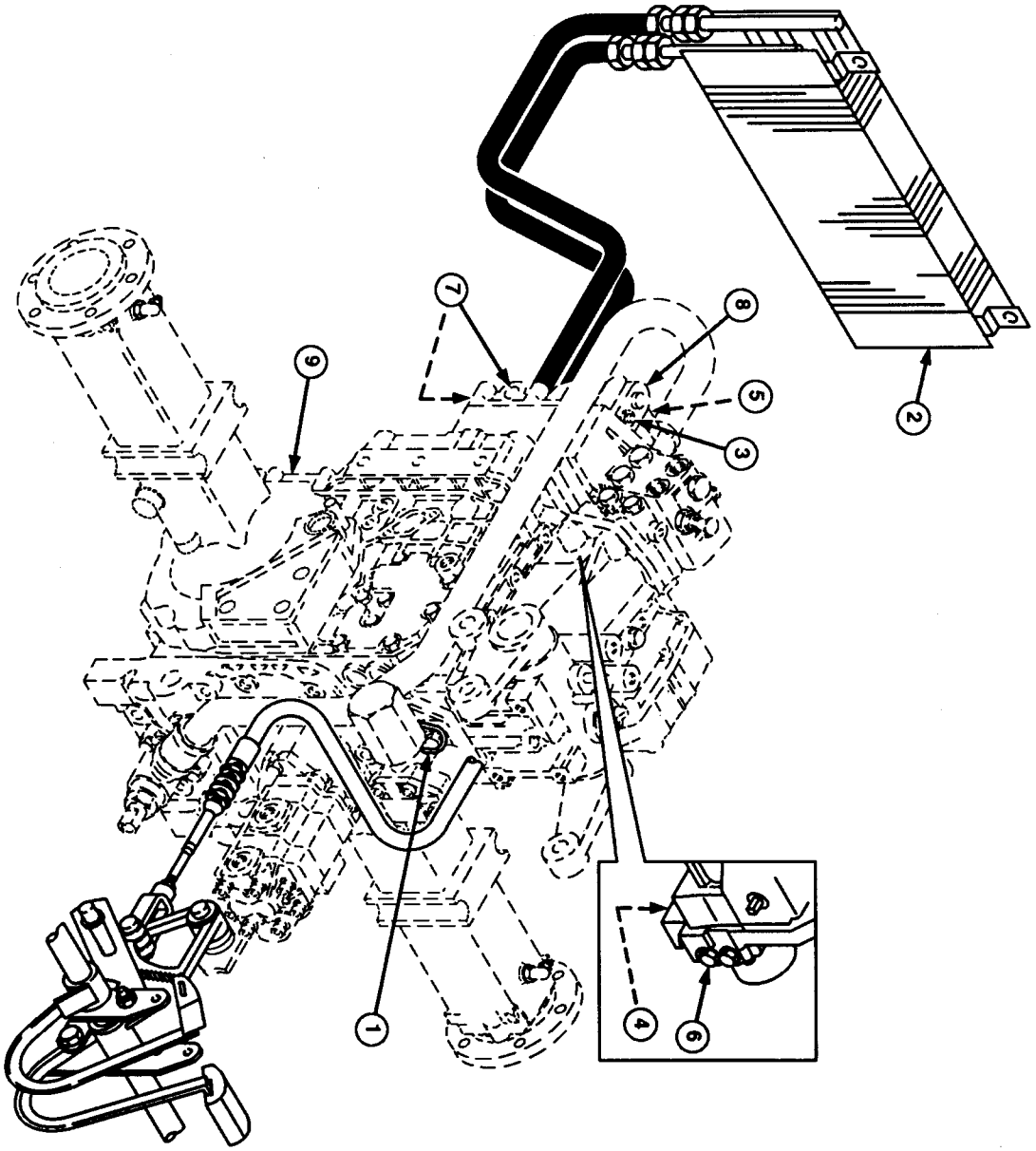
CONDITIONS:
- Transmission in neutral
- PTO off
- Engine stopped
- Use tests and adjustments in this group.

Test/Check Point	Normal	If Not Normal
1. Transaxle dipstick	Proper oil level and viscosity.	Add or change hydrostatic oil and filter.
	No transmission/transaxle leaks	Repair any leaks.
2. Oil cooler	Cooling fins free of dirt and obstructions.	Clean engine hood screen areas, oil coolers and radiator.
	Oil cooler supply and return line not obstructed or pinched.	Repair or replace any damaged lines.
3. Oil cooler by-pass valve	Bypass valve is free of obstruction and any damage to spring, valve, or valve seat.	Repair or replace parts as necessary. See Section 50.
4. Charge pump relief	Charge pump relief valve pressure is within specification.	Inspect charge pump relief valve for stuck or damaged condition.
		Adjust charge pressure relief valve. See this group.
		Repair transmission. See Section 50.
5. Charge pump	Charge pump flow is within specification.	Inspect transaxle suction screen and supply line for obstruction or air leaks.
		Repair or replace charge pump. See Section 50.
6. Reverse flow (inlet) check valve	Check valve is free of obstruction and any damage to spring, valve and valve seat.	Repair or replace parts as necessary. See Section 50.
7. Forward or reverse main relief and inlet check valves.	Transmission high pressure relief valves within specification. See test procedure in this group.	Inspect for damaged valve seat, valve or spring.
		Replace cartridge. See Section 50.
8. Transmission	Internal components free of extensive wear or damage.	Repair transmission. See Section 50.
9. Transaxle	Normal parts wear, no binding of shafts or gear mismatch.	Repair transaxle. See Section 50.
	Brake pads do not drag.	Repair or adjust brakes. See Section 60.

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M81520AE

HYDROSTATIC SYSTEM OPERATING TOO HOT



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Slide M81520AE

MX,25015HV,A30 -19-18JAN93

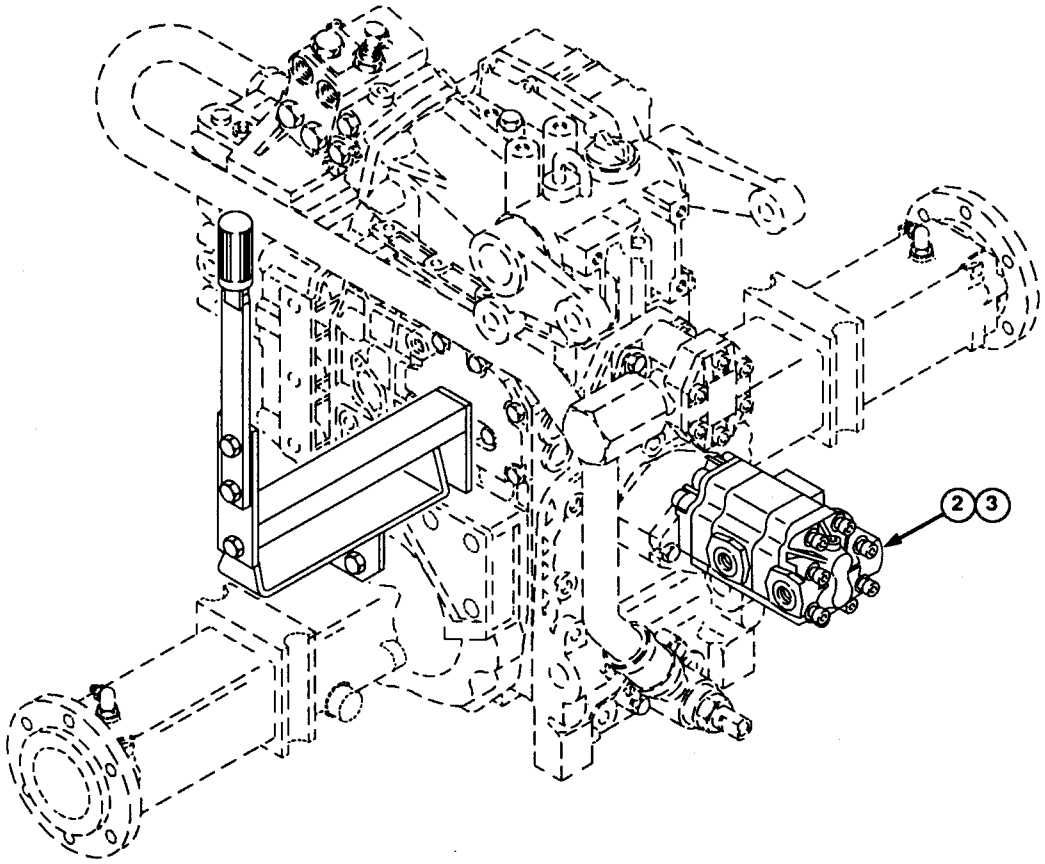
PTO SYSTEM DIAGNOSIS

NOTE: PTO clutch engages and disengages the hydraulic pump for the cutting unit motors.

CONDITIONS:
- Two-speed control lever in neutral position
- Park brake engaged
- PTO lever in off position.
- Engine operating at approximately half throttle.
- Lower cutting units to the ground.

Test/Check Point	Normal	If Not Normal
1. Cutting units (not shown)	Hydraulic motors must not rotate.	Check PTO clutch engagement pressure. See procedure in this group.
CONDITIONS: •Engage PTO lever		
2. Cutting units/two-stage pump	PTO must engage pump with smooth, modulated engagement. Hydraulic motors must rotate.	Adjust PTO lever. Check electrical system to make sure solenoid valves are operating properly. Check PTO clutch engagement pressure. Inspect and repair PTO clutch and lubrication components. Refer to Section 50.
CONDITIONS: •Disengage PTO lever		
3. Cutting units/two-stage pump	Hydraulic motors must stop rotating.	Check PTO clutch engagement pressure. Inspect clutch spring and piston. See Section 50.

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M81521AE

PTO SYSTEM DIAGNOSIS

Slide M81521AE

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DIAGNOSTIC INFORMATION

The diagnostic information in this group is used to test components related to a specific problem or system. Select a symptom from the list and follow the test procedures under the heading. The symptom headings are:

- Hydraulic lift system does not operate and no power steering
- Hydraulic lift system does not operate, power steering operates or is slow.
- Low or slow hydraulic lift power
- Hydraulic lift system operates erratically
- Excessive transaxle pump noise
- Hydrostatic oil foams
- Hydrostatic oil overheats
- Cutting units lift lever sticks or is difficult to move.
- Front and center cutting units will not raise
- Wing cutting units will not raise
- Wing cutting units lower with cutting units lever in raised, position.
- Excessive hydraulic pump noise
- Hydraulic oil foams
- Hydraulic oil overheats
- Cutting units do not turn or turn slow
- One or more cutting units turning backwards
- Oil leaking from cutting unit motor
- Frequent failure of hydraulic lines and O-rings.

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 this 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 arrow points to the exact point the test is to be made.

The slide number reference under the art is used for service training purposes only to match a specific piece of technical manual art to the same slide.

MX,27015HV,A1 -19-18JAN93

CHARGE PUMP RELIEF VALVE PRESSURE TEST

REASON:
To determine if charge pump relief pressure meets specifications.

EQUIPMENT:
- JTO5488 Fitting 7/16-20 M 37˚ x 7/16-20 MORB
- JTO3017 Hose
- JTO3344 2000 kPa (300 psi) Gauge

CONNECTIONS:
1. Warm oil to 43˚C (110˚F). (See procedure in Section 270, Group 15).

2. Stop engine. Lift and lock fuel tank.

CAUTION: To avoid injury from escaping hydraulic oil, relieve system pressure by stopping the engine and operating all hydraulic control valves.

3. Remove hex plug from charge relief port (D). Install test fitting.

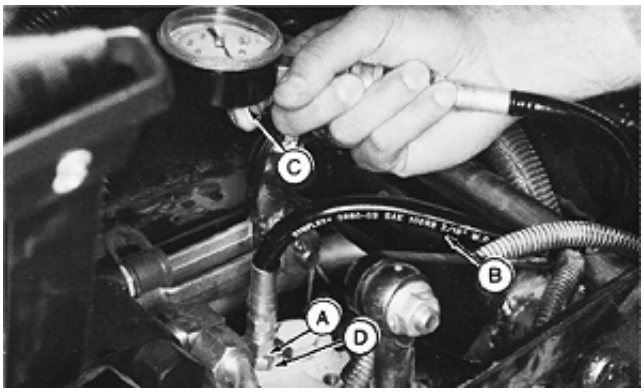
4. Assemble gauge and hose, then connect to test fitting.

PROCEDURE:
1. Start engine and run at 2800 rpm.

2. Observe pressure reading on gauge.

SPECIFICATIONS:
- Charge pump relief valve pressure .. 690—1241 kPa (6.9—12.4 bar) (100—180 psi)

RESULTS:
- If pressure reading is not within specifications, check charge pump flow and condition of relief valve. If pump flow and relief valve condition are OK, adjust relief valve. (See procedure in this group.)



M81360 -UN-03NOV92

Slide M81360

A—Connector
B—Hose
C—Gauge
D—Charge Relief Port

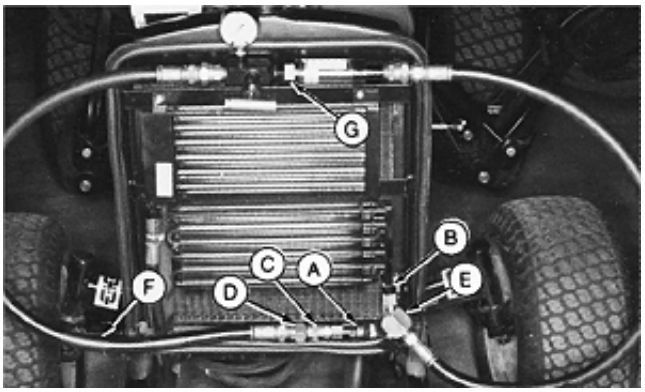
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MX,25015HV,A1 -19-18JAN93

CHARGE PUMP FLOW TEST

REASON:
To determine if charge pump can supply adequate flow.

EQUIPMENT:
- JTO3367 Fitting 1/2 M NPT x 13/16 M ORFS
- JTO3369 Fitting 3/4 F NPT x 1/2 F NPT
- JTO3368 45˚ Elbow Adapter 3/4 F NPT x 13/16 F ORFS
- JTO5531 Hose (2 used)
- STD 12 Flowmeter



Slide M81363

A—Line
B—Cooler Inlet
C—JTO3367 Fitting
D—JTO3369 Fitting
E—JTO3368 45˚ Elbow Adapter
F—JTO5531 Hose (2 used)
G—STD 12 Flowmeter

CONNECTIONS:

250
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CAUTION: Engine hood is heavy. Use lifting equipment during hood removal to prevent personal injury and machine damage.

1. Remove engine hood.

2. Warm hydraulic oil to 43˚C (110˚F). (See procedure in Section 270, Group 15.)

CAUTION: To avoid injury from escaping hydraulic oil, relieve system pressure by stopping the engine and operating all hydraulic control valves.

3. Disconnect line (A) from oil cooler inlet (B).

4. Connect JTO5531 hoses to flowmeter.

5. Connect JTO3367 and JTO3369 fittings (C and D) to hose on flowmeter inlet side. Connect JTO3368 elbow adapter (D) to hose on flowmeter outlet side.

6. Connect flowmeter inlet hose and fittings to oil cooler. Connect flowmeter outlet hose and adapter to disconnected line.

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CHARGE PUMP FLOW TEST—CONTINUED

PROCEDURE:

IMPORTANT: Tester control valve MUST be open before starting engine otherwise damage may occur to hydraulic components.

1. Open flowmeter valve fully.

2. Start engine and run at 2800 rpm.

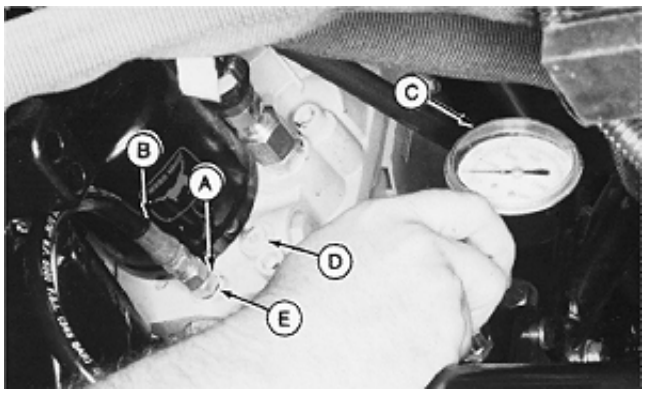
3. Record flowmeter reading.

SPECIFICATIONS:
• Charge pump flow .. 11.4 L/min (3.3 gpm) minimum

RESULTS:
• If flow is less than specification, inspect charge pump for wear or damage. Also check for internal transmission leakage, wear or damage.

MX,25015HV,A3A -19-18JAN93

TRANSMISSION HIGH PRESSURE RELIEF VALVES TEST



A—JTO5488 Fitting
B—JTO3364 Hose
C—JTO3362 Gauge
D—Forward Pressure Test Port
E—Reverse Pressure Test Port

Slide M81364

250
15
18

REASON:
To determine if transmission high-pressure relief valves are operating properly.

EQUIPMENT:
- JTO5488 Fitting 7/16-20 M 37˚ x 7/16-20 M ORB
- JTO3364 Hose
- JTO3362 Gauge 70000 kPa (700 bar) (10000 psi)

CONNECTIONS:
1.Warm hydraulic oil to 43˚C (110˚F). (See procedure in Section 270, Group 15.)

N **CAUTION: To avoid injury from escaping hydraulic oil, relieve system pressure by stopping the engine and operating all hydraulic control valves.**

2. Remove hex plug from forward pressure test port (D). Install JTO5488 fitting in port.

3. Assemble gauge and hose, then connect to fitting.

PROCEDURE:
1. Move two-speed axle lever to fast position. Apply brake pedal.

N **CAUTION: Mower may move slightly during test.**

2. Start engine and run at 2800 rpm. Apply slight pressure to forward travel pedal.

3. Record pressure reading. Shut off engine.

4. Remove gauge and fittings. Install plug.

5. Remove plug from reverse pressure test port (E). Install gauge and fittings.

6. Start engine and run at 2800 rpm. Apply slight pressure to reverse travel pedal.

7. Record pressure reading. Shut off engine.

SPECIFICATIONS:
- Forward and reverse relief valve pressure .. 41370—
  44817 kPa (413—448 bar) (6000—6500 psi) for both
  forward and reverse relief valves

RESULTS:
- If pressure reads low when applying either travel pedal, inspect the applicable relief valve for wear or damage. Also check transmission for internal leakage or damage.

MX,25015HV,A4 -19-18JAN93

PTO CLUTCH LUBE PRESSURE TEST

REASON:
To make sure proper lubrication and cooling oil flow is available.

EQUIPMENT:
- JT05486 Adapter
- JT03017 Hose
- JT03363 200 kPa (2 bar) (30 psi) Gauge

CONNECTIONS:
1. Remove 1/4 in. pipe plug on left side of transaxle.

2. Install JT05486 Adapter (A), JT03017 Hose (B) and JT03363 Gauge (C).

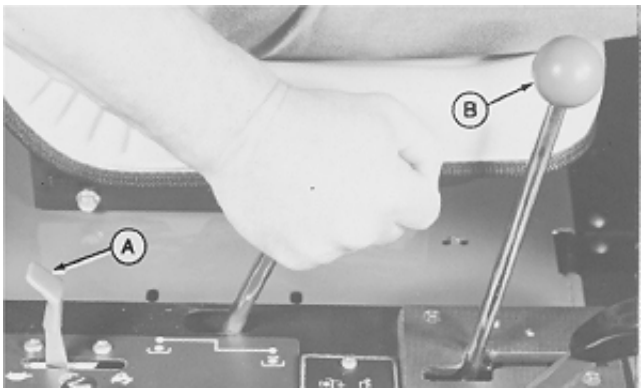
PROCEDURE:
1. Warm hydraulic oil. See procedure in this group.

2. Operate engine at fast idle.

3. Observe pressure gauge.

SPECIFICATIONS:
Engine speed .. 2800 rpm
Lube Pressure .. 21—41 kPa (0.2—0.4 bar) (3—6 psi)

RESULTS:
- If pressure is low, inspect lube relief valve, and PTO clutch components for wear or damage. Replace parts as necessary.
- If components look good inspect transaxle pump, flow control valve and steering valve.



Slide M35835

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19

MX,25015HV,A4D -19-18JAN93

PTO CLUTCH ENGAGEMENT PRESSURE TEST

REASON:
To ensure enough oil pressure is available to engage PTO clutch.

EQUIPMENT:
- JT03365 45° Elbow Fitting
- JT03017 Hose
- JT03344 2000 kPa (20 bar) (300 psi) Gauge

CONNECTIONS:
1. Remove 1/4 in. pipe plug from front of transaxle.

2. Install JT03365 Fitting (A), JT03017 Hose (B) and JT03344 Gauge (C).

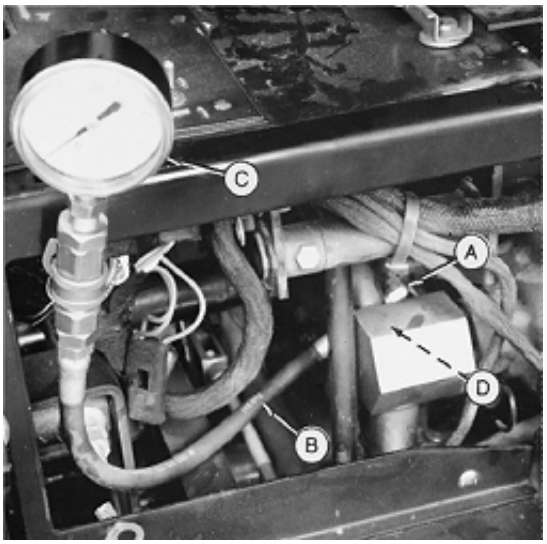
PROCEDURE:
1. Warm hydraulic oil. See procedure in this group.

2. Operator engine at fast idle.

3. Observe pressure gauge.

SPECIFICATIONS:
Engine Speed .. 2800 rpm
Clutch Engagement Pressure .. 827 kPa (8.3 bar) (120 psi)

RESULTS:
- If clutch pressure is low, remove delay relief valve (D) and shims under valve springs. Refer to Section 50.
- If pressure is still low, check transaxle pump, flow control valve and steering valve.



Slide E35854

MX,25015HV,A4E -19-18JAN93

TRANSMISSION NEUTRAL ADJUSTMENT—SERIAL NO. —840000

REASON:
To eliminate any forward or reverse creep when in neutral position.

EQUIPMENT:
- Hoist
- Jackstands (2)

PROCEDURE:
1. Lift machine until drive wheels are off the ground. Install jackstands under axle housings.

2. Disengage park brake and put seat switch in OVERRIDE position.

3. Move two-speed axle control lever to fast speed position.

CAUTION: Use extreme caution doing transmission neutral adjustment. Drive wheels, will turn.

4. Start engine and operate at half throttle.

5. Turn nuts (A) to adjust cable length between cable mounting slot and transmission cam. Adjust length until drive wheels stop turning.

6. Tighten nuts (A).

7. Put two-speed lever in neutral. Depress both forward and reverse speed pedals, then release.

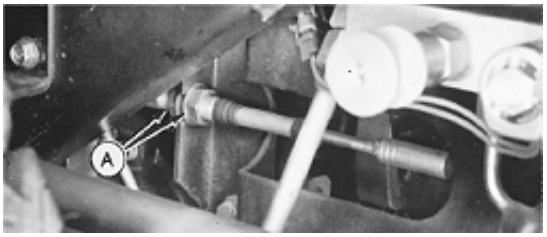
8. Again put transaxle in fast speed. Check drive wheels for movement. Repeat steps 5—8 as necessary.

9. Stop engine and lower machine to the ground.

RESULTS:
- If drive wheels continue to turn, check for worn or binding return-to-neutral linkage or too light of tension on neutral return spring. Check neutral return adjustment.



Slide E35886



Slide E35887

250
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21

MX,25015HV,A4A -19-18JAN93

TRANSMISSION NEUTRAL ADJUSTMENT—SERIAL NO. 840001—

REASON:
To eliminate any forward or reverse creep when in neutral position.

EQUIPMENT:
- Hoist
- Jackstands (2)

PROCEDURE:
1. Lift machine until drive wheels are off the ground. Install jackstands under axle housings.

2. Disengage park brake and put seat switch in OVERRIDE position.

250
15
22

3. Move two-speed axle control lever to fast speed position.

CAUTION: Use extreme caution doing transmission neutral adjustment. Drive wheels, will turn.

4. Start engine and operate at half throttle.

5. Loosen locking cap screw (B).

6. Turn eccentric nut (C) forward and backward until drive wheels stop turning. Turning eccentric nut will move transmission cam (A).

NOTE: Eccentric nut must be positioned rearward with respect to locking cap screw for correct adjustment.

7. Hold adjustment and tighten locking cap screw (B). Make sure adjustment did not change.

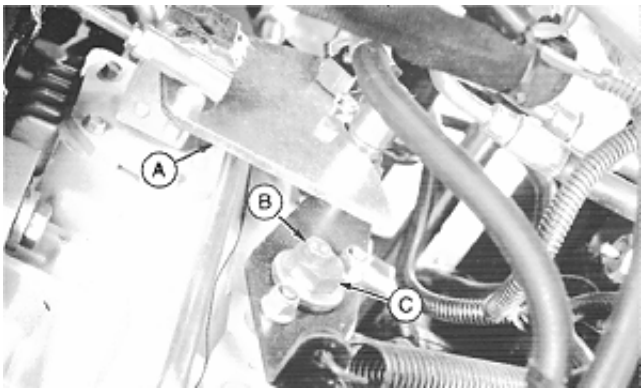
8. Put two-speed lever in neutral. Depress both forward and reverse speed pedals, then release.

9. Again put transaxle in fast speed. Check drive wheels for movement. Repeat steps 5—9 as necessary.

10. Stop engine and lower machine to the ground.

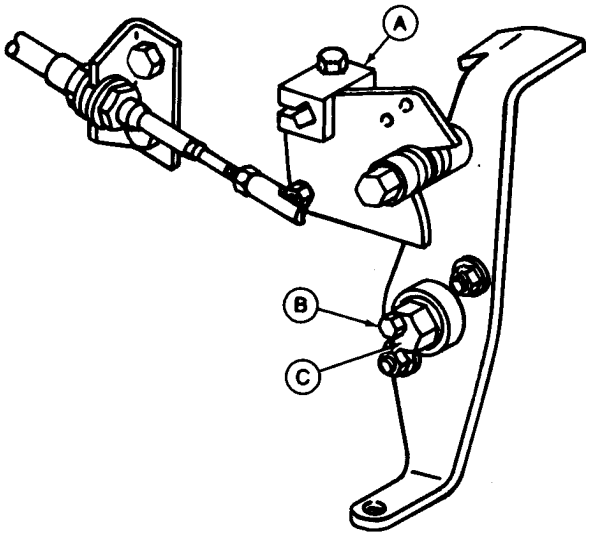
11. Check forward and reverse pedals for adjustment. (See procedure in this group.)

RESULTS:
- If drive wheels continue to turn, check for worn or binding return-to-neutral linkage or too light of tension on neutral return spring. Check neutral return adjustment.



M81302 -UN-19NOV92

Slide M81302



M81303 -UN-19NOV92

Slide M81303

MX,25015HV,A4B -19-18JAN93

TRANSMISSION NEUTRAL RETURN ADJUSTMENT

REASON:
To assure that the transmission always returns to neutral at the desired rate when the pedals are released.

PROCEDURE:

NOTE: The return spring length is only an initial setting. The length may vary according to operator's preference.

Neutral return linkage shown removed for clarity of photograph.

1. With travel pedals in neutral position, check length of return spring (A).

2. Loosen or tighten nuts (B) to adjust spring length.

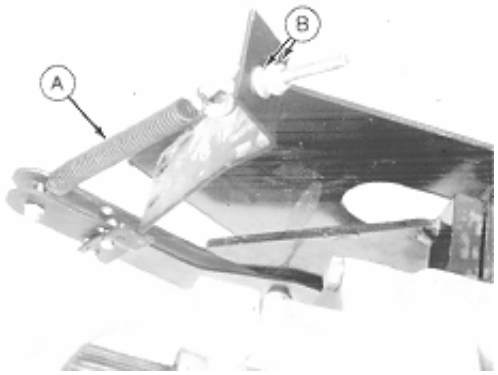
3. Put two-speed axle lever in fast speed position.

4. Start engine and operate at fast idle. Check stopping distance of mower:
- Depress forward travel pedal fully.
- Release pedal.
- Note distance traveled after releasing travel pedal.

SPECIFICATIONS:
- Return spring initial length
  3325 .. 133 mm (5-1/4 in.)
  3365 .. 203 mm (8 in.)

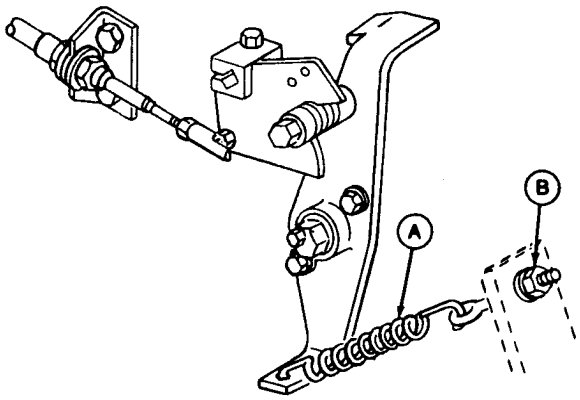
- Stopping distance at fast idle and fast speed .. 10.7 m (35 ft)

RESULTS:
- Transmission must return to neutral when travel pedals are released. Time required to return to neutral is adjusted to operator's preference.



M81490 -UN-30NOV92

Serial No. —840000



M81491 -UN-07JAN93

Serial No. 840001—

250
15
23

MX,25015HV,A4C -19-18JAN93

INSPECT AND ADJUST CHARGE RELIEF VALVE

REASON:
To check condition and adjustment of charge relief valve.

PROCEDURE:
1. Turn off engine.

2. Remove relief valve plug (A) from transmission.

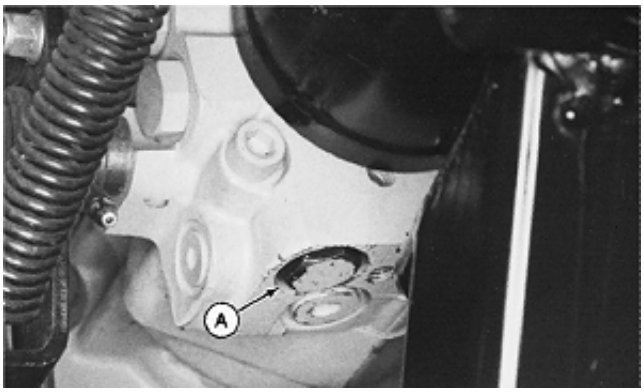
3. Inspect relief valve (D) and spring (C) for wear or damage. Replace as necessary.

NOTE: One 0.64 mm (0.025 in.) shim changes charge pump pressure by approximately 7 kPa (1 psi).

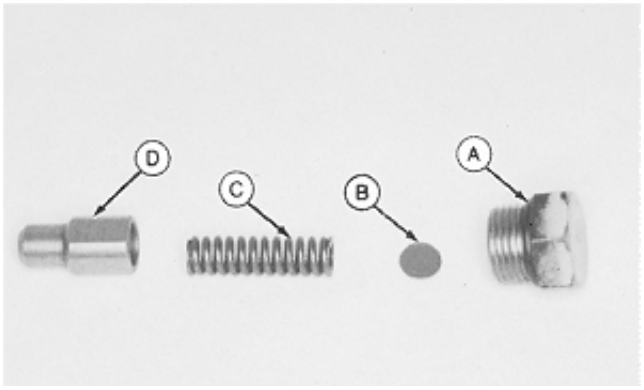
4. If relief valve is not damaged, add or remove shims (B) as necessary to adjust relief valve. Add shims to raise pressure; remove shims to lower pressure.

5. Install relief valve, spring and plug. Check charge relief valve pressure. (See procedure in this group.)

A—Relief Valve Plug
B—Shim
C—Spring
D—Relief Valve



Slide M81361



Slide M81362

MX,25015HV,A2 -19-18JAN93

DIFFERENTIAL LOCK PEDAL ADJUSTMENT

REASON:
To ensure proper engagement of differential lock.

PROCEDURE:
1. Start engine and operate at slow idle.

CAUTION: Mower may move slightly during test.

2. Apply slight pressure to forward travel pedal.

3. Apply differential lock pedal and hold. While holding, stop engine.

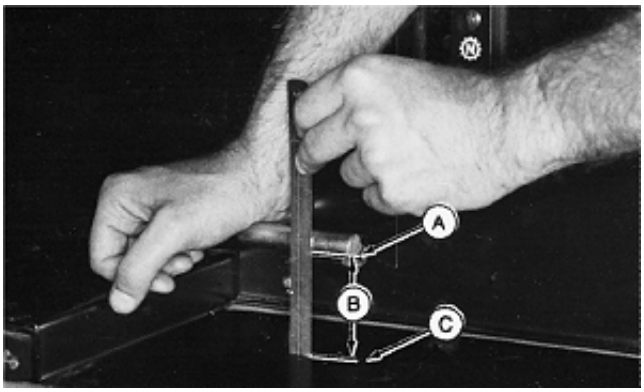
4. Check clearance (B) between bottom of pedal (A) and foot rest (C).

5. Adjust clearance as necessary by turning adjusting yoke (D).

6. Check to make sure differential lock engages. (See procedure in Section 210, Group 05.)

SPECIFICATIONS:
- 50—60 mm (2.0—2.4 in.)

RESULTS:
- If differential lock fails to engage after adjustment, repair differential lock assembly inside transaxle.



Slide M81365



Slide M81366

A—Differential Lock Pedal
B—Pedal Clearance
C—Foot Rest
D—Adjusting Yoke

MX,25015HV,A5 -19-18JAN93

PTO LEVER ADJUSTMENT

REASON:
To ensure proper engagement of PTO and hydraulic pump.

PROCEDURE:

CAUTION: Avoid injury from rotating blades. Keep hands and feet away while machine is running.

With PTO engaged, hydraulic pump will start and cutting reels will turn when lowered into mow position.

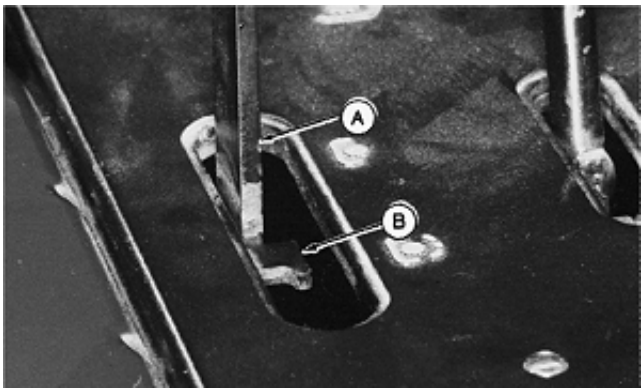
1. Engage park brake.

2. Move PTO lever (A) rearward to OFF position.

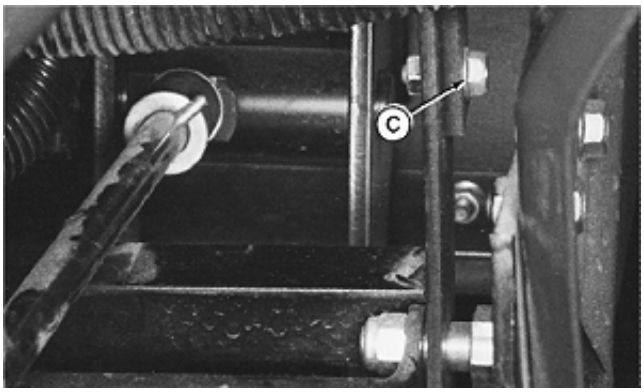
3. Start engine and operate at slow idle.

4. Move PTO lever forward to ON position. Listen for engagement of hydraulic pump. Also check travel of PTO lever. Hydraulic pump should engage as lever moves past ear (B) in PTO lever slot.

5. If adjustment is necessary, loosen lower cap screw (C) and adjust lever as needed. Tighten cap screw securely.



Slide M81367



Slide M81368

A—PTO Lever
B—Ear
C—Lower Cap Screw

MX,25015HV,A6 -19-18JAN93

PTO LEVER INTERLOCK ADJUSTMENT (S.N. —840000)

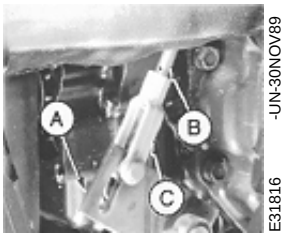
REASON:
To ensure proper engagement of PTO interlock.

NOTE: Linkage is located at the lower right corner of the transaxle.

PROCEDURE:
1. Move PTO lever to OFF position.

2. Remove pin from yoke (C). Pull PTO lever arm (A) and PTO rod (B) forward. Turn yoke until its hole aligns with top of slot in lever arm.

3. Install pin through yoke and arm.



Slide E31816

A—PTO Lever Arm
B—PTO Rod
C—Yoke

MX,25015HV,A7 -19-18JAN93

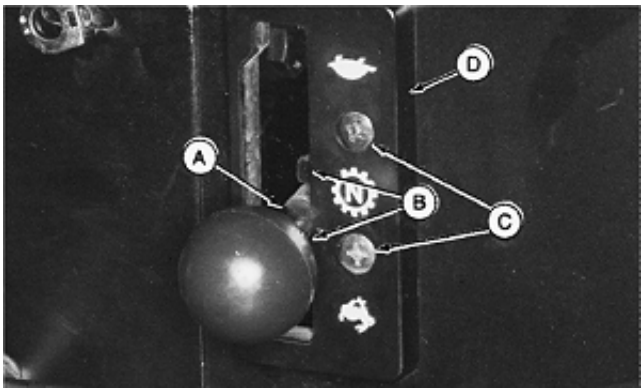
TWO-SPEED TRANSAXLE LEVER ADJUSTMENT

REASON:
To ensure proper engagement of two-speed transaxle.

PROCEDURE:
1. Move lever (A) to N (neutral) position. Lever should be between tangs (B) on two-speed transaxle quadrant (D).

2. If adjustment is needed, loosen screws (C). Move quadrant until lever is between tangs. Tighten screws.

RESULTS:
- If adjustment is correct and transaxle fails to engage, repair transaxle assembly. (See Section 50, Group 10).



M81369 -UN-03NOV92

Slide M81369

A—Lever
B—Tangs
C—Screws
D—Quadrant

MX,25015HV,A8 -19-18JAN93

CRUISE CONTROL LOCK ADJUSTMENT

REASON:
To make sure cruise control linkage is properly adjusted.

PROCEDURE:

NOTE: Before making adjustment, inspect linkage for wear or damage. Make repairs as necessary. (See Section 50, Group 20.)

1. Disengage service/park brake.

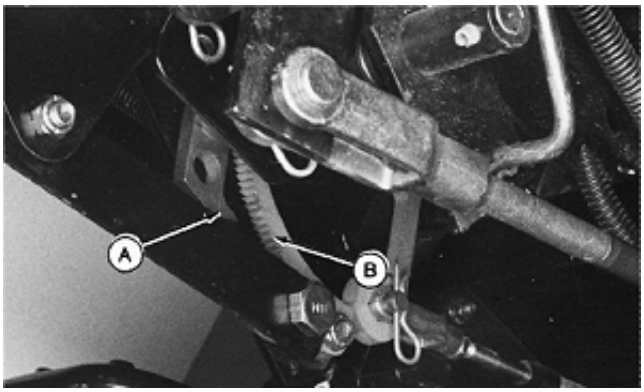
2. Engage cruise control lever.

3. Apply brake pedal 25—58 mm (1.0-2.3 in.). Pawl (A) must disengage from ratchet (B). If pawl doesn't disengage, adjustment is needed.

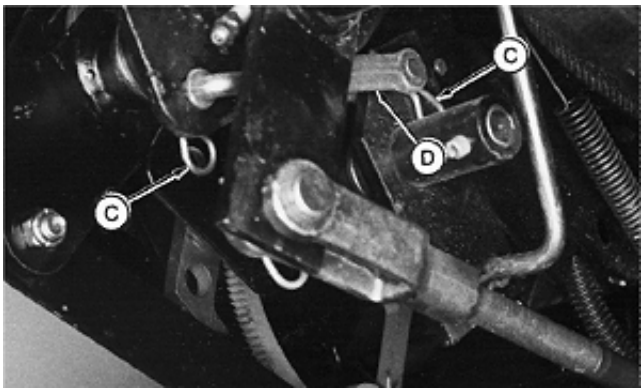
4. Remove pins (C). Adjust turnbuckle (D) until proper adjustment is achieved.

5. Check cruise control operation to make sure pawl engages and disengages properly.

A—Pawl
B—Ratchet
C—Pins
D—Turnbuckle



Slide M81370



Slide M81371

MX,25015HV,A9 -19-18JAN93

FORWARD AND REVERSE TRAVEL PEDAL ADJUSTMENT

REASON:
To ensure travel pedal range of motion is within the specified range.

PROCEDURE:
1. Disengage service/park brake. Release both travel pedals.

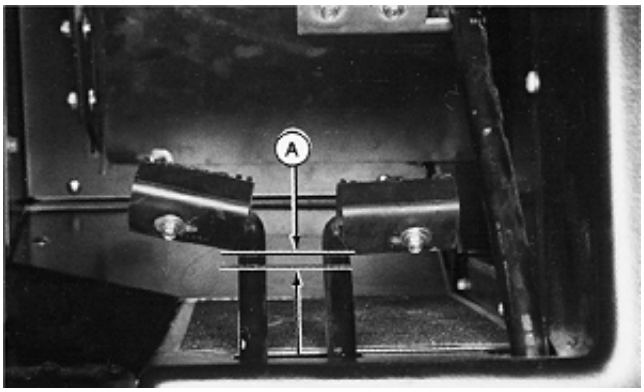
2. Measure height of travel pedals. Pedals should be about the same height, with no more than 15 mm (3/4 in.) difference.

3. If height difference (A) is greater than specifications, adjustment is necessary.

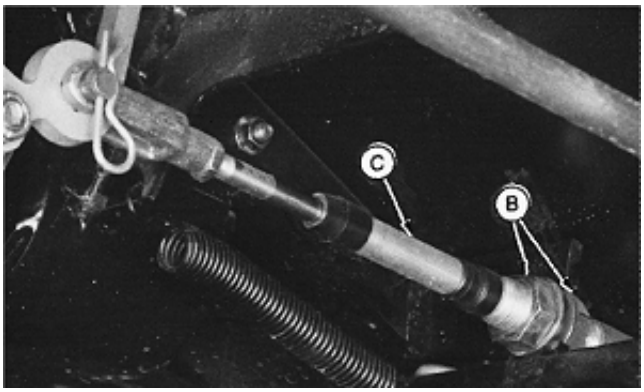
4. Loosen lock nuts (B). Move cable sleeve (C) back and forth by turning nuts until proper pedal height is obtained.

5. Tighten lock nuts.

A—Height Difference
B—Lock Nuts
C—Cable Sleeve



Slide M81372

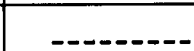
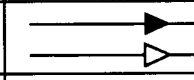
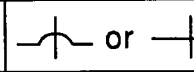


Slide M81374

MX,25015HV,A10 -19-18JAN93

HYDRAULIC CIRCUIT SYMBOLS

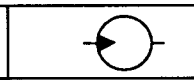
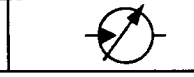
LINES

1		WORKING (MAIN) LINES
2		PILOT CONTROL LINES
3		DRAIN LINE
4		HYDRAULIC / PNEUMATIC } FLOW DIRECTION
5		CROSSING LINES
6		JOINING LINES
7		FLEXIBLE LINE

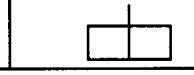
PUMPS

8		FIXED DISPLACEMENT
9		VARIABLE DISPLACEMENT

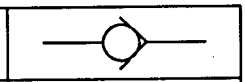
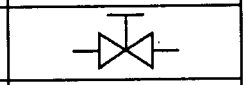
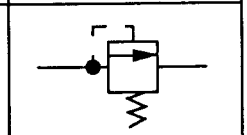
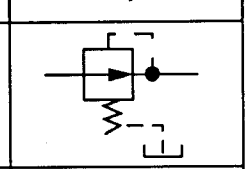
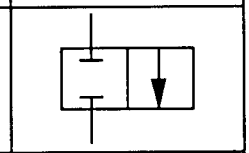
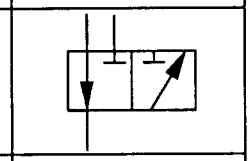
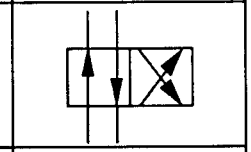
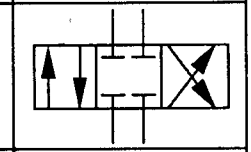
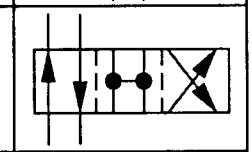
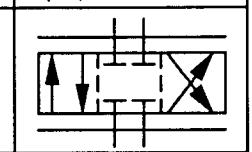
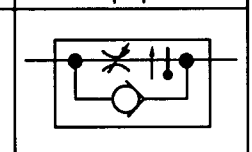
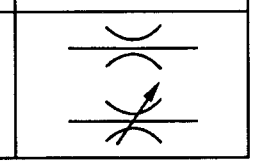
MOTORS

10		FIXED DISPLACEMENT
11		VARIABLE DISPLACEMENT

RESERVOIR

12		VENTED RESERVOIR
13		PRESSURIZED RESERVOIR
14		RESERVOIR RETURN - ABOVE FLUID LEVEL
15		RESERVOIR RETURN - BELOW FLUID LEVEL

VALVES

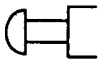
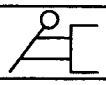
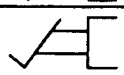
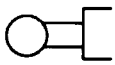
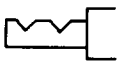
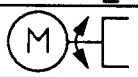
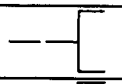
16		CHECK VALVE
17		MANUAL ON/OFF VALVE
19		PRESSURE RELIEF VALVE
20		PRESSURE REDUCTION VALVE
21		TWO POSITION, TWO CONNECTION VALVE
22		TWO POSITION, THREE CONNECTION VALVE
23		TWO POSITION, FOUR CONNECTION VALVE
24		THREE POSITION, FOUR CONNECTION VALVE
25		TWO POSITION, FOUR CONNECTION VALVE WITH TRANSMISSION
26		THREE POSITION, FOUR CONNECTION VALVE WITH INFINITE POSITIONING
27		ADJUSTABLE FLOW CONTROL VALVE (TEMPERATURE AND PRESSURE COMPENSATED)
18		FIXED / VARIABLE } ORIFICE

M81419AE -19-19NOV92

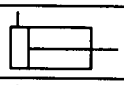
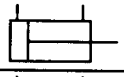
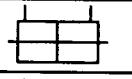
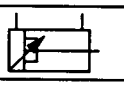
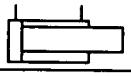
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MX,25020HV,A10 -19-18JAN93

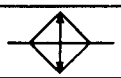
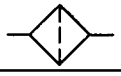
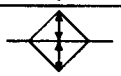
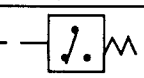
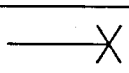
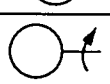
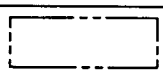
VALVE OPERATORS

28		SPRING
29		MANUAL
30		PUSH BUTTON
31		PUSH/PULL LEVER
32		PEDAL OR TREADLE
33		MECHANICAL
34		DETENTS
35		PRESSURE COMPENSATED
36		SOLENOID-SINGLE WINDING
37		REVERSING MOTOR
38		PILOT PRESSURE -REMOTE SUPPLY
39		PILOT PRESSURE -INTERNAL SUPPLY

CYLINDERS

40		SINGLE ACTING
41		DOUBLE ACTING, SINGLE ROD
42		DOUBLE ACTING, DOUBLE ROD
43		DOUBLE ACTING, ADJ. CUSHION, EXTEND ONLY
44		DOUBLE ACTING, DIFFERENTIAL PISTON

MISCELLANEOUS

45		COOLER
46		FILTER, STRAINER
47		HEATER
48		TEMPERATURE CONTROLLER
49		PRESSURE SWITCH
50		PRESSURE INDICATOR
51		TEMPERATURE INDICATOR
52		PRESSURE COMPENSATED
53		VARIABLE COMPONENT (SYMBOL THRU COMPONENT)
54		PLUG, TEST PORT, PRESSURE SUPPLY TEST
55		GAS CHARGED ACCUMULATOR
56		SPRING LOADED ACCUMULATOR
57		ELECTRIC MOTOR
58		SHAFT ROTATION (ARROW ON NEAR SIDE OF SHAFT)
59		COMPONENT OUTLINE

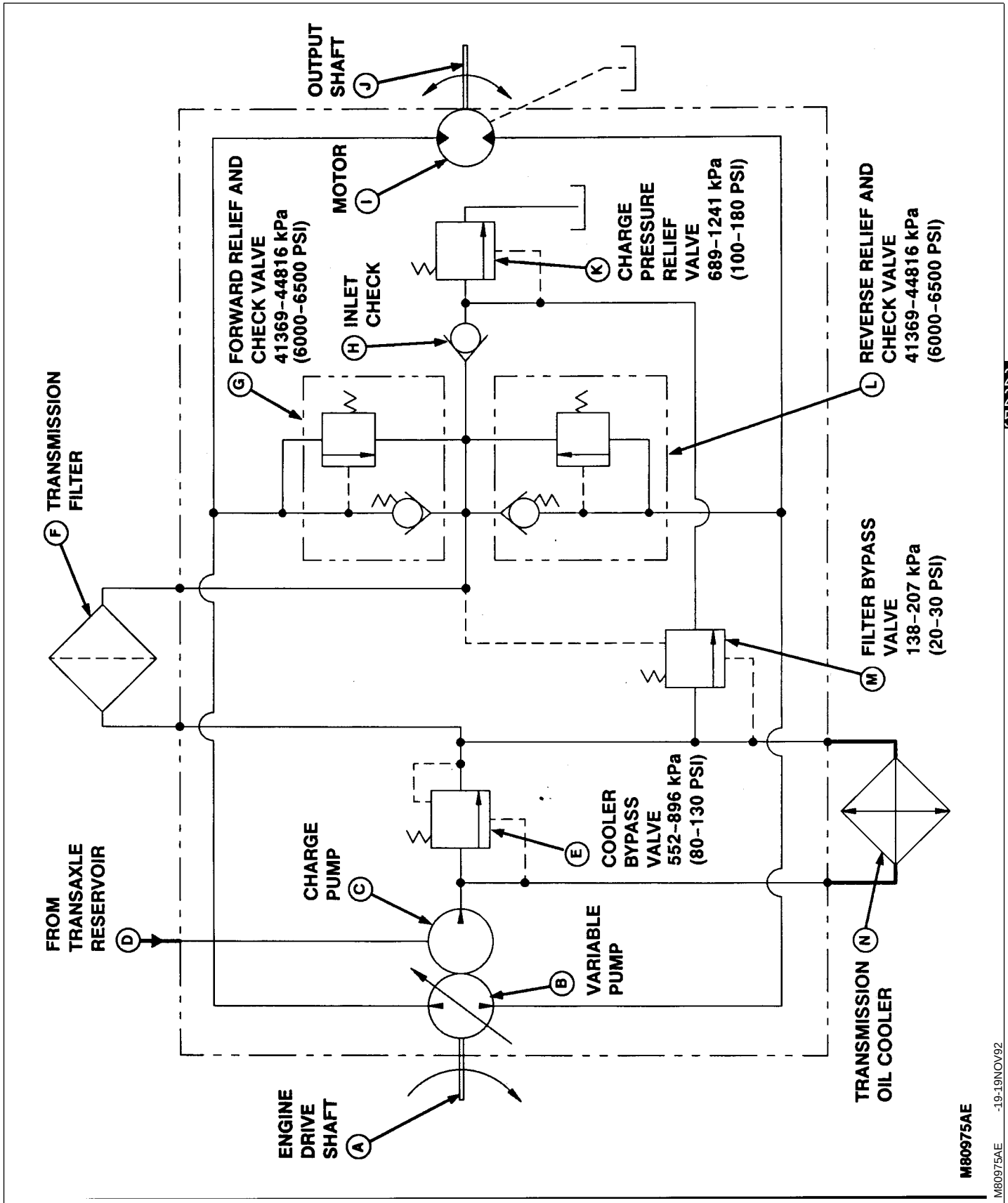
M81440AE -19-19NOV92

MX,25020HV,A11 -19-18JAN93

HYDROSTATIC TRANSMISSION SCHEMATIC

A—Engine Drive Shaft
B—Variable Pump
C—Charge Pump
D—From Transaxle Reservoir
E—Cooler Bypass Valve
F—Transmission Filter
G—Forward Relief and Check Valve
H—Inlet Check
I—Motor
J—Output Shaft
K—Charge Pressure Relief Valve
L—Reverse Relief and Check Valve
M—Filter Bypass Valve
N—Transmission Oil Cooler

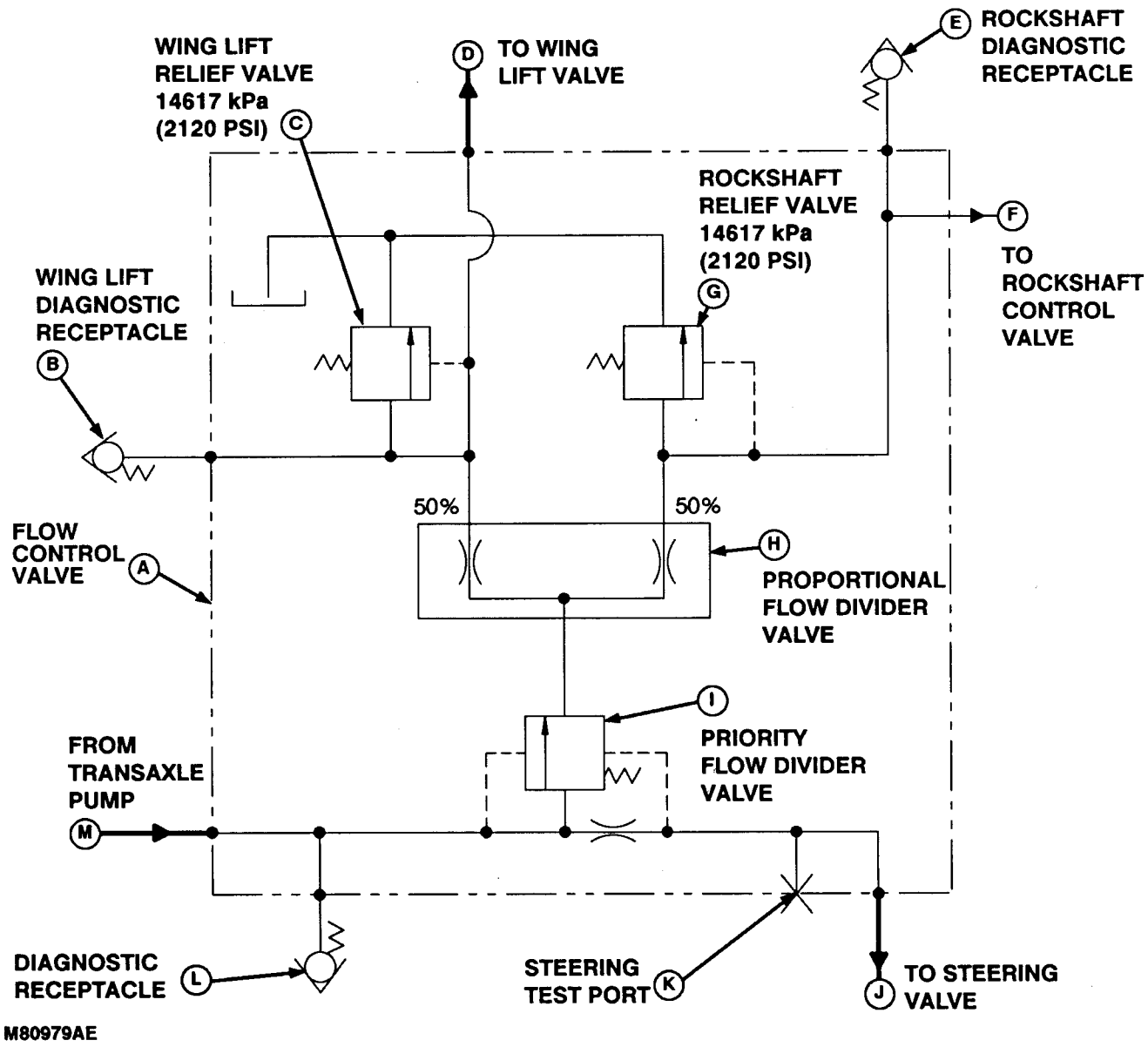
MX,25020HV,A3 -19-18JAN93



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MX,25020HV,A4 -19-18JAN93

FLOW CONTROL VALVE SCHEMATIC

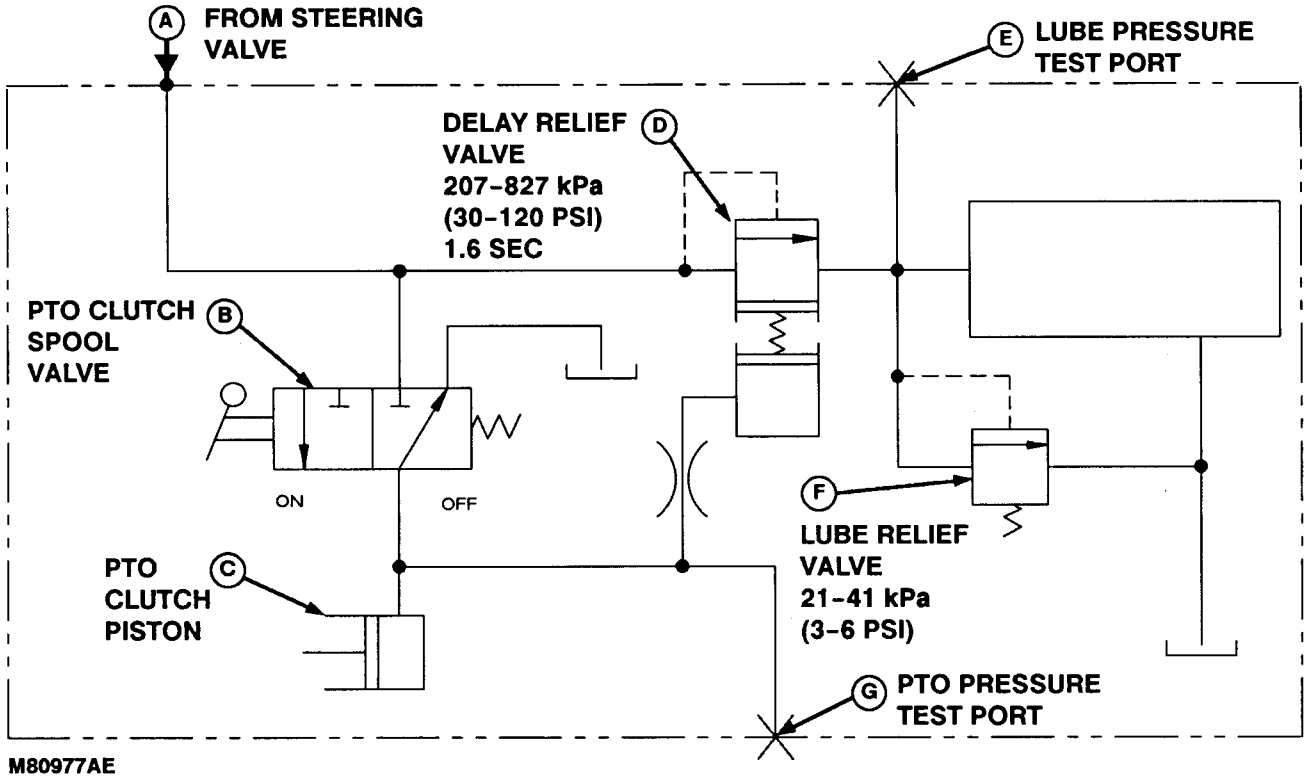


M80979AE -19-19NOV92

A—Flow Control Valve
B—Wing Lift Diagnostic Receptacle (S.N. 880001—)
C—Wing Lift Relief Valve
D—To Wing Lift Valve
E—Rockshaft Diagnostic Receptacle (S.N. 880001—)
F—To Rockshaft Control Valve
G—Rockshaft Relief Valve
H—Proportional Flow Divider
I—Priority Flow Divider Valve
J—To Steering Valve
K—Steering Test Port
L—Diagnostic Receptacle (S.N. —880000)
M—From Transaxle Pump

MX,25020HV,A6 -19-18JAN93

PTO CONTROL SCHEMATIC



M80977AE -19-19NOV92

A—From Steering Valve
B—PTO Clutch Spool Valve
C—PTO Clutch Piston
D—Delay Relief Valve
E—Lube Pressure Test Port
F—Lube Relief Valve
G—PTO Pressure Test Port

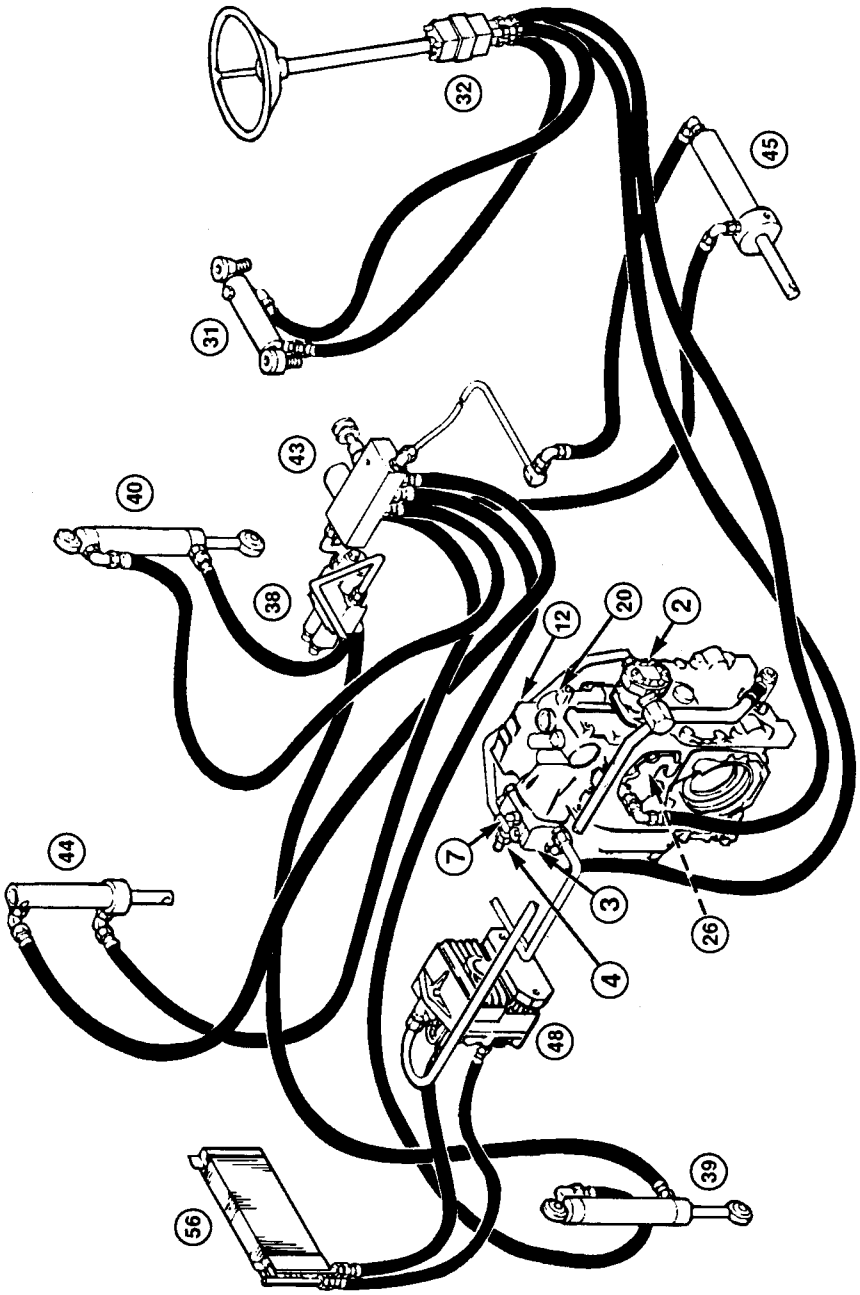
MX,25020HV,A9 -19-18JAN93

250 20 7

HYDRAULIC/HYDROSTATIC SCHEMATIC

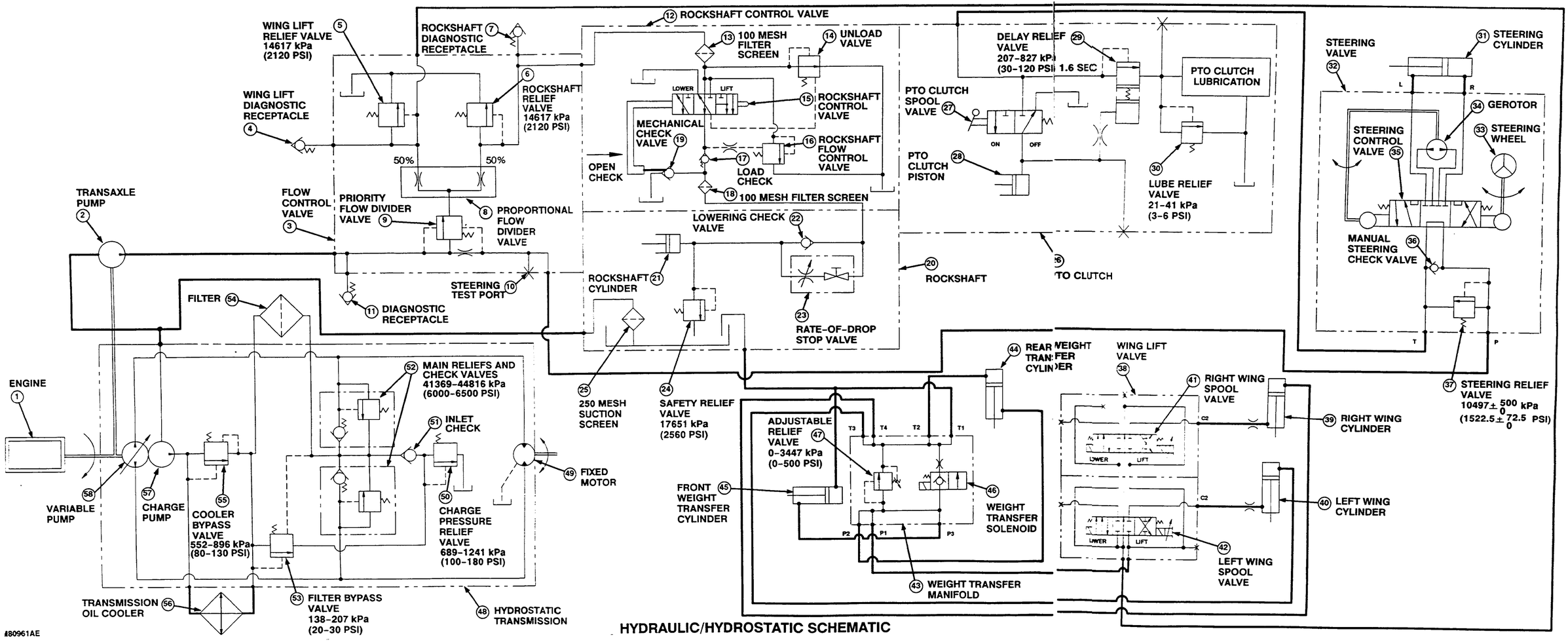
1—Engine
2—Transaxle Pump
3—Flow Control Valve
4—Wing Lift Diagnostic Receptacle (S.N. 880001—)
5—Wing Lift Relief Valve
6—Rockshaft Relief Valve
7—Rockshaft Diagnostic Receptacle (S.N. 880001—)
8—Proportional Flow Divider Valve
9—Priority Flow Divider Valve
10—Steering Test Port (Optional Diagnostic Receptacle)
11—Diagnostic Receptacle (S.N. —880000)
12—Rockshaft Control Valve
13—100 Mesh Filter Screen
14—Unload Valve
15—Rockshaft Control Valve
16—Rockshaft Flow Control Valve
17—Load Check
18—100 Mesh Filter Screen
19—Mechanical Check Valve
20—Rockshaft
21—Rockshaft Cylinder
22—Lowering Check Valve
23—Rate-of-Drop/Stop Valve
24—Safety Relief Valve
25—250 Mesh Suction Screen
26—PTO Clutch
27—PTO Clutch Spool Valve
28—PTO Clutch Piston
29—Delay Relief Valve
30—Lube Relief Valve
31—Steering Cylinder
32—Steering Valve
33—Steering Wheel
34—Gerotor
35—Steering Control Valve
36—Manual Steering Check Valve
37—Steering Relief Valve
38—Wing Lift Valve
39—Right Wing Cylinder
40—Left Wing Cylinder
41—Right Wing Spool Valve
42—Left Wing Spool Valve
43—Weight Transfer Manifold
44—Rear Weight Transfer Cylinder
45—Front Weight Transfer Cylinder
46—Weight Transfer Solenoid
47—Adjustable Relief Valve
48—Hydrostatic Transmission
49—Fixed Motor
50—Charge Pressure Relief Valve
51—Inlet Check
52—Main Reliefs and Check Valves
53—Filter Bypass Valve
54—Filter
55—Cooler Bypass Valve
56—Transmission Oil Cooler
57—Charge Pump
58—Variable Pump

MX,25020HV,A1 -19-18JAN93



M81407AE -19-21DEC92

MX,25020HV,A1A -19-18JAN93



#80961AE

HYDRAULIC/HYDROSTATIC SCHEMATIC

Section 260
STEERING/BRAKES OPERATION, TESTS, & ADJUSTMENTS

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COMPONENT LOCATION INFORMATION

This group contains component location drawings for the following steering and brake systems components:
•Steering System
•Brake System

Use the drawings when diagnosing a steering and brake problem and to help locate the components to be tested.

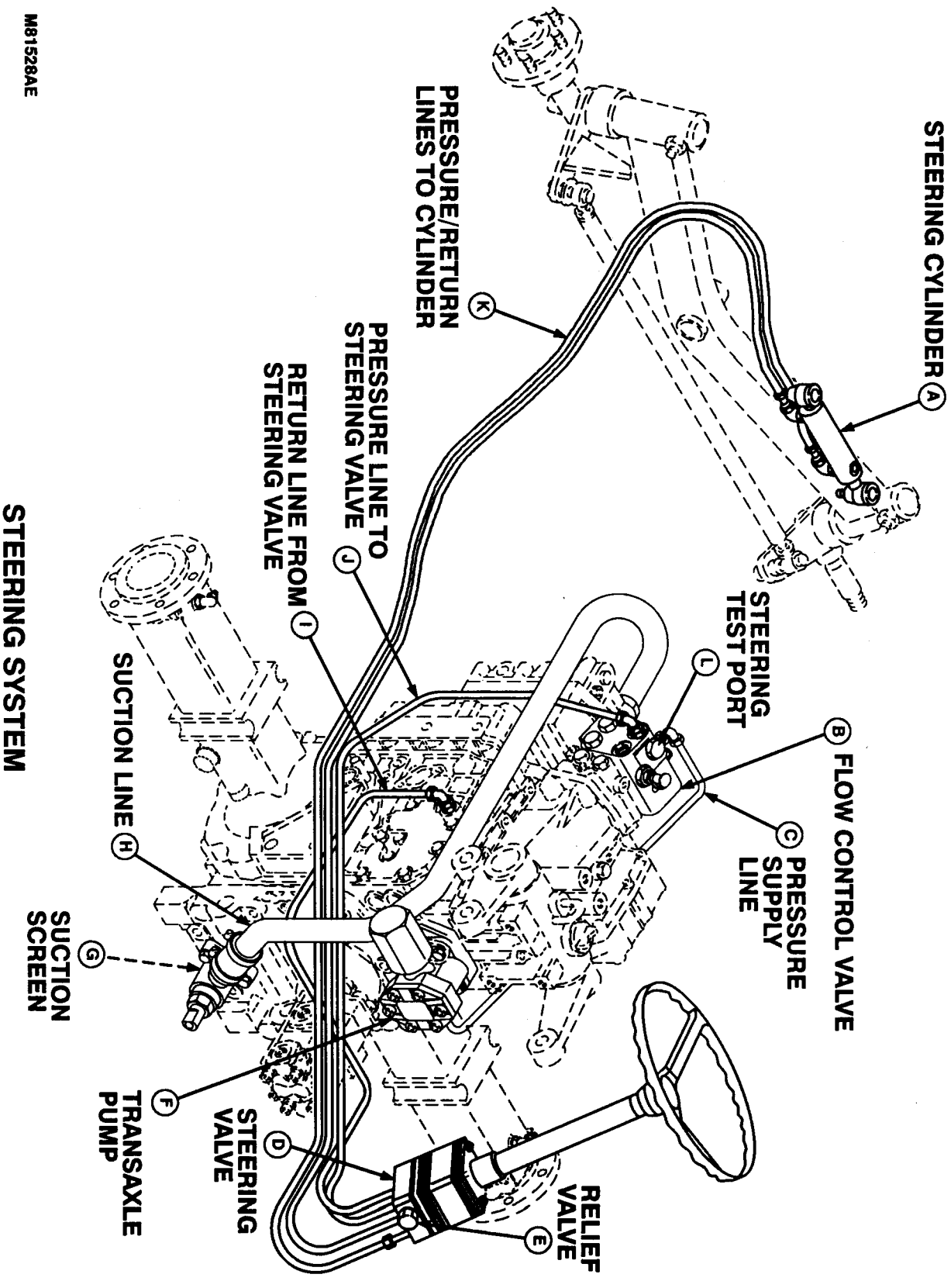
MX,26005GU,1 -19-26MAR92

STEERING SYSTEM COMPONENT LOCATION

A—Steering Cylinder
B—Flow Control Valve
C—Pressure Supply Line
D—Steering Valve
E—Relief Valve
F—Transaxle Pump
G—Suction Pick-Up Screen
H—Suction Line
I—Return Line From Steering Valve
J—Pressure Line to Steering Valve
K—Pressure/Return Lines to Cylinder
L—Steering Test Port

Slide M81528AE

MX,26005HV,A1 -19-18JAN93



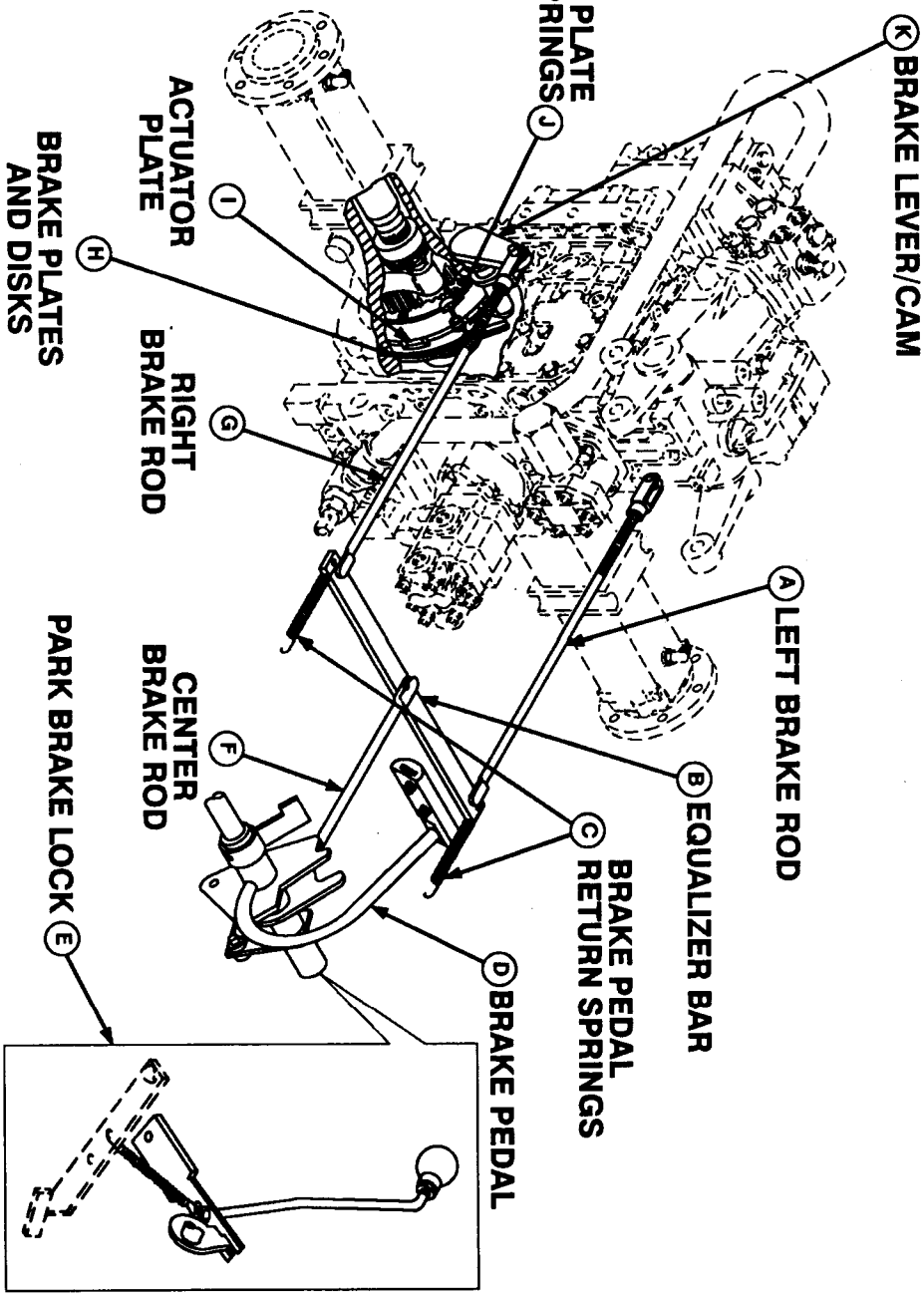
MX,26005HV,A2 -19-18JAN93

BRAKE SYSTEM COMPONENT LOCATION

A—Left Brake Rod
B—Equalizer Bar
C—Brake Pedal Return Springs
D—Brake Pedal
E—Park Brake Linkage
F—Center Brake Rod
G—Right Brake Rod
H—Brake Plates and Disks
I—Cam Plate
J—Brake Plate Return Springs
K—Brake Lever/Cam

Slide M81529AE

MX,26005HV,A3 -19-18JAN93



M81529AE -19-07JAN93

MX,26005HV,A4 -19-18JAN93

THEORY OF OPERATION INFORMATION

This group divides the steering and brake systems into individual components or sub-systems by function. The story contains information on function, component or sub-system identification and theory of operation.

The following systems or components are covered:
- Steering Valve—Neutral
- Steering Valve—Left Hand Turn
- Steering Valve—Right Hand Turn
- Steering Valve—Manual Turn
- Brake System

The slide number reference for the art is used for service training purposes only.

MX,26010HV,A1A -19-18JAN93

STEERING SYSTEM OPERATION

A—Steering Cylinder
B—Flow Control Valve
C—Pressure Supply Line
D—Steering Valve
E—Relief Valve
F—Transaxle Pump
G—Suction Pick-Up Screen
H—Suction Line
I—Return Line From Steering Valve
J—Pressure Line to Steering Valve
K—Pressure/Return Lines to Cylinder
L—Steering Test Port

Slide M81528AE

FUNCTION:
Provides the mower with either power or manual mode of steering control.

MAJOR COMPONENTS:
- Transaxle Pump
- Flow Control Valve
- Steering Valve
- Steering Cylinder

THEORY OF OPERATION:
The transaxle pump (F) draws oil from the transaxle case, through suction pick-up screen (G) and suction line (H). The pump supplies pressure oil to flow control valve (B) through pressure supply line (C). A priority valve inside the flow control valve provides oil flow, on demand, to steering valve (D).

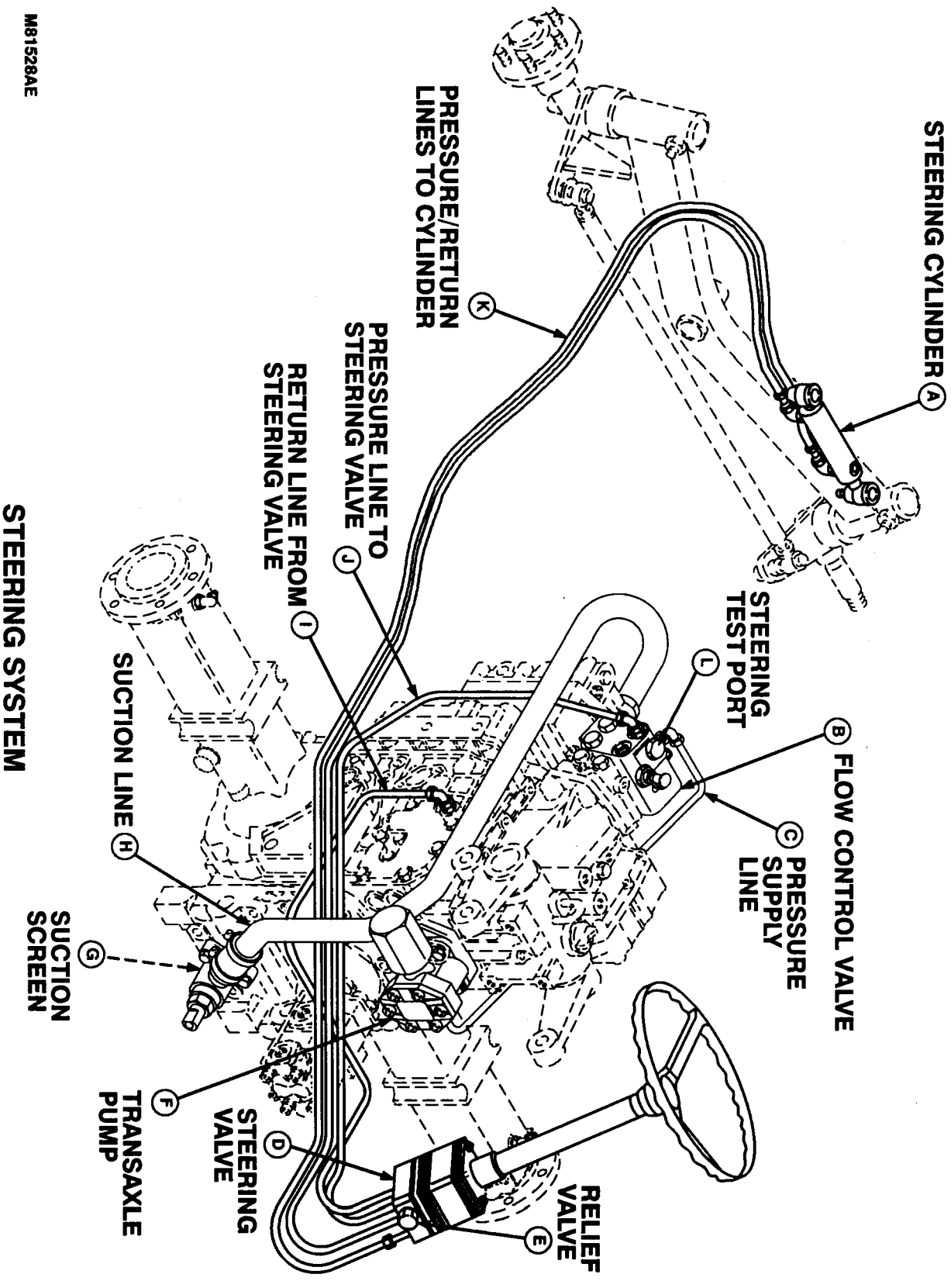
The steering valve is an open-center type valve. The valve consists of a self-centering valve plate and a fluid metering section (gerotor).

When the steering valve is in neutral position, the oil flows through the steering control valve and on to the transaxle for PTO operation and transaxle lubrication.

When the steering wheel is turned, the steering valve controls the oil flow to the steering cylinder (A). Return oil from the opposite end of the cylinder is routed back through the control valve and on to the transaxle.

Relief valve (E) protects the steering valve and steering hoses from high pressures. If pressure in the IN port exceeds approximately 10497 kPa (1522 psi), the relief valve opens, dumping the oil to the OUT port and to the transaxle sump through the PTO control valve.

MX,26010HV,A1 -19-18JAN93



MX,26010HV,A2 -19-18JAN93

STEERING VALVE OPERATION—NEUTRAL

A—Pressure Oil
B—Trapped Oil
C—Return Oil
D—Port RT
E—Port LT
F—Port OUT
G—Port IN
H—Relief Valve
I—Check Valve
J—Valve Plate
K—Fluid Metering Section (Gerotor)

Slide EXC3594AE

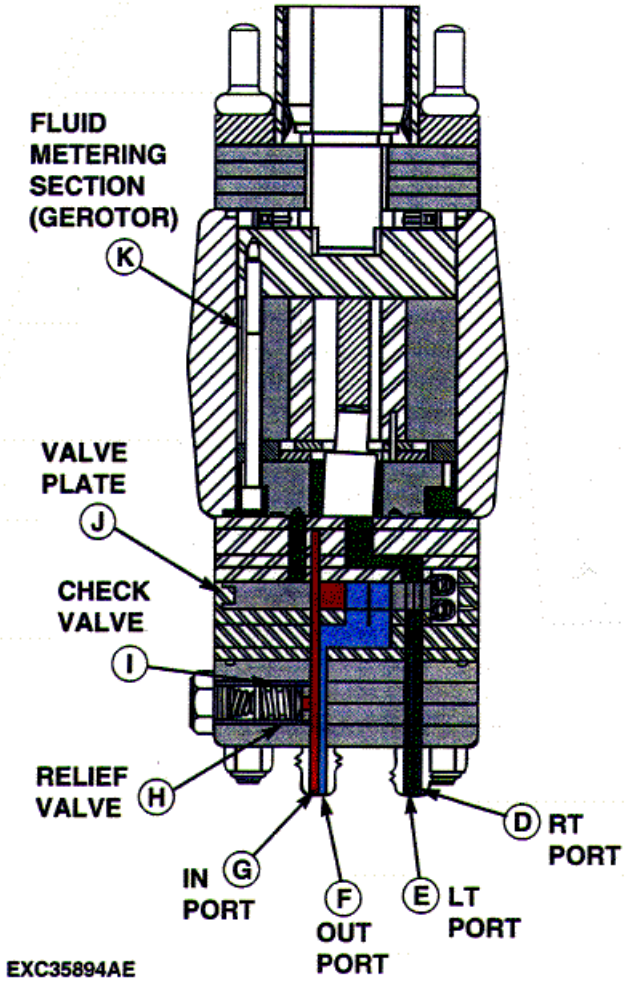
FUNCTION:
To block pressurized oil flow to the steering cylinder and hold the steering cylinder stationary when steering wheel is not turned.

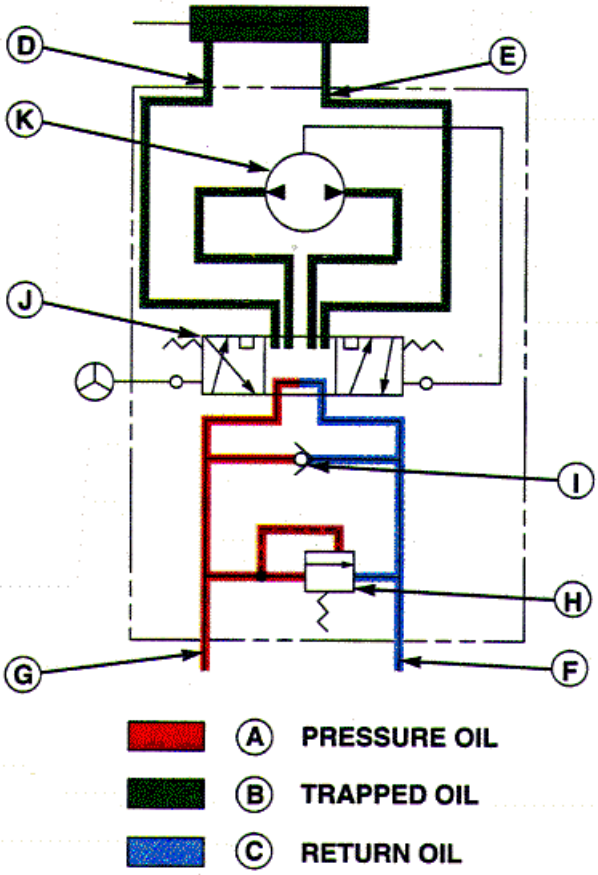
MAJOR COMPONENTS:
- Steering Valve
- Valve Plate
- Gerotor
- Steering Cylinder

THEORY OF OPERATION:
When the steering wheel is not turned, valve plate (J) is in the centered, neutral position. In this position, pressure oil (A) enters the steering valve through IN port (G). Oil then flows to the relief valve (H), check valve (I) and valve plate. The check valve is closed so oil flows through the valve plate to the OUT port (F). Oil then flows back to the transaxle through the PTO control valve.

In the neutral position, the valve plate traps oil between the gerotor and the steering cylinder. This keeps the steer wheels in the desired direction of travel until the steering wheel is moved.

MX,26010HV,A3 -19-18JAN93





MX,26010HV,A4 -19-18JAN93

STEERING VALVE OPERATION—LEFT TURN

A—Pressure Oil
B—Metered Oil
C—Return Oil
D—Port RT
E—Port LT
F—Port OUT
G—Port IN
H—Valve Plate
I—Drive Link Assembly
J—Gerotor
K—Steering Cylinder
L—Relief Valve
M—Centering Springs
N—Check Valve

Slide EXC35896AE

FUNCTION:
To provide metered pressure oil to the appropriate side of steering cylinder.

MAJOR COMPONENTS:
- Valve Plate
- Drive Link Assembly
- Gerotor
- Steering Cylinder
- Relief Valve
- Centering Springs

260
10
6

THEORY OF OPERATION:
When the steering wheel is turned to the left, drive link assembly (I) rotates valve plate (H), aligning the appropriate passages. This allows pressure oil (A) at IN port (G) to flow through the valve plate and to the appropriate side of gerotor (J), causing the gerotor to rotate. As the gerotor rotates, it meters oil flow back through the valve plate and out LT port (E).

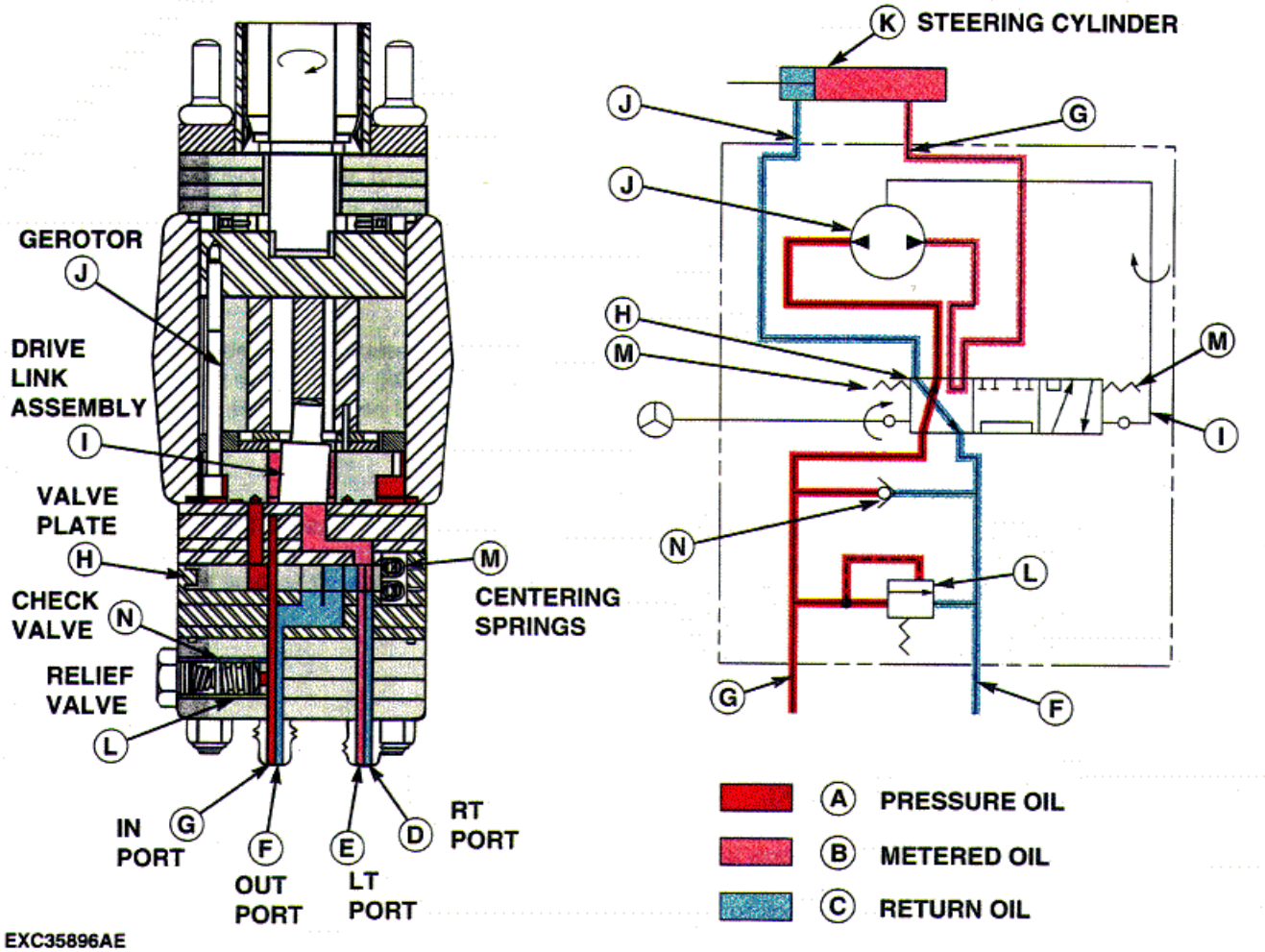
For S.N. —830000 units, oil flows from the LT port to the rod end of steering cylinder (K), causing the cylinder to retract and move the steer wheels. Oil in the piston end of the cylinder flows back to the steering valve, enters RT port (D), flows through the valve plate, out port (F) and back to the transaxle.

For S.N. 830001— units, oil flows from the LT port to the piston end of steering cylinder (K), causing the cylinder to extend and move the steer wheels. Oil in the rod end of the cylinder flows back to the steering valve, enters RT port (D), flows through the valve plate, out port (F) and back to the transaxle.

As soon as the steering wheel movement is stopped, centering springs (M) in the valve plate return the plate to the neutral position. Oil is trapped in the steering cylinder lines and the steer wheels remain in position.

If the steer wheels are against the stop or an obstruction and held there, the relief valve (L) will open, allowing pressure oil to flow to OUT port.

MX,26010HV,A5 -19-18JAN93



MX,26010HV,A6 -19-18JAN93

STEERING VALVE OPERATION—RIGHT TURN

A—Pressure Oil
B—Metered Oil
C—Return Oil
D—Port RT
E—Port LT
F—Port OUT
G—Port IN
H—Valve Plate
I—Drive Link Assembly
J—Gerotor
K—Steering Cylinder
L—Relief Valve
M—Centering Springs

Slide EXC35895AE

FUNCTION:
To provide metered pressure oil to the appropriate side of steering cylinder.

MAJOR COMPONENTS:
- Valve Plate
- Drive Link Assembly
- Gerotor
- Steering Cylinder
- Relief Valve
- Centering Springs

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8

THEORY OF OPERATION:
When the steering wheel is turned to the right, drive link assembly (I) rotates valve plate (H), aligning the appropriate passages. This allows pressure oil (A) at IN port (G) to flow through the valve plate and to the appropriate side of gerotor (J), causing the gerotor to rotate. As the gerotor rotates, it meters oil flow back through the valve plate and out RT port (D).

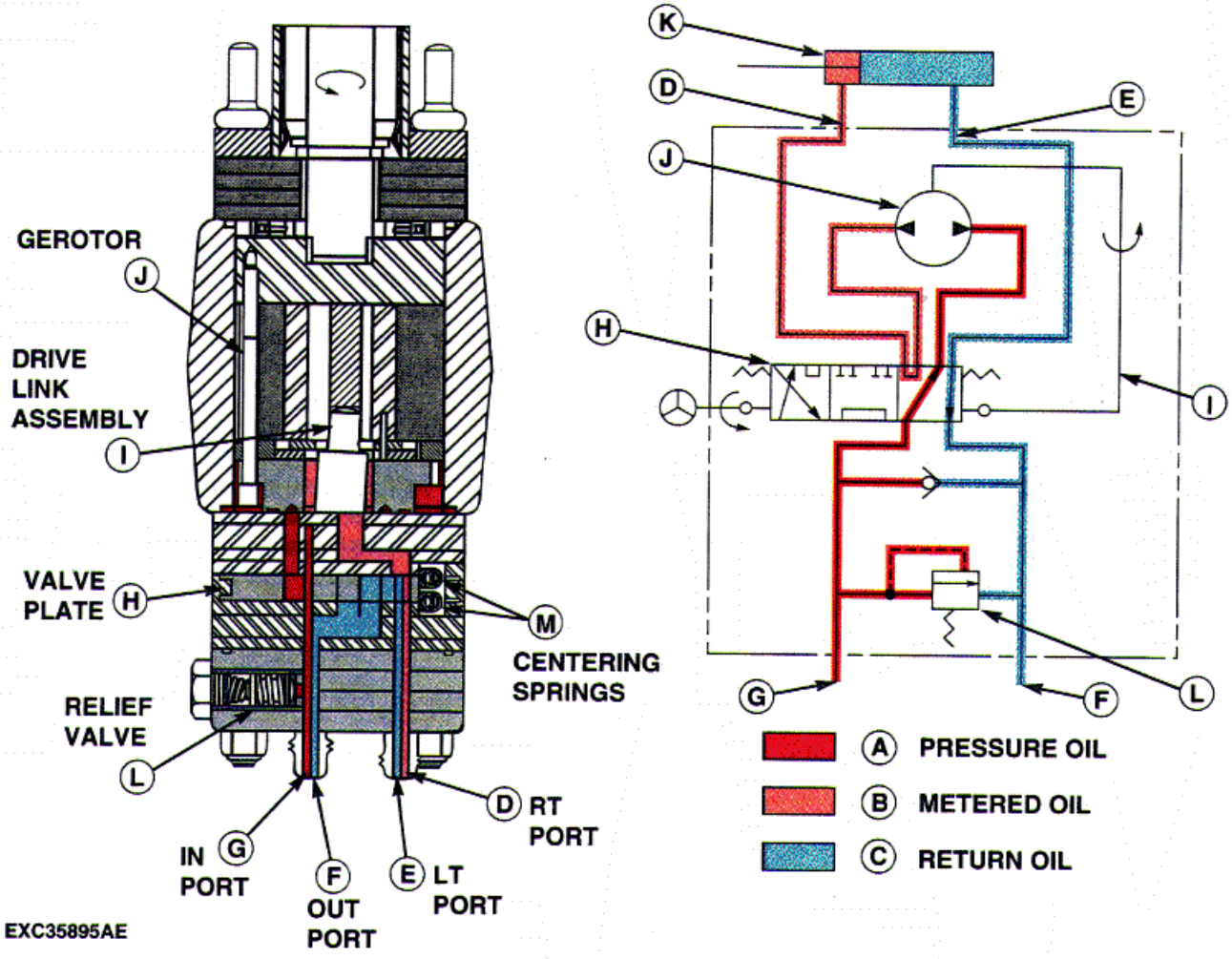
For S.N. —830000 units, oil flows from the RT port to the piston end of steering cylinder (K), causing the cylinder to extend and move the steer wheels. Oil in the rod end of the cylinder flows back to the steering valve, enters LT port (E), flows through the valve plate, out port (F) and back to the transaxle.

For S.N. 830001— units, oil flows from the RT port to the rod end of steering cylinder (K), causing the cylinder to retract and move the steer wheels. Oil in the piston end of the cylinder flows back to the steering valve, enters LT port (E), flows through the valve plate, out port (F) and back to the transaxle.

As soon as the steering wheel movement is stopped, centering springs (M) in the valve plate return the plate to the neutral position. Oil is trapped in the steering cylinder lines and the steer wheels remain in position.

If the steer wheels are against the stop or an obstruction and held there, the relief valve (L) will open, allowing pressure oil to flow to OUT port.

MX,26010HV,A7 -19-18JAN93



MX,26010HV,A8 -19-18JAN93

260 10 9

STEERING VALVE OPERATION—MANUAL STEER

A—Pressure Oil
B—Metered Oil
C—Return Oil
D—Port RT
E—Port LT
F—Port OUT
G—Port IN
H—Valve Plate
I—Drive Link Assembly
J—Gerotor
K—Steering Cylinder
L—Relief Valve
M—Centering Springs
N—Check Valve

Slide EXC35896AE

FUNCTION:
Provide manual steering if hydraulic pressure is not available.

MAJOR COMPONENTS:
- Valve Plate
- Drive Link Assembly
- Gerotor
- Steering Cylinder
- Check Valve
- Centering Springs

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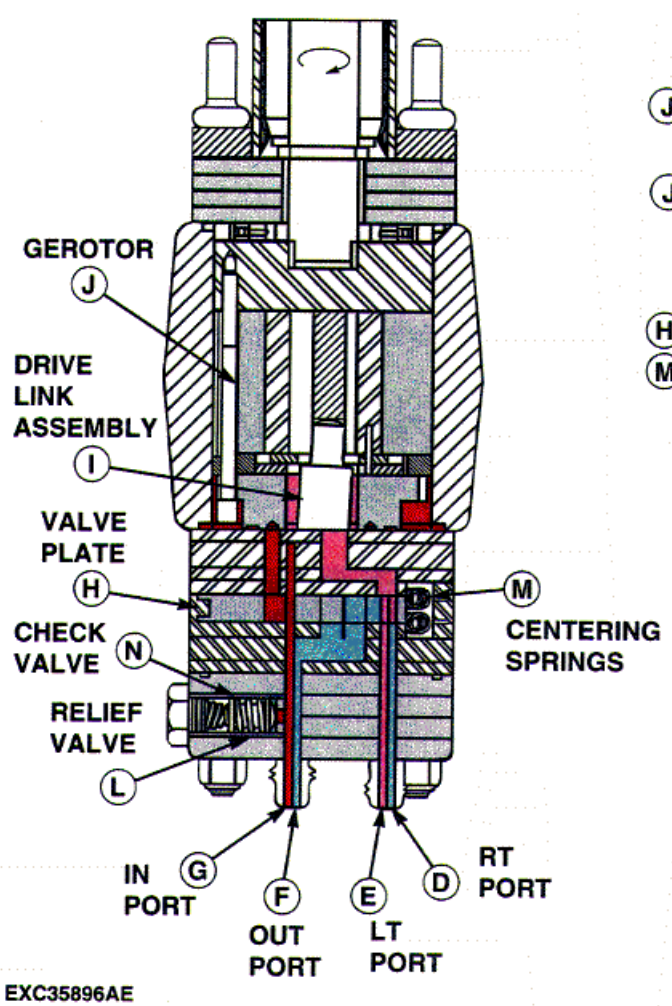
THEORY OF OPERATION:

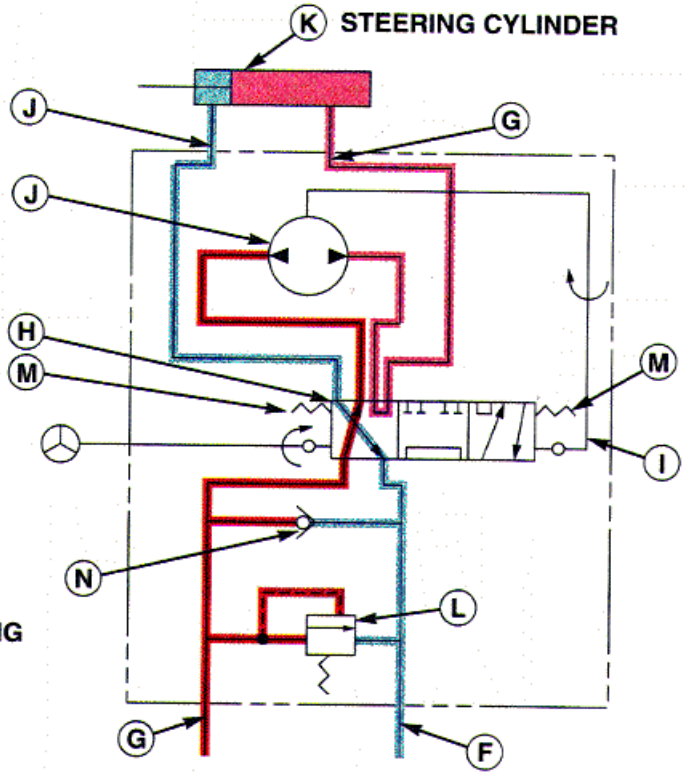
NOTE: Left-hand turn shown

If hydraulic pressure is lost, the mower can still be steered without hydraulic assistance. All components still function the same with the exception of the gerotor and check valve (N). The gerotor now acts as a pump moving oil from one side of the gerotor to the other as the steering wheel is moved. The check valve opens allowing oil to be drawn from the return side of steering cylinder. Hydraulic oil is forced, by the gerotor, to the rod end or piston end of the steering cylinder (K), depending on which way the steering wheel is turned.

When the rotation of the steering wheel stops, the centering springs (M) move the valve plate back to center position. At this point, the valve is back in the neutral position and will remain there until the steering wheel is moved again.

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A—Left Brake Rod
B—Equalizer Bar
C—Brake Pedal Return Springs
D—Brake Pedal
E—Park Brake Lock
F—Center Brake Rod
G—Right Brake Rod
H—Brake Plates and Friction Disks
I—Actuator Plate
J—Cam Plate Return Springs
K—Brake Lever/Cam

Slide M81529

FUNCTION:
Provides a means of stopping the mower and also prevent movement when not in use.

MAJOR COMPONENTS:
- Brake Pedal
- Linkage
- Brake Plates and Disks
- Park Brake Lock

THEORY OF OPERATION:
Pushing on brake pedal (D), causes brake linkages (A, B, F and G) to actuate brake lever/cam (K) on each side of transaxle.

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As the brake lever/cam rotates, it pushes against actuator plate (I), causing the plate to rotate.

Located between the actuator plate and final drive ring gear are six steel balls. Each ball rests in a ramped notch in the actuator plate and ring gear.

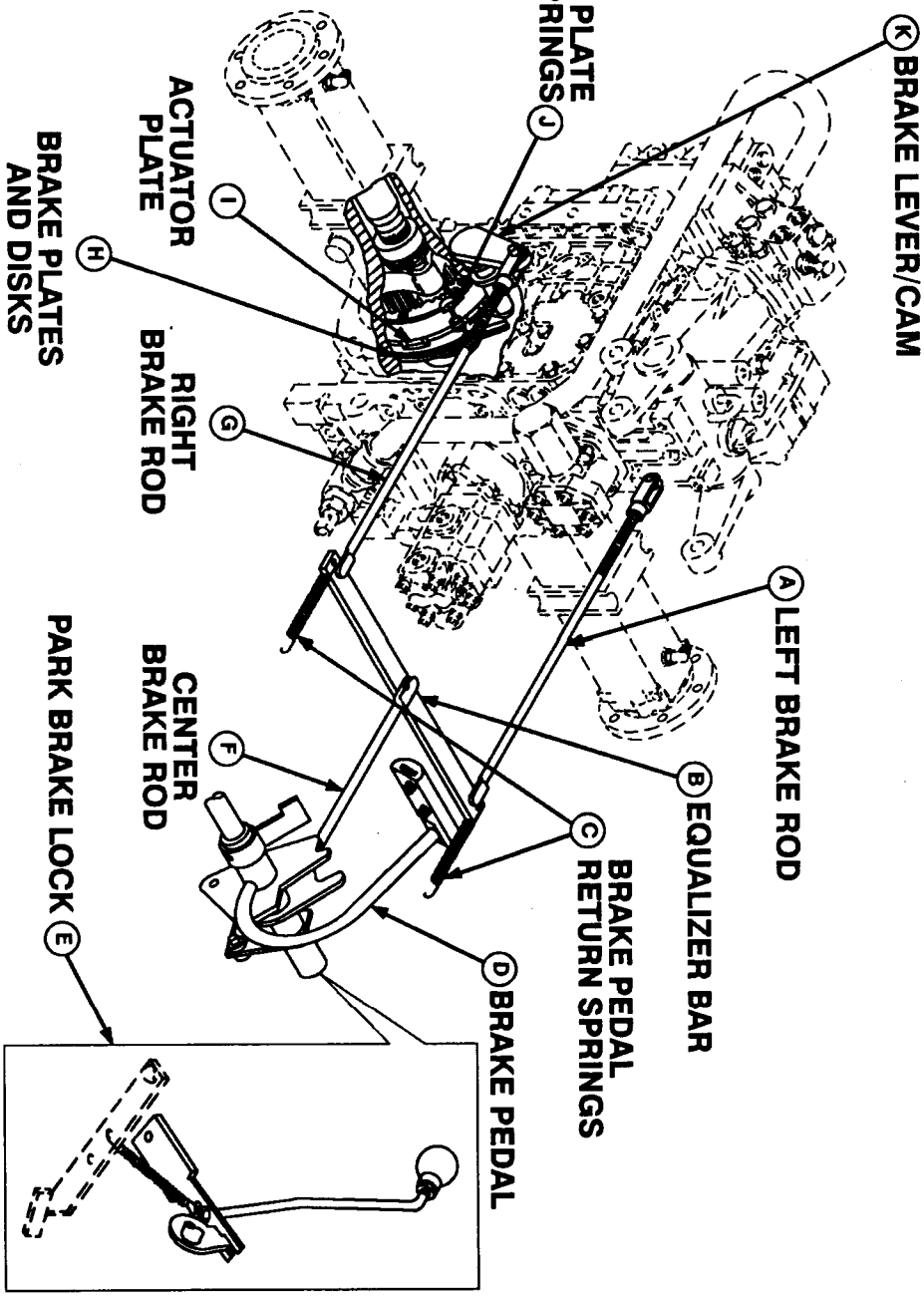
Rotation of the actuator plate rolls the balls up the ramps, pushing the actuator plate inward (away from the ring gear) and against the friction disk/brake plate assemblies.

Because the brake plates do not rotate and the friction disks are splined directly to the axle shafts, pressure applied to the friction disk/brake plate assemblies stop the axle shafts from rotating.

When the brakes are released, actuator plate return springs (J), pull the actuator plate away, releasing the pressure against the brake plate and disk assemblies. Brake return springs (C) return the brake pedals and linkage.

Park brake lock (E) locks the brakes in the engaged position to be used as a parking brake.

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MX,26010HV,A11 -19-18JAN93

DIAGNOSTIC INFORMATION

The diagnostic information in this group is used to test components related to a specific problem or system. Select a symptom or system from the list and follow the test procedures under that heading. The symptom or system headings are:

- Steers hard or no steering in both directions
- Steers hard or no steering in one direction
- Steering pulls in one direction
- Steering shimmy
- Slow steering response
- Steering effort is erratic
- Wheels continue to turn after steering wheel is stopped

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 this 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 arrow points to the exact point the test is to be made.

The slide number references under the art is used for service training purposes only.

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STEERS HARD OR NO STEERING IN BOTH DIRECTIONS

CONDITIONS:
- Transmission in neutral
- Park brake engaged
- Engine stopped

Test Location	Normal	If Not Normal
1. Tires (not shown)	Inflated to proper pressure.	Repair leak and/or inflate to specification. See Section 10.
2. Steering supply line and return line	Not blocked, kinked or leaking.	Repair or replace as necessary.
3. Suction line and flow control valve supply line	Not blocked, pinched or leaking.	Repair or replace as necessary.
4. Tie rod	Straight, does not bind.	Repair or replace tie rod. See Section 60.
5. Spindle shaft	Turns with little resistance (rear wheels off ground and steering cylinder disconnected).	Repair as necessary. See Remove, Inspect and Install Spindle Shaft and Bushings in Section 60.
6. Suction screen	Unobstructed oil flows easily through screen.	Clean or replace screen. See Section 50.

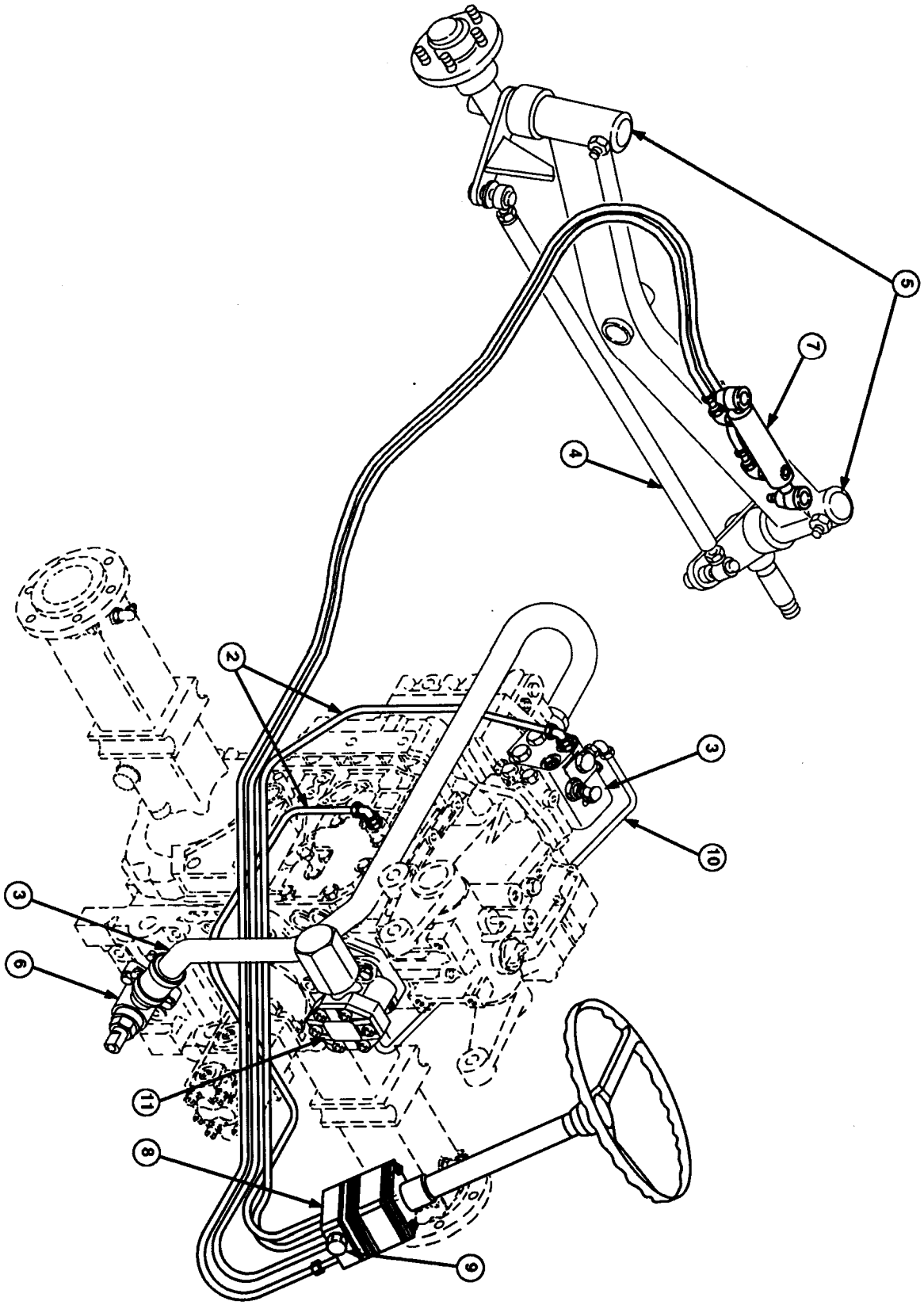
CONDITIONS:
- Transmission in neutral
- Park brake engaged
- Engine operating

7. Steering cylinder	No external or internal oil leakage. Cylinder rod is straight and extends and retracts smoothly.	See Test Steering System Leakage in this group.
8. Steering valve	No external or internal oil leakage.	See Test Steering Valve Leakage in this group.
9. Steering relief valve	Pressure setting within specification.	See Steering Relief Valve Pressure Test in this group.
10. Flow control valve	Maintains proper flow rate to steering valve.	See Steering System Flow Test in this group.
11. Transaxle pump	Provides proper oil flow for system operation.	See Transaxle Pump Flow Test in Section 270.

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M81530AE

STEERS HARD OR NO STEERING IN BOTH DIRECTIONS



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STEERS HARD OR NO STEERING IN ONE DIRECTION

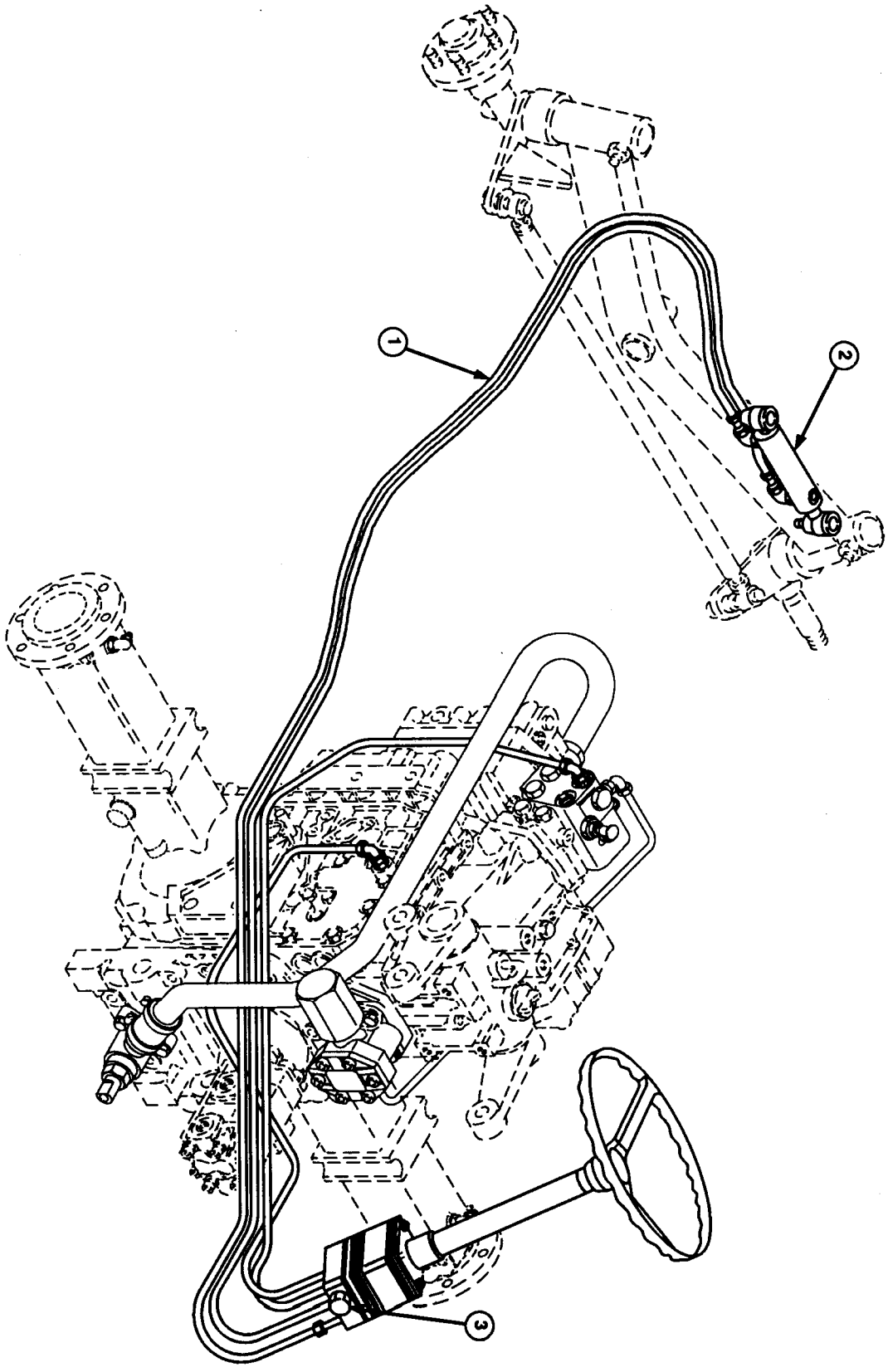
CONDITIONS:
- Transmission in neutral
- Park brake engaged
- Engine operating

Test Location	Normal	If Not Normal
1. Steering lines	Not blocked, kinked or leaking.	Repair or replace as necessary.
2. Steering cylinder	No external or internal oil leakage.	See Test Steering System Leakage in this group.
3. Steering valve	No external or internal oil leakage.	See Test Steering Valve Leakage in this group.

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M81531AE

STEERS HARD OR NO STEERING IN ONE DIRECTION



Slide M81531AE

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MX,26015HV,A5 -19-18JAN93

STEERING PULLS IN ONE DIRECTION

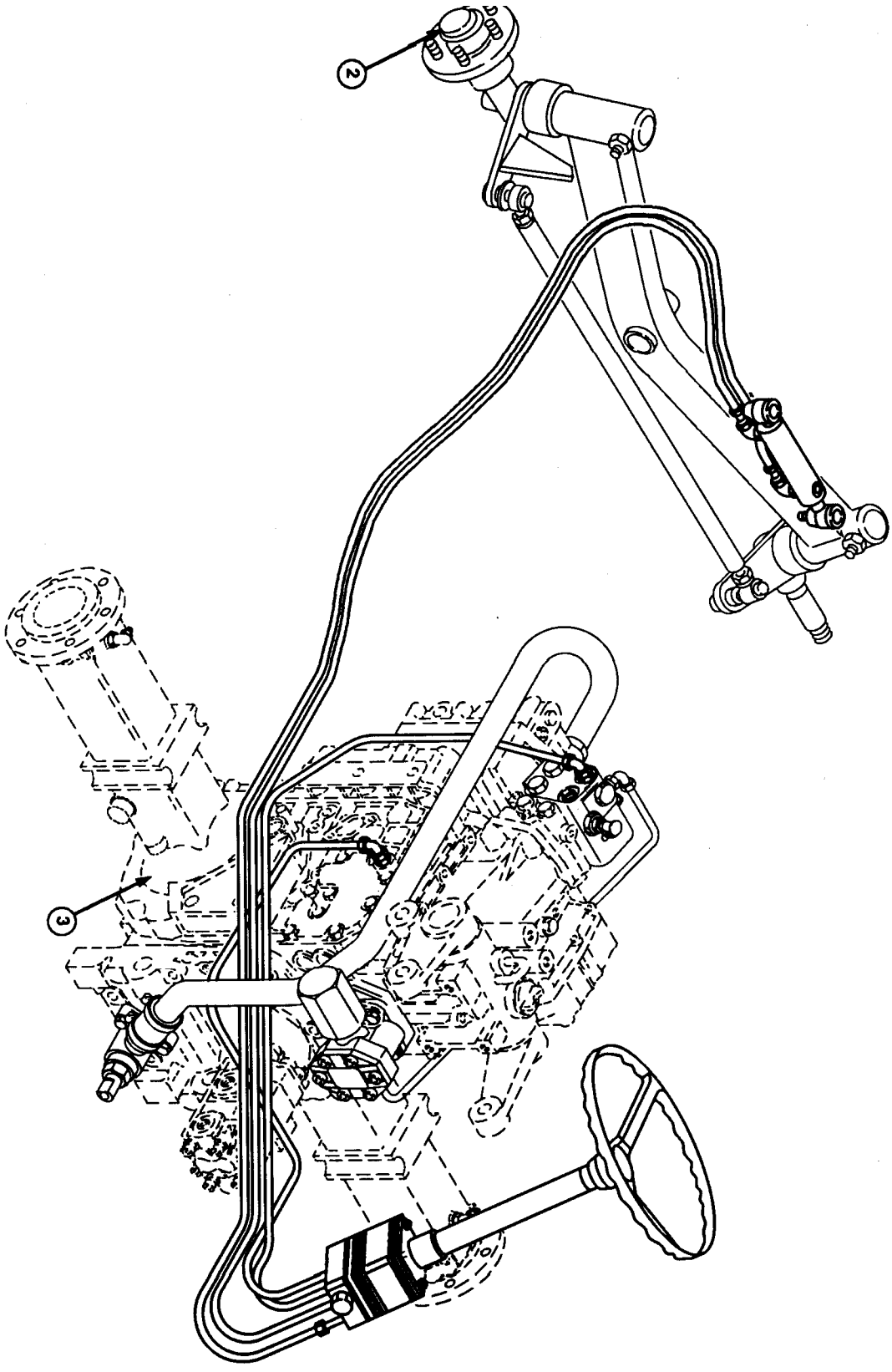
CONDITIONS:
- Transmission in neutral
- Park brake engaged
- Engine stopped

Test Location	Normal	If Not Normal
1. Tires (not shown)	Inflated to proper pressure.	Repair leak and/or inflate to specification, See Section 10.
2. Rear wheel bearings	Wheels turn with little resistance (rear wheels off ground). No excessive play in hubs.	Replace and pack wheel bearings. See Remove and Install Rear Wheel Bearings in Section 60.
3. Brakes	Both left and right brakes do not drag when released.	Repair brakes. See Remove, Inspect and Install Brakes in Section 60.

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M81532AE

STEERING PULLS IN ONE DIRECTION



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Slide M81532AE

MX,26015HV,A7 -19-18JAN93

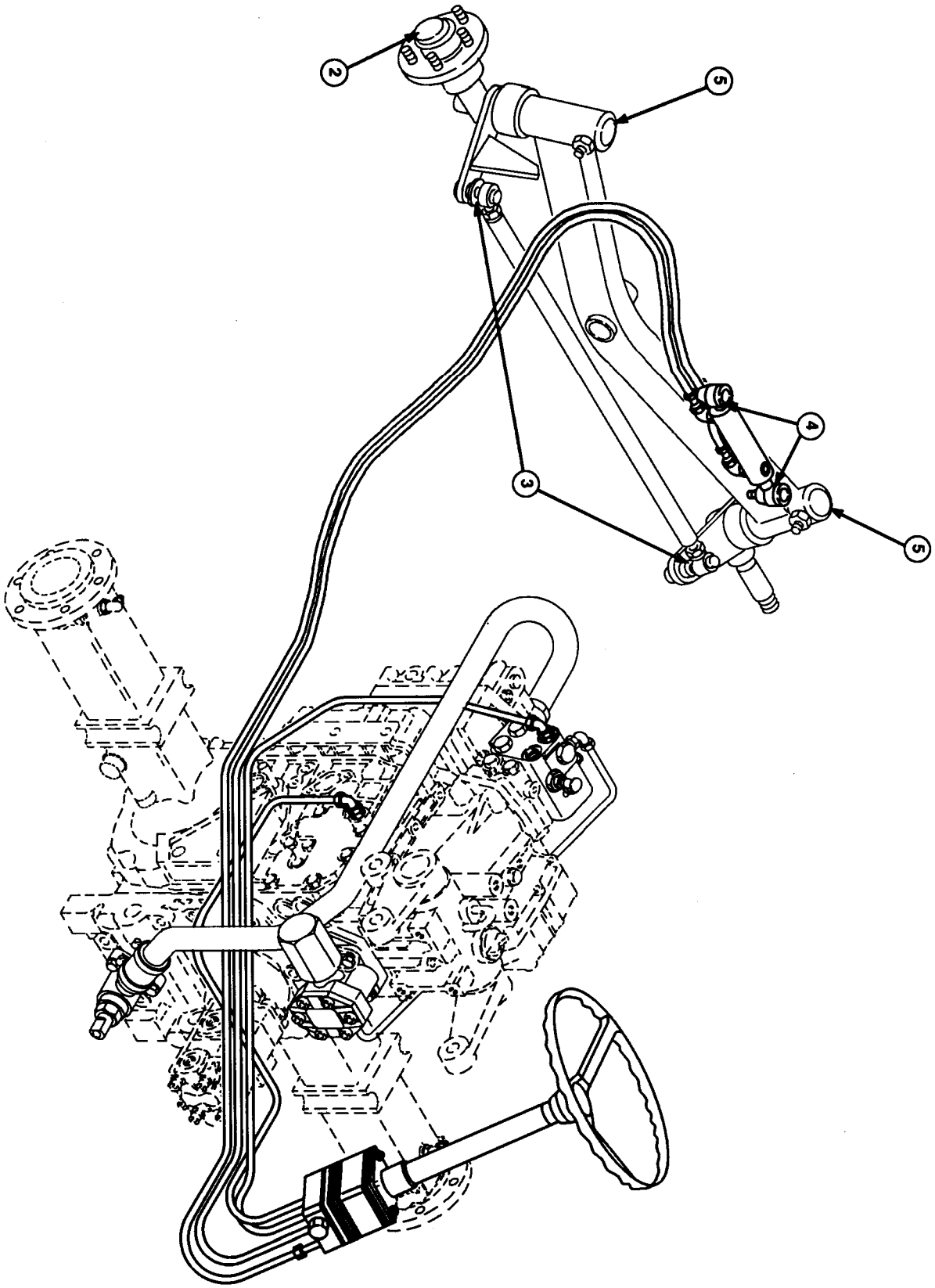
STEERING SHIMMY

CONDITIONS:
- Transmission in neutral
- Park brake engaged
- Engine stopped

Test Location	Normal	If Not Normal
1. Tires and wheel (not shown)	Tires run true (no wobble). Rims not bent.	Repair or replace as necessary.
2. Rear wheel bearings	No excessive play in wheel hubs.	Replace and/or pack bearings as necessary. See Remove and Install Rear Wheel Bearings in Section 60.
3. Tie rod ends	Tie rod ends are tight. Toe-in is within specifications.	Replace tie rod ends. Adjust toe-in. See Adjust Steering Toe-in in Section 60.
4. Steering cylinder ball joints	Ball joints are tight with no signs of wear.	Replace steering cylinder. See Remove and Install Steering Cylinder in Section 60.
5. Spindle shaft	No excessive play in bushings.	Replace bushings. See Remove, Inspect and Install Spindle Shaft and Bushings in Section 60.

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M81533AE



STEERING SHIMMY

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MX,26015HV,A9 -19-18JAN93

SLOW STEERING RESPONSE OR STEERING EFFORT IS ERRATIC

CONDITIONS:
- Operator in seat
- Engine operating

Test Location	Normal	If Not Normal
1. Steering lines	Not leaking.	Replace as necessary.
2. Steering wheel	No air in steering system.	Bleed hydraulic system. See Section 50.

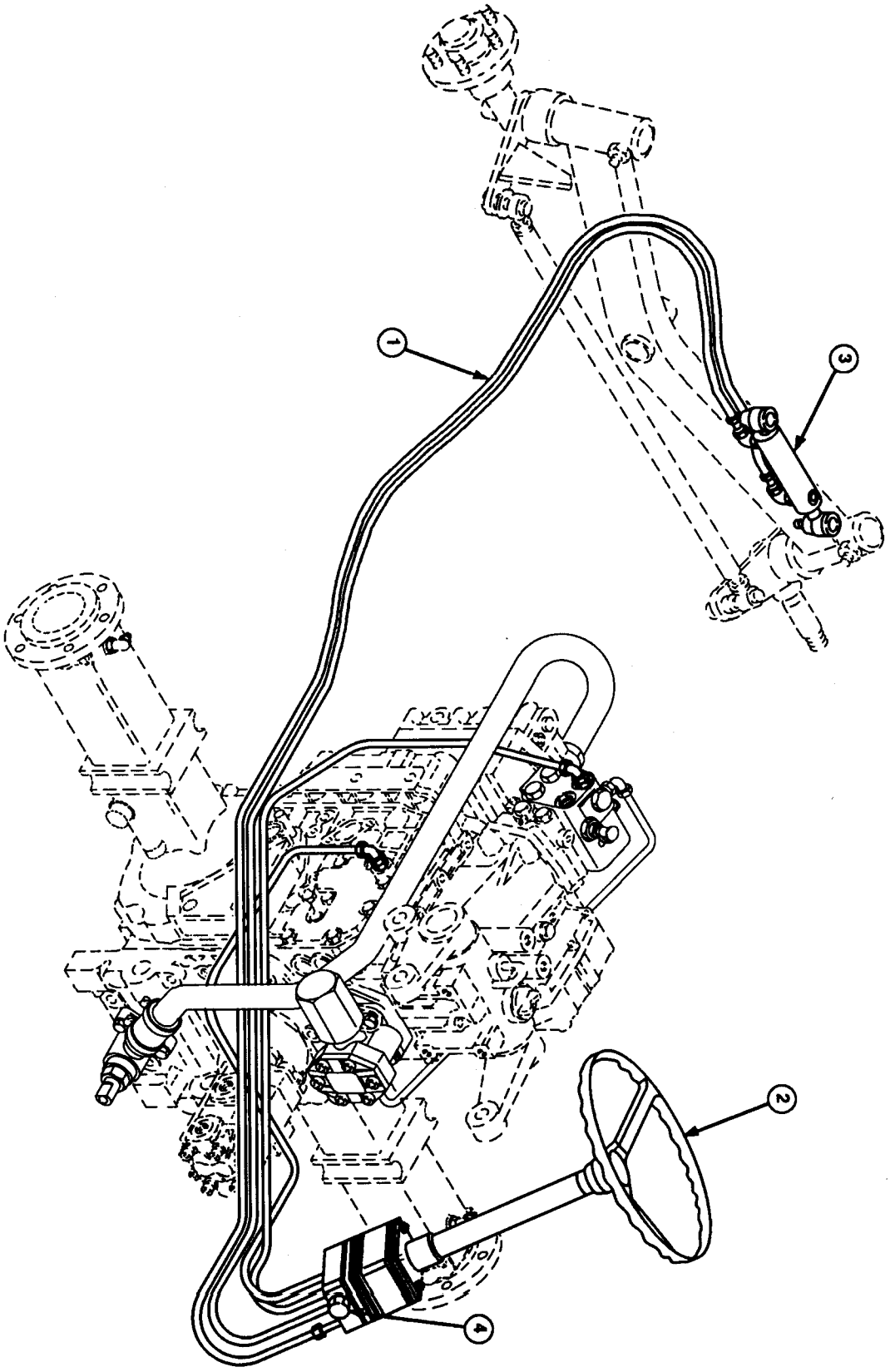
CONDITIONS:
- Transmission in neutral
- Park brake engaged
- Engine operating

3. Steering cylinder	No external or internal leakage.	See Test Steering System Leakage in this group.
4. Steering valve	No external or internal leakage.	See Test Steering Valve Leakage in this group.

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M81534AE

SLOW STEERING RESPONSE OR OR STEERING IS ERRATIC



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MX,26015HV,A11 -19-18JAN93

WHEELS CONTINUE TO TURN AFTER STEERING WHEEL IS STOPPED

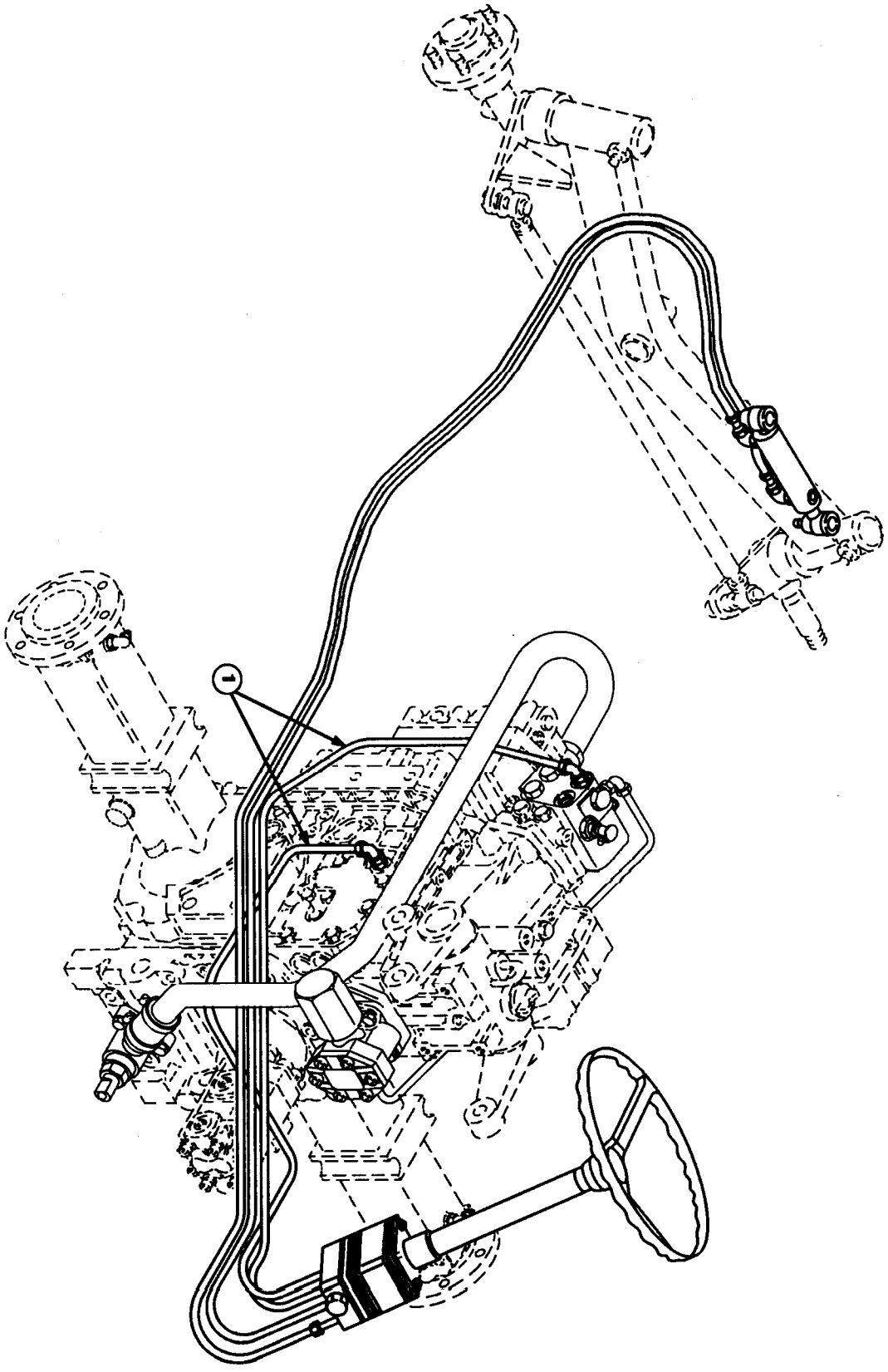
CONDITIONS:
- Transmission in neutral
- Park brake engaged
- Engine operating

Test Location	Normal	If Not Normal
1. Steering valve	No external or internal leakage.	See Test Steering Valve Leakage in this group.
	Valve plate returns to center position when steering wheel stops turning.	Repair steering valve. See Section 60.

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M81535AE

WHEELS CONTINUE TO TURN AFTER STEERING WHEEL IS STOPPED



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MX,26015HV,A13 -19-18JAN93

BRAKES DO NOT OPERATE PROPERLY

CONDITIONS:
- Operator in seat
- Engine stopped

Test Location	Normal	If Not Normal
1. Brake pedal	Clearance between pedal rod and edge of slot in cover is within specifications.	See Adjust Brake Linkage in this group.
	Pedal returns smoothly.	Inspect springs and linkage for damage or wear. Replace as necessary. See Section 60.
2. Left and right brake rods	Rods are equal in length and meet specification.	See Adjust Brake Linkage in this group.
3. Brake pedal lock	Holds brakes in engaged position when pedal is depressed. Mower should not move.	See Adjust Brake Linkage in this group.

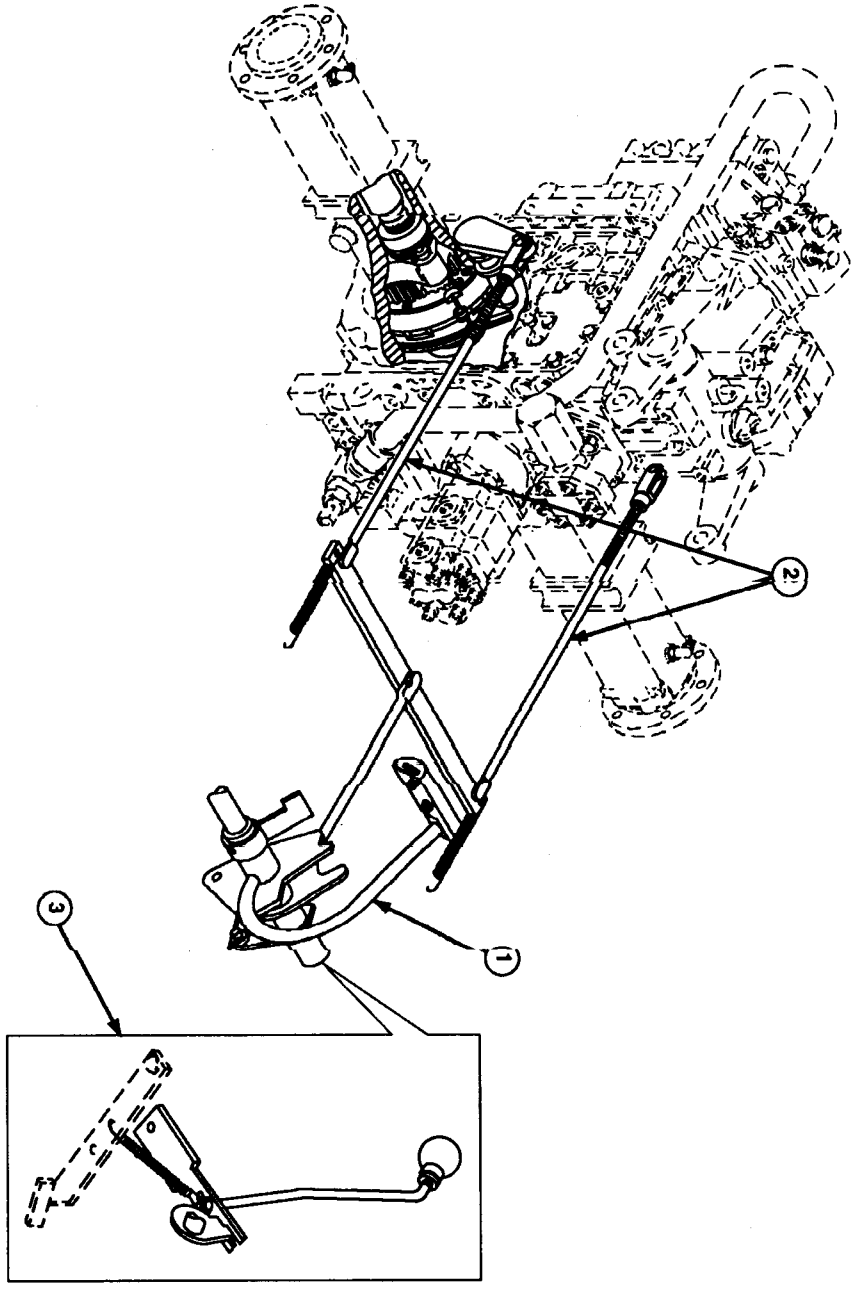
CONDITIONS:
- Operate mower on smooth flat surface

4. Brake pedal	Brakes operate smoothly and quietly.	Inspect components and linkages for damage or wear. Replace as necessary. See Section 60.
	Mower stops evenly (does not pull to one side)	Inspect internal brake components on the side that mower pulls toward. Repair or replace parts as necessary. See Section 60.

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M81536AE

BRAKES DO NOT OPERATE PROPERLY



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MX,26015HV,A15 -19-18JAN93

DIAGNOSTIC INFORMATION

The diagnostic information in this group is used to test components related to a specific problem or system. Select a symptom from the list and follow the test procedures under the heading. The symptom headings are:

- Hydraulic lift system does not operate and no power steering
- Hydraulic lift system does not operate, power steering operates or is slow.
- Low or slow hydraulic lift power
- Hydraulic lift system operates erratically
- Excessive transaxle pump noise
- Hydrostatic oil foams
- Hydrostatic oil overheats
- Cutting units lift lever sticks or is difficult to move.
- Front and center cutting units will not raise
- Wing cutting units will not raise
- Wing cutting units lower with cutting units lever in raised, position.
- Excessive hydraulic pump noise
- Hydraulic oil foams
- Hydraulic oil overheats
- Cutting units do not turn or turn slow
- One or more cutting units turning backwards
- Oil leaking from cutting unit motor
- Frequent failure of hydraulic lines and O-rings.

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 this 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 arrow points to the exact point the test is to be made.

The slide number reference under the art is used for service training purposes only to match a specific piece of technical manual art to the same slide.

MX,27015HV,A1 -19-18JAN93

STEERING RELIEF VALVE TEST

REASON:
Check relief valve opening pressure or leaking relief valve.

EQUIPMENT:
- JT03375 Adapter 7/16-20 M 37° x 9/16-18 M ORFS (A)
- JT03017 Hose with coupler (B)
- JT03345 Gauge with coupler 20,000 kPa (3000 psi) (C)
- 38H1414 Cap 9/16-18 ORFS (D)

CONNECTIONS:

NOTE: An additional diagnostic receptacle can be installed in plugged port (E) and gauge (A) connected to this receptacle for test. This will eliminate disconnecting hose from steering cylinder.

1. Assemble gauge, hose and adapter.

2. Disconnect hydraulic hose from rod end of steering cylinder.

3. Connect gauge and hose to hydraulic hose.

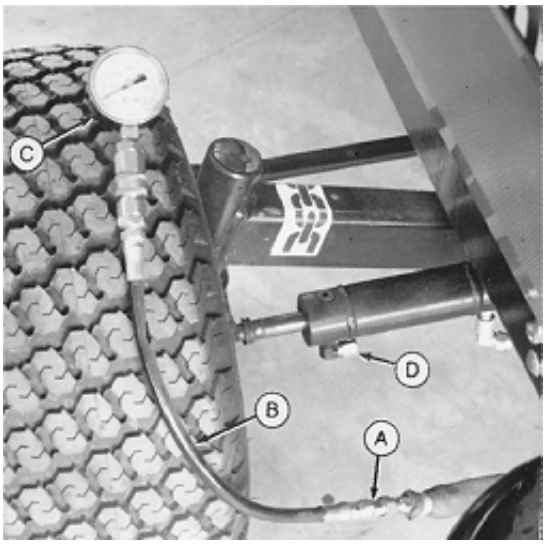
PROCEDURE:
1. Warm hydraulic oil. (See procedure in this group.)

2. Operate engine at fast idle.

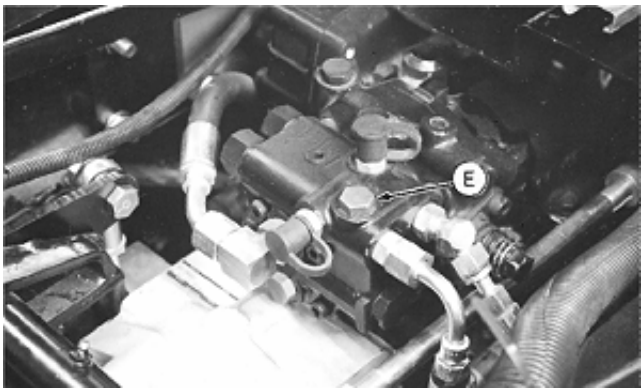
3. Turn steering wheel fully to the left and continue turning while observing the gauge.

SPECIFICATIONS:
- Steering relief valve pressure .. 10497—10997 kPa (105—110 bar) (1522.5—1595 psi)

RESULTS:
If pressure gauge reading is not within specifications, replace relief valve assembly. See procedure in Section 60, Group 05.



Slide E35897



Slide M81409

A—Adapter
B—Hose
C—Gauge
D—Cap
E—Optional Test Port

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STEERING SYSTEM FLOW TEST

REASON:
To determine if the proportional valve is supplying the steering system with priority oil flow at the correct flow rate.

EQUIPMENT:
- JT05469 Flowmeter Kit (A)
- JT03216 Fitting (C)
- JT03341 Fitting (D)
- JT03342 Coupler (E)

CONNECTIONS:
1. Disconnect supply line to the steering valve from flow control valve fitting.

2. Install JT03216 Fitting and JT03341 fitting into flow divider housing.

3. Connect JT05469 flowmeter hose to fitting, using JT03342 coupler.

4. Insert flowmeter return hose (B) into the transaxle fill hole.

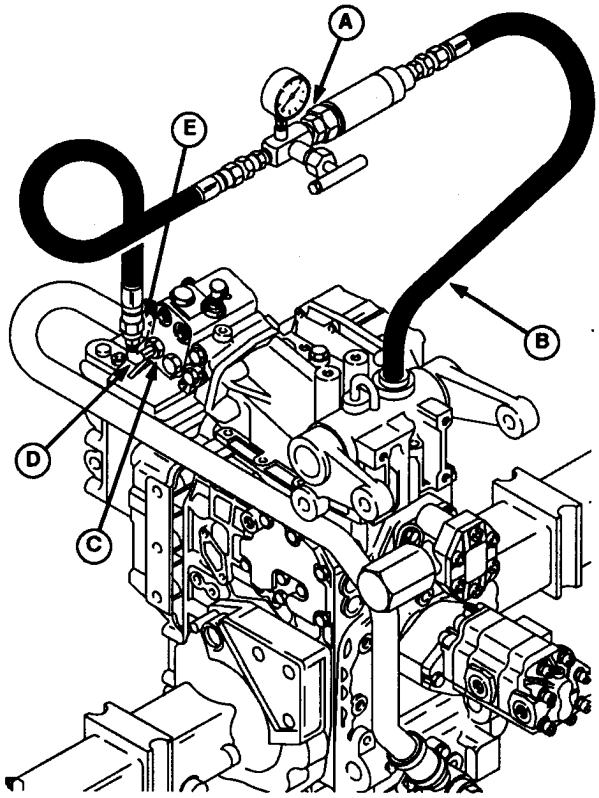
PROCEDURE:
1. Open valve on flowmeter.

2. Start engine and operate at fast idle.

3. Observe flow rate on flowmeter.

SPECIFICATION:
- Flow rate to steering valve .. 64 L/min

RESULTS:
- If flow rate is low, inspect priority divider valve in flow control valve for scoring and springs for equal tension or breakage. If valve and springs look good, see Section 270 for Hydraulic System Tests.



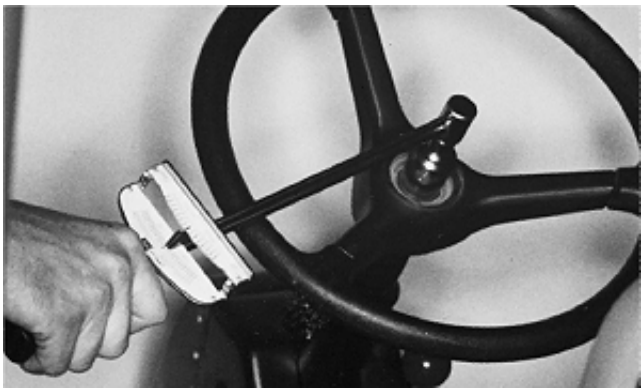
M81537AE -UN-07JAN93

Slide M81537AE

A—JT05469 Flowmeter
B—Return Hose
C—JT03216 Fitting
D—JT03341 Fitting
E—JT03342 Coupler

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STEERING SYSTEM LEAKAGE TEST



Slide M81510

REASON:
To check the steering system for internal leakage.

EQUIPMENT:
- Torque wrench

PROCEDURE:
1. Warm hydraulic oil. (See procedure in this group.)

2. Start engine and run at slow idle.

3. With wheels in a maximum right turn position, turn steering wheel with a constant torque of 6.8 N·m (60 lb-in.).

4. Observe the number of rotations of the steering wheel that occurs in one minute.

5. With wheels in a maximum left turn position, turn steering wheel with a constant torque of 6.8 N·m (60 lb-in.).

6. Observe the number of rotations of the steering wheel that occurs in one minute.

SPECIFICATIONS:
- Hydraulic Oil Temperature .. 43˚C (110˚F)
- Engine Speed Slow Idle .. 1000 rpm
- Maximum Right Turn rpm .. 6 rpm
- Maximum Left Turn rpm .. 6 rpm

RESULTS:
- If steering valve rpm is more than specifications, perform Steering Valve Leakage Test. (See procedure in this group.)

MX,26015HV,A18 -19-18JAN93

STEERING VALVE LEAKAGE TEST

REASON:
To check the steering valve and cylinder for internal leakage.

EQUIPMENT:
- Torque wrench
- 38H1145 M ORFS Plugs (2)

IMPORTANT: O-ring seal (ORFS) plugs must be used to plug pressurized hydraulic hoses.

PROCEDURE:
1. Heat hydraulic oil (See Hydraulic Oil Warm-up Procedure in this group.)

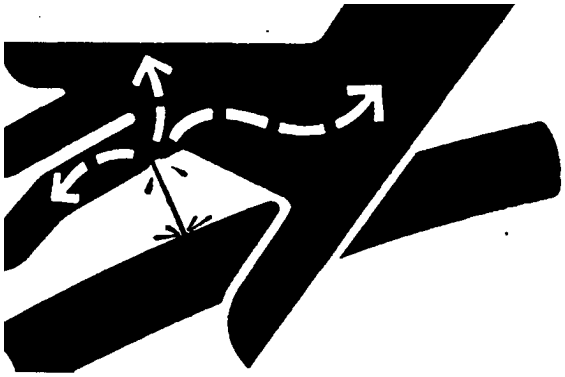
2. Stop the engine.

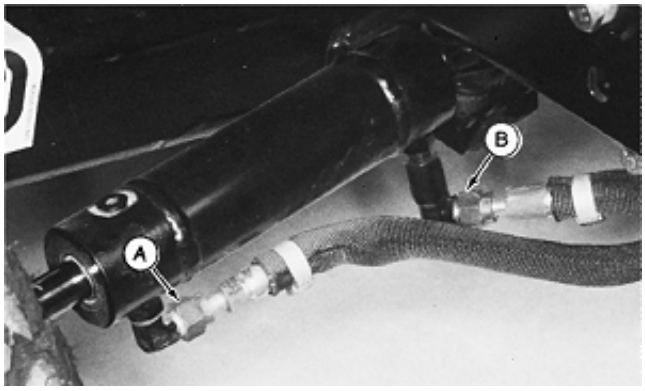
N **CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Avoid the hazard by relieving pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure. Search for leaks with a piece of cardboard. Protect hands and body from high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

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

3. Disconnect hoses (A and B) from steering cylinder. Close all openings using caps and two 9/16-18 MORFS plugs.

4. Start engine and run at slow idle.





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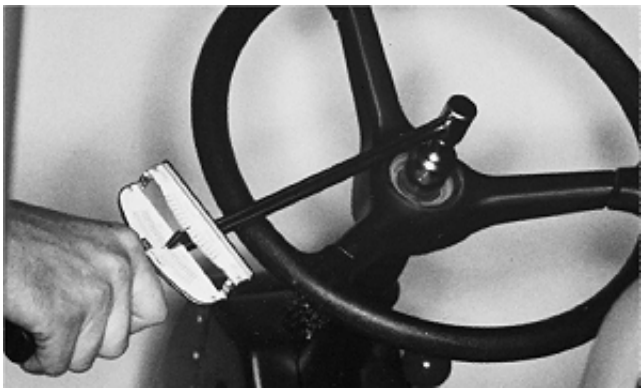
PROCEDURE—Continued:

5. With wheels in a maximum right turn position, turn steering wheel with a constant torque of 6.8 N·m (72 lb-in.).

6. Observe the number of rotations of the steering wheel that occurs in one minute.

7. With wheels in a maximum left turn position, turn steering wheel with a constant torque of 6.8 N·m (60 lb-in.).

8. Observe the number of rotations of the steering wheel that occurs in one minute.



Slide M81510

SPECIFICATIONS:
- Hydraulic Oil Temperature .. 43˚C (110˚F)
- Engine Speed Slow Idle .. 1000 rpm
- Maximum Right Turn rpm .. 6 rpm
- Maximum Left Turn rpm .. 6 rpm

RESULTS:
- If steering valve rpm equals or is less than specifications, replace steering cylinder. (See Section 60.)

- If steering valve rpm is more than specifications, repair steering valve. (See Section 60.)

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ADJUST BRAKES

REASON:
To achieve proper brake operation.

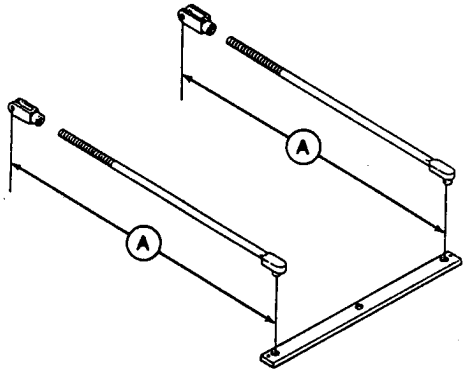
PROCEDURE:
1. Check initial length (A), of left and right brake rods. Rod lengths must be equal and meet specified length.

2. Depress brake pedal firmly. Clearance (B), between pedal rod and front edge of slot in cover, should meet specifications.

SPECIFICATIONS:
- Initial left/right brake rod length .. 557 mm (21.9 in.)
- Brake pedal clearance .. 6 mm (1/4 in.)

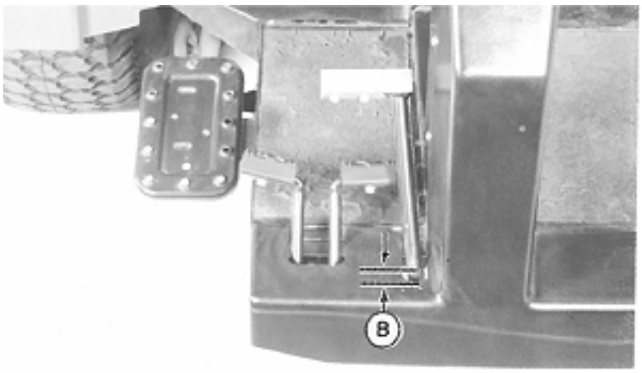
RESULTS:
- If left and right brake rods are not within specifications, disconnect brake rods and turn yoke, as necessary, to achieve specified length.

- If brake pedal clearance is not within specifications, disconnect center brake rod and turn yoke, as necessary, to achieve specified clearance.



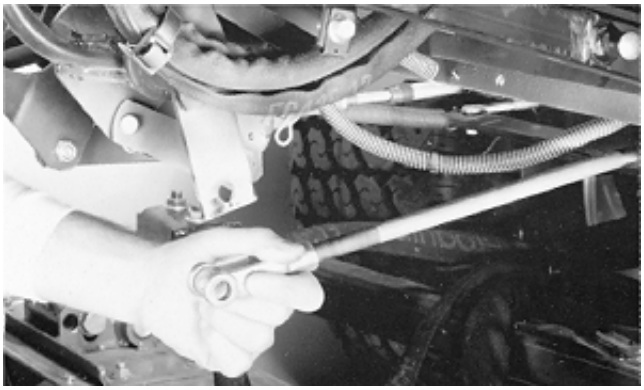
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ADJUST PARK BRAKE LOCK

REASON:
To achieve proper brake lock engage and disengagement.

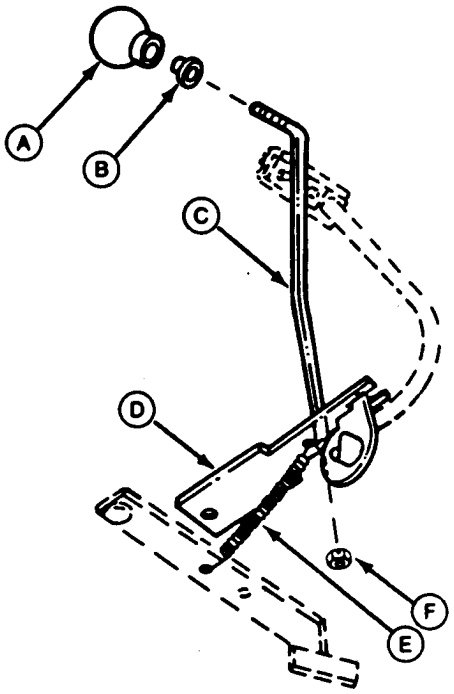
PROCEDURE:
1. Lower the park brake lock knob/rod assembly to the lowest part of slot in steering column.

2. Firmly depress the brake pedal. Pawl (D) should engage with ratchet plate and hold pedal in engaged position.

3. Firmly push brake pedal and move the knob/rod assembly to the high notch in steering column slot. Release pressure on brake pedal. Brakes should disengage.

RESULTS:
- If park brake lock does not engage, back-off adjustment nut (F) until pawl engages.

- If park brake lock does not disengage, tighten nut until brakes release.



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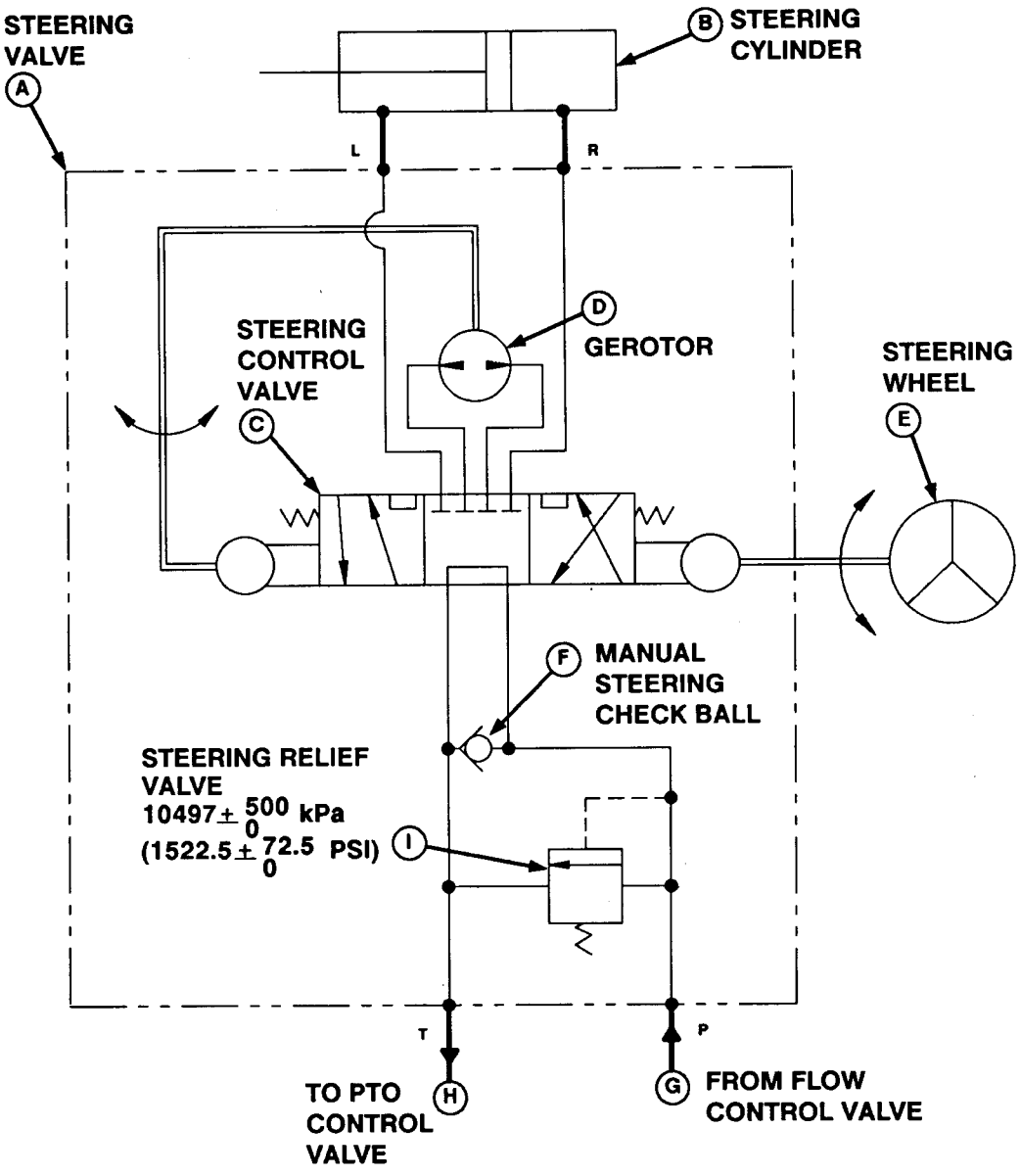
A—Knob
B—Weld Nut
C—Rod
D—Pawl
E—Spring
F—Nut

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STEERING SYSTEM SCHEMATIC



A—Steering Valve
B—Steering Cylinder
C—Steering Control Valve
D—Gerotor
E—Steering Wheel
F—Manual Steering Check Ball
G—From Flow Control Valve
H—To PTO Control Valve
I—Steering Relief Valve

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Section 270
HYDRAULIC SYSTEM OPERATION, TESTS AND ADJUSTMENTS

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COMPONENT LOCATION INFORMATION

This group contains component location drawings for the following systems:

- Hydraulic Lift System
- Mow Hydraulic System (S.N. —840000)
- Mow Hydraulic System (S.N. 840001—)

Use the drawings when diagnosing a hydraulic problem and to help locate the components to be tested.

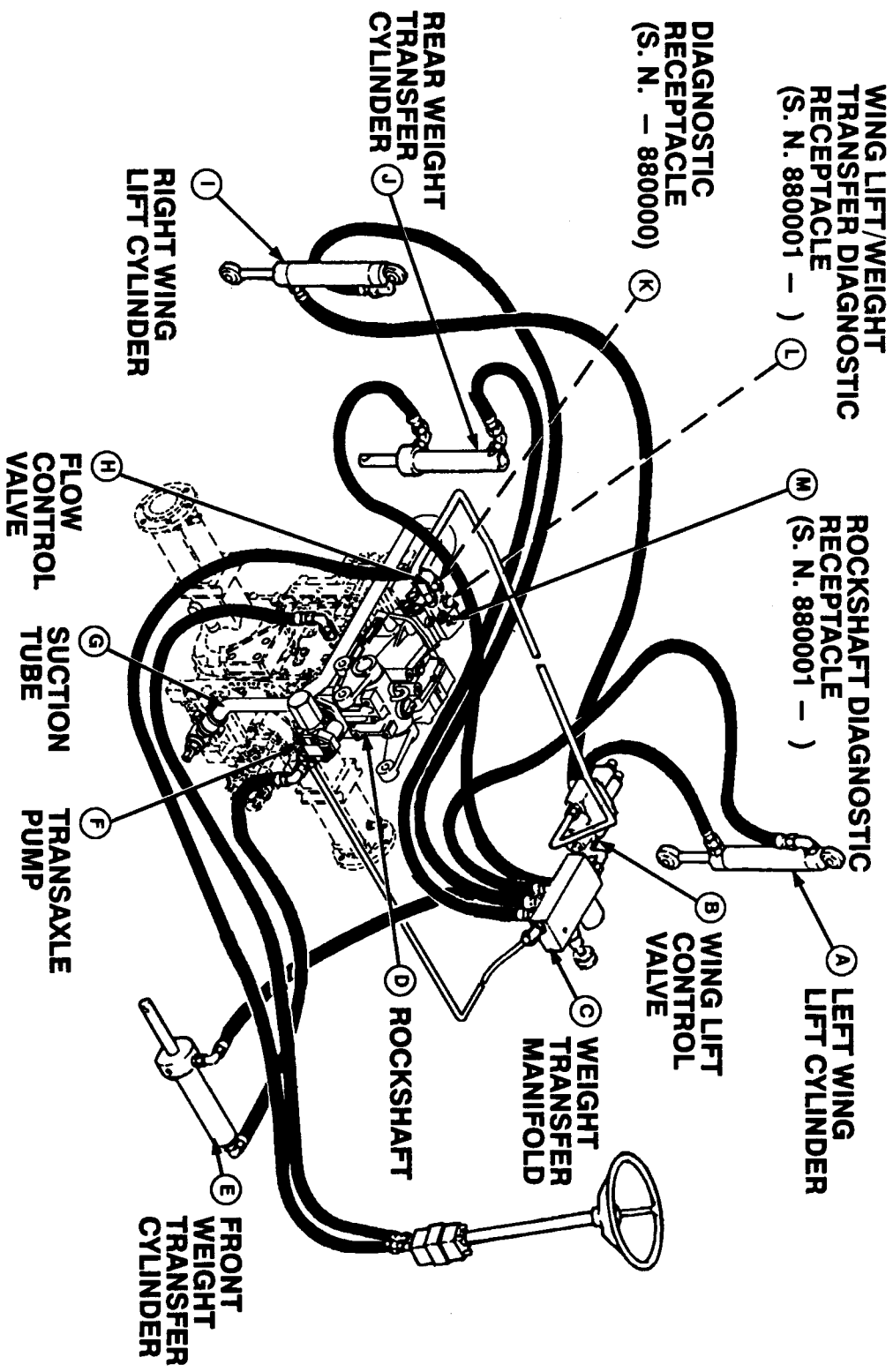
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HYDRAULIC LIFT SYSTEM COMPONENT LOCATION

A—Left Wing Lift Cylinder
B—Wing Lift Control Valve
C—Weight Transfer Manifold
D—Rockshaft
E—Front Weight Transfer Cylinder
F—Transaxle Pump
G—Suction Tube
H—Flow Control Valve
I—Right Wing Lift Cylinder
J—Rear Weight Transfer Cylinder

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HYDRAULIC LIFT SYSTEM COMPONENT LOCATION

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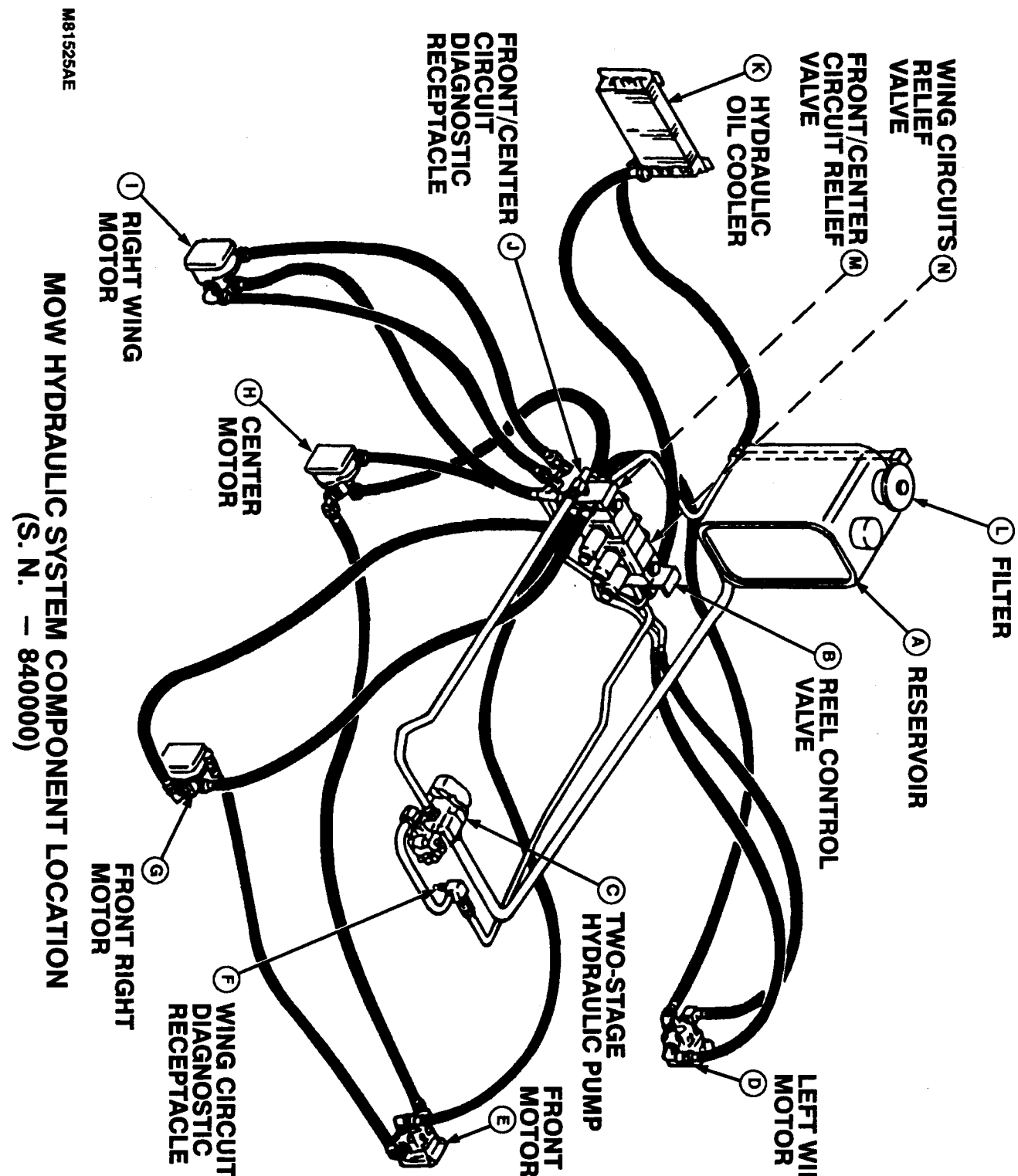
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MOW HYDRAULIC SYSTEM COMPONENT LOCATION (S.N. —840000)

A—Reservoir
B—Reel Control Valve
C—Two-Stage Hydraulic Pump
D—Left Wing Motor
E—Front Left Motor
F—Wing Circuits Diagnostic Receptacle
G—Front Right Motor
H—Center Motor
I—Right Wing Motor
J—Front/Center Circuit Diagnostic Receptacle
K—Hydraulic Oil Cooler
L—Filter
M—Front/Center Circuit Relief Valve
N—Wing Circuits Relief Valve

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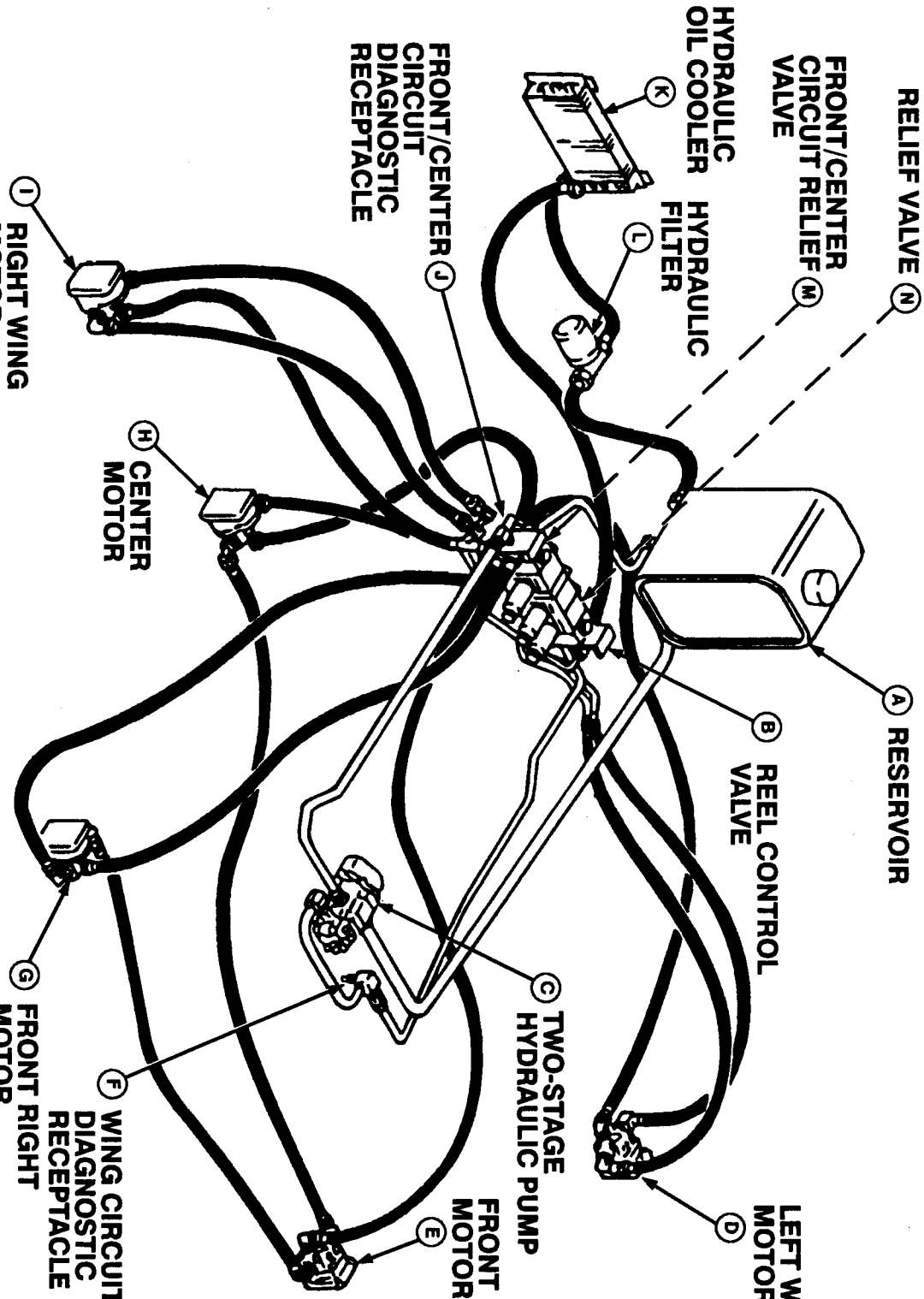
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MOW HYDRAULIC SYSTEM COMPONENT LOCATION (S.N. 840001—)

A—Reservoir
B—Reel Control Valve
C—Two-Stage Hydraulic Pump
D—Left Wing Motor
E—Front Left Motor
F—Wing Circuits Diagnostic Receptacle
G—Front Right Motor
H—Center Motor
I—Right Wing Motor
J—Front/Center Circuit Diagnostic Receptacle
K—Hydraulic Oil Cooler
L—Hydraulic Oil Filter
M—Front/Center Circuit Relief Valve
N—Wing Circuits Relief Valve

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THEORY OF OPERATION INFORMATION

This group explains operation of the hydraulic system and divides it into individual components or sub-systems by function. Each story contains information on function, component or sub-system identification and theory of operation.

The following systems or components are covered:
- Hydraulic Lift System
- Flow Control Valve
- Rockshaft System
- Wing Lift System
- Weight Transfer System
- Cutting Unit Control System
- Cutting Unit Motor

The slide number reference under the art is used for service training purposes only.

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HYDRAULIC LIFT SYSTEM OPERATION

A—Left Wing Lift Cylinder
B—Wing Lift Control Valve
C—Weight Transfer Manifold
D—Rockshaft
E—Front Weight Transfer Cylinder
F—Transaxle Pump
G—Suction Tube
H—Flow Control Valve
I—Right Wing Lift Cylinder
J—Rear Weight Transfer Cylinder

Slide M81527AE

FUNCTION:
Provide hydraulic power to lift and lower cutting units.

MAJOR COMPONENTS:
- Transaxle Pump
- Flow Control Valve
- Rockshaft Assembly
- Wing Lift Control Valve
- Wing Lift Cylinders

THEORY OF OPERATION:
The hydraulic lift system is an open-center system. Pressure oil for the lift system is supplied by the transaxle pump (F). The pump is connected directly to the drive shaft and operates any time the engine is operating. Oil is drawn from the transaxle sump through the suction tube (G) to the pump.

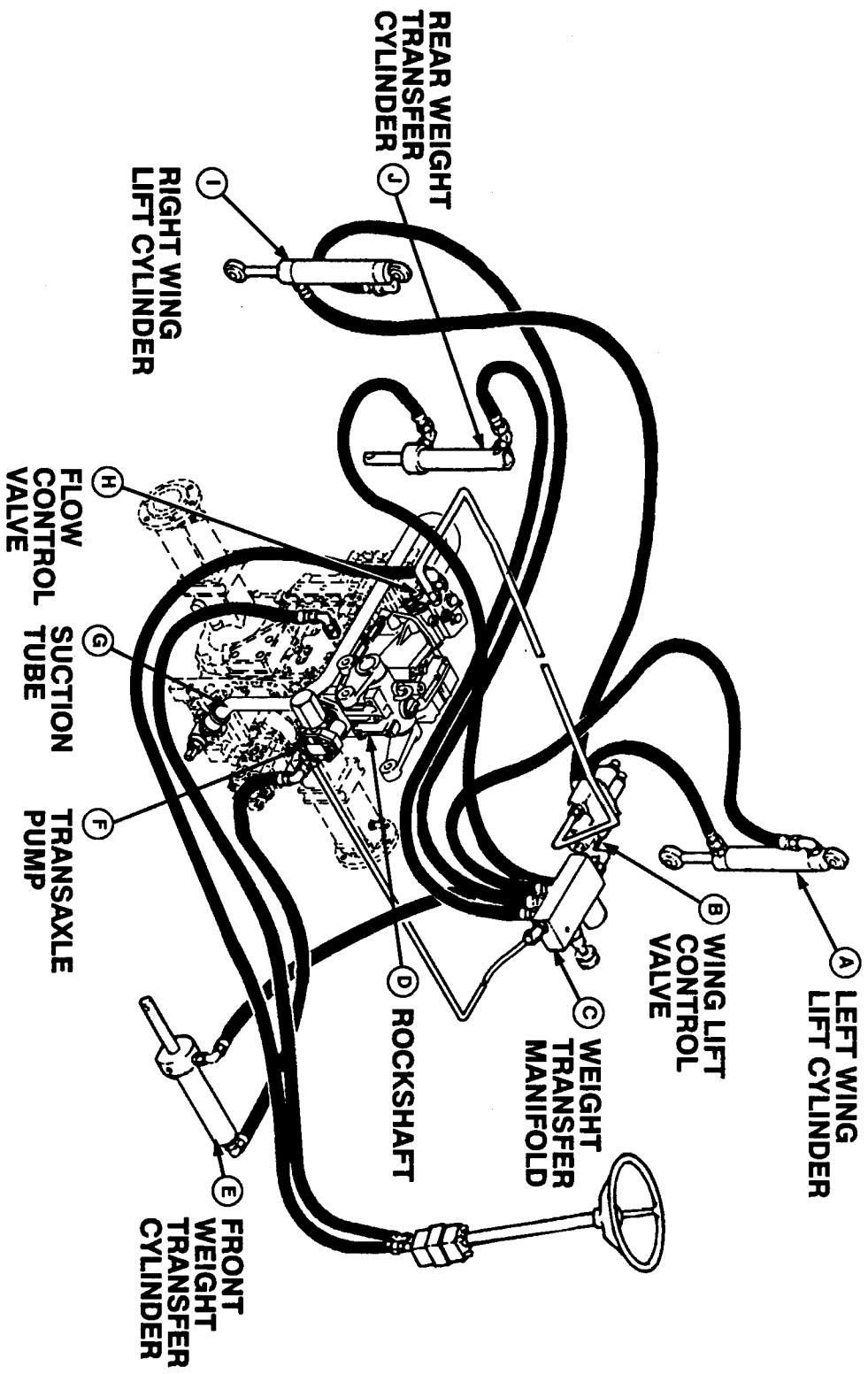
From the pump, oil flows to the flow control valve (H). The flow control valve distributes pressure oil to the steering valve, rockshaft assembly (D) and wing lift control valve.

To complete the hydraulic circuit, all return oil is routed to the transaxle sump.

Refer to respective theory of operation for the function of individual components in this group.

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FLOW CONTROL VALVE OPERATION

A—Wing Lift Relief Valve **B—Rockshaft Relief Valve** **C—Priority Flow Divider Valve** **D—Proportional Flow Divider Valve**

Slide EXC31905

FUNCTION:
Distribute pressure oil to steering, rockshaft and wing lift functions.

MAJOR COMPONENTS:
- Priority Flow Divider Valve
- Proportional Flow Divider Valve
- Wing Lift Relief Valve
- Rockshaft Relief Valve

THEORY OF OPERATION:
The priority valve is a multi-function valve which consists of two circuit relief valves (A) and (B), a priority flow divider valve (C), and a proportional flow divider valve (D).

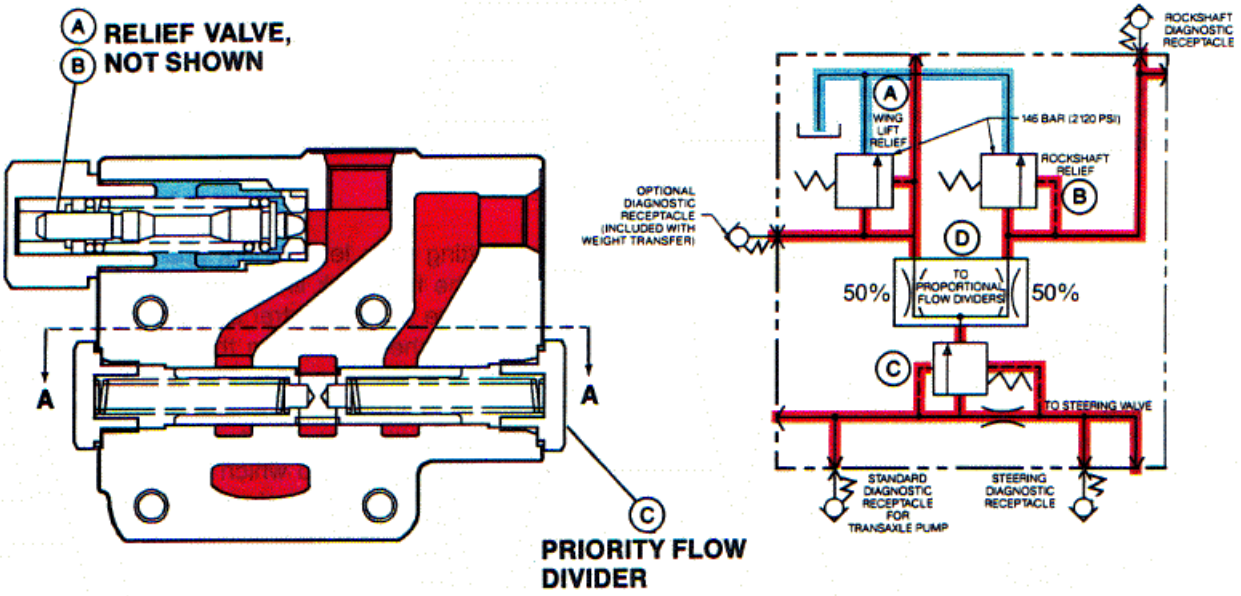
Pressure oil from the transaxle pump flows to the priority flow divider and on to the steering valve. The steering function has priority. The steering flow rate must be satisfied before oil flow can be routed to the proportional flow divider valve.

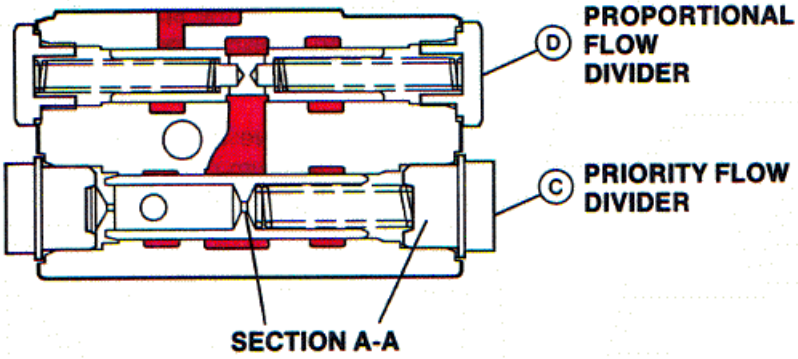
Steering function oil flow is controlled by the priority flow divider valve which maintains a flow rate of 6.4 L/min (1.69 gpm) for the steering circuit.

From the priority flow divider, the balance oil flow is routed to the proportional flow divider valve. The proportional valve equally divides the remaining oil flow (flow not used by power steering) between the rockshaft circuit and wing lift circuit.

The circuit relief valves are adjusted to the same relief pressure 14617 kPa (146 bar) (2120 psi). Relief valve (B) controls the circuit pressure for rockshaft operation; relief valve (A) controls the wing lift circuit pressure. When the circuit exceeds the pressure setting, pressure oil in the circuit is allowed to flow to the transaxle sump until pressure is reduced below the relief setting.

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ROCKSHAFT SYSTEM OPERATION

A—Flow From Flow Control Valve
B—100 Mesh Filter Screen
C—Unload Valve
D—Rockshaft Control Valve
E—Rockshaft Flow Control Valve
F—Load Check
G—100 Mesh Filter Screen
H—Mechanical Check
I—Connecting Plate
J—Lowering Check Valve
K—Rockshaft Piston and Cylinder
L—Rate-of-Drop/Stop Valve
M—Safety Relief Valve
N—250 Mesh Suction Screen
O—To Charge and Transaxle Pumps

Slide M80976AE

FUNCTION:
Raise and lower front and center cutting units.

MAJOR COMPONENTS:
- Rockshaft Control Valve
- Unload Valve
- Rockshaft Flow Control Valve
- Mechanical Check Valve
- Load Check Valve
- Lowering Check Valve
- Rate-of-Drop/Stop Valve
- Rockshaft Piston
- Safety Relief Valve

THEORY OF OPERATION:
The rockshaft control valve is located on the left side of the rockshaft. The rate-of-drop/stop valve (L) is located on the right side of the rockshaft and controls the rate of flow from the rockshaft cylinder (K).

As pressure oil (A) enters the rockshaft control valve, the oil flows through a filter screen (B) to the unload valve (C), the rockshaft control valve (D) and the rockshaft flow control valve (E). All of the valves are located in the rockshaft control valve.

LOWER POSITION
When the cutting units lever is in the lower, forward position, the control valve is moved to the lower position. Pressure oil unseats and flows through the unload valve to the transaxle sump. The connecting plate (I) moves with the control valve and pushes open the mechanical check (H).

Oil in the rockshaft cylinder (K) flows through the rate-of-drop/stop valve (L) because the lowering check (J) closes. From the rate-of-drop/stop valve, oil flows through the filter screen (G) and mechanical check to the transaxle sump. The cutting units will lower.

If the cutting units lever is not pushed all the way forward, the feedback linkage will push the rockshaft control valve to the neutral position. This closes the mechanical check, stopping the flow of oil from the rockshaft cylinder. Pressure oil continues to flow through the unload valve to sump. The cutting units will lower and then stop before contacting the ground. The position to which the cutting units lower is determined by how far forward the lever is moved.

RAISE POSITION:
When the cutting units lever is moved to the lift, rearward position, the rockshaft control valve allows pressure oil to flow to the spring side of the unload valve. Since the sensing pressure is the same on both sides, the spring closes the unload valve.

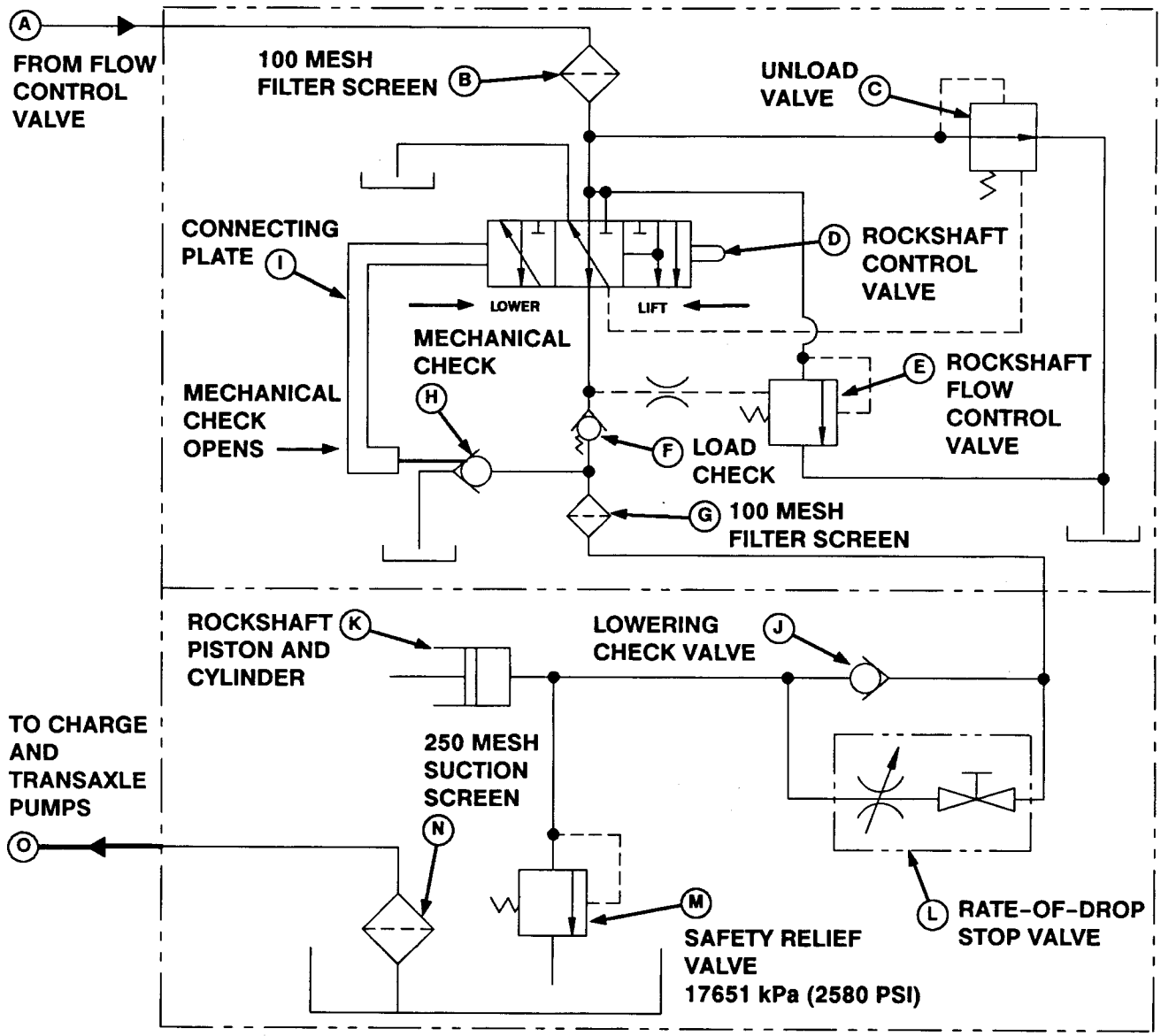
The flow control valve senses pressure on both sides to regulate a maximum of 30 L/min (7.9 gpm) flow to the rockshaft cylinder.

Regulated pressure oil flows through the load check (F), filter screen (G) and lower check (J) to the rockshaft cylinder. Cutting units will raise until the feedback linkage shifts the rockshaft control valve to the neutral position. Pressure oil again flows through the unload valve to sump because the spring side of the valve is connected to sump and pressure oil opens the valve.

The safety relief valve (M) protects the rockshaft system from high pressure loads. The check valve prevents high pressure loads from going back into the rockshaft control valve circuit.

The load check and the mechanical check trap the oil in the rockshaft cylinder to keep cutting units in the raised position.

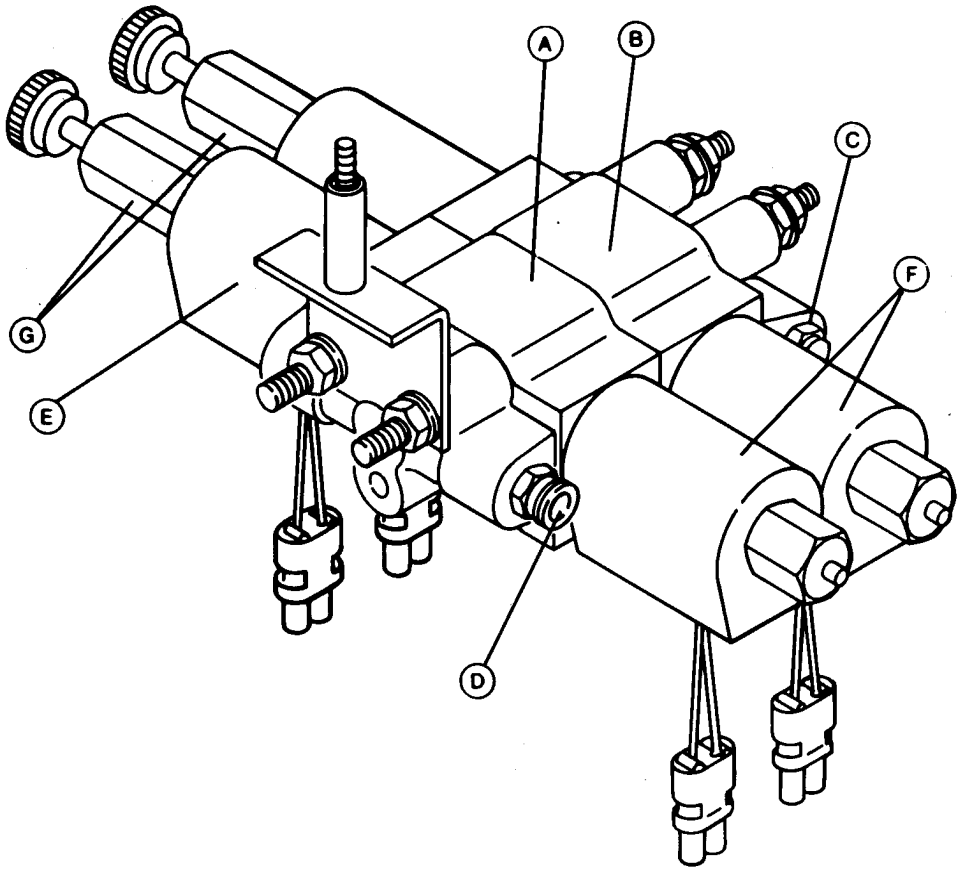
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MX,27010HV,A7 -19-18JAN93

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WING LIFT SYSTEM OPERATION—GENERAL



A—Right Wing Lift Valve Section
B—Left Wing Lift Valve Section
C—Inlet Manifold Section
D—Outlet Manifold Section
E—Lift Solenoid (2 used)
F—Lower Solenoid (2 used)
G—Rate-of-Drop Adjuster

Slide E34080

FUNCTION:
Controls lift and lower of wing cutting units.

MAJOR COMPONENTS:
- Transaxle Pump
- Flow Control Valve
- Wing Lift Control Valve
- Wing Lift Cylinders

THEORY OF OPERATION:
The transaxle pump supplies pressure oil to the flow control valve. The flow control valve directs oil to the steering valve first. When the steering function is satisfied, oil flow then continues to the rockshaft or wing lift control valve.

The wing lift control valve assembly consists of identical right (A) and left (B) lift valves “stacked” between common inlet (C) and outlet (D) sections. Each valve section is a three-position, solenoid-operated valve. In the neutral or de-energized position, oil flows through the inlet section, past each valve spool and through outlet manifold to the weight transfer manifold.

The valve work ports are designated C1 and C2. Port C1 is plugged. Port C2 is connected to the rod end of the respective lift cylinder.

MX,27010HV,A8 -19-18JAN93

WING LIFT SYSTEM OPERATION—RAISE POSITION

A—Pressure Oil
B—Return Oil
C—Trapped Oil
C1—Plugged Port
C2—Work Port
D—Lift Solenoid Coil
E—Valve Spool

Slide EXC35892AE

FUNCTION:
Controls lifting of wing cutting units.

MAJOR COMPONENTS:
- Transaxle Pump
- Flow Control Valve
- Wing Lift Control Valve
- Wing Lift Cylinders

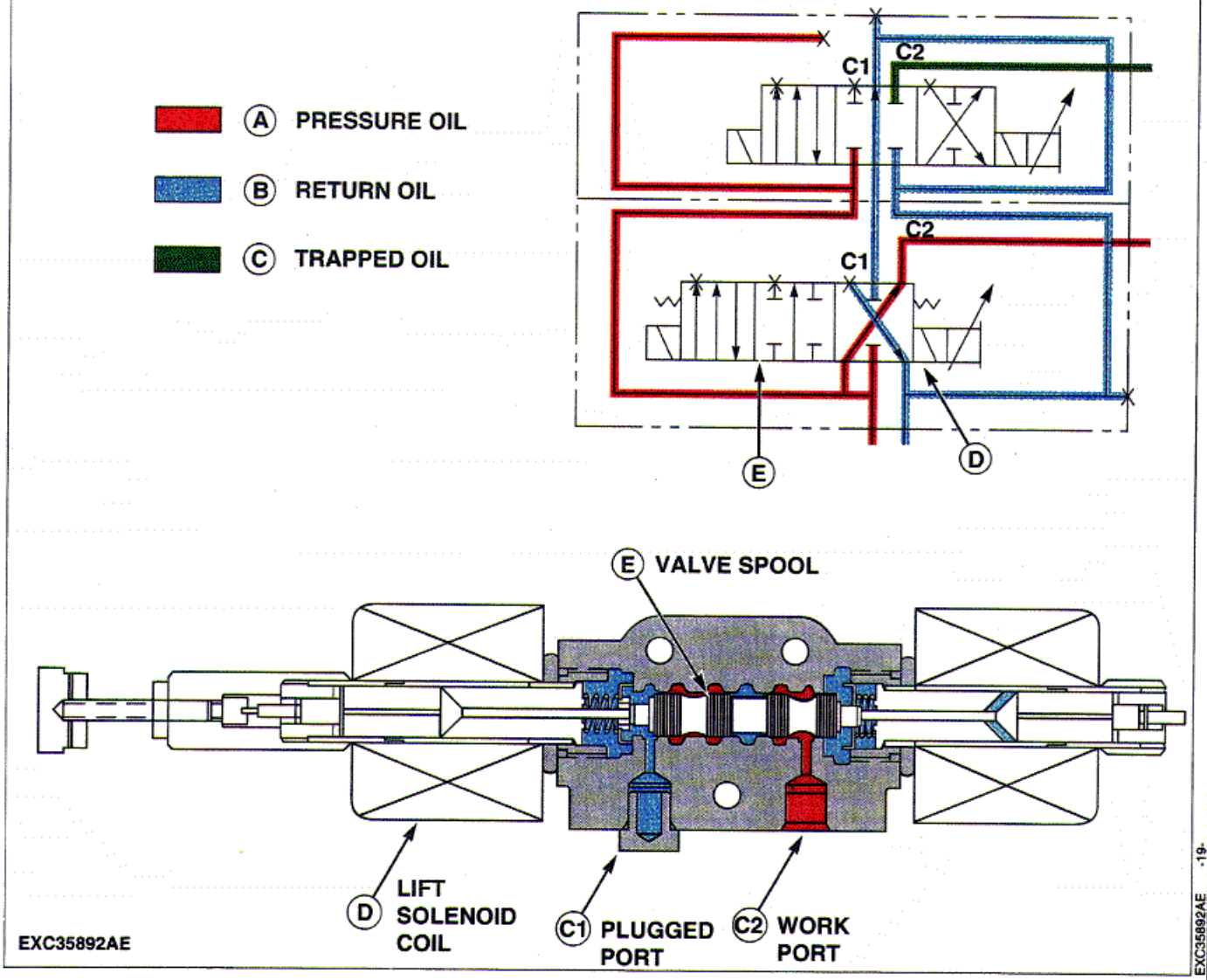
THEORY OF OPERATION:
When the operator selects the wing raise function (using the lift lever or the wing toggle switches), lift solenoid coil (D) is energized and valve spool (E) shifts forward. High pressure oil flows from the inlet manifold past the spool and out through port C2 to rod end of lift cylinder. Cylinder retracts, lifting the wing arm.

After the cylinders are fully retracted and the operator continues to activate the lift lever or switch, oil pressure builds in the lift circuit. When pressure becomes great enough, it opens wing lift relief valve located in flow control valve. Pressure oil then returns to the transaxle sump.

When the operator releases the lift lever or toggle switch, lift solenoid coil de-energizes. Centering springs push spool to center (OFF) position, which traps oil in the work port and cylinder.

Pressure oil always flows through the wing lift valve and continues on to the pressure side of the weight transfer manifold.

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MX,27010HV,A10 -19-18JAN93

WING LIFT SYSTEM OPERATION—LOWER POSITION

A—Pressure Oil
B—Return Oil
C—Trapped Oil
C1—Plugged Port
C2—Work Port
D—Lower Solenoid Coil
E—Valve Spool
F—Rate-Of Drop Adjuster

Slide EXC35893AE

FUNCTION:
Controls lowering of wing cutting units.

MAJOR COMPONENTS:
- Flow Control Valve
- Wing Lift Control Valve
- Wing Lift Cylinders

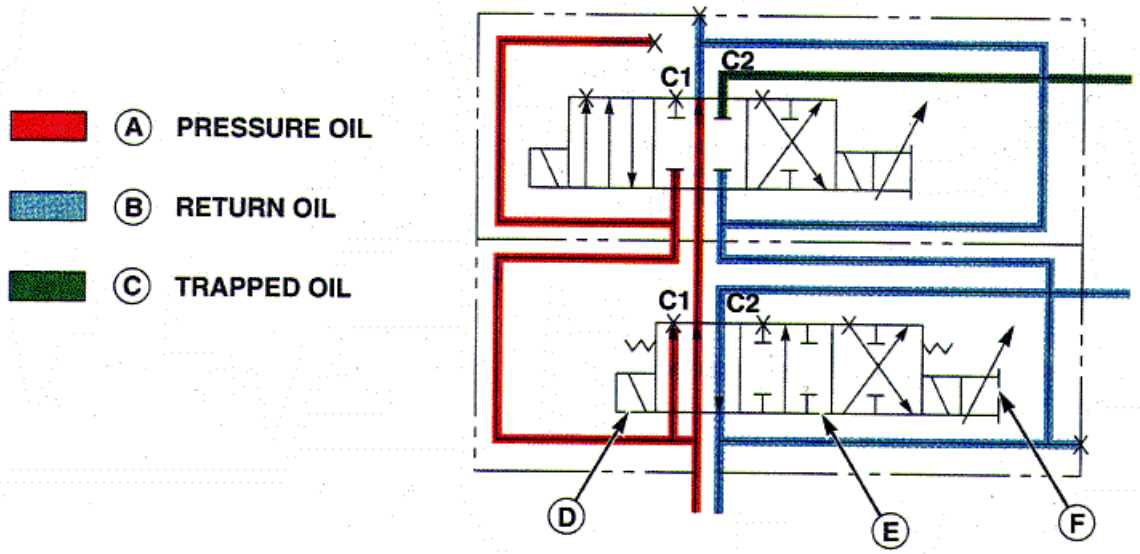
THEORY OF OPERATION:
When the operator selects the wing lower function (using the lift lever or wing toggle switches), lower solenoid coil (D) energizes and valve spool (E) shifts rearward. Port C2 is now connected to the return port of the control valve. The weight of the cutting unit and lift arm push oil from the cylinder, through port C2 and to outlet of wing control valve, allowing wing cutting unit to lower.

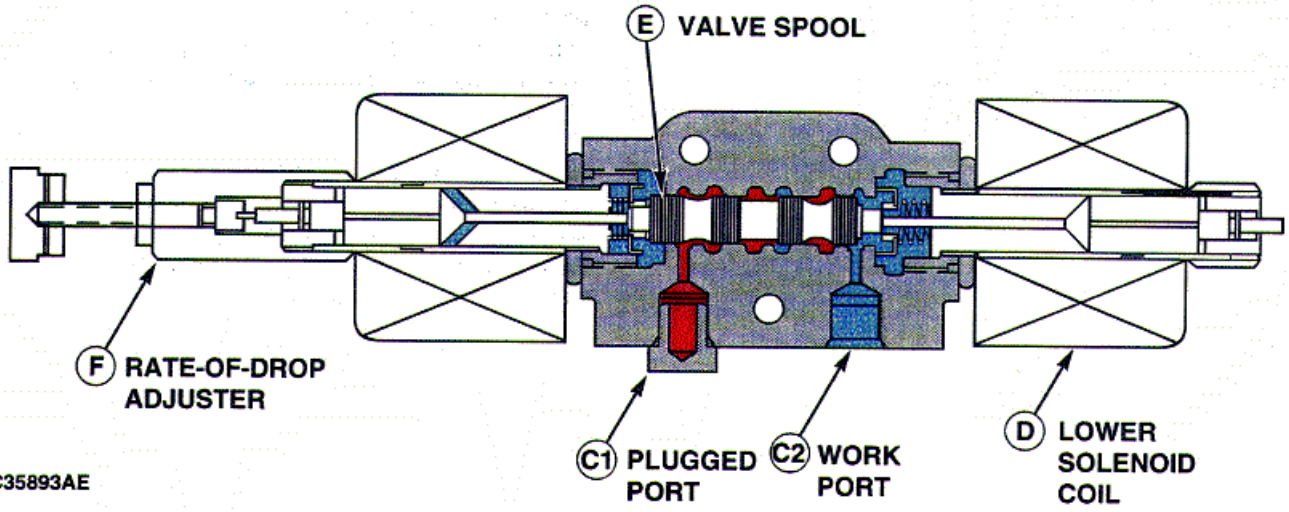
NOTE: The toggle switches must be used to lower the wing cutting units when they are raised above a 45˚ angle. If cutting units are lower than 45˚, they can be lowered with the lift lever. Key switch must be ON in both cases.

The rate-of-drop can be adjusted by turning knob of adjuster (F). The adjuster limits spool travel which regulates oil flow from the cylinder. When adjuster is turned clockwise, rate-of-drop decreases. When adjuster is turned counterclockwise, rate-of-drop increases.

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WEIGHT TRANSFER SYSTEM OPERATION—SYSTEM OFF

A—Pressure Oil
B—Return Oil
C—Two-Way Solenoid Valve
D—Adjustable Relief Valve
P1—Pressure Oil Port From Wing Lift Valve
P2—Pressure Oil Port From Center Weight Transfer Cylinder, Rod End
P3—Pressure Port From Front Weight Transfer Cylinder, Rod End
T1—Return Oil Port To Transaxle
T2—Return Port From Center Weight Transfer Cylinder, Head End
T3—Return Oil Port From Left Wing Cylinder, Head End
T4—Return Oil Port From Right Wing Cylinder, Head End

Slide EXC35891AE

FUNCTION:
Controls amount of machine weight applied to the front drive wheels.

MAJOR COMPONENTS:
- Transaxle Pump
- Flow Control Valve
- Weight Transfer Valve
- Right Wing Cylinder
- Left Wing Cylinder
- Front Weight Transfer Cylinder
- Rear Weight Transfer Cylinder

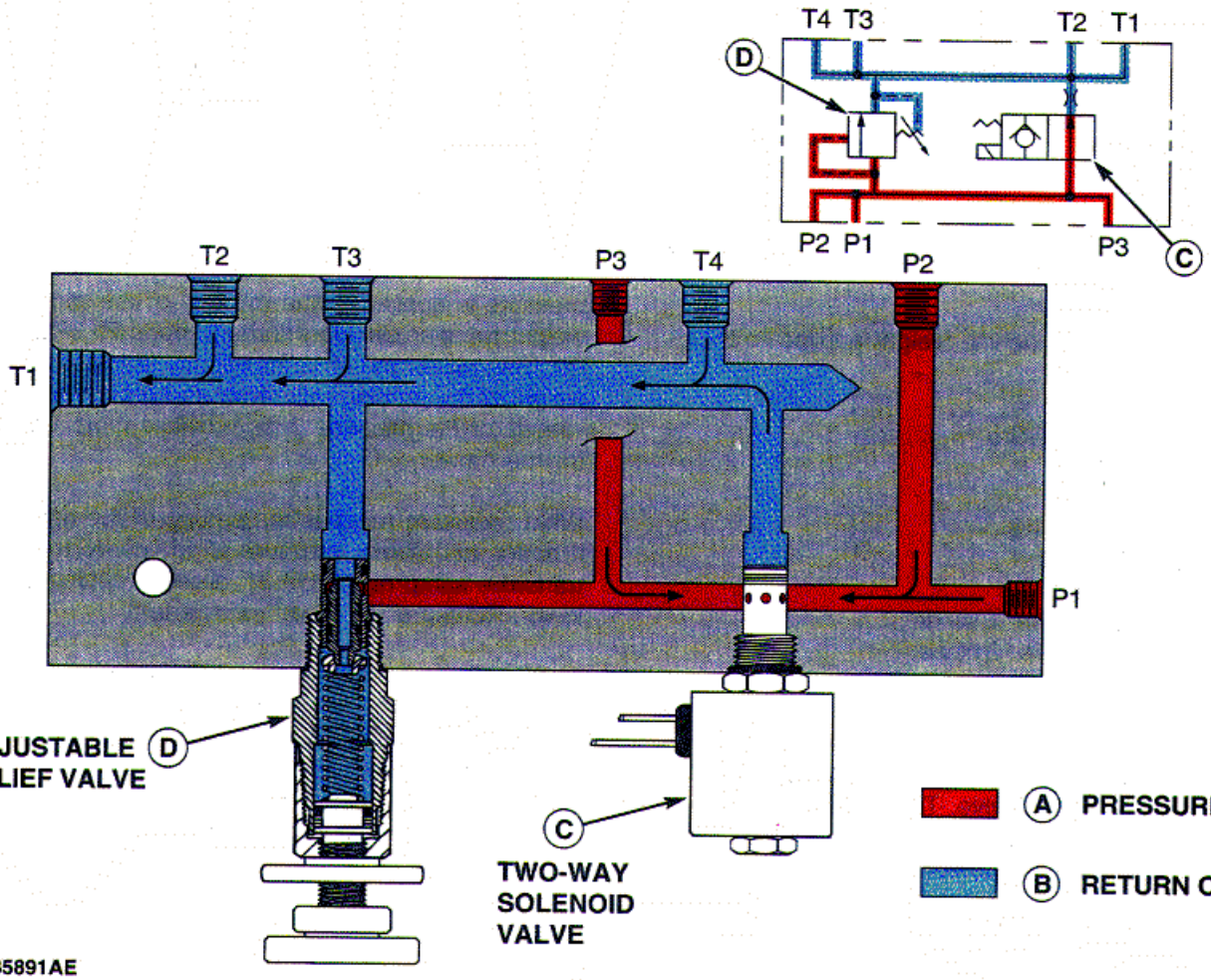
THEORY OF OPERATION:
The weight transfer valve assembly is a two-way solenoid valve (C) with an adjustable pressure relief valve (D) installed in parallel. The solenoid valve is a pull-type solenoid which permits oil flow through the valve in only one direction when the coil de-energizes.

With the weight transfer switch in the OFF (O) position, the solenoid coil is energized and routes oil flow through the valve. Pressure oil is allowed to flow to the transaxle jump through port T1.

Return oil from the center weight transfer cylinder and wing cylinders returns to the sump through the weight transfer valve manifold ports T2, T3, and T4. Return oil from front weight transfer cylinder is routed directly to transaxle sump.

With the weight transfer system off, minimum machine weight is applied to the drive wheels when all cutting units are lowered.

MX,27010HV,A13 -19-18JAN93



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MX,27010HV,A14 -19-18JAN93

WEIGHT TRANSFER SYSTEM OPERATION—SYSTEM ON

A—Pressure Oil
B—Return Oil
C—Two-Way Solenoid Valve
D—Adjustable Relief Valve
P1—Pressure Oil Port From Wing Lift Valve
P2—Pressure Oil Port From Center Weight Transfer Cylinder, Rod End
P3—Pressure Port From Front Weight Transfer Cylinder, Rod End
T1—Return Oil Port To Transaxle
T2—Return Port From Center Weight Transfer Cylinder, Head End
T3—Return Oil Port From Left Wing Cylinder, Head End
T4—Return Oil Port From Right Wing Cylinder, Head End

Slide EXC35890AE

FUNCTION:
Controls amount of machine weight applied to the drive wheels.

MAJOR COMPONENTS:
- Transaxle Pump
- Flow Control Valve
- Weight Transfer Valve
- Right Wing Cylinder
- Left Wing Cylinder
- Front Weight Transfer Cylinder
- Rear Weight Transfer Cylinder

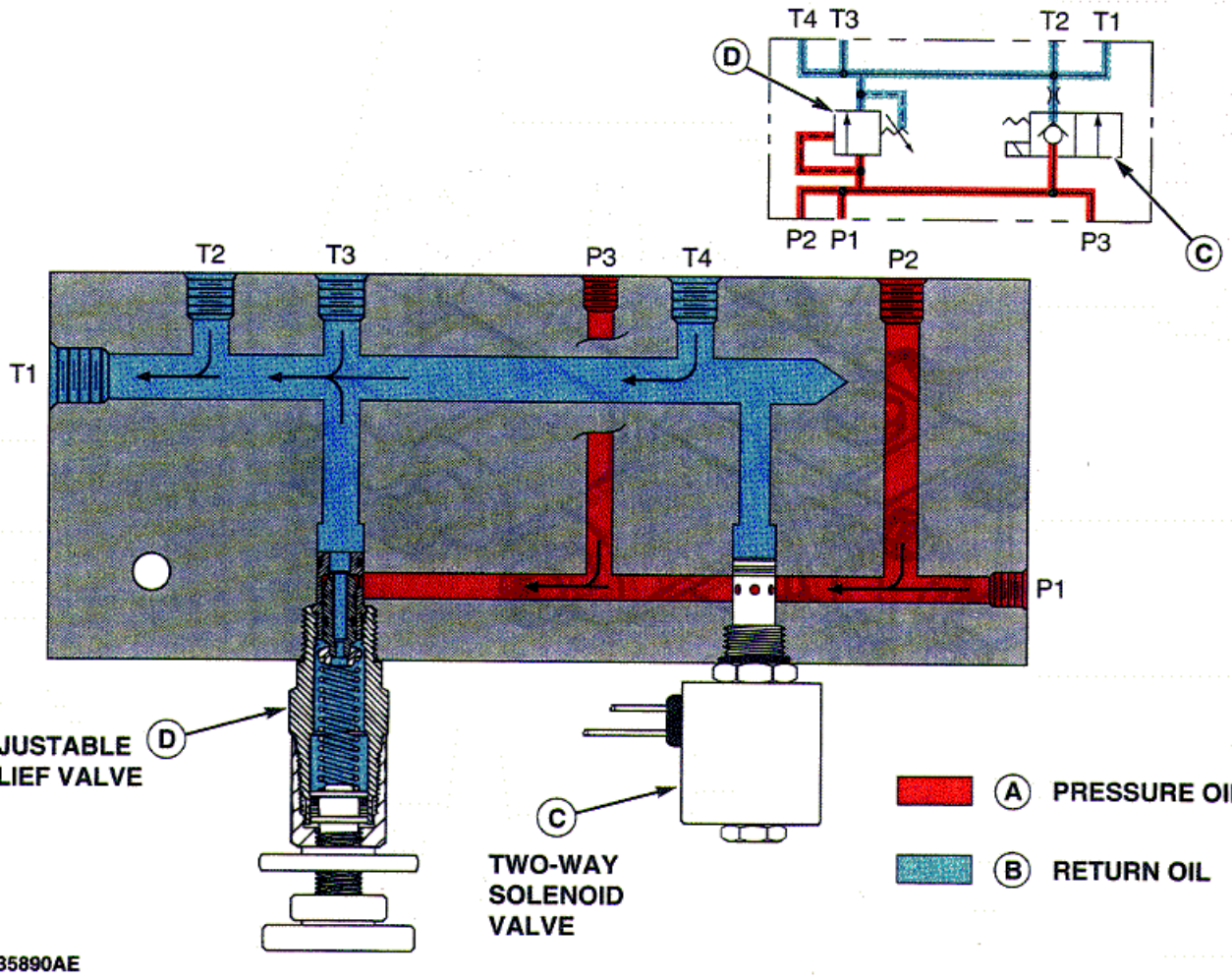
THEORY OF OPERATION:
With the weight transfer switch in the ON position, the solenoid (C) de-energizes which causes the valve to operate as a check valve. The flow of pressure oil to the transaxle sump is stopped. Oil flows past the solenoid valve to the adjustable relief valve.

Depending on the setting of the adjustable relief valve, 0—3447 kPa (0—35 bar) (0—500 psi), pressure is applied to the rod end of the wing and weight transfer cylinders through ports P1, P2, and P3. This raises the lift arms slightly, transferring the weight of the cutting units from the ground to the wheels of the machine. This provides more traction for the mower.

When pressure reaches the setting of the relief valve, it opens and allows pressure oil to flow to the transaxle sump return circuit, allowing cutting units to lower. Cutting units “float” on the turf.

NOTE: When the wing unit toggle switches are used to lower the wings with the weight transfer switch in the ON position, the weight transfer solenoid will activate and allow the wings to lower. The weight transfer solenoid activates only while toggle switch is held in the lower position.

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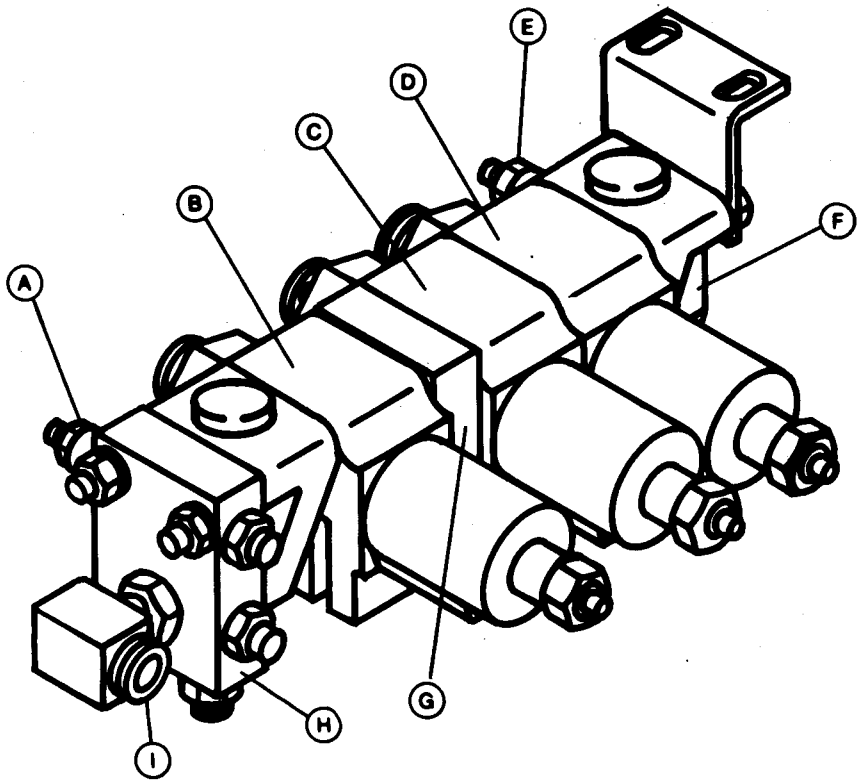


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EXC35890AE -19-

CUTTING UNIT CONTROL SYSTEM OPERATION —GENERAL



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A—Front And Center Cutting Units Relief Valve
B—Front And Center Cutting Units Control Valve Section
C—Right Wing Cutting Unit Control Valve Section
D—Left Wing Cutting Unit Control Valve Section
E—Wing Cutting Units Relief Valve
F—Wing Valve Sections Inlet
G—Right Wing Return Manifold Section
H—Motor Drain Return Manifold
I—Front And Center Valve Section Inlet

Slide E31898

FUNCTION:
Controls hydraulic power to the cutting unit motors.

MAJOR COMPONENTS:
- Hydraulic Pump
- Cutting Unit Control Valve
- Right Wing Motor
- Left Wing Motor
- Left Front Motor
- Right Front Motor
- Center Motor

THEORY OF OPERATION:
The cutting unit control valve consists of three stacked, solenoid-operated valve sections (B, C, and D). A return manifold (G) for the wing sections is mounted between front and center valve section and right wing valve section. The valve assembly includes two adjustable, direct-acting relief valves (A and E).

Relief valve (A) is the circuit relief valve for the front and center cutting units and is set at 17237—21374 kPa (172—214 bar) (2500—3100 psi). Relief valve (E) is the circuit relief valve for the wing cutting units and is set at 18616—22753 kPa (186—228 bar) (2700—3300 psi).

Each control valve section contains an open-center type spool valve where pressure oil flows through the valve sections when the valves are in the neutral position (coils de-energized).

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CUTTING UNIT CONTROL SYSTEM OPERATION —MOWING MODE

A—Pressure Oil **C—Solenoid Coil** **D—Valve Spool** **E—Cutting Unit Motor**
B—Return Oil

Slide EXC36001AE

FUNCTION:
Controls hydraulic power to the cutting unit motors.

MAJOR COMPONENTS:
- Hydraulic Pump
- Cutting Unit Control Valve
- Right Wing Motor
- Left Wing Motor
- Left Front Motor
- Right Front Motor
- Center Motor

THEORY OF OPERATION:
With the engine operating and the PTO engaged, pressure oil flows to each side of the cutting units control valve.

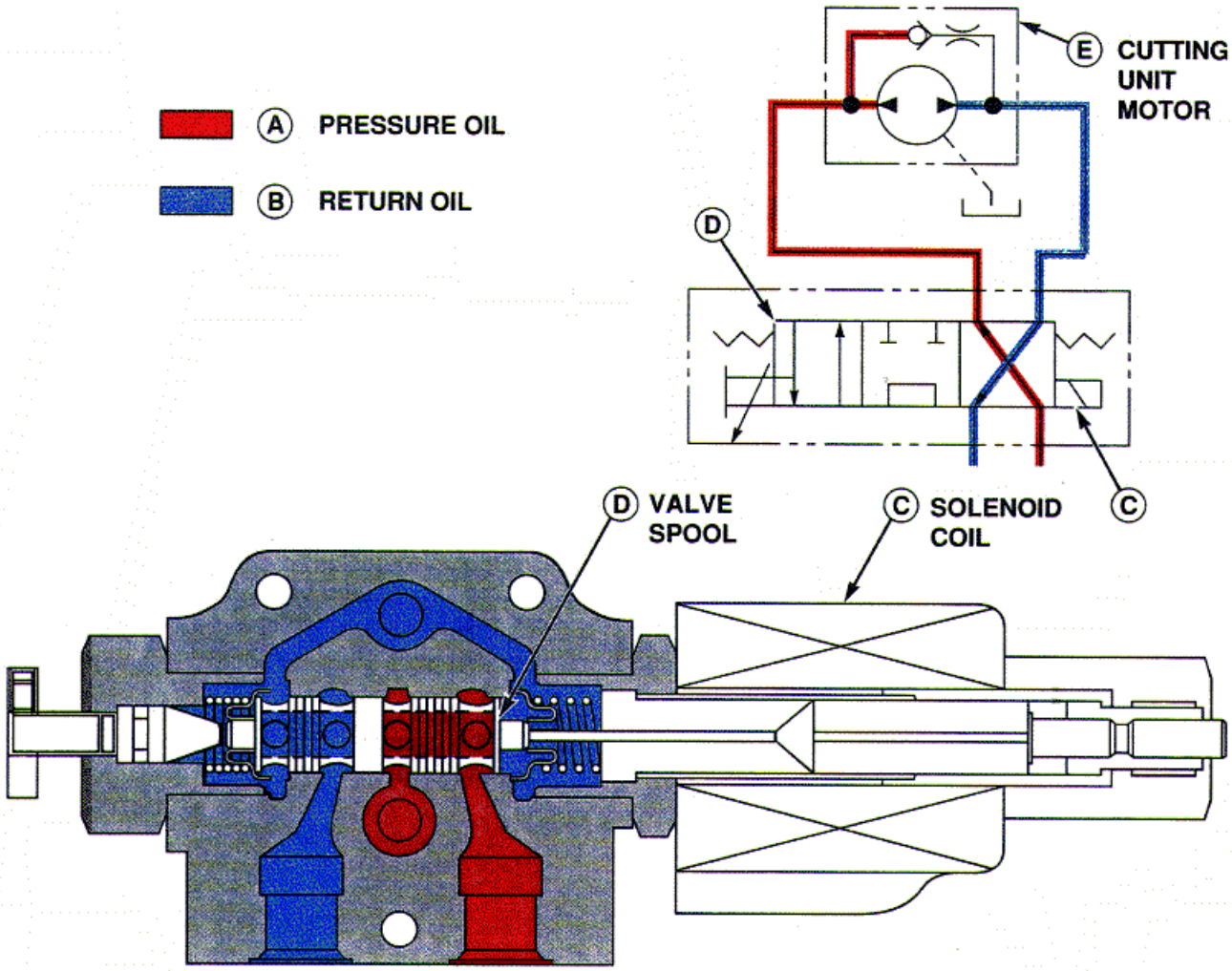
Lowering the cutting units using the cutting units lever energizes one, two or all three cutting unit valve solenoid coils (C).

When the solenoid coil energizes, the valve spool (D) shifts and pressure oil flows through valve spool to the cutting unit motor (E).

De-energizing the solenoid coil allows the springs to center the spool in the valve section. The spool blocks pressure oil, which then flows to the return manifold and back to the reservoir.

Return oil from the wing valve sections passes through the hydraulic oil cooler and filter before returning to reservoir.

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EXC36001AE

EXC36001AE -19-

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CUTTING UNIT CONTROL SYSTEM OPERATION —BACKLAP MODE

A—Pressure Oil **C—Backlap Thumb Screw** **D—Valve Spool** **E—Cutting Unit Motor**
B—Return Oil

Slide EXC36002AE

FUNCTION:
Controls hydraulic power to the cutting unit motors.

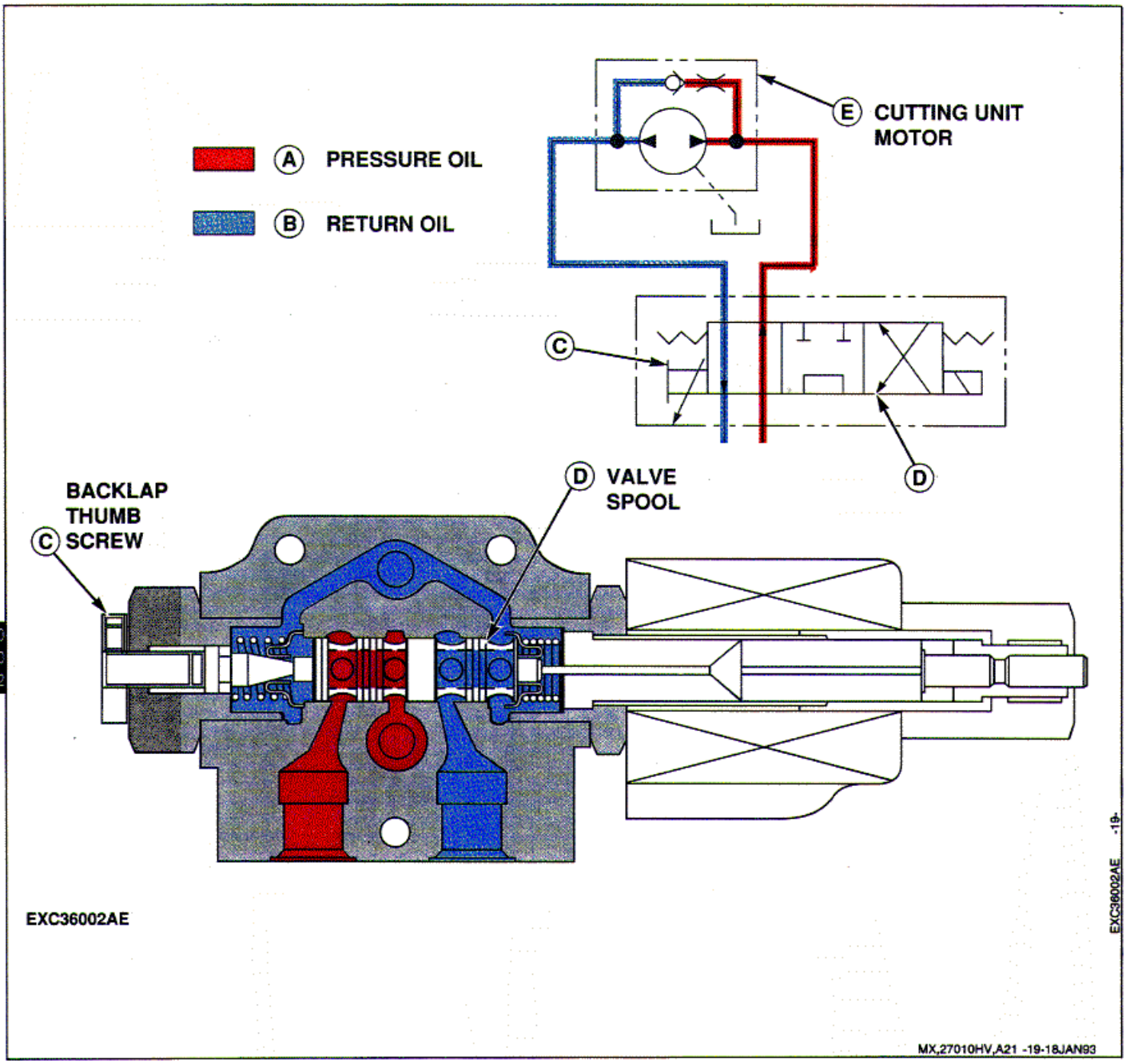
MAJOR COMPONENTS:
- Hydraulic Pump
- Cutting Unit Control Valve
- Right Wing Motor
- Left Wing Motor
- Left Front Motor
- Right Front Motor
- Center Motor

THEORY OF OPERATION:
In order to perform backlap operation, each cutting unit motor must operate in the reverse direction. Turning the thumb screw (C) clockwise shifts the valve spool forward.

With the PTO engaged, pressure oil will then flow through the spool to the outlet port of the cutting unit motor. The motor then rotates in the opposite direction. The thumb screw can be adjusted to “throttle” oil flow so motor can be adjusted to a safe, slow speed for backlapping.

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CUTTING UNIT MOTOR OPERATION

A—Motor Case
B—Displacement Gear with Drive Shaft
C—Displacement Gear
D—Check Valve
E—Ball
F—Oil Flow In
G—Oil Flow Out

Slide M81538AE/M81539AE

FUNCTION:
To supply rotating motion to cutting unit for mowing and backlapping.

MAJOR COMPONENTS:
- Motor Case
- Displacement Gears
- Check Valve

THEORY OF OPERATION:
Motor rotation is determined by viewing the shaft end of the motor. In this discussion, a clockwise rotating motor is shown.

MOW OPERATION
Pressure oil enters the motor. After rotating the gears in opposite directions, the oil exits the motor case and flows to the next motor or back to the reservoir.

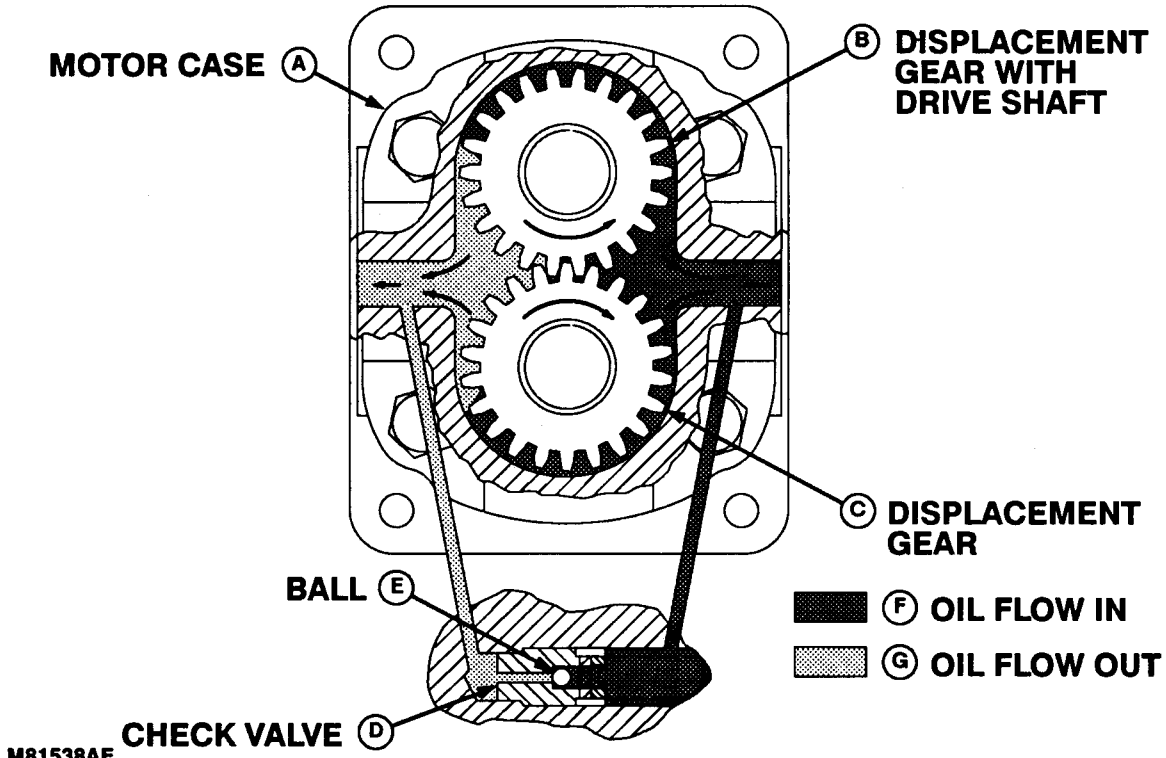
The check valve is closed in the mow function. Pressure oil flow seats the ball, forcing all oil flow through the motor gears.

BACKLAP OPERATION
The cutting unit control valve changes the direction of pressure oil flow to the motor. This causes the displacement gears to rotate in the other direction. Reels now rotate backwards for the backlapping procedure.

During backlapping, some pressure oil is allowed to bypass the displacement gears. Full hydraulic flow is not required for backlapping. The oil flow pushes the check valve ball off its seat. Some oil is allowed to flow through an orifice to the other side of the motor.

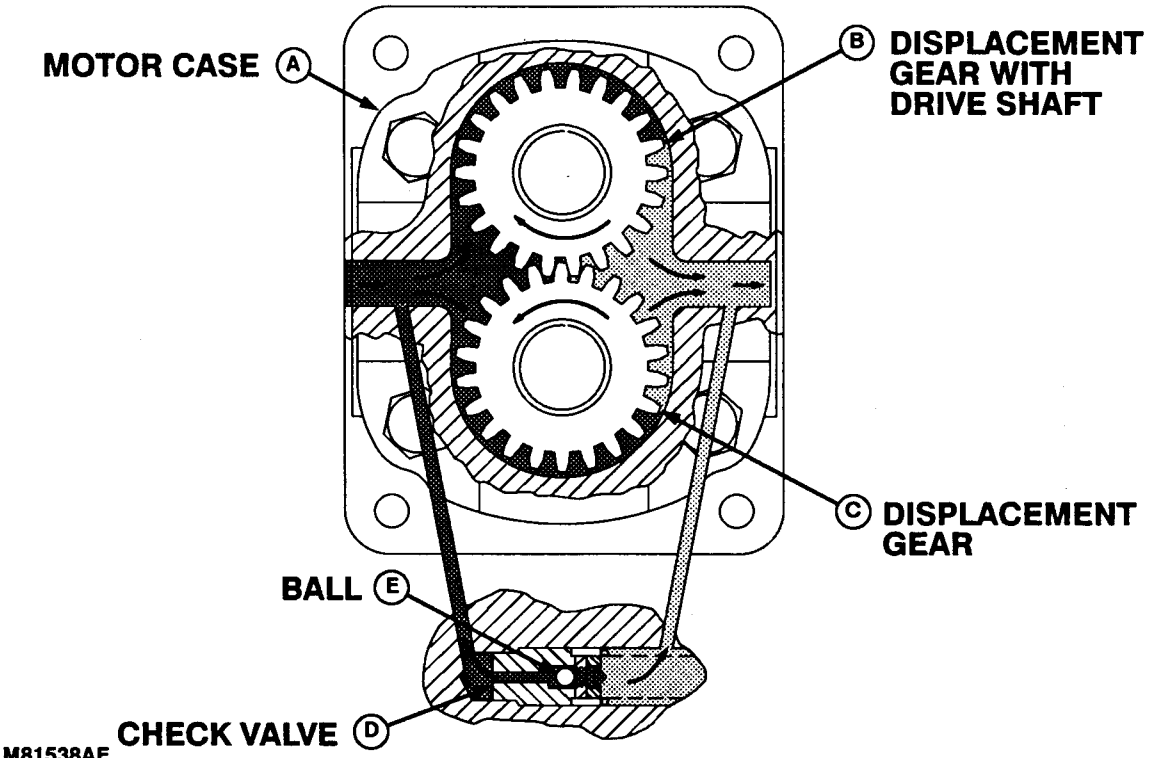
COOLING/LUBRICATION OPERATION
A small amount of pressure oil is used for lubrication and cooling. This small amount of oil passes the gears and bearings and flows to the drain port. A hose connects the motor drain port to the return manifold on the cutting unit control valve.

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MOW OPERATION

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BACKLAP OPERATION

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DIAGNOSTIC INFORMATION

The diagnostic information in this group is used to test components related to a specific problem or system. Select a symptom from the list and follow the test procedures under the heading. The symptom headings are:

- Hydraulic lift system does not operate and no power steering
- Hydraulic lift system does not operate, power steering operates or is slow.
- Low or slow hydraulic lift power
- Hydraulic lift system operates erratically
- Excessive transaxle pump noise
- Hydrostatic oil foams
- Hydrostatic oil overheats
- Cutting units lift lever sticks or is difficult to move.
- Front and center cutting units will not raise
- Wing cutting units will not raise
- Wing cutting units lower with cutting units lever in raised, position.
- Excessive hydraulic pump noise
- Hydraulic oil foams
- Hydraulic oil overheats
- Cutting units do not turn or turn slow
- One or more cutting units turning backwards
- Oil leaking from cutting unit motor
- Frequent failure of hydraulic lines and O-rings.

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 this 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 arrow points to the exact point the test is to be made.

The slide number reference under the art is used for service training purposes only to match a specific piece of technical manual art to the same slide.

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HYDRAULIC LIFT SYSTEM DOES NOT OPERATE AND NO POWER STEERING

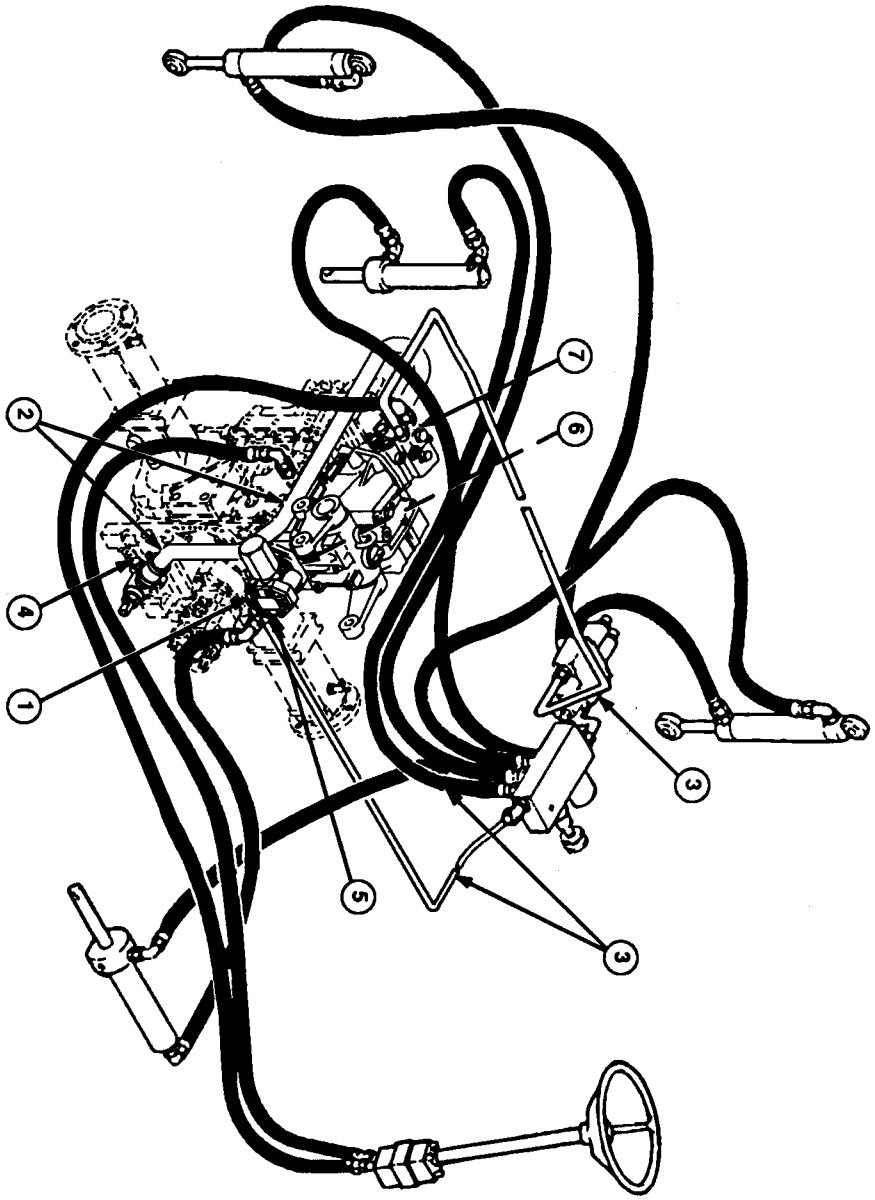
CONDITIONS:
- Transmission in neutral
- PTO disengaged
- Park brake engaged
- Engine stopped

Test Location	Normal	If Not Normal
1. Transaxle dipstick	Proper oil level and viscosity.	Add or change hydrostatic oil and filter.
	No transmission/transaxle leaks.	Repair any leaks.
2. Suction tube	No air leaks or restrictions.	Repair any suction tube leaks.
3. All lines and hoses.	Free of kinks, dents or restrictions.	Repair or replace lines and hoses as necessary.
4. Suction screen/vent	Free of restrictions or obstructions.	Clean or replace screen or vent.
5. Transaxle pump	Pump flow is within specification.	Repair or replace pump. See Section 70.
6. Transaxle pump coupler	Coupler in position and splines are not worn.	Replace coupler.
7. Flow control valve	Relief valves pressure settings within specification.	Repair or replace flow control valve parts as necessary. See Section 70.
	Priority flow divider within specification. Refer to Section 260.	

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HYDRAULIC LIFT SYSTEM DOES NOT OPERATE AND NO POWER STEERING



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HYDRAULIC LIFT SYSTEM DOES NOT OPERATE, POWER STEERING OPERATES OR IS SLOW

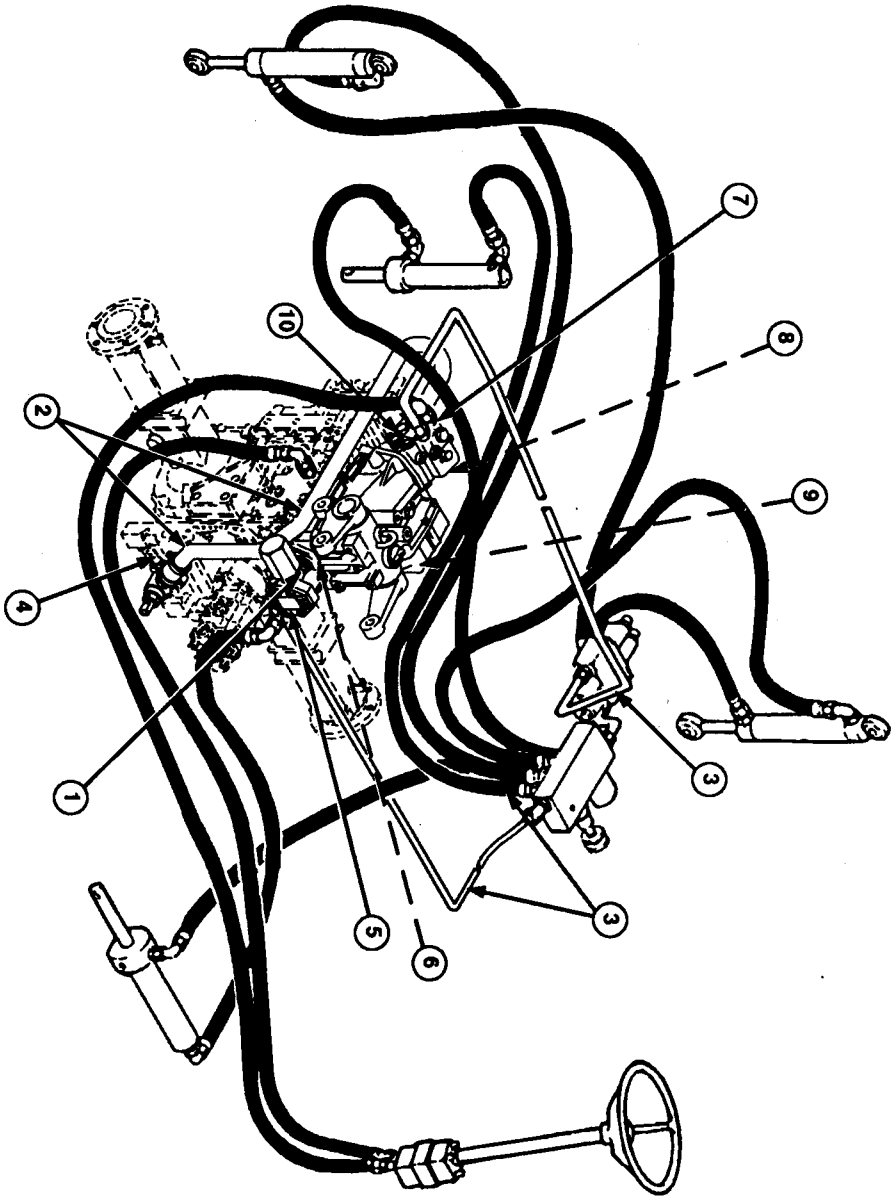
CONDITIONS:
- Transmission in neutral
- PTO disengaged
- Park brake engaged
- Engine stopped

Test/Location	Normal	If Not Normal
1. Transaxle dipstick	Proper oil level and viscosity.	Add or change hydrostatic oil and filter.
	No transmission/transaxle leaks.	Repair any leaks.
2. Suction tube	No air leaks or restrictions.	Repair any suction tube leaks.
3. All lines and hoses	Free of kinks, dents or restrictions.	Repair or replace lines and hoses as necessary.
4. Suction screen/vent	Free of restrictions or obstructions.	Clean or replace screen or vent.
5. Transaxle pump	Pump flow is within specification.	Repair or replace pump. See Section 70.
6. Transaxle pump coupler	Coupler in position and splines are not worn.	Replace coupler.
7. Flow control valve	Relief valves pressure settings within specification.	Repair or replace flow control valve parts as necessary. See Section 70.
	Priority flow divider within specification. Refer to Section 260.	
8. Rockshaft safety relief valve	Valve moves freely and does not stick.	Repair or replace parts as necessary. See Section 70.
	Open.	
9. Rockshaft control valve	Control, unload and flow valves not leaking or stuck open.	Repair or replace parts. See Section 70.
	O-rings between control valve and rockshaft housing sealed properly.	Replace O-rings.
	Screens between control valve and rockshaft housing free of obstructions.	Clean screens.
10. Rockshaft piston cover	Free of leaks, cracks or damage.	Repair or replace cover. See Section 70.

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M81543AE

HYDRAULIC LIFT SYSTEM DOES NOT OPERATE, POWER STEERING OPERATES OR IS SLOW



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LOW OR SLOW HYDRAULIC LIFT POWER

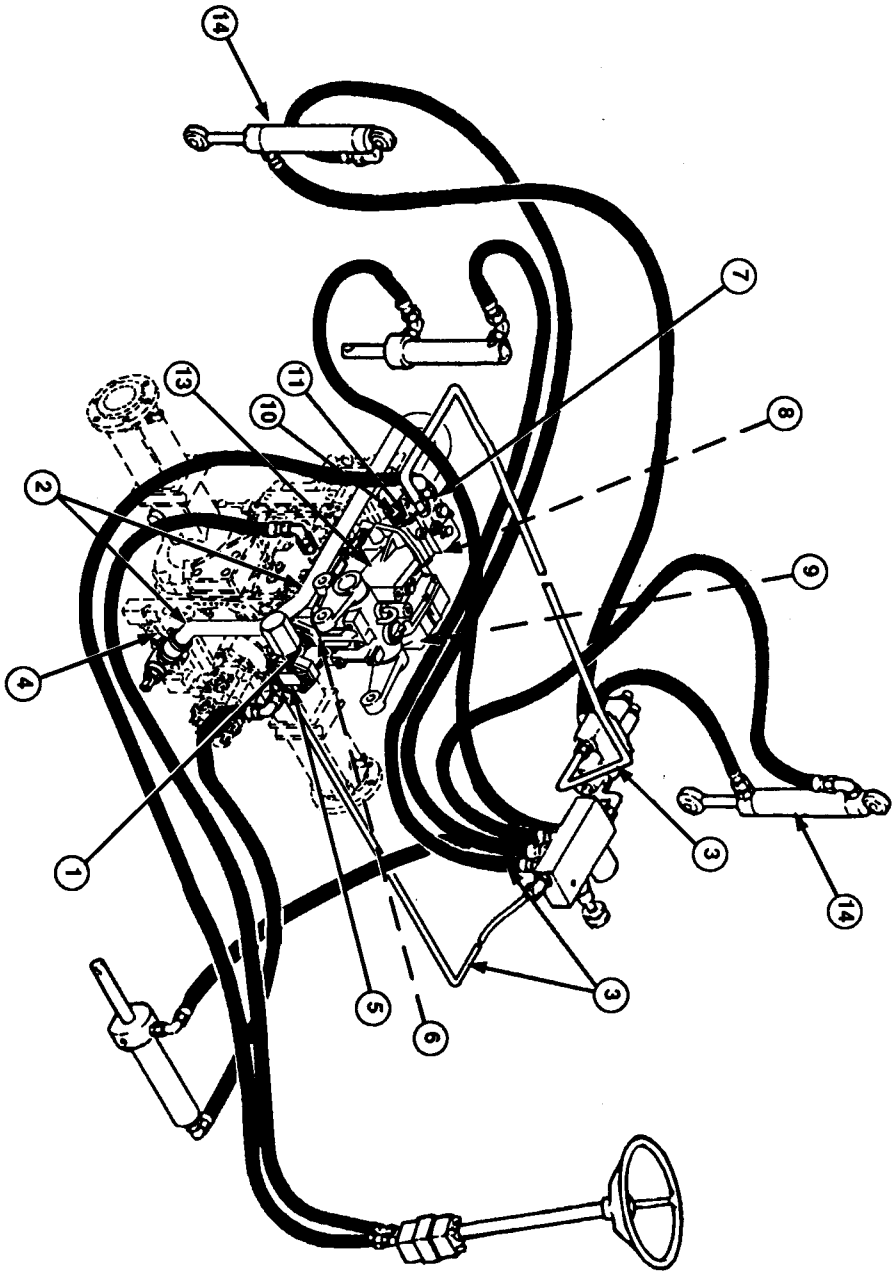
CONDITIONS:
- Transmission in neutral
- PTO disengaged
- Park brake engaged
- Engine stopped

Test/Location	Normal	If Not Normal
1. Transaxle dipstick	Proper oil level and viscosity.	Add or change hydrostatic oil and filter.
	No transmission/transaxle leaks.	Repair any leaks.
2. Suction tube	No air leaks or restrictions.	Repair any suction tube leaks.
3. All lines and hoses	Free of kinks, dents or restrictions.	Repair or replace lines and hoses as necessary.
4. Suction screen/vent	Free of restrictions or obstructions.	Clean or replace screen or vent.
5. Transaxle pump	Pump flow is within specification.	Repair or replace pump. See Section 70.
6. Transaxle pump coupler	Coupler in position and splines are not worn.	Replace coupler.
7. Flow control valve	Relief valves pressure settings within specification.	Repair or replace flow control valve as necessary. See Section 70.
	Priority flow divider within specification. Refer to Section 260.	
8. Rockshaft safety relief valve	Valve moves freely and does not stick.	Repair or replace parts as necessary. See Section 70.
	Open.	
9. Rockshaft control valve	Control, unload and flow valves not leaking or stuck open. Control spool scored or damaged.	Repair or replace parts. See Section 70.
	O-rings between control valve and rockshaft housing sealed properly.	Replace O-rings.
	Screens between control valve and rockshaft housing free of obstructions.	Clean screens.
10. Rockshaft piston cover	Free of leaks, cracks or damage.	Repair or replace cover. See Section 70.

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LOW OR SLOW HYDRAULIC LIFT POWER



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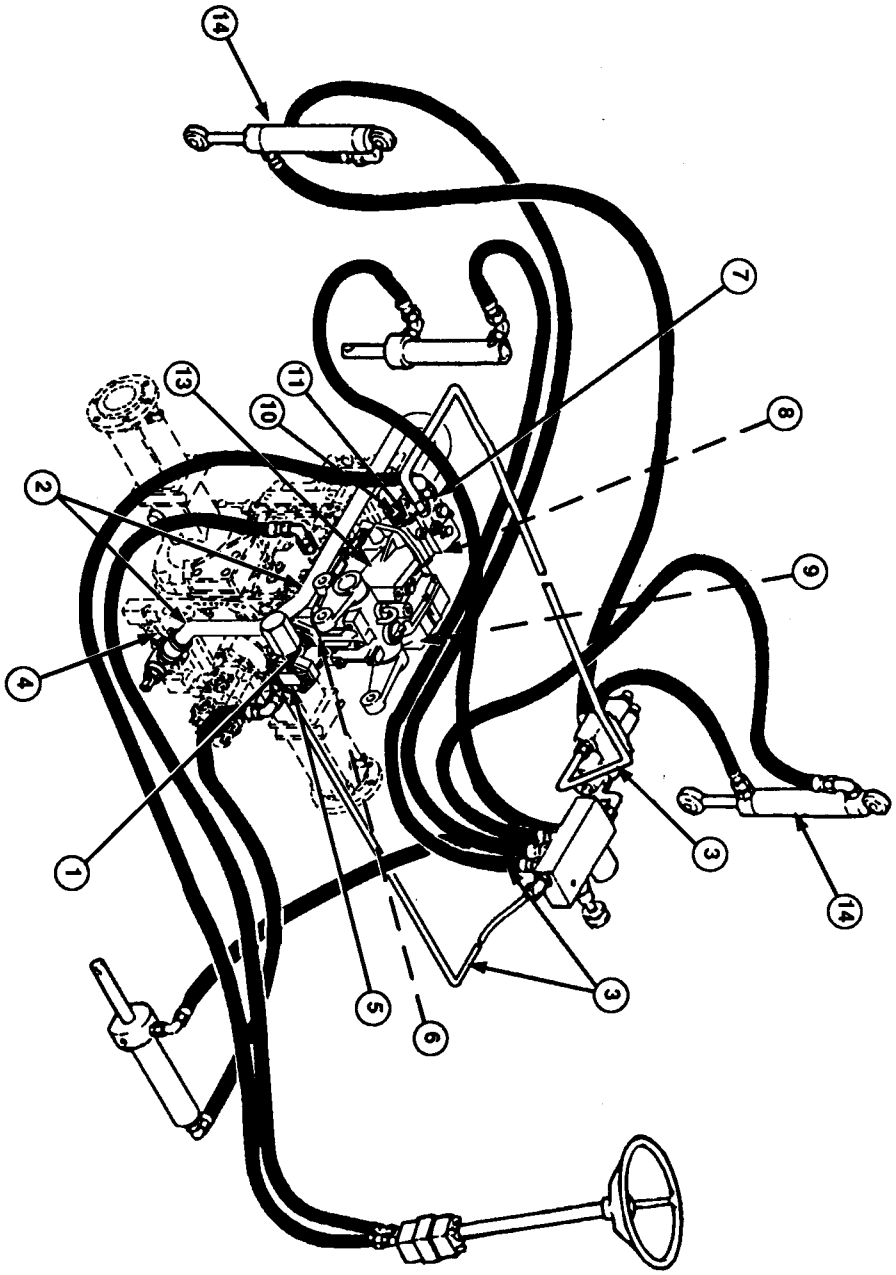
LOW OR SLOW HYDRAULIC LIFT POWER—CONTINUED

Test/Location	Normal	If Not Normal
11. Rate-of-drop/stop valve	Front and center cutting units lower at a moderate speed.	Bolt may be turned in too far. Adjust rate-of-drop.
12. Engine (not shown)	Fast and slow idle within specification.	Adjust engine speed as necessary. See Section 220.
13. Rockshaft piston and	Free of scoring or damage. Seal in good condition.	Repair or replace parts as necessary. See Section 70.
14. Wing lift cylinders	Cylinder leakage within specification.	Repair or replace wing cylinder(s). See Section 70.

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M81544AE

LOW OR SLOW HYDRAULIC LIFT POWER



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HYDRAULIC LIFT SYSTEM OPERATES ERRATICALLY

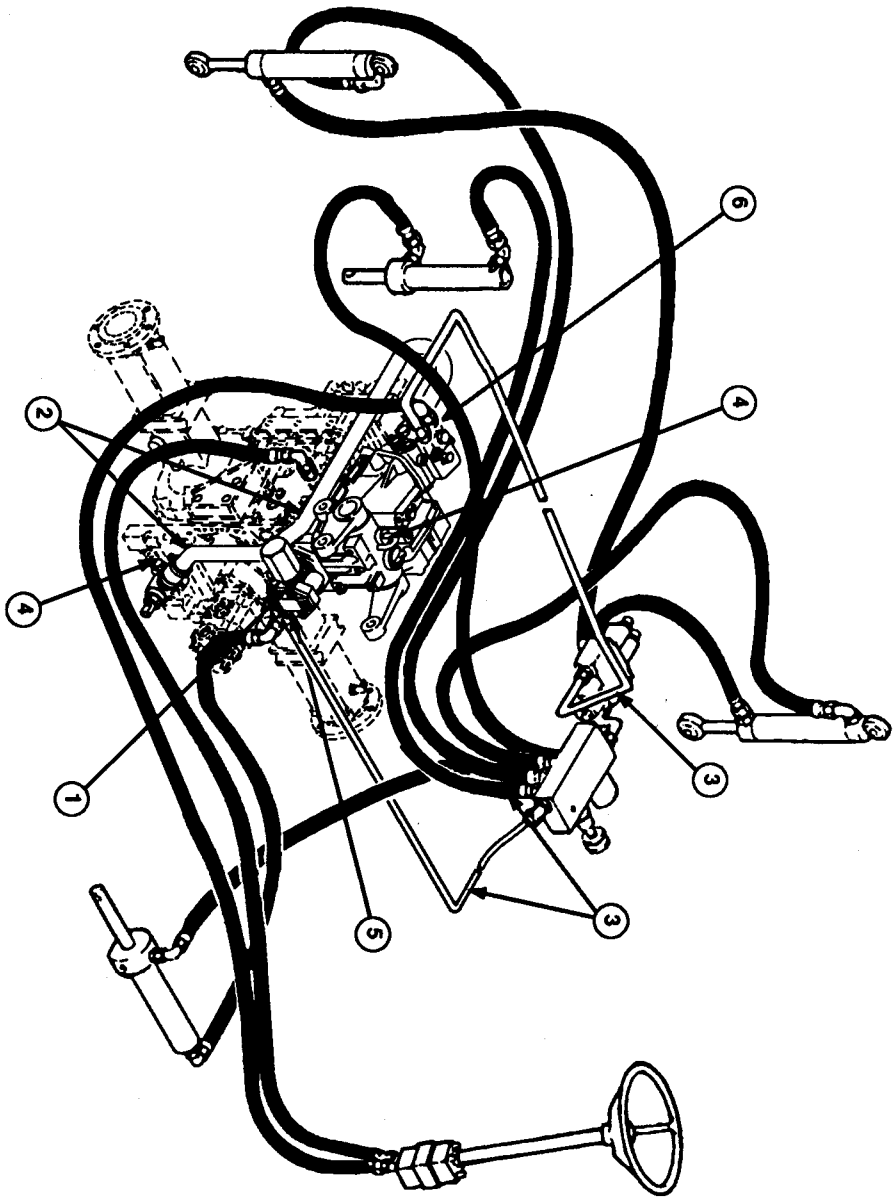
CONDITIONS:
- Transmission in neutral
- PTO disengaged
- Park brake engaged
- Engine stopped

Test/Location	Normal	If Not Normal
1. Transaxle dipstick	Proper oil level and viscosity.	Add or change hydrostatic oil and filter.
	No transmission/transaxle leaks.	Repair any leaks.
2. Suction tube	No air leaks or restrictions.	Repair any suction tube leaks.
		Bleed hydraulic system. See Section 70.
3. All lines and hoses	Free of kinks, dents or restrictions.	Repair or replace lines and hoses as necessary.
4. Suction screen/vent	Free of restrictions or obstructions.	Clean or replace screen or vent.
5. Transaxle pump	Pump flow is within specification.	Repair or replace pump. See Section 70.
6. Flow control valve	Wing and rockshaft relief valves operate within specification and smoothly.	Repair or replace parts as necessary.
	Priority and flow divider valves operate smoothly.	Inspect and repair as necessary.

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M81545AE

HYDRAULIC LIFT SYSTEM OPERATES ERRATICALLY



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EXCESSIVE TRANSAXLE PUMP NOISE

CONDITIONS:
- Transmission in neutral
- PTO disengaged
- Park brake engaged
- Engine stopped

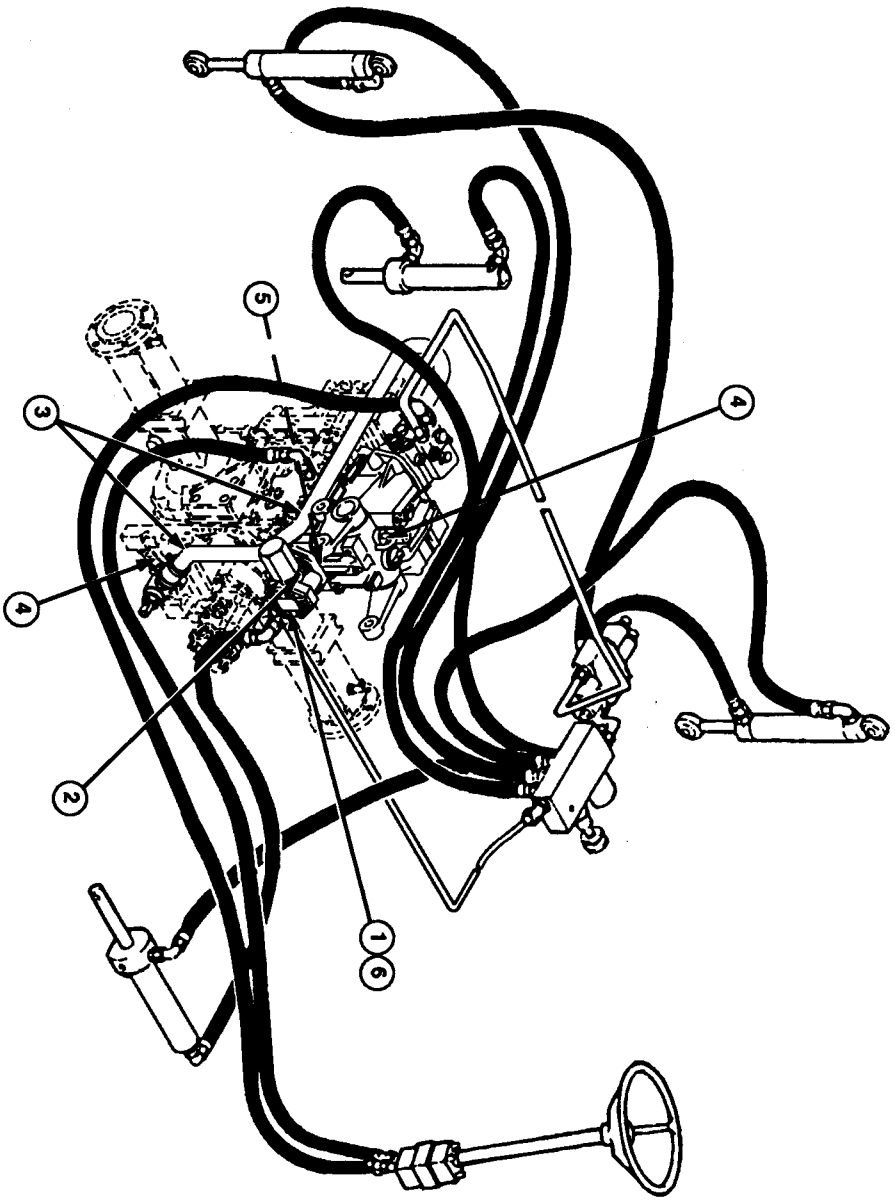
Test/Location	Normal	If Not Normal
1. Transaxle pump	All pump hardware is secure.	Tighten loose hardware to specification.
2. Transaxle dipstick	Proper oil level and viscosity.	Add or change hydrostatic oil and filter.
3. Suction tube	No air leaks or restrictions.	Repair any suction tube leaks. Bleed hydraulic system. See Section 70.
4. Suction screen/vent	Free of restrictions or obstructions.	Clean or replace screen or vent.
5. Transaxle pump coupler	Coupler in position and splines are not worn.	Replace coupler.
6. Transaxle pump	Pump flow is within specification.	Repair or replace pump. See Section 70.

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EXCESSIVE TRANSAXLE PUMP NOISE



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MX,27015HV,A11 -19-18JAN93

HYDROSTATIC OIL FOAMS

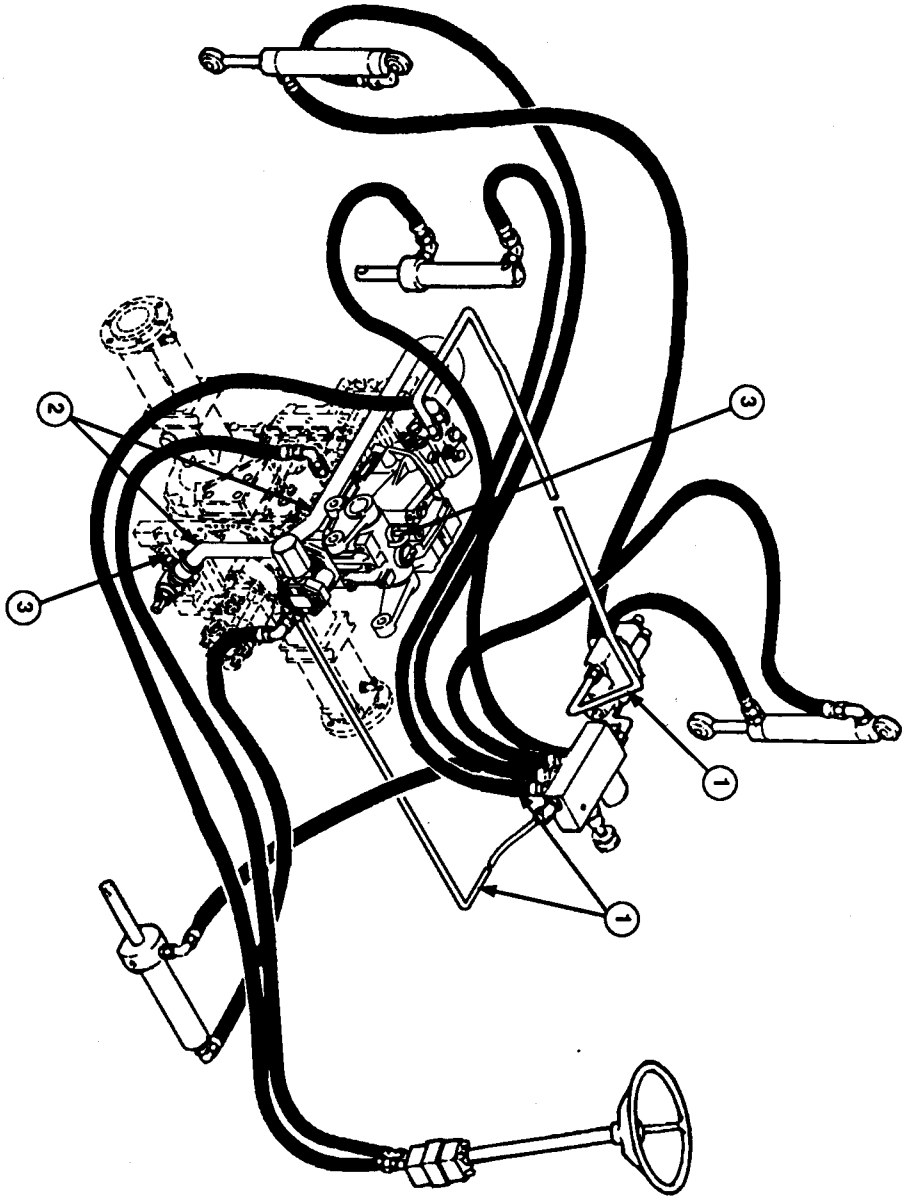
CONDITIONS:
- Transmission in neutral
- PTO disengaged
- Park brake engaged
- Engine stopped

Test/Location	Normal	If Not Normal
1. All lines and hoses	No clogging, restrictions or leaks.	Repair or replace as necessary.
2. Suction tube	No air leaks or restrictions.	Repair any suction tube leaks. Bleed hydraulic system. See Section 70.
3. Suction screen/vent	Free of restrictions or obstructions.	Clean or replace screen or vent.

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HYDROSTATIC OIL FOAMS



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HYDROSTATIC OIL OVERHEATS

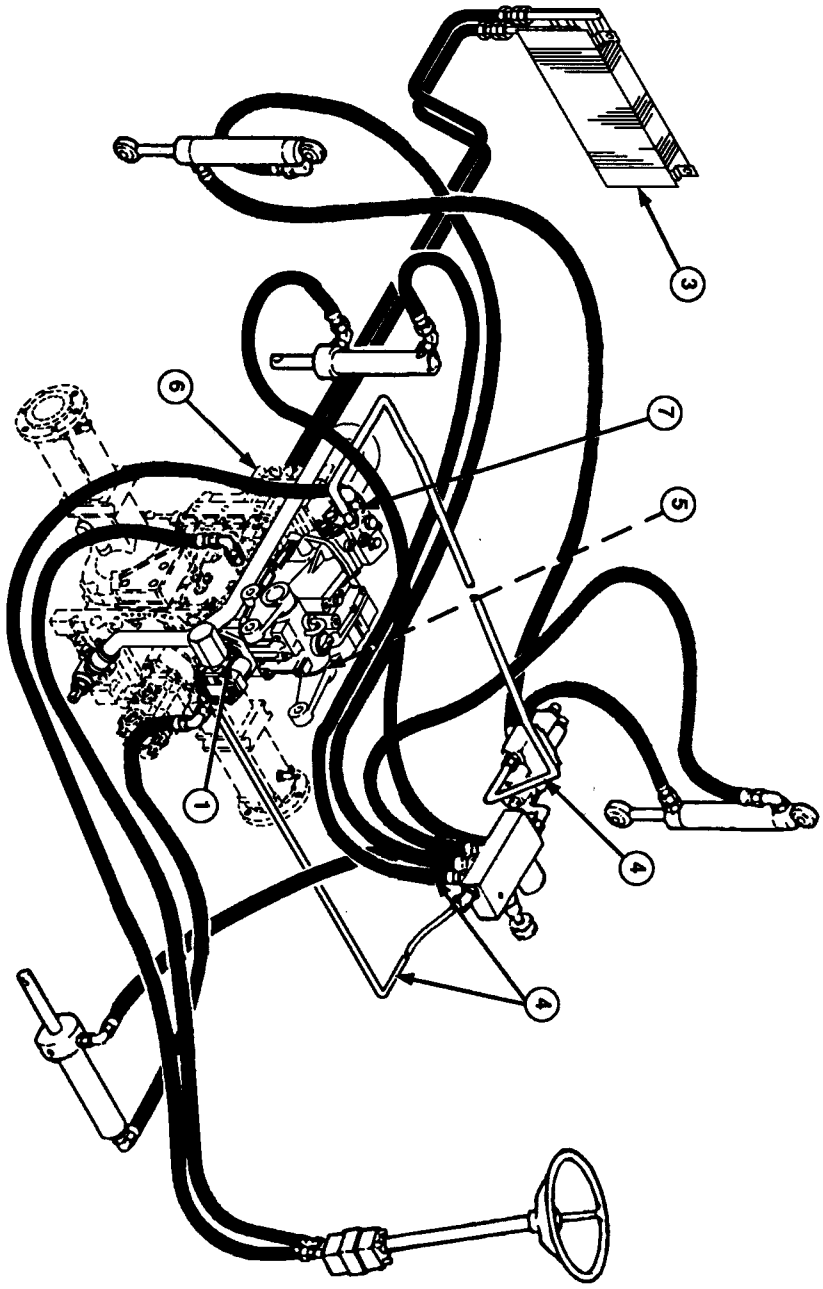
CONDITIONS:
- Transmission in neutral
- PTO disengaged
- Park brake engaged
- Engine stopped

Test/Location	Normal	If Not Normal
1. Transaxle dipstick	Proper oil level and viscosity.	Add or change hydrostatic oil and filter.
2. Operator (not shown)	Uses proper operating habits. Does not hold lift circuits over relief for long periods. Rate-of-drop/stop valve is not closed.	Review proper mower operation with operator.
3. Oil cooler/radiator	Fins free of dirt and obstruction. Free air flow passage.	Remove obstruction and clean fins.
4. All lines and hoses	Free of kinks, dents or restrictions.	Repair or replace lines and hoses as necessary.
5. Rockshaft feedback linkage	Adjusted properly so relief valve is not going over relief continuously.	Adjust feedback linkage. See procedure in this group.
6. Transmission	High pressure relief valves operating within specifications. Refer to Section 250.	Transmission operating over relief excessively, reduce load. Check “Hydrostatic Oil Temperature Too Hot“ in Section 250, Group 15.
7. Flow control valve	Relief valves pressure settings within specification. Priority flow divider within specification. Refer to Section 260.	Repair or replace flow control valve parts as necessary. See Section 70.

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HYDROSTATIC OIL OVERHEATS



Slide M81548AE

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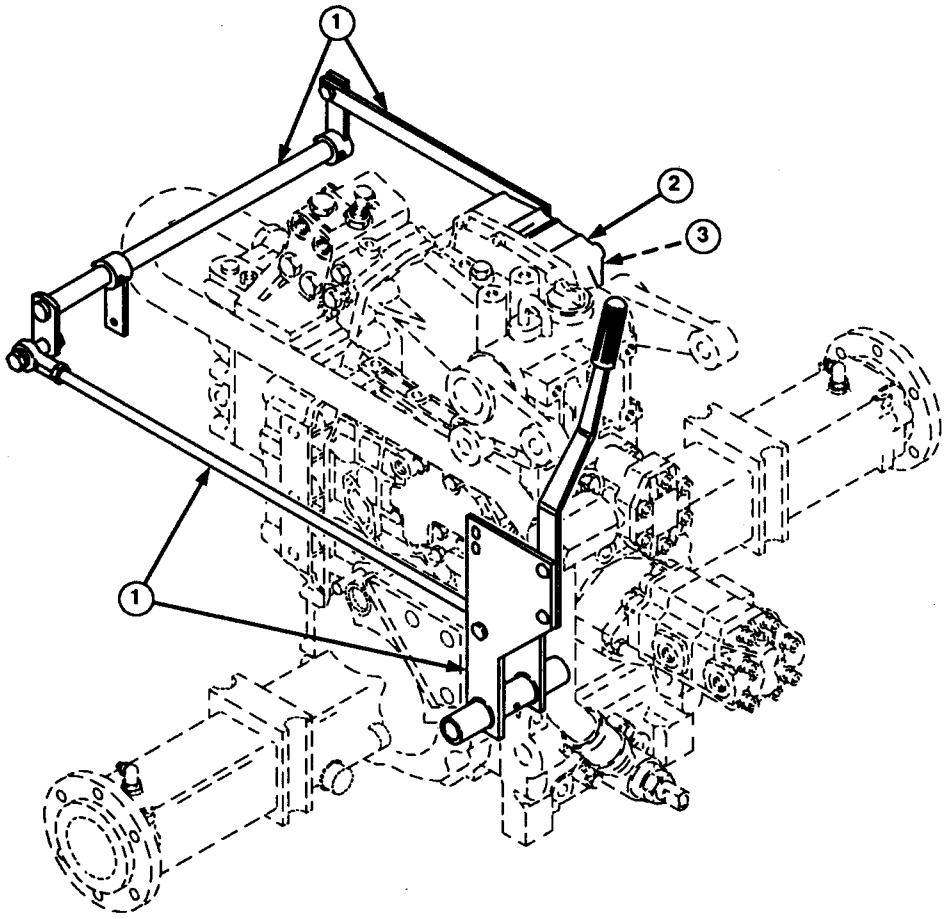
CUTTING UNITS LIFT LEVER STICKS OR IS DIFFICULT TO MOVE

CONDITIONS:
- Transmission in neutral.
- PTO disengaged
- Park brake engaged
- Engine stopped

Test/Location	Normal	If Not Normal
1. Cutting units lift lever	Linkage free to move, not bent and no binding present.	Repair or replace linkage components. See Section 70.
2. Rockshaft control valve cover	Linkage free to move. No burrs or binding.	Repair linkage. See Section 70.
3. Rockshaft control valve spool	Spool free of burrs, scoring or damage.	Repair rockshaft control valve.

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CUTTING UNITS LIFT LEVER STICKS OR IS DIFFICULT TO MOVE

Slide M81549AE

MX,27015HV,A17 -19-18JAN93

FRONT AND CENTER CUTTING UNITS WILL NOT RAISE

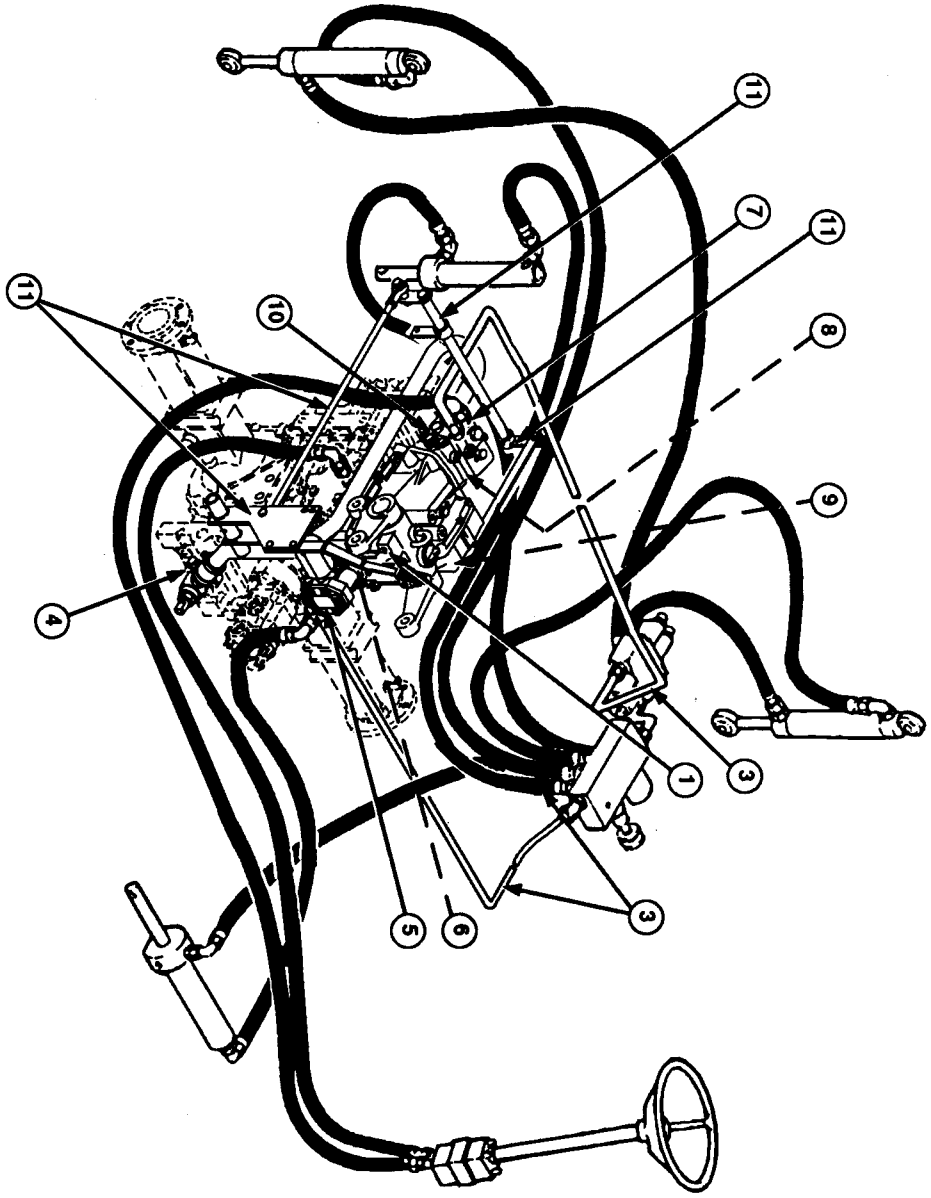
CONDITIONS:
- Transmission in neutral
- PTO disengaged
- Park brake engaged
- Engine stopped

Test/Location	Normal	If Not Normal
1. Transaxle dipstick	Proper oil level and viscosity.	Add or change hydrostatic oil and filter.
	No transmission/transaxle leaks.	Repair any leaks.
2. Suction tube	No air leaks or restrictions.	Repair any suction tube leaks.
3. All lines and hoses	Free of kinks, dents or restrictions.	Repair or replace lines and hoses as necessary.
4. Suction screen/vent	Free of restrictions or obstructions.	Clean or replace screen or vent.
5. Transaxle pump	Pump flow is within specification.	Repair or replace pump. See Section 70.
6. Transaxle pump color	Coupler in position and splines are not worn.	Replace coupler.
7. Flow control valve	Relief valves pressure settings within specification.	Repair or replace flow control valve parts as necessary. See Section 70.
	Priority flow divider within specification. Refer to Section 260.	
8. Rockshaft safety relief valve	Valve moves freely and does not stick.	Repair or replace parts as necessary. See Section 70.
	Open.	
9. Rockshaft control valve	Control, unload, mechanical check and flow valves not leaking or stuck open.	Repair or replace parts. See Section 70.
	O-rings between control valve and rockshaft housing sealed properly.	Replace O-rings.
	Screens between control valve and rockshaft housing free of obstructions.	Clean screens.
10. Rockshaft piston cover	Free of leaks, cracks or damage.	Repair or replace cover. See Section 70.

MX,27015HV,A18 -19-18JAN93

M81550AE

FRONT AND CENTER CUTTING UNITS WILL NOT RAISE



Slide M81550AE

M81550AE -19-11JAN93

MX,27015HV,A19 -19-18JAN93

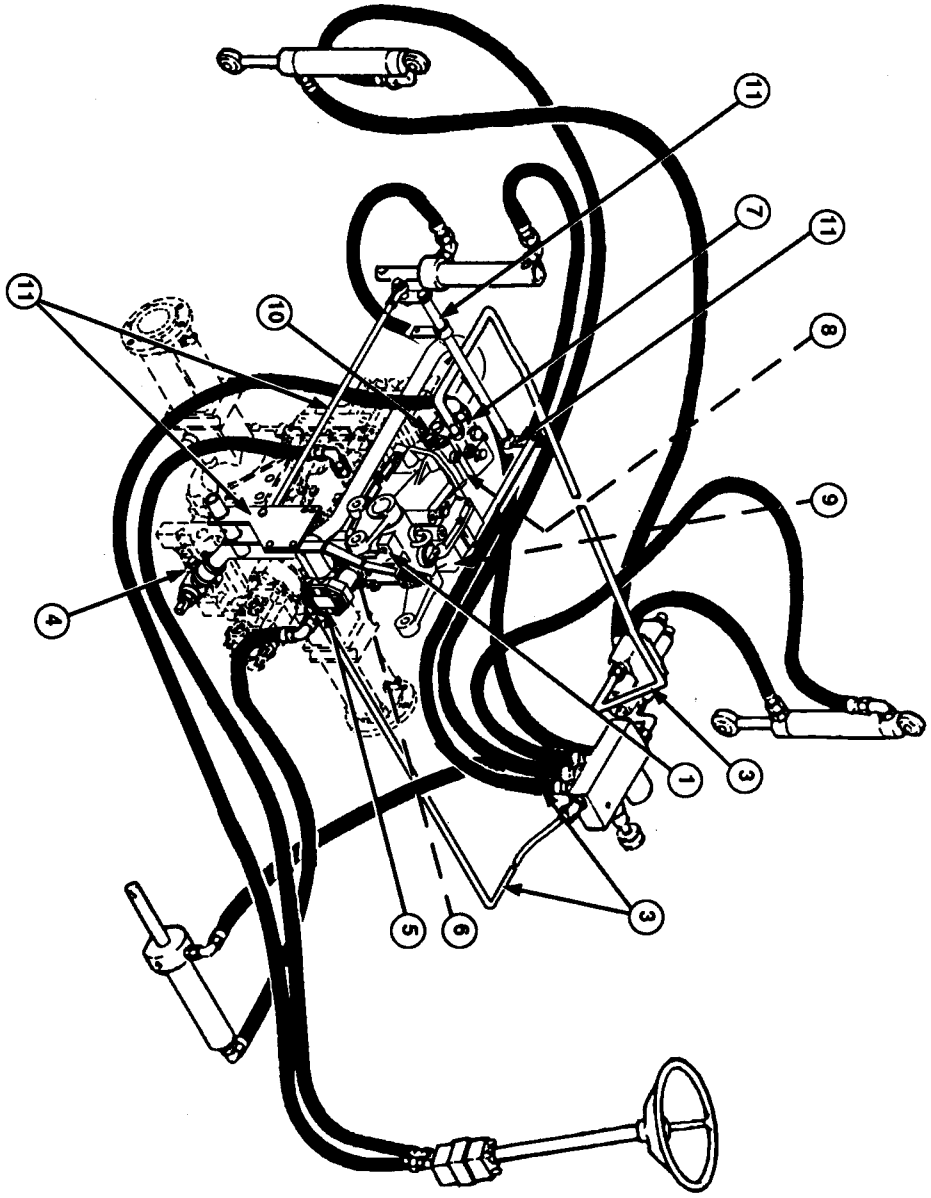
FRONT AND CENTER CUTTING UNITS WILL NOT RAISE—CONTINUED

Test/Location	Normal	If Not Normal
11. Cutting units lift lever	Linkage moves freely and not bent.	Repair or replace linkage components. See Section 70.
12. Rockshaft piston and housing	Free of scoring or damage. Seal in good condition.	Repair or replace parts as necessary.

MX,27015HV,A18A-19-18JAN93

M81550AE

FRONT AND CENTER CUTTING UNITS WILL NOT RAISE



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M81550AE -19-11JAN93

MX,27015HV,A19 -19-18JAN93

WING CUTTING UNITS WILL NOT RAISE

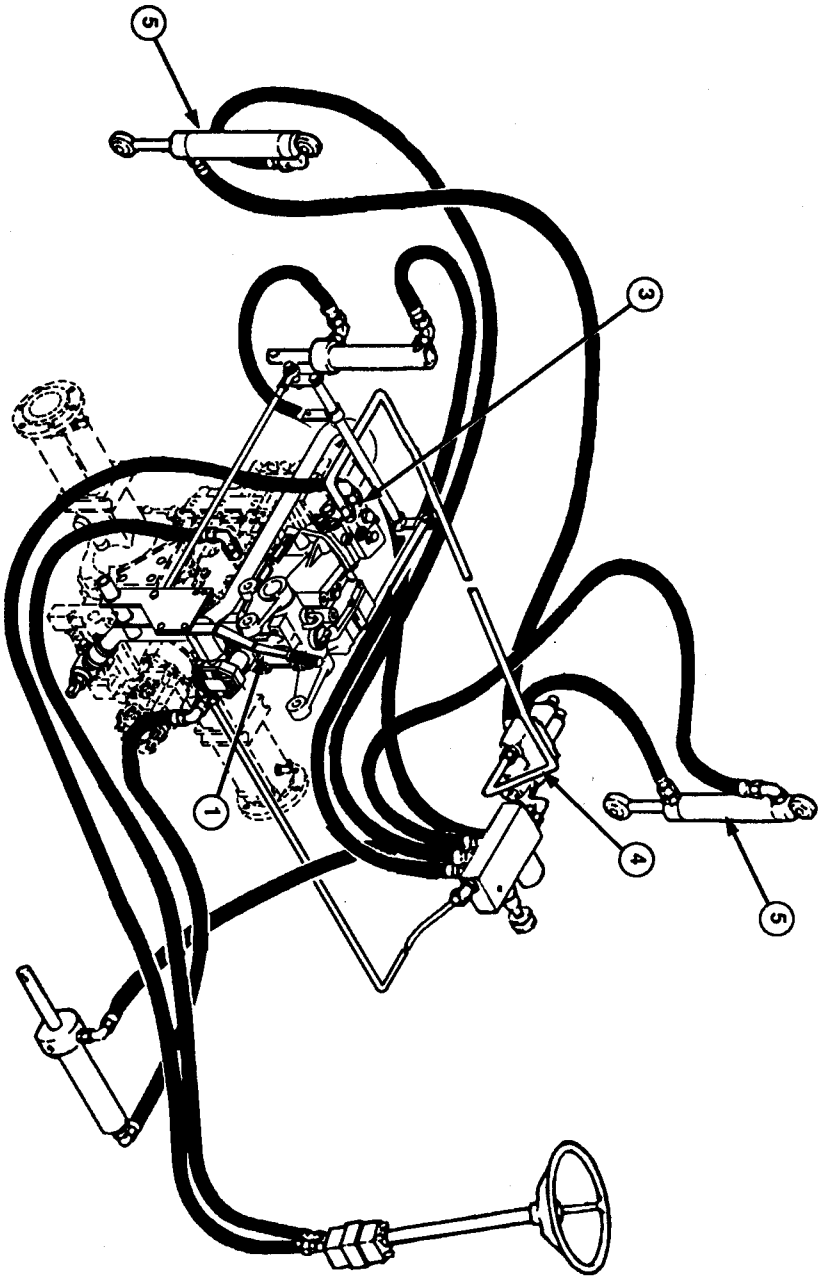
CONDITIONS:
- Transmission in neutral
- PTO disengaged
- Park brake engaged
- Engine stopped

Test/Location	Normal	If Not Normal
1. Cutting units lever	Actuator block engages and actuates wing lift switches when lever is pulled fully rearward.	Adjust actuator block or lift switches. See Section 240.
2. Wing lift electrical circuit (not shown)	Electrical power is supplied to wing lift solenoids.	Check electrical circuit. See Section 240.
3. Flow control valve	Wing relief valve pressure setting within specification.	Repair or replace flow control valve parts as necessary. See Section 70.
	Priority and proportional flow dividers free of obstructions or burrs.	
4. Wing lift control valve	Spool moves smoothly in bore. Valve free of scoring or damage. Seals not leaking.	Repair or replace valve. See Section 70.
5. Wing lift cylinders.	Cylinder leakage within specification.	Repair or replace cylinder(s).

MX,27015HV,A20 -19-18JAN93

M81551AE

WING CUTTING UNITS WILL NOT RAISE



Slide M81551AE

M81551AE -19-11JAN93

MX,27015HV,A21 -19-18JAN93

WING CUTTING UNITS LOWER WITH CUTTING UNITS LEVER IN RAISED POSITION

CONDITIONS:
- Transmission in neutral
- PTO disengaged
- Park brake engaged
- Engine stopped

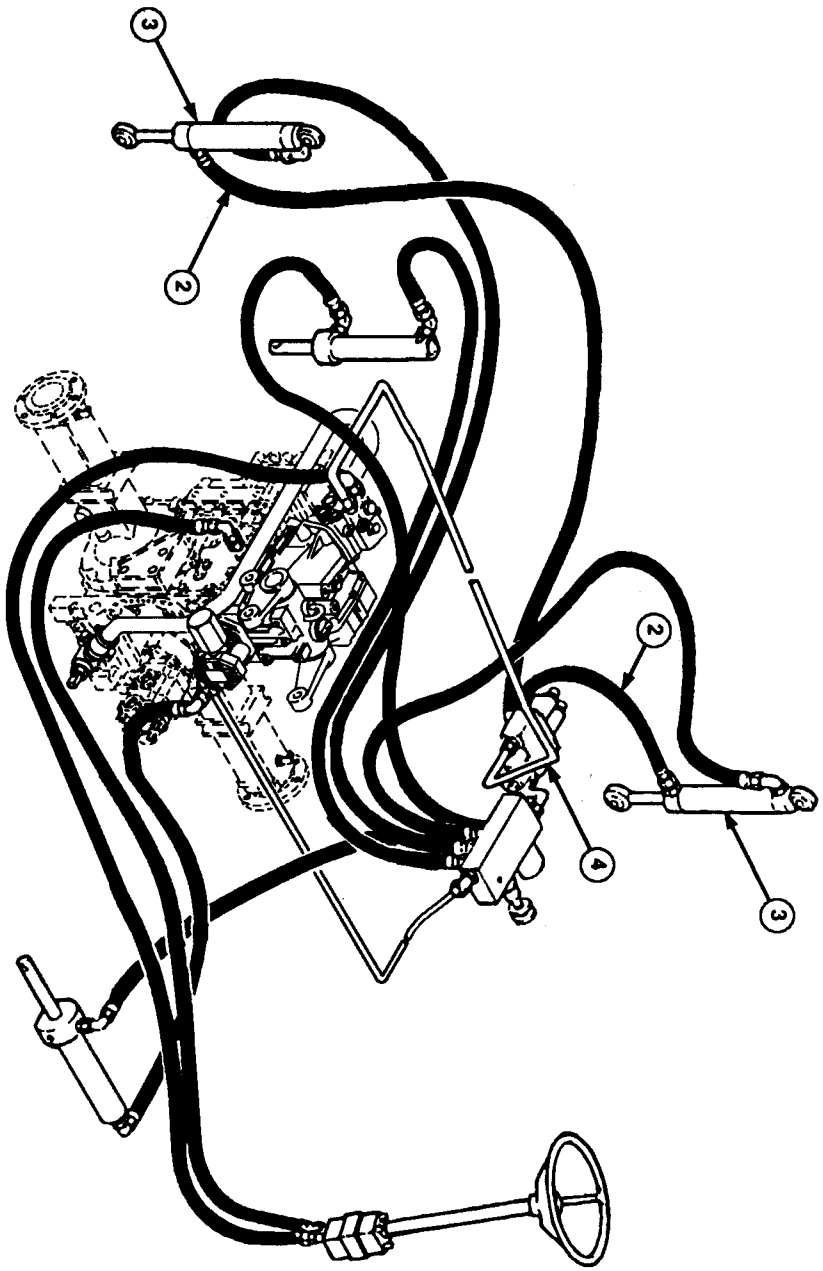
Test/Location	Normal	If Not Normal
1. Wing lift electrical circuit (not shown)	Electrical power is supplied to wing lift solenoids.	Check electrical circuit. See Section 240.
2. Cylinder hoses.	No visible leaks.	Repair leaks.
3. Lift cylinders.	Cylinder leakage within specification.	Repair or replace lift cylinder(s).
4. Wing lift control valve	Spool moves smoothly in bore. Valve free of scoring or damage. Seals not leaking.	Repair or replace valve. See Section 70.

MX,27015HV,A22 -19-18JAN93

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M81552AE

WING CUTTING UNITS LOWER WITH CUTTING UNIT LEVER IN RAISE, NEUTRAL POSITION



Slide M81552AE

M81552AE -19-11JAN93

MX,27015HV,A23 -19-18JAN93

EXCESSIVE HYDRAULIC PUMP NOISE

CONDITIONS:
- Transmission in neutral
- PTO engaged
- Park brake engaged
- Cutting units lowered

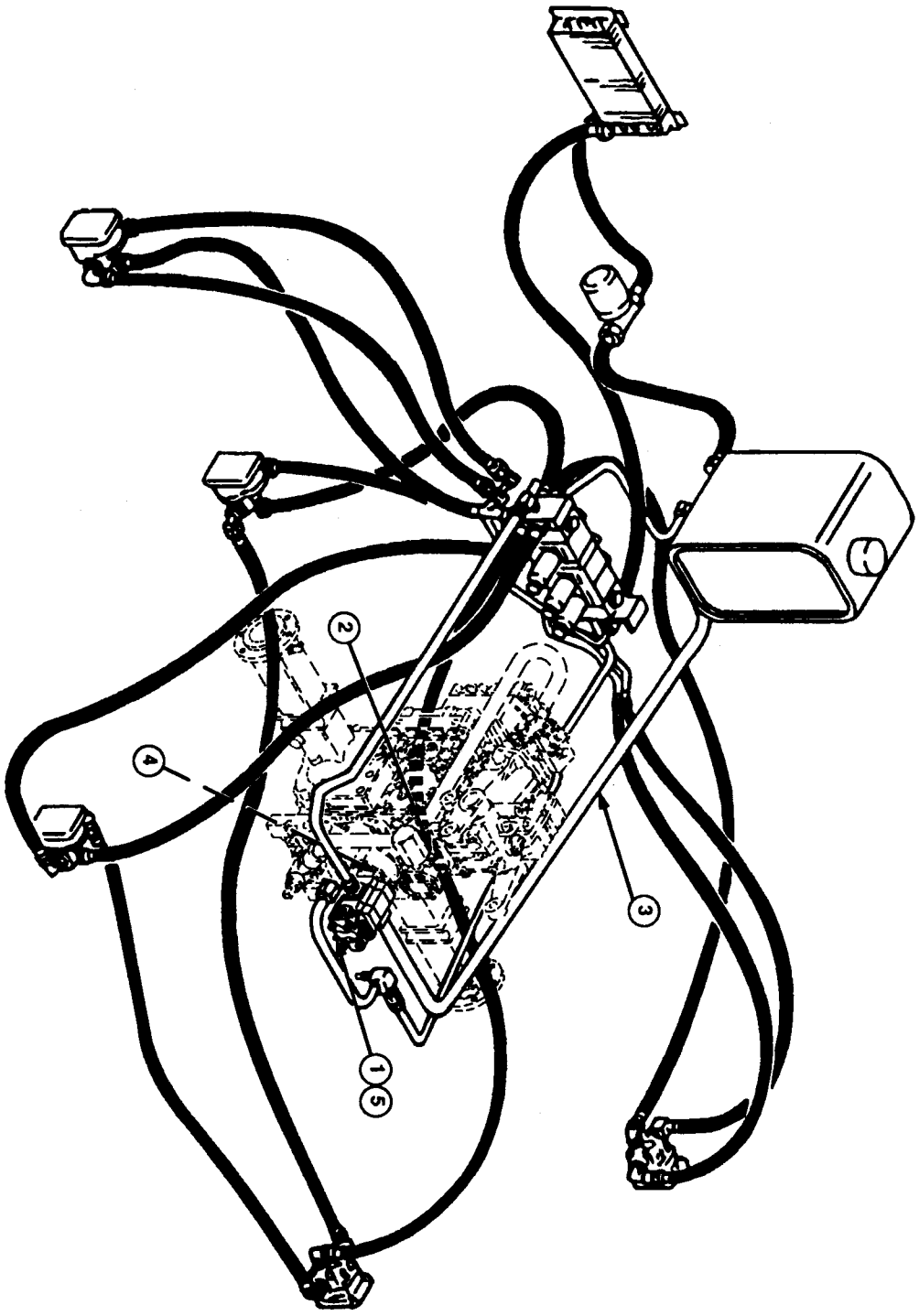
Test/Location	Normal	If Not Normal
1. Hydraulic pump	All pump hardware is secure.	Tighten loose hardware to specification.
2. Reservoir dipstick	Proper oil level and viscosity.	Add or change hydrostatic oil and filter.
3. Suction tube	No air leaks or restrictions.	Repair any suction tube leaks. Bleed hydraulic system. See Section 70.
	Free of restrictions or obstructions.	Clean or replace.
4. Hydraulic pump coupler	Coupler in position and splines are not worn.	Replace coupler.
5. Hydraulic pump	Pump flow is within specification.	Repair or replace pump. See Section 70.

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M81553AE

EXCESSIVE HYDRAULIC PUMP NOISE



Slide M81553AE

M81553AE -19-11JAN93

MX,27015HV,A25 -19-18JAN93

HYDRAULIC OIL FOAMS

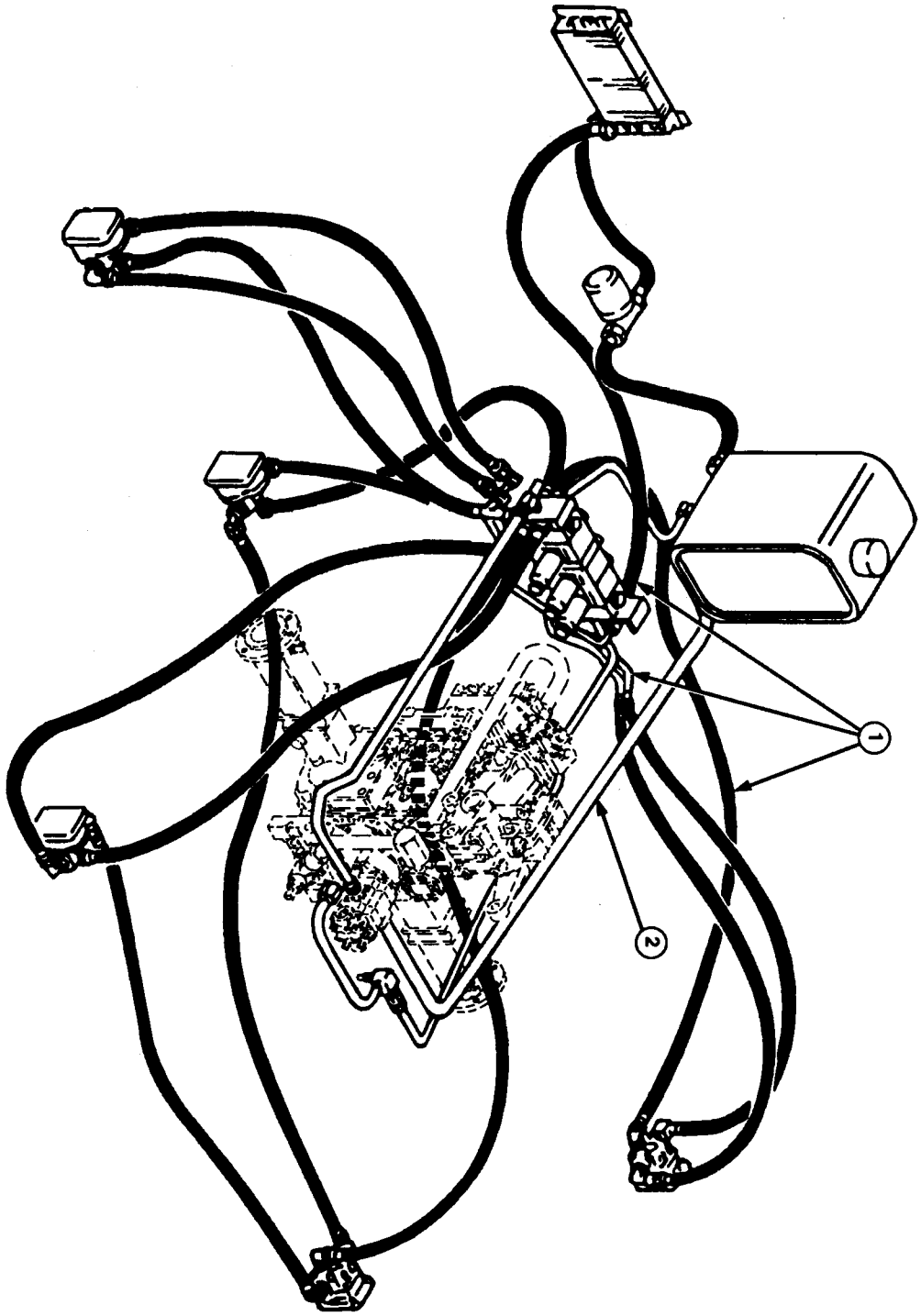
CONDITIONS:
- Transmission in neutral
- PTO engaged
- Park brake engaged
- Cutting units lowered

Test/Location	Normal	If Not Normal
1. All lines and hoses	No clogging, restrictions or leaks.	Repair or replace as necessary
2. Suction tube	No air leaks or restrictions.	Repair any suction tube leaks. Bleed hydraulic system. See Section 70.

MX,27015HV,A26 -19-18JAN93

M81554AE

HYDRAULIC OIL FOAMS



Slide M81554AE

M81554AE -19-11JAN93

MX,27015HV,A27 -19-18JAN93

HYDRAULIC OIL OVERHEATS

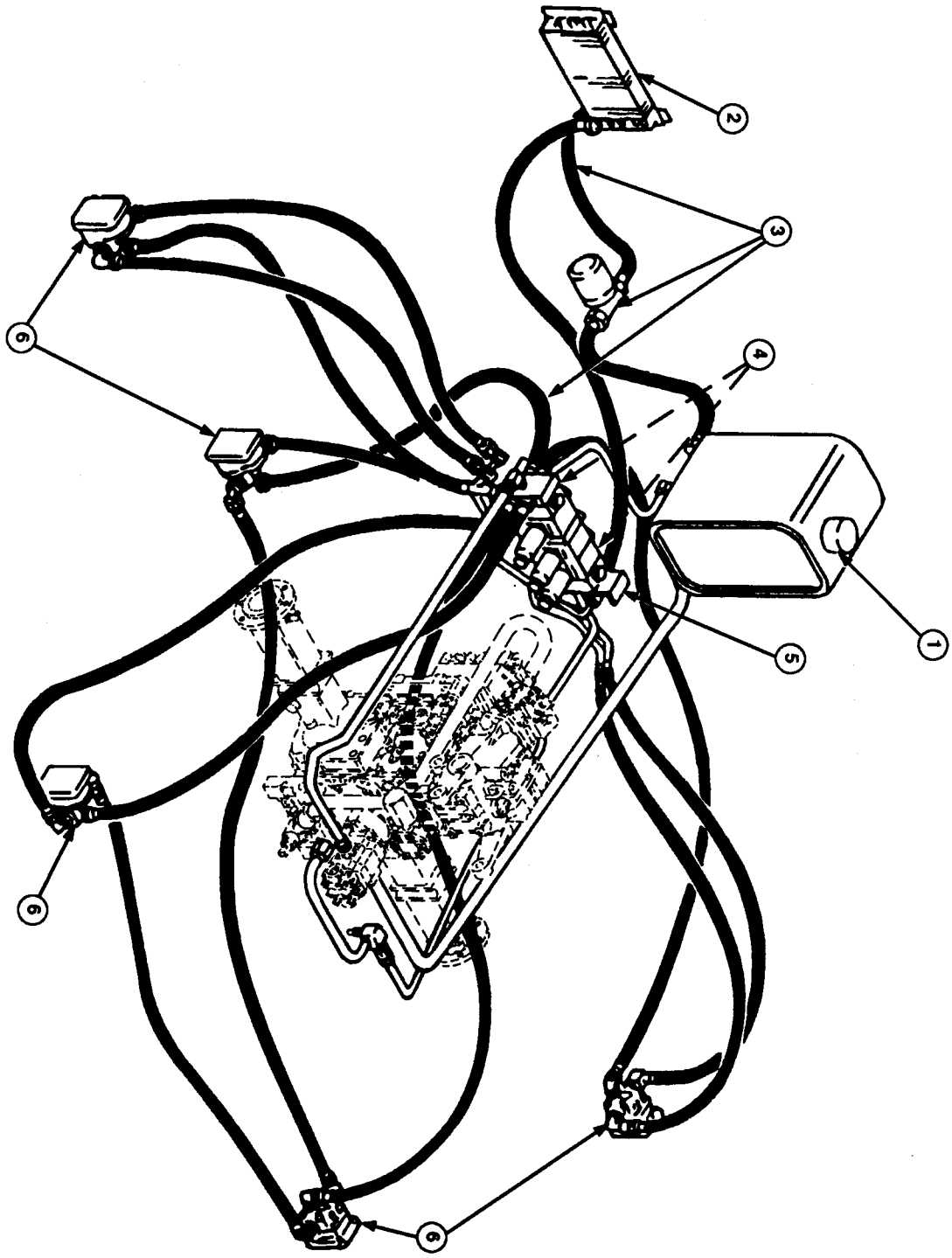
CONDITIONS:
- Transmission in neutral
- PTO engaged
- Park brake engaged
- Cutting units lowered

Test/Location	Normal	If Not Normal
1. Reservoir dipstick	Proper oil level and viscosity.	Add or change hydrostatic oil and filter.
2. Oil cooler/radiator	Fins free of dirt and obstruction. Free air flow passage.	Remove obstruction and clean fins.
3. All lines and hoses.	Free of kinks, dents or restrictions.	Repair or replace lines and hoses as necessary.
	Oil filter or bypass valve not obstructed	Replace oil filter and clean bypass valve and passage.
4. Front/center and wing relief valves.	Pressure relief valves operating within specifications.	Relief valves operating over relief extensively. Check for any binding in cutting units.
5. Reel control valve	Valve spools move smoothly in bores. Centering springs return spools to neutral position.	Inspect valve for damage or obstruction. Repair or replace real control valve components as necessary.
6. Cutting unit motors	Motor free of damage or wear.	Repair or replace motors as necessary.
	Motor check valve installed in the correct position for proper motor rotation.	Inspect position of motor check valve. Refer to Section 70.

MX,27015HV,A28 -19-18JAN93

M81555AE

HYDRAULIC OIL OVERHEATS



M81555AE -19-11JAN93

Slide M81555AE

MX,27015HV,A29 -19-18JAN93

CUTTING UNITS DO NOT TURN OR TURN SLOW

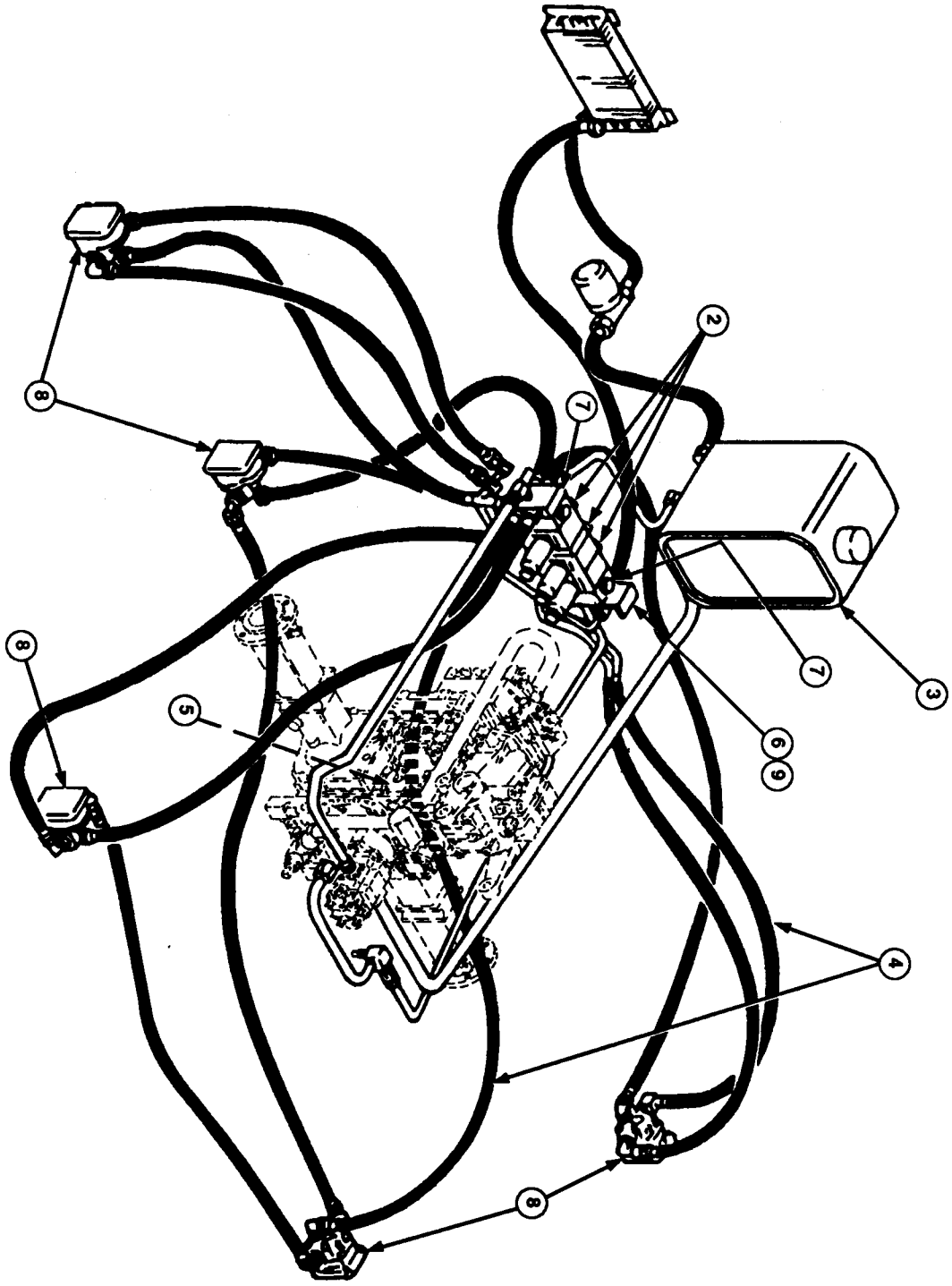
CONDITIONS:
- Transmission in neutral
- PTO engaged
- Park brake engaged
- Cutting units lowered

Test/Check Point	Normal	If Not Normal
1. Backlap switch (not shown)	Switch in the engaged position.	Move switch to the engaged position.
2. Control valve adjustment knobs	Knobs turned fully counterclockwise.	Turn knobs all the way out.
3. Reservoir dipstick	Proper oil level and viscosity.	Add or change hydraulic oil and filter.
4. All lines and hoses	Free of kinks or obstructions.	Repair or replace lines and hoses as necessary.
5. PTO engagement	PTO must engage pump with smooth, modulated engagement.	Inspect and repair PTO clutch and lubrication components. Refer to Section 50.
	PTO engagement pressure within specification.	
6. Reel control valve electrical circuits	Electrical power is supplied to reel solenoids.	Check electrical circuits. See Section 240.
7. Front/center and wing relief valves	Relief valve pressures within specification.	Adjust or replace relief valves as necessary.
8. Cutting unit motors	Free of leaks, wear or damage.	Inspect internal component of motor. Repair or replace components as necessary.
	Motor check valve installed in the correct position for proper motor rotation.	Inspect position of motor check valve. See Section 70.
9. Reel control valve	Spool moves smoothly in bore. Valve is free of scoring or damage. Seals not leaking.	Repair or replace valve. See Section 70.

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M81556AE

CUTTING UNITS DO NOT TURN OR TURN SLOW



M81556AE -19-11JAN93

Slide M81556AE

MX,27015HV,A31 -19-18JAN93

ONE OR MORE CUTTING UNITS TURNING BACKWARDS

CONDITIONS:
- Transmission in neutral
- PTO engaged
- Park brake engaged
- Cutting units lowered

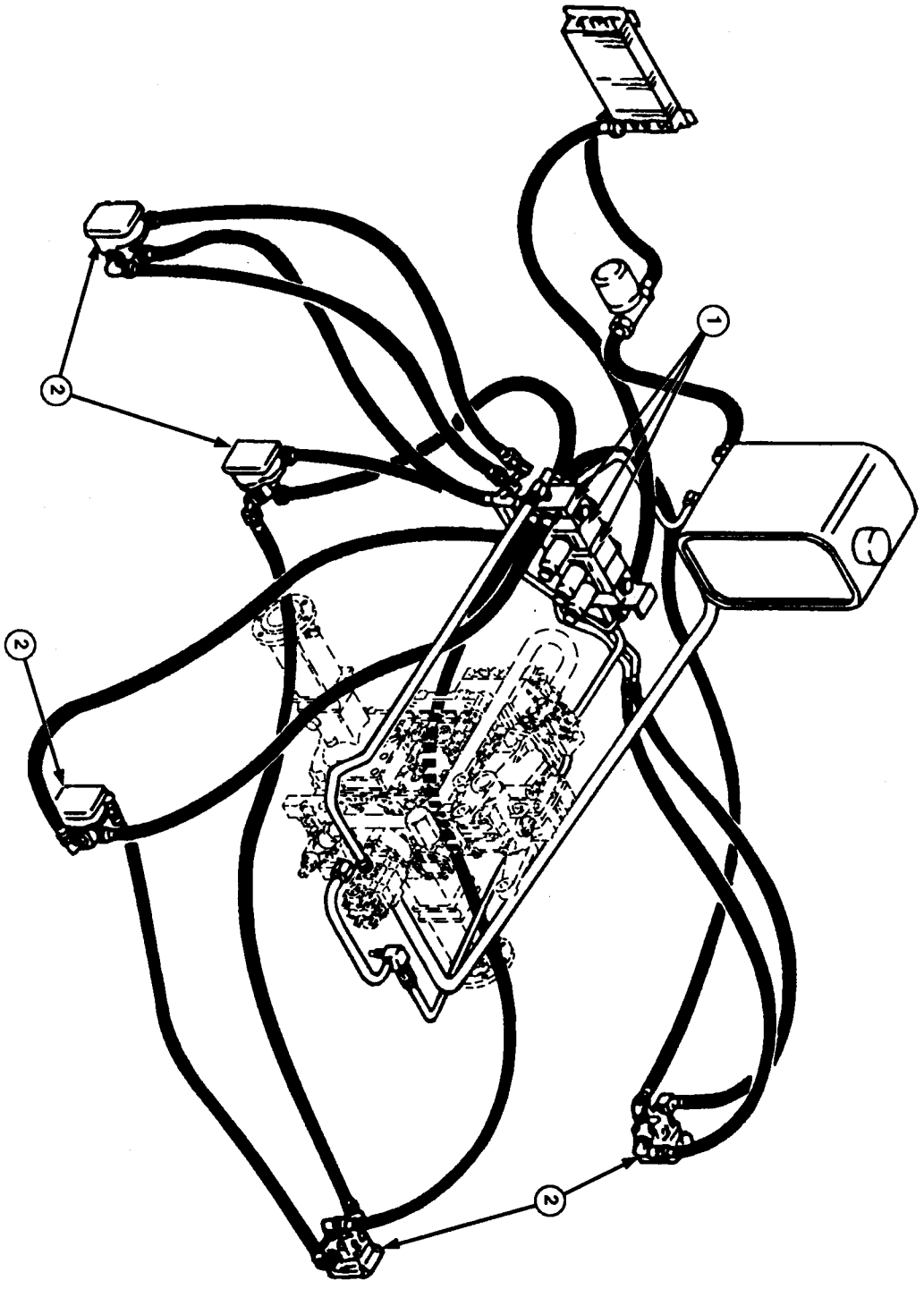
Test/Location	Normal	If Not Normal
1. Control valve adjustment knobs	Knobs turned fully counterclockwise.	Turn the knobs all the way out.
2. Cutting unit motors	Hoses connected properly.	Connect hoses to proper ports.
	Motor check valve installed in the correct position for proper motor rotation.	Inspect position of motor check valve. Refer to Section 70.

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M81557AE

ONE OR MORE CUTTING UNITS TURNING BACKWARDS



Slide M81557AE

M81557AE -19-11JAN93

MX,27015HV,A33 -19-18JAN93

OIL LEAKING FROM CUTTING UNIT MOTOR

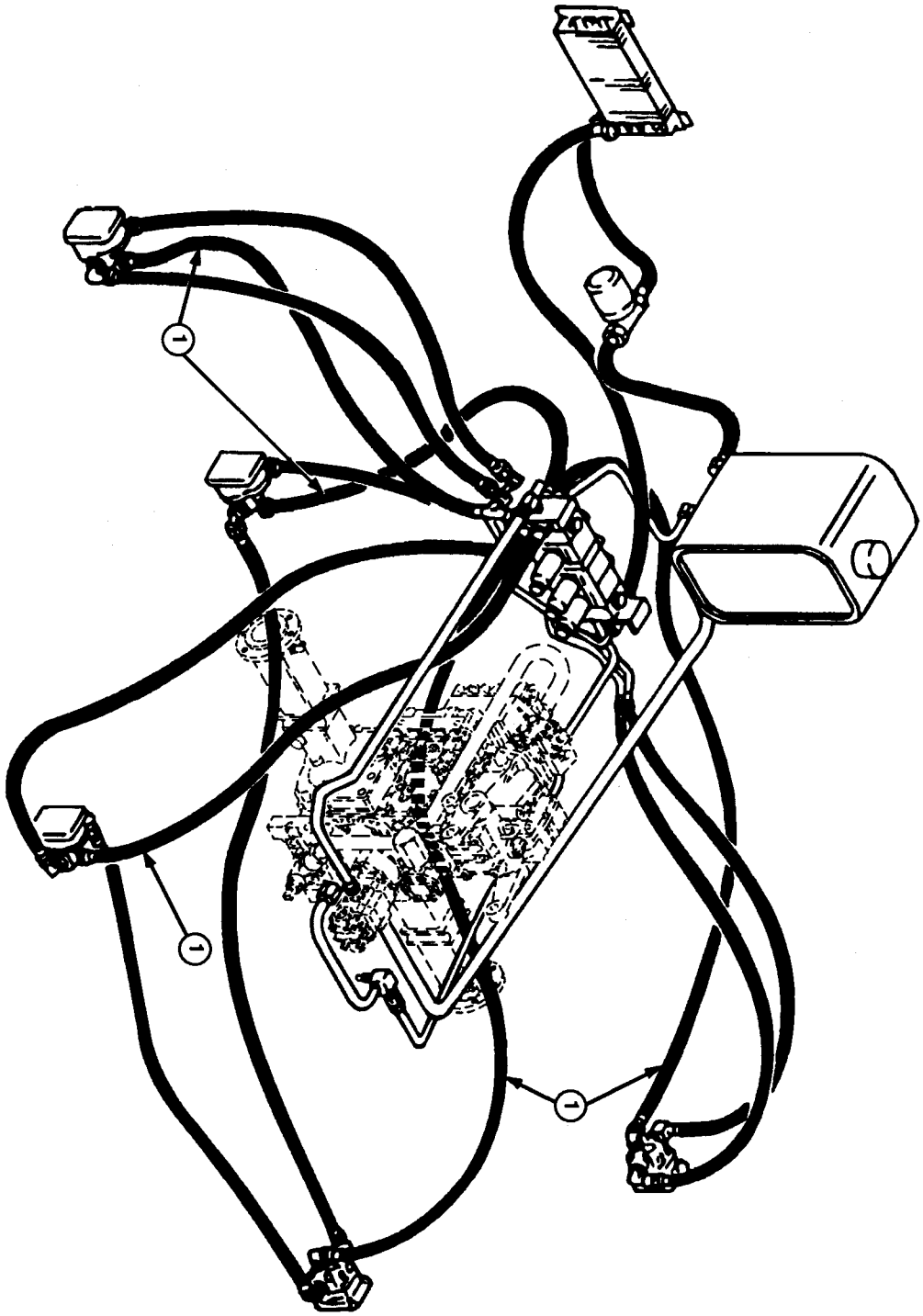
CONDITIONS:
- Transmission in neutral
- PTO engaged
- Park brake engaged
- Cutting units lowered

Test/Check Point	Normal	If Not Normal
1. Cutting unit motors	No visible oil leakage.	Inspect drain hose and return hose from motor for restriction or kinks. Remove restriction and replace motor seal.

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M81558AE

OIL LEAKING FROM CUTTING UNIT MOTOR



M81558AE -19-11JAN93

Slide M81558AE

MX,27015HV,A35 -19-18JAN93

FREQUENT FAILURE OF HYDRAULIC LINES AND O-RINGS

CONDITIONS:
- Transmission in neutral
- PTO engaged
- Park brake engaged
- Cutting units lowered

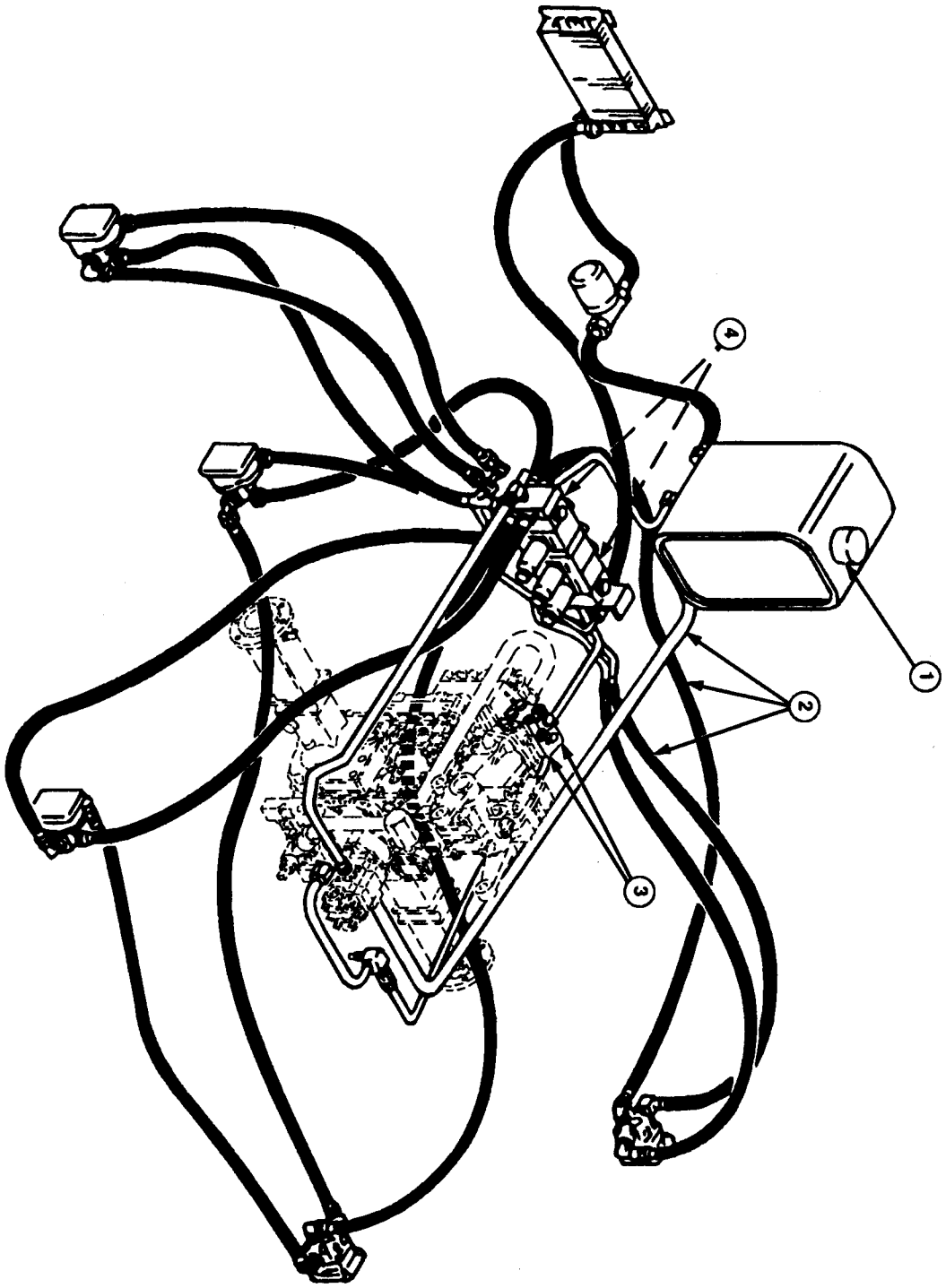
Test/Check Point	Normal	If Not Normal
1. Hydraulic reservoir	Proper oil and viscosity.	Change hydraulic oil and filter.
2. Hose and line connections	All connections tighten to proper torque.	Replace O-ring and tighten connection to proper torque.
3. Wing lift and rockshaft relief valves	Relief valve pressures within specification.	Adjust or replace relief valves.
4. Front/center and wing relief valves	Relief valve pressures within specification.	Adjust or replace relief valves.

MX,27015HV,A36 -19-18JAN93

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40

M81559AE

FREQUENT FAILURE OF HYDRAULIC LINES AND O-RINGS



M81559AE -19-11JAN93

Slide M81559AE

MX,27015HV,A37 -19-18JAN93

HYDRAULIC OIL WARMUP PROCEDURE

REASON:
When making hydraulic tests, the oil must be heated for accurate test results.

EQUIPMENT:
• JDG282 Temperature Gauge (A)

CONNECTIONS:
1. Install temperature gauge on transmission filter.

NOTE: Hood removed to show detail.

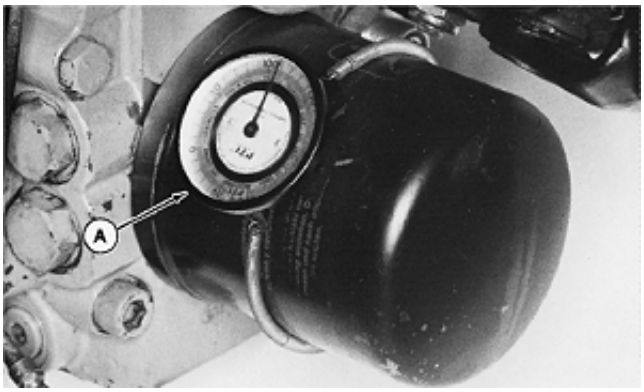
2. Put cardboard or paper around oil cooler to block air flow through cooler.

PROCEDURE:
1. Start engine and operate at fast idle.

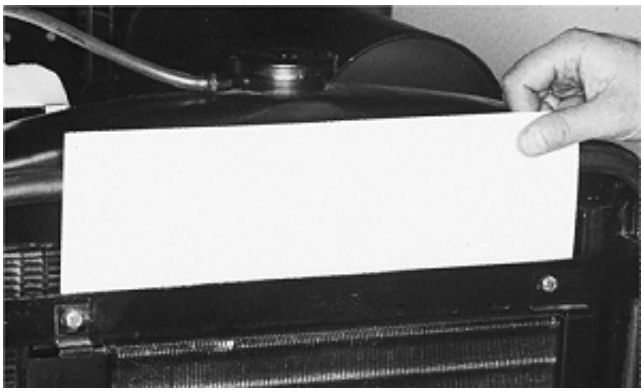
2. Operate all hydraulic functions to distribute heated oil through system.

3. Check temperature gauge. Repeat Step 2 until oil temperature is approximately 43˚C (110˚F).

4. Stop engine and operate all hydraulic controls to relieve pressure in the system.



Slide M81317



Slide M81318

MX,27015HV,A38 -19-18JAN93

TRANSAXLE PUMP FLOW TEST

REASON:
To check transaxle pump for sufficient flow to steering and lift systems.

EQUIPMENT:
- JTO5469 Flowmeter Kit (A)
- JTO3368 45˚ Elbow, 2 used (B)

CONNECTIONS:
1. Disconnect hose from transaxle pump output and flow control valve.

2. Connect inlet of flowmeter to transaxle pump.

3. Connect outlet of flow meter to flow control valve.

PROCEDURE:
1. Open valve of flowmeter fully.

2. Warm hydraulic oil. (See procedure in this group.)

3. Start engine and operate at 2800 rpm.

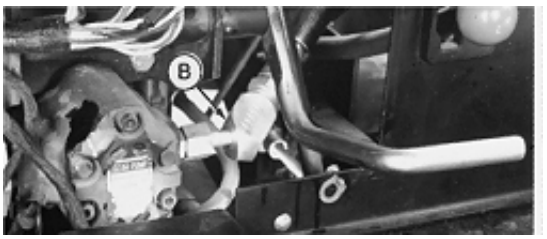
4. Check flowmeter reading.

SPECIFICATIONS:
- Oil temperature .. 43˚C (110˚F)
- Transaxle pump flow .. 33.5 L/min (8.85 gpm)

RESULTS:
If flow is less than specification:
- Check for restricted suction screen.
- Inspect suction tube for restrictions or air leaks.
- Inspect transaxle pump for wear or damage.



Slide E36011



Slide E36010

MX,27015HV,A39 -19-18JAN93

ROCKSHAFT RELIEF VALVE PRESSURE TEST

REASON:
To check rockshaft relief valve for proper pressure setting.

EQUIPMENT:
- JTO5850 Hose with Diagnostic Receptacle (A)
- JTO3345 Gauge 20000 kPa (200 bar) (3000 psi) (B)
- 100 mm (4 in.) Wooden Block (C)

CONNECTIONS:
1. Assemble gauge, hose and diagnostic receptacle.

2. Connect test equipment to diagnostic receptacle port at the rear or top of flow control valve.

PROCEDURE:
1. Warm hydraulic oil. (See procedure in this group.)

2. Start engine and operate at 2800 rpm.

3. Put wooden block (C) between frame and lift arm.

4. Move cutting units lever rearward to lift front and center cutting units. DO NOT pull lever all the way back to activate the wing lift solenoids.

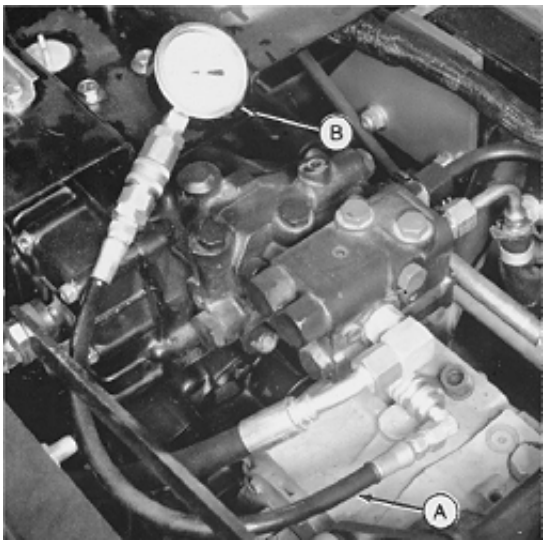
5. Check pressure gauge reading.

6. Lower cutting units to the ground.

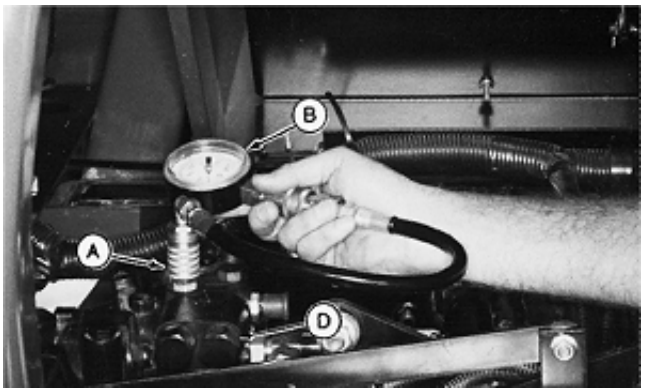
SPECIFICATIONS:
- Oil temperature .. 43˚C (110˚F)
- Rockshaft relief valve pressure .. 14617 kPa (146 bar) (2120 psi)

RESULTS:
If pressure is less than specification:
- Add a shim to rockshaft relief valve (D) and check pressure again. See Section 70, Group 10.

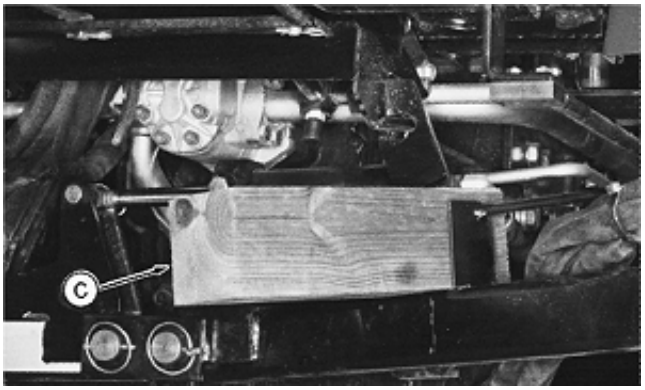
If pressure is greater than specification:
- Inspect rockshaft relief valve (D) for obstruction, wear or damage. See Section 70, Group 10.



Serial No. —880000



Serial No. 880001—



Slide M81400

MX,27015HV,A40 -19-18JAN93

ROCKSHAFT LEAKAGE TEST



Slide M81401

REASON:
To check rockshaft cylinder, housing or valve for leakage.

EQUIPMENT:
- Scale for measuring height

CONNECTIONS:
1. Warm hydraulic oil. (See procedure in this group.)

2. Make sure rockshaft feedback linkage is adjusted correctly. (See procedure in this group.)

PROCEDURE:
1. Start engine and lift front and center arms with cutting units, to full raise position.

2. Stop engine.

3. Measure height of lift arms near end of lift arms. Record height.

4. After 1 minute, measure height again at the same location.

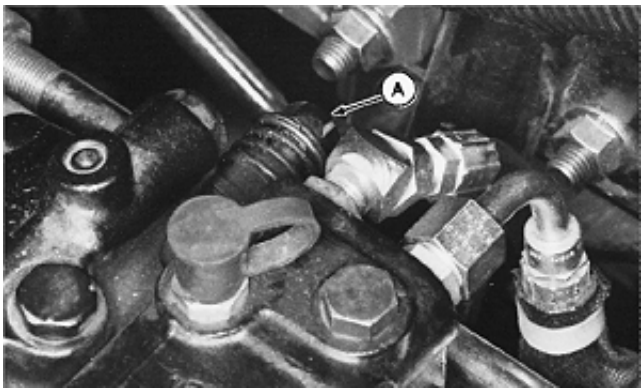
SPECIFICATIONS:
- Oil temperature .. 43˚C (110˚F)
- Maximum rockshaft leakage .. 2 mm (0.08 in.) drop in 1 min.

RESULTS:
If drop is within specification, rockshaft system is normal.

If drop is greater than specification, continue test.

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ROCKSHAFT LEAKAGE TEST—CONTINUED



Slide M81402

PROCEDURE:
5.Close rate-of-drop/stop valve (A) by turning clockwise.

6. Measure height of lift arms near end of lift arms. Record height.

7. After 1 minute, measure height again at the same location.

SPECIFICATIONS:
- Oil temperature .. 43˚C (110˚F)
- Maximum rockshaft leakage .. 2 mm (0.08 in.) drop in 1 min.

RESULTS:
If drop is within specification, inspect the following:
- Leaking or misadjusted lowering valve
- O-rings between rockshaft control valve and rockshaft housing
- Worn or damaged rockshaft valve spool or housing
- Rate-of-drop/stop valve damaged or leaking
- Refer to Section 70, Group 25 for repair

If drop is greater than specification, inspect the following:
- Damaged or leaking rockshaft safety relief valve
- Cracked or leaking piston cover
- Rockshaft piston O-rings
- Scored rockshaft cylinder
- Refer to Section 70, Group 25 for repair

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MX,27015HV,A42 -19-18JAN93

WING LIFT RELIEF VALVE PRESSURE TEST

REASON:
To check wing lift relief valve for proper pressure setting.

EQUIPMENT:
- JT05850 Hose with Diagnostic Receptacle (A)
- JT03345 Gauge 20000 kPa (200 bar) (3000 psi) (B)

CONNECTIONS:
1. Assemble gauge, hose and diagnostic receptacle.

2. Connect test equipment to diagnostic receptacle port at the rear of flow control valve.

PROCEDURE:
1. Warm hydraulic oil. (See procedure in this group.)

2. Start engine and operate at 2800 rpm.

3. Move one toggle switch to lift wing arm. Hold switch at lift position to force pressure oil through wing lift relief valve.

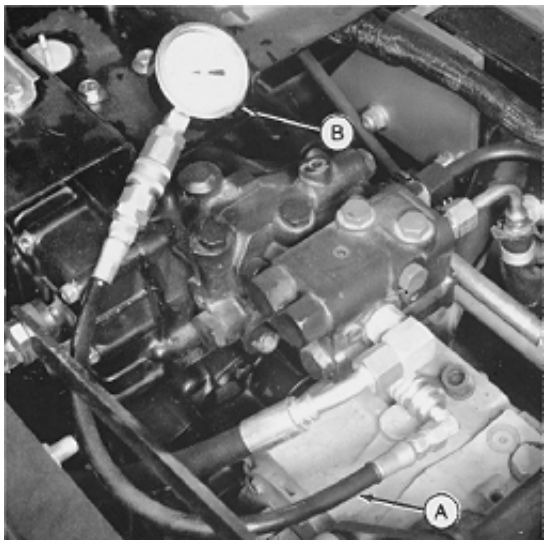
4. Check pressure gauge reading.

5. Lower cutting units to the ground.

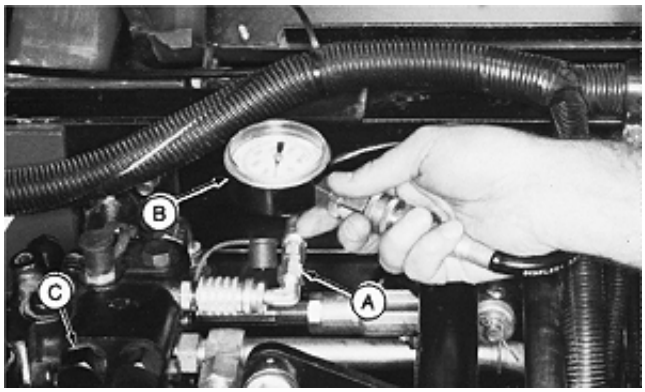
SPECIFICATIONS:
- Oil temperature .. 43˚C (110˚F)
- Wing lift relief valve pressure .. 14617 kPa (146 bar) (2120 psi)

RESULTS:
If pressure is less than specification:
- Add a shim to wing lift relief valve (C) and check pressure again. See Section 70, Group 10.

If pressure is greater than specification:
- Remove shim from wing lift relief valve (C) and check pressure again.
- Inspect wing lift relief valve for obstruction, wear or damage.
- See Section 70, Group 10.



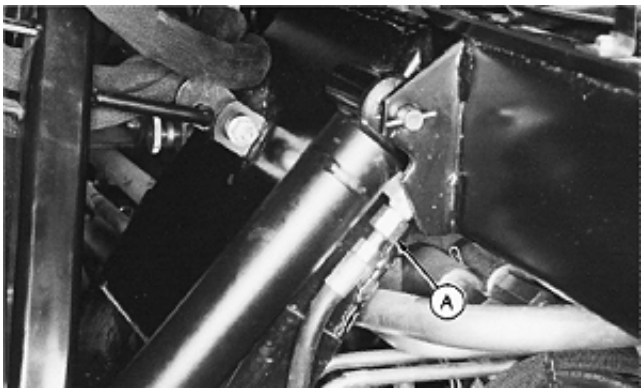
Serial No. —880000



Serial No. 880001—

MX,27015HV,A43 -19-18JAN93

WING LIFT CYLINDER LEAKAGE TEST



Slide E31883

REASON:
To check leakage of wing lift cylinder piston seal.

EQUIPMENT:
- 38H1146 ORFS Plug

CONNECTIONS:
1. Remove cutting unit from wing of cylinder to be tested.

2. Warm hydraulic oil. (See procedure in this group.)

3. Put lift wing in travel position and stop engine.

IMPORTANT: Plug must be installed in hose to prevent full pump flow from the hose.

4. Disconnect hose (A) from head end of the lift cylinder. Install plug in hose.

NOTE: Some oil will drip from open port of cylinder. This is not considered leakage.

PROCEDURE:
1. Start engine and operate at fast idle.

2. Move toggle switch of disconnected cylinder to lift position and hold.

3. Observe open port of lift cylinder for oil flow.

RESULTS:
If hydraulic oil continually flows or drips from open port, repair or replace wing lift cylinder.

If hydraulic oil does not flow or drip from open port, lift cylinder is good. Inspect wing lift valve for wear or damage if wings do not stay in a raised position.

If pressure is greater than specification:
- Remove shim from wing lift relief valve and check pressure again.
- Inspect wing lift relief valve for obstruction, wear or damage.

MX,27015HV,A44 -19-18JAN93

TRANSAXLE LUBE PRESSURE TEST

REASON:
To check lubrication oil for proper pressure setting.

EQUIPMENT:
- JTO5486 Fitting 1/4 M NPT x 7/16-20 M 37˚
- JTO3017 Hose (B)
- JTO3363 Gauge 200 kPa (2 bar) (30 psi) (C)

CONNECTIONS:
1. Assemble gauge and hose.

2. Remove pipe plug on left side of transaxle. Install fitting and test equipment.

PROCEDURE:
1. Warm oil to 43˚C (110˚F). (See procedure in this group.)

2. Start engine and operate at 2800 rpm.

3. Check pressure gauge reading.

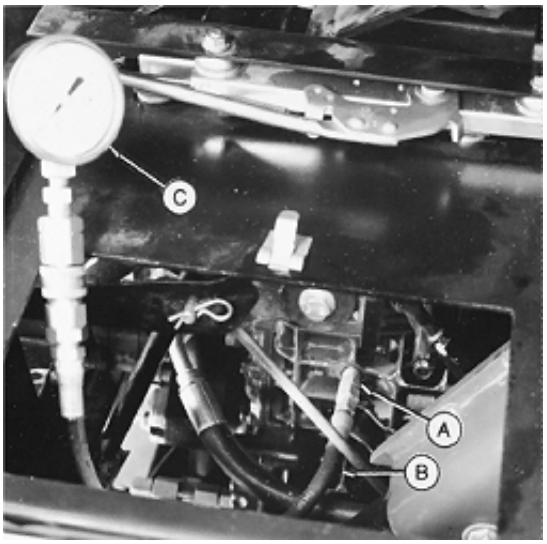
SPECIFICATIONS:
- Transaxle lube pressure .. 21—41 kPa (0.2—0.4 bar) (3—6 psi)

RESULTS:

NOTE: Lube relief valve is located behind cover on right side of transaxle.

If pressure is less than specification:
- Check lube relief valve, relief may be worn or stuck open.
- Inspect parts of the PTO system, parts may be excessively worn or leaking.
- See Section 50, Group 10 for repair.

If pressure is greater than specification:
- Inspect lube relief valve for restriction or not opening completely.
- Check PTO lube passages for restrictions.
- See Section 50, Group 10 for repair.



Slide E35853

MX,27015HV,A7 -19-18JAN93

HYDRAULIC PUMP FLOW TEST—FRONT/CENTER SECTION

REASON:
- To determine if front/center pump section provides adequate flow for front and center motors.

EQUIPMENT:
- JT05469 Flowmeter Kit (A)
- JT03012 Connector (2 used) (B)
- JT05690 ORFS Connector (2 used) (C)

CONNECTIONS:
1. Remove hydraulic line from hydraulic pump and cutting unit control valve right inlet port.

2. Install flowmeter and connectors. Make sure inlet of flowmeter is connected to pump and outlet connected to control valve.

IMPORTANT: Open valve of flowmeter before starting engine. Starting engine with valve closed or partially closed can damage hydraulic pump.

3. Open valve of flowmeter fully.

270
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PROCEDURE:
1. Warm hydraulic oil. (See procedure in this group.)

2. Start and operate engine at fast idle.

3. Move PTO lever to engaged position.

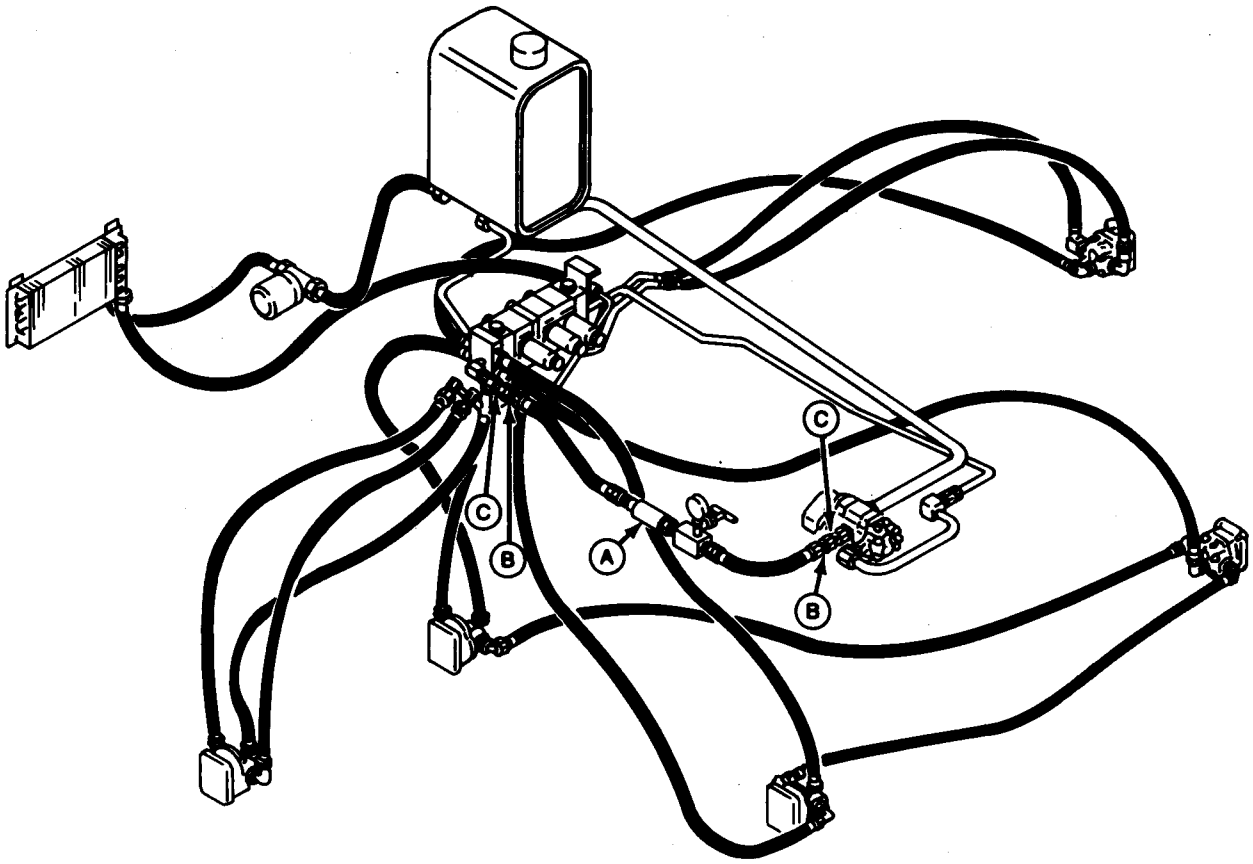
4. Observe flowmeter reading.

SPECIFICATIONS:
- Oil temperature .. 43˚C (110˚F)
- Engine speed .. 2800 rpm
- Pump flow—Front/center section .. 37.8 L/min (10 gpm)

RESULTS:
If pump flow is within specification, check front/center motors relief valve pressure.

If pump flow is not within specification, check:
- Reservoir oil level
- Obstructed or plugged reservoir filter
- Obstruction or air leak in suction tube.
- Pinched or obstructed line in the front/center motors circuit.
- Repair or replace hydraulic pump (Refer to Section 70.)

MX,27015HV,A45 -19-18JAN93



E36009 -UN-01APR91

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MX,27015HV,A46 -19-18JAN93

HYDRAULIC PUMP FLOW TEST—WING SECTION

REASON:
To determine if wing pump section provides adequate flow for wing motors.

EQUIPMENT:
- JT05469 Flowmeter Kit (A)
- JT03012 Connector (2 used) (B)
- JT05690 ORFS Connector (2 used) (C)

CONNECTIONS:
1. Remove steel hydraulic line from hydraulic pump and bulkhead fitting under left foot rest.

2. Install flowmeter and connectors. Make sure inlet of flowmeter is connected to pump and outlet connected to bulkhead fitting.

IMPORTANT: Open valve of flowmeter before starting engine. Starting engine with valve closed or partially closed can damage hydraulic pump.

3. Open valve of flowmeter fully.

270
15
52

PROCEDURE:
1. Warm hydraulic oil. (See procedure in this group.)

2. Start and operate engine at fast idle.

3. Move PTO lever to engaged position.

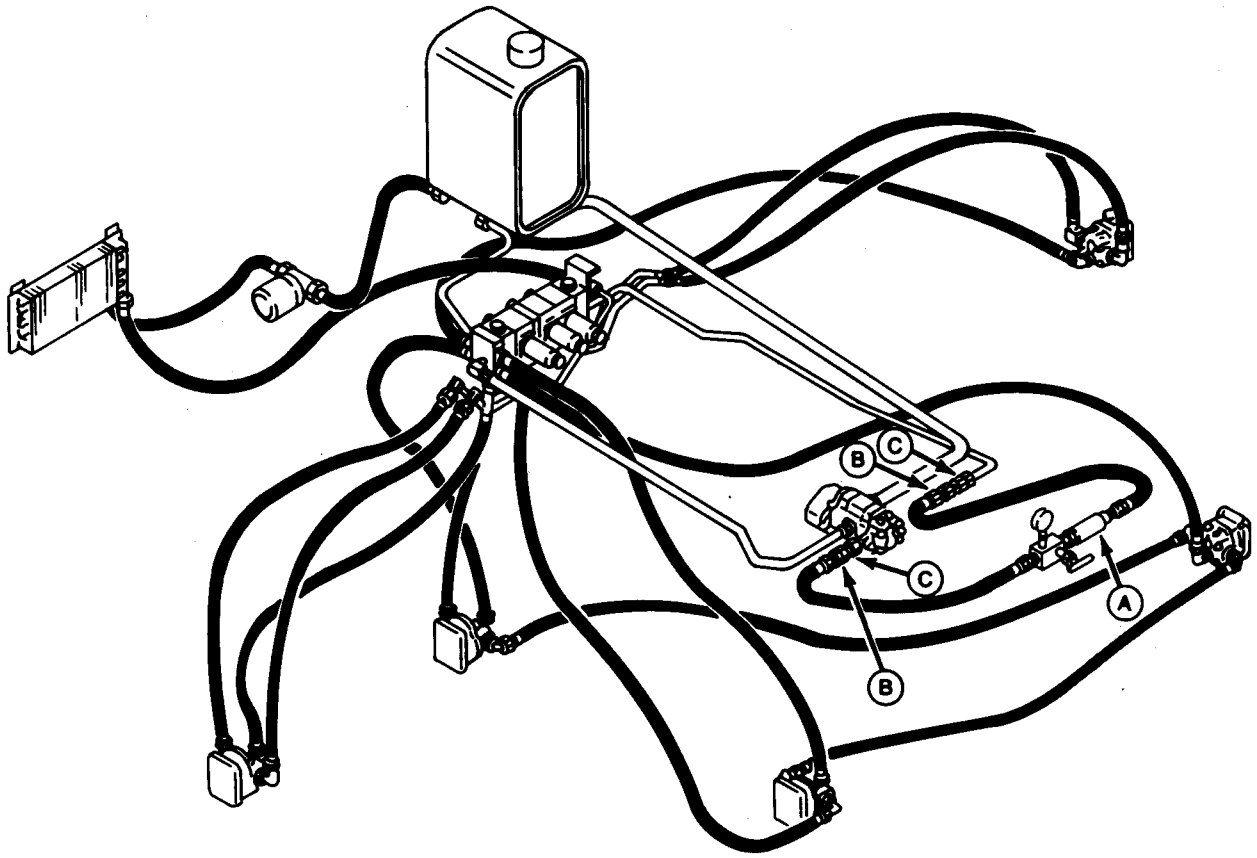
4. Observe flowmeter reading.

SPECIFICATIONS:
- Oil temperature .. 43˚C (110˚F)
- Engine speed .. 2800 rpm
- Pump flow—Wing section .. 37.8 L/min (10 gpm)

RESULTS:
If pump flow is within specification, check wing motors relief valve pressure.

If pump flow is not within specification, check:
- Reservoir oil level
- Obstructed or plugged reservoir filter
- Obstruction or air leak in suction tube.
- Pinched or obstructed line in the wing motor circuits.
- Repair or replace hydraulic pump (Refer to Section 70.)

MX,27015HV,A47 -19-18JAN93



E36008 -UN-01APR91

Slide E36008

MX,27015HV,A48 -19-18JAN93

FRONT/CENTER CUTTING UNIT MOTORS RELIEF VALVE TEST

REASON:
Check pressure setting of front/center cutting unit motor relief valve.

EQUIPMENT:
- JT05850 Hose with Diagnostic Receptacle (A)
- JT05473 Gauge 35000 kPa (350 bar) (5000 psi) (B)

CONNECTIONS:
1. Assemble gauge, hose and diagnostic receptacle.

2. Connect test equipment to diagnostic receptacle port at right, rear side of cutting unit control valve.

PROCEDURE:
1. Warm hydraulic oil. (See procedure in this group.)

2. Lower front and center cutting units. Keep wing units in transport position.

3. Stop engine.

4. Put a wooden block in the reel of a cutting unit to stall reel and stop the flow of oil in front and center motors.

5. Start and operate engine at fast idle.

6. Move PTO lever forward to engage hydraulic pump.

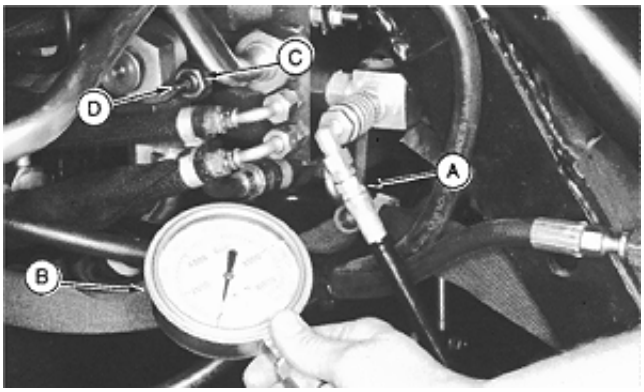
7. Check pressure gauge reading.

8. Disengage PTO lever.

SPECIFICATIONS:
- Oil temperature .. 43˚C (110˚F)
- Engine speed .. 2800 rpm
- Front/center relief pressure .. 17237—21374 kPa (172—214 bar) (2500—3100 psi)

RESULTS:
If relief pressure is within specification, relief valve is operating properly.

If relief pressure is not within specification:
- Loosen lock nut (C) of relief valve.
- Turn adjusting screw (D) clockwise to increase pressure, counterclockwise to decrease pressure.
- Adjust pressure to 19305 kPa (192 bar) (2800 psi).
- Hold adjusting screw while tightening lock nut.
- Replace relief valve if pressure can not be adjusted to specification.



-UN-10DEC92
M81517

Slide M81517

A—JT05850 Hose
B—JT05473 Gauge
C—Lock Nut
D—Adjusting Screw

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WING CUTTING UNIT MOTORS RELIEF VALVE TEST

REASON:
Check pressure setting of wing cutting unit motors relief valve.

EQUIPMENT:
- JT05850 Hose with Diagnostic Receptacle (A)
- JT05473 Gauge 35000 kPa (350 bar) (5000 psi) (B)

CONNECTIONS:
1. Assemble gauge, hose and diagnostic receptacle.

2. Connect test equipment to diagnostic receptacle port located left of the hydraulic pump.

PROCEDURE:
1. Warm hydraulic oil. (See procedure in this group.)

2. Lower all cutting units.

3. Stop engine.

4. Put a wooden block in the reel of a wing cutting unit to stall reel and stop the flow of oil in the wing motor.

5. Start and operate engine at fast idle.

6. Move PTO lever forward to engage hydraulic pump.

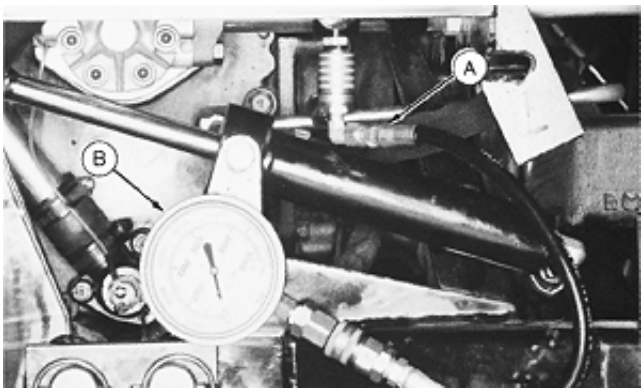
7. Check pressure gauge reading.

8. Disengage PTO lever.

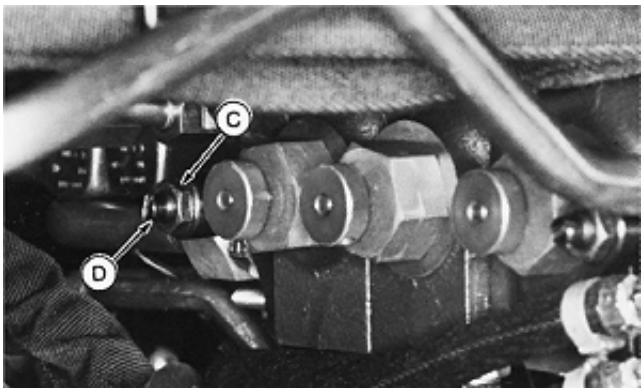
SPECIFICATIONS:
- Oil temperature .. 43˚C (110˚F)
- Engine speed .. 2800 rpm
- Wing motors relief pressure .. 18616—22753 kPa (186—228 bar) (2700—3300 psi)

RESULTS:
If relief pressure is within specification, relief valve is operating properly.

If relief pressure is not within specification:
- Loosen lock nut (C) of relief valve.
- Turn adjusting screw (D) clockwise to increase pressure, counterclockwise to decrease pressure.
- Adjust pressure to 20684 kPa (207 bar) (3000 psi).
- Hold adjusting screw while tightening lock nut.
- Replace relief valve if pressure can not be adjusted to specification.



Slide M81518



Slide M81519

A—JT05850 Hose
B—JT05473 Gauge
C—Lock Nut
D—Adjusting Screw

MX,27015HV,A50 -19-18JAN93

WEIGHT TRANSFER VALVE PRESSURE TEST

REASON:
Check operation of weight transfer valve.

EQUIPMENT:
- JT05850 Hose with Diagnostic Receptacle (A)
- JT05471 Gauge 7000 kPa (70 bar) (1000 psi) (B)

CONNECTIONS:
1. Assemble gauge, hose and diagnostic receptacle port at rear of flow control valve.

PROCEDURE:
1. Turn weight transfer valve knob (C) clockwise to increase system pressure.

2. Disengage PTO.

3. Lower cutting units to the ground using cutting units control lever.

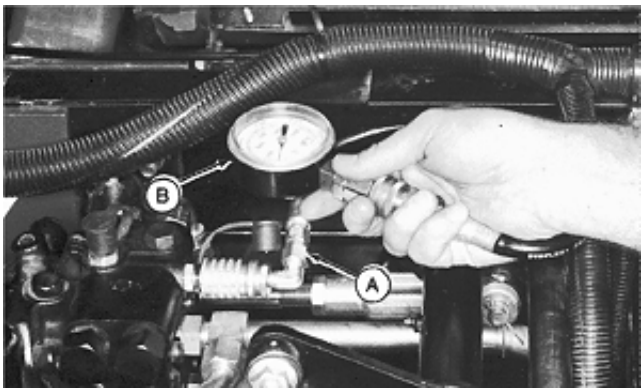
4. Operate engine at fast idle.

5. While observing gauge, turn weight transfer switch on and off several times.

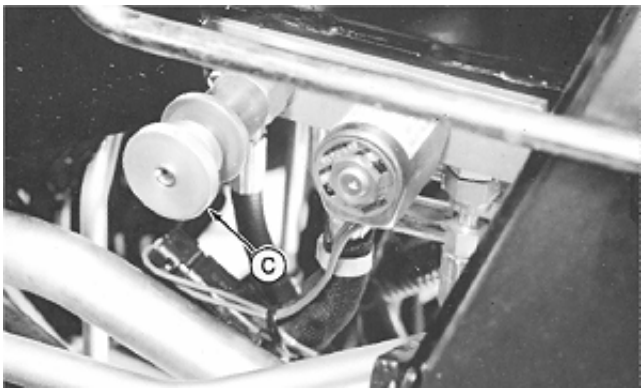
RESULTS:
Pressure reading must vary from on and off positions.

If there is very little or no pressure variance, inspect weight transfer valve assembly. Refer to Section 70.

If an electrical problem is suspected, refer to Section 240.



Slide M81540



Slide M81541

MX,27015HV,A51 -19-18JAN93

LIFT SYSTEM INITIAL ADJUSTMENTS

REASON:
To ensure proper initial setting of mower lift system.

PROCEDURE:
1. Lower cutting units to the ground.

2. Check length of horizontal lift rod (A). Length should be 490 mm (19.3 in.), measuring between centers of yoke pins located at each end of rod.

IMPORTANT: When equipped with grass catchers, refer to Adjust Center Cutting Unit Clearance in this group for vertical lift rod adjustment.

3. Check length of vertical lift rod (B). Length should be 495 mm (19.5 in.) between mounting hole centers. Adjust length by turning rod end as necessary.

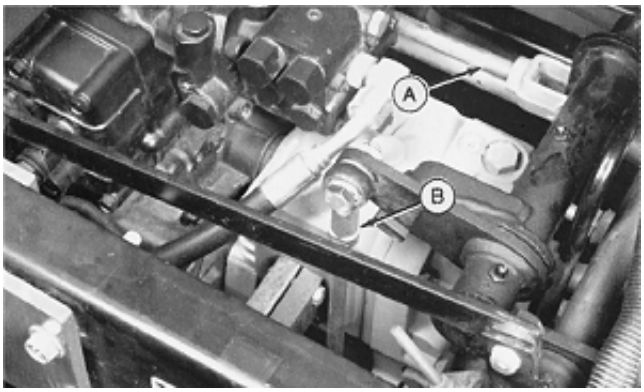
4. Check spring force required to move upper feedback input arm (C). (See Install Rockshaft Valve in Section 70, Group 25.)

NOTE: On some units, the stop cap screw is located inside the right main frame channel.

5. Check lift lever stop cap screw (D). Cap screw must extend 15 mm (0.59 in.) from the top surface of the cap screw head to the bracket. Adjust cap screw as needed and tighten lock nut.

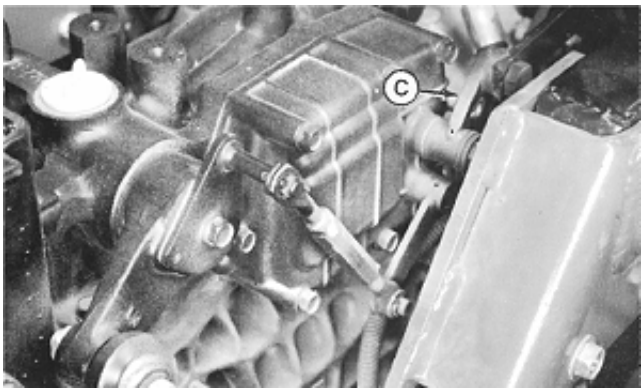
6. Check and adjust lift lever rod (F). Its length should measure 625 mm (24.6 in.) from roll pin at front of rod to center of mounting hole at rear. To adjust, loosen jam nut (E) and turn rod end. When adjustment is complete, tighten jam nut.

A—Horizontal Lift Rod
B—Vertical Lift Rod
C—Upper Feedback Input Arm
D—Stop Cap Screw
E—Jam Nut
F—Lift Lever Rod



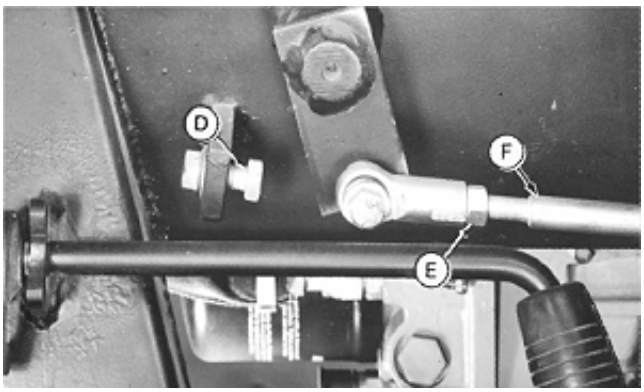
E36004 -UN-15MAR91

Slide E36004



M81375 -UN-03NOV92

Slide M81375



M81376 -UN-03NOV92

Slide M81376

MX,27015HV,A52 -19-18JAN93

ADJUST ROCKSHAFT FEEDBACK LINKAGE

REASON:
To ensure that the rockshaft reacts properly to changes in ground contour.

PROCEDURE:

IMPORTANT: This adjustment must be made without any weight on the rockshaft arms.

1. Lower cutting units to the ground.

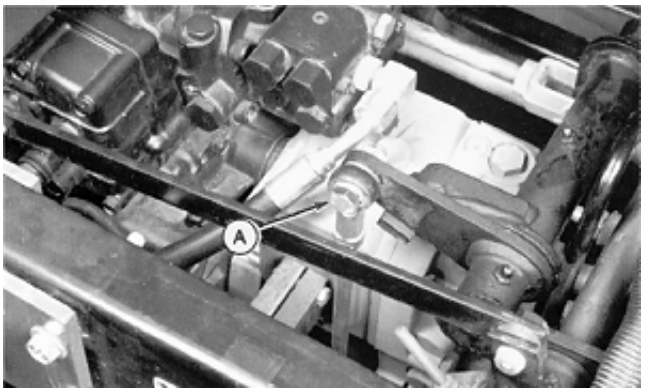
2. Raise and secure fuel tank.

3. Remove cap screw (A), washer, and nut to disconnect vertical lift rod.

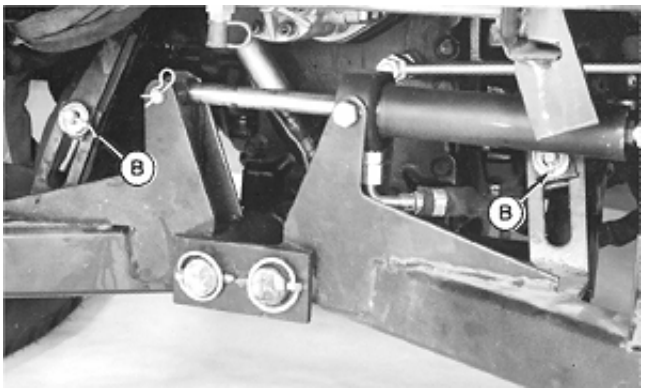
4. Remove quick lock pin (B), washer, spacer, and pin from both lift arms.

5. Turn rate-of-drop screw (C) counterclockwise until screw is adjusted fully open. Lower fuel tank.

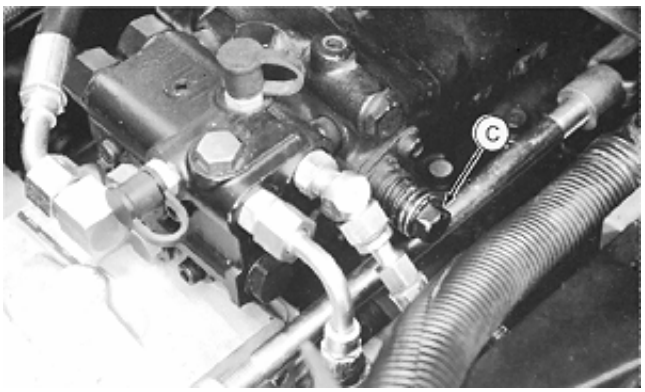
A—Cap Screw
B—Quick-Lock Pin
C—Rate-Of Drop Screw



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Slide M81377



Slide M81379

MX,27015HV,A53 -19-18JAN93

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ADJUST ROCKSHAFT FEEDBACK LINKAGE—CONTINUED

NOTE: Seat support removed to show detail.

6. Open top left access panel.

7. Loosen jam nut (A).

8. Start engine and operate at slow idle.

9. Use lift lever to raise rockshaft arms to full raise position.

10. Move turnbuckle (B) counterclockwise to shorten linkage. Continue until the engine starts to labor. This indicates that the relief valve is opening.

11. Move turnbuckle clockwise until the noise from the relief valve stops. Move the turnbuckle an additional 3/4—1 turn (4—6 flats) clockwise and tighten jam nut.

12. Cycle rockshaft arms to ensure proper operation. There should be a small amount of movement in rockshaft arms at full-raise position.

13. Lower rockshaft arms.

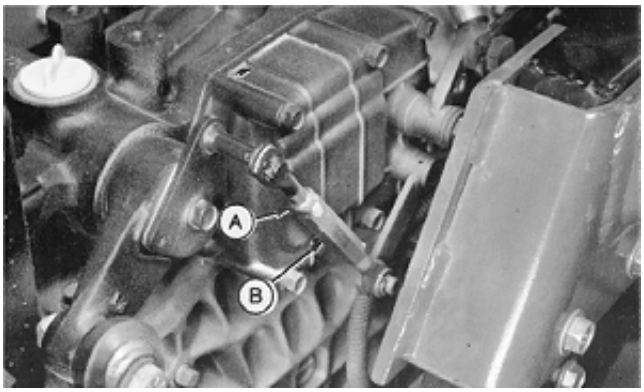
14. Connect front lift arms using pin, spacer, washer, and quick-lock pin (C).

15. Connect vertical lift rod using cap screw (D), washer, and nut.

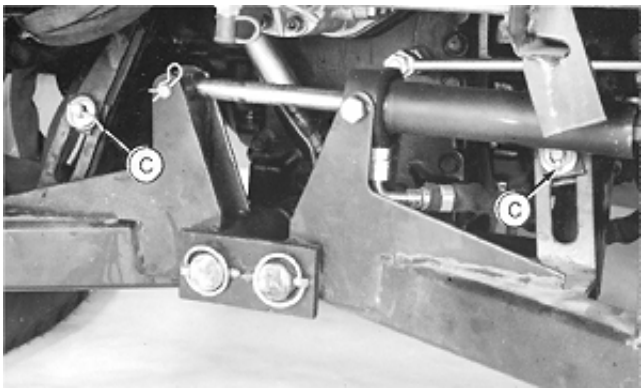
16. Raise cutting units and check front lift arm clearance. (See procedure in this group).

17. Check center cutting unit clearance. (See procedure in this group.)

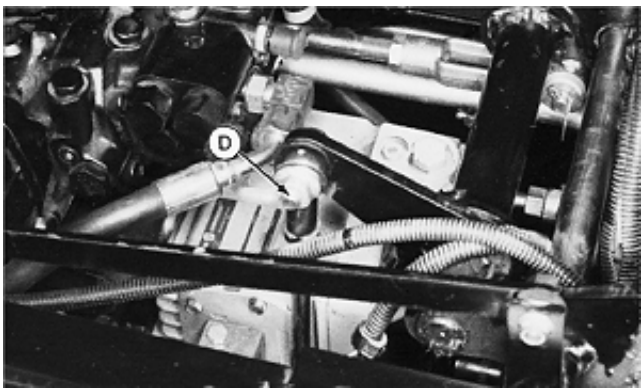
18. Adjust rate-of-drop. (See procedure in this group.)



Slide E35665



Slide M81380



Slide M81381

A—Jam Nut
B—Turnbuckle
C—Quick-Lock Pin
D—Cap Screw

MX,27015HV,A54 -19-18JAN93

ADJUST FRONT LIFT ARM CLEARANCE

REASON:
To make sure lift arms raise completely without contacting stops.

PROCEDURE:
1. Start engine. Move lift lever slowly rearward. Make sure front lift arms (C) do not bottom out on arm stop (A).

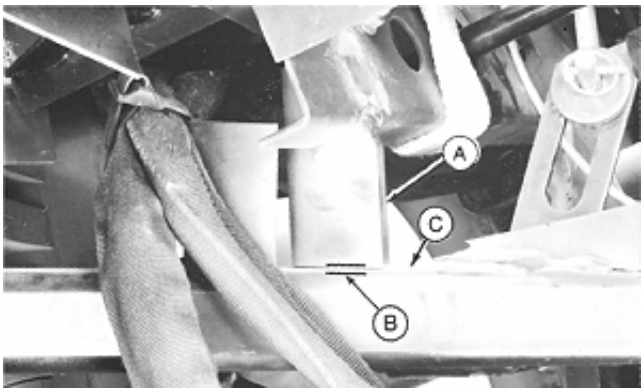
2. There should be a minimum gap (B) of 3 mm (1/8 in.) (B) between the lift arms and the arm stops when arms are in full-raise position. The lift arms should not contact the arm stops.

3. Loosen jam nut (D).

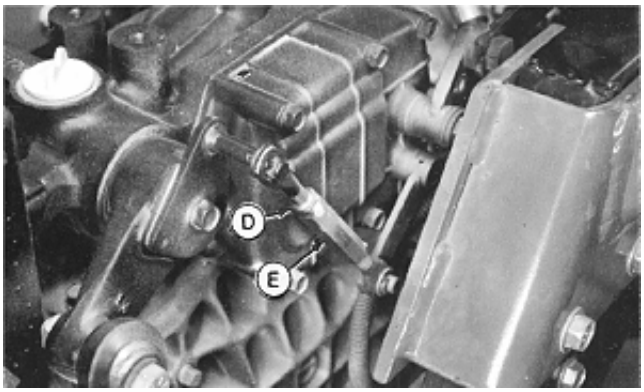
4. Turn the feedback linkage turnbuckle (E) clockwise to lengthen linkage and increase clearance between front lift arms and stops.

5. Tighten jam nut.

A—Arm Stop (2 used)
B—Gap
C—Lift Arm (2 used)
D—Jam Nut
E—Turnbuckle



Slide M81382



Slide M81383

MX,27015HV,A55 -19-18JAN93

ADJUST CENTER CUTTING UNIT CLEARANCE

REASON:
To ensure that center cutting unit raises to specified height.

PROCEDURE:
1. For units with grass catchers, hydraulic hose (A) must be turned as far forward as possible to clear grass catcher in raised position. Also move stop pads (C) on each side of machine to the lowest position. Remove cap screws (B) and nuts to move stop pads.

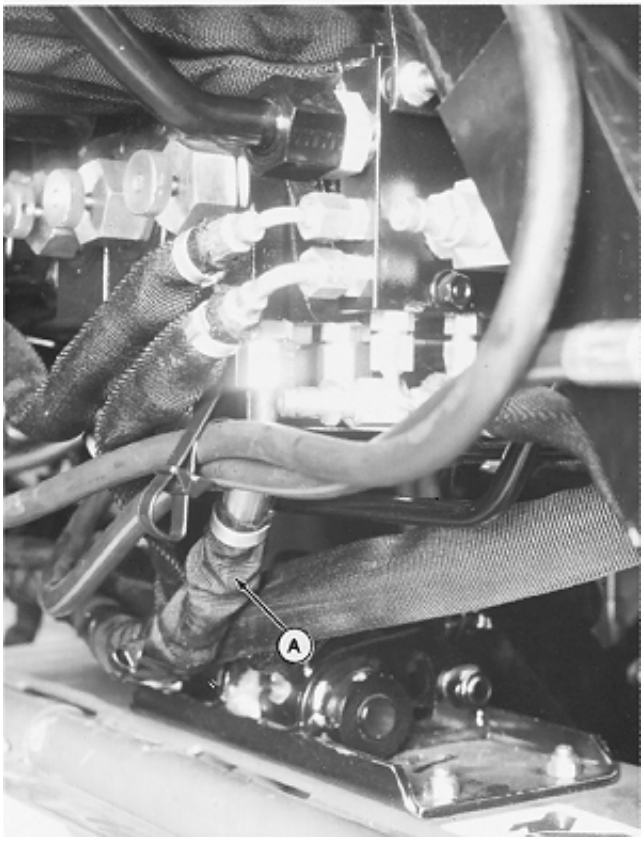
2. With engine running, move lift lever slowly rearward. Make sure center cutting unit does not hit stops.

3. With the cutting unit in the full upright position, the minimum clearance between the center cutting unit and the stop is 3—6 mm (1/8—1/4 in.).

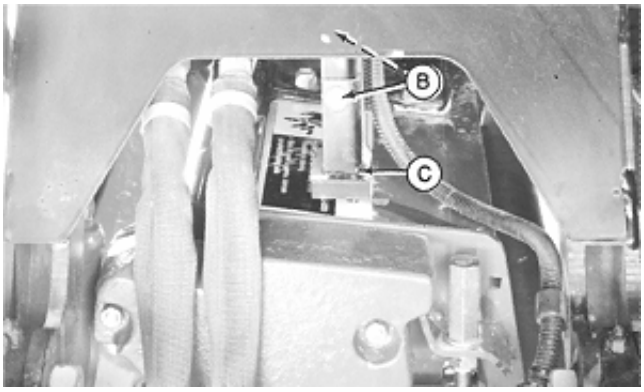
4. If clearance does not meet specification, lower cutting units to the ground. Disconnect vertical lift rod end (D). Turn end clockwise to reduce clearance and counterclockwise to increase clearance.

5. Connect vertical lift rod end. Repeat step 3.

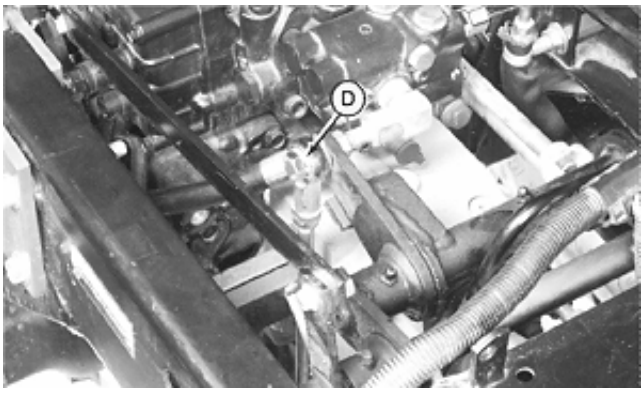
A—Hydraulic Hose
B—Cap Screw (2 used)
C—Stop Pad (2 used)
D—Rod End



Slide E35567



Slide M81384



Slide M81385

MX,27015HV,A56 -19-18JAN93

ADJUST RATE-OF-DROP

REASON:
To make sure cutting units respond correctly to changes in ground contour.

PROCEDURE:

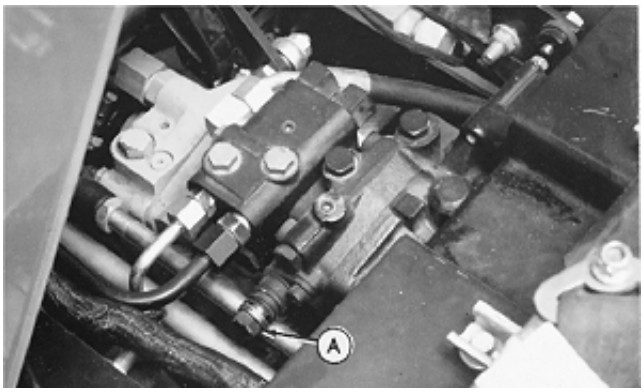
CAUTION: If rate-of-drop is set too fast, damage or injury may result. Adjust rate-of-drop so it is slow enough to be safe.

1. Run engine at fast idle and warm the oil.

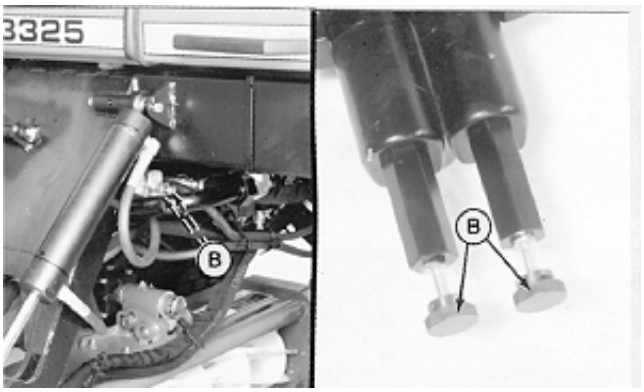
IMPORTANT: Allowing cutting units to drop too fast can damage turf and/or cutting units. Always lower cutting units gradually.

NOTE: Adjust rate-of-drop so cutting units lower at the appropriate speed for current turf conditions. Also make sure all cutting units lower at the same rate.

2. Turn screw (A) clockwise to slow rate-of-drop on three center cutting units. Turn knobs (B) clockwise to slow rate-of-drop on wing units.



Slide E36005



Slide E29873

MX,27015HV,A57 -19-18JAN93

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ADJUST WEIGHT TRANSFER SYSTEM WITHOUT PRESSURE GAUGE

REASON:
To make sure cutting units follow changes in ground contour.

PROCEDURE:

CAUTION: Weight transfer switch must be in OFF (O) position and valve must be completely open when cutting units are being removed to prevent arms from raising rapidly. Turn valve fully counterclockwise to open.

1. Start engine and run at fast idle to warm oil.

2. Move weight transfer switch (A) to on (+) position.

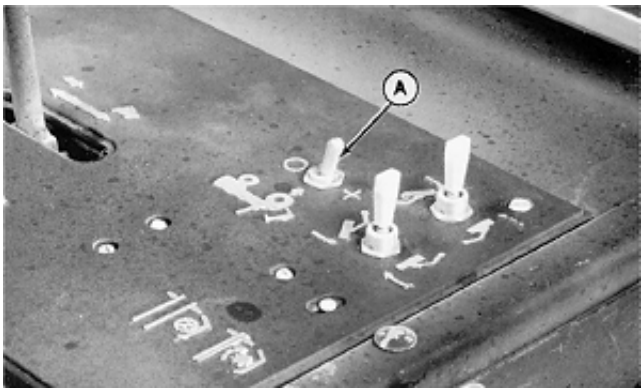
3. Operate mower on the turf. Turn thumbscrew (B) clockwise to adjust weight transfer to achieve desired traction or reduce weight of cutting unit on the turf.

NOTE: Additional weight can be added to drive wheels by adding ballast in the form of fluid or wheel weights. Excessive weight on drive wheels can cause compaction and damage turf. It may be desirable to transfer weight from cutting units to drive wheels in soft turf or newly-seeded turf areas.

4. Adjusting weight transfer valve may require an adjustment in cutting unit rate-of-drop. (See procedure in this group.)

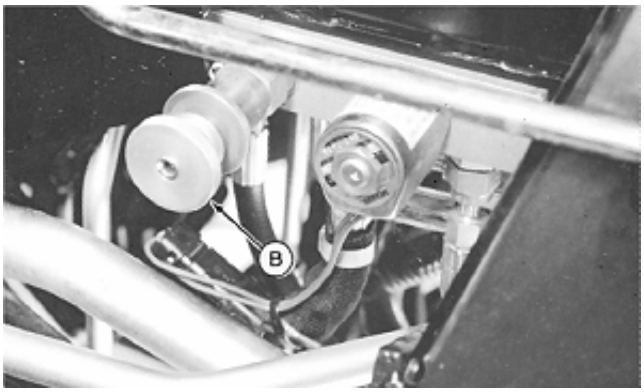
•Adjust rate-of-drop so cutting units follow ground contour as desired. Turn drop rate screws counter-clockwise to increase drop rate.

•If the cutting units do not follow ground contour as desired, increase rate-of-drop and/or decrease weight transfer pressure.



E34150 -UN-17MAY90

Slide E34150



M81387 -UN-17NOV92

Slide M81387

270
15
63

MX,27015HV,A58 -19-18JAN93

ADJUST WEIGHT TRANSFER SYSTEM WITH PRESSURE GAUGE

1. Connect a 0 to 3500 kPa (0 to 500 psi) gauge to the diagnostic receptacle (A) at the flow control valve (B).

CAUTION: Weight transfer switch (C) must be in OFF (O) position and valve must be completely open when cutting units are being removed to prevent arms from raising rapidly. Turn valve fully counterclockwise to open.

2. Start engine and run at fast idle to warm oil. Note pressure reading on gauge.

3. Turn thumbscrew (D) clockwise to increase system pressure. System pressure can be adjusted to any setting from 700 to 3500 kPa (100 to 500 psi). Cutting unit weight decreases as weight transfer pressure increases.

4. Adjust weight transfer valve as necessary to achieve desired traction.

NOTE: Additional weight can be added to drive wheels by adding ballast in the form of fluid or wheel weights. Excessive weight on drive wheels can cause compaction and damage turf. It may be desirable to transfer weight from cutting units to drive wheels in soft turf or newly-seeded turf areas.

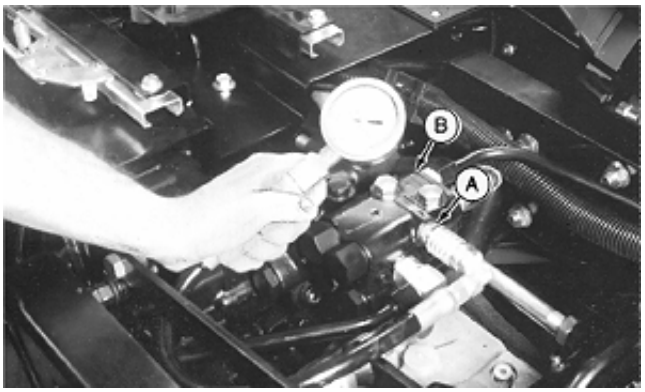
270
15
64

5. Adjusting weight transfer valve may require an adjustment in cutting unit rate-of-drop. (See procedure in this group.)

- Adjust rate-of-drop so cutting units follow ground contour as desired. Turn drop rate screws counter-clockwise to increase drop rate.

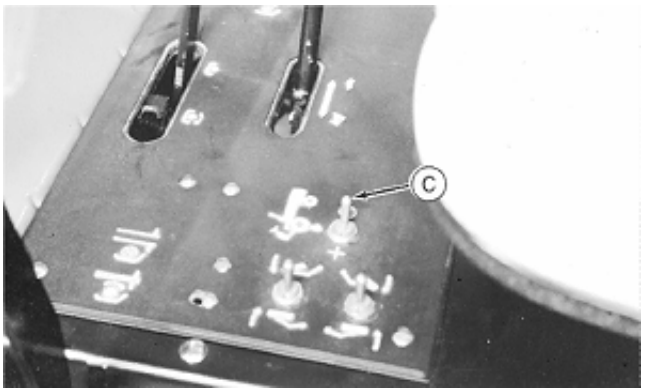
- If the cutting units do not follow ground contour as desired, increase rate-of-drop and/or decrease weight transfer pressure.

System Pressure	Approximate Weight of Cutting Unit
700 kPa (7 bar) (100 psi)	100 kg (220 lb)
1400 kPa (14 bar) (200 psi)	85 kg (190 lb)
2100 kPa (21 bar) (300 psi)	75 kg (160 lb)
2750 kPa (27.5 bar) (400 psi)	60 kg (130 lb)
3500 kPa (35 bar) (500 psi)	45 kg (95 lb)



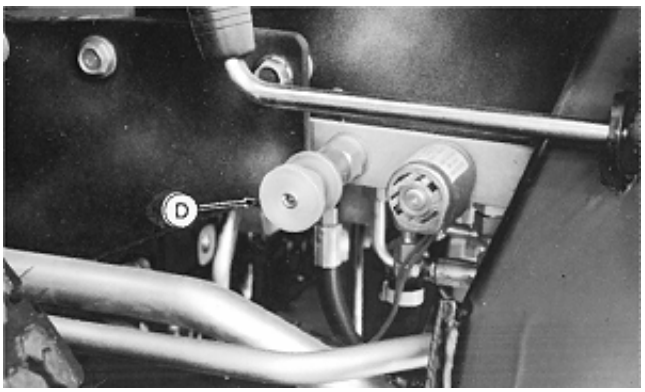
-UN-03NOV92
M81388

Slide M81388



-UN-17NOV92
M81389

Slide M81389



-UN-19NOV92
M81390

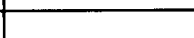
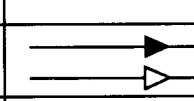
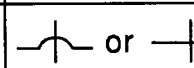
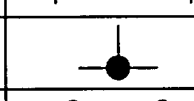
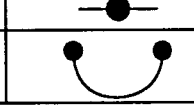
Slide M81390

A—Diagnostic Receptacle
B—Flow Control Valve
C—Weight Transfer Switch
D—Thumbscrew

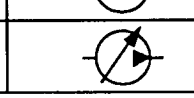
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HYDRAULIC CIRCUIT SYMBOLS

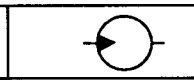
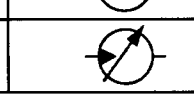
LINES

1		WORKING (MAIN) LINES
2		PILOT CONTROL LINES
3		DRAIN LINE
4		HYDRAULIC / PNEUMATIC } FLOW DIRECTION
5		CROSSING LINES
6		JOINING LINES
7		FLEXIBLE LINE

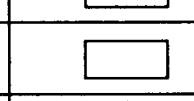
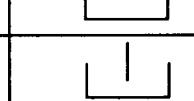
PUMPS

8		FIXED DISPLACEMENT
9		VARIABLE DISPLACEMENT

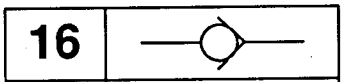
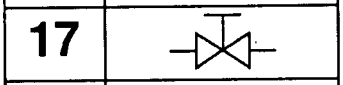
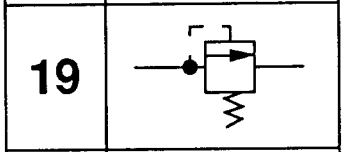
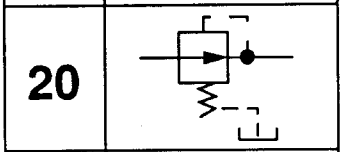
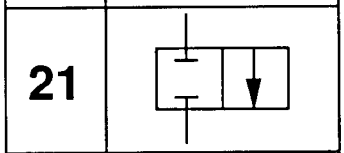
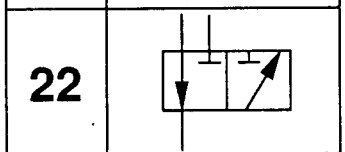
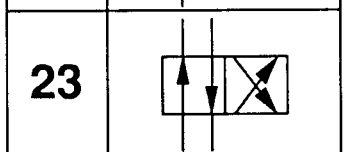
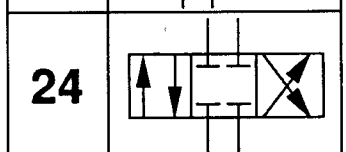
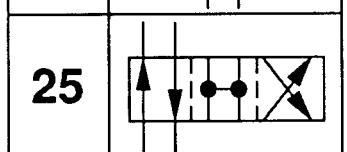
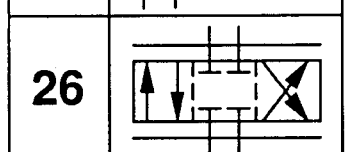
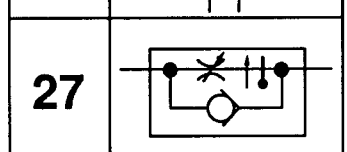
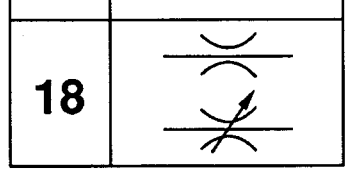
MOTORS

10		FIXED DISPLACEMENT
11		VARIABLE DISPLACEMENT

RESERVOIR

12		VENTED RESERVOIR
13		PRESSURIZED RESERVOIR
14		RESERVOIR RETURN - ABOVE FLUID LEVEL
15		RESERVOIR RETURN - BELOW FLUID LEVEL

VALVES

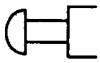
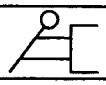
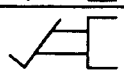
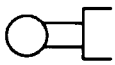
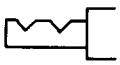
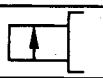
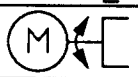
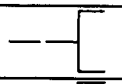
16		CHECK VALVE
17		MANUAL ON/OFF VALVE
19		PRESSURE RELIEF VALVE
20		PRESSURE REDUCTION VALVE
21		TWO POSITION, TWO CONNECTION VALVE
22		TWO POSITION, THREE CONNECTION VALVE
23		TWO POSITION, FOUR CONNECTION VALVE
24		THREE POSITION, FOUR CONNECTION VALVE
25		TWO POSITION, FOUR CONNECTION VALVE WITH TRANSMISSION
26		THREE POSITION, FOUR CONNECTION VALVE WITH INFINITE POSITIONING
27		ADJUSTABLE FLOW CONTROL VALVE (TEMPERATURE AND PRESSURE COMPENSATED)
18		FIXED / VARIABLE } ORIFICE

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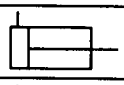
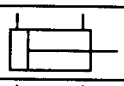
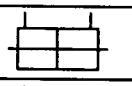
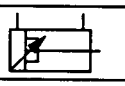
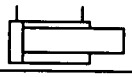
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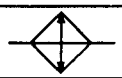
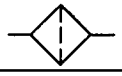
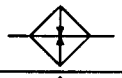
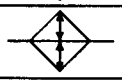
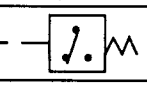
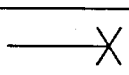
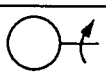
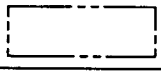
VALVE OPERATORS

28		SPRING
29		MANUAL
30		PUSH BUTTON
31		PUSH/PULL LEVER
32		PEDAL OR TREADLE
33		MECHANICAL
34		DETENTS
35		PRESSURE COMPENSATED
36		SOLENOID-SINGLE WINDING
37		REVERSING MOTOR
38		PILOT PRESSURE -REMOTE SUPPLY
39		PILOT PRESSURE -INTERNAL SUPPLY

CYLINDERS

40		SINGLE ACTING
41		DOUBLE ACTING, SINGLE ROD
42		DOUBLE ACTING, DOUBLE ROD
43		DOUBLE ACTING, ADJ. CUSHION, EXTEND ONLY
44		DOUBLE ACTING, DIFFERENTIAL PISTON

MISCELLANEOUS

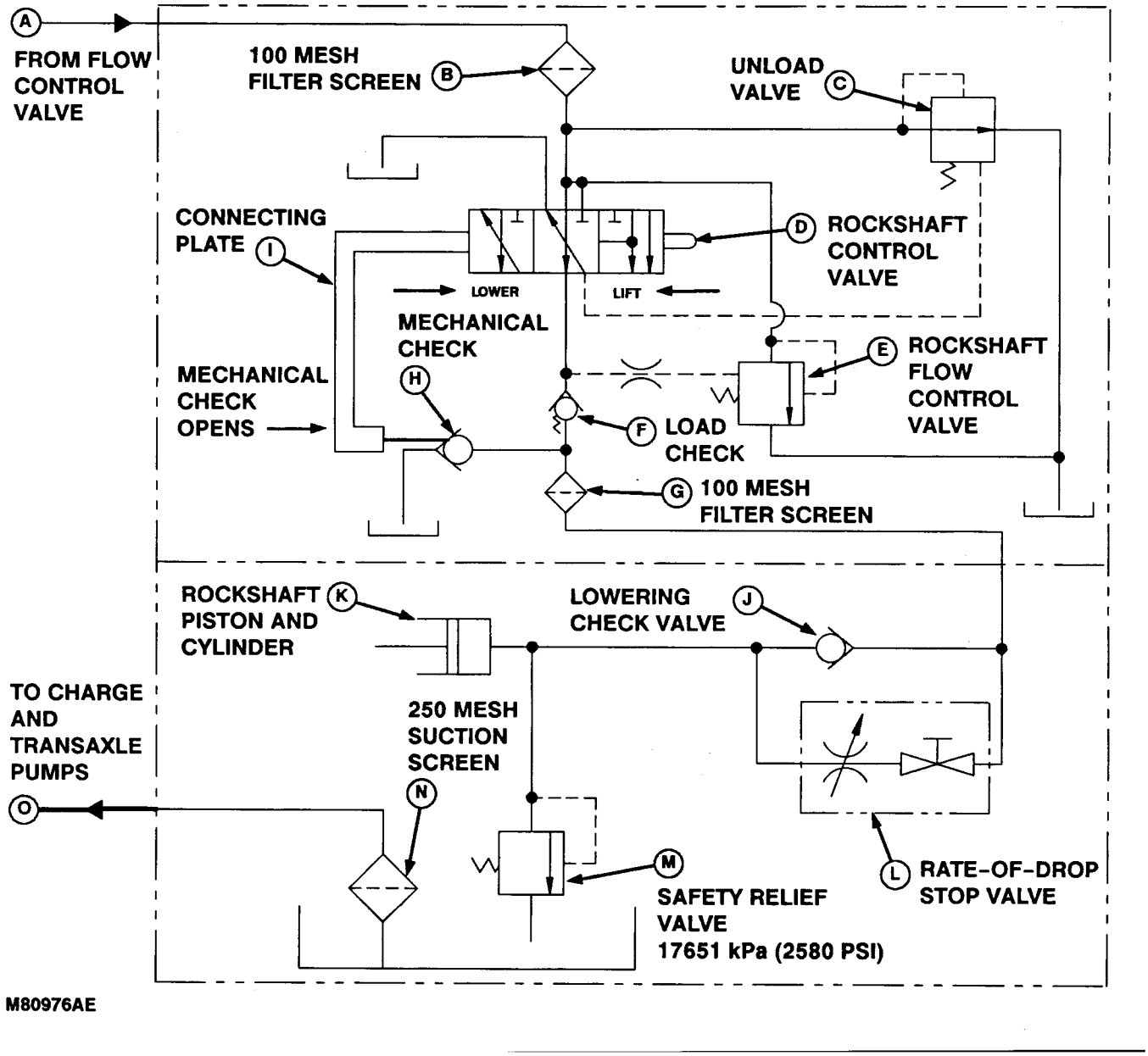
45		COOLER
46		FILTER, STRAINER
47		HEATER
48		TEMPERATURE CONTROLLER
49		PRESSURE SWITCH
50		PRESSURE INDICATOR
51		TEMPERATURE INDICATOR
52		PRESSURE COMPENSATED
53		VARIABLE COMPONENT (SYMBOL THRU COMPONENT)
54		PLUG, TEST PORT, PRESSURE SUPPLY TEST
55		GAS CHARGED ACCUMULATOR
56		SPRING LOADED ACCUMULATOR
57		ELECTRIC MOTOR
58		SHAFT ROTATION (ARROW ON NEAR SIDE OF SHAFT)
59		COMPONENT OUTLINE

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ROCKSHAFT CONTROL VALVE SCHEMATIC



A—From Flow Control Valve
B—100 Mesh Filter Screen
C—Unload Valve
D—Rockshaft Control Valve
E—Rockshaft Flow Control Valve
F—Load Check
G—100 Mesh Filter Screen
H—Mechanical Check
I—Connecting Plate
J—Lowering Check
K—Rockshaft Piston and Cylinder
L—Rate-of-Drop/Stop Valve
M—Safety Relief Valve
N—250 Mesh Suction Screen
O—To Charge and Transaxle Pumps

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270
20
3

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MX,27020HV,A6 -19-18JAN93

WEIGHT TRANSFER SCHEMATIC

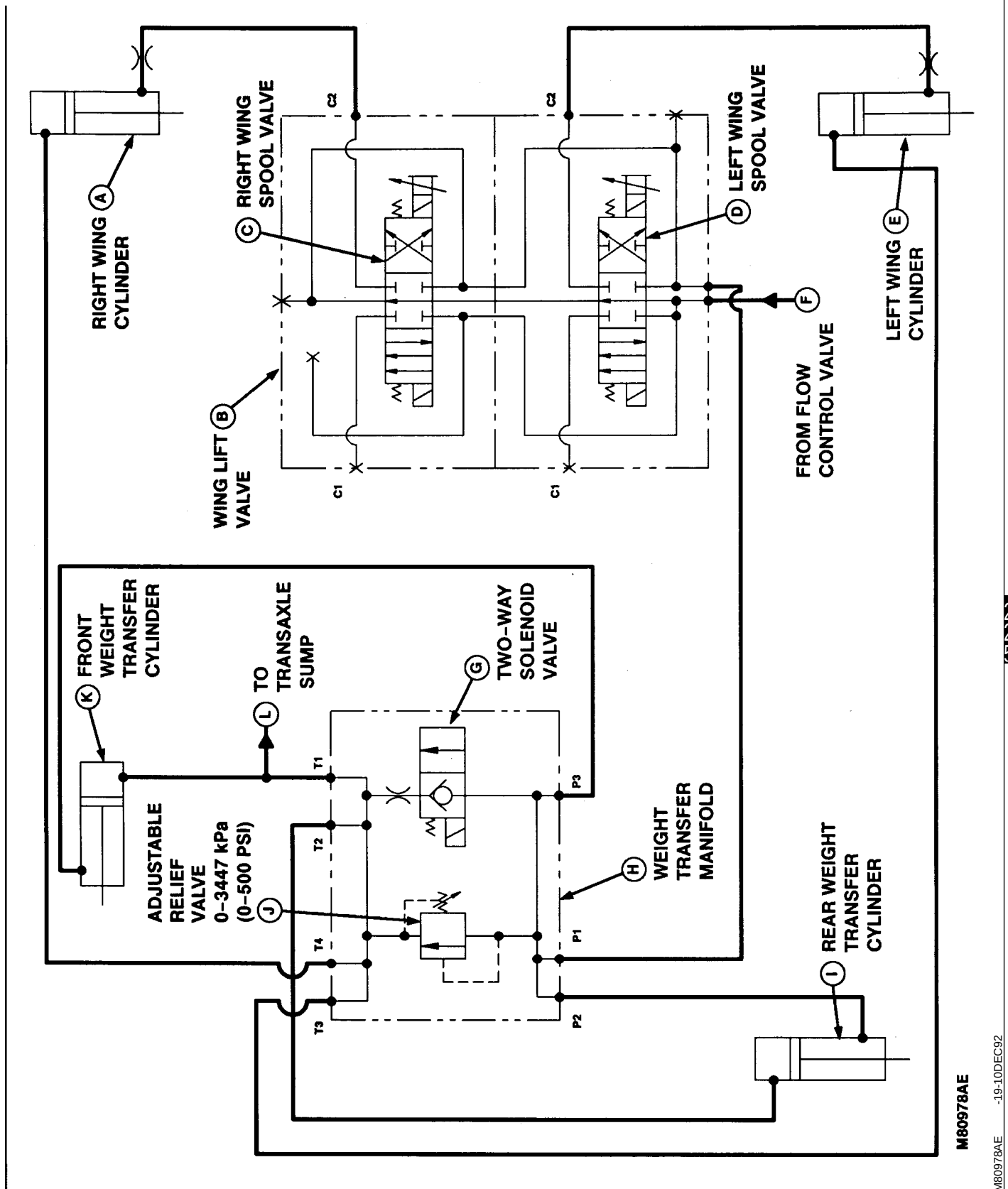
A—Right Wing Cylinder
B—Wing Lift Valve
C—Right Wing Spool Valve
D—Left Wing Spool Valve
E—Left Wing Cylinder
F—From Flow Control Valve
G—Two-Way Solenoid Valve
H—Weight Transfer Manifold
I—Rear Weight Transfer Manifold
J—Adjustable Relief Valve
K—Front Weight Transfer Cylinder
L—To Transaxle Sump

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NOTE: On machines without weight transfer function, ports P2, P3 and T2 are plugged.

Solenoid valve (G) and relief valve (J) are removed and openings are plugged but the internal passages are still connected between P and T ports.

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HYDRAULIC LIFT SCHEMATIC

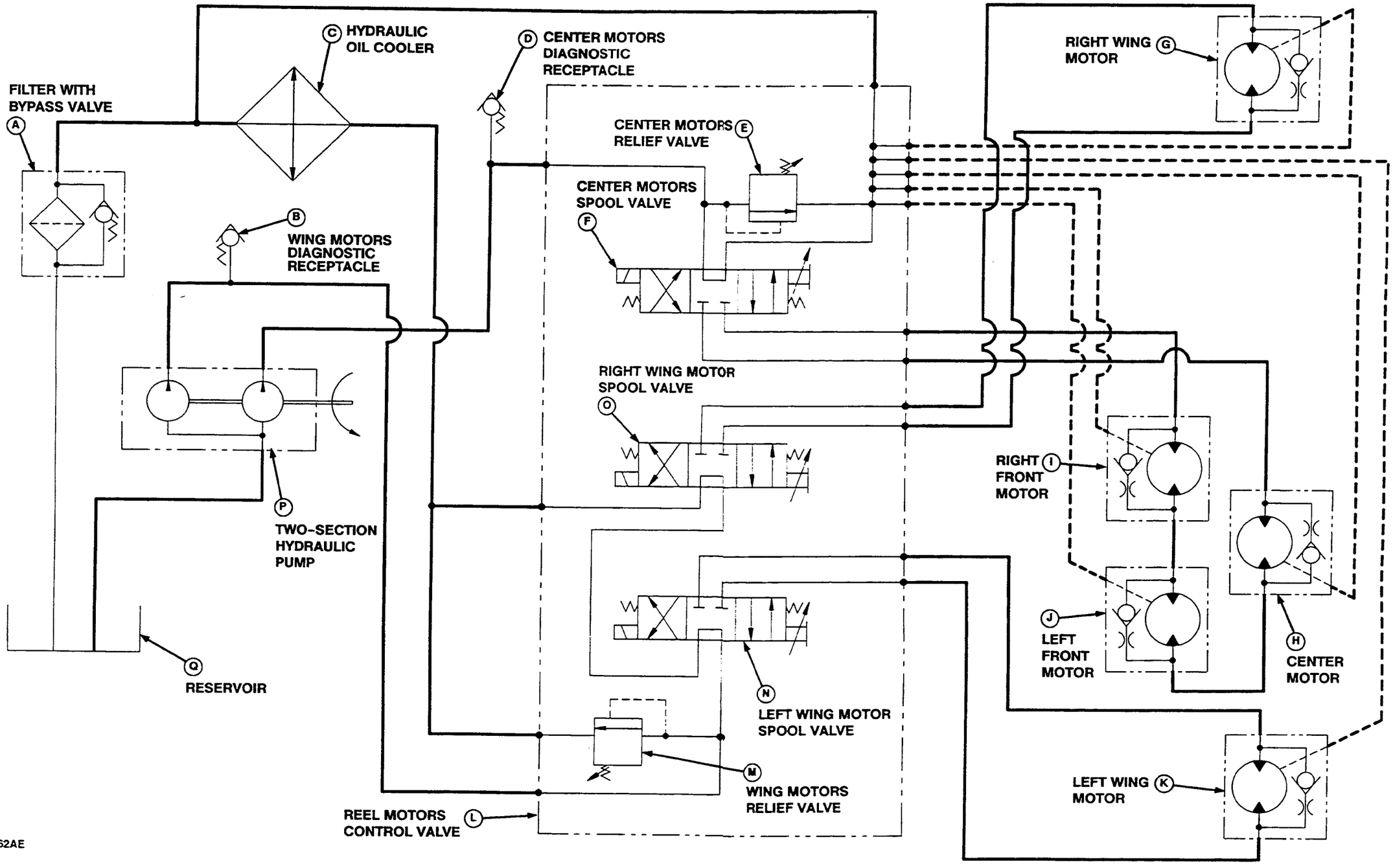
Refer to Section 250, Group 20 for complete machine hydrostatic/hydraulic schematic.

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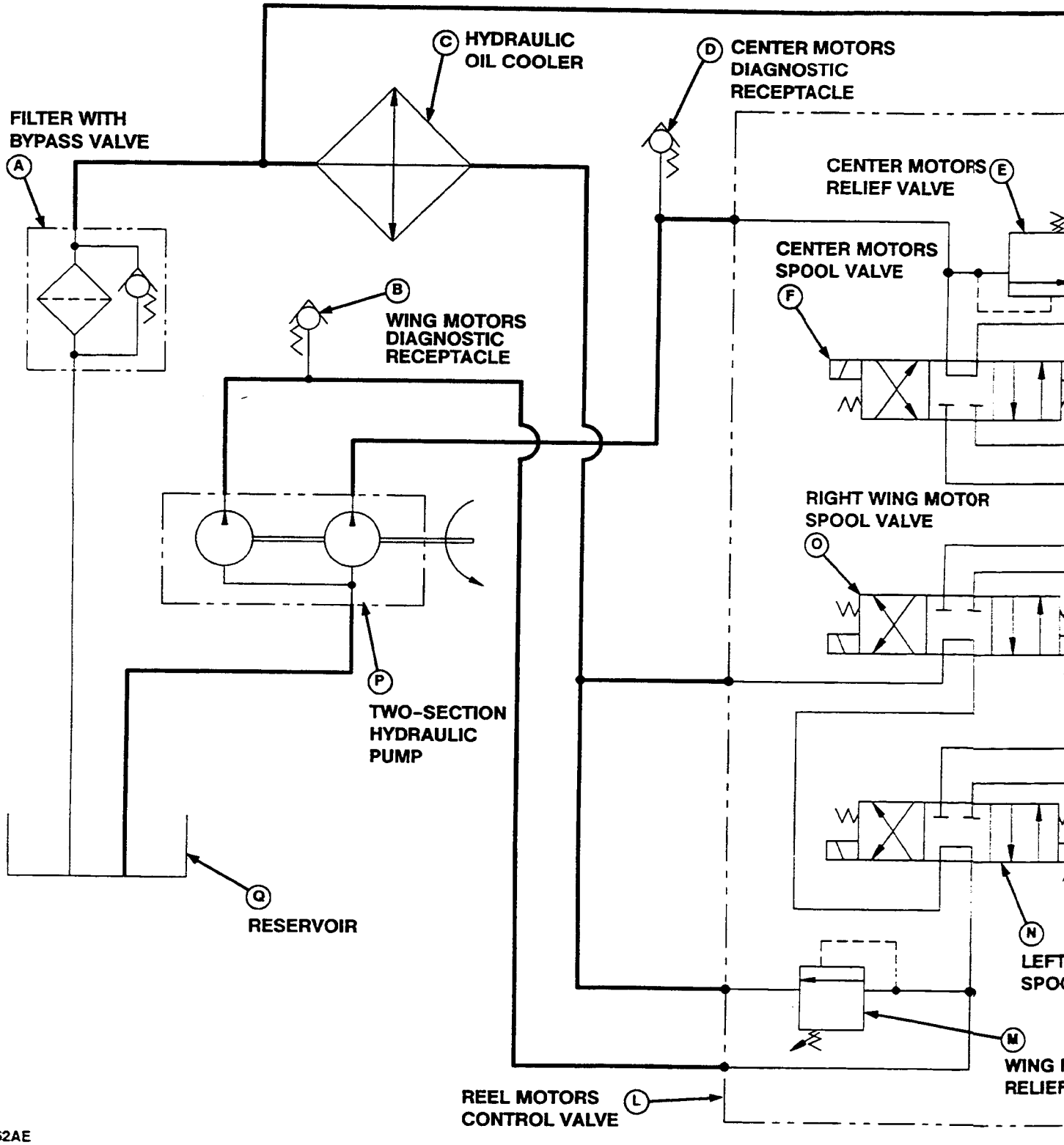
CUTTING UNITS HYDRAULIC SCHEMATICS

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B—Wing Motors Diagnostic Receptacle
C—Hydraulic Oil Cooler
D—Center Motors Diagnostic Receptacle
E—Center Motors Relief Valve
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L—Reel Motors Control Valve
M—Wing Motors Relief Valve
N—Left Wing Spool Valve
O—Right Wing Motor Spool Valve
P—Two-Section Hydraulic Pump
Q—Reservoir

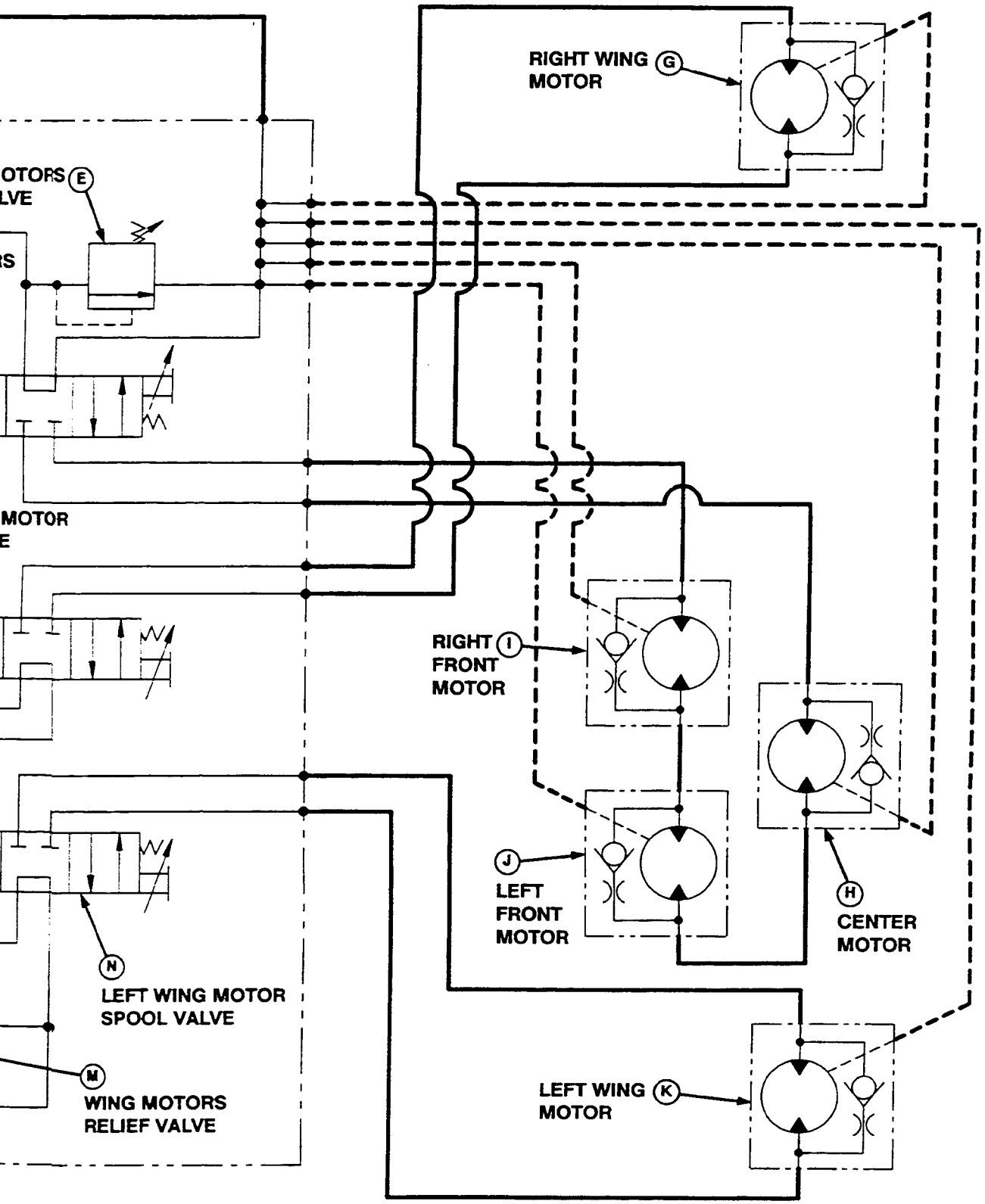
MX,27020HV,A1 -19-18JAN93



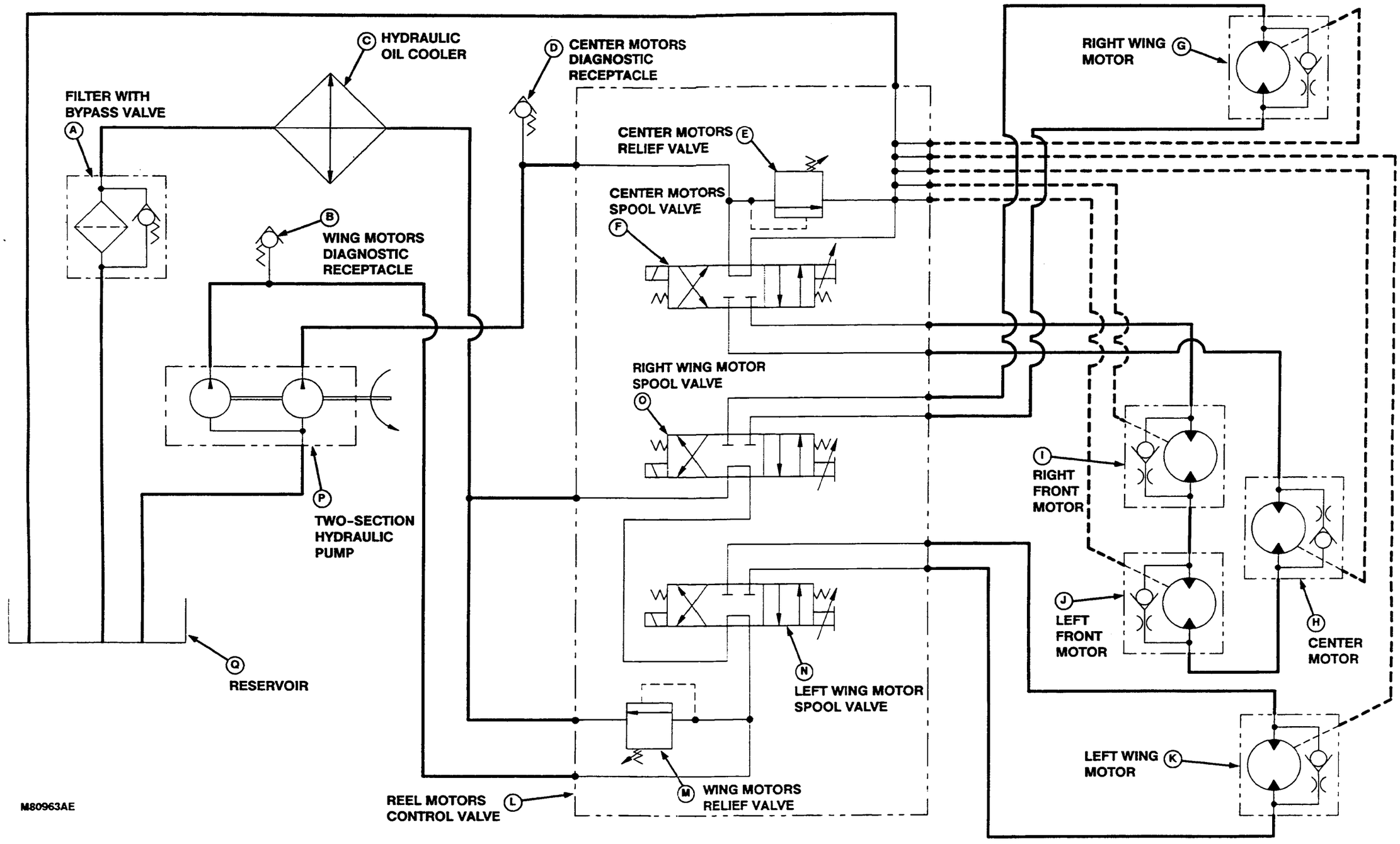
CUTTING UNITS HYDRAULIC SCHEMATIC (SERIAL NO. -840000)



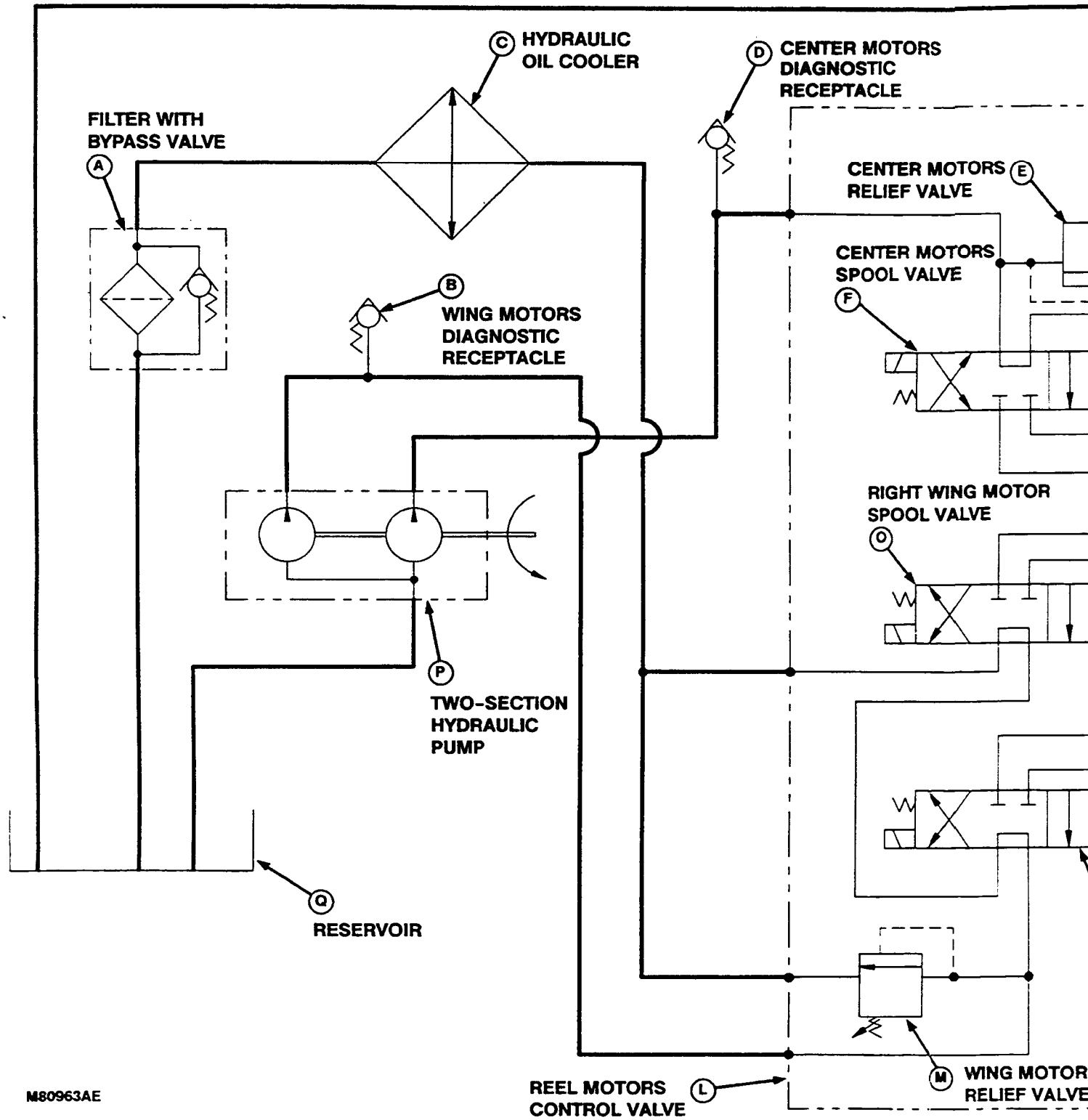
CUTTING UNITS HYDRAULIC SCHEMATIC (SERIAL



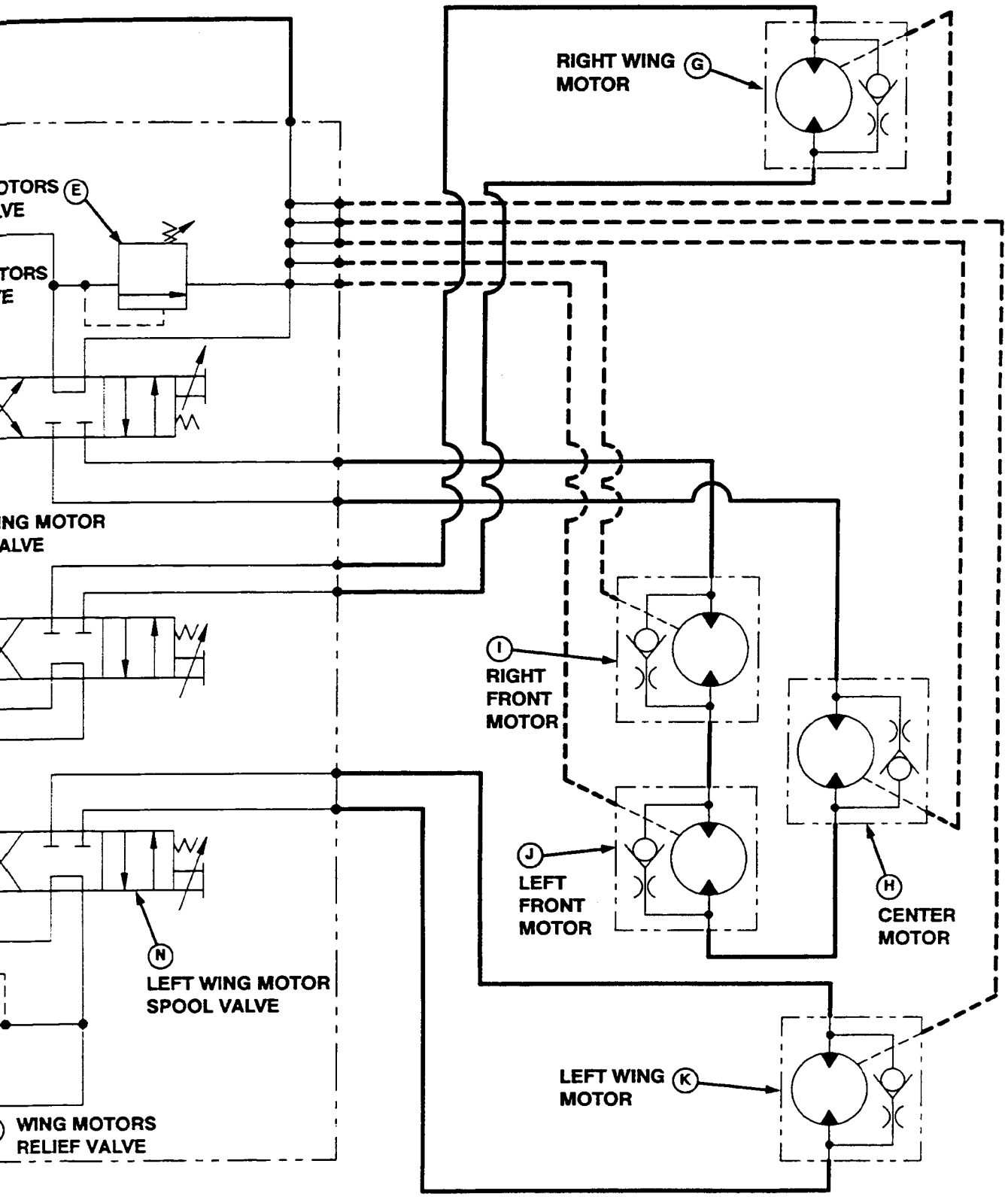
TIC (SERIAL NO. -840000)



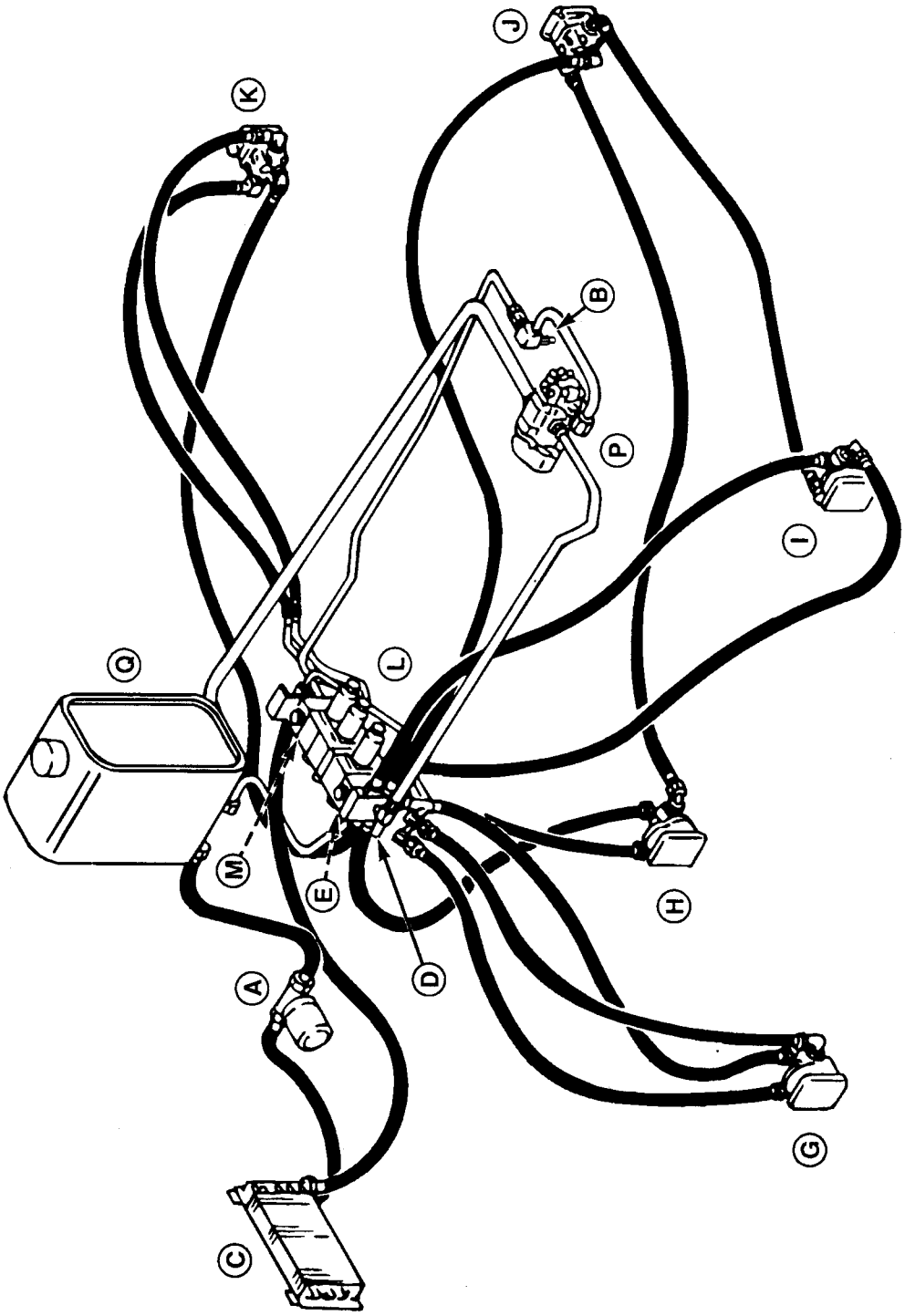
CUTTING UNITS HYDRAULIC SCHEMATIC (SERIAL NO. 840001-)



CUTTING UNITS HYDRAULIC SCHE



ULIC SCHEMATIC (SERIAL NO. 840001-)



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3365 Professional Turf Mower Rear Wheel Assist

Supplement to TM1427 (Issue 30MAR93)

TECHNICAL MANUAL

John Deere
Lawn & Grounds Care Division

TM1427S (28FEB94)

Litho in U.S.A

Introduction

FORWARD

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

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



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

This supplement is divided in two parts: repair and operation and tests. Repair section tells how to repair the components. Operation and tests section helps you identify the majority of routine failures quickly.

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

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

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

Introduction

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Group 05—RWA Electrical Components
Group 10—RWA Axle Assembly

SECTION 281 - 3365 REAR WHEEL ASSIST (RWA) OPERATION, TESTS AND ADJUSTMENTS

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

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Section 81
3365 REAR WHEEL ASSIST (RWA) REPAIR

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SPECIFICATIONS

Item	Measurement	Specification
Solenoid Coil-to-Control Valve Nut	Torque	18 N•m (159 lb-in.)

MX, 8105HV, SPEC -19-20Oct94

REPLACE SOLENOID COIL

1. Disconnect wiring connector (A).
2. Remove nut (B) and solenoid coil (C).
3. Install new solenoid coil and nut. Tighten nut to 18 N•m (159 lb-in.).
4. Connect wiring connector.

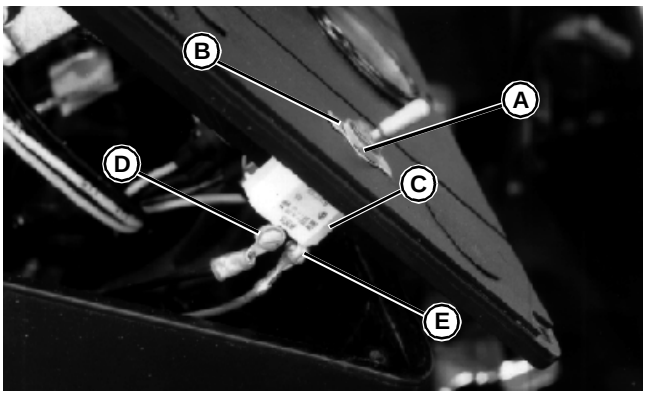


M81580 -UN-20Oct94

REPLACE TOGGLE SWITCH

1. Remove display console panel. (See procedure in TM1427 Section 40, Group 10.)
2. Remove nut (A) and plate (B). Push switch (C) down through panel.
3. Disconnect wiring leads (D and E).
4. Connect wiring leads to new switch.
5. Install switch, plate and nut.
6. Install display console panel.

A—Nut
B—Plate
C—Toggle Switch
D—Wire Lead from Fuse
E—Wire Lead from Harness

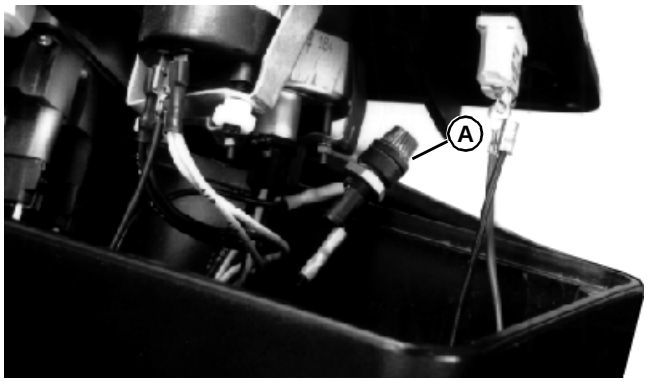


M81582 -UN-20Oct94

MX, 8105HV, A2 -19-20Oct94

REPLACE FUSE

1. Remove display console panel. (See procedure in TM1427 Section 40, Group 10.)
2. Replace fuse (A).
3. Install display console panel.



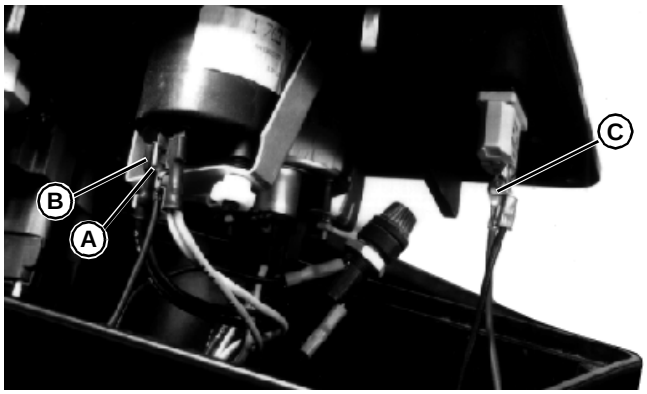
M81583 -UN-20Oct94

MX, 8105HV, A3 -19-20Oct94

REPLACE WIRING HARNESS

1. Remove display console panel. (See procedure in TM1427 Section 40, Group 10.)
2. Disconnect battery negative (-) cable.
3. Cut all tie straps.
4. Disconnect wiring lead (C).
5. Disconnect wiring connectors (A, B and D).
6. Remove and replace wiring harness.
7. Install new wiring harness.
8. Connect wiring connectors and lead.
9. Install new tie straps as necessary.
10. Connect negative (-) battery cable.
11. Install display console panel.

A—Hourmeter Ground Lead Wiring Connector
B—Harness Connector-to-Hourmeter
C—Harness Wiring Lead-to-Toggle Switch
D—Harness Connector-to-Control Valve Solenoid Coil



M81584 -UN-20Oct94



M81580 -UN-20Oct94

MX, 8105HV, A4 -19-20Oct94

SERVICE PARTS KITS

The following kits are available through your parts catalog:

Drive Motor Seal Kit

MX, 8110HV, KIT -19-20Oct94

SPECIFICATIONS

Item	Measurement	Specification
Control Valve Solenoid Coil Nut	Torque	18 N•m (159 lb-in.)
Rear Axle		
Pivot Pin Nut	Torque	509 N•m (375 lb-ft)
Steering Cylinder Slotted Nut	Torque	75 N•m (55 lb-ft)
Front of Axle-to-Frame	End Play (Approx.)	1 mm (0.040 in.)
Tie Rod End Slotted Nut	Torque	53 N•m (39 lb-ft)
Drive Motor		
Mounting Cap Screws	Torque	70 N•m (52 lb-ft)
Valve Housing-to-Bearing Housing Cap Screw	Torque	50 N•m (37 lb-ft)
Hub-to-Shaft Slotted Nut	Torque (Dry) Torque (Lube)	340 N•m (250 lb-ft) 270 N•m (200 lb-ft)

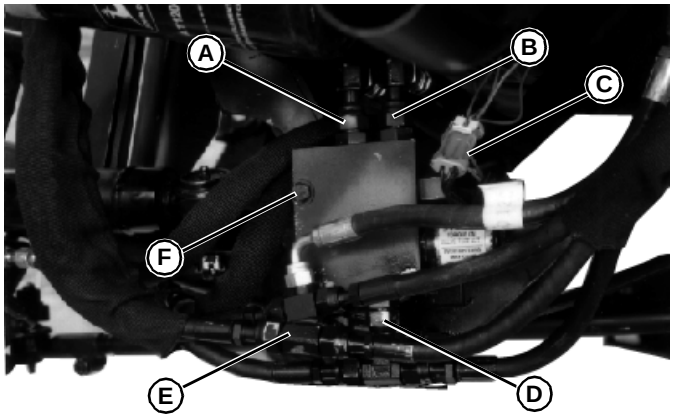
MX, 8110HV, SPEC -19-20Oct94

REMOVE AND INSTALL CONTROL VALVE

1. Tag all hydraulic hoses to aid in installation.
2. Disconnect hydraulic hoses (A and B) and hose tees (D and E). Close all openings with caps and plugs.
3. Disconnect wiring connector (C).
4. Put an alignment mark across control valve and bracket to aid in installation.
5. Remove two cap screws and nuts (F) and control valve.
6. Make repairs as necessary. (See procedure in this group.)
7. Align marks made during removal and install control valve, cap screws and nuts.
8. Connect wiring connector.

IMPORTANT: Always use new O-rings. Damaged or used O-rings will leak.

9. Install new O-rings and connect hydraulic hoses and tees.



M81585 -UN-20Oct94

A—Hose, Hydrostatic Transmission LH Port (Reverse)-to-Control Valve Port A

B—Hose, Hydrostatic Transmission RH Port (Forward)-to-Control Valve Port B

C—Wiring Connector

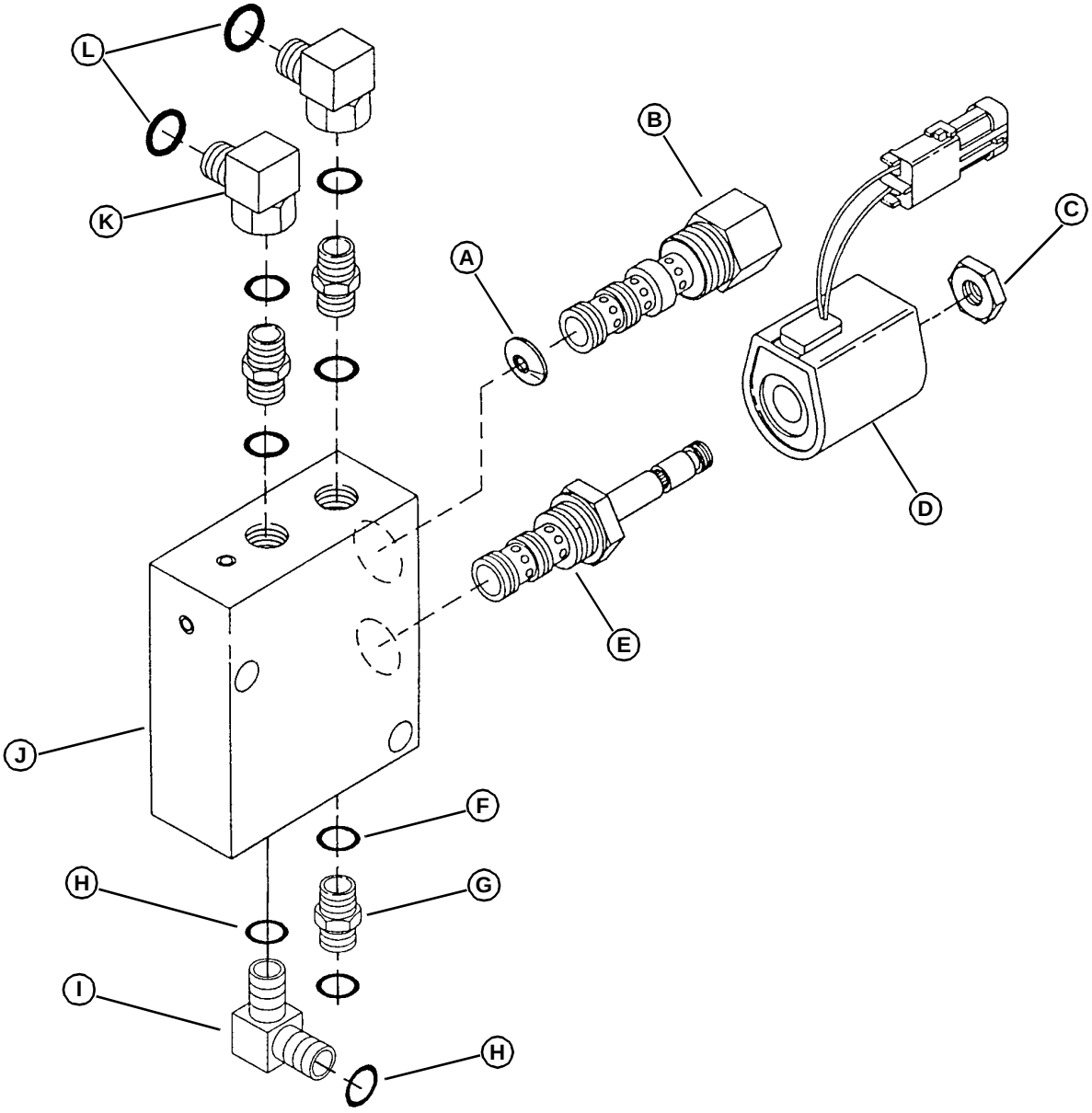
D—Hose Tee, Control Valve Port D-to-Front Port of Drive Motors

E—Hose Tee, Control Valve Port C-to-Rear Port of Drive Motors

F—Cap Screw and Nut (2 used)

MX, 8110HV, A1 -19-20Oct94

DISASSEMBLE, INSPECT AND ASSEMBLE CONTROL VALVE



M81586A -UN-20Oct94

A—Orifice
B—Spool Valve
C—Nut
D—Solenoid Coil
E—Solenoid Valve
F—O-Ring (6 used)
G—Adapter (3 used)
H—O-Ring (2 used)
I—90° Elbow
J—Control Valve
K—90° Elbow (2 used)
L—O-Rings

IMPORTANT: Always use new O-rings. Damaged or used O-rings will leak.

1. Remove parts (A—L).

2. Inspect all parts for wear or damage. Replace as necessary.

3. Apply clean hydraulic oil on all internal parts.

NOTE: Install orifice (A) with flat side toward spool valve (B).

4. Install parts (A—L). Tighten nut (C) to 18 N•m (159 lb-in.)

MX, 8110HV, A2 -19-20Oct94

REMOVE REAR AXLE

1. Tag hydraulic hoses to aid in installation.

2. Disconnect hydraulic hoses (A, B and D). Close all openings using caps and plugs.

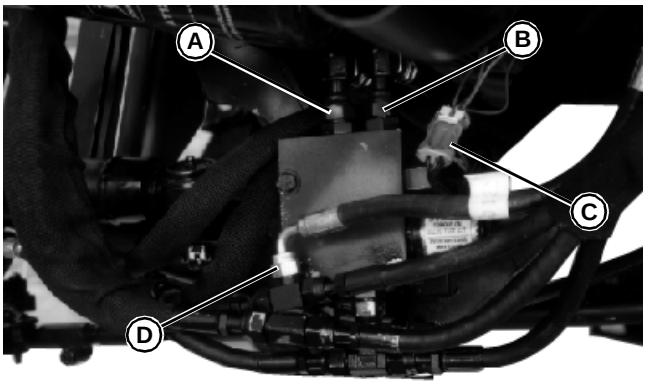
3. Disconnect wiring connector (C).

A—Hose, Hydrostatic Transmission LH Port (Reverse)-to-Control Valve Port A

B—Hose, Hydrostatic Transmission RH Port (Forward)-to-Control Valve Port B

C—Wiring Connector

D—Hose, Oil Cooler Hose Tee-to-Control Valve Tee



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MX, 8110HV, A3 -19-20Oct94

4. Raise rear of machine and support frame behind the axle.

5. Remove rear wheels.

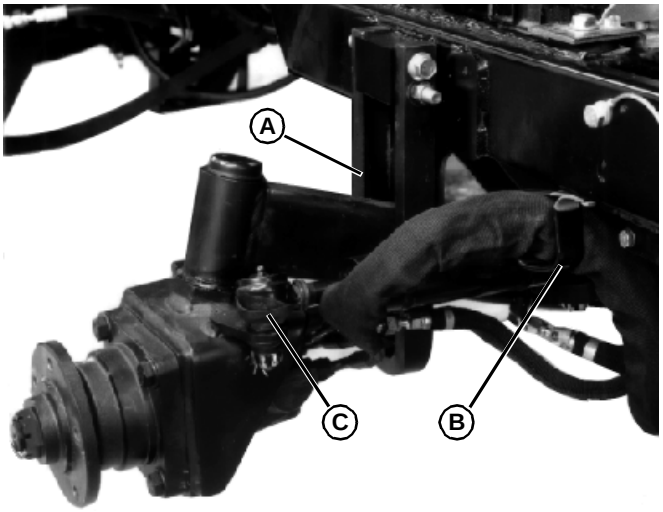
6. Support axle assembly with a floor jack.

7. Remove bracket support (A).

8. Remove hose clamp (B) from both sides of frame.

NOTE: Ends of steering cylinder are a tapered bore fit. Use a balljoint fork or puller to ease removal.

9. Remove cotter pin and slotted nut from each end of steering cylinder (C). Remove steering cylinder from axle.



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MX, 8110HV, A4 -19-20Oct94

10. Remove nut (E), pivot pin (A), washers (B) and shims (C).

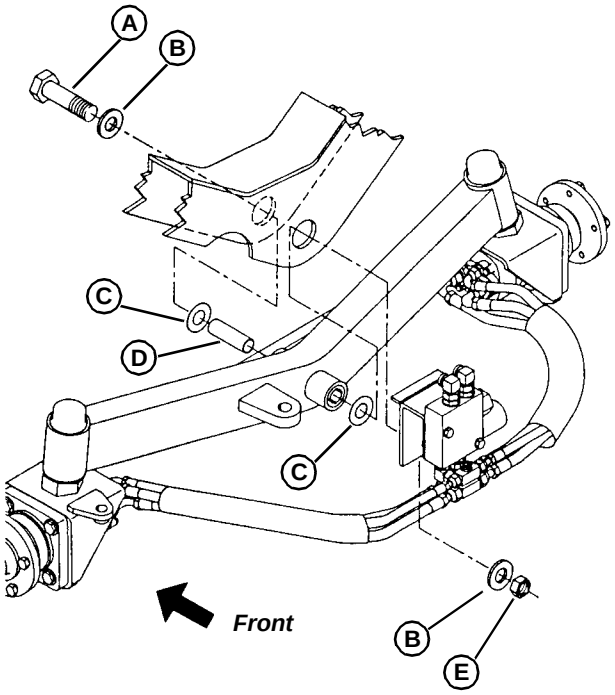
11. Lower axle assembly out of frame.

12. Remove bushing (D).

13. Inspect pivot pin and bushings for wear or damage. (See procedure in this group.)

14. If replacing axle, remove drive motors and spindle assemblies. (See procedures in this group.)

A—Pivot Pin
B—Washers
C—Shims (as required)
D—Bushing
E—Nut



M82468A -UN-20Oct94

MX, 8110HV, A5 -19-20Oct94

INSTALL REAR AXLE

1. Install drive motors and spindle assemblies, if removed. (See procedures in this group.)

2. Install bushing (D).

NOTE: Install shims between axle and machine frame.

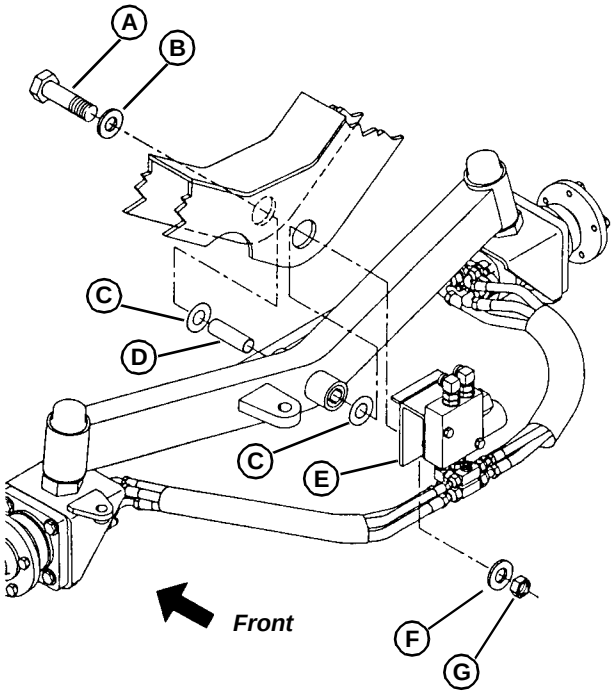
3. Raise axle assembly into frame. Install shims (C), washer (B) and pivot pin (A).

4. Install valve mounting bracket (E) over pivot pin in frame. Install washer (F) and nut (G). Tighten nut to 509 N•m (375 lb-ft).

5. Remove floor jack.

6. Check and adjust end play. (See procedure in this group.)

A—Pivot Pin
B—Washer
C—Shims (as required)
D—Bushing
E—Control Valve Mounting Bracket
F—Washer
G—Nut



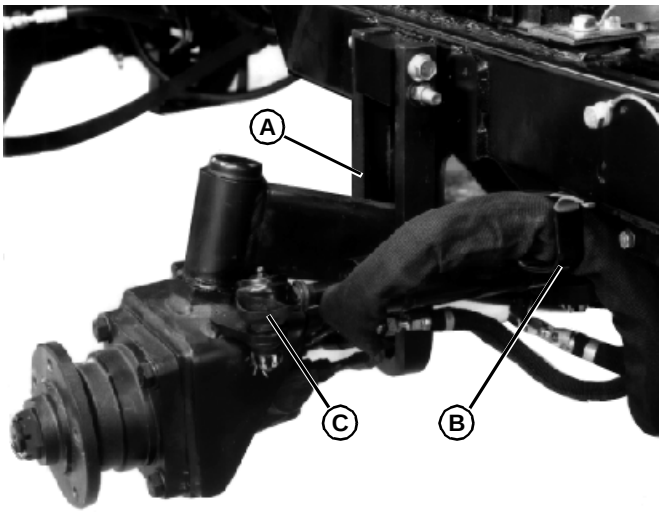
M82468A -UN-20Oct94

MX, 8110HV, A6 -19-20Oct94

7. Install steering cylinder (C). Install slotted nuts and tighten to 75 N•m (55 lb-ft). Install cotter pins.

8. Install hose clamp (B) on both sides of frame.

9. Install bracket support (A) and tighten lock nuts.



M81588 -UN-20Oct94

MX, 8110HV, A7 -19-20Oct94

10. Connect wiring connector (C).

IMPORTANT: Always use new O-rings. Damaged or used O-rings will leak.

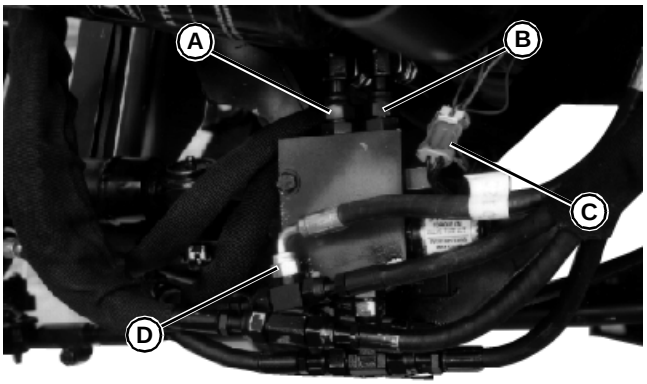
11. Install new O-rings and connect hydraulic hoses (A, B and D).

NOTE: Rear wheel drive must be run in forward direction for a few minutes to purge air from the system before wheel hubs turn.

12. Start machine and move RWA toggle switch to “ON” position. Press and hold forward speed control pedal down for a few minutes to purge air from the system. After wheel hubs have been turning in the forward direction for a few minutes, release the pedal, move toggle switch to “OFF” position and turn machine off.

13. Install rear wheels and lower machine.

14. Check traction unit hydrostatic transaxle oil level. Add oil as necessary.



M81585 -UN-20Oct94

A—Hose, Hydrostatic Transmission LH Port (Reverse)-to-Control Valve Port A

B—Hose, Hydrostatic Transmission RH Port (Forward)-to-Control Valve Port B

C—Wiring Connector

D—Hose, Oil Cooler Hose Tee-to-Control Valve Tee

MX, 8110HV, A8 -19-20Oct94

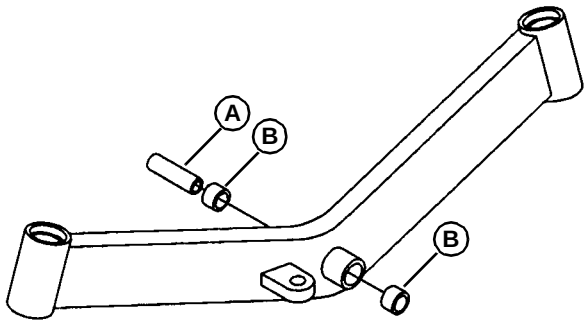
INSPECT AND REPLACE PIVOT PIN AND BUSHING

1. Inspect pivot pin and washers for wear or damage. Replace as necessary.

2. Remove inner bushing sleeve (A).

3. Inspect bushings (B) for wear or damage. Replace if necessary.

Replace bushings using a driver set. Install new bushings flush with axle surface.



M81593AE -UN-20Oct94

MX, 8110HV, A9 -19-20Oct94

CHECK AND ADJUST REAR AXLE END PLAY

1. Raise rear of machine and push axle assembly fully towards the rear.

2. Measure the clearance between front side of rear axle and machine frame. Clearance must be approximately 1 mm (0.040 in.).

3. If clearance is not according to specification, remove rear axle. (See procedure in this group.)

4. Add or remove shims as necessary. Add shims to reduce end play and remove shims to increase end play.

5. Install rear axle assembly.

6. Lubricate grease fitting at pivot pin with multipurpose grease.

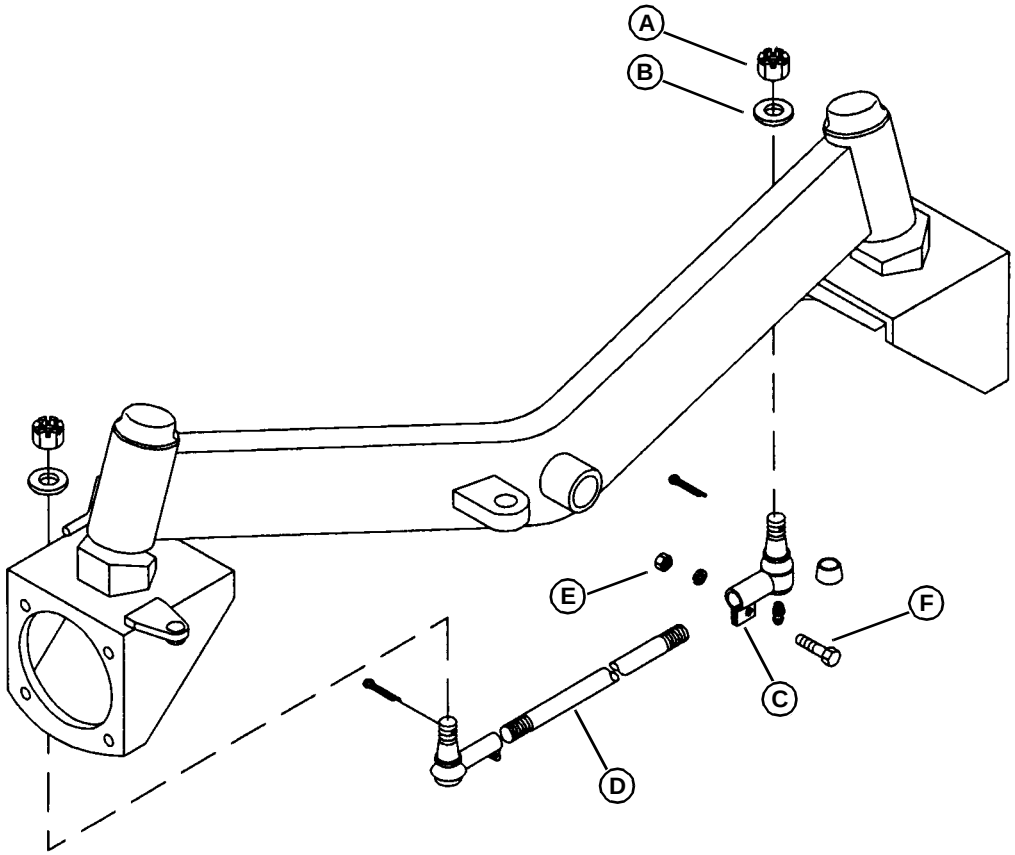


M82469 -UN-20Oct94

MX, 8110HV, A10 -19-20Oct94

81
10

REMOVE, INSPECT AND INSTALL TIE ROD ASSEMBLY



M81594AE -UN-20Oct94

A—Slotted Nut (2 used)
B—Washer (2 used)
C—Tie Rod End (2 used)
D—Tie Rod
E—Nut (2 used)
F—Cap Screw (2 used)

NOTE: Tie rod end is a tapered bore fit. Use a ball joint fork or puller to ease removal.

1. Remove cotter pins, nuts (A) and washers (B). Remove tie rod ends from spindle assemblies.

2. Loosen nuts (E) to remove tie rod ends (C).

3. Inspect all parts for wear or damage.

NOTE: Left tie rod end has left-hand threads.

4. Install parts (A—F).

5. Adjust length of tie rod assembly by turning tie rod end (C) so wheel is approximately straight forward when steering cylinder is centered and tie rod end fits into arm of spindle. Tighten nuts (E).

6. Install slotted nuts (A) and tighten to 53 N•m (39 lb-ft). Install cotter pins.

7. Adjust steering toe-in. (See procedure in Section 281, Group 15.)

MX, 8110HV, A11 -19-20Oct94

REMOVE AND INSTALL SPINDLE ASSEMBLY

1. Raise rear of machine and remove rear wheel.

2. Tag hydraulic hoses to aid in installation.

3. Disconnect hydraulic hoses (C—E). Close all openings using caps and plugs.

NOTE: Tie rod and steering cylinder ends are a tapered bore fit. Use a ball joint fork or puller to ease removal.

4. Remove cotter pin and slotted nut from tie rod end (B) and steering cylinder end (F). Remove ends from spindle assembly.

5. Remove dust cap (G).

6. Remove snap ring (H) and lower spindle assembly from axle.

7. Remove thrust washer (I) and washer (J).

8. Inspect spindle shaft for wear or damage. Replace if necessary.

9. Inspect spindle shaft bushings for wear or damage. (See procedure in this group.)

10. If replacing spindle, remove drive motors. (See procedure in this group.)

11. Install washers.

12. Apply multipurpose grease on spindle shaft.

13. Install spindle assembly, snap ring and dust cover.

14. Install steering cylinder and tie rod ends. Tighten slotted nuts to specification. Install cotter pins.

15. Connect hydraulic hoses.

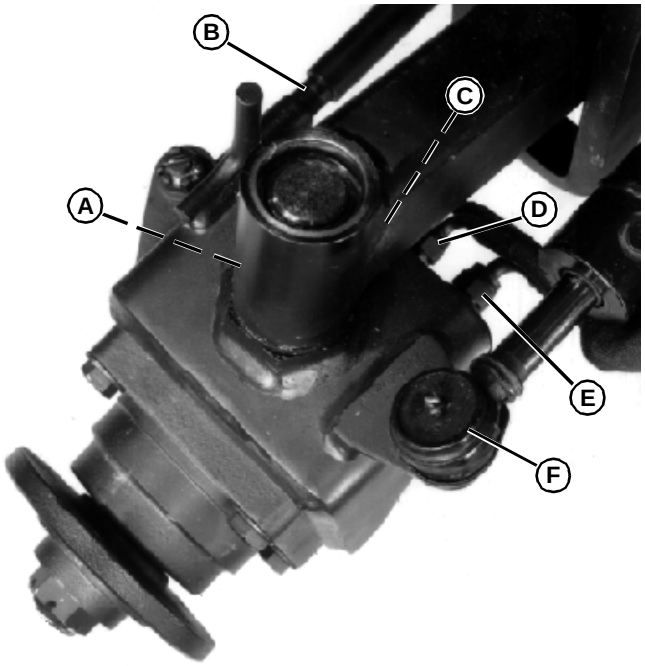
16. Lubricate grease fitting (A) with multipurpose grease.

17. Install rear wheel and lower machine.

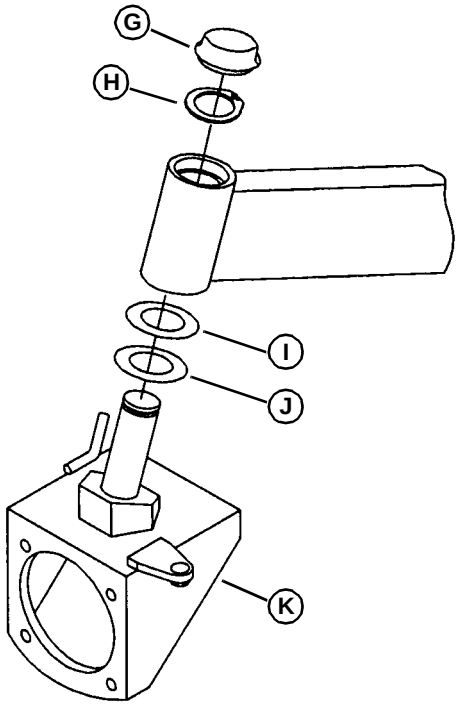
TORQUE SPECIFICATIONS

Slotted Nut	
Steering Cylinder	75 N•m (55 lb-ft)
Tie Rod End	53 N•m (39 lb-ft)

A—Grease Fitting
B—Tie Rod End
C—Hose, Front Port-to-Hose Tee from Control Valve Port D
D—Hose, Middle Port-to-Hose Tee from Oil Cooler
E—Hose, Rear Port-to-Hose Tee from Control Valve Port C
F—Steering Cylinder End
G—Dust Cap
H—Snap Ring
I—Thrust Washer
J—Washer
K—Spindle Assembly



M81587 -UN-20Oct94



M81591AE -UN-20Oct94

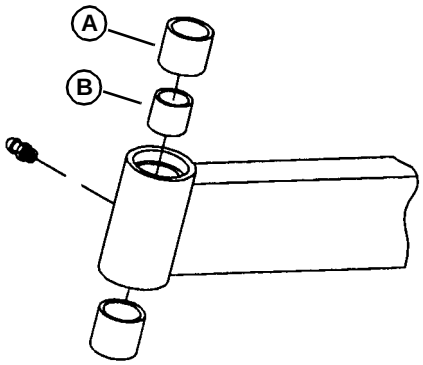
MX, 8110HV, A12 -19-20Oct94

INSPECT AND REPLACE SPINDLE SHAFT BUSHINGS

1. Inspect spindle shaft and bushings (A) for scoring or damage. Replace if necessary.

Replace bushings and spacer (B) using a driver set.

2. Apply multipurpose grease to all parts.



M81590AE -UN-20Oct94

MX, 8110HV, A13 -19-20Oct94

REMOVE AND INSTALL DRIVE MOTOR

1. Raise rear of machine and remove rear wheel.

2. Tag hydraulic hoses to aid in installation.

3. Disconnect hydraulic hoses (A—C). Close all openings using caps and plugs.

4. Remove four mounting cap screws and drive motor (D).

5. Make repairs as necessary. (See procedure in this group.)

6. Apply thread lock and sealer (medium strength) on threads of mounting cap screws.

7. Install drive motor and cap screws. Tighten cap screws to 70 N•m (52 lb-ft).

8. Connect hydraulic hoses.

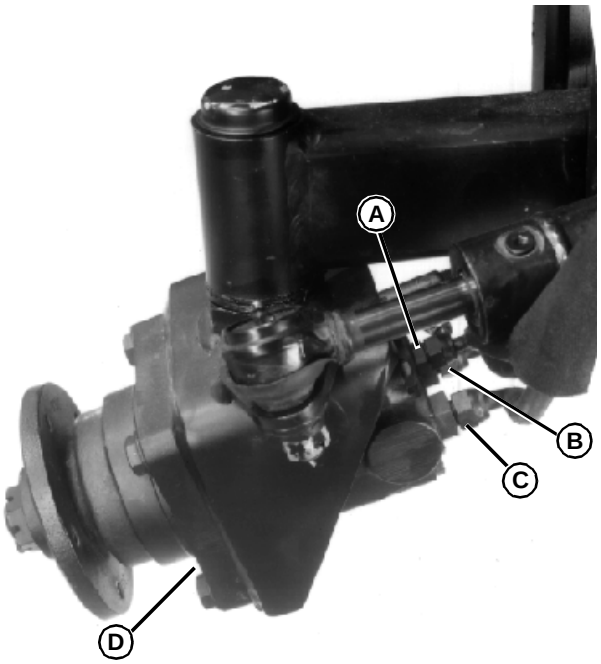
9. Install rear wheel and lower machine.

A—Hose, Middle Port-to-Hose Tee from Oil Cooler

B—Hose, Front Port-to-Hose Tee from Control Valve Port D

C—Hose, Rear Port-to-Hose Tee from Control Valve Port C

D—Drive Motor



M81595 -UN-20Oct94

MX, 8110HV, A14 -19-20Oct94

DISASSEMBLE AND INSPECT DRIVE MOTOR

IMPORTANT: Perform all repair procedures with drive motor in a vise. Clamp across mounting flange only. Excessive clamping pressure on motor housing will cause distortion.

1. Put drive motor in a soft-jawed vise with slotted nut facing up.

2. Remove cotter pin and slotted nut (B).

NOTE: Hub bore and shaft are a taper press fit.

3. Remove hub (C) using a three-jaw puller.

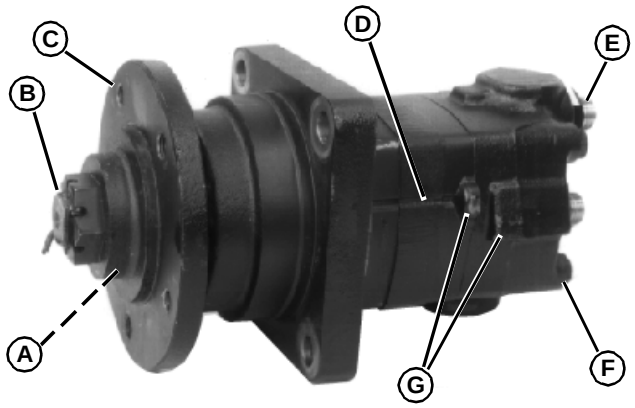
4. Remove key (A).

5. Remove motor from vise. Put back in vise with shaft end down.

6. Remove three fittings and O-rings (E).

NOTE: Note position of alignment grooves (D) and tabs (G) to aid in assembly. It may be helpful to label individual motor sections in the order they are removed.

7. Remove four cap screws (F).



M81599 -UN-20Oct94

A—Key
B—Slotted Nut
C—Hub
D—Alignment Grooves
E—Fitting and O-Ring (3 used)
F—Cap Screw (4 used)
G—Tabs

MX, 8110HV, A15 -19-20Oct94

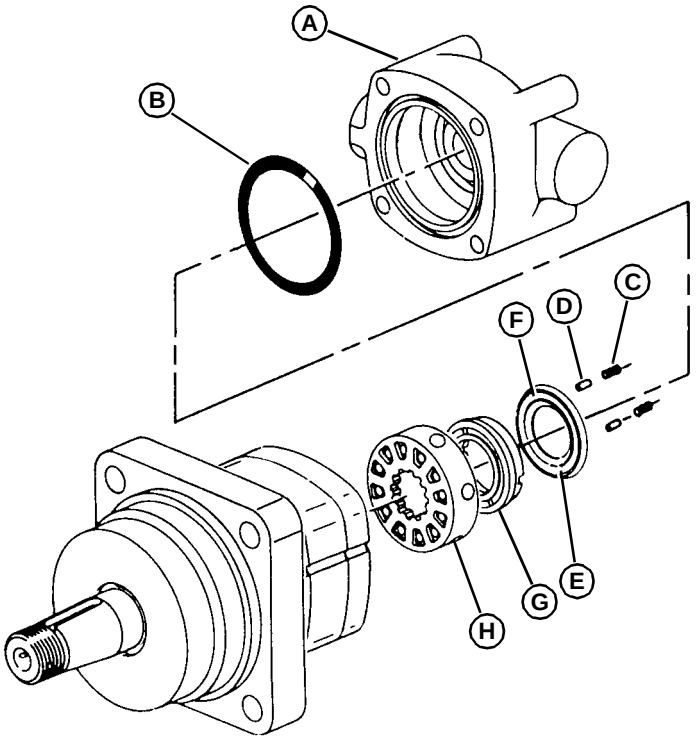
NOTE: By carefully lifting valve housing straight up; pins, springs, balance ring assembly and valve should remain on valve plate.

8. Remove valve housing (A). Lift valve housing straight up.

9. Remove springs (C), pins (D), balance ring assembly (G) and valve (H).

10. Remove seals (B, E, and F).

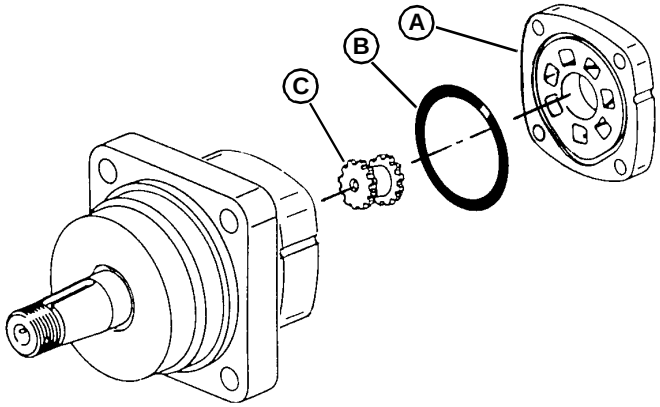
A—Valve Housing
B—Square Cut Seal
C—Spring (2 used)
D—Pin (2 used)
E—Outer Face Seal
F—Inner Face Seal
G—Balance Ring Assembly
H—Valve



M81600A -UN-20Oct94

MX, 8110HV, A16 -19-20Oct94

11. Remove valve plate (A), square cut seal (B) and valve drive (C).



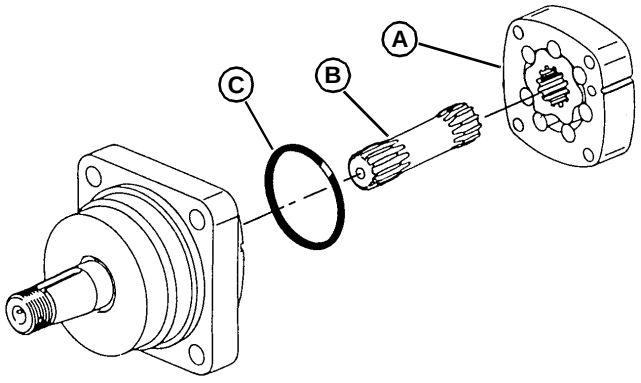
M81601A -UN-20Oct94

MX, 8110HV, A17 -19-20Oct94

IMPORTANT: Rolls and star are loose in Geroler assembly. Parts will separate and fall out if care is not taken during removal.

12. Remove Geroler assembly (A), making sure rolls and star are kept intact.

13. Remove drive shaft (B) and square cut seal (C).

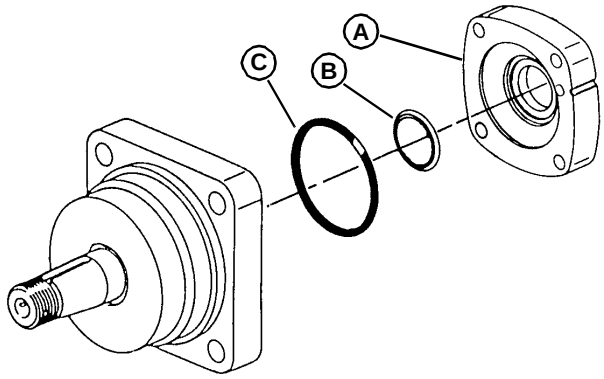


M81602A -UN-20Oct94

MX, 8110HV, A18 -19-20Oct94

14. Remove wear plate (A) and square cut seal (C).

15. Remove shaft face seal (B).



M81603A -UN-20Oct94

MX, 8110HV, A19 -19-20Oct94

NOTE: Shaft and bearing assembly are press fit in housing.

16. Press shaft and bearing assembly (A) from bearing housing (D).

17. Remove shaft seal (B), backup washer (C) and exclusion seal (E) using a screwdriver.

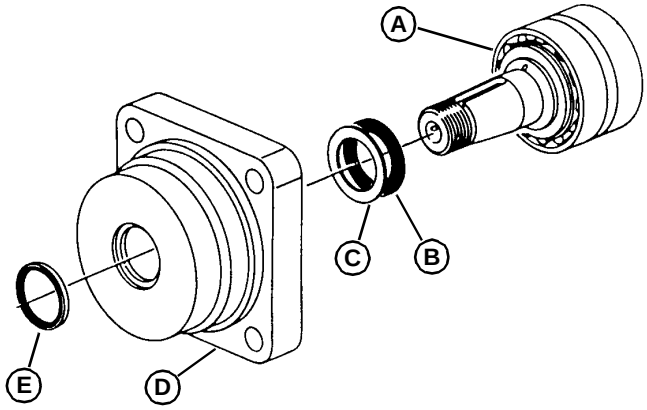
NOTE: Shaft and bearing assembly parts are not serviced separately. Replace as a unit.

IMPORTANT: Absolute cleanliness is essential when working on drive motor. Contamination can result in serious damage or inadequate operation.

DO NOT use shop towels or rags to dry cleaned parts. Lint will clog passages in the hydraulic system and cause damage.

18. Clean all metal parts with solvent and blow-dry with compressed air.

19. Inspect all parts for damage, nicks, or unusual wear patterns. Replace as necessary.



M81604A -UN-20Oct94

A—Shaft and Bearing Assembly
B—Shaft Seal
C—Backup Washer
D—Bearing Housing
E—Exclusion Seal

MX, 8110HV, A20 -19-20Oct94

ASSEMBLE DRIVE MOTOR

IMPORTANT: Always use new seals and O-rings. Damaged or used parts will leak.

NOTE: Lubricate all seals and O-rings with petroleum jelly during assembly.

Apply clean hydraulic oil on all internal parts during assembly.

1. Install new exclusion seal (A) using a seal driver set. Install seal with lips away from bearing housing (B).

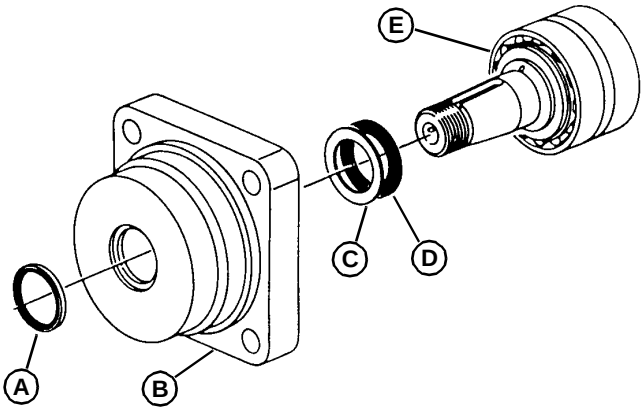
2. Install backup washer (C).

3. Install shaft seal (D) using a seal driver set. Install seal with lips away from backup washer.

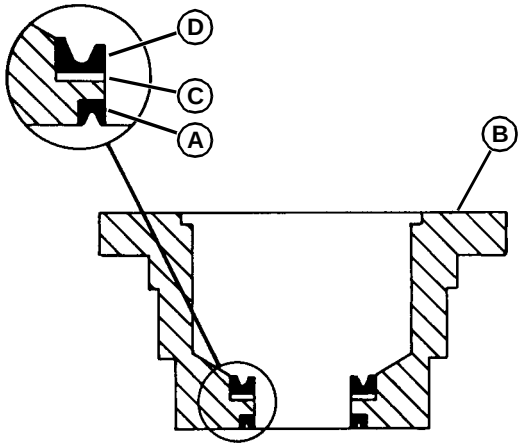
IMPORTANT: Put tape around end of shaft to prevent cutting seals. Damaged seals will leak.

4. Press shaft and bearing assembly (E) into bearing housing (B).

A—Exclusion Seal
B—Bearing Housing
C—Backup Washer
D—Shaft Seal
E—Shaft and Bearing Assembly



M81604A -UN-20Oct94



M81605A -UN-20Oct94

MX, 8110HV, A21 -19-20Oct94

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IMPORTANT: Perform all repair procedures with drive motor assembly in a vise. Clamp across mounting flange only. Excessive clamping pressure on motor housing will cause distortion.

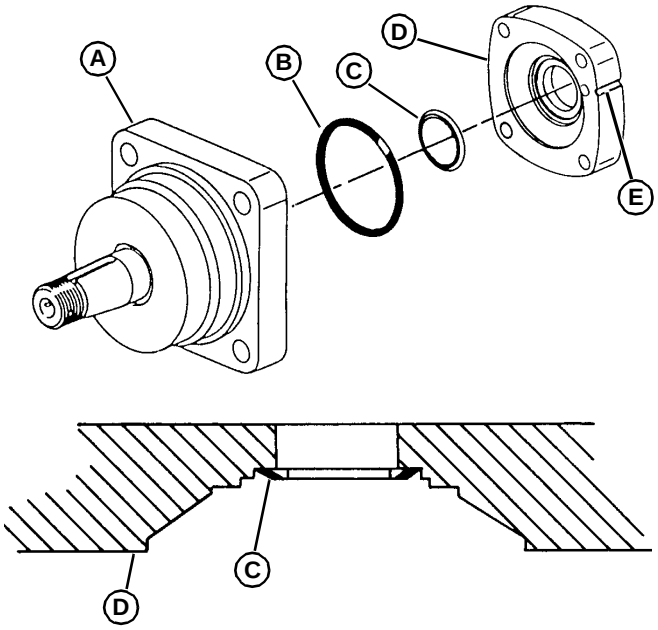
5. Install bearing assembly (A) in vise with shaft end down.

6. Install new square cut seal (B).

7. Install shaft face seal (C) in wear plate (D) as shown.

8. Align groove (E) on wear plate with groove on bearing housing. Install wear plate.

A—Bearing Assembly
B—Square Cut Seal
C—Shaft Face Seal
D—Wear Plate
E—Alignment Groove



M81603A -UN-20Oct94

M81606A -UN-20Oct94

MX, 8110HV, A22 -19-20Oct94

9. Install new square cut seal (A).

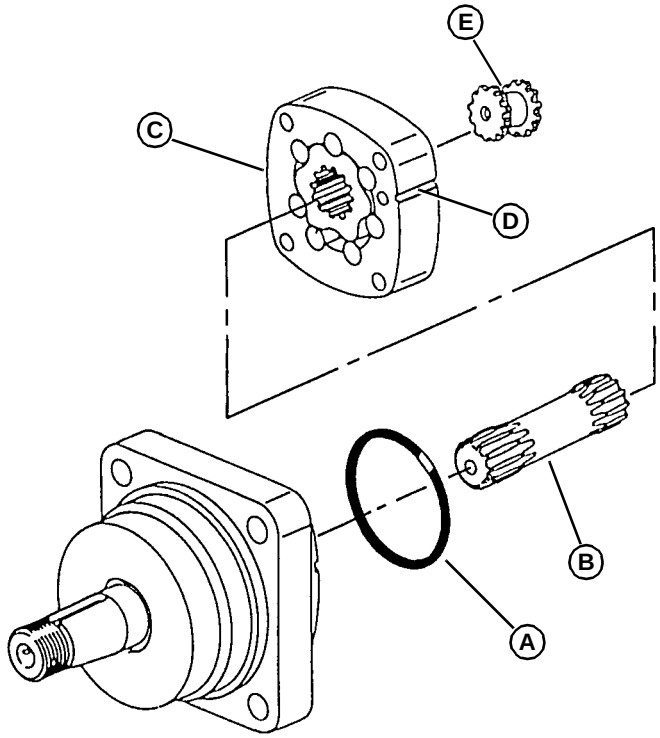
10. Install drive shaft (B) with longer splines toward motor assembly.

IMPORTANT: Rolls and star are loose in Geroler assembly. Parts will separate and fall out if care is not taken during installation.

11. Align groove (D) on Geroler assembly (C) with groove on wear plate. Install Geroler assembly, making sure rolls and star are kept intact.

12. Install valve drive (E).

A—Square Cut Seal
B—Drive Shaft
C—Geroler Assembly
D—Alignment Groove
E—Valve Drive



M81607A -UN-20Oct94

MX, 8110HV, A23 -19-20Oct94

IMPORTANT: Drive motor must be timed correctly for proper machine travel. Follow Steps 13 through 17 closely.

13. Locate largest open pocket (A) in Geroler assembly and mark it on the outside edge of Geroler assembly.

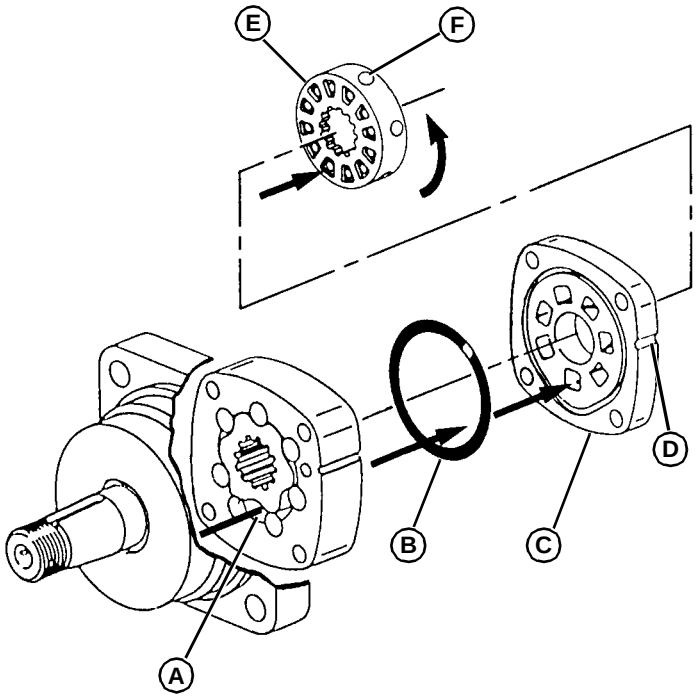
14. Install new square cut seal (B) in valve plate (C).

15. Align groove (D) on valve plate with groove on Geroler assembly. Install valve plate.

16. Locate the slot opening in valve plate (C) that is in-line with pocket (A).

17. Align any one of the six side openings (F) of valve (E) with the open slot of the valve plate that is in-line with pocket (A). Install valve (E) by rotating it clockwise until the splined teeth engage (1/2 spline tooth max.).

A—Largest Open Pocket
B—Square Cut Seal
C—Valve Plate
D—Alignment Groove
E—Valve
F—Side Opening (6 locations)



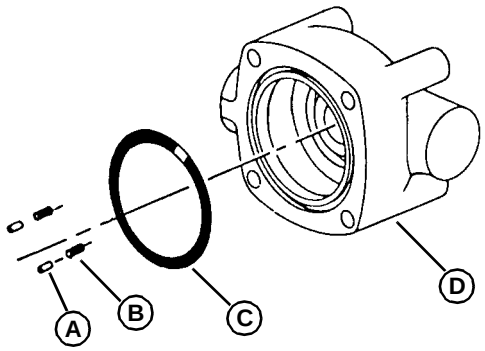
M81608A -UN-20Oct94

MX, 8110HV, A24 -19-20Oct94

18. Install square cut seal (C).

19. Apply petroleum jelly on springs (B) and pins (A) to hold in place. Install springs and pins in bores in valve housing (D).

A—Pin (2 used)
B—Spring (2 used)
C—Square Cut Seal
D—Valve Housing

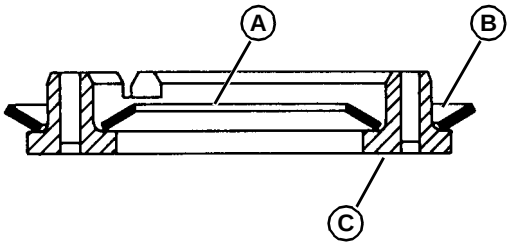


M81609A -UN-20Oct94

MX, 8110HV, A25 -19-20Oct94

20. Apply petroleum jelly on inner and outer face seals (A and B). Install seals on balance ring (C) as shown.

21. Apply petroleum jelly on balance ring assembly to hold in place. Align pin notches in balance ring with pins in valve housing. Install balance ring assembly.



M81610A -UN-20Oct94

MX, 8110HV, A26 -19-20Oct94

22. Align tabs (G) with groove (D) and install valve housing assembly. Check for proper placement. A slight spring action should be felt when pushing down on housing.

23. Install four cap screws (F). Tighten, in a criss-cross pattern, to specifications.

24. Install three O-rings and fittings (E).

25. Remove motor from vise. Put back in vise with shaft end up.

26. Install key (A), hub (C) and slotted nut (B). Tighten nut to specifications.

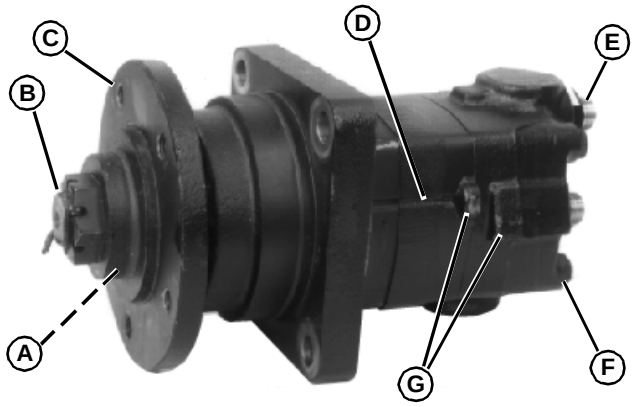
27. Install cotter pin.

TORQUE SPECIFICATIONS

Cap Screws (F) . . . . . 50 N•m (37 lb-ft)

Slotted Nut (B)
(Dry) . . . . . 340 N•m (250 lb-ft)
(Wet). . . . . 270 N•m (200 lb-ft)

A—Key
B—Slotted Nut
C—Hub
D—Alignment Grooves
E—O-Ring and Fitting (3 used)
F—Cap Screw (4 used)
G—Tabs



M81599 -UN-20Oct94

MX, 8110HV, A27 -19-20Oct94

Section 281
3365 REAR WHEEL ASSIST (RWA) OPERATION, TESTS AND ADJUSTMENTS

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COMPONENT LOCATION INFORMATION

This group contains the component location drawing for machines equipped with Rear Wheel Assist (RWA).

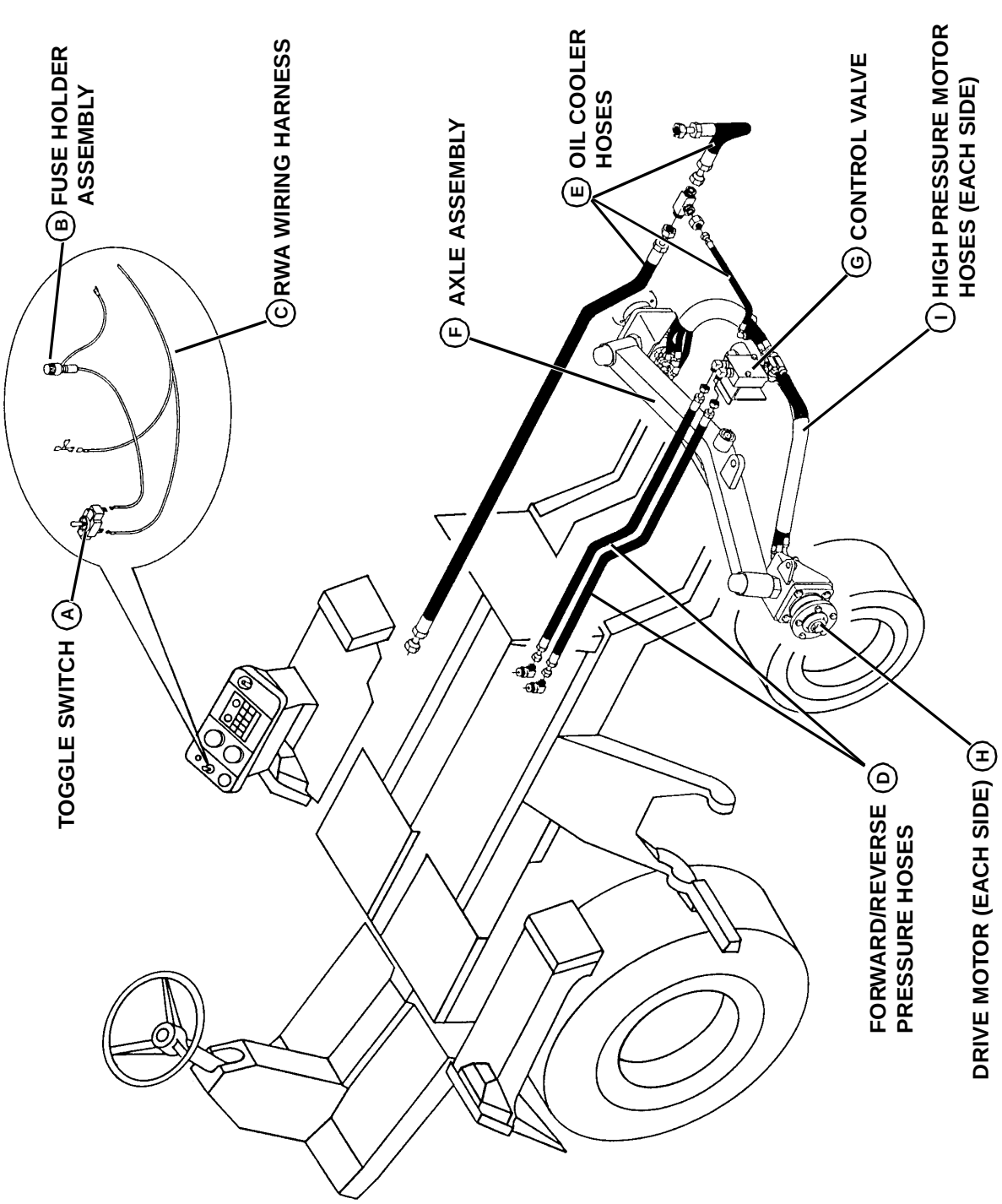
Use the drawing to help locate the components and familiarize yourself with the configuration of the Rear Wheel Assist system.

MX, 28105HV, A1 -19-20Oct94

RWA COMPONENTS

A—Toggle Switch
B—Fuse Holder Assembly
C—RWA Wiring Harness
D—Forward/Reverse Pressure Hoses
E—Oil Cooler Hoses
F—Axle Assembly
G—Control Valve
H—Drive Motor (each side)
I—High Pressure Motor Hoses (each side)

MX, 28105HV, A2 -19-20Oct94



RWA COMPONENTS

M81596A

M81596A -19-20Oct94

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THEORY OF OPERATION INFORMATION

This group divides Rear Wheel Assist into individual components or systems by function. The story contains information on function, component or system identification and theory of operation.

This group also divides the electrical system into an individual circuit by function. The RWA circuit has been isolated from the main wiring schematic and only shows the components that are used in that circuit. The theory of operation story explains: function of circuit, operation conditions, components used, and current flow.

The circuit schematic that accompanies the theory story is drawn in the operating condition with the battery or power circuit at the top and the ground circuit at the bottom.

The following systems or components are covered:

- RWA Circuit Operation
- RWA Hydrostatic System Operation
- Control Valve Operation
- Drive Motor Operation

MX, 28110HV, A1 -19-20Oct94

RWA CIRCUIT OPERATION

FUNCTION:

To engage the rear wheel drive assist system when the toggle switch is in the ON position.

OPERATING CONDITIONS:

The key switch must be in the ON or ACC position.

MAJOR COMPONENTS:

- Battery
- Fusible Link
- 20-Amp Fuse
- Key Switch
- Hourmeter
- 10-Amp Fuse
- Toggle Switch
- Solenoid

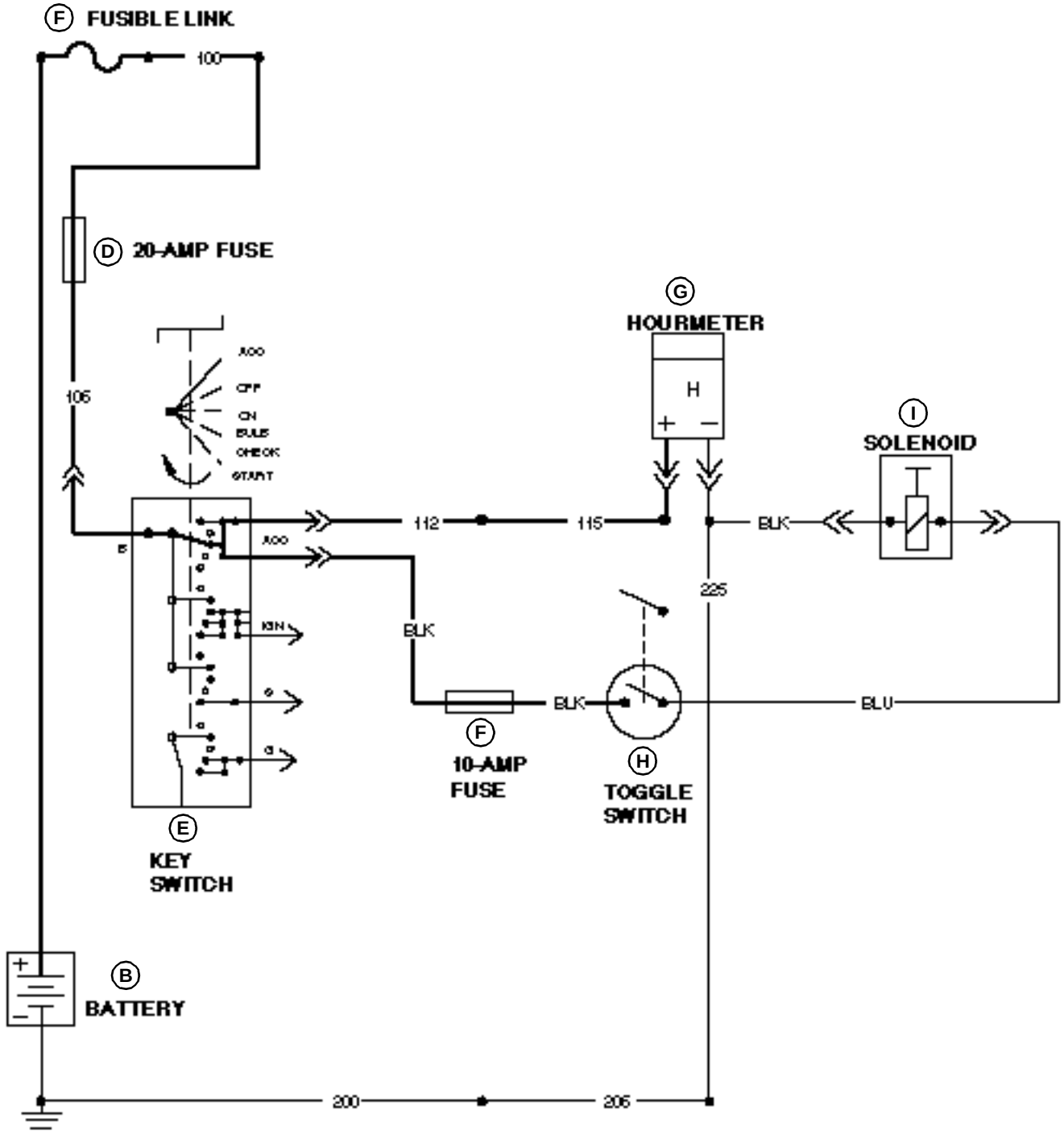
THEORY OF OPERATION:

Current in circuit (A) flows from battery (B), through fusible link (C), 20 amp fuse (D) and to key switch (E). Whenever key switch is in the ON or ACC position, current flows through 10 amp fuse (F) to toggle switch (H).

When the toggle switch is moved to the ON position, current flows through the switch to solenoid (I). The solenoid is connected to negative terminal of hourmeter (G), completing the path to ground.

A—Power Circuit
B—Battery
C—Fusible Link
D—20-Amp Fuse
E—Key Switch
F—10-Amp Fuse
G—Hourmeter
H—Toggle Switch
I—Solenoid

MX, 28110HV, A2 -19-20Oct94



MX, 28110HV, A3 -19-20Oct94

RWA HYDROSTATIC SYSTEM OPERATION

FUNCTION:

When engaged, the rear drive assist system provides additional traction.

THEORY OF OPERATION:

NOTE: The rear wheel drive assist system will actively drive in forward only. When the machine is being driven in reverse the rear wheel drive assist system will freewheel.

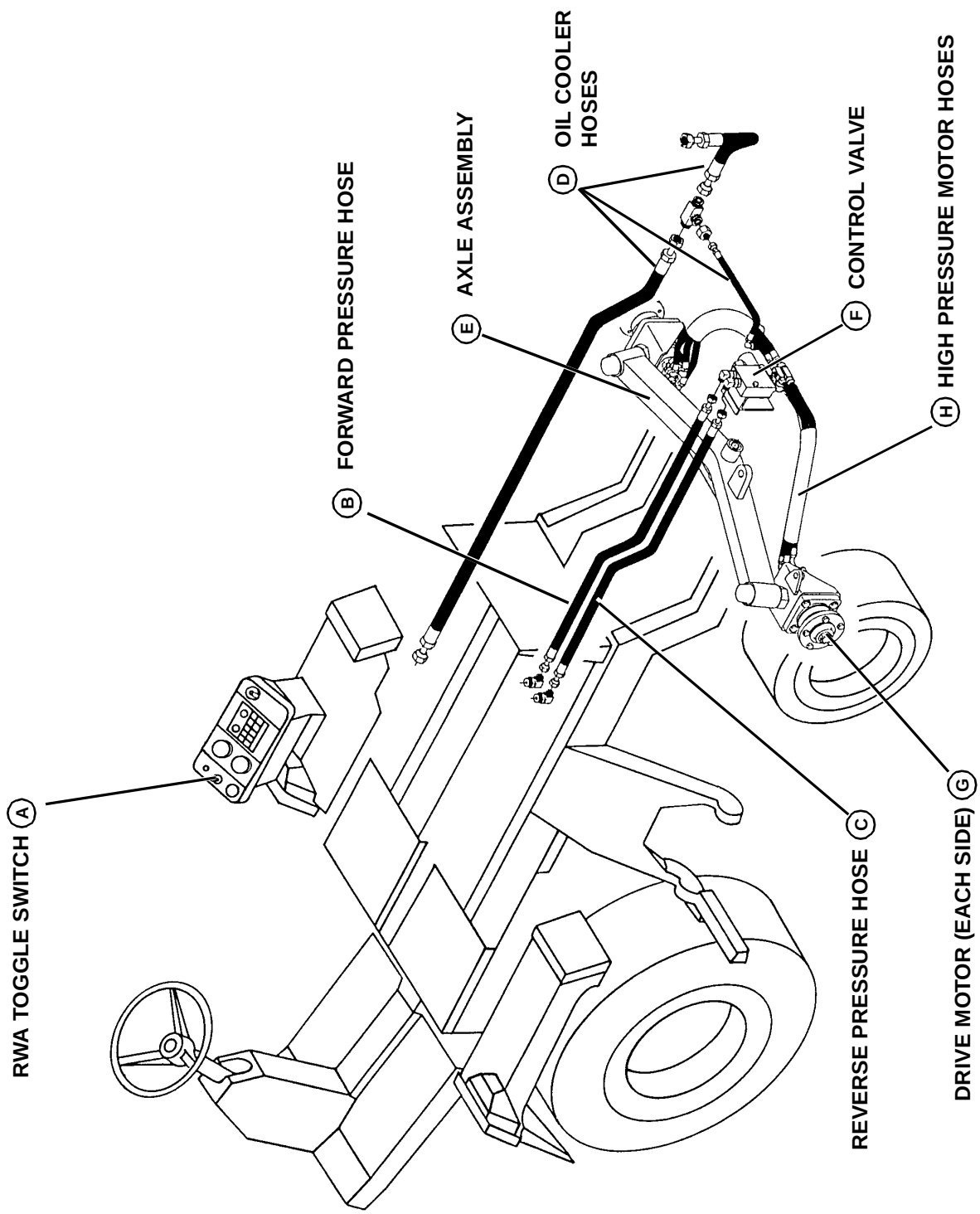
High pressure oil from the hydrostatic transaxle is delivered to the control valve (F) by the forward pressure hose (B). With toggle switch (A) in the ON position, the control valve directs high pressure oil to port “B” of both drive motors (G), driving the motors.

Oil exiting the motors at port “A” is directed back to the hydrostatic transmission through the control valve and reverse pressure hose (C).

Oil that leaks internally in the drive motors, collects in the body housing and is returned to the transmission oil cooler via a case drain in the motor housing.

A—RWA Toggle Switch
B—Forward Pressure Hose
C—Reverse Pressure Hose
D—Oil Cooler Hoses
E—Axle Assembly
F—Control Valve
G—Drive Motor (each side)
H—High Pressure Motor Hoses

MX, 28110HV, A4 -19-20Oct94



RWA HYDROSTATIC SYSTEM OPERATION

M81614A -19-20Oct94

MX, 28110HV, A5 -19-20Oct94

CONTROL VALVE OPERATION

FUNCTION:

Engages/disengages the rear wheel drive assist system, by controlling the flow of oil applied to the motors.

THEORY OF OPERATION:

NOTE: The rear wheel drive assist system will actively drive in forward only. When the machine is being driven in reverse the rear wheel drive assist system will freewheel. Forward operation shown.

When the operator places the toggle switch in the ON position, power is supplied to the solenoid valve coil moving the spool from the NEUTRAL to DRIVE position.

High pressure oil from the hydrostatic transmission enters the control valve at port “B” (B) and is applied to the solenoid valve (E). With the valve in the drive position, the spool directs pressurized oil to port “C” (C), routing oil to the motors.

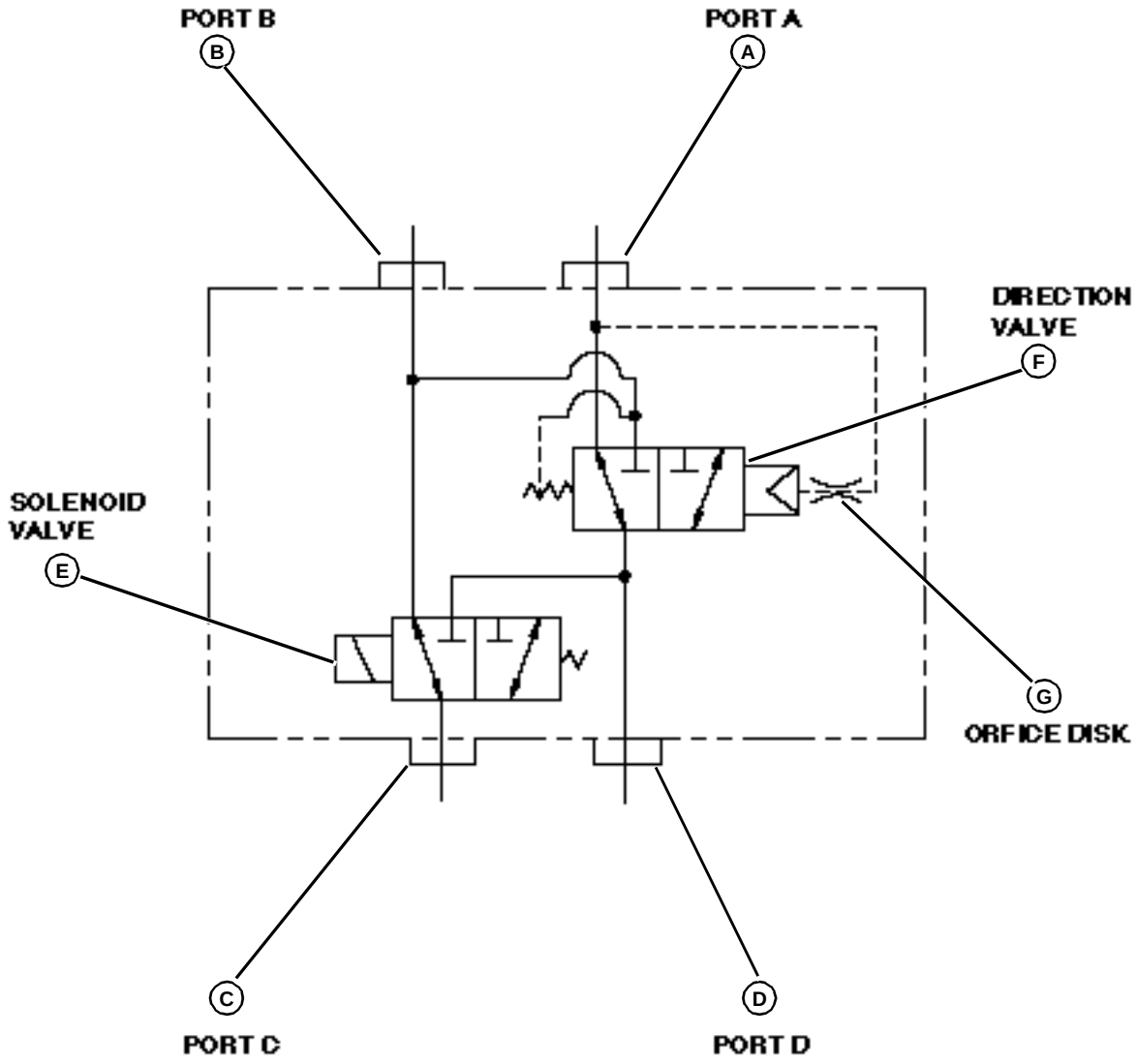
High pressure oil is also applied to the pilot line of the direction valve (F), shifting the direction valve spool to the forward position.

Oil returning from the motors at port “D” (D), passes through the direction valve and exits the control valve at port “A”, returning to the hydrostatic transmission.

When the machine is driven is reverse, high pressure oil is applied to the pilot line of the direction valve and orifice disc (G), causing the valve spool to change position. As the spool changes position, high pressure oil entering the control valve at port “A” is blocked at the direction valve. In this position a closed-loop circuit is formed between the drive motors and control valve assembly. The motors will not actively drive in this mode, but will freewheel as the machine is driven.

A—Port A
B—Port B
C—Port C
D—Port D
E—Solenoid Valve
F—Direction Valve
G—Orifice Disc

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M81613AE

CONTROL VALVE OPERATION

M81613AE -19-20Oct94

MX, 28110HV, A7 -19-20Oct94

DRIVE MOTOR OPERATION

FUNCTION:

To provide rear wheel drive assist, by converting hydraulic pressure to mechanical motion.

THEORY OF OPERATION:

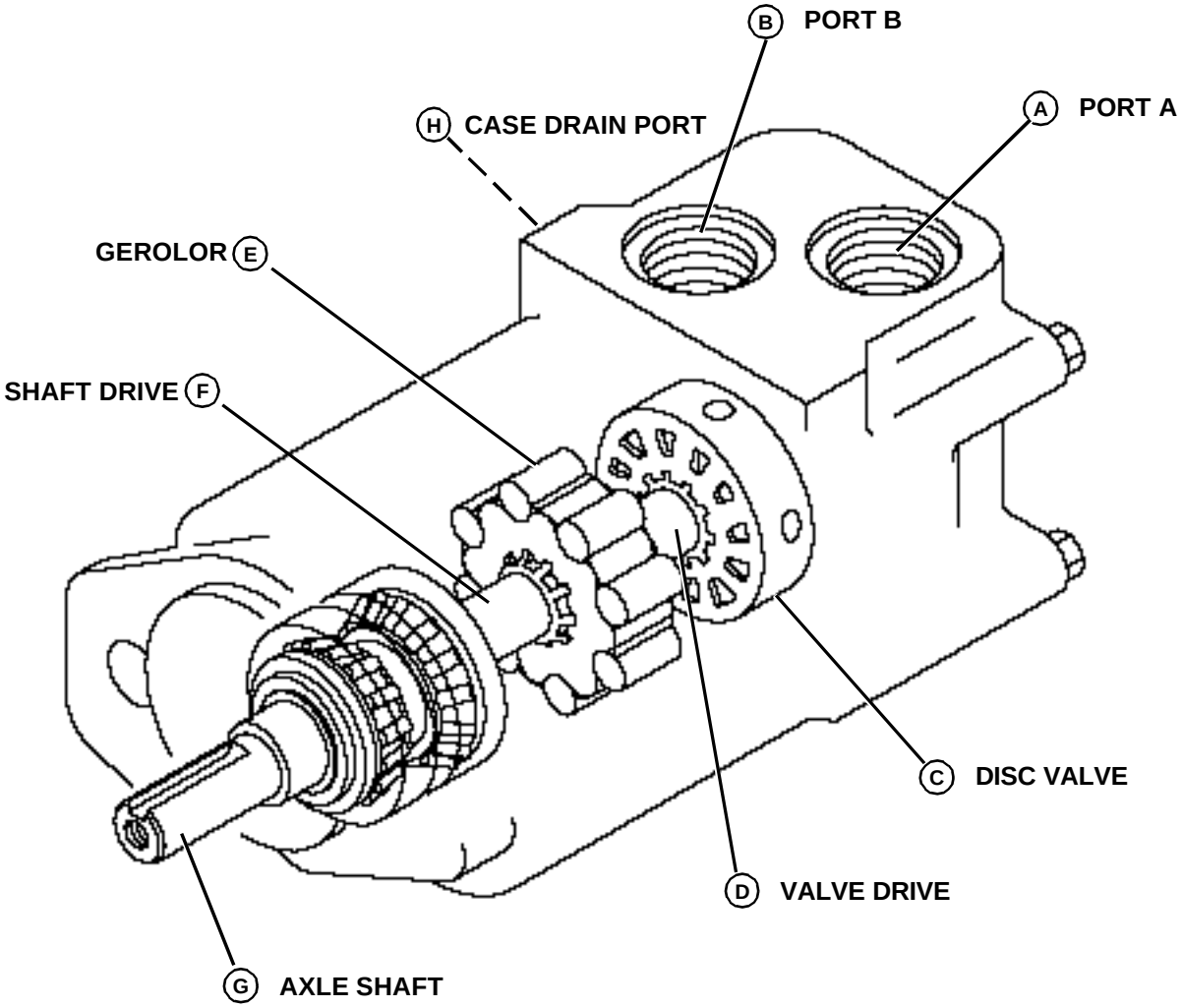
High pressure oil from the control valve enters the motor at port “B” (B), and is distributed to the Gerolor® (E) by the rotating valve disc valve (C). The pressurized oil causes the Gerolor® and attached shaft drive (F) and axle shaft (G) to rotate, driving the wheels. The Gerolor® also turns the valve drive (D) which causes the disc valve (C) to rotate.

Oil exiting the Gerolor® is routed to port “A” (A), for return to the hydrostatic pump via the control valve.

Oil that leaks internally in the drive motor, collects in the body housing and is returned to the transmission oil cooler via a case drain (H) in the motor housing.

A—Port A
B—Port B
C—Disc Valve
D—Valve Drive
E—Gerolor®
F—Shaft Drive
G—Axle Shaft
H—Case Drain Port

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M81611AE -19-20Oct94

M81611AE

DRIVE MOTOR OPERATION

MX, 28110HV, A7 -19-20Oct94

DIAGNOSTIC INFORMATION—ELECTRICAL SYSTEM

The diagnostics in this group are function-oriented. Select the appropriate function that applies to the problem and follow the test procedure 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 follow the test conditions and sequence carefully. The “Normal” column shows the expected reading or condition. If the results or test of the check are not normal, perform the test, check or adjustment listed in the “If Not Normal” column. The detailed tests or adjustments referred to in the “If Not Normal” column are located at the end of this group.

The components used in the circuit diagrams resemble actual machine components. The key number on the diagram determines the test sequence and the leader lines indicate diagnostic test points.

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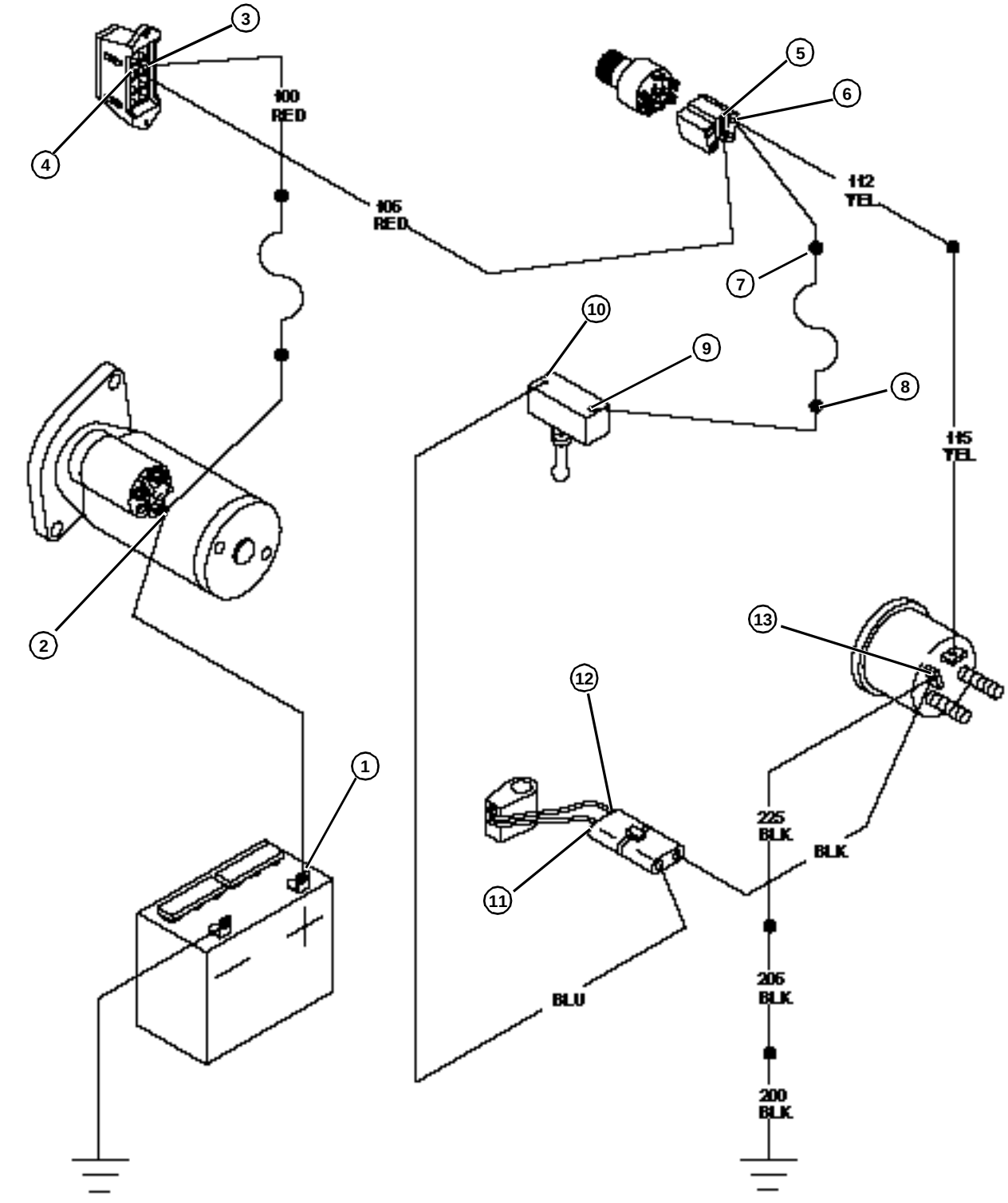
RWA SYSTEM TEST POINTS

CONDITIONS:

- Key switch in ON position, engine OFF.
- Meter set to DC volts position.
- Meter positive (red) lead connected to number test points.
- Meter negative (black) lead connected to ground.

Test Location	Normal	If Not Normal
1. Battery positive (+) post.	Minimum 12.4 volts.	Charge and load test battery.
2. Starter battery terminal.	Battery voltage.	Check for bad connections or a break in cable between battery and starter.
3. Wire no. 100 terminal of 20-amp fuse.	Battery voltage.	Check for failed fusible link at starter. If fusible link is bad, determine cause and replace fusible link. Also check for bad splice or broken wire no. 100.
4. Wire no. 106 terminal of 20-amp fuse.	Battery voltage.	Check for a blown fuse. If fuse is good, check for a bad connection at the fuse block.
5. Wire no. 106 terminal of key switch.	Battery voltage.	Check for bad connections or a break in wire no. 106.
6. ACC terminal of key switch.	Battery voltage.	Test key switch. (See procedure in TM1427 Section 240, Group 15.)
7. 10-amp fuse holder - black wire from key switch.	Battery voltage.	Check for bad connection or a break in black wire.
8. 10-amp fuse holder - black wire to toggle switch.	Battery voltage.	Check for a blown fuse.
9. Toggle switch - black wire from 10-amp fuse.	Battery voltage.	Check for bad connections or a break in black wire between 10-amp fuse and toggle switch.
10. Toggle switch - blue wire to solenoid.	Battery voltage.	Test toggle switch. See procedure in this group.
11. Solenoid side of RWA solenoid connector.	Battery voltage.	Check for bad connection or a break in wire from toggle switch.
12. Solenoid side of RWA solenoid connector.	Less than 0.2 volt.	Check continuity of wire from solenoid to wire no. 225.
13. Wire no. 225 of hourmeter.	Less than 0.2 volt.	Check continuity to ground of wire no. 225. Also check for splices connecting wire nos. 200, 206 and 225.

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RWA SYSTEM TEST POINTS

M81612AE -19-20Oct94

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DIAGNOSTIC INFORMATION—HYDROSTATIC SYSTEM

The diagnostic information is grouped under the following headings:

- Rear Wheel Drive Assist Does Not Operate
- Low Power -- Wheels Stall Easily
- One Wheel is Dragging or Locked up.

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 machine up to the test conditions listed and follow sequence carefully. The “Normal” column shows the expected reading or condition. If the results or test of the check are not normal, perform the test, check or adjustment listed in the “If Not Normal” column. The detailed tests or adjustments referred to in the “If Not Normal” column are located at the end of this 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.

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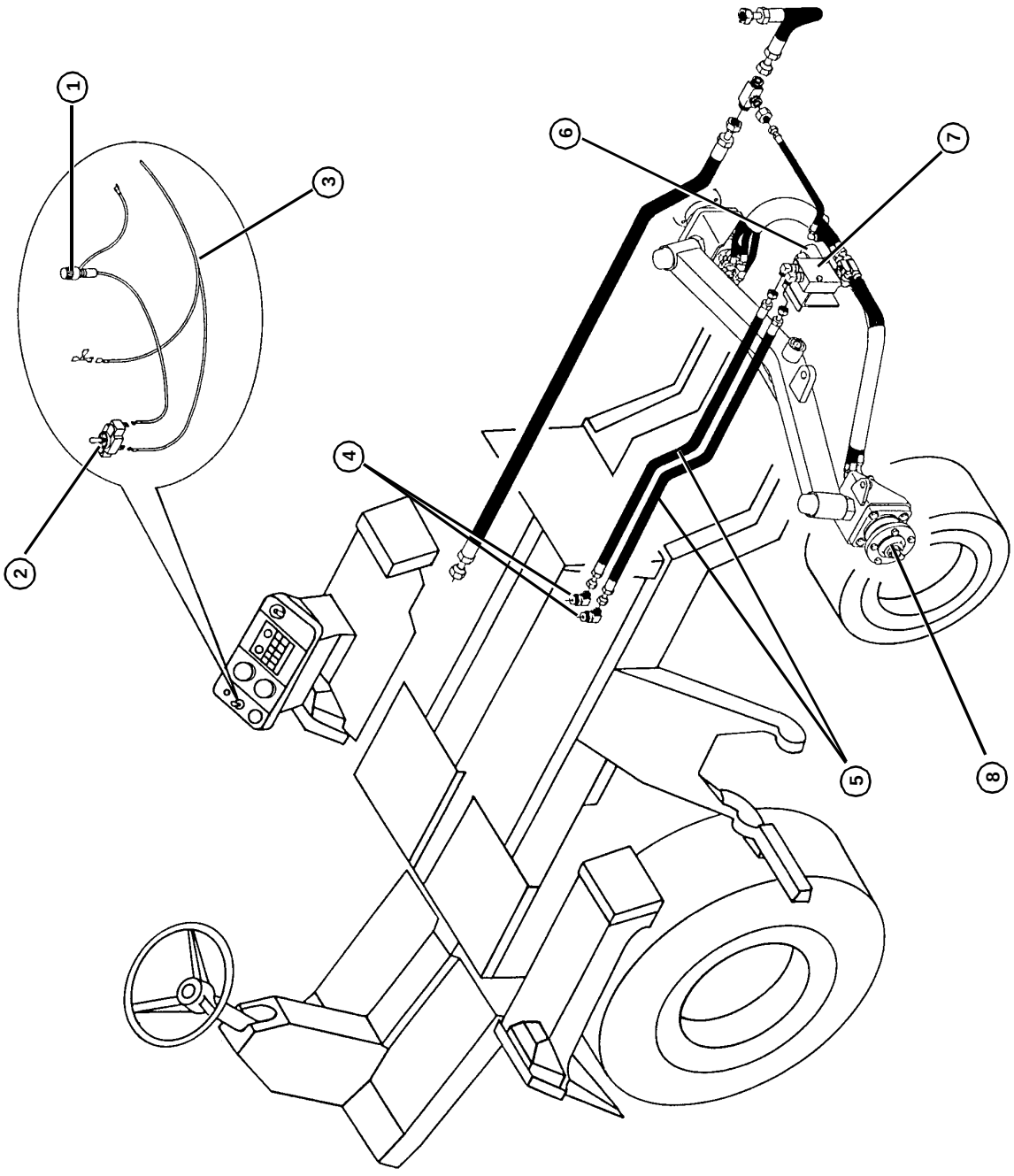
REAR WHEEL DRIVE ASSIST DOES NOT OPERATE

CONDITIONS:

- Transmission in neutral.
- PTO off.
- Engine stopped.

Test Location	Normal	If Not Normal
1. Fuse. (continuity through fuse).	Fuse not blown.	Test and replace fuse. (See procedure in this group.)
2. Toggle switch.	Switch operating properly.	Test and replace switch. (See procedure in this group.)
3. Wiring harness.	No loose connections or broken wires.	Test electrical system. (See RWA TEST POINTS in this group.)
4. Hydrostatic transmission ports.	Hydraulic oil pressure within specifications.	Test transmission high pressure relief valves. See procedure in TM 1427 Section 250, Group 15.
5. Forward/Reverse pressure hoses.	Hoses connected to correct hydrostatic transmission/control valve ports.	Connect hoses to correct ports.
6. Control valve solenoid.	Solenoid valve coil energizes when power applied.	Test solenoid valve coil. (See procedure in this group.)
7. Control valve assembly.	Solenoid Valve spool shifts freely.	Replace Control Valve Assembly.
8. Wheel motors.	High pressure hoses connected to correct motor ports.	Connect high pressure hoses to correct motor ports.
	Tires rotate freely by hand.	Repair or replace wheel motors.

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REAR WHEEL DRIVE ASSIST DOES NOT OPERATE

M81596A

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MX, 28115HV, A6 -19-20Oct94

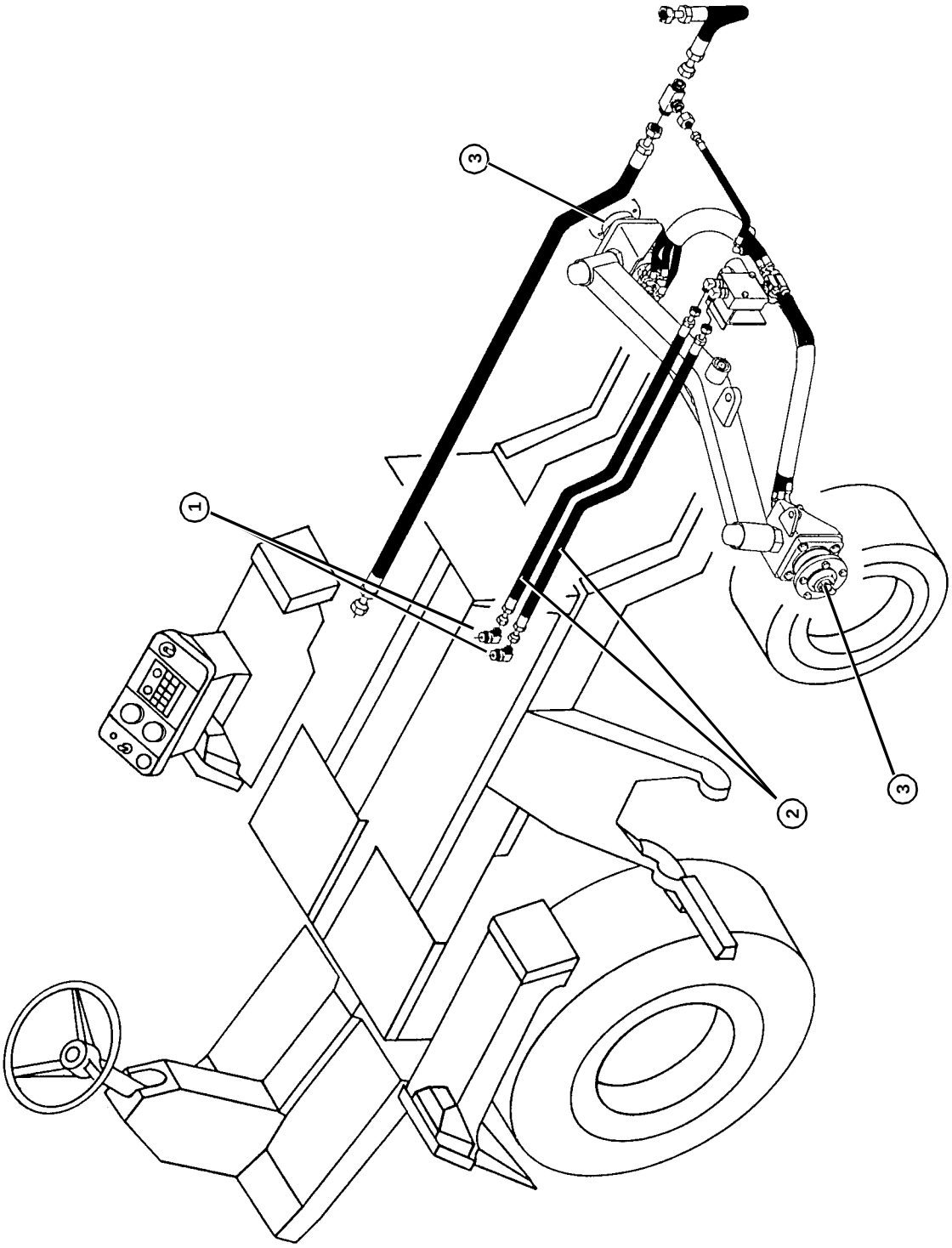
LOW POWER—WHEELS STALL EASILY

CONDITIONS:

- Transmission in neutral.
- PTO off.
- Engine stopped.

Test Location	Normal	If Not Normal
1. Hydrostatic transmission ports.	Hydraulic oil pressure within specifications.	Test transmission high pressure relief valves. (See procedure in TM1427 Section 250, Group 15.)
2. Forward/Reverse pressure hoses.	Hoses connected to correct hydrostatic transmission/control valve ports.	Connect hoses to correct ports.
	No sharp bends or restrictions.	Replace hoses.
3. Wheel motors.	No visible leakage.	Repair or replace wheel motors.

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LOW POWER – WHEELS STALL EASILY

M81614A -19-20Oct94

M81614A

MX, 28115HV, A8 -19-20Oct94

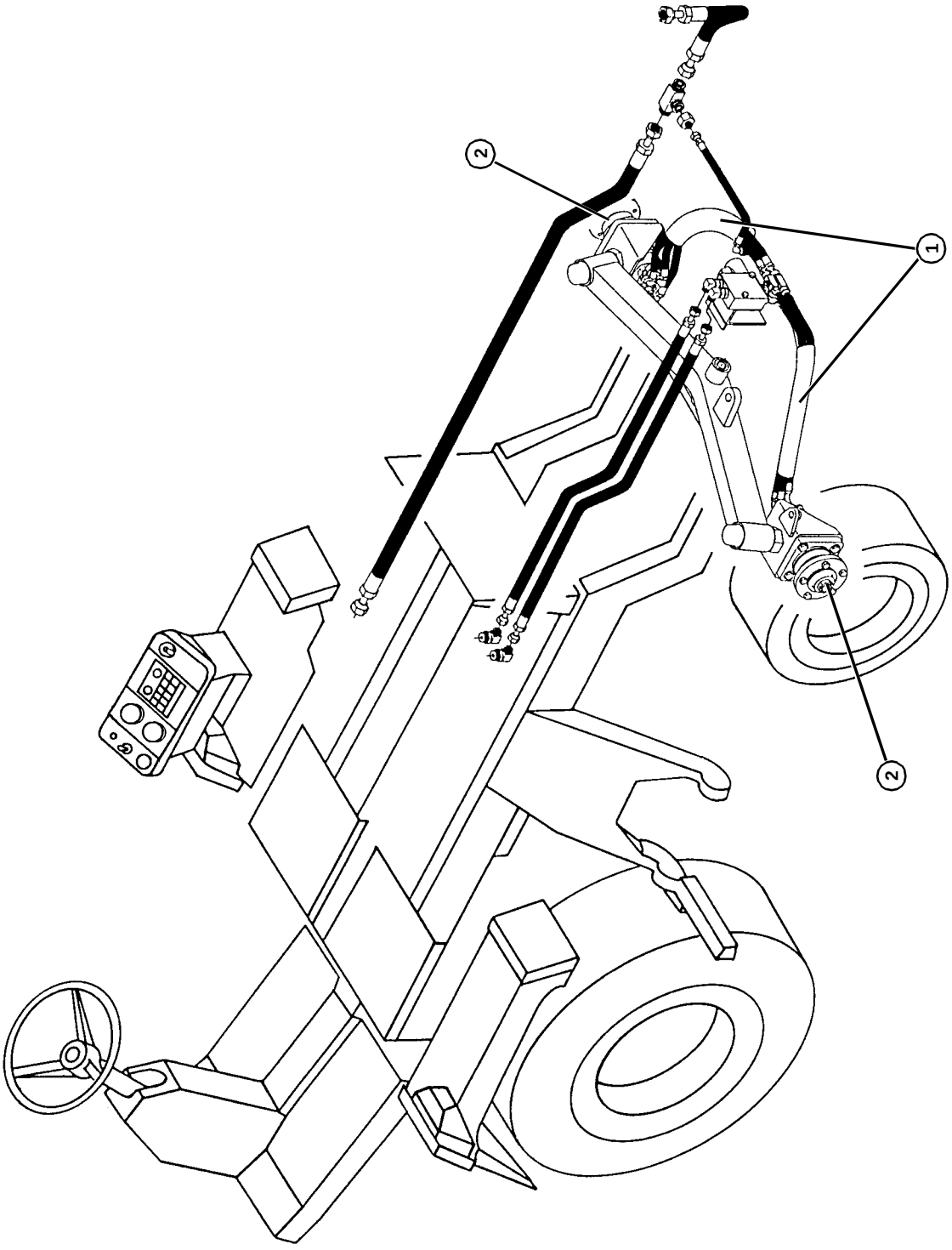
ONE WHEEL DRAGGING/LOCKED UP

CONDITIONS:

- Transmission in neutral.
- PTO off.
- Engine stopped.
- Rear tires off the ground.

Test Location	Normal	If Not Normal
1. High pressure motor hoses	No sharp bends or restrictions.	Replace hoses.
2. Wheel motors.	High pressure hoses connected to correct motor ports.	Connect high pressure hoses to correct motor ports.
	Tires rotate freely by hand.	Repair or replace wheel motors.

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ONE WHEEL DRAGGING/LOCKED UP

M81614A -19-20Oct94

M81614A

MX, 28115HV, A10 -19-20Oct94

FUSE TEST





M81597 -19-20Oct94

REASON:

To determine if fuse has failed.

EQUIPMENT:

- Ohmmeter

PROCEDURE:

1. Check visually for broken filament (A).
2. Set ohmmeter to 1X ohms scale.

NOTE: On analog (swing needle) ohmmeters, set zero point before every test.

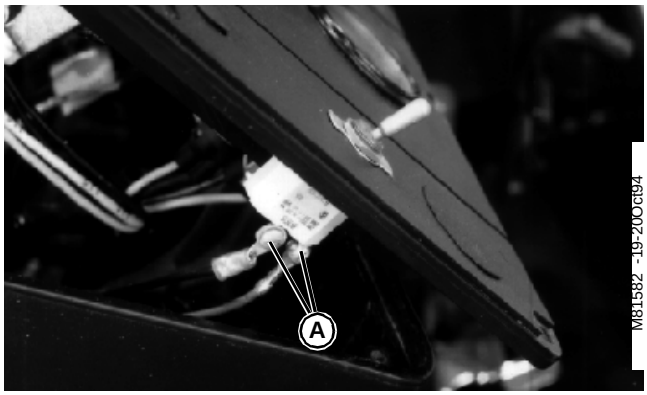
3. Connect ohmmeter leads to each end of fuse. Check for continuity across fuse.

RESULTS:

- If there is no continuity across fuse, replace fuse.

MX, 28115HV, A11 -19-20Oct94

TOGGLE SWITCH TEST



M81582 -19-20Oct94

REASON:

To determine if the toggle switch is operating properly.

EQUIPMENT:

- Ohmmeter or continuity tester.

PROCEDURE:

1. Disconnect wires (A) from switch.
2. Connect tester leads to terminals of switch.
3. Move switch toggle back and forth.

RESULTS:

- Switch must have continuity in one position and no continuity in the other. Replace switch if continuity is not correct.

MX, 28115HV, A12 -19-20Oct94

SOLENOID COIL TEST

REASON:

To determine the condition of the solenoid coil.

EQUIPMENT:

- Ohmmeter

PROCEDURE:

1. Disconnect solenoid connector.
2. Check resistance between coil terminals. Resistance must be 4—5 ohms.
3. Check for grounds or shorts, by connecting one tester lead to coil terminal and the other lead to bare metal of the coil case. There should be no continuity between terminal and case.

RESULTS:

- If resistance between terminals is not within specification, replace coil.
- If continuity exists between terminal and case, replace coil.



E35628 -19-20Oct94



E35629 -19-20Oct94

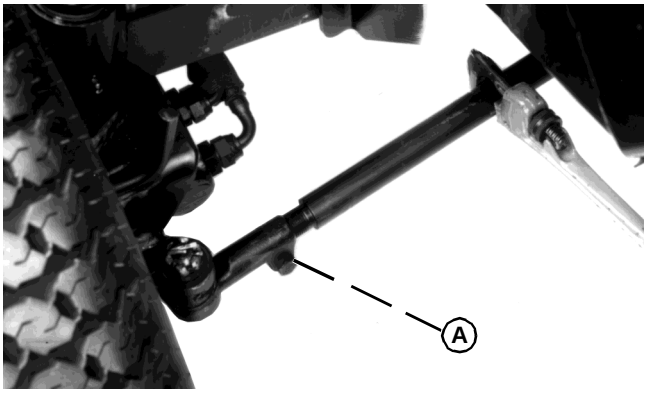
MX, 28115HV, A13 -19-20Oct94

STEERING TOE-IN ADJUSTMENT

1. Position wheels so that they are straight ahead.
2. Measure the distance between the front inner edges of the tires.
3. Measure the distance between the rear inner edges of the tires. When properly adjusted, rear distance should be 6 mm (1/4 in.) greater than front distance. If not, adjust tie rod length.
4. Loosen nut (A) on both tie rod ends.
5. Turn tie rod until toe-in is to specification.

IMPORTANT: Ball joints must move freely after tightening tie rod nuts.

6. Tighten nuts to 56 N•m (41 lb-ft).



M82477 -19-20Oct94

MX, 28115HV, A14 -19-20Oct94

SCHEMATICS INFORMATION

The electrical wiring schematic is drawn with the power in, or battery positive circuit across the top and the ground, or battery negative, circuit across the bottom. The flow is then, as much as possible, from top to bottom through each circuit and component. All components are shown in the off position.

See TM1427 Section 240, Group 20 to reference a Wire Color Chart, Electrical Schematic Symbols and the electrical Component Identification Tables.

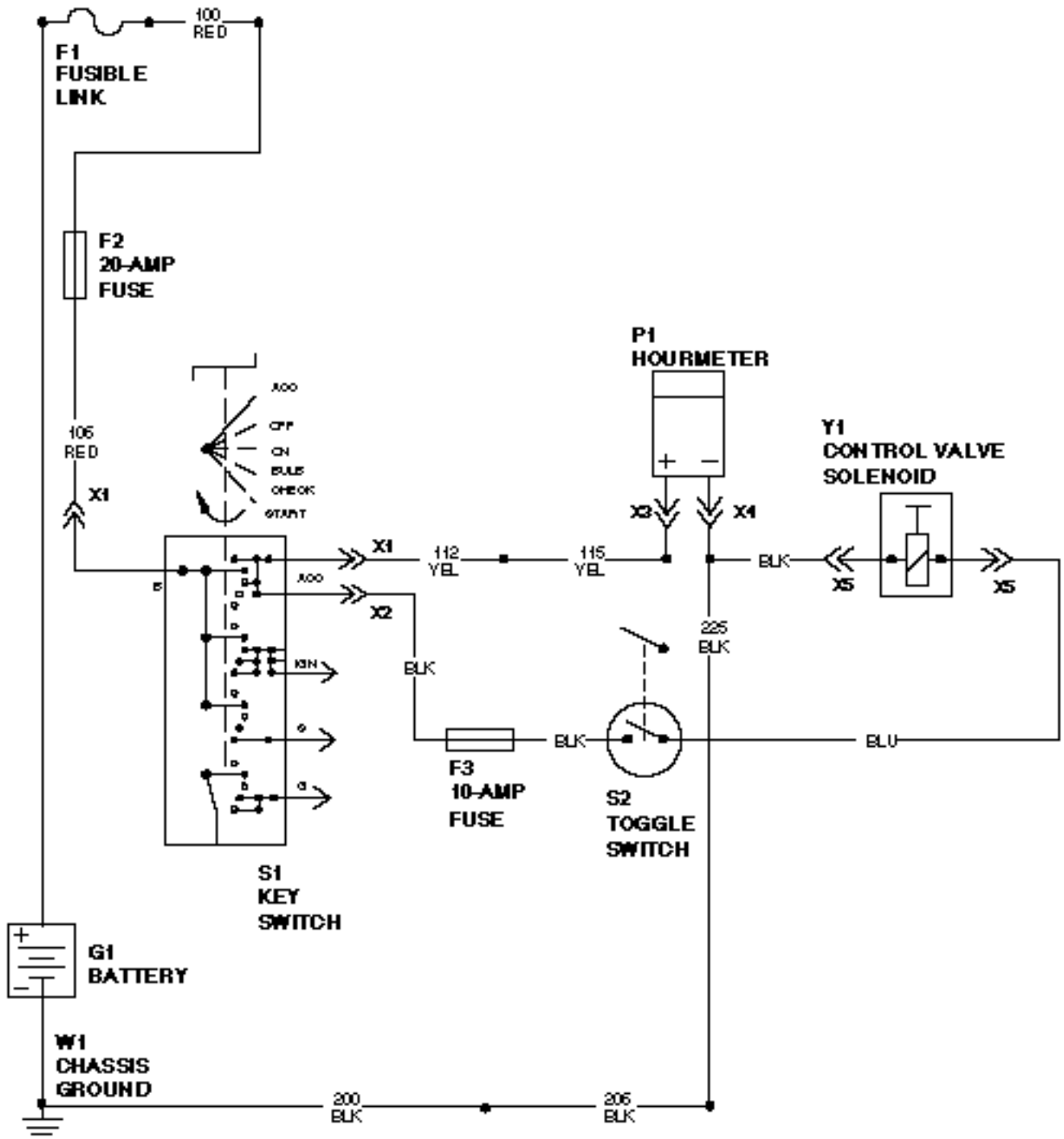
See TM1427 Section 250, Group 20 to reference the Hydraulic Circuit Symbols and the overall machine Hydraulic/Hydrostatic Schematic.

MX, 28120HV, A1 -19-20Oct94

RWA ELECTRICAL SCHEMATIC

F1—Fusible Link
F2—20-Amp Fuse
F3—10-Amp Fuse
G1—Battery
P1—Hourmeter
S1—Key Switch
S2—Toggle Switch
W1—Chassis Ground
X1—6-Pin Connector, Key Switch
X2—Single Blade Connector, Key Switch
X3—Single Blade Connector, Hourmeter (Positive)
X4—“Y” Connector, Hourmeter (Negative)
X5—2-Pin Weather Pack Connector, Control Valve Solenoid
Y1—Control Valve Solenoid

MX, 28120HV, A2 -19-20Oct94



SE10 REAR WHEEL ASSIST (RWA) CIRCUIT

M81598AE -19-20Oct94

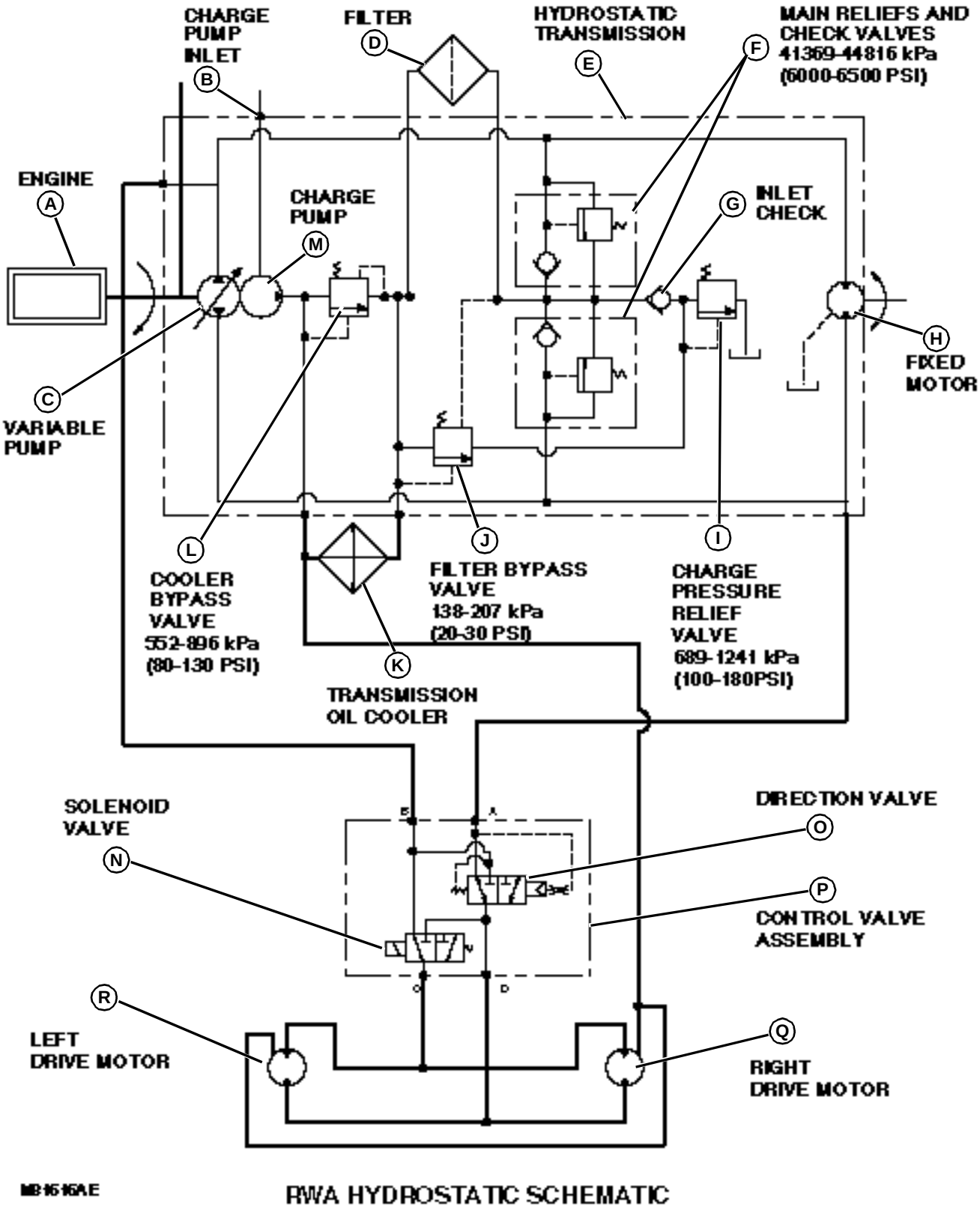
M81598AE

MX, 28120HV, A3 -19-20Oct94

RWA HYDROSTATIC SCHEMATIC

A—Engine
B—Charge Pump Inlet
C—Variable Pump
D—Filter
E—Hydrostatic Transmission
F—Main Reliefs and Check Valves
G—Inlet Check
H—Fixed Motor
I—Charge Pressure Relief Valve
J—Filter Bypass Valve
K—Transmission Oil Cooler
L—Cooler Bypass Valve
M—Charge Pump
N—Solenoid Valve
O—Direction Valve
P—Control Valve Assembly
Q—Right Drive Motor
R—Left Drive Motor

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RWA HYDROSTATIC SCHEMATIC

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..	art	m81591ae @ 300 dpi 81-10-9
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