1800
Utility Vehicle

John Deere Horicon Works
TM1527 (10APR92)

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.

P 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 diagnostics. Repair sections tell how to repair the components. Diagnostic 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.

Binders, binder labels, and tab sets can be ordered by John Deere dealers direct from the John Deere Distribution Service Center.

This manual is part of a total product support program.

FOS MANUALS—REFERENCE

TECHNICAL MANUALS—MACHINE SERVICE

COMPONENT MANUALS—COMPONENT SERVICE

Fundamentals of Service (FOS) Manuals cover basic theory of operation, fundamentals of troubleshooting, general maintenance, and basic type of failures and their causes. FOS Manuals are for training new personnel and for reference by experienced technicians.

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

Component Technical Manuals are concise service guides for specific components. Component technical manuals are written as stand-alone manuals covering multiple machine applications.

MX,TM1527,IFC -19-14APR92

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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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GENERAL INFORMATION

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RECOGNIZE SAFETY INFORMATION

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

Follow recommended precautions and safe operating practices.

T81389 -UN-07DEC88

DX,ALERT -19-04JUN90

UNDERSTAND SIGNAL WORDS

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

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

TS187 -19-30SEP88

DX,SIGNAL -19-09JAN92

FOLLOW SAFETY INSTRUCTIONS

Carefully read all safety messages in this manual and on your machine safety signs. Keep safety signs in good condition. Replace missing or damaged safety signs. Be sure new equipment components and repair parts include the current safety signs. Replacement safety signs are available from your John Deere dealer.

Learn how to operate the machine and how to use controls properly. Do not let anyone operate without instruction.

Keep your machine in proper working condition. Unauthorized modifications to the machine may impair the function and/or safety and affect machine life.

If you do not understand any part of this manual and need assistance, contact your John Deere dealer.

TS201 -UN-23AUG88

DX,READ -19-04JUN90

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

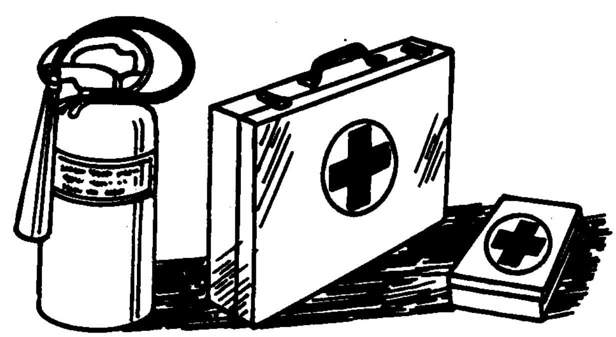
DX,SPARKS -19-04JUN90

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 -19-04JUN90

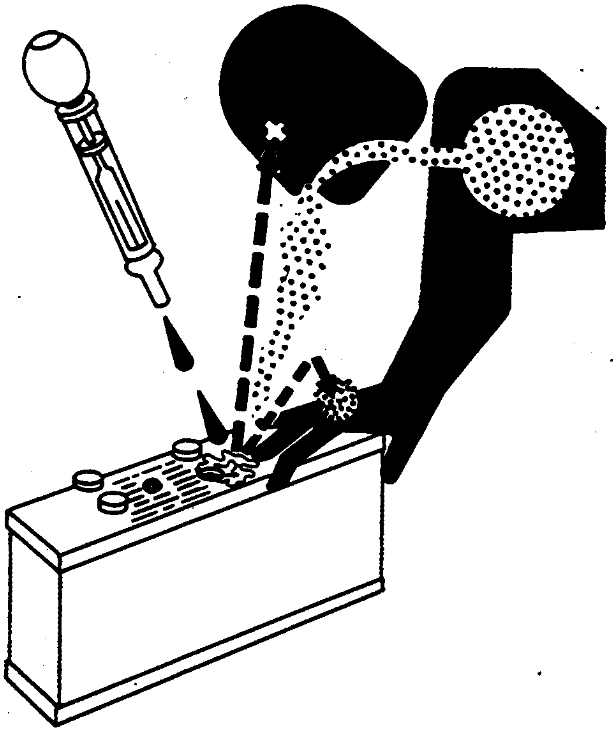
PREVENT ACID BURNS

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

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

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



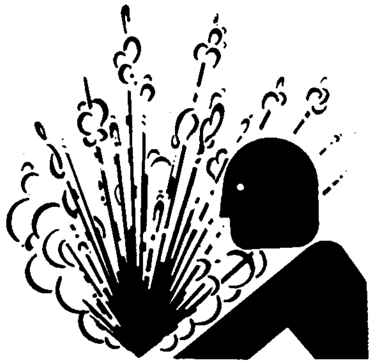
TS203 -UN-23AUG88

DX,POISON -19-04JUN90

SERVICE COOLING SYSTEM SAFELY

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

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

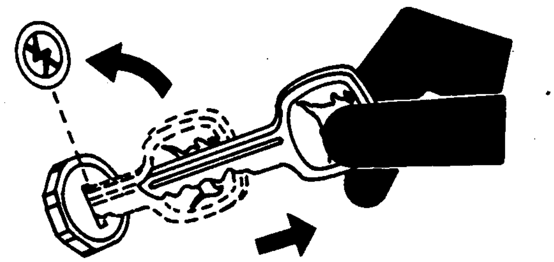


TS281 -UN-23AUG88

DX,RCAP -19-04JUN90

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.



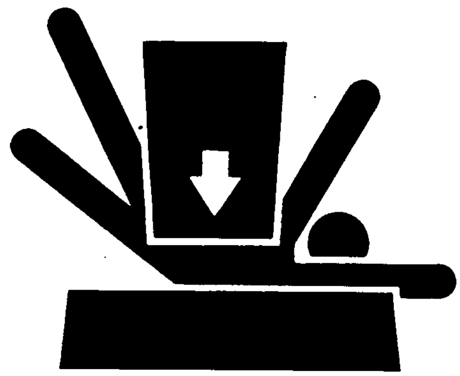
TS230 -UN-24MAY89

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

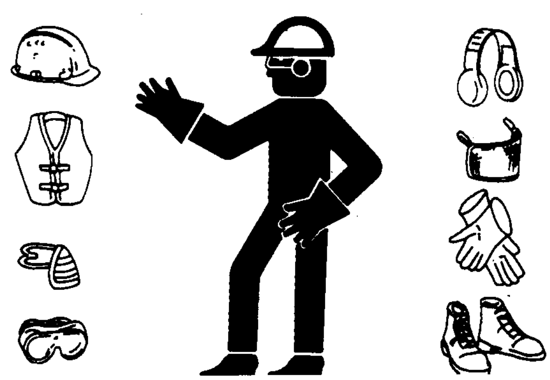
WEAR PROTECTIVE CLOTHING

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.

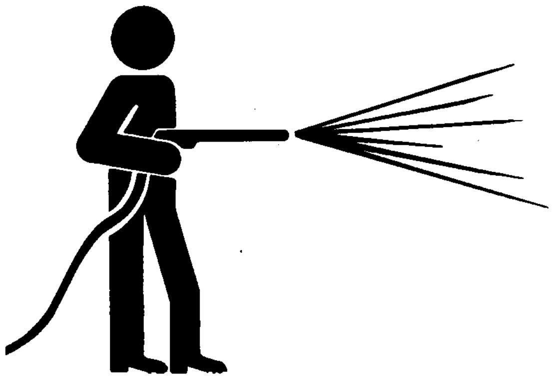


TS206 -UN-23AUG88

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.



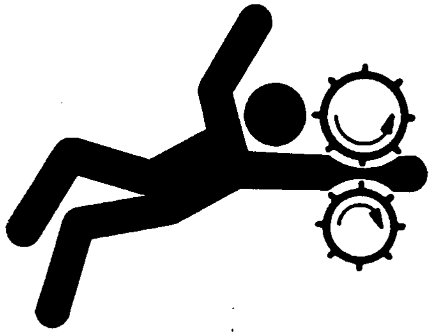
T6642EJ -UN-18OCT88

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.



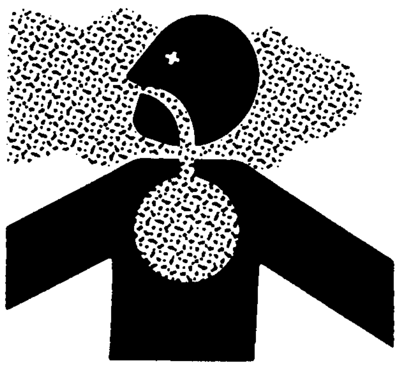
TS228 -UN-23AUG88

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

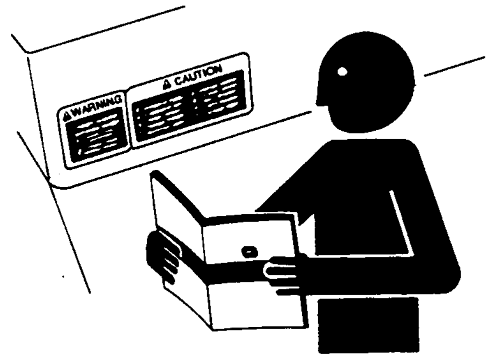
Illuminate your work area adequately but safely. Use a portable safety light for working inside or under the machine. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.

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.



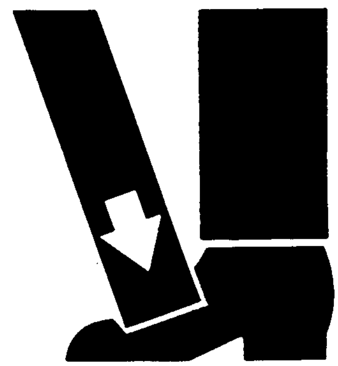
TS201 -UN-23AUG88

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

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.

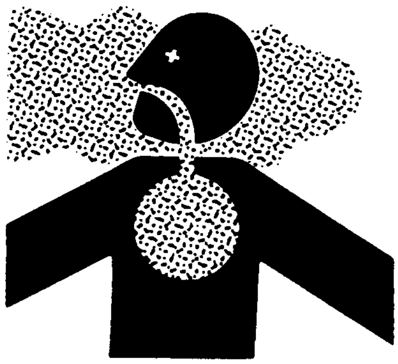
When inflating tires, use a clip-on chuck and extension hose long enough to allow you to stand to one side and NOT in front of or over the tire assembly. Use a safety cage if available.

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

TS952 -UN-12APR90

DX,TIRECP -19-24AUG90

AVOID HARMFUL ASBESTOS DUST



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

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

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

Keep bystanders away from the area.

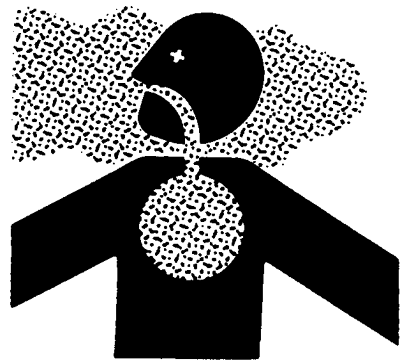
DX,DUST -19-15MAR91

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.

DX,TORCH -19-05OCT90

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.

DX,PAINT -19-04JUN90

USE PROPER TOOLS

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

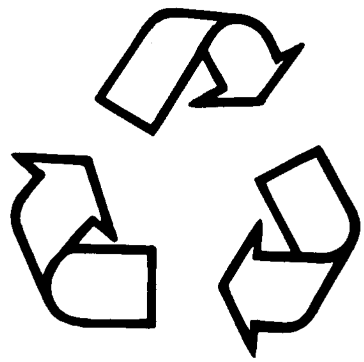
Use power tools only to loosen threaded parts and fasteners.

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.

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 -19-09AUG91

LIVE WITH SAFETY

TS231 -19-07OCT88

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

DX,LIVE -19-04JUN90

MACHINE SPECIFICATIONS

ENGINE

Make . . . Kawasaki
Type . . . Gasoline
Model . . . FD620D
Horsepower . . . 13.4 kW (18 hp)
Number of Cylinders . . . Two 90° V-Twin
Cycle . . . Four
Displacement . . . 617 cc (37.7 cu. in.)
Bore . . . 76 mm (2.99 in.)
Stroke . . . 68 mm (2.66 in.)
Compression Ratio . . . 9.0:1
Speed,Fast (no load) . . . 3600 ± 50 rpm
Speed,idle (no load) . . . 1550 ± 50 rpm
Lubrication . . . Full Pressure
Cooling System . . . Water Pump/Radiator
Oil Filter . . . Full Flow Replaceable
Air Cleaner . . . Dry, replaceable primary and secondary elements

FUEL SYSTEM

Fuel . . . Unleaded gasoline or leaded gasoline with an antilock index of 87 or higher
Fuel Filter . . . Replaceable in-line filter
Fuel Pump . . . Electric

ELECTRICAL SYSTEM

Type . . . 12 volt, negative ground
Charging System . . . Stator
Capacity . . . 20 amp Regulator
Battery Size . . . 430 CCA at -18°C (0° F), BCI-45, length 9.4 in., width 5.5 in., height 8.9 in.
Battery Reserve Capacity
at 25 amps . . . 80 min.

INSTRUMENTATION

Speedometer . . . Dash Mounted, In KPH and MPH readable to within ± .5 mph
Hourmeter . . . Dash Mounted, running with key in ON position
Tachometer . . . Dash Mounted, reading engine rpm
Low Battery Indicator Light . . . Dash Mounted, warning low battery voltage
Engine Coolant Temp. Indicator . . . Dash Mounted, warning high coolant temperature
Engine Oil Pressure Indicator Light . . . Dash Mounted, warning low oil pressure
Choke . . . Dash Mounted, for cold starting
Ignition Switch . . . Dash Mounted

POWER TRAIN

Transmission . . . Hydrostatic U-type
Manufacturer . . . Sauer Sundstrand 15 Series
Number of Speeds . . . Infinite
Travel Speeds
Forward . . . 0-18 km/h (0-11.5 mph)
Reverse . . . 0-9.7 km/h (0-6 mph)
Differential . . . Peerless 2-Speed (without Differential Lock and with Park Lock)

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MACHINE SPECIFICATIONS—CONTINUED

STEERING/BRAKES

Steering . . . . Power, Hydrostatic
Brakes . . . . Independent, shoe and drum. Rear Axle Mounted
Park Brake . . . . 1 Motion Release

CAPACITIES

Fuel Tank . . . . Translucent With No Graduations, 30 L (8 gallon) capacity
Transmission . . . . 7.1 L (7.5 U.S. qt)
Cooling System . . . . 3.5 L (3.8 U.S. qt)
Crankcase (w/ filter) . . . . 2.1 L (4.44 U.S. qt)
Crankcase (w/o filter) . . . . 1.9 L (4.0 U.S. qt)

TIRES

Front Tire Size/Type . . . . 23 x 10.5 - 12 Softrac
Front Tire Operating PSI . . . . (8-12 psi)
Rear Tire Size/Type . . . . 26 x 12.0 - 12 Softrac
Rear Tire Operating PSI . . . . (8-12 psi)

DIMENSIONS (BASE VEHICLE)

Wheel Base . . . . 61.5 in. (1562 mm)
Front Tread Width (center line) . . . . 54 in. (1372 mm)
Rear Tread Width (center line) . . . . 54 in. (1372 mm)
Outside Turning Radius . . . . 24 ft(7.32 m)
Inside Turning Radius . . . . 23.4 ft (7.11 m)
Ground Clearance . . . . 7 in. (178 mm)
Overall Length . . . . 120 in. (3048 mm)
Overall Width . . . . 65.6 in. (1667 mm)
Overall Height . . . . 50.5 in. (1283 mm)
Overall Weight* . . . . 1325 lbs (602 kg)
Front Axle Weight* . . . . 857 lbs (390 kg)
Rear Axle Weight* . . . . 468 lbs (213 kg)
Noise Levels
Low Idle at Operators Ear . . . .
High Idle at Operators Ear . . . .

VEHICLE USAGE (BASE VEHICLE WITH SPRAYER)

Spraying Speed ± tolerance . . . . 3-6 mph ± .5 mph
Speed Reduction Up 10% Grade
Transporting . . . . 2.3 mph (20% Reduction)
Spraying . . . . .6 - 1.5 mph (20% Reduction)
Max. Slope During Spraying Operation . . . . 20% (11.3 Degree)
Satisfies Stability Standards . . . . ANSI B71.4

**ALL WEIGHTS INCLUDE A 200 LB OPERATOR, FULL TANK OF FUEL, AND BATTERY.*

MX,1010HJ,1A -19-14APR92

REPAIR SPECIFICATIONS

Item	Measurement	Specification
SECTION 20 - ENGINE REPAIR		
For all engine repair specs-Use CTM39		
Engine-to-Frame Cap Screw	Torque	18 N·M (160 lb-in.)
Drive Shaft-to-Engine Cap Screw	Torque	35 N·M (27 lb-ft)
Cylinder Head Cap Screw	Torque	21 N·M (0.800 in.)
Outer Sheave Half-to-Flywheel Cap Screw	Torque	13 N·M (115 lb-in.)
Spark Plugs	Torque	20 N·M (177 lb-in.)
SECTION 30 - FUEL AND AIR REPAIR		
For all carburetor repair specifications - Use CTM39		
Transfer Pump	Flow Pressure	207 mL (7 oz)/30 sec min. 19.6 kPa (0.196 bar) (2.8 psi)
SECTION 50 - POWER TRAIN REPAIR		
TRANSMISSION		
Swashplate	Full Movement	25 mm (1 in.)
Meter Shaft Bearing Race	Mounting surface to bearing race	5 mm (0.187 in.)
Spring Pin-to-Swashplate	Depth	6 mm (0.250 in.)
Valve Plate Needle Bearings	Top of bearing to cover surface	3 mm (0.109 in.)
Cover-to-Housing Cap Screws	Torque	35 N·m (28 lb-ft)
Hydraulic Line Fitting	Torque	24 N·m (215 lb-in.)
Transmission-to-Differential cap screws	Torque	45 N·m (35 lb-ft)
CHARGE PUMP		
Pump-to-Transmission Cap Screws	Torque	70 N·m (50 lb-ft)
DIFFERENTIAL		
Carrier-to-Holder Cap Screw	Torque	52 N·m (37 lb-ft)
Cover-to-Case Cap Screw	Torque	22 N·m (192 lb-in.)
AXLES		
Axle-to-Differential Seal	Depth	3 mm (0.125 in.)
Axle-to-Differential Cap Screw	Torque	80 N·m (60 lb-ft)
Axle-to-Frame Cap Screw	Torque	106 N·m (78 lb-ft)

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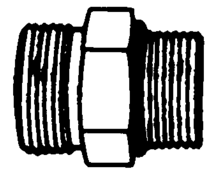
REPAIR SPECIFICATIONS—CONTINUED

Item	Measurement	Specification
SECTION 60 - STEERING AND BRAKE REPAIR		
STEERING		
Steering Wheel-to-column Nut	Torque	14 N·m (12 lb-in.)
Steering Valve Rotor-to-Stator	Maximum Clearance	0.08 N·m (0.003 in.)
Bushing	Depth below top of steering tube	2.5 mm (0.100 in.)
METERING ASSEMBLY-TO-VALVE		
Screw	Torque	1.4 N·m (12 lb-in.)
Steering Valve Nuts	Torque	30 N·m (22 lb-ft)
Relief Valve Plug	Torque	14 N·m (124 lb-in.)
Implement Relief Valve	Torque	14 N·m (124 lb-in.)
Steering Link-to-Axle Nut	Torque	75 N·m (55 lb-ft)
BRAKES		
Brake Plate-to-Frame Cap Screw	Torque	68 N·m (50 lb-ft)
Brake Drum-to-Axle Shaft Nut	Torque	115-156 N·m (85-115 lb-ft)
Hub-to-Drum Cap Screws	Torque	95 N·m (70 lb-ft)
FRONT AXLE		
Steering Link-to-Axle Nut	Torque	75 N·m (55 lb-ft)
Front Wheel Cap Screws	Torque	81-95 N·m (60-70 lb-ft)
Axle-to-Tie Rod End Nut	Torque	61 N·m (45 lb-ft)
Front Axle Mounting Bolt	Torque	668 N·m (150 lb-ft)

MX,1015HJ,1A -19-14APR92

SERVICE RECOMMENDATIONS FOR O-RING BOSS FITTINGS


T6243AE -UN-18OCT88

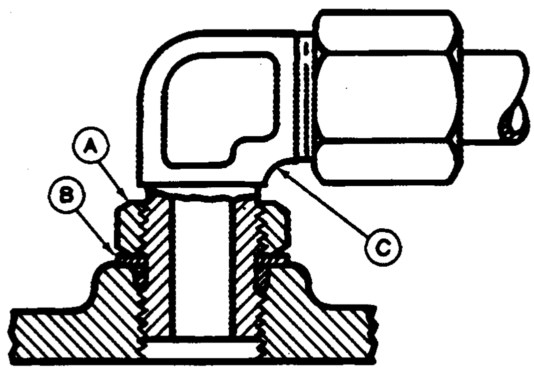
STRAIGHT FITTING

1. Inspect O-ring boss seat for dirt or defects.

2. Lubricate O-ring with petroleum jelly. Place electrical tape over threads to protect O-ring. Slide O-ring over tape and into O-ring groove of fitting. Remove tape.

3. Tighten fitting to torque value shown on chart.

ANGLE FITTING



T6520AB -UN-18OCT88

1. Back-off lock nut (A) and back-up washer (B) completely to head-end (C) of fitting.

2. Turn fitting into threaded boss until back-up washer contacts face of boss.

3. Turn fitting head-end counterclockwise to proper index (maximum of one turn).

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

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

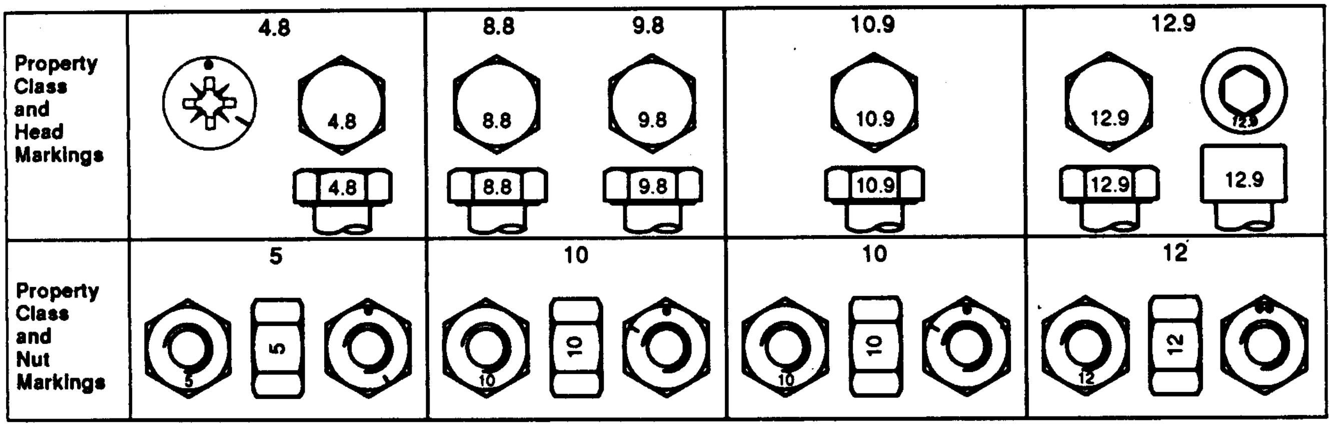
TORQUE VALUE

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

NOTE: Torque tolerance is ± 10%.

04T,90,K66 -19-21JAN92

METRIC BOLT AND CAP SCREW TORQUE VALUES



TS1163 -19-04MAR91

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	220	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.

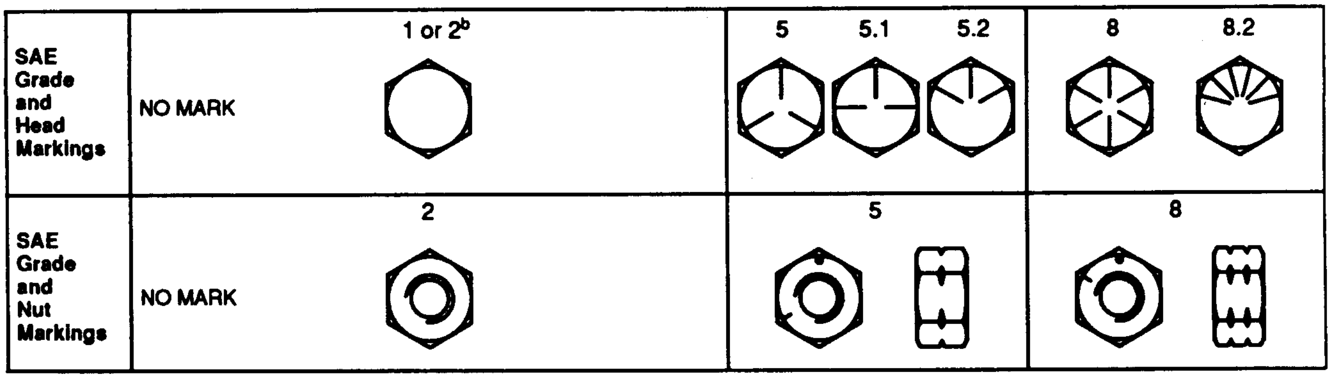
[a] *"Lubricated means coated with a lubricant such as engine oil, or fasteners with phosphate and oil coatings. "Dry means plain or zinc plated without any lubrication.*

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.

DX,TORQ2 -19-05JUN91

UNIFIED INCH BOLT AND CAP SCREW TORQUE VALUES



TS1162 -19-04MAR91

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.

[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.*

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.

DX,TORQ1 -19-15MAR91

FUEL

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

IMPORTANT: To avoid engine damage, DO NOT mix oil with gasoline.

Unleaded fuel is recommended because it burns cleaner and leaves less unburned deposits in engine combustion chamber. Regular leaded gasoline with an anti-knock index of 87 or higher may be used.

Use of gasohol is acceptable as long as the ethyl alcohol blend does not exceed 10 percent. Unleaded gasohol is preferred over leaded gasohol.

Fuel Tank Capacity . . . . 30 L (8 U.S. gal)

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

MX,1020HJ,1 -19-14APR92

STORING FUEL

If there is a very slow turnover of fuel in the fuel tank or supply tank, it may be necessary to add a fuel conditioner to prevent water condensation. Contact your John Deere dealer for proper service or maintenance recommendations.

DX,FUEL -19-04JUN90

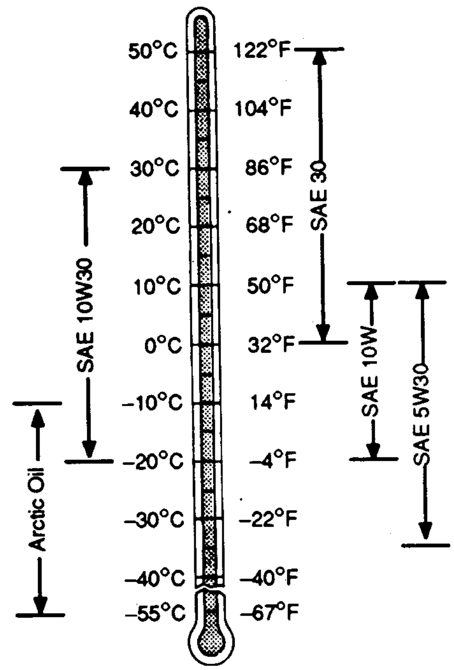
GASOLINE ENGINE OIL

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

John Deere PLUS-4® engine oil is recommended.

Other oils may be used if they meet API Service Classification SG or SF.

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



TS239 -19-28NOV90

DX,GAS -19-15MAR91

ENGINE COOLANT

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

HYDROSTATIC DRIVE OIL

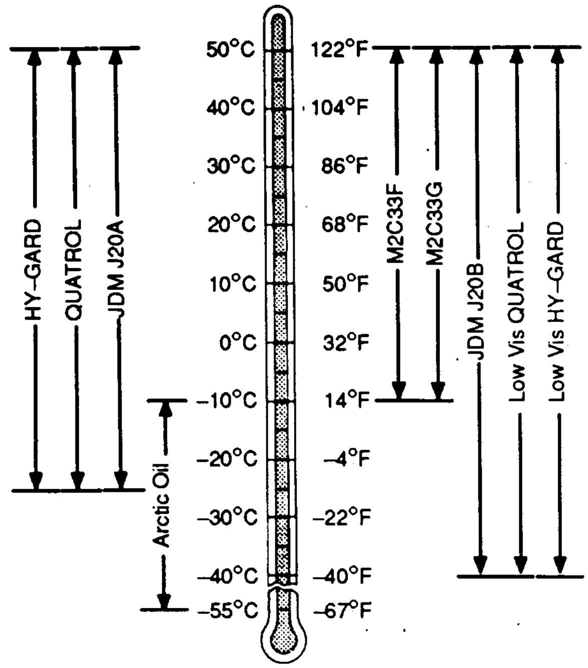
Use oil viscosity based on the expected air temperature range during the period between oil changes.

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

Other oils may be used if they are QUATROL® oils or if they meet John Deere Standard JDM J20A or J20B.

Automatic transmission fluids of Type M2C33F or M2C33G may also be used.

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



-19-28NOV90

TS244

DX,HOIL2 -19-15MAR91

EXTREME PRESSURE OR MULTIPURPOSE GREASE

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

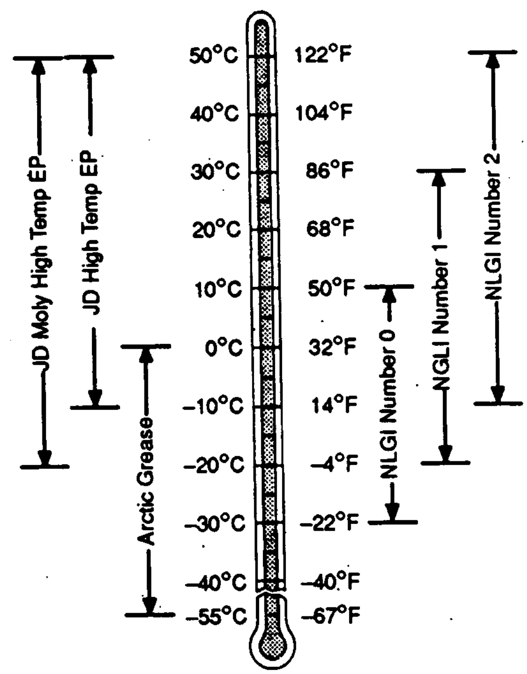
John Deere Moly High Temperature EP Grease and John Deere High Temperature EP Grease are recommended.

Other greases that may be used are:

• SAE Multipurpose EP Grease with 3 to 5 percent molybdenum disulfide.

• SAE Multipurpose EP Grease.

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



-19-28NOV90

TS248

DX,GREA1 -19-15MAR91

LUBRICANT STORAGE

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

Use clean containers to handle all lubricants.

Store lubricants and containers in an area protected from dust, moisture, and other contamination.

DX,LUBST -19-15MAR91

ALTERNATIVE LUBRICANTS

Conditions in certain geographical areas outside the United States and Canada may require different lubricant recommendations than these printed in the operator's manual. Consult manufacturer to obtain the alternative lubricant recommendations.

WX,622,FUEL,E -19-09MAY90

10
25
1

SERIAL NUMBERS

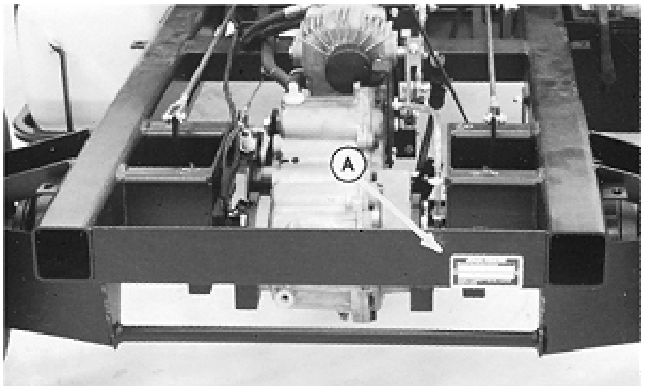
When working on machines or components that are covered by warranty, it is IMPORTANT that you include the tractor Product Identification Number and the component serial number on the warranty claim form.

the location of component serial number plates are shown below.

M21,1030R,1 -19-22APR85

RECORD PRODUCT IDENTIFICATION NUMBER

The tractors' 13 digit product identification number (A) is located on the rear of the vehicle frame.

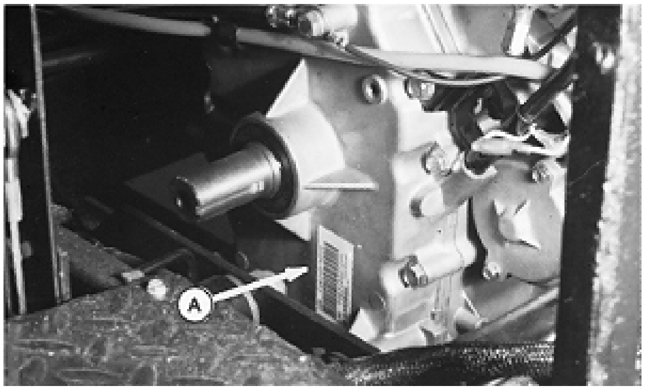


M46590 -UN-27MAR92

MX,1025HJ,1 -19-14APR92

RECORD ENGINE SERIAL NUMBER

The engine serial number is located in two places, the air cleaner housing and the front of the engine case (A).

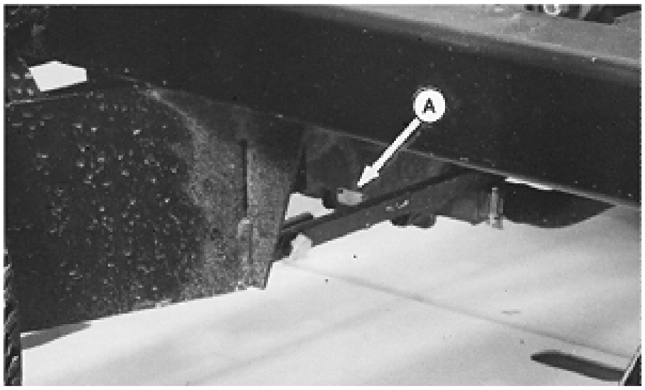


M46568 -UN-27MAR92

MX,1025HJ,2 -19-14APR92

RECORD DIFFERENTIAL SERIAL NUMBER

The vehicles' differential serial number plate (A) is located on the right side of the housing.



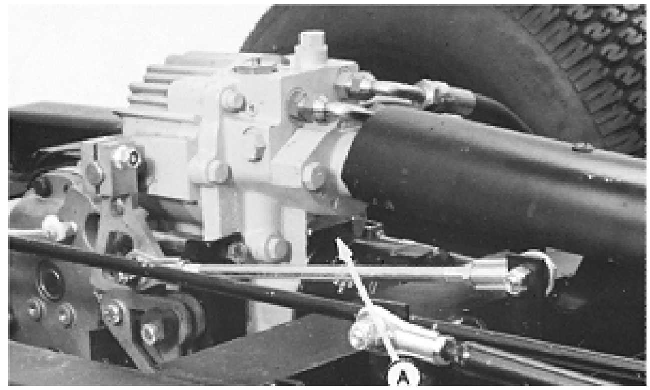
M46591 -UN-27MAR92

MX,1025HJ,3 -19-14APR92

RECORD HYDROSTATIC TRANSMISSION SERIAL NUMBER

Note: Rear mounted features must be removed to access serial number plate.

The hydrostatic transmission serial number (A) is embossed on the top of the case.



M46592 -UN-27MAR92

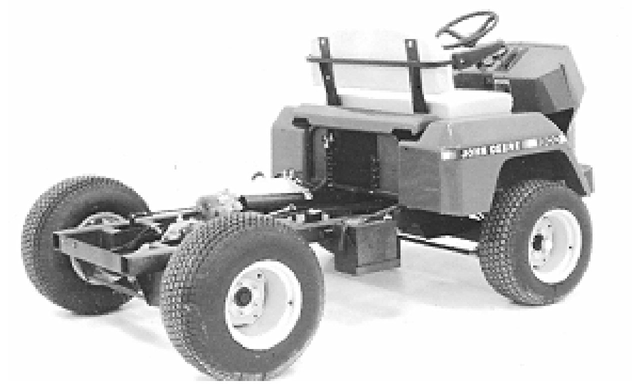
MX,1025HJ,4 -19-14APR92

FEATURES AND ATTACHMENTS INFORMATION

The information covered in this group pertains to the features of each of the models covered in this Technical Manual. It can be used in addition to the normal advertising literature or may help in determining which specific feature requires service. A list of all the available attachments and kits is also included.

MX,1030FS,1 -19-16SEP91

STANDARD FEATURES



M46593 -UN-27MAR92

•Kawasaki “V-Twin” K-Series Gasoline Engine
—Twin cylinder, liquid cooled
—FD620D, 14.9 kW (20 Hp)

•Sauer Sundstrand Series 15, Hydrostatic Transmission
—Infinite number of speeds

•Peerless Single Speed Differential
—Rear wheel drive
—Park lock

•Single Fuel Tank, 30.3 L (8 gal) Capacity
—3 L (.8 gal) per hour fuel consumption

•Hydrostatic Power Steering
—Front wheel steering

•Dry Shoe Brakes
—Two motion release
—Foot pedal for combination transmission return-to-neutral and actuation of brake.

•Transmission Oil Cooler

•Safety Start System
—Park brake switch and seat switch.

•INSTRUMENTATION-DASH MOUNTED
—Speedometer
—Engine rpm indicator
—Hourmeter
—Low battery indicator light
—Engine coolant temperature light
—Engine oil pressure indicator light

•TIRES
—Front - 23 x10.5 - 12 Softrac
—Rear - 26 x 12.0 -12 Softrac

MX,1030HJ,1 -19-14APR92

Section 20
Engine Repair

Contents

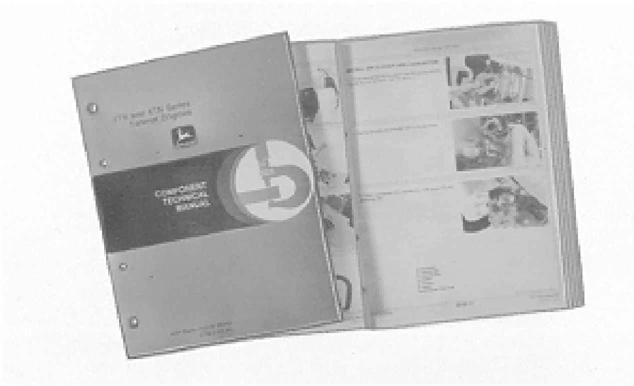
Page

Group 05—Engine
Remove Engine 20-05-2
Install Engine 20-05-4
Replace Cooling Fan Belt 20-05-5

JOHN DEERE ENGINE REPAIR—USE CTM39

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

Use the component manual in conjunction with this machine manual.



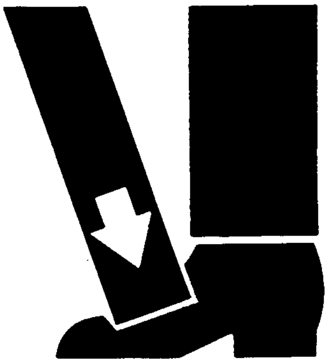
TS225 -UN-17JAN89

MX,2005FH,A1 -19-15JAN91

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 ENGINE

1. Disconnect battery negative (-) cable.

N **CAUTION: Allow muffler to cool before removing or serious burns may result.**

2. Remove exhaust pipe (A).

N **CAUTION: Gasoline vapor is explosive. Do Not expose to spark or flame or serious personal injury may result.**

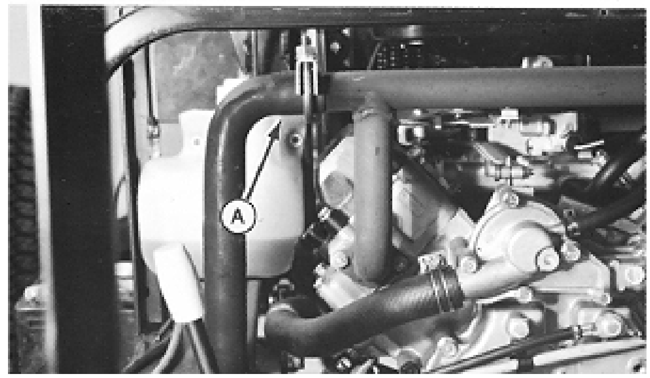
3. Disconnect and cap fuel line (B).

4. Disconnect throttle and choke cables (C).

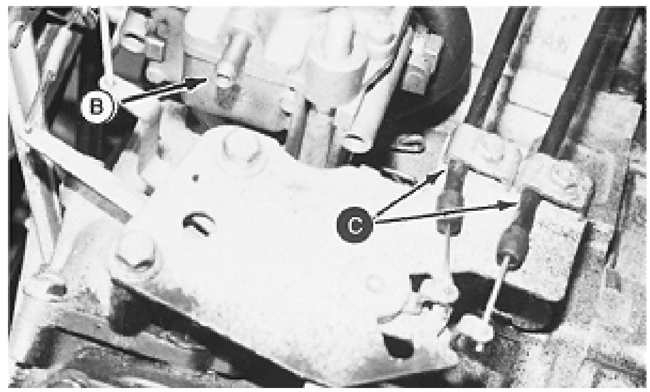
5. Disconnect drive shaft.

6. Disconnect engine to frame electrical harness (D).

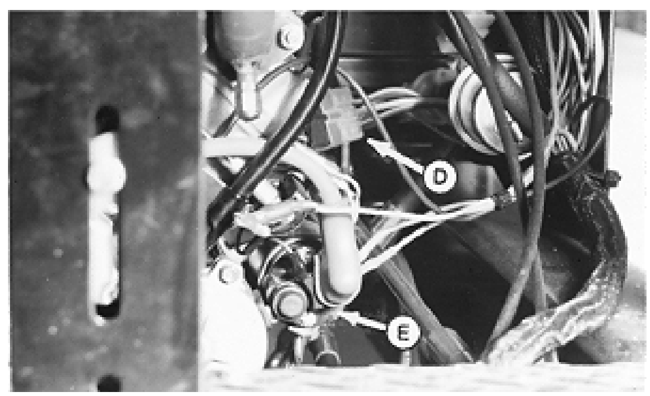
7. Disconnect battery and electrical connections from starter solenoid (E).



M46594 -UN-27MAR92



M46581 -UN-27MAR92



M46587 -UN-27MAR92

A—Exhaust Pipe
B—Fuel Line
C—Throttle, Choke Cable
D—Electrical Harness
E—Solenoid Connections

MX,2005HJ,1 -19-14APR92

8. Attach lifting brackets (A) such as JDG19 or JTO1748.

9. Attach a suitable hoist to the lifting brackets.

10. Remove four engine mounting bolts (B).

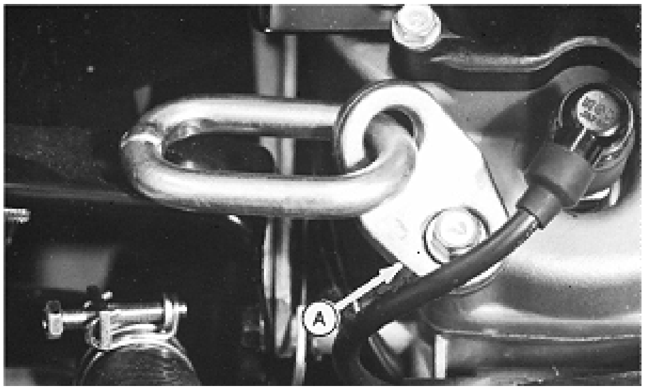
11. Carefully remove engine and radiator from vehicle chassis.

12. Remove coolant hoses (C).

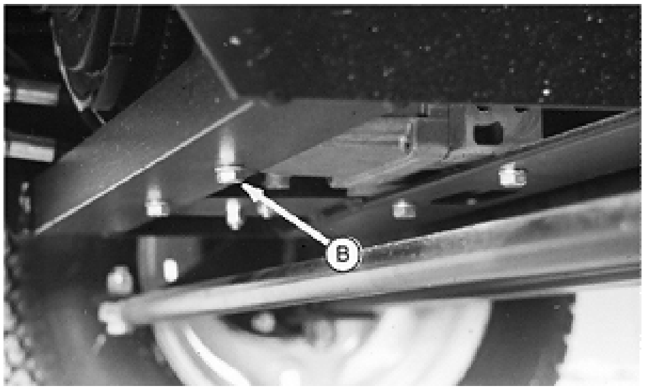
13. Remove four radiator mounting bolts (D) and remove radiator and shroud.

14. Make necessary repairs using CTM 39.

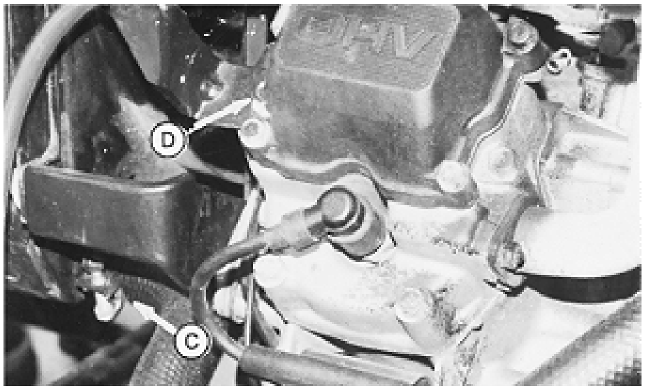
A—Lifting Brackets
B—Engine Mounting Bolts
C—Coolant Hoses
D—Radiator Mounting Bolts



M46595 -UN-27MAR92



M46571 -UN-27MAR92



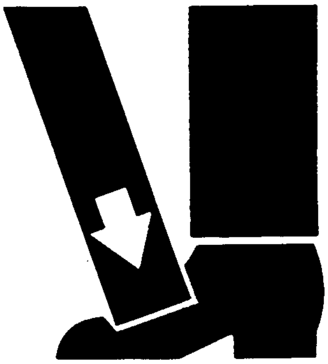
M46596 -UN-27MAR92

MX,2005HJ,2 -19-14APR92

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

INSTALL ENGINE

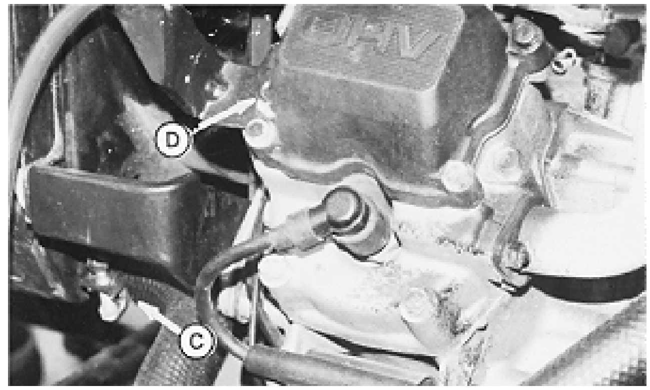
1. See Replace Cooling Fan Belt in this section. Refer to Section 220, Group 15 to adjust cooling fan belt.

2. Install radiator with shroud and secure with four cap screws (D). Install coolant hoses on engine and secure with clamps (C).

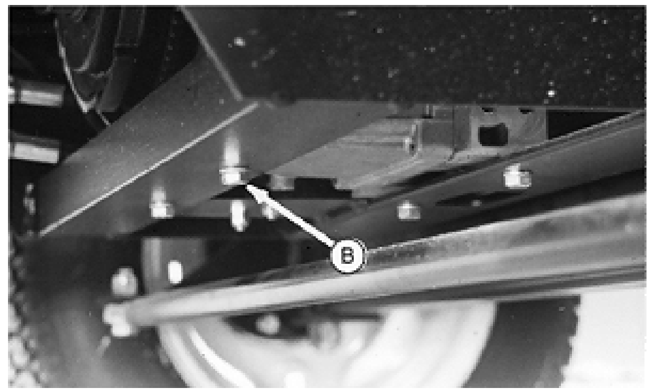
3. Lower engine and radiator into chassis.

4. Install four engine mounting bolts (B) and tighten to specifications.

5. Remove lifting brackets and tighten cylinder head cap screws to 21 N·m (186 lb-in.)



M46596 -UN-27MAR92

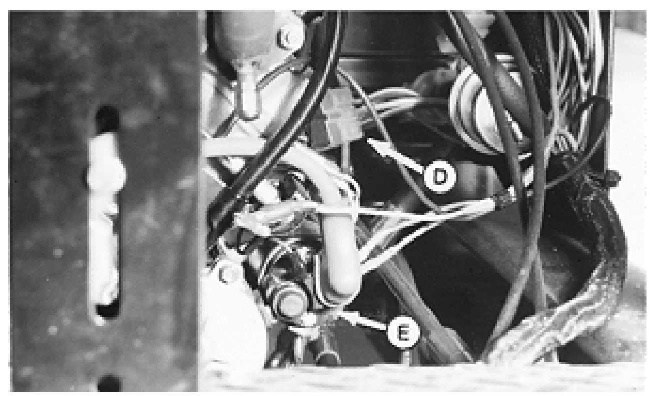


M46571 -UN-27MAR92

MX,2005HJ,3 -19-14APR92

6. Connect battery (+) leads, electrical leads (E) to starter solenoid, and electrical harness (D).

7. Connect engine to frame electrical harness.



M46587 -UN-27MAR92

MX,2005HJ,3A -19-14APR92

8. Connect drive shaft. Tighten cap screws to specifications.

9. Connect throttle and choke cables (C) to governor bracket.

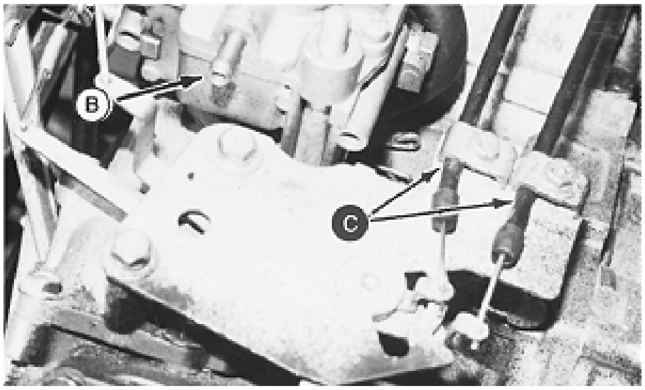
10. Connect fuel line (B) to carburetor.

11. Install muffler (A).

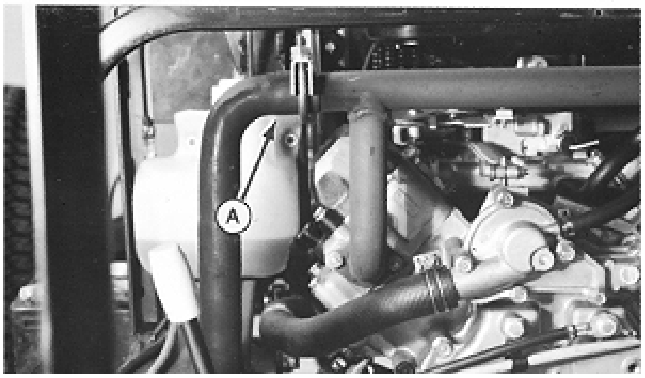
12. Connect battery (-) cable.

TORQUE SPECIFICATIONS

Engine Mount Cap Screws	18 N·m (160 lb-in.)
Drive Shaft Cap Screws	35 N·m (27 lb-ft)



M46581 -UN-27MAR92



M46594 -UN-27MAR92

MX,2005HJ,4 -19-14APR92

REPLACE COOLING FAN BELT

1. Disconnect battery negative (-) cable.

NOTE: Remove spark plugs to allow easy flywheel rotation.

2. Remove spark plugs.

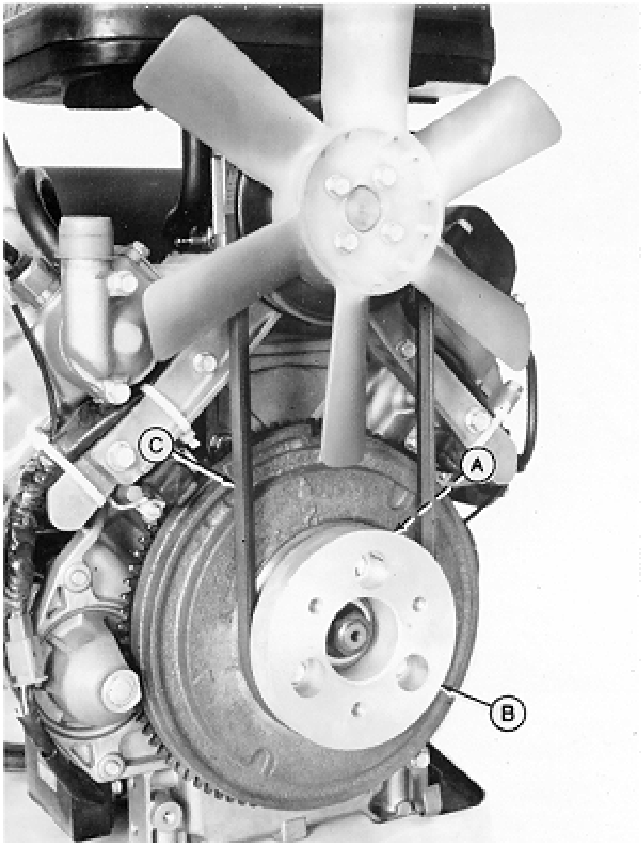
3. Disconnect drive shaft.

4. Remove outer sheave half (B) and shims(s) of fan pulley.

5. Replace belt (C).

NOTE: Removal of shims(s) (A) will allow outer sheave half to fit closer to flywheel, increasing belt tension.

6. Install shims as required.



M54133 -UN-25MAY90

MX,2005HJ,5 -19-14APR92

IMPORTANT: To avoid pinching fan belt between flywheel and outer sheave half, rotate flywheel while tightening outer sheave half mounting cap screws.

7. Install outer sheave half and cap screws loosely. Rotate flywheel while tightening mounting cap screws. Tighten cap screws to specifications.

8. Adjust cooling fan belt tension. (See Section 220, Group 15).

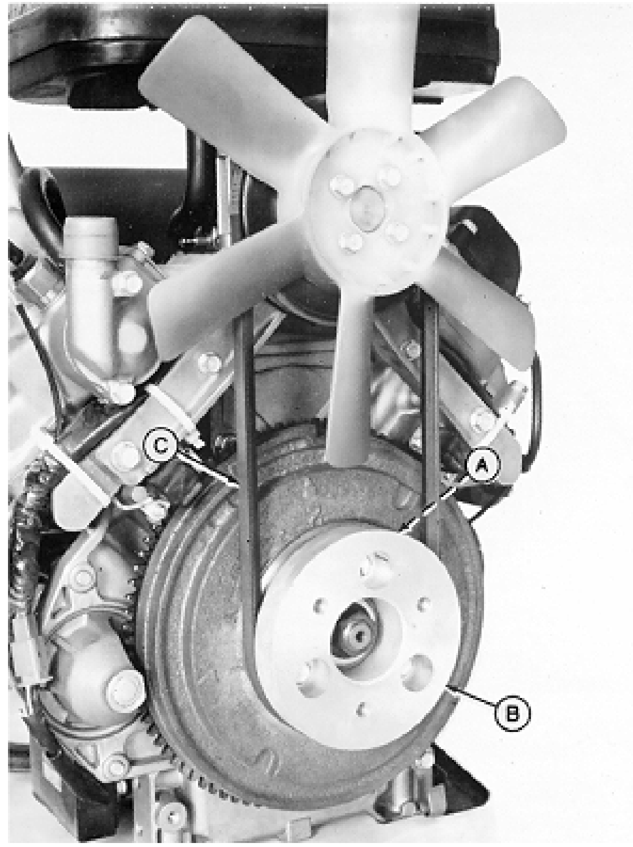
9. Connect drive shaft. Tighten cap screws to specifications.

10. Install spark plugs and tighten to specifications.

11. Connect negative (-) battery cable.

TORQUE SPECIFICATIONS

Outer Sheave Half	15 N·m (130 lb-in.)
Drive Shaft	35 N·m (27 lb-in.)
Spark Plugs	20 N·m (177 lb-in.)



M54133 -UN-25MAY90

MX,2005HJ,6 -19-14APR92

Section 30
FUEL AND AIR REPAIR

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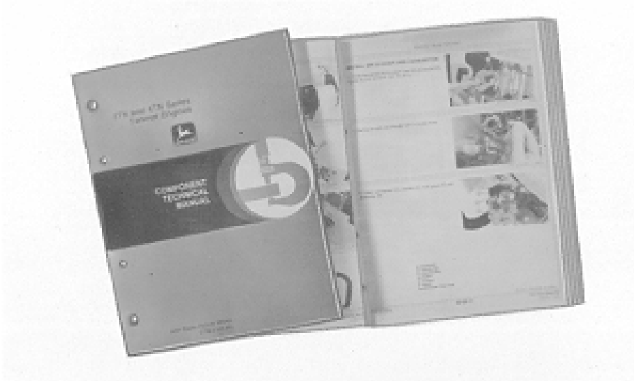
CARBURETOR REPAIR - USE CTM39

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

Use the component manual in conjunction with this machine manual.



TS225 -UN-17JAN89

MX,3005HJ,1 -19-14APR92

REPLACE FUEL FILTER

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

1. Disconnect hoses from filter (A). Close all openings using caps and plugs.

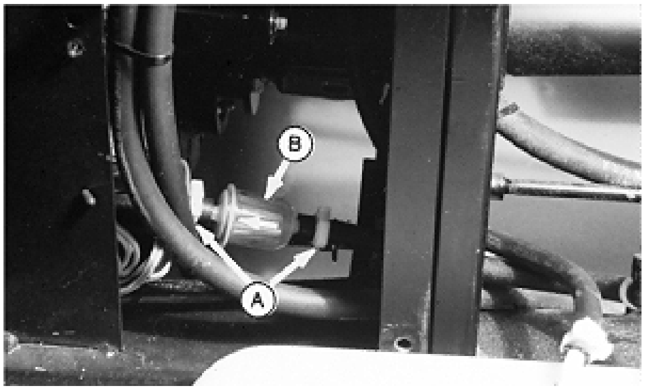
2. Remove filter.

NOTE: Arrow on filter housing must point in direction of fuel flow.

3. Install filter with arrow (B) pointing in direction of carburetor.

4. Connect hoses and tighten clamps.

5. Check for leaks with ignition switch in RUN position.



M46556 -UN-27MAR92

MX,3005HJ,2 -19-14APR92

REPLACE FUEL TRANSFER PUMP

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

1. Disconnect electrical leads (A).

2. Disconnect fuel lines (B,C).

3. Remove transfer pump mounting bolts (D).

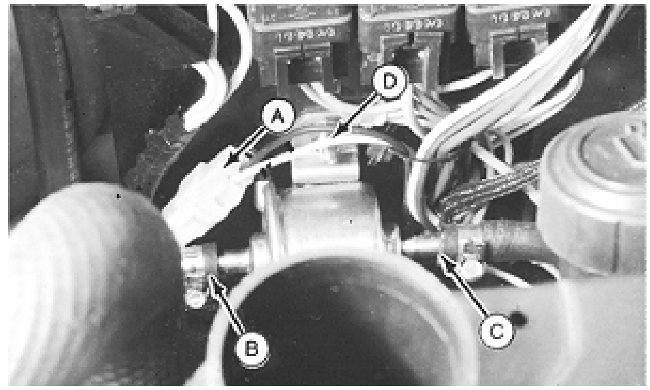
NOTE: Position the side of the transfer pump marked IN towards the rear of the vehicle.

4. Correctly position the fuel transfer pump and install the mounting bolts (D).

5. Locate the fuel line coming from the fuel filter and fuel tank and connect it to the transfer pump "IN" connection (B).

6. Locate the fuel line coming from the carburetor and connect it to the transfer pump OUT connection (C).

7. Connect the electrical connectors to the transfer pump (A).



M46597 -UN-27MAR92

A—Electrical Leads
B—"IN" Fuel Line
C—"OUT" Fuel Line
D—Mounting Bolts

MX,3005HJ,3 -19-14APR92

REPLACE FUEL LINES

N **CAUTION: Fuel vapor is explosive. Do Not expose to spark or flame. Serious personal injury can result.**

1. Remove the defective fuel line.

N **CAUTION: Only use fuel line that is approved for use with fuel systems. Serious personal injury can result if leaking fuel is ignited.**

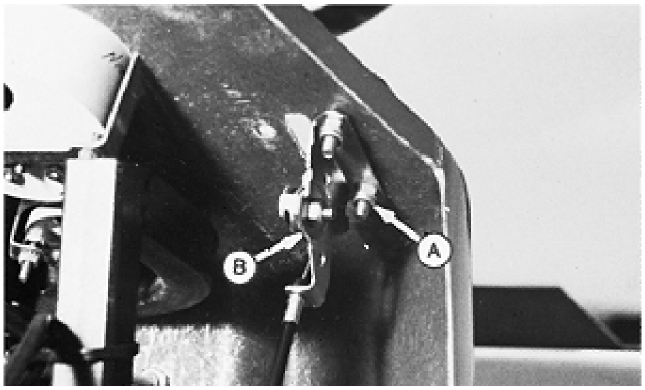
N **CAUTION: Ensure fuel line will not contact moving parts or linkages and avoid routing that will expose fuel line to heat, spark or flame. Serious personal injury could result.**

2. Ensure the fuel line is the correct length and has the correct inside diameter and install with serviceable clamps.

3. Check for fuel leaks and repair if necessary before returning the equipment to service.

MX,3005HJ,4 -19-14APR92

REPLACE THROTTLE CONTROL LEVER AND CABLE



M46588 -UN-27MAR92

1. Loosen cap screw securing throttle cable to governor bracket.

2. Remove knob from throttle arm.

3. Remove two screws (A) securing throttle lever to dashboard and remove throttle lever assembly (B).

4. Place throttle lever assembly (B) through dashboard and secure with two screws (A).

5. Install knob on throttle lever.

6. Route cable through guides and insert into throttle arm on governor bracket.

7. See Throttle Cable Adjustment Section 220, Group 15.

8. See Throttle Lever Adjustment Section 220, Group 15.

MX,3005HJ,5 -19-14APR92

REPLACE CHOKE CABLE

1. Raise seat and remove air cleaner assembly.

2. Remove clamp and disconnect choke cable from choke lever.

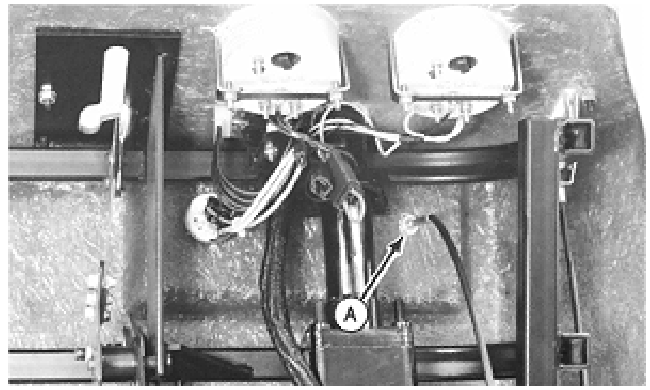
3. Loosen mounting nut (A) and slide nut onto cable sheathing.

4. Pull choke lever (B) and cable from dashboard. Do not loose mounting nut when removing cable from dashboard.

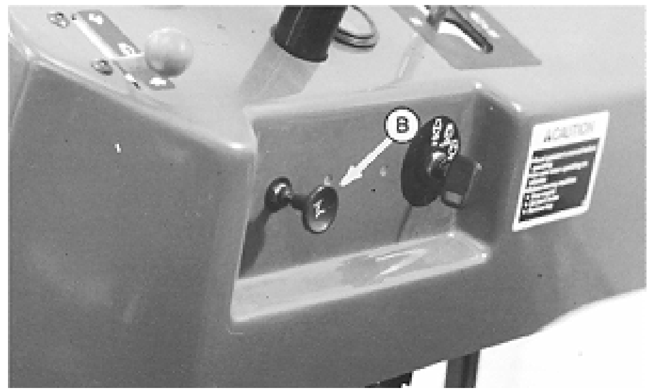
5. Guide choke cable (B) assembly through mounting hole in dashboard. Slide mounting nut (A) over cable end and secure cable assembly to dashboard.

6. Insert cable end into choke lever and secure cable sheathing to governor bracket with clamp and cap screw. See Choke Adjustment Section 220, Group 15.

NOTE: Front operator's station shroud removed for illustration purposes.



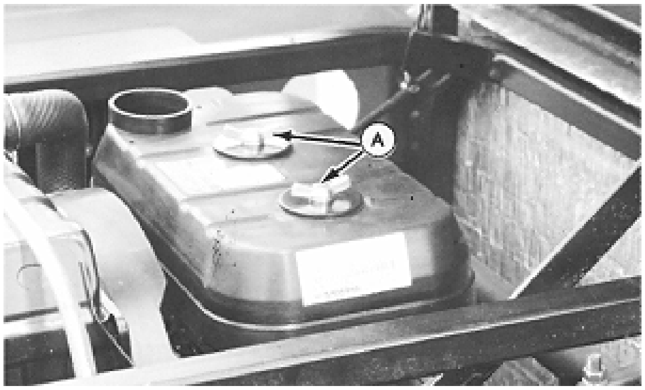
M46598 -UN-27MAR92



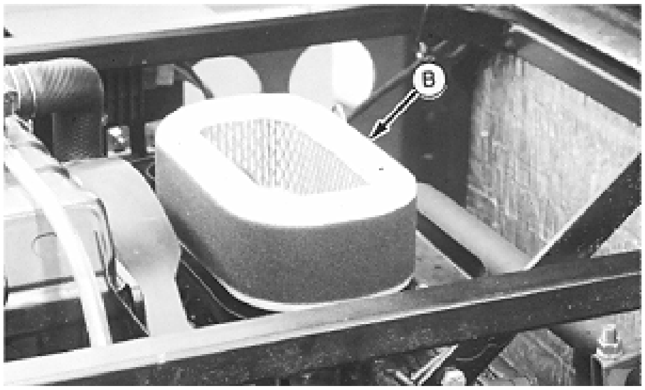
M46599 -UN-27MAR92

MX,3005HJ,6 -19-14APR92

REMOVE, INSPECT, AND INSTALL AIR CLEANER ELEMENTS



M46582 -UN-27MAR92



M46583 -UN-27MAR92

1. Lift seat to gain access to air cleaner.

2. Remove wing nuts (A), air cleaner cover, and element (B).

3. Inspect gasket for wear or damage. Replace if necessary.

4. Install element (B) and cover.

5. Secure cover with two wing nuts (A).

MX,3010HJ,1 -19-14APR92

Section 40
ELECTRICAL REPAIR

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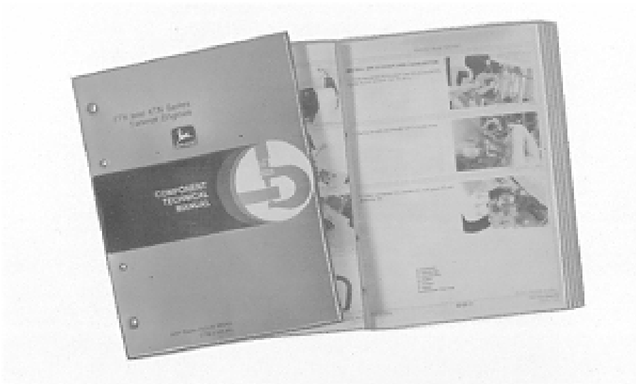
40

STATOR REPAIR - USE CTM39

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,4005HJ,1 -19-14APR92

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 -19-04JUN90

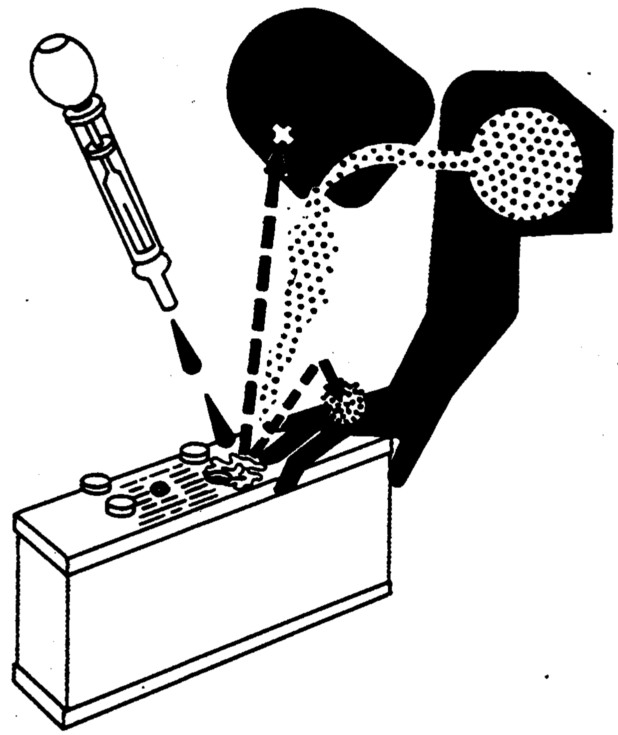
PREVENT ACID BURNS

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

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

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

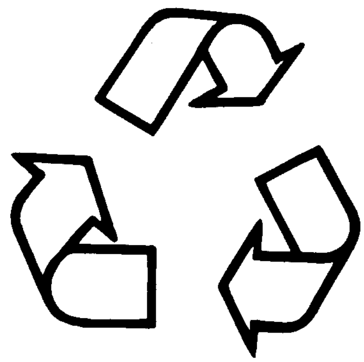
If acid is swallowed:
1. Drink large amounts of water or milk.
2. Then drink milk of magnesia, beaten eggs, or vegetable oil.
3. Get medical attention immediately.



TS203 -UN-23AUG88

DX,POISON -19-04JUN90

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.

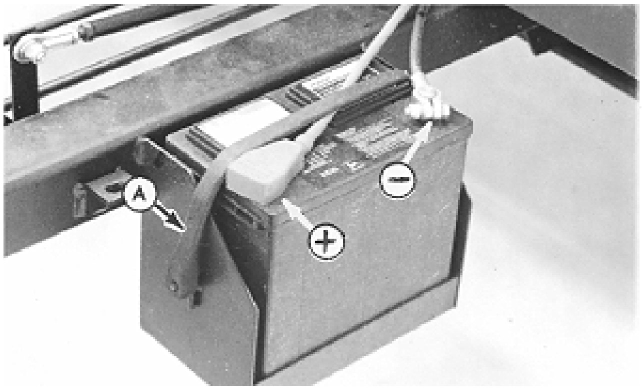
Do not pour waste onto the ground, down a drain, or into any water source.

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 -19-09AUG91

REMOVE AND INSTALL BATTERY



M46589 -UN-27MAR92

N **CAUTION: Always remove the (-) battery terminal first when disconnecting the battery. Failure to do so could result in severe personal injury.**

1. Disconnect battery (-) and (+) terminals.

2. Remove battery hold down strap (A). Remove battery.

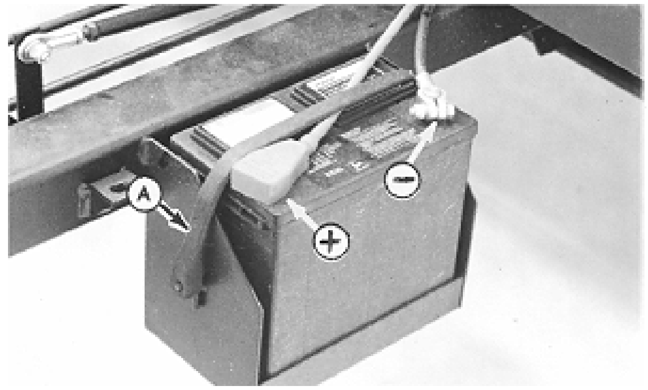
N **CAUTION: Always connect the battery (-) terminal last when connecting battery terminals. Failure to do so could result in severe personal injury.**

3. Place battery in holder and secure with hold down strap (A).

4. Ensure connections are clean and connect terminals (battery (-) cable last).

MX,4005HJ,2 -19-14APR92

REPLACE BATTERY CABLES



M46589 -UN-27MAR92

Caution: Always disconnect battery (-) cable first before disconnecting battery (+) and connect battery (-) last after connecting battery (+) to avoid serious personal injury.

1. Disconnect (-) battery cable.

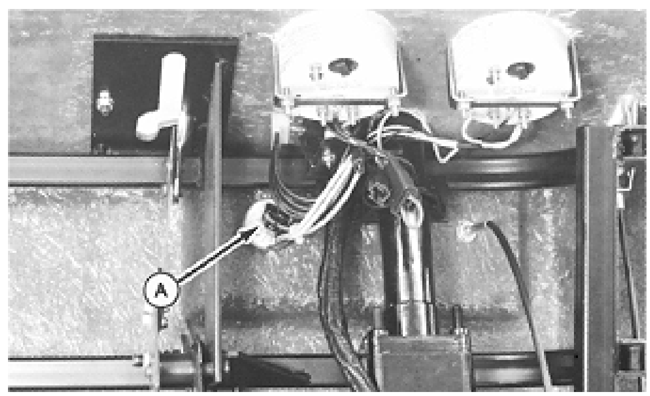
2. Remove defective cable. (Disconnect at battery first).

IMPORTANT: Replacement cable must be the proper gauge, have sufficient length to avoid moving linkages and allow for engine movement. Cable must be secured properly to avoid rubbing against metal that could wear through the protective cable insulation.

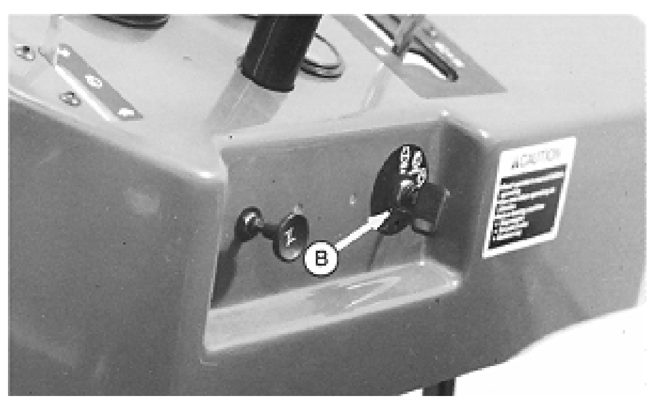
3. Ensure connections are clean and install cable.

MX,4005HJ,3 -19-14APR92

REPLACE IGNITION KEY SWITCH



M46601 -UN-27MAR92



M46600 -UN-27MAR92

1. Disconnect battery (-) cable.

2. Disconnect electrical connector (A) at starter switch.

3. Rotate knurled trim ring (B) counterclockwise and remove switch.

4. Position switch in mounting hole and install trim ring (B). Do Not tighten.

5. Insert key, ensure switch is OFF by rotating key counterclockwise and align key with off position labeled on dashboard decal. Tighten trim ring (B).

6. Connect electrical connector (A) and battery (-) cable and perform operational checkout.

MX,4005HJ,4 -19-14APR92

REPLACE VOLTAGE REGULATOR

1. Disconnect electrical connector (A) at regulator.

2. Remove two mounting bolts (B) securing regulator to vehicle frame.

3. Position regulator and ground wires on vehicle frame and secure with two cap screws (B).

4. Connect electrical connector (A) and perform an operational check of voltage regulator.

M46555 -UN-27MAR92

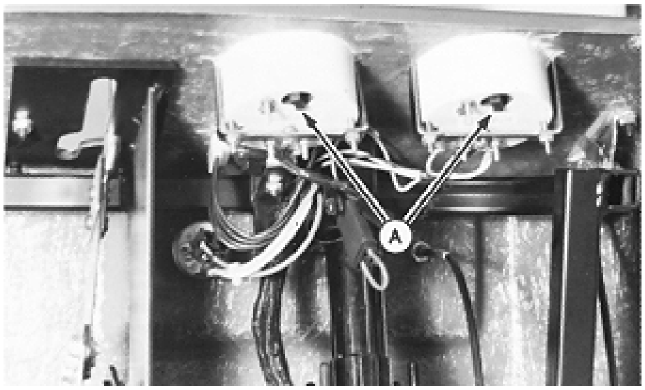
MX,4005HJ,5 -19-14APR92

REPLACE INSTRUMENT INDICATOR LAMPS

1. Identify lamp to be replaced and rotate lamp holder (A) counterclockwise to remove.

2. Remove bulb from holder and replace with a serviceable bulb.

3. Align tabs on bulb holder with slots in recepticle and rotate 1/4 turn clockwise to install.



M46584 -UN-27MAR92

MX,4005HJ,6 -19-14APR92

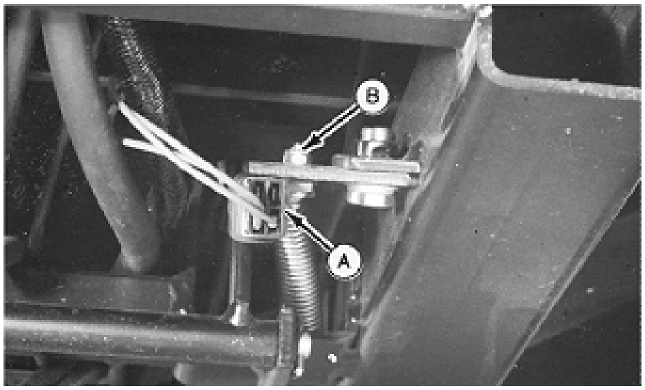
REPLACE STARTER INTERLOCK SWITCH

1. Disconnect electrical lead (A).

2. Remove two cap screws (B) and switch.

3. Position interlock switch and secure with two cap screws (B).

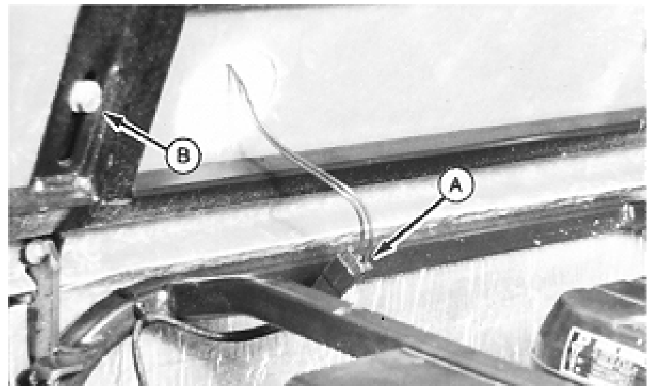
4. Connect electrical lead (A) and perform an operational check of switch.



M46575 -UN-27MAR92

MX,4005HJ,7 -19-14APR92

REPLACE SEAT SAFETY SWITCH



M46553 -UN-27MAR92

1. Disconnect seat switch at connector (A).

2. Remove four cap screws (B) securing seat cushion to platform.

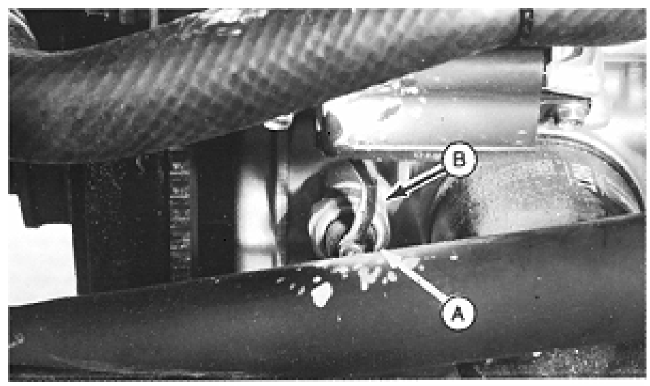
3. Replace cushion/switch.

4. Position seat cushion on platform and secure with four cap screws (B).

5. Connect seat switch wiring to connector (A).

MX,4005HJ,8 -19-14APR92

REPLACE OIL PRESSURE SENDER



M46602 -UN-27MAR92

1. Disconnect electrical lead (A).

2. Remove sender (B).

3. Apply teflon tape or a suitable sealant to threads of sender.

4. Install sender (B) and tighten until snug. DO NOT overtighten.

5. Connect electrical lead (A). Start engine and check for leaks.

MX,4005HJ,9 -19-14APR92

REPLACE COOLANT TEMPERATURE SENSOR

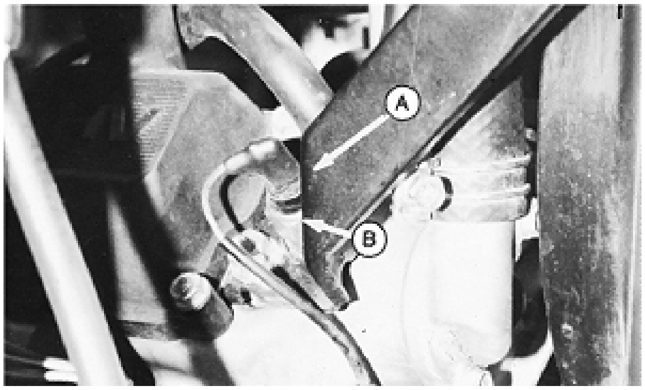
1. Disconnect electrical connector (A).

2. Remove sensor (B).

3. Apply teflon tape or a suitable sealant to threads of new sensor.

4. Install sensor (B) and tighten until snug, Do Not overtighten.

5. Connect electrical lead (A). Start engine and check for leaks.



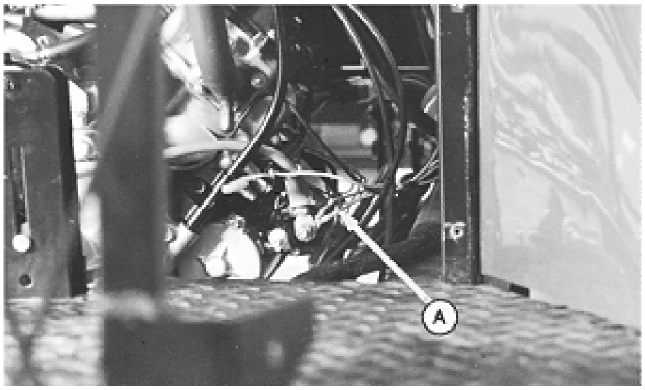
M46579 -UN-27MAR92

MX,4005HJ,10 -19-14APR92

REPLACE FUSIBLE LINK

1. Cut link (A) at splice points in harness.

2. Cut new link (A) to six inches and splice into harness.



M46603 -UN-27MAR92

MX,4005HJ,11 -19-14APR92

REMOVE AND INSTALL STARTER

1. Disconnect battery negative (-) cable.

2. Disconnect battery cable (A).

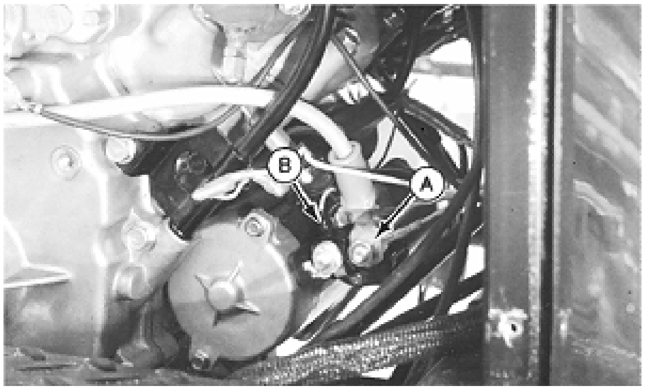
3. Disconnect solenoid wiring lead (B).

4. Remove two cap screws and starter.

5. Install starter and secure with two cap screws.

6. Connect battery cable (A) and solenoid wiring lead (B).

8. Connect battery (-) cable.



M46604 -UN-27MAR92

MX,4010HJ,1 -19-14APR92

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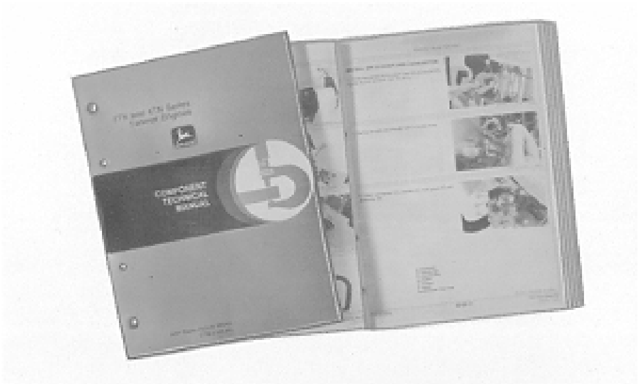
1

STARTER REPAIR - USE CTM39

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

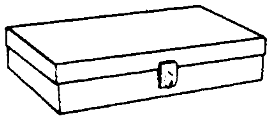
MX,4010HJ,2 -19-14APR92

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:

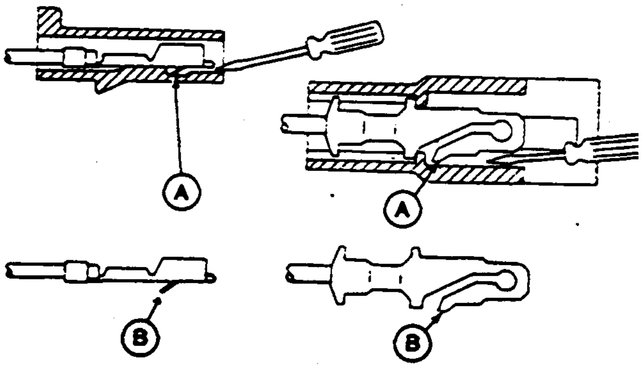
- RE11154 Electrical Connector and Wire Service Kit.

DX,ECONN,AE -19-04JUN90

REPLACE CONNECTOR BODY—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.



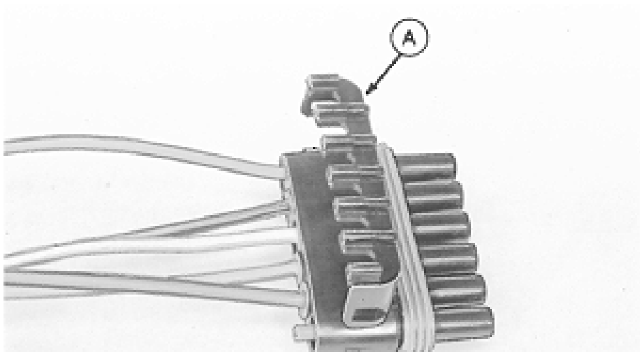
RW4218 -UN-23AUG88

MX,4025FH,A1 -19-26MAR92

REPLACE WEATHER PACK™ CONNECTOR

IMPORTANT: Identify wire color locations with connector terminal letters.

1. Open connector body (A).

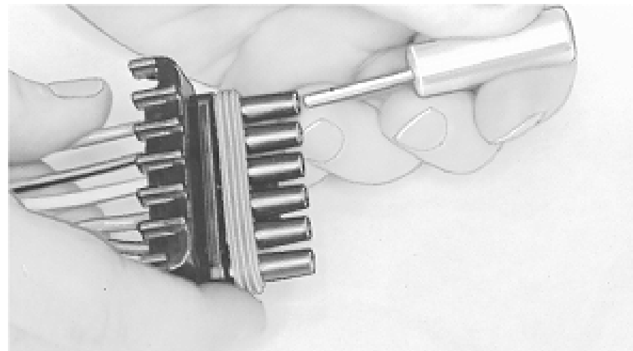


TS0127 -UN-23AUG88

WEATHER PACK is a trademark of PACKARD ELECTRIC

DX,ECONN,O -19-04JUN90

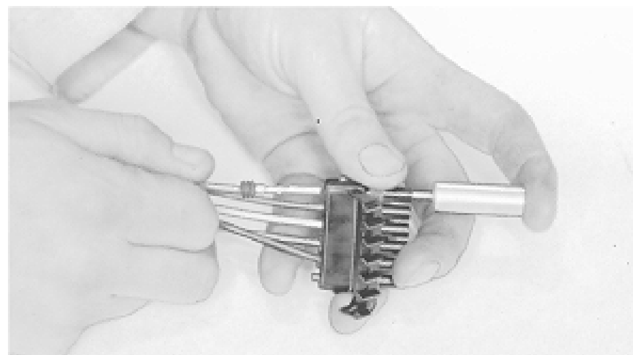
2. Insert JDG364 Extraction Tool over terminal contact in connector body.



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.



DX,ECONN,Q -19-04JUN90

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

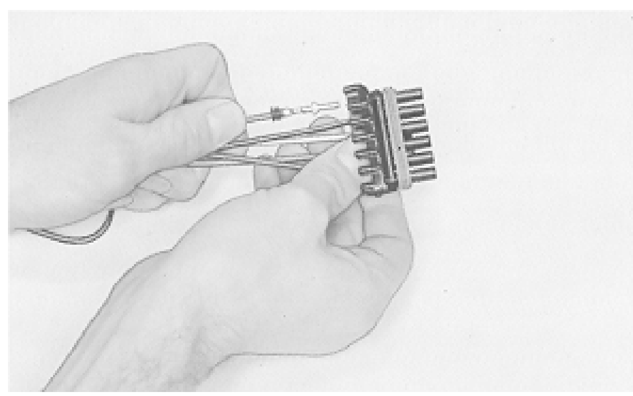
NOTE: Connector bodies are "keyed" for proper contact mating. Be sure contacts are in proper alignment.

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.



DX,ECONN,R -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.

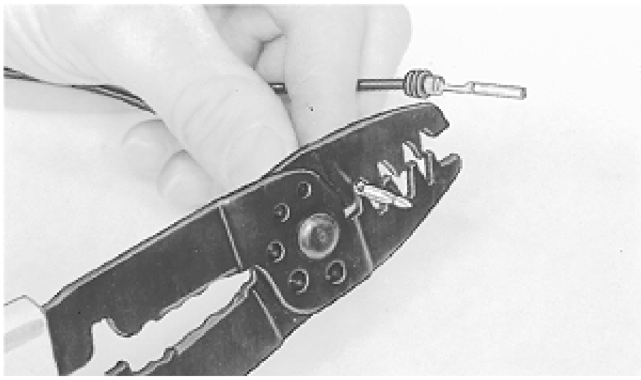
TS0136 -UN-23AUG88

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

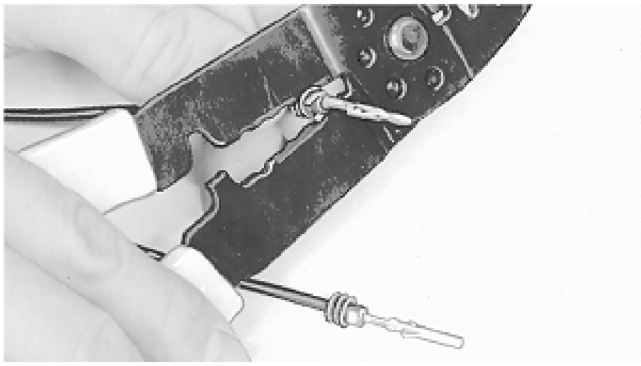
3. Place proper size contact on wire and use JDG144 Terminal Applicator to crimp contact in place with a “W” type crimp.



TS0137 -UN-23AUG88

DX,ECONN,AB -19-04JUN90

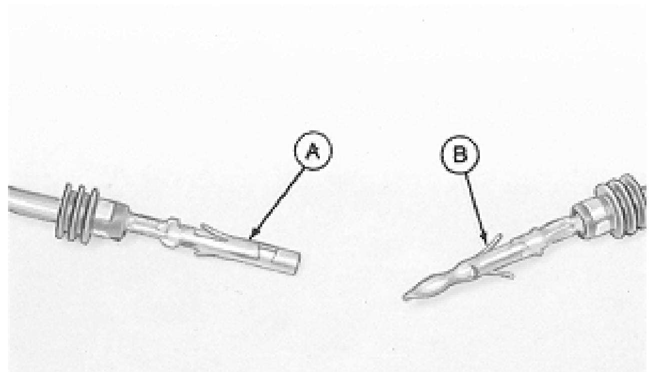
4. Use JDG144 Terminal Applicator to secure cable seal to contact as shown.



TS0138 -UN-23AUG88

DX,ECONN,AC -19-04JUN90

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



TS0139 -UN-02DEC88

DX,ECONN,AD -19-04JUN90

40
15
4

Section 50
POWER TRAIN REPAIR

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OTHER MATERIAL

Number	Name	Use
PT569	John Deere NEVER-SEEZ® Lubricant	Prevents parts from seizing or corroding.

NEVER-SEEZ is a trademark of the Emhart Chemical Group.

MX,5005FH,A1 -19-21NOV90

SERVICE PARTS KITS

The following kits are available through your parts catalog:

Check Valve Kit

Relief Valve Kit

Charge Pump Kit

MX,5005FH,A2 -19-21NOV90

REMOVE TRANSMISSION

1. Drain hydrostatic fluid.

2. Disconnect return hose and pressure line (A). Close all openings with caps and plugs.

NOTE: Guards removed for photos.

3. Disconnect and remove drive shaft. (See Group 20 in this section)

4. Disconnect shift linkage control rod (B).

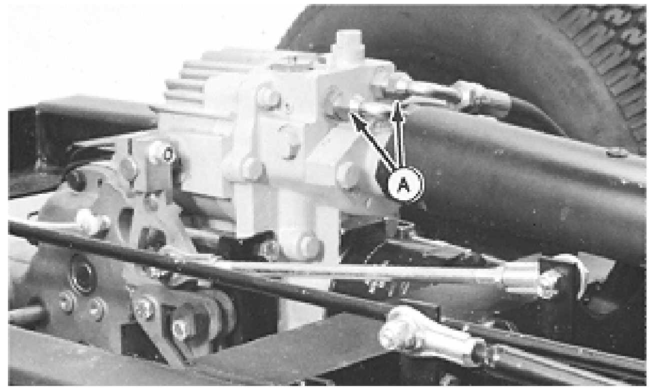
5. Disconnect suction hose (C).

6. Remove capscrew and eccentric (D).

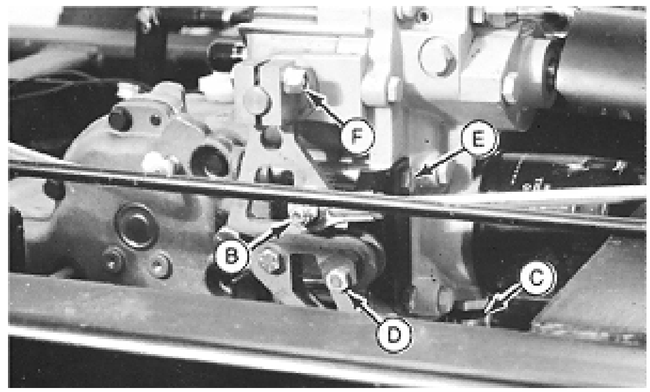
7. Remove four capscrews and spacers to remove transmission (E).

8. Loosen nut and bolt and slide shift linkage off shaft (F).

9. Make repairs as necessary. (See procedures in this group.)



M46605 -UN-27MAR92



M46606 -UN-27MAR92

A—Pressure and Return Lines
B—Control Rod
C—Suction Hose
D—Eccentric
E—Cap Screw
F—Shift Linkage

MX,5005HJ,1 -19-14APR92

DISASSEMBLE AND INSPECT TRANSMISSION

1. Clean outside of transmission with steam cleaner or diesel fuel.

2. Install transmission on bench fixture.

3. Remove filter (A).

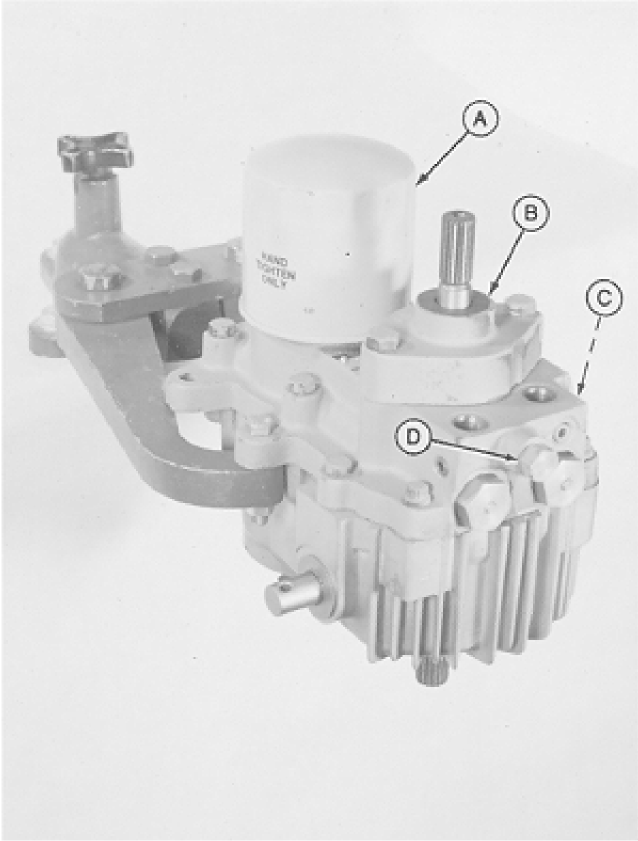
4. Remove charge pump (B). (See this group.)

5. Remove charge relief valve (C). (See this group.)

NOTE: Implement relief valve (D) is non-functional. Functional valve is located in steering valve.

6. Remove implement relief valve (D).

A—Oil Filter
B—Charge Pump
C—Charge Relief Valve
D—Implement Relief Valve (Non-Functional)



M36520 -UN-26AUG88

MX,5005FH,A9 -19-21NOV90

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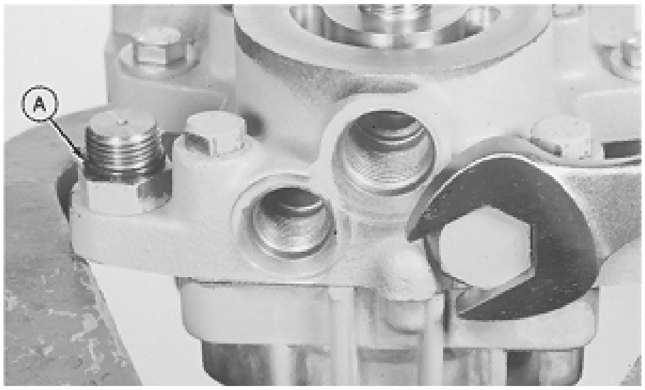
3

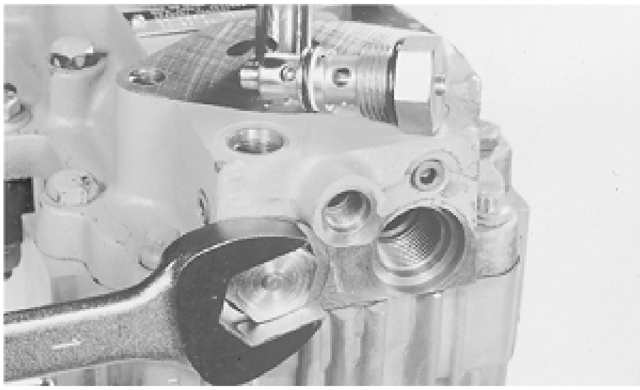
7. Remove two plugs and O-rings (A).



M36100 -UN-29AUG88

M45,5005A,41 -19-21NOV90

8. Remove two check valves.

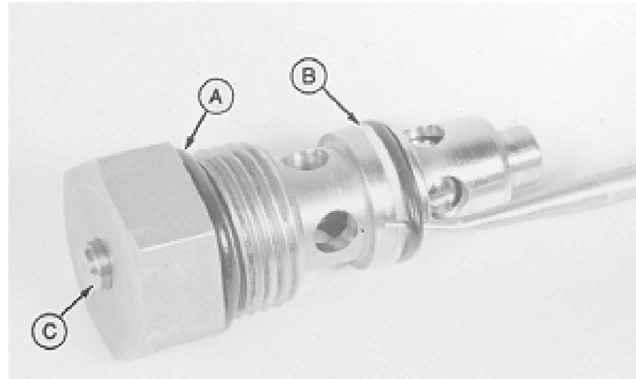


M36101 -UN-29AUG88

M45,5005A,42 -19-21NOV90

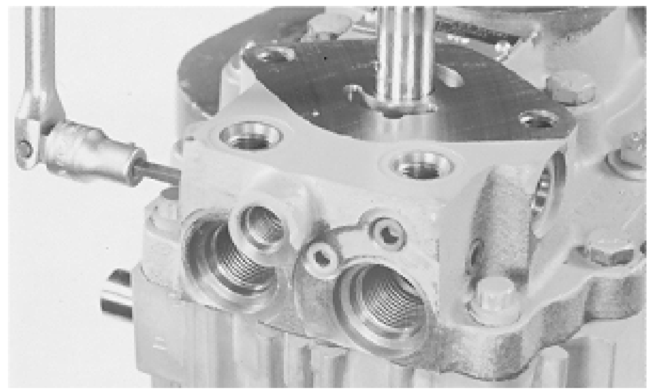
9. Remove O-ring, backup ring (B), and O-ring (A).

10. Internal valve (C) must move freely inside check valve.



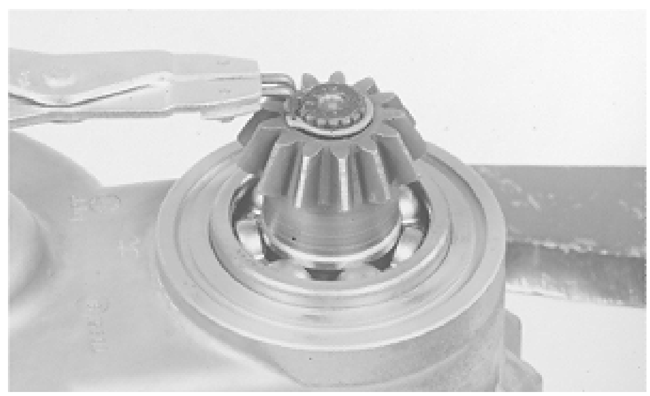
M45,5005C,40 -19-21NOV90

11. Remove four pipe plugs.



M45,5005A,44 -19-21NOV90

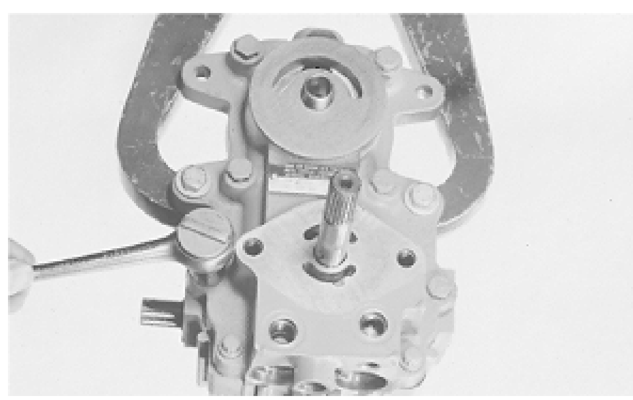
12. Remove snap ring to remove output shaft drive gear.



M45,5005A,45 -19-21NOV90

IMPORTANT: Do not disassemble the transmission any further while in the bench fixture.

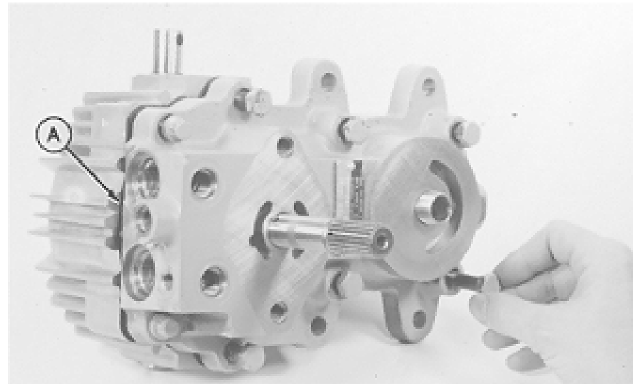
13. LOOSEN eight cap screws (do not remove). Remove transmission from bench fixture.



M45,5005C,41 -19-21NOV90

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

14. Put transmission on work bench and remove eight cap screws, center section, and gasket (A).



M36106 -UN-29AUG88

M45,5005C,42 -19-21NOV90

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

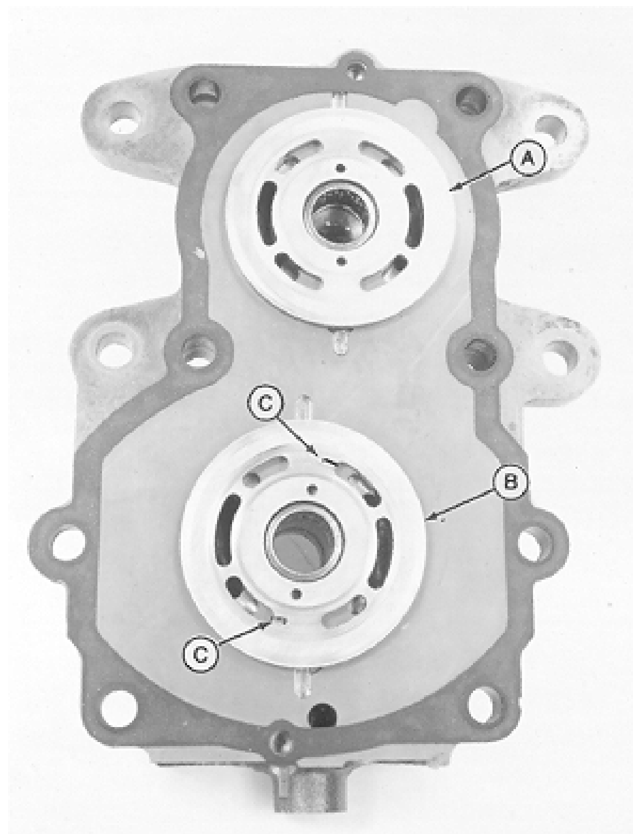
Keep pump and motor components separate. They are not interchangeable.

15. Remove valve plates (A and B). If necessary to pry valve plates loose, use only a non-metallic tool and pry only at dowel pin grooves.

Diesel fuel can be applied between valve plate and cylinder block to cut oil film.

NOTE: Scratches that can be felt with a fingernail or pencil lead indicate that valve plate should be replaced.

16. Clean and inspect valve plates. Replace plates that are warped, scratched, nicked or worn around ports; or if the bronze surface is scratched or discolored. Check that slotted ports (C) in pump valve plate are free of debris.



M54229 -UN-05OCT90

MX,5005FH,A10 -19-21NOV90

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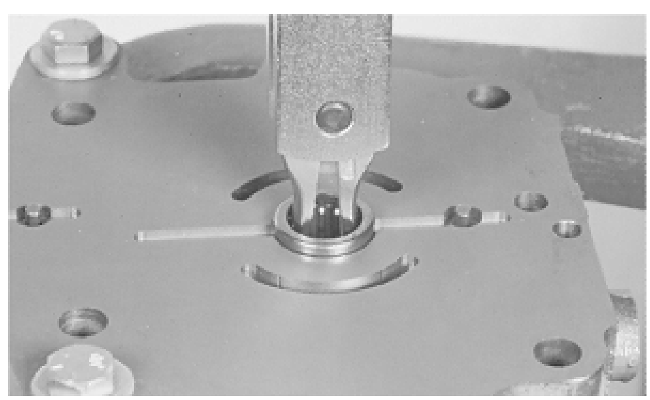
17. Inspect both bearings in center section, replace if necessary.

18. Install center section in bench fixture and remove bearing using a 2-jaw puller and a slide hammer.



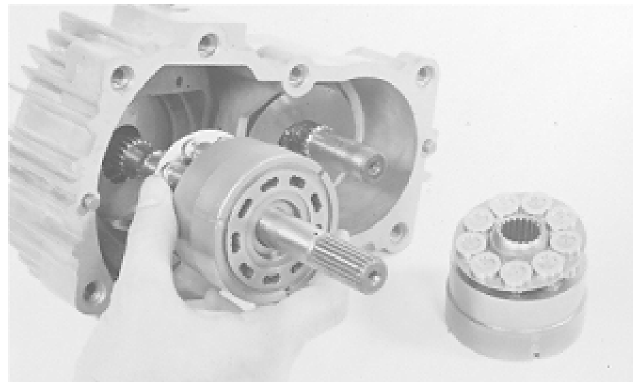
M36109 -UN-29AUG88

M45,5005A,49 -19-21NOV90

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

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

19. Remove motor and pump cylinder blocks.



M36110 -UN-29AUG88

MX,5005FH,A11 -19-21NOV90

20. Inspect cylinder block assemblies.

IMPORTANT: Do not interchange pistons between motor and pump cylinder blocks. Pistons and cylinder blocks are matched.

Lift piston retainer and pistons from cylinder block. Check for free movement of pistons in cylinder bores.

M36111 -UN-29AUG88

MX,5005FH,A12 -19-21NOV90

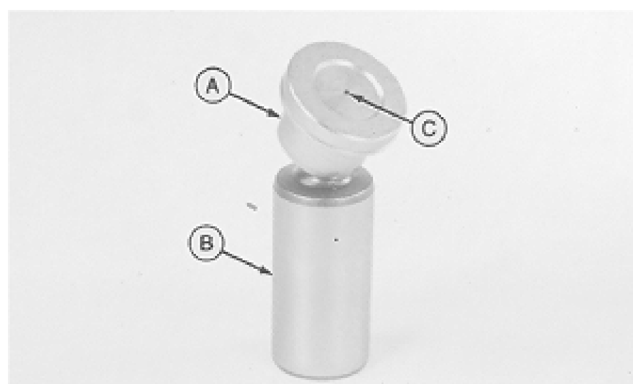
21. Remove and inspect all pistons.

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.

If any component of the piston is damaged, the cylinder block assembly must be replaced.



M36112 -UN-29AUG88

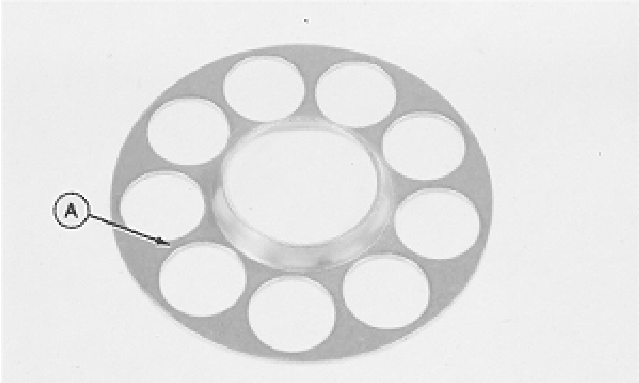
MX,5005FH,A13 -19-21NOV90

22. Remove and inspect both piston retainers.

Check retainer for flatness, nicks, burrs and discoloration.

Check area around piston slippers (A) for scoring.

If any part of the piston retainer is damaged, the cylinder block assembly must be replaced.



M36113 -UN-29AUG88

MX,5005FH,A14 -19-21NOV90

23. Inspect both cylinder blocks.

Check ball guide area (A) for scoring, wear and damage.

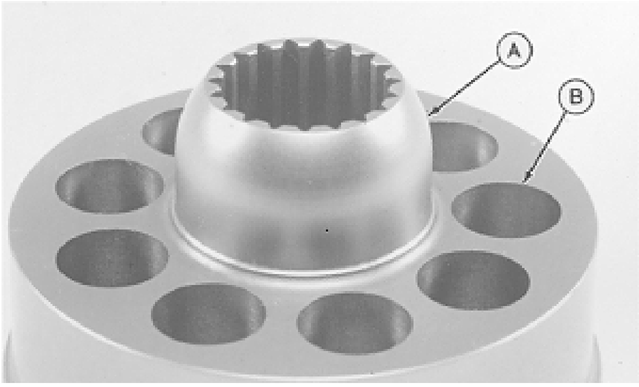
Check nine cylinder bores (B) for burrs and scoring.

Check lapped surface (C) for wear and damage.

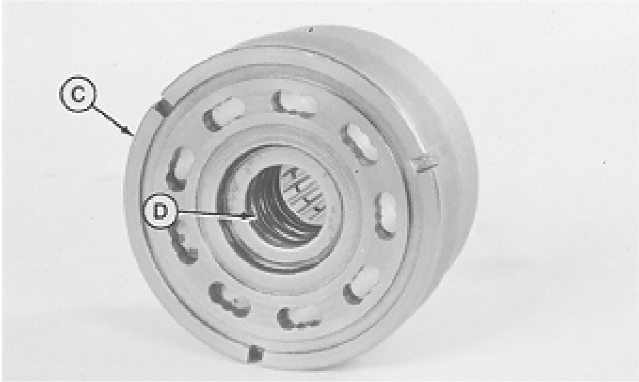
Check spring assembly (D) for damage and free movement.

If any part of the cylinder block is damaged, the cylinder block assembly must be replaced.

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



M36114 -UN-29AUG88



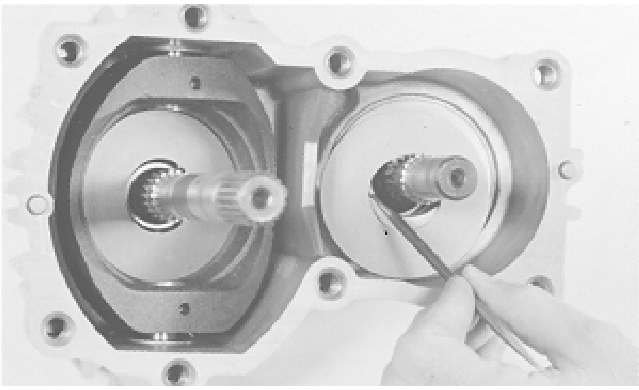
M36115 -UN-29AUG88

MX,5005FH,A15 -19-21NOV90

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

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

25. Inspect thrust plates. Check plates for scoring and smeared bronze material.



M36116 -UN-29AUG88

MX,5005FH,A16 -19-21NOV90

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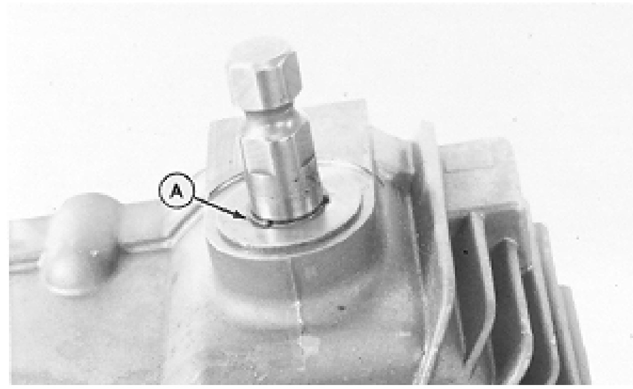
7

26. Remove snap ring and washer (A) from both trunion shafts.



MX,5005FH,A17 -19-21NOV90

IMPORTANT: Pump shaft and bearing assembly could restrict movement of swashplate. Full swashplate movement is approximately 25 mm (1 in.) in each direction. If necessary tap shaft with a soft faced hammer.

27. Push top of swashplate (C) down until it contacts the stops in the housing.

IMPORTANT: DO NOT drive pins after they bottom. Housing damage will result.

28. Drive pin (B) until it bottoms in housing.

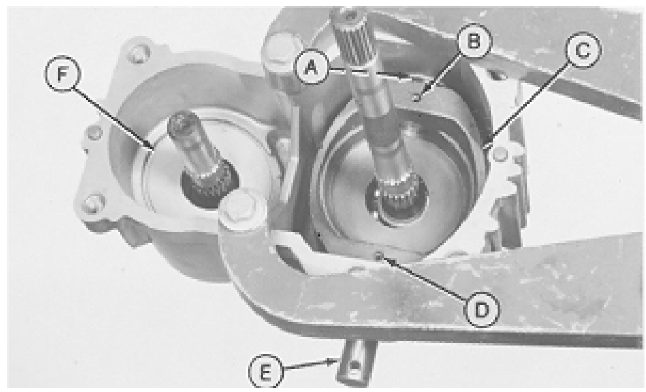
29. Drive two pins (D) until the lower one bottoms in housing.

30. Turn swashplate to the neutral position. Pins should fall into housing.

31. Repeat the above steps to remove second pin (D).

32. Remove control shaft (E) and trunion shaft (A) to remove swashplate.

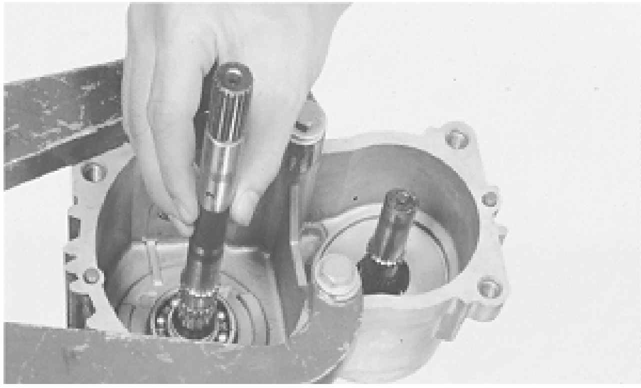
33. Inspect swashplate and motor housing (F).



A—Trunion Shaft
B—Spring Pin
C—Pump Swashplate
D—Spring Pin (2 used)
E—Control Shaft
F—Motor Housing

MX,5005FH,A18 -19-21NOV90

34. Remove pump shaft.

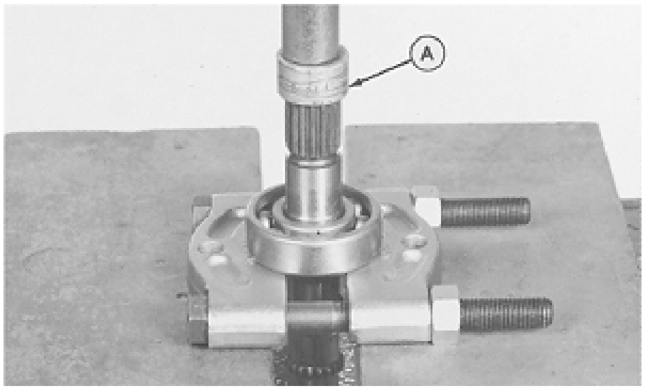


MX,5005FH,A19 -19-21NOV90

35. Inspect bearing, replace if necessary.

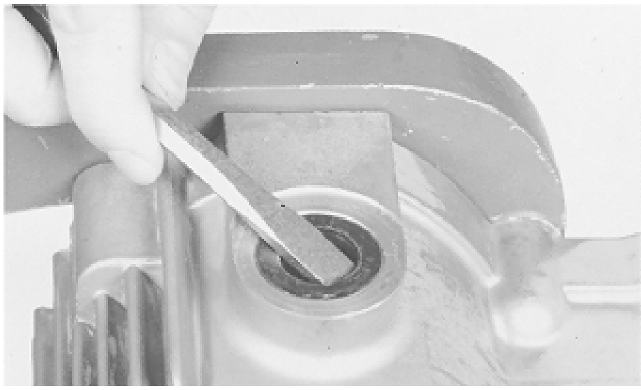
IMPORTANT: Be sure to hold shaft while removing bearing.

36. Remove bearing using a 1 in. driver disk (A), bearing puller attachment and a press.



MX,5005FH,A20 -19-21NOV90

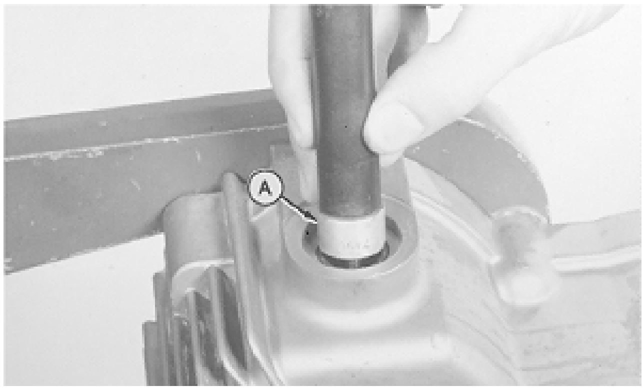
37. Remove three seals from housing.



MX,5005FH,A21 -19-21NOV90

38. Inspect both trunion bearings, replace if necessary.

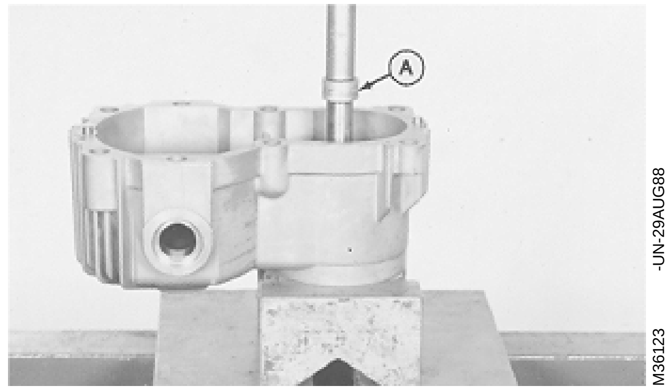
39. Drive bearings through housing using a 13/16 in. driver disk (A).



MX,5005FH,A22 -19-21NOV90

IMPORTANT: Be sure to hold shaft and bearing when removing from housing.

40. Remove motor shaft and bearing. Using a 1 in. driver disk (A), and a press.

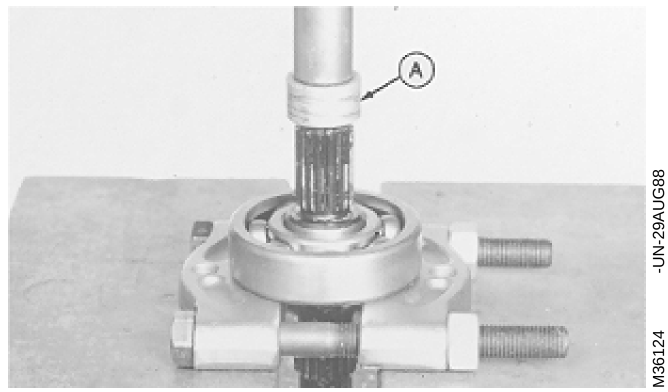


MX,5005FH,A23 -19-21NOV90

41. Inspect bearing, replace if necessary.

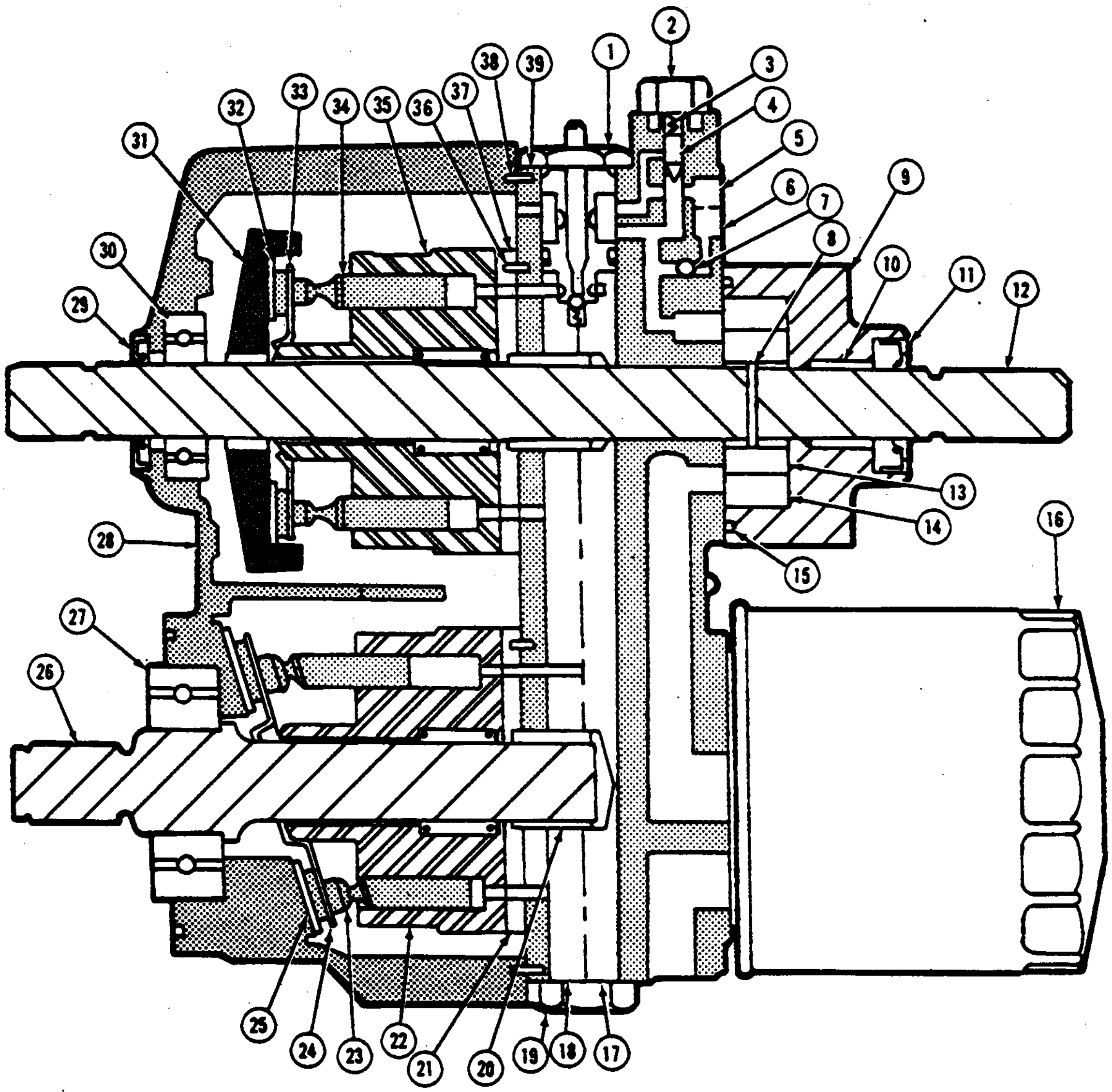
IMPORTANT: Be sure to hold shaft while removing bearing.

42. Remove bearing using a 1 in. driver disk (A), bearing puller attachment and a press.



MX,5005FH,A24 -19-21NOV90

CROSS SECTION OF TRANSMISSION

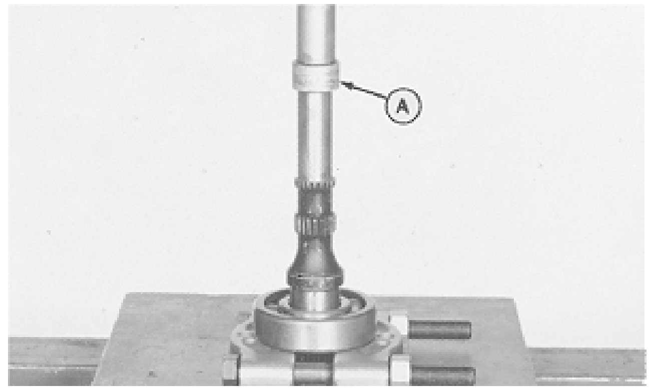


1—Check Valve Assembly
2—Implement Relief Valve Plug
3—Spring
4—Relief Valve
5—Return Port
6—Pressure Port
7—Charge Relief Valve Assembly
8—Pin
9—Charge Pump Housing
10—Bearing
11—Seal
12—Pump Shaft
13—Inner Rotor
14—Rotor Ring
15—O-Ring
16—Oil Filter
17—Oil Passage
18—Oil Passage
19—Plug (2 used)
20—Bearing (2 used)
21—Valve Plate
22—Cylinder Block Assembly
23—Pistons (9 used)
24—Piston Retainer
25—Thrust Plate
26—Motor Shaft
27—Bearing
28—Pump and Motor Housing
29—Seal
30—Bearing
31—Swashplate
32—Thrust Washer
33—Piston Retainer
34—Piston (9 used)
35—Cylinder Block Assembly
36—Dowel Pin (2 used)
37—Valve Plate
38—Dowel Pin (2 used)
39—Center Section

M45,5005A,64 -19-24FEB86

ASSEMBLE TRANSMISSION

1. Support bearing on bearing puller. Use a 1 in. driver disk (A) and press motor shaft into bearing until it is on shaft shoulder.



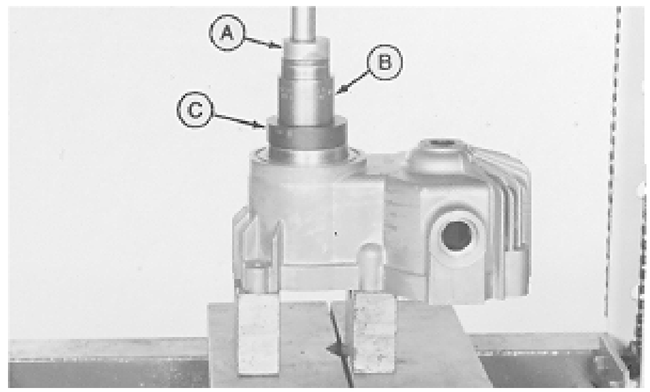
M36126 -UN-29AUG88

MX,5005FH,A25 -19-21NOV90

IMPORTANT: To prevent bearing damage, press only on outer race of bearing.

NOTE: There should be approximately 5 mm (0.187 in.) of bearing race above mounting surface.

2. Press motor shaft assembly into housing until bearing is at bottom of bore. Use a 1-7/16 driver disk (A), socket (B) and donut type disk (C).



M36127 -UN-29AUG88

MX,5005FH,A26 -19-21NOV90

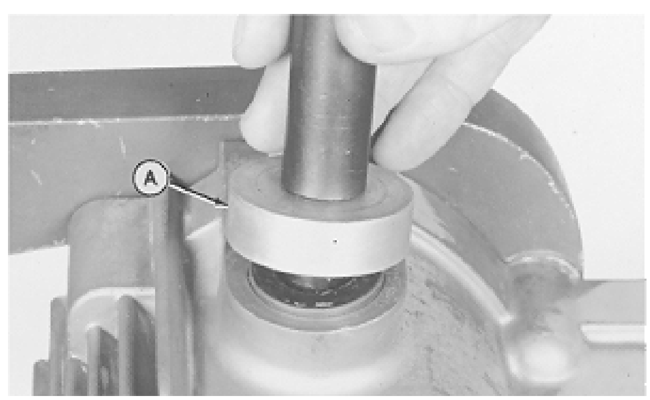
3. Install housing on bench fixture.

4. Install two needle bearings. Drive bearings into housing until they are flush with surface using a 1 in. driver disk (A).

M36128 -UN-29AUG88

M45,5005A,67 -19-21NOV90

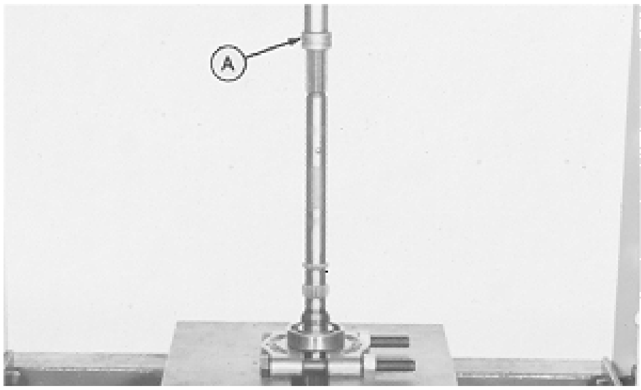
5. Install oil seals with spring side of seal towards inside of housing using a 1-7/16 in. driver disk (A).



M36129 -UN-29AUG88

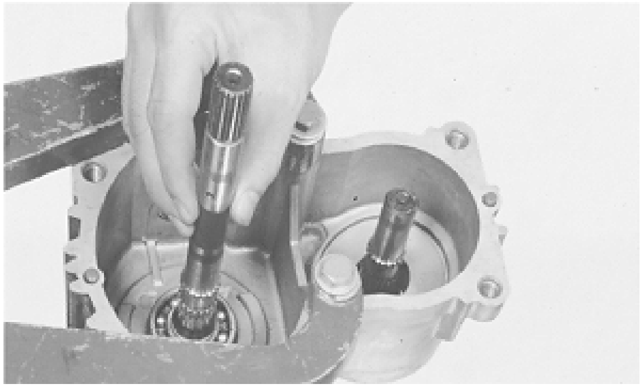
MX,5005FH,A27 -19-21NOV90

6. Push pump shaft into bearing until it is on the shaft shoulder using a 1-in. driver disk (A) bearing puller attachment and a press.



M45,5005A,69 -19-13MAR85

7. Install pump shaft.



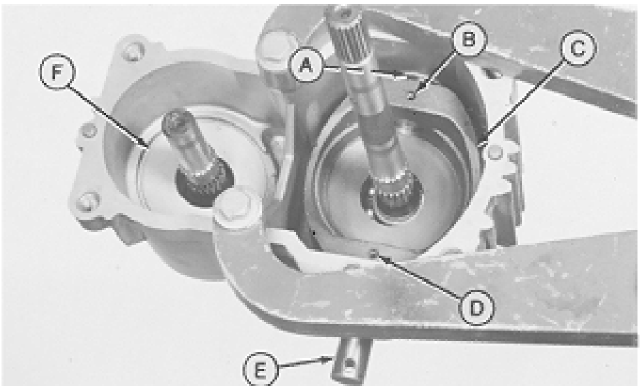
M45,5005A,70 -19-21NOV90

8. Install swashplate (C), shaft (E) and shaft (A).

IMPORTANT: Pump shaft and bearing assembly could restrict movement of swashplate. Full swashplate movement is approximately 25 mm (1 in.) in each direction. Tap shaft with soft faced hammer to seat bearing, if necessary.

9. Drive pin (B) into swashplate and shaft until pin is about 6 mm (0.250 in.) below surface.

10. Drive two pins (D) into swashplate and shaft until top pin is about 6 mm (0.250 in.) below surface.



A—Trunion Shaft
B—Spring Pin
C—Pump Swashplate
D—Spring Pin (2 used)
E—Control Shaft
F—Motor Housing

MX,5005FH,A28 -19-21NOV90

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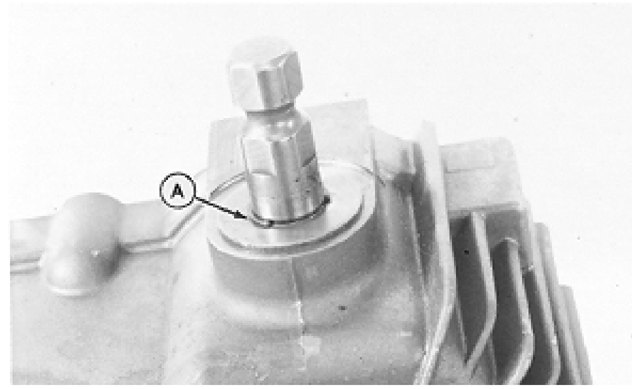
05
13

11. Install washer and snap ring (A) on both trunion shafts.

12. Remove housing from bench fixture.



M54228 -UN-05OCT90

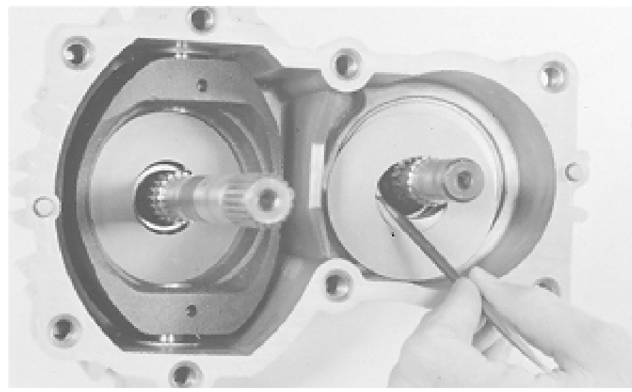
MX,5005FH,A29 -19-21NOV90

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

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

13. Coat all parts with John Deere All-Weather Hydrostatic Fluid or equivalent.

14. Install pump and motor thrust plates.



M36116 -UN-29AUG88

MX,5005FH,A30 -19-21NOV90

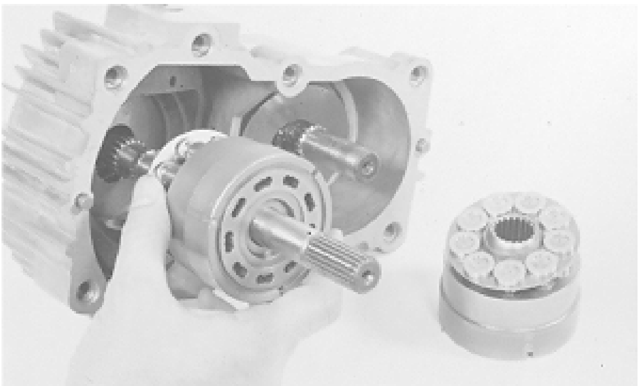
15. Install pistons and piston retainer.

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

M36111 -UN-29AUG88

MX,5005FH,A31 -19-21NOV90

16. Install pump and motor cylinder blocks.

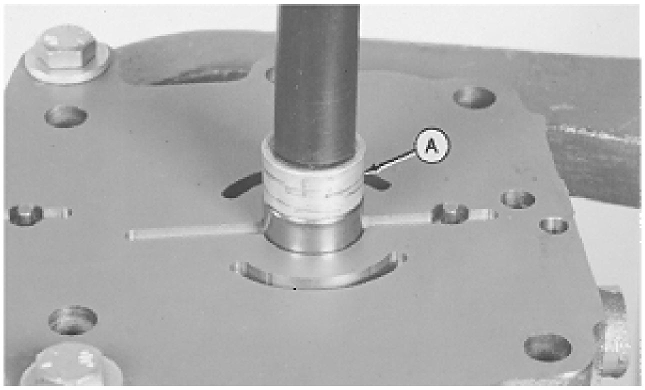


MX,5005FH,A32 -19-21NOV90

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

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

17. Install needle bearing using 5/8 in. driver disk (A). Bearings should protrude 3 mm (0.109 in.) above housing surface.

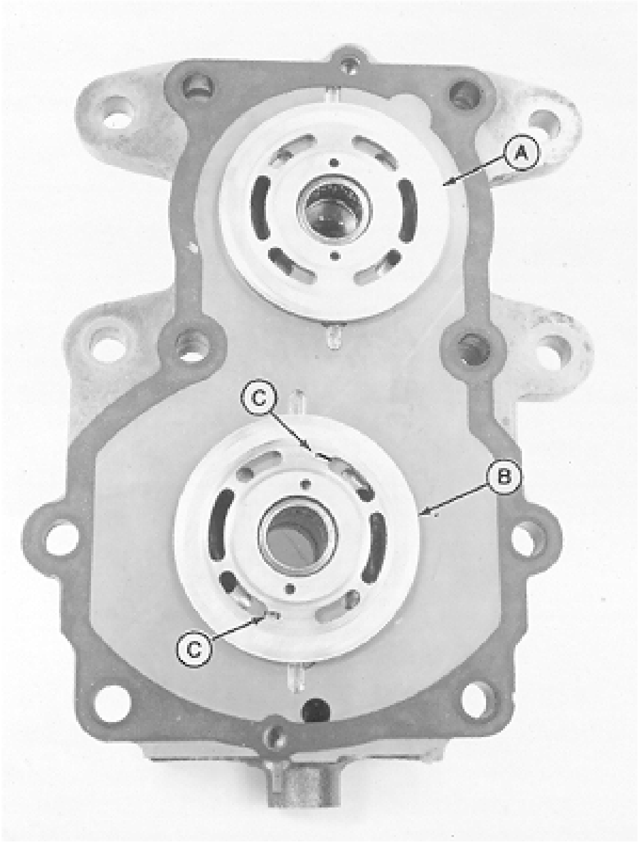


MX,5005FH,A33 -19-21NOV90

18. Coat valve plates with clean hydrostatic oil.

NOTE: Pump valve plate has two slotted ports (C).

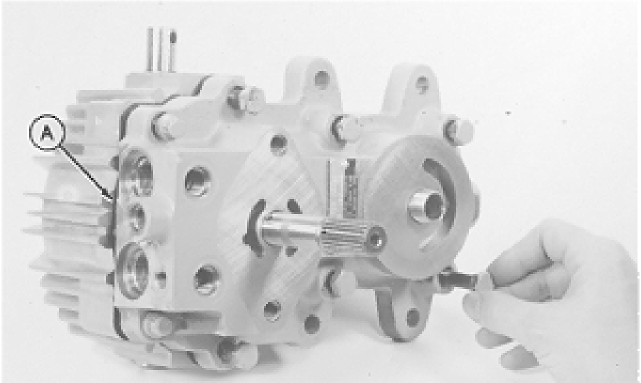
19. Install motor valve plate (A) and pump valve plate (B) on bearings. Align slots in plates with pins in housing.



MX,5005FH,A34 -19-21NOV90

NOTE: Do not scratch or nick lapped or machined surfaces during assembly.

20. Install center section and new gasket (A). Tighten cap screws evenly until snug.



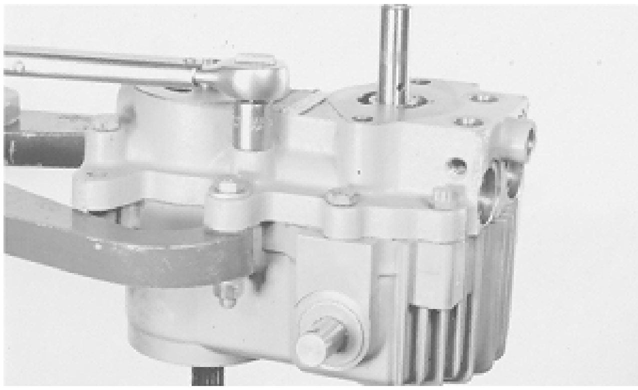
M36106 -UN-29AUG88

MX,5005FH,A35 -19-21NOV90

21. Install transmission in bench fixture.

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

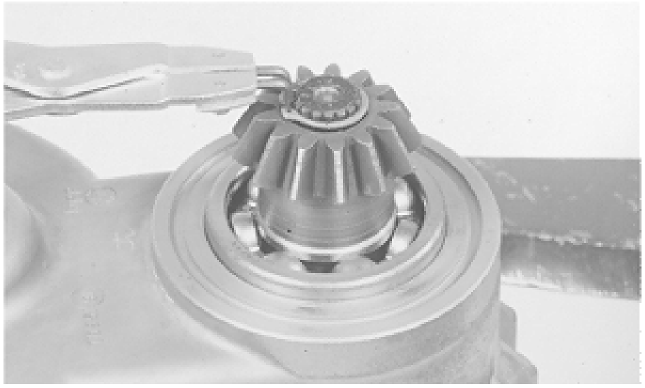
22. Tighten cap screws to 35 N·m (28 lb-ft).



M36134 -UN-29AUG88

MX,5005FH,A36 -19-21NOV90

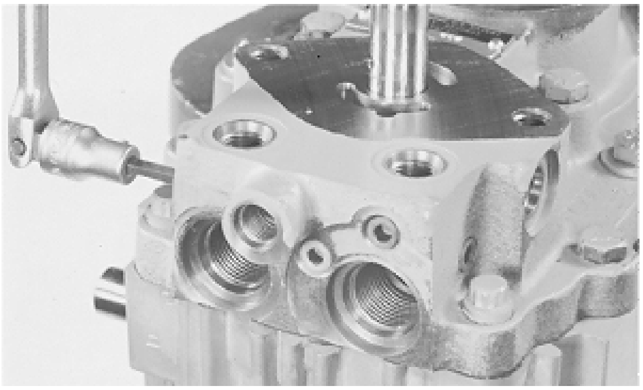
23. Install gear on motor shaft (output shaft). Install snap ring.



M36104 -UN-29AUG88

MX,5005FH,A37 -19-21NOV90

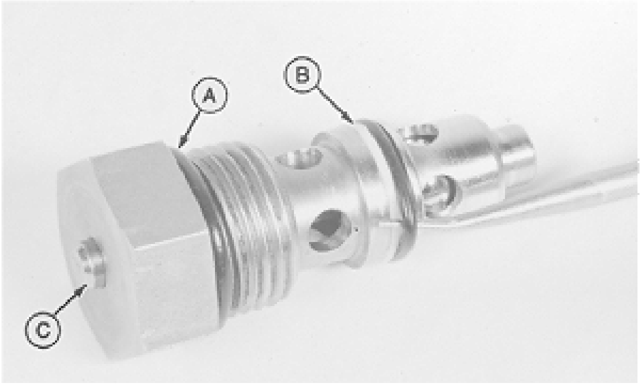
24. Install and tighten four pipe plugs.



M36103 -UN-29AUG88

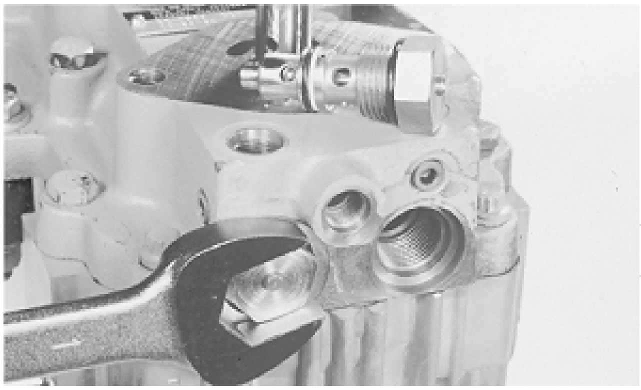
MX,5005FH,A38 -19-21NOV90

25. Install O-ring (A), backup ring (B) and O-ring. Internal valve (C) must move freely.



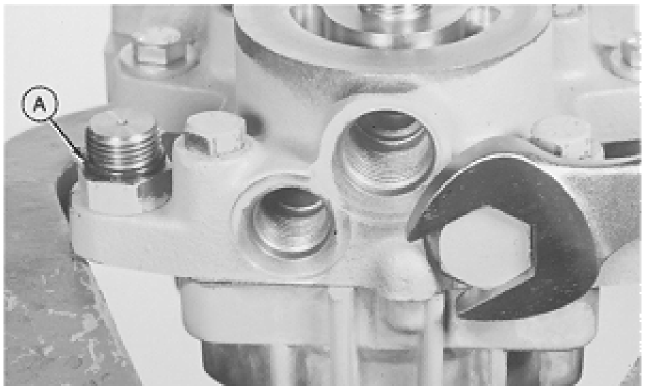
MX,5005FH,A39 -19-21NOV90

26. Install and tighten two check valves.



MX,5005FH,A40 -19-21NOV90

27. Install two plugs and O-ring (A).



MX,5005FH,A41 -19-21NOV90

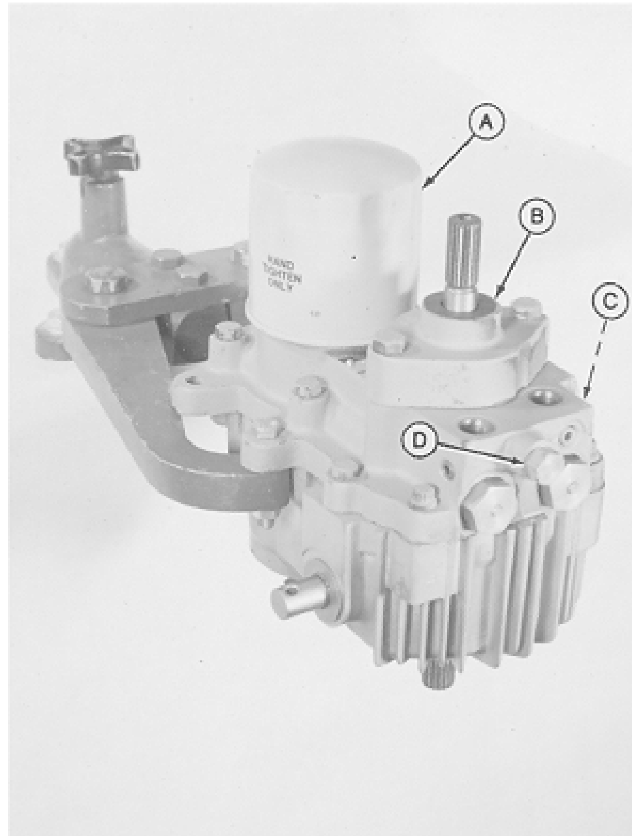
28. Install new filter (A).

29. Install valve (C). (See this group.)

30. Install valve (D).

31. Install charge pump (B). (See this group.)

A—Oil Filter
B—Charge Pump
C—Charge Relief Valve
D—Implement Relief Valve (Non-Functional)



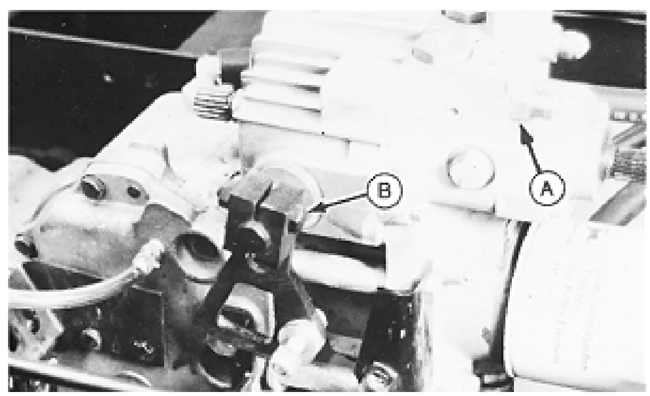
M36520 -UN-26AUG88

MX,5005FH,A42 -19-21NOV90

INSTALL TRANSMISSION

1. Install O-rings and fittings (A). Tighten fittings to 24 N·m (215 lb-in.).

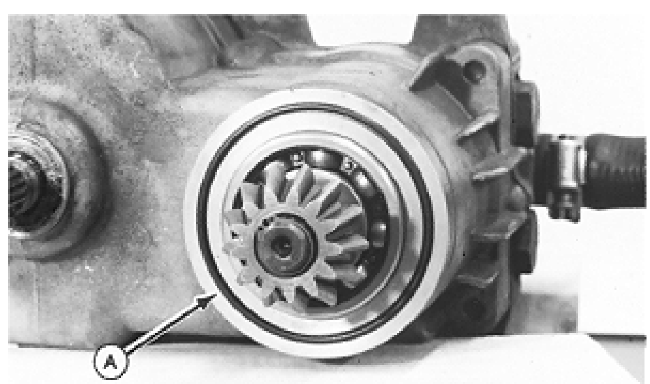
2. Install control lever (B).



M46608 -UN-27MAR92

MX,5005HJ,2 -19-14APR92

3. Lubricate O-ring (A) with Petroleum jelly and install in groove on transmission.



M46573 -UN-27MAR92

MX,5005HJ,3 -19-14APR92

4. Install transmission and spacers (D).

5. Install linkage mounting brackets and tighten cap screws (E) to 45 N·M (35 lb-ft).

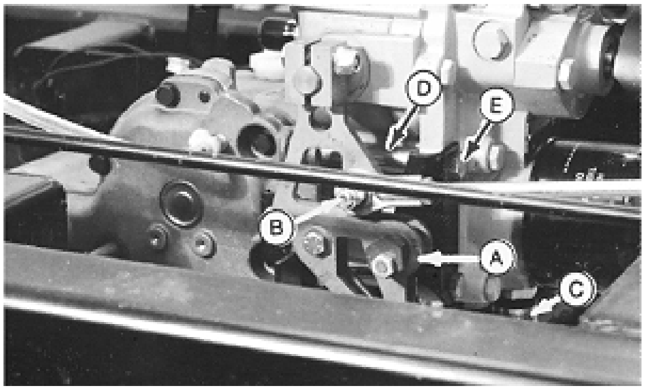
6. Position control arm and install eccentric (A). Secure with capscrew.

7. Attach shift rod (B).

8. Connect suction hose (C).

9. Install drive shaft and tighten capscrews to 35 N·m (28 lb-ft)..

10. Connect battery (-) cable.



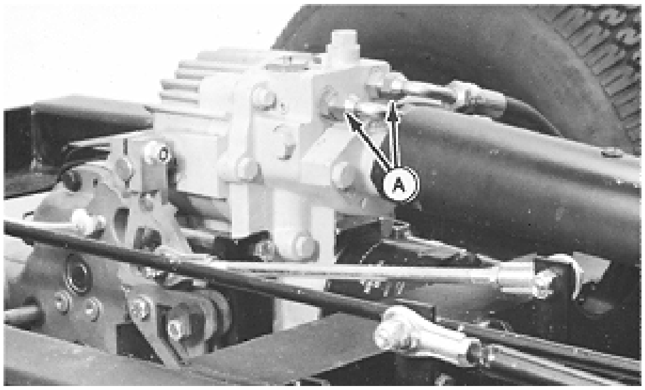
M46607 -UN-27MAR92

A—Eccentric
B—Shift Rod
C—Suction Hose
D—Spacers
E—Cap Screws

MX,5005HJ,4 -19-14APR92

11. Connect hydraulic lines (A).

12. See Neutral Return Adjustment Section 250, Group 15.



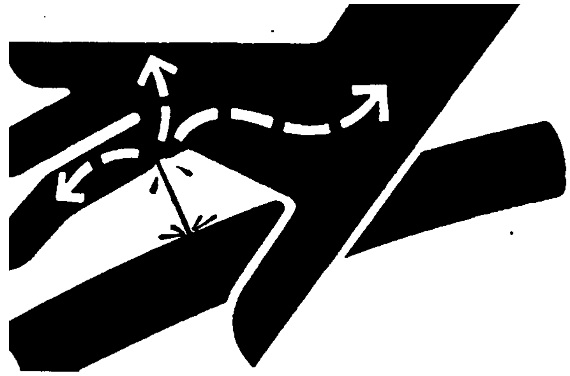
M46605 -UN-27MAR92

MX,5005HJ,5 -19-14APR92

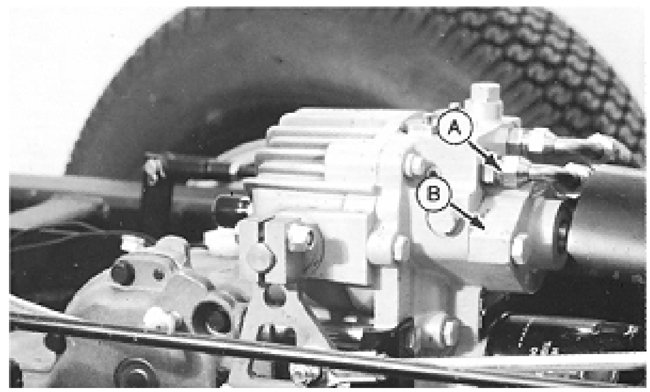
REMOVE AND INSTALL CHARGE PUMP

1. Remove drive shaft. (See Group 20 in this section.)

2. Loosen hydraulic fittings (A). Remove charge pump (B).



X9811 -UN-23AUG88



M46609 -UN-27MAR92

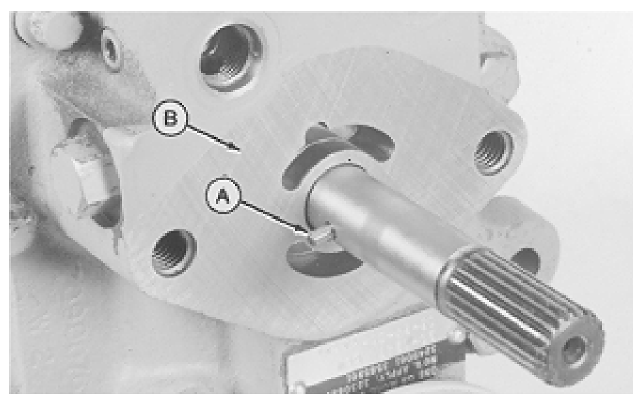
MX,5005HJ,6 -19-14APR92

NOTE: Transmission removed for clarity of photograph.

3. Inspect shear pin (A) for damage. Replace if necessary.

4. Clean and inspect machined surface (B) for severe scoring. Replace transmission if damaged.

5. Apply petroleum jelly to pin to prevent movement during charge pump installation. Pin must fit in large keyway in pump ring.



M36084 -UN-29AUG88

MX,5005FH,A50 -19-21NOV90

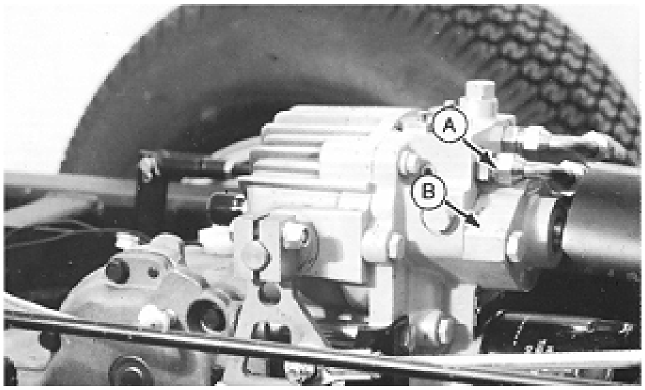
6. Coat lip of oil seal with petroleum jelly.

IMPORTANT: Do not damage seal when installing charge pump.

7. Install charge pump. Flat side of casting should be on relief valve (right) side (B). Tighten cap screws to 70 N·M (50 lb-ft).

8. Tighten hydraulic fittings (A).

9. Install drive shaft. (See this section)



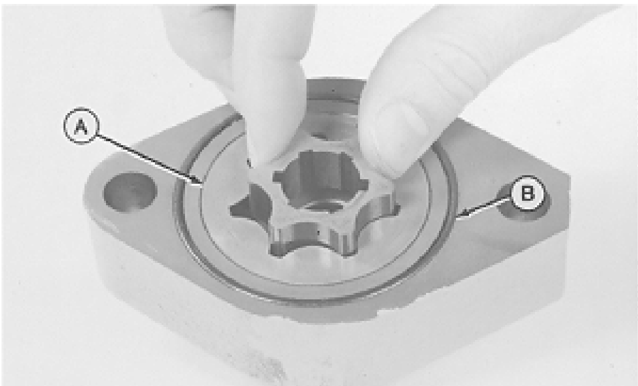
M46609 -UN-27MAR92

MX,5005HJ,7 -19-14APR92

DISASSEMBLE AND INSPECT CHARGE PUMP

1. Clean and inspect inner ring and rotor ring (A). Replace gerotor rings as a set if scored or damaged.

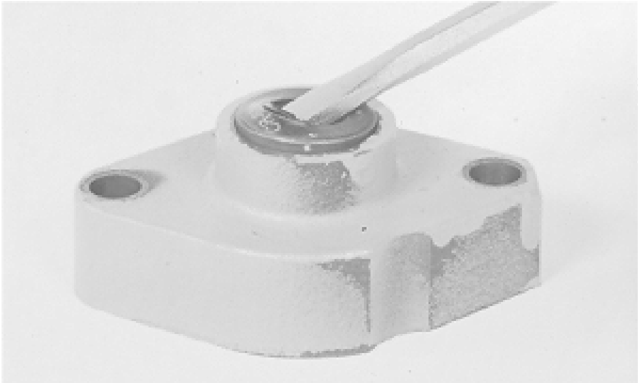
2. Remove O-ring (B).



M36085 -UN-29AUG88

MX,5005FH,A52 -19-21NOV90

3. Remove seal.



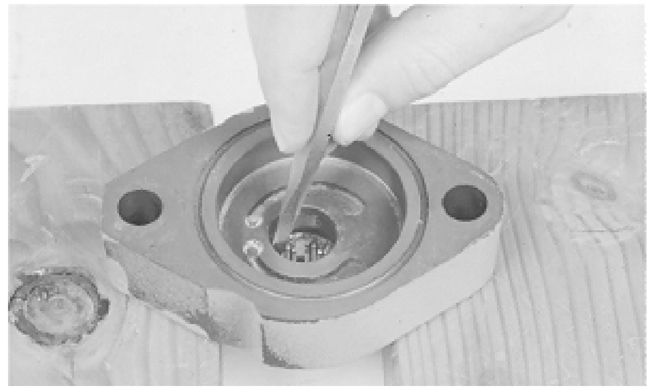
M36087 -UN-29AUG88

MX,5005FH,A53 -19-21NOV90

50
05
21

4. Remove bearing.

5. Clean and inspect housing. Replace entire charge pump if damaged.



M36088 -UN-29AUG88

MX,5005FH,A54 -19-21NOV90

ASSEMBLE CHARGE PUMP

1. Apply clean hydrostatic drive oil to all internal parts.

2. Install bearing flush with surface using a bearing, bushing and seal driver set.

M36089 -UN-29AUG88

MX,5005FH,A55 -19-21NOV90

50
05
22

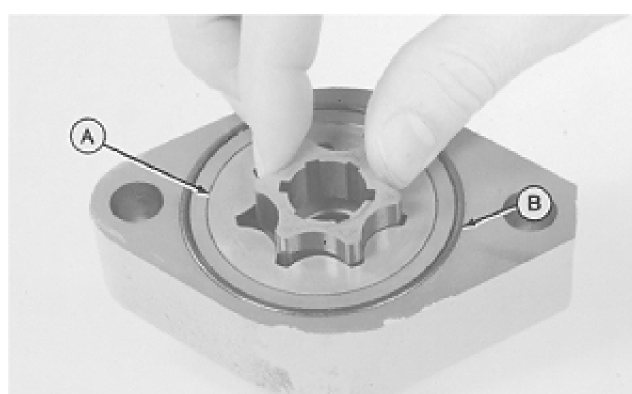
3. Install oil seal with spring side towards inside of housing.

M36136 -UN-29AUG88

MX,5005FH,A56 -19-21NOV90

4. Install O-ring. Apply petroleum jelly to seal to hold O-ring in groove.

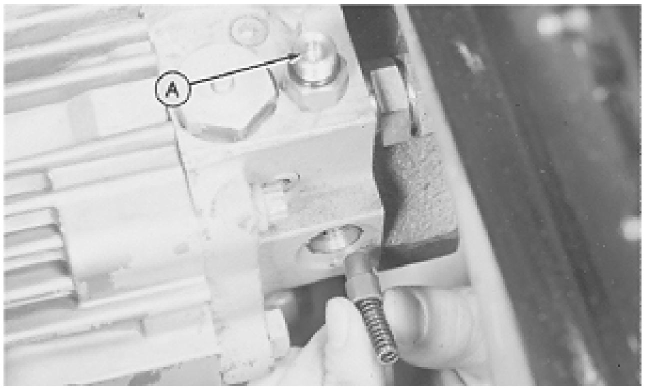
5. Install rotor ring (A) and inner ring. Check that gerotor set spins freely in housing.



M36085 -UN-29AUG88

MX,5005FH,A57 -19-21NOV90

REMOVE, INSPECT, AND INSTALL CHARGE RELIEF VALVE



M36092 -UN-29AUG88

1. Remove charge relief valve plug (A).

IMPORTANT: If relief valve is being disassembled to be cleaned, the same number and thicknesses of shims must be installed when reassembled.

2. Remove shims if installed, spring and valve.

3. Inspect valve and housing for wear or damage. Valve must slide freely in bore. Replace parts as required.

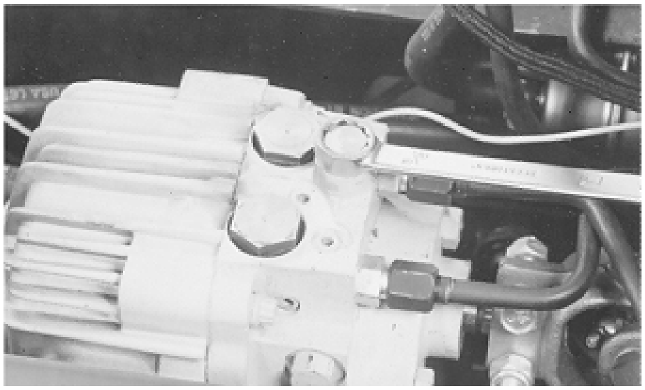
4. Clean and dry all parts.

5. Apply clean hydraulic fluid to valve, install valve, spring and shims (if removed) into housing bore.

6. Install charge relief plug.

MX,5005HJ,8 -19-14APR92

REMOVE AND INSTALL IMPLEMENT RELIEF VALVE


M36538 -UN-25JAN90

1. Remove implement relief valve plug (A).

IMPORTANT: If relief valve is being disassembled to be cleaned, the same number and thicknesses of shims must be installed when reassembled.

2. Remove shims (B) if installed, spring and valve.

3. Inspect valve and housing for wear or damage. Valve must slide freely in bore. Replace parts as required.

4. Clean and dry all parts.

5. Apply clean hydraulic fluid to valve, install valve, spring and shims (if removed) into housing bore.

6. Install implement relief plug.

MX,5005HJ,9 -19-14APR92

OTHER MATERIAL

Number	Name	Use
TY6305	John Deere Clean and Cure Primer	Cleans parts and speeds cure of sealant.
T43512	John Deere Thread Lock and Sealer (medium strength)	Retains cap screws.
TY6304	John Deere Flexible Sealant	Seals differential cover.

MX,5010FH,A1 -19-21NOV90

SHOP EQUIPMENT AND TOOLS

NOTE: Order tools from your SERVICE-GARD™ catalog, some tools may be available from a local supplier.

Name	Use
Hydraulic Jack	Lift Differential Assembly
Jack Stands	Support Tractor
13 Ton Puller Set	Service Bearings
Bushing, Bearing, and Seal Driver Set	Service Bearings

MX,5010HJ,1 -19-14APR92

OTHER MATERIAL

Number	Name	Use
	John Deere All-Weather Hydrostatic Fluid	Transmission fluid
T43511	John Deere LOCTITE® Clean and Cure Primer	Clean threads
T43512	John Deere LOCTITE® Threadlock and sealer (Medium strength)	Retain/Carrier/Cap Screws
TY6305	John Deere Flexible Sealant	To seal differential Cover

LOCTITE is a trademark of the Loctite Corp.

MX,5010HJ,2 -19-14APR92

REMOVE DIFFERENTIAL

1. Remove transmission. (See Group 05 in this section.)

2. Disconnect vent tube (A).

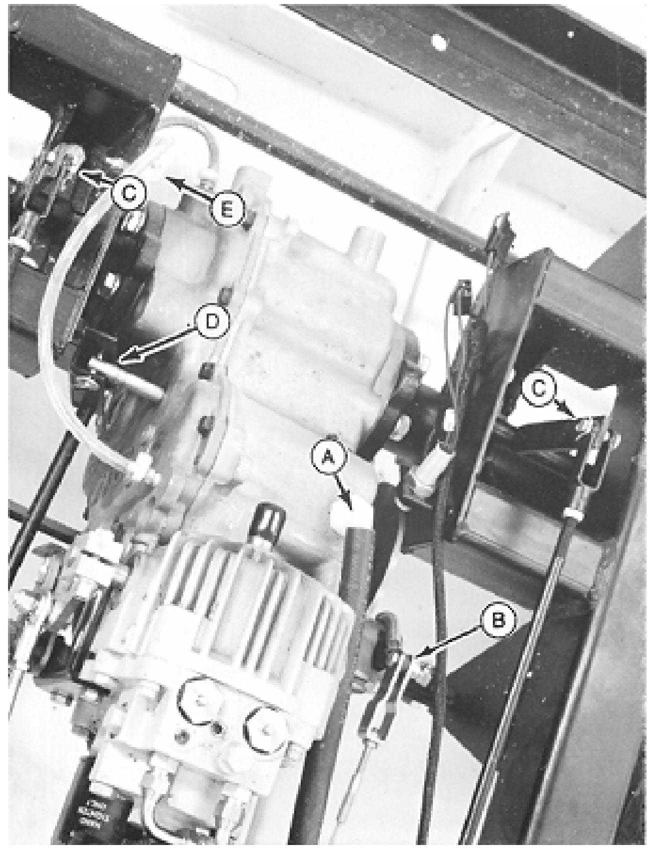
3. Disconnect parking brake cable (B).

4. Disconnect left and right brake linkages (C).

5. Disconnect High/Low shift linkage (D).

6. Disconnect hydraulic sight level gauge (E).

A—Vent Tube
B—Brake Cable
C—Brake Linkage
D—High/Low Shift
E—Hydraulic Gauge



M46610 -UN-27MAR92

MX,5010HJ,3 -19-14APR92

7. Raise and support machine.

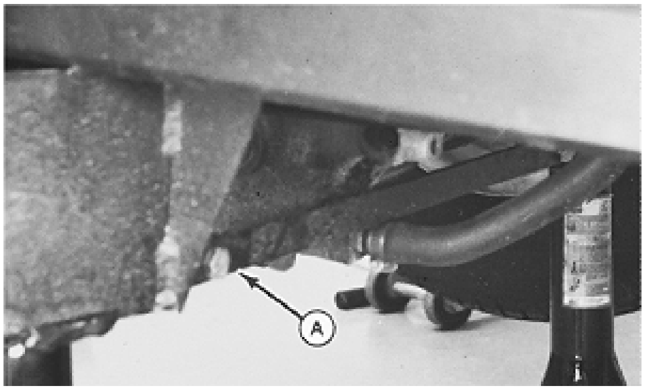
8. Remove bracket (A).

9. Remove wheels and axle stub shafts (B).

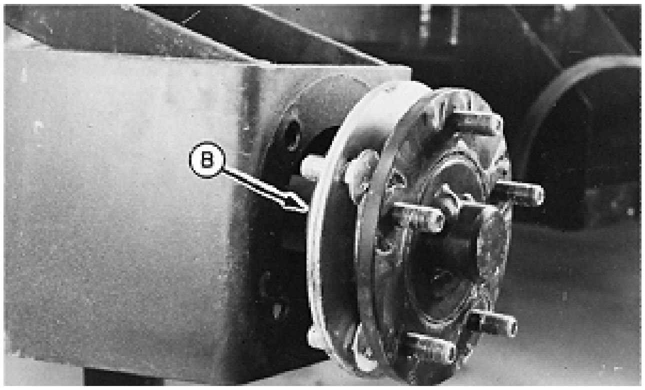
10. Support differential with a floor jack.

11. Remove two capscrews (C) from each side.

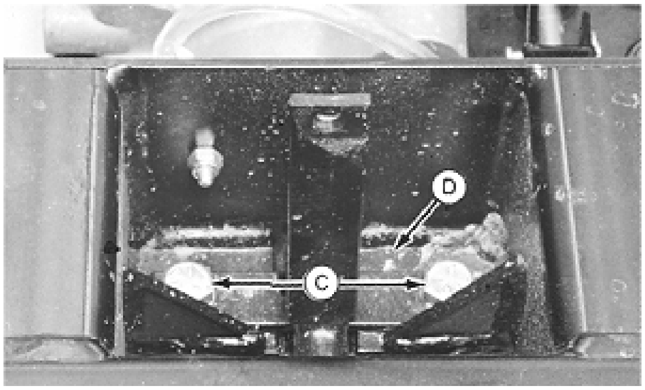
12. Slide brackets (D) inboard and remove from brake control arms.



M46611 -UN-27MAR92



M46662 -UN-27MAR92



M46663 -UN-27MAR92

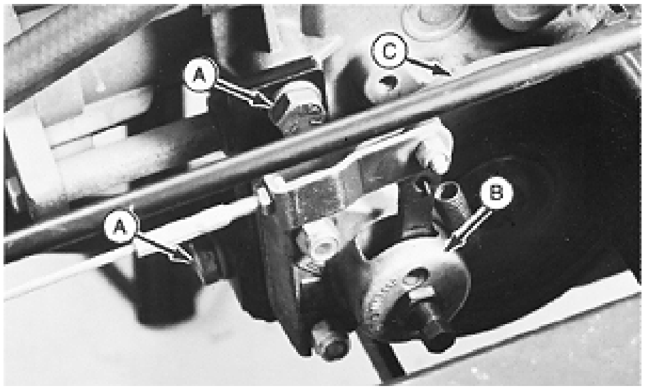
MX,5010HJ,4 -19-14APR92

13. Carefully lower differential to the floor.

14. Remove axle assemblies. (See Section 50 Group 20)

15. Remove two cap screws (A). Remove caliper (B) and slide disc (C) off shaft.

16. Make repairs as necessary. (See procedures in this group.)

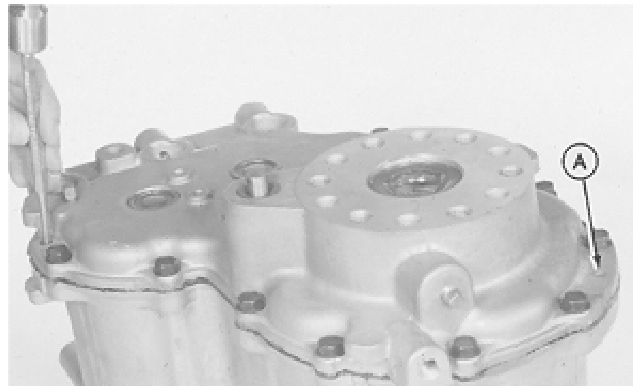


M46612 -UN-27MAR92

MX,5010HJ,5 -19-14APR92

DISASSEMBLE DIFFERENTIAL

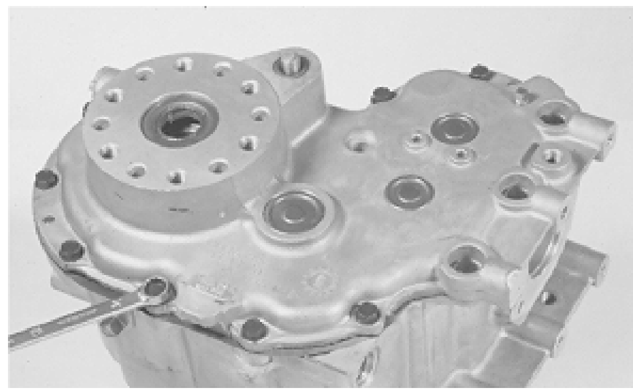
1. Drive two dowel pins (A) into differential case just far enough to clear the cover.



M36226 -UN-22NOV89

MX,5010HJ,6 -19-14APR92

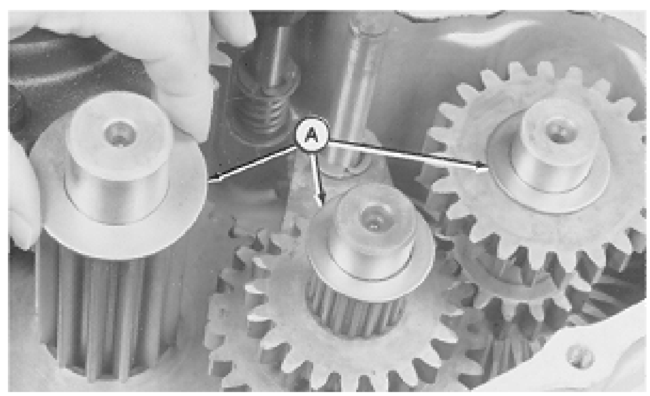
2. Remove cap screws to remove cover and gasket.



M36167 -UN-22NOV89

MX,5010HJ,7 -19-14APR92

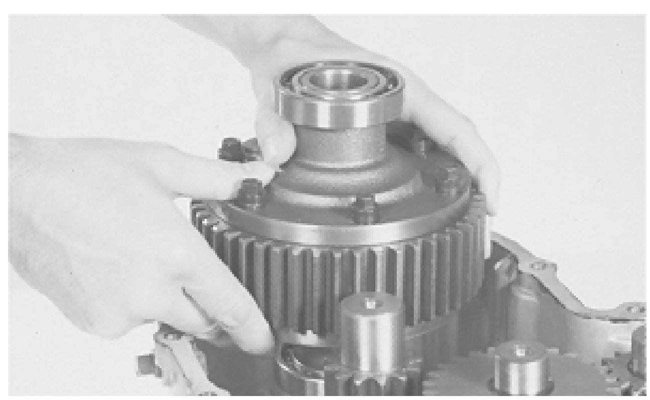
3. Remove three thrust washers (A).



M36228 -UN-22NOV89

MX,5010HJ,8 -19-14APR92

4. Remove differential.

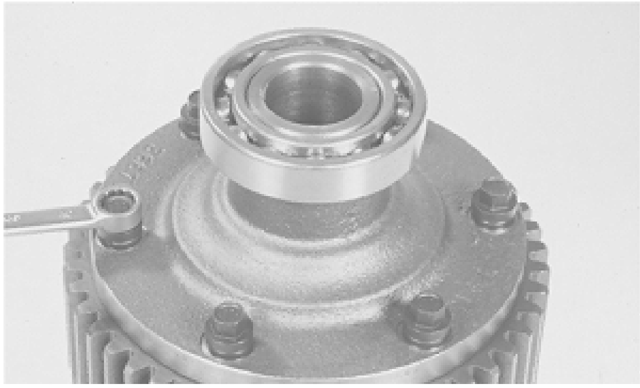


M36170 -UN-22NOV89

MX,5010HJ,9 -19-14APR92

5. Remove cap screws to separate carriers from ring gear.

NOTE: If necessary hold ring gear using a strap wrench when removing cap screws.



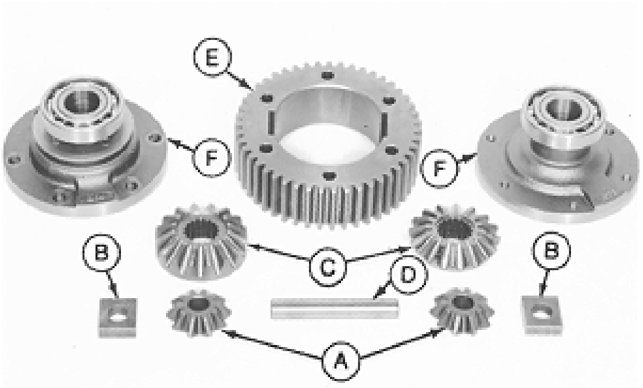
M36172 -UN-22NOV89

MX,5010HJ,10 -19-14APR92

6. Disassemble and inspect pinion assembly.

Inspect pinion gears (A and C), ring gear (E), pinion blocks (B),and cross shaft (D) for wear or damage. Replace if necessary.

A—Pinion Gear (2 used)
B—Pinion Block (2 used)
C—Pinion Gear (2 used)
D—Cross Shaft
E—Ring Gear
F—Carrier (2 used)
G—Pinion Gear with Holes.

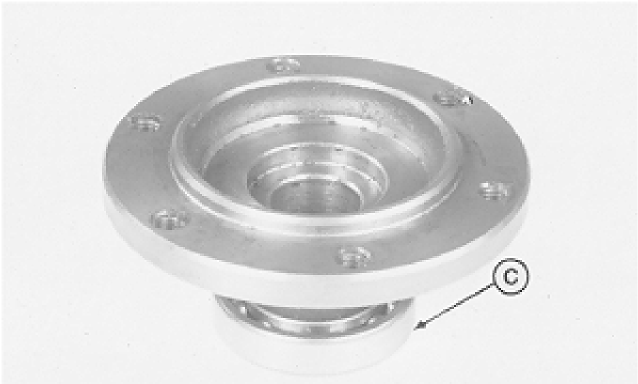


M31977 -UN-25AUG88

MX,5010HJ,11 -19-14APR92

7. Inspect carriers.

8. Inspect bearings (C).

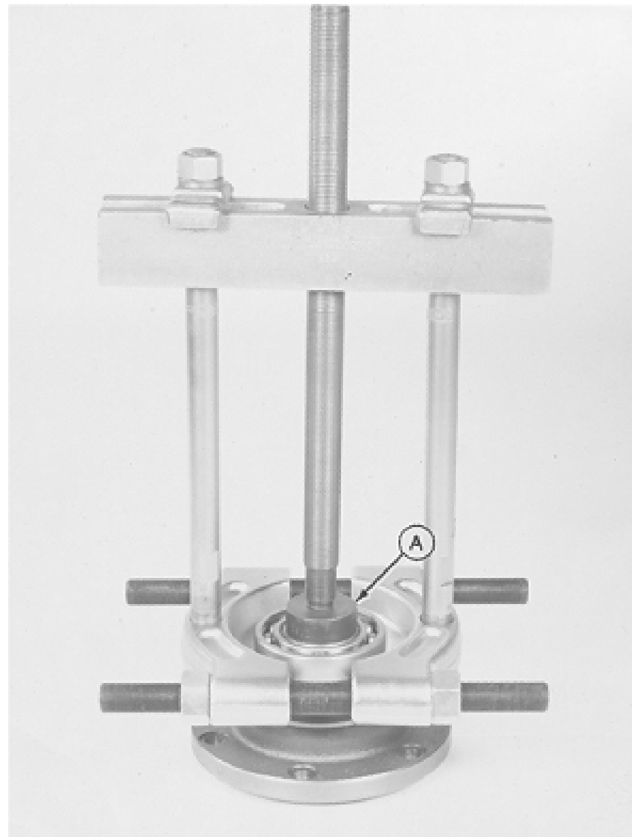


M36231 -UN-22NOV89

MX,5010HJ,12 -19-14APR92

9. Inspect bearings, replace if necessary.

10. Remove bearing using a 1-7/16 in. driver disk (A), bearing puller attachment and a push-puller with 6-3/4 in. legs.



M36174 -UN-22NOV89

MX,5010HJ,13 -19-14APR92

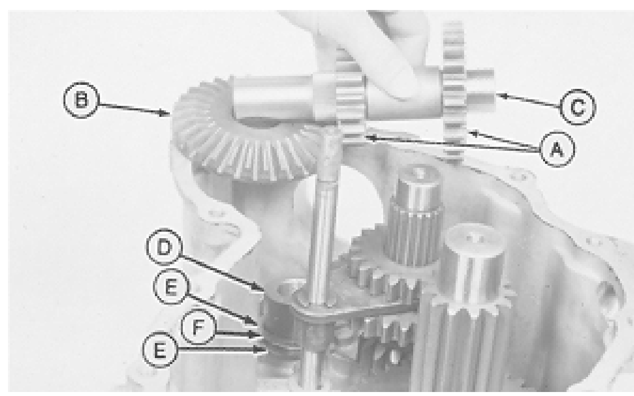
11. Remove and inspect countershaft assembly.

Inspect spur gear (A) and bevel gear (B) for worn or damaged teeth.

Inspect countershaft (C) for worn or damaged splines or bearing surfaces.

Inspect spacer (D) for wear or damage.

Inspect thrust washers (E) and thrust bearing (F) for wear or damage.

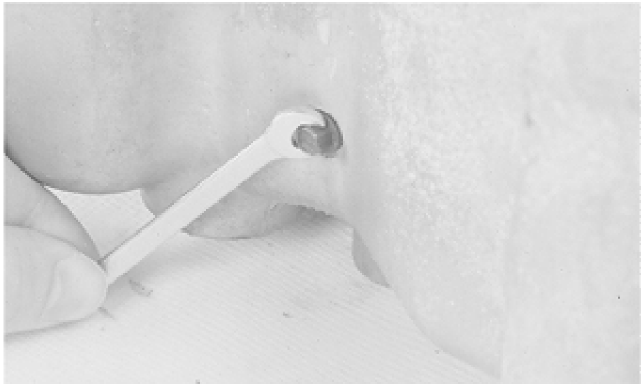


M36232 -UN-22NOV89

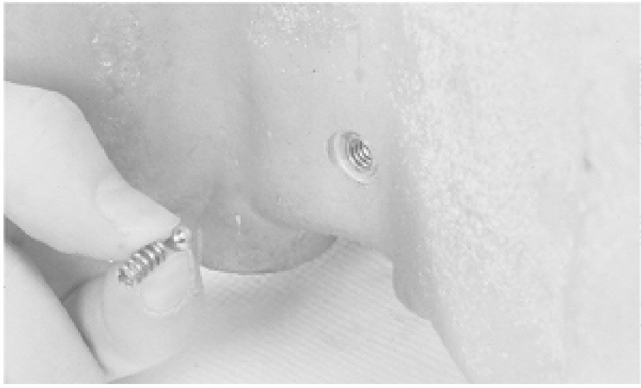
A—Spur Gear
B—Bevel Gear
C—Countershaft
D—Spacer
E—Thrust Washer (2 used)
F—Thrust Bearing

MX,5010HJ,14 -19-14APR92

12. Remove set screw, spring, and detent ball.



M36233 -UN-22NOV89



M36234 -UN-22NOV89

MX,5010HJ,15 -19-14APR92

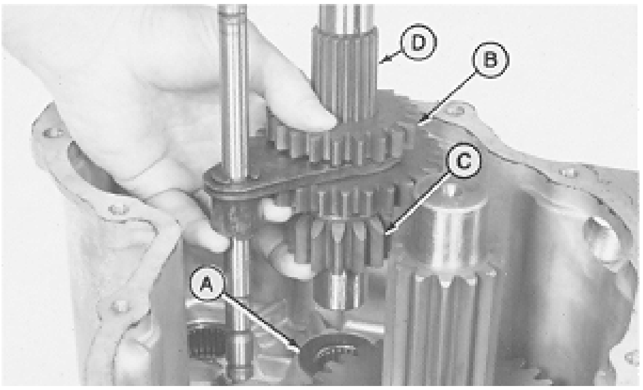
13. Remove shift rod assembly with intermediate shaft.

Inspect intermediate gears (B and C) for worn or damaged teeth.

Inspect intermediate shaft (D) for worn or damaged splines or bearing surfaces.

Inspect thrust washers (A) for wear or damage.

A—Thrust Washers
B—Intermediate Gear
C—Intermediate Gear
D—Intermediate Shaft

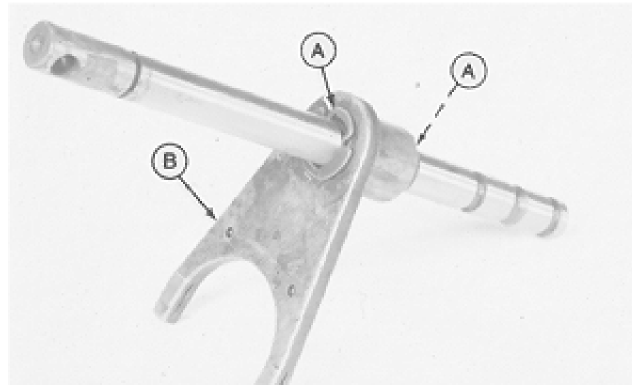


M36235 -UN-22NOV89

MX,5010HJ,16 -19-14APR92

14. Disassemble shift rod by removing two E-rings (A) and fork (B).

Inspect shaft for straightness, burrs, and damaged detent lands. Replace if necessary.



M36236 -UN-22NOV89

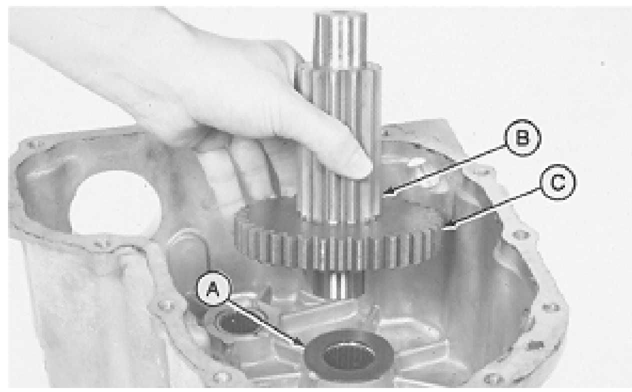
MX,5010HJ,17 -19-14APR92

15. Remove and inspect output shaft assembly.

Inspect output gear (C) for worn or damaged teeth.

Inspect output shaft (B) for wear on splined surfaces.

Inspect thrust washer (A) for wear or damage.



M36237 -UN-22NOV89

MX,5010HJ,18 -19-14APR92

16. Inspect and repair differential case and cover.

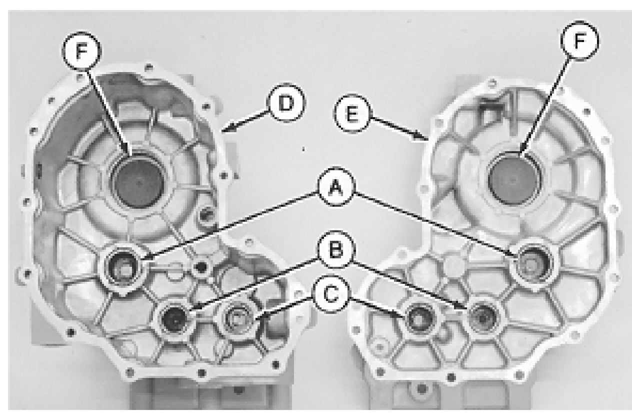
Inspect output shaft bearings (A), intermediate shaft bearings (B) and countershaft bearings (C) in case (D) and cover (E) for wear, damage or corrosion.

Check that bearings turn freely.

Inspect case and cover for cracks.

Inspect axle shaft seals (F) in case and cover.

Inspect shift rod seals for wear or damage.



M31920 -UN-28JUL89

MX,5010HJ,19 -19-14APR92

17. Replace bearings if necessary.

Bearing	Removal or Installation	Side Driven From	Pilot Size	Driver Size
Output Pinion Bearing	Remove	Outside	1-1/4 in.	1-9/16 in.
	Install	Inside	1-1/4 in.	1-9/16 in.
Shifter Shaft Bearing	Remove	Outside		1-1/4 in.
	Install	Inside	1 in.	1-1/4 in.
Countershaft Bearing	Remove	Outside		1-1/4 in.
	Install	Inside	1 in.	1-1/4 in.

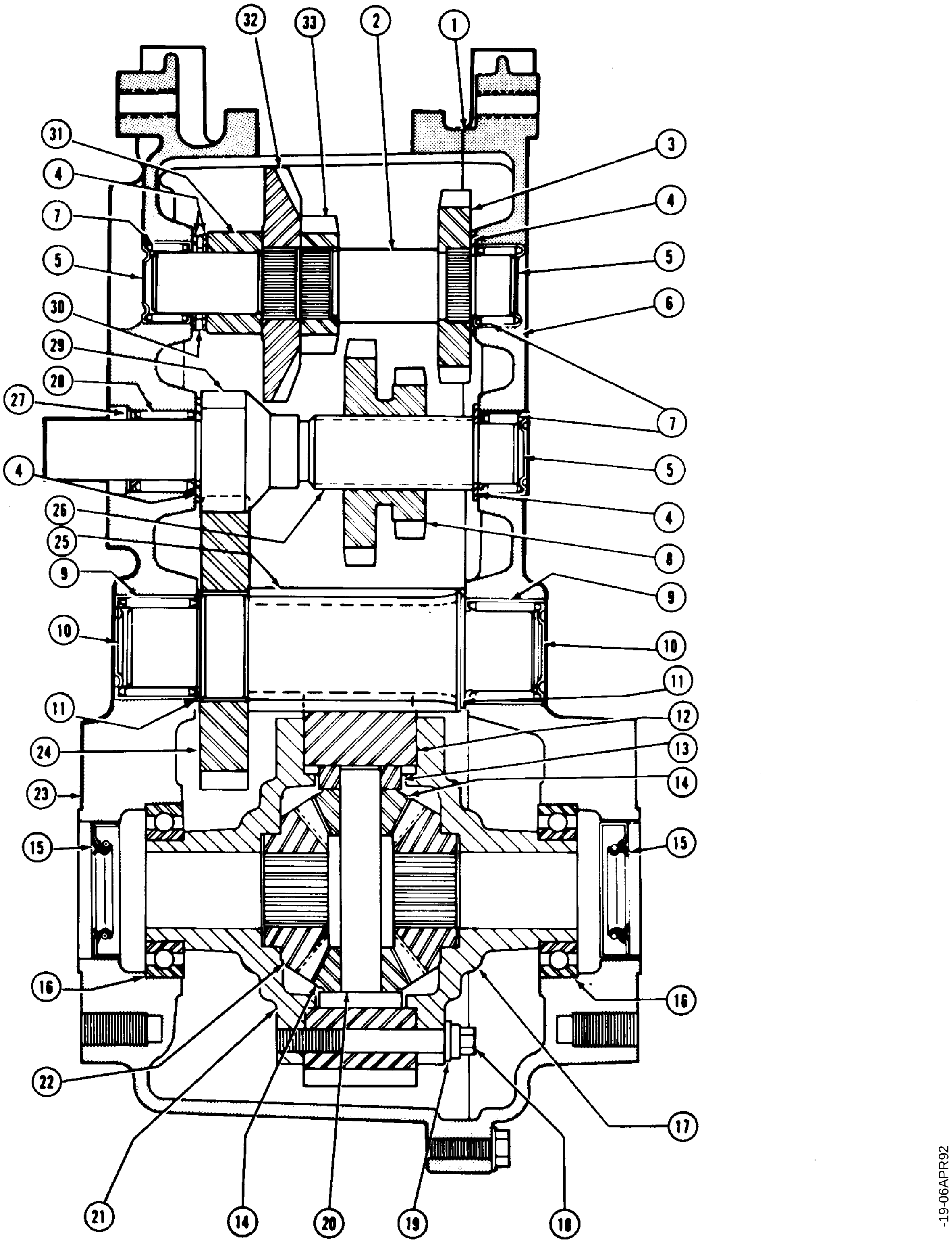
NOTE: Use a 1 in. driver disk to install a new shift rod seal.

MX,5010HJ,20 -19-14APR92

CROSS SECTION OF TWO-SPEED DIFFERENTIAL

1—Gasket
2—Counter Shaft
3—Gear (23 tooth)
4—Thrust Washers (5 used)
5—Seal (3 used)
6—Cover
7—Bearing (3 used)
8—Hi-Low Gear
9—Bearing (2 used)
10—Seal (2 used)
11—Thrust Washer (2 used)
12—Ring Gear
13—Support (2 used)
14—Pinion Gear (2 used)
15—Seal (2 used)
16—Bearing (2 used)
17—Carrier
18—Cap Screw (6 used)
19—Lock Washer (6 used)
20—Pin
21—Carrier
22—Gear
23—Case
24—Gear (37 tooth)
25—Output Shaft
26—Intermediate Shaft
27—Seal
28—Bearing
29—Gear (13 tooth)
30—Thrust Bearing
31—Spacer
32—Gear (30 tooth)
33—Gear (16 tooth)

MX,5010HJ,21 -19-14APR92



M46518 **CROSS SECTION 2-SPEED DIFFERENTIAL**

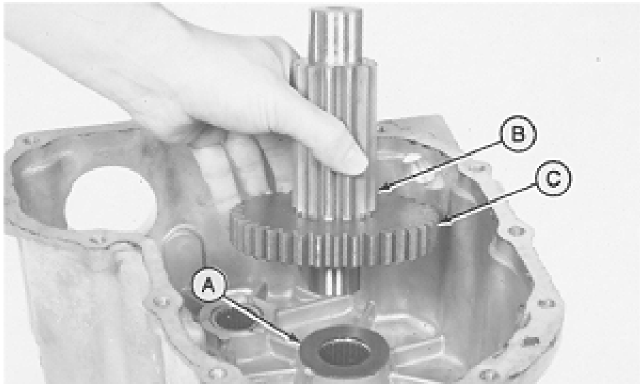
MX,5010HJ,22 -19-14APR92

ASSEMBLE DIFFERENTIAL

1. Put clean John Deere All-Weather Hydrostatic Fluid or an equivalent on all internal parts.

2. Assemble gear (C) and shaft (B).

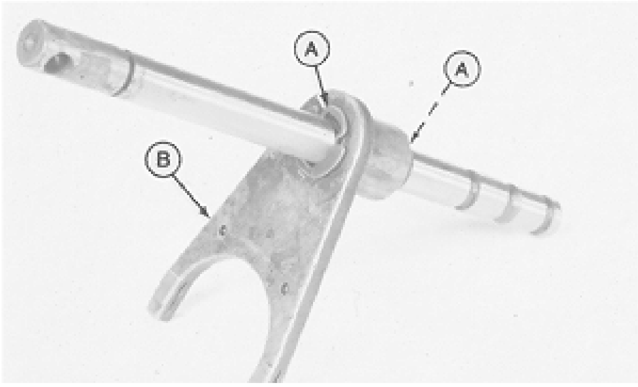
3. Install output shaft assembly and thrust washer (A).



M36237 -UN-22NOV89

MX,5010HJ,23 -19-14APR92

4. Assemble shift rod by installing fork (B) and two E-rings (A).



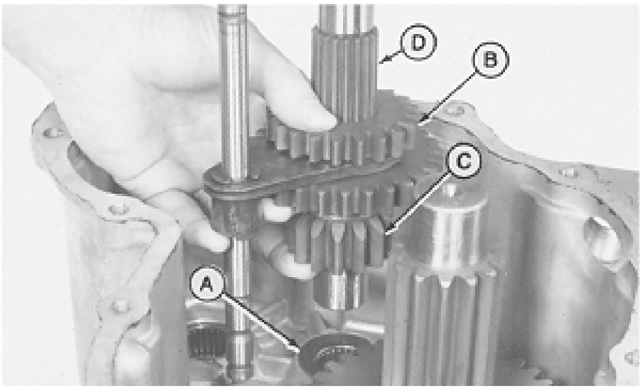
M36236 -UN-22NOV89

MX,5010HJ,24 -19-14APR92

5. Assemble gears (B and C) and shaft (D).

6. Install intermediate shaft assembly and thrust washer (A).

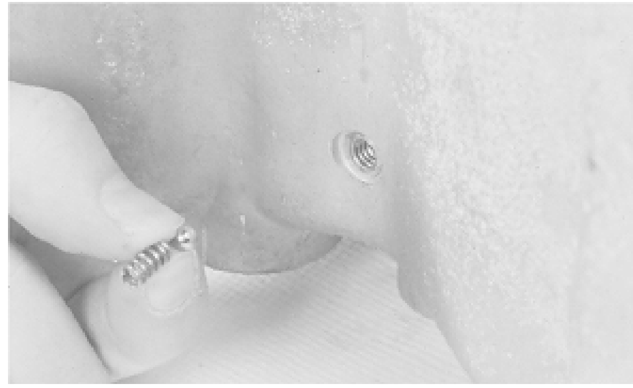
A—Thrust Washer
B—Intermediate Gear
C—Intermediate Gear
D—Intermediate Shaft



M36235 -UN-22NOV89

MX,5010HJ,25 -19-14APR92

7. Install detent ball and spring.



M36234 -UN-22NOV89

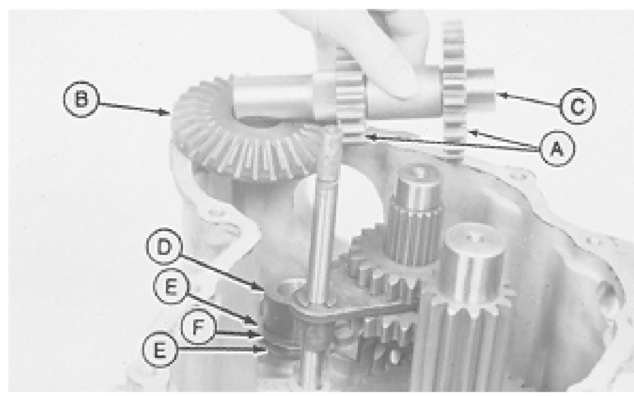
M36233 -UN-22NOV89

MX,5010HJ,26 -19-14APR92

8. Assemble gears (A and B) and shaft (C).

9. Install countershaft assembly, spacer (D), thrust bearing (F) and two thrust washers (E).

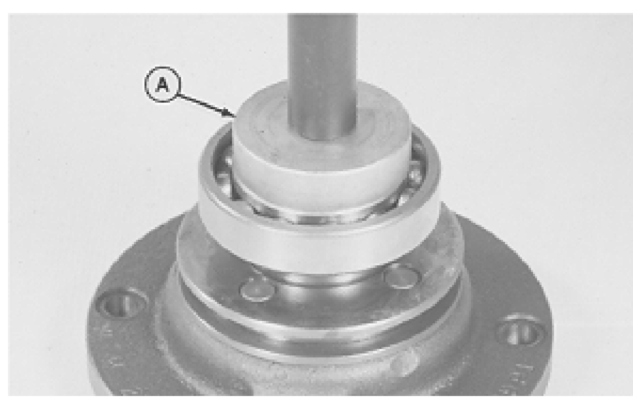
A—Spur Gear
B—Bevel Gear
C—Countershaft
D—Spacer
E—Thrust Washer (2 used)
F—Thrust Bearing



M36232 -UN-22NOV89

MX,5010HJ,27 -19-14APR92

10. Drive bearing onto shaft until flush using a 2 in. driver disk (A).

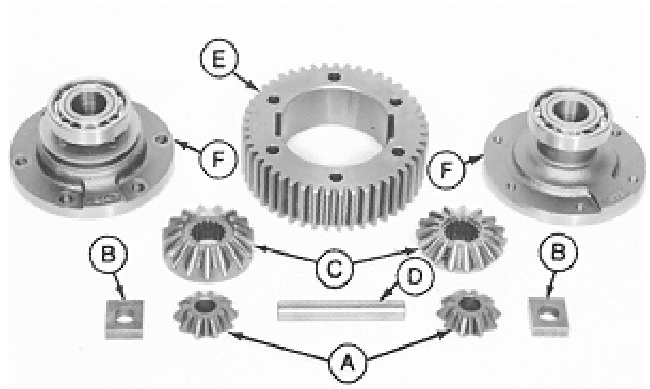


M36178 -UN-22NOV89

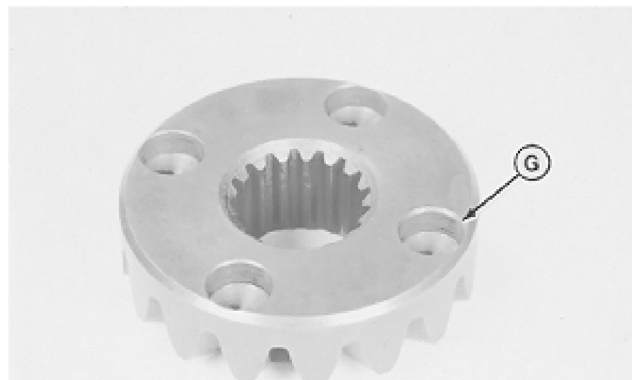
MX,5010HJ,28 -19-14APR92

11. Assemble carriers (F), ring gear (E), pinion gears (A and C), cross shaft (D), and supports (B).

A—Pinion Gear (2 used)
B—Pinion Block (2 used)
C—Pinion Gear (2 used)
D—Cross Shaft
E—Ring Gear
F—Carrier (2 used)
G—Pinion Gear with holes



M31977 -UN-25AUG88



M36173 -UN-29AUG88

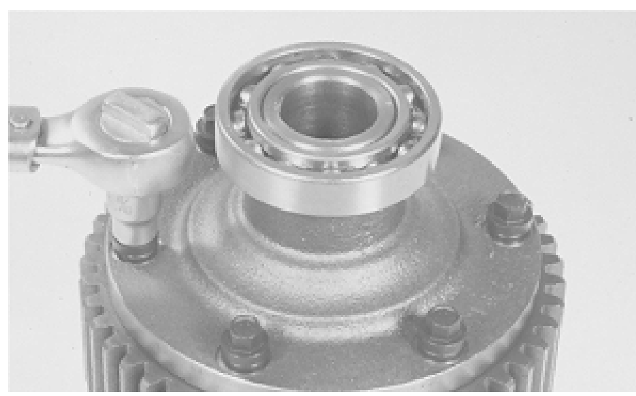
MX,5010HJ,29 -19-14APR92

12. Clean the threads of all six cap screws and threaded carrier, using clean and cure primer.

13. Apply thread lock and sealer (medium strength) to the thread of cap screws.

14. Install cap screws and tighten to 50—55 N·m (35—40 lb-ft).

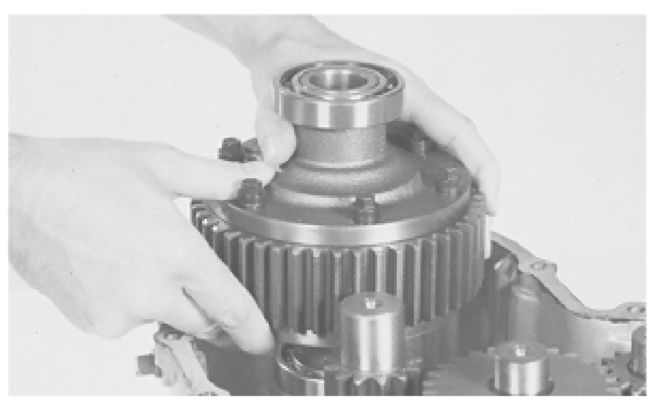
NOTE: If necessary hold ring gear using a strap wrench when tightening cap screws.



M36180 -UN-22NOV89

MX,5010HJ,30 -19-14APR92

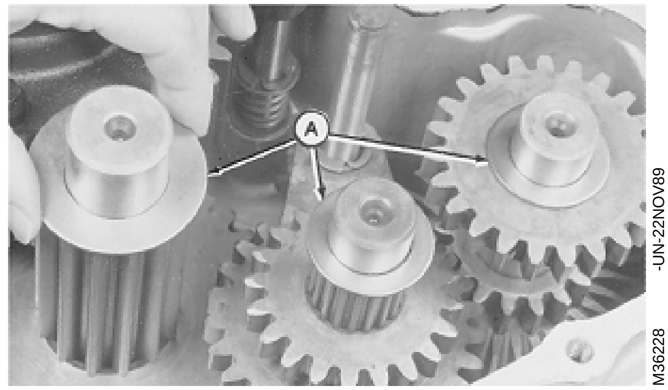
15. Install differential.



M36170 -UN-22NOV89

MX,5010HJ,31 -19-14APR92

16. Install three thrust washers (A).

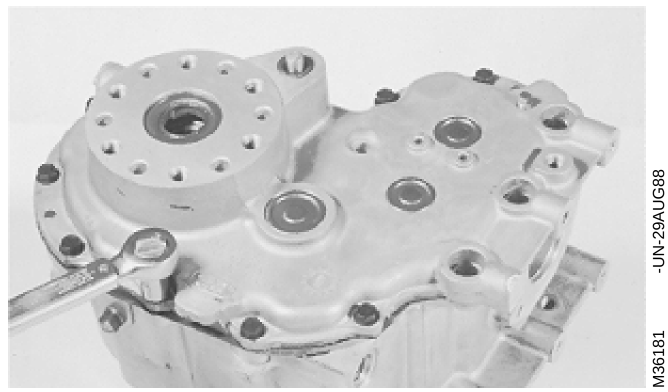


MX,5010HJ,32 -19-14APR92

17. Clean the cover and differential case sealing surfaces using clean and cure primer.

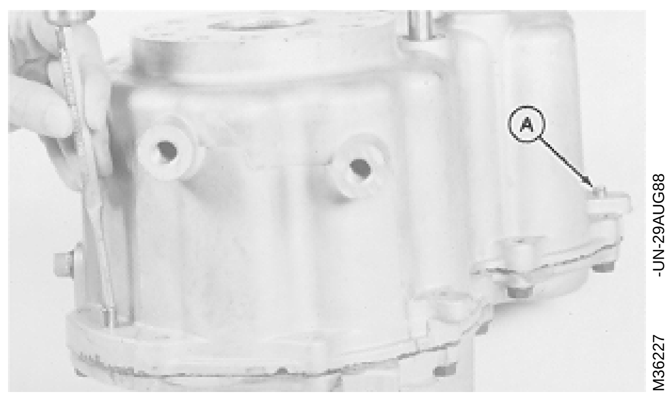
18. Apply flexible sealant or an equivalent on gasket surface of the differential cover and case.

19. Install gasket, cover, and 13 cap screws. Tighten cap screws to 20—25 N·m (15—18 lb-ft).



MX,5010HJ,33 -19-14APR92

20. Drive two dowel pins (A) into differential cover.



MX,5010HJ,34 -19-14APR92

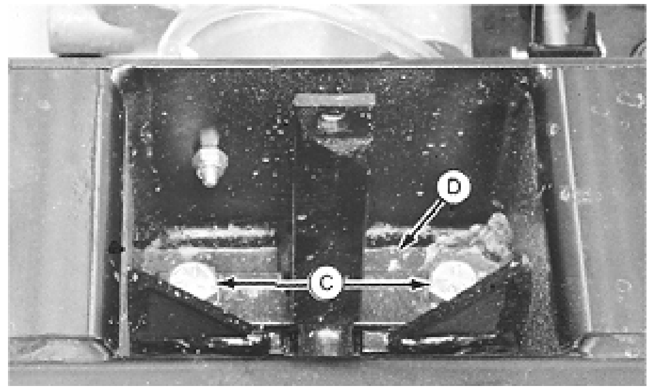
INSTALL DIFFERENTIAL

1. Install axle assemblies. (See Section 50 Group 20)

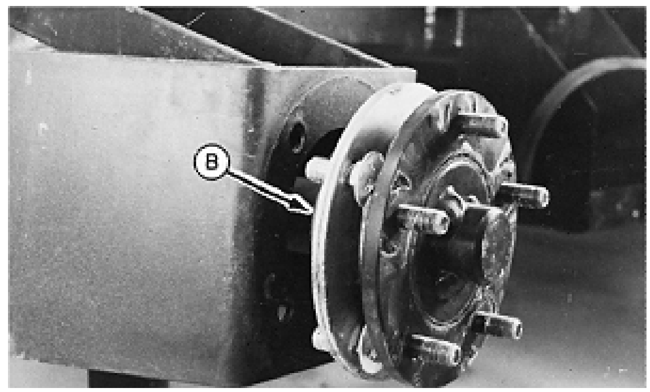
2. Raise differential into position, slide brackets (D) over brake control arms, install cap screws (C) and tighten to 106 N·m (78 lb-ft).

3. Install stub shafts (B) with lockwashers and nuts. Tighten to 80 N·m (60 lb-ft).

4. Install wheels and tighten cap screws to 70 ± 7 N·m (52 ± 5 lb-ft).



M46663 -UN-27MAR92



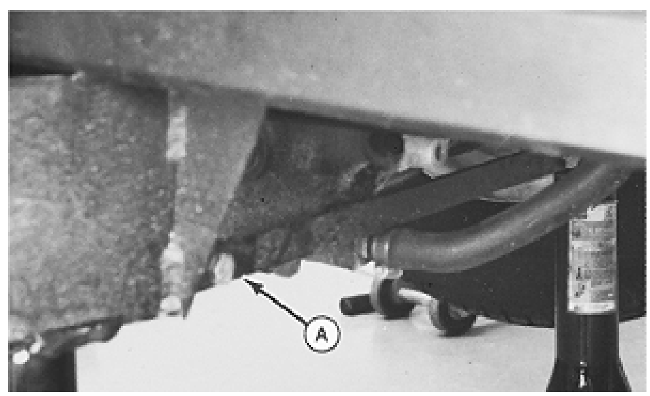
M46662 -UN-27MAR92

MX,5010HJ,35 -19-14APR92

5. Install frame support bracket (A).

6. Lower vehicle to the ground.

A—Vent Tube
B—Brake Cable
C—Brake Linkage
D—High/Low Shift
E—Hydraulic Gage

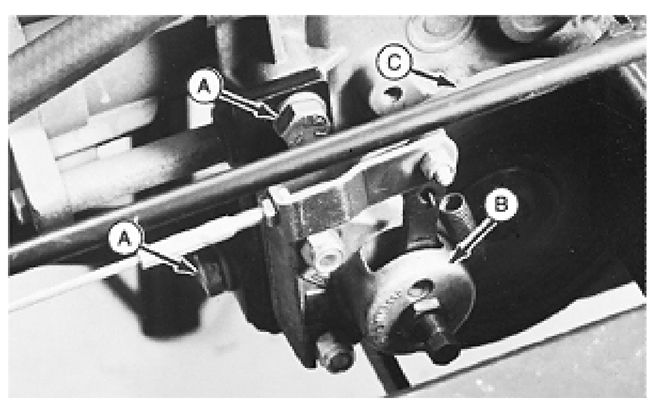


M46611 -UN-27MAR92

MX,5010HJ,36 -19-14APR92

7. Install disc and caliper. Secure with two cap screws.

A—Vent Tube
B—Brake Cable
C—Brake Linkage
D—High/Low Shift
E—Hydraulic Gage



M46612 -UN-27MAR92

MX,5010HJ,37 -19-14APR92

8. Attach hydraulic level sight gauge (E) to the frame.

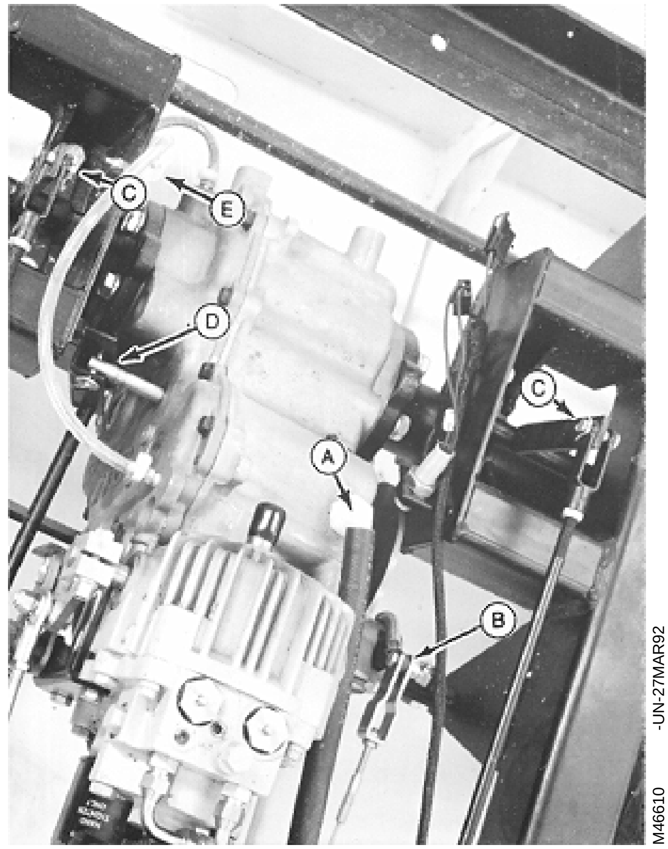
9. Connect High/Low shift linkage (D).

10. Connect brake control linkages (C).

11. Connect parking brake linkage (B).

12. Install transmission. (See Group 05 in this section.)

NOTE: See Section 250, Group 15 for Transmission Neutral Return Adjustment. Also see Section 260, Group 15 for Brake Linkage/Pedal Free-Play Adjustment and Park Brake Adjustment.



A—Vent Tube
B—Brake Cable
C—Brake Linkage
D—High/Low Shift
E—Hydraulic Gauge

MX,5010HJ,38 -19-14APR92

REMOVE TRANSMISSION CONTROL LINKAGE (SHIFTER)

1. Block wheels to prevent vehicle movement.

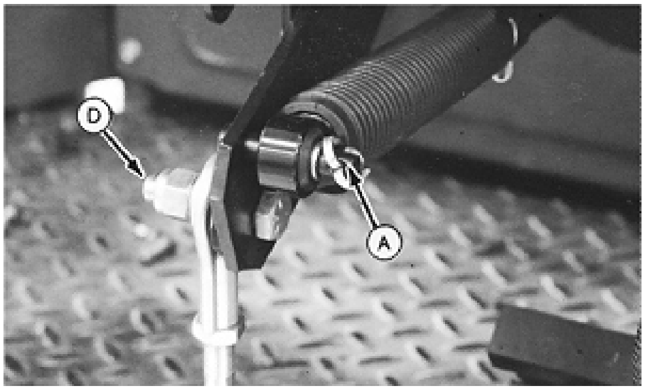
2. Remove shock dampener (A). (cylinder end first)

NOTE: Mark mounting plate position for reassembly.

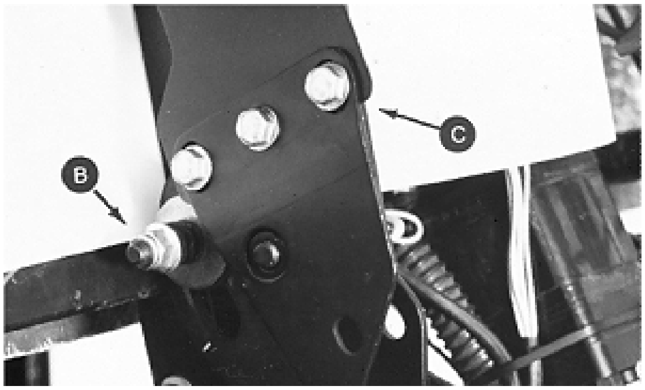
3. Disconnect shifter spring plate (C).

4. Disconnect control rod (D).

5. Remove nut and spring assembly (B).



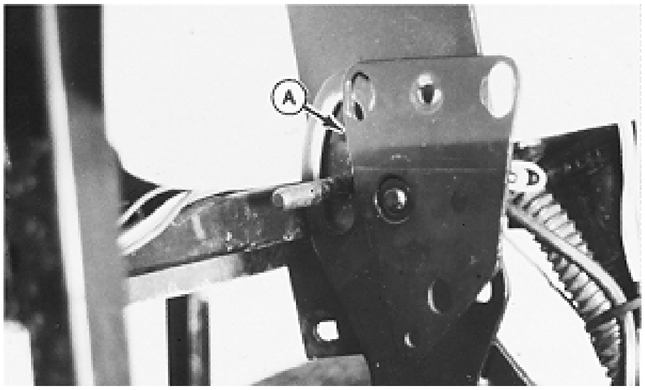
M46572 -UN-27MAR92



M46585 -UN-27MAR92

MX,5015HJ,1 -19-14APR92

6. Remove pivot plate (A).



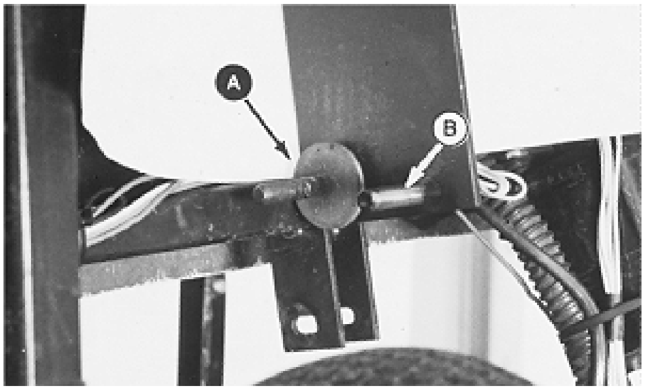
M46613 -UN-27MAR92

MX,5015HJ,2 -19-14APR92

INSTALL TRANSMISSION CONTROL LINKAGE (SHIFTER)

1. Install cup washer and friction disc (A).

2. Apply NEVER-SEEZ lubricant to pivot shaft (B). Install pivot plate.



M46586 -UN-27MAR92

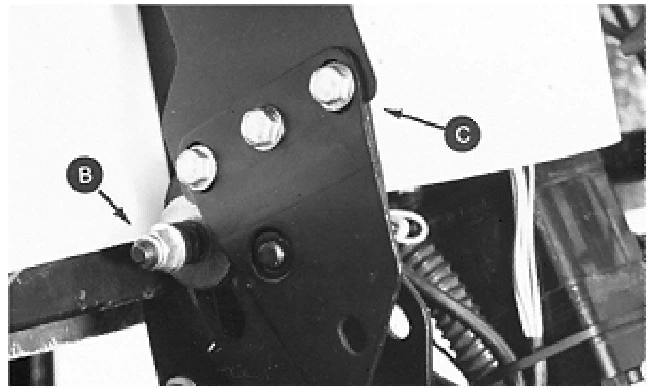
MX,5015HJ,3 -19-14APR92

3. Install friction disc, washer, spring and nut (B). (Do Not tighten)

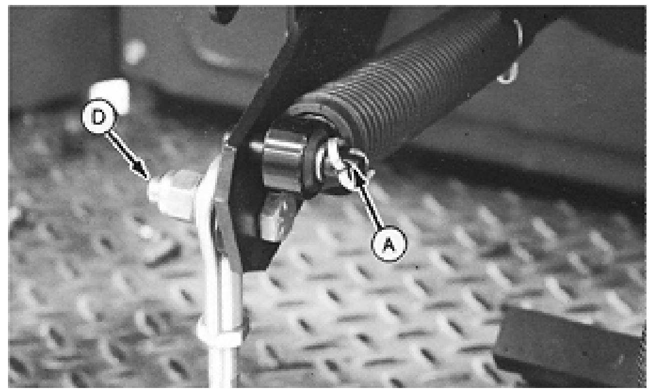
4. Align spring plate (C) with pivot plate (marked earlier) and secure with three cap screws.

5. Install shock dampener (A) and secure with washer and cotter keys.

6. Connect control rod (D) and secure with cap screw and nut.



M46585 -UN-27MAR92



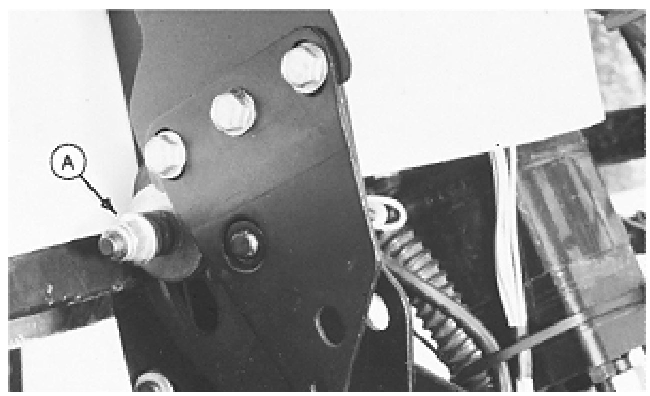
M46572 -UN-27MAR92

MX,5015HJ,4 -19-14APR92

7. Adjust tension with nut (A).

NOTE: Tension should be sufficient to hold the shifter in any selected position and still allow the shifter to be moved easily.

8. Check Neutral Return and Transmission Neutral Adjustments in Section 250, Group 15.



M46614 -UN-27MAR92

MX,5015HJ,5 -19-14APR92

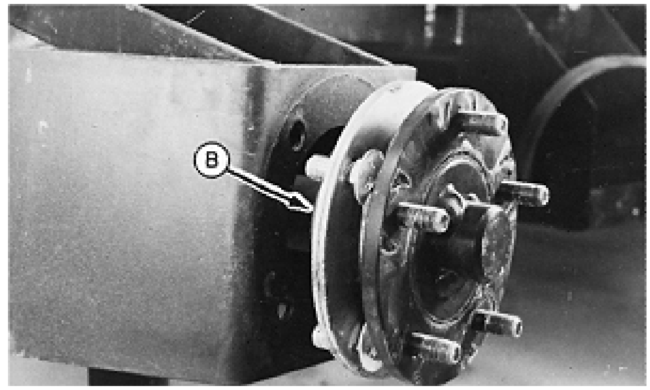
REMOVE AND INSPECT REAR AXLES

NOTE: Approximate differential/transmission capacity is 7.1 L (7.5 U.S. qt).

1. Drain hydrostatic oil.

2. Raise and support machine safely.

3. Remove wheel and stub shaft (B).



M46662 -UN-27MAR92

MX,5020HJ,1 -19-14APR92

4. Remove six cap screws (B) and hub.

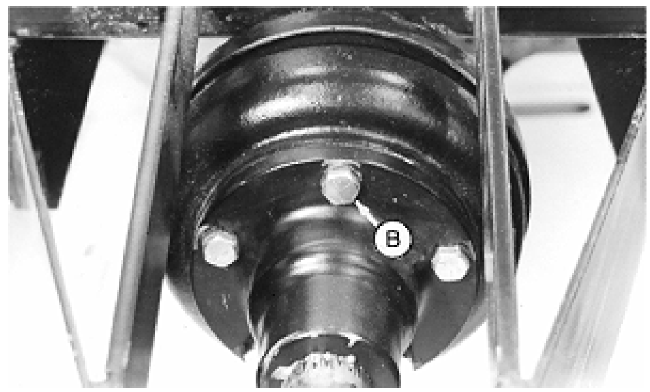
5. Bend edge of washer (C) flat against brake drum.

6. Remove nut (D) and washer.

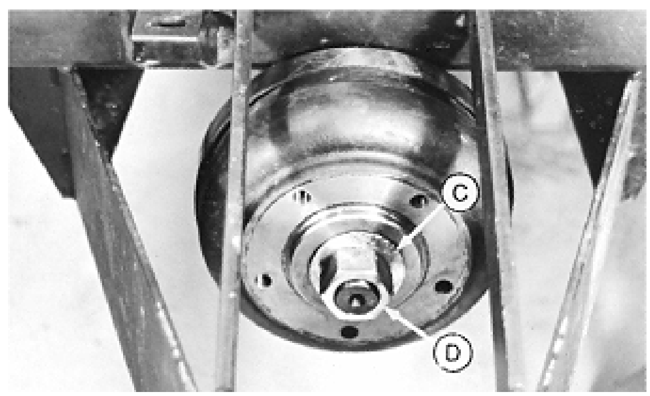
NOTE: it may be necessary to back off brake adjuster to remove brake drum. (See Remove and Inspect Brakes: Section 60, Group 15.)

7. Remove brake drum.

8. Disconnect brake linkage.



M46558 -UN-27MAR92

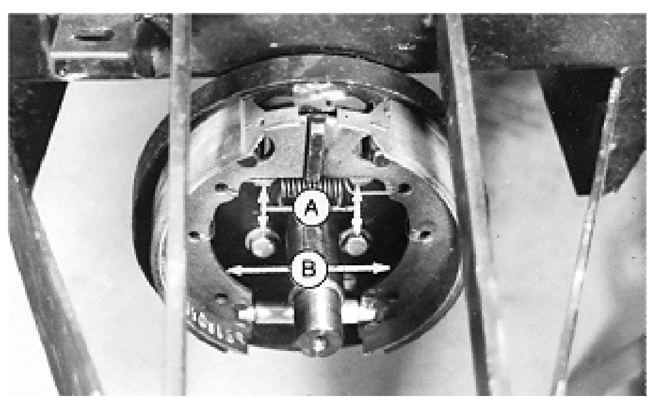


M46567 -UN-27MAR92

MX,5020HJ,2 -19-14APR92

9. Remove axle key and brake shoe assembly (B).

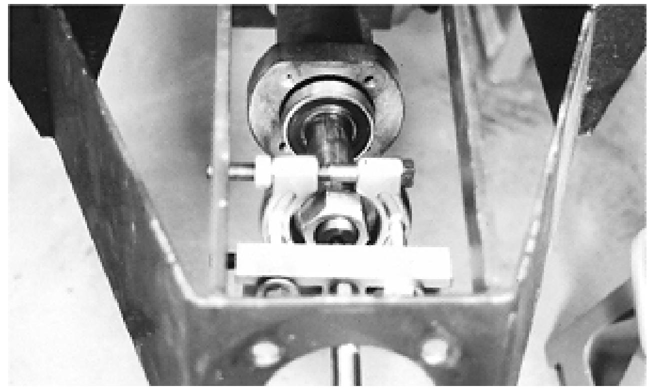
10. Remove four cap screws (A) and brake plate assembly.



M46565 -UN-27MAR92

MX,5020HJ,3 -19-14APR92

11. Remove axle shaft assembly using a knife-edge puller, H-bar, and slide hammer.

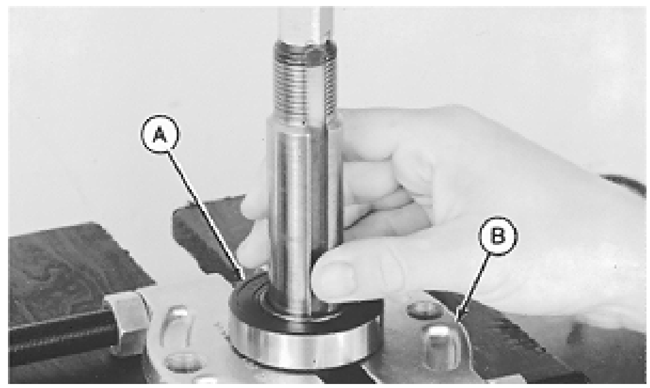


M46551 -UN-27MAR92

MX,5020HJ,4 -19-14APR92

12. Inspect bearing (A).

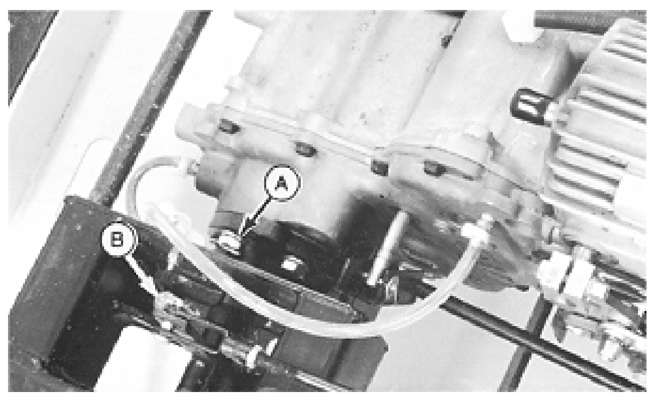
13. If bearing must be replaced, remove using a knife-edge puller (B) and a press.



M31951 -UN-25AUG88

MX,5020HJ,5 -19-14APR92

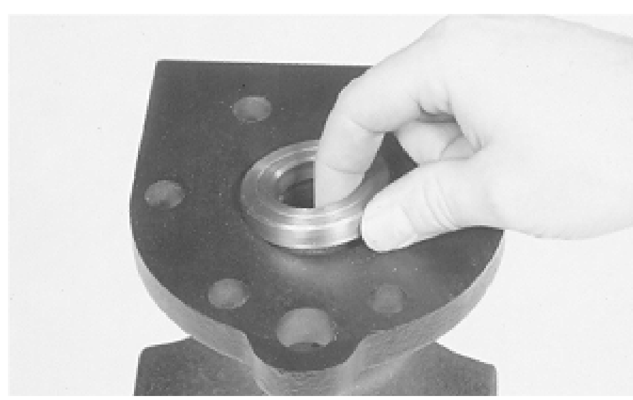
14. Support differential with a jack and remove eight cap screws to remove axle housing, six cap screws (A) secure the axle housing to the differential and two cap screws (B) secure the axle housing to the frame.



M46615 -UN-27MAR92

MX,5020HJ,6 -19-14APR92

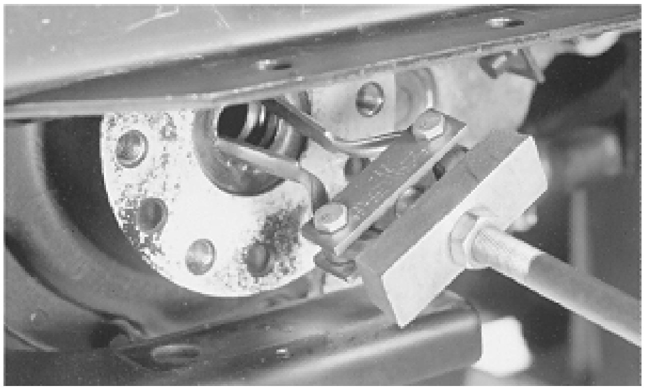
15. Remove spacer.



M36565 -UN-25JAN90

MX,5020HJ,6A -19-14APR92

16. Remove seal from differential using a 2-jaw puller and a slide hammer.

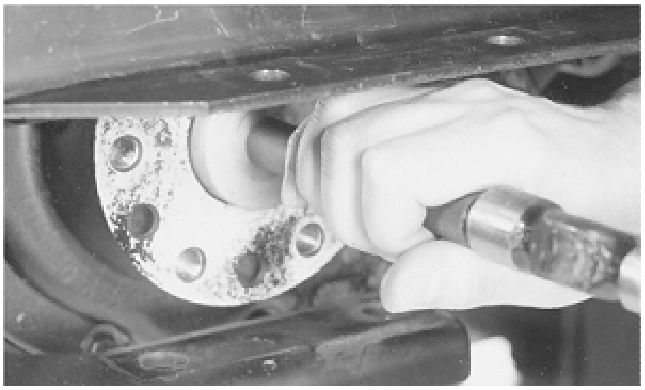


M36566 -UN-25JAN90

MX,5020HJ,7 -19-14APR92

INSTALL REAR AXLES

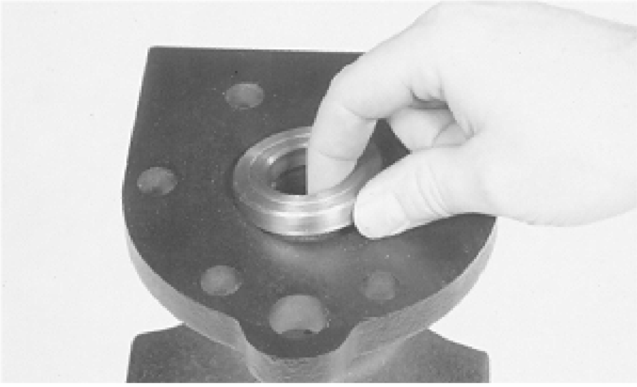
1. Install seal 3 mm (1/8 in.) below machined surface of differential using a 2 1/16 in. driver disk.



M36567 -UN-25JAN90

MX,5020HJ,8 -19-14APR92

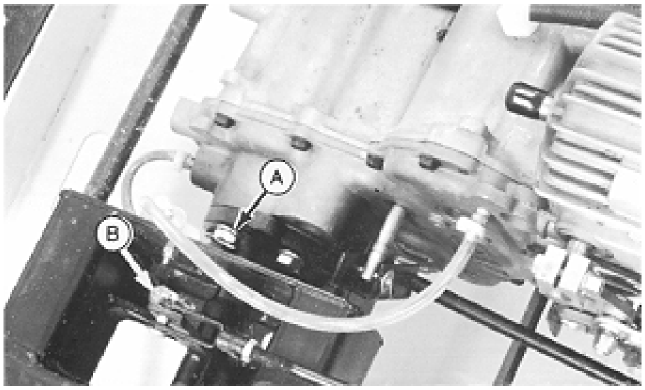
2. Install spacer.



M36565 -UN-25JAN90

MX,5020HJ,9 -19-14APR92

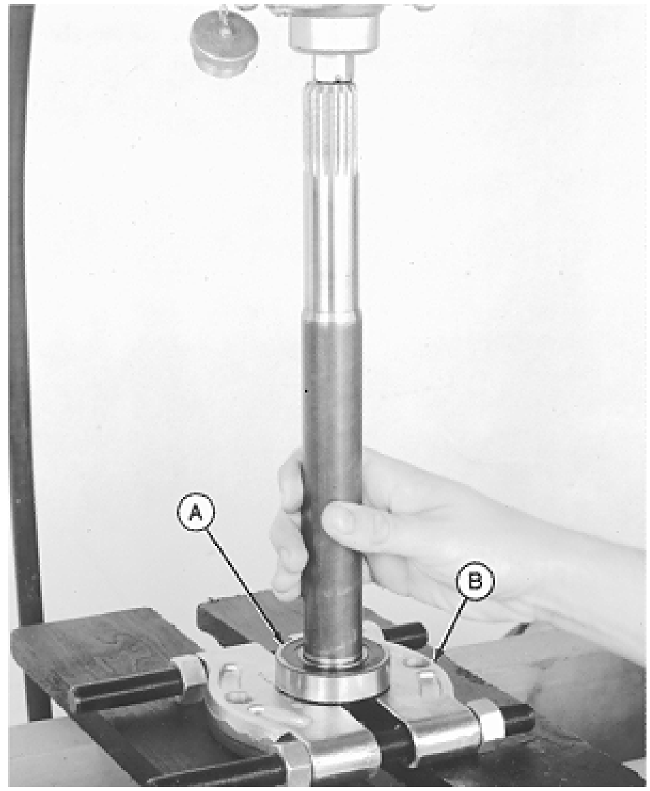
3. Install axle housing and fasten with six cap screws (A). Tighten cap screws to 81 N·m (60 lb-ft). Install two differential-to-frame cap screws (B) tighten to 106 N·m (78 lb-ft).



M46615 -UN-27MAR92

MX,5020HJ,10 -19-14APR92

4. Install bearing (A) on axle shaft using a bearing puller (B) and a press. Push bearing tight against axle shaft shoulder.

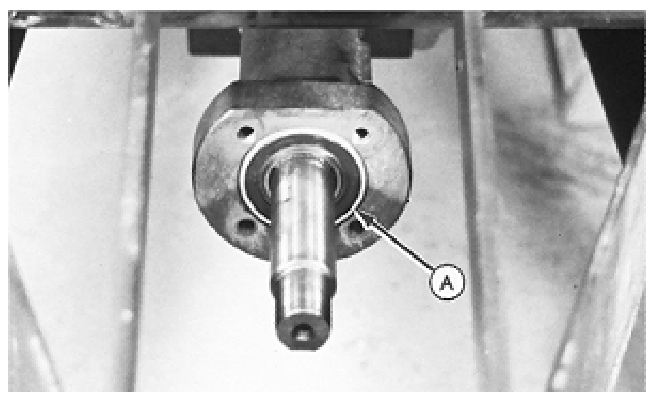


MX,5020HJ,11 -19-14APR92

5. Apply clean transmission fluid to the splined end of the axle shaft.

6. Carefully install axle shaft into housing and through seal in differential. Align splines on shaft with splined gear inside differential.

7. Tap shaft assembly into axle housing until bearing (A) is flush with housing.



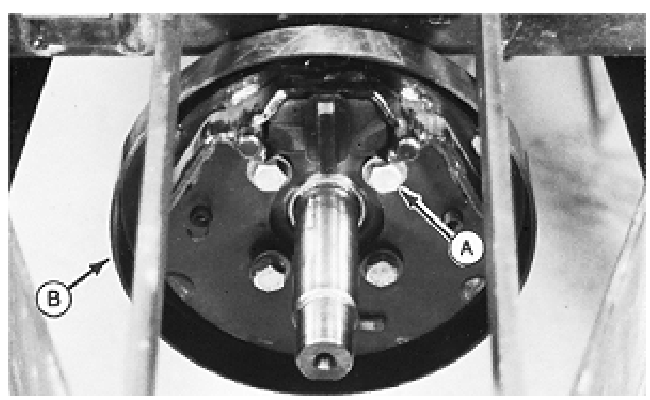
MX,5020HJ,12 -19-14APR92

8. Clean the threads of all four brake plate cap screws and threaded axle housing using clean and cure primer.

9. Apply thread lock and sealer (medium strength) on threads of cap screws.

10. Install brake plate assembly (B) on axle. Install and tighten four cap screws (A) to 68 N·m (50 lb-ft).

11. Install brake assembly. See Install Brakes in Section 60, Group 15.



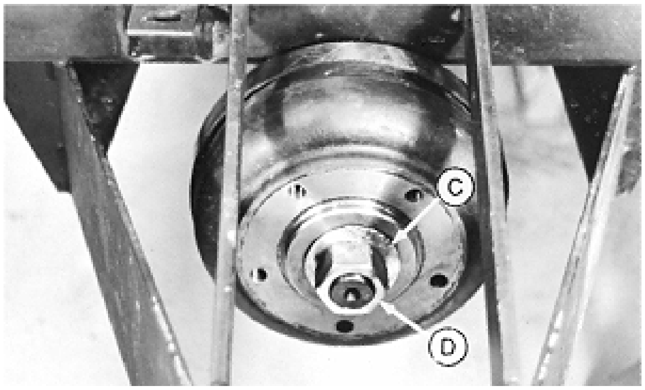
MX,5020HJ,13 -19-14APR92

12. Apply Never-Seez Lubricant on axle shaft.

13. Install key and brake drum.

14. Install washer (C) and nut (D). Tighten nut to 115-156 N·m (85-115 lb-ft).

15. Bend one side of washer (C) over nut (D) to lock nut in place.



M46567 -UN-27MAR92

MX,5020HJ,15 -19-14APR92

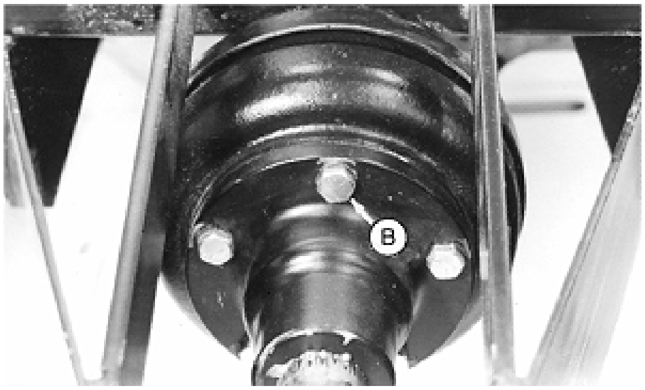
16. Install hub and secure with five cap screws (B). Tighten to 95 N·m (70 lb-ft).

17. Install stub shafts and secure with lockwashers and nuts (A). Tighten to 106 N·m (78 lb-ft).

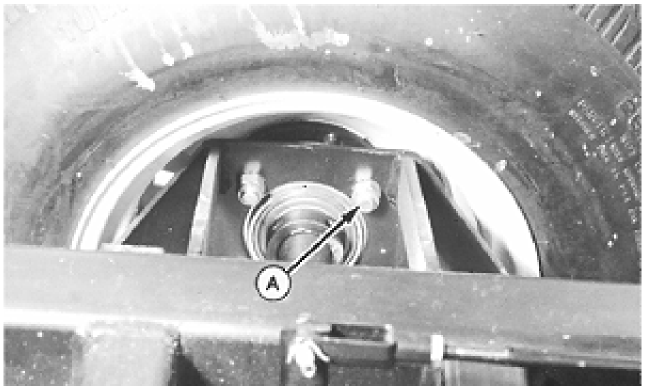
18. Install wheel and fasten with five cap screws. Tighten cap screws to 70 ± 7 N·m (52 ± 5 lb-ft).

19. Raise vehicle, remove support stands, and lower vehicle.

20. Fill differential with the recommended amount of John Deere All-Weather Hydrostatic Fluid.



M46558 -UN-27MAR92



M46617 -UN-27MAR92

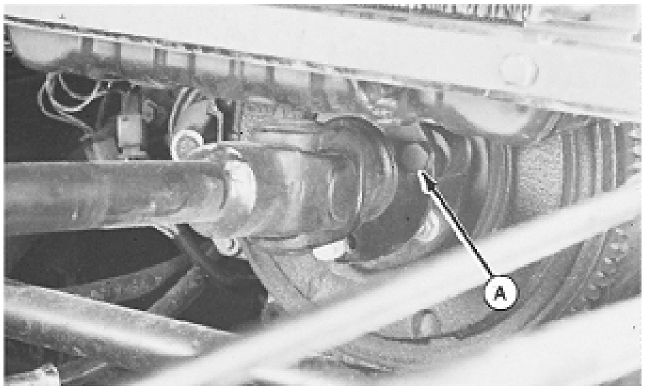
MX,5020HJ,16 -19-14APR92

REMOVE DRIVE SHAFT

NOTE: Guard removed for photo.

1. Remove three cap screws (A).

2. Slide drive shaft off of transmission input shaft.



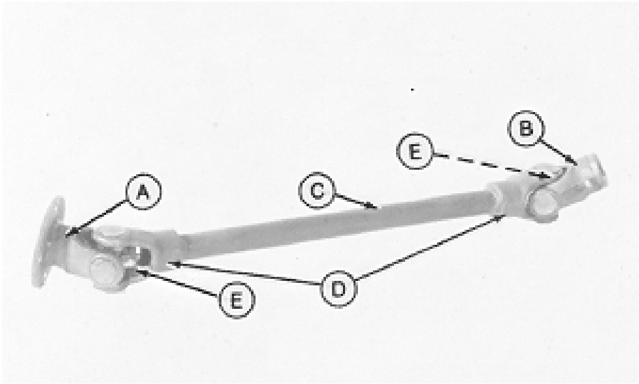
M46689 -UN-27MAR92

MX,5025HJ,1 -19-14APR92

DISASSEMBLE DRIVE SHAFT

1. Inspect flanged yoke (A), splined yoke (B), shaft (C), end yokes (D) and cross and bearing assembly (E) for cracks, wear, and bending.

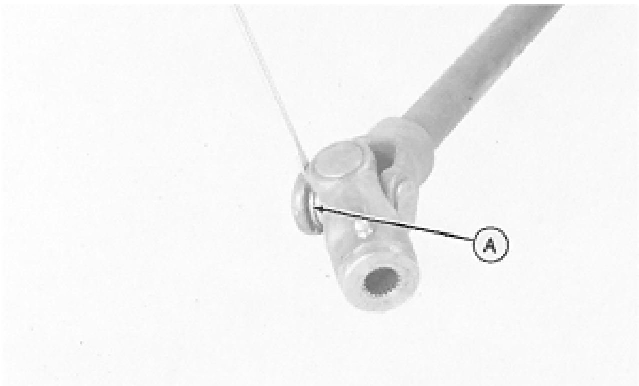
A—Flanged Yoke
B—Splined Yoke
C—Shaft
D—End Yoke (2 used)
E—Cross and Bearing Assembly (2 used)



M43747 -UN-12JAN90

M21,5025K,7 -19-12AUG86

2. Remove four snap rings (A).



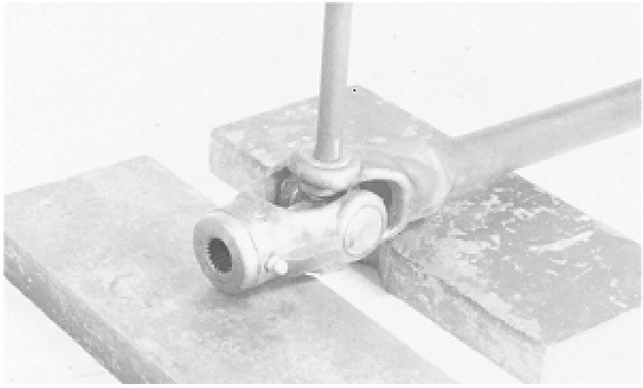
M43748 -UN-12JAN90

M21,5025K,8 -19-08SEP86

3. Remove cross and bearing assembly using soft metal rod. Push bearing down until it can be removed.

4. Turn cross and bearing assembly over. Push down until bearing can be removed.

5. Separate end yoke from splined yoke.

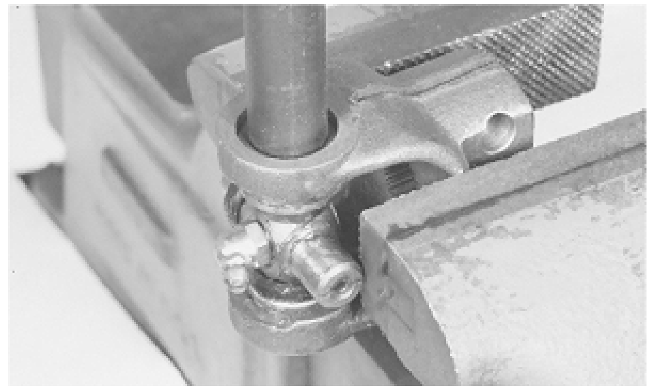


M43739 -UN-12JAN90

M21,5025K,9 -19-17SEP86

6. Remove cross and bearing assembly using a soft metal rod. Push bearing down until bottom bearing can be removed.

7. Remove cross and top bearing.



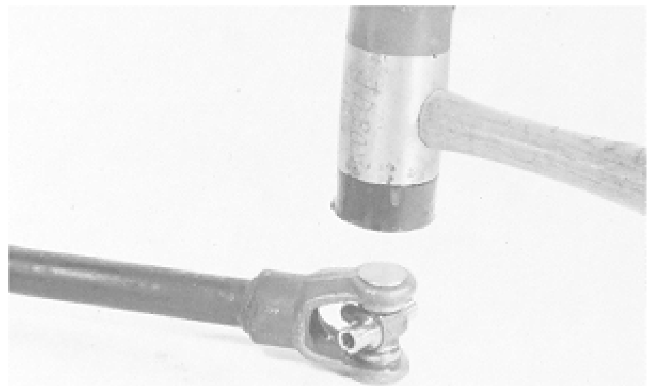
M36591 -UN-25JAN90

M21,5025K,10 -19-12AUG86

ASSEMBLE DRIVE SHAFT

IMPORTANT: Be careful not to damage needle rollers and seal while installing cross and bearing assembly.

1. Install cross and bearing assembly using soft-faced hammer. Push bearing down until snap ring groove is inside end yoke.



M43752 -UN-12JAN90

M21,5025K,11 -19-12AUG86

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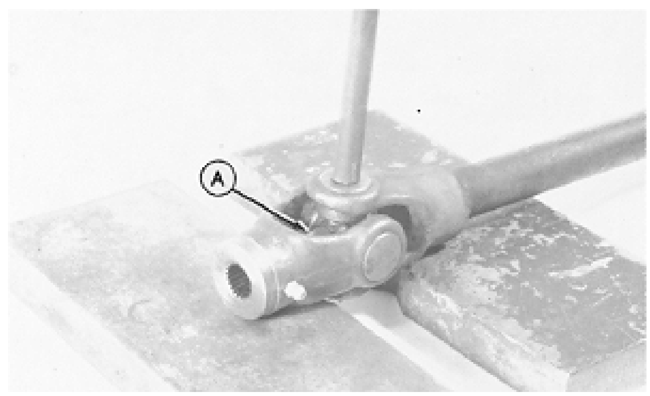
2. Install cross in splined yoke with grease fitting toward splined yoke (A).

3. Install bearing with soft metal rod. Push bearing down until snap ring groove is inside splined yoke.

4. Turn cross and bearing assembly over and install other bearing.

5. Install four snap rings.



M43753 -UN-12JAN90

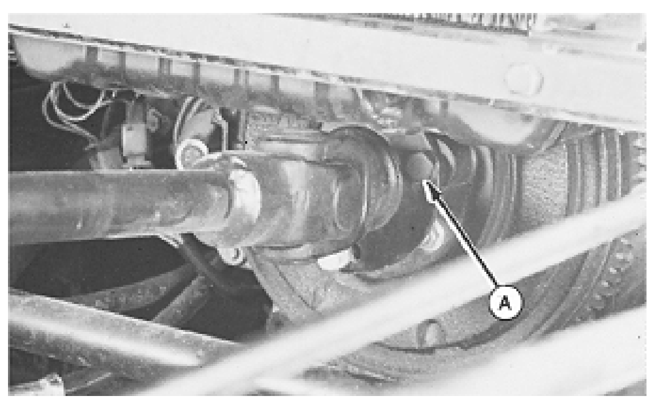
M21,5025K,12 -19-12AUG86

INSTALL DRIVE SHAFT

NOTE: Guard removed for photo.

1. Slide drive shaft onto transmission input shaft.

2. Secure with three cap screws (A). Tighten to 35 N·m (28 lb-ft).



M46689 -UN-27MAR92

MX,5025HJ,2 -19-14APR92

Section 60
STEERING AND BRAKE REPAIR

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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
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

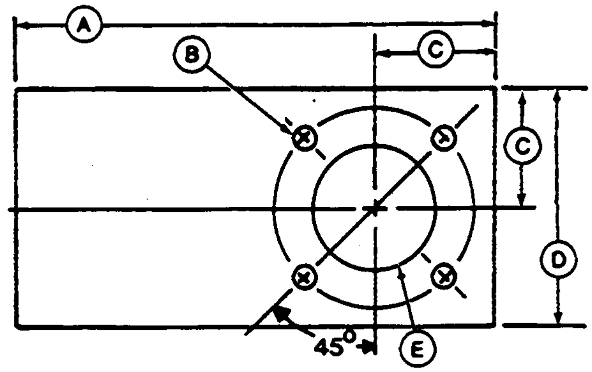
MX,HU,6005R,1 -19-28JUN91

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.



M36877 -UN-28APR89

A—203 mm (8.0 in.)
B—9.5 mm (3/8 in.)[1]
C—51 mm (2.0 in.)
D—102 mm (4.0 in.)
E—51 mm (2.0 in.) Diameter Hole

[1] *Four Diameter Holes Equally Spaced on a 83 mm (3-1/4 in.) Diameter Circle*

MX,HU,6005R,2 -19-28JUN91

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

MX,HU,6005R,3 -19-28JUN91

SERVICE PARTS KITS

The following kits are available through your parts catalog:

Steering Control Valve Seal Kit

MX,HU,6005R,4 -19-28JUN91

SPECIFICATIONS

Maximum allowable rotor-to-stator clearance . . . . 0.08 mm (0.003 in.)

Dimension from top of steering tube to bushing . . . . 2.5 mm (0.1 in.)

Metering assembly screws torque . . . . 1.4 ± 0.1 N·m (12 ± 1 lb-in.)

Port cover nuts torque . . . . 30 ± 3 N·m (266 ± 27 lb-in.)

Check ball plug torque . . . . 14 ± 3 N·m (124 ± 27 lb-in.)

MX,HU,6005R,5 -19-28JUN91

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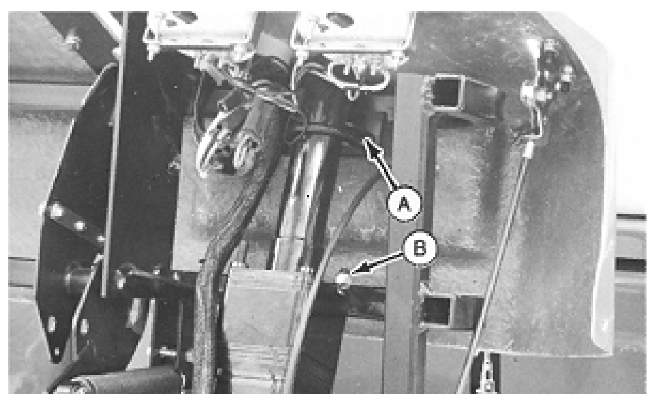
2

REMOVE STEERING VALVE



M46664 -UN-27MAR92

1. Remove front cowling.

2. Remove steering wheel.

3. Remove steering column (A) and steering valve mounting bolts (B).

N **CAUTION: To avoid injury from escaping hydraulic oil under pressure, relieve the pressure in the system by stopping the engine, and working the steering wheel back and forth several times.**

4. Disconnect hydraulic lines on steering valve.

NOTE: If necessary put identification tags on hydraulic lines to aid installation.

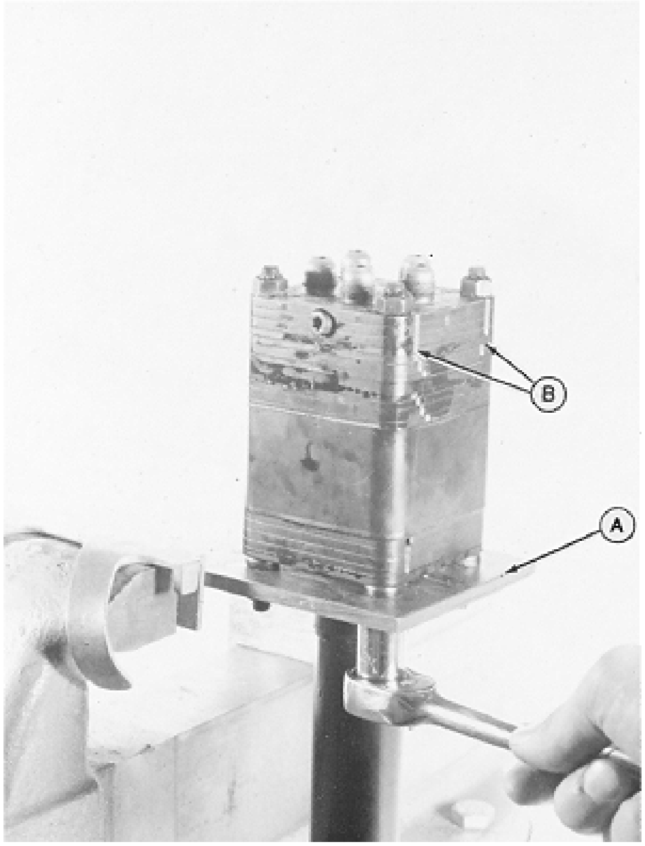
MX,6005HJ,1 -19-14APR92

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). (See Fabricated Tools in this group.) Fasten valve to fixture using four 5/16-24 UNF nuts.

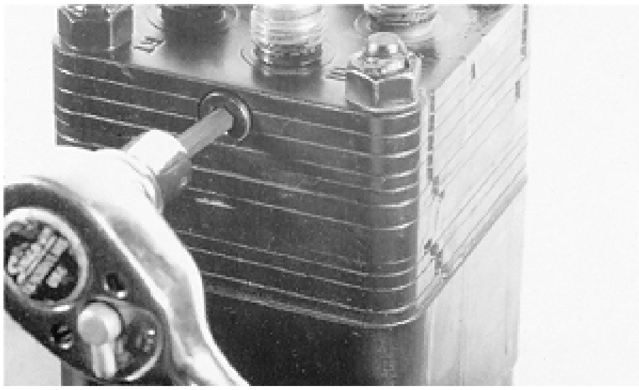
NOTE: Check position of alignment grooves (B) in valve body to aid in assembly.



M43839 -UN-08JAN90

MX,6005HJ,2 -19-14APR92

2. Loosen plug one turn.

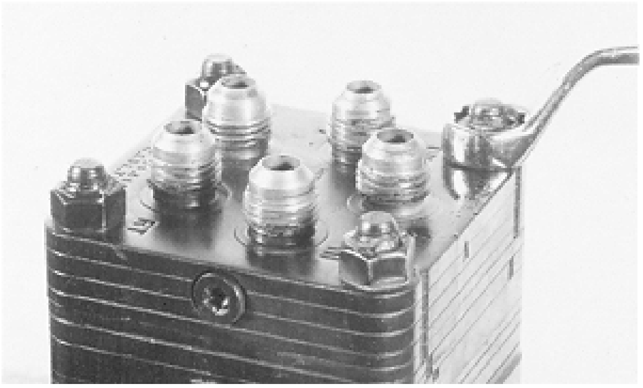


M43840 -UN-08JAN90

MX,6005HJ,3 -19-14APR92

IMPORTANT: Do not damage fittings during nut removal. Do not nick or scratch the machined surfaces of the steering valve.

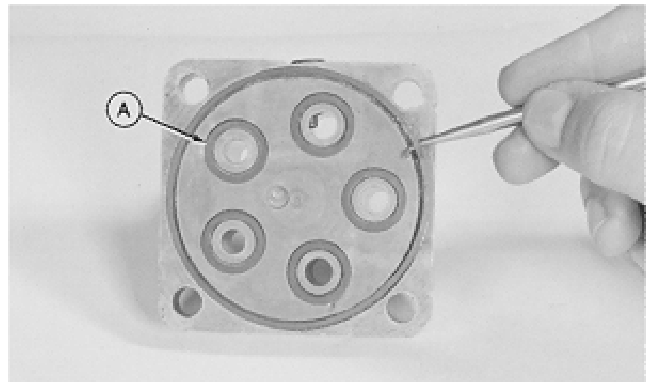
3. Remove nuts to remove port cover assembly (four plates bonded together).



M43841 -UN-08JAN90

MX,6005HJ,4 -19-14APR92

4. Remove seal ring and five O-rings (A).

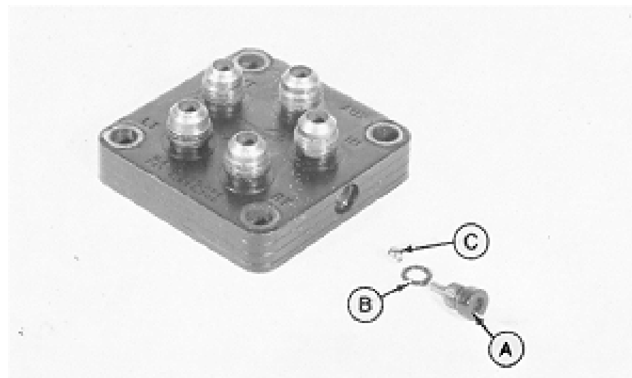


M36834 -UN-29AUG88

MX,6005HJ,5 -19-14APR92

5. Remove plug (A), O-ring (B), and check ball (C).

6. Inspect port cover for scratches on machined surfaces for damage to fittings. Replace cover if damaged.



M43832 -UN-08JAN90

MX,6005HJ,6 -19-14APR92

NOTE: Port manifold has three springs that may come loose during disassembly.

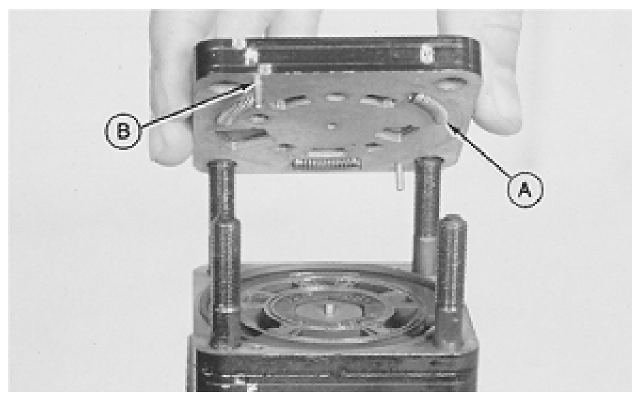
7. Carefully remove port manifold (three plates bonded together).

IMPORTANT: Do Not interchange springs. The steering valve has two sets of springs. Keep springs with respective manifold.

8. Remove three springs (A).

9. Inspect springs and pins (B) for distortion, wear, or damage.

NOTE: If one spring is damaged, all six springs must be replaced.

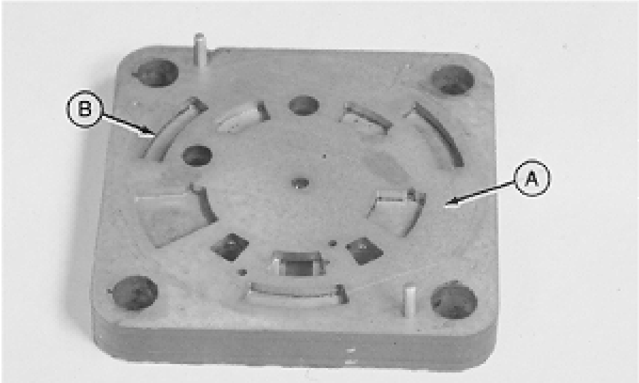


M36836 -UN-29AUG88

MX,6005HJ,7 -19-14APR92

10. 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.

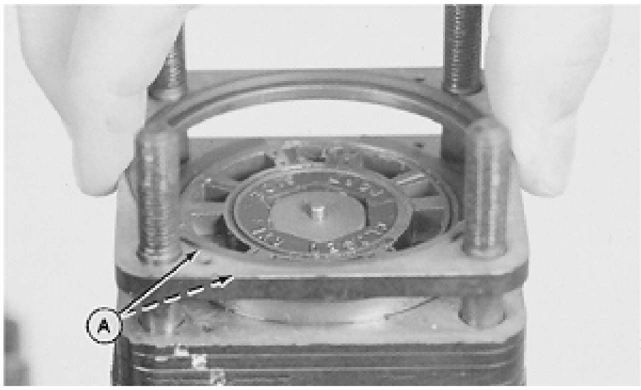
NOTE: Scoring is indicated by fine scratches or grooves cut into the manifold. When these scratches can be detected by feel, finger nail or lead pencil, the manifold should be replaced.



M36837 -UN-29AUG88

M21,6005R,16 -19-01MAR90

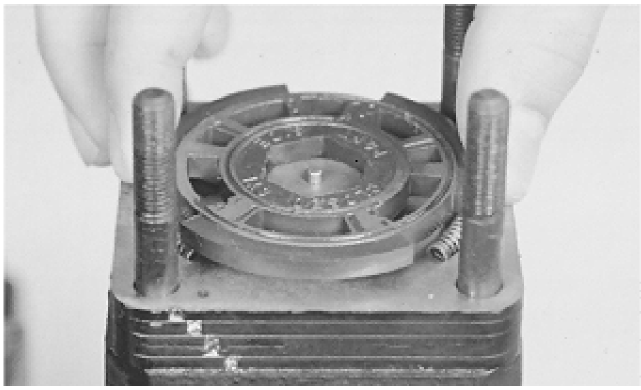
11. Remove the valve ring and two seal rings (A). Check valve ring for nicks and scoring. If the valve ring is damaged, it must be replaced.



M36838 -UN-29AUG88

M21,6005R,17 -19-01MAR90

12. 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.



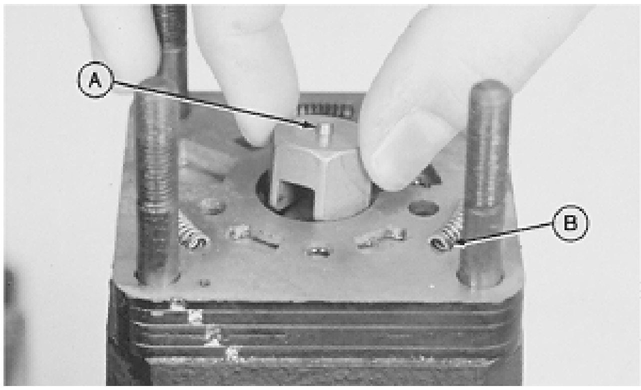
M36839 -UN-29AUG88

M21,6005R,18 -19-01MAR90

13. 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.

14. Remove three springs (B).

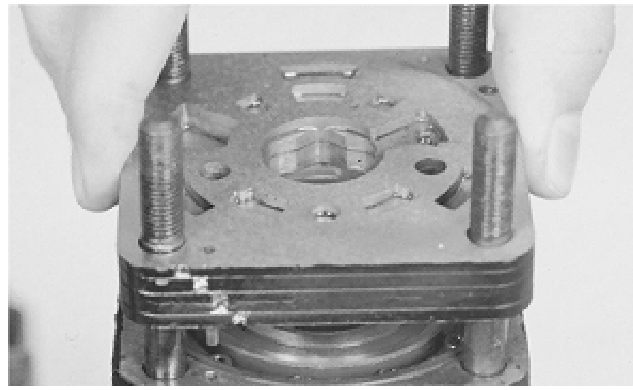
15. Inspect springs for broken coils, wear, or damage.



M36840 -UN-29AUG88

M21,6005R,19 -19-01MAR90

16. 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.

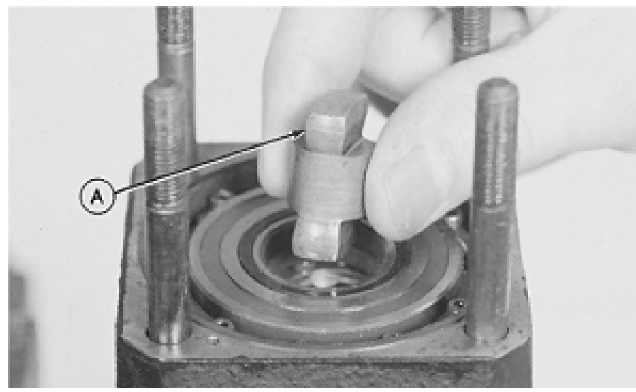


M36841 -UN-29AUG88

MX,6005HJ,8 -19-14APR92

DISASSEMBLE METERING SECTION

1. Remove drive link. Check the four crowned surfaces (A) for wear or scoring.



M36842 -UN-29AUG88

M21,6005R,21 -19-01MAR90

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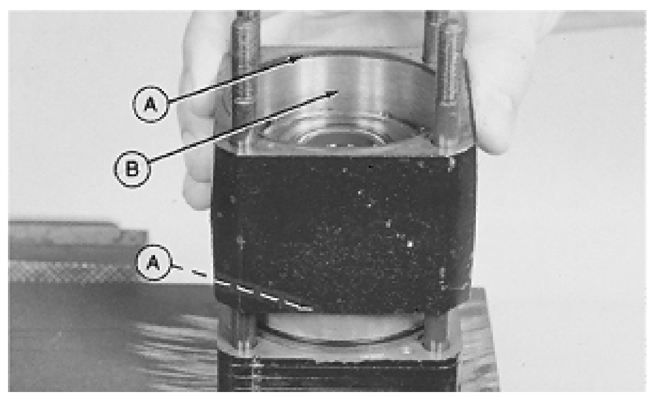
2. Remove metering ring and upper and lower seals (A). If the bore (B) is scored, the metering ring must be replaced.

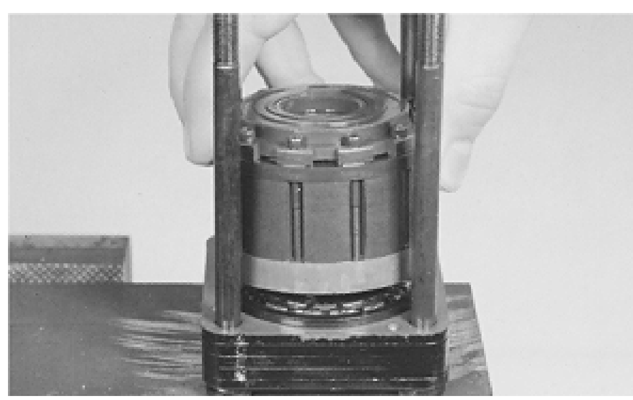


M36843 -UN-29AUG88

M21,6005R,22 -19-01MAR90

IMPORTANT: Do not clamp metering assembly in a vise.

3. Remove metering assembly. Put assembly on a clean surface.

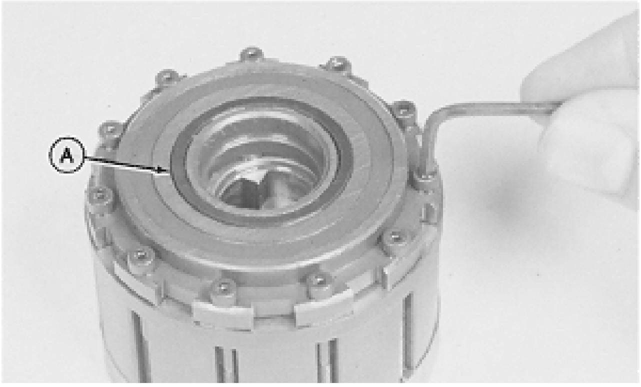


M36844 -UN-29AUG88

M21,6005R,23 -19-01MAR90

4. Remove commutator seal (A).

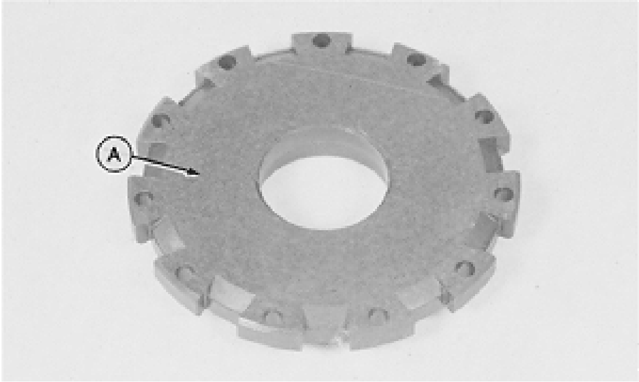
5. Remove 11 screws to remove commutator cover. Inspect screws for damage and replace if necessary.



M36845 -UN-29AUG88

M21,6005R,24 -19-01MAR90

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.



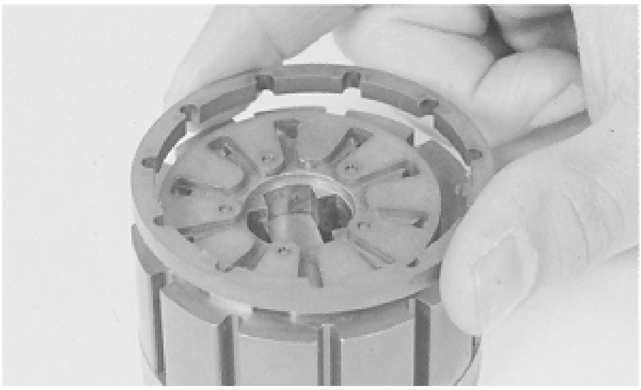
M36846 -UN-29AUG88

M21,6005R,25 -19-01MAR90

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.



M36847 -UN-29AUG88

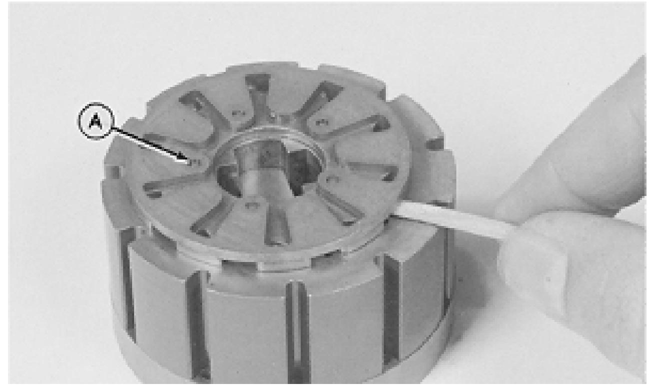
M21,6005R,26 -19-01MAR90

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.



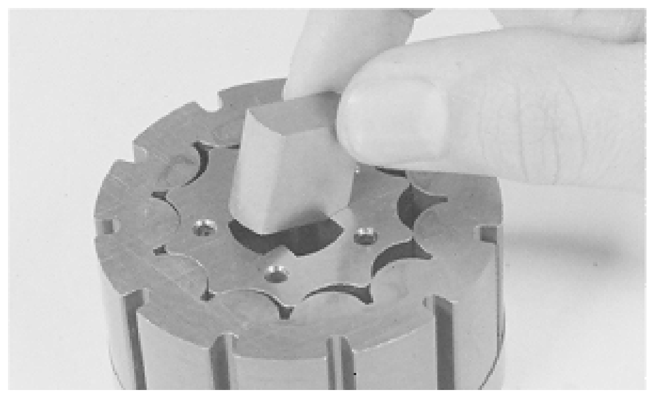
M36848 -UN-29AUG88

M21,6005R,27 -19-01MAR90

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 or stator face for grooves or scoring.

NOTE: Stator and rotor are a matched set. If either are worn or damaged, both must be replaced.



M36849 -UN-29AUG88

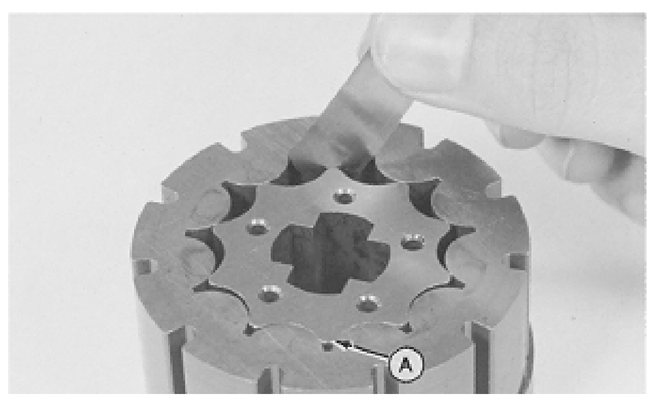
M21,6005R,28 -19-01MAR90

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.

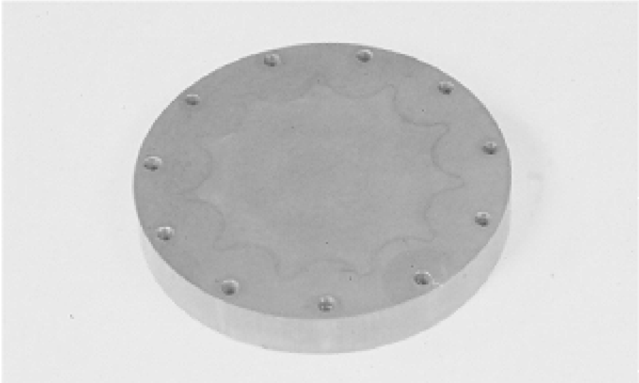


M36850 -UN-29AUG88

M21,6005R,29 -19-01MAR90

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.

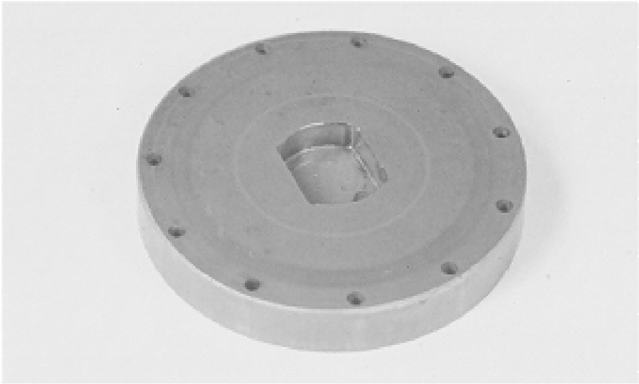


M36851 -UN-29AUG88

M21,6005R,30 -19-01MAR90

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.



M36852 -UN-29AUG88

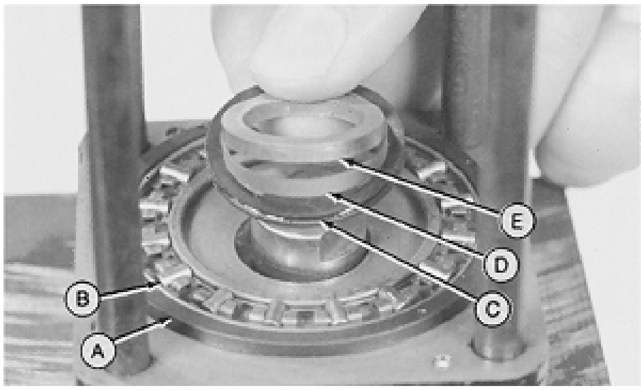
M21,6005R,31 -19-01MAR90

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



M36853 -UN-29AUG88

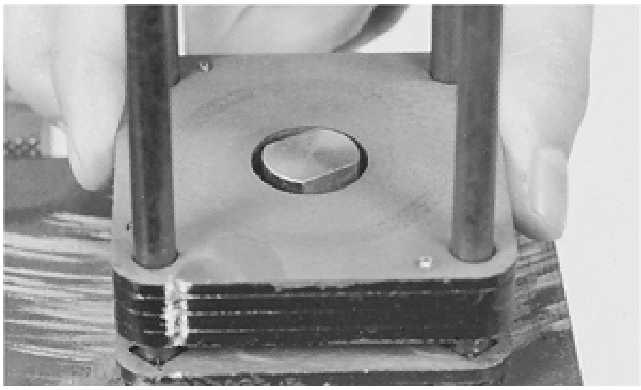
M21,6005R,32 -19-01MAR90

DISASSEMBLE STEERING TUBE SECTION

1. Remove upper cover plate (four plates bonded together).

Check plate surface for grooves, dents, or metal flakes.

A polished pattern due to the action of the seal is normal.



M36854 -UN-29AUG88

M21,6005R,33 -19-01MAR90

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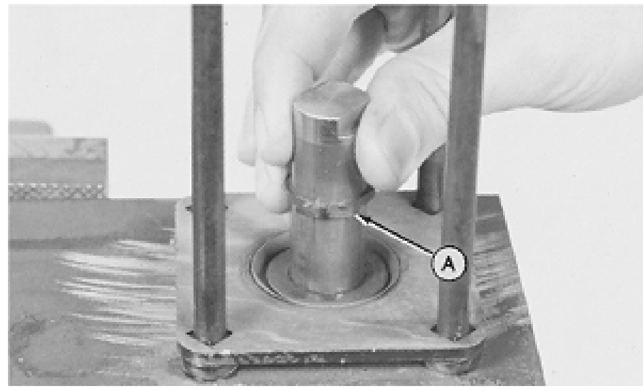
2. Remove steering shaft and snap ring (A).

3. Inspect steering shaft serrations, threads, and flats for grooves, wear, or damage.

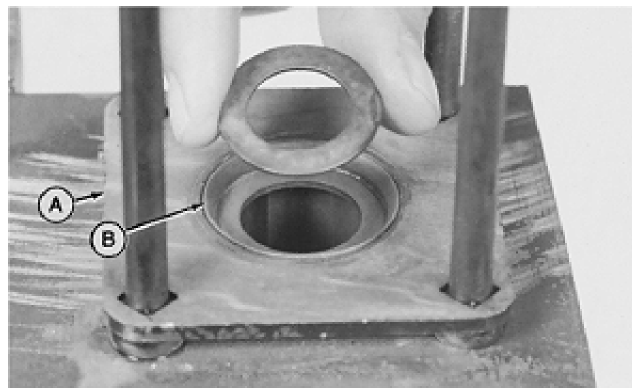


M36855 -UN-29AUG88

M21,6005R,34 -19-01MAR90

4. Remove washer and steering tube (A).

NOTE: Steering tube and retaining plate (B) are a matched set. If either part is worn or damaged, both must be replaced.



M36856 -UN-29AUG88

M21,6005R,35 -19-01MAR90

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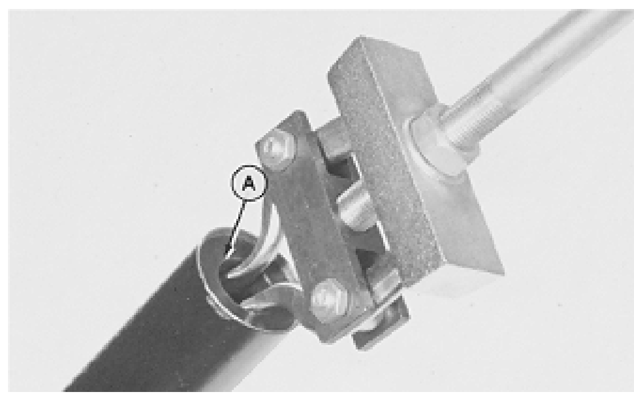
IMPORTANT: Hold steering tube in a soft-jaw vice. Be careful not to crush steering tube.

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.

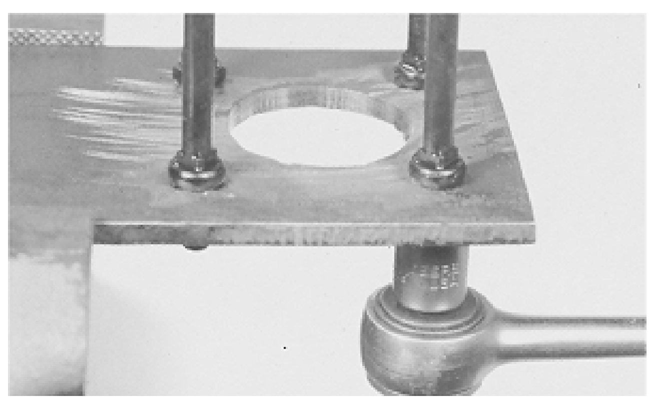


M36857 -UN-29AUG88

M21,6005R,36 -19-01MAR90

7. Remove nuts holding the four bolts to the fixture, and remove the bolts.

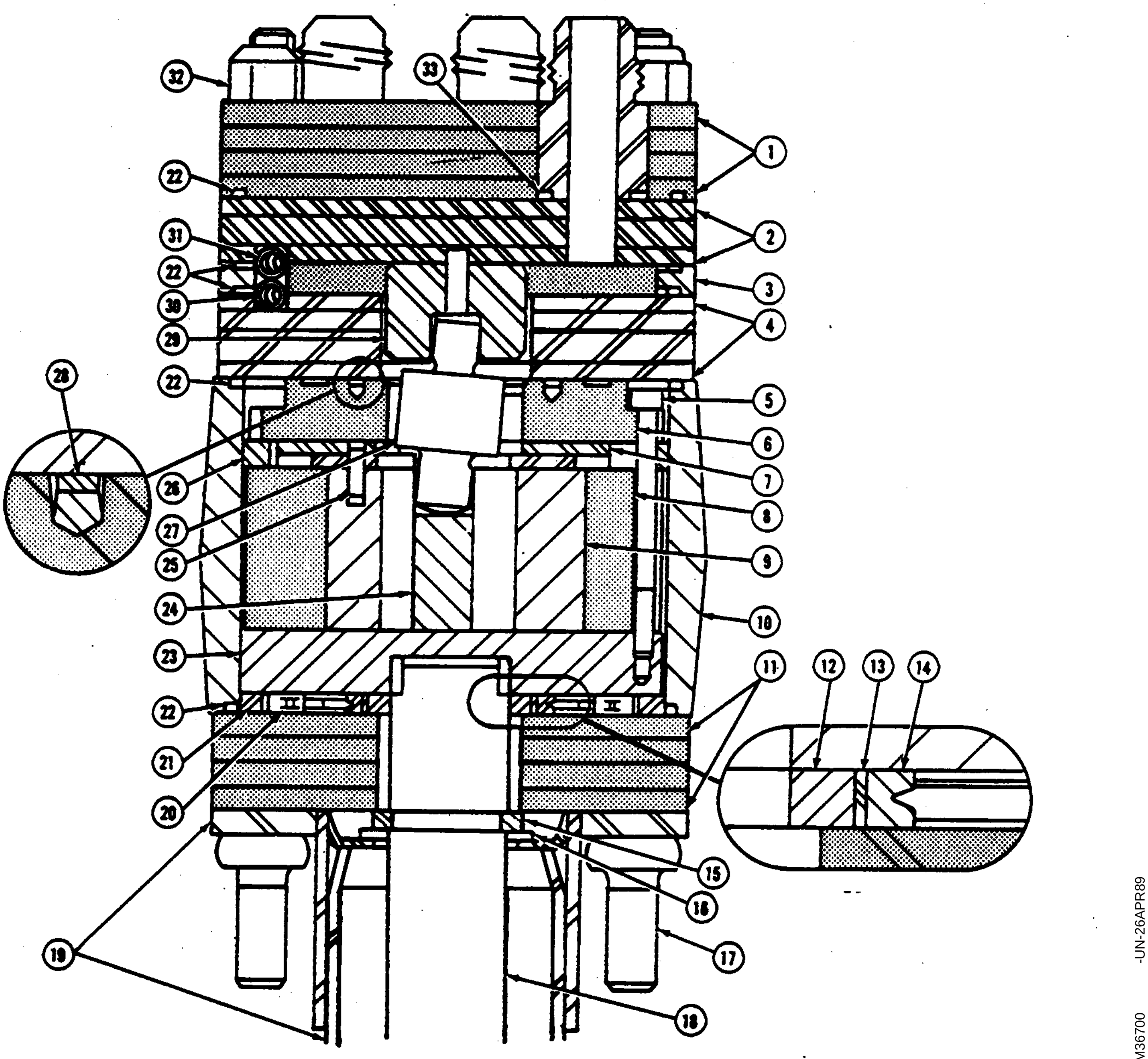
Check bolt threads for wear or damage.



M36858 -UN-29AUG88

M21,6005R,37 -19-01MAR90

CROSS SECTION OF STEERING VALVE



1—Port Cover
2—Port Manifold
3—Valve Assembly
4—Isolation Manifold
5—Cap Screw
6—Commutator Cover
7—Commutator
8—Stator
9—Rotor
10—Metering Ring
11—Upper Cover Plate
12—Seal Spacer
13—Back-Up Ring
14—Face Seal
15—Snap Ring
16—Washer
17—Bolt (4 used)
18—Steering Shaft
19—Steering Tube
20—Thrust Bearing
21—Thrust 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)

MX,6005HJ,9 -19-14APR92

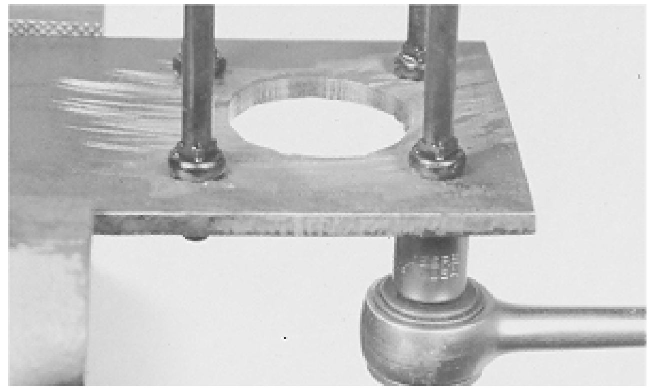
ASSEMBLE STEERING TUBE SECTION

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 and tighten finger tight.



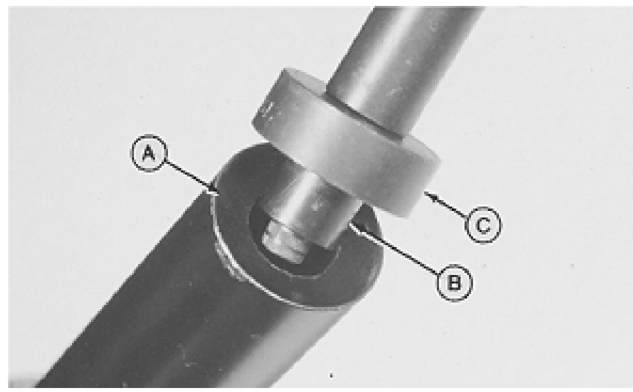
M36858 -UN-29AUG88

M21,6005R,39 -19-01MAR90

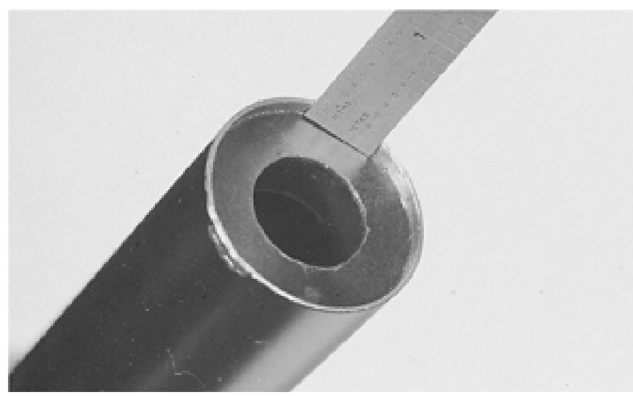
5. Install bushing (A) with recesses away from driver using a 3/4-in. driver disk (B) and a l-3/8-in. driver disk (C). Push bushing down until it is 2.5 mm (0.l in.) below top of steering tube.

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.



M36859 -UN-29AUG88



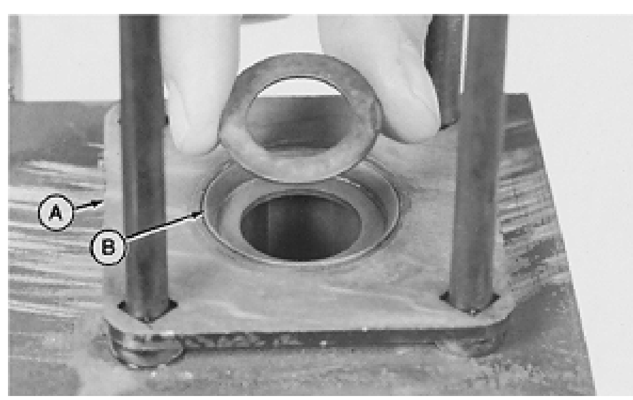
M36860 -UN-29AUG88

M21,6005R,40 -19-01MAR90

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.

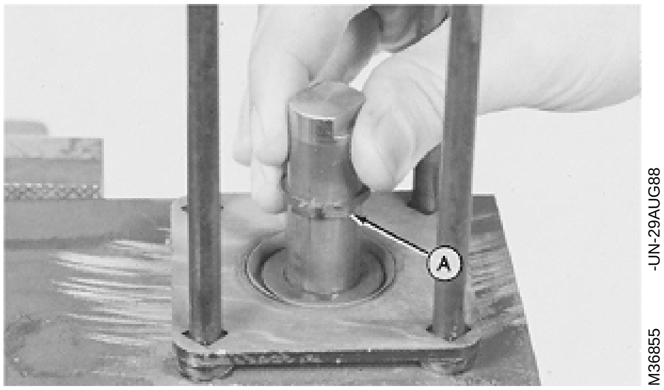


M36856 -UN-29AUG88

M21,6005R,41 -19-01MAR90

11. Install snap ring (A) on steering shaft.

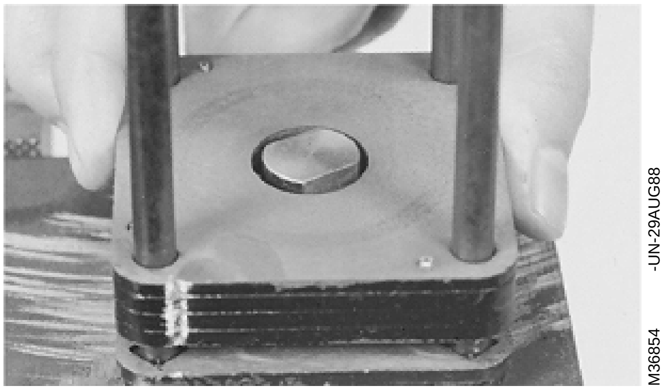
12. Install steering shaft with threaded end down into steering tube.



M21,6005R,42 -19-01MAR90

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.



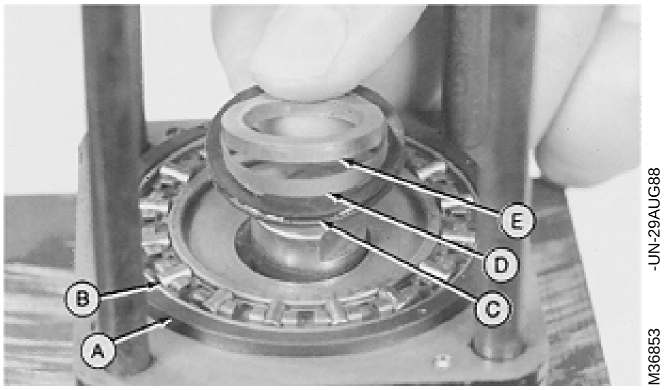
M21,6005R,43 -19-01MAR90

ASSEMBLE METERING SECTION

1. Apply clean multi-purpose grease on the face of the upper cover plate, steering shaft end, and thrust bearing.

2. Install parts (A-E).

A—Thrust Bearing Spacer
B—Thrust Bearing
C—Face Seal
D—Back-Up Ring
E—Seal Spacer



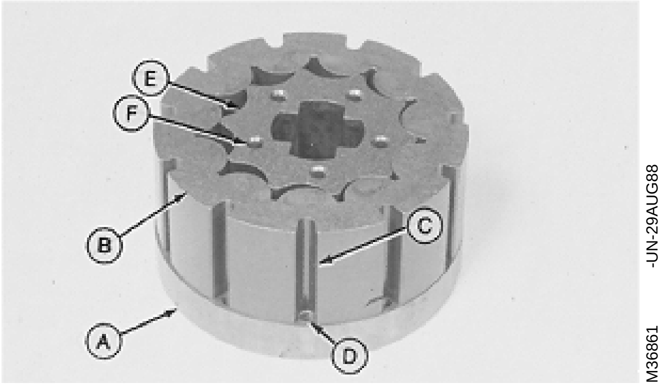
M21,6005R,44 -19-01MAR90

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	**D—Drive Plate Holes**
B—Stator	**E—Rotor**
C—Stator Slots	**F—Pin Holes**



M21,6005R,45 -19-01MAR90

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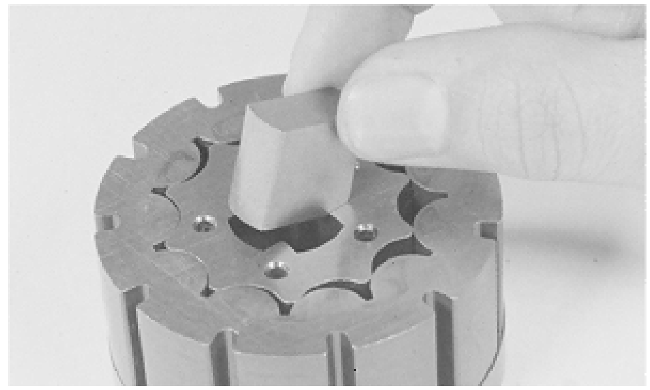
05
13

6. Apply multi-purpose grease on spacer.

7. Install spacer in rotor drive slot.



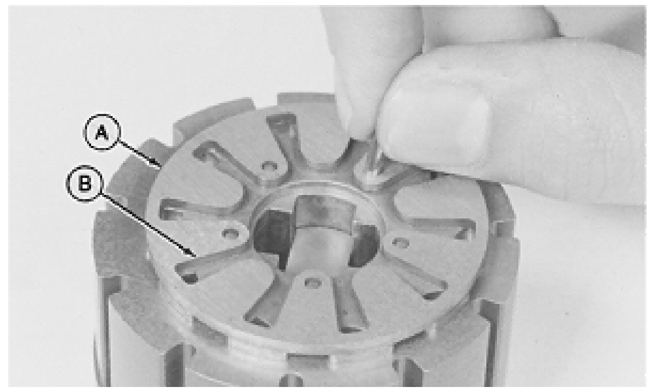
M21,6005R,46 -19-01MAR90

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.



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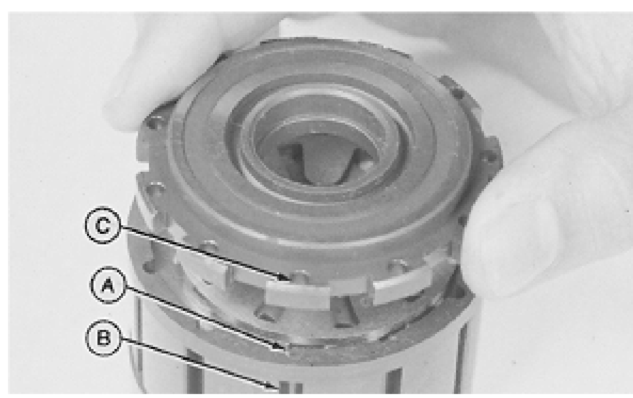
14

M21,6005R,47 -19-01MAR90

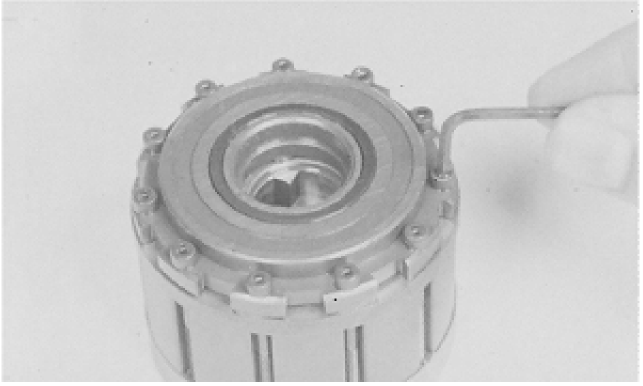
11. Align commutator ring slots (A) with stator slots (B) and install commutator ring.

12. Align commutator cover holes (C) with commutator ring slots. Install commutator cover with flat surface toward commutator.



M21,6005R,48 -19-01MAR90

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.



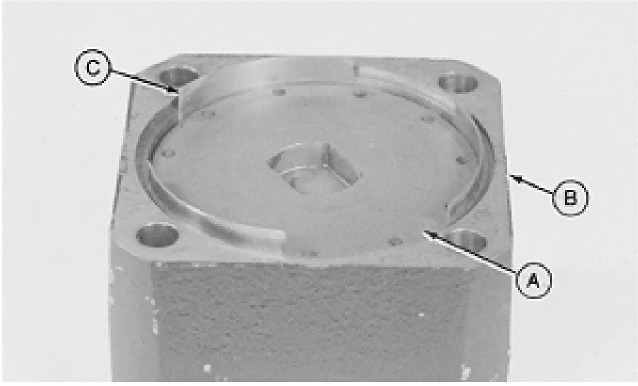
M36880 -UN-29AUG88

M21,6005R,49 -19-01MAR90

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).

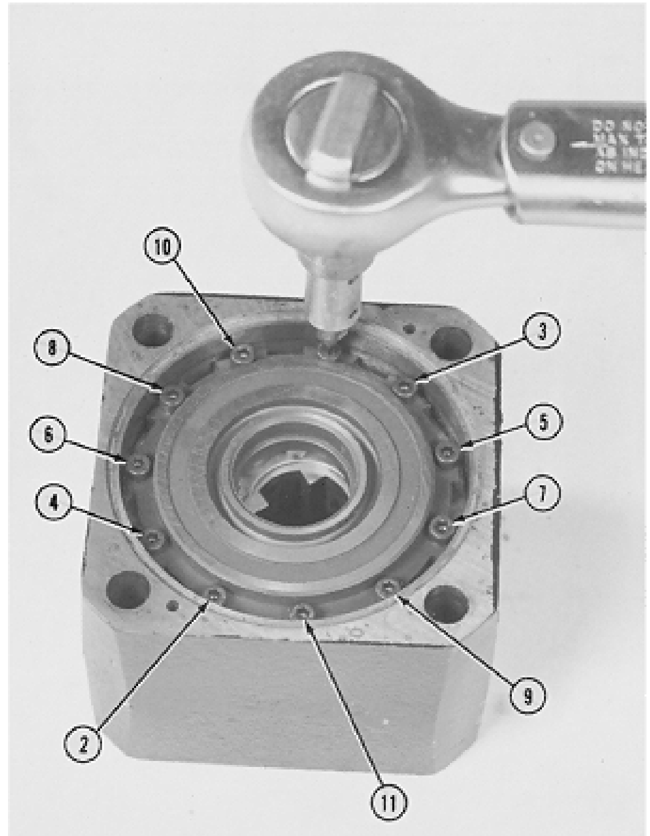
15. Make six pieces of 0.18mm (0.007 in.) shim stock (C), approximately 13 mm (0.5 in.) wide X 38 mm (1.5 in.) long. Install two shims each between drive plate and metering ring 120° apart.



M36864 -UN-29AUG88

M21,6005R,50 -19-01MAR90

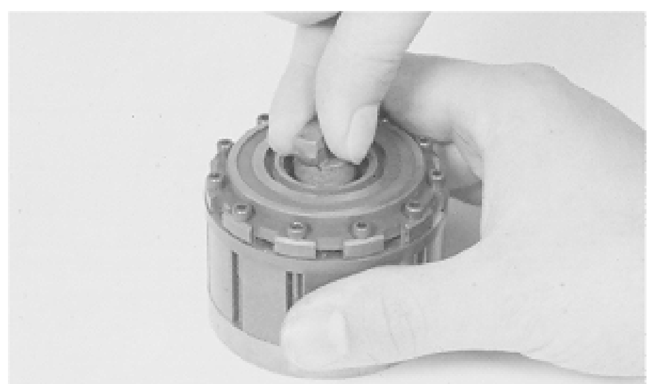
16. Turn metering ring over on a flat surface and push metering assembly down. Tighten 11 screws in several steps and in the sequence shown to 1.4± 0.1 N·m (12± 1 lb-in.).



M21,6005R,51 -19-01MAR90

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.

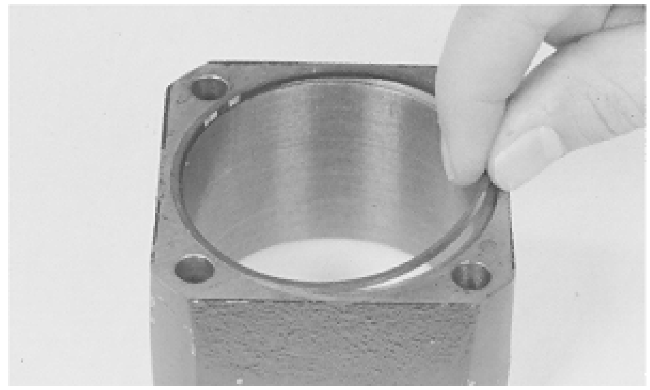


M21,6005R,52 -19-01MAR90

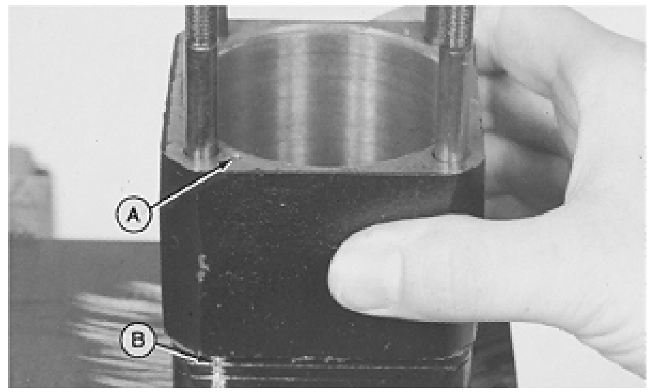
18. Apply clean multi-purpose grease on seal ring. Install seal ring on metering ring end with no pin holes.

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.



M36867 -UN-29AUG88

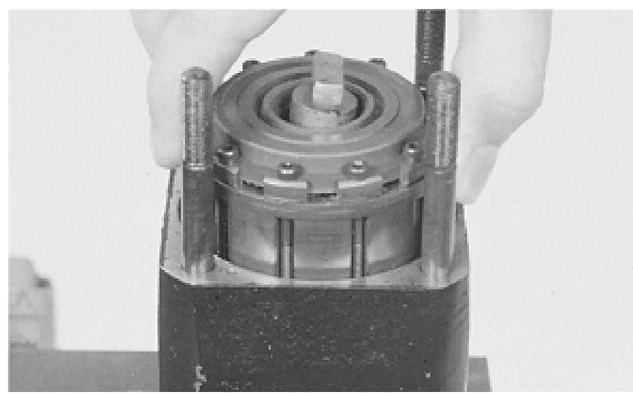


M36879 -UN-29AUG88

M21,6005R,53 -19-01MAR90

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.



M36868 -UN-29AUG88

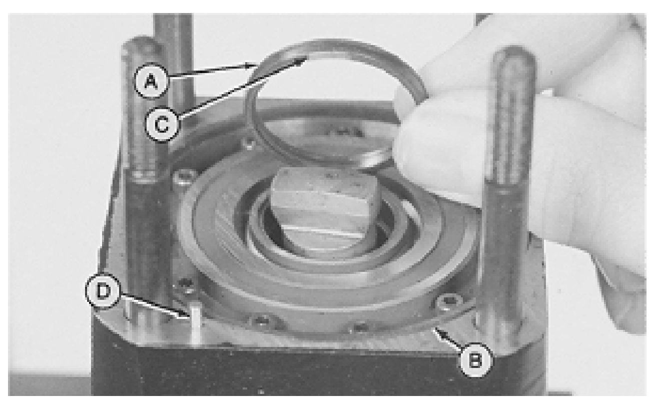
M21,6005R,54 -19-01MAR90

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)



M36869 -UN-29AUG88

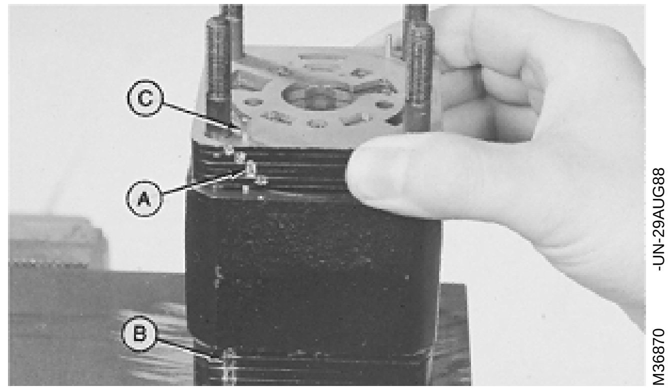
M21,6005R,55 -19-01MAR90

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.

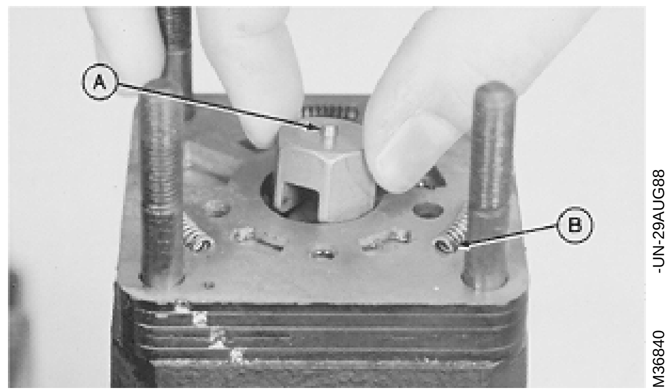
2. Install pins (C).



M21,6005R,56 -19-01MAR90

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.



M21,6005R,57 -19-01MAR90

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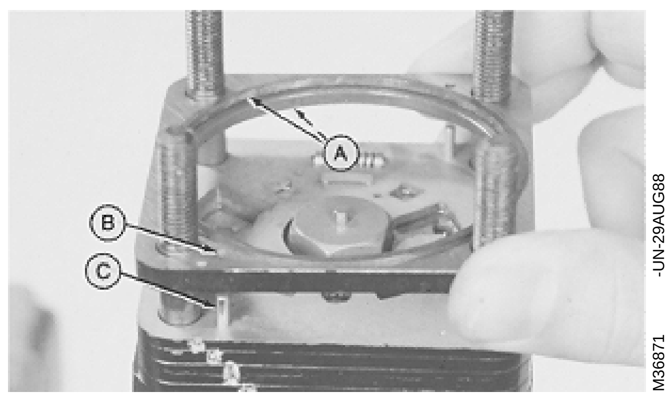
05
18

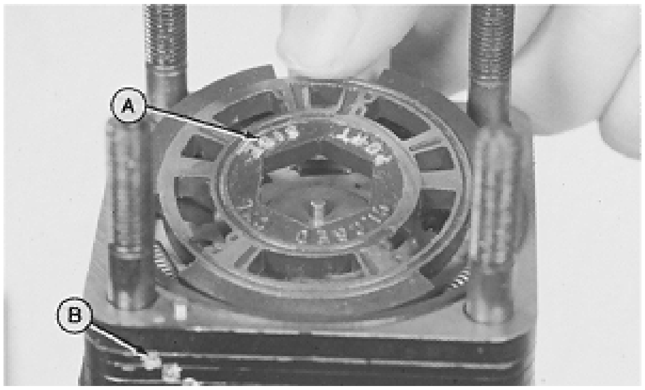
5. Apply clean multi-purpose grease on seal rings (A). Install seal rings on valve ring.

6. Align valve ring holes (B) with pins (C) to install valve ring.



M21,6005R,58 -19-01MAR90

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.



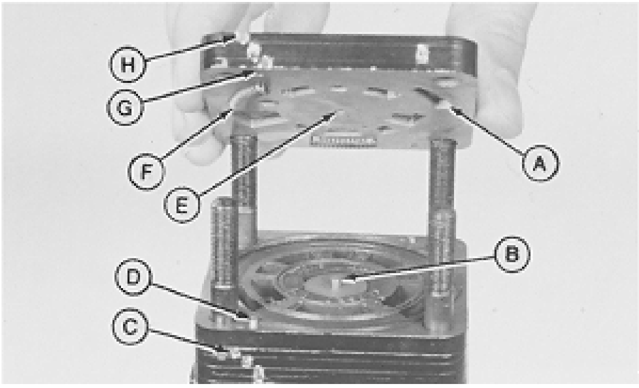
7. Install valve plate, with "PORT SIDE" up, on isolation manifold. Turn valve plate to make sure springs are centered in valve plate spring slots.

8. Apply clean hydrostatic oil on valve plate.

M21,6005R,59 -19-01MAR90

9. Install three 25 mm (1 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.

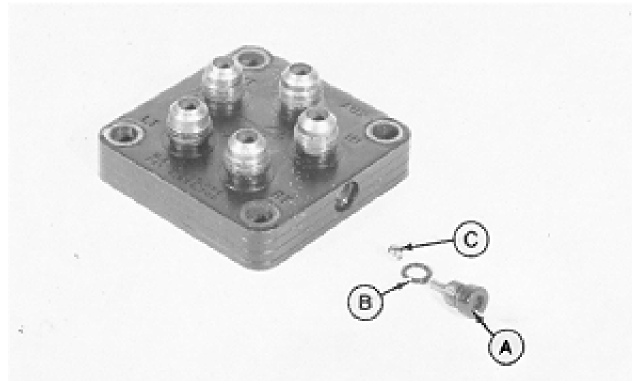


10. Install port manifold with springs toward valve plate. Be sure pins (D) engage alignment holes (G) in port manifold. Be sure hex drive assembly pin (B) engages center hole (E) in port manifold.

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 Hold (2 used)
H—Port Manifold Grooves

M21,6005R,60 -19-01MAR90

11. Install O-ring (B) on plug (A). Install check ball (C). Be sure check ball is seated in bottom of hole. Install and tighten plug.



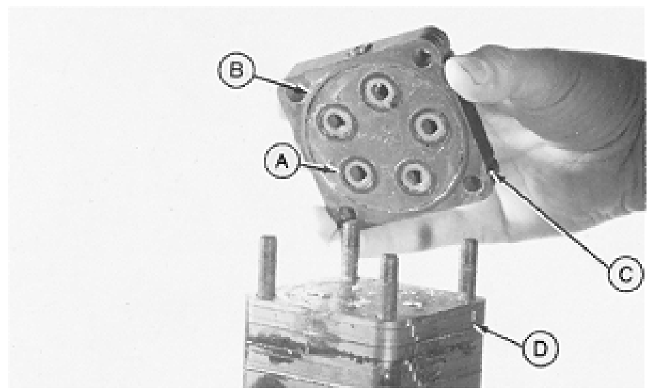
M43832 -UN-08JAN90

MX,6005HJ,10 -19-14APR92

12. Apply clean multipurpose grease on five 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 manifold.

13. Install port cover with seals toward port manifold.



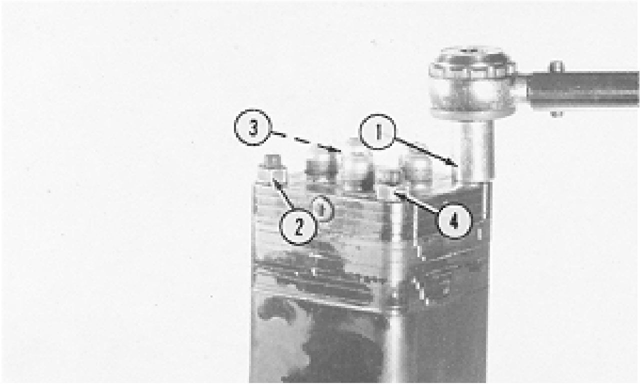
M43843 -UN-08JAN90

A—O-rings (5 used)
B—Seal Ring
C—Port Cover Alignment Grooves
D—Port Manifold Alignment Grooves

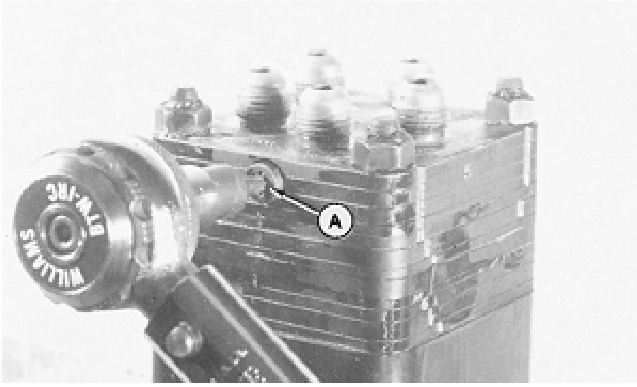
MX,6005HJ,11 -19-14APR92

14. Install and tighten four nuts in the sequence shown. Tighten in several steps to 30 ± 3 N·m (22 ± 2 lb-ft).

15. Tighten plug (A) to 14 ± 3 N·m (124 ± 27 lb-in.). Remove steering valve from fixture.



M43845 -UN-11NOV89

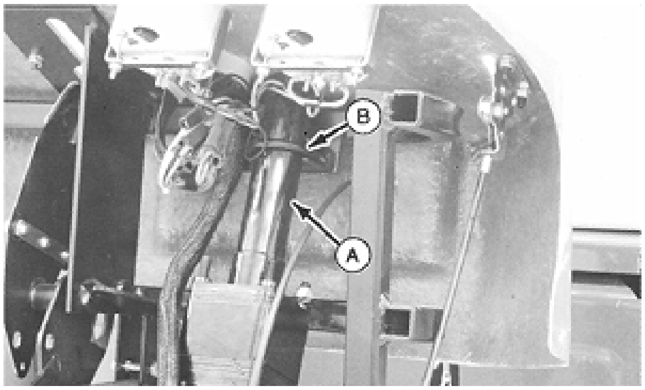


M43844 -UN-08JAN90

MX,6005HJ,12 -19-14APR92

INSTALL STEERING VALVE

1. Position steering unit in vehicle and guide steering shaft (A) through bracket (B) and dash panel.

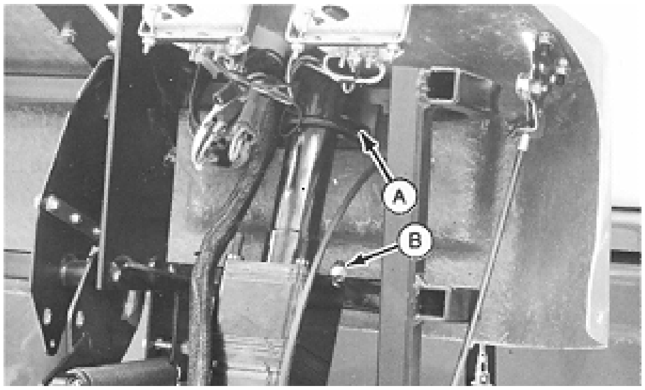


M46665 -UN-27MAR92

MX,6005HJ,13 -19-14APR92

2. Install steering valve (B) and column mounting hardware (A).

3. Install steering wheel.

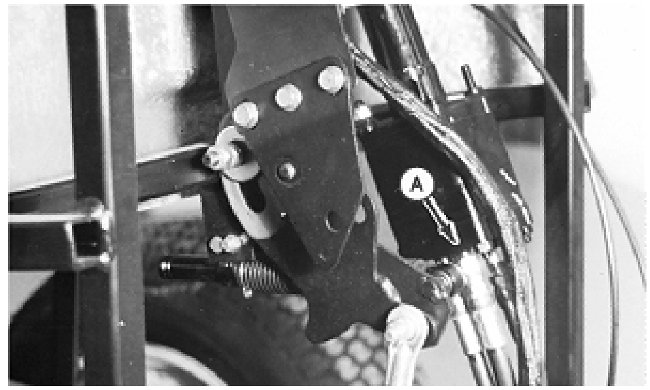


M46664 -UN-27MAR92

MX,6005HJ,14 -19-14APR92

4. Remove plugs from lines and fittings.

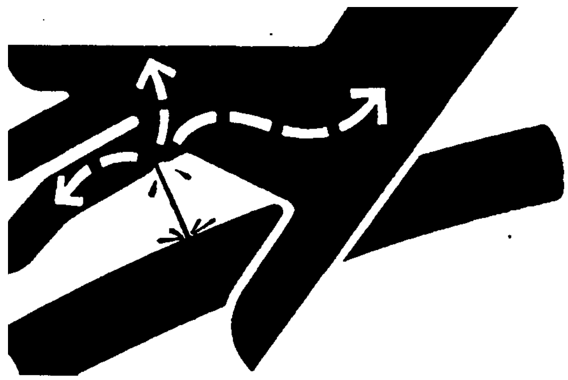
5. Connect hydraulic lines (A) to bottom of steering unit.



M46569 -UN-27MAR92

MX,6005HJ,15 -19-14APR92

AVOID HIGH-PRESSURE FLUIDS



X9811 -UN-23AUG88

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.

6. Start engine and check for leaks.

7. Turn front wheels from lock to lock several times.

8. Shut off engine and check hydraulic fluid level. Fill to proper level (See Lubrication, General, Section 10.)

MX,6005HJ,16 -19-14APR92

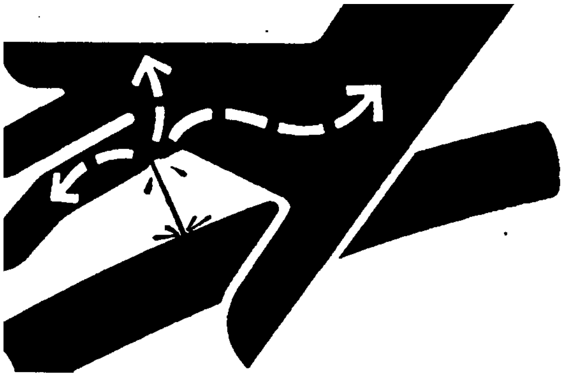
OTHER MATERIALS

Sealing Compound

John Deere All-Weather Hydraulic Fluid or Type “F” Automotive Automatic Transmission Fluid

MX,6010HJ,1 -19-14APR92

AVOID HIGH-PRESSURE FLUIDS



X9811 -UN-23AUG88

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

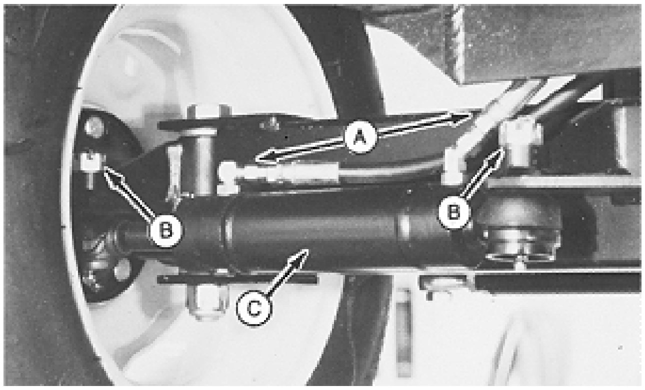
Avoid the hazard by relieving pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure.

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.

DX,FLUID -19-09AUG91

REMOVE STEERING CYLINDER



M46618 -UN-27MAR92

1. Disconnect hydraulic hoses at lines (A).

IMPORTANT: Plug hoses and tubes to prevent system contamination. Tag hoses and tubes for assembly.

2. Remove pins, nuts, and bolts (B).

3. Lift steering cylinder (C) off vehicle.

MX,6010HJ,2 -19-14APR92

REPAIR STEERING CYLINDER

NOTE: Cylinder is not repairable. If defective, replace complete assembly.

1. Remove hoses and fittings from old cylinder.

2. Place new cylinder in soft-jawed vise.

3. Apply sealing compound to threads of fittings and install fittings.

M31823 -UN-28JUL89

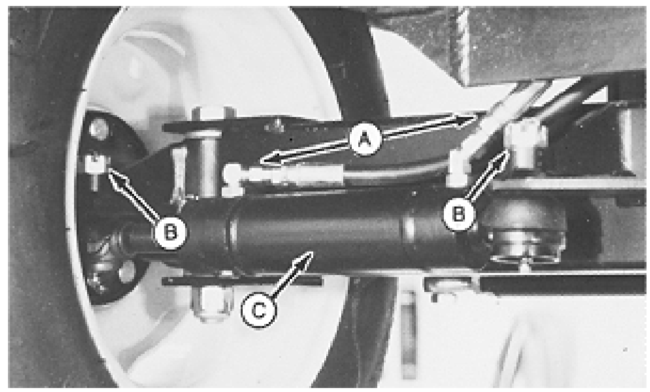
MX,6010HJ,3 -19-14APR92

INSTALL STEERING CYLINDER

1. Position cylinder (C) on vehicle, and install bolts, and nuts (B). Tighten nuts to 163 N·m (120 lb-ft) torque.

2. Install cotter pins.

3. Attach hydraulic lines (A).

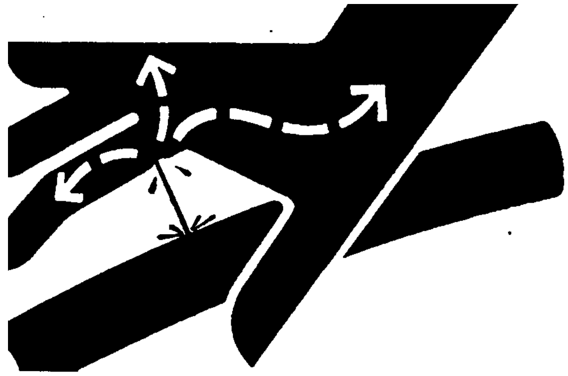


M46618 -UN-27MAR92

MX,6010HJ,4 -19-14APR92

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

4. Start engine and check for leaks.

5. Turn front wheels from lock to lock several times.

6. Shut off engine and check hydraulic fluid level. Fill to proper level (See Lubrication, General, Section 10.)

MX,6010HJ,5 -19-14APR92

OTHER MATERIAL

Number	Name	Use
	John Deere LOCTITE®	Clean threads.
T43511	Clean and Cure Primer	
T43512	John Deere LOCTITE Threadlock and Sealer (Medium Strength)	Retain brake plate cap screws.
PT569	John Deere NEVER-SEEZ® Lubricant	Lubricate axle shaft.

LOCTITE is a trademark of Loctite Corp.

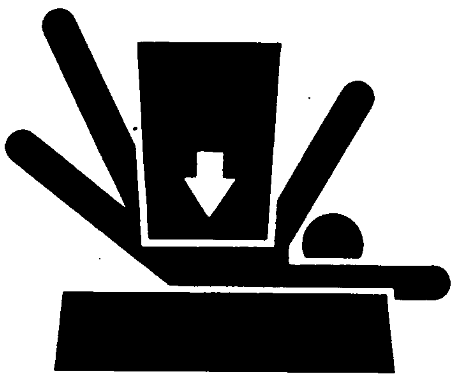
NEVER-SEEZ is a trademark of the Never-Seez Compound Corp.

MX,6015HJ,1 -19-14APR92

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.

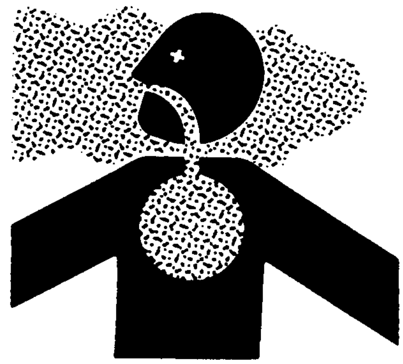
Do not support the machine on cinder blocks, hollow tiles, or props that may crumble under continuous load. Do not work under a machine that is supported solely by a jack. Follow recommended procedures in this manual.



TS229 -UN-23AUG88

DX,LOWER -19-04JUN90

AVOID HARMFUL ASBESTOS DUST



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

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

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

Keep bystanders away from the area.

DX,DUST -19-15MAR91

REMOVE BRAKES

1. Park vehicle safely.

2. Disconnect battery negative (-) cable.

3. Lift rear of vehicle and support with stands.

4. Remove five cap screws to remove wheel.

5. Remove four nuts and lock washers (A) and remove stub shaft.

6. Remove five cap screws (B) and hub.

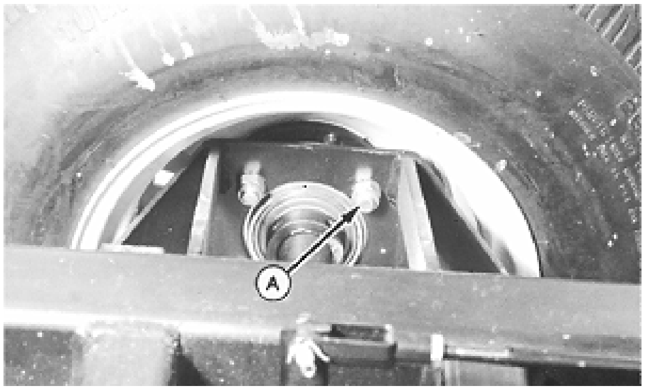
7. Bend edges of washer (C) flat against drum.

8. Remove nut and washer (D).

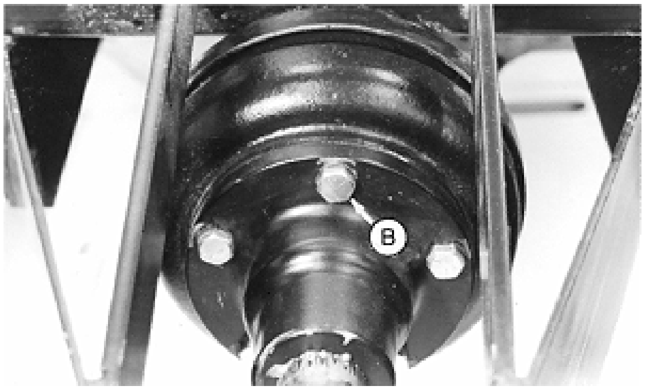
9. Pull drum off axle.

If drum hits shoes, turn the adjuster to reduce the drag on drum.

If drum is tight on shaft from corrosion, remove drum using a three-leg wheel puller. DO NOT use an impact puller.



M46617 -UN-27MAR92



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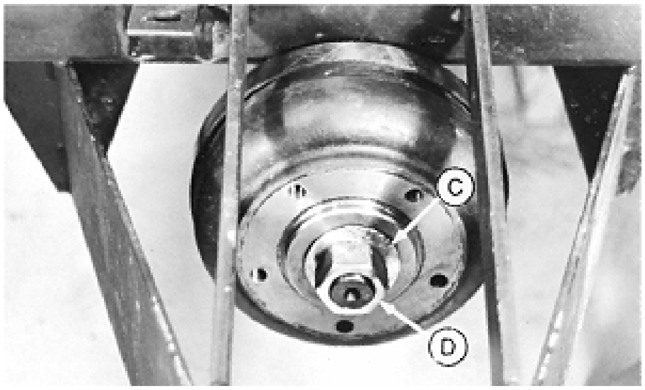


M46567 -UN-27MAR92

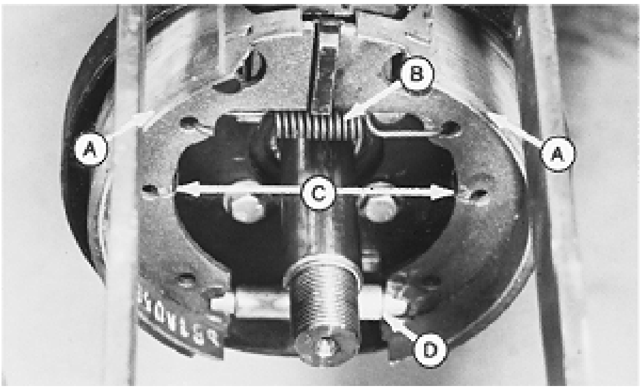
MX,6015HJ,2 -19-14APR92

NOTE: If brake lining thickness is equal to or less than its backing plate thickness, replace linings.

10. Inspect lining on brake shoes (A) for wear or oil contamination. Replace shoes if worn, inspect axle oil seal if shoes are oily.

11. Inspect return spring (B) and hold-down springs (C) for wear or stretching.

12. Check adjuster assembly (D) for ease of movement.

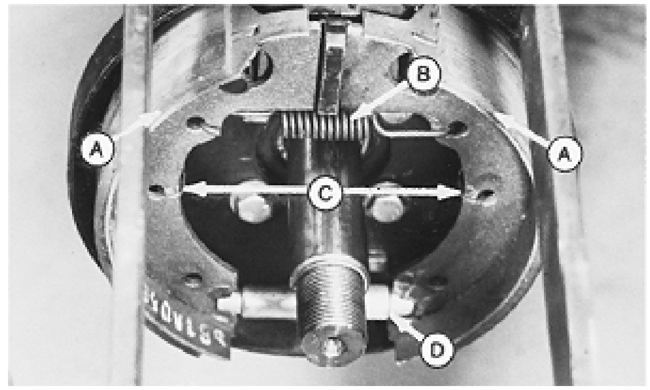


M46627 -UN-27MAR92

MX,6015HJ,3 -19-14APR92

13. Remove brake return spring (B), hold-down springs (C), adjuster (D) and shoes (A).

A—Shoes
B—Return Spring
C—Hold-Down Springs
D—Adjuster



MX,6015HJ,4 -19-14APR92

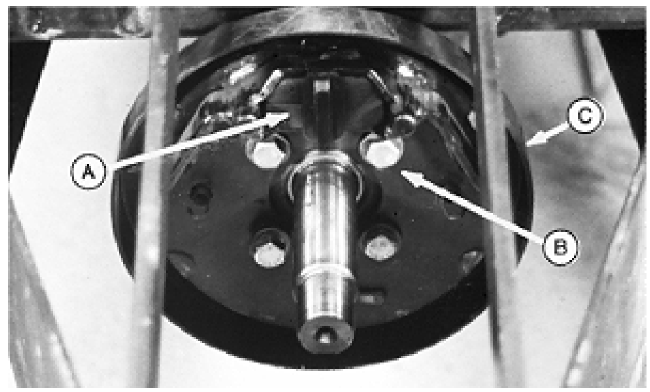
14. Disassemble adjuster and clean with a suitable solvent. Apply NEVER-SEEZ® lubricant to threads and sliding surface of the adjuster. Assemble adjuster.

NOTE: Do not remove parts (A,B and C) unless worn or damaged.

15. Remove foam seal (A).

16. Remove four cap screws and brake plate (B).

17. Remove grass shield (C).



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MX,6015HJ,5 -19-14APR92

INSTALL BRAKES

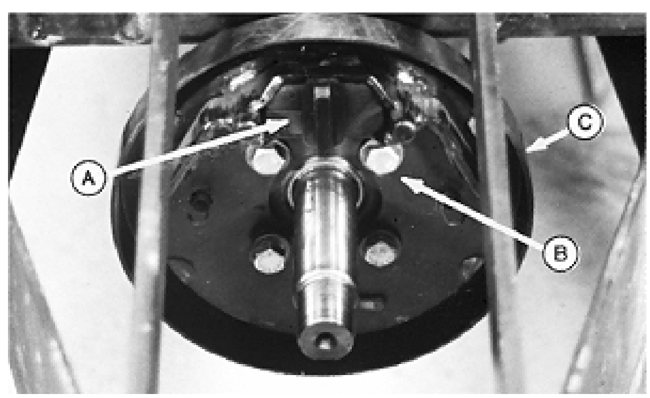
1. Install grass shield (C).

2. Install brake plate.

3. Clean cap screw threads using clean and cure primer. Apply thread lock and sealer (medium strength) to threads of cap screws.

4. Install and tighten cap screws (B) to 68 N·m (50 lb-ft).

5. Install foam seal (A).



Slide

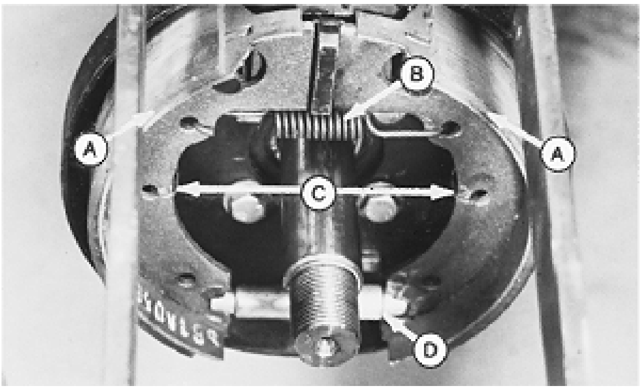
MX,6015HJ,6 -19-14APR92

6. Install spring (B) on brake shoes (A).

7. Install brake shoes and spring assembly.

8. Connect springs (C).

9. Install adjuster (D).



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A—Brake Shoes
B—Return Spring
C—Hold-Down Springs
D—Adjuster Assembly

MX,6015HJ,7 -19-14APR92

10. Install brake drum (without key).

11. Remove rubber cap (A) and turn adjuster until brake shoes just contact brake drums. Brake drum should spin freely on axle with minimum drag on brake shoes.

12. Push brake pedals down firmly to seat brake shoes.

13. Remove brake drum.

14. Apply John Deere TY6305 or equivalent multipurpose grease to axle shaft.

15. Install key and brake drum.

16. Install washer and nut (D). Tighten to specifications.

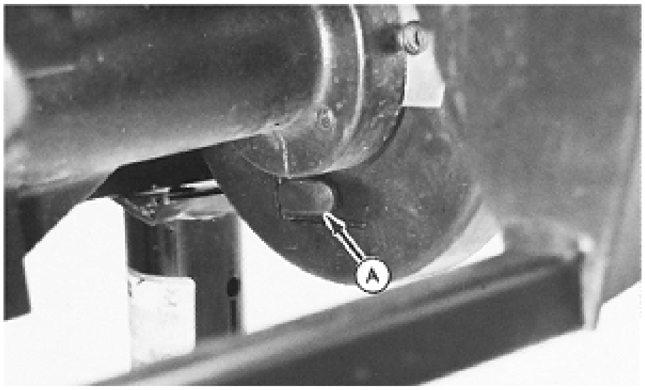
17. Bend one side of washer (C) against flat of nut.

18. Install hub on brake drum. Tighten five cap screws (B) to specifications.

TORQUE SPECIFICATIONS

Brake drum to axle shaft nut . . . . 115-156 N·m (85-115 lb-ft)

Hub to Drum Cap Screws . . . . 95 N·m (70 lb-ft)



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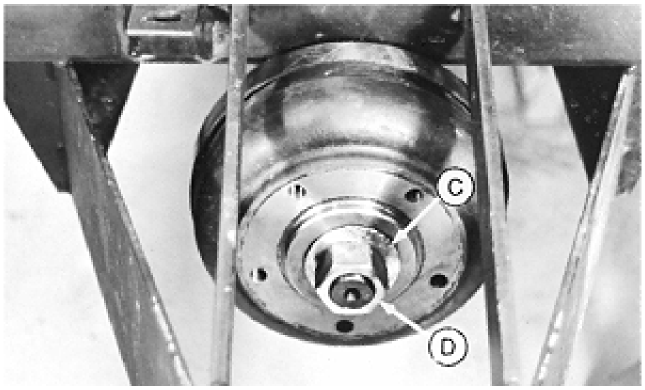

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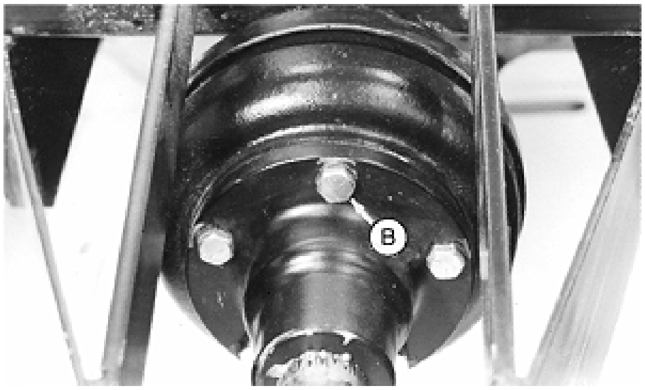

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MX,6015HJ,8 -19-14APR92

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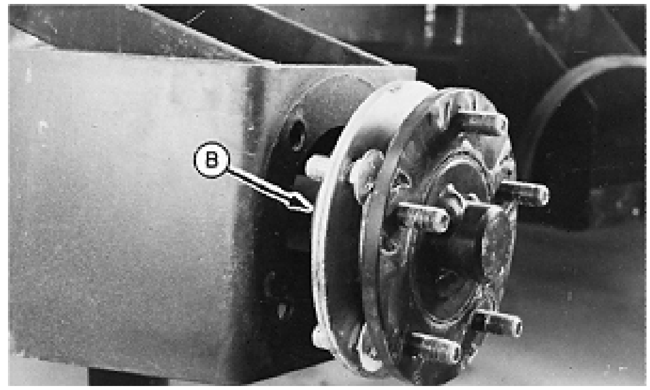
19. Coat splines of stub shaft (B) with NEVER-SEEZ®, install and secure with lock washers and nuts. Tighten to specifications.

20. Install wheels and tighten cap screws to specifications.

TORQUE SPECIFICATIONS

Hub to Drum	95 N·m (70 lb-ft)
Wheel to Stub Shaft	70 ± 7 N·m 52 ± 5 lb-ft



M46662 -UN-27MAR92

MX,6015HJ,9 -19-14APR92

REMOVE BRAKE PEDAL

1. Place blocks in front and behind wheels to prevent vehicle movement.

2. Release parking brake (A) and shift transmission to neutral.

M46688 -UN-27MAR92

MX,6015HJ,10 -19-14APR92

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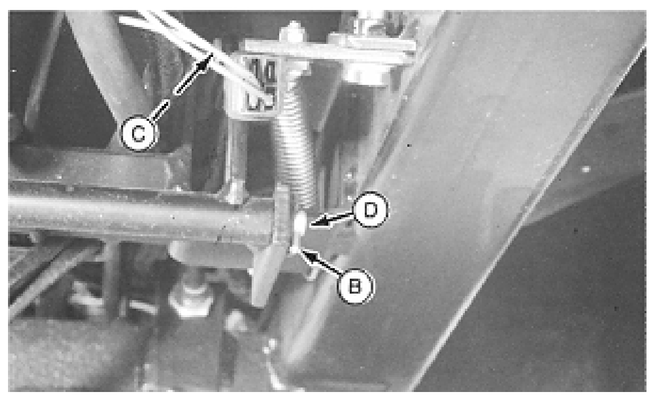
NOTE: Floorboard removed for photos.

3. Remove pin (C) from brake linkage.

4. Remove roll pin (B) with a suitable drift and extract pivot shaft (D).

5. Inspect parts for damage or wear and repair or replace as necessary.



M46687 -UN-27MAR92

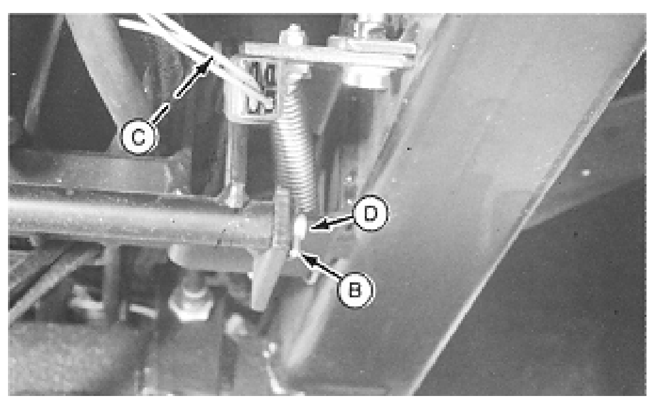
MX,6015HJ,11 -19-14APR92

INSTALL BRAKE PEDAL

1. Lubricate pivot shaft (D) with NEVER-SEEZ® and install through bracket and pedal assembly.

2. Install roll pin (B). Connect pedal assembly to linkage, install linkage pin (C), and secure with cotter pin.

3. See Transmission Return to Neutral Section 250, Group 15 and Brake Pedal Free Play in Section 260, Group 15.



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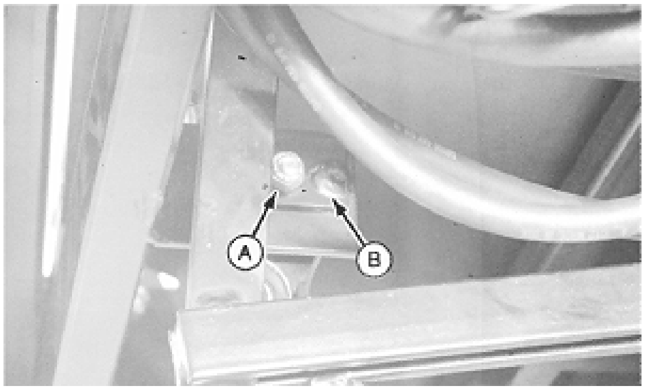
MX,6015HJ,12 -19-14APR92

REMOVE AND INSPECT NEUTRAL RETURN LINKAGE



1. Place blocks in front and behind wheels to prevent vehicle movement.

2. Disconnect control rod at shifter.

3. Disconnect control rod. Remove cap screw (A) securing pivot pin (B) to frame.

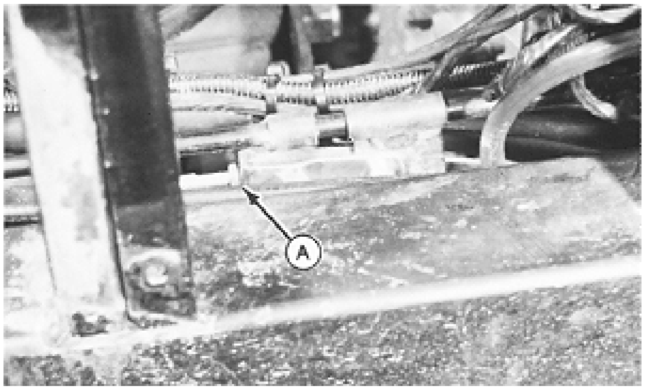
4. Remove linkage and inspect for bent or worn parts. Repair or replace as necessary.

5. Coat pivot pin (B) with NEVER-SEEZ® lubricant. Position linkage between frame attachment points and insert pivot pin. Secure with cap screw (A).

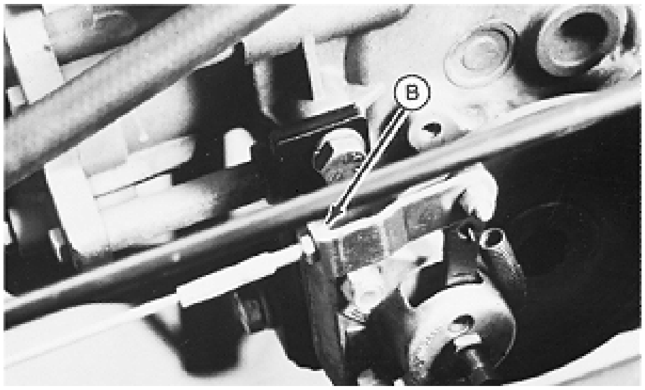
6. Attach control rods. See Return to Neutral Adjustment Section 250, Group 15.

MX,6015HJ,13 -19-14APR92

REMOVE AND INSPECT PARK BRAKE LINKAGE



Service brake linkage



Parking brake caliper

1. Place blocks in front and behind wheels to prevent vehicle movement.

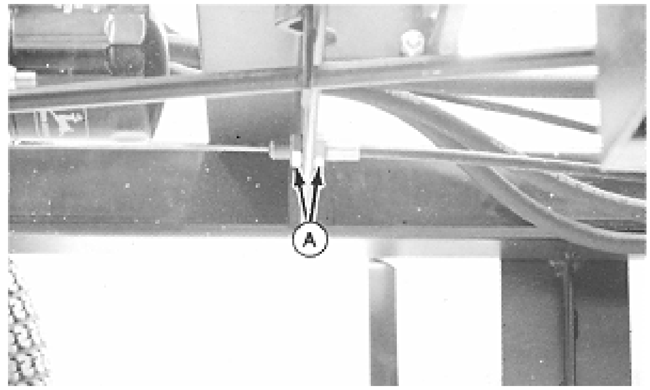
2. Release parking brake lever.

3. Disconnect cables from clevises at service brake linkage (A) and parking brake caliper (B).

MX,6015HJ,14 -19-14APR92

4. Remove nuts and cable sheathing (A) at frame mounting locations and pull cables from frame.

5. Remove two cap screws (B) and parking brake lever assembly (C).



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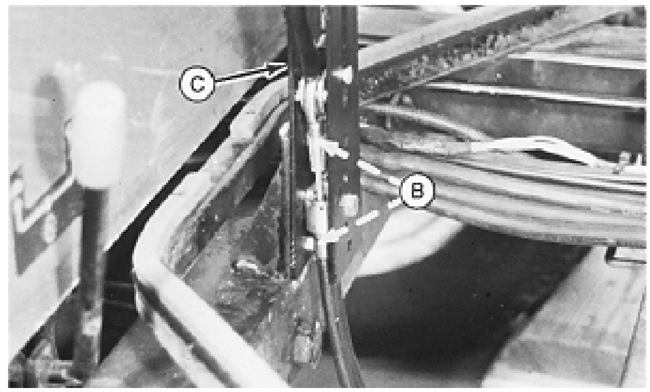


M46577 -UN-27MAR92

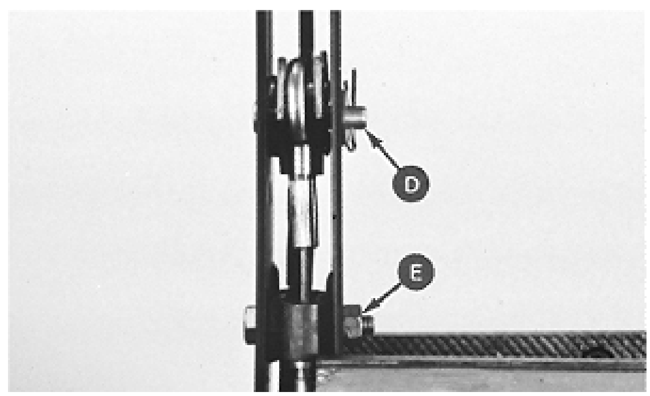
MX,6015HJ,15 -19-14APR92

6. Remove clevis pin (D).

7. Remove cap screw, spacer, and nut (E).

8. Separate clevis pins, cables, and brackets (F).

9. Inspect clevis pins for wear and inspect clevis mounting points for elongation. Inspect cables for fraying, binding, or kinks. Replace worn parts as necessary.



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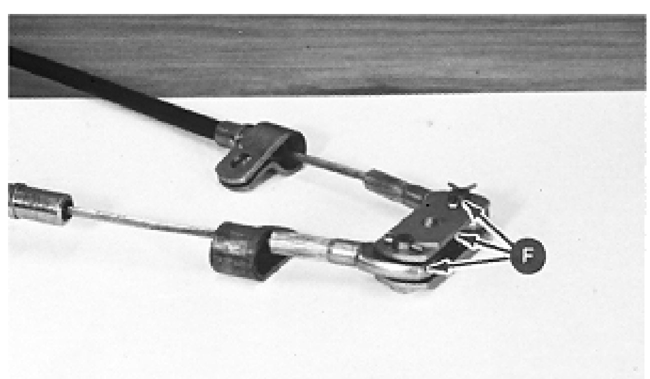


M46560 -UN-27MAR92

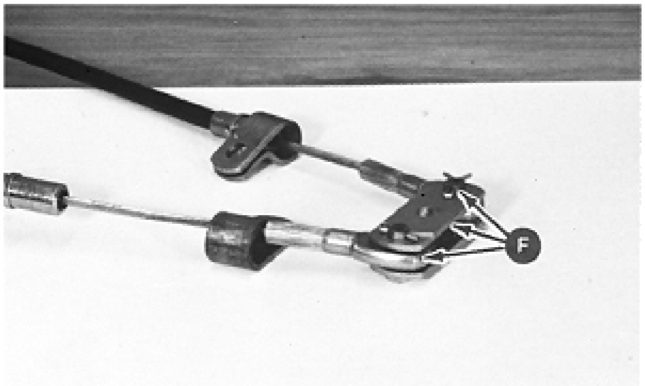
MX,6015HJ,16 -19-14APR92

INSTALL PARK BRAKE LINKAGE

1. Position cable ends between brackets and install clevis pins, secure with cotter keys (F).

2. Align cable sheathe brackets and spacer with mounting location on handle assembly and secure with cap screw and nut (E). Ensure cable sheathe shoulder (G) is seated against bracket before tightening cap screw.

3. Install clevis pin through handle assembly and bracket, secure with a washer and cotter pin (D).



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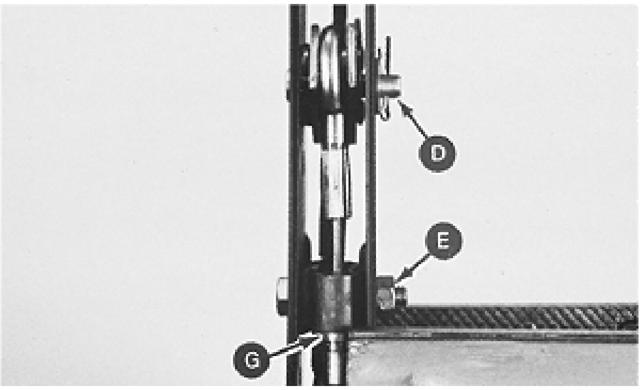

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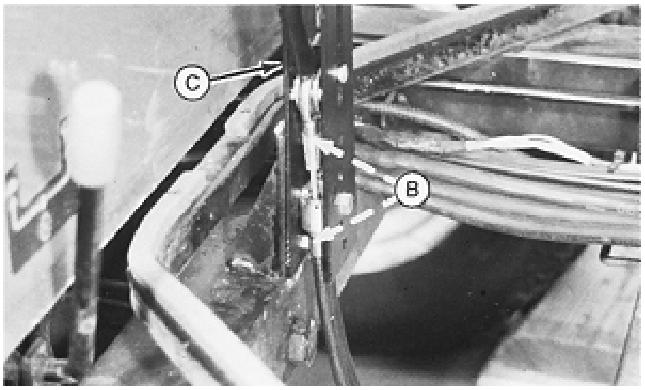
MX,6015HJ,17 -19-14APR92

4. Secure handle assembly (C) to frame with two cap screws and nuts (B).

5. Install cable, sheathing, and mounting nut (A). Slide cable through guide in frame and into mounting holes.

6. Install the other cable mounting nut, center the cable sheathing to obtain an equal number of exposed threads on both ends of the sheathing.



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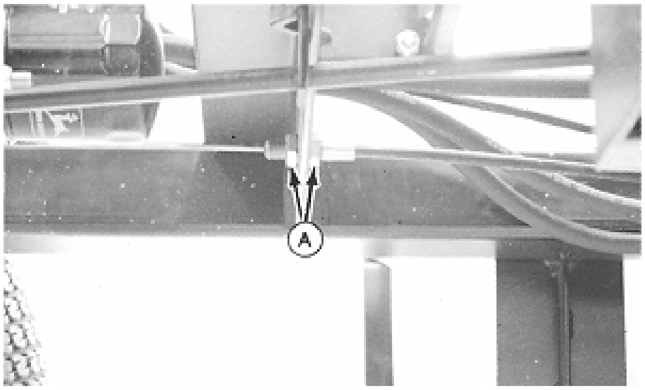

M46624 -UN-27MAR92

MX,6015HJ,18 -19-14APR92

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7. Position clevis between two nuts on the threaded portion of cable end (A).

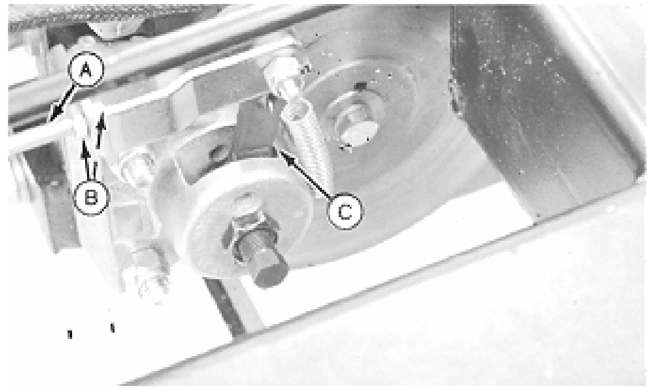
NOTE: Make adjustments with parking brake "OFF".

8. Loosen set screw and rotate knurled knob until parking brake handle is horizontal in the "OFF" position.

9. At the caliper cable, use adjusting nuts (B) to align clevis with lever and install cap screw. The lever (C) will contact the caliper casting with no slack in cable when adjusted properly.

10. Adjust the service brake cable clevis to allow a 1/8" gap (D) between lever and shoulder as shown.

11. See Brake Shoe Adjustment and Park Brake Adjustment Section 250, Group 15. See Transmission Neutral Return Adjustment Section 250, Group 15.



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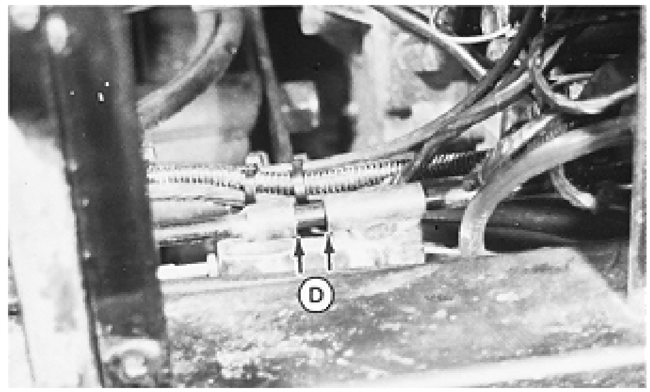

M46574 -UN-27MAR92

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Section 80
MISCELLANEOUS

Contents

Page

Group 05—Front/Rear Wheel Bearing Repair
Front Wheel Bearing Repair 80-05-1
Rear Wheel Bearing Repair 80-05-2
Front Axle Service 80-05-4

FRONT WHEEL BEARING REPAIR

NOTE: Front fender removed for photos.

1. Place blocks in front and behind rear wheels to prevent vehicle movement. Raise front of vehicle with a suitable jack and install support stands.

2. Remove wheel and dust cap (A).

3. Remove cotter pin, retaining nut, washer, and outer wheel bearing (B).

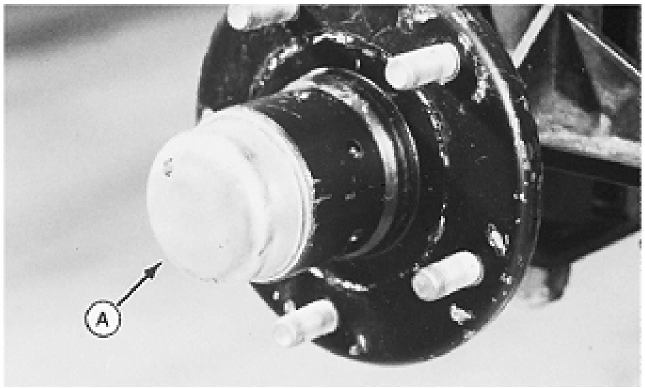
4. Remove grease seal and inner wheel bearing from hub (C).

N **CAUTION: Do not spin bearings using compressed air or serious personal injury may result.**

5. Clean parts in a suitable solvent and allow to air dry. Inspect bearings and races for cracks, pitting, wear or bluing caused by excess heat. Replace parts as necessary.

6. Pack bearings with a suitable grease and place inner bearing into hub (C).

A—Dust Cap
B—Outer Wheel Bearing
C—Inner Wheel Bearing
D—Grease Seal
E—Retaining Nut



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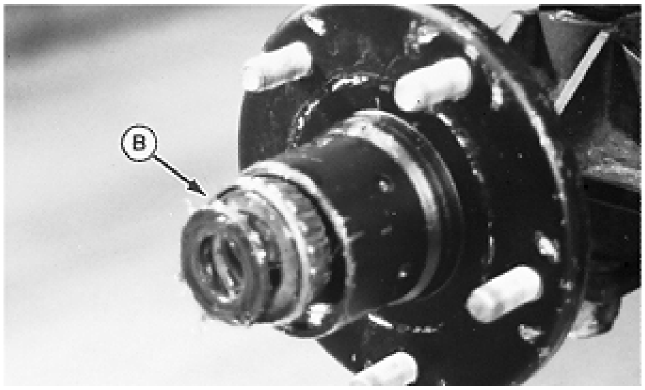

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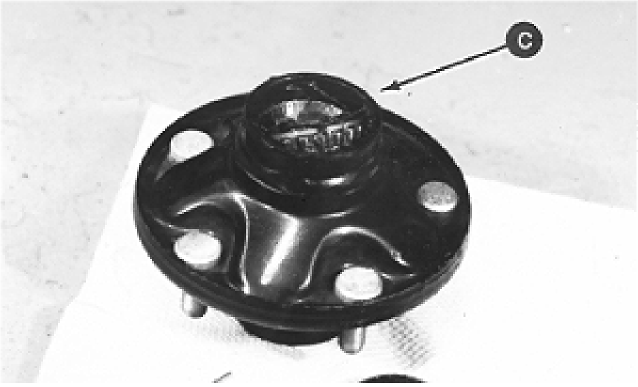

M46550 -UN-27MAR92

MX,8005HJ,1 -19-14APR92

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1

NOTE: Front fender removed for photos.

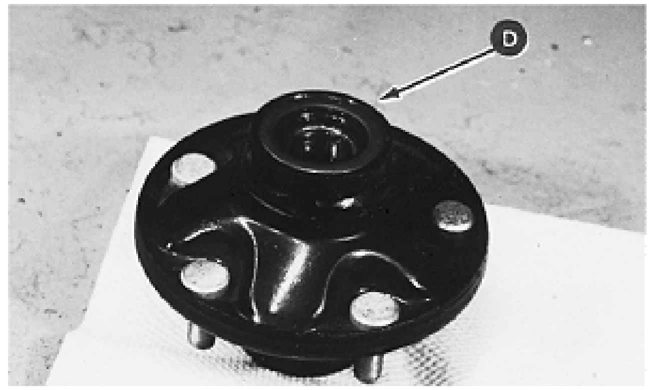
7. Use a suitable seal driver and install seal flush with end of hub (D).

8. Position hub on axle and install outer bearing. Install washer and nut. Tighten retaining nut (E) while spinning hub until bearings are seated. Back off nut 1/2 turn or until pin can be inserted through nut and hole in axle.

9. Insert cotter key and install dust cover. Install wheel and secure with five cap screws. Tighten to 70 ± 7 N·m (52 ± 5 lb-ft).

10. Raise vehicle, remove stands and lower vehicle safely to the ground.

A—Dust Cap
B—Outer Wheel Bearing
C—Inner Wheel Bearing
D—Grease Seal
E—Retaining Nut



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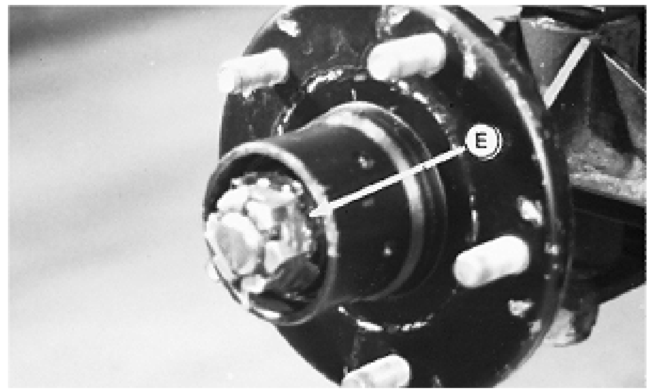

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MX,8005HJ,2 -19-14APR92

REAR WHEEL BEARING REPAIR

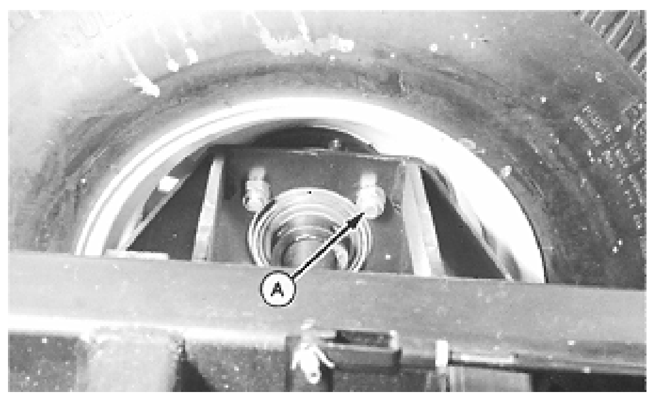
1. Place blocks in front and behind front wheels to prevent vehicle movement.

2. Raise the rear of the vehicle with a suitable jack and install support stands.

3. Remove wheel and remove four nuts and lockwashers (A) securing the stub shaft to the vehicle frame. Remove the stub shaft (B).

4. Remove set screw. Rotate locking collar 1/4 turn. Remove locking collar from stub shaft.

5. Slide bearing assembly off stub shaft.



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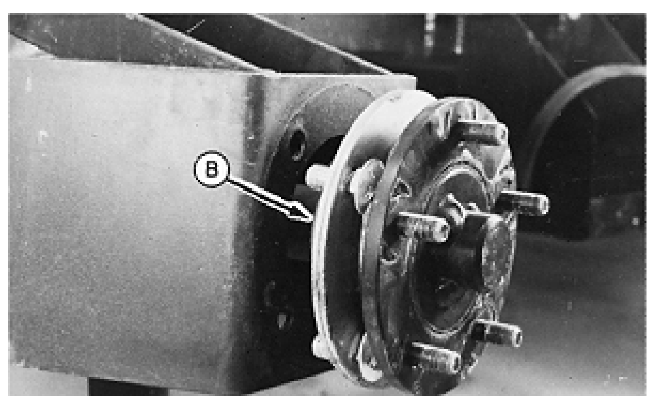

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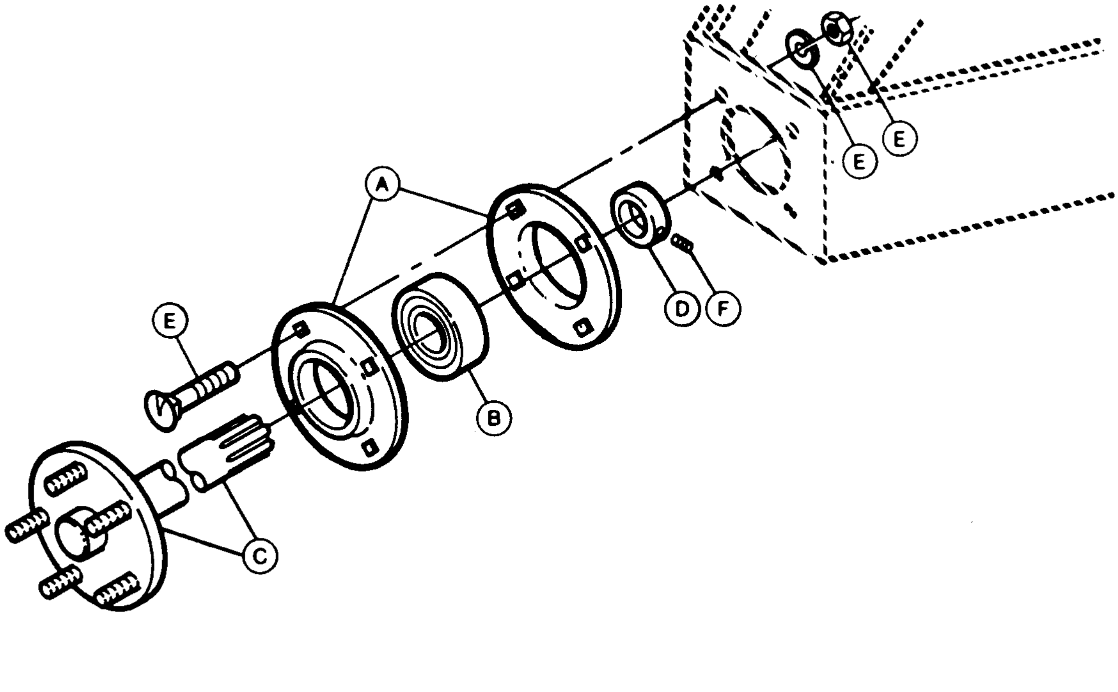

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M46668

A—Flangettes
B—Bearing
C—Stub Shaft
D—Locking Collar
E—Mounting Hardware
F—Set Screw

6. Use a screwdriver to separate the flangettes (A) and bearing (B), reassemble the flangettes on a new bearing.

7. Position the bearing assembly on the frame. Slide the stub shaft (C) through the bearing assembly partially and slide the locking collar (D) onto the shaft.

8. Slide the stub shaft into the hub as far as possible and secure bearing assembly with four lockwashers and nuts (E), tighten to ???.

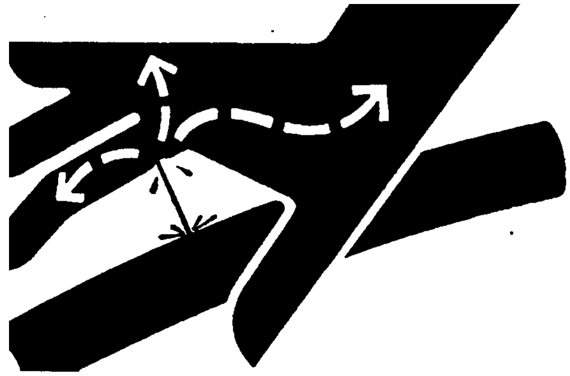
9. Slide the locking collar (D) over the bearing, rotate the locking collar 1/4 turn and install the set screw (F).

10. Install wheel and secure with five cap screws, tighten to 70 ± 7 N·m (52 ± 5 lb-ft).

11. Raise vehicle, remove support stands and lower vehicle safely to the ground.

MX,8005HJ,4 -19-14APR92

AVOID HIGH-PRESSURE FLUIDS



X9811 -UN-23AUG88

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

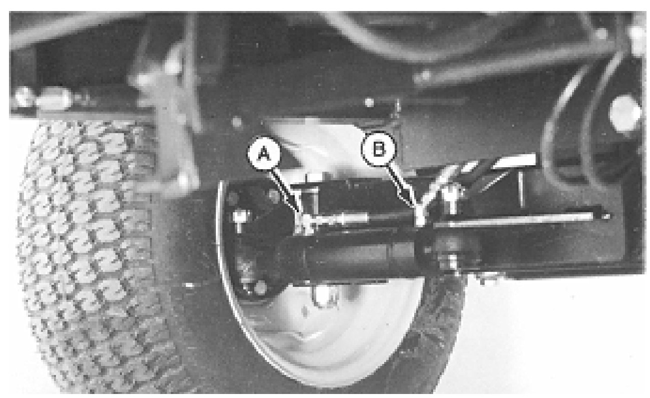
Avoid the hazard by relieving pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure.

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.

DX,FLUID -19-09AUG91

FRONT AXLE SERVICE



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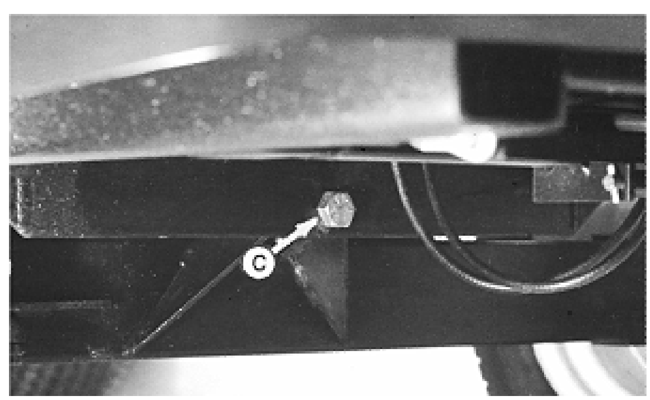


M46669 -UN-27MAR92

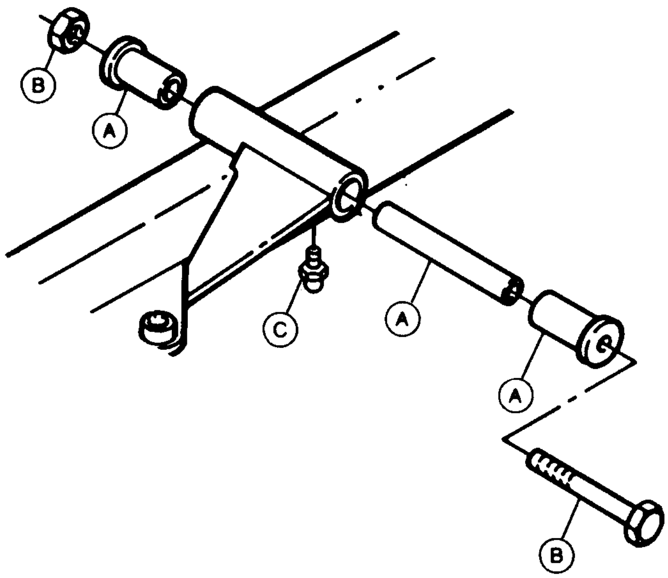
1. Place blocks in front and behind rear wheels to prevent vehicle movement.

2. Raise front of vehicle with a suitable jack and install support stands.

3. Disconnect hydraulic fittings (A,B) at steering cylinder and install caps and plugs.

4. Use a suitable jack under the front axle for support while removing the nut and bolt (C) securing the front axle to the frame.

MX,8005HJ,5 -19-14APR92



M46670

-UN-01APR92

M46670

5. Remove and inspect bushings (A). Replace worn parts as necessary.

6. Install bushings and raise axle assembly into position.

7. Install cap screw and nut (B), torque to 668 N·m (150 lb-ft).

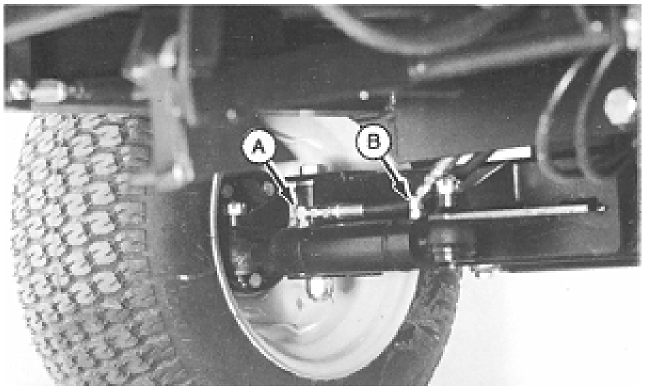
8. Service fitting (C) with grease.

MX,8005HJ,6 -19-14APR92

9. Reconnect hydraulic fittings (A,B) and lower vehicle safely to the ground.

10. Start vehicle and check for proper movement of steering mechanism.

11. Operate steering in both directions several times to bleed air from hydraulic system, check fluid level and service to proper level.



M46632 -UN-27MAR92

MX,8005HJ,7 -19-14APR92

Section 210
OPERATIONAL CHECKOUT PROCEDURES

Contents

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TEST AND ADJUSTMENT SPECIFICATIONS

ITEM	SPECIFICATION
ENGINE	
Slow idle	1550 ± 50 rpm
Fast idle	3600 ± 50 rpm
Compression pressure (min)	1171 kPa (11.71 bar) (170 psi)
Maximum variation between cylinders	97 kPa (0.96 bar) (14 psi)
Crankcase vacuum (min)	18 cm (7 in.) water
Valve clearance (cold)	0.25 mm (0.010 in.)
Valve clearance adjusting nut torque	9 N·m (79 lb-in.)
Oil pressure	
Pressure sensor activates	Below 28 kPa (0.28 bar) (4 psi)
Pressure (fast idle min)	276 kPa (2.76 bar) (40 psi)
Oil filter bypass valve opening pressure	96 kPa (0.96 bar) (14 psi)
Cooling system pressure	
Maximum test pressure	117 kPa (1.17 bar) (17 psi)
Minimum pressure after 15 seconds	90 kPa (0.90 bar) (13 psi)
Radiator cap	
Opening pressure	97—104 kPa (0.97—1.04 bar) (14—15 psi)
Minimum pressure	90 kPa (0.90 bar) (13 psi)
Coolant recovery tank level	25—51 mm (1—2 in.)
Thermostat	
Begin opening	63—66°C (145—150°F)
Full open	80°C (176°F)
Spark plug gap	0.64 mm (0.025 in.)
Torque	25 N·m (221 lb-in.)
Fan drive belt	
Deflection with 245—391 N (55—88 lb force) applied between fan and outer drive sheave	12—19 mm (0.472—0.748 in.)

MX,21005HJ,1 -19-14APR92

ITEM	SPECIFICATION
ENGINE—CONTINUED	
FUEL/AIR	
Fuel transfer pump	
Flow (min)	207 mL (7 oz)/30 seconds
Pressure (min)	19.6 kPa (0.196 bar) (2.8 psi)
Throttle lever friction movement	35—53 N (8—12 lb force)
ELECTRICAL	
Battery	12.4 volts
Stator	
Regulated amperage/voltage	15 amps (min) at 12.2—13.8 volts
Unregulated voltage	26 VAC at fast idle
Resistance	0.11—0.18 ohms
Starter	
Amp draw/RPM	72 amps at 500 RPM
No-load amps/RPM	50 amps at 6000 RPM
Starter connection regulated voltage	15 amps (min) at 11.8—13.2 volts
Spark plug cap resistance	Marked on cap
Pulser Harness	
Connector resistance	85—270 ohms
Ignition coil	
Primary winding resistance	3.4—4.5 ohms
Secondary winding resistance	10.4—15.6 K-ohms
POWER TRAIN	
Transmission oil operating temperature (max)	93°C (200°F)
Steering valve pressure—neutral	
Oil temperature	43°C (110°F)
Engine speed (slow idle)	1550 ± 50 rpm
Pressure	620—1240 kPa (6.2—12.4 bar) (90—180 psi)
Charge pump pressure—neutral	
Oil temperature	43°C (110°F)
Engine speed (slow idle)	1550 ± 50 rpm
Pressure	620—1240 kPa (6.2—12.4 bar) (90—180 psi)
Charge pump flow	
Oil temperature	43°C (110°F)
Engine speed	3600 ± 50 rpm
Test pressure	3450 kPa (34.5 bar) (500 psi)
Flow (min)	6.8 L/min (1.8 gpm)
Implement relief valve pressure	
Oil temperature	43°C(110°F)
Engine speed (fast idle)	3600 ± 50 rpm
Test pressure	6550—7930 kPa (65.5—79.3 bar) (950—1150 psi)
Charge relief valve adjustment	Shim as required

MX,21005HJ,2 -19-14APR92

ITEM	SPECIFICATION
STEERING AND BRAKES	
Steering system leakage	
Oil temperature	43°C (110°F)
Engine speed (slow idle)	1550 ± 50 rpm
Maximum turn with a constant torque of 68 N·m (72 lb-in.) in either direction	6 rpm
Steering valve leakage	
Oil temperature	43°C (110°F)
Engine speed (slow idle)	1550 ± 50 rpm
Maximum turn with a constant torque of 68 N·m (72 lb-in.) in either direction	6 rpm
Steering cylinder ball joint nut torque	75 N·m (55 lb-ft)
Toe-in adjustment	
Distance between front tires-to-distance between rear tires	5 mm (0.187 in.) difference

MX,21005HJ,3 -19-14APR92

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.

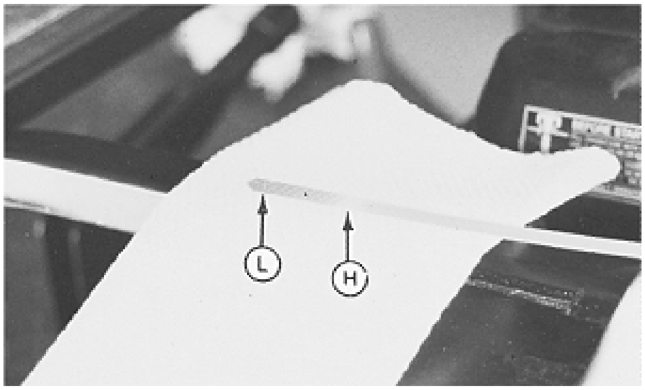
Each checkout lists:
•Conditions - How the unit should be set up for the checkout.
•Normal - What should happen or be heard or be seen.
•If Not Normal - Where to go if other tests or adjustments are needed.

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,21010HJ,1 -19-14APR92

ENGINE OIL CHECK



M46619 -UN-27MAR92

Conditions:
•Engine cold or “OFF” for at least 5 min.
•Key switch off
•Machine on level surface

Normal:
•Oil between “L” and “H” marks on dipstick
•Correct viscosity
•Not milky, burnt, or contaminated with metal chips
•Breather tube not clogged

If Not Normal:
•Add correct viscosity oil
•Clean breather tube
•Inspect gaskets, seals, or plugs for leaks. See Section 220.

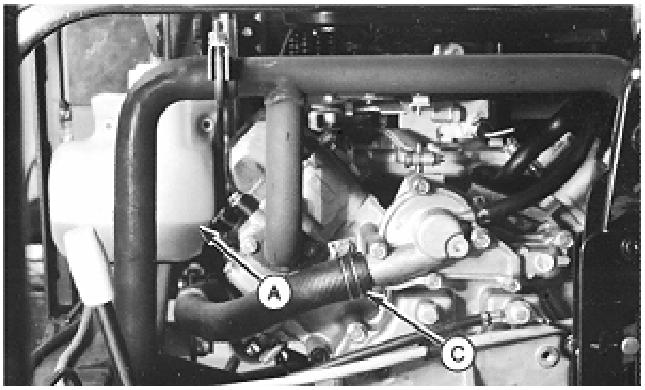
MX,21010HJ,2 -19-14APR92

COOLING SYSTEM CHECK

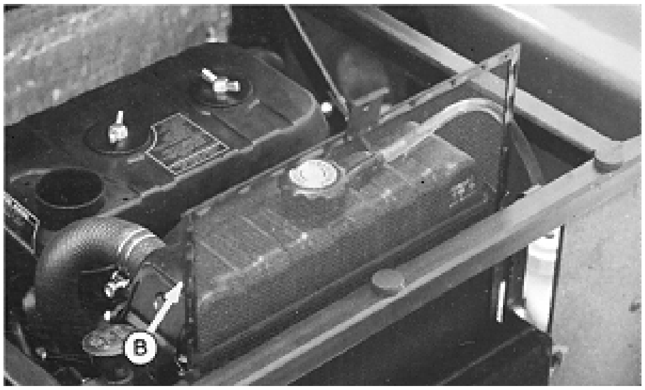
Conditions:
•Engine cold
•Key switch OFF
•Machine on level surface

Normal:
•25—51 mm (1—2 in.) coolant in recovery tank (A)
•Coolant not contaminated
•Fan blades straight
•Radiator/screen free of debris (B)
•All hoses in good condition. Hose clamps tight (C)
•Fan belt should deflect between
12—19 mm (0.472—0.748 in.) with 245—319 N
(55—88 lb force) applied between fan and outer
drive sheave
•Hydraulic oil cooler free of debris

If Not Normal:
•Add proper coolant mix
•Inspect all connections for leaks. See Section 220 for cooling system pressure test.
•Clean, repair, replace, or adjust as required



M46630 -UN-27MAR92

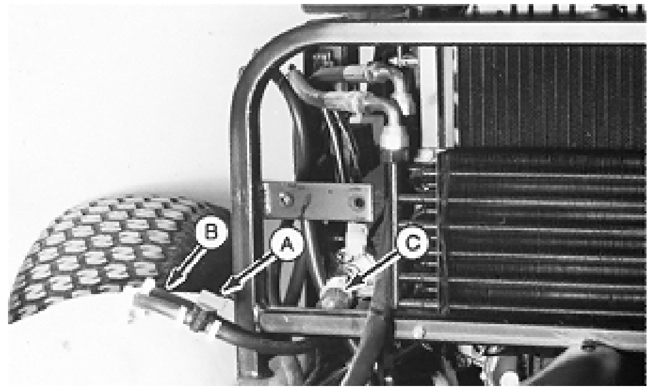


M46629 -UN-27MAR92

MX,21010HJ,3 -19-14APR92

210
10
3

FUEL SYSTEM CHECK



M46666 -UN-27MAR92

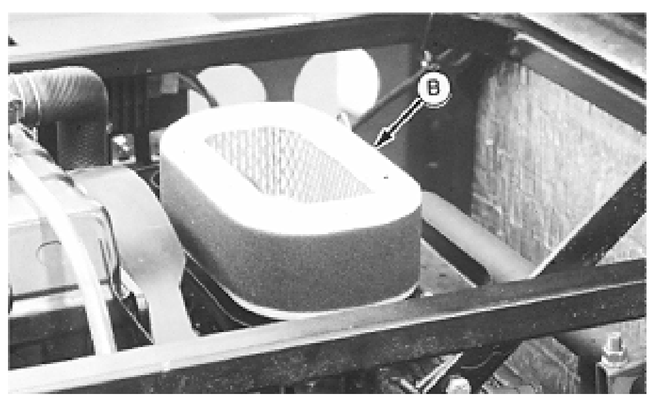
Conditions:
•Engine cold
•Key switch OFF

Normal:
•Fuel level OK
•Fuel not contaminated
•Correct grade of fuel
•Fuel tank shut-off valve in correct position (A)
•Fuel tank vent (B) not clogged
•Fuel tank and lines in good condition
 No leaks
•Fuel filter (C) free of dirt

If Not Normal:
•Drain and clean fuel tank. Add correct grade of fuel
•Move fuel tank shutoff valve to correct position (A)
•Clean fuel tank cap vent line (B)
•Clean or replace lines as required
•Replace fuel filter (C)
 See operators manual

MX,21010HJ,4 -19-14APR92

AIR INTAKE SYSTEM CHECK



M46583 -UN-27MAR92

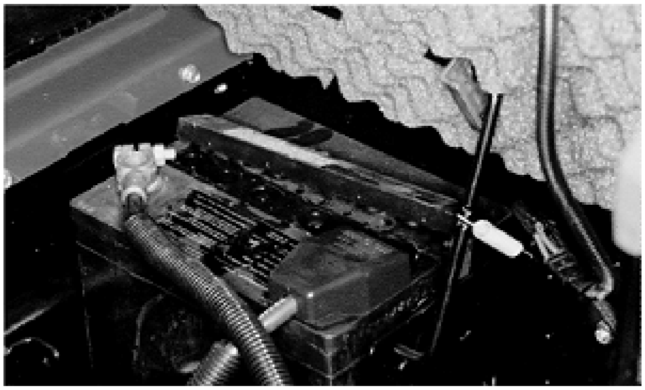
Conditions:
•Engine cold
•Key switch OFF

Normal:
•Primary and secondary elements (B) not plugged
•Air cleaner housing sealed no leaks

If Not Normal:
•Clean, repair or replace as required

MX,21010HJ,5 -19-14APR92

ELECTRICAL SYSTEM CHECK


M54316 -UN-25OCT90

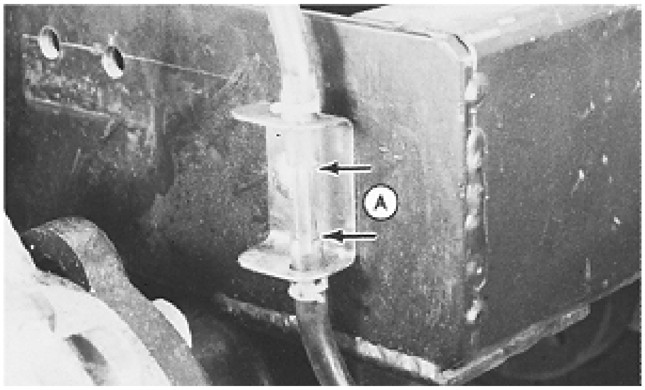
Conditions:
•Key switch OFF

Normal:
•Battery electrolyte level OK
•Battery cables clean not corroded
•Fuses OK

If Not Normal:
•Add distilled water to battery. See operators manual
•Clean or replace cables
•Replace fuses as required

MX,21010HJ,6 -19-14APR92

HYDRAULIC SYSTEM CHECK



M46620 -UN-27MAR92

Conditions:
•Key switch OFF

Normal:
•Oil between marks on sight tube
•Correct grade of oil
•Oil not contaminated
•Control lever(s) move smoothly
•Vent tubes open
•Suction Hose not collapsed

If Not Normal:
•Add correct grade oil
•Drain and refill with correct grade oil
•Inspect and repair as required. See Section 250

MX,21010HJ,7 -19-14APR92

MISCELLANEOUS CHECKS

Conditions:
•Key switch OFF

Normal:
•Drive shaft not damaged. Well lubricated
•Tires in good condition. Correct pressure

If Not Normal:
•Repair as required

MX,21010HJ,8 -19-14APR92

CHECKING INDICATOR LAMPS

M46671 -UN-27MAR92

Conditions:
•Operator on seat

Procedure:
•Turn key switch to START position

Normal:
•Charge lamp should light and stay on.
•Oil pressure lamp should light and stay on
•Coolant temperature lamp should light and stay on

If Not Normal:
•Check fuses located under seat
•Go to Section 240, Group 15

MX,21010HJ,9 -19-14APR92

TRANSFER PUMP CHECK

M46672 -UN-27MAR92

Conditions:
•Turn key switch to ON position

Normal:

•Fuel transfer pump must run making a “ticking” sound

If Not Normal:
•Go to Section 240

MX,21010HJ,10 -19-14APR92

STARTING CIRCUIT CHECK


M46671 -UN-27MAR92

Conditions:
•Operator on seat
•Transmission control in neutral position

Procedure:
•Use choke as needed
•Turn key switch to START position

Normal:
•Starter must crank
•Engine must start and run
•All indicator lamps must be OFF

If Not Normal:
•Starting circuit or lamps not OK: Go to Section 240
•Engine cranks but does not start: Go to Section 220

Conditions:
•Engine stopped
•Operator off seat
•Transmission control in neutral position
•Service-park brake disengaged

Procedure:
•Turn key switch to START position

Normal:
•Starter must not crank engine

If Not Normal:
•Go to Section 240

MX,21010HJ,11 -19-14APR92

STARTING CIRCUIT CHECK—CONTINUED


M46671 -UN-27MAR92

Conditions:
•Operator off seat
•Transmission control in neutral position
•Service-park brake engaged

Procedure:
•Turn key switch to START position

Normal:
•Starter must crank engine
•Engine must start and run
•All indicator lamps must be OFF

If Not Normal:
•Starting circuit or lamps not OK: Go to Section 240
•Engine cranks but does not start: Go to Section 220

MX,21010HJ,12 -19-14APR92

ENGINE PERFORMANCE CHECK


M46673 -UN-27MAR92

Conditions:
•Operator on seat
•Transmission control in neutral position

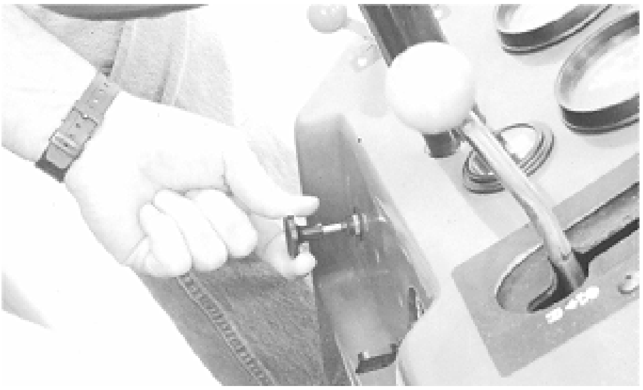
Procedure:
•Start engine and allow it to warm up
•Move throttle lever from slow to fast idle

Normal:
•Engine must accelerate and decelerate smoothly without hesitation
•Governor should maintain constant speed without surging
•Exhaust should be clear

If Not Normal:
•Go to Section 220

MX,21010HJ,13 -19-14APR92

CHOKE LEVER CHECK


M46674 -UN-27MAR92

Conditions:
•Operator on seat
•Transmission control in neutral position

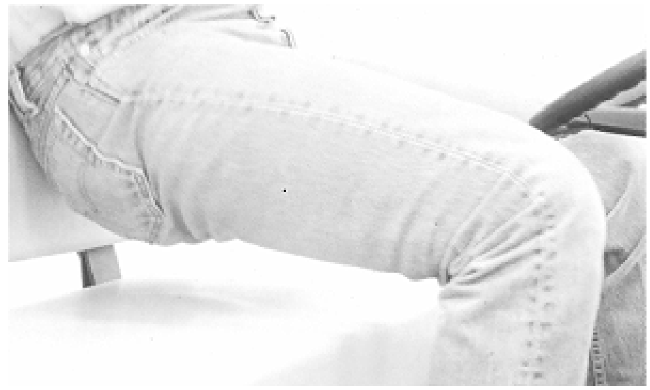
Procedure:
•Run engine at half throttle
•Quickly pull choke knob fully out, then push in

Normal:
•Engine must falter, then resume speed

If Not Normal:
•Go to Section 220

MX,21010HJ,14 -19-14APR92

SEAT SWITCH CHECK FOR ENGINE CIRCUIT



M46675 -UN-27MAR92

Conditions:
•Operator on seat
•Transmission control in neutral position
•Service-park brake disengaged

Procedure:
•Run engine at half throttle
•Quickly raise off seat and sit back down

Normal:
•Engine may falter but must stay running

Procedure:
•Raise off seat

Normal:
•Engine must STOP

Conditions:
•Operator on seat
•Run engine at slow idle

Procedure:
•Apply service-park brake
•Raise off seat

Normal:
•Engine must NOT stop

If Not Normal:
•Go to Section 240

MX,21010HJ,15 -19-14APR92

TRANSMISSION FORWARD—REVERSE CHECK

M46676 -UN-27MAR92

Conditions:
•Operator on seat
•Transmission control lever in neutral position
•Service-park brake disengaged

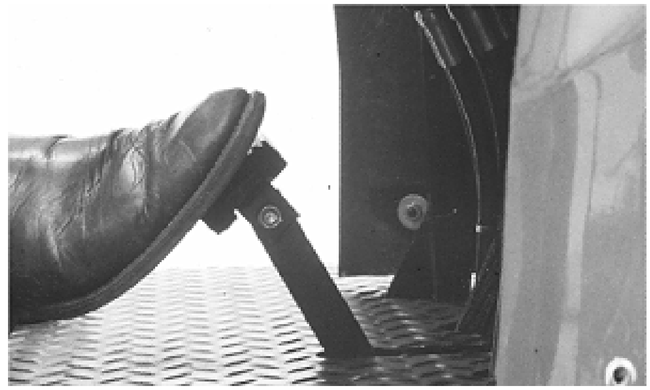
Procedure:
•Run engine at full throttle
•Advance forward control lever fully, then reverse control lever fully

Normal:
•Machine must accelerate and decelerate smoothly from forward to reverse

If Not Normal:
•Go to Section 250

MX,21010HJ,16 -19-14APR92

TRANSMISSION NEUTRAL RETURN CHECK



M46677 -UN-27MAR92

M46678 -UN-27MAR92

Conditions:
•Operator on seat
•Transmission control in forward position
•Service-park brake disengaged

Procedure:
•Depress service brake pedal.

Normal:
•Transmission control must return to neutral position

If Not Normal:
•Go to Section 250

Conditions:
•Operator on seat
•Transmission control in reverse position
•Service-park brake disengaged

Procedure:
•Depress service brake pedal.

Normal:
•Transmission control must return to neutral position

If Not Normal:
•Go to Section 250

Conditions:
•Operator on seat
•Transmission control in forward position
•Service-park brake disengaged

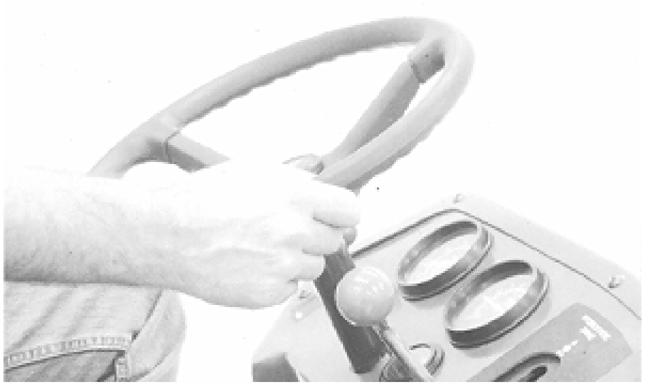
Procedure:
•Engage parking brake.

Normal:
•Transmission control must return to neutral position

If Not Normal:
•Go to Section 250

MX,21010HJ,17 -19-14APR92

POWER STEERING CHECK



Conditions:
•Operator on seat
•Transmission control in neutral position
•Service-park brake disengaged

Procedure:
•Run engine at full throttle
•Turn steering wheel full left, then full right.

Normal:
•Wheels must move from stop-to-stop
•Wheels must move smoothly in both directions
•Wheels must stop turning when steering wheel is stopped

If Not Normal:
•Go to Section 260

MX,21010HJ,18 -19-14APR92

CHECKOUT PROCEDURE COMPLETE

If you completed the checkout procedure and did not isolate a malfunction, the problem may be intermittent.

Procedure:
•Try to duplicate the conditions of the malfunction identified by the operator
•Repeat system checkout in this group.

IF MALFUNCTION IS NOT IDENTIFIED AFTER REPEATING SYSTEM CHECKOUT PROCEDURE, FACTORY ASSISTANCE IS AVAILABLE THROUGH THE DEALER TECHNICAL ASSISTANCE CENTER (DTAC).

MX,21010HJ,19 -19-14APR92

Section 220
ENGINE OPERATION, TESTS, AND ADJUSTMENTS

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COMPONENT LOCATION INFORMATION

This group contains component location drawings for the following engine system components:

- Engine
- Lubrication System
- Engine Cooling System

Use the drawings when diagnosing an engine problem and to help locate the components to be tested.

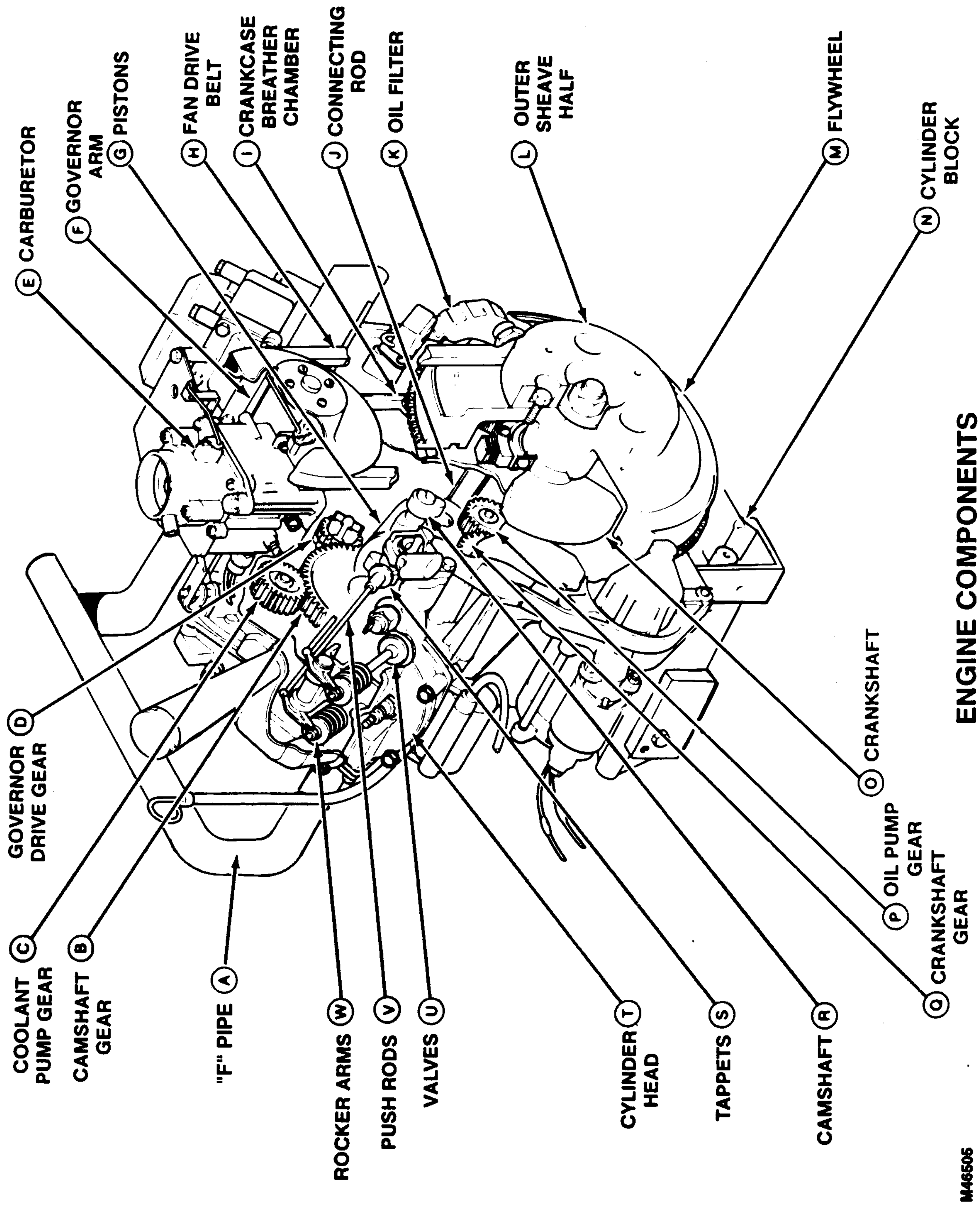
MX,22105HJ,A1 -19-14APR92

ENGINE COMPONENTS

A—F-Pipe
B—Camshaft Gear
C—Coolant Pump Gear
D—Governor Drive Gear
E—Carburetor
F—Governor Arm
G—Pistons
H—Fan Drive Belt
I—Crankcase Breather Chamber
J—Connecting Rod
K—Oil Filter
L—Outer Sheave Half
M—Flywheel
N—Cylinder Block
O—Crankshaft
P—Oil Pump Gear
Q—Crankshaft Gear
R—Camshaft
S—Tappets
T—Cylinder Head
U—Valves
V—Push Rods
W—Rocker Arms

Slide M46505

MX,22005HJ,A1 -19-14APR92



M46505 -19-09MAR92

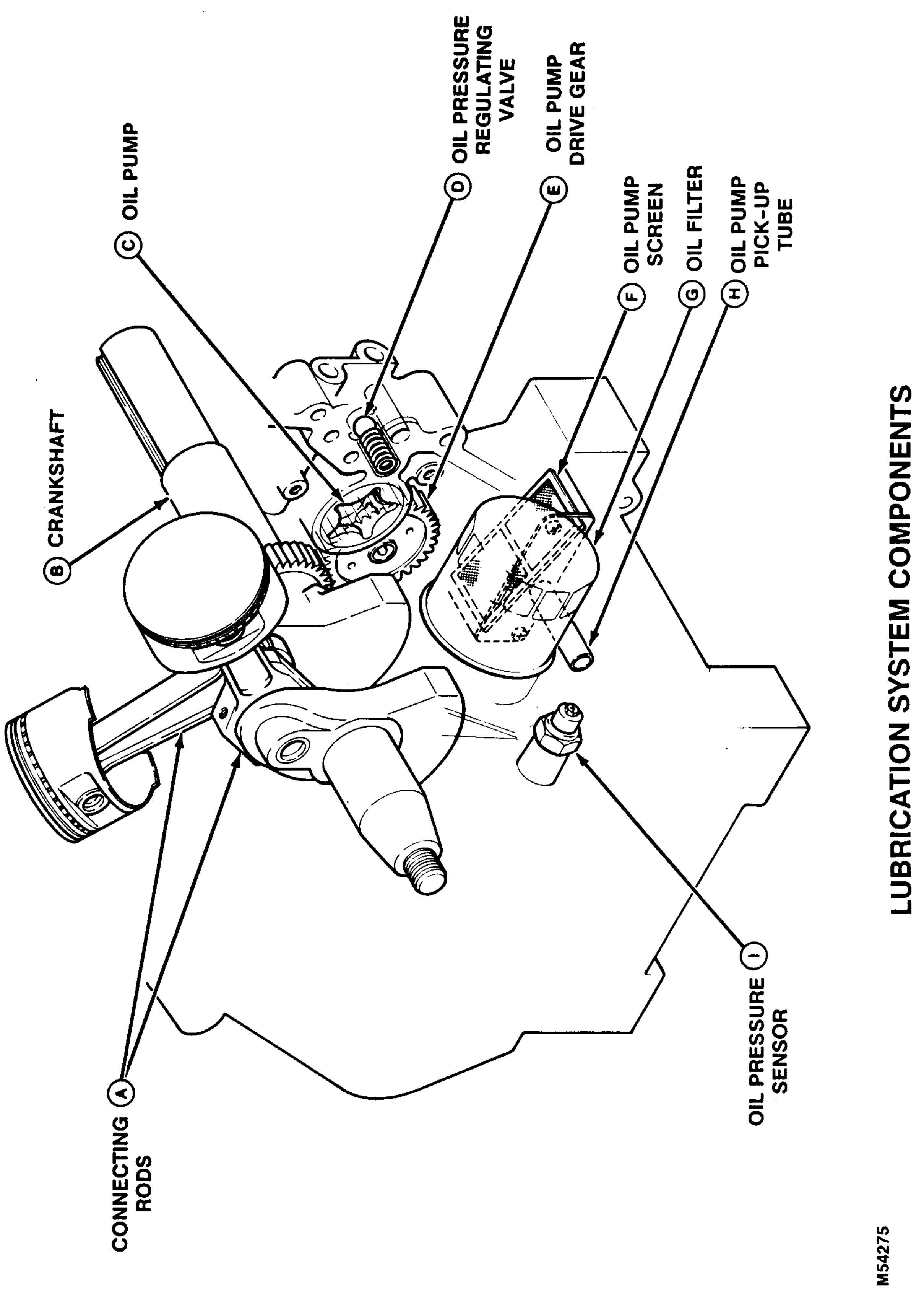
MX,22005HJ,A2 -19-14APR92

LUBRICATION SYSTEM COMPONENTS

A—Connecting Rods
B—Crankshaft
C—Oil Pump
D—Oil Pressure Regulating Valve
E—Oil Pump Drive Gear
F—Oil Pump Screen
G—Oil Filter
H—Oil Pump Pick-up Tube
I—Oil Pressure Sensor

Slide M54275

MX,22005HJ,A3 -19-14APR92



M54275 -19-09OCT90

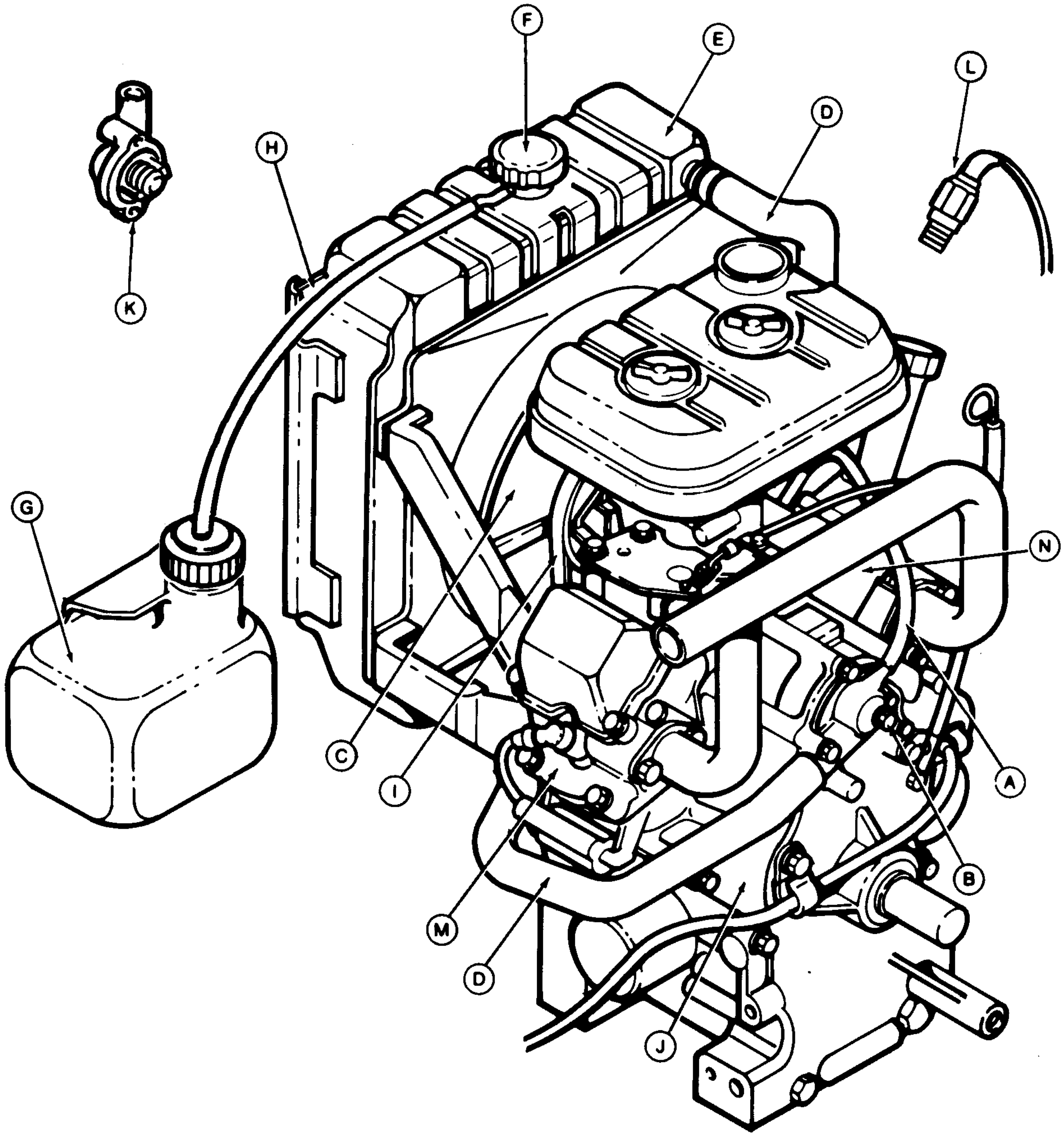
MX,22005HJ,A4 -19-14APR92

ENGINE COOLING SYSTEM COMPONENTS

A—Coolant By-pass Hose
B—Coolant Pump
C—Cooling Fan
D—Coolant Hoses
E—Radiator
F—Pressure Cap
G—Coolant Recovery Tank
H—Radiator Screen
I—Fan Drive Belt
J—Engine Block
K—Thermostat
L—Coolant Temperature Sensor
M—Cylinder Heads

Slide M46506

MX,22005HJ,A5 -19-14APR92



M46506 **ENGINE COOLING SYSTEM COMPONENTS**

THEORY OF OPERATION INFORMATION

This group divides the engine 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
- Engine Lubrication System
- Oil Filter
- Engine Cooling System

The slide number reference under the art is used for service training purposes only.

MX,22010HJ,A1 -19-14APR92

CRANKCASE BREATHER OPERATION

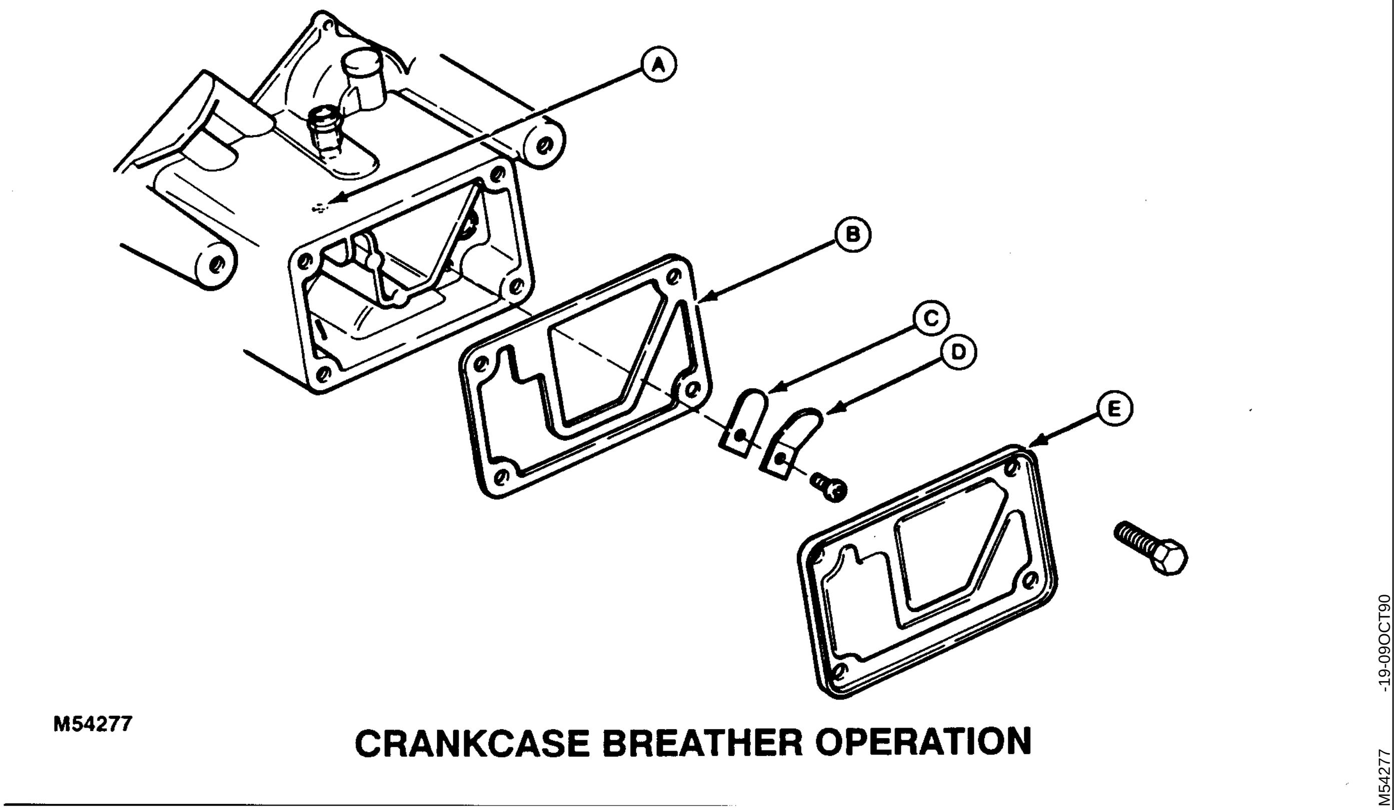
Function:
Vents crankcase fuel and water vapor out of engine without losing engine oil. Maintains crankcase vacuum.

Major Components:
•Breather Chamber Cover
•Gasket
•Reed Valves
•Back Plates

Theory of Operation:
Up and down movement of the piston creates air flow in the crankcase. Reed valves (C) act as one-way valves to only allow air flow out of the crankcase, maintaining a vacuum. The vacuum is necessary to prevent oil from being forced past piston rings, seals, and gaskets.

Oil laden air from the crankcase passes through the reed valves, where oil is separated from the air and drained back to the crankcase. The breather vents through the air cleaner, to prevent dirt from entering the crankcase.

MX,22010HJ,A2 -19-14APR92



A—Drain Hole
B—Gasket
C—Reed Valve
D—Back Plate (2 used)
E—Cover

Slide M54277

MX,22010HJ,A3 -19-14APR92

LUBRICATION SYSTEM OPERATION

A—Crankshaft Main Bearing (Flywheel Side)
B—Connecting Rod Journals
C—Connecting Rod Passage
D—Crankshaft Main Bearing (PTO Side)
E—Oil Pump
F—Oil Pressure Regulating Valve
G—Intake Screen
H—Oil Filter
I—Oil Pressure Sensor
J—Low Pressure Oil
K—Pressure Free Oil

Slide MXC54278

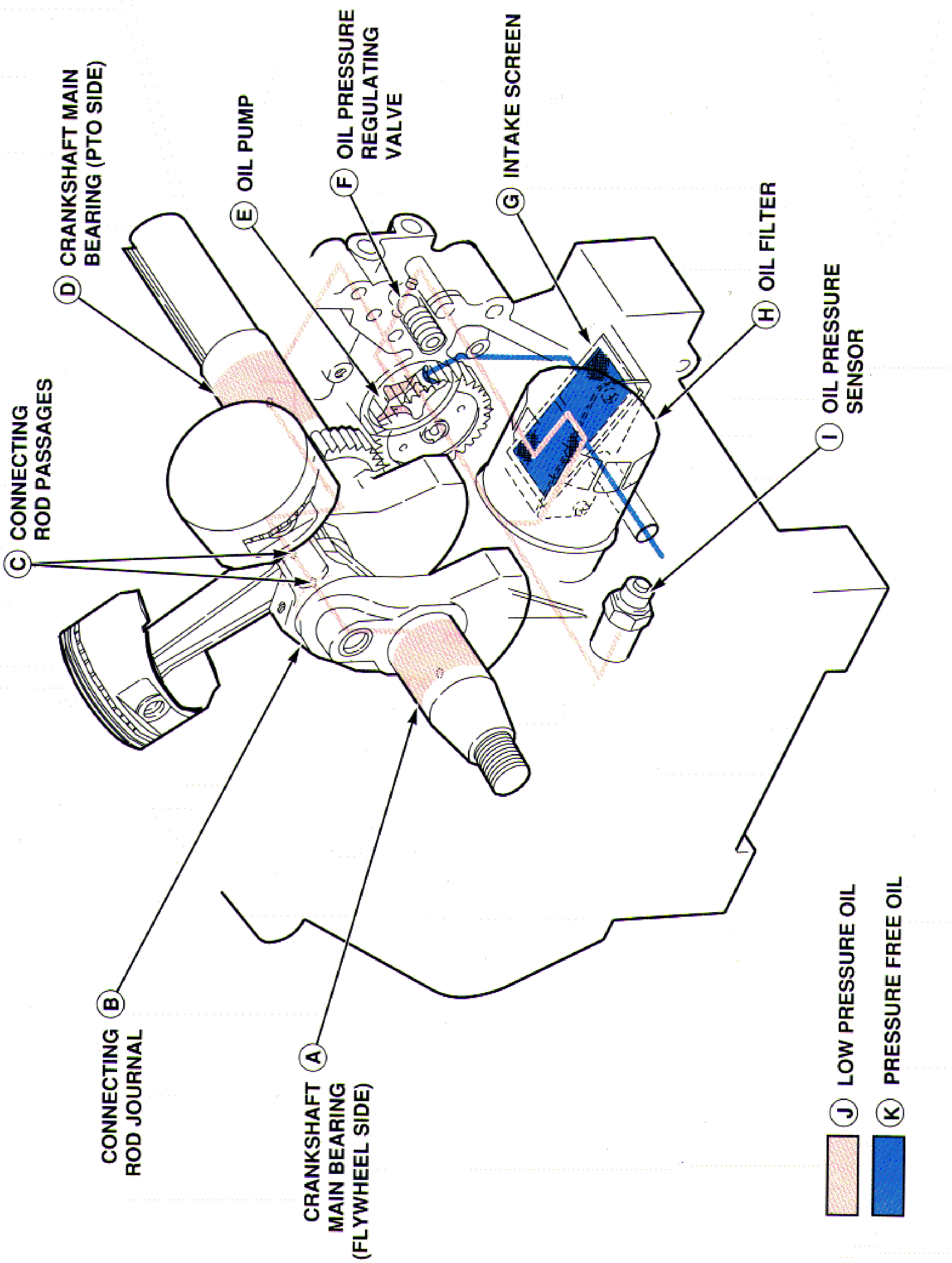
Function:
A full pressure system lubricates engine parts with clean oil.

Major Components:
•Cylinder Heads
•Engine Block
•Oil Pump
•Intake Screen
•Oil Filter
•Pressure Regulating Valve
•Oil Pressure Sensor
•Oil Pump Drive Gear

Theory of Operation:
A positive displacement gerotor pump (E) draws pressure free oil (K) from the sump through screen (G). Pressure oil (J) from the pump flows to the oil pressure regulating valve (F). The oil pressure regulating valve limits the oil pressure to approximately 296 kPa (2.96 bar) (43 psi) and protects the oil pump from damage if an oil passage becomes blocked. If oil pressure exceeds 296 kPa (2.96 bar) (43 psi), the relief valve opens allowing oil to return to sump. Regulating valve is not adjustable .

Pressure oil from the regulating valve passage flows to the oil filter (H). An oil pressure sensor (I) mounted above the oil filter turns on a warning light if oil pressure is below 28 kPa (0.28 bar) (4 psi). Filtered pressure oil flows through a passage in the oil sump to the crankshaft main bearing (PTO side) (D). Drilled passages in the crankshaft distribute oil from the main bearing to the connecting rod journals (B), and crankshaft main bearing (flywheel side) (A). A drilled passage in the connecting rods allow oil from the connecting rod journal to lubricate the piston and cylinder.

MX,22010HJ,A4 -19-14APR92



LUBRICATION SYSTEM OPERATION

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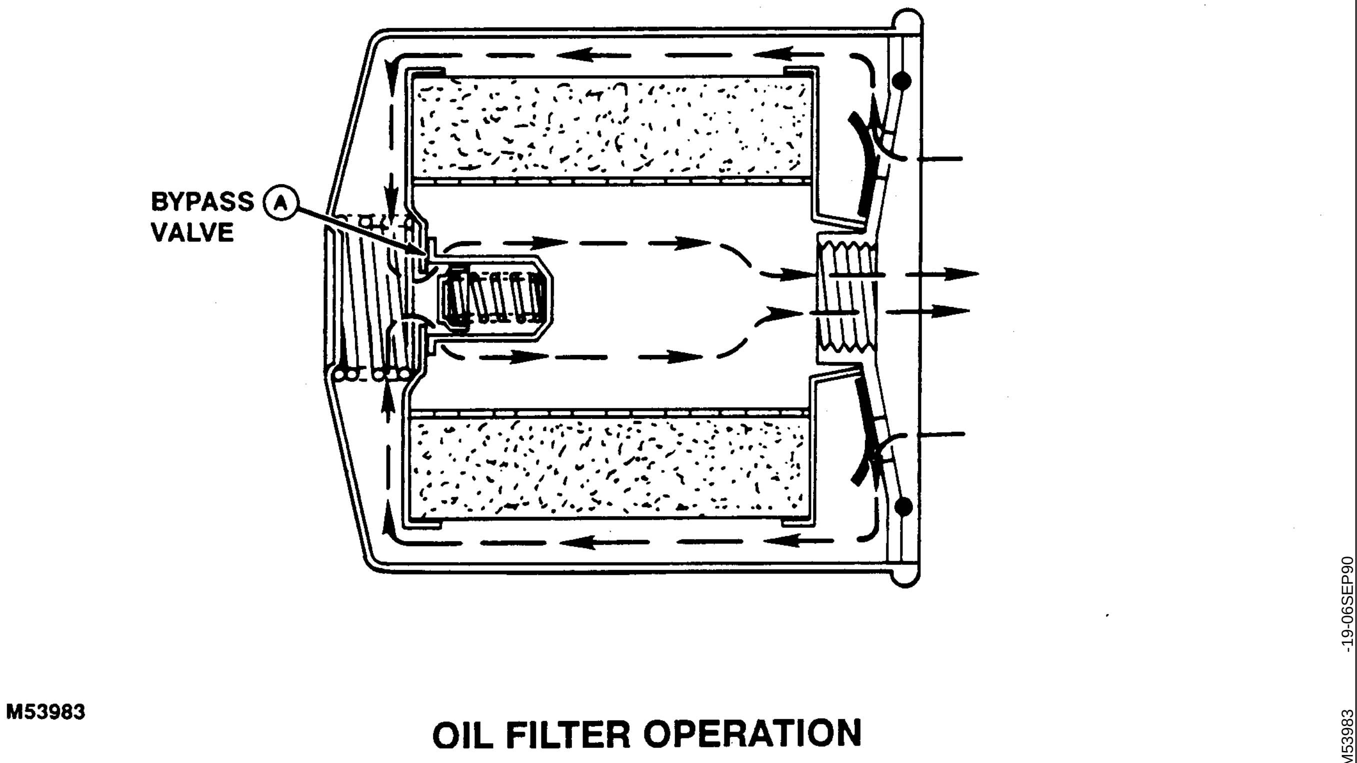
MX,22010HJ,A5 -19-14APR92

OIL FILTER OPERATION



Slide M53983

Function:
Filters 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) to ensure 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,22010HJ,A6 -19-14APR92

ENGINE COOLING SYSTEM OPERATION

A—Coolant By-pass Hose
B—Coolant Pump
C—Pressure Cap
D—Coolant Recovery Tank
E—Radiator Screen
F—Radiator
G—Thermostat
H—Coolant Temperature Sensor

Function:
The coolant pump circulates coolant through the cooling system, drawing hot coolant from the engine block, circulating it through the radiator for cooling.

Major Components:
•Radiator
•Coolant Hoses
•Coolant Pump
•Cooling Fan
•Fan Belt
•Engine Block
•Cylinder Heads
•Thermostat
•Coolant Temperature Sensor
•Coolant Recovery Tank
•Pressure Cap
•By-pass Hose
•Coolant Pump Drive Gear

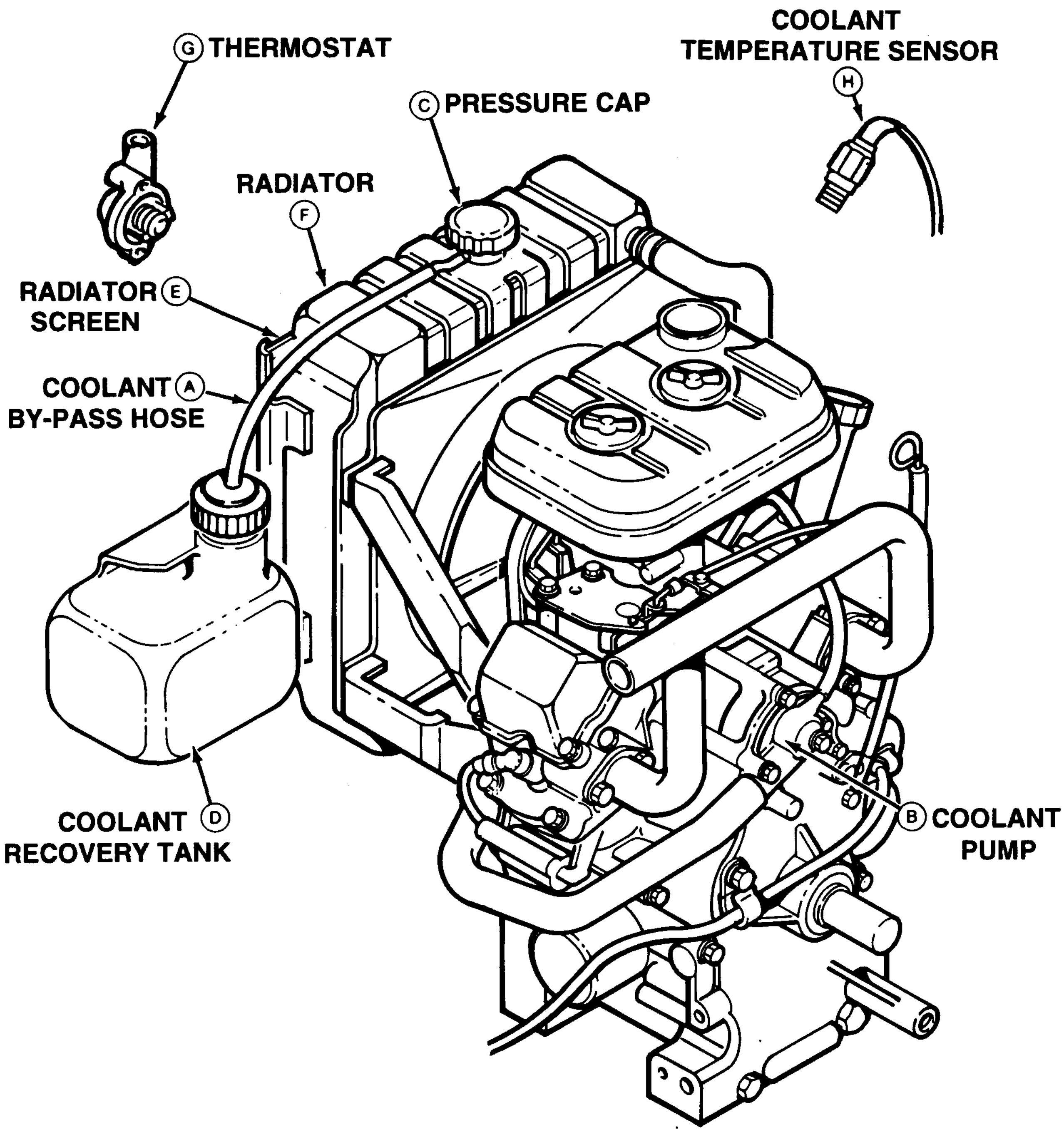
Theory of Operation:
The water pump (B) draws coolant from the bottom of the radiator (F) when the thermostat (G) is open or from the bypass (A) when the thermostat is closed. Coolant from the water pump flows to the water jackets in block, up through cylinder heads and then to the thermostat housing.

When the engine temperature is below 82°C (180°F), the thermostat is closed and coolant is directed back to the water pump through bypass hose (A) to be recirculated. This allows the engine to warm up to operating temperature quickly.

When the engine temperature is 82°C (180°F), the thermostat begins to open and is fully open at 95°C (203°F). Coolant from the water jackets and cylinder heads now flow through the radiator and is cooled by the radiator fan.

The radiator cap (C) maintains a constant pressure of 103 kPa (1.0 bar) (15 psi) inside the radiator which actually raises the boiling point of the coolant. The radiator cap contains a pressure valve and a vacuum valve. When the coolant is hot and pressure is above 103 kPa (1.0 bar) (15 psi), the pressure valve opens allowing some coolant to flow to the recovery tank (D). After the engine is stopped, the coolant cools and the pressure inside the radiator decreases. The pressure difference between the radiator and recovery tank forces the vacuum valve open and some coolant from the recovery tank flows back to the radiator.

MX,22010HJ,A8 -19-14APR92



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ENGINE COOLING SYSTEM OPERATION

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M46507

Slide M46507

MX,22010HJ,A9 -19-14APR92

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
- Engine backfires—while running
- Engine backfires through muffler when shut off
- Engine misses
- Engine surging
- Engine flooding
- Lack of fuel in carburetor
- Engine stops when hot
- Exhaust smokes—black or grey
- Smokes blue or uses excess oil
- Engine uses too much 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,22015HJ,A1A -19-14APR92

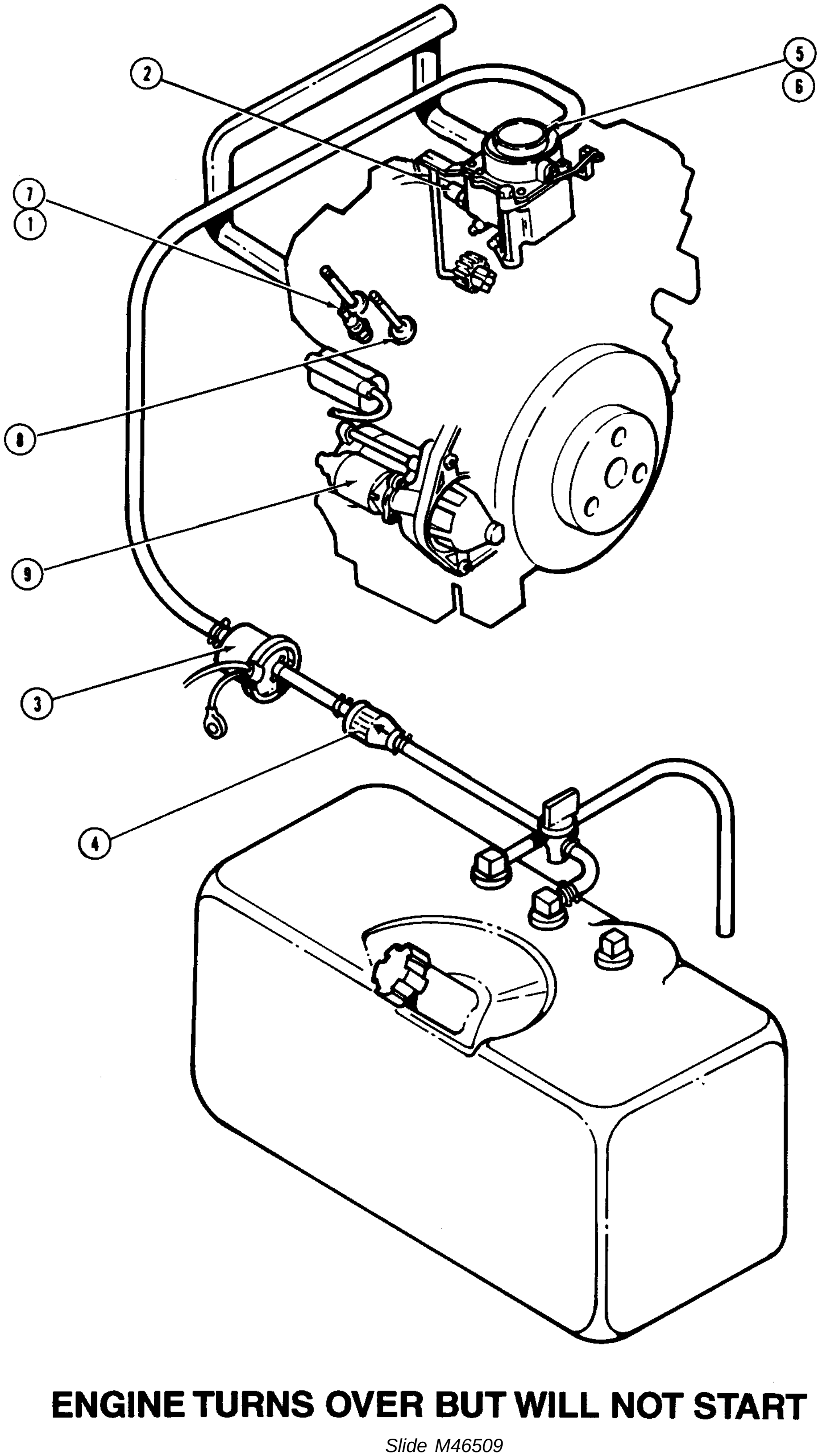
ENGINE TURNS OVER BUT WILL NOT START

Conditions:
•Transmission in neutral
•Park brake locked
•Key switch OFF

NOTE: Starter Duty Cycle is 5 sec. ON, 10 sec. OFF.

Test Location	Normal	If Not Normal
1. Spark plugs	Good hot spark Plug dry Plug gap 0.64 mm (0.025 in.)	See Ignition Spark Test. If plugs are full of fuel—see Engine Flooding. Gap or replace plugs. Check air cleaner for plugging.
2. Fuel Shut-off Solenoid	"Clicking" sound with key ON and in START	See Electrical Circuit Test Section 240 See Fuel Shut-off Solenoid Test.
3. Fuel transfer pump	Constant pressure and volume with Key switch ON and in START position Minimum Flow 207 mL (7 oz)/30 sec. Minimum Pressure 19.6 kPa (0.196 bar) (2.8 psi)	See Electrical Circuit Test. See Section 240. See Fuel Transfer Pump Flow and Pressure Tests. Check fuel lines for restrictions. Check fuel tank air vents.
4. Fuel filter	Fuel flows at outlet	Replace element.
5. Carburetor bowl	Full of good quality fuel	See Lack of Fuel in Carburetor. Use remote fuel source to carburetor.
6. Carburetor	Choke plate fully closed with throttle lever in full choke position	Adjust choke. See Choke Adjustment.
7. Spark plug ports	Cylinder compression of 1171 kPa (11.71 bar) (170 psi) minimum with a 97 kPa (0.96 bar) (14 psi) maximum difference between cylinders	Check valve adjustment then retest. Repair engine. See Section 20.
8. Valves	Cold engine valve clearance of 0.25 mm (0.010 in.)	Adjust—See Valve Clearance Adjustment.
9. Starter	Cranking rpm—300 rpm Amp draw—72 amp at 500 rpm	Look for engine load. Replace starter. See Section 40.

MX,22015HJ,A1 -19-14APR92



M46509

ENGINE TURNS OVER BUT WILL NOT START

Slide M46509

M46509 -UN-09MAR92

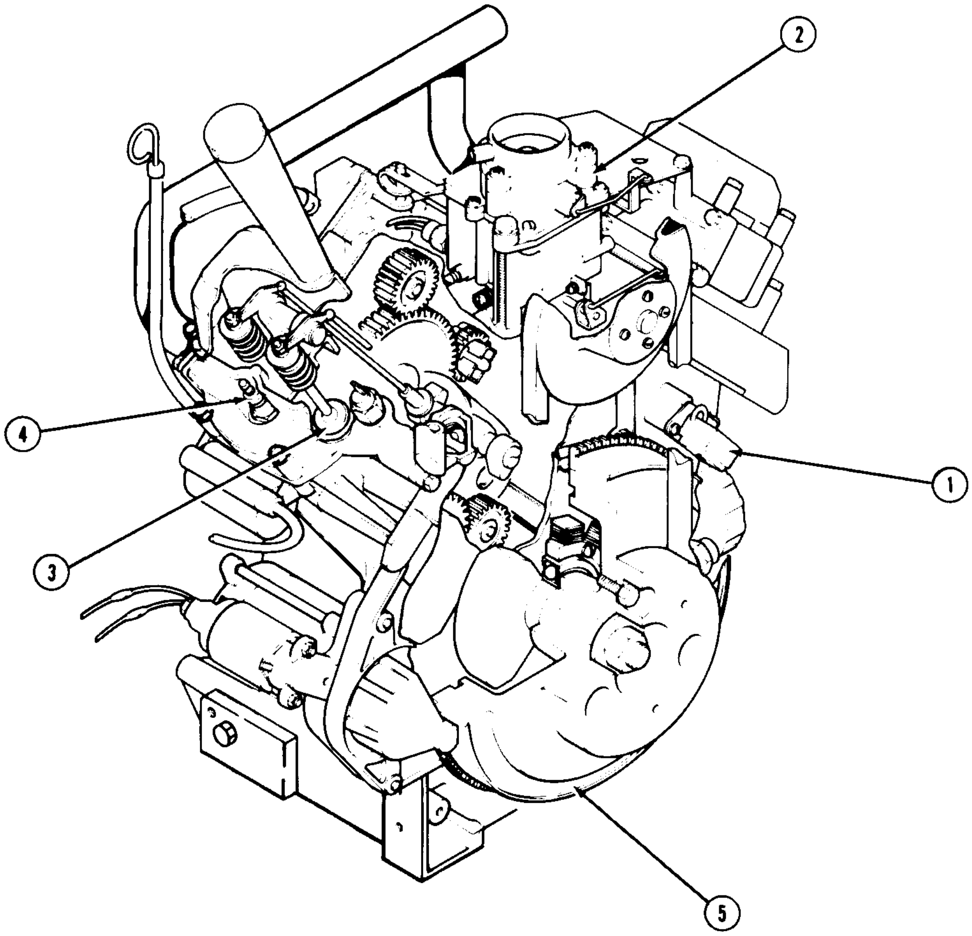
MX,22015HJ,A2 -19-14APR92

ENGINE BACKFIRES—WHILE RUNNING

Conditions:
•Transmission in neutral
•Park brake locked
•Key switch-as required

Test Location	Normal	If Not Normal
1. Ignition system	Ignition system Hot blue spark Connection to pulser clean and in good condition	Test ignition system components. See Section 240. Check pulser connections.
2. Carburetor	Choke plate fully open with knob in down position	Adjust choke. See Choke Adjustment.
	Smooth idle at 1450 rpm	Adjust idle mixture. See Carburetor Idle Mixture Screw Adjustment.
	Float level correct	Adjust or replace. See Section 30.
3. Valves	Cold engine valve clearance of 0.25 mm (0.010 in.)	Adjust—See Valve Clearance Adjustment.
	Both open same amount. Intake valves completely closed	Replace camshaft. See Section 20. Check for sticking valve or burnt intake valve.
4. Spark plugs	Spark not fouled	Spark plugs fouled. Replace.
5. Flywheel	Flywheel key in good condition	Replace key.

MX,22015HJ,A3 -19-14APR92



M46540

ENGINE BACKFIRES-WHILE RUNNING

Slide M46540

M46540 -UN-09MAR92

MX,22015HJ,A4 -19-14APR92

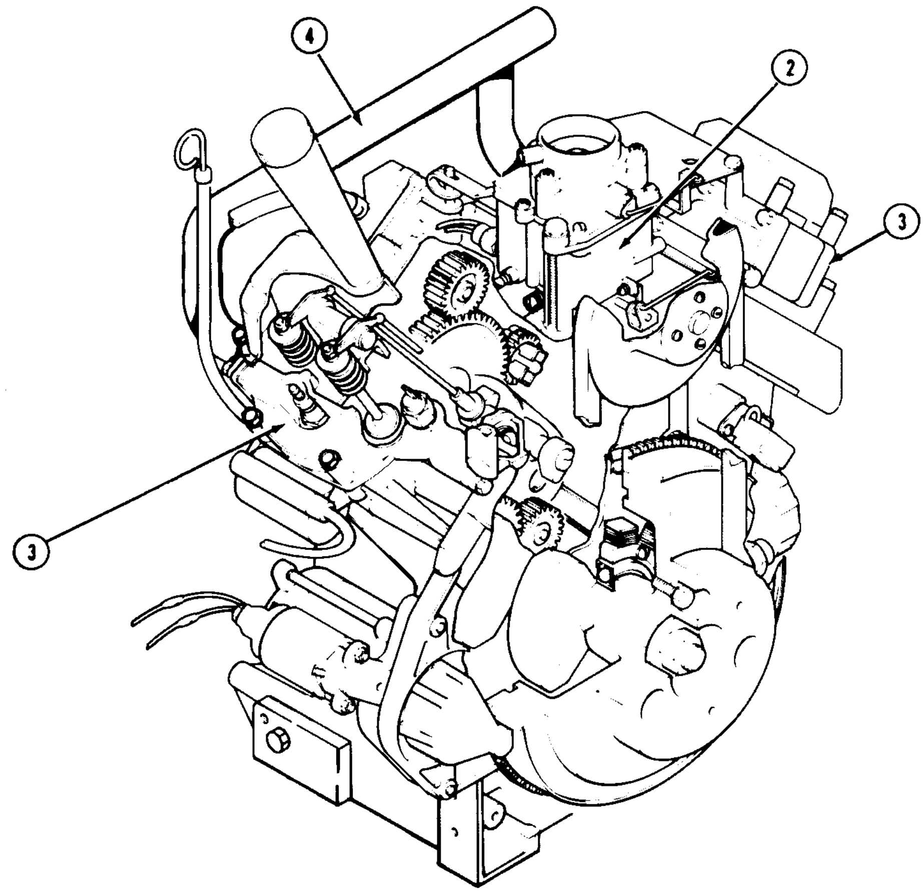
ENGINE BACKFIRES THROUGH MUFFLER WHEN SHUT OFF

Conditions:
•Transmission in neutral
•Park brake locked
•Key switch-as required

NOTE: Let engine idle 15—20 seconds before shutting off.

Test Location	Normal	If Not Normal
1. Air cleaner	No air restriction	Clean or replace air cleaner elements.
2. Carburetor	Smooth idle at 1500 rpm	Adjust idle mixture. See Carburetor Idle Mixture Screw Adjustment.
	Good fuel level and float not full of fuel	Adjust or replace float. See Section 30.
3. Cylinder heads	No exhaust leaks at muffler connection	Replace muffler gaskets. Tighten mounting hardware.
4. Muffler	No leaks or punctures	Replace muffler.

MX,22015HJ,A3A -19-14APR92



M46541 **ENGINE BACKFIRES THROUGH MUFFLER WHEN SHUT OFF**

Slide M46541

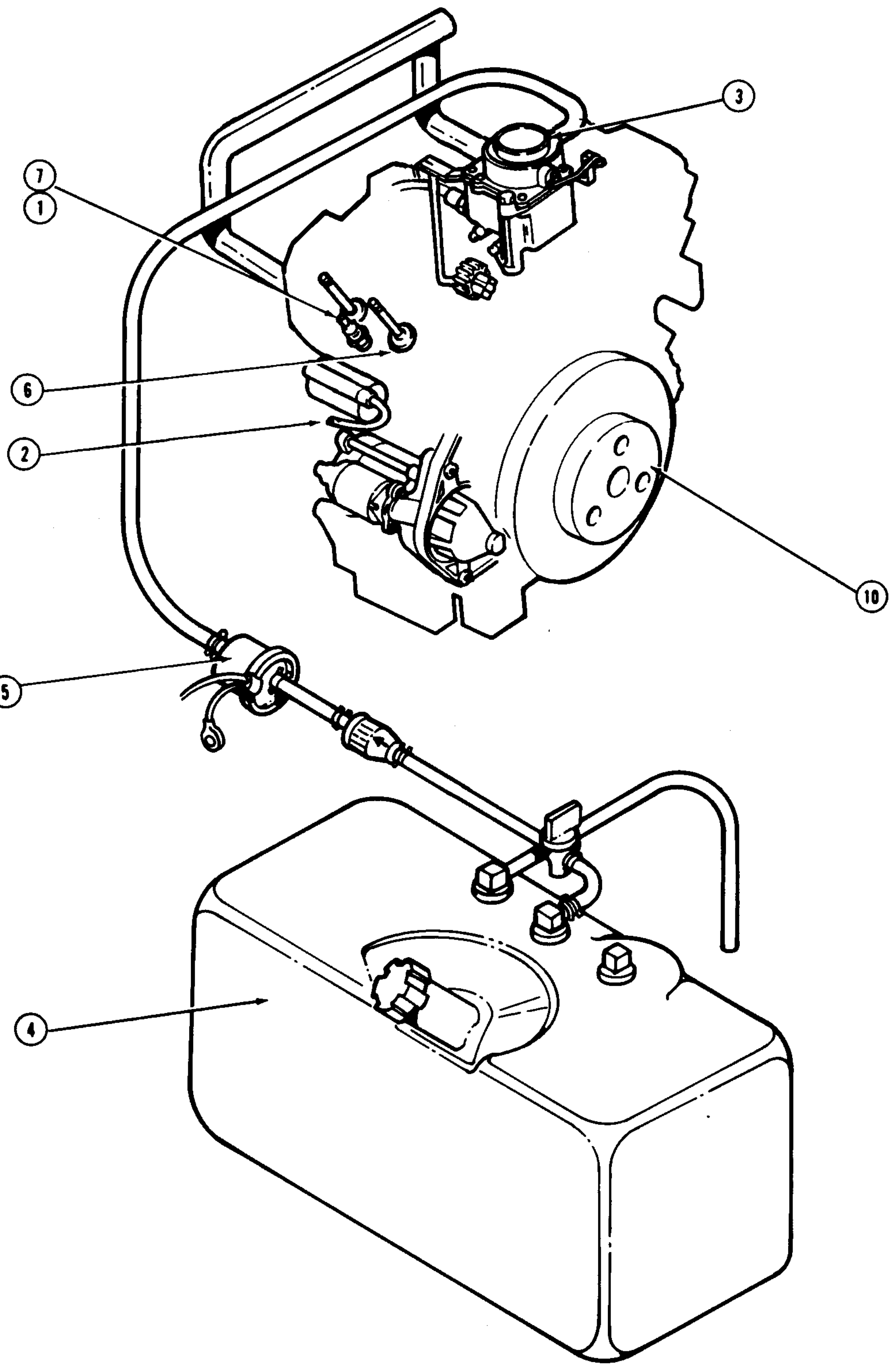
MX,22015HJ,A4A -19-14APR92

ENGINE MISSES

Conditions:
•Transmission in neutral
•Park brake locked
•Key switch-as required

Test Location	Normal	If Not Normal
1. Spark plugs	Plugs not fouled. Gap correct 0.64 mm (0.025 in.)	Spark plugs fouled. Replace.
	Plugs dry	If plugs are full of fuel-see Engine Flooding.
2. Ignition coil wires	Wires dry and insulation good Wires and connection to pulser in good condition.	Dry or replace wires. Test pulser. See Section 240.
3. Carburetor	Choke plate fully open with knob in down position	Adjust choke. See Choke Adjustment.
	Smooth idle at 1500 rpm	Adjust idle mixture. See Carburetor Idle Mixture Screw Adjustment.
	Float adjustment correct	Adjust or replace. See Section 30.
4. Fuel tank	Fresh fuel, free of water	Flush tank and refill with correct fuel.
	Tank is clean	
5. Fuel transfer pump	Constant pressure and volume with key switch ON and in START position, Minimum flow 207 mL (7 oz)/30 sec. Minimum pressure 19.6 kPa (0.196 bar) (2.8 psi)	See Fuel Transfer Pump Flow and Pressure Tests.
6. Valves	Cold engine valve clearance of 0.25 mm (0.010 in.)	Adjust—See Valve Clearance Adjustment.
	Both open same amount	Replace camshaft. See Section 20.
7. Spark plug ports	Cylinder compression of 1171 kPa (11.71 bar) (170 psi) minimum with 97 kPa (0.96 bar) (14 psi) maximum difference between cylinders	Repair engine. See Section 20.
8. Ignition system (not shown)	Good spark at correct time Correct firing order	See Ignition System Checks. See Section 240.
9. Cooling system (not shown)	Engine warming up to operating temperature	Test thermostat. Replace if necessary. Clean radiator and screen.
10. Flywheel	Key in good condition	Replace key.

MX,22015HJ,A5 -19-14APR92



M46510

ENGINE MISSES

Slide M46510

-UN-09MAR92

M46510

MX,22015HJ,A6 -19-14APR92

ENGINE SURGING

NOTE: Surging is usually the result of a lean mixture (not enough fuel or too much air).

Conditions:
•Transmission in neutral
•Park brake locked
•Key switch-as required

Test Location	Normal	If Not Normal
1. Air Cleaner	No air restriction	Clean or replace air cleaner element.
2. Fuel tank cap	No pressure or vacuum when removed from tank	Check vent.
3. Carburetor	Choke plate fully open with knob in down position	Adjust choke. See Choke Adjustment.
	Smooth idle at 1500 rpm	Adjust idle mixture. See Carburetor Idle Mixture Screw Adjustment.
	Good fuel level and float not full of fuel	Adjust or replace float. See Section 30.
	No varnish or debris on all internal passages	Clean internal passages. See Section 30.
4. Governor linkage	Governor adjusted	See Governor Adjustment.
5. Intake manifold	No change in engine performance while spraying aerosol lubricant around carburetor and intake gaskets while engine is running	Replace gaskets.
6. Fuel transfer pump	Constant pressure and volume with key switch ON and in START position Minimum flow 207 mL (7 oz.)/30 sec. Minimum pressure 19.6 kPa (0.196 bar) (2.8 psi)	See Fuel Transfer Pump Flow and Pressure Tests.

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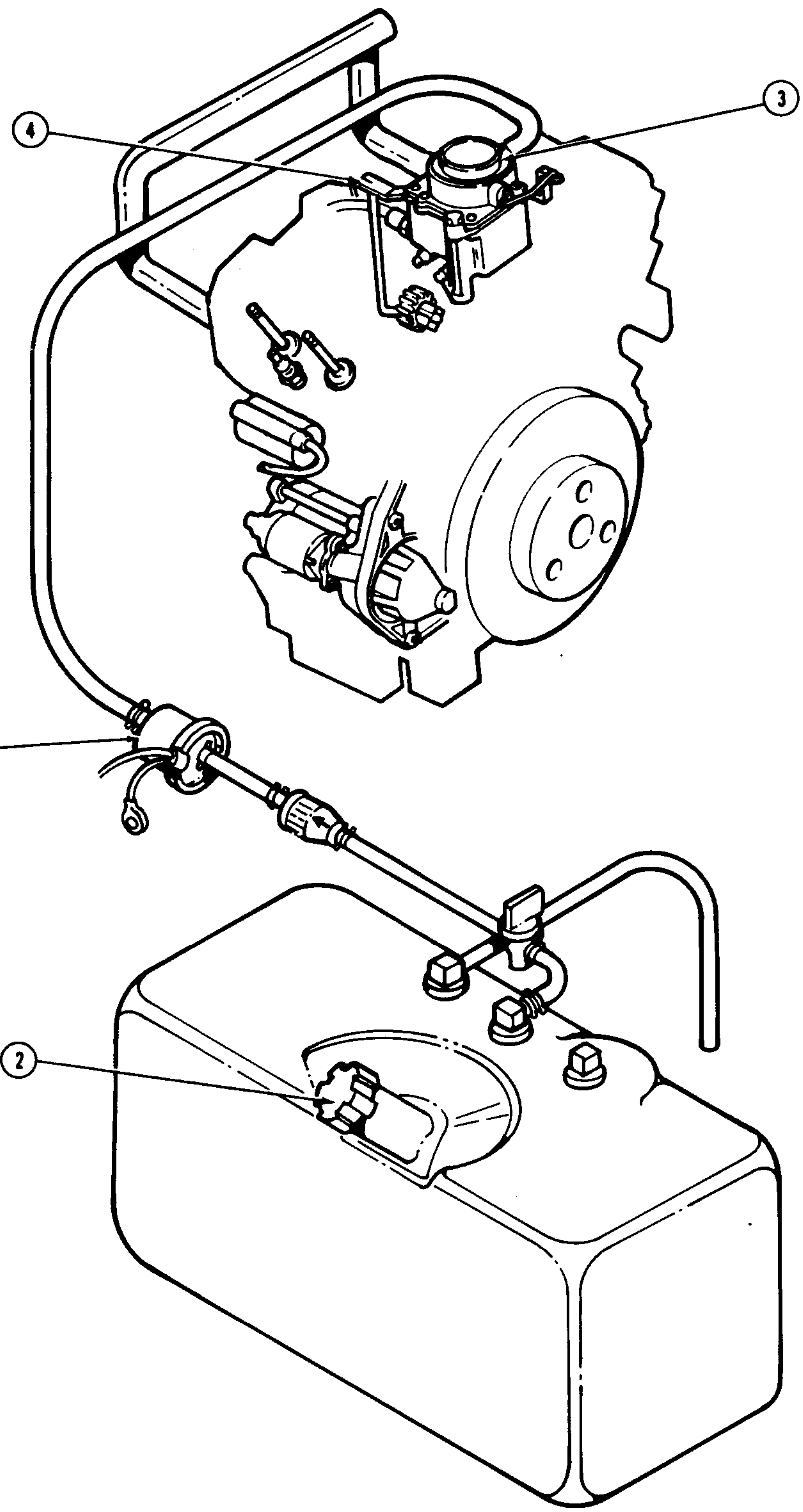
MX,22015HJ,A7 -19-14APR92



M46511

ENGINE SURGING

Slide M46511

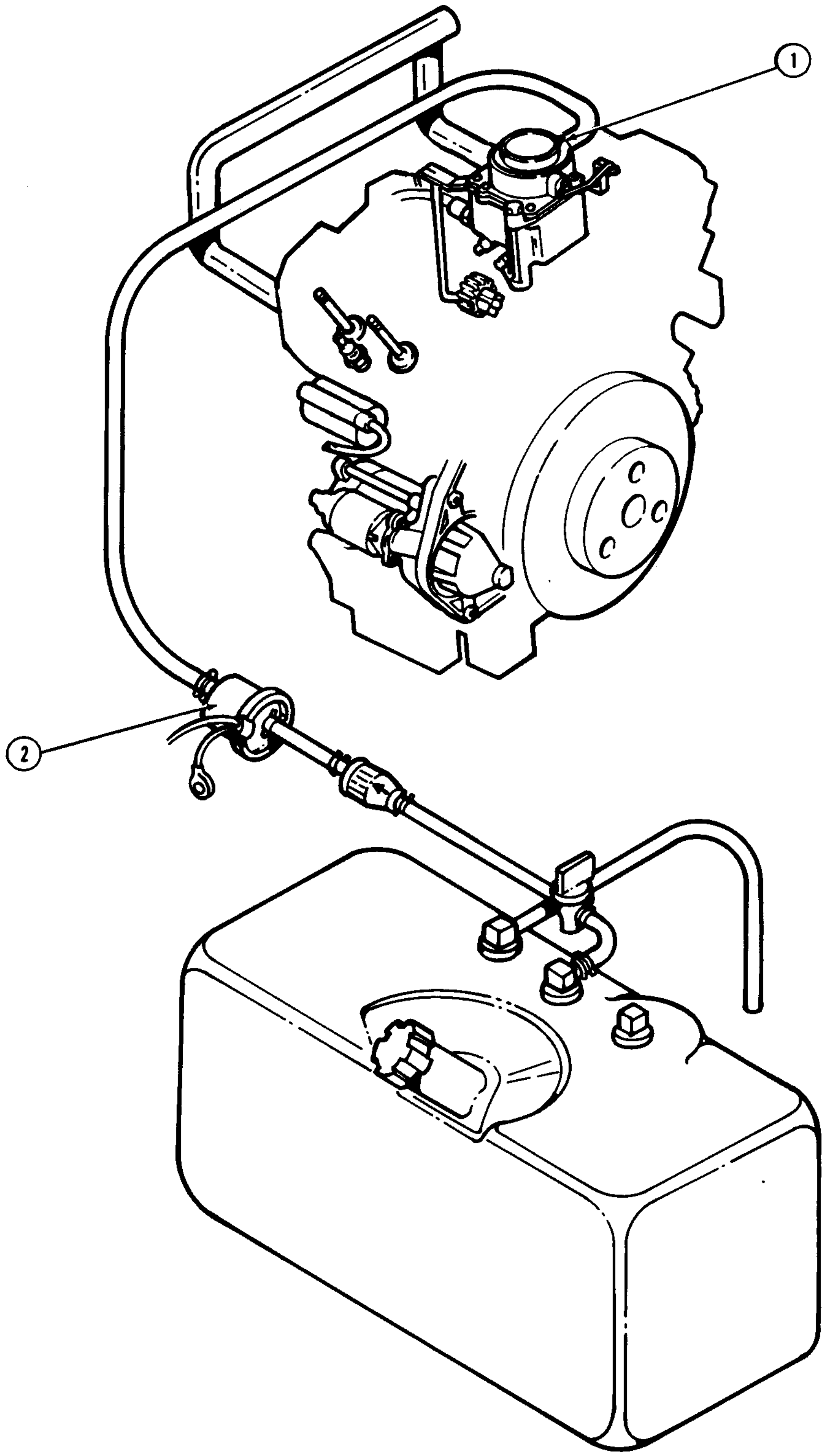
MX,22015HJ,A8 -19-14APR92

ENGINE FLOODING

Conditions:
•Transmission in neutral
•Park brake locked
•Key switch OFF

Test Location	Normal	If Not Normal
1. Carburetor	Choke plate fully open with knob in down position	Adjust choke. See Choke Adjustment.
	Smooth idle at 1500 rpm	Adjust idle mixture. See Carburetor Idle Mixture Screw Adjustment.
	Good fuel level and float not full of fuel	Adjust or replace float. See Section 30.
	Float inlet needle and seat not worn	Replace float and seat. See Section 30.
	No leaks	Repair or replace carburetor. See Section 30.
2. Fuel transfer pump	Constant pressure and volume with key switch ON and in START position, Minimum flow 207 mL (7 oz)/30 sec. Minimum pressure 14 kPa (0.14 bar) (2 psi)	See Fuel Transfer Pump Pressure and Flow Tests.

MX,22215HJ,A10 -19-14APR92



M46512

ENGINE FLOODING

Slide M46512

MX,22015HJ,A9 -19-14APR92

LACK OF FUEL IN CARBURETOR

Conditions:
•Transmission in neutral
•Park brake locked
•Key switch-as required

Test Location	Normal	If Not Normal
1. Fuel tank	Sufficient fuel level	Fill tank with correct fuel.
	Clean, good grade of fuel	Drain tank and refill with clean, good quality fuel.
2. Complete fuel system	No leaks	Repair leaks. See Section 30.
3. Fuel transfer pump supply line	Fuel present	Inspect filter, fuel lines, or fuel tank screen. See Section 30.
4. Fuel transfer pump	Constant pressure and volume with key switch ON and in START position Minimum flow 207 mL (7 oz)/30 sec. Minimum pressure 19.6 kPa (0.196 bar) (2.8 psi)	Check electrical circuits. See Section 240. See Fuel Transfer Pump Flow and Pressure Tests.
5. Fuel line-to-carburetor	No air bubbles	Insulate lines or try different fuel.
6. Fuel tank cap	No pressure or vacuum when removed from tanks	Clean vent line.
7. Carburetor	Inlet needle restricted or passages clogged	Clean carburetor. Adjust float. See Section 30.

MX,22015HJ,A10 -19-14APR92

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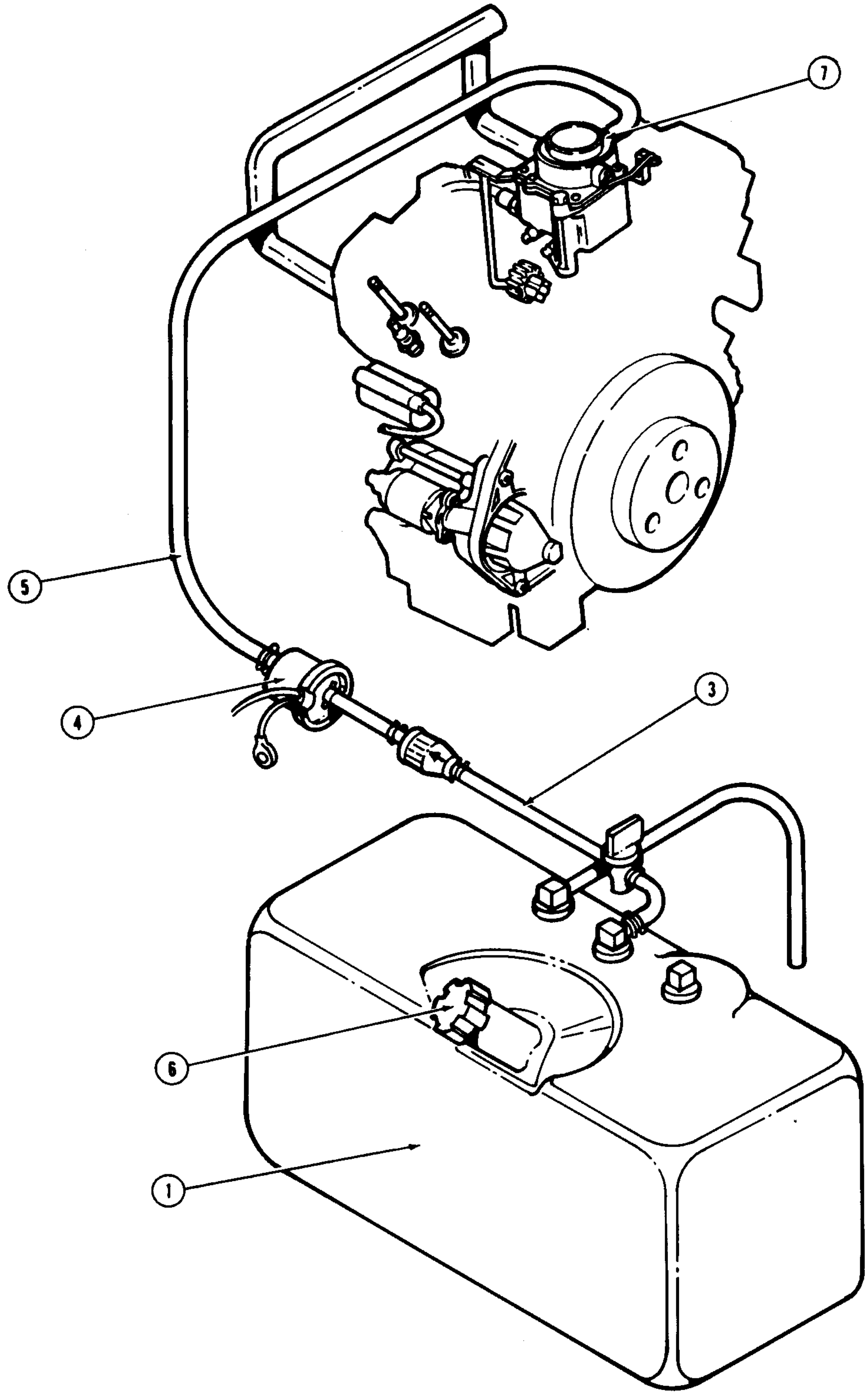


LACK OF FUEL IN CARBURETOR

Slide M46513

M46513 -UN-09MAR92

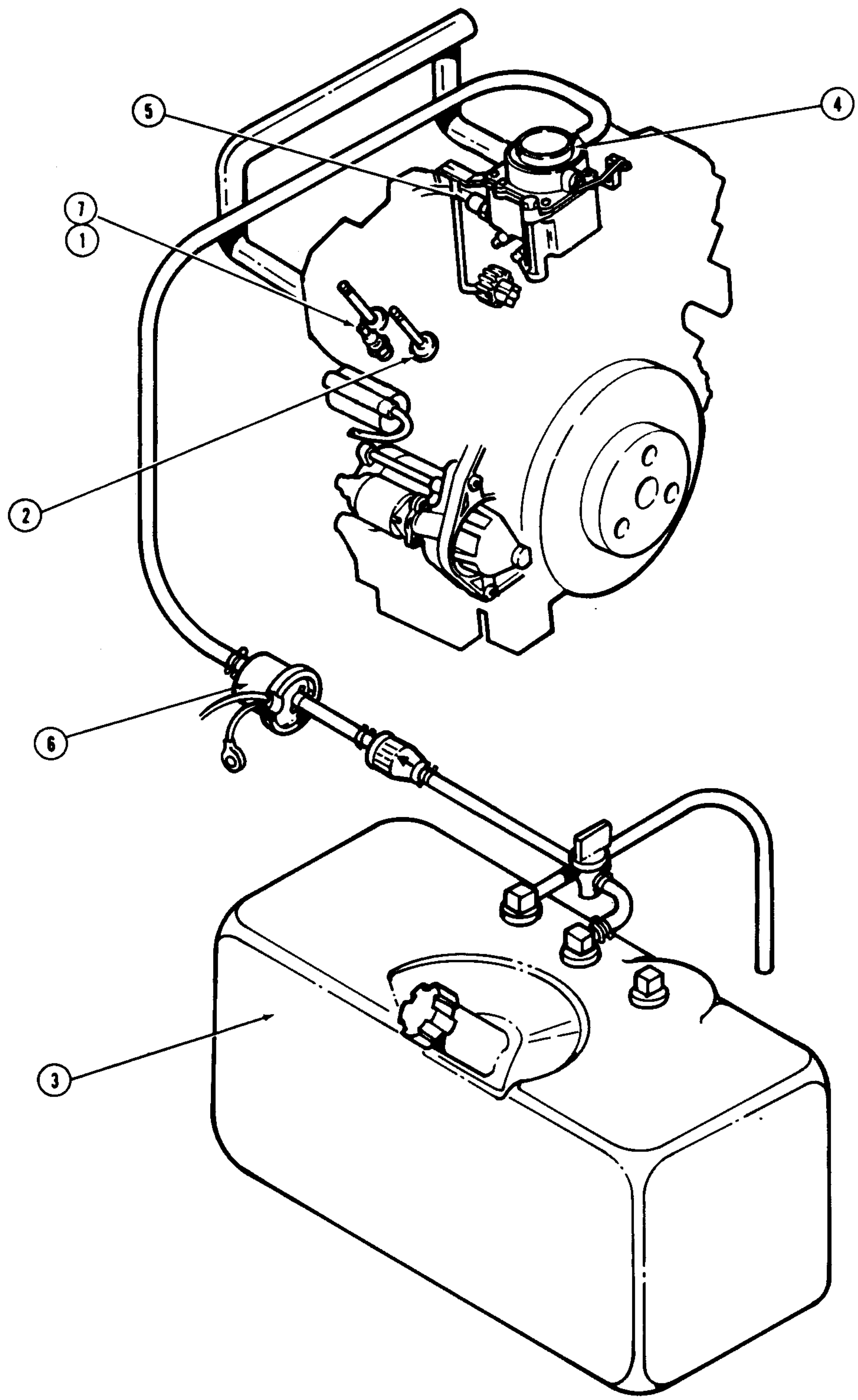
MX,22015HJ,A11 -19-14APR92

ENGINE STOPS WHEN HOT

Conditions:
- Transmission in neutral
- Park brake locked
- Key switch-as required

Test Location	Normal	If Not Normal
1. Spark plug ports	Cylinder compression of 1171 kPa (11.71 bar) (170 psi) minimum with a 97 kPa (0.96 bar) (14 psi) maximum difference between cylinders	Repair engine. See Section 20.
2. Valves	Cold engine valve clearance of 0.25 mm (0.010 in.)	Adjust—-See Valve Clearance Adjustment.
3. Fuel tank	Clean, good grade of fuel Tank is clean and vent open	Drain tank and refill with clean, good quality fuel.
4. Carburetor bowl	Full of fuel	See Lack of Fuel In Carburetor.
5. Fuel Shut-off Solenoid	"Clicking" sound with key ON and in START position	See Electrical Circuit Tests Section 240. Fuel Shut-off Solenoid Test
6. Fuel transfer pump	Constant pressure and volume with key switch ON and in START position Minimum flow 207 mL (7 oz)/30 sec. Minimum pressure 19.6 kPa (0.196 bar) (2.8 psi)	See Fuel Transfer Pump Pressure and Flow Tests.
7. Spark plugs	Plugs not fouled. Gap correct 0.64 mm (0.025 in.)	Spark plugs fouled. Replace.
8. Ignition system	Good spark at correct time	See Ignition System Checks. See Section 240.

MX,22015HJ,A12 -19-14APR92



-UN-09MAR92

M46514

M46514

ENGINE STOPS WHEN HOT

Slide M46514

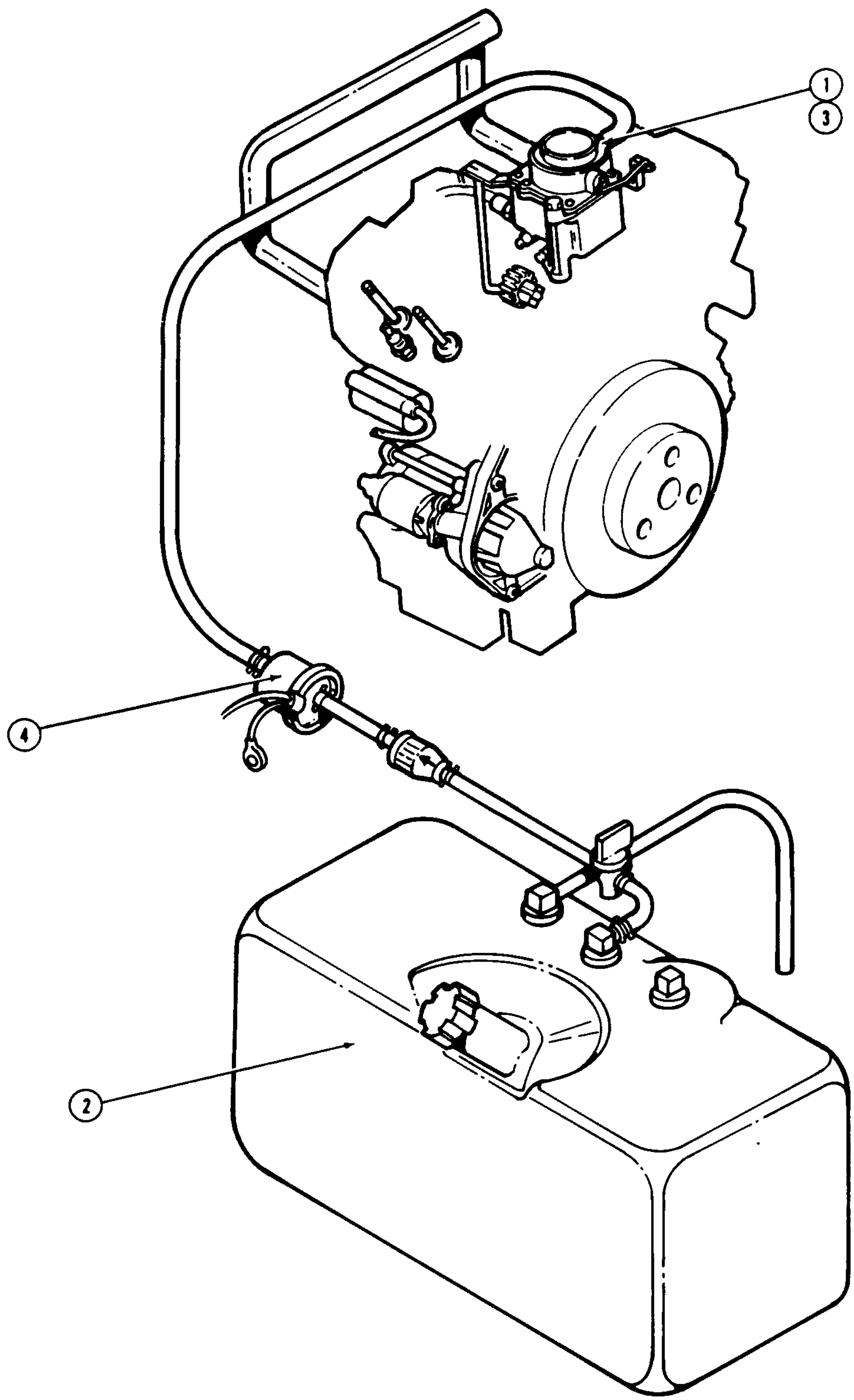
MX,22015HJ,A13 -19-14APR92

ENGINE EXHAUST SMOKES—BLACK OR GREY

Conditions:
•Transmission in neutral
•Park brake locked
•Key switch ON

Test Location	Normal	If Not Normal
1. Air cleaner	No restriction	Clean or replace air cleaner elements.
2. Fuel tank	Clean fresh fuel	Replace with correct fuel.
3. Carburetor	Choke plate fully open with knob in down position	Adjust choke. See Choke Adjustment.
	Float inlet needle and seat not worn	Replace float and seat. See Section 30.
	Float not full of fuel	Replace float. See Section 30.
	Correct main jet size for elevation	Replace main jet with correct size. See Section 30.
4. Fuel transfer pump	Constant pressure and volume with key switch ON and in START position Minimum flow 207 mL (7 oz)/30 sec. Minimum pressure 19.6 kPa (0.196 bar) (2.8 psi)	See Fuel Transfer Pump Pressure and Flow Tests.

MX,22015HJ,A14 -19-14APR92



M46515

ENGINE EXHAUST SMOKES-BLACK OR GRAY

Slide M46515

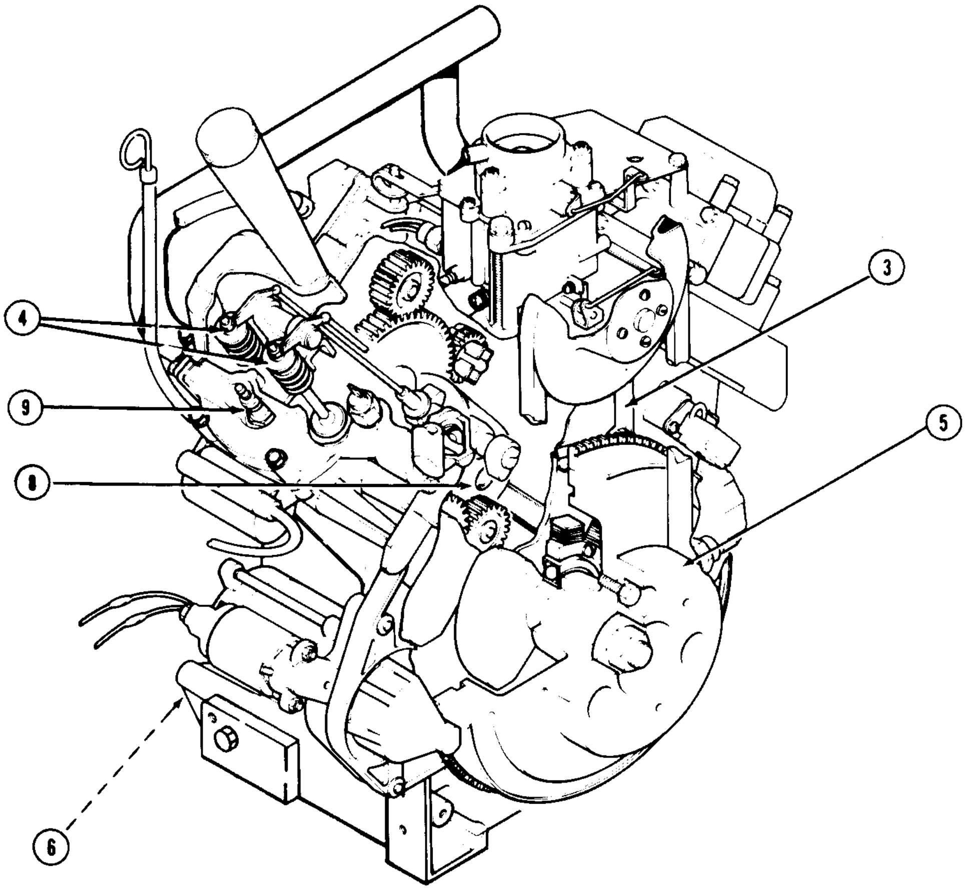
MX,22015HJ,A15 -19-14APR92

ENGINE SMOKES BLUE OR USES EXCESS OIL

Conditions:
•Transmission in neutral
•Speed control lever fast idle
•Key switch ON

Test Location	Normal	If Not Normal
1. Engine gaskets/seals	No external leaks	Replace. See Section 20.
2. Air cleaner (not shown)	No restriction	Clean or replace air cleaner elements.
3. Crankcase breather	Reed valve clean and not restricted	Clean or replace.
4. Valve guide and seals	Not worn or leaking	Repair or replace. See Section 20.
5. Oil pressure sender port	Oil pressure of 276 kPa (2.76 bar) (40 psi) minimum at fast idle	Inspect and clean regulating valve. Replace valve if necessary. See Section 20.
6. Oil	Correct viscosity	Drain and replace with correct viscosity. See Operators Manual.
7. Engine internal parts	Within wear limits. Rings not stuck	Repair or replace. See Section 20.
	Cylinder bore not worn or scored	Repair or replace. See Section 20.
8. Piston rings	Rings OK	Replace. See Section 20.
9. Spark plug ports	Cylinder compression of 1171 kPa (11.71 bar) (170 psi) minimum with a 97 kPa (0.96 bar) (14 psi) maximum difference between cylinders	Repair engine. See Section 20.
10. Cooling system (not shown)	Not running hot Run at normal temperature Thermostat operating	See Engine Coolant Operating Temperature incorrect.

MX,22015HJ,A16 -19-14APR92



M46539 **ENGINE SMOKES BLUE OR USES EXCESS OIL**

M46539 -UN-09MAR92

Slide M46539

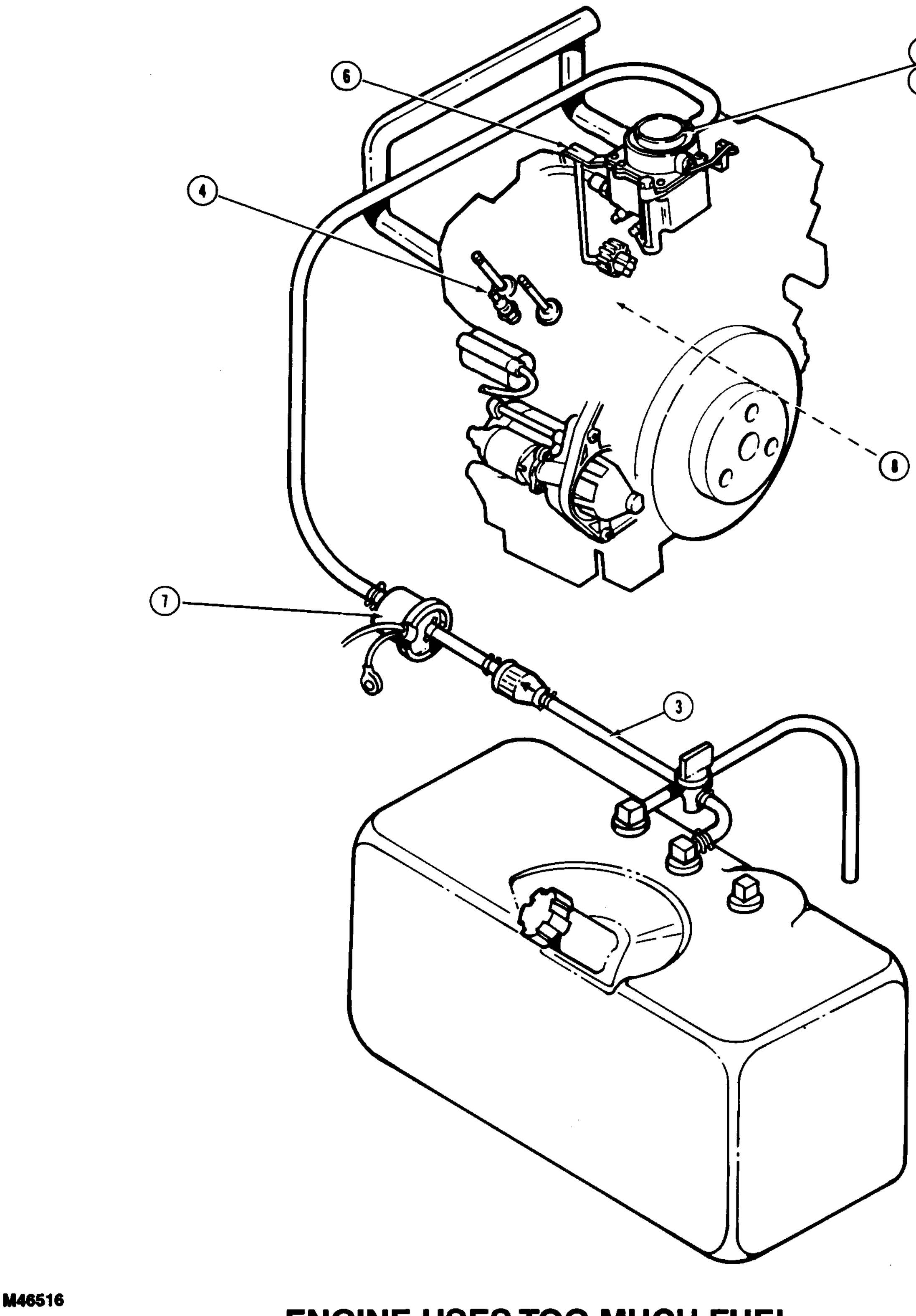
MX,22015HJ,A17 -19-14APR92

ENGINE USES TOO MUCH FUEL

Conditions:
•Transmission in neutral
•Park brake locked
•Key switch—as required

Test Location	Normal	If Not Normal
1. Brakes (not shown)	Not dragging	Adjust brakes. (See Section 260, Group 15.)
2. Air cleaner	No restriction	Clean or replace air cleaner elements. See Operators Manual.
3. Complete fuel system	No leaks	Repair leaks. See Section 30.
4. Spark plugs	Plugs not fouled. Gap correct 0.64 mm (0.025 in.)	Gap or replace plugs.
5. Carburetor	Proper throttle lever and cable operation	Adjust throttle lever and cable. See Throttle Cable and Lever Adjustments.
	Choke plate fully open with knob in down position	Adjust choke. See Choke Adjustment.
	Smooth idle at 1450 rpm	Adjust idle mixture. See Carburetor Idle Mixture Screw Adjustment.
	Slow idle speed 1500—1600 rpm	Adjust. See Slow Idle Adjustment.
	Fast idle speed 3600 ± 50 rpm	Adjust. See Fast Idle Adjustment.
	Float inlet needle and seat not worn	Replace float and seat. See Section 30.
	Float adjustment correct	Adjust or replace. See Section 30.
	Correct main jet size for elevation	Replace main jet with correct size. See Section 30.
6. Governor Linkage	Governor adjusted	Adjust. See Governor Adjustment.
7. Fuel transfer pump	Constant pressure and volume with key switch ON and in START position. Minimum flow 207 mL (7 oz) /30 sec. Minimum pressure 19.6 kPa (0.196 bar) (2.8 psi)	See Fuel Transfer Pump Flow and Pressure Tests.
8. Engine internal parts	Within wear limits	Repair or replace parts. See Section 20.
9. Hydraulic system	Hydraulic load is normal	See Section 270, Group 15.

MX,22015HJ,A17A-19-14APR92



ENGINE USES TOO MUCH FUEL

Slide M46516

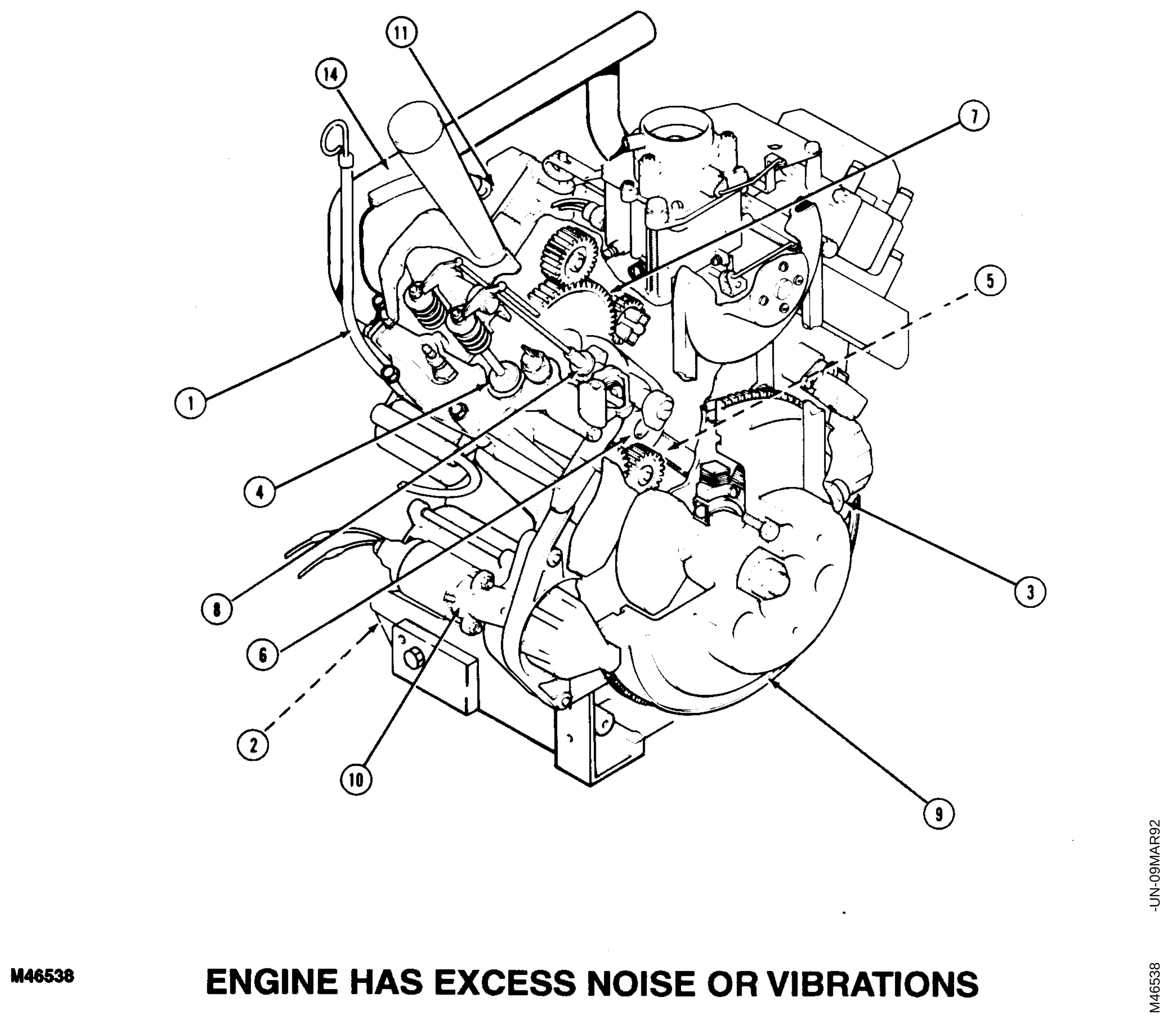
MX,22015HJ,A17B-19-14APR92

ENGINE HAS EXCESS NOISE OR VIBRATIONS

Conditions:
•Transmission in neutral
•Park brake locked
•Key switch OFF

Test Location	Normal	If Not Normal
1. Dipstick tube	Crankcase oil level is between marks on dipstick	Add to correct level with correct viscosity. See Operators Manual.
2. Oil	Correct viscosity Oil	See Oil in Coolant or Coolant in Oil. Drain and replace with correct viscosity. See Operators Manual.
3. Oil pressure sender port	Oil pressure of 276 kPa (2.76 bar) (40 psi) minimum at fast idle More than 14 psi at Low Idle	Inspect and clean regulating valve. Replace valve if necessary. See Section 20. Check engine clearance.
4. Valves	Cold engine valve clearance of 0.25 mm (0.010 in.)	Adjust valves. See Valve Clearance Adjustment.
5. Bearings	Clearance within specifications See Section 20	Repair. See Section 20.
6. Pistons	Piston rings OK	Replace. See Section 20.
7. Timing gears	Meshing correctly	Replace. See Section 20.
8. Tappets	No noise	Adjust valves. See Valve Clearance Adjustment. Check camshaft for wear.
9. Flywheel	Not loose	Check flywheel nut torque. See Section 20.
10. Starter	Not contacting flywheel	Tighten mounting cap screws. Repair starter. See Section 40.
11. Coolant pump	No vibration No noise	Inspect. Replace if necessary. See Section 20.
12. Drive shaft (not shown)	No vibration Couplers, U-joints and connections tight PTO Clutch, tight or binding	Inspect. Repair or replace parts if necessary. See Section 50.
13. All Hardware	Tight	Tighten.
14. Muffler	Mounting hardware tight Not restricted	Tighten mounting hardware. Replace if necessary.

MX,22015HJ,A18 -19-14APR92



Slide M46538

MX,22015HJ,A19 -19-14APR92

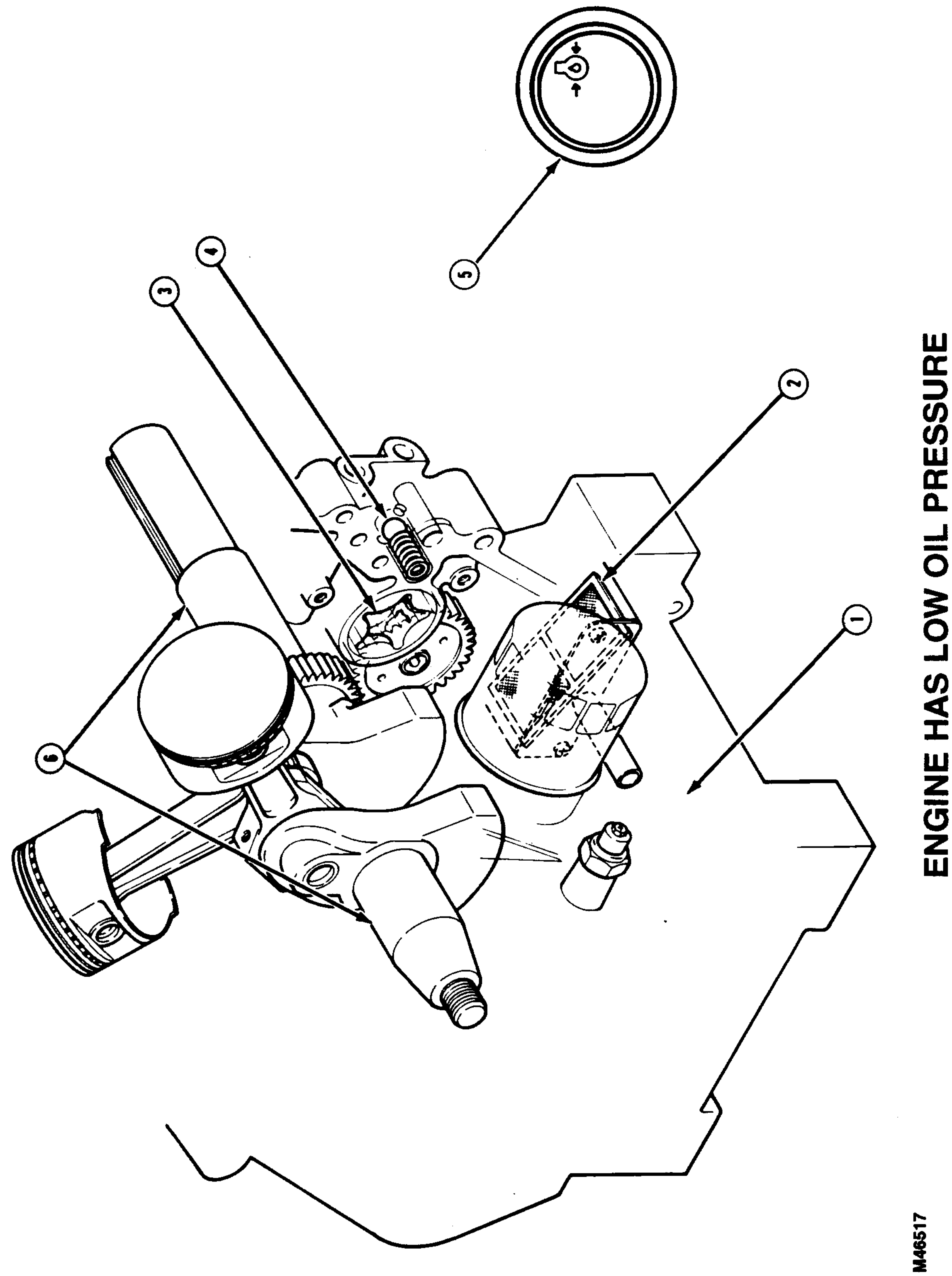
ENGINE HAS LOW OIL PRESSURE

Conditions:
•Transmission in neutral
•Speed control lever fast idle
•Key switch ON

Test Location	Normal	If Not Normal
1. Crankcase	Crankcase oil level is between marks on dipstick Correct viscosity for ambient temperature	Add to correct level with correct viscosity. See Operators Manual.
2. Oil pump intake screen	Screen clean/no damage	Clean or replace. See Section 20.
3. Oil pump	Clearance within specifications See Section 20.	Replace parts worn excessively. See Section 20.
4. Oil pressure regulating valve	Valve free in bore. Spring within specifications. See Section 20	Inspect and clean valve. Replace as necessary. See Section 20. Check block for cracks.
5. Oil pressure indicator	Light on at less than 96 kPa (0.96 bar) (14 psi) at low idle Light off above 96 kPa (0.96 bar) (14 psi)	See Section 240. Replace Oil Pressure sensor.
6. Bearings	Clearance within specifications See Section 20	Repair. See Section 20.

Slide M46517

MX,22015HJ,A20 -19-14APR92



M46517 -UN-09MAR92

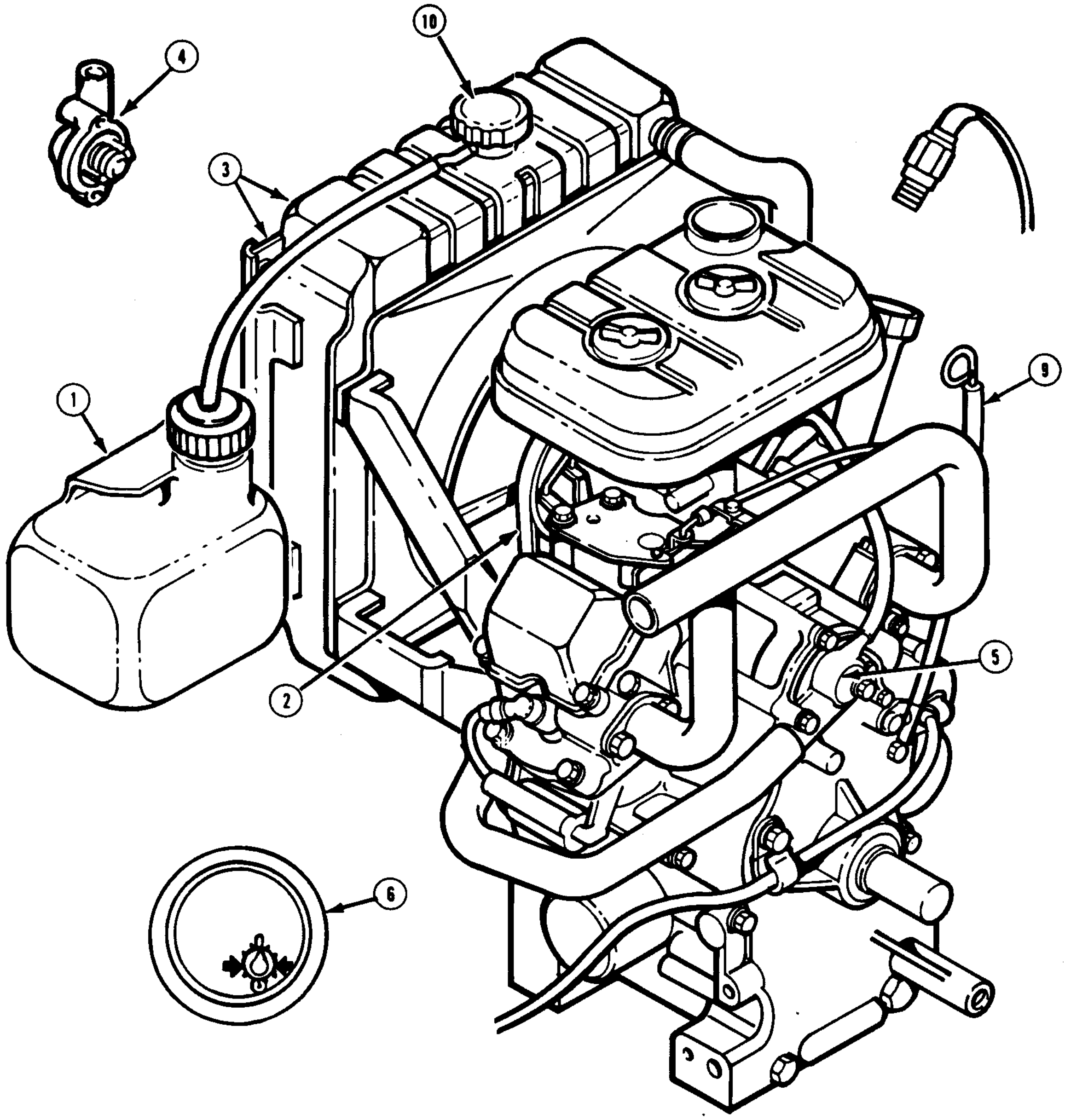
MX,22015HJ,A20A-19-14APR92

ENGINE COOLANT OPERATING TEMPERATURE INCORRECT

Conditions:
•Transmission in neutral
•Speed control lever fast idle
•Key switch ON

Test Location	Normal	If Not Normal
1. Coolant recovery tank	Coolant level 25—51 mm (1—2 in.) in recovery tank	Fill to correct level with correct coolant mix. See Operator's Manual.
2. Fan drive belt	12—19 mm (0.472—0.748 in.) deflection with 245—391 N (55—88 lb force) applied between fan and outer sheave half	Adjust or replace. See Section 20.
3. Radiator/Screen	Free of dirt/trash	Clean.
4. Thermostat	Starts to open at 63—66°C (145—150°F) full open 80°C (176°F)	Replace.
5. Coolant pump	Clearance within specifications No "play" in bearing/no leaks Drive gears in good condition	Replace or repair. See Section 20.
6. Coolant temperature Indicator	Indicator lamp not illuminated Light on at 111°C (232°F)	Test circuit. See Section 240.
7. Pistons (not shown)	No scoring	Replace. See Section 20.
8. Load applied (not shown)	Within horsepower available Hydraulic system neutralized	Reduce load. Check hydraulic system. See Section 270.
9. Dipstick tube	Crankcase oil level is between marks on dipstick	Add to correct level with correct viscosity. See Operator's Manual.
10. Radiator cap	Operating within range Not leaking Minimum pressure 90 kPa (0.90 bar)(13 psi)	Replace cap.

MX,22015HJ,A21 -19-14APR92



-UN-09MAR92

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M46508

M46508 ENGINE COOLANT OPERATING TEMPERATURE INCORRECT

Slide M46508

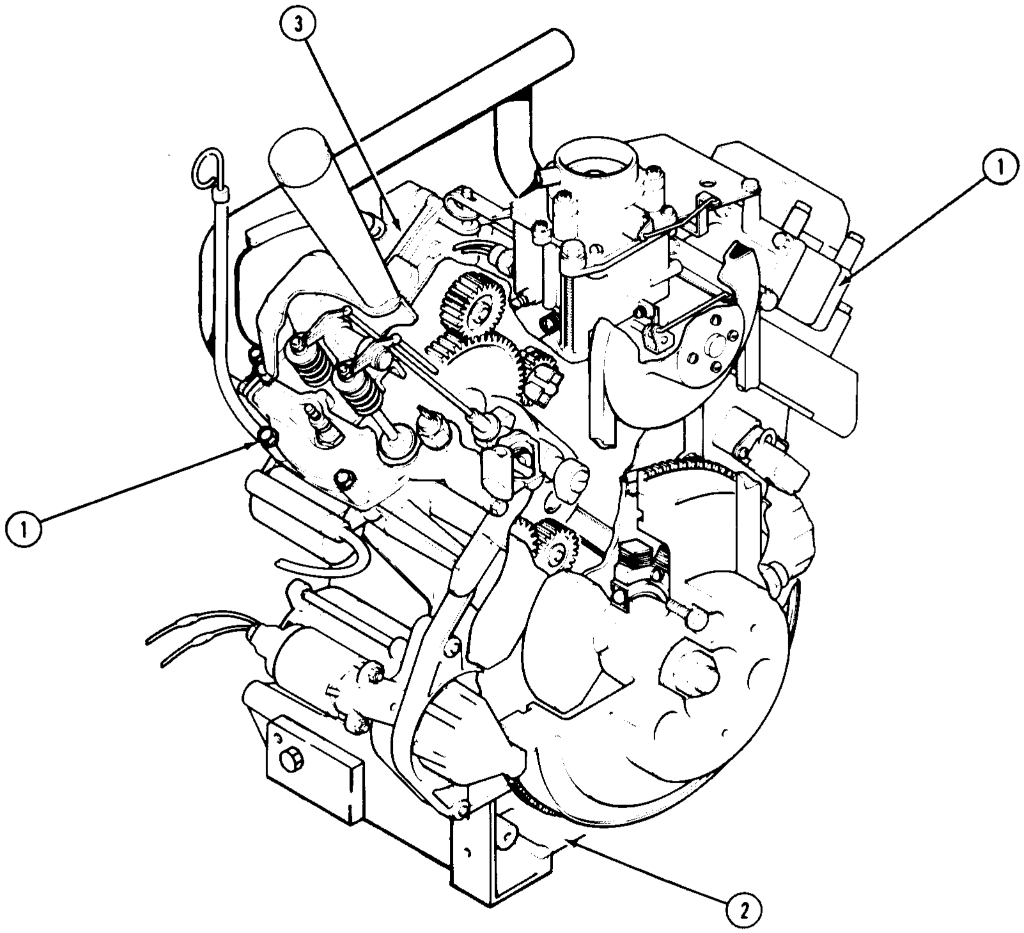
MX,22015HJ,A22 -19-14APR92

OIL IN COOLANT OR COOLANT IN OIL

Conditions:
•Transmission in neutral
•Speed control lever fast idle
•Key switch ON

Test Location	Normal	If Not Normal
1. Head gaskets	Complete seal	Replace—Check heads and block for flatness. See Section 20.
2. Block/Heads	No cracks	Replace. See Section 20.
3. Coolant pump	Drain hole not plugged. Coolant pump seats not leaking	Check coolant pump drain passage for plugging. Repair or replace coolant pump. (See Section 20.)

MX,22015HJ,A23 -19-14APR92



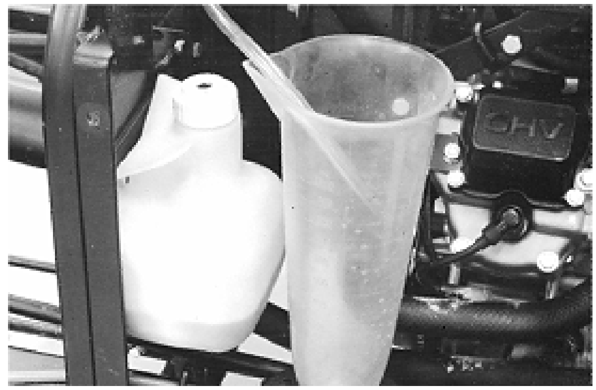
M46542 **OIL IN COOLANT OR COOLANT IN OIL**

M46542 -UN-09MAR92

Slide M46542

MX,22015HJ,A24 -19-14APR92

RADIATOR BUBBLE TEST



Reason:
To determine if compression pressure is leaking past head gaskets.

Procedure:
1. With coolant at proper level and radiator cap tight, start and run engine to bring it to operating temperature.

2. Disconnect overflow hose from coolant recovery tank.

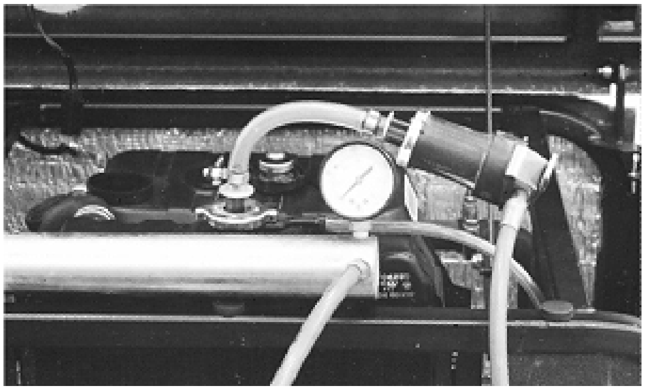
3. Put end of hose in a container of water.

4. Check for bubbles coming from hose.

Results:
•If bubbles are present, replace head gaskets. (See CTM 39)

MX,22015HJ,A25 -19-14APR92

COOLING SYSTEM TEST



Slide M46526

Reason:
Inspect cooling system for leaks.

Equipment:
•D05104ST Cooling System Pressure Pump
•JDG692 Adaptor

Connections:
1. Remove cap and attach Pressure Pump to radiator.

Procedure:
1. Apply 117 kPa (1.17 bar) (17 psi) maximum pressure.

2. Check for leaks.

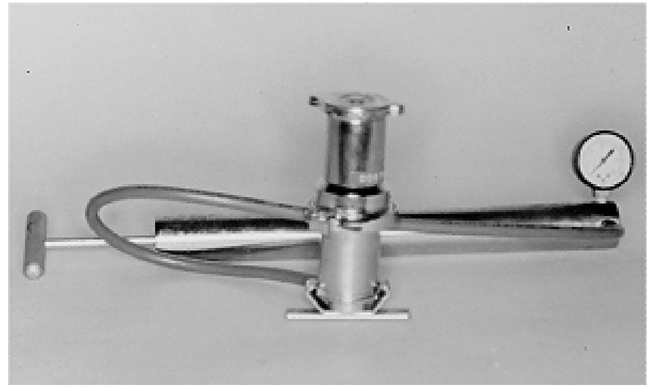
Specifications:
•Minimum pressure after 15 seconds .. 90 kPa (0.90 bar) (13 psi)

Results:
•Pressure should hold to specifications. If pressure decreases, check for leaks. Repair leaks or replace parts as necessary. (See Section 20.)

•If pressure test still indicates leakage and all external leaks have been stopped, a defective head gasket or cracked block may be the cause. (See CTM 39.)

MX,22015HJ,A26 -19-14APR92

RADIATOR CAP PRESSURE TEST



Slide M54060

Reason:
Test radiator cap for operating in correct pressure range.

Equipment:
•D05104ST Cooling System Pressure Pump
•JDG692 Adaptor

Connections:
1. Install radiator cap on Pressure Pump.

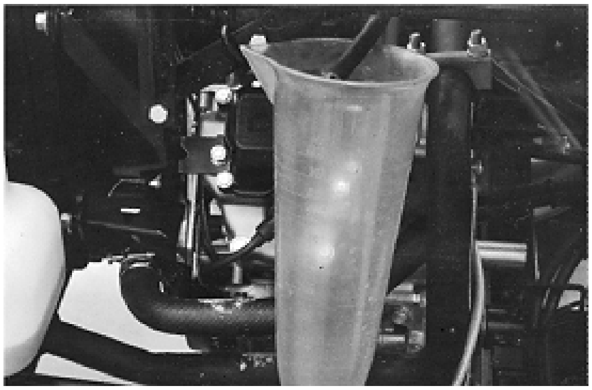
Procedure:
1. Apply pressure and observe when cap relieves.

Specifications:
•Opening pressure .. 97—104 kPa (0.97—1.04 bar) (14—15 psi)
•Minimum pressure .. 90 kPa (0.90 bar) (13 psi)

Results:
•If cap leaks, retighten and test again. Replace cap if pressure is not according to specifications.

MX,22015HJ,A27 -19-14APR92

FUEL TRANSFER PUMP FLOW TEST



Slide M46528

Reason:
To determine proper fuel flow and pressure from transfer pump.

Equipment:
•Graduated container

Connections:
1. Disconnect fuel supply hose from carburetor and put end in a graduated container.

Procedure:
1. Turn key switch ON for 30 seconds. DO NOT start engine.

Specifications:
•Minimum fuel flow .. 207 mL (7 oz)/30 seconds

Results:
•If fuel flow is below minimum, replace filter then test again.

•If fuel flow is still below minimum, replace transfer pump. (See Section 30.)

MX,22015HJ,A28 -19-14APR92

FUEL TRANSFER PUMP PRESSURE TEST

Reason:
To determine proper transfer pump pressure.

Equipment:
•JDG356 Fuel Pump Pressure Test Kit

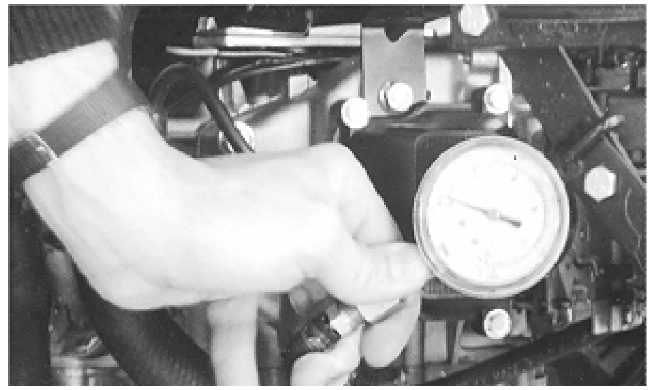
Connections:
1.Disconnect fuel supply hose from carburetor and connect to gauge from Test Kit.

Procedure:
1. Turn key switch ON. DO NOT start engine. Observe pressure reading.

Specifications:
•Minimum fuel pressure .. 19.6 kPa (0.196 bar) (2.8 psi)

Results:
•If pressure is below minimum, replace filter then test again.

•If pressure is still below minimum, replace transfer pump. (See Section 30.)



M46527 -UN-27MAR92

Slide M46527

MX,22015HJ,A29 -19-14APR92

ENGINE OIL PRESSURE TEST

Reason:
To determine if bearings or lubrication system components are worn.

Equipment:
•JDG465 Special Socket
•JT05577 Pressure Gauge Assembly
•JT03017 Hose Assembly
•JT03349 Connector

NOTE: Engine should be at normal operating temperature.

Connections:
1. Remove oil pressure sender (JDG465 Socket may be used).

NOTE: Thread is 1/8“ BSP, use JT03349 Connector, hose and 0—700 kPa (0—6.9 bar) (0—100 psi) gauge.

2. Install JT03349 Connector.

3. Connect JT05577 Pressure Gauge Assembly and JT03017 Hose Assembly.

Procedure:
1. Start engine. If pressure reading is below 69 kPa (0.68 bar) (10 psi), STOP ENGINE and determine cause.

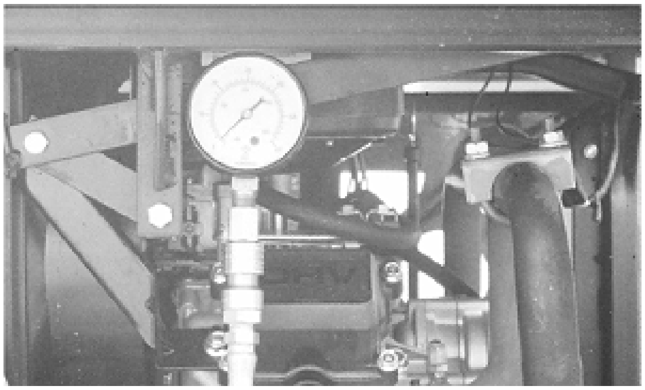
IMPORTANT: Do not run engine without oil pressure.

2. Run engine approximately 5 minutes to heat oil. Run at fast idle and check oil pressure.

Specifications:
•Minimum Engine Oil Pressure .. 276 kPa (2.76 bar) (40 psi)

Results:
•If oil pressure is not within specifications, inspect oil pressure relief valve for broken or worn spring, stuck or damaged valve. (See CTM 39.)

•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. (See CTM 39.)



M46529 -UN-27MAR92

Slide M46529

MX,22015HJ,A30 -19-14APR92

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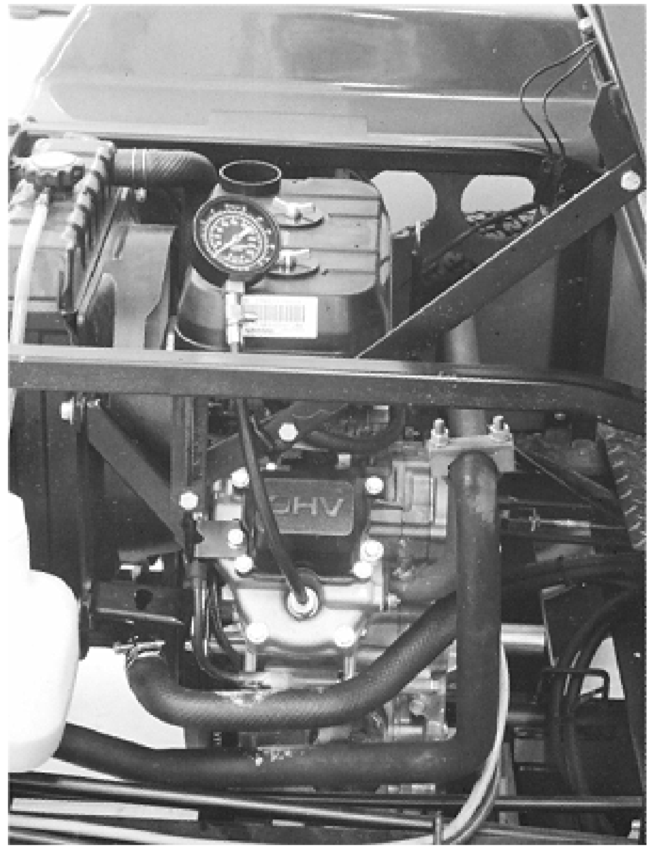
CYLINDER COMPRESSION PRESSURE TEST



M46530 -UN-27MAR92

Slide M46530

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

Equipment:
•JDM59 Compression Gauge

Connections:
1. Remove spark plugs.

2. Install JDM59 Compression Gauge.

NOTE: Engine should be at normal operating temperature.

Procedure:
1. Disconnect wiring connector (A) from positive terminal of both coils.

2. Move throttle lever to fast idle position. Push choke knob down.

IMPORTANT: DO NOT overheat starting motor during test. Starter Duty Cycle is 5 sec. ON, 10 sec. OFF.

3. Crank engine for three to five compression strokes.

4. Record pressure reading for each cylinder.

Specifications:
•Minimum compression .. 1171 kPa (11.71 bar) (170 psi)
•Maximum difference between cylinders .. 97 kPa (0.96 bar) (14 psi)

Results:
•If pressure reading is below specification, squirt clean engine oil into cylinders through spark plug ports and repeat test.

•If pressure increases significantly, check piston, rings, and cylinder walls for wear or damage. (See Section 20.)

•If pressure does not increase significantly after retest, check for leaking valves, valve seats or cylinder head gaskets. (See Section 20.)

MX,22015HJ,A31 -19-14APR92

IGNITION SPARK TEST

Reason:
To determine the condition of the ignition system and spark plugs.

Equipment:
•Jumper Wire

Procedure:

NOTE: Perform this test for both spark plugs.

1. Remove spark plug from cylinder to be tested.

2. Connect coil wiring lead to spark plug.

CAUTION: Position spark plug away from spark plug port. Spark could ignite fuel mixture in cylinder during test.

3. Connect a jumper wirer from spark plug to engine ground or ground plug to engine.

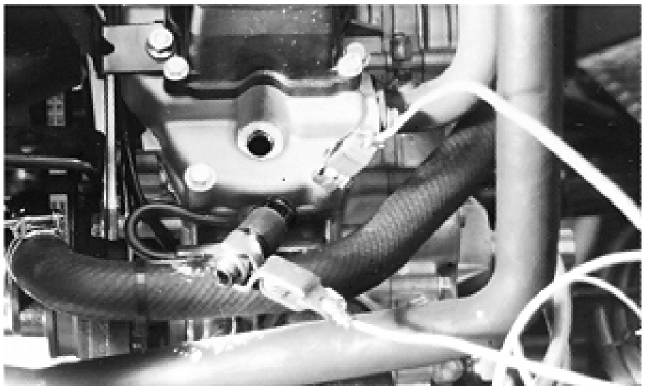
4. Disconnect positive (+) wire (A) from coil of cylinder not being tested.

IMPORTANT: DO NOT overheat starting motor during test. Starter Duty Cycle is 5 sec. ON, 10 sec. OFF.

5. Crank engine. Check for spark.

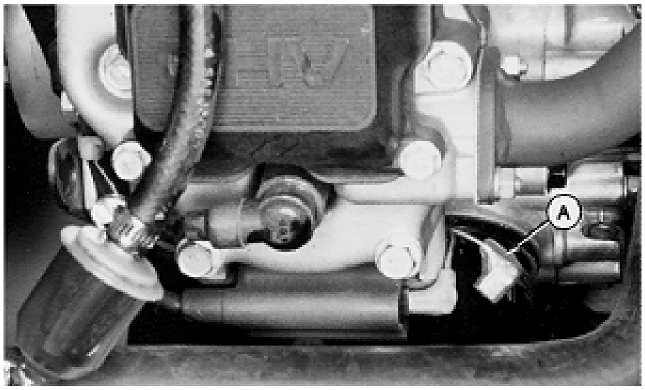
Results:
•If spark is "blue" hot, clean and regap plugs. (See procedure in Operator's Manual.)

•If no spark appears or is "yellow" or weak, test ignition components. (See Section 240.)



M46531 -UN-27MAR92

Slide M46531



M52480 -UN-09OCT90

Slide M52480

MX,22015HJ,A33 -19-14APR92

THROTTLE LEVER ADJUSTMENT

Reason:
To achieve smooth throttle lever movement with a slight drag.

Connections:
1. Connect a scale near the end of the throttle lever.

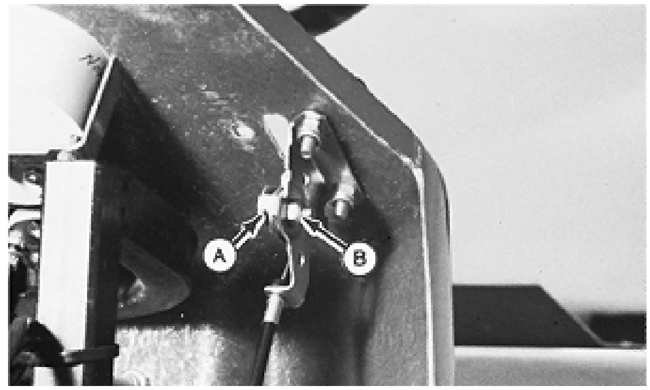
Procedure: 1. Remove front cowling.

2. Adjust friction disks (A) by tightening or loosening lock nut (B) until throttle lever movement meets specifications.

NOTE: Make sure throttle cable is not binding or stuck.

3. Install front cowling.

Specifications:
•Throttle lever movement .. 35—53 N (8—12 lb force)



Slide M46576

MX,22015HJ,A34 -19-14APR92

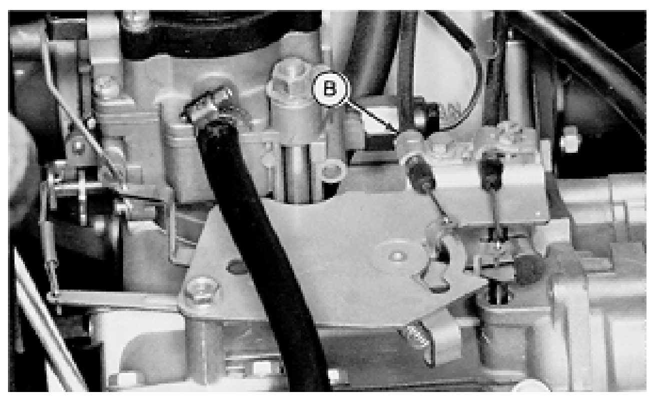
THROTTLE CABLE ADJUSTMENT

Reason:
To obtain correct governor linkage position.

Procedure:
1. Move throttle lever on instrument panel to within 2—3 mm (0.080—0.120 in.) from fast idle end of slot (A).

2. Loosen throttle cable clamp (B).

3. Pull throttle cable to hold governor linkage in maximum position. Tighten cable clamp (B).



Slide M54301

MX,22015HJ,A35 -19-14APR92

CHOKE ADJUSTMENT

Reason:
To obtain correct choke plate position.

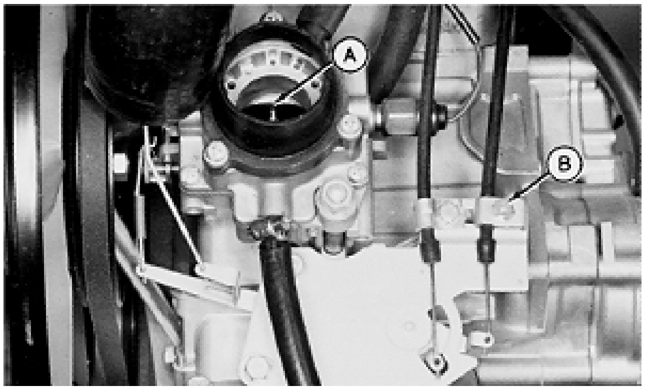
Procedure:
1. Adjust throttle cable. (See procedure in this group.)

2. Remove air intake cover from carburetor.

3. Loosen choke cable clamp (B). Push choke control knob in. Hold choke plate (A) straight up in carburetor and tighten cable clamp (B).

4. Pull choke control knob out. Choke plate must close.

5. Install air intake cover.



Slide M54302

MX,22015HJ,A36 -19-14APR92

CARBURETOR IDLE MIXTURE SCREW ADJUSTMENT

Reason:
To obtain correct fuel/air mixture at idle speed.

Procedure:

IMPORTANT: Do not turn idle mixture screw tight. Tightening screw will damage the needle and seat.

1. Turn idle mixture screw (B) clockwise until lightly seated. Then turn counterclockwise 1-3/8 turns.

2. Lock park brake. Run engine for 10 minutes.

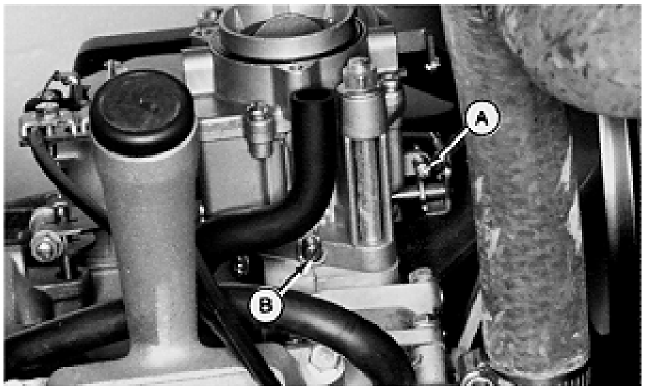
3. Move throttle lever to slow idle position.

N **CAUTION: Engine will be HOT. Be careful not to burn hands.**

4. Hold throttle lever against low speed stop (A).

5. Turn idle mixture screw (B) in until engine speed drops, then out until engine speed increases and begins to drop again.

6. Adjust idle mixture screw for highest engine speed between drops, then turn screw out an additional 1/4 turn.



Slide M54303

MX,22015HJ,A37 -19-14APR92

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GOVERNOR ADJUSTMENT

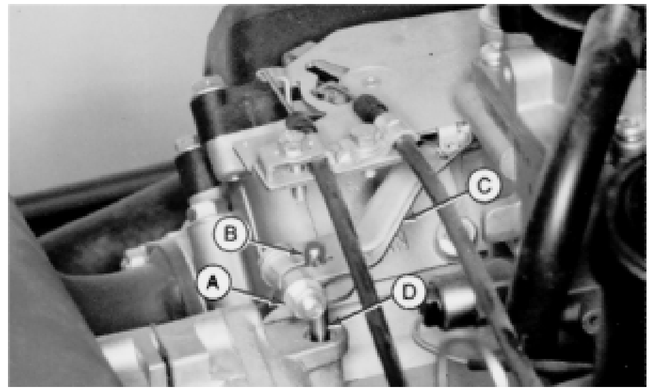
Reason:
To correctly position governor arm against flyweight assembly for proper governor response.

Procedure:
1. Loosen nut (A).

2. Turn governor arm (C) counterclockwise and hold.

3. Turn governor shaft (D) full counterclockwise using a small shaft through hole (B).

4. Tighten nut.



M54304 -UN-09OCT90

Slide M54304

A—Nut
B—Hole
C—Governor Arm
D—Governor Shaft

MX,22015HJ,A38 -19-14APR92

SLOW IDLE ADJUSTMENT

Reason:
To achieve a smooth running engine at slow idle.

Procedure:
1. Adjust carburetor idle mixture screw. (See procedure in this group.)

2. Lock park brake. Start engine and run for 10 minutes.

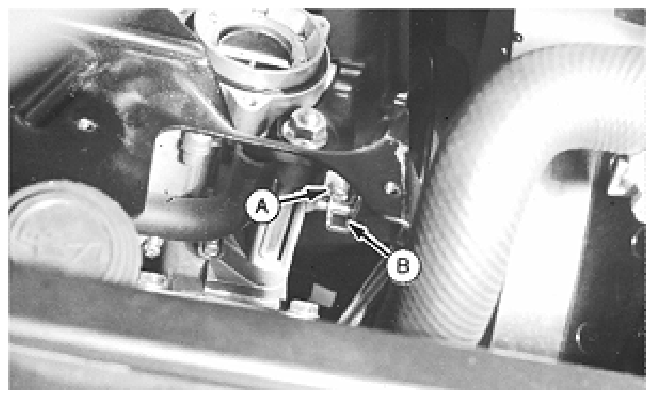
3. Move throttle lever to slow idle position.

4. Hold throttle lever (B) against screw (A). Check slow idle speed.

5. After idle speed adjustment, adjust throttle cable. (See procedure in this group.)

Specifications:
•Slow Idle Speed .. 1500—1600 rpm

Results:
•If slow idle rpm is not according to specifications, turn screw (A) to adjust.



M46534 -UN-14APR92

MX,22015HJ,A39 -19-14APR92

FAST IDLE ADJUSTMENT

Reason:
To check and adjust the fast idle or operating range of the engine.

Procedure:
1. Adjust carburetor idle mixture screw. (See procedure in this group.)

2. Lock park brake. Start engine and run for 10 minutes.

3. Move throttle lever to fast idle position.

4. Loosen cap screws (A).

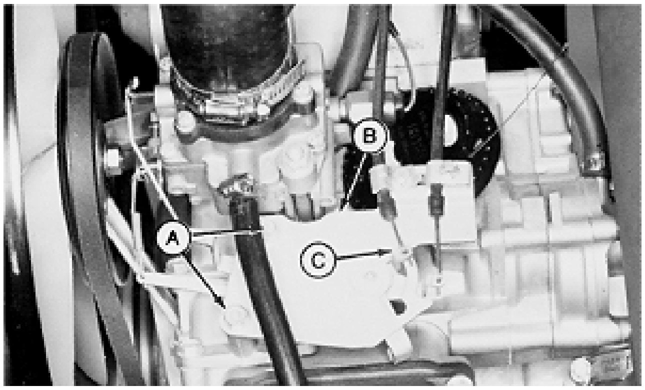
5. Turn control lever (C) counterclockwise until it touches the control plate (B).

6. Move control plate left or right until the tachometer reads the correct rpm specification.

8. Tighten cap screws.

9. Adjust choke. (See procedure in this group.)

Specifications:
•Fast Idle Speed .. 3600 ± 50 rpm



M54306 -UN-09OCT90

Slide M54306

MX,22015HJ,A40 -19-14APR92

VALVE CLEARANCE ADJUSTMENT

Reason:
Check and adjust valve clearance for proper engine operation.

Procedure:

NOTE: Valve clearance adjustment is made with engine cold.

Check valve clearance for each cylinder separately.

No. 1 cylinder is the right-hand cylinder viewed from the flywheel.

1. Remove spark plugs.

2. Remove valve covers.

NOTE: As the flywheel rotates on the compression stroke, air will be forced out of the spark plug opening. Use a light to see down the spark plug opening and stop turning the flywheel when the piston is at the top of its stroke. Notice that both valves are fully closed.

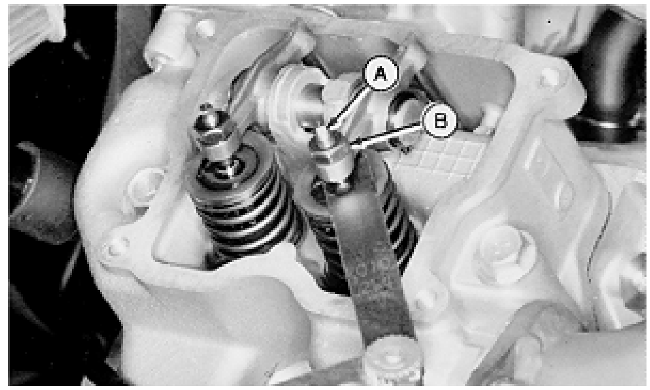
3. From rear of machine, turn crankshaft counterclockwise until No. 1 piston is at highest point in compression stroke.

4. Measure valve clearance. See specifications.

5. Repeat procedure for No. 2 cylinder.

Specifications:
•Valve Clearance .. 0.25 mm (0.010 in.)
•Nut Torque .. 9 N·m (79 lb-in.)
•Spark Plug Torque .. 25 N·m (221 lb-in.)

Results:
•To adjust valve clearance, loosen nut (B) and turn screw (A) to correct clearance. Hold screw while tightening nut to specifications.



M54307 -UN-25SEP90

Slide M54307

MX,22015HJ,A41 -19-14APR92

COOLING FAN DRIVE BELT ADJUSTMENT

Reason:
To keep proper tension on belt to drive cooling fan.

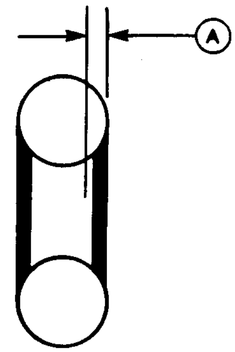
Equipment:
•JDST28 Belt Tension Gauge

Procedure:
1. Use JDST28 Belt Tension Gauge to check belt deflection (A) between fan and drive sheave. See specifications.

Specifications:
•Applied force .. 245—391 N (55—88 lb force)
•Deflection (A) .. 12—19 mm (0.472—0.748 in.

Results:
•If deflection is not within specifications, remove outer sheave and add or remove shims as necessary.

M54337



M54337 -19-25OCT90

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Section 230
FUEL 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
•Carburetor
•Air Intake System

Use the drawings when diagnosing a fuel/air problem and to help locate the components to be tested.

MX,23205HJ,A1 -19-14APR92

FUEL SYSTEM COMPONENTS

A—Governor
B—Carburetor
C—In-Line Fuel Filter
D—Supply Line
E—Fuel Transfer Pump
F—Suction Line
G—Fuel Tank

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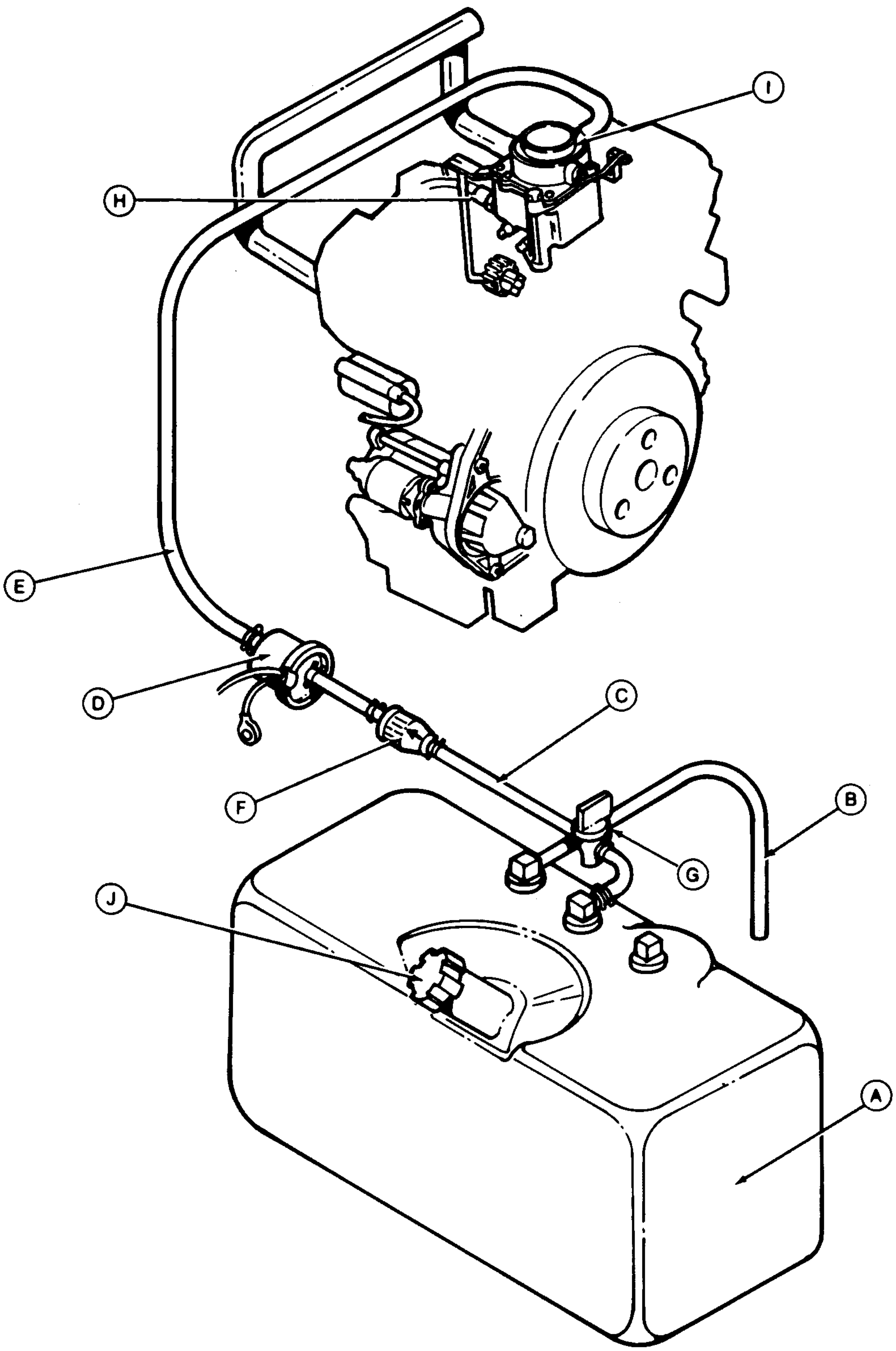
MX,23005HJ,A1 -19-14APR92



M46521 **FUEL SYSTEM COMPONENT LOCATION**

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MX,23005HJ,A2 -19-14APR92

CARBURETOR COMPONENTS

A—Choke Valve
B—Air Intake
C—Choke Shaft Assembly
D—Needle Valve
E—Gasket
F—Float
G—Main Jet High Altitude Kit
H—Slow Idle Jet
I—Carburetor Body
J—Throttle Shaft Assembly
K—Spring
L—Throttle Valve
M—Idle Speed Screw
N—Spring
O—Idle Mixture Screw
P—Drain Screw
Q—Spring
R—Main Jet

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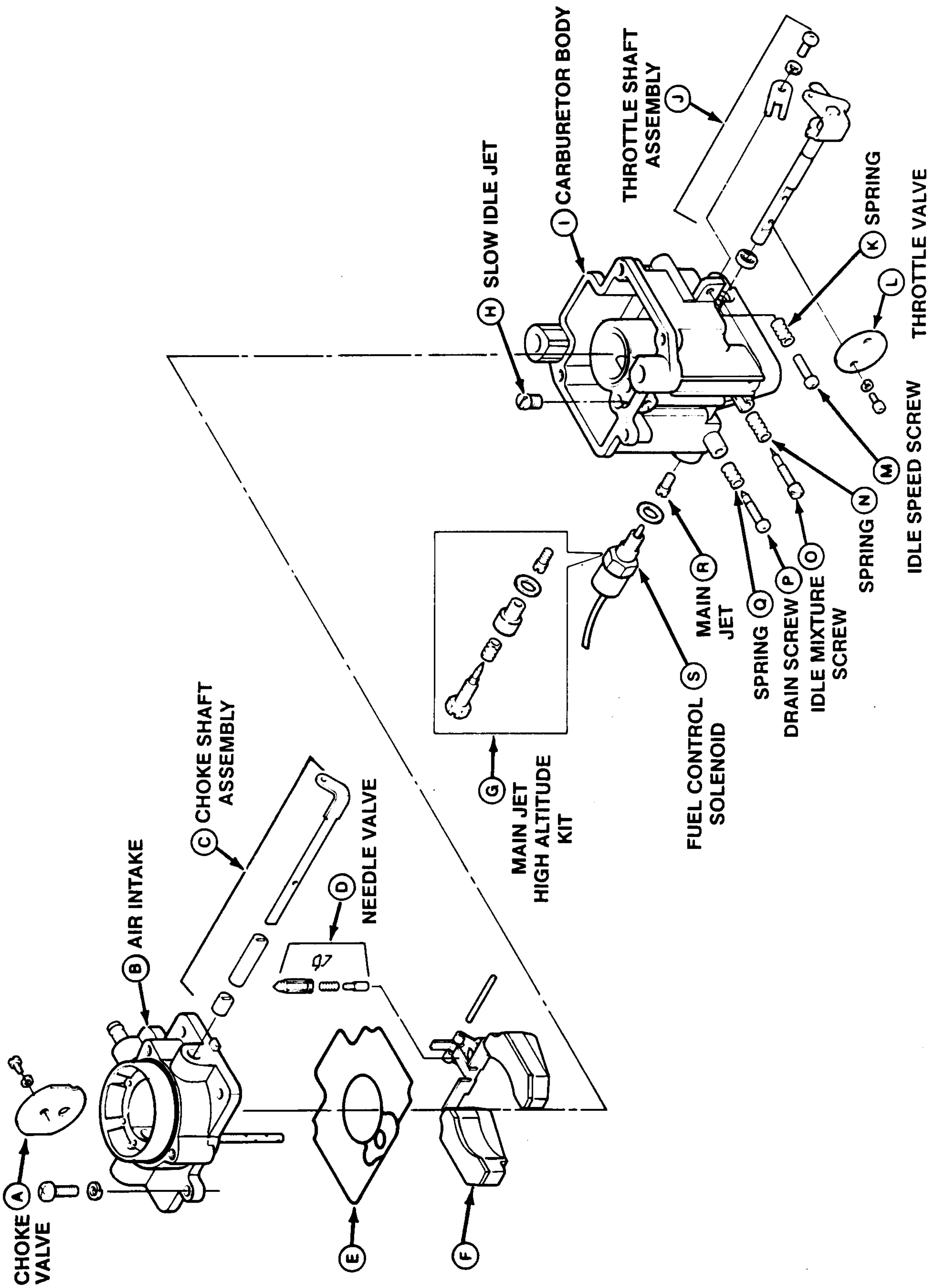
NOTE: Carburetor may be equipped with a variable main jet high altitude kit (G).

MX,23005HJ,A3 -19-14APR92



CARBURETOR COMPONENTS

M54262

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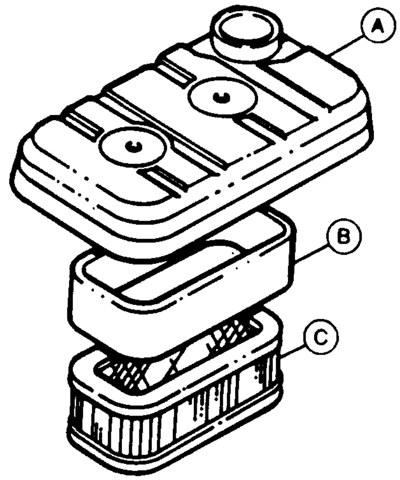
MX,23005HJ,A4 -19-14APR92

AIR INTAKE SYSTEM COMPONENTS

A—Air Cleaner Housing
B—Primary Element
C—Secondary Element



M46667 -UN-01APR92

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MX,23005HJ,A5 -19-14APR92

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
- Carburetor
- Carburetor—Main Circuit
- Carburetor—Idle Circuit (No Load)
- Carburetor—Idle Circuit (Acceleration)
- Carburetor—Start Circuit (Choke)
- Governor
- Governor—Starting
- Governor—High Idle
- Air Intake System

The slide number reference under the art is used for service training purposes only.

MX,23210HJ,A1 -19-14APR92

FUEL SYSTEM OPERATION

A—Governor
B—Carburetor
C—In-Line Fuel Filter
D—Fuel Transfer Pump
E—Fuel Tank
F—Medium Pressure Fuel
G—Suction Fuel

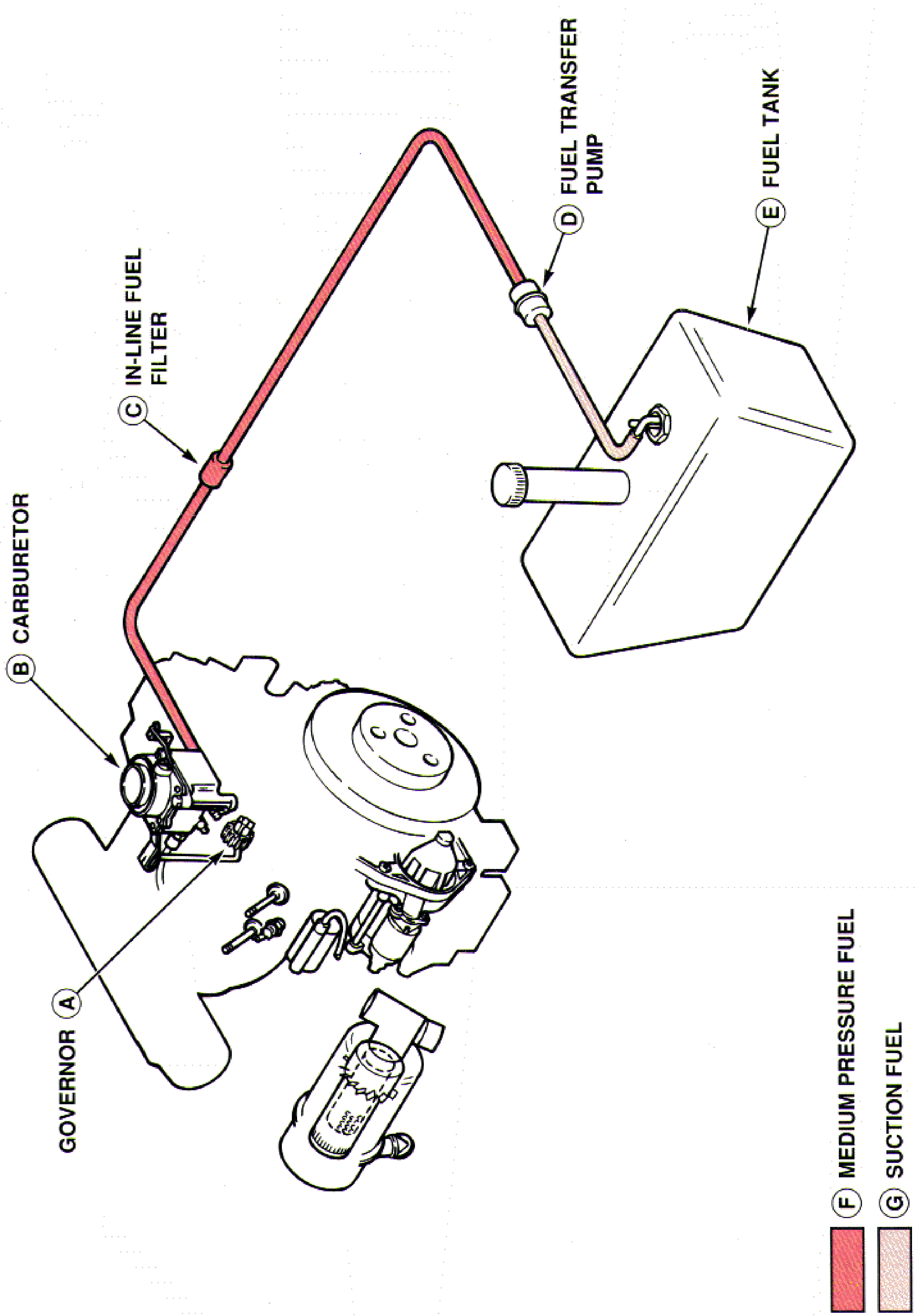
Slide MXC54264

Function:
Fuel system supplies fuel/air mixture to combustion chambers.

Major Components:
•Fuel Tank
•Fuel Transfer Pump
•In-Line Fuel Filter
•Carburetor
•Governor
•Fuel Supply Lines

Theory of Operation:
Fuel is supplied to the carburetor by a pressurized fuel system. The fuel tank (E) is vented through the underside of the fuel tank cap. The transfer pump (D) draws suction fuel (G) from the fuel tank through the fuel tank screen, to pump inlet. The fuel filter uses a paper element to remove debris from the fuel and is clear to facilitate service. Medium pressure fuel from the outlet of the transfer pump flows through in-line fuel filter (C) to the carburetor (B). Fuel pressure is maintained at the carburetor inlet needle until the float allows more fuel in the bowl.

MX,23010HJ,A1 -19-14APR92



MXC54264

FUEL SYSTEM OPERATION

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MX,23010HJ,A2 -19-14APR92

CARBURETOR OPERATION

A—Venturi
B—Choke Plate
C—Emulsion Tube
D—Fuel Level
E—Float
F—Main Jet
G—Idle Jet
H—Throttle Plate
I—Inlet Supply Line
J—Inlet Needle Valve
K—Low Pressure Fuel
L—Medium Pressure Fuel
M—Air
N—Atomized Fuel

Slide MXC54076

Function:
Carburetor regulates, atomizes and transfers fuel/air mixture to combustion chamber.

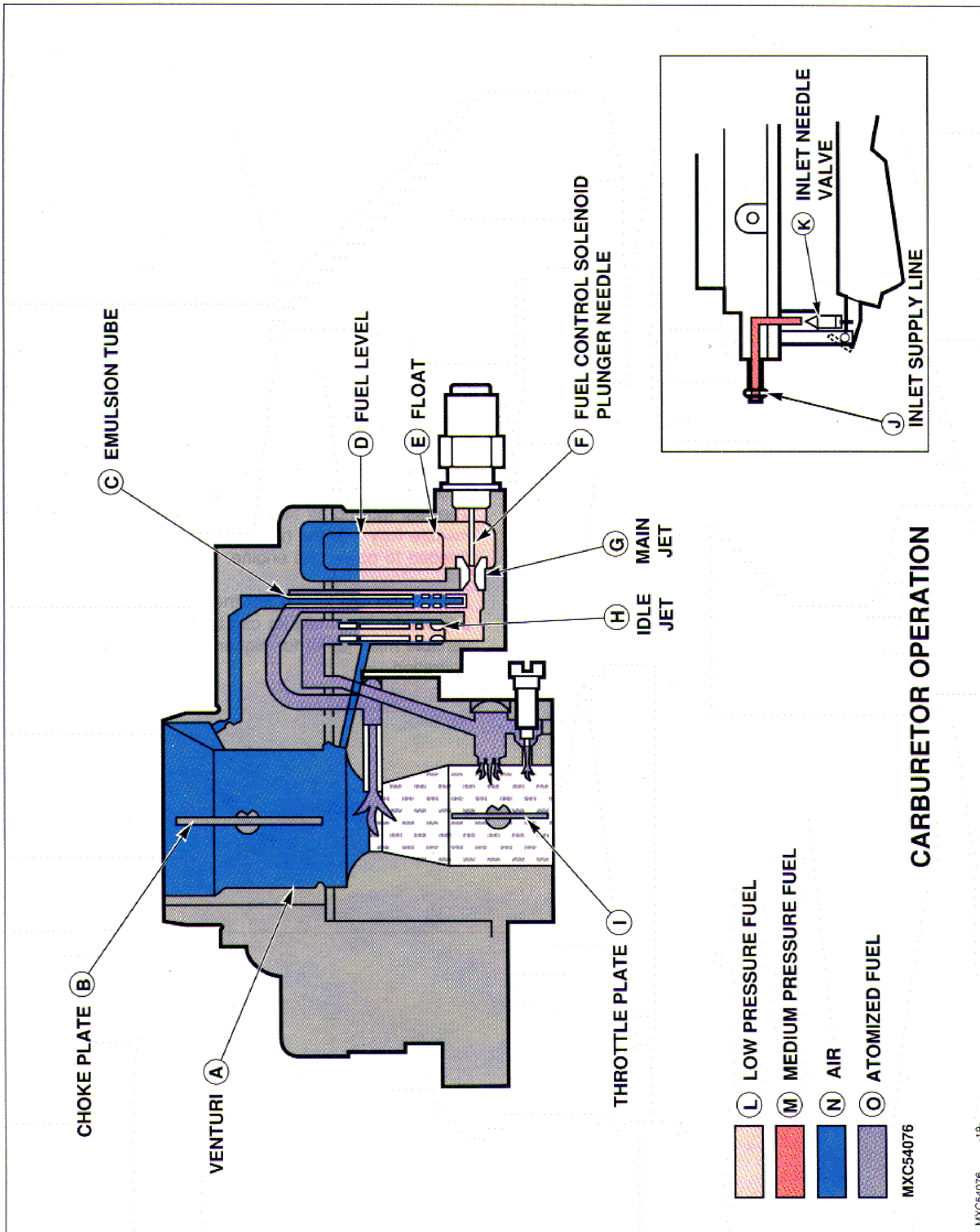
Major Components:
•Inlet Supply Line
•Inlet Needle Valve
•Venturi
•Throttle Plate
•Choke Plate
•Emulsion Tube
•Idle Jet
•Float
•Main Jet

Theory of Operation:
The purpose of float (E) is to provide the carburetor with a constant fuel supply at a constant level (D). Fuel is supplied under medium pump pressure (L) via the inlet supply line (I). Flow into the bowl is controlled by the opening and closing of the inlet needle valve (J). The inlet needle valve is attached to float (E) inside the bowl. The float is continually moving up and down as the engine operates, opening and closing off fuel flow into the bowl.

Proper fuel level in the float bowl is important to the operation of the carburetor. Atmospheric air pressure (M) on the fuel in the bowl combines with the design of the carburetor to provide both the atomization and transfer of atomized fuel (N) through the passages of the carburetor.

There are three operation circuits: Main Circuit, Idle Circuit and Start (Choke) Circuit.

MX,23210HJ,A4 -19-14APR92



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MX,23010HJ,A4 -19-14APR92

CARBURETOR OPERATION—MAIN CIRCUIT

A—Main Nozzle
B—Venturi
C—Choke Plate
D—Main Jet Air Bleed
E—Emulsion Tube
F—Main Jet
G—Idle Jet
H—Low Pressure Fuel
I—Air
J—Atomized Fuel

Function:
Main circuit delivers the majority of the fuel/air mixture to the venturi.

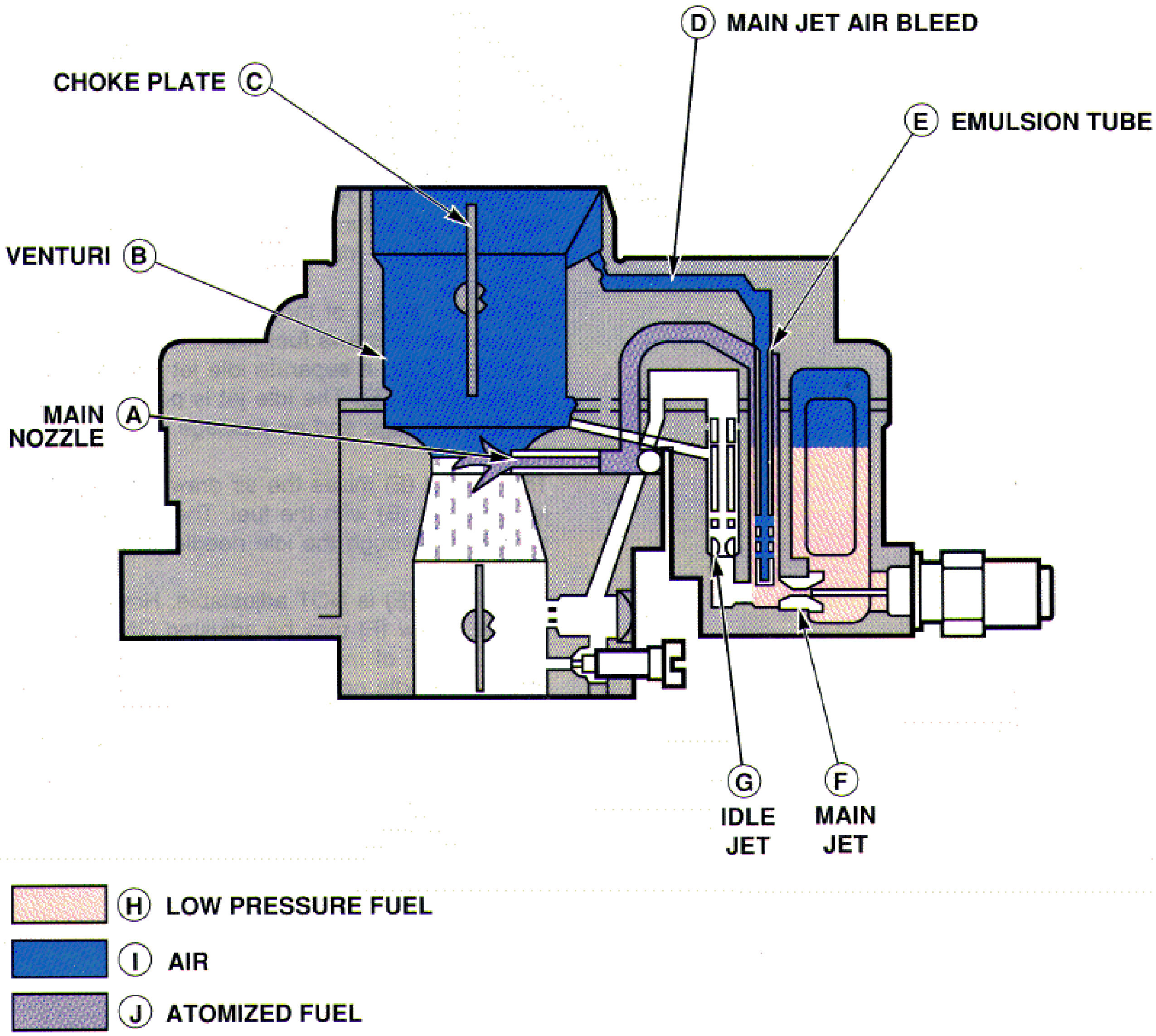
Major Components:
•Inlet Supply Line
•Inlet Needle Valve
•Venturi
•Throttle Plate
•Choke Plate
•Main Nozzle
•Float
•Main Jet
•Emulsion Tube

Theory of Operation:
The main circuit functions when the engine is operating at partial (not idle) to full throttle with the choke plate (C) fully open. In this condition, air flows very quickly through the venturi (B) and past the main nozzle (A). Air flow volume, velocity, and pressure differences in the venturi and main nozzle cause fuel to be drawn through the main jet (F) and into the cavity surrounding the emulsion tube (E).

At the same time, air is also drawn through the main air bleed (D) into the emulsion tube (E). Here, the fuel is mixed with air bubbles created by the small holes in the emulsion tube. Raw fuel and air begin atomizing into a mixture light enough to be drawn through the main nozzle (A) and into the venturi (B). The fast moving air flow in the venturi atomizes the mixture fully into the highly combustible mixture needed to power the engine.

Neither the idle jet (G) nor the main jet (F) are adjustable. The main jet can be replaced with a variable main jet kit for higher or lower altitude operation.

MX,23210HJ,A6 -19-14APR92



CARBURETOR OPERATION - MAIN CIRCUIT

Slide MXC54077

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MX,23010HJ,A5 -19-14APR92

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CARBURETOR OPERATION—IDLE CIRCUIT (NO LOAD)

A—Transition Holes
B—Idle Jet Air Bleed
C—Main Jet
D—Idle Jet Supply Passage
E—Idle Jet
F—Idle Mixture Screw
G—Idle Needle Jet
H—Throttle Plate
I—Low Pressure Fuel
J—Air
K—Atomized Fuel

Function:
The idle circuit provides fuel to operate the engine under idle, no-load conditions.

Major Components:
•Throttle Plate
•Idle Jet
•Idle Mixture Screw
•Main Jet
•Float
•Carburetor Body

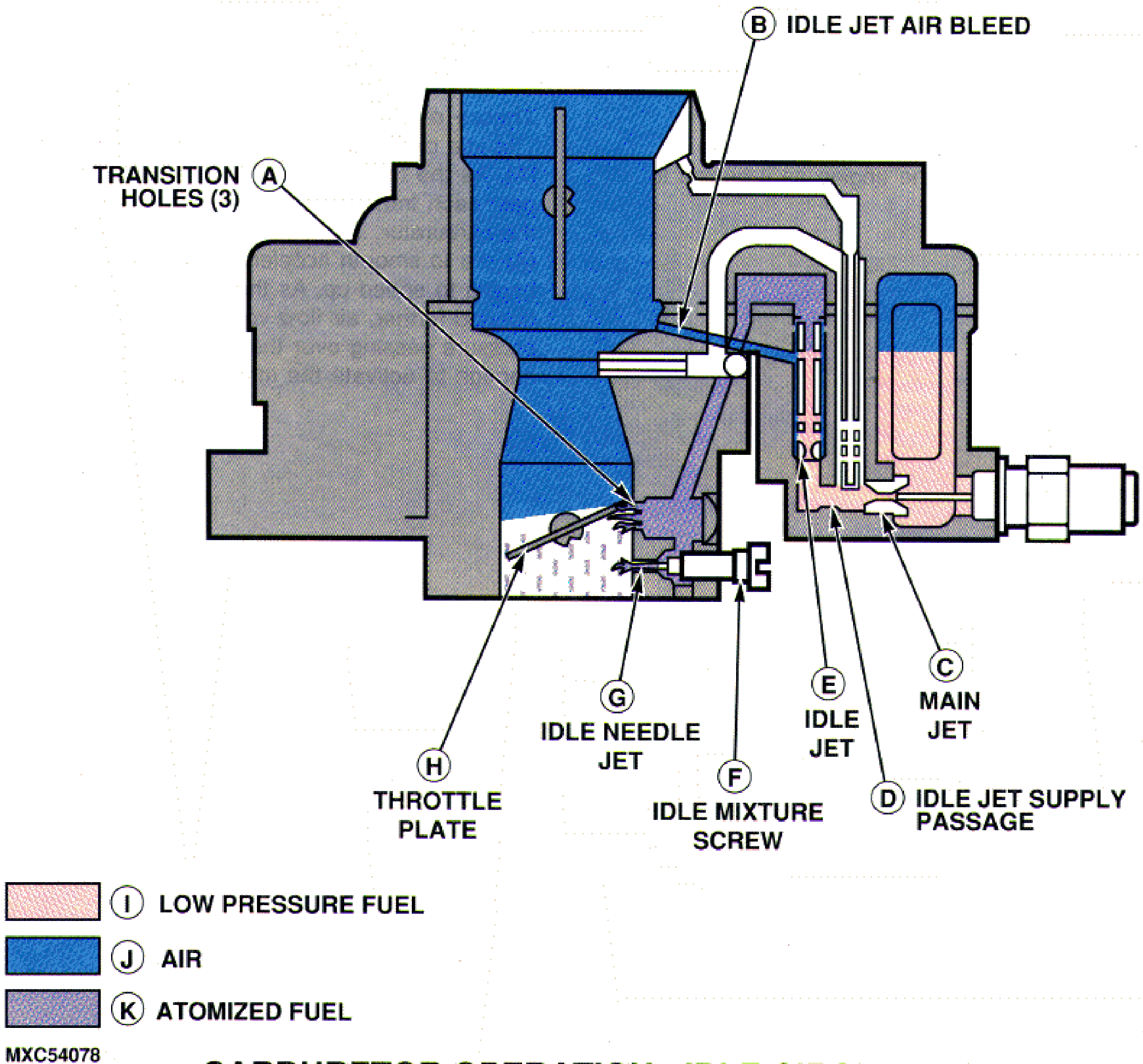
Theory of Operation:
The throttle plate (H) will be nearly closed when the engine is at idle. Air flow through the venturi does not have enough volume, velocity, nor pressure to draw fuel through the main circuit.

The intake stroke of the engine creates a slight vacuum which draws fuel from the bowl, through the main jet (C), to a separate idle jet supply passage (D) to the idle jet (E). The idle jet is positioned between the fuel passage and air passage.

The idle jet (E) mixes the air drawn through the idle jet air bleed (B) with the fuel. The mixture enters the carburetor through the idle needle jet (G).

The idle jet (E) is NOT adjustable. However, the idle mixture screw (F) may be adjusted ONLY to control the VOLUME of mixture entering the carburetor through the idle needle jet (G) and the transition holes (A).

MX,23210HJ,A8 -19-14APR92



CARBURETOR OPERATION - IDLE CIRCUIT (NO LOAD)

Slide MXC54078

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MX,23010HJ,A6 -19-14APR92

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CARBURETOR OPERATION—IDLE CIRCUIT (ACCELERATION)

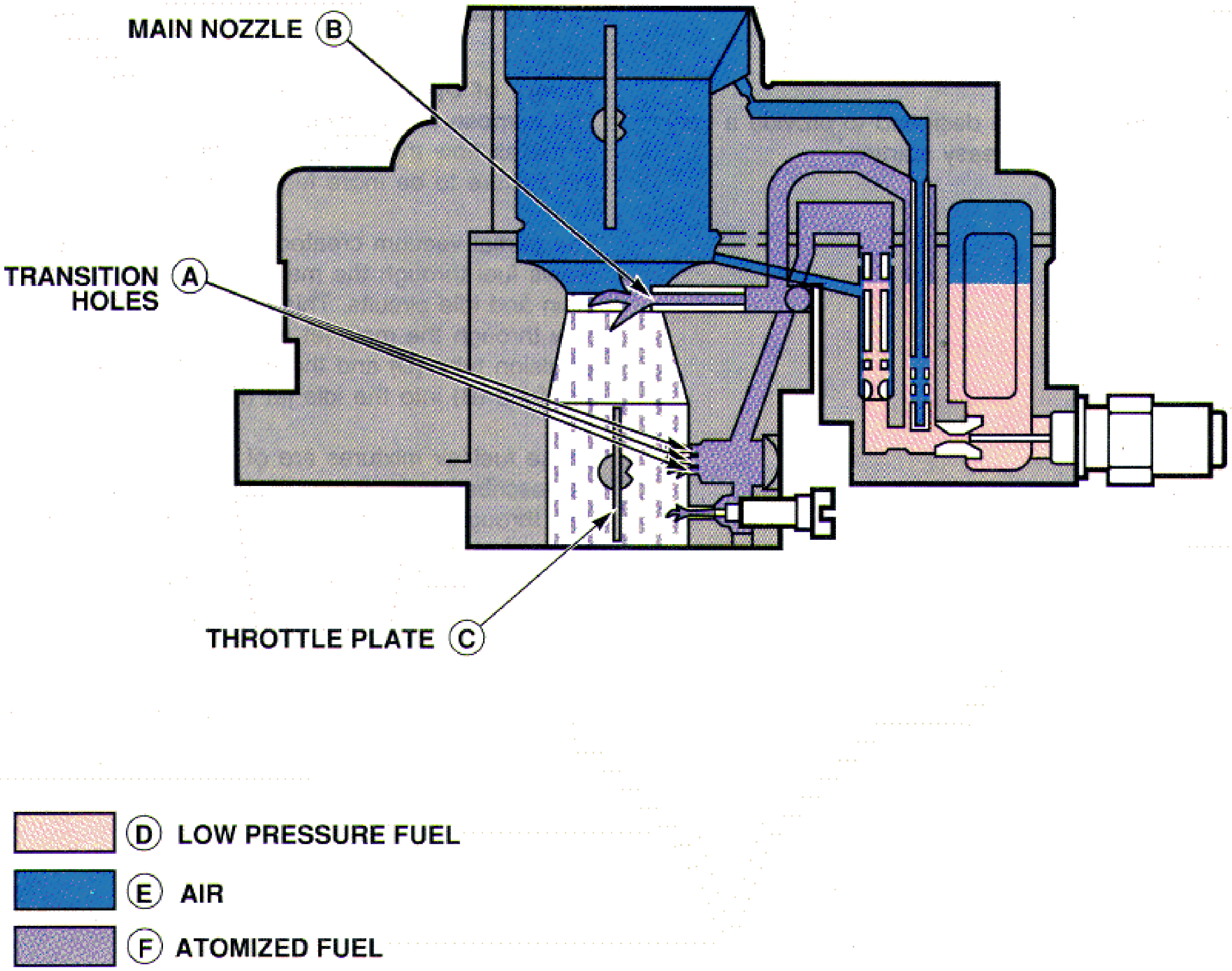
A—Transition Holes
B—Main Nozzle
C—Throttle Plate
D—Low Pressure Fuel
E—Air
F—Atomized Fuel

Function:
The idle circuit regulates fuel flow to achieve a smooth acceleration of the engine as it begins to speed up.

Major Components:
•Throttle Plate
•Main Nozzle
•Choke Plate
•Idle Jet
•Idle Mixture Screw
•Main Jet
•Float
•Carburetor Body
•Emulsion Tube

Theory of Operation:
The idle circuit contains one or more transition holes (A). As the throttle plate (C) begins to open, it moves past each transition hole allowing more fuel to enter the carburetor. The purpose of the transition holes (A) are to smooth acceleration of the engine as it begins to speed up. As the throttle plate (C) is opened further, air flow volume, velocity, and pressure passing over the main nozzle (B) increases enough to activate the main circuit.

MX,23210HJ,A10 -19-14APR92



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CARBURETOR OPERATION - IDLE CIRCUIT (ACCELERATION)

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MX,23010HJ,A7 -19-14APR92

CARBURETOR OPERATION—START CIRCUIT (CHOKE)

A—Choke Plate
B—Idle Jet Air Bleed
C—Main Jet Air Bleed
D—Emulsion Tube
E—Main Jet
F—Idle Jet
G—Low Pressure Fuel
H—Air
I—Atomized Fuel

Function:
The start (choke) circuit is designed to provide a very fuel-rich mixture to aid in easy starting.

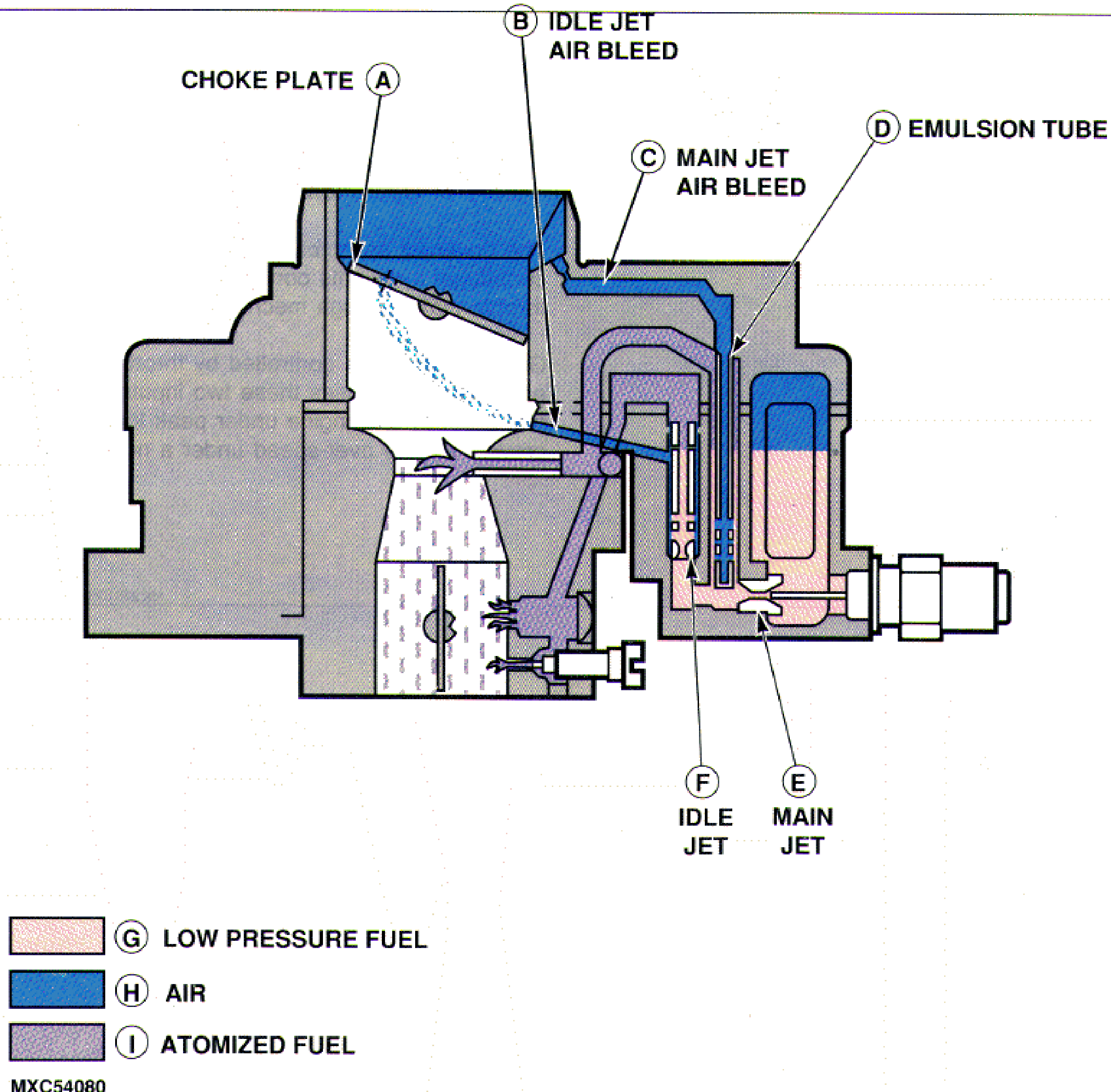
Major Components:
•Throttle Plate
•Main Nozzle
•Choke Plate
•Idle Jet
•Idle Mixture Screw
•Main Jet
•Float
•Carburetor Body

Theory of Operation:
The purpose of the choke plate (A) is to restrict most of the air flow through the carburetor; thus, allowing the mixture to be more fuel-rich for easy starting.

The partial vacuum created by the intake stroke draws fuel through the main jet (E) and into both the main and idle circuits. This fuel mixes with the air flow through the main jet air bleed (C) into the emulsion tube (D) and the air flow through the idle jet air bleed (B) into the idle jet (F).

These fuel/air mixtures are of the same proportions as described before; except, there is now less air flow through the venturi (with the choke plate (A) being closed) to atomize these mixtures fully. This fuel-rich mixture ignites easy for easier starts.

MX,23210HJ,A12 -19-14APR92



CARBURETOR OPERATION - START CIRCUIT (CHOKE)

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MX,23010HJ,A8 -19-14APR92

GOVERNOR OPERATION

A—Governor Spring
B—Governor Arm
C—Throttle Control Link and Spring
D—Thrust Sleeve
E—Flyweights
F—Governor Drive Gear
G—Governor Shaft

Function:
Governor regulates engine rpm.

Major Components:
•Governor Arm
•Governor Shaft
•Governor Spring
•Governor Drive Gear
•Flyweights
•Thrust Sleeve
•Throttle Lever
•Throttle Control Link and Spring

Theory of Operation:

The governor assembly consists of gear driven centrifugal flyweights connected to the carburetor throttle plate through mechanical linkage.

Governor action is controlled by throttle position and engine speed. It uses these two inputs to, deliver more fuel to the engine under peak loads and to prevent engine over-speed under a no-load condition.

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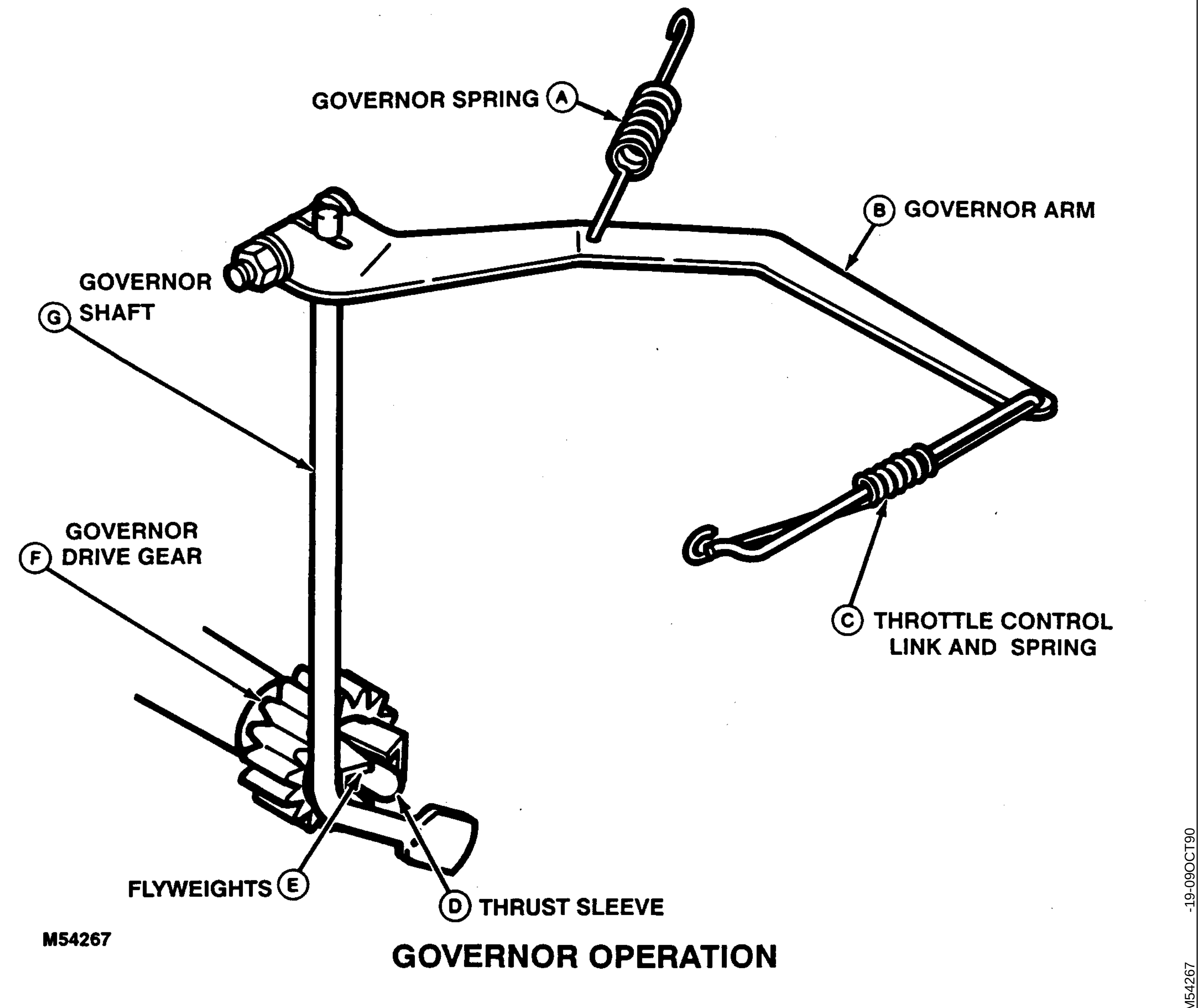

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MX,23010HJ,A10 -19-14APR92

GOVERNOR OPERATION—STARTING

A—Governor Spring
B—Governor Arm
C—Throttle Control Link and Spring
D—Thrust Sleeve
E—Flyweights
F—Governor Drive Gear
G—Governor Shaft

Function:
Governor maintains a set engine speed under varying loads.

Major Components:
•Governor Arm
•Governor Shaft
•Governor Spring
•Governor Drive Gear
•Flyweights
•Thrust Sleeve
•Throttle Lever
•Throttle Control Link and Spring

Theory of Operation:
When the engine is stopped, the governor spring (A) moves arm (B) and shaft (G) against thrust sleeve (D), which forces the flyweights (E) closed. In this position, throttle control link and spring (C) hold carburetor throttle plate fully open to supply enough fuel for engine start.

As the engine starts and picks up speed, the governor gear (F), turning with camshaft rotation, increases the centrifugal forces on the flyweights (E), which begin to swing out. This forces thrust sleeve (D) against shaft (G) and causes the arm (B) to move, to close the carburetor throttle plate, via link and spring (C), to reach the pre-set throttle speed setting.

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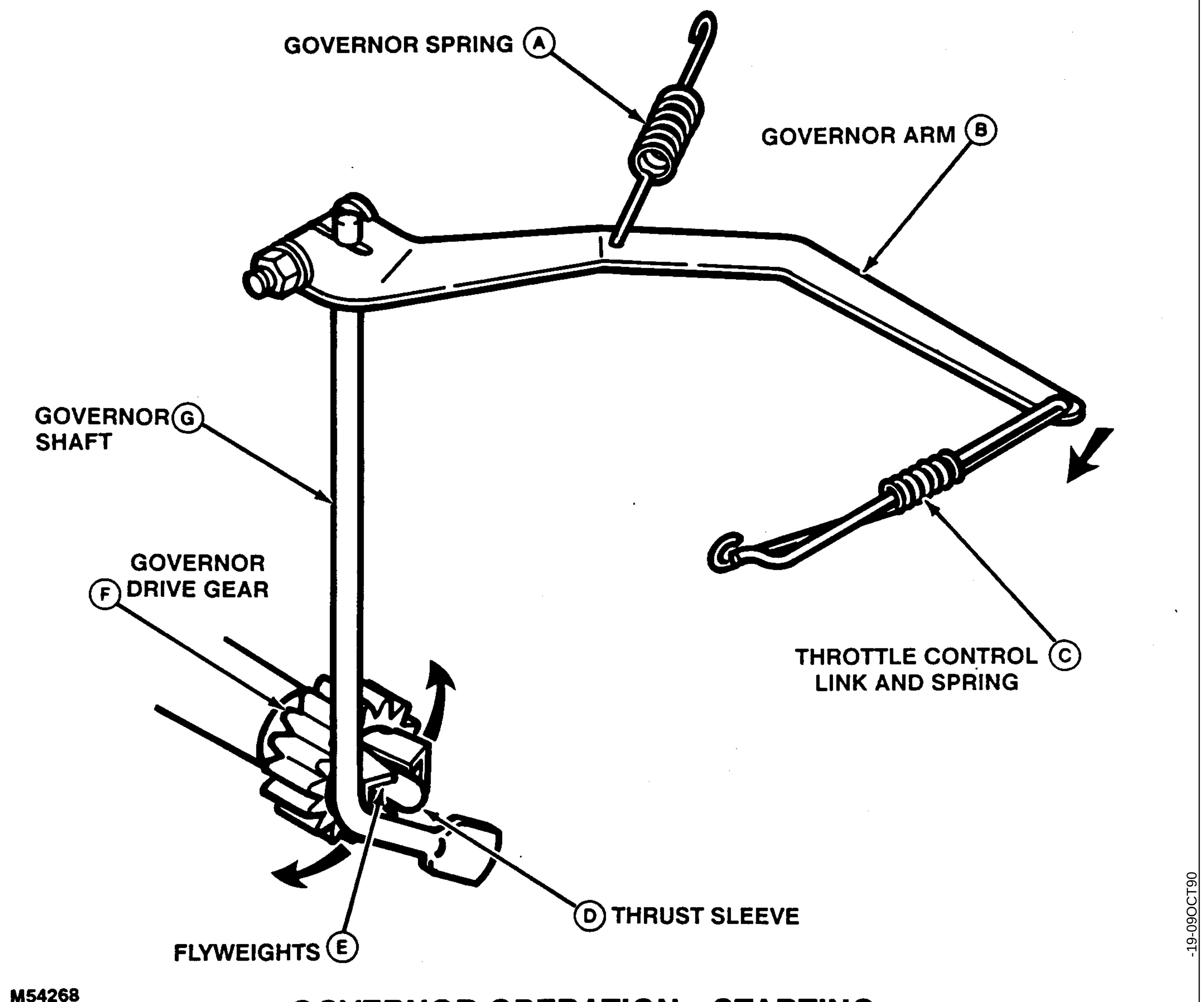

GOVERNOR OPERATION—STARTING

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MX,23010HJ,A12 -19-14APR92

GOVERNOR OPERATION—HIGH IDLE

A—Governor Spring
B—Governor Arm
C—Throttle Control Link and Spring
D—Flyweights
E—Governor Drive Gear

Function:
Governor maintains a set engine speed under varying loads.

Major Components:
•Governor Arm
•Governor Shaft
•Governor Spring
•Governor Drive Gear
•Flyweights
•Thrust Sleeve
•Throttle Lever
•Throttle Control Link and Spring

Theory of Operation:
When the engine reaches the desired speed, the centrifugal forces on the flyweights (D) equals the governor spring tension (A) maintaining the desired engine speed. If the engine encounters more load, engine speed decreases and the flyweights' centrifugal force decreases (via decreasing gear (E) speed). This allows the governor spring tension (A) to dominate and move arm (B) away from carburetor to open the throttle plate, via throttle control link and spring (C), to increase engine speed to overcome the increased load. This cycle continues during all phases of engine operation.

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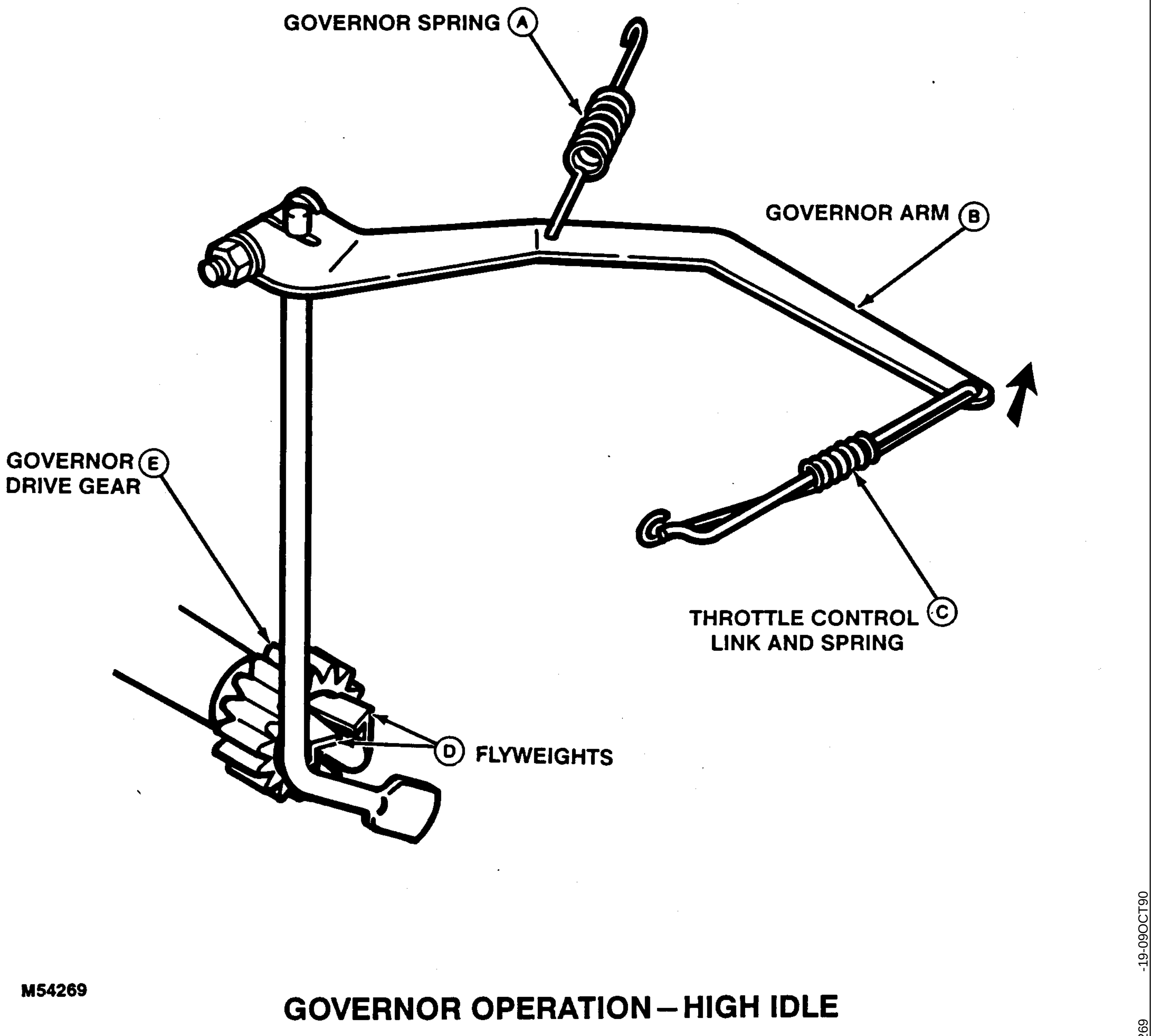

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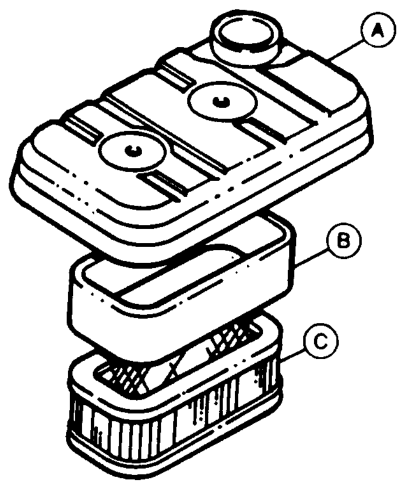
MX,23010HJ,A14 -19-14APR92

AIR INTAKE SYSTEM OPERATION



A—Air Cleaner Housing **B—Primary Element** **C—Secondary Element**

Function:
Air intake system filters air needed for combustion.

Major Components:
•Air Cleaner Housing
•Primary Element
•Secondary Element

Theory of Operation:

Air enters through an opening at the top of the air cleaner housing (A) where it is filtered by two elements. The first element, the primary element (B), is made of an elastic fiber that stretches over the secondary element (C) and prevents the secondary element from being embedded with large foreign matter such as grass or leaves. The secondary element is designed to prevent fine dust and particles from entering the intake system and damaging the internal components of the engine, such as rings, cylinders and bearings.

MX,23210HJ,A20 -19-14APR92

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:

•Battery
•Key Switch
•Speedometer
•Tachometer
•Warning Light Indicators
•Starter Interlock Switch
•Voltage Regulator
•Transfer Pump
•Fuses
•Ignition Relay
•PTO Relay
•Starter Relay
•Starter
•Starter Solenoid
•Battery Cables
•Ignition Coils
•Ignition module
•Pulsers
•Stator
•Water Temperature Sender
•Oil Pressure Sender
•Fuel Shutoff Solenoid
•Speed Sensor

Use the drawings when diagnosing an electrical problem and to help locate the components to be tested.

MX,24005HJ,1 -19-14APR92

ELECTRICAL COMPONENTS

A—Stator
B—Key Switch
C—15 and 20 Amp Fuses
D—Battery Positive Cable
E—Fusible Links
F—Engine Connector
G—Ignition Coils
H—Fuel Shut-off Solenoid
I—Starter Solenoid and Starter Motor
J—Wiring Harness Ground
K—Coolant Temperature Switch
L—Oil Pressure Switch
M—Tachometer
N—Ignition Module and Ignition Module Connectors
O—Battery Negative Cable
P—Speed Sensor
Q—Battery
R—Regulator/Rectifier
S—Battery Discharge Lamp
T—Oil Pressure Lamp
U—Coolant Temperature Lamp
V—Starter Interlock Switch
W—Seat Switch
X—Ignition Relay
Y—Starter Relay
Z—PTO Relay

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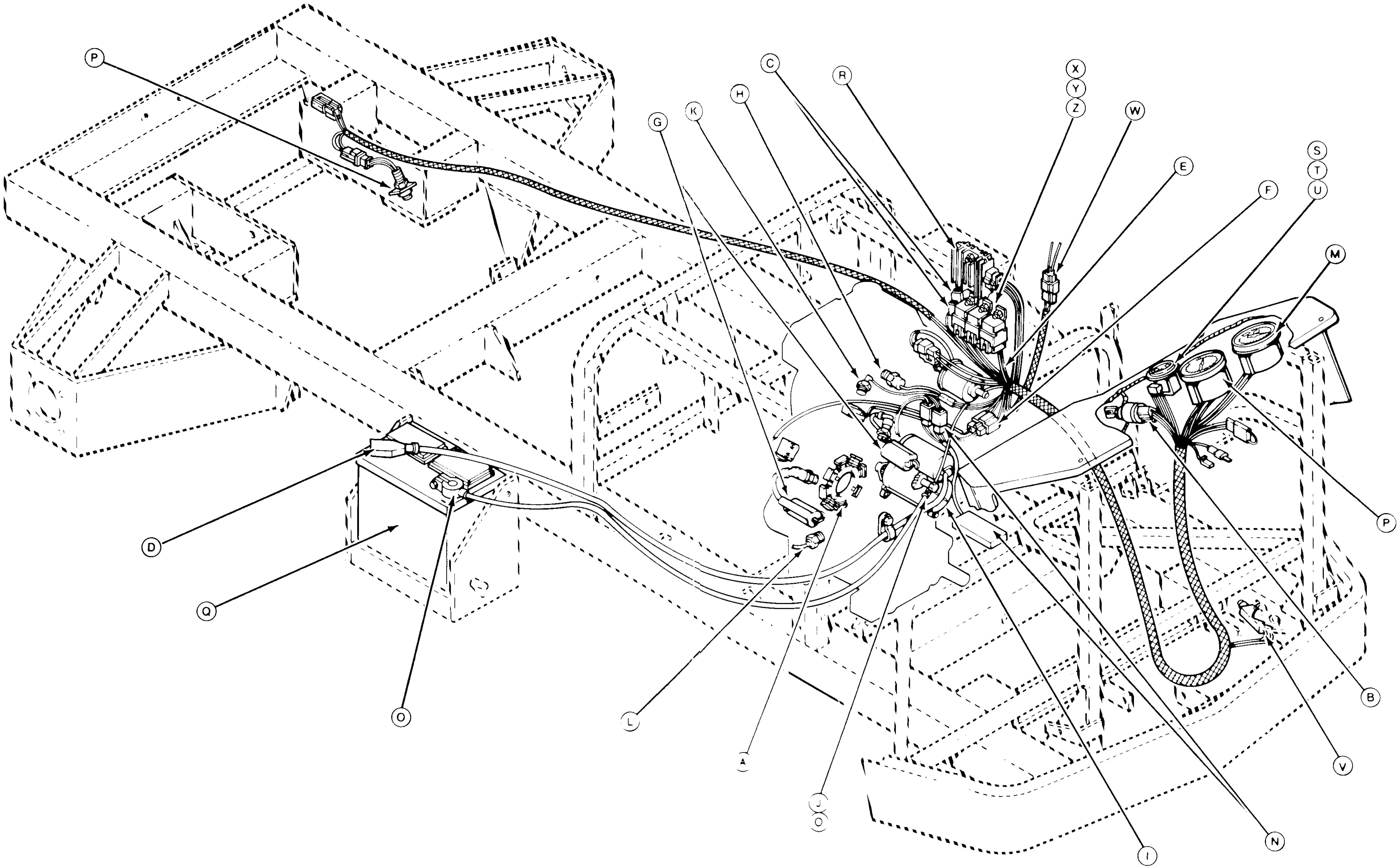

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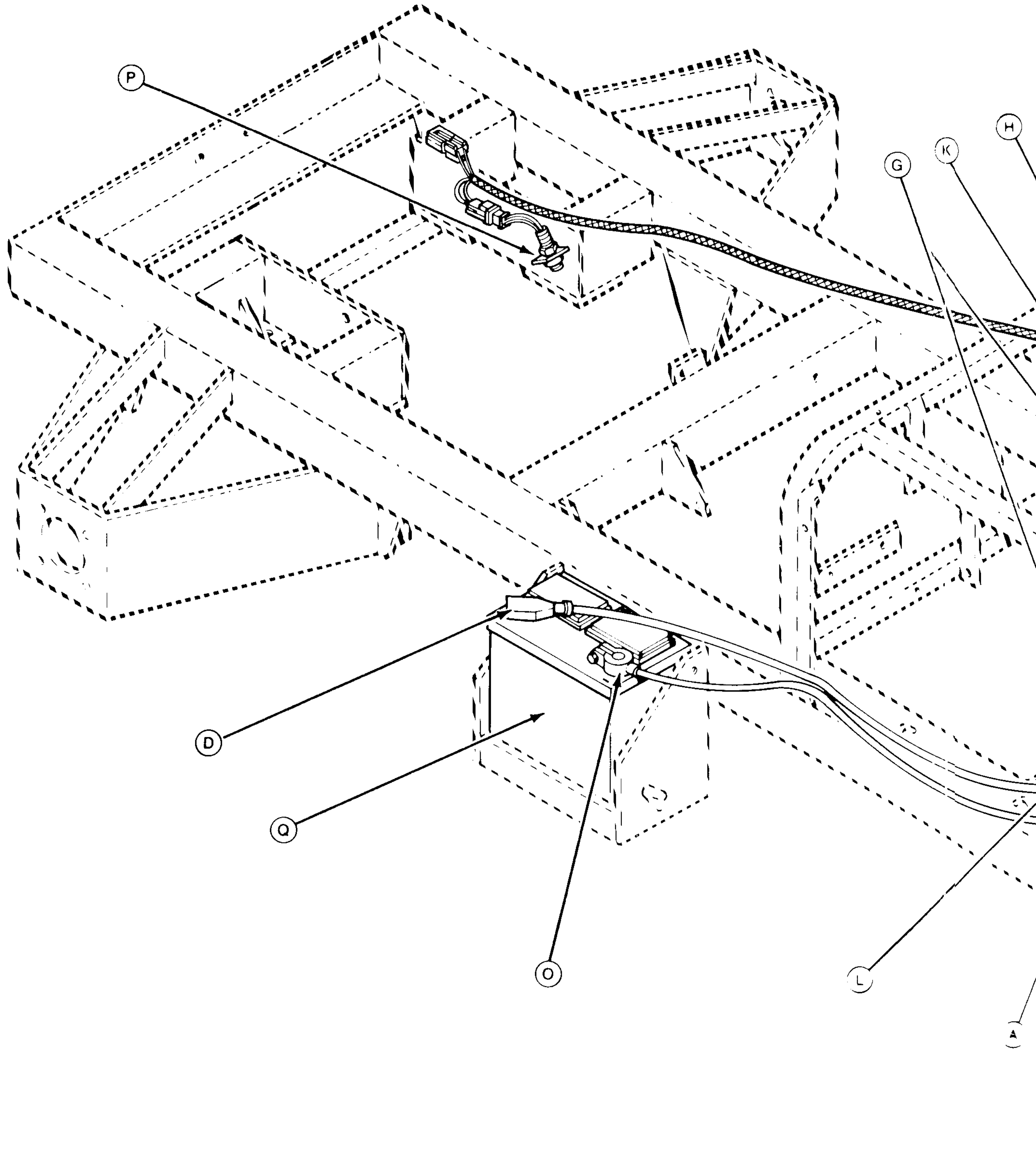
ELECTRICAL COMPONENTS



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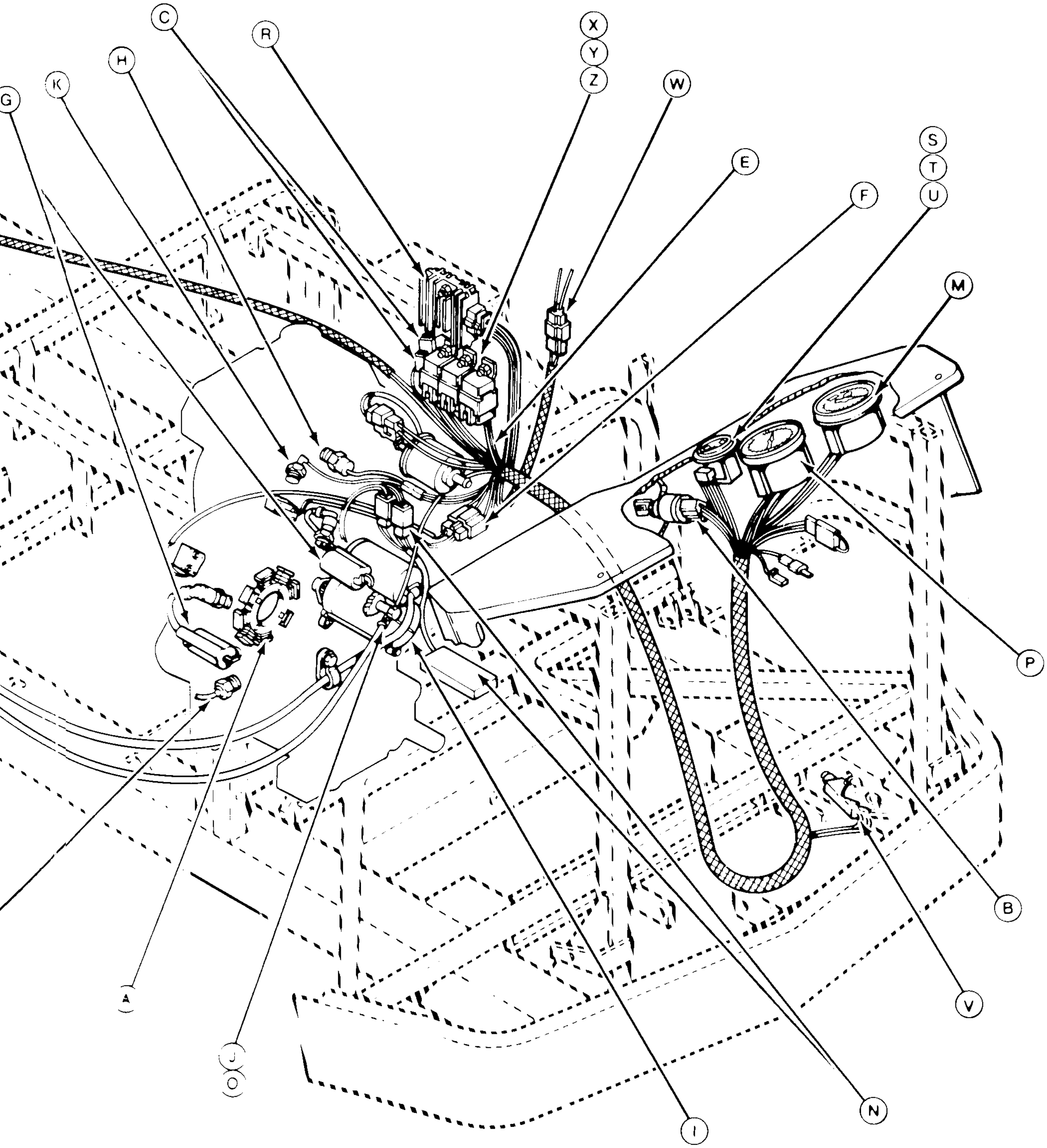
ELECTRICAL COMPON



. COMPONENTS

THEORY OF OPERATION INFORMATION

This group divides the electrical system into individual components or circuits by function. Each circuit is isolated from the main wiring schematic and only shows the components that are used in it. The story contains information on function, component or circuit identification and theory of operation.

The circuit schematics are drawn with the components in the operating position, with the power, or battery positive, into them across the top and the ground, or battery negative, across the bottom. **COLOR IS USED TO IDENTIFY SUB-CIRCUITS AND MAY NOT MATCH THE ACTUAL COLORS OF THE WIRES ON THE UNIT.**

The following systems or components are covered:
•Cranking Circuit Operation
•Ignition Circuit Operation
•Charging Circuit Operation
•Low Oil Pressure Lamp Circuit Operation
•Coolant Temperature Lamp Circuit Operation

The slide number reference under the art is used for service training purposes only.

MX,24010HJ,1 -19-14APR92

WIRE COLOR CHART

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

MX,24010HJ,2 -19-14APR92

CRANKING CIRCUIT OPERATION

A—Power Circuit
B—Starter Interlock Circuit
C—Starter Solenoid Circuit
D—Starter Power Circuit
E—Ground Circuit
F1—Fusible Link
F3—Fusible Link
F2—15 Amp Fuse
G1—Battery
K1—Start Relay
K4—Starter Solenoid
M1—Starting Motor
S1—Key Switch
S4—PTO Switch
S3—Starter Interlock Switch
W1—Engine Ground

Slide MXC46544

Function:
The cranking system is used to energize the starting motor.

Operating Conditions:
In order to crank the engine, the key switch must be in the start position, the PTO switch (if equipped) must be off, and the brake pedal must be depressed (starter interlock switch closed). The operator does not have to be on the seat (seat switch closed) to crank the engine.

Major Components:
•Battery
•Fusible Link
•Key Switch
•15 Amp Fuse
•Starter Interlock Switch
•Starter Relay
•Starter Solenoid
•Starter

Theory of Operation:
The starting motor is a solenoid shift design. The power circuit provides current to the key switch and protects the cranking circuit with a 15 amp fuse. Current flows from the battery positive terminal to the starter solenoid battery terminal, fusible link, start relay terminal, and key switch battery terminal. Current from the start relay terminal cannot flow to the starter solenoid until the start relay coil is energized, closing the relay. The start relay coil receives energizing current from the starter interlock circuit. With the key switch in the START position, current flows to the 15 amp fuse and PTO switch (if installed).

The PTO switch (if installed) is used in the starter interlock circuit to prevent the engine from cranking if the PTO is engaged. With the PTO switch closed (PTO disengaged), current flows to the starter interlock switch. On units not equipped with a PTO switch, a jumper wire is used to carry current directly to the starter interlock switch.

The starter interlock switch is located just forward of the brake pedal linkage on the left frame rail. When the brake pedal is depressed or the parking brake lever is engaged, the starter interlock switch is closed. The starter interlock switch is used in the starter interlock circuit to prevent the engine from cranking if the brake pedal is not depressed.

With the starter interlock switch closed, current flows to the start relay coil terminal through the starter switch and to ground. Closing the starter interlock switch sends current to the starter relay coil, energizing the relay and allowing current to flow to the starter solenoid. With the solenoid main contacts closed, high current from the battery flows across the main contacts of the starter solenoid to the starter motor, resulting in starter motor operation.

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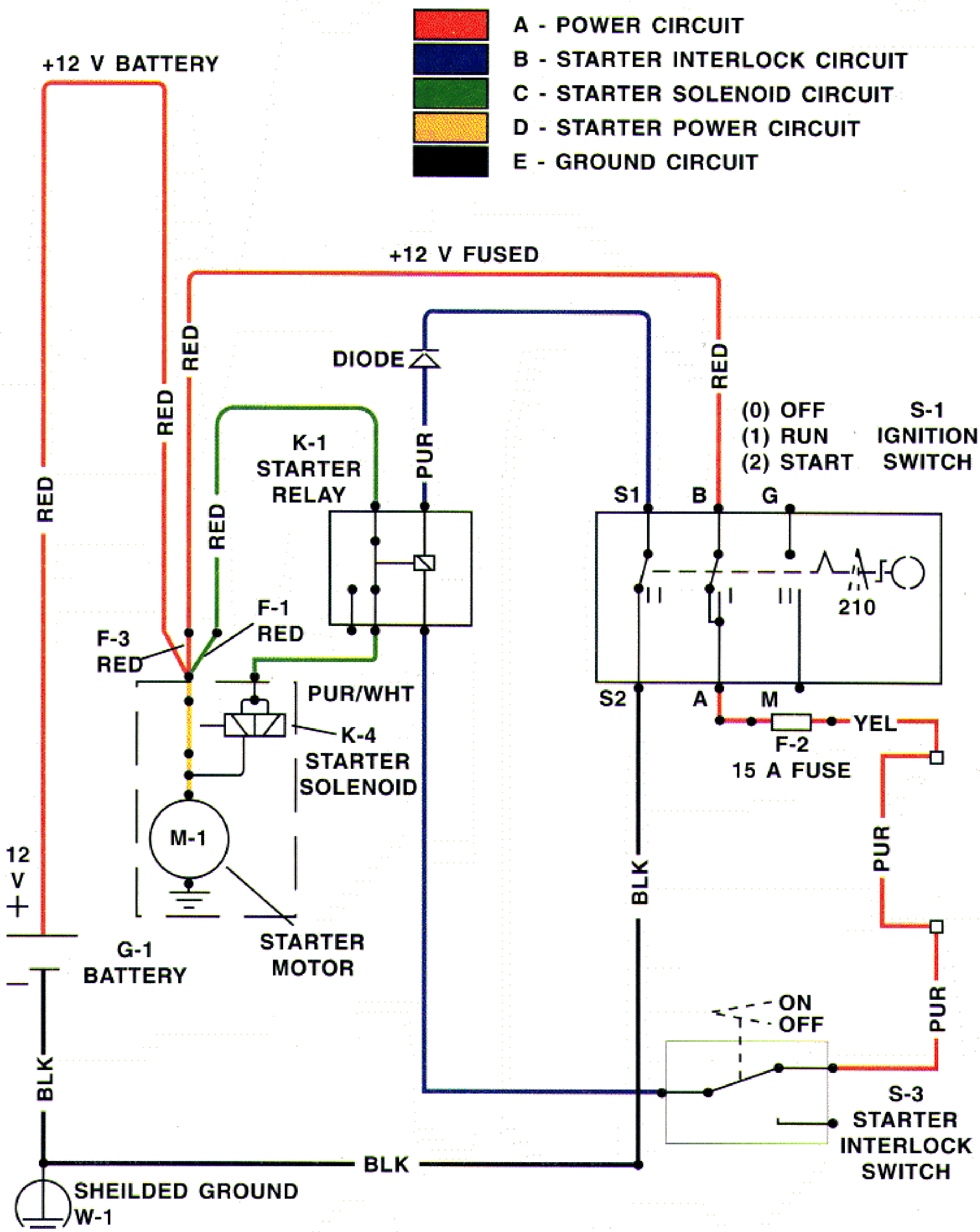

CRANKING CIRCUIT OPERATION

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IGNITION CIRCUIT OPERATION

A—Power Circuit
A1—Ignition Module
B—Starter Interlock Circuit
B1—Left Pulser Coil
B2—Right Pulser Coil
C—Seat Switch Circuit
D—Ignition Relay Circuit
E—Primary Coil Circuit
E1—Left Spark Plug
E2—Right Spark Plug
F—Secondary Coil Circuit
F3—Fusible Link
F2—15 Amp Fuse
G—Pulser Coil Circuit
G1—Battery
H—Ground Circuit
K2—Ignition Relay
S1—Key Switch
S2—Seat Switch
S4—PTO Switch
S3—Starter Interlock Switch
T1—Left Ignition Coil
T2—Right Ignition Coil
W1—Engine Ground

Slide MXC46545

Function:
To create a spark that ignites the fuel/air mixture in the engine.

Operating Conditions:
To produce a spark; the key switch must be in the run or start position, and the operator must be on the seat (seat switch closed) or the starter interlock circuit must be energized. To energize the starter interlock circuit, the PTO switch must be off (if equipped) and the brake pedal must be depressed (starter interlock switch closed).

Major Components:
•Battery
•Fusible Link
•Key Switch
•15 Amp Fuse
•PTO Switch (if equipped)
•Starter Interlock Switch
•Ignition Relay
•Flywheel
•Ignition Module
•Ignition Coils
•Pulser Coils
•Spark Plugs

Theory of Operation:
The ignition system is a transistor-controlled battery ignition design. The battery supplies current to the ignition coil primary circuit. A transistor in the ignition module controls ignition coil primary current flow. The pulser coils mounted next to the flywheel control the ignition module transistor. Ignition timing is controlled by the ignition module and is not adjustable. The engine is shut off by de-energizing the ignition relay which stops current flow to the ignition coils and fuel shut-off solenoid. The ignition relay is de-energized if the operator gets off the seat with the PTO engaged or the brake pedal not depressed.

The power circuit provides current to the key switch, energizes the ignition relay circuit, and protects the ignition circuit with a 15 amp fuse. Current flows from the battery positive terminal to the fusible link, and key switch battery terminal. With the key switch in the RUN position, current flows to the 15 amp fuse, ignition relay terminal, seat switch, and PTO switch. Current cannot flow to the ignition module and the ignition coils until the ignition relay is energized. Energizing current for the ignition relay must come from the starter interlock circuit or the seat switch circuit.

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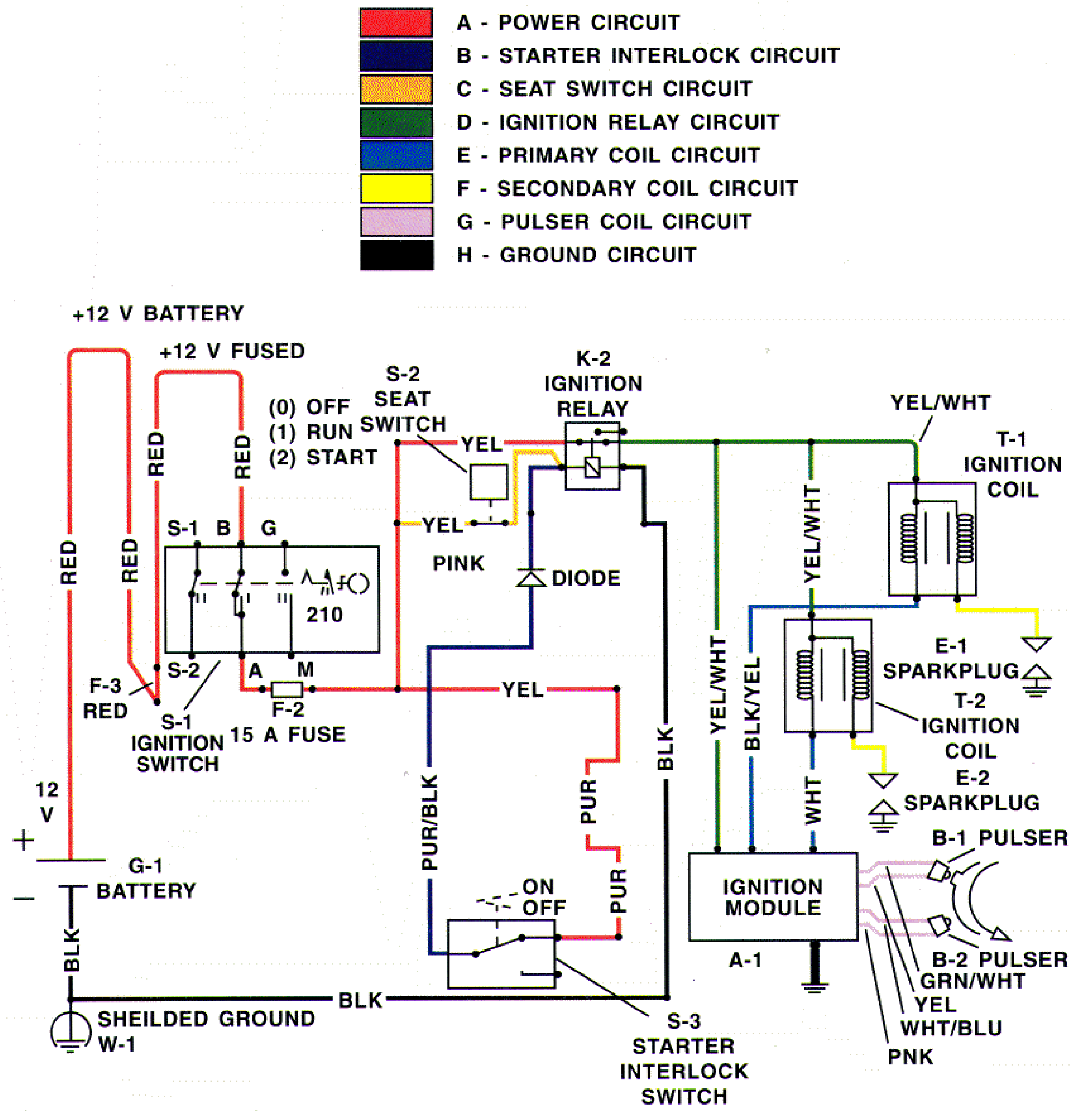
MX,24010HJ,5 -19-14APR92



IGNITION CIRCUIT OPERATION

MXC46545

MX,24010HJ,6 -19-14APR92

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IGNITION CIRCUIT OPERATION-CONTINUED

A—Power Circuit
A1—Ignition Module
B—Starter Interlock Circuit
B1—Left Pulser Coil
B2—Right Pulser Coil
C—Seat Switch Circuit
D—Ignition Relay Circuit
E—Primary Coil Circuit
E1—Left Spark Plug
E2—Right Spark Plug
F—Secondary Coil Circuit
F3—Fusible Link
F2—15 Amp Fuse
G—Pulser Coil Circuit
G1—Battery
H—Ground Circuit
K2—Ignition Relay
S1—Key Switch
S2—Seat Switch
S4—PTO Switch
S3—Starter Interlock Switch
T1—Left Ignition Coil
T2—Right Ignition Coil
W1—Engine Ground

Slide MXC46545

The PTO switch (if equipped) is used in the starter interlock circuit to prevent the ignition relay from energizing if the PTO is engaged with the operator off the seat. With the PTO switch closed (PTO disengaged), current flows to the starter interlock switch.

NOTE: If the vehicle is not equipped with a PTO switch, current flows directly from the 15 amp fuse to the starter interlock switch through a jumper wire.

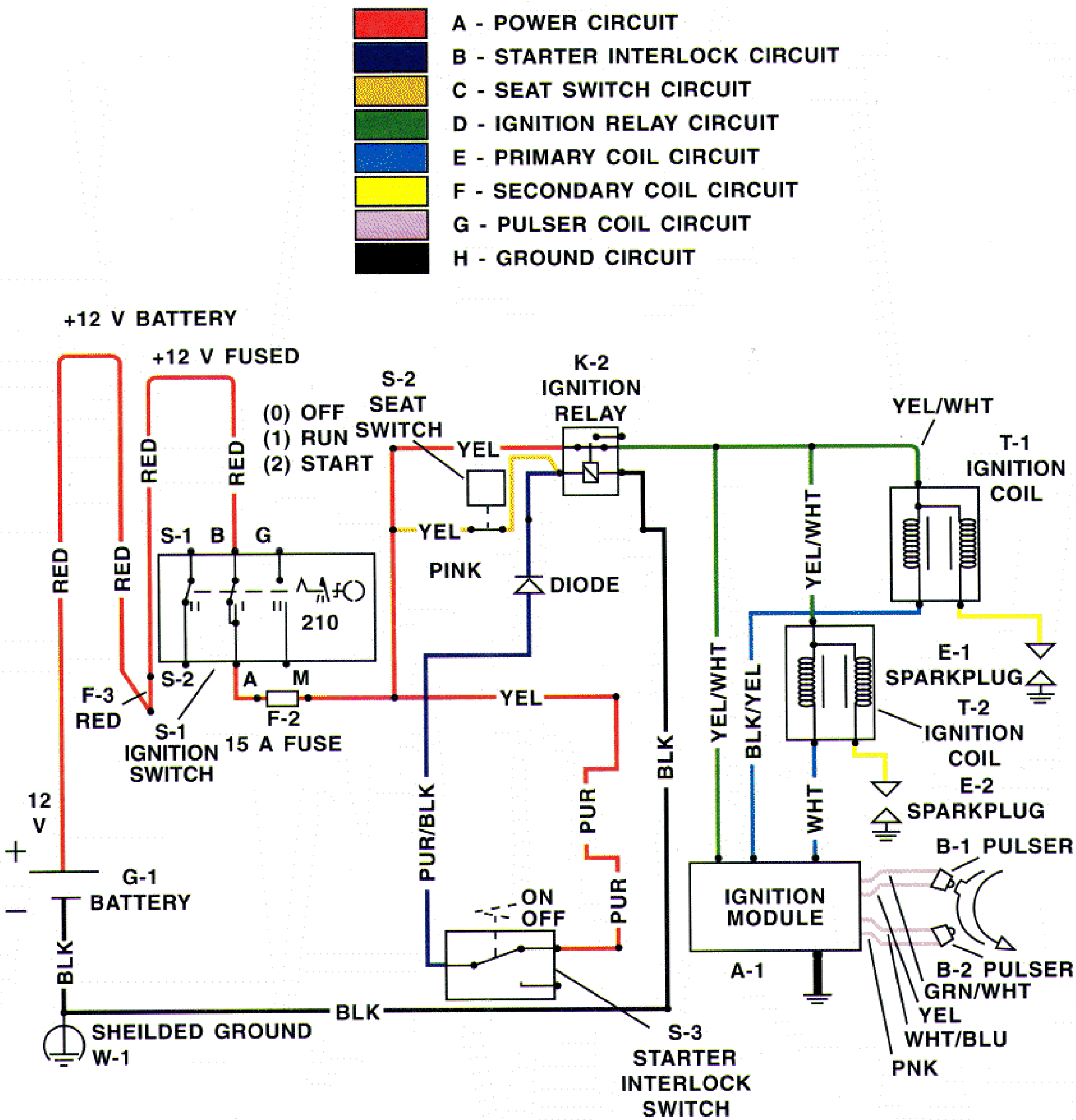
The starter interlock switch is frame mounted directly forward of the brake pedal linkage. When the brake pedal is depressed, the starter interlock switch is closed. The starter interlock switch is used in the starter interlock circuit to prevent the ignition relay from energizing if the brake pedal is not depressed with the operator off the seat.

With the starter interlock switch closed, current flows to the ignition relay coil terminal and energizes the coil, closing the relay. Closing the relay sends current to the ignition module, ignition coils and fuel shut-off solenoid. An alternate current path for the ignition circuit is provided with the operator on the seat. With the seat switch closed, current flows to the ignition relay coil keeping the relay energized.

As the flywheel turns, a reluctor on the flywheel travels past the pulser coil and produces current in the pulser coil by electromagnetic induction. Two pulser coils, one for each cylinder, are mounted in a fixed position next to the flywheel. Pulser coil current flows to a transistor inside the ignition module and energizes the transistor. With the transistor energized, the transistor provides a path to ground for ignition coil current flow through the primary windings.

In the spark stage (spark produced), the trailing edge of the reluctor travels past the pulser coil. Pulser coil current flow to the ignition module transistor stops and the transistor is de-energized. With the transistor de-energized, the transistor opens breaking the path to ground for ignition coil primary coil current. When the current flow stops, the primary coil electromagnetic field collapses and induces high voltage current in the secondary coil. The high voltage current flows through the ignition coil wire to the spark plug. The voltage is now high enough to jump the spark plug gap and a spark is produced. Each spark plug fires on both the compression and exhaust strokes. The spark produced during the exhaust stroke does not affect engine operation because there is no compression or combustible mixture in the cylinder.

MX,24010HJ,7 -19-14APR92



IGNITION CIRCUIT OPERATION

MXC46545

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MXC46545

MX,24010HJ,8 -19-14APR92

CHARGING CIRCUIT OPERATION

A—Power/Battery Charging Circuit
B—Voltage Sensing Circuit
C—Stator Circuit
D—Battery Discharge Lamp Circuit
E—Ground Circuit
F3—Fusible Link
F2—15 Amp Fuse
G1—Battery
G—Stator
ALT—Battery Discharge Lamp
R1—Regulator-Rectifier
W1—Engine Ground

Slide MXC46546

Function:
To maintain battery voltage between 11.8 and 13.2.

Operating Conditions:
The key switch must be in the run position with the engine running for the charging system to operate.

Major Components:
•Battery
•Fusible Link
•Key Switch
•15 Amp fuse
•Regulator/rectifier
•Stator
•Battery Discharge Lamp

Theory of Operation:
The charging system is a permanent magnet and stator design. Charging output is controlled by a regulator/rectifier. A battery discharge lamp warns the operator if the stator stops charging. The battery discharge lamp circuit monitors stator output, not battery voltage.

The power/battery charging circuit provides current to the key switch battery terminal and protects the charging circuit with a fusible link. With the key switch in the run position, current flows from battery positive terminal to fusible link, key switch, 15 amp fuse, and regulator/rectifier. The voltage sensing circuit allows the regulator/rectifier to monitor battery voltage.

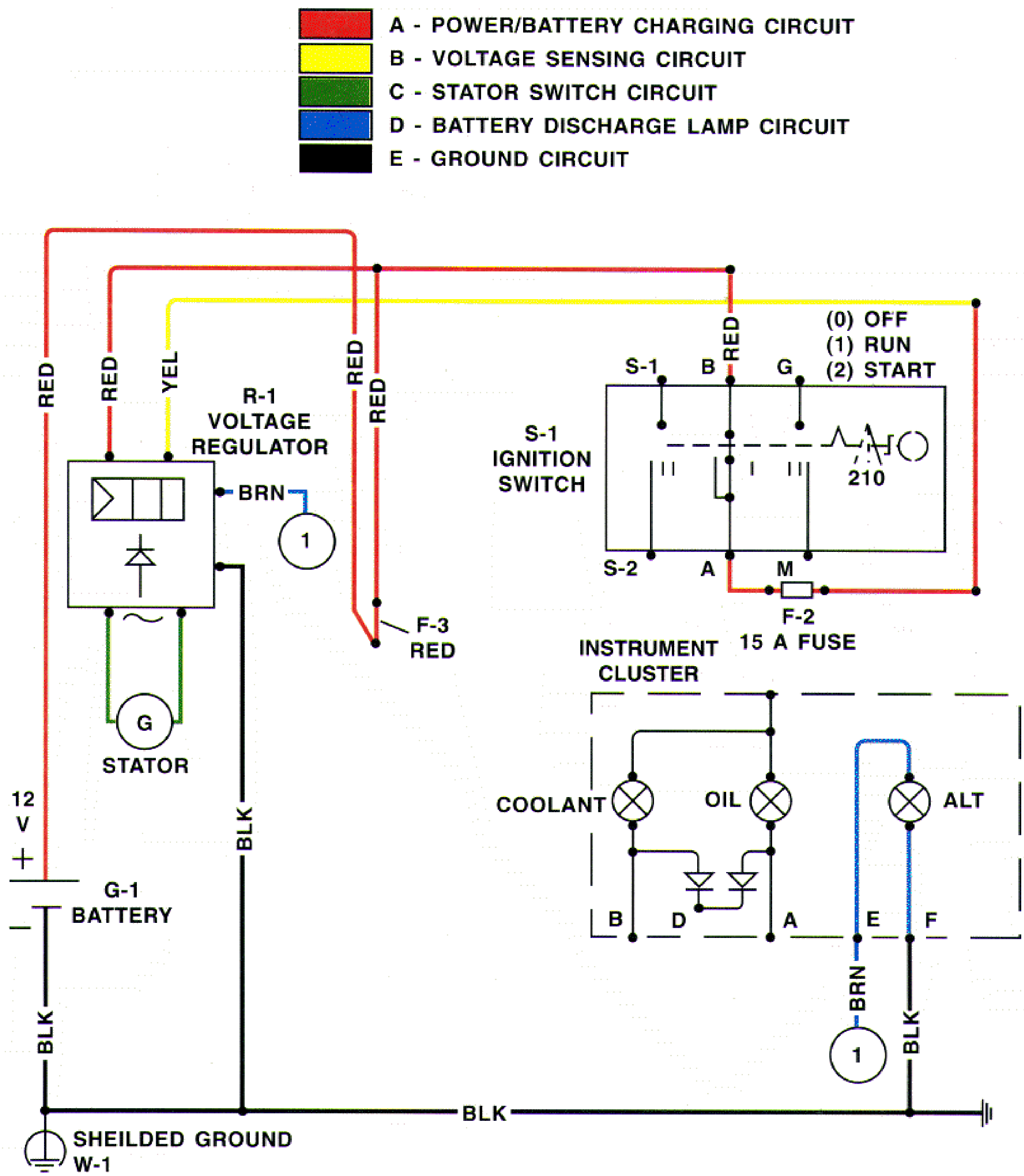
As the flywheel turns, a permanent magnet located in the flywheel induces AC current in the stator windings. The AC current flows to the regulator/rectifier. The regulator/rectifier converts AC current to DC current needed to charge the battery.

If battery voltage is low, the regulator/rectifier allows DC current to flow to the battery to charge it through the power/battery charging circuit. When the battery is fully charged, the regulator stops current flow to the battery.

If stator output current to the regulator/rectifier stops, the regulator/rectifier provides current to the battery discharge lamp to light the lamp.

The ground circuit provides a path to ground for the regulator/rectifier.

MX,24010HJ,9 -19-14APR92



CHARGING CIRCUIT OPERATION

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MX,24010HJ,10 -19-14APR92

LOW OIL PRESSURE LAMP CIRCUIT OPERATION

A—Power Circuit
B—Ground Circuit
S6—Oil Pressure Switch
F3—Fusible Link
F2—15 Amp Fuse
G1—Battery
OIL—Oil Pressure Lamp
S1—Key Switch
W1—Ground Circuit

Slide MXC46547

Function:
To illuminate the low oil pressure lamp and alert the operator that the engine oil pressure is too low for continued operation.

Operating Conditions:
The key switch must be in the run position and the oil pressure switch must be closed (engine off or low oil pressure).

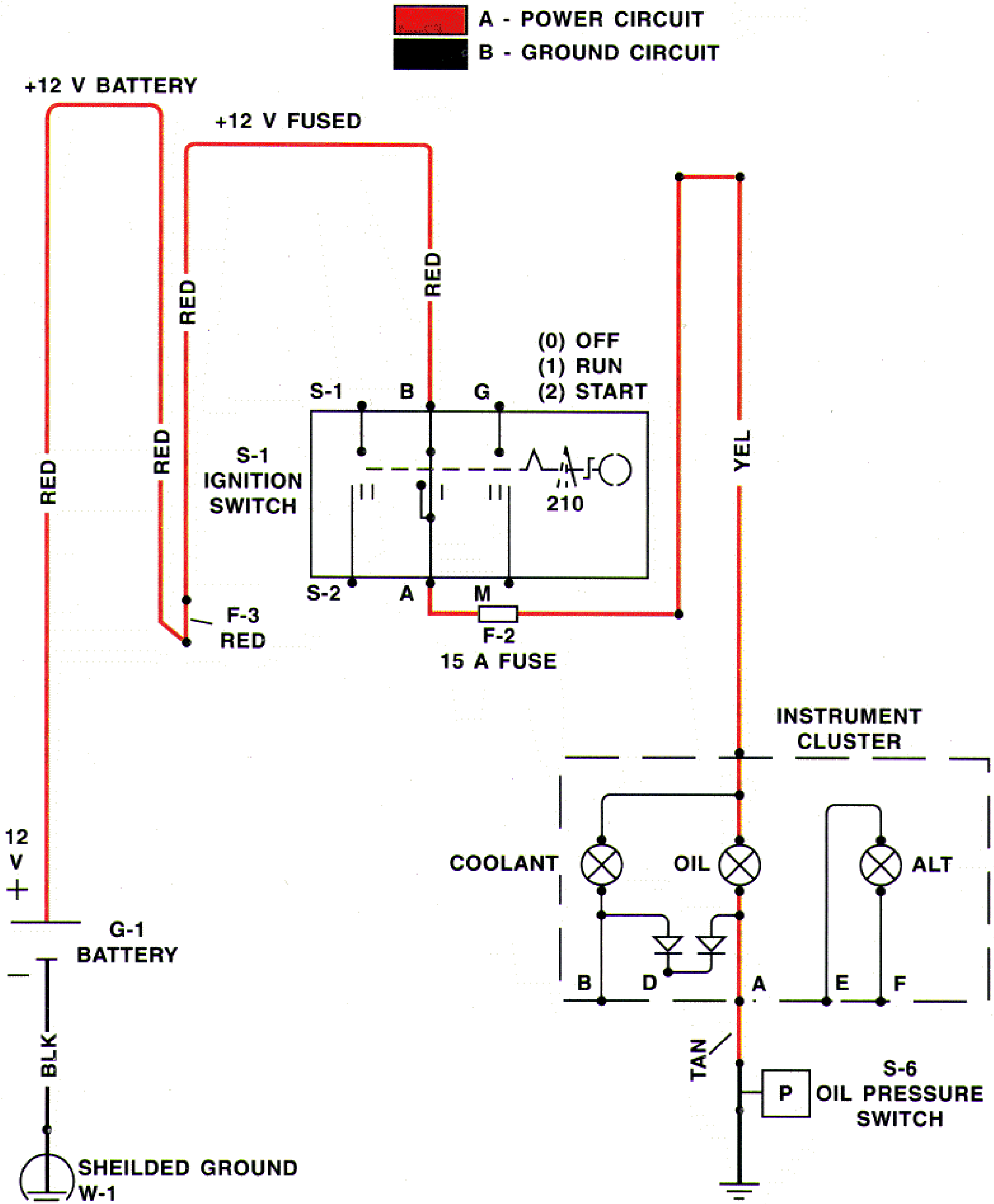
Major Components:
•Battery
•Fusible Link
•Key Switch
•15 Amp Fuse
•Oil Pressure Lamp
•Oil Pressure Switch

Theory of Operation:
The low oil pressure lamp system uses a pressure actuated switch to provide a path to ground for the low oil pressure lamp. The switch is closed when engine oil pressure is at or below 28 kPa (4psi).

The power circuit provides current to the key switch and protects the low oil pressure lamp circuit with a 15 amp fuse. Current flows from the battery positive terminal to the fusible link and key switch battery terminal. With the key switch in the run position, current flows to the 15 amp fuse and the low oil pressure lamp. If the engine is not running or oil pressure is at or below 28 kPa (4 psi), the oil pressure switch will be closed. The oil pressure switch completes the path to ground and the low oil pressure lamp comes on. When the engine starts and oil pressure increases above 28 kPa (4 psi), the oil pressure switch opens, breaking the path to ground and the lamp goes out.

The ground circuit provides a path to ground, through the oil pressure switch, for the low oil pressure lamp.

MX,24010HJ,11 -19-14APR92



MXC46547

LOW OIL PRESSURE LAMP CIRCUIT OPERATION

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MX,24010HJ,12 -19-14APR92

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COOLANT TEMPERATURE LAMP CIRCUIT OPERATION

A—Power Circuit
B—Coolant Temperature Lamp Check Circuit (START)
C—Coolant Temperature Lamp Check Circuit (RUN)
D—Ground Circuit
S5—Coolant Temperature Switch
F1—Fusible Link
F2—15 Amp Fuse
G1—Battery
OIL—Oil Pressure Lamp
CLT—Coolant Temperature Lamp
S1—Key Switch
W1—Ground Circuit

Slide MXC46548

Function:
To illuminate the coolant temperature lamp and alert the operator that the engine temperature is too high for continued operation.

Operating Conditions:
The key switch must be in the run position and the coolant temperature switch must be closed (engine coolant temperature high) or the key switch must be in the start position with the coolant temperature switch open.

Major Components:
•Battery
•Fusible Link
•Key Switch
•15 Amp Fuse
•Oil Pressure Lamp
•Coolant Temperature Lamp
•Coolant Temperature Switch

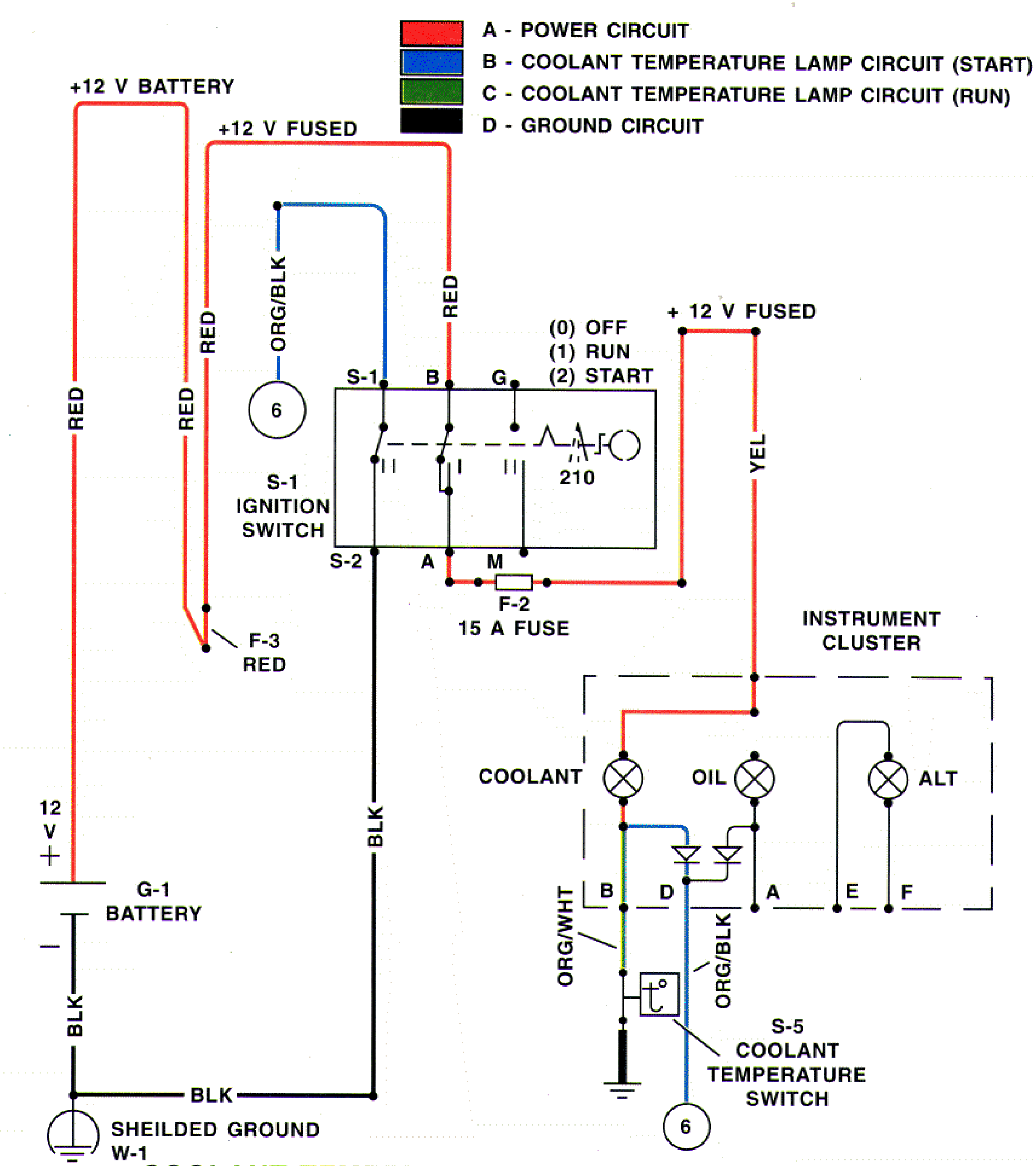
Theory of Operation:
The coolant temperature lamp circuit uses a temperature actuated switch to provide a path to ground for the coolant temperature lamp. The switch is closed when engine coolant temperature is above 111˚C (232˚F).

The power circuit provides current to the key switch and protects the coolant temperature lamp circuit with a 15 amp fuse. Current flows from the battery positive terminal to the fusible link and key switch battery terminal. With the key switch in the run position, current flows to the 15 amp fuse, the low oil pressure lamp and the coolant temperature lamp. If the engine coolant temperature is above 111˚C (232˚F), the coolant temperature switch will be closed. The coolant temperature switch completes the path to ground and the coolant temperature lamp comes on. When the engine coolant temperature is below 111˚C (232˚F), the coolant temperature switch opens, breaking the path to ground and the lamp goes out.

Normally the coolant temperature switch is always open when the engine is operating at normal temperature and the coolant temperature lamp is not on. A coolant temperature lamp check circuit through the key switch is used to verify operation of the coolant temperature lamp. With the key switch in the start position, current from the coolant temperature lamp flows to the key switch terminals S1 and S2 and then to ground lighting the lamp. A diode in the coolant temperature lamp check circuit prevents current flow to the start relay.

The ground circuit provides a path to ground, through the coolant temperature switch, for the coolant temperature lamp.

MX,24010HJ,13 -19-14APR92



COOLANT TEMPERATURE LAMP CIRCUIT OPERATION

MXC46548

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MX,24010HJ,14 -19-14APR92

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:
•Cranking Circuit Test Points
•Ignition Circuit Test Points

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.

MX,24015HJ,1 -19-14APR92

CRANKING CIRCUIT TEST POINTS

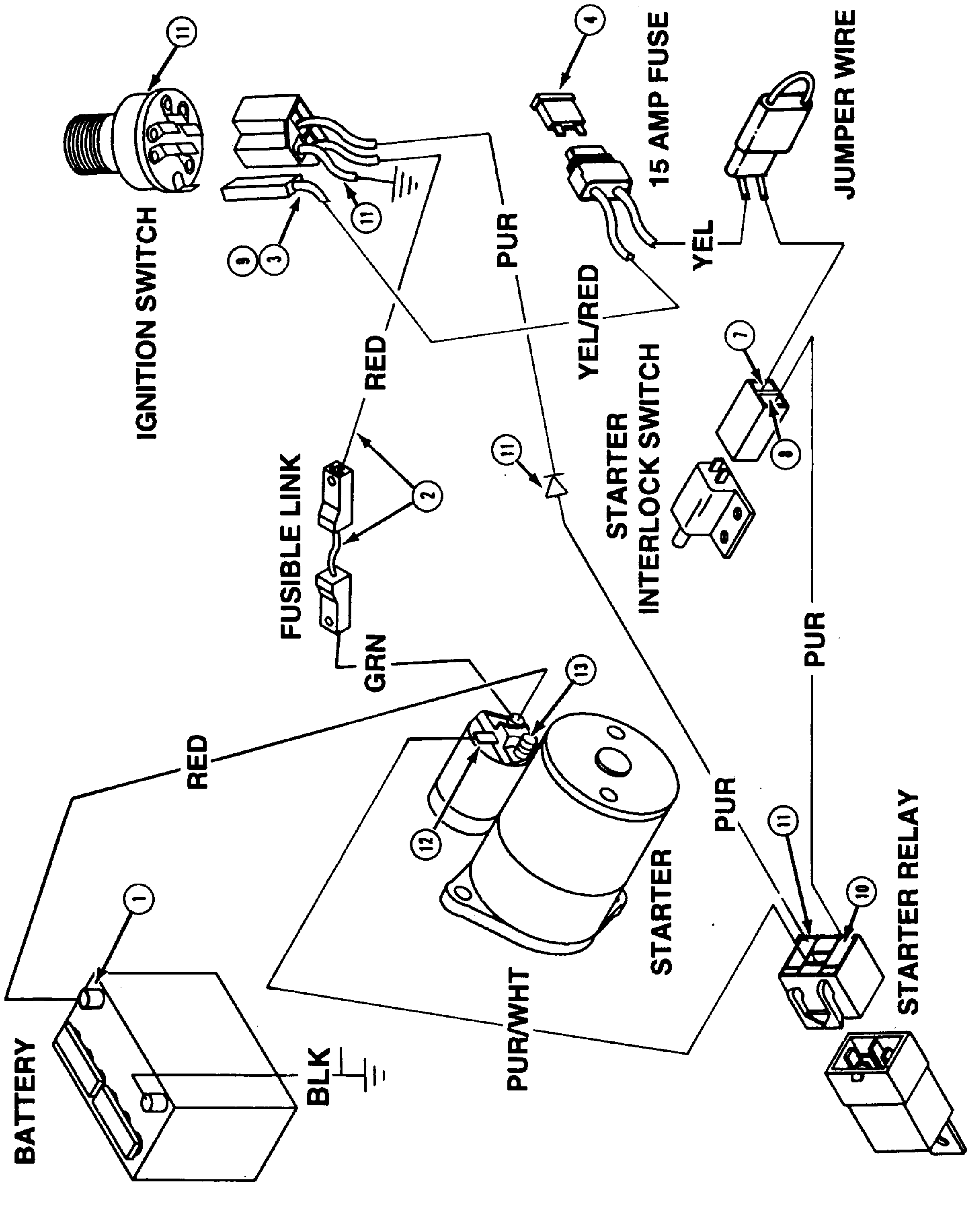
Conditions:
•Fully charged battery
•Transmission in neutral
•Park brake engaged
•Key switch in on position
•Meter negative (—) lead on battery negative (—) terminal
•Meter positive (+) lead on numbered test point

Test Location	Normal	If Not Normal
1. Battery positive terminal	11.8-13.2 volts	test battery
2. Key switch terminal	battery voltage	check battery cable connection, fusible link, and red wire
3. Key switch terminal	battery voltage	replace key switch
4. 15 amp fuse	battery voltage	check 15 amp fuse
5. PTO switch (if installed)	battery voltage	replace yellow wire
6. PTO switch (if installed)	battery voltage	replace PTO switch
7. Starter interlock switch	battery voltage	test purple wire
8. Starter interlock switch	battery voltage	test switch

Conditions:
•key switch in start position

10. Key switch terminal	battery voltage	test switch
11. Starter relay terminal	battery voltage	test purple wire between relay and starter interlock switch
NOTE: Disconnect battery (-) cable for this test.		
12. Starter relay terminal	continuity to ground	test diode, wiring to key switch, key switch and wiring from key switch to ground
NOTE: Reconnect battery (-) cable.		
13. Starter solenoid terminal	battery voltage	test fusible link, wiring to starter relay, starter relay and Pur/Whi wire to starter solenoid
14. Starter motor	turning with 72 amp draw (max)	test solenoid and starter motor

MX,24015HJ,2 -19-14APR92



CRANKING CIRCUIT TEST POINTS

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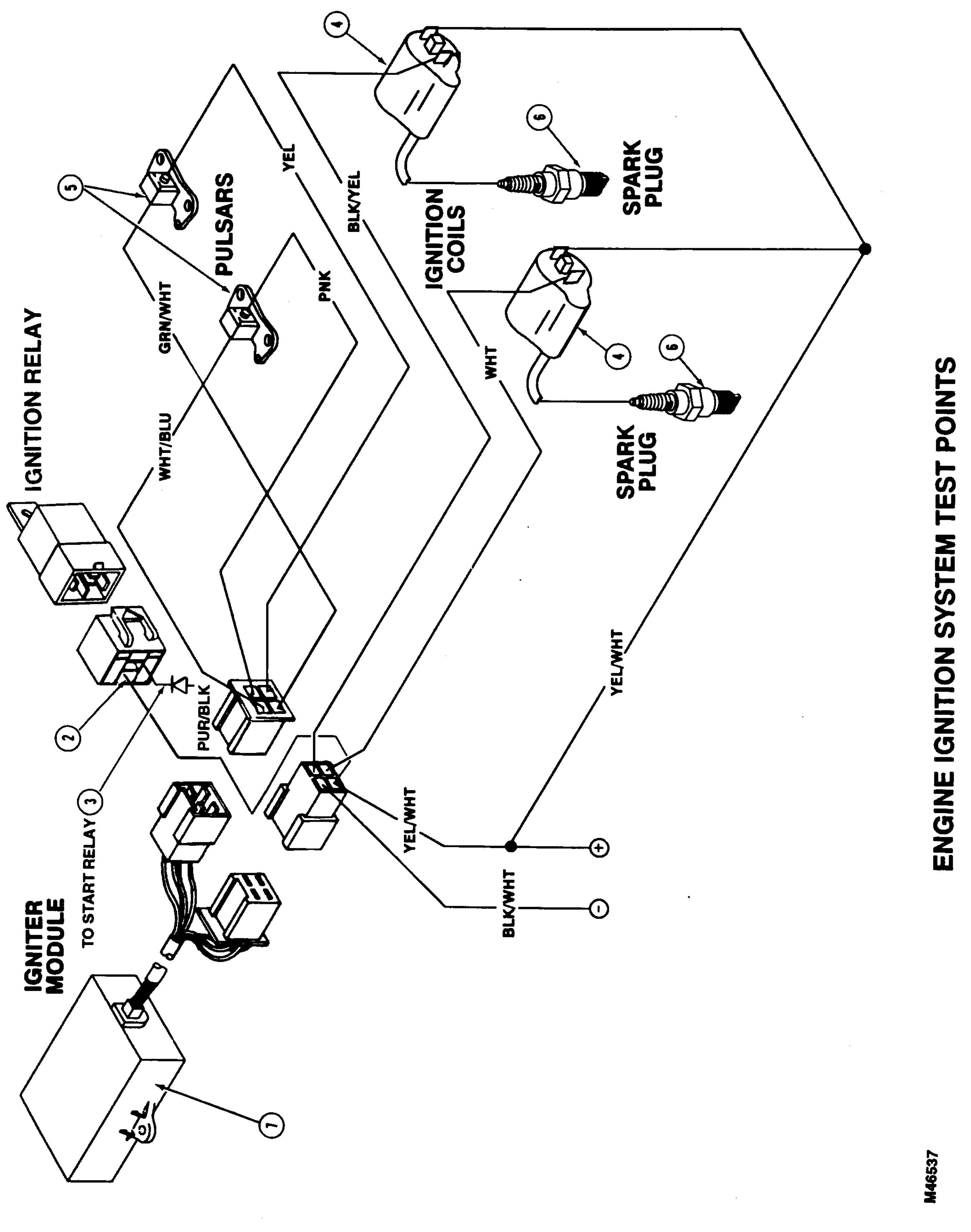
MX,24015HJ,3 -19-14APR92

IGNITION CIRCUIT TEST POINTS

Conditions:
- •Engine cranks
- •Fully charged battery
- •Park brake engaged
- •Operator off seat
- •Key switch in RUN position
- •Meter negative (—) lead on engine ground
- •Meter positive (+) lead on numbered test point

Test Location	Normal	If Not Normal
1. Battery positive terminal	11.8-13.2 volts	test battery
2. Ignition relay	battery voltage	test relay after accomplishing step 3.
3. Ignition relay	battery voltage	check for battery voltage with seat switch depressed, if battery voltage is present only with seat switch depressed, test PUR/BLK wire and diode
4. Ignition coils	primary resistance = 3.4-4.6 ohms secondary resistance = 10.4-15.5 K ohms core-infinite	replace coil
5. Pulsers	resistance = 85-270 ohms	replace pulser
6. Spark Plugs	hot blue spark	replace plugs
7. Ignition module-check resistance or replace ignition module	resistance meets specifications	replace ignition module

MX,24015HJ,4 -19-14APR92



M46537 -19-09MAR92

MX,24015HJ,5 -19-14APR92

COMMON CIRCUIT TEST

1. Using the wiring diagram or schematic, locate and disconnect the component (+) wire at the component.

2. Turn the IGN switch to ON or RUN and turn the component switch to ON. Connect a voltmeter (+) lead to the end of the wire being tested and the (-) lead to ground and record voltage.

3. The voltage being read should be battery voltage

4. If there is no voltage or voltage is low, use the voltmeter to test the wire at several points, working your way towards the component switch.

5. At the point where you find battery voltage, the circuit from there to the battery is good and from that point to the component is defective.

6. Repair or replace the defective wire and repeat the test.

IMPORTANT: Before replacing any component, check ground connections.

MX,24015HJ,6 -19-14APR92

TEST GROUND CIRCUIT

Reason:
To check for opens or poor connections in the ground circuit.

Equipment:
•Ohmmeter or continuity tester

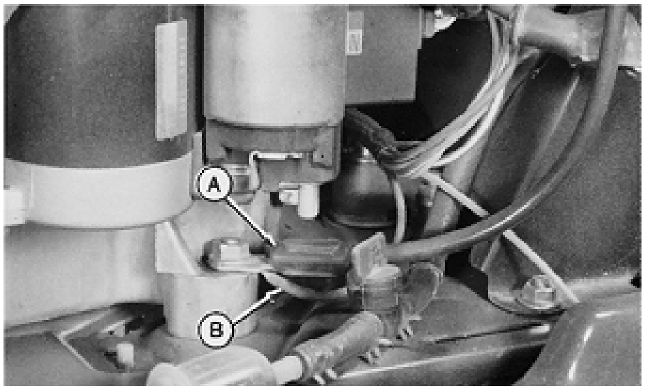
Procedure:
1. Turn key switch to off position.

2. Put transmission in neutral.

3. Connect ohmmeter or continuity tester to negative terminal of battery and ground terminal of circuit or component to be tested.

4. Check for continuity.

Results: If continuity is not indicated, check for open wiring or poor connections.



M45858 -UN-20NOV90

Slide M45858

A—Battery Negative Terminal To Engine Ground
B—Wiring Harness To Engine Ground

MX,24015HJ,7 -19-14APR92

BATTERY TEST

Reason:
To check condition of battery and determine battery voltage.

Equipment:
•Hydrometer
•Voltmeter or JTO5685 Battery Tester

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 was added, charge battery for 20 minutes at 10 amps.

4. Remove surface charge by placing a small load on the battery for 15 seconds.

5. Check specific gravity of each cell with a hydrometer.

6. Check battery voltage with voltmeter or JTO5685 Battery Tester.

Specifications:
•Minimum specific gravity .. 1.225 with less than 50 point variation
•Minimum battery voltage .. 12.4 volts

Results:
•Battery voltage less than 12.4 VDC, charge battery. See Charge Battery in this group.

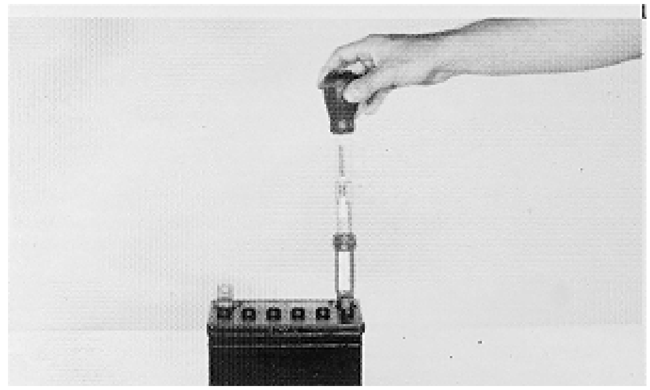
•Battery voltage more than 12.4 VDC, test specific gravity.

•All cells less than 1.175, charge battery at 10 amp rate. See Charge Battery in this group.

•All cells less than 1.225 with less than 50 point variation, charge battery at 10 amp rate. See Charge Battery in this group.

•All cells more than 1.225 with less than 50 point variation, load test battery. See Load Test Battery in this group.

•More than 50 point variation: replace battery.



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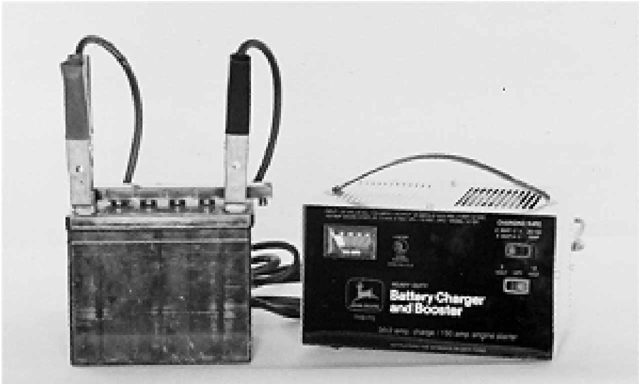
MX,24015HJ,8 -19-14APR92

CHARGE BATTERY



Slide M49598

Reason:
To increase battery charge after battery has been discharged.

Equipment:
•Battery charger (variable rate)

Procedure:

NOTE: See BATTERY TEST in this group before charging battery.

1. Connect variable rate charger to battery.

NOTE: Maximum charge time at boost setting is 10 minutes. Allow additional 5 minutes for each 10 degrees below 70 degrees F.

2. Start charger at slow rate. Increase charge rate one setting at a time. Check charger ammeter after 1 minute at each setting. Maintain 10 amp charge rate. Use boost setting as necessary.

3. Check if battery is accepting a 10 amp charge after 10 minutes at boost setting.

—Battery will not accept 10 amp charge after 10 minutes at boost setting: replace battery.

—Battery is accepting 10 amp charge after 10 minutes at boost setting, and battery did not need water: go to steps 6 and 7.

—Battery is accepting 10 amp charge after 10 minutes at boost setting, but battery did need water or all cells were below 1.175: go to steps 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.

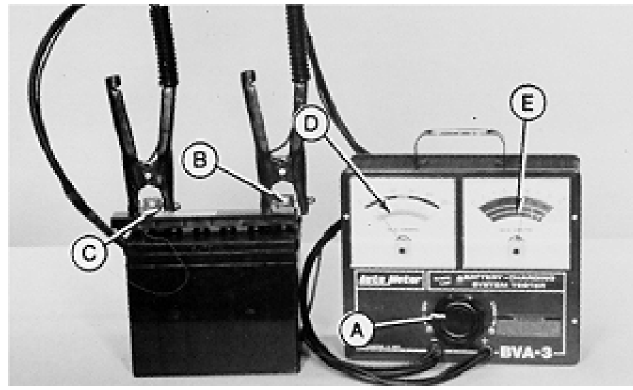
NOTE: If battery was discharged at slow or unknown rate, charge at 10—15 amps for 6—12 hours. (Maintenance-free battery: 12—24 hours.) If battery was discharged at fast rate, charge at 20—25 amps for 2—4 hours. (Maintenance-free battery: 4—8 hours.)

6. Continue charging battery until specific gravity is 1.230-1.265 points.

7. Load test battery. (See this group.)

MX,24015HJ,9 -19-14APR92

LOAD TEST BATTERY



Slide M49597

Reason:
To check condition of battery under load.

Equipment:
•JTO5685 Battery Tester

Connections:
1. Turn load knob (A) of tester counter-clockwise to off.

2. Connect tester positive cable (B) to battery positive terminal.

3. Connect tester negative cable (C) to battery negative terminal.

Procedure:
1. Turn load knob of tester clockwise until amperage reading (D) is equal to:

A. Cold cranking amperage rating (use blue scale).

—OR—

B. Three times ampere hour rating (use black scale).

2. Hold for 15 seconds and turn load knob of tester off.

3. Repeat procedure steps 1 and 2 from above and read condition of battery at DC Volts scale (E).

Results:
•If the battery does not pass the test and has not been charged, charge battery and retest. See Charge Battery in this group.

•If the battery does not pass the test and has been charged, replace the battery.

MX,24015HJ,10 -19-14APR92

REGULATED AMPERAGE TEST

Reason:
To determine charging output of the regulator/rectifier.

Equipment:
•JTO5712 Current Gun
•JTO5685 Battery Tester

Connections:
1. Put JTO5712 Current Gun over SMALL RED WIRE. Set Current Gun for DC current.

2 Turn load knob (A) fully out (counterclockwise). Connect JTO5685 Battery Tester to battery.

Procedure:

IMPORTANT: Perform this test quickly to prevent damage to battery tester. DO NOT apply full load to battery for more than 10 seconds.

1. Start and run engine at full throttle.

2. Turn load knob in until voltage read on the tester voltage scale is 11 volts and read amperage.

Specifications:
•Minimum regulated amperage .. 15 amps
•Engine speed .. 3400 rpm

Results:
•If reading does not meet specifications, test UNREGULATED VOLTAGE OUTPUT in this group.

•If unregulated voltage output meets the specifications and voltage and ground to the regulator/rectifier is verified, replace the regulator/rectifier

M45852 -UN-20NOV90

Slide M45852

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MX,24015HJ,11 -19-14APR92

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REGULATED VOLTAGE TEST

Reason:
To determine regulated voltage output of the regulator/rectifier.

Equipment:
•Voltmeter

Connections:
1. Remove surface charge from battery by placing a small load on the battery for 15 seconds.

2. Set voltmeter for 25 or 50 DC volts scale.

3. Connect meter red lead to positive battery terminal.

4. Connect meter black lead to negative battery terminal.

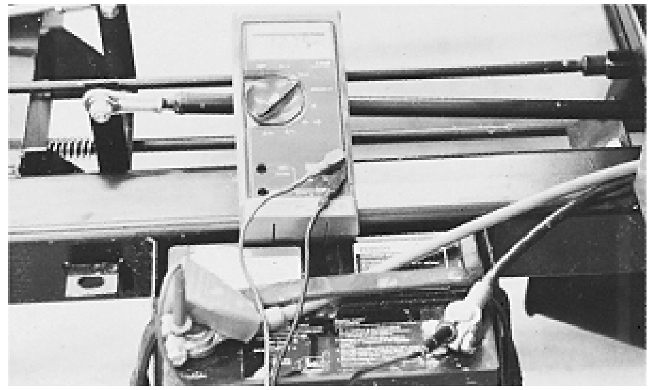
Procedure:
1. Start and run engine at 3400 rpm.

2. Read meter several times during 5 minutes of running time.

Specifications:
•Regulated voltage .. 12.2 - 14.7 VDC at 3400 rpm

Results:
•If the DC voltage stays below the minimum specification, test Unregulated Voltage Output in this group.

•If the DC voltage goes above the maximum specification, replace the regulator.


M46653 -UN-27MAR92

Slide M46653

MX,24015HJ,12 -19-14APR92

UNREGULATED VOLTAGE OUTPUT TEST

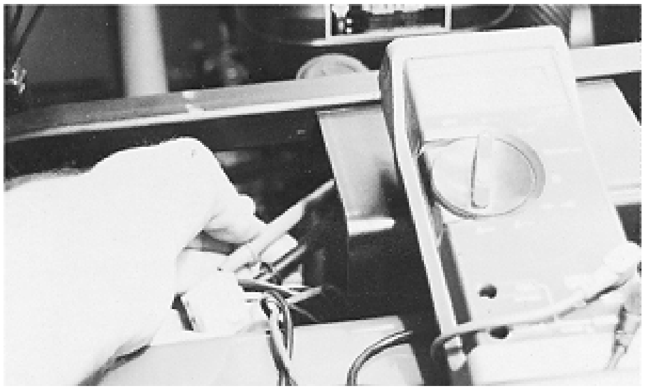
Reason:
To measure stator voltage output to determine stator condition.

Equipment:
•Voltmeter

Connections:
1. Disconnect regulator/rectifier connector.

2. Set voltmeter to AC voltage.

3. Connect meter across stator wires, Red meter lead to BRN/YEL wire and Black lead to BRN/WHT lead of engine connector.



M46654 -UN-27MAR92

Slide M46654

Procedure:
1. Start and run engine at fast idle.

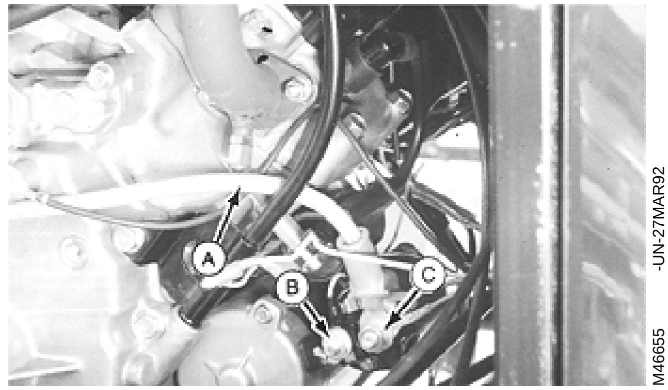
2. Measure stator voltage.

Specifications:
•Engine speed .. 3400 rpm
•Minimum stator voltage .. 26

Results:
•If reading is less than specifications, check flywheel magnet and then replace stator.

MX,24015HJ,13 -19-14APR92

TEST STARTER SOLENOID



Slide No. M46655

Reason:
To determine if starter solenoid or starter motor is defective.

Connections:
1. Move key switch to off position.

2. Engage park brake.

3. Disconnect and ground spark plug leads.

4. Disconnect red wire from starter solenoid terminal.

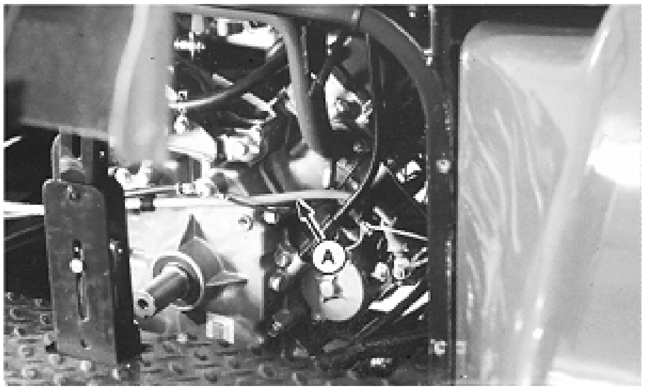
Procedure:
1. Test cranking circuit to determine if voltage is present at starter solenoid.

2. Remove red and black rubber boots from terminals (B and C).

3. Connect jumper wire between starter solenoid large terminals (B and C).
—Starter runs: See CTM 39 to test solenoid or replace solenoid.
—Starter does not run: Check battery cable (A), then replace starter. Also check battery ground cable.

MX,24015HJ,14 -19-14APR92

TEST STARTER AMP DRAW



Slide M46656

Reason:
To determine the amperage required to crank the engine and check starter motor operation under load.

Equipment:
•JTO5712 Current Gun

Connections:
1. Put transmission in neutral. Engage park brake.

2. Test system ground connections and battery.

3. Disconnect and ground spark plug leads.

Procedure: 1. Install current gun on battery positive lead (A).

2. Turn ignition switch to the START position.

3. Read amperage on meter.

Specifications:
•Maximum starter amp draw ..72 amps

Results:
•If amperage is above specification, test Starter No-Load RPM and Amperage in this group to determine if starter is binding or damaged. If starter is good, check internal engine components, or PTO drive for binding or damage.

MX,24015HJ,15 -19-14APR92

TEST STARTER NO-LOAD AMPERAGE

Reason:
To determine if starter has excessive amperage draw under no-load.

Equipment:
•JTO5712 Current Gun

Procedure:

IMPORTANT: Complete this test in 20 seconds or less to prevent starter damage.

NOTE: Check that battery is fully charged and of proper size to ensure accuracy of test.

1. Attach current gun to positive battery cable (A).

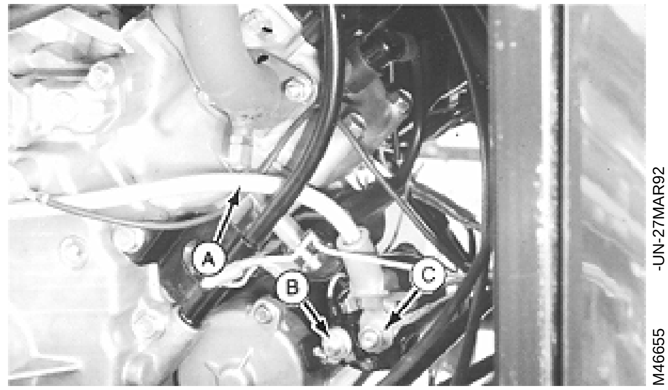
2. Connect a jumper cable to (+) battery terminal at solenoid (C).

3. Connect opposite jumper cable lead to starter motor lead (B).

4. Measure starter amperage.

Specifications:
•Maximum starter amperage .. 50 amps

Results:
•If amperage is out of specification, check for binding or seized bearings, sticking brushes, dirty or worn commutator. Repair or replace starter.



Slide M46655

MX,24015HJ,16 -19-14APR92

PULSER COIL TEST

Reason:
To determine condition of pulser coil windings and verify pulser coil wire continuity.

Equipment:
•Ohmmeter

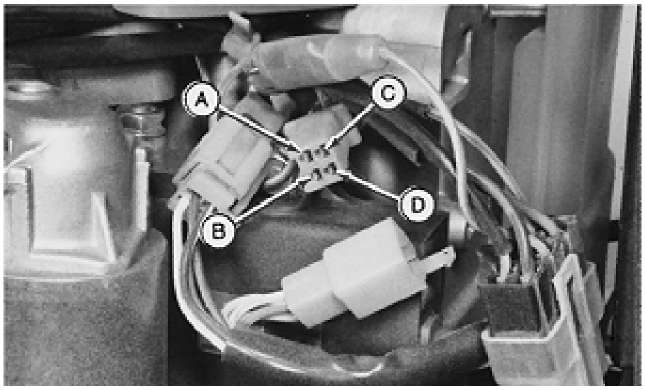
Procedure:
1. Turn key switch to off position.

2. Disconnect 4-pin pulser connector.

3. Measure resistance between white/blue wire (A) and pink wire (B), then green/white wire (C) and yellow wire (D) at pulser side of connector.

Specifications:
•Pulser coil resistance ..85-270 ohms

Results:
•If resistance does not meet specifications, replace the pulser coil.



M45715 -UN-20NOV90

Slide M45715

MX,24015HJ,17 -19-14APR92

TEST IGNITION COIL

Reason:
To determine condition of ignition coil windings.

Equipment:
•Ohmmeter

Procedure:
1. Put transmission in neutral. Put key switch in off position.

2. Remove spark plug cap from spark plug wire.

3. Disconnect wires from ignition coil positive and negative terminals.

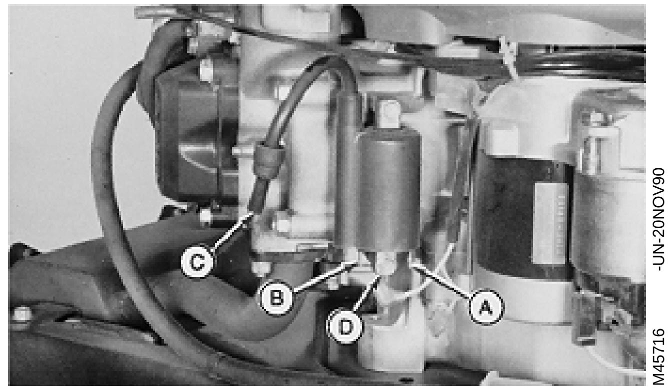
4. Measure primary coil resistance between positive (wide) terminal (A) and negative (narrow) terminal (B).

5. Measure secondary coil resistance between positive terminal (A) and spark plug wire (C).

6. Measure core insulation resistance between positive terminal (A) and core (D) and also between spark plug wire (C) and core (D).

Specifications:
•Primary coil resistance .. 3.4-4.6 ohms
•Secondary coil resistance ..10.4-15.5 K ohms
•Core insulation resistance .. infinite (no continuity)

Results:
•If resistance does not meet specifications, replace the ignition coil.



Slide M45716

MX,24015HJ,18 -19-14APR92

TEST IGNITION MODULE

Reason:
To determine if ignition module is defective.

Procedure:
The ignition module is very sensitive to the type of meter used to check resistance. Due to variations in the meters, the best way to determine if the ignition module is good is to replace the questionable ignition module with a known good module.

Results:
•If the new ignition module does not solve the problem, check the other ignition components.

MX,24015HJ,19 -19-14APR92

SPARK PLUG CAP TEST

M48364 -UN-25OCT89

Slide M48364

Reason:
To determine if spark plug cap is defective.

Equipment:
•Ohmmeter

Procedure:
1. Turn key switch off. Put transmission in neutral.

2. Disconnect spark plug cap.

3. Measure resistance across spark plug cap terminals. Resistance should be about the same as marked on the spark plug cap.

Specifications:
•Spark plug cap resistance .. marked on cap

Results:
•If resistance does not meet specification, replace spark plug cap.

MX,24015HJ,20 -19-14APR92

ADJUST SPARK PLUG GAP

Reason:
To maintain the correct gap between the center electrode and the tab needed to produce a good spark.

Equipment:
•0.76 mm (0.030 in.) feeler gauge

Procedure:

IMPORTANT: Do not clean spark plug with sand paper or abrasives. Engine scoring can result.

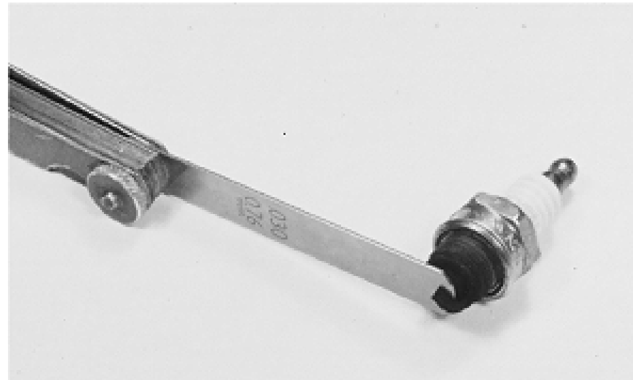
1. Scrap or wire brush deposits from spark plug.

2. Inspect spark plug for:
—Cracked porcelain.
—Pitted or damaged electrodes.

3. Check spark plug gap (A) using a feeler gauge. Set gap to 0.76 mm (0.030 in.).

4. Install and tighten spark plug to 25 N·m (18 lb-ft).

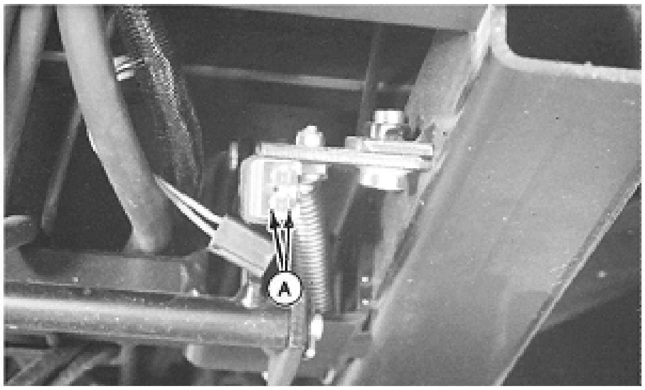
Specifications:
•Spark plug gap .. 0.7 mm (0.028 in.)
•Spark plug torque .. 14 N·m (12 lb-ft)



Slide M48365

MX,24015HJ,21 -19-14APR92

TEST STARTER INTERLOCK SWITCH



Slide M46680

Reason:
To test for continuity of the starter interlock switch when the brake pedal is depressed or park brake is engaged.

Equipment:
•Ohmmeter or continuity tester

Connections:
1. Turn key switch off.

2. Disconnect starter interlock switch connector.

3. Depress brake pedal.

Procedure:
1. Check continuity across terminals (A).

2. Release brake pedal.

3. Check continuity across terminals.

Specifications:
•Switch should have continuity only when the brake pedal is depressed.

Results:
•If the continuity is not correct, replace switch.
•Also check brake linkage for wear at point of switch contact.

Connections:
•Key switch off
•Park brake engaged

Procedure:
1. Check continuity across terminals.

Specifications:
•Switch should have continuity with the parking brake engaged.

Results:
•If no continuity exists, replace switch.

MX,24015HJ,22 -19-14APR92

TEST SEAT SWITCH

Reason:
To test the seat switch for continuity with the operator on the seat (plunger depressed).

Equipment:
•Ohmmeter or continuity tester

Connections:
1. Put transmission in neutral. Engage park brake.

2. Put key switch in the off position.

3. Disconnect seat switch connector.

Procedure:
1. Depress the seat cushion.

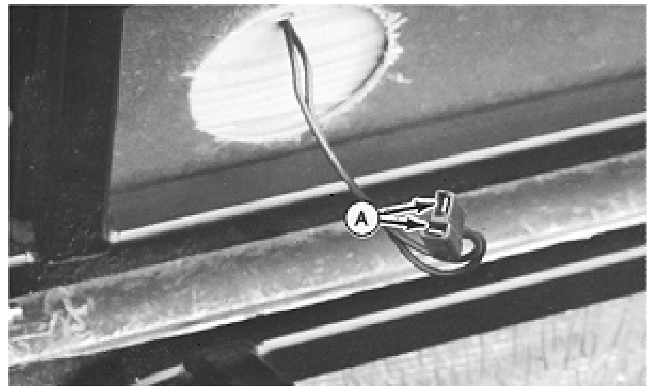
2. Check continuity across connector terminals (A). There should be continuity.

3. Release the seat cushion.

4. Check continuity across connector terminals. There should be no continuity.

Specifications:
•Seat cushion depressed .. continuity
•Seat cushion released .. no continuity

Results:
•If the seat switch has no continuity with pressure applied to the seat cushion, replace the seat cushion. The seat switch cannot be removed for servicing.



M46681 -UN-27MAR92

Slide M46681

MX,24015HJ,23 -19-14APR92

TEST KEY SWITCH

Reason:
•To test operation of key switch.

Equipment:
•Ohmmeter or Continuity Tester

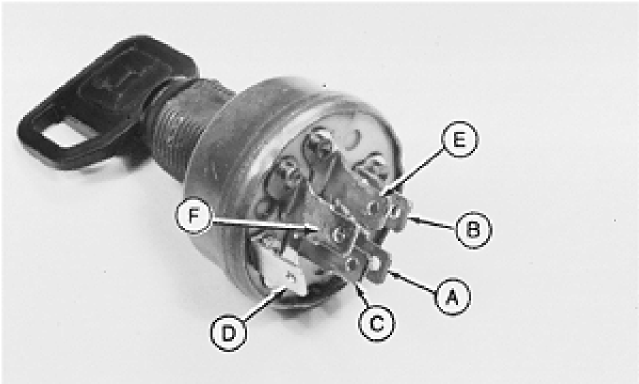
Procedure:
1. Disconnect key switch connector.

2. Test switch continuity in “OFF”, “RUN” and “START” positions, using an ohmmeter.

KEY SWITCH CONTINUITY

SWITCH POSITION	TERMINAL CONTINUITY
OFF	M—G (A and B)
RUN	B—A (C and D)
START	B—A (C and D)
	S1—S2 (E and F)

Results:
•If continuity is not correct, replace switch.



Slide M48366

MX,24015FH,A32 -19-21NOV90

TEST RELAY

Reason:
To test operation of relay.

Equipment:
•Ohmmeter or Continuity Tester

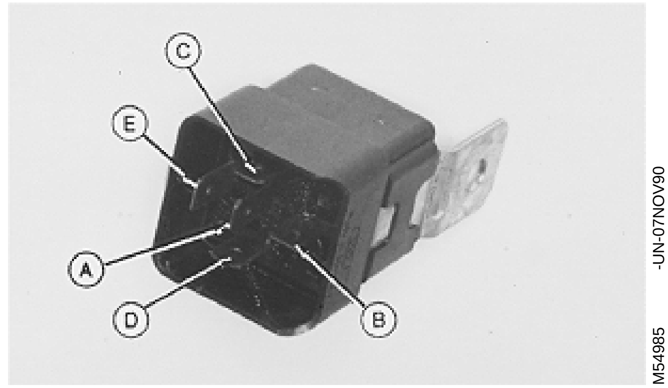
Connections:
Disconnect relay from connector.

Procedure:
1. Check for continuity between terminals 87A and 30 (A and B), and 85 and 86 (C and D).

2. Check for no continuity between terminals 87 and 30 (E and B).

3. Connect a jumper wire from battery positive (+) terminal to relay terminal 85. Connect a jumper wire from relay terminal 86 to ground (-). Continuity should now exist between terminals 87 and 30.

Results:
•If continuity is not correct, replace relay.



Slide M54985

A—Terminal 87A
B—Terminal 30
C—Terminal 85
D—Terminal 86
E—Terminal 87

MX,24015FH,A36 -19-21NOV90

TEST DIODE

Reason:
To determine condition of diode.

Equipment:
•Ohmmeter or Continuity Tester or Diode Tester

Procedure:
1. Connect ohmmeter to each end of diode and check for continuity.

2. Reverse leads and check for continuity.

Results:
•Diode should have continuity in one direction only. If continuity is not correct, replace diode.

M48387 -UN-25OCT89

Slide M48387

M48388 -UN-25OCT89

Slide M48388

MX,24015FH,A38 -19-21NOV90

240
15
26

OIL PRESSURE INDICATOR TEST

Reason:
To determine what component in the oil pressure indicating system is malfunctioning.

Conditions:
•Engine Oil Pressure Test, Section 220, Group 15 has been accomplished.
•Engine Low Oil Pressure Light stays on when engine is operating.

Connections:
1. Disconnect electrical lead (A) at oil pressure sender (B).

Procedure:
1. Turn ignition switch to the RUN position.

Specifications:
•Oil pressure light should not be on.

Results:
•If light stays on, inspect wiring to the indicator for a short to ground.
•If light goes out, replace oil pressure switch.

Conditions:
•Engine Low Oil Pressure Light does not come on when cranking engine.

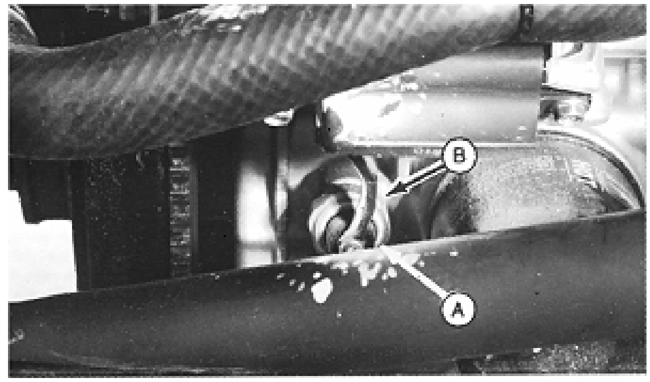
Connections:
1. Disconnect electrical lead (A) at oil pressure sender (B).

2. Use a jumper wire to ground electrical lead to chassis.

Procedure:
1. Turn ignition switch to RUN position.

Specifications:
•Oil pressure light should be on.

Results:
•If light comes on, replace sender.
•If light does not come on, test indicator bulb and wire to indicator for an open circuit or corroded connection.

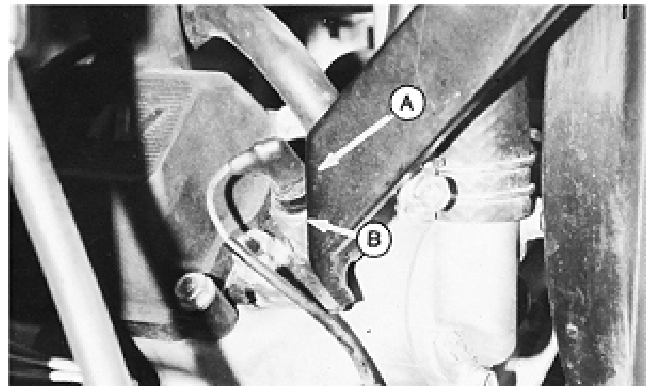


M46602 -UN-27MAR92

Slide M46602

MX,24015HJ,24 -19-14APR92

COOLANT TEMPERATURE INDICATOR TEST



M46579 -UN-27MAR92

Slide M46579

Reason:
To determine what component in the coolant over temperature indicating system is malfunctioning.

Conditions:
•Coolant over temperature indicator light stays on when engine is cold.

Connections:
1. Remove electrical connector (A) from temperature sensor (B).

Procedure:
1. Turn ignition switch to run position.

Specifications:
•Light should not be on.

Results:
•If light stays on, inspect wire to indicator for a short to ground.
•If light goes out, replace sender.

Conditions:
•Coolant over temperature light does not come on with ignition switch in start position.

Connections:
1. Connect voltmeter (-) lead to chassis ground.

2. Disconnect starter interlock switch.

Procedure:
1. Turn ignition switch to START position.

2. Test ORG/BLK wire at ignition switch for battery voltage.

Specifications:
•Battery voltage should be indicated on voltmeter.

Results:
•No voltage, replace bulb and test again.
•No voltage after replacing bulb, test wiring to indicator bulb and diode at indicator.

MX,24015HJ,25 -19-14APR92

TACHOMETER FAILURE

Reason:
To determine cause of failure or incorrect indication.

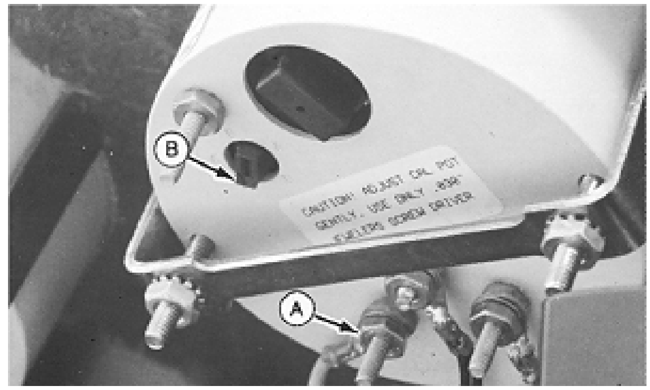
Condition:
•Engine running

Connections:
1. Remove wire connector from terminal “S” (A) on rear of tachometer.

2. Connect a hand-held tachometer to the wire that was removed from terminal “S”.

Procedure:
1. Start engine and read RPM.

Results:
•If no RPM indication, remove tachometer connection at ignition coil and test for continuity of wiring to the indicator.
•If RPM indication is good, check tachometer ground connection, if ground is good, replace tachometer.
•If the hand-held tachometer RPM indication differs from the machine tachometer, ensure the selector switch is set at “4” (B). Replace the tachometer if selector switch setting is correct and tachometer reads improperly.



Slide M46679

MX,24015HJ,26 -19-14APR92

SCHEMATICS INFORMATION

The wiring schematics are drawn without switch or relay connections made. Starting from the battery, follow the current flow and draw in switch connections as needed to energize the circuit. The flow is then, as much as possible, from top to bottom through each circuit and component.

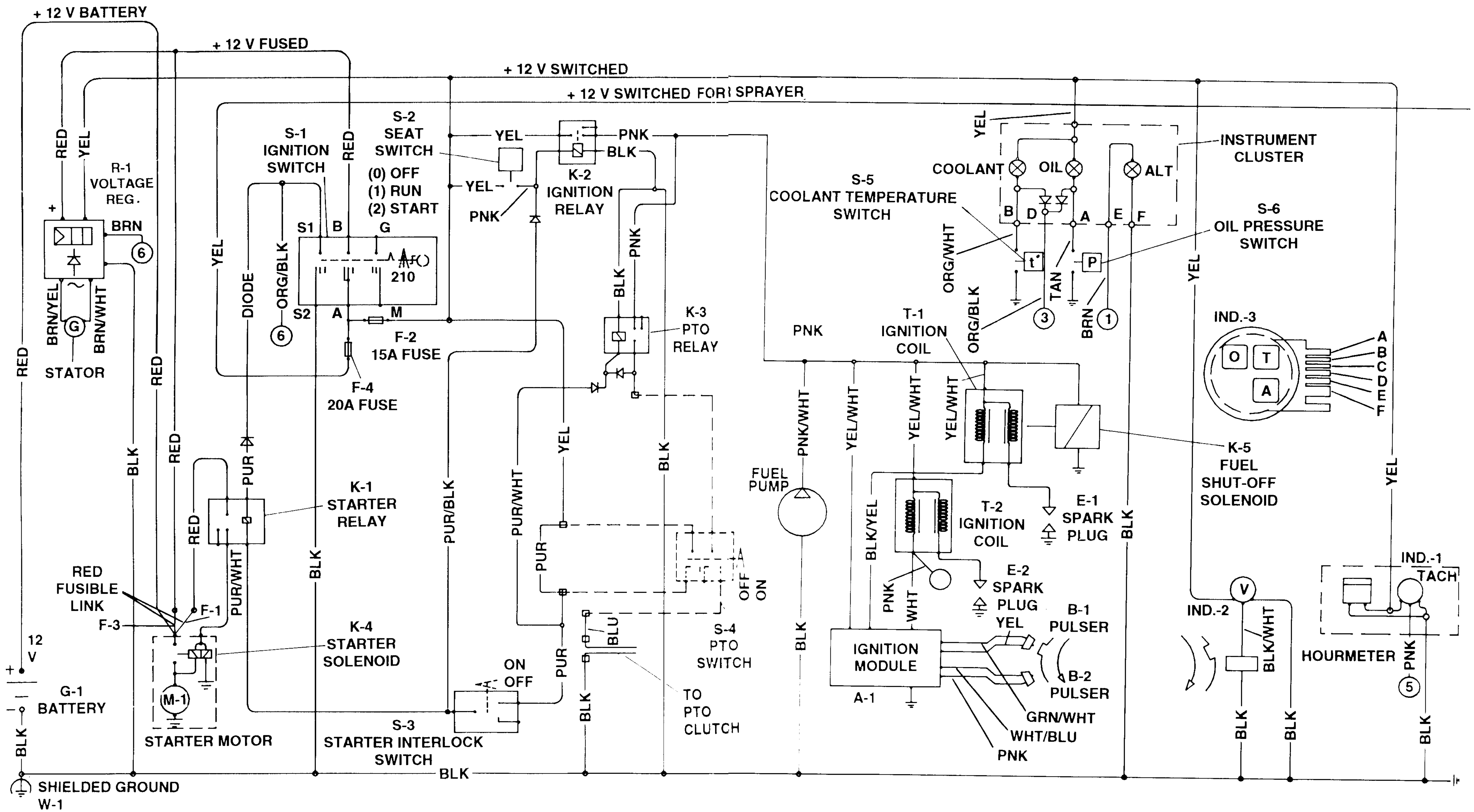
MX,24020HJ,1 -19-14APR92

ELECTRICAL SCHEMATIC LEGEND

A1—Ignition Module
B1—Left Pulser Coil
B2—Right Pulser Coil
S6—Oil Pressure Switch
S5—Coolant Temperature Switch
E1—Left Spark Plug
E2—Right Spark Plug
F1—Fusible Link
F3—Fusible Link
F2—15 Amp Fuse
F4—20 Amp Fuse
G1—Battery
G—Stator
A—Battery Discharge Lamp
O—Oil Pressure Lamp
T—Coolant Temperature Lamp
ID1—Tachometer
ID2—Speedometer
ID3—Oil Pressure, Alternator, Coolant Temperature Indicator
K1—Start relay
K2—Ignition Relay
K3—PTO Relay
K4—Starter Solenoid
K5—Fuel Shutoff Solenoid
M1—Starting Motor
R1—Regulator/Rectifier
S1—Key Switch
S2—Seat Switch
S4—PTO Switch
S3—Starter Interlock Switch
T1—Left Ignition Coil
T2—Right Ignition Coil
W1—Engine Ground

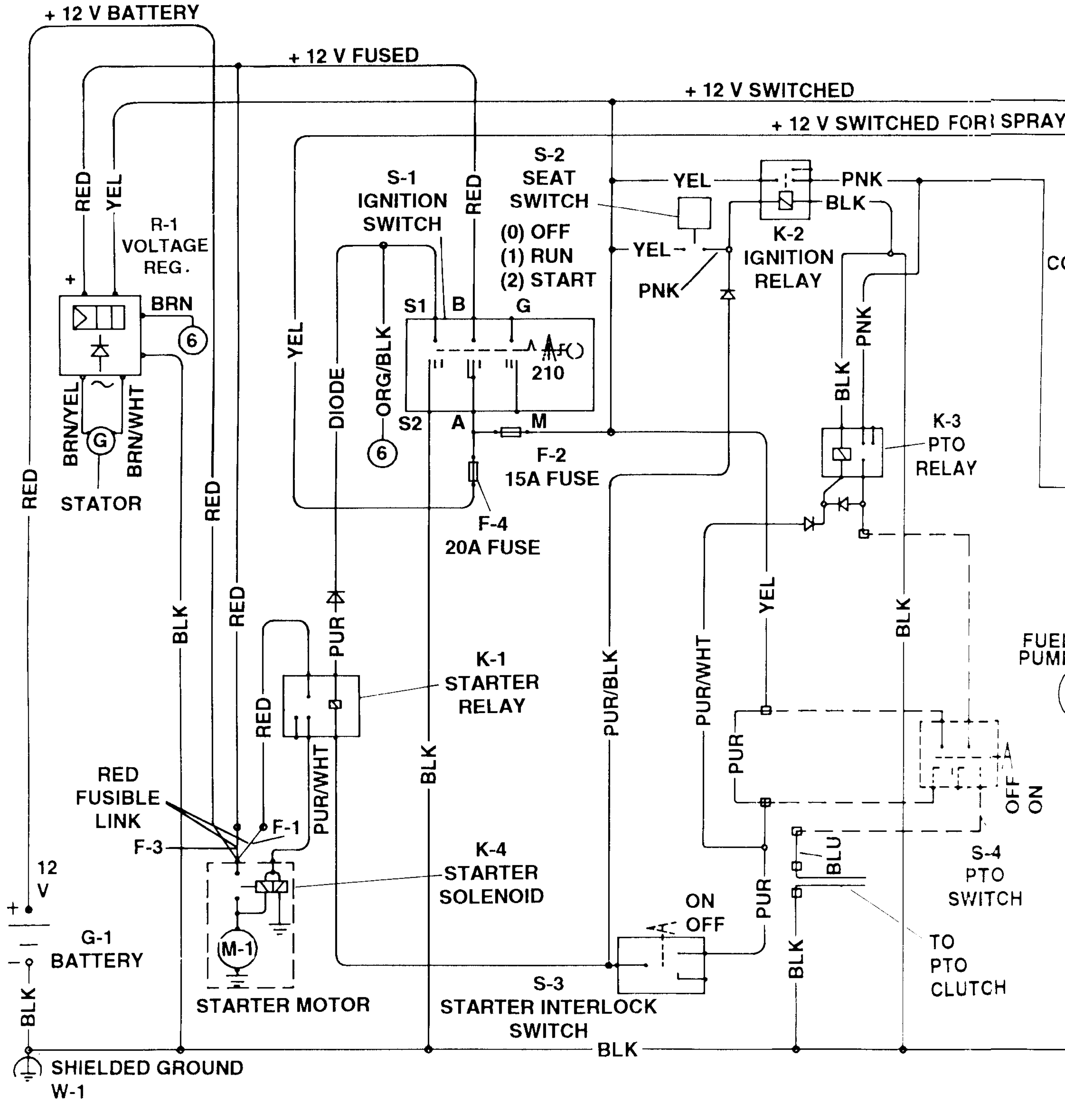
Slide M46543

MX,24020HJ,2 -19-14APR92



M46543

1800 UV ELECTRICAL SCHEMATIC



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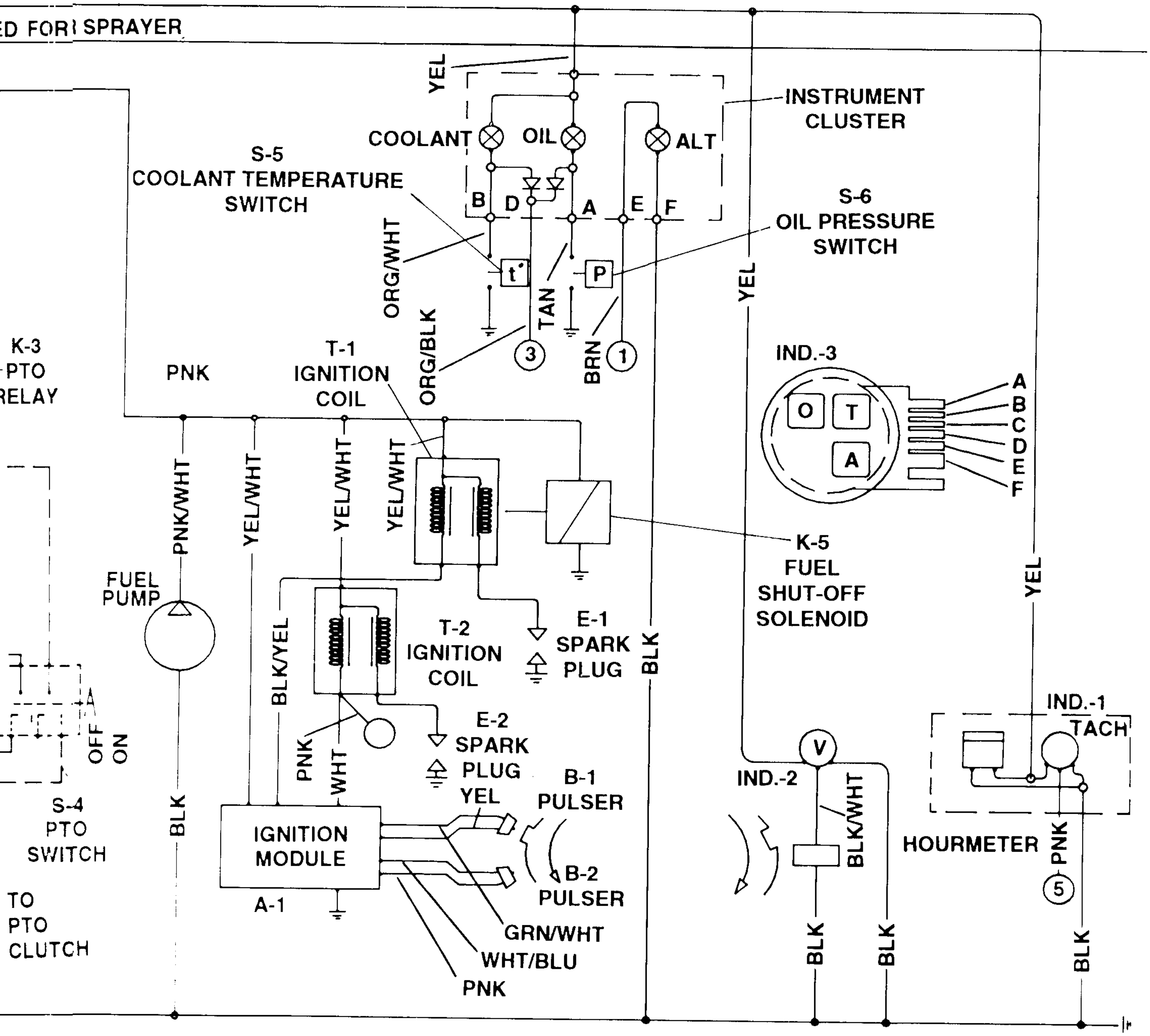
1800 UV ELECTRICAL



LECTRICAL SCHEMATIC

Section 250
POWER TRAIN OPERATION, TESTS, AND ADJUSTMENTS

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COMPONENT LOCATION INFORMATION

This group contains component location drawings for the following power train components:
•Power Train System

Use the drawings when diagnosing a power train problem and to help locate the components to be tested.

MX,25005HJ,1 -19-14APR92

POWER TRAIN COMPONENT LOCATION

A—Hydrostatic Transmission
B—Hydraulic Fluid Level Sight Gauge
C—Differential
D—Axle Housing
E—Control Shaft
F—Transmission Oil Filter
G—Drive Shaft
H—Charge Pump

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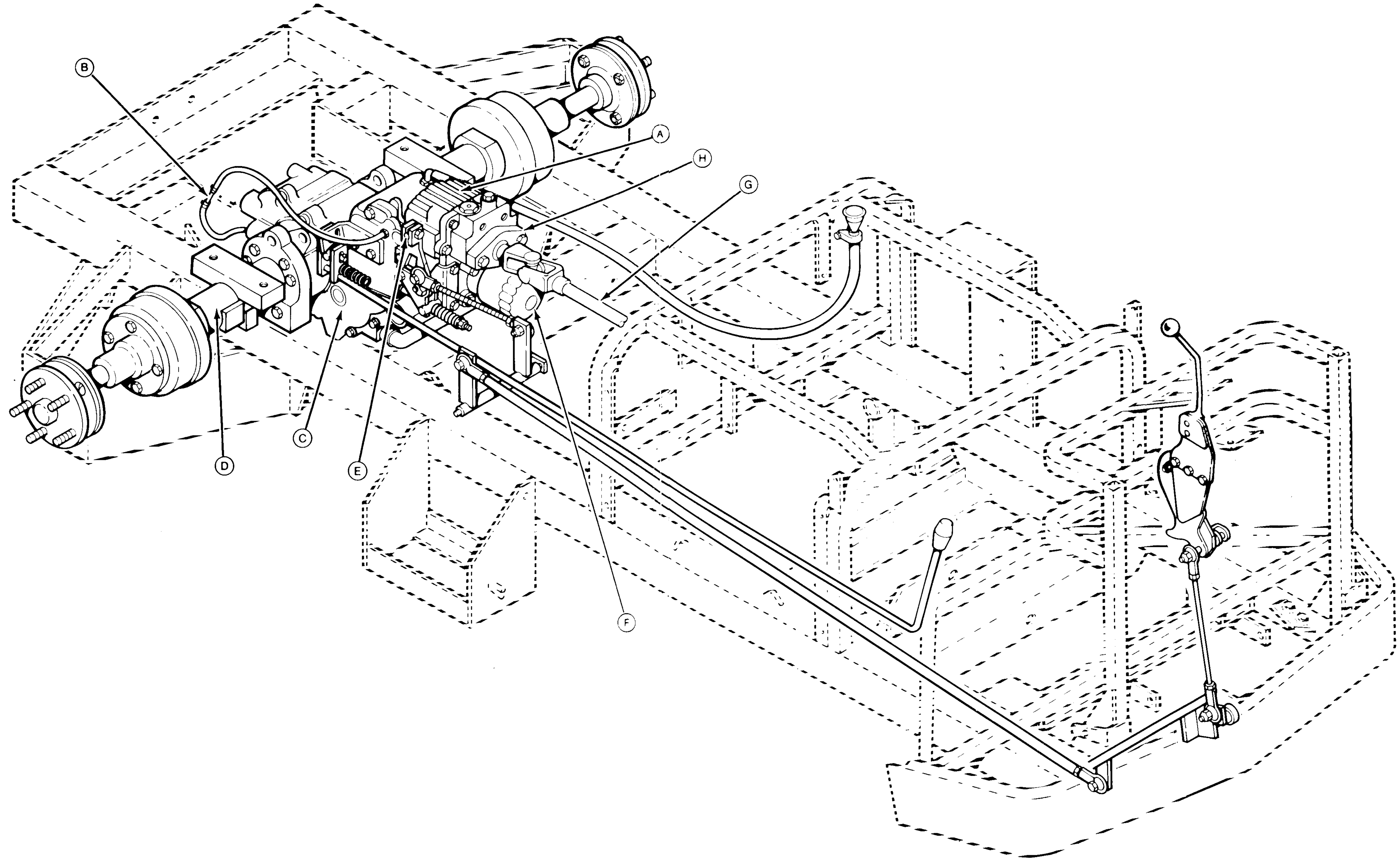
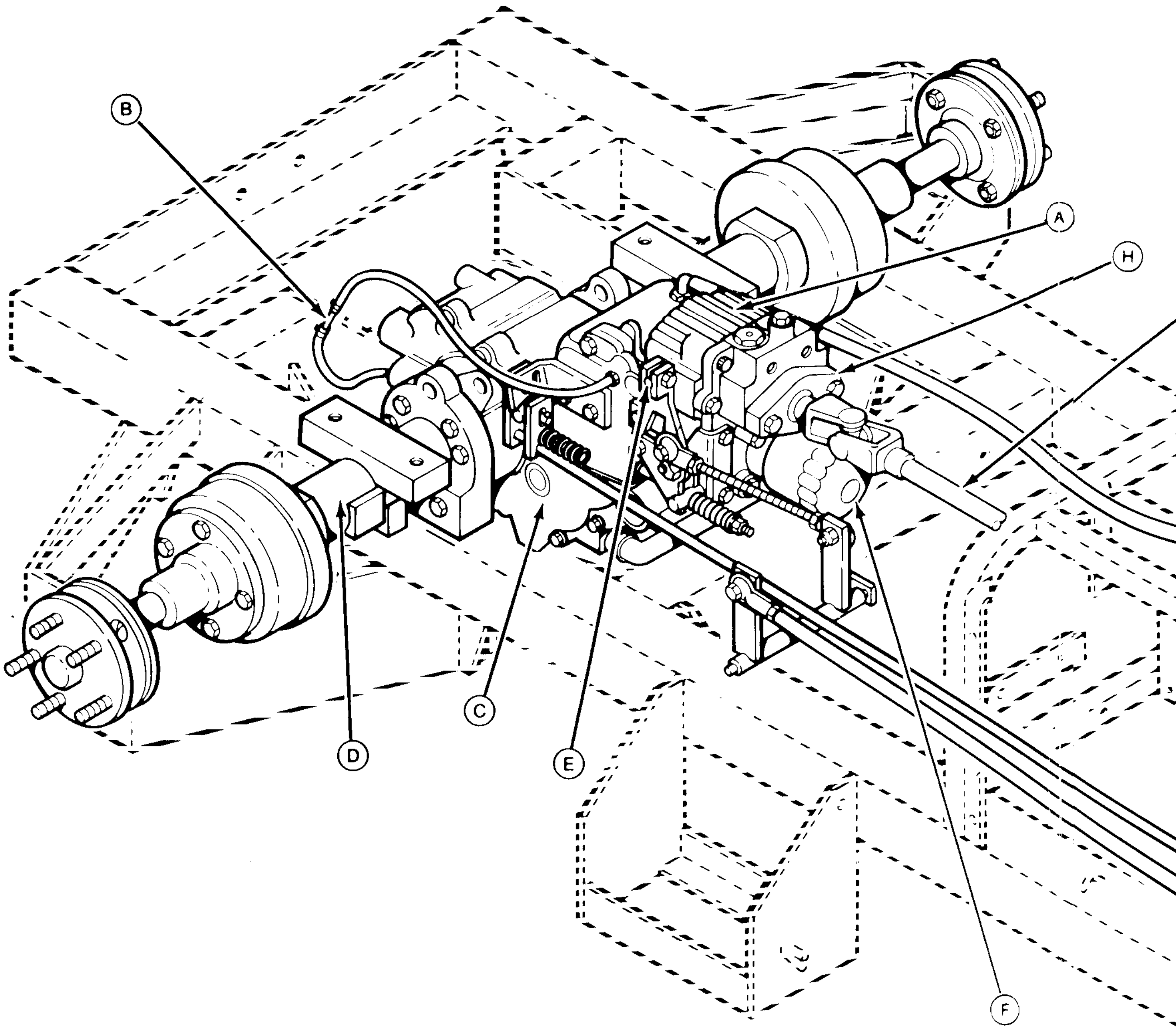
MX,25005HJ,2 -19-14APR92



M46523

POWERTRAIN COMPONENT LOCATION



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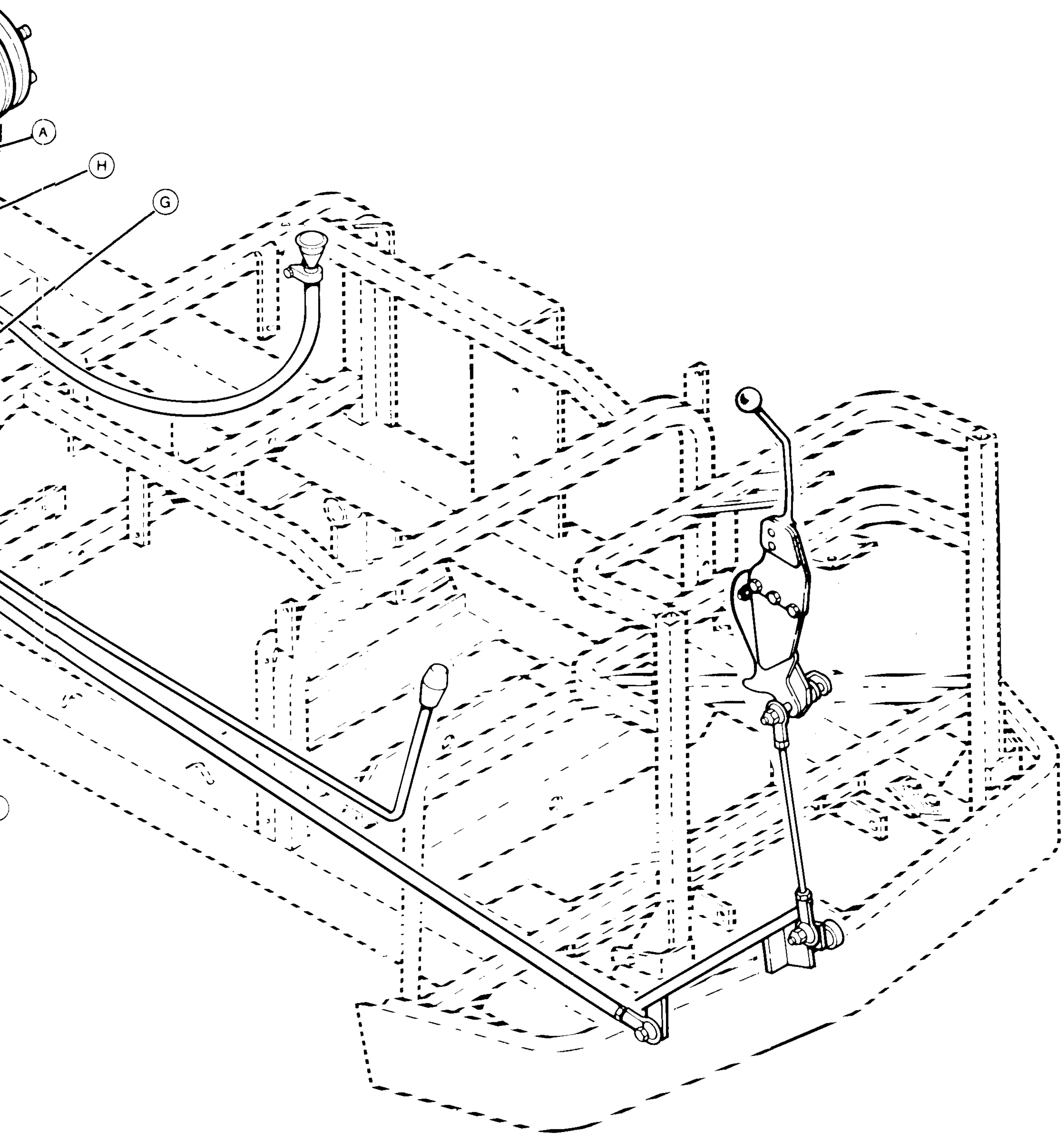
POWERTRAIN C(OMPO



N C'OMPONENT LOCATION

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:
•Transmission—Neutral
•Transmission—Forward
•Transmission—Reverse
•Differential

The slide number reference under the art is used for service training purposes only.

MX,25010HJ,1 -19-14APR92

TRANSMISSION OPERATION—NEUTRAL

A—Variable Displacement Pump
B—Check Valve (2 used)
C—Implement Relief Valve
D—Pressure Port
E—Return Port
F—Charge Relief Valve
G—Charge Pump
H—Oil Filter
I—Case Drain
J—Fixed Displacement Motor
K—Lubricating Oil
L—Charge Pressure Oil
M—Return Oil
N—Suction Oil

NOTE: Transmission operation is shown with engine running.

Function:
The transmission controls machine travel speed and direction. In addition to lubricating all internal components in the differential, the transmission supplies hydraulic oil to the hydraulic system.

Major Components:
•Charge Pump
•Oil Filter
•Transmission Case
•Variable Displacement Pump
•Check Valves
•Charge Relief Valve
•Fixed Displacement Motor
•Input Shaft
•Output Shaft

Theory of Operation:
The hydrostatic transmission consists of a variable displacement, axial piston pump (A) connected in a closed loop to a fixed displacement, axial piston motor (J). A charge pump and valve system is used to charge and lubricate the transmission.

The charge pump (G) is a gerotor-type fixed displacement pump. It continually pumps oil through out the entire hydrostatic/hydraulic system whenever the engine is running.

The charge relief valve (F) is a shim adjustable, direct acting-type relief valve. It provides sufficient back pressure to lubricate (K) the rotating groups of the transmission.

The hydrostatic pump (A) is a variable displacement, axial piston pump. The output of the pump is variable through the means of a moveable swash plate and mechanical linkage.

The hydrostatic motor (J) is a bi-directional, fixed displacement, axial piston motor. The motor has a fixed displacement (piston area) because the rotating group is inclined with the transmission housing. This motor is capable of turning in both directions.

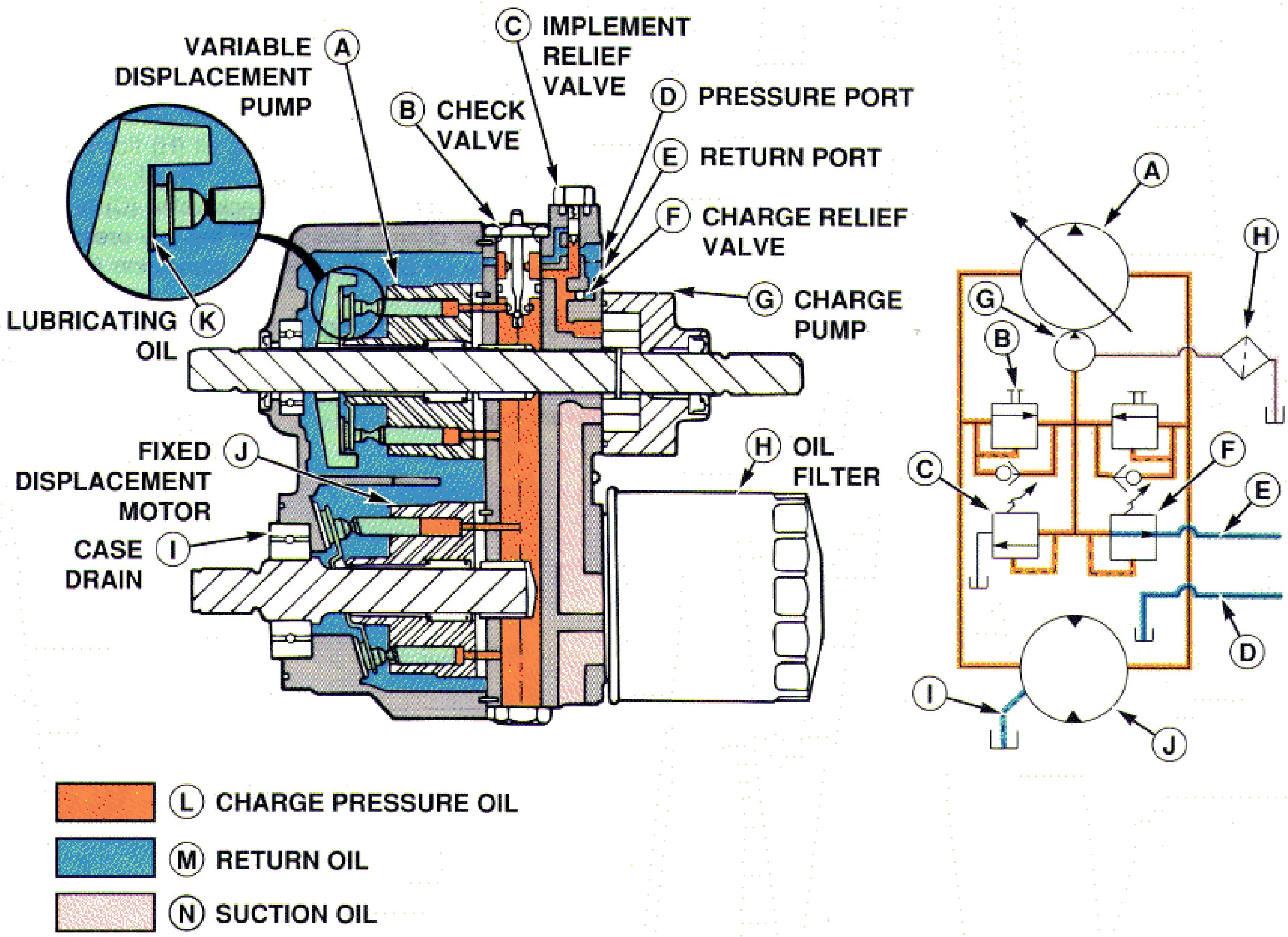
The check valves (B) that connect the pump and motor oil passages limit oil flow to one direction.

When the transmission is in neutral and the engine running, the charge pump (G) will draw oil (N) through the filter (H) from the differential. Charge pressure (L) is created by the charge relief valve (F). Oil is then forced through check valves (B) to lubricate the pump and motor rotating groups.

Oil (M) that is not used for lubrication is routed out the pressure port (D) to the hydraulic system. If no component requires oil, oil is routed back to the return port (E) and into the transmission housing. Oil is used to cool and lubricate the rotating groups and then returned to the differential through the bearing on the motor shaft.

The implement relief valve (C) protects the entire hydrostatic/hydraulic system from excessive pressure in the system. The relief valve is non-adjustable.

MX,25010HJ,2 -19-14APR92



MXC54173

TRANSMISSION OPERATION - NEUTRAL

MXC54173 -19-

Slide MXC54173

MX,25010HJ,3 -19-14APR92

TRANSMISSION OPERATION—FORWARD

A—Swash Plate
B—Pump
C—Check Valve
D—Check Valve
E—Output Shaft
F—Motor
G—Lubricating Oil
H—High Pressure Oil
I—Charge Pressure Oil
J—Return Oil
K—Suction Oil

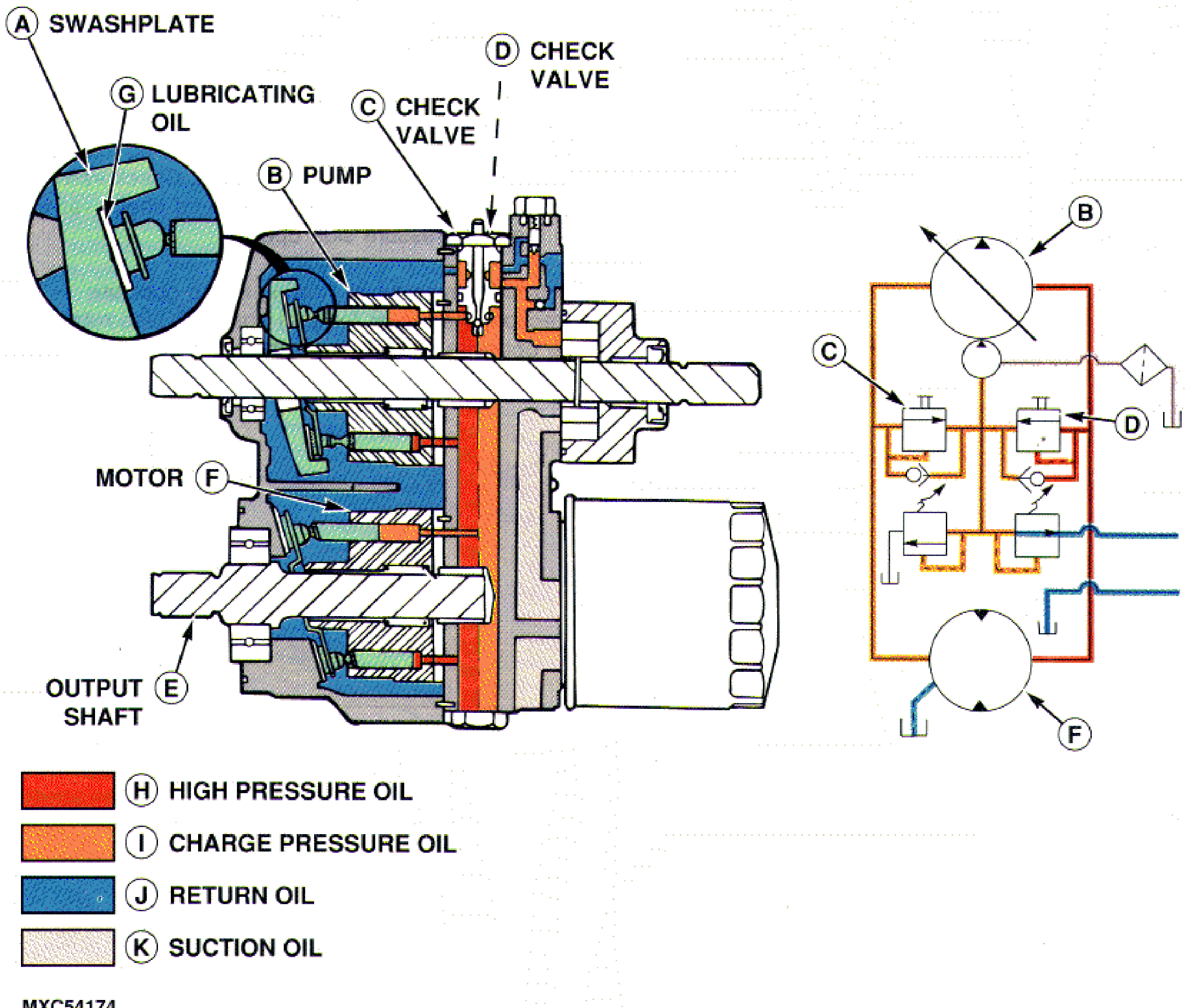
Function:
The transmission transfers or relays engine power output to the differential to move the machine forward.

Major Components:
•Charge Pump
•Oil Filter
•Transmission Case
•Variable Displacement Pump
•Check Valves
•Charge Relief Valve
•Fixed Displacement Motor
•Input Shaft
•Output Shaft

Theory of Operation:
Mechanical linkage moves the swash plate (A) forward resulting in high pressure oil (H) flowing in one side of the closed loop circuit. Check valve (D) is closed by high pressure oil. Check valve (C) remains open to allow charge pressure in the low pressure side to make up any oil used for lubrication (G).

Charge pressure entering the pump (B) plus high pressure oil in the closed loop entering the motor (F) causes the motor (output) shaft (E) to rotate for forward operation.

MX,25010HJ,4 -19-14APR92



TRANSMISSION OPERATION - FORWARD

Slide MXC54174

MXC54174 -19-

MX,25010HJ,5 -19-14APR92

TRANSMISSION OPERATION—REVERSE

A—Swash Plate
B—Check Valve
C—Check Valve
D—Output Shaft
E—High Pressure Oil
F—Charge Pressure Oil
G—Return Oil
H—Suction Oil

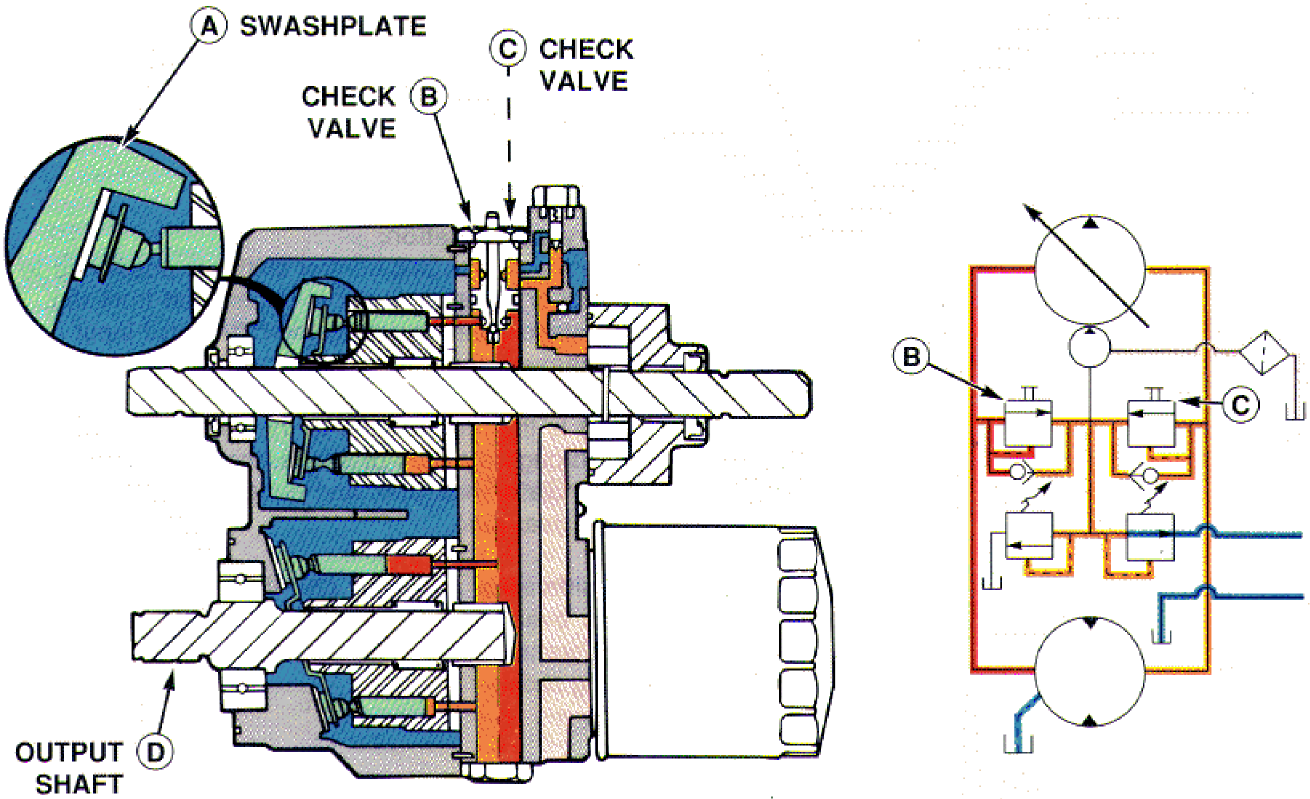
Function:
The transmission transfers or relays engine power output to the differential to move the machine rearward.

Major Components:
•Charge Pump
•Oil Filter
•Transmission Case
•Variable Displacement Pump
•Check Valves
•Charge Relief Valve
•Fixed Displacement Motor
•Input Shaft
•Output Shaft

Theory of Operation:
When the angle of the swash plate (A) is reversed, high pressure oil (E) flowing in the closed loop circuit is pumped in the opposite direction. Check valve (B) on the high pressure side closes and check valve (C) on the low pressure side opens.

With high pressure oil flowing in the opposite direction, the motor (output) shaft (D) also rotates in the opposite direction causing machine to move in reverse.

MX,25010HJ,6 -19-14APR92



E HIGH PRESSURE OIL

F CHARGE PRESSURE OIL

G RETURN OIL

H SUCTION OIL

MXC54175

TRANSMISSION OPERATION - REVERSE

Slide MXC54175

MXC54175 -19-

MX,25010HJ,7 -19-14APR92

DIFFERENTIAL OPERATION

A—Differential Lock
B—Differential Assembly
C—Output Shaft Assembly
D—Intermediate Shaft Assembly
E—Countershaft Assembly
F—Transmission Output Gear

Slide M46518

Function:
The differential distributes engine power evenly to each axle. Each axle is free to rotate at different speeds. The differential also acts as a reservoir for the hydraulic system.

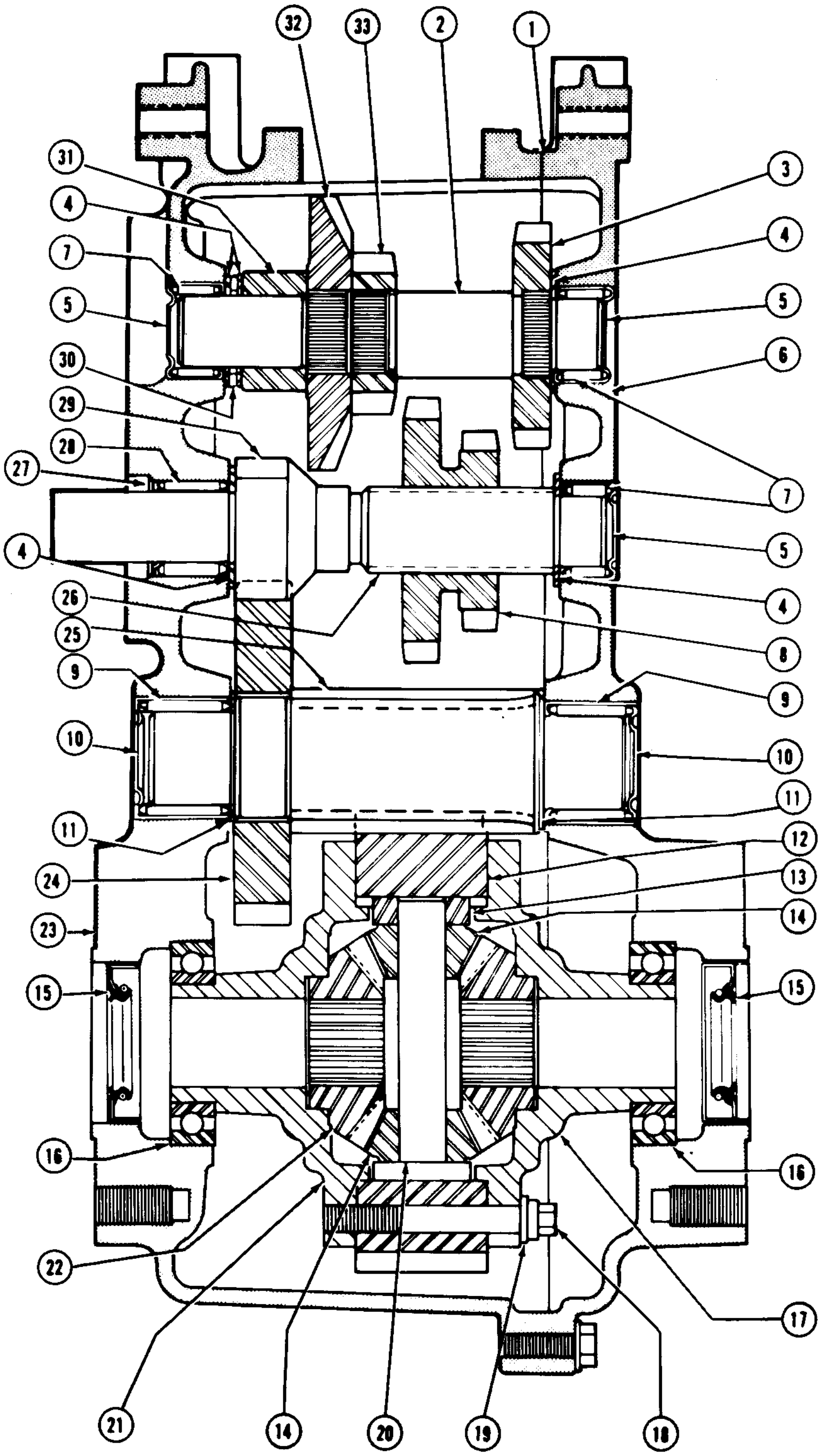
Major Components:
•Countershaft Assembly
•Intermediate Shaft Assembly
•Output Shaft Assembly
•Differential Assembly
•Shift Rod Assembly
•Differential Case

Theory of Operation:
When the hydrostatic control shifter is positioned to forward or reverse, power is transmitted from the hydrostatic transmission to the differential input gear (32), through the transmission output gear.

Power is then transmitted to the differential assembly (20) through a series of shafts: the countershaft (2), intermediate shaft (30), and output shaft (9) in a 20.4:1 gear ratio.

The differential assembly (20) then distributes the power evenly to each axle. Each axle is free to rotate at different speeds according to ground conditions or turning radius.

MX,25010HJ,8 -19-14APR92



M46518

CROSS SECTION 2-SPEED DIFFERENTIAL

MX,25010HJ,9 -19-14APR92

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:

•Machine Moves in One Direction Only or Freewheels
•Machine Will Not Move in Either Direction
•Transmission Operation is Slow, Erratic, or Has Low Power, or Speed Will Not Increase.
•Machine Will Not Reach Full Speed
•Transmission Operating 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 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.

MX,25015HJ,1 -19-14APR92

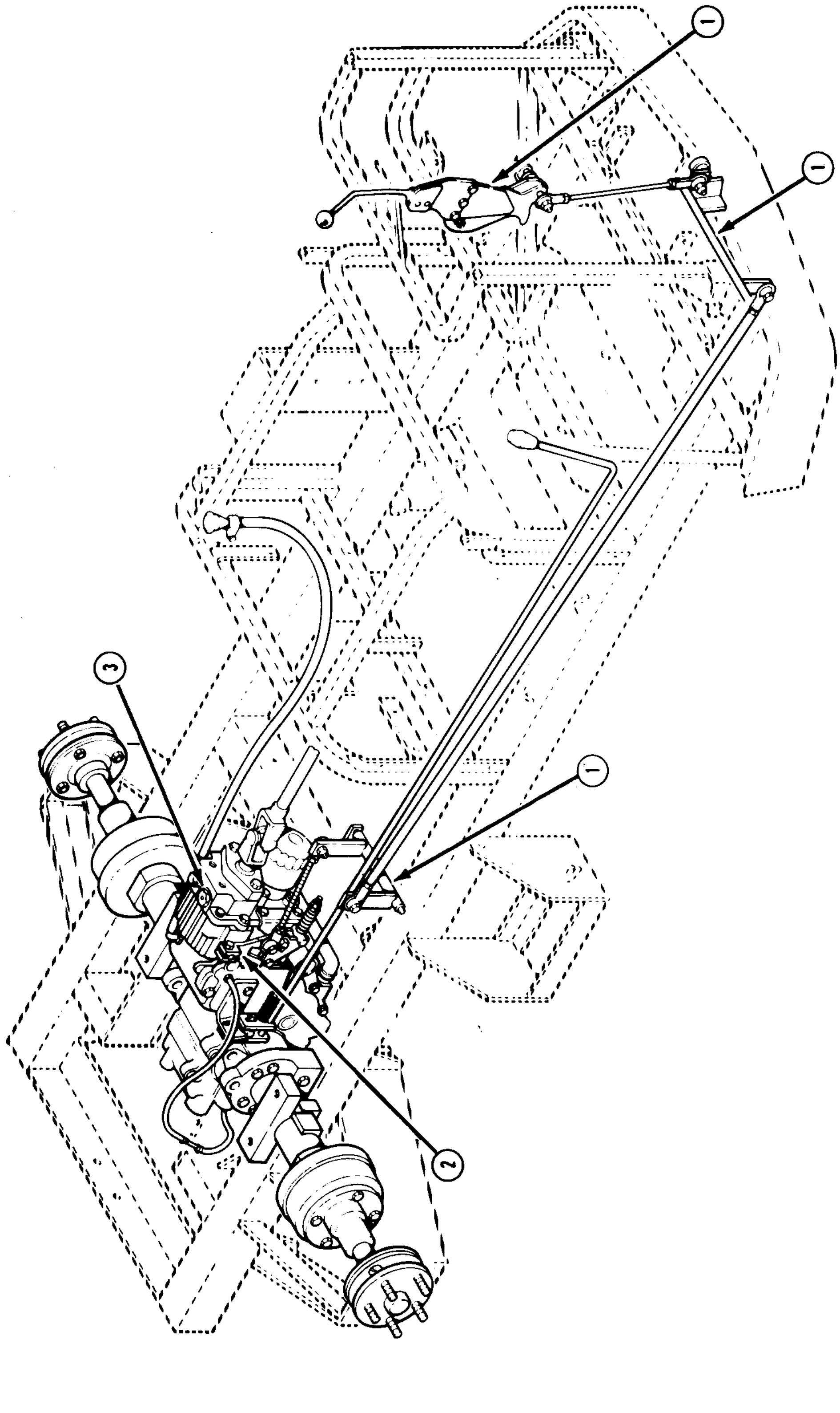
MACHINE MOVES IN ONE DIRECTION ONLY OR FREEWHEELS

Conditions:
•Park brake engaged
•Engine not running

Test Location	Normal	If Not Normal
1. Transmission control linkage	Moves smoothly	Inspect linkage for wear or damage. Repair or replace as necessary. See Section 50.
2. Transmission control shaft	Control lever-to-shaft cap screw is tight and not worn	Tighten cap screw. Replace if necessary.
3. Transmission check valves	No clogging or restriction	Check. See Check Valve Debris Check.
	No damage to seat or seals Check ball free	Inspect for wear or damage. Replace as as necessary. See Section 50.

Slide M46649

MX,25015HJ,2 -19-14APR92



MACHINE MOVES IN ONE DIRECTION ONLY OR FREEWHEELS

M46649

M46649 -19-06APR92

MX,25015HJ,3 -19-14APR92

MACHINE WILL NOT MOVE IN EITHER DIRECTION

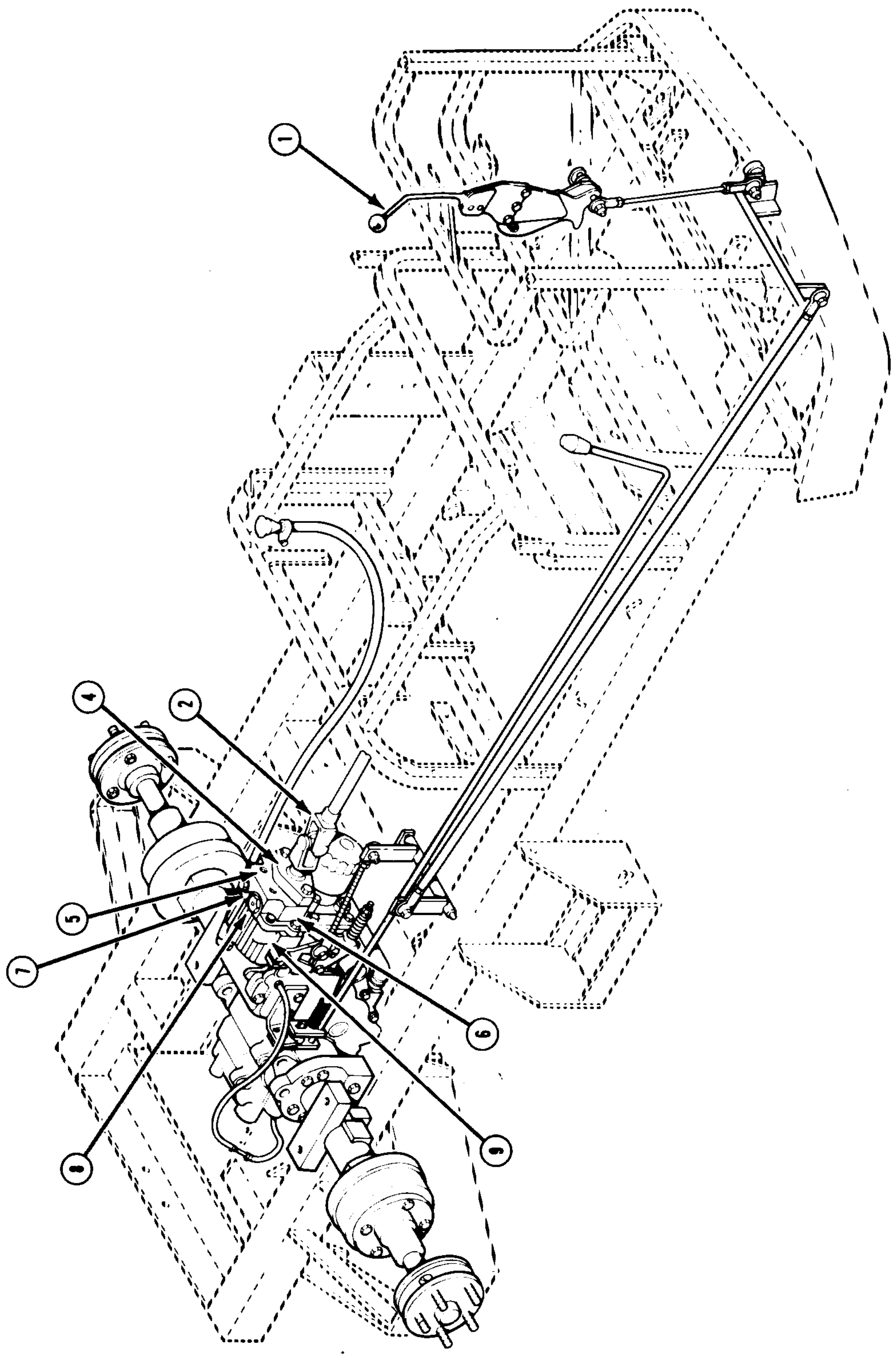
Conditions:
•Park brake engaged
•Engine not running

Test Location	Normal	If Not Normal
1. Transmission control and linkage	Shifter moves smoothly	Inspect linkage for wear or damage. Repair or replace as necessary. See Section 50.
2. Drive shaft	Cap screws tight No wear or damage	Tighten cap screws. Repair or replace as necessary. See Section 50.
3. Drive sheave	Cap screws tight	Tighten cap screws. Replace if necessary. See Section 50.
4. Charge pump	Correct installation Flat side of housing must face toward charge relief valve	Remove and install in correct position. See Section 50.
	Charge pump pressure is 620—1240 kPa (6.2—12.4 bar) (90—180 psi) at slow idle	Test. See Charge Pump Pressure Test.
5. Charge pump suction line	Hose clamps are tight Hose is not restricted or leaking	Repair or replace as needed. Bleed hydraulic system. See Section 70.
6. Charge relief valve	No valve or spring damage	Inspect and replace if necessary. See Section 50. Adjust. See Charge Relief Valve Adjustment.
7. Transmission test port	Charge pump pressure is 620—1240 kPa (6.2—12.4 bar) (90—180 psi) at slow idle	Test pressure. See Charge Pump Pressure Test.
	Implement relief pressure is 6550—7930 kPa (65.5—79.3 bar) (950—1150 psi) at fast idle and control valve lever in raise position	Test pressure. See Implement Relief Valve Pressure Test.
8. Transmission check valves	No clogging or restriction	Check. See Check Valve Debris Check.
	No damage to seat or seals Check ball free	Inspect for wear or damage. Replace as as necessary. See Section 50.
9. Transmission	Machine moves freely No noise	Remove and inspect internal parts. Replace as necessary. See Section 50.

Slide M46650

MX,25015HJ,4 -19-14APR92

MACHINE WILL NOT MOVE IN EITHER DIRECTION



M46650 -19-06APR92

M46650

MX,25015HJ,5 -19-14APR92

TRANSMISSION OPERATION IS SLOW, ERRATIC, OR HAS LOW POWER, OR SPEED WILL NOT INCREASE

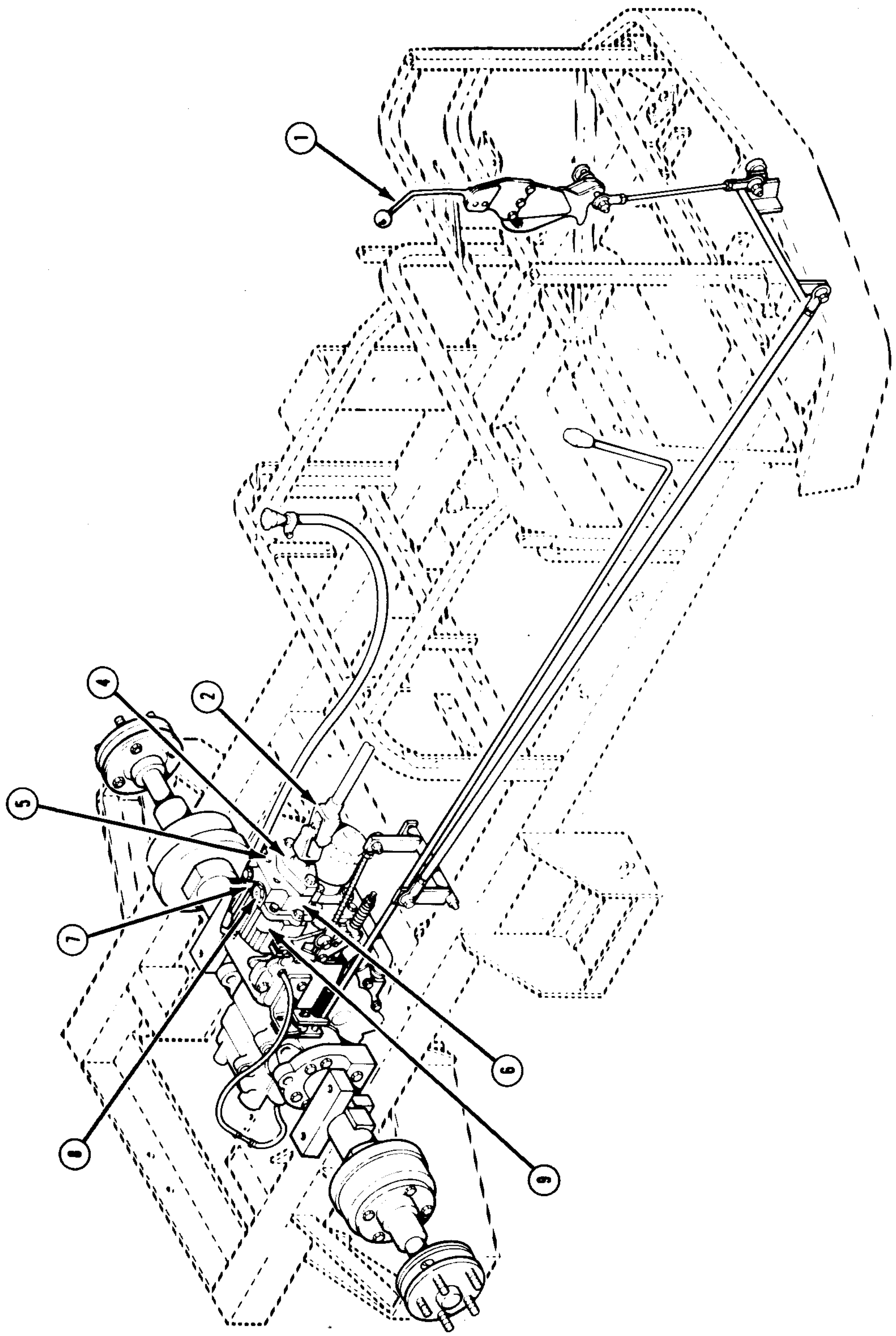
Conditions:
•Park brake engaged
•Engine not running

Test Location	Normal	If Not Normal
1. Transmission control linkage	Moves smoothly	Inspect linkage for wear or damage. Repair or replace as necessary. See Section 50.
2. Drive shaft	Cap screws tight No wear or damage	Tighten cap screws. Repair or replace as necessary. See Section 50.
3. Drive sheave	Cap screws tight No wear or damage	Tighten cap screws. Replace if necessary. See Section 50.
4. Charge pump	Correct installation Flat side of housing must face toward charge relief valve	Remove and install in correct position. See Section 50.
	Charge pump pressure is 620—1240 kPa (6.2—12.4 bar) (90—180 psi) at slow idle	Test. See Charge Pump Pressure Test.
5. Charge pump suction line	Hose clamps are tight Hose is not restricted or leaking	Repair or replace as needed. Bleed hydraulic system. See Section 70.
6. Charge relief valve	No valve or spring damage	Inspect and replace if necessary. See Section 50. Adjust. See Charge Relief Valve Adjustment.
7. Transmission test port	Charge pump pressure is 620—1240 kPa (6.2—12.4 bar) (90—180 psi) at slow idle	Test pressure. See Charge Pump Pressure Test.
	Implement relief pressure is 6550—7930 kPa (65.5—79.3 bar) (950—1150 psi) at fast idle and control valve lever in raise position	Test pressure. See Implement Relief Valve Pressure Test.
8. Transmission check valves	No clogging or restriction	Check. See Check Valve Debris Check.
	No damage to seat or seals Check ball free	Inspect for wear or damage. Replace as as necessary. See Section 50.
9. Transmission	Machine moves freely No noise	Remove and inspect internal parts. Replace as necessary. See Section 50.

Slide M46651

MX,25015HJ,6 -19-14APR92

TRANSMISSION OPERATION IS SLOW, ERRATIC, OR HAS LOW POWER, OR SPEED WILL NOT INCREASE



M46651 -19-06APR92

MX,25015HJ,7 -19-14APR92

MACHINE WILL NOT REACH FULL SPEED

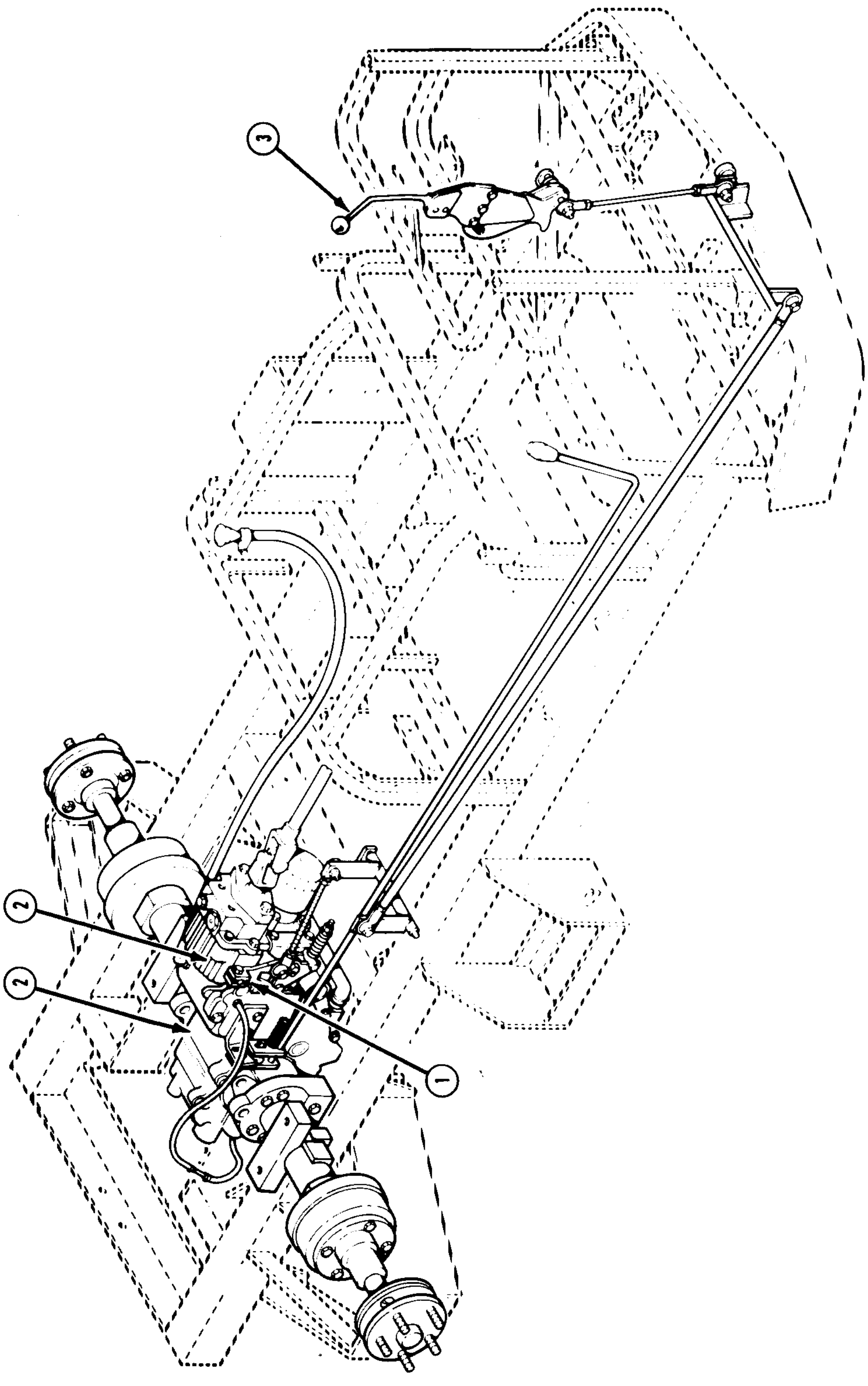
Conditions:
•Park brake engaged
•Engine not running

Test Location	Normal	If Not Normal
1. Transmission control shaft	Control lever-to-shaft cap screw is tight and not worn	Tighten cap screw. Replace if necessary.
2. Transmission and Differential	Mounting cap screws are tight	Tighten.
3. Transmission control linkage	Moves smoothly	Inspect linkage for wear or damage. Repair or replace as necessary. See Section 50.
4. Engine throttle linkage (not shown)	Not worn or damaged	Repair or replace as necessary.
5. Engine	Engine fast idle is 3800±100 rpm	Adjust. See Section 220.

Slide M46652

MX,25015HJ,8 -19-14APR92

MACHINE WILL NOT REACH FULL SPEED



M46652 -19-06APR92

MX,25015HJ,9 -19-14APR92

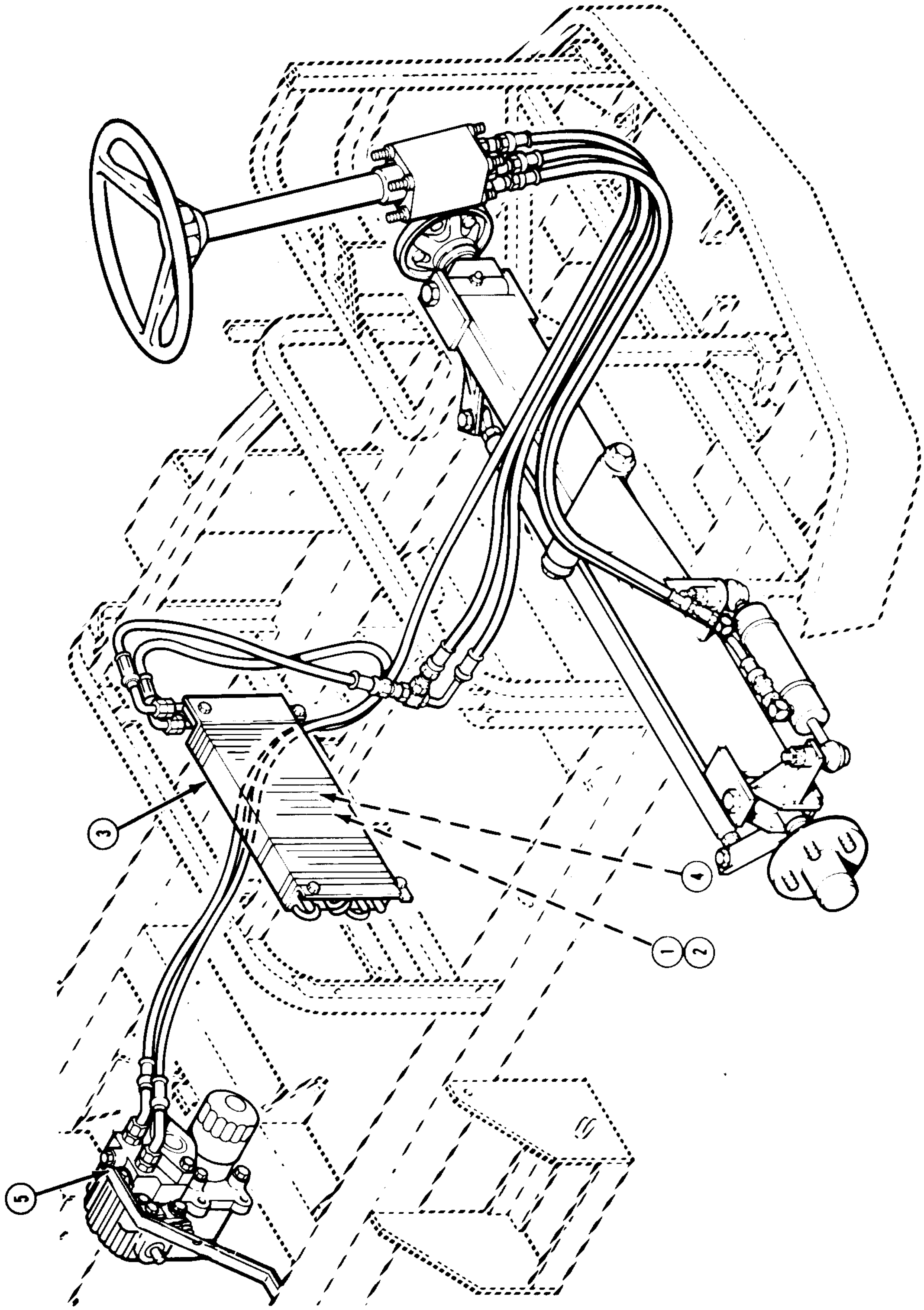
TRANSMISSION OPERATING HOT

Conditions:
•Park brake engaged
•Engine not running

Test Location	Normal	If Not Normal
1. Radiator screen	Clean and clear of debris	Clean.
2. Radiator	Clean and clear of debris	Clean.
3. Oil cooler	Clean and clear of debris	Clean.
	Inlet and return hoses are not restricted or leaking	Repair or replace.
4. Engine fan	Not damaged	Repair or replace as necessary.
	Fan belt not worn, damaged or loose	Adjust tension. Replace if necessary. See Section 220
5. Transmission test port	When steering wheel is turned, pressure increases When steering wheel is stopped, pressure should drop to normal	Check pressure. See Steering Valve Neutral Check.

Slide M46638

MX,25015HJ,10 -19-14APR92



TRANSMISSION OPERATING HOT

M46638 M46638 -19-06APR92

MX,25015HJ,11 -19-14APR92

HYDRAULIC OIL WARM-UP PROCEDURE

Reason:
When making hydraulic tests the oil must be heated to the specified temperature for the tests to be accurate.

Equipment:
•JDG282 Temperature Gauge

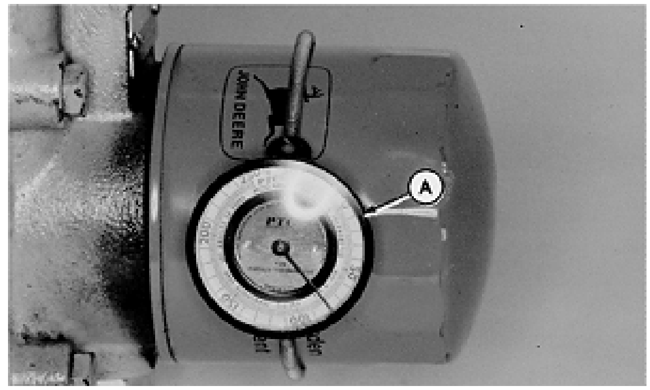
Connections:
1. Install JDG282 Temperature Gauge (A) on transmission oil filter.

2. Put cardboard or paper around oil cooler to restrict air flow.

Procedure:
1. Apply park brake. Start engine and run at full throttle.

2. Periodically cycle all hydraulic functions to distribute heated oil.

3. Heat oil to temperature specified in test.



M54162 -UN-16JUL90

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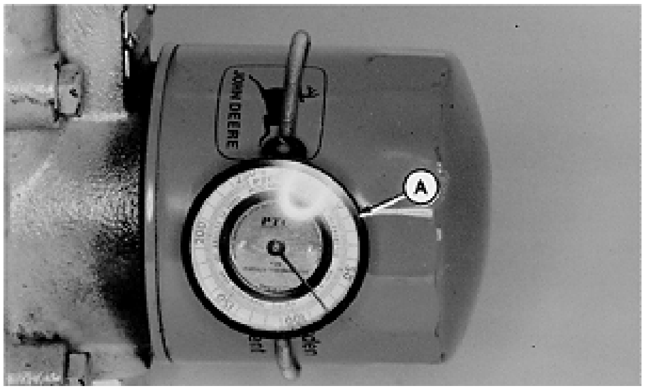
MX,25015HJ,12 -19-14APR92

TRANSMISSION OIL TEMPERATURE CHECK

Reason:
To determine operating temperature of hydrostatic transmission.

Equipment:
•JDG282 Temperature Gauge

Connections:
1. Install JDG282 Temperature Gauge (A) on transmission oil filter.



Slide M54162

Procedure:
1. Apply park brake. Start engine and run at full throttle.

2. Periodically cycle all hydraulic functions to distribute heated oil.

3. Observe temperature reading.

Specifications:
•Continuous Operating Temperature .. 93°C (200°F) Maximum.

Results:
•If temperature exceeds specifications see Transmission Operating Hot.

MX,25015HJ,13 -19-14APR92

CHECK VALVE DEBRIS CHECK

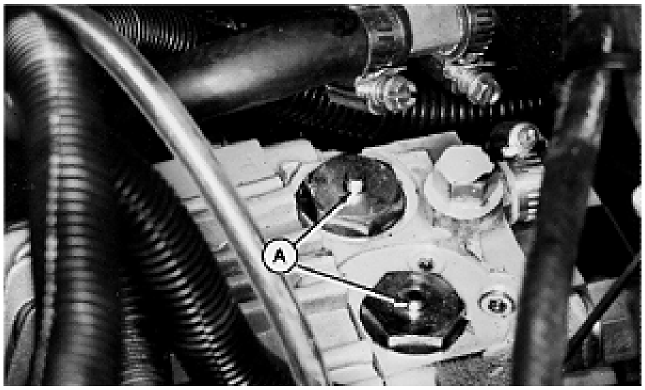
Reason:
To remove debris from valves.

Procedure:
1. Stop the engine.

2. Disengage service-park brake.

3. Hold check valve pins (A) down.

4. Push machine forward.

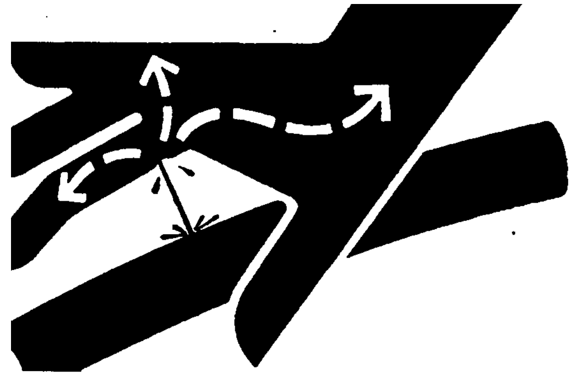


Slide M54187

Results:
•If machine does not move or moves in one direction only, inspect check valves for wear or damage. (See Section 50.)

MX,25015HJ,16 -19-14APR92

CHARGE PUMP PRESSURE TEST



Reason:
To determine charge pump pressure and to adjust relief valve.

Equipment:

NOTE: Make test connections from JT01765 Consumer Products Hydraulic Fitting Kit.

•JT03339 Connector
•JT03107 Adaptor
•JT03017 Hose
•JT03344 Gauge 2000 kPa (20 bar) (300 psi)

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 may call the Deere & Company Medical Department in Moline, Illinois, or other knowledgeable medical source.

MX,25015HJ,17 -19-14APR92

Connections:
1. Remove test port plug.

2. Install JT03339 Connector (A), JT03107 Adaptor (B), JT03017 Hose (C) and JT03344 Gauge (D).

Procedure:
1. Heat hydraulic oil to specifications. (See procedure in this group.)

2. Operate engine at slow idle.

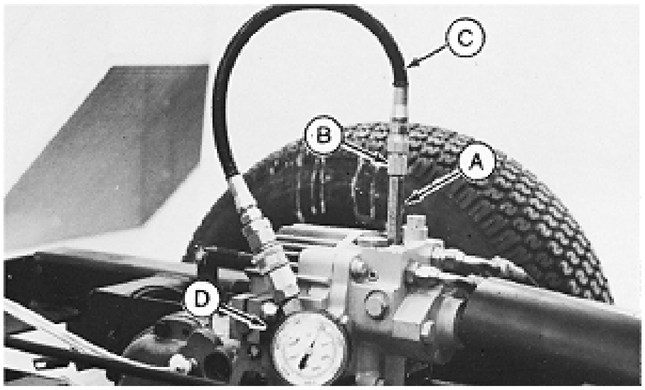
3. Observe pressure gauge reading.

Specifications:
•Hydraulic Oil Temperature .. 43°C (110°F)
•Engine Speed Slow Idle:
1350 ± 50 rpm
•Charge Pressure .. 620—1240 kPa (6.2—12.4 bar) (90—180 psi)

NOTE: It is normal for charge pressure to increase as engine speed increases. Charge pressure up to 3448 kPa (500 psi) at fast idle is normal.

Results:
•If pressure is not within specifications, adjust charge relief valve then repeat test. (See procedure in this group.)

• If pressure still is not within specifications, an abnormal internal leak within the transmission is suspected. Inspect transmission internal parts. Replace as necessary. (See Section 50.)



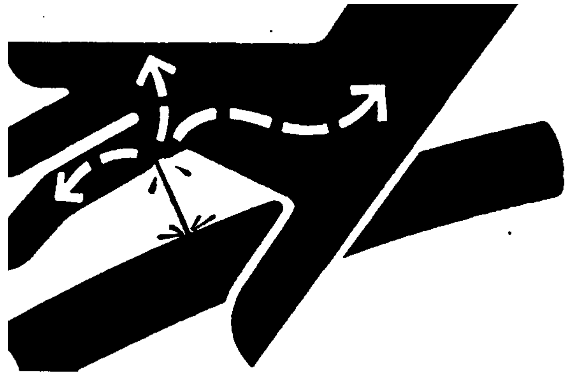
M46661 -UN-27MAR92

Slide M46661

A—JT03339 Connector
B—JT03107 Adaptor
C—JT03017 Hose
D—JT03344 Gauge 2000 kPa (20 bar) (300 psi)

MX,25015HJ,18 -19-14APR92

CHARGE RELIEF VALVE ADJUSTMENT



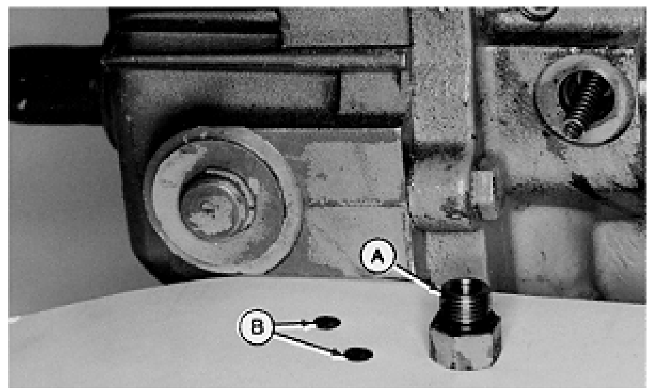
Reason:
To adjust charge pump pressure.

Procedure:
1. Remove cap (A).

NOTE: For every 0.254 mm (0.010 in.) of shim thickness there is approximately a 15 kPa (0.15 bar) (2 psi) change in relief valve opening pressure.

2. Add shims (B) as necessary.

3. Install cap.



SHIM SIZE SPECIFICATIONS

Shim Size	Approximate Pressure Change
0.127 mm (0.005 in.)	10 kPa (0.10 bar) (1 psi)
0.254 mm (0.010 in.)	15 kPa (0.15 bar) (2 psi)
0.381 mm (0.015 in.)	20 kPa (0.20 bar) (3 psi)
0.508 mm (0.020 in.)	30 kPa (0.30 bar) (4 psi)

MX,25015FH,A24 -19-19MAR92

IMPLEMENT RELIEF PRESSURE TEST

Connections:

1. Remove test port plug.

2. Install JTO3339 Connector (A), JTO3107 Adaptor (B), JTO3017 Hose (C) and JTO3345 Gauge (D).

Procedure:

1. Heat hydraulic oil to specifications. (See procedure in this group)

2. Operate engine at fast idle.

3. Turn steering wheel in full left or right position.

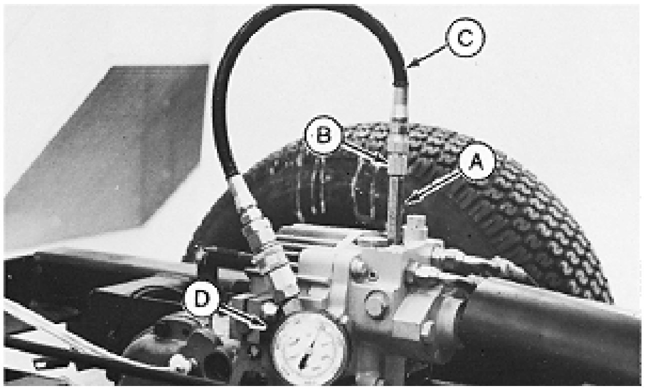
4. Observe pressure reading.

Specifications:

•Hydraulic oil temperature .. 43˚C (10˚F)
•Engine Speed .. 3800 RPM ± 100
•Implement Pressure .. 6550-7930 kPa (65.5-79.3 bar)(950-1150 psi)

Results:

•If pressure is not within specifications, see Parts Catalog for shim kit to adjust pressure. Replace if necessary.

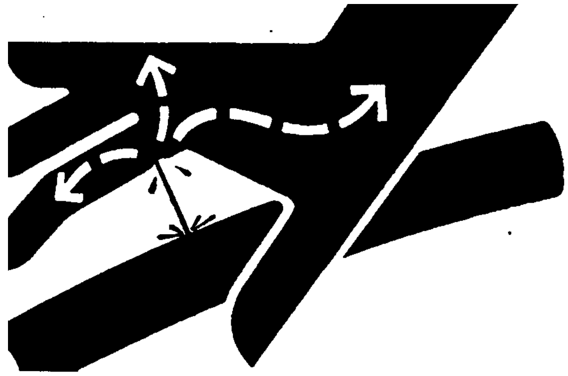


M46661 -UN-27MAR92

A—JTO3339 Connector
B—JTO3107 Adaptor
C—JTO3017 Hose
D—JTO3345 Gauge 20,000 kPa (3000 PSI)

MX,25015HJ,19 -19-14APR92

CHARGE PUMP FLOW TEST



X9811 -UN-23AUG88

Reason:
To determine condition of the charge pump.

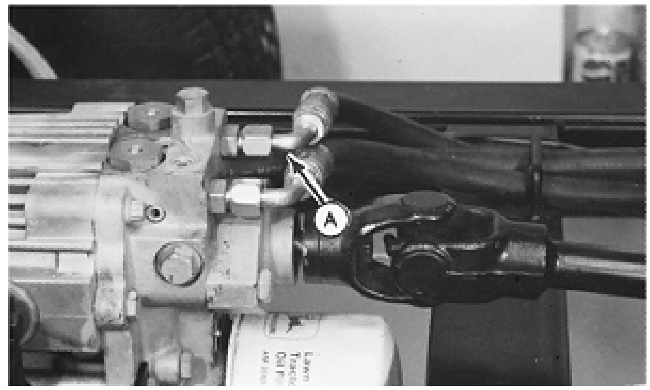
Equipment:

NOTE: Make test connections from JT01765 Consumer Products Hydraulic Fitting Kit and JT05469 Flow meter Kit.

Control valve ports:
•JT03036 Connector
•JT03341 90˚ Elbow
•JT03342 Coupler (2)
•JTO5469 Flowmeter

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 may call the Deere & Company Medical Department in Moline, Illinois, or other knowledgeable medical source.



M46660 -UN-27MAR92

Slide M46660

Connections:
1. Disconnect return line (A).
2. Connect flowmeter as shown.

MX,25015HJ,20 -19-14APR92

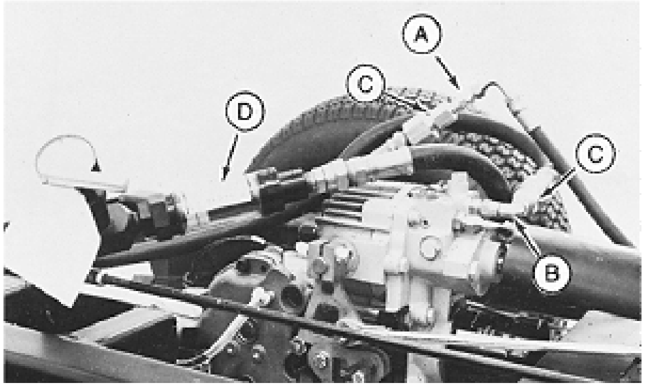
Procedure:
1. Heat Hydraulic oil to specifications. (See procedure in this group.)

2. Operate engine at specified speed.

3. Observe flowmeter reading.

Specifications:
•Hydraulic Oil Temperature .. 43°C (110°F)
•Engine Speed: 3700 rpm
•Test Pressure .. 3450 kPa (34.5 bar) (500 psi)
•Minimum Pump Flow:6.8 L/min (1.8 gpm)

Results:
•If flow is less than specifications, inspect charge pump for wear or damage. (See Section 50.)



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A—JT03036 Connector
B—JT03341 90° Elbow
C—JT03342 Coupler (2 used)
D—JT05469 Flowmeter

MX,25015HJ,21 -19-14APR92

TRANSMISSION NEUTRAL RETURN ADJUSTMENT

Reason:
To ensure that the transmission always returns to neutral when the normal or parking brakes are applied.

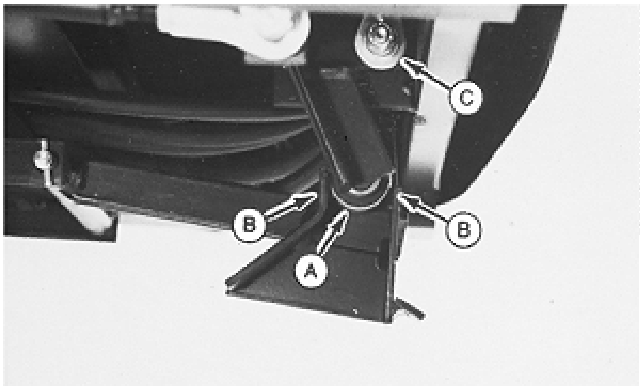
Procedure:
1. Release parking brake.

2. Shift transmission control lever to neutral.

3. Depress brake pedal fully to position release roller (A) between the parallel surfaces of the release ramps (B) located on the brake pedal assembly.

4. Adjust linkage rod (C) to center the roller (A) between the parallel surfaces of the release ramps (B).

5. Refer to Transmission Neutral Adjustment in Section 250, Group 15.



Slide M46658

MX,25015HJ,23 -19-14APR92

250
15
20

TRANSMISSION NEUTRAL ADJUSTMENT

Reason:
To assure that machine does not creep when shifter is in neutral.

Equipment:
•Hoist
•Jackstands (2)

NOTE: If creep is intermittent, inspect transmission control linkage for wear or damage before adjusting transmission neutral.

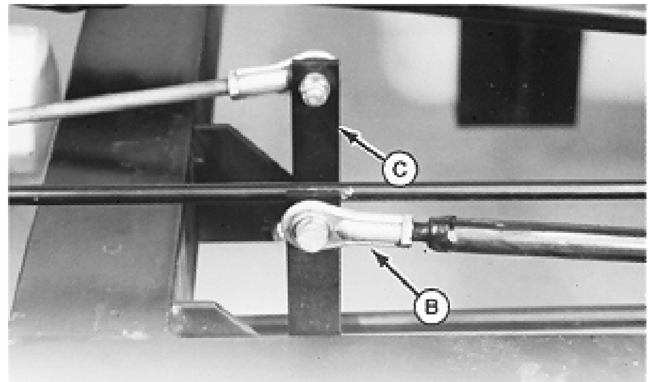
Procedure:
1. Refer to Transmission Neutral Return Adjustment Section 250, Group 15 and accomplish before attempting this adjustment.

2. Lift machine with a hoist until drive wheels are off the ground.

3. Put jackstands under frame.

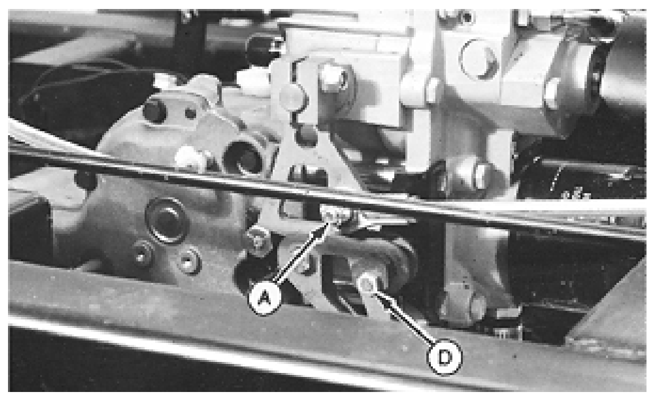
4. Disconnect shift linkage (A).

5. Adjust linkage rod (B) until bellcrank arms (C) are vertical.



M46570 -UN-27MAR92

M46636 -UN-27MAR92



M46637 -UN-27MAR92

A—Shift Rod
B—Linkage Rod
C—Bellcrank Arm
D—Eccentric
E—Throttle

MX,25015HJ,24 -19-14APR92

TRANSMISSION NEUTRAL ADJUSTMENT—CONTINUED

Procedure Continued:

6. Loosen eccentric locking nut (D) and rotate eccentric until high point is at the top.

7. Adjust length of linkage rod (A) so that the rod will slip easily over the attaching bolt. Secure linkage rod to pivot arm.

N **CAUTION: Use extreme caution when doing this adjustment. Drive wheels are free to spin.**

8. Have someone push down center of seat cushion to activate seat safety switch, or use a jumper wire to bypass the seat switch.

9. Start engine.

10. Move throttle lever to full engine speed (E).

11. With brakes disengaged, and engine running at full throttle, rotate eccentric until wheels stop turning. Tighten eccentric locking bolt (D).

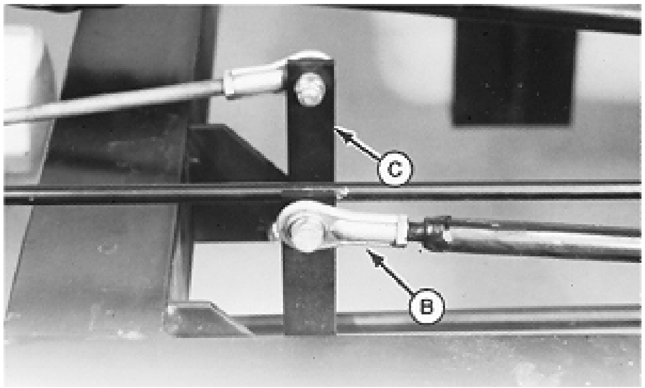
12. Stop engine.

Results:

•If drive wheels continue to turn, repeat adjustment procedures.

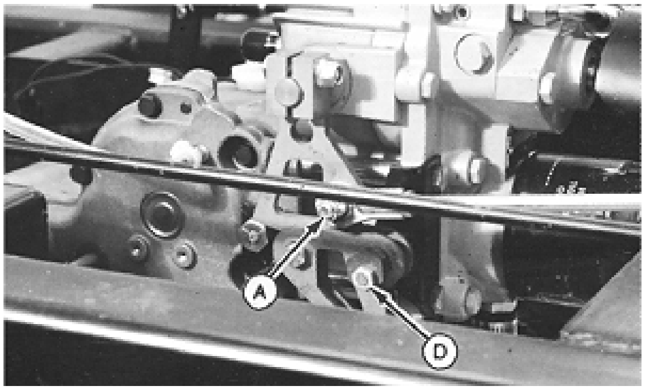
N **CAUTION: Remove jumper wire from seat switch if installed.**

A—Shift Rod
B—Linkage Rod
C—Bellcrank Arm
D—Eccentric
E—Throttle



M46570 -UN-27MAR92

M46636 -UN-27MAR92



M46637 -UN-27MAR92

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Section 260
STEERING AND BRAKES OPERATION, TESTS, & ADJUSTMENTS

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COMPONENT LOCATION INFORMATION

This group contains component location drawings for the following steering and brake system 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,26005HJ,1 -19-14APR92

STEERING SYSTEM COMPONENT LOCATION

A—Oil Cooler
B—Transmission
C—Steering Wheel
D—Steering Valve
E—Pressure Lines
F—Hydraulic Oil Filter
G—Tie Rod
H—Steering Cylinder

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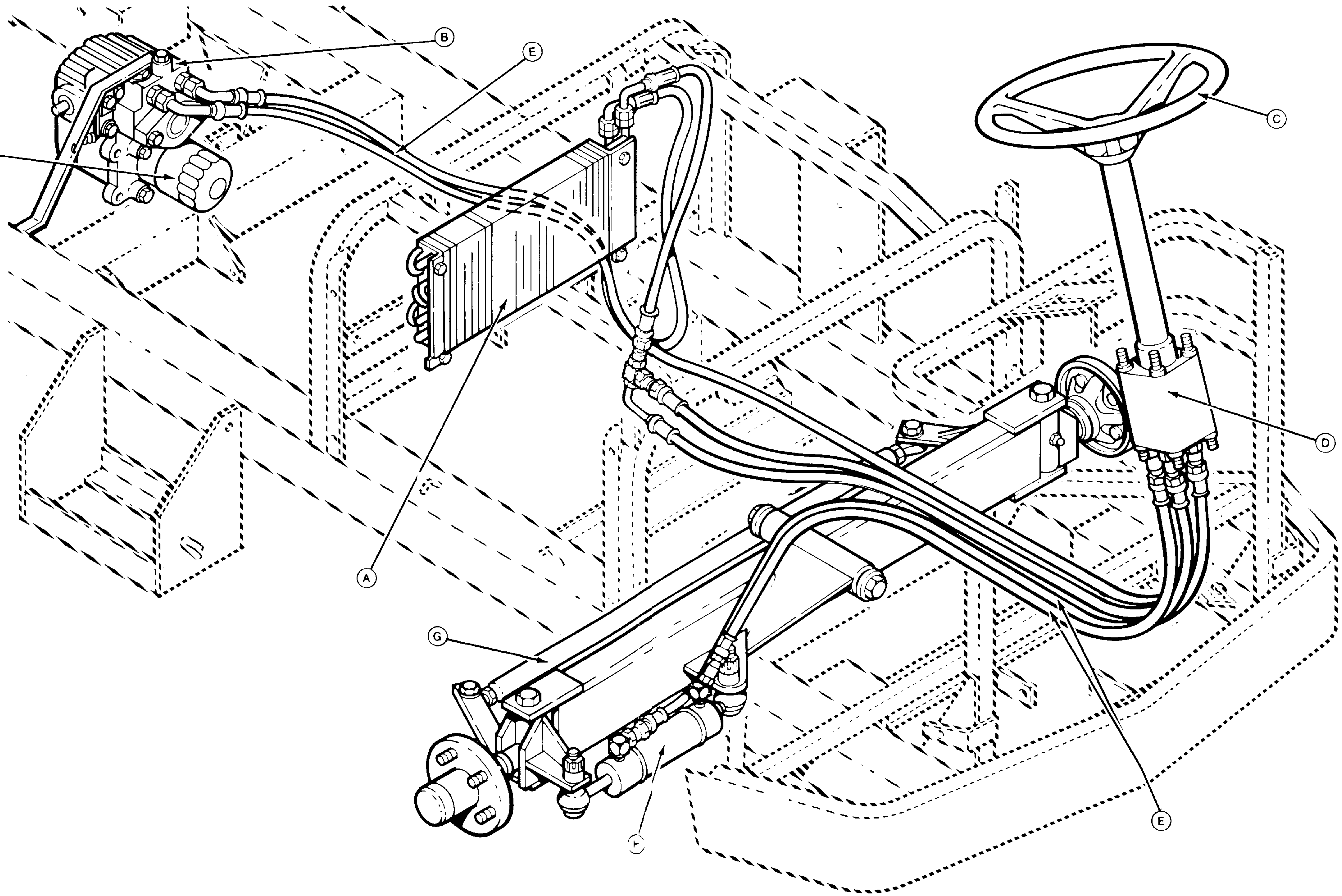
MX,26005HJ,2 -19-14APR92



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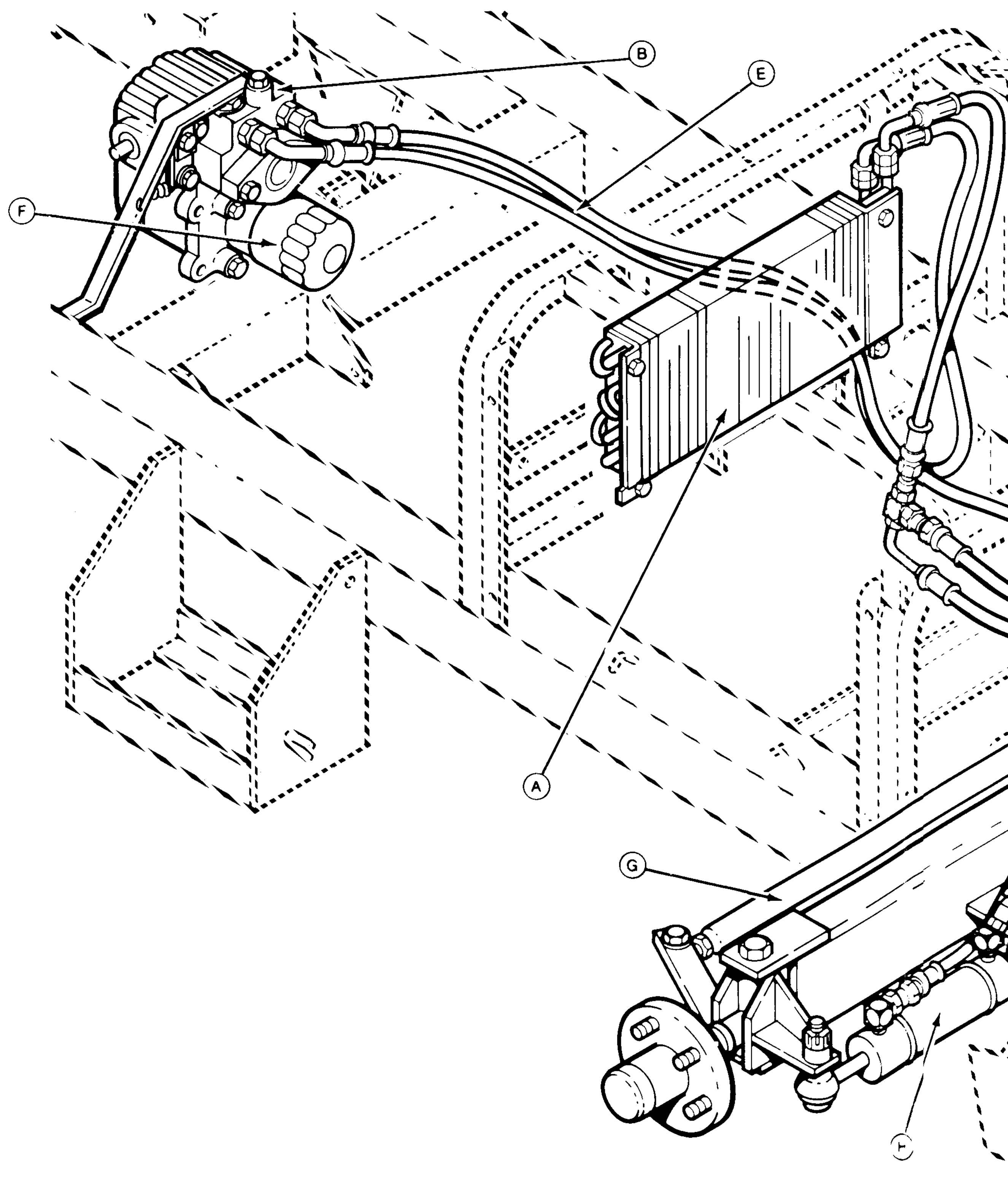
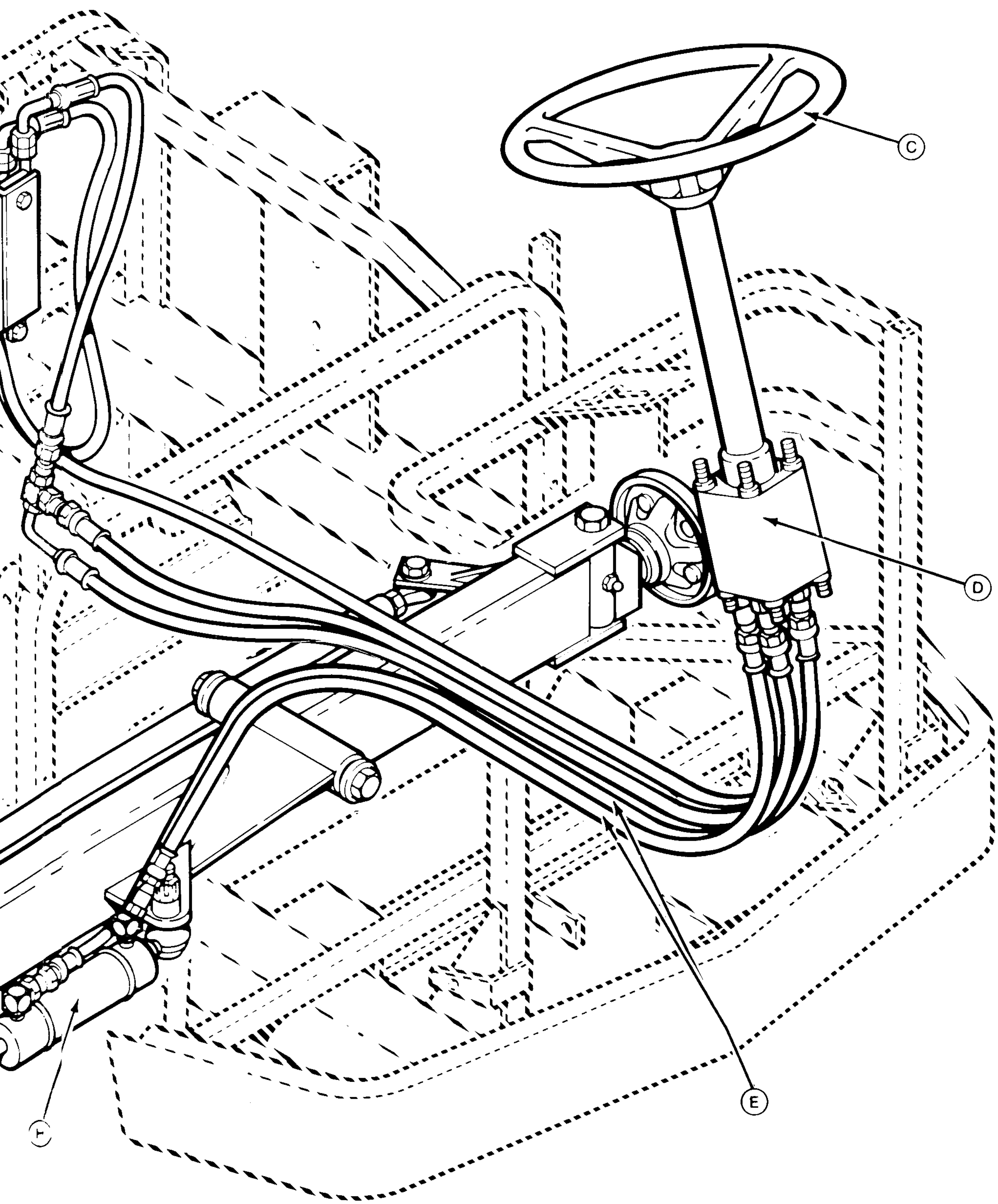
STEERING SYSTEM COMPONENT LOCATION



M46519

STEERING SYSTEM COMP



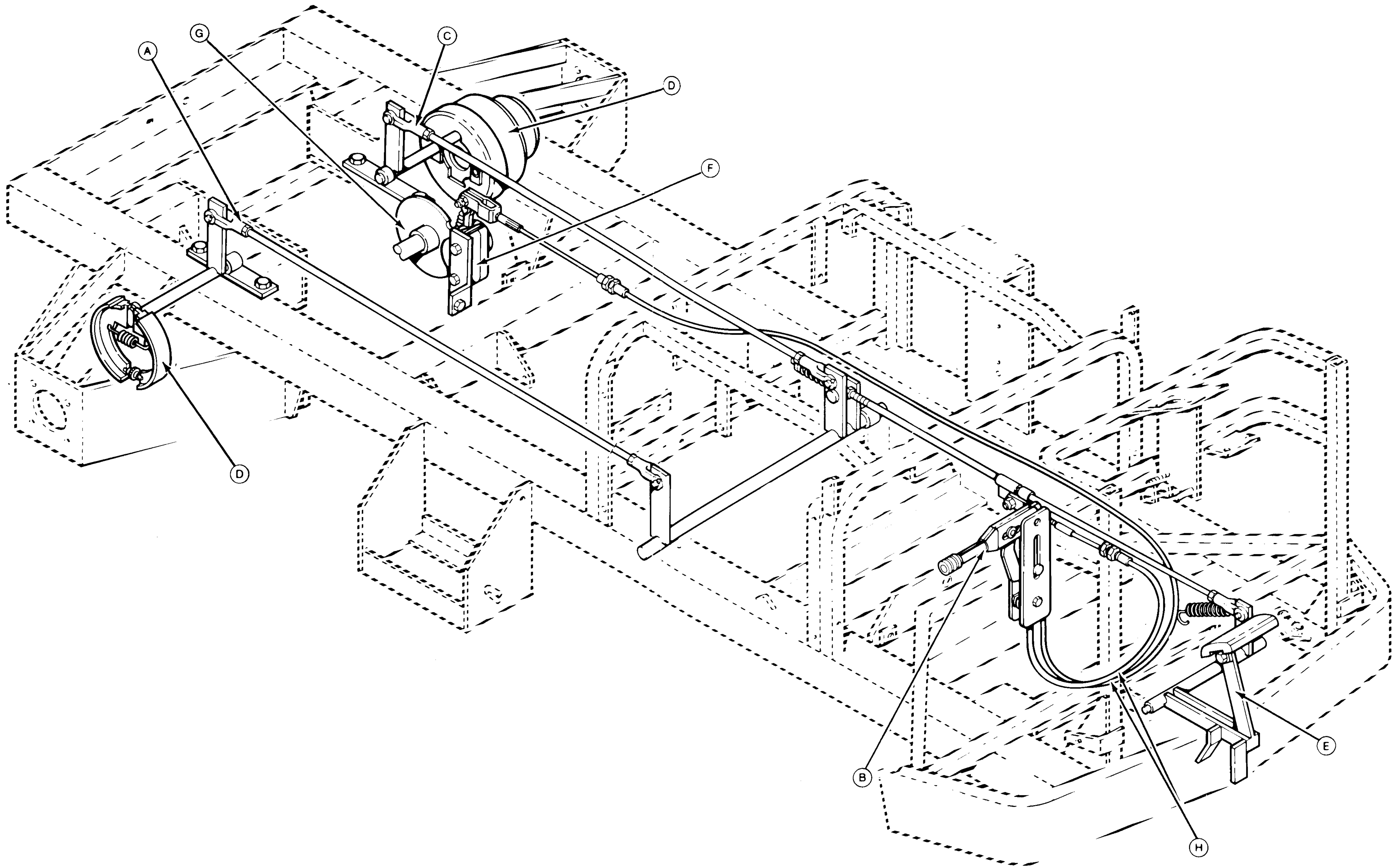
STEM COMPONENT LOCATION

BRAKE SYSTEM COMPONENT LOCATION

A—Right Brake Adjustment Link
B—Service-Park Brake Lever
C—Left Brake Adjustment Link
D—Brake Drums and Shoes
E—Normal Brake Pedal
F—Parking Brake Caliper and Disc

Slide M46520

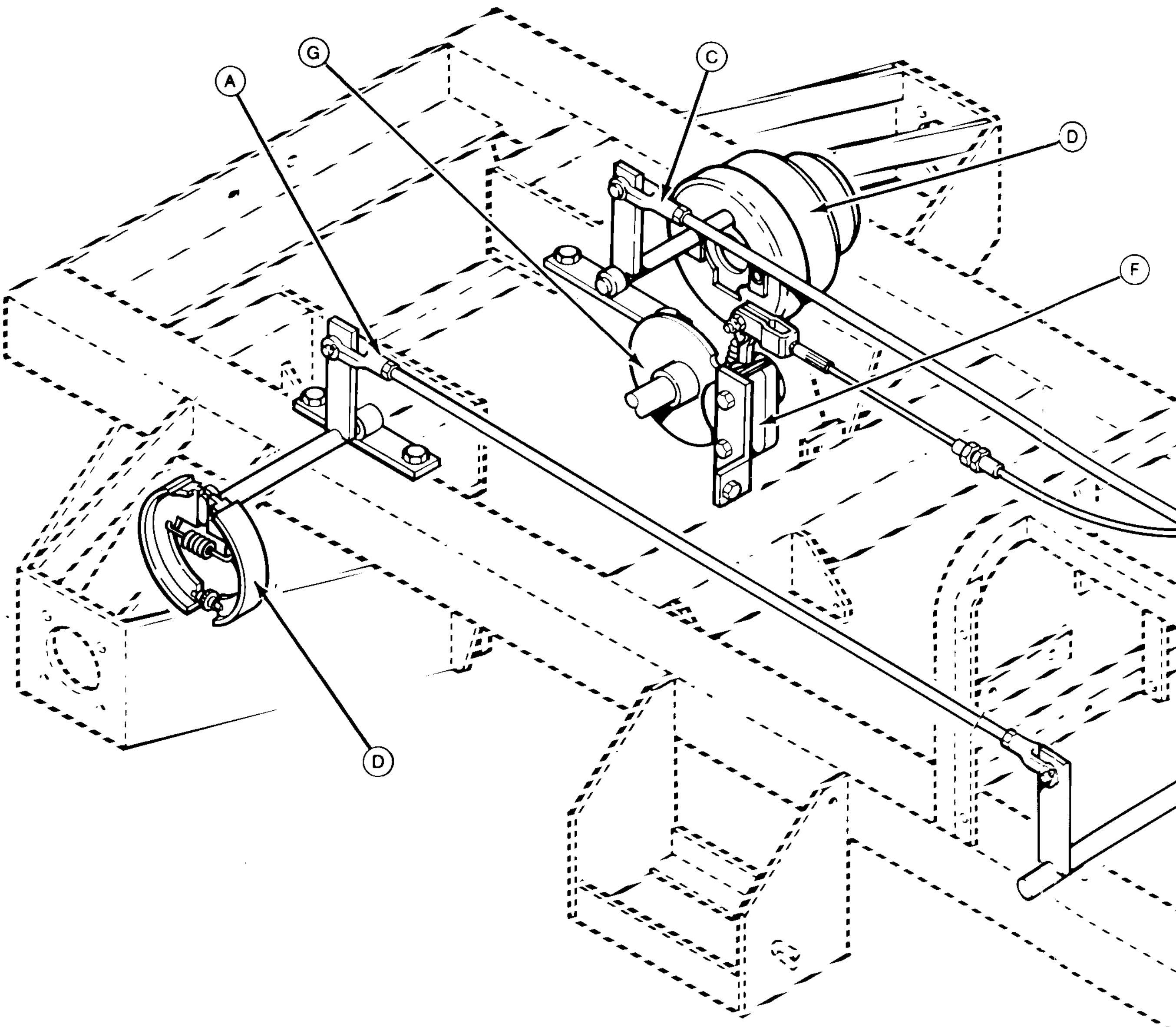
MX,26005HJ,4 -19-14APR92



M46520

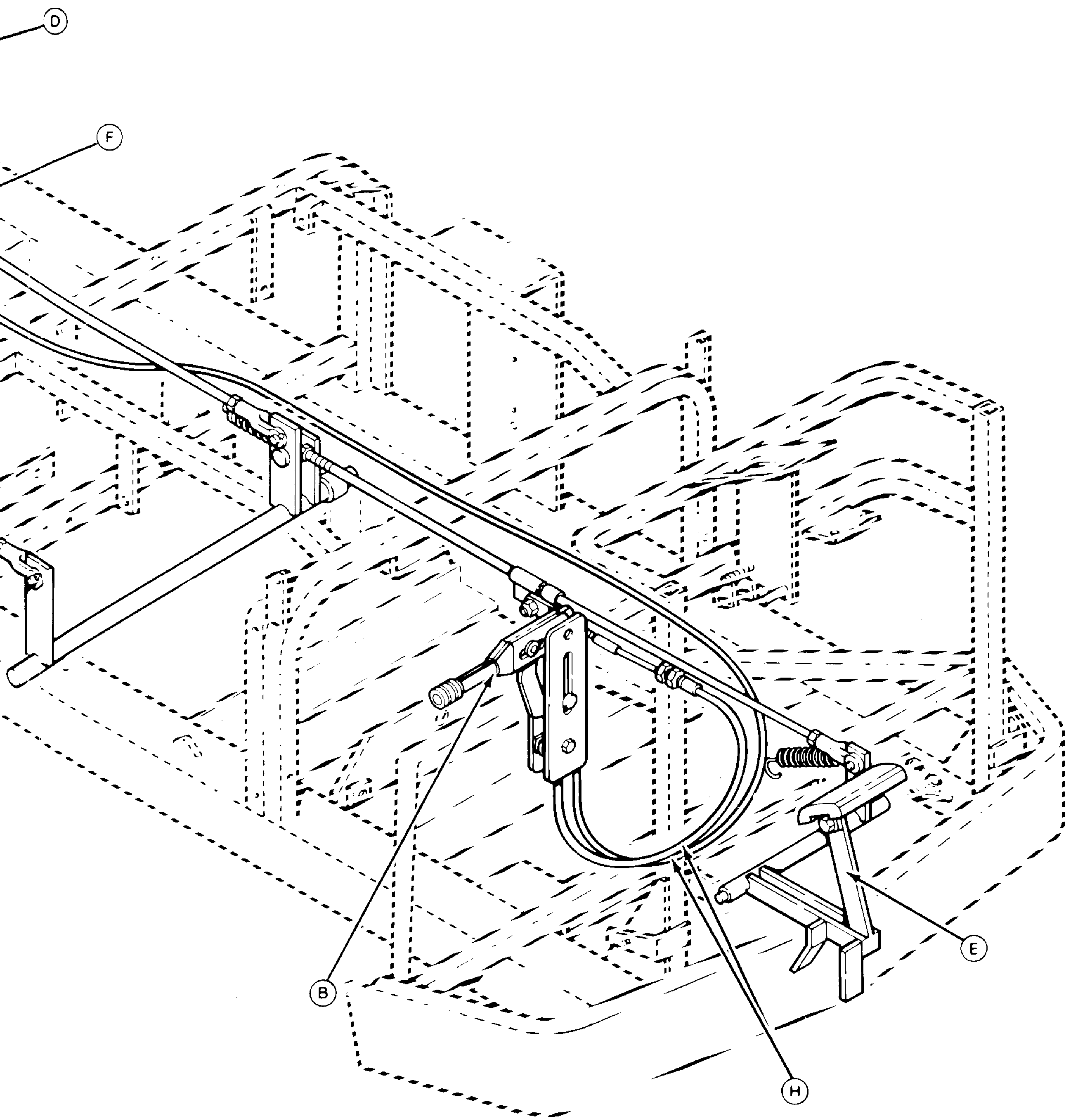
BRAKE SYSTEM COMPONENT LOCATION

MX,26005HJ,5 -19-14APR92



M46520

BRAKE SYSTEM COMPO



M COMPONENT LOCATION

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
•Brake System

The slide number reference under the art is used for service training purposes only.

MX,26010HJ,1 -19-14APR92

STEERING VALVE OPERATION—NEUTRAL

A—Port "LT"
B—Port "RT"
C—Port "OUT"
D—Port "IN"
E—Port "AUX"
F—Control Valve
G—Fluid Metering Section (Pump)
H—System Oil
I—Trapped Oil

Function:
When the steering wheel is not moving, the steering valve traps oil in the steering cylinder while routing system oil back to the hydrostatic transmission.

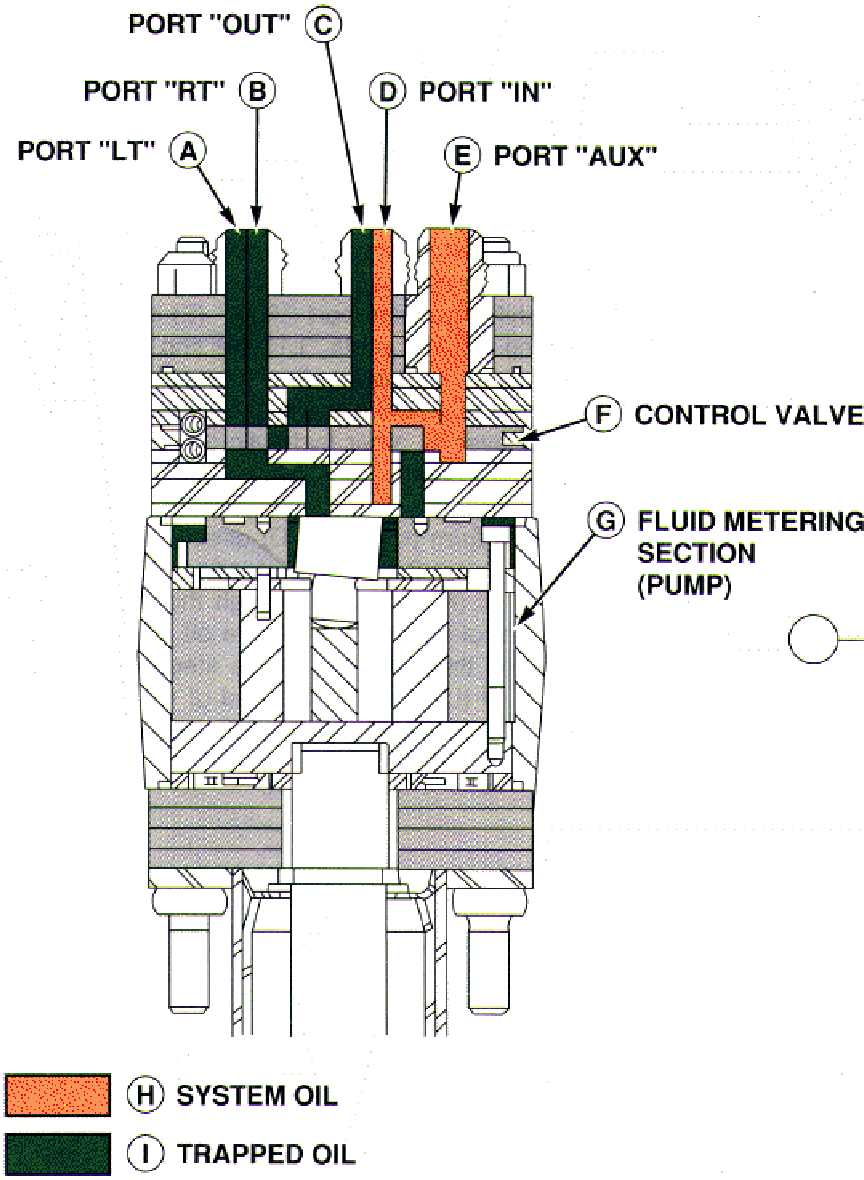
Major Components:
•Steering Wheel
•Steering Valve
•Steering Cylinder
•Pressure Lines

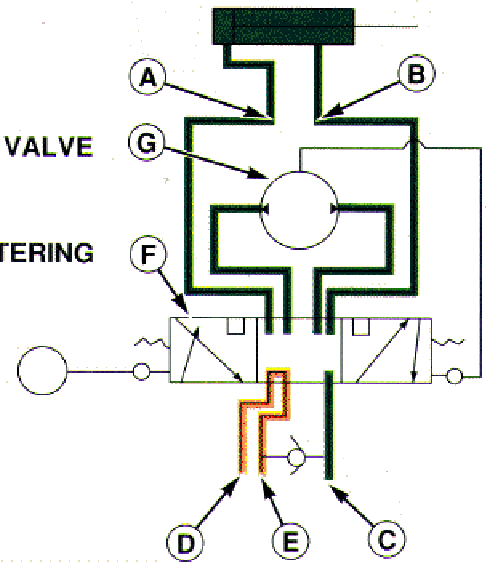
Theory of Operation:
The steering valve is a open-center type valve. This design (5-line) steering valve provides priority steering in this vehicles hydraulic system.

The steering valve consists of a self-centering fluid control valve (F) and a fluid metering section (G). These are hydraulically and mechanically interconnected inside the unit.

Whenever the steering wheel is not moving, the control valve (F) moves to the neutral position. In this position system oil (H) entering the steering valve through port "IN" (D) is allowed to flow through the control valve (F) and out port "AUX" (E). In this position the control valve is blocking oil from entering the fluid metering section (G), therefore trapping oil (I) in the rest of the steering system.

MX,26010HJ,2 -19-14APR92





MXC54149

STEERING VALVE OPERATION - NEUTRAL

Slide MXC54149

MXC54149 -19-

MX,26010HJ,3 -19-14APR92

STEERING VALVE OPERATION—LEFT HAND TURN

A—Port “LT”
B—Port “RT”
C—Port “OUT”
D—Port “IN”
E—Port “AUX”
F—Control Valve
G—Drive Link Assembly
H—Gerotor Motor
I—Steering Cylinder
J—Pressure Oil
K—System Oil
L—Return Oil
M—Trapped Oil

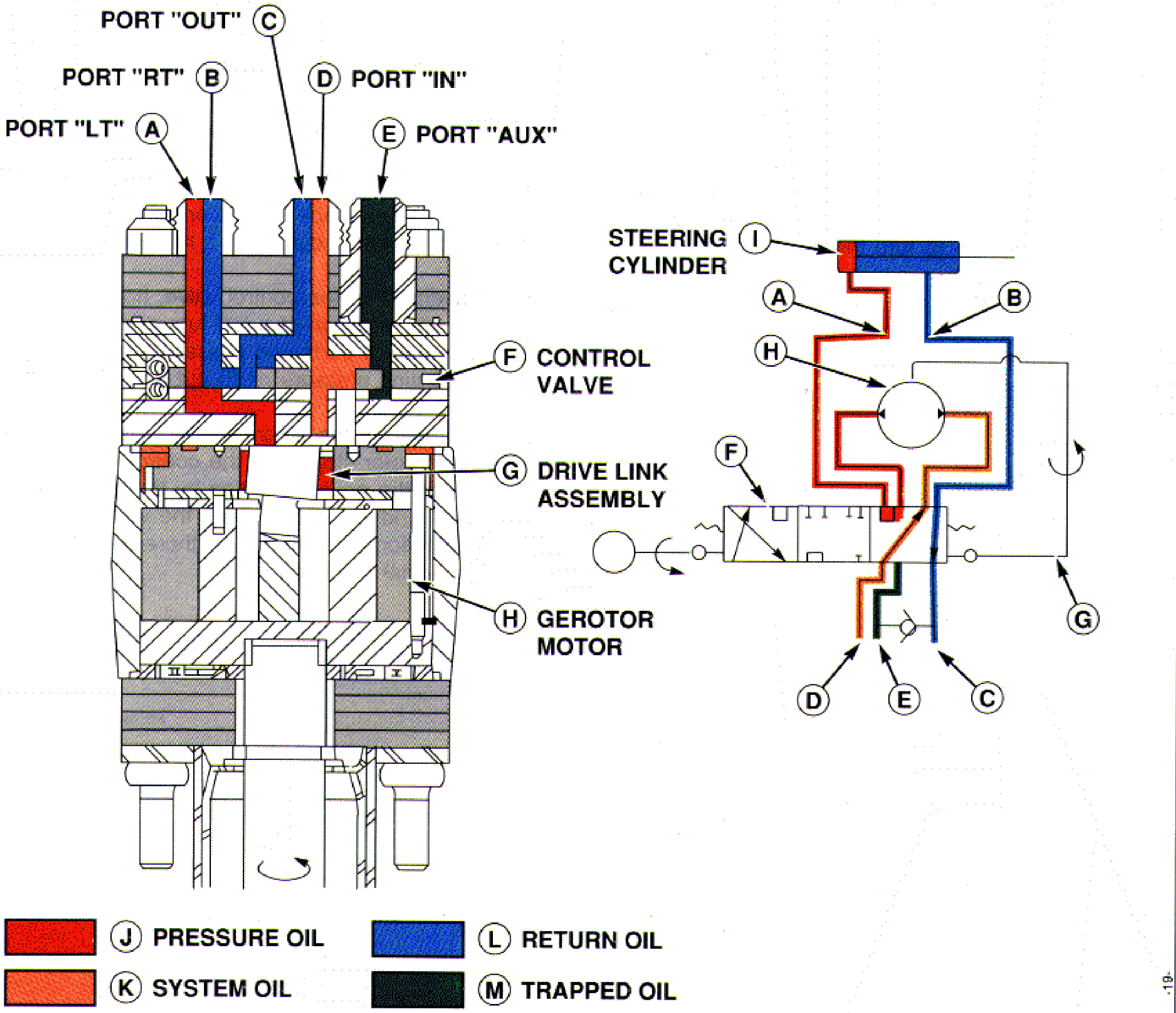
Function:
When the steering wheel is turned left from neutral position, the steering valve routes all system oil to the steering cylinder to turn the wheels left.

Major Components:
•Steering Wheel
•Steering Valve
•Steering Cylinder
•Pressure Lines

Theory of Operation:
As the steering wheel is turned to the left, the control valve (F) is shifted by the drive link assembly (G). This shifting closes port “AUX” (E) and opens the steering cylinder ports “LT” (A) and “RT” (B). When port “AUX” is closed, all system oil (K) is routed through the steering valve giving the steering valve priority over all other hydraulic components in the hydraulic system.

Oil flows from port “IN” (D) directly to the inlet of the gerotor motor (H). As the steering wheel is turned, system oil (K) is forced through the gerotor motor (H) and control valve (F). Pressure oil (J) is routed to port “LT” and the head end of the steering cylinder (I). Return oil (L) from the rod end of the cylinder is routed back to port “RT” (B) through the control valve and “OUT” port (C).

MX,26010HJ,4 -19-14APR92



MXC54150

STEERING VALVE OPERATION - LEFT HAND TURN

Slide MXC54150

MX,26010HJ,5 -19-14APR92

STEERING VALVE OPERATION—RIGHT HAND TURN

A—Centering Springs
B—Centering Springs
C—Port “LT”
D—Port “RT”
E—Port “OUT”
F—Port “IN”
G—Port “AUX”
H—Control Valve
I—Pressure Oil
J—System Oil
K—Return Oil

Function:
When the steering wheel is turned right from neutral position, the steering valve routes all system oil to the steering cylinder to turn the wheels right.

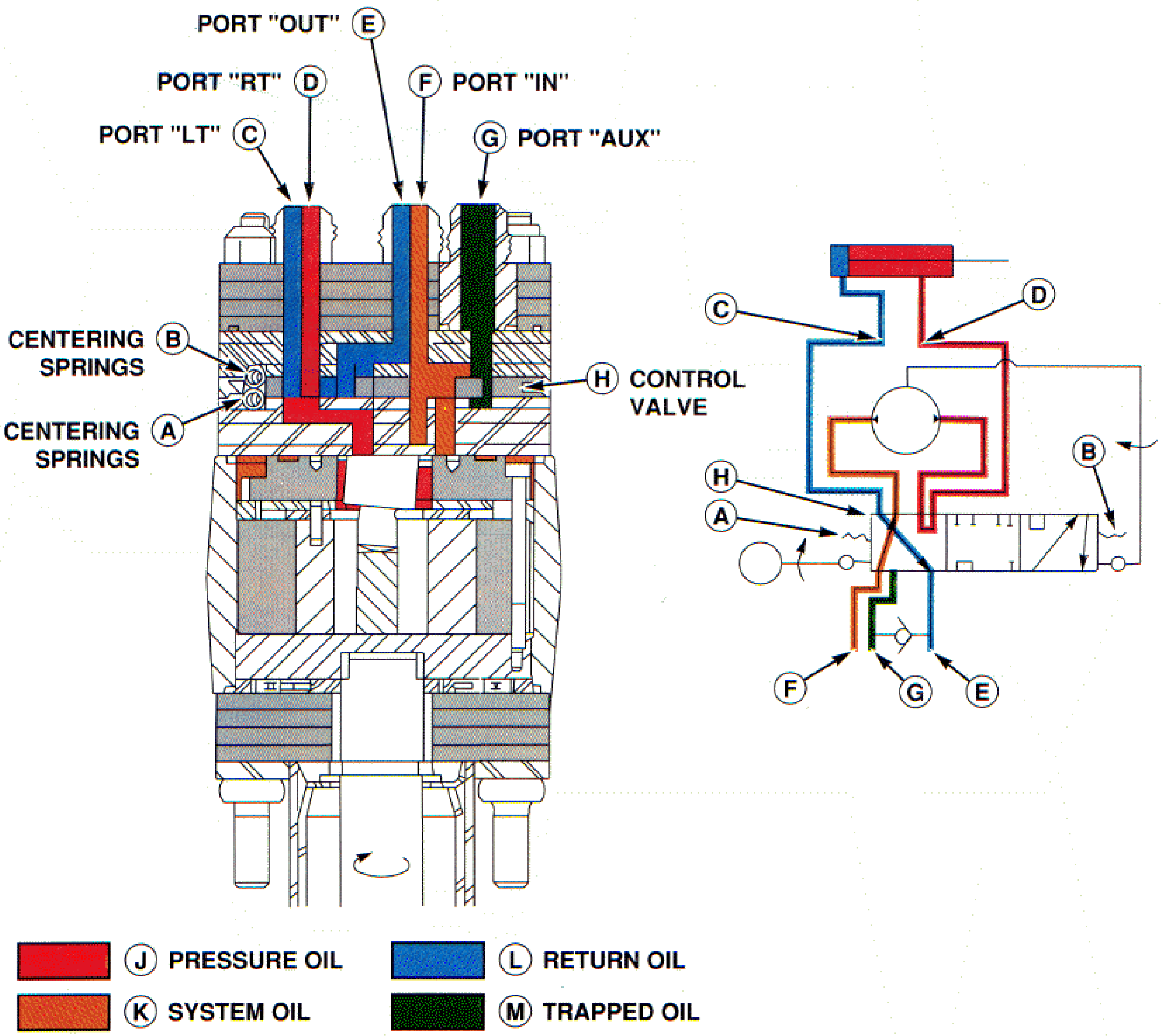
Major Components:
•Steering Wheel
•Steering Valve
•Steering Cylinder
•Pressure Lines

Theory of Operation:
When the steering wheel is turned to the right, movement takes place in the control valve (H) similar to the movement occurring in a left-hand turn.

The movement of the control valve, however, is in the opposite direction of a left turn and oil is routed through different ports and passages in the control valve, directing pressure oil (I) out port “RT” (D).

When rotation of the steering wheel stops, oil flow from the gerotor stops and the control valve (H) is returned to the neutral position by the centering springs (A and B). At this point, the valve is in the neutral position and will remain there until the steering wheel is moved again.

MX,26010HJ,6 -19-14APR92



STEERING VALVE OPERATION - RIGHT HAND TURN

Slide MXC54151

MXC54151 -19-

MX,26010HJ,7 -19-14APR92

BRAKE SYSTEM OPERATION

A—Service-Park Brake Lever
B—Brake Shoes
C—Brake Drum
D—Normal Brake Pedal
E—Park Brake Disc and Caliper

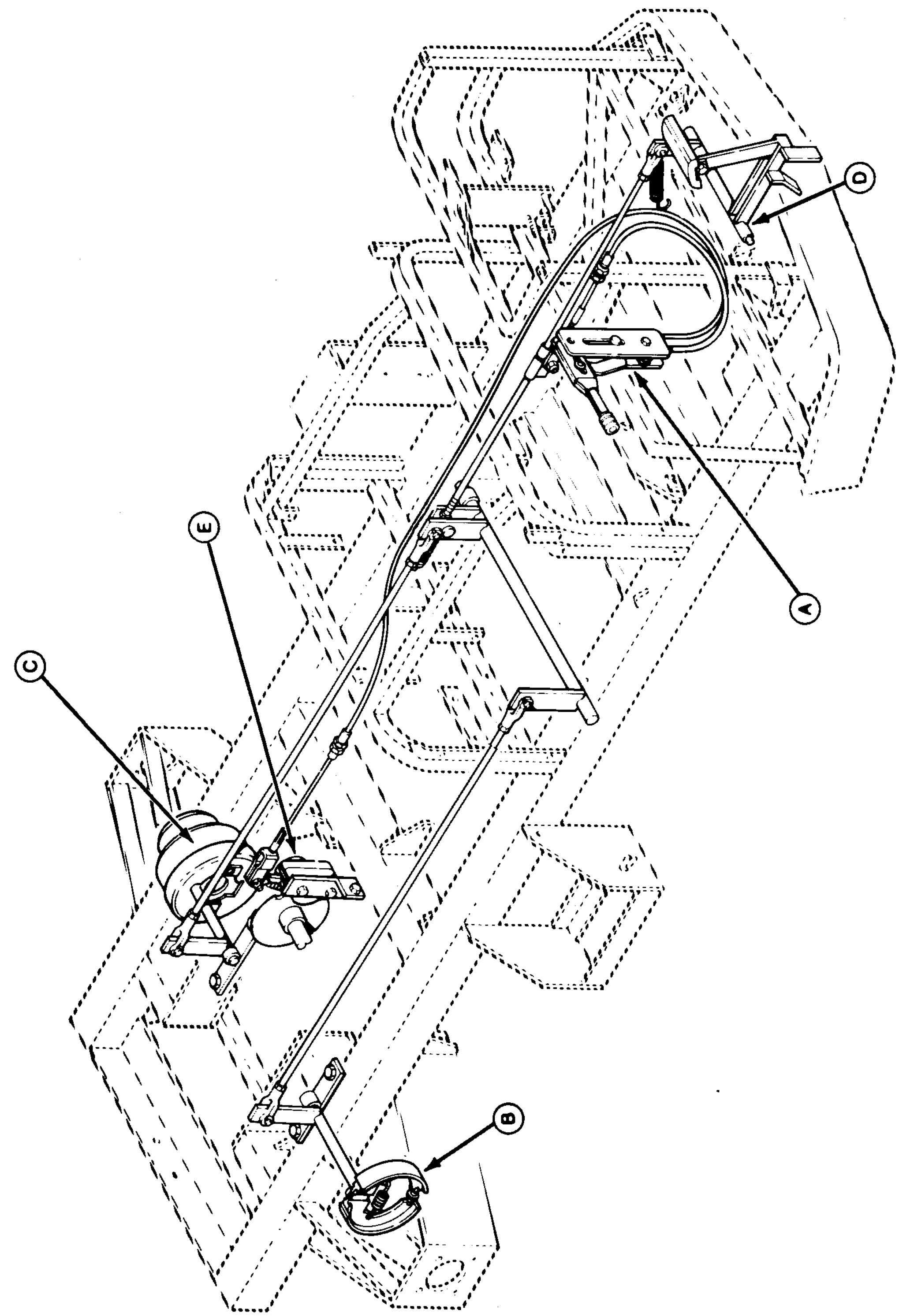
Function:
Provides a normal means of stopping the Utility Vehicle and also prevents movement when not in use.

Major Components:
•Service-Park Brake Lever
•Linkage
•Brake Drums and Shoes
•Normal Brake Pedal
•Park Brake Disc and Caliper

Theory of Operation:
Pressure applied to the brake pedal, through mechanical linkage, returns the transmission to Neutral and applies pressure to the brake shoes and drums providing braking action. The parking brake, in addition to returning the transmission to Neutral and applying the normal brakes, applies pressure to a disc brake assembly mounted on the Differential.

MX,26010HJ,8 -19-14APR92

BRAKE SYSTEM OPERATION



M46695 -UN-07APR92

M46695

Slide M46695

MX,26010HJ,9 -19-14APR92

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:

- •Steering Wanders
- •Steering Shimmy
- •Sluggish Steering Response
- •Lost Motion at Steering Wheel
- •High Steering Effort in One Direction
- •High Steering Effort in Both Directions
- •Steering Effort is Erratic
- •Wheels Continue Turning After Steering Wheel is Stopped
- •Brakes Do Not Operate Properly

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.

MX,26015HJ,1 -19-14APR92

STEERING WANDERS

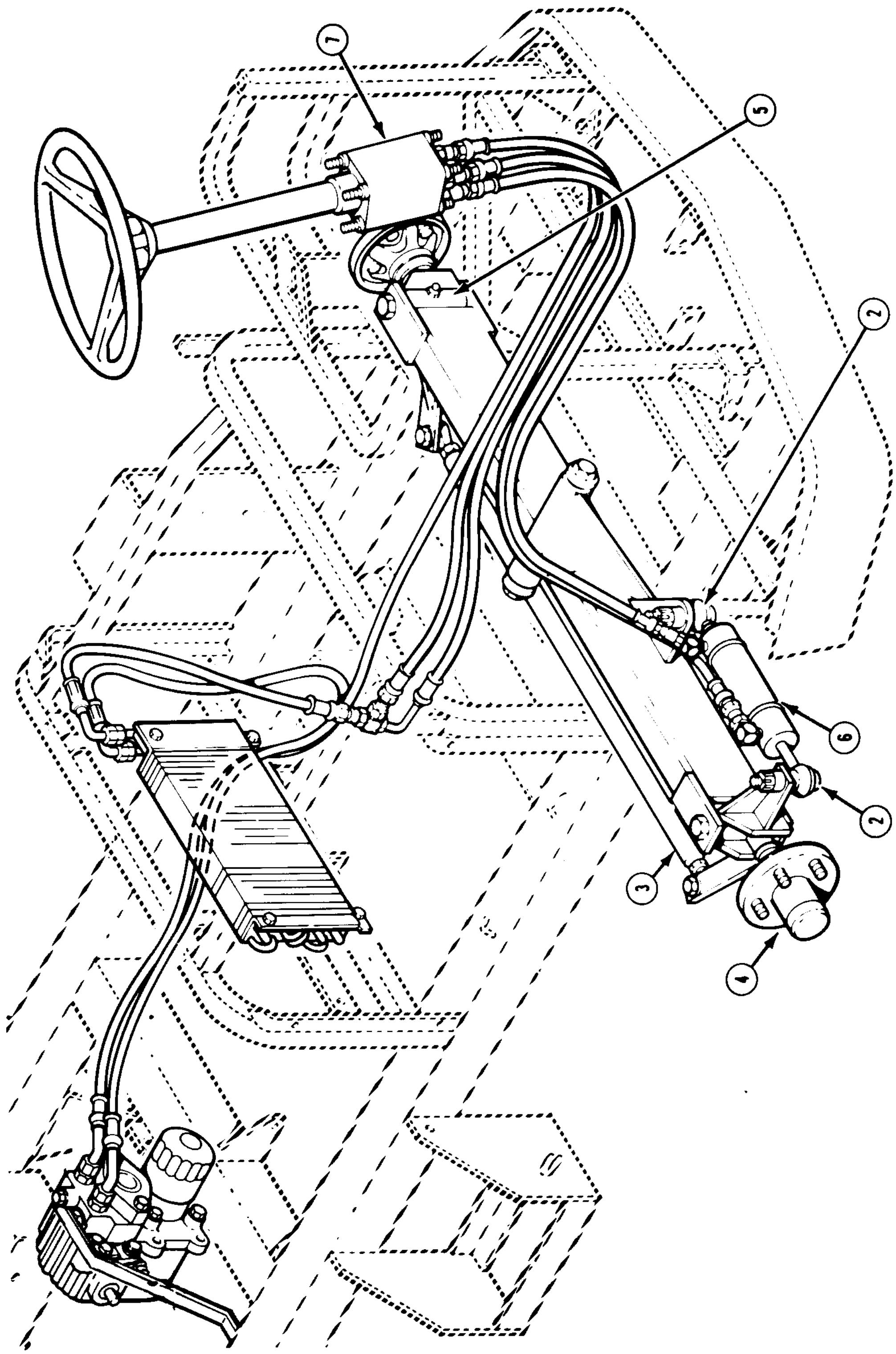
Conditions:
•Park brake engaged
•Engine not running

Test Location	Normal	If Not Normal
1. Tires	Correct size and pressure	See Operator's Manual.
2. Steering cylinder ball joints	Ball joints are tight and no signs of wear	Adjust. See Steering Link Adjustment. Replace if necessary.
3. Tie rod	Tie rod is tight and no signs of wear	Adjust toe-in. See Toe-In Adjustment. Replace if necessary.
4. Front wheels	Bearings clean and not worn	Replace parts. See Section 80.
	Toe-in adjustment is correct	Adjust toe-in. See Toe-In Adjustment.
5. Front axle spindles	Bushings clean and not worn	Replace parts. See Section 60.
6. Steering cylinder	No external/internal oil leakage	Test steering system. See Steering System Leakage Test.
7. Steering valve	No external/internal oil leakage	Test steering system. See Steering System Leakage Test.

NOTE: If the problem still exists after accomplishing these test procedures, inspect the tires for a distorted appearance, this may suggest that the plies in the tire may have separated. Tire replacement is necessary to correct this problem.

MX,26015HJ,2 -19-14APR92

STEERING WANDERS



M46639 -19-06APR92

MX,26015HJ,3 -19-14APR92

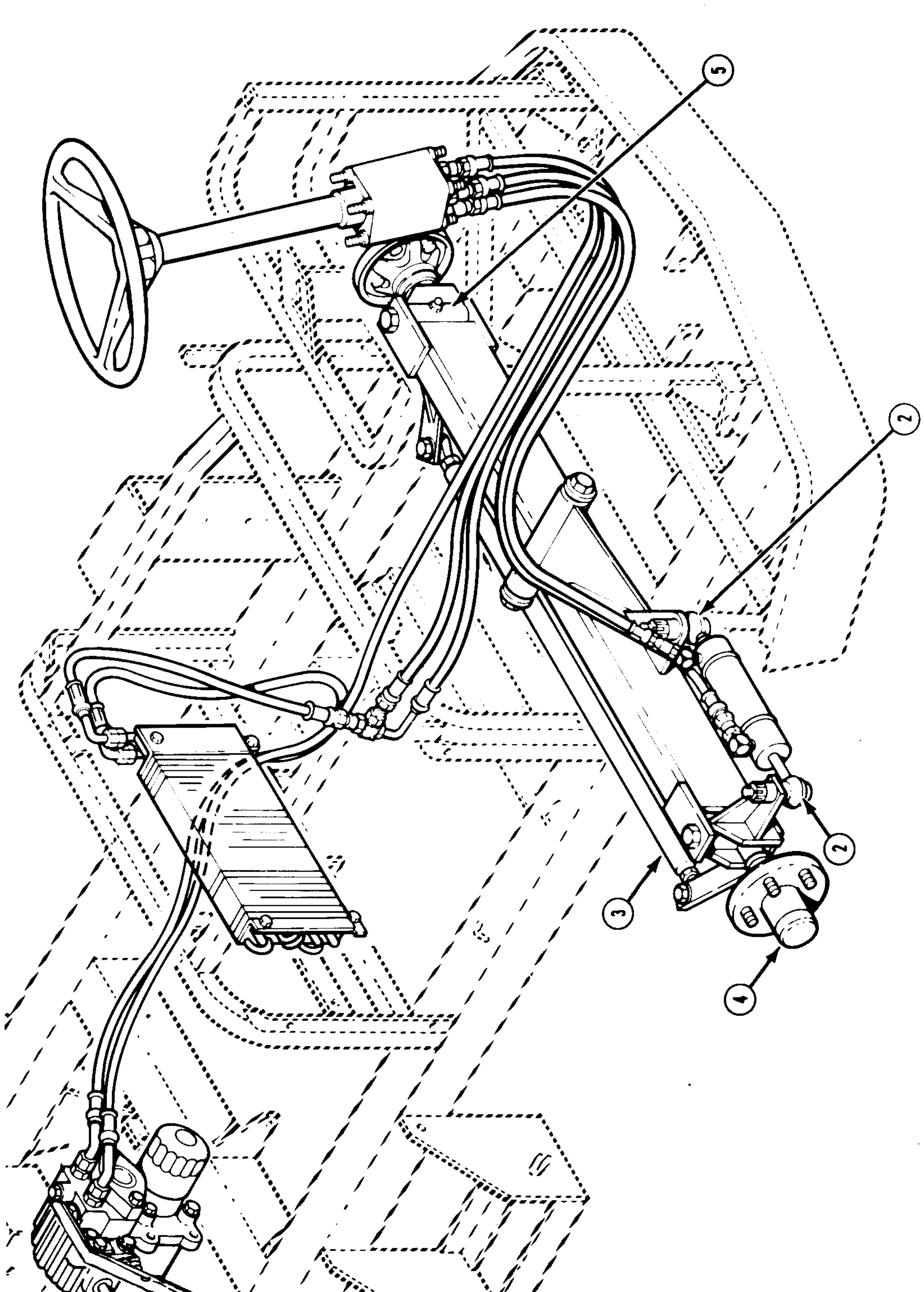
STEERING SHIMMY

Conditions:
•Park brake engaged
•Engine not running

Test Location	Normal	If Not Normal
1. Wheels	Properly mounted and secure	Repair.
2. Steering cylinder ball joints	Ball joints are tight and no signs of wear	Adjust. See Steering Link Adjustment. Replace if necessary.
3. Tie rod	Tie rod is tight and no sign of wear	Adjust toe-in. See Toe-In Adjustment. Replace if necessary.
4. Front wheels	Bearings clean and not worn	Replace parts. See Section 80.
	Toe-in adjustment is correct	Adjust toe-in. See Toe-In Adjustment.
5. Front axle spindles	Bushings clean and not worn	Replace parts. See Section 60.
6. Sight tube on differential	Hydrostatic fluid clear and not foamy	Bleed hydraulic system. See Section 60. Replace with clean oil. See Operator’s Manual.

MX,26015HJ,4 -19-14APR92

STEERING SHIMMY



M46640 -19-06APR92

MX,26015HJ,5 -19-14APR92

SLUGGISH STEERING RESPONSE

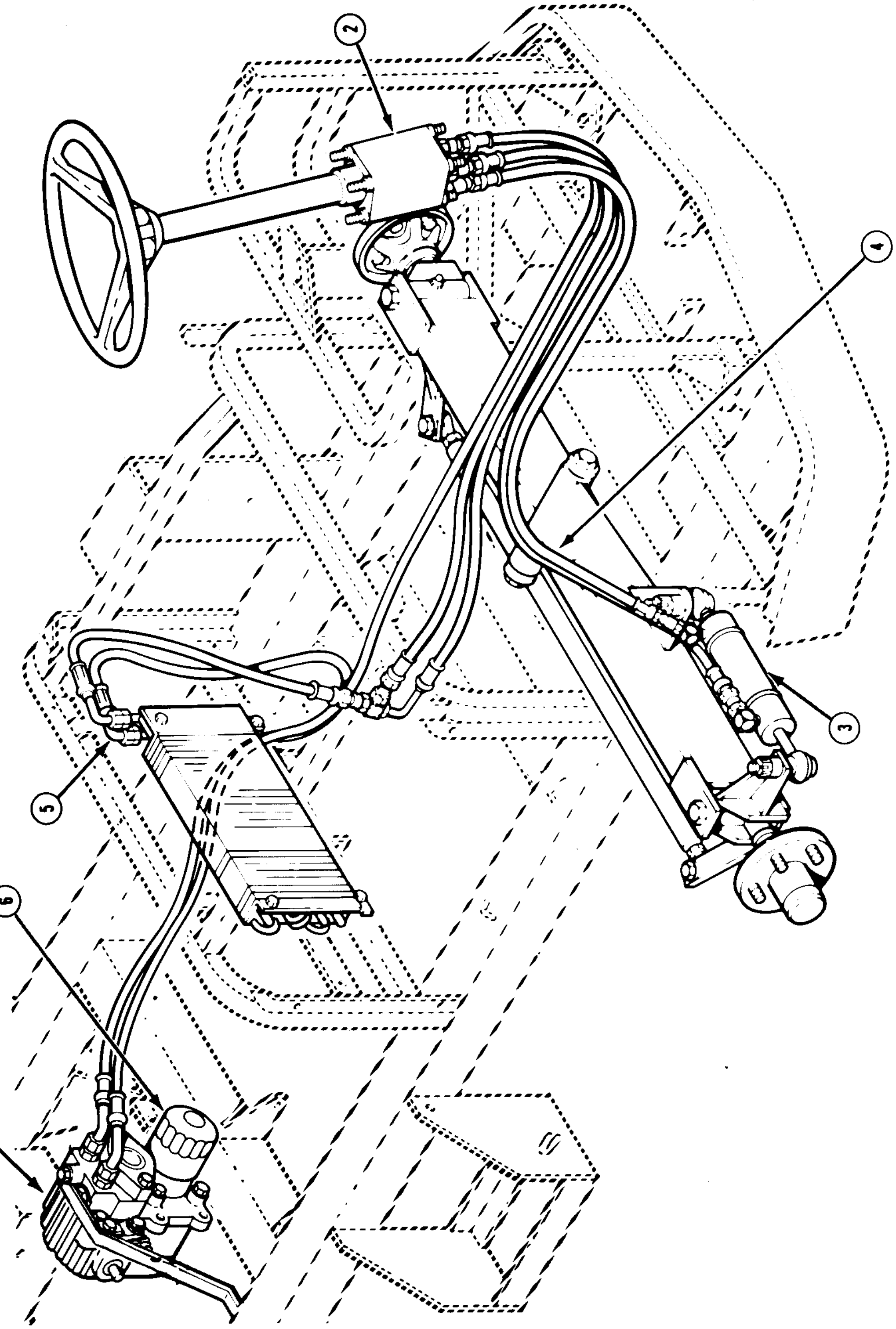
Conditions:
•Park brake engaged
•Engine not running

Test Location	Normal	If Not Normal
1. Sight tube on side of differential	Hydrostatic fluid clear and not foamy	Bleed hydraulic system. See Section 60. Replace with clean oil. See Operator's Manual.
2. Steering valve	No external/internal oil leakage	Test steering system. See Steering System Leakage Test.
3. Steering cylinder	No external/internal oil leakage	Test steering system. See Steering System Leakage Test.
4. Pressure lines from steering valve to steering cylinder	No external oil leakage	Test steering system. See Steering System Leakage Test.
5. Oil cooler return line	No kinks or restriction	Replace lines or cooler. See Section 70.
6. Transmission oil filter	No clogging or restriction	Replace. See Operator's Manual.

Conditions:
•Park brake engaged
•Operator on seat
•Engine running

7. Transmission	Charge pump pressure is 620—1240 kPa (6.2—12.4 bar) (90—180 psi) at slow idle	Test charge pump pressure and flow. See Section 250.
8. Flywheel	Engine rpm: Slow idle 1550 ± 100 rpm Fast idle 3800 ± 100 rpm	Adjust engine rpm. See Section 220.

MX,26015HJ,6 -19-14APR92



SLUGGISH STEERING RESPONSE

M46641

M46641 -19-06APR92

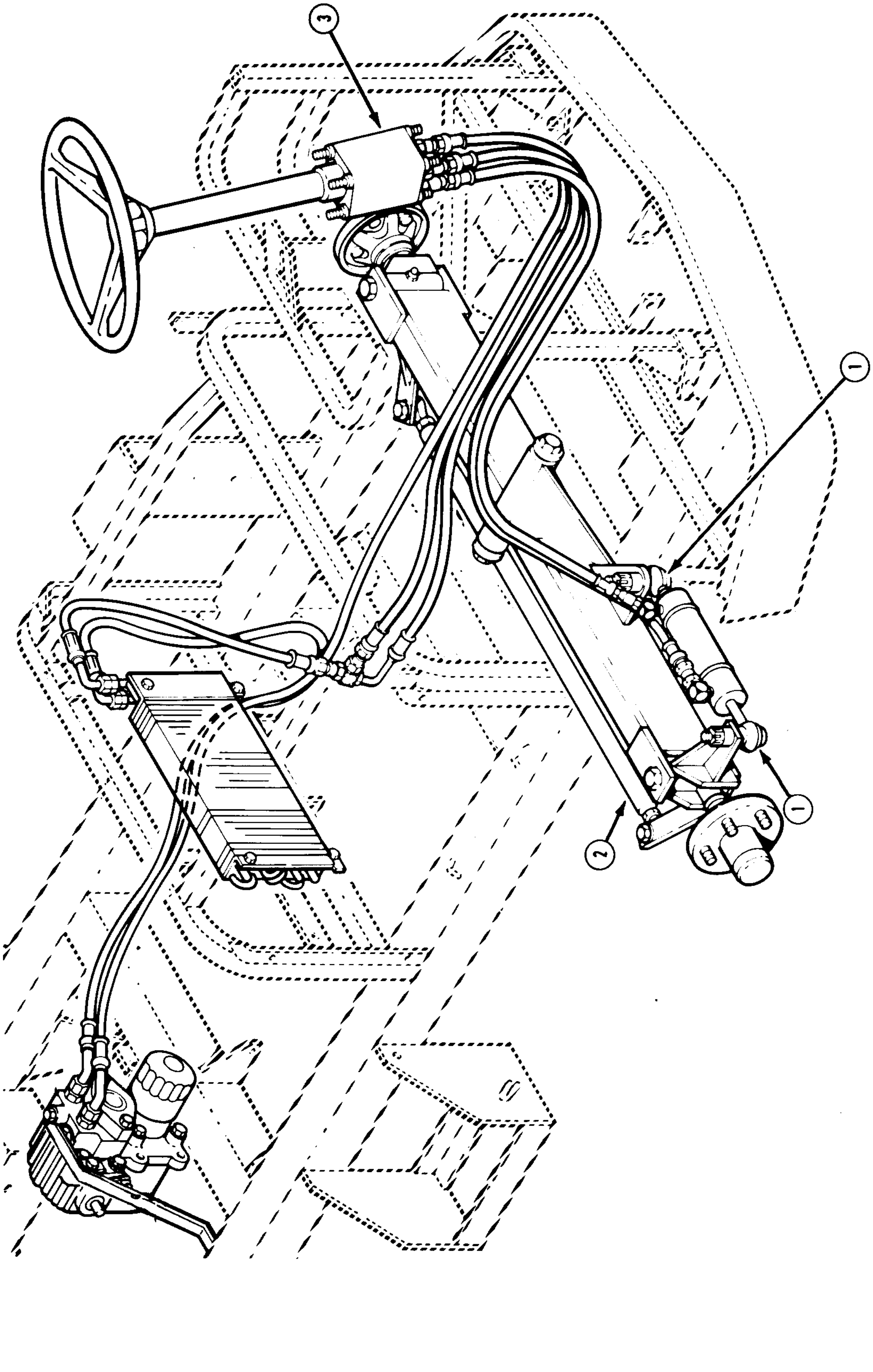
MX,26015HJ,7 -19-14APR92

EXCESSIVE STEERING WHEEL FREE PLAY

Conditions:
•Park brake engaged
•Engine not running

Test Location	Normal	If Not Normal
1. Steering cylinder ball joints	Ball joints are tight and no signs of wear	Adjust. Replace if necessary.
2. Tie rod	Tie rod is tight and no signs of wear	Adjust toe-in. See Toe-In Adjustment. Replace if necessary.
3. Steering valve	Securely mounted	Tighten mounting nuts.
4. Sight tube on front of differential	Hydrostatic fluid clear and not foamy	Bleed hydraulic system. Section 60. Replace with clean oil. See Operator's Manual.

MX,26015HJ,8 -19-14APR92



EXCESSIVE STEERING WHEEL FREE PLAY

M46642

M46642 -19-06APR92

MX,26015HJ,9 -19-14APR92

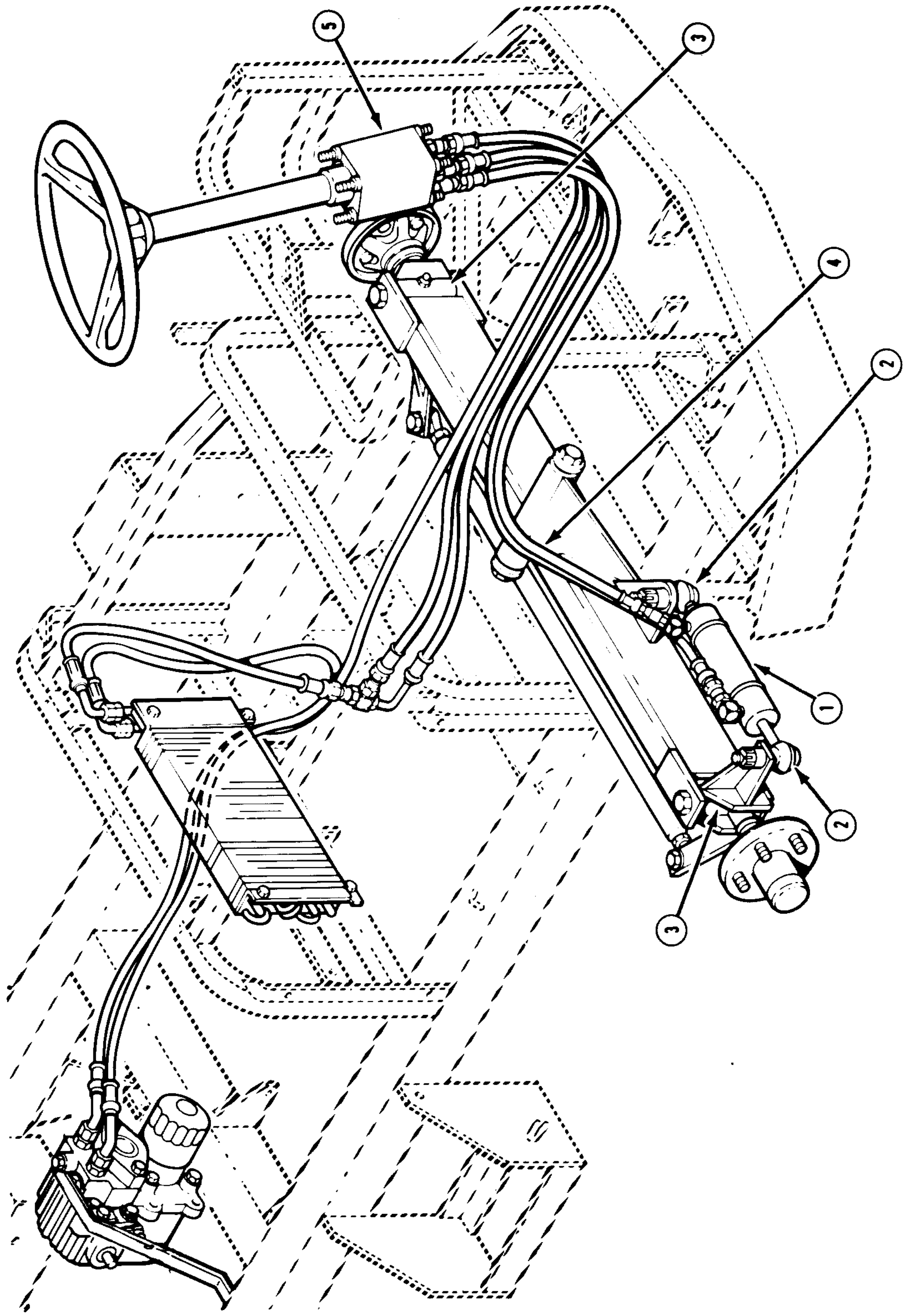
HIGH STEERING EFFORT IN ONE DIRECTION

Conditions:
•Park brake engaged
•Engine not running

Test Location	Normal	If Not Normal
1. Steering cylinder	No external oil leaks or visible damage	Test steering system. See Steering System Leakage Test.
	Cylinder rod not bent	Replace cylinder. See Section 60.
2. Steering cylinder ball joints	Ball joints are tight and no signs of wear	Replace if necessary.
3. Steering spindle	Free to rotate Lubricated	Repair. See Section 60.
4. Pressure lines from steering valve to steering cylinder	No restrictions or sharp bends	Replace lines.
5. Steering valve	No external oil leaks or visible damage	Test steering system. See Steering System Leakage Test.
	Valve operates smoothly without sticking	Disassemble, inspect and clean or replace parts as necessary. See Section 60.

Slide M46643

MX,26015HJ,10 -19-14APR92



HIGH STEERING EFFORT IN ONE DIRECTION

I6643

M46643 -19-06APR92

MX,26015HJ,11 -19-14APR92

HIGH STEERING EFFORT IN BOTH DIRECTIONS

Conditions:
•Park brake engaged
•Engine not running

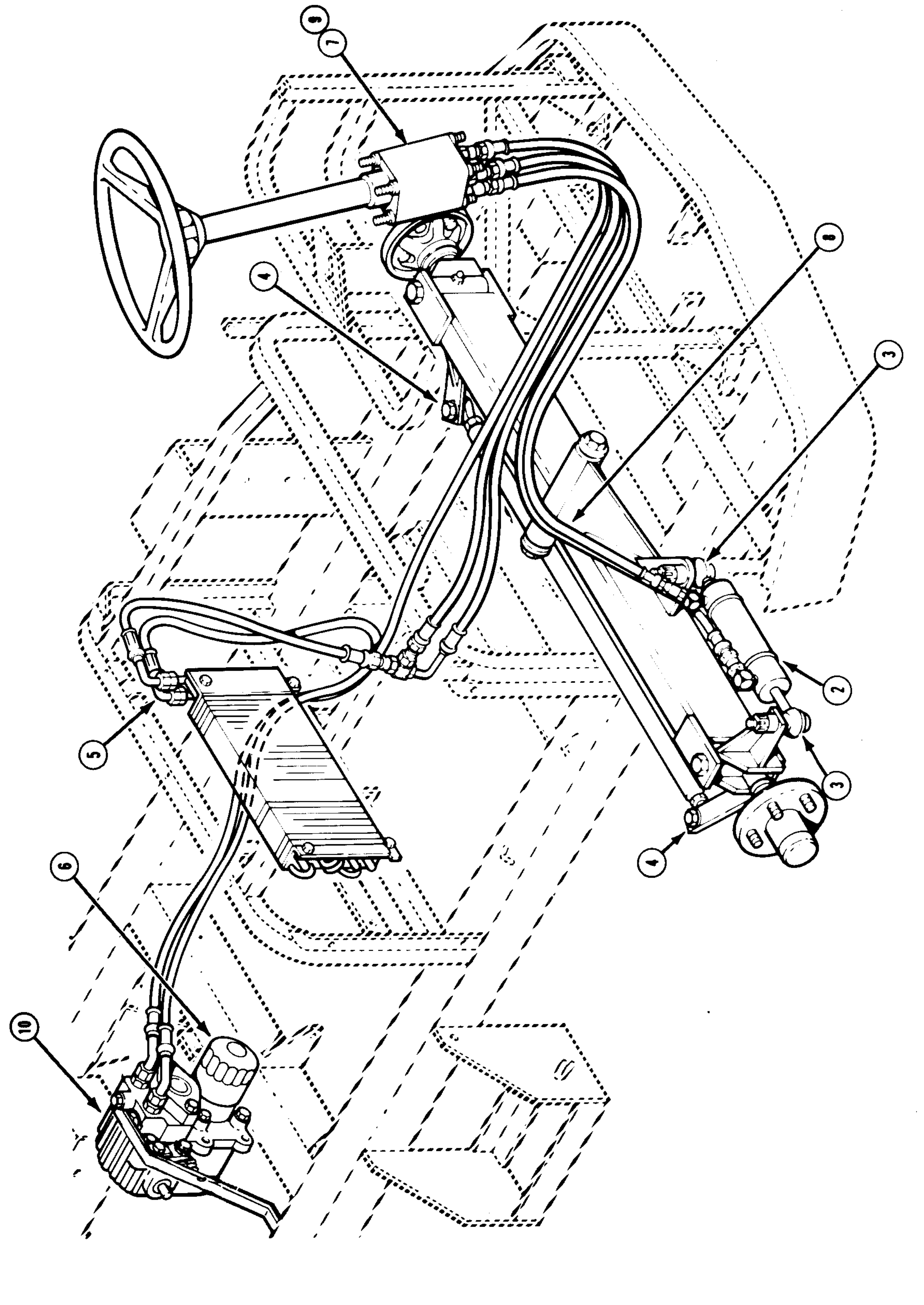
Test Location	Normal	If Not Normal
1. Wheels and tires	Properly inflated and secure	Repair.
2. Steering cylinder	Cylinder rod not bent	Replace cylinder. See Section 60.
3. Steering cylinder ball joint	Ball joints are tight and no signs of wear	Replace if necessary.
4. Tie rod ball joints	Tie rod is tight and free to rotate No signs of wear	Replace if necessary.
5. Oil cooler return line	No kinks or restriction	Replace lines or cooler. See Section 70.
6. Transmission oil filter	No clogging or restriction	Replace. See Operator’s Manual.
7. Steering valve	Valve operates smoothly without sticking	Disassemble, inspect and clean or replace parts as necessary. See Section 60.

Conditions:
•Park brake engaged
•Operator on seat
•Engine running

Test Location	Normal	If Not Normal
8. Pressure lines from steering valve to steering cylinder	No external oil leakage	Test steering system. See Steering System Leakage Test.
9. Steering valve	No internal oil leakage	Test steering system. See Steering System Leakage Test.
10. Transmission	Charge pump pressure is 620—1240 kPa (6.2—12.4 bar) (90—180 psi) at slow idle	Test charge pump pressure and flow. See Section 250.
11. Flywheel	Engine rpm: Slow idle 1550 ± 100 rpm Fast idle 3800 ± 100 rpm	Adjust engine rpm. See Section 220.

Slide M46644

MX,26015HJ,12 -19-14APR92



HIGH STEERING EFFORT IN BOTH DIRECTIONS

M46644

M46644 -19-06APR92

MX,26015HJ,13 -19-14APR92

WHEELS DO NOT HIT STOP

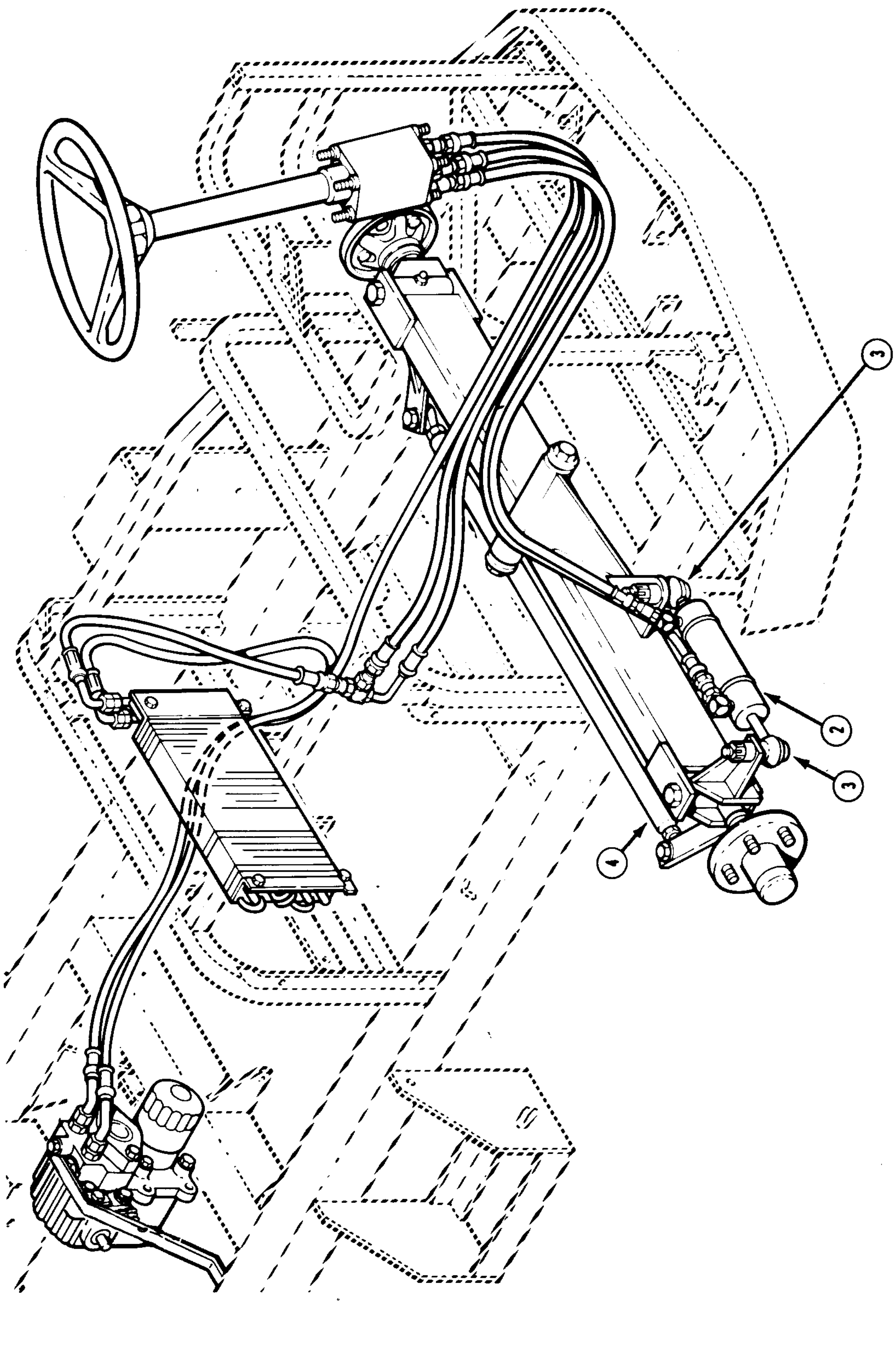
Conditions:
•Park brake engaged
•Engine not running

Test Location	Normal	If Not Normal
1. Front Wheels	Toe-in adjustment is correct	Adjust. See Toe-In Adjustment.
2. Steering cylinder	Cylinder rod not bent	Replace cylinder. See Section 60.
3. Steering cylinder ball joints	Ball joints are tight and no signs of wear or damage	Replace if necessary.
4. Tie rod	Tie rod is tight and no signs of wear or damage	Adjust toe-in. See Toe-In Adjustment. Replace if necessary.

Slide M46645

MX,26015HJ,14 -19-14APR92

WHEELS DO NOT HIT STOP



M46645

M46645 -19-06APR92

MX,26015HJ,15 -19-14APR92

STEERING EFFORT IS ERRATIC

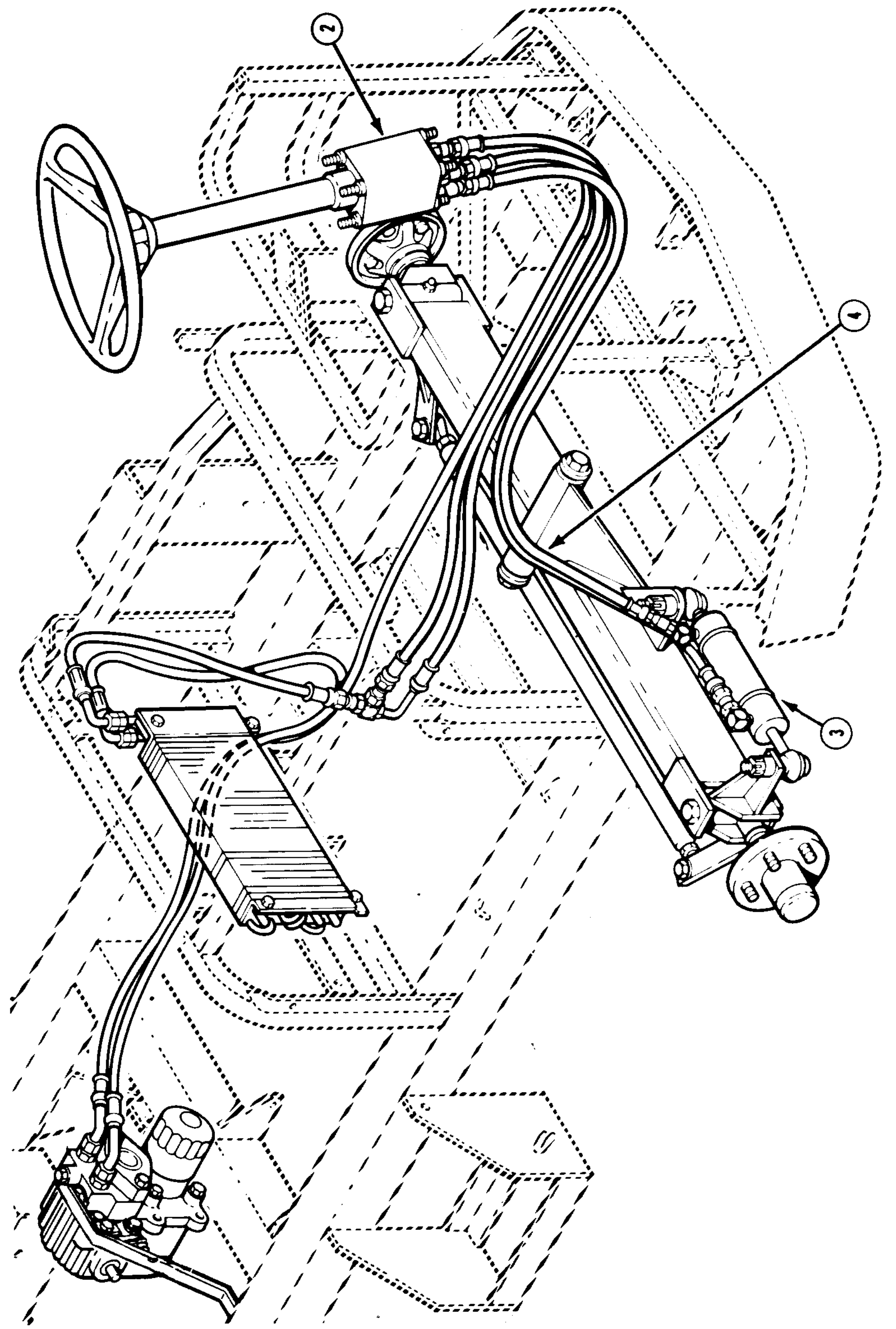
Conditions:
•Park brake engaged
•Engine running

Test Location	Normal	If Not Normal
1. Sight tube on front of differential	Hydrostatic fluid clear and not foamy	Bleed hydraulic system. See Section 60. Replace with clean oil. See Operator’s Manual.
2. Steering valve	No external oil leakage	Test steering system. See Steering System Leakage Test.
3. Steering cylinder	No external oil leakage	Test steering system. See Steering System Leakage Test.
4. Pressure lines from steering valve to steering cylinder	No external oil leakage	Test steering system. See Steering System Leakage Test.

Slide M46646

MX,26015HJ,16 -19-14APR92

STEERING EFFORT IS ERRATIC



M46646 -19-06APR92

MX,26015HJ,17 -19-14APR92

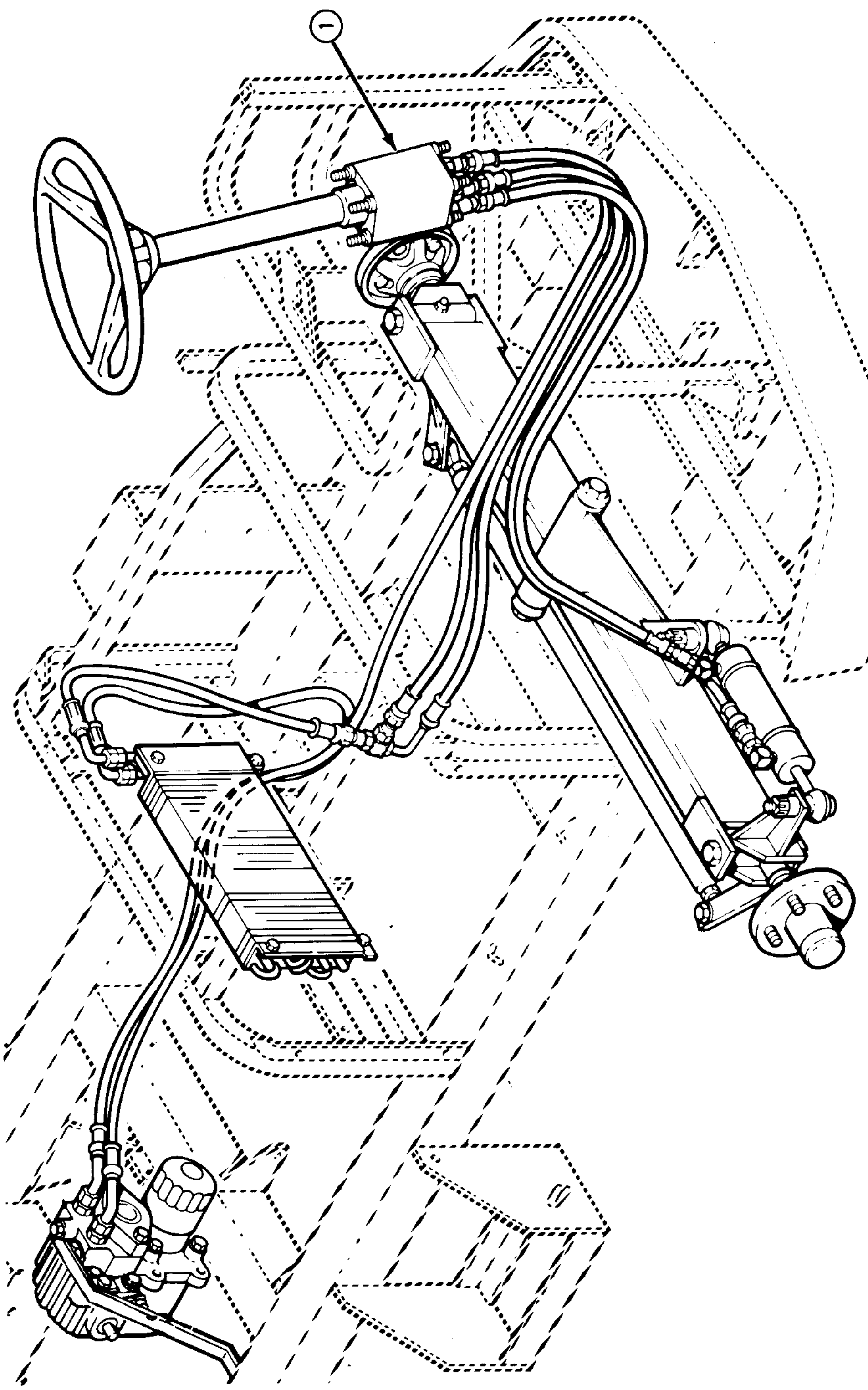
WHEELS CONTINUE TURNING AFTER STEERING WHEEL IS STOPPED

Conditions:
•Park brake engaged
•Engine not running

Test Location	Normal	If Not Normal
1. Steering valve	Valve operates smoothly	Disassemble, inspect and clean or replace parts as necessary. See Section 60.

Slide M46647

MX,26015HJ,18 -19-14APR92



WHEELS CONTINUE TURNING AFTER STEERING WHEEL IS STOPPED

M46647 -19-06APR92

M46647

MX,26015HJ,19 -19-14APR92

BRAKES DO NOT OPERATE PROPERLY

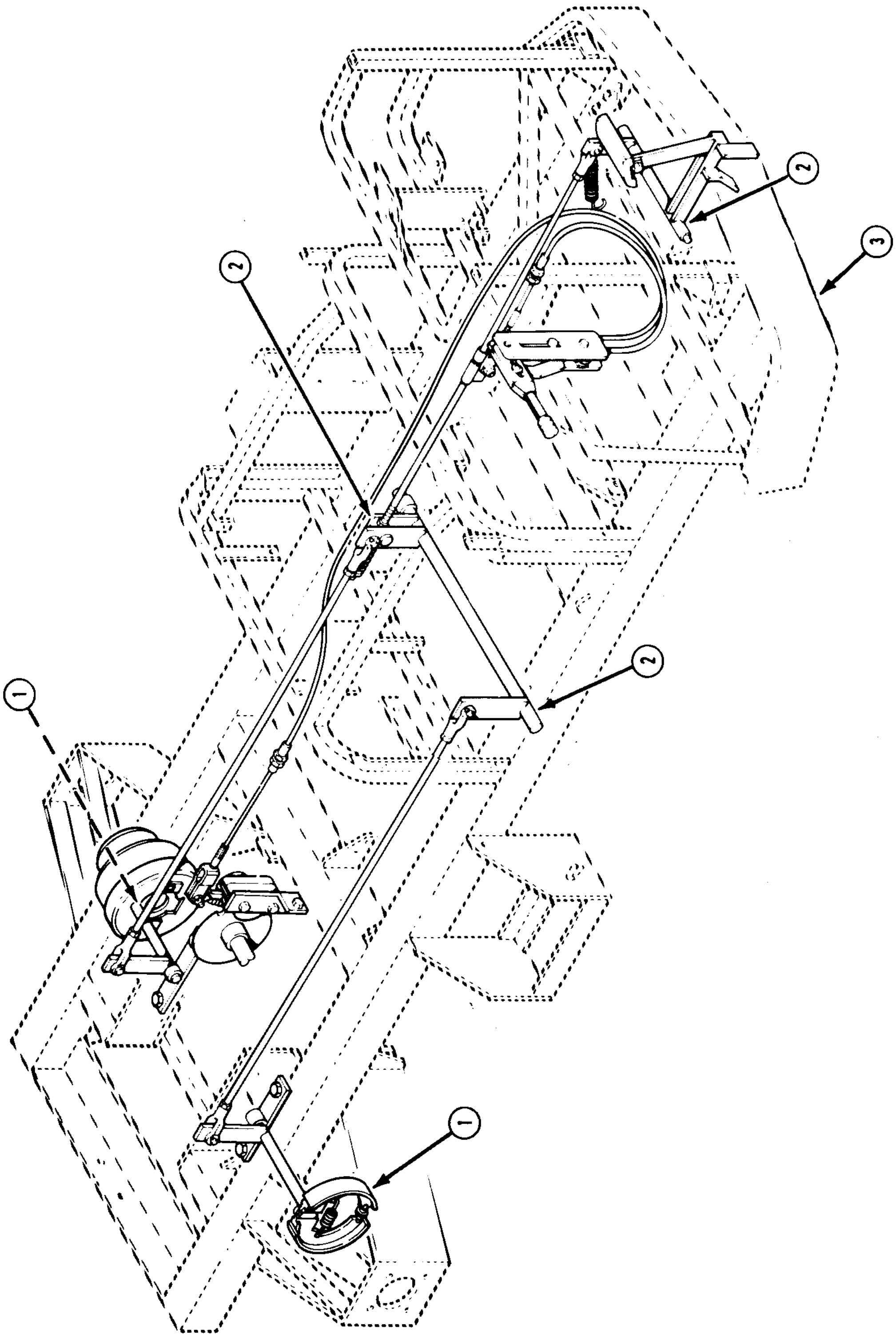
Conditions:
•Operator in seat
•Engine running

Test Location	Normal	If Not Normal
1. Brake shoes	Dry	Allow sufficient drying time.
	Properly adjusted	See Brake Shoe Adjustment.
	Not worn	Replace.
	Not oily or greasy	Determine cause and repair. Replace brake shoes.
2. Linkage	Not worn, bent or binding	Determine cause and repair or replace as necessary.
3. Vehicle	Does not exceed design weight limitations	Remove excess weight.

Slide M46648

MX,26015HJ,20 -19-14APR92

BRAKES DO NOT OPERATE PROPERLY



M46648 -19-06APR92

MX,26015HJ,21 -19-14APR92

HYDRAULIC OIL WARM-UP PROCEDURE

Reason:
When making hydraulic tests the oil must be heated to the specified temperature for the tests to be accurate.

Equipment:
•JDG282 Temperature Gauge

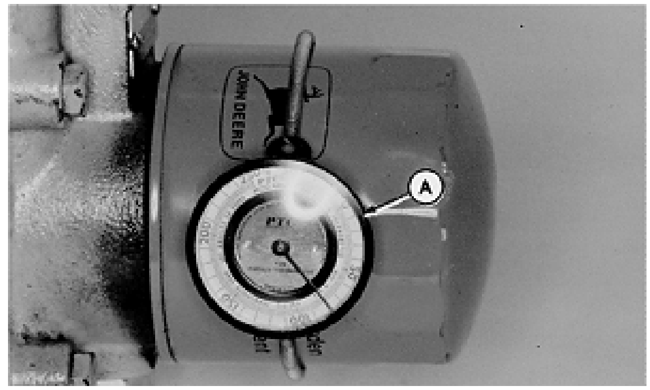
Connections:
1. Install JDG282 Temperature Gauge (A) on transmission oil filter.

2. Put cardboard or paper around oil cooler to restrict air flow.

Procedure:
1. Apply park brake. Start engine and run at full throttle.

2. Periodically cycle all hydraulic functions to distribute heated oil.

3. Heat oil to temperature specified in test.



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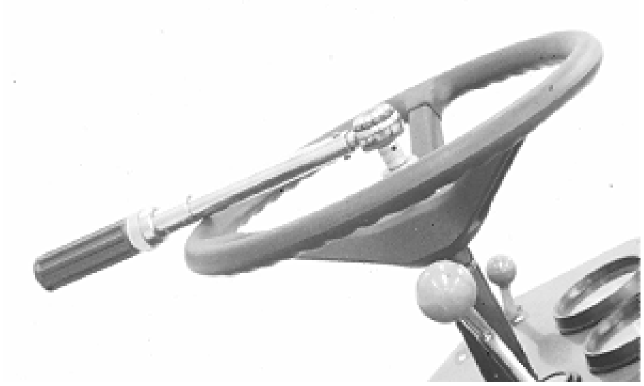
MX,26015HJ,22 -19-14APR92

STEERING SYSTEM LEAKAGE TEST



Reason:
To check the steering system for internal leakage.

Equipment:
•Torque wrench

Procedure:
1. Heat hydraulic oil to 43°C (110°F). (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 (72 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 (72 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: 1550 ± 100 rpm
•Maximum Right Turn rpm .. 6 rpm
•Maximum Left Turn rpm .. 6 rpm

Results:
•If rpm is more than specifications, perform Steering Valve Leakage Test. (See procedure in this group.)

MX,26015HJ,23 -19-14APR92

STEERING VALVE LEAKAGE TEST

Reason:
To check the steering valve and cylinder for internal leakage.

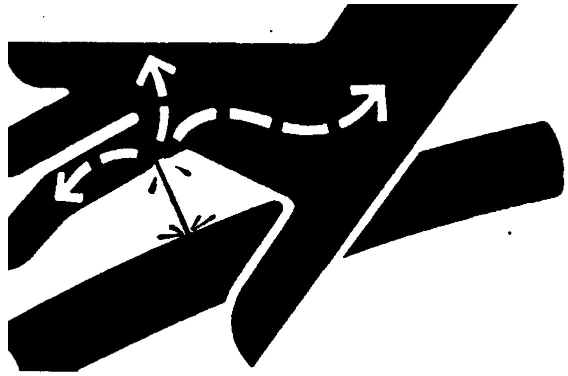
Equipment:
•Torque wrench
•(2) JT03392 Plugs

IMPORTANT: O-ring seal (ORS) plugs must be used to plug pressurized hydraulic hoses.

Procedure:
1. 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 may call the Deere & Company Medical Department in Moline, Illinois, or other knowledgeable medical source.



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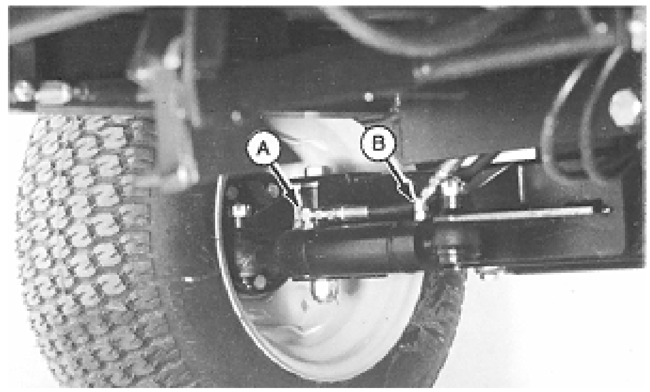
2. Disconnect hoses (A and B) from steering cylinder. Close all openings using caps and ORS plugs such as JT03392 Plugs.

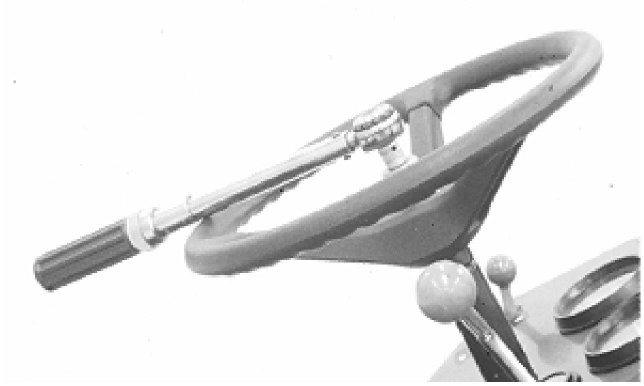


M46632 -UN-27MAR92

3. Start engine and run at slow idle.

MX,26015HJ,24 -19-14APR92

STEERING VALVE LEAKAGE TEST — CONTINUED


M46631 -UN-27MAR92

Procedure—continued:

4. With wheels in a maximum right turn position, turn steering wheel with a constant torque of 6.8 N·m (72 lb-in.).

5. Observe the number of rotations of the steering wheel that occurs in one minute.

6. With wheels in a maximum left turn position, turn steering wheel with a constant torque of 6.8 N·m (72 lb-in.).

7. Observe the number of rotations of the steering wheel that occurs in one minute.

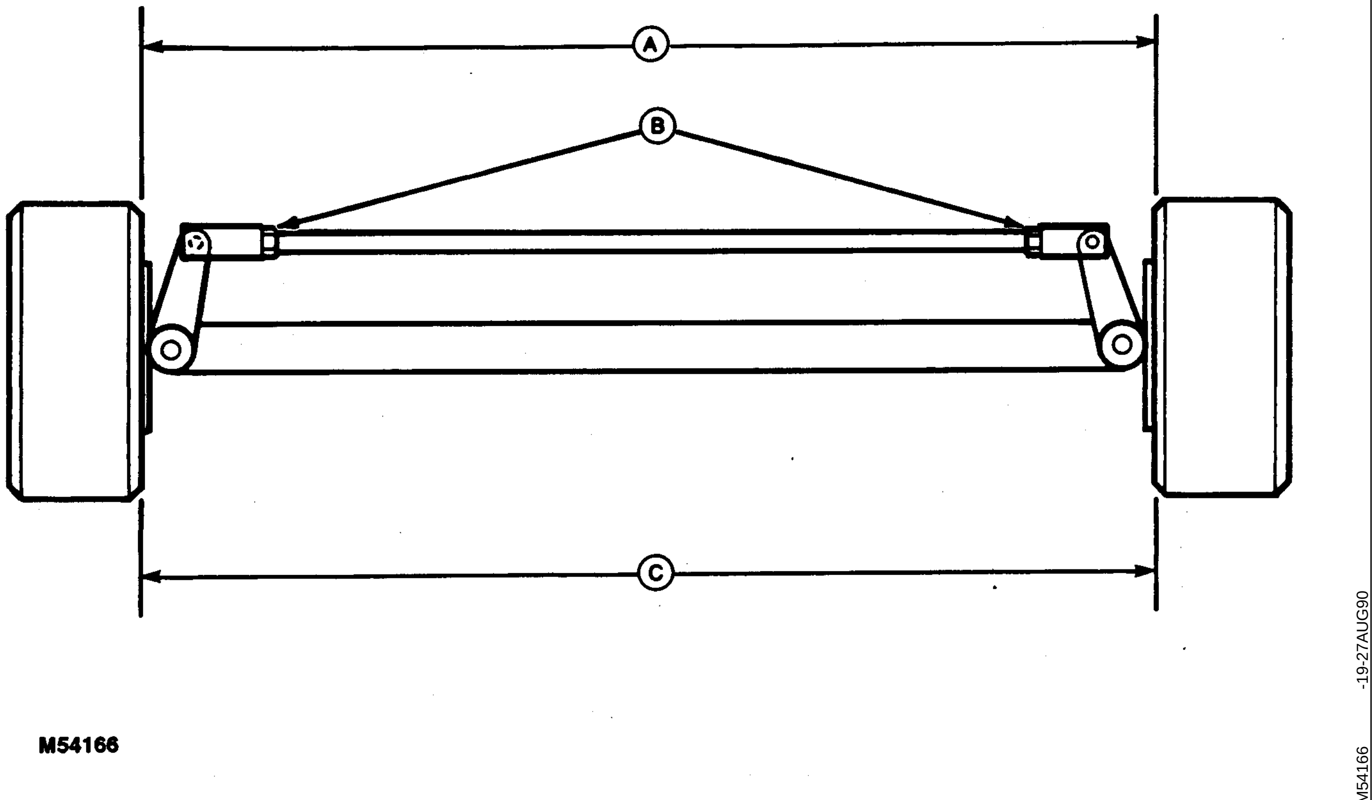
Specifications:
•Hydraulic Oil Temperature .. 43°C (110°F)
•Engine Speed Slow Idle: 1550 ± 100 rpm
•Maximum Right Turn rpm .. 6 rpm
•Maximum Left Turn rpm .. 6 rpm

Results:
•If rpm equals or is less than specifications, replace steering cylinder. (See Section 60.)

•If rpm is more than specifications, repair steering valve. (See Section 60.)

MX,26015HJ,25 -19-14APR92

TOE-IN ADJUSTMENT



Slide M54166

Reason:
To reduce tire wear and drag.

Procedure:
1. Park machine on level surface.

2. Turn steering wheel so front wheels are in the straight-ahead position.

3. Measure distance (A) between tire beads at front of tire, hub height. Record measurement.

4. Measure distance (C) between tire beads at rear of tire, hub height. Record measurement.

Specifications:
•Distance (A) should be 5 mm (0.187 in.) less than distance (C)

Results:
•If not according to specifications, loosen nuts (B) and turn tie rod until toe-in is to correct specification. Tighten nuts.

MX,26015HJ,26 -19-14APR92

BRAKE SHOE ADJUSTMENT

Reason:
To achieve maximum brake shoe-to-drum contact.

Procedure:
1. Raise rear of machine.

2. Install support stands.

NOTE: Wheel and brake drum are removed for clarity of photograph.

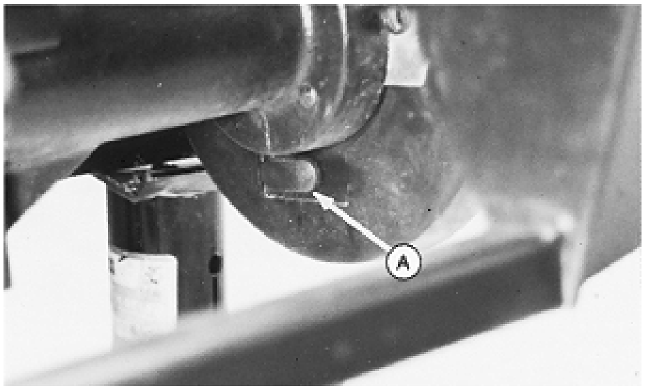
3. Remove rubber grommet. Reach through slot (A) in back plate with screwdriver for access to star adjuster.

4. Turn adjusting star with screwdriver until brake shoes begin to drag on drum.

5. Push brake pedals down firmly to seat brake shoes and check adjustment. Adjust brakes so brake shoes just clear drums and do not drag when pedals are released.

6. Repeat adjustment procedure on opposite wheel.

7. Remove support stands and lower machine.



M46578 -UN-27MAR92

MX,26015HJ,27 -19-14APR92

BRAKE LINKAGE AND PEDAL FREE-PLAY ADJUSTMENT

Reason:
To obtain proper free-play between pedal and brakes for smooth braking action.

Procedure:

1. Place blocks in front and behind wheels and release parking brake.

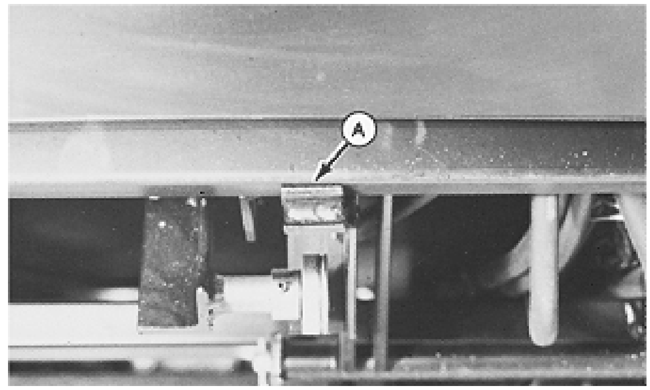
2. Inspect brake linkage for wear or binding and repair or replace as necessary.

3. Ensure brake pedal is fully released (stop (A) is contacting frame).

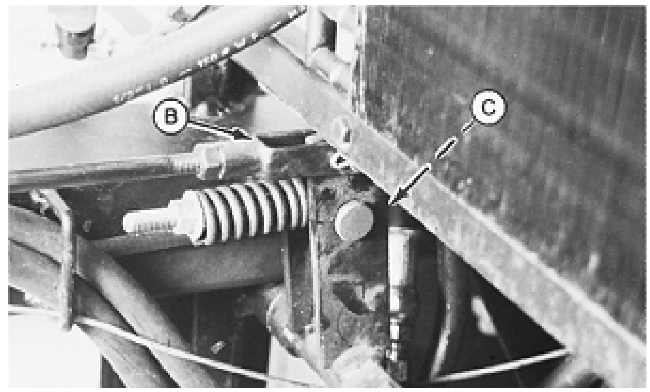
4. Hold the lever arm linkage (B) tight against the adjusting washer and nut (C) while visually inspecting the lever arms (D) for vertical position.

5. Use adjusting nuts to obtain a vertical position of the lever arms. Stop the adjustment at the point that either the left or right lever arm (D) is vertical.

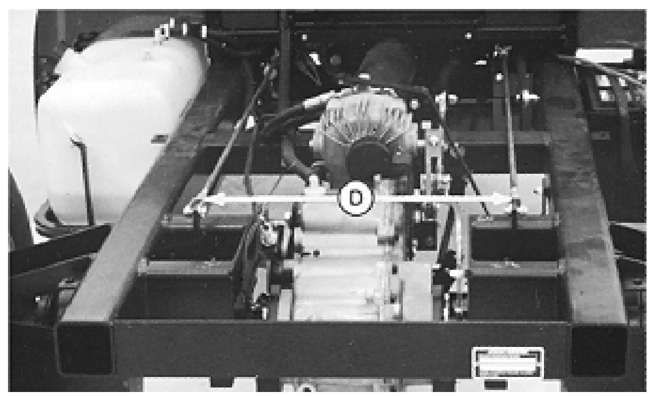
6. Use the rod end (D) adjustment to correctly position the lever arm that is not vertical.



M46633 -UN-27MAR92



M46635 -UN-27MAR92



M46634 -UN-27MAR92

A—Brake Pedal Stop
B—Lever Arm Linkage
C—Adjusting Nut
D—Lever Arms

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PARK BRAKE ADJUSTMENT

Reason:
To achieve positive braking action with parking brake engaged.

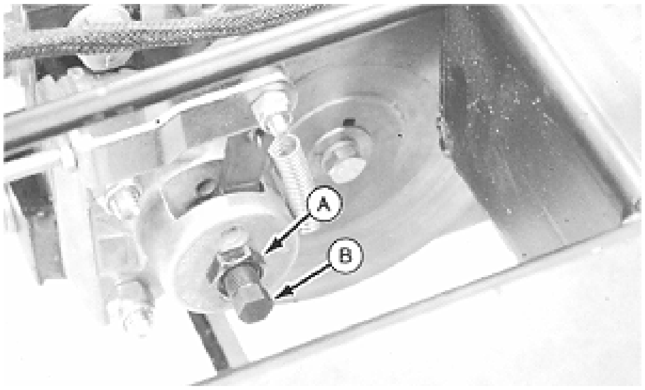
Procedure:

1. Park vehicle on a level surface and release parking brake.

2. Loosen adjusting screw jam nut (A).

3. Turn adjusting screw (B) in until a slight rubbing noise is heard as the disc rotates.

4. Tighten jam nut.



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