670, 770, 790, 870, 970, 1070 Compact Utility Tractors

TECHNICAL MANUAL

John Deere
Worldwide Commercial and
Consumer Equipment Division

TM1470 (15MAR99)
Replaces TM1470 (15MAR94)

Litho in U.S.A

Introduction

FOREWORD

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

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

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

Technical manuals are divided in two parts: repair and 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.

O53,TMIFC -19-10MAR88

Contents

SECTION 10—GENERAL INFORMATION
- Group 05—Safety
- Group 10—General Specifications
- Group 15—Repair Specifications
- Group 20—Fuel and Lubricants
- Group 25—Serial Number Locations

SECTION 20—ENGINE REPAIR
- Group 05—670/770
- Group 06—870/970/1070
- Group 07—790
- Group 10—Cooling System
- Group 15—Throttle and Governor Control Linkage
- Group 20—Fuel System

SECTION 40—ELECTRICAL SYSTEM
- Group 05—Alternator
- Group 10—Starter
- Group 15—Sender, Switches and Gauges

SECTION 50—POWER TRAIN REPAIR—670/770/790
- Group 05—Clutch Housing
- Group 06—Single Stage Clutch
- Group 07—Dual Stage Clutch
- Group 10—Transmission
- Group 15—Rear PTO Drive Shaft
- Group 20—Differential
- Group 25—Final Drive
- Group 30—Mechanical Front Wheel Drive
- Group 35—Throttle and Governor Control Linkage

Section 55—POWER TRAIN REPAIR —870/970/1070
- Group 05—Clutch Housing
- Group 06—Dual Stage Clutch
- Group 10—Transmission
- Group 15—Rear PTO Drive Shaft
- Group 20—Differential
- Group 25—Final Drive
- Group 30—Mechanical Front Wheel Drive—870
- Group 35—Mechanical Front Wheel Drive —970/1070
- Group 40—Mid Mount PTO

SECTION 60—STEERING AND BRAKE REPAIR
- Group 05—Manual Steering
- Group 10—Power Steering
- Group 15—Brake Repair—670/770/790
- Group 20—Brake Repair—870/970/1070

SECTION 70—HYDRAULIC REPAIR
- Group 05—Hydraulic Pump and Filter
- Group 10—Rockshaft—670/770/790
- Group 11—Rockshaft—870/970/1070
- Group 15—Selective Control Valve
- Group 20—Rear Auxiliary Hydraulic Lines

SECTION 80—MISCELLANEOUS REPAIR
- Group 05—Wheels
- Group 10—Front Axle
- Group 15—Hood
- Group 20—3-Point Hitch
- Group 25—Seat and Support
- Group 30—Roll-Gard
- Group 35—Mower Spindles
- Group 40—Mower Gearbox

SECTION 210—OPERATIONAL CHECKOUT PROCEDURE AND SPECIFICATIONS
- Group 05—Test and Adjustment Specifications
- Group 10—Operational Checkout Procedures

SECTION 220—ENGINE OPERATION, TESTS, AND ADJUSTMENTS
- Group 05—Component Locations
- Group 10—Theory of Operation
- Group 15—Engine System Diagnosis

SECTION 240—ELECTRICAL SYSTEM OPERATION AND TESTS
- Group 05—Component Location
- Group 10—Theory of Operation
- Group 15—Diagnosis and Test
- Group 20—Schematic

Continued on next page

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.

TM1470-19-15JAN99

COPYRIGHT©1999
DEERE & COMPANY
Moline, Illinois
All rights reserved
A John Deere ILLUSTRUCTION™ Manual

SECTION 250—POWER TRAIN—670/770/790
Group 05—Component Location
Group 10—Theory of Operation
Group 15—Diagnosis and Test

SECTION 255—POWER TRAIN—870/970/1070
Group 05—Component Location
Group 10—Theory of Operation
Group 15—Diagnosis and Test

SECTION 260—STEERING AND BRAKES
Group 05—Component Location
Group 10—Theory of Operation
Group 15—Diagnosis and Test

SECTION 270—HYDRAULIC SYSTEM
Group 05—Component Location
Group 10—Theory of Operation
Group 15—Diagnosis and Test
Group 20—Schematic

240

250

255

260

270

INDX

Section 10
GENERAL INFORMATION

Contents

Page

Group 05—Safety 10-05-1

Group 10—General Specifications
Machine Specifications
670/770/790. 10-10-1
870/970/1070. 10-10-4

Group 15—Repair Specifications
Repair Specifications 10-15-1
Metric Series Torque Chart 10-15-10
Inch Series Torque Chart 10-15-11

Group 20—Fuel and Lubricants
Fuel Specifications. 10-20-1
Fuel Storage. 10-20-1
Filling the Fuel Tank 10-20-2
Diesel Engine Oil 10-20-3
Engine Coolant. 10-20-4
Anti-Chatter Transmission/Hydraulic Oil. . . .10-20-4
Gear Oil 10-20-5
Extreme Pressure Grease 10-20-5
Alternative Lubricants 10-20-6
Lubricant Storage. 10-20-6

Group 25—Serial Number Locations 10-25-1

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

O53,ALERT -19-16JUN87

UNDERSTAND SIGNAL WORDS

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

Safety signs with signal word DANGER or WARNING are typically near specific hazards.

General precautions are listed on CAUTION safety signs. CAUTION also calls attention to safety messages in this manual.



TS187 -19-30SEP88

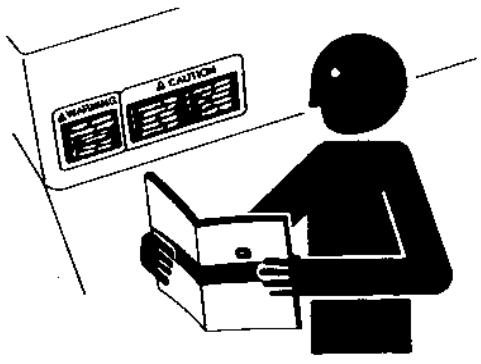
O53,SIGNAL -19-07OCT85

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.

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.



TS201 -UN-23AUG88

O53,READ -19-23APR87

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

O53,FLAME -19-05JAN88

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

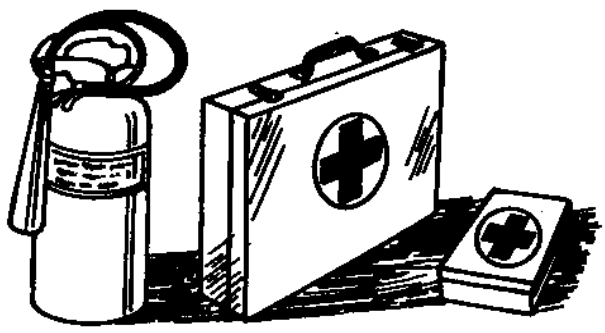
O53,SPARKS -19-05JAN88

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

O53,FIRE2 -19-03MAR88

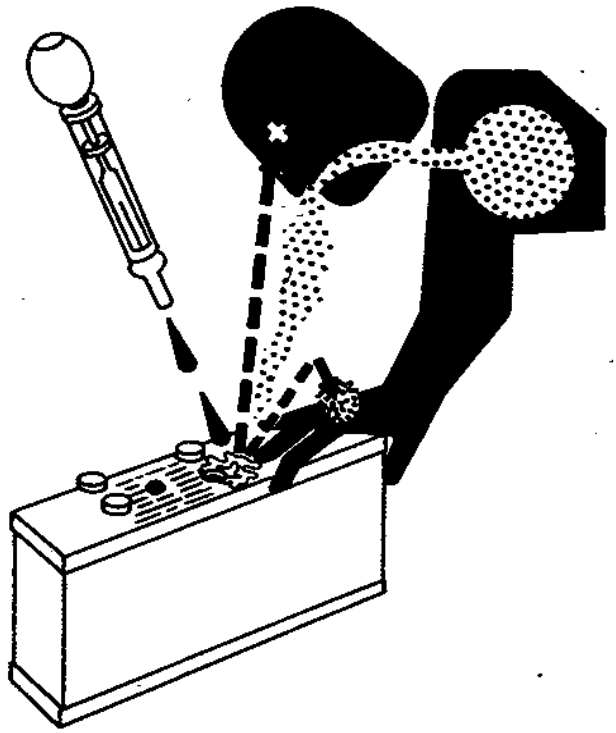
PREVENT ACID BURNS

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

O53,POISON -19-21DEC87

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

O53,RCAP -19-29NOV88

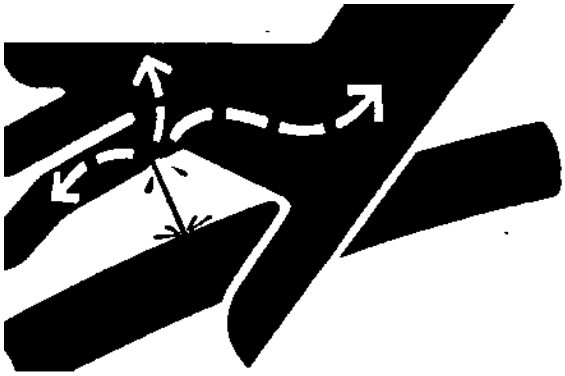
AVOID HIGH-PRESSURE FLUIDS

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

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

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

If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury may call the Deere & Company Medical Department in Moline, Illinois, or other knowledgeable medical source.

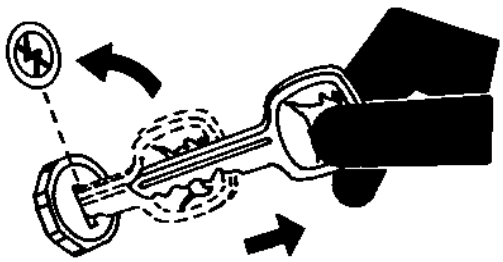


X9811 -UN-23AUG88

O53,FLUID -19-01DEC88

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.



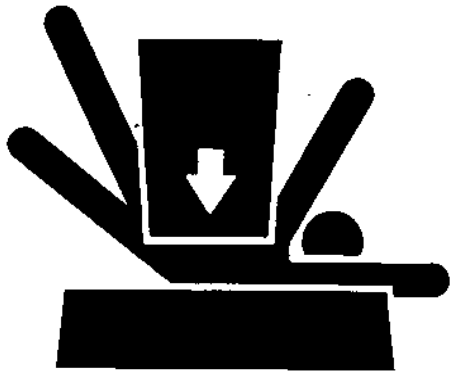
TS230 -UN-24MAY89

O53,PARK -19-05JAN88

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

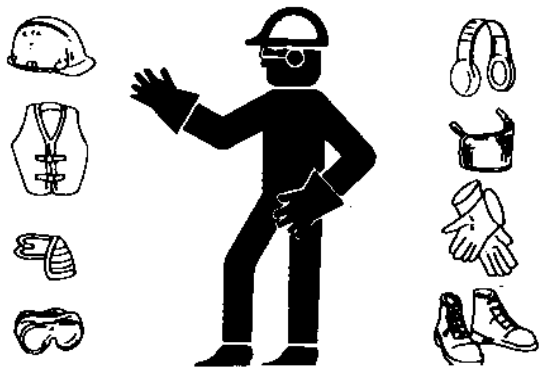
O53,LOWER -19-21DEC87

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.



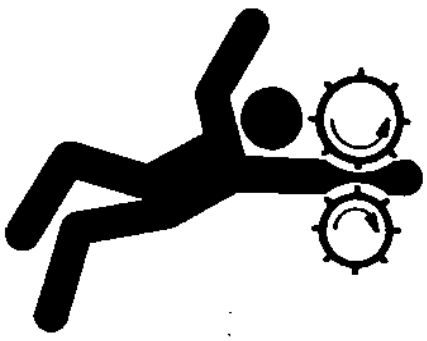
TS206 -UN-23AUG88

O53,WEAR -19-23APR87

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.



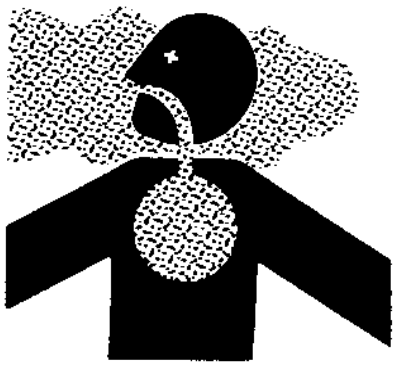
TS228 -UN-23AUG88

O53,LOOSE -19-21DEC87

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

O53,AIR -19-05JAN88

UNDERSTAND CORRECT SERVICE

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.

Catch draining fuel, oil, or other fluids in suitable containers. Do not use food or beverage containers that may mislead someone into drinking from them. Wipe up spills at once.



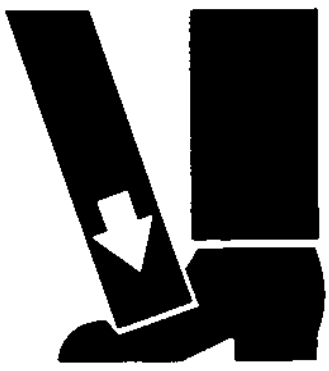
TS223 -UN-23AUG88

O53,LIGHT -19-23FEB88

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.



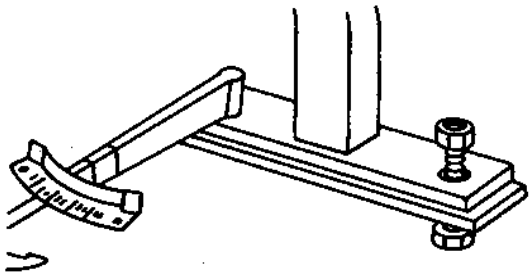
TS226 -UN-23AUG88

O53,LIFT -19-05JAN88

KEEP ROPS INSTALLED PROPERLY

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

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



-UN-23AUG88

TS212

O53,ROPS3 -19-23APR87

SERVICE TIRES SAFELY

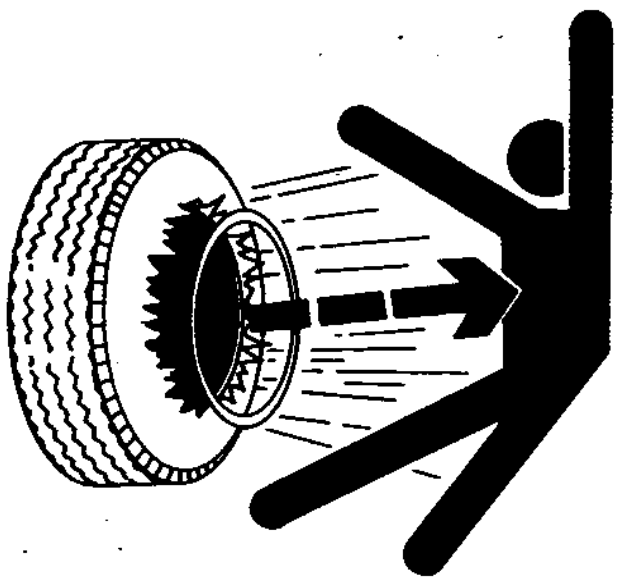
Explosive separation of a tire and rim parts can cause serious injury or death.

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.

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.



-UN-23AUG88

TS211

O53,RIM -19-21DEC87

10
05
8

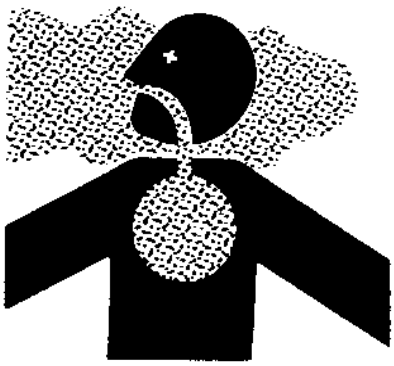
AVOID HARMFUL ASBESTOS DUST

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

Components in John Deere 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 of asbestos containing materials. When servicing, wear an approved respirator. A special vacuum cleaner is recommended to clean asbestos. If not available, wet the asbestos containing materials with a mist of oil or water.

Keep bystanders away from the area.

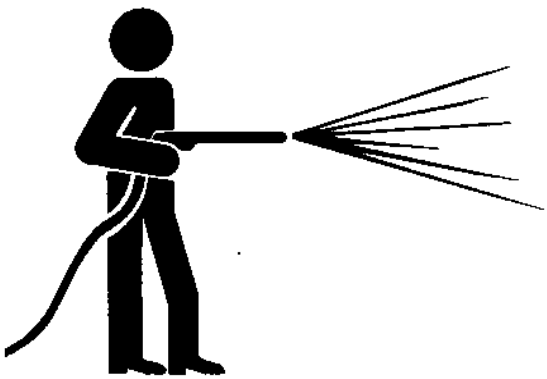


TS220 -UN-23AUG88

O53,DUST -19-14APR88

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

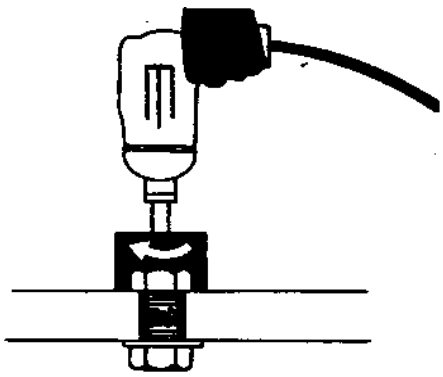
O53,CLEAN -19-19JAN88

USE TOOLS PROPERLY

Use tools appropriate to the work. Makeshift tools, parts, and procedures will not make good repairs.

Use pneumatic and electric tools only to loosen threaded parts and fasteners. Never use such tools to tighten fasteners, especially on light alloy parts.

Use only replacement parts meeting John Deere specifications.



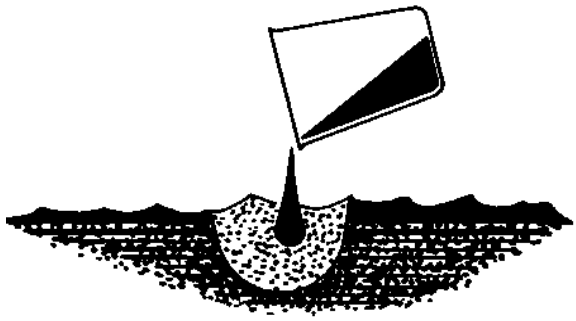
TS221 -UN-23AUG88

O53,REPAIR -19-21DEC87

DISPOSE OF FLUIDS PROPERLY

Improperly disposing of fluids can harm the environment and ecology. Before draining any fluids, find out the proper way to dispose of waste from your local environmental agency.

Avoid pouring oil into the ground, down a drain, or into a stream, pond, or lake. Observe relevant environmental protection regulations when disposing of oil, fuel, coolant, brake fluid, filters, batteries, and other harmful waste.



TS222 -UN-23AUG88

O53,DRAIN -19-15AUG89

LIVE WITH SAFETY

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



TS231 -19-07OCT88

O53,LIVE -19-05JAN88

MACHINE SPECIFICATIONS—670, 770 AND 790

	670	770	790
ENGINE			
Make	Yanmar	Yanmar	Yanmar
Type	Diesel	Diesel	Diesel
Model	3TNA72-UJX	3TN82-RJX	3TNE84
Horsepower (Net)	13.8 kW (18.5 hp)	17.2 kW (24 hp)	19.7 kW (27 hp)
PTO Horsepower	11.9 kW (16 hp)	14.9 kW (20 hp)	18.6 kW (25 hp)
Rated Engine Speed	2850 rpm	2600 rpm	2600 rpm
Operating Range	800—3025 rpm	800—2775 rpm	925—2810 rpm
Number of Cylinders	3	3	3
Displacement	879 cm^3 (53.6 cu.in.)	1362 cm^3 (83.1 cu.in.)	1496 cm^3 (91.3 cu.in.)
Bore and Stroke	72 x 72 mm (2.83 x 2.83 in.)	82 x 86 mm (3.22 x 3.39 in.)	82 x 86 mm (3.22 x 3.39 in.)
Compression Ratio	22.3:1	18.1:1	18.0:1
Fast Idle	3000—3050 rpm	3000—3050 rpm	2920 ± 25 rpm
Slow Idle	900—950 rpm	900—950 rpm	925 rpm
Start Aid	Glow Plug	Air Heater	Air Heater
Firing Order	1-3-2	1-3-2	1-3-2
Timing	16° BTDC	16° BTDC	14° +/- 1° BTDC
Lubrication	Pressurized	Pressurized	Pressurized
Cooling System	Water Pump	Water Pump	Water Pump
Air Cleaner	Dry Element	Dry Element	Dry Element
Engine Shutoff	Key Switch	Key Switch	Key Switch
ELECTRICAL SYSTEM			
Type	12 Volt	12 Volt	12 Volt
Battery Size	420 Cold Cranking amps at -18°C	420 Cold Cranking amps at -18°C	500 Cold Cranking amps at -18°C
Alternator	20 Amp	20 Amp	20 Amp
FUEL SYSTEM			
Type	Indirect Injection	Direct Injection	Direct Injection
Injection Pump Type	In-Line with Electric Shutoff	In-Line with Electric Shutoff	In-Line with Electric Shutoff
Fuel Consumption at 75% load (Mowing)	0.9 gal/hr	1.0 gal/hr	1.3 gal/hr
DRIVE TRAIN			
Transmission Type	Sliding Gear	Sliding Gear	Sliding Gear
Number of Speeds	8 Forward, 2 Reverse	8 Forward, 2 Reverse	8 Forward, 2 Reverse
Travel Speeds at Full Engine RPM	Equipped with 9.5-16 R-1 tires	Equipped with 12.4-16 R-1 tires	Equipped with 12.4-16 R-1 tires
Forward Gears			
1st	1.1 km/h (0.7 mph)	1.3 km/h (0.8 mph)	1.2 km/h (0.9 mph)
2nd	1.6 km/h (1.0 mph)	1.8 km/h (1.1 mph)	1.6 km/h (1.0 mph)
3rd	2.2 km/h (1.4 mph)	2.5 km/h (1.6 mph)	2.3 km/h (1.4 mph)
4th	3.9 km/h (2.4 mph)	4.4 km/h (2.7 mph)	4.0 km/h (2.5 mph)
5th	4.9 km/h (3.0 mph)	5.6 km/h (3.5 mph)	5.1 km/h (3.2 mph)
6th	6.8 km/h (4.2 mph)	7.7 km/h (4.8 mph)	7.0 km/h (4.4 mph)
7th	9.6 km/h (5.9 mph)	11.1 km/h (6.8 mph)	10.0 km/h (6.2 mph)
8th	16.6 km/h (10.3 mph)	19.1 km/h (11.8 mph)	17.3 km/h (10.8 mph)

	670	770	790
REVERSE GEARS			
1st Gear	1.1 km/hr (0.7 mph)	1.3 km/hr (0.8 mph)	1.2 km/hr (0.9 mph)
2nd Gear	4.8 km/hr (3.0 mph)	5.4 km/hr (3.4 mph)	4.9 km/hr (3.1 mph)
Final Drive	Spur Gear	Spur Gear	Spur Gear
Brakes	Dry Shoe	Dry Shoe	Dry Shoe
Steering (Base) (Optional)	Manual Power	Manual Power	Manual Power—2WD Power—4WD
Clutch (Base) (Optional)	Single Stage Dry Dual Stage Dry	Single Stage Dry Dual Stage Dry	Single Stage Dry—2WD Dual Stage Dry—4WD
HYDRAULIC SYSTEM			
Type of System	Open Center	Open Center	Open Center
Working Pressure	14135 kPa (141.3 bar) (2050 psi)	14135 kPa (141.3 bar) (2050 psi)	14135 kPa (141.3 bar) (2050 psi)
Pump (Type)	Dual Gear	Dual Gear	Dual Gear
Pump Capacity	20.9 L/min (5.5 gpm)	21.1 L/min (5.6 gpm)	21.1 L/min (5.6 gpm) Power Steering— 16.3 L/min (4.3 gpm)
Hitch Lift Capacity at 24 In. Behind Lift Links	358 kg (790 lbs)	370 kg (815 lbs)	370 kg (815 lbs)
Lift Control Type	Position	Position	Position
PTO			
Type (Base) (Optional)	Transmission Drive Continuous Live	Transmission Drive Continuous Live	Transmission Drive Continuous Live
Speed (PTO rpm at rated engine speed)			
Mid PTO	2275 rpm	2076 rpm	2076 rpm
Rear PTO	594 rpm	540 rpm	540 rpm
Brake	Mid PTO only	Mid PTO only	Mid PTO only
CAPACITIES			
Fuel Tank	24.0 L (6.3 U.S.gal)	24.0 L (6.3 U.S.gal)	24.0 L (6.3 U.S.gal)
Cooling System	3.8 L (4.0 U.S. qt)	4.8 L (1.25 U.S.gal)	4.8 L (1.25 U.S.gal)
Engine Crankcase (w/filter)	2.6 L (2.7 U.S. qt)	4.0 L (4.2 U.S. qt)	4.1 L (4.3 U.S. qt)
Hydraulic System Transmission	15 L (4.0 U.S. gal)	15 L (4.0 U.S. gal)	15 L (4.0 U.S. gal)
Front Axle Gear Case (4WD)	2.3 L (2.25 U.S. qt)	2.3 L (2.25 U.S. qt)	2.3 L (2.25 U.S. qt)
TIRES			
Standard Equipment			
Front	5.00-12	6.50-10	6.00-12
Rear	9.50-16	12.40-16	12.40-16

	670	770	790
STANDARD EQUIPMENT			
Dimensions:			
Rear Ground Clearance	247.3 mm (9.7 in.)	304.3 mm (12 in.)	304.3 mm (12 in.)
Front Axle Ground Clearance			
(2WD)	340 mm (13.4 in.)	340 mm (13.4 in.)	340 mm (13.4 in.)
(MFWD)	252 mm (9.9 in.)	264 mm (10.4 in.)	264 mm (10.4 in.)
Overall Length			
(with 3-pt hitch)	2762.5 mm (108.8 in.)	2823.5 mm (111.2 in.)	2823.5 mm (111.2 in.)
(without 3-pt hitch)	2141 mm (84.3)	2230.5 mm (87.8)	2230.5 mm (87.8)
Overall Width			
(with turf tires)	1344 mm (52.9)	1367 mm (53.8)	1367 mm (53.8)
Height			
To Top of Hood	1179.4 mm (46.4 in.)	1227.7 mm (48.1 in.)	1227.7 mm (48.1 in.)
To Top of ROPS	1949.3 mm (76.7 in.)	2006.3 mm (79.0 in.)	2006.3 mm (79.0 in.)
WHEEL TREAD			
Standard Equipment			
Front Wheels	957 mm (37.7 in.)	970 mm (38.2 in.)	970 mm (38.2 in.)
Rear Wheels	1024 mm (40.3 in.)	1016 mm (40 in.)	1334 mm (52.5 in.)
APPROXIMATE WEIGHT			
2 Wheel Drive	829 kg (1827 lbs)	895 kg (1978 lbs)	895 kg (1973 lbs)
MFWD	910 kg (2008 lbs)	976 kg (2150 lbs)	976 kg (2151 lbs)

(Specications and design subject to change without notice.)

	870	**970**	**1070**
ENGINE			
Make	Yanmar	Yanmar	Yanmar
Type	Diesel	Diesel	Diesel
Model	3TNA84-UJX	4TN84-RJX	4TN84-RJX
Horsepower (Net)	20.9 kW (28 hp)	24.6 kW (33 hp)	28.7 kW (38.5 hp)
PTO Horsepower	18.6 kW (25 hp)	22.4 kW (30 hp)	26.1 kW (35 hp)
Rated Engine Speed	2600 rpm	2600 rpm	2700 rpm
Operating Range	800—2775 rpm	800—2775 rpm	800—2875 rpm
Number of Cylinders	3	4	4
Displacement	1431 cm^3 (87.3 cu. in.)	1816 cm^3 (110.8 cu. in.)	1906 cm^3 (116.3 cu. in.)
Bore and Stroke	84 x 86 mm (3.31 x 3.39 in.)	84x 86 mm (3.31 x 3.39in.)	84 x 86 mm (3.31 x 3.39in.)
Compression Ratio	17.8:1	17.8:1	17.8:1
Fast Idle	2750—2800 rpm	2750—2800 rpm	2850—2900 rpm
Slow Idle	900—950 rpm	900—950 rpm	900—950 rpm
Start Aid	Air Heater	Air Heater	Air Heater
Firing Order	1-3-2-1	1-3-4-2-1	1-3-4-2-1
Timing	16° BTDC	16° BTDC	16° BTDC
Lubrication	Pressurized	Pressurized	Pressurized
Cooling System	Water Pump	Water Pump	Water Pump
Air Cleaner	Dry Type w/ Safety	Dry Type w/ Safety	Dry Type w/ Safety
Engine Shutoff	Key Switch	Key Switch	Key Switch
ELECTRICAL SYSTEM			
Type	12 Volt	12 Volt	12 Volt
Battery Size	447 Cold Cranking amps at -18°C	550 Cold Cranking amps at -18°C	550 Cold Cranking amps at -18°C
Alternator	20 Amp	20 Amp	20 Amp
FUEL SYSTEM			
Type	Direct Injection	Direct Injection	Direct Injection
Injection Pump Type	In-Line w/ Electric Shutoff	In-Line w/ Electric Shutoff	In-Line w/ Electric Shutoff
Fuel Consumption at 75% load (Mowing)	1.25 gal/hr (approx.)	1.47 gal/hr (approx.)	1.72 gal/hr (approx.)
9th Gear	17.1 km/h (10.6 mph)	18.3 km/h (11.4 mph)	19.8 km/h (12.3 mph)

	870	**970**	**1070**
DRIVE TRAIN			
Transmission Type	Sliding Collar	Sliding Collar	Synchromesh
Number of Speeds **	9 Forward, 2 (3) Reverse	9 Forward, 2 (3) Reverse	9 Forward, 2 (3) Reverse
Travel Speeds at Full Engine Rpm w/ Rear Tire Types *	12.4-24 R-1	12.4-28 R-1	13.6-28 R-3
Forward Gears			
1st Gear	1.4 km/h (0.9mph)	1.5 km/h (0.9 mph)	1.6 km/h (1.0 mph)
2nd Gear	1.9 km/h (1.2 mph)	2.1 km/h (1.3 mph	2.2 km/h (1.4 mph
3rdGear	2.5 km/h (1.5 mph)	2.6 km/h (1.6 mph)	2.9 km/h (1.8 mph)
4th Gear	4.7 km/h (2.9 mph)	5.0 km/h (3.1 mph)	5.4 km/h (3.4 mph)
5th Gear	6.5 km/h (4.0 mph)	6.9 km/h (4.3 mph)	7.5 km/h (4.7mph)
6th Gear	8.3 km/h (5.2 mph)	8.9 km/h (5.5 mph)	9.6 km/h (6.0 mph)
7th Gear	9.6 km/h (6.0 mph)	10.3 km/h (6.4 mph)	11.1 km/h (6.9 mph)
8th Gear	13.4 km/h (8.3 mph)	14.3 km/h (8.9 mph)	15.5 km/h (9.6 mph)
9th Gear	17.1 km/h (10.6 mph)	18.3 km/h (11.3 mph)	19.8 km/h (12.3 mph)
Reverse Gears			
1st Gear	1.6 km/h (1.0 mph)	1.4 km/h (0.9 mph)	1.8 km/h (1.1 mph)
2nd Gear	5.4 km/h (3.3 mph)	5.8 km/h (3.6 mph	6.2 km/h (3.9 mph
3rd Gear **	11.1km/h (6.9mph)	12.1 km/h (7.4 mph)	12.8 km/h (8.0 mph)
Final Drive	Planetary	Planetary	Planetary
Brakes	Wet Disk	Wet Disk	Wet Disk
Steering (Base)	Manual	Manual	
(Optional)	Hydrostatic Power	Hydrostatic Power	—
Clutch (Base)	Dual Stage Dry	Dual Stage Dry	Dual Stage Dry

NOTE:

* Travel speeds with optional rear tires vary as follows:

870 Tractor: 6 percent slower with 355/80D R-3 tires.

4 percent slower with 11.2-24 R-1 tires.

970 Tractor: 12 percent slower with 11.2-24 R-1 tires.

4 percent faster with 13.6-28, R-3 tires.

11 percent slower with 44.0 x 18.00 G-2 turf tires.

8 percent slower with 12.4-24 R-1 tires.

4 percent slower with 13.6-24 R-1 tires.

1070 Tractor: 22 percent slower with 21.5L-16.1 R-3 tires.

14 percent slower with 44 x 18.00-20 G-2 turf tires.

8 percent slower with 13.6-24 R-1 tires.

Slowest ground speed—All tractors with standard tires is 0.5 km/h (0.3 mph).

** Linkage lockout removed starting with 1991 Model Year to allow 3rd Reverse.

	870	**970**	**1070**
HYDRAULIC SYSTEM			
Type of System	Open Center	Open Center	Open Center
Working Pressure	15514 kPa (155 bar) (2250 psi)	15514 kPa (155 bar) (2250 psi)	15514 kPa (155 bar) (2250 psi)
Pump (Type)	Dual gear	Dual gear	Dual gear
Pump Capacity	30.5 L/min (8.1 gpm)	32.9 L/min (8.7 gpm)	34.1 L/min (9.0 gpm)
Hitch Lift Capacity at 24 in. behind Lift Links	853 kg (1880 lbs)	916 kg (2020 lbs)	916 kg (2020 lbs)
Lift Control Type	Position	Position	Load and Depth
PTO			
Type	Continuous Live	Continuous Live	Continuous Live
Speed (PTO rpm at rated engine speed)			
Mid PTO	2100 rpm	2100 rpm	2100 rpm
Rear PTO	540 rpm	540 rpm	540 rpm
Brake	Mid PTO only	Mid PTO only	Mid PTO only
CAPACITIES			
Fuel Tank	32.0 L (8.5 U.S. gal)	32.0 L (8.5 U.S. gal)	40.0 L (10.6 U.S. gal)
Cooling System	5.2 L (5.5 U.S. qt)	5.8 L (6.1 U.S. qt)	5.8 L (6.1 U.S. qt)
Engine Crankcase (w/ filter)	4.8 L (5.1 U.S. qt)	5.3 L (5.6 U.S. qt)	5.3 L (5.6 U.S. qt)
Hydraulic System	21.0 L (5.5 U.S. gal)	21.0 L (5.5 U.S. gal)	21.0 L (5.5 U.S. gal)
MFWD Axle Gear Case	6.0 L (6.3 U.S. qt)	7.5 L (7.9 U.S. qt)	7.5 L (7.9 U.S. qt)

	870	970	1070
TIRES			
Standard Equipment			
2WD			
Front	5.00-15	5.50-16	6.00-16
Rear	11.2-24	12.4-28	13.6-24
MFWD			
Front	7-14	7-16	8-16
Rear	12.4-24	13.6-24	13.6-28
STANDARD EQUIPMENT			
Dimensions:			
Ground Clearance			
Front Axle			
2WD	301 mm (11.9 in.)	372 mm (14.6 in.)	346 mm (13.6 in.)
MFWD	323 mm (12.7 in.)	348 mm (13.7 in.)	395 mm (15.6 in.)
Overall Length	3128 mm (123 in.)	3128 mm (123 in.)	3128 mm (123 in.)
Overall Width (With Turf Tires)	1635 mm (64.4 in.)	2255 mm (88.8 in.)	2255 mm (88.8 in.)
Height			
To Top of Hood			
2WD	1279 mm (50.4 in.)	1351 mm (53.2 in.)	1325 mm (52.2 in.)
MFWD	1301 mm (51.2 in.)	1325 mm (52.2 in.)	1373 mm (54.0 in.)
*To Top of ROPS			
2WD	2081 mm (81.9 in.)	2153 mm (84.8 in.)	2127 mm (83.7 in.)
MFWD	2103 mm (82.8 in.)	2127 mm (83.7 in.)	2175 mm (85.6 in.)
WHEEL TREAD (Center-to-Center)			
Standard Equipment			
2WD			
Front Wheels	1166—1470 mm (45.9—57.9 in.)	1212—1616 mm (47.7—63.6 in.)	1420—1928 mm (55.9—75.9 in.)
Rear Wheels	1066—1472 mm (42—55 in.)	1150—1500 mm (45.3—59 in.)	1300—1804 mm (51.2—71.1 in.)
MFWD			
Front Wheels	1003 mm (39.5 in.)	1238 mm (48.7 in.)	1250 mm (49.2 in.)
Rear Wheels	1172—1472 mm (46.2—58 in.)	1172—1472 mm (46.2—58 in.)	1302—1910 mm (51.3—75.3 in.)
APPROXIMATE WEIGHT**			
2WD	1141 kg (2515 lb)	1211 kg (2670 lb)	1352 kg (2980 lb)
MFWD	1211 kg (2670 lb)	1381 kg (3045 lb)	1481 kg (3265 lb)

**Add 4 inches to top of ROPS if equipped with a canopy.*

***Weights will vary slightly with optional tires.*

(Specifications and design subject to change without notice.)

MX,1010DG,A6 -19-03OCT89

670/770/790 TRACTOR REPAIR SPECIFICATIONS

SECTION 20—ENGINE REPAIR

Item	Measurement	Specification
670/770 Repair Specifications—Use CTM-3 790 Repair Specifications—Use Section 20		
Engine-to-Clutch Housing Screws—670/770/790	Torque	54 N•m (40 lb-ft)
Front End-to-Engine Screws—670/770/790	Torque	90 N•m (65 lb-ft)

SECTION 40—ELECTRICAL SYSTEM

Item	Measurement	Specification
For All Repair Specifications—Use CTM-3		
Steering Wheel Lock Nut	Torque	27 N•m (20 lb-ft)

SECTION 50—POWER TRAIN REPAIR

Item	Measurement	Specification
Clutch Housing		
Clutch Housing-to-Engine Cap Screw	Torque	54 N•m (40 lb-ft)
Clutch Housing-to-Transmission Cap Screw	Torque	54 N•m (40 lb-ft)
Clutch Release Shaft Bushing	Depth	13 mm (0.080 in.)
Clutch/Brake Pedal Shaft Bushings	Depth	32 mm (1.250 in.)
Single Stage Clutch		
Clutch Assembly-to-Flywheel Cap Screw	Torque	27 N•m (20 lb-ft)
Clutch Drive Surface	Maximum Flatness	0.40 mm (0.016 in.)
Clutch Disk	Minimum Thickness	6.40 mm (0.251 in.)
Flywheel Pilot Bushing	Maximum ID	15.03 mm (0.592 in.)
Bearing Sleeve Bushing	Depth	13 mm (0.500 in.)
Dual Stage Clutch For Repair Specifications See Section 55, Group 06		
Bearing Sleeve Bushing	Depth	13 mm (0.500 in.)

Continued on next page

Item	Measurement	Specification
Transmission		
Transmission-to-Clutch Housing Cap Screw	Torque	54 N·m (40 lb-ft)
Differential Drive Shaft Bearing Housing Cap Screw	Torque	36 N·m (27 lb-ft)
Differential Drive Shaft Nuts	Torque	108 N·m (80 lb-ft)
Rear PTO Drive Shaft		
Rear Plate-to-Roll-Gard Cap Screw	Torque	365 N·m (195 lb-ft)
Drawbar Plate-to-Transmission Housing Cap Screw	Torque	340 N·m (250 lb-ft)
Differential		
Bearing Quill-to-Transmission Housing Cap Screw	Torque	27 N·m (20 lb-ft)
Bearing and Ring Gear	Maximum Heat	150˚C (300˚F)
Ring Gear-to-Differential Carrier Cap Screw	Torque	54 N·m (40 lb-ft)
Differential Drive Shaft-to-Ring Gear Backlash	Backlash	0.13—0.18 mm (0.005—0.007 in.)
Final Drive		
Final Drive-to-Transmission Housing Cap Screw	Torque	50 N·m (36 lb-ft)
Drawbar Plate-to-Transmission Housing Cap Screw	Torque	340 N·m (250 lb-ft)
Seal Housing Cover-to-Final Drive Housing Cap Screw	Torque	27 N·m (20 lb-ft)
Axle Bearing	Maximum Heat	150˚C (300˚F)
Mechanical Front Wheel Drive		
Drive Gear-to-Differential Drive Shaft Nuts	Torque	108 N·m (80 lb-ft)
Front Wheel Cap Screw	Torque	133 N·m (98 lb-ft)

Continued on next page.

MX,1015DG,A2 -19-10JAN90

Item	Measurement	Specification
Spindle Housing and Outer Drive Assembly-to-Axle Housing Cap Screw	Torque	51 N·m (39 lb-ft)
Castle Nuts	Torque	68 N·m (50 lb-ft)
Input Shaft-to-Ring Gear Backlash	Backlash	0.08—0.13 mm (0.003—0.005 in.)
Mid Mount PTO		
Drawbar Plate-to-Transmission Housing Cap Screw	Torque	340 N·m (250 lb-ft)
Gearbox-to-Transmission Housing Cap Screws and Nut	Torque	50 N·m (37 lb-ft)

SECTION 60—STEERING AND BRAKE REPAIR

Item	Measurement	Specification
Manual Steering		
Pitman Arm Retaining Nut	Torque	172 N·m (127 lb-ft)
Steering Wheel Lock Nut	Torque	27 N·m (20 lb-ft)
Cover-to-Gearbox Cap Screw	Torque	26 N·m (226 lb-in.)
Steering Wheel	Maximum Free Play	20—50 mm (1.0—2.0 in.)
Power Steering		
Column-to-Dashboard Support Cap Screw	Torque	108 N·m (80 lb-ft)
Hydraulic Valve Cap Screw	Initial Torque	11 N·m (95 lb-in.)
	Final Torque	21 N·m (182 lb-in.)
Cylinder-to-Front Axle Nuts	Torque	128 N·m (94 lb-ft)
Cylinder Lock Nut	Torque	61 N·m (45 lb-ft)
Hydraulic Pump-to-Engine Cap Screw	Torque	26 N·m (226 lb-in.)
Hydraulic Line Flange Cap Screw	Torque	6 N·m (53 lb-in.)
Hydraulic Pump Cover-to-Housing Cap Screw	Torque	15 N·m (133 lb-in.)
Brakes		
Rear Wheel Cap Screw	Torque	190 N·m (140 lb-ft)

Continued on next page.

SECTION 70—HYDRAULIC REPAIR

Item	Measurement	Specification
Hydraulic Pump		
Pump-to-Engine Cap Screw	Torque	26 N·m (226 lb-in.)
Hydraulic Line Flange Cap Screw	Torque	6 N·m (53 lb-in.)
Pump Cover-to-Housing Cap Screw	Torque	15 N·m (133 lb-in.)
Rockshaft		
Piston Cover-to-Case Cap Screw	Torque	95 N·m (70 lb-ft)
Case	Approximate Weight	31.6 kg (70 lb)
Case-to-Transmission Housing Cap Screw	Torque	54 N·m (40 lb-ft)
Control Valve-to-Case Socket Head Cap Screw	Torque	26 N·m (226 lb-in.)
Lift Arm Bushing	Depth Below Bore Surface	7 mm (0.283 in.)
Lift Arm-to-Rockshaft Cap Screw	Torque	88 N·m (65 lb-ft)
SCV		
Spool Guide-to-Spool End	Torque	20 N·m (180 lb-in.)

SECTION 80—MISCELLANEOUS REPAIR

Item	Measurement	Specification
Wheels		
Retaining Nut	Torque	80 N·m (65 lb-ft)
Wheel Cap Screw	Torque	133 N·m (98 lb-ft)
Front Axle		
Pivot Pin-to-Axle Cap Screw	Torque	88 N·m (65 lb-ft)
Hood		
Hood Latch	Maximum Clearance	10 mm (0.394 in.)
ROLL GARD		
Post-to-Crossmember Cap Screw	Torque	123 N·m (91 lb-ft)
Post-to-Transmission Housing Cap Screw	Torque	265 N·m (195 lb-ft)

MX,1015DG,A4 -19-10JAN90

870/970/1070 TRACTOR REPAIR SPECIFICATIONS

SECTION 20—ENGINE REPAIR

Item	Measurement	Specification
For all repair specifications—Use CTM-3		
Engine-to-Clutch Housing Cap Screw	Torque	113 N·m (83 lb-ft)
Front End-to-Engine Cap Screw	Torque	90 N·m (65 lb-ft)

SECTION 40—ELECTRICAL SYSTEM

Item	Measurement	Specification
For all repair specifications—Use CTM-3		
Senders, Switches and Gauges		
Mid Mount PTO Cover-to-Final Drive Housing Cap Screw	Torque	90 N·m (65 lb-ft)
Mid Mount PTO Cover-to-Gearbox Cap Screw	Torque	50 N·m (35 lb-ft)
Steering Wheel Lock Nut	Torque	27 N·m (20 lb-ft)

SECTION 55—POWER TRAIN REPAIR

Item	Measurement	Specification
Clutch Housing		
Clutch Housing-to-Engine Cap Screw	Torque	113 N·m (83 lb-ft)
Clutch Housing-to-Transmission Cap Screw	Torque	85 N·m (63 lb-ft)
Clutch Housing-to-Transmission Nut	Torque	80 N·m (59 lb-ft)
Clutch Release Shaft Bushings	Depth	13 mm (0.080 in.)
Clutch/Brake Pedal Shaft Right-Hand Inside Bushing	Depth	32 mm (1.250 in.)
Clutch/Brake Pedal Shaft Left-Hand Inside Bushing	Depth	25 mm (0.984 in.)

Continued on next page.

MX,1015DG,A5 -19-10JAN90

Item	Measurement	Specification
Dual Stage Clutch		
Clutch Assembly-to-Flywheel Cap Screw	Torque	22 N•m (16 lb-ft)
Cap Screw Head to Clutch Hub	Clearance	1.50 mm (0.060 in.)
Cap Screw Head to Clutch Hub Nut	Torque	18 N•m (159 lb-in.)
Clutch Finger Screw-to-Flywheel: 670/770/790	Distance	99 mm (3.901 in.)
870/970/1070	Distance Tolerance	113 mm (4.452 in.) 0.7 mm (0.028 in.)
Clutch Finger Nut	Torque	19 N•m (168 lb-in.)
PTO Clutch Disk	Minimum Thickness	7.00 mm (0.270 in.)
Traction Clutch Disk	Minimum Thickness	7.60 mm (0.300 in.)
Flywheel Pilot Bushing—670/770/790	Maximum ID	15.03 mm (0.592 in.)
Clutch Drive Surface: 670/770/790	Maximum Flatness	0.40 mm (0.016 in.)
870/970/1070	Maximum Flatness	0.20 mm (0.008 in.)
Bearing Sleeve Bushing 670/770/790	Depth	13 mm (0.500 in.)
870/970/1070	Depth	4.5 mm (0.178 in.)
Transmission		
Transmission-to-Clutch Housing Cap Screw	Torque	85 N•m (63 lb-ft)
Transmission-to-Clutch Housing Nut	Torque	80 N•m (59 lb-ft)
Differential		
Differential Backlash	Backlash	0.13—0.18 mm (0.005—0.007 in.)
Mechanical Front Wheel Drive—870		
Drive Gear-to-Differential Drive Shaft Nuts	Torque	88 N•m (65 lb-ft)
Front Wheel Cap Screw	Torque	217 N•m (160 lb-ft)
Spindle Housing and Outer Drive Assembly-to-Axle Housing Cap Screw	Torque	51 N•m (39 lb-ft)

Item	Measurement	Specification
Castle Nuts	Torque	68 N·m (50 lb-ft)
Outer Drive-to-Spindle Housing Cap Screw	Torque	90 N·m (66 lb-ft)
Steering Arm-to-Outer Drive Cap Screw	Torque	51 N·m (36 lb-ft)
Steering Arm-to-Spindle Housing Nut	Torque	187 N·m (138 lb-ft)
Ring Gear-to-Differential Carrier Cap Screw	Torque	40 N·m (29 lb-ft)
Spindle Pinion Gear-to-Outer Drive Gear	Backlash	0.10—0.15 mm (0.004—0.006 in.)
Axle Bevel Gear-to-Spindle Bevel Gear	Backlash	0.10—0.15 mm (0.004—0.006 in.)
Differential Drive Shaft-to-Ring Gear	Backlash	0.17—0.23 mm (0.007—0.009 in.)
Steering Arm-to-Spindle Housing	Maximum Clearance	0.30 mm (0.012 in.)
Mechanical Front Wheel Drive—970/1070		
Drive Gear-to-Housing Drive Shaft Nuts	Torque	88 N·m (65 lb-ft)
Front Wheel Cap Screw	Torque	190 N·m (140 lb-ft)
Spindle Housing and Outer Drive Assembly-to-Axle Housing Cap Screw	Torque	51 N·m (39 lb-ft)
Castle Nuts	Torque	68 N·m (50 lb-ft)
Ring Gear-to-Differential Carrier Cap Screw	Torque	80 N·m (59 lb-ft)
Spindle Pinion Gear-to-Outer Drive Gear	Backlash	0.20—0.35 mm (0.008—0.014 in.)
Axle Bevel Gear-to-Spindle Bevel Gear	Backlash	0.20—0.35 mm (0.008—0.014 in.)
Differential Drive Shaft-to-Ring Gear	Backlash	0.13—0.18 mm (0.005—0.007 in.)

Continued on next page.

MX,1015DG,A7 -19-10JAN90

10 15 8

Item	Measurement	Specification
Mid Mount PTO		
Rear Cover-to-Rear PTO Cover Cap Screw	Torque	27 N·m (20 lb-ft)
Linkage Cover-to-Gearbox Cap Screw	Torque	50 N·m (35 lb-ft)
Gearbox-to-Transmission Housing Cap Screw	Torque	75 N·m (55 lb-ft)

SECTION 60—STEERING AND BRAKE REPAIR

Item	Measurement	Specification
Manual Steering		
Pitman Arm Retaining Nut	Torque	172 N·m (127 lb-ft)
Steering Wheel Lock Nut	Torque	27 N·m (20 lb-ft)
Cover-to-Gearbox Cap Screw	Torque	26 N·m (226 lb-in.)
Steering Wheel	Maximum Free Play	20—50 mm (1.0—2.0 in.)
Power Steering		
Column-to-Dashboard Support Cap Screw	Torque	108 N·m (80 lb-ft)
Hydraulic Valve Cap Screw	Initial Torque	11 N·m (95 lb-in.)
	Final Torque	21 N·m (182 lb-in.)
Cylinder-to-Front Axle Nuts	Torque	128 N·m (94 lb-ft)
Cylinder Lock Nut	Torque	61 N·m (45 lb-ft)
Hydraulic Pump-to-Engine Cap Screw	Torque	26 N·m (226 lb-in.)
Hydraulic Line Flange Cap Screw	Torque	6 N·m (53 lb-in.)
Hydraulic Pump Cover-to-Housing Cap Screw	Torque	15 N·m (133 lb-in.)

SECTION 70—HYDRAULIC REPAIR

Item	Measurement	Specification
Hydraulic Pump		
Pump-to-Engine Cap Screw	Torque	26 N·m (226 lb-in.)
Hydraulic Line Flange Cap Screw	Torque	6 N·m (53 lb-in.)
Pump Cover-to-Housing Cap Screw	Torque	15 N·m (133 lb-in.)

Continued on next page.

MX,1015DG,A8 -19-10JAN90

Item	Measurement	Specification
Rockshaft		
Piston Cover-to-Case Cap Screw	Torque	95 N·m (70 lb-ft)
870/970 Case	Approximate Weight	63.5 kg (140 lb)
1070 Case	Approximate Weight	75 kg (165 lb)
Case-to-Transmission Housing Cap Screw	Torque	88 N·m (65 lb-ft)
Control Valve-to-Case Socket Head Cap Screw	Torque	26 N·m (226 lb-in.)
Lift Arm Bushing	Depth Below Bore Surface	7 mm (0.283 in.)
Lift Arm-to-Rockshaft Cap Screw	Torque	88 N·m (65 lb-ft)
SCV		
Spool Guide-to-Spool End	Torque	20 N·m (180 lb-in.)

SECTION 80—MISCELLANEOUS REPAIR

Item	Measurement	Specification
Wheels		
Retaining Nut	Torque	80 N·m (65 lb-ft)
Wheel Cap Screw	Torque	217 N·m (160 lb-ft)
Front Axle		
Pivot Pin-to-Axle Cap Screw	Torque	217 N·m (160 lb-ft)
Hood		
Hood Latch	Maximum Clearance	10 mm (0.394 in.)
ROLL-GARD		
870/970	Approximate Weight	51 kg (112 lb)
1070	Approximate Weight	51.7 kg (114 lb)
Frame-to-Final Drive Housing Cap Screw	Torque	136 N·m (100 lb-ft)
Frame-to-Bottom Plate Cap Screw	Torque	332 N·m (245 lb-ft)
Rear Wheel Cap Screw	Torque	190 N·m (140 lb-ft)

MX,1015DG,A9 -19-10JAN90

METRIC CAP SCREW TORQUE VALUES

10
15
10

Property Class and Head Markings	4.6	4.8	8.8 9.8	10.9	12.9
Property Class and Nut Markings	5	5	10	10	12

DIA.	WRENCH SIZE	4.6		4.8		8.8 or 9.8		10.9		12.9	
		OIL	DRY	OIL	DRY	OIL	DRY	OIL	DRY	OIL	DRY
		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)	N•m(lb-ft)	N•m(lb-ft)
M3	5.5mm	0.4(0.2)	0.5(0.3)	0.5(0.4)	0.7(0.5)	1(0.8)	1.3(1)	1.5(1)	2(1.5)	1.5(1)	2(1.5)
M4	7mm	0.9(0.6)	1.1(0.8)	1(0.9)	1.5(1)	2.5(1.5)	3(2)	3.5(2.5)	4.5(3)	4(3)	5(4)
M5	8mm	1.5(1)	2.5(1.5)	2.5(1.5)	3(2)	4.5(3.5)	6(4.5)	6.5(4.5)	9(6.5)	7.5(5.5)	10(7.5)
M6	10mm	3(2)	4(3)	4(3)	5.5(4)	7.5(5.5)	10(7.5)	11(8)	15(11)	13(9.5)	18(13)
M8	13mm	7(5)	9.5(7)	10(7.5)	13(10)	18(13)	25(18)	25(18)	35(26)	30(22)	45(33)
M10	16mm	14(10)	19(14)	20(15)	25(18)	35(26)	50(37)	55(41)	75(55)	65(48)	85(63)
M12	18mm	25(18)	35(26)	35(26)	45(33)	65(48)	85(63)	95(70)	130(97)	110(81)	150(111)
M14	21mm	40(30)	50(37)	55(41)	75(55)	100(74)	140(103)	150(111)	205(151)	175(129)	240(177)
M16	24mm	60(44)	80(59)	85(63)	115(85)	160(118)	215(159)	235(173)	315(232)	275(203)	370(273)
M18	27mm	80(59)	110(81)	115(85)	160(118)	225(166)	305(225)	320(236)	435(321)	375(277)	510(376)
M20	30mm	115(85)	160(118)	165(122)	225(166)	320(236)	435(321)	455(356)	620(457)	535(395)	725(535)
M22	33mm	160(118)	215(159)	225(167)	305(225)	435(321)	590(435)	620(457)	840(620)	725(535)	985(726)
M24	36mm	200(148)	275(203)	285(210)	390(288)	555(409)	750(553)	790(583)	1070(789)	925(682)	1255(926)
M27	41mm	295(218)	400(295)	415(306)	565(417)	810(597)	1100(811)	1155(852)	1565(1154)	1350(996)	1835(1353)
M30	46mm	400(295)	545(402)	565(417)	770(568)	1100(811)	1495(1103)	1570(1158)	2130(1571)	1835(1353)	2490(1837)
M33	51mm	545(402)	740(546)	770(568)	1050(774)	1500(1106)	2035(1500)	2135(1575)	2900(2139)	2500(1844)	3390(2500)
M36	55mm	700(516)	950(700)	990(730)	1345(992)	1925(1420)	2610(1925)	2740(2021)	3720(2744)	3205(2364)	4355(3212)

TS298 -19-09AUG89

CAUTION: Use only metric tools on metric hardware. Other tools may not fit properly. They may slip and cause injury.

DO NOT use these values if a different torque value or tightening procedure is listed for a specific application. Torque values listed are for general use only. Check tightness of cap screws periodically.

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

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

Make sure fastener threads are clean and 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 amount shown in chart. Tighten toothed or serrated-type lock nuts to full torque value.

O53,TORQ2 -19-07OCT88

INCH CAP SCREW TORQUE VALUES

SAE Grade	Head Markings	SAE Grade	Nut Markings
SAE GRADE 1 SAE GRADE 2	No Mark	2	No Mark

SAE Grade	Head Markings	SAE Grade
SAE GRADE 5 SAE GRADE 5.1 SAE GRADE 5.2		5 Nut Markings

SAE Grade	Nut Markings	SAE Grade
SAE GRADE 8 SAE GRADE 8.2		8 Nut Markings

DIA.	WRENCH SIZE	SAE GRADE 1 OIL	SAE GRADE 1 DRY	*SAE GRADE 2 OIL	*SAE GRADE 2 DRY	SAE GRADE 5 OIL	SAE GRADE 5 DRY	SAE GRADE 8 OIL	SAE GRADE 8 DRY
		N•m(lb-in)	N•m(lb-in)	N•m(lb-in)	N•m(lb-in)	N•m(lb-in)	N•m(lb-in)	N•m(lb-in)	N•m(lb-in)
#6		0.5(4.5)	0.7(6)			1.4(12)	1.7(15)		
#8		0.9(8)	1.2(11)			2.4(21)	3.2(28)		
#10		1.4(12)	1.8(16)			3.4(30)	4.6(41)		
#12		2(19)	2.8(25)			5.4(48)	7.3(65)		
		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	7/16	3.5(2.5)	4(3)	5(4)	7(5)	8(6)	11(8)	12(8.5)	16(12)
5/16	1/2	7(5)	9(6.5)	10(7.5)	14(10)	16(12)	23(17)	24(18)	33(24)
3/8	9/16	12(8.5)	16(12)	19(14)	24(18)	30(22)	41(30)	41(30)	54(40)
7/16	5/8	19(14)	26(19)	30(22)	41(30)	47(35)	68(50)	68(50)	95(70)
1/2	3/4	24(21)	41(30)	47(35)	61(45)	75(55)	102(75)	102(75)	142(105)
9/16	13/16	41(30)	54(40)	68(50)	88(65)	108(80)	142(105)	149(110)	203(150)
5/8	15/16	54(40)	75(55)	88(65)	122(90)	149(110)	197(145)	203(150)	278(205)
3/4	1-1/8	102(75)	136(100)	163(120)	217(160)	258(190)	353(260)	366(270)	495(365)
7/8	1-5/16	163(120)	244(165)	163(120)	224(165)	414(305)	563(415)	590(435)	800(590)
1	1-1/2	244(180)	332(245)	244(180)	332(245)	624(460)	848(625)	881(650)	1193(880)
1-1/8	1-11/16	346(255)	468(345)	346(255)	468(345)	780(575)	1058(780)	1248(920)	1695(1250)
1-1/4	1-7/8	488(360)	664(490)	488(360)	665(490)	1098(810)	1492(1100)	1763(1300)	2393(1765)
1-3/8	2-1/16	637(470)	868(640)	637(470)	868(640)	1438(1061)	1953(1440)	2312(1705)	3140(2315)
1-1/2	2-1/4	848(625)	1153(850)	848(625)	1153(850)	1912(1410)	2590(1910)	3065(2260)	4163(3070)

TS297 -19-09AUG89

DO NOT use these values if a different torque value or tightening procedure is listed for a specific application. Torque values listed are for general use only. Check tightness of cap screws periodically.

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

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

Make sure fastener threads are clean and 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 amount shown in chart. Tighten toothed or serrated-type lock nuts to full torque value.

**For SAE Grade 2 fasteners (152 mm) 6-in. or less in length, use torque values for SAE Grade 2. For fasteners longer than (152 mm) 6-in., use SAE Grade 1 torque values.*

O53,TORQ1 -19-03MAR89

FUEL SPECIFICATIONS

Use ONLY clean, high-quality fuel.

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

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

Use Grade No. 1-D fuel for all air temperatures at altitudes above 1500 m (5000 ft).

IMPORTANT: Use fuel with less than 1.0 per cent sulfur. If possible, use fuel with less than 0.5 per cent sulfur.

If fuel sulfur is more than 0.5 per cent, change engine oil and filter every 100 hours.

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

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

Cloud Point—For cold weather operation, cloud point should be 912° C (10° F) below lowest normal air temperature.

MX,1020DG,A1 -19-03OCT89

FUEL STORAGE

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

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

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

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

Store fuel drum on its side with plug up.

MX,1020DG,A2 -19-03OCT89

DO NOT USE GALVANIZED CONTAINERS

IMPORTANT: Diesel fuel stored in galvanized containers reacts with zinc coating on the container to form zinc flakes. If fuel contains water, a zinc gel will also form. The gel and flakes will quickly plug fuel filters and damage fuel injectors and fuel pumps.

DO NOT USE a galvanized container to store diesel fuel.

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

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

MX,1020DG,A3 -19-03OCT89

FILLING THE FUEL TANK

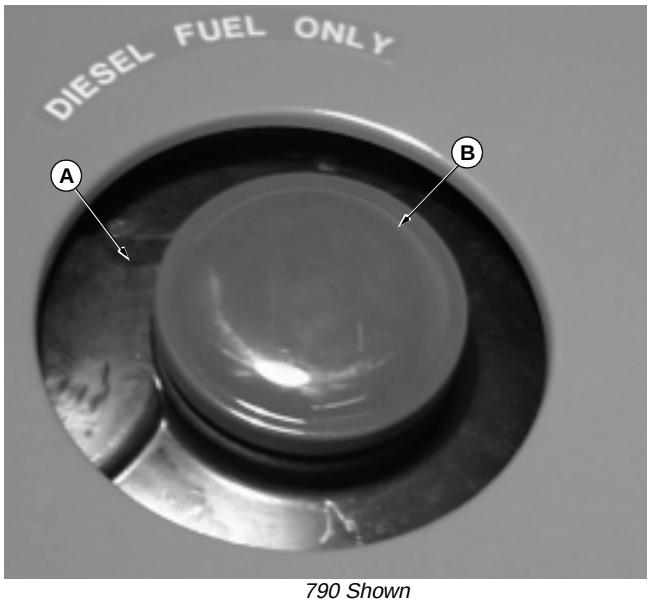
CAUTION: Handle fuel carefully. Do not smoke while you fill the fuel tank or service the fuel system. Fill fuel tank only to bottom of filler neck.

IMPORTANT: On 670/770/790 tractors, be sure to clean fuel spill tray (A) before removing fuel cap (B). DO NOT permit dirt or trash to get into the fuel system.

Fill fuel tank at end of each day's operation or when fuel gauge shows 1/4 or less fuel in tank. Fill fuel tank only to bottom of filler neck.

FUEL TANK CAPACITY

670/770/790 . . . . . 24 L (6.3 U.S. gal)
870/970. . . . . 32 L (8.5 U.S. gal)
1070 . . . . . 40 L (10.6 U.S. gal)



M97667

790 Shown



M52859

970 Shown

DIESEL ENGINE OIL

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

John Deere TORQ-GARD SUPREME PLUS-50™ engine oil is recommended. This oil is specially formulated to provide superior protection against high temperature thickening and wear as well as exceptional cold weather starting performance; these properties allow an extended drain interval and may result in longer engine life.

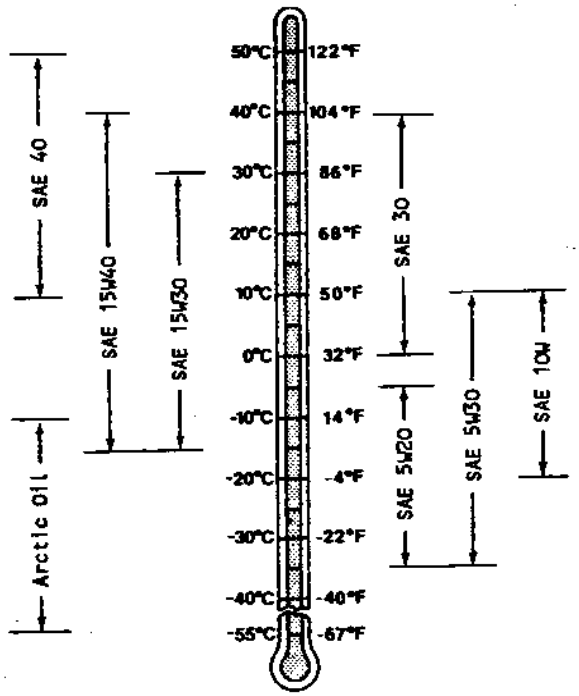
If John Deere TORQ-GARD SUPREME PLUS-50 engine oil and a John Deere oil filter are used, the oil and filter change interval may be extended by 50 hours.

John Deere TORQ-GARD SUPREME® engine oil is also recommended. Other oils may be used if they meet one or more of the following:

- API Service Classification CE or CD
- Military Specification MIL-L-2104D or MIL-L-2104C

SAE 5W20, SAE 5W30, and arctic oil viscosity grades meeting API Service Classification CC may be used, but oil and filter must be changed at one-half the normal interval.

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



TS238 -19-09NOV88

O53,ENOIL -19-22FEB88

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.

O53,COOL -19-18FEB88

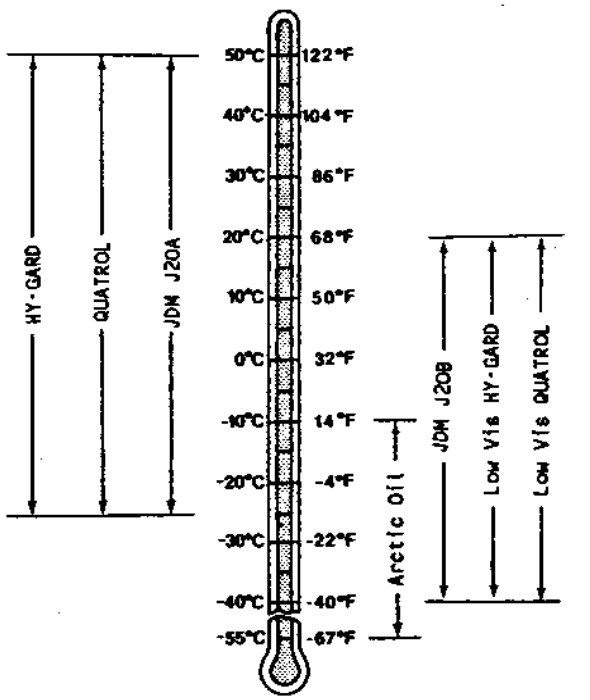
ANTI-CHATTER TRANSMISSION/HYDRAULIC OIL

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 HY-GARD oil is specially formulated to minimize wet brake chatter, to provide optimum clutch engagement, and to provide maximum protection against mechanical wear, corrosion, and foaming.

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

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



O53,ANTI -19-18FEB88

GEAR OIL

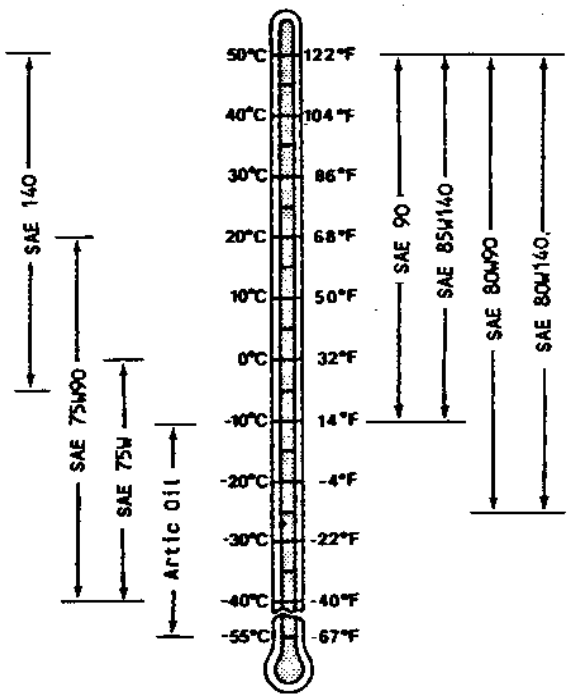
Use oil viscosity based on the expected air temperature range during the period between oil changes.

John Deere GL-5 Gear Lubricant is recommended.

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

- API Service Classification GL-5
- Military Specification MIL-L-2105D
- Military Specification MIL-L-2105C
- Military Specification MIL-L-2105B

Oils meeting Military Specification MIL-L-10324A may be used as arctic oils.



TS245 -19-09NOV88

O53,GEOIL -19-23FEB88

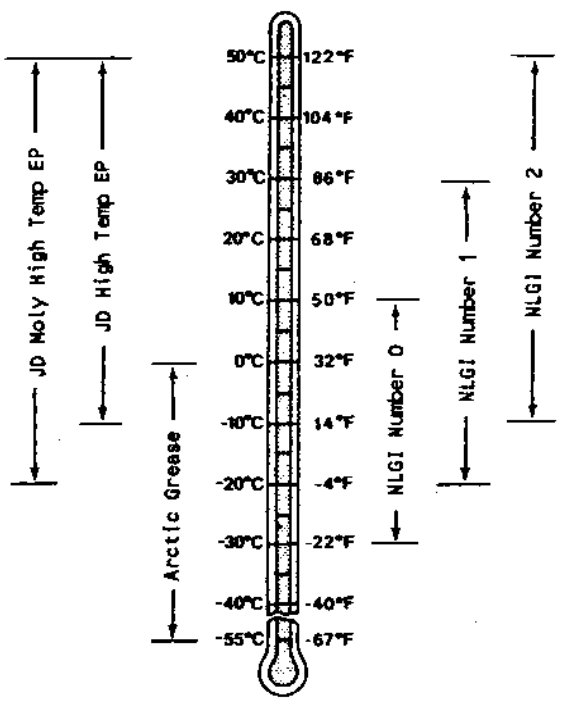
EXTREME PRESSURE GREASE

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.



TS248 -19-07OCT88

O53,GREA1 -19-08FEB88

ALTERNATIVE LUBRICANTS

Additional information on cold weather operation is available from your John Deere dealer.

Conditions in certain geographical areas may require special lubricants and lubrication practices which do not appear in this operator's manual. If you have any questions, consult your John Deere dealer to obtain the latest information and recommendations.

O53,ALTER -19-05AUG86

LUBRICANT STORAGE

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

Use clean containers to handle all lubricants.

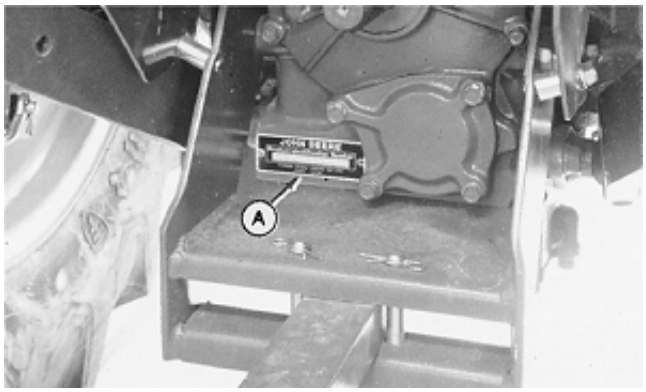
Store lubricants and containers in an area protected from dust, moisture, and other contamination.

O53,LUBST -19-29FEB88

RECORD PRODUCT IDENTIFICATION NUMBER

Record the tractor's 13 digit product identification number (A), located near PTO on transmission case, in the space provided. Your John Deere dealer will need to know this number when ordering parts.

Product Identification Number _____



1070 Shown

MX,1025DG,A1 -19-03OCT89

RECORD ENGINE SERIAL NUMBER

Record the tractor's engine serial number (A) in the space provided. Your John Deere dealer will need to know this number when ordering parts.

Engine Serial Number _____

1070 Shown



MX,1025DG,A2 -19-03OCT89

STANDARD FEATURES—670/770

- Yanmar “TN” Series Engine
  —Three cylinders, liquid cooled

  —670 3TNA72, 18.5 Hp.
  indirect injection
  glow plug starting aid

  —770 3TN82, 24 Hp.
  direct injection
  intake air heater starting aid

- Sliding Gear, Two Range Transmission
  —Eight speeds forward and two reverse
  —Differential lock
  —Rear 540 rpm PTO
  —Independent dry shoe brakes

- Open-Center Hydraulic System
  —Rockshaft with category 1 three-point hitch

- Operator Presence System
  —Shuts down engine if operator leaves seat with mid or rear PTO engaged

- Roll-Gard and Seat Belt
  —Protects operator in the event of a tip-over



-UN-09JAN89
M52686

Slide No. 1 670



-UN-09JAN89
M52687

Slide No. 2 770

MX,1030DG,A1 -19-29NOV89

FACTORY OPTIONS—670/770

- Two-Stage Clutch
  —provides continuous live PTO
  —Stops tractor without disengaging PTO

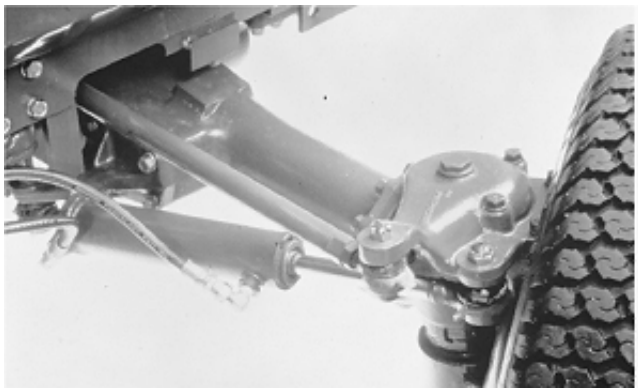
- Hydrostatic Power Steering
  —Separate power steering pump
  —When ordered, tractor comes with two-stage clutch with live PTO
  —No kits to install. (Not available for field installation).

- Mechanical Front-Wheel Drive
  —Engage on the go (collar shift design)



-UN-09JAN89
M52692

Slide No. 3 Dual-Stage Clutch



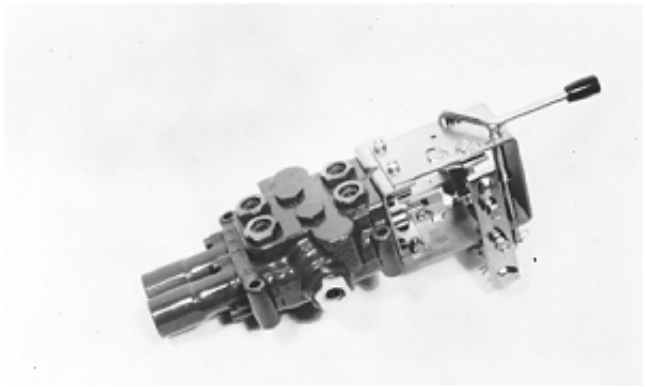
-UN-09JAN89
M52693

Slide No. 4 MFWD and Steering Cyl.

MX,1030DG,A2 -19-29NOV89

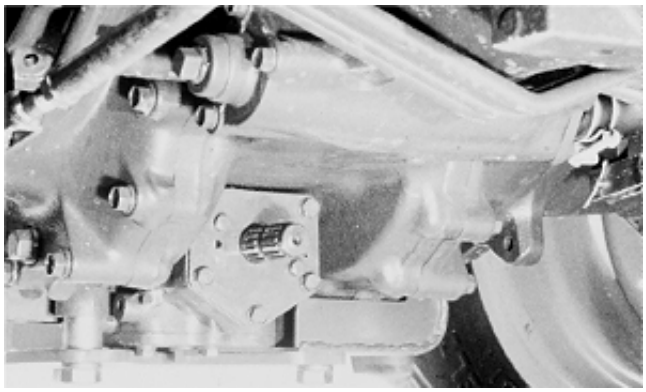
FIELD INSTALLED OPTIONS—670/770/870/970/1070

- Selective Control Valve (SCV)
  - —Single lever operation
  - —Regenerative for faster operation
- Mid-PTO
  - —2100 rpm
  - —Independently controlled
  - —Wet disk brake, activated when PTO is disengaged
- Rear Auxiliary Hydraulics
  - —Operates implements with an open-center control valve such as a backhoe or log splitter
- Hydraulic Oil Filter Kit
  - —Standard with power steering
- Turn Signals and Rear Work Lights



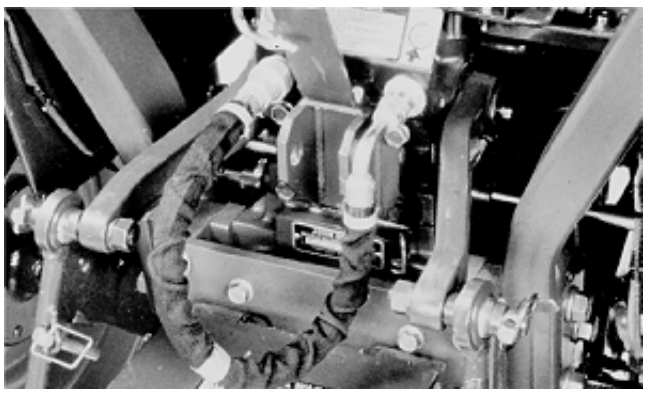
-UN-09JAN89
M52784

Slide No. 5 SCV Lever



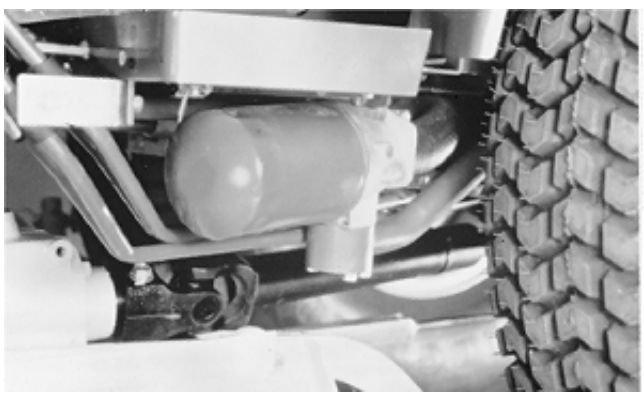
-UN-19JAN90
M48558

Slide No. 6 Mid-PTO



-UN-19JAN90
M48559

Slide No. 7 Rear Hyd Kit



-UN-09JAN89
M52767

Slide No. 8 Oil Filter Kit

MX,1030DG,A3 -19-29NOV89

STANDARD FEATURES—870/970

- Yanmar “TN” Series Engine
  —870 3TN84 28 Hp.
  —970 4TN82 33 Hp.
  Balanced Egnine (4TN82)
  direct injection
  intake air heater starting aid
  Key switch controlled fuel shut-off

- Collar Shift, Three Range Transmission
  —Nine speeds forward, two reverse
  —Planetary final drive
  —Wet disk brakes
  —Differential lock

- Open-Center Hydraulics
  —Rockshaft with category 1, three point hitch

- Operator Presence System
  —Shuts down engine if operator leaves seat with mid or rear PTO engaged

- Roll-Gard and Seat Belt
  —Protects operator in the event of a tip-over



M52688 -UN-09JAN89

Slide No. 9 870



M52689 -UN-09JAN89

Slide No. 10 970

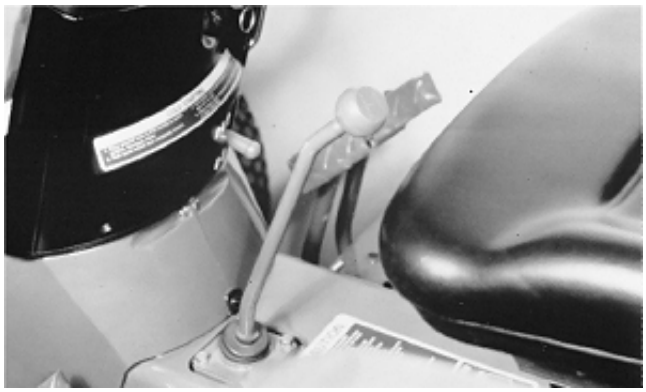
MX,1030DG,A4 -19-09NOV89

FACTORY OPTIONS—870/970

- Synchromesh Transmission
  —Provides on the go shifting within speed ranges and faster shuttle shifting between forward and reverse

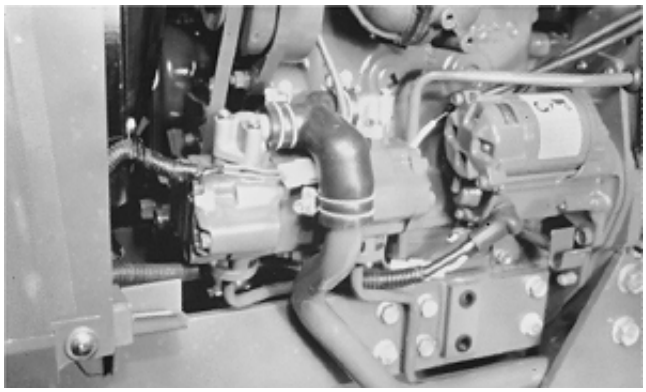
- Hydrostatic Power Steering
  —Has its own hydraulic pump
  —When ordered, tractor comes with Synchromesh transmission
  —No kits to install. (Not available for field installation

- Mechanical Front-Wheel drive
  —On the go engagement



-UN-09JAN89
M52744

Slide No. 11 Synchronized Trans.



-UN-09JAN89
M52766

Slide No. 12 Power Steering Pump

MX,1030DG,A5 -19-29NOV89

STANDARD FEATURES—1070

- Yanmar “TN” Series Engine
  —1070 4TN84 38.5 Hp
  Balanced Engine
  direct injection
  intake air heater starting aid
  Key switch controls fuel shut-off

- Synchromesh, Three Range Transmission
  —Nine speeds forward, two reverse
  —Planetary final drive
  —Wet disk brakes
  —Differential lock

- Open-Center Hydraulics
  —Rockshaft with category 1, three point hitch
  —Load and depth sensing

- Operator Presence System
  —Shuts down engine if operator leaves seat with mid or rear PTO engaged

- Roll-Gard and Seat Belt
  —Protects operator in the event of a tip-over



-UN-09JAN89
M52690

Slide No. 13 1070



-UN-19JAN90
M48560

Slide No. 14 Draft Control

MX,1030DG,A6 -19-09NOV89

FACTORY OPTIONS—1070

- Mechanical Front-Wheel drive
  —On the go engagement



-UN-09JAN89
M52691

Slide No. 15 MFWD

MX,1030DG,A7 -19-11NOV89

Section 20
ENGINE REPAIR

Contents

Page

Group 05–Engine–670/770

Engine Repair–Use CTM-3 20-05-1
Other Materials 20-05-1
Remove and Install Engine 20-05-2

Group 06–Engine–870/970/1070

Engine Repair–Use CTM-3 20-06-1
Other Materials 20-06-1
Remove and Install Engine 20-06-2

Group 07–Engine–790

Specifications
- General Specifications. 20-07-1
- Repair Specifications. 20-07-1
- Tests and Adjustment Specifications 20-07-4

Operational Tests 20-07-4
Torque Values, Non-Standard
- Fasteners. 20-07-4

Special Tools 20-07-5
Other Materials 20-07-5
Remove and Install Engine 20-07-7
Engine Repair 20-07-14
- Rocker Cover Removal/Installation 20-07-14
- Rocker Arm Assembly 20-07-14
- Rocker Arm Components 20-07-15
- Cylinder Head And Valves Removal And Installation 20-07-17
- Cylinder Head And Valves Disassembly And Assembly 20-07-18
- Valve Seats 20-07-19
- Intake and Exhaust Valves 20-07-20
- Valve Recession 20-07-21
- Valve Guides 20-07-21
- Valve Springs. 20-07-22
- Exhaust Manifold 20-07-23
- Intake Manifold 20-07-23
- Grind Valve Seats 20-07-23
- Lap Valves 20-07-24
- Measure Piston-to-Cylinder Head Clearance. 20-07-24
- Piston and Connecting Rod. 20-07-25
- Connecting Rod Bearing 20-07-29
- Piston Ring Groove 20-07-29
- Piston Ring End Gap 20-07-30
- Piston Pin 20-07-30
- Piston Pin Bore. 20-07-31
- Piston Pin Bushing 20-07-31
- Piston Diameter 20-07-32
- Cylinder Bore 20-07-32
- Deglazing 20-07-33
- Reboring. 20-07-33
- Crankshaft Rear Oil Seal 20-07-34
- Crankshaft Front Oil Seal 20-07-35
- Crankshaft and Main Bearings 20-07-35
- Flywheel 20-07-39
- Camshaft 20-07-40
- Camshaft Followers 20-07-43
- Timing Gear Cover 20-07-44
- Idler Gear 20-07-45
- Timing Gear Cover Mounting Plate 20-07-46
- Oil Pan and Strainer 20-07-46
- Oil Pump. 20-07-46
- Fuel Filter Assembly. 20-07-48
- Thermostat and Water Pump 20-07-49
- Component location–Fuel Supply 20-07-50
- Starting Motor Removal and Installation 20-07-52
- Starting Motor Disassembly and Assembly. 20-07-53
- Starting Motor Inspection/Test 20-07-56
- Starting Motor Gear Train. 20-07-58
- Starting Motor Solenoid 20-07-60
- Alternator Removal And Installation 20-07-61
- Alternator Disassembly 20-07-62
- Alternator Components 20-07-65

Group 10–Cooling System

Radiator
- 670/770/790/870/970/1070
- Remove, Inspect and Install 20-10-1

Group 15–Throttle and Governor Control Linkage

Throttle Control Linkage
- 670/770/790/870/970/1070
- Inspect and Repair 20-15-1

Group 20–Fuel System

Injection Pump, Nozzle, and Governor Repair–
770/870/970/1070–Use CTM-3 20-20-1
Fuel Injection Pump—790 20-20-1
Fuel Injection Nozzles—790. 20-20-3
Remove, Inspect, and Install Fuel Tank
670/770/790 20-20-6
870/970/1070 20-20-7
Replace
Fuel Supply Pump 20-20-3
Fuel Shut-Off Solenoid. 20-20-3
Intake Air Heater–770/790/870/970/1070 20-20-4

YANMAR ENGINE REPAIR—USE CTM-3

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

Use the component manual in conjunction with this machine manual.



TS225 -UN-17JAN89

20
05
1

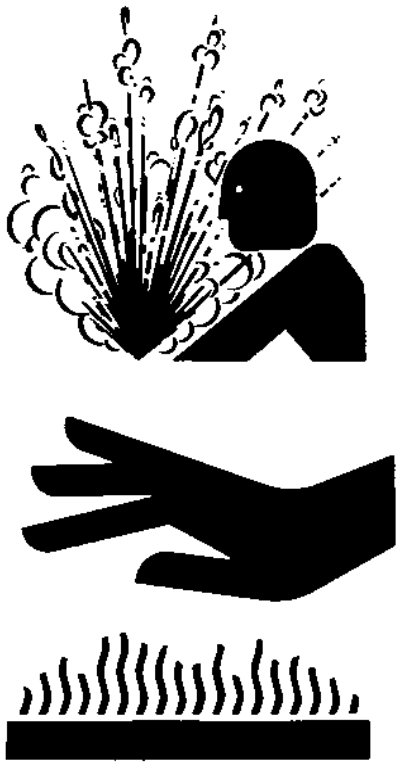
MX,2005DG,A1 -19-09JUN89

OTHER MATERIAL

Number	Name	Use
T43512	Thread Lock and Sealer (Medium Strength)	Apply to threads of front frame mounting cap screws.

MX,2005DG,A2 -19-20OCT89

REMOVE ENGINE



TS281 -UN-23AUG88

TS271 -UN-23AUG88

1. Remove fuel tank. (See procedure in Group 20.)

2. Remove starter. (See procedure in Section 40, Group 10.)

3. MFWD: Remove drive shaft. (See procedure in Section 50, Group 30.)

4. Remove fuel shut-off solenoid. (See procedure in Group 20.)

N **CAUTION: 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.

NOTE: Approximate coolant capacity is:
670.....3.8 L (4.0 qt)
770.....4.8 L (5.1 qt)

5. Drain coolant.

6. Remove radiator and air cleaner hoses. Close all openings using caps and plugs.

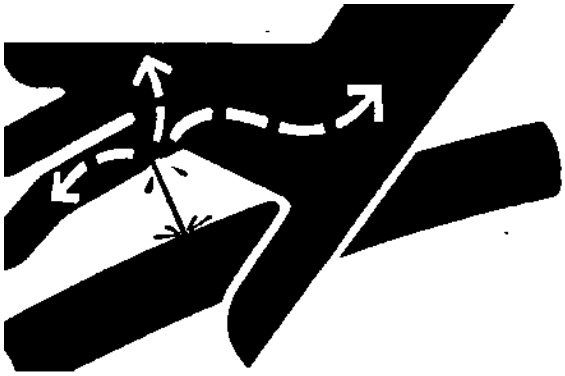
N **CAUTION: Muffler may be hot. Allow muffler to cool before removing.**

7. Remove muffler and gasket.

MX,2005DG,A3 -19-20OCT89

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.



X9811 -UN-23AUG88

20 05 3

8. Lower rockshaft arms.

9. Manual steering: Disconnect drag link (E).

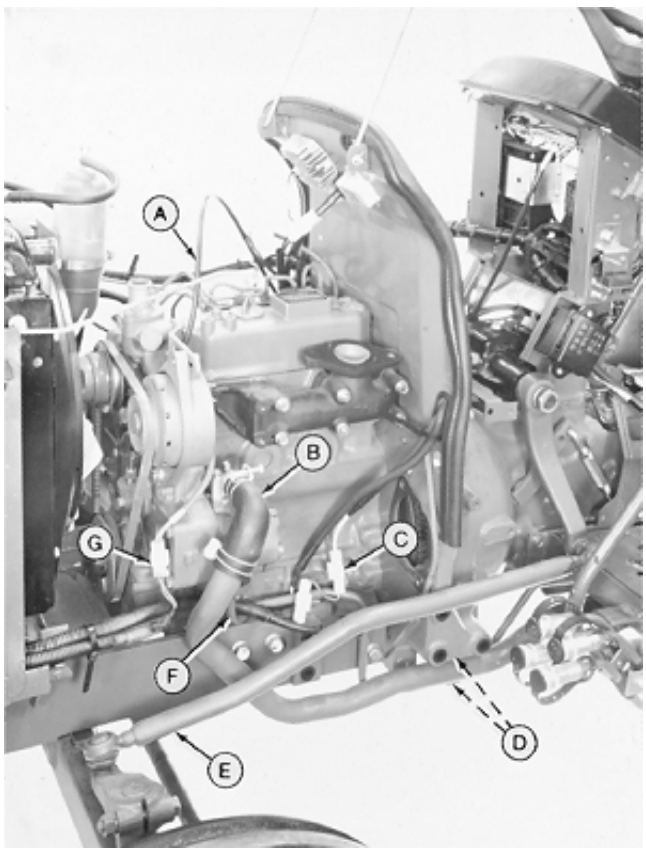
10. Remove line clamp cap screws (D).

11. Disconnect hose (B) and flange (F). Close all openings with caps and plugs.

12. Power steering: Remove hydraulic lines. (See procedure in Section 60, Group 10.)

13. Disconnect wiring connectors (C and G).

14. Disconnect cable (A).



M53550 -UN-20NOV89

Left-Hand Side Shown

A—Hour Meter Cable
B—Pressure Line Hose
C—Fusible Link Connector
D—Cap Screws (2 used)
E—Drag Link
F—Supply Line Mounting Flange
G—Alternator Wiring Connector

MX,2005DG,A4 -19-20OCT89

15. Close shutoff valve on fuel filter.

16. Disconnect lines (F and H). Close all openings using caps and plugs.

17. Disconnect wiring harness (C and G).

18. Disconnect wiring leads (D and J).

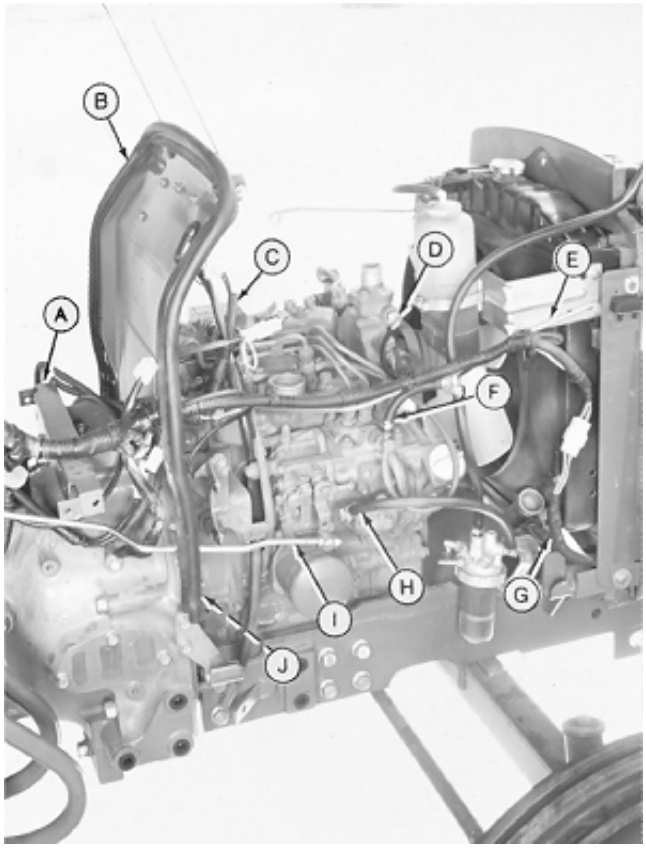
19. Remove support rod (E).

20. Remove control rod (I).

21. Remove air shield (B).

22. Remove bracket (A).

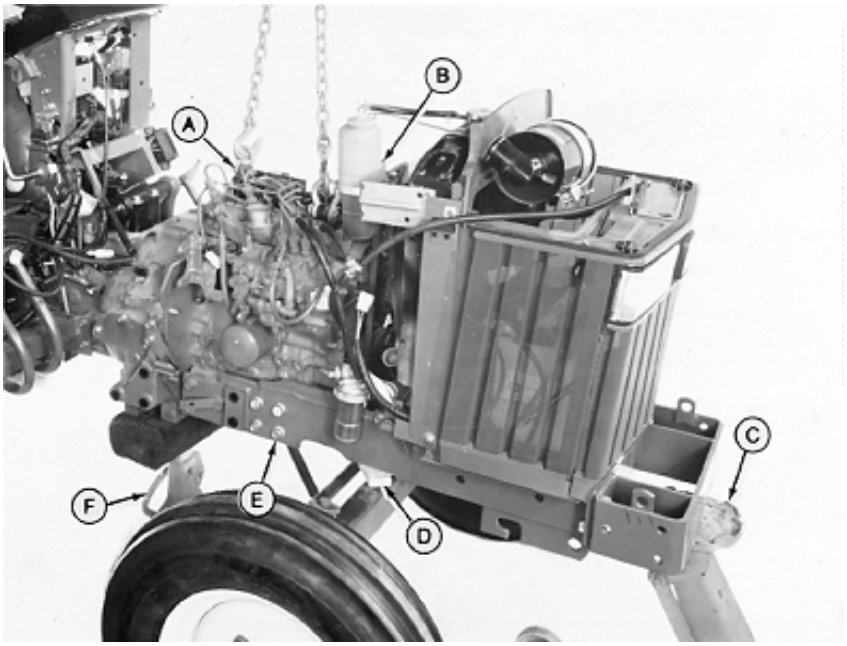
A—Fuel Tank Support Bracket
B—Air Shield
C—Wiring Harness
D—Coolant Temperature Switch Wiring Lead
E—Radiator Support Rod
F—Return Fuel Leak-Off Line
G—Wiring Harness
H—Fuel Pump Supply Line
I—Throttle Control Rod
J—Engine Oil Pressure Switch Wiring Lead



M53551 -UN-20NOV89

Right-Hand Side Shown

MX,2005DG,A5 -19-20OCT89



A—Lifting Brackets (2 used)
B—Recovery Tank Assembly
C—Floor Jack
D—Wood Block (2 used)
E—Cap Screw (12 used)
F—Support Stand

23. Remove recovery tank assembly (B).

24. Remove rocker arm cover.

25. Install lifting brackets such as JDG19 or JT01748 Lifting Brackets (A).

26. Attach a hoist to engine.

27. Install support stand (F) under clutch housing.

28. Install a floor jack (C) under front weight support.

29. Install a wood block (D) between front axle and frame on both sides.

30. Remove six cap screws (E) from each side of frame.

31. Roll front end away from tractor.

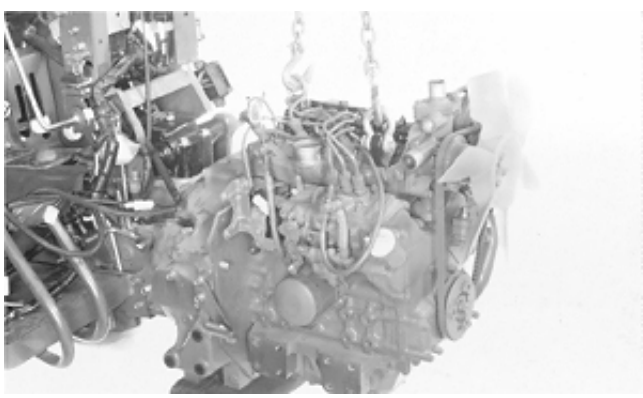
MX,2005DG,A6 -19-20OCT89

NOTE: Put transmission in neutral to ease clutch shaft alignment with engine during installation.

32. Put transmission shift lever in neutral.

33. Remove eight cap screws and lock washers. Remove engine.

34. Make repairs as necessary. (See CTM-3.)



MX,2005DG,A7 -19-20OCT89

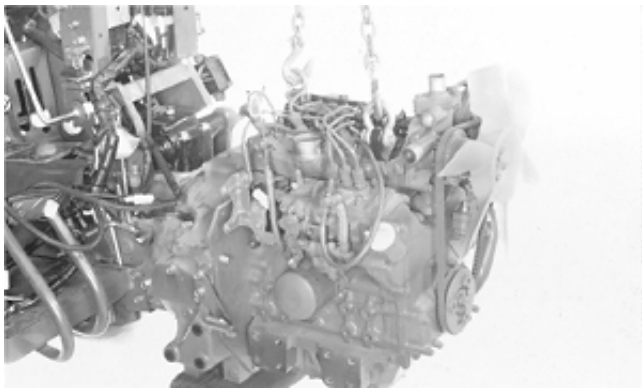
INSTALL ENGINE

1. Put transmission shift lever in neutral to ease clutch shaft alignment with engine.

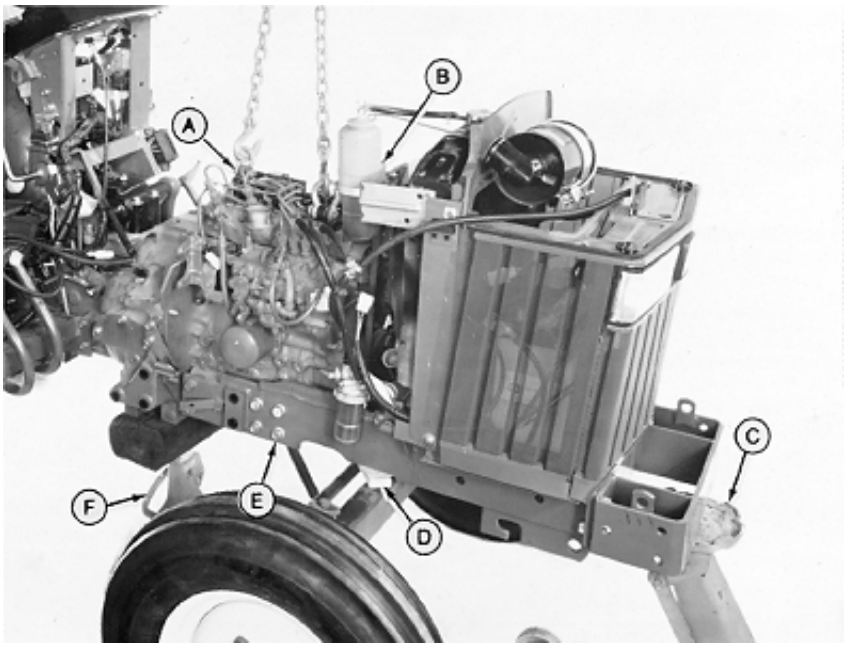
2. Apply multipurpose grease to end of clutch shaft.

NOTE: Turn flywheel when installing engine, to engage engine with clutch shaft(s).

3. Install engine. Tighten cap screws to 54 N·m (40 lb-ft).



MX,2005DG,A8 -19-20OCT89



A—Lifting Brackets (2 used)
B—Recovery Tank Assembly
C—Floor Jack
D—Wood Block (2 used)
E—Cap Screw (12 used)
F—Support Stand

4. Apply thread lock and sealer (medium strength) to threads of cap screws (E).

5. Install front end to tractor. Tighten cap screws (E) to 90 N·m (65 lb-ft).

6. Remove wood blocks (D), floor jack (C) and support stand (F).

7. Remove lifting brackets (A).

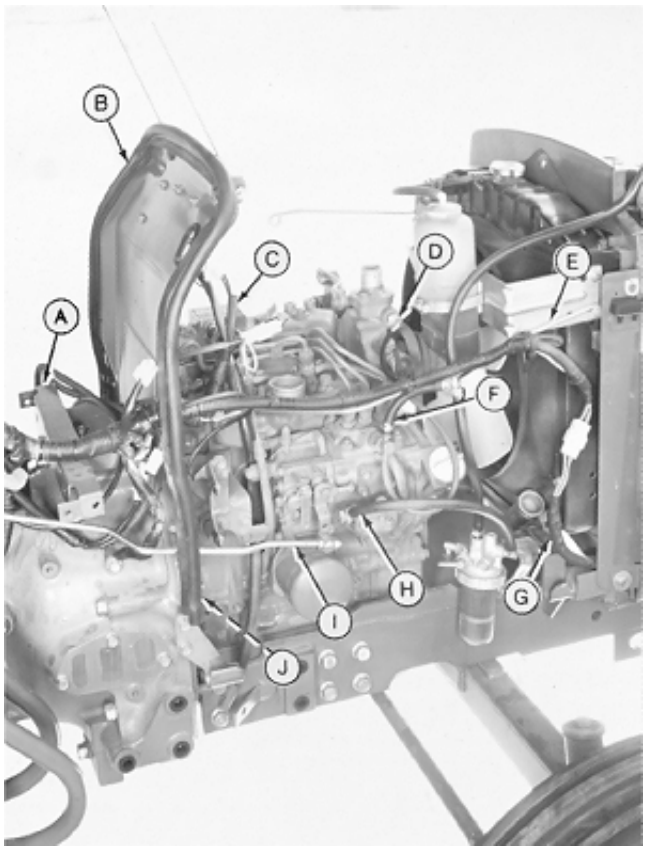
8. Install rocker arm cover.

9. Install recovery tank assembly (B).

MX,2005DG,A9 -19-20OCT89

10. Install bracket (A).
11. Install air shield (B).
12. Install control rod (I).
13. Install support rod (E).
14. Connect wiring leads (D and J).
15. Connect wiring harness (C and G).
16. Connect lines (F and H).
17. Open shutoff valve on fuel filter.

A—Fuel Tank Support Bracket
B—Air Shield
C—Wiring Harness
D—Coolant Temperature Switch Wiring Lead
E—Radiator Support Rod
F—Return Fuel Leak-Off Line
G—Wiring Harness
H—Fuel Pump Supply Line
I—Throttle Control Rod
J—Engine Oil Pressure Switch Wiring Lead



Right-Hand Side Shown

MX,2005DG,A10 -19-20OCT89

18. Connect cable (A).

19. Connect wiring connectors (C and G).

20. Power steering: Install hydraulic lines. (See procedure in Section 60, Group 10.)

21. Connect flange (F) and hose (B).

22. Install line clamp cap screws (D).

23. Manual steering: Connect drag link (E).

24. Install muffler and new gasket.

25. Install radiator and air cleaner hoses.

26. MFWD: Install drive shaft. (See procedure in Section 50, Group 30.)

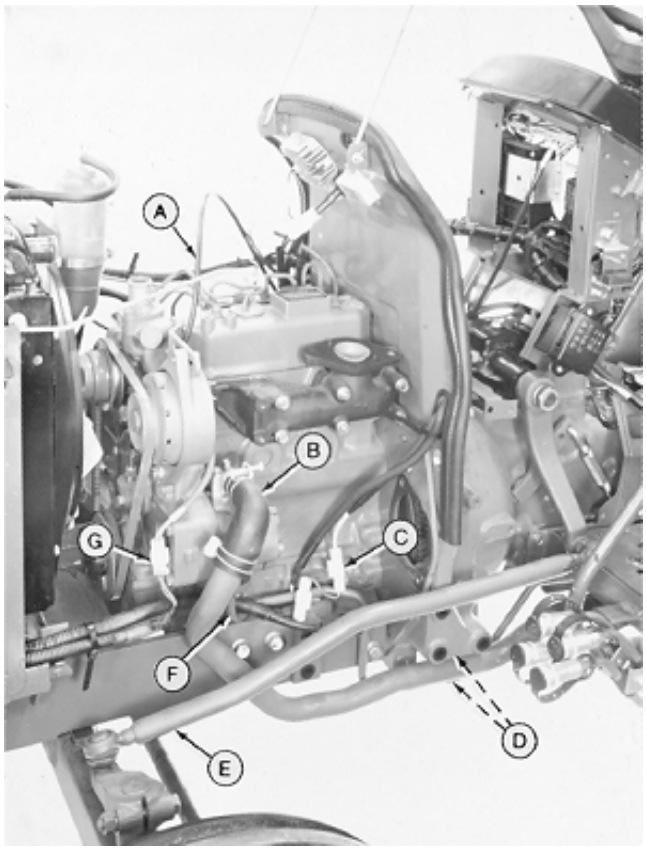
27. Install starter. (See procedure in Section 40, Group 10.)

28. Install fuel shut-off solenoid. (See procedure in Group 20.)

29. Install fuel tank. (See procedure in Group 20.)

30. Fill radiator with proper coolant to top of filler neck. (See Engine Coolant in Section 10, Group 20.)

31. Adjust throttle control linkage. (See Section 220, Group 15.)



Left-Hand Side Shown

A—Hour Meter Cable
B—Pressure Line Hose
C—Fusible Link Connector
D—Cap Screws (2 used)
E—Drag Link
F—Supply Line Mounting Flange
G—Alternator Wiring Connector

MX,2005DG,A11 -19-20OCT89

YANMAR ENGINE REPAIR—USE CTM-3

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

Use the component manual in conjunction with this machine manual.



TS225 -UN-17JAN89

MX,2006DG,A1 -19-09JUN89

OTHER MATERIAL

Number	Name	Use
T43512	Thread Lock and Sealer (Medium Strength)	Apply to threads of front frame mounting cap screws.

MX,2006DG,A2 -19-20OCT89

REMOVE ENGINE

1. Remove hood. (See procedure in Section 80, Group 15.)

2. Remove engine side shields and lower dash covers.

20 06 2

3. Remove starter. (See procedure in Section 40, Group 10.)

4. MFWD: Remove drive shaft. (See procedure in Section 55, Group 30 or 35.)

N **CAUTION: 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.

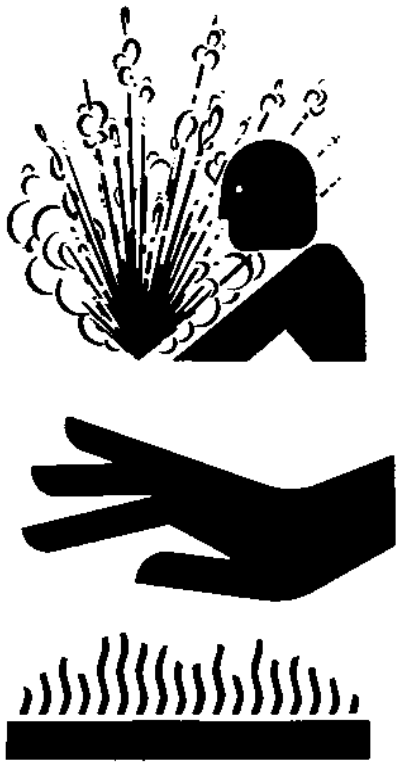
NOTE: Approximate coolant capacity is:
870.....5.2 L (5.5 qt)
970/1070.....5.8 L (6.1 qt)

5. Drain coolant.

6. Remove radiator and air cleaner hoses. Close openings with caps and plugs.

N **CAUTION: Muffler may be hot. Allow muffler to cool before removing.**

7. Remove muffler and gasket.



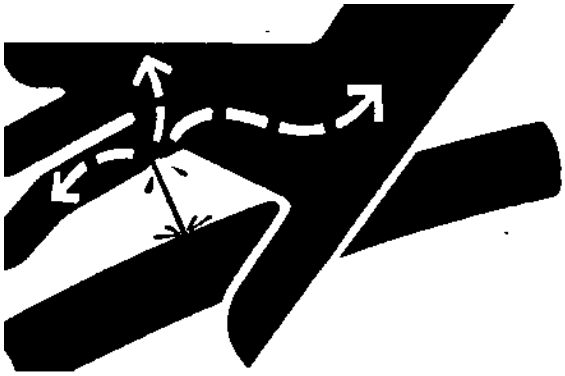
TS271 -UN-23AUG88

TS281 -UN-23AUG88

MX,2006DG,A3 -19-01NOV89

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.



X9811 -UN-23AUG88

20 06 3

8. Lower rockshaft arms.

9. Disconnect hose (I) and flange (H). Close openings with caps and plugs.

10. Power steering: Disconnect flange (J).

Manual steering: Disconnect drag link.

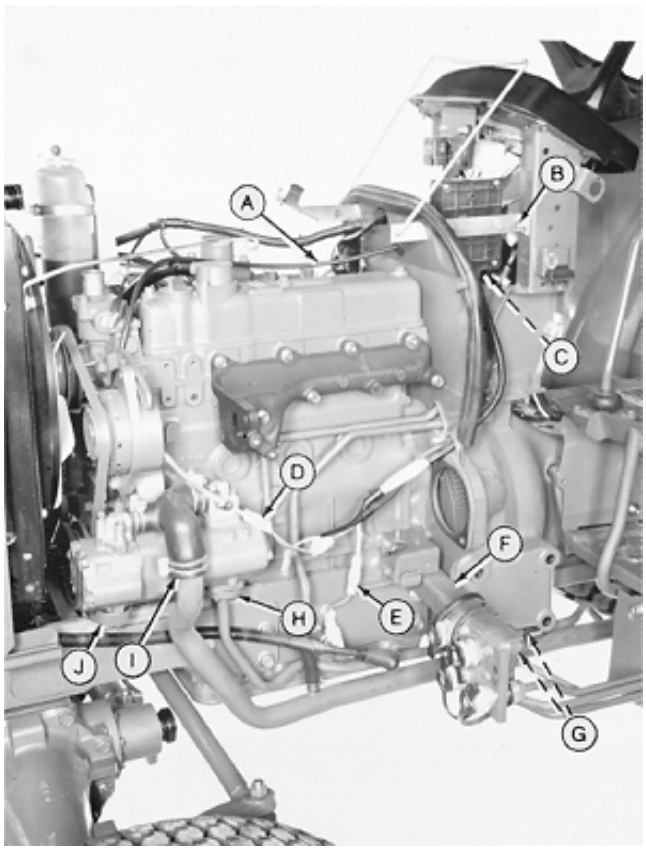
11. Remove bracket (F), if equipped with SCV.

12. Remove line clamp cap screws (G).

13. Disconnect cable (A).

14. Disconnect wiring connectors (C, D and E).

15. Remove cap screw (B).



M53571 -UN-20NOV89

Left-Hand Side Shown

A—Hour Meter Cable
B—Cap Screw
C—Control Box Wiring Connector
D—Alternator Wiring Connector
E—Fusible Link Connector
F—Bracket
G—Cap Screws (2 used)
H—Hydraulic Pump Pressure Line Mounting Flange
I—Suction Line Hose
J—Power Steering Hydraulic Pump Pressure Line Mounting Flange

MX,2006DG,A4 -19-01NOV89

16. Close shutoff valve on fuel filters.

17. Disconnect lines (I and J). Close openings with caps and plugs.

18. Remove control rod (K).

19. Remove support rod (F).

20. Remove fuse block from support (B).

21. Remove cap screw (R).

22. Disconnect wiring harness (C, D and G).

23. Disconnect wiring leads (E, H and L).

24. Disconnect wiring connector (P).

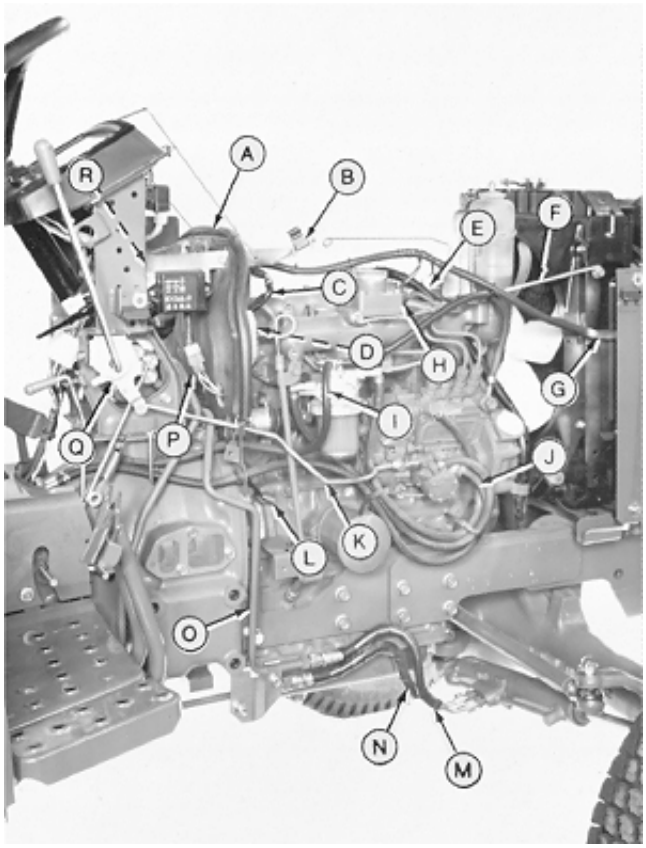
25. Remove rubber molding and air shield (A).

NOTE: For tractors with manual steering, GO to Step 31.

26. Disconnect lines (M and N). Close all openings using caps and plugs.

27. Remove throttle lever control assembly (Q).

28. Remove line (O).



M53572 -UN-20NOV89

Right-Hand Side Shown

A—Air Shield
B—Support
C—Wiring Harness-to-Rectifier
D—Wiring Harness Ground-to-Engine
E—Coolant Temperature Switch Wiring Lead
F—Radiator Support Rod
G—Wiring Harness to Headlights
H—Air Heater Wiring Lead
I—Return Fuel Leak-Off Line
J—Fuel Pump Supply Line
K—Throttle Control Rod
L—Engine Oil Pressure Switch Wiring Lead
M—Power Steering Valve-to-Cylinder Rod End Line
N—Power Steering Valve-to-Cylinder Head End Line
O—Hydraulic Line
P—Fuel Shut-Off Solenoid Wiring Connector
Q—Throttle Lever Control Assembly

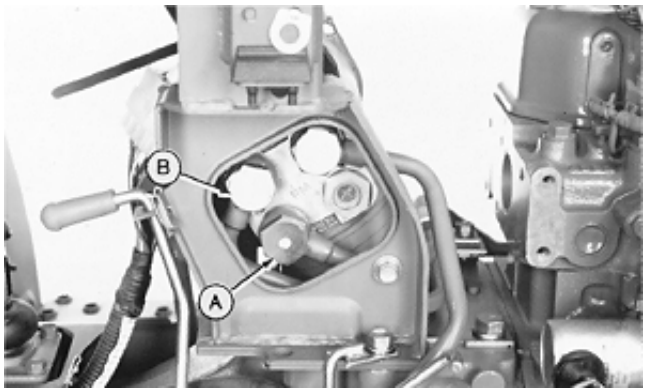
MX,2006DG,A5 -19-02NOV89

NOTE: Banjo connector (A) also acts as a filter.

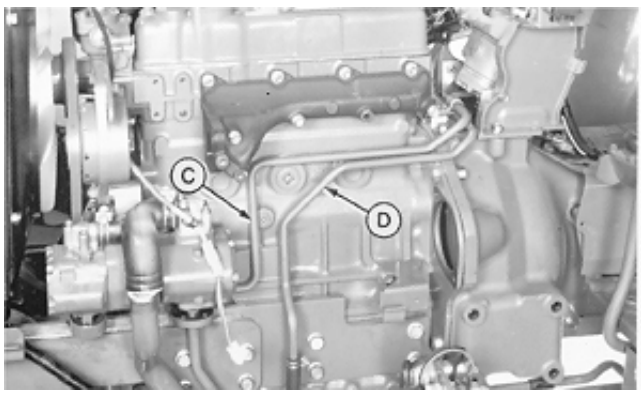
29. Remove banjo connectors (A and B) and washers.

30. Remove lines (C and D). Close all openings with caps and plugs.

A—Banjo Connector/Filter
B—Banjo Connector
C—Power Steering Valve Supply Line
D—Power Steering Valve Return Line



M53573 -UN-20NOV89



M53574 -UN-20NOV89

MX,2006DG,A6 -19-02NOV89

31. Remove rocker arm cover.

32. Install lifting brackets such as JDG19 Special Mounting Brackets (A).

33. Attach a hoist to engine.

34. Install support stand (F) under clutch housing.

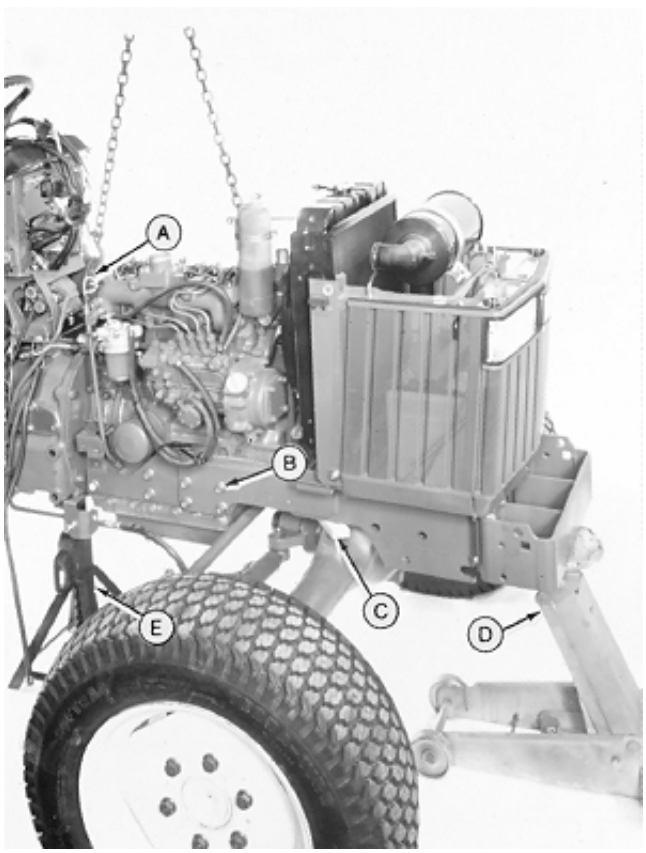
35. Install a floor jack (C) under front weight support.

36. Install a wood block (D) between front axle and frame on both sides.

37. Remove cap screws (E) from each side of frame.

38. Roll front end away from tractor.

A—Lifting Brackets (2 used)
B—Cap Screw (15 used)
C—Wood Block (2 used)
D—Floor Jack
E—Support Stand



M53575 -UN-20NOV89

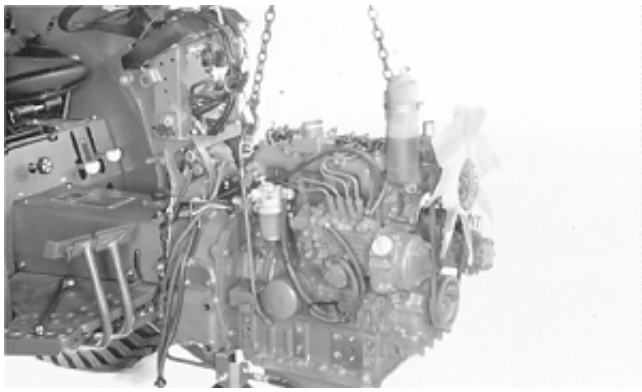
MX,2006DG,A7 -19-02NOV89

NOTE: Put transmission in neutral to ease clutch shaft alignment with engine during installation.

39. Put transmission shift lever in neutral.

40. Remove eight cap screws and lock washers. Remove engine.

41. Make repairs as necessary. (See CTM-3.)



MX,2006DG,A8 -19-02NOV89

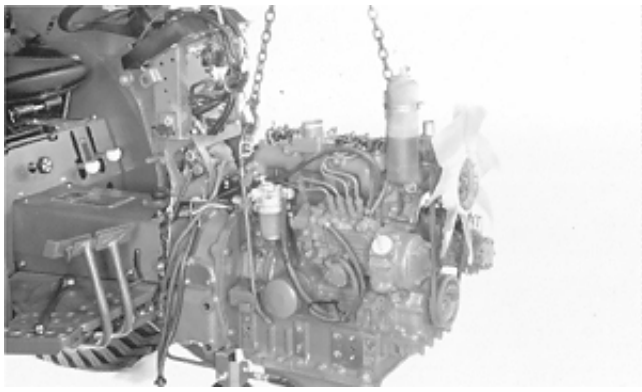
INSTALL ENGINE

1. Put transmission shift lever in neutral to ease clutch shaft alignment with engine.

2. Apply multipurpose grease to end of clutch shaft.

NOTE: Turn flywheel when installing engine, to engage engine with clutch shafts.

3. Install engine. Tighten cap screws to 113 N·m (83 lb-ft).



MX,2006DG,A9 -19-02NOV89

4. Apply thread lock and sealer (medium strength) to threads of cap screws (B).

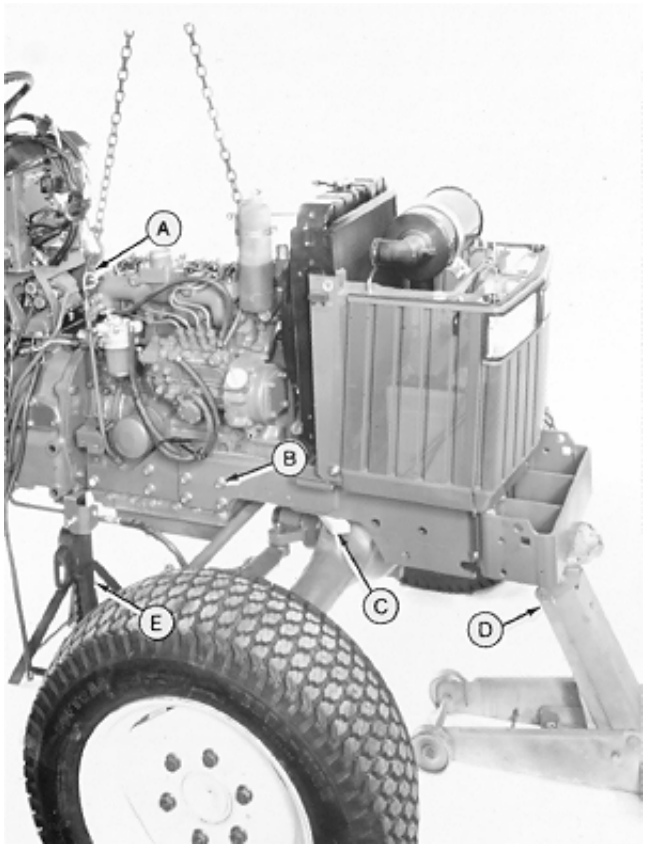
5. Install front end to tractor. Tighten cap screws (B) to 90 N·m (65 lb-ft).

6. Remove wood blocks (D), floor jack (C) and support stand (F).

7. Remove lifting brackets (A).

8. Install rocker arm cover.

A—Lifting Brackets (2 used)
B—Cap Screw (15 used)
C—Wood Block (2 used)
D—Floor Jack
E—Support Stand



M53575 -UN-20NOV89

MX,2006DG,A10 -19-02NOV89

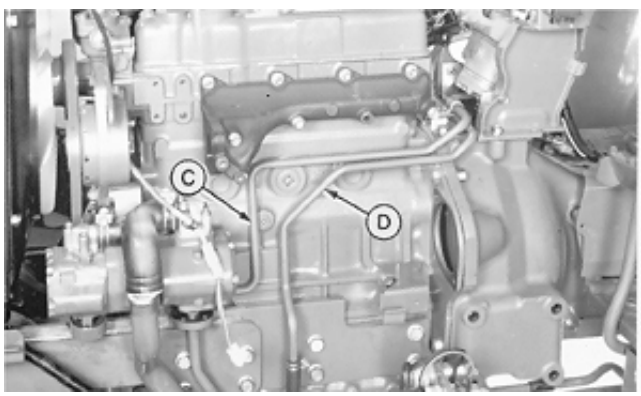
NOTE: For tractors with manual steering, GO to Step 15.

IMPORTANT: There must be one copper washer on each side of of banjo connector when installing lines.

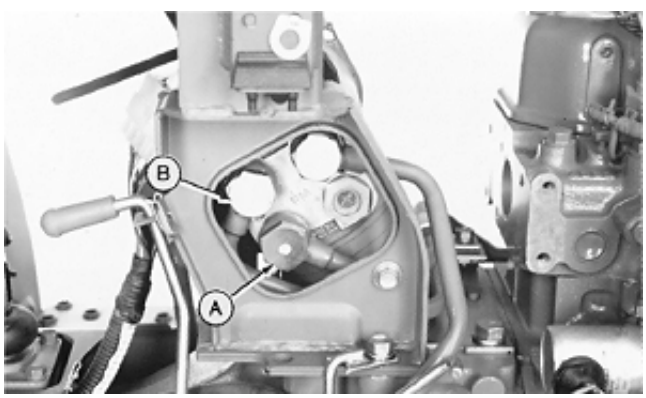
9. Install lines (C and D).

10. Install banjo connectors (A and B) and new washers.

A—Banjo Connector/Filter
B—Banjo Connector
C—Power Steering Valve Supply Line
D—Power Steering Valve Return Line



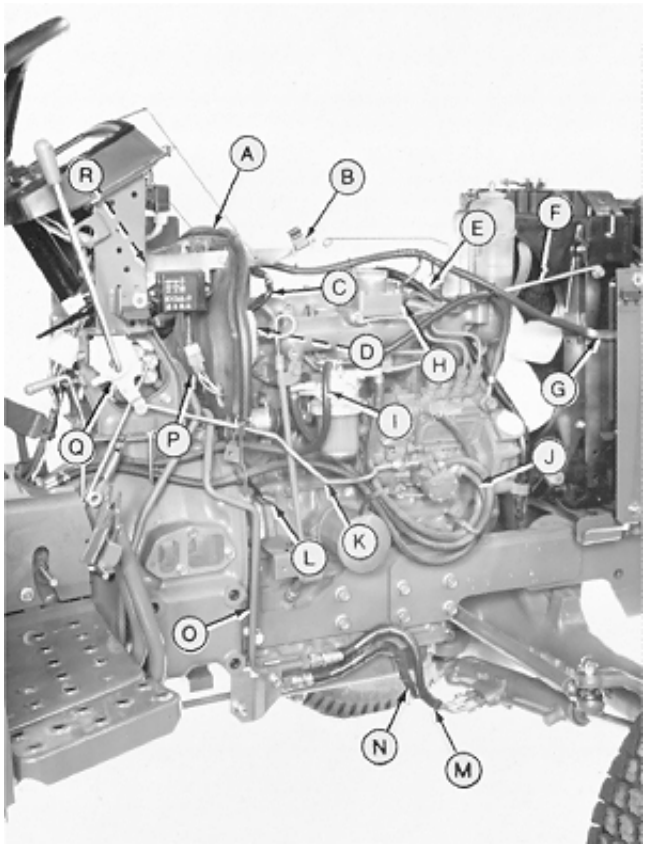
M53574 -UN-20NOV89



M53573 -UN-20NOV89

MX,2006DG,A11 -19-02NOV89

11. Install line (O).
12. Install throttle lever control assembly (Q).
13. Connect lines (M and N).
14. Install air shield (A) and rubber molding.
15. Connect wiring connector (P).
16. Connect wiring leads (E, H and L).
17. Connect wiring harness (C, D and G).
18. Install cap screw (R).
19. Install fuse block to support (B).
20. Install support rod (F).
21. Install control rod (K).
22. Connect lines (I and J).
23. Open shutoff valve on fuel filters.



Right-Hand Side Shown

A—Air Shield
B—Support
C—Wiring Harness-to-Rectifier
D—Wiring Harness Ground-to-Engine
E—Coolant Temperature Switch Wiring Lead
F—Radiator Support Rod
G—Wiring Harness to Headlights
H—Air Heater Wiring Lead
I—Return Fuel Leak-Off Line
J—Fuel Pump Supply Line
K—Throttle Control Rod
L—Engine Oil Pressure Switch Wiring Lead
M—Power Steering Valve-to-Cylinder Rod End Line
N—Power Steering Valve-to-Cylinder Head End Line
O—Hydraulic Line
P—Fuel Shut-Off Solenoid Wiring Connector
Q—Throttle Lever Control Assembly

MX,2006DG,A12 -19-02NOV89

24. Install cap screw (B).

25. Connect wiring connectors (C, D and E).

26. Connect cable (A).

27. Power steering: Connect flange (J).

Manual steering: Connect drag link.

28. Connect hose (I) and flange (H).

29. Install line clamp cap screws (G).

30. Install bracket (F), if equipped with SCV.

31. Install muffler and gasket.

32. Install radiator and air cleaner hoses.

33. MFWD: Install drive shaft. (See procedure in Section 55, Group 30 or 35.)

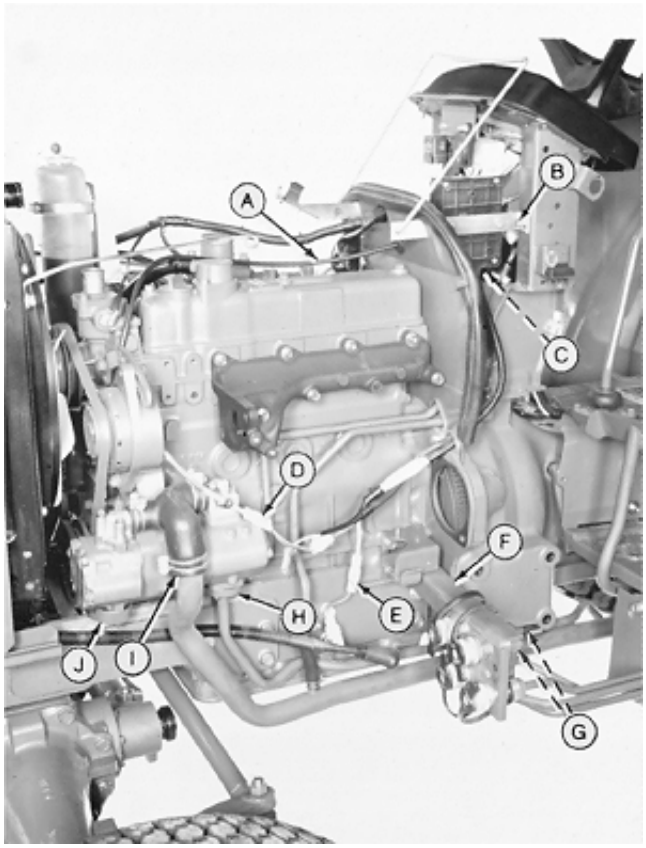
34. Install starter. (See procedure in Section 40, Group 10.)

35. Install lower dash covers and engine side shields.

36. Install hood. (See procedure in Section 80, Group 15.)

37. Fill radiator with proper coolant to top of filler neck. (See Engine Coolant in Section 10, Group 20.)

38. Adjust throttle control linkage. (See Section 220, Group 15.)



Left-Hand Side Shown

A—Hour Meter Cable
B—Cap Screw
C—Control Box Wiring Connector
D—Alternator Wiring Connector
E—Fusible Link Connector
F—Bracket
G—Cap Screws (2 used)
H—Hydraulic Pump Pressure Line Mounting Flange
I—Suction Line Hose
J—Power Steering Hydraulic Pump Pressure Line Mounting Flange

MX,2006DG,A13 -19-01NOV89

ESSENTIAL OR RECOMMENDED TOOLS

NOTE: Order tools from your Service-Gard™ Catalog. Some tools may the available from a local supplier.

Valve Seat Puller JDE41296–Essential

Use to remove intake and exhaust valves.

Hand Tachometer. JT05719–Recommended
or JT05801–Recommended

Use to measure engine speed.

Magnetic Follower Holder Kit D15001NU

Use to hold cam followers when removing and installing camshaft.

Nozzle Cleaning Kit JDF13

Use to clean fuel injection nozzles.

Valve Guide Driver JDE118

Use to remove and install valve guides in cylinder head.

8 mm (0.31 in.) Valve
Guide Reamer D20021WI–Recommended

Use to ream 8 mm (0.31in.) valve guides.

Valve Inspection Center . . . D05058ST–Recommended

Use to check valve face runout and bent valves.

OTHER MATERIALS

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

LOCTITE® is a registered trademark of the Loctite Corp.

SPECIFICATIONS

GENERAL SPECIFICATIONS

Make	Yanmar
Model Number	3TNE84
Type	4-Cycle Diesel
Rated Engine Speed	2600 rpm
Gross Horsepower @ Rated Engine Speed	22.4 kW (30 hp)
Torque@ Rated Engine Speed	73.4 N•m (54.1 lb-ft)
Number of Cylinders	3
Bore	84 mm (3.31 in.)
Stroke	90 mm (3.54 in.)
Displacement	1.496 L (91.3 cu in.)
Firing Order	1—3—2
Direction of Rotation	Counterclockwise (viewed from flywheel)
Combustion System	Direct Injection Type
Compression Ratio	18 to 1
Cooling	Liquid
Coolant Capacity	4.8 L (5.1 qt.)
Oil Capacity (w/filter)	Approximately 4.1 L (4.3 qt)
Governor	Centrifugal
Slow Idle	950 ± 50 rpm
High Idle (No Load)	2920 ± 25 rpm

REPAIR SPECIFICATIONS

Valve Train	
Rocker Arm Shaft OD	15.97 - 15.98 mm (0.628 - 0.629 in.)
Wear Limit	15.95 mm (0.628 in.)
Rocker Arm and Shaft Support Bushing ID	16.00 - 16.02 mm (0.630 - 0.631 in.)
Wear Limit	16.09 mm (0.633 in.)
Oil Clearance	0.02 - 0.05 mm (0.001 - 0.002 in.)
Wear Limit	0.15 mm (0.006 in.)
Push Rod Bend	0.0 - 0.03 mm (0.0 - 0.001 in.)
Cylinder Head and Valves	
Cylinder Head Distortion	0.0 - 0.05 mm (0.0 - 0.002 in.)
Wear Limit	0.15 mm (0.006 in.)
Intake Valve Seat Width	1.07 - 1.24 mm (0.042 - 0.049 in.)
Wear Limit	1.74 mm (0.069 in.)
Exhaust Valve Seat Width	1.24 - 1.45 mm (0.042 - 0.049 in.)
Wear Limit	1.94 mm (0.076 in.)
Intake Valve Stem OD	7.96 - 7.98 mm (0.313 - 0.314 in.)
Wear Limit	7.9 mm (0.311 in.)
Exhaust Valve Stem OD	7.96 - 7.97 mm (0.313 - 0.314 in.)
Wear Limit	7.9 mm (0.311 in.)
Valve Head Thickness	
Intake	1.24 - 1.44 mm (0.049 - 0.057 in.)
Exhaust	1.35 - 1.55 mm (0.053 - 0.061 in.)
Wear Limit	0.50 mm (0.020 in.)
Intake Valve Recession	0.31 - 0.51 mm (0.012 - 0.020 in.)
Wear Limit	1.00 mm (0.039 in.)
Exhaust Valve Recession	0.3 - 0.5 mm (0.012 - 0.020 in.)
Wear Limit	1.00 mm (0.039 in.)

Valve Guide Stem-To-Guide Oil Clearance	
Intake	0.04 - 0.07 mm (0.001 - 0.003 in.)
Exhaust	0.05 - 0.08 mm (0.002 - 0.003 in.)
Wear Limit	0.20 mm (0.008 in.)
Valve Guide ID	8.01 - 8.03 (0.315 - 0.316 in.)
Wear Limit	8.10 mm (0.319 in.)
Valve Guide Projection	15 mm (0.591 in.)
Valve Spring Free Length	42.0 mm (1.654 in.)
Maximum Spring Inclination	1.10 mm (0.044 in.)
Valve Spring Tension	
(Measured With Spring Compressed 1.0 mm (0.039 in.)	2.36 - 3.10 kg (5.20 - 6.83 lb)
Valve Seat Surface Angle	
Exhaust Valve	45°
Intake Valve	30°
Valve Timing	
Intake Valve Opens	10° - 20° BTDC
Intake Valve Closes	40° - 50° ABDC
Exhaust Valve Opens	51° - 61° BBDC
Exhaust Valve Closes	13° - 23° ATDC

Cylinder Head and Valves

Piston-to-Cylinder Head Clearance	0.66 - 0.78 mm (0.026 - 0.031 in.)
Second Compression Piston Ring Minimum Side Clearance	0.05 - 0.08 mm (0.002 - 0.003 in.)
Oil Control Piston Ring Groove Width	4.02 - 4.03 mm (0.158 - 0.159 in.)
Oil Control Piston Ring Width	3.97 - 3.99 mm (0.156 - 0.157 in.)
Oil Control Piston Ring Minimum Side Clearance	0.03 - 0.06 mm (0.001 - 0.002 in.)
Piston Ring End Gap	0.20 - 0.40 mm (0.008 - 0.016 in.)
Wear Limit	1.50 mm (0.059 in.)

Piston Pin

Piston Pin OD	25.99 - 26.00 mm (1.023 - 1.024 in.)
Wear Limit	25.90 mm (1.020 in.)
Piston Pin Bushing ID	26.03 - 26.04 mm (1.025 - 1.025 in.)
Wear Limit	26.10 mm (1.028 in.)
Piston Pin-To-Rod Bore Oil Clearance	0.03 - 0.05 mm (0.001 - 0.002 in.)
Wear Limit	0.2 mm (0.008 in.)
Piston Pin Bore (In Piston) ID	26.00 - 26.01 mm (1.024 - 1.024 in.
Wear Limit	26.02 mm (1.024 in.)
Piston Pin-To-Piston Oil Clearance	0.00 - 0.02 mm (0 - 0.001 in.)
Wear Limit	0.12 mm (0.005 in.)

Piston

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

Cylinder Bore ID

Cylinder Standard Bore ID	84.00 - 84.03 mm (3.307 - 3.308 in.)
Wear Limit	84.20 mm (3.315 in.)
Oversize Bore ID	84.25 - 84.28 mm (3.317 - 3.318 in.)
Piston-to-Cylinder Clearance	0.055 mm (0.002 in.)
Cylinder Roundness	0.00 - 0.01 mm (0 - 0.0004 in.)
Wear Limit	0.03 mm (0.001 in.)
Cylinder Taper	0.00 - 0.01 mm (0 - 0.0004 in.)
Wear Limit	0.03 mm (0.001 in.)

Deglazing	30 - 40° crosshatch pattern
Reboring	30 - 40° crosshatch pattern

Crankshaft and Main Bearings

Connecting Rod Crankshaft Journal OD	
Connecting Rod Crankshaft Journal OD	47.95 - 47.96 mm (1.888 - 1.888 in.)
Wear Limit	47.91 mm (1.886 in.)
Main Bearing Journal OD	53.95 - 53.96 mm (2.124 - 2.124 i
Wear Limit	53.91 mm (2.122 in.)
Main Bearing Oil Clearance	.0.04 - 0.07 mm (0.002 - 0.003 in.)
Wear Limit	0.16 mm (0.006 in.)
Crankshaft Bend (Maximum)	0.02 mm (0.001 in.)
Crankshaft End Play	0.09 - 0.27 mm (0.004 - 0.011 in.)

Camshaft

Camshaft End Play	0.05 - 0.25 mm (0.002 - 0.010 in.)
Camshaft Bend	0 - 0.02 mm (0 - 0.001 in.)
Wear Limit	0.05 mm (0.002 in.)
Camshaft Side Gap	0.05 - 0.25 mm (0.002 - 0.010 in.)
Lobe Height- Intake and Exhaust	38.64 - 38.77 mm (1.521 - 1.526 in.)
Wear Limit	38.40 mm (1.512 in.)
Bearing Journal OD	
Flywheel Side and Gear Side	44.93 - 44.95 mm (1.769 - 1.770 in.)
Intermediate Journal	44.91 - 44.94 mm (1.768 - 1.769 in.)
Wear Limit	44.85 mm (1.766 in.)
Oil Clearance (Gear and Flywheel Ends)	0.04 - 0.13 mm (0.002 - 0.005 in.)
Oil Clearance (Intermediate)	0.07 - 0.12 mm (0.003 - 0.005 in.)

Camshaft Followers

Stem OD	11.98 - 11.99 mm (0.471 - 0.472 in.)
Wear Limit	11.93 mm (0.470 in.)
Bore ID	12.00 - 12.02 mm (0.472 - 0.473 in.)
Wear Limit	12.05 mm (0.474 in.)
Oil Clearance	0.01 - 0.04 mm (0.0004 - 0.0016 in.)
Wear Limit	0.12 mm (0.005 in.)

Idler Gear

Shaft OD	45.95 - 45.98 mm (1.809 - 1.810 in.)
Wear Limit	45.93 mm (1.808 in.)
Bushing ID	46.00 - 46.03 mm (1.811 - 1.812 in.)
Wear Limit	46.08 mm (1.814 in.)
Clearance	0.15 mm (0.006 in.)

Oil Pump

Rotor Shaft OD to Side Cover Hole ID Clearance	0.01 - 0.04 mm (0.001 - 0.002 in.)
Wear Limit	0.20 mm (0.008 in.)
Inner Rotor and Outer Rotor-to-Pump Body Side Clearance	0.03 - 0.09 mm (0.001 - 0.004 in.)
Wear Limit	0.15 mm (0.006 in.)
Outer Rotor to Pump Body Clearance	0.10 - 0.16 mm (0.004 - 0.006 in.)
Wear Limit	0.25 mm (0.010 in.)
Inner Rotor to Outer Rotor Clearance Wear Limit	0.15 mm (0.006 in.)

TESTS AND ADJUSTMENT SPECIFICATIONS

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

OPERATIONAL TESTS

Cooling System Test Pressure	88 ± 15 kPa (12.8 ± 2.2 psi)
Thermostat Opening Temperature	69.5 - 72.5° C (157 - 163° F)
Minimum Lift Height above 85° C (185° F)	8.0 mm (0.315 in.)
Radiator Cap Opening Pressure	0.9 ± 0.15 kg/cm^2, 88 ± 15 kPa (12.8 ± 2.2 psi)
Cylinder Compression Pressure	3236 ± 98 kPa (469 ± 14 psi)
Minimum	2550 ± 98 kPa (370 ± 14 psi)
Difference Between Cylinders (Maximum)	245 ± 49 kPa (36 ± 7 psi)
Oil Pressure (Rated Speed)	0.34 ± 0.05 MPa (49 ± 7.2 psi)
Slow Idle (Minimum)	0.06 MPa (8.7 psi)
Oil Relief Valve Opening Pressure	294 - 392 kPa (43 - 57 psi)
Oil Pressure Switch Opening Pressure	3 - 4 kPa (6 - 9 psi)

TORQUE VALUES, NON-STANDARD FASTENERS

Cylinder Head Bolts (Lubricating Oil Applied)	85 - 91 N•m (63 - 67 lb-ft)
Connecting Rod Bolts (Lubricating Oil Applied)	44 - 54 N•m (33 - 40 lb-ft)
Flywheel Mounting Bolts (Lubricating Oil Applied)	83 - 88 N•m (62 - 65 lb-ft)
Main Bearing Bolts (Lubricating Oil Applied)	96 - 100 N•m (71 - 74 lb-ft)
Crankshaft Pulley Bolt (Lubricating Oil Applied)	113 - 122 N•m (83 - 90 lb-ft)
Fuel Injector Nozzle Nut	6.8 - 8.8 N•m (60 - 78 lb-in)
Governor Weight Support Nut	44 - 49 N•m (33 - 36 lb-ft)
Rocker Arm Mounting Cap Screw and Nut	26 N•m (19 lb-ft)
Oil Pump Mounting Cap Screw	25 N•m (18 lb-ft)
Starting Motor Mounting Bolts	47 N•m (35 lb-ft)

REMOVE ENGINE

1. Disconnect **NEGATIVE** (-) battery cable, **POSITIVE** (+) battery cable, battery holddown bracket and remove battery from tractor.

2. Remove hood. (See Section 80, Group 15.)

3. Remove fuel tank. (See procedure in Section 20, Group 20.)

4. Remove starter. (See procedure in Section 20, Group 07.)

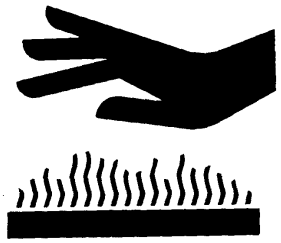
5. MFWD: Remove drive shaft. (See procedure in Section 50, Group 30.)

6. Remove fuel shut-off solenoid. (See procedure in Section 20, Group 20.)



TS281

CAUTION: 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.



TS271

NOTE: Approximate coolant capacity is 4.8 L (5.1 qt).

7. Drain coolant.

8. Remove radiator and air cleaner hoses. Close all openings using caps and plugs.

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

9. Remove muffler and gasket.

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.



X9811

8. Lower rockshaft arms.

9. Manual steering: Disconnect drag link (E).

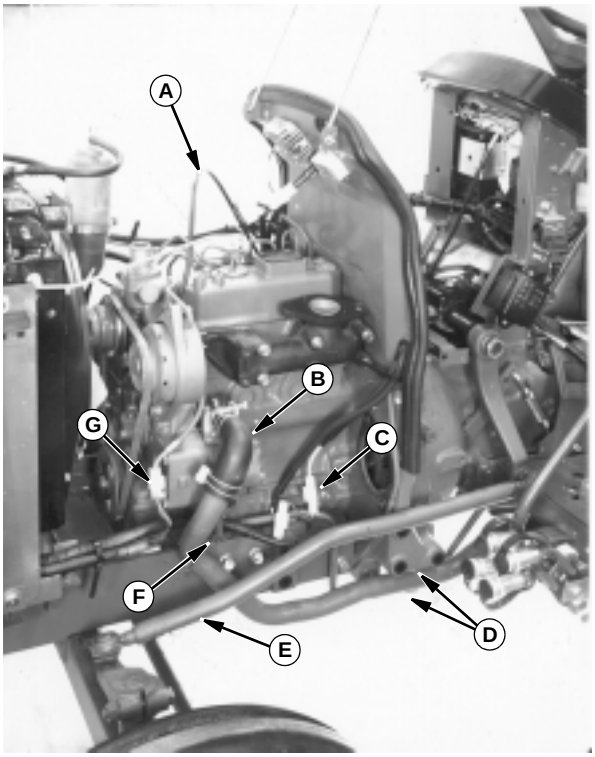
10. Remove line clamp cap screws (D).

11. Disconnect hose (B) and flange (F). Close all openings with caps and plugs.

12. Remove power steering hydraulic lines. (See procedure in Section 60, Group 10.)

13. Disconnect wiring connectors (C) and (G).

14. Disconnect cable (A).



M53550

Left-Hand Side Shown

A—Hour Meter Cable
B—Pressure Line Hose
C—Fusible Link Connector
D—Cap Screws (2 used)
E—Drag Link
F—Supply Line Mounting Flange
G—Alternator Wiring Connector

14. Close shutoff valve on fuel filter.

15. Disconnect lines (F and H). Close all openings using caps and plugs.

16. Disconnect wiring harness (C and G).

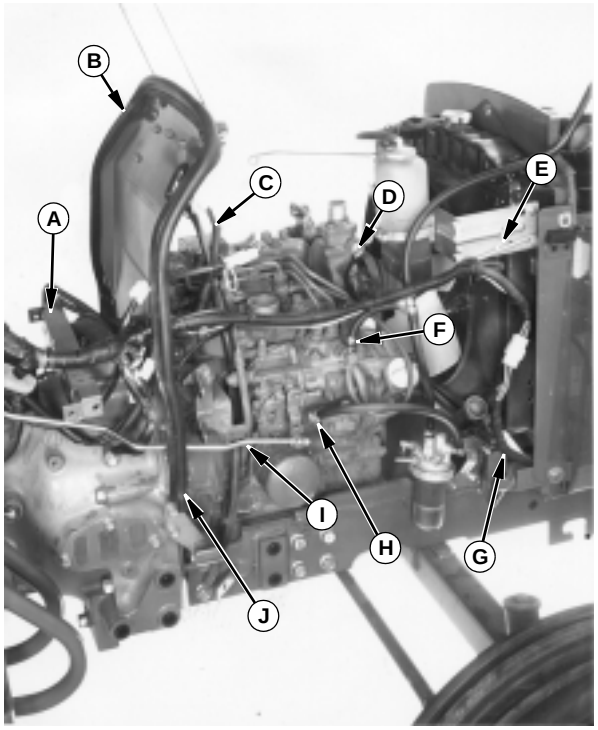
17. Disconnect wiring leads (D and J).

18. Remove support rod (E).

19. Remove control rod (I).

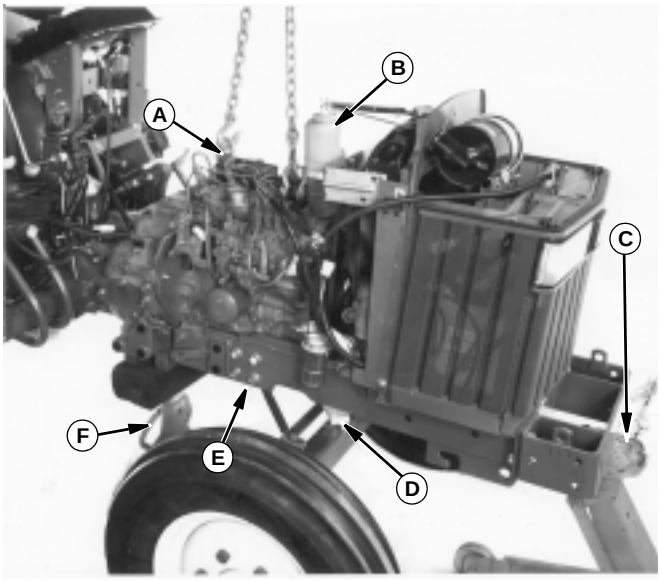
20. Remove air shield (B).

21. Remove bracket (A).



Right-Hand Side Shown

A—Fuel Tank Support Bracket
B—Air Shield
C—Wiring Harness
D—Coolant Temperature Switch Wiring Lead
E—Radiator Support Rod
F—Return Fuel Leak-Off Line
G—Wiring Harness
H—Fuel Pump Supply Line
I—Throttle Control Rod
J—Engine Oil Pressure Switch Wiring Lead



M53552

A—Lifting Brackets (2 used)
B—Recovery Tank Assembly
C—Floor Jack
D—Wood Block (2 used)
E—Cap Screw (12 used)
F—Support Stand

22.Remove recovery tank assembly (B).

23. Remove rocker arm cover.

24. Install lifting brackets such as JDG19 or JT01748 Lifting Brackets (A).

25. Attach a hoist to engine.

26. Install support stand (F) under clutch housing.

27.Install a floor jack (C) under front weight support.

28. Install a wood block (D) between front axle and frame on both sides.

29. Remove six cap screws (E) from each side of frame.

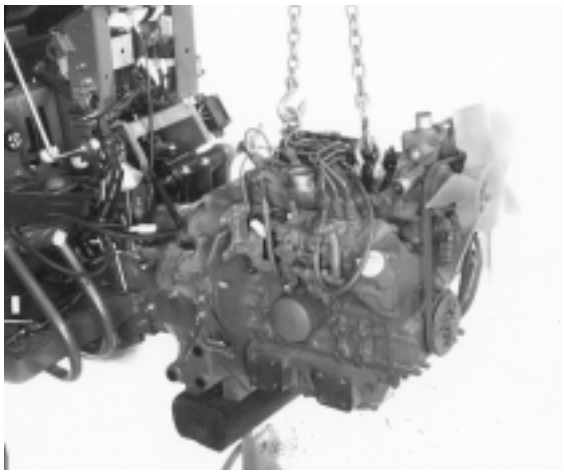
30. Roll front end away from tractor.

NOTE: Put transmission in neutral to ease clutch shaft alignment with engine during installation.

31. Put transmission shift lever in neutral.

32. Remove engine.

33. Make repairs as necessary.



M53553

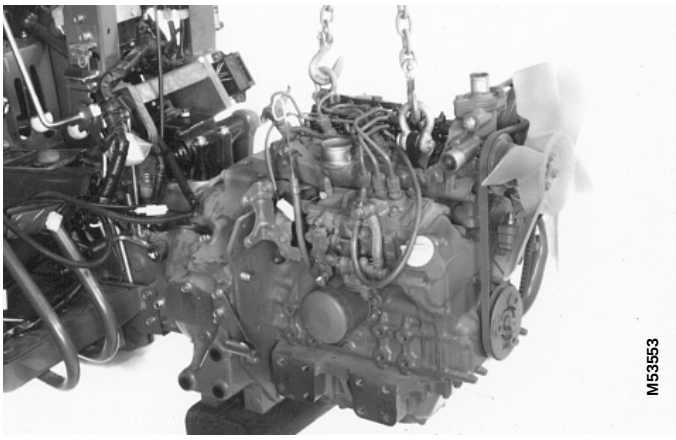
INSTALL ENGINE

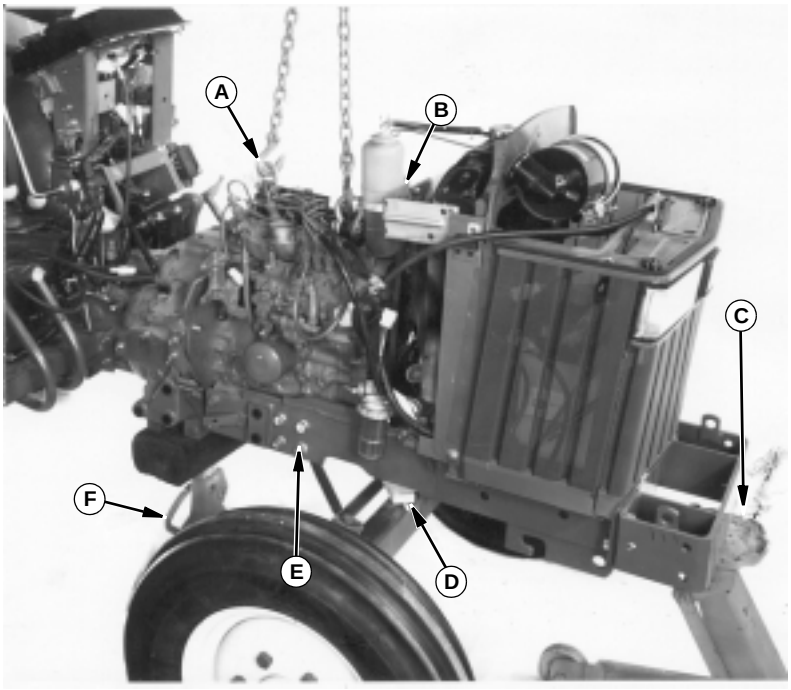
1. Put transmission shift lever in neutral to ease clutch shaft alignment with engine.

2. Apply multipurpose grease to end of clutch shaft.

NOTE: Turn flywheel when installing engine, to engage engine with clutch shaft(s).

3. Install engine. Tighten cap screws to 54 N•m (40 lb-ft).





A—Lifting Brackets (2 used)
B—Recovery Tank Assembly
C—Floor Jack
D—Wood Block (2 used)
E—Cap Screw (12 used)
F—Support Stand

4. Apply thread lock and sealer (medium strength) to threads of cap screws (E).

5. Install front end to tractor. Tighten cap screws (E) to 90 N•m (65 lb-ft).

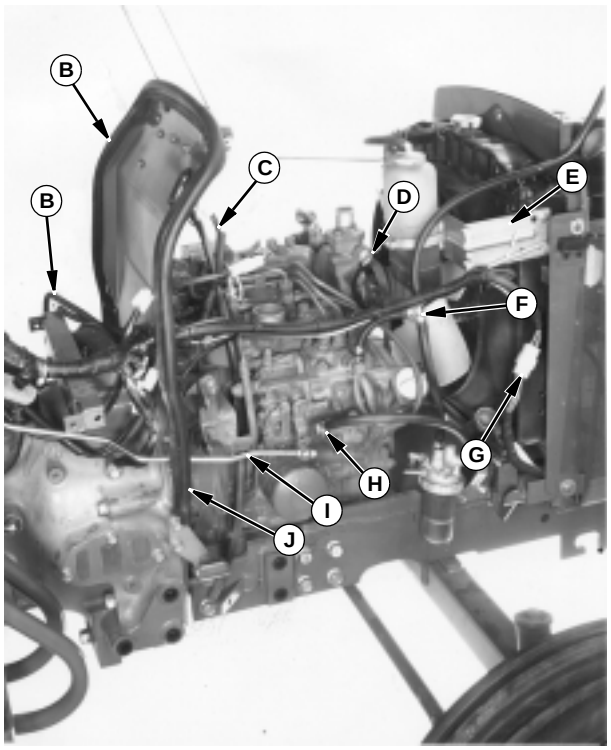
6. Remove wood blocks (D), floor jack (C) and support stand (F).

7. Remove lifting brackets (A).

8. Install rocker arm cover.

9. Install recovery tank assembly (B)

10. Install bracket (A).
11. Install air shield (B).
12. Install control rod (I).
13. Install support rod (E).
14. Connect wiring leads (D and J).
15. Connect wiring harness (C and G).
16. Connect lines (F and H).
17. Open shutoff valve on fuel filter.
18. Install battery.



Right-Hand Side Shown

A—Fuel Tank Support Bracket
B—Air Shield
C—Wiring Harness
D—Coolant Temperature Switch Wiring Lead
E—Radiator Support Rod
F—Return Fuel Leak-Off Line
G—Wiring Harness
H—Fuel Pump Supply Line
I—Throttle Control Rod
J—Engine Oil Pressure Switch Wiring Lead

18.Connect cable (A).

19.Connect wiring connectors (C and G).

20.Power steering: Install hydraulic lines. (See procedure in Section 60, Group 10.)

21.Connect flange (F) and hose (B).

22.Install line clamp cap screws (D).

23.Manual steering: Connect drag link (E).

24.Install muffler and new gasket.

25.Install radiator and air cleaner hoses.

26.MFWD: Install drive shaft. (See procedure in Section 50, Group 30.)

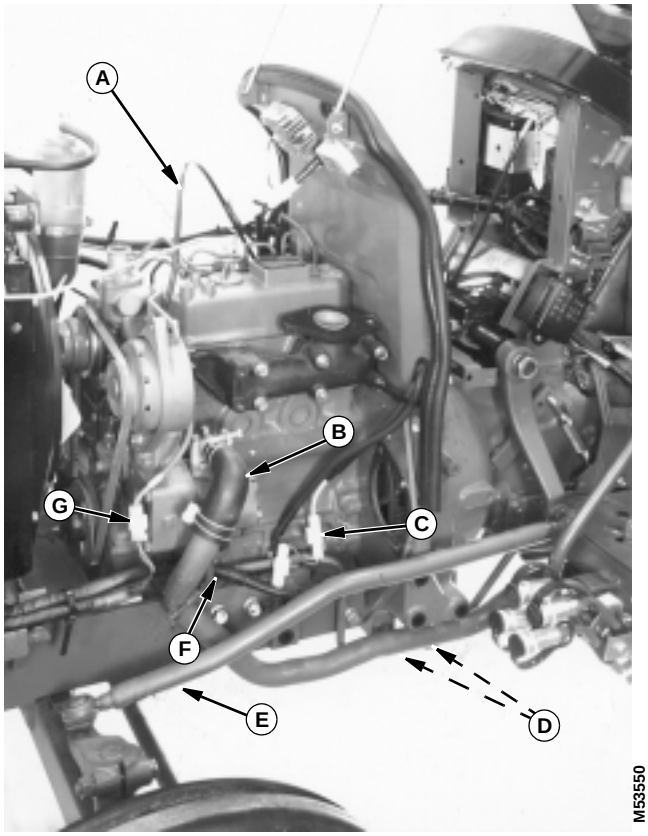
27.Install starter. (See procedure in Section 40, Group 10.)

28.Install fuel shut-off solenoid. (See procedure in Group 20.)

29.Install fuel tank. (See procedure in Group 20.)

30.Fill radiator with coolant to 4.8 L (3.1 qt.). (See Engine Coolant in Section 10, Group 20.)

31.Adjust throttle control linkage. (See Section 220, Group 15.)

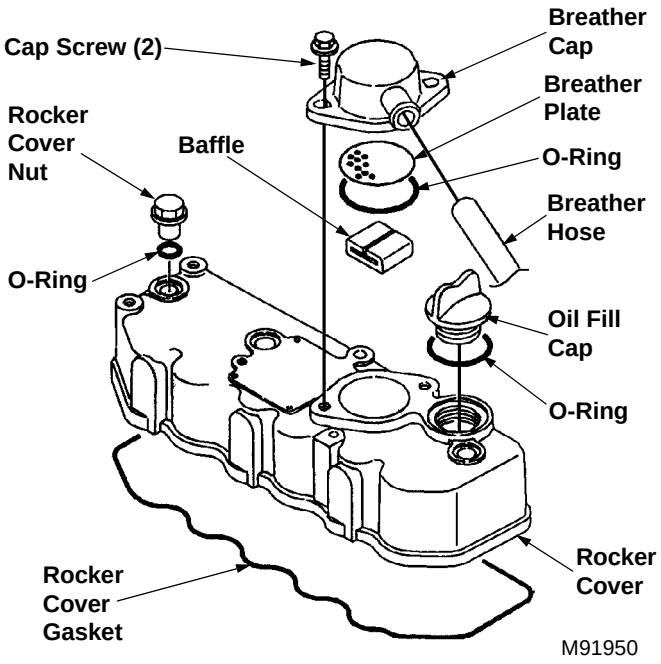


Left-Hand Side Shown

A—Hour Meter Cable
B—Pressure Line Hose
C—Fusible Link Connector
D—Cap Screws (2 used)
E—Drag Link
F—Supply Line Mounting Flange
G—Alternator Wiring Connector

ROCKER COVER REMOVAL/INSTALLATION

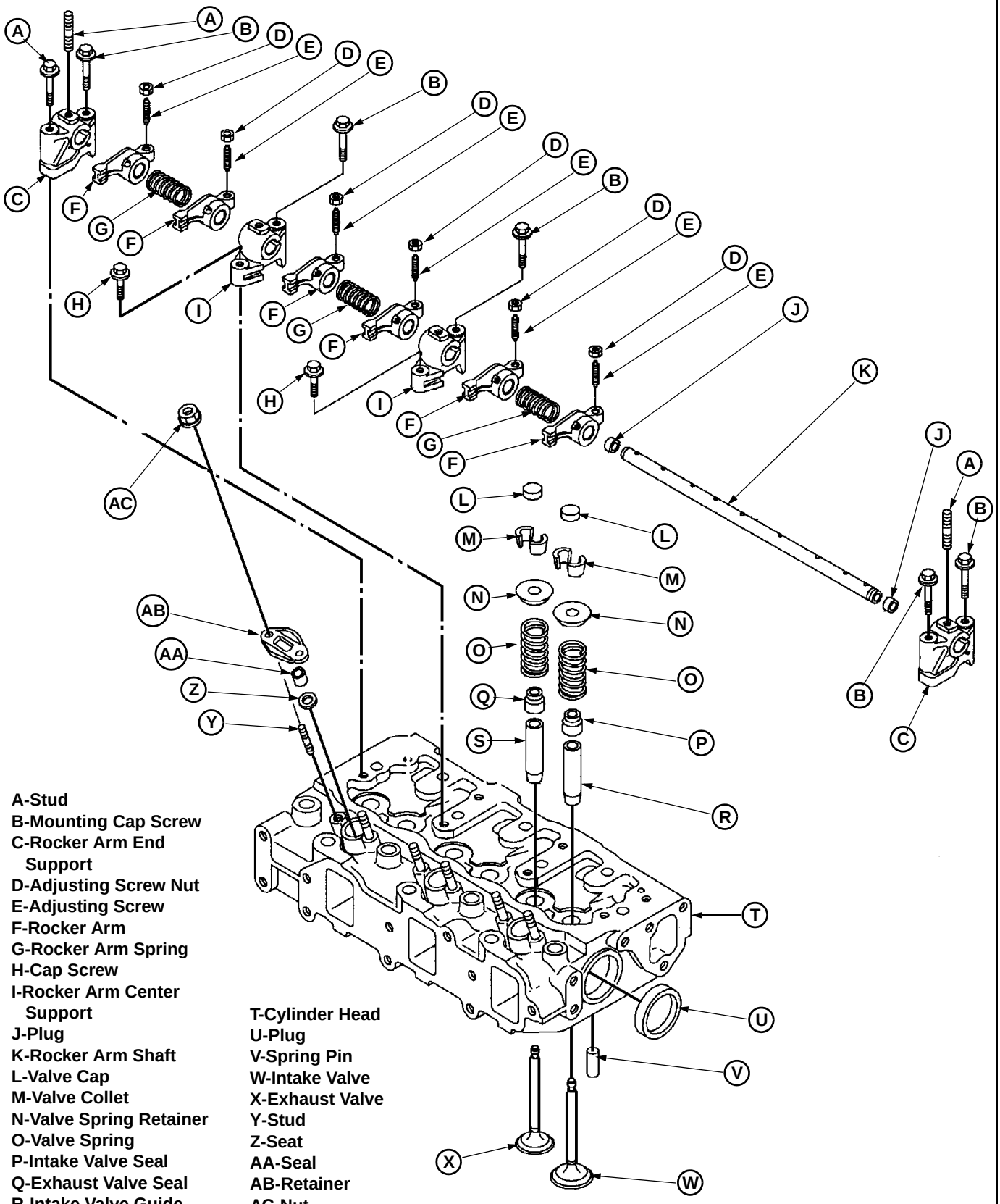
1. Remove the air cleaner and muffler.
2. Remove three rocker cover nuts.
3. Remove the breather hose.
4. Remove the rocker cover from the cylinder head.
5. Clean the crankcase breather baffle.
6. Remove the breather cap, plate and baffle.
7. Wash the baffle in a safe solvent and blow dry with air. Replace the baffle if it comes apart or is deteriorated.
8. Install the baffle.
9. Install the breather plate and a new O-ring before replacing breather cover.
10. Inspect the rocker cover gasket before reinstalling the rocker arm cover. Replace if damaged.
11. Clean the cylinder head surface and install the rocker cover to the cylinder head. Install the rocker cover nuts.



REMOVAL/INSTALLATION AND DISASSEMBLY/ ASSEMBLY:

1. Remove the rocker cover. See “ROCKER COVER REMOVAL/INSTALLATION in this group.
2. Remove the rocker arm end support and rocker arm center support mounting cap screws.
3. Lift the rocker arm assembly from the cylinder head and set the assembly on a bench.
4. If the rocker arm shaft assembly is to be disassembled, replace components in same location on the rocker arm shaft they were removed from.
5. Note the positions of the rocker arm assembly components. Slide the components off the rocker arm shaft.
6. Lift the push rods from the cylinder head and note the order of removal for reassembly.
7. Inspect the rocker arm components and push rods.
8. Reinstall the push rods to their original location in the cylinder head, with the ball shaped end down in head.
9. Lubricate all parts with clean oil during assembly.
10. Assemble the rocker arm assembly components in the reverse order of removal.
11. Place the rocker arm assembly on the cylinder head.
12. Align the rocker arms with the valves and push rods.
13. Align the rocker arm end supports and center supports with the corresponding holes in the head.
14. Install the rocker arm support cap screws. Tighten the cap screws to **26 N•m (19 lb-ft).**
15. Adjust the valve clearance.

ROCKER ARM COMPONENTS



A-Stud
B-Mounting Cap Screw
C-Rocker Arm End Support
D-Adjusting Screw Nut
E-Adjusting Screw
F-Rocker Arm
G-Rocker Arm Spring
H-Cap Screw
I-Rocker Arm Center Support
J-Plug
K-Rocker Arm Shaft
L-Valve Cap
M-Valve Collet
N-Valve Spring Retainer
O-Valve Spring
P-Intake Valve Seal
Q-Exhaust Valve Seal
R-Intake Valve Guide
S-Exhaust Valve Guide
T-Cylinder Head
U-Plug
V-Spring Pin
W-Intake Valve
X-Exhaust Valve
Y-Stud
Z-Seat
AA-Seal
AB-Retainer
AC-Nut

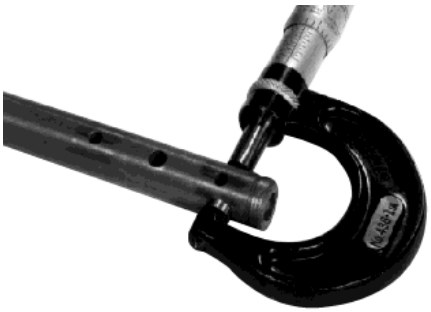
M91949

INSPECTION:

1. Measure the outer diameter of the rocker arm shaft.

• Rocker arm shaft OD is **15.97 - 15.98 mm (0.628 - 0.629 in.).**

• Replace the rocker arm shaft if the OD is less than **15.95 mm (0.628 in.).**



M35262

2. Measure the inner diameters of the rocker arms and supports.

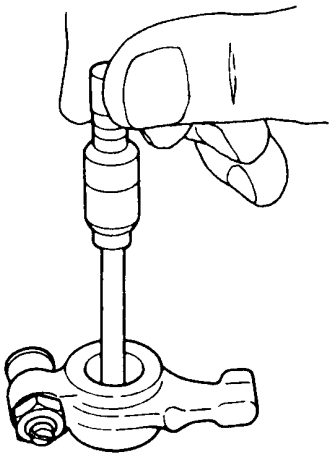
• Standard ID is **16.00 - 16.02 mm (0.630 - 0.631 in.).**

• Replace the rocker arms or supports if the ID is more than **16.09 mm (0.633 in.)**.

3. Measure the rocker arm shaft to rocker arm bushing oil clearance. Oil clearance is the difference between the OD of the rocker arm shaft and the ID of the rocker arms.

• Standard oil clearance is **0.02 - 0.05 mm (0.001 - 0.002 in.)**.

• If the clearance exceeds **0.14 mm (0.006 in.)** replace the rocker arm shaft and rocker arms.

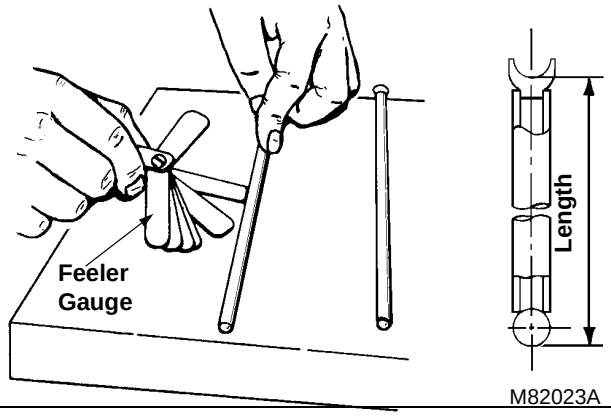


M82022A

MEASURE BENDING OF PUSH ROD:

1. Place the push rod on a flat surface. Use a feeler gauge to measure any gaps between the push rod and flat surface.

• Replace any push rod with more than **(0.03 mm (0.001 in.)** bend.



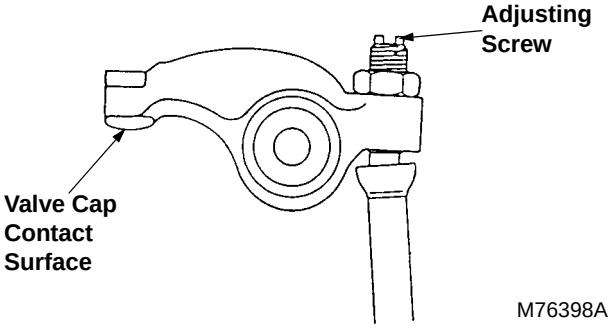
M82023A

INSPECT ROCKER ARM CONTACT SURFACES:

1. Check the surface of the adjusting screw that contacts the push rod for wear. Replace the adjusting screw if it is worn or damaged.

2. Check the surface of the rocker arm that comes in contact with the valve cap for wear. Replace rocker arm if necessary.

3. Check the socket portion of the push rod where the valve clearance adjusting screw contacts the push rod. Replace

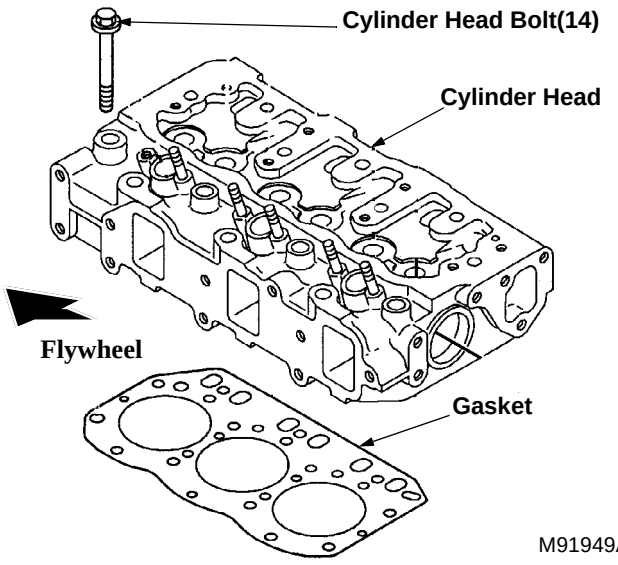


M76398A

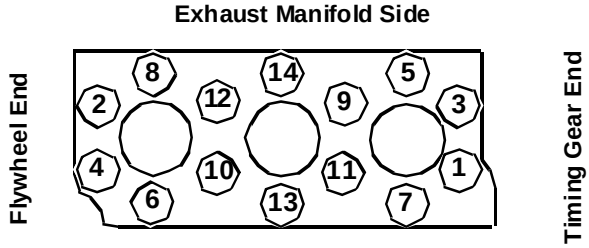
CYLINDER HEAD AND VALVES REMOVAL AND INSTALLATION

REMOVAL:

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



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



Cylinder Head Bolt- Order of Removal

INSTALLATION:

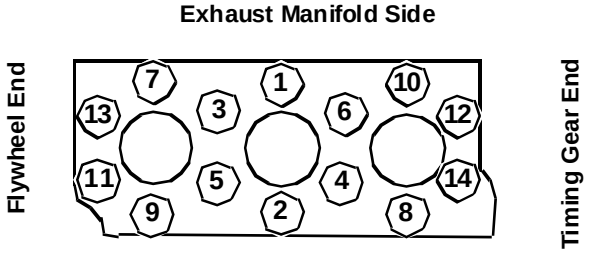
1. Reassemble the cylinder head and valves. See “CYLINDER HEAD AND VALVES DISASSEMBLY AND ASSEMBLY in this group.

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

2. Place a new cylinder head gasket on the engine block. Dowels in the engine block will assist in aligning the gasket.
3. Place the cylinder head on the engine block. Dowels in the engine block will again assist in alignment.
4. Dip the head bolts in clean engine oil, install and tighten in the sequence shown, in three stages of gradually-increasing torque. Tighten the head bolts to specification.

SPECIFICATION:

Cylinder Head Bolt Torque . . . 85 - 91 N•m (63 - 67 lb-ft)



Cylinder Head Bolt- Tightening Order

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

5. Install the fuel injection nozzles. See “FUEL INJECTION NOZZLES” in this group.

6. Install the water pump. See “THERMOSTAT AND WATER PUMP” in this group.

7. Install the exhaust and intake manifolds. See “EXHAUST MANIFOLD” and “INTAKE MANIFOLD” in this group.

8. Install the rocker arm assembly, push rods and valve caps. See “ROCKER COVER REMOVAL/INSTALLATION and “ROCKER COVER COMPONENTS” in this group.

CYLINDER HEAD AND VALVES DISASSEMBLY AND ASSEMBLY

1. Remove the valve caps from the valves. The valve caps should be installed on the valves they were removed from.

2. Compress the valve spring using a valve spring compressor and remove the collet halves, retainer, valve spring and valve stem seal for each valve.

3. The intake and exhaust valve guides are press fit. Replace the guides only if necessary. See “VALVE GUIDES” in this group.).

4. The valve seats are not replaceable. If inspection of the cylinder head reveals valve seats that are damaged or worn beyond repair, the cylinder head must be replaced. See “CYLINDER HEAD AND VALVES DISASSEMBLY AND ASSEMBLY” in this group.

5. Inspect all remaining parts for wear or damage. See “CYLINDER HEAD AND VALVES DISASSEMBLY AND ASSEMBLY” in this group.

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

6. Install new valve stem seals over the valve guides.

7. Apply clean engine oil on intake and exhaust valve stems during assembly.

8. Install the valve springs with smaller pitch end or paint mark toward cylinder head.

9. Compress the valve springs and retainer until the collet halves are able to be installed in the grooves of the valve stem.

10. Carefully release the tension on the spring compressor.

11. Tap on the end of the valve with a plastic hammer to ensure the collet halves have seated properly on the valve stem.

12. Repeat for the remaining valves.

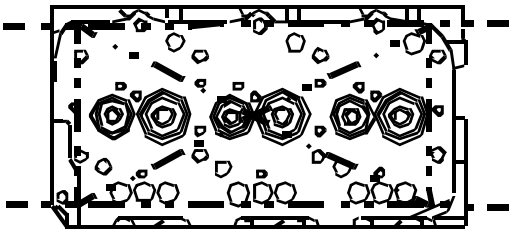
13. Measure valve recession if new valves were installed. See “VALVE RECESSION” in this group.

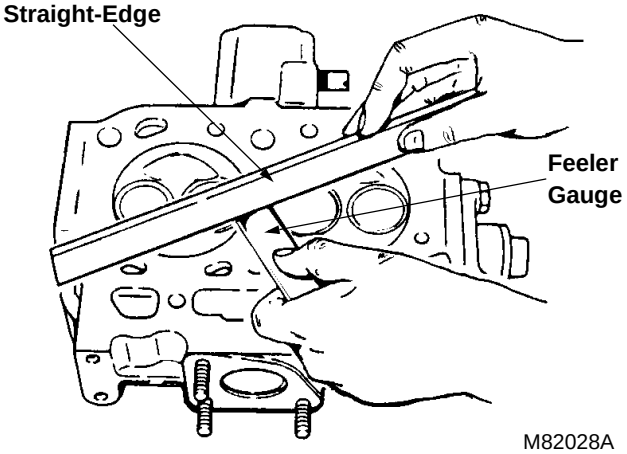
NOTE: After each valve has been assembled, tap on top of valve stem with a plastic hammer to seat retainer.

NSPECTION/REPLACEMENT:

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

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





M82028A

2. If the cylinder head was resurfaced:

• Measure piston-to-cylinder head clearance. See “MEASURE PISTON-TO-CYLINDER HEAD CLEARANCE in this group.

• Measure valve recession. See “CYLINDER HEAD AND VALVES DISASSEMBLY AND ASSEMBLY in this group.

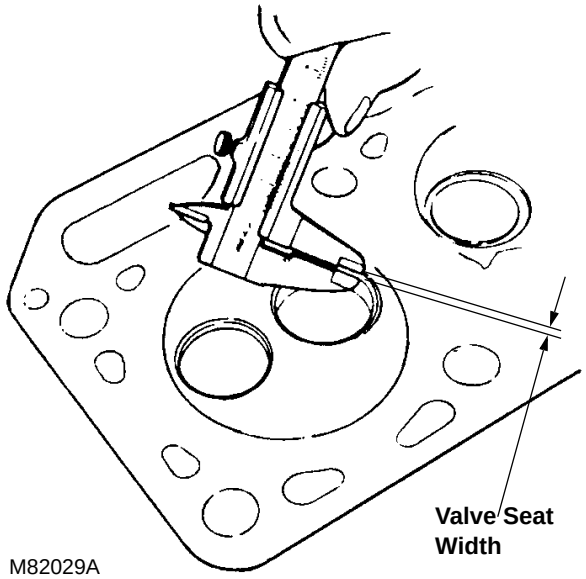
• Measure valve seat width.See “VALVE SEATS” in this group.

VALVE SEATS

1. Measure the valve seat widths.

SPECIFICATION:
Intake Valve
Seat Width1.07 - 1.24 mm (0.042 - 0.049 in.)
Wear Limit . . . . . .1.74 mm (0.069 in.)
Exhaust Valve
Seat Width1.24 - 1.45 mm (0.049 - 0.057 in.)
Wear limit . . . . . .1.94 mm (0.076 in.)

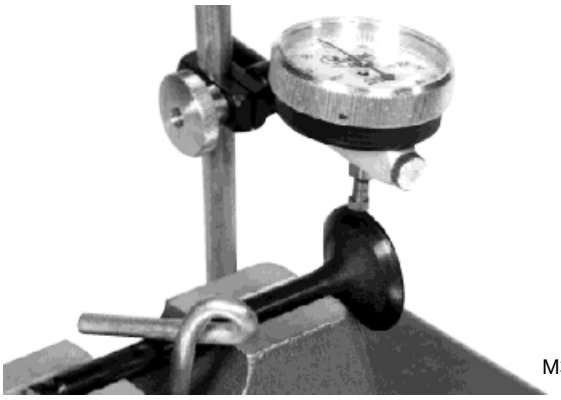
2. If necessary, grind the valve seats to meet specifications. See “GRIND VALVE SEATS” in this group.



M82029A

INTAKE AND EXHAUST VALVES

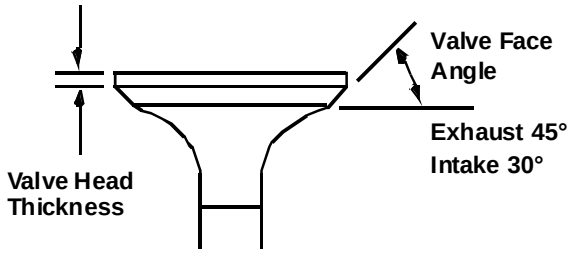
1. Check the valves for out-of-round, bent or warped condition using a valve inspection center. Replace valve if necessary.



M35307

2. If the valve faces are worn, burned or pitted, grind valves to proper face angle.

• If the valve head thickness is less than **0.50 mm (0.020 in.)** after grinding, replace the valve.



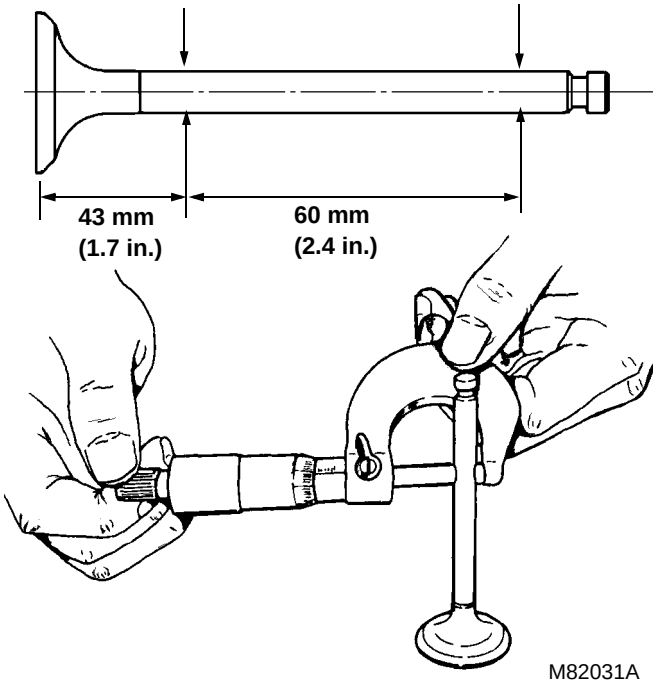
3. Measure the valve stem diameter at two locations, as shown.

SPECIFICATION:

Intake Valve
- Stem OD . . . . . 7.96 - 7.98 mm (0.313 - 0.314 in.).
- Wear Limit . . . . . 7.90 mm (0.311 in.)

Exhaust Valve
- Stem OD . . . . . 7.96 - 7.97mm (0.313 - 0.314 in.).
- Wear Limit . . . . . 7.90 mm (0.311 in.)

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

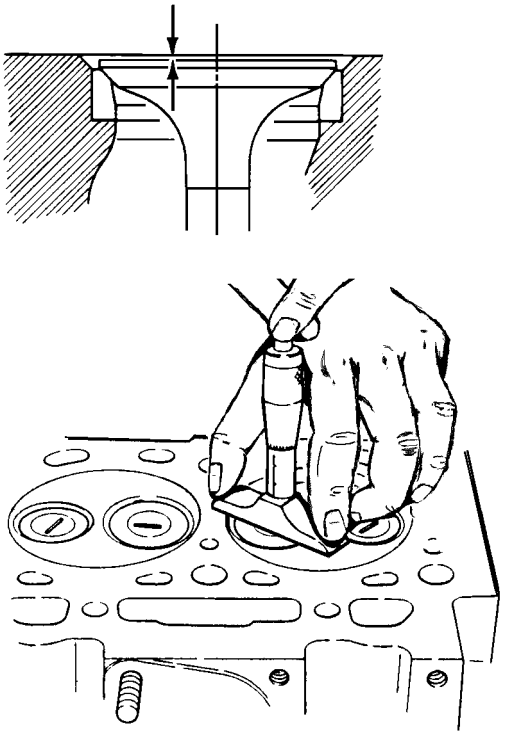


M82031A

VALVE RECESSION

1. Measure valve recession using a depth gauge.

SPECIFICATION:
Intake Valve
Recession. . . . . .1.07 - 1.24 mm (0.042 - 0.049 in.)
Wear Limit. . . . . 1.00 mm (0.039 in.)
Exhaust Valve
Recession. . . . . .0.3 - 0.5 mm (0.012 - 0.020 in.)
Wear Limit. . . . . .1.00 mm (0.039 in.



M82032A

VALVE GUIDES

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

SPECIFICATION:
Intake Valve
ID . . . . . 8.01 - 8.03 mm (0.315 - 0.316 in.).
Wear Limit. . . . . 8.10 mm (0.319 in.)
Exhaust Valve
Recession. . . . . .0.3 - 0.5 mm (0.012 - 0.020 in.)
Wear Limit. . . . . 1.00 mm (0.039 in.)

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

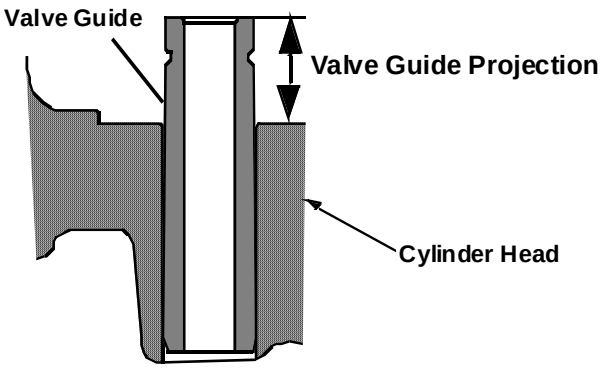
SPECIFICATION:
Valve Stem-To-Guide Oil Clearance
Intake Valve. . . . . .0.04 - 0.07 mm (0.001 - 0.003 in.)
Wear Limit. . . . . 0.20 mm (0.008 in.)
Exhaust Valve . . . . . .0.05 - 0.08 mm (0.002 - 0.003 in.)
Wear Limit. . . . . 0.20 mm (0.008 in.)

• If the ID of the valve guide is less than the wear limit, determine the guide-to-stem oil clearance (guide diameter minus stem diameter).

• If the oil clearance exceeds **0.15 mm (0.006 in.)** but is less than **0.20 mm (0.008 in.)**, knurl the valve guides using D-20019WI Valve Guide Knurler

• If clearance exceeds 0.20 mm (0.008 in.), replace valve guides using JDE118 Valve Guide Driver.

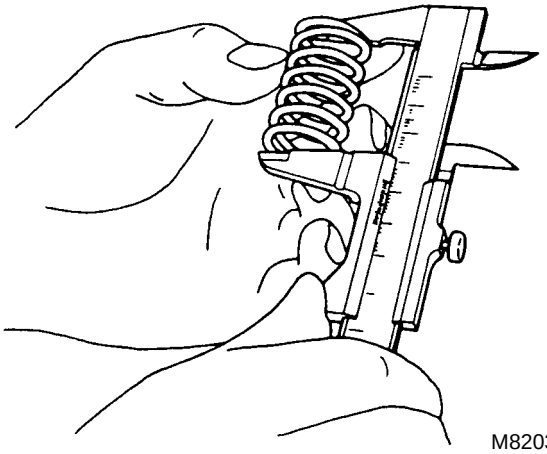
SPECIFICATION:
Valve Guide Projection . . . . . 5 mm (0.591 in.)
•Ream the inside diameter of valve guides using D-20021WI Valve Guide Reamer.



VALVE SPRINGS

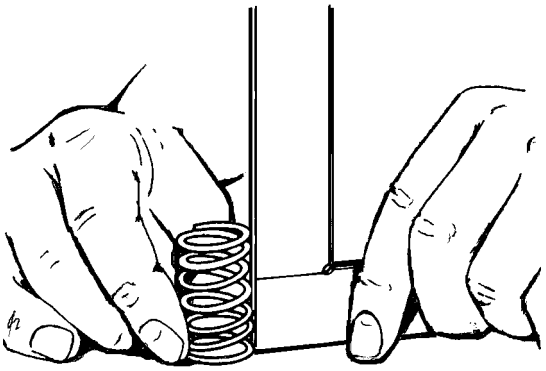
1. Measure the valve spring free length.

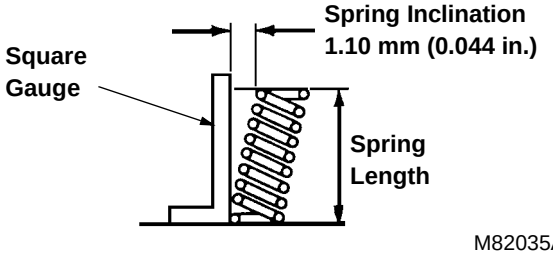
SPECIFICATION:
Valve Spring Free Length . . . . . 42 mm (1.654 in.)



2. Measure the spring inclination.

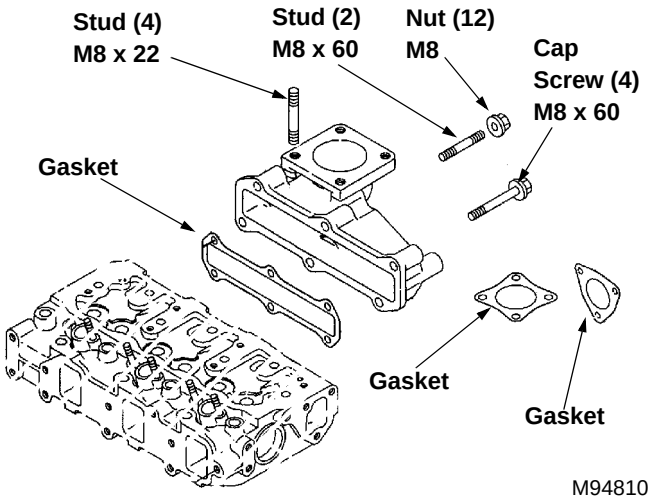
• Replace the spring if the measurement exceeds **1.10 mm (0.044 in.)**





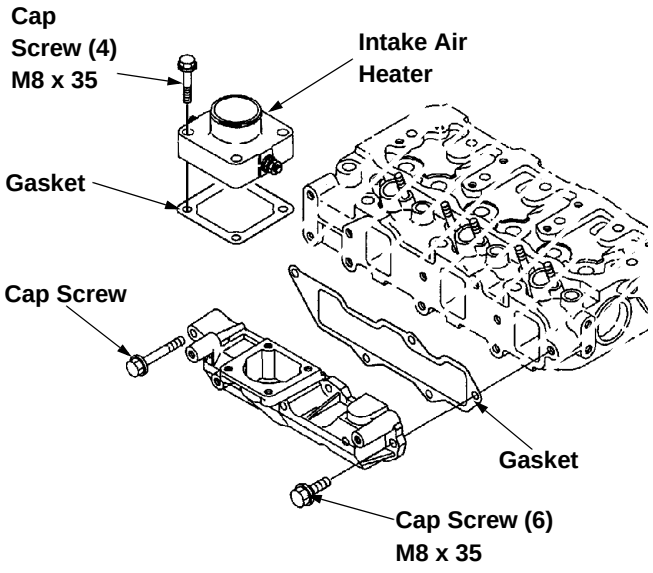
EXHAUST MANIFOLD

1. Remove the muffler and gasket.
2. Remove the exhaust manifold and gasket.
3. Clean the mating surfaces, and replace the exhaust manifold gasket.
4. Install the exhaust manifold. Tighten all fasteners.
5. Install muffler and new gasket.



INTAKE MANIFOLD

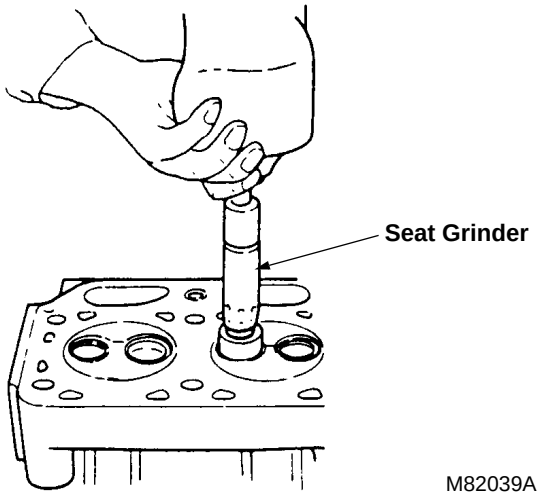
1. Remove the fuel filter bracket (not shown).
2. Remove the intake air heater.
3. Remove the fuel injection lines (not shown).
4. Remove the intake manifold.
5. Clean the mating surfaces, and replace the intake manifold gasket.
6. Install the intake manifold.
7. Replace the intake air heater gasket,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



GRIND VALVE SEATS

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

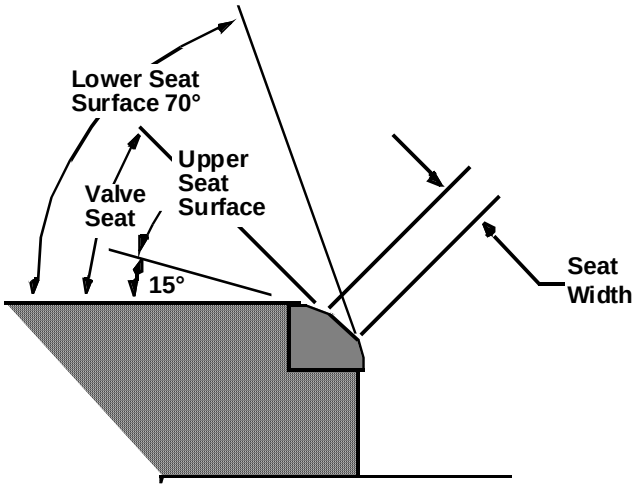
1. Grind the intake valve seat using a 30° seat grinder and the exhaust valve seat using a 45° seat grinder. Follow the tool manufacturers instructions
2. Measure the valve seat width after grinding.
3. If the seat is too wide after grinding, grind the lower seat surface using a 70° seat grinder until the seat width is close to specifications.
4. Grind the upper seat surface using a 15° seat grinder until the seat width is narrowed to specifications.



5. If the valve seats are ground, measure valve recession. See “CYLINDER HEAD AND VALVES DISASSEMBLY AND ASSEMBLY in this group. Check the contact pattern between the seat and valve with bluing dye.

6. Lap the valves. See “LAP VALVES” in this group.

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



LAP VALVES

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

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

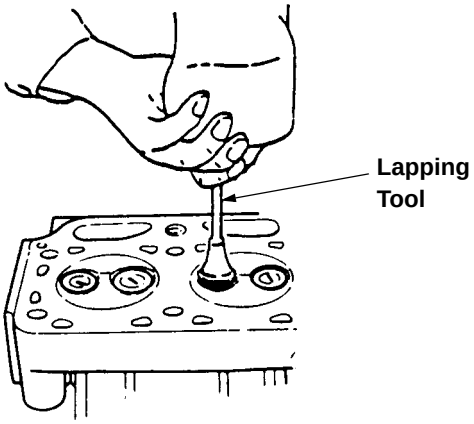
1. Apply a small amount of fine lapping compound to the face of the valve.

2. Turn the valve to lap the valve to the seat.

3. Lift the valve from the seat every 8 to 10 strokes. Lap until a uniform ring appears around the surface of the valve face.

4. Wash all parts in solvent to remove lapping compound. Dry all parts.

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



M82041A

MEASURE PISTON-TO-CYLINDER HEAD CLEARANCE

1. Place three **10 mm (0.4 in.)** long pieces of **1.5 mm (0.06 in.)** diameter soft wire in three positions on the flat part of the piston head.

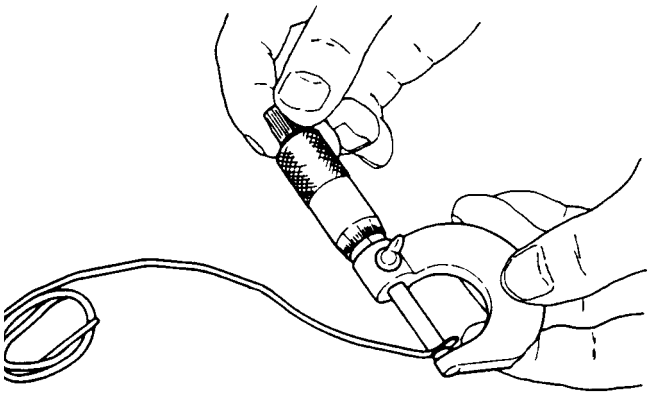
2. Install the cylinder head and old gasket. Install cylinder head bolts and tighten in proper sequence. See “CYLINDER HEAD AND VALVES REMOVAL AND INSTALLATION” in this group.

3. Slowly turn the crankshaft one complete revolution.

4. Remove the cylinder head and gasket.

5. Measure the thickness of the flattened section of each piece of wire. Calculate the average thickness of the wires to obtain the piston-to-cylinder head clearance specification.

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



M82042A

PISTON AND CONNECTING ROD

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

REMOVAL:

1. Remove the oil pan, and oil pickup tube.

2. Remove the cylinder head. See “CYLINDER HEAD AND VALVES REMOVAL AND INSTALLATION” in this group.

3. Check the cylinder bore for ridges. These ridges can cause damage to piston if ridge is not removed.

4. If necessary, remove any ridge from the top of the cylinder bore using a ridge reamer.

5. Measure the connecting rod side play. See “CONNECTING ROD SIDE PLAY CHECK” in Section 220, Group 15.

6. Measure the crankshaft end play. See “CRANKSHAFT AND MAIN BEARINGS” in this group.

7. Measure the connecting rod bearing clearance. See “CONNECTING ROD BEARING CLEARANCE CHECK” in Section 220, Group 15.

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

8. Remove the rod bolts, connecting rod cap and bearing inserts.

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

9. Note the connecting rod alignment mark in relation to the cylinders. Starting at the flywheel end with cylinder number one, then two, etc.

10. Push the piston and connecting rod out of the cylinder bore using a wooden dowel.

11. Disassemble and inspect all parts for wear or damage. See “PISTON AND CONNECTING ROD” in this group.

12. Inspect the cylinder bore. See “CYLINDER BORE“ in this group.

INSTALLATION:

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

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

1. Assemble the piston and connecting rod. See “PISTON AND CONNECTING ROD” in this group.

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

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

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

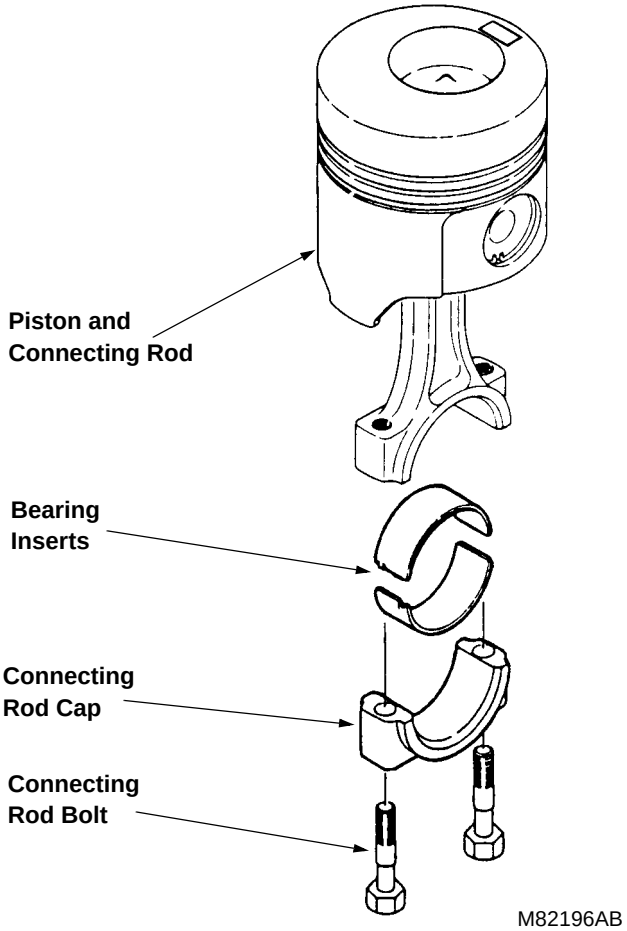
IMPORTANT: Connecting rod caps must be installed on the same connecting rods they were removed from.

4. Match the connecting rods to caps using alignment marks. Install the rod caps.

5. Dip the entire connecting rod bolt in clean engine oil. Install new bolts and tighten to specification.

SPECIFICATION:
Connecting Rod Bolt Torque
. . . . . .44 - 54 N•m (33 - 40 lb-ft)

6. If a new piston and connecting rod were installed, stamp a number corresponding to the cylinder number on the connecting rod and rod cap.



M82196AB

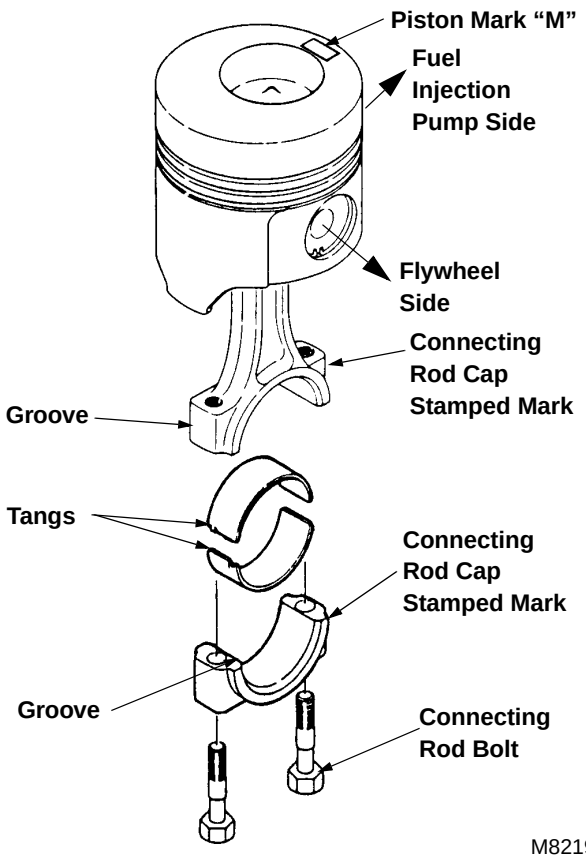
7. Install the cylinder head. See “CYLINDER HEAD AND VALVES REMOVAL AND INSTALLATION” in this group.

8. Install the oil pan, and oil pickup tube.

DISASSEMBLY:

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

- Put a mark on each piston and connecting rod to aid in assembly.
- The piston pin bushing is a press fit in the connecting rod. Remove the bushing only if replacement is necessary. See “PISTON AND CONNECTING RODS” In this group.
- Inspect all parts for wear or damage. Replace as necessary.



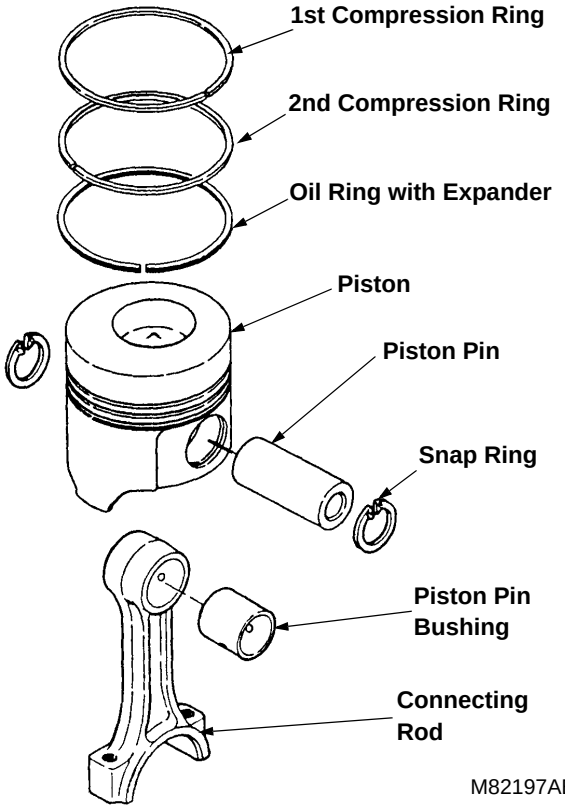
M82196AB

ASSEMBLY:

•Apply clean engine oil to all parts during assembly.

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

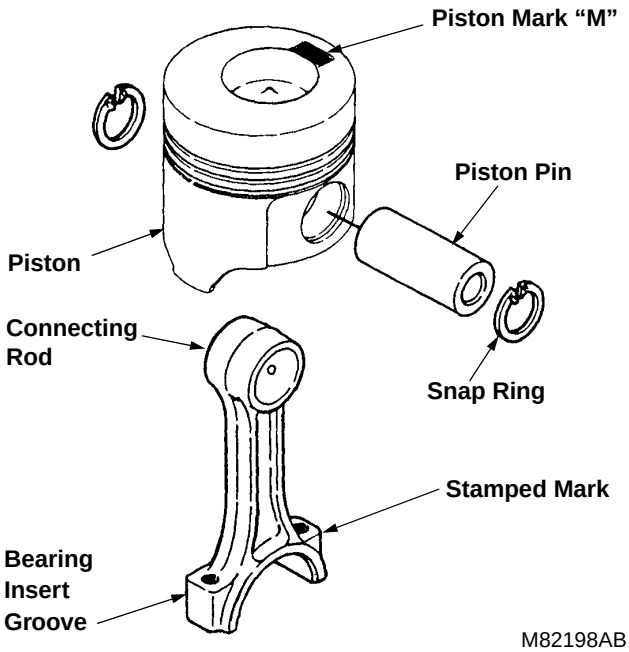
1. Assemble the piston to the connecting rod with piston mark “M” on the same side as the connecting rod stamped mark. If a new connecting rod is used, assemble the piston to the connecting rod with piston mark “M” opposite the connecting rod bearing insert groove. Be sure the oil hole in the piston pin bushing is aligned with the hole in the connecting rod.



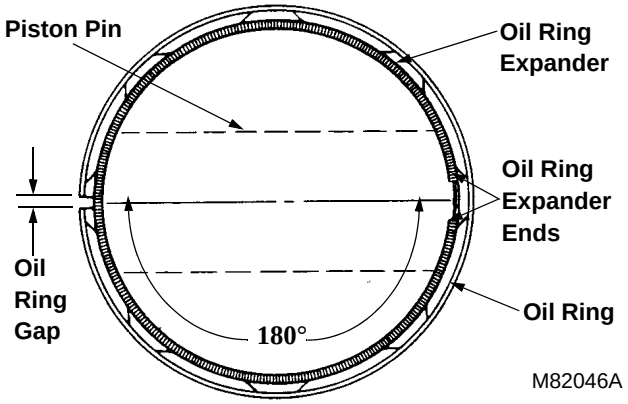
M82197AB

2. Install the piston pin and retaining/snap ring.
Install an oil ring expander in the bottom ring groove of the piston, with the ends above either end of the piston pin.

3. Install an oil ring expander in the bottom ring groove of the piston, with the ends above either end of the piston pin.



4. Install the oil ring over the expander with the oil ring gap opposite (180°) of the oil expander ends.

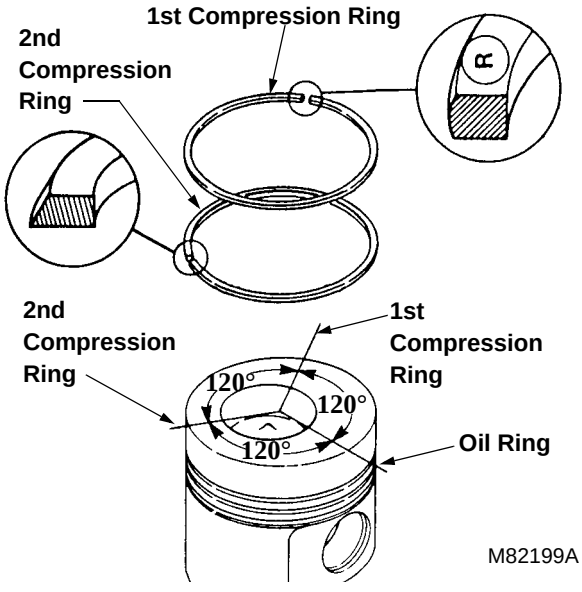


5. Install the second compression ring, with the small diameter of taper toward top of piston, in the middle groove. Turn the ring until the gap is 120° away from the oil ring gap.

6. Install the first compression ring (chrome plated), with the manufacturer's mark “R”, “T” or “RN” (near the ring gap) toward the top of the piston, in the top groove. Turn the ring

INSPECTION/REPLACEMENT:

- Inspect all parts for wear or damage. Replace as necessary.
- Measure the crankshaft connecting rod journal diameter.



CONNECTING ROD BEARING

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

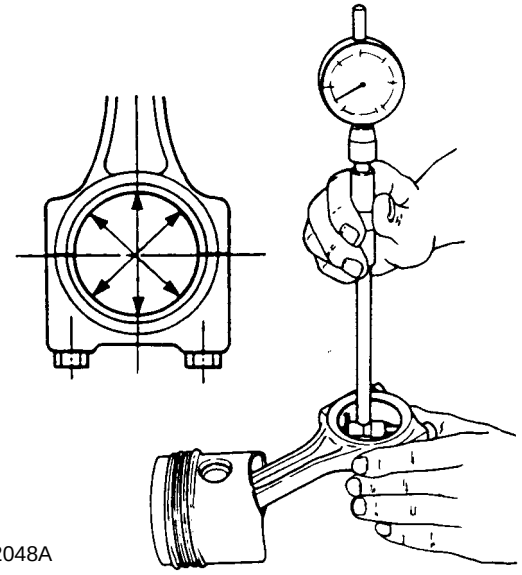
SPECIFICATION:
Connecting Rod
Bolt Torque . . . . . .44 - 54 N•m (33 - 40 lb-ft)

2. Measure the connecting rod bearing diameter.

SPECIFICATION:
Connecting Rod
Bearing ID . . . . . 51.00 - 51.01 mm (2.008 - 2.008 in.**)**

RESULT:

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


M82048A

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

SPECIFICATION:
Connecting Rod Bearing
Oil Clearance. . . . . .0.04 - 0.07mm (0.002 - 0.003 in.)
Wear Limit . . . . . 0.16 mm (0.006 in.)

RESULT:

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

PISTON RING GROOVE

1. With the rings installed on the piston, measure the piston ring groove side clearance. Measure at several places around each piston.

2. Replace the rings or the piston if the clearances exceed specification.

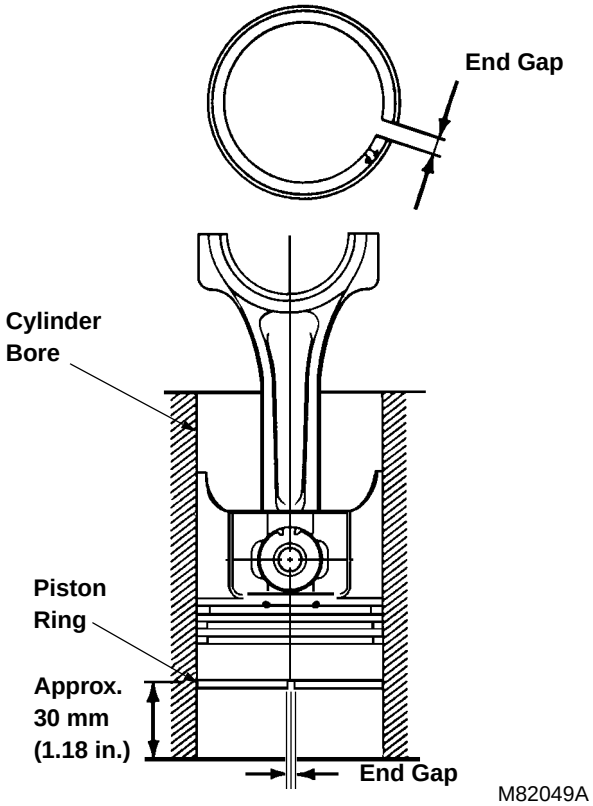
SPECIFICATION:
First Compression Ring Groove
Side Clearance . . . 0.08 - 0.11 mm (0.003 - 0.004 in.)
Second Compression Ring Groove
Side Clearance . . . 0.05 - 0.08 mm (0.002 - 0.003 in.)
Oil Control Ring Groove
Side Clearance . . . 0.03 - 0.06 mm (0.001 - 0.002 in.)


M35360

PISTON RING END GAP

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

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

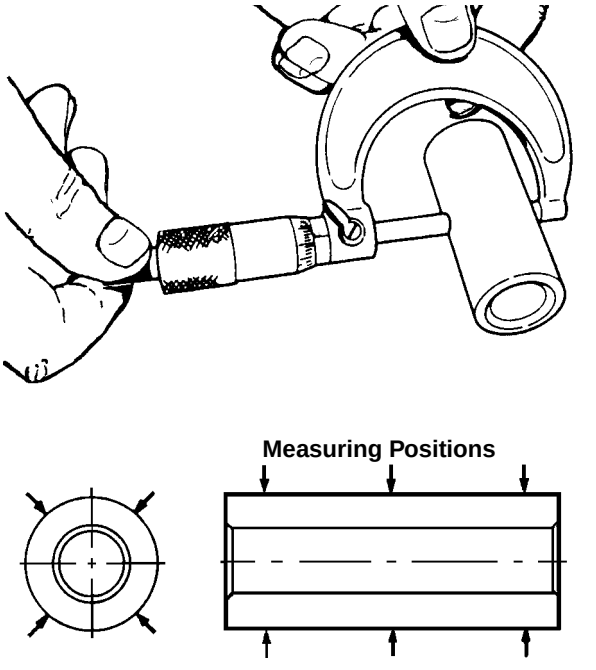


M82049A

PISTON PIN

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

SPECIFICATION:
Piston Pin OD . . . . 25.99 - 26.00 mm (1.023 - 1.024 in.)
Wear Limit. . . . . 25.90 mm (1.020 in.)



M82050A

PISTON PIN BORE



M37683

1. Measure the pin bore diameter in the piston.

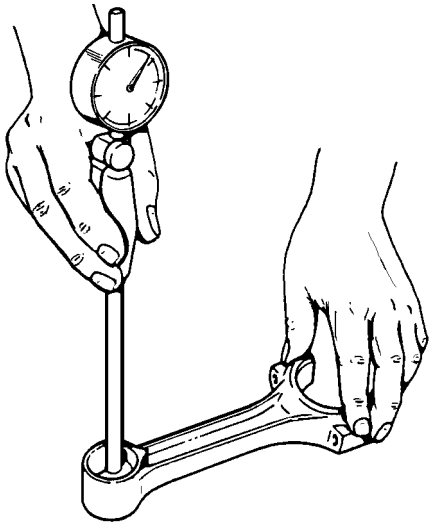
SPECIFICATION:
Piston Pin Bore ID 26.00 - 26.01 mm (1.024 - 1.024 in.)
Wear Limit . . . . . 26.02 mm (1.024 in.)

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

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

- If the piston pin bore exceeds the wear limit, replace the piston.
- If the piston pin is less than the wear limit, replace the piston pin.
- If the bore clearance exceeds the wear limit replace the piston, piston pin or both.

PISTON PIN BUSHING



M82051A

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

SPECIFICATION:
Piston Pin
Bushing ID. . . . . 26.03 - 26.04 mm (1.025 - 1.025 in.)
Wear Limit . . . . . 26.10 mm (1.028 in.)

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

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

- If the bushing clearance (bushing ID minus pin OD) exceeds specification replace the bushing or the piston pin.

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

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

PISTON DIAMETER

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

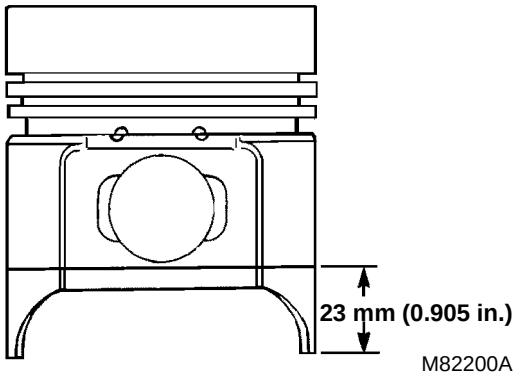
1. Measure the piston diameter perpendicular to the piston pin bore **23 mm (0.905 in.)** from the bottom of the piston skirt.

SPECIFICATION:

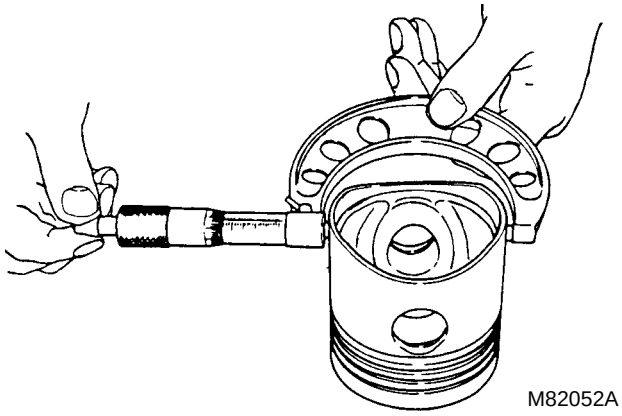
Standard
- Piston OD. . . . . 83.95 - 83.98 mm (3.305 - 3.306 in.)
- Wear Limit . . . . . 83.90 mm (3.303 in.)

Oversize
- Piston OD. . . . . 84.20 - 84.23 mm (3.315 - 3.316 in.)
- Wear Limit . . . . . 84.10 mm (3.311 in.)

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



M82200A


M82052A

CYLINDER BORE

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

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

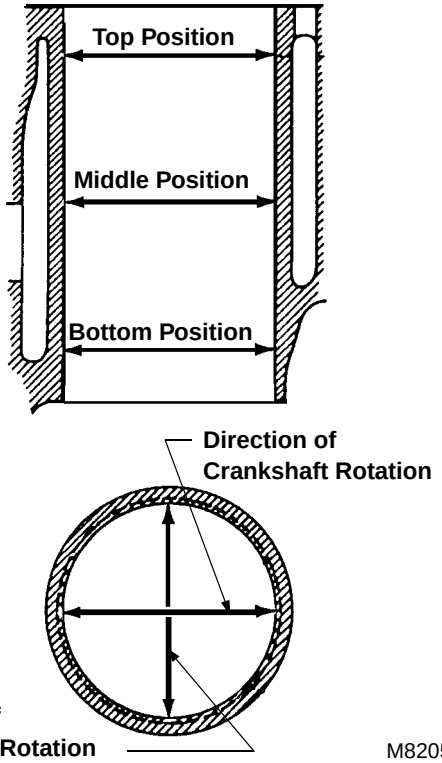
SPECIFICATION:

Standard Cylinder
- Bore ID. . . . . 84.00 - 84.03 mm (3.307 - 3.308 in.)
- Wear Limit . . . . . 84.20 mm (3.315 in.)

Oversize Cylinder
- Bore ID. . . . . 84.25 - 84.28 mm (3.317 - 3.318 in.)
- Piston-to-Cylinder Clearance . . . 0.055 mm (0.002 in.)

Cylinder Roundness . 0.00 - 0.01 mm (0.00 - 0.000 4in.)
- Wear Limit . . . . . 0.03 mm (0.001 in.)

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



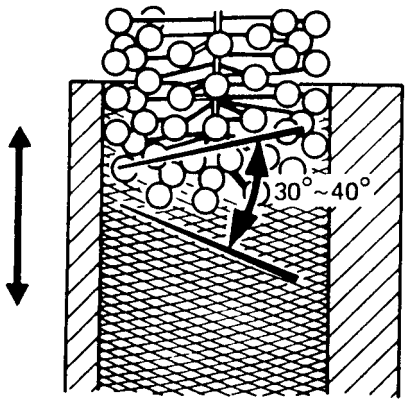
M82053A

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

DEGLAZING:

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

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



M82054A

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

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

REBORING:

NOTE: The cylinder block can be rebored to use oversize pistons and rings. Pistons and rings are available in 0.25 mm (0.010 in.) oversize.

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

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

2. Adjust the hone so the lower end is even with the lower end of cylinder bore.
3. Adjust the rigid hone stones until they contact the narrowest point of the cylinder.

4. Coat the cylinder with honing oil. The hone should turn by hand. Adjust the hone if it is too tight.

5. Run the drill press at about 250 rpm. Move the hone up and down in order to obtain a **30 - 40° crosshatch pattern.**

NOTE: Measure the bore when the cylinder is cool.

6. Stop the press and check the cylinder diameter.

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

7. Remove the rigid hone when the cylinder is within **0.03 mm (0.001 in.)** of desired size.

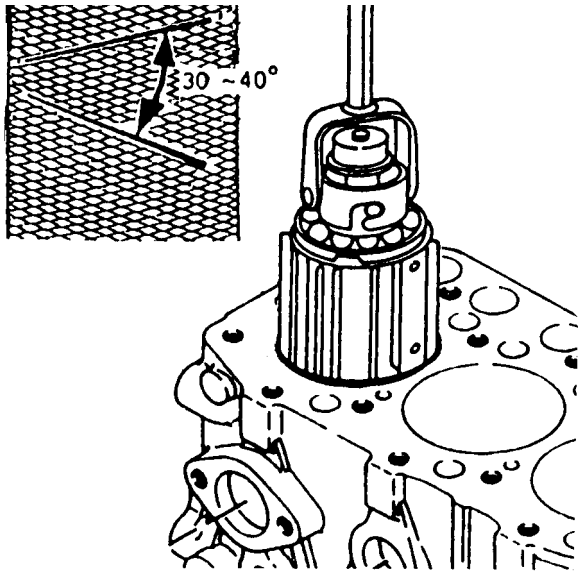
8. Use a flex hone with 180 grit stones for honing to final size.

9. Check the bore for size, taper and out-of-round. (See *Inspection* procedures.)

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

10. Clean the cylinder thoroughly using warm soapy water until clean white rags show no discoloration.

11. Dry the cylinder and apply engine oil.



M52959

CRANKSHAFT REAR OIL SEAL

REPLACEMENT:

1. Split the tractor. See “REMOVE ENGINE” shown earlier in this group.

2. Remove the drive coupling.

3. Remove flywheel. See “FLYWHEEL in this group.

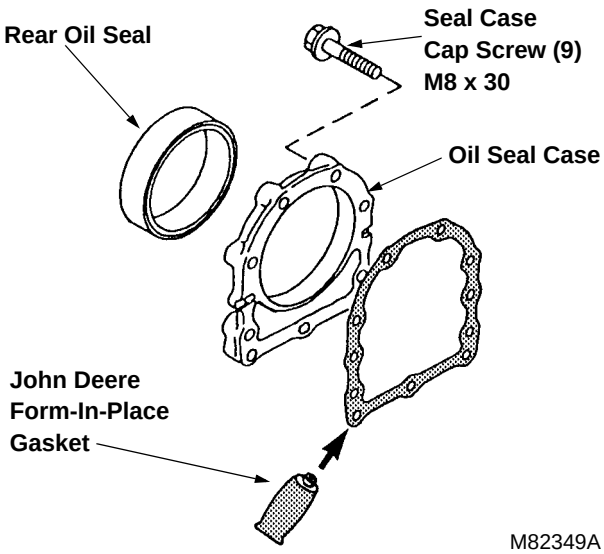
4. Remove the rear oil seal case-to-crankcase extension cap screws and the oil seal case-to- crankcase cap screws.

5. Remove the rear oil seal case.

6. Replace the oil seal. Install the seal, with the lip toward the cylinder block, flush with the surface of the oil seal case.

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

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

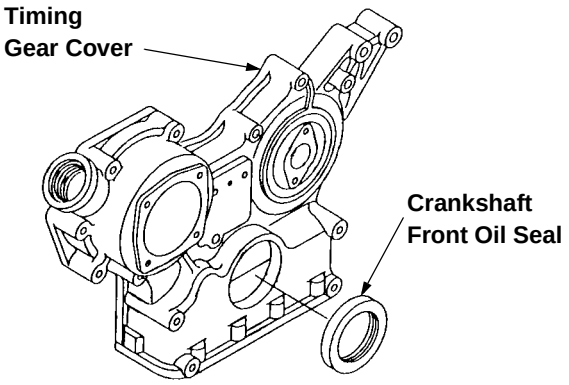


M82349A

CRANKSHAFT FRONT OIL SEAL

1. Remove the timing gear cover. See “TIMING GEAR COVER” in this group.

2. Replace the oil seal. Install the seal with the lip toward inside of gear housing cover, flush with the surface of the cover.



M82203A

CRANKSHAFT AND MAIN BEARINGS

REMOVAL:

1. Check the crankshaft end play. See “CRANKSHAFT END PLAY CHECK” in Section 220, Group 15.

2. Remove the cylinder head. See “CYLINDER HEAD AND VALVES REMOVAL AND INSTALLATION in this group.

3. Remove the rear oil seal. See “CRANKSHAFT REAR OIL SEAL” in this group.

4. Remove the timing gear cover mounting plate. See “TIMING GEAR COVER” in this group.

5. Check the crankshaft rod bearing clearance. See “CONNECTING ROD BEARING CLEARANCE CHECK” in Section 220, Group 15.

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

6. Check the crankshaft main bearing clearance. See “CRANKSHAFT MAIN BEARING CLEARANCE CHECK” in Section 220, Group 15.

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

7. Remove the connecting rod bolts and rod caps. Discard the connecting rod bolts.

8. Push the pistons and connecting rods away from crankshaft.

9. Remove the block thrust bearings and main bearing inserts.

10. Inspect all parts for wear or damage.

11. Remove the block thrust bearings and main bearing inserts.

12. Inspect all parts for wear or damage.

INSTALLATION:

- Apply clean engine oil to all parts during installation.

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

1. Install the grooved bearing inserts in the crankshaft bearing bores, aligning the tangs with the slots in the bores.

2. Install the block thrust bearings with the oil grooves facing away from the engine block.

3. Install the crankshaft.

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

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

5. Install the thrust bearings, with the oil grooves facing away from the cap, in the number "1" main bearing cap.

6. Install the main bearing caps in their original locations with arrows pointing toward the flywheel side of the engine.

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

7. Dip each main bearing bolt entirely in clean engine oil. Install the bolts and tighten. DO NOT tighten to specifications.

8. Using a soft-faced hammer, tap the front end of the crankshaft then the rear end of the crankshaft to align the thrust bearings.

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

SPECIFICATION:
Main Bearing
Bolt Torque . . . . . 96 - 100 N•m (71 - 74 lb-ft)

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

10. Match the connecting rod caps to the rods using alignment marks. Install the caps to the rods.

11. Dip entire connecting rod bolt in clean engine oil. Install new bolts to the rods, and tighten to specification.

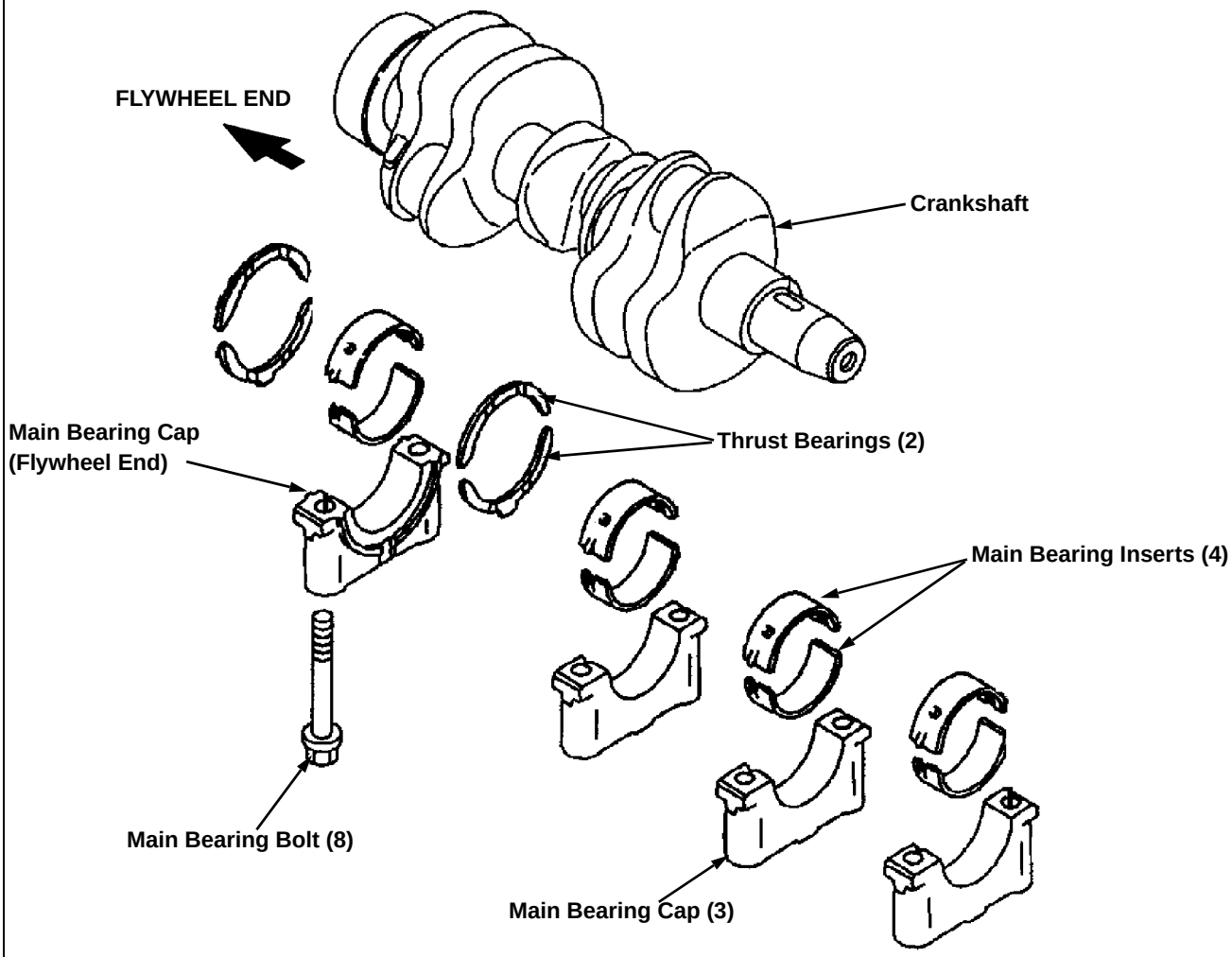
SPECIFICATION:
Connecting Rod
Bolt Torque . . . . . .44 - 54 N•m (33 - 40 lb-ft)

12. Install the timing gear cover mounting plate. See “TIMING GEAR COVER MOUNTING PLATE in this group.

13. Install the rear oil seal. See “CRANKSHAFT REAR OIL SEAL” in this group.

14. Install the flywheel. See “FLYWHEEL” in this group.

15. Install the timing gear cover. See “TIMING GEAR COVER in this group.



M91948C

16. Install the front oil seal. See “CRANKSHAFT FRONT OIL SEAL” in this group.

17. Install the oil pan.

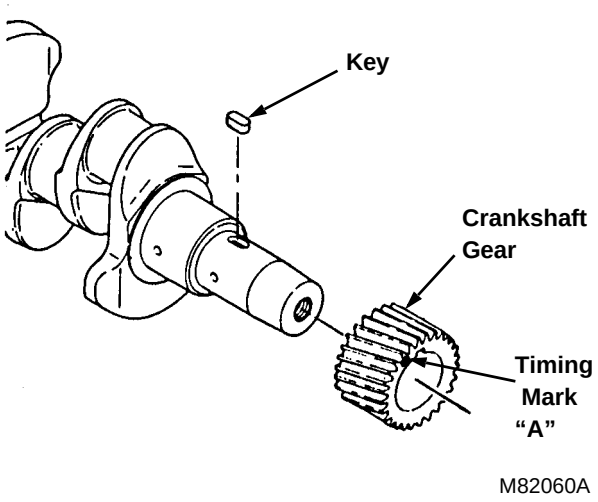
INSPECTION/REPLACEMENT:

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

REPLACE GEAR:

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

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

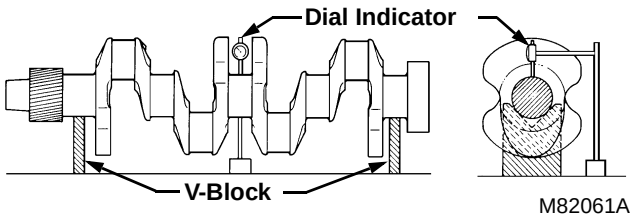


M82060A

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

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

4. Measure the crankshaft connecting rod journal and main bearing journal diameters at several places around each journal.



M82061A

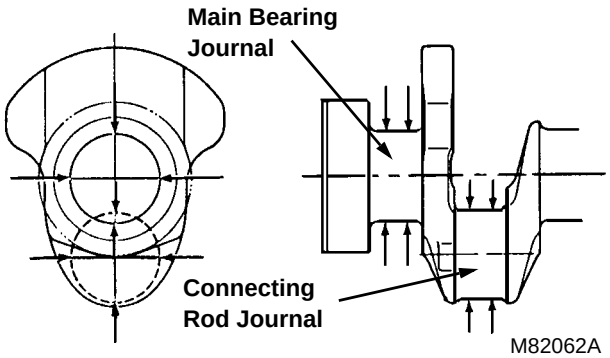
SPECIFICATIONS:

Connecting Rod
  Journal OD47.95 - 47.96 mm (1.888 - 1.888 in.)
  Wear Limit . . . . . 47.91 mm (1.886 in.)
Main Bearing
  Journal OD. . . . . 53.95 - 53.96 mm (2.124 - 2.124 in.)
  Wear Limit . . . . . 53.91 mm (2.122 in.)

• If the journal diameter is less than the specification, but greater than the wear limit, have the journals ground undersize by a qualified machine shop.

• If journals are ground, undersize bearing inserts must be installed. Bearing inserts are available in **0.25 mm (0.010 in.)** undersize.

• If the journal diameter is less than the wear limit, replace the crankshaft.



M82062A

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

SPECIFICATIONS:
Main Bearing
Bolt Torque . . . . . 96 - 100 N•m (71 - 74 lb-ft)

6. Measure the main bearing inner diameter.

• Subtract the main bearing journal OD of the crankshaft from the main bearing ID to obtain the main bearing oil clearance.

SPECIFICATIONS:
Main Bearing
Oil Clearance. . . . . 0.04 - 0.07 mm (0.002 - 0.003 in.)
Wear Limit . . . . . 0.15 mm (0.006 in.)

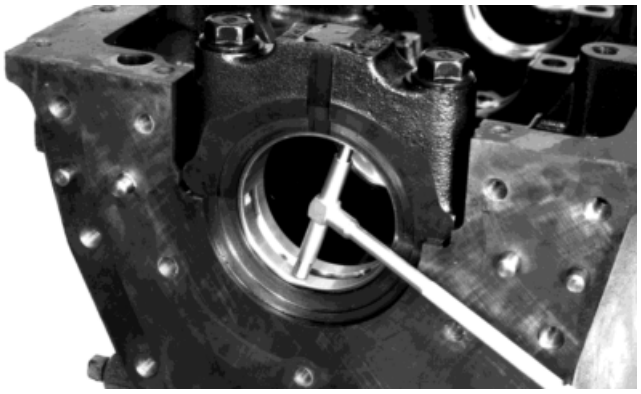
• If the crankshaft is within specification, but the main bearing oil clearance exceeds the wear limit, replace the bearing inserts.

• If the crankshaft is not within specification, have crankshaft journals ground undersize by a qualified machine shop and install undersized bearing inserts.

• If the crankshaft is worn past the wear limit, replace the crankshaft.

7. Clean and inspect the oil passages in the main bearing journals, connecting rod journals and main bearing bores in cylinder block.

8. Inspect the crankshaft for cracks or damage. Replace if necessary.


M82063

FLYWHEEL

IMPORTANT: Always install new flywheel mounting bolts.

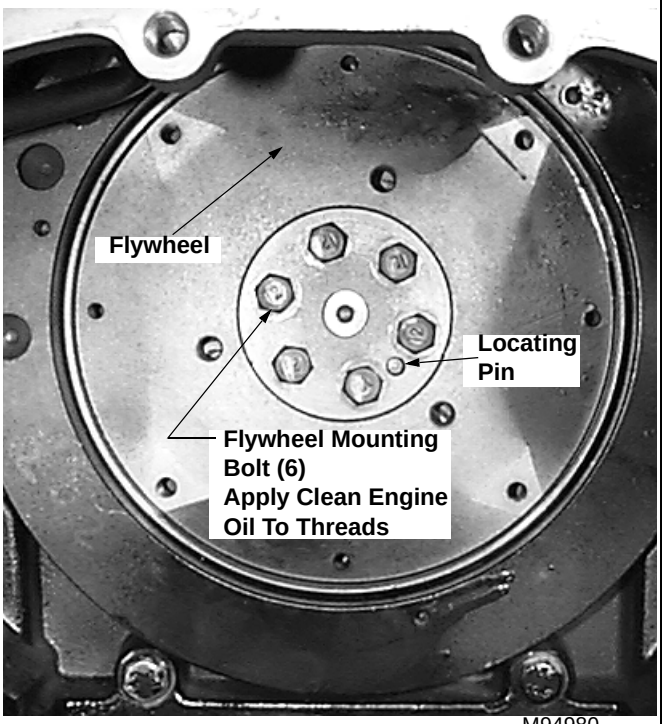
1. Split the tractor. See “REMOVE ENGINE” shown earlier in this group.

2. Remove flex-plate, clutch or coupling cap screws and remove from the flywheel.

3. Remove the flywheel mounting cap screws and remove the flywheel from crankshaft.

4. Use the pin in the crankshaft to correctly locate the flywheel on the crankshaft.

5. Install the flywheel. Apply lubrication oil to the flywheel bolts and tighten to **83 - 88 N•m (62 - 65 lb-ft).**



M94980

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

IMPORTANT: On tractors using a flex plate, the flex plate MUST be installed with flat rivet heads of spline drive toward engine or hydraulic pump seal will be damaged.

7. Measure flywheel flatness. Place a straight edge across the flywheel surface opposite of ring gear. Measure the clearance between the straight edge and the flywheel surface with a feeler gauge. Replace the flywheel if the clearance exceeds **0.02 mm (0.001 in.)**.


M35227

CAMSHAFT

REMOVAL:

1. Remove the rocker arm assembly and push rods. See “ROCKER ARM COMPONENTS” in this group.

2. Remove the timing gear cover. See “TIMING GEAR COVER” in this group.

3. Check the camshaft end play. See “CAMSHAFT END PLAY CHECK” in Section 220, Group 15.

4. Check the backlash of the timing gears. See “TIMING GEAR BACKLASH CHECK” in Section 220, Group 15.

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

5. Hold the cam followers away from the camshaft using a magnetic follower holder kit such as D15001NU.

6. Rotate the crankshaft and align the timing marks.

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

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

8. Inspect all parts for wear or damage.

INSTALLATION:

- Apply clean engine oil on all parts during installation.

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

1. Rotate the crankshaft to align the timing marks.

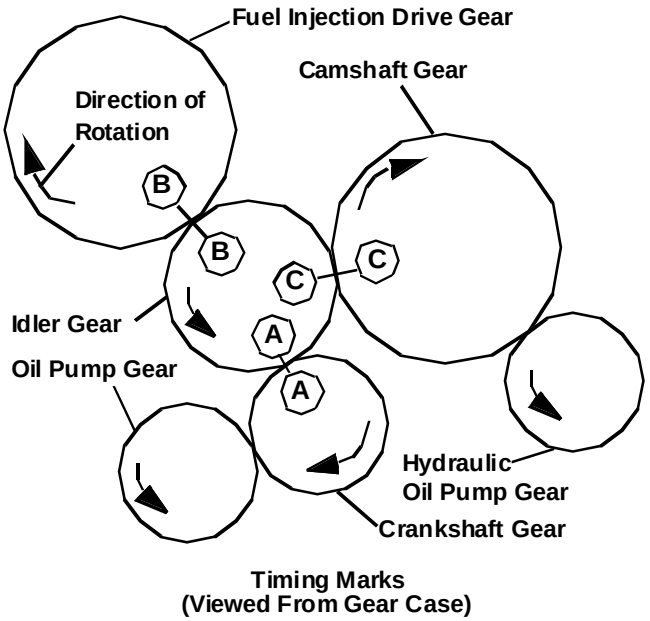
NOTE: The fuel injection drive gear, the camshaft gear and the crankshaft gear all must be correctly timed to the idler gear. It is not necessary to time the oil pump gear.
Due to the odd number of teeth on the idler gear, timing marks will only align periodically.

2. Install the camshaft.

3. Install the thrust plate and cap screws.

4. Install the timing gear cover. See “TIMING GEAR COVER” in this group.

5. Install the push rods and rocker arm assembly. See “ROCKER COVER REMOVAL/INSTALLATION” in this group.



Timing Marks (Viewed From Gear Case)

INSPECTION/REPLACEMENT:

1. Check the camshaft side gap using a feeler gauge.

• If the side gap exceeds **0.05 - 0.25 mm (0.002 - 0.010in.)**, remove the gear and replace thrust plate.

2. Remove the gear (if required) from camshaft using a knife-edge puller and a press.

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

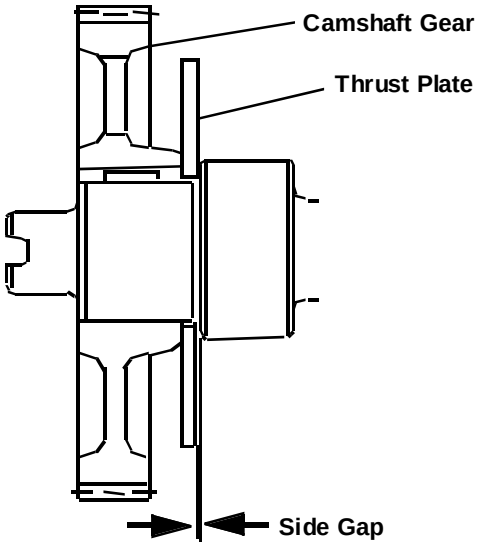
CAUTION: DO NOT heat oil over 182° C (360° F). Oil fumes or oil can ignite above 193° C (380° F). Use a thermometer. Do not allow a flame or heating element to come in direct contact with the oil. Heat the oil in a well-ventilated area. Plan a safe handling procedure to avoid burns.

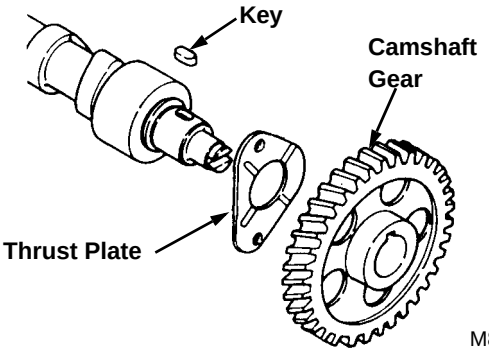
1. Heat the gear in oil to approximately **150°C (300°F)**.

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

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

• Thrust plate must spin freely on camshaft.

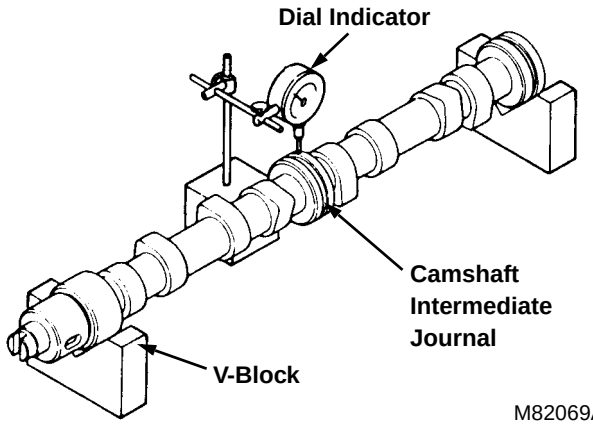




M82068A

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

• If the variation is greater than **0.02 mm (0.001 in.)**, replace the camshaft.

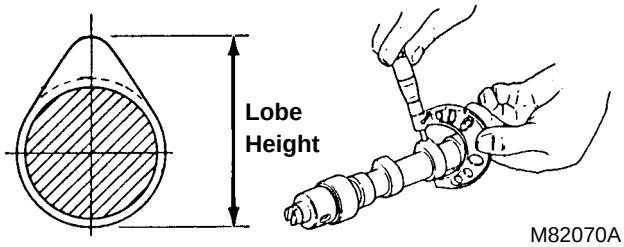


M82069A

4. Measure the camshaft lobe height.

• Camshaft lobe height is **38.64 - 38.77 mm (1.521 - 1.526 in.).**

• If the lobe height is less than 38.40 mm (1.512 in.), replace the camshaft.



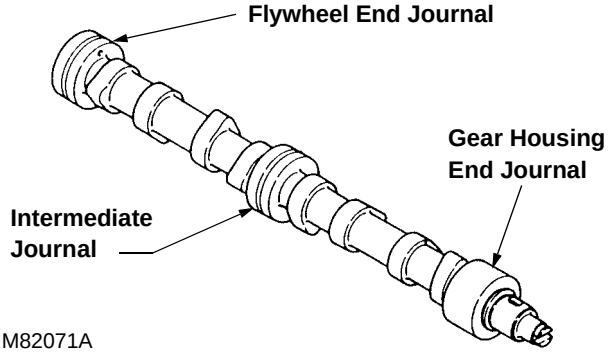
M82070A

5. Measure the camshaft journal diameters.

• Gear housing and flywheel end camshaft journal OD is **44.93 - 44.95 mm (1.769 - 1.770 in.)**

• Intermediate camshaft journal OD is **44.91 - 44.94 mm (1.768 - 1.769 in.).**

If the journal diameters are less than **44.85 mm (1.766 in.)**, replace the camshaft.



M82071A

6. Measure the camshaft bushing diameter at the gear housing end.

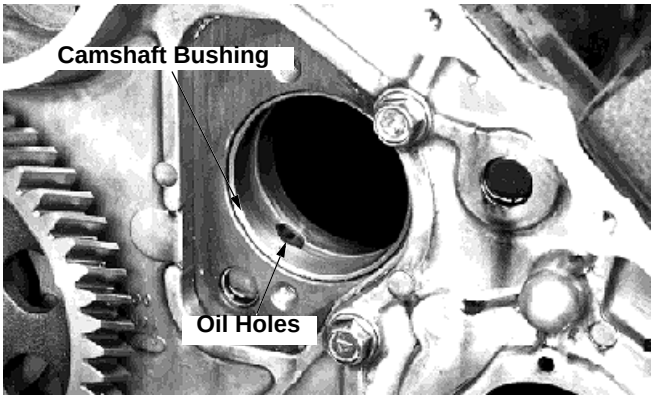
• Standard camshaft bushing ID is **44.99 - 45.06 mm (1.771 - 1.774 in.)**

• Replace the bushing if the diameter exceeds **45.10 mm (1.776 in.).**

• If the bushing clearance (bushing ID minus camshaft journal OD) exceeds **0.20 mm (0.008 in.)**, replace the bushing, camshaft or both.

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

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



M82072

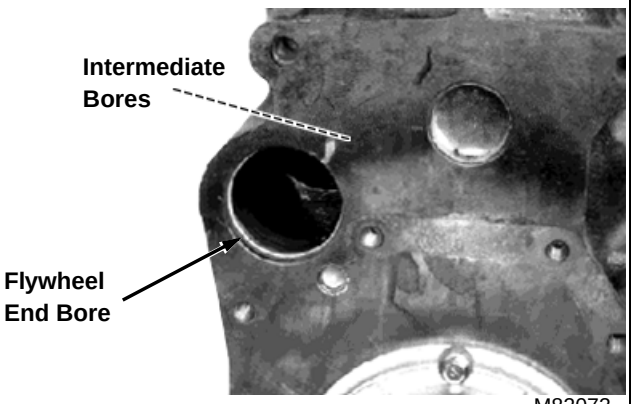
9. Measure the intermediate and flywheel end of the camshaft bore diameters.

• Standard camshaft bore ID is **45.00 - 45.025 mm (1.772 - 1.773 in.)**

• If the bore diameter exceeds **45.10 mm (1.776 in.)**, replace cylinder block.

• If the bore clearance (bore ID minus camshaft journal OD) exceeds **0.20 mm (0.008 in.)**, replace camshaft, cylinder block or both.

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



M82073

CAMSHAFT FOLLOWERS

1. Remove the camshaft. See “CAMSHAFT” in this group.

2. Remove the oil pan and strainer.

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

3. Put a mark on each cam follower and the cylinder block bore to aid in installation.

4. Remove the cam followers.

5. Inspect all parts for wear or damage.

6. Apply clean engine oil to all parts during installation.

7. Installation is done in the reverse order of removal.

INSPECTION:

8. Inspect the cam follower contact surface for abnormal wear. Replace if necessary.

9. Measure the cam follower stem diameter.

• Standard cam follower stem OD is **11.98 - 11.99 mm (0.471 - 0.472 in.)**

• If the stem diameter is less than **11.93 mm (0.470 in.)**, replace cam follower.

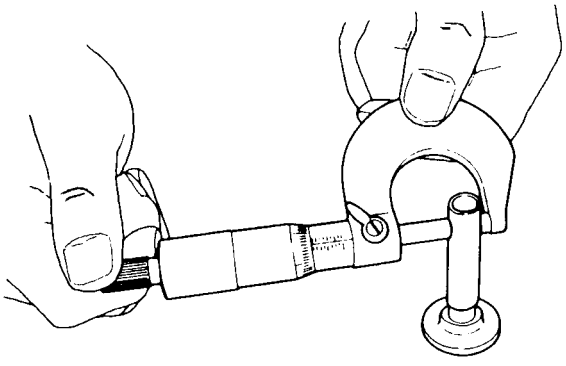
10. Measure the cam follower bore diameter in the cylinder block.

• Standard cam follower bore ID is **12.00 - 12.02 mm (0.472 - 0.473 in.)**

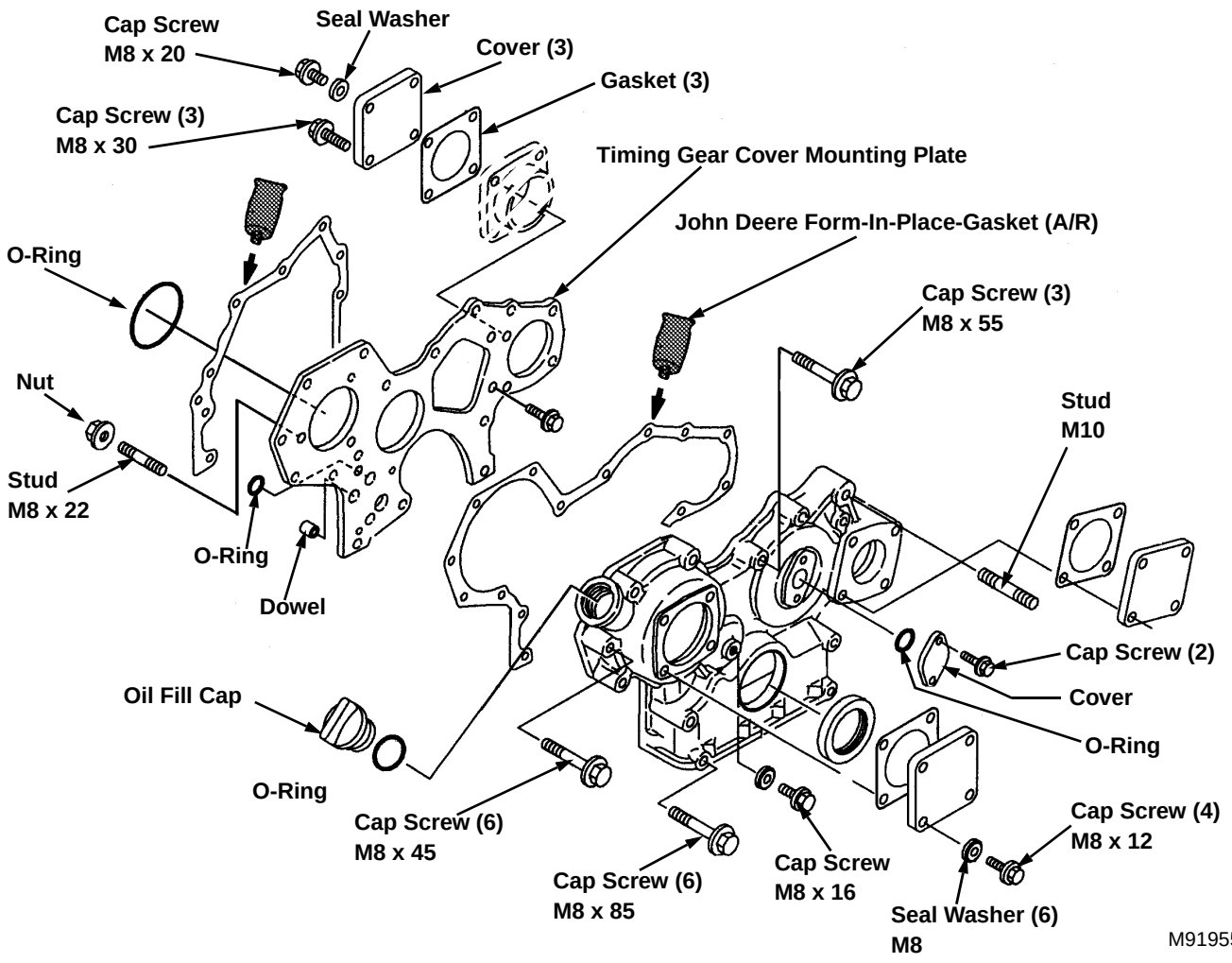
• If the cam follower bore diameter exceeds **12.05 mm (0.474 in.)**, replace the cylinder block.

• Standard cam follower bore clearance is **0.01 - 0.04 mm (0.0004 - 0.002 in.)**.

•If the bore clearance (bore ID minus follower stem OD) exceeds **0.12 mm (0.005 in.)**, replace the cam follower, cylinder block or both.


M82075A

TIMING GEAR COVER

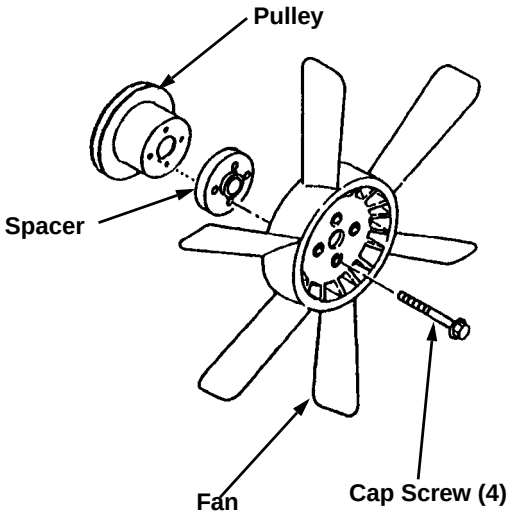


REMOVAL/INSTALLATION:

1. Remove the alternator and belt.
2. Remove the fan, spacer and pulley.
3. Remove the crankshaft pulley cap screw and washer.
4. Remove the crankshaft pulley using a two-jaw puller.

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

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



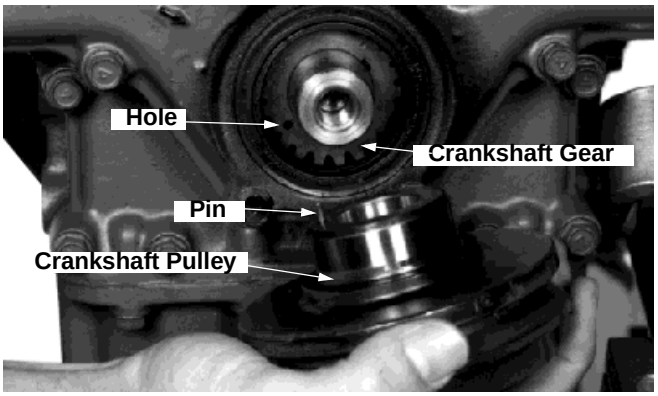
• Replace the oil seal using a driver set. Install the seal with lip toward inside of gear housing cover. Install the seal flush with surface of cover.

7. Installation is done in the reverse order of removal.

• Replace the seal washer.

• Align the pin in crankshaft pulley with the hole in the crankshaft gear. Install the crankshaft pulley.

• Adjust the fan/alternator drive belt tension.



M35295

IDLER GEAR

REMOVAL/INSTALLATION:

1. Remove the timing gear cover. See “TIMING GEAR COVER” in this group.

2. Check the backlash of timing gears. See “TIMING GEAR BACKLASH CHECK” in Section 220, Group 15.

NOTE: Due to the odd number of teeth on the idler gear, timing marks will only align periodically. When all timing marks on gears align, the piston closest to the water pump is at TDC on compression stroke. Number one cylinder is closest to the flywheel.

3. Rotate the crankshaft and align the timing marks.

4. Remove two cap screws, shaft and gear.

5. Inspect all parts for wear or damage.

• Installation is done in the reverse order of removal.

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

• Measure the idler gear shaft diameter.

• Standard idler gear shaft OD is **45.95 - 45.98 mm (1.809 - 1.810 in.)**

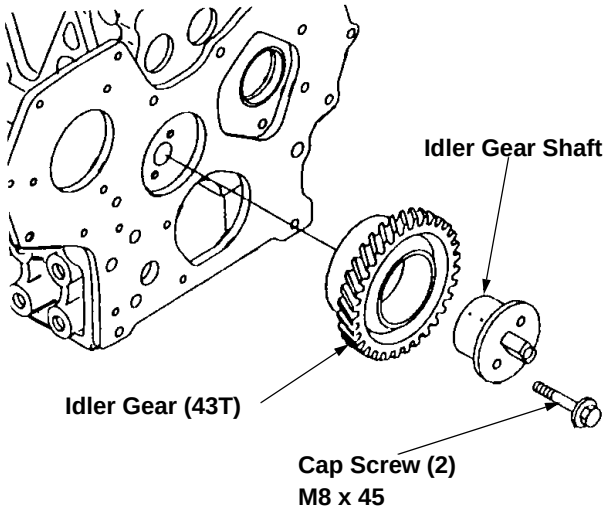
• If the shaft diameter is less than **45.93 mm (1.808 in.)**, replace idler gear shaft.

7. Measure the idler gear bushing diameter.

• Standard idler gear bushing ID is **46.00 - 46.03 mm (1.811 - 1.812 in.)**.

• Replace the bushing if diameter exceeds **46.03 mm (1.812 in.).**

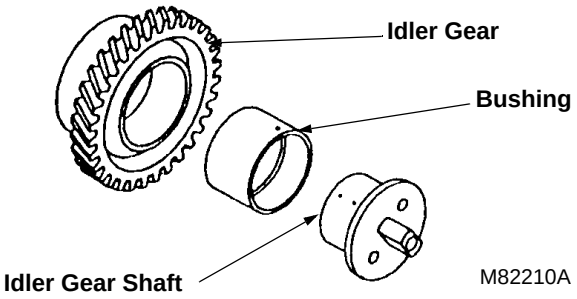
• If the bore clearance (bushing ID minus shaft OD) exceeds **0.15 mm (0.006 in.),** replace the bushing, shaft, or both.



M82209A

REPLACE THE BUSHING:

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



TIMING GEAR COVER MOUNTING PLATE

REMOVAL/INSTALLATION:

1. Remove the camshaft. See “CAMSHAFT” on page 43.
2. Remove the idler gear. See “IDLER GEAR” on page 48.
3. Remove the fuel injection pump.
4. Remove the oil pump. See “OIL PUMP” on page 49.
5. Remove the mounting cap screws and plate.
6. Replace the O-rings.
7. Installation is the reverse of removal.

OIL PAN AND STRAINER

REMOVAL/INSTALLATION:

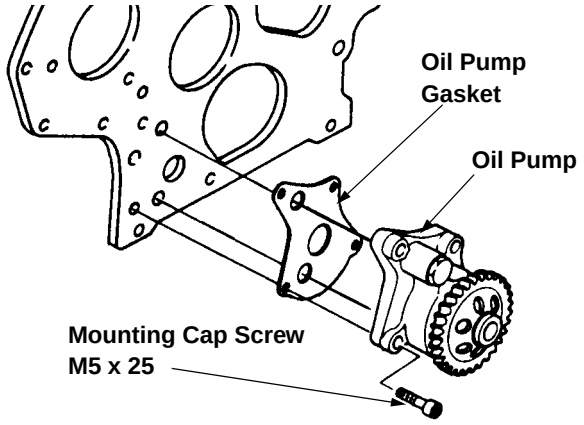
NOTE: The engine must be removed from the tractor to remove the oil pan.

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

OIL PUMP

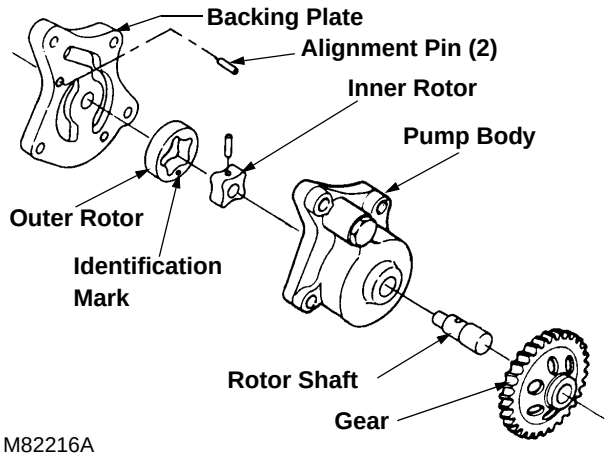
REMOVAL/INSTALLATION:

1. Remove the timing gear cover. See “TIMING GEAR COVER” in this group.
2. Check the oil pump gear backlash. Replace the oil pump assembly if backlash is more than **0.12 mm (0.005 in.)**.
3. Remove the mounting cap screws, the oil pump and gasket.
4. Inspect all parts for wear or damage.



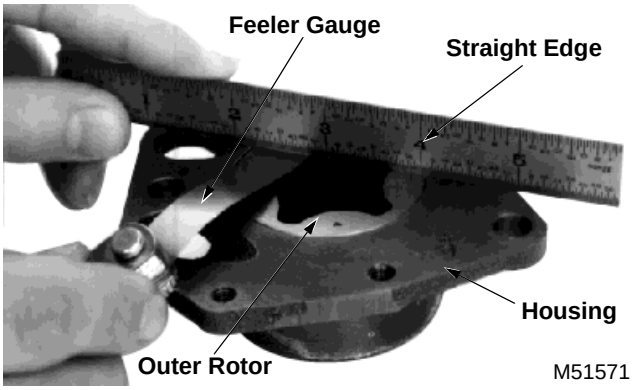
DISASSEMBLY/ASSEMBLY:

1. The gear is press fit on rotor shaft. Remove gear using a knife edge puller and a press.
2. Inspect all parts for wear or damage.
3. Coat all parts with clean engine oil.
4. Install the outer rotor with identification mark facing toward rotor shaft assembly.
5. Measure the rotor shaft outer diameter and the shaft hole diameter in cover.Standard clearance is **0.01 - 0.04 mm (0.001 - 0.002 in.)**.
   - Replace the pump if the clearance is greater than **0.2 mm (0.008 in.).**



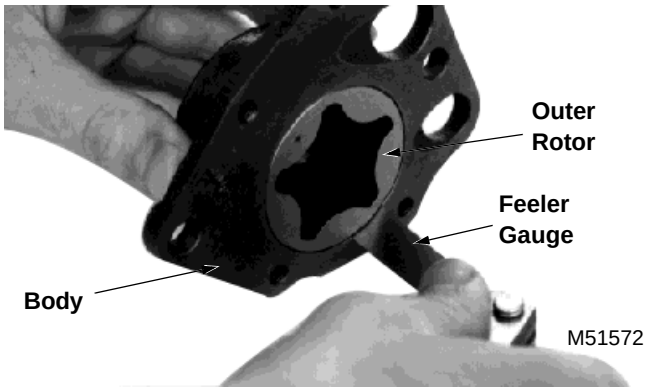
M82216A

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



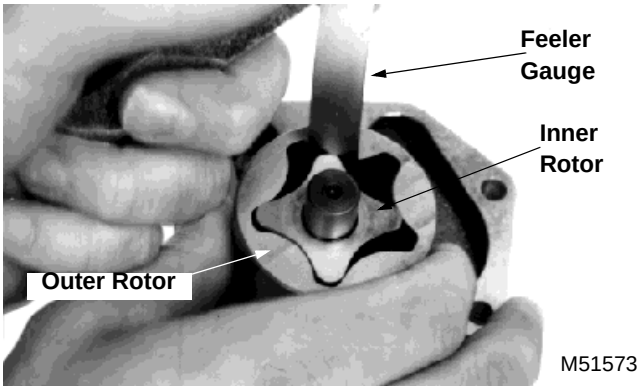
M51571

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



M51572

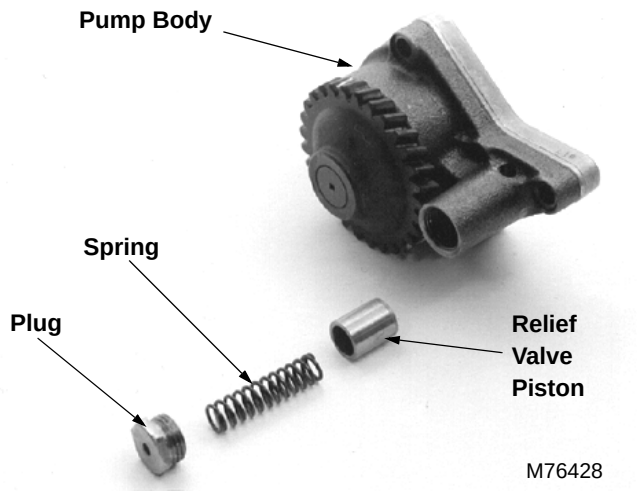
8. Check inner-to-outer rotor clearance.
   - Replace the pump if clearance is more than **0.15 mm (0.006 in.)**.



M51573

9. Check the oil pressure relief valve. If the relief valve piston is sticking in the pump body, clean parts to allow free movement of the piston in pump body.

10. Inspect the spring for cracks. The spring is not serviceable. If damage is identified, replace the oil pump assembly.



FUEL FILTER ASSEMBLY

1. Remove the retaining ring from the mounting base while holding on to the filter cover.

2. Remove the filter cover from the mounting base.

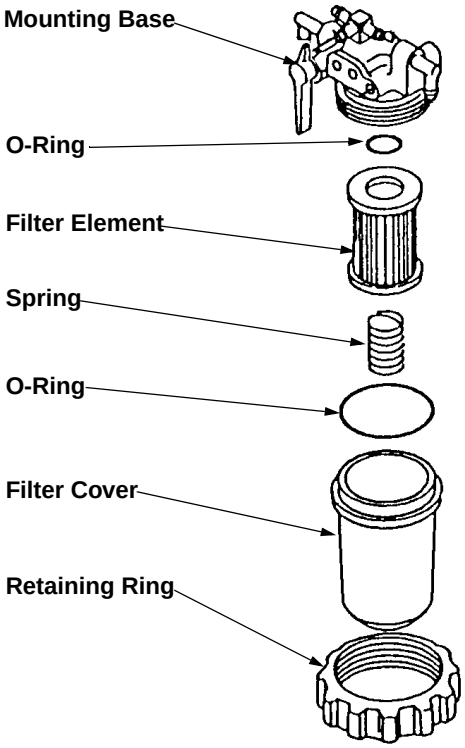
3. Remove and replace the O-rings and filter element.

4. Be sure the spring is in the filter cover and place the filter element in the filter cover.

5. Before installing the filter cover and element in the mounting base, verify the O-ring is in the groove inside the mounting base.

6. Install the filter cover and the element in the mounting base.

7. Place the retaining ring over filter cover and screw on the mounting base to retain filter cover to mounting base.
•Tighten only enough to keep the filter assembly from leaking. Overtightening the retaining nut may damage the filter cover or retaining ring.



THERMOSTAT AND WATER PUMP

1. Open the engine drain valve to drain coolant.
2. Disconnect the coolant temperature sensor lead.
3. Disconnect the upper and lower radiator hoses.
4. Remove the fan/alternator drive belt.
5. Remove the cap screws, fan, spacer and pulley.
6. Remove the mounting cap screws, pump and gasket.
7. Inspect the pump for wear or damage.
8. Test the thermostat for proper operation. See “THERMOSTAT OPENING TEST” in Section 220, Group 15.
9. Installation is done in the reverse order of removal.
10. Adjust the fan/alternator drive belt tension.

INSPECTION:

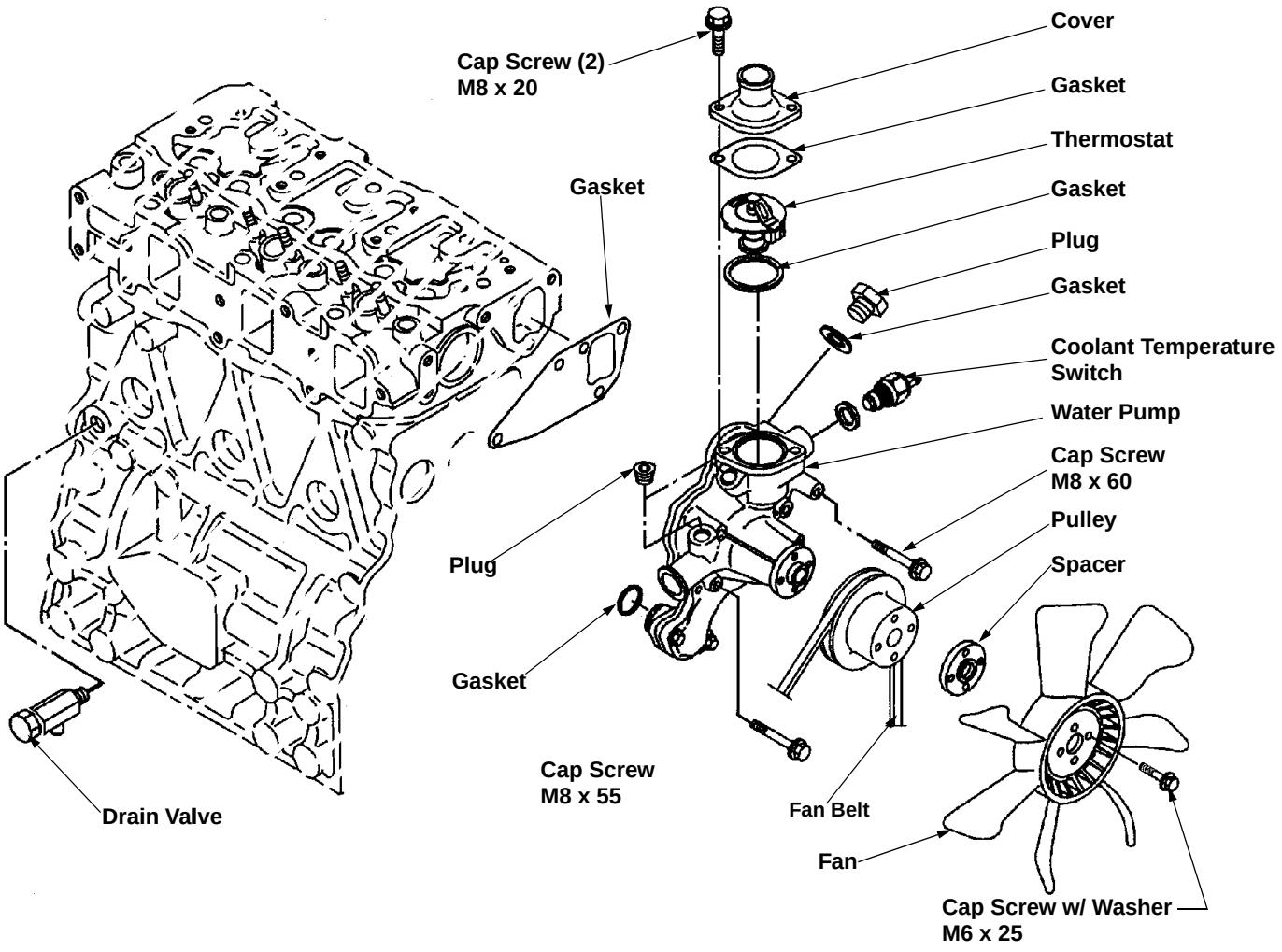
1. Inspect the water pump for coolant leakage. If the origin of the leak cannot be determined, test the cooling system. See “COOLING SYSTEM PRESSURE TEST” in Section 220, Group 15.

• If coolant is leaking at the pulley flange:
The shaft seal is defective. Replace the water pump.

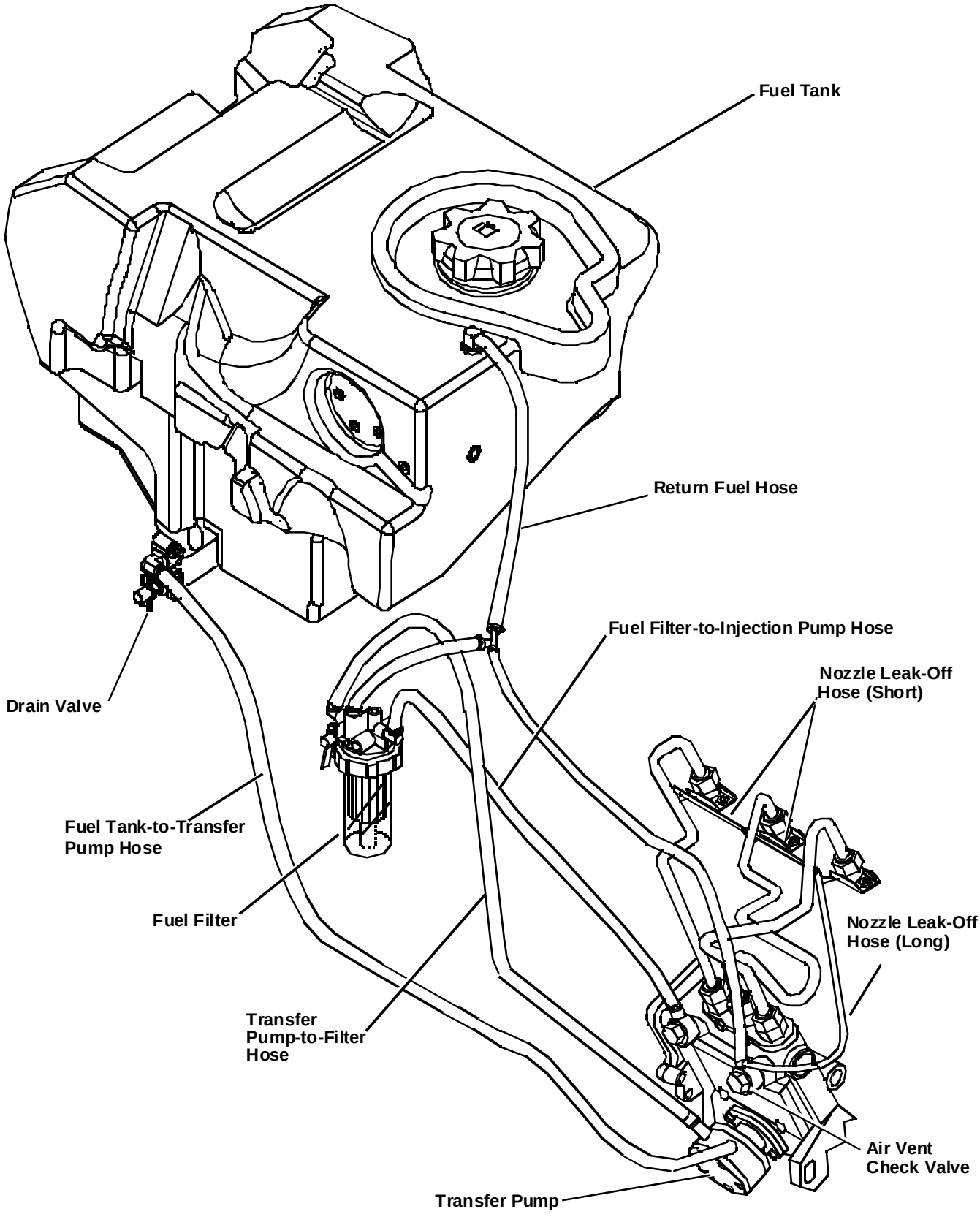
• If coolant is leaking between the cylinder head and the pump housing:
The gasket between the head and the pump is defective. Remove the water pump and replace the gasket.

2. Inspect the water pump for a worn bearing shaft by removing the fan belt and checking for excessive movement of the fan. Replace the water pump if excessive movement is noticed.

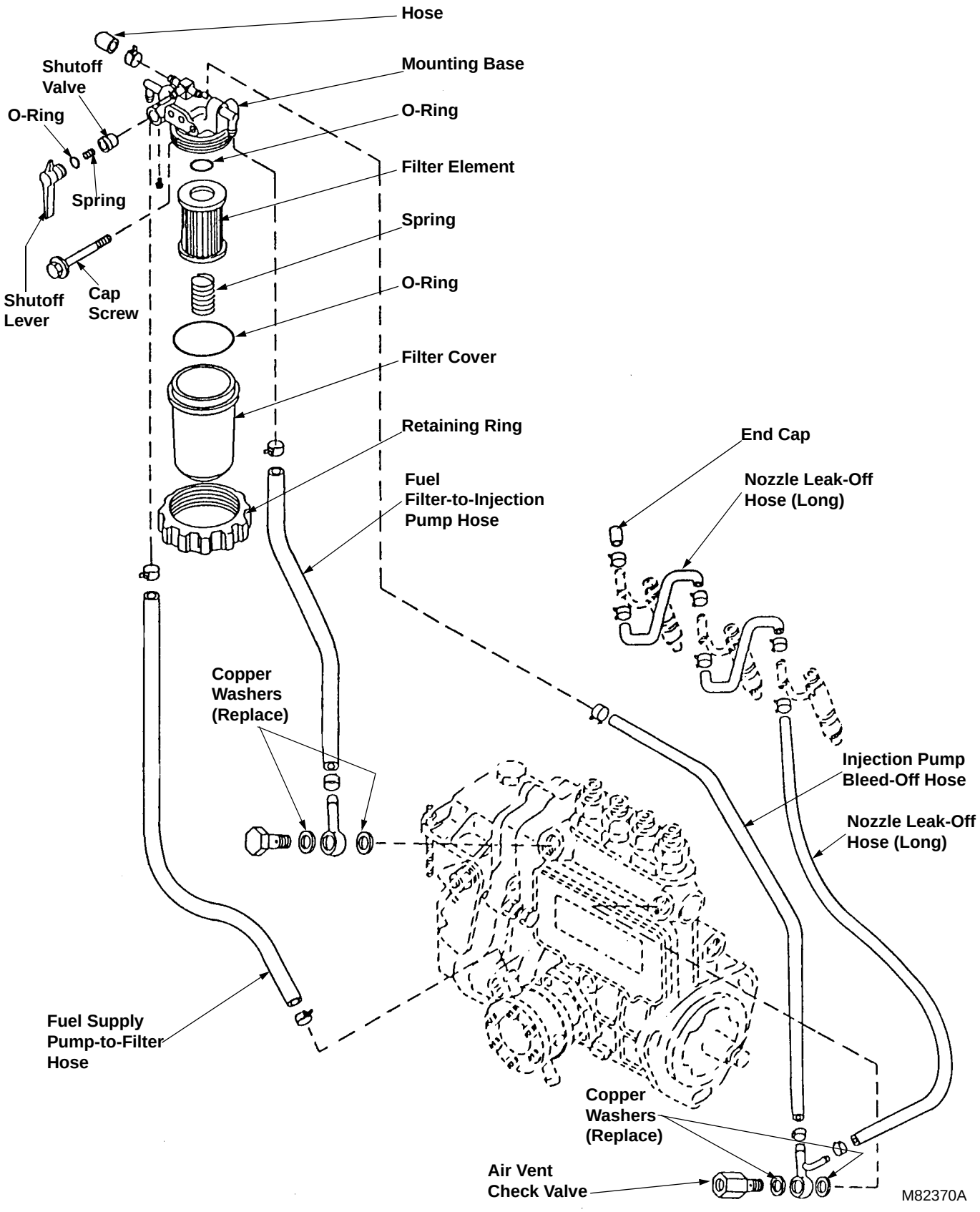
• If the bearing shaft is making noise when operating:
Check the fan belt tension. If adjustment does not relieve the noise, the bearing shaft is defective. Replace the water pump.



COMPONENT LOCATION FUEL SUPPLY



COMPONENT LOCATION FUEL SUPPLY (continued)



STARTING MOTOR REMOVAL AND INSTALLATION

REMOVAL:

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

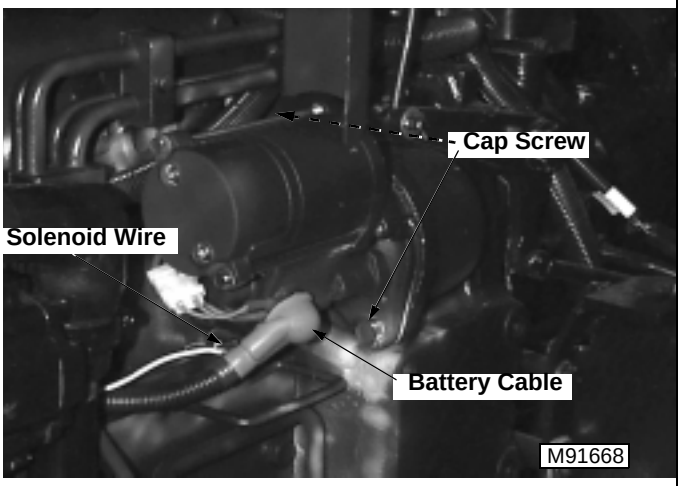
1. Remove the alternator. See “ALTERNATOR REMOVAL AND INSTALLATION in this group.

2. Remove the nut securing the battery cable and wires on the starting motor.

3. Disconnect the starting motor solenoid wire.

4. Remove the cap screws securing the starting motor to the bell housing. Remove the starting motor.

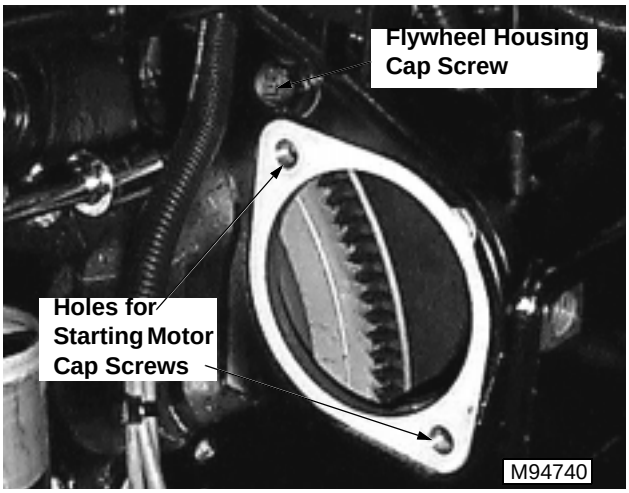
NOTE: The starting motor is fastened to the tractor with two cap screws. It is NOT necessary to remove the cap screw from the flywheel housing to remove the starting motor.



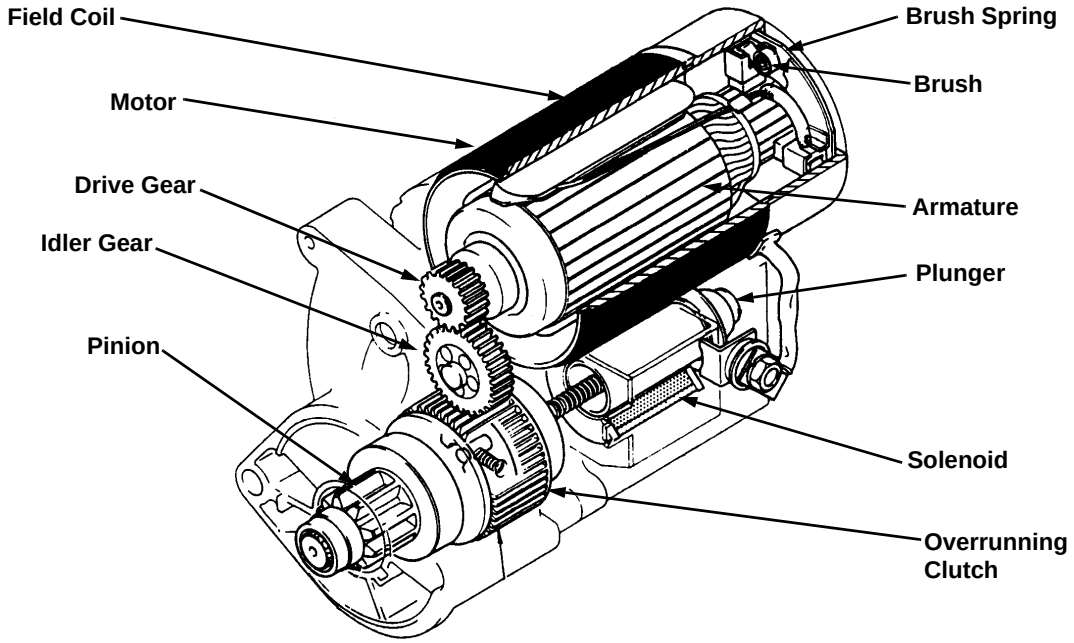
INSTALLATION:

Installation is done in the reverse order of removal.

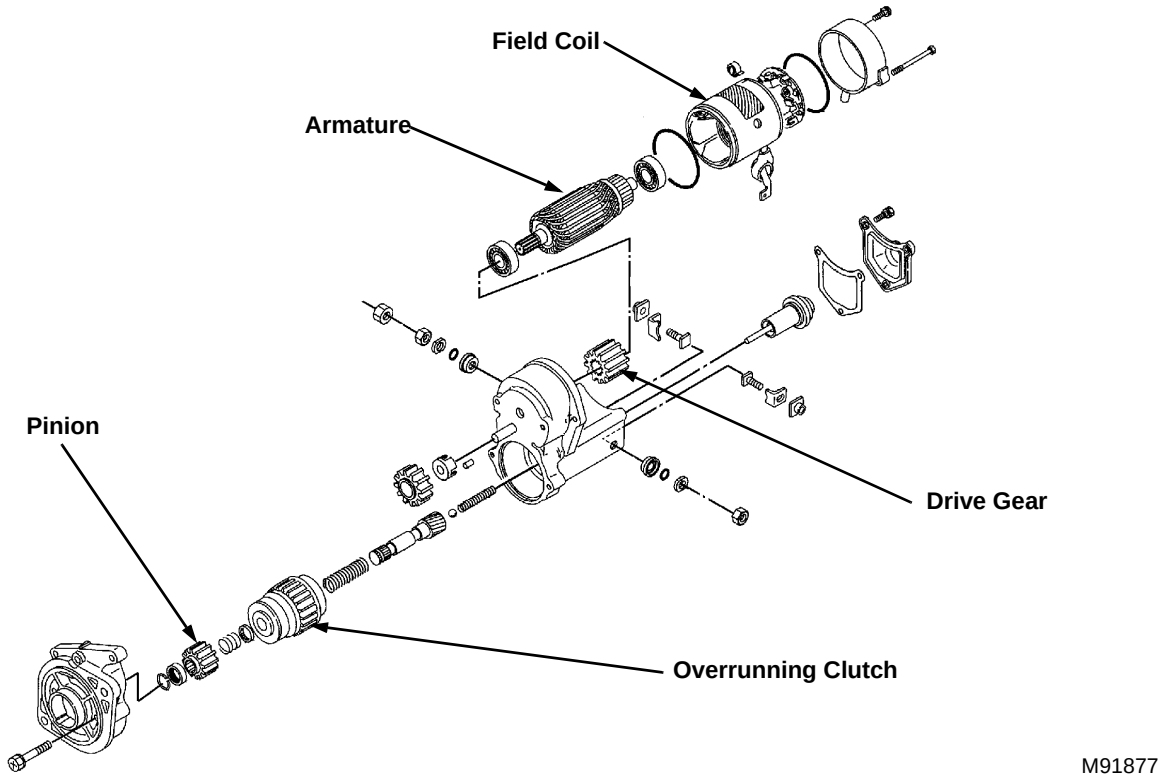
IMPORTANT: DO NOT overtighten the starting motor cap screws! Tighten the starting motor cap screws to 47 N•m (35 lb-ft).



STARTING MOTOR DISASSEMBLY AND ASSEMBLY



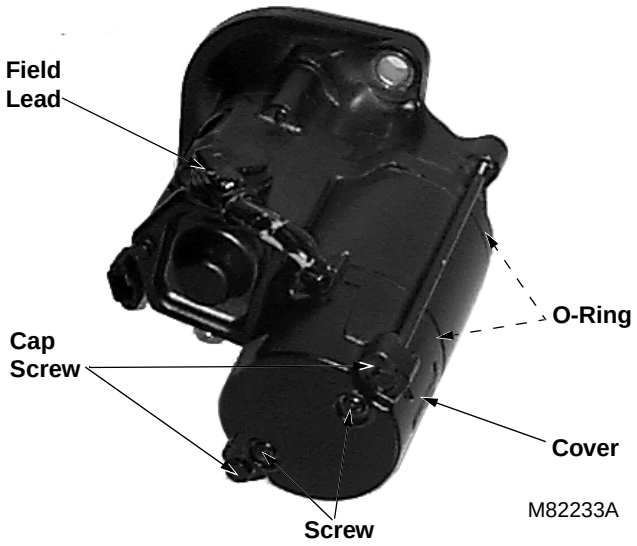
M94643



M91877

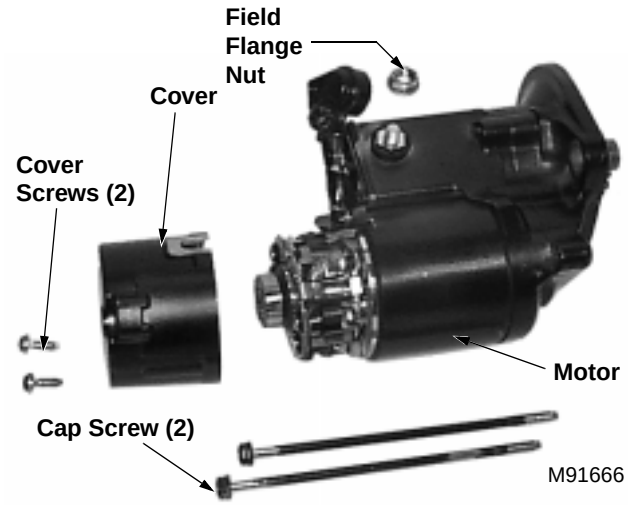
DISASSEMBLY:

1. Disconnect the field lead.
2. Remove the cover screws.
3. Remove the cap screws that secure the motor to the clutch housing.

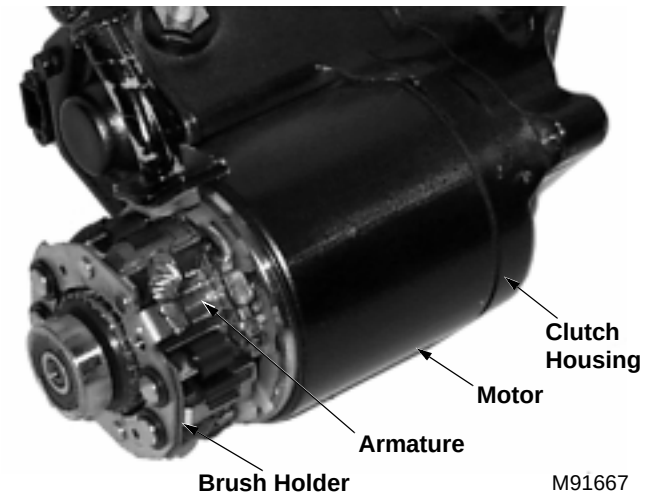


4. Separate the cover from the motor.

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

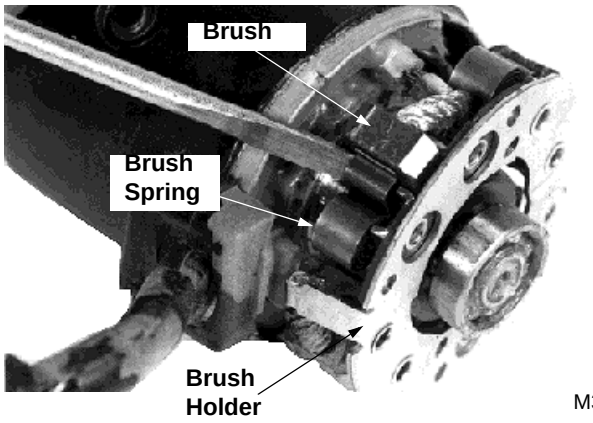


6. Remove motor, armature and brush holder as a unit from the clutch housing.



6. Pry the brush springs away and pull the negative brushes up enough to allow the springs to hold the brushes in place.Remove the brush holder.

7. Remove the armature from the field coil housing.



M36754

8. Remove the bearings from the armature.

NOTE: The bearings are press fit. Remove the bearings using a knife-edge puller.

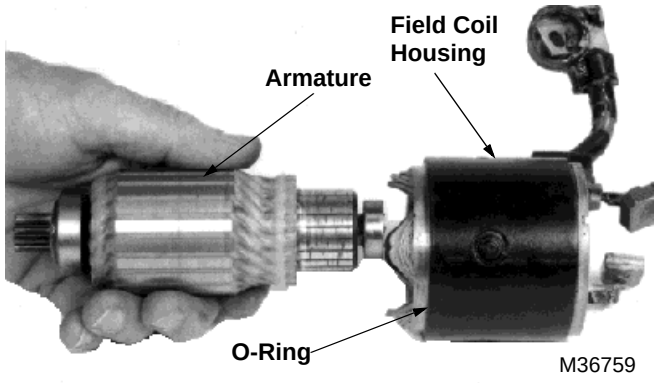
9. Install the bearings to the armature. See “REPLACE BEARINGS in this group.

10. Inspect and test the brushes, holder, field coil and armature. See “STARTING MOTOR INSPECTION/ TEST” in Section 220, Group 15.

ASSEMBLY:

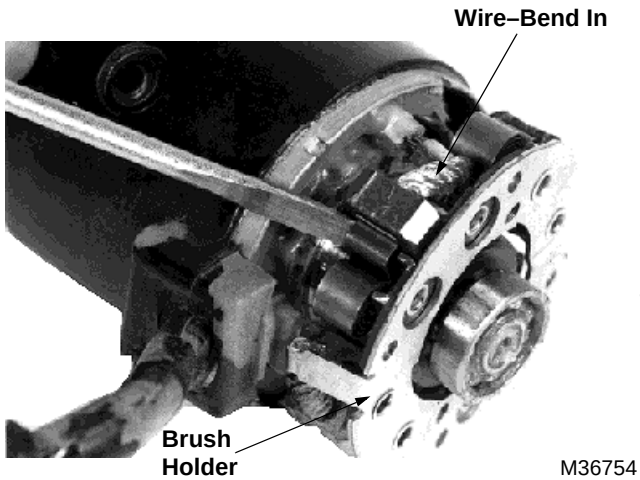
Assembly is done in the reverse order of disassembly.

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



M36759

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



M36754

STARTING MOTOR INSPECTION/TEST

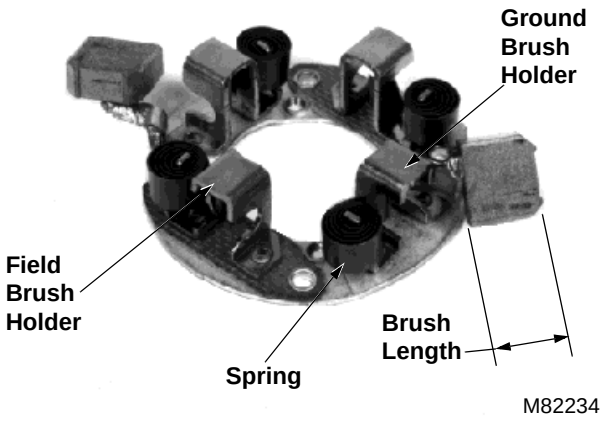
1. Measure brush lengths. Minimum brush length is **8.5 mm (0.335 in.)**. Replace brush if brush length is below minimum.

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

2. Test brush holder:

3. Touch one probe of tester to negative brush holder and other probe to field brush holder.

- If there is continuity, replace the brush holder.
- Inspect springs for wear or damage. Replace if necessary.



M82234

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

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

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

5. Test for open field coil:
•Touch one probe of tester to each field coil brush.
•If there is no continuity, the field coil is open and the field coil housing assembly must be replaced.

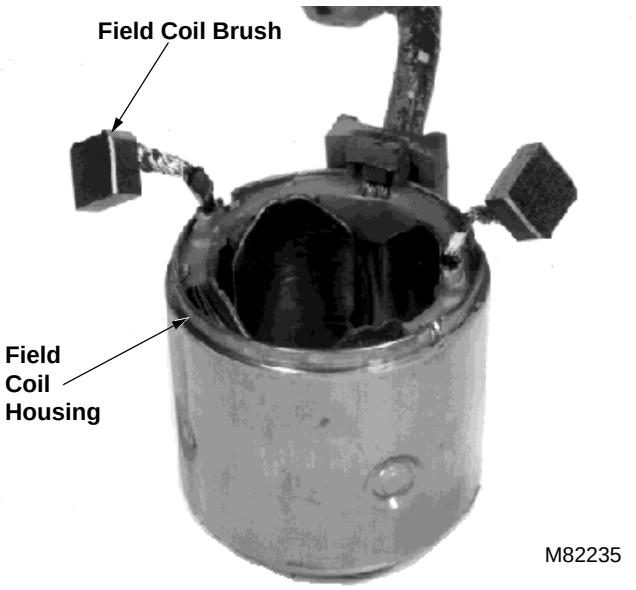
6. Inspect armature. Look for signs of dragging against pole shoes.

7. Inspect commutator. Look for roughness, burned bars, or any material which might cause short circuits between bars. If necessary, clean and touch up with 400 sandpaper. NEVER use emery cloth. Clean all dust from armature when finished.

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

8. Test for grounded windings:

- Touch probes on one commutator bar and armature shaft. Armature windings are connected in series, so only one commutator bar needs to be checked.
- If test shows continuity, a winding is grounded and the armature must be replaced.

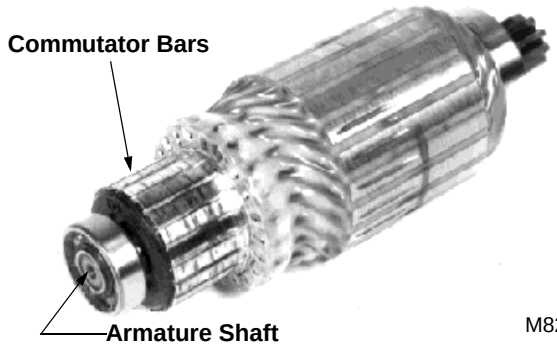


M82235

9. Test for open circuit windings:

• Touch probes on two different commutator bars.

•If test shows no continuity, there is an open circuit and the armature must be replaced.



M82236

10. Test for short circuit windings using a growler.

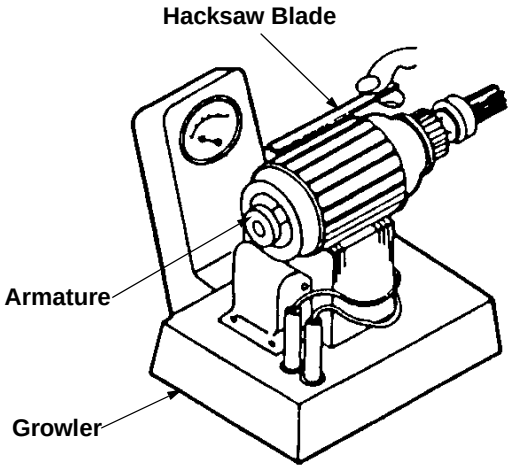
• Put armature in a growler and hold a hacksaw blade above each slot while slowly rotating armature.

• If coil is shorted, the blade will vibrate on the slot.

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

11. If test indicates short circuit windings, clean the commutator of dust and filings. Check the armature again. If the test still indicates a short circuit, replace the armature.

12. Inspect armature cover and housing bearings for wear or damage. Replace if necessary.



M82125A

REPLACE BEARINGS:

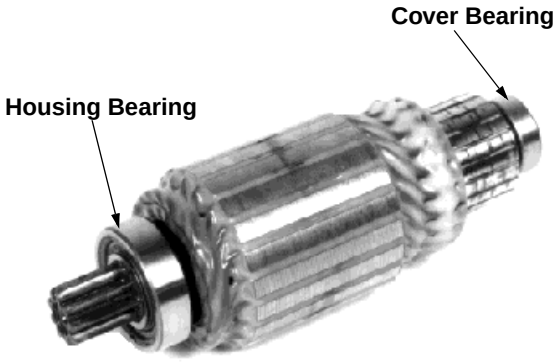
1. Remove the bearings using a knife-edge puller set.

NOTE: The bearings are press fit.

2. Install a new housing bearing tight against the shoulder of the shaft using a piece of pipe.

3. Install a new cover bearing tight against the shoulder of the shaft using a driver set.

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



M82237

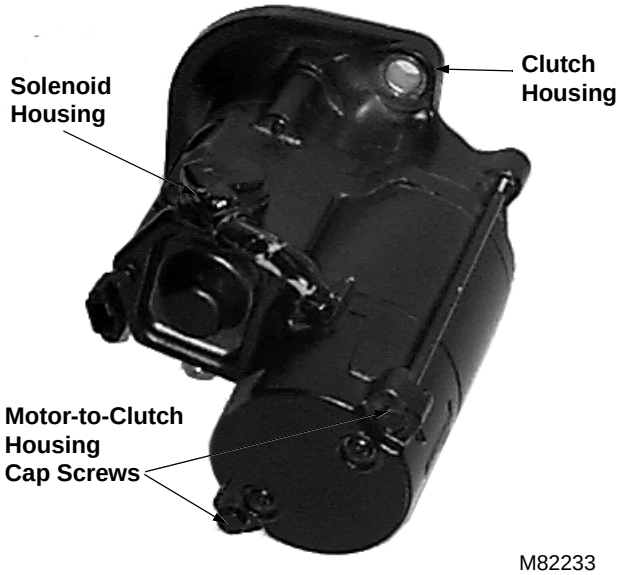
STARTING MOTOR GEAR TRAIN

Disassembly/Inspection:

1. Remove the motor from the clutch housing.

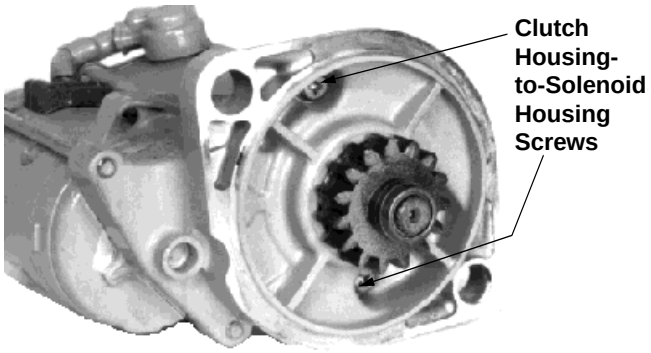
• Remove the field wire and two motor-to-clutch housing cap screws.

• Remove two cap screws attaching the motor to the clutch housing.



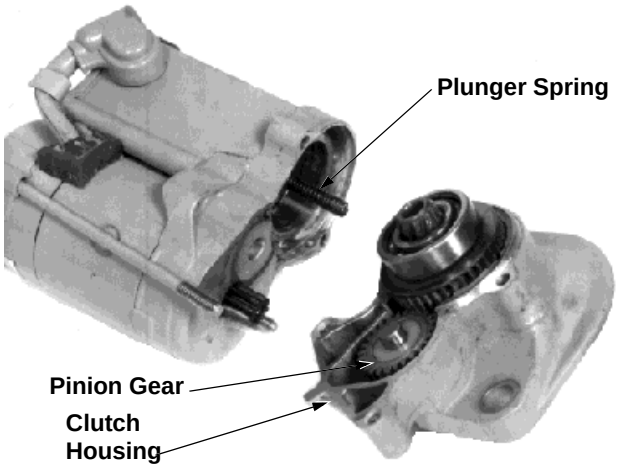
M82233

2. Remove two clutch housing-to-solenoid housing screws to separate the clutch housing from the solenoid/motor assembly.



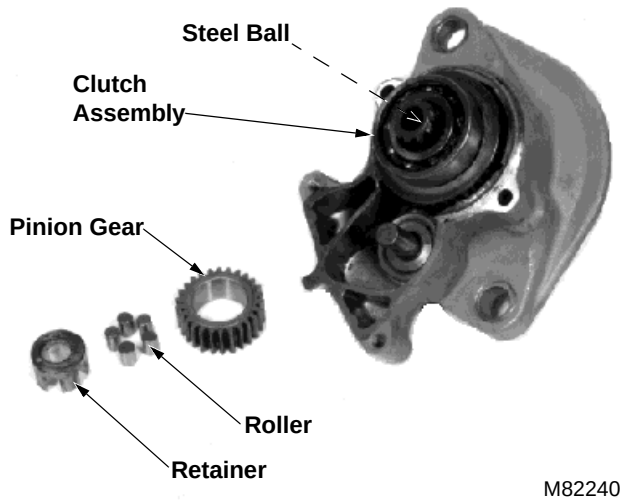
M82238

3. Remove the plunger spring.



M82239

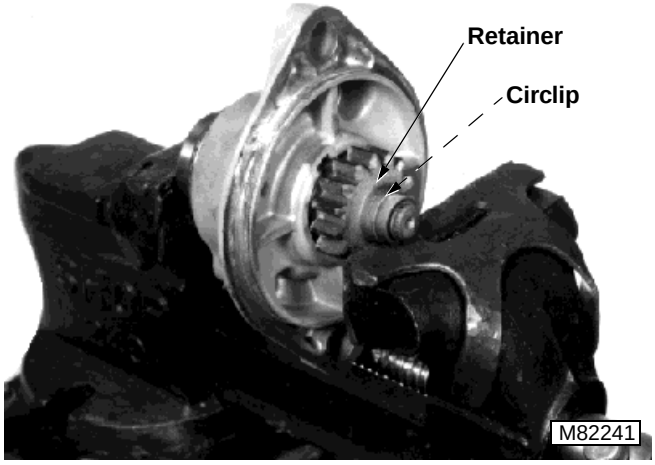
4. Remove the retainer, five rollers and pinion gear.
5. Remove the steel ball.



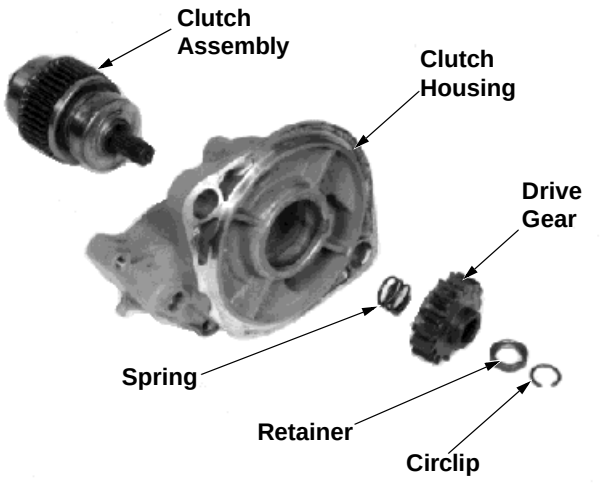
6. Put the clutch housing assembly into a soft-jawed vice, as shown.
7. Tighten the vise slowly, until the drive gear compresses.
8. Remove the retainer and circlip.

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

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



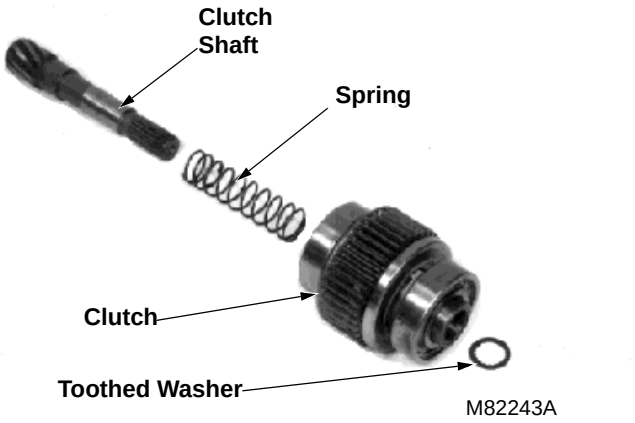
NOTE: The starting motor clutch assembly has no serviceable components. The following steps will allow a technician to disassemble the clutch assembly to determine serviceability. If any of the components are worn or damaged the starting motor must be replaced



10. Remove the drive gear, spring and clutch assembly from the housing.Remove the toothed washer, spring and clutch shaft.

11. Inspect all parts for wear or damage.

12. Remove the drive gear, spring, and clutch assembly from the housing.

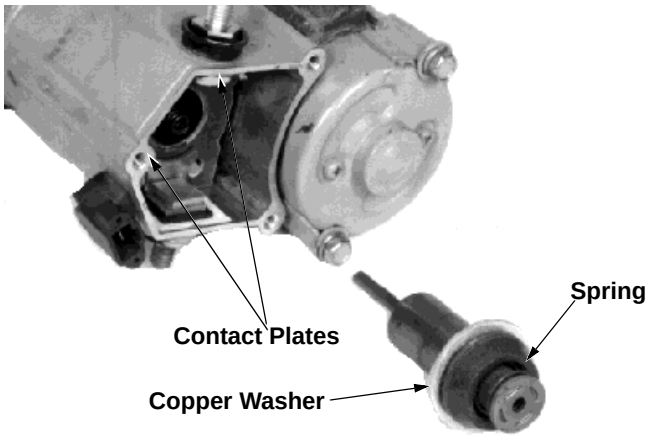


STARTING MOTOR SOLENOID

NOTE: The solenoid is the same for both models 1.4 kW and 2.0 kW starting motors.

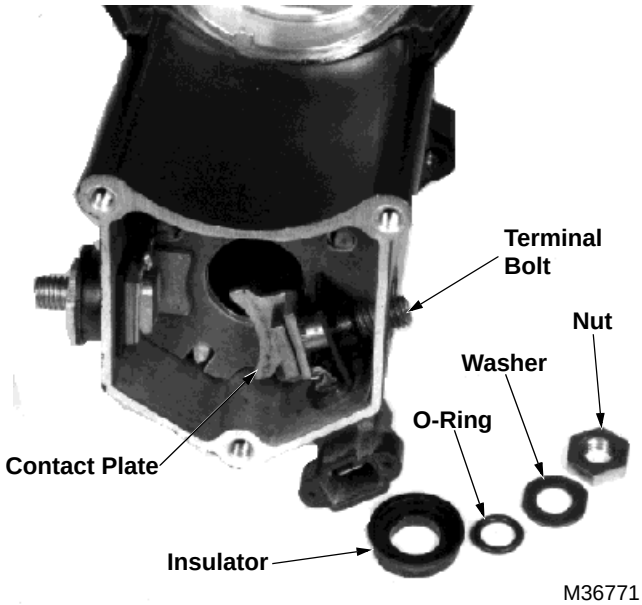
DISASSEMBLY/INSPECTION:

1. Disconnect the field lead.
2. Remove three screws, the cover and gasket.
3. Remove the plunger.



4. Disassemble the terminals and contact plates. Remove the parts from each terminal in order shown.

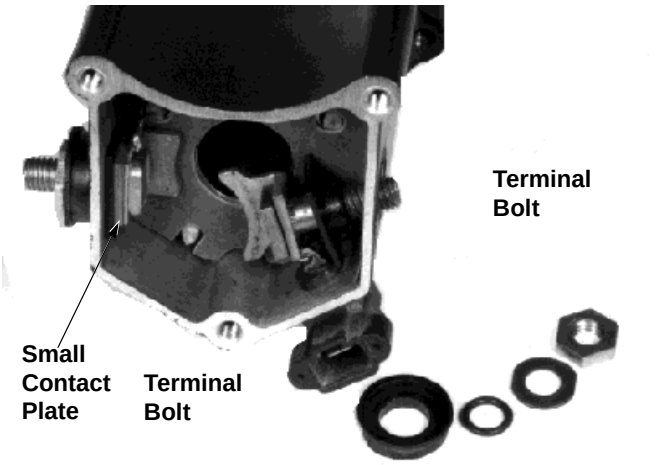
5. Inspect the copper washer and contact plates for excessive burning or pitting. Clean burnt areas to improve electrical contact. Replace the contacts or plunger if necessary. The solenoid is not serviceable. If defective, replace the solenoid housing assembly.



ASSEMBLY:

Assembly is done in the reverse order of disassembly.

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

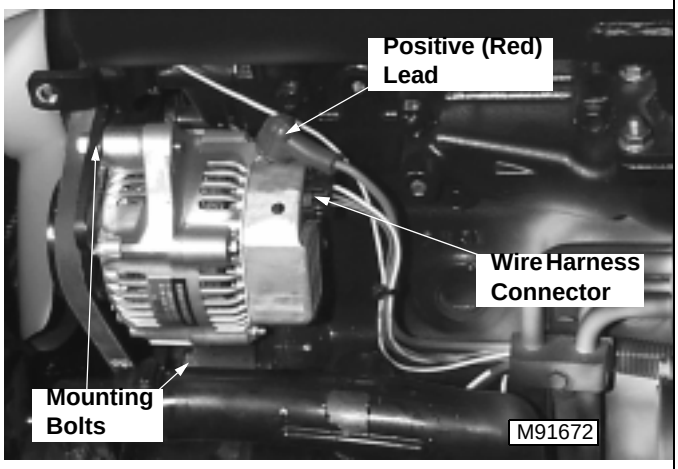


ALTERNATOR REMOVAL AND INSTALLATION

Removal:

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

1. Remove the negative cable from the battery.
2. Remove the left side panels as required to access the alternator.
3. Lift the plastic protective cover from the positive (red) lead. Remove the nut and washer, and remove the lead from the alternator stud.
4. Remove the wire harness connector from the alternator and move the wiring harness to the side
5. Remove the mounting bolts. Remove the alternator.



INSTALLATION:

Installation is done in the reverse order of removal.

• Tighten the drive belt. See “FAN//ALTERNATOR DRIVE BELT ADJUSTMENT” in Section 220, Group 15.

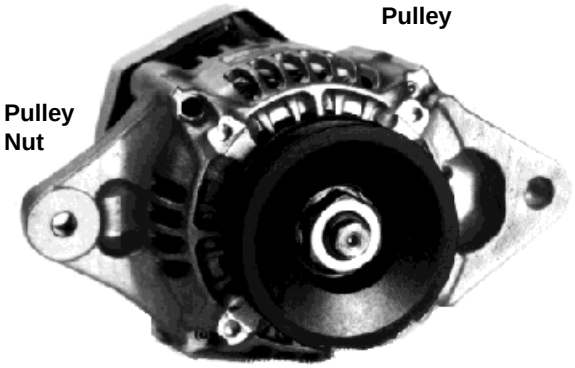
ALTERNATOR DISASSEMBLY

EQUIPMENT:

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

SPECIFICATIONS:

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



M52469

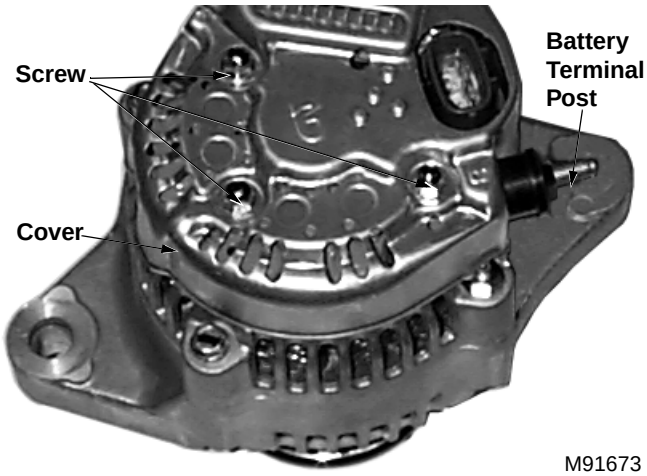
DISASSEMBLY:

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

1. Remove the pulley nut and pulley.

2. Remove the nut, washer and insulator from the battery terminal post.

3. Remove three screws securing the cover to the body. Remove the cover.

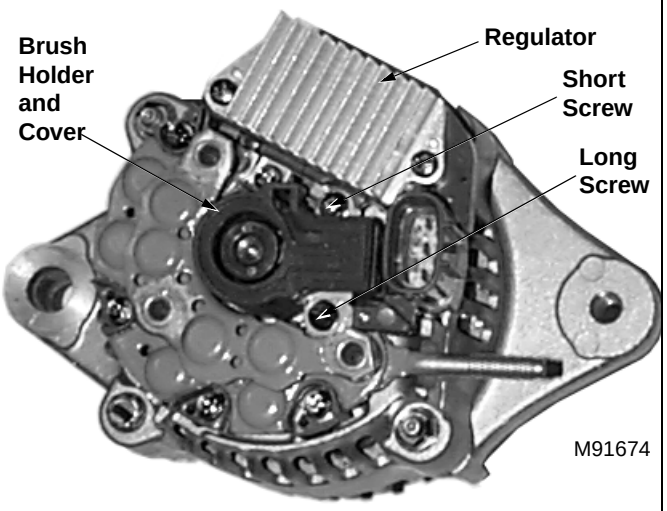


M91673

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

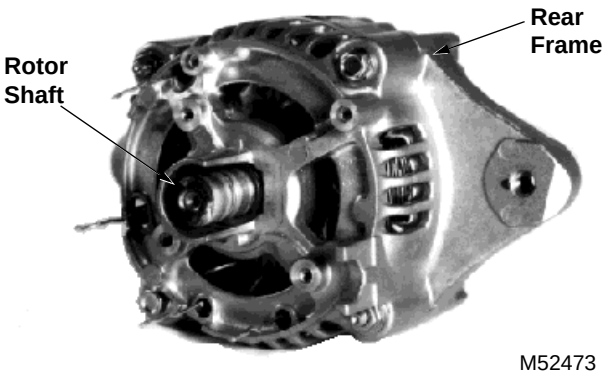
NOTE: Remember the location of the short screw on the regulator tab.

5. Remove the three screws securing the voltage regulator to body. Remove the voltage regulator.

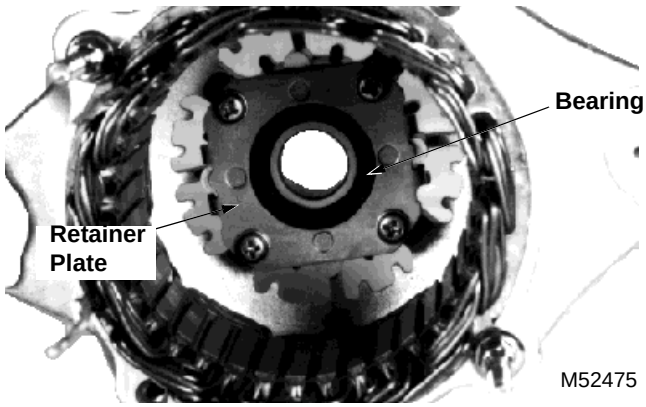


M91674

6. Remove four screws and straighten the wire leads.
7. Remove the rectifier.
8. Remove the rear case assembly.
9. Press the rotor shaft from the rear case.

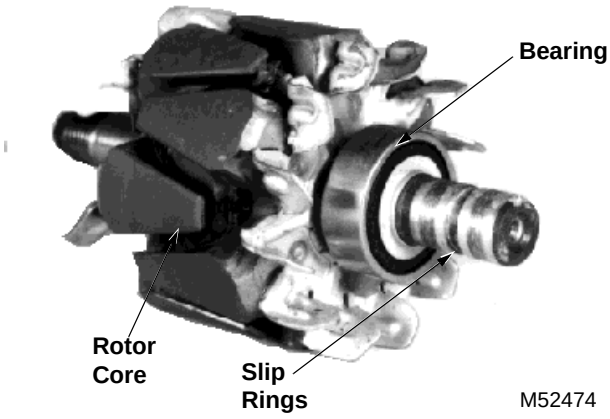


10. Remove the retainer plate.
11. Press the standard bearing from the case.



INSPECTION:

1. Inspect the bearing for smooth rotation. Replace if necessary.



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

5. Check for continuity between the slip rings and the rotor core. Replace the rotor assembly if there is continuity.

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

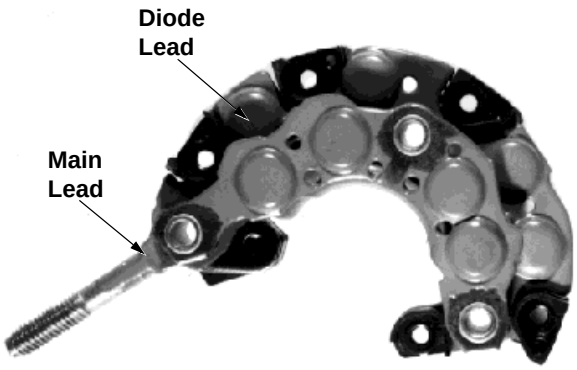
6. Inspect the stator for defective insulation, discoloration, or burned odor.

7. Check for continuity between each of the four stator leads and the body. Replace the frame assembly if there is continuity.

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

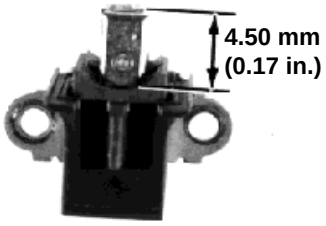
NOTE: Set the ohmmeter to the K ohm range.

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



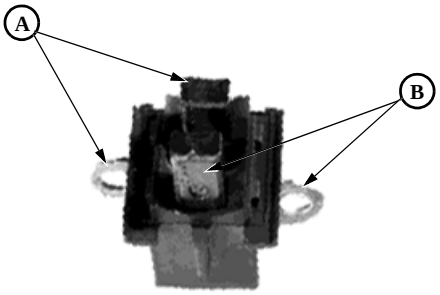
M52477

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



M52478

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



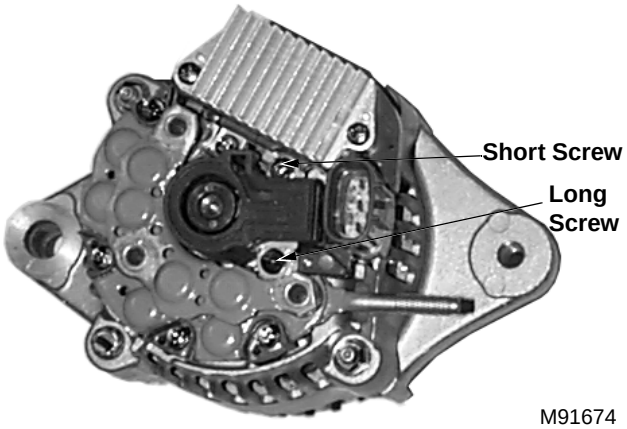
M52479

ASSEMBLY:

Assembly procedure is the reverse of disassembly.

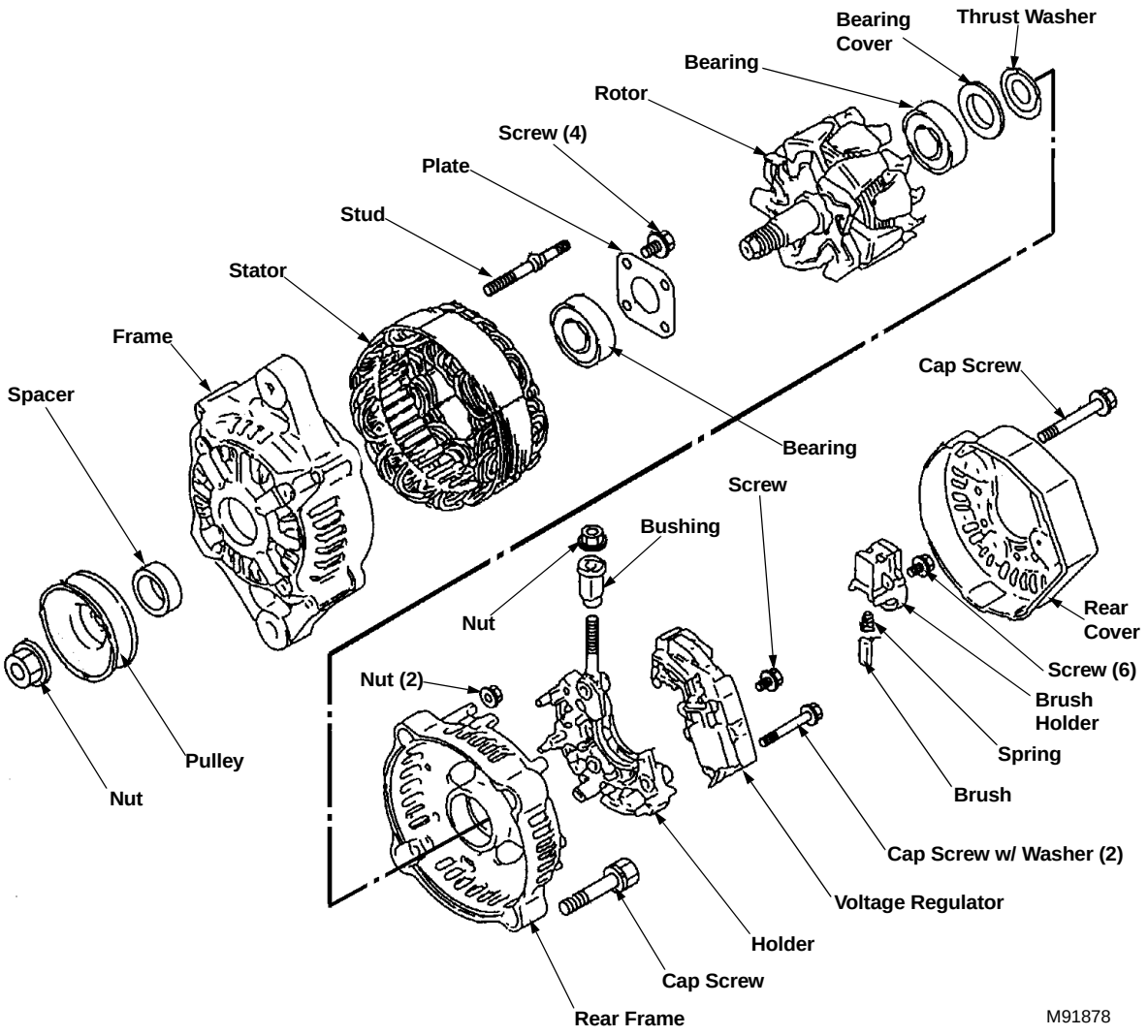
IMPORTANT: Check that the rotor fan does not contact the case, and that the rotor assembly turns smoothly in the bearing.

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



M91674

ALTERNATOR COMPONENTS



M91878

REMOVE, INSPECT AND INSTALL RADIATOR

1. Remove engine side shields.

2. On 670/770/790: Remove muffler.



TS225

CAUTION: 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 top first stop to relieve pressure before removing completely.

NOTE: Radiator capacity is approximately:
670—3.8 L (4.0 qt)
770—4.8 L (5.1 qt)
790—4.8 L (5.1 qt)
870—5.2 L (5.5 qt)
970/1070—5.8 L (6.1 qt)

3. Drain coolant.

4. Remove air cleaner hose and radiator hoses. Close all openings with caps and plugs.

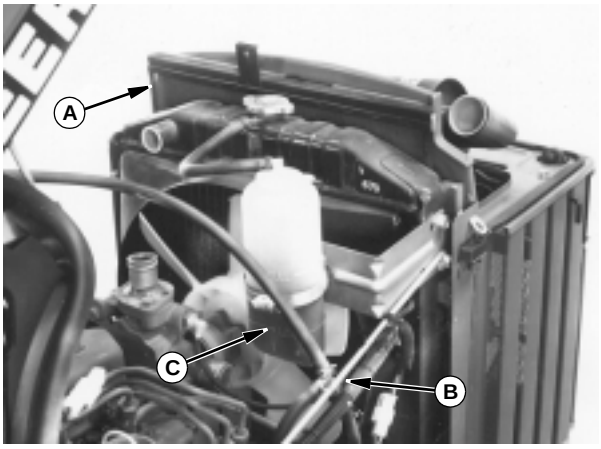
5. Remove screen (A).

6. Remove support(s) (B).

7. Remove recovery tank assembly (C).

8. Remove fan shroud and place over engine.

9. Remove radiator mounting nuts and radiator.



M53096

670 Shown

10. Inspect support cushions (A) for excessive wear or damage. Replace if necessary.

CAUTION: Reduce compressed air to less than 210 kPa (2 bar) (30 psi) when using for cleaning purposes. Clear area of bystanders, guard against flying chips, and wear personal protection equipment including eye protection.

11. Check radiator for debris lodged in fins. Clean radiator using compressed air or pressure washer.

12. Inspect radiator for bent fins, cracks and damaged seams. Repair as necessary.

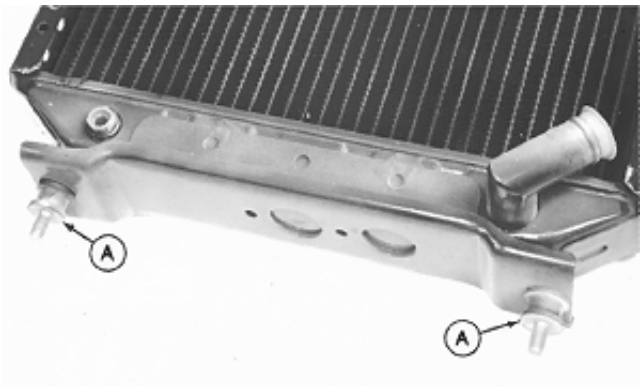
13. Install radiator.

14. Install fan shroud, recovery tank assembly, support(s), screen and muffler.

15. Install all hoses.

16. Install drain plug and fill radiator with proper coolant to top of filler neck. (See Engine Coolant in Section 10, Group 20.)

17. Start engine and allow it to reach proper operating temperature. Check radiator, hoses and connections for leaks. Recheck coolant level.



M53097 -UN-18JUL89

MX,2010DG,A2 -19-11MAY89

INSPECT AND REPAIR THROTTLE CONTROL LINKAGE

1. Remove right-hand engine shield.

2. On 670/770/790: Remove dash cover and right-hand lower dash cover.

3. On 870/970/1070: Remove dash, lower dash and clutch housing covers.

4. Disconnect control rod (A) and spring (B).

5. Remove throttle lever control assembly (D).

6. On 670/770/790: Remove e-clip and foot pedal (E).

7. On 870/970/1070: remove shoulder bolt and foot pedal.

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

9. Inspect friction disk (F) for cracks, glazing or excessive wear. Replace if necessary.

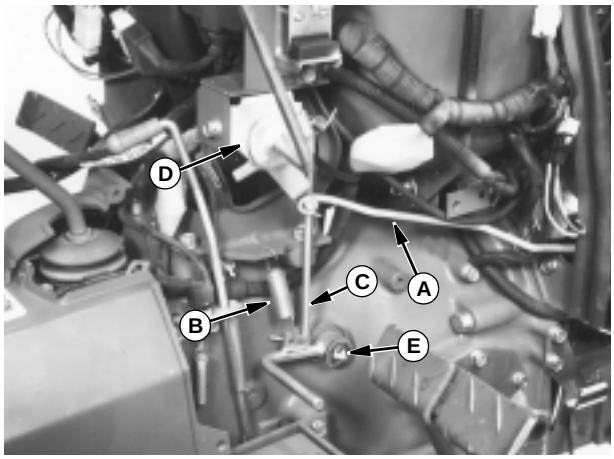
10. Assemble throttle lever control.

11. Install lever and foot control assemblies.

12. Connect control rod and spring.

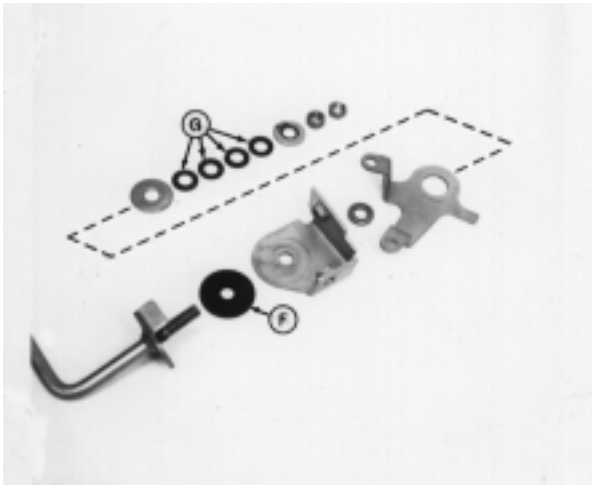
13. Adjust throttle control linkage. (See Section 220, Group 15.)

14. Install covers and engine shield.



M53098

670 Shown



M53099

A—Control Rod

B—Spring

C—Throttle Link

D—Throttle Lever Control Assembly

E—Foot Pedal

F—Friction Disk

G—Conical Washer

INJECTION PUMP, NOZZLE AND GOVERNOR REPAIR—USE CTM-3

670, 770, 870, 970, 1070—For complete repair information the component technical manual (CTM) is also required.

Use the component manual in conjunction with this machine manual.

790—For complete repair information see group 7 in this section.

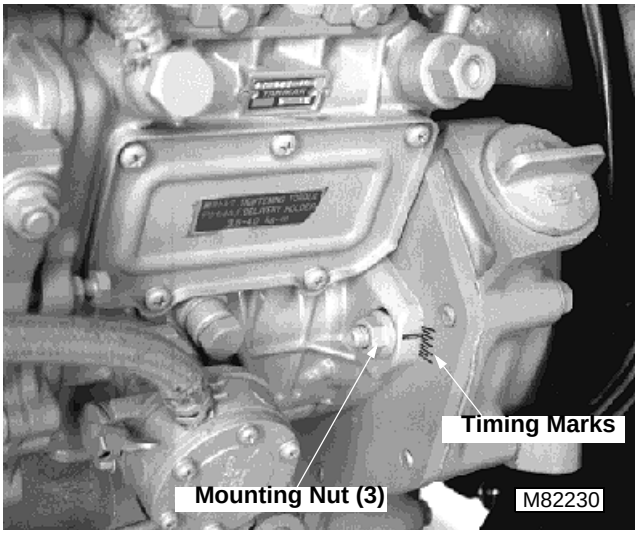
FUEL INJECTION PUMP

REMOVAL

CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Avoid the hazard by relieving pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure. Search for leaks with a piece of cardboard. Protect hands and body from high pressure fluids. If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury may call the Deere & Company Medical Department in Moline, Illinois, or other knowledgeable medical source.

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

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

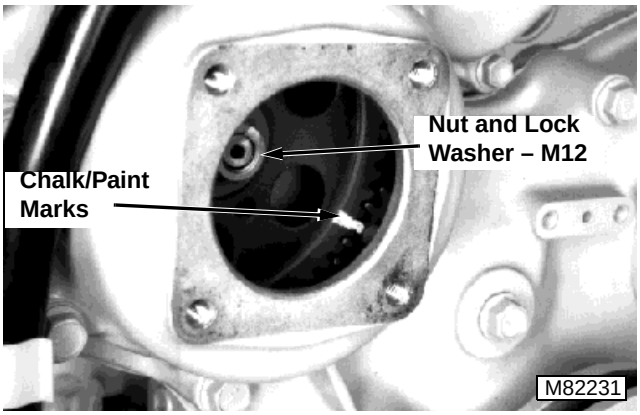


8. Remove three mounting nuts.

9. Remove four cap screws, washers, the cover and gasket.

10. Use chalk or paint to mark the injection pump gear to the idler gear.

11. Remove the nut and lock washer.



12. Use a puller to remove the gear from the injection pump shaft.

13. Remove the injection pump and O-ring.

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

INSTALLATION:

1. Install a new O-ring to the injection pump.

2. Put the injection pump onto the back of the gear cover mounting plate. Align the key on the shaft with the keyway in the gear. Be sure to align the marks on gears made during removal.

3. Install lock washer and nut. Tighten to specification.

4. Install a new gasket, cover, four washers and cap screws.

5. Install three mounting nuts. Do not tighten.

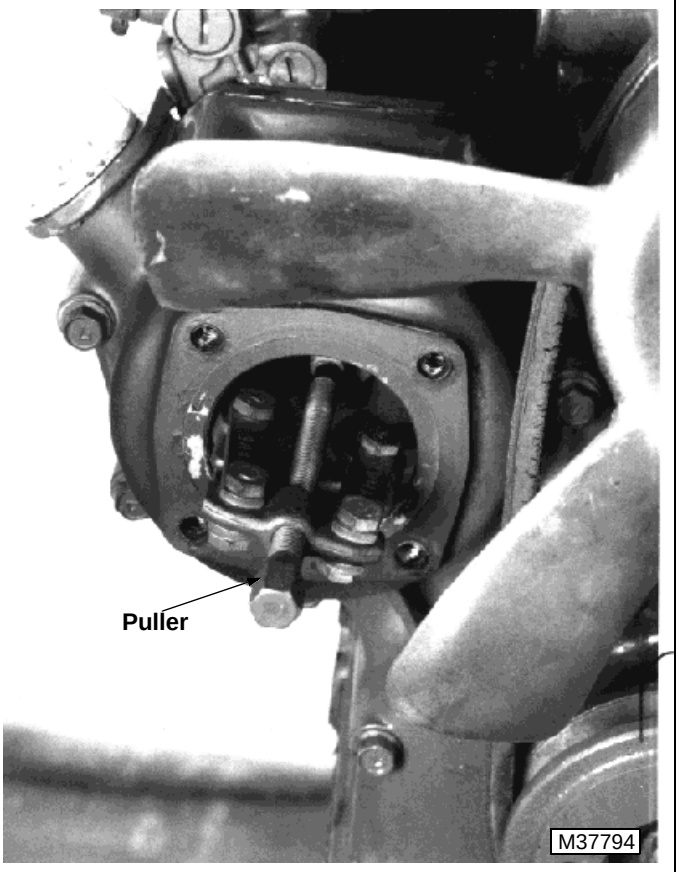
6. Align the timing marks on the mounting plate and injection pump to the same place as when removed. Tighten the mounting nuts to specifications.

7. Connect the fuel shutoff solenoid link.

8. Connect the fuel filter hoses.

9. Install fuel injection lines and tighten line clamp cap screws.

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



10. Remove the fill plug and add clean engine oil to the housing. Add until the oil begins to drip out of external lube line inlet.

11. Install the external lube line. When installing the line, put one copper washer between the mounting bolt head and lube line and the other between the lube line and housing.

12. If a new injection pump is being installed, check and adjust injection pump static timing.

FUEL INJECTION NOZZLES

REMOVAL

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

1. Clean the injection pump lines and area around the pump using a parts cleaning solvent or steam cleaner.

CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Avoid the hazard by relieving pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure. Search for leaks with a piece of cardboard. Protect hands and body from high pressure fluids. If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury may call the Deere & Company Medical Department in Moline, Illinois, or other knowledgeable medical source.

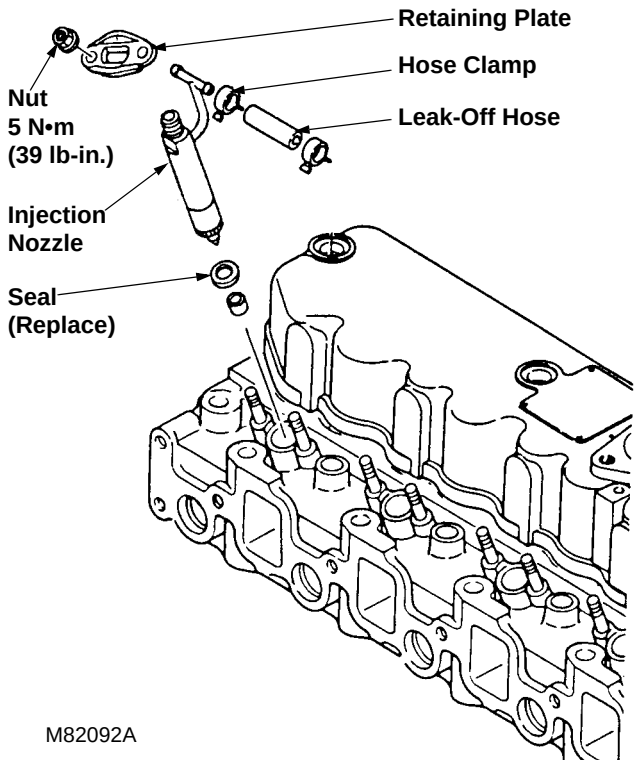
NOTE: The nozzles are matched to the cylinders. If removing more than one nozzle, tag the nozzles, according to the cylinder from which it was removed.

2. Loosen the fuel injection line connectors-to-nozzles slightly to release pressure in the fuel system.

3. Loosen the clamp(s) and remove the fuel injection lines.

4. Remove the clamps and leakoff hoses.

5. Remove the nuts and retaining plates.



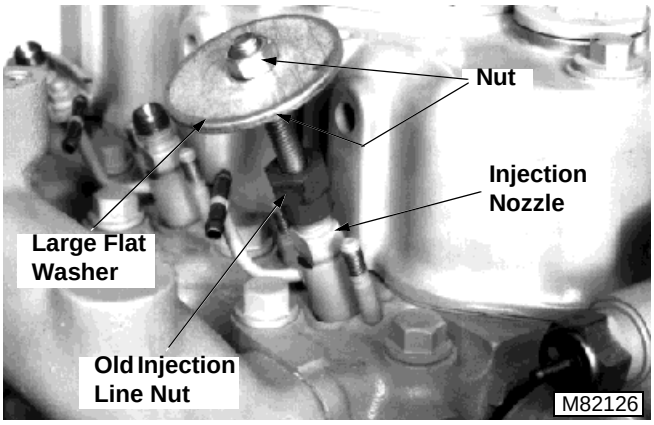
M82092A

6. Remove the injection nozzle, seat and seal. If the seat and seal stay in the cylinder head, thread a cap screw into the seat and pull it from cylinder head.

If any nozzles are stuck in the cylinder head:

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

7. Test the injection nozzles. See “FUEL INJECTION NOZZLE TEST” in Section 220, Group 15.



INSTALLATION

Installation is done in the reverse order of removal.

- Install a new seat and seal when installing injection nozzles.

DISASSEMBLY/ASSEMBLY:

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

1. Remove the retaining nut and disassemble the internal parts of the injection nozzle. Keep the parts organized for ease of assembly.

2. Clean and inspect the nozzle assembly. See “FUEL INJECTION NOZZLES” on page 57.

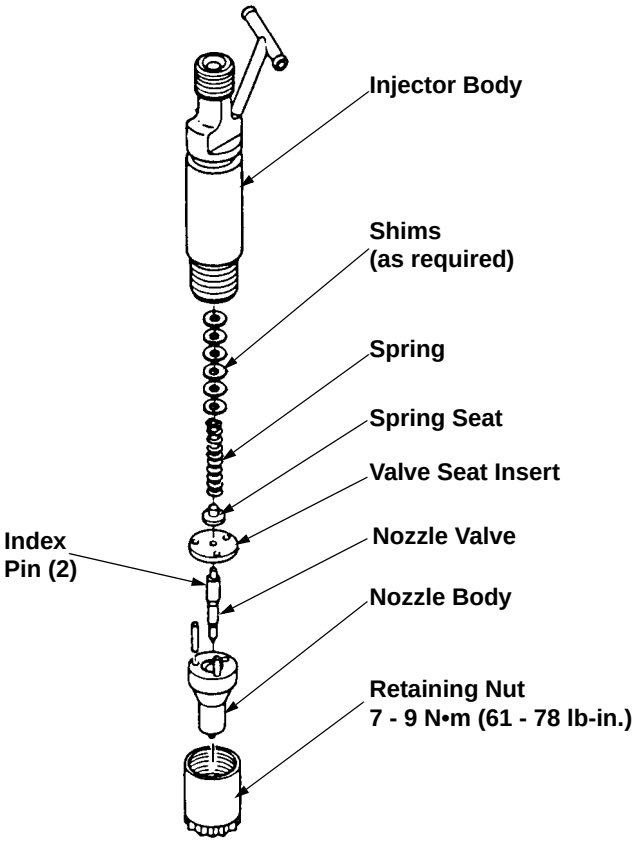
3. Carefully clamp the injector body in a soft-jaw vice.

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

4. Reassemble the fuel nozzle in the order shown above.

5. Tighten the retaining nut to **7 - 9 N•m (61 - 78 lb-in.)**.

6. After assembly is complete, test the injection nozzle. See “FUEL INJECTION NOZZLE TEST” in Section 220, Group 15.



CROSS SECTION

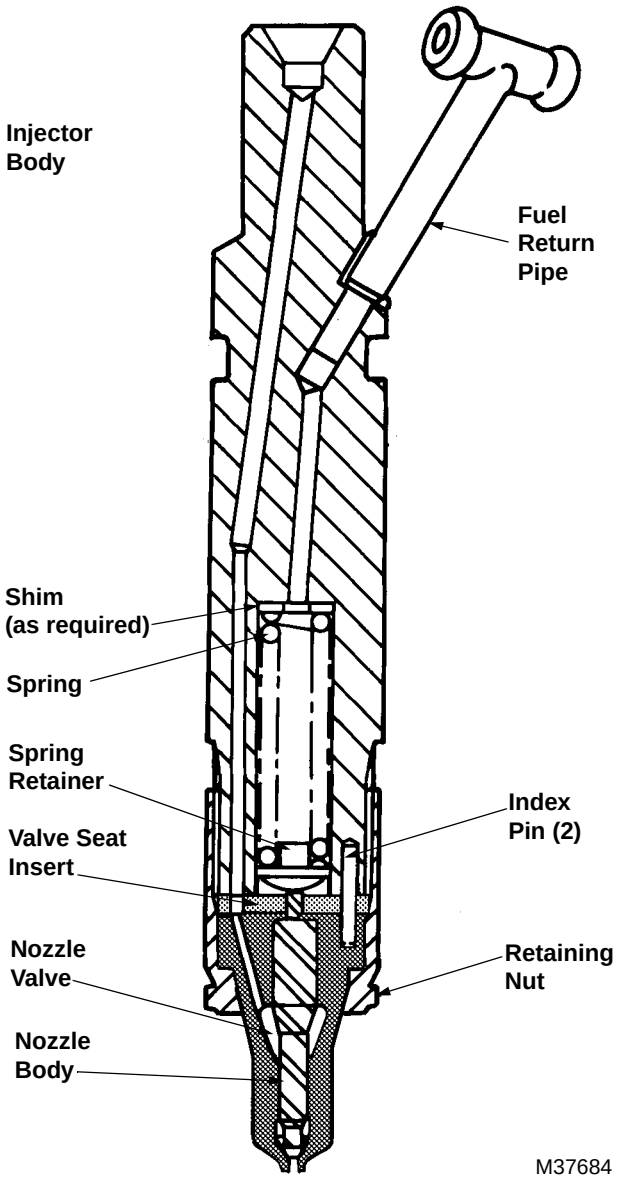
CLEANING/INSPECTION:

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

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

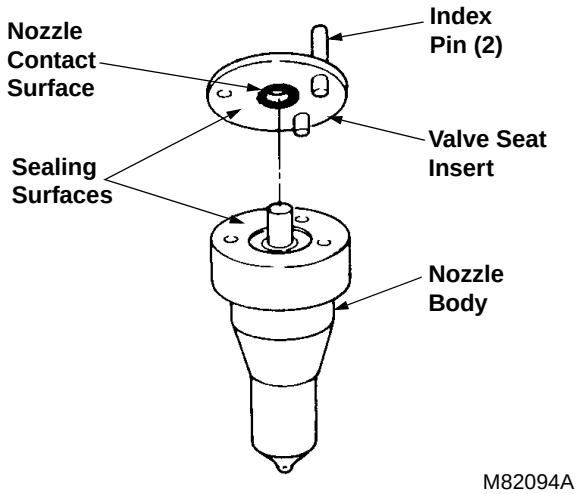
IMPORTANT: Never use a steel brush to clean nozzles as this will distort the spray hole.

2. Remove any carbon from used nozzles, and clean the nozzles by washing in diesel fuel. If parts are coated with hardened carbon or lacquer, it may be necessary to use a brass wire brush (supplied in Nozzle Cleaning Kit).



3. After removing carbon or lacquer from the exterior of nozzle, inspect the sealing surfaces between the valve seat insert and the nozzle body for nicks or scratches.

4. Inspect the condition of the valve seat insert and nozzle body. The contact area of the valve seat insert (both parts) must not be scored or pitted. Use an inspection magnifier (No. 16487 or equivalent) to aid in making the inspection.



5. Inspect the piston (large) part of the nozzle valve to see that it is not scratched or scored and that the lower (tip) end of the valve is not broken. If any of these conditions are present, replace the nozzle assembly.

6. Further inspect the nozzle assembly by performing a slide test. Use the following procedure:

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

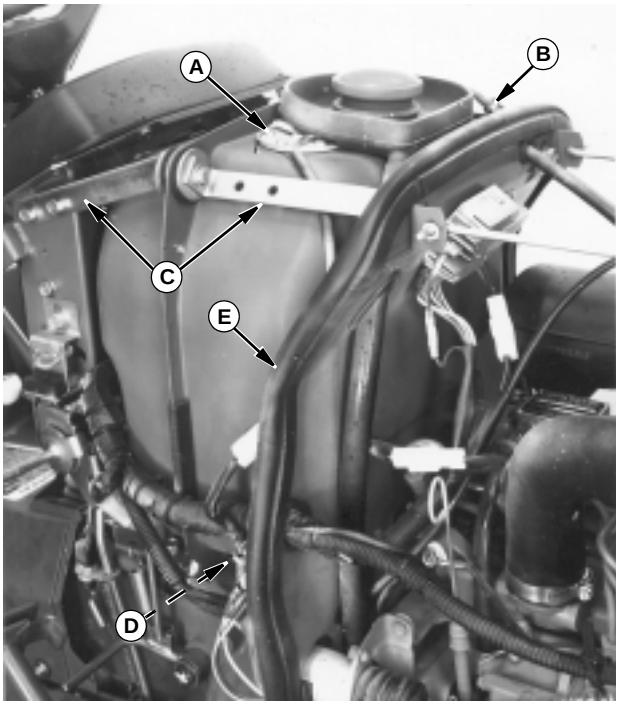
Replace the nozzle assembly if the valve does not slide freely to its seat.

REMOVE, INSPECT AND INSTALL FUEL TANK—670/770/790

1. Remove hood. (See Section 80, Group 15.)
2. Remove engine side shields and lower dash covers.

NOTE: Fuel tank capacity is 24 L (6.3 U.S. gal).

3. Close shut-off valve at fuel filter. Disconnect fuel line from fuel filter and drain fuel tank.
4. Disconnect wiring leads (A) and return hose (B). Close all openings with caps and plugs.
5. Remove brackets (C) and cap screws (D).
6. 770/790 Tractor: Remove air shield (E).
7. Loosen 4 steering column bolts.
8. Pull steering column toward seat and remove fuel tank.
9. Inspect rubber isolators on top and bottom of tank for excessive wear or damage. Replace if necessary.
10. Install fuel tank and brackets.
11. 770/790 Tractor: Install air shield.
12. Connect hoses and wiring leads.
13. Install engine side shields, lower dash covers and hood.
14. Fill fuel tank with proper fuel. (See Section 10, Group 20.)



M53100

A—Wiring Leads
B—Return Hose
C—Support Brackets
D—Cap Screws
E—Air Shield

REPLACE FUEL SUPPLY PUMP

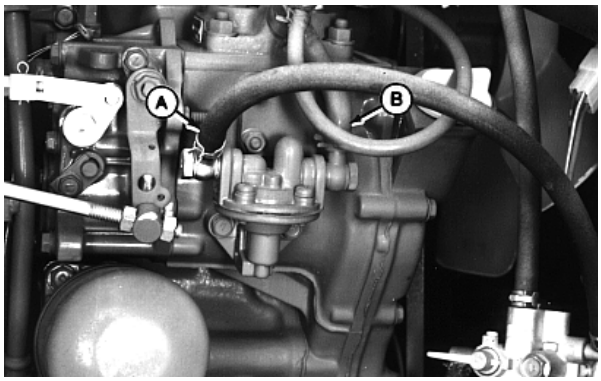
1. Remove right-hand engine shield.
2. On 670/770: Close shut-off valve at fuel filter.

On 790/870/970/1070: Close shut-off valve at fuel/water separator and fuel filter.

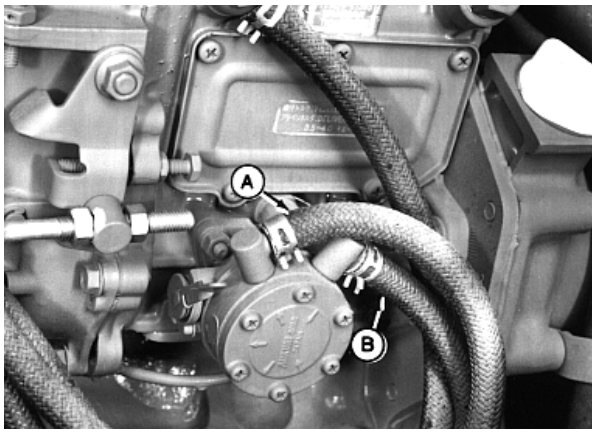
3. Disconnect hoses (A and B). Close all openings with caps and plugs.
4. On 670: Remove two capscrews and fuel supply pump.

On 770/790/870/970/1070: Remove two nuts, lock washers, and fuel supply pump.

5. Install fuel -supply pump with new gasket.
6. Open shut-off valve at fuel filter (s).



670 Shown



870/970/1070 Shown 770/790 Similar

REPLACE FUEL SHUT-OFF SOLENOID

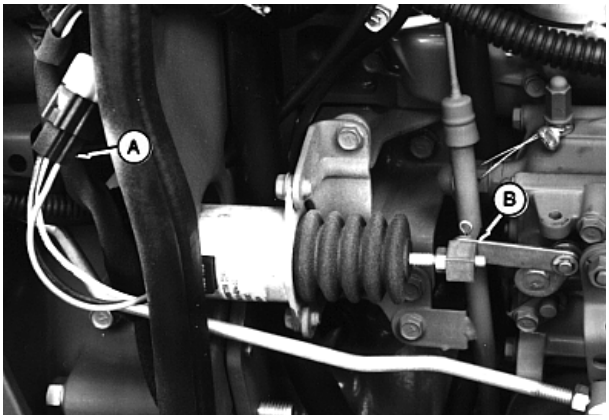
1. Remove right-hand engine shield.
2. On 870/970/1070: Remove fuel filter.

NOTE: 790 Fuel Shut-Off Solenoid—Do not disconnect wiring connector or linkage. Remove capscrews to remove solenoid.

3. On 670/770/870/970/1070: Disconnect wiring connector (A) and link (B).
4. Remove bracket capscrews and remove fuel shut-off solenoid.
5. Install solenoid and connect wiring connector and link.

NOTE: 790 Fuel Shut-Off Solenoid does not require adjustment.

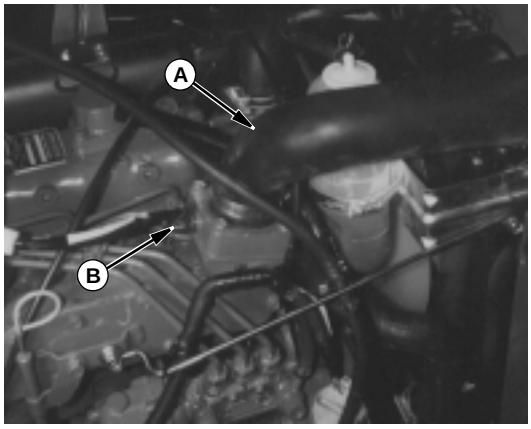
6. 670/770/870/970/1070: Adjust fuel shut-off solenoid linkage (see Section 240, Group 15).
7. On 870/970/1070: Install fuel filter.



670 Shown

REPLACE INTAKE AIR HEATER—770/790/870/970/1070

1. Remove right-hand engine shield.
2. Disconnect air cleaner hose (A). Close all openings with caps and plugs.
3. Disconnect wiring lead (B).
4. Remove four cap screws and intake air heater.
5. Install intake air heater and new gasket.
6. Connect wiring lead and hose.



790 Shown

Section 40
ELECTRICAL SYSTEM

Contents

Page

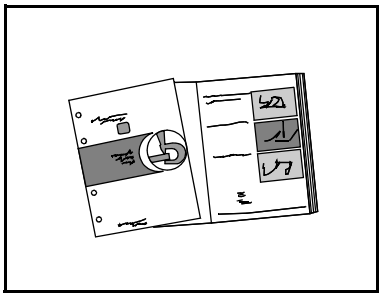
Group 05—Alternator
Alternator Repair 40-05-1
Remove and Install Alternator 40-05-1
Replace Voltage Regulator 40-05-1

Group 10—Starter

Starter Repair 40-10-1
Remove and Install Starter 40-10-1

Group 15—Senders, Switches and Gauges
Replace
- Fuses 40-15-1
- Seat Safety Switch 40-15-1
- Transmission Neutral Start Switch 40-15-2
- Rear PTO Neutral Start Switch 40-15-2
- Mid Mount PTO Neutral Start Switch—670/770/790 40-15-2
- Mid Mount PTO Neutral Start Switch—670/770/790 40-15-3
- Key Switch 40-15-3
- Park Brake Indicator Switch 40-15-4
- Coolant Temperature Switch 40-15-4
- Engine Oil Pressure Switch 40-15-5
- Fuel Level Sensor—670/770/790 40-15-5
- Fuel Level Sensor—870/970/1070 40-15-5
- Light Switch 40-15-6
- Instrument Indicator Lamps 40-15-6
- Instrument Panel 40-15-7

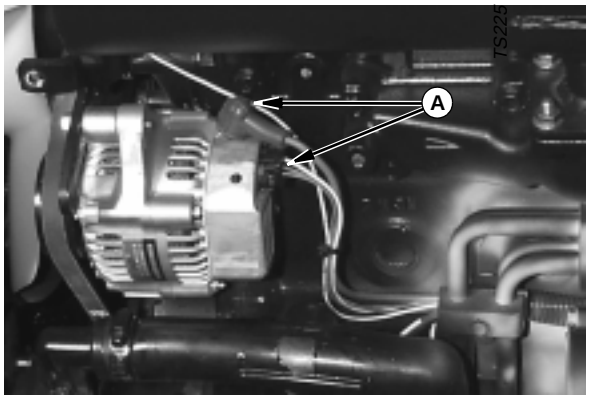
ALTERNATOR REPAIR



For complete alternator repair information on the 660/770/870/970/1070, use the component technical manual CTM-3. Additional information can be found in Section 240 of this manual.

For complete alternator repair information on the 790 tractor, see Sections 20 and 240 in this manual.

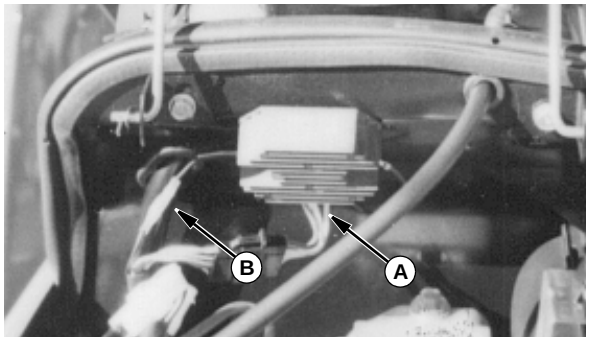
REMOVE AND INSTALL ALTERNATOR



790 Shown

1. Disconnect negative (-) battery cable.
2. Remove left-hand engine shield.
3. Disconnect wiring harness (A).
4. Remove alternator.
5. Make repairs as necessary. (See CTM-3.)
For 790, see Sections 20 and 240.
6. Install alternator.
7. Connect wiring harness and battery cable.
8. Adjust fan belt tension. (See Section 220, Group 15.)

REPLACE VOLTAGE REGULATOR



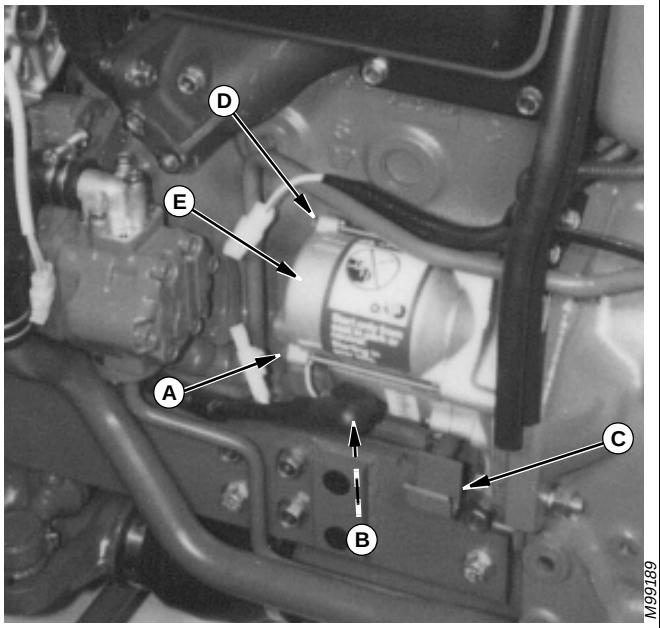
790 Shown

1. Disconnect wiring connectors (A and B).
2. Replace voltage regulator.

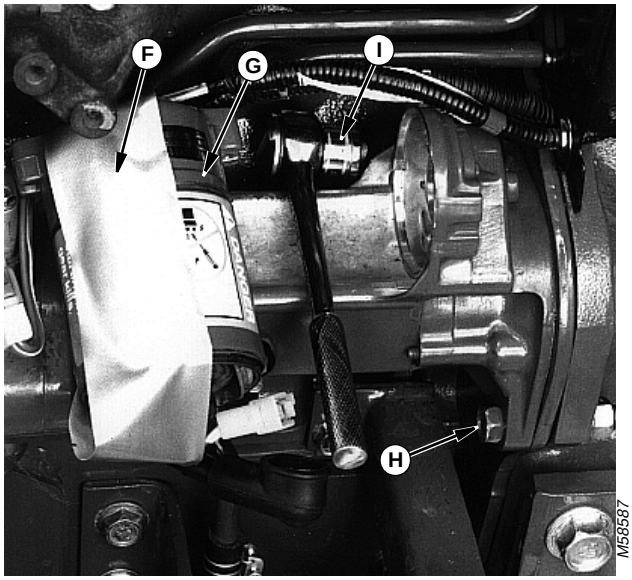
STARTER REPAIR

For complete starter repair information on the 660/770/870/970/1070, use the component technical manual CTM-3. Additional information can be found in Section 240 of this manual.

For complete starter repair information on the 790 tractor, see Sections 20 and 240 in this manual.



1. Lift hood and remove the left-hand engine shield.
2. On 870/970/1070: Also remove the left-hand lower dash cover.
3. Disconnect the positive (+) battery cable (B) and the wiring harness fusible link connector (A).
4. Remove side shield pivot bracket (C), if necessary.
5. Remove starter motor capscrews (D).
6. Remove starter motor assembly (E) while keeping the assembly intact.



7. Apply tape (F) over starter motor housing and the armature will hold assembly together.

IMPORTANT: Do not pull out rubber grommet (G).

8. Remove starter solenoid/gear housing capscrews (H).

NOTE: Loosen the inner capscrew using a Flank Drive Flare Nut Socket (I).
Reference: Snap-On Number FRXM17.

9. Make repairs as necessary. (See CTM-3 for 660/770/870/970/1070. For the 790 tractor, see Section 20 and 240 for repair procedures).

NOTE: When reassembling the starter motor, be sure that the rubber grommet (F) is properly installed to prevent moisture from entering the housing.

10. Connect the wiring harness connector (A) and cable (B).
11. 870/970/1070 Install lower dash cover.
12. Install left engine shield.

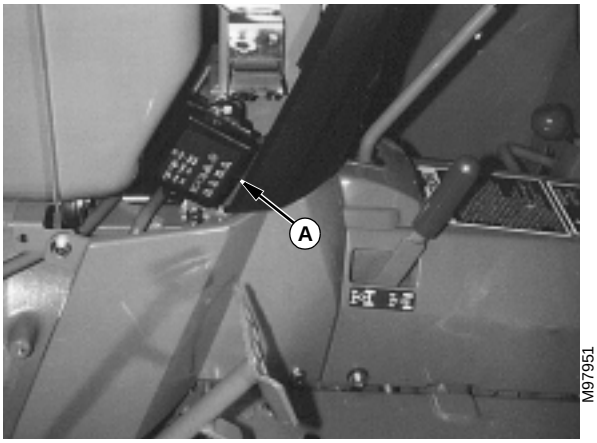
REPLACE FUSES

1. Open Hood.

2. Remove cover (A).

IMPORTANT: Make sure to replace fuse of proper amperage.

3. Replace defective fuse(s) and install cover.



670/770/790 Shown

REPLACE SEAT SAFETY SWITCH

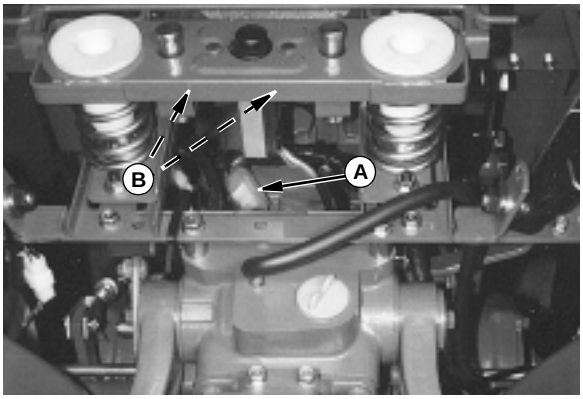
1. Tilt seat up.

2. Disconnect wiring connector (A).

3. On 670/770/790: Remove cotter pins, washers and springs (B) and switch.

On 870/970/1070: Remove two cap screws and switch.

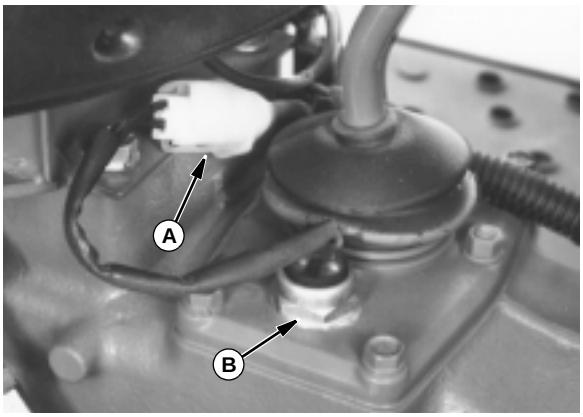
4. Replace switch, if necessary.



670/770/790 Shown

REPLACE TRANSMISSION NEUTRAL START SWITCH

1. Remove engine shields, lower dash covers and clutch housing cover.
2. Disconnect wiring connector (A).
3. Replace switch (B) and packing.

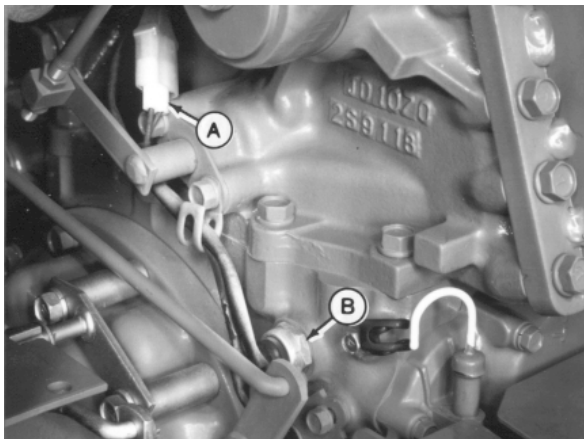


670/770/790 Shown

REPLACE REAR PTO NEUTRAL START SWITCH

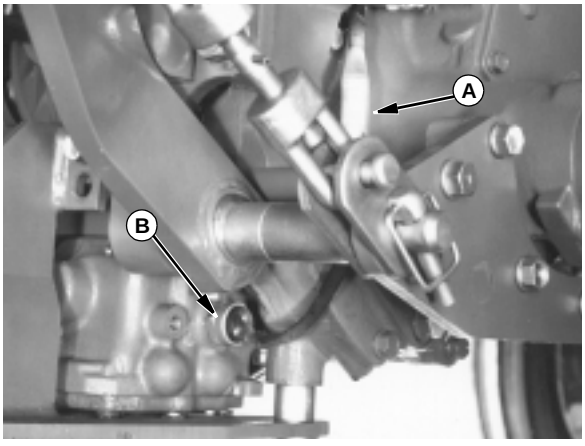
NOTE: 790 Shown.

1. On 670/770/790: Move seat forward and tilt up.
2. Move PTO lever(s) up to engaged position.
3. Disconnect wiring connector (A).
4. Replace switch (B) and O-ring.



REPLACE MID PTO NEUTRAL START SWITCH—670/770/790

1. Remove drawbar plate.
2. Remove mid PTO switch cover.
3. Disconnect wiring connector (A).
4. Replace switch (B) and O-ring.

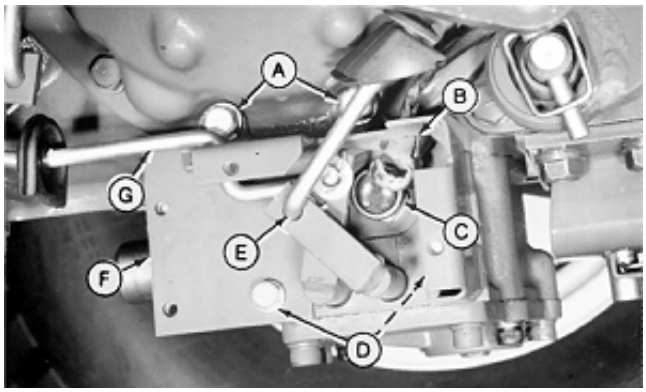


REPLACE MID PTO NEUTRAL START SWITCH—870/970/1070

1. Remove mid PTO linkage cover.
2. Disconnect rods (E and G).
3. Disconnect wiring connector. Remove grommet (B).
4. Remove cap screws (A and D). Remove cover (F).
5. Replace switch (C) and O-ring.
6. Install cover. Tighten cap screws to specifications.
7. Connect wiring connector and rods.
8. Install grommet and linkage cover.

TORQUE SPECIFICATIONS

Cap Screws (A)	90 N·m (65 lb-ft)
Cap Screws (D)	50 N·m (35 lb-ft)



M53179 -UN-12FEB90

A—Cap Screws
B—Grommet
C—Neutral Start Switch
D—Cap Screws
E—Turnbuckle Rod
F—Inner Cover
G—Spring Capsule Rod

MX,4015DG,A6 -19-15JUN89

REPLACE KEY SWITCH

1. Remove dash cover.
2. Disconnect two wiring connectors.
3. Turn retainer (A) counterclockwise to remove washer and switch.
4. Install switch, washer and retainer.
5. Connect wiring connectors and install lower dash panel.



M53191 -UN-18JUL89

MX,4015DG,A7 -19-15JUN89

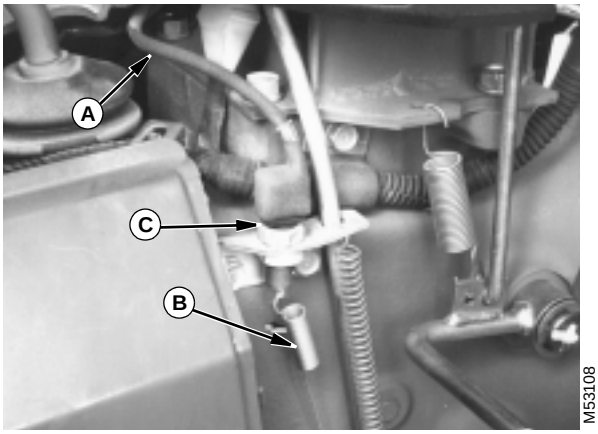
REPLACE PARK BRAKE INDICATOR SWITCH

1. On 670/770/790: Remove dash cover, right-hand engine shield and lower dash cover.

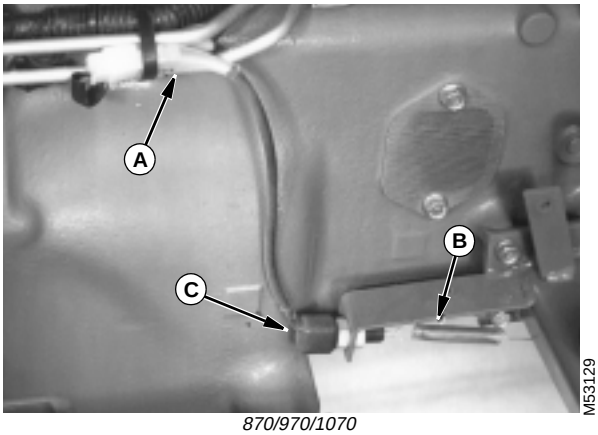
On 870/970/1070: Remove engine shields, Lower dash covers, clutch housing cover and right-hand step plate.

2. Disconnect wiring connector (A) and spring (B).

3. Replace switch (C).



670/770/790



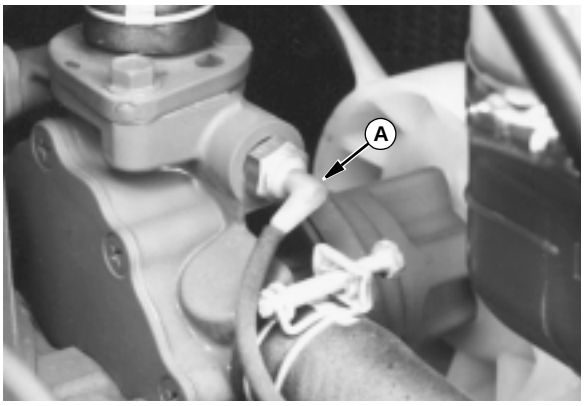
870/970/1070

REPLACE COOLANT TEMPERATURE SWITCH

1. Open hood.

2. Disconnect wiring lead (A).

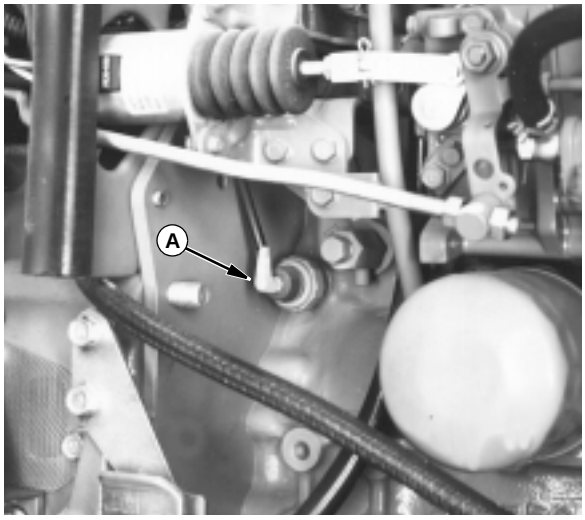
3. Replace switch.



670 Shown

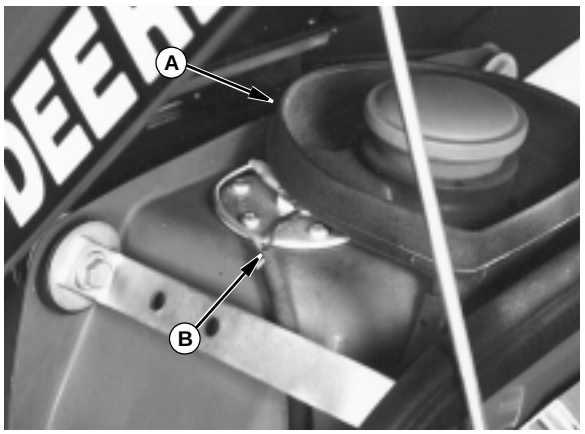
REPLACE ENGINE OIL PRESSURE SWITCH

1. Remove right-hand engine shield.
2. Disconnect wiring lead (A).
3. Replace switch.



REPLACE FUEL LEVEL SENSOR—670/770/790

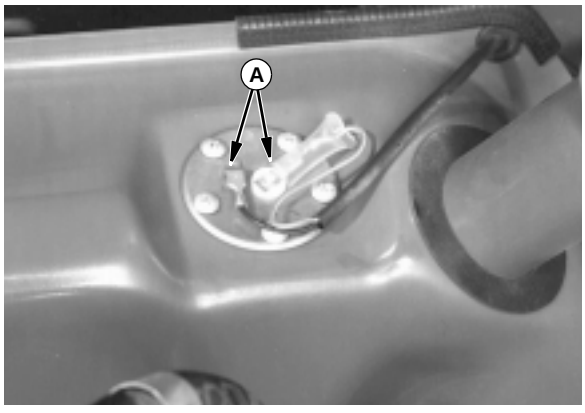
1. Open hood.
2. Remove spill tray (A).
3. Disconnect wiring leads (B).
4. Replace sensor and gasket.



670 Shown

REPLACE FUEL LEVEL SENSOR—870/970/1070

1. Remove ROLL-GARD. (See Section 80, Group 30.)
2. Disconnect wiring leads (A).
3. Replace sensor and gasket.



REPLACE LIGHT SWITCH

1. Remove dash cover.

2. Remove screw (A) and knob.

3. Remove nut and washer (B).

4. Disconnect wiring connector and remove switch.





MX,4015DG,A13 -19-20JUN89

40
15
6

NOTE: Make sure tab (A) aligns with slot in instrument panel when installing switch.

5. Align tab (A) with slot in instrument panel and install switch.

6. Connect wiring connector.

7. Install lower dash panel and knob.



MX,4015DG,A14 -19-20JUN89

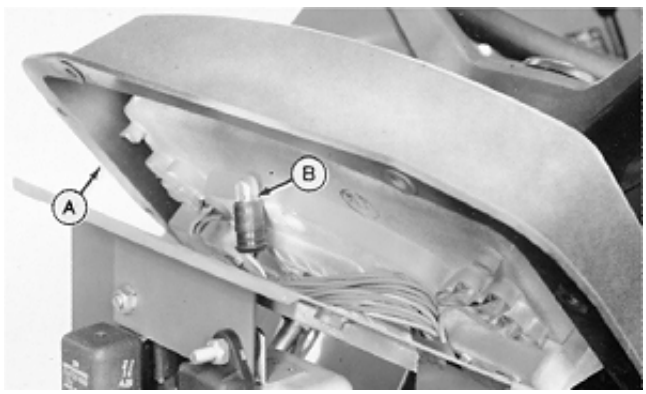
REPLACE INSTRUMENT INDICATOR LAMPS

1. Remove hood. (See Section 80, Group 15.)

2. Remove six screws and lift up instrument panel (A).

3. Pull out rubber socket and replace defective lamp (B), as necessary.

4. Install instrument panel and tighten screws.

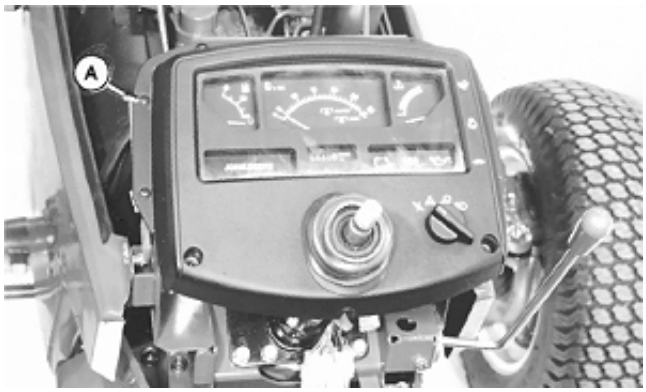


970 Shown

MX,4015DG,A15 -19-20JUN89

REPLACE INSTRUMENT PANEL ASSEMBLY

1. Remove hood. (See Section 80, Group 15.)
2. Remove steering wheel.
3. Remove six screws (A).
4. Disconnect wiring connectors and hour meter cable.
5. Remove instrument panel assembly.



970 Shown

MX,4015DG,A16 -19-20JUN89



A—Seal
B—Reflector
C—Window
D—Instrument Panel
E—Meter
F—Case
G—Wiring Harness

6. Inspect and replace parts as necessary.
7. Install instrument panel assembly.
8. Connect wiring connectors and hour meter cable.
9. Install steering wheel. Tighten lock nut to 27 N·m (20 lb-ft).

MX,4015DG,A17 -19-20JUN89

Section 50
POWER TRAIN REPAIR—670/770/790

Contents

Page

Group 05—Clutch Housing
Other Material 50-05-1
Separate Engine From Clutch Housing 50-05-1
Install Engine to Clutch Housing 50-05-4
Clutch Housing
Remove 50-05-6
Install 50-05-9
Inspect and Replace Seal and Bushings 50-05-12
Inspect and Repair Clutch Pedal and Linkage 50-05-13

Group 06—Single Stage Clutch
Essential Tools 50-06-1
Remove and Install 50-06-1
Inspect and Repair Clutch and Flywheel . . .50-06-2
Clutch Release Mechanism and Clutch Shaft
Remove, Inspect and Install 50-06-4

Group 07—Dual Stage Clutch
Essential Tools 50-07-1
Dual Stage Clutch Repair and Adjustment. .50-07-1
Clutch Release Mechanism and Clutch Shaft
Remove, Inspect and Install 50-07-2

Group 10—Transmission
Other Materials 50-10-1
Separate Transmission from Clutch Housing 50-10-2
Install Transmission to Clutch Housing 50-10-5
Gear Shift Lever
Inspect and Repair 50-10-8
Range Shift Lever and Shaft Assembly
Inspect and Repair 50-10-8
Bearing Quill Assembly
Remove and Install 50-10-10
Disassemble, Inspect and Assemble. . . .50-10-11

Group 15—Rear PTO Drive Shaft
Other Materials 50-15-1
Lever and Shift Linkage
Remove, Inspect and Install 50-15-1

Page

Rear PTO Shaft Assembly
Remove and Install. 50-15-3
Disassemble, Inspect and Assemble 50-15-5

Group 20—Differential
Other Materials 50-20-1
Differential
Remove and Install. 50-20-1
Disassemble, Inspect and Assemble 50-20-4
Adjust
Differential Cone Point 50-20-5
Differential Drive Shaft-to-Ring Gear Backlash 50-20-6
Differential Lock
Remove, Inspect and Install 50-20-7

Group 25—Final Drive
Other Materials 50-25-1
Final Drive Assembly
Remove and Install—Right-Hand Side. . . 50-25-1
Remove and Install—Left-Hand Side 50-25-3
Axle Shaft
Remove, Inspect and Install 50-25-4
Pinion Shaft
Remove, Inspect and Install 50-25-7

Group 30—Mechanical Front Wheel Drive
Other Materials 50-30-1
Lever and Linkage
Inspect and Repair 50-30-1
Transmission Output Shaft and Drive Gear
Remove, Inspect and Install 50-30-2
Drive Shaft
Remove, Inspect and Install 50-30-3
Axle
Remove and Install. 50-30-4
Spindle Housing and Outer Drive
Remove and Install. 50-30-6
Outer Drive
Disassemble, Inspect and Assemble 50-30-7

Continued on next page

Spindle Housing
Disassemble, Inspect and Assemble 50-30-9
Differential and Shafts
Disassemble and Inspect 50-30-11
Assemble 50-30-14
Adjust Input Shaft-to-Ring Gear
Backlash 50-30-16

Group 35— Mid Mount PTO
Other Materials 50-35-1
Control Lever and Linkage
Inspect and Repair 50-35-1
Mid Mount PTO Gearbox
Remove and Install 50-35-3
Disassemble and Inspect 50-35-5
Assemble 50-35-7

OTHER MATERIAL

Number	Name	Use
TY6305	Clean and Cure Primer	To clean and cure surfaces prior to application of adhesives or sealants.
TY6304	Flexible Sealant	To provide a seal between mating surfaces.

MX,5005DG,A1 -19-23OCT89

SEPARATE ENGINE FROM CLUTCH HOUSING

1. Remove fuel tank. (See procedure in Section 20, Group 20.)

2. Remove starter. (See procedure in Section 40, Group 10.)

3. MFWD: Remove drive shaft. (See procedure in Group 30.)

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

4. Remove muffler and gasket.

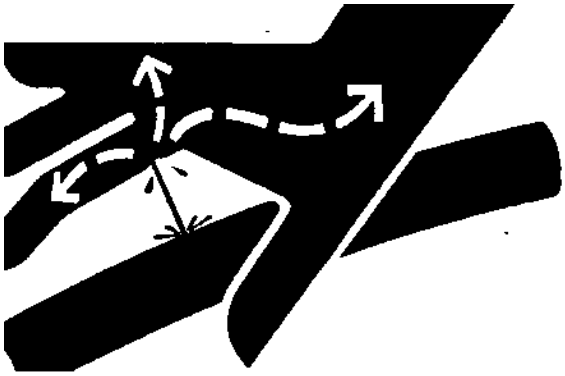


TS271 -UN-23AUG88

MX,5005DG,A2 -19-23OCT89

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.



-UN-23AUG88
X9811

50
05
2

5. Lower rockshaft arms.

6. Manual steering: Disconnect drag link (D).

7. Remove line clamp cap screws (C).

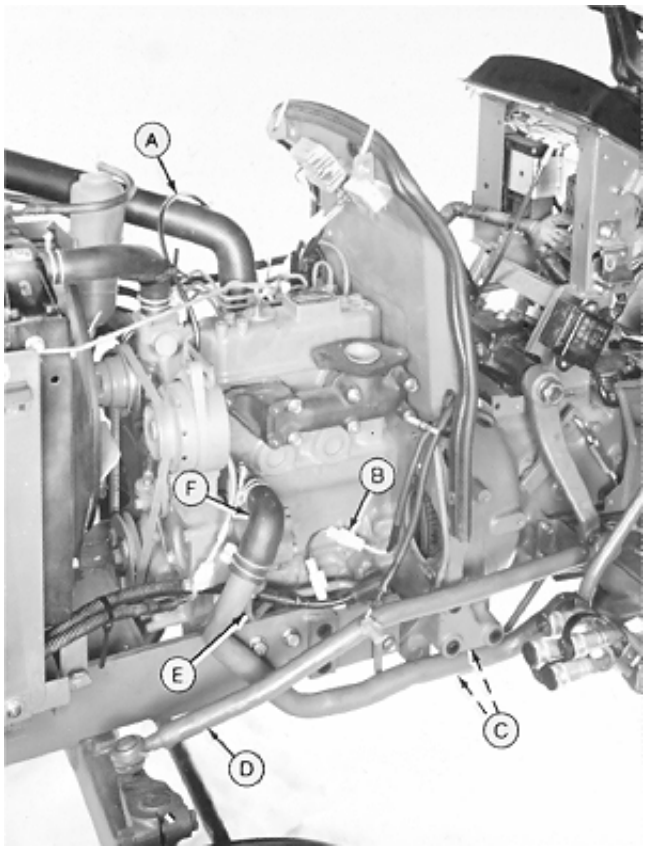
8. Disconnect hose (F) and flange (E). Close all openings with caps and plugs.

9. Power steering: Remove hydraulic lines. (See procedure in Section 60, Group 10.)

10. Disconnect wiring connector (B).

11. Disconnect cable (A).

A—Tachometer Cable
B—Fusible Link Connector
C—Cap Screws (2 used)
D—Drag Link
E—Pressure Line Mounting Flange
F—Suction Line Hose



-UN-20NOV89
M53554

Left-Hand Side

MX,5005DG,A3 -19-23OCT89

12. Disconnect wiring harness (C and F). Remove tie straps (E).

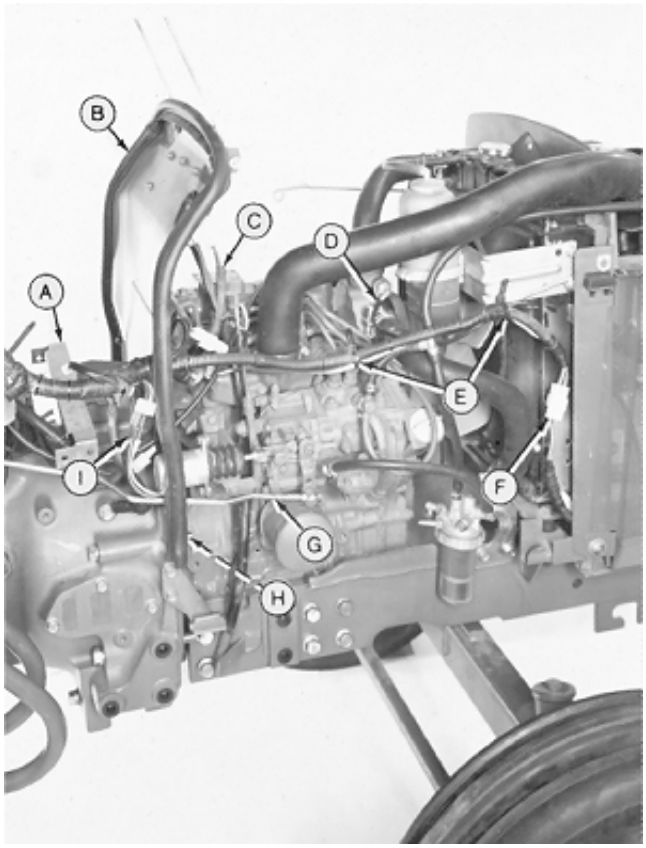
13. Disconnect wiring leads (D and H) and connector (I).

14. Remove control rod (G).

15. Remove air shield (B).

16. Remove bracket (A).

A—Fuel Tank Support Bracket
B—Air Shield
C—Wiring Harness
D—Coolant Temperature Switch Wiring Lead
E—Tie Strap (2 used)
F—Wiring Harness
G—Throttle Control Rod
H—Engine Oil Pressure Switch Wiring Lead
I—Fuel Shut-Off Solenoid Wiring Connector



Right-Hand Side

MX,5005DG,A4 -19-23OCT89

17. Remove rocker arm cover.

18. Install lifting brackets such as JDG19 or JT01748 Lifting Brackets (A).

19. Attach a hoist to engine.

20. Install support stand (C) under clutch housing.

21. Install wood blocks in front and back of rear tires.

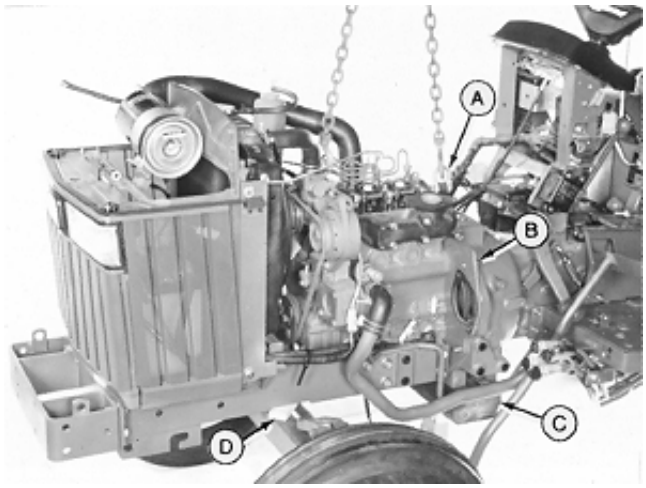
22. Install a wood block (D) between front axle and frame on both sides.

NOTE: Put transmission in neutral to ease clutch shaft alignment with engine during installation.

23. Put transmission shift lever in neutral.

24. Remove eight cap screws (B) from housing.

25. Roll front end away from tractor.



M53556 -UN-18DEC89

A—Lifting Brackets (2 used)
B—Cap Screw (8 used)
C—Support Stand
D—Wood Block (2 used)

MX,5005DG,A5 -19-20OCT89

INSTALL ENGINE TO CLUTCH HOUSING

1. Put transmission shift lever in neutral to ease clutch shaft alignment with engine.

2. Apply multipurpose grease to end of clutch shaft.

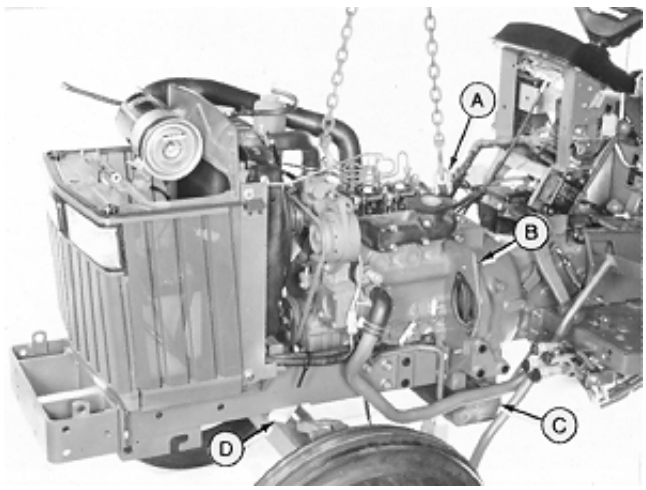
NOTE: Turn flywheel when installing front end, to engage engine with clutch shaft(s).

3. Install front end to clutch housing. Tighten cap screws (B) to 54 N·m (40 lb-ft).

4. Remove wood blocks (D) and support stand (C).

5. Remove lifting brackets (A).

6. Install rocker arm cover.



M53556 -UN-18DEC89

A—Lifting Brackets (2 used)
B—Cap Screw (8 used)
C—Support Stand
D—Wood Block (2 used)

MX,5005DG,A6 -19-23OCT89

7. Install bracket (A).

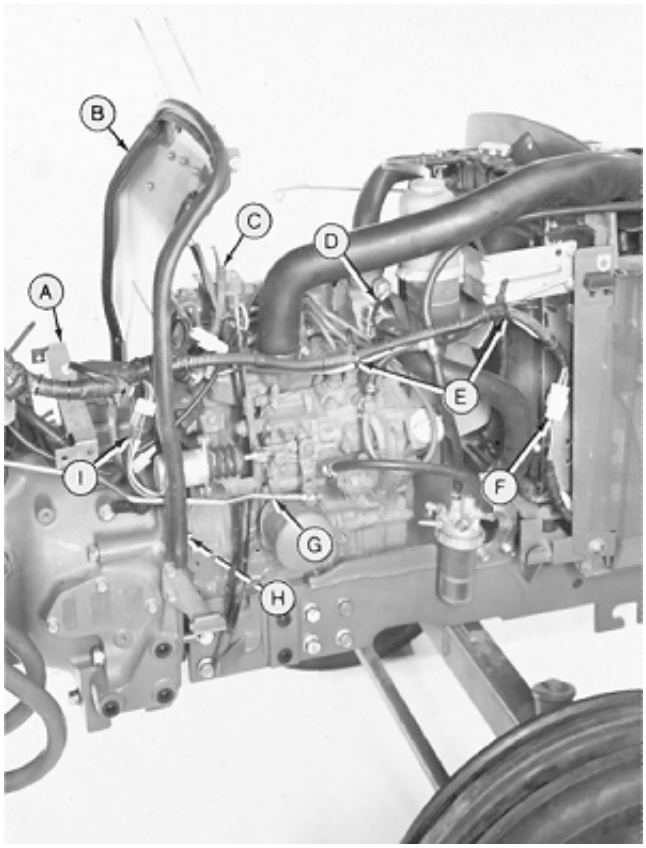
8. Install air shield (B).

9. Install control rod (G).

10. Connect wiring leads (H and D) and connector (I).

11. Connect wiring harness (C and F). Install tie straps (E).

A—Fuel Tank Support Bracket
B—Air Shield
C—Wiring Harness
D—Coolant Temperature Switch Wiring Lead
E—Tie Strap (2 used)
F—Wiring Harness
G—Throttle Control Rod
H—Engine Oil Pressure Switch Wiring Lead
I—Fuel Shut-Off Solenoid Wiring Connector



Right-Hand Side

MX,5005DG,A7 -19-23OCT89

12. Connect cable (A).

13. Connect wiring connector (B).

14. Power steering: Install hydraulic lines. (See procedure in Section 60, Group 10.)

15. Connect flange (E) and hose (F).

16. Install line clamp cap screws (C).

17. Manual steering: Connect drag link (D).

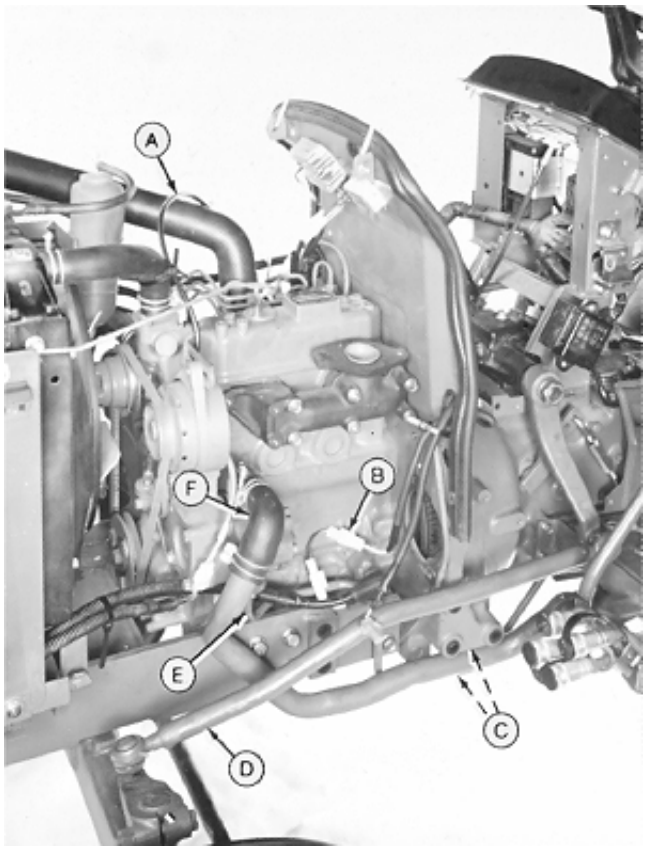
18. Install muffler and new gasket.

19. MFWD: Install drive shaft. (See procedure in Group 25.)

20. Install starter. (See procedure in Section 40, Group 10.)

21. Install fuel tank. (See procedure in Section 20, Group 20.)

22. Adjust throttle control linkage. (See Section 220, Group 15.)



M53554 -UN-20NOV89

Left-Hand Side

A—Tachometer Cable
B—Fusible Link Connector
C—Cap Screws (2 used)
D—Drag Link
E—Pressure Line Mounting Flange
F—Suction Line Hose

MX,5005DG,A8 -19-23OCT89

REMOVE CLUTCH HOUSING

1. Separate engine from clutch housing. (See procedure in this group.)

NOTE: The approximate capacity of transmission is 15 L (4 U.S. gal).

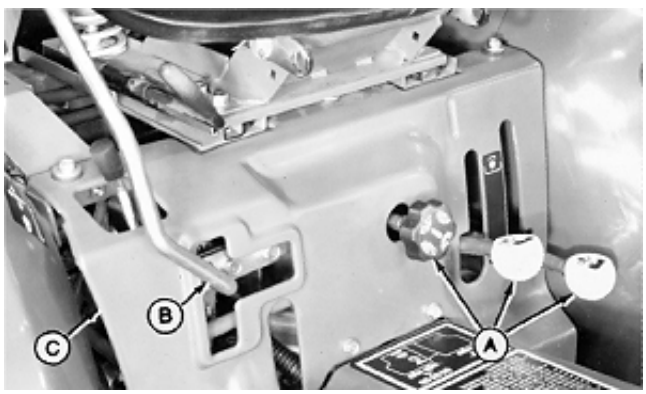
2. Drain transmission.

3. Remove SCV lever (B), if equipped.

4. Remove knobs (A) and panel (C).

NOTE: If tractor is NOT equipped with SCV, Go to Step 10.

5. Remove right-hand fender.



M53250 -UN-05JAN90

MX,5005DG,A9 -19-23OCT89

6. Loosen two clamps (A).

7. Remove banjo connectors and washers (C). Close all openings with caps and plugs.

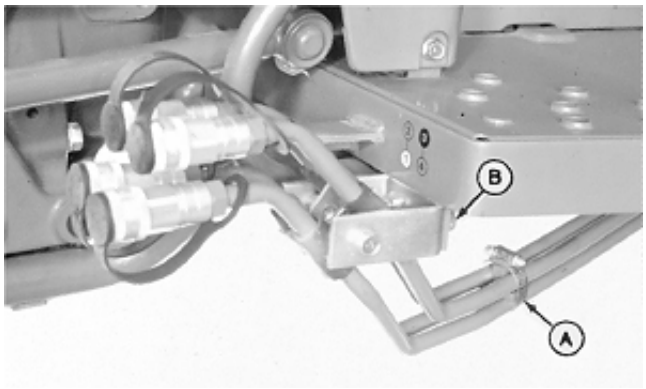
8. Remove two cap screws (B).

9. Remove long line assembly.

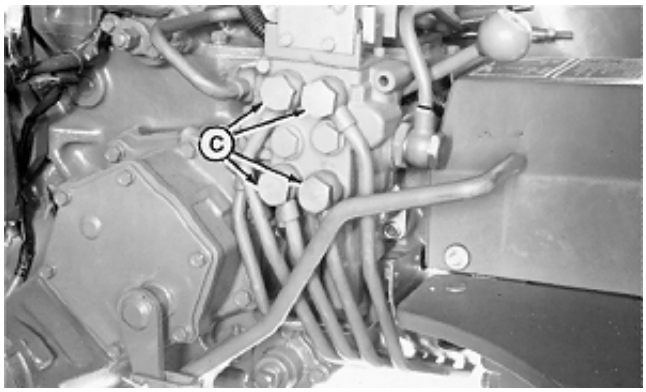
10. Install support stands under front of transmission and end of drawbar.

11. Remove clutch housing cover.

12. Remove step plates.



-UN-05JAN90
M53251



-UN-05JAN90
M53265

MX,5005DG,A10 -19-23OCT89

13. Disconnect link (E).

14. Disconnect rod (A), if equipped.

15. Remove line clamp (C).

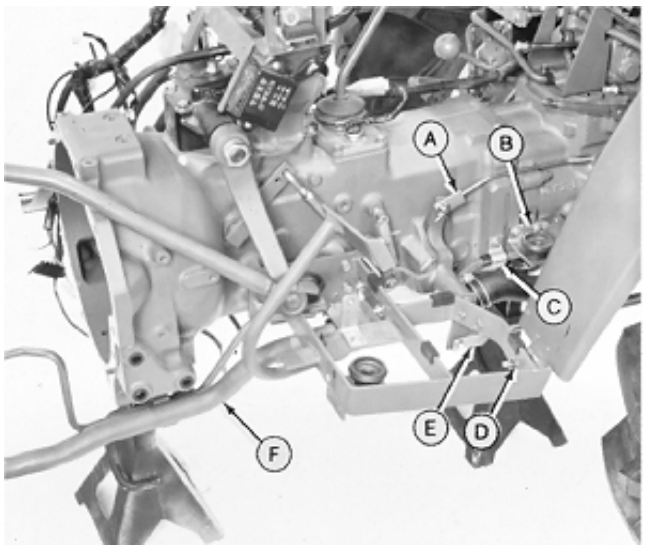
16. Remove support bracket (B).

17. Remove suction line (F).

18. Hydraulic oil filter: Disconnect suction hose from transmission housing.

19. Remove cap screw, washers and nut (D).

A—Mid Mount PTO Brake Rod
B—Step Plate Support Bracket
C—Line Clamp
D—Cap Screw, Washers and Nut
E—Brake Link
F—Suction Line



-UN-18DEC89
M53563

Left-Hand Side

MX,5005DG,A11 -19-23OCT89

20. Disconnect wiring harness (C) and remove from tie strap.

21. Remove clamp (D).

22. Disconnect wiring connector (A).

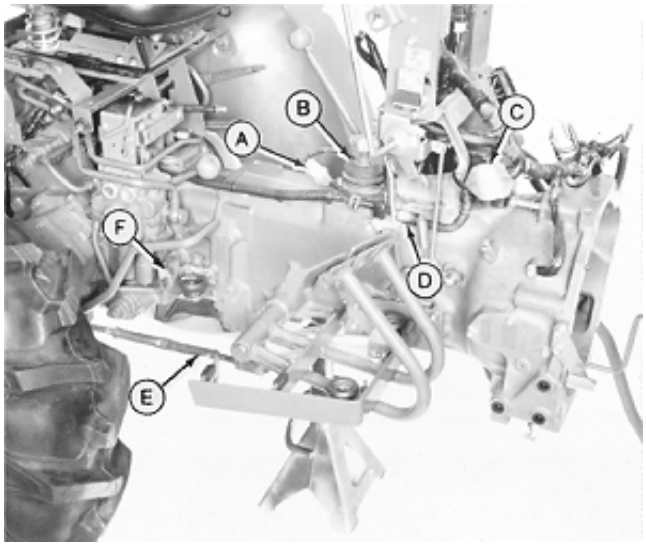
23. Disconnect link (E).

24. Remove support bracket (F).

25. Remove shift lever assembly (B) and gasket.

26. Without SCV: Remove fender-to-step plate support cap screw, washers and nut.

A—Transmission Neutral Start Switch Wiring Connector
B—Shift Lever Assembly
C—Wiring Harness
D—Clamp
E—Brake Link
F—Step Plate Support Bracket



Right-Hand Side

MX,5005DG,A12 -19-23OCT89

IMPORTANT: If equipped with dual clutch, rear PTO connecting shaft may remove with housing. Coupling on end of shaft may drop into transmission housing. After lifting chains or straps are attached to clutch housing assembly, lower support stand under drawbar and pivot rear end to rest on stand. If coupling falls into transmission housing, remove rockshaft to retrieve coupling. (See procedure in Section 70, Group 10.)

27. Install chains or lifting strap to clutch housing assembly.

28. Remove clutch housing and gasket.

29. Make repairs as necessary. (See procedure in this group.)



MX,5005DG,A13 -19-23OCT89

INSTALL CLUTCH HOUSING

NOTE: Turn clutch shaft(s) when installing clutch housing, to engage shaft(s) with main shaft and/or PTO connecting shaft.

1. Clean mating surfaces of transmission and clutch housings using clean and cure primer. Apply flexible sealant to mating surfaces.

2. Install clutch housing and new gasket. Tighten cap screws and nuts to 54 N·m (40 lb-ft).



M53565 -UN-18DEC89

MX,5005DG,A14 -19-23OCT89

3. Without SCV: Install fender-to-step plate support cap screw, washers and nut.

4. Clean mating surfaces of clutch housing and shift lever assembly using clean and cure primer. Apply flexible sealant to mating surfaces.

5. Install shift lever assembly (B) and new gasket.

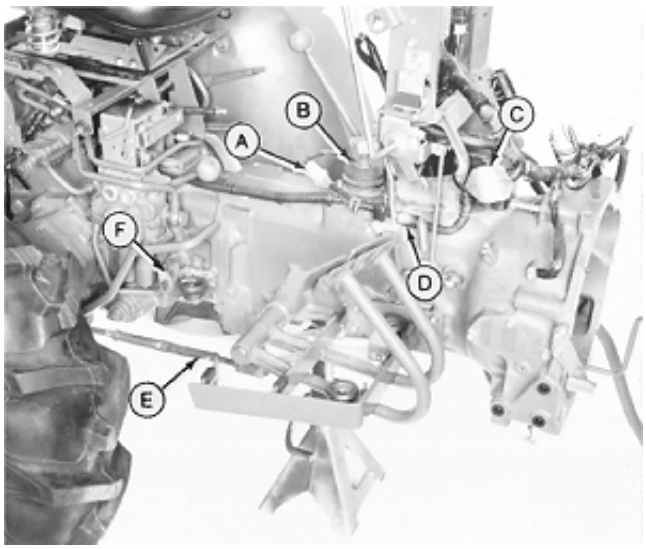
6. Install support bracket (F).

7. Connect link (E).

8. Connect wiring connector (A).

9. Install clamp (D).

10. Connect wiring harness (C) and install tie strap.



M53564 -UN-18DEC89

Right-Hand Side

A—Transmission Neutral Start Switch Wiring Connector
B—Shift Lever Assembly
C—Wiring Harness
D—Clamp
E—Brake Link
F—Step Plate Support Bracket

MX,5005DG,A15 -19-23OCT89

11. Install cap screw, washers and nut (D).

12. Install suction line (F).

13. Hydraulic oil filter: Connect suction hose to transmission housing.

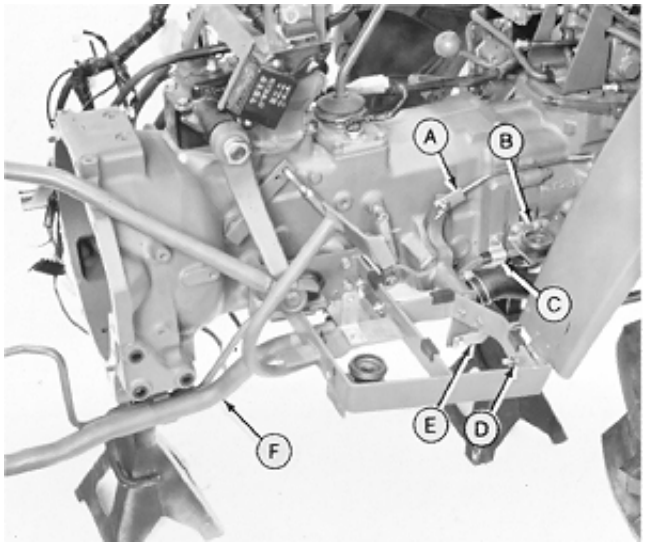
14. Install support bracket (B).

15. Install line clamp (C).

16. Connect rod (A), if equipped.

17. Connect link (E).

A—Mid Mount PTO Brake Rod
B—Step Plate Support Bracket
C—Line Clamp
D—Cap Screw, Washers and Nut
E—Brake Link
F—Suction Line



M53563 -UN-18DEC89

Left-Hand Side

50
05
10

MX,5005DG,A16 -19-23OCT89

18. Remove support stand from front of transmission.

NOTE: If tractor is NOT equipped with SCV, Go to Step 24.

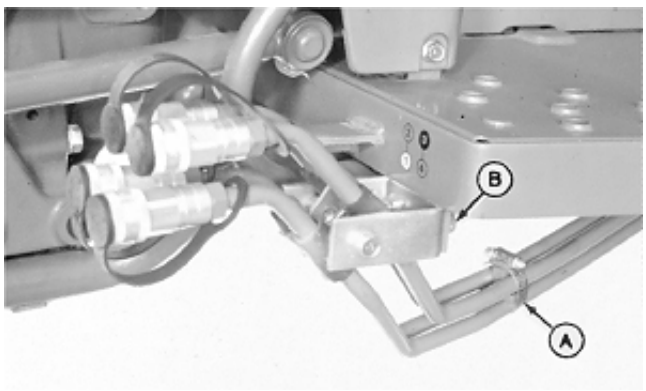
19. Install long line assembly.

20. Install banjo connectors and washers (C). Leave loose.

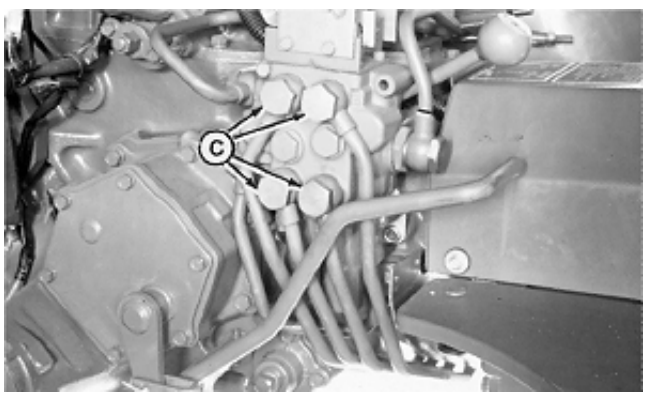
21. Install two cap screws (B). Tighten banjo connectors previously installed.

22. Tighten two clamps (A).

23. Install right fender.



M53251 -UN-05JAN90



M53265 -UN-05JAN90

MX,5005DG,A17 -19-23OCT89

24. Install panel (C) and knobs (A).

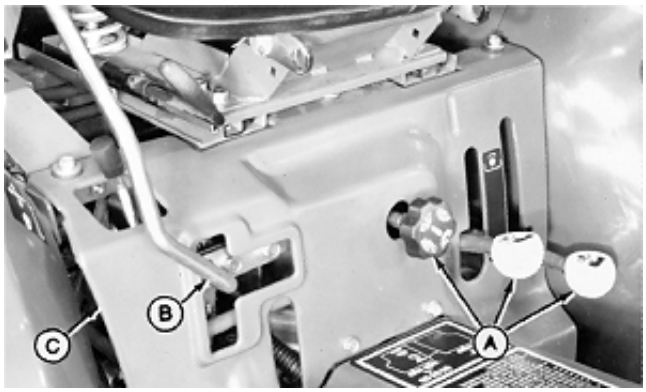
25. Install SCV lever (B), if equipped.

26. Install engine to clutch housing. (See procedure in this group.)

27. Adjust clutch pedal free-play. (See procedure in Section 250, Group 15.)

28. Install step plates and clutch housing cover.

29. Fill transmission with proper oil. (See Section 10, Group 20.)



M53250 -UN-05JAN90

MX,5005DG,A18 -19-23OCT89

INSPECT AND REPLACE CLUTCH HOUSING SEAL AND BUSHINGS

1. Inspect housing for cracks or damage. Replace if necessary.

2. Remove clutch release mechanism and clutch shaft(s). (See procedure in Group 06.)

3. Inspect seal for wear or damage. Replace as necessary.

4. Replace seal (M) using a bearing, bushing and seal driver set.

5. Apply multipurpose grease to inside lip of seal (M).

6. Remove brake pedals and shaft. (See Section 60, Group 15.)

50 05 12

7. Inspect bushings for wear or damage. Replace as necessary.

NOTE: Remove bushings only if replacement is necessary.

8. Remove bushings (F and G) using a blind hole puller set.

9. Remove bushings (D) using a bearing, bushing and seal driver set.

10. Install all bushings using a bearing, bushing and seal driver set.

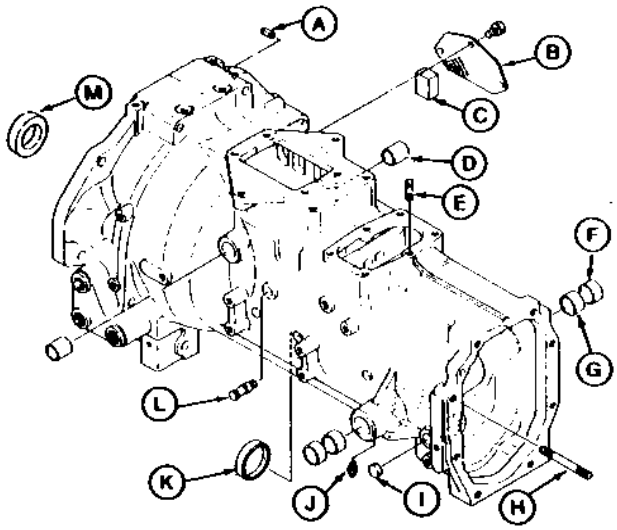
Install bushings (D and G) below housing surface according to specifications.

Install bushings (F) flush with housing surface.

11. Apply multipurpose grease to all lubrication fittings.

BUSHING DEPTH SPECIFICATIONS

Bushings (D)	13 mm (0.080 in.)
Bushing (G)	32 mm (1.250 in.)



M53566 -UN-20NOV89

A—Spring Pin (2 used)
B—Screen
C—Foam Pad
D—Bushing (2 used)
E—Stud (2 used)
F—Bushing (2 used)
G—Bushing (2 used)
H—Stud (2 used)
I—Plug
J—Lubrication Fitting (2 used)
K—Plug
L—Pin (2 used)
M—Seal

MX,5005DG,A19 -19-23OCT89

INSPECT AND REPAIR CLUTCH PEDAL AND LINKAGE

1. Remove clutch housing cover.

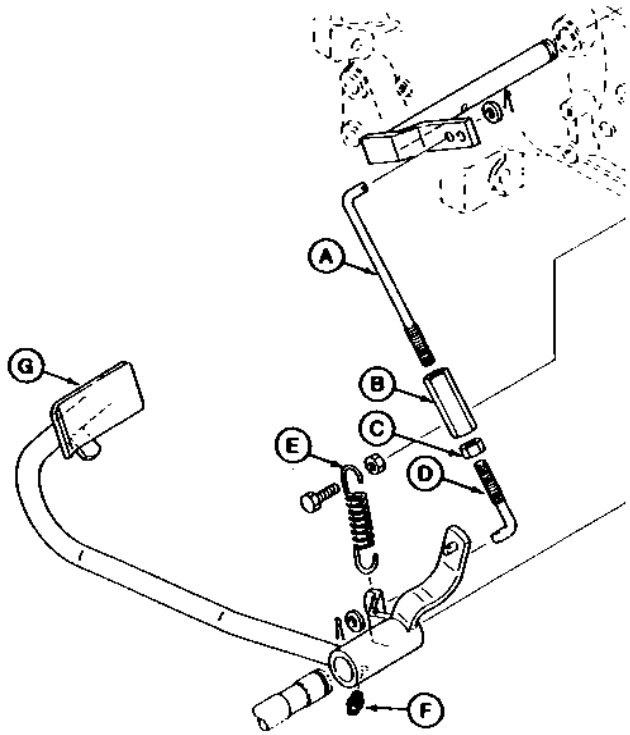
2. Remove brake pedals and shaft. (See Section 60, Group 15.)

3. Inspect parts for wear or damage. Replace as necessary.

4. Apply multipurpose grease to all lubrication fittings.

5. Adjust clutch pedal free-play. (See procedure in Section 250, Group 15.)

A—Rod
B—Turnbuckle
C—Nut
D—Rod
E—Spring
F—Lubrication Fitting
G—Pedal



M53567 -UN-20NOV89

MX,5005DG,A20 -19-29SEP89

ESSENTIAL TOOLS

NOTE: Order tools from your SERVICE-GARD™ Catalog. Some tools may be available from a local supplier.

O53,TOOLS -19-13JUL88

Universal Clutch Alignment Tool Kit JDG689

To align single stage clutch assembly.

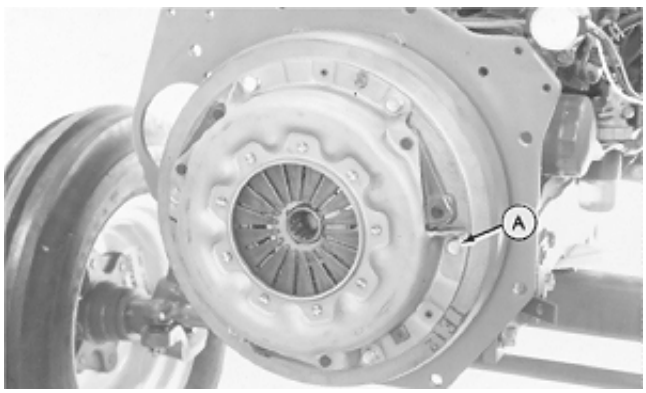
53T,JDG689 -19-14NOV89

REMOVE AND INSTALL SINGLE STAGE CLUTCH

1. Separate engine from clutch housing. (See procedure in Group 05.)

2. Remove six cap screws (A) and clutch assembly.

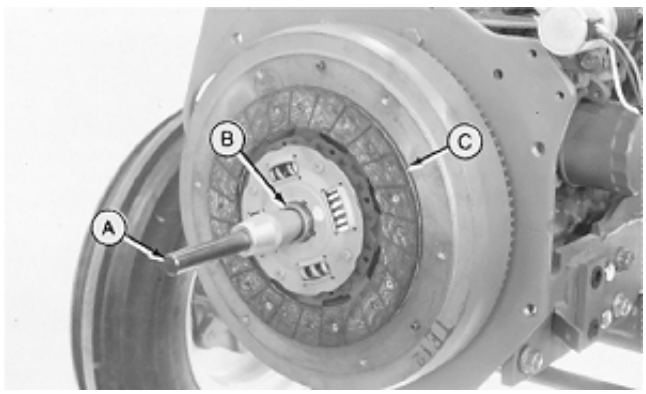
3. Inspect and repair clutch and flywheel. (See procedure in this group.)



MX,5006DG,A1 -19-23OCT89

4. Place clutch disk (C) on flywheel with long end of hub (B) facing away from flywheel.

5. Insert clutch alignment tool (A), from a Universal Clutch Alignment Tool Kit JDG689, into hub and clutch shaft pilot bushing in flywheel.



MX,5006DG,A2 -19-23OCT89

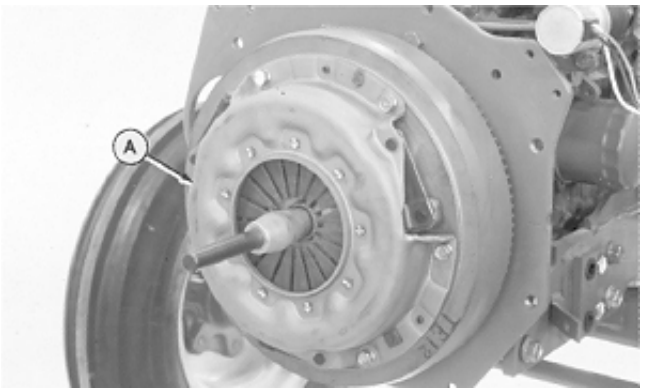
6. Install clutch cover (A) with clutch alignment tool still in place.

7. Install cap screws and tighten to 27 N·m (20 lb-ft).

8. Remove clutch alignment tool.

9. Install front end to clutch housing. (See procedure in Group 05.)

10. Adjust clutch pedal free-play. (See procedure in Section 250, Group 15.)



-UN-20NOV89
M53559

MX,5006DG,A3 -19-23OCT89

INSPECT AND REPAIR CLUTCH AND FLYWHEEL

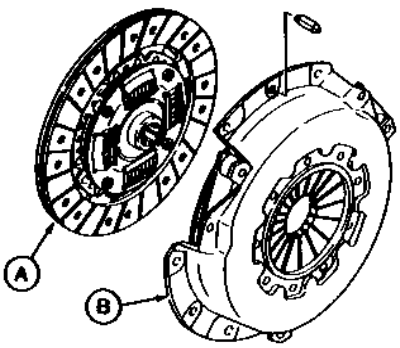
1. Inspect drive surface of pressure plate (B) for distortion and scratches.

2. Measure flatness of drive surface using a straight-edge and feeler gauge. Replace clutch cover assembly if drive surface is not flat to within 0.4 mm (0.016 in.).

3. Clean any rust or oil from drive surface using a light abrasive.

4. Inspect clutch disk (A) for wear or damage. Replace if necessary.

5. Measure thickness of clutch disk. Replace disk if less than 6.4 mm (0.251 in.).



-UN-20NOV89
M53589

MX,5006DG,A4 -19-23OCT89

6. Inspect flywheel pilot bushing (A). Replace bushing if ID is more than 15.03 mm (0.592 in.).

Remove bushing using a blind hole puller set.

Install new bushing flush with flywheel using a bearing, bushing and seal driver set.

7. Inspect flywheel friction drive surface for distortion and scratches.

8. Measure flatness of drive surface using a straight-edge and feeler gauge. Replace flywheel if drive surface is not flat to within 0.4 mm (0.016 in.).

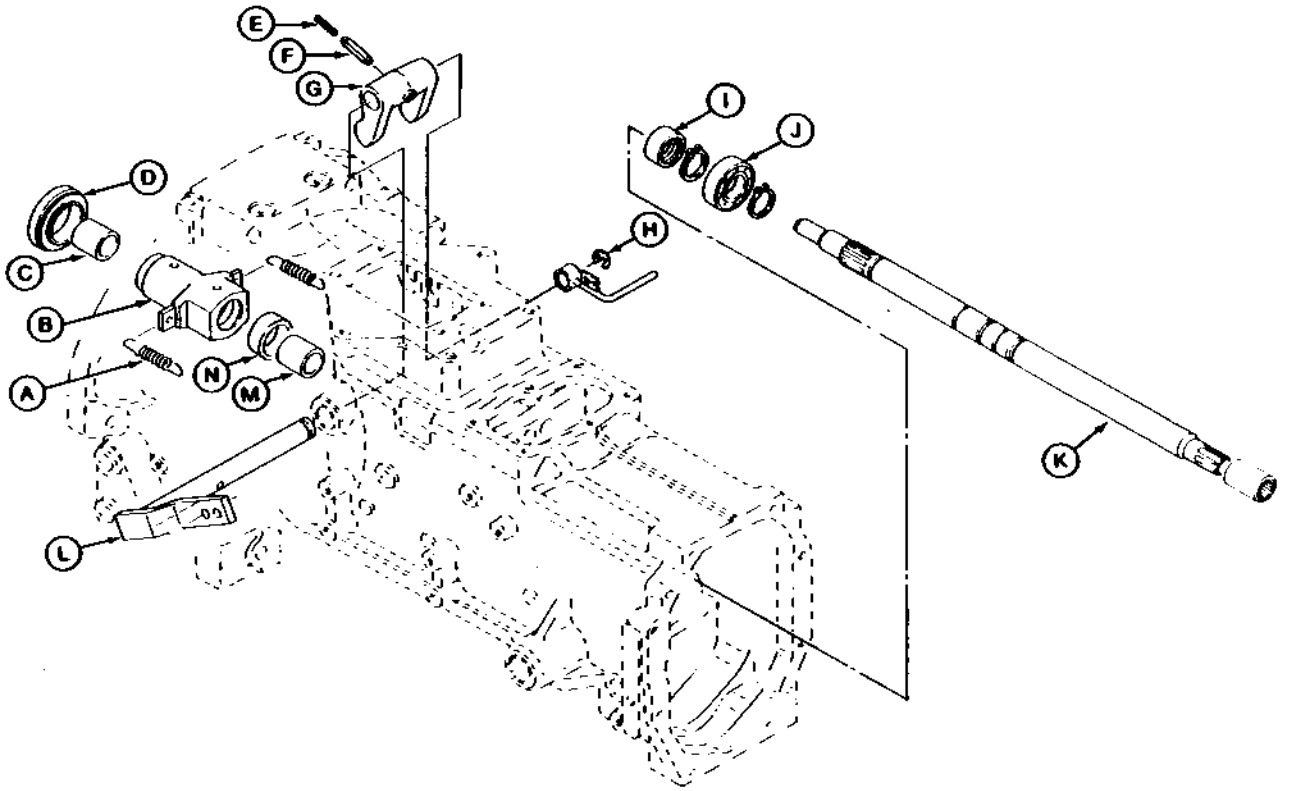
9. Clean any rust or oil from drive surface using a light abrasive.



RW594 -UN-30NOV88

MX,5006DG,A5 -19-23OCT89

REMOVE, INSPECT AND INSTALL CLUTCH RELEASE MECHANISM AND CLUTCH SHAFT



M53560 -UN-20NOV89

50 06 4

A—Release Spring (2 used)
B—Bearing Sleeve
C—Bushing
D—Release Bearing
E—Spring Pin
F—Spring Pin
G—Clutch Release Yoke
H—E-Clip
I—Sleeve
J—Ball Bearing
K—Clutch Shaft
L—Clutch Release Shaft
M—Bushing
N—Seal (2 used)

NOTE: Clutch housing must be removed to service clutch shaft. Clutch release mechanism can be serviced by separating engine from clutch housing. (See procedure in Group 05.)

1. Remove clutch housing. (See procedure in Group 05.)

2. Remove parts (A—N).

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

NOTE: Remove bearings or bushings only if replacement is necessary.

4. Remove bearings (D and J) using a knife-edge puller and a press.

5. Remove bushings (C and M) using a blind hole puller set.

6. Install bushing (C) 13 mm (0.500 in.) in from end of sleeve (B) using a press.

7. Press bushing (M) in until flush with end of sleeve (B).

8. Install bearing (D) with flat side toward sleeve (B).

9. Install all parts.

10. Install clutch housing. (See procedure in Group 05.)

11. Adjust clutch pedal free-play. (See procedure in Section 250, Group 15.)

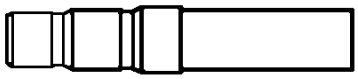
MX,5006DG,A6 -19-23OCT89

ESSENTIAL TOOLS

NOTE: Order tools from your SERVICE-GARD™ Catalog. Some tools may be available from your local supplier.

Clutch Alignment Tool JDG693

Tool is used to align dual-stage clutch assembly.

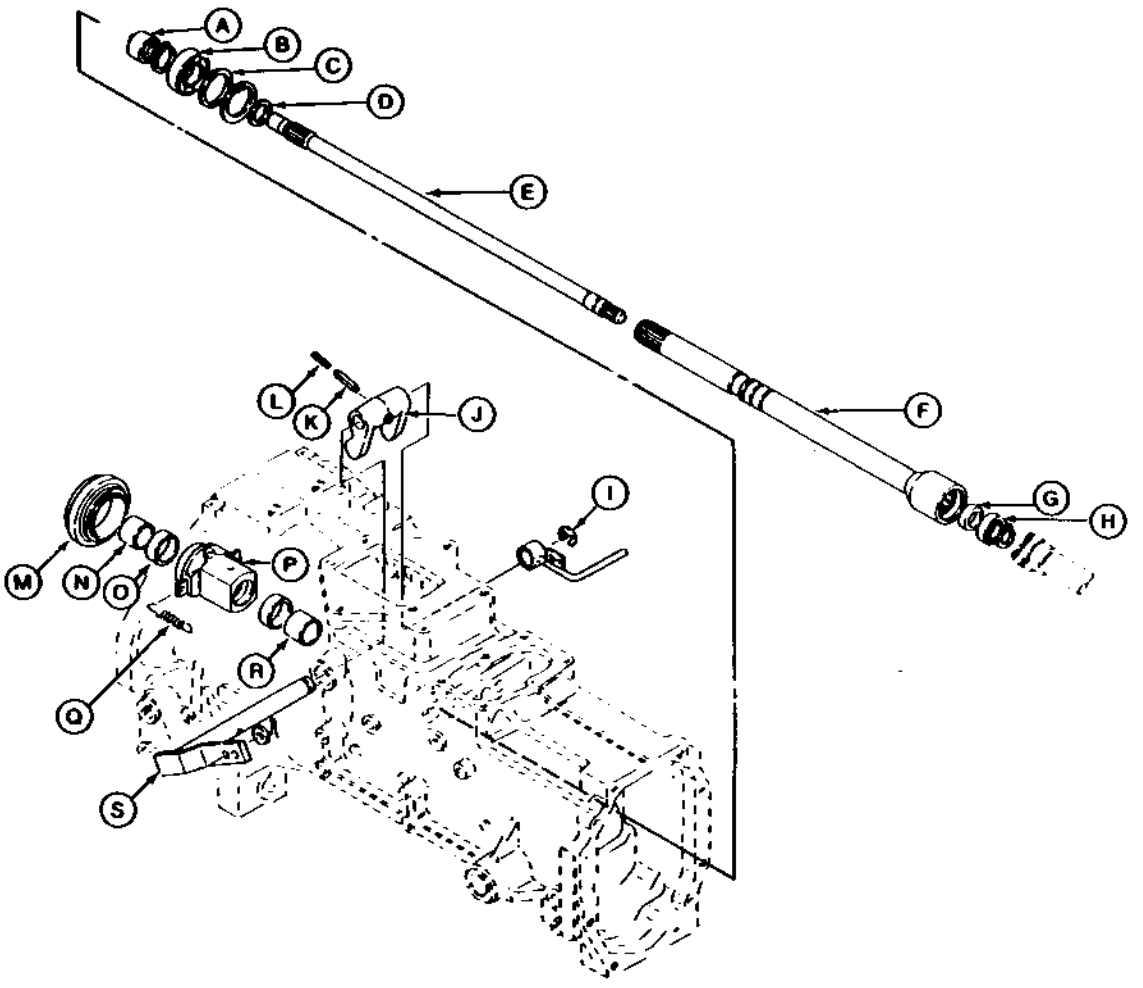


JDG693

DUAL STAGE CLUTCH—670/770/790

For dual stage clutch repair and adjustments, see Section 55, Group 06.

REMOVE, INSPECT AND INSTALL CLUTCH RELEASE MECHANISM AND CLUTCH SHAFTS



A—Sleeve
B—Ball Bearing
C—Spacer
D—Washer
E—PTO Clutch Shaft
F—Transmission Clutch Shaft
G—Seal
H—Ball Bearing
I—E-Clip
J—Clutch Release Yoke
K—Spring Pin
L—Spring Pin
M—Release Bearing
N—Bushing
O—Seal (2 used)
P—Bearing Sleeve
Q—Release Spring (2 used)
R—Bushing
S—Clutch Release Shaft

MX,5007DG,A2 -19-03NOV89

NOTE: Clutch housing must be removed to service main clutch shaft and PTO clutch shaft. Clutch release mechanism can be serviced by separating engine from clutch housing. (See procedure in Group 05.)

1. Remove clutch housing. (See procedure in Group 05.)

2. Remove parts (A—S).

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

NOTE: Remove bearings or bushings only if replacement is necessary.

4. Remove bearings (M and B) using a knife-edge puller and a press.

5. Remove bushings (N and R) using a blind hole puller set.

6. Install bushing (N) 13 mm (0.500 in.) in from end of sleeve (P) using a press.

7. Press bushing (R) in until flush with end of sleeve (P).

8. Install bearing (M) with flat side away from sleeve (P).

9. Install all parts.

10. Install clutch housing. (See procedure in Group 05.)

11. Adjust clutch pedal free-play. (See procedure in Section 250, Group 15.)

MX,5007DG,A3 -19-09JAN90

OTHER MATERIAL

Number	Name	Use
TY6305	Clean and Cure Primer	To clean and cure surfaces prior to application of adhesives or sealants.
TY6304	Flexible Sealant	To provide a seal between mating surfaces.

MX,5010DG,A1 -19-23OCT89

SEPARATE TRANSMISSION FROM CLUTCH HOUSING

1. Remove 3-point hitch. (See procedure in Section 80, Group 20.)

2. Remove rear auxiliary hydraulic lines, if equipped. (See procedure in Section 70, Group 20.)

3. Remove seat and support. (See procedure in Section 80, Group 25.)

4. Remove dash covers.

5. Remove clutch housing cover and step plates.

NOTE: The approximate capacity of transmission is 15 L (4 U.S. gal).

50
10
2

6. Drain transmission.

7. SCV: Remove cap screws (H).

8. Remove brake link (G).

9. Remove support bracket (D).

10. Disconnect suction hose (E).

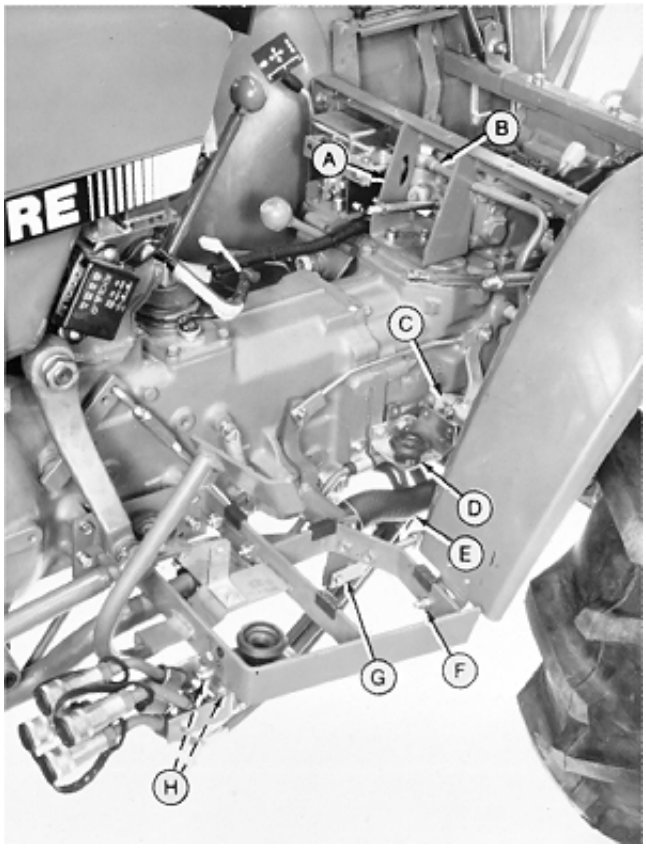
Hydraulic oil filter: Disconnect suction hose from transmission housing.

11. Remove cap screw, washers and nut (F).

12. Mid mount PTO: Remove shaft assembly (C).

13. Remove support (A).

14. Disconnect pressure line (B). Close all openings with caps and plugs.



Left-Hand Side

A—Support
B—Pressure Line
C—Bellcrank Shaft Assembly
D—Step Plate Support Bracket
E—Suction Hose
F—Cap Screw, Washers and Nut
G—Brake Link
H—Cap Screws (2 used)

MX,5010DG,A2 -19-15NOV89

15. Disconnect wiring harness (D) and remove from tie strap.

16. Remove clamp (E).

17. Disconnect wiring connector (B).

18. Remove brake link (F).

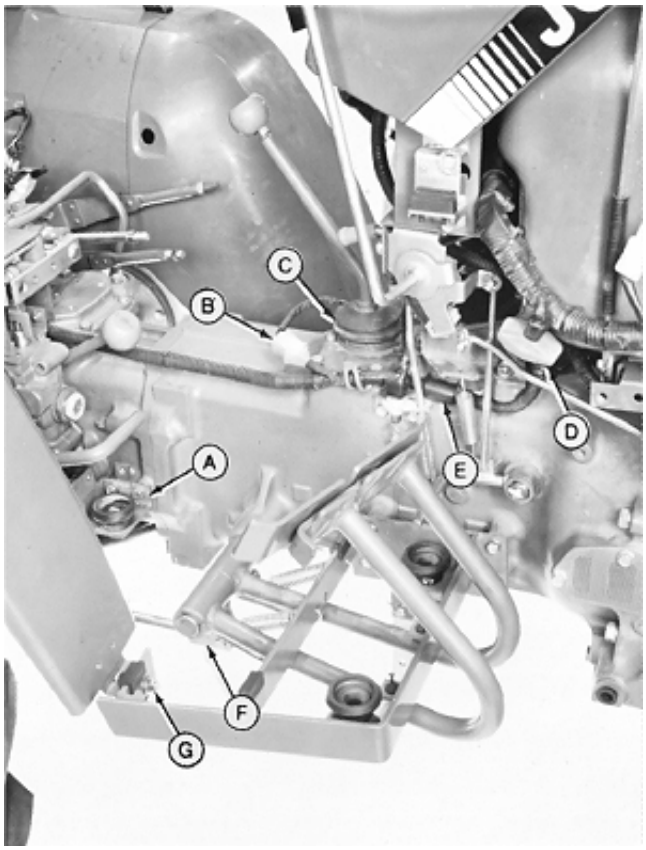
19. Remove support bracket (A).

20. Remove cap screw, washers and nut (G).

21. Put transmission shift lever in neutral.

22. Remove shift lever assembly (C) and gasket.

A—Step Plate Support Bracket
B—Transmission Neutral Start Switch Wiring Connector
C—Shift Lever Assembly
D—Wiring Harness
E—Clamp
F—Brake Link
G—Cap Screw, Washers and Nut



M53932 -UN-18DEC89

Right-Hand Side

MX,5010DG,A3 -19-15NOV89

IMPORTANT: If equipped with dual clutch, rear PTO connecting shaft may stay with clutch housing. Coupling on end of shaft may drop into transmission housing. Remove rockshaft to retrieve coupling. (See procedure in Section 70, Group 10.)

23. Install wood blocks in front and back of front tires.

24. Install a wood block between front axle and frame on both sides.

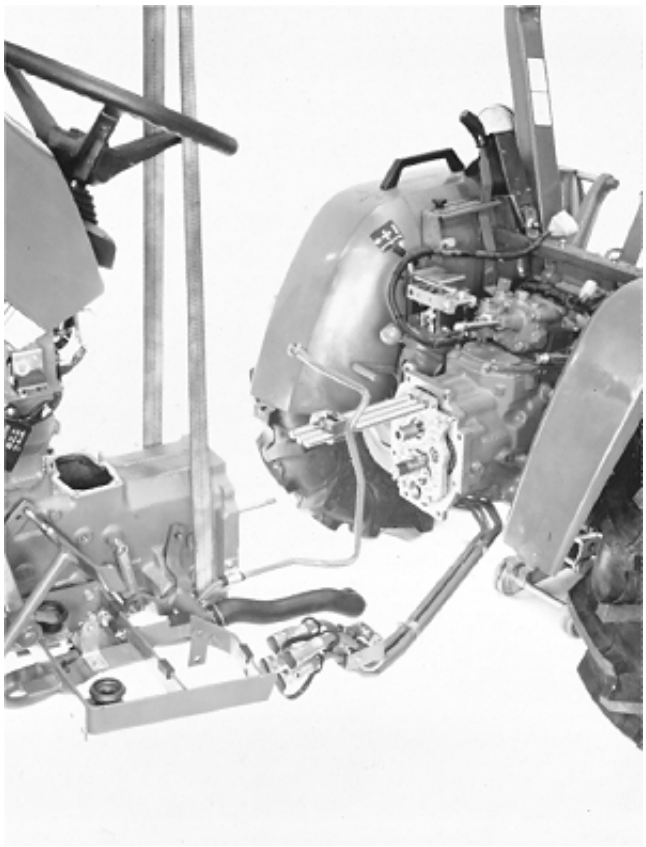
25. Install a floor jack under rear of clutch housing and under rear of transmission housing.

26. Remove clutch-to-transmission housing cap screws and nuts.

27. Roll rear end away from tractor.

28. Install a support stand under drawbar and front of transmission.

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



M53933 -UN-18DEC89

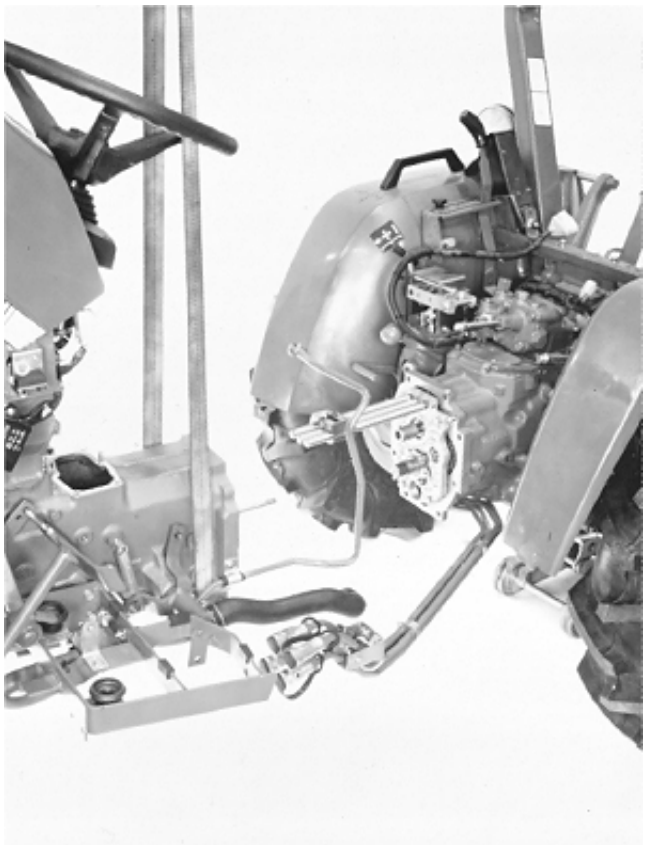
MX,5010DG,A4 -19-15NOV89

INSTALL TRANSMISSION TO CLUTCH HOUSING

NOTE: Turn rear PTO shaft when installing transmission, to engage with clutch shaft(s).

1. Clean mating surfaces of transmission and clutch housings using clean and cure primer. Apply flexible sealant to mating surfaces.

2. Install transmission and new gasket. Tighten cap screws and nuts to 54 N·m (40 lb-ft).



M53933 -UN-18DEC89

MX,5010DG,A5 -19-15NOV89

3. Clean mating surfaces of clutch housing and shift lever assembly using clean and cure primer. Apply flexible sealant to mating surfaces.

4. Install shift lever assembly (C) and new gasket.

5. Install cap screw, washers and nut (G).

6. Install support bracket (A).

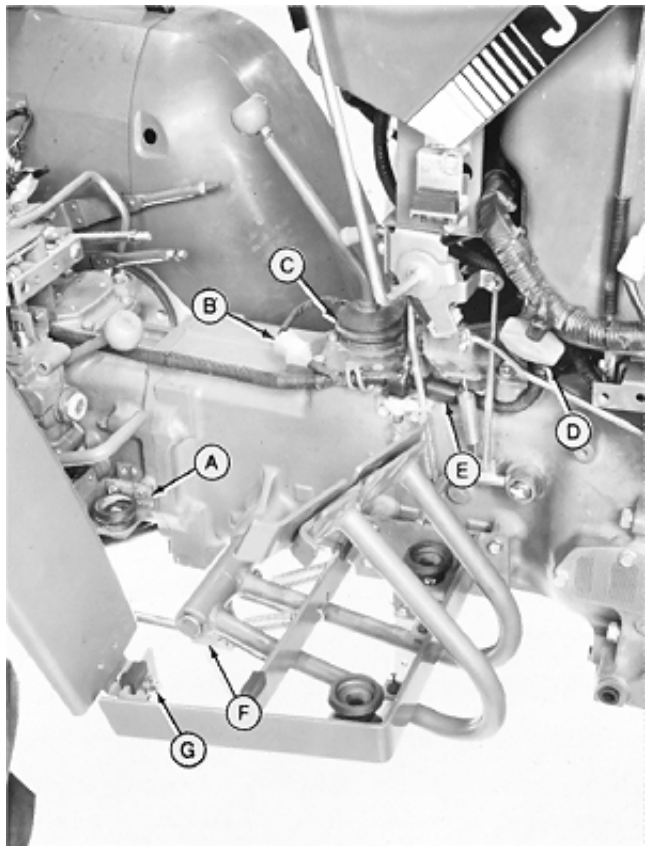
7. Install brake link (F).

8. Connect wiring connector (B).

9. Install clamp (E).

10. Connect wiring harness (D) and install tie strap.

A—Step Plate Support Bracket
B—Transmission Neutral Start Switch Wiring Connector
C—Shift Lever Assembly
D—Wiring Harness
E—Clamp
F—Brake Link
G—Cap Screw, Washers and Nut



Right-Hand Side

MX,5010DG,A6 -19-15NOV89

11. Connect pressure line (B).

12. Install support (A).

13. Mid mount PTO: Install shaft assembly (C).

14. Install cap screw, washers and nut (F).

15. Connect suction hose (E).

Hydraulic oil filter: Connect suction hose to transmission housing.

16. Install support bracket (D).

17. Install brake link (G).

18. SCV: Install cap screws (H).

19. Adjust clutch pedal free-play. (See procedure in Section 250, Group 15.)

20. Install step plates and clutch housing cover.

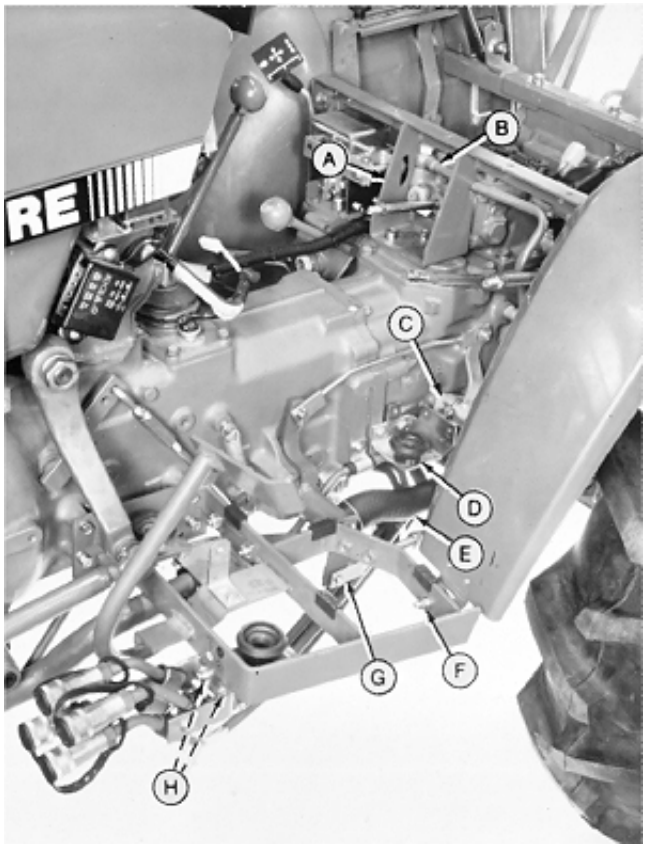
21. Install dash covers.

22. Install seat and support. (See procedure in Section 80, Group 25.)

23. Install rear auxiliary hydraulic lines, if equipped. (See procedure in Section 70, Group 20.)

24. Install 3-point hitch. (See procedure in Section 80, Group 20.)

25. Fill transmission with proper transmission/hydraulic oil. (See Section 10, Group 20.)



Left-Hand Side

A—Support
B—Hydraulic Pressure Line
C—Bellcrank Shaft Assembly
D—Step Plate Support Bracket
E—Suction Hose
F—Cap Screw, Washers and Nut
G—Brake Link
H—Cap Screws (2 used)

MX,5010DG,A7 -19-15NOV89

INSPECT AND REPAIR TRANSMISSION GEAR SHIFT LEVER

1. Remove lower dash and clutch housing covers.

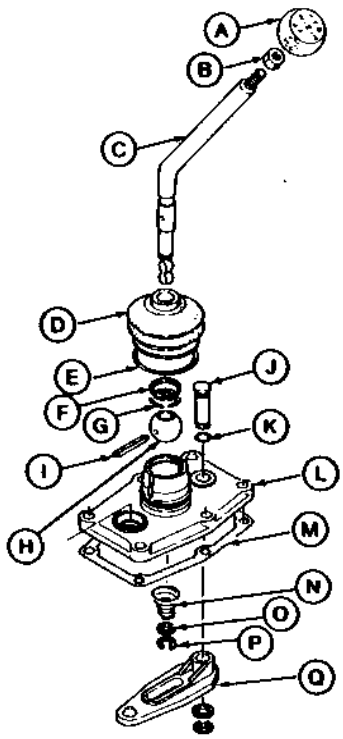
2. Remove shift lever assembly and gasket.

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

4. Clean mating surfaces of clutch housing and shift lever cover using clean and cure primer. Apply flexible sealant to mating surfaces.

5. Install shift lever assembly and new gasket.

A—Knob
B—Nut
C—Lever
D—Boot
E—Ring
F—Rim
G—Rim
H—Ball
I—Spring Pin
J—Pin
K—Packing
L—Cover
M—Gasket
N—Spring
O—Washer (2 used)
P—E-Clip (2 used)
Q—Guide



-UN-07DEC89
M53863

MX,5010DG,A8 -19-16NOV89

50
10
8

INSPECT AND REPAIR RANGE SHIFT LEVER AND SHAFT ASSEMBLY

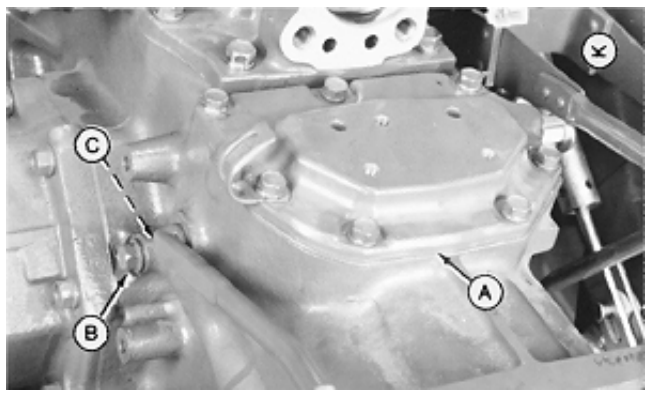
1. Remove SCV, if equipped. (See procedure in Section 70, Group 15.)

2. Remove rockshaft slow return valve. (See procedure in Section 70, Group 10.)

3. Remove cover and gasket (A).

4. Remove cap screw and washer (B).

5. Remove detent spring and ball (C).



-UN-18DEC89
M53906

MX,5010DG,A9 -19-16NOV89

NOTE: To prevent spring pins (A and E) from falling into transmission housing, insert a length of wire into the bottom of pins.

6. Remove parts (D—G).

NOTE: To remove shaft (C), bearing quill assembly must be removed.

7. Remove bearing quill assembly. (See procedure in this group.)

8. Remove spring pin (A) to remove fork (B) and shaft (C).

9. Inspect parts for wear or damage. Replace as necessary.

10. Apply clean transmission/hydraulic oil to all internal parts.

NOTE: Install pins (E) with splits facing 180° (opposite) each other.

11. Install all parts.

12. Apply thread lock and sealer (medium strength) to threads of detent assembly cap screw.

13. Install ball, detent spring, washer and cap screw.

14. Clean mating surfaces of transmission housing and cover using clean and cure primer. Apply flexible sealant to mating surfaces.

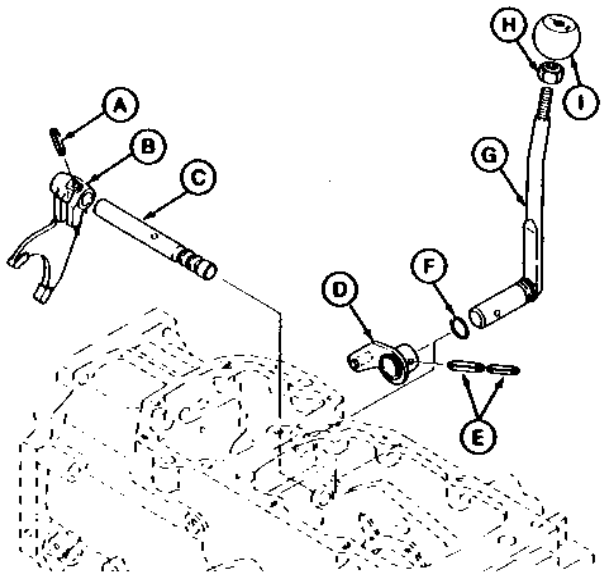
15. Install cover and new gasket.

16. Apply thread lock and sealer (medium strength) to threads of cap screws.

17. Install and tighten cap screws.

18. Install rockshaft slow return valve. (See procedure in Section 70, Group 10.)

19. Install SCV, if equipped. (See procedure in Section 70, Group 15.)

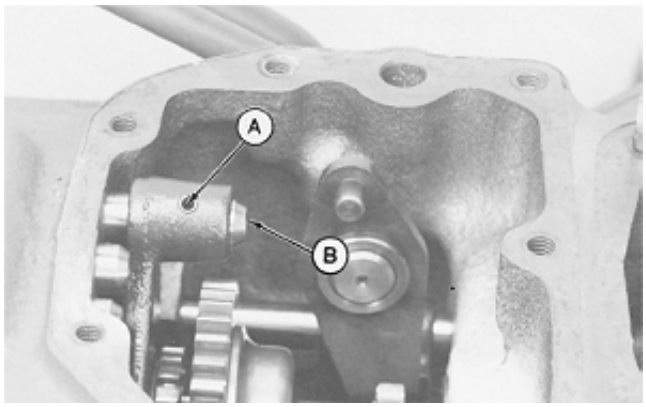


M53864 -UN-07DEC89

A—Spring Pin
B—Fork
C—Shaft
D—Shift Arm
E—Spring Pins
F—Packing
G—Lever
H—Nut
I—Knob

MX,5010DG,A10 -19-16NOV89

REMOVE AND INSTALL BEARING QUILL ASSEMBLY



RW847 -UN-30NOV88

1. Separate transmission from clutch housing. (See procedure in this group.)

2. Remove range shift lever and shaft assembly. (See Inspect and Repair Range Shift Lever and Shaft Assembly in this group.)

NOTE: To prevent spring pin (A) from falling into transmission housing, insert a length of wire into the bottom of pin.

3. Remove spring pin (A).

CAUTION: A detent ball will spring from hole in top of quill plate as fork shaft is driven from quill assembly.

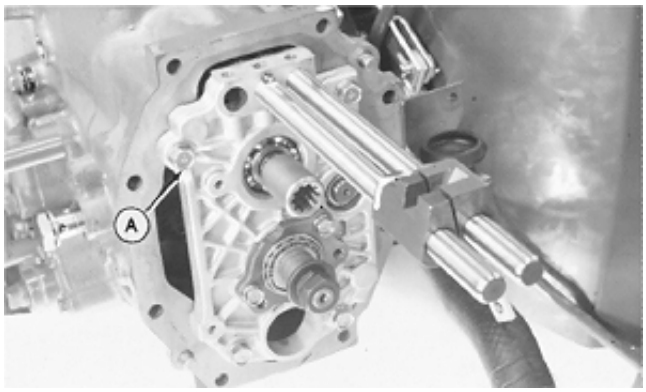
50 10 10

4. Remove shifter shaft (B) using a brass drift and hammer.

5. Remove detent ball, spring and shift fork.

MX,5010DG,A11 -19-16NOV89

IMPORTANT: When removing bearing quill assembly, cam on end of main shaft (dual clutch: coupling on end of PTO connectiong shaft) may drop into transmission housing. Keep assembly level when removing.



-UN-18DEC89
M53907

6. Remove four cap screws and lock washers (A). Remove bearing quill assembly.

7. Make repairs as necessary. (See procedure in this group.)

8. Install bearing quill assembly and tighten cap screws.

9. Install shift fork, spring and detent ball.

10. Install fork shaft.

11. Install range shift lever and shaft assembly. (See Inspect and Repair Range Shift Lever and Shaft Assembly in this group.)

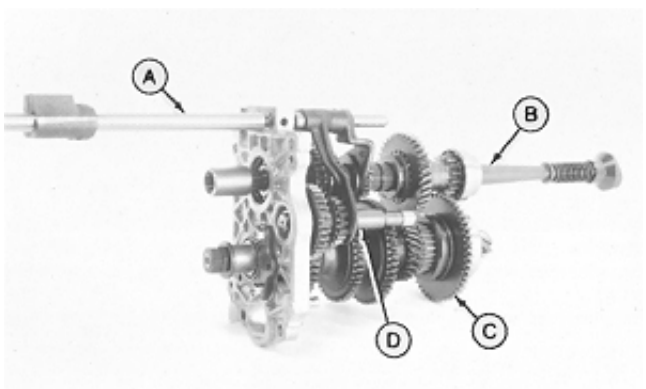
12. Install transmission to clutch housing. (See procedure in this group.)

MX,5010DG,A12 -19-27NOV89

DISASSEMBLE, INSPECT AND ASSEMBLE BEARING QUILL ASSEMBLY

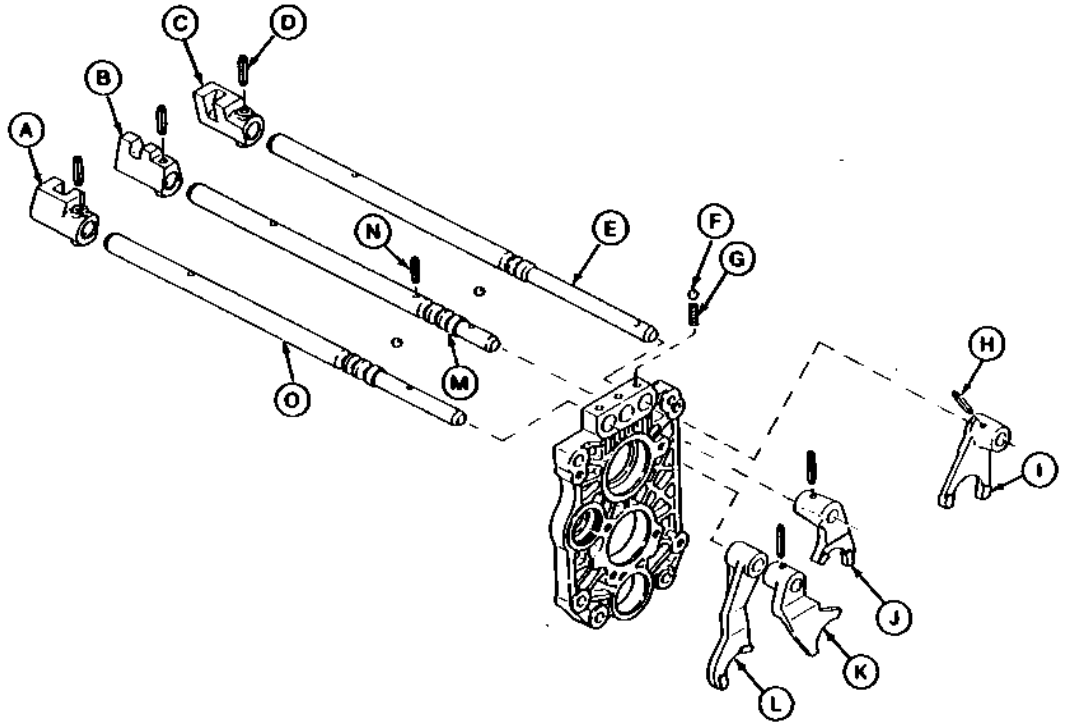
1. Inspect parts (A—D). Disassemble shaft assemblies as necessary.

A—Gear Shift Shafts
B—Main Transmission Input Shaft
C—Differential Drive Shaft
D—Reverse Shaft



-UN-18DEC89
M53908

MX,5010DG,A13 -19-01DEC89



A—1-R Yoke
B—2-3 Yoke
C—4 Yoke
D—Spring Pin (3 used)
E—4 Shifter Shaft
F—Ball (3 used)
G—Spring (3 used)
H—Spring Pin (3 used)
I—4 Shift Fork
J—2-3 Shift Fork
K—1 Shift Fork
L—R Shift Fork
M—2-3 Shifter Shaft
N—Spring Pin
O—1-R Shifter Shaft

Gear Shift Shafts

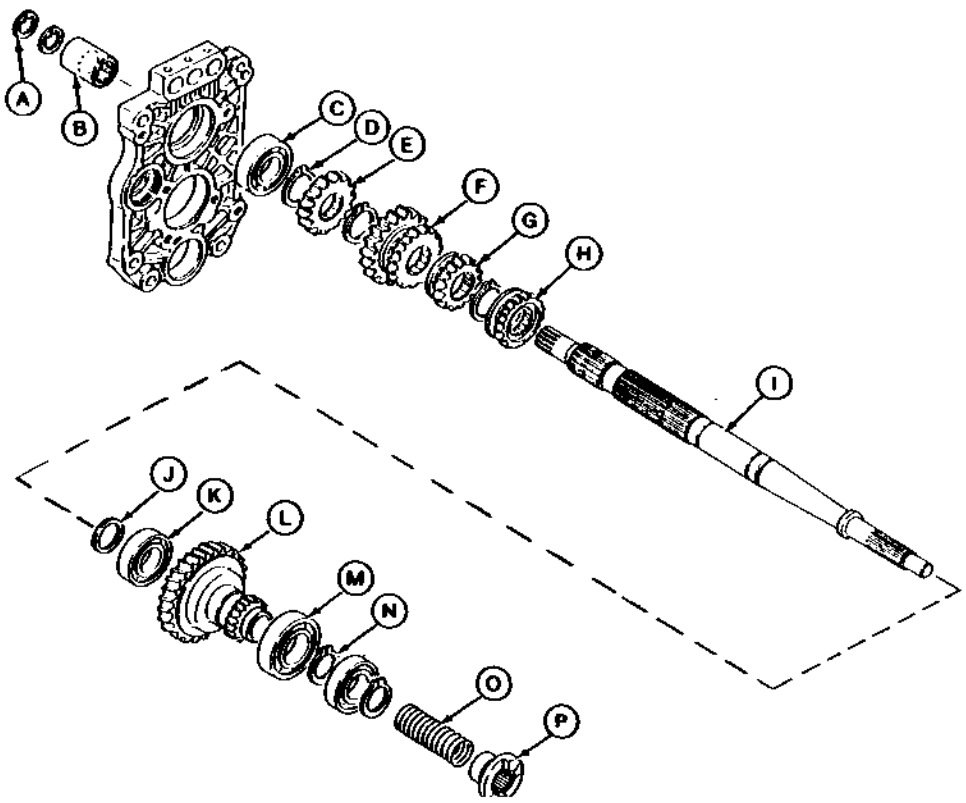
NOTE: Parts (C—I) were removed during bearing quill assembly removal.

CAUTION: Balls (F) will spring from holes in plate as shafts are driven from bearing quill assembly.

2. Remove parts (A—O).

3. Inspect parts for wear or damage. Replace as necessary.

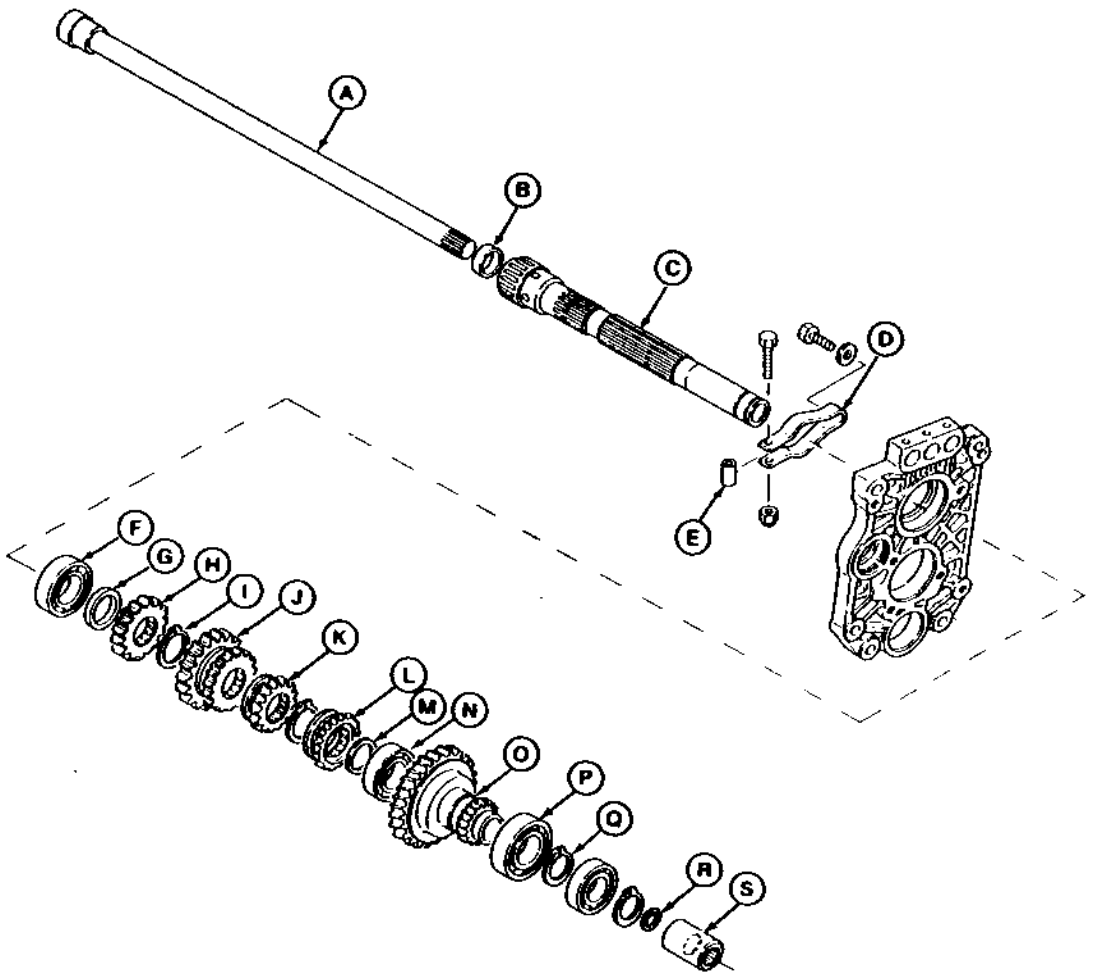
MX,5010DG,A14 -19-01DEC89



A—Snap Ring (2 used)
B—Collar
C—Ball Bearing
D—Snap Ring (3 used)
E—Gear 24T
F—Sliding Gear
G—Sliding Gear 19T
H—Sliding Gear
I—Main Shaft
J—Spacer
K—Ball Bearing (2 used)
L—Reduction Gear
M—Ball Bearing
N—Snap Ring (2 used)
O—Spring
P—Front Overrunning Clutch

Main Shaft—Single Stage Clutch

MX,5010DG,A15 -19-01DEC89



A—PTO Connecting Shaft
B—Bushing
C—Transmission Input Shaft
D—Leaf Spring
E—Spacer
F—Ball Bearing
G—Spacer
H—Gear 24T
I—Snap Ring (2 used)
J—Sliding Gear
K—Sliding Gear 19T
L—Sliding Gear
M—Spacer
N—Ball Bearing (2 used)
O—Reduction Gear
P—Ball Bearing
Q—Snap Ring (2 used)
R—Snap Ring
S—Collar

Main Shaft—Dual Stage Clutch

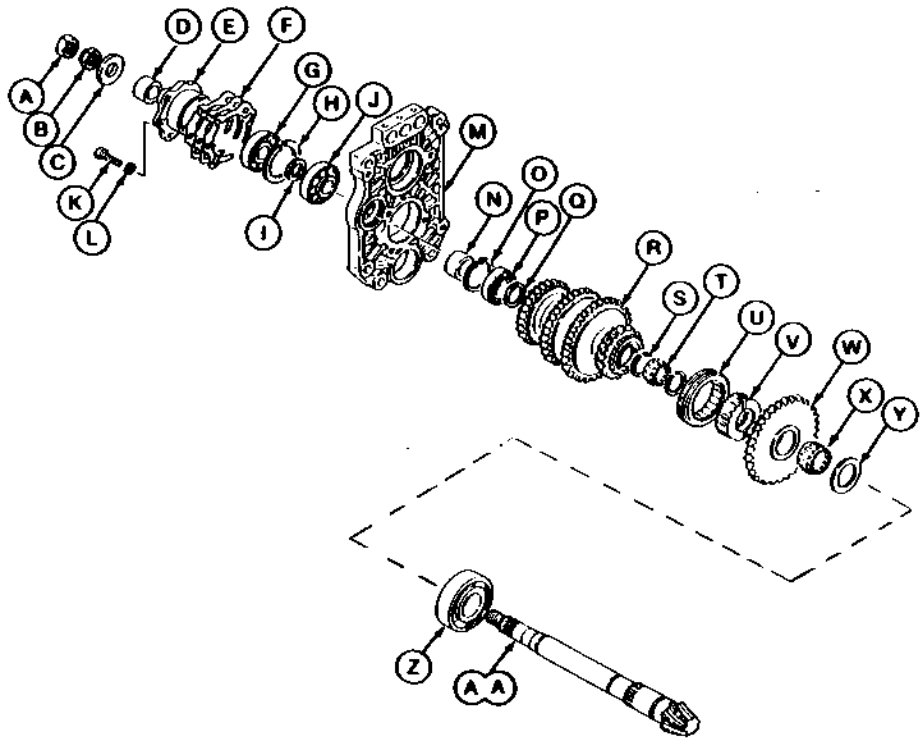
4. Remove shaft assembly from bearing quill plate using a soft-faced mallet.

5. Disassemble parts (A—S).

6. Inspect parts for wear or damage. Replace as necessary.

7. Apply clean transmission/hydraulic oil to all parts during assembly.

MX,5010DG,A16 -19-01DEC89



A—Nut
B—Nut
C—Washer
D—Bushing Gear (MFWD)
E—Bearing Housing
F—Shims (as required)
G—Ball Bearing
H—Ring
I—Spacer
J—Bearing
K—Cap Screw (3 used)
L—Lock Washer (3 used)
M—Bearing Quill Plate
N—Spacer
O—Snap Ring
P—Ball Bearing
Q—Spacer
R—Cluster Gear
S—Ring (2 used)
T—Needle Bearing
U—Sliding Gear
V—Sleeve
W—Gear 48T
X—Needle Bearing
Y—Thrust Washer
Z—Ball Bearing
AA—Drive Shaft

Differential Drive Shaft

8. Remove parts (A—D).

9. Remove cap screws (K) and lock washers (L).

10. Install two cap screws (K) in jack screw holes in housing (E). Turn cap screws in, until they bottom on housing.

11. Remove shims (F).

IMPORTANT: Support drive shaft assembly when removing bearing housing from bearing quill plate (M).

12. Remove housing (E) using a knife-edge puller and a press.

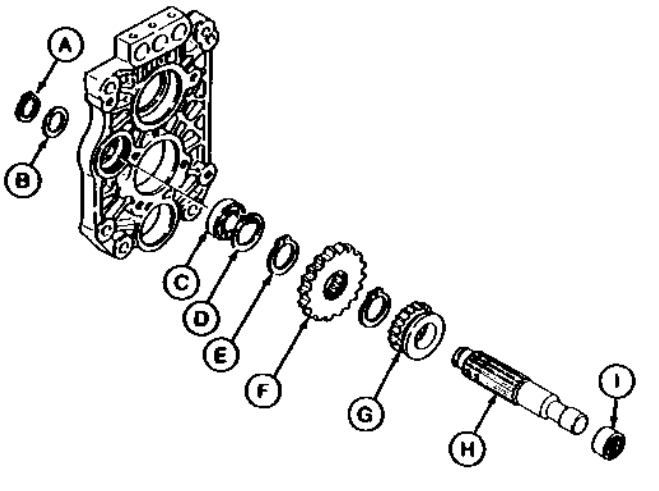
13. Remove cluster gear (R) using a knife-edge puller and a press.

NOTE: Remove bearings only if replacement is necessary.

14. Disassemble parts (N—AA).

15. Inspect parts for wear or damage. Replace as necessary.

MX,5010DG,A18 -19-01DEC89



A—Snap Ring
B—Washer
C—Ball Bearing
D—Snap Ring
E—Snap Ring (2 used)
F—Gear 30T
G—Sliding Gear
H—Reverse Shaft
I—Needle Bearing

50
10
16

Reverse Shaft

16. Remove snap ring (A) and washer (B).

17. Remove shaft assembly from bearing quill plate using a soft-faced mallet.

NOTE: Needle bearing (I) is press fit in transmission housing.

Remove bearings only if replacement is necessary.

18. Disassemble parts (C—H).

19. Inspect parts for wear or damage. Replace as necessary.

Remove bearing (I) using a bearing, bushing and seal driver set.

20. Apply clean transmission/hydraulic oil to all parts during assembly.

MX,5010DG,A17 -19-01DEC89

21. Apply clean transmission/hydraulic oil to all parts during assembly.

22. Assemble all parts.

IMPORTANT: Original shims can be installed unless differential shaft and ring gear are replaced. The differential shaft and ring gear must be replaced as a set, and differential cone point and backlash adjusted. (See procedure in Group 20.)

23. Apply thread lock and sealer (medium strength) to cap screws (K) and nuts (A and B). Install and tighten to specifications.

TORQUE SPECIFICATIONS

Cap Screws (K)	36 N·m (27 lb-ft)
Nuts (A and B)	108 N·m (80 lb-ft)

MX,5010DG,A19 -19-19DEC89

OTHER MATERIAL

Number	Name	Use
TY6305	Clean and Cure Primer	To clean and cure surfaces prior to application of adhesives or sealants.
TY6304	Flexible Sealant	To provide a seal between mating surfaces.
T43512	Thread Lock and Sealer (Medium Strength)	Apply to threads of mounting cap screws.

MX,5015DG,A1 -19-04DEC89

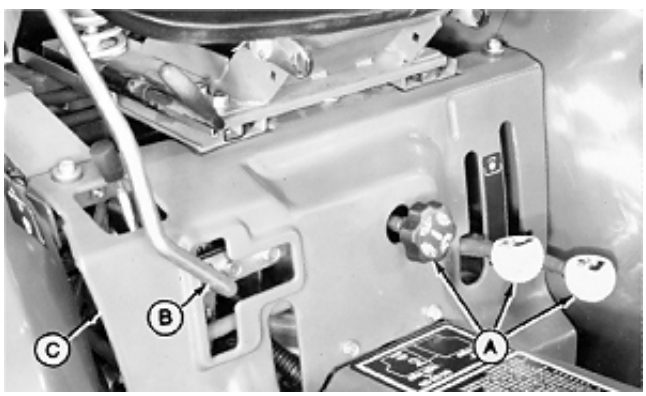
REMOVE, INSPECT AND INSTALL REAR PTO LEVER AND SHIFT LINKAGE

1. Remove knobs (A).

2. Remove SCV lever (B), if equipped.

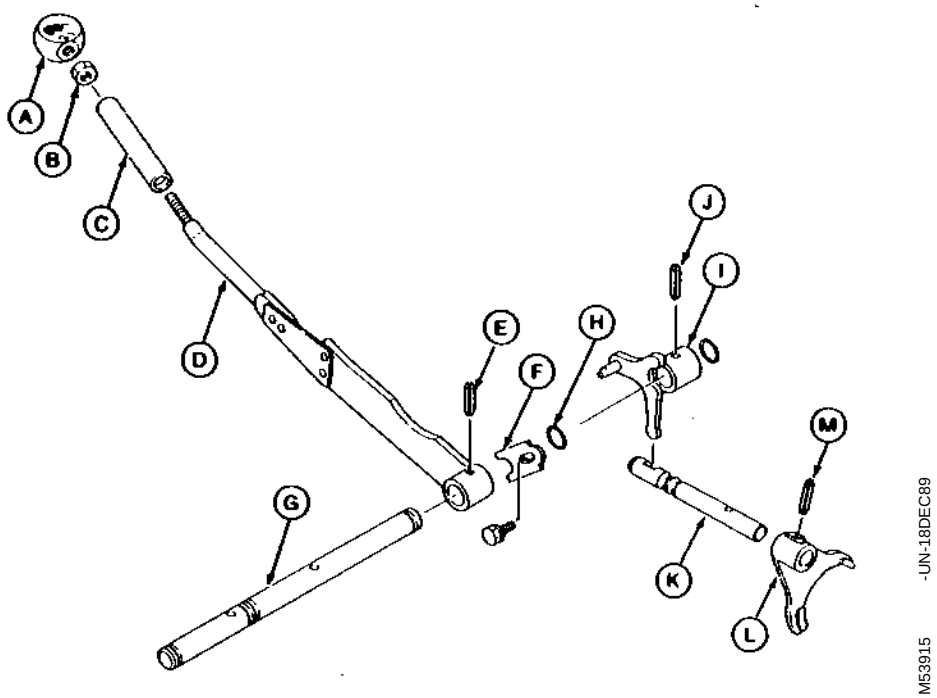
3. Remove panel (C).

4. Mid mount PTO: Remove control lever. (See Inspect and Repair Lever and Linkage in Group 35.)



-UN-05JAN90
M53250

MX,5015DG,A2 -19-04DEC89



A—Knob
B—Nut
C—Tube
D—Lever
E—Spring Pin
F—Lock Plate
G—Change Arm Shaft
H—Packing (2 used)
I—Change Arm
J—Spring Pin
K—Shift Shaft
L—Shift Fork
M—Spring Pin

5. Remove left-hand fender.

NOTE: To service parts (G—J), remove rockshaft case. (See Section 70, Group 10.)

To service parts (K—M), remove rear PTO drive shaft assembly. (See procedure in this group.)

6. Remove parts (A—M).

7. Inspect parts for wear or damage. Replace as necessary.

8. Install all parts.

9. Install fender.

10. Mid mount PTO: Install lever. (See procedure in Group 35.)

11. Install panel, knobs and SCV lever, if equipped.

MX,5015DG,A3 -19-04DEC89

REMOVE AND INSTALL REAR PTO DRIVE SHAFT ASSEMBLY

NOTE: The approximate capacity of transmission is 15 L (4 U.S. gal).

1. Drain transmission.

2. Remove left-hand fender.

3. Mid mount PTO: Remove e-clip and washer (C).

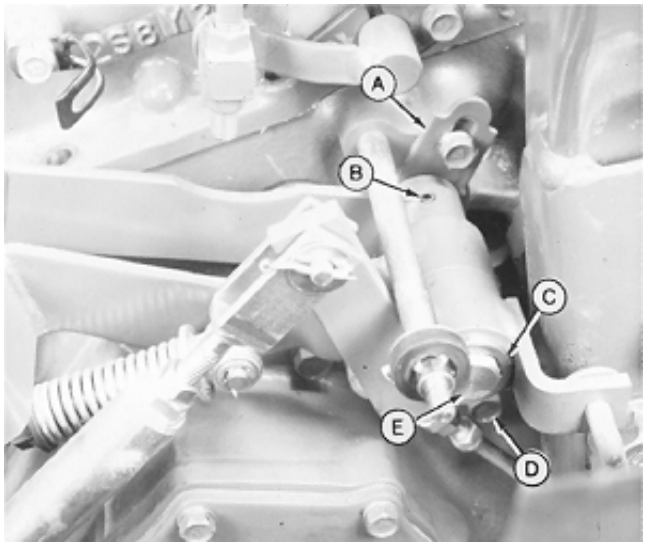
4. Remove spring pin (B).

5. Remove lock plate (A).

6. Drive shaft (E) toward transmission housing using a soft-faced mallet.

NOTE: Remove detent ball using a magnet.

7. Remove cap screw, seal, spring and detent ball (D).



M53917 -UN-18DEC89

A—Lock Plate
B—Spring Pin
C—E-Clip and Washer
D—Cap Screw, Seal, Spring and Detent Ball
E—Shaft

MX,5015DG,A4 -19-04DEC89

8. Remove 3-point hitch.

9. Remove shield (C).

10. Remove plate (E).

11. Mid mount PTO: Remove cover (D).

12. Remove cap screws (F) and brackets.

13. Remove cap screws (A and B) and plate.

14. Remove rear PTO drive shaft assembly (G) and gasket.

15. Make repairs as necessary. (See procedure in this group.)

50
15
4

16. Clean mating surfaces of transmission housing and rear PTO cover using clean and cure primer. Apply flexible sealant to mating surfaces.

17. Install rear PTO drive shaft assembly and new gasket.

18. Apply thread lock and sealer (medium strength) to threads of cap screws (A, B and F).

19. Install plate and brackets. Tighten cap screws (A) to specifications.

20. Mid mount PTO: Install cover.

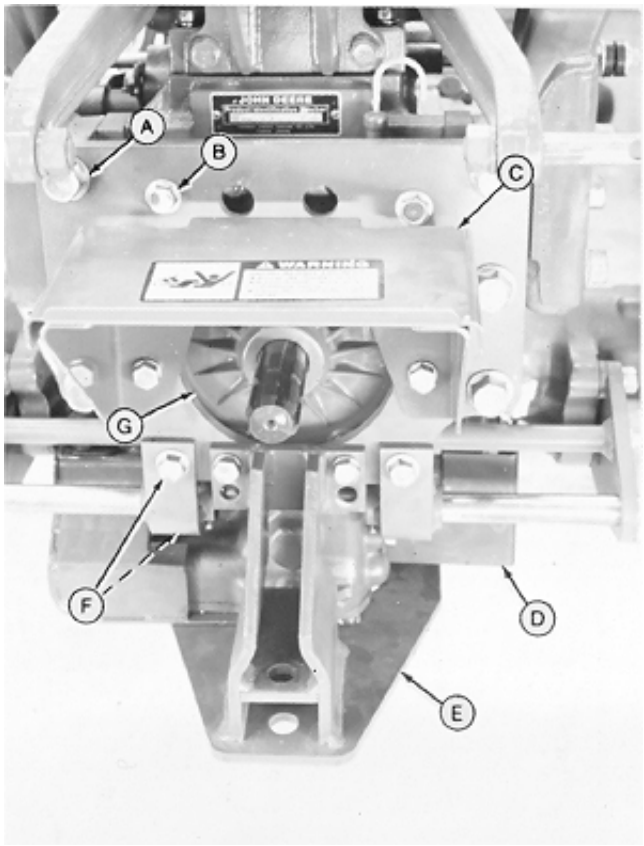
21. Install drawbar plate. Tighten bottom cap screws to specifications.

22. Install 3-point hitch.

TORQUE SPECIFICATIONS

Cap Screws (A) . . . . . 265 N·m (195 lb-ft)

Bottom Cap Screws
Drawbar Plate . . . . . 340 N·m (250 lb-ft)



-UN-18DEC89
M53913

A—Cap Screw (6 used)
B—Cap Screw (2 used)
C—PTO Shield
D—Mid Mount PTO Cover
E—Drawbar Plate
F—Cap Screws (4 used)
G—Rear PTO Drive Shaft Assembly

MX,5015DG,A5 -19-04DEC89

23. Install detent ball (D), spring, seal and cap screw.

NOTE: When driving shaft toward transmission housing, rotate shaft to engage shift arm with shaft inside transmission housing.

24. Drive shaft (E), from right-hand side, toward transmission housing using a soft-faced mallet.

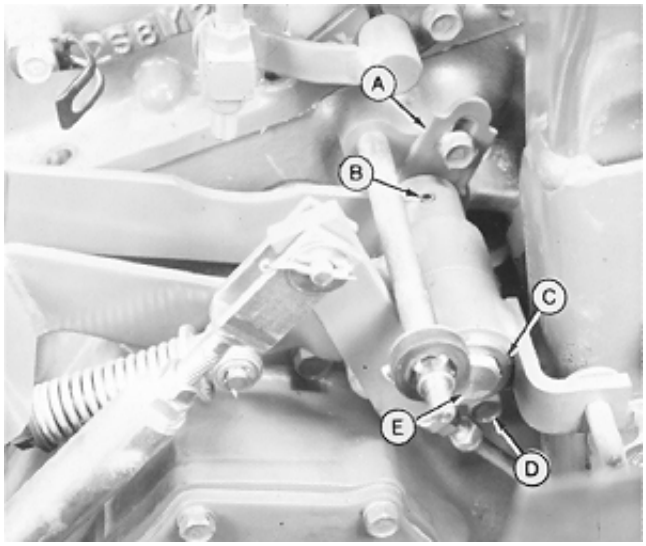
25. Install lock plate (A).

26. Install spring pin (B).

27. Mid mount PTO: Install e-clip and washer (C).

28. Install left-hand fender.

29. Fill transmission with proper transmission/hydraulic oil. (See Section 10, Group 20.)



M53917 -UN-18DEC89

A—Lock Plate
B—Spring Pin
C—E-Clip and Washer
D—Cap Screw, Seal, Spring and Detent Ball
E—Shaft

MX,5015DG,A6 -19-04DEC89

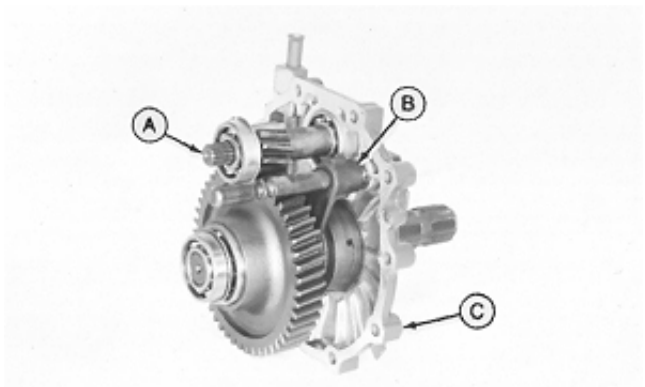
DISASSEMBLE, INSPECT AND ASSEMBLE REAR PTO DRIVE SHAFT ASSEMBLY

1. Remove pinion shaft (A).

2. Remove cover (C) using a press.

3. Remove shift shaft assembly (B).

4. Replace seal in cover using a bearing, bushing and seal driver set.



M53918 -UN-18DEC89

MX,5015DG,A7 -19-04DEC89

NOTE: Remove bearings and bushing only if replacement is necessary.

5. Remove parts (A—E).

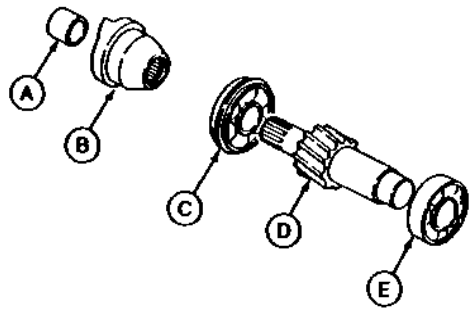
Remove bearings (C and E) using a 2-jaw puller.

Single stage clutch: Remove bushing (A) using a blind hole puller set. Install bushing flush to outside surface of cam (B) using a bearing, bushing and seal driver set.

6. Inspect parts for wear or damage. Replace as necessary.

7. Apply clean transmission/hydraulic oil to all parts.

8. Assemble parts.

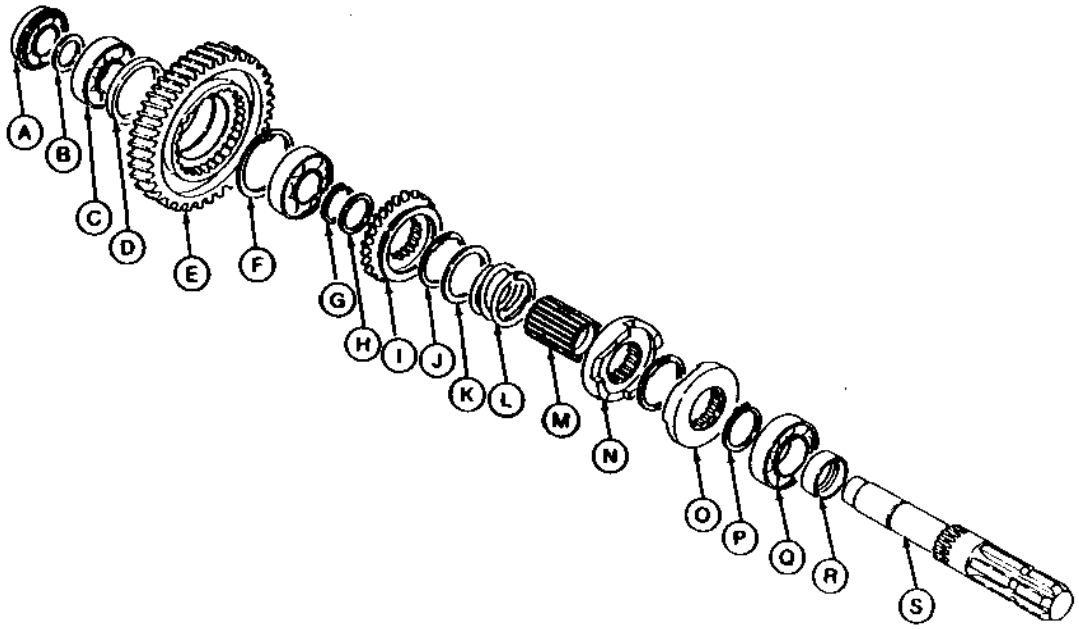


M53914 -UN-18DEC89

Pinion Shaft

A—Bushing (Single Stage Clutch)
Snap Ring (Dual Stage Clutch)
B—Cam (Single Stage Clutch)
Coupling (Dual Stage Clutch)
C—Ball Bearing
D—Shaft
E—Ball Bearing

MX,5015DG,A8 -19-04DEC89



A—Ball Bearing
B—Spacer
C—Ball Bearing (2 used)
D—Spacer
E—Gear
F—Snap Ring
G—Snap Ring
H—Guide
I—Sliding Gear
J—Snap Ring (2 used)
K—Spacer
L—Spring
M—Slider Sleeve
N—Overrunning Clutch (Front)
O—Overrunning Clutch (Rear)
P—Snap Ring
Q—Ball Bearing
R—Sleeve
S—Drive Shaft

Rear PTO Drive Shaft

NOTE: Drive shaft for single stage clutch shown. Parts (G and H) and (J—O) are on single stage clutch only.

9. Remove parts (A—E) using a press.

NOTE: Bearings (C) are slip fit.

10. Disassemble parts (F—S).

Remove bearing (Q) using a knife-edge puller.

11. Inspect parts for wear or damage. Replace as necessary.

12. Apply clean transmission/hydraulic oil to all parts.

13. Assemble parts.

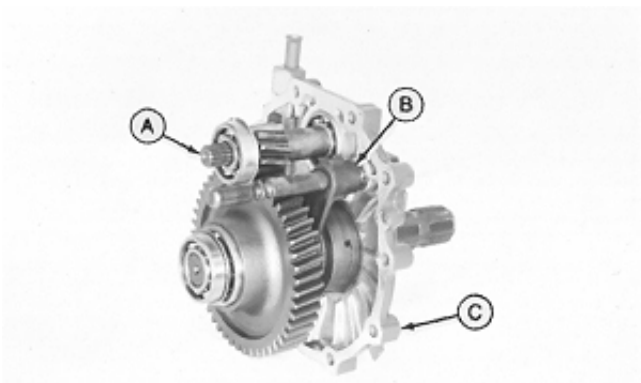
MX,5015DG,A9 -19-04DEC89

14. Install shift shaft assembly (B).

15. Apply multipurpose grease to lips of seal in cover.

16. Install cover (C) using a soft-faced mallet.

17. Install pinion shaft (A).



MX,5015DG,A10 -19-04DEC89

OTHER MATERIAL

Number	Name	Use
T43512	Thread Lock and Sealer (Medium Strength)	Apply to threads of ring gear cap screws.

MX,5020DG,A1 -19-04DEC89

REMOVE AND INSTALL DIFFERENTIAL

1. Remove transmission bearing quill assembly. (See procedure in Group 10.)

2. Remove rockshaft case. (See procedure in Section 70, Group 10.)

3. Remove final drive assemblies. (See procedure in Group 25.)

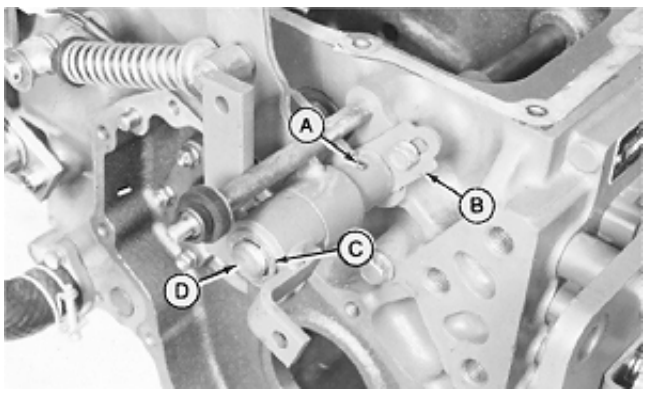
4. Mid mount PTO: Remove e-clip and washer (C).

5. Remove spring pin (A).

6. Remove lock plate (B).

N **CAUTION: Mid mount PTO control lever is under spring pressure. When driving shaft toward transmission housing, do not drive shaft past mid mount PTO control lever.**

7. Drive shaft (D) toward transmission housing using a brass drift and hammer.



M53916 -UN-18DEC89

A—Spring Pin
B—Lock Plate
C—E-Clip and Washer
D—Shaft

MX,5020DG,A2 -19-04DEC89

NOTE: Shims are on left-hand side only.

8. Remove cap screws and lock washers (B).

9. Install two cap screws in jack screw holes (A). Turn cap screws in to remove bearing quill (C) and shims (D).

10. Remove right-hand side bearing quill.

11. Remove differential assembly.

12. Make repairs as necessary. (See procedure in this group.)

13. Install differential assembly.

IMPORTANT: Original shims can be installed unless differential shaft and ring gear are replaced. The differential shaft and ring gear must be replaced as a set, and differential cone point and backlash adjusted. (See procedures in this group.)

14. Install shims and bearing quill. Tighten cap screws (B) to 27 N·m (20 lb-ft).



M53920 -UN-18DEC89

A—Jack Screw Holes
B—Cap Screw and Lock Washer (5 used)
C—Bearing Quill
D—Shims (as required)

MX,5020DG,A3 -19-04DEC89

NOTE: When driving shaft toward transmission housing, rotate shaft to engage rear PTO shift arm with shift shaft.

15. Drive shaft (D), from right-hand side, toward transmission housing using a soft-faced mallet.

16. Install lock plate (B).

17. Install spring pin (A).

18. Mid mount PTO: Install e-clip and washer (C).

IMPORTANT: Do not adjust cone point or backlash unless the ring gear was replaced or if the amount of side shims are in question.

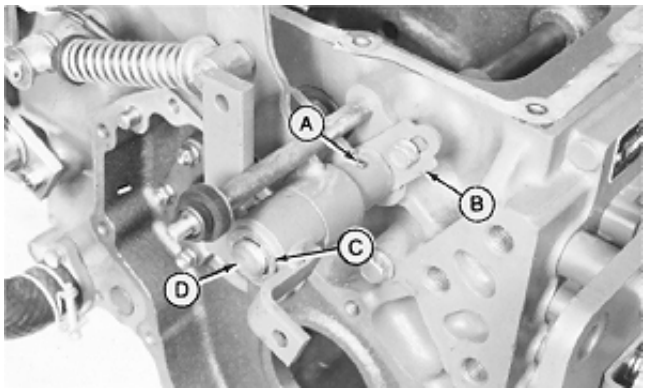
19. Adjust differential cone point. (See procedure in this group.)

20. Adjust differential drive shaft-to-ring gear backlash. (See procedure in this group.)

21. Install final drive assemblies. (See procedure in Group 25.)

22. Install rockshaft case. (See procedure in Section 70, Group 10.)

23. Install transmission bearing quill assembly. (See procedure in Group 10.)



M53916 -UN-18DEC89

A—Spring Pin
B—Lock Plate
C—E-Clip and Washer
D—Shaft

MX,5020DG,A4 -19-04DEC89

DISASSEMBLE, INSPECT AND ASSEMBLE DIFFERENTIAL ASSEMBLY

IMPORTANT: If ring gear (F) is to be reused, mark gear and carrier (E) for installation in same position.

1. Disassemble parts (A—K).

NOTE: Remove bearings and bushings only if replacement is necessary.

Remove bearings (B) using a knife edge puller and a press.

Remove bushings (C) using a blind hole puller set.

2. Inspect parts for wear or damage. Replace as necessary.

IMPORTANT: The differential housing can be distorted if bearings or ring gear are pressed on cold.

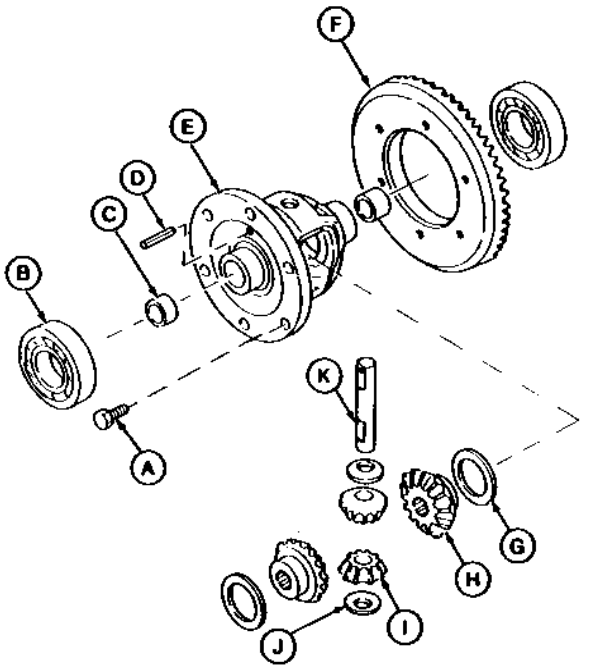
CAUTION: DO NOT heat oil over 182˚C (360˚F). Oil fumes or oil can ignite above 193˚C (380˚F). Use a thermometer. DO NOT allow a flame or heating element to come in direct contact with the oil. Heat the oil in a well-ventilated area.

3. Heat bearings and ring gear to 150˚C (300˚F).

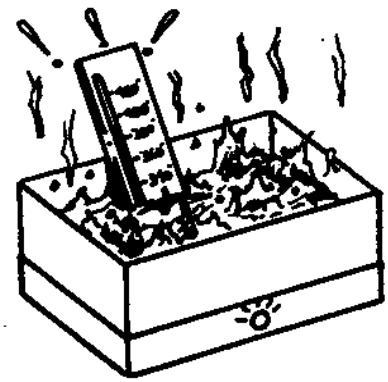
4. Assemble all parts.

5. Apply thread lock and sealer (medium strength) to threads of cap screws (A).

6. Install cap screws and tighten to 54 N·m (40 lb-ft).



M53922 -UN-18DEC89



T81191 -UN-23FEB89

A—Cap Screw (6 used-670)
Cap Screw and Lock Washer (8 used-770)
B—Ball Bearing (2 used)
C—Bushing (2 used-670 only)
D—Spring Pin
E—Differential Carrier
F—Ring Gear
G—Thrust Washer (2 used)
H—Bevel Gear (2 used)
I—Bevel Pinion (2 used)
J—Thrust Washer (2 used)
K—Pinion Shaft

MX,5020DG,A5 -19-04DEC89

ADJUST DIFFERENTIAL CONE POINT

IMPORTANT: Adjust cone point only if ring gear and differential drive shaft were replaced. If gear and shaft were not replaced, use same shim pack or same thickness of original shims removed.

NOTE: Apply paint to about ten or twelve teeth on ring gear.

1. Paint ring gear teeth, from toe (A) to heel (B), with a mixture of red lead and linseed oil.

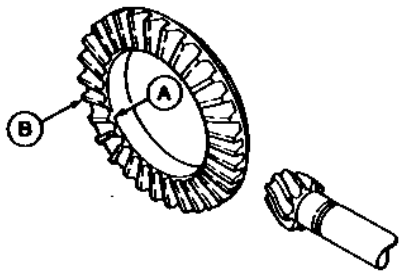
2. Apply a small amount of resistance to ring gear with a flat steel bar and one rotate differential drive shaft using a wrench. Rotate ring gear at least one complete revolution in each direction.

3. Check ring gear tooth contact pattern. Pattern shold be preferred pattern (C).

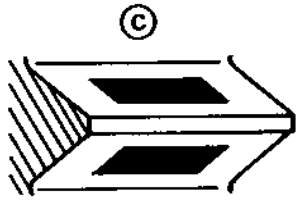
4. To correct a shallow pattern (D), loosen cap screws from bearing quill (H) and remove shims (I) until the preferred pattern (C) is obtained. To correct a deep pattern (E), add shims.

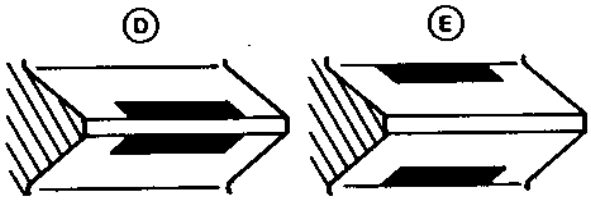
5. To correct toe pattern (F), increase differential drive shaft-to-ring gear backlash. To correct heel pattern (G), decrease backlash. (See Adjust Differential Drive Shaft-to-Ring Gear Backlash in this group.)

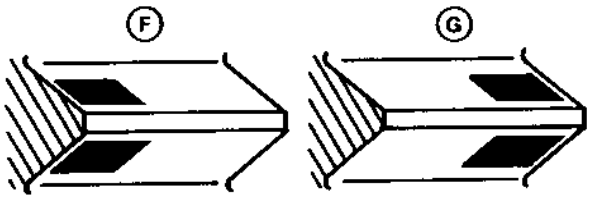
A—Ring Gear Toe (inside)
B—Ring Gear Heel (outside)
C—Preferred Pattern
D—Shallow Pattern
E—Deep Pattern
F—Toe Pattern
G—Heel Pattern
H—Bearing Quill
I—Shims



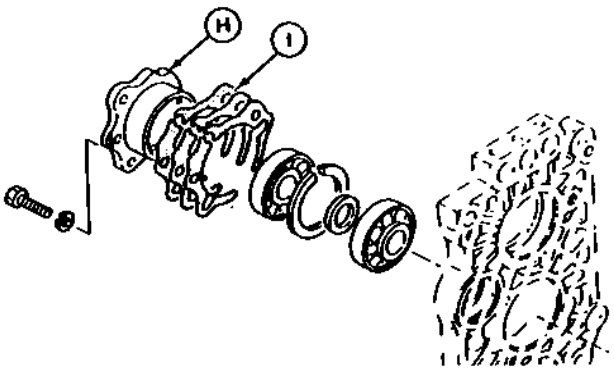
M53935 -UN-29JAN90







M53936 -UN-29JAN90



M53937 -UN-29JAN90

MX,5020DG,A6 -19-04DEC89

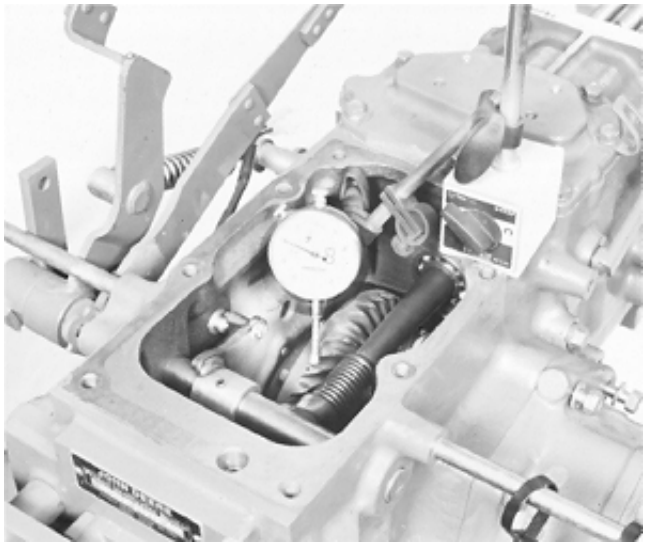
ADJUST DIFFERENTIAL DRIVE SHAFT-TO-RING GEAR BACKLASH

IMPORTANT: Always check and adjust backlash after cone point adjustment. Do not adjust backlash unless the ring gear was replaced or if the amount of side shims are in question.

1. While slowly rotating differential carrier, lightly tap carrier with a soft-faced mallet to seat carrier and bearing against left-hand side quill.

2. Attach a dial indicator to housing as shown with contact point positioned on ring gear splines.

3. While holding input shaft, move carrier and ring gear to determine backlash. Backlash should be 0.13—0.18 mm (0.005—0.007 in.).



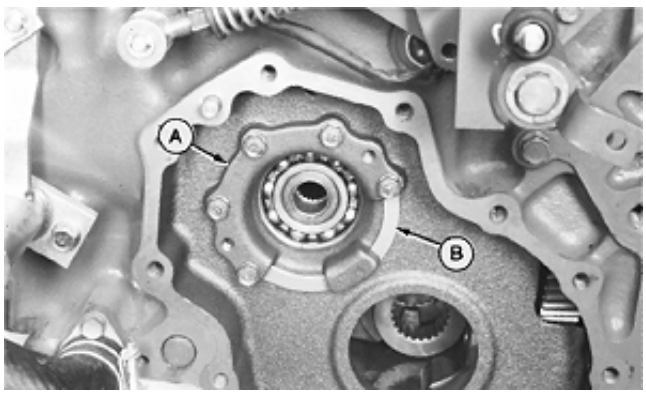
M53928 -UN-18DEC89

MX,5020DG,A7 -19-04DEC89

4. To adjust backlash, remove left side quill (A).

5. Remove shims (B) to decrease backlash, and add to increase.

6. Recheck backlash after removing or adding shims.



M53929 -UN-18DEC89

MX,5020DG,A8 -19-04DEC89

REMOVE, INSPECT AND INSTALL DIFFERENTIAL LOCK

1. Remove differential. (See procedure in this group.)

NOTE: Differential lock pedal and fork need not be removed to service parts (I—L).

2. Remove transmission housing oil filter.

NOTE: Parts (J—L) are on right-hand final drive assembly.

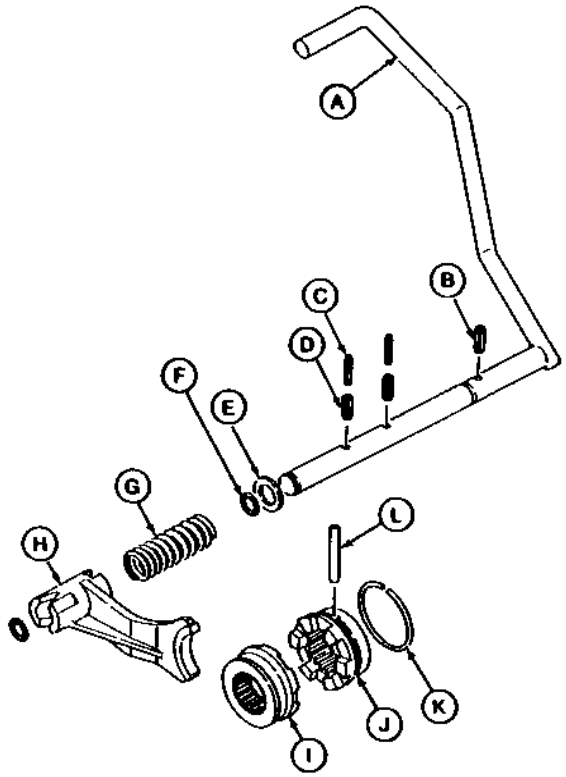
3. Remove parts (A—L).

4. Inspect parts for wear or damage. Replace as necessary.

NOTE: Install pins (C) inside pins (D) with splits facing 180° (opposite) each other.

5. Install all parts.

A—Differential Lock Pedal
B—Spring Pin
C—Spring Pin (2 used)
D—Spring Pin (2 used)
E—Spacer
F—Packing (2 used)
G—Spring
H—Differential Lock Fork
I—Left-Hand Locking Collar
J—Right-Hand Locking Collar
K—Ring
L—Pin



M53923 -UN-18DEC89

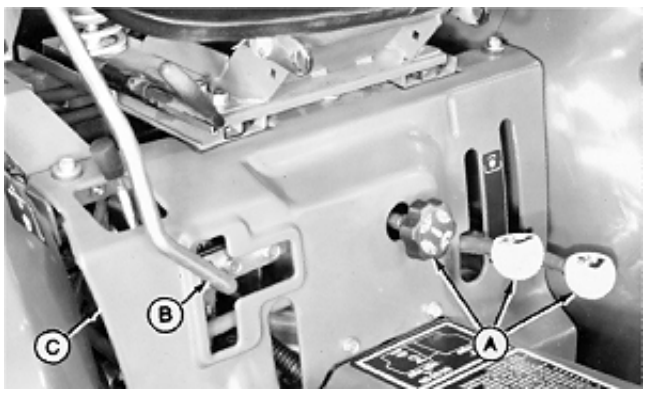
MX,5020DG,A9 -19-05DEC89

OTHER MATERIAL

Number	Name	Use
TY6305	Clean and Cure Primer	To clean and cure surfaces prior to application of adhesives or sealants.
TY6304	Flexible Sealant	To provide a seal between mating surfaces.

MX,5025DG,A1 -19-23OCT89

REMOVE AND INSTALL FINAL DRIVE ASSEMBLY—RIGHT-HAND SIDE



M53250 -UN-05JAN90

NOTE: The approximate capacity of transmission is 15 L (4 U.S. gal).

1. Drain transmission.

2. Install a block of wood between front axle and frame on both sides.

3. Remove ROLL-GARD. (See procedure in Section 80, Group 30.)

4. Remove rear wheel.

5. Remove 3-point hitch.

NOTE: If tractor is not equipped with SCV, Go to Step 11.

6. Remove lever (B).

7. Remove knobs (A) and panel (C).

8. Remove step plate.

MX,5025DG,A2 -19-05DEC89

9. Remove support bracket (E).

10. Remove line (D). Close openings with caps and plugs.

11. Remove cap screw (A).

12. Disconnect brake rod (F).

13. Mid mount PTO: Remove cover (B).

14. Mid mount PTO: Disconnect wiring connector (C).

15. Remove final drive assembly (G) and gasket.

16. Make repairs as necessary. (See Remove, Inspect and Install Axle Shaft and Pinion Shaft in this group.)

50
25
2

17. Clean mating surfaces of transmission and final drive housings using clean and cure primer. Apply flexible sealant to mating surfaces.

18. Install final drive assembly and new gasket. Tighten cap screws to 50 N·m (36 lb-ft).

19. Mid mount PTO: Connect wiring connector and install cover.

20. Connect brake rod.

21. Install cap screw.

NOTE: If tractor is not equiped with SCV, Go to Step 25.

22. Install return line.

23. Install support bracket and step plate.

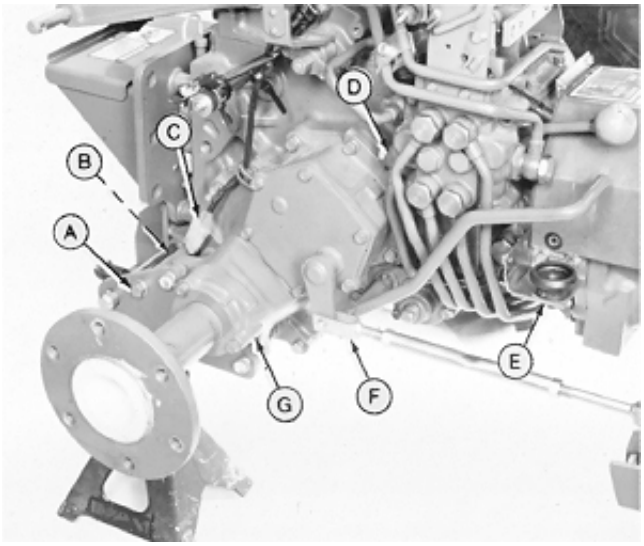
24. Install panel, knobs and control rod.

25. Install 3-point hitch.

26. Install wheel.

27. Install ROLL-GARD. (See procedure in Section 80, Group 30.)

28. Fill transmission with proper transmission/hydraulic oil. (See Section 10, Group 20.)



M53926 -UN-18DEC89

A—Cap Screw
B—Mid Mount PTO Switch Cover
C—Wiring Connector
D—SCV Pressure Line
E—Step Plate Support Bracket
F—Brake Rod
G—Final Drive Assembly

MX,5025DG,A3 -19-12DEC89

REMOVE AND INSTALL FINAL DRIVE ASSEMBLY—LEFT-HAND SIDE

NOTE: Right-hand final drive must be removed to aid left-hand final drive installation.

1. Remove right-hand final drive assembly (See procedure in this group.)

2. Remove rear wheel.

3. Disconnect brake rod (G).

4. Remove cap screw (B).

NOTE: If tractor is not equipped with mid mount PTO, Go to Step 9.

5. Remove bracket (E).

6. Remove drawbar plate (C).

7. Disconnect rod (A).

8. Remove cover (D).

9. Remove final drive assembly (F) and gasket.

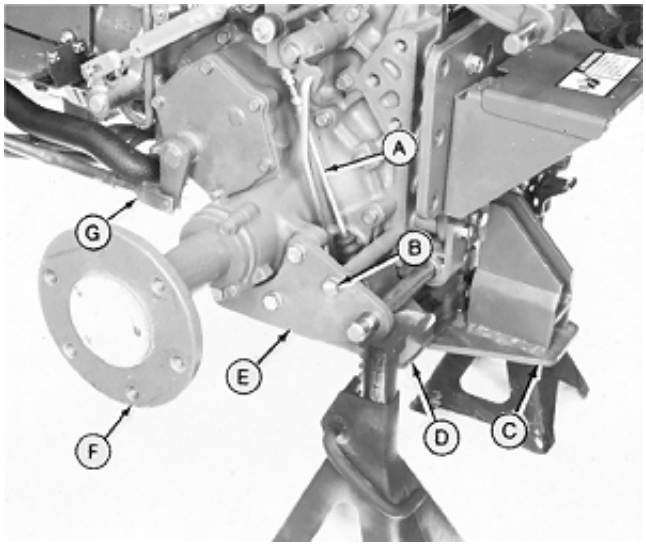
10. Make repairs as necessary. (See Remove, Inspect and Install Axle Shaft and Pinion Shaft in this group.)

11. Clean mating surfaces of transmission and final drive housings using clean and cure primer. Apply flexible sealant to mating surfaces.

NOTE: Align differential lock cam with final drive assembly from right-hand side of tractor during installation. Move differential lock pedal up and down, if necessary.

12. Install final drive assembly and new gasket. Align differential lock cam with final drive assembly. Tighten cap screws to specifications.

NOTE: If tractor is not equipped with mid mount PTO, Go to Step 16.



M53927 -UN-18DEC89

A—Mid Mount PTO Control Rod
B—Cap Screw
C—Drawbar Plate
D—Cover
E—Bracket
F—Final Drive Assembly
G—Brake Rod

MX,5025DG,A4 -19-12DEC89

13. Install cover and connect rod.

14. Install bracket.

15. Install drawbar plate. Tighten bottom cap screws to specifications.

16. Install cap screw.

17. Connect brake rod.

18. Install wheel.

19. Install right-hand final drive assembly (See procedure in this group.)

TORQUE SPECIFICATIONS

50
25
4

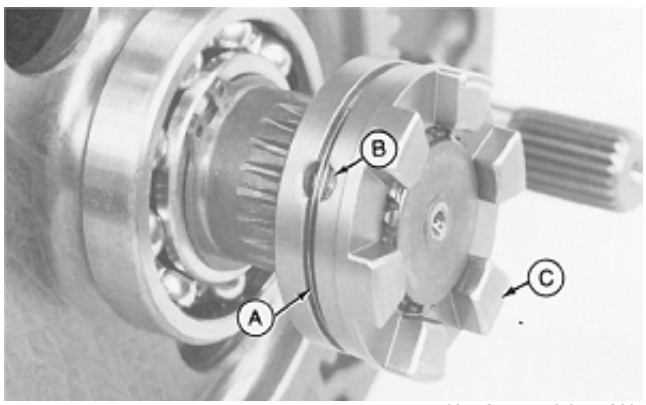
Final Drive Assembly
Cap Screws . . . . . 50 N·m (36 lb-ft)

Drawbar Plate Bottom
Cap Screws . . . . . 340 N·m (250 lb-ft)

MX,5025DG,A10 -19-09JAN90

REMOVE, INSPECT, AND INSTALL AXLE SHAFT

1. Right-hand side axle shaft: Remove spring wire (A), pin (B) and locking collar (C).



-UN-30NOV88
RW897

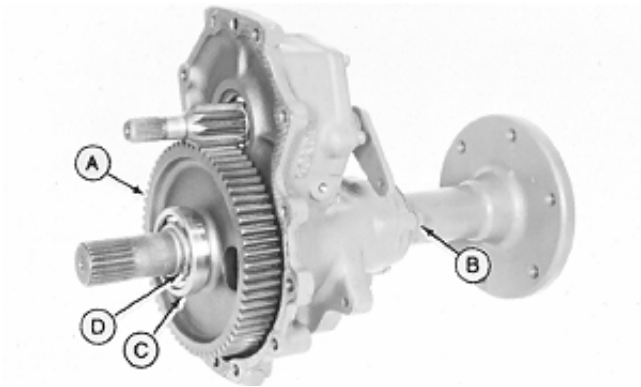
MX,5025DG,A5 -19-05DEC89

2. Remove cap screws and lock washers (B).

3. Remove snap ring (D).

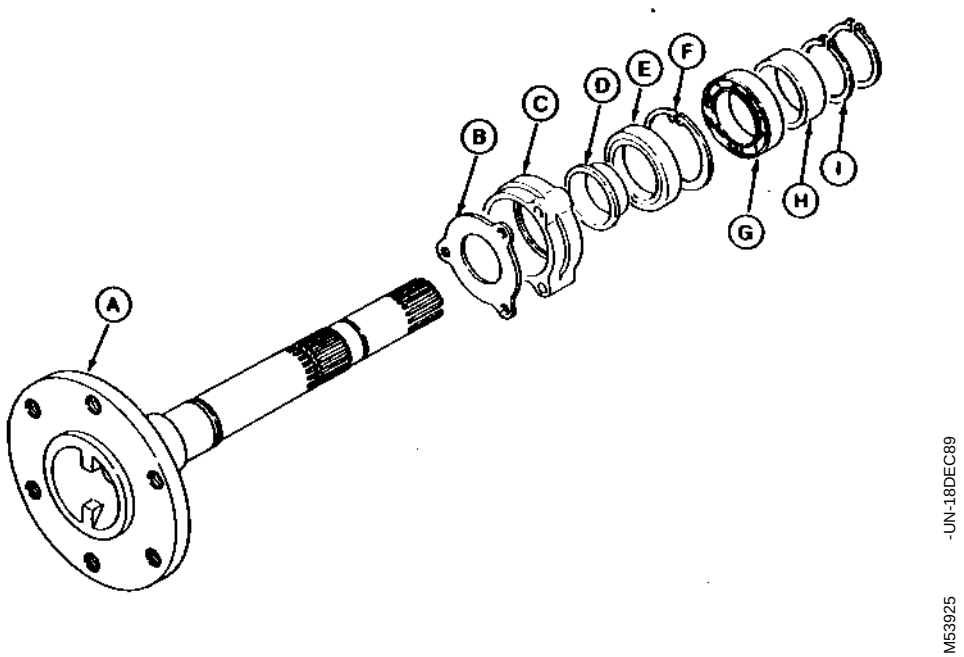
4. Remove bearing (C), gear (A), axle shaft assembly and gasket from final drive housing using a lead hammer.

A—Drive Gear
B—Cap Screw and Lock Washer (3 used)
C—Ball Bearing
D—Snap Ring



Left-Hand Final Drive Shown

MX,5025DG,A6 -19-05DEC89



A—Axle Shaft
B—Seal Housing Cover
C—Seal Housing
D—Sleeve
E—Seal
F—Snap Ring
G—Ball Bearing
H—Sleeve
I—Snap Ring (2 used)

5. Remove snap rings (I).

6. Remove parts (B—H) from shaft (A) using a press.

7. Inspect parts for wear or damage. Replace as necessary.

8. Install seal with open side toward snap ring (F).

9. Apply multipurpose grease to lips of seal.

10. Install all parts.

MX,5025DG,A7 -19-05DEC89

11. Clean mating surfaces of final drive and bearing housings using clean and cure primer. Apply flexible sealant to mating surfaces.

12. Install axle shaft assembly and new gasket into final drive housing.

13. Install cap screws and lock washers (B). Tighten cap screws to 27 N·m (20 lb-ft).

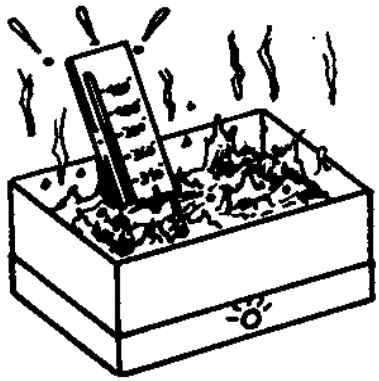
14. Install gear (A).

CAUTION: DO NOT heat oil over 182˚C (360˚F). Oil fumes or oil can ignite above 193˚C (380˚F). Use a thermometer. DO NOT allow a flame or heating element to come in direct contact with the oil. Heat the oil in a well-ventilated area.

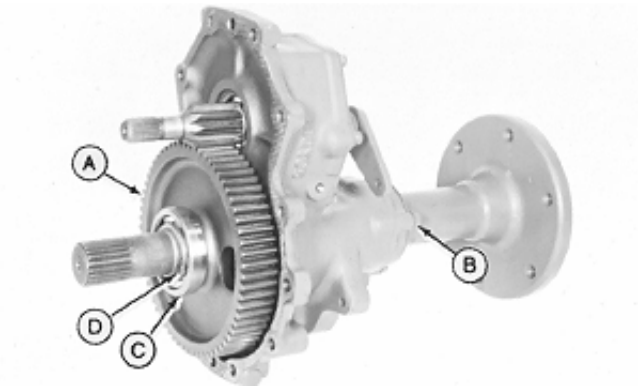
15. Heat bearing (C) to 150˚C (300˚F).

16. Install bearing (C) and snap ring (D).

17. Right-hand side axle shaft: Install locking collar, pin and spring wire.



T81191 -UN-23FEB89



M53924 -UN-18DEC89

A—Drive Gear
B—Cap Screw and Lock Washer (3 used)
C—Ball Bearing
D—Snap Ring

MX,5025DG,A8 -19-05DEC89

REMOVE, INSPECT, AND INSTALL PINION SHAFT

1. Remove axle shaft. (See procedure in this group.)

2. Remove brake drum. (See Remove, Inspect and Install Brakes in Section 60, Group 15.)

3. Remove spring pin (D).

4. Remove pinion shaft assembly using a soft-faced mallet.

5. Remove sleeve (B) and bearing (C) using a knife-edge puller and a press.

6. Replace seal (A) using a bearing, bushing and seal driver set.

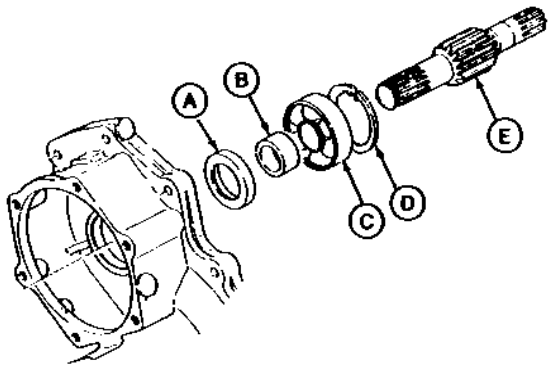
7. Install seal with open side toward bearing (C).

8. Apply multipurpose grease to lips of seal.

9. Install all parts.

10. Install brake drum. (See Remove, Inspect and Install Brakes in Section 60, Group 15.)

11. Install axle shaft. (See procedure in this group.)



M53930 -UN-18DEC89

A—Seal
B—Sleeve
C—Ball Bearing
D—Snap Ring
E—Pinion Shaft

MX,5025DG,A9 -19-05DEC89

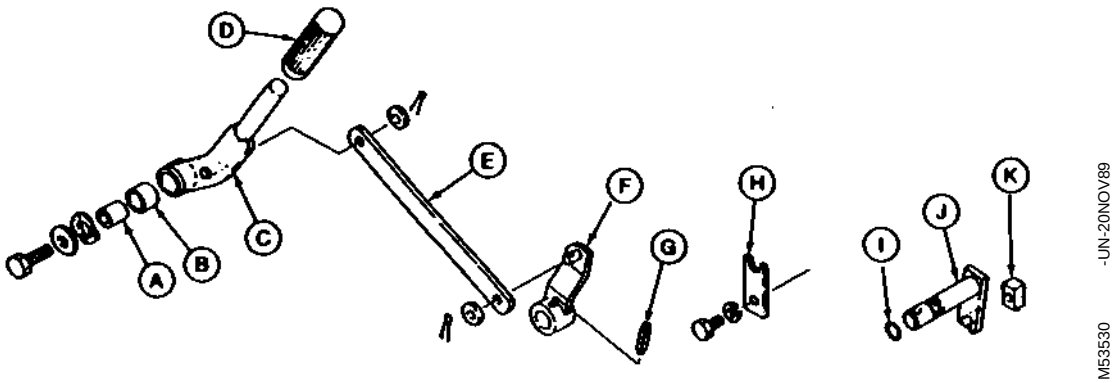
OTHER MATERIAL

Number	Name	Use
T43512	Thread Lock and Sealer (Medium Strength)	Apply to threads of outer drive and differential carrier mounting cap screws.
TY6305	Clean and Cure Primer	To clean and cure surfaces prior to application of adhesives or sealants.
TY6304	Flexible Sealant	To provide a seal between mating surfaces.

MX,5030DG,A1 -19-26SEP89

50 30 1

INSPECT AND REPAIR MFWD LEVER AND LINKAGE



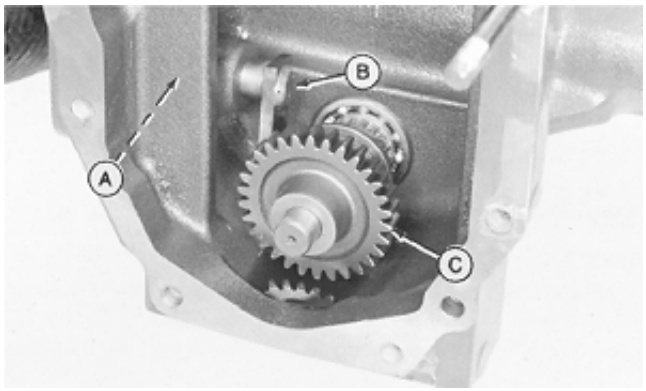
A—Bushing
B—Bushing
C—Lever
D—Knob
E—Link
F—Arm
G—Spring Pin
H—Plate
I—Packing
J—Arm
K—Shift Collar

Remove clutch housing cover and left-hand step plate.

NOTE: To repair or replace parts (I, J and K), separate transmission from clutch housing. (See procedure in Group 10.)

MX,5030DG,A2 -19-26SEP89

REMOVE, INSPECT AND INSTALL TRANSMISSION OUTPUT SHAFT AND MFWD DRIVE GEAR



M53861 -UN-20NOV89

1. Separate transmission from clutch housing. (See procedure in Group 10.)

2. Loosen lock plate cap screw (A) and push shift arm (B) away from shift.

3. Remove output shaft assembly (C) using a soft-faced mallet on splined end.

50
30
2

MX,5030DG,A3 -19-08NOV89

CAUTION: Balls (D) and spring (E) will shoot out of shaft when removing sliding gear (G). Use care when removing gear.

NOTE: Remove bearings only if replacement is necessary.

4. Remove parts (A—J).

Replace bearing (B) using a knife-edge puller and a press.

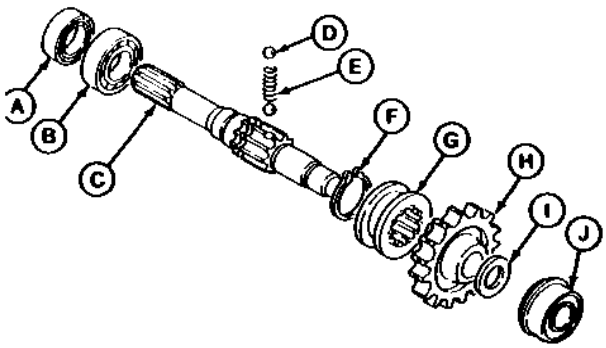
Replace seal (A) using a bearing, bushing and seal driver set.

Remove bearing (J) from quill using a blind hole puller set. Install bearing using a bearing, bushing and seal driver set.

5. Inspect all parts for wear damage. Replace as necessary.

6. Apply multipurpose grease to inside lip of seal (A).

7. Assemble all parts.



M53599 -UN-07DEC89

A—Seal
B—Ball Bearing
C—Output Shaft
D—Ball (2 used)
E—Spring
F—Snap Ring
G—Sliding Gear
H—Gear
I—Washer
J—Ball Bearing

MX,5030DG,A4 -19-08NOV89

8. Remove nuts, spacer and drive gear (A).

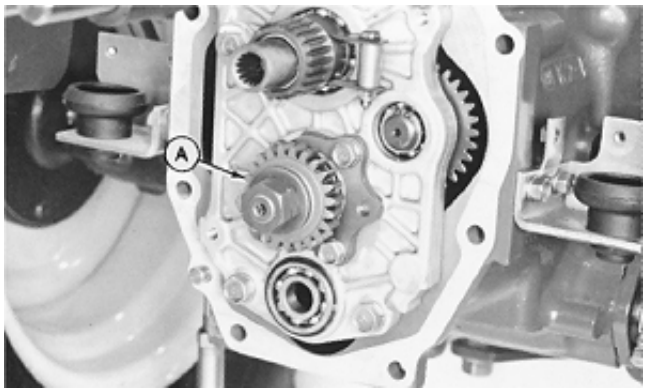
9. Inspect gear for wear or damage. Replace if necessary.

10. Apply clean transmission/hydraulic oil to all parts during assembly.

11. Install drive gear, spacer and nuts. Tighten nuts to 108 N·m (80 lb-ft).

12. Install output shaft assembly.

13. Install transmission to clutch housing. (See procedure in Group 10.)

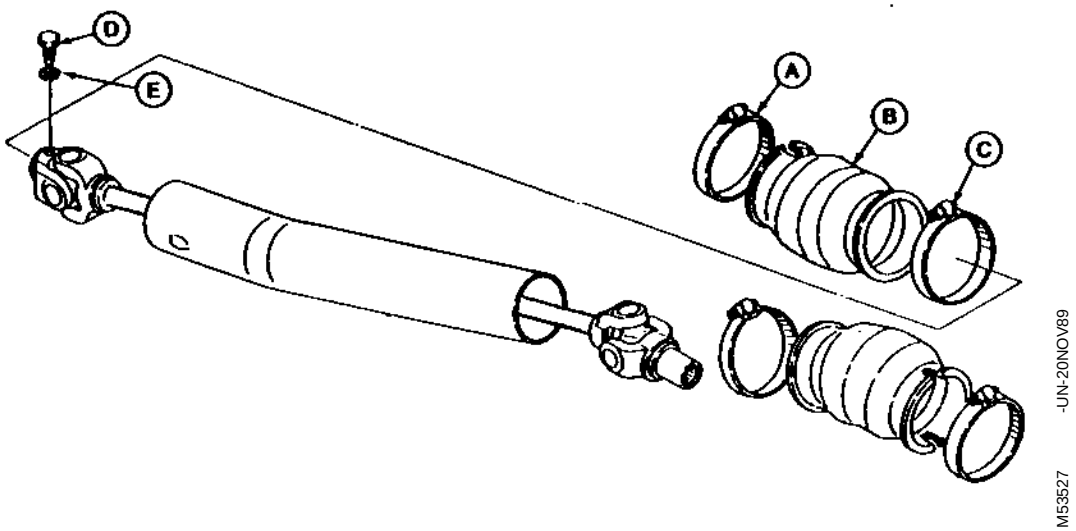


-UN-20NOV89
M53862

MX,5030DG,A5 -19-08NOV89

50
30
3

REMOVE, INSPECT AND INSTALL MFWD DRIVE SHAFT



-UN-20NOV89
M53527

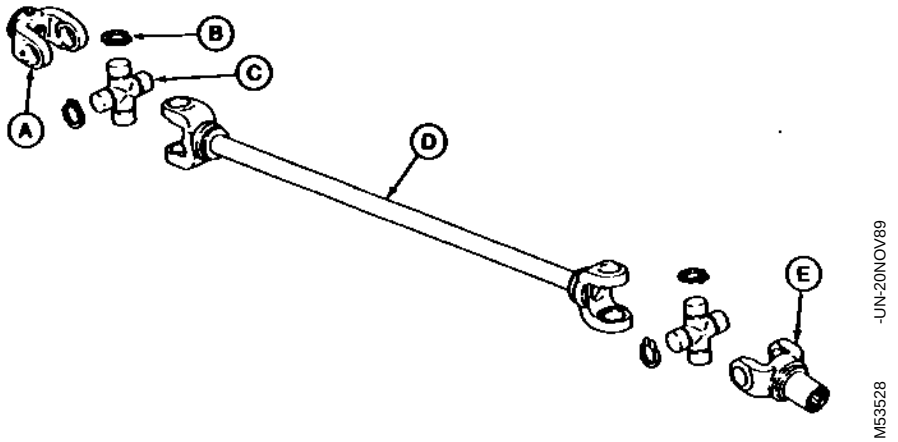
A—Clamp (3 used)
B—Boot (2 used)
C—Clamp
D—Cap Screw
E—Lock Washer

1. Loosen clamps (A and C) and slide boots (B) away from universal joint.

2. Remove cap screw (D) and lock washer (E).

3. Remove drive shaft assembly.

MX,5030DG,A6 -19-26SEP89



A—Yoke
B—Snap Ring (8 used)
C—Spider (2 used)
D—Shaft
E—Yoke

4. Remove snap rings (B).

5. Remove spiders (C) using a brass drift and hammer.

6. Repair or replace parts as necessary.

7. Assemble parts (A—E).

8. Install drive shaft assembly.

MX,5030DG,A7 -19-26SEP89

REMOVE AND INSTALL MFWD AXLE

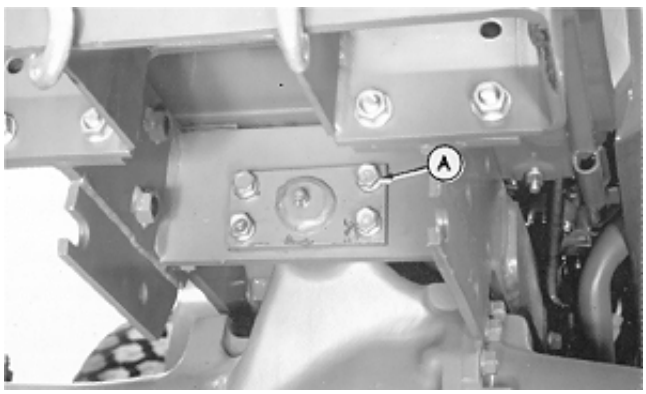
1. Remove drive shaft. (See procedure in this group.)

2. Power steering: Remove power steering cylinder. (See Section 60, Group 10.)

Manual steering: Disconnect drag link.

3. Raise front of tractor and remove front wheels.

4. Remove pivot pin cap screws (A).



MX,5030DG,A8 -19-14SEP89

5. Place a floor jack under center of axle and remove pivot pin (A), shims, washers (B) and collar (D).

6. Remove axle.

7. Make repairs as necessery. (See procedures in this group.)

8. Install axle. Lift axle into place and align axle housing hole with pivot pin hole.

IMPORTANT: If equipped, be sure grease fitting (D) on pivot pin assembly points down when installed.

9. Install pivot pin (A), with grease fitting pointing down, through collar (C), washers (B) and axle.

10. Tighten pivot pin cap screws.

11. Check and adjust axle free-play. (See procedure in Section 80, Group 10.)

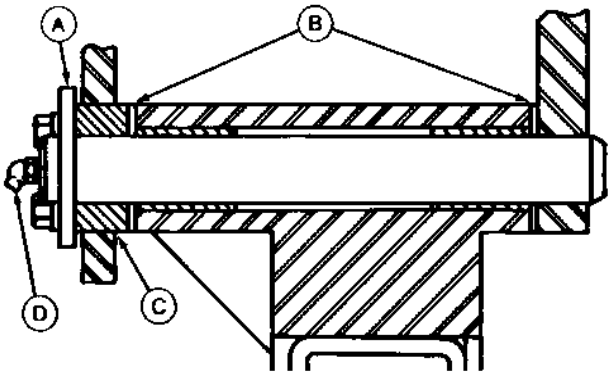
12. Install wheels. Tighten cap screws to 133 N·m (98 lb-ft).

13. Power steering: Install power steering cylinder.

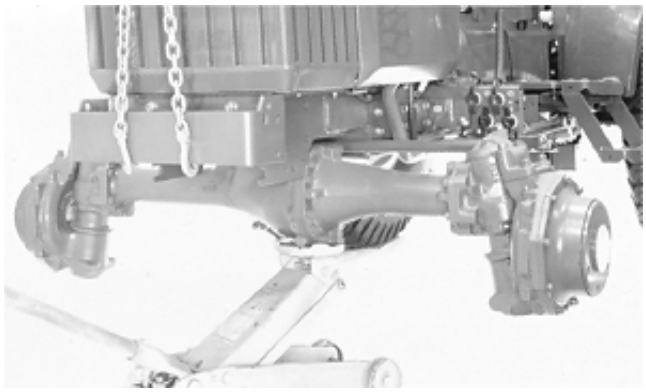
Manual steering: Connect drag link.

14. Install drive shaft.

15. Lubricate front axle pivot pin assembly with multipurpose grease. (See Section 10, Group 20.)



M53185 -UN-18JUL89



M53512 -UN-20NOV89

A—Pivot Pin
B—Washers (2 used)
C—Collar
D—Grease Fitting

MX,5030DG,A9 -19-14SEP89

REMOVE AND INSTALL SPINDLE HOUSING AND OUTER DRIVE

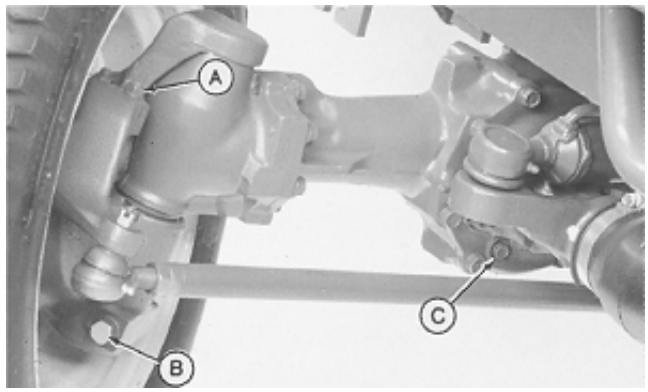
NOTE: Spindle/Outer drive assembly can be serviced without removing axle.

1. Install a wooden block between axle and frame.

NOTE: Approximate capacity of axle housing is 2.13 L (2.25 qt).

2. Remove plugs (A , B and C) to drain axle housing.

3. Remove front wheel.



-UN-26SEP88
M61703

50
30
6

MX,5030DG,A10 -19-21SEP89

4. Disconnect tie rod (C).

5. Power steering: Disconnect power steering cylinder.

Manual steering: Disconnect drag link.

6. Place a floor jack under bottom of outer drive housing.

7. Remove six cap screws and lock washers (A) to remove outer drive assembly.

8. Remove O-ring (B).

9. Make repairs as necessary. (See Disassemble, Inspect and Assemble Outer Drive and Disassemble, Inspect and Assemble Spindle Housing in this group.)

10. Apply petroleum jelly to O-ring and install on axle housing.

11. Apply thread lock and sealer (medium strength) to threads of cap screws.

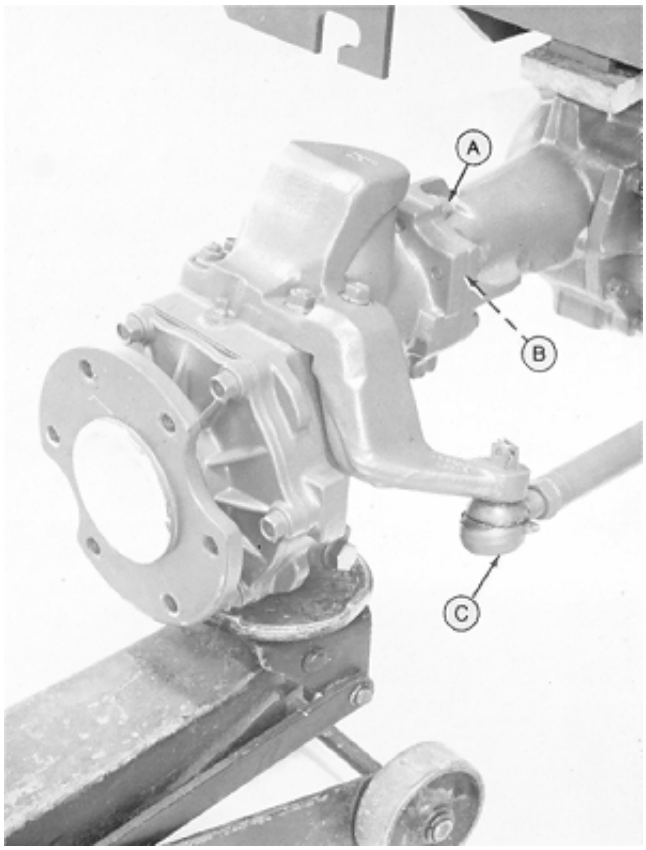
12. Install outer drive assembly and cap screws. Tighten to 51 N·m (39 lb-ft).

13. Connect tie rod and power steering cylinder or drag link, if equipped. Tighten nuts to 68 N·m (50 lb-ft).

14. Install drain plugs.

15. Install wheel. Tighten cap screws to 133 N·m (98 lb-ft).

16. Fill axle housing with proper gear oil. (See Section 10, Group 20.)



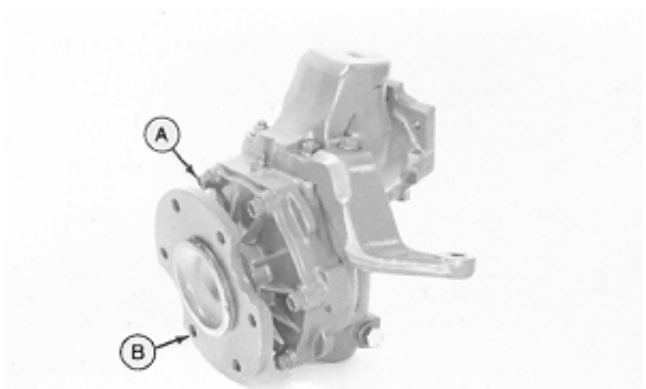
M53841 -UN-20NOV89

MX,5030DG,A11 -19-21SEP89

DISASSEMBLE, INSPECT AND ASSEMBLE OUTER DRIVE

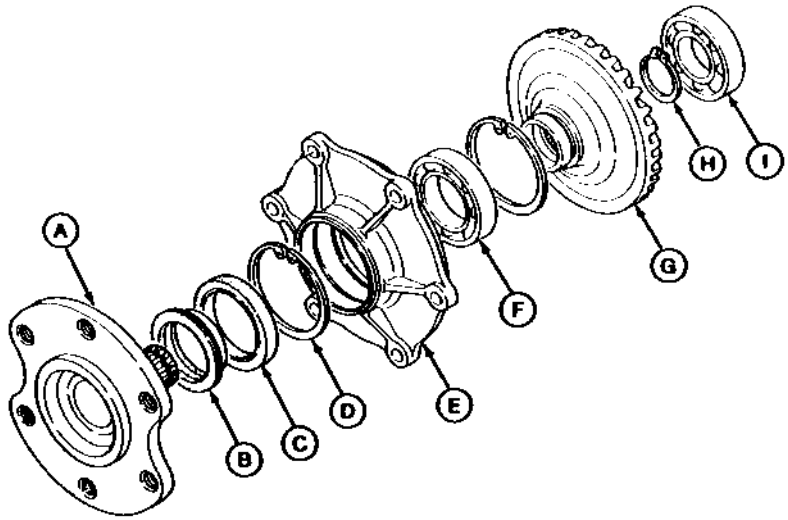
1. Remove six cap screws (A).

2. Remove outer drive assembly (B) and gasket using a soft-faced mallet.



M53842 -UN-20NOV89

MX,5030DG,A12 -19-09NOV89



A—Hub Shaft
B—Sleeve
C—Seal
D—Snap Ring (2 used)
E—Case Cover
F—Ball Bearing
G—Outer Drive Gear
H—Snap Ring
I—Ball Bearing

NOTE: Bearing (I) is a slip fit.

3. Remove bearing (I) and snap ring (H).

4. Remove shaft (A) using a two-jaw puller on gear (G).

5. Remove gear (G) from cover (E) using a press.

NOTE: Remove bearings only if replacement is necessary.

6. Remove snap rings (D).

7. Replace bearing (F) using a bushing, bearing and seal driver set.

8. Remove sleeve (B) and seal (C) using a screwdriver.

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

10. Apply gear oil to all internal parts during assembly.

11. Apply multipurpose grease to lips of seal (C).

12. Assemble parts (A—I).

13. Clean mating surfaces of cover and case using clean and cure primer. Apply flexible sealant to mating surfaces.

14. Install outer drive assembly, new gasket and cap screws.

MX,5030DG,A13 -19-09NOV89

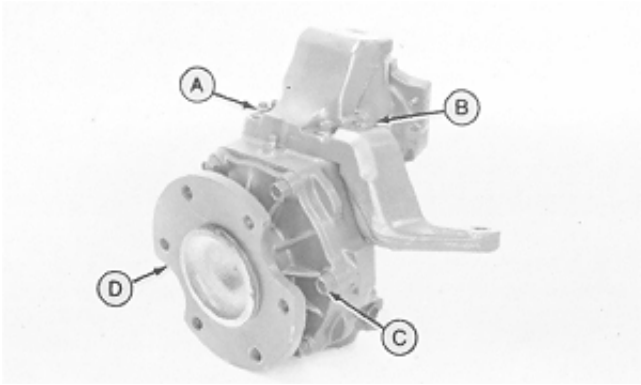
DISASSEMBLE, INSPECT AND ASSEMBLE SPINDLE HOUSING

1. Remove six cap screws (C).

2. Remove after drive assembly (D) and gasket.

3. Remove nut and lock washers (A) and cap screws (B).

A—Nut and Lock Washer (2 used)
B—Cap Screw (2 used)
C—Cap Screw (6 used)
D—Outer Drive Assembly



M53844 -UN-20NOV89

MX,5030DG,A14 -19-09NOV89

4. Separate steering arm (A), housing (J) and case (R) using a soft-faced mallet.

5. Remove shaft (I) from case (R) using a soft-faced mallet.

6. Remove parts (F—H) and (S—U).

NOTE: Remove bearings and seals only if replacement is necessary.

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

8. Apply gear oil to all internal parts during assembly.

9. Apply multipurpose grease to lips of seals (C and M).

50 30 10

10. Assemble parts (A—U).

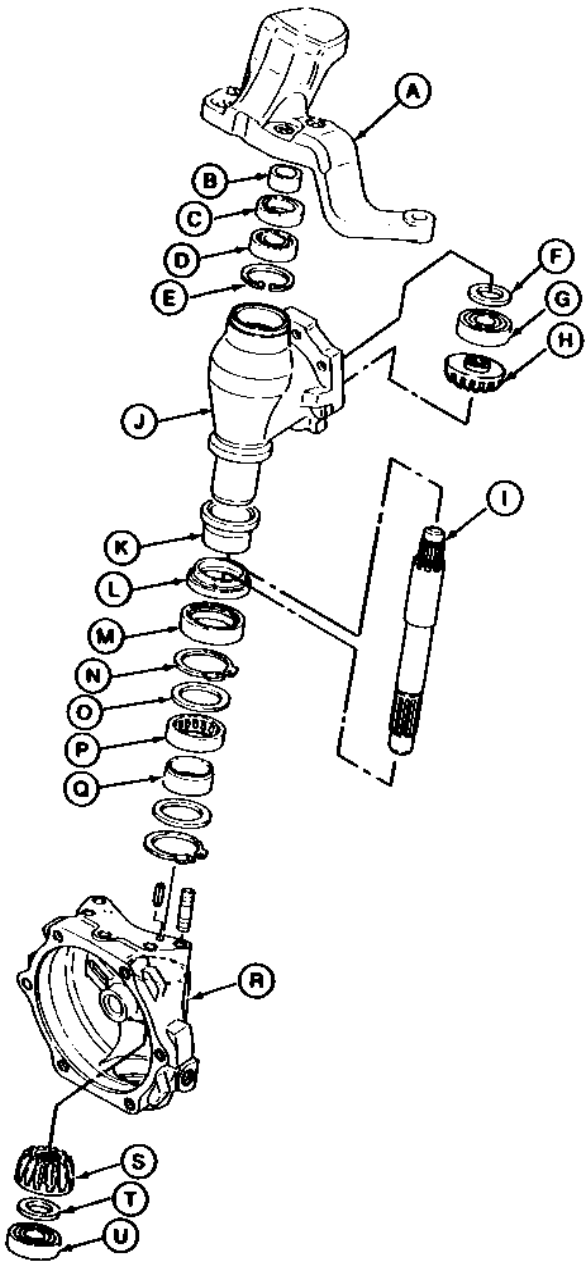
Install bearings and seals using a bushing, bearing and seal driver set.

11. Install steering arm nuts and cap screws.

12. Clean mating surfaces of outer drive assembly cover and case using clean and cure primer. Apply flexible sealant to mating surfaces.

13. Install outer drive assembly, new gasket and cap screws.

A—Steering Arm
B—Sleeve
C—Seal
D—Ball Bearing
E—Snap Ring
F—Washer
G—Ball Bearing
H—Spindle Bevel Gear
I—Spindle Shaft
J—Spindle Housing
K—Sleeve
L—Bushing
M—Seal
N—Snap Ring (2 used)
O—Washer (2 used)
P—Needle Bearing
Q—Bearing Race
R—Gear Case
S—Pinion Gear
T—Washer
U—Ball Bearing



M53845 -UN-07DEC89

MX,5030DG,A15 -19-09NOV89

DISASSEMBLE AND INSPECT DIFFERENTIAL AND SHAFTS

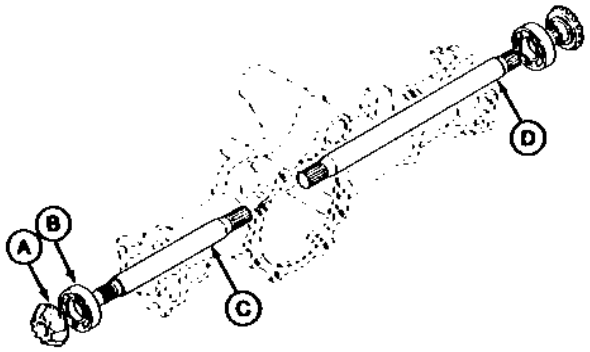
1. Remove power steering cylinder, if equipped. (See procedure in Section 60, Group 10.)

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

3. Remove outer drives. (See procedure in this group.)

4. Remove parts (A—D).

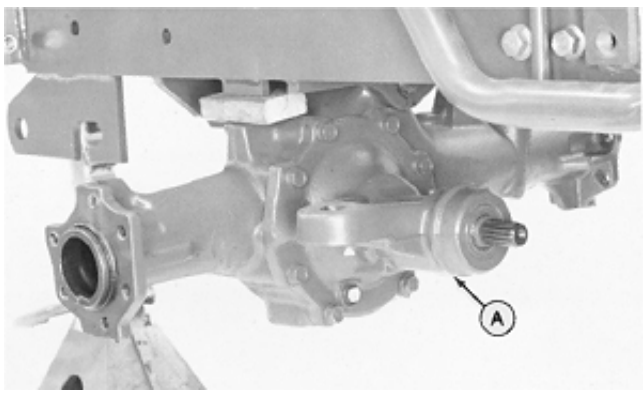
A—Axle Bevel Gear (2 used)
B—Ball Bearing (2 used)
C—Left-Hand Axle Shaft
D—Right-Hand Axle Shaft



M53846 -UN-07DEC89

MX,5030DG,A16 -19-09NOV89

5. Remove eight cap screws and differential drive assembly (A) and gasket.



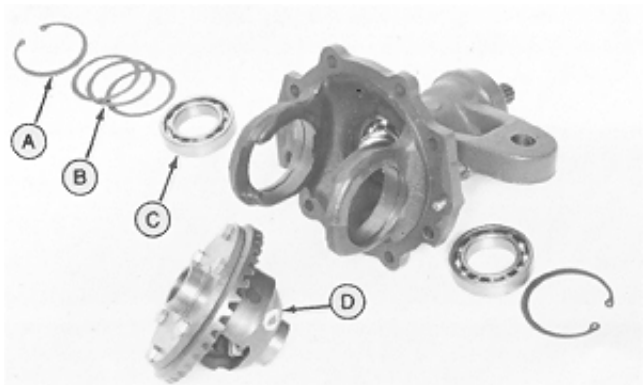
M53847 -UN-20NOV89

MX,5030DG,A17 -19-09NOV89

NOTE: Bearings (C) are slip fit.

6. Remove snap rings (A), shims (B) and bearings (C) to remove differential carrier assembly (D).

A—Snap Ring (2 used)
B—Shims (as required)
C—Ball Bearings (2 used)
D—Differential Carrier



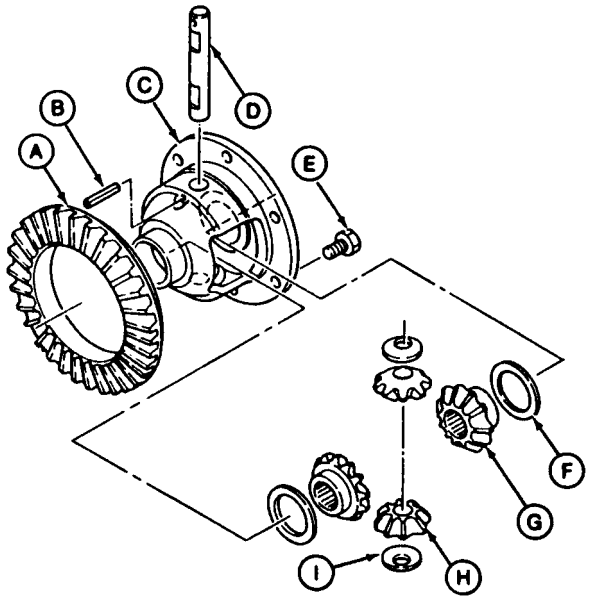
M53848 -UN-20NOV89

MX,5030DG,A18 -19-09NOV89

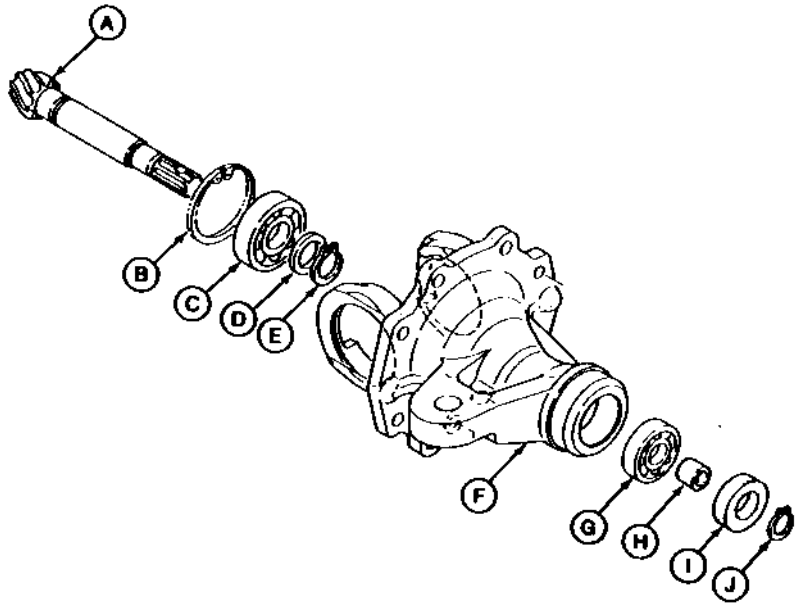
7. Disassemble parts (A—I).

8. Inspect parts for wear or damage. Replace if necessary.

A—Ring Gear
B—Spring Pin
C—Differential Carrier
D—Pinion Shaft
E—Cap Screw (10 used)
F—Thrust Washer (2 used)
G—Bevel Gear (2 used)
H—Bevel Pinion (2 used
I—Thrust Washer (2 used)



M53849



A—Input Shaft
B—Snap Ring
C—Ball Bearing
D—Spacer
E—Snap Ring
F—Differential Carrier Case
G—Ball Bearing
H—Sleeve
I—Seal
J—Snap Ring

9. Remove snap rings (B and J).

10. Remove input shaft assembly using a soft-faced mallet.

NOTE: Remove bearings and seal only if replacement is necessary.

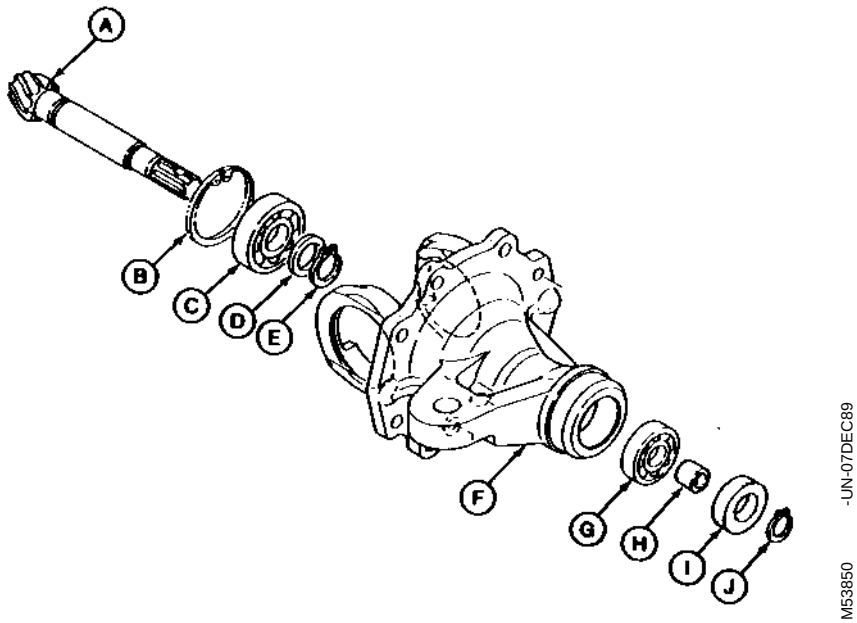
11. Remove bearings (C and G) using a knife-edge puller and a press.

12. Replace seal (I) using a bearing, bushing and seal driver set.

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

MX,5030DG,A20 -19-09NOV89

ASSEMBLE DIFFERENTIAL AND SHAFTS



A—Input Shaft
B—Snap Ring
C—Ball Bearing
D—Spacer
E—Snap Ring
F—Differential Carrier Case
G—Ball Bearing
H—Sleeve
I—Seal
J—Snap Ring

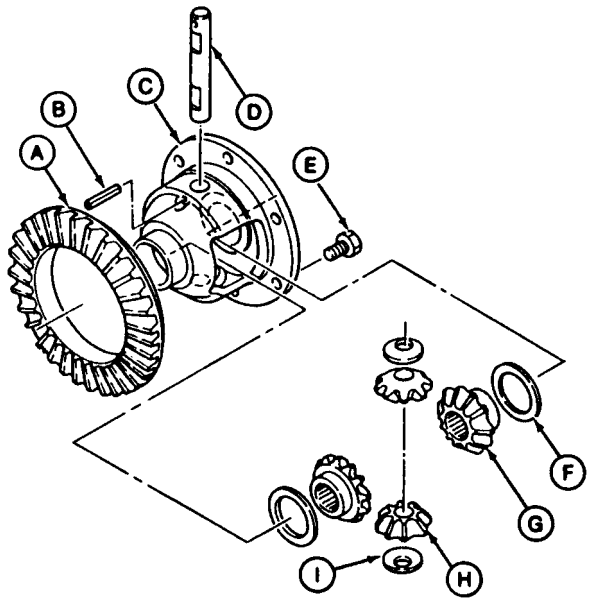
1. Apply gear oil to all internal parts during assembly.
2. Assemble parts (C, D, E, G, and H) to Shaft (A).
3. Install input shaft assembly using a soft-faced mallet.
4. Install snap rings (B and J).

MX,5030DG,A21 -19-21SEP89

5. Apply thread lock and sealer (medium strength) to threads of cap screws (E).

6. Assemble parts (A—I).

A—Ring Gear
B—Spring Pin
C—Differential Carrier
D—Pinion Shaft
E—Cap Screw (10 used)
F—Thrust Washer (2 used)
G—Bevel Gear (2 used)
H—Bevel Pinion (2 used
I—Thrust Washer (2 used)



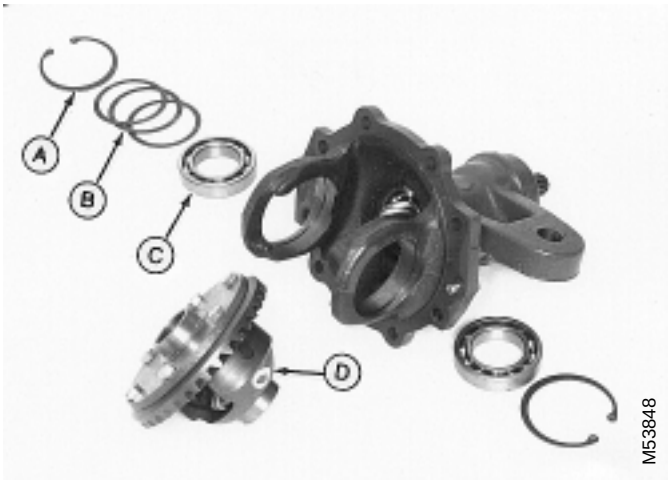
M53849

7. Install parts (A—D).

NOTE: Adjust backlash only if new parts are installed or the amount of shims are in question

8. Adjust input shaft-to-ring gear backlash. (See procedure in this group.)

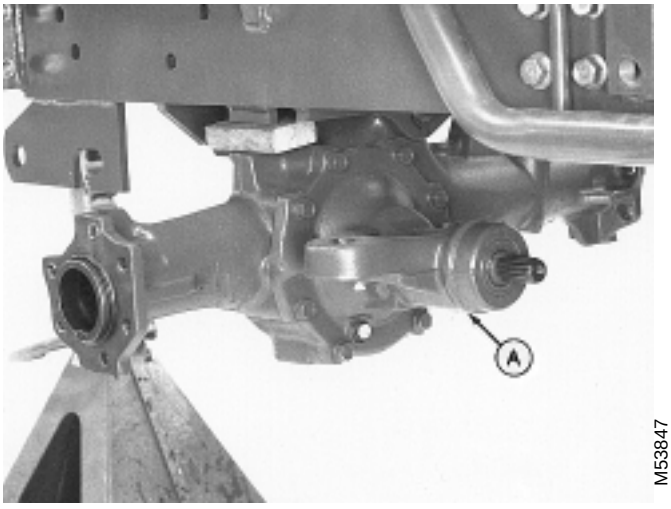
A—Snap Ring (2 used)
B—Shims (as required)
C—Ball Bearings (2 used)
D—Differential Carrier



M53848

9. Clean mating surfaces of differential carrier case and axle housing using clean and cure primer. Apply flexible sealant to mating surfaces of case and housing.

10. Install differential drive assembly (A), new gasket and cap screws.



M53847

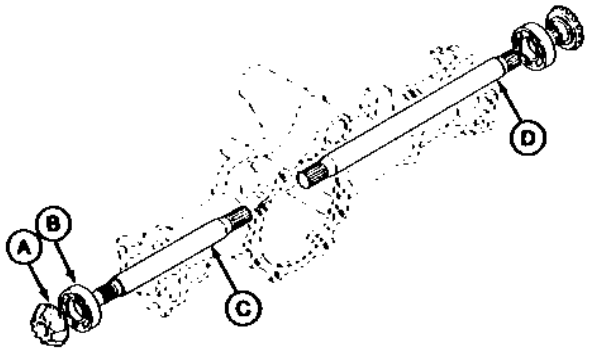
11. Install parts (A—D).

12. Install outer drives. (See procedure in this group.)

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

14. Install power steering cylinder, if equipped. (See procedure in Section 60, Group 10.)

A—Axle Bevel Gear (2 used)
B—Ball Bearing (2 used)
C—Left-Hand Axle Shaft
D—Right-Hand Axle Shaft



M53846 -UN-07DEC89

MX,5030DG,A25 -19-09NOV89

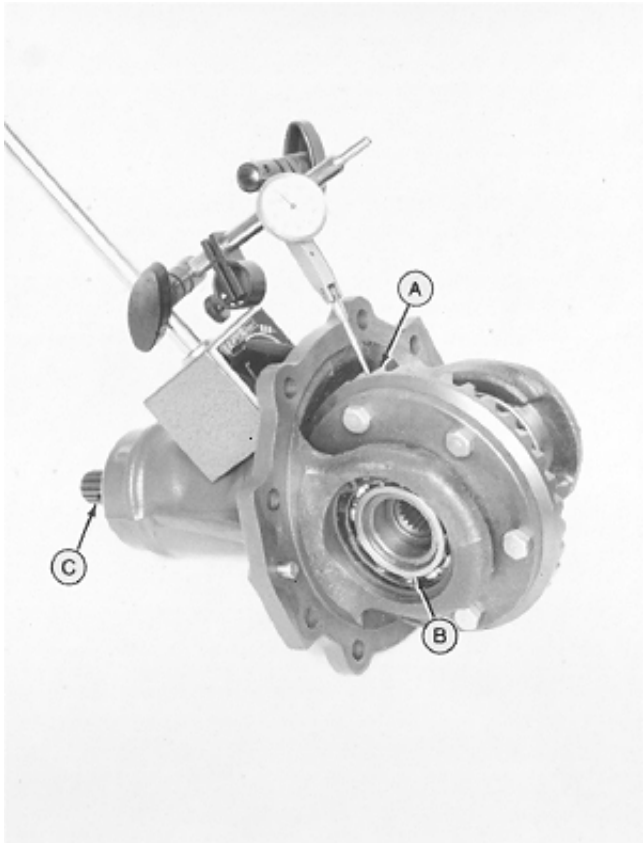
ADJUST INPUT SHAFT-TO-RING GEAR BACKLASH

50
30
16

1. Lightly tap carrier (B) with a soft-faced mallet to make sure bearing on other side of ring gear is seated.

2. Attach a dial indicator to housing as shown with contact point positioned on ring gear splines (A).

3. While holding input shaft (C), move carrier and ring gear to determine backlash. Backlash should be 0.08—0.13 mm (0.003—0.005 in.).



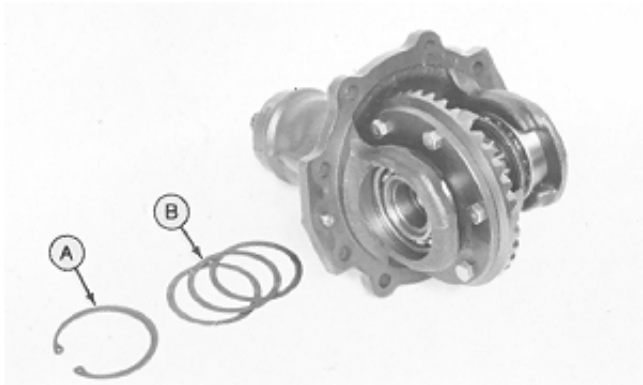
M53851 -UN-20NOV89

MX,5030DG,A26 -19-09NOV89

4. To adjust backlash, remove snap ring (A).

5. Remove shims (B) to increase backlash, and add to decrease.

6. Recheck backlash after removing or adding shims.



M53852 -UN-20NOV89

MX,5030DG,A27 -19-21SEP89

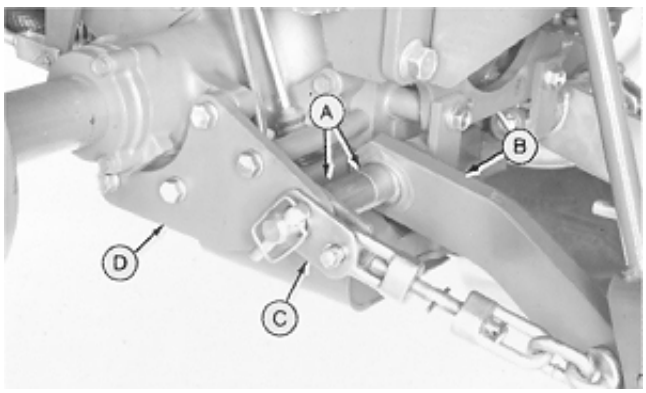
OTHER MATERIAL

Number	Name	Use
TY6305	Clean and Cure Primer	To clean and cure surfaces prior to application of adhesives or sealants.
TY6304	Flexible Sealant	To provide a seal between mating surfaces.

MX,5035DG,A1 -19-04OCT89

INSPECT AND REPAIR CONTROL LEVER AND LINKAGE

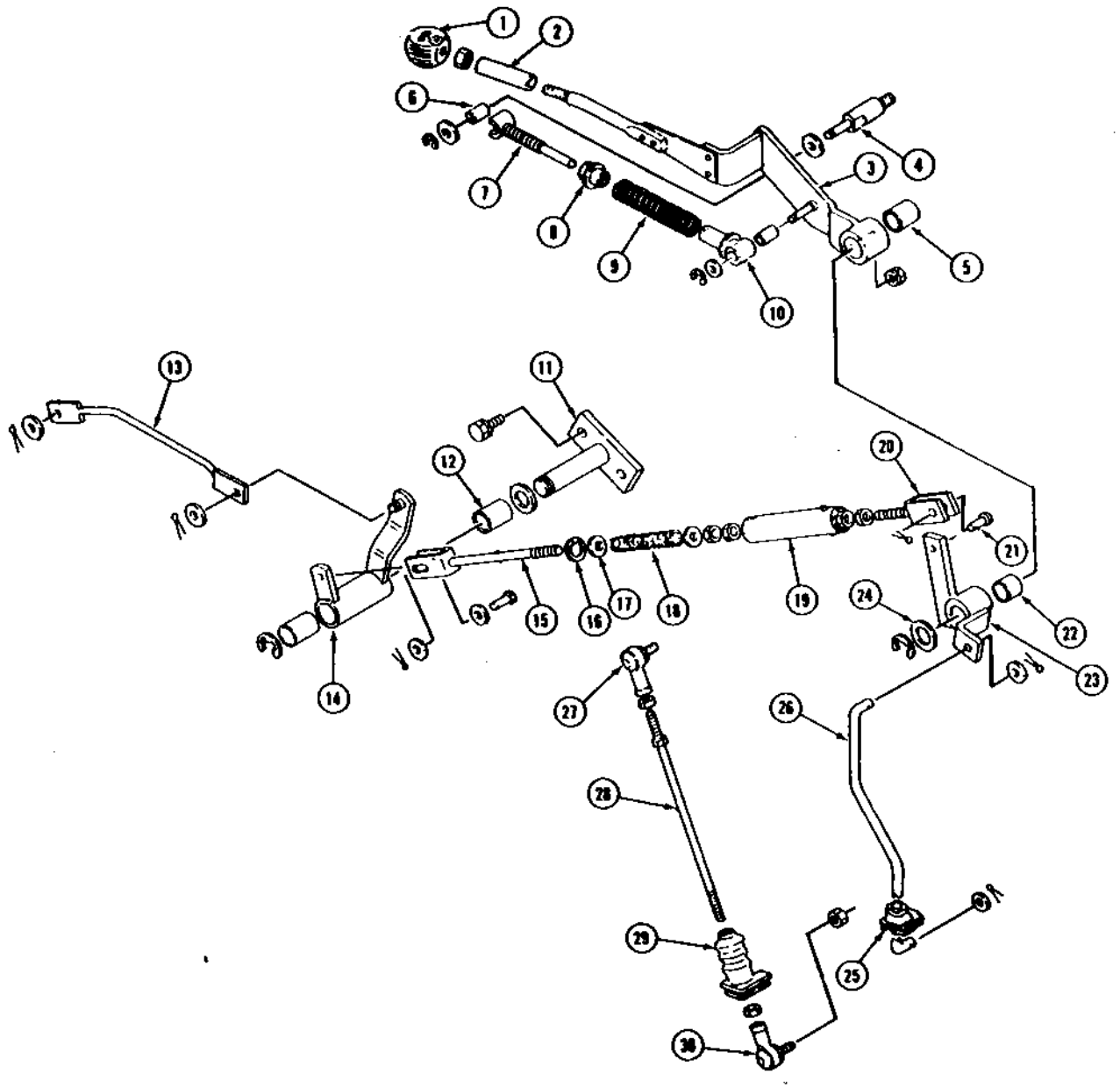
1. Remove lower dash and clutch housing covers.
2. Remove left rear wheel.
3. Remove left-hand fender.
4. Remove drawbar assembly.
5. Disconnect sway link (C).
6. Remove bushings (A) and draft arm (B).
7. Remove four cap screws and bracket (D).
8. Remove gearbox covers.



M53568 -UN-20NOV89

A—Bushings
B—Draft Arm
C—Sway Link
D—Bracket

MX,5035DG,A2 -19-26OCT89



M53532 -UN-20NOV89

1—Knob
2—Protection Tube
3—Lever
4—Special Bolt
5—Tube
6—Bushing (2 used)
7—Spring Rod
8—Spring Plate
9—Spring
10—Spring Plate
11—Shaft
12—Bushing (2 used)
13—Brake Rod
14—Mid Bellcrank
15—Brake Rod
16—Ring
17—Spacer
18—Spring
19—Spring Holder
20—Clevis
21—Pin
22—Bushing
23—Brake Arm
24—Spacer
25—Boot
26—Brake Rod
27—Ball Joint Socket
28—Rod
29—Boot
30—Ball Joint Socket

MX,5035DG,A3 -19-29SEP89

CAUTION: Spring (9) is under pressure. Before removing linkage, loosen plate (8) to relieve tension on spring (9).

9. Loosen plate (8) to relieve tension on spring (9).

10. Inspect parts for wear or damage. Replace as necessary.

11. Adjust linkage. (See Section 250, Group 15.)

12. Install covers, fender and wheel.

13. Install draft link assembly.

14. Install drawbar assembly. Tighten bottom cap screws to 340 N·m (250 lb-ft).

MX,5035DG,A4 -19-29SEP89

REMOVE AND INSTALL MID MOUNT PTO GEARBOX

1. Remove drawbar assembly.

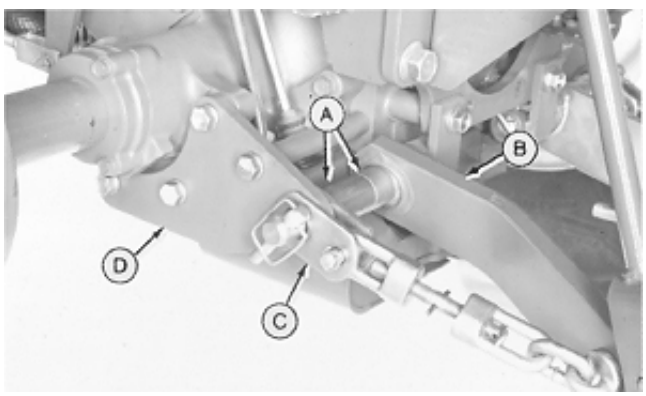
NOTE: The approximate capacity of transmission is 15 L (4 U.S. gal).

2. Drain transmission.

3. Disconnect sway link (C).

4. Remove bushings (A) and draft arm (B).

5. Remove four cap screws and bracket (D).



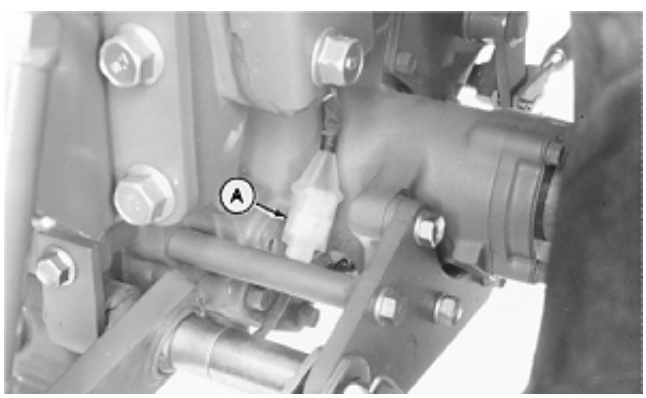
M53568 -UN-20NOV89

A—Bushings
B—Draft Arm
C—Sway Link
D—Bracket

MX,5035DG,A5 -19-26OCT89

6. Remove gearbox covers.

7. Disconnect wiring connector (A).



M53546 -UN-20NOV89

MX,5035DG,A6 -19-29SEP89

8. Disconnect control rods (A and B).

9. Remove bracket (F).

10. Remove cap screws (D and E), nut (C), lock washers and gearbox.

11. Make repairs as necessary. (See procedure in this group.)

12. Install gearbox and new O-ring. Tighten cap screws and nut to specifications.

13. Install bracket.

14. Connect control rods and wiring connector.

15. Install covers.

16. Install draft link assembly.

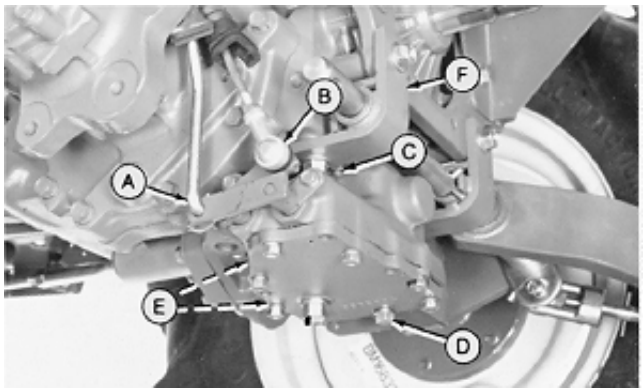
17. Install drawbar assembly. Tighten bottom cap screws to specifications.

18. Fill transmission with proper transmission/hydraulic oil. (See Section 10, Group 20.)

TORQUE SPECIFICATIONS

Cap Screws (D and E) and Nut (C) . . . . . 50 N·m (37 lb-ft)

Drawbar Bottom Cap Screws . . . . . 340 N·m (250 lb-ft)



-UN-29JAN90
M53547

A—Brake Control Rod
B—Shift Control Rod
C—Nut
D—Cap Screw
E—Cap Screws (2 used)
F—Bracket

MX,5035DG,A7 -19-29SEP89

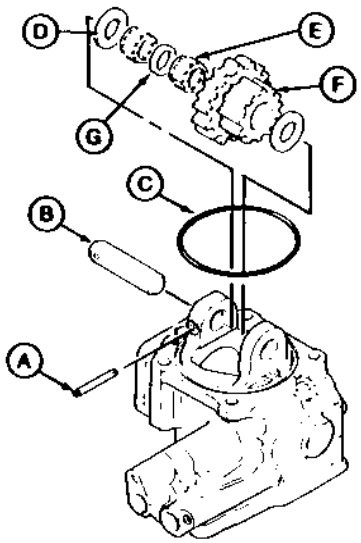
DISASSEMBLE AND INSPECT MID MOUNT PTO GEARBOX

1. Remove O-ring (C).

2. Remove pin (A).

3. Remove shaft (B) using a brass drift and hammer.

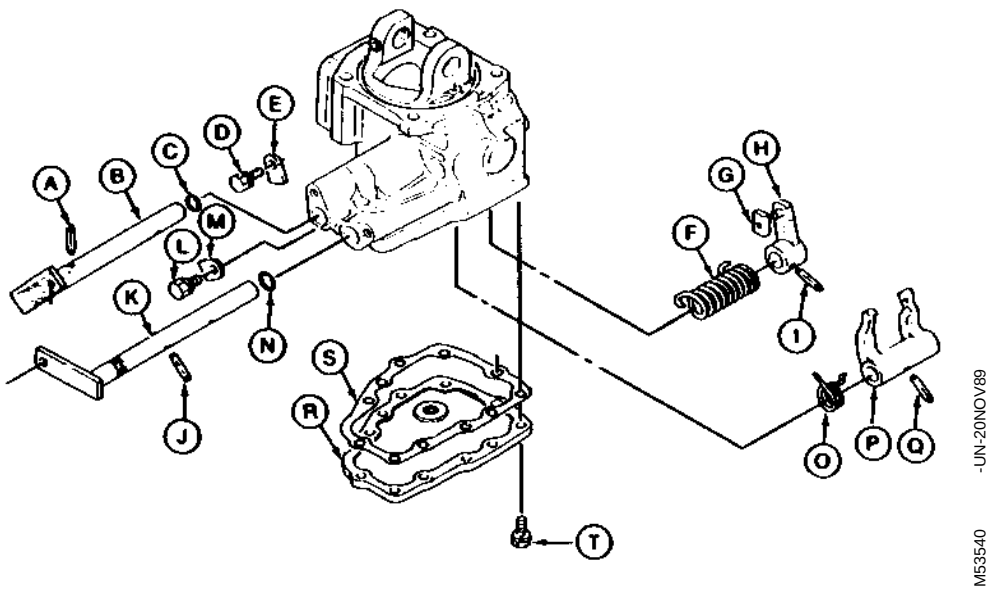
4. Remove parts (D—G).



M53539 -UN-20NOV89

A—Spring Pin
B—Idler Shaft
C—O-Ring
D—Washer (2 used)
E—Needle Bearing (2 used)
F—Idler Gear
G—Washer

MX,5035DG,A8 -19-04OCT89



M53540 -UN-20NOV89

A—Spring Pin
B—Shift Shaft
C—O-Ring
D—Cap Screw
E—Plate
F—Spring
G—Shifter
H—Shift Arm
I—Spring Pin
J—Spring Pin
K—Brake Shaft
L—Cap Screw
M—Plate
N—O-Ring
O—Spring
P—Brake Lever
Q—Spring Pin
R—Case Cover
S—Gasket
T—Cap Screw (7 used)

5. Put gearbox assembly in a soft-jawed vise and remove cap screws (T), cover (R) and gasket (S).

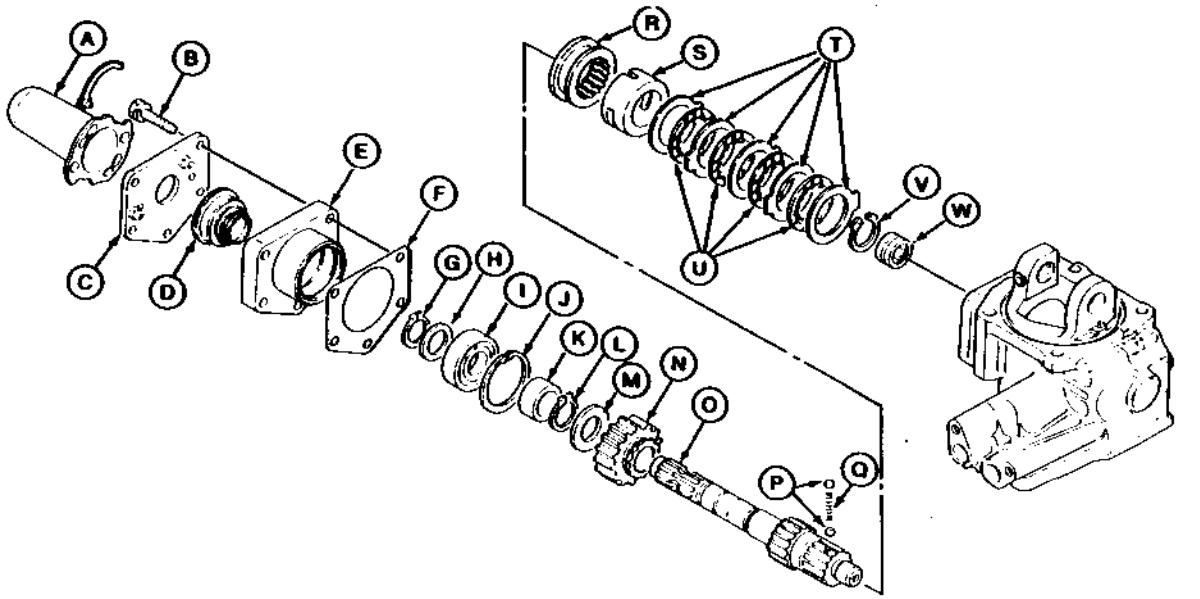
6. Remove pins (J and Q).

7. Remove parts (K—P).

8. Remove pins (A and I).

9. Remove parts (B—H).

MX,5035DG,A9 -19-04OCT89



A—Cover
B—Cap Screw (5 used)
C—Cover
D—Seal
E—Seal Case
F—Gasket
G—Snap Ring
H—Spacer
I—Ball Bearing
J—Snap Ring
K—Bushing
L—Snap Ring
M—Washer
N—Drive Gear
O—Drive Shaft
P—Balls
Q—Spring
R—Sliding Collar
S—Actuator
T—Plates (5 used)
U—Brake Disks (4 used)
V—Snap Ring
W—Needle Bearing

10. Remove cover (A).

11. Remove cap screws (B) and cover (C).

N **CAUTION: Balls (P) and spring (Q) will shoot out of shaft when removing sliding gear (R). Use care when removing gear.**

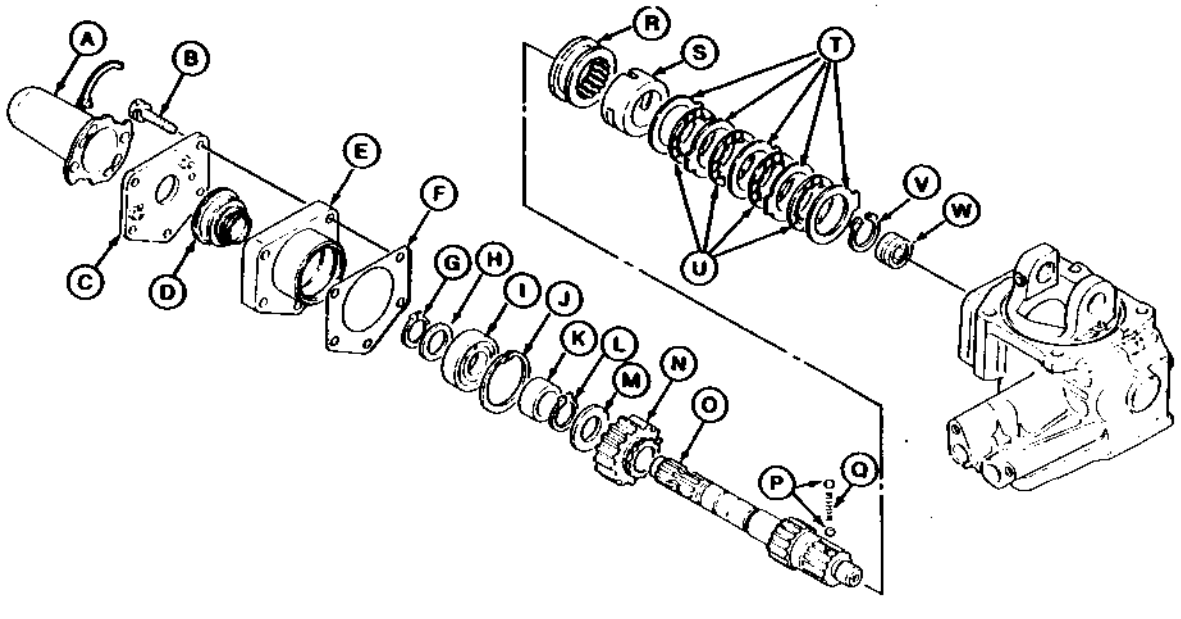
12. Remove parts (D—W).

13. Remove seal (D) using a bearing, bushing and seal driver set.

14. Inspect all parts for wear damage. Replace as necessary.

MX,5035DG,A10 -19-04OCT89

ASSEMBLE MID MOUNT PTO GEARBOX



A—Cover
B—Cap Screw (5 used)
C—Cover
D—Seal
E—Seal Case
F—Gasket
G—Snap Ring
H—Spacer
I—Ball Bearing
J—Snap Ring
K—Bushing
L—Snap Ring
M—Washer
N—Drive Gear
O—Drive Shaft
P—Balls
Q—Spring
R—Sliding Collar
S—Actuator
T—Plates (5 used)
U—Brake Disks (4 used)
V—Snap Ring
W—Needle Bearing

1. Apply clean transmission/hydraulic oil to all internal parts during assembly.

2. Apply multipurpose grease to inside lips of seal (D).

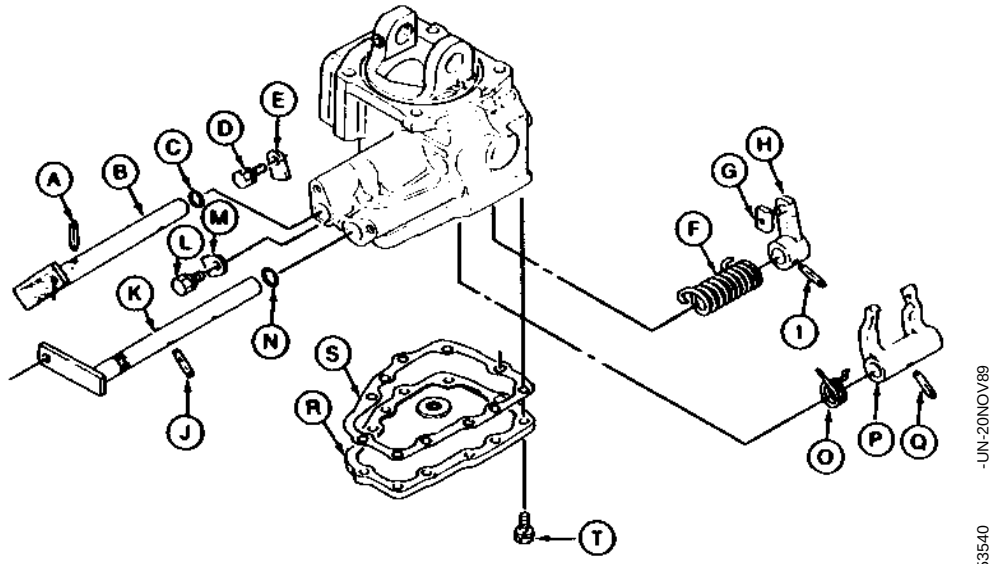
3. Clean mating surfaces of gearbox and seal case using clean and cure primer. Apply flexible sealant to mating surfaces.

4. Install parts (A—W).

Install washer (M) with groove toward gear (N).

Install seal (D) using a bearing, bushing and seal driver set.

MX,5035DG,A11 -19-04OCT89



50
35
8

A—Spring Pin
B—Shift Shaft
C—O-Ring
D—Cap Screw
E—Plate
F—Spring
G—Shifter
H—Shift Arm
I—Spring Pin
J—Spring Pin
K—Brake Shaft
L—Cap Screw
M—Plate
N—O-Ring
O—Spring
P—Brake Lever
Q—Spring Pin
R—Cover
S—Gasket
T—Cap Screw (7 used)

5. Apply multipurpose grease to new O-rings (C and N).

6. Install parts (B—H).

7. Install pins (A and I).

8. Install parts (K—P).

9. Install pins (J and Q).

10. Clean mating surfaces of gearbox and cover using clean and cure primer. Apply flexible sealant to mating surfaces.

11. Install gasket (S), cover (R) and cap screws (T).

MX,5035DG,A12 -19-04OCT89

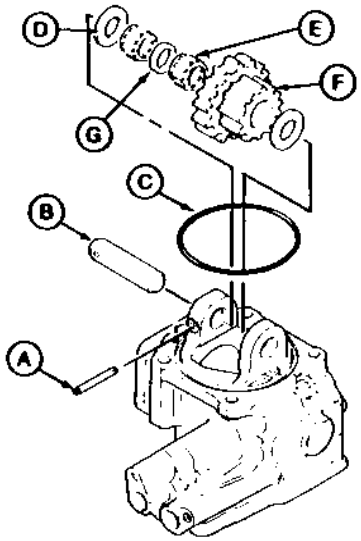
12. Install parts (A—G).

Install washers (D) with groove toward gear (F).

13. Apply petroleum jelly to new O-ring (C).

14. Install O-ring.

A—Spring Pin
B—Idler Shaft
C—O-Ring
D—Washer (2 used)
E—Needle Bearing (2 used)
F—Idler Gear
G—Washer



M53539 -UN-20NOV89

MX,5035DG,A13 -19-04OCT89

SECTION 55
POWER TRAIN REPAIR—870/970/1070

Contents

Page

Group 05—Clutch Housing
Other Material 55-05-1
Separate Engine from Clutch Housing 55-05-1
Install Engine to Clutch Housing 55-05-5
Clutch Housing
Remove 55-05-8
Install 55-05-10
Inspect and Replace Seal and Bushings 55-05-12
Inspect and Repair Clutch Pedal and Linkage 55-05-13

Group 06—Essential Tools
Remove and Install Dual Stage Clutch 55-05-1
Inspect and Repair Clutch Assembly and Flywheel 55-05-4
Clutch Release Mechanism and Clutch Shaft—870/970/1070
Remove, Inspect and Install 55-05-7

Group 10—Transmission
Other Materials 55-10-1
Separate Transmission from Clutch Housing 55-10-2
Install Transmission to Clutch Housing 55-10-6
Gear Shift Lever
Inspect and Repair 55-10-9
Range Shift Lever and Linkage
Inspect and Repair 55-10-10
Range Shift Shaft Assembly
Remove, Inspect and Install 55-10-11
Bearing Quill Assembly
Remove and Install 55-10-11
Disassemble, Inspect and Assemble 55-10-12
Reverse Idler Shaft
Remove, Inspect and Install 55-10-17
Differential Drive Shaft
Remove, Inspect and Install 55-10-18

Group 15—Rear PTO Drive Shaft
Other Materials 55-15-1
Lever and Shift Linkage
Remove, Inspect and Install 55-15-1
Rear PTO Drive Shaft Assembly
Remove and Install 55-15-3
Disassemble, Inspect and Assemble 55-15-4

Page

Group 20—Differential
Other Material 55-20-1
Differential
Remove and Install. 55-20-1
Disassemble, Inspect and Assemble 55-20-2
Adjust Differential Cone Point. 55-20-2a
Adjust Differential Backlash 55-20-3
Differential Lock
Remove, Inspect and Install 55-20-4

Group 25—Final Drive
Other Material 55-25-1
Final Drive Assembly
Remove and Install. 55-25-1
Planetary Drive Assembly
Remove, Inspect and Install 55-25-3
Shaft Assembly
Remove, Inspect and Install 55-25-5

Group 30—Mechanical Front Wheel Drive—870
Other Material 55-30-1
Lever and Linkage
Inspect and Repair 55-30-1
Transmission Output Shaft and Drive Gear
Remove, Inspect and Install 55-30-2
Drive Shaft
Remove, Inspect and Install 55-30-4
Axle
Remove and Install. 55-30-5
Spindle Housing and Outer Drive
Remove and Install. 55-30-7
Outer Drive
Disassemble, Inspect and Assemble 55-30-9
Spindle Housing
Disassemble, Inspect and Assemble . . . 55-30-11
Differential and Shafts
Disassemble and Inspect 55-30-14
Assemble 55-30-16

Continued on next page

Page

Adjust Backlash
Spindle Pinion Gear to
Outer Drive Gear 55-30-17
Axle Bevel Gear to
Spindle Bevel Gear 55-30-18
Differential Drive Shaft to
Ring Gear. 55-30-18
Check Steering Arm to
Spindle Housing Clearance 55-30-19

Group 35—Mechanical Front Wheel Drive—970/1070
Other Material 55-35-1
Lever and Linkage
Inspect and Repair. 55-35-1
Transmission Output Shaft
and Drive Gear
Remove, Inspect and Install. 55-35-2
Drive Shaft
Remove, Inspect and Install. 55-35-4
Axle
Remove and Install 55-35-5
Spindle Housing and Outer Drive
Remove and Install 55-35-7
Outer Drive
Disassemble, Inspect and Assemble 55-35-9
Spindle Housing
Disassemble, Inspect and Assemble . . . 55-35-11
Differential and Shafts
Disassemble and Inspect. 55-35-13
Assemble 55-35-15
Adjust Backlash
Spindle Pinion Gear to
Outer Drive Gear 55-35-16
Axle Bevel Gear to
Spindle Bevel Gear 55-35-17
Differential Drive Shaft to
Ring Gear. 55-35-18

Group 40—Mid Mount PTO
Other Materials 55-40-1
Control Lever and Linkage
Inspect and Repair. 55-40-2
Mid Mount PTO Gearbox
Remove and Install 55-40-3
Disassemble and Inspect. 55-40-5
Assemble 55-40-8

OTHER MATERIAL

Number	Name	Use
TY6305	Clean and Cure Primer	To clean and cure surfaces prior to application of adhesives or sealants.
TY6304	Flexible Sealant	To provide a seal between mating surfaces.
T43512	Thread Lock and Sealer (Medium Strength)	Apply to threads of manual steering gearbox mounting cap screws.

MX,5505DG,A1 -19-23OCT89

SEPARATE ENGINE FROM CLUTCH HOUSING



TS271 -UN-23AUG88

1. Remove hood. (See procedure in Section 80, Group 15.)
2. Remove engine side shields.
3. Remove lower dash covers.
4. Remove starter. (See procedure in Section 40, Group 10.)
5. MFWD: Remove drive shaft. (See procedure in Group 30 or 35.)

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

6. Remove muffler and gasket.

MX,5505DG,A2 -19-23OCT89

7. Disconnect cable (A).

8. Disconnect wiring connectors (C and D).

9. Remove bracket (E), if equipped with SCV.

10. Remove hydraulic line clamp cap screws (F).

11. Remove cap screw (B).

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.**

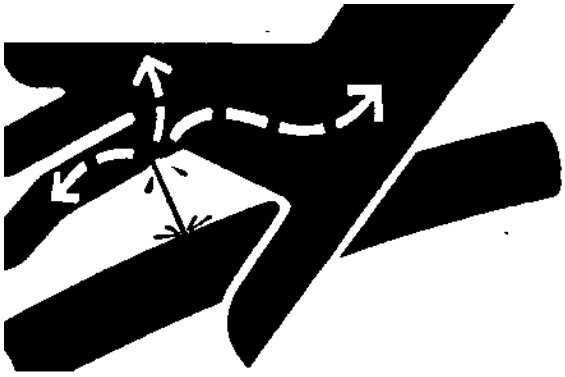
If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury may call the Deere & Company Medical Department in Moline, Illinois, or other knowledgeable medical source.

12. Lower rockshaft arms.

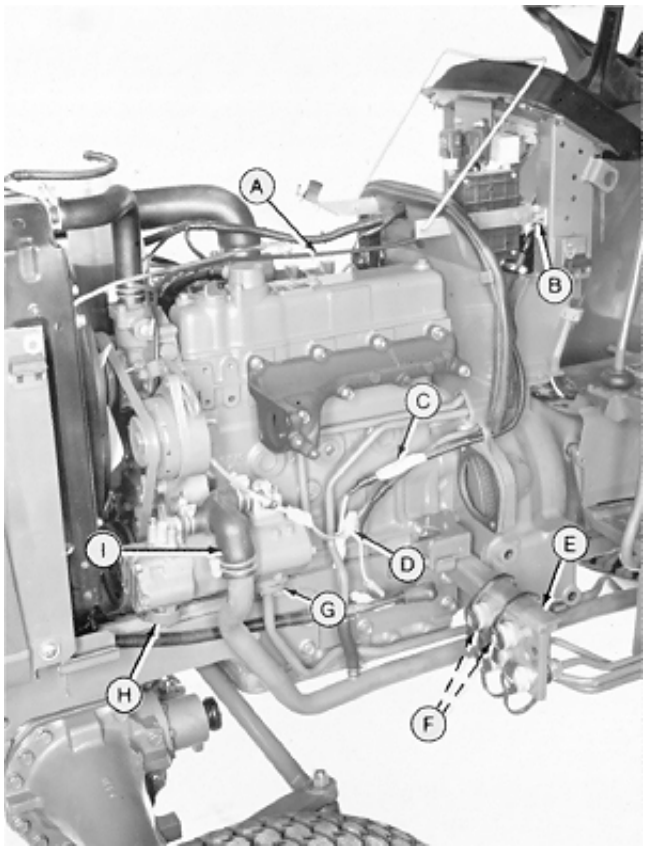
13. Disconnect hose (I) and flange (G). Close openings with caps and plugs.

14. Power steering: Disconnect flange (H).

Manual steering: Disconnect drag link.



-UN-23AUG88
X9811



-UN-20NOV89
M53569

Left-Hand Side

A—Hour Meter Cable
B—Cap Screw
C—Fusible Link Connector
D—Alternator Wiring Connector
E—Coupler Mounting Bracket
F—Cap Screws (2 used)
G—Hydraulic Pump Pressure Line Mounting Flange
H—Power Steering Hydraulic Pump Pressure Line Mounting Flange
I—Suction Line Hose

MX,5505DG,A3 -19-23OCT89

15. Close shutoff valve on fuel filters.

16. Disconnect hoses (J and K). Close openings with caps and plugs. Remove hoses from holder (I).

17. Remove control rod (E).

18. Disconnect main wiring harness (B) at dashboard.

19. Remove cap screw (A).

NOTE: For tractors with manual steering, Go to Step 27.

20. Disconnect lines (F and G). Close openings with caps and plugs.

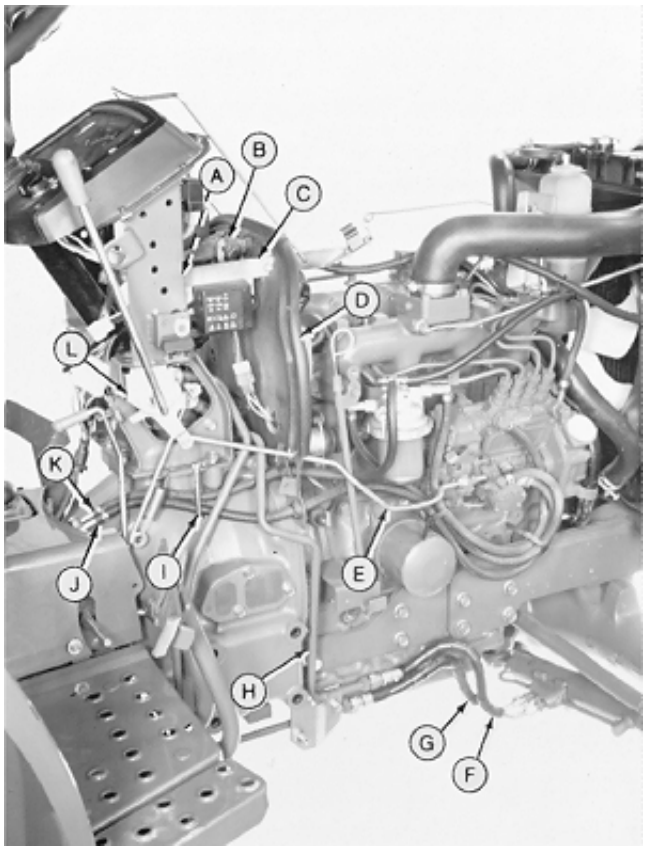
21. Remove throttle lever control assembly (L).

22. Remove line (H).

23. Remove fuse block from support (C).

24. Remove rubber molding and air shield (D).

A—Cap Screw
B—Main Wiring Harness
C—Support
D—Air Shield
E—Throttle Control Rod
F—Power Steering Valve-to-Cylinder Rod End Line
G—Power Steering Valve-to-Cylinder Head End Line
H—Hydraulic Line
I—Holder
J—Fuel Pump Supply Hose
K—Return Fuel Leak-Off Hose
L—Throttle Lever Control Assembly



M53570 -UN-20NOV89

Right-Hand Side

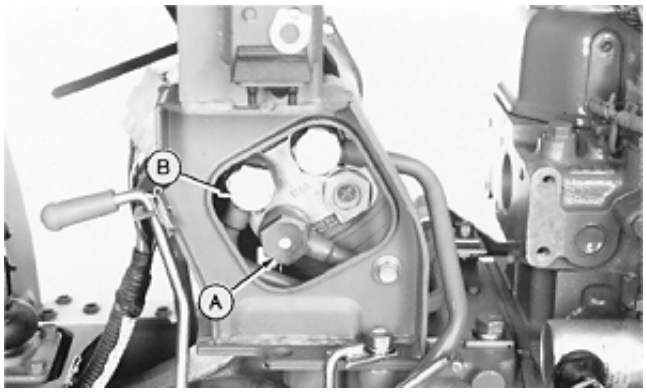
MX,5505DG,A4 -19-23OCT89

NOTE: Banjo connector (A) also acts as a filter.

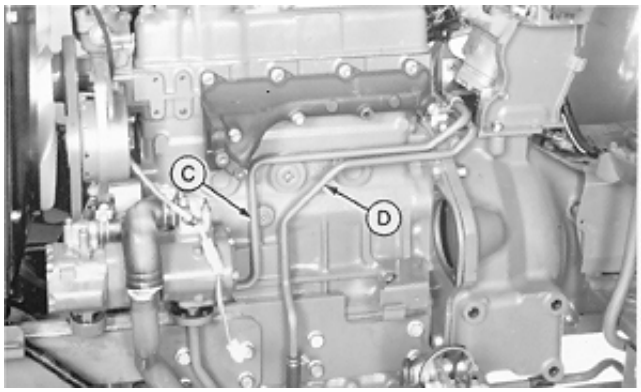
25. Remove banjo connectors (A and B) and washers.

26. Remove lines (C and D). Close all openings with caps and plugs.

A—Banjo Connector/Filter
B—Banjo Connector
C—Power Steering Valve Supply Line
D—Power Steering Valve Return Line



M53573 -UN-20NOV89



M53574 -UN-20NOV89

55 05 4

MX,5505DG,A5 -19-02NOV89

27. Remove rocker arm cover.

28. Install lifting brackets such as JDG19 Special Mounting Brackets (D).

29. Attach a hoist to engine.

30. Install support stand (B) under clutch housing.

31. Install wood blocks in front and back of rear tires.

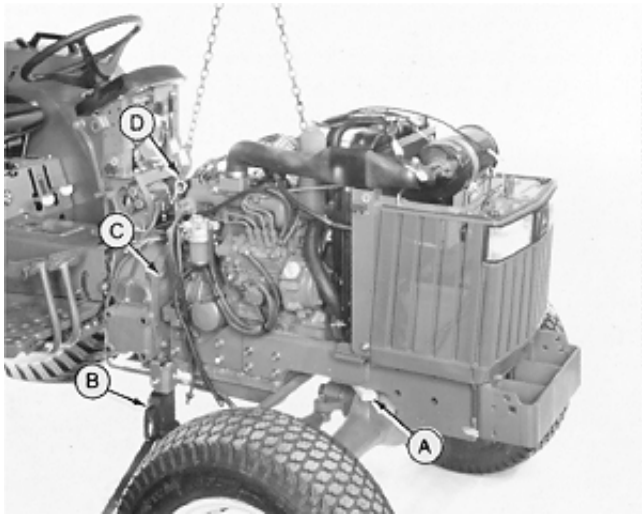
32. Install a wood block (A) between front axle and frame on both sides.

NOTE: Put transmission in neutral to ease clutch shaft alignment with engine during installation.

33. Put transmission shift lever in neutral.

34. Remove eight cap screws and lock washers (C).

35. Roll front end away from tractor.



M53577 -UN-20NOV89

A—Wood Block (2 used)
B—Support Stand
C—Cap Screw and Lock Washer (8 used)
D—Lifting Brackets (2 used)

MX,5505DG,A6 -19-20OCT89

INSTALL ENGINE TO CLUTCH HOUSING

1. Put transmission shift lever in neutral to ease clutch shaft alignment with engine.

2. Apply multipurpose grease to end of clutch shaft.

NOTE: Turn flywheel when installing front end, to engage engine with clutch shafts.

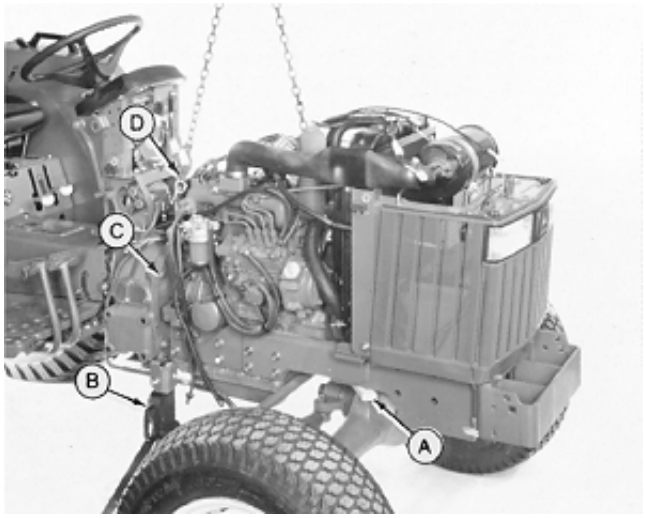
3. Install engine to clutch housing. Tighten cap screws (C) to 113 N·m (83 lb-ft).

4. Remove wood blocks (A) and support stand (B).

5. Remove lifting brackets (D).

6. Install rocker arm cover.

NOTE: For tractors with manual steering, Go to Step 13.



M53577 -UN-20NOV89

A—Wood Block (2 used)
B—Support Stand
C—Cap Screw and Lock Washer (8 used)
D—Lifting Brackets (2 used)

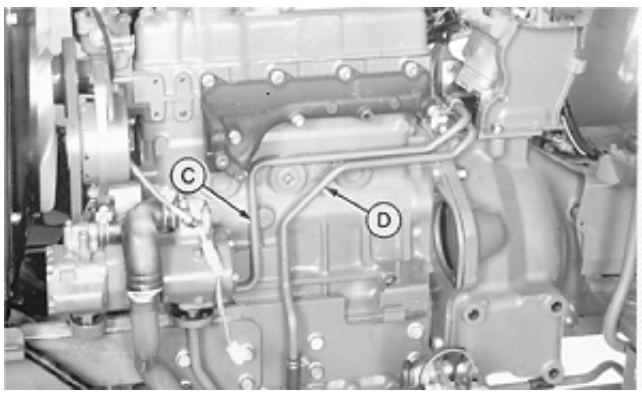
MX,5505DG,A7 -19-02NOV89

IMPORTANT: There must be one copper washer on each side of of banjo connector when installing lines.

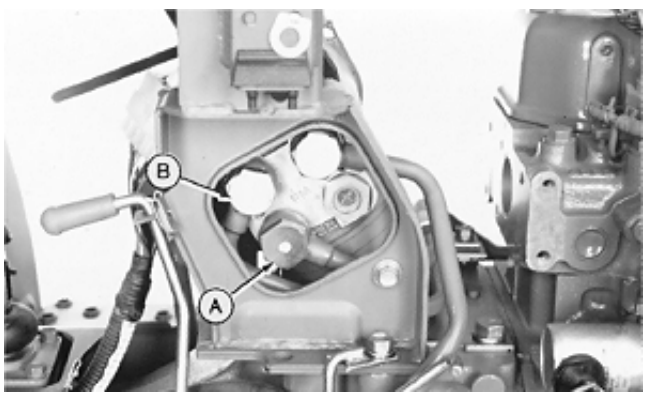
7. Install lines (C and D).

8. Install banjo connectors (A and B) and new washers.

A—Banjo Connector/Filter
B—Banjo Connector
C—Power Steering Valve Supply Line
D—Power Steering Valve Return Line



M53574 -UN-20NOV89



M53573 -UN-20NOV89

MX,5505DG,A8 -19-02NOV89

9. Install air shield (D) and rubber molding.

10. Install fuse block on support (C).

11. Install line (H).

12. Connect lines (G and F).

13. Install cap screw (A).

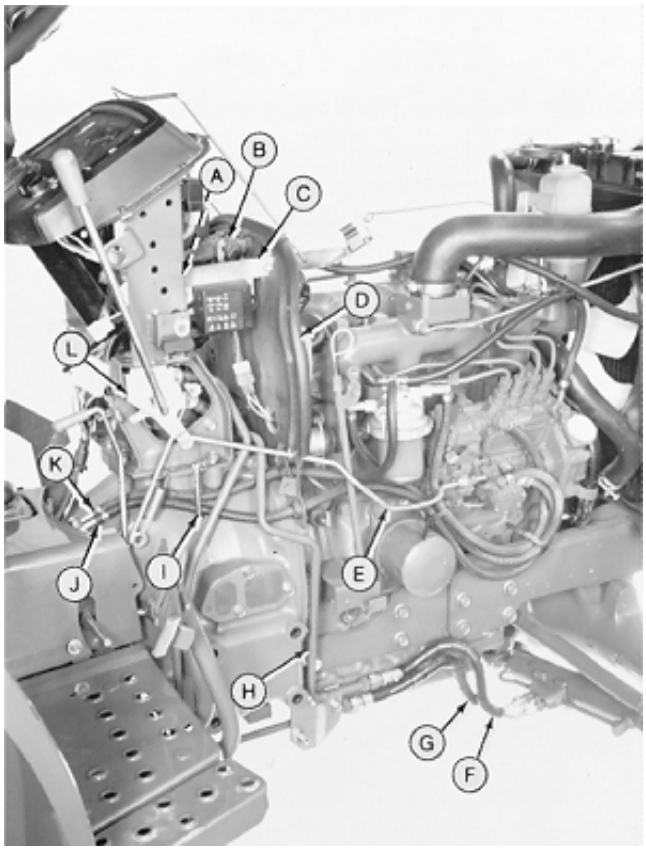
14. Connect main wiring harness (B).

15. Install control rod (E).

16. Insert hoses (J and K) through bracket (I). Connect hoses.

17. Open shutoff valve on fuel filters.

A—Cap Screw
B—Main Wiring Harness
C—Support
D—Air Shield
E—Throttle Control Rod
F—Power Steering Pump-to-Cylinder Rod End Hydraulic Line
G—Power Steering Pump-to-Cylinder Head End Hydraulic Line
H—Hydraulic Line
I—Holder
J—Fuel Pump Supply Hose
K—Return Fuel Leak-Off Hose



Right-Hand Side

MX,5505DG,A9 -19-23OCT89

18. Power steering: Connect flange (H).

Manual steering: Connect drag link.

19. Connect flange (G) and hose (I).

20. Install hydraulic line clamp cap screws (F).

21. Install cap screw (B).

22. Install bracket (E), if equipped with SCV.

23. Connect wiring connectors (C and D).

24. Connect cable (A).

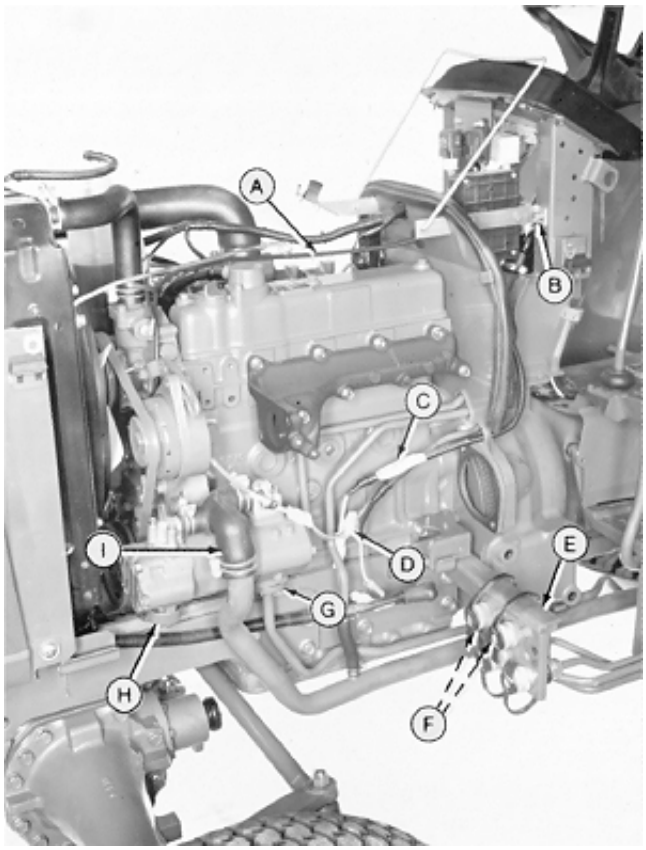
25. Install muffler and new gasket.

26. MFWD: Install drive shaft. (See procedure in Group 30 or 35.)

27. Install starter. (See procedure in Section 40, Group 10.)

28. Install hood. (See procedure in Section 80, Group 15.)

29. Adjust throttle control linkage. (See Section 220, Group 15.)



M53569 -UN-20NOV89

Left-Hand Side

A—Hour Meter Cable
B—Cap Screw
C—Fusible Link Connector
D—Alternator Wiring Connector
E—SCV Mounting Bracket
F—Cap Screws (2 used)
G—Hydraulic Pump Pressure Line Mounting Flange
H—Power Steering Hydraulic Pump Pressure Line Mounting Flange
I—Suction Line Hose

MX,5505DG,A10 -19-23OCT89

REMOVE CLUTCH HOUSING

1. Separate engine from clutch housing. (See procedure in this group.)

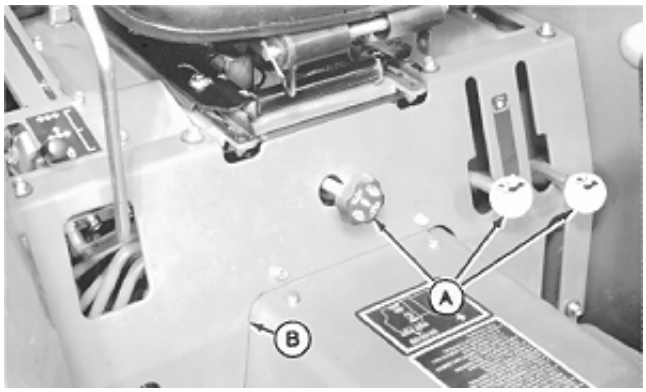
2. Remove knobs (A) and panel (B).

3. Remove clutch housing cover.

4. Remove step plates.

NOTE: The approximate capacity of transmission is 21 L (5.5 U.S. gal).

5. Drain transmission.



M53258 -UN-18JUL89

MX,5505DG,A11 -19-03NOV89

6. Remove spring (B).

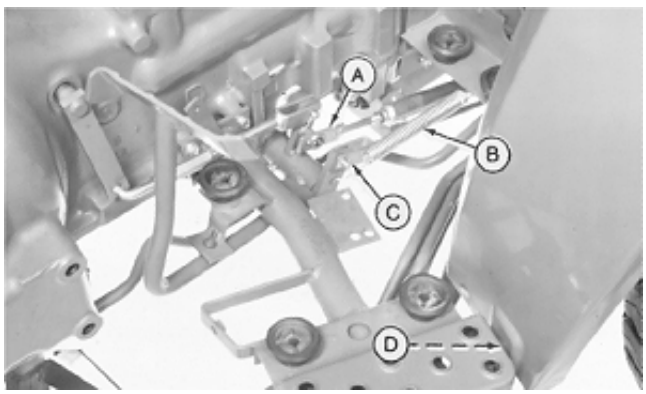
7. Disconnect link (C).

8. Disconnect rod (A), if equipped.

9. Remove cap screw and washers (D).

10. Remove hydraulic pump suction line.

11. Hydraulic oil filter: Remove supply hose from transmission housing.



M53579 -UN-20NOV89

A—Mid PTO Brake Rod
B—Spring
C—Brake Link
D—Cap Screw and Washers

MX,5505DG,A12 -19-03NOV89

12. Power steering: Remove power steering valve hydraulic line.

13. Disconnect wiring harness (F).

14. Remove tie strap (C).

15. Disconnect wiring connectors (B and D).

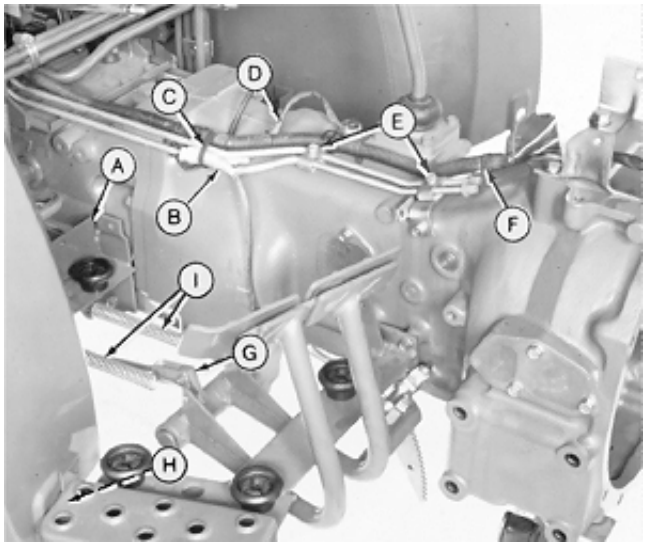
16. Remove line clamps (E).

17. Disconnect link (G).

18. Disconnect springs (I).

19. Remove step plate support (A).

20. Remove cap screw and washers (H).



M53580 -UN-20NOV89

A—Rear Step Plate Support
B—Park Brake Indicator Switch Wiring Connector
C—Tie Strap
D—Transmission Neutral Start Switch Wiring Connector
E—Line Clamps (2 used)
F—Wiring Harness
G—Brake Link
H—Cap Screw and Washers
I—Springs (2 used)

MX,5505DG,A13 -19-03NOV89

21. Put range shift lever in position 2.

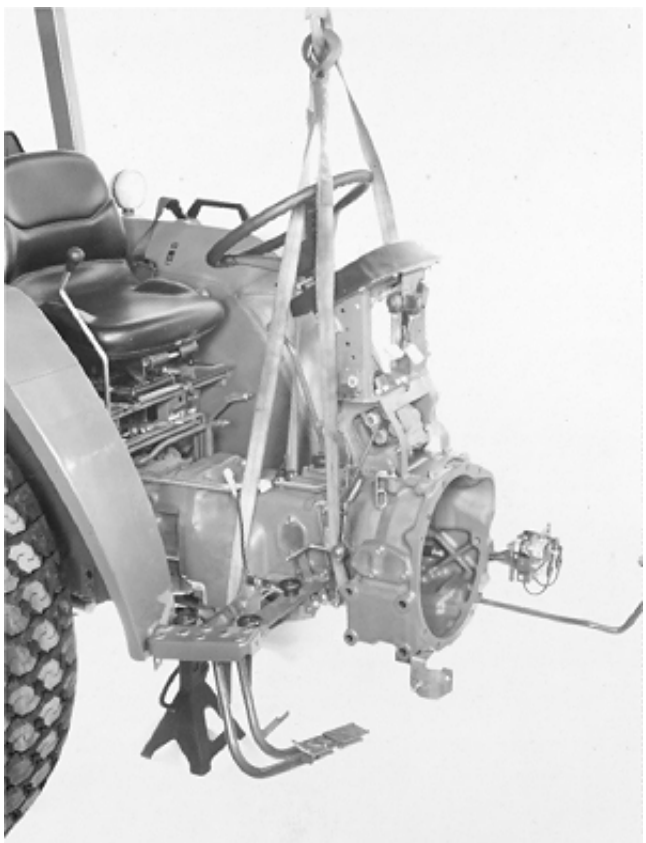
IMPORTANT: Rear PTO connecting shaft may remove with housing. Coupling on end of shaft may drop into transmission housing. After lifting chains or straps are attached to clutch housing assembly, lower support stand under drawbar and pivot rear end to rest on stand. If coupling falls into transmission housing, remove rockshaft to retrieve coupling. (See procedure in Section 70, Group 11.)

22. Install support stands under end of drawbar and front of transmission.

23. Attach lifting chains or strap to housing.

24. Remove clutch housing and gasket.

25. Make repairs as necessary. (See procedure in this group.)



M53578 -UN-07DEC89

MX,5505DG,A14 -19-03NOV89

INSTALL CLUTCH HOUSING

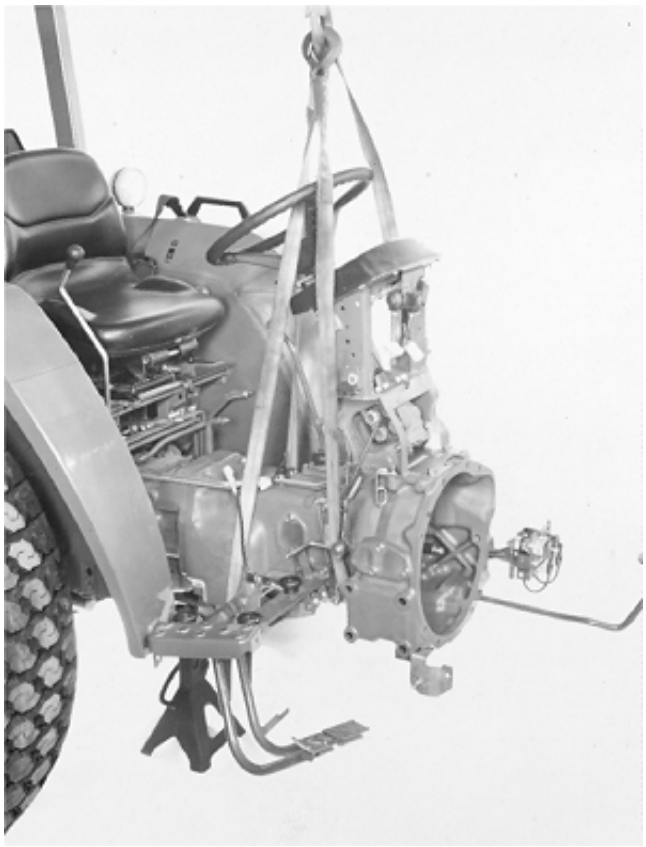
NOTE: When installing clutch housing, turn clutch shafts to align with PTO connecting shaft and pinion gear.

1. Clean mating surfaces of transmission and clutch housings using clean and cure primer. Apply flexible sealant to mating surfaces.

2. Install clutch housing and new gasket. Tighten cap screws and nuts to specifications.

TORQUE SPECIFICATIONS

Cap Screws	85 N·m (63 lb-ft)
Nuts	80 N·m (59 lb-ft)



M53578 -UN-07DEC89

MX,5505DG,A15 -19-03NOV89

3. Install cap screw and washers (H).

4. Install step plate support (A).

5. Connect springs (I).

6. Connect link (G).

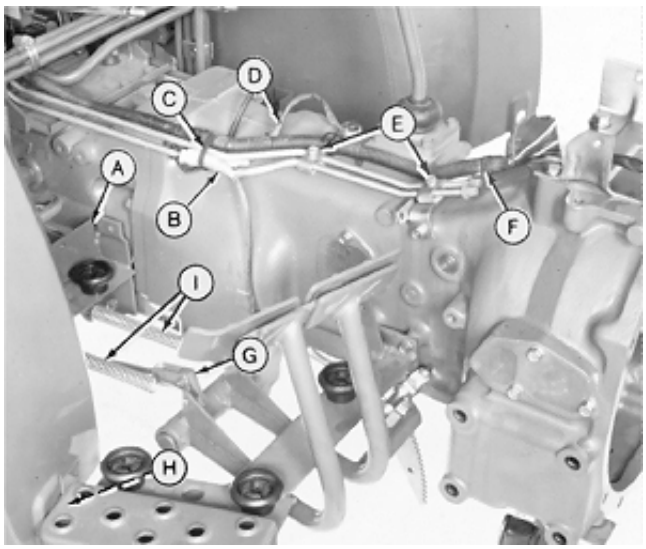
7. Install line clamps (E).

8. Connect wiring connectors (B and D).

9. Install tie strap (C).

10. Connect wiring harness (F).

11. Power steering: Install power steering valve hydraulic line.



M53580 -UN-20NOV89

A—Rear Step Plate Support
B—Park Brake Indicator Switch Wiring Connector
C—Tie Strap
D—Transmission Neutral Start Switch Wiring Connector
E—Line Clamps (2 used)
F—Wiring Harness
G—Brake Link
H—Cap Screw and Washers
I—Springs (2 used)

MX,5505DG,A16 -19-03NOV89

12. Install large hydraulic supply line.

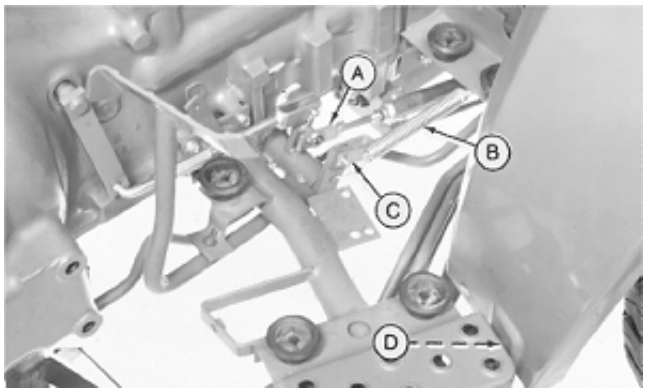
13. Hydraulic oil filter: Install supply hose to transmission housing.

14. Install cap screw and washers (D).

15. Connect rod (A), if equipped.

16. Connect link (C).

17. Install spring (B).



M53579 -UN-20NOV89

A—Mid PTO Brake Rod
B—Spring
C—Brake Link
D—Cap Screw and Washers

MX,5505DG,A17 -19-03NOV89

18. Install step plates.

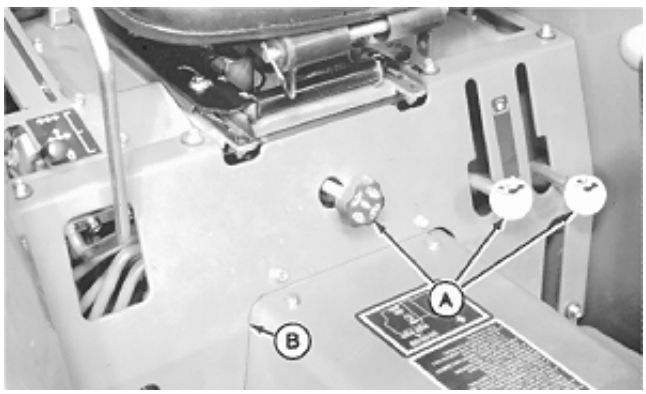
19. Adjust clutch pedal free-play. (See procedure in Section 255, Group 15.)

20. Install clutch housing cover.

21. Install knobs (A) and panel (B).

22. Install engine to clutch housing. (See procedure in this group.)

23. Fill transmission with proper oil. (See Section 10, Group 20.)



M53258 -UN-18JUL89

MX,5505DG,A18 -19-03NOV89

INSPECT AND REPLACE CLUTCH HOUSING SEAL AND BUSHINGS

1. Inspect housing for cracks or damage. Replace if necessary.

2. Remove bearing quill assembly to replace seal (A). (See procedure in Group 10.)

3. Remove brake pedals and shaft. (See Section 60, Group 15.)

4. Inspect seal and bushings for wear or damage. Replace as necessary.

5. Replace seal (A) using a bearing, bushing and seal driver set.

6. Apply multipurpose grease to inside lip of seal (A).

NOTE: Remove bushings only if replacement is necessary.

7. Replace bushings (D, F and G) using a bearing, bushing and seal driver set.

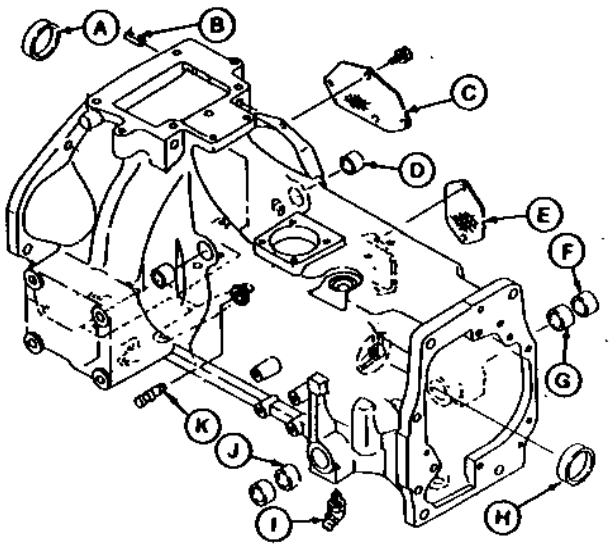
Install bushings (D, G and J) below housing surface according to specifications.

Install bushings (F) flush with housing surface.

8. Apply multipurpose grease to all lubrication fittings.

BUSHING DEPTH SPECIFICATIONS

Bushings (D)	13 mm (0.080 in.)
Bushing (G)	32 mm (1.250 in.)
Bushing (J)	25 mm (0.984 in.)



M53581 -UN-20NOV89

A—Seal
B—Spring Pin (2 used)
C—Screen
D—Bushing (2 used)
E—Screen
F—Bushing (2 used)
G—Bushing
H—Plug
I—Lubrication Fitting (2 used)
J—Bushing
K—Pin (2 used)

55 05 12

MX,5505DG,A19 -19-03NOV89

INSPECT AND REPAIR CLUTCH PEDAL AND LINKAGE

1. Remove clutch housing cover.

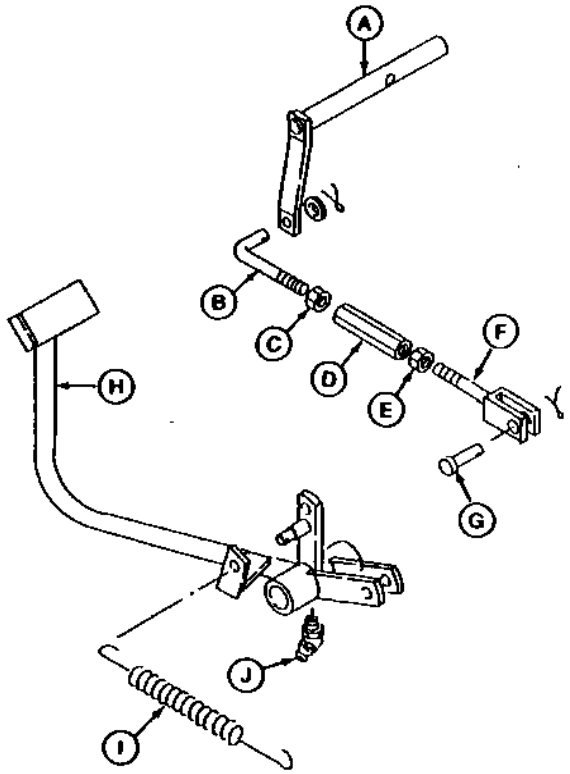
2. Remove brake pedals and shaft. (See Section 60, Group 15.)

3. Inspect parts for wear or damage. Replace as necessary.

4. Apply multipurpose grease to all lubrication fittings.

5. Adjust clutch pedal free-play. (See procedure in Section 255, Group 15.)

A—Release Shaft
B—Rod
C—Nut
D—Turnbuckle
E—Nut
F—Yoke
G—Pin
H—Pedal
I—Spring
J—Lubrication Fitting



M53582 -UN-20NOV89

MX,5505DG,A20 -19-03NOV89

ESSENTIAL TOOLS

NOTE: Order tools from your Service-Gard™Catalog.
Some tools may be available from a local supplier.

Clutch Alignment Tool JDG693

To align dual-stage clutch assembly—670/770/790

Clutch Finger Adjusting Gauge JDG52

To adjust PTO clutch fingers—870/970/1070

REMOVE AND INSTALL DUAL STAGE CLUTCH

NOTE: 870/970/1070 is shown throughout procedure.

1. Separate engine from clutch housing. (See procedure in Group 05 or Section 50, Group 05 for 670/770/790.)

IMPORTANT: Install clutch alignment tool in clutch assembly to keep PTO Clutch disk from falling from assembly.

2. Insert clutch alignment tool (A) into hub and pilot bushing in flywheel. Use JDG693 Clutch Alignment Tool on 670/770/790 or JDG689 Universal Clutch Alignment Tool Kit on 870/970/1070.

3. Remove six cap screws, washers and lock washers (B). Remove clutch assembly.

4. Inspect and repair clutch assembly and flywheel. (See procedure in this group.)



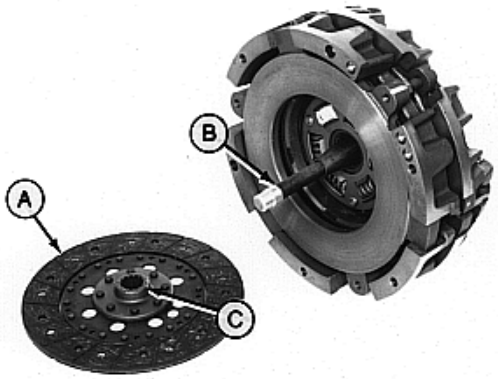
M53583

4. Install clutch alignment tool (B) into clutch assembly.

5. Place PTO clutch disk (A) on alignment tool with long end of hub (C) facing toward clutch assembly.

6. Install clutch assembly with clutch alignment tool (A) still in place. There will be slight movement (clearance) between the straight (non-tapered) section of the tool hub and the traction clutch hub.

NOTE: Thin tape could also be wrapped around the tool hub to better center the traction clutch.



M53584

7. Push the tapered end of the clutch alignment tool forward to hold the PTO clutch in place during tightening of the clutch assembly to the pressure plate. If closer centering is necessary, visually center the traction clutch within the pressure plate by aligning the clutch river heads so that they are equally spaced around the inside diameter of the pressure plate.

8. Install cap screws (B) and tighten to 22 N•m (16 lb-ft).

9. Remove clutch alignment tool.

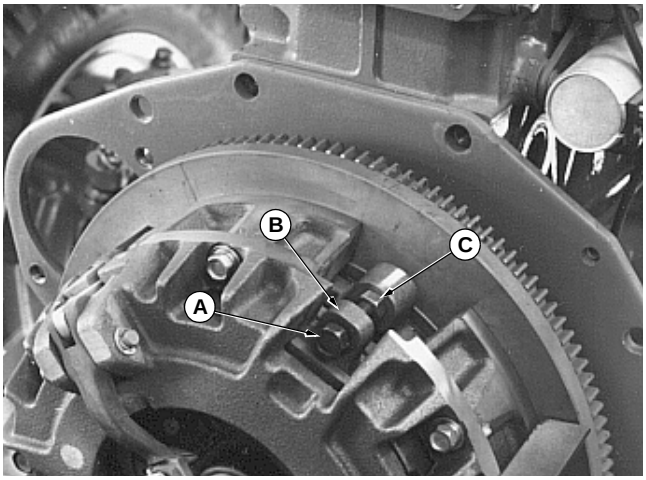


M53583

10. Screw in cap screws (A).

11. Set clearance between cap screw head (A) and clutch hub (B) at 1.5 mm (0.060 in.) using a feeler gauge.

12. Tighten nuts (C) to 18 N•m (159 lb-in). Recheck cap screw head clearance.



M53585

13. On 670/770/790: Place a straight edge across the top of each screw (A) and parallel with flywheel.

Measure the distance from flywheel to both ends of straight edge. If not according to specifications, loosen nut (B) and turn screw.

Tighten nuts (B) to 19 N•m (168 lb-in).

Repeat procedure for each dutch finger.

On 870/970/1070: Use JDG52 Clutch Adjusting Gauge (shown).

14. Adjust clutch finger screw (A) to touch raised center portion of tool.

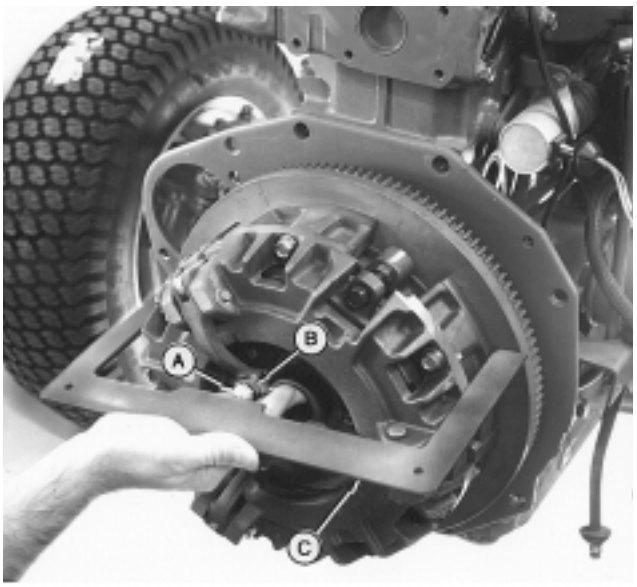
15. Tighten nut (B) to 19 N•m (168 lb-in).

16. Repeat procedure for each clutch finger.

17. Install engine to clutch housing. (See procedure in Group 05 or Section 50, Group 05 for 670/770/790.)

18. Adjust clutch pedal free-play. (See procedure in Section 250 or 255, Group 15.)

•If not equipped with a Clutch Adjusting Gauge, follow adjustment procedures and specifications below.



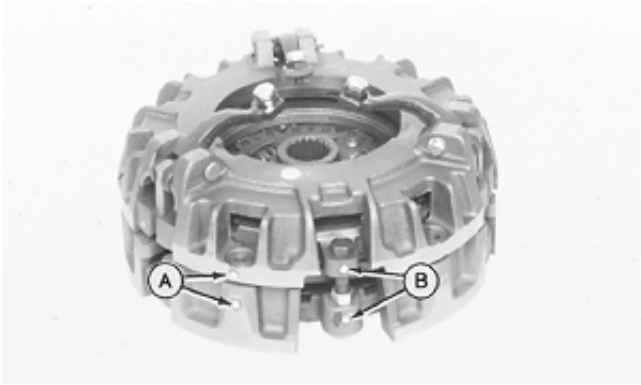
M53853

CLUTCH FINGER SCREW-TO-FLYWHEEL SPECIFICATIONS

670/770/790	98.5 (3.878 in.)
870/970/1070	113 mm (4.452 in.)
Tolerance	98.5 (3.878 in.)

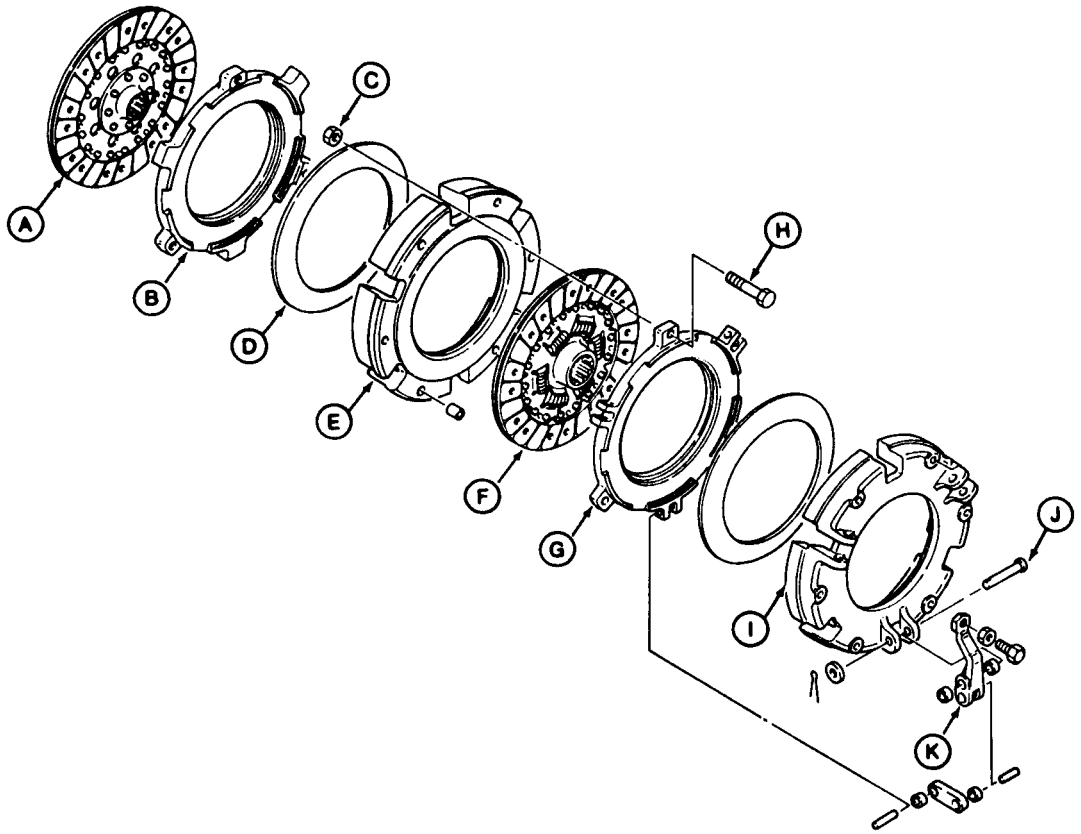
INSPECT AND REPAIR CLUTCH ASSEMBLY AND FLYWHEEL

1. Put alignment marks (A and B) on covers and pressure plates to aid in assembly.



-UN-20NOV89
M53586

MX,5506DG,A6 -19-03NOV89



670/770/790 Shown

A—PTO Clutch Disk
B—Pressure Plate
C—Nut (3 used)
D—Spring Disk (2 used)
E—Cover
F—Traction Clutch Disk
G—Pressure Plate
H—Cap Screw (3 used)
I—Cover
J—Pin (3 used)
K—Clutch Finger (3 used)

2. Inspect drive surface of pressure plates (B and G) and cover (E) for distortion and scratches.

3. Measure flatness of drive surfaces using a straight-edge and feeler gauge. Replace pressure plates or cover if surfaces are not flat to within 0.2 mm (0.008 in.).

4. Clean any rust or oil from drive surfaces using a light abrasive.

5. Inspect clutch disks (A and F) for damage or wear. Replace if necessary.

6. Measure thickness of disks (A and F). Replace disks if less than specifications.

MINIMUM CLUTCH DISK THICKNESS

Disk (A) . . . . . 7.0 mm (0.270 in.)

Disk (F) . . . . . 7.6 mm (0.300 in.)

NOTE: Match up alignment marks made before disassembly.

7. Assemble clutch assembly. Install disk (F) with longer hub facing toward fingers (K).

8. Install cap screws (H) and nuts (C). Leave loose.

9. On 670/770/790: Inspect flywheel pilot bushing. Replace bushing if ID is more than 15.03 mm (0.592 in.).

On 870/970/1070: Inspect flywheel pilot bearing (B). Replace bearing if worn or damaged.

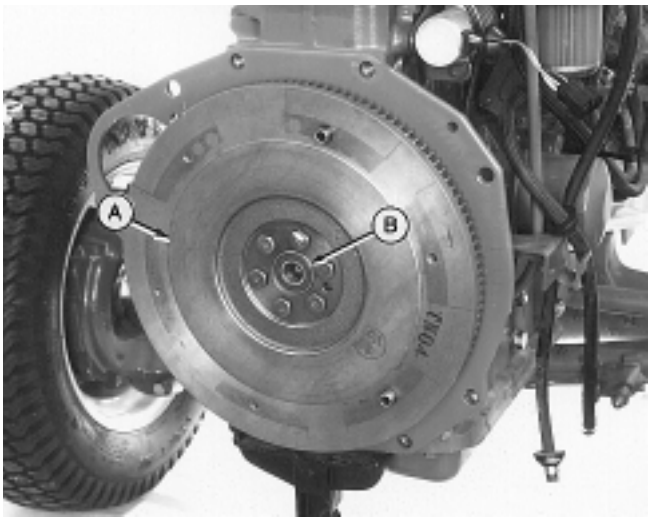
10. Remove bushing or bearing using a blind hole puller set.

Install new bushing or bearing flush with flywheel using a bearing, bushing and seal driver set.

11. Inspect flywheel drive surface (A) for distortion and scratches.

12. Measure flatness of drive surface using a straightedge and feeler gauge. Replace flywheel if drive surface is not flat to within specifications.

13. Clean any rust or oil from drive surface using a light abrasive.



870/970/1070 Shown

FLYWHEEL DRIVE SURFACE FLATNESS

670/770/790 . . . . . 0.4 mm (0.016 in.)

870/970/1070 . . . . . 0.2 mm (0.008 in.)

REMOVE, INSPECT AND INSTALL CLUTCH RELEASE MECHANISM AND CLUTCH SHAFT—870/970/1070

NOTE: To service transmission drive shaft, disassembly is required. (See procedure in Group 10.) Clutch release mechanism and PTO clutch shaft can be serviced by separating engine from clutch housing.

1. Separate engine from clutch housing. (See procedure in Group 06.)

2. Remove shaft (F).

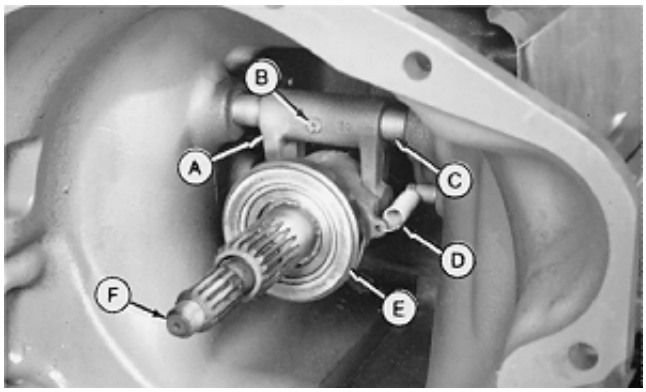
3. Disconnect springs (D).

4. Remove release assembly (E).

5. Remove clutch housing cover.

6. Disconnect clutch link.

7. Remove spring pins (B), shaft (C) and yoke (A).



M53591 -UN-20NOV89

A—Clutch Release Yoke
B—Spring Pins
C—Clutch Release Shaft
D—Release Spring (2 used)
E—Clutch Release Bearing Assembly
F—PTO Clutch Shaft

55
06
7

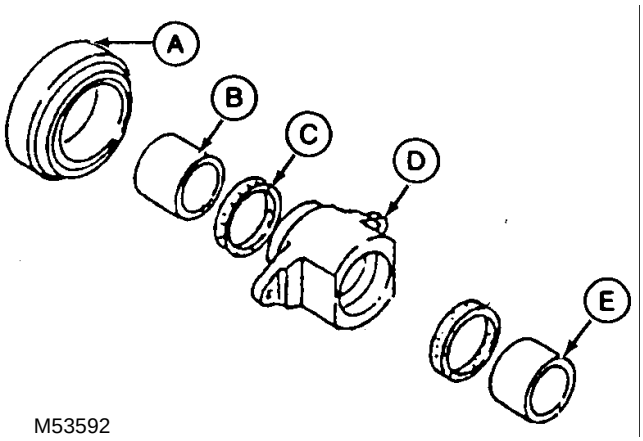
MX,5506DG,A10 -19-03NOV89

7. Inspect parts for wear or damage. If any of the parts (A) through (E) require replacement, they are only available in an assembly.

8. Install all parts.

9. Install engine to clutch housing. (See procedure in Group 05.)

10. Adjust clutch pedal free-play. (See procedure in Section 250 or 255, Group 15.



M53592

OTHER MATERIAL

Number	Name	Use
TY6305	Clean and Cure Primer	To clean and cure surfaces prior to application of adhesives or sealants.
TY6304	Flexible Sealant	To provide a seal between mating surfaces.

MX,5510DG,A1 -19-23OCT89

SEPARATE TRANSMISSION FROM CLUTCH HOUSING

1. MFWD: Remove drive shaft. (See procedure in Group 30 or 35.)

2. Remove engine side shields.

3. Remove dash and lower dash covers.

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.

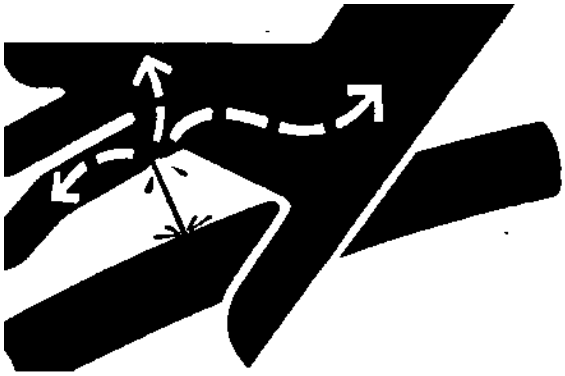
4. Lower rockshaft arms.

5. Remove bracket (B), if equipped with SCV.

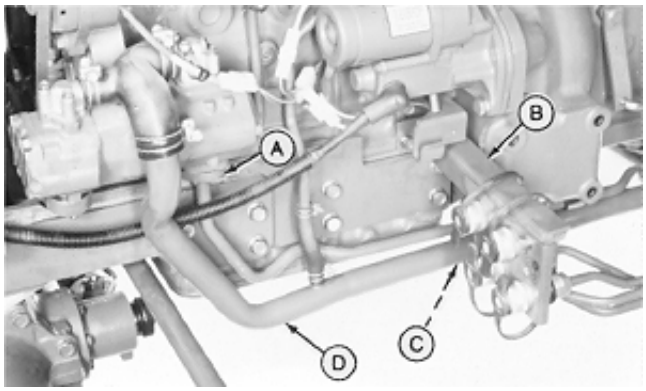
6. Remove hydraulic line clamp cap screws (C).

7. Remove line (D).

8. Disconnect flange (A). Close all openings with caps and plugs.



-UN-23AUG88
X9811



-UN-07DEC89
M53868

A—Hydraulic Pump Pressure Line Flange
B—SCV Coupler Mounting Bracket
C—Cap Screws (2 used)
D—Hydraulic Pump Suction Line

55
10
2

MX,5510DG,A2 -19-20NOV89

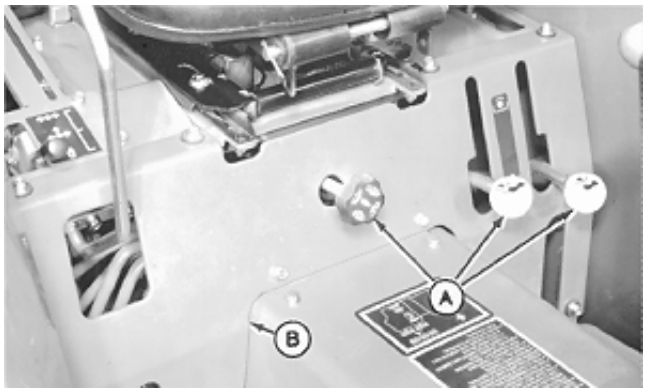
9. Remove knobs (A) and panel (B).

10. Remove clutch housing cover.

11. Remove step plates.

NOTE: The approximate capacity of transmission is 21 L (5.5 U.S. gal).

12. Drain transmission.



-UN-18JUL89
M53258

MX,5510DG,A3 -19-20NOV89

13. Hydraulic oil filter: Remove suction line (D).

14. Remove spring (C).

15. Remove link (B).

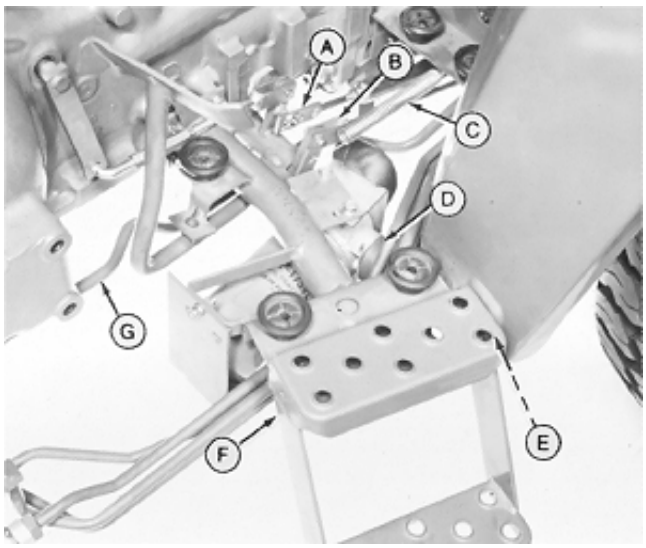
16. Disconnect link (A), if equipped.

17. Remove line (G).

18. SCV: Remove step plate support (F).

19. Remove cap screw and washers (E).

A—Mid PTO Brake Rod
B—Brake Link
C—Spring
D—Suction Line
E—Cap Screw and Washers
F—Step Plate Support
G—Hydraulic Pump Pressure Line



-UN-07DEC89
M53869

MX,5510DG,A4 -19-20NOV89

20. Close shut-off valve on fuel filters.

21. Disconnect lines (G). Close openings using caps and plugs.

22. Remove line clamps (E).

23. Disconnect wiring harness (F).

24. Remove tie strap (C).

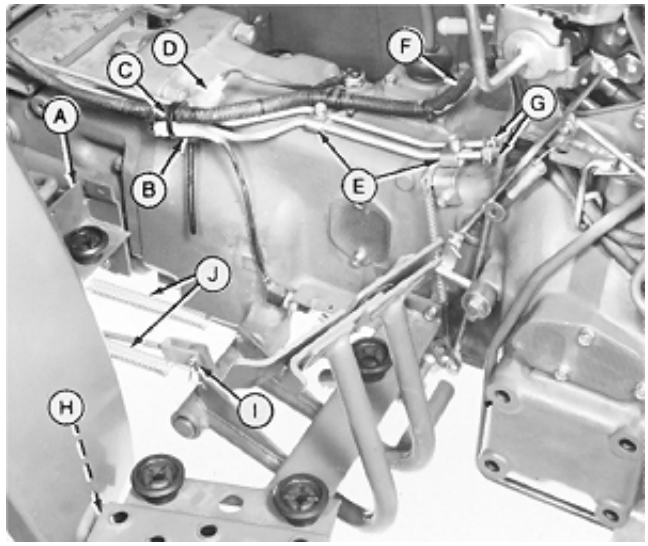
25. Disconnect wiring connectors (D and B).

26. Remove link (I).

27. Disconnect springs (J).

28. Remove step plate support (A).

29. Remove cap screw and washers (H).



M53870 -UN-07DEC89

A—Rear Step Plate Support
B—Park Brake Indicator Switch Wiring Connector
C—Tie Strap
D—Transmission Neutral Start Switch Wiring Connector
E—Line Clamps (2 used)
F—Wiring Harness
G—Fuel Lines
H—Cap Screw and Washers
I—Brake Link
J—Springs (2 used)

MX,5510DG,A5 -19-20NOV89

55
10
4

30. Put range shift lever in position 2.

IMPORTANT: Rear PTO connecting shaft may stay with clutch housing. Coupling on end of shaft may drop into transmission housing. Remove rockshaft to retrieve coupling. (See procedure in Section 70, Group 11.)

N **CAUTION: If tractor is not equipped with a 3-point hitch, install floor jack under front of transmission.**

31. Install a floor jack under drawbar assembly.

32. Install a wood block between front axle and frame on both sides.

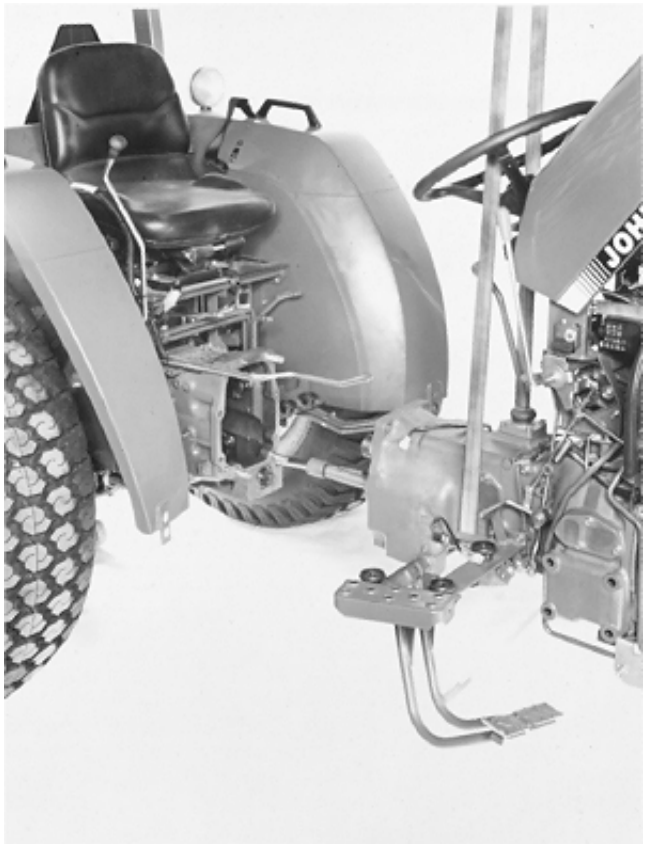
33. Install wood blocks in front and back of front tires.

34. Install lifting chains or strap around clutch housing and attach to a hoist.

35. Remove nuts and cap screws. Roll transmission away from clutch housing.

36. Install a support stand under drawbar and front of transmission.

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



M53871 -UN-07DEC89

MX,5510DG,A6 -19-20NOV89

INSTALL TRANSMISSION TO CLUTCH HOUSING

NOTE: When installing transmission, turn rear PTO shaft to align PTO connecting shaft and pinion shaft with clutch housing shafts.

1. Clean mating surfaces of transmission and clutch housings using clean and cure primer. Apply flexible sealant to mating surfaces.

2. Install transmission and new gasket. Tighten capscrews and nuts to specifications.

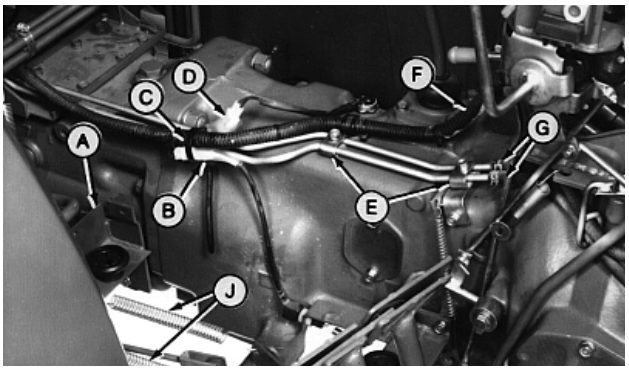
TORQUE SPECIFICATIONS

Cap Screws
—670, 770, 790 . . . . . 57 N•m (42 lb-ft)
—870, 970, 1070 . . . . . 88 N•m (65 lb-ft)
Nuts
—670, 770, 790 . . . . . 52 N•m (38 lb-ft)
—870, 970, 1070 . . . . . 187 N•m (138 lb-ft)



M53871

3. Install cap screw and washers (H).
4. Install step plate support (A).
5. Connect springs (J).
6. Install link (I).
7. Connect wiring connectors (D and B).
8. Install tie strap (C).
9. Connect wiring harness (F).
10. Install line clams (E).
11. Connect lines (G).
12. Open shut-off valve on fuel filters.



M53870

A—Rear Step Plate Support
B—Park brake Indicator Switch Wiring Connector
C—Tie Strap
D—Transmission Neutral Start Switch Wiring Connector
E—Line Clamps (2 used)
F—Wiring Harness
G—Fuel Lines
H—Cap Screw and Washers
I—Brake Link
J—Springs (2 used)

13. Install cap screw and washers (E).

14. SCV: Install step plate support (F).

15. Install line (G).

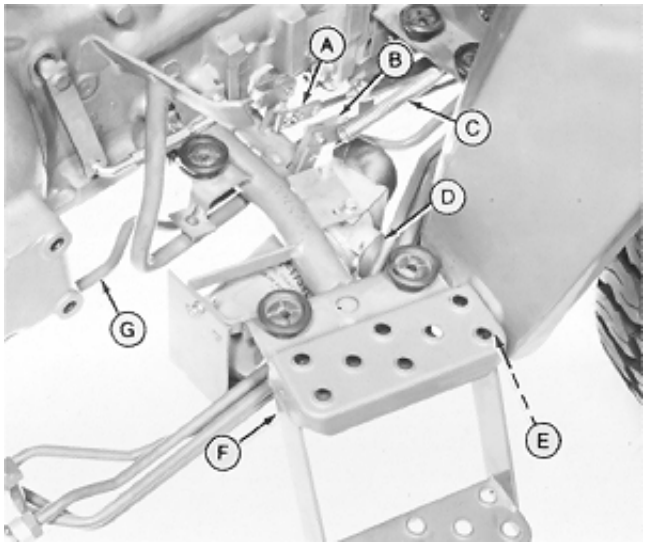
16. Connect link (A), if equipped.

17. Install link (B).

18. Install spring (C).

19. Hydraulic oil filter: Install suction line (D).

A—Mid PTO Brake Rod
B—Brake Link
C—Spring
D—Suction Line
E—Cap Screw and Washers
F—Step Plate Support
G—Hydraulic Pump Pressure Line



-UN-07DEC89
M53869

55
10
7

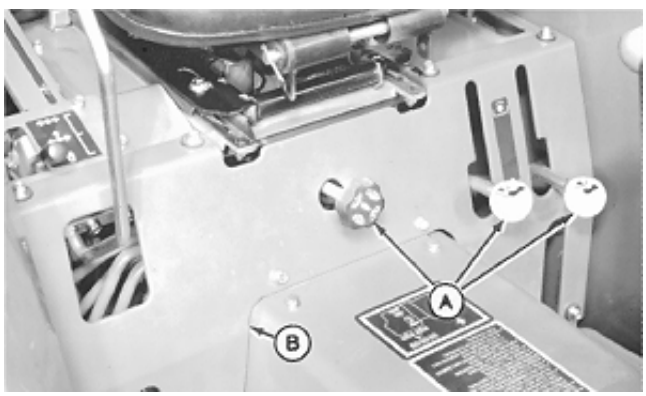
MX,5510DG,A9 -19-20NOV89

20. Adjust clutch pedal free-play. (See procedure in Section 250 or 255, Group 15.)

21. Install step plates.

22. Install clutch housing cover.

23. Install knobs (A) and panel (B).



-UN-18JUL89
M53258

MX,5510DG,A10 -19-20NOV89

24. Connect flange (A).

25. Install line (D).

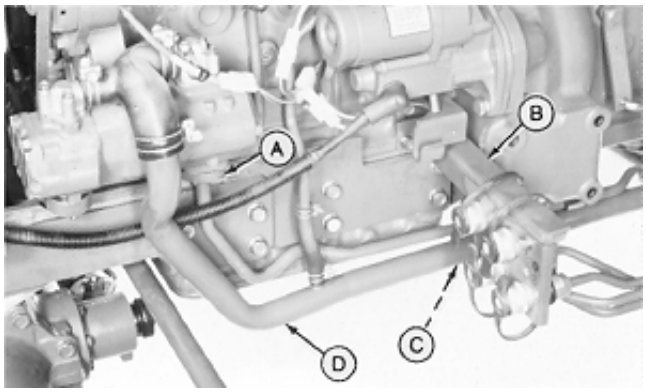
26. Install hydraulic line clamp cap screws (C).

27. Install bracket (B), if equipped with SCV.

28. Install dash, lower dash covers and engine side shields.

29. MFWD: Install drive shaft. (See procedure in Group 30 or 35.)

30. Fill transmission with proper oil. (See Section 10, Group 20.)



A—Hydraulic Pump Pressure Line Flange
B—SCV Coupler Mounting Bracket
C—Cap Screws (2 used)
D—Hydraulic Pump Suction Line

MX,5510DG,A11 -19-20NOV89

55
10
8

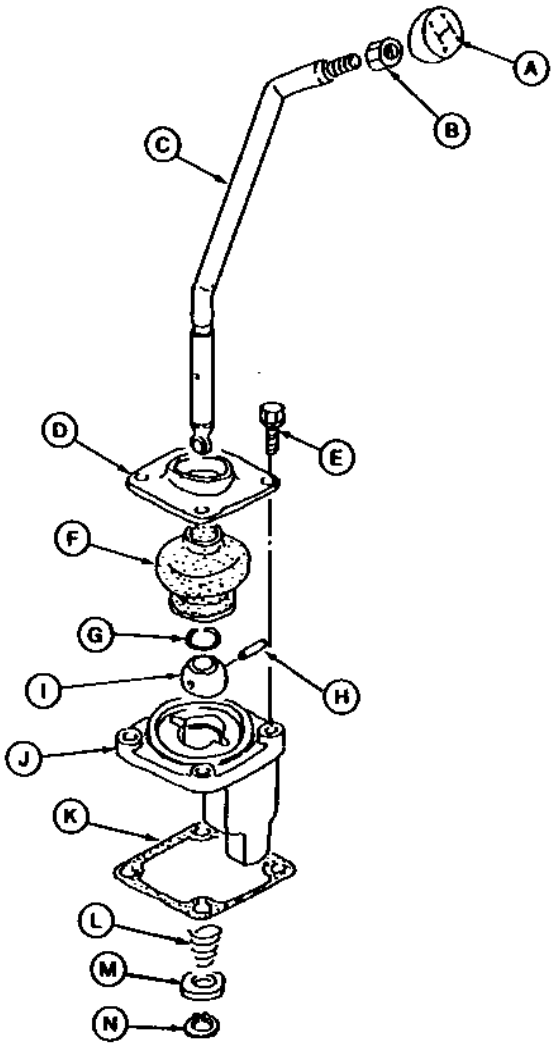
INSPECT AND REPAIR TRANSMISSION GEAR SHIFT LEVER

1. Inspect parts for wear or damage. Replace if necessary.

2. Clean mating surfaces of clutch housing and shift lever retainer using clean and cure primer. Apply flexible sealant to mating surfaces.

3. Install shift lever assembly and new gasket.

A—Knob
B—Nut
C—Lever
D—Boot Holder
E—Cap Screw (4 used)
F—Boot
G—Circlip
H—Pin
I—Ball
J—Retainer
K—Gasket
L—Spring
M—Washer
N—Snap Ring



M53854 -UN-07DEC89

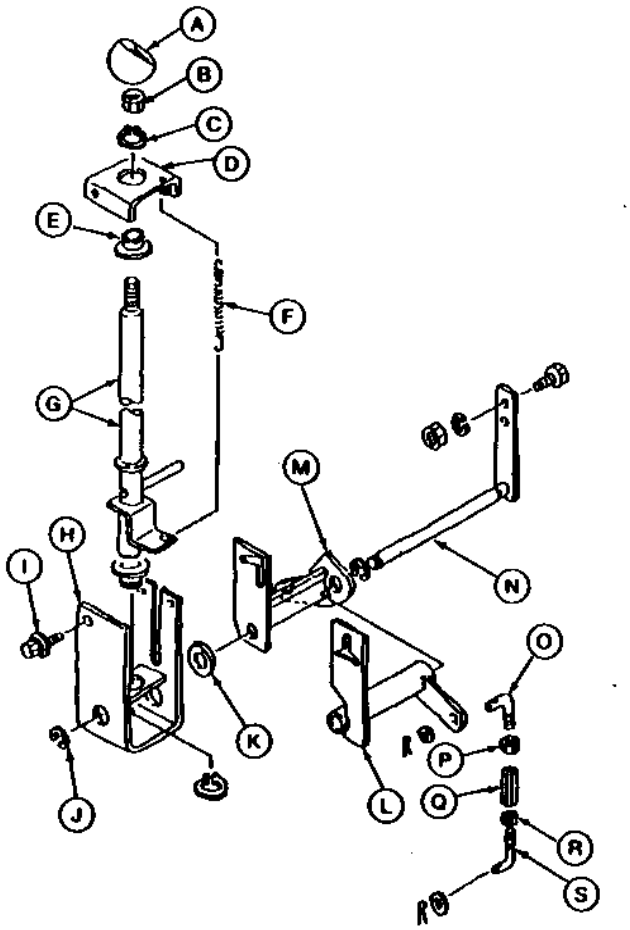
MX,5510DG,A12 -19-10NOV89

INSPECT AND REPAIR TRANSMISSION RANGE SHIFT LEVER AND LINKAGE

1. Remove left-hand fender.

2. Inspect parts for wear or damage. Replace if necessary.

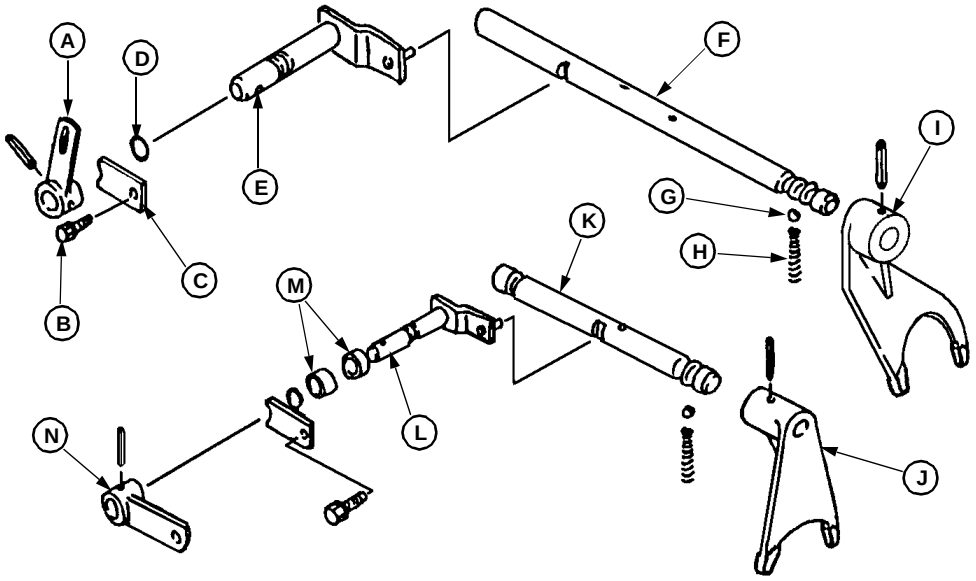
A—Knob
B—Nut
C—Snap Ring (2 used)
D—Support
E—Bushing (2 used)
F—Spring
G—Lever
H—Support
I—Cap Screw (3 used)
J—Snap Ring (2 used)
K—Washer
L—Arm
M—Arm
N—Pivot
O—Rod
P—Nut
Q—Turnbuckle
R—Nut
S—Rod



MX,5510DG,A13 -19-10NOV89

55
10
10

REMOVE, INSPECT AND INSTALL TRANSMISSION RANGE SHIFT SHAFT ASSEMBLY



M53872

A-3-2 Change Arm
B-Cap Screw (2 used)
C-Lock Plate
D-Packing (2 used)
E-3-2 Shift Arm
F-3-2 Shift Shaft
G-Ball (2 used)
H-Spring (2 used)
I-3-2 Speed Fork
J-1-N Shift Fork
K-1-N Shift Shaft
L-1-N Shift Arm
M-Bushing (2 used)
N-1-N Change Arm

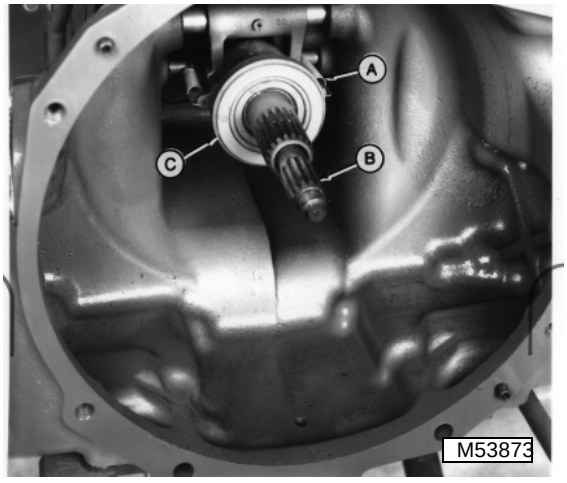
1. Separate transmission from clutch housing. (See procedure in this group.)
2. Remove rockshaft case. (See procedure in Section 70, Group 11.)
3. Loosen cap screws (B). Pull arms (E and L) away from shafts (F and K).

C **CAUTION: Balls (G) will spring from holes in housing as shafts are driven from transmission housing.**

4. Remove parts (A–N).
5. Inspect parts for wear or damage. Replace as necessary.
6. Apply clean transmission/hydraulic oil to all internal parts during installation.

REMOVE AND INSTALL BEARING QUILL ASSEMBLY

1. Remove clutch housing. (See procedure in Group 05.)
2. Remove rear PTO shaft (B).
3. Disconnect springs (A).
4. Remove clutch release mechanism (C).



M53873

5. Remove gear shift lever assembly.

6. Remove transmission neutral start switch.

7. Remove four cap screws (A).

8. Remove bearing quill assembly by tapping on opposite end of main shaft using a lead hammer.

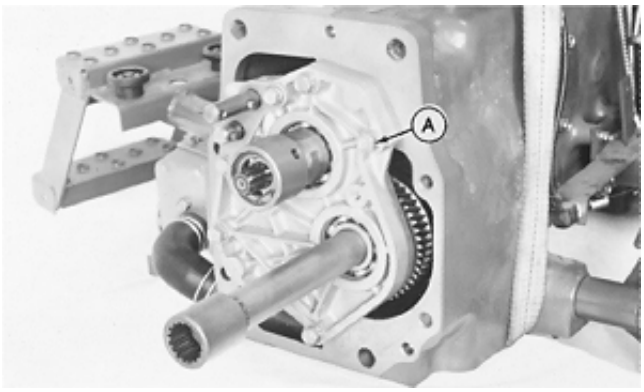
9. Make repairs as necessary. (See procedure in this group.)

10. Install bearing quill assembly and tighten cap screws.

11. Install transmission neutral start switch and gear shift lever.

12. Install clutch release mechanism and rear PTO clutch shaft.

13. Install clutch housing. (See procedure in Group 05.)



-UN-07DEC89
M53874

55
10
12

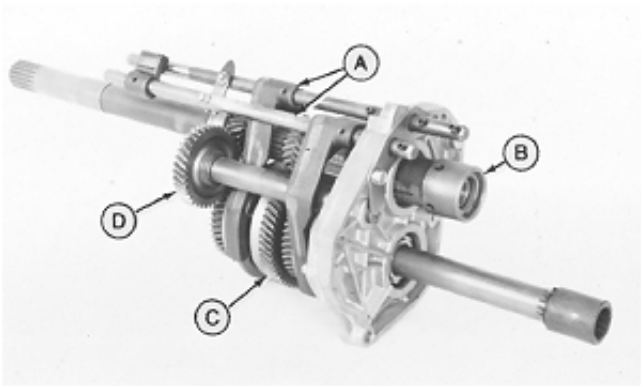
MX,5510DG,A16 -19-20NOV89

DISASSEMBLE, INSPECT AND ASSEMBLE BEARING QUILL ASSEMBLY

1. Inspect parts (A—D). Disassemble shaft assemblies as necessary.

2. Remove shaft assemblies (B and C) from bearing quill plate using a soft-faced mallet.

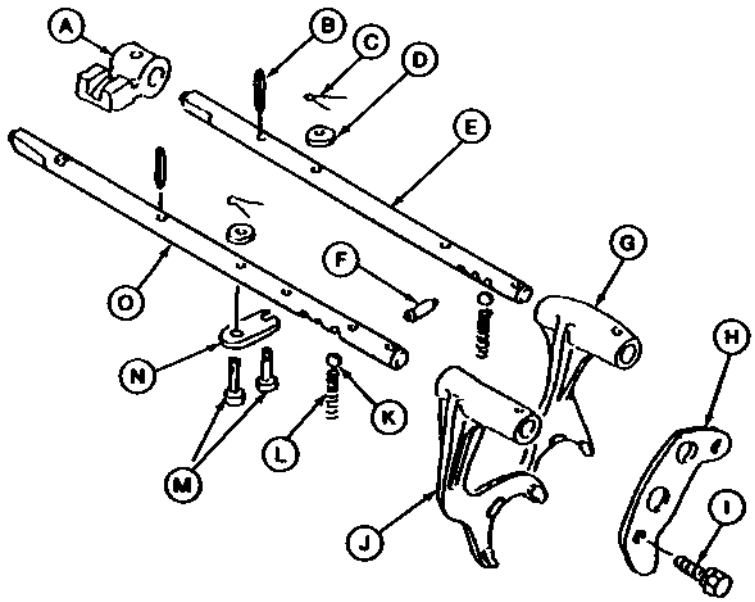
A—Gear Shift Shaft Assembly
B—Transmission Input Shaft
C—Transmission Output Shaft. (Synchronizer or Collar Shift Assembly)
D—Idler Shaft



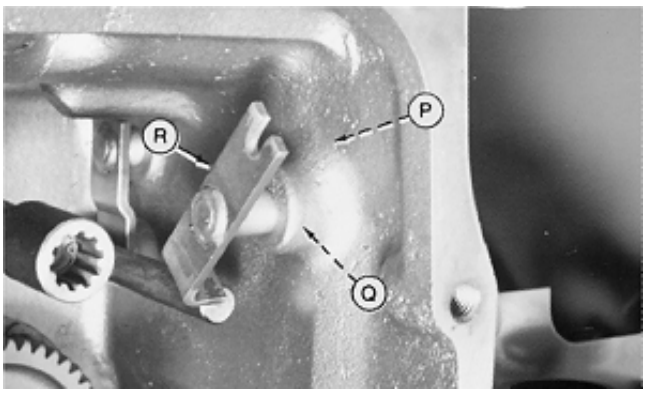
-UN-07DEC89
M53875

Synchronizer Assembly Shown

MX,5510DG,A17 -19-20NOV89



Gear Shift Shaft Assembly



Third Speed Reverse Lock-Out

55
10
13

A—Shifter
B—Spring Pin (7 used)
C—Cotter Pin (2 used)
D—Washer (2 used)
E—2-3 Shift Shaft
F—Pin
G—2-3 Shift Fork
H—Lock-Out Holder
I—Cap Screw (2 used)
J—1-R Shift Fork
K—Ball (2 used)
L—Spring (2 used)
M—Pin (2 used)
N—Arm
O—1-R Shift Shaft
P—Cap Screw
Q—Packing
R—Lock-Out Arm

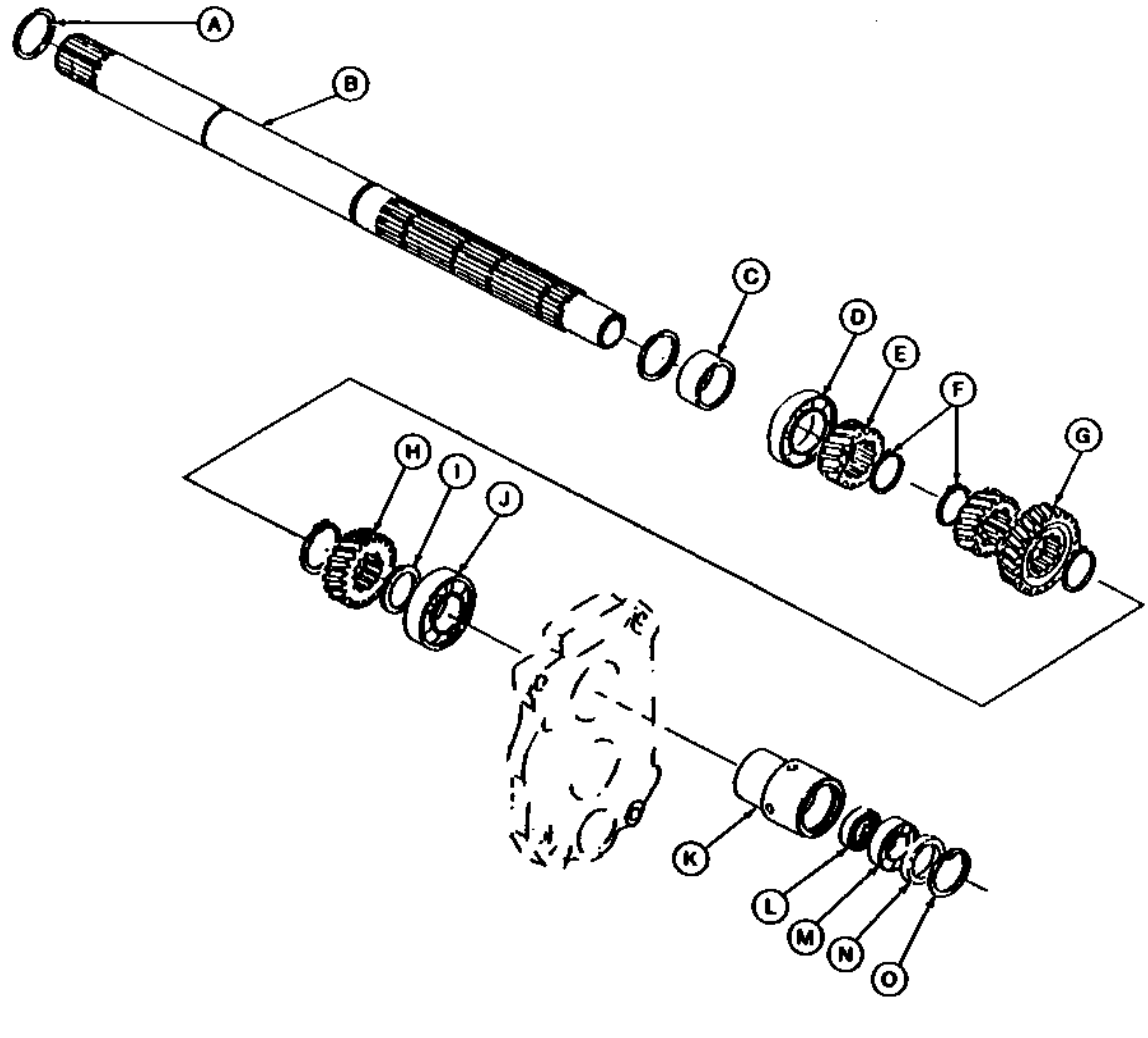
CAUTION: Balls (K) will spring from holes in plate as shafts are driven from bearing quill assembly.

3. Remove parts (A—O).

4. Loosen lock plate cap screw (P) to remove arm (R) and packing (Q) from transmission housing.

5. Inspect parts for wear or damage. Replace as necessary.

MX,5510DG,A18 -19-21NOV89



A—Circlip (2 used)
B—Input Shaft
C—Collar
D—Ball Bearing
E—Gear 21T (2 used)
F—Snap Ring (4 used)
G—Gear 31T
H—Gear 27T
I—Spacer
J—Ball Bearing
K—Oil Seal Case
L—Seal
M—Ball Bearing
N—Bushing
O—Snap Ring

Transmission Input Shaft

6. Disassemble parts (A—O).

Remove collar (C), case (K) and bearings (D and J) using a knife edge puller and a press.

7. Inspect parts for wear or damage. Replace as necessary.

8. Apply multipurpose grease to lips of seal (L) during assembly.

9. Apply clean transmission/hydraulic oil to all parts during assembly.

MX,5510DG,A19 -19-21NOV89

10. Disassemble parts (A—E).

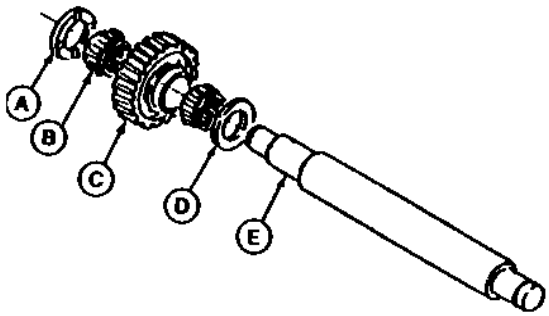
11. Inspect parts for wear or damage. Replace as necessary.

NOTE: Install washer (A) with grooves toward gear.

12. Apply petroleum jelly to washer (A) to hold in place.

13. Apply clean transmission/hydraulic oil to all parts during assembly.

A—Washer
B—Needle Bearing (2 used)
C—Gear 36T
D—Washer
E—Shaft

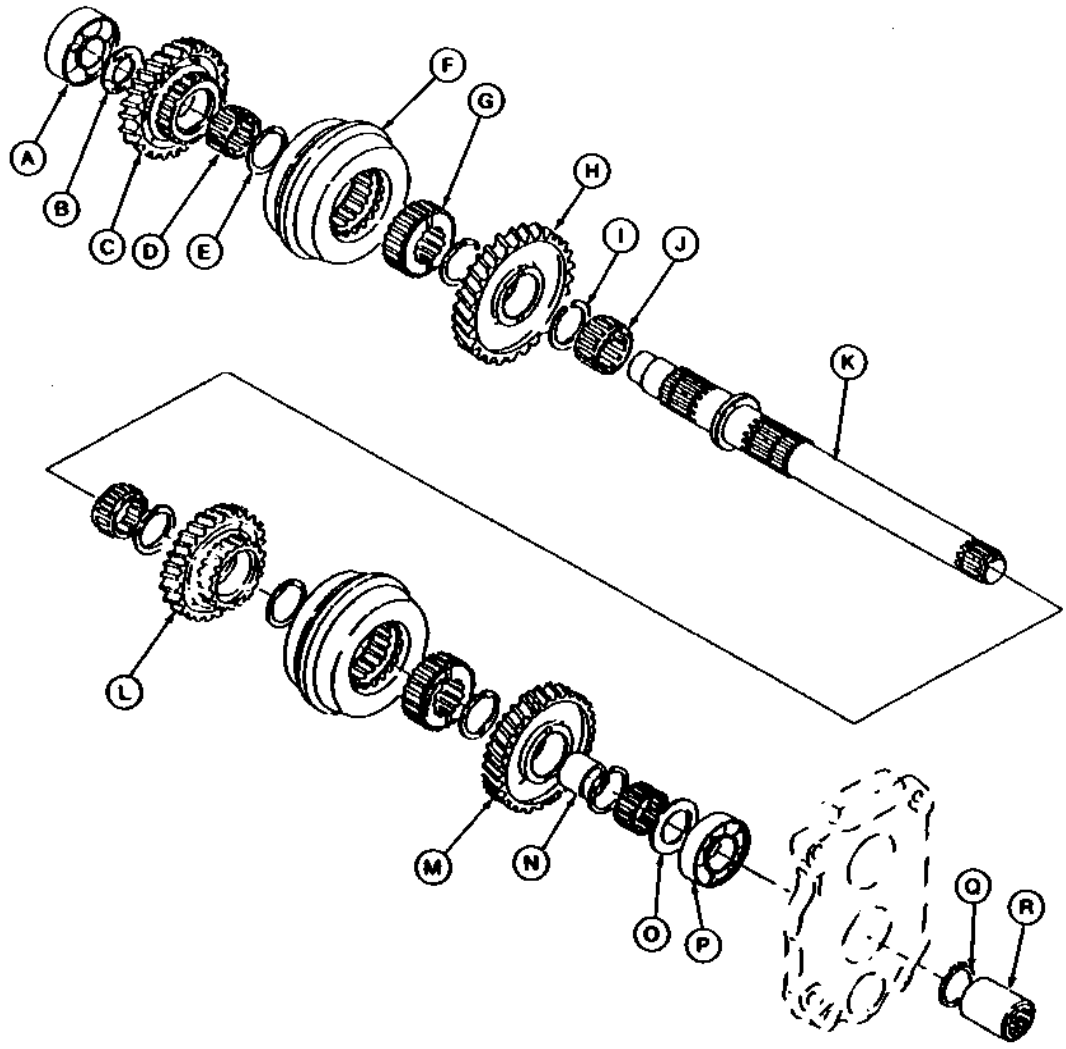


Idler Shaft

M53879 -UN-07DEC89

MX,5510DG,A20 -19-21NOV89

55
10
15



A—Ball Bearing
B—Washer
C—Gear 46T
D—Needle Bearing
E—Snap Ring (4 used)
F—Synchronizer (2 used)
G—Splined Bushing (2 used)
H—Gear 53T
I—Circlip (3 used)
J—Needle Bearing (3 used)
K—Output Shaft
L—Gear 44T
M—Gear 49T
N—Bushing
O—Washer
P—Ball Bearing
Q—Snap Ring
R—Coupling

Transmission Output Shaft Assembly

55
10
16

NOTE: Synchronizer assembly is shown. For driven shaft with collar shift assembly, sliding gears are in place of synchronizers (F).

Bearing (A) may remain in clutch housing during quill assembly removal. Remove bearing using a blind hole puller.

14. Disassemble parts (A—R).

Remove bearing (P) using a knife edge puller and a press.

15. Inspect parts for wear or damage. Replace as necessary.

NOTE: Install washer (B) with grooves toward gear.

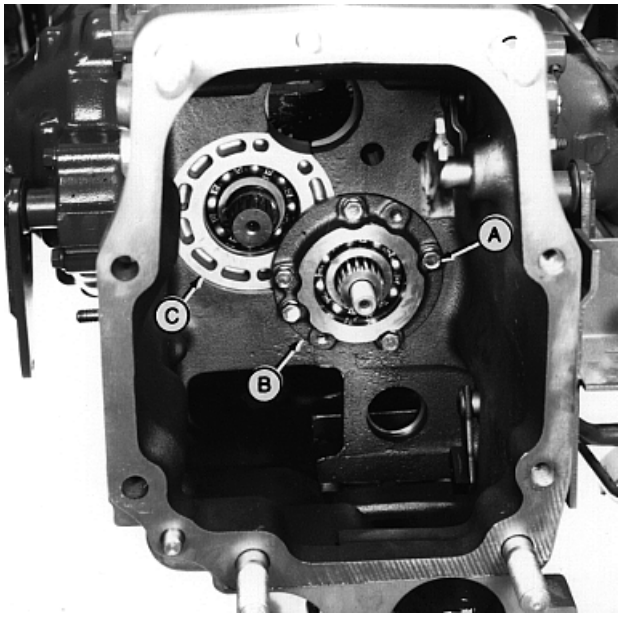
16. Apply petroleum jelly to washer (B) to hold in place.

17. Apply clean transmission/hydraulic oil to all parts during assembly.

MX,5510DG,A21 -19-21NOV89

REMOVE, INSPECT AND INSTALL REVERESE IDLER SHAFT

1. Remove transmission range shift shaft assembly. (See procedure in this group.)
2. MFWD: Remove transmission output shaft and drive gear. (See procedure in group 30 or 35.)
3. Remove (4—670/770/790, 5—870/970/1070) cap screws (A).
4. Pull differential drive shaft assembly (B) and reverse idler shaft assembly (C) forward.
5. Remove pinion shaft assembly.



M53885

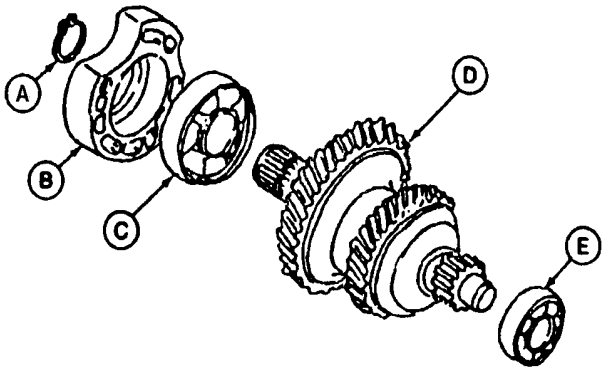
6. Remove parts (A—E).

Remove bearing (E) using a knife edge puller and a press.

Remove bearing (B) using a 2-jaw puller.

Replace bearing (C) using a bearing, bushing and seal driver set.

7. Inspect parts for wear or damage. Replace as necessary.
8. Install reverse idler shaft and differential drive shaft assemblies.
9. MFWD: Install transmission output shaft and MFWD drive gear (See procedure in Group 30 or 35.)
10. Install transmission range shift shaft assembly. (See procedure in this group.)



M53881

A—Snap Ring
B—Bushing
C—Ball Bearing
D—Reverse Idler Shaft
E—Ball Bearing

REMOVE, INSPECT AND INSTALL DIFFERENTIAL DRIVE SHAFT

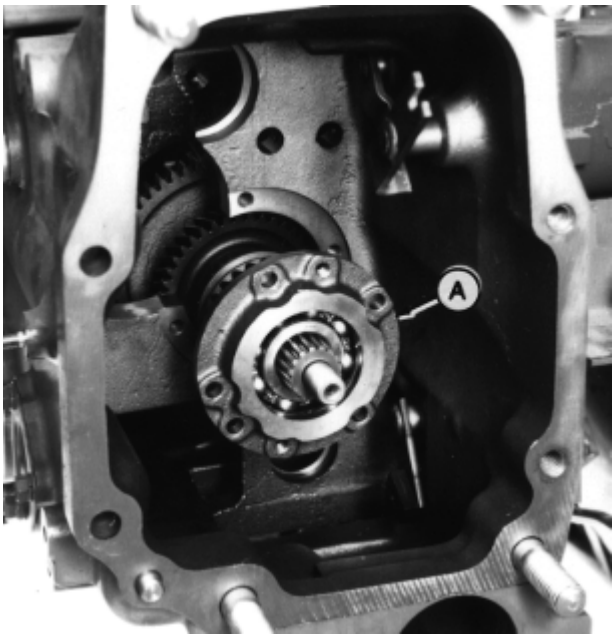
7. Remove reverse idler shaft. (See procedure in this group.)

8. Remove differential lock assembly. (See procedure in Group 20.)

9. Remove transmission filter.

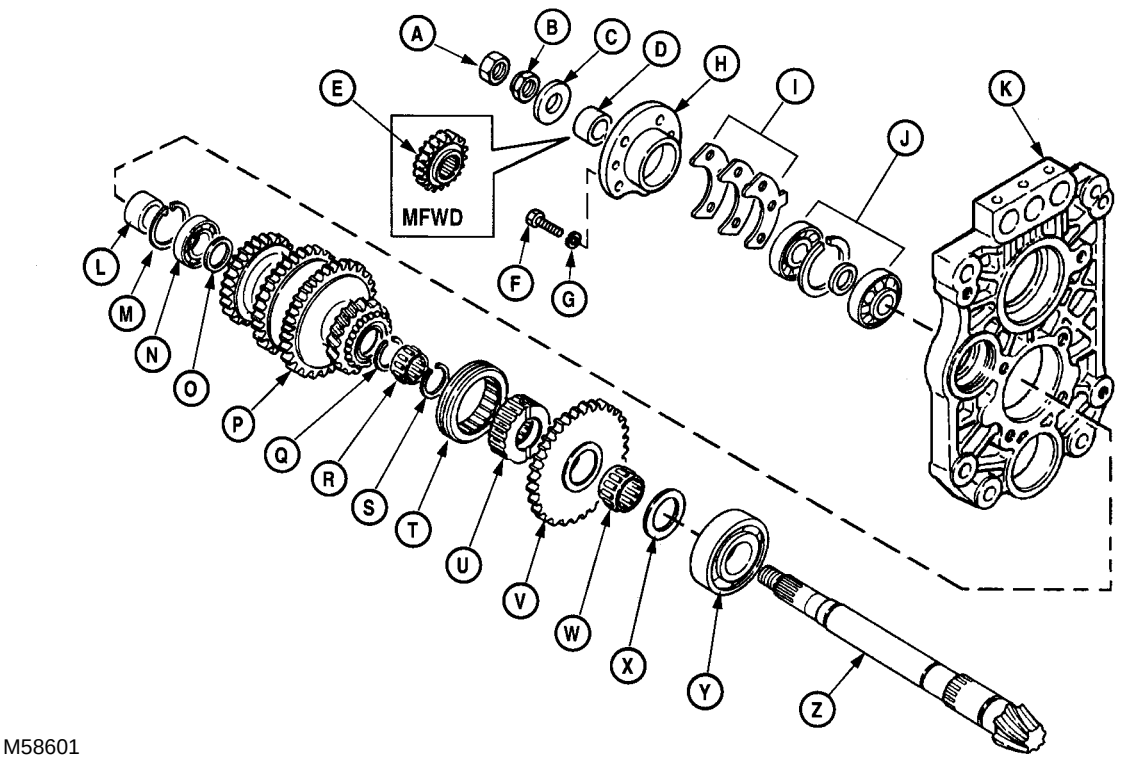
NOTE: Remove shaft assembly through top of transmission housing.

10. Remove differential drive shaft assembly (A).



M53886

DIFFERENTIAL DRIVE SHAFT (670-770-790)



M58601

A—Nut
B—Nut
C—Washer
D—Spacer (without MFWD)
E—Gear (with MFWD)
F—Capscrew
G—Lockwasher
H—Retainer
I—Adjusting Shims
J—Taper Bearing Ass'y
K—Plate
L—Spacer
M—Snap Ring
N—Ball Bearing
O—Spacer
P—Gear/Countershaft
Q—Snap Ring
R—Needle bearing
S—Snap Ring
T—Shifter
U—Splined Sleeve
V—Gear
W—Needle Bearing
X—Thrust Washer
Y—Ball Bearing
Z—Differential Drive Shaft

5. Remove parts (A—Z). Remove bearing (Y) using a knife edge puller and a press. Remove retainer (H) using a 2-jaw puller.

6. Inspect parts for wear or damage. Replace as necessary.

7. Apply clean transmission/hydraulic oil to all parts during assembly.

IMPORTANT: If the differential drive shaft and ring gear are replaced, cone point and backlash must be checked and adjusted per procedure in Group 20.

8. Install differential drive shaft assembly and tighten inner nut (B) per torque specifications. Install and lock outer nut (A) against nut (B) by tightening per torque specifications.

9. Install transmission filter.

10. Install differential lock assembly. (See procedure in Group 20).

11. Install reverse idler shaft. (See procedure in Group 20).

TORQUE SPECIFICATIONS

Retainer Cap Screws (F) (Dry-without oil) . . . . . 26 N•m (19 lb-ft)
DDS Nuts (A), (B) . . . . . 98 N•m (72 lb-ft)

OTHER MATERIAL

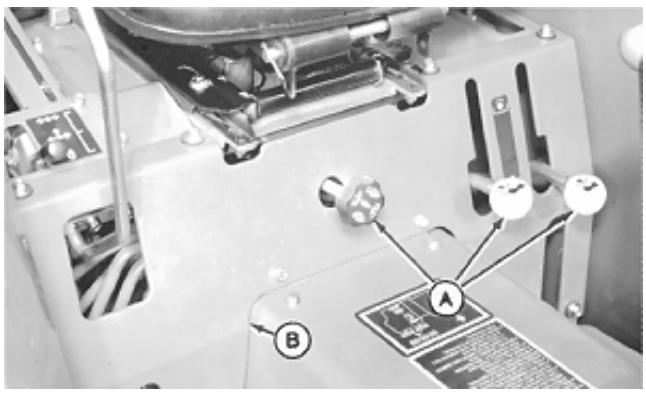
Number	Name	Use
TY6305	Clean and Cure Primer	To clean and cure surfaces prior to application of adhesives or sealants.
TY6304	Flexible Sealant	To provide a seal between mating surfaces.

MX,5515DG,A1 -19-23OCT89

REMOVE, INSPECT AND INSTALL REAR PTO LEVER AND SHIFT LINKAGE

1. Remove knobs (A) and panel (B).

2. Mid mount PTO: Remove lever. (See procedure in Group 40.)



M53258 -UN-18JUL89

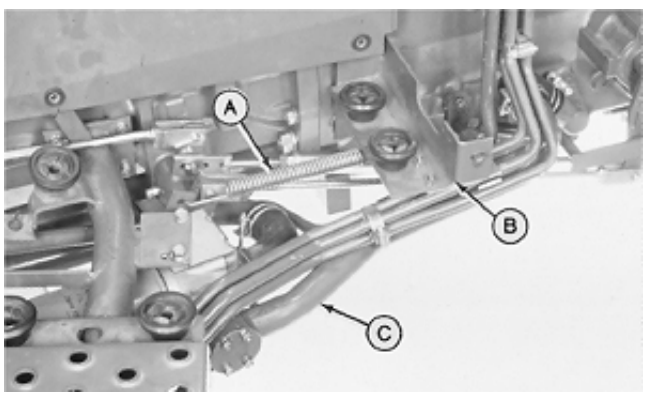
MX,5515DG,A2 -19-25NOV89

3. Remove left-hand fender and step plate.

4. Remove brake spring (A).

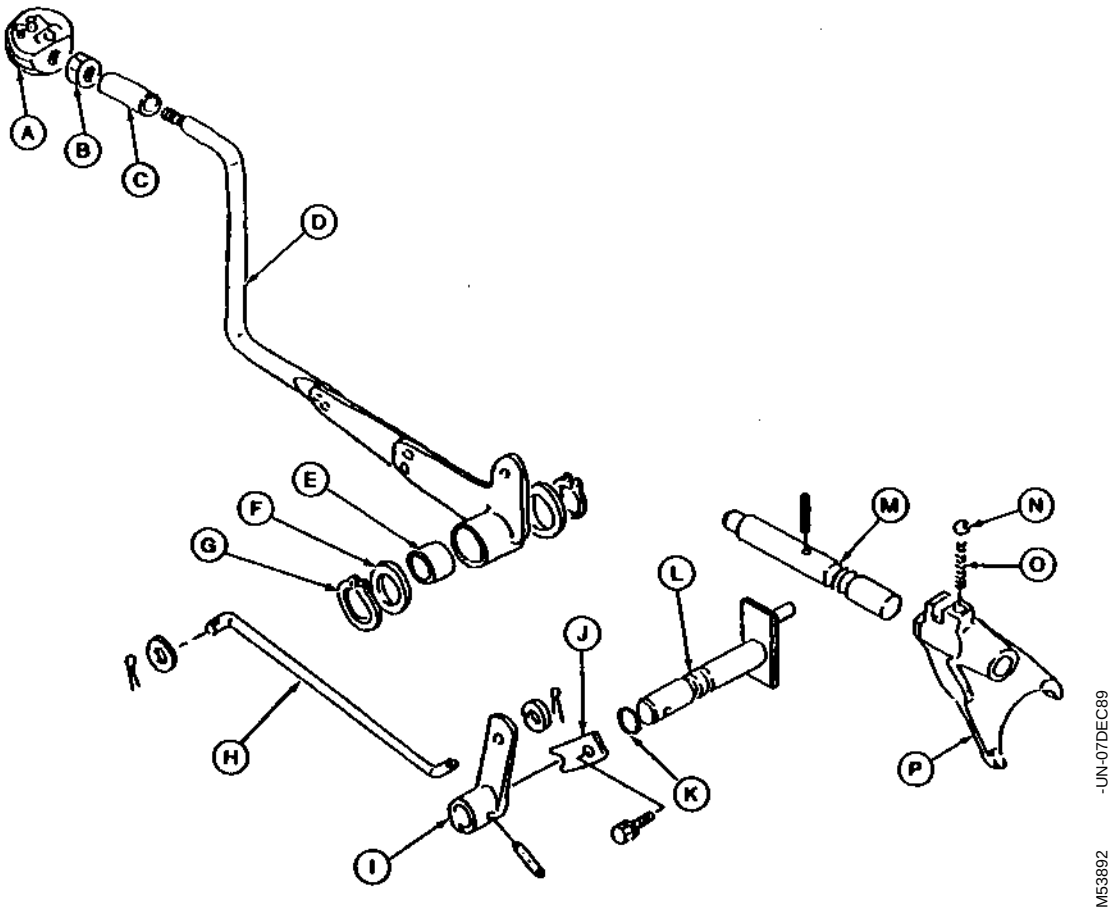
5. Remove step plate support (B).

6. Hydraulic oil filter: Drain transmission and remove suction line (C).



M53891 -UN-07DEC89

MX,5515DG,A3 -19-25NOV89



55
15
2

A—Knob	**E—Bushing**	**I—Change Arm**	**M—Shift Shaft**
B—Nut	**F—Washer (2 used)**	**J—Lock Plate**	**N—Ball**
C—Tube	**G—Snap Ring (2 used)**	**K—Packing**	**O—Spring**
D—Lever	**H—Rod**	**L—Change Arm Shaft**	**P—Shift Shaft Fork**

NOTE: To service parts (K—P), remove rear PTO drive shaft assembly. (See procedure in this group.)

CAUTION: Ball (N) will spring from hole in fork (P) as shaft (M) is driven out.

7. Remove parts (A—P).

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

9. Install all parts.

10. Hydraulic oil filter: Install suction line. Fill transmission with proper transmission/hydraulic oil.

11. Install step plate support, brake spring, step plate and fender.

12. Mid mount PTO: Install lever. (See procedure in Group 40.)

13. Install panel and knobs.

MX,5515DG,A4 -19-25NOV89

REMOVE AND INSTALL REAR PTO DRIVE SHAFT ASSEMBLY

1. Remove 3-point hitch.

2. Remove drawbar.

NOTE: The approximate capacity of transmission is 21 L (5.5 U.S. gal).

3. Drain transmission.

4. Remove master PTO shield.

5. Loosen lock plate cap screw (A). Pull lever away from transmission housing.

6. Mid mount PTO: Remove shaft assembly (C).

IMPORTANT: When removing rear PTO shaft assembly, PTO connecting shaft may remove also. Coupling on front end of shaft may fall into transmission housing. Remove cover under front of transmission housing to remove coupling.

7. Remove cap screws, rear PTO drive shaft assembly and gasket (B).

8. Make repairs as nesessary. (See procedure in this group.)

9. Clean mating surfaces of transmission housing and rear PTO cover using clean and cure primer. Apply flexible sealant to mating surfaces.

10. Install rear PTO drive shaft assembly and new gasket.

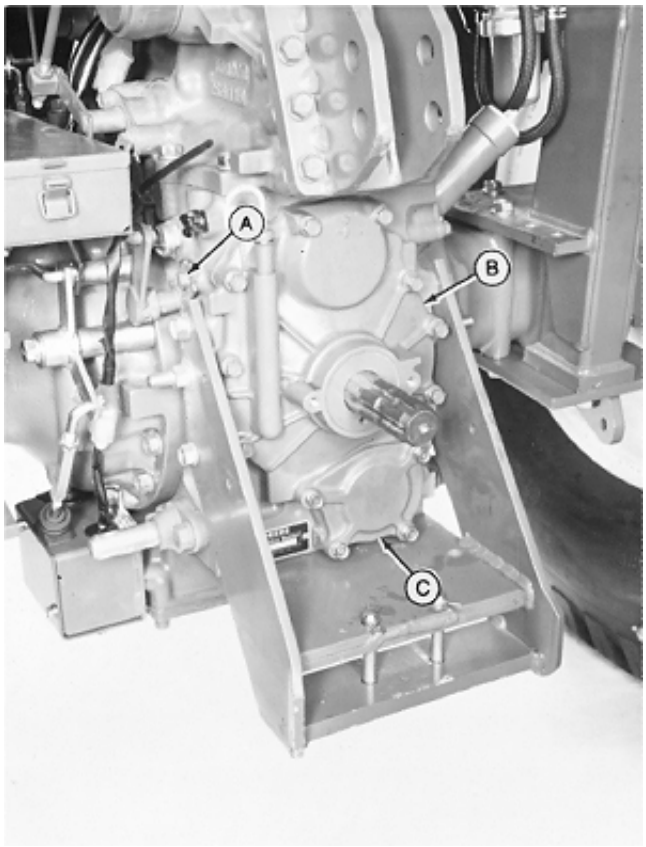
11. Mid mount PTO: Install shaft assembly.

12. Push lever toward transmission housing and tighten lock plate cap screw.

13. Install master PTO shield.

14. Install drawbar and 3-point hitch.

15. Fill transmission with proper oil. (See Section 10, Group 20.)



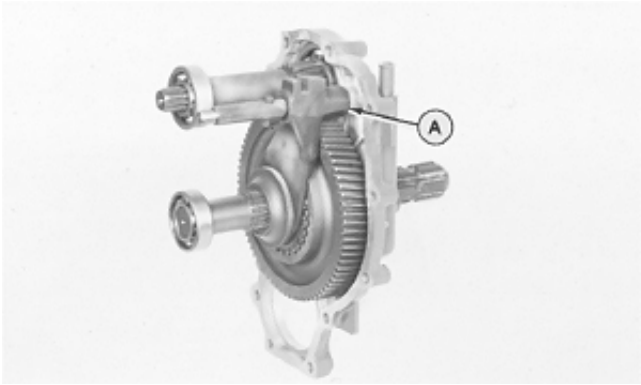
M53893 -UN-07DEC89

55 15 3

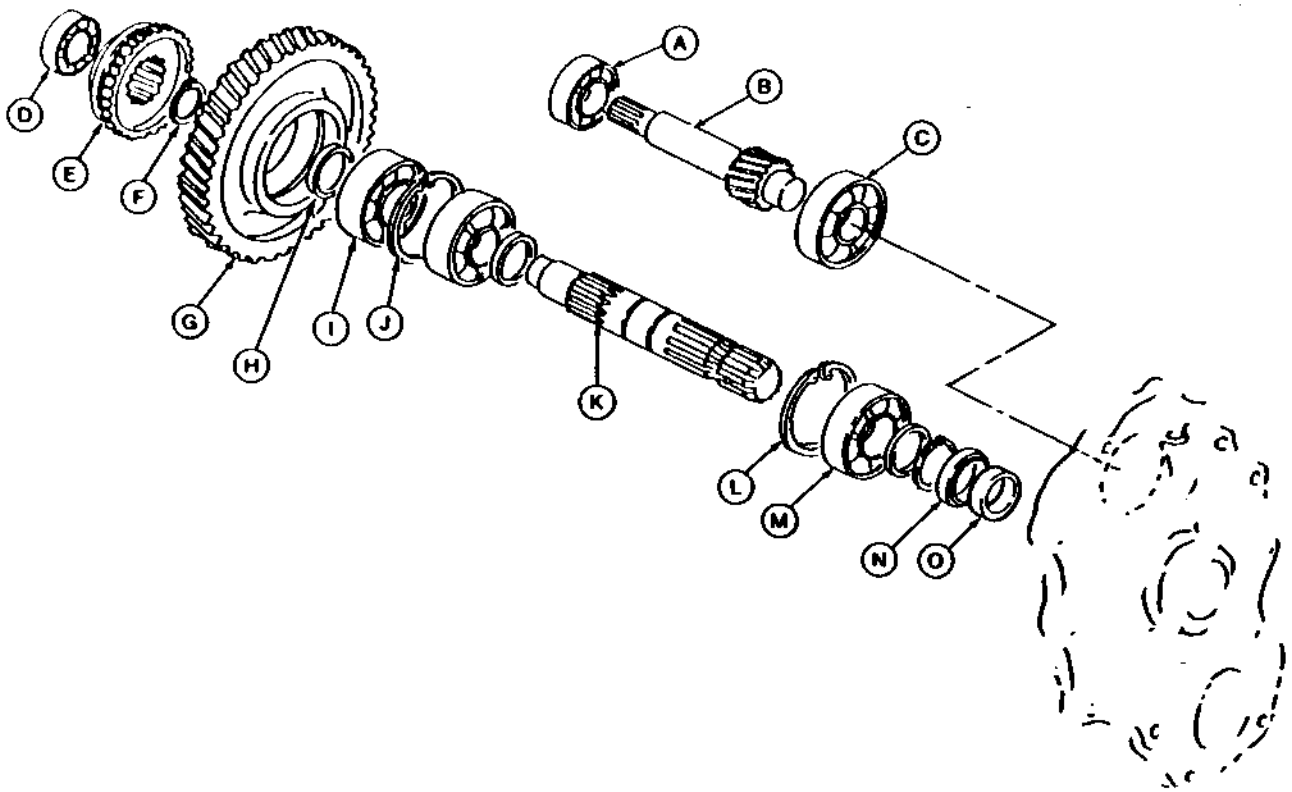
MX,5515DG,A5 -19-25NOV89

DISASSEMBLE, INSPECT AND ASSEMBLE REAR PTO DRIVE SHAFT ASSEMBLY

1. Remove shift shaft assembly (A). (See Remove, Inspect and Install Lever and Shift Linkage in this group , for disassembly of shift shaft.)



MX,5515DG,A6 -19-25NOV89



M53895 -UN-07DEC89

55 15

A—Ball Bearing
B—Pinion Shaft
C—Ball Bearing
D—Ball Bearing
E—Gear
F—Snap Ring (2 used)
G—Gear
H—Washer (3 used)
I—Ball Bearing (2 used)
J—Snap Ring
K—Drive Shaft
L—Snap Ring
M—Ball Bearing
N—Spacer
O—Seal

2. Disassemble parts (A—O).

Pry gear (G) from shaft (K).

Remove bearing (D) using a 2-jaw puller.

NOTE: Remove bearings only if replacement is necessary.

Remove bearings (A, and C) using a 2-jaw puller.

Remove bearing (M) using a knife edge puller and a press.

Remove bearings (I) from gear (G) using a blind hole puller set.

3. Inspect parts for wear or damage. Replace as necessary.

4. Apply multipurpose grease to lips of seal (O) during assembly.

5. Apply clean transmission/hydraulic oil to all parts during assembly.

6. Assemble all parts.

MX,5515DG,A7 -19-25NOV89

OTHER MATERIAL

Number	Name	Use
T43512	Thread Lock and Sealer (Medium Strength)	Apply to threads of ring gear cap screws.

MX,5520DG,A1 -19-21NOV89

REMOVE AND INSTALL DIFFERENTIAL ASSEMBLY

1. Remove differential lock assembly. (See procedure in this group.)

2. Remove final drive assemblies. (See procedure in Group 25.)

3. Remove cover (A) and shims (C).

4. Remove differential assembly (B) using a bushing, bearing and seal driver set from right-hand side of tractor.

5. Make repairs as necessary. (See procedure in this group.)

6. Install differential assembly.

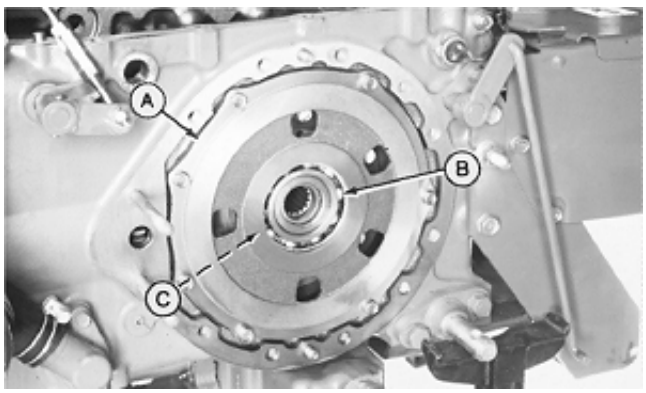
7. Install shims and cover.

IMPORTANT: Do not adjust backlash unless the ring gear was replaced or if the amount of side shims are in question.

8. Adjust differential backlash. (See procedure in this group.)

9. Install final drive assemblies. (See procedure in Group 25.)

10. Install differential lock assembly. (See procedure in this group.)



M53896 -UN-07DEC89

Left-Hand Side Shown

55 20 1

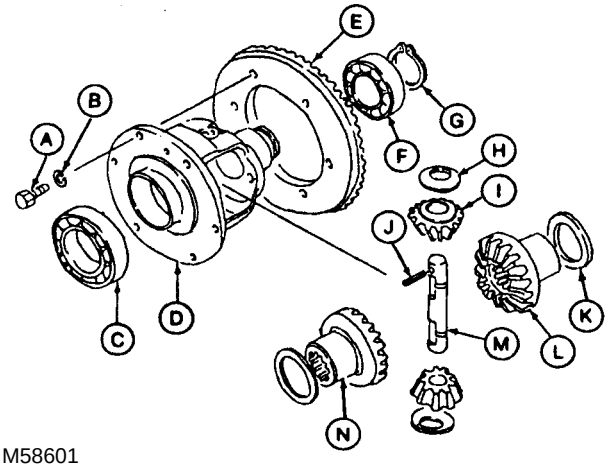
MX,5520DG,A2 -19-21NOV89

DISASSEMBLE, INSPECT AND ASSEMBLE DIFFERENTIAL ASSEMBLY

1. Disassemble parts (A—N).
2. Remove bearing (C) using a knife edge puller and a press.
3. Inspect parts for wear or damage. Replace if necessary.
4. Apply thread lock and sealer (medium strength) to threads of capscrews (A). Install and tighten per below specifications.
5. Assemble all remaining parts.

TORQUE SPECIFICATIONS

—770, 790, 870 . . . . . 26 N•m (19 lb-ft)
—670, 970, 1070 . . . . . 51 N•m (38 lb-ft)

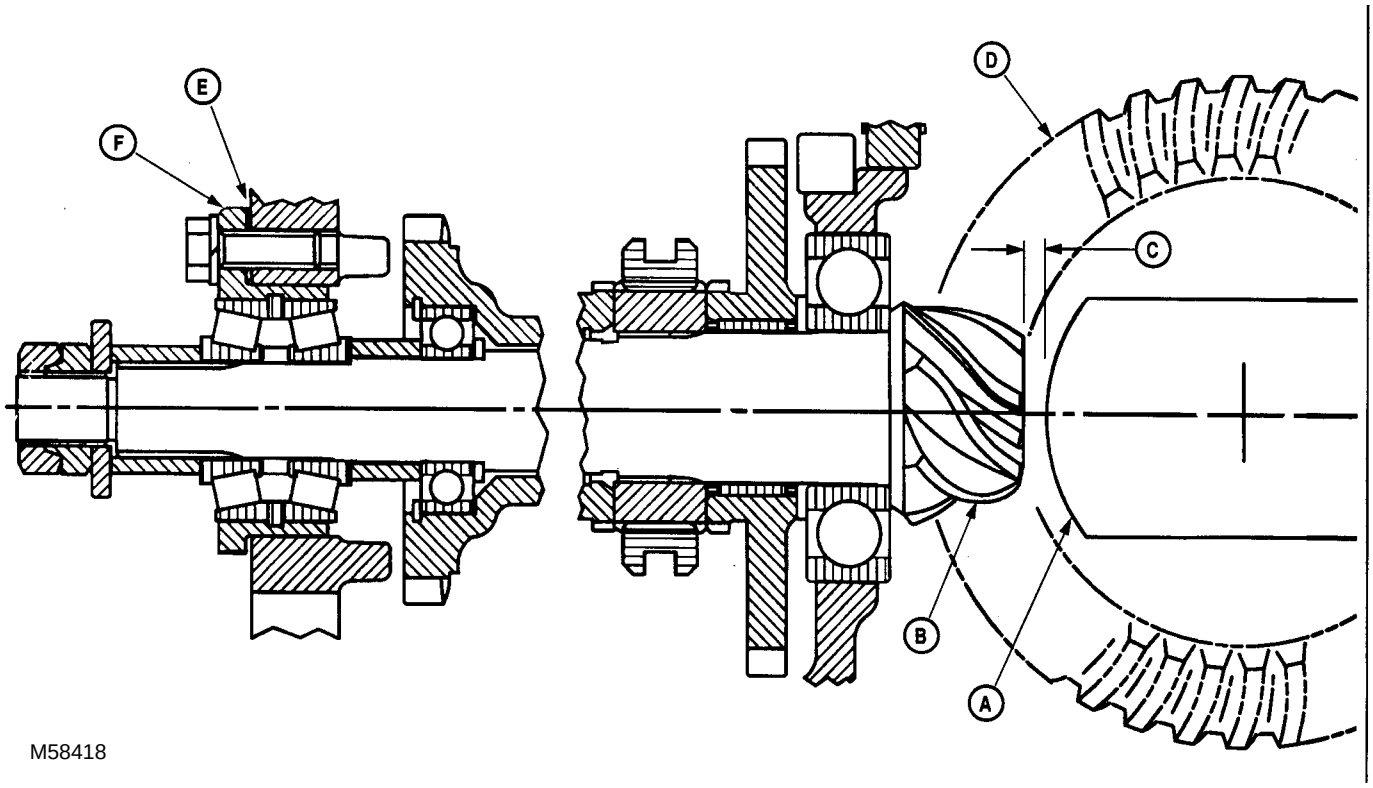


M58601

970/1070 Shown

A—Cap Screw (12 used-870 6 used-670, 970, 1070 8 used-770, 790)
B—Lock Washer
C—Ball Bearing
D—Differential Carrier
E—Ring Gear
F—Ball Bearing
G—Snap Ring (970, 1070)
H—Thrust Washer (2 used)
I—Bevel Pinion (2 used)
J—Spring Pin
K—Thrust Washer (2 used)
L—Right-hand Bevel Gear
M—Pinion Shaft
N—Left-Hand Bevel Gear

ADJUST DIFFERENTIAL CONE POINT—670, 770, 790



M58418

A—Differential Carrier
B—Differential Drive Shaft
C—Clearance
D—Ring Gear
E—Adjusting Shims
F—Front Bearing Retainer

1. Install differential drive shaft (B) per procedure in Group 10, using a 1 mm (0.040 in.) shim pack (E).

NOTE: Shims (E) are available in 0.1 mm (0.004 in.), 0.3 mm (0.012 in.), and 0.5 mm (0.020 in.) thickness.

2. Measure clearance (C) between the pinion end of the differential drive shaft and the differential carrier, using a feeler gage and/or any known dimension gage block.

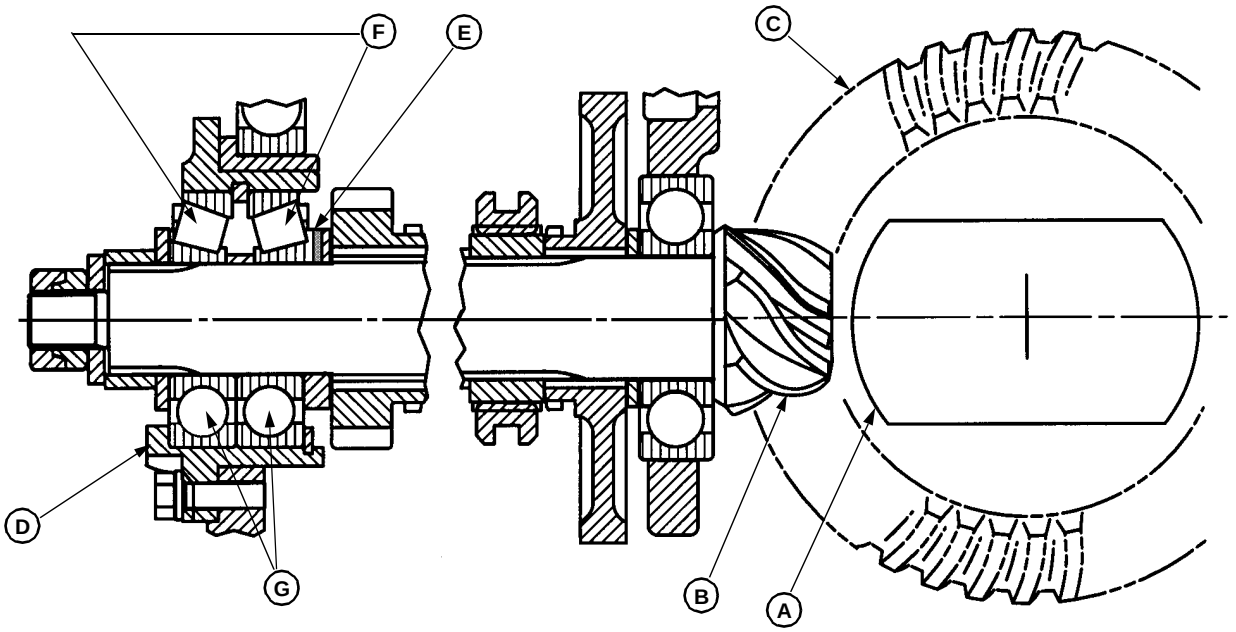
3. If clearance (C) does not meet specification, increase shim pack thickness (E) to increase clearance (B), or decrease shim pack thickness (E) to decrease clearance (C).

4. If shims are either added or removed, re-check pinion-to-carrier clearance (C).

IMPORTANT: Always check and adjust differential drive shaft to ring gear backlash after a cone point adjustment has been made.

CLEARANCE (B) SPECIFICATION
—670 . . . . . 16.5 ± 0.050 mm (0.65 ± 0.002 in.)
—770 . . . . . 3 ± 0.050 mm (0.12 ± 0.002 in.)
—790 . . . . . 3 ± 0.050 mm (0.12 ± 0.002 in.)

ADJUST DIFFERENTIAL CONE POINT—1070



M58419

A-Differential Carrier
B-Differential Drive Shaft
C-Ring Gear
D-Front Bearing Retainer
E-Adjusting Shims
F-Taper Bearing Assembly (1070)
G-Ball Bearing Assembly (870, 970)

1. With retainer (D) lying on a flat surface, install the inner bearing of bearing assembly (F) against snap ring (S).
2. Seat inner bearing of bearing assembly (F).
3. Apply a hand force in the (X) direction (see Figure 1) to the inner bearing of assembly (F).
4. Measure dimension (Z) from the front bearing retainer (D) face to the inner bearing end of assembly (F).
5. Based on the value of dimension (Z), refer to Table 1 to determine number of cone point adjusting shims (E).

NOTE: Adjusting shims (E) are only available in one size of 0.1 mm (0.04 in.).

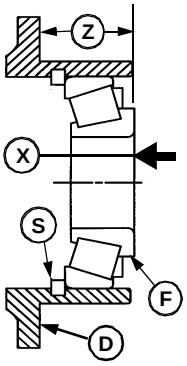
6. Install shims (E) and complete installation of differential drive shaft assembly per procedure in Group 10.

IMPORTANT: Always check and adjust differential drive shaft to ring gear backlash after a cone point adjustment has been made.

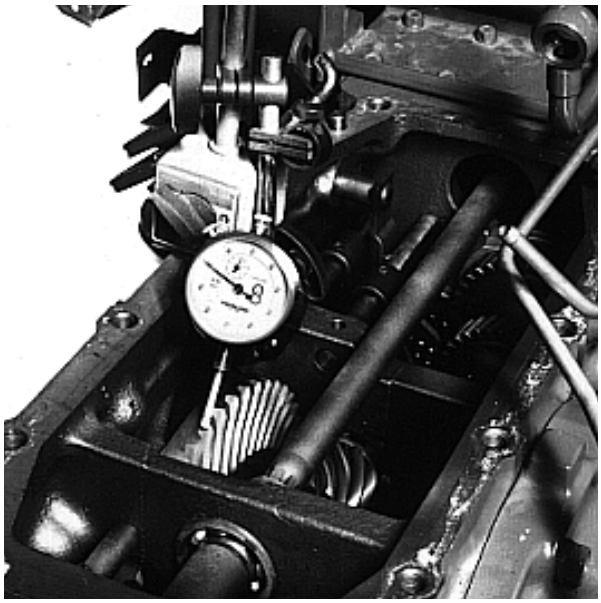
Table 1: 1070 Only

Dimension (Z)		Number of (E) Shims
Min	Max	
28.55	28.65	4
28.65	28.75	3
28.75	28.85	2 (Standard)
28.85	28.95	1
28.95	29.05	0

Figure 1.



ADJUST DIFFERENTIAL BACKLASH



NOTE: This adjustment places the differential ring gear in proper relationship with the spiral bevel pinion from side-to-side.

IMPORTANT: Always check and adjust backlash after cone point adjustment has been made. Do not adjust backlash unless the ring gear was replaced or the amount of side shims are in question.

1. While slowly rotating the differential housing carrier, use a soft-faced mallet to lightly tap the face of the ring gear to move it and the carrier toward the left-side bearing quill/cover.

NOTE: This is to insure that the carrier and bearings are seated.

2. Attach a dial indicator (A) to the transmission case housing as shown.

a) Be sure the dial indicator base is firmly attached.

b) The contact point of the indicator should be located toward the outer part of the ring gear tooth and as close to perpendicular to the tooth as possible.

3. While holding the differential spiral bevel pinion shaft stationary at the pinion, rotate the ring gear and note the backlash reading on the dial indicator.

BACKLASH SPECIFICATIONS

—Pinion-to-Gear Backlash
. . . . . .0.13—0.18 mm (0.005—0.007 in.)

4. To adjust backlash, remove left-side cover (A) (870, 970, 1070) or bearing quill (670, 770, 790).

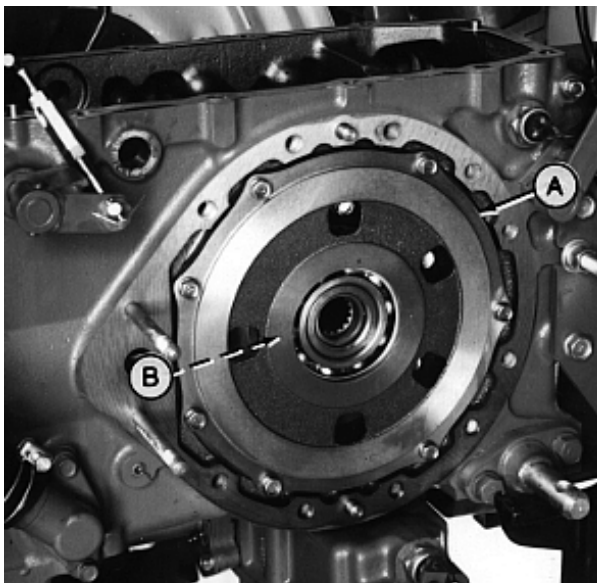
5. Remove shims (B) located inside of cover (870, 970, 1070) or inside quill (670,770, 790) to decrease backlash, or add shims to increase backlash.

NOTE: Side shims are available in 0.1 mm (0.004 in.), 0.3 mm (0.012 in.), and 0.5 mm (0.020 in.) thickness.

6. Recheck backlash after removing or adding shims.

TORQUE SPECIFICATIONS

—Bearing Quill/Cover to Transmission
Case Cap Screws (C) . . . . . .26 N•m (19 lb-ft)



870-970-1070 Shown

7. 870/970: Remove ring (F).

1070: Remove spring pins (I).

8. Remove shafts (A) using a press.

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

10. Apply clean transmission/hydraulic oil to all parts during assembly.

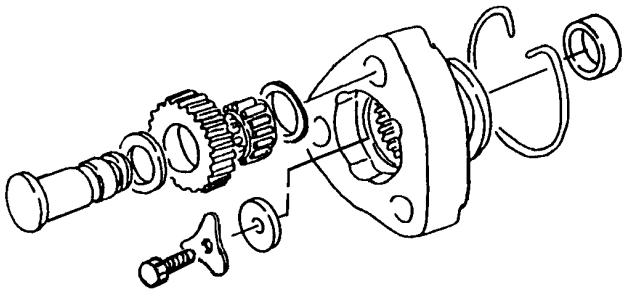
11. Assemble all parts.

12. Install planet pinion carrier assembly.

13. Install lockplate (J) and cap screw (K), tighten per torque specifications.

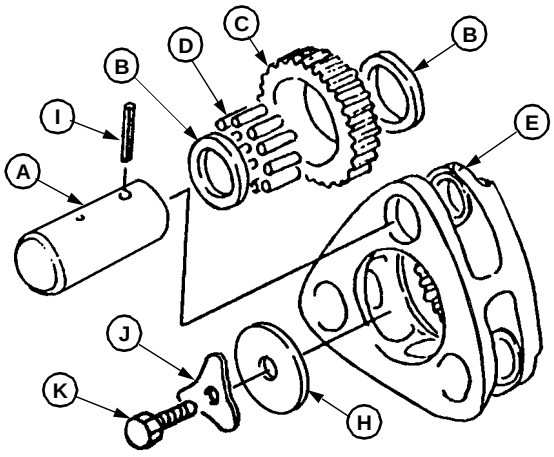
14. Install ring gear and drive shaft.

15. Install brakes. (See procedure in Section 60, Group 20).



870/970

M53903



1070

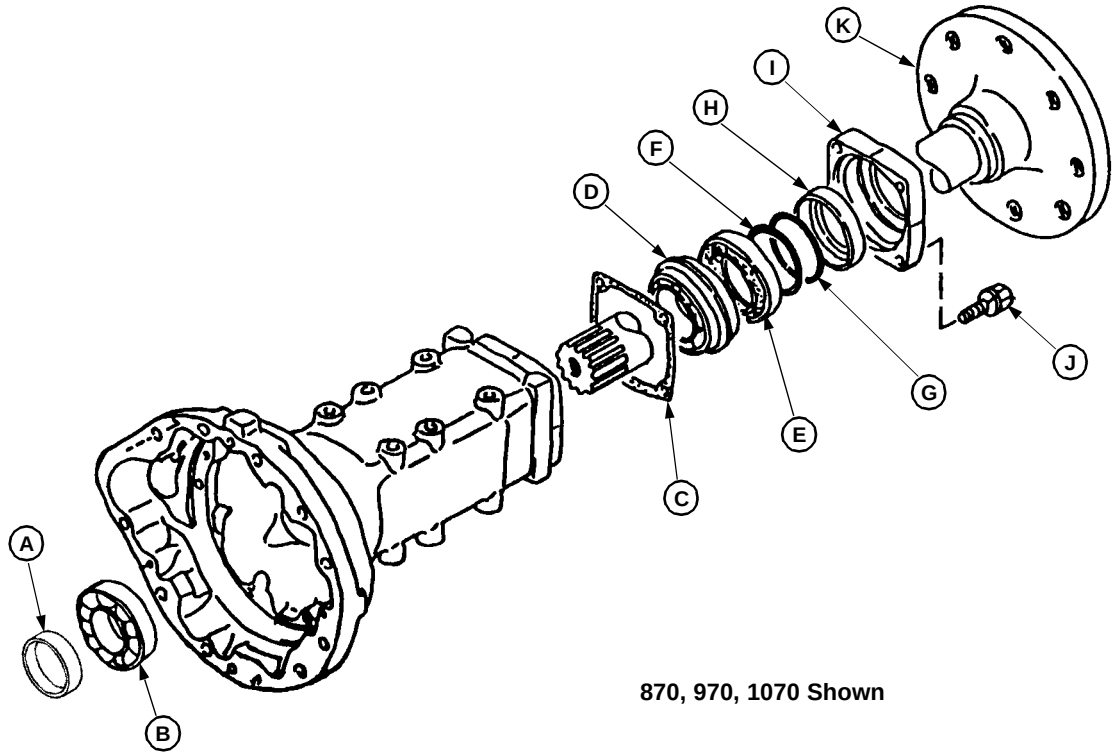
M53904

TORQUE SPECIFICATIONS

Ring Gear to Axle Housing Cap Screws
—870, 970, 1070 . . . . . 51 N•m (38 lb-ft)
Carrier to Axle Shaft Cap Screw (K)
—870, 970, 1070 . . . . . 88 N•m (65 lb-ft)

A-Planet Pinion Shaft
B-Thrust Washer
C-Planet Pinion Gear
D-870/970 Needle Bearing, 1070 Needles
E-Planet Pinion Carrier
F-Lock Ring
G-Spacer
H-Washer
I-Spring Pin
J-Lockplate
K-Capscrew

REMOVE, INSPECT AND INSTALL AXLE SHAFT ASSEMBLY



870, 970, 1070 Shown

M53905

A-Spacer
B-Ball Bearing
C-Gasket
D-Bearing, Ball
E-Seal
F-Ring
G-Packing
H-Spacer
I-Housing, Oil Seal
J-Cap Screw
K-Axle Shaft

7. Remove planetary drive assembly. (See procedure in this group.)

8. Remove cap screws (J).

9. Remove axle shaft (K) using a lead hammer.

10. Remove parts (A—K).

NOTE: Remove bearings only if replacement is necessary.

Remove bearing (A) using a 2-jaw puller.

Remove bearing (D) using a knife-edge puller and a press.

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

12. Apply multipurpose grease to lips of seal (E) during assembly.

13. Apply clean transmission/hydraulic oil to all internal parts during assembly.

14. Clean mating surfaces of final drive housing and cover using clean and cure primer. Apply flexible sealant to mating surfaces.

15. Install all parts.

16. Install planetary drive assembly. (See procedure in this group).

TORQUE SPECIFICATIONS

Oil Seal Housing Cap Screws (J)
—870, 970. . . . . 26 N•m (19 lb-ft)
—1070. . . . . 51 N•m (38 lb-ft)

10. Attach lifting chains or strap to final drive housing.

IMPORTANT: When removing housing, drive shaft and brake disks may drop. Keep final drive assembly level.

11. Remove final drive assembly and gasket.

12. Make repairs as necessary. (See procedure in this group.)

13. Clean mating surfaces of transmission and final drive housings using clean and cure primer. Apply flexible sealant to mating surfaces.

14. Install final drive assembly and new gasket.

15. Connect brake rod.

16. Install SCV, if equipped. (See Section 70, Group 15.)

NOTE: Steps 17, 18 and 19 are for left-hand side only.

17. MFWD: Install arm and control lever.

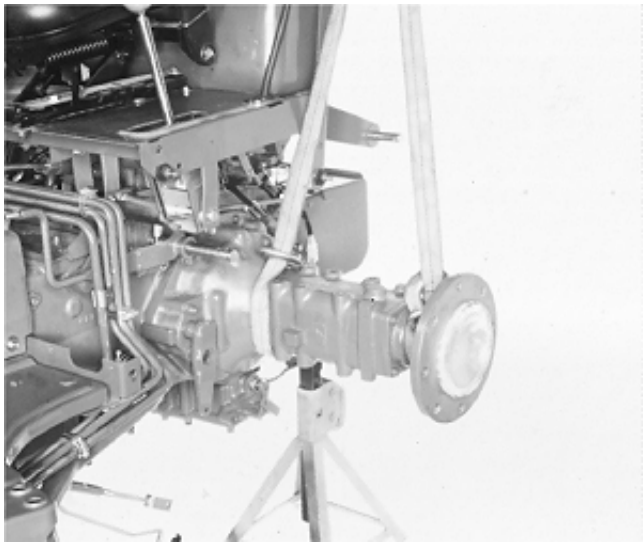
18. Mid mount PTO: Install gearbox cover, lever and linkage.

19. Install ROLL-GARD. (See procedure in Section 80, Group 30.)

20. Install fenders.

21. Install 3-point hitch.

22. Fill transmission with proper transmission/hydraulic oil. (See Section 10, Group 20.)



M53900 -UN-07DEC89

MX,5525DG,A3 -19-27NOV89

REMOVE, INSPECT AND INSTALL PLANETARY DRIVE ASSEMBLY

1. Remove brakes. (See procedure in Section 60, Group 20.)

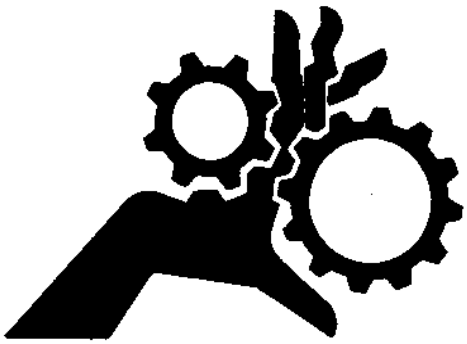
NOTE: Drive shaft may be removed with brake disks as an assembly.

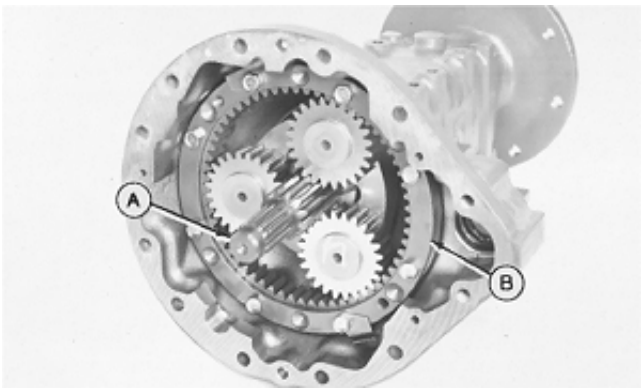
2. Remove drive shaft (A).

CAUTION: Gears may turn. Keep fingers away from planetary gears.

NOTE: Before removing ring gear, note location of brake spring clips.

3. Remove ring gear (B).


T6639GK -UN-19OCT88



M53901 -UN-07DEC89

MX,5525DG,A4 -19-27NOV89

4. Remove lock plate (C).

5. Remove cap screw (A).

6. Remove planet pinion carrier assembly (B).



M53902 -UN-07DEC89

MX,5525DG,A5 -19-27NOV89

7. 870/970: Remove wire (F).

1070: Remove spring pins (I).

8. Remove shafts (A) using a press.

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

10. Apply clean transmission/hydraulic oil to all parts during assembly.

11. Assemble all parts.

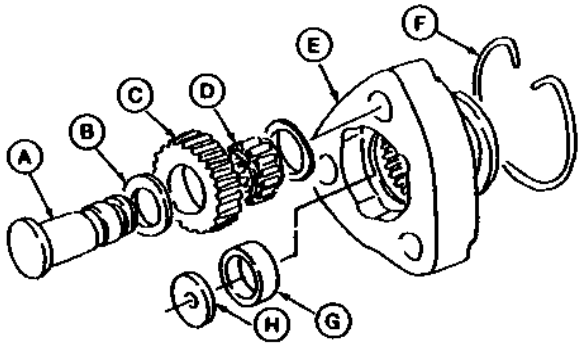
12. Install planet pinion carrier assembly.

13. Install lock plate and cap screw.

14. Install ring gear and drive shaft.

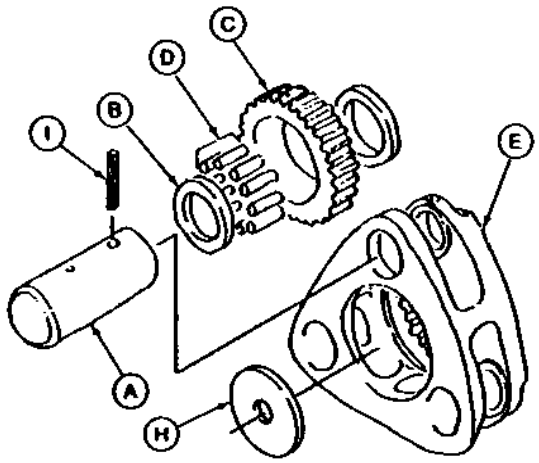
15. Install brakes. (See procedure in Section 60, Group 20.)

A—Planet Pinion Shaft (3 used)
B—Thrust Washer (6 used)
C—Planet Pinion Gear (3 used)
D—870/970 Needle Bearing (3 used)
1070 Needles (30 used)
E—Planet Pinion Carrier
F—Lock Ring
G—Spacer
H—Washer
I—Spring Pin (3 used)



M53903 -UN-07DEC89

870/970

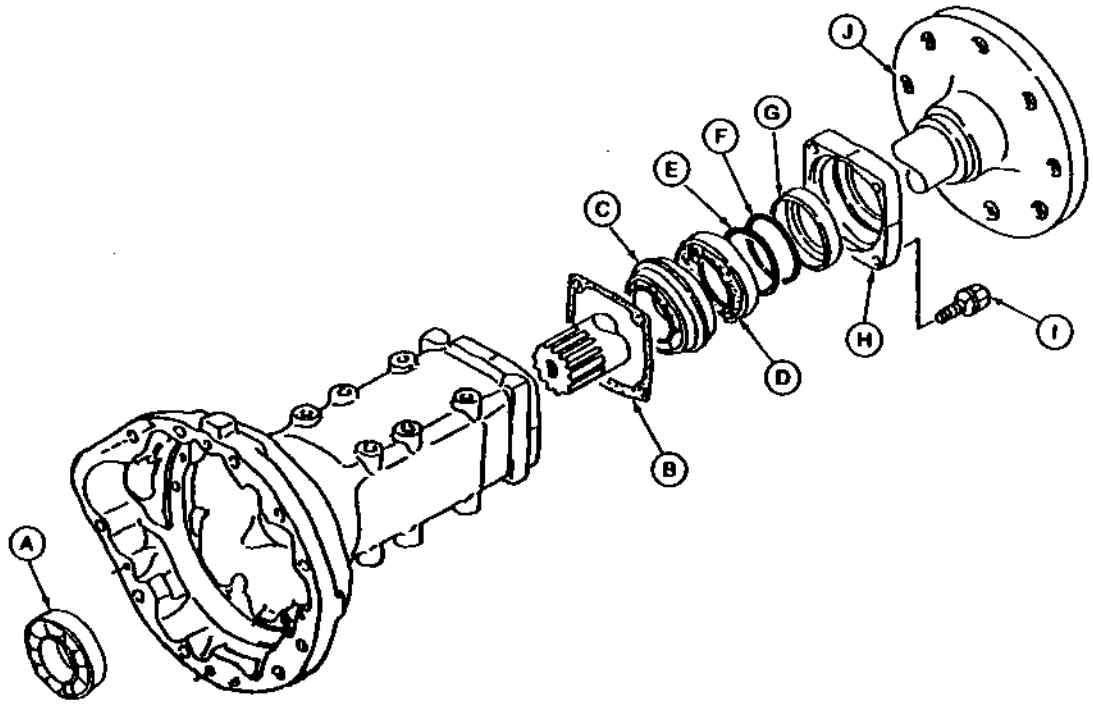


M53904 -UN-07DEC89

1070

MX,5525DG,A6 -19-27NOV89

REMOVE, INSPECT AND INSTALL AXLE SHAFT ASSEMBLY



M53905 -UN-07DEC89

A—Ball Bearing
B—Gasket
C—Bearing
D—Seal
E—Spacer
F—Packing
G—Spacer
H—Cover
I—Cap Screw (4 used)
J—Axle Shaft

1. Remove planetary drive assembly. (See procedure in this group.)

2. Remove cap screws (I).

3. Remove axle shaft (J) using a lead hammer.

4. Remove parts (A—H).

NOTE: Remove bearings only if replacement is necessary.

Remove bearing (A) using a 2-jaw puller.

Remove bearing (C) using a knife-edge puller and a press.

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

6. Apply multipurpose grease to lips of seal (D) during assembly.

7. Apply clean transmission/hydraulic oil to all internal parts during assembly.

8. Clean mating surfaces of final drive housing and cover using clean and cure primer. Apply flexible sealant to mating surfaces.

9. Install parts all parts.

10. Install planetary drive assembly. (See procedure in this group.)

MX,5525DG,A7 -19-27NOV89

OTHER MATERIAL

Number	Name	Use
TY6305	Clean and Cure Primer	To clean and cure surfaces prior to application of adhesives or sealants.
TY6304	Flexible Sealant	To provide a seal between mating surfaces.
T43512	Thread Lock and Sealer (Medium Strength)	Apply to threads of outer drive and differential carrier mounting cap screws.

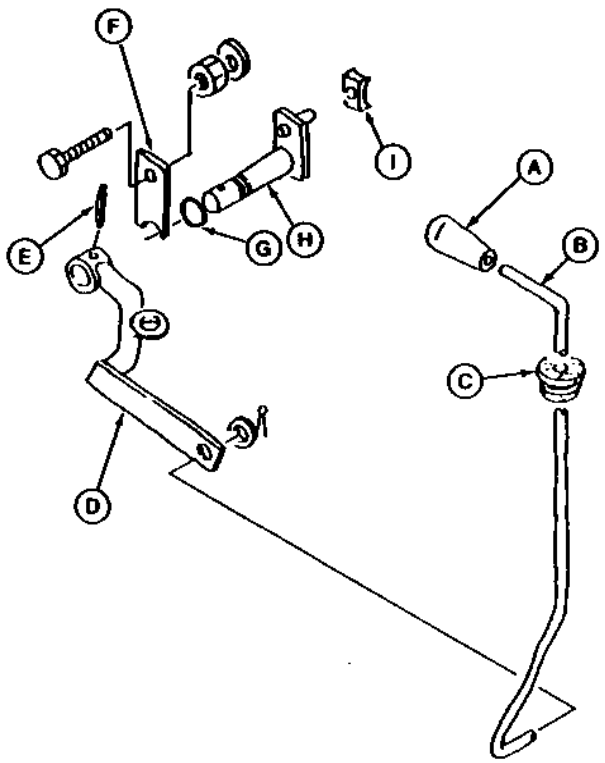
MX,5530DG,A1 -19-09OCT89

INSPECT AND REPAIR MFWD LEVER AND LINKAGE

Remove left-hand fender.

NOTE: To repair or replace parts (G, H and I), separate transmission from clutch housing. (See procedure in Group 10.)

A—Knob
B—Lever
C—Guide
D—Arm
E—Spring Pin
F—Plate
G—Packing
H—Arm
I—Shift Collar



M53531 -UN-20NOV89

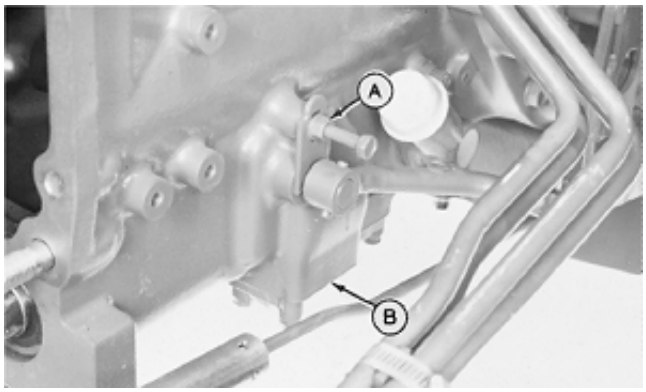
MX,5530DG,A2 -19-26SEP89

REMOVE, INSPECT AND INSTALL TRANSMISSION OUTPUT SHAFT AND MFWD DRIVE GEAR

1. Separate transmission from clutch housing. (See procedure in Group 10.)

2. Loosen lock plate cap screw (A) and pull on arm.

3. Remove cover and gasket (B).



MX,5530DG,A3 -19-08NOV89

4. Remove nuts, spacer and drive gear (A).

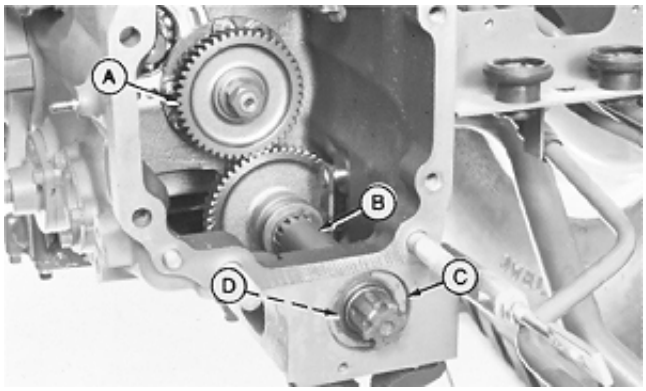
5. Inspect drive gear for wear or damage. Replace if necessary.

NOTE: Seal (C) can be replaced without separating transmission from clutch housing.

6. Pry out seal (C).

7. Remove snap ring (D).

8. Remove output shaft assembly (B) using a slide hammer.



A—Drive Gear
B—Output Shaft Assembly
C—Seal
D—Snap Ring

MX,5530DG,A4 -19-08NOV89

CAUTION: Balls (E) and spring (F) will shoot out of shaft when removing sliding gear (H). Use care when removing gear.

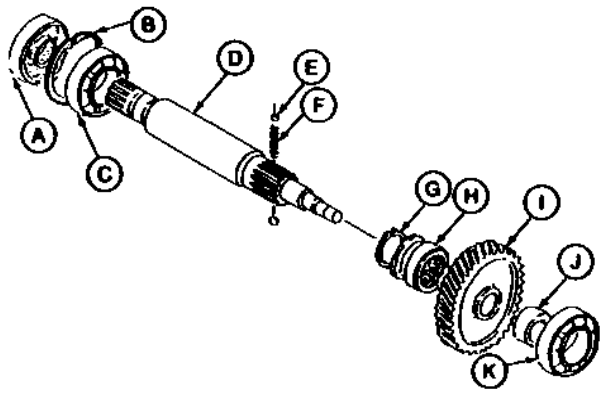
9. Inspect parts for wear damage. Replace as necessary.

NOTE: Remove bearings only if replacement is necessary.

Bearing (K) is slip fit.

Replace bearing (C) using a knife-edge puller and a press.

10. Apply clean transmission/hydraulic oil to all parts during assembly.



M53600 -UN-07DEC89

A—Seal
B—Snap Ring
C—Ball Bearing
D—Output Shaft
E—Ball (2 used)
F—Spring
G—Snap Ring
H—Sliding Gear
I—Gear
J—Spacer
K—Ball Bearing

55 30 3

MX,5530DG,A5 -19-08NOV89

11. Install output shaft assembly (B).

12. Apply multipurpose grease to inside lip of seal (C).

13. Install snap ring (D) and seal (C).

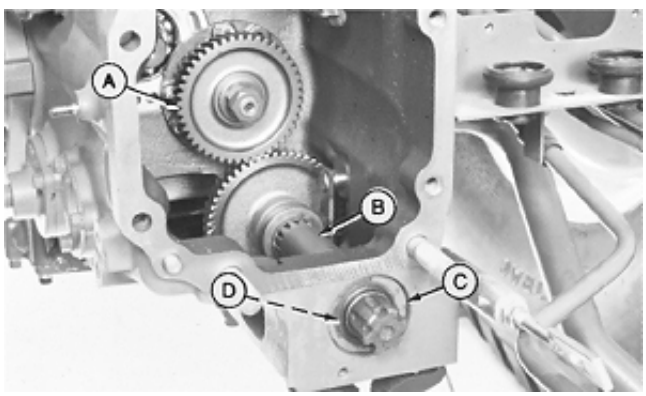
14. Install drive gear (A) with long end toward rear of transmission housing. Install spacer and nuts. Tighten nuts to 88 N·m (65 lb-ft).

15. Clean mating surfaces of bottom cover and housing using clean and cure primer. Apply flexible sealant to mating surfaces.

16. Install bottom cover and new gasket.

17. Push arm in and tighten lock plate cap screw.

18. Install transmission to clutch housing. (See procedure in Group 10.)

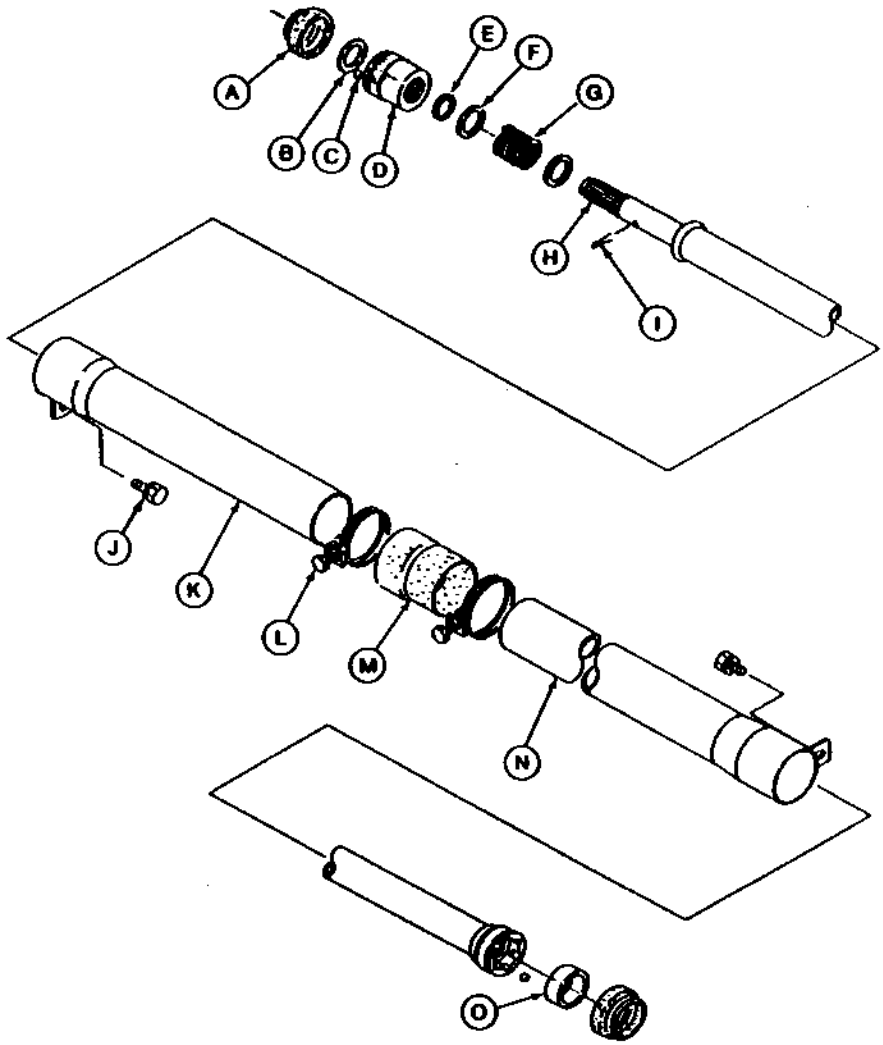


M53867 -UN-07DEC89

A—Drive Gear
B—Output Shaft Assembly
C—Seal
D—Snap Ring

MX,5530DG,A6 -19-08NOV89

REMOVE, INSPECT AND INSTALL MFWD DRIVE SHAFT



A—Boot (2 used)
B—Spacer
C—Ball (12 used)
D—Coupling
E—Seal
F—Washer (2 used)
G—Spring
H—Shaft
I—Cotter Pin
J—Cap Screw (2 used)
K—Cover
L—Clamp (2 used)
M—Boot
N—Cover
O—Spacer

1. Loosen clamps (L).
2. Remove cap screws (J).
3. Move cover (K) toward the rear.
4. Remove cotter pin (I).

NOTE: Be careful not to lose balls (C) and spacer (B) when removing drive shaft assembly.

5. Remove drive shaft assembly.
6. Repair or replace parts as necessary.
7. Apply multipurpose grease to balls (C) and ends of drive shaft.
8. Install drive shaft assembly.

MX,5530DG,A7 -19-27SEP89

REMOVE AND INSTALL MFWD AXLE

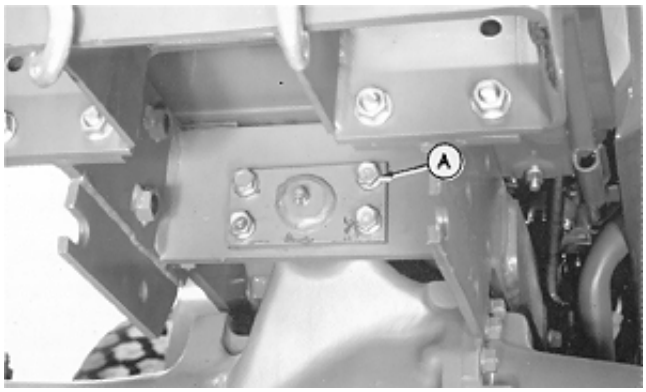
1. Remove drive shaft. (See procedure in this group.)

2. Power steering: Remove power steering cylinder. (See Section 60, Group 10.)

Manual steering: Disconnect drag link.

3. Raise front of tractor and remove front wheels.

4. Remove pivot pin cap screws (A).



M53511 -UN-20NOV89

MX,5530DG,A8 -19-14SEP89

5. Place a floor jack under center of axle and remove pivot pin (A), shims, washers (B) and collar (D).

6. Remove axle.

7. Make repairs as necessery. (See procedures in this group.)

8. Install axle. Lift axle into place and align axle housing hole with pivot pin hole.

IMPORTANT: If equipped with lubrication fitting, be sure fitting on pivot pin assembly points down when installed.

9. Install pivot pin (A), with lubrication fitting (D) pointing down, through collar (C), washers (B) and axle.

10. Tighten pivot pin cap screws.

11. Check and adjust axle free-play. (See procedure in Section 80, Group 10.)

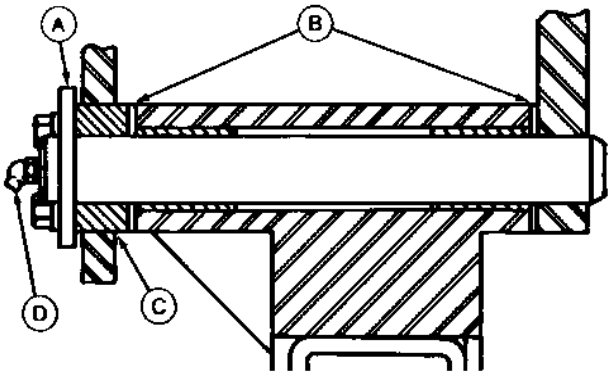
12. Install wheels. Tighten cap screws to 217 N·m (160 lb-ft).

13. Power steering: Install power steering cylinder.

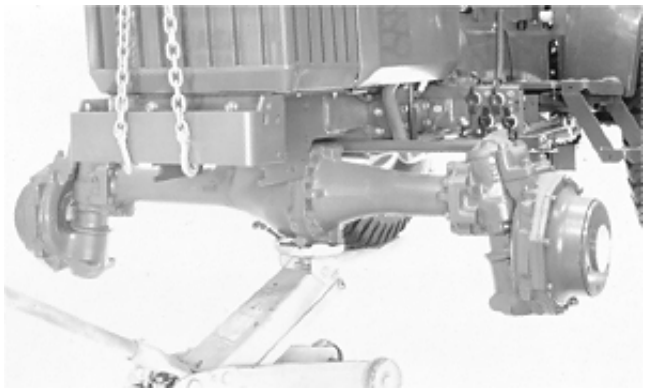
Manual steering: Connect drag link.

14. Install drive shaft.

15. Lubricate front axle pivot pin assembly with multipurpose grease. (See Section 10, Group 20.)



M53185 -UN-18JUL89



M53512 -UN-20NOV89

A—Pivot Pin
B—Washers (2 used)
C—Collar
D—Lubrication Fitting

MX,5530DG,A9 -19-14SEP89

REMOVE AND INSTALL SPINDLE HOUSING AND OUTER DRIVE

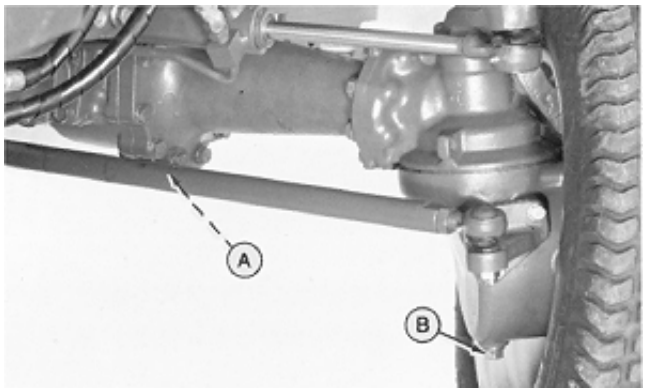
NOTE: Spindle housing and outer drive assembly can be serviced without removing axle.

1. Install a wooden block between axle and frame.

NOTE: Approximate capacity of axle housing is 2.13 L (2.25 qt).

2. Remove plugs (A and B) to drain axle housing.

3. Remove front wheel.



M53857 -UN-20NOV89

MX,5530DG,A10 -19-21SEP89

4. Disconnect tie rod (D).

5. Power steering: Disconnect power steering cylinder (A).

Manual steering: Disconnect drag link.

6. Place a floor jack under bottom of outer drive housing.

7. Remove eight cap screws and lock washers (B) to remove outer drive assembly with axle shaft.

8. Remove O-ring (C).

9. Make repairs as necessary. (See Disassemble, Inspect and Assemble Outer Drive and Disassemble, Inspect and Assemble Spindle Housing in this group.)

10. Apply petroleum jelly to O-ring (C) and install on axle housing.

11. Apply thread lock and sealer (medium strength) to threads of cap screws.

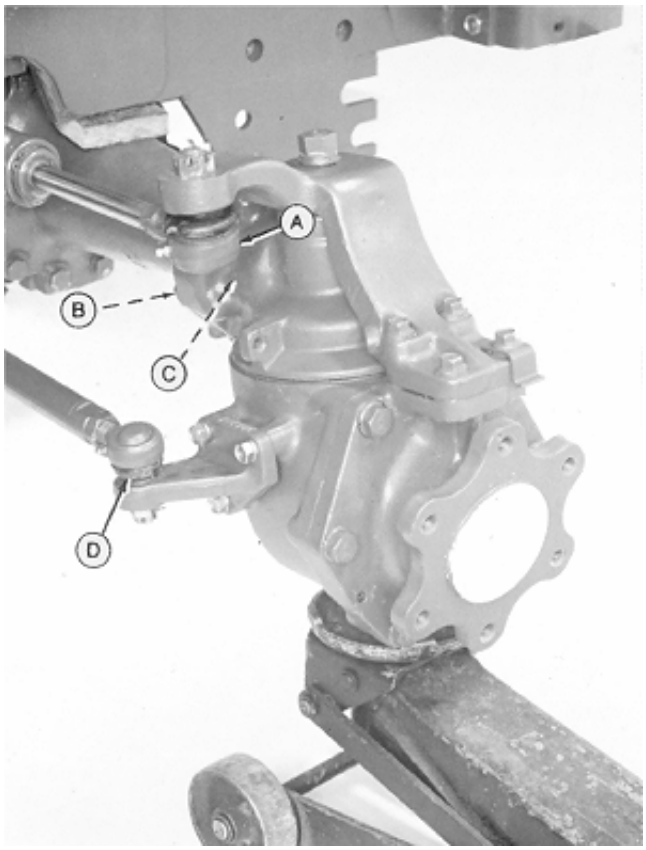
12. Install outer drive assembly and cap screws. Tighten to 51 N·m (39 lb-ft).

13. Connect tie rod and power steering cylinder or drag link, if equipped. Tighten nuts to 68 N·m (50 lb-ft).

14. Install drain plugs.

15. Install wheel. Tighten cap screws to 217 N·m (160 lb-ft).

16. Fill axle housing with proper gear oil. (See Section 10, Group 20.)



M53593 -UN-20NOV89

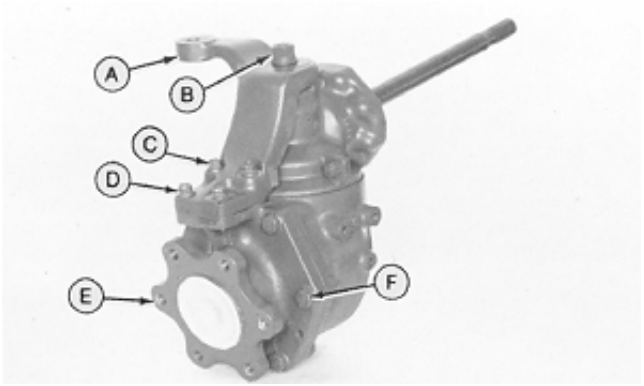
Right-Hand Side Shown

A—Power Steering Cylinder
B—Cap Screw and Lock Washer (8 used)
C—O-Ring
D—Tie Rod

MX,5530DG,A11 -19-21SEP89

DISASSEMBLE, INSPECT AND ASSEMBLE OUTER DRIVE

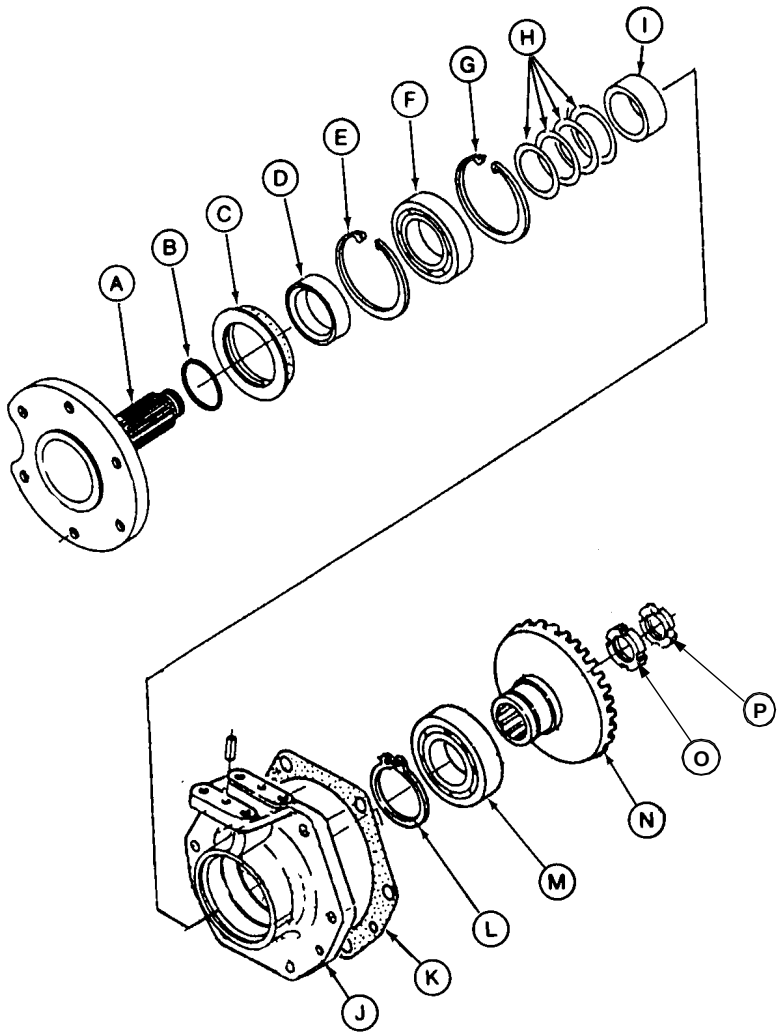
1. Remove cap screws and lock washers (C and D).
2. Remove nut and washers (B).
3. Remove steering arm (A).
4. Remove six cap screws and lock washers (F).
5. Remove outer drive assembly (E).



M53594 -UN-20NOV89

A—Steering Arm
B—Nut, Washer and Lock Washer
C—Cap Screw and Lock Washer (2 used)
D—Cap Screw and Lock Washer (2 used)
E—Outer Drive Assembly
F—Cap Screw and Lock Washer (2 used)

MX,5530DG,A12 -19-03OCT89



M53534

A-Hub Shaft
B-O-Ring
C-Seal
D-Bushing
E-Snap Ring
F-Ball Bearing
G-Snap Ring
H-Shims (as required)
I-Bushing
J-Bearing Case
K-Gasket
L-Snap Ring
M-Ball Bearing
N-Outer Drive Gear
O-Inner Nut
P-Outer Nut

6. Remove nuts (O—P).

7. Remove gear (N) from shaft (A) using a knife-edge puller and a press.

8. Remove shaft (A) from case (J) using a press.

NOTE: Remove bearings only if replacement is necessary.

9. Remove snap ring (L). Remove bearing (M) using a knife-edge puller and a press.

10. Remove parts (B—I).

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

12. Apply gear oil to all internal parts during assembly.

13. Assemble parts (A—P)

NOTE: Tighten nut (O) to remove all end play.

14. Using a channel lock wrench, lock nut (P) against nut (O) by tightening to a feel of approximately 80 N•m (60 lb-ft).

15. Secure locking of nuts to each other by using a punch.

16. Both nuts (O) and (P) have eccentric I.D.'s (inside diameters) to one another. You may view this by placing nuts face-to-face and watching the I.D.'s as you rotate one nut.

17. Clean mating surfaces of cases using clean and cure primer. Apply flexible sealant to mating surfaces.

15. Install outer drive assembly and gasket. Tighten cap screws (F) to specifications.

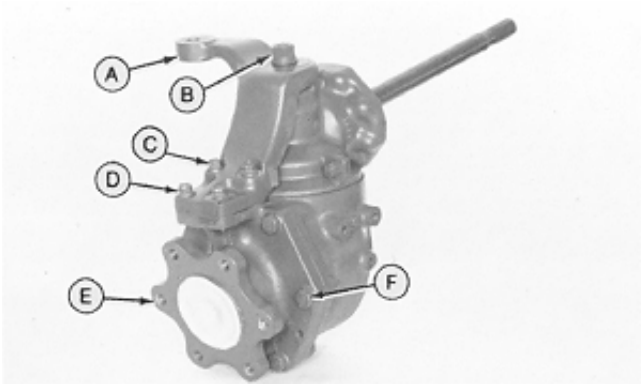
NOTE: Adjust backlash only if new parts are installed or the amount of shims are in question.

16. Adjust spindle pinion gear-to-outer drive gear backlash. (See procedure in this group.)

17. Install steering arm (A). Tighten cap screws (C and D) and nut (B) to specifications.

TORQUE SPECIFICATIONS

Cap Screws (F)	90 N·m (66 lb-ft)
Cap Screws (C and D)	51 N·m (36 lb-ft)
Nut (B)	187 N·m (138 lb-ft)



M53594 -UN-20NOV89

A—Steering Arm
B—Nut, Washer and Lock Washer
C—Cap Screw and Lock Washer (2 used)
D—Cap Screw and Lock Washer (2 used)
E—Outer Drive Assembly
F—Cap Screw and Lock Washer (2 used)

55 30 11

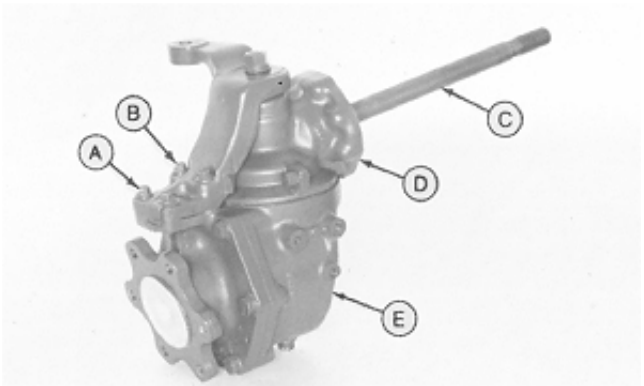
MX,5530DG,A14 -19-03OCT89

DISASSEMBLE, INSPECT AND ASSEMBLE SPINDLE HOUSING

1. Remove axle shaft assembly (C).

2. Remove cap screws and lock washers (A and B).

3. Use a lead hammer to break lower drive housing (D) loose from spindle housing (E). Remove spindle housing assembly.



M53595 -UN-20NOV89

A—Cap Screw and Lock Washer (2 used)
B—Cap Screw and Lock Washer (2 used)
C—Axle Shaft Assembly
D—Lower Drive Housing
E—Spindle Housing

MX,5530DG,A15 -19-03OCT89

4. Remove spacer (T) and replace seal (U), if necessary.

5. Remove snap ring (N) to remove parts (K, L, M and S) from shaft (J).

6. Remove snap ring (K). Separate gear (L) from gear (S) using a press.

NOTE: Remove bearings only if replacement is necessary.

7. Remove bearing (M) using a knife-edge puller and a press.

8. Remove parts (A—F).

9. Remove key (I) and tap spindle shaft (J) from housing.

10. Remove parts (O—R).

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

12. Apply gear oil to all internal parts during assembly.

13. Apply multipurpose grease to lips of seals (F and U).

14. Assemble parts (F—U).

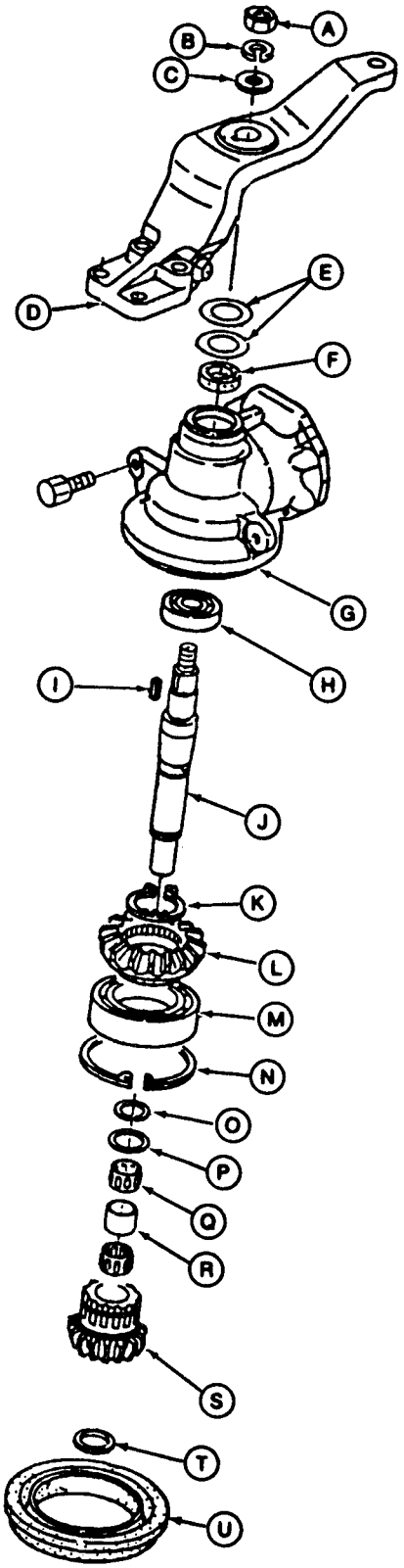
Install bearings and seals using a bushing, bearing and seal driver set.

NOTE: Adjust backlash only if new parts are installed or the amount of shims are in question.

15. Install axle shaft assembly.

16. Adjust axle bevel gear-to-spindle bevel gear backlash. (See procedure in this group.)

A—Ring Gear
B—Spring Pin
C—Differential Carrier
D—Pinion Shaft
E—Cap Screw 10 used
F—Thrust Washer (2 used)
G—Bevel Gear (2 used)
H—Bevel Pinion (2 used
I—Thrust Washer (2 used)
J—Spindle Shaft
K—Snap Ring
L—Spindle Bevel Gear
M—Ball Bearing
N—Snap
O—Ring (2 used)
P—Washer (2 used)
Q—Bearing (2 used)
R—Spacer
S—Outer Pinion Gear
T—Spacer
U—Seal



M53535

17. Install spindle housing assembly on lower drive housing.

18. Adjust spindle pinion gear-to-outer drive gear backlash. (See procedure in this group.)

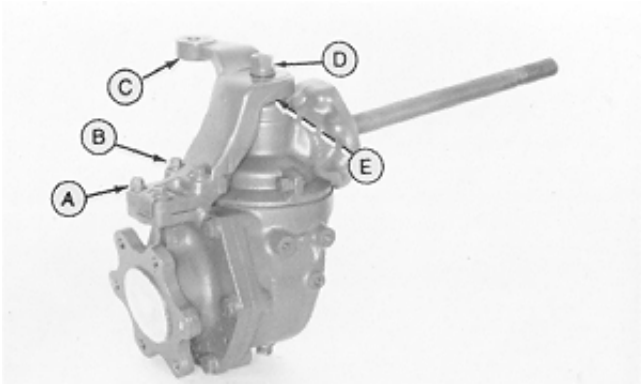
19. Install shims (E) and steering arm (C). Tighten cap screws (A and B) and nut (D) to specifications.

20. Check steering arm-to-spindle housing clearance. (See procedure in this group.)

TORQUE SPECIFICATIONS

Cap Screws (A and B) . . . . . 51 N·m (36 lb-ft)

Nut (D) . . . . . 187 N·m (138 lb-ft)



M53596 -UN-20NOV89

A—Cap Screw (2 used)
B—Cap Screw (2 used)
C—Steering Arm
D—Nut
E—Shims (as required)

55 30 13

MX,5530DG,A17 -19-03OCT89

DISASSEMBLE AND INSPECT DIFFERENTIAL AND SHAFTS

1. Remove power steering cylinder, if equipped. (See procedure in Section 60, Group 10.)

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

3. Remove spindle housings. (See procedure in this group.)

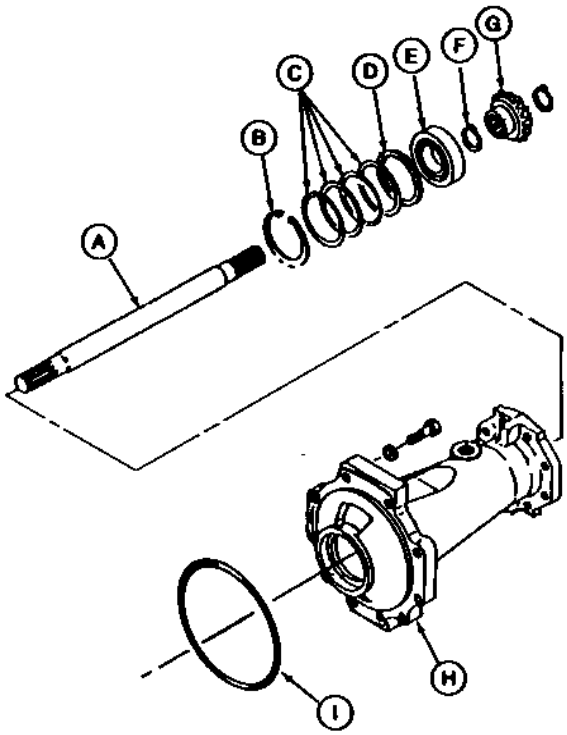
4. Remove snap ring (B) to remove parts (A) and (C—G) from outer drive.

NOTE: Remove bearing only if replacement is necessary.

Remove bearing (E) using a knife-edge puller and a press.

5. Remove front axle. (See procedure in this group.)

6. Remove ten cap screws and lock washers to remove housing (H) and O-ring (I).



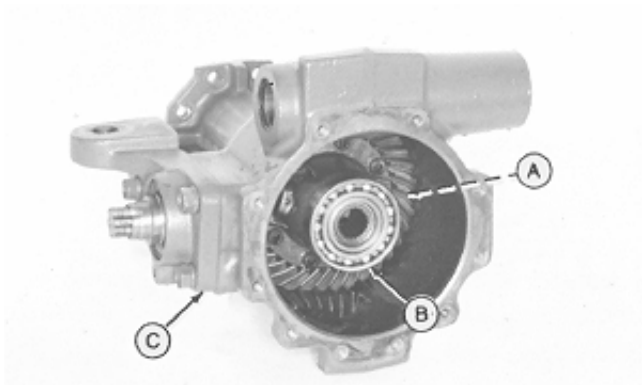
M53536 -UN-20NOV89

A—Axle Shaft
B—Snap Ring
C—Shims (as required)
D—Spacer
E—Ball Bearing
F—Snap Ring (2 used)
G—Axle Bevel Gear
H—Axle Housing
I—O-Ring

MX,5530DG,A18 -19-21SEP89

7. Remove four cap screws and input shaft assembly (C).

8. Remove differential carrier assembly (B) and shims (A).



M53597 -UN-20NOV89

MX,5530DG,A19 -19-21SEP89

9. Put gear end of differential drive shaft in a soft-jawed vise and remove spacer (H).

10. Disassemble parts (A—H).

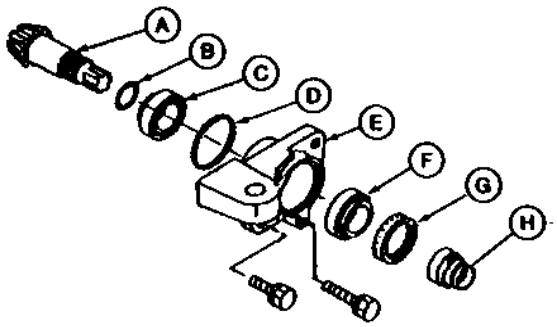
Remove shaft (A) using a press.

NOTE: Remove bearings only if replacement is necessary.

11. Remove bearing (C) using a knife-edge puller and a press.

12. Remove bearing (F) and seal (G) using a bearing, bushing and seal driver set.

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



-UN-20NOV89
M53537

A—Differential Drive Shaft
B—O-Ring
C—Ball Bearing
D—Packing
E—Housing
F—Ball Bearing
G—Seal
H—Spacer

MX,5530DG,A20 -19-21SEP89

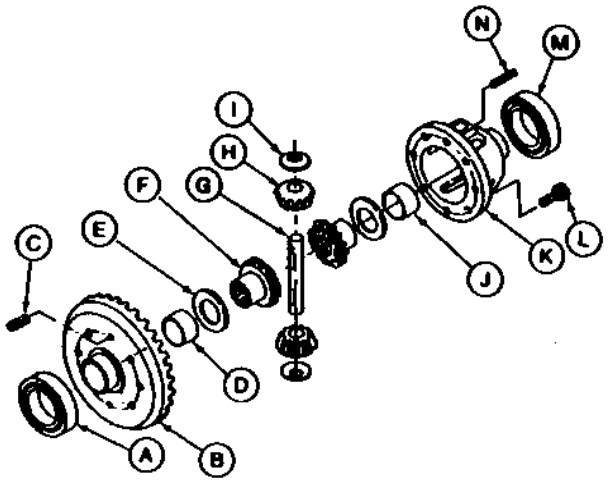
14. Disassemble parts (A—N).

NOTE: Remove bearings only if replacement is necessary.

15. Remove bearings (A and M) using a knife-edge puller and a press.

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

A—Ball Bearing
B—Ring Gear
C—Spring Pin (2 used)
D—Bushing
E—Thrust Washer (2 used)
F—Bevel Gear (2 used)
G—Pinion Shaft
H—Bevel Pinion (2 used)
I—Thrust Washer (2 used)
J—Bushing
K—Differential Carrier
L—Socket Head Cap Screw (6 used)
M—Ball Bearing
N—Spring Pin



-UN-20NOV89
M53538

MX,5530DG,A21 -19-21SEP89

ASSEMBLE DIFFERENTIAL AND SHAFTS

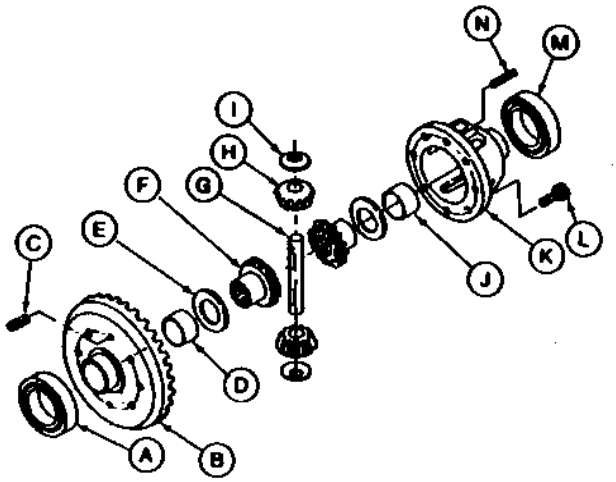
1. Apply gear oil to all internal parts during assembly.

2. Assemble parts (A—N).

Install bearings (A and M) using a bushing, bearing and seal driver set.

3. Apply thread lock and sealer (medium strength) to threads of cap screws (L).

4. Install cap screws and tighten to 40 N·m (29 lb-ft).



-UN-20NOV89
M53538

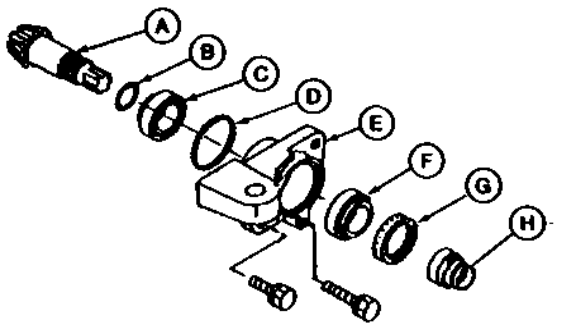
A—Ball Bearing
B—Ring Gear
C—Spring Pin (2 used)
D—Bushing
E—Thrust Washer (2 used)
F—Bevel Gear (2 used)
G—Pinion Shaft
H—Bevel Pinion (2 used)
I—Thrust Washer (2 used)
J—Bushing
K—Differential Carrier
L—Socket Head Cap Screw (6 used)
M—Ball Bearing
N—Spring Pin

55
30
16

MX,5530DG,A22 -19-21SEP89

5. Apply multipurpose grease to lips of seal (G).

6. Assemble parts (A—H).



-UN-20NOV89
M53537

A—Differential Drive Shaft
B—O-Ring
C—Ball Bearing
D—Packing
E—Housing
F—Ball Bearing
G—Seal
H—Spacer

MX,5530DG,A23 -19-21SEP89

7. Install shims (A) and differential carrier assembly (B).

8. Install differential drive shaft assembly (C).

NOTE: Adjust backlash only if new parts are installed or the amount of shims are in question.

9. Adjust differential drive shaft-to-ring gear backlash. (See procedure in this group.)

10. Adjust axle bevel gear-to-spindle bevel gear backlash. (See procedure in this group.)

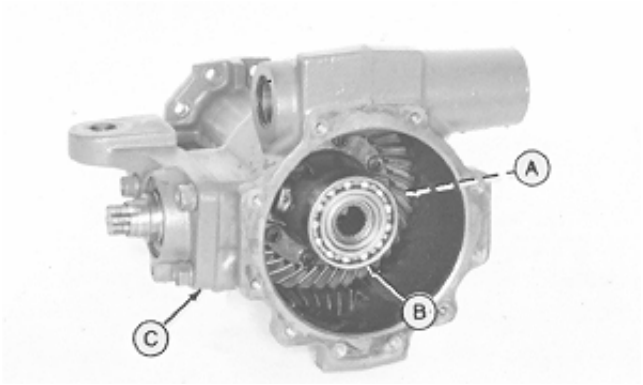
11. Install O-ring and axle housing.

12. Install front axle. (See procedure in this group.)

13. Install spindle housings. (See procedure in this group.)

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

15. Install power steering cylinder, if equipped. (See procedure in Section 60, Group 10.)



M53597 -UN-20NOV89

MX,5530DG,A24 -19-21SEP89

ADJUST SPINDLE PINION GEAR-TO-OUTER DRIVE GEAR BACKLASH

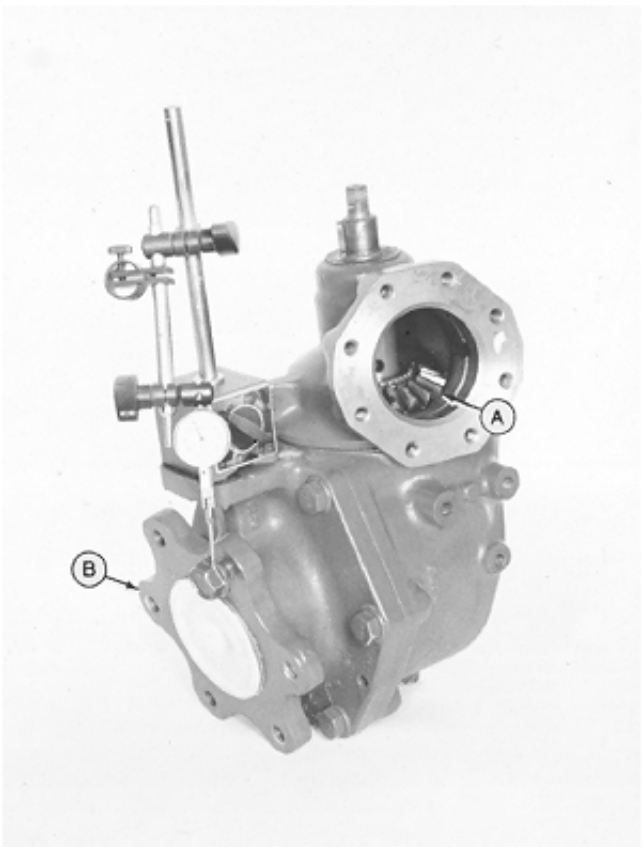
1. Assemble drive housing as shown.

2. Attach a dial indicator to housing as shown with contact point positioned on a wheel hub cap screw.

3. While holding spindle gear (A), move hub (B) and observe indicator reading to determine backlash. Backlash should be 0.10—0.15 mm (0.004—0.006 in.).

4. To adjust backlash, remove outer cover and final drive gear to gain access to shims. Remove shims to increase backlash, and add to decrease.

5. Recheck backlash after removing or adding shims.



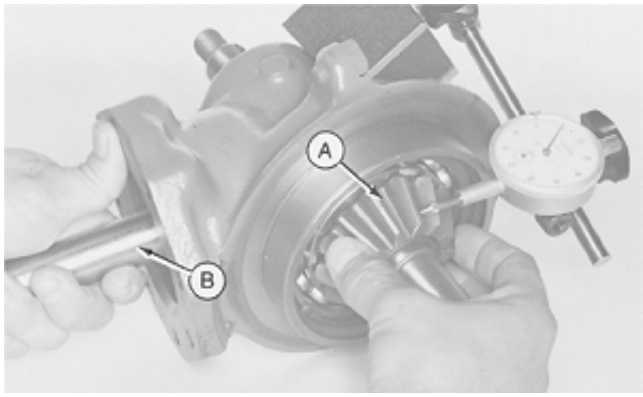
M53598 -UN-20NOV89

MX,5530DG,A25 -19-03OCT89

ADJUST AXLE BEVEL GEAR-TO-SPINDLE BEVEL GEAR BACKLASH

1. Attach a dial indicator to spindle housing as shown, with contact point positioned on final pinion gear splines (A).

2. While pulling outward on axle shaft (B) and holding it stationary, move final pinion gear (A) and observe indicator reading to determine backlash. Backlash should be 0.10—0.15 mm (0.004—0.006 in.).

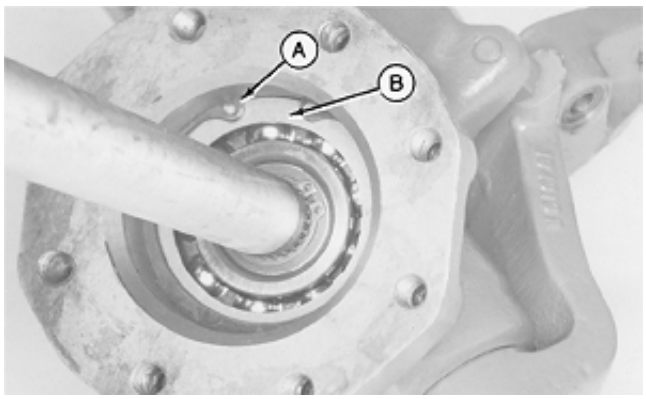


RW1598 -UN-30NOV88

MX,5530DG,A26 -19-03OCT89

3. To adjust backlash, remove snap ring (A) and add shims (B) to decrease backlash, and remove to increase.

4. Recheck backlash after removing or adding shims.



RW1541 -UN-30NOV88

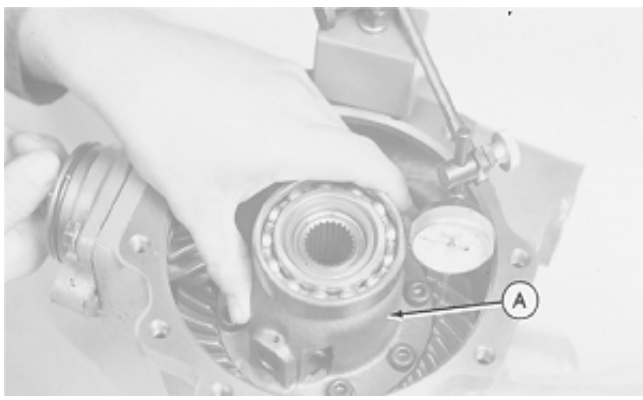
MX,5530DG,A27 -19-03OCT89

ADJUST DIFFERENTIAL DRIVE SHAFT-TO-RING GEAR BACKLASH

1. Lightly tap carrier (A) with a soft faced hammer to make sure bearing on other side of ring gear is seated.

2. Attach a dial indicator to housing as shown with contact point positioned on ring gear splines.

3. While holding input shaft, move carrier and ring gear to determine backlash. Backlash should be 0.17—0.23 mm (0.007—0.009 in.).



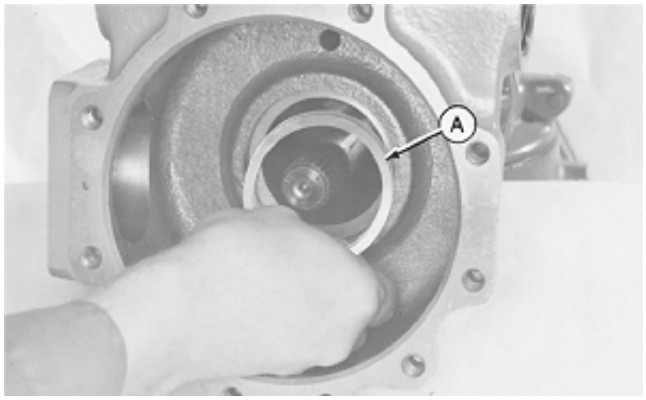
RW1594 -UN-30NOV88

MX,5530DG,A28 -19-21SEP89

4. To adjust backlash, remove input shaft and differential carrier assembly.

5. Remove shims (A) to increase backlash, and add to decrease.

6. Recheck backlash after removing or adding shims.



RW1581 -UN-30NOV88

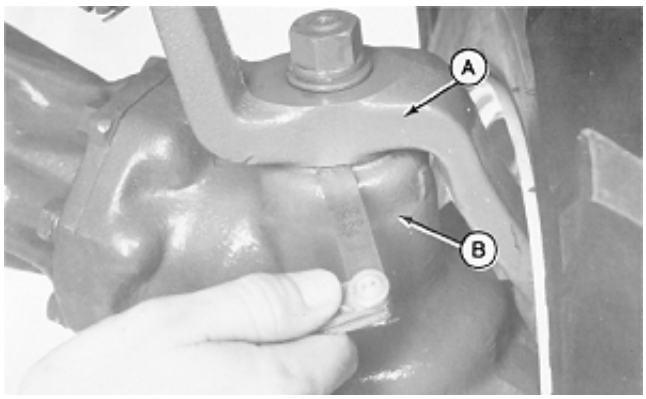
MX,5530DG,A29 -19-21SEP89

CHECK STEERING ARM-TO-SPINDLE HOUSING CLEARANCE

1. Install outer drive. (See procedure in this group.) Remove jack stands or supports so weight of tractor is on front axle.

2. Insert a feeler gauge between steering arm (A) and spindle housing (B). Clearance should be 0.3 mm (0.012 in.) or less.

3. To adjust clearance, support bottom of outer drive and remove steering arm. Add or subtract shims between spindle housing and steering arm as necessary.



RW1607 -UN-30NOV88

MX,5530DG,A30 -19-03OCT89

OTHER MATERIAL

Number	Name	Use
TY6305	Clean and Cure Primer	To clean and cure surfaces prior to application of adhesives or sealants.
TY6304	Flexible Sealant	To provide a seal between mating surfaces.
T43512	Thread Lock and Sealer (Medium Strength)	Apply to threads of outer drive and differential carrier mounting cap screws.

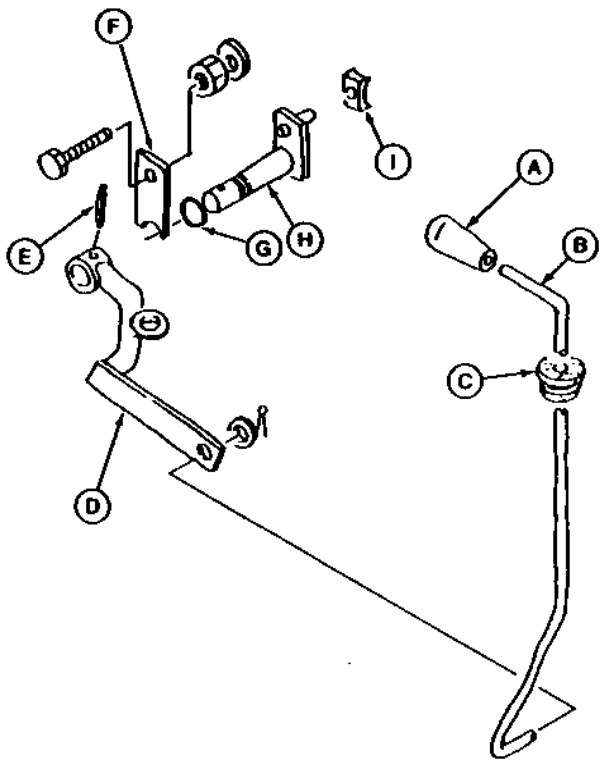
MX,5535DG,A1 -19-09OCT89

INSPECT AND REPAIR MFWD LEVER AND LINKAGE

Remove left rear fender.

NOTE: To repair or replace parts (G, H and I), separate transmission from clutch housing. (See procedure in Group 10.)

A—Knob
B—Lever
C—Guide
D—Arm
E—Spring Pin
F—Plate
G—Packing
H—Arm
I—Shift Collar



M53531 -UN-20NOV89

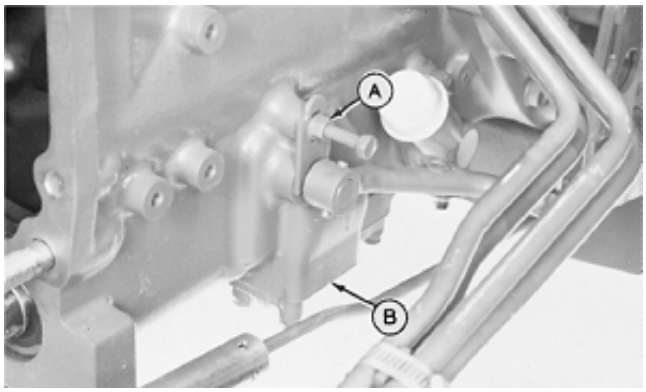
MX,5535DG,A2 -19-26SEP89

REMOVE, INSPECT AND INSTALL TRANSMISSION OUTPUT SHAFT AND MFWD DRIVE GEAR

1. Separate transmission from clutch housing. (See procedure in Group 10.)

2. Loosen lock plate cap screw (A) and pull on arm.

3. Remove cover and gasket (B).



MX,5535DG,A3 -19-08NOV89

4. Remove nuts, spacer and drive gear (A).

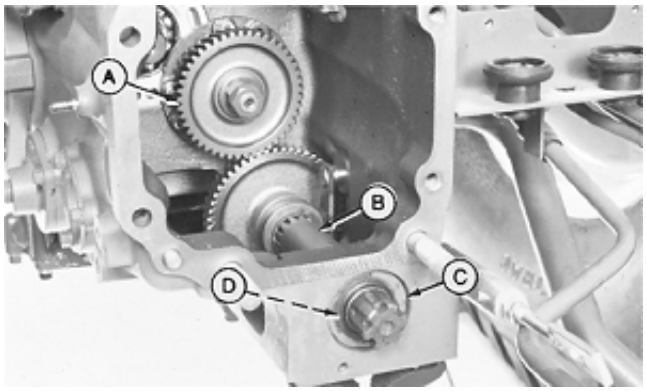
5. Inspect drive gear for wear or damage. Replace if necessary.

NOTE: Seal (C) can be replaced without separating transmission from clutch housing.

6. Pry out seal (C).

7. Remove snap ring (D).

8. Remove output shaft assembly (B) using a slide hammer.



A—Drive Gear
B—Output Shaft Assembly
C—Seal
D—Snap Ring

MX,5535DG,A4 -19-08NOV89

C **CAUTION: Balls (E) and spring (F) will shoot out of shaft when removing splined collar (H). Use care when removing collar.**

9. Inspect parts for wear damage. Replace as necessary.

NOTE: Remove bearings only if replacement is necessary.

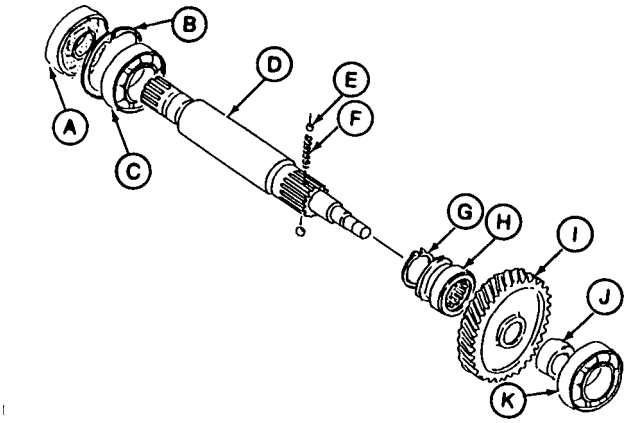
Bearing (K) is slip fit.

Replace bearing (C) using a knife-edge puller and a press.

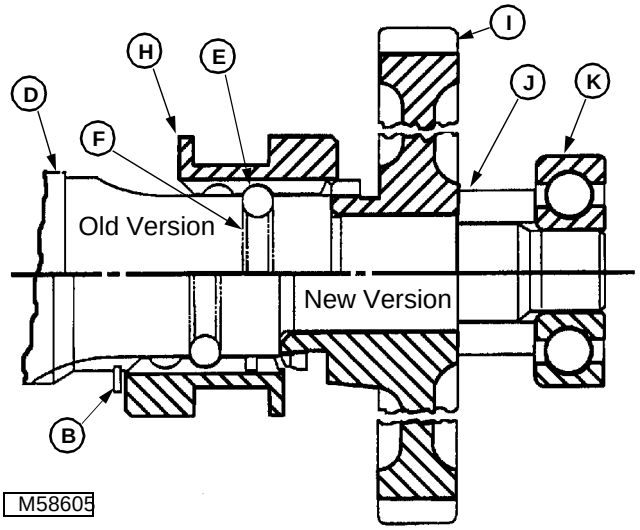
10. Apply clean transmission/hydraulic oil to all parts during assembly.

11. Install output shaft assembly (B)

NOTE: There is an old and a new version collar design. The old version is shown on the upper half and the new version is shown on the lower half of the section drawing to the right.



A-Seal
B-Snap Ring
C-Ball Bearing
D-Output Shaft
E-Ball (2 used)
F-Spring
G-Snap Ring
H-Splined Collar
I-Gear
J-Spacer
K-Ball Bearing



The “starting” serial numbers for the “new” version are as follows:

- 870—00870B103296
- 970—00970B103342
- 1070—01070A103969

12. Install output shaft assembly (B).

13. Apply multipurpose grease to inside lip of seal (C).

14. Install snap ring (D) and seal (C).

15. Install drive gear (A) with long end toward rear of transmission housing. Install spacer and nuts. Tighten nuts to 88 N•m (65 lb-ft).

16. Clean mating surfaces of bottom cover and housing using clean and cure primer. Apply flexible sealant to mating surfaces.

17. Install bottom cover and new gasket.

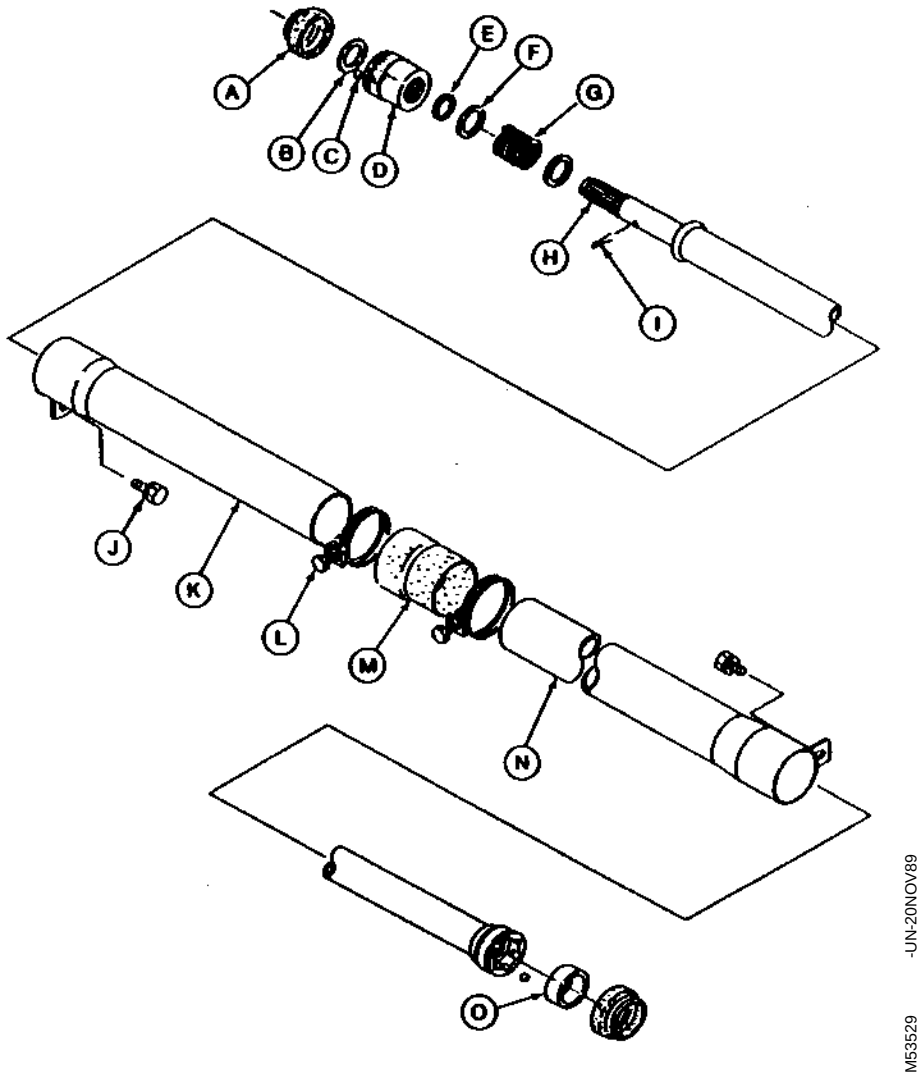
18. Push arm in and tighten lock plate cap screw.

19. Install transmission to clutch housing. (See procedure in Group 10.)



A-Drive Gear
B-Output Shaft Assembly
C-Seal
D-Snap Ring

REMOVE, INSPECT AND INSTALL MFWD DRIVE SHAFT



A—Boot (2 used)
B—Spacer
C—Ball (12 used)
D—Coupling
E—Seal
F—Washer (2 used)
G—Spring
H—Shaft
I—Cotter Pin
J—Cap Screw (2 used)
K—Cover
L—Clamp (2 used)
M—Boot
N—Cover
O—Spacer

1. Loosen clamps (L).
2. Remove cap screws (J).
3. Move cover (K) toward the rear.
4. Remove cotter pin (I).

NOTE: Be careful not to lose balls (C) and spacer (B) when removing drive shaft assembly.

5. Remove drive shaft assembly.
6. Repair or replace parts as necessary.
7. Apply multipurpose grease to balls (C) and ends of drive shaft.
8. Install drive shaft assembly.

MX,5535DG,A7 -19-27SEP89

REMOVE AND INSTALL MFWD AXLE

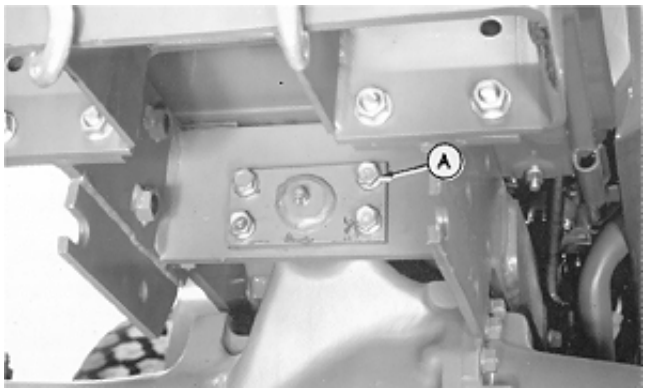
1. Remove drive shaft. (See procedure in this group.)

2. Power steering: Remove power steering cylinder. (See Section 60, Group 10.)

Manual steering: Disconnect drag link.

3. Raise front of tractor and remove front wheels.

4. Remove pivot pin cap screws (A).



M53511 -UN-20NOV89

MX,5535DG,A8 -19-14SEP89

5. Place a floor jack under center of axle and remove pivot pin (A), shims, washers (B) and collar (D).

6. Remove axle.

7. Make repairs as necessery. (See procedures in this group.)

8. Install axle. Lift axle into place and align axle housing hole with pivot pin hole.

IMPORTANT: If equipped, be sure grease fitting (D) on pivot pin assembly points down when installed.

9. Install pivot pin (A), with grease fitting pointing down, through collar (C), washers (B) and axle.

10. Tighten pivot pin cap screws.

11. Check and adjust axle free-play. (See procedure in Section 80, Group 10.)

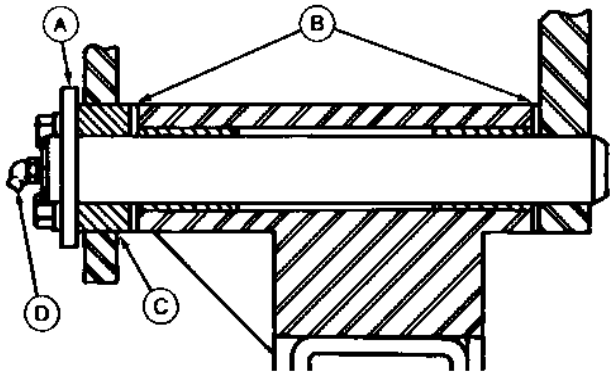
12. Install wheels. Tighten cap screws to 190 N·m (140 lb-ft).

13. Install power steering cylinder, if equipped.

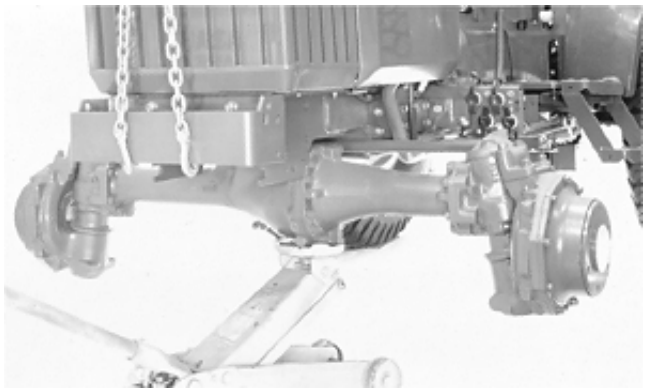
Connect drag link, if equipped.

14. Install drive shaft.

15. Lubricate front axle pivot pin assembly with multipurpose grease. (See Section 10, Group 20.)



M53185 -UN-18JUL89



M53512 -UN-20NOV89

A—Pivot Pin
B—Washers (2 used)
C—Collar
D—Grease Fitting

MX,5535DG,A9 -19-14SEP89

REMOVE AND INSTALL SPINDLE HOUSING AND OUTER DRIVE

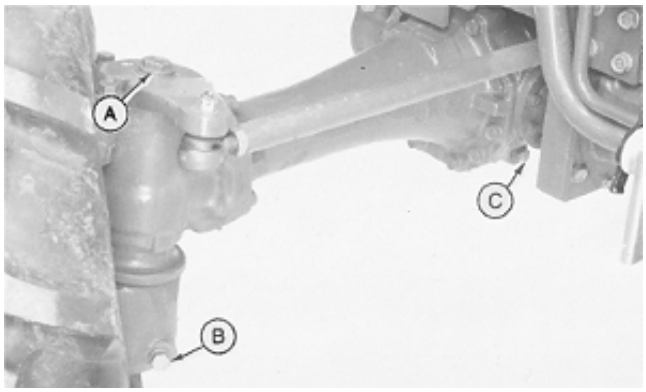
NOTE: Spindle and outer drive assembly can be serviced without removing axle.

1. Install a wooden block between axle and frame.

NOTE: Approximate capacity of axle housing is 2.13 L (2.25 qt).

2. Remove plugs (A , B and C) to drain axle housing.

3. Remove front wheel.



-UN-12JAN89
M52892

MX,5535DG,A10 -19-21SEP89

4. Disconnect tie rod (A).

5. Power steering: Disconnect power steering cylinder.

Manual steering: Disconnect drag link.

6. Place a floor jack under bottom of outer drive housing.

7. Remove eight cap screws (B) and outer drive assembly.

8. Remove O-ring (C).

9. Make repairs as necessary. (See Disassemble, Inspect and Assemble Outer Drive and Disassemble, Inspect and Assemble Spindle Housing in this group.)

10. Apply petroleum jelly to O-ring (C) and install on axle housing.

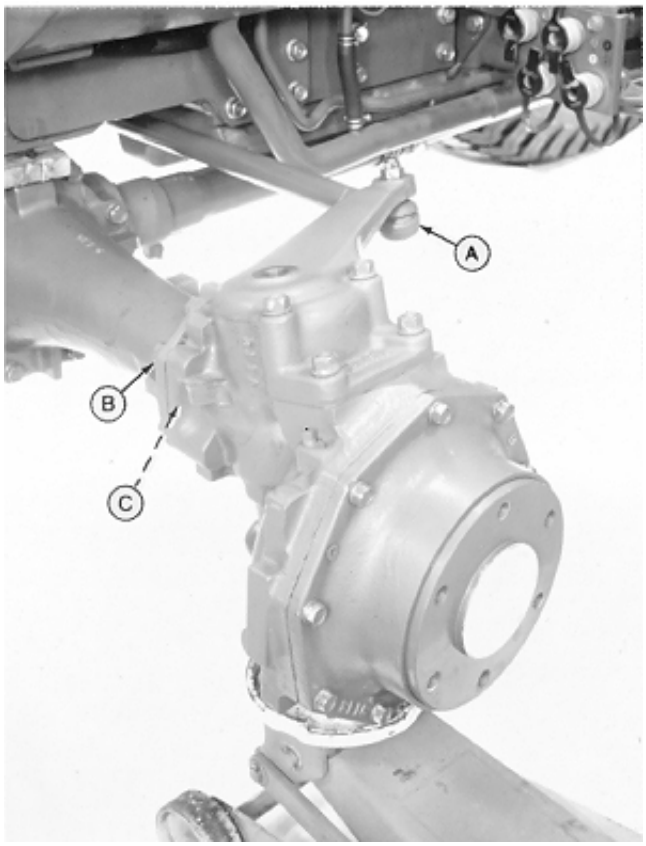
11. Apply thread lock and sealer (medium strength) to threads of cap screws.

12. Install outer drive assembly and cap screws. Tighten to 51 N·m (39 lb-ft).

13. Connect tie rod and power steering cylinder or drag link, if equipped. Tighten nuts to 68 N·m (50 lb-ft).

14. Install drain plugs.

15. Install wheel. Tighten cap screws to 190 N·m (140 lb-ft).

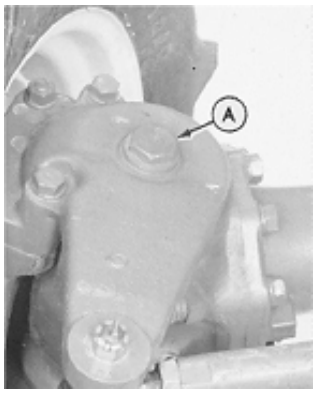


M53520 -UN-20NOV89

MX,5535DG,A11 -19-21SEP89

16. Remove fill cap/plug (A).

17. Fill axle housing with proper gear oil. (See Section 10, Group 20.)



M52873 -UN-12JAN89

MX,5535DG,A12 -19-21SEP89

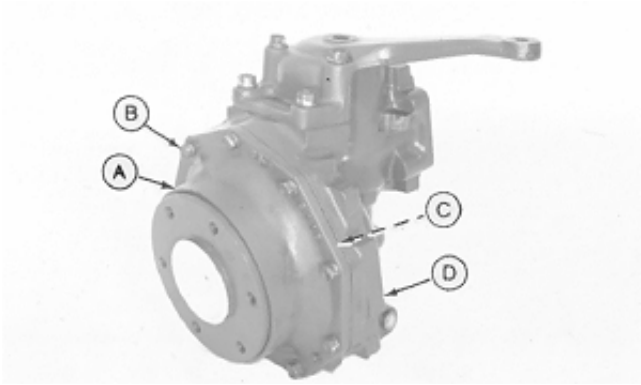
DISASSEMBLE, INSPECT AND ASSEMBLE OUTER DRIVE

1. Remove nine cap screws (B).

IMPORTANT: Be careful not to damage shims when prying outer drive assembly away from spindle housing.

2. Pry outer drive assembly (A) away from housing (D).

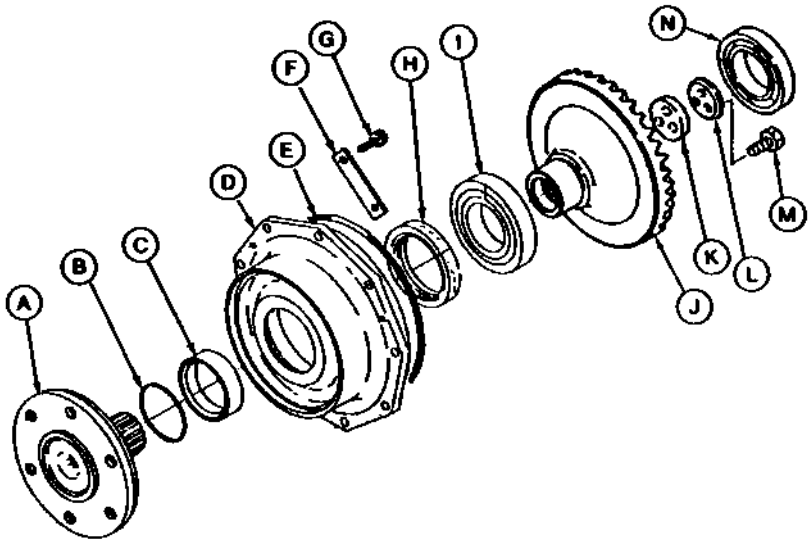
3. Remove shims (C) and outer drive assembly.



M53515 -UN-20NOV89

A—Outer Drive Assembly
B—Cap Screw (9 used)
C—Shims (as required)
D—Housing

MX,5535DG,A13 -19-21SEP89



A—Hub Shaft
B—O-Ring
C—Bushing
D—Bearing Case
E—O-Ring
F—Support (2 used)
G—Cap Screw (4 used)
H—Seal
I—Ball Bearing
J—Outer Drive Gear
K—Washer
L—Washer
M—Cap Screw (3 used)
N—Ball Bearing

55 35 10

4. Remove parts (M, L and K).

5. Remove shaft (A) and gear (J) from case (D) using a press.

NOTE: Remove bearings only if replacement is necessary.

6. Remove bearing (N) using a 2-jaw puller.

7. Remove cap screws (G) and supports (F).

8. Remove bushing (C) and bearing (I) using a bushing, bearing and seal driver set.

9. Remove seal (H) from case using a screwdriver.

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

11. Apply gear oil to all internal parts during assembly.

12. Apply multipurpose grease to lips of seal (H).

13. Assemble parts (A—N).

14. Apply petroleum jelly to O-ring (E). Install O-ring.

15. Install outer drive assembly, shims and cap screws.

NOTE: Adjust backlash only if new parts are installed or the amount of shims are in question.

16. Adjust spindle pinion gear-to-outer drive gear backlash. (See procedure in this group.)

MX,5535DG,A14 -19-21SEP89

DISASSEMBLE, INSPECT AND ASSEMBLE SPINDLE HOUSING

1. Remove nine cap screws (B).

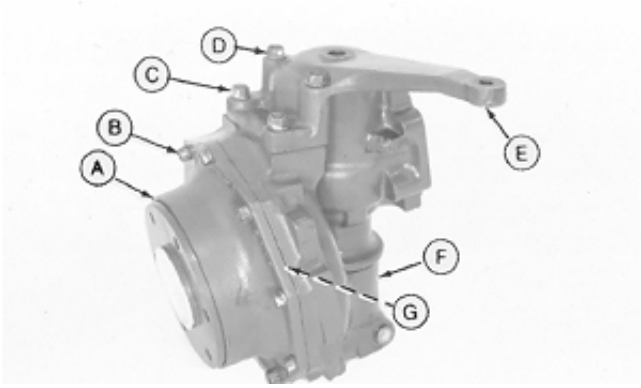
IMPORTANT: Be careful not to damage shims when prying outer drive assembly away from spindle housing.

2. Pry outer drive assembly (A) away from housing (F).

3. Remove shims (G) and outer drive assembly.

4. Remove nuts (C) and cap screws (D).

5. Remove steering arm (E) using a soft-faced mallet.



M53516 -UN-20NOV89

A—Outer Drive Assembly
B—Cap Screw (9 used)
C—Nut (2 used)
D—Cap Screw (2 used)
E—Steering Arm
F—Drop Housing
G—Shims (as required)

MX,5535DG,A15 -19-21SEP89

55
35
11

6. Remove housing (G) and shaft (M).

7. Remove parts (E and F) and (H and I).

NOTE: Remove bearings only if replacement is necessary.

8. Remove parts (A—D) and (L and K) using a 2-jaw puller.

9. Remove bearings (F and H) using a knife-edge puller and a press.

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

11. Apply gear oil to all internal parts during assembly.

12. Apply multipurpose grease to lips of seals (B and L).

13. Assemble parts (A—M).

Install bearings and seals using a bushing, bearing and seal driver set.

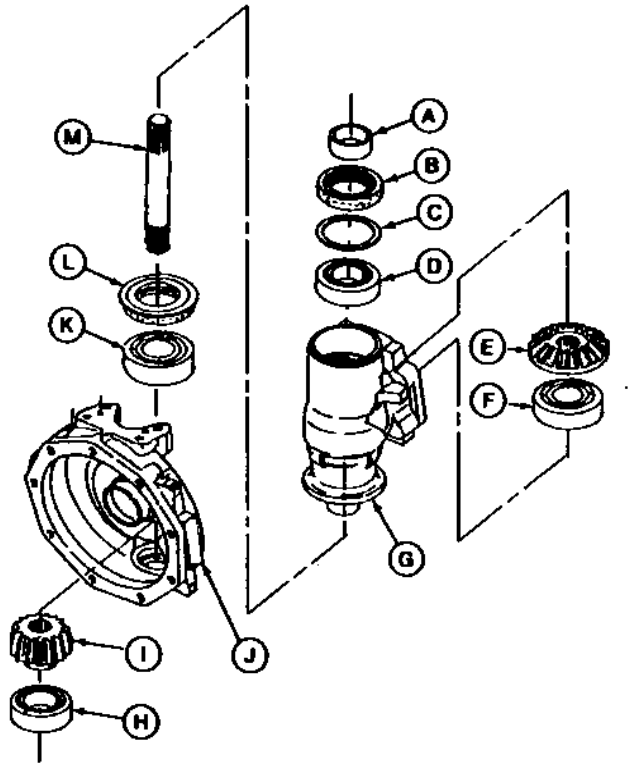
14. Install steering arm, nuts and cap screws.

NOTE: Adjust backlash only if new parts are installed or the amount of shims are in question.

15. Adjust axle bevel gear-to-spindle bevel gear backlash. (See procedure in this group.)

16. Install outer drive assembly, shims and cap screws.

17. Adjust spindle pinion gear-to-outer drive gear backlash. (See procedure in this group.)



M53514 -UN-20NOV89

A—Sleeve
B—Seal
C—Spacer
D—Ball Bearing
E—Spindle Bevel Gear
F—Ball Bearing
G—Spindle Housing
H—Ball Bearing
I—Spindle Pinion Gear
J—Drop Housing
K—Ball Bearing
L—Seal
M—Spindle Shaft

MX,5535DG,A16 -19-21SEP89

DISASSEMBLE AND INSPECT DIFFERENTIAL AND SHAFTS

1. Remove power steering cylinder, if equipped. (See procedure in Section 60, Group 10.)

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

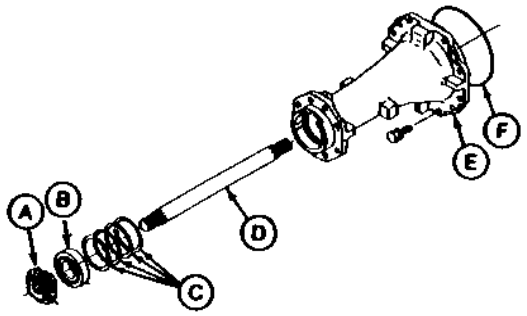
3. Remove outer drives. (See procedure in this group.)

4. Install a support stand under end of center housing.

5. Remove parts (A—F).

NOTE: Remove bearing only if replacement is necessary.

Remove bearing (B) using a knife-edge puller and a press.



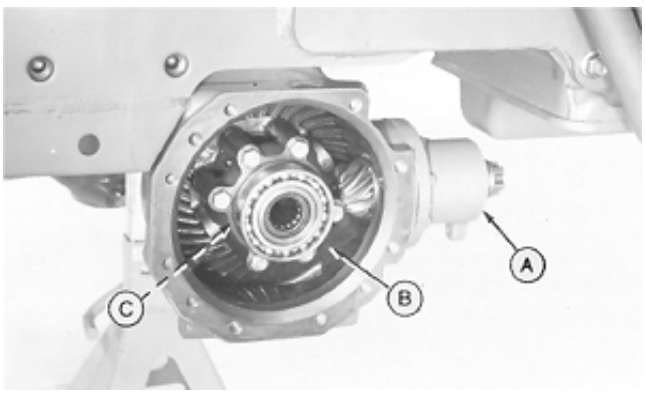
M53521 -UN-20NOV89

A—Axle Bevel Gear
B—Ball Bearing
C—Shims (as required)
D—Axle Shaft
E—Axle Housing
F—O-Ring

MX,5535DG,A17 -19-21SEP89

6. Remove eight socket head cap screws and differential drive shaft assembly (A).

7. Remove differential carrier assembly (B) and shims (C).



M53522 -UN-20NOV89

MX,5535DG,A18 -19-21SEP89

8. Put gear end of drive shaft in a soft-jawed vise and remove spacer (H).

9. Disassemble parts (A—H).

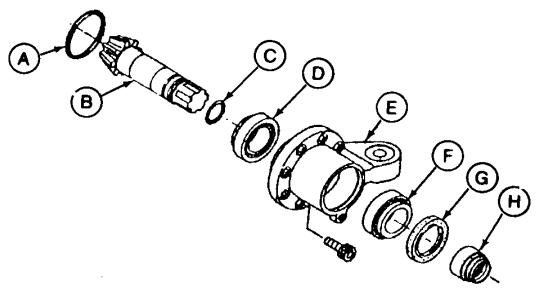
Remove shaft (B) using a press.

NOTE: Remove bearings only if replacement is necessary.

10. Remove bearing (D) using a knife-edge puller and a press.

11. Remove bearing (F) and seal (G) using a bearing, bushing and seal driver set.

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



M53522

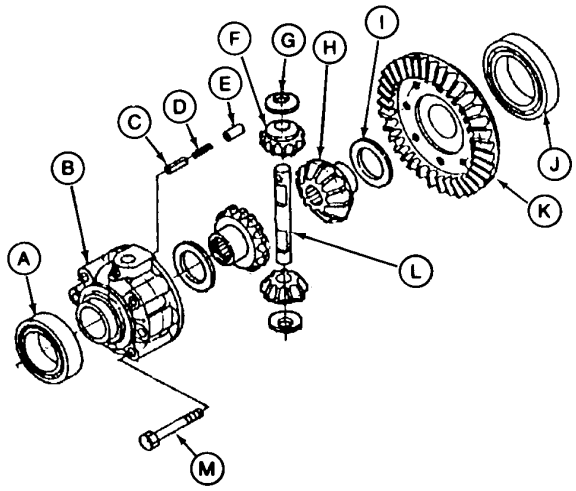
A-O-Ring
B-Differential Drive Shaft
C-O-Ring
D-Ball Bearing
E-Housing
F-Taper Bearing
G-Seal
H-Spacer

13. Disassemble parts (A—M).

NOTE: Remove bearings only if replacement is necessary.

14. Remove bearings (A and J) using a knife-edge puller and a press.

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



M53524

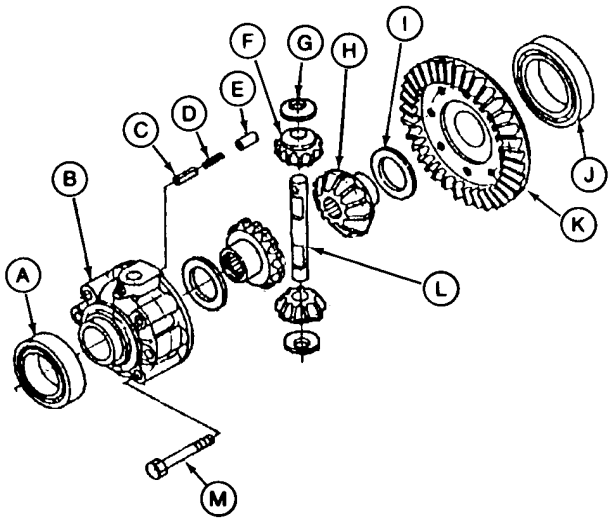
A-Ball Bearing
B-Differential Carrier
C-Spring Pin
D-Spring Pin
E-Dowel Pin (2 used)
F-Bevel Pinion (2 used)
G-Thrust Washer (2 used)
H-Bevel Gear (2 used)
I-Thrust Washer (2 used)
J-Ball Bearing
K-Ring Gear
L-Pinion Shaft
M-Cap Screw (6 used)

ASSEMBLE DIFFERENTIAL AND SHAFTS

7. Apply gear oil to all internal parts during assembly.
8. Assemble parts (A—M).

Install bearings (A and J) using a bushing, bearing and seal driver set.

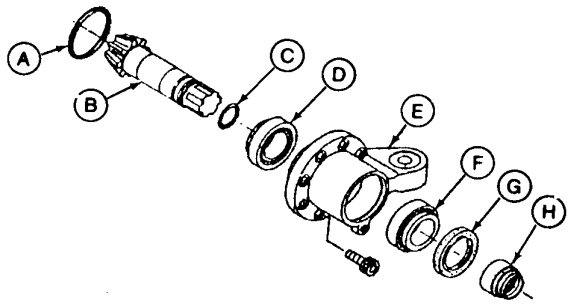
9. Apply thread lock and sealer (medium strength) to threads of cap screws (M).
10. Install cap screws and tighten to 80 N•m (59 lb-ft).



M53524

A-Ball Bearing
B-Differential Carrier
C-Spring Pin
D-Spring Pin
E-Dowel Pin (2 used)
F-Bevel Pinion (2 used)
G-Thrust Washer (2 used)
H-Bevel Gear (2 used)
I-Thrust Washer (2 used)
J-Ball Bearing
K-Ring Gear
L-Pinion Shaft
M-Cap Screw (6 used)

11. Apply multipurpose grease to lips of seal (G).
12. Assemble parts (A—H).



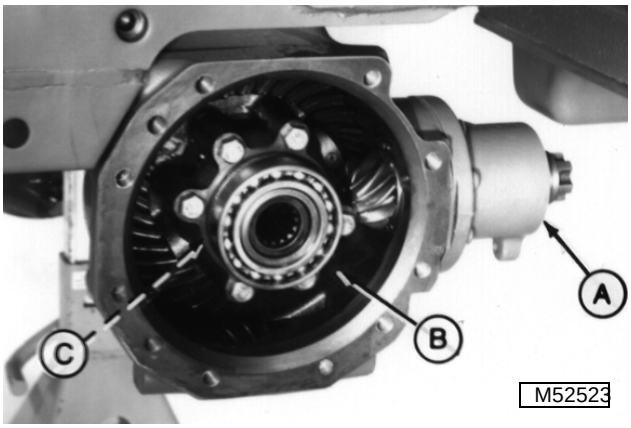
M53523

A-O-Ring
B-Differential Drive Shaft
C-O-Ring
D-Ball Bearing
E-Housing
F-Taper Bearing
G-Seal
H-Spacer

7. Install shims (C) and differential carrier assembly (B).
8. Install input shaft assembly (A).

NOTE: Adjust backlash only if new parts are installed or the amount of shims are in question.

9. Adjust differential drive shaft-to-ring gear backlash. (See procedure in this group.)
10. Adjust axle bevel gear-to-spindle gear backlash. (See procedure in this group.)
11. Install axle housing, axle shaft, shims and bevel gear.
12. Install outer drives. (See procedure in this group.)
13. Install drive shaft. (See procedure in this group.)
14. Install power steering cylinder, if equipped. (See procedure in Section 60, Group 10.)



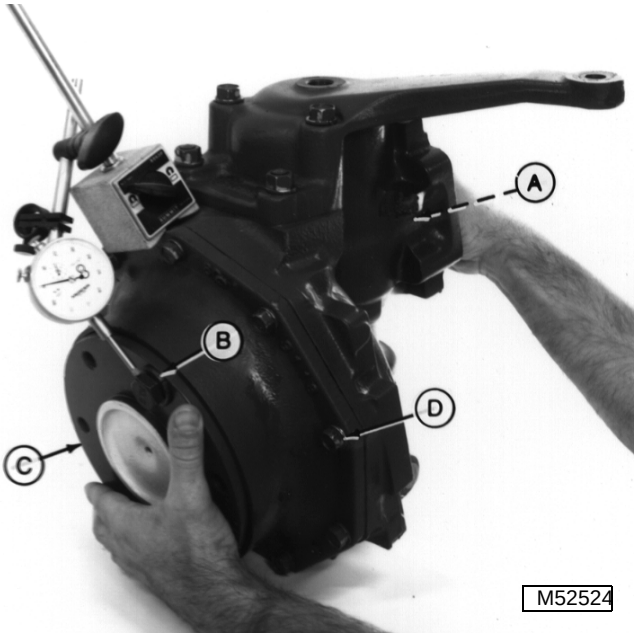
A-Input Assembly
B-Differential Carrier Assembly
C-Shims

ADJUST SPINDLE PINION GEAR-TO-OUTER DRIVE GEAR BACKLASH

1. Attach a dial indicator to housing as shown with contact point positioned on a wheel hub cap screw (B).
2. While holding spindle gear (A), move hub (C) and observe indicator reading to determine backlash. Backlash should be 0.20—0.35 mm (0.008—0.014 in.).

NOTE: Shims are designed to hang on cap screws.

3. To adjust backlash, loosen cap screws (D). Add shims to increase backlash, and remove to decrease.
4. Tighten cap screws securely.
5. Recheck backlash after removing or adding shims.



A-Spindle Gear
B-Wheel Hub Cap Screw
C-Wheel Hub
D-Cap Screws (9 used)

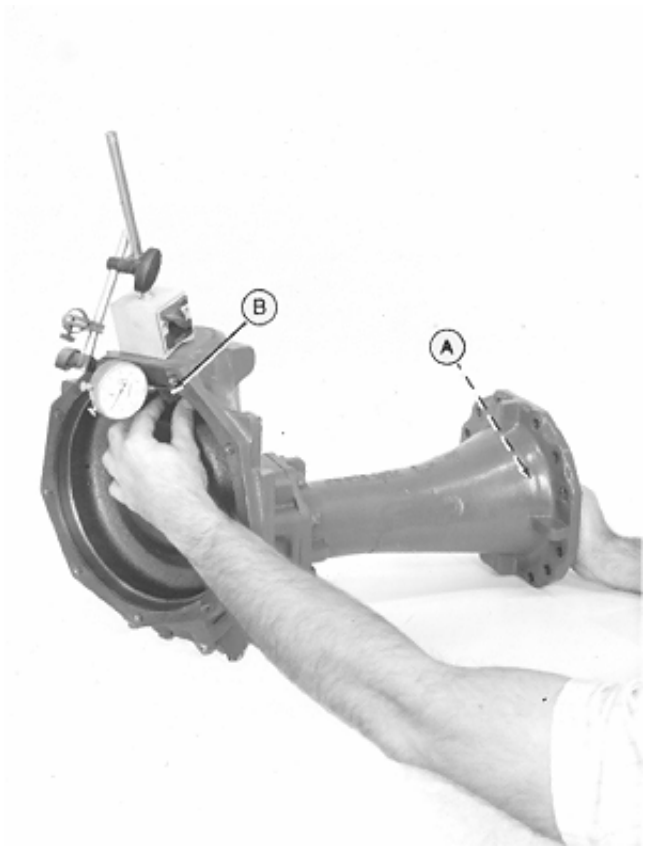
ADJUST AXLE BEVEL GEAR-TO-SPINDLE BEVEL GEAR BACKLASH

NOTE: To perform this adjustment on opposite side, remove differential assembly. (See Disassemble, Inspect and Assemble Differential and Shafts in this group.)

1. Assemble outer drive assembly to axle housing.

2. Attach a dial indicator to housing as shown, with contact point (B) positioned on final pinion gear splines.

3. While holding axle shaft (A), move spindle pinion gear and observe indicator reading to determine backlash. Backlash should be 0.20—0.35 mm (0.008—0.014 in.).



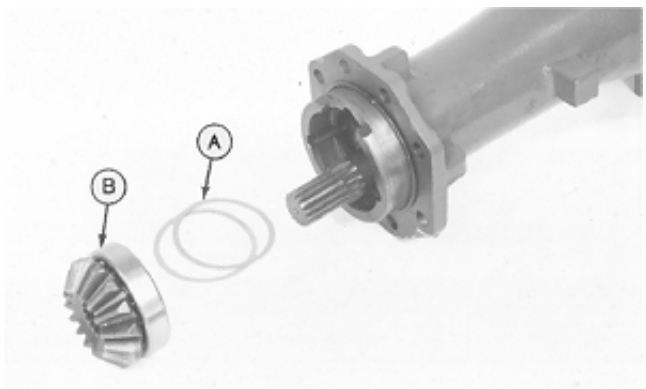
M53518 -UN-20NOV89

MX,5535DG,A25 -19-21SEP89

4. To adjust backlash, remove outer drive assembly.

5. Remove axle bevel gear (A) and add shims (B) to decrease backlash, and remove to increase.

6. Recheck backlash after removing or adding shims.



M53519 -UN-20NOV89

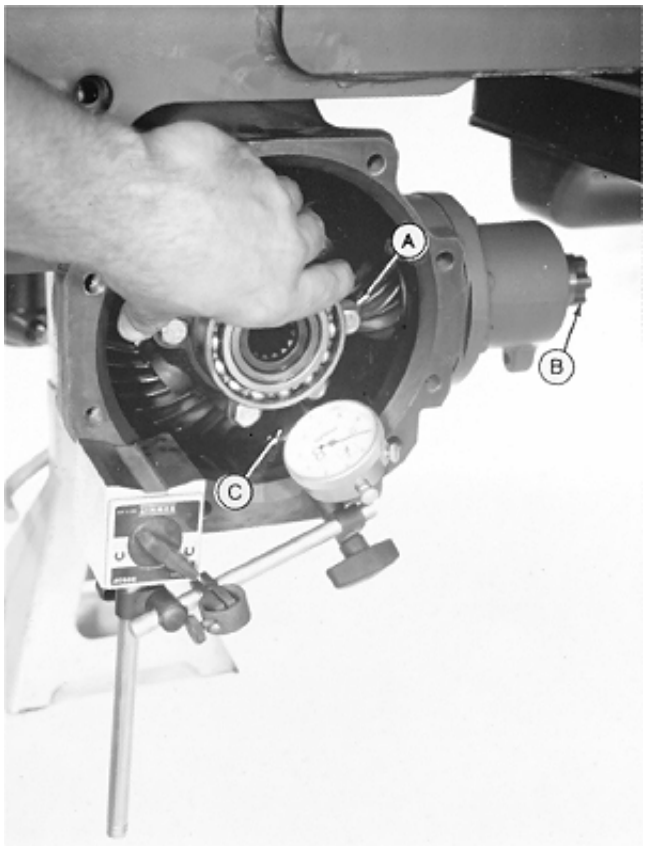
MX,5535DG,A26 -19-21SEP89

ADJUST DIFFERENTIAL DRIVE SHAFT-TO-RING GEAR BACKLASH

1. Lightly tap carrier (A) with a soft faced hammer to make sure bearing on other side of ring gear is seated.

2. Attach a dial indicator to housing as shown with contact point positioned on ring gear splines (C).

3. While holding input shaft (B), move carrier and ring gear to determine backlash. Backlash should be 0.13—0.18 mm (0.005—0.007 in.).



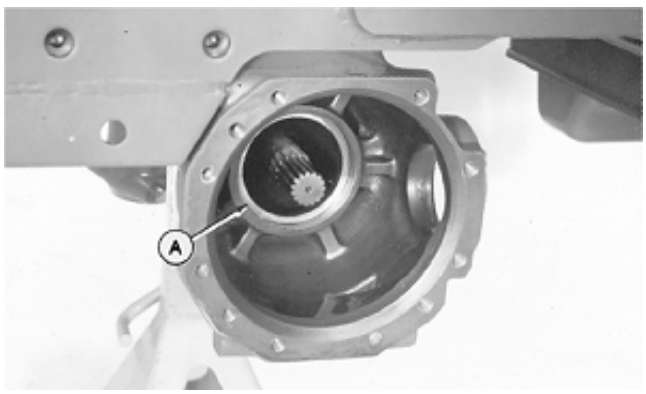
M53525 -UN-20NOV89

MX,5535DG,A27 -19-21SEP89

4. To adjust backlash, remove input shaft and differential carrier assembly.

5. Remove shims (A) to increase backlash, and add to decrease.

6. Recheck backlash after removing or adding shims.



M53526 -UN-20NOV89

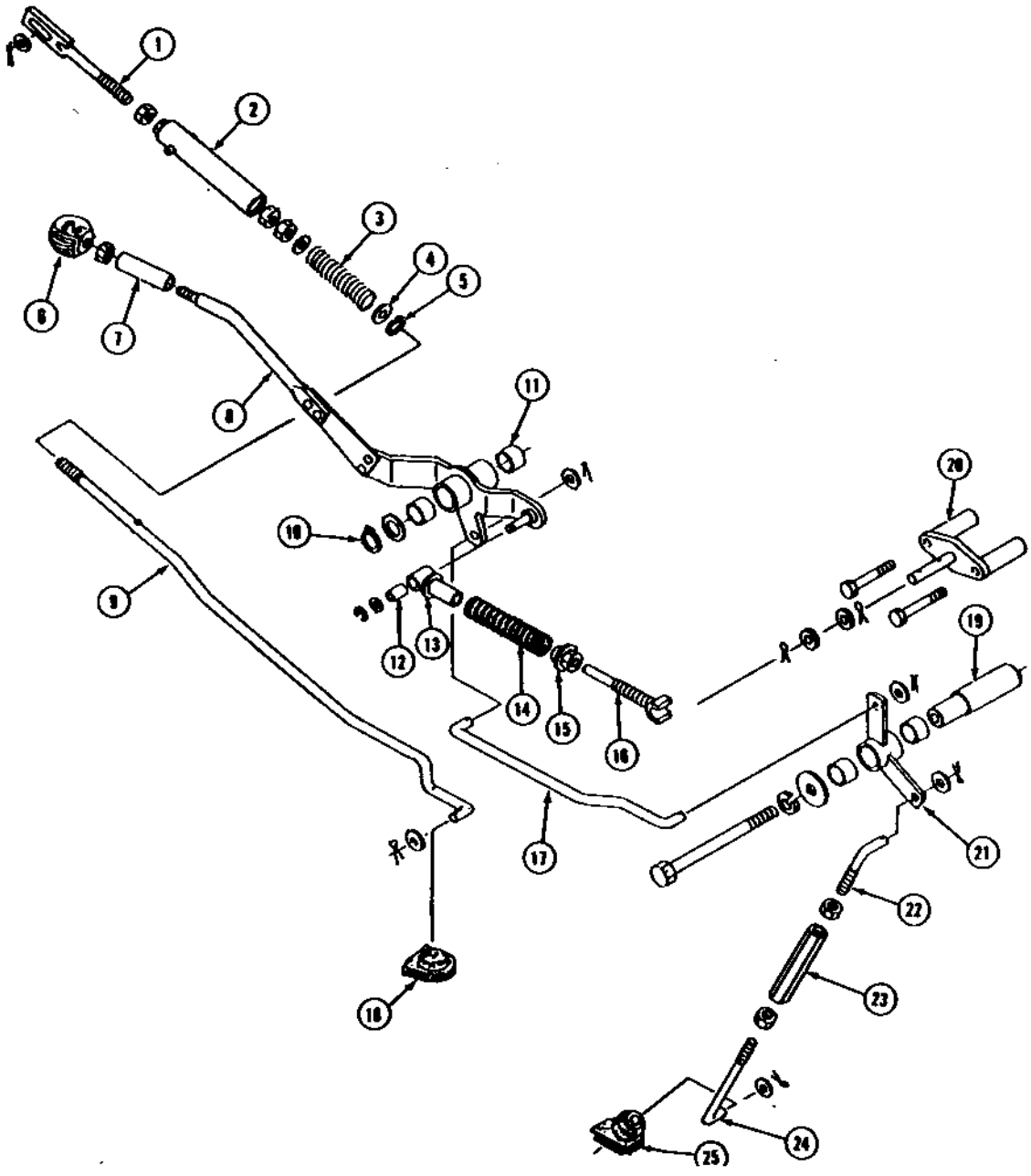
MX,5535DG,A28 -19-21SEP89

OTHER MATERIAL

Number	Name	Use
TY6305	Clean and Cure Primer	To clean and cure surfaces prior to application of adhesives or sealants.
TY6304	Flexible Sealant	To provide a seal between mating surfaces.

MX,5540DG,A1 -19-04OCT89

INSPECT AND REPAIR CONTROL LEVER AND LINKAGE



M53533 -UN-20NOV89

1—Brake Rod
2—Spring Holder
3—Spring
4—Spacer
5—Ring
6—Knob
7—Protection Tube
8—Lever
9—Brake Rod
10—Snap Ring
11—Bushing (4 used)
12—Bushing
13—Spring Plate
14—Spring
15—Seat Plate
16—Spring Rod
17—Rod
18—Grommet
19—Shaft
20—Bellcrank
21—Counter Lever
22—Rod
23—Turnbuckle
24—Rod
25—Grommet

MX,5540DG,A2 -19-29SEP89

1. Remove left draft arm/lift link assembly from 3-point hitch.

2. Remove left rear wheel.

3. Remove left-hand fender.

4. Remove tool box.

5. Remove left-hand step plate.

6. Remove mid mount PTO gearbox cover.

CAUTION: Spring (14) is under pressure. Before removing linkage, loosen plate (15) to relieve spring tension.

7. Loosen plate (15) to relieve tension on spring (14).

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

9. Install cover, step plate, toolbox, fender and wheel.

10. Adjust linkage. (See Section 255, Group 15).

MX,5540DG,A3 -19-29SEP89

REMOVE AND INSTALL MID MOUNT PTO GEARBOX

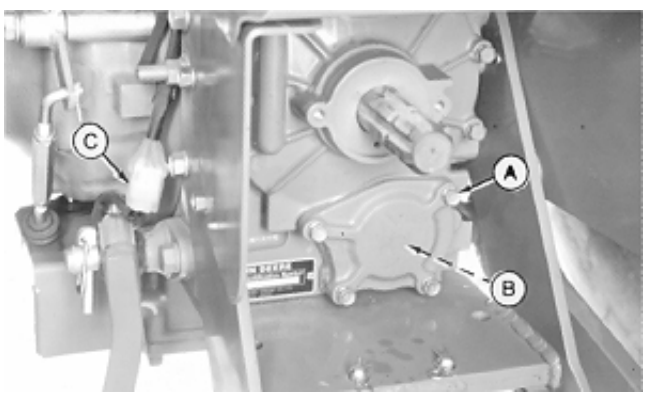
NOTE: The approximate capacity of transmission is 21 L (5.5 U.S. gal).

1. Drain transmission/hydraulic oil.

2. Remove four cap screws (A) and cover.

3. Remove rear shaft assembly (B).

4. Disconnect wiring connector (C).



-UN-20NOV89
M53548

MX,5540DG,A4 -19-29SEP89

5. Remove gearbox outer cover.

6. Remove rubber grommet (A) and pull wiring connector through hole in cover.

7. Disconnect control rods (D and E).

8. Remove two cap screws (C).

9. Remove four socket head cap screws and lock washers (B) to remove gearbox.

10. Make repairs as necessary. (See this group.)

11. Install gearbox and new O-ring. Install cap screws loose.

12. Install rear shaft assembly.

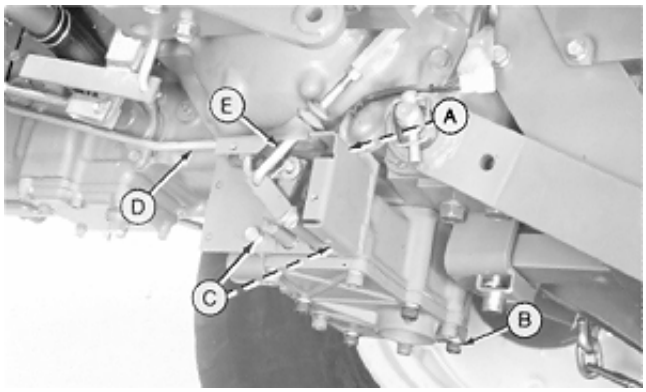
13. Install rear cover and new O-ring. Tighten cap screws to specifications.

14. Tighten cap screws (B and C) to specifications.

15. Connect control rods and wiring connector.

16. Install outer cover.

17. Fill transmission with proper oil. (See Section 10, Group 20.)



-UN-20NOV89
M53549

A—Rubber Grommet
B—Socket Head Cap Screws and Lock Washers (4 used)
C—Cap Screws (2 used)
D—Brake Control Rod
E—Shift Control Rod

TORQUE SPECIFICATIONS

Rear Cover Cap Screws	27 N·m (20 lb-ft)
Cap Screws (C)	50 N·m (35 lb-ft)
Socket Head Cap Screws (B)	75 N·m (55 lb-ft)

55
40
4

MX,5540DG,A5 -19-29SEP89

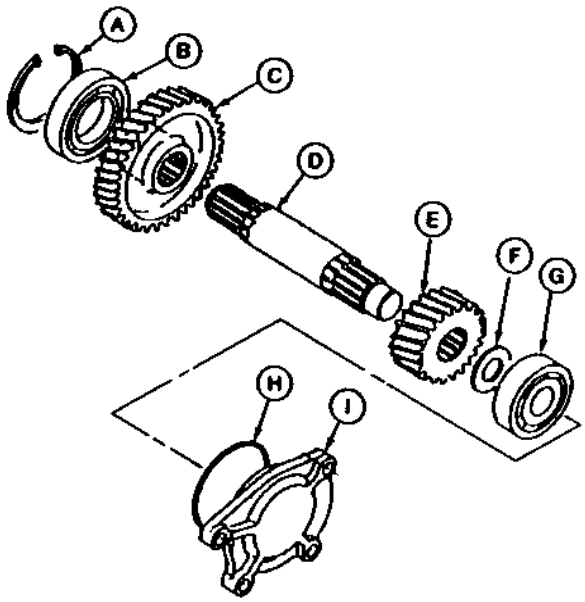
DISASSEMBLE AND INSPECT MID MOUNT PTO GEARBOX

NOTE: Remove bearings only if replacement is necessary.

1. Remove bearings (B and G) using a knife-edge puller and a press.

2. Remove parts (A—I).

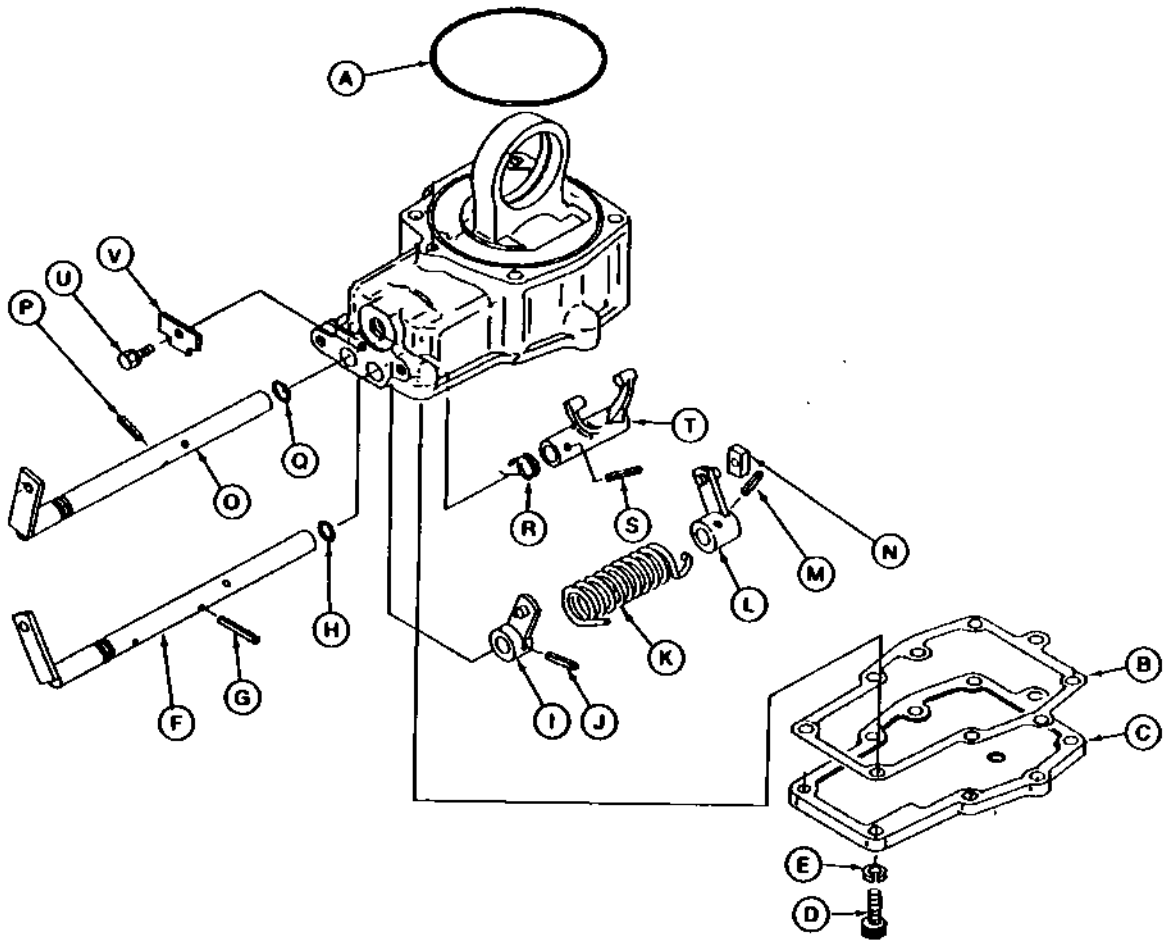
A—Snap Ring
B—Ball Bearing
C—Gear
D—Idle Shaft
E—Gear
F—Spacer
G—Ball Bearing
H—O-Ring
I—Cover



M53542 -UN-20NOV89

55
40
5

MX,5540DG,A6 -19-09OCT89



55
40
6

A—O-Ring
B—Gasket
C—Cover Cover
D—Socket Head Cap Screw (5 used)
E—Lock Washer (5 used)
F—Shift Shaft
G—Spring Pin
H—O-Ring
I—Switch Arm
J—Spring Pin
K—Spring
L—Shift Arm
M—Spring Pin
N—Shifter
O—Brake Shaft
P—Spring Pin
Q—O-Ring
R—Spring
S—Spring Pin
T—Brake Lever
U—Cap Screw
V—Plate

3. Remove O-ring (A).

4. Put gearbox assembly in a soft-jawed vise and remove socket head cap screws (D), lock washers (E), cover (C) and gasket (B).

5. Remove cap screw (U) and plate (V).

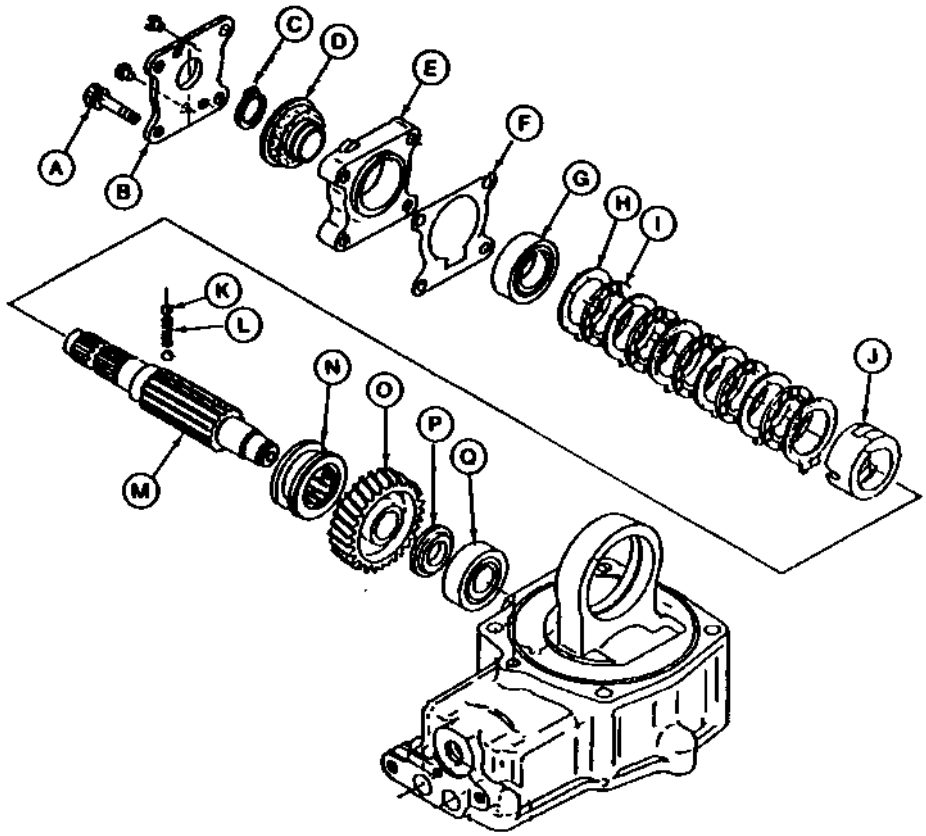
6. Remove pins (G, J and M).

7. Remove parts (F—N).

8. Remove pins (P and S).

9. Remove parts (O—T).

MX,5540DG,A7 -19-09OCT89



A—Cap Screw (4 used)
B—Cover
C—Snap Ring
D—Seal
E—Seal Case
F—Gasket
G—Ball Bearing
H—Plates (6 used)
I—Brake Disks (5 used)
J—Actuator
K—Ball (2 used)
L—Spring
M—Drive Shaft
N—Sliding Gear
O—Drive Gear
P—Washer
Q—Ball Bearing

10. Remove cap screws (A) and cover (B).

11. Remove snap ring (C).

12. Remove seal (D) using a screwdriver.

13. Remove case (E) and gasket.

14. Pry between bearing (Q) and washer (P) with a screwdriver to remove shaft assembly from bearing.

CAUTION: Balls (K) and spring (L) will shoot out of shaft when removing sliding gear (N). Use care when removing gear.

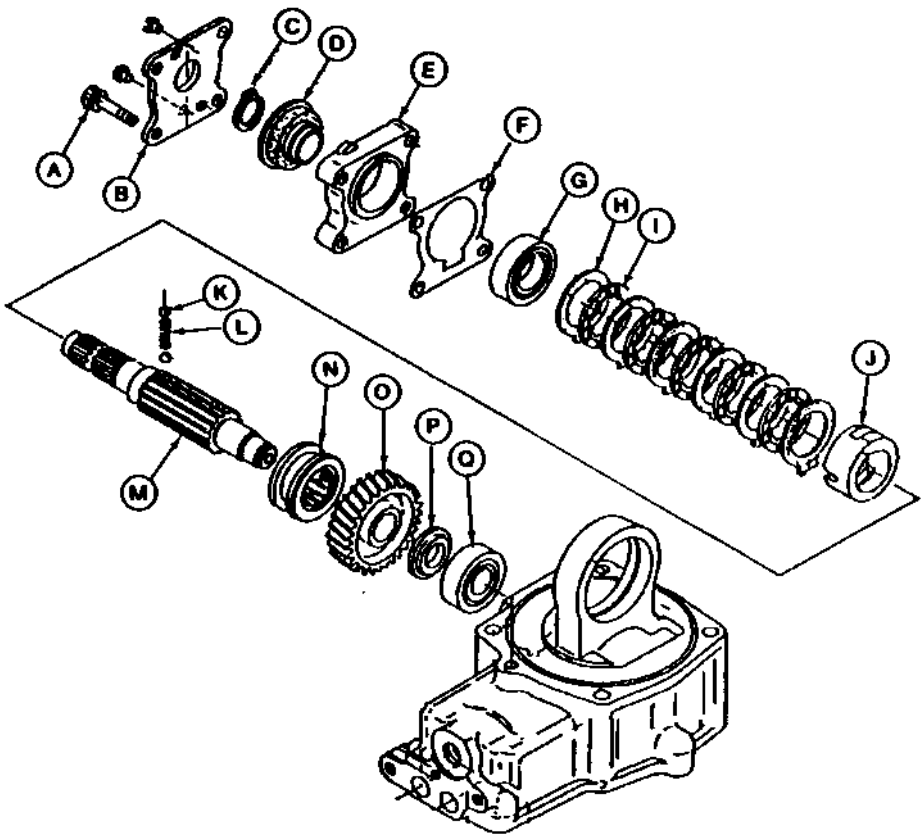
15. Remove parts (G—Q).

16. Remove bearing (G) using a knife-edge puller and a press.

17. Inspect all parts for wear damage. Replace as necessary.

MX,5540DG,A8 -19-09OCT89

ASSEMBLE MID MOUNT PTO GEARBOX



55
40
8

A—Cap Screw (4 used)
B—Cover
C—Snap Ring
D—Seal
E—Seal Case
F—Gasket
G—Ball Bearing
H—Plates (6 used)
I—Brake Disks (5 used)
J—Actuator
K—Ball (2 used)
L—Spring
M—Drive Shaft
N—Sliding Gear
O—Drive Gear
P—Washer
Q—Ball Bearing

1. Apply clean transmission/hydraulic oil to all internal parts during assembly.

2. Install bearing (G) on shaft using a press.

3. Apply multipurpose grease to inside lips of seal (D).

4. Install seal using a bearing, bushing and seal driver set.

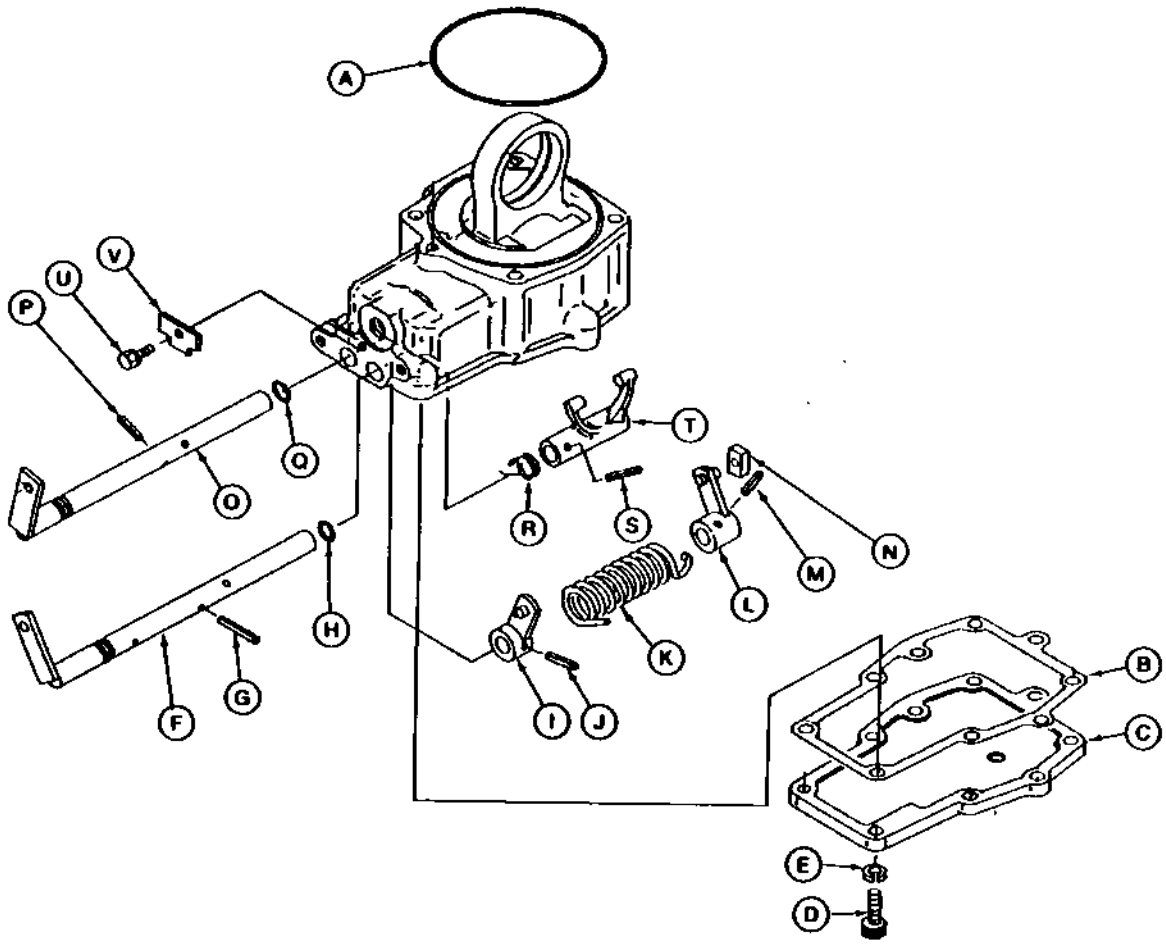
5. Clean mating surfaces of gearbox and seal case using clean and cure primer. Apply flexible sealant to mating surfaces of gearbox and case.

IMPORTANT: Install gear (N) with bevel toward gear (O).

6. Install parts (A—Q).

7. Tap on end of shaft (M) with a soft-faced mallet to seat shaft assembly and bearing (Q).

MX,5540DG,A9 -19-09OCT89



A—O-Ring
B—Gasket
C—Cover Cover
D—Socket Head Cap Screw (5 used)
E—Lock Washer (5 used)
F—Shift Shaft
G—Spring Pin
H—O-Ring
I—Switch Arm
J—Spring Pin
K—Spring
L—Shift Arm
M—Spring Pin
N—Shifter
O—Brake Shaft
P—Spring Pin
Q—O-Ring
R—Spring
S—Spring Pin
T—Brake Lever
U—Cap Screw
V—Plate

8. Apply multipurpose grease to new O-rings (H and Q).

9. Install parts (O—T).

10. Install pins (P and S).

11. Install parts (F—N).

12. Install pins (G, J and M).

13. Install plate (V) and cap screw (U).

14. Clean mating surfaces of gearbox and cover using clean and cure primer. Apply flexible sealant to mating surfaces of gearbox and cover.

15. Install gasket, cover (C), lock washers (E) and socket head cap screws (D).

16. Apply petroleum jelly on O-ring (A).

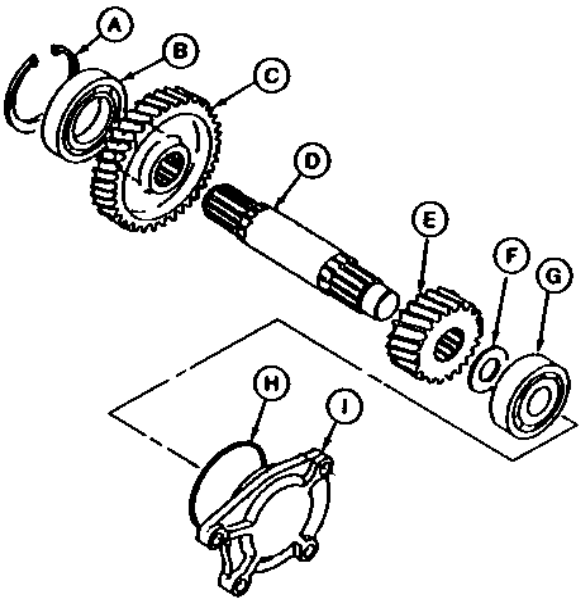
17. Install O-ring.

MX,5540DG,A10 -19-09OCT89

18. Install bearings (B and G) using a bearing, bushing and seal driver set.

19. Install parts (A—I).

A—Snap Ring
B—Ball Bearing
C—Gear
D—Idle Shaft
E—Gear
F—Spacer
G—Ball Bearing
H—O-Ring
I—Cover



M53542 -UN-20NOV89

55
40
10

MX,5540DG,A11 -19-09OCT89

Section 60
STEERING AND BRAKE REPAIR

Contents

Page

Group 05—Manual Steering
Other Materials 60-05-1
Service Parts Kits 60-05-1
Steering Column Assembly
  Remove and Install. 60-05-2
  Disassemble, Inspect and Assemble . . . 60-05-4
Adjust Steering Free Play. 60-05-5

Group 10—Power Steering
Essential Tools 60-10-1
Service Parts Kit 60-10-1
Steering Column Assembly
  Remove and Install 60-10-2
  Disassemble, Inspect and Assemble. 60-10-3
Steering Valve
  Disassemble and Inspect 60-10-3
  Assemble. 60-10-6
Steering Cylinder
  Remove and Install 60-10-10
  Disassemble, Inspect and Assemble. . . .60-10-11
Steering Pump
  Remove and Install 60-10-13
  Disassemble, Inspect and Assemble. . . .60-10-14
Remove and Install Hydraulic Lines. 60-10-16

Group 15—Brake Repair—670/770/790
Brake Pedals and Linkage
  Inspect and Repair 60-15-1
  Seat Safety Switch 40-15-1
Remove, Inspect and Install Brakes. 60-15-3

Group 20—Brake Repair—870/970/1070
Brake Pedals and Linkage
  Inspect and Repair 60-20-1
Remove, Inspect and Install Brakes. 60-20-2

OTHER MATERIAL

Number	Name	Use
TY6299	Liquid Gasket Maker	Apply to crosshaft cover gasket.
T43512	Thread Lock and Sealer (medium strength)	Apply to steering housing-to-clutch housing cap screws.

MX,6005DG,A1 -19-11MAY89

SERVICE PARTS KITS

The following kits are available through your parts catalog:

Adjusting Screw Shim Kit

MX,6005DG,A2 -19-11MAY89

REMOVE AND INSTALL STEERING COLUMN ASSEMBLY

1. For 670/770/790: Remove fuel tank. (See Section 20, Group 20.)

For 870/970: Remove engine shields and lower dash covers.

2. Remove hood. (See Section 80, Group 15.)

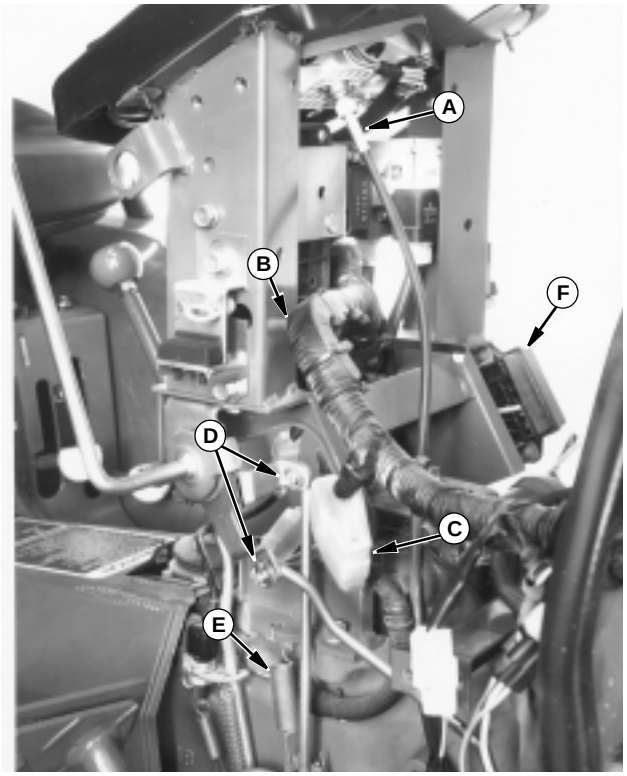
3. Remove steering wheel.

4. Disconnect cable (A), wiring harness (B), wiring connector (C), linkage (D) and spring (E).

5. Remove fuse holder (F).

6. Remove dashboard support.

A—Hour Meter Cable
B—Wiring Harness
C—Wiring Connector
D—Throttle Control Linkage
E—Throttle Control Return Spring
F—Fuse Holder



670 shown

7. Scribe a mark (A) on pitman arm in alignment with index mark on shaft (B) to aid in assembly.

IMPORTANT: When removing pitman arm, do not strike end of shaft or puller. Damage to gearbox could occur.

8. Remove pitman arm retaining nut and lock washer. Remove pitman arm using a 2-jaw puller.

9. Remove four cap screws and steering column assembly.

10. Make repairs as necessary. (See procedure in this group.)

11. Apply thread lock and sealer (medium strength) to threads of steering housing-to-clutch housing cap screws.

12. Install steering column assembly and tighten cap screws to specifications.

13. Align pitman arm to shaft. Install lock washer and nut. Tighten to specifications.

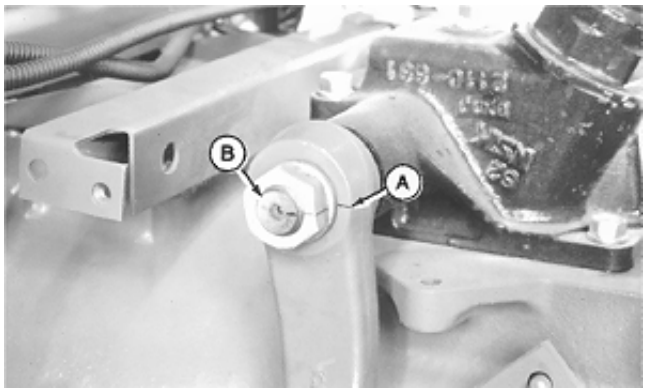
14. Install support and fuse holder.

15. Connect linkage, spring, wiring harness and cable.

16. Install steering wheel. Tighten lock nut to specifications.

17. Adjust steering free play. (See procedure in this group.)

18. Install covers and shields.



670 Shown

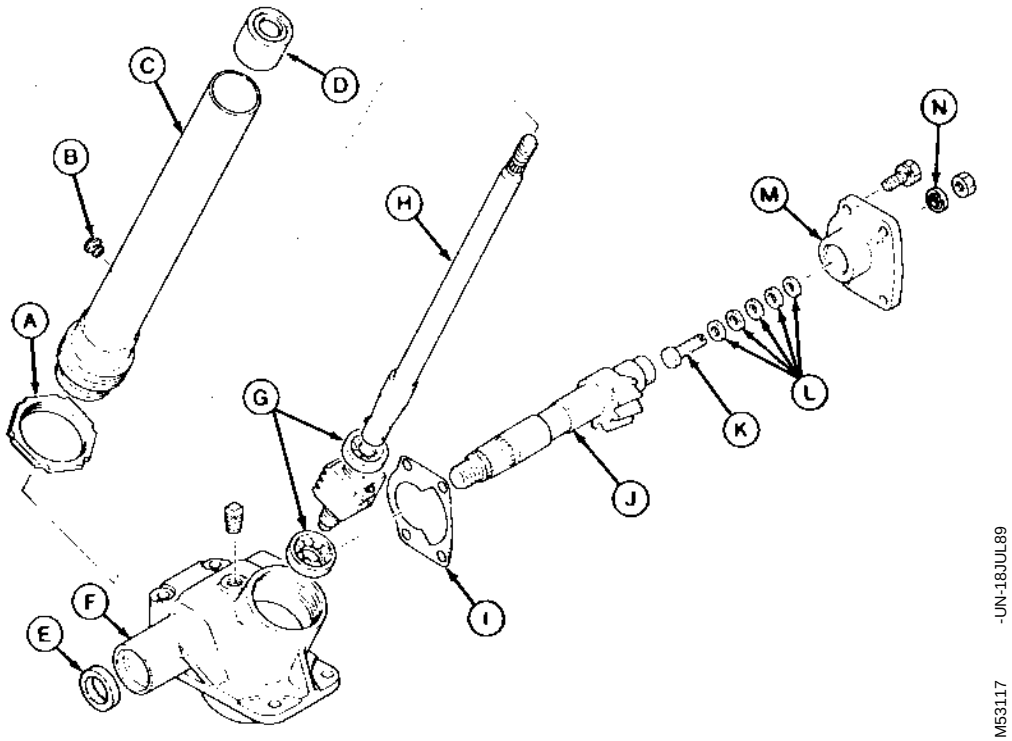
TORQUE SPECIFICATIONS

Steering Housing-to-Clutch Housing Cap Screws	108 N·m (80 lb-ft)
Pitman Arm Retaining Nut	172 N·m (127 lb-ft)
Steering Wheel Lock Nut	27 N·m (20 lb-ft)

60 05 3

MX,6005DG,A4 -19-11MAY89

DISASSEMBLE, INSPECT AND ASSEMBLE STEERING COLUMN ASSEMBLY



A—Nut
B—Plug
C—Column
D—Bushing
E—Seal
F—Housing
G—Bearings
H—Shaft
I—Gasket
J—Cross Shaft
K—Adjusting Screw
L—Shims
M—Cover
N—Seal

60
05
4

NOTE: Steering gear housing need not be removed unless there is damage to the housing casting.

1. Remove steering column assembly, if necessary. (See procedure in this group.)

2. Remove cover (M) and cross shaft (J).

3. Remove nut (A), column (C) and shaft (H).

4. Inspect all parts for cracks, damage or excessive wear. Replace as necessary.

5. Replace seals (E and N) using a bushing, bearing and seal driver set. Apply multipurpose grease to inside of seal lips.

6. Assemble housing. Fill housing with multipurpose grease. (See Section 10, Group 20.)

IMPORTANT: Before tightening cover cap screws, be sure adjusting screw (K) is loose. Damage to cross shaft may occur.

7. Apply liquid gasket maker to new gasket (I).

8. Install gasket and cover. Tighten cap screws to 26 N·m (226 lb-in.).

9. Install steering housing, if removed.

10. Adjust steering free play. (See procedure in this group.)

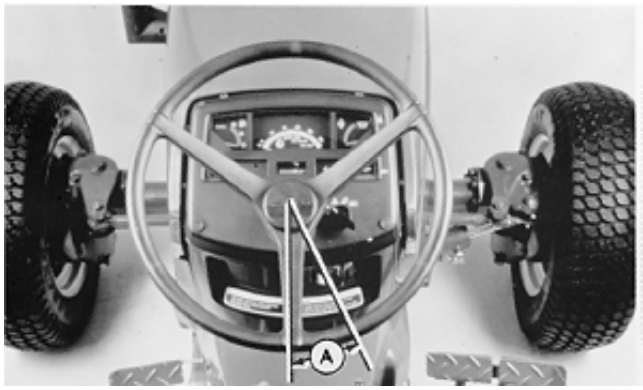
MX,6005DG,A5 -19-11MAY89

ADJUSTING STEERING FREE PLAY

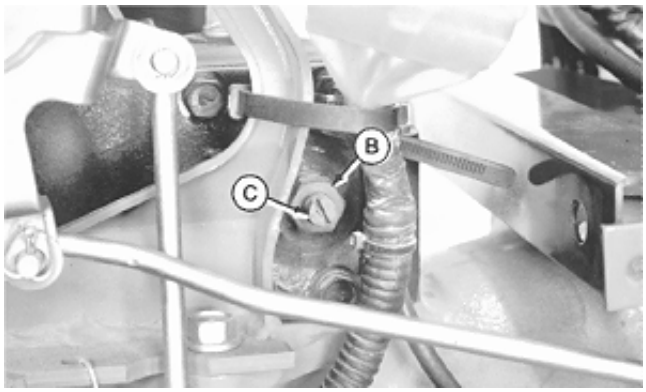
1. With front wheels in the straight ahead position, move steering wheel back and forth until slight movement of pitman arm is seen. Maximum play (A) of steering wheel measured at outer rim should be 20—50 mm (1.0—2.0 in.).

2. Free play is adjusted by loosening lock nut (B) and turning adjusting screw (C) clockwise to reduce play and counterclockwise to increase play. Tighten lock nut.

NOTE: Standard adjustment of steering gear is a quarter-turn counterclockwise when steering wheel becomes hard to turn as steering gear passes over center position.



M53118 -UN-12FEB90



M53132 -UN-18JUL89

MX,6005DG,A6 -19-11MAY89

ESSENTIAL TOOLS

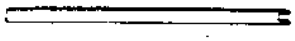
NOTE: Order tools from your SERVICE-GARD™ Catalog. Some tools may be available from a local supplier.

O53,TOOLS -19-13JUL88

T6514DC -UN-23AUG88

Steering Spring Installer KML10018-3

Install springs.



53T,KML100,183 -19-10SEP87

SERVICE PARTS KITS

The following kits are available through your parts catalog:

Steering Valve Seal Kit

MX,6010DG,A1 -19-05SEP89

60
10
1

REMOVE AND INSTALL POWER STEERING COLUMN ASSEMBLY

11. Remove throttle control linkage. (See Section 20, Group 15.)

12. Remove steering wheel.

13. Remove rubber boot (A).

14. Remove banjo connectors (D and E) and washers (C). Close all openings with caps and plugs.

15. Remove tie strap (B).

16. Disconnect wiring harness (F).

17. Remove four cap screws (G) and steering column assembly.

18. Make repairs as necessary. (See procedure in this group.)

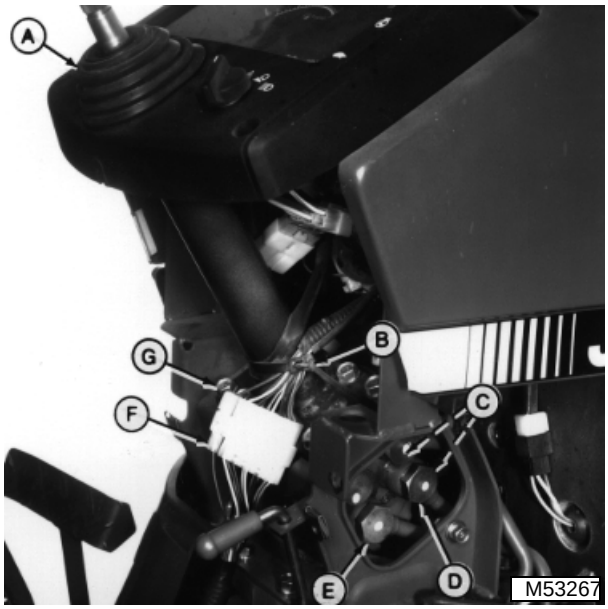
19. Install steering column assembly and tighten cap screws to 108 N•m (80 lb-ft).

IMPORTANT: There must be one copper washer on each side of banjo connector when connecting lines.

20. Connect hydraulic lines with banjo connectors and new washers.

21. Connect wiring harness.

22. Install tie strap, rubber boot and steering wheel.



A-Rubber Boot
B-Tie Strap
C-Washers (8 used)
D-Banjo Connector (3 used)
E-Banjo Connector; Early—Check Valve
F-Rear Wiring Harness
G-Capscrew (4 used)

DISASSEMBLE, INSPECT AND ASSEMBLE POWER STEERING COLUMN ASSEMBLY

1. Remove steering valve. (For valve repair, see procedure in this group.)

2. Remove snap ring (J) to remove parts (C—I).

3. Replace seal (A) using a bushing, bearing and seal driver set.

4. Inspect all parts for cracks, damage or excessive wear. Replace as necessary.

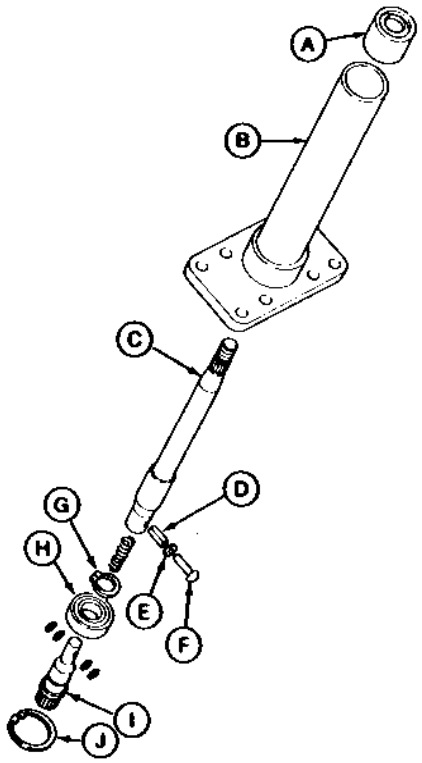
5. Apply multipurpose grease to inside lips of seal (A) and to gear teeth of shaft (I).

6. Assemble all parts.

7. Install new seal (A) flush with top of steering column.

8. Install steering valve.

A—Seal
B—Column
C—Shaft
D—Spring Pin
E—Washer
F—Pin
G—Snap Ring
H—Ball Bearing
I—Shaft
J—Snap Ring



-UN-20NOV89
M53268

60
10
3

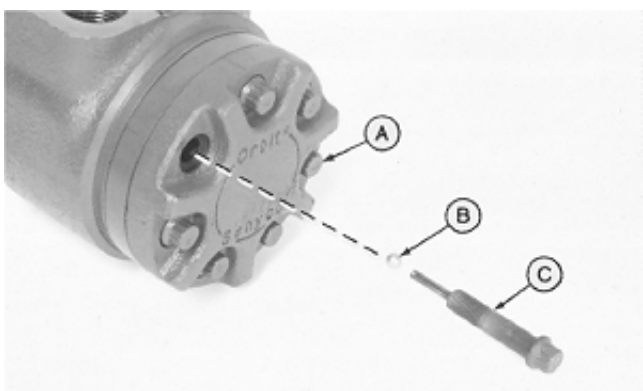
MX,6010DG,A3 -19-05SEP89

DISASSEMBLE AND INSPECT POWER STEERING VALVE

1. Remove cap screw (C).

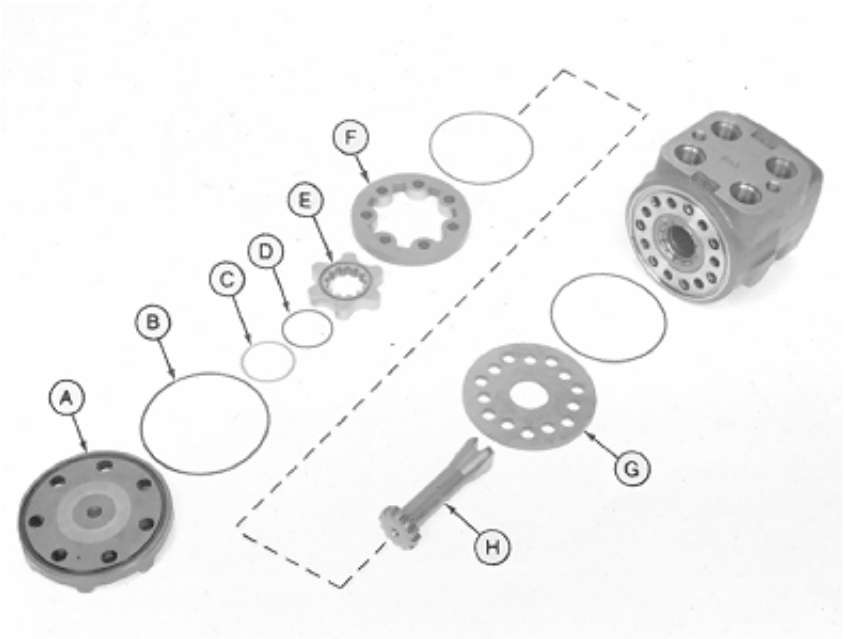
2. Tip valve over to remove ball (B).

3. Put valve in a soft-jawed vise and remove six cap screws (A).



-UN-20NOV89
M53269

MX,6010DG,A4 -19-05SEP89



A—Cap
B—O-Ring (3 used)
C—Seal
D—O-Ring
E—Cam
F—Gerotor
G—Wear Plate
H—Drive Shaft

NOTE: Be careful not to drop cam (E) when removing gerotor (F).

4. Remove parts (A—H).

60
10
4

MX,6010DG,A5 -19-05SEP89

5. Remove valve from soft-jawed vise.

6. Pry ring (H) from valve housing using a screwdriver.

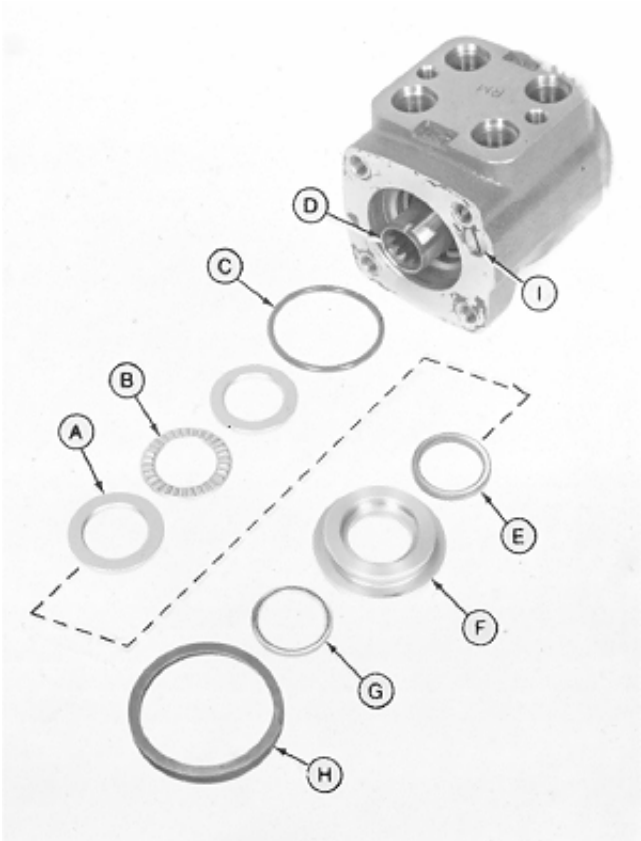
7. While rotating spool and sleeve (D), push assembly toward top of housing just enough to unseat bushing (F).

8. Remove parts (A—C) and (E—G).

IMPORTANT: Relief valve (I) is non-serviceable. DO NOT remove.

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

A—Bearing Race (2 used)
B—Thrust Bearing
C—O-Ring
D—Spool and Sleeve
E—Ring Seal
F—Seal Gland Bushing
G—Dust Seal
H—Retaining Ring
I—Relief Valve



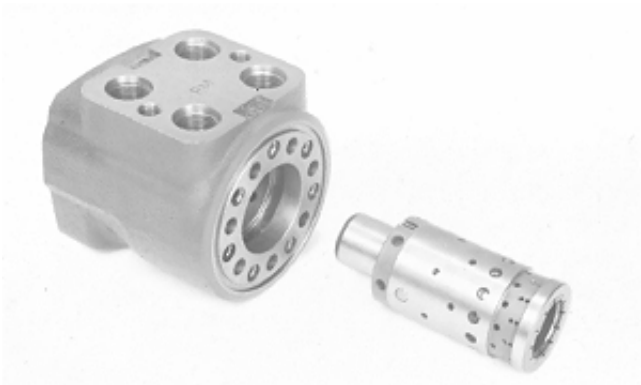
M53271 -UN-20NOV89

MX,6010DG,A6 -19-05SEP89

NOTE: Housing, spool and sleeve are serviced as an assembly.

IMPORTANT: If it is necessary to remove spool and sleeve from housing for cleaning, be careful to prevent these parts from binding. Tolerances in this area are very close and when replacement is necessary the spool, sleeve and housing must be ordered as an assembly.

10. Rotate spool and sleeve to remove from bottom of housing.



M53272 -UN-20NOV89

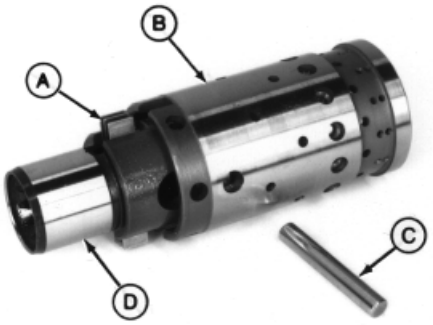
MX,6010DG,A7 -19-05SEP89

11. Remove pin (C).

12. Push spool (D) forward in sleeve (B) and remove centering springs (A).

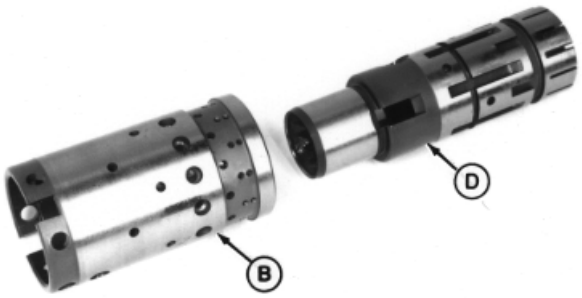
13. Push spool back through sleeve to remove.

14. Inspect parts for excessive wear or damage. Replace as necessary.



M53273

A-Centering Spring Set (6 used)
B-Sleeve
C-Pin
D-Spool



M53274

ASSEMBLE POWER STEERING VALVE

NOTE: A seal kit is available for steering valve repair.

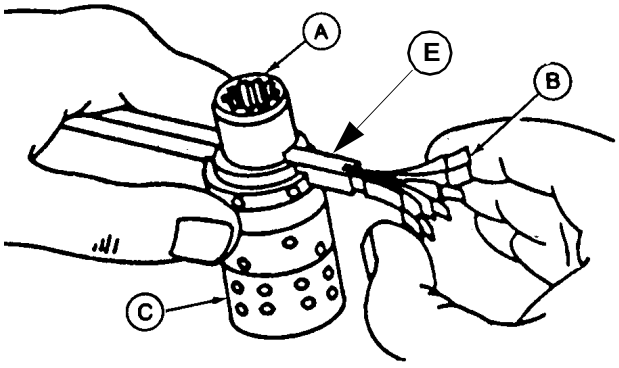
1. Apply clean transmission/hydraulic oil to all internal parts.

2. Assemble spool (A) and sleeve (C) with centering spring (B) slots aligned. Check that spool rotates smoothly in sleeve.

3. Insert KML10018-3 Spring Installation Tool (E) through spring slot. Install one end of spring set extended edges (D) down and arched centers together, into tool.

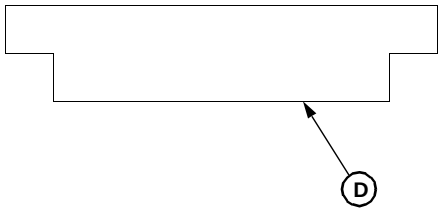
4. Compress spring set and push into spring slot while withdrawing tool. Install spring set flush with outer surface of spool and sleeve.

5. Install pin.

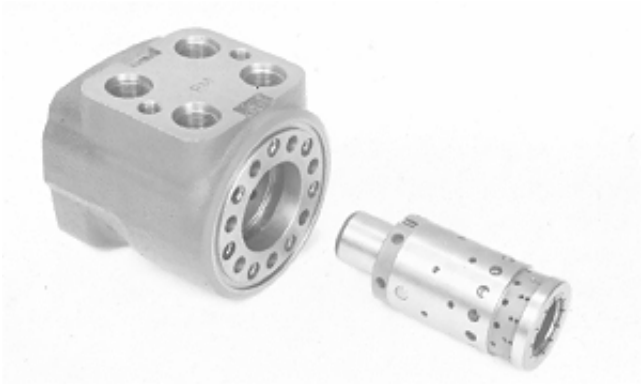


M53275

A-Spool
B-Centering Spring Set (6 used)
C-Sleeve
D-Extended Edges
E-Spring Installation Tool



6. Rotate spool and sleeve while installing into housing.



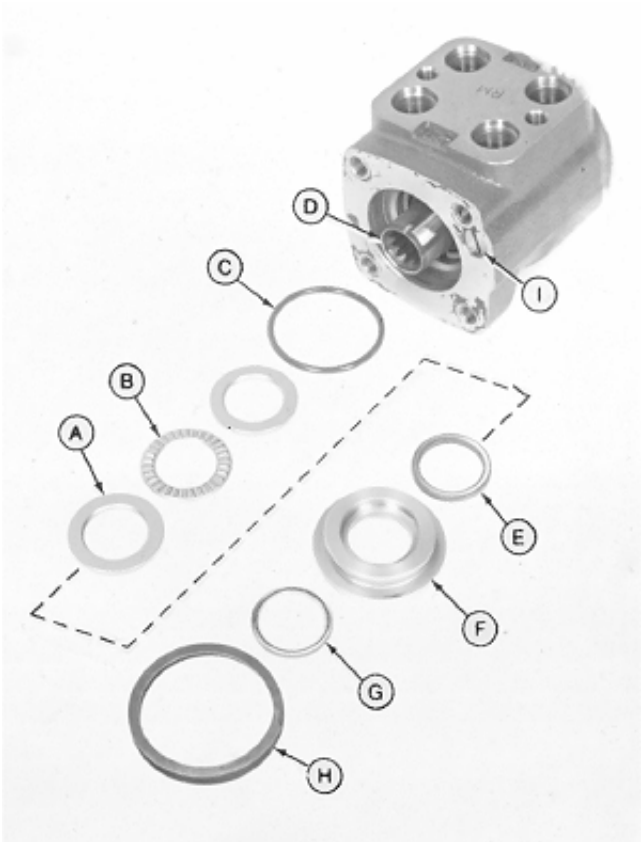
M53272 -UN-20NOV89

MX,6010DG,A10 -19-05SEP89

NOTE: Install dust seal (G) with flat side facing bushing (F).

7. Install parts (A—C) and (E—H).

A—Bearing Race (2 used)
B—Thrust Bearing
C—O-Ring
D—Spool and Sleeve
E—Ring Seal
F—Seal Gland Bushing
G—Dust Seal
H—Retaining Ring
I—Relief Valve



M53271 -UN-20NOV89

MX,6010DG,A11 -19-05SEP89

8. Put valve in a soft-jawed vise.

9. Apply petroleum jelly to all O-rings to hold in place during assembly.

10. Install O-ring (E) and wear plate (F).

11. Install drive shaft (D), engaging slotted end to pin.

12. Assemble gerotor and cam. Install O-ring in gerotor.

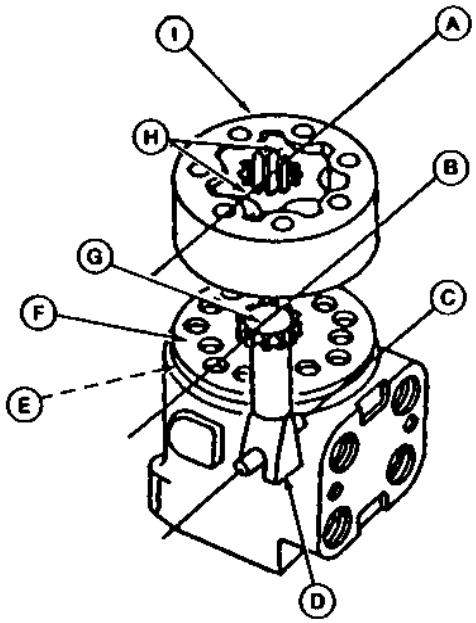
IMPORTANT: Violent steering wheel oscillation can occur if gerotor is not timed. For correct operation the drive shaft must be installed so slotted end is in alignment with one of the gerotor cam valleys.

13. With O-ring side of gerotor (I) toward housing, align star valleys (H) with marks (G) and install. Check alignment of reference lines (A, B and C).

14. Install O-ring and seal on gerotor cam.

15. Align cap screw holes without disengaging gerotor from drive shaft.

16. Install O-ring and end cap.



M53501 -UN-20NOV89

A—Gerotor Cam Valley Reference Line
B—Drive Shaft Mark Reference Line
C—Pin Location Reference Line
D—Drive Shaft
E—O-Ring
F—Wear Plate
G—Drive Shaft Marks
H—Gerotor Cam Valleys
I—Gerotor

MX,6010DG,A12 -19-05SEP89

60
10
8

17. Install cap screws (A) finger tight.

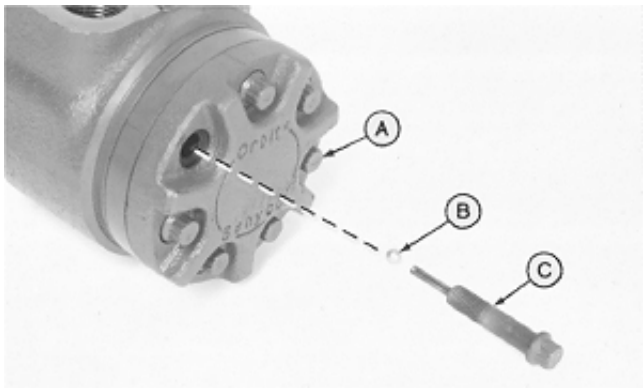
18. Install steel ball (B) and cap screw (C).

19. Tighten cap screws using sequence shown.

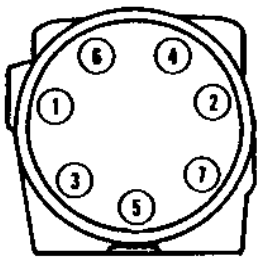
TORQUE SPECIFICATIONS

Initial Sequence . . . . . 11 N·m (95 lb-in.)

Final Sequence . . . . . 21 N·m (182 lb-in.)



M53269 -UN-20NOV89

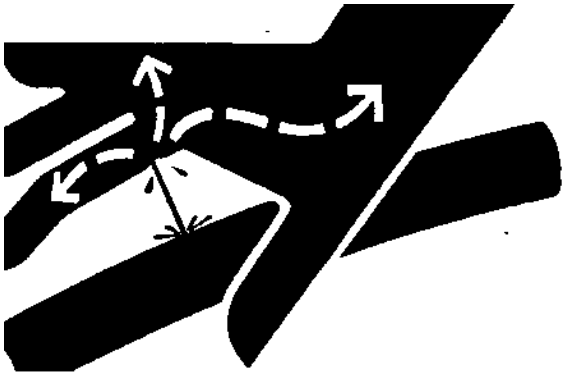


M53502 -UN-20NOV89

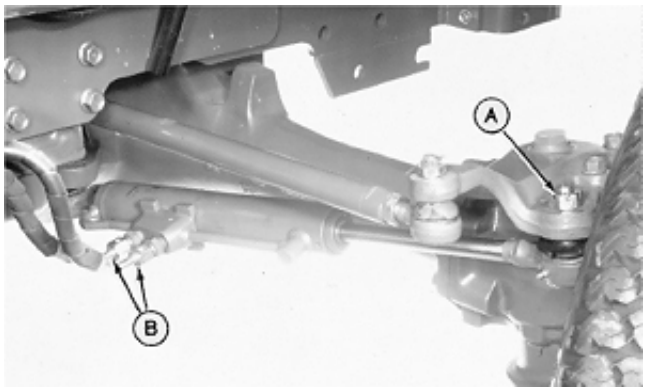
MX,6010DG,A13 -19-05SEP89

60
10
9

REMOVE AND INSTALL POWER STEERING CYLINDER



-UN-23AUG88 X9811



-UN-20NOV89 M53503

970 With MFWD Shown

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.

1. Disconnect hydraulic lines (B). Close all openings with caps and plugs.

2. Remove cotter pin and nut (A) from each end of cylinder.

3. Remove cylinder.

60 10 10

4. Make repairs as necessary. (See procedure in this group.)

5. Install cylinder and nuts. Tighten nuts to 128 N·m (94 lb-ft). Install cotter pin.

6. Connect hydraulic lines.

MX,6010DG,A14 -19-05SEP89

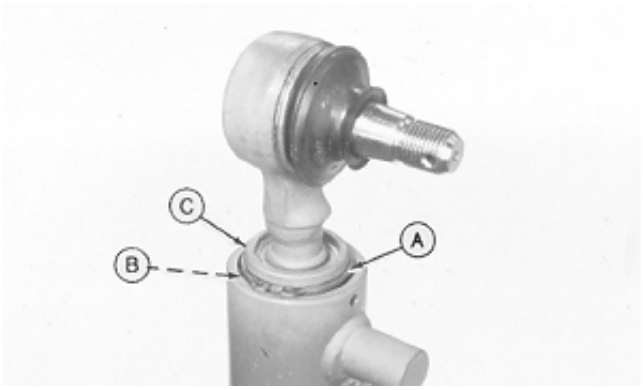
DISASSEMBLE, INSPECT AND ASSEMBLE POWER STEERING CYLINDER

NOTE: Two and four wheel drive steering cylinder repair is the same.

1. Remove snap ring (A).

2. Use a hammer and brass drift to push cap (C) past circlip (B). Remove circlip.

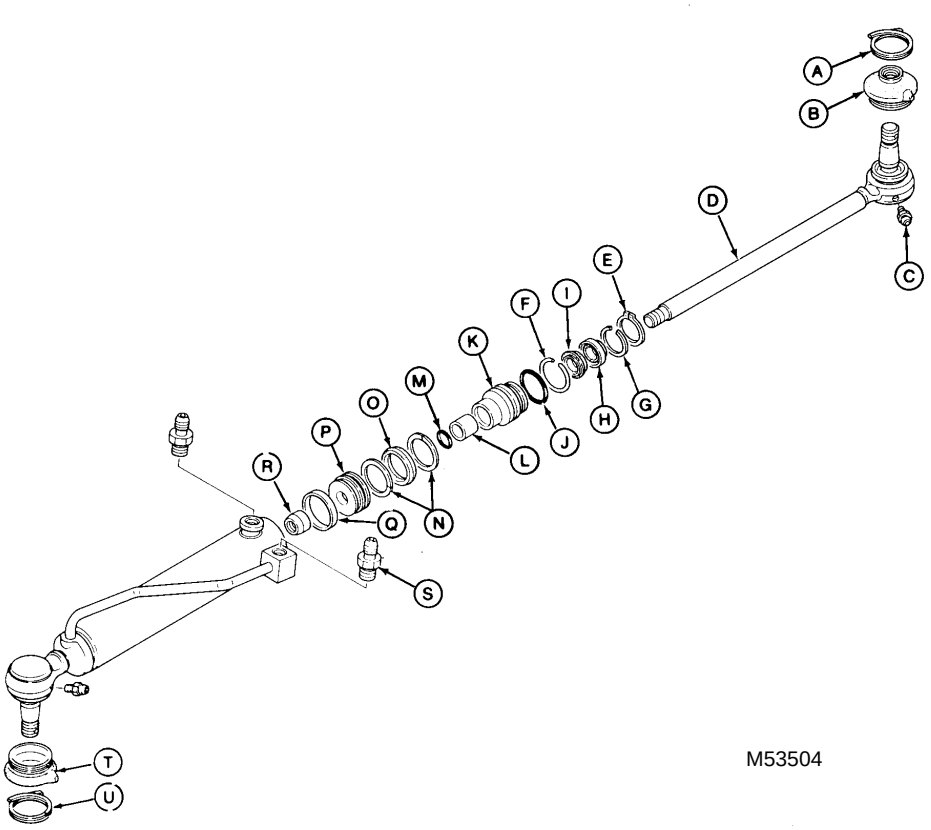
3. Remove rod assembly from cylinder barrel.



M53505 -UN-20NOV89

MX,6010DG,A15 -19-05SEP89

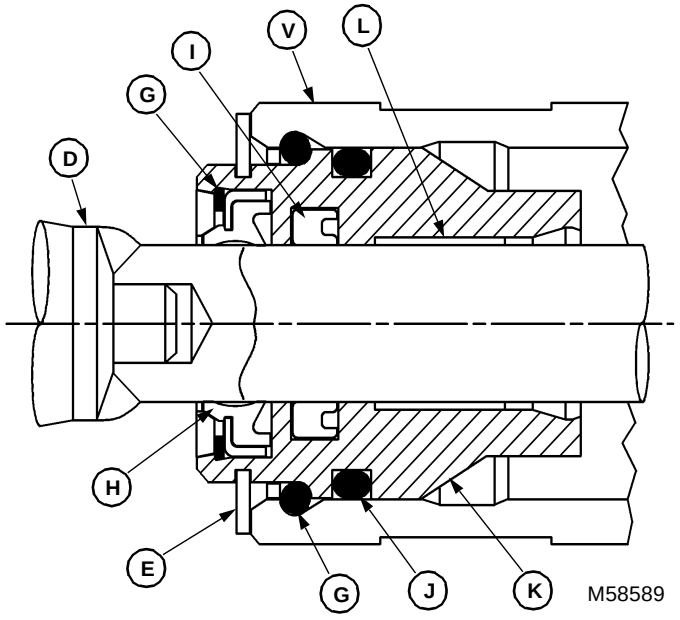
60
10
11



M53504

A-Cover Ring
B-Cover
C-Grease Fitting (2 used)
D-Cylinder Rod
E-Snap Ring (External)
F-Ring
G-Snap Ring (Internal)
H-Scraper
I-Seal
J-Packing
K-Cap
L-Bushing
M-Packing
N-Back-up Ring
O-Seal
P-Piston
Q-Wear Ring
R-Lock Nut
S-Fitting (2 used)
T-Cover
U-Cover Ring
V-Cylinder Barrel

4. Put rod assembly in a soft-jawed vise and remove lock nut (R).
5. Remove parts (G—Q).
6. Remove bushing (L) using a blind hole puller.
7. Inspect all parts for wear or damage. Replace as necessary.
8. Install new packing and seals.
9. Apply clean hydraulic oil to all internal parts during assembly.
10. Install bushing (L) and scraper (H) using a bushing, bearing and seal driver set.
11. Assemble all parts. Tighten lock nut (R) to 61 N•m (45 lb-ft).
12. Install rod assembly into cylinder barrel (V).
13. Install scraper (H) and internal snap ring (G).



M58589

REMOVE AND INSTALL POWER STEERING PUMP

1. Remove left-hand engine shield.

2. Remove flange (A) and line (C). Close all openings with caps and plugs.

3. On 770/790/870/970/1070, remove cap screws (B) and nuts (D). Remove pump and gasket.

On 670, remove four cap screws.

4. Make repairs as necessary.

5. Install pump and new gasket. Tighten cap screws and nuts to specifications.

6. Install new O-rings on flange and line.

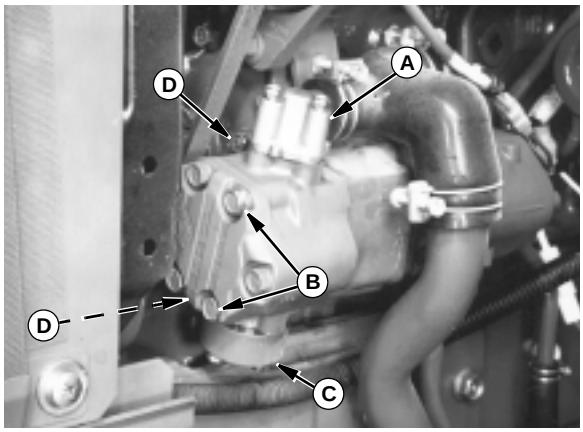
7. Install flange and line. Tighten to specifications.

8. Install left-hand engine shield.

TORQUE SPECIFICATIONS

Pump Mounting Cap Screws . . . . . 26 N•m (226 lb-in)

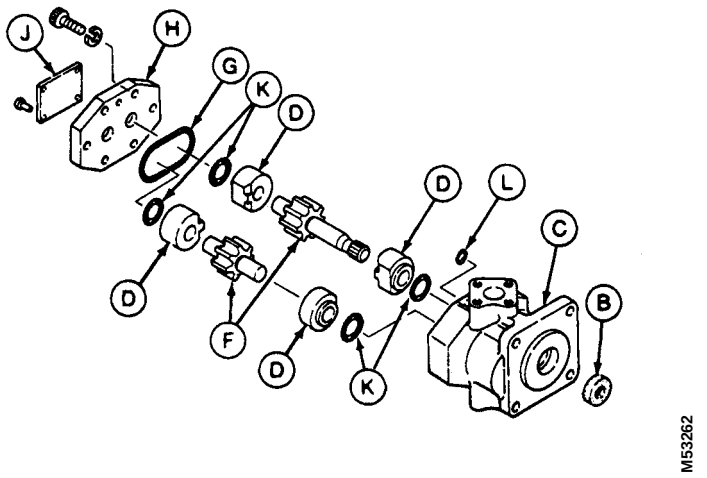
Flange (A) and Line (C) Cap Screws . . . . 6 N•m (53 lb-in)



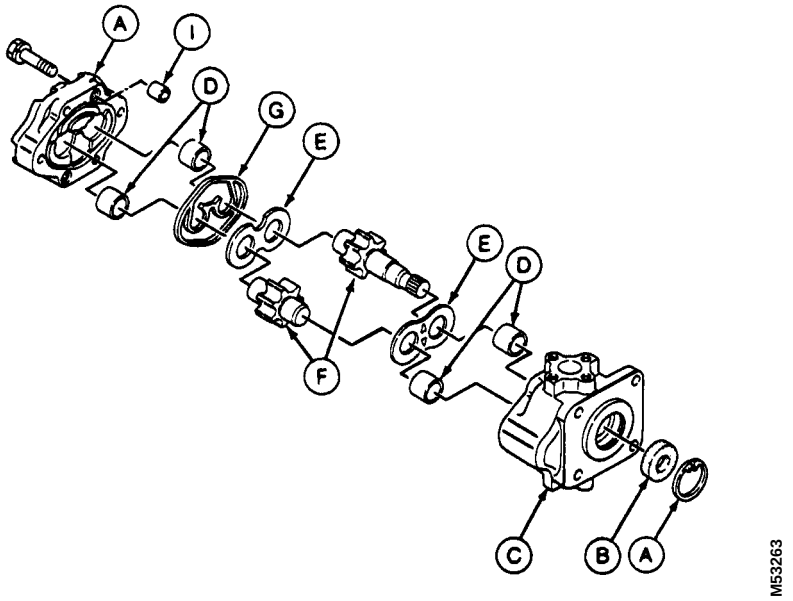
970 shown

A—Suction Line Mounting Flange
B—Cap Screws
C—Pressure Line
D—Nuts

DISASSEMBLE, INSPECT AND ASSEMBLE POWER STEERING PUMP



670



770/790/870/970/1070

A—Snap Ring
B—Seal
C—Pump Housing
D—Bushings
E—Bearing Plate
F—Pump Shafts
G—Packing
H—Cover
I—Alignment Pin (2 used)
J—Plate
K—O-Rings (4 used)
L—O-Ring

IMPORTANT: Disassemble pump in a clean area. Keep individual components together as matched sets.

1. Scribe a mark across the housing and cover to aid in assembly.

2. Remove cover (H).

3. Check shafts (F), bushings (D), plates (E) and housing (C) for scoring or excessive wear. Replace if necessary.

4. Remove snap ring (A), if equipped, and seal (B).

5. Install new seal using a bushing, bearing and seal driver set. Apply multipurpose grease to seal lips.

6. Install snap ring.

7. Install new packing (G) and O-rings (K and L), if equipped. Apply a light coat of grease to hold in place.

IMPORTANT: Apply clean transmission/hydraulic oil to all internal parts before assembly. Premature pump failure can result if pump is assembled dry.
On 770/790/870/970/1070: Plates (E) must be installed with brass side facing pump shaft gears and oil groove positioned toward IN side of cover.

8. Assemble pump.

9. Align cover and housing with mark made during disassembly. Install cap screws and tighten to 15 N•m (133 lb-in.).

REMOVE AND INSTALL POWER STEERING HYDRAULIC LINES

NOTE: 670/770/790 shown. 870/970/1070 is similar.

1. Remove throttle control lever assembly. (See Inspect and Repair Throttle Control Linkage in Section 20, Group 15.)

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.

2. Lower rockshaft arms.

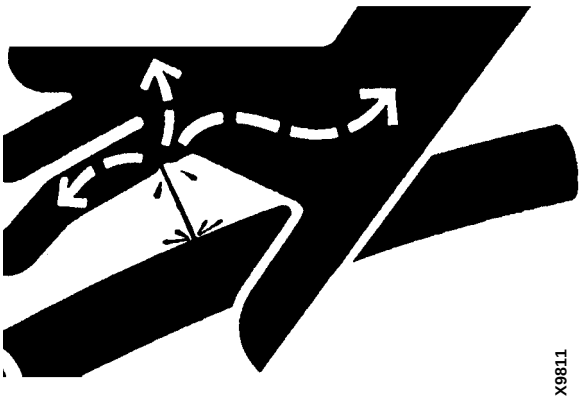
3. Remove left-hand lower dash cover.

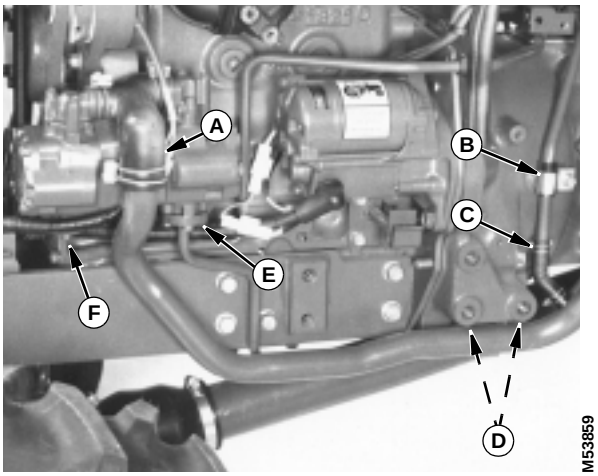
4. Remove line clamps (B and D).

5. Disconnect flanges (E and F).

6. Disconnect hoses (A and C). Close all openings with caps and plugs.

7. 870/970/1070: Remove air shield mounting cap screws.





A—Hydraulic Pump Suction Hose

B—Line Clamp

C—Power Steering Valve Return Hose

D—Line Clamps

E—Hydraulic Pump Pressure Line Flange

F—Power steering Hydraulic Pump Pressure Line Flange

8. Remove line clamp (D).

9. Disconnect lines (C). Close openings with caps and plugs.

NOTE: Banjo connector (B) also acts as a filter.

10. Remove banjo connectors and washers (A and B).

11. Remove lines.

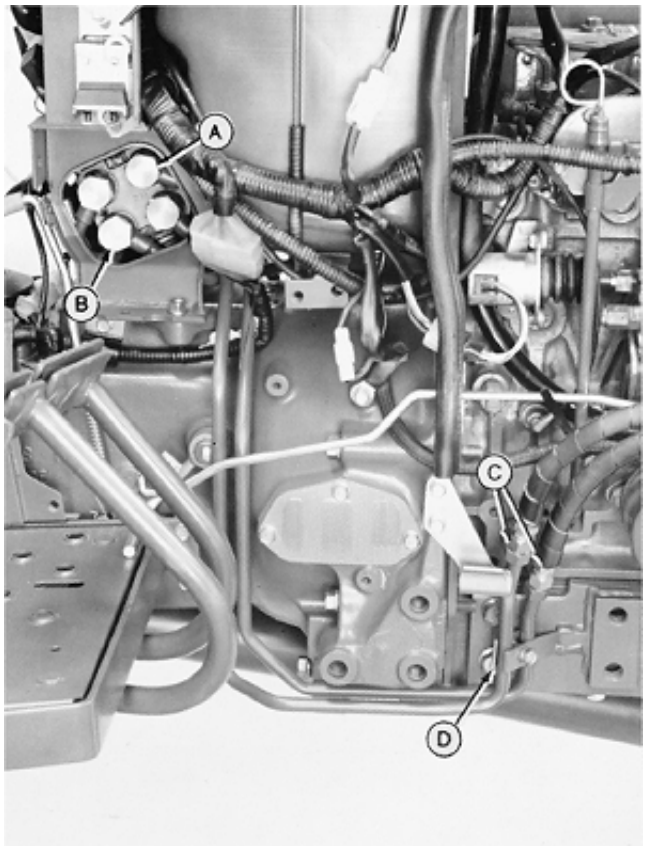
IMPORTANT: There must be one copper washer on each side of banjo connector when installing connectors.

12. Install hydraulic lines, banjo connectors and washers.

13. Connect all hoses and flanges. Tighten cap screws to 6 N·m (53 lb-in.).

14. Install line clamps.

15. 870/970/1070: Install air shield mounting cap screws.



M53860 -UN-20NOV89

A—Banjo Connector (3 used)
B—Banjo Connector/Filter
C—Power Steering Cylinder Hydraulic Lines
D—Line Clamp

60 10 17

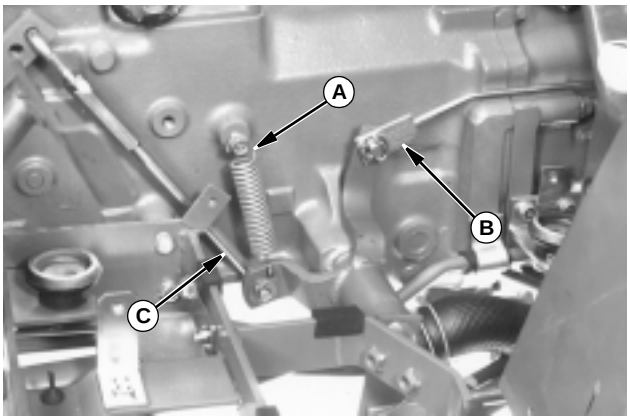
MX,6010DG,A21 -19-08NOV89

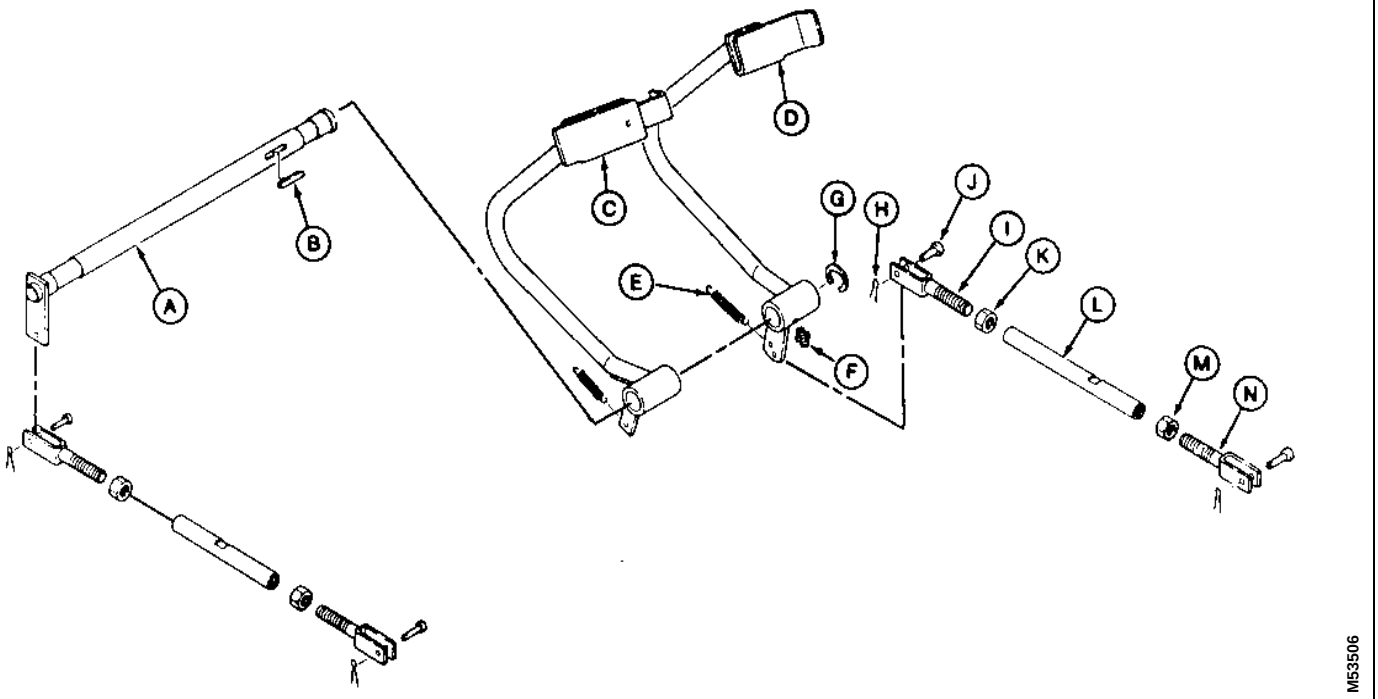
INSPECT AND REPAIR BRAKE PEDALS AND LINKAGE

1. Remove step plates.

2. Disconnect clutch pedal spring (A) and link rods (B and C).

3. Remove hydraulic oil filter assembly, if equipped. (See Section 70, Group 05.)





A—Shaft
B—Key
C—Left-Hand Pedal
D—Right-Hand Pedal
E—Spring (2 used)
F—Lubrication Fitting
G—E-Clip
H—Pin (4 used)
I—Yoke (2used)
J—Pin (4 used)
K—Nut (2 used)
L—Turnbuckle (2 used)
M—Nut (2 used)
N—Yoke (2 used)

4.Disconnect springs (E).

5. Remove pins (H and J) to disconnect brake linkage.

6. Remove e-clip (G), shaft (A) and pedals (C and D).

7. Inspect parts for wear or damage. Replace as necessary.

8. Install all parts.

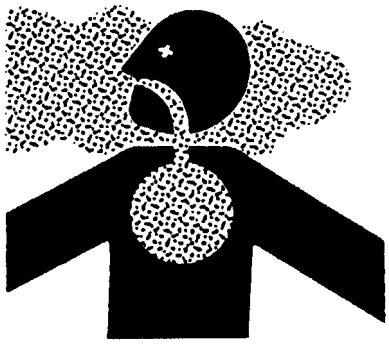
9. Connect linkages and springs.

10. Apply multipurpose grease to all lubrication fittings.

11. Adjust clutch pedal free-play. (See Section 250, Group 15.)

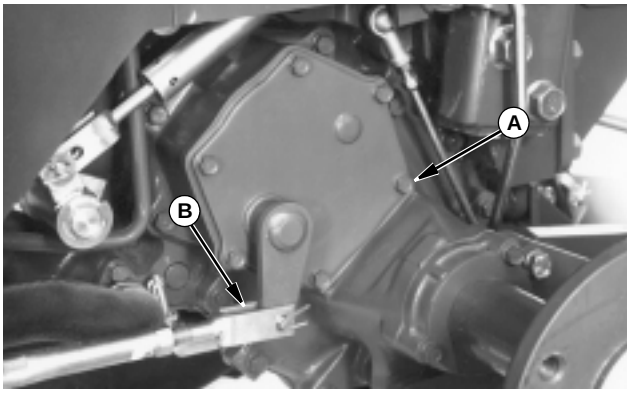
12. Adjust brake pedal free-play and linkage. (See Section 260, Group 15.)

REMOVE, INSPECT AND INSTALL BRAKES



TS220

CAUTION: Avoid breathing dust that may be generated when handling components containing asbestos fibers. Inhaled asbestos fibers may cause lung cancer. 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 of asbestos containing materials. When servicing, wear an approved respirator. A special vacuum cleaner is recommended to clean asbestos. If not available, wet the asbestos containing materials with a mist of oil or water. Keep bystanders away from the area.



M53507

1. Remove rear wheel.

2. Disconnect linkage (B).

3. Remove six cap screws and lock washers (A) to remove cover and brake shoe assembly.

4. Remove snap ring (H) and washer (J), if equipped.
5. Disassemble parts (A—G).

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

7. Install new O-rings and gasket.

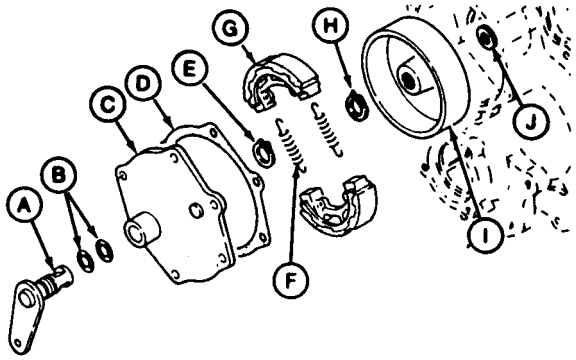
8. Apply multipurpose grease to splined inside diameter of brake drum.

9. Assemble all parts.

10. Install gasket, cover and brake shoe assembly.

11. Connect linkage.

12. Install rear wheel. Tighten cap screws to 190 N•m (140 lb-ft).

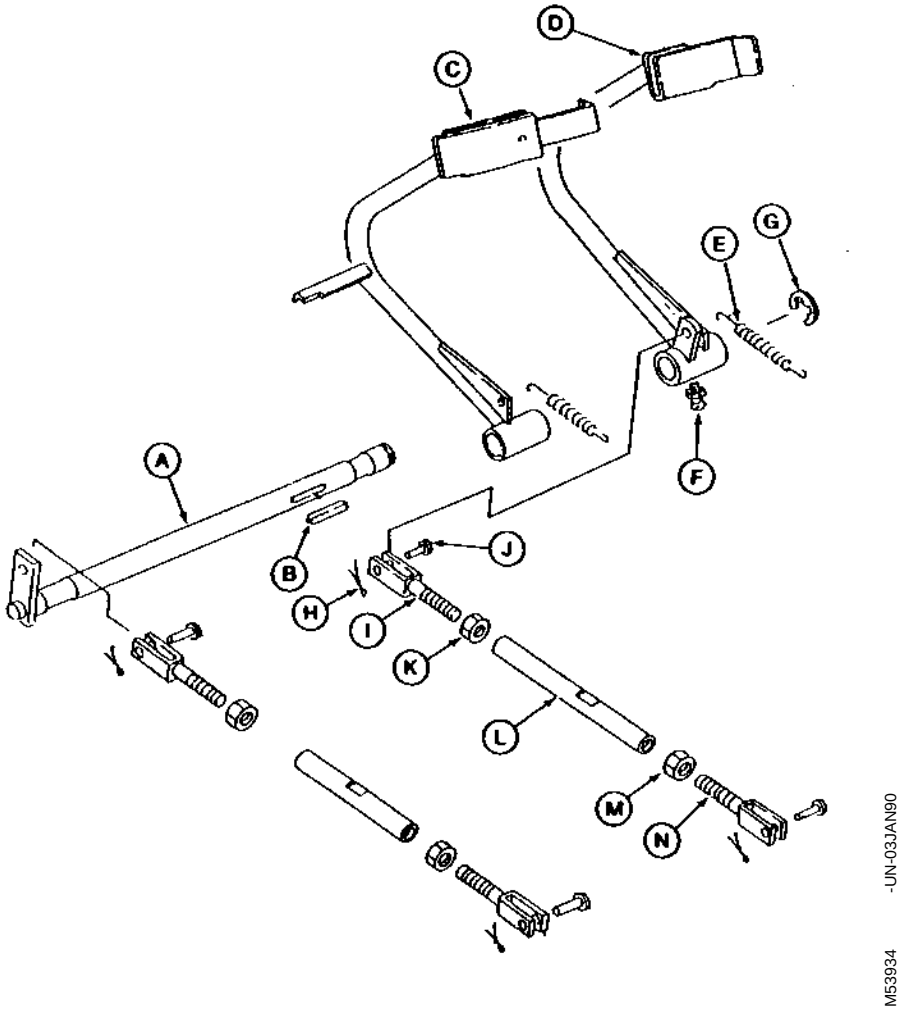


M53508

670 Left-Hand Side Shown

A—Cam Lever
B—O-Rings
(2 used on 670)
(1 used on 770/790)
C—Cover
D—Gasket
E—Snap Ring
F—Spring (2 used)
G—Brake Shoe (2 used)
H—Snap Ring
I—Brake drum
J—Washer

INSPECT AND REPAIR BRAKE PEDALS AND LINKAGE



A—Shaft
B—Key
C—Left-Hand Pedal
D—Right-Hand Pedal
E—Spring (2 used)
F—Grease Fitting
G—E-Clip
H—Pin (4 used)
I—Yoke (2 used)
J—Pin (4 used)
K—Nut (2 used)
L—Turnbuckle (2 used)
M—Nut (2 used)
N—Yoke (2 used)

1. Remove step plates.

2. Disconnect clutch pedal spring and linkage.

3. Remove hydraulic oil filter assembly, if equipped. (See Section 70, Group 05.)

4. Disconnect springs (E).

5. Remove pins (H and J) to disconnect brake linkage.

6. Remove e-clip (G), shaft (A) and pedals (C and D).

7. Inspect parts for wear or damage. Replace as necessary.

8. Install all parts.

9. Connect linkages and springs.

10. Apply multipurpose grease to all grease fittings.

11. Adjust clutch pedal free-play. (See Section 255, Group 15.)

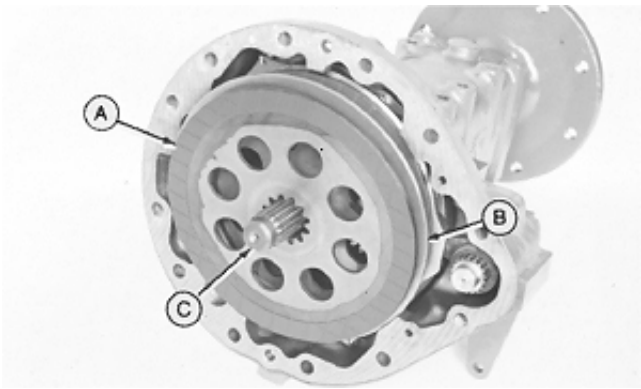
12. Adjust brake pedal free-play and linkage. (See Section 260, Group 15.)

MX,6020DG,A1 -19-14DEC89

REMOVE, INSPECT AND INSTALL BRAKES

1. Remove final drive assembly. (See procedure in Section 55, Group 25.)

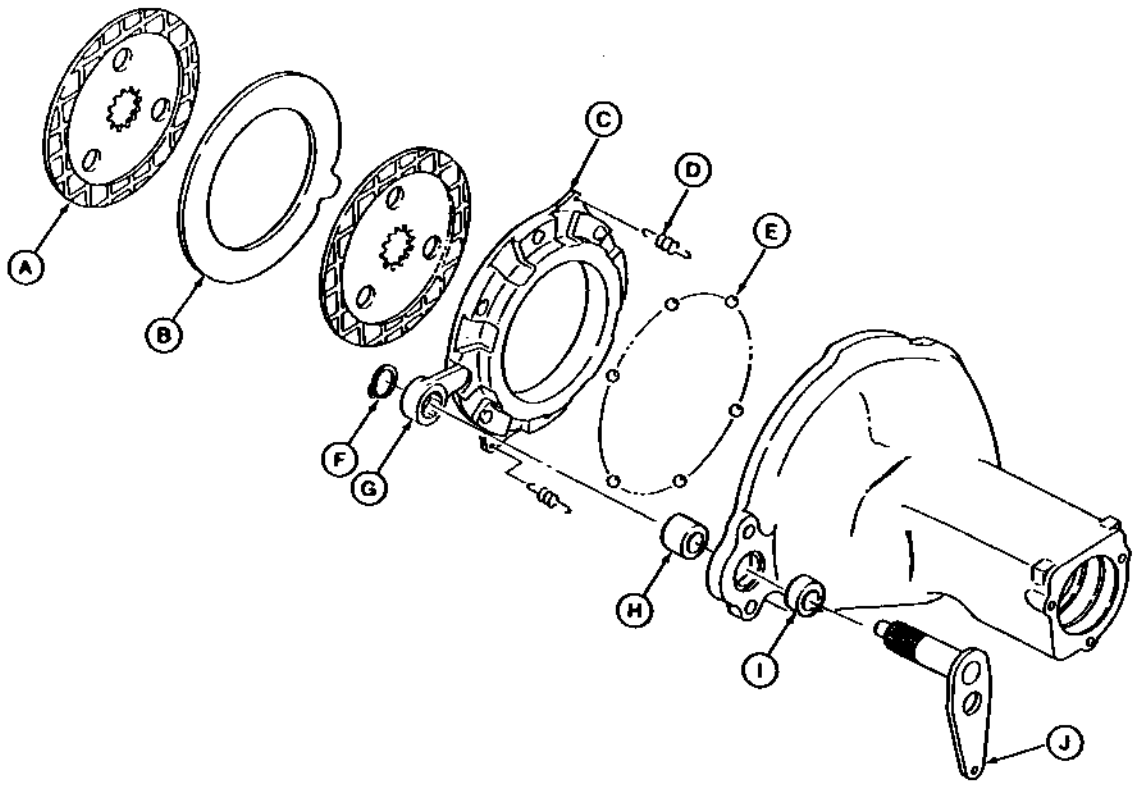
2. Remove friction disks (A), friction plates (B) and drive shaft (C).



M53887 -UN-07DEC89

MX,6020DG,A2 -19-19DEC89

60
20
2



M53888 -UN-07DEC89

A—Friction Disk (as required)
B—Friction Plate (as required)
C—Actuator
D—Spring (2 used)
E—Steel Ball (6 used)
F—Snap Ring
G—Cam Lever
H—Bushing
I—Seal
J—Cam Lever Shaft

NOTE: Balls (E) will fall out of final drive assembly when disconnecting springs.

3. Disconnect springs (D) to remove actuator (C) and balls (E).

4. Remove parts (F—J).

Replace seal (I) using a bearing, bushing and seal driver set.

5. Inspect parts for wear or damage. Replace as necessary.

6. Apply multipurpose grease to inside lips of seal.

7. Apply petroleum jelly to hold balls (E) in place during installation of actuator.

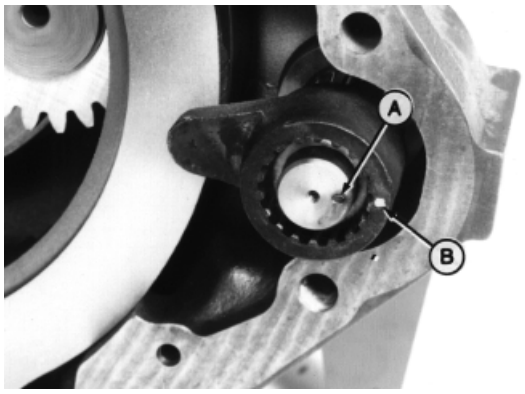
MX,6020DG,A3 -19-25NOV89

IMPORTANT: Align match marks on cam lever and shaft during installation.

8. Left-hand side—Install cam lever with match mark (B) in alignment to cam lever shaft match mark (A).

9. Right-hand side—Install cam lever with match mark (B) aligned 180° apart to cam lever shaft match mark (A).

10. Install all parts.



M53889

IMPORTANT: Align friction plates with final drive housing.

11. Install friction plate(s) with tab (A) in alignment with final drive housing.

12. Install drive shaft, friction plates and friction disks.

13. Install final drive assembly. (See procedure in Section 55, Group 25.)



M53890

Section 70
HYDRAULIC REPAIR

Contents

Page

Group 05—Hydraulic Pump and Filter
Hydraulic Pump
Remove and Install. 70-05-1
Disassemble, Inspect and Assemble . . . 70-05-2
Hydraulic Pump Drive Assembly
Remove, Inspect and Install 70-05-3
Hydraulic Oil Filter Assembly
Remove and Install. 70-05-5
Replace Oil Filter 70-05-6

Group 10—Rockshaft—670/770/790
Other Materials 70-10-1
Control Lever and Linkage
Inspect and Repair 70-10-2
System Relief Valve
Remove, Inspect and Install 70-10-3
Thermo-Relief Valve
Remove, Inspect and Install 70-10-3
Slow Return Valve, Piston Cover and Piston
Remove, Inspect and Install 70-10-5
Rockshaft Case
Remove and Install 70-10-7
Control Valve
Remove and Install. 70-10-8
Disassemble, Inspect and Assemble . . . 70-10-9
Rockshaft Lift Arms
Remove, Inspect and Install 70-10-10

Group 11—Rockshaft—870/970/1070
Other Materials 70-11-1
Inspect and Repair Control Lever and Linkage
870/970 70-11-2
1070. 70-11-4
Draft Sensing—1070
Inspect and Repair 70-11-6
System Relief Valve
Remove, Inspect and Install 70-11-7
Thermo-Relief Valve
Remove, Inspect and Install 70-11-8
Slow Return Valve, Piston Cover and Piston
Remove, Inspect and Install 70-11-10

Page

Rockshaft Case
Remove and Install. 70-11-12
Control Valve
Remove and Install. 70-11-14
Disassemble, Inspect and Assemble . . . 70-11-15
Rockshaft Lift Arms
Remove, Inspect and Install 70-11-16

Group 15—Selective Control Valve
Other Materials 70-15-1
Levers and Linkage
Inspect and Repair 70-15-1
Control Valve
Remove and Install—670/770/790 70-15-2
Remove and Install—870/970/1070 70-15-5
Disassemble, Inspect and Assemble 70-15-8

Group 20—Rear Auxiliary Hydraulic Lines
Remove and Install Hydraulic Lines
670/770/790 70-20-1
870/970/1070 70-20-3

REMOVE AND INSTALL HYDRAULIC PUMP

1. Remove left-hand engine shield.

2. Remove hydraulic line hold-down clamp cap screws.

3. Remove flange (A) and line (D). Close all openings with caps and plugs.

4. On 670: Remove cap screws and nuts (C) and cap screw (B). Remove pump and gasket.

On 770/790/870/970/1070: Remove cap screws (C) and nuts (B). Remove pump and gasket.

5. Make repairs as necessary. (See procedure in this group.)

6. Install pump and new gasket.

7. Install cap screws and nuts. Tighten to specifications.

8. Install new O-rings on flange and line.

9. Install flange and line. Tighten to specifications.

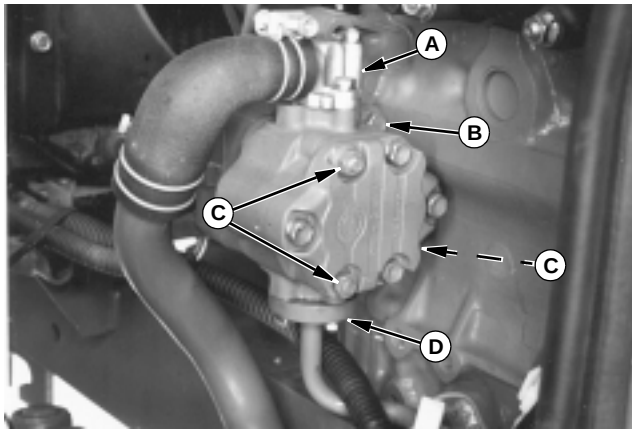
10. Install and tighten hydraulic line hold-down clamp cap screws.

11. Install left-hand engine shield.

TORQUE SPECIFICATIONS

Pump Mounting Cap Screws . . . . . .26 N•m (230 lb-in)

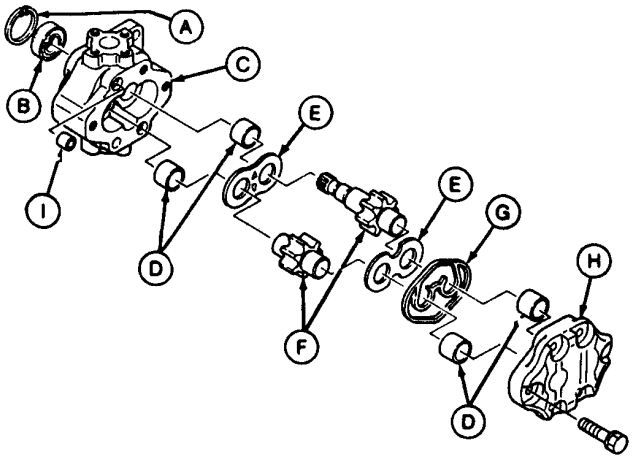
Flange (A) and Line (C) Cap Screws . . . .6 N•m (53 lb-in)



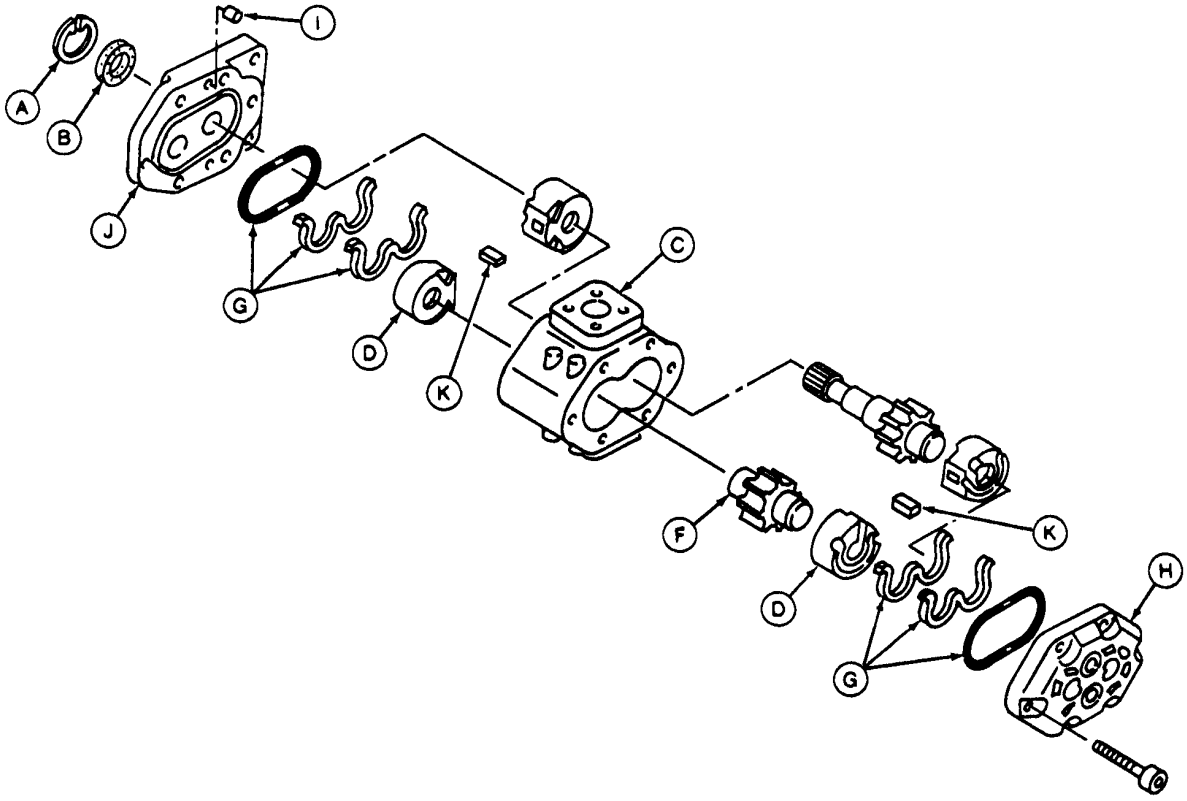
670 Manual Steering Shown

A—Suction Line Mounting Flange
B—Cap Screw
C—Cap Screws and Nuts
D—Pressure Line

DISASSEMBLE, INSPECT AND ASSEMBLE HYDRAULIC PUMP



670/770/790



870/970/1070

A—Snap Ring
B—Seal
C—Pump Housing
D—Bushings
E—Bearing Plate
F—Pump Shafts
G—Packing
H—Cover
I—Alignment Pin (2 used)
J—Flange
K—Key

IMPORTANT: Disassemble pump in a clean area. Keep individual components together as matched sets.

1. Scribe a mark across the housing and cover to aid in assembly.

2. Remove cover (H).

3. Check shafts (F), bushings (D), plates (E) and housing (C) for scoring or excessive wear. Replace if necessary.

4. Remove snap ring (A) and seal (B).

5. Install new seal using a bushing, bearing and seal driver set. Apply multipurpose grease to seal lips.

6. Install snap ring.

7. Install new packing (G). Apply a light coat of grease to hold in place.

IMPORTANT: Apply clean transmission/hydraulic oil to all internal parts before assembly. Premature pump failure can result if pump is assembled dry.

On 670/770/790: Plates (E) must be installed with brass side facing pump shaft gears and oil groove positioned toward IN side of cover.

8. Assemble pump.

9. Align cover and housing with mark made during disassembly. Install cap screws and tighten to 15 N•m (133 lb-in.).

REMOVE, INSPECT AND INSTALL HYDRAULIC PUMP DRIVE ASSEMBLY

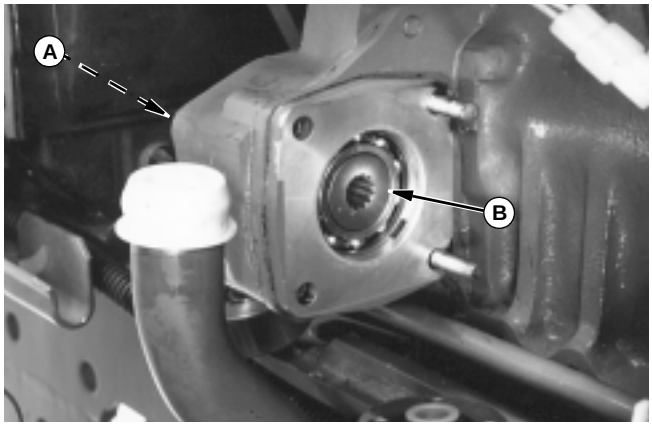
1. Remove hydraulic pump. (See procedure in this group.)

2. Remove power steering pump, if equipped. (See Section 60, Group 10.)

Remove cover (A), if equipped.

3. Tap on drive gear (B), from front of engine, with a rubber mallet to remove pump drive assembly.

On 670: Tap on drive gear (B), from rear of engine, with a rubber mallet to remove pump drive assembly.



770/790/870/970/1070 Shown

4. Remove flange (A) if equipped, using a press.

5. Inspect all parts for wear or damage.

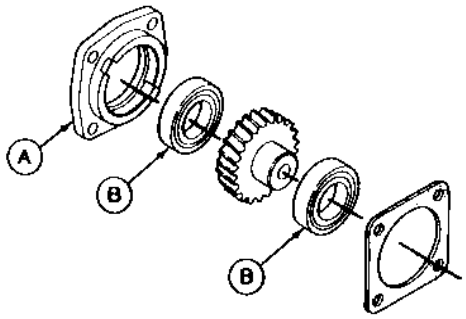
NOTE: Remove bearings only if replacement is necessary.

6. Remove bearings (B) using a knife-edge puller.

7. Assemble pump drive assembly.

8. Install pump drive assembly and new gasket.

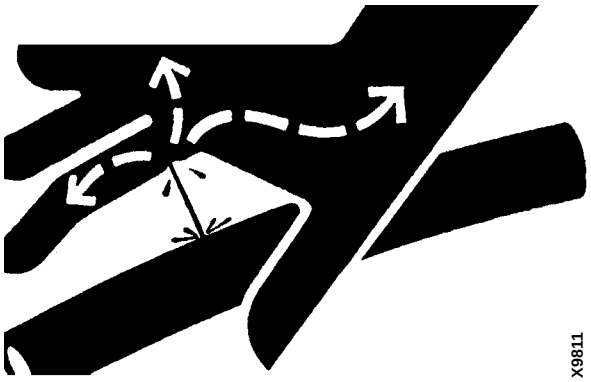
9. Install cover, if equipped.



M53190 -UN-18JUL89

MX,7005DG,A5 -19-19JUN89

REMOVE AND INSTALL HYDRAULIC OIL FILTER ASSEMBLY—IF EQUIPPED



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.

1. Lower rockshaft arms.

NOTE: The approximate capacity of transmission is:
670/770/790.....15 L (4 U.S. gal)
870/970/1070.....21 L (5.5 U.S. gal)

2. Drain hydraulic oil from transmission.

3. Remove left-hand step plate.

NOTE: Left fender was removed for clarity of photograph.

4. Remove guard (A).

5. Disconnect hose (C).

6. Remove four cap screws to remove flange (D) and O-ring. Close all openings with caps and plugs.

7. Remove two cap screws (B) and filter assembly.

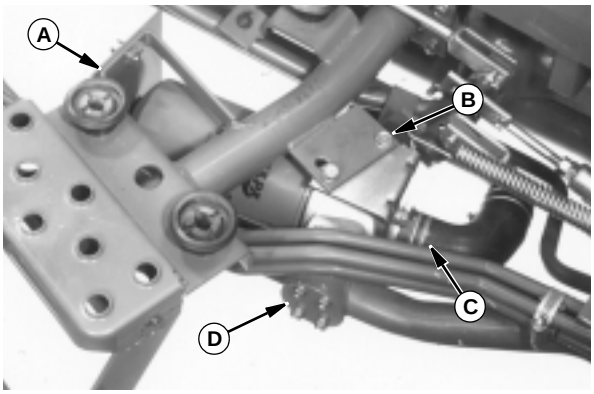
8. Install filter assembly.

9. Install O-ring and flange.

10. Connect hose.

11. Install guard and step plate.

12. Fill transmission with proper oil. (See Section 10, Group 20.)



970 Shown

A—Guard
B—Cap Screws (2 used)
C—Hose
D—Flange

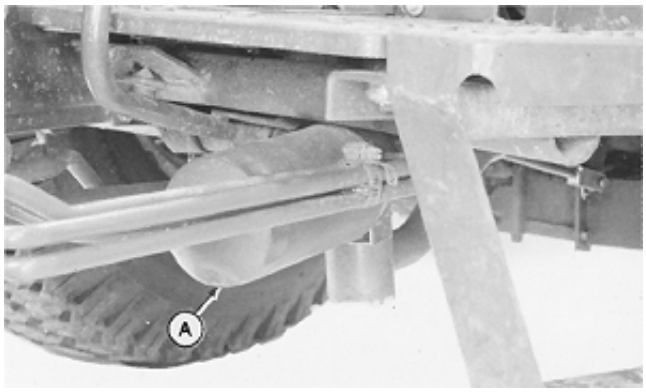
REPLACE HYDRAULIC OIL FILTER—IF EQUIPPED

1. Remove filter guard, if equipped.

NOTE: Some oil may come out of filter and base during removal. Use a drain pan to prevent an oil spill.

2. Turn filter (A) counterclockwise using a filter wrench.

3. Discard filter.



M52889 -UN-12JAN89

1070 Shown

MX,7005DG,A7 -19-11MAY89

4. Put a film of clean transmission/hydraulic oil on seal of new filter.

5. Fill the filter 1/3 full with transmission/hydraulic oil. (See Section 10, Group 20.)

6. Install and tighten filter QUICKLY until it contacts the mounting surface. Tighten filter BY HAND an additional 1/2 turn.

7. Install filter guard, if equipped.



M33797 -UN-07SEP88



M33753 -UN-07SEP88

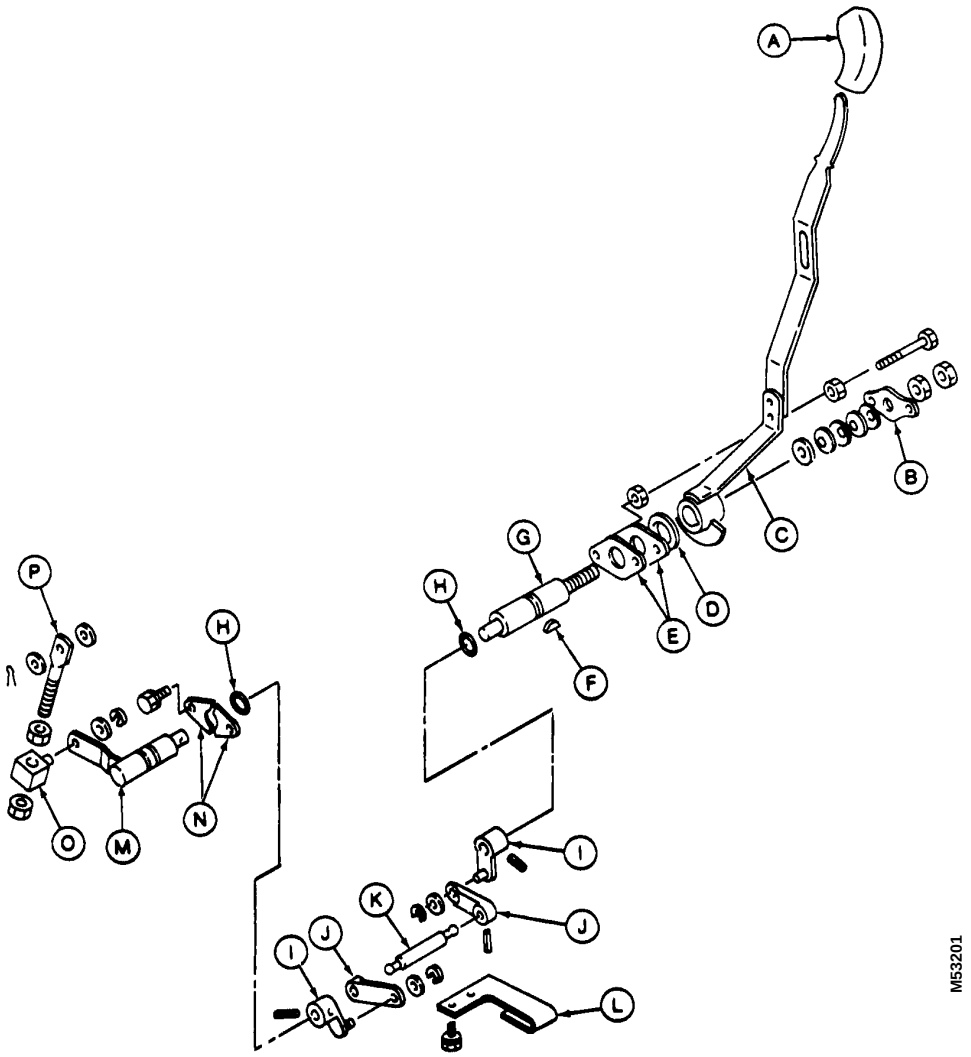
MX,7005DG,A8 -19-11MAY89

OTHER MATERIAL

Number	Name	Use
TY9375	John Deere Pipe Sealant with TEFLON™	Apply to threads of pipe plugs in control valve

TEFLON is a trademark of the Du Pont Co.

INSPECT AND REPAIR CONTROL LEVER AND LINKAGE



A—Knob	**E—Plates**	**I—Lever**	**M—Shaft**
B—Plate	**F—Woodruff Key**	**J—Bar**	**N—Holder**
C—Control Lever	**G—Shaft**	**K—Bar**	**O—Bar**
D—Friction Washer	**H—O-Ring (2 used)**	**L—Guide**	**P—Feed Back Rod**

NOTE: To inspect parts (G—M), rockshaft case must be removed.

1. Remove rockshaft case. (See procedure in this group.)

2. Inspect friction washer (D) for wear or damage.

3. Inspect parts and replace as necessary.

4. Install shafts (G and M) with new O-rings (H).

5. Apply multipurpose grease to pivot end of bar (O) and rod (P).

6. Install rockshaft case. (See procedure in this group.)

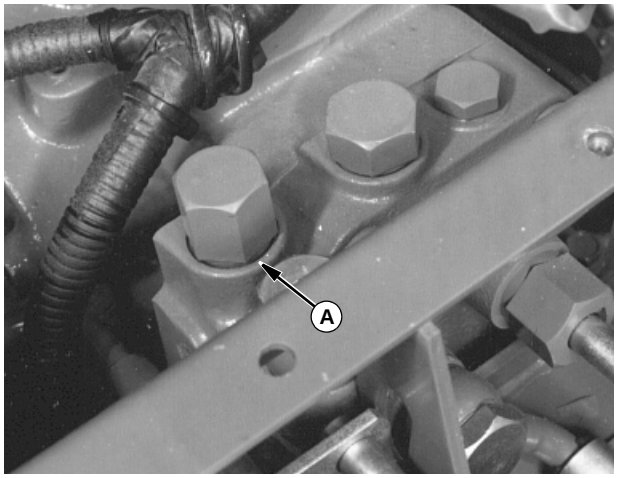
7. Adjust position control lever linkage. (See Section 270, Group 15.)

REMOVE, INSPECT AND INSTALL SYSTEM RELIEF VALVE

1. Lower rockshaft arms.

2. Remove seat and support. (See Section 80, Group 25.)

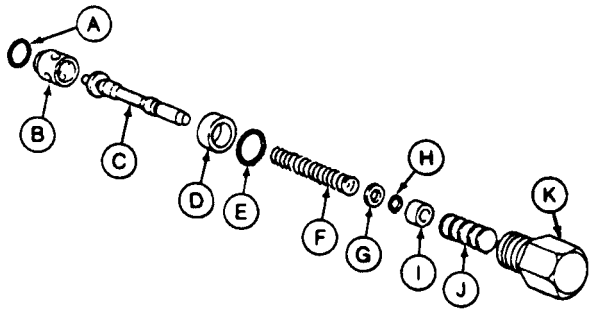
3. Remove relief valve assembly (A).



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

5. Apply clean transmission/hydraulic oil to all parts.

6. Install relief valve assembly with new O-rings (A, E and H).



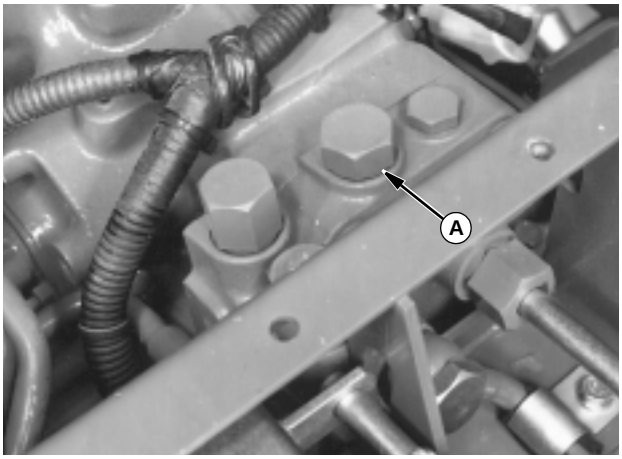
A—O-Ring
B—Valve Seat
C—Poppet
D—Bushing
E—O-Ring
F—Spring
G—Washer
H—O-Ring
I—Bushing
J—Shim (As Required)
K—Plug

REMOVE, INSPECT AND INSTALL THERMO-RELIEF VALVE

1. Lower rockshaft arms.

2. Remove seat and support. (See Section 80, Group 25.)

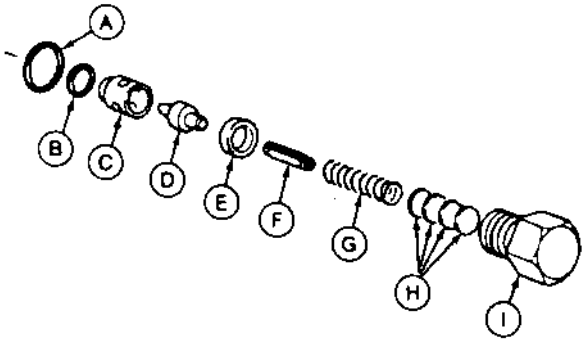
3. Remove relief valve assembly (A).



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

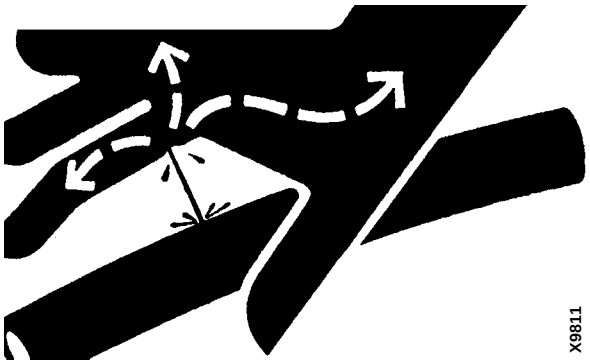
5. Apply clean transmission/hydraulic oil to all parts.

6. Install relief valve assembly with new O-rings (A and B).

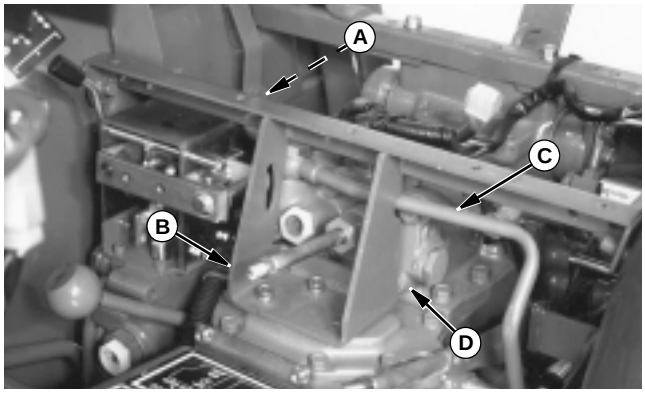


A—O-Ring
B—O-Ring
C—Valve Seat
D—Poppet
E—Bushing
F—Spring Pin
G—Spring
H—Shim (As Required)
I—Plug

REMOVE, INSPECT AND INSTALL SLOW RETURN VALVE, PISTON COVER AND PISTON



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.



A—SCV Line

B—Fender Front Support

C—Hydraulic Pump Pressure Line

D—Piston Cover

1. Lower rockshaft arms.

2. Remove seat and support. (See Section 80, Group 25.)

3. Remove rear auxiliary hydraulic lines, if equipped. (See Section 70, Group 20.)

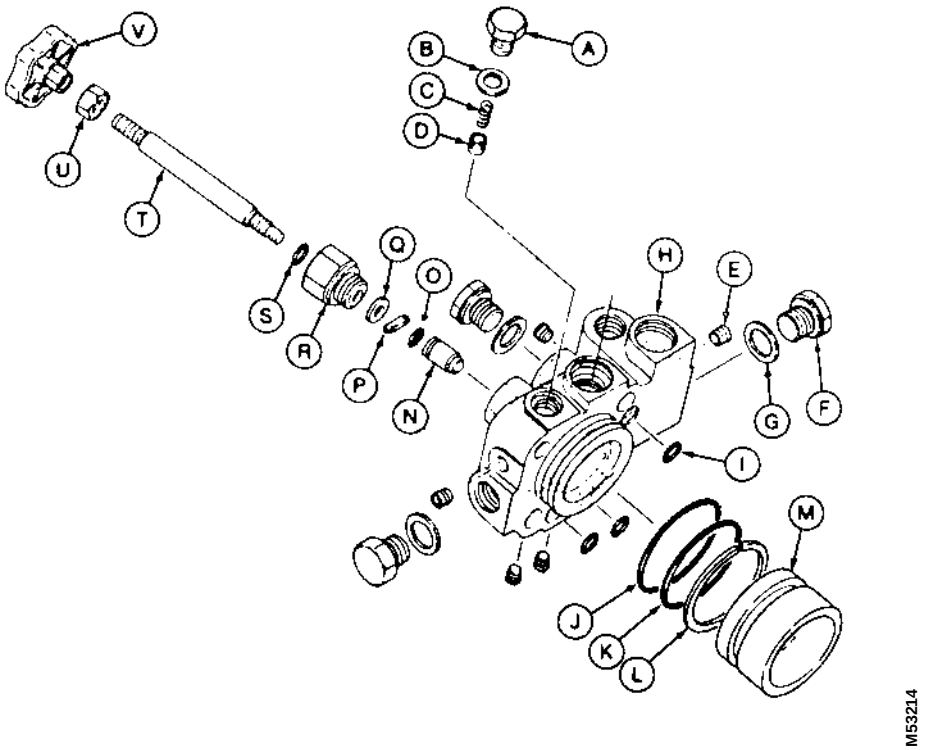
4. Remove line (A), if equipped.

5. Remove support (B).

6. Remove clamps along line (C) from rockshaft cover to hydraulic pump.

7. Disconnect line (C). Close all opening using caps and plugs.

8. Remove four cap screws and lock washers to remove piston cover (D).



A—Plug
B—Gasket
C—Spring
D—Lowering Check Valve Poppet
E—Pipe Plug (5 used)
F—Plug (3 used)
G—Gasket (3 used)
H—Piston Cover
I—O-Ring (3 used)
J—O-Ring
K—O-Ring
L—Back up Ring
M—Piston
N—Slow Return Valve
O—O-Ring
P—Pin
Q—Washer
R—Screw Guide
S—O-Ring
T—Stop Valve Bolt
U—Nut
V—Knob

9. Remove guide (R).

10. Remove pin (P) to separate parts (Q—T).

11. Use a small punch to push valve (N) and O-ring (O) from back side of piston cover (H).

12. Manually raise rockshaft lift arms and push piston (M) back into bore against push rod. With a fast downward jerk of the lift arms, piston can be slid from bore.

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

14. Apply clean transmission/hydraulic oil to all parts.

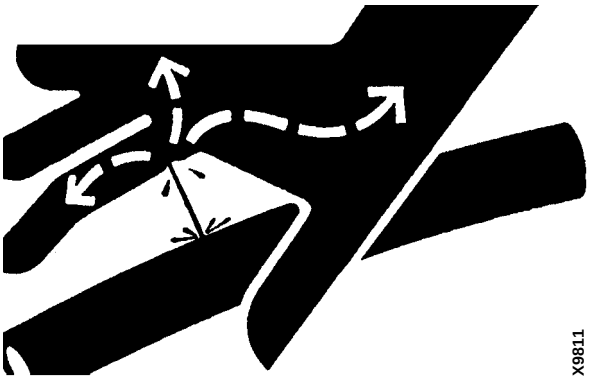
15. Install new O-rings.

16. Install piston and piston cover assembly. Tighten cap screws to 95 N•m (70 lb-ft).

17. Connect hydraulic pump pressure line. Install line clamps.

18. Install fender support and SCV line, if equipped.

REMOVE AND INSTALL ROCKSHAFT CASE



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.

1. Lower rockshaft arms.

2. Remove seat and support. (See Section 80, Group 25.)

3. Remove rear auxiliary hydraulic lines, if equipped. (See Section 70, Group 20.)

4. Remove lift links from rockshaft arms.

5. Remove knob (B) and guide (A).

6. Remove support (D and E).

7. Disconnect wiring harness (C).

8. Remove line (G), if equipped.

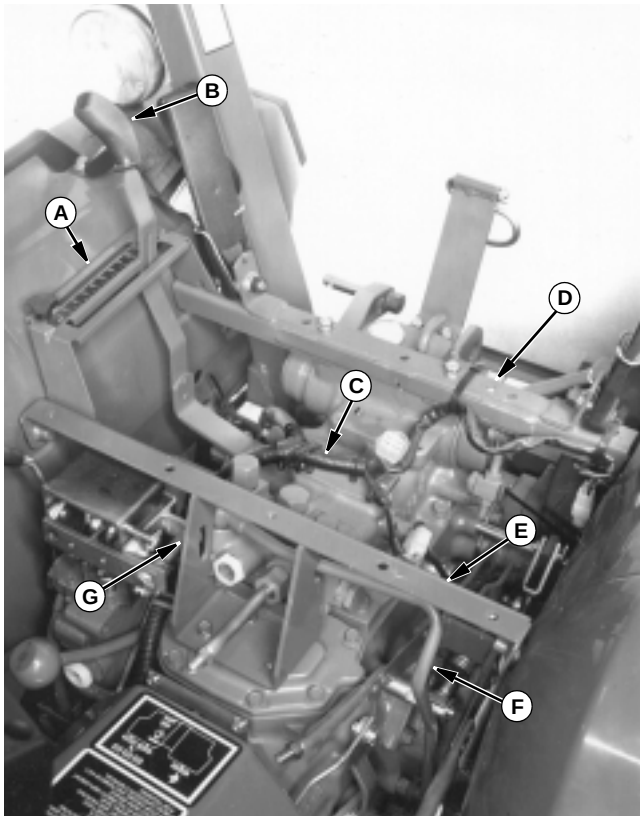
9. Remove line clamps along line (F) from rockshaft cover to hydraulic pump.

10. Disconnect line (F). Close all openings with caps and plugs.

c CAUTION: The approximate weight of rockshaft case assembly is 31.6 kg (70 lb).

11. Remove eight cap screws and rockshaft case assembly.

12. Make repairs as necessary. (See procedure in this group.)



A— Lever Guide
B—Knob
C—Wiring Harness
D—Fender Support-Rear
E—Fender Support-Front
F—Hydraulic Pressure Line
G—SCV Hydraulic Line

13. Install rockshaft case and new gasket. Tighten cap screws to 54 N•m (40 lb-ft).

14. Connect hydraulic pump pressure line. Install line clamps.

15. Install SCV line, if equipped and fender supports.

16. Connect wiring harness. Secure to supports with tie straps.

17. Install guide, knob and lift links.

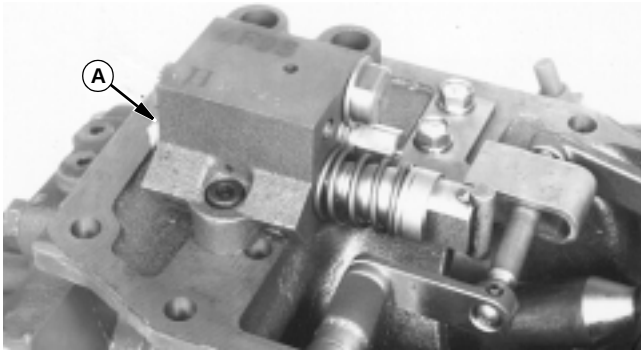
REMOVE AND INSTALL ROCKSHAFT CONTROL VALVE

1. Remove rockshaft case. (See procedure in this group.)

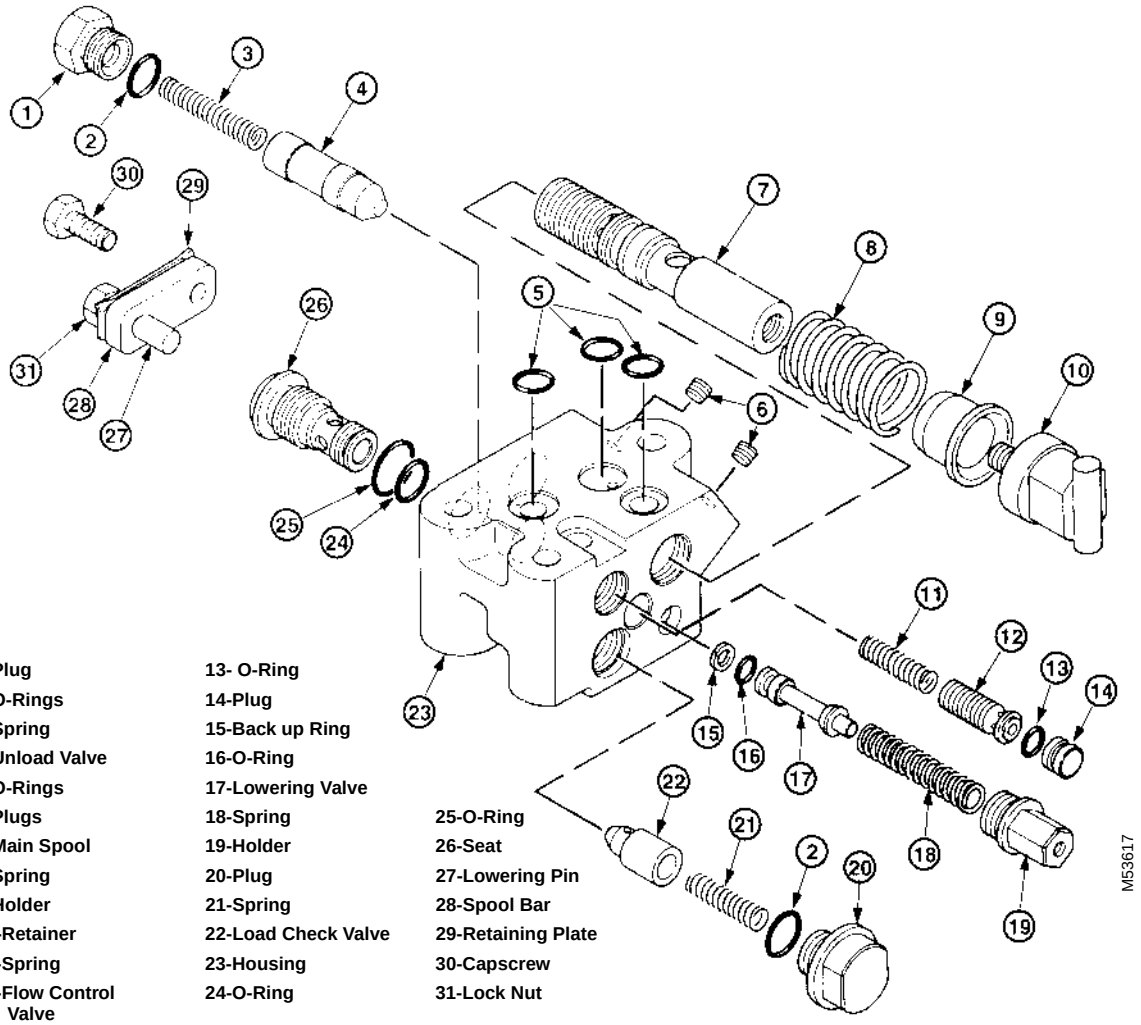
2. Remove three socket head cap screws and control valve (A).

3. Make repairs as necessary. (See procedure in this group.)

4. Install control valve with three new O-rings. Tighten socket head cap screws to 26 N•m (226 lb-in.).



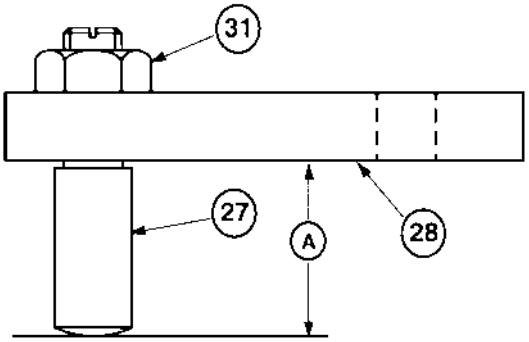
DISASSEMBLE, INSPECT AND ASSEMBLE ROCKSHAFT CONTROL VALVE



1-Plug	13- O-Ring	
2-O-Rings	14-Plug	
3-Spring	15-Back up Ring	
4-Unload Valve	16-O-Ring	
5-O-Rings	17-Lowering Valve	
6-Plugs	18-Spring	25-O-Ring
7-Main Spool	19-Holder	26-Seat
8-Spring	20-Plug	27-Lowering Pin
9-Holder	21-Spring	28-Spool Bar
10-Retainer	22-Load Check Valve	29-Retaining Plate
11-Spring	23-Housing	30-Capscrew
12-Flow Control Valve	24-O-Ring	31-Lock Nut

1. When removing and inspecting lowering pin (27), **DO NOT disassemble parts (27—31)**. The pin adjustment is pre-set at the factory and should be serviced only as an assembly. However, if accidentally disassembled, please do the following:

—Adjust lock nut (31) until lowering pin (27), protrudes a distance of (A) from spool bar (28). (A) = 14.2 mm (0.165 in.) (670/770/790)

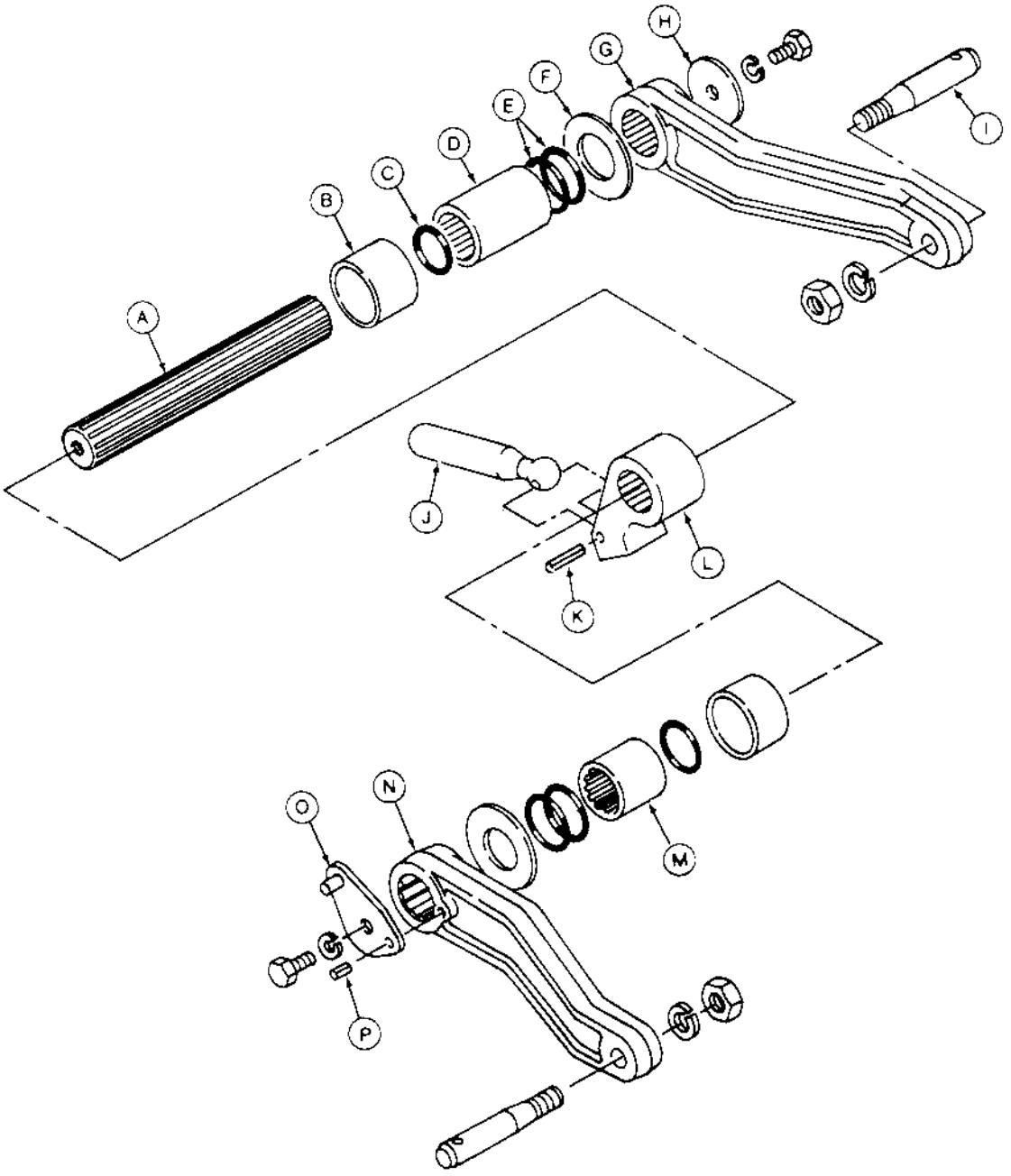


2. Inspect all remaining parts for wear or damage. Replace as necessary.

3. Apply clean transmission/hydraulic oil to all parts.

4. Apply pipe sealant with TEFLON or equivalent to threads of plugs (6) and install.

REMOVE, INSPECT AND INSTALL ROCKSHAFT LIFT ARMS



A—Rockshaft
B—Bushing (2 used)
C—O-Ring (2 used)
D—Long Sleeve
E—O-Rings (4 used)
F—Washer (2 used)
G—Arm
H—Washer
I—Shaft (2 used)
J—Piston Rod
K—Pin
L—Crank
M—Short Sleeve
N—Arm
O—Plate
P—Pin

1. Remove rockshaft case. (See procedure in this group.)

2. Disconnect feed back link from plate (O).

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

NOTE: Bushings (B) are pressed in rockshaft housing.

4. Replace bushings (B) using a bushing driver set. Press new bushings into rockshaft housing so bushing outer edge is at least 7 mm (0.283 in.) below bore surface.

5. Apply clean transmission/hydraulic oil to all internal parts.

6. Install crank arm assembly (A) into rockshaft housing.

7. Install rockshaft (B), aligning marks (C).

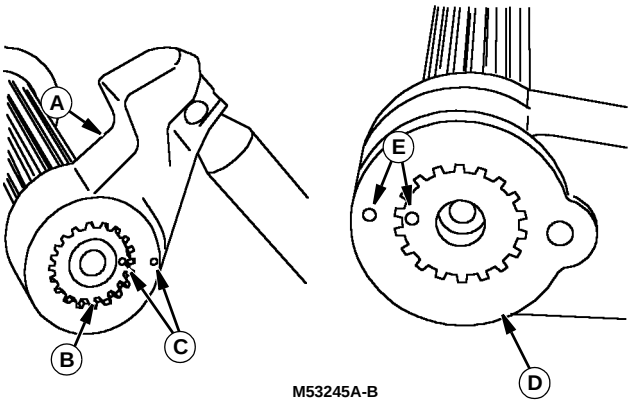
IMPORTANT: Be sure sleeves are installed tappered end first.

8. Install new O-rings, sleeves and washers.

9. Install lift arms (D) to rockshaft, aligning marks (E).

10. Install washer and plate. Tighten cap screws to 50 N•m (37 lb-ft)

11. Connect feed back link.



M53245A-B

A—Crank Arm Assembly
B—Rockshaft
C—Index Marks
D—Lift Arm
E—Index Marks

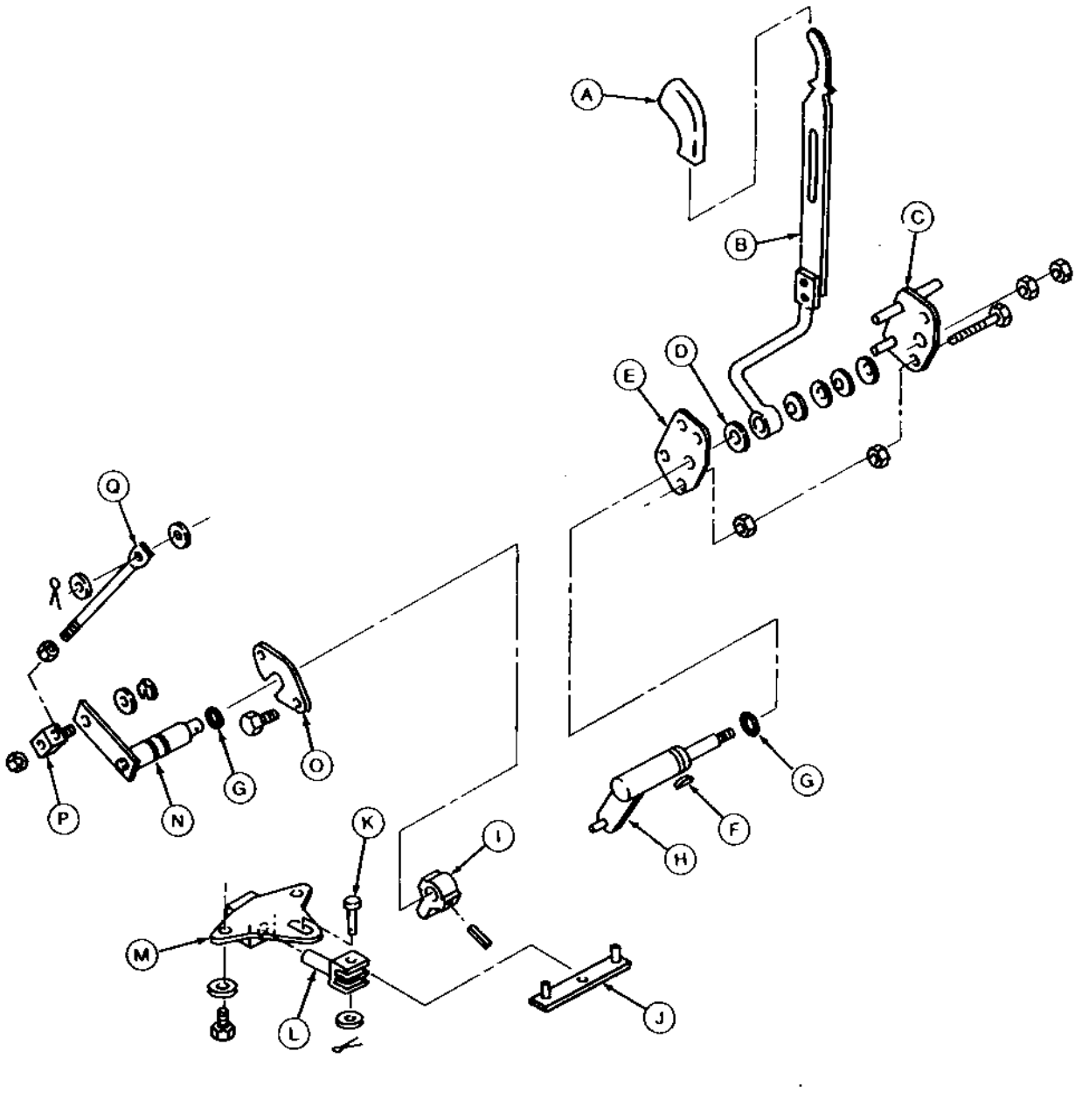
OTHER MATERIAL

Number	Name	Use
TY9375	John Deere Pipe Sealant with TEFLON™	Apply to threads of pipe plugs in control valve.

TEFLON is a trademark of the Du Pont Co.

MX,7010DG,A1 -19-29JUN89

INSPECT AND REPAIR CONTROL LEVER AND LINKAGE—870/970



A—Knob
B—Control Lever
C—Plate
D—Friction Washer
E—Plate
F—Woodruff Key
G—O-Ring (2 used)
H—Shaft
I—Arm
J—Bar
K—Pin
L—Rod
M—Plate
N—Shaft
O—Plate
P—Bar
Q—Feed Back Rod

MX,7011DG,A1 -19-23JUN89

NOTE: To inspect parts (G—N), rockshaft case must be removed.

1. Remove rockshaft case. (See procedure in this group.)

2. Inspect friction washer (D) for wear or damage.

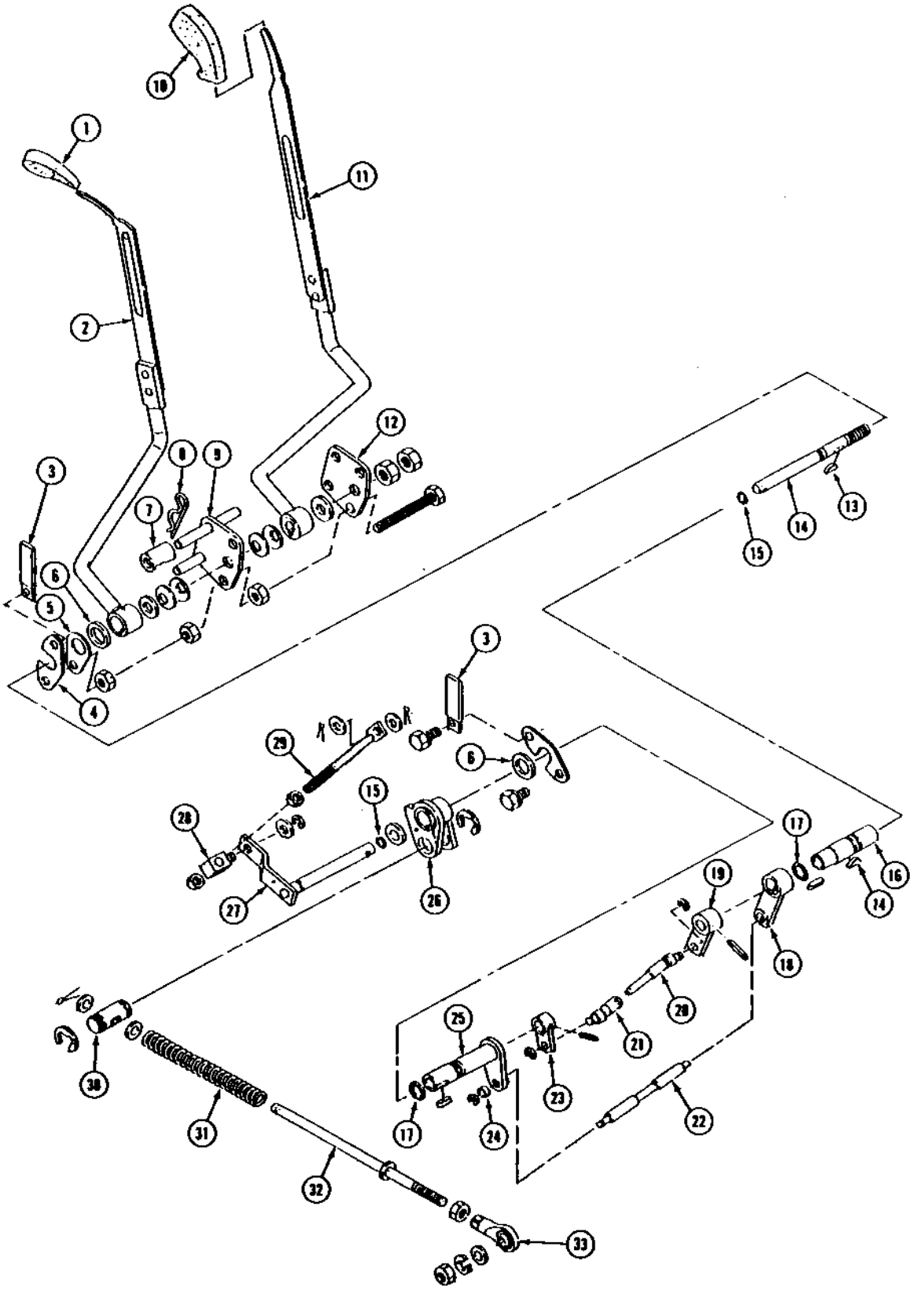
3. Inspect parts and replace as necessary.

4. Install shafts (H and N) with new O-rings (F).

5. Apply multipurpose grease to pivot end of bar (P) and rod (Q).

6. Adjust position control lever linkage. (See Section 275, Group 15.)

MX,7011DG,A2 -19-23JUN89



MX,7011DG,A3 -19-23JUN89

1—Knob
2—Lift Control Lever
3—Plate
4—Plate
5—Plate
6—Friction Washer (2 used)
7—Spacer
8—Clip
9—Plate
10—Knob
11—Draft Control Lever
12—Plate
13—Shaft
14—Woodruff Key (2 used)
15—O-Ring (2 used)
16—Shaft
17—O-Ring (2 used)
18—Arm
19—Arm
20—Bar
21—Bar
22—Bar
23—Arm
24—Spacer
25—Arm
26—Arm
27—Arm
28—Bar
29—Feed Back Rod
30—Shaft
31—Spring
32—Rod
33—Rod End

Legend for Control Lever & Linkage

NOTE: To inspect parts (13—27), rockshaft case must be removed.

1. Remove rockshaft case. (See procedure in this group.)

2. Inspect friction washers (6) for wear or damage.

3. Inspect aprts and replace as necessary.

4. Install new O-rings during assembly.

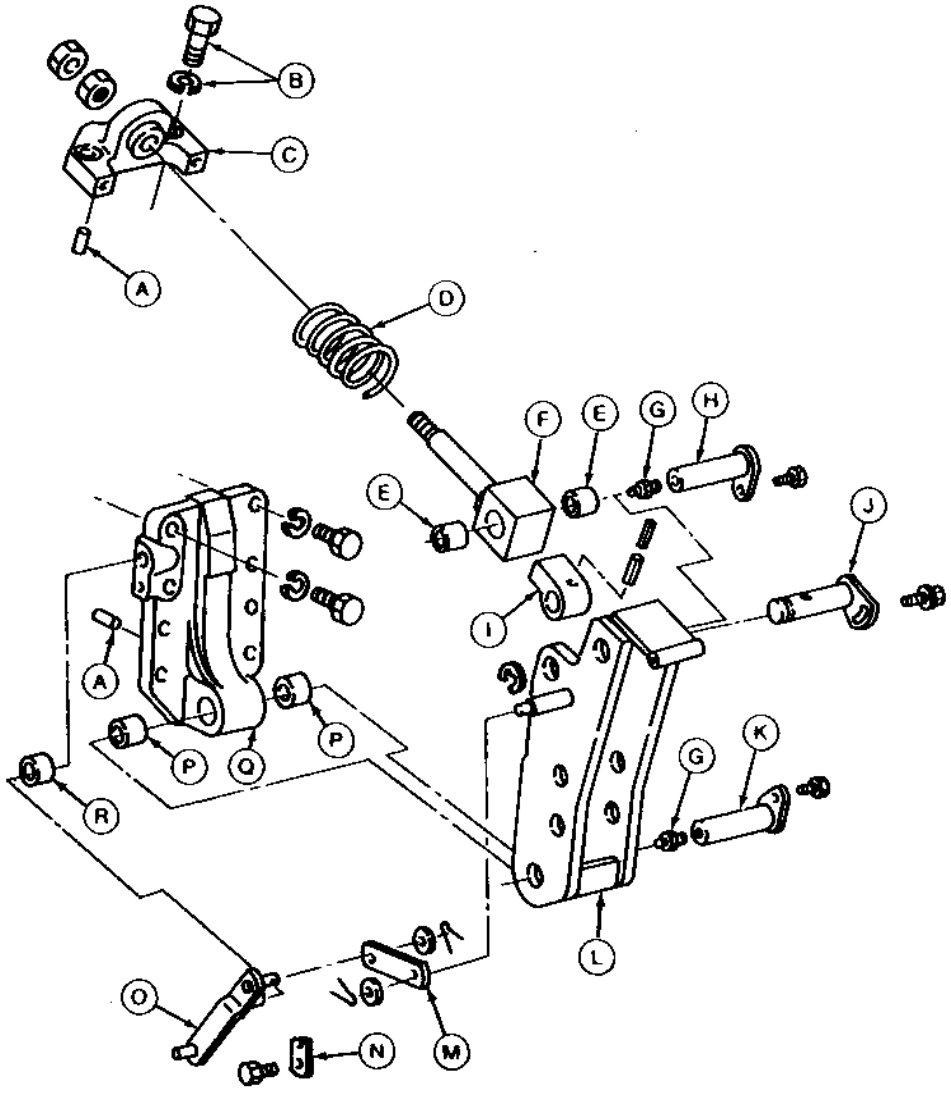
5. Apply multipurpose grease to pivot end of bar (28) and rod (29).

6. Adjust position control lever linkage. (See procedure in Section 275, Group 15.)

7. Adjust draft sensing lever linkage. (See procedure in Section 275, Group 15.)

MX,7011DG,A4 -19-13DEC89

INSPECT AND REPAIR DRAFT SENSING SUPPORT ASSEMBLY—1070



70
11
6

A—Alignment Pin
B—Cap Screw and Lock Washer (2 used)
C—Spring Holder
D—Spring Sensor
E—Bushings
F—Rod
G—Grease Fitting
H—Shaft
I—Lock Cam
J—Lock Shaft
K—Shaft
L—Top Link Bracket
M—Link Plate
N—Arm Plate
O—Feed Back Link
P—Bushings
Q—Support
R—Bushing

MX,7011DG,A5 -19-23JUN89

1. Lower rockshaft arms.

2. Move draft sensing control lever full forward.

3. Remove center link.

4. If equipped with rear auxiliary hydraulics, remove hydraulic hose and bracket.

5. Remove draft sensing spring shield.

6. Disconnect plate (M).

7. Remove shaft (H and K) and bracket (L).

8. Remove cap screws and lock washers (B) to remove spring assembly.

9. Disconnect link (O).

10. Remove eight cap screws and lock washers to remove support (Q).

11. Inspect parts and replace as necessary.

12. Remove bushing (R) using a blind hole puller.

13. Replace bushings (E and P) using a bushing driver set and press.

14. Install support, spring assembly and bracket.

15. Apply multipurpose grease to I.D. of bushing (R), pivot points on link (O) and link pivot pin on bracket (L).

16. Connect linkage.

17. Install draft sensing spring shield.

18. If equipped with rear auxiliary hydraulics, install mounting bracket and hydraulic hose.

19. Lubricate grease fittings (G) with multipurpose grease. (See Section 10, Group 20.)

20. Adjust draft sensing lever linkage. (See Section 275, Group 15.)

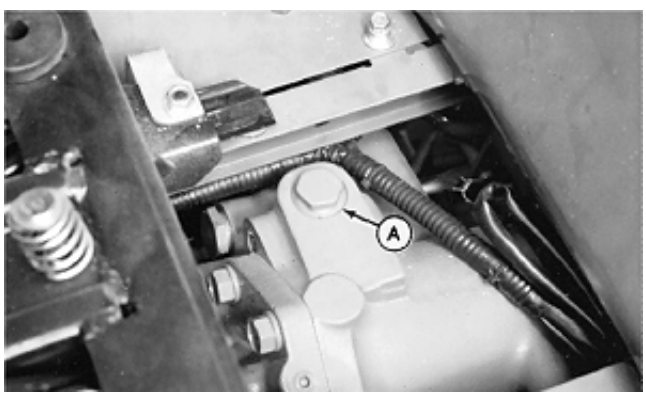
MX,7011DG,A6 -19-20DEC89

REMOVE, INSPECT AND INSTALL SYSTEM RELIEF VALVE

1. Lower rockshaft arms.

2. Move seat forward and tilt up.

3. Remove relief valve assembly (A).



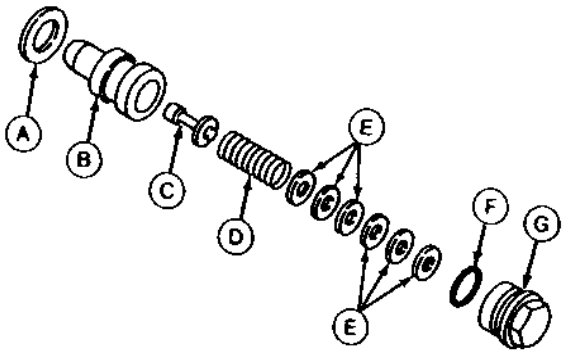
MX,7011DG,A7 -19-26JUN89

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

5. Apply clean transmission/hydraulic oil to all parts.

6. Install relief valve assembly with new O-ring (F).

A—Washer
B—Valve Seat
C—Poppet
D—Spring
E—Shim (As Required)
F—O-Ring
G—Plug



-UN-18JUL89
M53208

MX,7011DG,A8 -19-26JUN89

REMOVE, INSPECT AND INSTALL THERMO-RELIEF VALVE

1. Lower rockshaft arms.

2. Move seat forward and tilt up.

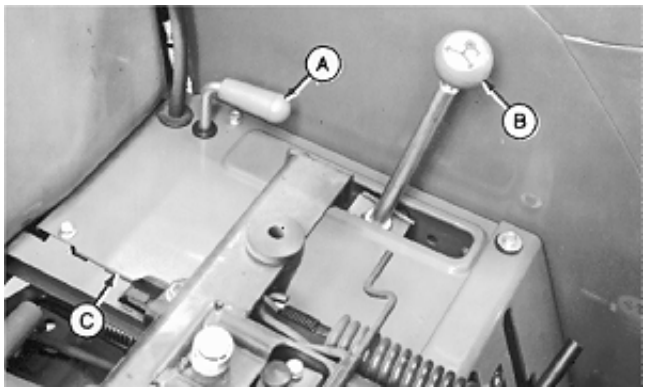
3. Remove MFWD lever (A), if equipped.

4. Remove knob (B).

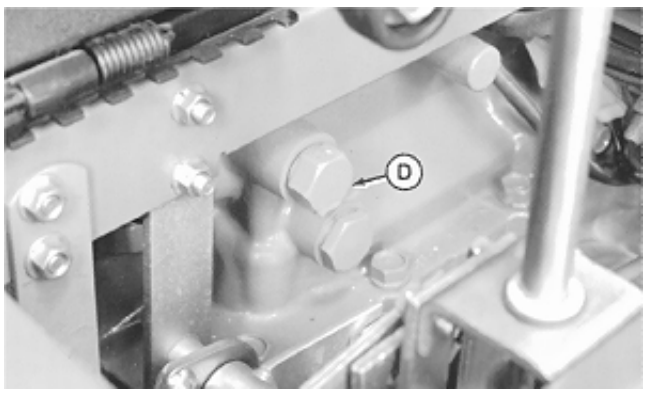
5. Remove four cap screws and washers to move cover (C) out of way.

6. Remove relief valve assembly (D).

A—MFWD Lever
B—Range Shift Lever Knob
C—Cover
D—Relief Valve Assembly



-UN-21FEB90
M53211



-UN-18JUL89
M53212

MX,7011DG,A9 -19-26JUN89

70
11
8

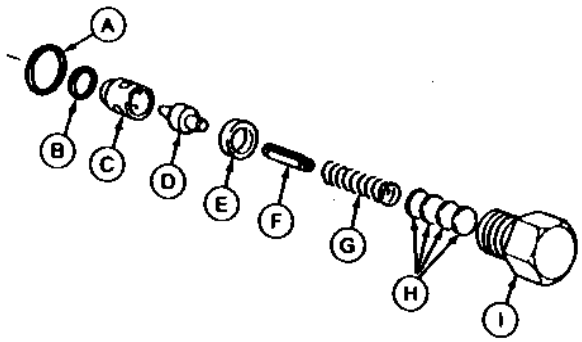
7. Inspect all parts for wear or damage. Replace as necessary.

8. Apply clean transmission/hydraulic oil to all parts.

9. Install relief valve assembly with new O-ring (F).

10. Install cover, knob and MFWD lever, if equipped.

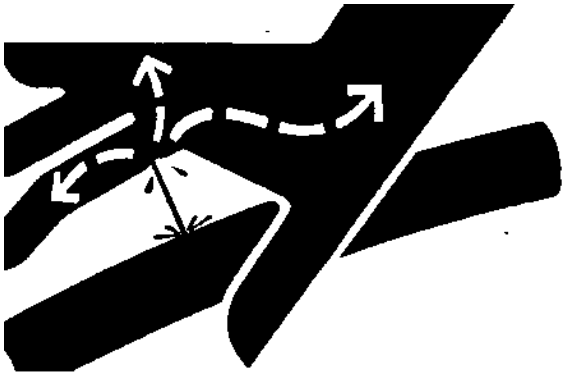
A—Washer
B—Valve Seat
C—Poppet
D—Spring
E—Shim (As Required)
F—O-Ring
G—Plug



M53210 -UN-05JAN90

MX,7011DG,A10 -19-26JUN89

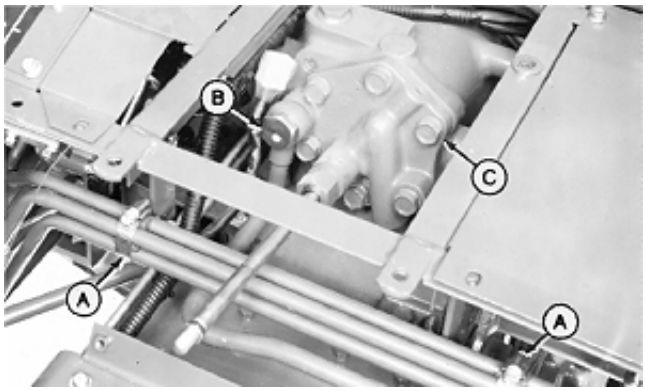
REMOVE, INSPECT AND INSTALL SLOW RETURN VALVE, PISTON COVER AND PISTON



X9811 -UN-23AUG88

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.



M53215 -UN-05JAN90

1. Lower rockshaft arms.

2. Remove seat and support. (See Section 80, Group 25.)

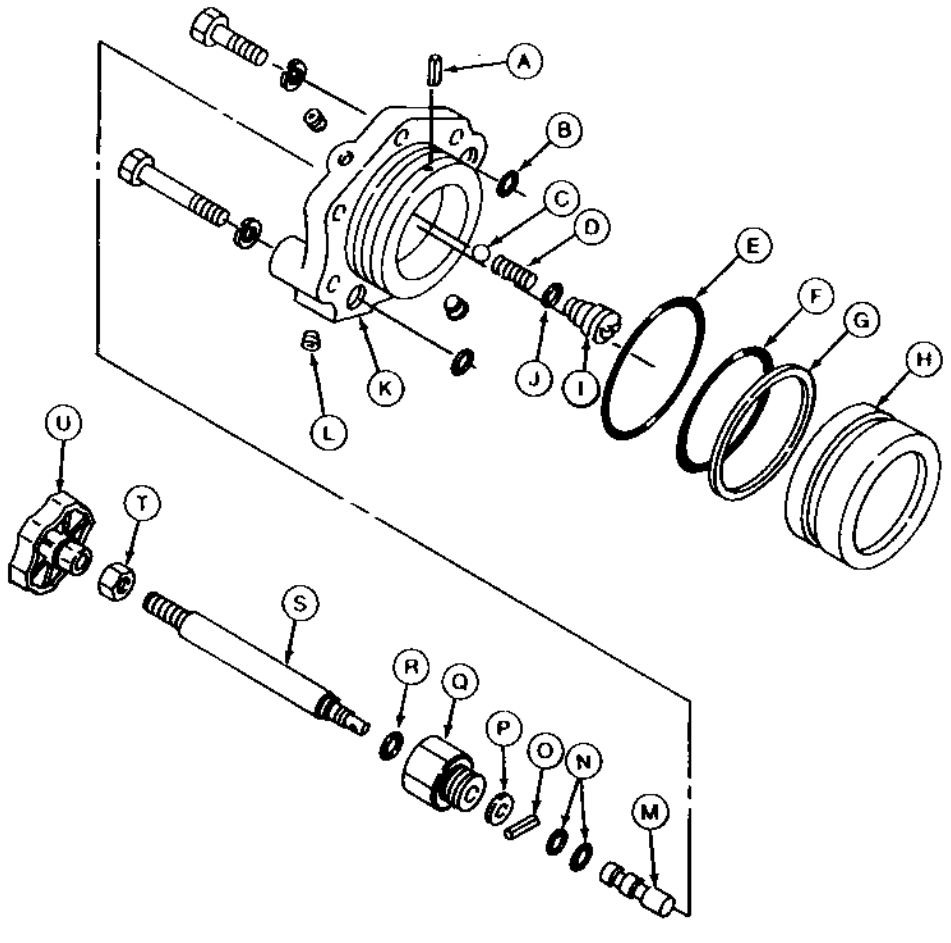
3. Loosen line clamps (A), if equipped.

4. Remove line clamps along line (B) from rockshaft cover to hydraulic pump. Disconnect line (B). Close all openings using caps and plugs.

5. Remove six cap screws and lock washers to remove rockshaft cover (C).

70
11
10

MX,7011DG,A11 -19-19DEC89



A—Pin
B—O-Ring (2 used)
C—Ball
D—Lowering Check Valve Spring
E—O-Ring
F—O-Ring
G—Back up Ring
H—Piston
I—Check Valve Plug
J—O-Ring
K—Piston Cover
L—Pipe Plug (5 used)
M—Slow Return Valve
N—O-Rings
O—Pin
P—Washer
Q—Screw Guide
R—O-Ring
S—Stop Valve Bolt
T—Nut
U—Knob

6. Remove guide (Q).

7. Remove pin (O) to separate parts (P—S).

8. Use a small punch to push valve (M) and O-rings (N) from back side of piston cover (K).

9. Manually raise rockshaft lift arms and push piston (H) back into bore against push rod. With a fast downward jerk of the lift arms, piston can be slid from bore.

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

11. Apply clean transmission/hydraulic oil to all parts.

12. Install new O-rings.

13. Install piston and rockshaft cover assembly. Tighten cap screws to 95 N·m (70 lb-ft).

14. Connect hydraulic pump pressure line. Install line clamps.

15. Tighten SCV line clamps, if equipped.

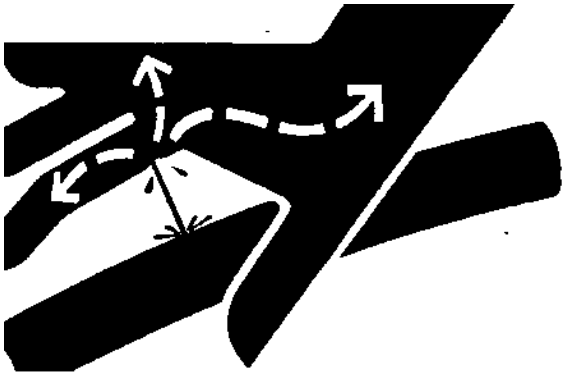
70
11
11

MX,7011DG,A12 -19-26JUN89

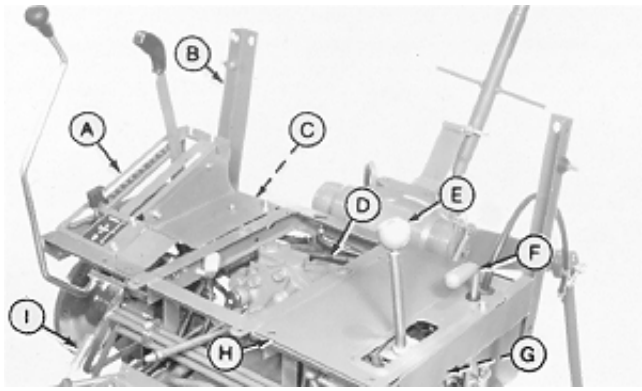
REMOVE AND INSTALL ROCKSHAFT CASE

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.



-UN-23AUG88
X9811



-UN-25JUL89
M53238

1. Lower rockshaft arms.

2. Remove seat and support. (See Section 80, Group 25.)

3. Remove fuel tank. (See Section 20, Group 20.)

4. Remove fenders.

5. Remove rear auxiliary hydraulic lines, if equipped. (See Section 70, Group 20.)

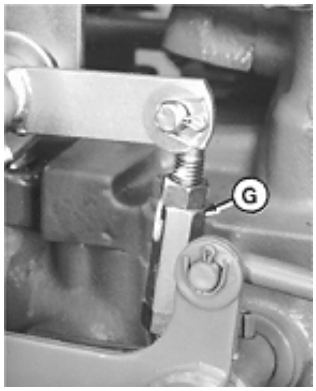
6. Remove lever (F), if equipped.

7. Remove knob (E), cover (H) and guide (A).

8. Disconnect spring (I), link (G) and fuel hose (C). Close all openings with caps and plugs.

9. Remove support (B).

10. Disconnect wiring harness (D).



-UN-18JUL89
M53239

A—Lever Guide
B—Fender Support
C—Fuel Supply Hose
D—Wiring Harness
E—Knob
F—MFWD Lever
G—Link
H—Cover
I—Spring

MX,7011DG,A13 -19-27JUN89

70
11
12

11. If equipped with SCV (Selective Control Valve), remove line (A) and three cap screws and lock washers (C).

12. Loosen line clamps (E), if equipped.

13. Remove line clamps along line (B) from rockshaft cover to hydraulic pump.

14. Disconnect line (B). Close all openings with caps and plugs.

15. Remove line clamp (D).

16. Remove lift link arms and center link.

N **CAUTION: The approximate weight of rockshaft case assembly is:**
870/970 .....63.5 kg (140 lb).
1070 .....75 kg (165 lb).

IMPORTANT: Do not pry between rockshaft case and rear PTO quill. PTO quill is aluminum and could be damaged.

17. Remove twelve cap screws and rockshaft case assembly.

18. Make repairs as necessary. (See procedure in this group.)

19. Install rockshaft case and new gasket. Tighten cap screws to 88 N·m (65 lb-ft).

20. Install lift link arms and center link.

21. Connect pressure line and install all clamps.

22. Install SCV mounting cap screws and lock washers and hydraulic line. Tighten all line clamps.

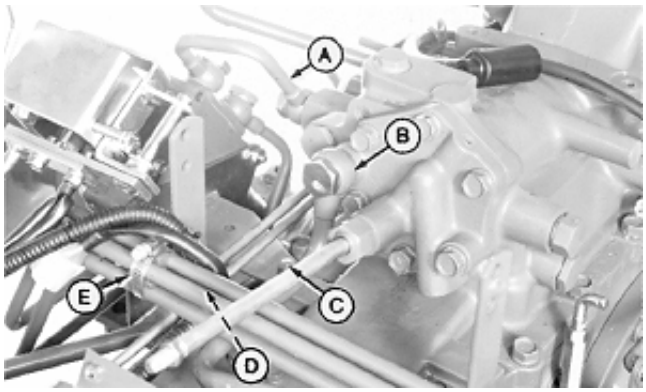
23. Connect wiring harness.

24. Install fender support.

25. Connect spring, fuel hose and speed range shift link.

26. Install guide, cover, knob and MFWD lever, if equipped.

27. Install fenders.



M53240 -UN-05JAN90

A—SCV Line
B—Pressure Line
C—Cap Screw and Lock Washer (3 used)
D—Fuel Line Clamp
E—SCV Line Clamps

70
11
13

MX,7011DG,A14 -19-27JUN89

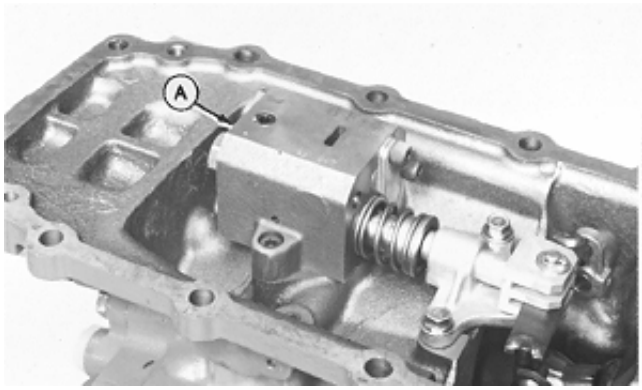
REMOVE AND INSTALL ROCKSHAFT CONTROL VALVE

1. Remove rockshaft case. (See procedure in this group.)

2. Remove three socket head cap screws and control valve (A).

3. Make repairs as necessary. (See procedure in this group.)

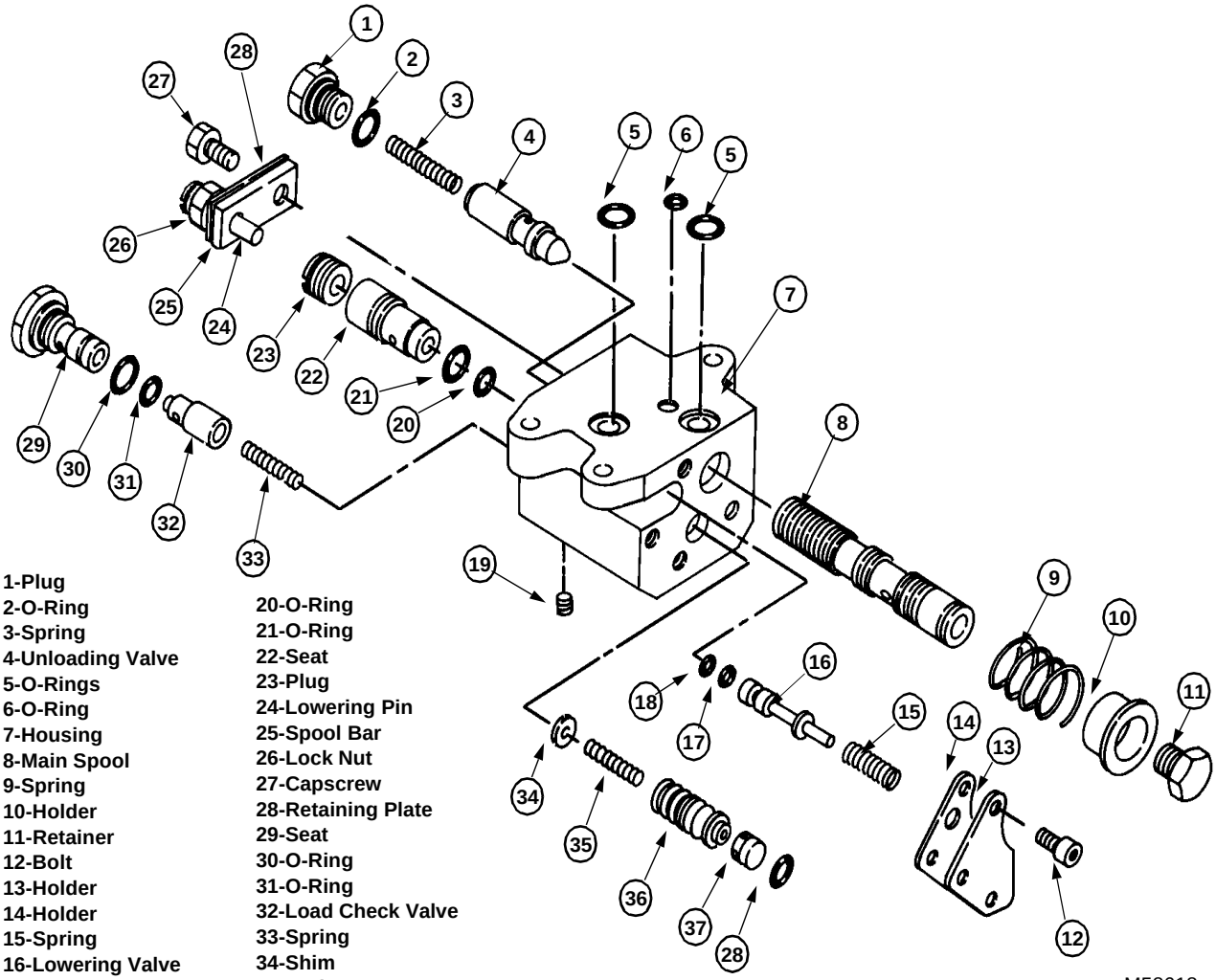
4. Install control valve with three new O-rings. Tighten socket head cap screws to 26 N·m (226 lb-in.)



M53865 -UN-07DEC89

MX,7011DG,A15 -19-27JUN89

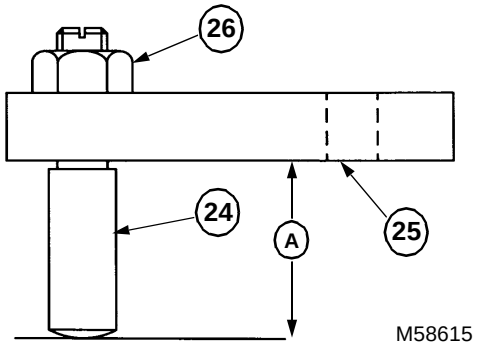
DISASSEMBLE, INSPECT AND ASSEMBLE ROCKSHAFT CONTROL VALVE



1-Plug
2-O-Ring
3-Spring
4-Unloading Valve
5-O-Rings
6-O-Ring
7-Housing
8-Main Spool
9-Spring
10-Holder
11-Retainer
12-Bolt
13-Holder
14-Holder
15-Spring
16-Lowering Valve
17-O-Ring
18-Back up Ring
19-Plug
20-O-Ring
21-O-Ring
22-Seat
23-Plug
24-Lowering Pin
25-Spool Bar
26-Lock Nut
27-Capscrew
28-Retaining Plate
29-Seat
30-O-Ring
31-O-Ring
32-Load Check Valve
33-Spring
34-Shim
35-Spring
36-Flow Control Valve
37-Plug

1. When removing and inspecting lowering pin (24), **DO NOT disassemble parts (24—28)**. The pin adjustment is pre-set at the factory and should be serviced only as an assembly. However, if accidentally disassembled, please do the following:

—Adjust lock nut (26) until lowering pin (24) protrudes a distance of (A) from spool bar (25). (A) = 21.6 mm (870, 970, 1070)



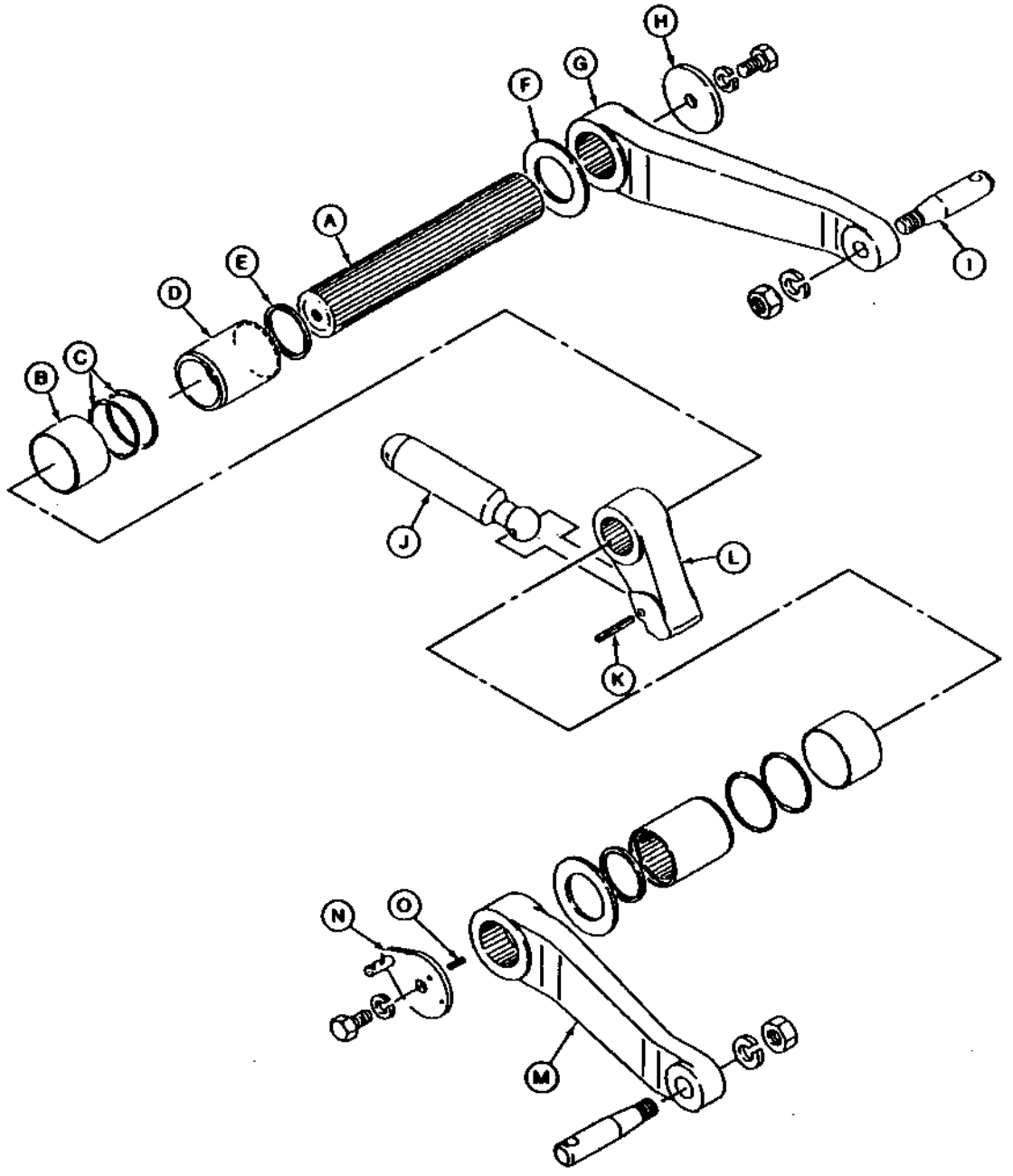
2. Inspect all remaining parts for wear or damage. Replace as necessary.

3. Apply clean transmission/hydraulic oil to all parts.

4. Install new O-rings.

5. Apply pipe sealant with TEFLON or equivalent to threads of plugs (6) and install.

REMOVE, INSPECT AND INSTALL ROCKSHAFT LIFT ARMS



A—Rockshaft
B—Bushing (2 used)
C—O-Ring (4 used)
D—Sleeve (2 used)
E—Splined Seal (2 used)
F—Washer (2 used)
G—Arm
H—Washer
I—Shaft (2 used)
J—Piston Rod
K—Pin
L—Crank
M—Arm
N—Plate
O—Pin

MX,7011DG,A17 -19-28JUN89

1. Remove rockshaft case. (See procedure in this group.)

2. Disconnect feed back link from plate (O).

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

NOTE: Bushings (B) are pressed in rockshaft housing.

4. Replace bushings (B) using a bushing driver set. Press new bushings into rockshaft housing so bushing outer edge is at least 7 mm (0.283 in.) below bore surface.

5. Apply clean transmission/hydraulic oil to all internal parts.

MX,7011DG,A18 -19-28JUN89

6. Install crank arm assembly (A) into rockshaft housing.

7. Install rockshaft (B), aligning marks (C).

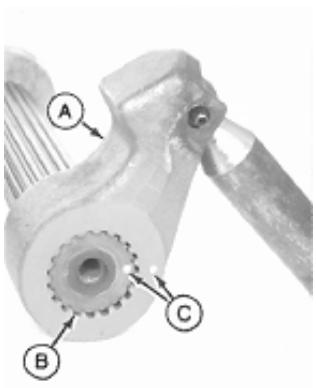
IMPORTANT: Be sure sleeves are installed tappered end first.

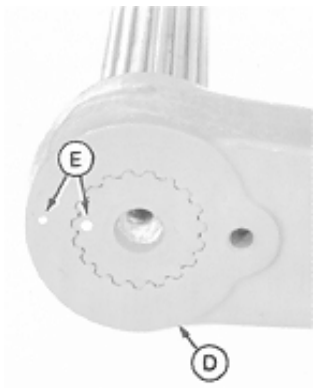
8. Install new O-rings, sleeves and washers.

9. Install lift arms (D) to rockshaft, aligning marks (E).

10. Install washer and plate. Tighten cap screws to 88 N·m (65 lb-ft).

11. Connect feed back link.





A—Crank Arm Assembly
B—Rockshaft
C—Index Marks
D—Lift Arm
E—Index Marks

MX,7011DG,A19 -19-28JUN89

OTHER MATERIAL

Number	Name	Use
TY9375	John Deere Pipe Sealant with TEFLON™	Apply to threads of pipe plug in housing.
T43513	Thread Lock and Sealer (High Strength)	Apply to threads of control valve spool guides.

TEFLON is a trademark of the Du Pont Co.

MX,7015DG,A1 -19-29JUN89

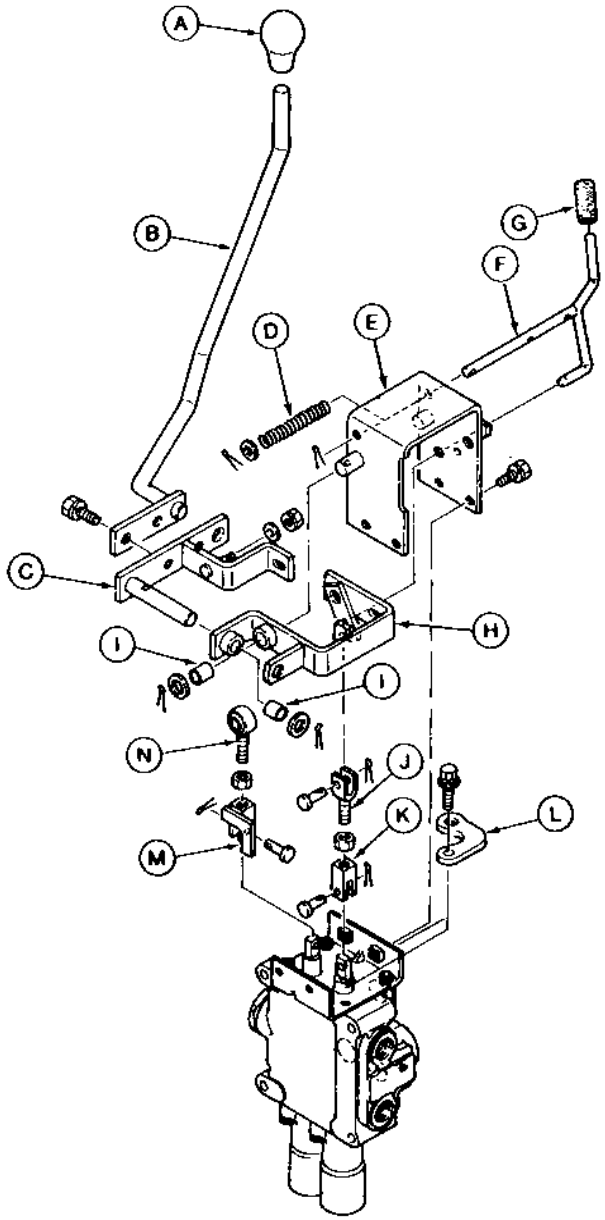
INSPECT AND REPAIR SCV CONTROL LEVER LINKAGE

1. Remove seat and support. (See Section 80, Group 25.)

2. On 870/970/1070, remove rockshaft lever guide.

3. Inspect parts and replace as necessary.

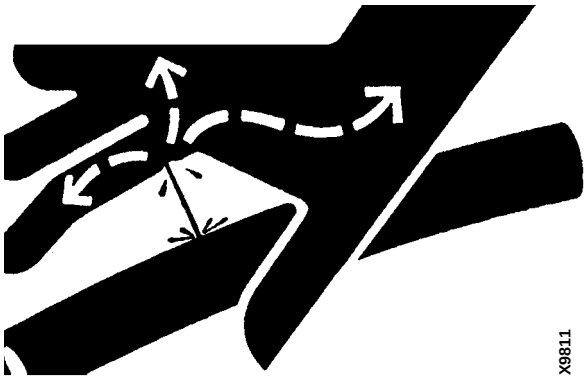
A—Knob
B—Control Lever
C—Bucket Control Arm
D—Spring
E—Link Support
F—Lockout Lever
G—Knob
H—Link Arm
I—Bushing (2 used)
J—Clevis
K—Clevis
L—Stopper Plate
M—Clevis
N—End Rod



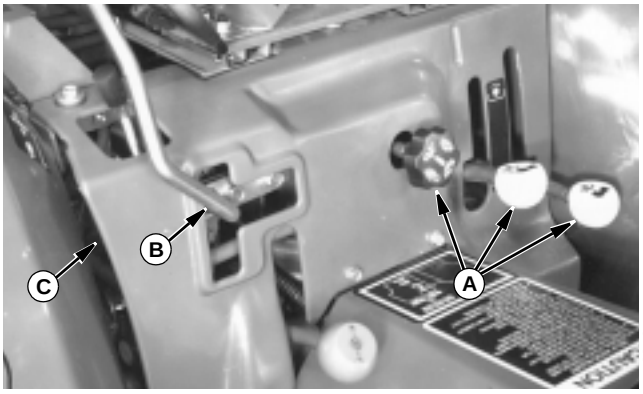
M53248 -UN-18JUL89

MX,7015DG,A2 -19-30JUN89

REMOVE AND INSTALL SCV CONTROL VALVE—670/770/790



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.



1. Lower rockshaft arms.

2. Remove rear auxiliary line assembly, if equipped. (See Section 70, Group 20.)

3. Remove knobs (A), SCV lever (B) and panel (C).

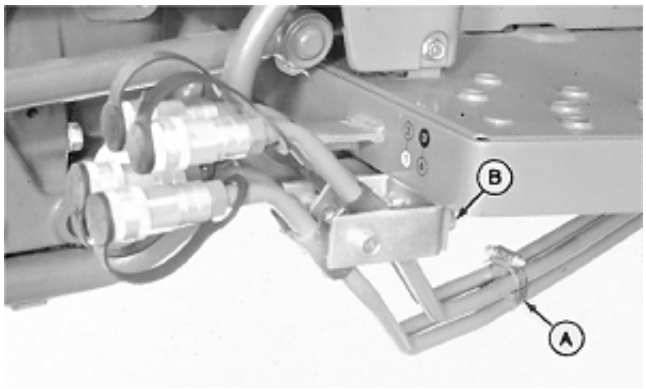
4. Remove right fender.

5. Loosen two clamps (A).

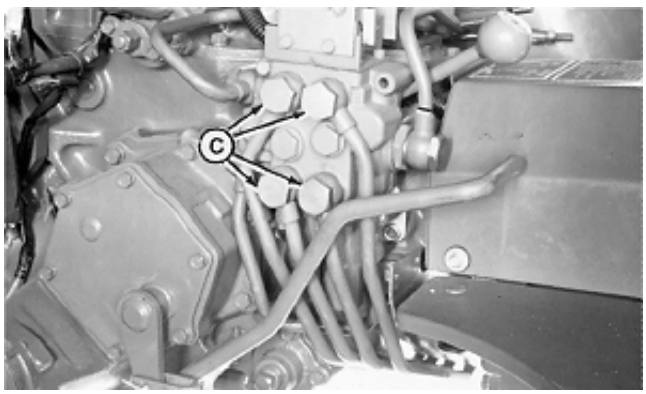
6. Remove banjo connectors and washers (C). Close all openings with caps and plugs.

7. Remove two cap screws (B).

8. Remove long line assembly.



-UN-05JAN90
M53251



-UN-05JAN90
M53265

MX,7015DG,A4 -19-30JUN89

9. Remove short lines (C and D). Close all openings with caps and plugs.

10. Remove short line (A), if equipped.

11. Remove three cap screws and control valve (B).

12. Make repairs as necessary. (See procedure in this group.)

13. Install control valve.

IMPORTANT: There must be one copper washer on each side of banjo connector when installing lines.

14. Install short hydraulic lines with banjo connectors and new washers.

15. Install long hydraulic line assembly bracket cap screws. Leave loose.

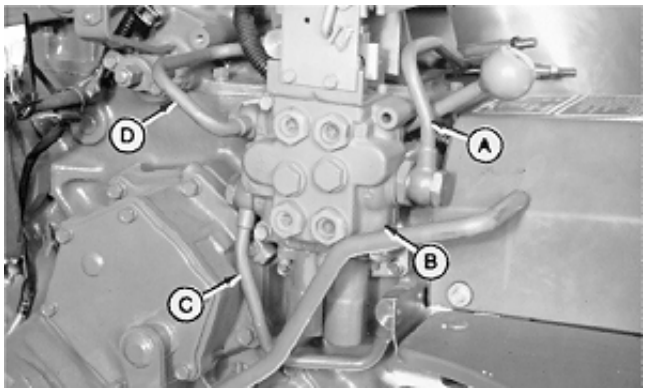
16. Install long hydraulic line assembly banjo connectors and new washers.

17. Tighten cap screws installed in Step 15.

18. Tighten all line clamps.

19. Install fender, panel, knobs and lever.

20. Start tractor and raise rockshaft arms. Check and repair any leaks as necessary.

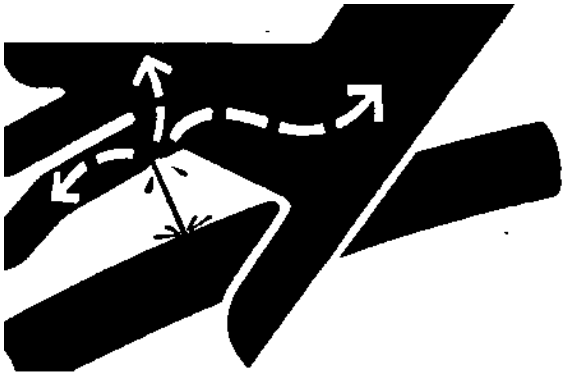


-UN-05JAN90
M53266

A—Return Line to Rockshaft
B—Control Valve
C—Return Line to Case
D—Pressure Line from Rockshaft

MX,7015DG,A5 -19-30JUN89

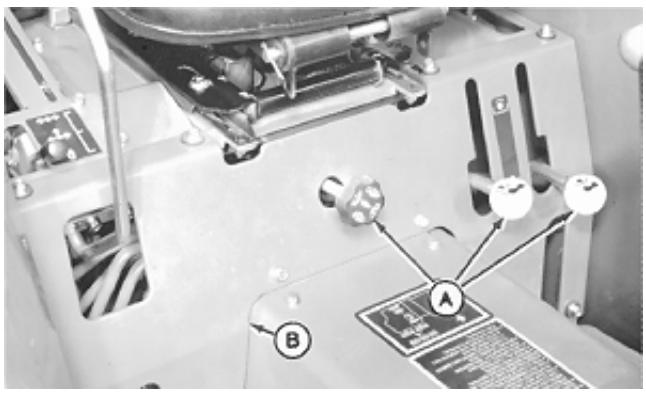
REMOVE AND INSTALL SCV CONTROL VALVE—870/970/1070



X9811 -UN-23AUG88

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.



M53258 -UN-18JUL89

1. Lower rockshaft arms.

2. Remove rear auxiliary lines, if equipped. (See Section 70, Group 20.)

3. Remove knobs (A) and panel (B).

4. Remove SCV lever.

5. Remove right rear fender.

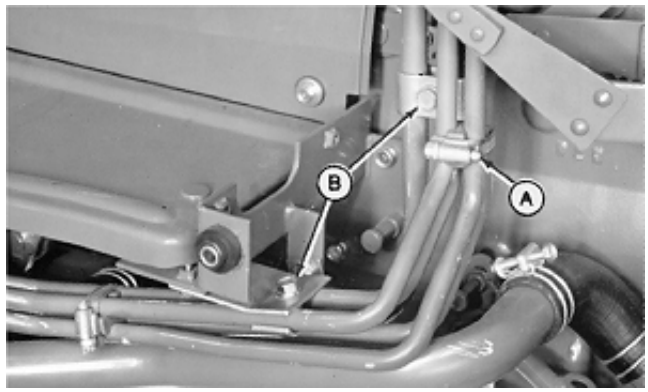
MX,7015DG,A6 -19-12JUL89

NOTE: Left fender removed for clarity of photograph.

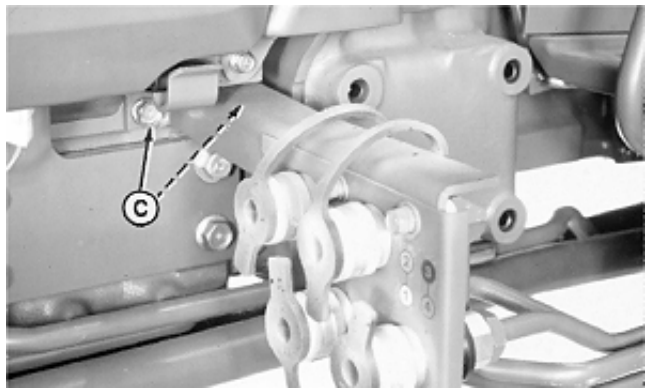
6. Loosen five line clamps (A).

7. Remove cap screws (B) and clamps.

8. Remove cap screws (C).



-UN-05JAN90
M53259



-UN-05JAN90
M53260

MX,7015DG,A7 -19-12JUL89

NOTE: Right rear wheel removed for clarity of photograph.

9. Disconnect spring (B).

10. Remove connectors and washers (A). Close all openings with caps and plugs. Move long line assembly away from control valve.

11. Remove short lines (E and F). Close all openings with caps and plugs.

12. Remove short line (D), if equipped.

13. Remove three cap screws, lock washers and control valve (C).

14. Make repairs as necessary. (See procedure in this group.)

15. Install control valve.

IMPORTANT: There must be one copper washer on each side of banjo connector when installing lines.

16. Install short hydraulic lines with banjo connectors and new washers.

17. Install long hydraulic line assembly with banjo connectors and new washers. Leave loose.

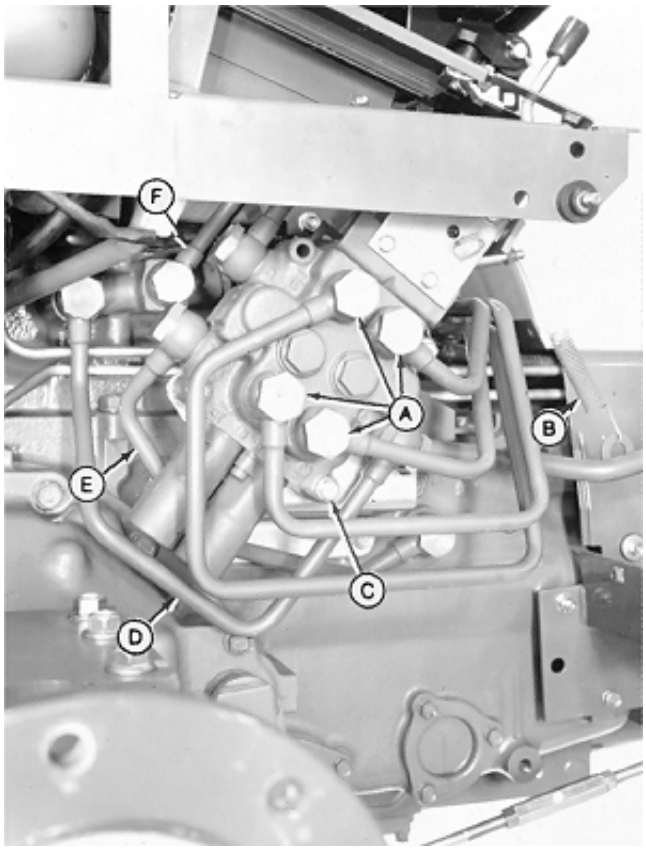
18. Install clamps and front bracket cap screws.

19. Tighten banjo connectors installed in Step 17.

20. Tighten all line clamps.

21. Install spring, fender, lever, panel and knobs.

22. Start tractor and raise rockshaft arms. Check and repair any leaks as necessary.



M53261 -UN-05JAN90

A—Banjo Connectors and Washers
B—Return Spring
C—SCV Control Valve
D—Return Line to Rockshaft
E—Return Line to Case
F—Pressure Line from Rockshaft

MX,7015DG,A8 -19-12JUL89

DISASSEMBLE, INSPECT AND ASSEMBLE SCV CONTROL VALVE

NOTE: There are 2 versions of SCV valve assemblies shown in this manual. See your Parts Catalog for additional identification of parts.

IMPORTANT: Spools and housing are matched and must be replaced as a unit. Spools must be installed into the same bores from which they were removed for proper operation of each function.

14. Remove parts (A—Y).

15. Clamp flat end of spool (L) in a soft jawed vise.

NOTE: High strength thread lock and sealer has been applied to the threads of spool end guides. Heat applied to guide ends of spools (S, T) will soften the thread lock and sealer.

16. Apply heat to guide end of spools (S, T). Remove parts (O—W).

17. Remove and inspect all other parts for wear or damage. Replace as necessary.

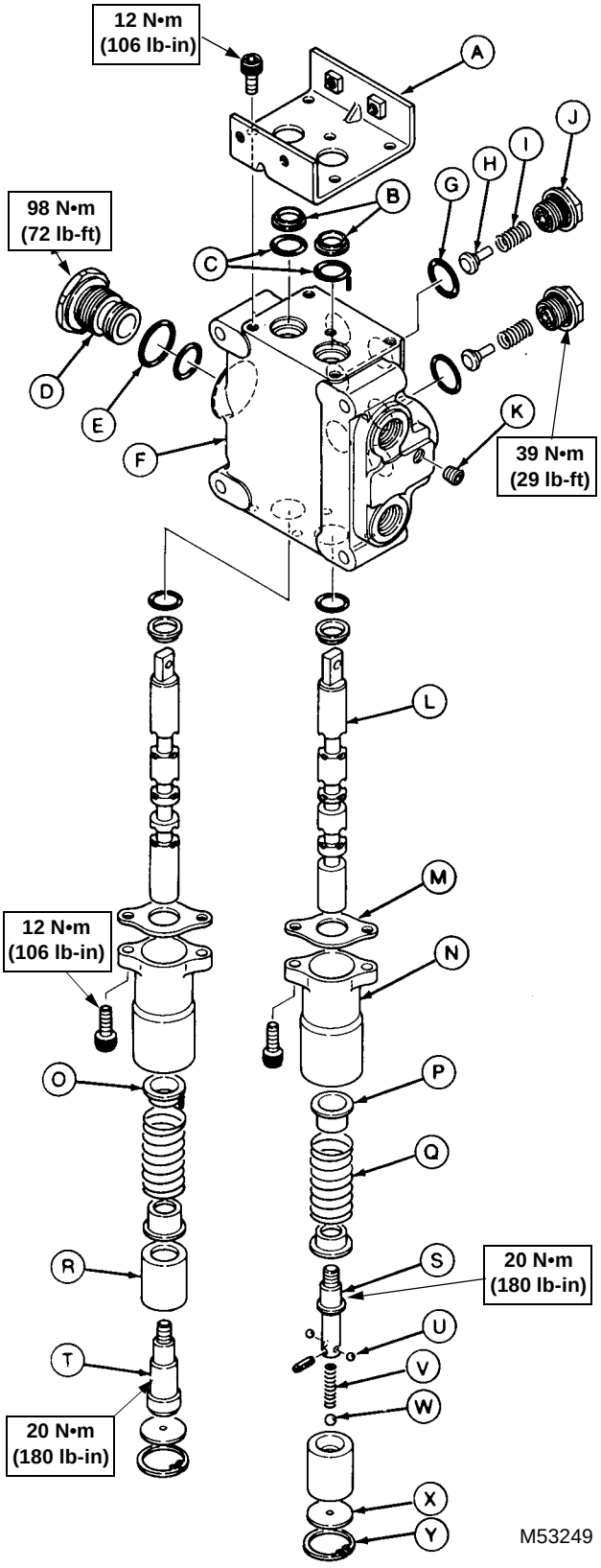
18. Apply thread lock and sealer (high strength) to threads of guides (S and T). Install parts (O—W).

19. Apply multipurpose grease to springs (Q and V) and balls (U).

20. Apply clean transmission/hydraulic oil to all other internal parts.

21. Install new seals and O-rings.

22. Apply pipe sealant with TEFLON or equivalent to threads of plug (K) and install.



KANZAKI ASSEMBLY SHOWN (Early Version)

A-Bracket
B-Seals (4 used)
C-O-Rings (4 used)
D-Plug
E-O-Ring
F-Housing
G-O-Ring (3 used)
H-Load Check Valve (2 used)
I-Spring (2 used)
J-Plug (2 used)
K-Pipe Plug
L-Boom Spool (2 used)
M-Bucket Spool Plate (2 used)
N-Cover (2 used)
O-Retainer (2 used)
P-Retainer (2 used)
Q-Spring (2 used)
R-Retainer (2 used)
S-Guide
T-Guide
U-Detent Ball (2 used)
V-Spring
W-Ball
X-Cover (2 used)
Y-Snap Ring (2 used)

DISASSEMBLE, INSPECT AND ASSEMBLE SCV CONTROL VALVE

NOTE: There are 2 versions of SCV valve assemblies shown in this manual. See your Parts Catalog for additional identification of parts.

IMPORTANT: Spools and housing are matched and must be replaced as a unit. Spools must be installed into the same bores from which they were removed for proper operation of each function.

1. Clamp flat end of spools (9, 15) in a soft jawed vise.

NOTE: High strength thread lock and sealer has been applied to the threads of spool end guides (17, 20). Heat applied to guide end of spools will soften the thread lock and sealer.

2. Apply heat to guide (17, 20) end of spools. Remove spools and remaining parts from bores.

3. Remove all other remaining parts from the valve assembly and inspect for wear or damage. Replace as necessary.

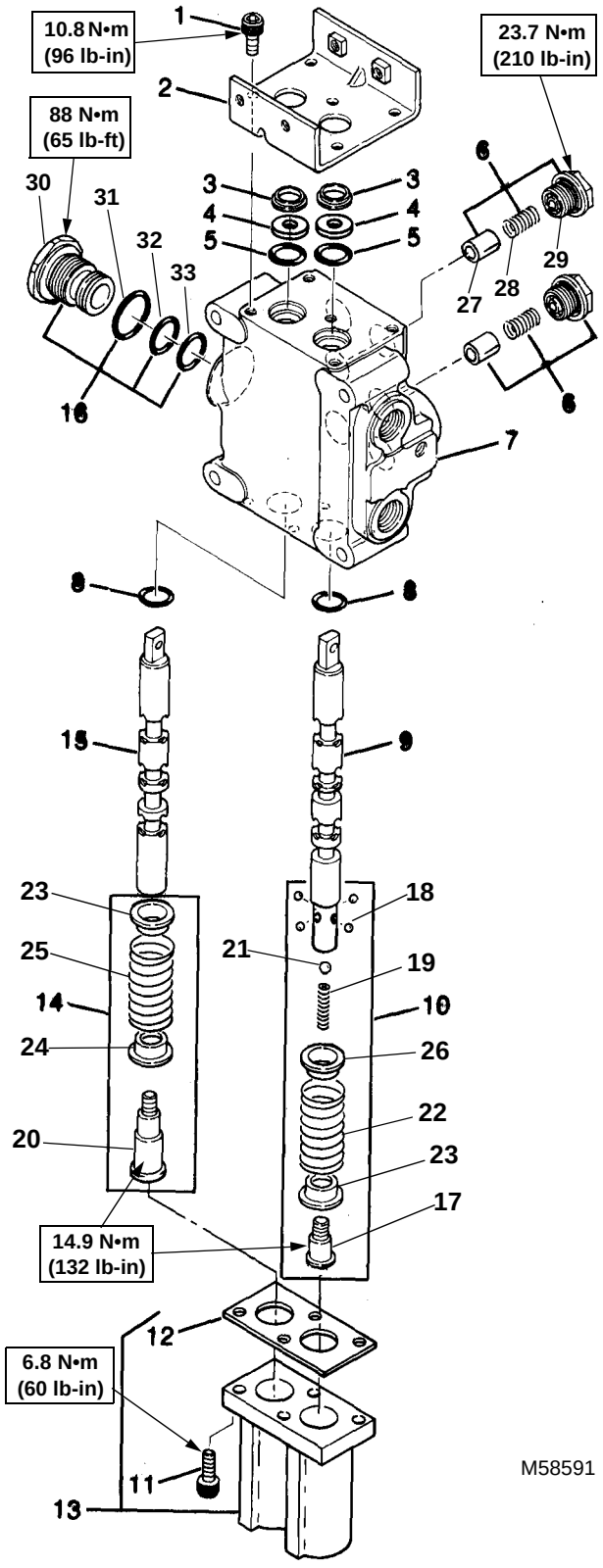
4. Apply thread lock and sealer (high strength) to threads of guides (17, 20).

5. Install all parts in reverse order of disassembly.

6. Apply multipurpose grease to springs (19, 25) and balls (18, 21).

7. Apply clean transmission/hydraulic oil to all other internal parts.

8. Install new seals and O-rings.



DANFOSS/DUKES ASSEMBLY SHOWN

IMPORTANT: Nameplate has valve assembly version identified as either 1560-AA or 1560-AC.

1-Hex Socket Screw (5 used)
2-Mounting Bracket
3-Seal (2 used)
4-Spacer (2 used)
5-O-Ring (2 used)
6-Load Check Kit (2 used)
7-Valve Housing
8-O-Ring (2 used)
9-Float Spool
10-Spring Center Float Kit
11-Hex Socket Screw (4 used)
12-Gasket
13-End Cap Kit
14-Spring Center Regen. Kit
15-Regen. Spool
16-Power Beyond Plug Assembly
17-Guide
18-Ball
19-Spring
20-Guide
21-Ball
22-Spring
23-Spacer (2 used)
24-Spacer
25-Spring
26-Detent
27-Load Check Poppet (2 used)
28-Spring (2 used)
29-Plug (2 used)
30-Power Beyond Bushing
31-O-Ring
32-Back-up Ring
33-O-Ring

REMOVE AND INSTALL REAR AUXILIARY HYDRAULIC LINES—670/770/790



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.

1. Lower rockshaft arms.

2. Remove center link.

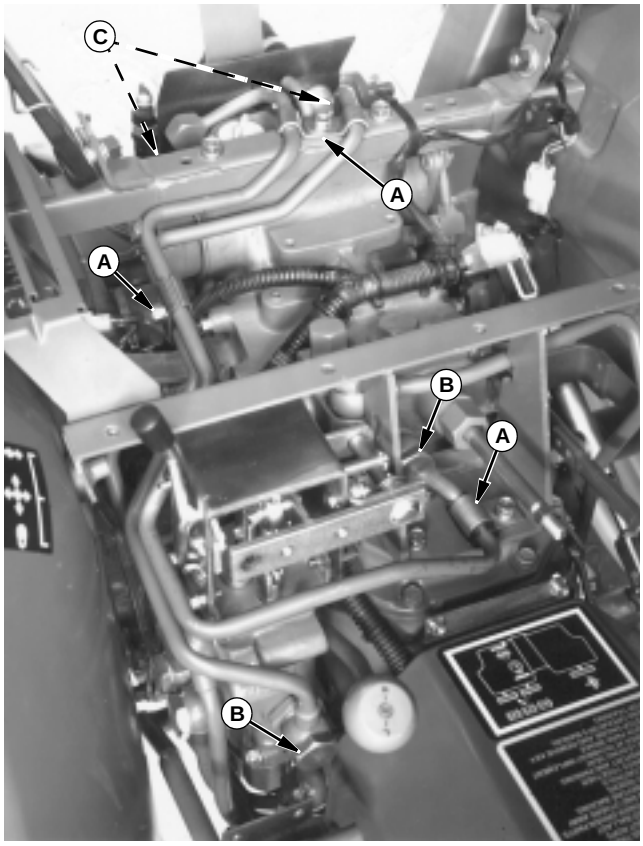
3. Remove seat and support. (See Section 80, Group 25.)

4. Remove three line clamps (A).

5. Remove banjo connectors and washers (B). Close all openings with caps and plugs.

6. Remove cap screws (C).

7. Remove rear auxiliary hydraulic line assembly.



With SCV Shown

8. Install line assembly. Leave cap screws loose.

IMPORTANT: There must be one copper washer on each side of banjo connector when installing lines.

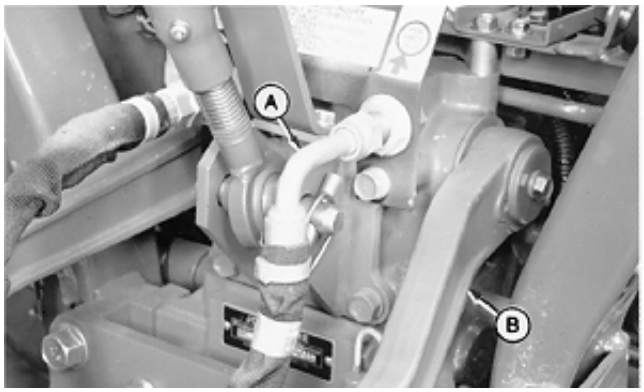
9. Install banjo connectors and new washers. Tighten fittings and bracket cap screws securely.

10. Install line clamps and center link.

IMPORTANT: Hydraulic hose must be reinstalled if an implement with open center valve is not installed.Hydraulic hose must be vertical to lift arms to eliminate lift arm from striking hose.

11. If removed, install hydraulic hose (A) vertical to lift arm (B).

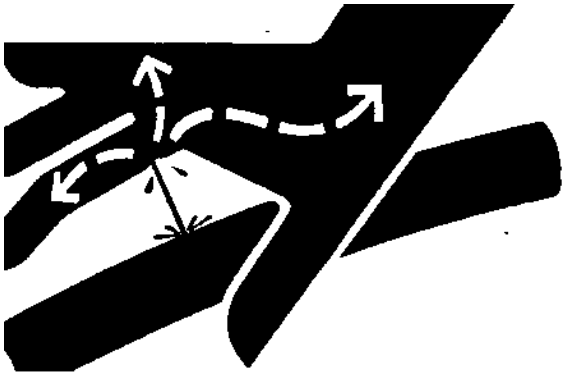
12. Start tractor and raise rockshaft arms. Check and repair any leaks as necessary.



M53252 -UN-20NOV89

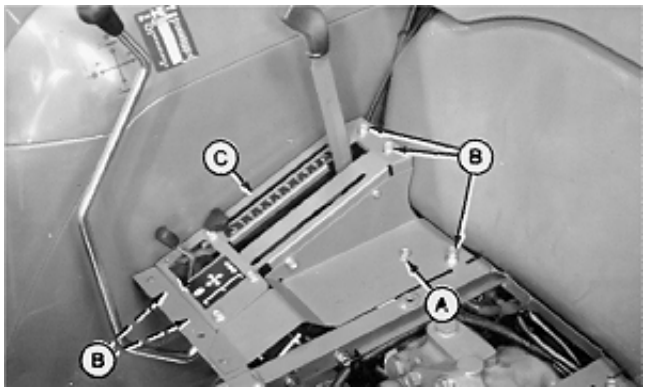
MX,7020DG,A2 -19-11JUL89

REMOVE AND INSTALL REAR AUXILIARY HYDRAULIC LINES—870/970/1070


X9811 -UN-23AUG88

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.



M53253 -UN-29JAN90

With SCV Shown

1. Lower rockshaft arms.

2. Remove center link.

3. Remove seat and support. (See Section 80, Group 25.)

4. On 1070, remove rockshaft lever knob.

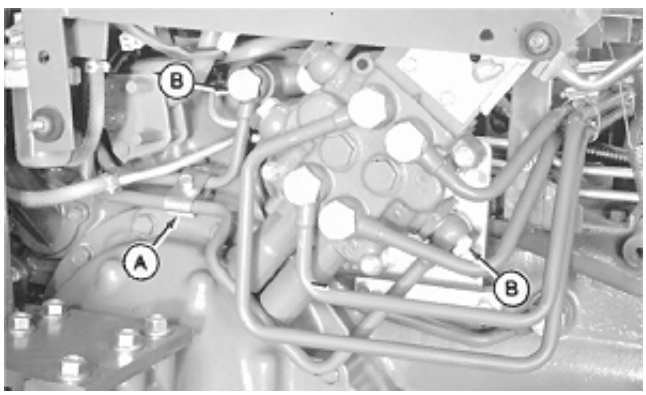
5. Remove cap screw (A), cap screws (B) and lever guide (C).

MX,7020DG,A3 -19-11JUL89

6. If equipped with SCV, remove right rear fender.

7. Remove line clamp (A).

8. Remove banjo connectors and washers (B). Close all openings with caps and plugs.



M53254 -UN-18JUL89

With SCV Shown

MX,7020DG,A4 -19-11JUL89

9. Remove hydraulic hose (A).

10. Remove nut and washer (B).

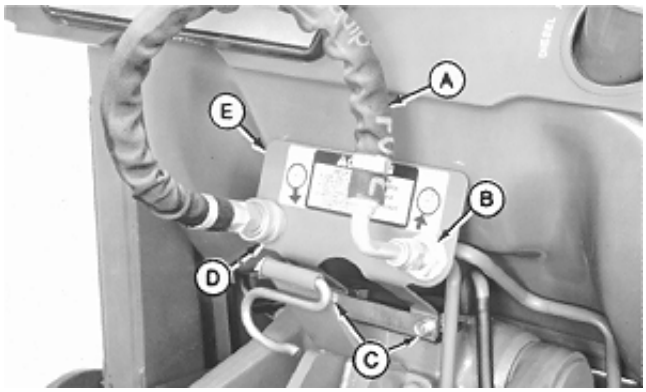
11. On 870/970, remove cap screws and nuts (C).

On 1070, remove cap screws.

12. Disconnect female coupler (D) and remove bracket assembly (E).

13. Remove rear auxiliary hydraulic lines.

If equipped with SCV, tip up back of supply line and slide under and along outside of SCV pressure lines.



870/970 Shown

A—Hydraulic Hose
B—Nut and Washer
C—Cap Screws and Nuts
D—Female Coupler
E—Bracket Assembly

MX,7020DG,A5 -19-11JUL89

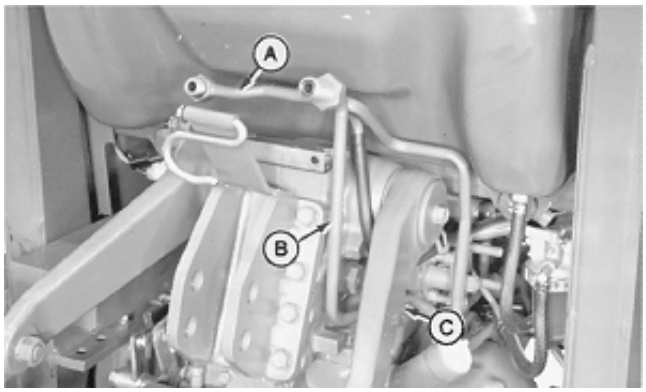
14. Install return line (B) inside and under rockshaft lift arm (C) and along right side of axle housing.

15. Install supply line (A) over and outside of rockshaft lift arm (C), along right side of axle housing.

If equipped with SCV, slide supply line (A) to the outside of SCV pressure lines and tip up back of supply line to slide under SCV pressure lines.

IMPORTANT: There must be one copper washer on each side of banjo connector when installing lines.

16. Install banjo connectors and new washers. Leave loose.



870/970 Shown

MX,7020DG,A6 -19-11JUL89

17. Install bracket assembly and connect female coupler to supply line.

18. Install washer and nut to return line.

19. Install new O-ring in end of return line (B).

IMPORTANT: Hydraulic hose must be reinstalled if an implement with open center valve is not installed. Hydraulic hose must face up to eliminate rubbing on adjustable center link.

20. Install hydraulic hose (A) to return line facing up.

21. Plug end of hose into female coupler (C).

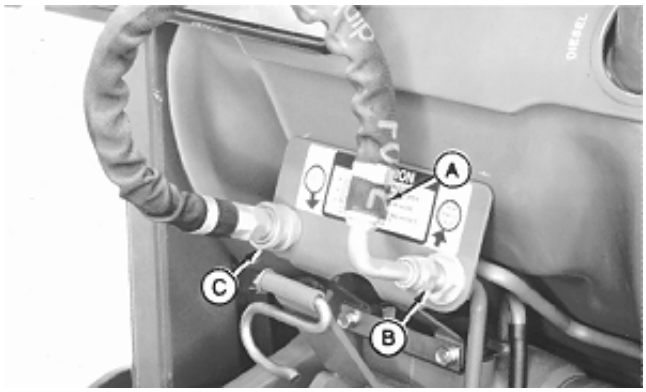
22. Install line clamp.

23. Tighten banjo connectors installed in Step 16.

24. Install lever guide, fender and center link.

25. On 1070, install rockshaft lever knob.

26. Start tractor and raise rockshaft arms. Check and repair any leaks as necessary.



M53257 -UN-18JUL89

870/970 Shown

MX,7020DG,A7 -19-11JUL89

Section 80
MISCELLANEOUS REPAIR

Contents

Page

Group 05—Wheels
Wheel Bearings
Inspect and Replace 80-05-1

Group 10—Front Axle
Remove and Install 80-10-1
Inspect and Replace Pivot Pin
and Bushings—870,970,1070 80-10-3
Remove and Install Spindle Shaft 80-10-4
Inspect and Replace
Spindle Shaft Bushings 80-10-5
Check and Adjust Axle Free-Play 80-10-6

Group 15—Hood
Remove and Install 80-15-1
Adjust Hood Latch Clearance 80-15-1

Group 20—3-Point Hitch
Inspect and Repair
Draft Links 80-20-1
Adjustable Lift Link—670/770/790 80-20-2
Adjustable Lift Link—870/970/1070 80-20-3
Center Link 80-20-4

Group 25—Seat and Support
Remove and Install 80-25-1

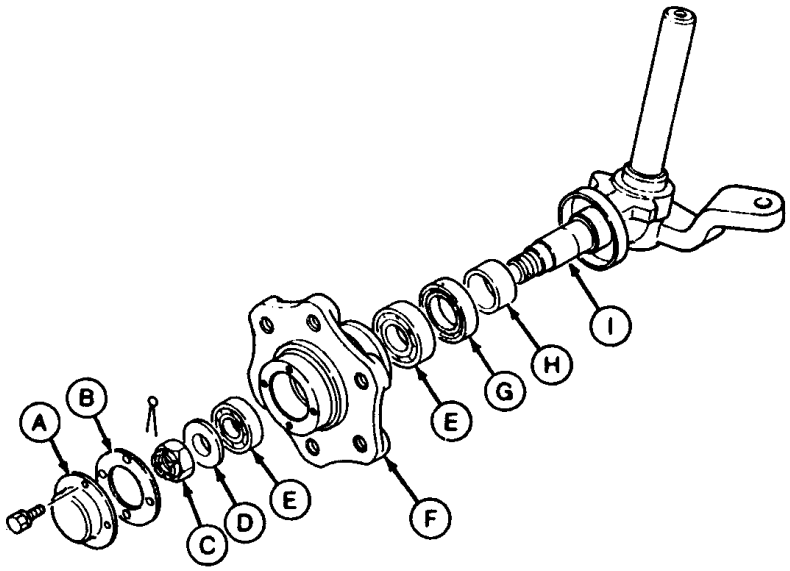
Group 30—Roll-Gard
Remove and Install
670/770/790. 80-30-1
870/970/1070. 80-30-3

Page

Group 35—Mower Spindles
Service Equipment and Tools 80-35-1
Other Material 80-35-1
Specifications 80-35-1
Remove Spindle Assembly 80-35-2
Disassemble Spindles
60 and 72 In. Mowers 80-35-3
Cross-Section View
60 and 72 In. Mowers 80-35-6
Assemble Spindle
60 and 72 In. Mowers 80-35-8
Disassemble Spindles—50 In. Mowers. . . 80-35-12
Cross Section View—50 In. Mowers. 80-35-16
Assemble Spindles—50 In. Mowers 80-35-18
Install Spindle Assembly 80-35-22

Group 40—Mower Gearbox
Service Equipment and Tools 80-40-1
Other Material 80-40-1
Specifications 80-40-2
Remove Mower Gearbox 80-40-2
Disassemble Gearbox. 80-40-4
Cross-Section View
Early 60 and 72 In. Mowers 80-35-12
Cross-Section View
Late 60 and 72 In. Mowers. 80-40-14
Cross-Section View—50 In. Mowers. 80-40-16
Assemble Mower Gearbox 80-40-18
Install Mower Gearbox 80-40-25

INSPECT AND REPLACE WHEEL BEARINGS



M53120

A—Hub Cap
B—Gasket
C—Retaining Nut
D—Washer
E—Bearing
F—Wheel Hub
G—Seal
H—Spacer
I—Spindle

NOTE: To prevent axle from tilting, insert a block of wood between axle and frame.

1. Place a small piece of wood between axle and frame on both sides.

2. Raise tractor and remove wheel.

3. On 670/770/790: Remove tie rod end (E).

On 870/970/1070: Remove steering cylinder from spindle, if equipped.

NOTE: On 670/770/790: Arm (B) is on right-hand spindle, if equipped with power steering.

4. Inspect bearings for scratches or score marks on outer race. Make sure bearings rotate freely. Replace if necessary.

5. Pack bearings with multipurpose grease.

6. Install bearings and seal using a bushing, bearing and seal driver set.

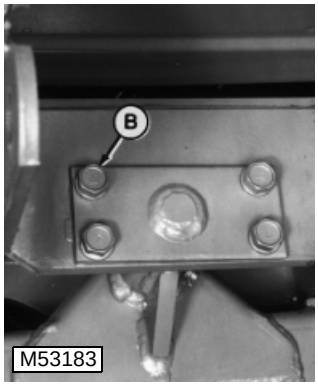
REMOVE AND INSTALL FRONT AXLE

1. If equipped with power steering: Remove steering cylinder. (See Section 60, Group 10.)

If equipped with manual steering: Disconnect drag link (A).

2. Raise front of tractor and remove front wheels.
3. Remove pivot pin capscrews (B).





4. Place a floor jack under center of axle and remove pivot pin, shims, washers, and spacer.

5. Remove axle.

6. Inspect pivot pin and bushings (see procedure in this group).

7. Install axle. Lift axle into place and align axle housing hole with pivot pin hole.

IMPORTANT: If equipped, be sure grease fitting (B) on pivot pin assembly (C) points down (6 o'clock) when installed.

8. Install pivot pin (C) through spacer (F), washers (E), and axle (H).

9. Tighten pivot pin capscrews (A).

10. Check and adjust axle assembly free-play (see procedure in this group.

11. Install wheels. Tighten capscrews to specifications.

12. Connect drag link, if equipped.

13. Install power steering cylinder, if equipped (see Section 60, Group 10).

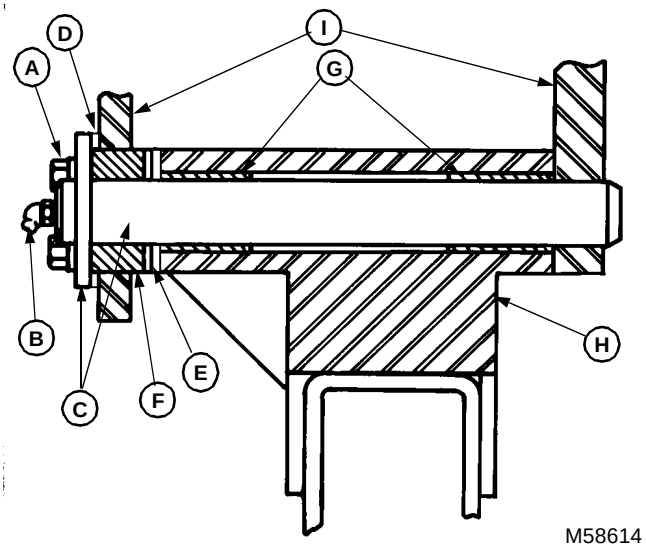
14. Lubricate front axle pivot assembly with multipurpose grease (see Section 10, Group 20).

TORQUE SPECIFICATIONS

Pivot Pin Cap Screws . . . . . 88 N•m (65 lb-ft)
Wheel to Hub Capscrews . . . . . 132 N•m (97 lb-ft)



M53184



M58614

A-Capscrew
B-Grease Fitting
C-Pivot Pin/Flange
D-Adjusting Shims
E-Washer (2 used)
F-Spacer
G-Bushing
H-Axle Housing
I-Frame

INSPECT AND REPLACE PIVOT PIN AND BUSHINGS

1. Inspect parts A—G for wear or damage. Replace if necessary.

2. Remove bushings (G) from the axle using a blind-hole puller set.

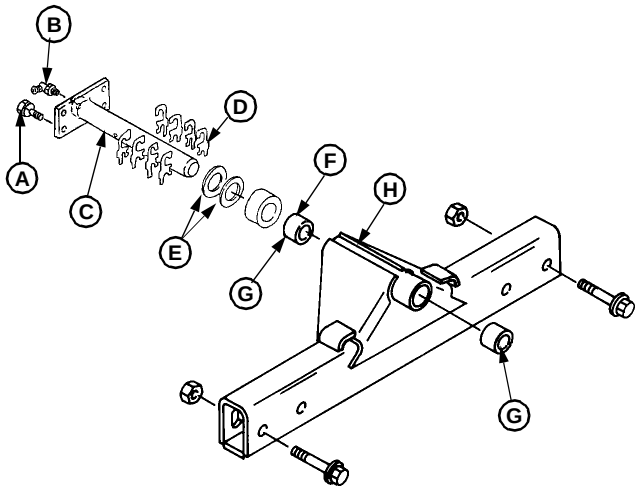
3. Install one of two bushings (G) on greased pivot pin (C).

4. Using the pivot pin (C) as a pilot and a driver, install bushing (G) into axle bore until flush with surface.

5. Drive pivot pin out of installed bushing and repeat same procedure with second bushing (G).

6. Check and adjust axle assembly end-play (see procedure in this group.

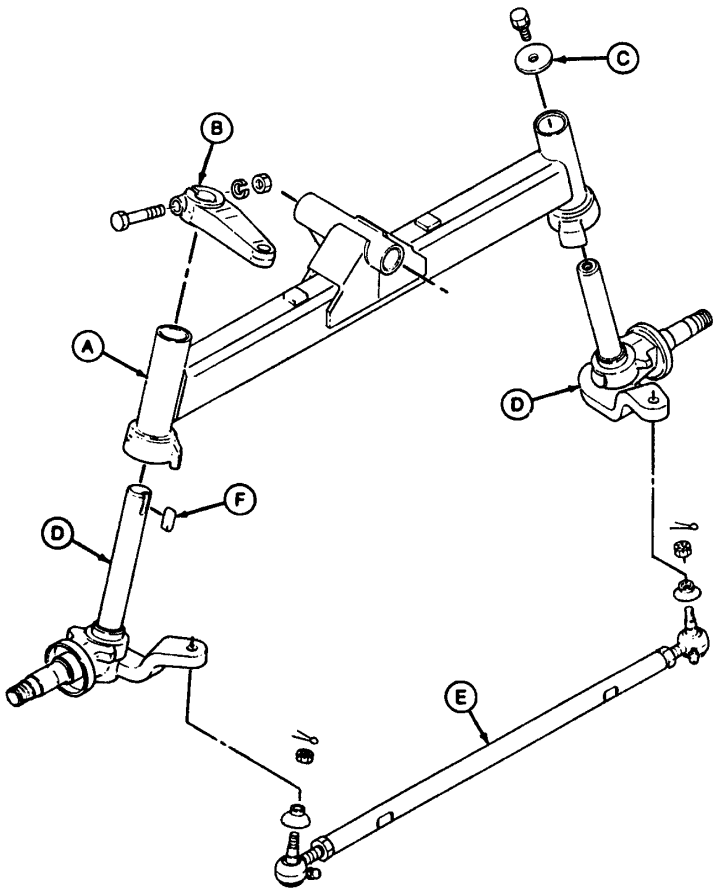
870-970-1070 Standard Axle w/o Power Steering



M58606

A-Capscrew
B-Grease Fitting
C-Pivot Pin
D-Adjusting Shims
E-Washer (2 used)
F-Spacer
G-Bushing
H-Axle

REMOVE AND INSTALL SPINDLE SHAFT



M53125

A—Front Axle **C—Washer** **E—Tie Rod** **F—Key**
B—Arm **D—Spindle**

670/770/790 Manual Steering Shown

NOTE: To prevent axle from tilting, insert a block of wood between axle and frame.

1. Place a small piece of wood between axle and frame on both sides.

2. Raise tractor and remove wheel.

3. On 670/770/790: Remove tie rod end (E).

On 870/970/1070: Remove steering cylinder from spindle, if equipped.

NOTE: On 670/770/790: Arm (B) is on right-hand spindle, if equipped with power steering.

4. Remove arm (B), key (F), and spindle (D).

5. Inspect spindle shaft and bushings for wear or damage. (See procedure in this group.)

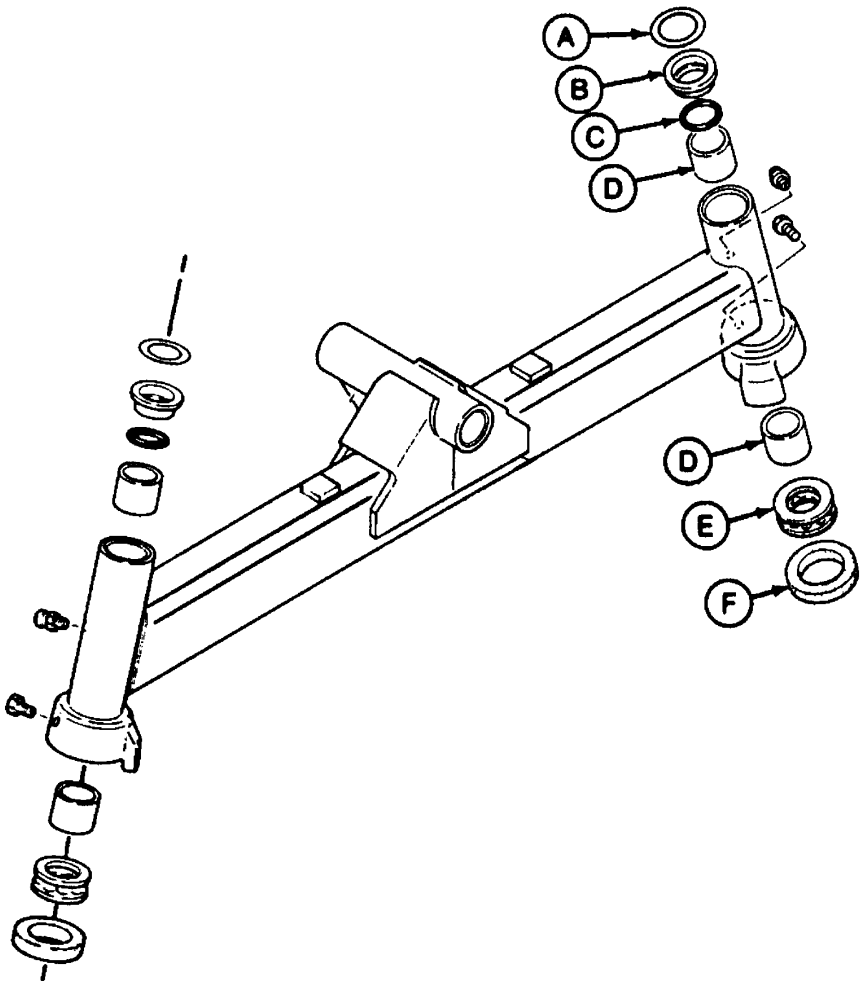
6. Install spindle, key and arm.

7. On 670/770/790: Install tie rod.

On 870/970/1070: Install steering cylinder, if equipped.

8. Install wheel.

INSPECT AND REPLACE SPINDLE SHAFT BUSHINGS



MS3126

A—Shim
B—Retainer
C—O-Ring
D—Bushing
E—Bearing
F—Seal

670/770/790 Shown

1. Inspect bearings (E) for wear or damage. Make sure bearing rotates freely. Replace if necessary.

2. Inspect spindle shaft and bushings for wear or damage. Replace if necessary.

3. Remove bushings (D) from axle using a blind hole puller set.

4. Install new bushings and seals (F) using a bushing, bearing and seal driver set. Install seals with springloaded side facing toward bearing.

5. Apply multipurpose grease to all parts and assemble.

CHECK AND ADJUST AXLE FREE-PLAY

1. Jack up the tractor and loosen the center pivot pin assembly capscrews (A) enough to allow the axle to pivot freely.

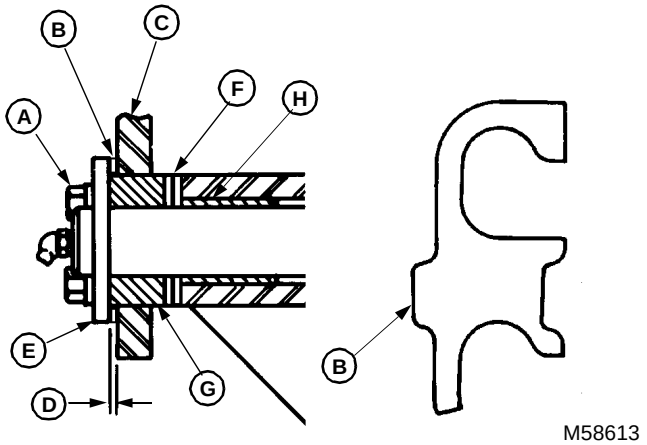
2. Force the axle assembly to the rear and measure the gap (D), located between the pivot pin flange (E) and frame (C).

NOTE: Adjusting shims (B) now come in one size of 0.25 mm (0.010 in.). Formerly there was an additional size of 0.50 mm (0.010 in.). The shims are designed to hang on the top two capscrews (A) between the flange (E) and the frame (C).

3. Install necessary shims (B) to obtain axle free-play per specifications.

4. Tighten capscrews (A) per specifications.

5. Check axle assembly to be sure that it pivots freely.



M58613

A-Capscrew
B-Adjusting Shims
C-Frame
D-Gap
E-Pivot Pin Flange
F-Washer (2 used)
G-Spacer
H-Bushing

SPECIFICATIONS

Pivot Pin Cap Screws . . . . . 88 N•m (65 lb-ft)
Axle Free-play . . . . . 0–0.60 mm (0–0.024 in.)

REMOVE AND INSTALL HOOD

1. Remove dash cover.

2. Remove cap screw and washer (A).

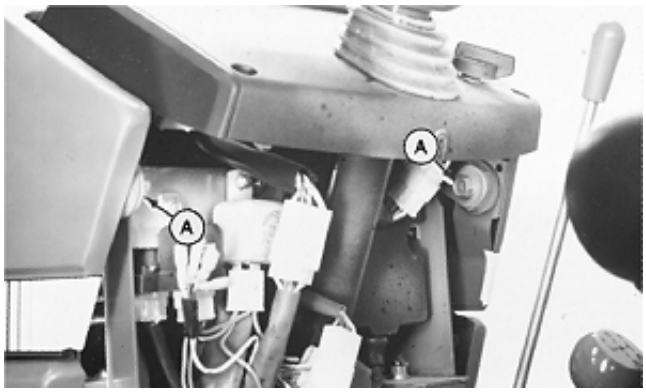
3. Remove cushion (B) and bushing (C) from each side.

3. Remove hood.

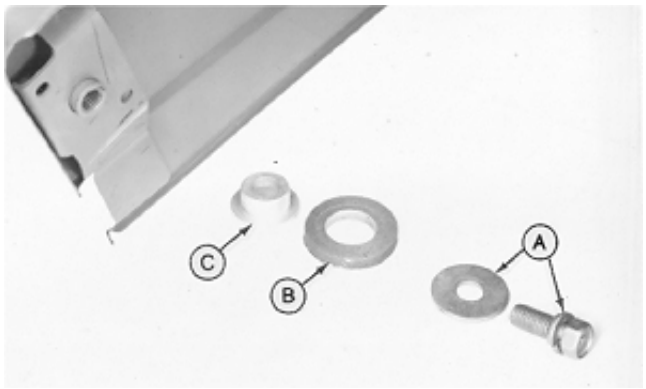
4. Inspect support cushions (B) for excessive wear or damage. Replace if necessary.

5. Install hood and dash cover.

6. Check and adjust hood latch clearance. (See procedure in this group.)



670 Shown



MX,8015DG,A1 -19-12MAY89

CHECK AND ADJUST HOOD LATCH CLEARANCE

1. Check hood clearance (A). If clearance is more than 10 mm (0.394 in.), adjust hood latch height.

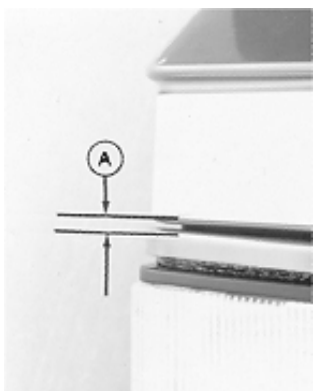
2. Remove front grille.

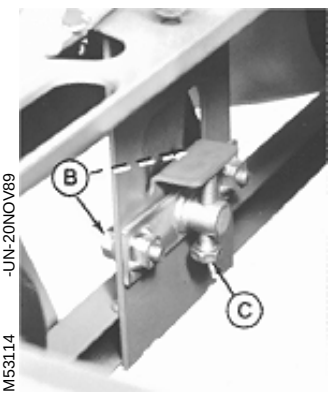
3. Loosen cap screws (B).

4. Adjust cap screw (C). Turn cap screw clockwise to lower or counterclockwise to raise hood latch.

5. Tighten cap screws (B) securely.

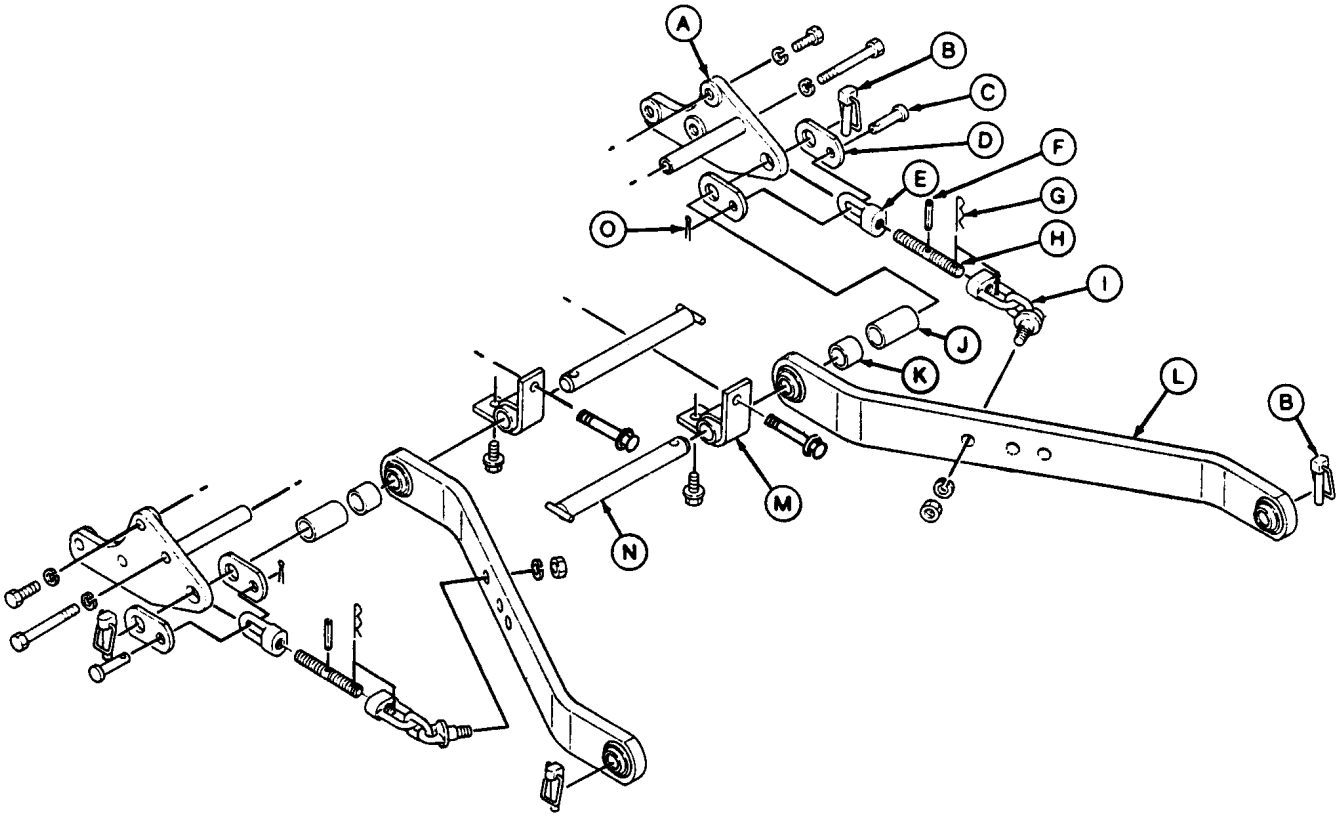
6. Install front grille.





MX,8015DG,A2 -19-11MAY89

INSPECT AND REPAIR DRAFT LINKS

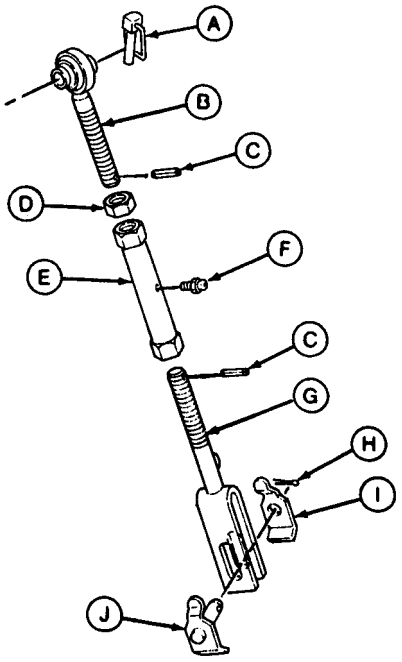


A—Bracket	**E—Link Nut**	**I—Sway Link**	**M—Draft Arm Support**
B—Quick-Lock Pin	**F—Roll Pin**	**J—Bushing**	**N—Draft Arm Support Shaft**
C—Drilled Pin	**G—Spring Pin**	**K—Bushing**	**O—Cotter Pin**
D—Link Plate	**H—Sway Link Bolt**	**L—Draft Arm**	

670/770/790 Shown

Inspect draft link assembly for wear or damage.
Replace as necessary.

INSPECT AND REPAIR ADJUSTABLE LINK—670/770/790



M53122

A—Quick-Lock Pin
B—Ball Swivel End
C—Roll Pins
D—Jam Nut
E—Lift Link Body
F—Grease Zerk
G—Yoke End
H—Cotter Pin
I—Float Stop Plate
J—Float Stop Pin

NOTE: To prevent axle from tilting, insert a block of wood between axle and frame.

1. Remove grease zerk (F).

2. Remove grease from zerk hole using solvent and compressed air.

3. Thread either link end (B or G) in until roll pin (C) is centered with grease zerk hole.

4. Turn lift link so zerk hole faces downward. Tap lift link lightly, roll pin (C) should fall out. Thread end out. Repeat procedure to remove other end.

5. Inspect lift link assembly for wear or damage. Replace as necessary.

INSPECT AND REPAIR ADJUSTABLE LIFT LINK—870/970/1070

1. Remove grease zerk (O).

2. Remove grease from zerk hole using solvent and compressed air.

3. Thread rod (D) in until roll pin (F), is centered with grease zerk hole.

4. Turn lift link so zerk hole faces downward. Tap lift link lightly, roll pin (F) should fall out. Thread housing assembly out.

5. Remove snap ring (G), washer and pin (K) to separate arm (B) from housing (H).

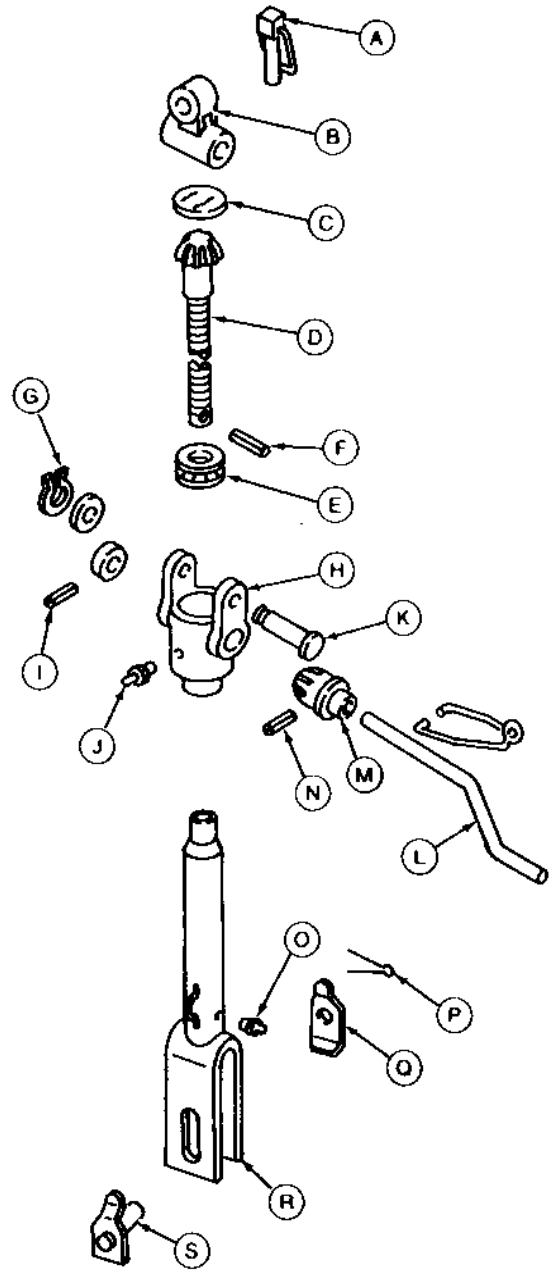
6. Remove roll pin (I) and washer.

7. Remove pinion (M) with handle (L).

8. Tap on threaded end of gear rod (D) with a rubber mallet to remove seal (C).

9. Remove gear rod and bearing (E). Remove bearing with a bushing, bearing and seal driver set if necessary.

10. Inspect lift link assembly for wear or damage. Replace as necessary.



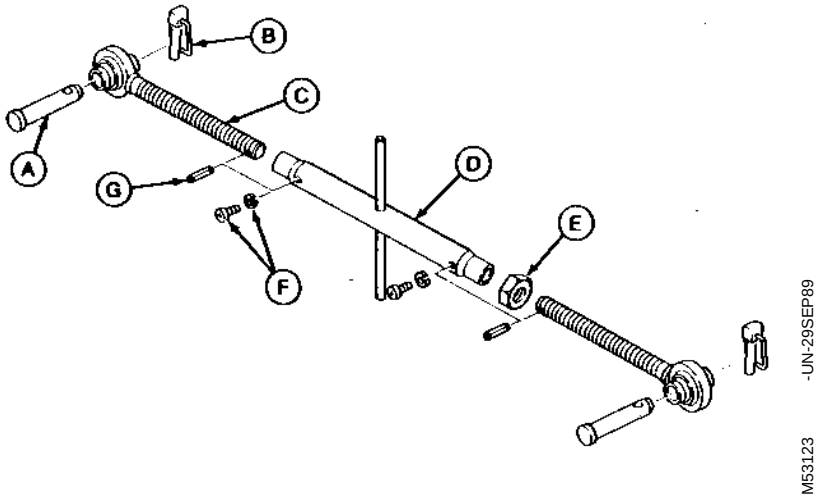
A—Quick-Lock Pin
B—Arm
C—Seal
D—Gear Rod
E—Bearing
F—Roll Pin
G—Snap Ring
H—Housing
I—Roll Pin
J—Grease Zerk
K—Pin
L—Crank Handle
M—Pinion
N—Roll Pin
O—Grease Zerk
P—Cotter Pin
Q—Float Stop Plate
R—Yoke
S—Float Stop Pin

M53127 -UN-18JUL89

MX,8020DG,A3 -19-12JUN89

80 20 3

INSPECT AND REPAIR CENTER LINK



A—Drilled Pin
B—Quick-Lock Pin
C—Center Link End
D—Center Link Body
E—Jam Nut
F—Screws and Lock Washers
G—Roll Pin

1. Remove screws and lock washers (F).

2. Thread either link end (C) in until roll pin (G), is centered with hole.

3. Turn center link so hole faces downward. Tap center link lightly, roll pin (G) should fall out. Thread end out. Repeat procedure to remove other end.

4. Inspect center link assembly for wear or damage. Replace as necessary.

MX,8020DG,A4 -19-11MAY89

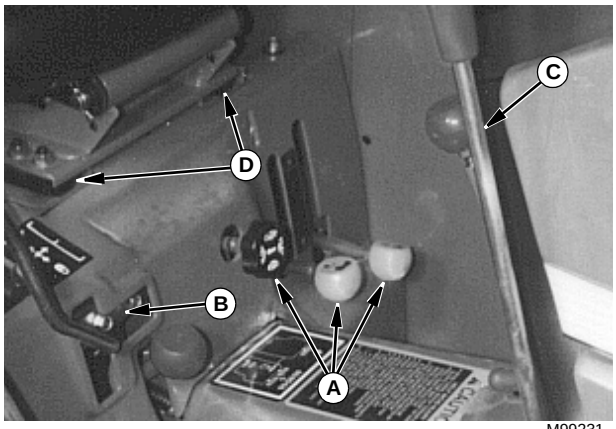
80
20
4

REMOVE AND INSTALL SEAT AND SUPPORT

1. Remove knobs (A).
2. On 670/770/790: Remove SCV lever (B), if equipped.

NOTE: On 670/770/790: Move seat forward to remove top cap screw from front panel.

3. Remove front panel (C).
4. Remove nuts (D).



M99231

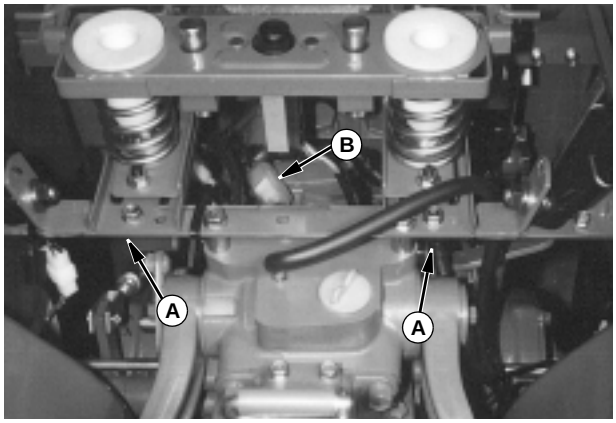
670/770/790 Shown

A—Knobs
B—SCV Lever
C—Front Panel
D—Nuts

5. Slide seat forward and tilt up.
6. On 670/770/790: Remove cap screws, washers and nuts (A).

On 870/970/1070: Remove nuts.

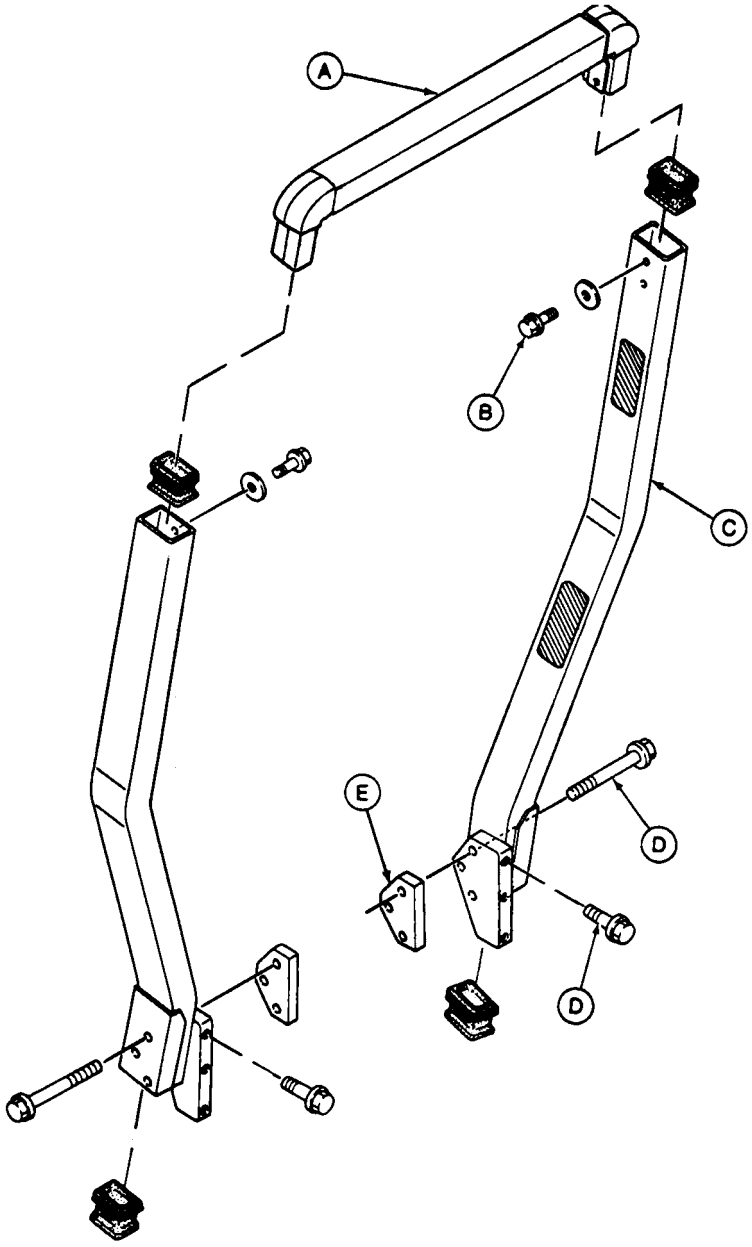
7. Disconnect wiring harness (B).
8. Remove seat and support.
9. Install seat and support.
10. Connect wiring harness.
11. Install front panel, knobs, and SCV lever, if equipped.



M99230

670/770/790 Shown

REMOVE AND INSTALL ROLL-GARD®—670/770/790



M53199

A—Crossmember Assembly
B—Cap Screws (2 used per side)
C—Post
D—Cap Screws (6 used per side)
E—Spacer

1. Remove fenders.

2. Mid mount PTO: Disconnect mid mount PTO brake rod.

3. Loosen cap screws (B and D).

4. Remove cap screws (B) and washers.

5. Remove crossmember assembly (A).

6. Remove cap screws (D), spacer (E) and post (C).

TORQUE SPECIFICATIONS

Cap Screws (B) . . . . . 123 N·m (91 lb-ft)

Cap Screws (D) . . . . . 265 N·m (195 lb-ft)

7. Install spacer, post and cap screws. Leave cap screws loose.

8. Install crossmember assembly, washers and cap screws.

9. Tighten all cap screws to specifications.

10. Mid mount PTO: Connect brake rod.

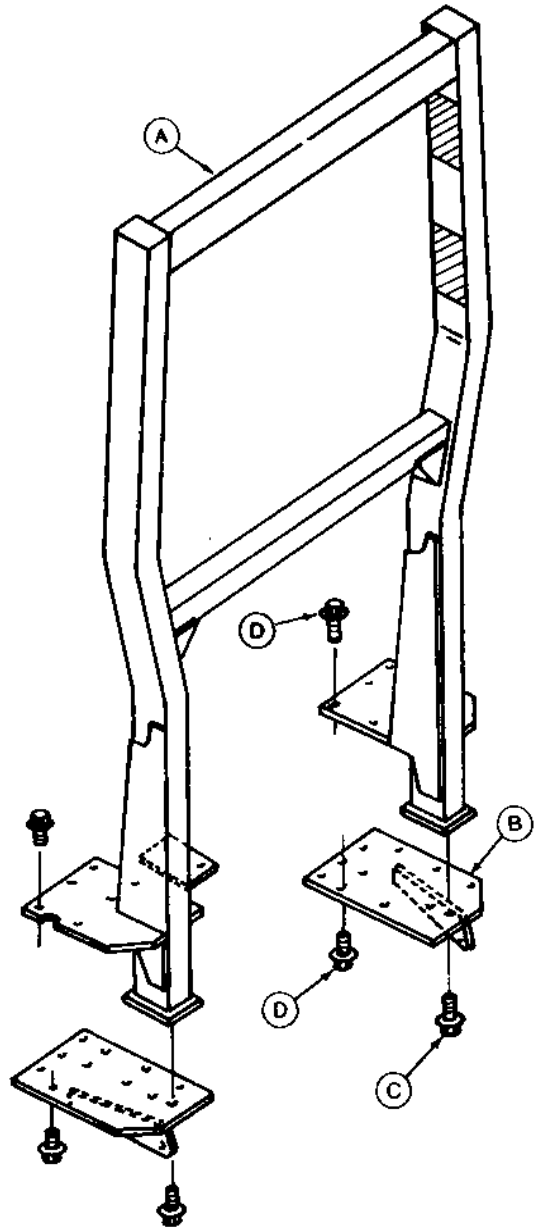
11. Install fenders.

MX,8030DG,A4 -19-05DEC89

80
30
2

REMOVE AND INSTALL ROLL-GARD®—870/970/1070

A—Roll-Gard Frame
B—Bottom Plate
C—Cap Screws (2 used per side)
D—Cap Screws (12 used per side)



M53200 -UN-18JUL89

MX,8030DG,A2 -19-20JUN89

80 30 3

1. Install a block of wood between front axle and have on both sides.

2. Remove rear tires.

3. Remove SMV sign and fuel tank shrouds.

4. Disconnect sway links.

5. Remove tool box.

N **CAUTION: The approximate weight of ROLL-GARD is:**
870/970 .....51 kg 9112 lb)
1070 .....51.7 kg (114 lb)

6. Attach a hoist to ROLL-GARD frame (A) and remove.

7. Remove plates (B).

NOTE: Bottom plates are not the same. Welded tab ears on bottom of plates should point in toward drawbar when installed.

8. Install bottom plates with tab ears pointing in towards drawbar. Leave cap screws loose.

9. Align ROLL-GARD frame with bottom plate and install cap screws loosely.

10. Tighten all cap screws to specifications.

11. Connect sway links.

12. Install tool box, shrouds, SMV sign and wheels.

TORQUE SPECIFICATIONS

Cap Screws (D)	136 N·m (100 lb-ft)
Cap Screws (C)	332 N·m (245 lb-ft)
Rear Wheel Cap Screws	190 N·m (140 lb-ft)

MX,8030DG,A3 -19-20DEC89

80
30
4

SERVICE EQUIPMENT AND TOOLS

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

Name	Use
1-7/8 in. O. D. Pipe	To install seal.
Bushing, Bearing, and Seal Driver Se	To service bearings and seal.
Snap Ring Pliers Set	To remove snap rings.
Knife-Edge Puller	To service bearings.
Hydraulic Press	To remove/install bearings and seals.
13/16 in. O. D. Pipe	To install shaft assembly.

OTHER MATERIAL

Number	Name	Use
T43512	John Deere LOCTITE® Thread Lock and Sealer (medium strength)	Apply to threads of hub and shaft.

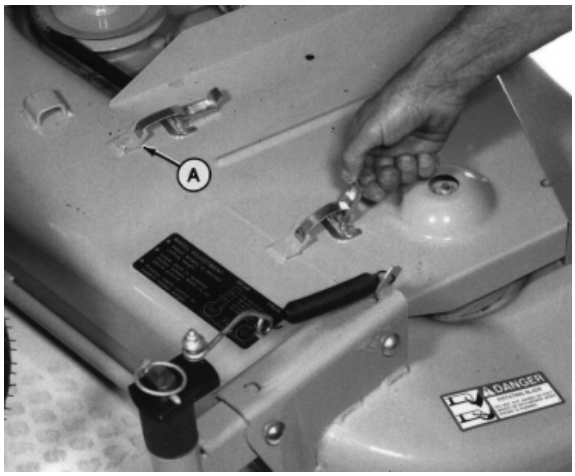
LOCTITE is trademark of the Loctite Compound Corp.

SPECIFICATIONS

Item	Measurement	Specification
Seal	Depth below surface	Flush
Spindle Nut		
50 in. Mower	Torque	140 N•m (103 lb-ft)
60 in. and 72 in. Mower	Torque	163 N•m (120 lb-ft)
Blade Cap Screw		
50 in. Mower	Torque	73 ± 5 N•m (54 ± 4 lb-ft)
60 in. and 72 in. Mower	Torque	113 ±11 N•m (83 ± 8 lb-ft)
Gearbox Mounting Capscrew	Torque	50 N•m (37 lb-ft)

REMOVE SPINDLE ASSEMBLY

1. Remove belt shields (A).



M39722

23. 2. Loosen belt.

24. 60 AND 72-INCH MOWERS:
    a. Loosen nut and remove stop

25. 50-INCH MOWERS:
    a. Loosen idler stop nut.
    b. Loosen eye bolt on end of idler spring.
    c. Put 3/8 in. drive in pivot plate hole to turn plate and release spring tension.

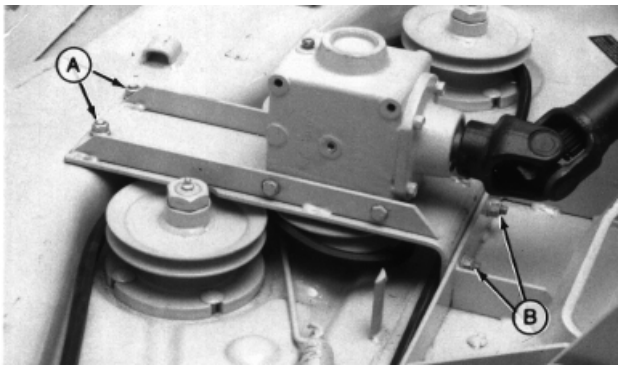


M39729 **60-In. Mower Shown**

NOTE: To remove center spindle assembly, the gear box assembly must be removed. Otherwise go to Step 5.

26. Remove belt from sheaves.

27. Remove lock nuts and washers (A). Remove lock nuts and cap screws (B). Remove gear box assembly with PTO shaft.

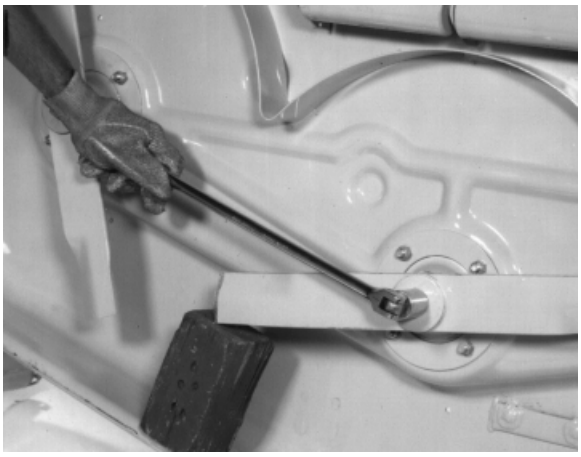


M43683

C **CAUTION: Blades may be sharp. When you handle blades, wear gloves, or wrap a shop cloth around blade.**

5. Put a block of wood between mower blade and deck.

6. Remove cap screw, washer, blade, and anti-wrap cup (if equipped).

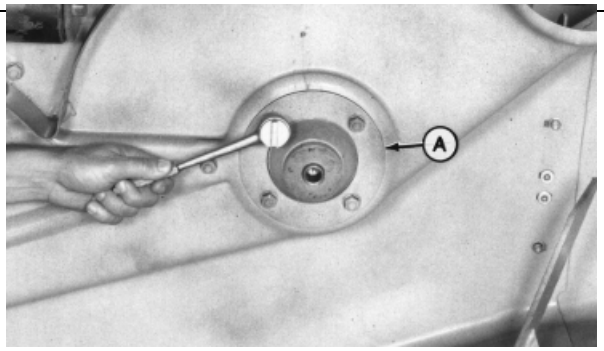


M35758

7. Remove nuts and carriage bolts.

8. Remove ring (A). Pull spindle assembly from mower deck.

60-In. Mower Shown



M37328

DISASSEMBLE SPINDLES—60/72-IN. MOWERS

9. Clamp lower hub of spindle assembly in a vise.

10. Remove grease fitting.



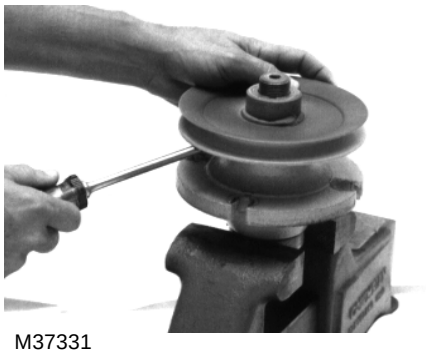
M37329

3. Remove nut.



M37330

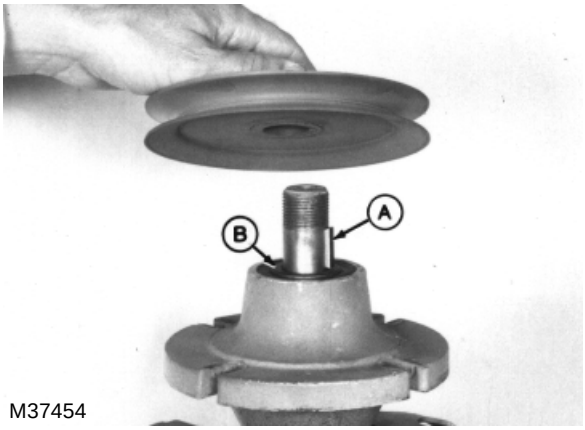
4. Loosen sheave. Be careful not to bend flanges.



M37331

NOTE: The 60-inch mower has a two-bladed fan included (not shown).

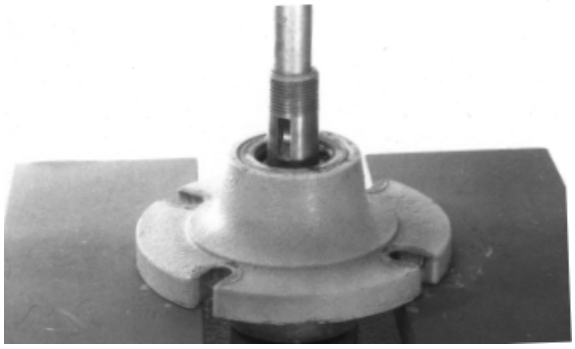
5. Remove sheave. Remove key (A) and bushing (B).



M37454

6. Press shaft from housing

Lower bearing and spacer may come out with shaft; if they don't, move the spacer to one side and press bearing out—press against inner bearing ring surface only.



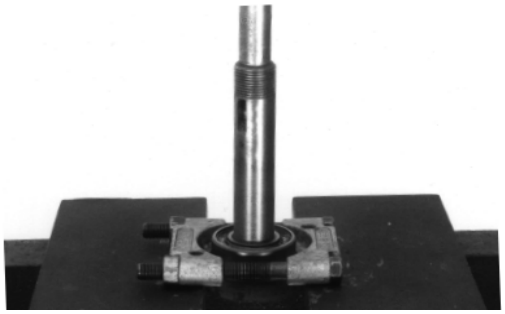
M37333

7. Remove spacer.



M37334

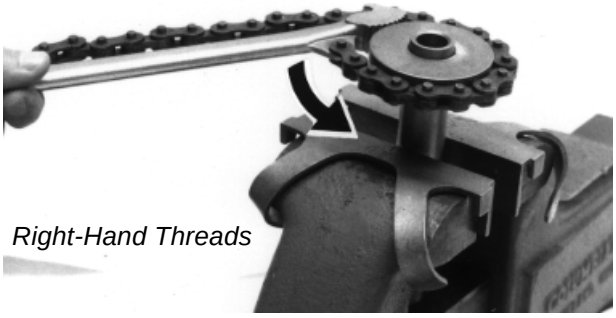
8. Remove bearing using a knife-edge puller.



M37335

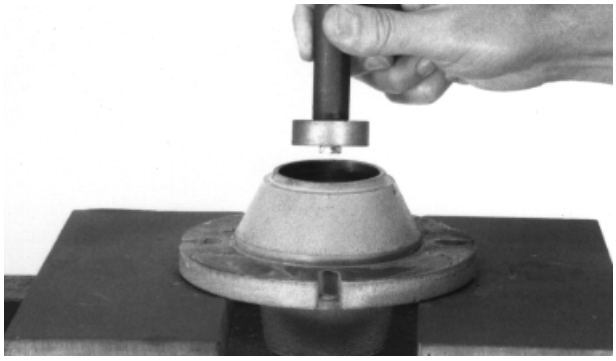
9. Inspect shaft for excessive wear or damage. If shaft or hub is not worn or damaged, it is not necessary to separate.

10. To separate, hold shaft in a soft-jaw vise and remove hub.



M37339

11. Use a 1-1/2-in driver disk to remove upper bearing and seal. Be sure disk does not press on snap ring.



M37337

12. Remove snap rings.

13. Clean inside of housing with solvent. Be sure to remove all metal shavings and grit.

Check for wear or damage in bearing seating areas; replace, if required.



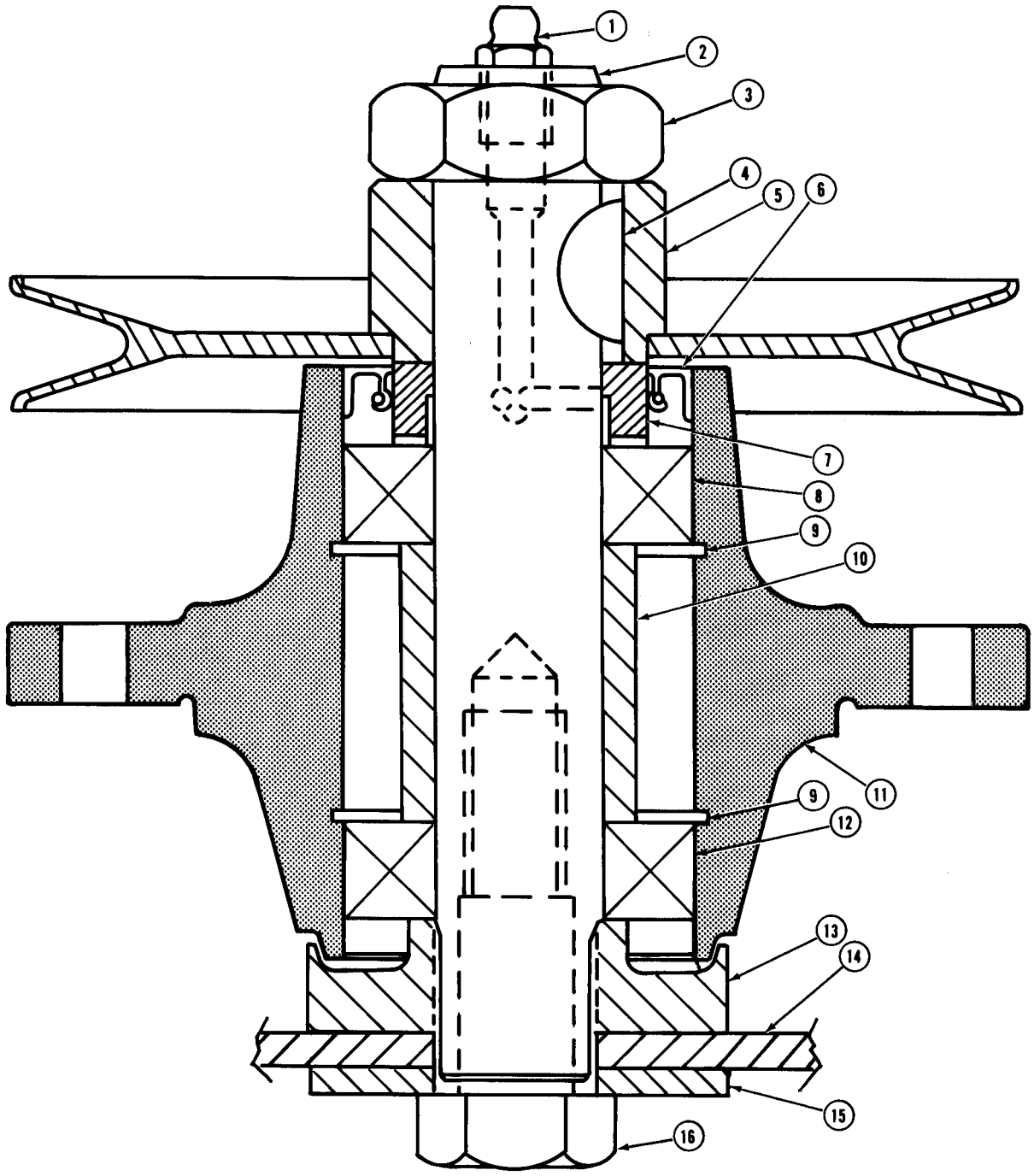
M37338

Mower Spindles Cross-Section View—60 and 72-In Mowers

1-Grease Fitting
2-Shaft
3-Nut
4-Key
5-Sheave
6--Seal
7-Bushing (used on later units)
8-Upper Bearing
9-Snap Ring (2 used)
10-Spacer
11-Housing
12-Lower Bearing
13-Hub
14-Blade
15-Washer
16-Cap Screw

CROSS-SECTION VIEW—60 AND 72-IN. MOWERS

Mower Spindles Cross-Section View—60 and 72-In Mowers



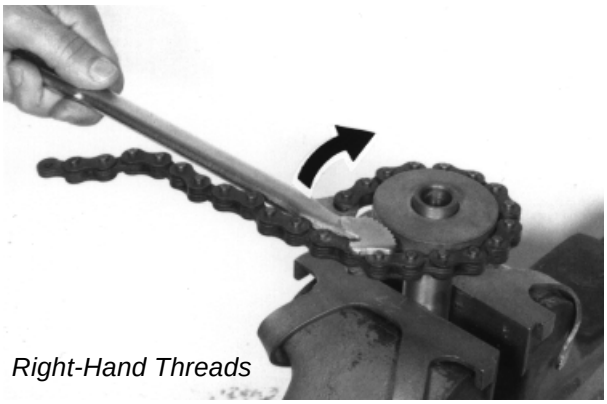
M37428

Mower Spindles Cross-Section View—60 and 72-In Mowers

ASSEMBLE SPINDLES—60/72-IN. MOWERS

IMPORTANT: Always install new bearings and seals when servicing spindles.

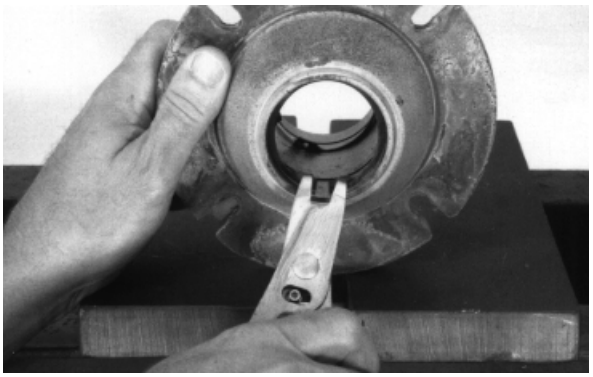
23. Clean threads on shaft and hub using clean and cure primer. Apply thread lock and sealer (medium strength) on threads. Install hub on shaft. Tighten to 163 N•m (120 lb-ft).



Right-Hand Threads

M37336

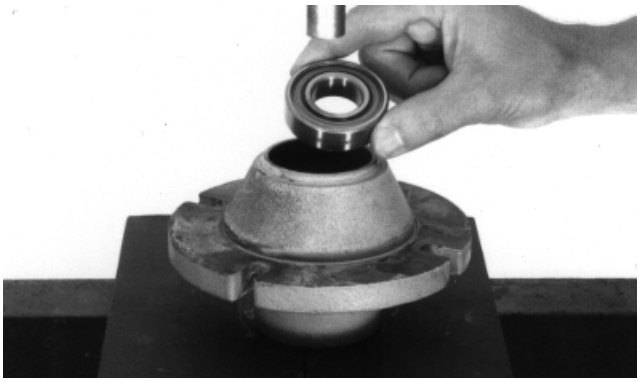
24. Install snap rings.



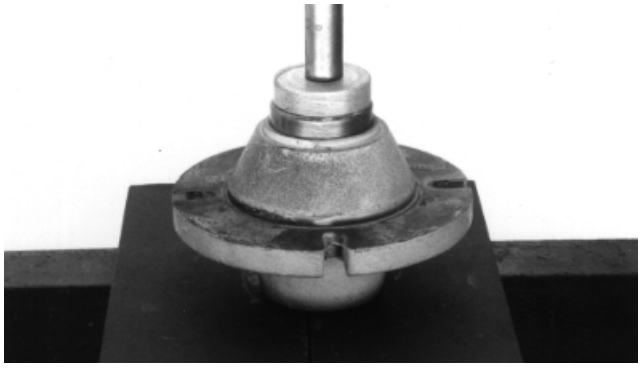
M37338

3. Pack both bearings with John Deere Multi-Purpose Grease or equivalent.

4. Turn housing bottom-side up to install lower bearing (sealed on one side only). Be sure bearing seal faces up. Press bearing against snap ring using a 1-15/16 in. disk.



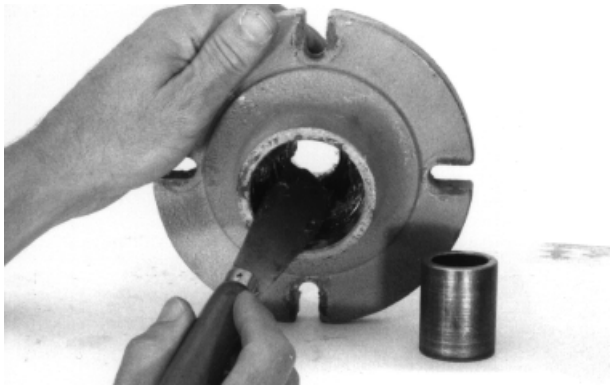
M37340



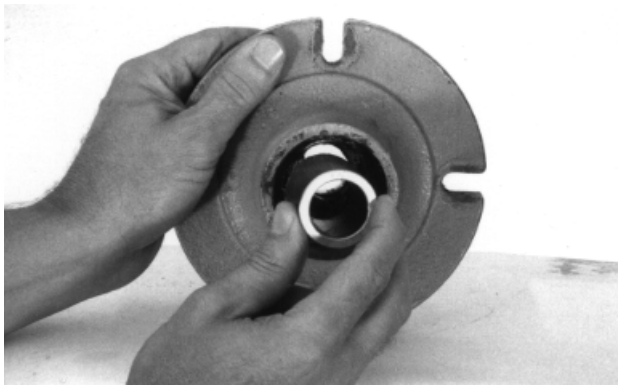
M37341

5. Apply John Deere Multi-Purpose Grease or equivalent to area between snap rings.

6. Put spacer against lower bearing. Be sure there is enough grease to hold spacer centered in bore.

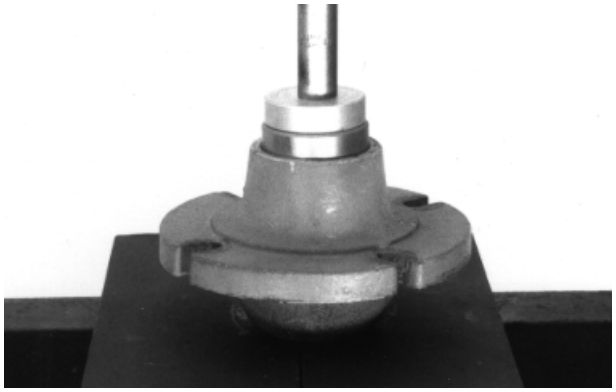


M37342



M37343

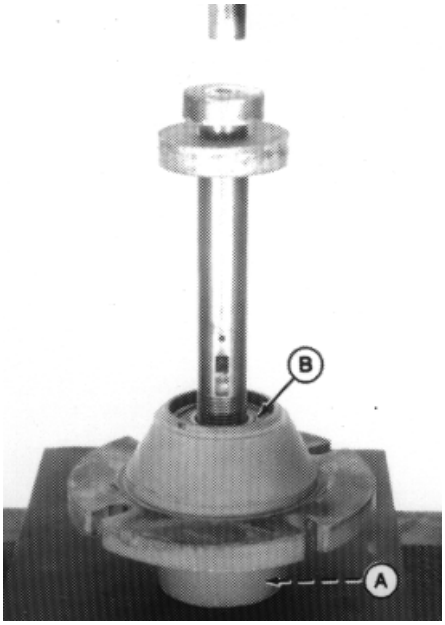
7. Turn housing top-side-up to install upper non-sealed bearing. Press bearing against spacer, using a 1-15/16 in. disk. Support both the inner and outer rings of both upper and lower bearings with a flat disk.



M37344

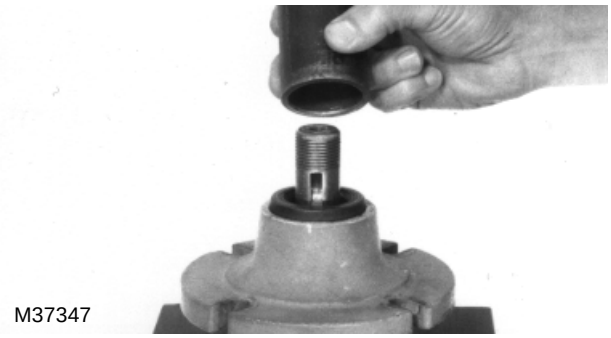
8. Put housing bottom-side-up on a press plate with a 1-1/16 in. hole or gap (A) so upper bearing is centered over hole or gap (A).

9. Look inside spindle to be sure spacer aligns with bearings inside housing and hole or gap of press plate, then install hub and shaft assembly. Press shaft through both bearings and spacer until hub stops against lower bearing (B).



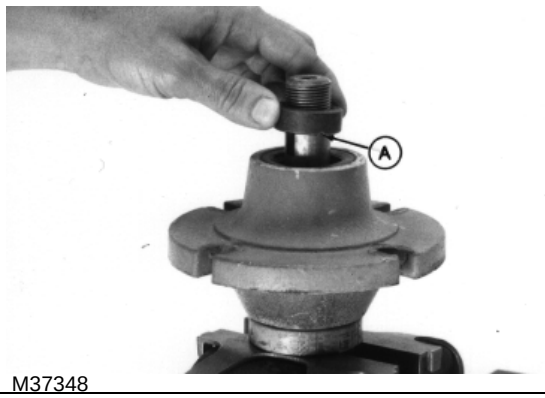
M37345

10. Turn spindle over to install top seal. Press seal flush with rim of housing, using a 1-7/8-in. OD pipe for a driver.



M37347

11. Coat outer surface of bushing with grease before you install it with notch (A) toward bearing.

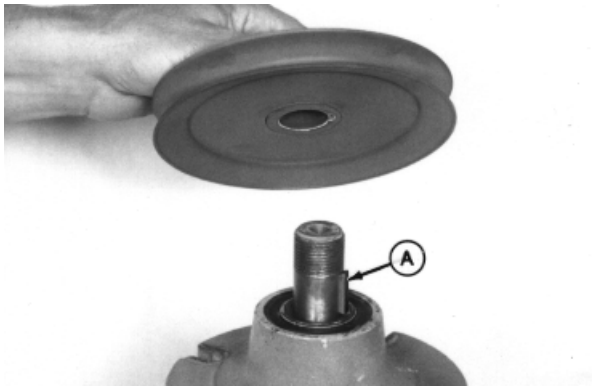


M37348

12. Install key (A). Be sure key is seated to prevent metal shavings from contaminating bearings.

NOTE: NOTE: The 60-inch mower has a two-bladed fan included (not shown).

13. Install sheave with welded side of hub away from bearing.



M37455

14. Hold spindle assembly in a vise by the lower hub to install nut. Tighten nut to 163 N•m (120 lb-ft).

15. Turn casting on spindle to check for free spin.



M37350

16. Install grease fitting.

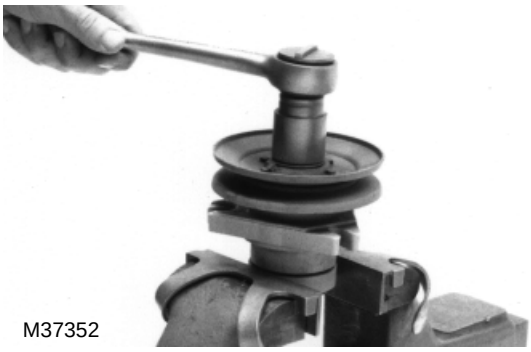
17. Fill spindle housing completely with John Deere Multi-Purpose grease or equivalent.



M37329

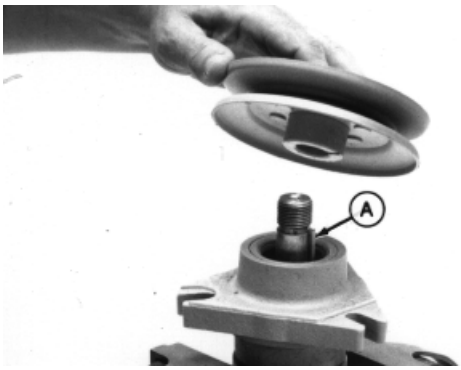
DISASSEMBLE SPINDLES—50-IN. MOWERS

23. Clamp lower hub of spindle assembly in a vise.
24. Remove grease fitting.
25. Remove nut.



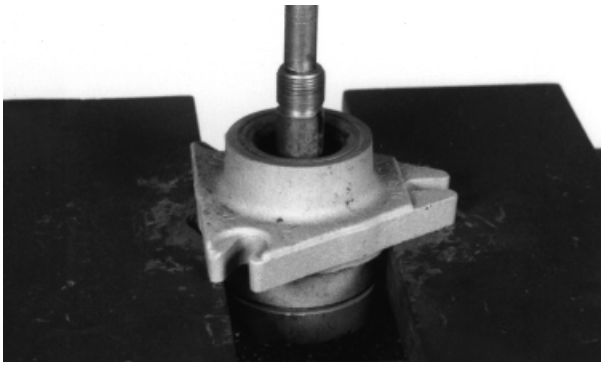
M37352

26. Remove sheave. Be careful not to bend flanges.
27. Remove key (A).



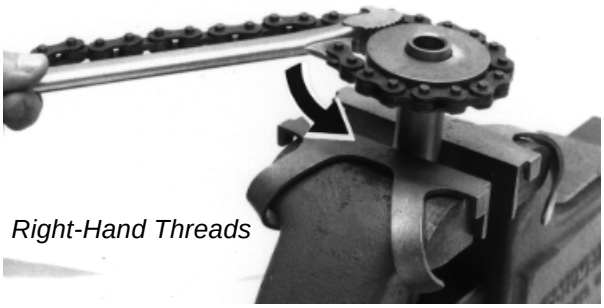
M37353

28. Press shaft from housing.



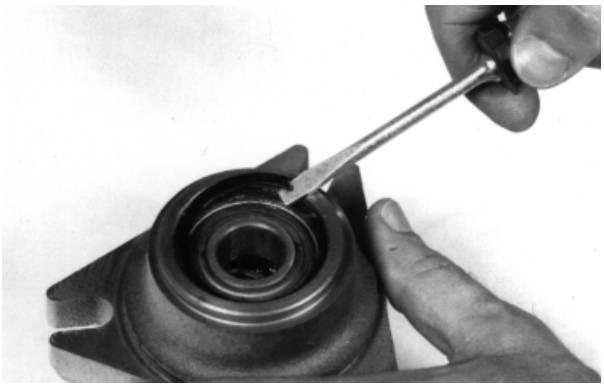
M37367

29. Inspect shaft for excessive wear or damage. If shaft or hub is not worn or damaged, it is not necessary to separate them.
30. If it is required to separate hub from shaft, hold shaft in a soft-jaw vise and remove hub.



M37339

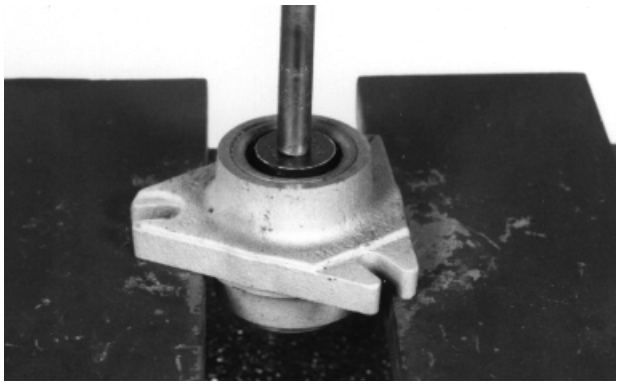
9. Remove snap ring.



M37368

NOTE: There is another snap ring on top of the lower bearing. DO NOT try to push the lower bearing completely out of hub.

10. Press bearings until upper bearing just contacts the snap ring. Use a 1-1/4 in. driver disk.



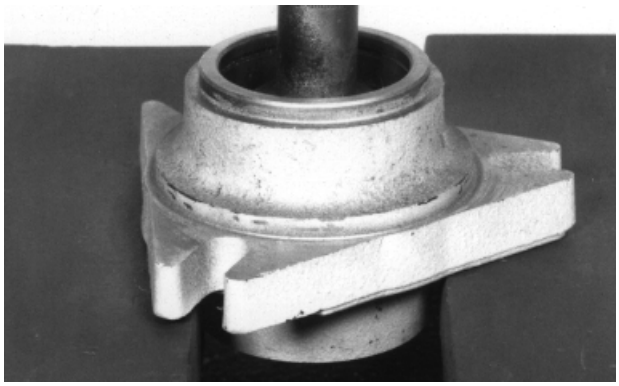
M37369

11. Move the spacer between bearings off-center. Remove the lower bearing and spacer.



M37370

12. Use a 1-1/4 in. driver disk to remove upper bearing and seal. Be sure disk does not press on snap ring.

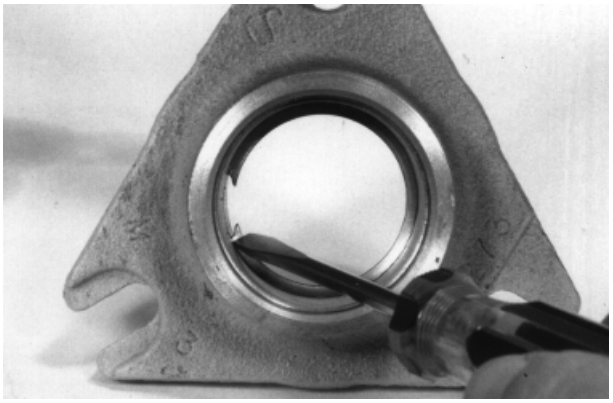


M37371

13. Remove snap ring (if necessary).

Clean inside of housing with solvent. Be sure to remove all metal shavings and grit.

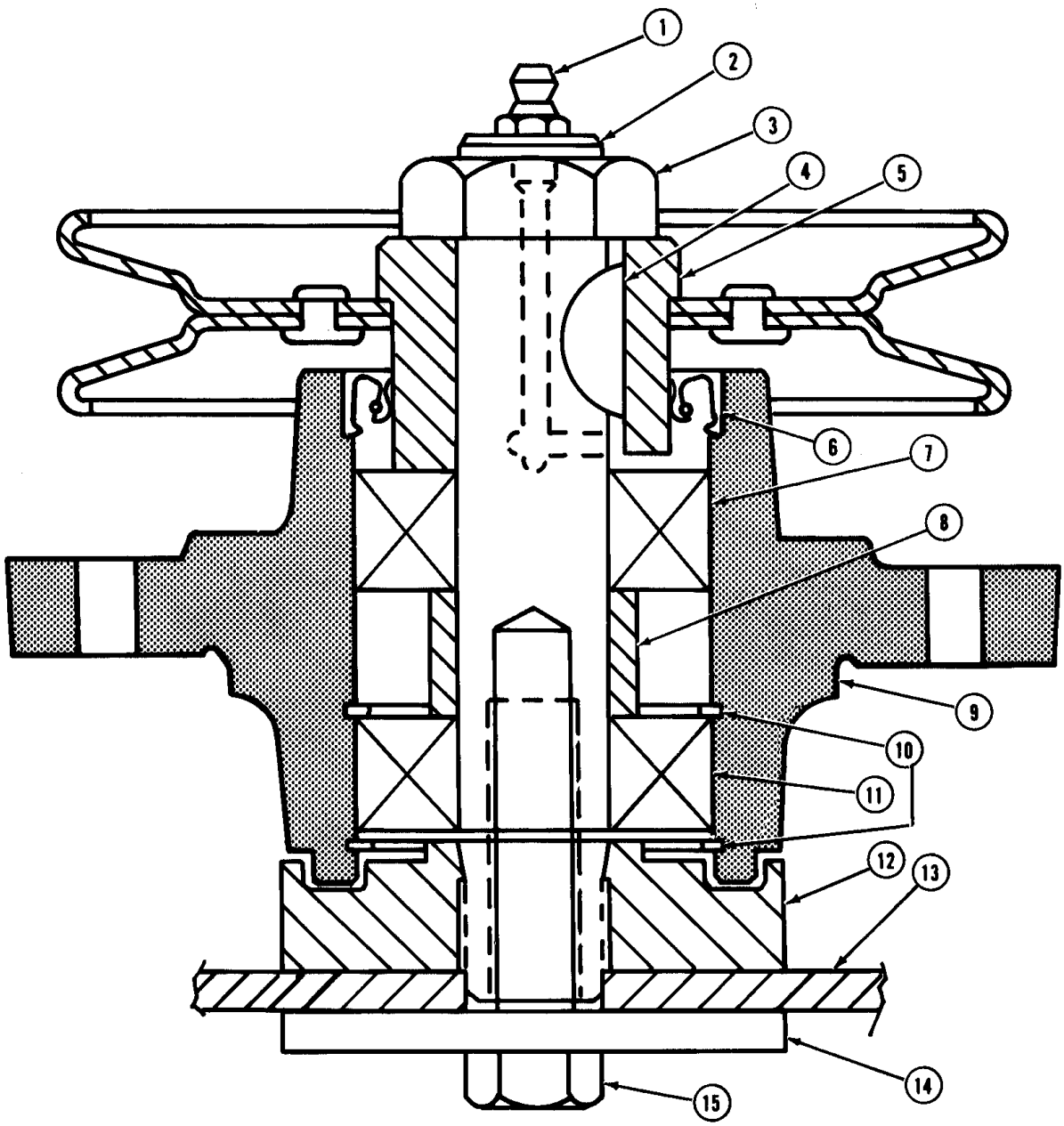
Check for wear or damage in bearing seating areas.



M37372

1-Grease Fitting
2-Shaft
3-Nut
4-Key
5-Sheave
6-Seal
7-Upper Bearing
8-Spacer
9-Housing
10-Snap Ring (2 used)
11-Lower Bearing
12-Hub
13-Blade
14-Washer
15-Cap Screw

CROSS-SECTIONAL VIEW—50-IN. MOWERS

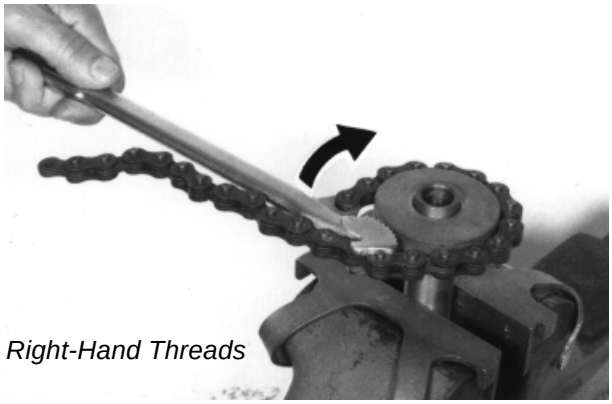


M37427

ASSEMBLE SPINDLES—50-IN. MOWERS

IMPORTANT: Always install new bearings and seals when servicing spindles.

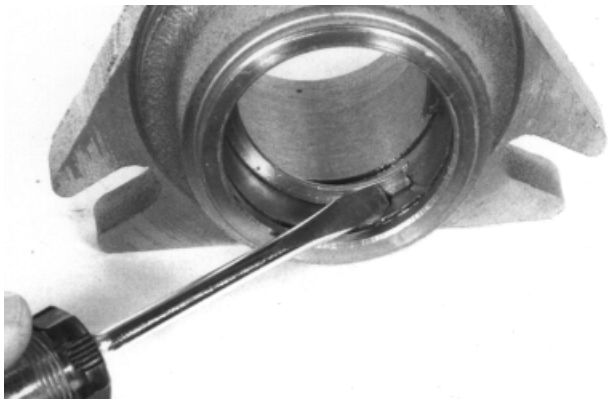
23. Clean threads on shaft and hub using clean and cure primer. Apply thread lock and sealer (medium strength) on threads. Install hub on shaft.



Right-Hand Threads

M37336

24. Install upper snap ring.



M37444

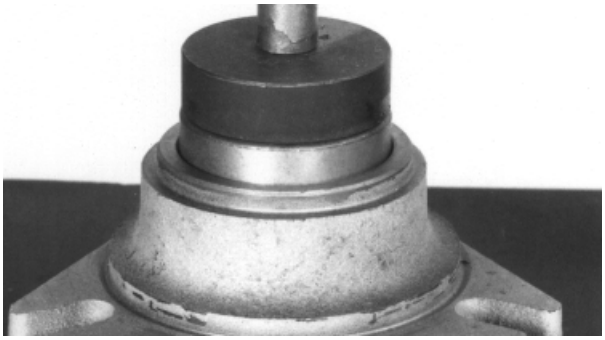
3. Pack both bearings with John Deere Multi-Purpose Grease or equivalent.

NOTE: When you install bearings and shaft you must support both inner and outer ring surfaces of bearings or you may damage bearings.

4. Turn spindle housing bottom-side-up to install lower bearing (with seal on one side) in bottom of spindle housing. Be sure bearing seal faces up. Press bearing against snap ring using a 1-3/4 in. disk.



M37445



M37451

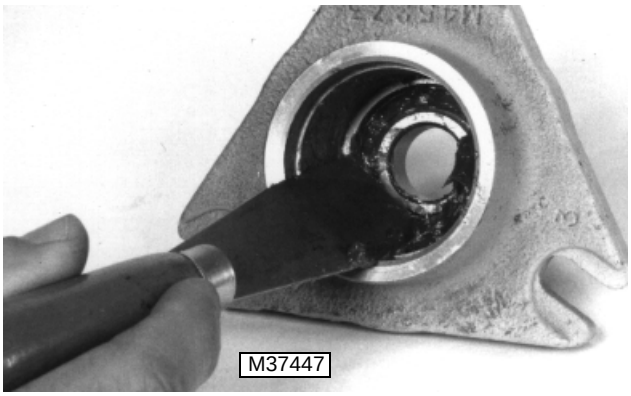
5. Install outer snap ring.



M37446

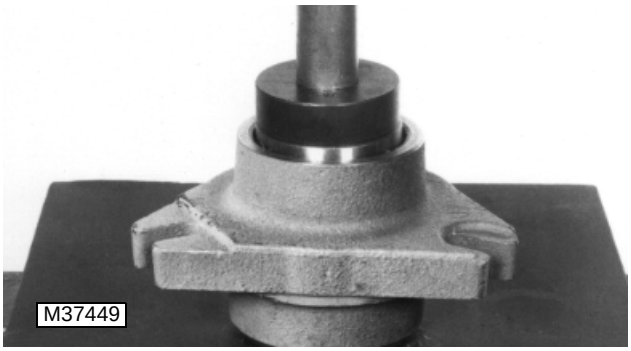
6. Turn housing top-side-up to apply John Deere Multi-Purpose Grease or equivalent to area between snap rings.

7. Put spacer against lower bearing. Be sure there is enough grease to hold spacer centered in bore.



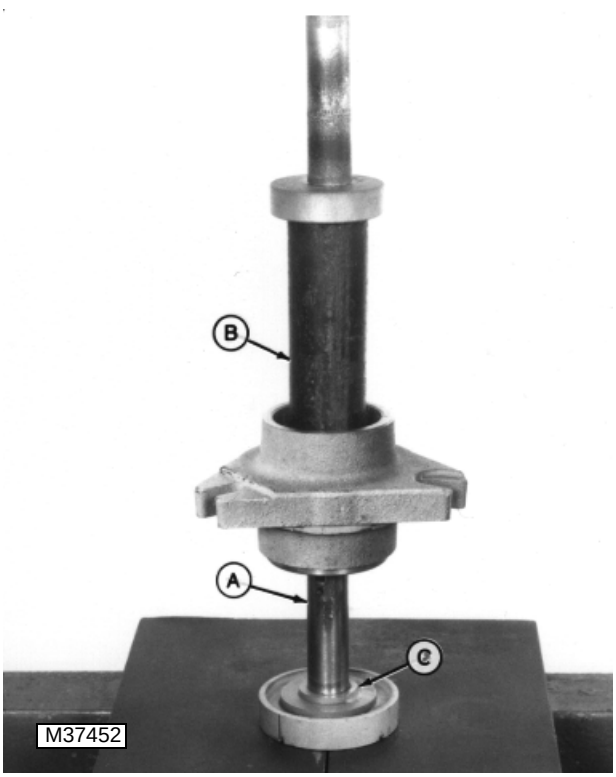


8. Install upper bearing. Press bearing against spacer using a 1-3/4 in. disk.



9. Align center spacer with upper and lower bearings. Install shaft assembly (A) using a 13/16 in. ID pipe (B), at least 62 mm (2-1/2 in.) long, for a driver.

10. Press against inner bearing race until lower bearing touches hub (C).

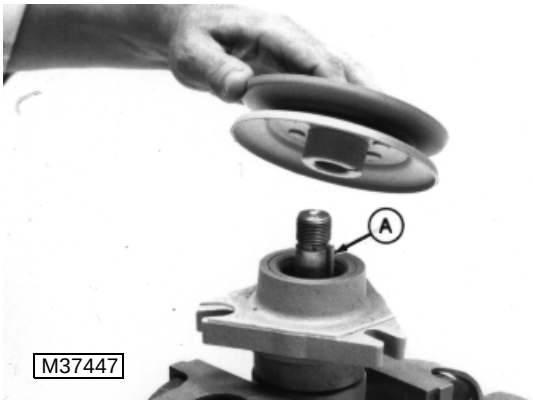


11. Install seal. Press seal flush with rim of housing, using a 1-7/8 in. OD pipe for a driver.



12. Install key (A). Be sure key is well-seated to prevent metal shavings from contaminating bearings.

13. Apply grease on outer surface of sheave hub. Install sheave with welded side of hub upward.



14. Hold spindle assembly in a vise by the lower hub to install nut. Tighten spindle nut to 140± 7 N•m (103 ± 5 lb-ft).

15. Turn casting on spindle to check for free spin.

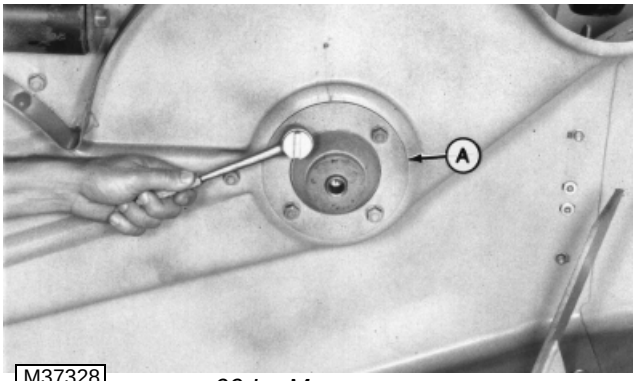
16. Install grease fitting.

17. Fill spindle housing completely with John Deere Multi-Purpose grease or equivalent.


M37453

Install Spindle Assembly

1. Put spindle assembly in mower deck. Install ring (A), carriage bolts and nuts.



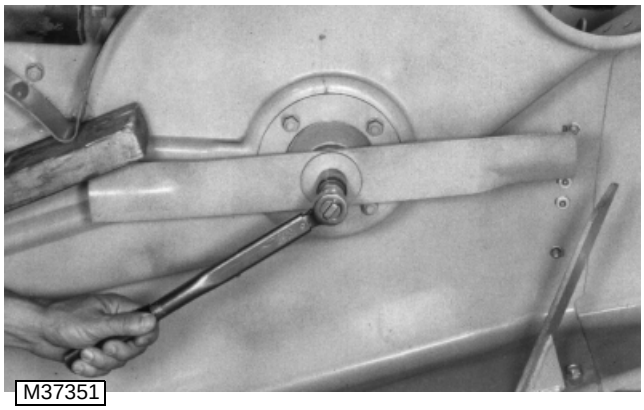
M37328

60 In. Mower

C **CAUTION: Protect hands when you handle mower blades: wear gloves or wrap sharp end of blade with a shop cloth.**

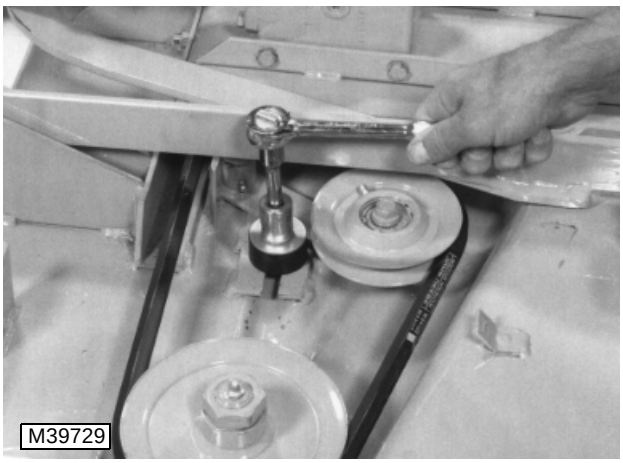
2. Install mower blade, washer, and cap screw.

3. Put a block of wood between mower deck and blade. Tighten cap screw.


M37351

UNIT	MEASUREMENT	SPECIFICATION
50 In. Mower	Torque	73 ± 5 N•m (54 ± 4 lb-ft)
60 and 72-In. Mowers	Torque	113± 11 N•m (83 ± 8 lb-ft)

4. Install and fasten gearbox assembly (if removed).
5. Install belt on sheaves.
6. Tighten belt:
7. 60 and 72-in. mower— install idler arm stop up against idler arm.
8. 50-in. mower— turn pivot plate with 3/8 in. drive to tighten belt. Install idler arm stop up against idler arm. Tighten bolt.
9. Install belt shields.



60 In. Mower Shown

SERVICE EQUIPMENT AND TOOLS

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

Name	Use
13-Ton Puller Set	To service bearings and sheave
Bushing, Bearing, and Seal Driver Set	To service bearings and seals
1-7/8 in. O. D. Pipe	To install input shaft seal.
Snap Ring Pliers Set	To remove snap rings.
1-5/16 in. O. D. Pipe	To install bearings.

OTHER MATERIAL

Number	Name	Use
TY6341	John Deere SLIP-PLATE® Lubricant	Lubricate inside diameter of gears
PT569	John Deere NEVER-SEEZ® Lubricant	Lubricate drive shafts

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

SPECIFICATIONS

Item	Measurement	Specifications
Soft Plug	Depth	1.6 mm (0.0625 in.)
Seal	Depth	2.5 mm (0.100 in.)
Breather	Torque	8.5 N•m (75 lb-in)
Shaft Cover Cap Screw	Torque	23 N•m (200 lb-in)
Output Shaft	End Play	Zero
Output Shaft	Rolling Drag Torque	0.4±1.0 N•m (5 ±15 oz-in)
Gearbox Assembly Mounting Cap Screws	Torque	55 N•m (40 lb-ft)
Drive Sheave Cap Screw—Left-Hand Threads (Late Model 60/70 Mower Gearboxes)	Torque	129 N•m (95 lb-ft)
Drive Sheave Cap Screw—Right-Hand Threads (Late Model 261/272 Mower Gearboxes)	Torque	319 N•m (235 lb-ft)

REMOVE GEARBOX

23. Remove belt shields.

2. Loosen belt.

60 AND 72-INCH MOWER
a. Loosen nut and remove stop.

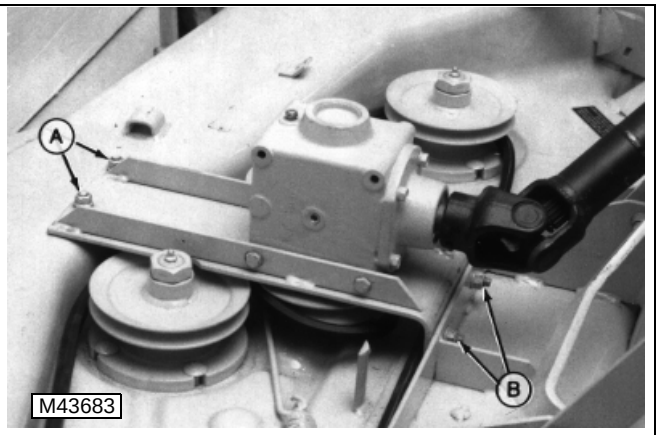
50-INCH MOWER:
a. Loosen idler stop nut.
b. Loosen eye bolt on end of idler spring.
c. Use 3/8 in. drive in pivot plate hole to turn plate and release spring tension.



60 In. Mower Shown

3. Remove belt from sheaves.

4. Remove lock nuts and washers (A). Remove lock nuts and cap screws (B). Remove gearbox assembly with PTO shaft.



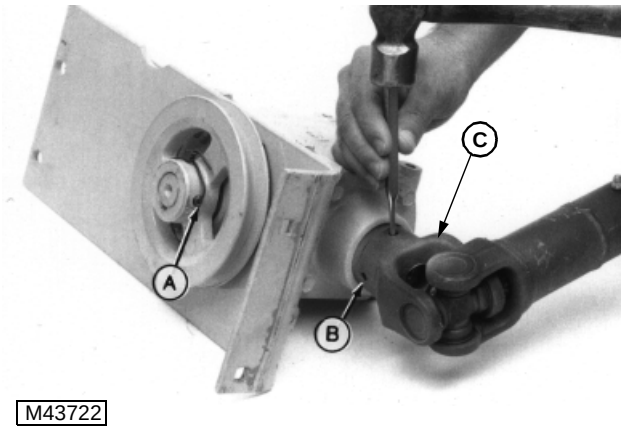
60/72 In. Mowers

NOTE: Some shaft yokes (C) instead of a spring pin/safety wire fastener.

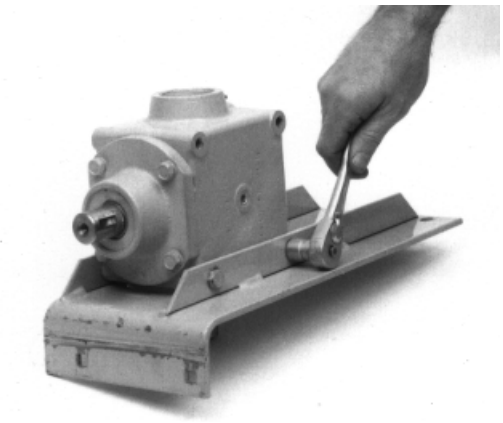
5. Remove safety wires and spring pins (A) from PTO shaft and drive sheave.

6. Loosen set screw (B) and remove PTO shaft and key.

7. Remove drive sheave and key. Use a gear puller if necessary.



8. Remove cap screws to remove gearbox from mounting assembly.



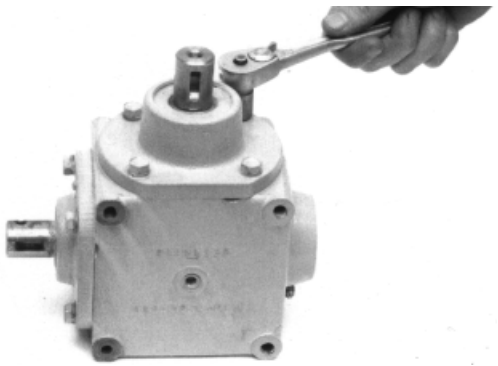
M43723

DISASSEMBLE MOWER GEARBOX

NOTE: This disassembly procedure is for all three mower gearboxes, any differences are noted where appropriate next to the art.

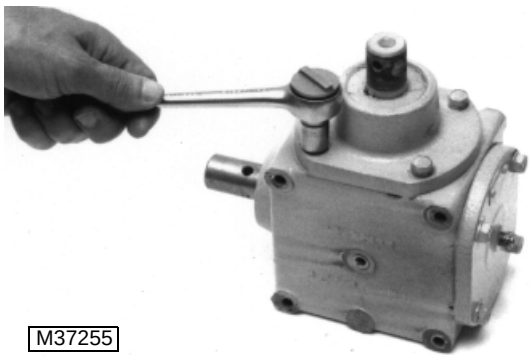
IMPORTANT: When removing roller bearings and races, keep each set together as they are a matched set. DO NOT mix bearings and races.

1. Remove input shaft cover. Drain oil from gearbox.



M43724

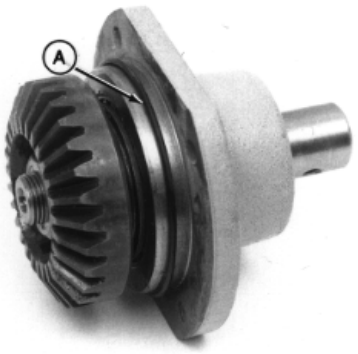
60/72 In.Gearbox



M37255

50 In. Gearbox

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

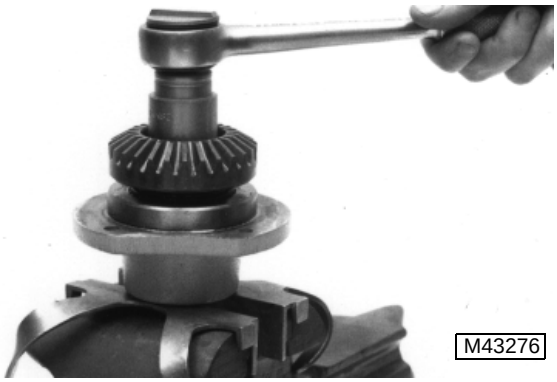


M43725

All Gearboxes

3. Hold input shaft in a soft-jaw vise. Remove nut and washer.

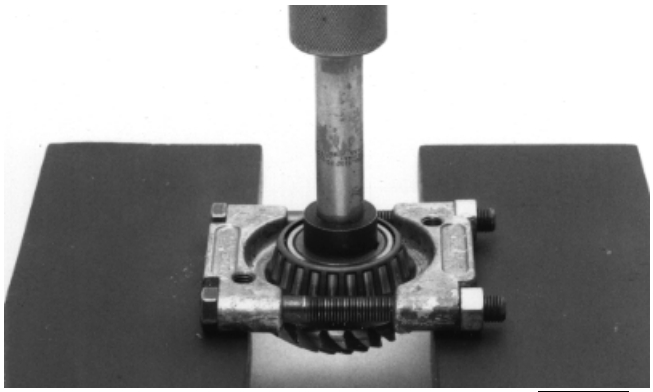
4. Remove gear and bearing assembly. Use puller if necessary. Inspect gear for wear or damage. Replace, if necessary. Remove woodruff key.



All Gearboxes

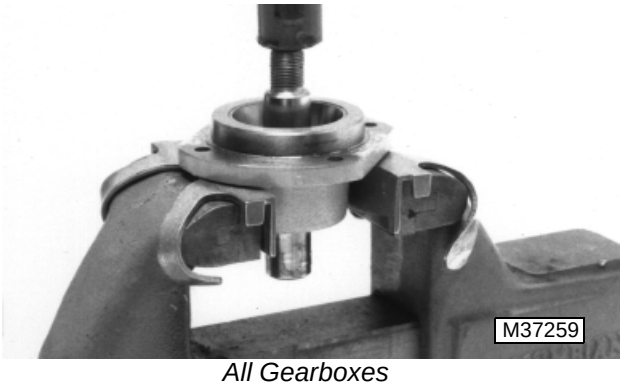
NOTE: Remove and replace bearing only if worn.

5. Remove bearing from gear. Use a knife-edge puller and press with a 1-1/4 in. disk on top of bearing.



All Gearboxes

6. Remove input shaft, bearing, snap ring, and seal.



All Gearboxes

IMPORTANT: Bearing and race are a matched set. Keep them together. Replace bearing and race as a set if either is defective.

7. Remove bearing race if worn or damaged.



All Gearboxes

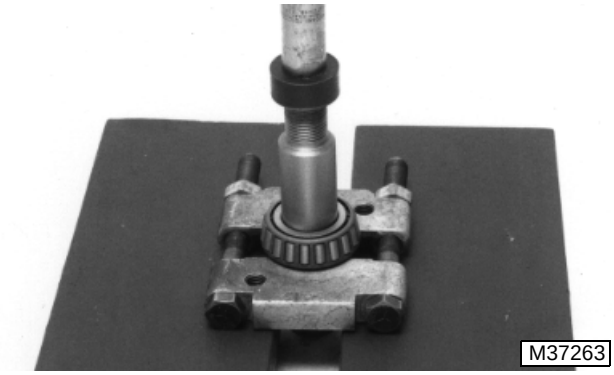
8. Remove and discard seal. (Woodruff key, removed in Step 4, shown installed for clarity reasons only.



All Gearboxes

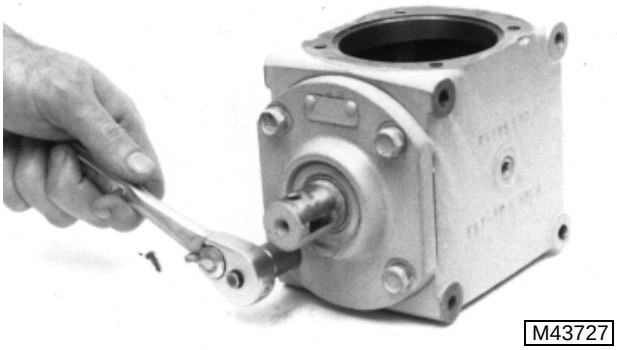
NOTE: Remove bearing only if replacement is necessary.

9. Press shaft out of bearing. Be sure snap ring under bearing does not rest on puller.

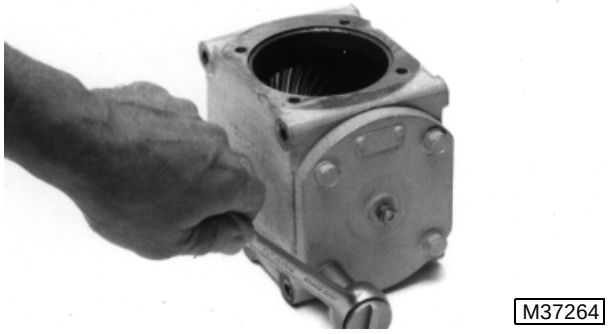


All Gearboxes

10. Remove output shaft cover.

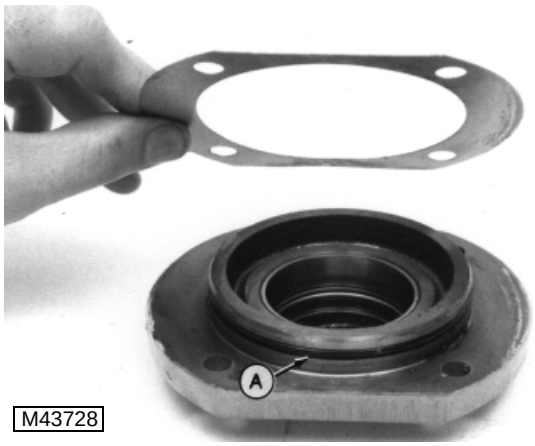


60/72 In. Gearboxes



50 In. Gearbox

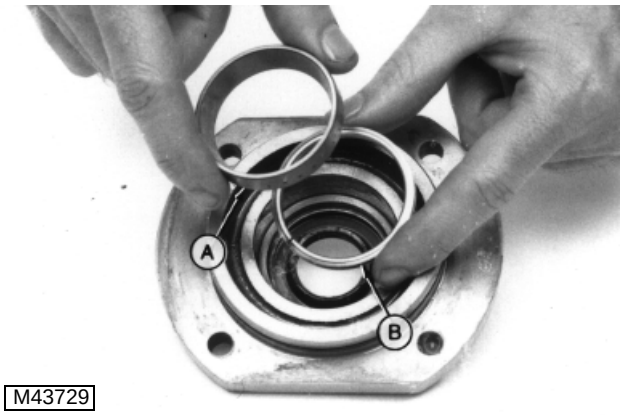
11. Remove O-ring (A) and shim. Shim may be attached to the cover or the gearbox housing. Discard O-ring.



All Gearboxes

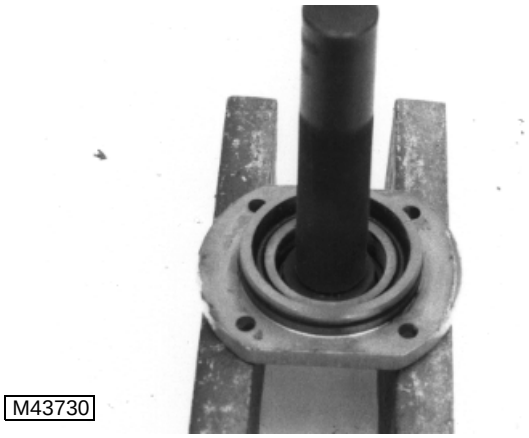
12. Remove output shaft bearing race (A) and crush ring (B) from cover. Discard crush ring. Inspect bearing race for wear. Replace, if necessary, as a set with bearing, do not mix old with new.

NOTE: 50-In. gearbox output shaft cover requires you to remove bearing race (A) and crush ring (B) with a large, straight-blade screwdriver.



All Gearboxes—60/72 In. Gearboxes Shown

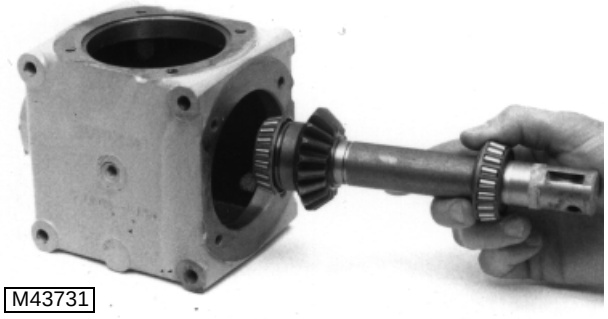
13. Remove output shaft seal with a 1-11/16 in. driver disk, from inside-out.



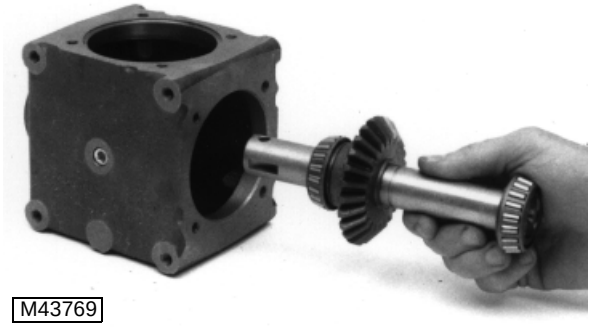
60/72 In. Gearboxes

NOTE: Later 60/72-in. gearboxes have a tapered shaft with left-hand internal threads. Turn in a clockwise direction to remove cap screw and turn in a counterclockwise direction to install cap screw.

14. Remove output shaft assembly.

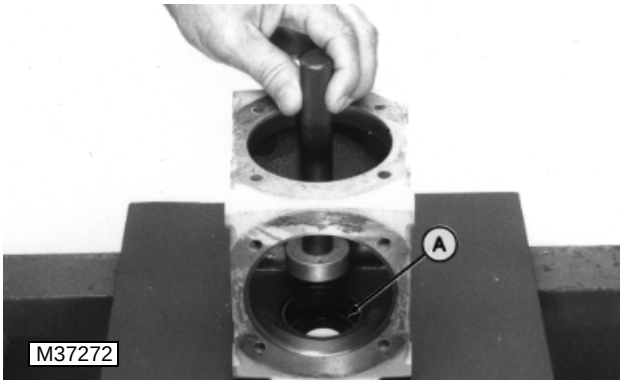


60/72 In. Gearboxes



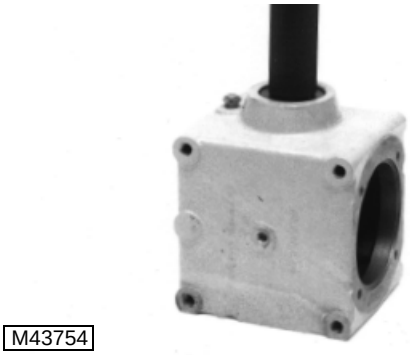
50 In. Gearbox

15. Drive output shaft seal out with a 1-9/16 in. driver disk, from inside-out.



50 In. Gearbox

16. Remove output shaft bearing race with a 1-11/16 in. driver disk, from the outside-in.

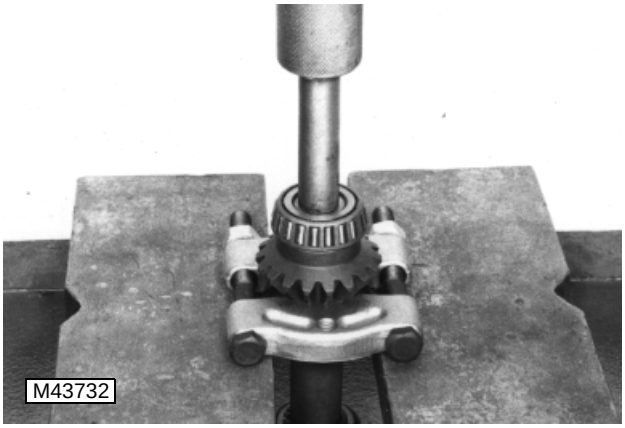


50 In. Gearbox

NOTE: If there is a shim between the bearing and gear, it must be used when bearing is installed.

17. Remove bearing and gear from output shaft with knife-edge puller and press. Be sure not to damage snap ring below gear. Remove woodruff key.

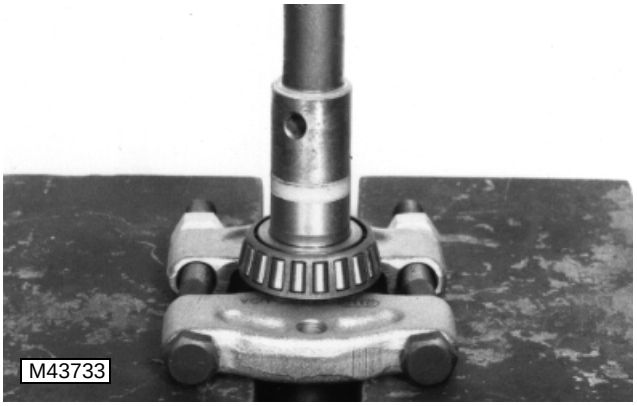
18. 18. Inspect bearing and gear for pits or damage. Replace, if necessary.



All Gearboxes—60/72 In. Gearboxes Shown

NOTE: Remove bearing only if replacement is necessary.

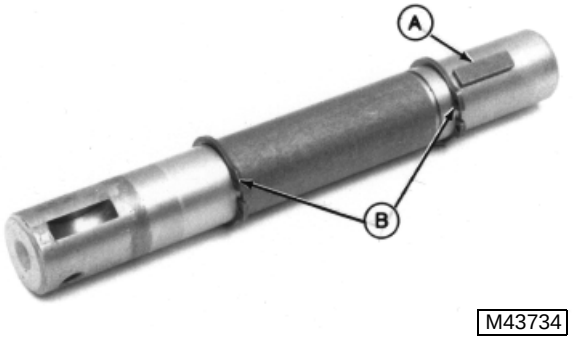
19. Remove bearing from gear with knife-edge puller and press.



All Gearboxes—60/72 In. Gearboxes Shown

20. Inspect woodruff key (A) and snap rings (B), replace if required.

NOTE: Woodruff key (A) (removed in Step 16) shown installed for clarity reasons only.



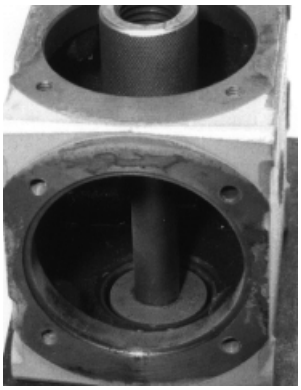
All Gearboxes—60/72 In. Gearboxes Shown

21. Remove soft plug (A) (60/72-In. Mowers only) with a 1-5/8 in. driver disk, from inside-out.



M43735

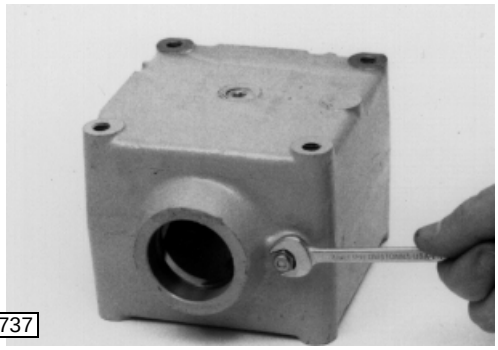
60/72 In. Gearboxes



M43736

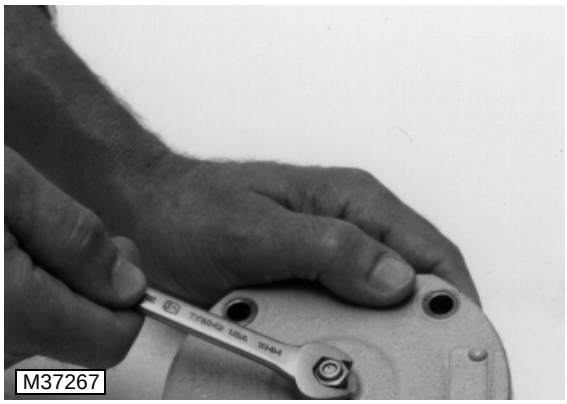
50 In. Gearbox

22. Remove breather. Inspect air passage and clean or replace as necessary.



M43737

60/72 In. Gearboxes



M37267

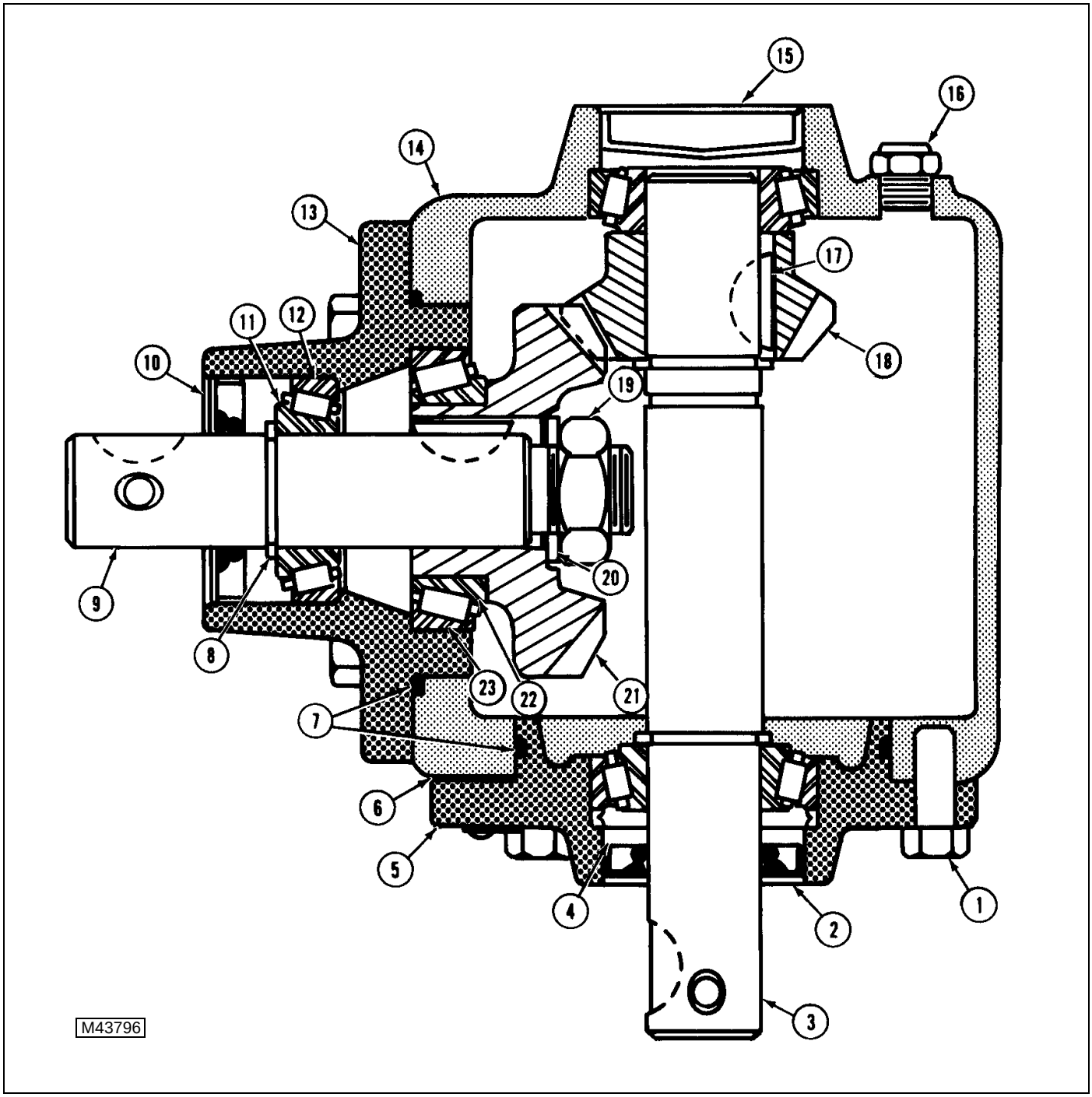
50 In. Gearbox

Mower Gearbox/Cross-Section View— Early 60/72-In. Mowers

CROSS-SECTION VIEW—GEARBOX—60/72-IN. EARLY MODEL MOWERS

1-Cap Screw (8 used)
2-Seal
3-Output Shaft
4-Crush Ring
5-Shaft Cover
6-Shim
7-O-Ring (2 used)
8-Snap Ring (3 used)
9-Input Shaft
10-Seal
11-Bearing Assembly (3 used)
12-Bearing Race (3 used)
13-Shaft Cover
14-Gearbox Case
15-Soft Plug
16-16-Breather
17-Woodruff Key (2 used)
18-Output Beveled Gear
19-Nut
20-Washer
21-Input Beveled Gear
22-Bearing Assembly
23-Bearing Race

Mower Gearbox/Cross-Section View— Early 60/72-In. Mowers

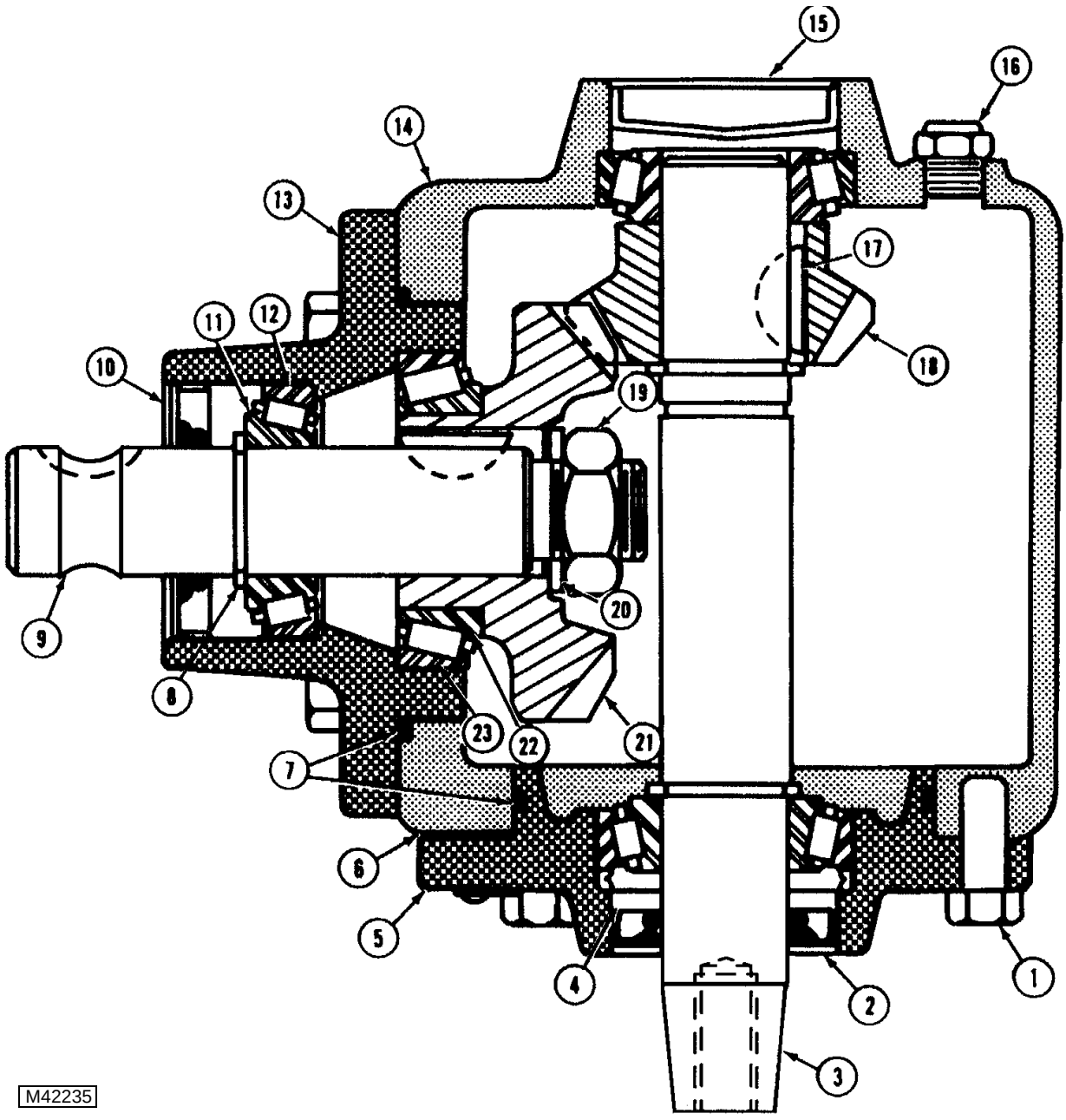


Mower Gearbox/Cross-Section View—Late 60/72-In.

CROSS-SECTION VIEW—GEARBOX—60/72-IN. LATE MODEL MOWERS

1-Cap Screw (8 used)
2-Seal
3-Tapered Output Shaft with Internal Left-Hand Threads
4-Crush Ring
5-Shaft Cover
6-Shim
7-O-Ring (2 used)
8-Snap Ring (3 used)
9-Input Shaft
10-Seal
11-Bearing Assembly (3 used)
12-Bearing Race (3 used)
13-Shaft Cover
14-Gearbox Case
15-Soft Plug
16-Breather
17-Woodruff Key (2 used)
18-Output Beveled Gear
19-Nut
20-Washer
21-Input Beveled Gear
22-Bearing Assembly
23-Bearing Race

Mower Gearbox/Cross-Section View—Late 60/72-In.

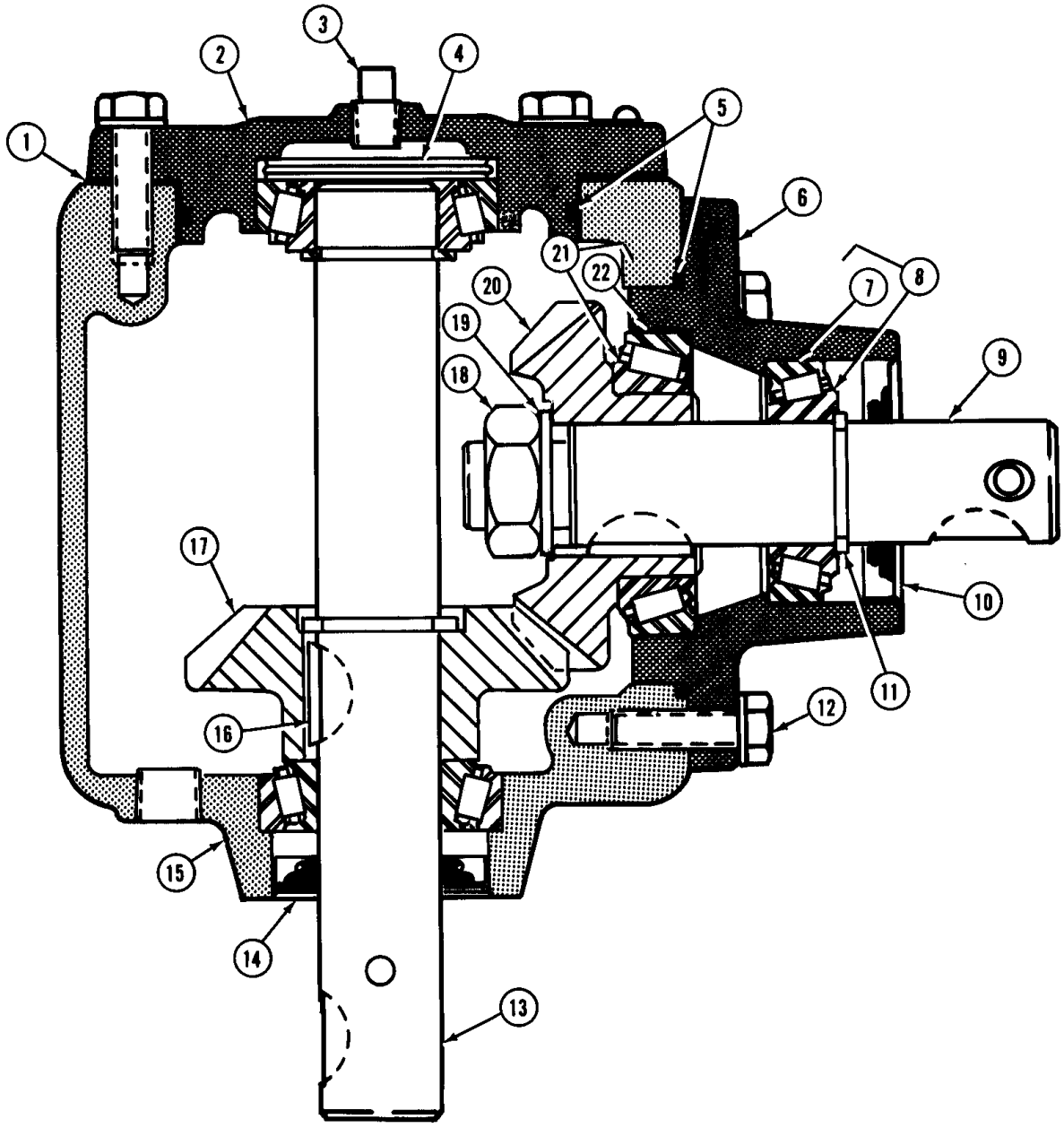


Mower Gearbox Cross-Section View—50-In. Mowers

CROSS-SECTION VIEW—GEARBOX—50-IN. MOWERS

23-Shim
24-Shaft Cover
25-Breather
26-Crush Ring
27-O-Ring (2 used)
28-Shaft Cover
29-Bearing Race
30-Bearing Assembly (3 used)
31-Input Shaft
32-Seal
33-Snap Ring (3 used)
34-Cap Screw (8 used)
35-Output Shaft
36-Seal
37-Gearbox Case
38-Woodruff Key (2 used)
39-Output Beveled Gear
40-Nut
41-Washer
42-Input Beveled Gear
43-Bearing Assembly
44-Bearing Race

Mower Gearbox Cross-Section View—50-In. Mowers

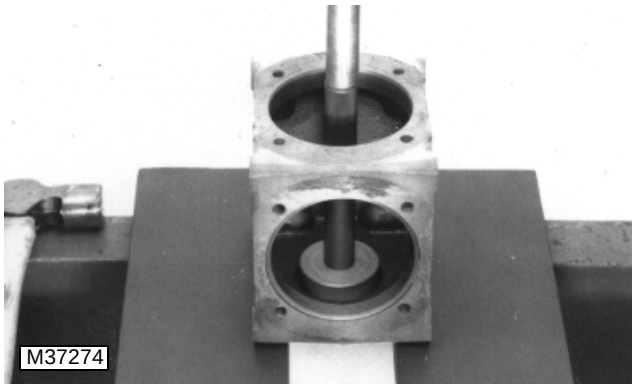


ASSEMBLE MOWER GEARBOX

NOTE: This assembly procedure is for all three mower gearboxes, any differences are noted where appropriate next to the art.

IMPORTANT: When installing new roller bearings and races, keep each set together as they are received, they are a matched set. DO NOT mix bearings and races.

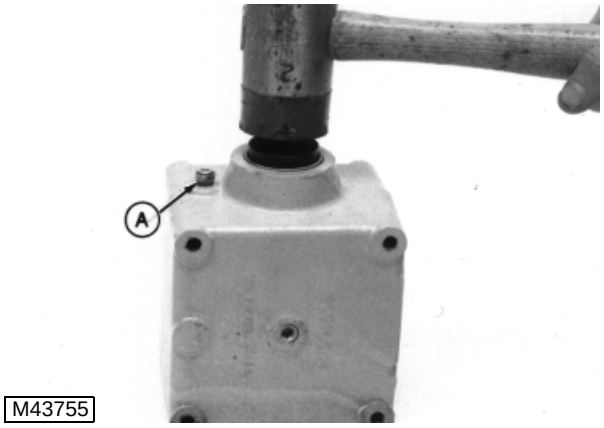
23. Install new output shaft bearing race with a 1-15/16 in. driver disk.



All Gearboxes

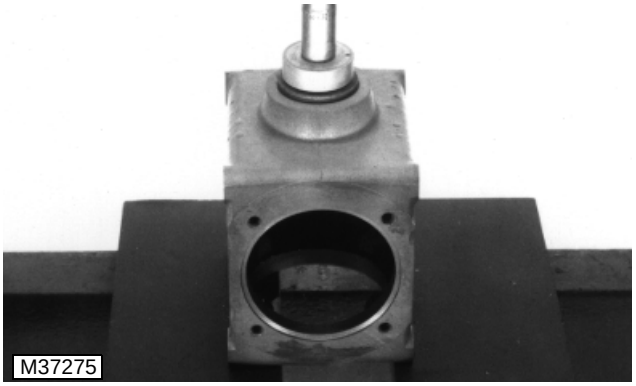
24. Install new soft plug with a 1-9/16 in. driver disk to 1.6 mm (0.0625 in.) below surface.

25. Install and tighten breather (A) to 8.5 N•m (76.5 lb-in.).



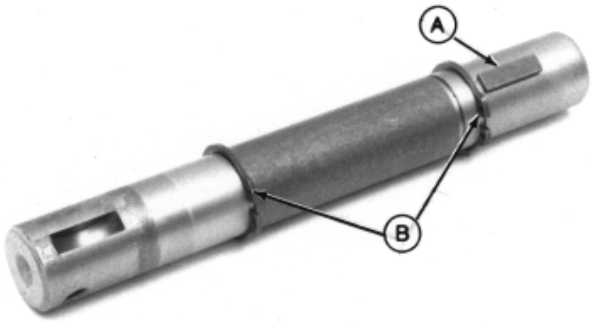
60/72 In. Gearboxes

26. Install new seal. Use a 1-11/16 in. driver disk to press seal to 2.5 mm (0.100 in.) below surface.



50 In. Gearbox

5. Install woodruff key (A) and snap rings (B) on output shaft.



M43734

All Gearboxes—60/72 In. Output Shaft Shown

6. Install new bearing tight against snap ring (A) with a 1-5/16 in. OD pipe. Press on inner bearing race only.

NOTE: Late model 60/72-In. gearboxes have a tapered end with internal left-hand threads.



M43756

60/72 In. Gearboxes

7. Apply SLIP-PLATE lubricant to inside diameter of gear and install on woodruff key, until gear contacts snap ring.

NOTE: Service bearing may have a shim in the box along with a new outer race. Bearing, race, and shim are a matched set. Keep them together.

8. Install shim (if equipped) and new bearing tight against gear with a 1-5/16 in. OD pipe. Press on inner bearing race only.



M43757

60/72 In. Gearboxes

10. Apply SLIP-PLATE lubricant to inside diameter of gear and install on woodruff key, until gear contacts snap ring.

NOTE: Service bearing may have a shim in the box along with a new outer race. Bearing, race, and shim are a matched set. Keep them together.

11. Install shim (if equipped) and new bearing tight against gear with a 1-5/16 in. OD pipe. Press on inner bearing race only.



M43770

50 In. Gearbox

12. Install new bearing tight against snap ring with a 1-5/16 in. OD pipe. Press on inner bearing race only.

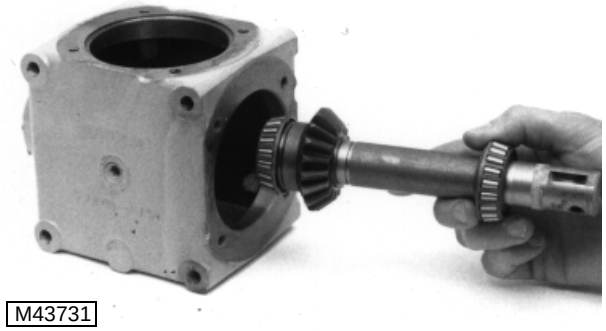


M43771

50 In. Gearbox

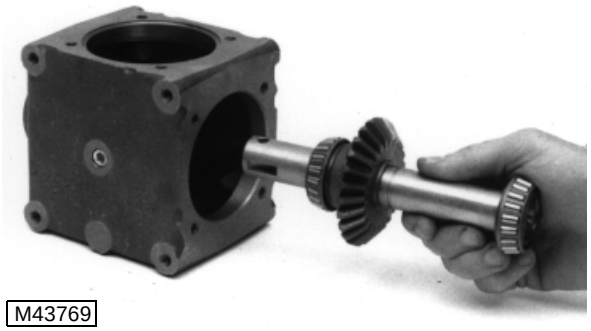
NOTE: Late model 60/72-In. gearboxes have a tapered output shaft with internal left-hand threads.

12. Install output shaft assembly.



M43731

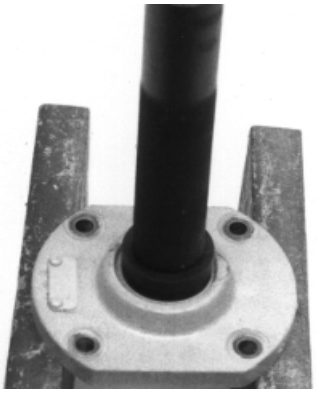
60/72 In. Gearboxes



M43769

50 In. Gearbox

13. Install new seal into output shaft cover with 1-11/16 in. driver disk to 2.5 mm (0.100 in.) below surface, from outside-in.



M43744

60/72 In. Gearboxes

14. Turn output shaft cover over to install new crush ring (B), bearing race (A) and new o-ring.

NOTE: 50-In. output shaft cover requires you to install the new crush ring (B) and bearing race (A) before you install cover breather.



M43729

60/72 In. Gearboxes

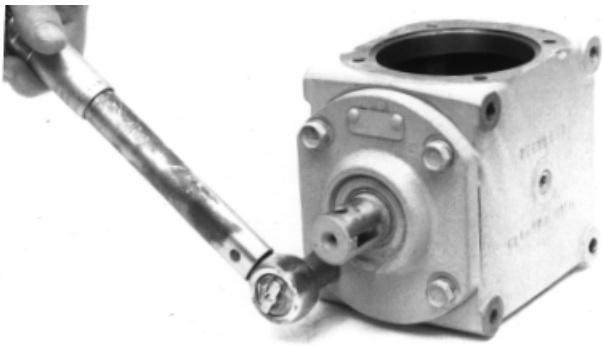
NOTE: Late model gearbox output shafts for 60/72-In. Mowers are tapered, with internal left-hand threads.

15. To set end play on output shaft first install cover without O-ring and shim.

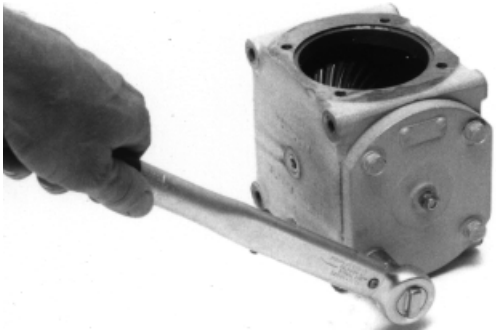
16. Tighten cap screws evenly in 6 N•m (50 lb-in) increments to a final 23 N•m (200 lb-in).

17. Remove cover again to install O-ring and shim.

18. Install cover. Tighten cap screws (see Step 16 above) and, on 50-In. gearbox, install breather. Tighten 50-in. gearbox breather to 8.5 N•m (76.5 lb-in.).

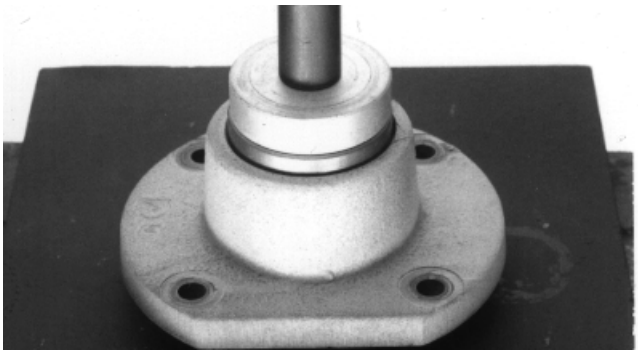


M43745 *60/72 In. Gearboxes*



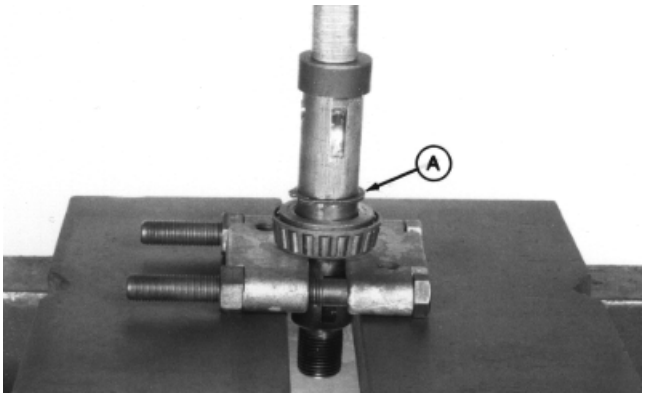
M37279 *50 In. Gearbox*

19. Install new bearing races in input shaft cover. Use 1-15/16 in. and 2-1/2 in. driver disk.



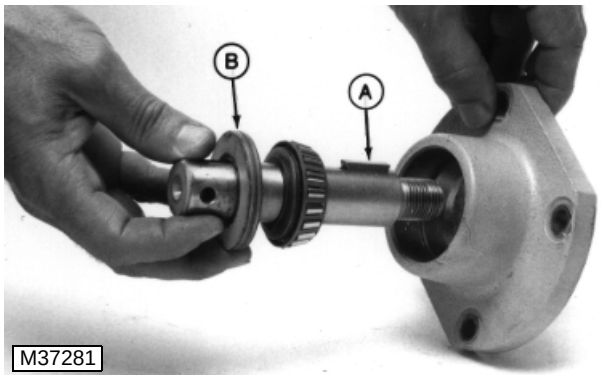
M37282 *All Gearboxes*

20. Press bearing input shaft on until bearing is tight against snap ring (A). Be sure bearing is supported on inner race only.



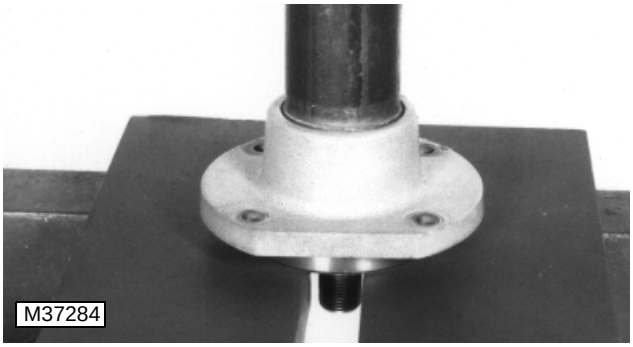
M37280 *All Gearboxes*

21. Install woodruff key (A) and new seal (B). Install input shaft assembly in cover.



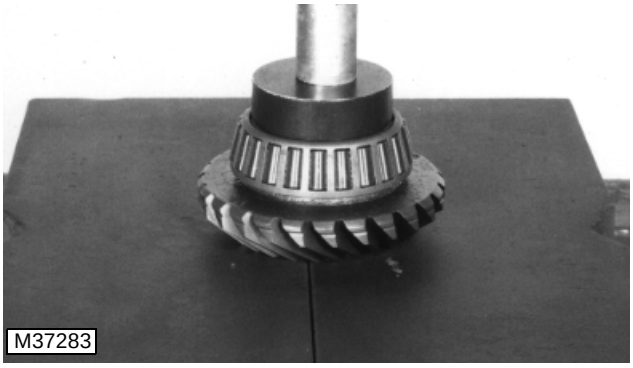
All Gearboxes

22. Press input seal 2.5 mm (0.100 in.) below surface with a 1-7/8 in. OD pipe.



All Gearboxes

23. Install shim (if equipped) and bearing on gear. Use a 1-3/4 in. driver disk.

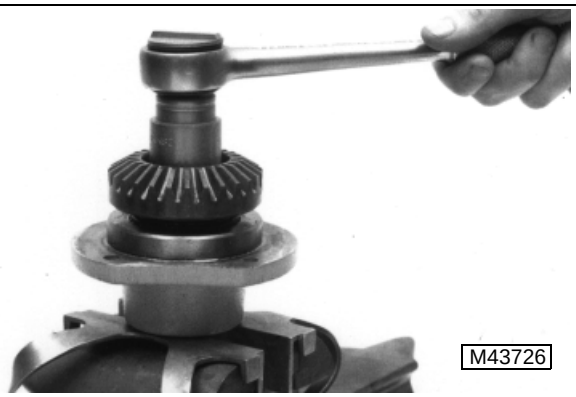


All Gearboxes

24. Hold shaft in a soft-jaw vise. Apply SLIP-PLATE lubricant to inside diameter of gear.

25. Install gear and bearing assembly on input shaft. Be sure groove in gear aligns with woodruff key.

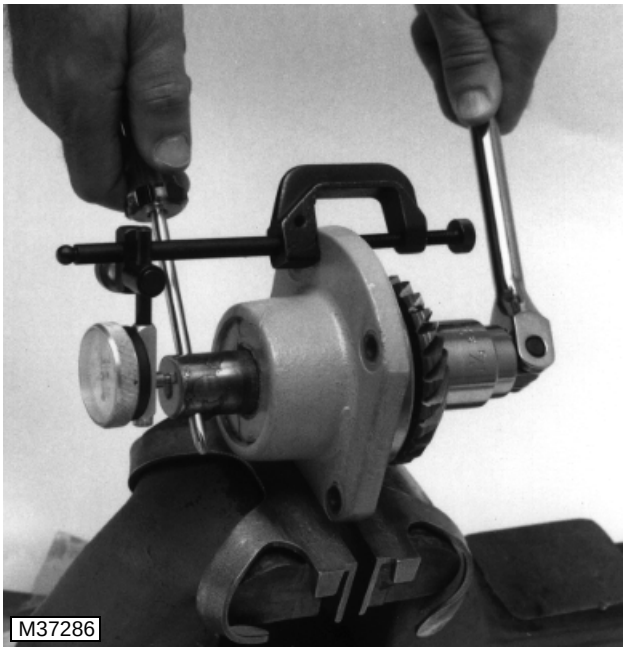
26. Install washer and lock nut.



All Gearboxes

27. To measure shaft end play, tighten lock nut until zero end play is set.

Zero end play should provide 0.4—1.0 N•m (5—15 oz-in) rolling drag torque. Gear should turn with hand force.

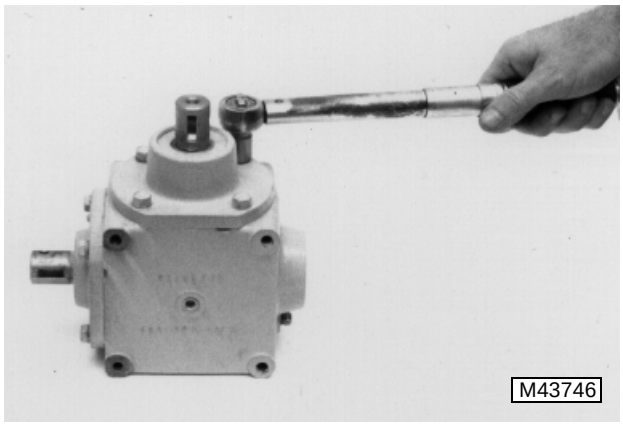


All Gearboxes

28. Install new O-ring on cover.

29. Fill case with 0.5 (1 pt) John Deere GL-5 Gear Lubricant or equivalent.

30. Install input shaft cover. Tighten cap screws to 23 N•m (17 lb-ft).



All Gearboxes

INSTALL MOWER GEARBOX

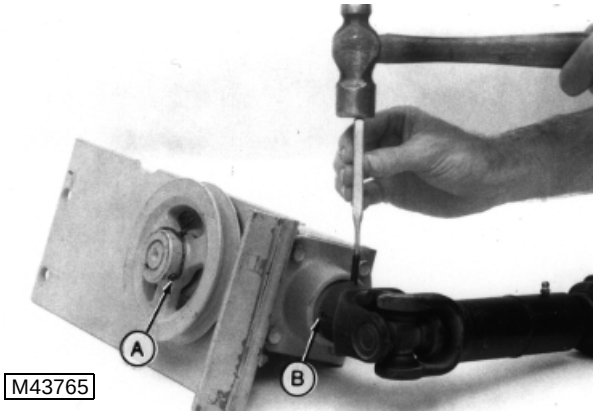
23. Install gearbox on mounting assembly. Install and tighten cap screws.

24. Install woodruff keys. Apply NEVER-SEEZ® lubricants to shafts.

NOTE: Some shaft yokes use a clamp/bolt fastener instead of a spring pin and safety wire.

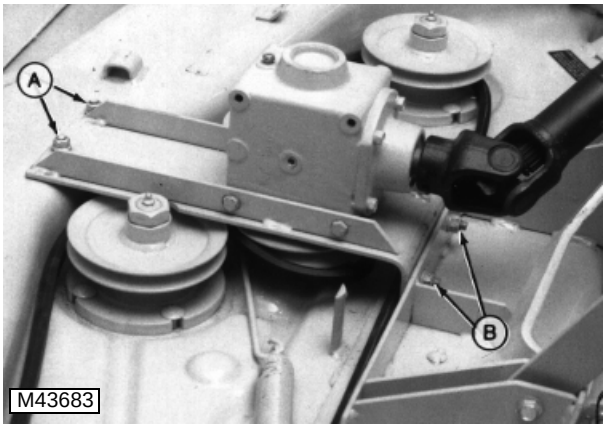
25. Install PTO shaft and drive sheave. Install spring pins and safety wires (A). On late model 60/72-in. gearboxes, the output shaft is tapered with internal, left-hand threads. Tighten drive sheave cap screw in a counterclockwise direction to 130 N•m (95 lb-ft).

26. Tighten set screw (B).



M43765

27. Install gearbox assembly on mower deck. Fasten with locknuts and washers (A), locknuts and cap screws (B). Tighten to 55 N•m (40 lb-ft).



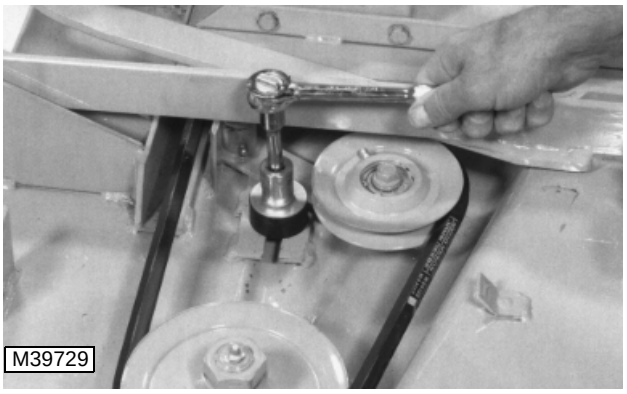
M43683

6. Install belt on sheaves.
7. Tighten belt:

60/72-IN. MOWERS:
Install idler arm stop up against idler arm. Tighten bolt.

50-IN. MOWERS:
Turn pivot plate with 3/8 in. drive to tighten belt. Install idler arm stop up against idler arm. Tighten bolt.

8. Install belt shields.



60/72 In. Mowers Shown

Section 210
OPERATIONAL CHECKOUT PROCEDURE AND SPECIFICATIONS

Contents

Page

Group 05—Test And Adjustment Specification 210-05-1

Group 10—Operational Checkout Procedure
Before You Start 210-10-1
Coolant Level Check 210-10-1
Fan and Belt Check 210-10-1
Engine Oil Check 210-10-2
Transmission/Hydraulic Oil Check 210-10-2
MFWD Oil Check 210-10-2
Air Intake System Check 210-10-2
Fuel Filter Check 210-10-2
Fuel/Water Separator Check 870/970/1070 210-10-3
Indicator Light Bulbs Check 210-10-3
Fuel Gauge Check 210-10-3
Speed Control Lever Check 210-10-3
Start Up Check 210-10-3
Engine Performance Check 210-10-4
Light Circuit Check 210-10-4
Park Brake Indicator Light Check 210-10-4
Temperature Gauge Check 210-10-4
Tachometer Check 210-10-4
Safety Interlock System Check 210-10-5
Operator Presence System Check 210-10-5
Power Steering Check 210-10-6
Clutch Check 210-10-6
Transmission Shift Check 210-10-6
Range Lever Shift Check 210-10-6
Shift Lever Interlock Check (870/970/1070 Only) 210-10-6
MFWD Drive Check 210-10-7
Brake Check 210-10-7
Brake Adjustment Check 210-10-7
Selective Control Valve Check 210-10-7
Rockshaft Check 210-10-8

ITEM	SPECIFICATION
ENGINE	
Slow Idle	900-950 rpm
Fast Idle	
670	3025 rpm
770/790/870/970	2920 ± 25 rpm
1070	2875 rpm
Rated Speed	
670	2850 rpm
770/790/870/970	2600 rpm
1070	2700 rpm
Compression Pressure	
Minimum	2448 kPa (355 psi)
Maximum Difference Between Cylinders	490 kPa (71 psi)
Valve Clearance (cold)	0.2 mm (0.008 in.)
Timing	
670	0.5 mm (0.020 in.) shim
770 and 970 (TN82)	6th line from top
870 and1070 (TN84)	Between 3rd and 4th mark from top
790	14° ± 1 degree BTDC
Oil Pressure	296—434 kPa (43—63psi)
Fuel Transfer Pump	
Flow (min)	50 mL/15 sec (1.5 oz/15 sec)
Pressure (min)	29 kPa (4.2 psi)
Nozzle Cracking Pressure	
670	11242—12202 kPa (1630—1770 psi)
770/790/870/970/1070	19120—20080 kPa (2773—2913 psi)
Cooling System Pressure	0.9 bar (12.8 psi)
Thermostat (full open)	85°C (180°F)
Fan Belt Tension	13 mm (0.5 in.) at 24 lb
Speed Control Lever Friction	4.5—6 Kg (10—14 lb)
ELECTRICAL	
Battery	12 volt
Starter Draw (max amps/min rpm)	300 amp/300 rpm
Starter No—Load (max amps/min rpm)	120 amp/3000 rpm
Alternator	
Unregulated Output (std 20 amp)	40 VAC
Unregulated Output (optional 35 amp)	11 VAC min (each lead)

ITEM	SPECIFICATION
Fuses	
Headlight	15 amp
Taillight	5 amp
Floodlamp	10 amp
Warning Lamp	15 amp
Indicator Light	10 amp
Safety System and Fuel Solenoid	3 amp
POWER TRAIN	
Mid-PTO Brake	Stop within 3 sec
Mid-PTO Engagement Spring Length	59 mm (2-3/8 in.)
Clutch Pedal Free Travel	
670-770-790	18-22 mm (3/4-7/8 in.)
870/970/1070	20-25 mm (5/8-1 in.)
STEERING AND BRAKES	
Brake Pedal Free Travel	35 mm (1-3/8 in.)
Toe-In	3-9 mm (1/8-3/8 in.)
Wheel Free-Play (manual steering	Less than 50 mm (2 in.)
Steering Relief Valve	8274-9653 kPa (1200-1400 psi)
Steering Pump Flow	15.1 L/m at 2600 rpm (4 gpm at 2600 rpm)
HYDRAULIC SYSTEM	
Pump Flow (minimum)	
670 (2800 rpm)	17 L/m @ 10342 kPa (4.5 gpm @ 1500 psi)
770/790 (2600 rpm)	17 L/m @ 10342 kPa (4.5 gpm @ 1500 psi)
870/970/1070 (2600 rpm)	26.5 L/m @ 10342 kPa (7.0 gpm @ 1500 psi)
Main system Relief Valve	
670	10342-14480 kPa (2000-2100 psi)
770/790	15170-15860 kPa (2200-2300 psi)
870/970/1070	15170-15860 kPa (2200-2300 psi)

BEFORE YOU START

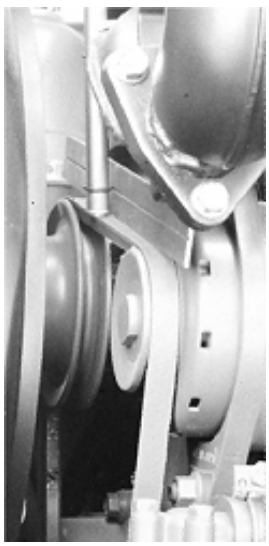
This procedure is designed to perform a quick check of the machine in a step-by-step method. We recommend you perform these checks for the entire machine, then refer to individual system sections, for detailed procedures to isolate any problems noted during checkout. These procedures also provide a systematic method to evaluate trade-in equipment or to perform an annual checkout.

A large majority of typical machine problems can be resolved using operational diagnostics with the senses of “LOOK”, “LISTEN”, and “FEEL”.

Perform these checks on a level surface. Special tools are not required.

Begin with step one and read from left to right. Read the complete step, then perform the check. After completing checkout, refer to appropriate sections for correction of indicated problems.

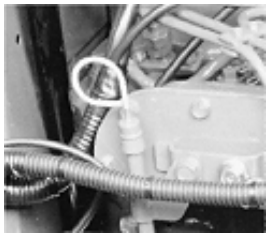
MX,21005DG,A1 -19-06DEC89

; **COOLANT LEVEL CHECK**	 M70704 -UN-18DEC89	NORMAL: 25—51 mm (1—2 in.) in recovery tank, radiator full *LOOK: Check coolant for signs of engine oil or other contaminates.*	IF NOT NORMAL: Add proper coolant mix. Inspect hoses, pump, radiator, and connection for leaks. See Section 220 for Coolant Pressure Test. MX,21005DG,A2 -19-06DEC89
‘ **FAN AND BELT CHECK**	 M70706 -UN-18DEC89	NORMAL: Blades straight, with clearance from shroud and nearby components. Belt should deflect 13 mm (1/2 in.) with 11 kg (24 lb) force applied between alternator and engine pulleys.	IF NOT NORMAL: Repair, replace or adjust as required. MX,21005DG,A3 -19-06DEC89

210
10
1

Æ ENGINE OIL CHECK

—Engine cold
—Tractor on level surface



M48561 -UN-18DEC89

NORMAL:
Between marks on dipstick.

Check oil condition:
Not milky or burnt.

IF NOT NORMAL:
Add proper viscosity oil.
Inspect gaskets, seals and plugs for leaks.

Milky or burnt
Refer Section 220

MX,21005DG,A4 -19-06DEC89

Å TRANSMISSION/ HYDRAULIC OIL CHECK

—Tractor level
—Attachments lowered



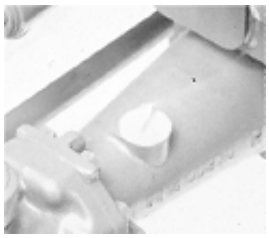
M48562 -UN-18DEC89

NORMAL:
Between marks on dipstick.

IF NOT NORMAL:
Add hydraulic oil.
Inspect pipes, hoses gaskets for leaks or use of hydraulic cylinder.

MX,21005DG,A5 -19-06DEC89

Ö MFWD OIL CHECK



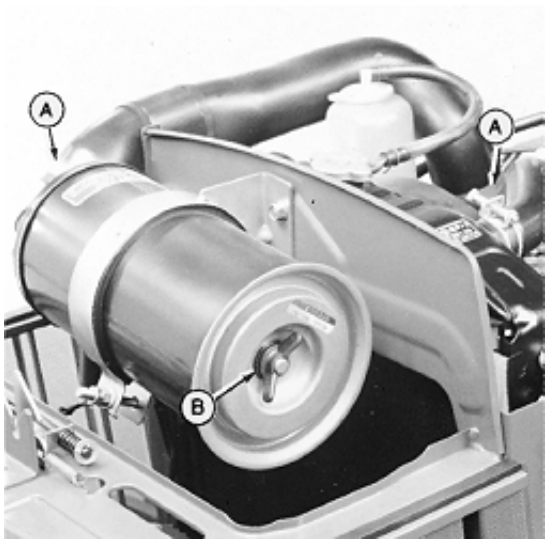
M48563 -UN-18DEC89

NORMAL:
Oil at top mark on dipstick.

IF NOT NORMAL:
Add gear lubricant.
Check for leaks.

MX,21005DG,A6 -19-06DEC89

Ò AIR INTAKE SYSTEM CHECK



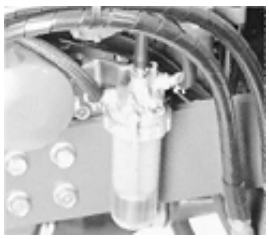
M70705 -UN-18DEC89

NORMAL:
Hose clamps (A) tight.
Grill and radiator screens free of debris.
Air cleaner element (B) not plugged.

IF NOT NORMAL:
Tighten clamps.
Clean as necessary.

MX,21005DG,A7 -19-06DEC89

Õ FUEL FILTER CHECK

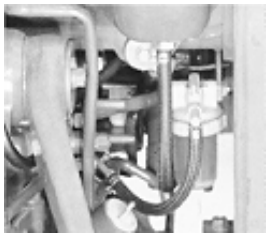
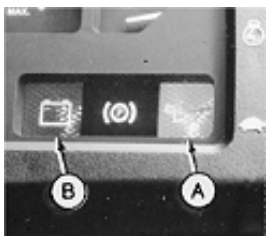
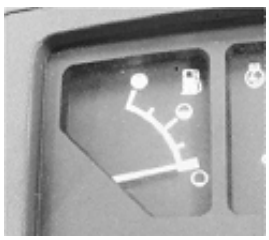
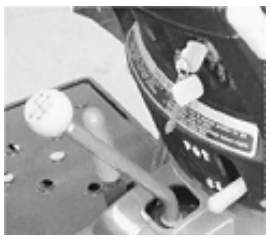


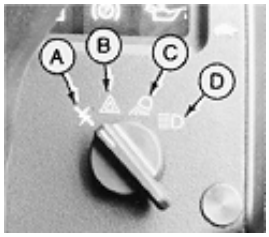
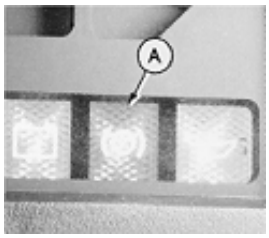
M70711 -UN-18DEC89

NORMAL:
Sediment bowl free of dirt.

IF NOT NORMAL:
Service per operator manual.

MX,21005DG,A8 -19-06DEC89

Ú **FUEL/WATER SEPARATOR CHECK 870-970-1070**	 M48565 -UN-18DEC89	NORMAL: Bowl free of water.	IF NOT NORMAL: Service per operator manual. MX,21005DG,A9 -19-06DEC89
Ü **INDICATOR LIGHT BULBS CHECK** Key switch “ON”	 M70726 -UN-18DEC89	NORMAL: Oil pressure and charge indicator lamps “ON”.	IF NOT NORMAL: Check bulb(s). If still not on, See Section 240 Oil Pressure and Charge Light Circuits. MX,21005DG,A10 -19-06DEC89
1Ô **FUEL GAUGE CHECK** Key switch “ON”.	 M70728 -UN-18DEC89	NORMAL: Gauge should move to indicate approximate fuel level in tank.	IF NOT NORMAL: See Section 240 Fuel Gauge Circuit. MX,21005DG,A11 -19-06DEC89
1 ! **SPEED CONTROL LEVER CHECK**	 M70707 -UN-18DEC89	NORMAL: Hand lever (A) should move from slow to fast with slight drag. Foot lever (B) should move slow to fast with spring return (hand lever in slow position).	IF NOT NORMAL: Check for binding linkage or debris. Adjust drag as necessary. (See Section 220, Group 15). MX,21005DG,A12 -19-06DEC89
1@ **START UP CHECK** Transmission “NEUTRAL” PTO’s “OFF” Speed control “FAST” Key switch “START”	 M48564 -UN-18DEC89	NORMAL: Engine should crank and run. Charge indicator light and oil pressure light should go out within 5 seconds.	IF NOT NORMAL: See Section 240 Electrical and Section 220 Engine. MX,21005DG,A13 -19-06DEC89

1# **ENGINE PERFORMANCE CHECK**	Engine running move speed control lever slow to fast.	NORMAL: Engine should accelerate smoothly without hesitation. Governor should maintain constant speed without surging. Exhaust should be clear.	IF NOT NORMAL: See Section 220 Engine. MX,21005DG,A14 -19-06DEC89
1$ **LIGHT CIRCUIT CHECK**	 M70729 -UN-18DEC89	NORMAL: Position A—No lights on. Position B—Warning flashers on. Position C—Headlamps, tail lights and rear floods (optional) ON. Position D—Headlamps, tail lights and warning flashers ON.	IF NOT NORMAL: See Section 240 Lighting System Tests. MX,21005DG,A15 -19-06DEC89
1% **PARK BRAKE INDICATOR LIGHT CHECK** Park brake lever “UP”. Brake pedals “DOWN”. Key switch “ON”.	 M70730 -UN-18DEC89	NORMAL: Indicator light (A) should flash.	IF NOT NORMAL: See Section 240 Park Brake Light Circuit. MX,21005DG,A16 -19-06DEC89
1Û **TEMPERATURE GAUGE CHECK**	 M70727 -UN-18DEC89	NORMAL: After engine has operated for several minutes gauge should indicate in normal range.	IF NOT NORMAL: See Section 240 Coolant Temperature Gauge Circuit. MX,21005DG,A17 -19-06DEC89
1& **TACHOMETER CHECK** Operate engine at slow idle and fast idle.	 M70715 -UN-18DEC89	NORMAL: Tachometer should indicate engine speeds see Specifications.	IF NOT NORMAL: No reading: Check drive. Readings not to specifications: Check speeds with master speed indicator. Adjust idle speed as necessary See Section 220. MX,21005DG,A18 -19-06DEC89

1* **SAFETY INTERLOCK SYSTEM CHECK** • Transmission neutral start —Transmission shift lever in any gear. —Clutch pedal down. —Turn key switch to **"START".** • Rear PTO —Lever for rear PTO "UP" (engaged). • Front PTO —Lever for front PTO "UP" (engaged).	NORMAL: Starter should not engage. Starter should not engage. Fuel solenoid should not pull in. Starter should not engage. Fuel solenoid should not pull in.	IF NOT NORMAL: See Section 240 Starting Circuit.

MX,21005DG,A19 -19-06DEC89

1(**OPERATOR PRESENCE SYSTEM CHECK** • Front PTO —Engine running. —Front PTO engaged.	• Rear PTO. —Engine Running. —Rear PTO engaged. • Front PTO. —Engine running. —Rear PTO engaged. —Seat bypass switch **"UP".**	

NORMAL: Engine should stop when operator raises off seat.	Engine should stop when operator raises off seat. Engine should continue to run.	IF NOT NORMAL: See Section 240 Fuel Shut-Off Circuit.

MX,21005DG,A20 -19-06DEC89

2Ô POWER STEERING CHECK

Engine running at full throttle.



M48566 -UN-18DEC89

NORMAL:
Front wheels should turn full left and full right with smooth, constant effort until a solid stop at end of full turn.

IF NOT NORMAL:
See Section 260 Steering System.

MX,21005DG,A21 -19-06DEC89

2! CLUTCH CHECK

Push on clutch pedal.



M48567 -UN-18DEC89

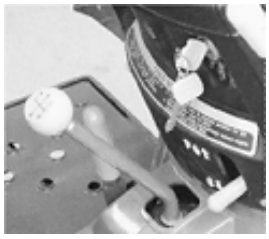
NORMAL:
There should be about 20 mm (3/4 in.) free travel.
Tractors with constant running PTO: At approximately one half pedal travel more force should be required to complete travel.

IF NOT NORMAL:
See Section 250 Clutch.

MX,21005DG,A22 -19-06DEC89

2@ TRANSMISSION SHIFT CHECK

Move lever to each selection.



M48564 -UN-18DEC89

NORMAL:
Lever should move to a detented position for each selection.

IF NOT NORMAL:
See Section 250.

MX,21005DG,A23 -19-06DEC89

2# RANGE LEVER SHIFT CHECK

Move lever to each selection.



M48568 -UN-18DEC89

NORMAL:
Lever should move to a detented position for each selection. When pushed down in “N” should freely slide up.

IF NOT NORMAL:
See Section 250 Range Lever Adjustment.

MX,21005DG,A24 -19-06DEC89

210
10
6

2$ SHIFT LEVER INTERLOCK CHECK (870-970-1070 ONLY)

Move range lever to “III”.
Move transmission lever to “R”.

NORMAL:
Range lever should move to neutral as transmission lever is moved to reverse.

IF NOT NORMAL:
See Section 250

MX,21005DG,A25 -19-06DEC89

2% **MFWD DRIVE CHECK**

Engage MFWD.
Drive slowly forward turn steering full left or right.



M48569 -UN-18DEC89

NORMAL:
One front tire should slightly spin or scuff.

NOTE: If necessary repeat with MFWD disengaged and compare results.

IF NOT NORMAL:
See Section 250

MX,21005DG,A26 -19-06DEC89

2Û **BRAKE CHECK**

Drive tractor straight forward (with transport latch disengaged).
Alternately apply left and right brakes.



M48570 -UN-18DEC89

NORMAL:
Front of tractor should try to move in direction of brake being applied.

IF NOT NORMAL:
See Section 260 Brake Operation and Tests.

MX,21005DG,A27 -19-06DEC89

2& **BRAKE ADJUSTMENT CHECK**

Press both pedals at same time to end of free travel.



M48570 -UN-18DEC89

NORMAL:
Brake latch should move freely into slot.

IF NOT NORMAL:
See Section 260 Brake Adjustment.

MX,21005DG,A28 -19-06DEC89

2* **SELECTIVE CONTROL VALVE CHECK**

NOTE: Lever lock must be in "UNLOCK" position (center).



M48571 -UN-18DEC89

ACTION:
A Pull SCV lever to rear and release.

B Push SCV lever forward to first stop and release.

C Push SCV lever forward into float detent.

D Pull SCV lever to left and release.

E Push SCV lever to right and release.

NOTE: "Regen" lockout stop may restrict total movement, depending on its placement.

NORMAL:
A Lever should return to "Neutral".

B Lever should return to "Neutral".

C Lever should stay in float until manually returned to neutral.

D Lever should return to neutral.

E Lever should return to neutral.

IF NOT NORMAL:
Check lever pivots and links for binding.

MX,21005DG,A29 -19-06DEC89

2(**ROCKSHAFT CHECK**

Stop valve fully open. Engine running at fast idle.

NOTE: 1070—Draft control lever "Forward".



M48572 -UN-18DEC89

ACTION:

A Push rockshaft control fully forward.

B Pull rockshaft control one half travel to rear.

C Pull rockshaft control fully to rear.

D Manually raise rockshaft arms against stop.

E Push Rockshaft control lever fully forward. Close (turn CW) stop valve. With engine running pull control lever to rear.

NORMAL:

A Rockshaft arms should drop.

NOTE: May be necessary to push arms down.

B Rockshaft arms should raise one-half travel.

C Rockshaft arms should raise full height.

D Arms should have some "free travel".

E Arms should not move.

N **CAUTION: Continued operation in this mode will heat oil as it is pumped past relief.**

IF NOT NORMAL:
See Section 270 Rockshaft Test and Adjust.

MX,21005DG,A30 -19-06DEC89

210
10
8

Section 220
ENGINE OPERATION, TESTS, ADJUSTMENTS AND CHECKS

Contents

Page

Group 05–Component Locations

Engine Component Location 220-05-1
Lubrication System
Components Location 220-05-1
Fuel System
Components Location 220-05-1

Group 10–Theory of Operation

Engine Information 220-10-1
Air Intake System Operation 220-10-2
Engine Cooling System Operation 220-10-4
Engine Lubrication System Operation. . . .220-10-6
Fuel System Operation
–670, 770, 790. 220-10-8
–870, 970, 1070. 220-10-10
Fuel Injection Pump Operation
–Pump at Bottom of Stroke 220-10-12
–Pump at Top of Stroke 220-10-14
Injection Nozzle Operation
–Indirect Injection (Pintle Type)
–670. 220-10-16
Direct Injection
–770, 790, 870, 970,1070 220-10-18
Precombustion Chamber Operation
–670 (Indirect Injection) 220-10-20
Combustion Chamber Operation
–770, 790, 870, 970,1070
(Direct Injection) 220-10-22
Governor Operation
–770, 790, 870, 970, 1070. 220-10-24
–Starting 220-10-26
–High Idle, Maximum Torque. 220-10-28
Engine Balancer Operation
–970, 1070. 220-10-30

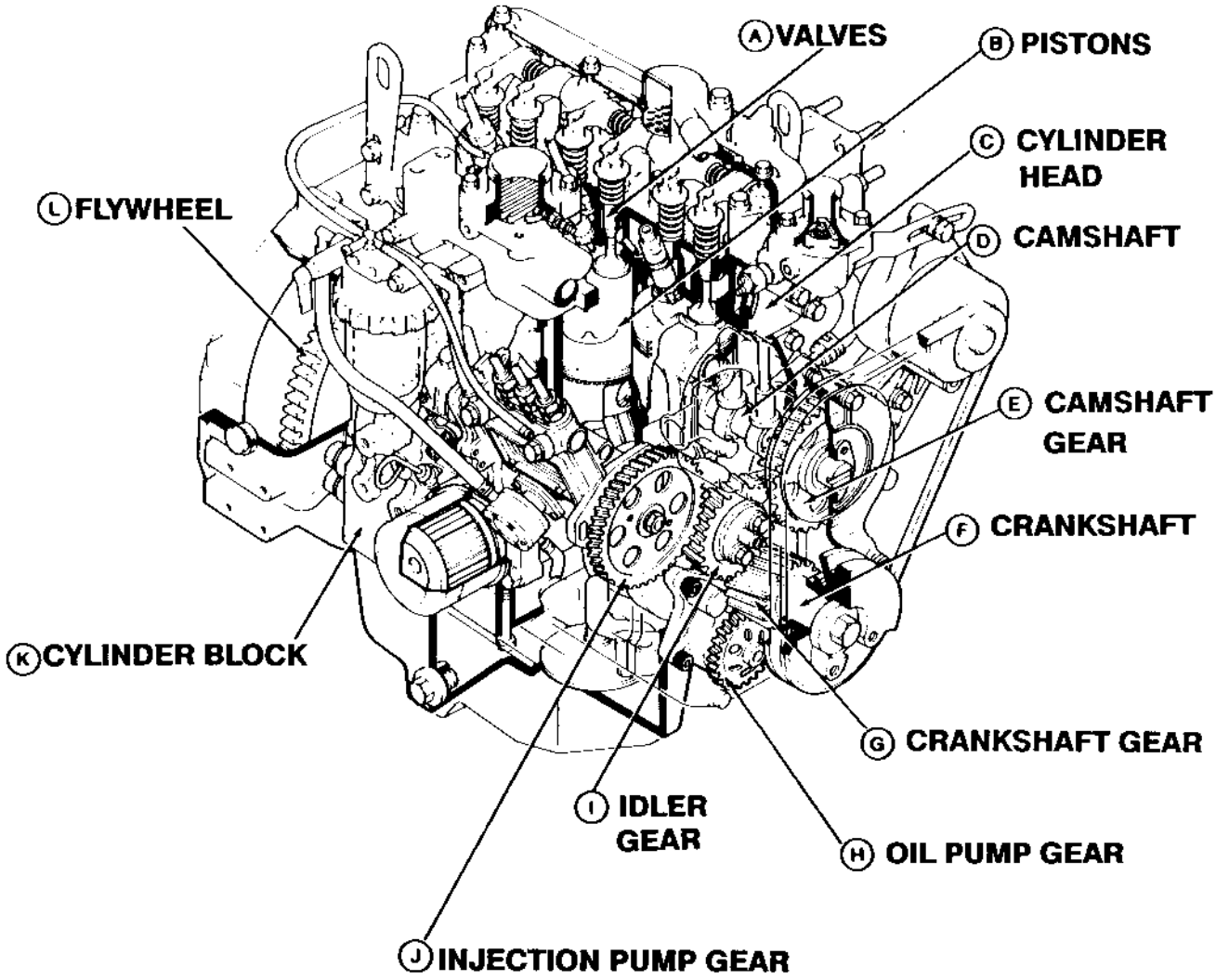
Group 15–Engine System Diagnosis

Engine Problem Identification 220-15-1
Essential Tools. 220-15-1
Engine
–Turns Over But Will Not Stop Or
–Starts Hard 220-15-2
–Runs Irregularly or Stalls Frequently . . .220-15-4

Page

–Runs Rough 220-15-6
–Low Power 220-15-8
–Exhaust Smokes–Black or Grey. 220-15-10
–Smokes Excessive–White 220-15-12
–Uses Excess Fuel. 220-15-14
–Has Excess Noise or Vibrations 220-15-16
–Uses Excess Oil or Smokes Blue. . . . 220-15-18
–Has Low Oil Pressure. 220-15-20
–Coolant Temperature Incorrect. 220-15-22
–Oil In Coolant or Coolant In Oil. 220-15-24
Adjust
–Fuel Shutoff Solenoid 220-15-25
–Speed Control Linkage. 220-15-25
–Slow Idle Adjustment–790 . . . . . 220-15-27a
–Fast Idle Adjustment–790. . . . . 220-15-27b
Test Fuel Transfer Pump. 220-15-28
Cylinder Compression Pressure Test . . . 220-15-29
Timing Injection System–670 220-15-30
Injection Pump Static Timing Adjustment
–770, 790, 870, 970, 1070 220-15-32
Injection Nozzle Test–790 220-15-35
Engine–
–Oil Pressure Test 220-15-36
–Adjust Oil Pressure. 220-15-37
–Adjust Fan/Alternator Drive Belt 220-15-37
Radiator Bubble Test 220-15-38
Cooling System Pressure Test 220-15-39
Radiator Cap Pressure Test–790 220-15-39
Air Intake System Leakage Test–790. . . 220-15-40
Fuel Supply Pump Pressure Test–790. . 220-15-40
Fuel System Leakage Test–790. 220-15-41
Bleed Fuel System–790 220-15-41
Thermostat Opening Test–790. 220-15-42
Valve Clearance Adjustment–790 220-15-43
Connecting Rod–790
–Side Play Check 220-15-43
–Bearing Clearance Check 220-15-45
Crankshaft–790
–End Play Check 220-15-47
–Main Bearing Clearance Check 220-15-47
Valve Lift Check–790 220-15-49
Camshaft End Play Check–790 220-15-49
Timing Gear Backlash Check–790. 220-15-50

ENGINE COMPONENT LOCATION



M70906

ENGINE COMPONENT LOCATION

-19-11DEC89

M70906

A—Valves
B—Pistons
C—Cylinder Head
D—Camshaft
E—Camshaft Gear
F—Crankshaft
G—Crankshaft Gear
H—Oil Pump Gear
I—Idler Gear
J—Injection Pump Gear
K—Cylinder Block
L—Flywheel

Slide No. 16

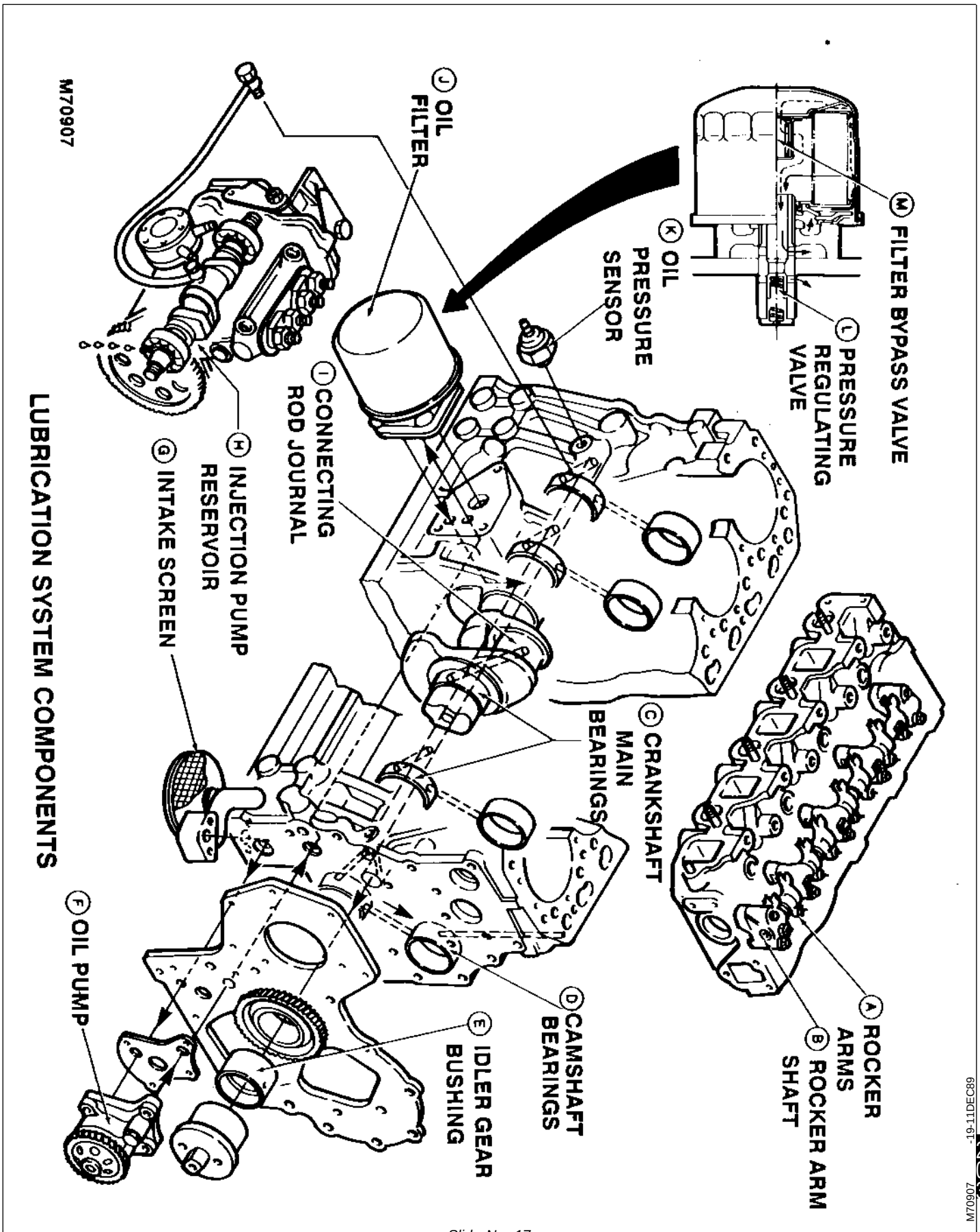
220
05
1

MX,22005DG,A1 -19-06DEC89

LUBRICATION SYSTEM COMPONENT LOCATION

A—Rocker Arms
B—Rocker Arm Shaft
C—Crankshaft Main Bearing
D—Camshaft Bearings
E—Idler Gear Bushing
F—Oil Pump
G—Intake Screen
H—Injection Pump Reservoir
I—Connecting Rod Journal
J—Oil Filter
K—Oil Pressure Sensor
L—Pressure Regulating Valve
M—Filter Bypass Valve

MX,22005DG,A2 -19-06DEC89



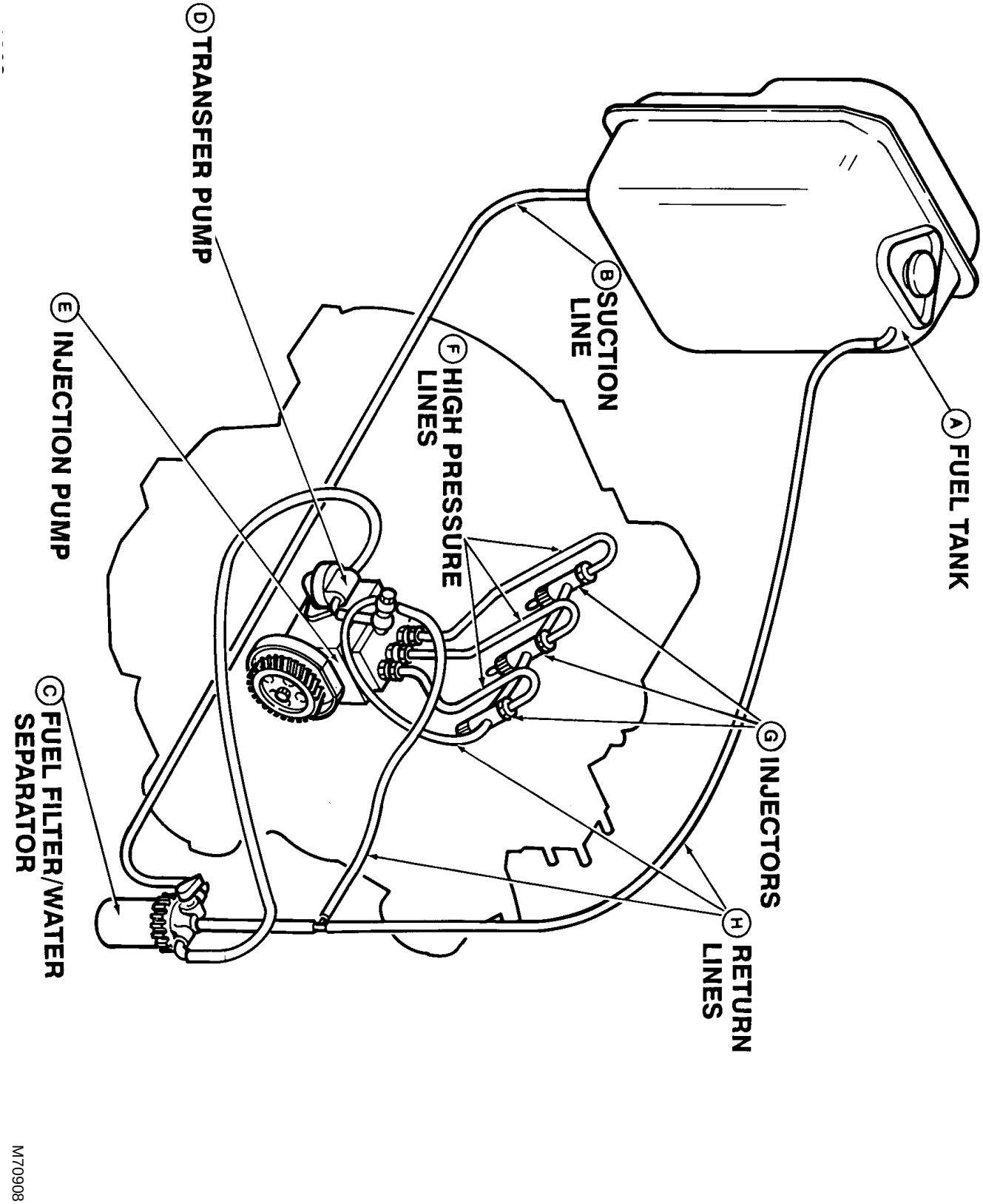
Slide No. 17

MX,22005DG,A3 -19-06DEC89

FUEL SYSTEM COMPONENTS–670/770/790

A-Fuel Tank
B-Suction Line
C-Fuel Filter/Water Separator
D-Transfer Pump
E-Injection Pump
F-High Pressure Lines
G-Injectors
H-Return Lines

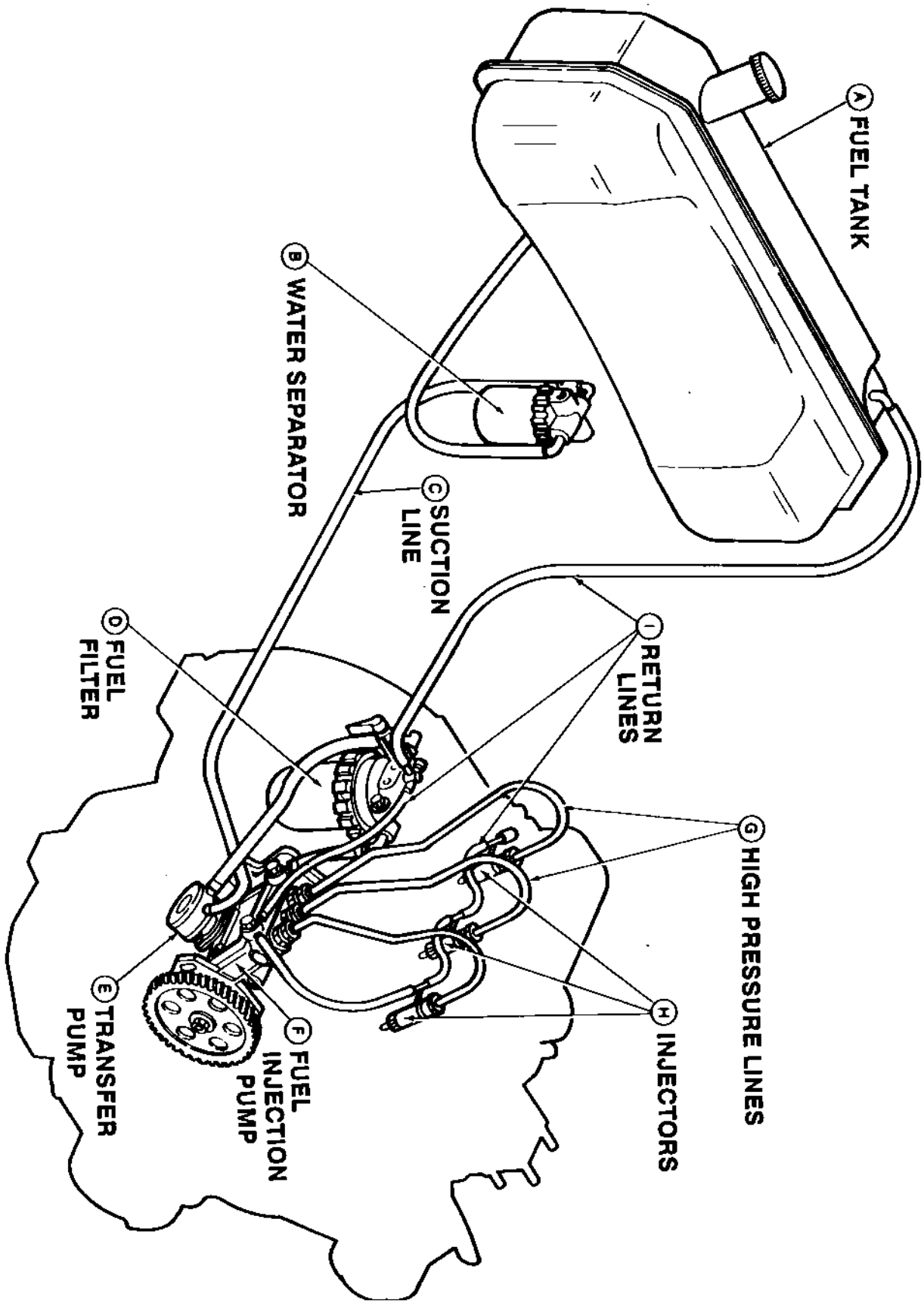
FUEL SYSTEM COMPONENTS–670/770/790



FUEL SYSTEM COMPONENTS—870/970/1070

A—Fuel Tank
B—Water Separator
C—Suction Lines
D—Fuel Filter
E—Transfer Pump
F—Fuel Injection Pump
G—High Pressure Lines
H—Injectors
I—Return Lines

MX,22005DG,A6 -19-06DEC89



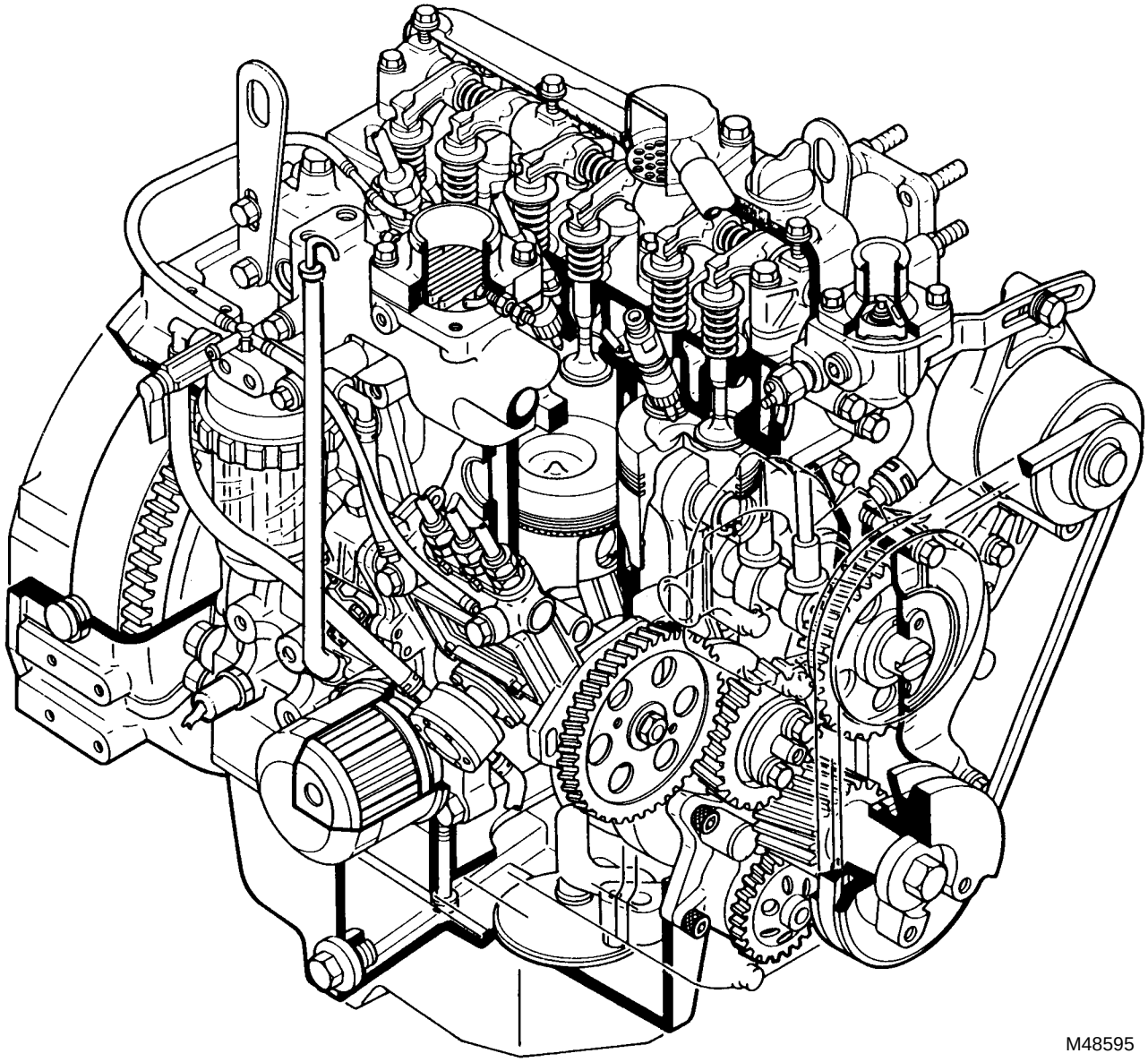
M70909 -19-11DEC89

220 05 7

Slide No. 19

MX,22005DG,A7 -19-06DEC89

YANMAR TN SERIES DIESEL ENGINE INFORMATION



M48595

The 70 Series Compact Utility Tractors use the TN series engine. The 670 engine has indirect injection. The 770, 870, 970, and 1070 all use a direct injection fuel system.

The 790 Compact Utility Tractor uses the TNE series engine which uses a direct injection fuel system.

Model	Engine	kW/Horsepower
670	3TNA72-UJX	13.8 kW (18.5 hp)
770	3TN82-RJX	17.9 kW (24 hp)
790	3TNE84	19.7 kW (27 hp)
870	3TN84-RJX	20.9 kW (28 hp)
970	4TN82-RJX	24.6 kW (33 hp)
1070	4TN84-RJX	28.7 kW (38.5 hp)

AIR INTAKE SYSTEM OPERATION

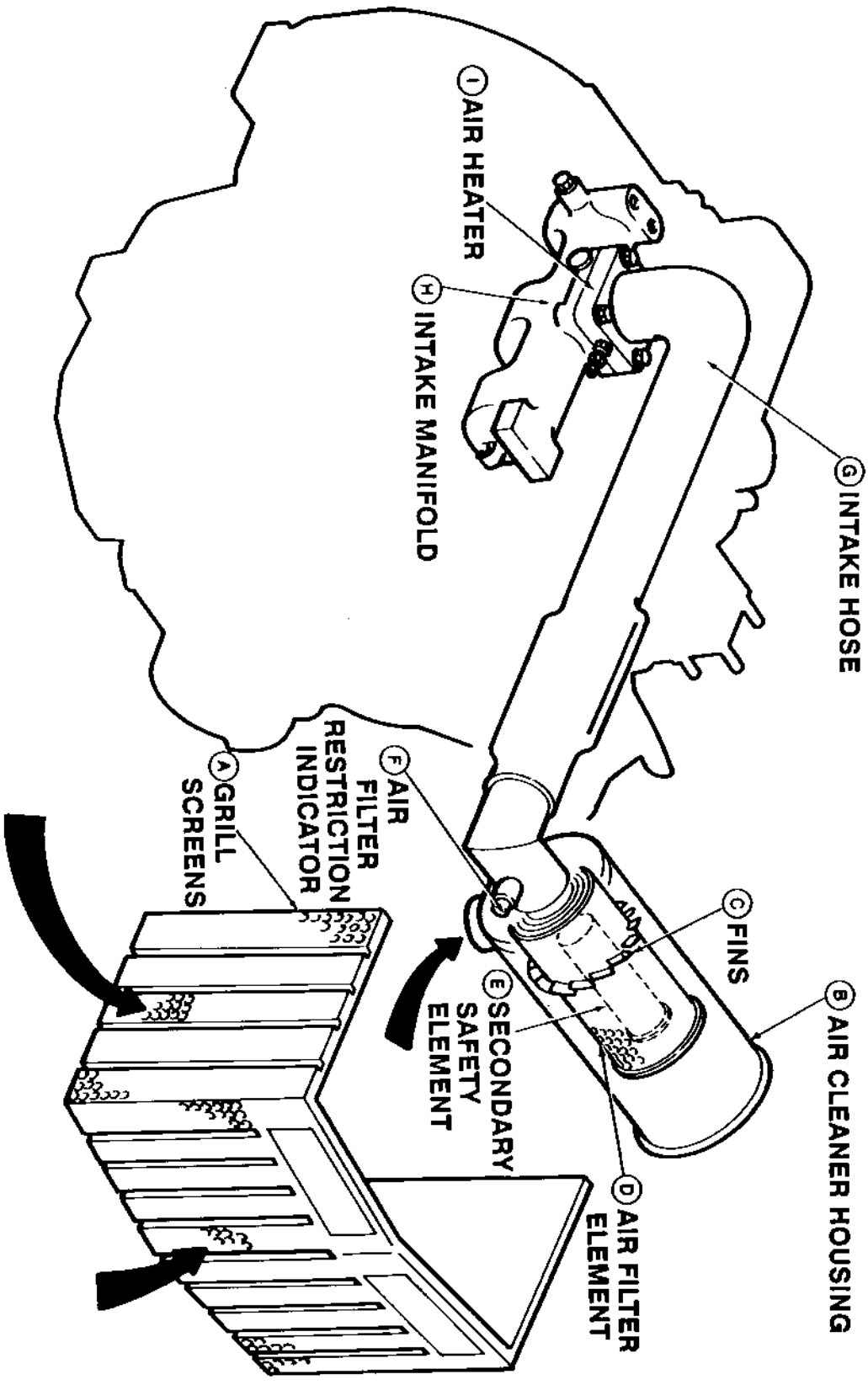
A-Grill Screens
B-Air Cleaner Housing
C-Fins
D-Air Filter Element
E-Secondary Safety Element (790, 870, 970, and 1070)
F-Air Filter Restriction Indicator
G-Intake Hose
H-Intake Manifold
I-Air Heater (Not used on 670)

Air for combustion enters tractor through the grill screen (A) to the air cleaner housing (B).

Fins (C) placed at an angle, direct air around the filter element in circular motion, throwing larger particles to the unloader valve.

The 790, 870, 970, and 1070 also have a secondary safety element (E). An air filter restriction indicator (F) may be installed at the air cleaner outlet.

The 770, 790, 870, 970, and 1070 have an air intake heater (I) installed at the intake manifold inlet (H) to aid in starting.



220 10 3

Slide No. 21

MX,22010DG,A3 -19-06DEC89

ENGINE COOLING SYSTEM OPERATION

A—Coolant Recovery Tank
B—Thermostat
C—Coolant Temperature Sensor
D—Radiator
E—Pressure Cap
F—Radiator Screen
G—Coolant Hoses
H—Cooling Fan
I—Coolant Pump
J—Cylinder Block
K—Cylinder Head

An impeller type pump (I) draws coolant from the lower radiator tank (D) and pumps it into coolant passages in block, up through head, past thermostat (B) and temperature gauge sender (C), then back to the top radiator tank.

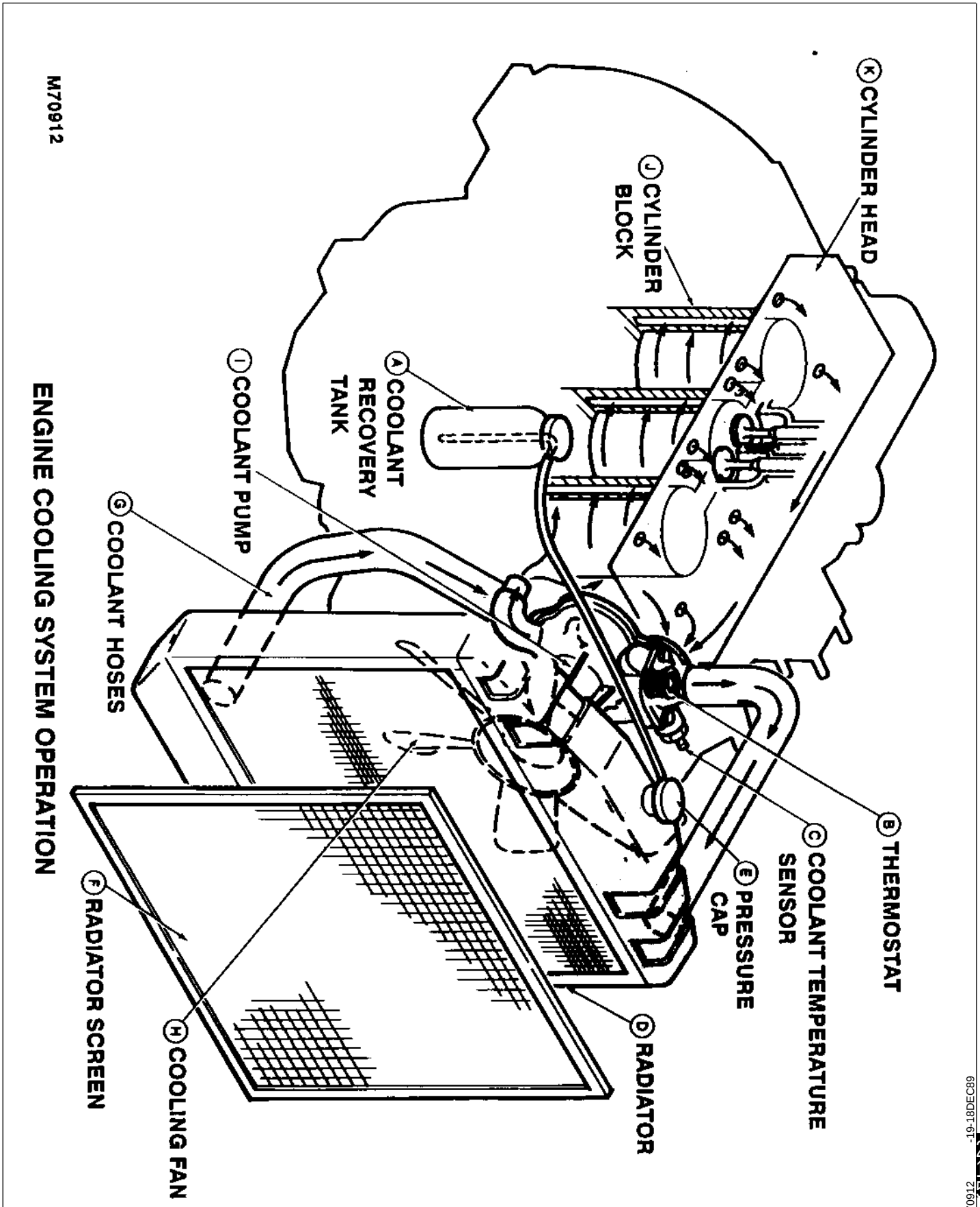
A fan mounted to coolant pump draws air through grill screen (F) and radiator discharging it across the engine.

As the coolant is heated and expands it overflows past radiator pressure cap (E) to coolant recovery tank (A).

Passages permit some coolant to bypass the thermostat (when closed) to provide more uniform warm-up of engine parts.

MX,22010DG,A4 -19-06DEC89

220
10
4



Slide No. 22

MX,22010DG,A5 -19-06DEC89

ENGINE LUBRICATION SYSTEM OPERATION

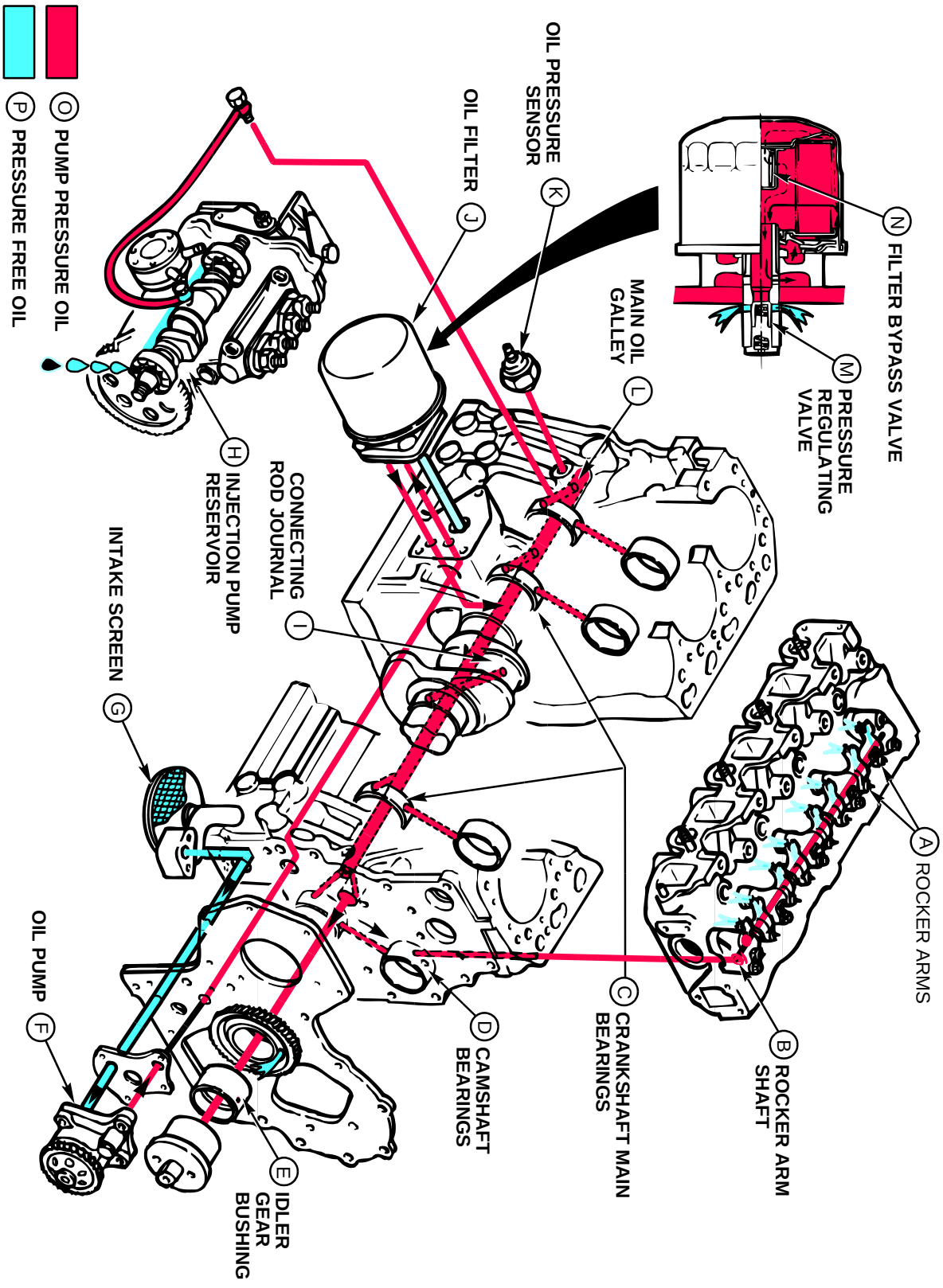
A-Rocker Arms
B-Rocker Arm Shaft
C-Crankshaft Main Bearings
D-Camshaft Bearings
E-Idler Gear Bushing
F-Oil Pump
G-Intake Screen
H-Injection Pump Reservoir
I-Connecting Rod Journal
J-Oil Filter
K-Oil Pressure Sensor
L-Main Oil Galley
M-Pressure Regulating Valve
N-Filter Bypass Valve
O-Pump Pressure Oil
P-Pressure Free Oil

Engine parts are lubricated with a full pressure system. A rotary type oil pump (F) draws oil through the sump intake screen (G) and directs it to the full flow oil filter (J) and pressure regulating valve (M).

Passages drilled in the engine block, head, and crankshaft distribute oil to the moving parts.

The filter has a bypass valve that routes unfiltered oil to the operating system if the filter is plugged.

ENGINE LUBRICATION SYSTEM OPERATION



MXC70910

FUEL SYSTEM OPERATION—670, 770, 790

Suction fuel (I) flows from fuel tank (A) to fuel filter/ water separator (C) to transfer pump (D).

The transfer pump forces low pressure fuel (G) to the fuel gallery of the injection pump (E).

The injection pump meters fuel as determined by the governor and delivers high pressure fuel (F) to the injectors (B).

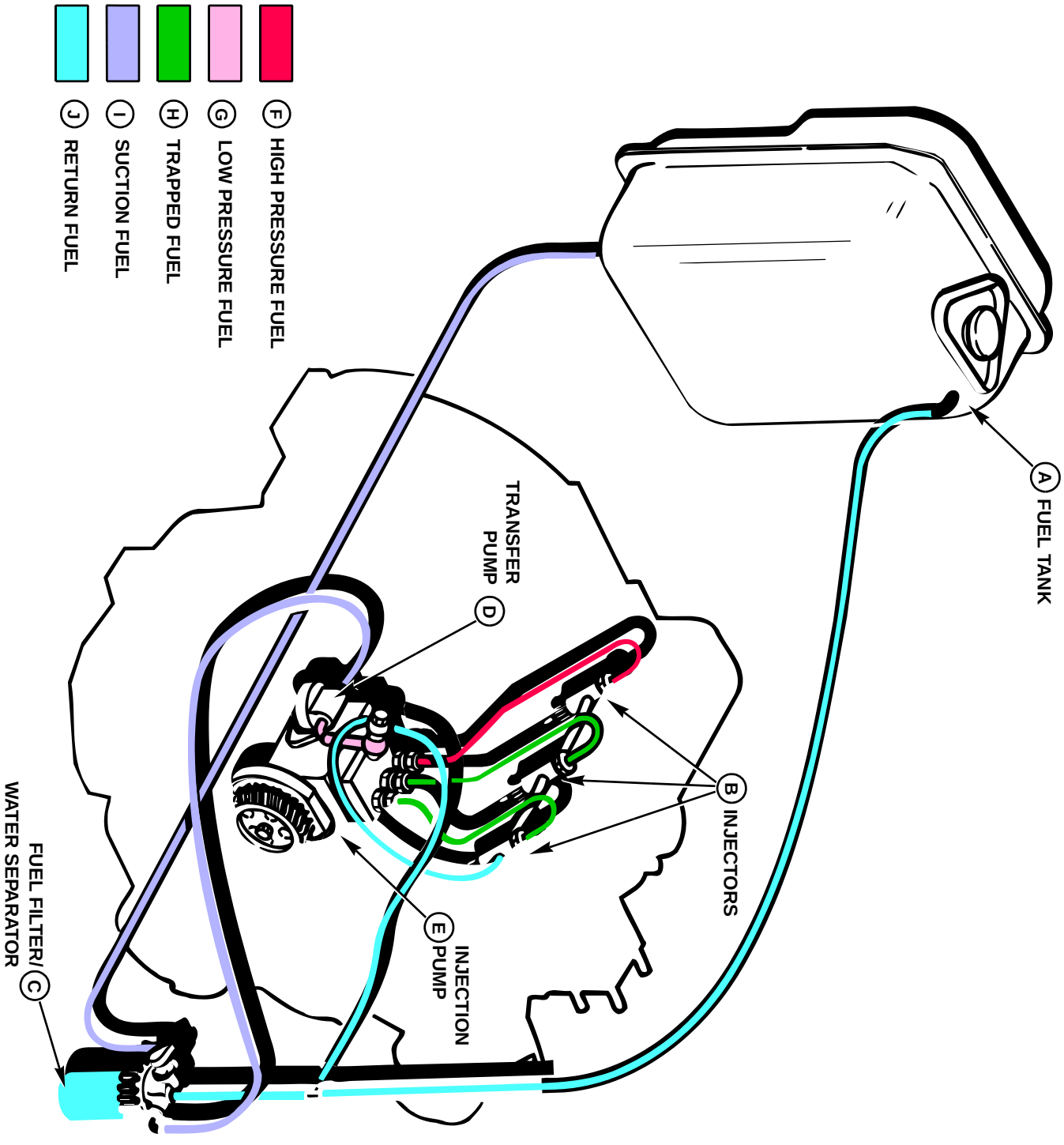
The injectors prevent flow until high pressure is reached, then opening the injector valves and spraying atomized fuel into the combustion chambers.

Injector lines have trapped fuel (H) whenever injection is not taking place.

Any air in the system is bled out with the return fuel (J) to the fuel tank.

Small amounts of fuel are allowed to leak past the injectors for lubrication, after which are returned to the fuel tank.

FUEL SYSTEM OPERATION—670, 770, 790



A-Fuel Tank
B-Injector
C-Fuel Filter/Water Separator
D-Fuel Transfer Pump
E-Injection Pump

FUEL SYSTEM OPERATION—870,970,1070

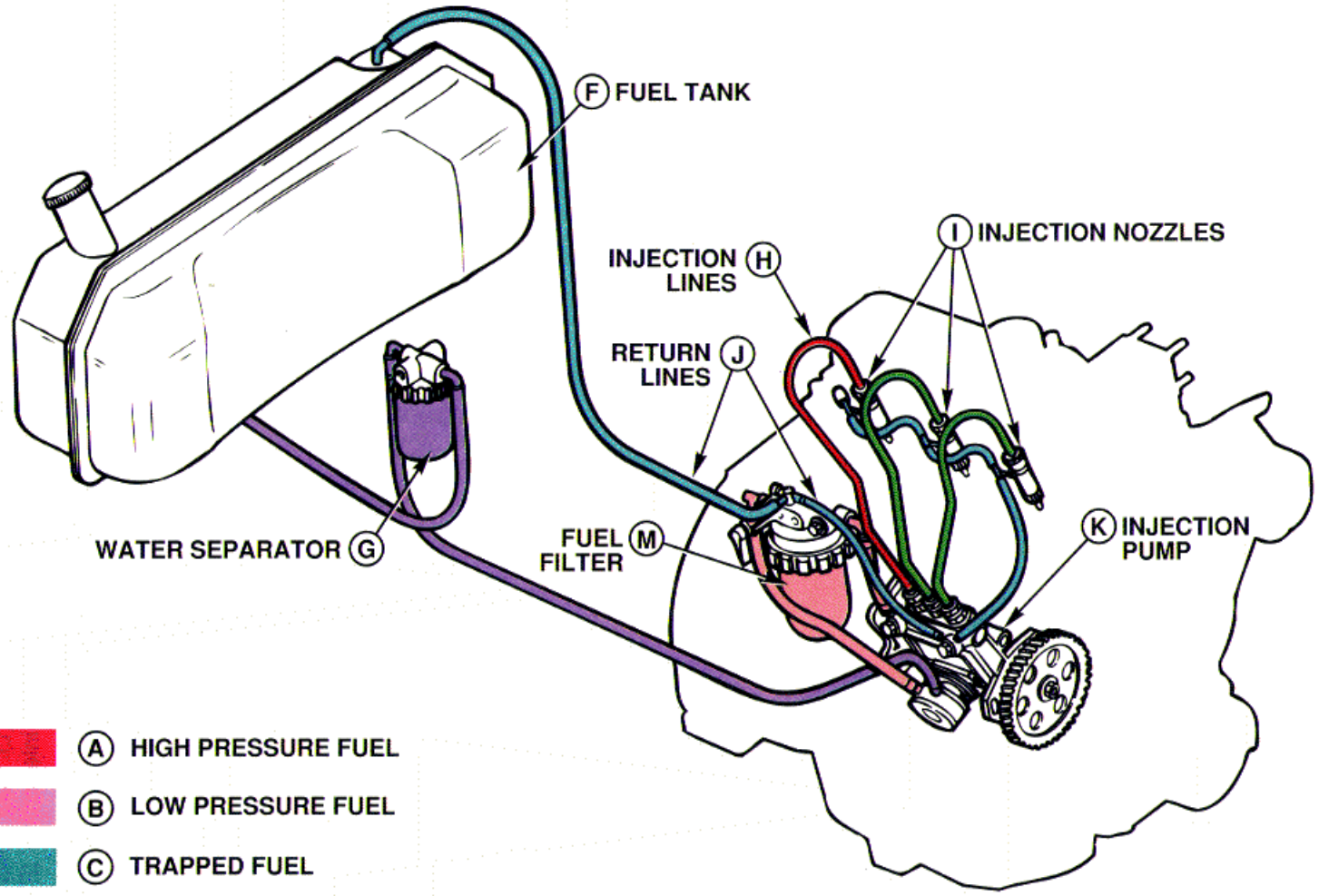
A—High Pressure Fuel
B—Low Pressure Fuel
C—Trapped Fuel
D—Suction Fuel
E—Return Fuel
F—Fuel Tank
G—Water Separator
H—Injection Lines
I—Injection Nozzles
J—Return Lines
K—Injection Pump
L—Transfer Pump
M—Fuel Filter

Suction fuel (D) flows from the fuel tank (F) through water separator (G) to transfer pump (L). The transfer pump forces fuel (B) through filter (M) to the gallery of the injection pump (K). The injection pump meters fuel and pumps it through high pressure injection lines (H) to injector nozzles (I). The injector nozzle valve prevents flow until a high pressure (A) is reached. When the pressure is reached the valve opens, atomizing the fuel as it enters the combustion chamber. Injection lines have trapped fuel (C) whenever injection is not taking place.

Any air in the fuel is bled to return lines (J). No manual bleeding is necessary.

Small amounts of fuel are allowed to leak past nozzle valves for lubrication and are returned to the fuel tank.

MXC48490 -19-30JUL88



MXC48490

FUEL SYSTEM OPERATION - 870/970/1070

MX,22010DG,A11 -19-06DEC89
160290

FUEL INJECTION PUMP OPERATION (BOTTOM OF STROKE)

A—Low Pressure Fuel
B—Trapped Fuel
C—Fuel Injection Line
D—Fuel Inlet Fitting
E—Inlet Orifice
F—Barrel
G—Control Rack
H—Roller Tappet
I—Camshaft
J—Control Sleeve
K—Plunge
L—Fuel Gallery
M—Valve Seat
N—Delivery Valve
O—Spring

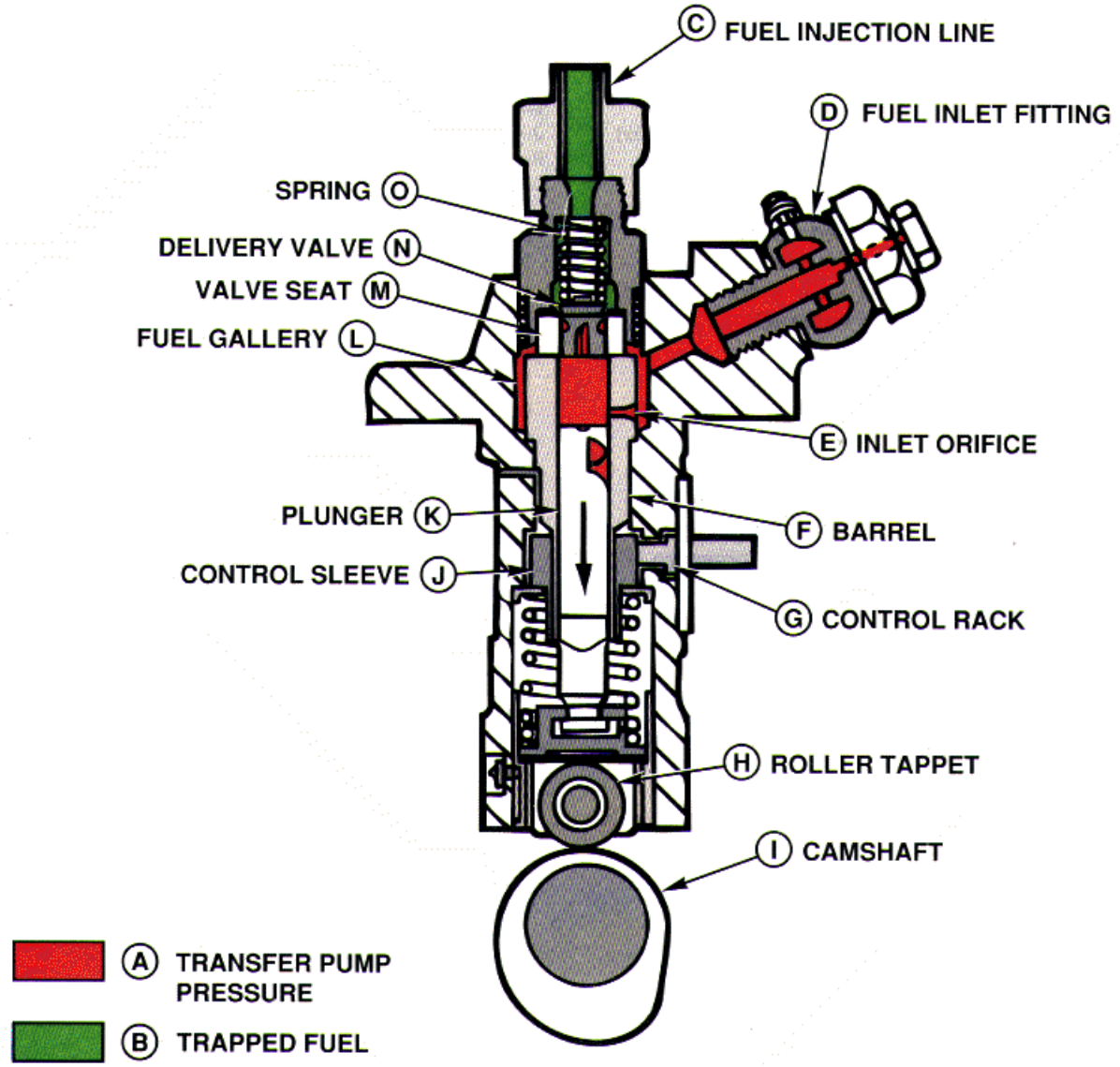
The fuel injection pump is a variable-displacement, in-line plunger-type pump. It is located on the left side of the engine. The pump is driven by a camshaft (I) which turns at one-half engine speed.

When the plunger (K) is in the downward position, filtered low pressure fuel (A) from the fuel transfer pump flows through the fuel inlet fitting (D), to the fuel gallery (L). Fuel flows from the fuel gallery through the inlet orifice (E) and fills the plunger area.

Whenever the plunger is in the downward position, the delivery valve (N) is held closed against the valve seat (M), by spring pressure (O) and trapped fuel pressure (B). In this position, fuel flow to the fuel injection line (C) and nozzle is blocked.

MX,22010DG,A12 -19-06DEC89

220
10
12



INJECTION PUMP OPERATION (Bottom of Stroke)

Slide No. 26

MX,22010DG,A13 -19-06DEC89

INJECTION PUMP OPERATION (PUMP AT TOP OF STROKE)

A—High Pressure Fuel
B—Low Pressure Fuel
C—Fuel Injection Line
D—Fuel Inlet Fitting
E—Inlet Orifice
F—Plunger Groove (Helix)
G—Barrel
H—Control Rack
I—Roller Tappet
J—Camshaft
K—Control Sleeve
L—Plunger
M—Fuel Gallery
N—Valve Seat
O—Delivery Valve
P—Spring

When the roller tappet (I) is moved up by the camshaft (J), the inlet orifice (E) is blocked by the plunger (L). Fuel in the plunger area is compressed and forced against the delivery valve (O).

When fuel pressure is high enough to overcome spring (P), the delivery valve is lifted upward off the vale seat (N). High pressure fuel (A) flows past the delivery valve to the fuel injection line (C) and then to the fuel injection nozzle. The delivery valve is held open only when the fuel pressure in the plunger area is greater than the delivery valve spring pressure (P).

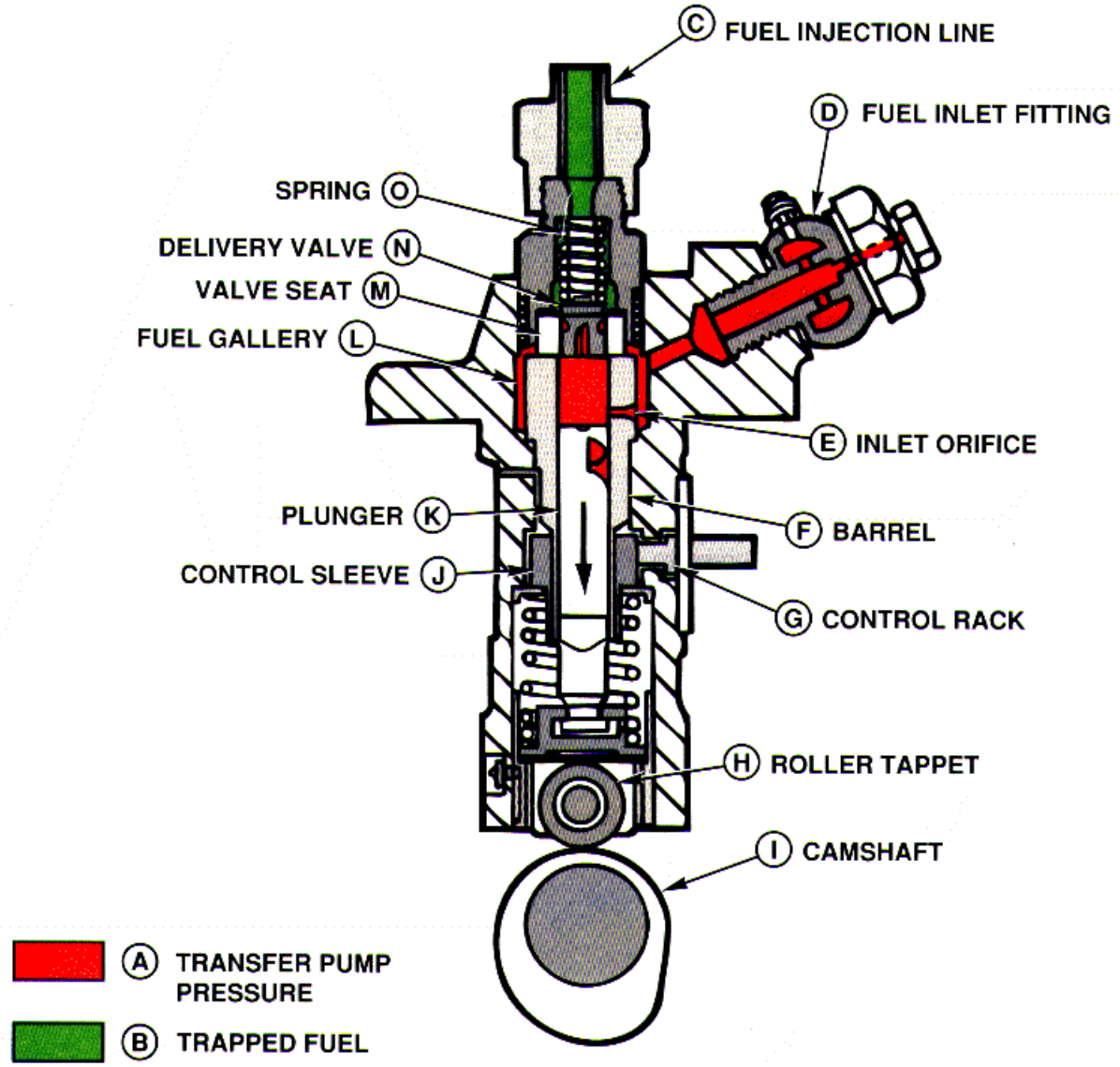
As the plunger continues moving upward, the plunger groove (F) aligns with the inlet orifice (E) . The pressure in the plunger area is higher than the pressure in the fuel gallery (M). This causes fuel to flow from the plunger area, through the plunger groove and inlet orifice to the fuel gallery.

Fuel flow through the inlet orifice causes pressure in the plunger area to decrease. With pressure equal on both sides of the delivery valve, spring force closes the delivery valve and stops the fuel flow to injection nozzle.

A governor-operated control rack (H) is connected to the control sleeve (K) and plunger (L) to regulate the quantity of fuel delivery to the nozzles. The control sleeve turns the plunger and increases or decreases the amount of plunger movement before the plunger groove (F) and inlet orifice (E) are aligned.

MX,22010DG,A14 -19-06DEC89

220
10
14



INJECTION PUMP OPERATION (Bottom of Stroke)

Slide No. 26

MX,22010DG,A13 -19-06DEC89

INDIRECT INJECTION NOZZLE OPERATION—670 (PINTLE TYPE)

A—High Pressure Fuel
B—Return Fuel
C—Fuel Inlet Passage
D—Fuel Return Passage
E—Shim
F—Nozzle Fitting
G—Retainer
H—Seat
I—Nozzle Body
J—Valve Seat
K—Orifice
L—Pintle
M—Spring
N—Injector Body
O—Return Line
P—Return Connector

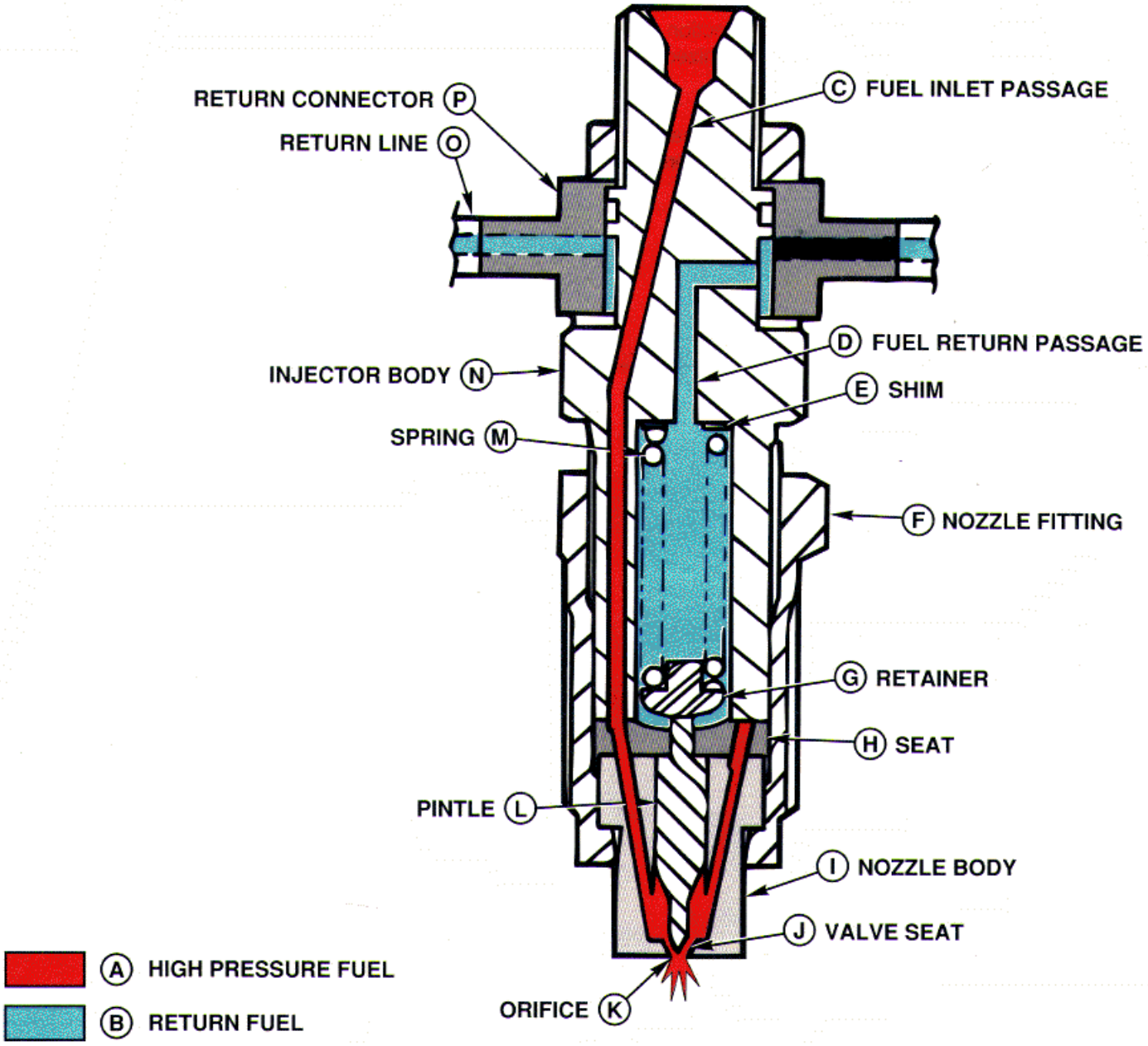
The fuel injection nozzle has an inward opening pintle-type valve.

Fuel from the pump (A) flows through an inlet passage (C) to the pintle valve (L). When pressure against the valve increases above spring tension (M), the valve is lifted off its seat (J), permitting fuel to be forced through nozzle body orifice (K) in an atomized form into the precombustion chamber.

A small amount of fuel leaks past nozzle valve to lubricate valve and body, then flows through a return passage (D) to return lines (O) and tank.

MX,22010DG,A16 -19-06DEC89

220
10
16



MXC48493

INDIRECT INJECTION NOZZLE OPERATION (Pintle Type)

MXC48493 -19-30JUL88

DIRECT INJECTION NOZZLE OPERATION (Hole Type)–770, 790, 870, 970, and 1070

A-High Pressure Fuel
B-Return Fuel
C-Return Pipe
D-Dowel Pin
E-Seat
F-Nozzle Nut
G-Nozzle Valve Seat
H-Injector Holes
I-Nozzle Body
J-Nozzle Valve
K-Retainer
L-Spring
M-Shim

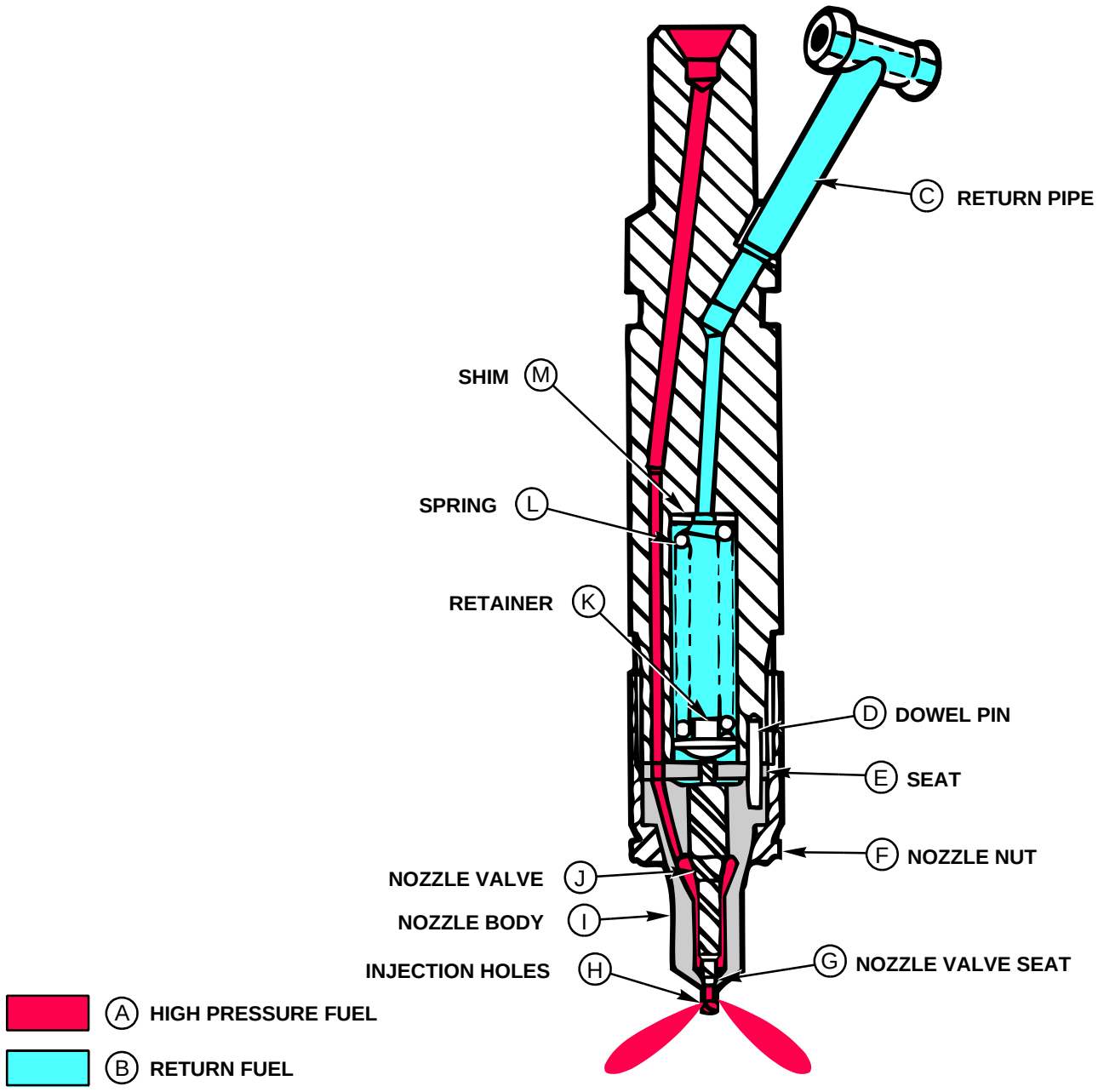
The fuel injection used in direct injection engines is a multi-hole type that sprays atomized fuel directly into the cylinder.

Fuel from the injection pump flows through an inlet passage to the shim-adjusted nozzle valve (J).

When the pressure is high enough, the nozzle valve is pushed off its seat, injecting fuel through the injection holes (H).

A small amount of fuel leaks past the nozzle valve in order to lubricate internal components, afterwards returning to the fuel tank via the fuel return pipe (C).

DIRECT INJECTION NOZZLE OPERATION (Hole Type)–770, 790, 870, 970, and 1070



MXC70747

DIRECT INJECTION NOZZLE OPERATION (Hole Type)

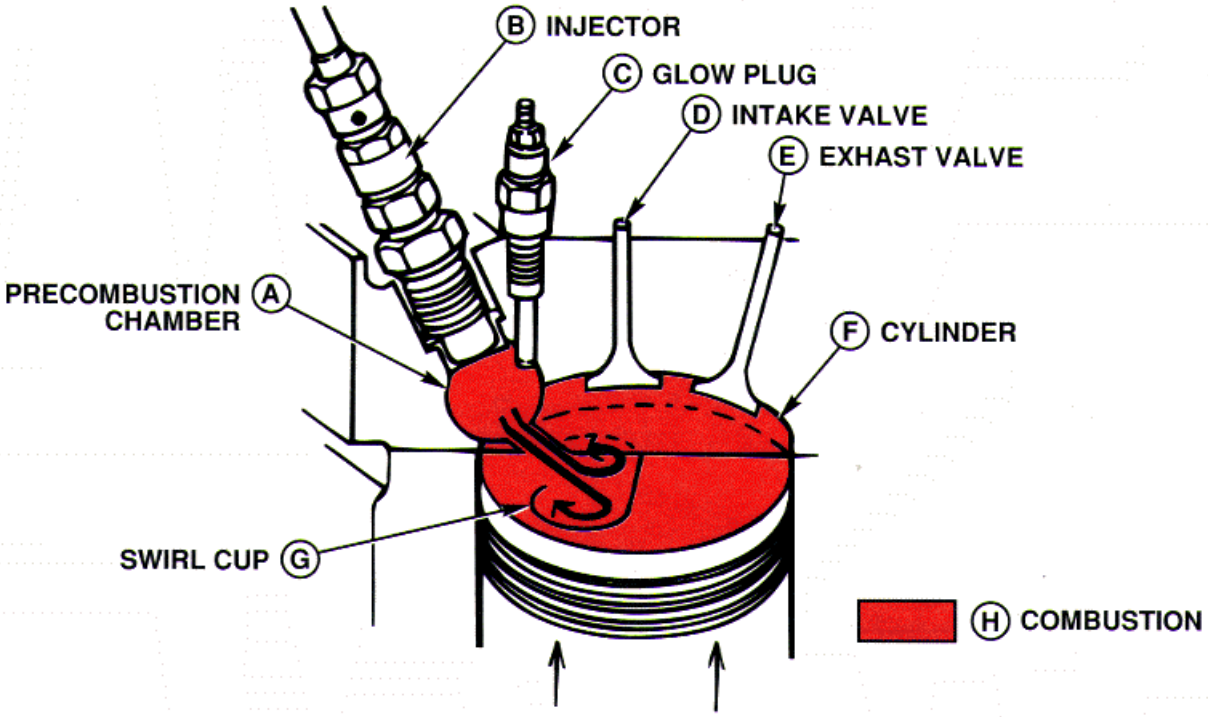
PRECOMBUSTION CHAMBER OPERATION—670

The model 670 tractor engine uses the indirect injection system. A pre-combustion chamber (A) is located in the cylinder head with a small opening into the cylinder.

As the piston comes up on the compression stroke, some of the air is forced through the opening into the pre-combustion chamber. The opening is shaped to direct this air flow into a turbulent action as it is being compressed and heated. At 16° BTDC crankshaft rotation, injection of fuel begins. The injector (B) sprays atomized fuel into the pre-combustion chamber turbulent air. Heat from the compressed air ignites the fuel, increasing pressure in the pre-combustion chamber forcing the burning mixture into the cylinder (F) where it mixes with the air in the piston swirl cup (G).

Expansion for the burning mixture forces the piston down in its power stroke.

When starting a cold engine, compression pressure may not provide enough heat to ignite the fuel when injected into a cold pre-combustion chamber. An electrically operated glow plug (C) is installed into the pre-combustion to provide added heat to ignite the fuel as it is injected. The glow plugs are energized during starting and also may be pre-heated by turning the key switch counterclockwise and holding for up to 30 seconds.



PRECOMBUSTION CHAMBER OPERATION
(Indirect Injection)

MXC70748

MXC70748 -19-30JUL88

A—Precombustion Chamber
B—Injector
C—Glow Plug
D—Intake Valve
E—Exhaust Valve
F—Cylinder
G—Swirl Cup
H—Combustion

Slide No. 30

MX,22010DG,A21 -19-06DEC89

DIRECT INJECTION COMBUSTION CHAMBER OPERATION–770, 790, 870, 970, and 1070

The 770, 790, 870, 970, and 1070 tractor engines use the direct injection system.

The swirl cup (A) is formed in the head of the piston.

As the piston travels upward on it's compression stroke, the shape of the swirl cup causes the air to swirl as it is compressed and heated.

At 16° BTDC crankshaft rotation position, fuel is injected by the multi-hole injector (D).

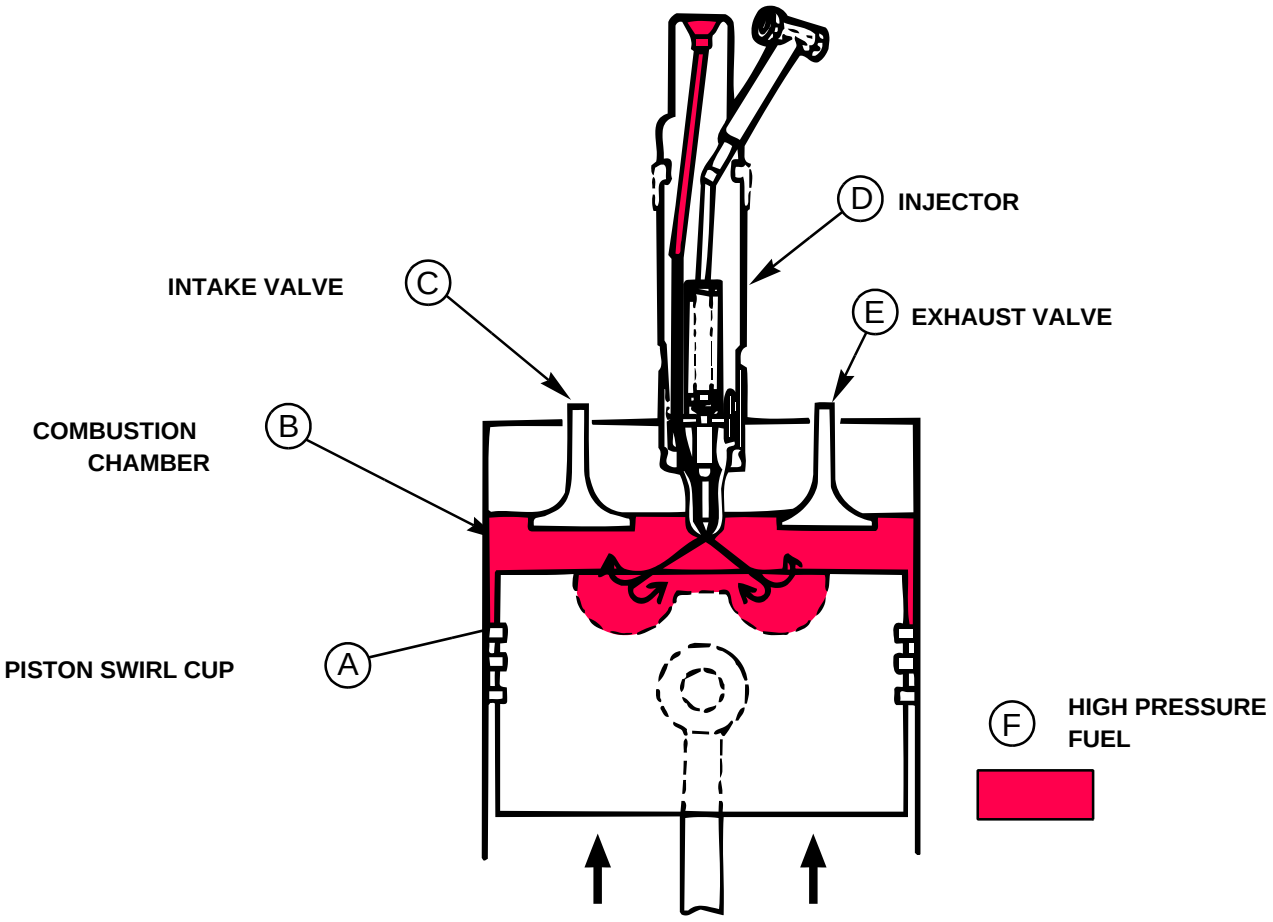
The swirling action of the air thoroughly mixes the atomized fuel and air for complete burning, as the piston travels into the power stroke.

When starting a cold engine, compression of ambient temperature air may not provide enough heat for ignition.

To aid cold temperature starting, an electrically operated heater is located at the intake manifold inlet.

The heater is energized during starting and may also be activated (pre-heated) by rotating the key switch counterclockwise, and holding it there for up to 30 seconds.

DIRECT INJECTION COMBUSTION CHAMBER OPERATION–770, 790, 870, 970, and 1070



MXC70749 **DIRECT INJECTION COMBUSTION CHAMBER**

GOVERNOR OPERATION–770, 790, 870, 970, and 1070

A-High Idle Stop
B-Governor Spring
C-Tension Spring
D-Fuel Control Link
E-Control Rack
F-Flyweights
G-Enrichment Spring
H-Thrust Sleeve
I-Governor Lever Assembly
J-Low Idle Stop
K-Throttle Stop
L-Fuel Shutoff lever
M-Torque Spring Capsule

The injector pump governor is a mechanical, centrifugal flyweight type.

On the 670 tractor, the governor is contained in a housing mounted to the timing gear case. It is serviced separately from the injection pump.

On the 770, 790, 870, 970, and 1070 tractors, the governor is assembled to the injection pump and serviced with the injection pump.

The internal components and operation of each governor are similar to one another.

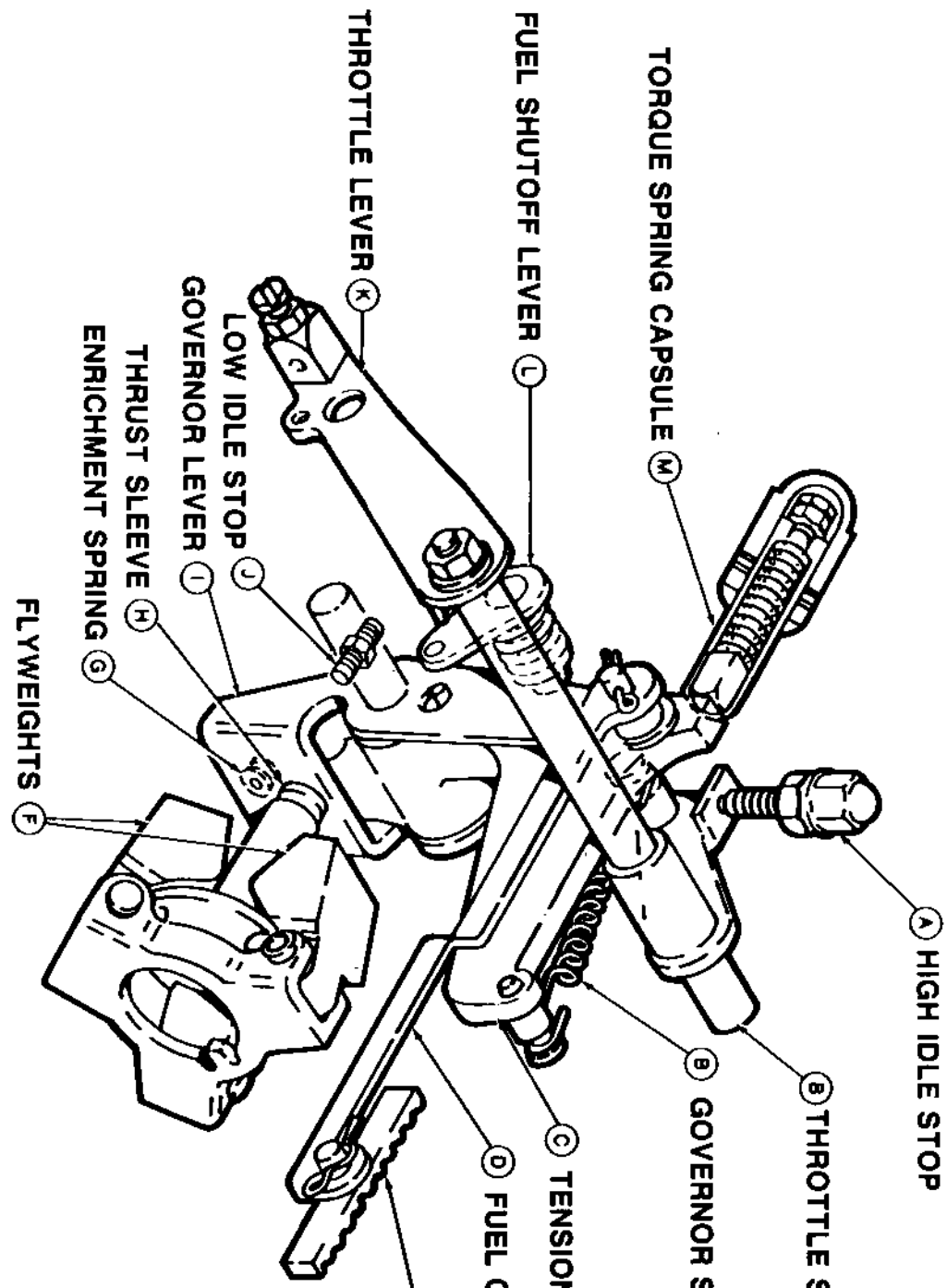
The flyweights (F) are mounted on the injection pump camshaft.

The flyweights move the thrust sleeve (H) in and out with changes in engine rpm.

The thrust sleeve works against a button surface on the governor lever (I).

The governor lever is connected to the injection pump control rack (E) by the fuel control link (D).

The governor spring (B) connects tension lever (C) to throttle lever (K).



FUEL INJECTION PUMP GOVERNOR

M48494 -19-09JAN90

220 10 25

Slide No. 32

MX,22010DG,A25 -19-06DEC89

GOVERNOR OPERATION—STARTING

A—Shut-Off Lever
B—Governor Spring
C—Tension Lever
D—Starting Fuel Delivery
E—Maximum Fuel
F—Minimum Fuel
G—Enrichment Spring
H—Governor Lever

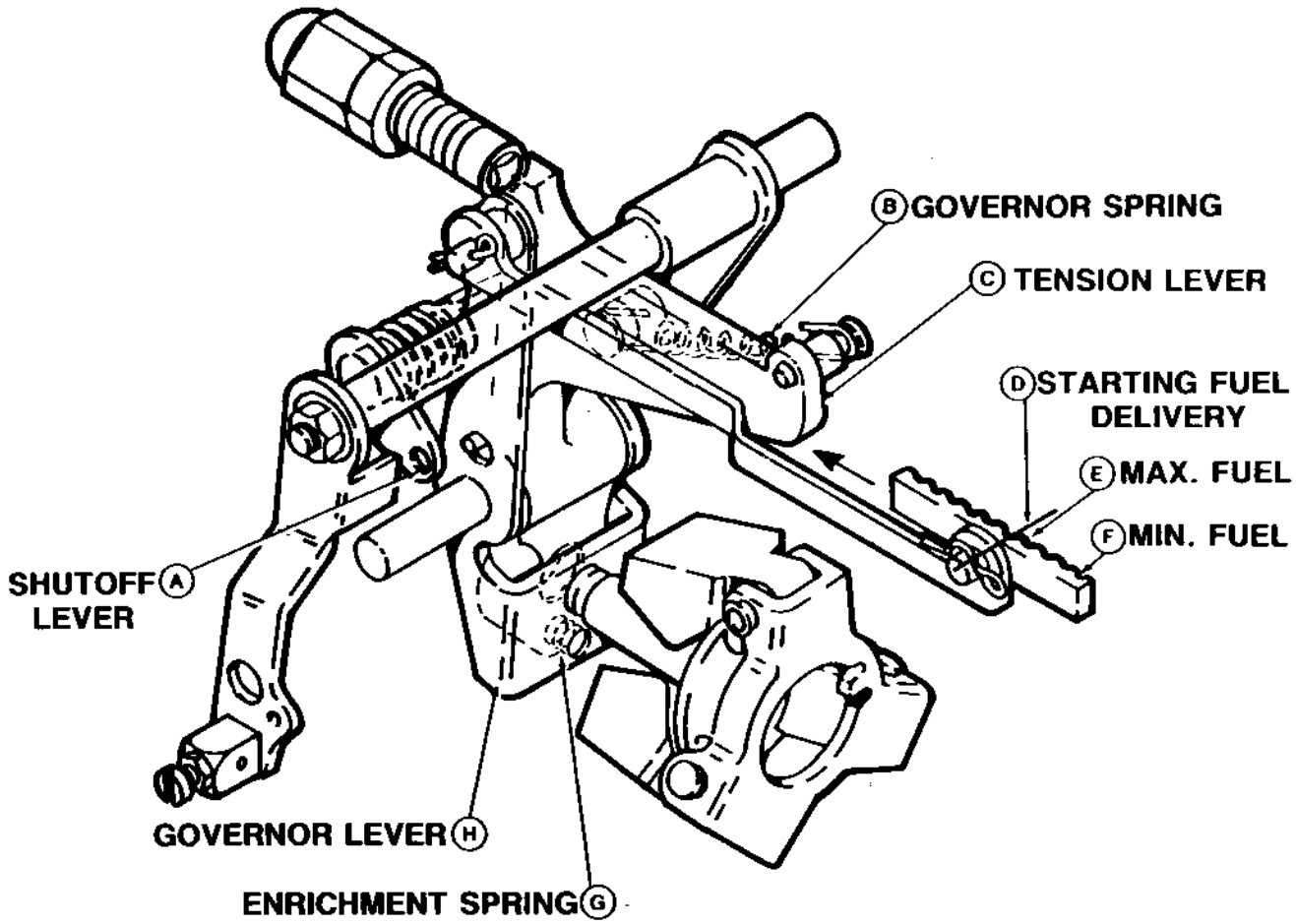
When the key switch is turned to “ON”, a fuel solenoid pulls the shut-off lever (A) to the “RUN” position. This permits the governor spring (B) to move the tension lever (C), pulling the control rack left. The enrichment spring (G) extends, pulling the rack an additional amount to give starting fuel delivery.

After the engine starts as speed increases, centrifugal force moves the flyweights outward forcing the thrust sleeve against the button on the governor lever. The enrichment spring compresses and remains compressed while the engine is running. The forces generated by the flyweights against the governor lever overcome governor spring tension, pushing the rack to the right. This reduces fuel delivery to an amount that will maintain the RPM established by the speed control lever setting.

When the key is turned “OFF”, the fuel shut-off solenoid is de-energized. The spring on the shut-off lever rotates the shaft so the high spot moves the governor lever to the right, pushing the rack to a “NO” fuel position, stopping the engine.

MX,22010DG,A26 -19-06DEC89

220
10
26



-19-09JAN90

M48495

GOVERNOR OPERATION — STARTING

Slide No. 33

MX,22010DG,A27 -19-06DEC89

220
10
27

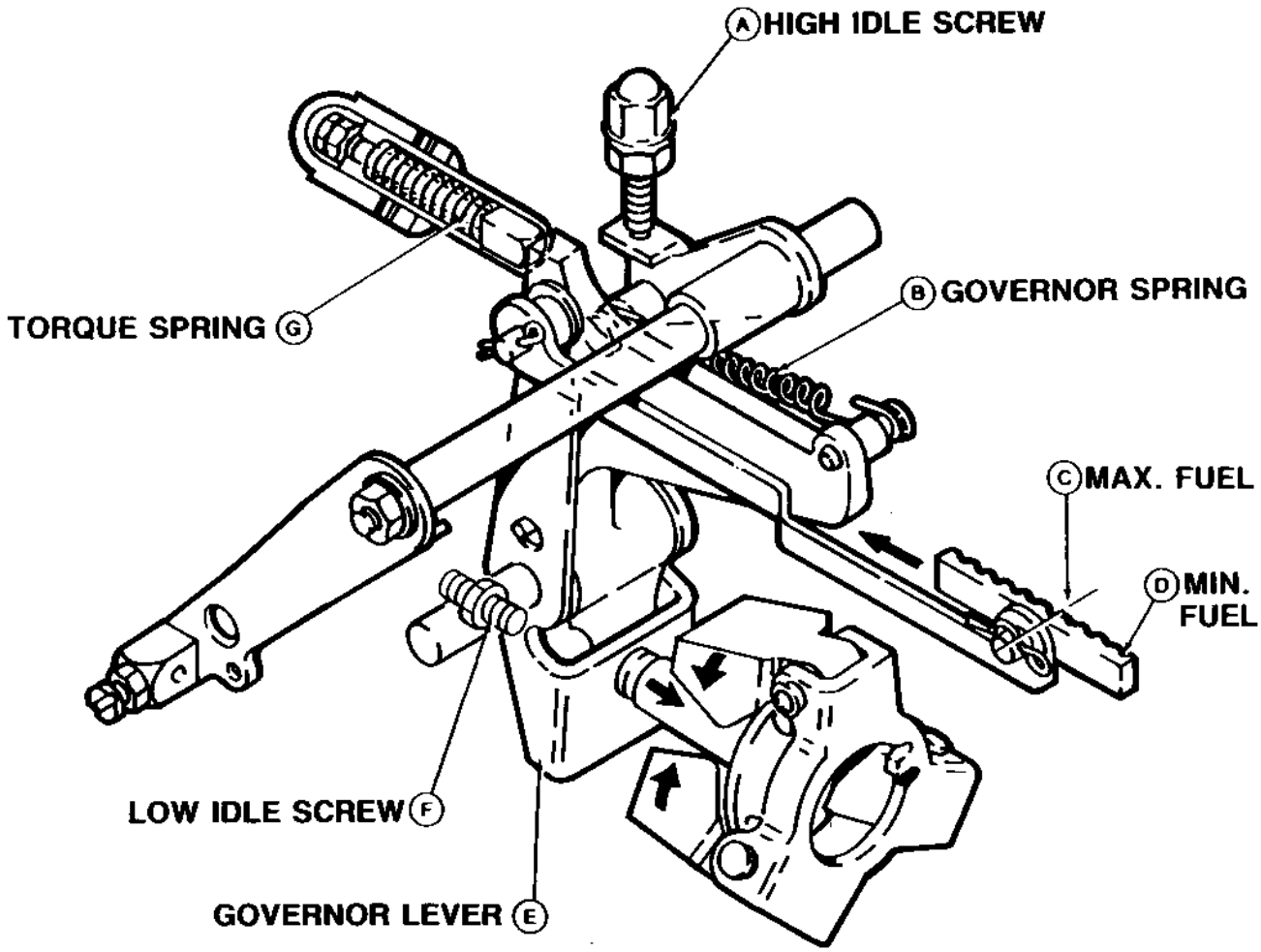
GOVERNOR OPERATION—HIGH IDLE, MAXIMUM TORQUE

When a load is applied, decreasing engine speed, the flyweight force is reduced against the governor lever. The spring (B) can then pull the lever assembly and the rack to increase fuel delivery and bring RPM back up to preset speed.

Additional load would further reduce the flyweight force permitting the governor spring to pull tension lever against the torque spring (G), compressing it and moving the rack to the maximum torque fuel delivery (C).

A high idle adjusting screw (A), and low idle screw (F), provide stops for the speed control lever.

MX,22010DG,A28 -19-06DEC89



-19-09JAN90

M48496

GOVERNOR OPERATION — HIGH IDLE - MAX. TORQUE

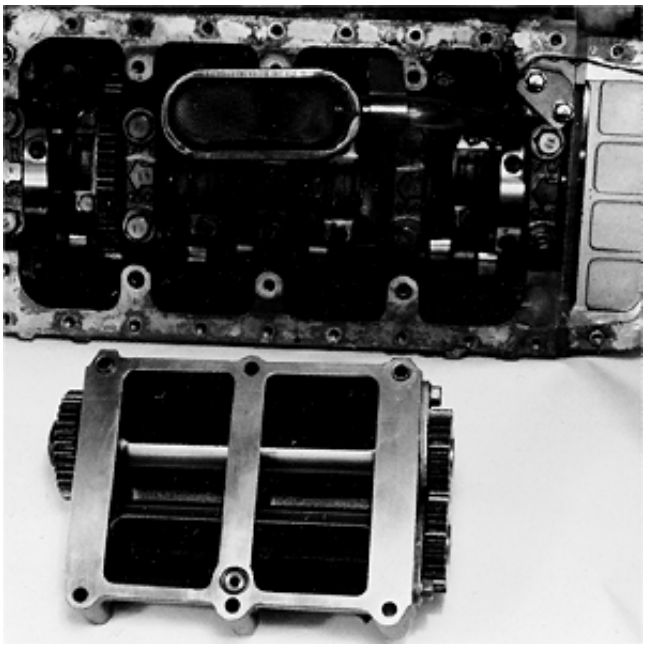
A—High Idle Screw
B—Governor Spring
C—Maximum Fuel
D—Minimum Fuel
E—Governor Lever
F—Low Idle Screw
G—Torque Spring

Slide No. 34

MX,22010DG,A29 -19-06DEC89

220
10
29

ENGINE BALANCER OPERATION—970/1070



Slide No. 35

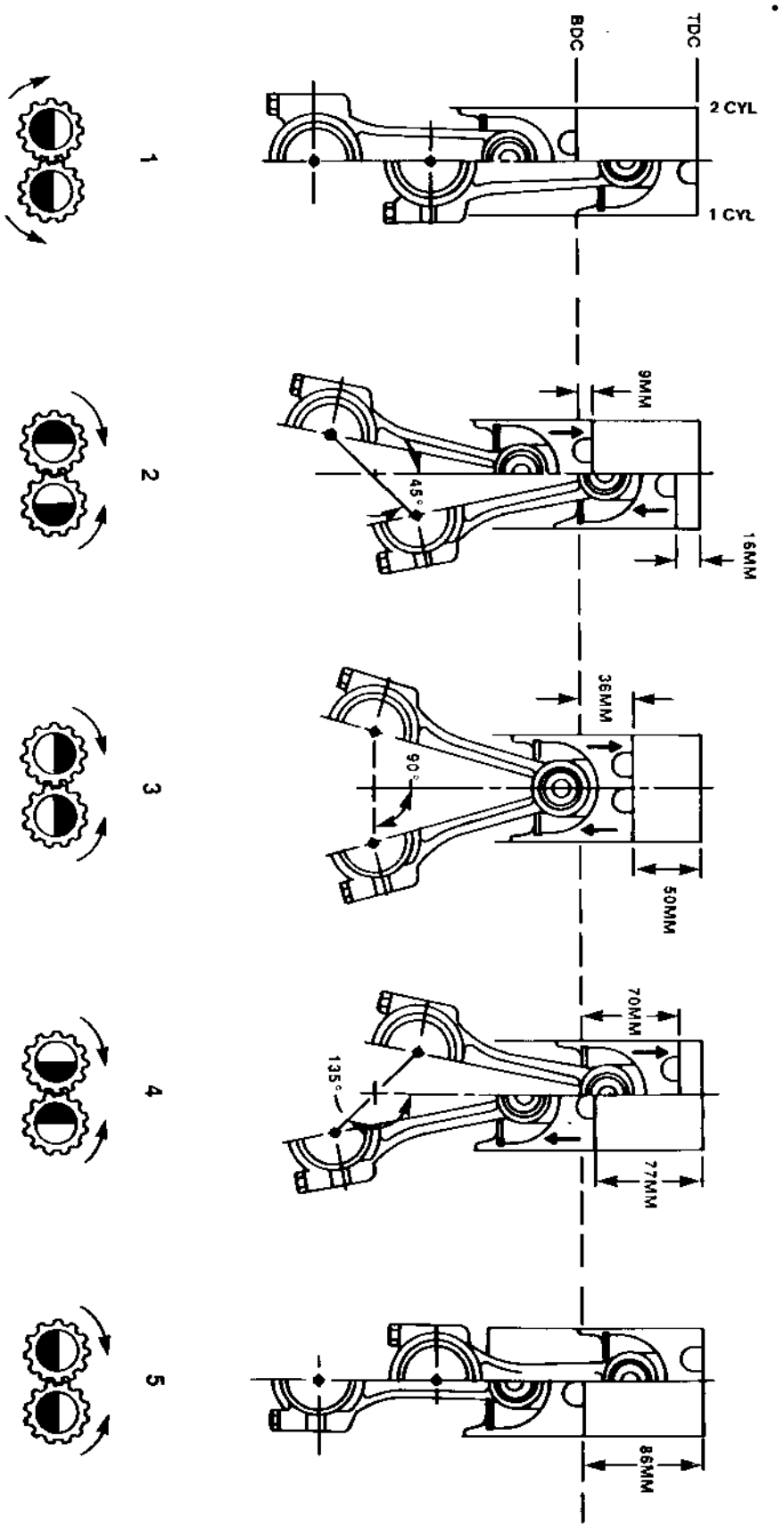
In-line 2 and 4 cylinder engines with crankshaft, throws 180˚ apart have some unbalanced forces of the reciprocating parts. Most of these forces are offset by parts moving in opposite directions. However, the forces are not entirely cancelled. During each 45˚ segment of crankshaft rotation, the No. 1 piston and connecting rod moves a different distance than the No. 2 piston and connecting rod. Since the crankshaft throws move at equal speed, the parts moving farther must also move faster. As engine speeds increase and/or parts get heavier, vibrations resulting from the unbalanced movements may become objectionable.

To minimize these vibrations the 970 and 1070 tractor engines have a balancer assembly mounted to the block, below the crankshaft. It is driven by a gear on the crankshaft. The balancer has 2 shafts, counter-rotating, with balancing weights, turning at double crankshaft RPM.

The balancer weights are timed to the crankshaft so that when No. 1 piston travels downward from TDC to horizontal crankshaft position, the balancer weights both move upward. The weights are then positioned so they can move downward as the No. 2 piston moves up from horizontal crankshaft position to TDC.

MX,22010DG,A30 -19-06DEC89

220
10
30



M70913 -19-22DEC89

220 10 31

Slide No. 36

MX,22010DG,A31 -19-06DEC89

ENGINE PROBLEM IDENTIFICATION

If the engine does not operate properly, select the appropriate symptom/problem from the following pages headings.

After selecting the appropriate symptom/problem, perform the test/check in the order shown under the appropriate heading.

The middle “NORMAL” column shows the normal reading or condition.

If the result of the test/check is not normal, perform the tests or adjustments shown in the “IF NOT NORMAL” column, to help isolate or repair the malfunction.

ESSENTIAL OR RECOMMENDED TOOLS

NOTE: Order tools from your Service-Gard™ Catalog. Some tools may the available from a local supplier.

Spring Scale. JDT42–Recommended
. . . . . .9.07 kg (20 lb)
or JDG94–Recommended
. . . . . 10.25 kg (22.6 lb)

Use to measure speed control lever friction.

Hand Tachometer. JT05719–Recommended
or JT05801–Recommended

Use to check engine speed.

Cooling System
Tester Adapter JDG692–Recommended
Cooling System
Pressure Pump D05104ST–Recommended

Use for connecting tester and testing cooling system.

Compression Test
Gauge Assembly JT01682–Recommended
Special Connector JT01680–Recommended
Adapter–670 . . . . . JDG472–Essential
Adapter
–770, 790, 870, 970, 1070 . . . . . JDG560–Essential

Use for adapting gauge and hose and measuring cylinder compression.

Fuel Pump Pressure Kit JDG356–Recommended

Use to test fuel pump.

Diesel Fuel Injection
Nozzle Tester D01109AA–Recommended
Adapter Set. D01110AA–Recommended

Use to connect to and test fuel injection nozzles.

Manifold Pressure Tester
133 N (30 lb) JDE147–Recommended

Use to test intake manifold pressure.

Belt Tension Gauge
. . . . . JDST28–Recommended

Use to measure belt tension and deflection.

Digital Multimeter JT05791–Recommended

Use to isolate engine electrical problems.

Diesel Rough Idle
Test Harness. JT02018–Recommended

Plugs into JT05791 Digital Multimeter to analyze for problem cylinders.. . . . . .

Hose Assembly. JT03017–Essential

Use with adapter and gauge for pressure testing.

Pressure Gauge
700 kPa (100 psi) JT07034–Recommended

Use to measure hydraulic oil pressure.

Oil Pressure Gauge Connector. . . . JT03349–Essential

Use for connecting test hose to engine block.

ENGINE TURNS OVER BUT WILL NOT START OR STARTS HARD

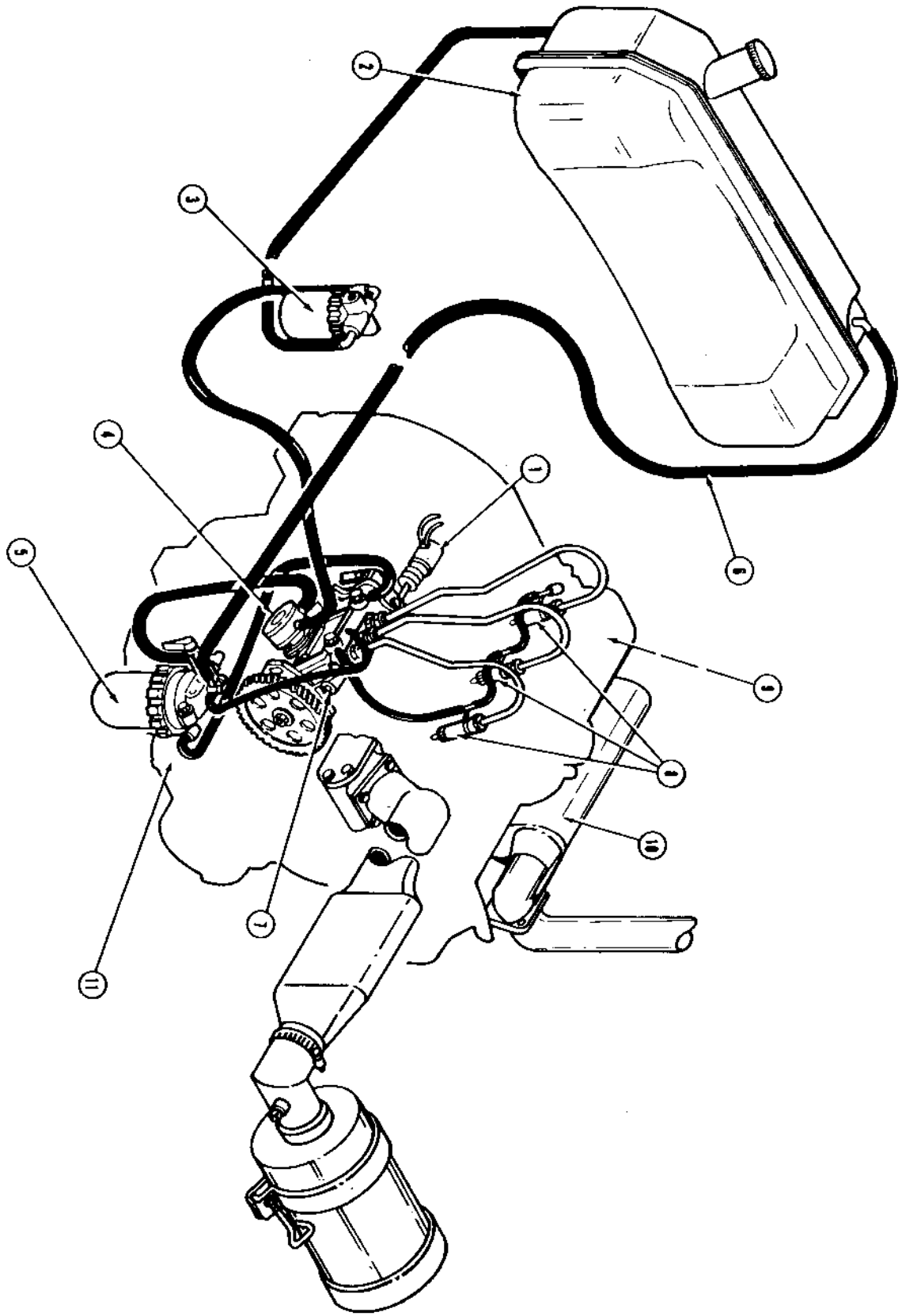
Test Conditions (unless otherwise specified).

- Transmission in NEUTRAL
- PTO(s) OFF
- Speed control lever in FAST IDLE position

TEST/CHECK POINT	NORMAL	IF NOT NORMAL
1. Fuel shutoff solenoid	Pulls injection pump lever when key switch is turned on and in the START position.	Check for binding linkage/correct adjustment. Check solenoid electrical circuit, see Section 240.
2. Fuel tank	Pulls injection pump lever when key switch is turned on and in the START position.	Replace with specified fuel.
3. Water separator–870,970, 1070	Fuel flows at outlet.	Open shut off valve. Replace element.
4. Fuel transfer pump	Fuel flows at outlet when engine is cranking.	See “Test Fuel Transfer Pump”.
5. Fuel filter	Fuel flows at outlet. On 870, 970, 1070, must be hand pumped at transfer pump.	Open shut off valve. Replace element.
6. Fuel return line	Small amount of fuel flow to tank when engine is running.	Clean or replace fuel line.
7. Injection pump	Delivers fuel to injectors when cranking (with fuel lines cracked open at injectors).	Remove and service, see section 20, group 20.
8. Injectors	Correct spray pattern when tested.	Clean, repair, adjust, or replace as necessary, see section 20, group 20.
9. Valves	Clearance of 0.2 mm (0.008 in.).	Adjust, see section, group 7.
10. Starting aids	Heats properly when key switch is turned to PREHEAT and START positions.	Check circuit, see Section 240.
11. Crankcase oil	Flows easily.	Drain and replace with specified viscosity.

M48583

ENGINE STARTS HARD



M48583 -19-09JAN90

220 15 3

Slide No. 37

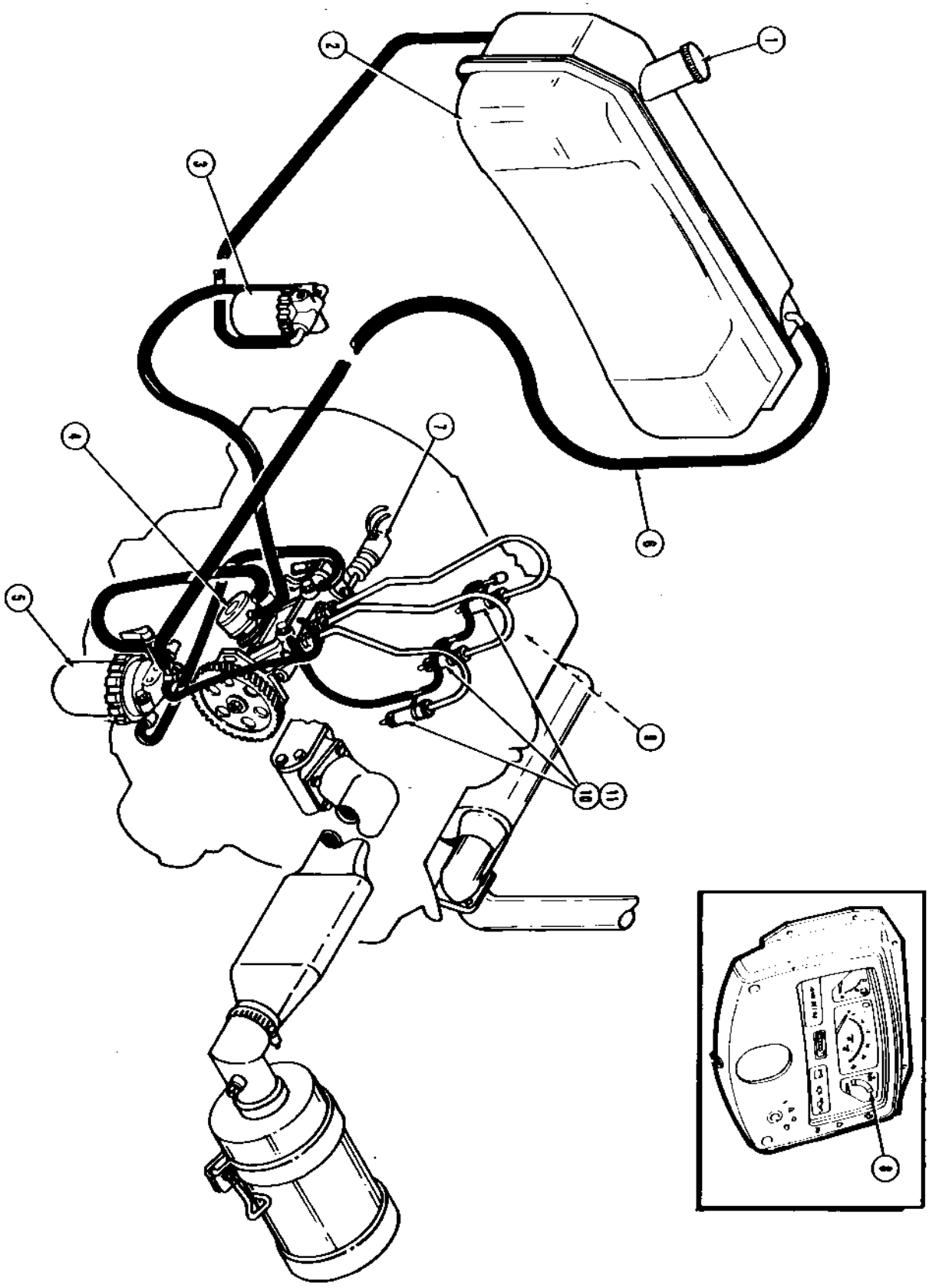
MX,22015DG,A2 -19-12DEC89

ENGINE RUNS IRREGULARLY OR STALLS FREQUENTLY

TEST/CHECK POINT	NORMAL	IF NOT NORMAL
1. Fuel tank cap	No pressure or vacuum when removed from tank	Clean vent.
2. Fuel tank	Clean diesel fuel only	Replace with correct fuel.
3. Water separator (870-970-1070)	Fuel flows at outlet	Open shut off valve. Replace element.
4. Fuel transfer pump	Fuel flows at outlet when engine cranked	See “Test Fuel Transfer Pump”.
5. Fuel filter	Fuel flows at outlet, 870-970-1070 must be hand pumped at transfer pump	Open shut off valve. Replace element.
6. Fuel return line	Small amount of fuel flows when engine running	Clean or replace line.
7. Fuel solenoid	Pulls injection pump shutoff lever when key switch turned on	Check for binding linkage. Check for correct adjustment. Check electrical circuit. See Section 240.
8. Temperature gauge	Gauge reads in green band	See “Coolant Operating Temperature Incorrect”.
9. Valves	Clearance of 0.2 mm (.008 in.)	Adjust, see CTM-3.
10. Injectors Test opening pressure Test spray pattern	See CTM-3 for test procedures and specifications	Clean, adjust, repair, or replace as required.
11. Cylinders-Test compression	Cylinder compression (minimum) 2448 kPa (355 psi) with a 490 kPa (71 psi) maximum difference between cylinders	Repair engine, see CTM-3.

M48585

ENGINE STALLS

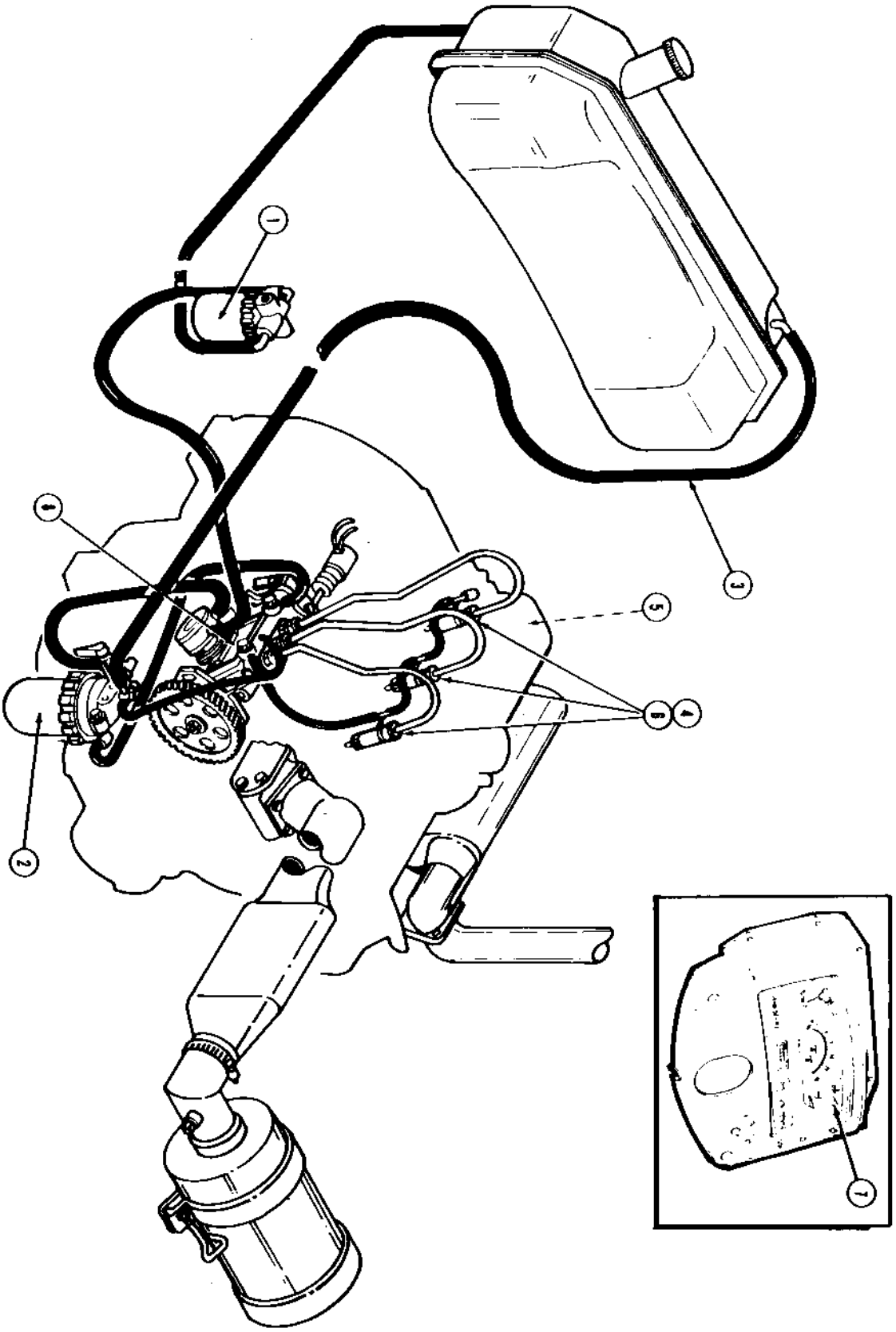


ENGINE RUNS ROUGH

TEST/CHECK POINT	NORMAL	IF NOT NORMAL
28. Water separator (870-970-1070)	Fuel flows at outlet	Open shut off valve. Replace element.
29. Fuel filter	Fuel flows at outlet, (870-970-1070 must be hand pumped at transfer pump).	Open shut off valve. Replace element.
30. Fuel return line	Small amount of fuel flows when engine running.	Clean or replace line.
31. Injectors Test opening pressure Test spray pattern	See CTM-3 for test procedures and specifications.	Clean, adjust, repair, or replace as required.
32. Valves	Clearance of 0.2 mm (.008 in.)	Adjust, see CTM-3.
33. Cylinders-Test compression	Cylinder compression (minimum) 2448 kPa (355 psi) with a 490 kPa (71 psi) maximum difference between cylinders.	Repair engine, see CTM-3.
34. Temperature gauge	Gauge reads in green band.	See “Coolant Operating Temperature Incorrect”.
35. Injection pump	Delivers fuel to injectors when engine cranked (lines cracked open at injectors).	Remove and service, see CTM-3.

M48586

ENGINE RUNS ROUGH



M48586 -19-09JAN90

220 15 7

Slide No. 39

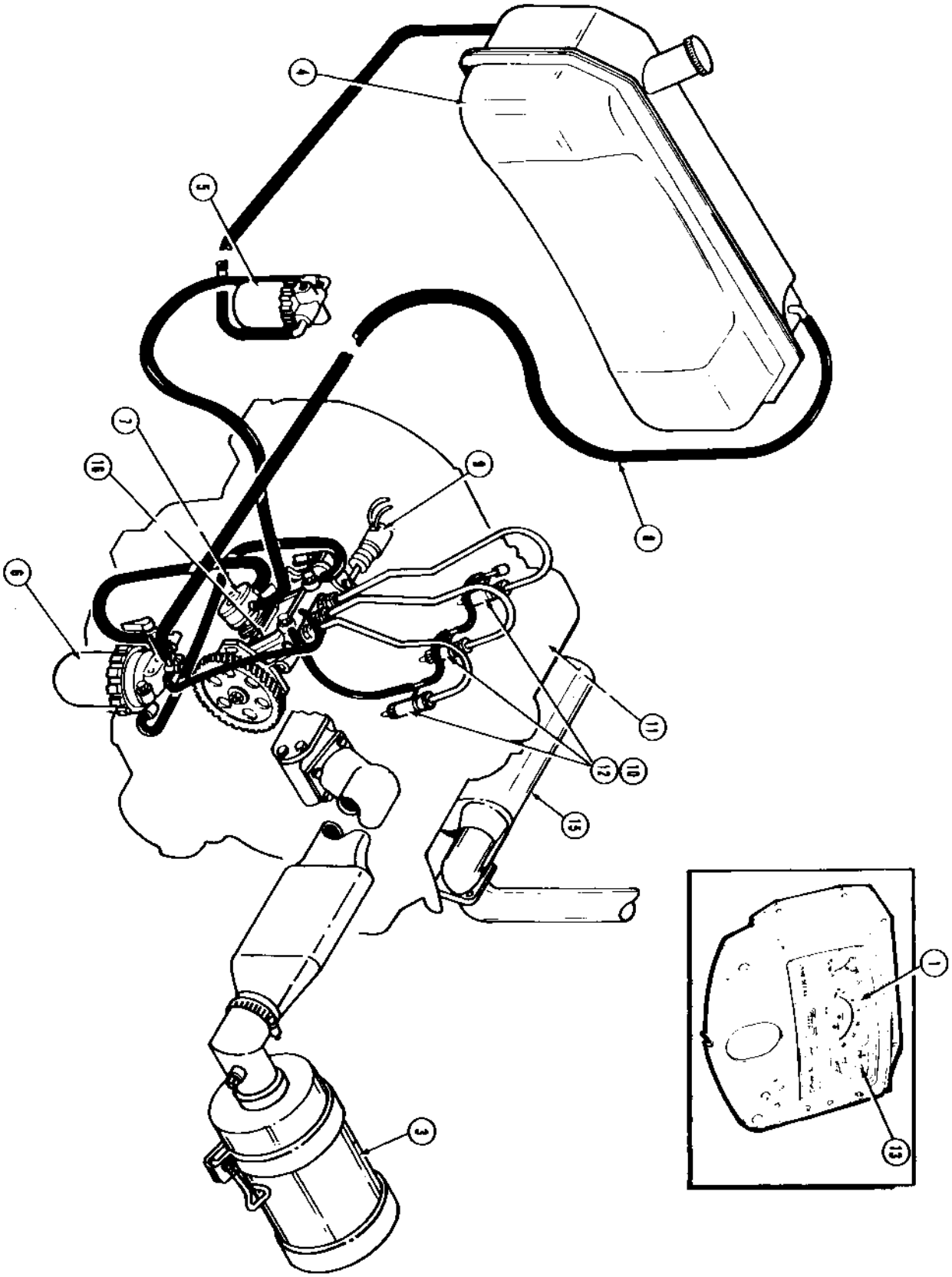
MX,22015DG,A6 -19-12DEC89

ENGINE LOW POWER

TEST/CHECK POINT	NORMAL	IF NOT NORMAL
1. Tachometer	Reads rated rpm at full load.	Load excessive—reduce load or shift to lower gear. Check fast idle speed. See “Tests and Adjustments”.
2. Wheels (not shown)	Slippage 10-15% 2WD, 8-12% MFWD.	Adjust amount of ballast. Reduce excess load. Clean or replace air cleaner element. See Operator’s Manual.
3. Air cleaner	No restriction	Clean or replace air cleaner element. See Operator’s Manual.
4. Fuel tank	Correct grade of diesel fuel only.	Drain and replace with correct fuel.
5. Water separator	Fuel flows at outlet.	Open shut off valve. Replace element.
6. Fuel filter	Fuel flows at outlet, 870-970-1070 must be hand pumped at transfer pump).	Open shut off valve. Replace element.
7. Fuel transfer pump	Fuel flows at outlet when engine cranked.	See “Tests and Adjustments”.
8. Fuel return line	Small amount of fuel flows when engine running.	Clean or replace line.
9. Fuel solenoid	Pulls injection pump shutoff lever when key switch is turned to “on”.	Check for binding linkage. Check for correct adjustment. Check electrical circuit, see Section 240.
10. Injectors Test opening pressure Test spray pattern	See CTM-3 for test procedures and specifications.	Clean, adjust, repair, or replace as required.
11. Valves	Clearance of 0.2 mm (.008 in.)	Adjust or repair, see CTM-3.
12. Cylinders-Test Compression	Cylinder compression (minimum) 2448 kPa (355 psi) with a 490 kPa (71 psi) maximum difference between cylinders.	Repair engine, see CTM-3.
13. Temperature gauge	Gauge reads in green band.	See “Coolant Operating Temperature Incorrect”.
14. Hydraulic system (not shown)	No load with valves in neutral.	See section 270.
15. Muffler	Low restriction, operate briefly without muffler to check.	Replace muffler if significant improvement when operating without.
16. Injection pump	Delivers fuel to injectors when engine cranked (lines cracked open at injectors).	Remove and service, see CTM-3.

M48587

ENGINE LOW POWER



M48587 -19-09JAN90

220 15 9

Slide No. 40

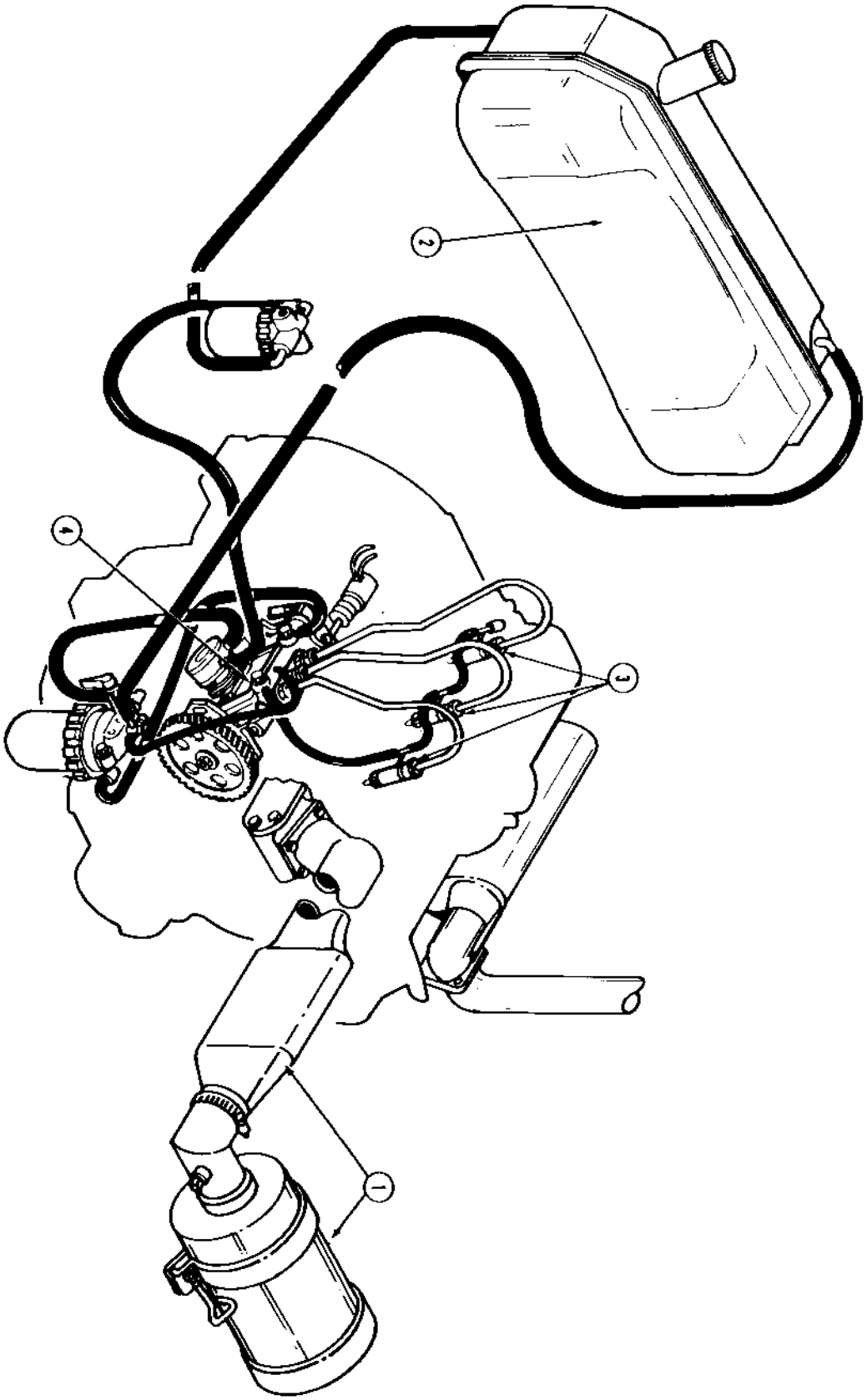
MX,22015DG,A8 -19-12DEC89

ENGINE SMOKES–BLACK OR GREY

TEST/CHECK POINT	NORMAL	IF NOT NORMAL
1. Air intake	No restriction	Service-See Operator's Manual.
2. Fuel tank	Diesel fuel of correct grade	Replace with fuel of correct specifications.
3. Injectors	Correct spray pattern/opening pressure when tested. See Section 20, group 20.	Clean, repair, adjust or replace as necessary. See Section 20, group 20.
4. Injection pump/governor	Delivers correct amount of fuel for load.	670–Adjust torque capsule. 770, 790, 870, 970, 1070–Remove pump and have serviced. Reduce load or shift to lower gear.

M48588

ENGINE EXHAUST SMOKE BLACK OR GREY



M48588 -19-09JAN90

220
15
11

Slide No. 41

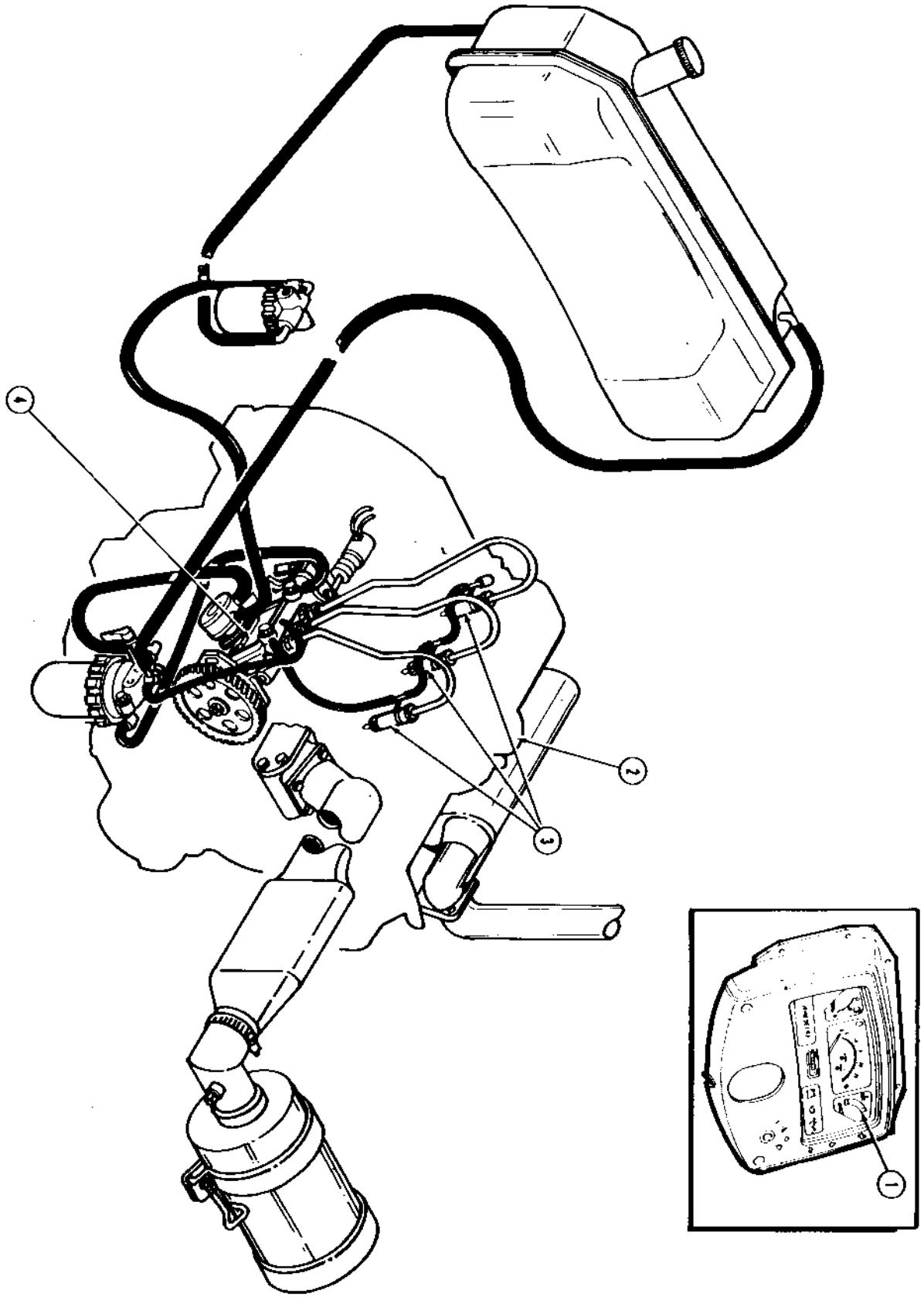
MX,22015DG,A10 -19-12DEC89

ENGINE SMOKES EXCESSIVE-WHITE

TEST/CHECK POINT	NORMAL	IF NOT NORMAL
1. Temperature gauge	Gauge reads in green band.	See “Coolant Operating Temperature Incorrect”.
2. Starting aids	Heats while cranking.	Check circuit/components, see Section 240.
3. Cylinders-Test compression	Cylinder compression (minimum) 2448 kPa (355 psi) with a 490 kPa (71 psi) maximum difference between cylinders.	Repair engine, see CTM-3.
4. Injection pump timing	See “Timing Injection System” diagram.	Time to specifications.

M48589

ENGINE EXHAUST SMOKE WHITE



M48589 -19-09JAN90

220 15 13

Slide No. 42

MX,22015DG,A12 -19-12DEC89

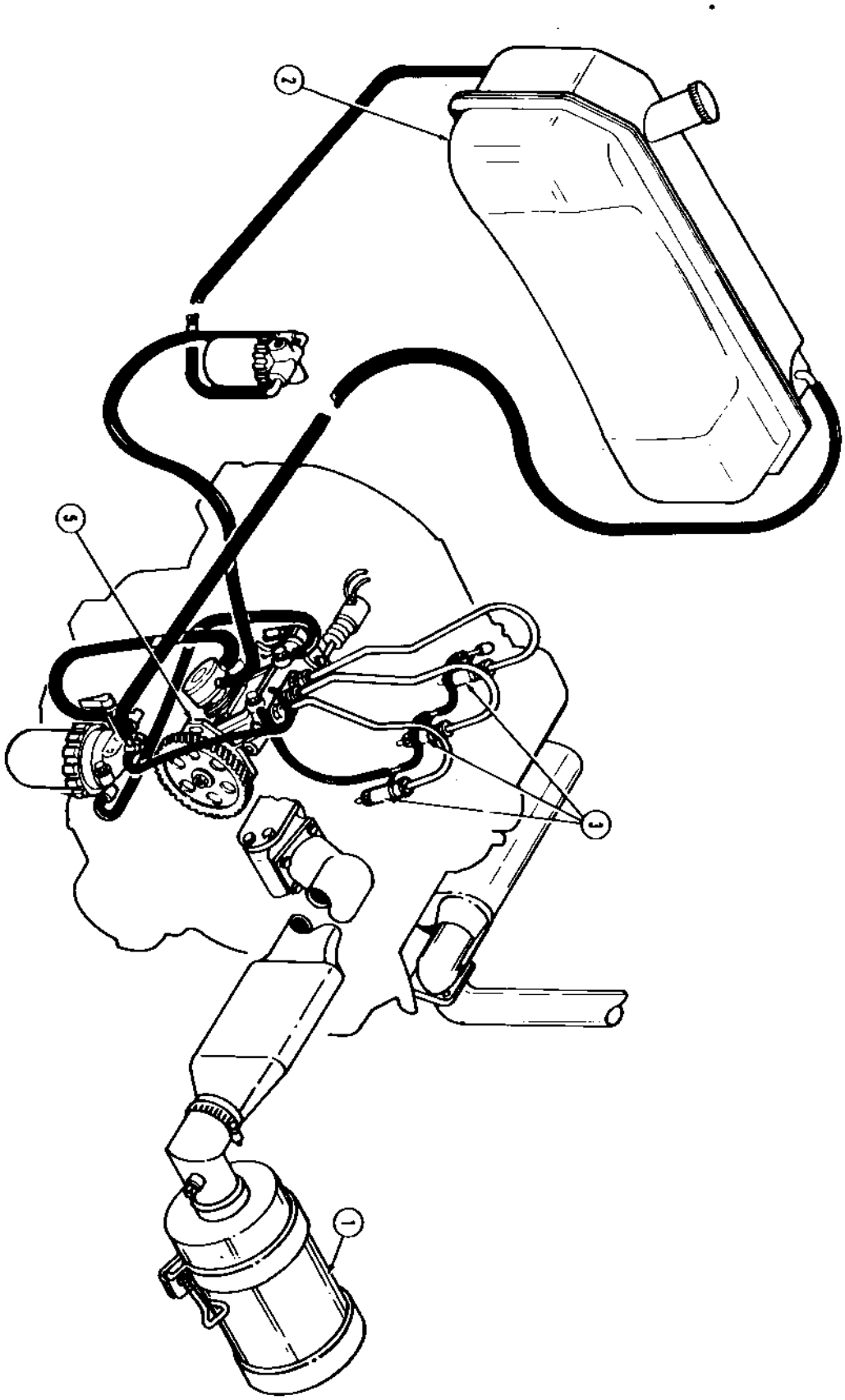
ENGINE USES EXCESS FUEL

TEST/CHECK POINT	NORMAL	IF NOT NORMAL
1. Air intake system	No restrictions-Grill screens and air cleaner element free of dirt and debris	Service. See Operators Manual.
2. Fuel	Diesel fuel of correct grade	Drain and replace with correct specifications. See Operators Manual.
3. Injectors Test spray pattern Test opening pressure	See CTM-3 for test procedures and specifications	Clean, adjust, repair or replace as required.
4. Load applied (not shown)	Within horsepower range of tractor	Reduce load. Shift to lower gear. Adjust implement.
5. Injection pump timing	See Tests and Adjustments for correct mark alignment	Set to specification.

MX,22015DG,A13 -19-12DEC89

M48590

ENGINE USES EXCESSIVE FUEL



M48590 -19-09JAN90

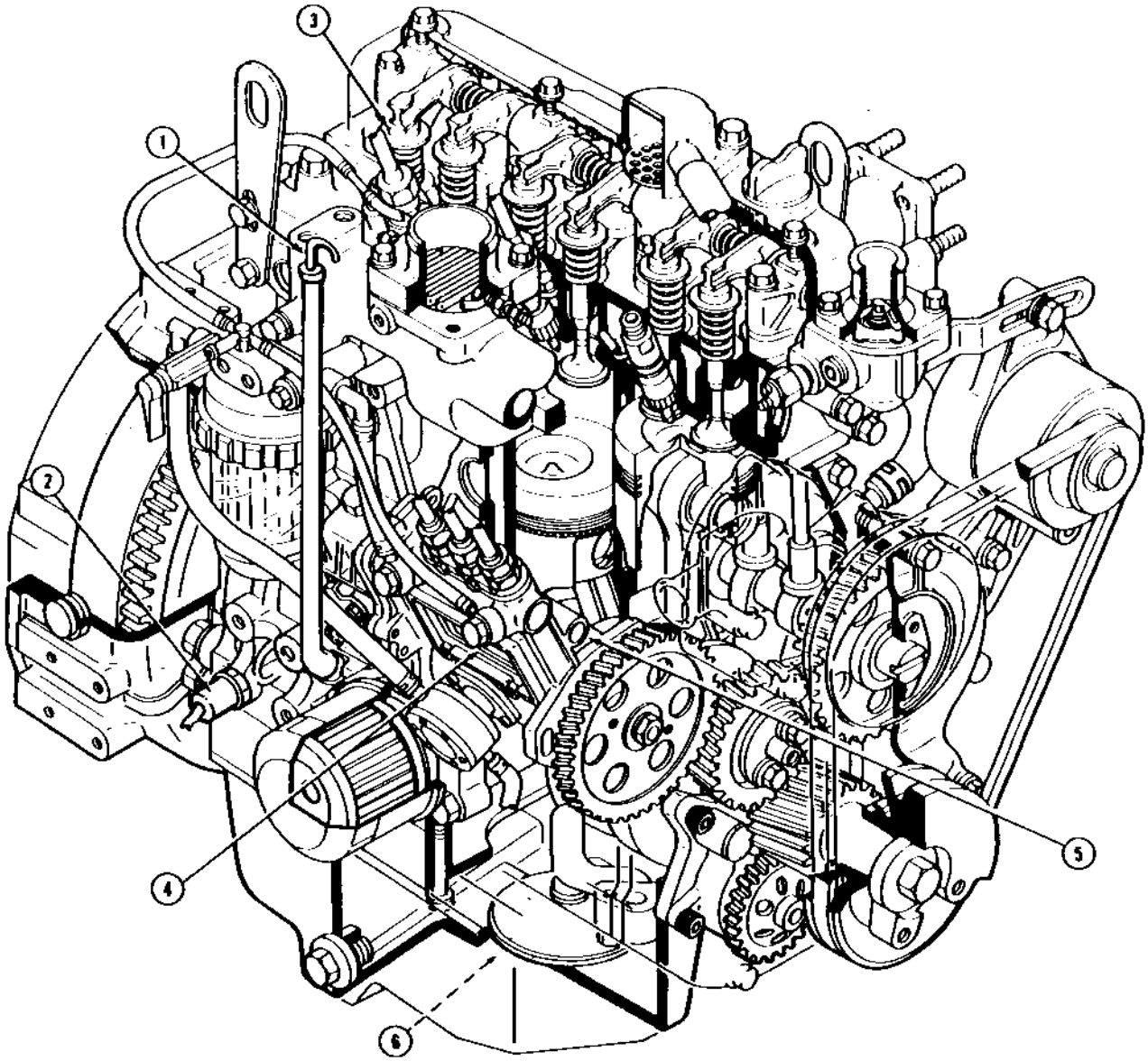
220 15 15

Slide No. 43

MX,22015DG,A14 -19-12DEC89

ENGINE HAS EXCESS NOISE OR VIBRATIONS

TEST/CHECK POINT	NORMAL	IF NOT NORMAL
1. Crankcase oil level	Between marks on dipstick	Add oil to correct level.
2. Engine oil pressure	365 ± 69 kPa (53 ± 10 psi)	See “Adjust Engine Oil Pressure”.
3. Valves	Clearance of 0.2 mm (.008 in.)	Adjust, see CTM-3.
4. Injection system	Timed to correct mark	Adjust, see “Timing Injection System”.
5. Bearings	Clearance per specifications	Repair, see CTM-3.
6. Engine balancer (970-1070 only).	Timed to crankshaft	Install correctly, see CTM-3.



M48591

EXCESSIVE ENGINE NOISE OR VIBRATION

-19-09JAN90

M48591

Slide No. 44

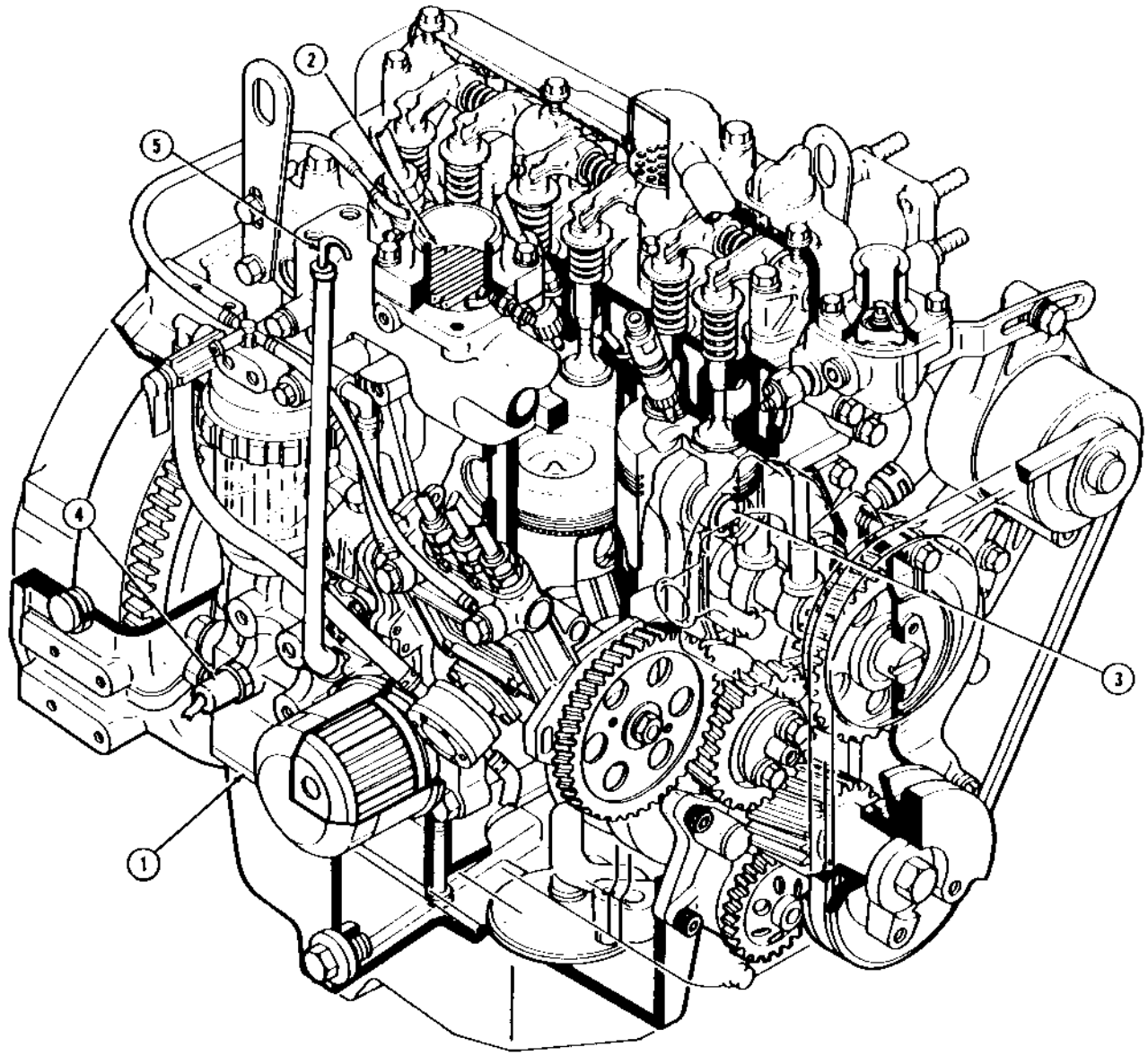
MX,22015DG,A16 -19-12DEC89

220
15
17

ENGINE USES EXCESS OIL OR SMOKES BLUE

TEST/CHECK POINT	NORMAL	IF NOT NORMAL
1. Gaskets/Seals	No external leaks	Replace.
2. Air intake system	No restrictions	Clean or replace element.
3. Internal parts	Within wear limits. See CTM-3-Rings not stuck	Replace.
4. Oil pressure	365 ± 69 kPa (53 ± 10 psi) (at fast idle)	Adjust regulating valve
5. Oil	Correct viscosity for ambient temperature	Replace with correct viscosity. See Operators Manual.

MX,22015DG,A17 -19-12DEC89



M48592

ENGINE EXHAUST SMOKE BLUE (USES OIL)

-19-09JAN90

M48592

Slide No. 45

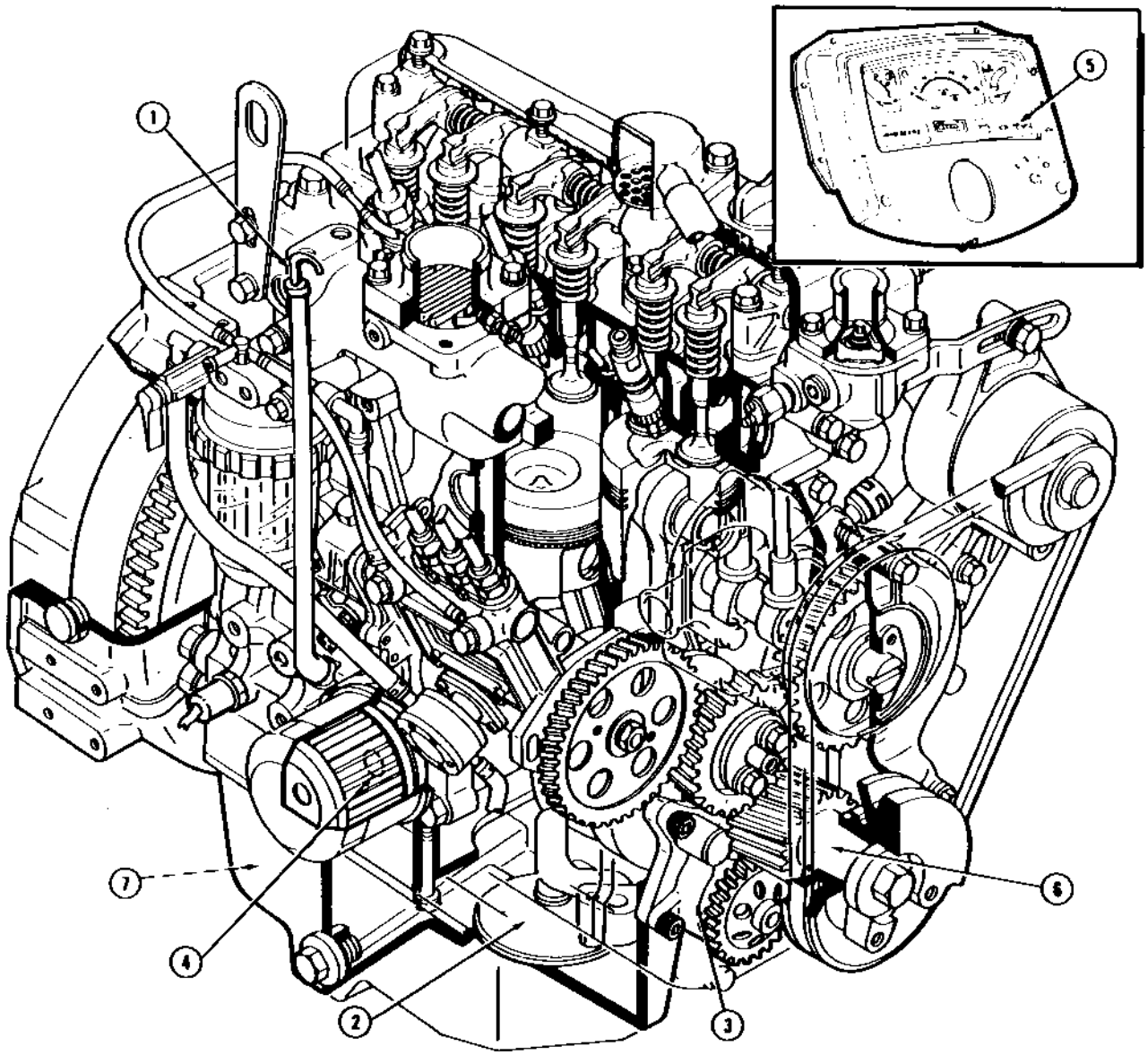
MX,22015DG,A18 -19-12DEC89

220
15
19

ENGINE HAS LOW OIL PRESSURE

TEST/CHECK POINT	NORMAL	IF NOT NORMAL
1. Crankcase dipstick	Level between marks	Add to correct level.
2. Oil pump intake screen	Screen open	Clean or replace.
3. Oil pump	Clearances within specifications See CTM-3	Replace parts worn excessively
4. Oil pressure regulating valve	Valve free in bore. Spring within specifications. See CTM-3	Replace parts. Adjust spring.
5. Oil pressure indicator	Light on at less than 48 kPa (7 psi)	See Section 240.
6. Bearings	Clearance within specification- See CTM-3	Replace
7. Oil	Correct viscosity for ambient temperature	Drain and replace with correct oil. See Operators Manual.

MX,22015DG,A19 -19-12DEC89



M48593

ENGINE OIL PRESSURE LOW

-19-09JAN90

M48593

Slide No. 46

MX,22015DG,A20 -19-12DEC89

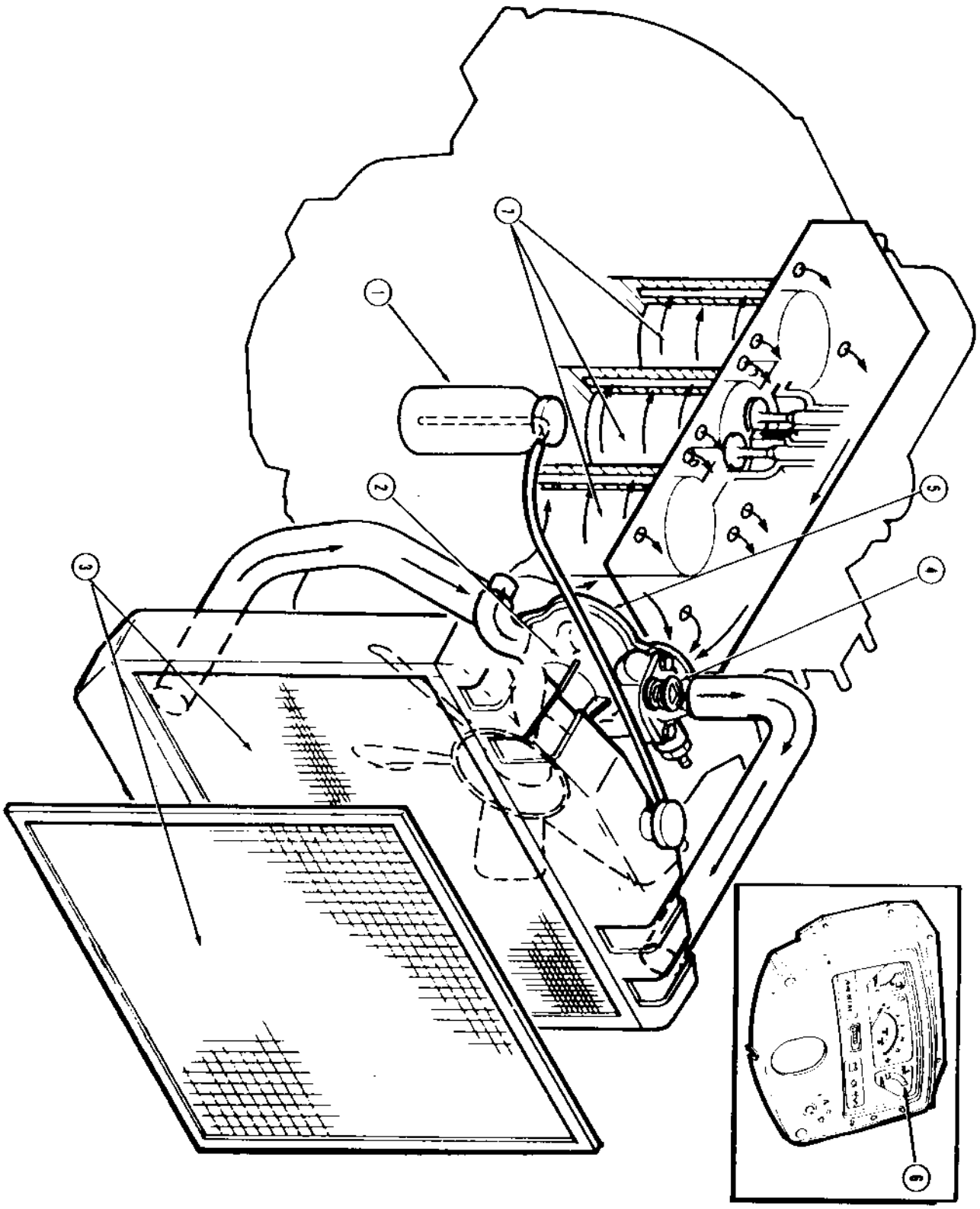
220
15
21

ENGINE COOLANT TEMPERATURE INCORRECT

TEST/CHECK POINT	NORMAL	IF NOT NORMAL
1. Coolant Level	Level between lines of recovery tank.	Fill to correct level.
2. Fan/water pump belt	13 mm (0.5 in.) deflection with 107 N (24 lb) force applied between fan and alternator pulley.	Adjust.
3. Radiator/Screen	Free of dirt/trash.	Clean.
4. Thermostat	Starts to open at 68°C (155°F). Fully open at 85°C (185°F).	Replace.
5. Coolant Pump	Clearance within specifications. No “play” in bearing.	repair.
6. Temperature Gauge	Reads in green band.	Test circuit. See Section 240.
7. Pistons	No scoring.	Replace.
8. Load Applied	Within horsepower available.	Reduce load/shift to lower gear.

M48594

ENGINE COOLANT TEMPERATURE INCORRECT



M48594 -19-09JAN90

220 15 23

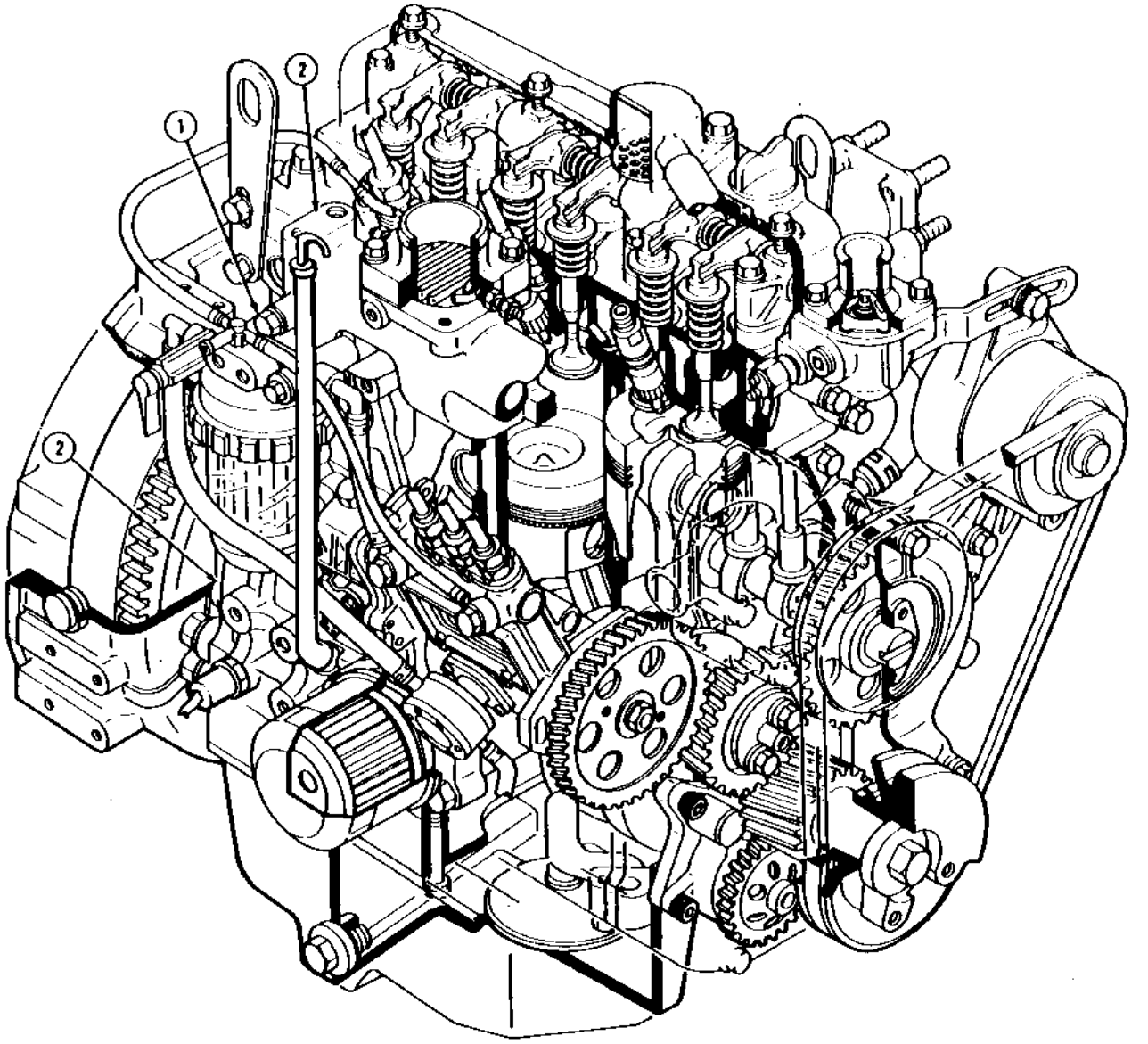
Slide No. 47

MX,22015DG,A22 -19-12DEC89

OIL IN COOLANT OR COOLANT IN OIL

TEST/CHECK POINT	NORMAL	IF NOT NORMAL
1. Head gasket	Complete seal	Replace-Check head and block for flatness.
2. Block/Head	No cracks	Replace.

MX,22015DG,A23 -19-12DEC89



M48595

OIL IN COOLANT OR COOLANT IN OIL

M48595 -19-09JAN90

Slide No. 48

MX,22015DG,A24 -19-12DEC89

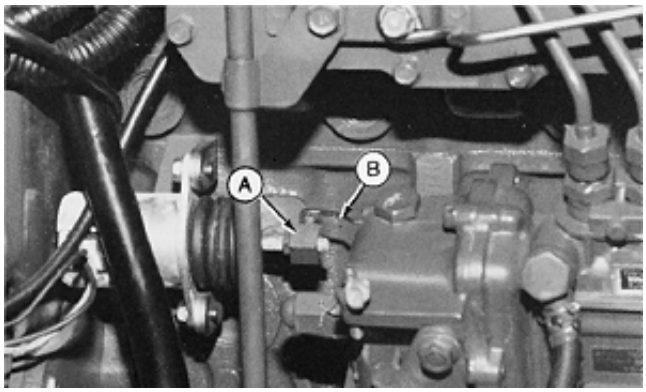
ADJUST FUEL SHUTOFF SOLENOID

1. Disconnect link (A) from solenoid to injection pump shut off lever.

2. Turn key switch “ON” solenoid plunger should pull in.

3. Push injection pump shut off lever (B) against stop (toward solenoid).

4. Turn adjusting pin until it aligns with hole in link. Turn out 2 additional turns. Assemble and check for free movement when key switch is turned on.



-UN-20DEC89
M48252

Slide No. 49

MX,22015DG,A25 -19-12DEC89

ADJUST SPEED CONTROL LINKAGE

1. Check linkage for binding or interference by debris.

2. Check speed control lever friction disk adjustment with pull scale.

Specification 4.5—6 kg (10—14 lbs) force required to move lever.



-UN-20DEC89
M70719

Slide No. 50

MX,22015DG,A26 -19-12DEC89

3. Adjust friction disk. Loosen from jam. Turn nut to obtain specified force to move lever (See specification in step 2).



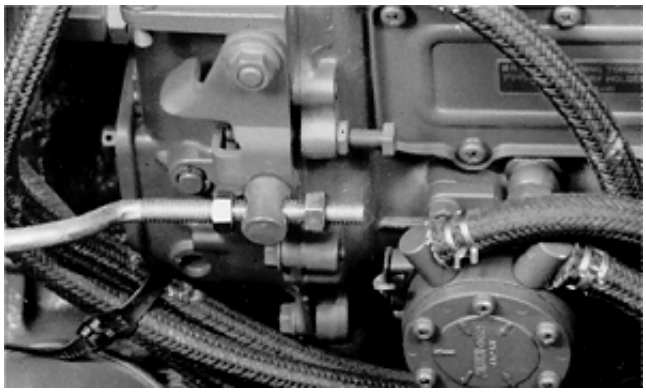
-UN-20DEC89
M70720

Slide No. 51

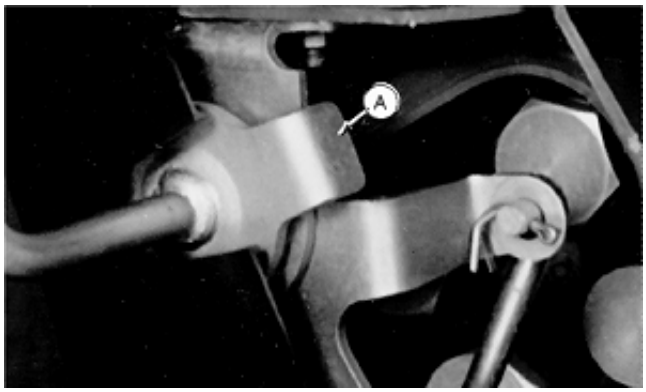
MX,22015DG,A27 -19-12DEC89

4. Loosen jam nuts on speed control rod.

5. Move speed control lever to slow idle position. Tab (A) must contact stop on pedestal. Spring should hold foot speed control lever against tab on hand lever.



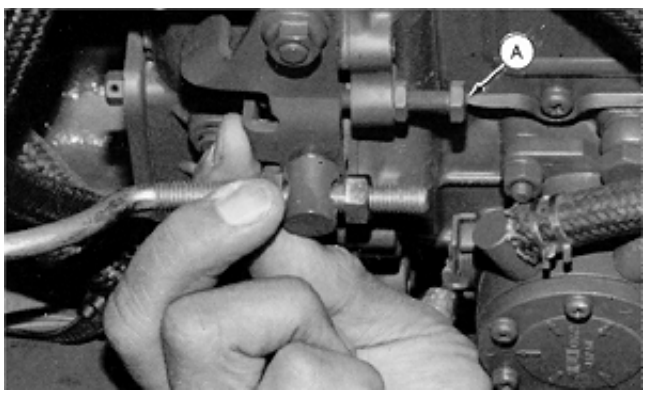
Slide No. 52



Slide No. 53

MX,22015DG,A28 -19-12DEC89

6. Hold tab on injection pump lever against slow idle adjusting screw (A). Start engine, observe RPM. Turn slow idle screw to obtain 900—950 rpm. Holding tab against screw, tighten jam nuts on speed control rod to maintain 900—950 RPM.



Slide No. 54

MX,22015DG,A29 -19-12DEC89

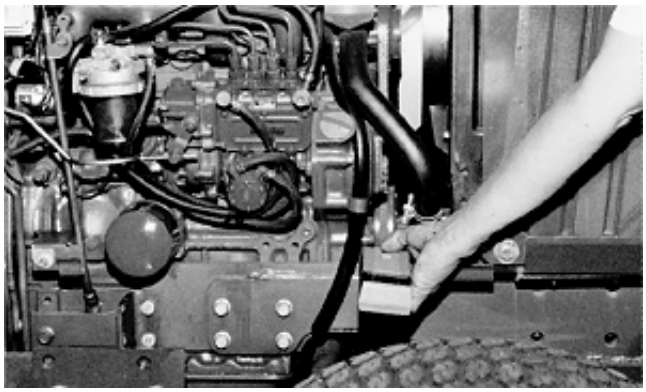
220
15
26

7. Move speed control lever forward to fast idle position and check speed with hand tachometer. (JTO1636 or JTO5719.)

SPECIFICATIONS

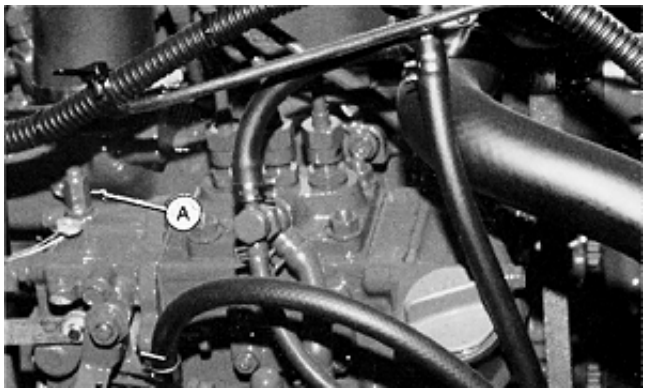
670	3000—3050 RPM
770, 870, 970	2750—2800 RPM
1070	2850—2900 RPM

NOTE: Fast idle adjusting screw is sealed. Slight adjustment to speed may be made without removal of seal. Additional change will require removing seal. Turn screw to obtain correct RPM.



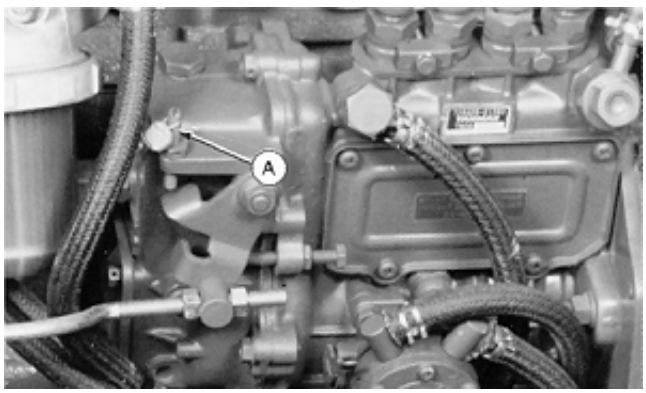
M70741 -UN-20DEC89

Slide No. 55



M48606 -UN-20DEC89

Slide No. 56 - 670 Fast Idle Screw



M48607 -UN-20DEC89

Slide No. 57 - 970 Fast Idle Screw

MX,22015DG,A30 -19-13DEC89

220
15
27

SLOW IDLE ADJUSTMENT–790

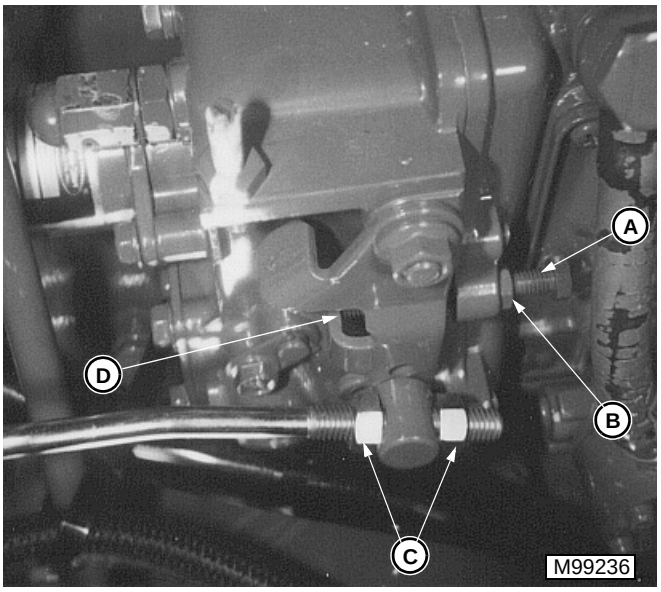
Reason:

To achieve proper slow idle rpm, and to provide adequate rpm to keep the engine running smoothly without stalling.

Equipment:

- JT05719 Hand Held Digital Tachometer

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



Procedure:

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

SPECIFICATION:

790 Slow Idle Speed. . . . . 925 rpm

Results:

1. If the slow idle rpm does not match the specification, loosen slow idle stop screw jam nut (B) and speed control lever jam nuts (C).
2. While holding injection pump throttle lever bent tab (D) against fast idle stop screw (A), rotate slow idle stop screw (A) clockwise to increase slow idle speed, or counterclockwise to decrease slow idle speed.
3. When slow idle speed matches specification, tighten all jam nuts.
4. If the engine still does not match the slow idle speed specification, have the injection pump inspected by a diesel injection service.

FAST IDLE ADJUSTMENT–790

Reason:

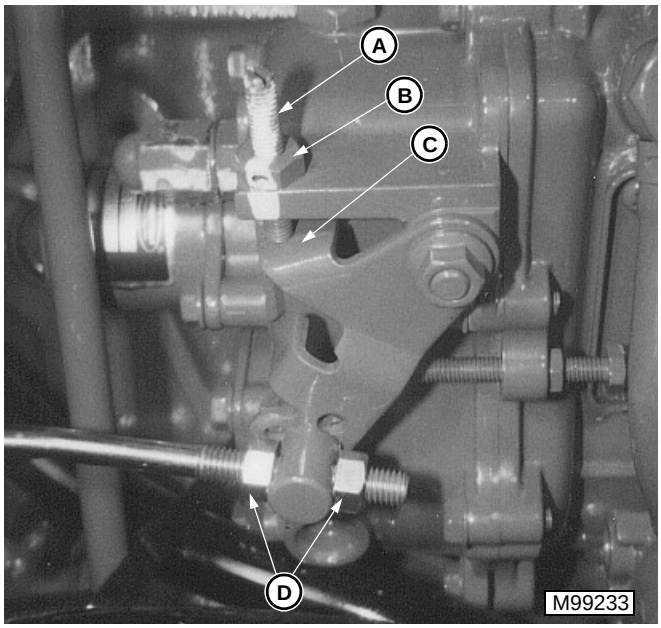
To achieve proper fast idle speed and ensure that the engine is running at proper rpm for peak performance.

Equipment:

- JT05719 Hand Held Digital Tachometer

Procedure:

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



SPECIFICATION:

790 Fast Idle Speed . . . . . 2920 ± 25 rpm

Results:

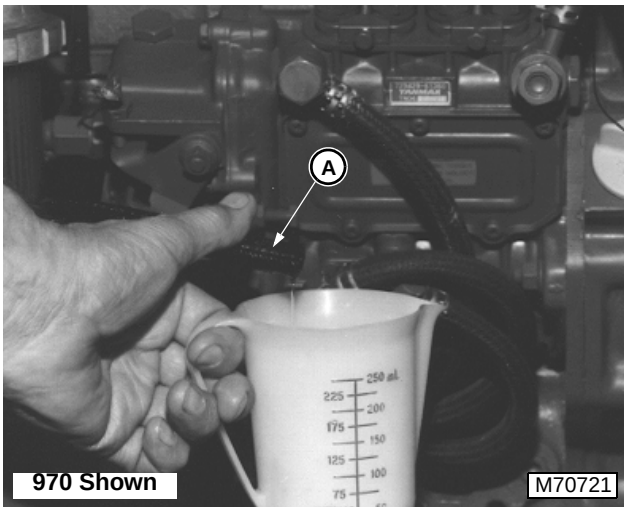
1. If the fast idle rpm does not match the specification, loosen fast idle stop screw jam nut (B) and speed control lever jam nuts (D).
2. While holding injection pump throttle lever (C) against fast idle stop screw (A), rotate fast idle stop screw (A) clockwise to decrease the engine speed, or counterclockwise to increase the engine speed.
3. When fast idle speed matches specification, tighten all jam nuts.
4. If the engine still does not match the fast idle speed specification, have the injection pump inspected by a diesel injection service.

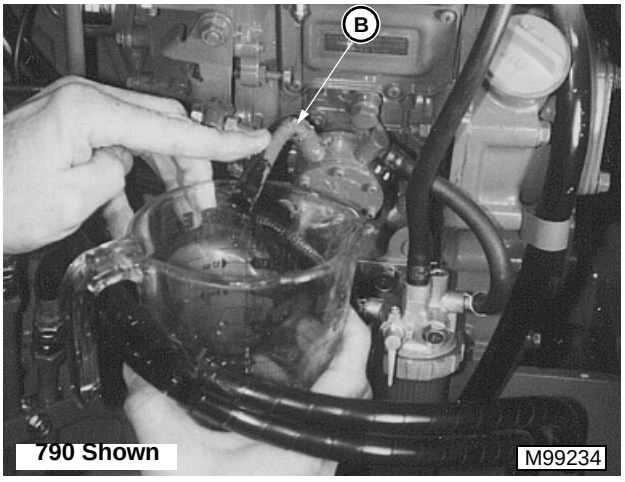
TEST FUEL TRANSFER PUMP

SPECIFICATION:
Fuel temperature for tests. . . . . 15–25°C (59–77°F)
Fuel flow for 15 sec. . . . . .50 mL (1.5 oz-in.)

1. Disconnect the fuel shutoff solenoid wire.

2. Disconnect fuel transfer pump outlet hose (A) from injection pump (670, 770,790) or fuel filter (870, 970, 1070). Collect fuel in graduated container as key switch is turned to “START” position to crank engine 15 seconds. Compare fuel amount to specifications.



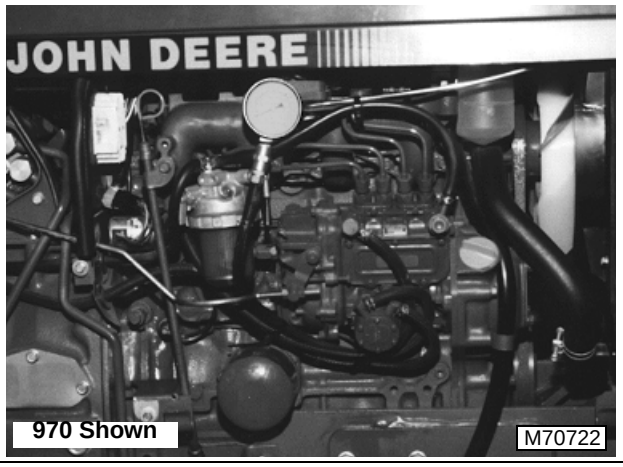


3. Connect gauge from JDG356 Fuel pump Pressure Test Kit to transfer pump outlet hose.

4. Turn key switch to “START” position and observe pressure reading as engine cranks.

SPECIFICATION:
Fuel Pressure . . . . . 29 kPa (4.2 psi)

5. If flow or pressure readings do not match the specification, replace fuel transfer pump.



CYLINDER COMPRESSION PRESSURE TEST

Reason:

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

Equipment:

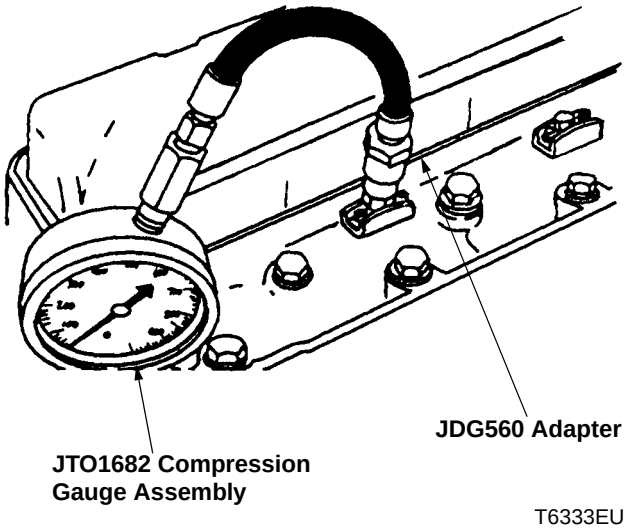
- JT01682 Compression Gauge Assembly
- 670–JDG472 Adapter
- 770, 790, 870, 970, 1070–JDG560 Adapter

Procedure:

1. Remove the injection nozzles.
2. Install the heat protector from end of injector and install JDG560 adapter.
3. Install JT01682 Compression Gauge Assembly and JDG560 Adapter.
4. Disconnect the fuel control solenoid connector.

IMPORTANT: DO NOT overheat the starting motor during this test.

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



T6333EU

SPECIFICATION:

Cylinder Compression Pressure:
790
–Normal . . . . . 3236 ± 98 kPa (469 ± 14 psi)
–Minimum . . . . . 2550 ± 98 kPa (370 ± 14 psi)
670, 770, 870, 970, 1070
–Minimum . . . . . 2448 kPa (355 psi)

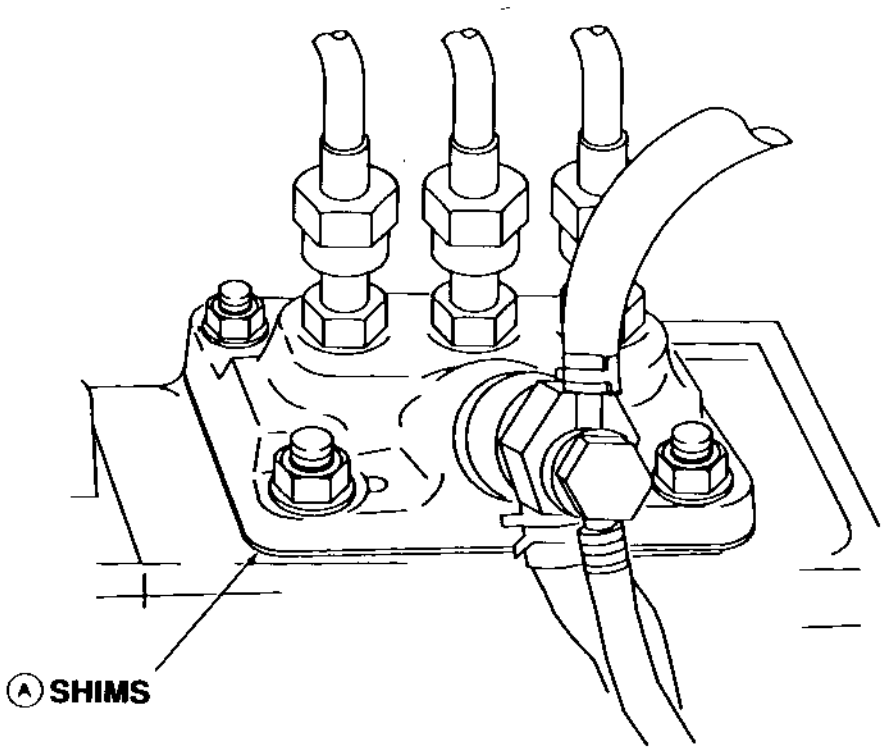
Difference Between Cylinders:
790–Maximum . . . . . 245 ± 49 kPa (36 ± 7 psi)
670, 770, 870, 970, 1070
–Maximum . . . . . 490 kPa (71 psi)

Minimum Cranking Speed:
All . . . . . 250 rpm

Results:

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

TIMING INJECTION SYSTEM—670



M48596

INJECTION PUMP TIMING - 670

-19-09JAN90

M48596

Slide No. 61—670 Injection Pump

670 injection pump timing is determined by a shim pack. Correct shim pack thickness is 0.5 mm (0.020 in.).

MX,22015DG,A33 -19-13DEC89

220
15
30

INJECTION PUMP STATIC TIMING ADJUSTMENT–770, 790, 870, 970, 1070

Reason:

To make sure that the injection pump timing matches the manufacturers specification.

Equipment:

- Timing Tool (No. 1 fuel injection line cut off at first bend)
- External fuel supply

Procedure:

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

Check the fuel, fuel supply system, injectors, air intake system and cylinder compression before continuing.

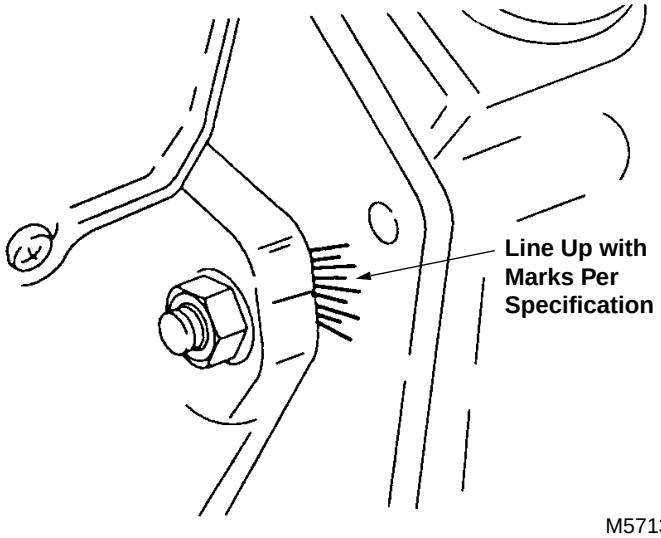
Modification or alteration of the injection pump, pump timing in any way not approved by the manufacturer will terminate the warranty obligation.

NOTE: If the injection pump has been removed from engine without disturbing engine crankshaft and pump shaft, perform step 1 only. Otherwise, perform the entire timing procedure.

1. Align the arrow or line on the injection pump flange to the lines/marks on the timing gear mounting plate per specifications on following page.

NOTE: Normal rotation, as viewed from the flywheel end, is counterclockwise. The number one fuel injection line is toward the flywheel.

2. Remove the number one fuel injection line.



M57132

3. Install the timing tool (number one fuel line cut off at first bend).

4. Turn the crankshaft pulley in either direction until the No. 1 cylinder top dead center (TDC) mark appears in the viewing port of the transmission tunnel.

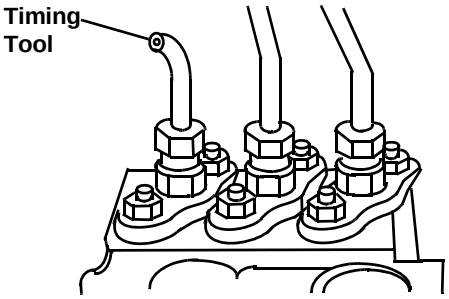
5. Prime the pump to fill it with fuel. **1 L (1.06 qt)** of fuel is more than adequate.

6. Turn the key switch to the RUN position and listen for the audible “click” when the fuel shutoff solenoid energizes.

NOTE: The safety switches must be in the same position as they would be for starting the tractor in order for the fuel shutoff solenoid to operate.

7. Turn the flywheel counterclockwise (as viewed from the flywheel end) until the tip of timing tool has become **MOIST** with fuel.

8. Check the injection pump timing marks on the flywheel. The index mark on the flywheel housing must line up between the injection pump timing marks on flywheel.



SPECIFICATION:

790 . . . . . Between 5th and 6th Marks
770, 970 . . . . . 6th Mark
870, 1070 . . . . . Between 3rd and 4th Marks

Results:

- If timing does not match the specification, loosen the pump mounting bolts.
- Turn the pump toward the engine block to retard the timing, or away from the block to advance the timing.
- Recheck the timing.
- If the timing did not change, remove pump and have it tested by a diesel injection service shop.
- If the timing is correct, remove timing tool, and install the number one injection line.

INJECTION NOZZLE TEST–790

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.

Reason:

To verify proper operation of the fuel injection nozzles.

Equipment:

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

Connections:

1. Connect the fuel injection nozzle to D01109AA Diesel Fuel Injection Nozzle Tester using parts from D01110AA Adapter Set and 23622 Straight Adapter.

IMPORTANT: Use clean filtered diesel fuel when testing injection nozzles to get best test results.

Modification or alteration of the injection nozzles in any way not approved by the manufacturer will terminate the warranty obligation.

Procedure 1:

Test the fuel injection nozzle opening pressure following the Nozzle Tester manufacturer's instructions.

The opening pressure is:
19600 +1000/–0 kPa (2843 +145/–0 psi).

Results:

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

Procedure 2:

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

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

Results:

• Fuel should not leak from the nozzle when the nozzle is pressurized.

• If the injection nozzle leaks fuel, disassemble and inspect the nozzle assembly for contamination. Inspect the valve seating surface. Replace the nozzle assembly if necessary.

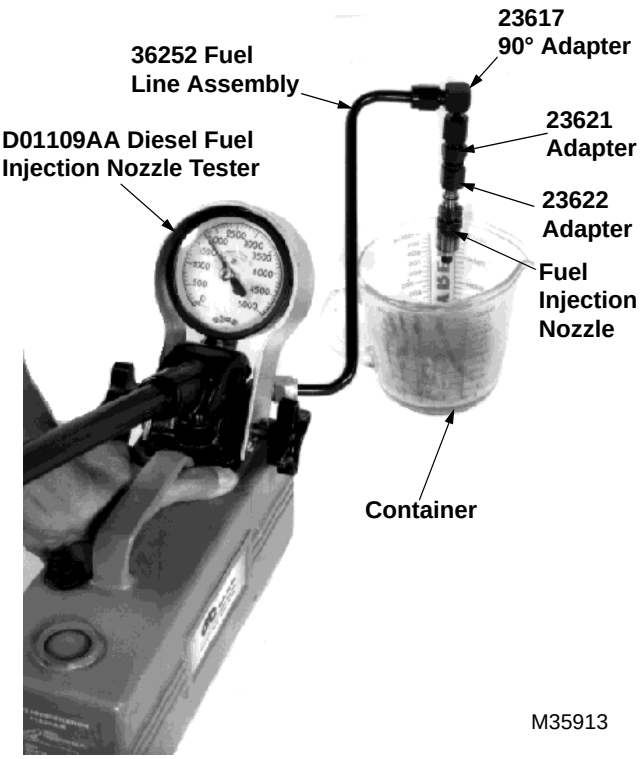
Procedure 3:

1. Test the fuel injection nozzle **chatter and spray pattern** following the nozzle tester manufacturer's instructions.
2. Pressurize nozzle to **19600 kPa (2843 psi)**.
3. With slow hand lever movement there should be a “chatter” sound.
4. With fast hand lever movement the nozzle should exhibit a fine atomized spray pattern.
5. Place a sheet of white paper **30 cm (12 in.)** below the nozzle. The injection spray should form a perfect circle on the paper.

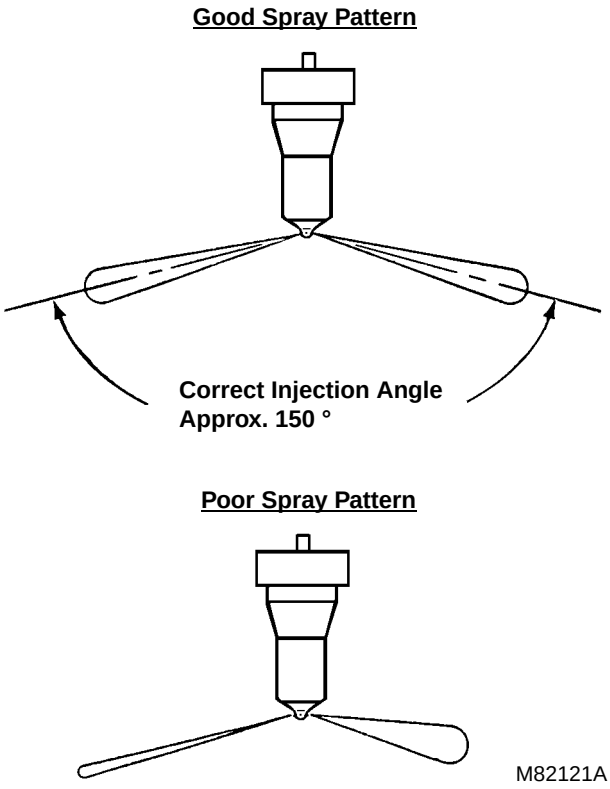
Results:

• If nozzle chatter or the spray pattern does not meet specifications, disassemble the injection nozzle and inspect the nozzle assembly for contamination. Inspect the valve seating surface. Replace the nozzle assembly if necessary.

• If there is excessive difference in the spray angle or injection angle, incomplete atomizing or sluggish starting/ stopping of injection, disassemble the injection nozzle and inspect the nozzle assembly for contamination. Replace the nozzle assembly if necessary.



M35913



M82121A

ENGINE OIL PRESSURE TEST

Reason:

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

Equipment:

- JDG465 Special Socket
- JT03017 Hose Assembly
- JT07034 or JT05577 Pressure Gauge –700 kPa (100 psi)
- JT03349 Connector

Procedure:

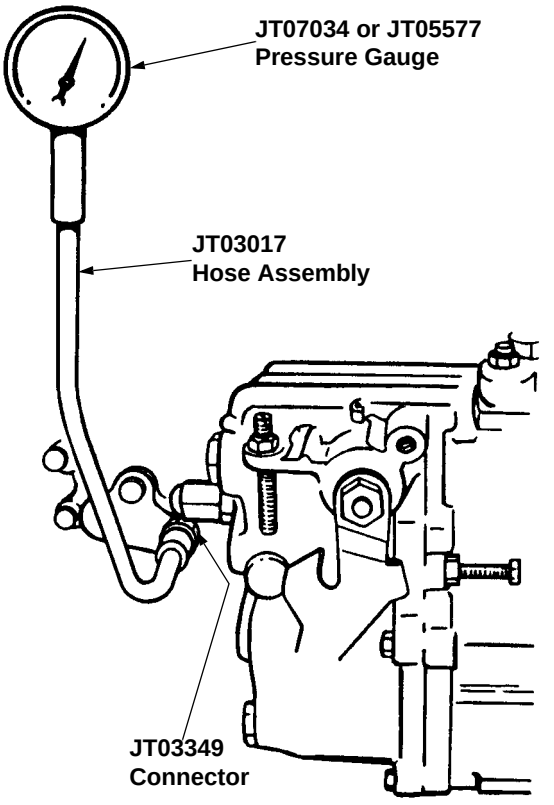
1. Remove oil pressure sender from block. Use of JDG465 Special Socket is recommended.
2. Install connector.
3. Connect hose assembly and pressure gauge.

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

4. Start the engine. If the pressure reading is below **60 kPa (8.7 psi) at slow idle rpm, STOP THE ENGINE**.
5. If the oil pressure is at least **60 kPa (8.7 psi),** run the engine approximately five minutes to heat the oil. Check the oil pressure at **2700 rpm.**

SPECIFICATION:

Engine Oil Pressure . . . . . 337 ± 50 kPa (49 ± 7.2 psi)



T6471FB

Results:

- If the oil pressure does not match the specification, inspect the oil pump.
- If the oil pump matches specifications, the engine may have parts worn beyond specifications. See the TROUBLESHOOTING CHART in CTM-3 for more information.

ADJUST ENGINE OIL PRESSURE

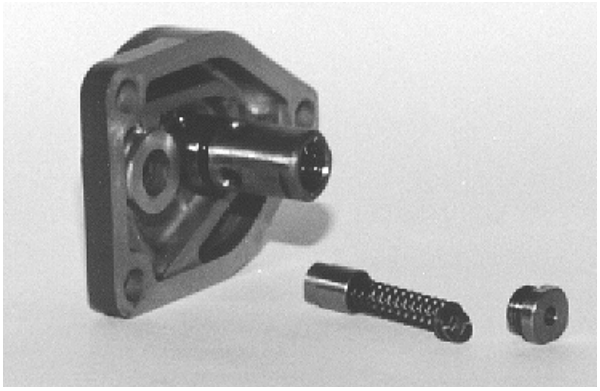
1. If oil pressure does not match the specification, inspect the oil pressure regulating valve for a broken spring, or a stuck or damaged valve.

2. If valve is serviceable, shim until pressure matches the specification.

SPECIFICATION:

NOTE: Each 1 mm (0.039 in.) shim changes pressure as follows:

670 . . . . . 10.9 kPa (1.6 psi)
770, 790, 870, 970, 1070 . . . . . 15.6 kPa (2.3 psi)

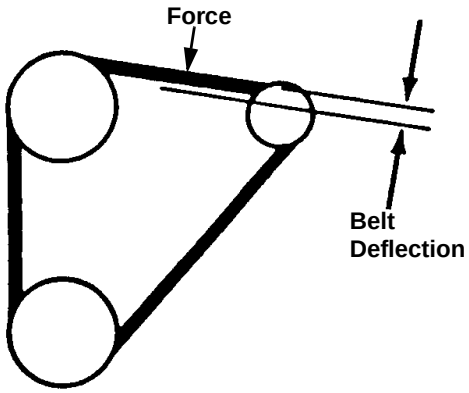


M48603

ADJUST FAN / ALTERNATOR DRIVE BELT

1. Adjust belt tension so that when the specified force is applied between the fan and alternator pulleys, it causes the specified belt deflection. Use of JDST-28 Belt Tension Gauge is recommended.

SPECIFICATION:
Belt Tension Force . . . . . 98 N (22 lb)
Belt Deflection . . . . . 10–15 mm (0.4–0.6 in.)



M54014

RADIATOR BUBBLE TEST–790

Reason:

To determine if compression pressure is leaking from cylinder.

Equipment:

- JDG560 Adapter

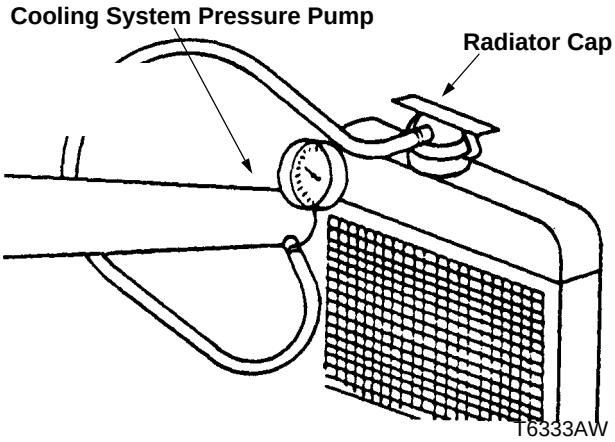
Procedure:

1. With the coolant at the proper level and the radiator cap tight, run the engine for 5 minutes to bring it to operating temperature.
2. Remove the cap from the recovery tank.
3. Check for bubbles coming from the overflow hose at the bottom of the tank.
4. If bubbles are present, isolate the source of the compression leak.
5. Remove the injection nozzles.
6. Install JDG560 Adapter in the injection port of the cylinder to be tested.
7. Move the piston to the bottom of the stroke with intake and exhaust valves closed.
8. Connect the hose from a compressed air source to the adapter.
9. Apply shop air pressure into the cylinder.
10. Check for bubbles in the recovery tank or air escaping from the muffler, air cleaner or oil fill opening.
11. Repeat for each cylinder.

Results:

- If bubbles are present in the recovery tank, check for cracks in the cylinder head and block. Check for a damaged head gasket.
- If air escapes from the muffler, check for a worn exhaust valve.
- If air escapes from the air cleaner, check for a worn intake valve.
- If air escapes from the engine oil fill, check for worn piston rings.

COOLING SYSTEM PRESSURE TEST



Reason:

Inspect the cooling system for leaks.

Equipment:

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

Procedure:

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

Results:

- Pressure should hold to **88 ± 15 kPa (12.8 ± 2.2 psi)**. If pressure decreases, check for leaks. Repair leaks or replace parts as necessary.
- If the pressure test still indicates leakage after all external leaks have been stopped, a defective head gasket, cracked block, or cylinder head may be the cause. See “RADIATOR BUBBLE TEST” on page 38.

RADIATOR CAP PRESSURE TEST–790

Reason:

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

Equipment:

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

Procedure:

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

Results:

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

AIR INTAKE SYSTEM LEAKAGE TEST–790

Reason:

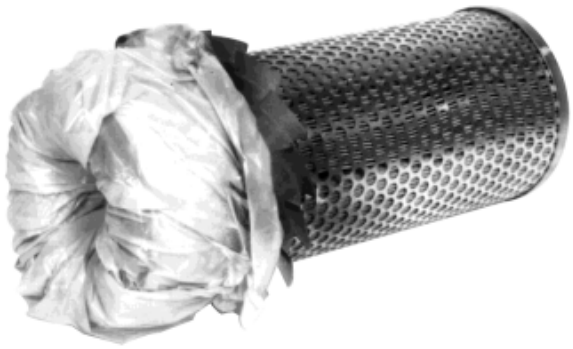
Check for leaks in the air intake system.

Equipment:

- Air Pressure Regulator

Procedure:

1. Remove the air filter restriction switch and install the test fitting.
2. Connect the air pressure regulator to manifold using the hose and fitting from air cleaner.
3. Remove the air cleaner cover and the main filter element.
4. Put a large plastic bag into and over end of main filter element. Install the main filter element and cover.
5. Pressurize the air intake system between **34 - 69 kPa (5 - 10 psi)**. If the air intake system cannot be pressurized, turn the engine slightly to close valves.
6. Spray a soap solution over all the connections from the air cleaner to the intake manifold and check for leaks



M82124

Results:

- Find leaks and repair or replace parts as necessary.

FUEL SUPPLY PUMP PRESSURE TEST–790

Reason:

To determine supply pump operating pressure.

Equipment:

- JT03274 Hose Fitting
- JT01609 Female Quick Coupler
- JT03115 Gauge w/Male Quick Coupler (0 - 150 psi)

Procedure:

1. Disconnect the supply pump-to-filter hose.
2. Install the hose fitting, coupler and gauge.
3. Turn the key switch to run position.
4. The minimum fuel pressure is **29 kPa (4.3 psi).**

Results:

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

FUEL SYSTEM LEAKAGE TEST–790

Reason:

Tests the fuel system plumbing for external leakage. This test also determines if air is entering the fuel system at connections, allowing fuel to siphon back to tank.

Procedure:

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

CAUTION: DO NOT apply more than 103 kPa (15 psi) air pressure to the fuel system. Damage to the injection pump or personal injury may result.

3. Apply **34 - 69 kPa (5 - 10 psi)** air pressure to fuel supply hose until all fuel is drained from the system.
4. Plug the end of the fuel return hose.
5. Apply **34 - 69 kPa (5 - 10 psi)** air pressure to the fuel system at the fuel supply line. DO NOT exceed a maximum pressure of **103 kPa (15 psi)**.
6. Apply liquid soap and water solution to all joints and connections in the fuel system, and inspect for leaks.

Results:

- Find leaks and repair or replace parts as necessary.

BLEED FUEL SYSTEM–790

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

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

THERMOSTAT OPENING TEST–790

Reason:

To determine opening temperature of thermostat.

Equipment:

- Thermometer
- Glass Container
- Heating Unit

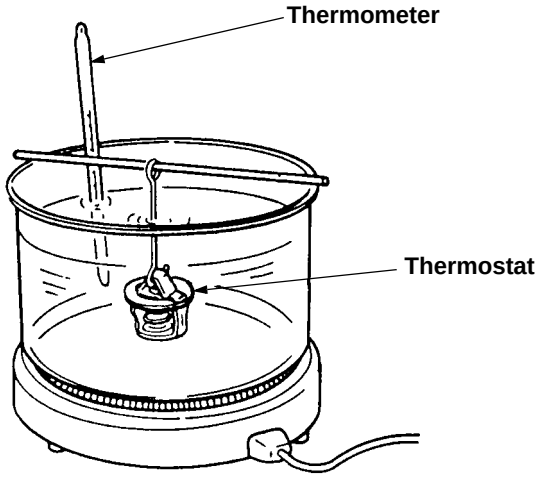
Procedure:

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

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

SPECIFICATION:

Begin Opening
Temperature . . . . . 69.5 - 72.5° C (157 - 163° F)
Fully Open
Temperature . . . . . 85° C (185° F)
Fully Open Lift Height . . . . . .8 mm (0.31 in.)



M82122A

Results:

- If the opening temperatures do not match the specification, replace the thermostat.
- If the fully open lift height do not match the specification, or if the closing action is not smooth and slow, replace the thermostat.

VALVE CLEARANCE ADJUSTMENT–790

Reason:

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

Equipment:

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

Procedure:

1. The engine must be cool (room temperature) before the valve clearance is checked.
2. Be sure ignition key is OFF before attempting to turn engine by hand.
3. Open the hood and remove the engine side covers.
4. Remove the rocker arm cover. See “ROCKER ARM REMOVAL/INSTALLATION” in Section 20, Engine Repair.
5. Locate the inspection hole in right side of the transmission tunnel. The flywheel can be seen inside the inspection hole.

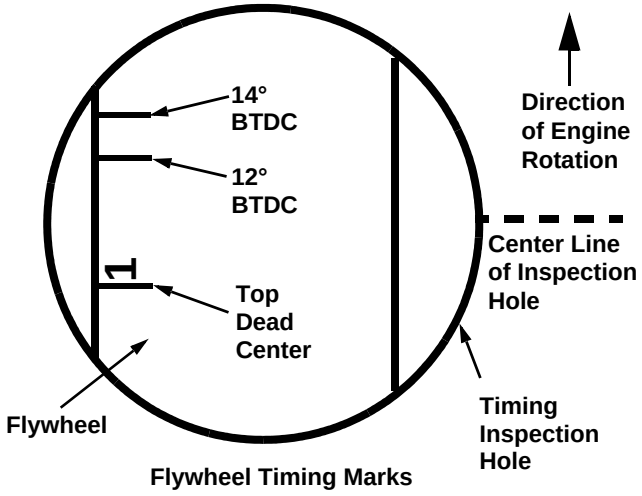
NOTE: “Top Dead Center (TDC)” is when the piston is at it’s highest point of travel in the cylinder on the compression stroke.
Number one cylinder is located at rear of engine (flywheel side).

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

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

7. Try to move rocker arms and/or push rods for No. 1 cylinder:

- If the rocker arms and push rods are loose, the piston is at TDC on the compression stroke. Go to step 8.
- If the rocker arms and/or push rods are not loose, rotate the flywheel one revolution (360°), and recheck the rocker arms and push rods.



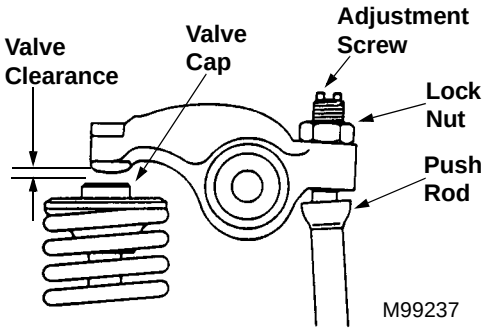
Flywheel Timing Marks

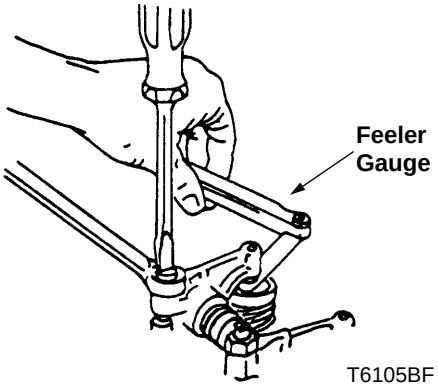
8. Slide a feeler gauge between the valve cap and rocker arm to measure the valve clearance.

9. To adjust the valves, loosen the lock nut and turn the adjustment screw until the blade of the feeler gauge can be inserted between the rocker arm and valve cap. Hold the adjusting screw while tightening the lock nut.

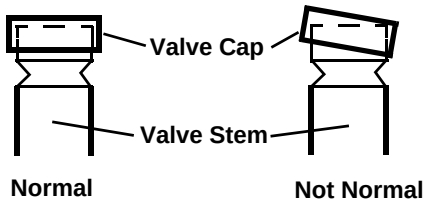
10. Recheck the valve clearance after tightening the lock nut.

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





11. Check that the valve cap on the valve stem remained seated on the valve and inside the valve spring retainer.



12. Turn the crankshaft pulley counter clockwise (as viewed from operator's seat or flywheel end) approximately 2/3 of a revolution (240°) while watching the observation hole for the number three timing mark.

13. Check that the rocker arms and push rods for cylinder number three are loose.

14. Repeat steps 7 – 13 for number three cylinder.

15. Repeat steps 7 – 11 for number two cylinder.

16. Replace the rocker arm cover, air cleaner bracket and housing, and the muffler.

17. Replace the engine side covers and hood.

CONNECTING ROD SIDE PLAY CHECK–790

Reason:

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

Equipment:

- Feeler Gauge

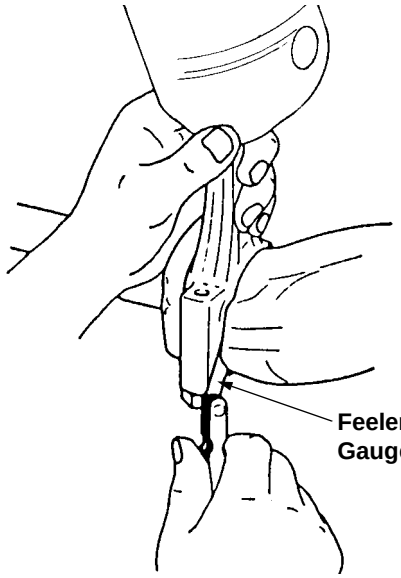
NOTE: The engine must be removed from the tractor to perform this procedure.

Procedure:

1. Remove the oil pan, and oil pickup.
2. Insert a feeler gauge, according to specifications, between the connecting rod cap and the crankshaft.
3. Connecting rod side play should match specification.

SPECIFICATION:

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



M82116

Results:

- If connecting rod side play does not match specification, replace the bearing inserts or the connecting rod.

CONNECTING ROD BEARING CLEARANCE CHECK–790

Reason:

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

Equipment:

- PLASTIGAGE®

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

Procedure:

1. Remove the oil pan, and oil pickup.

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

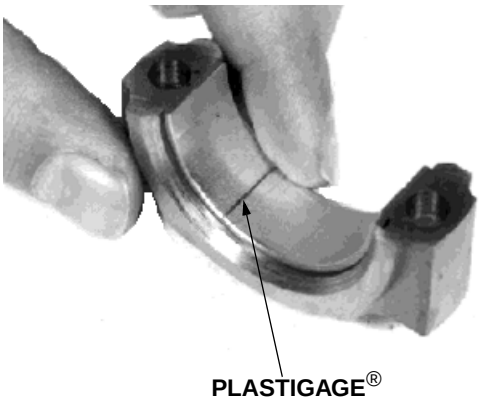
2. Remove the connecting rod cap.

3. Wipe oil from the bearing insert and the crankshaft journal.

4. Put a piece of PLASTIGAGE®, or an equivalent, along the full length of the bearing insert approximately **6 mm (0.25 in.)** off center.

5. Turn the crankshaft approximately 30° from bottom dead center.

6. Install the connecting rod end cap and original rod bolts. Tighten the rod bolts to specification.



M35351

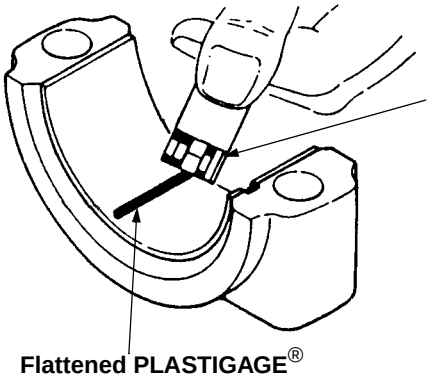
SPECIFICATION:
Connecting Rod
Bolt Torque . . . . . .44 - 54 N•m (33 - 40 lb-ft)

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

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

8. Use the graduation marks on the envelope to compare the width of the flattened PLASTIGAGE® at its widest point. The number within the graduation marks indicates the bearing clearance in inches or millimeters depending on which side of the envelope is used.

9. Measure the connecting rod bearing oil clearance.



M82117A

SPECIFICATION:
Connecting Rod Bearing
Oil Clearance . . . . . 0.04 - 0.07 mm (0.002 - 0.003 in.)
Wear Limit . . . . . 0.16 mm (0.006 in.)

Result:

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

10. Remove the PLASTIGAGE®.

PLASTIGAGE® is a registered trademark of the DANA Corporation.

CRANKSHAFT END PLAY CHECK–790

Reason:

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

Equipment:

- Dial Indicator

Procedure:

NOTE: Crankshaft end play can be measured at front end or rear end of crankshaft. Procedure is performed from the rear end. The flywheel is removed to show detail.

1. Fasten the dial indicator to engine and position indicator tip on end of crankshaft.

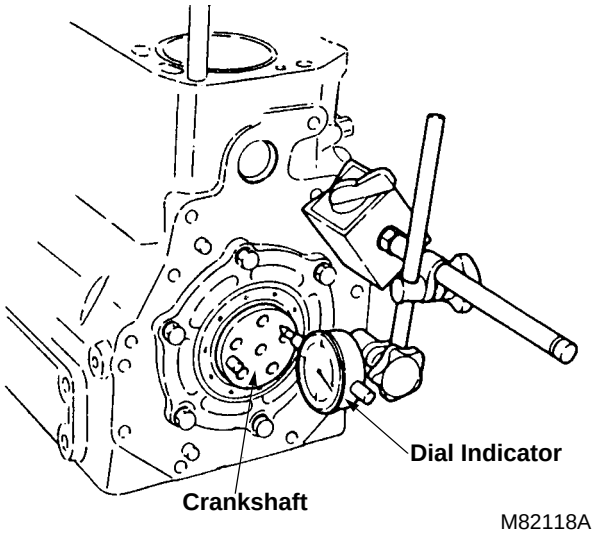
IMPORTANT: Do not use excessive force when moving crankshaft to avoid damaging bearings.

2. Push the crankshaft toward rear as far as possible.
3. Zero the dial indicator.
4. Using a bar, gently pry the crankshaft as far forward as possible.

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

Results:

- If the end play does not match specification, replace the thrust bearings.



M82118A

CRANKSHAFT MAIN BEARING CLEARANCE CHECK–790

Reason:

To measure oil clearance between main bearing and crankshaft journal.

Equipment:

- PLASTIGAGE®

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

Procedure:
1. Remove the oil pan, and oil pickup.

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

2. Remove the main bearing cap.

3. Wipe oil from the bearing insert and the crankshaft journal.

4. Put a piece of PLASTIGAGE®, or an equivalent, along the full length of the bearing insert approximately **6 mm (0.25 in.)** off center.

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

SPECIFICATION:
Main Bearing Bolt Torque . . .96 - 100 N•m (71 - 74 lb-ft)

6. Remove the bolts and main bearing caps.

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

7. Use the graduation marks on the envelope to compare the width of the flattened PLASTIGAGE® at its widest point. The number within the graduation marks indicates the bearing clearance in inches or millimeters, depending on which side of the envelope is used.

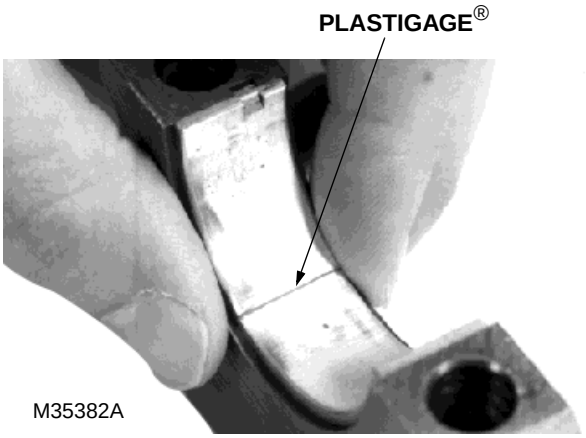
SPECIFICATION:
Main Bearing
Oil Clearance . . . . . 0.04 - 0.07 mm (0.002 - 0.003 in.)
Wear Limit . . . . . 0.16 mm (0.006 in.)

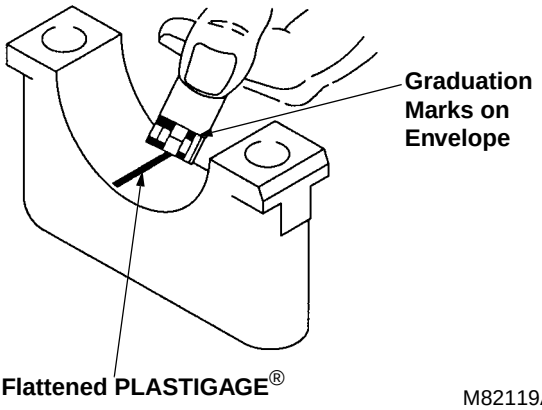
Result:

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

8. Remove PLASTIGAGE®.

®PLASTIGAGE is a registered trademark of the DANA Corporation.





VALVE LIFT CHECK–790

Reason:

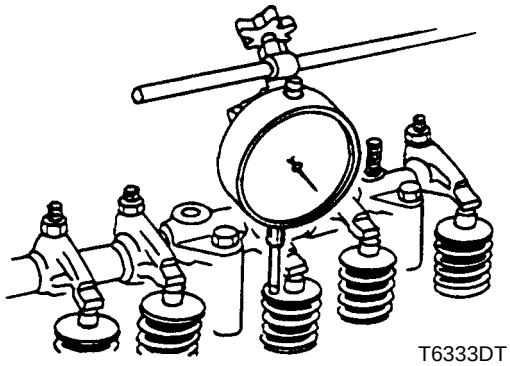
Check wear on cam lobes, followers, and/or push rods.

Equipment:

- Dial Indicator

Procedure:

1. Remove the rocker arm cover. See “ROCKER ARM REMOVAL/INSTALLATION” in Section 20, Engine Repair.
2. Adjust the valve clearance.
3. Fasten the dial indicator to the engine and position the indicator tip on the valve retainer. The valve must be fully closed and the rocker arm must move freely.
4. Zero the dial indicator.
5. Manually turn the crankshaft pulley clockwise (from the fan end).
6. Observe the dial indicator as the valve is moved to the full open position. Repeat for each valve.



T6333DT

Results:

- The valve lift should be the same for all valves. If one or more valves have less travel than the others, remove and inspect the camshaft, followers and push rods. See “CAMSHAFT” in Section 20, Engine Repair.
- If the camshaft, followers and push rods match the specification, remove and inspect the cylinder head. See “CYLINDER HEAD AND VALVES REMOVAL AND INSTALLATION” in Section 20, Engine Repair.

CAMSHAFT END PLAY CHECK–790

Reason:

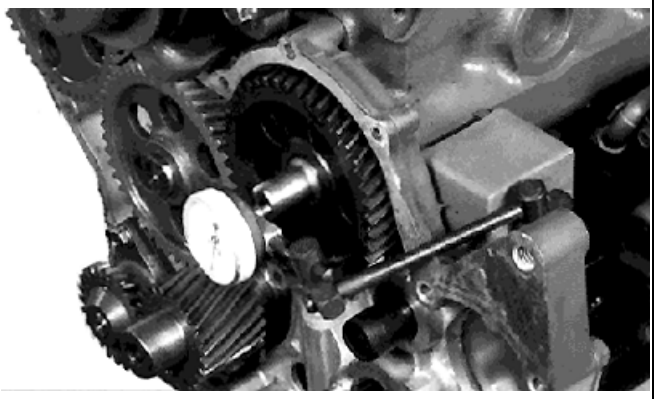
To determine proper side clearance between camshaft gear end journal and thrust plate.

Equipment:

- Dial Indicator

Procedure:

1. Remove the timing gear cover. See “TIMING GEAR COVER” in Section 20, Engine Repair.
2. Fasten the dial indicator to the engine and position indicator tip on end of camshaft.
3. Push the camshaft toward the rear as far as possible.



M37512

4. Zero the dial indicator.
5. Pull the camshaft forward as far as possible.

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

Results:

• If the end play does not match specification, remove the camshaft and replace the thrust plate. See “CAMSHAFT” in Section 20, Engine Repair.

TIMING GEAR BACKLASH CHECK–790

Reason:

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

Equipment:

• Dial Indicator

Procedure:
1. Measure the backlash between meshing gears.

SPECIFICATIONS
Oil Pump Gear . . . . . 0.11 - 0.19 mm (0.004 - 0.008 in.)
All Other Gears. . . . . 0.07 - 0.15 mm (0.003 - 0.006 in.)

Results:

• If backlash does not match the specification, replace meshing gears as a set:

Idler Gear, Camshaft Gear, Crankshaft Gear, Oil Pump Gear and/ or Idler Gear, Fuel Injection Pump Gear.

Section 240
ELECTRICAL SYSTEM OPERATION AND TESTS

Group 05—Electrical Component Location
670 Engine Electrical Components240-05-1
770/870/970/1070 Engine
Electrical Components240-05-2
670/770 Dash Electrical Components240-05-3
870/970/1070 Dash
Electrical Components240-05-4
670/770 Machine
Electrical Components240-05-5
870/970/1070 Machine
Electrical Components240-05-6

Group 10—Theory of Operation
Electrical Theory of Operation
Information240-10-1
Wire Color Code240-10-1
Cranking System
Old Version240-10-2
New Version240-10-3a
Fuel Shut-Off Solenoid Pull-In System
Old Version240-10-4
New Version240-10-5a
Fuel Shut-Off Hold-In System
Old Version240-10-6
New Version240-10-7a
Fuel Shut-Off Hold-In System (Override Position)
Old Version240-10-8
New Version240-10-9a
Charging System240-10-10
Glow Plug System240-10-12
Air Heater System240-10-14
Lighting System240-10-16
Instrument Light System240-10-18

Group 10—Electrical System Diagnosis/Test
Before You Start240-15-1
Fuse Block240-15-2
Cranking System Test Points
Old Version240-15-4
New Version240-15-7a
Fuel Shut-Off Solenoid Pull-In System Test Points/
Operator On Seat
Old Version 240-15-8
New Version 240-15-11a
PTO in Off Position/Operator Off Seat
Old Version 240-15-12
New Version 240-15-15a
Fuel Shut-Off Hold-In System
Operator on Seat 240-15-16
Override Position
Old Version 240-15-18
New Version 240-15-19a
Test Points
Charging System 240-15-20
Glow Plug System 240-15-22
Air Heater System 240-15-24
Park Brake Indicator Light Circuit 240-15-26
Warning Light Circuit 240-15-28
Flood Light Circuit 240-15-30
Headlamp/Taillamp/Dash-Gauge
Lamp Circuit 240-15-32
Instrument Light System. 240-15-34
Battery Tests 240-15-38
Charge Battery 240-15-38
Load Test Battery 240-15-40
Alternator Unregulated Voltage
Output Test 240-15-41
Test
Alternator Stator Winding 240-15-42
Regulated Voltage Output 240-15-43
Starter Solenoid 240-15-44
Cranking Speed and
Starter Amp Draw. 240-15-45
Starter No-Load Amperage 240-15-46
Neutral Start Relay 240-15-46
Neutral Start Switch 240-15-47
Mid PTO Switch 240-15-47
Rear PTO Switch 240-15-48
Seat Switch 240-15-48
Ignition Switch 240-15-49
Light Switch 240-15-49
Fuel Shut-Off Pull-In Coil Relay 240-15-50

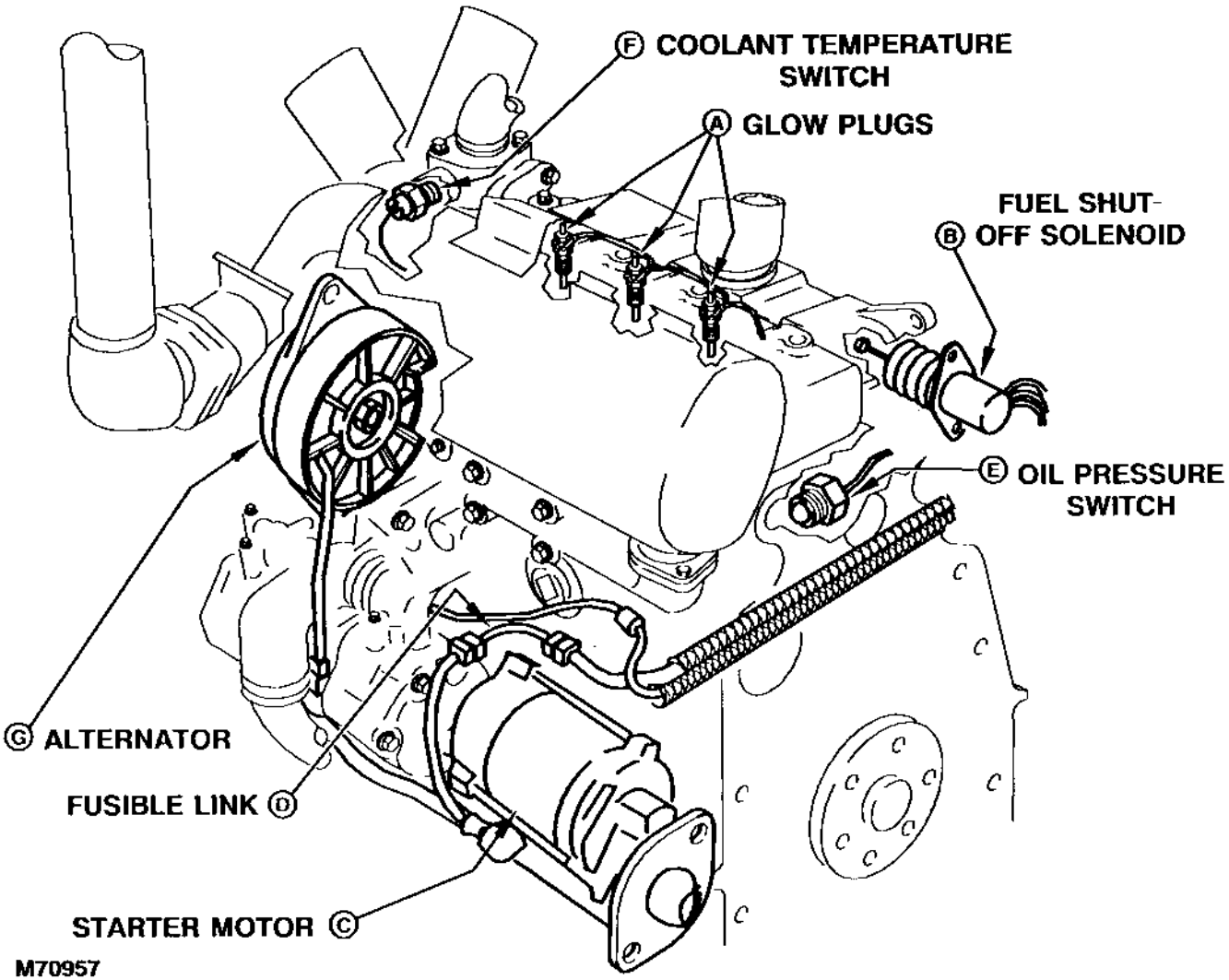
Continued on next page

Page

Test (continued)
Fuel Shut-Off Solenoid240-15-51
Glow Plug Resistor240-15-52
Glow Plug240-15-53
Air Heater240-15-53
Water Temperature Sender240-15-53
Fuel Gauge Sender240-15-54
Oil Pressure Switch240-15-54
Park Brake Indicator Switch240-15-54
Adjust Park Brake Indicator Switch240-15-55

Group 20—Electrical System Schematic
Old Version240-20-1
New Version240-20-2

670 ENGINE ELECTRICAL COMPONENTS



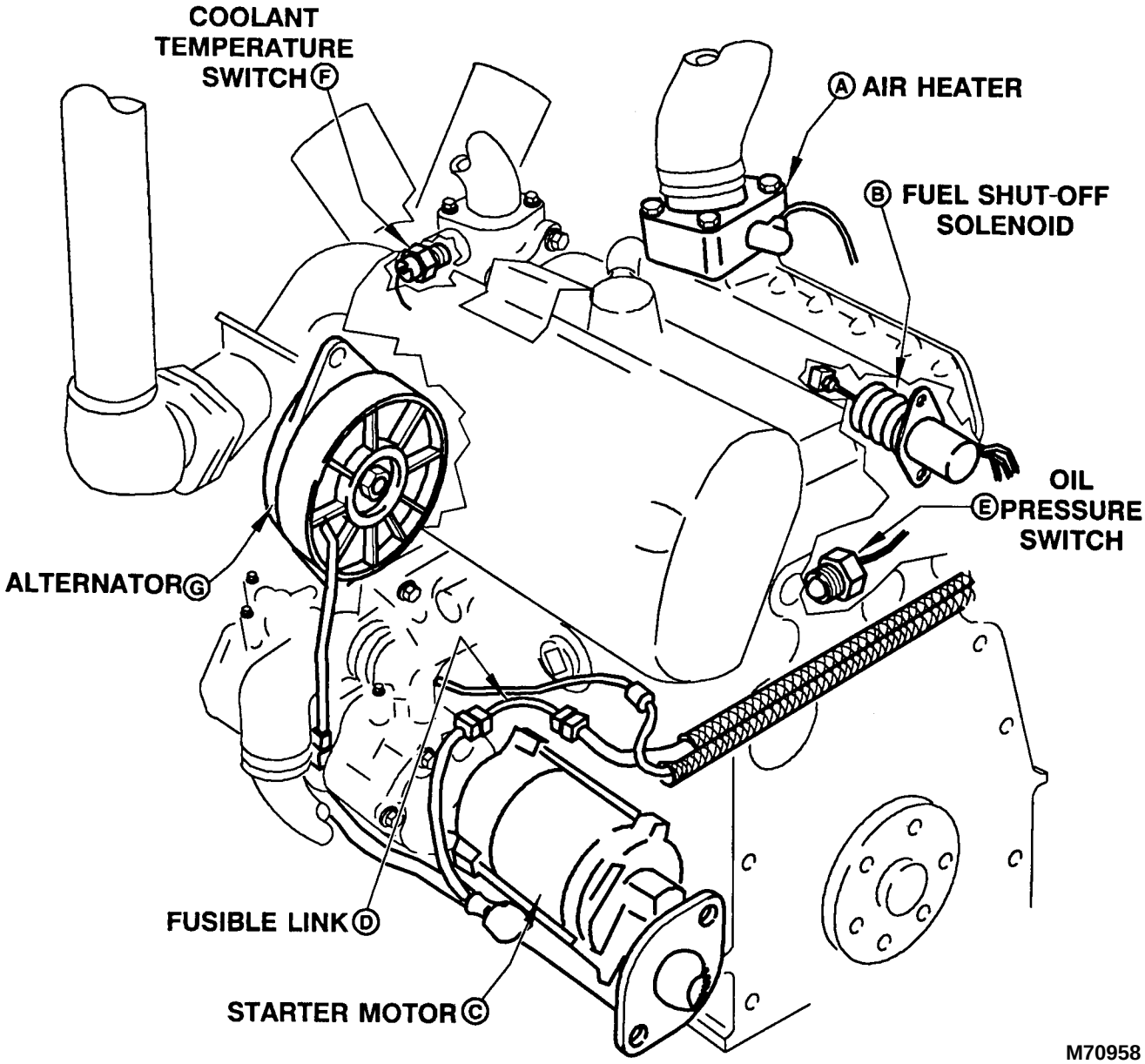
670 ENGINE ELECTRICAL COMPONENTS

A—Glow Plugs
B—Fuel Shut-Off Solenoid
C—Starter Motor
D—Fusible Link
E—Oil Pressure Switch
F—Coolant Temperature Switch
G—Alternator

Slide No. 69

MX,24005DG,A1 -19-25SEP89

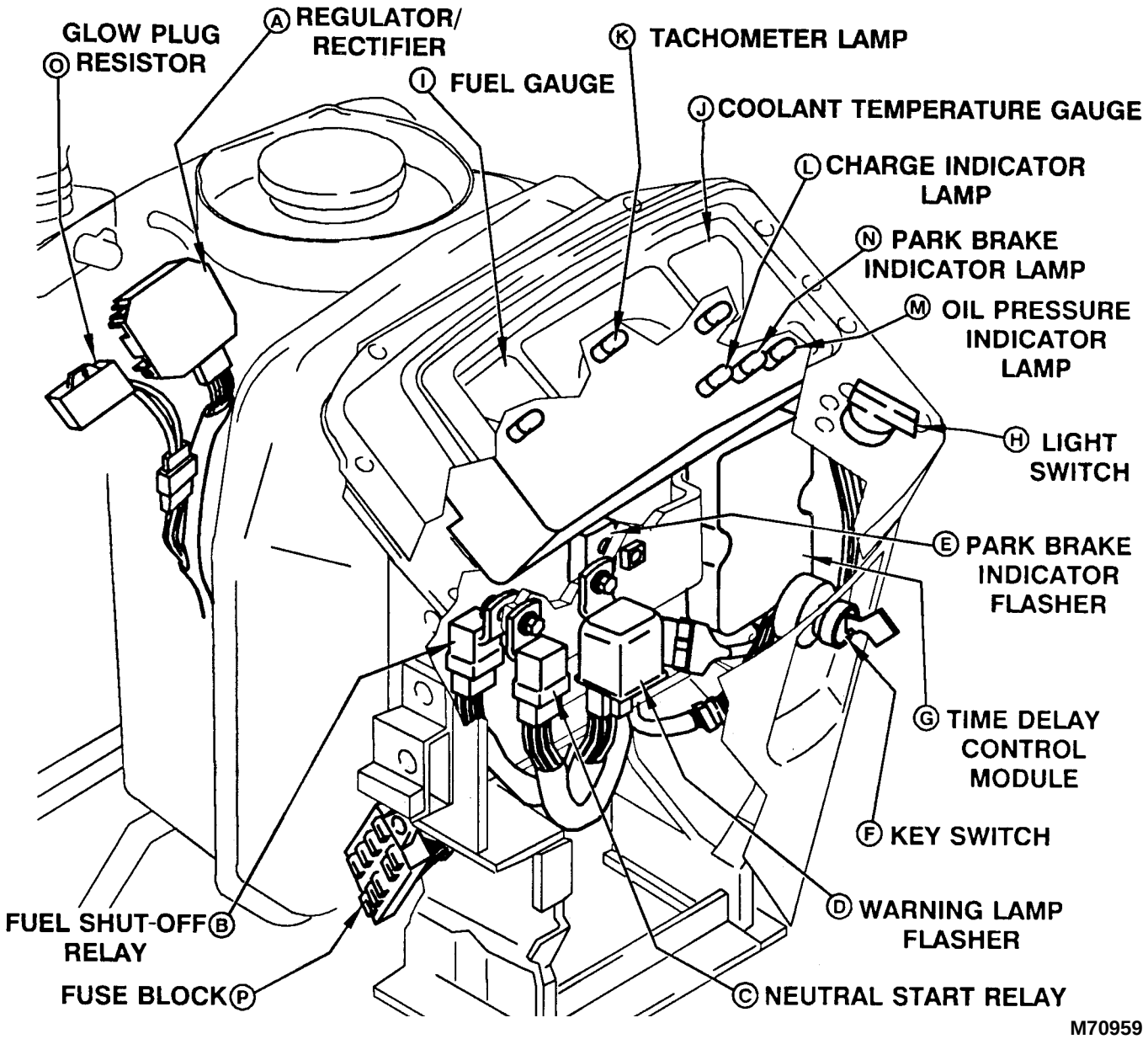
770/790/870/970/1070 ENGINE ELECTRICAL COMPONENTS



770/790/870/970/1070 ENGINE ELECTRICAL COMPONENTS

A—Air Heater
B—Fuel Shut-Off Solenoid
C—Starter Motor
D—Fusible Link
E—Oil Pressure Switch
F—Coolant Temperature Switch
G—Alternator

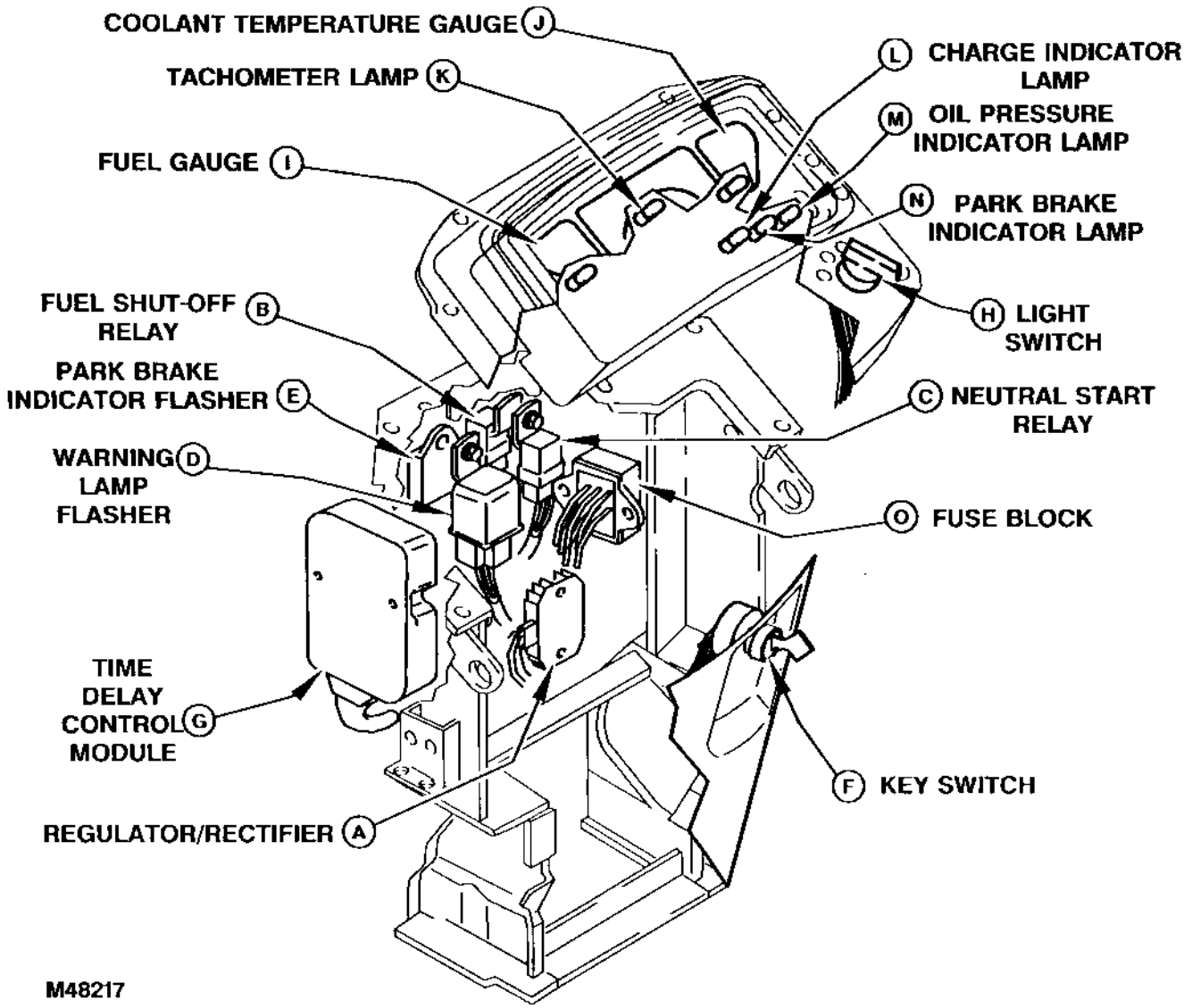
670/770/790 DASH ELECTRICAL COMPONENTS



670/770/790 DASH ELECTRICAL COMPONENTS

A—Regulator Rectifier	**E—Park Brake Indicator Flasher**	**I—Fuel Gauge**	**M—Oil Pressure Indicator Lamp**
B—Fuel Shut-Off Relay	**F—Key Switch**	**J—Coolant Temperature Gauge**	**N—Park Brake Indicator Lamp**
C—Neutral Start Relay	**G—Time Delay Control Module**	**K—Tachometer Lamp**	**O—Glow Plug Resistor**
D—Warning Lamp Flasher	**H—Light Switch**	**L—Charge Indicator Lamp**	**P—Fuse Block**

870/970/1070 DASH ELECTRICAL COMPONENTS



8-9-1070 DASH ELECTRICAL COMPONENTS

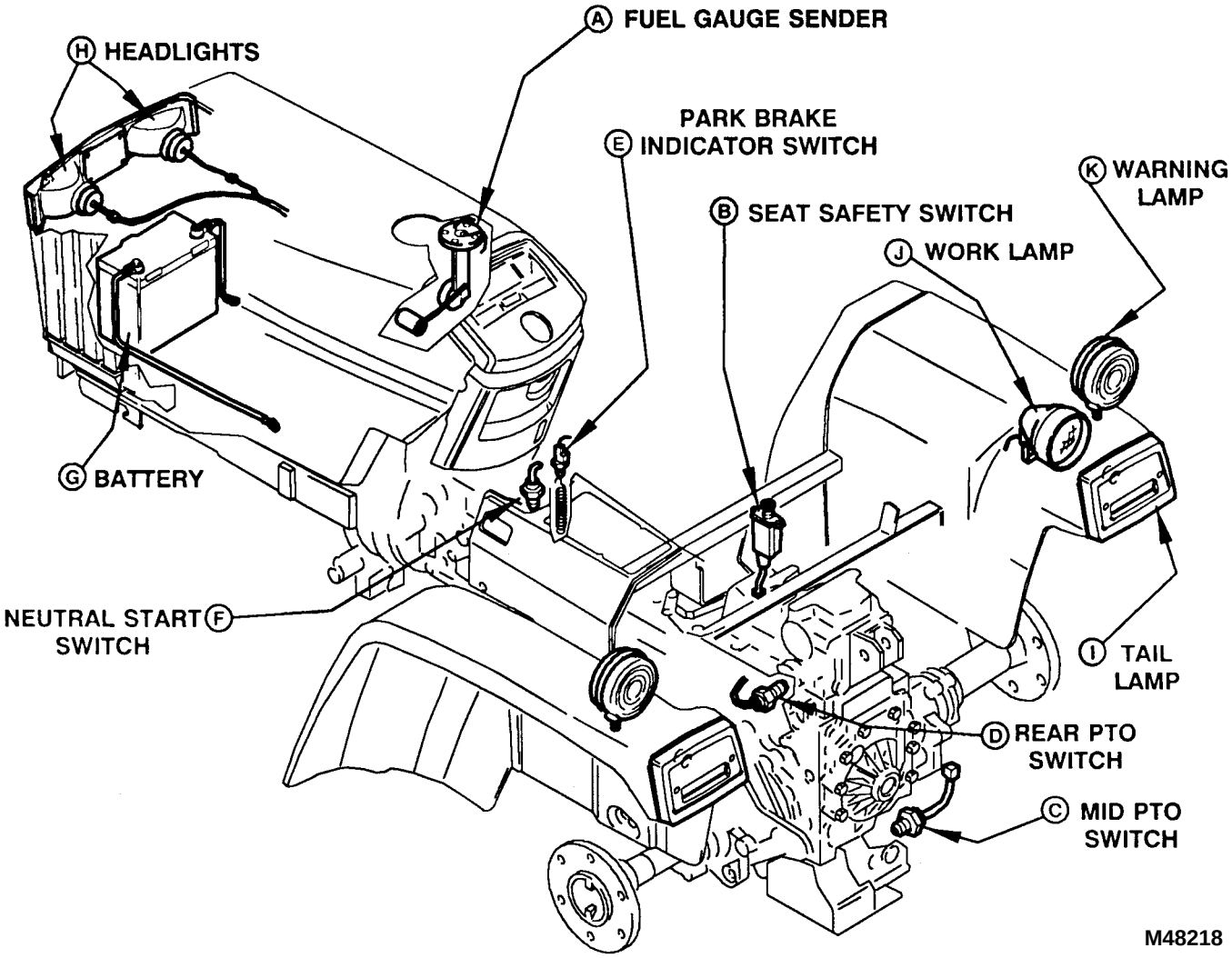
M48217 -19-03JAN90

A—Regulator Rectifier
B—Fuel Shut-Off Relay
C—Neutral Start Relay
D—Warning Lamp Flasher
E—Park Brake Indicator Flasher
F—Key Switch
G—Time Delay Control Module
H—Light Switch
I—Fuel Gauge
J—Coolant Temperature Gauge
K—Tachometer Lamp
L—Charge Indicator Lamp
M—Oil Pressure Indicator Lamp
N—Park Brake Indicator Lamp
O—Fuse Block

Slide No. 72

MX,24005DG,A4 -19-25SEP89

670/770/790 MACHINE ELECTRICAL COMPONENTS

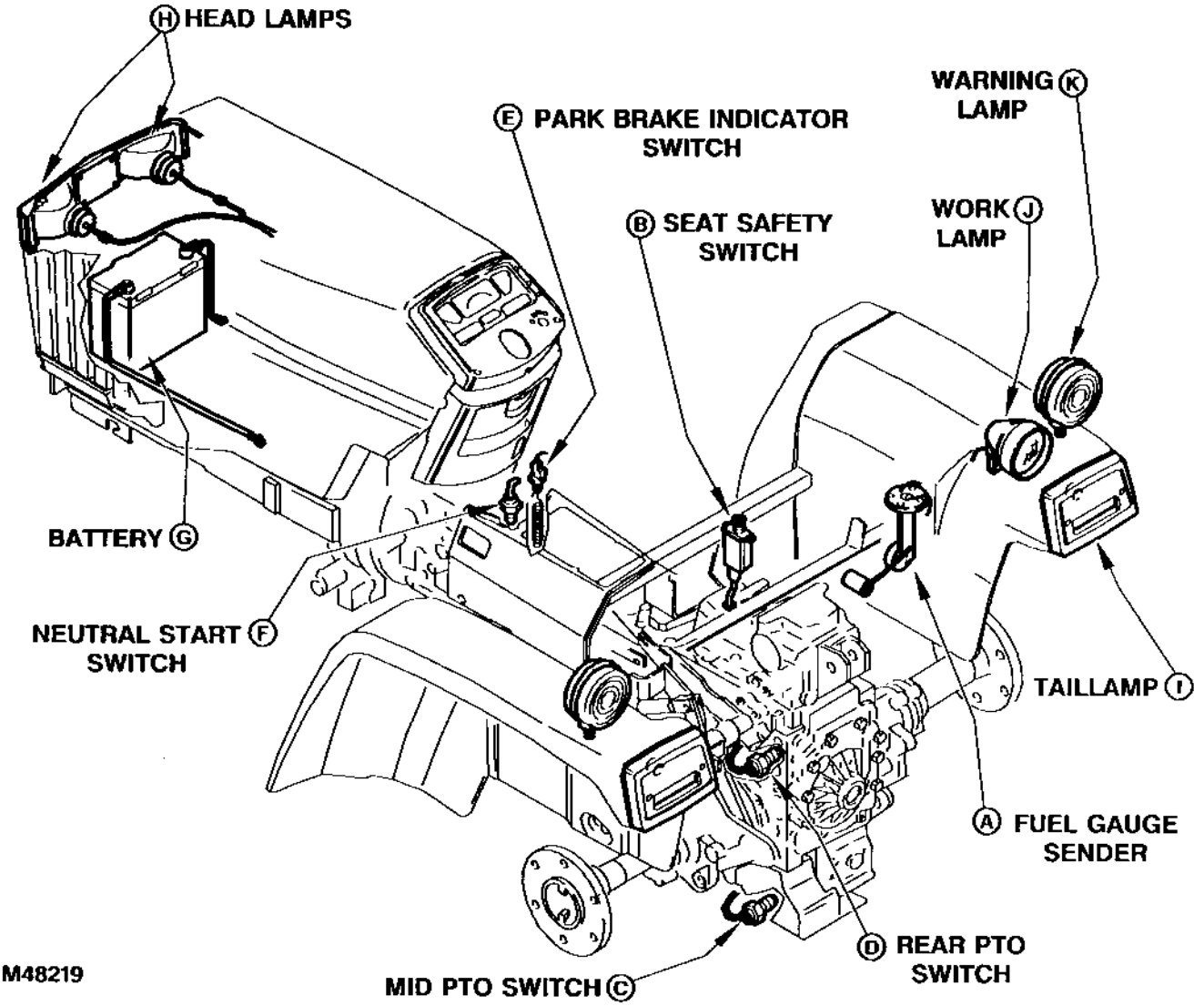


670/770/790 MACHINE ELECTRICAL COMPONENTS

A—Fuel Gauge Sender	D—Rear PTO Switch	G—Battery	J—Work Lamp (Optional)
B—Seat Safety Switch	E—Park Brake Indicator Switch	H—Head Lamps	K—Warning Lamp
C—Mid PTO Switch	F—Neutral Start Switch	I—Tail Lamps	

870/970/1070 MACHINE ELECTRICAL COMPONENTS

240
05
6



-19-03JAN90

M48219

8-9-1070 MACHINE ELECTRICAL COMPONENTS

A—Fuel Gauge Sender	D—Rear PTO Switch	F—Neutral Start Switch	I—Tail Lamps
B—Seat Safety Switch	E—Park Brake Indicator Switch	G—Battery	J—Work Lamp (Optional)
C—Mid PTO Switch		H—Head Lamps	K—Warning Lamp

Slide No. 74

MX,24005DG,A6 -19-25SEP89

ELECTRICAL THEORY OF OPERATION INFORMATION

This Group divides the electrical system into individual circuits by function. Each circuit has been isolated from the main wiring schematic and only shows the components that are used in that circuit. The theory of operation story explains: Function of the circuit, operation conditions, component used, and current flow.

The circuit schematic that accompanies each theory story is drawn in the operating condition with the battery or power circuit on top and the ground circuit on the bottom. Color is used to identify different sub-circuits. The color used is not necessarily the color of the wire lead. The slide number reference under the art is used for service training purposes to match a specific piece of technical manual art to the same slide.

WIRE COLOR CODE

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

Blk/Blu	Black/Blue
Blk/Red	Black/Red
Blk/Yel	Black/Yellow
Blu/Yel	Blue/Yellow
Dk Brn/Lt Grn	Dark Brown/Light Green
Dk Brn/Red	Dark Brown/Red
Dk Brn/Yel	Dark Brown/Yellow
Dk Blu	Dark Blue
Dk Grn	Dark Green
Grn/Blu	Green/Blue
Grn/Red	Green/Red
Grn/Yel	Green/Yellow
Grn/Wht	Green/White
Pur/Wht	Purple/White
Red/Blk	Red/Black
Red/Blu	Red/Blue
Red/Grn	Red/Green
Red/Yel	Red/Yellow
Red/Wht	Red/White
Wht/Blk	White/Black
Wht/Blu	White/Blue
Wht/Red	White/Red
Yel/Blu	Yellow/Blue
Yel/Red	Yellow/Red
Yel/Wht	Yellow/White

CRANKING SYSTEM —(OLD VERSION)

“ENDING” SERIAL NUMBERS

- 670—670A104012
- 670 European Version—670A101145
- 770—770A105926
- 870—870A101860
- 870—870B103794
- 970—970A101517
- 970—970B103214
- 1070—1070A103813

FUNCTION: To energize the Starter Motor providing the following criteria is met.

1. Mid and Rear PTO are ”OFF”
2. Transmission is in ”NEUTRAL”

MAJOR COMPONENTS:

Mid PTO Switch
Rear PTO Switch
Transmission Neutral Switch
Starter
Key Switch
Neutral Start Relay
Time Delay Control Module (TDCM)

THEORY:

(L) Power Circuit: Provides power to the Key Switch and also to the Starter Motor after the Starter Solenoid has been engaged.

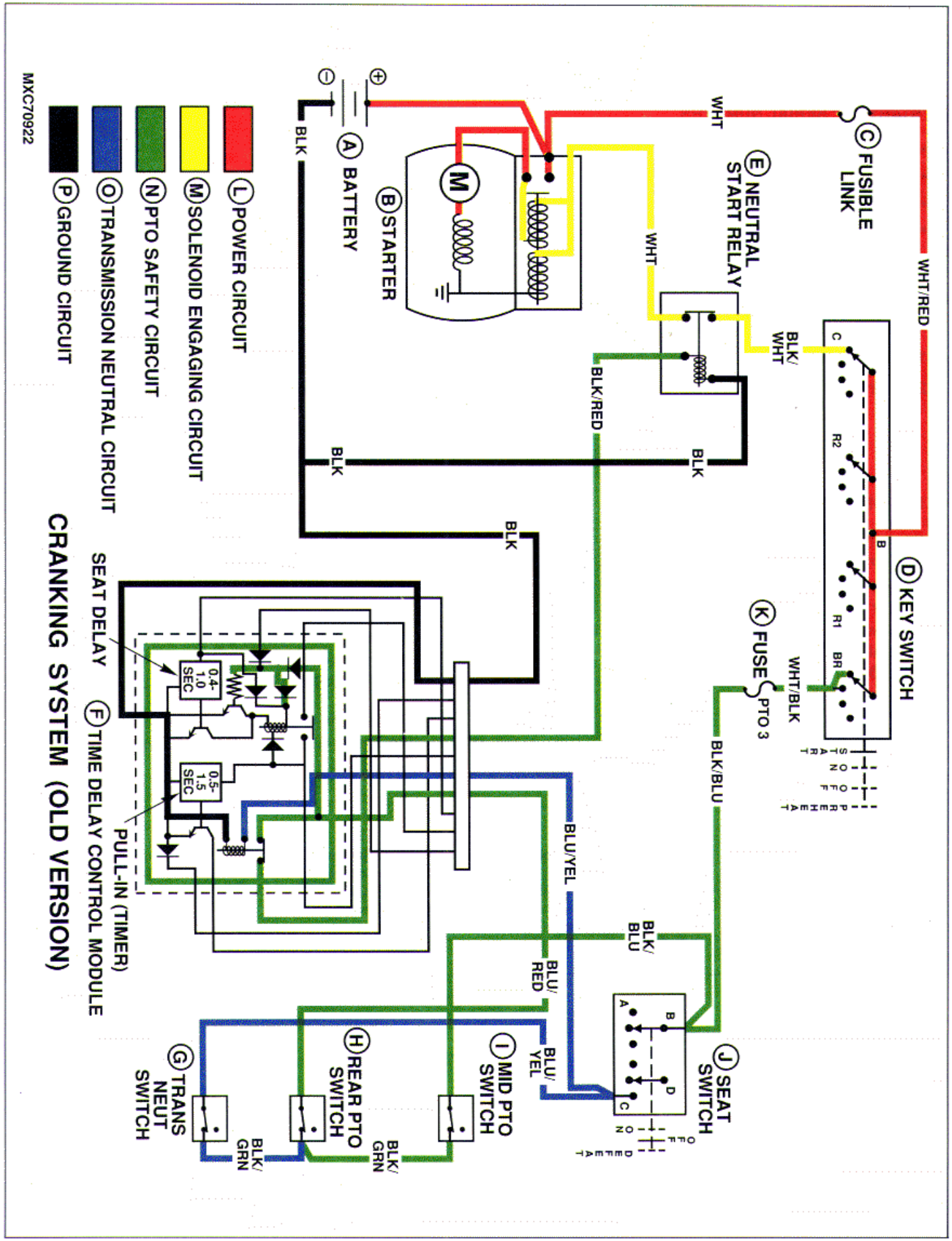
(M) Solenoid Engagement Circuit: Energizes the Starter Solenoid providing the Neutral Start Relay has been closed.

(N) PTO Safety Circuit: Requires both PTO switches to be off (both PTO’s off) before routing current through the Time Delay Control Module (TDCM) to close the Neutral Start Relay.

(O) Transmission Neutral Circuit: Requires the Transmission Neutral Switch to be closed (transmission in Neutral) before closing the hold-in relay in the TDCM that allows the PTO Safety Circuit to function.

(P) Ground Circuit: Provides a path to ground for the Transmission Neutral Circuit and PTO Safety Circuit.

A-Battery
B-Starter
C-Fusible Link
D-Key Switch
E-Neutral Start Relay
F-Time Delay Control Module
G-Transmission Neutral Switch
H-Rear PTO Switch
I-Mid PTO Switch
J-Seat Switch
K-Fuse (PTO)
L-Power Circuit
M-Solenoid Engaging Circuit
N-PTO Safety Circuit
O-Transmission Neutral Circuit
P-Ground Circuit


CRANKING SYSTEM (OLD VERSION)
MXC70922
L POWER CIRCUIT
M SOLENOID ENGAGING CIRCUIT
N PTO SAFETY CIRCUIT
O TRANSMISSION NEUTRAL CIRCUIT
P GROUND CIRCUIT
A BATTERY
B STARTER
C FUSIBLE LINK
D KEY SWITCH
E NEUTRAL START RELAY
F TIME DELAY CONTROL MODULE
G TRANS NEUT SWITCH
H REAR PTO SWITCH
I MID PTO SWITCH
J SEAT SWITCH
K FUSE
PTO 3
SEAT DELAY
PULL-IN (TIMER)
0.4-1.0 SEC
0.5-1.5 SEC
WHT/RED
WHT
BLK
BLK/WHT
BLK/RED
BLK/BLU
BLU/YEL
BLU/RED
BLK/GRN
WHT/BLK
START
ON
OFF
PREHEAT
R1
R2
BR
B
C
A
D

CRANKING SYSTEM —(NEW VERSION)

“STARTING” SERIAL NUMBERS

- •670—670A104013
- •670 European Version—670A101146
- •770—770A105927
- •790—All
- •870—870A101861
- •870—870B103795
- •970—970A101518
- •970—970B103215
- •1070—1070A103814

FUNCTION: To energize the starter motor providing the following criteria is met.

•Mid and Rear PTO are “OFF”.

•Transmission is in “Neutral”.

MAJOR COMPONENTS:

Mid PTO Switch
Rear PTO Switch
Transmission Neutral Switch
Starter
Key Switch
Neutral Start Relay
Time Delay Control Module (TDCM)

THEORY:

(L) Power Circuit: Provides power to the Key Switch and also to the Starter Motor after the Starter Solenoid has been engaged.

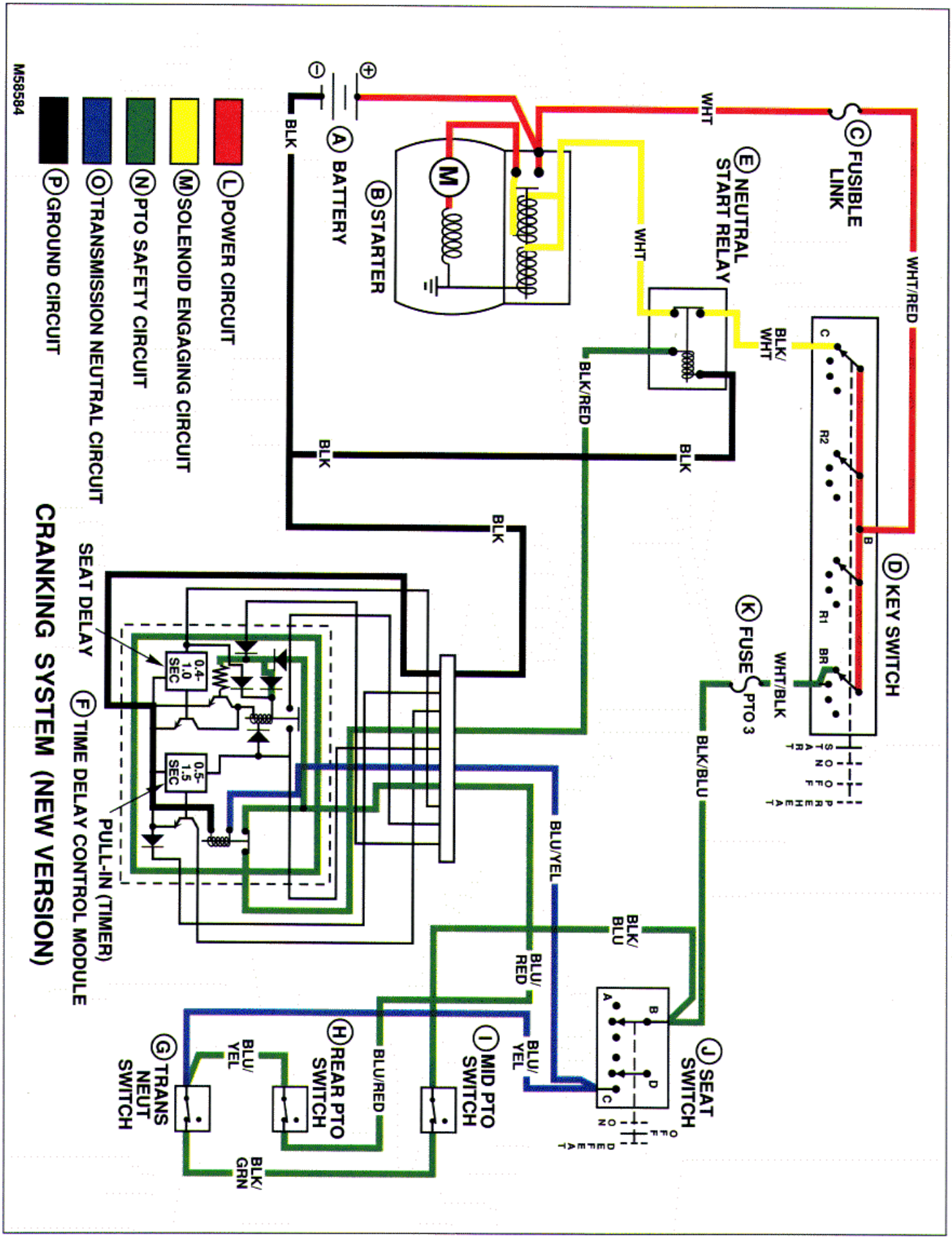
(M) Solenoid Engagement Circuit: Energizes the Starter Solenoid providing the Neutral Start Relay has been closed.

(N) PTO Safety Circuit: Requires both PTO switches to be off (both PTO’s off) before routing current through the Time Delay Control Module (TDCM) to close the Neutral Start Relay.

(O) Transmission Neutral Circuit: Requires the Transmission Neutral Switch to be closed before closing the hold-in relay in the TDCM that allows the PTO Safety Circuit to function.

(P) Ground Circuit: Provides a path to ground for the transmission Neutral Circuit and PTO Safety Circuit.

A—Battery
B—Starter
C—Fusible Link
D—Key Switch
E—Neutral Start Relay
F—Time Delay Control Module
G—Transmission Neutral Switch
H—Rear PTO Switch
I—Mid PTO Switch
J—Seat Switch
K—Fuse (PTO)
L—Power Circuit
M—Solenoid Engaging Circuit
N—PTO Safety Circuit
O—Transmission Neutral Circuit
P—Ground Circuit


CRANKING SYSTEM (NEW VERSION)
M58584
L POWER CIRCUIT
M SOLENOID ENGAGING CIRCUIT
N PTO SAFETY CIRCUIT
O TRANSMISSION NEUTRAL CIRCUIT
P GROUND CIRCUIT
A BATTERY
B STARTER
C FUSIBLE LINK
D KEY SWITCH
E NEUTRAL START RELAY
F TIME DELAY CONTROL MODULE
G TRANS NEUT SWITCH
H REAR PTO SWITCH
I MID PTO SWITCH
J SEAT SWITCH
K FUSE
PTO 3
SEAT DELAY
PULL-IN (TIMER)
0.4-1.0 SEC
0.5-1.5 SEC
WHT/RED
WHT
BLK
BLK/WHT
BLK/RED
WHT/BLK
BLK/BLU
BLU/YEL
BLU/RED
BLK/GRN
BLU/YEL
START
OPERATE
OFF
NO
NEED
SEAT

FUEL SHUT-OFF PULL-IN SYSTEM —(OLD VERSION)

“ENDING” SERIAL NUMBERS

- 670—670A104012
- 670 European Version—670A101145
- 770—770A105926
- 870—870A101860
- 870—870B103794
- 970—970A101517
- 970—970B103214
- 1070—1070A103813

FUNCTION: To energize the Fuel Shut-Off Solenoid pull- in winding, which releases the injection pump linkage from the shut-off position. To accomplish this the following criteria must be met.

- Operator must be “ON” seat

or

- both the Mid PTO and Rear PTO are “OFF”.

MAJOR COMPONENTS:

Key Switch
Fuel Shut-Off Pull-In Coil Relay
Fuel Shut-Off Solenoid
Time Delay Control Module (TDCM)
Seat Switch
Mid PTO Switch
Rear PTO Switch

THEORY:

(L) Power Circuit: Provides power to the Key Switch.

(M) Fuel Shut-Off Relay Circuit: Closes the Fuel Shut-Off Pull-In Coil Relay.

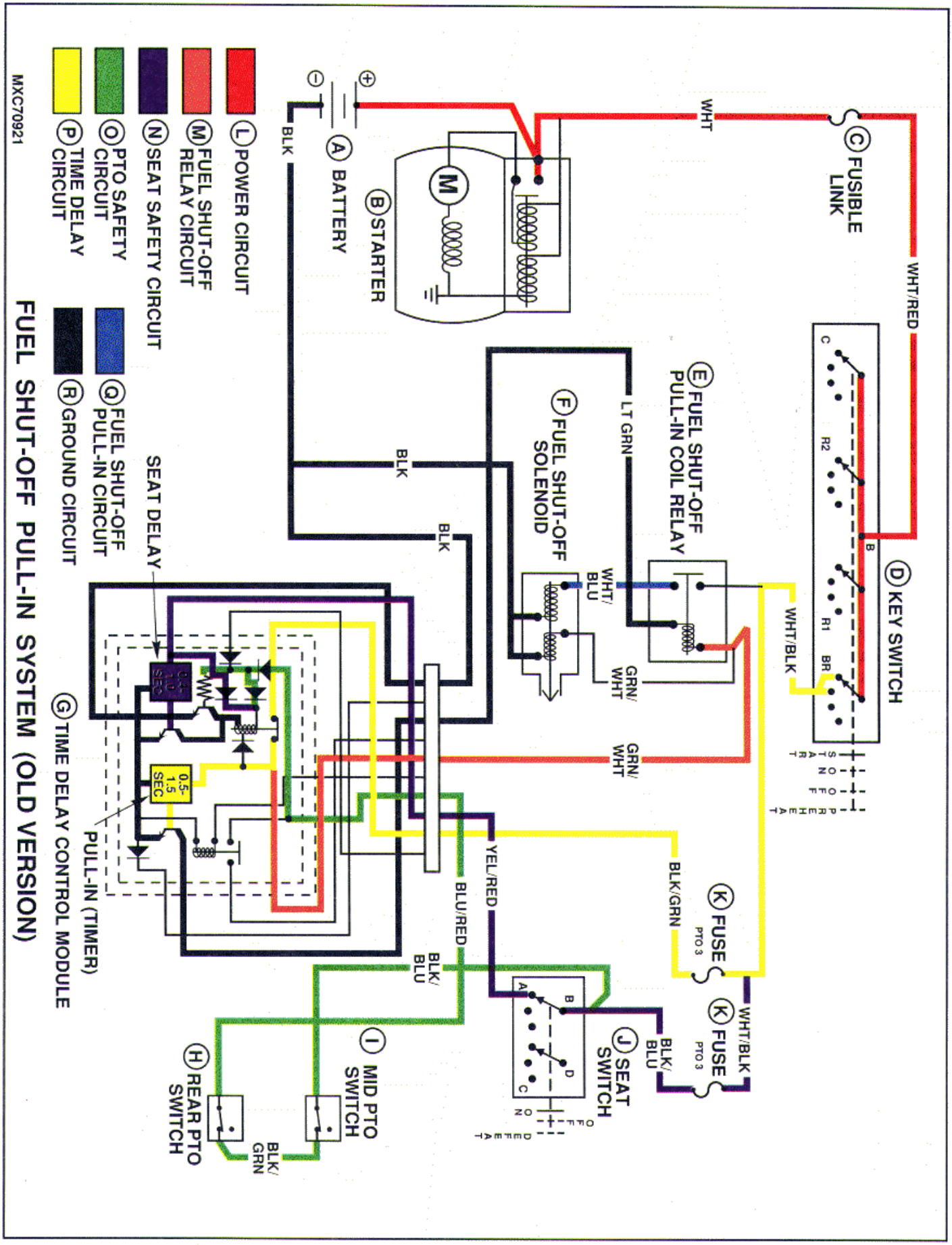
(N) Seat Safety Circuit: Whether or not the operator is “ON” or “OFF” the seat, this circuit provides a current path to the PTO Safety Circuit. Unlike the “NEW” version, if both PTO’s are “OFF”, the “OLD” version will allow the operator to be “OFF” the seat without stopping fuel flow to the engine.

(P) Time Delay Circuit: Provides a path to ground through the TDCM for the Fuel Shut-Off Relay Circuit. This Time Delay Circuit will operate for only 0.5—1.5 seconds after the key is turned on.

(Q) Fuel Shut-Off Pull-In Circuit: Energizes the Fuel Shut-Off Solenoid pull-in winding for as long as the Fuel Shut-Off Pull-In Coil Relay is closed.

(R) Ground Circuits: Provide a path to ground for the Fuel Shut-Off Pull-In Coil Relay, Fuel Shut-Off Solenoid, Time Delay Circuit, PTO Safety Circuit and Seat Safety Circuit.

A-Battery
B-Starter
C-Fusible Link
D-Key Switch
E-Fuel Shut-Off Pull-In Coil Relay
F-Fuel Shut-Off Solenoid
G-Time Delay Control Module
H-Rear PTO Switch
I-Mid PTO Switch
J-Seat Switch
K-Fuse
L-Power Circuit
M-Fuel Shut-Off Relay Circuit
N-Seat Switch Circuit
O-PTO Safety Circuit
P-Time Delay Circuit
Q-Fuel Shut-Off Pull-In Circuit
R-Ground Circuit


FUEL SHUT-OFF PULL-IN SYSTEM (OLD VERSION)
MXC7921
L POWER CIRCUIT
M FUEL SHUT-OFF RELAY CIRCUIT
N SEAT SAFETY CIRCUIT
O PTO SAFETY CIRCUIT
P TIME DELAY CIRCUIT
Q FUEL SHUT-OFF PULL-IN CIRCUIT
R GROUND CIRCUIT
A BATTERY
B STARTER
C FUSIBLE LINK
D KEY SWITCH
E FUEL SHUT-OFF PULL-IN COIL RELAY
F FUEL SHUT-OFF SOLENOID
G TIME DELAY CONTROL MODULE
H REAR PTO SWITCH
I MID PTO SWITCH
J SEAT SWITCH
K FUSE PTO 3
SEAT DELAY
PULL-IN (TIMER)
0.5-1.5 SEC
0.5-1.0 SEC
WHT
WHT/RED
BLK
LT GRN
WHT/BLU
GRN/WHT
WHT/BLK
BLK/GRN
YEL/RED
BLU/RED
BLK/BLU
BLK/GRN
START
RUN
OFF
ON
PTO

FUEL SHUT-OFF PULL-IN SYSTEM —(NEW VERSION)

“STARTING” SERIAL NUMBERS

- •670—670A104013
- •670 European Version—670A101146
- •770—770A105927
- •790—All
- •870—870A101861
- •870—870B103795
- •970—970A101518
- •970—970B103215
- •1070—1070A103814

FUNCTION: To energize the Fuel Shut-Off Pull-In Coil Relay, which in turn energizes the Fuel Shut-Off Solenoid Pull-In Circuit which releases the injection pump linkage from the shutoff position. To accomplish this, the following criteria must be met.

•Operator must be “ON” seat

or

•both the Mid PTO and Rear PTO are “OFF” **and** the transmission is in “NEUTRAL”.

MAJOR COMPONENTS:
Key Switch
Fuel Shut-Off Pull-In Coil Relay
Fuel Shut-Off Solenoid
Time Delay Control Module (TDCM)
Seat Switch
Mid PTO Switch
Rear PTO Switch

THEORY:

(L) Power Circuit: Provides power to the Key Switch.

(M) Fuel Shut-Off Relay Circuit: Closes Fuel Shut-Off Pull-In Coil Relay.

(N) Seat Safety Circuit: Whether or not the operator is “ON” or “OFF” the seat, this circuit provides a current path to the PTO Safety Circuit. Unlike the “OLD” version, if both PTO’s are “OFF” and the transmission is in gear, when the operator lifts up “OFF” the seat, the “NEW” version “will” stop fuel flow (0.4—1.0 seconds later) to the engine.

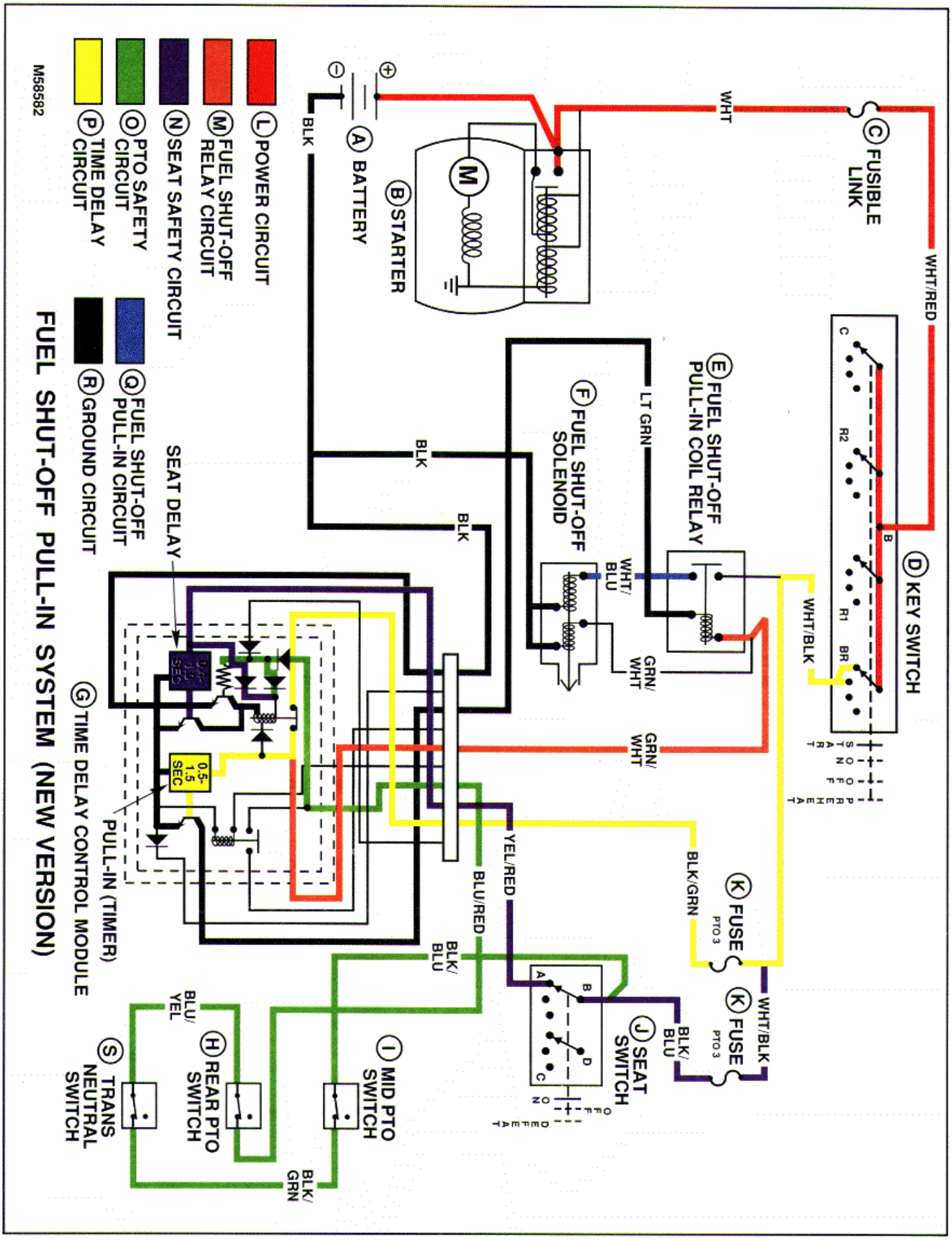
(O) PTO Safety Circuit: If the operator is “OFF” the seat, this circuit ensures that the Mid PTO must be “OFF” (switch closed) and the transmission is in “NEUTRAL” (switch closed) before closing a path to the TDCM time delay circuit (P).

(P) Time Delay Circuit: Provides a path to ground through the TDCM for the Fuel Shut-Off Relay Circuit. This Time Delay Circuit will operate for only 0.5—1.5 seconds after the key is turned on.

(Q) Fuel Shut-Off Pull-In Circuit: Energizes the Fuel Shut-Off Solenoid pull-in winding for as long as the Fuel Shut-Off Pull-In Coil Relay is closed.

(R) Ground circuits: Provide a path to ground for the Fuel Shut-Off Pull-In Coil Relay, Fuel Shut-Off Solenoid, Time Delay Circuit, PTO Safety Circuit and Seat Safety Circuit.

A—Battery
B—Starter
C—Fusible Link
D—Key Switch
E—Fuel Shut-Off Pull-In Coil Relay
F—Fuel Shut-Off Solenoid
G—Time Delay Control Module
H—Rear PTO Switch
I—Mid PTO Switch
J—Seat Switch
K—Fuse
L—Power Circuit
M—Fuel Shut-Off Pull-In Coil Circuit
N—Seat Switch Circuit
O—PTO Safety Circuit
P—Time Delay Circuit
Q—Fuel Shut-Off Pull-In Circuit
R—Ground Circuit
S—Ground Circuit


FUEL SHUT-OFF PULL-IN SYSTEM (NEW VERSION)
M58582
L POWER CIRCUIT
M FUEL SHUT-OFF RELAY CIRCUIT
N SEAT SAFETY CIRCUIT
O PTO SAFETY CIRCUIT
P TIME DELAY CIRCUIT
Q FUEL SHUT-OFF PULL-IN CIRCUIT
R GROUND CIRCUIT
A BATTERY
B STARTER
C FUSIBLE LINK
D KEY SWITCH
E FUEL SHUT-OFF PULL-IN COIL RELAY
F FUEL SHUT-OFF SOLENOID
G TIME DELAY CONTROL MODULE
H REAR PTO SWITCH
I MID PTO SWITCH
J SEAT SWITCH
K FUSE
S TRANS NEUTRAL SWITCH
SEAT DELAY
PULL-IN (TIMER)
0.4-1.5 SEC
0.5-1.5 SEC
WHT
WHT/RED
BLK
LT GRN
WHT/BLU
GRN/WHT
WHT/BLK
BLK/GRN
YEL/RED
BLU/RED
BLK/BLU
BLU/YEL
BLK/GRN
PTO 3
OFF
ON
START

FUEL SHUT-OFF HOLD-IN SYSTEM —(OLD VERSION)

“ENDING” SERIAL NUMBERS

- 670—670A104012
- 670 European Version—670A101145
- 770—770A105926
- 870—870A101860
- 870—870B103794
- 970—970A101517
- 970—970B103214
- 1070—1070A103813

FUNCTION: To energize the Fuel-Shut-Off Solenoid which keeps the injection pump linkage in such a position to maintain fuel flow to the engine. To accomplish this, the following criteria must be met.

- Operator must be “ON” seat

or

- both the Mid PTO and Rear PTO are “OFF”.

MAJOR COMPONENTS:

Fuel Shut-Off Pull-In Coil Relay
Fuel Shut-Off Solenoid
Time Delay Control Module (TDCM)
Seat Switch
Mid PTO Switch
Rear PTO Switch

THEORY:

(L) Power Circuit: Provides power to the Key Switch.

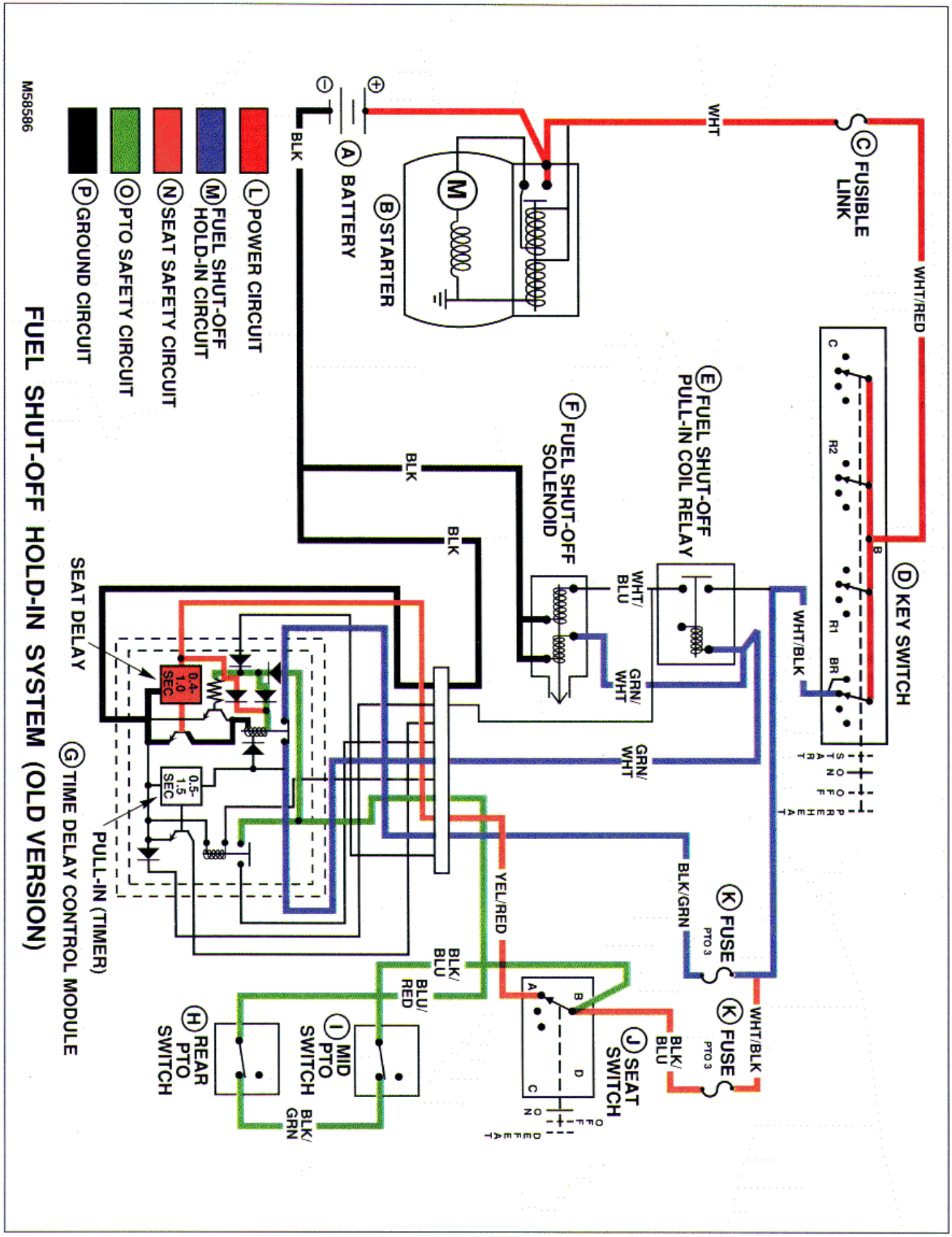
(M) Fuel Shut-Off Hold-In Circuit: If the hold-in relay located in the Time Delay Control Module (TDCM) is closed, this circuit energizes the Fuel Shut-Off Pull-In Coil Relay and Fuel Shut-Off Solenoid hold-in windings. This in turn positions the injection pump linkage such that fuel flow to the engine is maintained.

(N) Seat Safety Circuit: Whether or not the operator is “ON” or “OFF” the seat, this circuit provides a current path to the PTO Safety Circuit. Unlike the “NEW” version, if both PTO’s are “OFF”, the “OLD” version will allow the operator to be “OFF” the seat without stopping fuel flow to the engine.

(O) PTO Safety Circuit: With both PTO’s “OFF” (Key Switch in the “START” or “ON” position), this circuit constantly energizes the TDCM hold-in relay.

(P) Ground Circuit: Provides a path to ground for the Fuel Shut-Off and Seat Safety Circuits.

A-Battery
B-Starter
C-Fusible Link
D-Key Switch
E-Fuel Shut-Off Pull-In Coil Relay
F-Fuel Shut-Off Solenoid
G-Time Delay Control Module
H-Rear PTO Switch
I-Mid PTO Switch
J-Seat Switch
K-Fuse
L-Power Circuit
M-Fuel Shut-Off Solenoid Pull-In Circuit
N-Seat Safety Circuit
O-PTO Safety Circuit
P-Ground Circuit


FUEL SHUT-OFF HOLD-IN SYSTEM (OLD VERSION)
M58586
(L) POWER CIRCUIT
(M) FUEL SHUT-OFF HOLD-IN CIRCUIT
(N) SEAT SAFETY CIRCUIT
(O) PTO SAFETY CIRCUIT
(P) GROUND CIRCUIT
(A) BATTERY
(B) STARTER
(C) FUSIBLE LINK
(D) KEY SWITCH
(E) FUEL SHUT-OFF PULL-IN COIL RELAY
(F) FUEL SHUT-OFF SOLENOID
(G) TIME DELAY CONTROL MODULE
(H) REAR PTO SWITCH
(I) MID PTO SWITCH
(J) SEAT SWITCH
(K) FUSE PTO 3
(K) FUSE PTO 3
SEAT DELAY
PULL-IN (TIMER)
0.4-1.0 SEC
0.5-1.5 SEC
WHT
WHT/RED
BLK
BLK
BLK
WHT/BLU
GRN/WHT
GRN/WHT
WHT/BLK
BLK/GRN
YEL/RED
BLK/BLU
BLU/RED
BLK/GRN
BLK/BLU
WHT/BLK
START
ACC
OFF
R1
R2
B
BR
C
A
B
C
D
NO
OFF
ACC
START

FUEL SHUT-OFF HOLD-IN SYSTEM —(NEW VERSION)

“STARTING” SERIAL NUMBERS

- •670—670A104013
- •670 European Version—670A101146
- •770—770A105927
- •790—All
- •870—870A101861
- •870—870B103795
- •970—970A101518
- •970—970B103215
- •1070—1070A103814

FUNCTION: To energize the Fuel Shut-Off Pull-In Coil Relay, which in turn energizes the Fuel Shut-Off Solenoid Pull-In Circuit which releases the injection pump linkage from the shutoff position. To accomplish this, the following criteria must be met.

•Operator must be “ON” seat

or

•both the Mid PTO and Rear PTO are “OFF” **and** the transmission is in “NEUTRAL”.

MAJOR COMPONENTS:
Key Switch
Fuel Shut-Off Pull-In Coil Relay
Fuel Shut-Off Solenoid
Time Delay Control Module (TDCM)
Seat Switch
Mid PTO Switch
Rear PTO Switch

THEORY:

(L) Power Circuit: Provides power to the Key Switch.

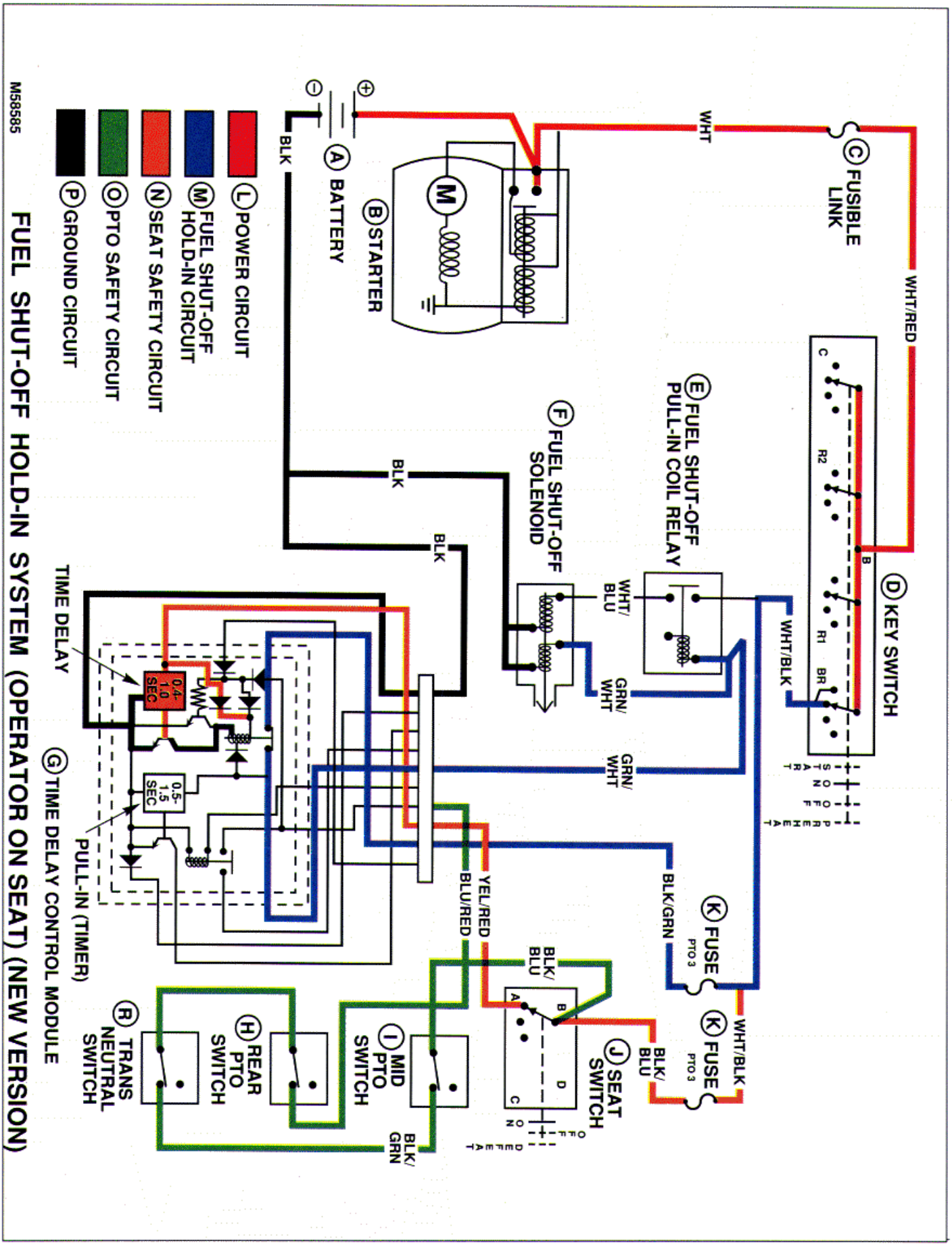
(M) Fuel Shut-Off Relay Circuit: If the hold-in relay located in the Time Delay Circuit (TDCM) is closed, this circuit energizes the Fuel Shut-Off Pull-In Coil Relay and Fuel Shut-Off Solenoid hold-in windings. This in turn positions the injection pump linkage such that fuel flow to the engine is maintained.

(N) Seat Safety Circuit: Whether or not the operator is “ON” or “OFF” the seat, this circuit provides a current path to the PTO Safety Circuit. Unlike the “OLD” version, if both PTO’s are “OFF” and the transmission is in gear, when the operator lifts up “OFF” the seat, the “NEW” version “will” stop fuel flow (0.4—1.0 seconds later) to the engine.

(O) PTO Safety Circuit: with both PTO’s “OFF” (Key Switch in the “START” or “ON” position), this circuit constantly energizes the TDCM hold-in relay.

(P) Ground Circuit: Provides a path to ground for the Fuel Shut-Off and Seat Safety Circuits.

A—Battery
B—Starter
C—Fusible Link
D—Key Switch
E—Fuel Shut-Off Pull-In Coil Relay
F—Fuel Shut-Off Solenoid
G—Time Delay Control Module
H—Rear PTO Switch
I—Mid PTO Switch
J—Seat Switch
K—Fuse
L—Power Circuit
M—Fuel Shut-Off Solenoid Pull-In Circuit
N—Seat Safety Circuit
O—PTO Safety Circuit
P—Ground Circuit
Q—Transmission Neutral Switch


M58585
FUEL SHUT-OFF HOLD-IN SYSTEM (OPERATOR ON SEAT) (NEW VERSION)
L POWER CIRCUIT
M FUEL SHUT-OFF HOLD-IN CIRCUIT
N SEAT SAFETY CIRCUIT
O PTO SAFETY CIRCUIT
P GROUND CIRCUIT
A BATTERY
B STARTER
C FUSIBLE LINK
D KEY SWITCH
E FUEL SHUT-OFF PULL-IN COIL RELAY
F FUEL SHUT-OFF SOLENOID
G TIME DELAY CONTROL MODULE
H REAR PTO SWITCH
I MID PTO SWITCH
J SEAT SWITCH
K FUSE PTO 3
R TRANS NEUTRAL SWITCH
TIME DELAY
PULL-IN (TIMER)
0.4-1.0 SEC
0.5-1.5 SEC
WHT
WHT/RED
BLK
WHT/BLK
WHT/BLU
GRN/WHT
BLK/GRN
YEL/RED
BLU/RED
BLK/BLU
BLK/GRN
C
R2
B
R1
BR
A
D
NO
OFF

FUEL SHUT-OFF HOLD-IN SYSTEM (OVERRIDE POSITION) —(OLD VERSION)

“ENDING” SERIAL NUMBERS

- 670—670A104012
- 670 European Version—670A101145
- 770—770A105926
- 870—870A101860
- 870—870B103794
- 970—970A101517
- 970—970B103214
- 1070—1070A103813

FUNCTION: To maintain current to the Fuel Shut-Off Hold-In Circuit which keeps the injection pump linkage in such a position to maintain fuel flow to the engine. This system allows the operator to be “OFF” the seat with the engine running providing the following criteria are met.

- Seat Switch is in the “DEFEAT” position.
- Mid PTO is “OFF”.
- Transmission in “NEUTRAL”.

MAJOR COMPONENTS:

Key Switch
Fuel Shut-Off Pull-In Coil Relay
Fuel Shut-Off Solenoid
Seat Switch
Mid PTO Switch
Time Delay Control Module (TDCM)
Transmission Neutral Switch

THEORY:

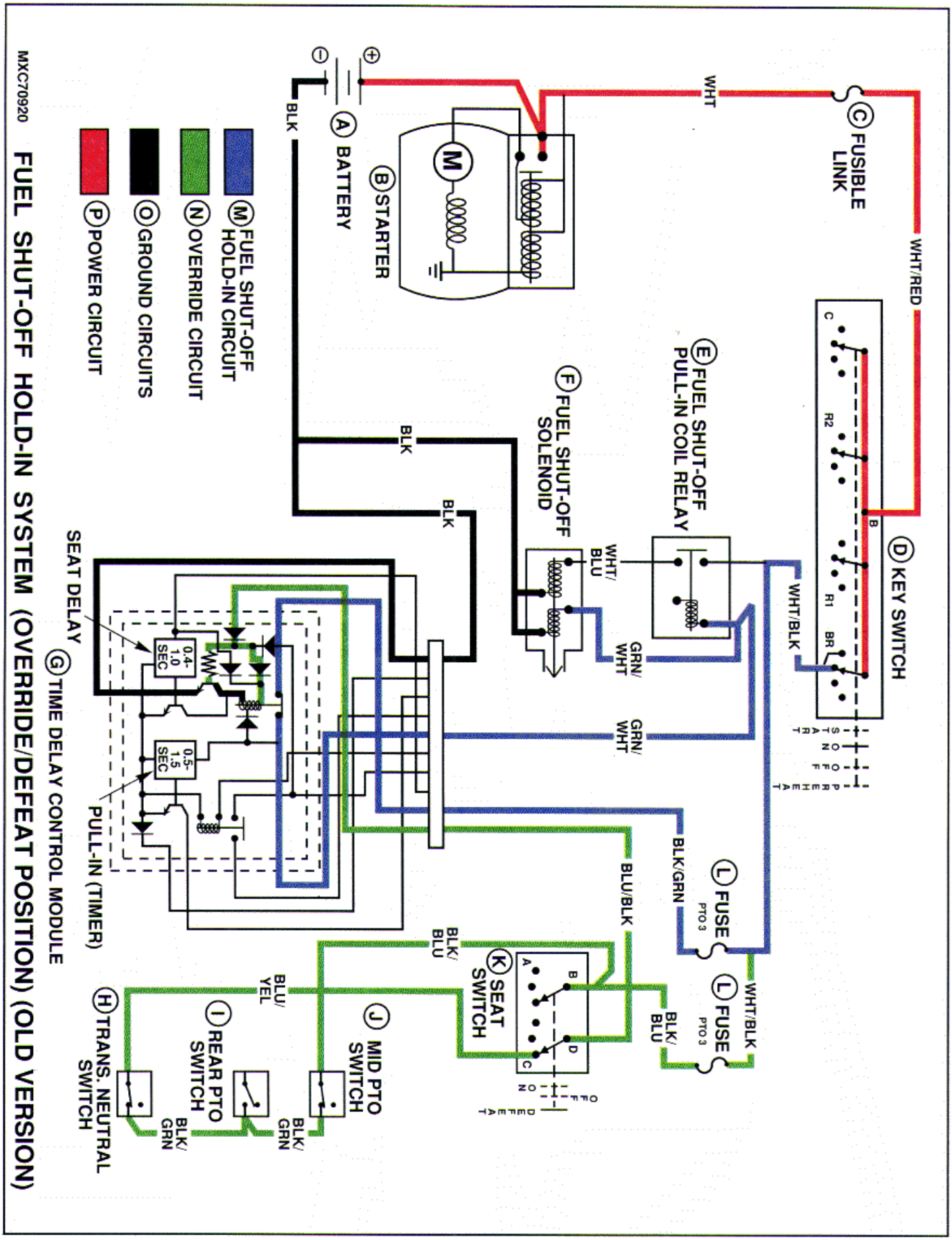
(P) Power Circuit: Provides power to the Key Switch.

((M) Fuel Shut-Off Hold-In Circuit: If the hold-in relay located in the Time Delay Control Module (TDCM) is closed, this circuit energizes the Fuel Shut-Off Pull-In Coil Relay and Fuel Shut-Off Solenoid hold-in windings. This in turn positions the injection pump linkage such that fuel flow to the engine is maintained.

(N) Override Circuit: Closes the hold-in relay located in the TDCM as long as the Seat Switch is in the “DEFEAT” position, the Mid PTO is “OFF” (Rear PTO can be on), and the Transmission is in “NEUTRAL”.

(O) Ground Circuit: Provides a path to ground for the Fuel Shut-Off Solenoid and the Override Circuit.

A-Battery
B-Starter
C-Fusible Link
D-Key Switch
E-Fuel Shut-Off Pull-In Coil Relay
F-Fuel Shut-Off Solenoid
G-Time Delay Control Module
H-Transmission Neutral Switch
I-Rear PTO Switch
J-Mid PTO Switch
K-Seat Switch
L-Fuse
M-Fuel Shut-Off Solenoid
N-Override Circuit
O-Ground Circuit
P-Power Circuit
Hold-In Circuit


MXC70920
FUEL SHUT-OFF HOLD-IN SYSTEM (OVERRIDE/DEFEAT POSITION) (OLD VERSION)
(A) BATTERY
(B) STARTER
(C) FUSIBLE LINK
(D) KEY SWITCH
(E) FUEL SHUT-OFF PULL-IN COIL RELAY
(F) FUEL SHUT-OFF SOLENOID
(G) TIME DELAY CONTROL MODULE
(H) TRANS. NEUTRAL SWITCH
(I) REAR PTO SWITCH
(J) MID PTO SWITCH
(K) SEAT SWITCH
(L) FUSE PTO 3
(M) FUEL SHUT-OFF HOLD-IN CIRCUIT
(N) OVERRIDE CIRCUIT
(O) GROUND CIRCUITS
(P) POWER CIRCUIT
SEAT DELAY
PULL-IN (TIMER)
0.4-1.0 SEC
0.5-1.5 SEC
WHT
WHT/RED
WHT/BLK
BLK
GRN/WHT
WHT/BLU
BLK/GRN
BLU/BLK
BLK/BLU
BLU/YEL
BLK/GRN
OFF
ON
DEFEAT
START
R1
R2
BR
A
B
C
D

FUEL SHUT-OFF HOLD-IN SYSTEM (OVERRIDE POSITION) —(NEW VERSION)

"STARTING" SERIAL NUMBERS

- •670—670A104013
- •670 European Version—670A101146
- •770—770A105927
- •790—All
- •870—870A101861
- •870—870B103795
- •970—970A101518
- •970—970B103215
- •1070—1070A103814

FUNCTION: To maintain current to the Fuel Shut-Off Hold-In Circuit which keeps the injection pump linkage in such a position to maintain fuel flow to the engine. This system allows the operator to be "OFF" the seat with the engine running providing the following criteria are met.

•Seat Switch is in the "DEFEAT" position.

•Mid PTO is "OFF".

•Transmission is in "NEUTRAL"

MAJOR COMPONENTS:
Key Switch
Fuel Shut-Off Pull-In Coil Relay
Fuel Shut-Off Solenoid
Seat Switch
Mid PTO Switch
Time Delay Control Module (TDCM)
Transmission Neutral Switch

THEORY:

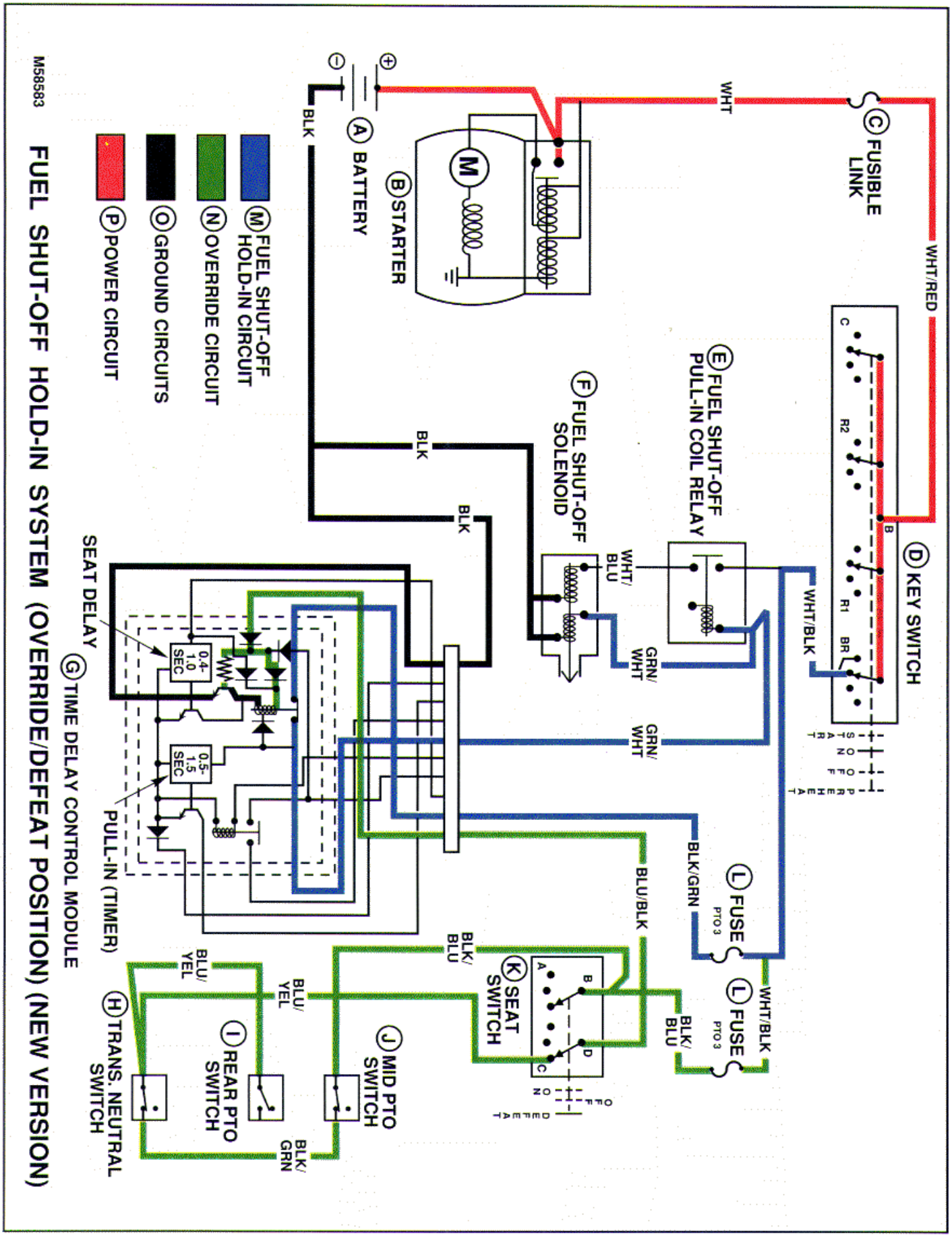
(P) Power Circuit: Provides power to the Key Switch.

(M) Fuel Shut-Off Relay Circuit: If the hold-in relay located in the Time Delay Circuit (TDCM) is closed, this circuit energizes the Fuel Shut-Off Pull-In Coil Relay and Fuel Shut-Off Solenoid hold-in windings. This in turn positions the injection pump linkage such that fuel flow to the engine is maintained.

(N) Override Circuit: Closes the hold-in relay located in the TDCM as long as the Seat Switch is in the "DEFEAT" position, the Mid PTO is "OFF" (Rear PTO can be on), and the Transmission is in "Neutral".

(O) Ground Circuit: Provides a path to ground for the Fuel Shut-Off Solenoid and the override circuit.

A—Battery
B—Starter
C—Fusible Link
D—Key Switch
E—Fuel Shut-Off Pull-In Coil Relay
F—Fuel Shut-Off Solenoid
G—Time Delay Control Module
H—Transmission Neutral Start Switch
I—Rear PTO Switch
J—Mid PTO Switch
K—Seat Switch
L—Fuse
M—Fuel Shut-Off Hold-In Circuit
N—Override Circuit
O—Ground Circuit
P—Power Circuit


FUEL SHUT-OFF HOLD-IN SYSTEM (OVERRIDE/DEFEAT POSITION) (NEW VERSION)
M58583
Ⓜ FUEL SHUT-OFF HOLD-IN CIRCUIT
Ⓝ OVERRIDE CIRCUIT
Ⓞ GROUND CIRCUITS
Ⓟ POWER CIRCUIT
Ⓐ BATTERY
Ⓑ STARTER
Ⓒ FUSIBLE LINK
Ⓓ KEY SWITCH
Ⓔ FUEL SHUT-OFF PULL-IN COIL RELAY
Ⓕ FUEL SHUT-OFF SOLENOID
Ⓖ TIME DELAY CONTROL MODULE
Ⓗ TRANS. NEUTRAL SWITCH
Ⓘ REAR PTO SWITCH
Ⓙ MID PTO SWITCH
Ⓚ SEAT SWITCH
Ⓛ FUSE PTO 3
WHT
WHT/RED
BLK
WHT/BLK
WHT/BLU
GRN/WHT
BLK/GRN
BLU/BLK
BLK/BLU
BLU/YEL
BLK/GRN
SEAT DELAY
PULL-IN (TIMER)
0.4-1.0 SEC
0.5-1.5 SEC
START
RUN
OFF
DEFEAT
ON

CHARGING SYSTEM

FUNCTION: To monitor system output and maintain the battery charge.

MAJOR COMPONENTS:

Key Switch
Charge Indicator Lamp
Alternator
Rectifier/Regulator
Battery

THEORY:

(I) Power Circuit: Provides power to the Key Switch.

(J) Stator AC Circuit: Provides alternating current produced by the alternator to the rectifier/regulator.

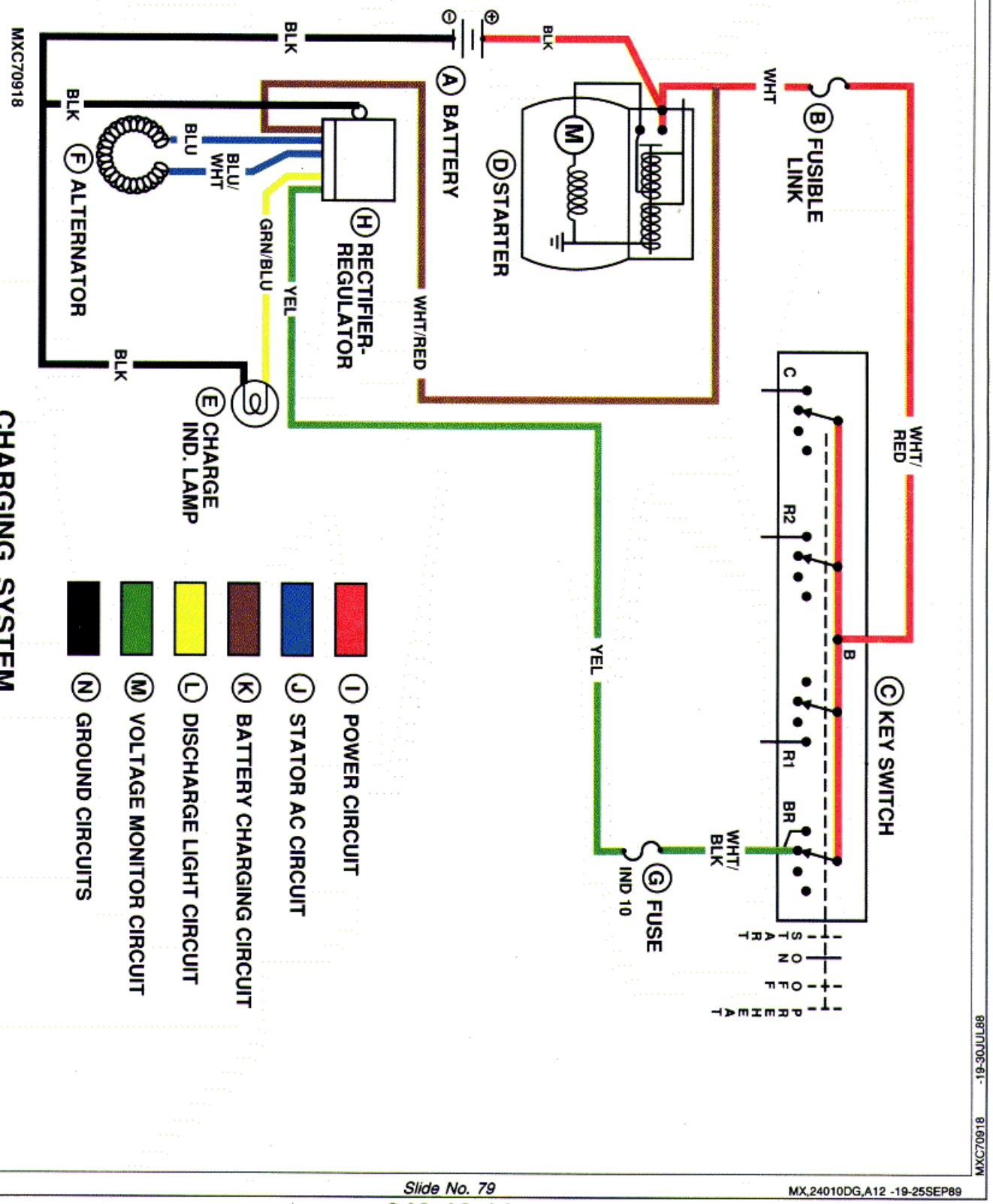
(K) Battery Charging Circuit: Provides charging current which has been converted to DC by the rectifier/regulator to the battery.

(L) Discharge Light Circuit: Receives current whenever the rectifier/regulator senses that the alternator is not putting out any current.

(M) Voltage Monitor Circuit: Monitors the battery voltage so that the rectifier/regulator can compare battery voltage to alternator output and control the amount of charge being sent to the battery.

(N) Ground Circuits: Provide a path to ground for the charge indicator lamp and rectifier/regulator.

L-Battery
M-Fusible Link
N-Key Switch
O-Starter
P-Charge Indicator Lamp
Q-Alternator
R-Fuse
S-Rectifier Regulator
T-Power Circuit
U-Stator AC Circuit
V-Battery Charging Circuit
W-Discharge Light Circuit
X-Voltage Monitor Circuit
Y-Ground Circuits


CHARGING SYSTEM
MXC70918
BLK
BLK
BLK
BLK
BLU
BLU/
WHT
GRN/BLU
YEL
WHT/RED
YEL
WHT
BLK
WHT/
RED
WHT/
BLK
R2
R1
BR
B
C
START
STOP
PREHEAT
Ⓐ BATTERY
Ⓑ FUSIBLE LINK
Ⓒ KEY SWITCH
Ⓓ STARTER
Ⓔ CHARGE IND. LAMP
Ⓕ ALTERNATOR
Ⓖ FUSE
IND 10
Ⓗ RECTIFIER-REGULATOR
Ⓘ POWER CIRCUIT
Ⓙ STATOR AC CIRCUIT
Ⓚ BATTERY CHARGING CIRCUIT
Ⓛ DISCHARGE LIGHT CIRCUIT
Ⓜ VOLTAGE MONITOR CIRCUIT
Ⓝ GROUND CIRCUITS
MXC70918 -19-30JUL88

GLOW PLUG SYSTEM

FUNCTION: To energize the 3 glow plugs that set in the precombustion chamber of the indirect injection engine. This allows the operator to heat that area for better cold weather starting.

MAJOR COMPONENTS:

Key Switch
Glow Plugs
Glow Plug Resistor

THEORY:

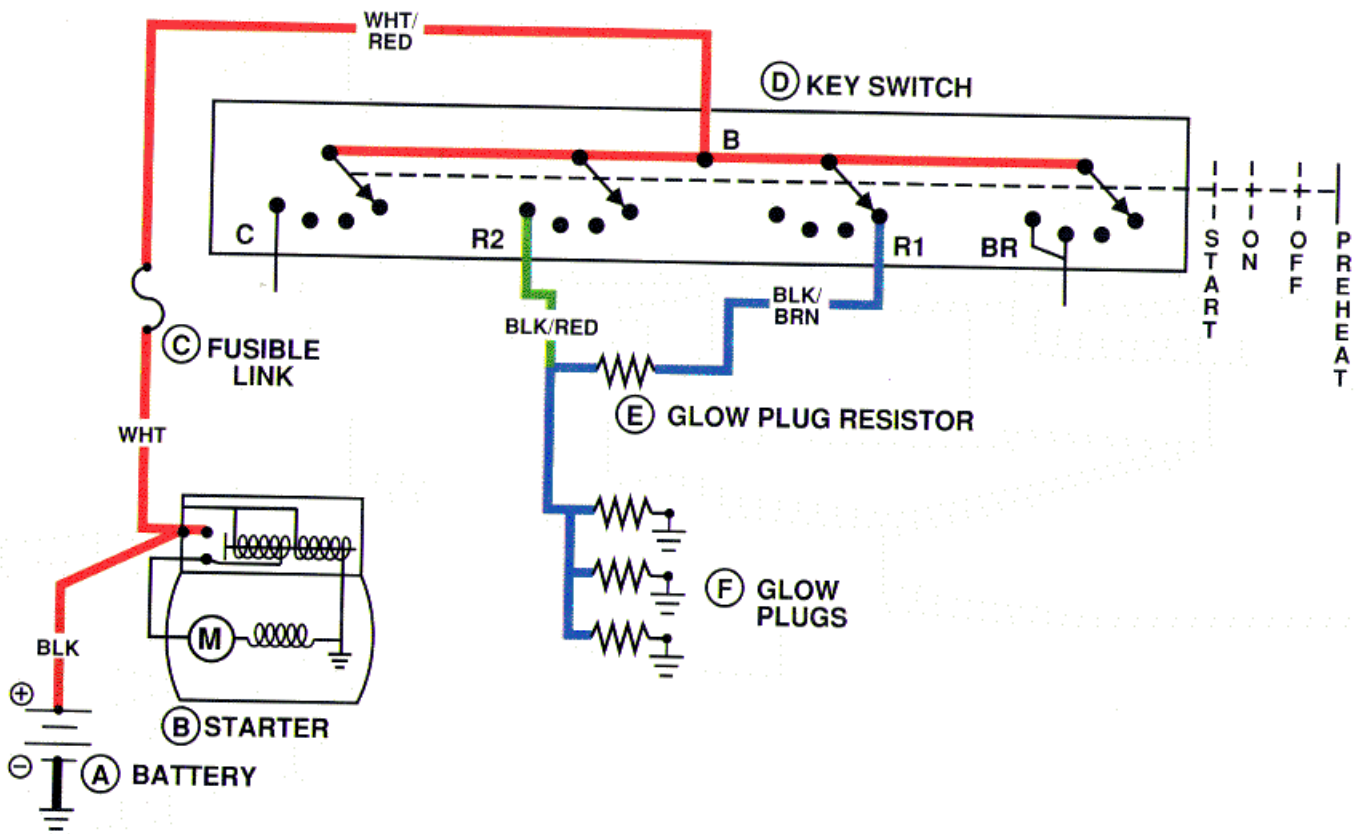
(G) Power Circuit: Provides power to the key switch.

(H) Glow Plug Circuit: (Preheat): If the operator holds the key in the preheat position battery current will flow across a resistor to the glow plugs. The resistor reduces current flow so that the glow plugs do not burn out if the key remains in the preheat position too long.

(I) Glow Plug Circuit (Start): During the time that the operator holds the key in the start position the glow plugs will again be energized. In this position the resistor is not used.

A—Battery
B—Starter
C—Fusible Link
D—Key Switch
E—Glow Plug Resistor
F—Glow Plugs
G—Power Circuit
H—Glow Plug Circuit (Pre-Heat)
I—Glow Plug Circuit (Start)

MX,24010DG,A13 -19-25SEP89



MXC70917

GLOW PLUG SYSTEM

AIR HEATER SYSTEM

FUNCTION: To energize the air heater that sets in the air intake manifold of the direct injection engine. This allows the operator to preheat incoming air for better cold weather starting.

MAJOR COMPONENTS:

Key Switch

Air Heater

THEORY:

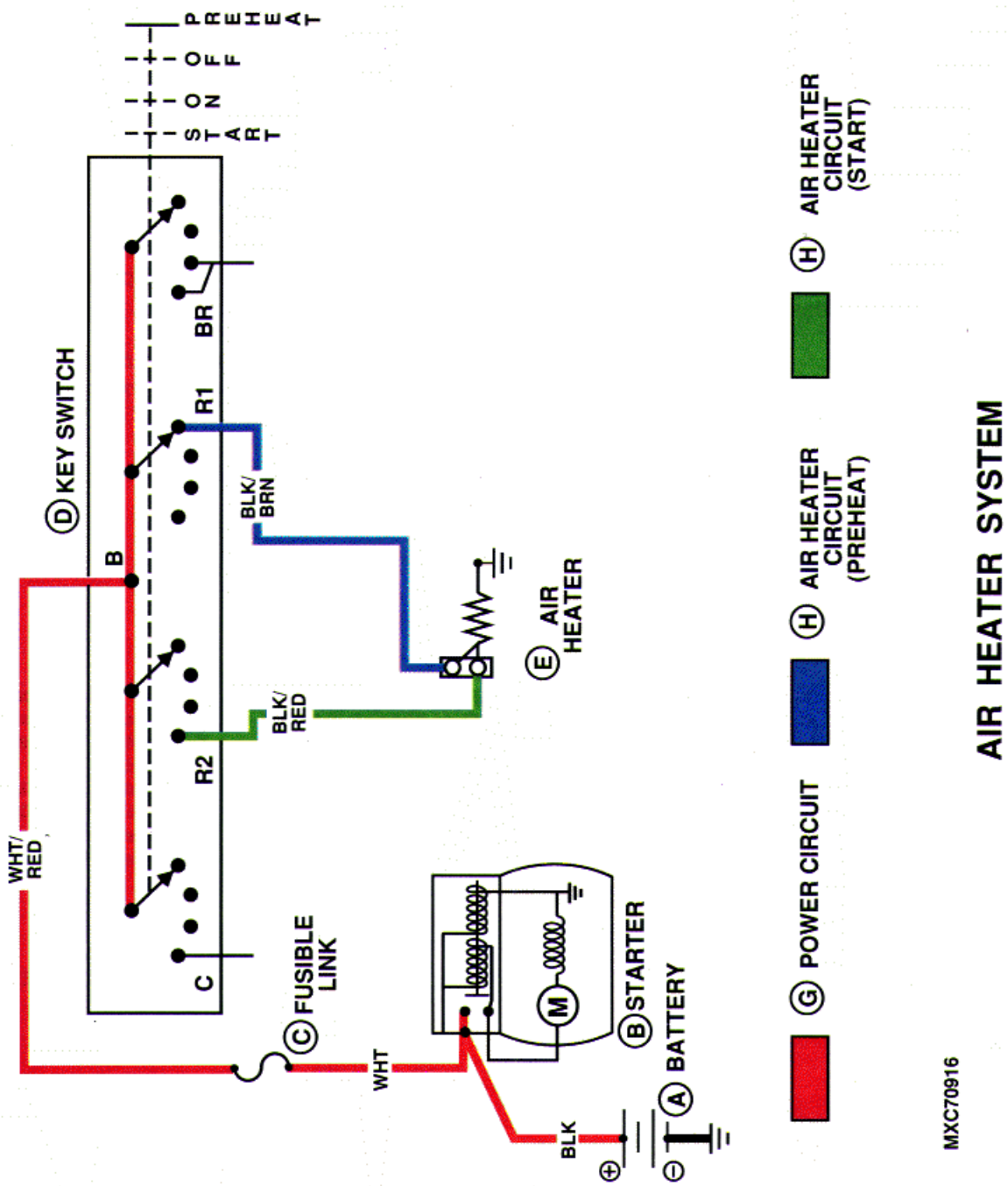
(F) Power Circuit: Provides power to the key switch.

(G) Air Heater Circuit (Pre-Heat): If the operator holds the key in the preheat position battery current flows to the air heater.

(H) Air Heater Circuit (Start): During the time that the operator holds the key in the start position the air heater will again be energized.

A—Battery
B—Starter
C—Fusible Link
D—Key Switch
E—Air Heater
F—Power Circuit
G—Air Heater Circuit (Pre-Heat)
H—Air Heater Circuit (Start)

MX,24010DG,A15 -19-25SEP89



MXC70916 -19-30JUL88

LIGHTING SYSTEM

FUNCTION: To provide power to the lights that operate off the light switch circuit.

MAJOR COMPONENTS:

Key Switch
Light Switch
Headlamps
Tail Lamps
Flood Lamps
Temperature Gauge Lamp
Fuel Gauge Lamp
Flood Lamps
Warning Lamp
Park Brake Indicator Lamp

THEORY:

(U) Power Circuit: Provides power to the key switch.

(V) Light Switch Circuit: Provides power to the light switch.

(W) Flood Lamp Circuit: Energizes the flood lamps with the light switch in the work position.

(X) Headlight and Dash Circuit: Energizes the head lamps, tail lamps, temperature gauge lamp, fuel gauge lamp and tachometer lamp when the light switch is in the work or run position.

(Y) Warning Lamp Circuit: Energizes the warning lamp when the light switch is in the warn or run position. A flasher causes the warning lamp to flash.

(Z) Brake Indicator Circuit: If the brakes are applied and locked the park brake switch will create a path to ground for the brake indicator circuit. The brake indicator lamp will then flasher because of a flasher in the system.

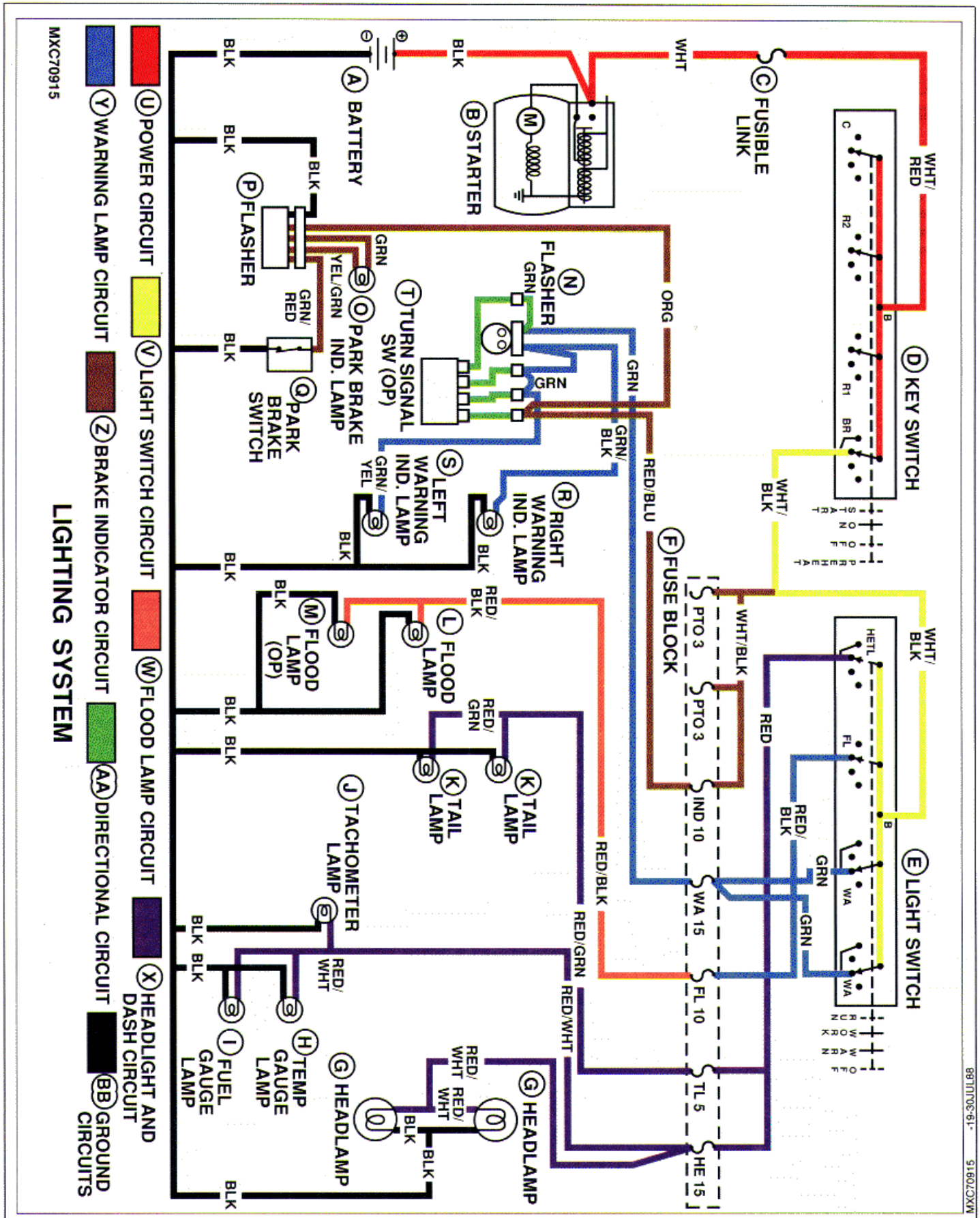
(A) Directional Circuits: These circuits are available as an option. It adds one more warning lamp that will flash in the warn or run position and a turn signal switch that allows the warning lamps to indicate a turning direction.

NOTE: When this option is added the jumper wire between the turn signal connectors is cut and taped.

(B) Ground Circuits: Provide a path to ground for all the lighting circuits.

A—Battery
B—Starter
C—Fusible Link
D—Key Switch
E—Light Switch
F—Fuse Block
G—Headlamp
H—Temperature Gauge Lamp
I—Fuel Gauge Lamp
J—Tachometer Lamp
K—Tail Lamp
L—Flood Lamp
M—Flood Lamp (Optional)
N—Flasher
O—Park Brake Indicator Lamp
P—Flasher
Q—Park Brake Switch
R—Right Warning Indicator Lamp
S—Left Warning Indicator Lamp
T—Turn Signal Switch (Optional)
U—Power Circuit
V—Light Switch Circuit
W—Flood Lamp Circuit
X—Headlamp and Dash Circuit
Y—Warning Lamp Circuit
Z—Brake Indicator Circuit
AA—Directional Circuit
BB—Ground Circuit

MX,24010DG,A17 -19-25SEP89


LIGHTING SYSTEM
MXC70915
(U) POWER CIRCUIT
(V) LIGHT SWITCH CIRCUIT
(W) FLOOD LAMP CIRCUIT
(X) HEADLIGHT AND DASH CIRCUIT
(Y) WARNING LAMP CIRCUIT
(Z) BRAKE INDICATOR CIRCUIT
(AA) DIRECTIONAL CIRCUIT
(BB) GROUND CIRCUITS
(A) BATTERY
(B) STARTER
(C) FUSIBLE LINK
(D) KEY SWITCH
(E) LIGHT SWITCH
(F) FUSE BLOCK
(G) HEADLAMP
(H) TEMP GAUGE LAMP
(I) FUEL GAUGE LAMP
(J) TACHOMETER LAMP
(K) TAIL LAMP
(L) FLOOD LAMP
(M) FLOOD LAMP (OP)
(N) FLASHER
(O) PARK BRAKE IND. LAMP
(P) FLASHER
(Q) PARK BRAKE SWITCH
(R) RIGHT WARNING IND. LAMP
(S) LEFT WARNING IND. LAMP
(T) TURN SIGNAL SW (OP)
WHT/RED
WHT
BLK
ORG
GRN
GRN/BLK
GRN/YEL
YEL/GRN
GRN/RED
WHT/BLK
RED/BLU
RED/BLK
RED/GRN
RED/WHT
RED
BLK
PTO 3
IND 10
WA 15
FL 10
TL 5
HE 15
HETL
FL
WA
RUN
ACCESSORY
OFF
START
MXC70915 -19-30JUL88

INSTRUMENT LIGHT SYSTEM

FUNCTION: To provide power to the warning lights and gauges that operate directly off the key switch.

MAJOR COMPONENTS:

Key Switch
Oil Pressure Indicator Lamp
Oil Pressure Switch
Water Temperature Gauge
Water Temperature Sender
Fuel Gauge
Fuel Gauge Sender

THEORY:

(L) Power Circuit: Provides power to the key switch.

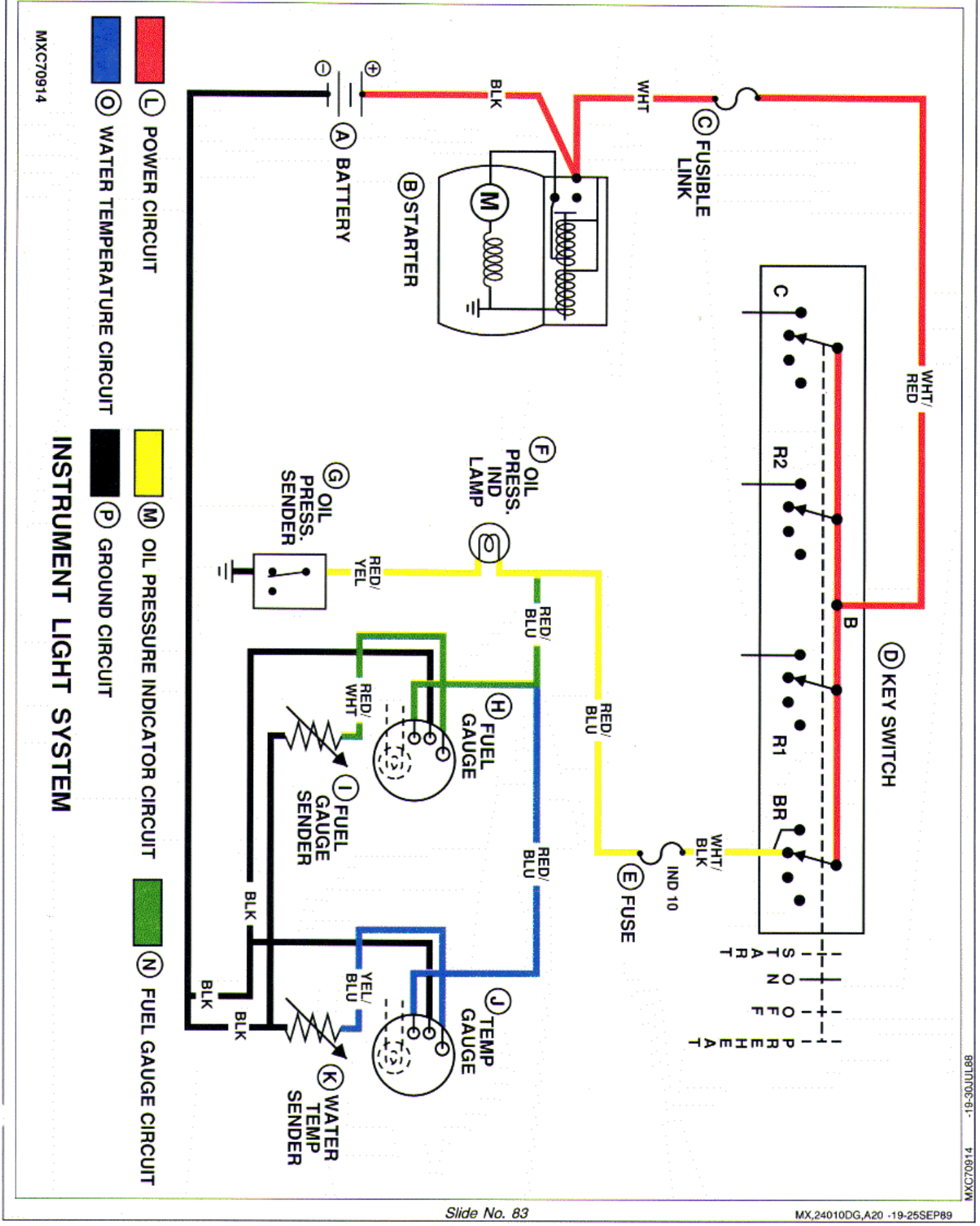
(M) Oil Pressure Indicator Circuit: Contains a pressure sensitive switch which will close a path to ground so that the light will illuminate if engine oil pressure is below 7 psi (48 kPa).

(N) Fuel Gauge Circuit: Contains a float type sender with a variable resistor. The variable amount of resistance at the sender determines the position of the fuel gauge indicator.

(O) Water Temperature Circuit: Contains a temperature sensitive sender with a variable resistor. The amount of resistance at the sender determines the position of the temperature gauge indicator.

A—Battery
B—Starter
C—Fusible Link
D—Key Switch
E—Fuse
F—Oil Pressure Indicator Lamp
G—Oil Pressure Switch
H—Fuel Gauge
I—Fuel Gauge Sender
J—Temperature Gauge
K—Water Temperature Sender
L—Power Circuit
M—Oil Pressure Indicator Circuit
N—Fuel Gauge Circuit
O—Water Temperature Circuit
P—Ground Circuit

MX,24010DG,A19 -19-25SEP89


INSTRUMENT LIGHT SYSTEM
MXC7914
(L) POWER CIRCUIT
(M) OIL PRESSURE INDICATOR CIRCUIT
(N) FUEL GAUGE CIRCUIT
(O) WATER TEMPERATURE CIRCUIT
(P) GROUND CIRCUIT
(A) BATTERY
(B) STARTER
(C) FUSIBLE LINK
(D) KEY SWITCH
(E) FUSE
(F) OIL PRESS. IND LAMP
(G) OIL PRESS. SENDER
(H) FUEL GAUGE
(I) FUEL GAUGE SENDER
(J) TEMP GAUGE
(K) WATER TEMP SENDER
WHT
BLK
WHT/ RED
WHT/ BLK
RED/ BLU
RED/ YEL
RED/ WHT
YEL/ BLU
C
R2
R1
BR
B
START
ON
OFF
HEAT
IND 10
MXC7914 -19-30JUL88

BEFORE YOU START

The procedures in this group provide you with the detailed diagnostic information you will need to isolate a malfunction. Basic equipment is used. It is assumed that you are familiar with the machine and its electrical components.

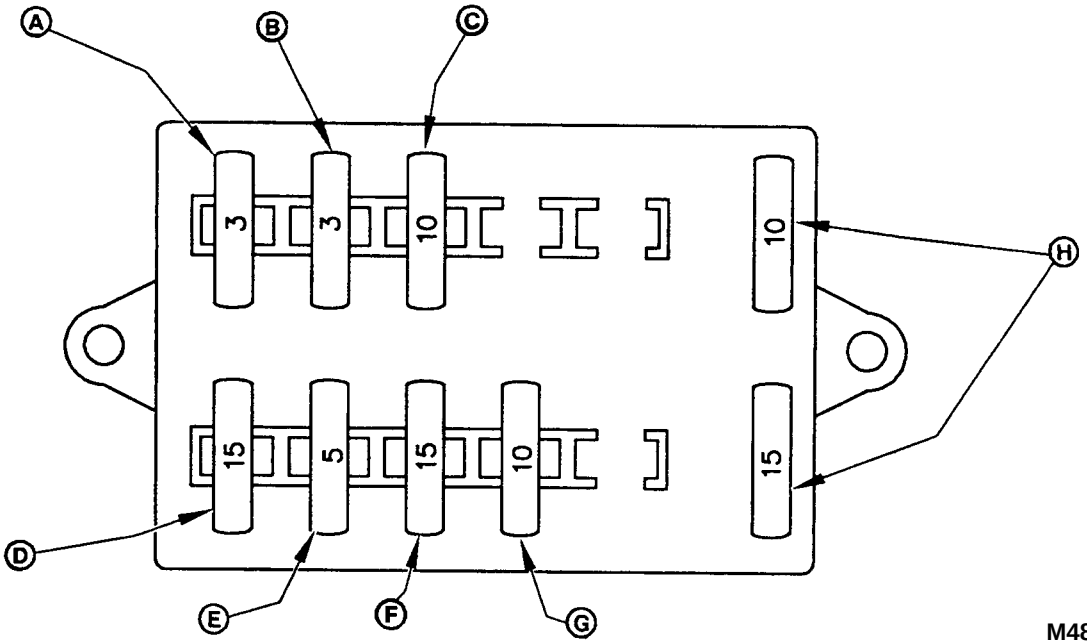
As with any electrical system, it is very important that all ground connections are clean and tight and that the battery is fully charged.

Before doing any testing, verify the system ground circuits and test the battery.

Always start with the first test and follow the sequence. Use the diagram to identify the test points. If a test point is difficult to get at, go to the next test point. If that test fails, the previous test must be performed to isolate the component or wire failure.

MX,24015DG,A1 -19-25SEP89

FUSE BLOCK



M48442

FUSE BLOCK

A—Safety System Fuse (3 Amp)—Protects the Seat Safety Circuit, PTO Safety Circuit, Transmission Neutral Circuit and Time Delay Control Module.

B—Fuel Shut Off Solenoid Fuse (3 Amp)—Protects the Fuel Shut Off Solenoid System and Time Delay Control Module.

C—Indicator Light Fuse (10 Amp)—Protects Indicator Lights.

D—Headlight Fuse (15 Amp)—Protects Gauge Lights and Headlights.

E—Taillight Fuse (5 Amp)—Protects Tail Lights.

F—Warning Lamp Fuse (15 Amp)—Protects the Warning Lights and Optional Flashers.

G—Flood Lamp Fuse (10 Amp)—Protects Flood Lamps.

H—Spare Fuses.

CRANKING SYSTEM TEST POINTS —(OLD VERSION)

TEST CONDITIONS:

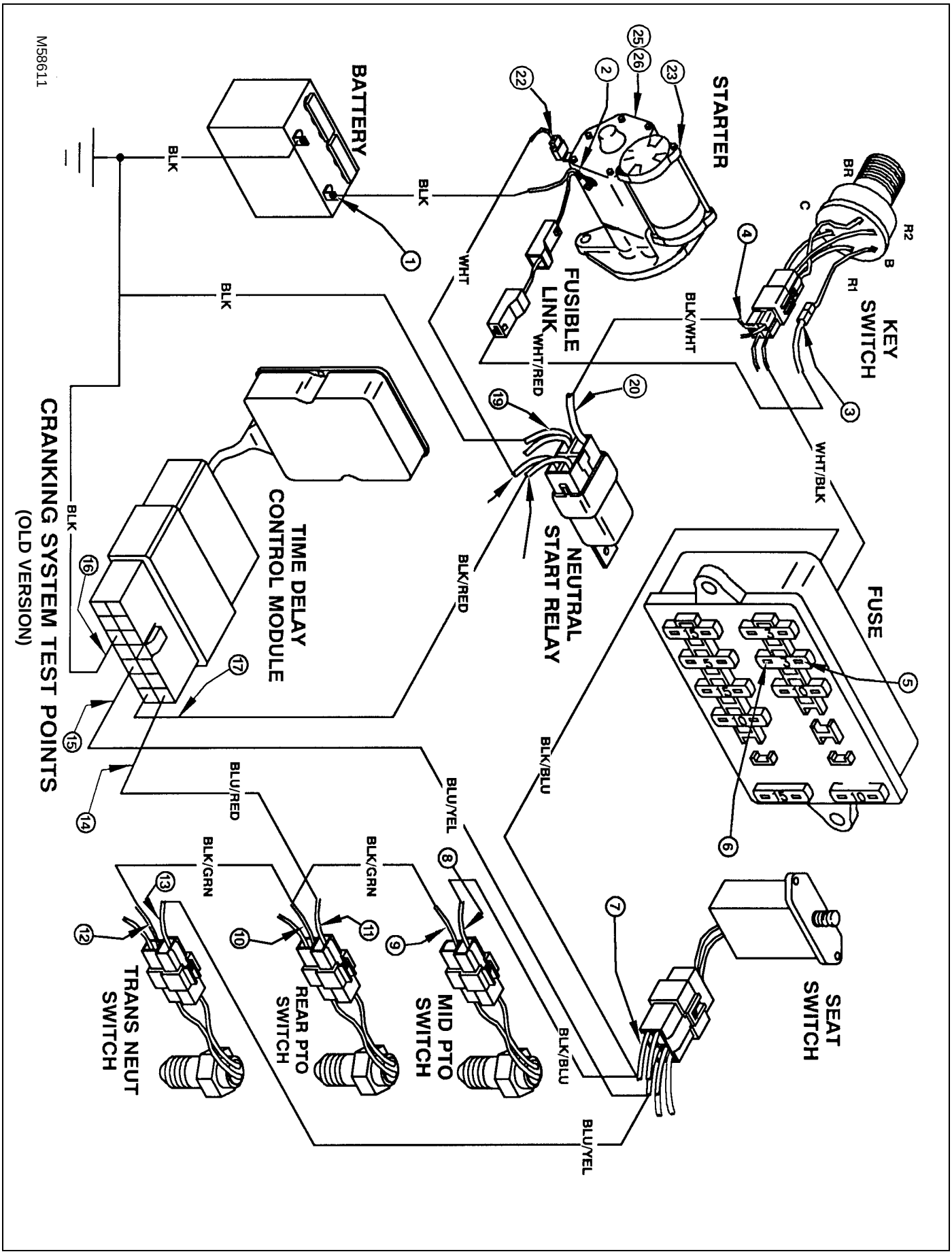
- Both PTO's in "OFF" position.
- Transmission is in "NEUTRAL".
- Key Switch is in "ON" position.

"ENDING" SERIAL NUMBERS

- 670—670A104012
- 670 European Version—670A101145
- 770—770A105926
- 870—870A101860
- 870—870B103794
- 970—970A101517
- 970—970B103214
- 1070—1070A103813

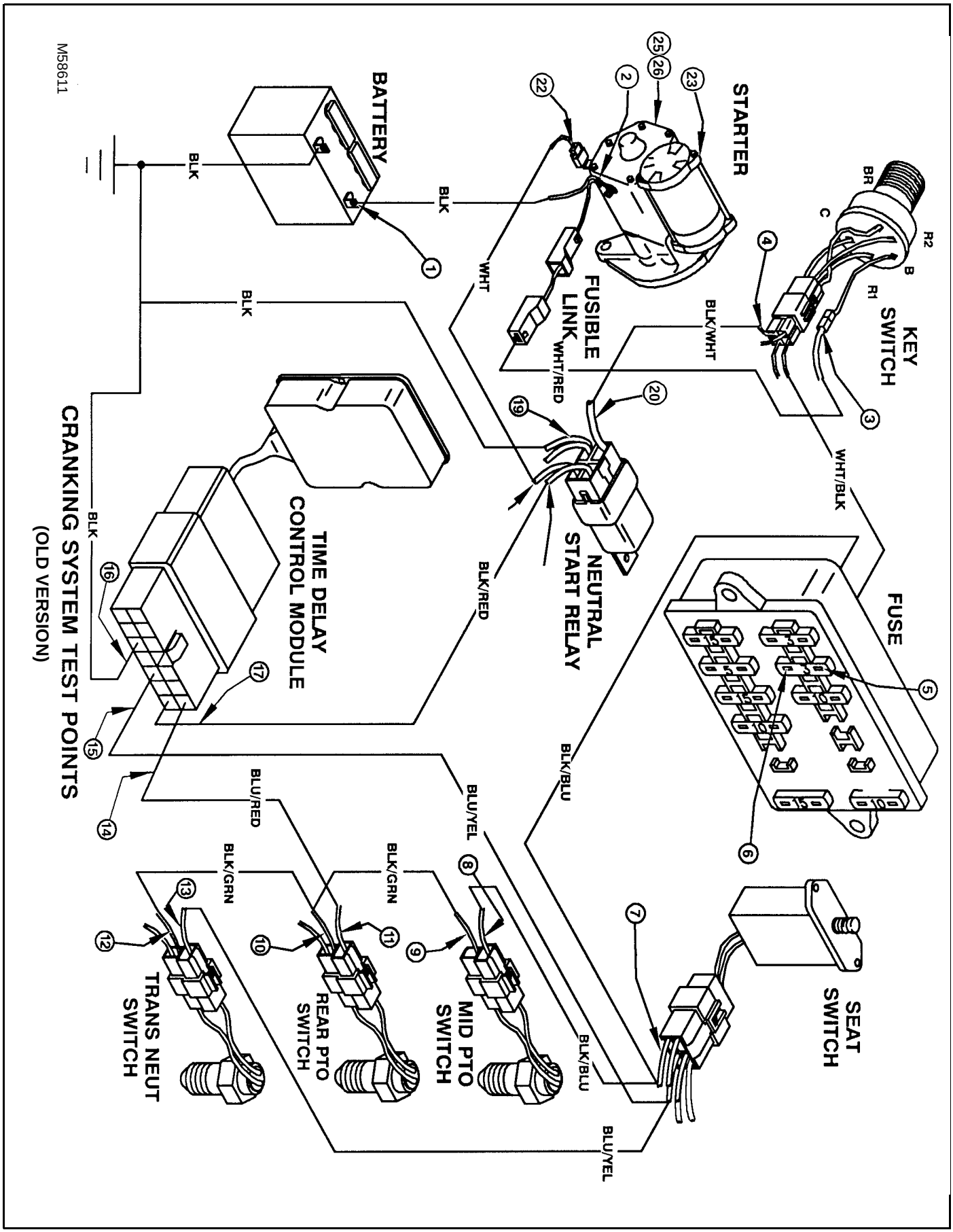
IMPORTANT: Disconnect white lead from starter solenoid (test point 22) when performing Test Check Points 1 through 22.

Test Check Points	Normal	If Not Normal
1. Battery Positive	11.8—13.2 Volts	Test battery
2. Starter Connector	Battery voltage	Check Blk wire
3. Key Switch Terminal B	Battery voltage	Check Wht/Red wire and fusible link
4. Key Switch Terminal BR	Battery voltage	Test Key Switch
5. 3 Amp Fuse (Hot Side)	Battery voltage	Check red wire
6. 3 Amp Fuse (Protected Side)	Battery voltage	Test fuse Check fuse block
7. Seat Switch	Battery voltage	Check Blk/Blu wire
8. Mid PTO Switch	Battery voltage	Check Blk/Blu wire
9. Mid PTO Switch	Battery voltage	Test mid PTO switch
10. Rear PTO Switch	Battery voltage	Check Blk/Grn wire
11. Rear PTO Switch	Battery voltage	Test rear PTO switch
12. Transmission Neutral Switch	Battery voltage	Check Blk/Grn wire
13. Transmission Neutral Switch	Battery voltage	Test Transmission Neutral Switch
14. TDCM (Blu/Red)	Battery voltage	Check Blu/Red wire
15. TDCM (Blu/Yel)	Battery voltage	Check Blu/Yel wire


M58611
CRANKING SYSTEM TEST POINTS
(OLD VERSION)
BATTERY
STARTER
KEY SWITCH
FUSIBLE LINK
NEUTRAL START RELAY
TIME DELAY CONTROL MODULE
FUSE
SEAT SWITCH
MID PTO SWITCH
REAR PTO SWITCH
TRANS NEUT SWITCH
BLK
WHT
BLK/WHT
WHT/RED
WHT/BLK
BLK/RED
BLK/BLU
BLU/YEL
BLU/RED
BLK/GRN
BR
C
R2
B
R1

CRANKING SYSTEM TEST POINTS —(OLD VERSION) —CONTINUED

Test Check Points	Normal	If Not Normal
IMPORTANT: Turn Key Switch "OFF" before next Test Point Check.		
16. TDCM Blk Wire to Tractor Ground	Continuity	Check Blk
IMPORTANT: Turn Key Switch "ON" before next Test Point Check.		
17. TDCM (Blk/Red)	Battery Voltage	Replace TDCM
18. Neutral Start Relay (Blk/Red)	Battery Voltage	Check Blk/Red wire
IMPORTANT: Turn Key Switch "OFF" before next Test Point Check.		
19. Neutral Start Relay wire to Tractor Ground	Continuity	Check Blk wire
IMPORTANT: Hold key in "Start" position for remaining tests.		
20. Neutral Start Relay	Battery voltage	Test Key Switch check Blk/Wht wire
21. Neutral Start Relay	Battery voltage	Test relay
IMPORTANT: Reconnect white lead to starter solenoid.		
22. Starter Solenoid	Battery voltage	Check Wht wire
IMPORTANT: Disconnect Fuel Shut-Off Solenoid to prevent engine from starting during remaining tests.		
23. Test Solenoid	Engage and stay engaged	Replace solenoid
24. Test for voltage drop between test points 1 and 2.	Less than 0.5 volts	Check battery to starter cable
25. Test Starter Cranking Speed and Amp Draw	300 Amps at 300 rpm	Check that engine is not locked up
26. Test Start No-Load Amperage and RPM	Less than 120 Amp over 3000 RPM	Replace starter


CRANKING SYSTEM TEST POINTS
(OLD VERSION)
M58611
BATTERY
STARTER
KEY SWITCH
FUSIBLE LINK
NEUTRAL START RELAY
TIME DELAY CONTROL MODULE
FUSE
SEAT SWITCH
MID PTO SWITCH
REAR PTO SWITCH
TRANS NEUT SWITCH
BLK
WHT
BLK/WHT
WHT/RED
WHT/BLK
BLK/RED
BLK/BLU
BLU/YEL
BLU/RED
BLK/GRN
BR
C
R2
B
R1

CRANKING SYSTEM TEST POINTS —(NEW VERSION)

TEST CONDITIONS:

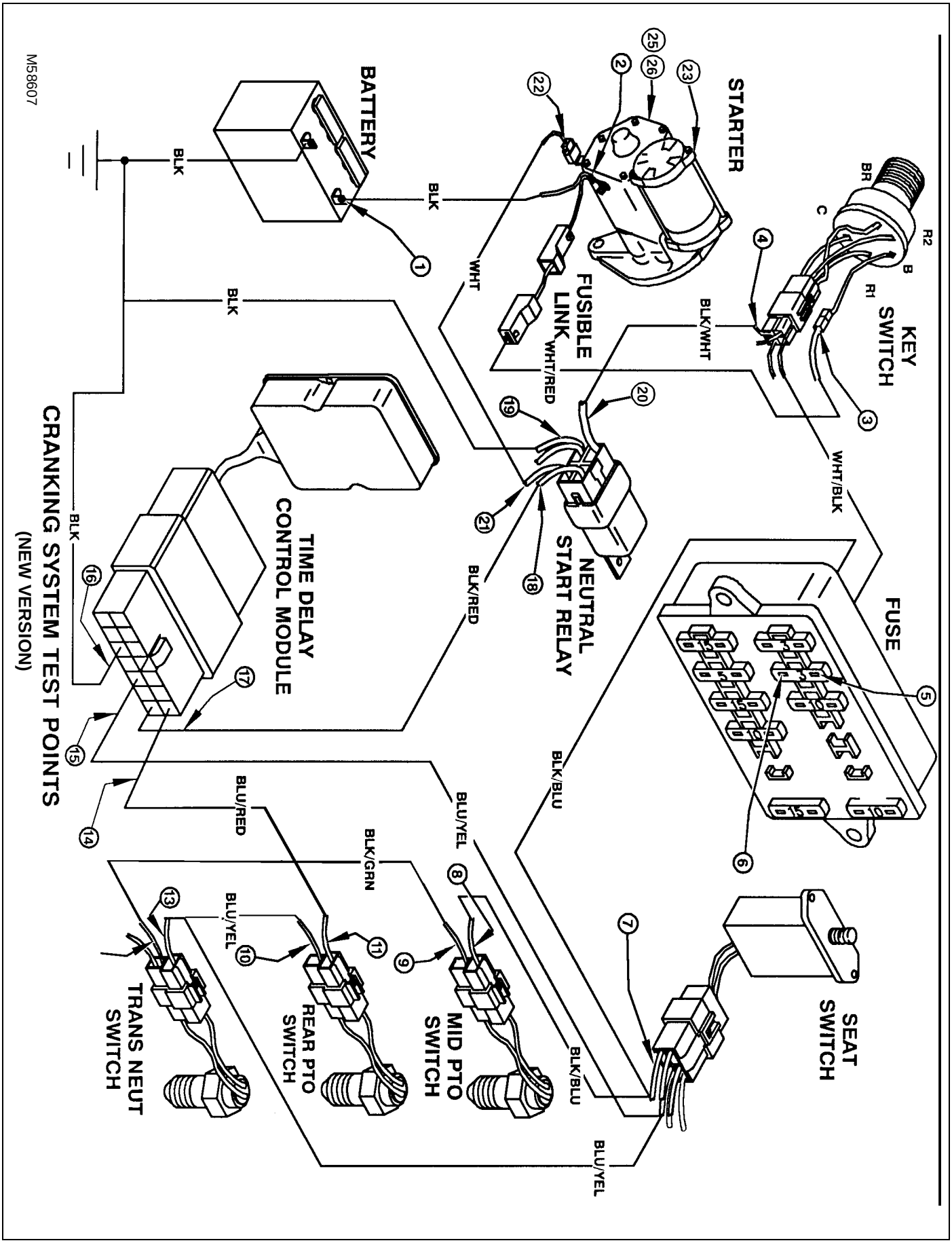
- Both PTO's in "OFF" position
- Transmission in "NEUTRAL"
- Key Switch in "ON" position

IMPORTANT: Disconnect white lead from starter solenoid (Test Point 22) when performing Test Points 1 through 22

"STARTING" SERIAL NUMBERS

- 670—670A104013
- 670 European Version—670A101146
- 770—770A105927
- 790—All
- 870—870A101861
- 870—870B103795
- 970—970A101518
- 970—970B103215
- 1070—1070A103814

Test Check Points	Normal	If Not Normal
1. Battery Positive	11.8—13.2 Volts	Test battery
2. Starter Connector	Battery voltage	Check Blk wire
3. Key Switch Terminal B	Battery voltage	Check Wht/Red wire and fusible link
4. Key Switch Terminal BR	Battery voltage	Test Key Switch
5. 3 Amp Fuse (Hot Side)	Battery voltage	Check Red wire
6. 3 Amp Fuse (Protected Side)	Battery voltage	Test fuse Check fuse block
7. Seat Switch	Battery voltage	Check Blk/Blu wire
8. Mid PTO Switch	Battery voltage	Check Blk/Blu wire
9. Mid PTO Switch	Battery voltage	Test Mid PTO Switch
10. Rear PTO Switch	Battery voltage	Check Blk/Grn wire
11. Rear PTO Switch	Battery voltage	Test rear PTO Switch
12. Transmission Neutral Switch	Battery voltage	Check Blk/Grn wire
13. Transmission Neutral Switch	Battery voltage	Test Transmission Neutral Switch
14. TDCM (Blu/Red)	Battery voltage	Check Blu/Red wire
15. TDCM (Blu/Yel)	Battery voltage	Check Blu/Yel wire


M58607
CRANKING SYSTEM TEST POINTS
(NEW VERSION)
BATTERY
STARTER
KEY SWITCH
FUSIBLE LINK
FUSE
NEUTRAL START RELAY
TIME DELAY CONTROL MODULE
SEAT SWITCH
MID PTO SWITCH
REAR PTO SWITCH
TRANS NEUT SWITCH
BLK
WHT
BLK/WHT
WHT/RED
WHT/BLK
BLK/RED
BLK/BLU
BLU/YEL
BLU/RED
BLK/GRN
BR
C
R2
B
R1

CRANKING SYSTEM TEST POINTS —(NEW VERSION) —CONTINUED

Test Check Points	Normal	If Not Normal
16. TDCM Blk Wire to Tractor Ground	Continuity	Check Blk
17. TDCM (Blk/Red)	Battery Voltage	Replace TDCM
18. Neutral Start Relay (Blk/Red)	Battery Voltage	Check Blk/Red wire

IMPORTANT: Turn Key Switch "OFF" before next Test Point Check.

19. Neutral Start Relay wire to Tractor Ground	Continuity	Check Blk wire

IMPORTANT: Hold Key Switch in "START" position for remaining tests.

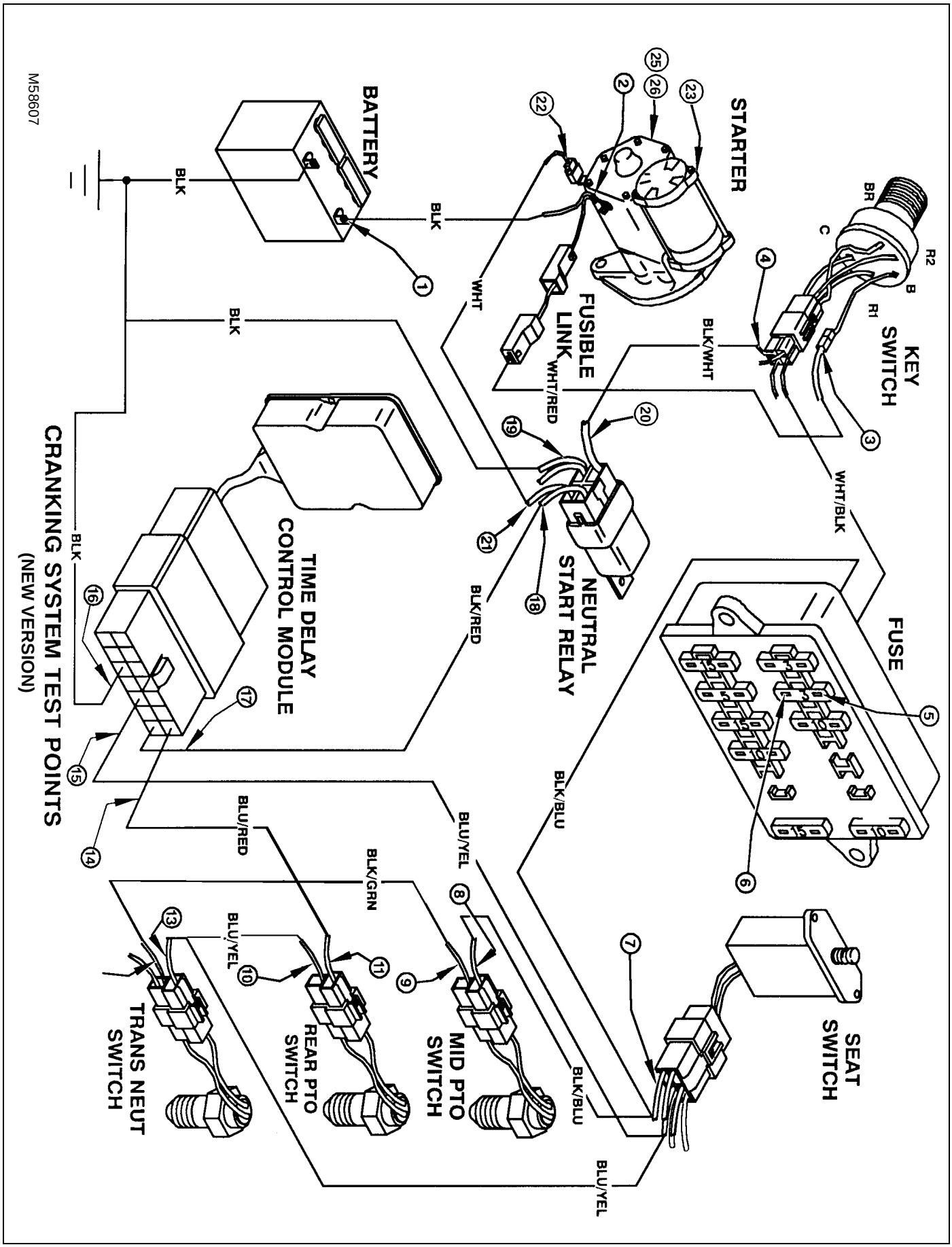
20. Neutral Start Relay	Battery voltage	Test Key Switch check Blk/Wht wire
21. Neutral Start Relay	Battery voltage	Test relay

IMPORTANT: Reconnect white lead to starter solenoid.

22. Starter Solenoid	Battery voltage	Check Wht wire

IMPORTANT: Disconnect Fuel Shut-Off Solenoid to prevent engine from starting during remaining testa.

23. Test Solenoid	Engage and stay engaged	Replace solenoid
24. Test for voltage drop between test points 1 and 2.	Less than 0.5 volts	Check battery to starter cable
25. Test Starter Cranking Speed and Amp Draw	300 Amps at 300 rpm	Check that engine is not locked up
26. Test Starter No-Load Amperage and RPM	Less than 120 Amp over 3000 RPM	Replace starter


M58607
CRANKING SYSTEM TEST POINTS
(NEW VERSION)
BATTERY
STARTER
KEY SWITCH
FUSIBLE LINK
NEUTRAL START RELAY
TIME DELAY CONTROL MODULE
FUSE
SEAT SWITCH
MID PTO SWITCH
REAR PTO SWITCH
TRANS NEUT SWITCH
BLK
WHT
BLK/WHT
WHT/RED
WHT/BLK
BLK/RED
BLK/BLU
BLU/RED
BLU/YEL
BLK/GRN
BR
C
B
R2
R1

FUEL SHUT-OFF PULL-IN SYSTEM TEST POINTS (OPERATOR ON SEAT) —(OLD VERSION)

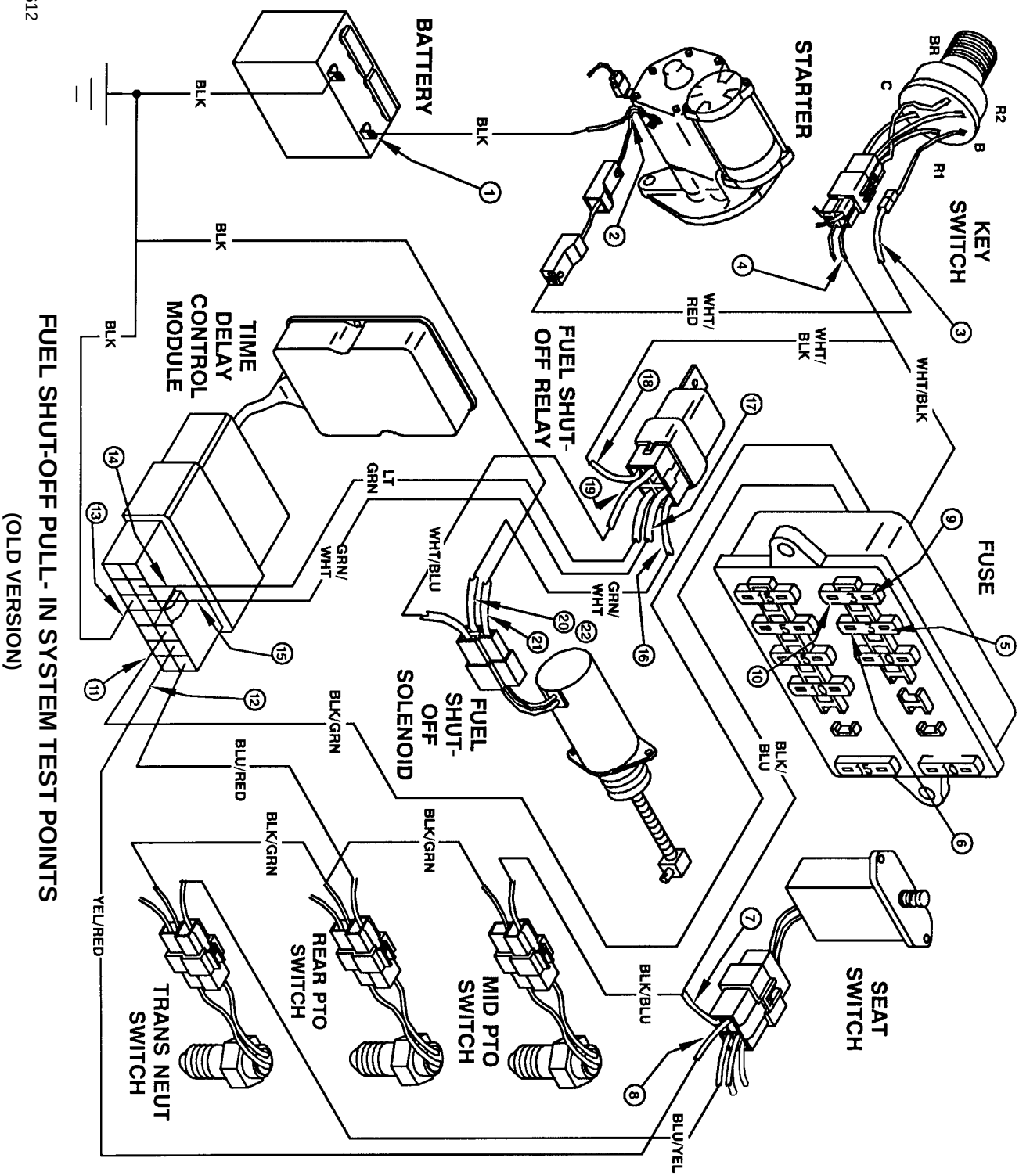
TEST CONDITIONS:

- Seat Switch “DEPRESSED”
- Key Switch in "ON" position

“ENDING” SERIAL NUMBERS

- 670—670A104012
- 670 European Version—670A101145
- 770—770A105926
- 870—870A101860
- 870—870B103794
- 970—970A101517
- 970—970B103214
- 1070—1070A103813

Test Check Points	Normal	If Not Normal
1. Battery Positive	11.8—13.2 Volts	Test battery
2. Starter Connection	Battery voltage	Check Blk wire
3. Key Switch Terminal B	Battery voltage	Check Wht/Red wire and fusible link
4. Key Switch Terminal BR	Battery voltage	Test Key Switch
5. 3 Amp Fuse (Hot Side)	Battery voltage	Check Wht/Blk wire
6. 3 Amp Fuse (Protected Side)	Battery voltage	Test fuse Check fuse block
7. Seat Switch	Battery voltage	Check Blk/Blu wire
8. Seat Switch	Battery voltage	Test Seat Switch
9. 3 Amp Fuse (Hot Side)	Battery voltage	Check Wht/Blk wire
10. 3 Amp Fuse (Protected Side)	Battery voltage	Test fuse Check fuse block
11. TDCM (Blk/Grn)	Battery voltage	Check Blk/Grn wire
12. TDCM (Yel/Red)	Battery voltage	Check Yel/Red wire
IMPORTANT: Turn Key Switch “OFF” before next Test Point Check.		
13. TDCM Blk Wire to Tractor Ground	Continuity	Check Blk wire



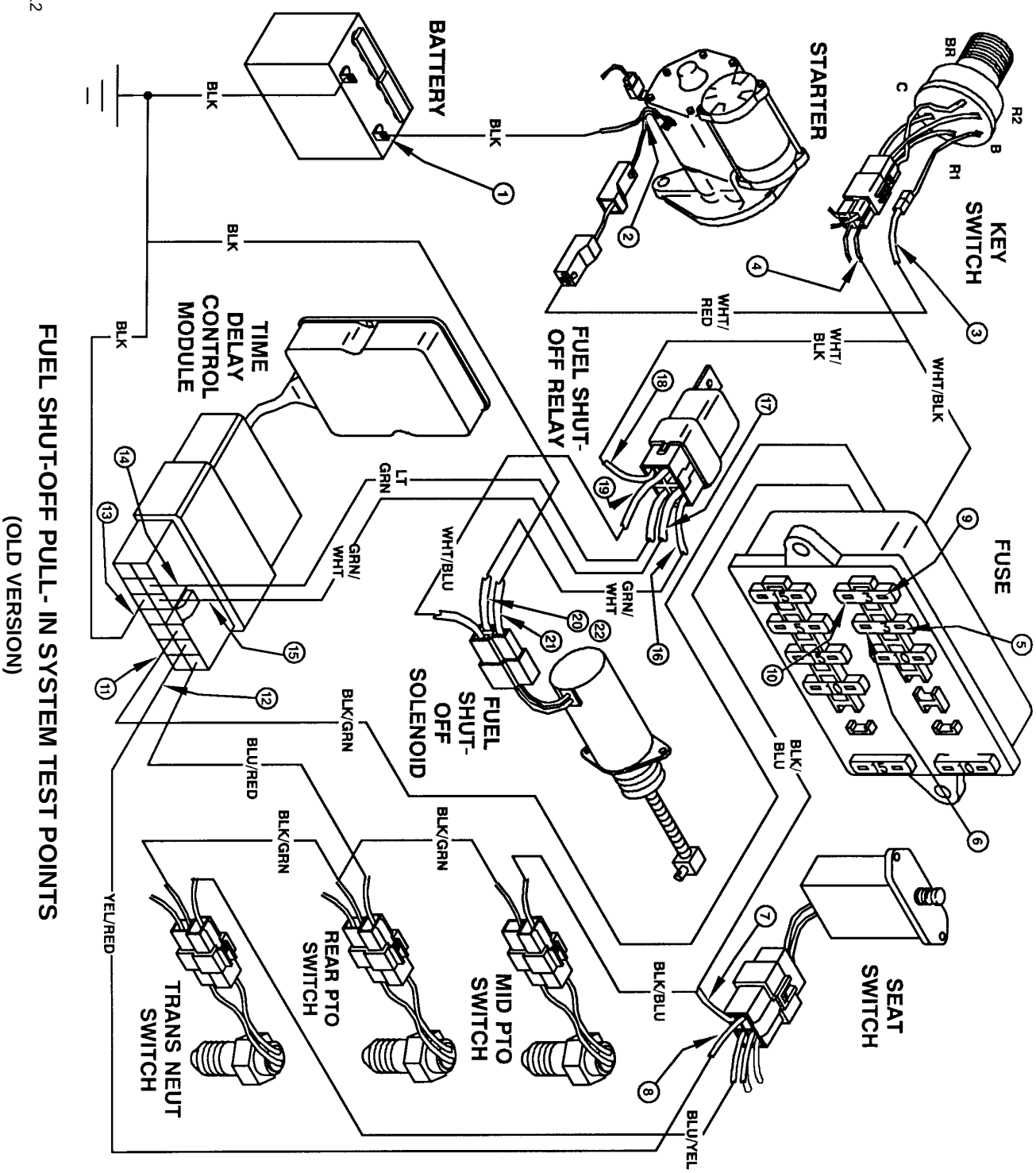
FUEL SHUT-OFF PULL- IN SYSTEM TEST POINTS

(OLD VERSION)

FUEL SHUT-OFF PULL-IN SYSTEM TEST POINTS —(OLD VERSION)/(OPERATOR ON SEAT) —CONTINUED

IMPORTANT: Unless otherwise specified, from this point on the Key Switch must be turned "OFF", then put in the "ON" position after the test connection is made. The normal reading will occur for only 0.5—1.5 seconds after the key is moved to "ON". This is due to the function of the Time Delay Control Module (TCDM).

Test Check Points	Normal	If Not Normal
IMPORTANT: Turn Key Switch "ON" before next Test Point Check.		
14. TDCM (Lt Grn) Wire to Tractor Ground	0 volts for 0.5—1.5 seconds Battery voltage after 0.5—1.5 seconds.	Replace TDCM
15. TDCM (Grn/Wht)	Battery voltage	Replace TDCM
16. Fuel Shut-Off Pull-In Coil Relay	Battery voltage	Check Grn/Wht wire
17. Lt Grn Wire to Tractor Ground	0 volts for 0.5—1.5 seconds Battery voltage after 0.5—1.5 seconds.	Check Lt Grn Wire
18. Fuel Shut-Off Pull-In Coil Relay	Battery voltage (constant)	Check Wht/Blk wire
19. Fuel Shut-Off Pull-In Coil Relay	Battery voltage (0.5—1.5 seconds)	Test relay
20. Fuel Shut-Off Solenoid	Battery voltage (0.5—1.5 seconds)	Check Wht/Blu wire
IMPORTANT: Turn Key Switch "OFF" before next Test Point Check.		
21. Fuel Shut-Off Solenoid (Blk) to Tractor Ground	Continuity	Check Blk wire
IMPORTANT: Turn Key Switch "ON" before next Test Point Check.		
22. Fuel Shut-Off Solenoid	Pulls in/amperage not excessive.	Replace Fuel Shut-Off Solenoid



FUEL SHUT-OFF PULL- IN SYSTEM TEST POINTS

(OLD VERSION)

FUEL SHUT-OFF PULL-IN SYSTEM TEST POINTS —(PTO IN "OFF" POSITION) —(OPERATOR ON SEAT) —(NEW VERSION)

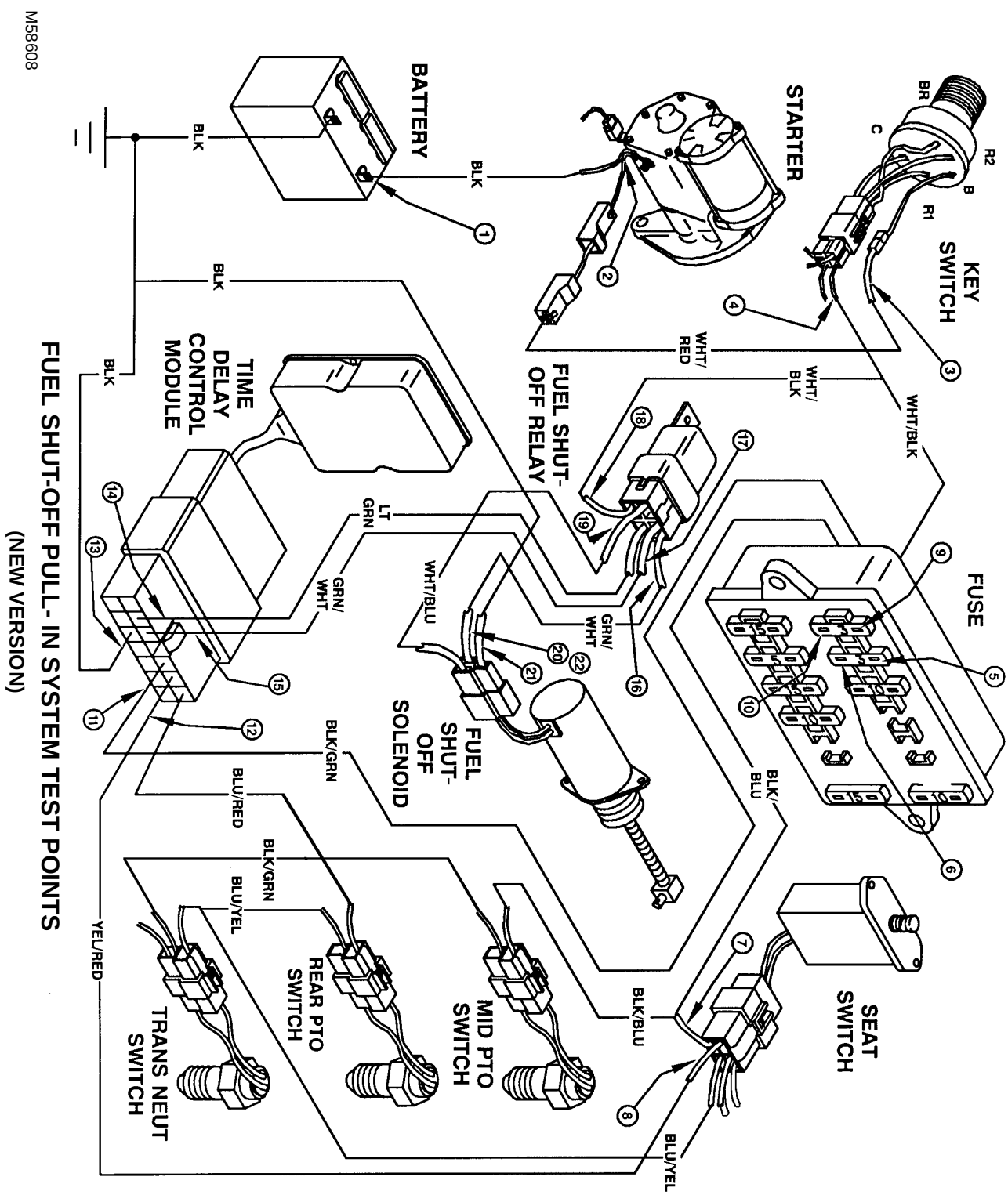
TEST CONDITIONS:

- Both PTO's in "OFF" position
- Key Switch in "ON" position

"STARTING" SERIAL NUMBERS

- 670—670A104013
- 670 European Version—670A101146
- 770—770A105927
- 790—All
- 870—870A101861
- 870—870B103795
- 970—970A101518
- 970—970B103215
- 1070—1070A103814

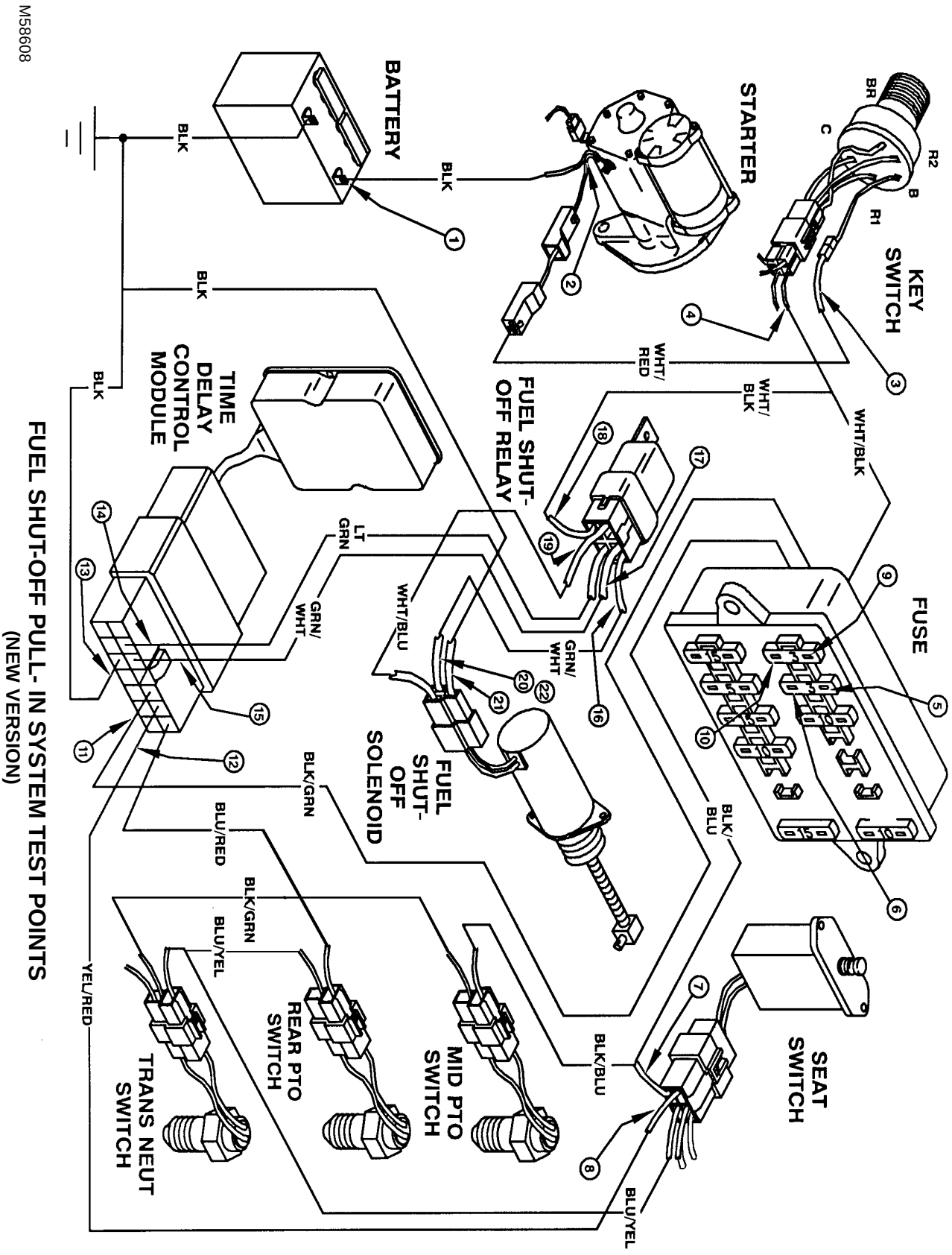
Test Check Points	Normal	If Not Normal
1. Battery Positive	11.8—13.2 Volts	Test battery
2. Starter Connector	Battery voltage	Check Blk wire
3. Key Switch Terminal B	Battery voltage	Check Wht/Red wire and fusible link
4. Key Switch Terminal BR	Battery voltage	Test Key Switch
5. 3 Amp Fuse (Hot Side)	Battery voltage	Check Wht/Blk wire
6. 3 Amp Fuse (Protected Side)	Battery voltage	Test fuse Check fuse block
7. Seat Switch	Battery voltage	Check Blk/Blu wire
8. Mid PTO Switch	Battery voltage	Check Blk/Blu wire
9. Mid PTO Switch	Battery voltage	Test Mid PTO Switch
10. Rear PTO Switch	Battery voltage	Check Blu/Yel wire
11. Rear PTO Switch	Battery voltage	Test Rear PTO Switch
12. 3 Amp Fuse (Hot Side)	Battery voltage	Check Wht/Blk wire
13. 3 Amp Fuse (Protected Side)	Battery voltage	Test fuse Check fuse block
14. TDCM (Blk/Grn)	Battery voltage	Check Blk/Grn wire
15. TDCM (Yel/Red)	Battery voltage	Check Yel/Red wire
IMPORTANT: Turn Key Switch "OFF" before next Test Point Check.		
16. TDCM Blk Wire to Tractor Ground	Continuity	Check Blk wire


M58608
FUEL SHUT-OFF PULL- IN SYSTEM TEST POINTS
(NEW VERSION)
BATTERY
STARTER
KEY SWITCH
BR
C
R2
B
R1
FUSE
TIME DELAY CONTROL MODULE
FUEL SHUT-OFF RELAY
FUEL SHUT-OFF SOLENOID
SEAT SWITCH
MID PTO SWITCH
REAR PTO SWITCH
TRANS NEUT SWITCH
BLK
WHT/RED
WHT/BLK
WHT/BLK
LT GRN
GRN/WHT
WHT/BLU
GRN/WHT
BLK/BLU
BLK/GRN
BLU/RED
BLK/GRN
BLU/YEL
YEL/RED
BLK/BLU
BLU/YEL
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22

FUEL SHUT-OFF PULL-IN SYSTEM TEST POINTS —(NEW VERSION)/(OPERATOR ON SEAT) —CONTINUED

IMPORTANT: Unless otherwise specified, from this point on the Key Switch must be turned "OFF", then put in the "ON" position after the test connection is made. The normal reading will occur for only 0.5—1.5 seconds after the key is moved to "ON". This is due to the function of the Time Delay Control Module (TCDM).

Test Check Points	Normal	If Not Normal
IMPORTANT: Turn Key Switch "ON" before next Test Point Check.		
14. TDCM (Lt Grn) Wire to Tractor Ground	0 volts for 0.5-1.5 seconds Battery voltage after 0.5-1.5 seconds.	Replace TDC
15. TDCM (Grn/Wht)	Battery voltage	Replace TDC
16. Fuel Shut-Off Pull-In Coil Relay	Battery voltage	Check Grn/Wht wire
17. Lt Grn Wire to Tractor Ground	0 volts for 0.5-1.5 seconds Battery voltage after 0.5-1.5 seconds.	Check Lt Grn Wire
18. Fuel Shut-Off Pull-In Coil Relay	Battery voltage (constant)	Check Wht/Blk wire
19. Fuel Shut-Off Pull-In Coil Relay	Battery voltage (0.5-1.5 seconds)	Test relay
20. Fuel Shut-Off Solenoid	Battery voltage (0.5-1.5 seconds)	Check Wht/Blu wire
IMPORTANT: Turn Key Switch "OFF" before next Test Point Check.		
21. Fuel Shut-Off Solenoid (Blk) to Tractor Ground	Continuity	Check Blk wire
IMPORTANT: Turn Key Switch "ON" before next Test Point Check.		
22. See Fuel Shut-Off Solenoid Test later in this group.		



FUEL SHUT-OFF PULL- IN SYSTEM TEST POINTS
(NEW VERSION)

FUEL SHUT-OFF PULL-IN SYSTEM TEST POINTS —(PTO IN OFF POSITION)/(OPERATOR OFF SEAT) —(OLD VERSION)

TEST CONDITIONS:

- Both PTO “OFF”
- Key Switch in "ON" position

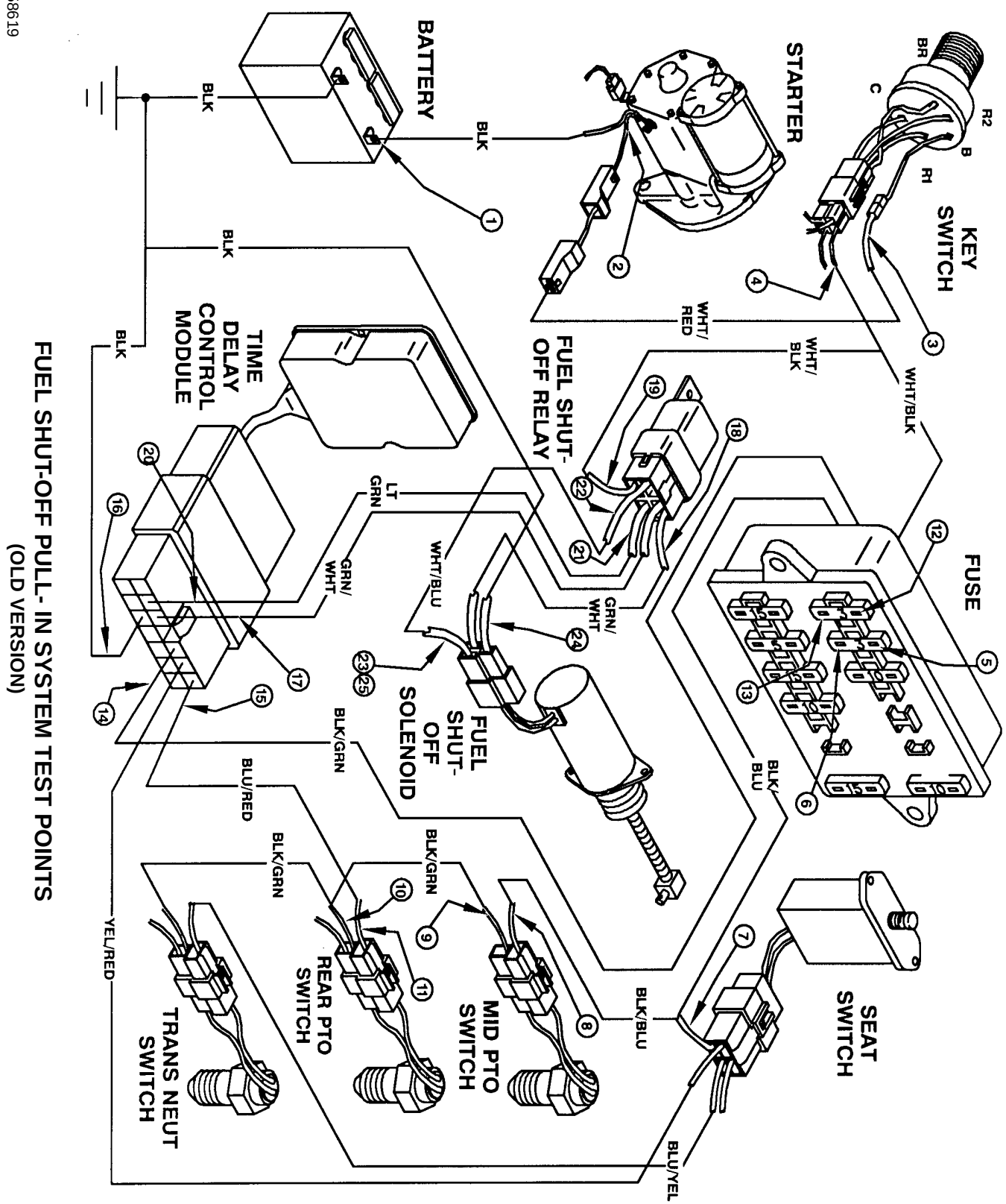
“ENDING” SERIAL NUMBERS

- 670—670A104012
- 670 European Version—670A101145
- 770—770A105926
- 870—870A101860
- 870—870B103794
- 970—970A101517
- 970—970B103214
- 1070—1070A103813

Test Check Points	Normal	If Not Normal
1. Battery Positive	11.8—13.2 Volts	Test battery
2. Starter Connection	Battery voltage	Check Blk wire
3. Key Switch Terminal B	Battery voltage	Check Wht/Red wire and fusible link
4. Key Switch Terminal BR	Battery voltage	Test Key Switch
5. 3 Amp Fuse (Hot Side)	Battery voltage	Check Wht/Blk wire
6. 3 Amp Fuse (Protected Side)	Battery voltage	Test fuse Check fuse block
7. Seat Switch	Battery voltage	Check Blk/Blu wire
8. Mid PTO Switch	Battery voltage	Check Blk/Blu wire
9. Mid PTO Switch	Battery voltage	Test Mid PTO Switch
10. Rear PTO Switch	Battery voltage	Check Blk/Grn wire
11. Rear PTO Switch	Battery voltage	Test Rear PTO Switch
12. 3 Amp Fuse (Hot Side)	Battery voltage	Check Wht/Blk wire
13. 3 Amp Fuse (Protected Side)	Battery voltage	Test fuse Check fuse block
14. TDCM (Blk/Grn)	Battery voltage	Check Blk/Grn wire
15. TDCM (Blu/Red)	Battery voltage	Check Blu/Red wire

IMPORTANT: Turn Key Switch “OFF” before next Test Point Check.

16. TDCM Blk Wire to Tractor Ground	Continuity	Check Blk wire

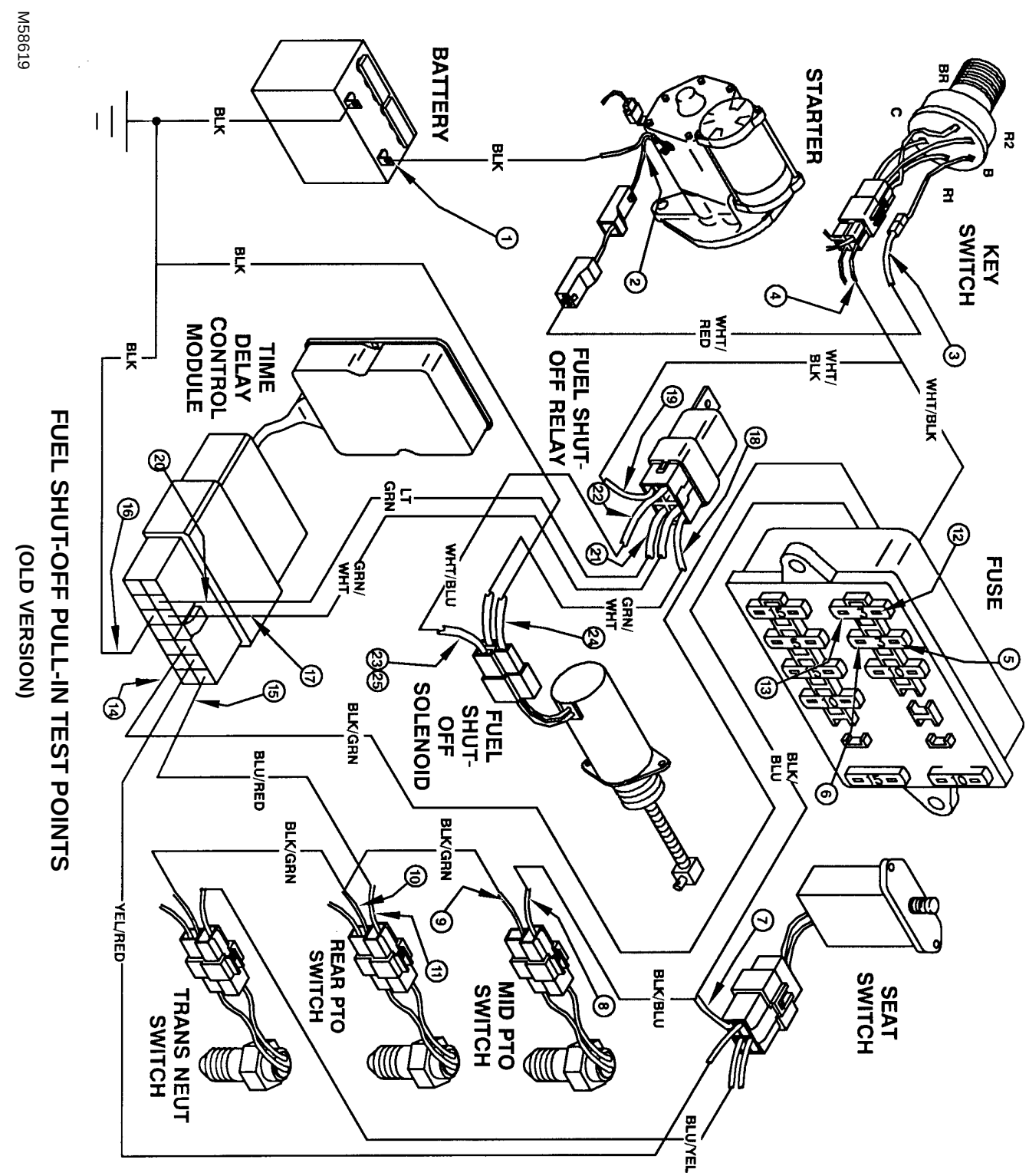


FUEL SHUT-OFF PULL- IN SYSTEM TEST POINTS
(OLD VERSION)

FUEL SHUT-OFF PULL-IN SYSTEM TEST POINTS —(PTO IN OFF POSITION)/(OPERATOR OFF SEAT) —(OLD VERSION) —CONTINUED

IMPORTANT: Unless otherwise specified from this point on, the Key Switch must be turned "OFF", then put in the "ON" position after the test connection is made. The normal reading will occur for only 0.5—1.5 seconds after the key is moved to "ON". This is due to the function of the Time Delay Control Module (TCDM).

Test Check Points	Normal	If Not Normal
IMPORTANT: Turn Key Switch "ON" before next Test Point Check.		
17. TDCM (Grn/Wht) Wire to Tractor Ground	0 volts for 0.5-1.5 seconds Battery voltage after 0.5-1.5 seconds.	Replace TDCM
18. TDCM (Grn/Wht)	Battery voltage	Check Grn/Wht wire
19. Fuel Shut-Off Pull-In Coil Relay (Lt Grn)	0 volts for 0.5-1.5 seconds Battery voltage after 0.5-1.5 seconds.	Replace Relay
20. TDCM (Lt Grn)	0 volts for 0.5-1.5 seconds Battery voltage after 0.5-1.5 seconds.	Check Lt Grn Wire or Replace TDCM
21. Fuel Shut-Off Pull-In Coil Relay	Battery voltage (constant)	Check Wht/Blk wire
22. Fuel Shut-Off Pull-In Coil Relay	Battery voltage (0.5-1.5 seconds)	Test relay
23. Fuel Shut-Off Solenoid	Battery voltage (0.5-1.5 seconds)	Check Wht/Blu wire
IMPORTANT: Turn Key Switch "OFF" before next Test Point Check.		
24. Fuel Shut-Off Solenoid (Blk) to Tractor Ground	Continuity	Check Blk wire
25. See Fuel Shut-Off Solenoid Test later in this group.		



FUEL SHUT-OFF PULL-IN TEST POINTS

(OLD VERSION)

FUEL SHUT-OFF PULL-IN SYSTEM TEST POINTS —(PTO IN "OFF" POSITION) —(OPERATOR ON SEAT) —(NEW VERSION)

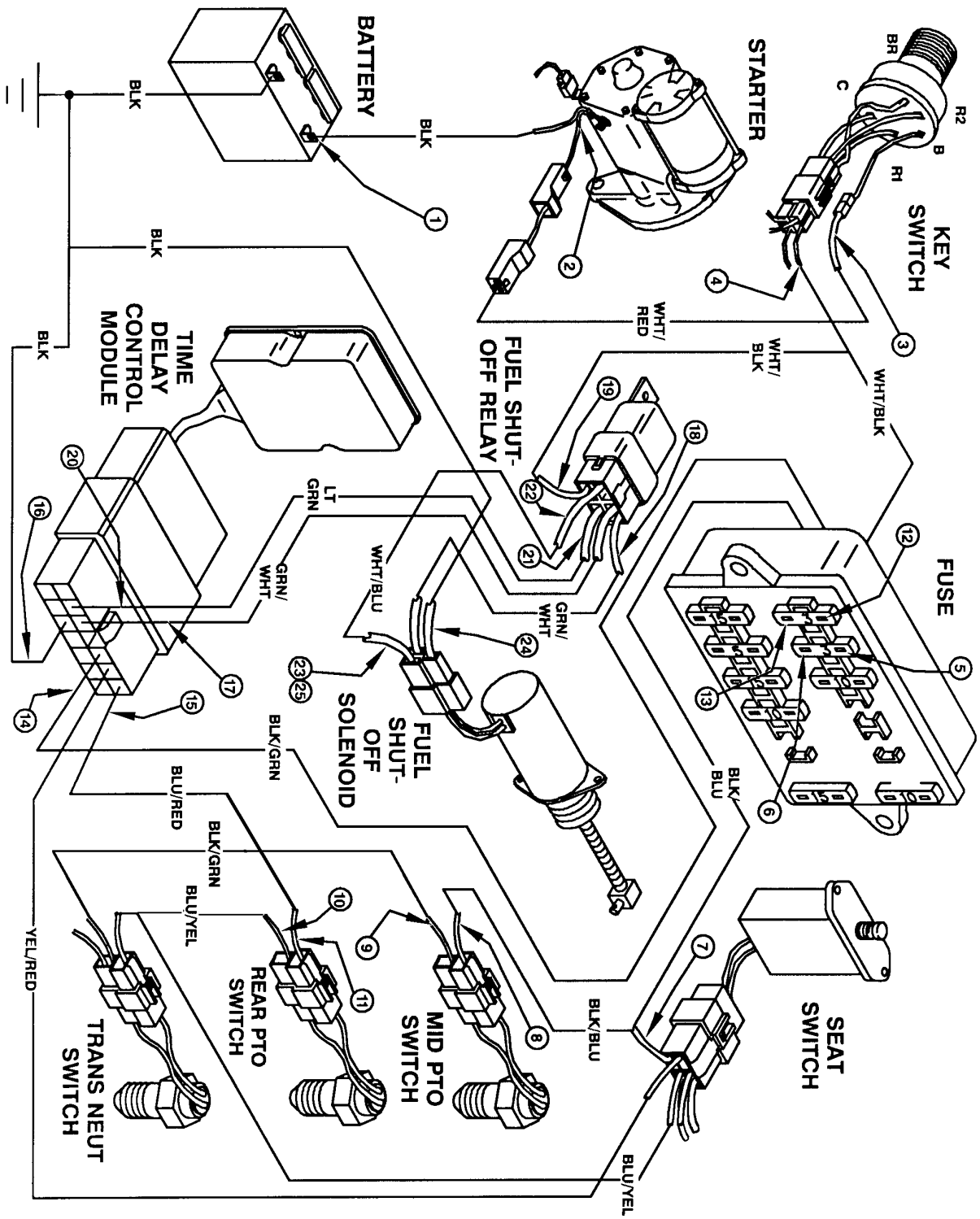
TEST CONDITIONS:

- Both PTO's in "OFF" position
- Key Switch in "ON" position

"STARTING" SERIAL NUMBERS

- 670—670A104013
- 670 European Version—670A101146
- 770—770A105927
- 790—All
- 870—870A101861
- 870—870B103795
- 970—970A101518
- 970—970B103215
- 1070—1070A103814

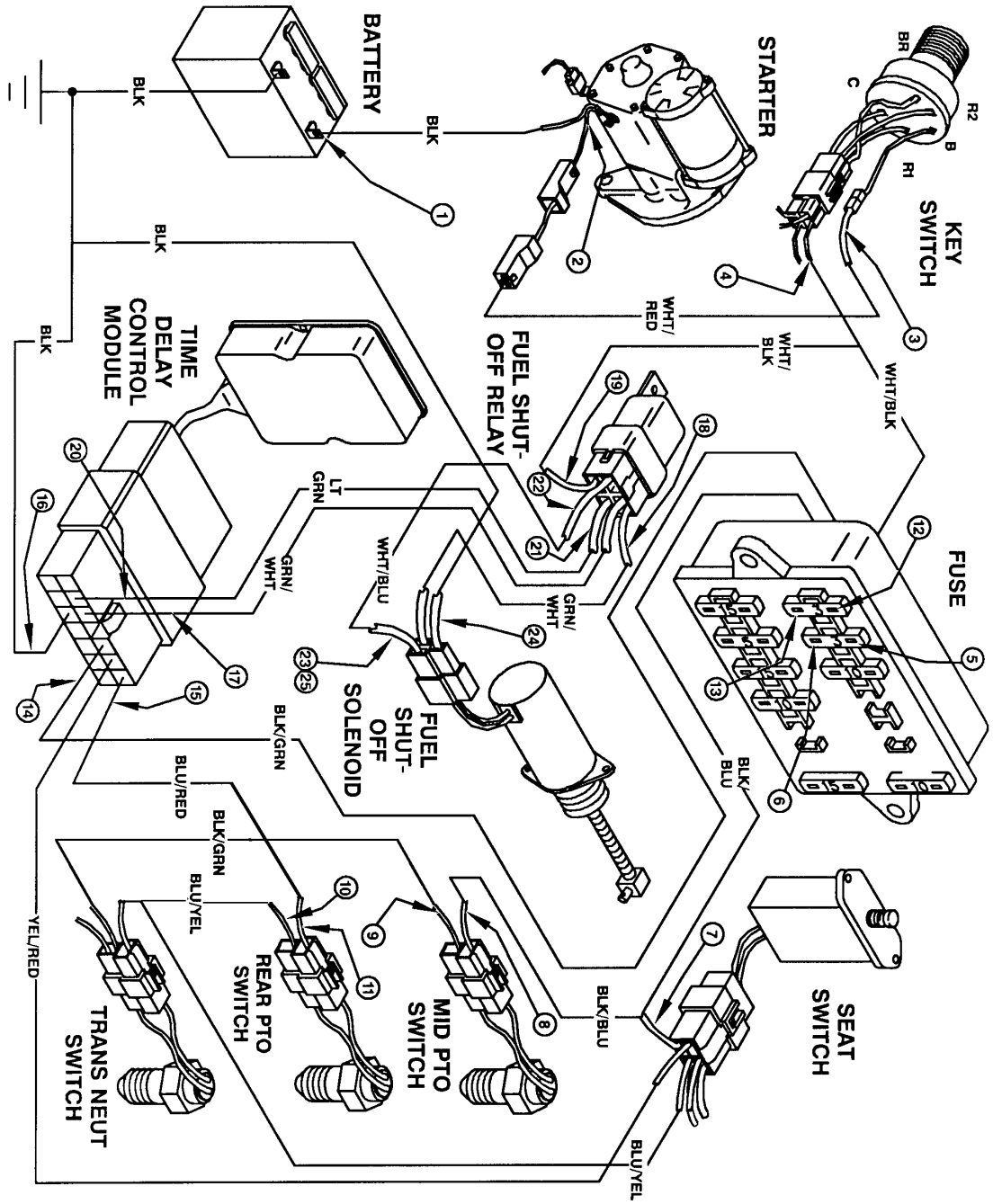
Test Check Points	Normal	If Not Normal
1. Battery Positive	11.8—13.2 Volts	Test battery
2. Starter Connector	Battery voltage	Check Blk wire
3. Key Switch Terminal B	Battery voltage	Check Wht/Red wire and fusible link
4. Key Switch Terminal BR	Battery voltage	Test Key Switch
5. 3 Amp Fuse (Hot Side)	Battery voltage	Check Wht/Blk wire
6. 3 Amp Fuse (Protected Side)	Battery voltage	Test fuse Check fuse block
7. Seat Switch	Battery voltage	Check Blk/Blu wire
8. Mid PTO Switch	Battery voltage	Check Blk/Blu wire
9. Mid PTO Switch	Battery voltage	Test Mid PTO Switch
10. Rear PTO Switch	Battery voltage	Check Blu/Yel wire
11. Rear PTO Switch	Battery voltage	Test Rear PTO Switch
12. 3 Amp Fuse (Hot Side)	Battery voltage	Check Wht/Blk wire
13. 3 Amp Fuse (Protected Side)	Battery voltage	Test Fuse Check Fuse Block
14. TDCM (Blk/Grn)	Battery voltage	Check Blu/Grn wire
15. TDCM (Blu/Red)	Battery voltage	Check Blu/Red wire
IMPORTANT: Turn Key Switch "OFF" before next Test Point Check.		
16. TDCM Blk Wire to Tractor Ground	Continuity	Check Blk wire


M58610
FUEL SHUT-OFF PULL- IN TEST POINTS
(NEW VERSION)
BATTERY
STARTER
KEY SWITCH
BR
C
R2
B
R1
FUSE
TIME DELAY CONTROL MODULE
FUEL SHUT-OFF RELAY
FUEL SHUT-OFF SOLENOID
SEAT SWITCH
MID PTO SWITCH
REAR PTO SWITCH
TRANS NEUT SWITCH
BLK
WHT/RED
WHT/BLK
WHT/BLK
LT GRN
GRN/WHT
WHT/BLU
GRN/WHT
BLK/BLU
BLK/GRN
BLU/RED
BLK/GRN
BLU/YEL
YEL/RED
BLK/BLU
BLU/YEL
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25

FUEL SHUT-OFF PULL-IN SYSTEM TEST POINTS —(PTO IN OFF POSITION)/(OPERATOR OFF SEAT) —(NEW VERSION) —CONTINUED

IMPORTANT: Unless otherwise specified, from this point on the Key Switch must be turned "OFF", then put in the "ON" position after the test connection is made. The normal reading will occur for only 0.5—1.5 seconds after the key is moved to "ON". This is due to the function of the Time Delay Control Module (TCDM).

Test Check Points	Normal	If Not Normal
IMPORTANT: Turn Key Switch "ON" before next Test Point Check.		
17. TDCM (Grn/Wht) Wire to Tractor Ground	0 volts for 0.5-1.5 seconds Battery voltage after 0.5-1.5 seconds.	Replace TDCM
18. TDCM (Grn/Wht)	Battery voltage	Check Grn/Wht wire
19. Fuel Shut-Off Pull-In Coil Relay (Lt Grn)	0 volts for 0.5-1.5 seconds Battery voltage after 0.5-1.5 seconds.	Replace Relay
20. TDCM (Lt Grn)	0 volts for 0.5-1.5 seconds Battery voltage after 0.5-1.5 seconds.	Check Lt Grn Wire or Replace TDCM
21. Fuel Shut-Off Pull-In Coil Relay	Battery voltage (constant)	Check Wht/Blk wire
22. Fuel Shut-Off Pull-In Coil Relay	Battery voltage (0.5-1.5 seconds)	Test relay
23. Fuel Shut-Off Solenoid	Battery voltage (0.5-1.5 seconds)	Check Wht/Blu wire
IMPORTANT: Turn Key Switch "OFF" before next Test Point Check.		
24. Fuel Shut-Off Solenoid (Blk) to Tractor Ground	Continuity	Check Blk wire
25. See Fuel Shut-Off Solenoid Test later in this group.		



M58610

FUEL SHUT-OFF PULL- IN TEST POINTS

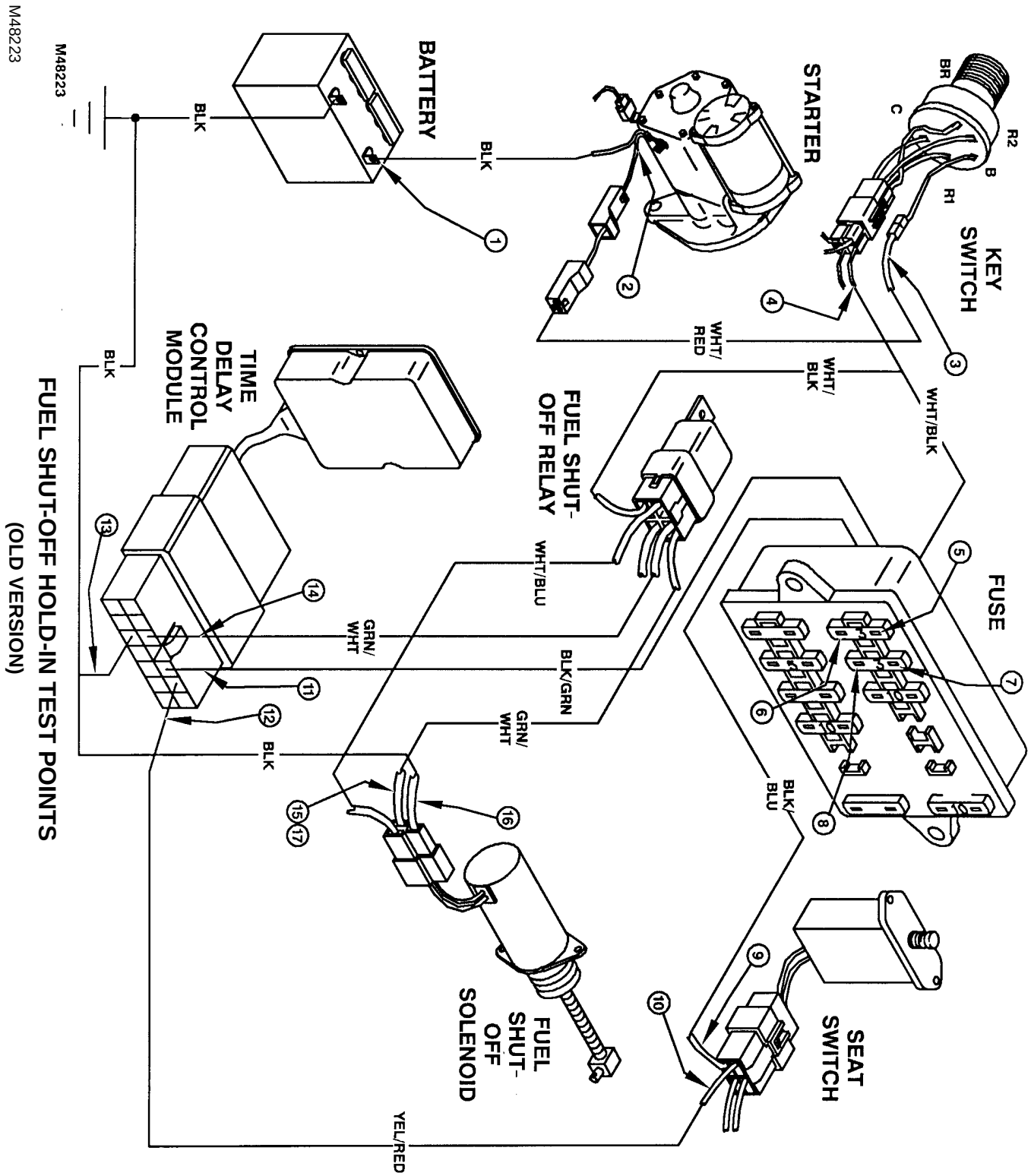
(NEW VERSION)

FUEL SHUT-OFF HOLD-IN SYSTEM TEST POINTS —(OPERATOR ON SEAT) —(OLD VERSION)

TEST CONDITIONS:

- Seat Switch “DEPRESSED”
- Key Switch in "ON" position

Test Check Points	Normal	If Not Normal
1. Battery Positive	11.8—13.2 Volts	Test battery
2. Starter Connection	Battery voltage	Check Blk wire
3. Key Switch Terminal B	Battery voltage	Check Wht/Red wire and fusible link
4. Key Switch Terminal BR	Battery voltage	Test Key Switch
5. 3 Amp Fuse (Hot Side)	Battery voltage	Check Wht/Blk wire
6. 3 Amp Fuse (Protected Side)	Battery voltage	Test fuse Check fuse block
7. 3 Amp Fuse (Hot Side)	Battery voltage	Check Wht/Blk wire
8. 3 Amp Fuse (Protected Side)	Battery voltage	Test fuse Check fuse block
9. Seat Switch	Battery voltage	Check Blk/Blu wire
10. Seat Switch	Battery voltage	Test Seat Switch
11. TDCM (Blk/Grn)	Battery voltage	Check Blk/Grn wire
12. TDCM (Yel/Red)	Battery voltage	Check Yel/Red wire
IMPORTANT: Turn Key Switch “OFF” before next Test Point Check.		
13. TDCM Blk Wire to Tractor Ground	Continuity	Check Blk wire
IMPORTANT: Turn Key Switch “ON” before next Test Point Check.		
15. TCDM (Grn/Wht)	Battery voltage	Replace TCDM
16. Fuel-Shut-Off Solenoid	Battery voltage	Check Grn/Wht wire
IMPORTANT: Turn Key Switch “OFF” before next Test Point Check.		
17. Fuel Shut-Off Solenoid (Blk) to Tractor Ground	Continuity	Check Blk wire
18. See Fuel Shut-Off Solenoid Test later in this group.		



FUEL SHUT-OFF HOLD-IN TEST POINTS
(OLD VERSION)

FUEL SHUT-OFF HOLD-IN SYSTEM (OVERRIDE POSITION) —(OLD VERSION)

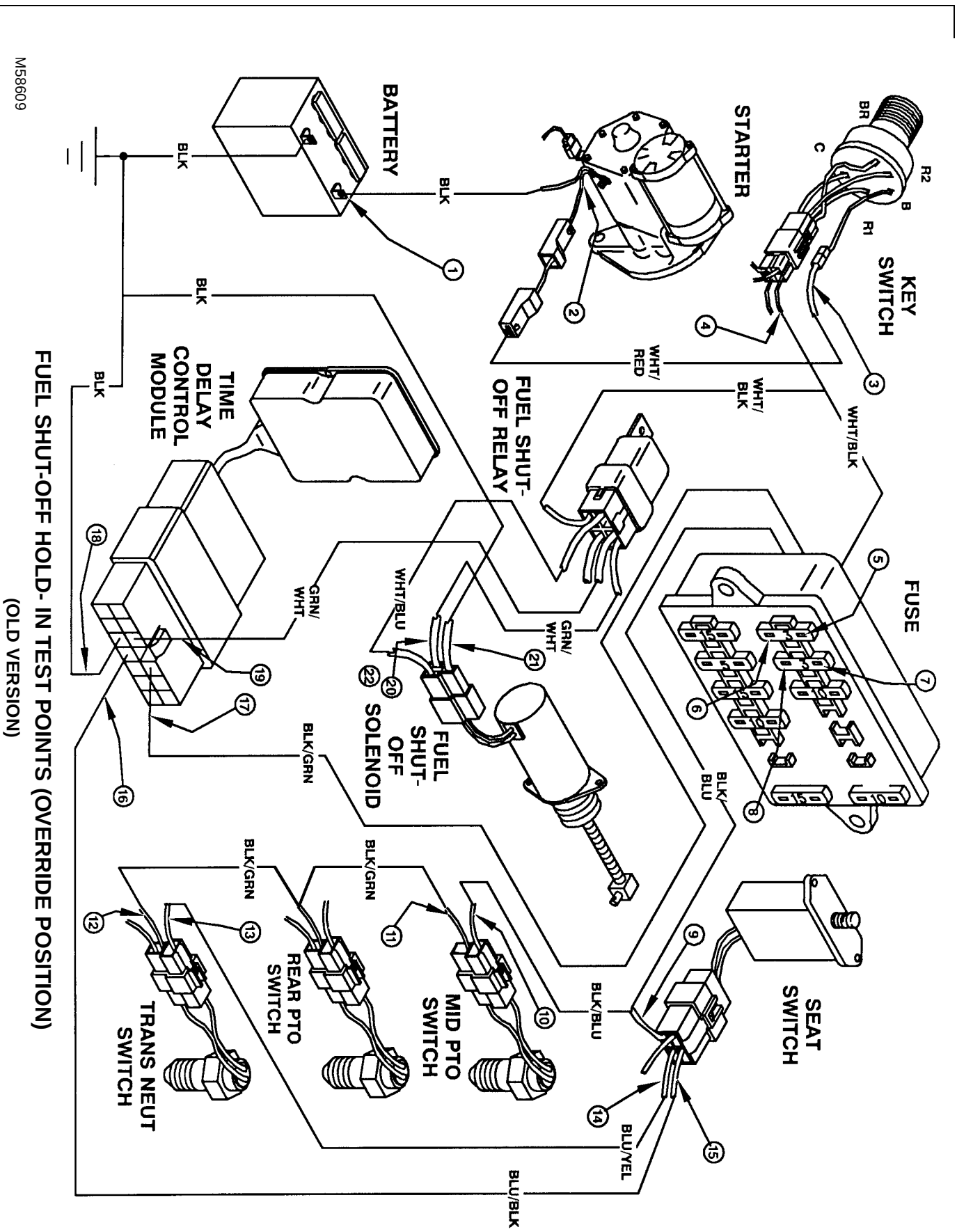
TEST CONDITIONS:

- Seat Switch pulled up to “DEFEAT”
- Transmission in “NEUTRAL”
- Mid PTO in “OFF” position
- Rear PTO in “ON” position
- Key Switch in “ON” position

“ENDING” SERIAL NUMBERS

- 670—670A104012
- 670 European Version—670A101145
- 770—770A105926
- 870—870A101860
- 870—870B103794
- 970—970A101517
- 970—970B103214
- 1070—1070A103813

Test Check Points	Normal	If Not Normal
1. Battery Positive	11.8—13.2 Volts	Test Battery
2. Starter Connector	Battery voltage	Check Blk wire
3. Key Switch Terminal B	Battery voltage	Check Wht/Red wire
4. Key Switch Terminal BR	Battery voltage	Test Key Switch
5. 3 Amp Fuse (Hot Side)	Battery voltage	Check Wht/Blk wire
6. 3 Amp Fuse (Protected Side)	Battery voltage	Test fuse and block
7. 3 Amp Fuse (Hot Side)	Battery voltage	Check Wht/Blk wire
8. 3 Amp Fuse (Protected Side)	Battery voltage	Test fuse and block
9. Seat Switch	Battery voltage	Check Blk/Blu wire
10. Mid PTO Switch	Battery voltage	Check Blk/Blu wire
11. Mid PTO Switch	Battery voltage	Test Mid PTO switch
12. Transmission Neutral Switch	Battery voltage	Check Blk/Grn wire
13. Transmission Neutral Switch	Battery voltage	Test Transmission Neutral Switch
14. Seat Switch	Battery voltage	Check Blu/Yel wire
15. Seat Switch	Battery voltage	Test Seat Switch
16. TDCM (Blk/Grn)	Battery voltage	Check Blk/Grn wire
17. TDCM (Blu/Blk)	Battery voltage	Check Blu/Blk wire
IMPORTANT: Turn Key Switch “OFF” before next Test Point Check.		
19. TDCM Blk Wire to Tractor Ground	Continuity	Check Blk wire
IMPORTANT: Turn Key Switch “ON” before next Test Point Check.		
21. TCDM (Grn/Wht)	Battery voltage	Replace TCDM
22. Fuel-Shut-Off Solenoid	Battery voltage	Check Grn/Wht wire
IMPORTANT: Turn Key Switch “OFF” before next Test Point Check.		
23. Fuel Shut-Off Solenoid (Blk) to Tractor Ground	Continuity	Check Blk wire
24. See Fuel Shut-Off Solenoid Test later in this group.		



FUEL SHUT-OFF HOLD- IN TEST POINTS (OVERRIDE POSITION)

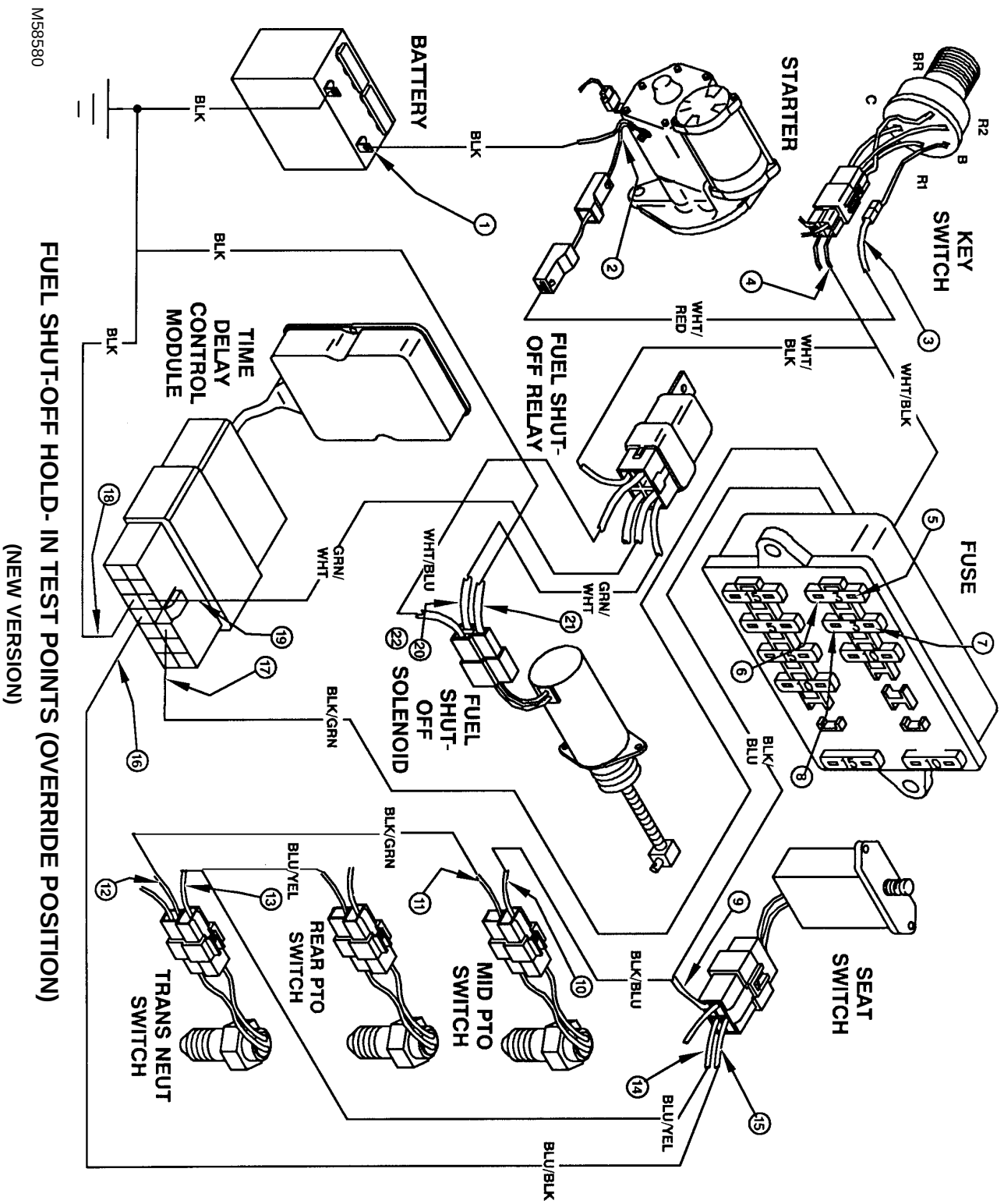
(OLD VERSION)

FUEL SHUT-OFF HOLD-IN SYSTEM (OVERRIDE POSITION) — (NEW VERSION)

TEST CONDITIONS:

- Seat Switch pulled up to “DEFEAT”
- Transmission in “NEUTRAL”
- Mid PTO in “OFF” position
- Rear PTO in “ON” position
- Key Switch in "ON" position

Test Check Points	Normal	If Not Normal
1. Battery Positive	11.8—13.2 Volts	Test Battery
2. Starter Connector	Battery voltage	Check Blk wire
3. Key Switch Terminal B	Battery voltage	Check Wht/Red wire
4. Key Switch Terminal BR	Battery voltage	Test Key Switch
5. 3 Amp Fuse (Hot Side)	Battery voltage	Check Wht/Blk wire
6. 3 Amp Fuse (Protected Side)	Battery voltage	Test fuse and block
7. 3 Amp Fuse (Hot Side)	Battery voltage	Check Wht/Blk wire
8. 3 Amp Fuse (Protected Side)	Battery voltage	Test fuse and block
9. Seat Switch	Battery voltage	Check Blk/Blu wire
10. Mid PTO Switch	Battery voltage	Check Blk/Blu wire
11. Mid PTO Switch	Battery voltage	Test Mid PTO switch
12. Transmission Neutral Switch	Battery voltage	Check Blk/Grn wire
13. Transmission Neutral Switch	Battery voltage	Test Transmission Neutral Switch
14. Seat Switch	Battery voltage	Check Blu/Yel wire
15. Seat Switch	Battery voltage	Test Seat Switch
16. TDCM (Blk/Grn)	Battery voltage	Check Blk/Grn wire
17. TDCM (Blu/Blk)	Battery voltage	Check Blu/Blk wire
IMPORTANT: Turn Key Switch “OFF” before next Test Point Check.		
18. TDCM Blk Wire to Tractor Ground	Continuity	Check Blk wire
IMPORTANT: Turn Key Switch “ON” before next Test Point Check.		
19. TCDM (Grn/Wht)	Battery voltage	Replace TCDM
20. Fuel-Shut-Off Solenoid	Battery voltage	Check Grn/Wht wire
IMPORTANT: Turn Key Switch “OFF” before next Test Point Check.		
21. Fuel Shut-Off Solenoid (Blk) to Tractor Ground	Continuity	Check Blk wire
22. See Fuel Shut-Off Solenoid Test later in this group.		



FUEL SHUT-OFF HOLD- IN TEST POINTS (OVERRIDE POSITION)

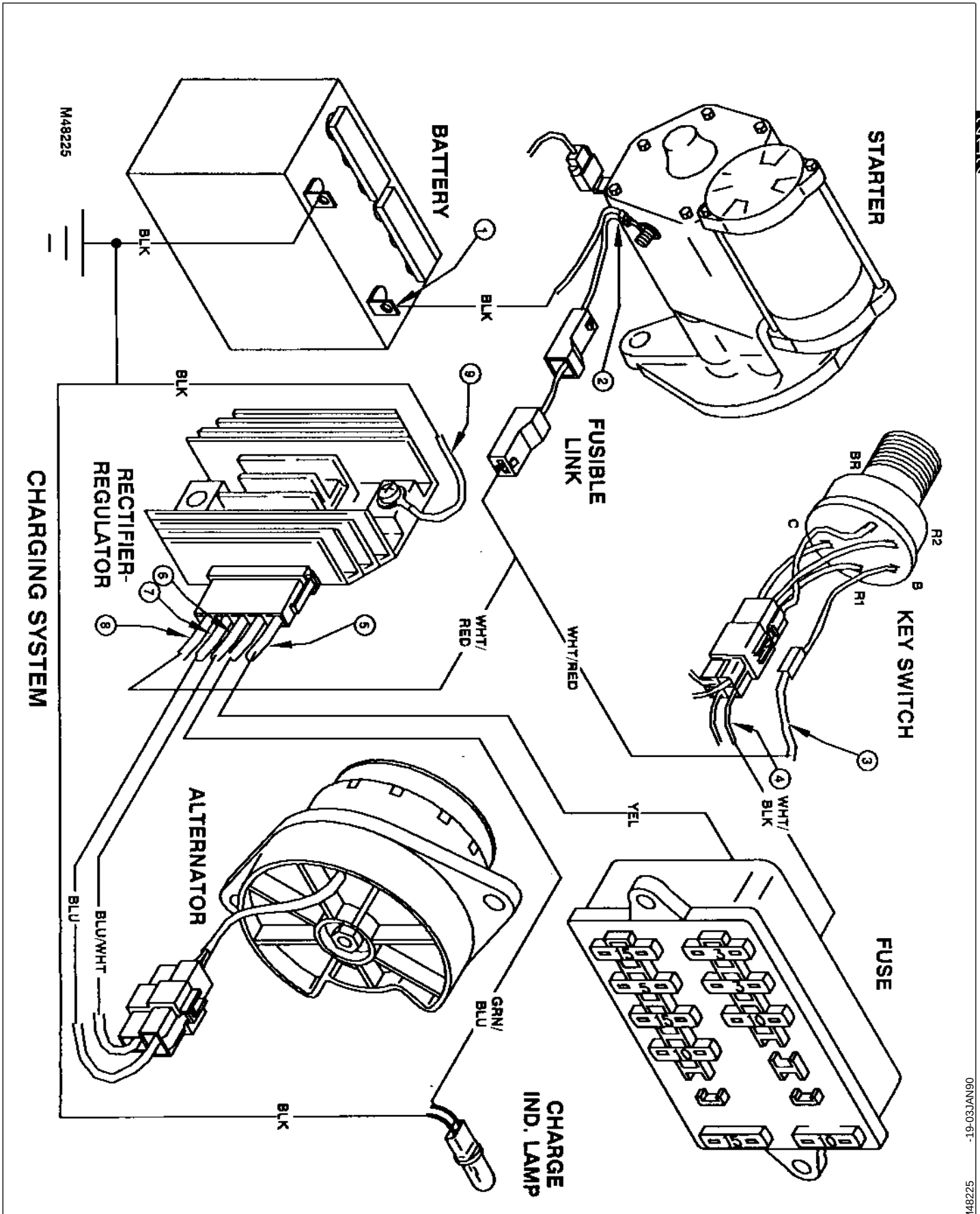
(NEW VERSION)

CHARGING SYSTEM TEST POINTS

TEST CONDITIONS:

- PTO “OFF”
- Key Switch “ON”
- Park Brake “LOCKED”
- Transmission in “NEUTRAL”
- Rectifier/Regulator Harness “DISCONNECTED”

Test Check Points	Normal	If Not Normal
1. Battery Positive	11.8—13.2 Volts	Test Battery
2. Starter Connector	Battery voltage	Check Blk wire
3. Key Switch Terminal B	Battery voltage	Check Wht/Red wire and fusible link
4. Key Switch Terminal BR	Battery voltage	Test Key Switch
5. Rectifier/Regulator (Yel wire)	Battery voltage	Check Blk/Wht wire, Yel wire, fuse and connections.
NOTE: Start engine and run at 2500 rpm for test (6—8).		
6-7. Rectifier/Regulator (Regulator disconnected)	Standard 20 Amp 40 VAC Optional 35 Amp Min 11 VAC	Check Blu and Blu/Wht wires. Check belt tension. Test Alternator.
8. Wht/Red Rectifier/Regulator wire	14 Volts (Min) 15 Volts (Max)	Check Wht/Red wire and connections. Replace Regulator. See Regulated Output Test.
IMPORTANT: Turn Key Switch “OFF” before next Test Point Check.		
9. Blk wire to tractor ground	Continuity	Check Blk wire



Slide No. 90

MX,24015DG,A14 -19-25SEP89

GLOW PLUG SYSTEM TEST POINTS

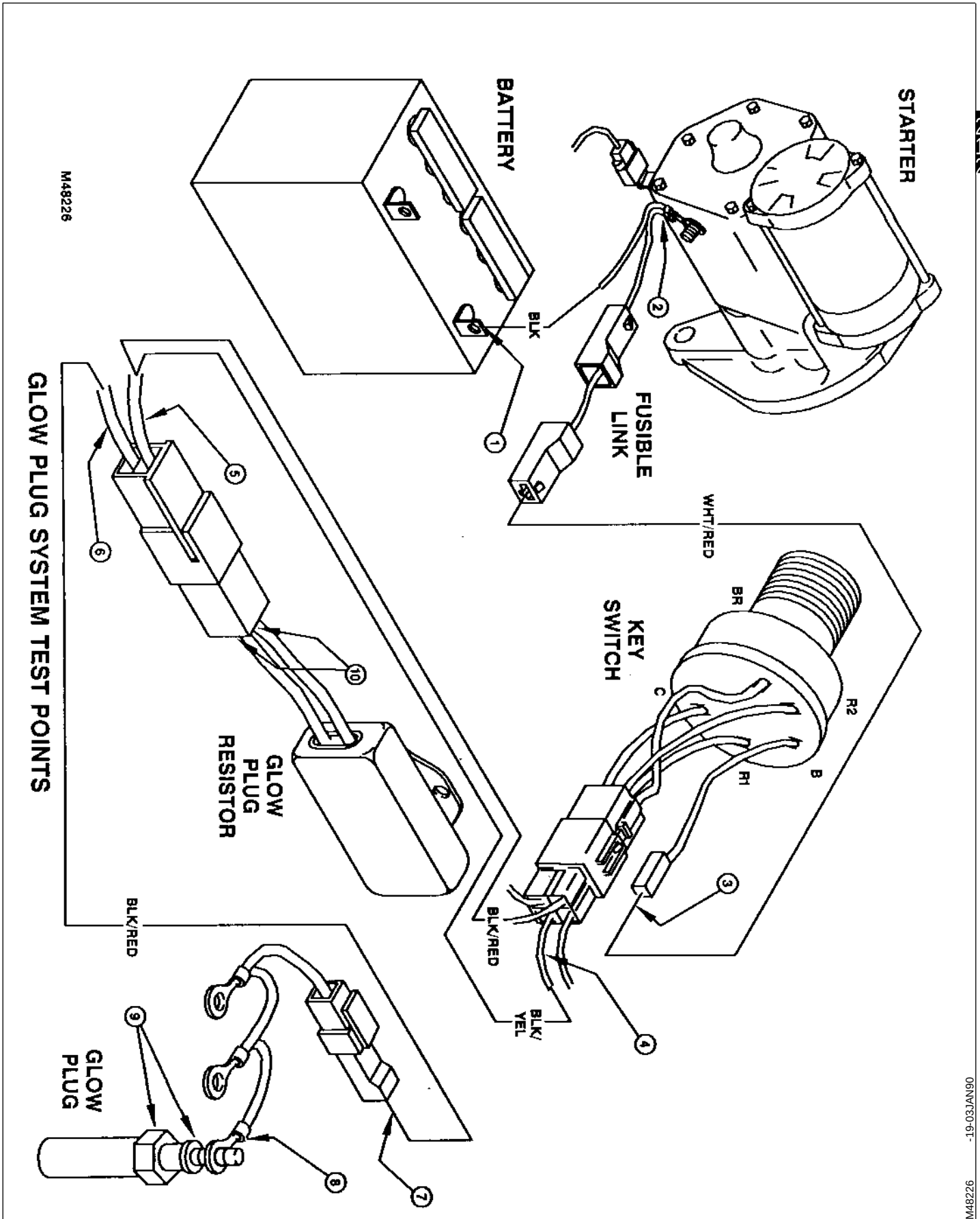
TEST CONDITIONS:

•Key in preheat position

240
15
22

Test Check Points	Normal	If Not Normal
1. Battery Positive	11.8—13.2 volts	Test Battery
2. Starter Connector	Battery voltage	Check Blk wire
3. Key Switch Terminal B	Battery voltage	Check Wht/Red wire and fusible link
4. Key Switch Terminal RI	Battery voltage	Test key switch
5. Glow Plug Resistor	Battery voltage	Check Blk/Yel wire
6. Glow Plug Resistor	Battery voltage	Replace resistor
7. Front Glow Plug	Battery voltage	Check Blk/Red wire
NOTE: Turn key to start position.		
8. Front Glow Plug	Battery voltage	Check Blk/Red wire
9. Glow Plug (Resistance)	0.2 ohms	Replace glow plug
10. Resistor (Resistance)	0.2 ohms	Replace resistor

MX,24015DG,A15 -19-25SEP89



Slide No. 91

MX,24015DG,A16 -19-25SEP89

AIR HEATER SYSTEM TEST POINTS

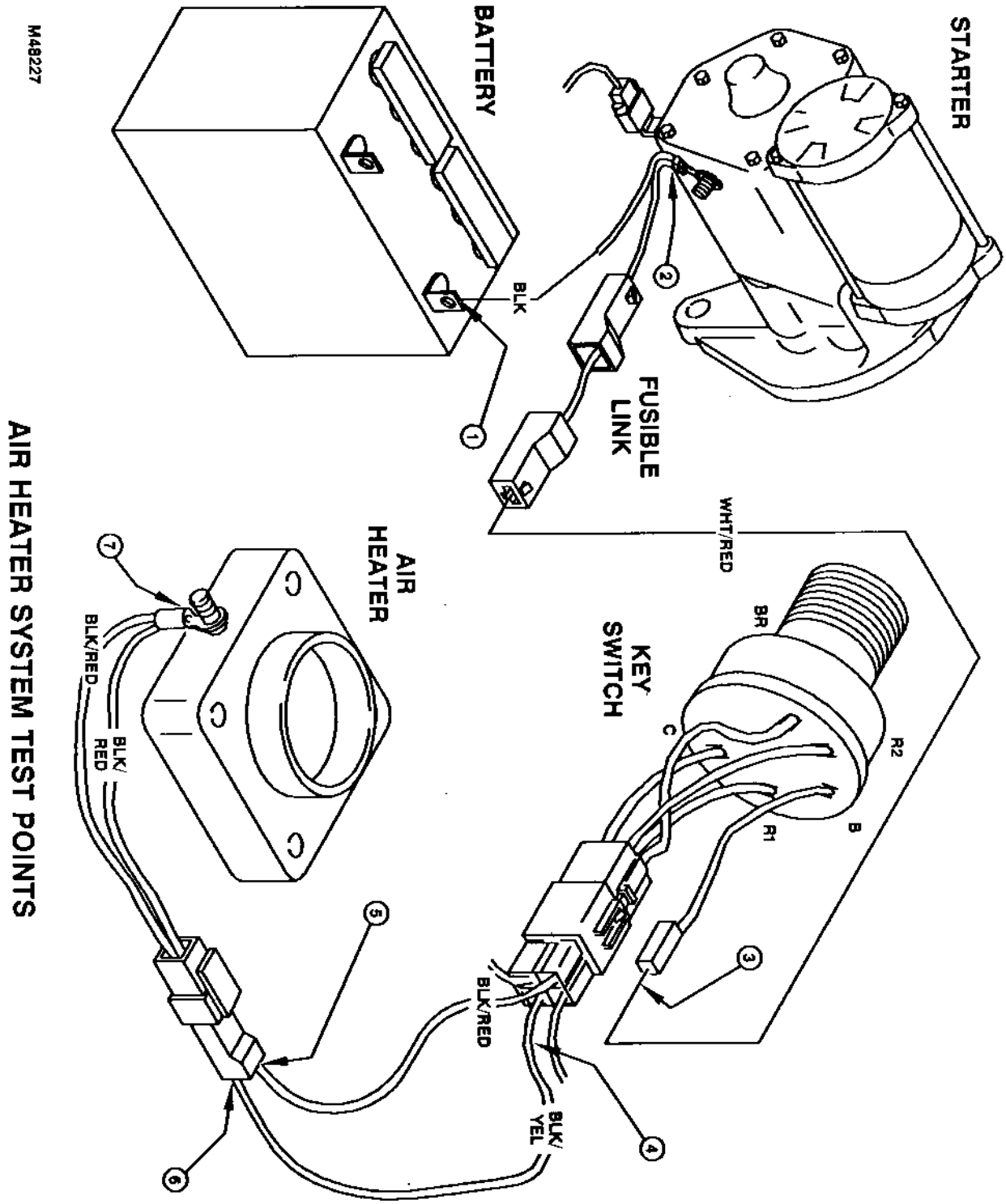
TEST CONDITIONS:

•Key in preheat position

240
15
24

Test Check Points	Normal	If Not Normal
1. Battery Positive	11.8—13.2 volts	Test Battery
2. Starter Connector	Battery voltage	Check Blk wire
3. Key Switch Terminal B	Battery voltage	Check Wht/Red wire and fusible link
4. Key Switch Terminal RI	Battery voltage	Test key switch
5. Air Heater	Battery voltage	Check Blk/Yel wire
NOTE: Turn key to start position.		
6. Air Heater	Battery voltage	Check Brn wire
7. Air Heater Resistance	0.6 ohms	Replace air heater

MX,24015DG,A17 -19-25SEP89



M48227 -19-03JAN90

Slide No. 92

MX,24015DG,A18 -19-25SEP89

PARK BRAKE INDICATOR LIGHT CIRCUIT TEST POINTS

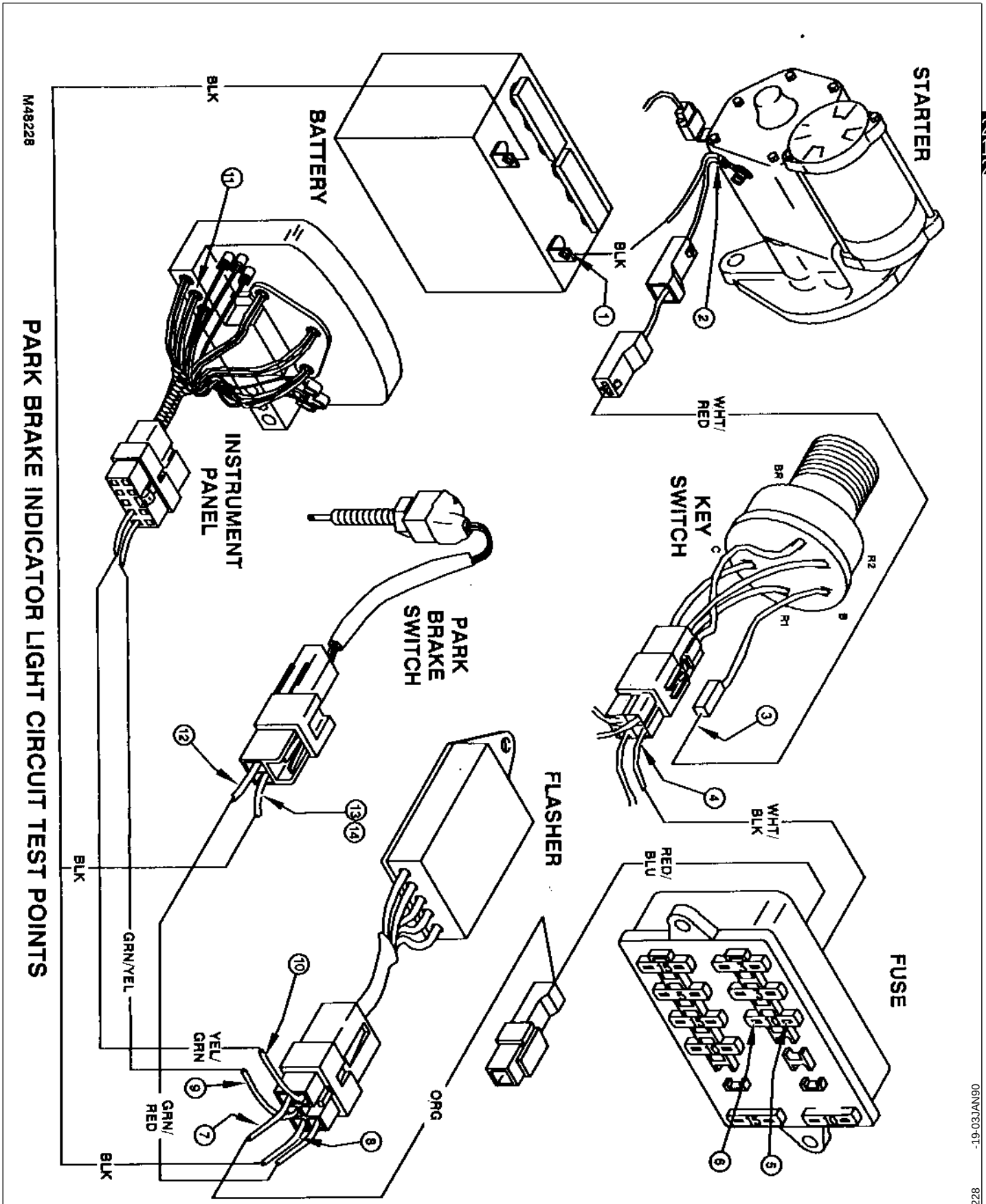
TEST CONDITIONS:

240
15
26

•Key switch in run position
•Park Brake latch in lock position

Test Check Points	Normal	If Not Normal
1. Battery Positive	11.8—13.2 volts	Test Battery
2. Starter Connector	Battery voltage	Check Blk wire
3. Key Switch Terminal B	Battery voltage	Check Wht/Red wire and fusible link
4. Key Switch Terminal BR	Battery voltage	Test key switch
5. 10 Amp Fuse (Hot Side)	Battery voltage	Check Wht/Blk wire
6. 10 Amp Fuse (Protected Side)	Battery voltage	Test fuse Test fuse bar
7. Flasher	Battery voltage	Check Org and Red/Blu wires
8. Blk Wire to Ground	Good continuity	Check Blk wire
9. Flasher	0 volts (ground side)	Replace flasher
10. Park Brake Indicator Lamp	0 volts	Check Grn wire
11. Flasher	Battery voltage (intermittently)	Check bulb and Grn/Yel wire
12. Park Brake Switch	0 volts (brake locked) 0.7 volts (brake released)	Check Grn/Red wire
13. Park Brake Switch	0 volts	Test park brake switch
14. Blk Wire to Ground	Good continuity	Check Blk wire

MX,24015DG,A19 -19-25SEP89



Slide No. 93

MX,24015DG,A20 -19-25SEP89

WARNING LIGHT CIRCUIT TEST POINTS

TEST CONDITIONS:

240
15
28

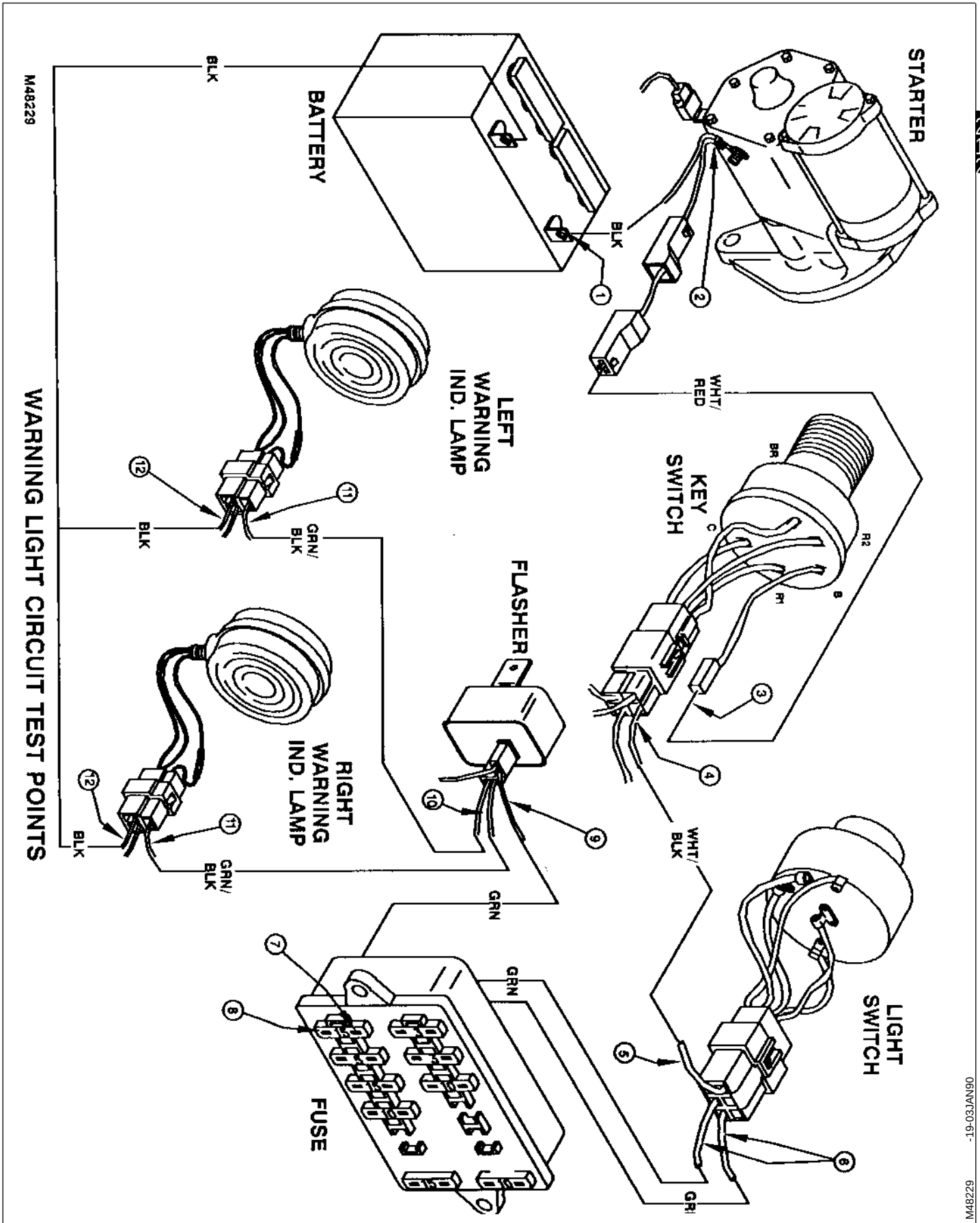
- Key switch in run position
- Light switch in warning position
- Make sure bulbs are in good condition

Test Check Points	Normal	If Not Normal
1. Battery Positive	11.8—13.2 volts	Test Battery
2. Starter Connector	Battery voltage	Check Blk wire
3. Key Switch Terminal B	Battery voltage	Check Wht/Red wire and fusible link
4. Key Switch Terminal BR	Battery voltage	Test key switch
5. Light Switch	Battery voltage	Check Wht/Blk wire
6. Light Switch (Both Terminals)	Battery voltage	Test light switch

NOTE: Repeat test 6 with light switch in "ON" position.

7. 15 Amp Fuse (Hot Side)	Battery voltage	Check Grn wires
8. 15 Amp Fuse (Protected Side)	Battery voltage	Test fuse Test fuse block
9. Flasher	Battery voltage	Check Grn wire
10. Flasher	Battery voltage (intermittently)	Replace flasher
11. Warning Lamp Socket (center contact)	Battery voltage (intermittently)	Check Grn/Blk wire or Grn/Yel wire
12. Warning lamp socket (outer shell)	Good continuity	Check Blk wires

MX,24015DG,A21 -19-25SEP89



Slide No. 94

MX,24015DG,A22 -19-25SEP89

FLOOD LIGHT CIRCUIT TEST POINTS

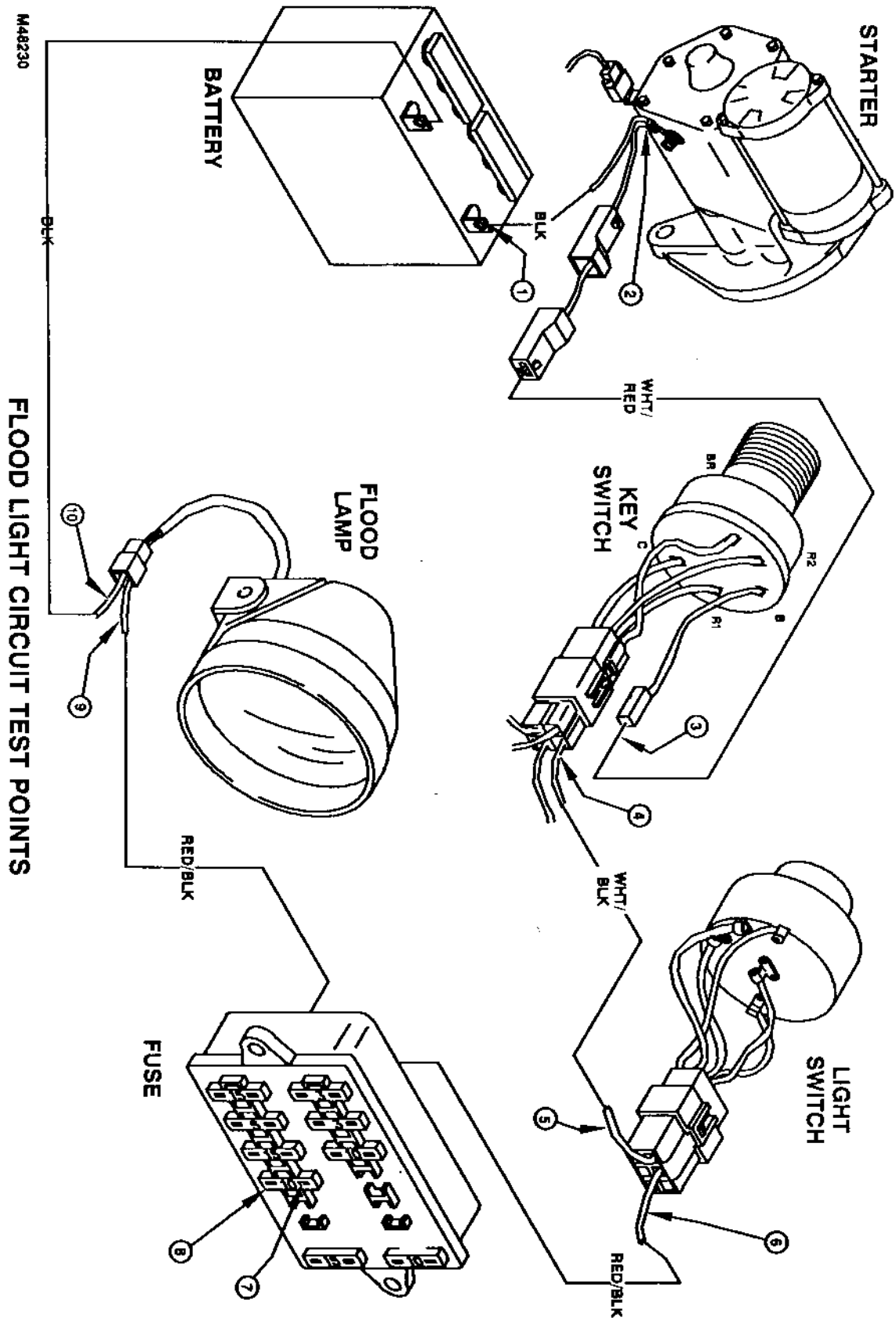
TEST CONDITIONS:

240
15
30

•Key switch in “ON” Position
•Light switch in work position
•Make sure that bulbs are in good condition

Test Check Points	Normal	If Not Normal
1. Battery Positive	11.8—13.2 volts	Test Battery
2. Starter Connector	Battery voltage	Check Blk wire
3. Key Switch Terminal B	Battery voltage	Check Wht/Red wire and fusible link
4. Key Switch Terminal BR	Battery voltage	Test key switch
5. Light Switch	Battery voltage	Check Wht/Blk wire
6. Light Switch	Battery voltage	Test light switch
7. 10 Amp Fuse (Hot Side)	Battery voltage	Check Red wire
8. 10 Amp Fuse (Protected Side)	Battery voltage	Check fuse
9. Flood Lamps	Battery voltage	Check Red/Blk wires
10. Blk Ground Wires to Tractor Ground	Good continuity	Check Blk wires

MX,24015DG,A23 -19-25SEP89



M48230 -19-03JAN90

Slide No. 95

MX,24015DG,A24 -19-25SEP89

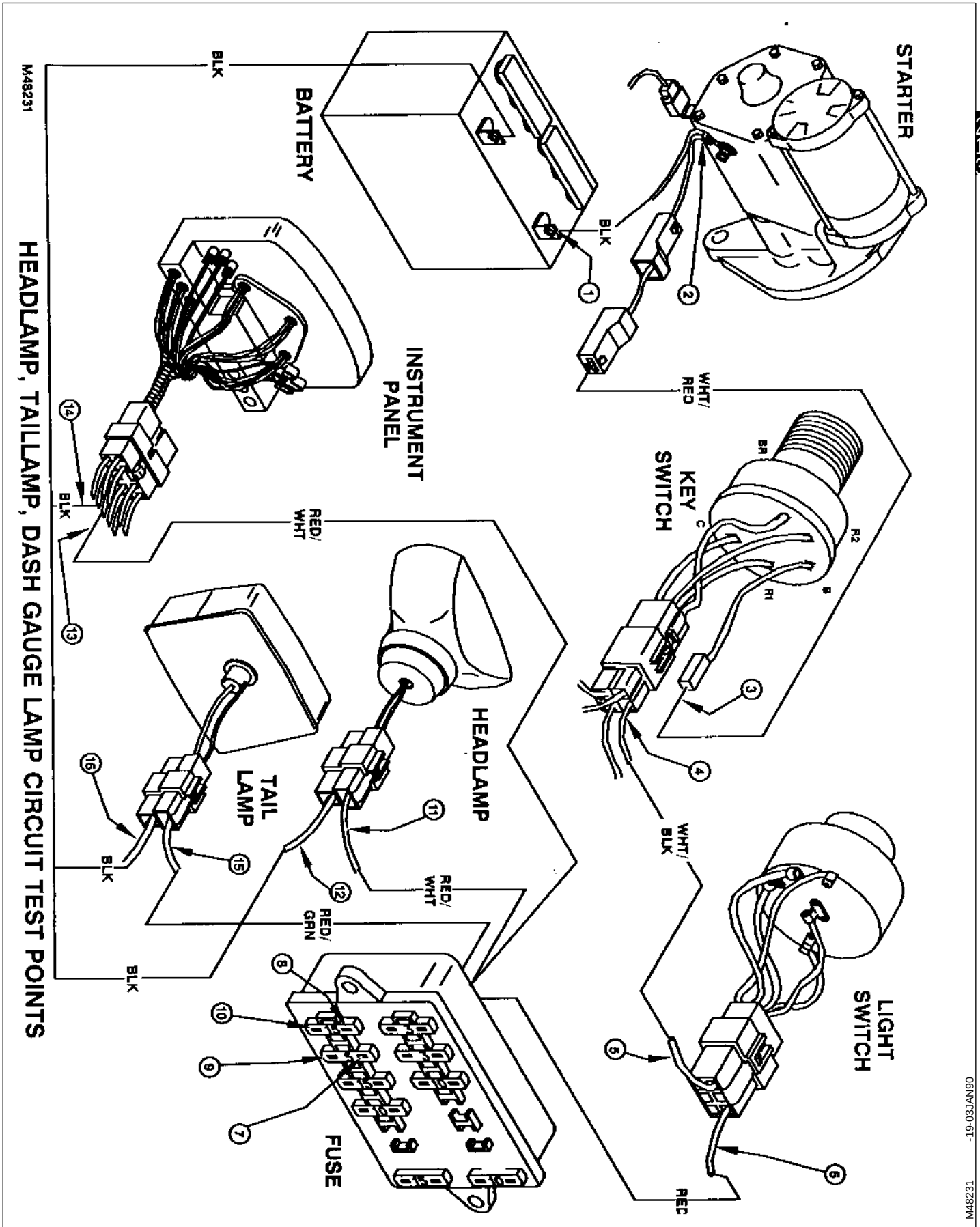
HEADLAMP/TAILLAMP/DASH-GAUGE LAMP CIRCUIT TEST POINTS

TEST CONDITIONS:

- Key switch in run position
- Light switch in “ON” position
- Make sure that bulbs are in good condition

Test Check Points	Normal	If Not Normal
1. Battery Positive	11.8—13.2 volts	Test Battery
2. Starter Connector	Battery voltage	Check Blk wire
3. Key Switch Terminal B	Battery voltage	Check Wht/Red wire and fusible link
4. Key Switch Terminal BR	Battery voltage	Test key switch
5. Light Switch	Battery voltage	Check Wht/Blk wire
6. Light Switch	Battery voltage	Test light switch
7. 5 Amp Fuse (Hot Side)	Battery voltage	Check Red wire
8. 15 Amp Fuse (Hot Side)	Battery voltage	Check Red wire
9. 5 Amp Fuse (Protected Side)	Battery voltage	Check fuse
10. 15 Amp Fuse (Protected Side)	Battery voltage	Check fuse
11. Headlamp	Battery voltage	Check Red/Wht wire
12. Blk Ground Wire to Tractor Ground	Continuity	Check Blk wire
13. Fuel Gauge Lamp	Battery voltage	Check Red/Wht wire
14. Blk Ground Wires to Tractor	Continuity	Check Blk wire
15. Taillamps	Battery voltage	Check Red/Grn wire
16. Blk Ground Wires to Tractor Ground	Continuity	Check Blk wires

MX,24015DG,A25 -19-25SEP89



Slide No. 96

MX,24015DG,A26 -19-25SEP89

INSTRUMENT SYSTEM TEST POINTS

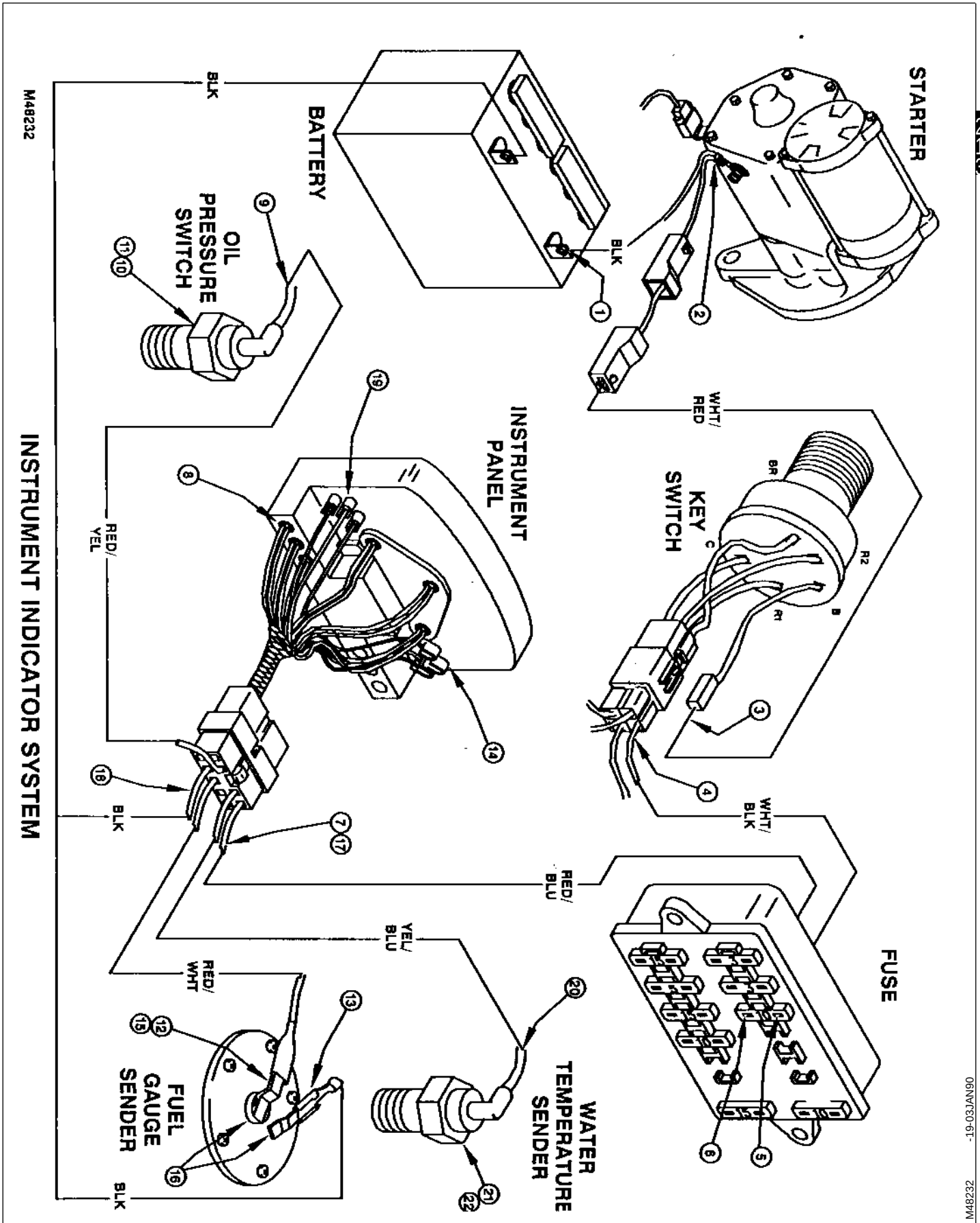
TEST CONDITIONS:

•Key switch in run position

NOTE: If all instruments are inoperative start with test 1. Perform tests 8 through 11 if the oil pressure light is the only problem. Perform tests 12 through 17 if fuel gauge is the only problem. Perform tests 18 through 23 if water temperature gauge is the only problem.

Test Check Points	Normal	If Not Normal
1. Battery Positive	11.8—13.2 volts	Test Battery
2. Starter Connector	Battery voltage	Check Blk wire
3. Key Switch Terminal B	Battery voltage	Check Wht/Red wire and fusible link
4. Key Switch Terminal BR (key in start position)	Battery voltage	Test key switch
5. Fuse (10 Amp)	Battery voltage	Check Wht/Blk wire
6. Fuse (10 Amp)	Battery voltage	Check fuse
7. Instrument power lead	Battery voltage	Check Red/Blu wire
8. Check Oil Pressure Lamp Bulb	Good condition	Check lamp socket or replace bulb.
9. Oil Pressure Switch	Less than 0.5 volts with switch closed, battery voltage with switch open.	Check Red/Yel wire
10. Sender to Tractor Ground	Continuity	Check ground through block or replace sender.
11. Test Oil Pressure Switch	Closes below 7 psi	Replace sender.
12. Fuel Gauge	Battery voltage	Check Red/Wht wire
13. Blk wire to Tractor Ground	Continuity	Check Blk wire
14. Fuel Gauge	Gauge will vary with sender position	Test Gauge
15. Fuel Gauge Sender		
—Wire disconnected	—Gauge should read “Empty”	Check Red/Wht wire
—Wire grounded	—Gauge should read “Full”	Replace fuel gauge
16. Fuel Gauge Sender	Resistance Increases as float lowers	Replace fuel sender

MX,24015DG,A27 -19-25SEP89



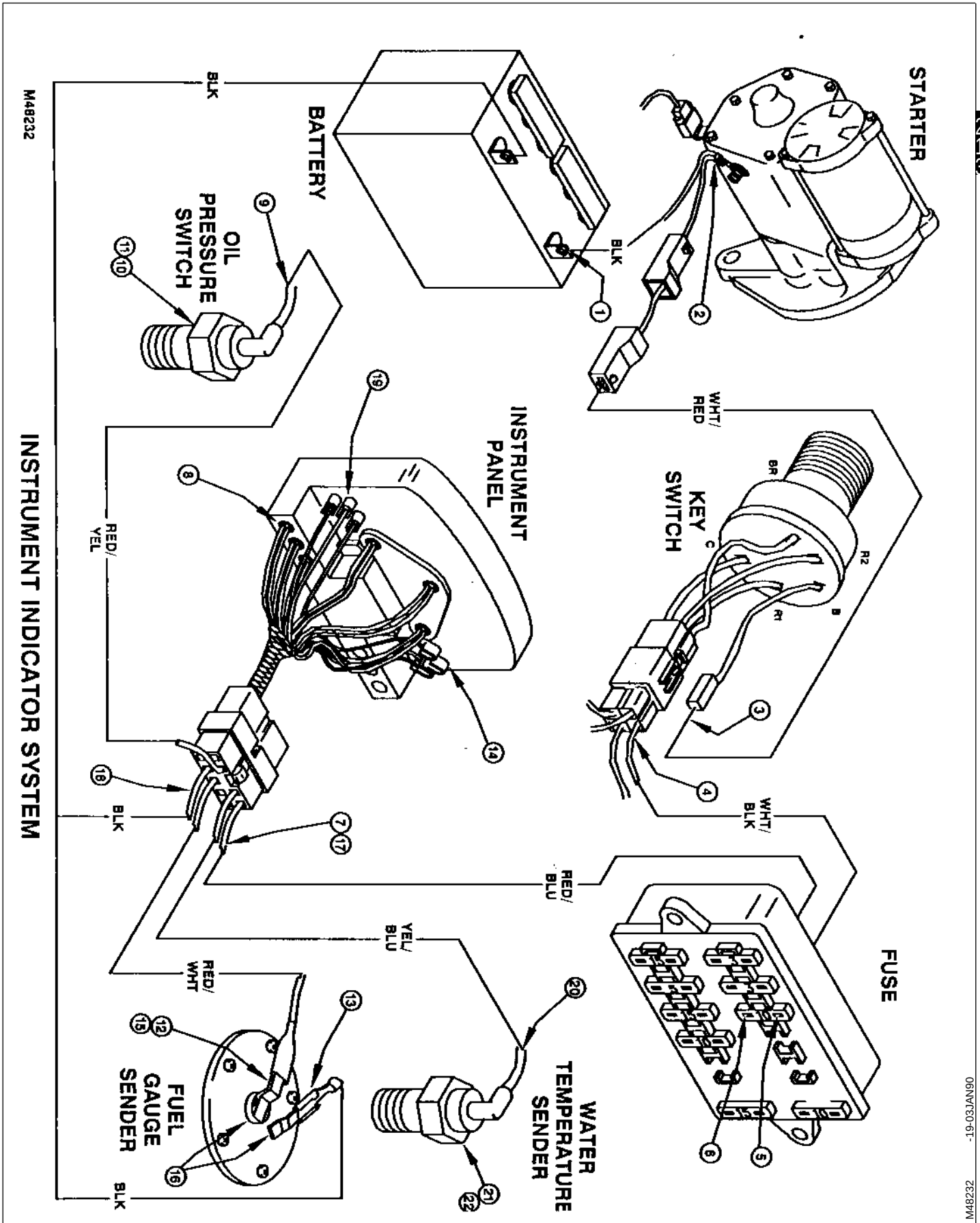
Slide No. 97

MX,24015DG,A28 -19-25SEP89

INSTRUMENT SYSTEM TEST POINTS—CONTINUED

17. Temperature Gauge	Battery voltage	Check Red/Blu wire.
18. Blk Wire to Tractor Ground	Continuity	Check Blk wire .
19. Temperature Gauge	Voltage varies with temperature	If 0 volts, replace gauge.
20. Water Temperature Sender —With sender wire disconnected —With sender wire grounded	 —Gauge reads “Cold” —Gauge reads “Hot”	 Check Yel/Blu wire or replace gauge.
21. Sender to tractor ground	Continuity	Check ground thru block or replace sender.
22. Test Water Temperature Sender	Resistance decreases as temperature increases	Replace sender.

MX,24015DG,A27A-19-25SEP89



Slide No. 97

MX,24015DG,A28 -19-25SEP89

BATTERY TESTS

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. Check specific gravity of each cell with a hydrometer.

•All cells less than 1.175: charge battery at 10 amp rate.

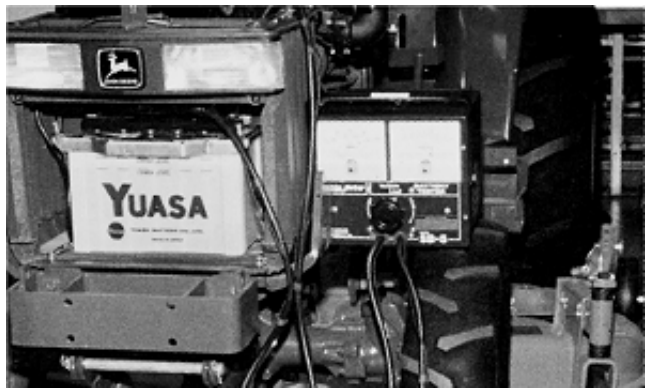
•All cells less than 1.225 with less than 50 point variation: load test battery.

•All cells less than 1.225 with less than 50 point variation: continue test.

•More than 50 point variation: replace battery.

5. Check battery voltage with voltmeter or JT05685 Battery Tester.

•Battery voltage less than 12.4 V: see CHARGE BATTERY in this group.
•Battery voltage more than 12.4 V: see LOAD TEST BATTERY in this group.



Slide No. 98

MX,24015DG,A29 -19-25SEP89

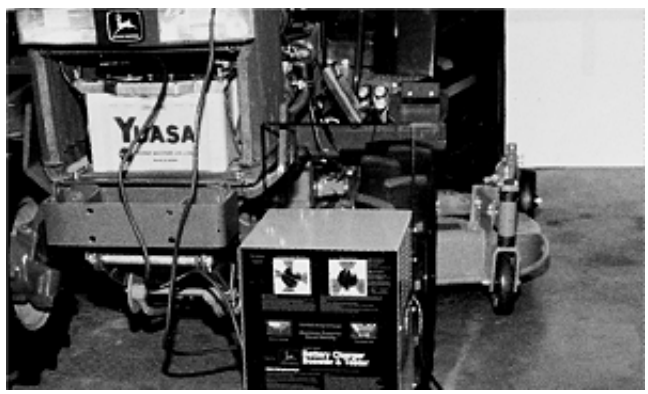
CHARGE BATTERY

NOTE: See TEST BATTERY 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.



Slide No. 99

MX,24015DG,A30 -19-25SEP89

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. (See TEST BATTERY in this group): 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 batter: 4—8 hours.)

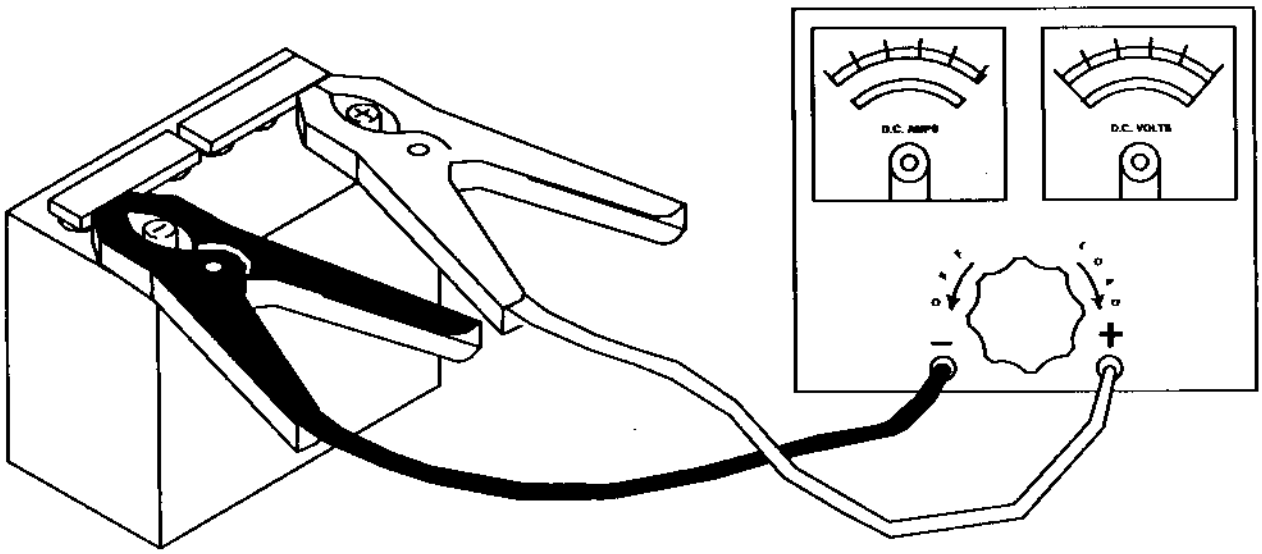
6. Continue charging battery until specific gravity is 1.230—1.265 points.

7. Load test battery. (See this group.)

MX,24015DG,A31 -19-25SEP89

LOAD TEST BATTERY

240
15
40



M48235

BATTERY LOAD TEST

-19-03JAN90

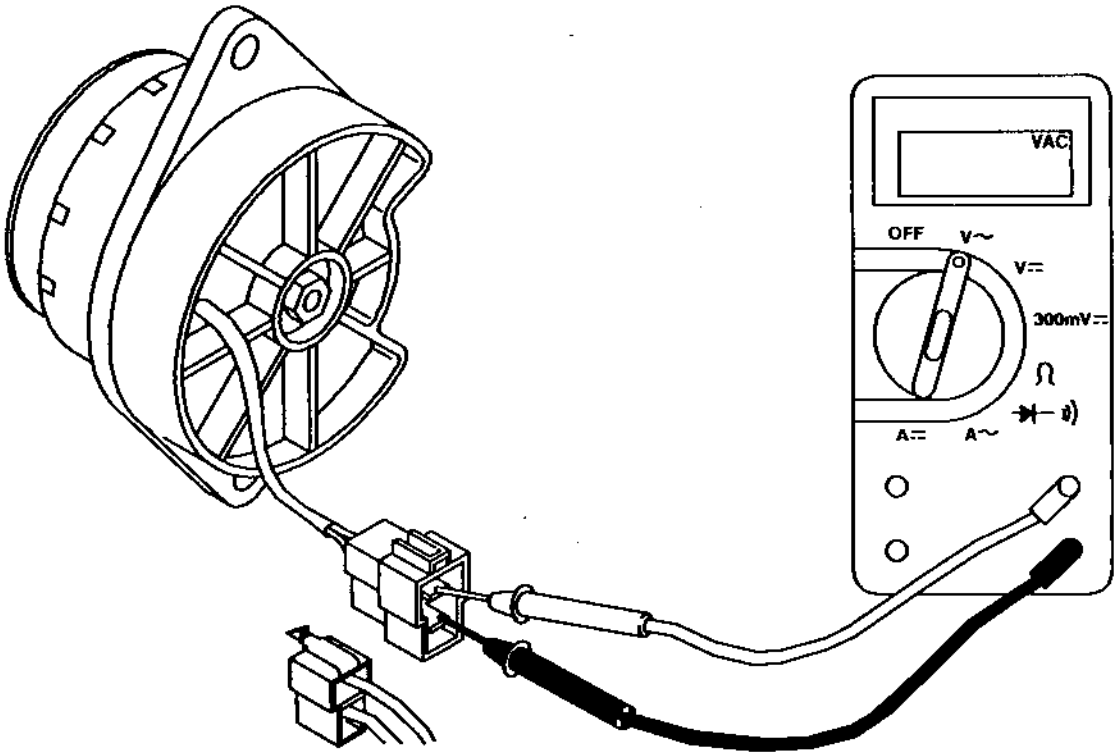
M48235

Slide No. 100

Connect JTO 5685 tester to battery. Follow instructions on back of meter for test battery. Replace battery if necessary.

MX,24015DG,A32 -19-25SEP89

ALTERNATOR UNREGULATED VOLTAGE OUTPUT TEST



M48237

ALTERNATOR UNREGULATED OUTPUT TEST

-19-03JAN90

M48237

Slide No. 101

1. Disconnect alternator from regulator/rectifier.

2. Run engine at fast idle.

3. Set voltmeter to 100 VAC. Connect meter across terminals (A).

SPECIFICATIONS

20 Amp Alternator . . . . . 40 VAC (min)

35 Amp Alternator . . . . . 11 VAC (min) (each lead)

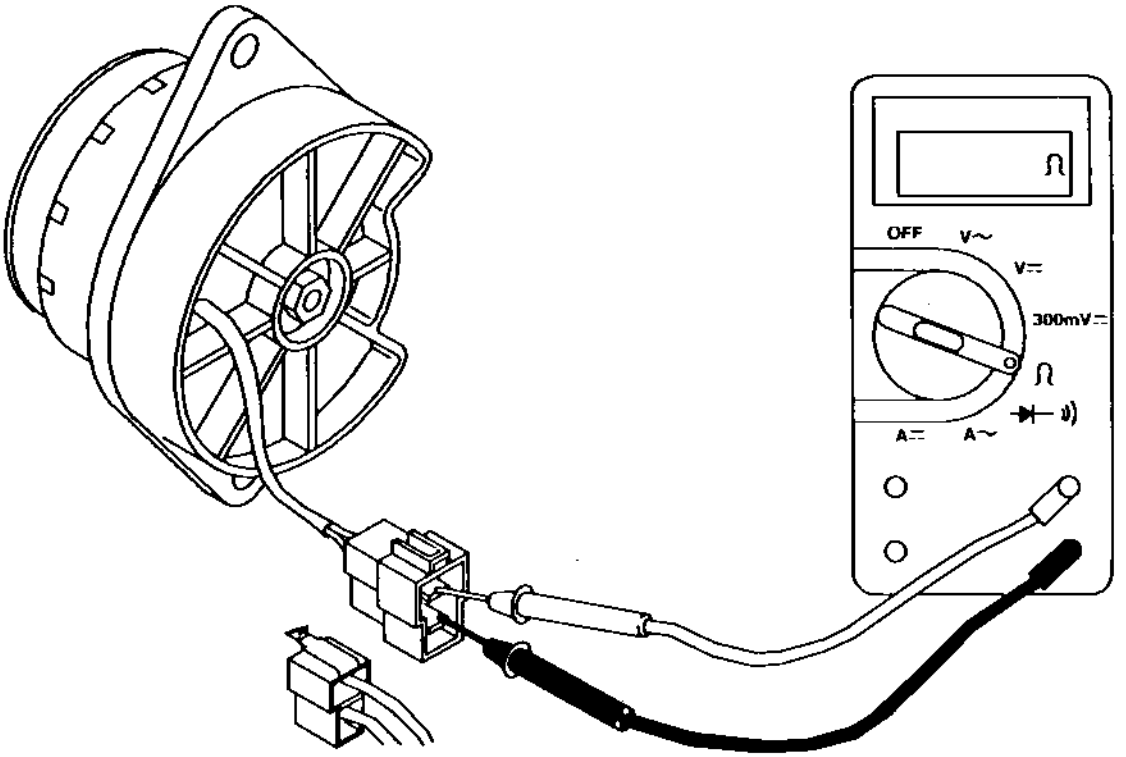
NOTE: On 35 amp alternator, disconnect all three leads. With engine at fast idle measure voltage of each lead with voltmeter positive lead to one of alternator leads. Connect negative lead of voltmeter to good ground.

4. Replace stator if reading is less than specifications.

MX,24015DG,A37 -19-25SEP89

TEST ALTERNATOR STATOR WINDING

240
15
42



STATOR RESISTANCE TEST

-19-03JAN90
M48238

Slide No. 102

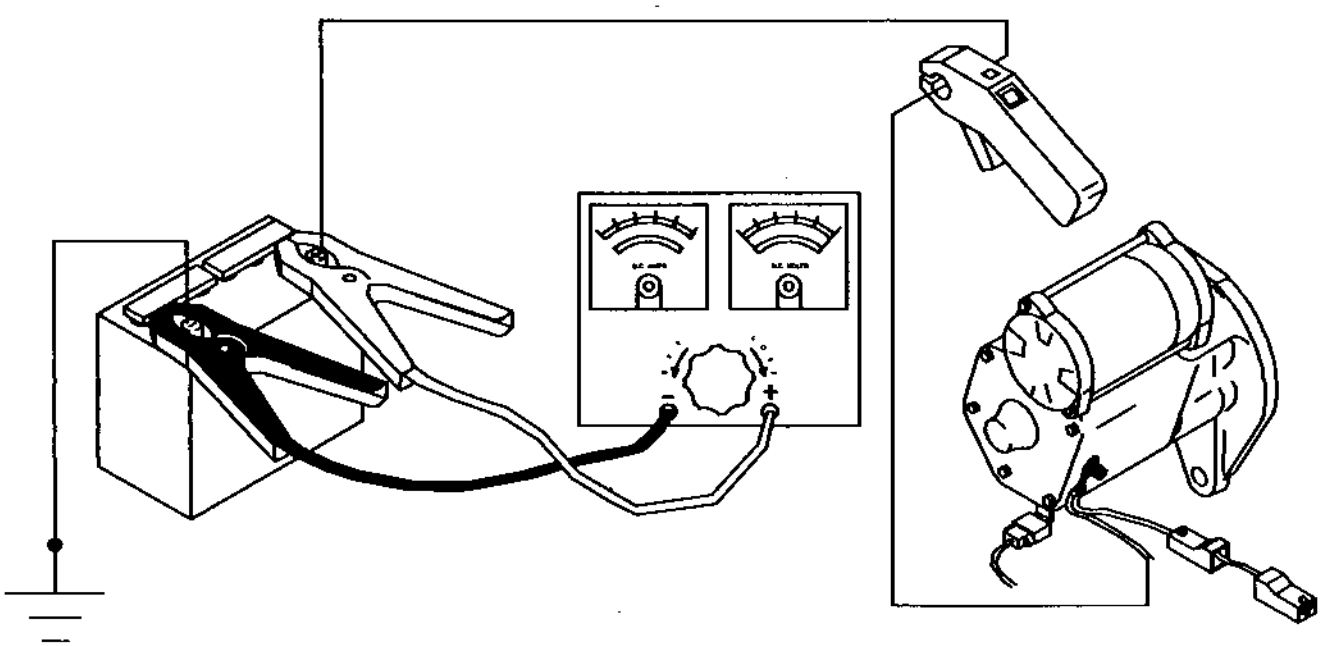
Check the stator windings for open circuit and grounding:

1. Disconnect alternator wiring harness and connect an ohmmeter across the two terminals. Meter should show continuity. If meter does not show continuity, stator windings are probably open-circuited. Repair alternator.

2. Connect ohmmeter to either terminal of alternator wiring connector and to alternator frame. Meter should NOT show continuity. If meter shows continuity, stator windings are probably grounded. Repair alternator.

MX,24015DG,A38 -19-25SEP89

TEST REGULATED OUTPUT



M48239

REGULATED VOLTAGE OUTPUT TEST

Slide No. 103

IMPORTANT: Perform this test quickly to prevent damage to battery tester. DO NOT apply full load to battery for more than 5—10 seconds.

1. Put JT05712 Current Gun over positive battery cable. Set Current Gun for DC current.

2. Turn load knob (A) fully out (counterclockwise). Connect JT05685 Battery Tester to battery.

SPECIFICATIONS

Battery Voltage	14 volts (min)
20 Amp Alternator	17 Amps (min)
35 Amp Alternator	32 Amps (min)

3. Run engine at full throttle.

4. Read battery voltage. If less than specification, replace regulator and retest.

5. Turn load knob in until maximum amperage output is obtained. If reading does not meet specifications, see TEST UNREGULATED VOLTAGE OUTPUT in this group, or for excessive amperage lead on electrical system.

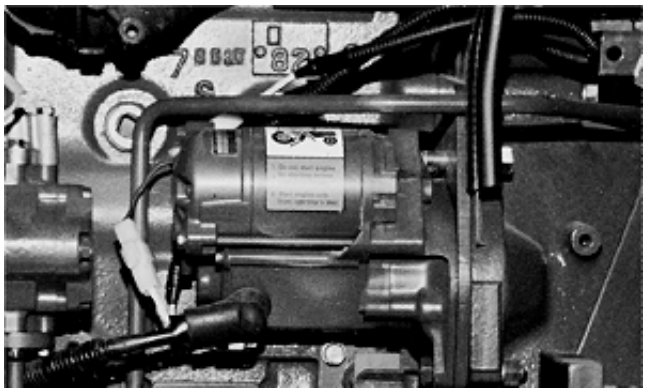
MX,24015DG,A39 -19-25SEP89

TEST STARTER SOLENOID

1. Test cranking system first to make sure voltage is available to starter solenoid.

2. Turn key to start and observe that the solenoid engages and stays engaged.

3. If solenoid does not engage, chatters or clicks check the engine ground strap or replace the starter solenoid.



M48240 -UN-09JAN90

Slide No. 104

MX,24015DG,A40 -19-25SEP89

TEST CRANKING SPEED AND STARTER AMP DRAW

1. Disconnect Fuel Shut-off Solenoid connector to prevent engine from starting during test.

IMPORTANT: Turn load knob (A) fully counterclockwise before making any test connections.

2. Connect JT05685 Battery Tester to battery: red lead to positive terminal, black lead to negative terminal.

NOTE: Battery must be fully charged.

3. Read voltage on meter while cranking engine.

4. Check engine rpm while cranking, using photo tachometer JT05719 (B).

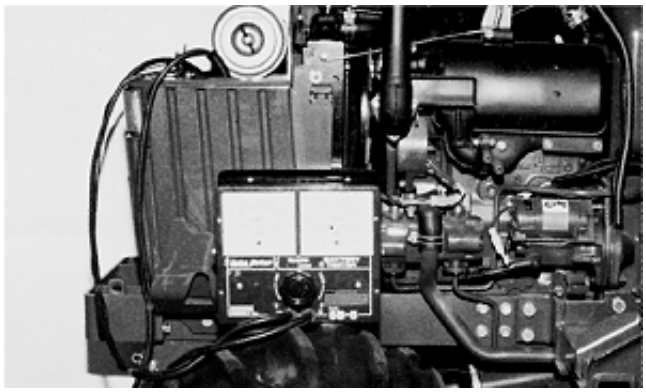
5. Turn ignition key to OFF. Adjust load knob until battery voltage reads the same as when cranking.

6. Read amperage on meter.
   —Amps out of specification, or in specification but rpm is low:
   Make sure engine is not locked up then perform starter no load rpm test.

7. Turn load knob fully counterclockwise.

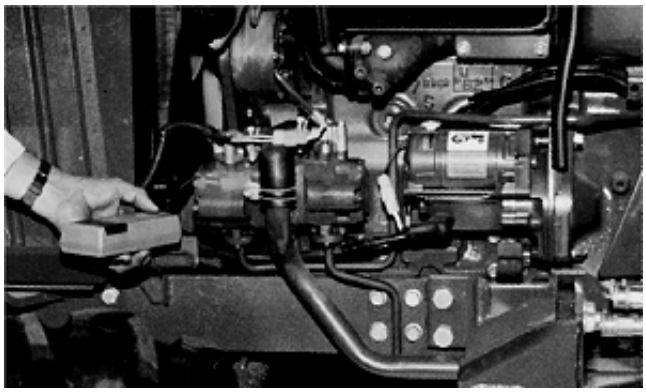
SPECIFICATIONS

Starter draw (max)	300 Amps
Cranking speed min	300 rpm



-UN-09JAN90
M48241

Slide No. 105



-UN-09JAN90
M48242

Slide No. 106

MX,24015DG,A41 -19-25SEP89

TEST STARTER NO-LOAD AMPERAGE

IMPORTANT: Complete this test in 20 seconds or less to prevent starter damage.

240
15
46

NOTE: Check that battery is fully charged and of proper size to ensure accuracy of test.

1. Connect jumper cables to battery.

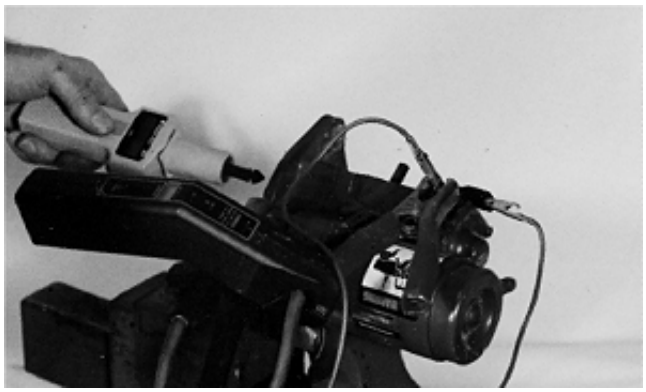
2. Connect negative cable to starter body. Connect positive cable to terminal (A).

3. Use jumper wire to connect terminals (A) and (B).

4. Measure starter amperage with JT05712 Current Gun.

5. Check RPM with photo tachometer JT05719 or mechanical tachometer D-050115.

If rpm is below 3000 or if amperage draw is above 100 amps disassemble and repair the starter.



-UN-19JAN90
M48243

Slide No. 107

MX,24015DG,A42 -19-25SEP89

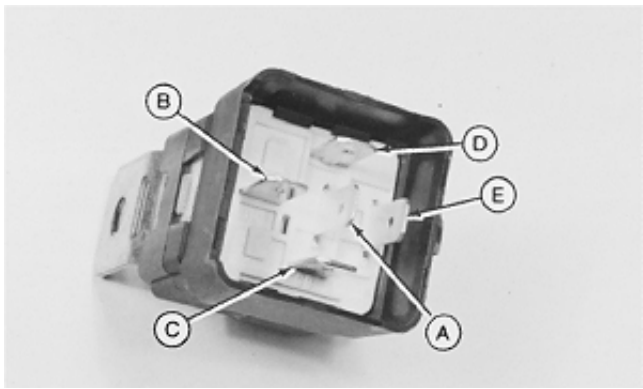
TEST NEUTRAL START RELAY

1. Apply voltage to terminal 85, ground terminal 86.

2. Listen for relay to click.

3. There should be continuity between relay terminals 87 and 30. There should be no continuity between relay terminals 87A and 30.

4. Replace faulty relay.



-UN-25OCT89
M48376

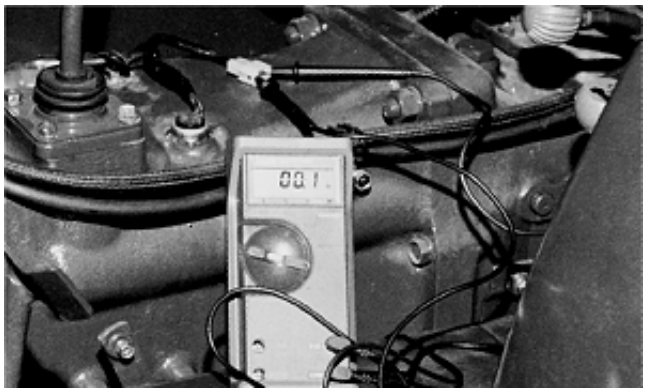
Slide No. 108

MX,24015DG,A43 -19-25SEP89

TEST NEUTRAL START SWITCH

1. Test for continuity between terminals of neutral start switch.

2. There should be continuity only when the transmission is in neutral. If the switch doesn't function correctly the switch is defective or the rod on the transmission shifter is broken.



-UN-09JAN90
M48244

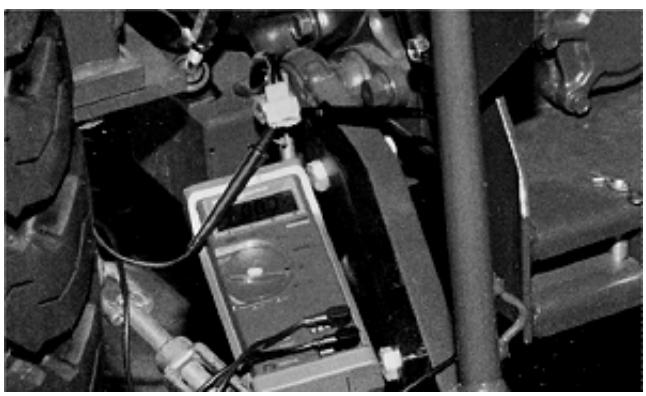
Slide No. 109

MX,24015DG,A44 -19-25SEP89

TEST MID PTO SWITCH

1. Test for continuity between terminals of the mid PTO switch.

2. There should be continuity only when the PTO lever is in the off position. If the switch doesn't function correctly the switch is defective or the pin on the PTO clutch linkage is worn.



-UN-09JAN90
M48245

Slide No. 110

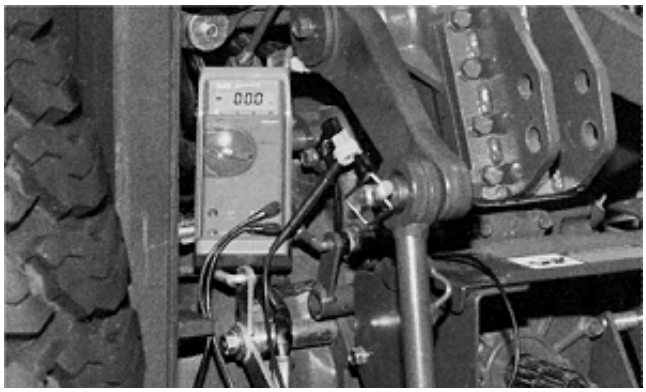
MX,24015DG,A45 -19-25SEP89

TEST REAR PTO SWITCH

1. Test for continuity between terminals of the rear PTO switch.

240
15
48

2. There should be continuity only when the PTO lever is in the off position. If the switch doesn't function correctly the switch is defective or the pin on the PTO clutch linkage is worn.



M48246 -UN-09JAN90

Slide No. 111

MX,24015DG,A46 -19-25SEP89

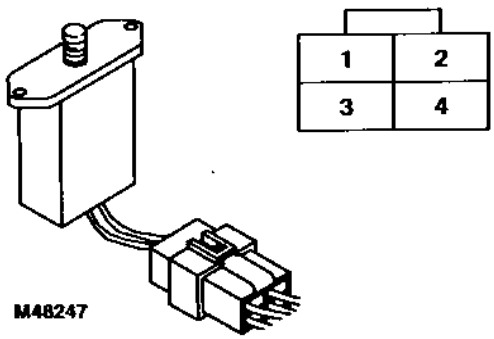
TEST SEAT SWITCH

Separate the 4 terminal connector from the seat switch and test for continuity between the terminals shown below with the switch in the position called out.

Top Position—Continuity between 2 and 4 only

Center Position—No continuity

Lower Position—continuity between 1 and 3 only



M48247 -UN-09JAN90

Slide No. 112

MX,24015DG,A47 -19-25SEP89

TEST IGNITION SWITCH

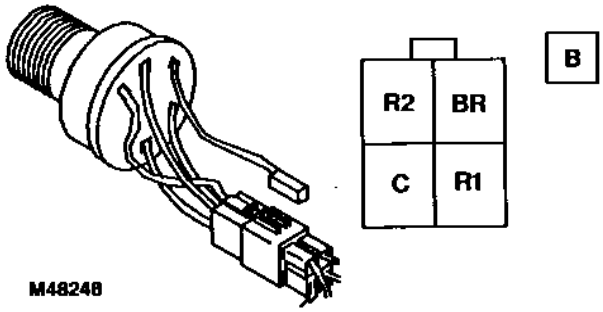
Test continuity between the terminals of the key switch with the key in the positions called out.

Preheat Position—B, BR and RI

Off Position—No continuity

On Position—B and BR

Start Position—B, BR, R2 and C



Slide No. 113

-UN-09JAN90
M48248

MX,24015DG,A48 -19-25SEP89

TEST LIGHT SWITCH

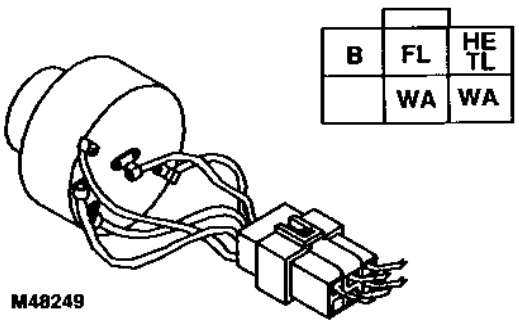
Test for continuity between terminals of the light switch in the positions called out.

Off Position—No continuity

Warn Position—B and WA

Work Position—B, FL and HETL

Run Position—B, HETL and WA



Slide No. 114

-UN-09JAN90
M48249

MX,24015DG,A49 -19-25SEP89

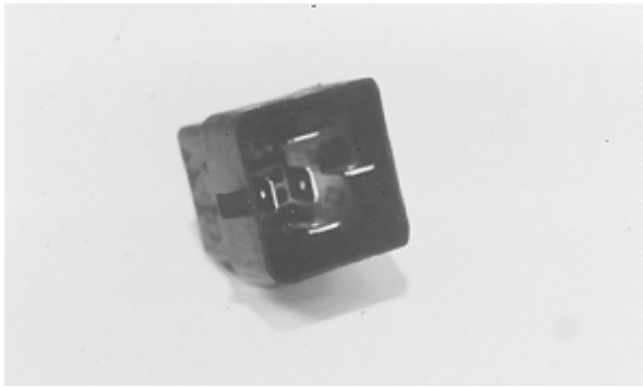
TEST FUEL SHUT-OFF RELAY

1. Apply voltage to terminal 85. Ground terminal 86.

2. Listen for relay to click.

3. There should be continuity between relay terminals 87 and 30. There should be not continuity between relay terminals 87A and 30.

4. Replace faulty relay.

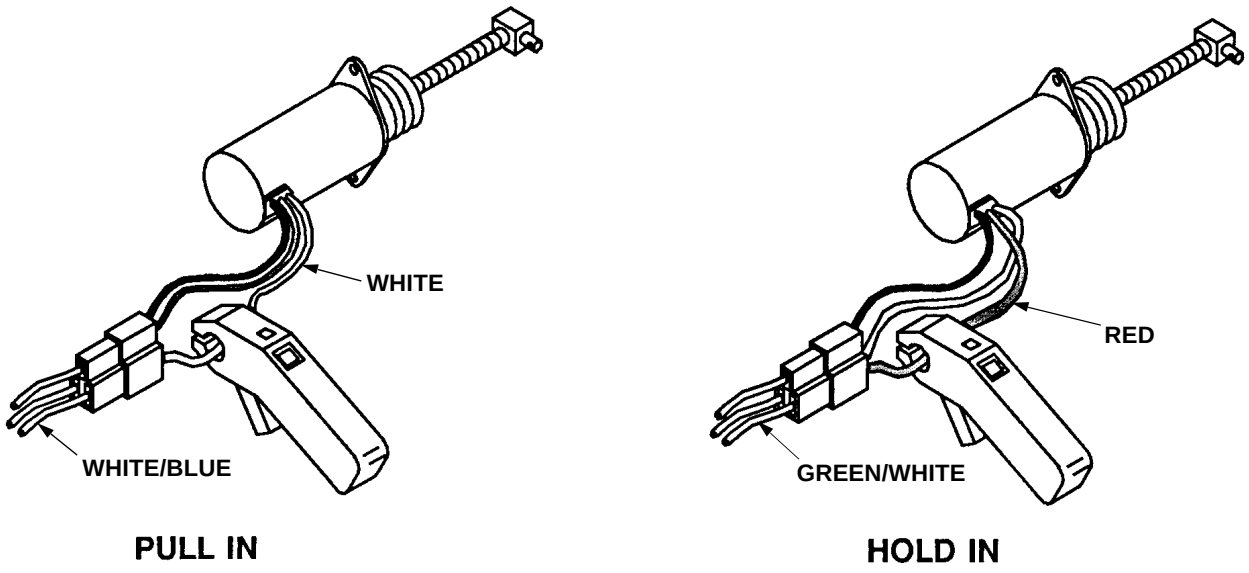


M53136 -UN-25AUG89

Slide No. 115

MX,24015DG,A50 -19-25SEP89

TEST FUEL SHUT-OFF SOLENOID



FUEL SHUT-OFF SOLENOID AMPERAGE TEST

Perform Fuel Shut-Off Pull-in and Hold-in system tests (earlier in this group) to make sure that adequate voltage (11.8—13.2 v) is getting to the solenoid.

Use JT05712 Current Gun to check specified amperage per the following procedure.

1. Turn the ignition switch key to the “OFF” position.

2. Place the gun over the “white” wire (solenoid side of the connector).

3. Turn the ignition switch key to the “ON” position and observe the “maximum” pull-in reading.

NOTE: The JTO5712 gun may not be sensitive enough to display the 1 amp. reading, but instead may display null or zero (0).

4. Turn the ignition switch key to the “OFF” position.

5. Place the gun over the “red” wire (solenoid side of the connector).

6. Turn the ignition switch key to the “ON” position and observe the “maximum” hold-in reading.

NOTE: If the wiring harness is not hooked up to the solenoid wiring, the specified amperage could be exceeded.

7. If Pull-In Amperage lasts longer than 1.5 seconds, replace the Time Delay Control Module (TDCM).

SPECIFICATIONS

— Pull-In Amperage (Max)
(for up to 1.5 seconds) . . . . . 50 Amps

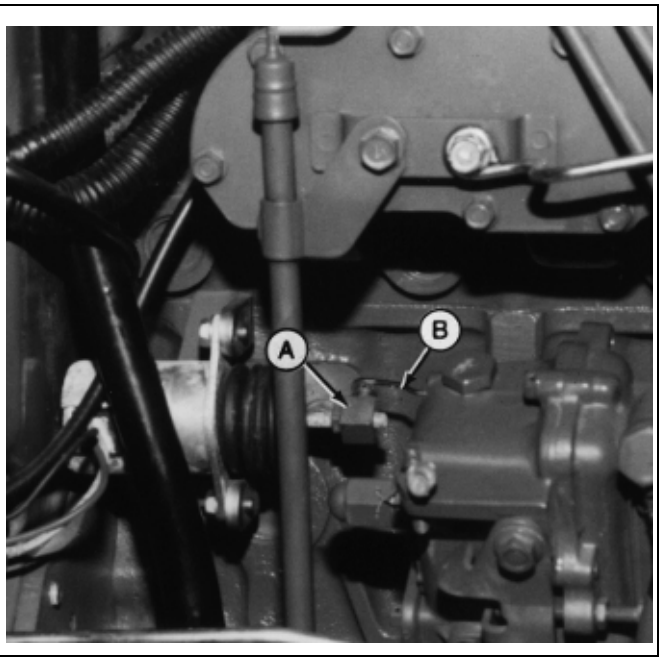
— Hold-In Amperage (Max continuous) . . . . 1 Amp

ADJUST FUEL SHUT-OFF SOLENOID LINKAGE

1. Disconnect fuel shut-off arm (B) from solenoid plunger (B).

2. Turn Key Switch on and push plunger in until it is held by the solenoid.

3. Push shut-off arm toward solenoid and adjust link until it aligns with hole in arm. Turn link two additional turns away from solenoid and attach arm.



TEST GLOW PLUG RESISTOR

Test for continuity through the glow plug resistor. If continuity does not exist, replace the resistor.

Resistance Specification . . . . . 0.2 Ohm



TEST GLOW PLUG

Test for continuity between the glow plug connection and the engine. If continuity does not exist replace the glow plug.

Test resistance . . . . . 0.2 ohm

Slide No. 118

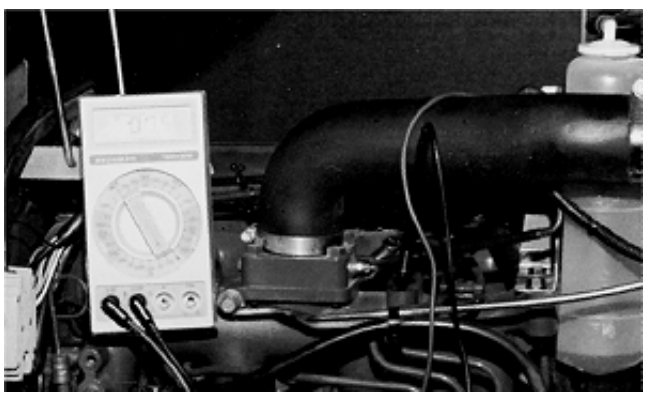


MX,24015DG,A54 -19-25SEP89

TEST AIR HEATER

Test for continuity between the air heater connector and the engine. If continuity does not exist replace the air heater.

Slide No. 119

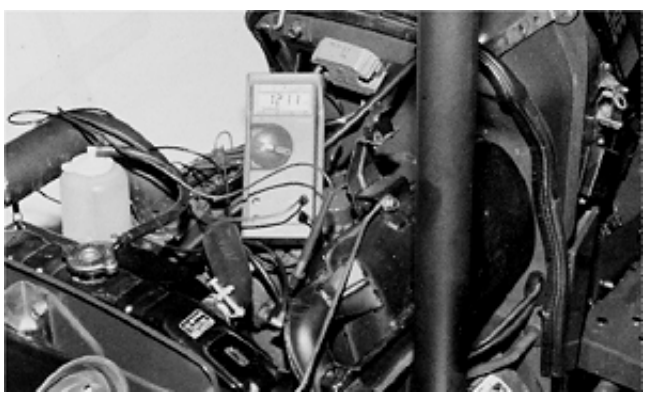


MX,24015DG,A55 -19-25SEP89

TEST WATER TEMPERATURE SENDER

Check resistance between connections on water temperature sender starting with the engine cold and running the engine until warm. Resistance should decrease as temperature increases.

Slide No. 120

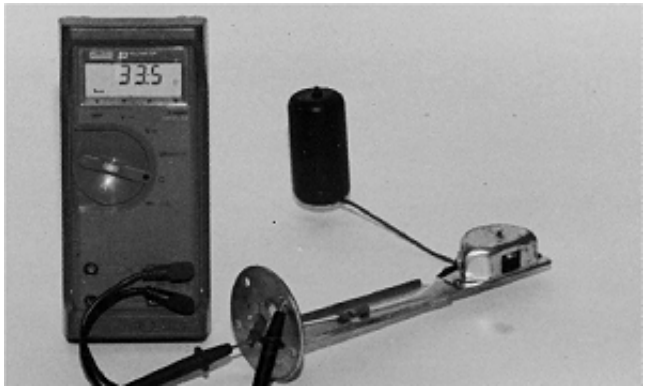


MX,24015DG,A56 -19-25SEP89

TEST FUEL GAUGE SENDER

Remove fuel gauge sender and check resistance between connections on sender. Resistance should increase as float is lowered.

Slide No. 121



-UN-09JAN90
M48257

MX,24015DG,A57 -19-25SEP89

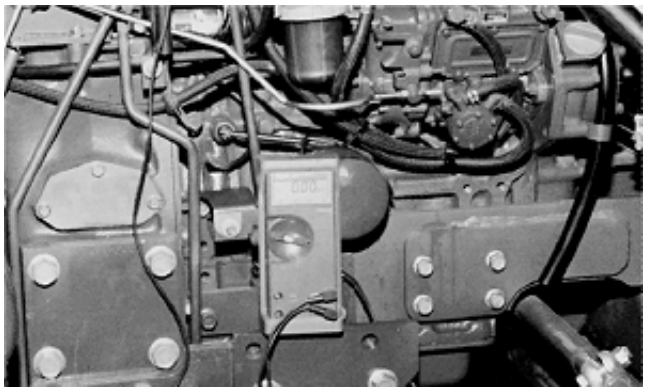
TEST OIL PRESSURE SWITCH

Check for continuity between connections on oil pressure switch.

Engine off—Continuity
Engine running—No Continuity

If the continuity exists when engine is running check engine oil pressure to make sure it is over 7 psi.

If oil pressure is above 7 psi and continuity exists replace the switch.



-UN-09JAN90
M48258

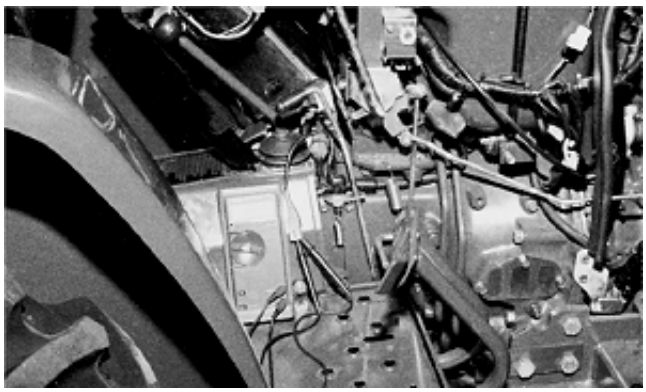
Slide No. 122

MX,24015DG,A58 -19-25SEP89

TEST PARK BRAKE INDICATOR SWITCH

Separate the connector for the park brake indicator switch. Check for continuity when the park brake lever is in the lock position only. If not the spring is broken or disconnected, the switch is out of adjustment or the switch is defective.

Slide No. 123



-UN-09JAN90
M48259

MX,24015DG,A59 -19-25SEP89

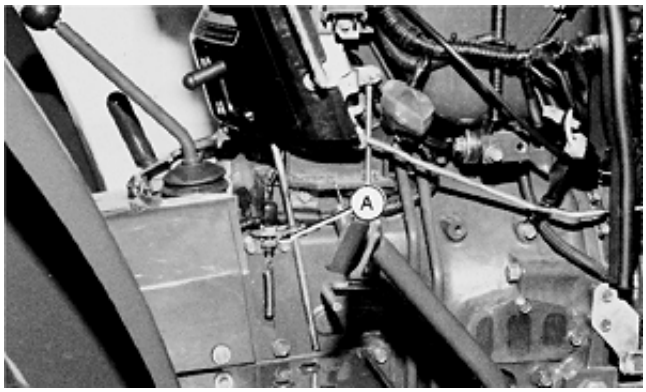
ADJUST PARK BRAKE INDICATOR SWITCH

1. Place the key in the on position and engage the park brake.

2. Loosen the lower lock nut and raise the indicator switch (A) until the park brake indicator light flashes.

3. Tighten the two lock nuts to hold the switch in this position.

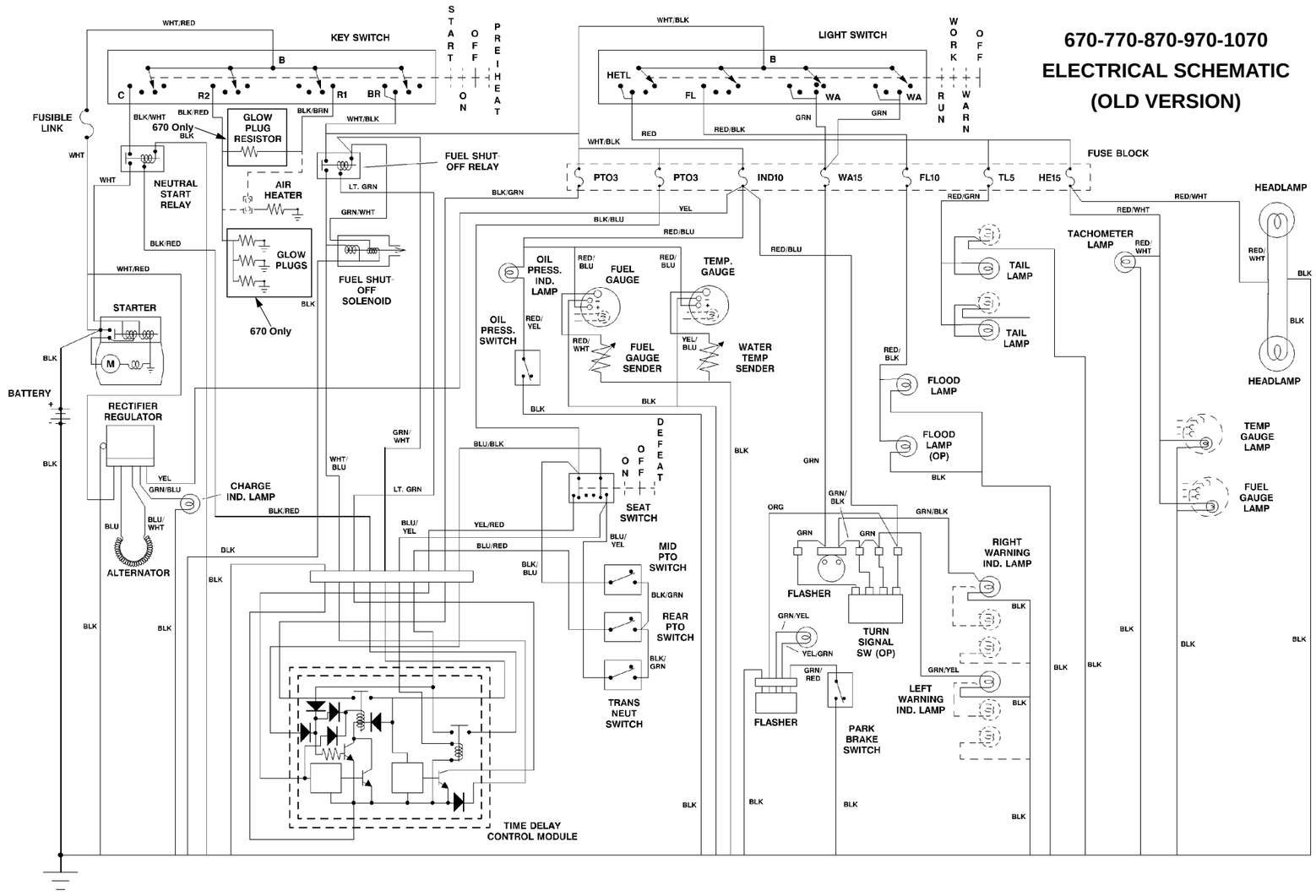
NOTE: The indicator switch housing is plastic. Put very minimal force on lock nuts when tightening or the housing will break.



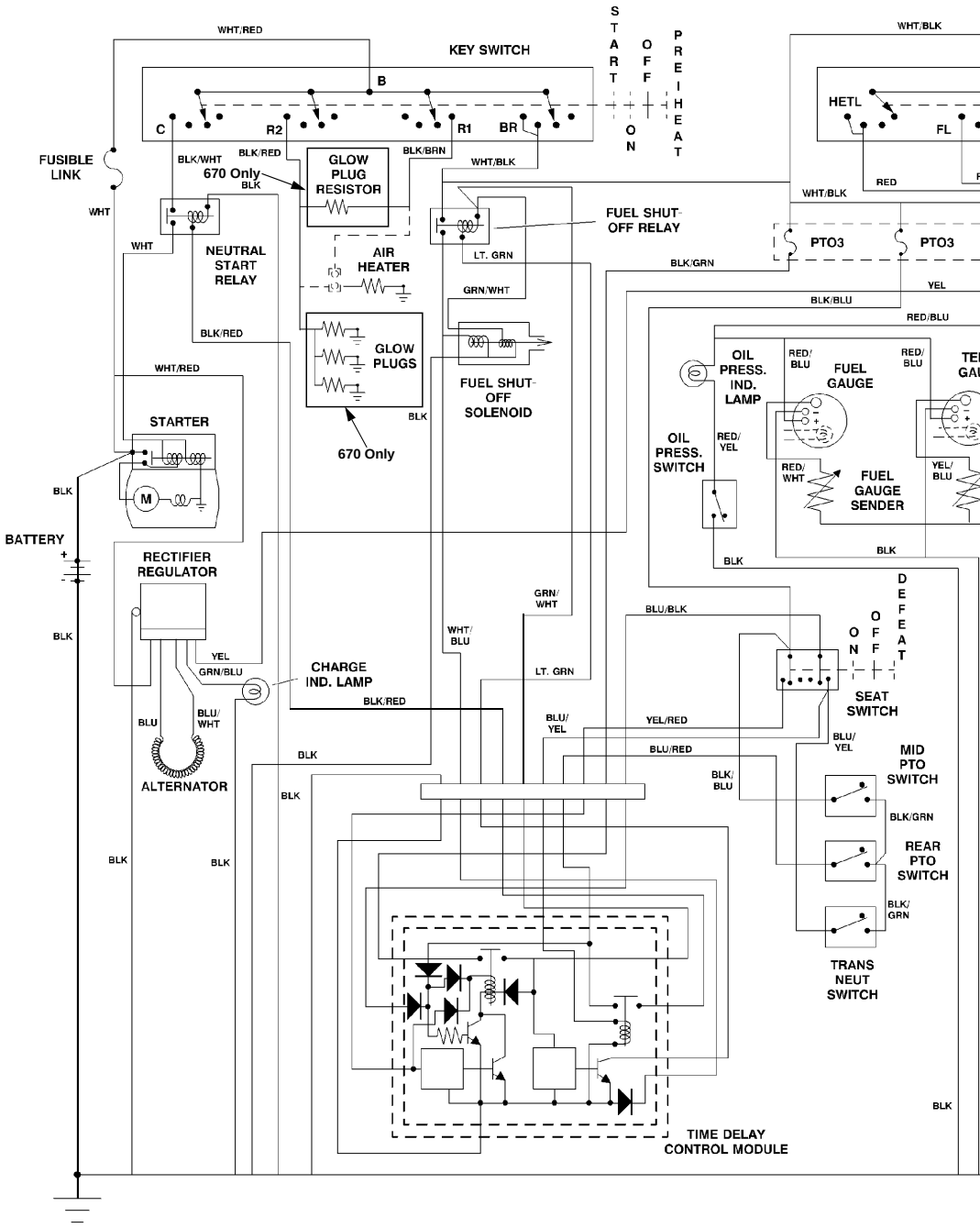
Slide No. 124

MX,24015DG,A60 -19-25SEP89

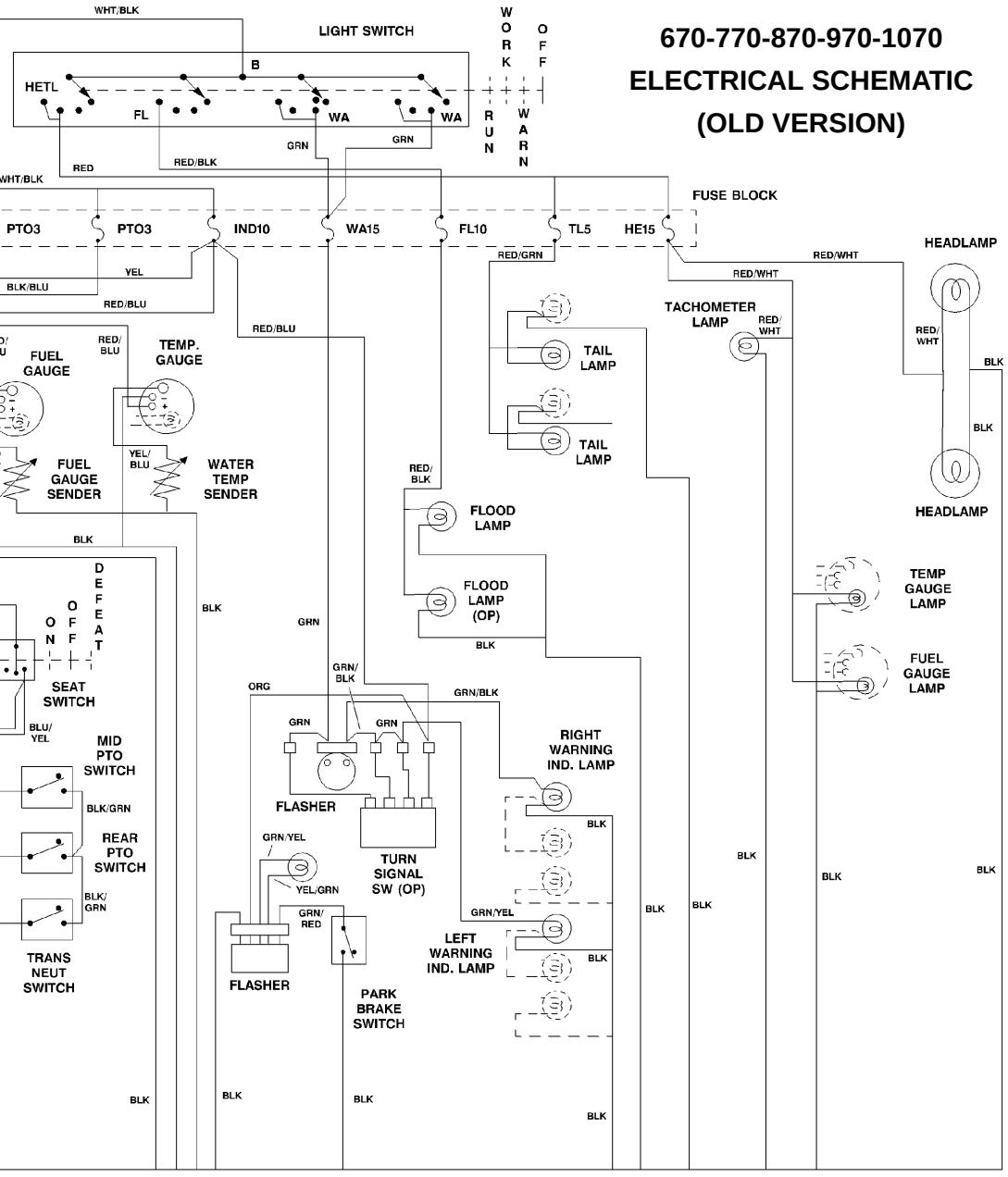
Electrical System Schematic



M58604

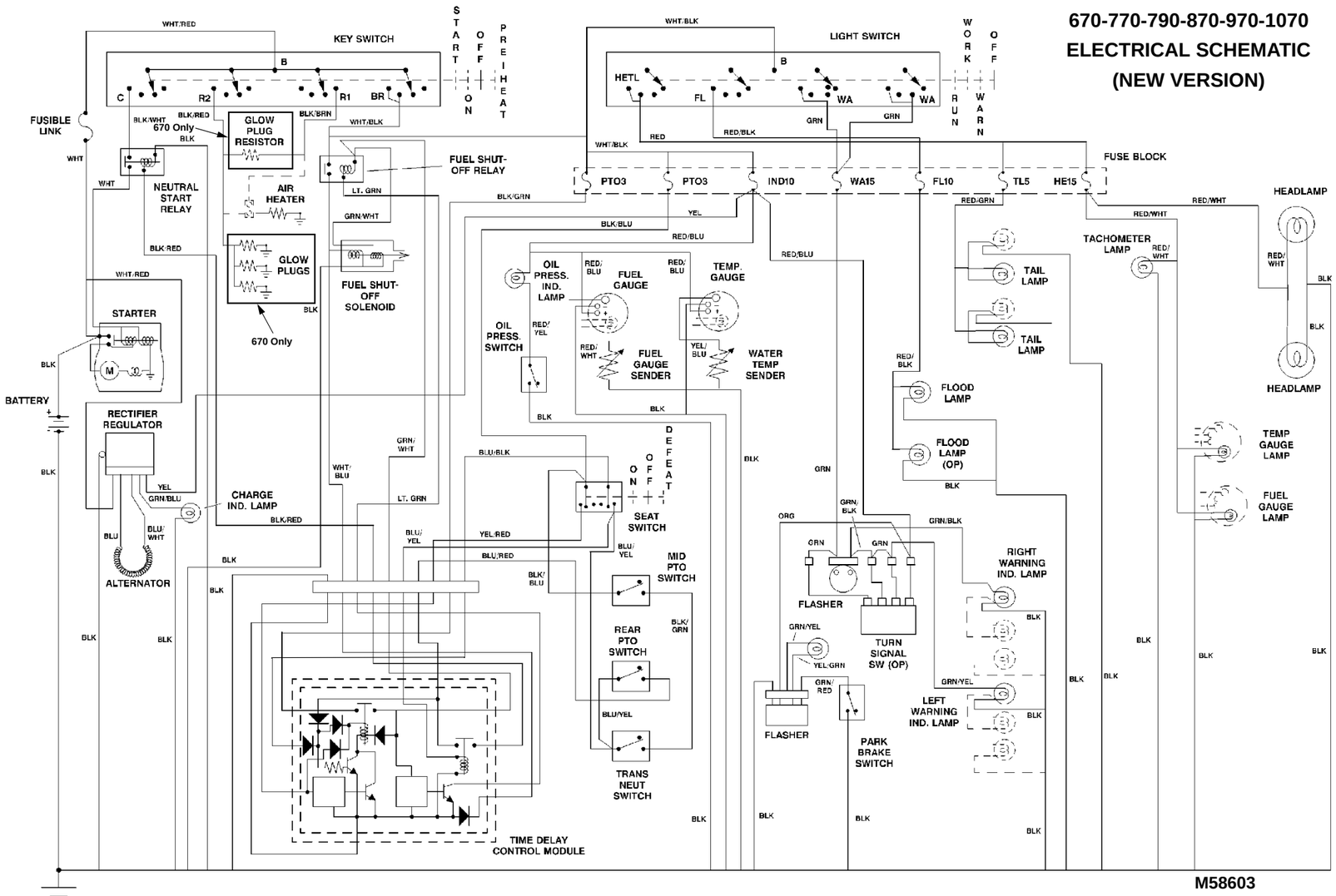

KEY SWITCH
START
ON
OFF
PREHEAT
B
C
R2
R1
BR
WHT/RED
FUSIBLE LINK
WHT
BLK/WHT
670 Only
BLK
BLK/RED
GLOW PLUG RESISTOR
BLK/BRN
WHT/BLK
NEUTRAL START RELAY
AIR HEATER
FUEL SHUT-OFF RELAY
LT. GRN
BLK/GRN
GRN/WHT
GLOW PLUGS
FUEL SHUT-OFF SOLENOID
670 Only
STARTER
M
BATTERY
RECTIFIER REGULATOR
ALTERNATOR
BLU
BLU/WHT
YEL
GRN/BLU
CHARGE IND. LAMP
WHT/BLU
GRN/WHT
BLU/BLK
YEL/RED
BLU/RED
BLU/YEL
BLK/BLU
HETL
FL
RED
PTO3
PTO3
YEL
BLK/BLU
RED/BLU
OIL PRESS. IND. LAMP
RED/BLU
FUEL GAUGE
OIL PRESS. SWITCH
RED/YEL
RED/WHT
FUEL GAUGE SENDER
YEL/BLU
SEAT SWITCH
MID PTO SWITCH
REAR PTO SWITCH
TRANS NEUT SWITCH
BLK/GRN
BLK/GRN
TIME DELAY CONTROL MODULE
BLK

up 20
natic

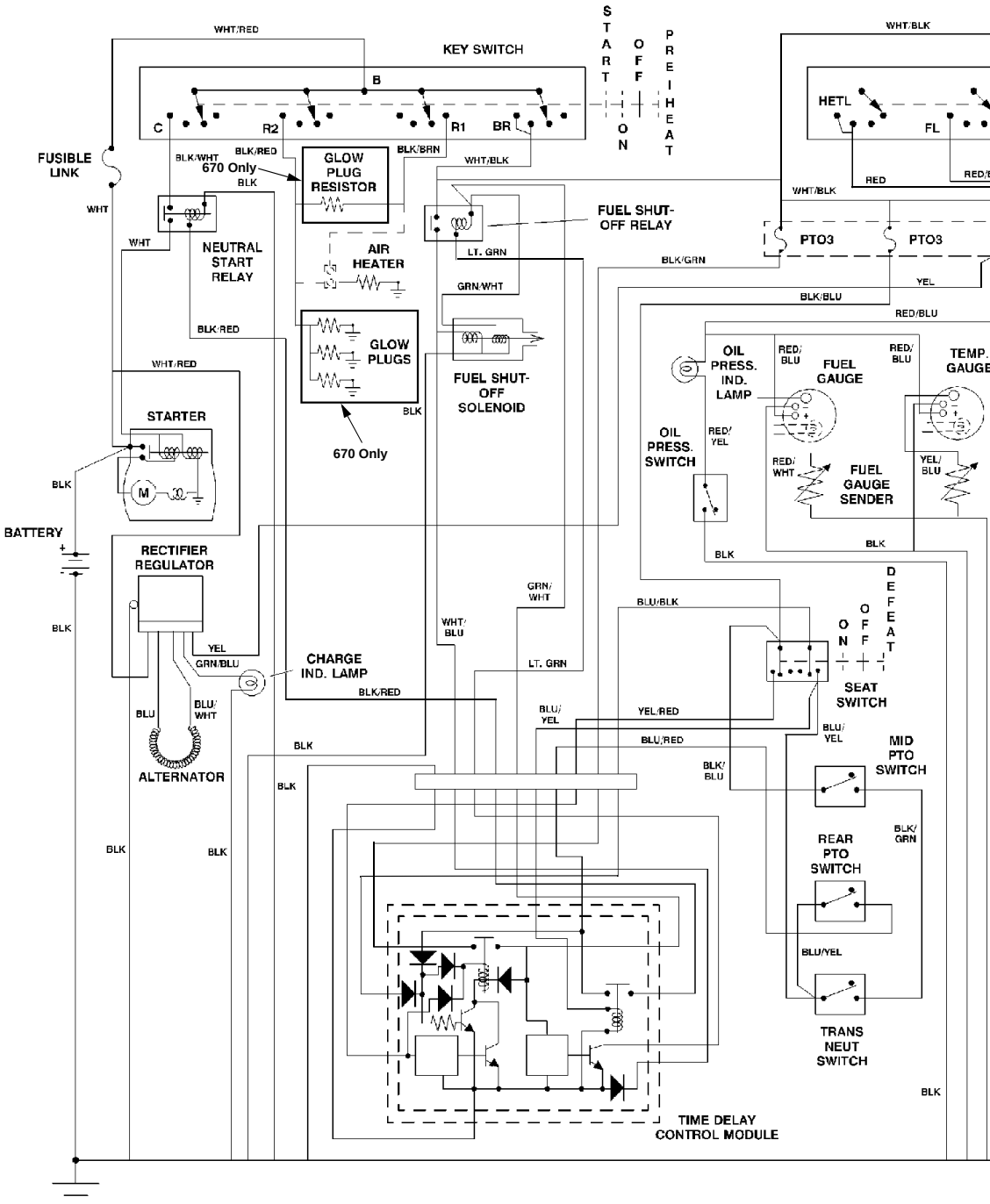


M58604

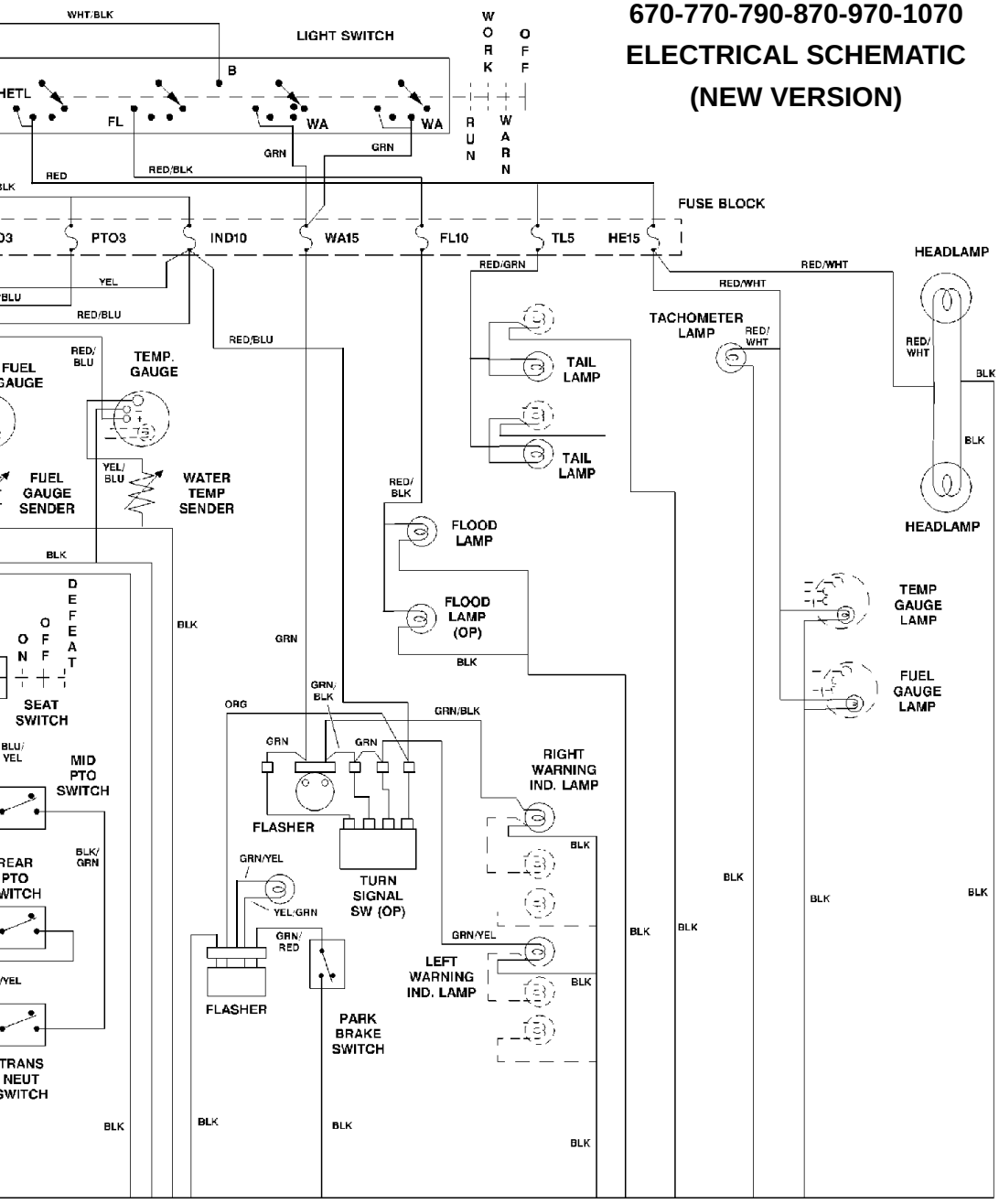
670-770-790-870-970-1070 ELECTRICAL SCHEMATIC (NEW VERSION)



M58603

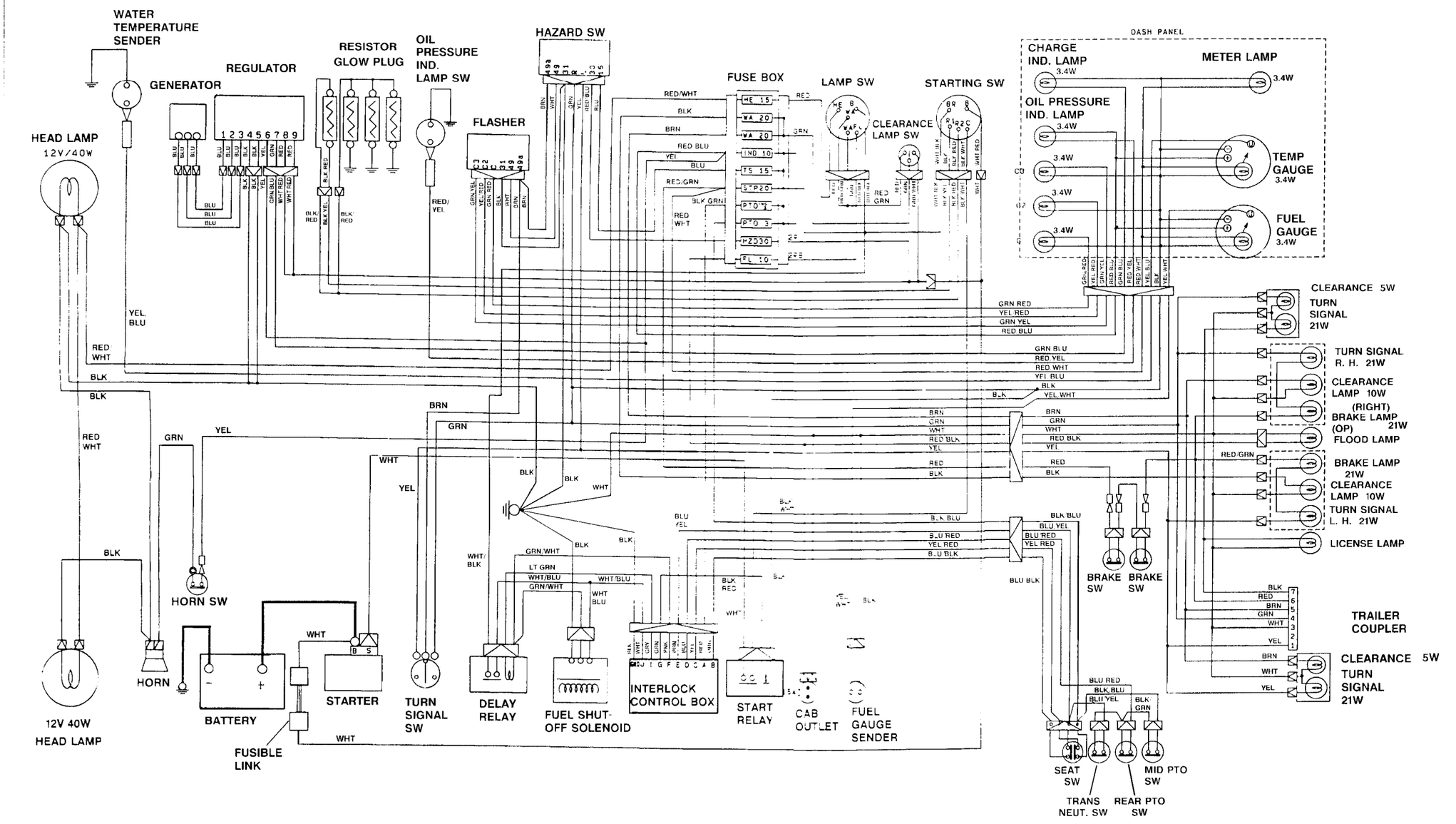

KEY SWITCH
START
ON
OFF
PREHEAT
B
C
R2
R1
BR
WHT/RED
FUSIBLE LINK
WHT
BLK/WHT
670 Only
BLK/RED
GLOW PLUG RESISTOR
BLK/BRN
WHT/BLK
BLK
NEUTRAL START RELAY
AIR HEATER
FUEL SHUT-OFF RELAY
LT. GRN
BLK/GRN
GRN/WHT
GLOW PLUGS
FUEL SHUT-OFF SOLENOID
BLK/RED
WHT/RED
STARTER
M
BLK
670 Only
BATTERY
RECTIFIER REGULATOR
YEL
GRN/BLU
CHARGE IND. LAMP
BLU
BLU/WHT
ALTERNATOR
BLK
WHT/BLK
HETL
FL
RED
RED/BLU
PTO3
PTO3
YEL
BLK/BLU
OIL PRESS. IND. LAMP
RED/BLU
FUEL GAUGE
TEMP. GAUGE
OIL PRESS. SWITCH
RED/YEL
RED/WHT
FUEL GAUGE SENDER
YEL/BLU
BLK
GRN/WHT
WHT/BLU
BLU/BLK
DEFEAT
ON
OFF
SEAT SWITCH
YEL/RED
BLU/YEL
BLU/RED
BLK/BLU
MID PTO SWITCH
BLK/GRN
REAR PTO SWITCH
BLU/YEL
TRANS NEUT SWITCH
TIME DELAY CONTROL MODULE

670-770-790-870-970-1070
ELECTRICAL SCHEMATIC
(NEW VERSION)

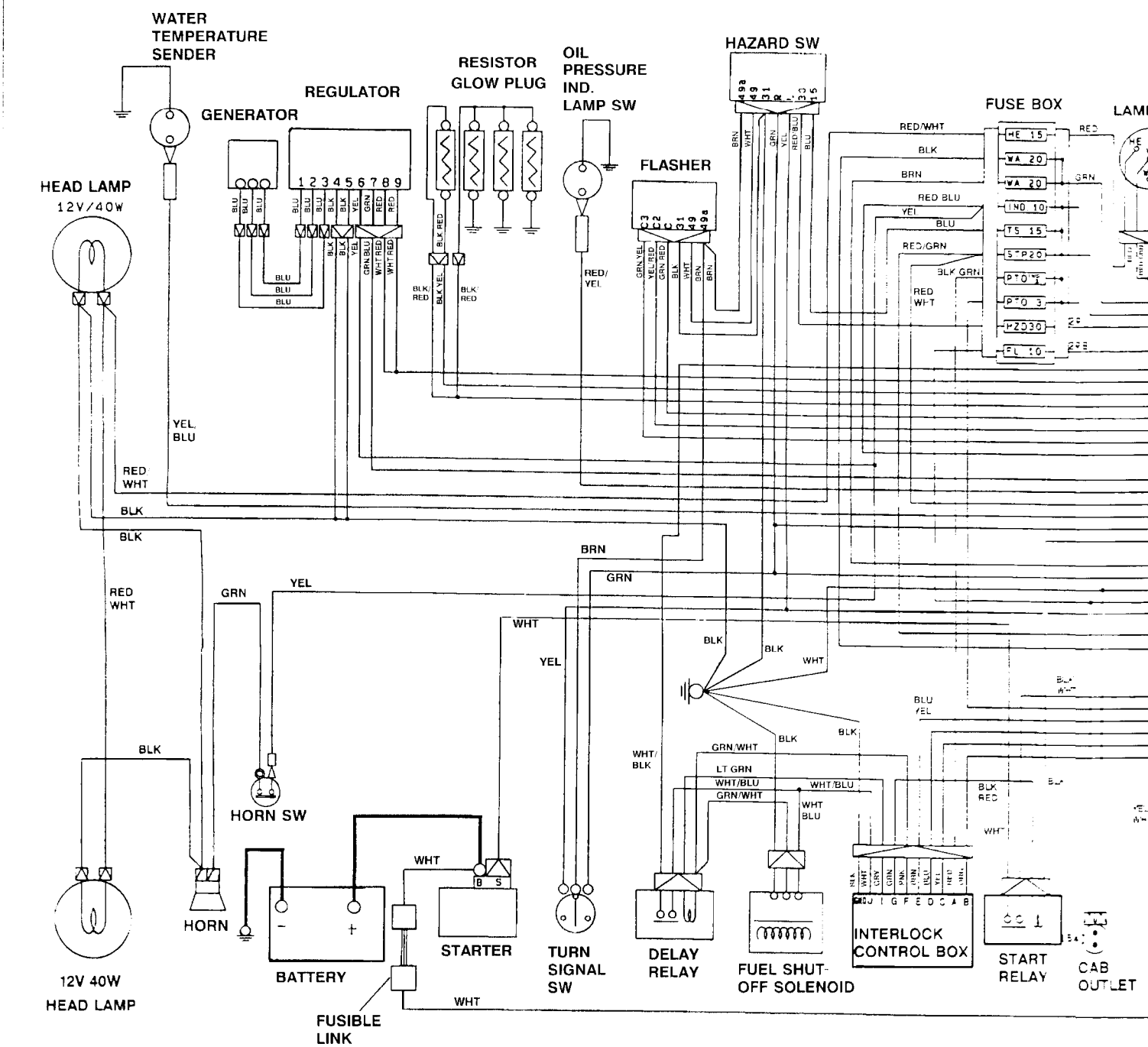


M58603

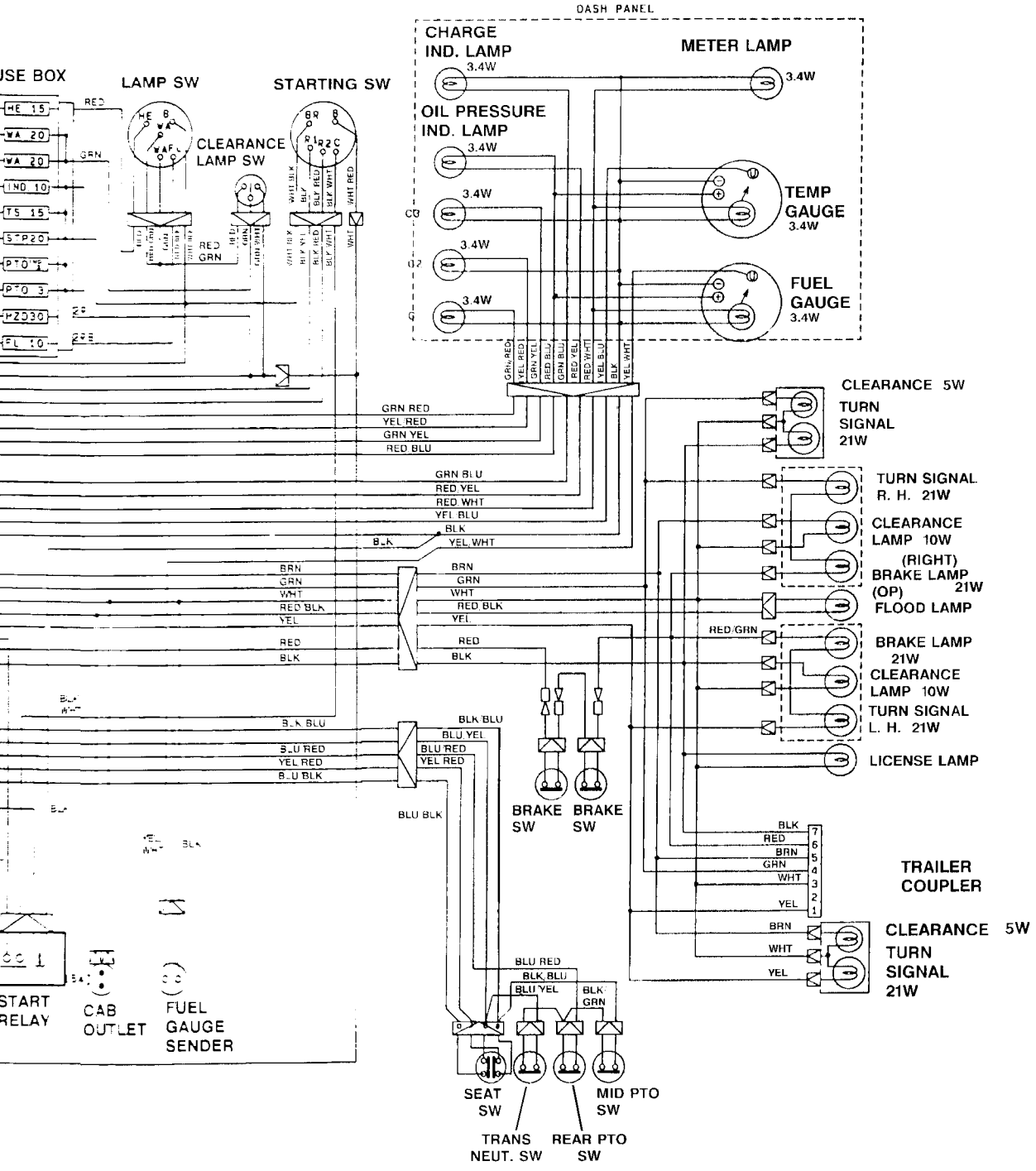
670 EUROPEAN ELECTRICAL SCHEMATIC



M58588


WATER TEMPERATURE SENDER
GENERATOR
REGULATOR
RESISTOR GLOW PLUG
OIL PRESSURE IND. LAMP SW
HAZARD SW
FLASHER
FUSE BOX
HEAD LAMP 12V/40W
HORN SW
HORN
BATTERY
STARTER
FUSIBLE LINK
TURN SIGNAL SW
DELAY RELAY
FUEL SHUT-OFF SOLENOID
INTERLOCK CONTROL BOX
START RELAY
CAB OUTLET
12V 40W HEAD LAMP

670 EUROPEAN
ELECTRICAL SCHEMATIC



M58588

Section 250
POWER TRAIN 670/770/790

Contents

Page

Group 05—Power Train Component Location 670/770/790

About the Power Train 250-05-1
Component Location
- Power Train 250-05-2
- Single Stage Clutch 250-05-4
- Dual Stage Clutch 250-05-5
- Sliding Gear Transmission 250-05-6
- Speed Selector Control 250-05-7
- Range Selection Lever 250-05-8
- Final Drive 250-05-9
- Mechanical Front Wheel Drive 250-05-10
- Rear PTO (Single Stage Clutch Tractors) 250-05-12
- Rear PTO (Dual Stage Clutch Tractors) 250-05-13
- Rear PTO Linkage 250-05-14
- Mid PTO 250-05-15

Group 10—Power Train Theory of Operation 670/770/790

Clutch Ventilation and Drain 250-10-1
Single Stage Clutch Engaged 250-10-2
Single Stage Clutch Disengaged 250-10-3
Dual Stage Clutch
- Engaged 250-10-4
- Transmission Disengaged PTO Engaged 250-10-6
- Transmission and PTO Disengaged 250-10-8

Sliding Gear Transmission
- Neutral 250-10-10
- Low Range 250-10-12
- High Range 250-10-14

Differential Lock Operation 250-10-16
Differential Power Flow 250-10-18
Mechanical Front Wheel Drive Power Flow 250-10-20
Rear PTO Power Flow 250-10-22
Mid PTO Operation 250-10-24
Mid PTO Linkage Operation
- Lever Disengaged 250-10-25
- Lever Engaged 250-10-26
- Clutch Depressed—PTO Engaged 250-10-27

Overrunning Clutches 250-10-28

Page

Group 15—Power Train Diagnosis and Test 670/770/790

About This Group 250-15-1
Isolate the Problem Area
- Single Stage Clutch 250-15-2
- Dual Stage Clutch 250-15-6

Adjust Mid PTO Linkage 250-15-10
Adjust Clutch Pedal Free Travel 250-15-12

ABOUT THE POWER TRAIN

The 670, 770 and 790 Tractors use a common sliding gear transmission with a collar shift Hi-Lo range selection.

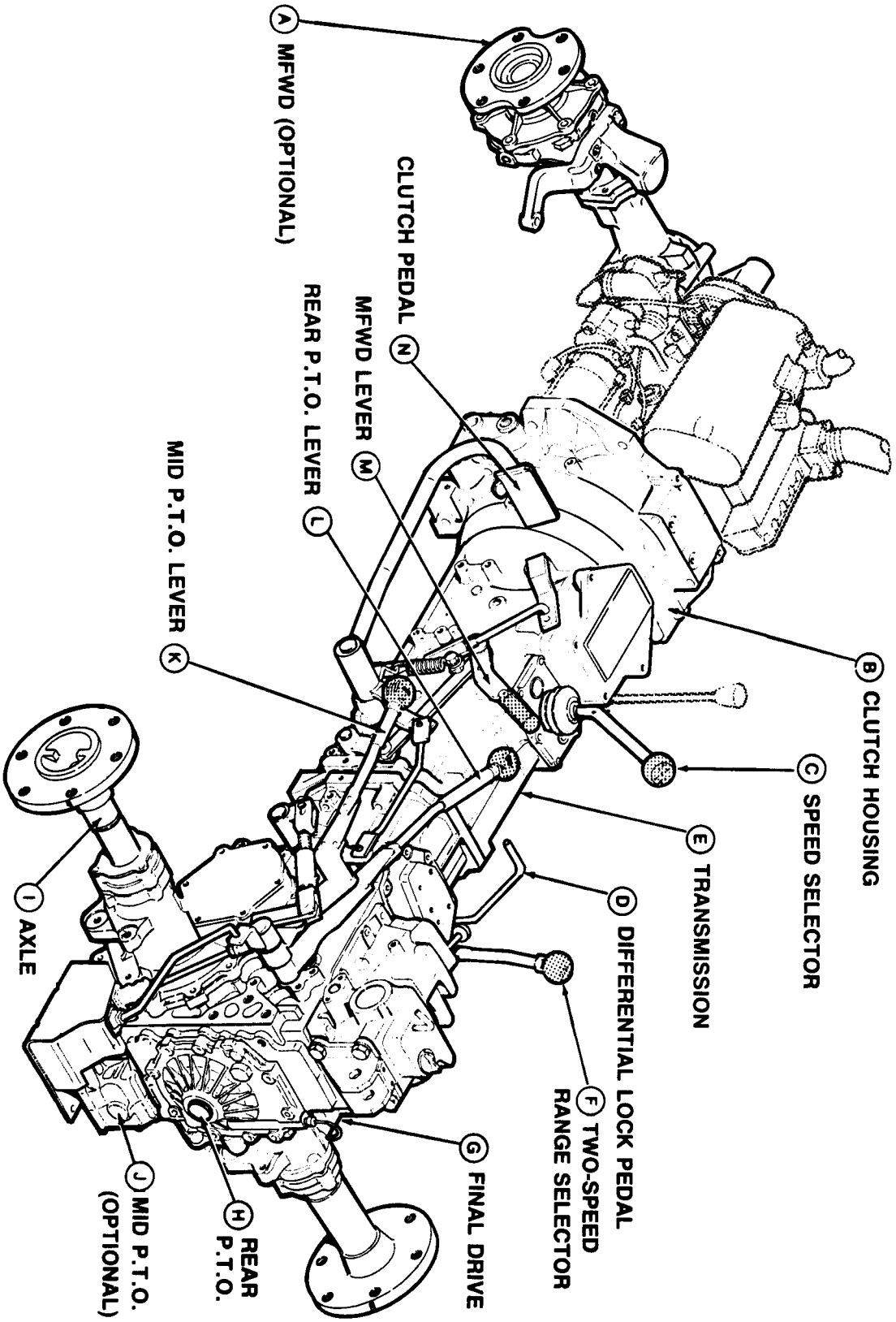
A single stage clutch is standard with an optional dual stage clutch to provide continuous live PTO.

Mechanical front wheel drive is a factory option.

Rear 540 rpm PTO is standard and 2100 rpm mid-PTO is optional.

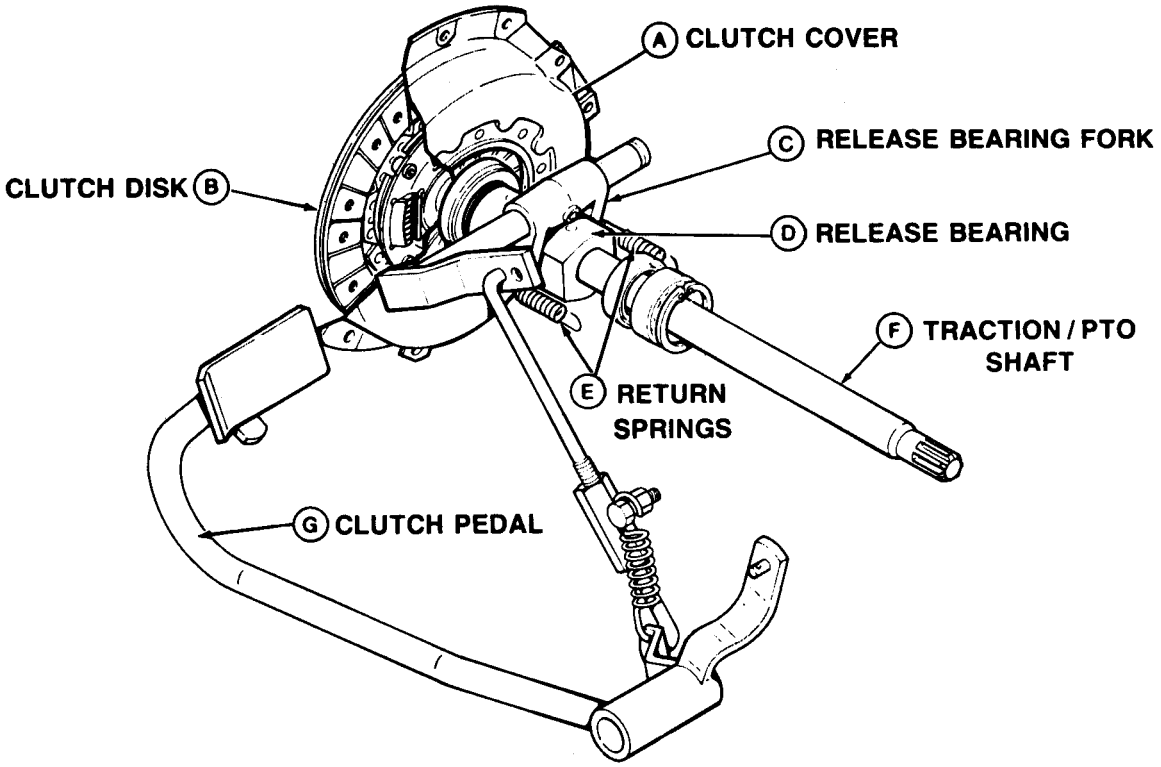
POWER TRAIN COMPONENT LOCATION

A—MFWD (Optional)
B—Clutch Housing
C—Speed Selector
D—Differential Lock Pedal
E—Transmission
F—Two Speed Range Selector
G—Final Drive
H—Rear PTO
I—Axle
J—Mid PTO (Optional)
K—Mid PTO Lever
L—Rear PTO Lever
M—MFWD Lever
N—Clutch Pedal



POWER TRAIN COMPONENT LOCATION

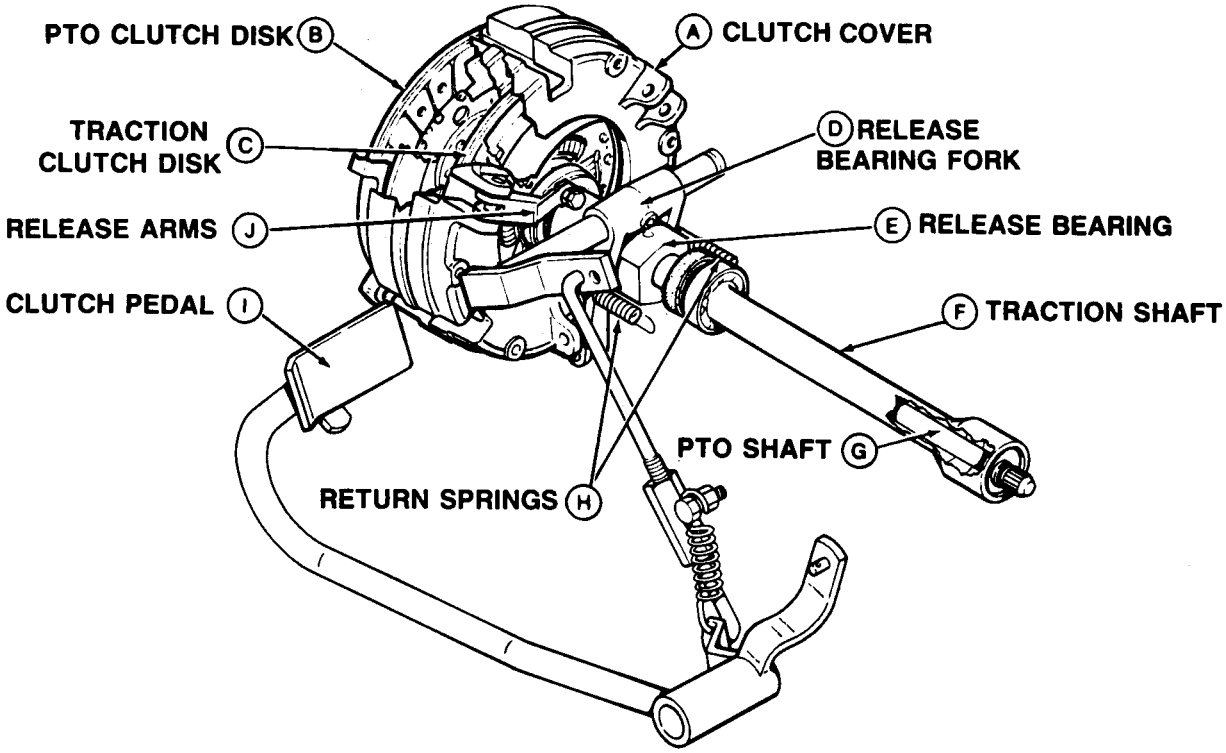
SINGLE STAGE CLUTCH COMPONENT LOCATION



SINGLE STAGE CLUTCH COMPONENT

A—Clutch Cover
B—Clutch Disk
C—Release Bearing Fork
D—Release Bearing
E—Return Springs
F—Traction/PTO Shaft
G—Clutch Pedal

DUAL STAGE CLUTCH COMPONENT LOCATION

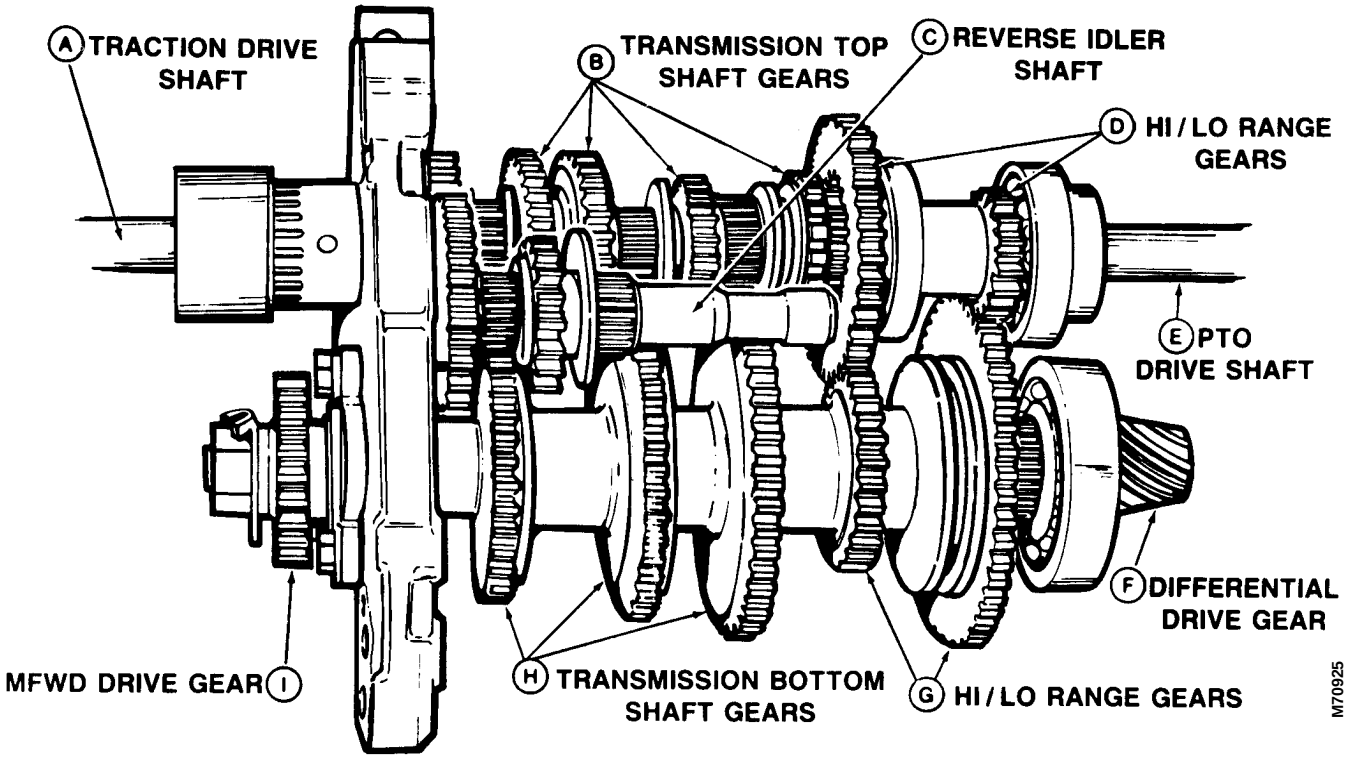


M70928

DUAL STAGE CLUTCH COMPONENT

A—Clutch Cover
B—PTO Clutch Disk
C—Traction Clutch Disk
D—Release Bearing Fork
E—Release Bearing
F—Traction Shaft
G—PTO Shaft
H—Return Springs
I—Clutch Pedal
J—Release Arms

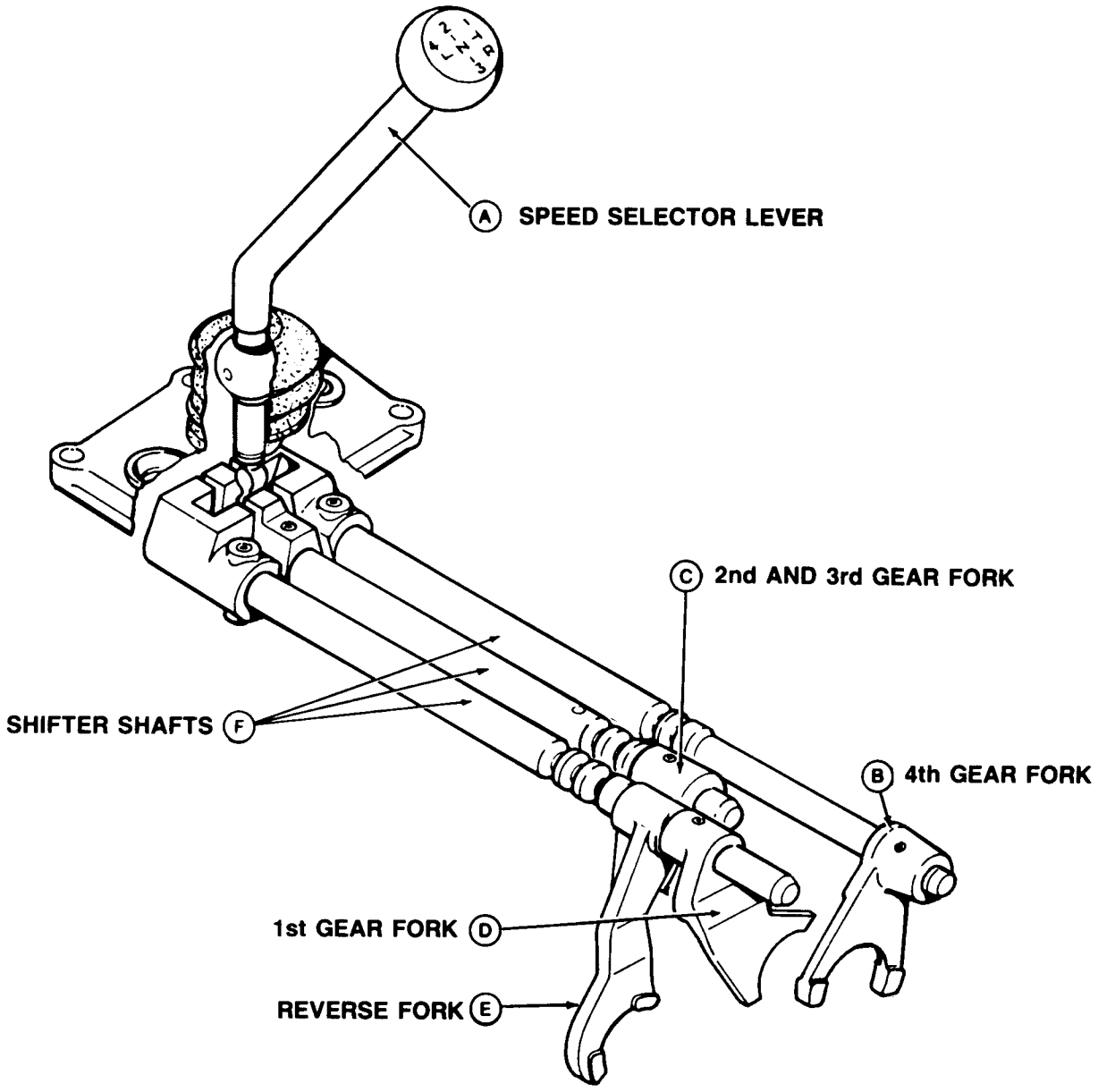
SLIDING GEAR TRANSMISSION COMPONENT LOCATION



SLIDING GEAR TRANSMISSION COMPONENTS

A—Traction Drive Shaft
B—Transmission Top Shaft Gears
C—Reverse Idler Shaft
D—Hi/Lo Range Gears
E—PTO Drive Shaft
F—Differential Drive Gear
G—Hi/Lo Range Gears
H—Transmission Bottom Shaft Gears
I—MFWD Drive Gear

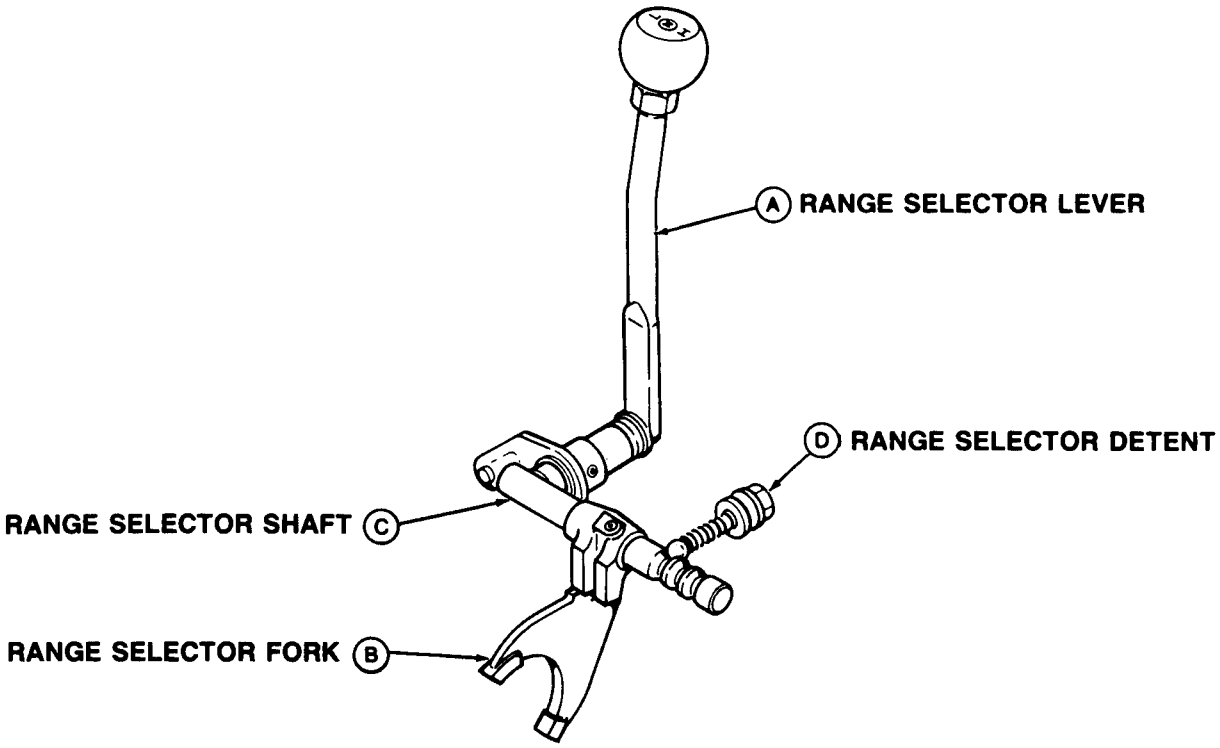
SPEED SELECTOR CONTROL COMPONENT LOCATIONS



SLIDING GEAR TRANSMISSION COMPONENTS

A—Speed Selector Lever
B—4th Gear Fork
C—2nd and 3rd Gear Fork
D—1st Gear Fork
E—Reverse Fork
F—Shifter Shafts

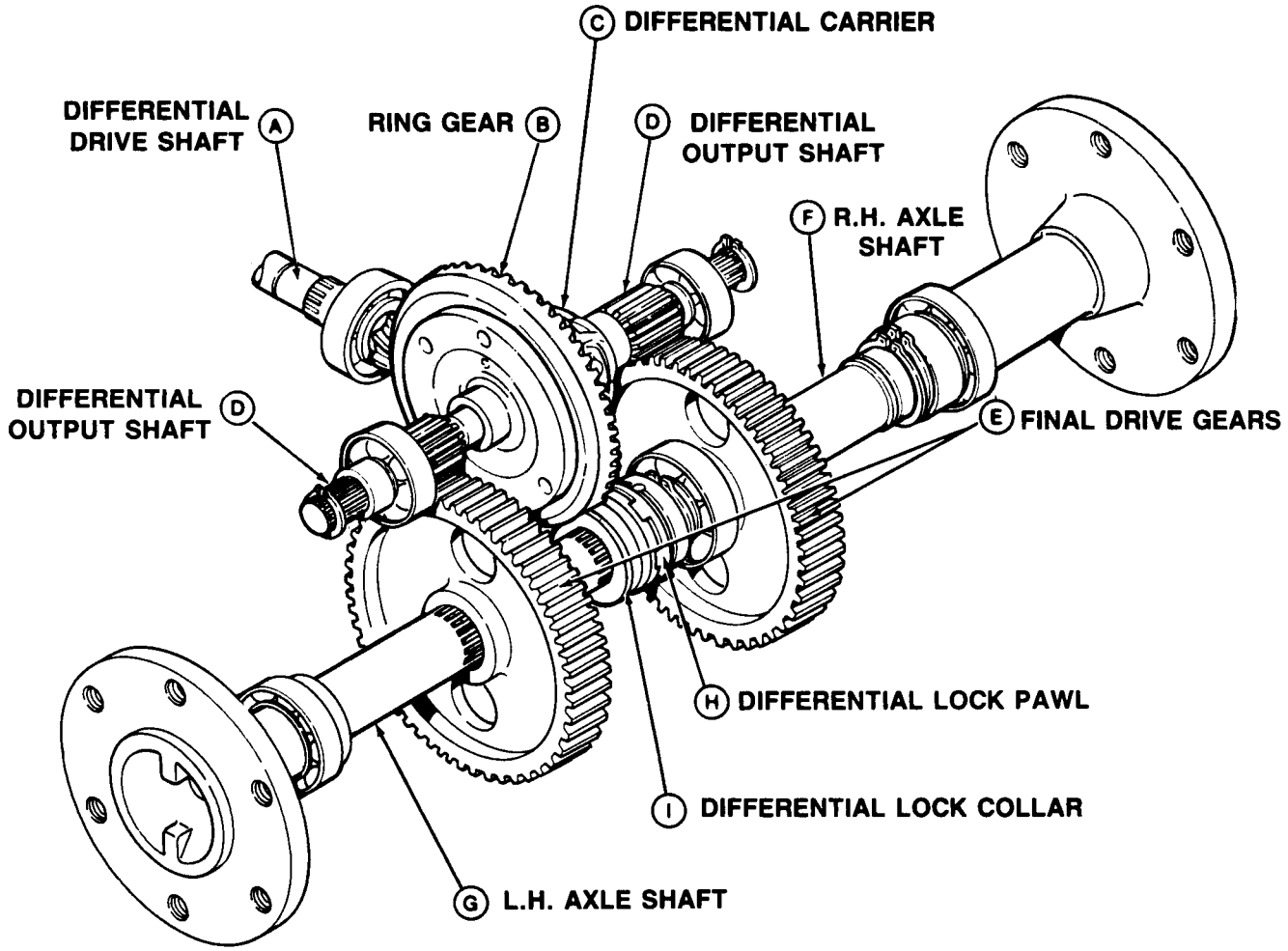
RANGE SELECTOR LEVER COMPONENT LOCATION



RANGE SELECTOR LEVER COMPONENTS

A—Range Selector Lever
B—Range Selector Fork
C—Range Selector Shaft
D—Range Selector Detent

FINAL DRIVE COMPONENT LOCATION

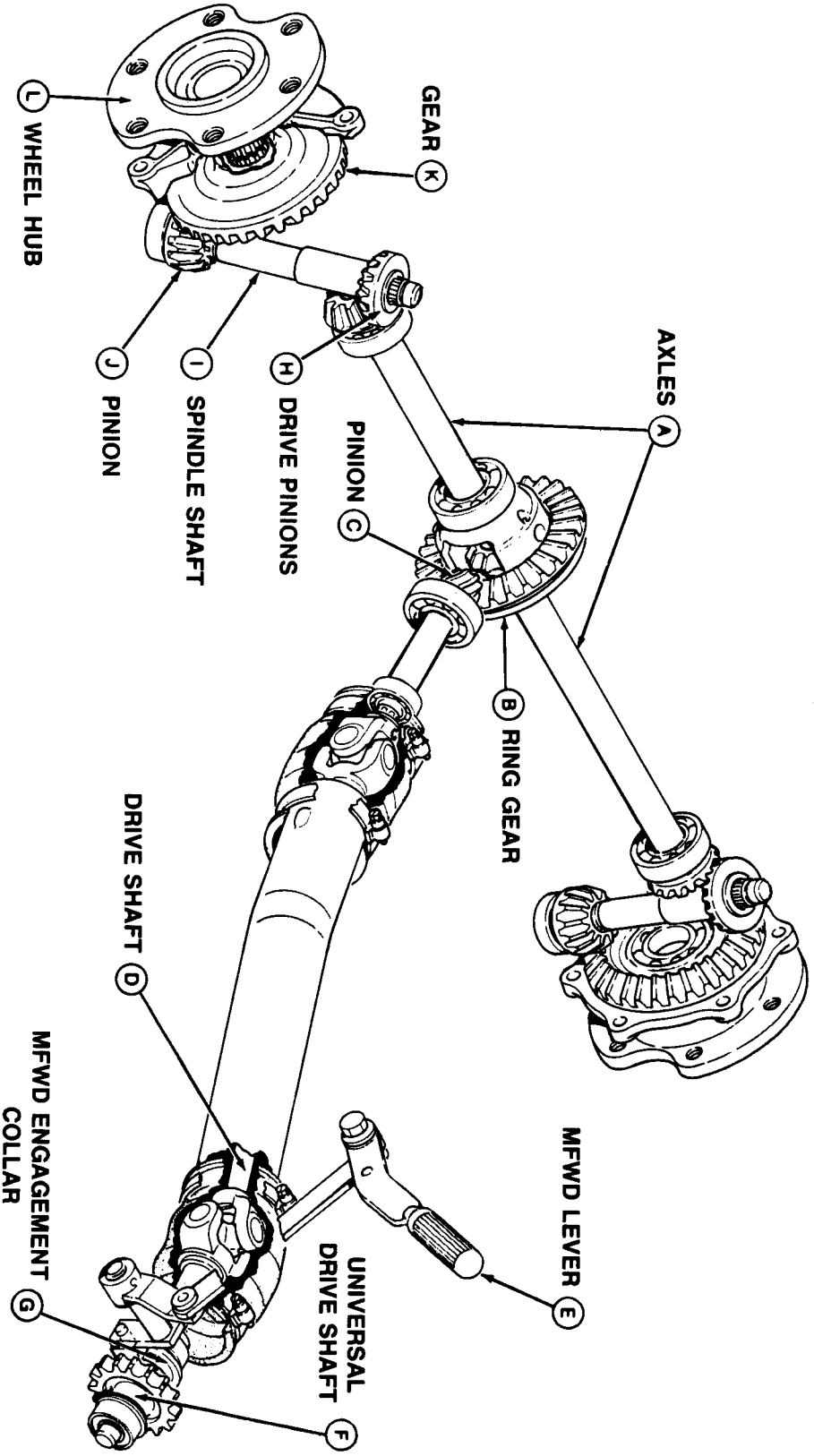


FINAL DRIVE COMPONENTS

A—Differential Drive Shaft
B—Ring Gear
C—Differential Carrier
D—Differential Output Shaft
E—Final Drive Gears
F—R.H. Axle Shaft
G—L.H. Axle Shaft
H—Differential Lock Pawl
I—Differential Lock Collar

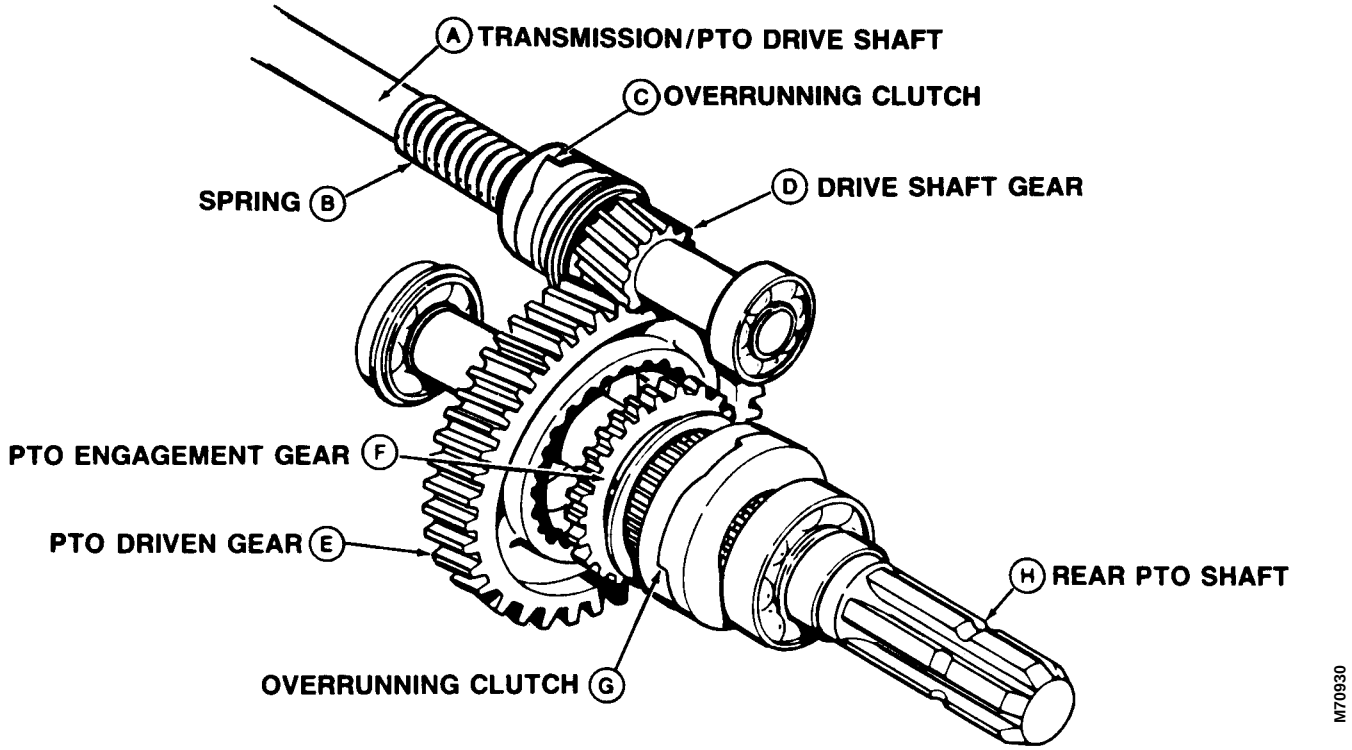
MECHANICAL FRONT WHEEL DRIVE COMPONENT LOCATION

A—Axles
B—Ring Gear
C—Pinion
D—Drive Shaft
E—MFWD Lever
F—Universal Drive Shaft
G—MFWD Engagement Collar
H—Drive Pinions
I—Spindle Shaft
J—Pinion
K—Gear
L—Wheel Hub



MECHANICAL FRONT WHEEL DRIVE COMPONENTS

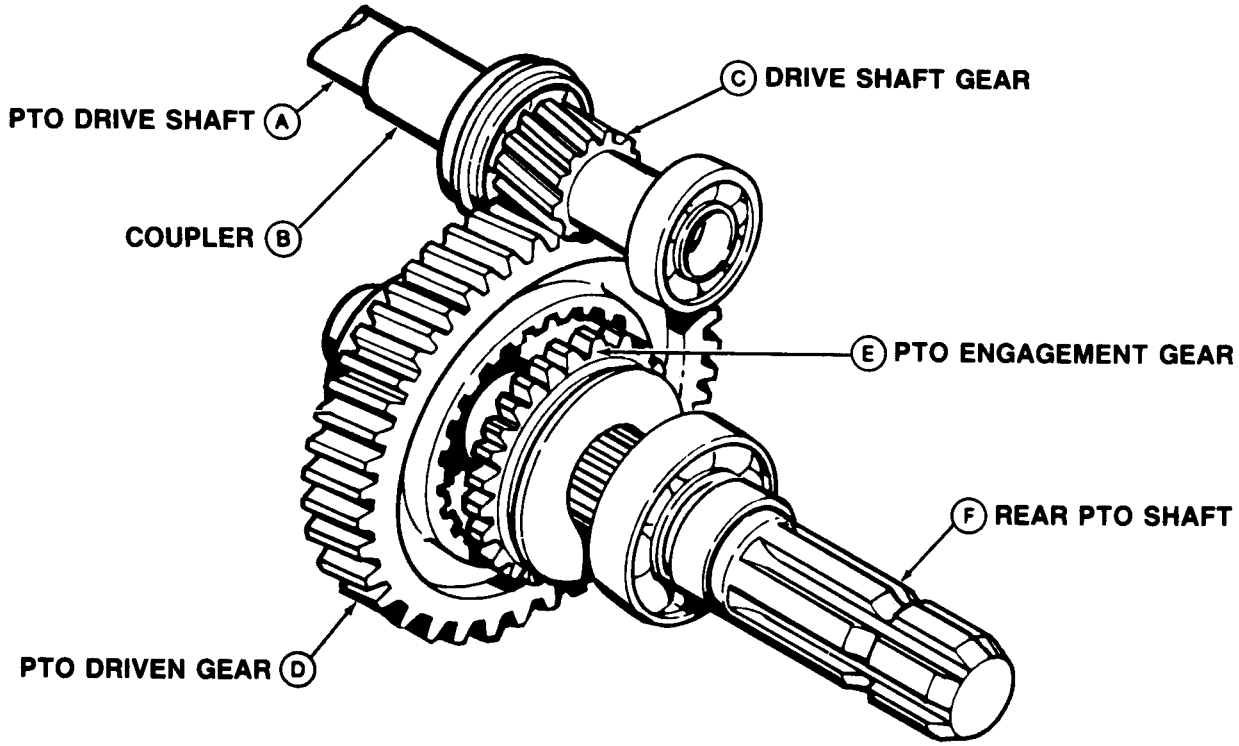
REAR PTO (SINGLE STAGE CLUTCH TRACTORS) COMPONENT LOCATION



REAR PTO (SINGLE STAGE CLUTCH) COMPONENTS

A—Transmission/PTO Drive Shaft	C—Overrunning Clutch	E—PTO Driven Gear	G—Overrunning Clutch
B—Spring	D—Drive Shaft Gear	F—PTO Engagement Gear	H—Rear PTO Shaft

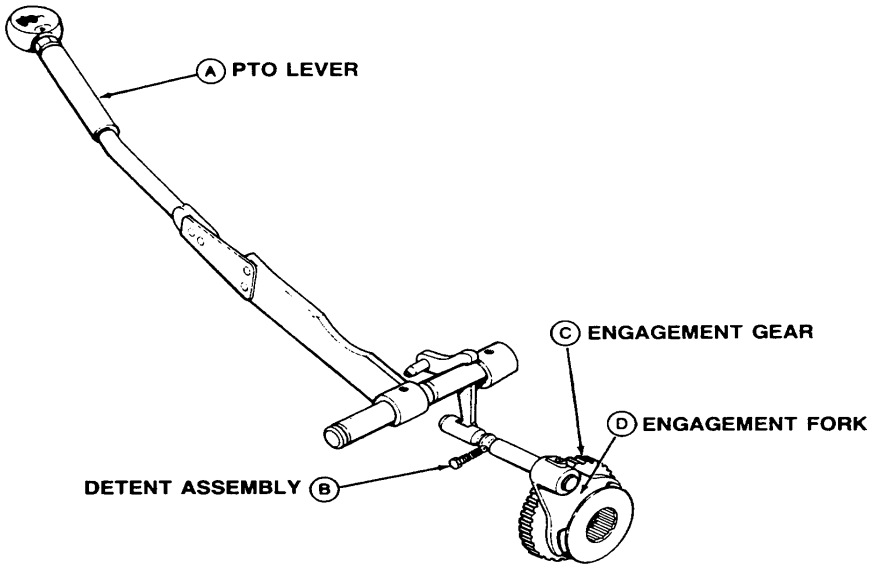
REAR PTO (DUAL STAGE CLUTCH TRACTORS) COMPONENT LOCATION



REAR PTO (DUAL STAGE CLUTCH) COMPONENTS

A—PTO Drive Shaft
B—Coupler
C—Drive Shaft Gear
D—PTO Driven Gear
E—PTO Engagement Gear
F—Rear PTO Shaft

REAR PTO LINKAGE COMPONENT LOCATION

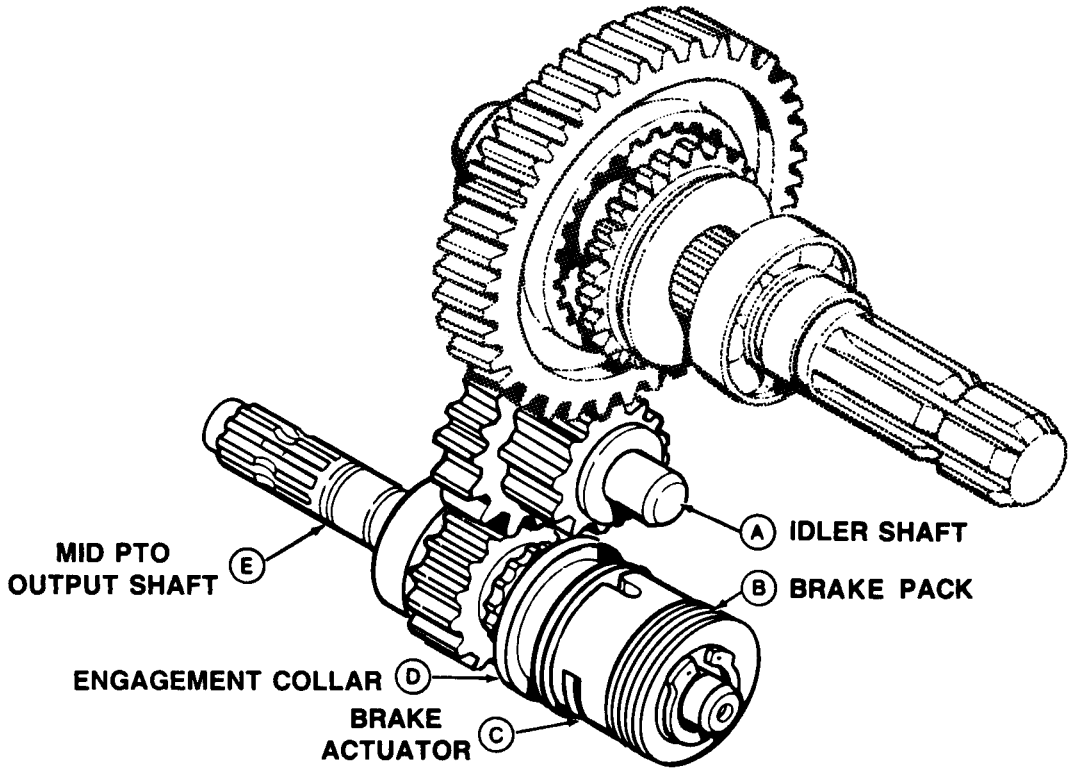


M70952

REAR PTO LINKAGE COMPONENTS

A—PTO Lever **B—Detent Assembly** **C—Engagement Gear** **D—Engagement Fork**

MID PTO COMPONENT LOCATION

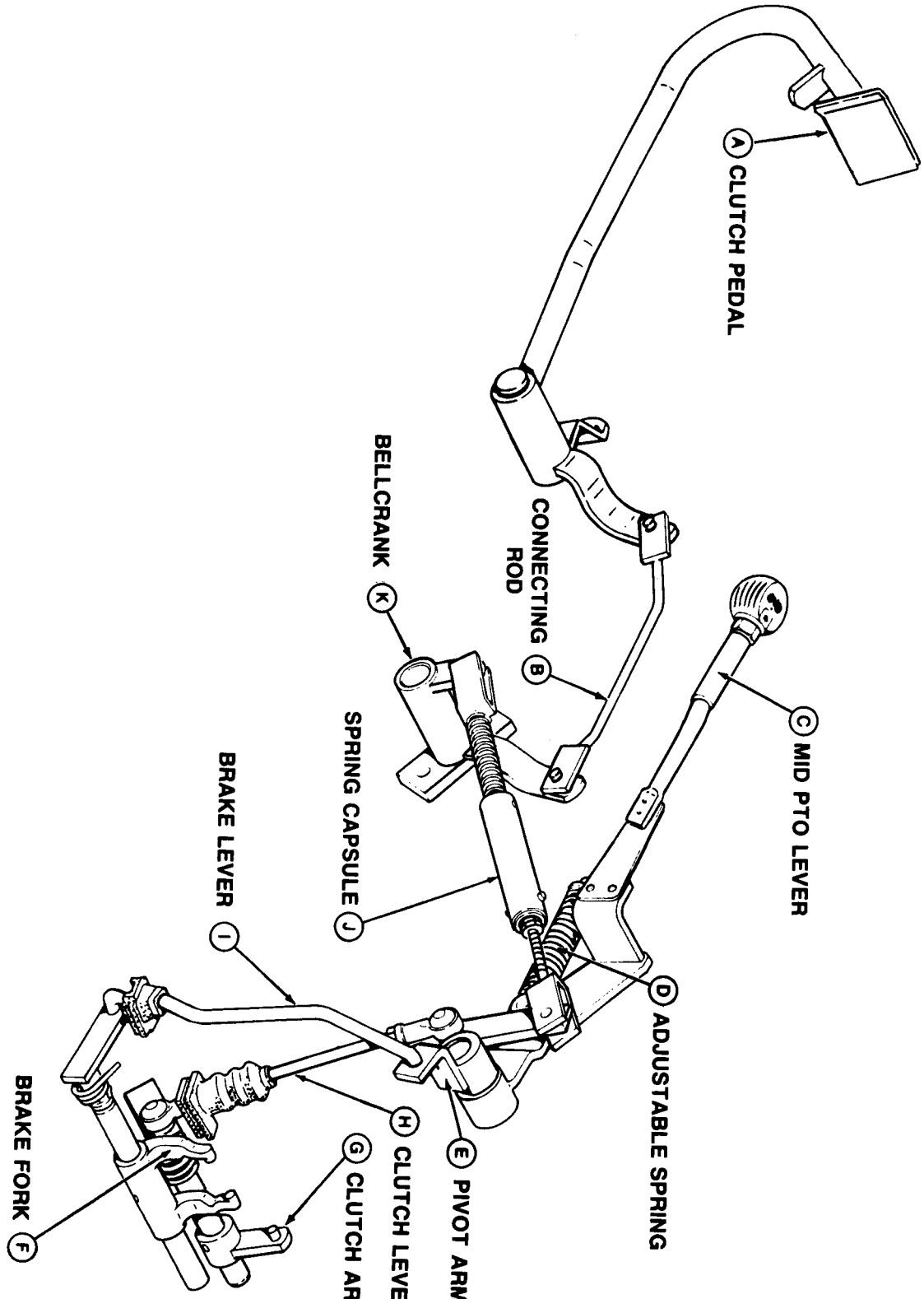


MID PTO COMPONENTS

A—Idler Shaft
B—Brake Pack
C—Brake Actuator
D—Engagement Collar
E—Mid PTO Output Shaft

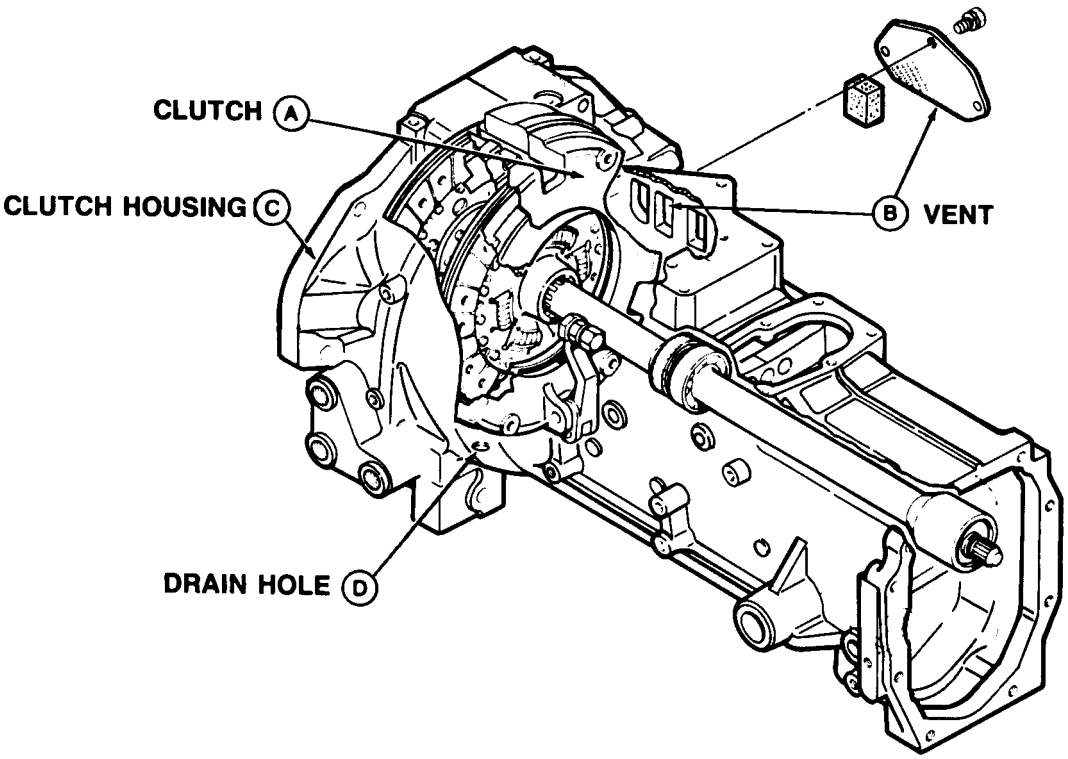
MID PTO LINKAGE COMPONENT LOCATION

A—Clutch Pedal
B—Connecting Rod
C—Mid PTO Lever
D—Adjustable Spring
E—Pivot Arm
F—Brake Fork
G—Clutch Arm
H—Clutch Lever
I—Brake Lever
J—Spring Capsule
K—Bell Crank



MID PTO LINKAGE COMPONENTS

CLUTCH VENTILATION AND DRAIN



M70935

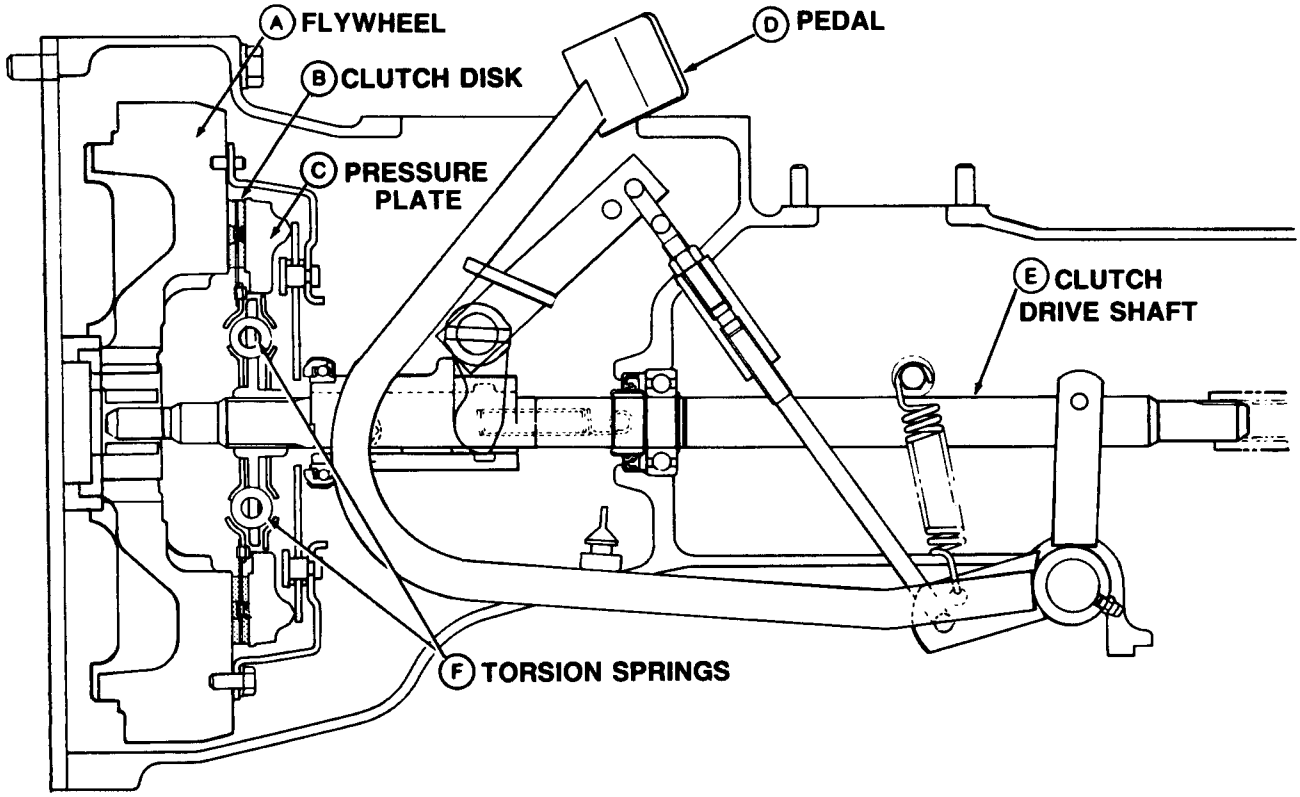
CLUTCH VENT AND DRAIN

A—Clutch **B—Vent** **C—Clutch Housing** **D—Drain Hole**

A vent in the side of the clutch housing allows air flow within the housing. As the engine is running the clutch rotation provides air movement. This vent allows cool air to enter the housing while the engine is running and provides a way for warm air to escape after the engine is shut off. This will reduce condensation.

A drain hole allows any moisture that has accumulated in the clutch housing to escape.

SINGLE STAGE CLUTCH ENGAGED



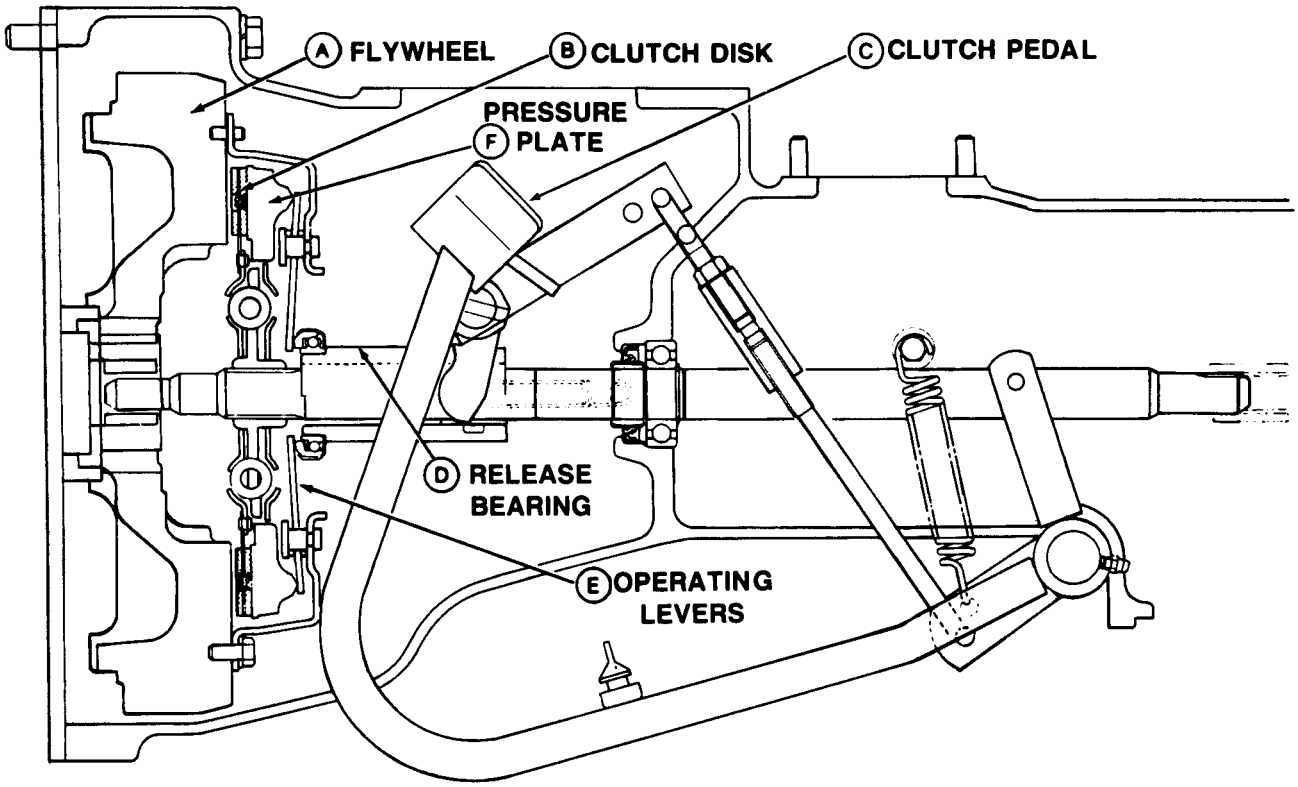
SINGLE STAGE CLUTCH ENGAGED

A—Flywheel
B—Clutch Disk
C—Pressure Plate
D—Pedal
E—Clutch Drive Shaft
F—Torsion Springs

The single stage clutch connects the engine flywheel (A) to the clutch drive shaft (E). In the engaged position the pedal (D) is released. The pressure plate (C) is applying pressure against the clutch disk which forces it in contact with the flywheel.

Power flow is from the engine flywheel through the clutch to the clutch drive shaft. The torsion springs (F) in the clutch disk dampen the disk facings during engagement.

SINGLE STAGE CLUTCH DISENGAGED



SINGLE STAGE CLUTCH DISENGAGED

A—Flywheel **C—Clutch Pedal** **E—Clutch Operating Levers** **F—Pressure Plate**
B—Clutch Disk **D—Release Bearing**

When the clutch pedal is depressed on a single stage clutch the linkage forces the release bearing (D) against the clutch operating levers (E). The outer ends of the clutch operating levers pull back on the pressure plate (F).

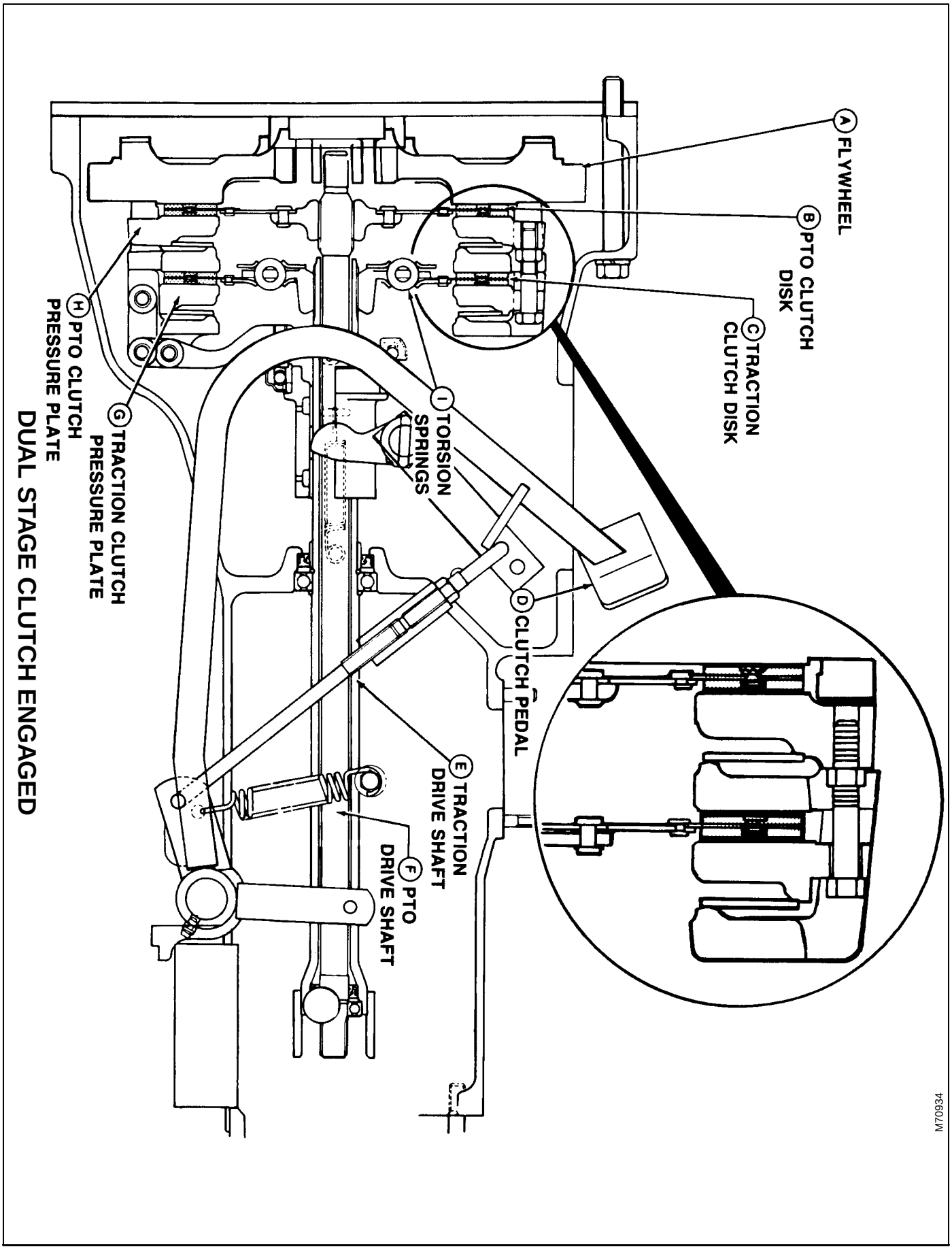
The pressure plate is no longer applying pressure against the clutch disk (B) therefore the disk is not in contact with the flywheel (A).

DUAL STAGE CLUTCH ENGAGED

A—Flywheel
B—PTO Clutch Disk
C—Traction Clutch Disk
D—Clutch Pedal
E—Traction Drive Shaft
F—PTO Drive Shaft
G—Traction Clutch Pressure Plate
H—PTO Clutch Pressure Plate
I—Torsion Springs

The dual stage clutch has two clutch assemblies, the PTO clutch which is attached to the PTO drive shaft and the traction clutch which is attached to the traction drive shaft. In the engaged position the clutch pedal is released. The pressure plate is applying pressure against the clutch disk which forces them in contact with the flywheel.

Power flow is from the engine flywheel through the PTO clutch to the PTO drive shaft. The same is occurring from the engine flywheel through the traction clutch to the traction drive shaft. The traction clutch has torsion springs to dampen the disk facings during engagement.

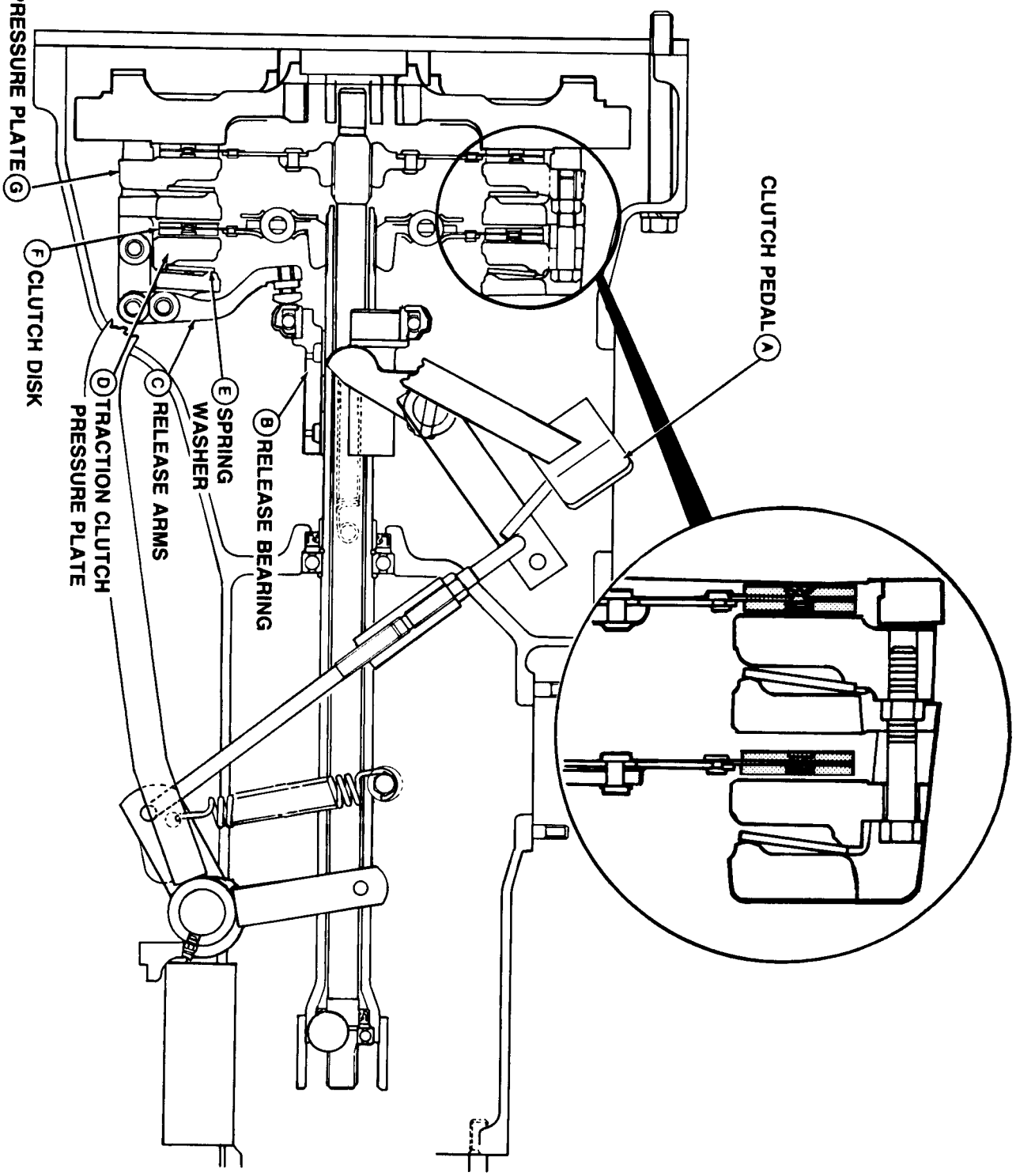


DUAL STAGE CLUTCH ENGAGED

DUAL STAGE CLUTCH TRANSMISSION DISENGAGED PTO ENGAGED

A—Clutch Pedal
B—Release Bearing
C—Release Arms
D—Traction Clutch Pressure Plate
E—Spring Washer
F—Clutch Disk
G—PTO Pressure Plate

When the clutch pedal is partially depressed the transmission is disengaged. The pedal linkage forces the release bearing against three release arms and pivots them forward. The arms act as levers to force the traction clutch pressure plate rearward and compress the spring washers. This releases the clamping action of the spring washers which was holding the clutch disk against back surface of the PTO pressure plate.

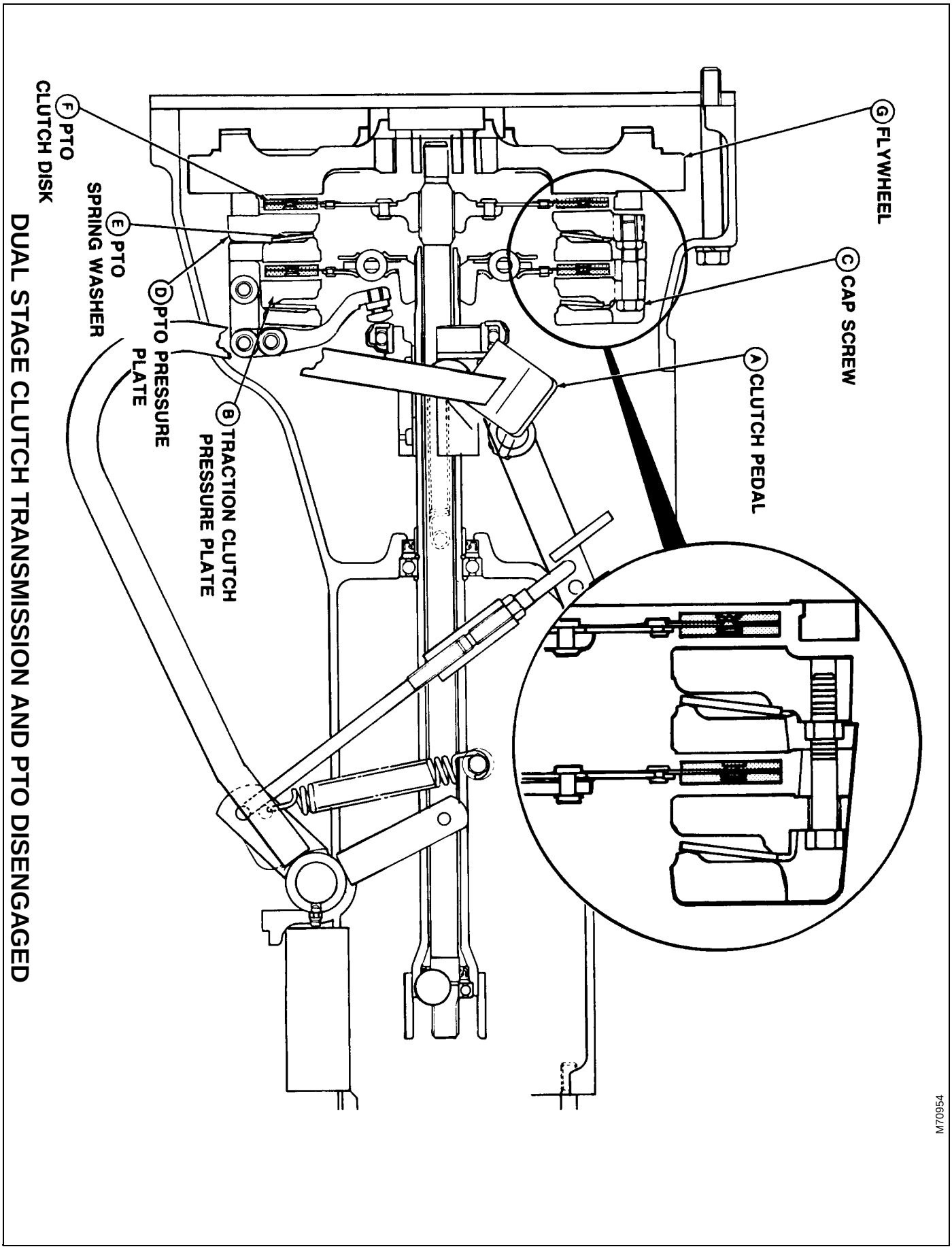


DUAL STAGE CLUTCH TRANSMISSION DISENGAGED / PTO ENGAGED

DUAL STAGE CLUTCH TRANSMISSION AND PTO DISENGAGED

A—Clutch Pedal
B—Traction Clutch Pressure Plate
C—Cap Screw
D—PTO Pressure Plate
E—PTO Spring Washer
F—PTO Clutch Disk
G—Flywheel

When the clutch pedal is fully depressed the transmission and PTO are disengaged. The traction clutch is disengaged as described on the previous page. Continuing to depress the pedal moves the traction clutch pressure plate rearward farther. When it contacts the cap screw connected to the PTO clutch pressure plate it pulls the cap screw and PTO clutch pressure plate back. This compresses the PTO spring washer which was holding the PTO clutch disk against the flywheel.



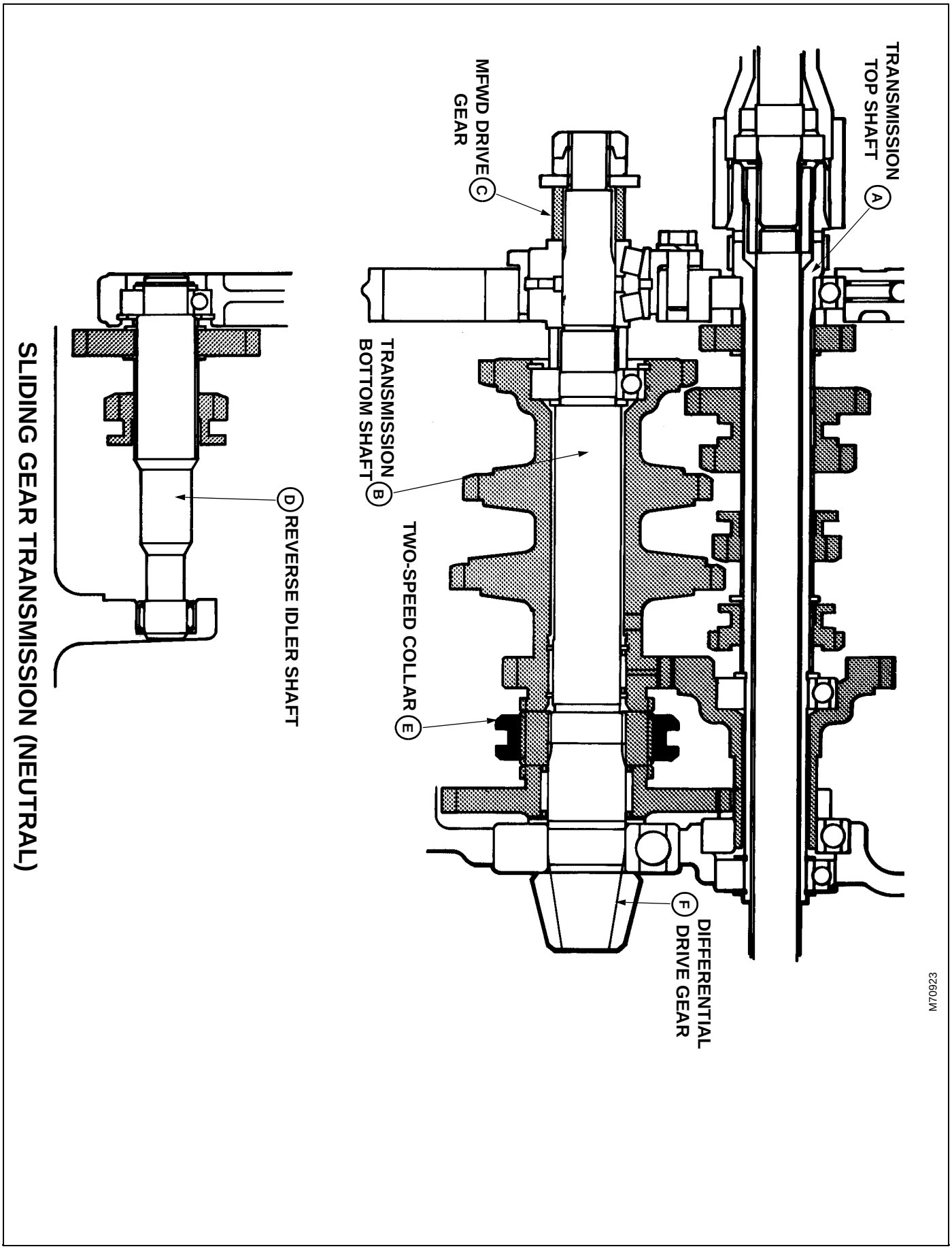
DUAL STAGE CLUTCH TRANSMISSION AND PTO DISENGAGED

SLIDING GEAR TRANSMISSION (NEUTRAL)

A—Transmission Top Shaft
B—Transmission Bottom Shaft
C—MFWD Drive Gear
D—Reverse Idler Shaft
E—Two Speed Collar
F—Differential Drive Gear

The sliding gear transmission is shown here in the neutral position. None of the gears on the top shaft (A) are in mesh with the gears on the bottom shaft (B) or reverse idler shaft (D).

The two speed collar (E) is in the center (neutral) position.



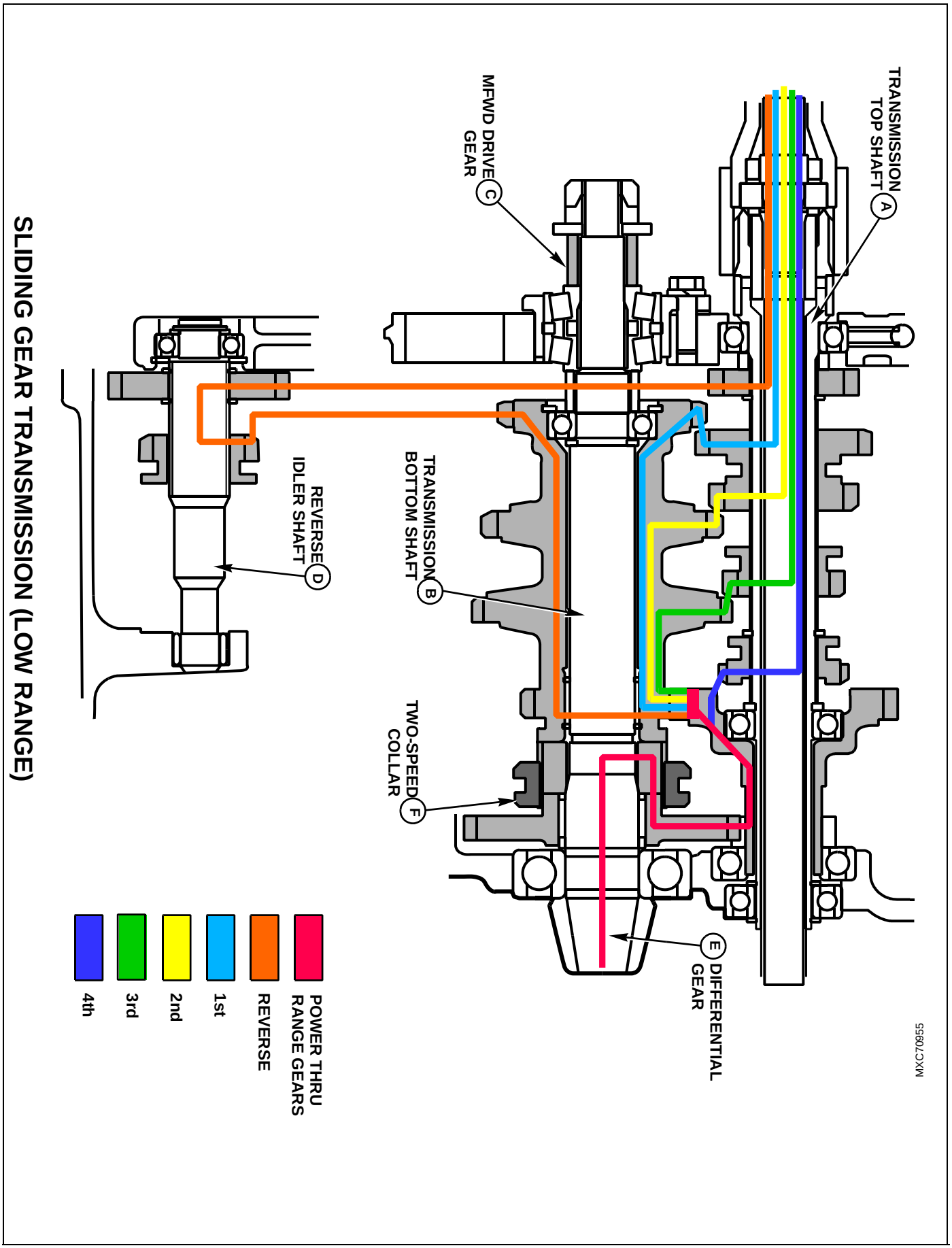
SLIDING GEAR TRANSMISSION (NEUTRAL)

SLIDING GEAR TRANSMISSION (LOW RANGE)

A—Transmission Top Shaft
B—Transmission Bottom Shaft
C—MFWD Drive Gear
D—Reverse Idler Shaft
E—Differential Gear
F—Two Speed Collar

The sliding gear transmission is shown here with the two speed collar moved rearward to the low range position. If one of the gears on the transmission top shaft is slid into engagement with the corresponding gear on the bottom shaft travel will occur at that forward speed.

If the shift collar is moved into engagement on the reverse idler shaft power will flow through the differential shaft in reverse through the corresponding gears shown.

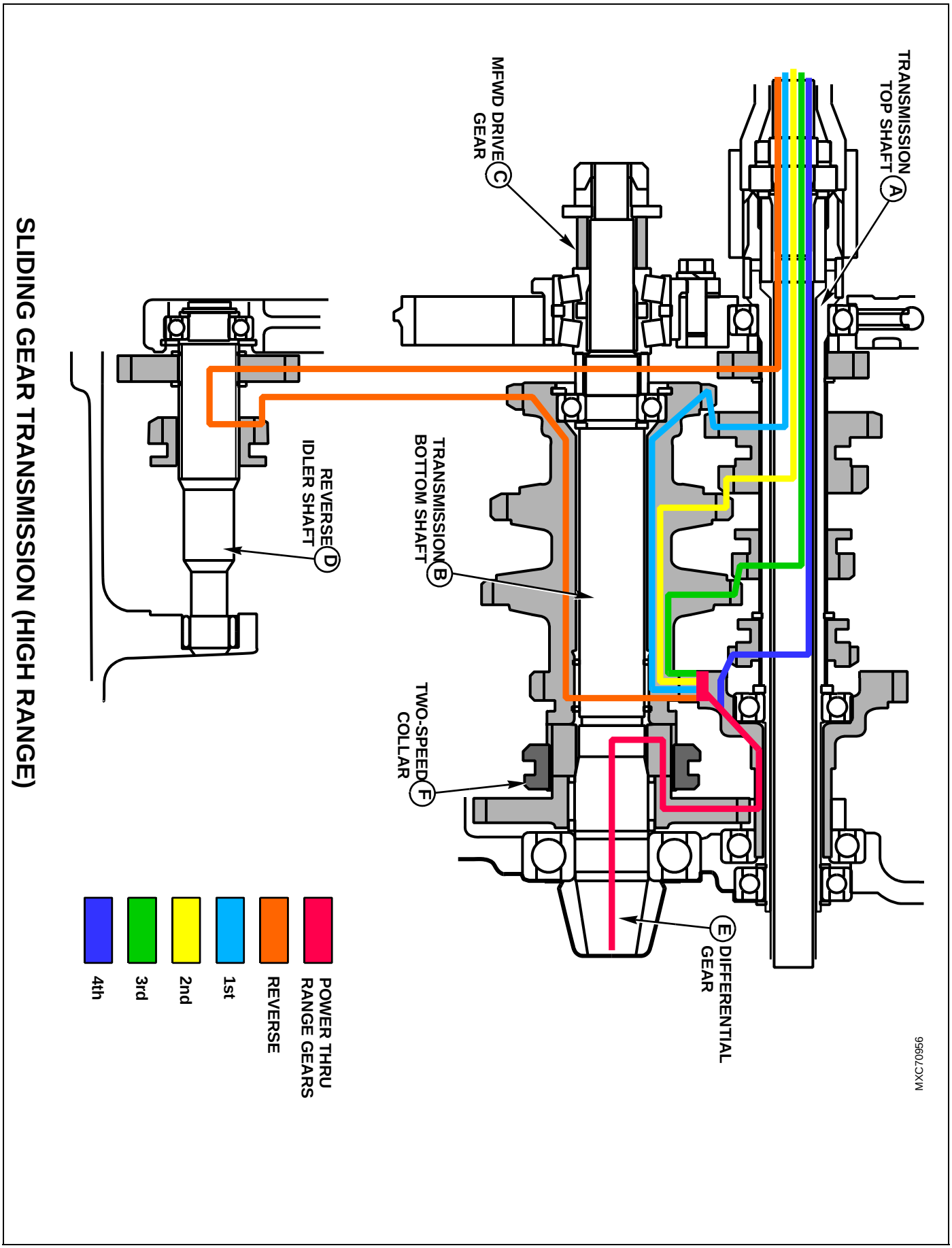

SLIDING GEAR TRANSMISSION (LOW RANGE)
TRANSMISSION TOP SHAFT A
MFWD DRIVE GEAR C
REVERSE IDLER SHAFT D
TRANSMISSION BOTTOM SHAFT B
TWO-SPEED COLLAR F
DIFFERENTIAL GEAR E
POWER THRU RANGE GEARS
REVERSE
1st
2nd
3rd
4th
MX,C70955

SLIDING GEAR TRANSMISSION (HIGH RANGE)

A—Transmission Top Shaft
B—Transmission Bottom Shaft
C—MFWD Drive Gear
D—Reverse Idler Shaft
E—Differential Gear
F—Two Speed Collar

The sliding gear transmission is shown here with the two speed collar (F) moved forward to the high range position. If one of the gears on the transmission top shaft (A) is slid into mesh with the corresponding gear on the bottom shaft (B) forward travel will occur at that speed.

If the shift collar on the reverse idler shaft (D) is gear engaged, power will flow through the differential shaft (E) in reverse through the corresponding gears shown.


SLIDING GEAR TRANSMISSION (HIGH RANGE)
TRANSMISSION TOP SHAFT A
MFWD DRIVE GEAR C
REVERSE IDLER SHAFT D
TRANSMISSION BOTTOM SHAFT B
TWO-SPEED COLLAR F
E DIFFERENTIAL GEAR
POWER THRU RANGE GEARS
REVERSE
1st
2nd
3rd
4th
MX670956

DIFFERENTIAL LOCK OPERATION

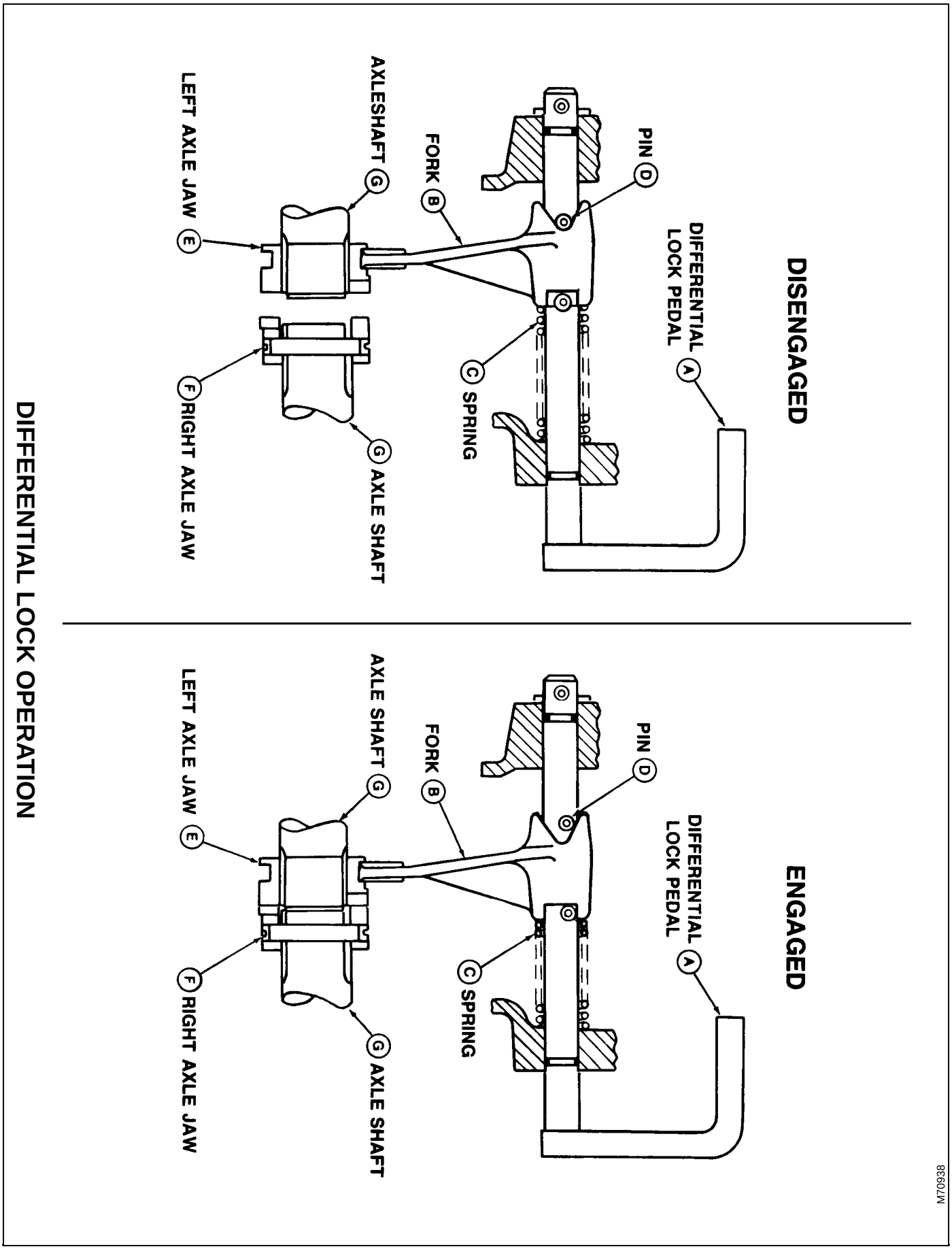
A—Pedal
B—Fork
C—Spring
D—Pin
E—Left Axle Jaw
F—Right Axle Jaw
G—Axle Shafts

Engaging the differential lock, locks the two axle shafts together and keeps an equal amount of power to both axles (eliminates differential action).

Depressing the pedal (A) rotates a pin (D) that sets in the comramp of the fork (B). As the pin rotates it forces the fork to the left compressing the spring (C).

Since the fork surrounds the right axle jaw (F) the jaw will move to the left and engage with the left axle jaw (E). The axles have to be rotating before the jaws can align.

When the pedal is released the spring will disengage the differential lock once the torsional forces on the axles is reduced.



DIFFERENTIAL LOCK OPERATION

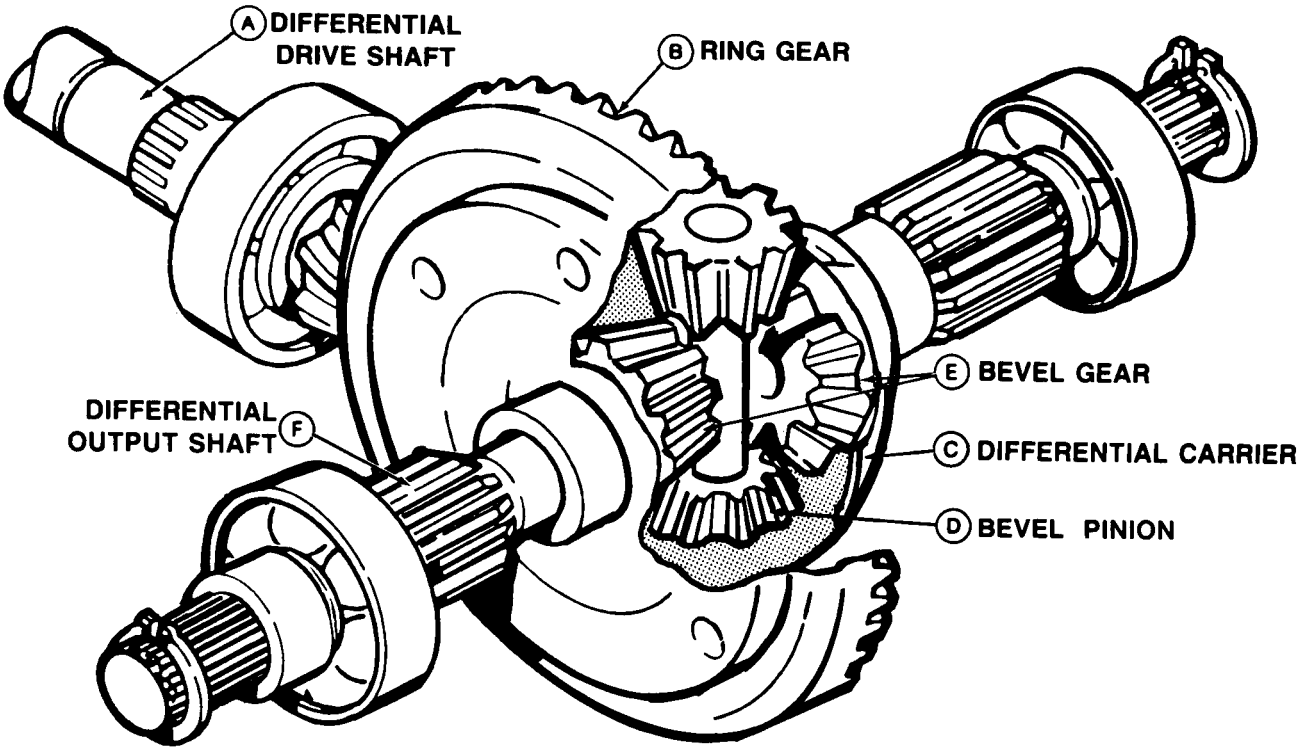
DIFFERENTIAL POWER FLOW

A—Differential Drive Shaft
B—Ring Gear
C—Differential Carrier
D—Bevel Pinions
E—Bevel Gears
F—Differential Output Shaft

The differential transmits power from the differential drive shaft to the final drive pinion shaft. The final drive gears then drive the axle shaft.

Power flows through the two bevel gears and two bevel pinions.

When the tractor turns sharply, one axle is held stationary. The result is that the bevel pinions rotate on their own axis and walk around the stationary bevel gears. The turning ring gear transmits power through the pinion to the opposite bevel gear.



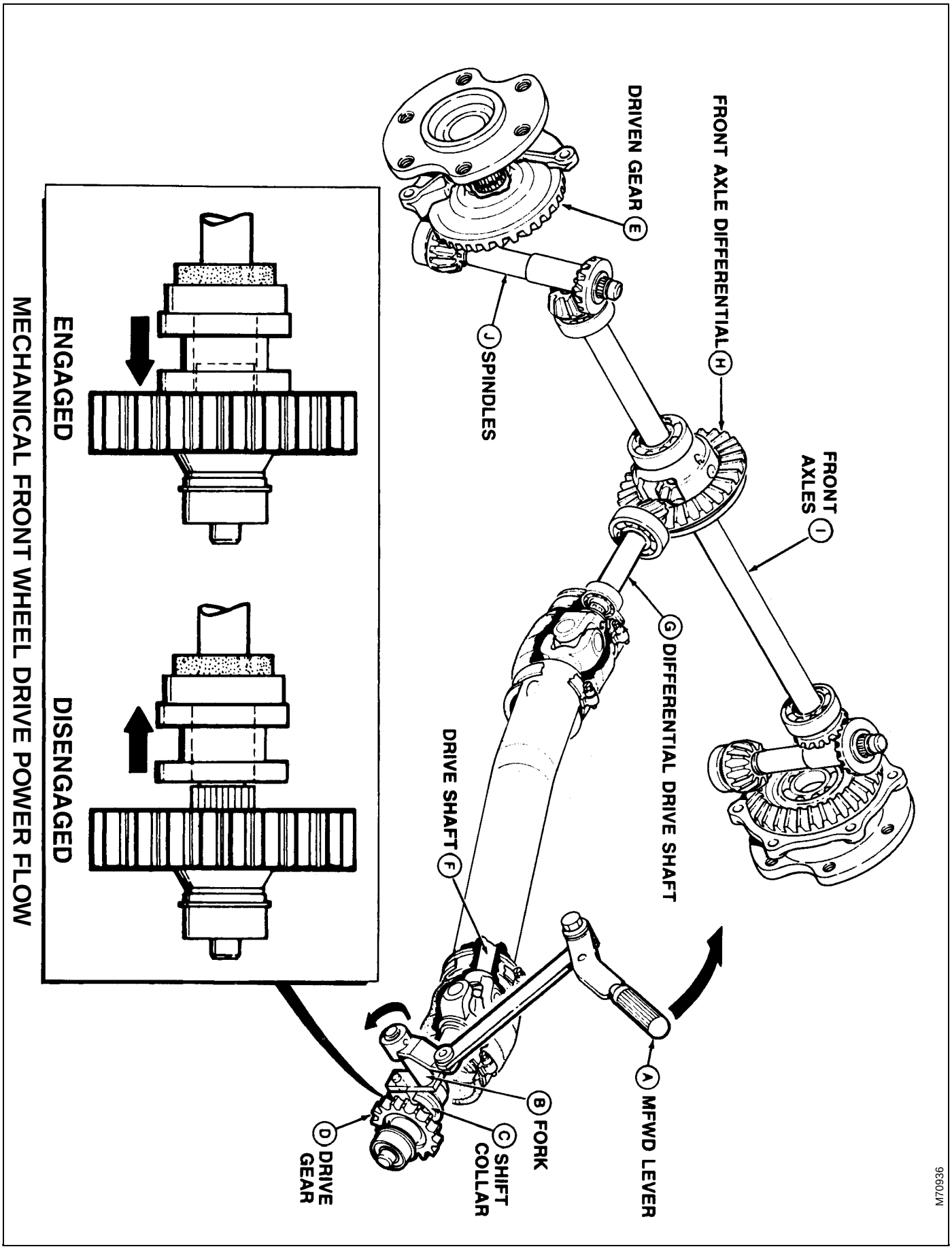
DIFFERENTIAL POWER FLOW

MECHANICAL FRONT WHEEL DRIVE POWER FLOW

A—MFWD Lever
B—Fork
C—Shift Collar
D—Drive Gear
E—Driven Gear
F—Drive Shaft
G—Differential Drive Shaft
H—Front Axle Differential
I—Front Axles
J—Spindles

The MFWD is engaged by moving the lever forward. The fork on the end of the linkage moves the shift collar back to engage the drive gear with the drive shaft.

Power is then transmitted from the differential drive shaft through the MFWD drive shaft, the front axle differential, front axles and spindles.

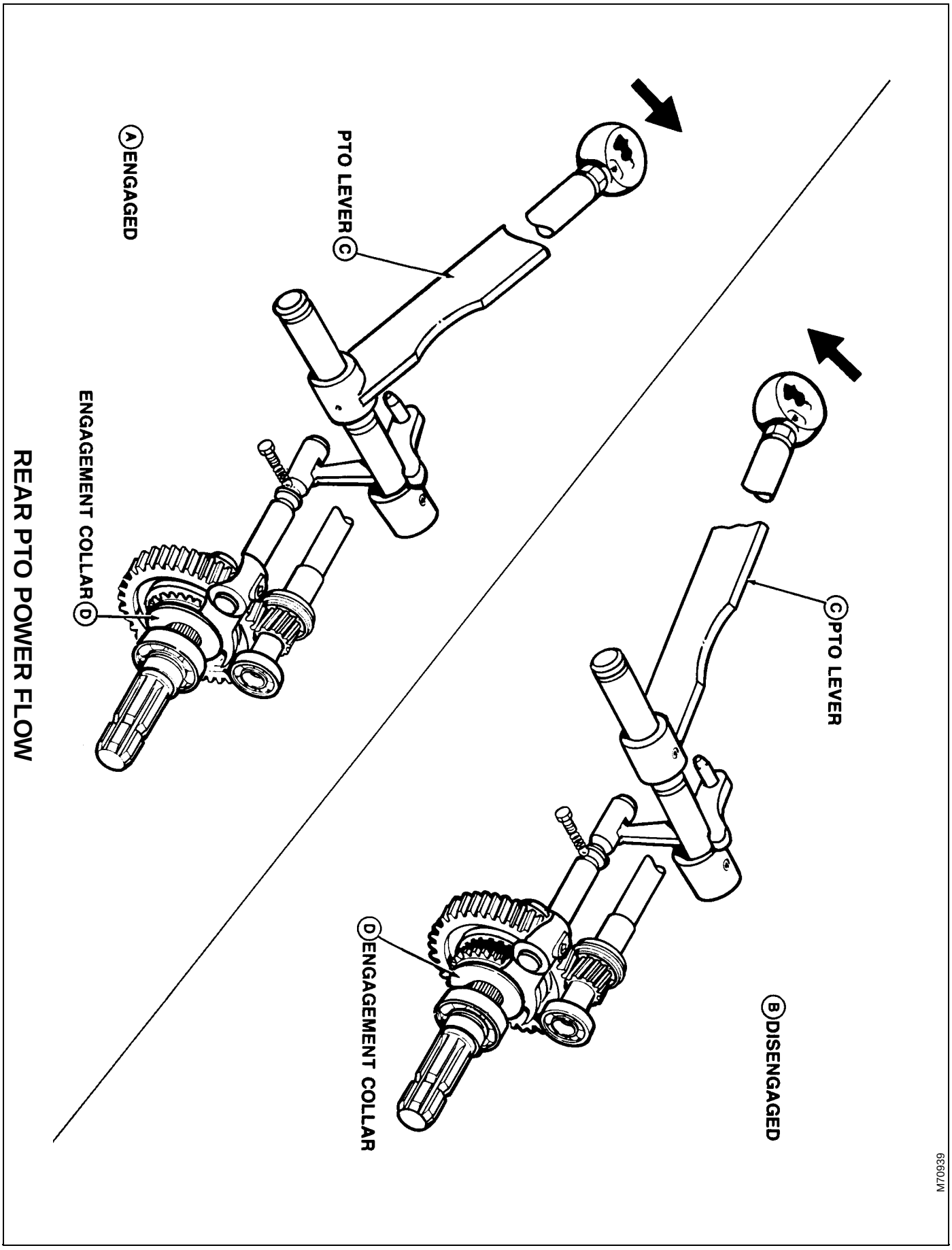

FRONT AXLE DIFFERENTIAL (H)
DRIVEN GEAR (E)
(J) SPINDLES
FRONT AXLES (I)
(G) DIFFERENTIAL DRIVE SHAFT
DRIVE SHAFT (F)
(A) MFWD LEVER
(B) FORK
(C) SHIFT COLLAR
(D) DRIVE GEAR
ENGAGED
DISENGAGED
MECHANICAL FRONT WHEEL DRIVE POWER FLOW
M70936

REAR PTO POWER FLOW

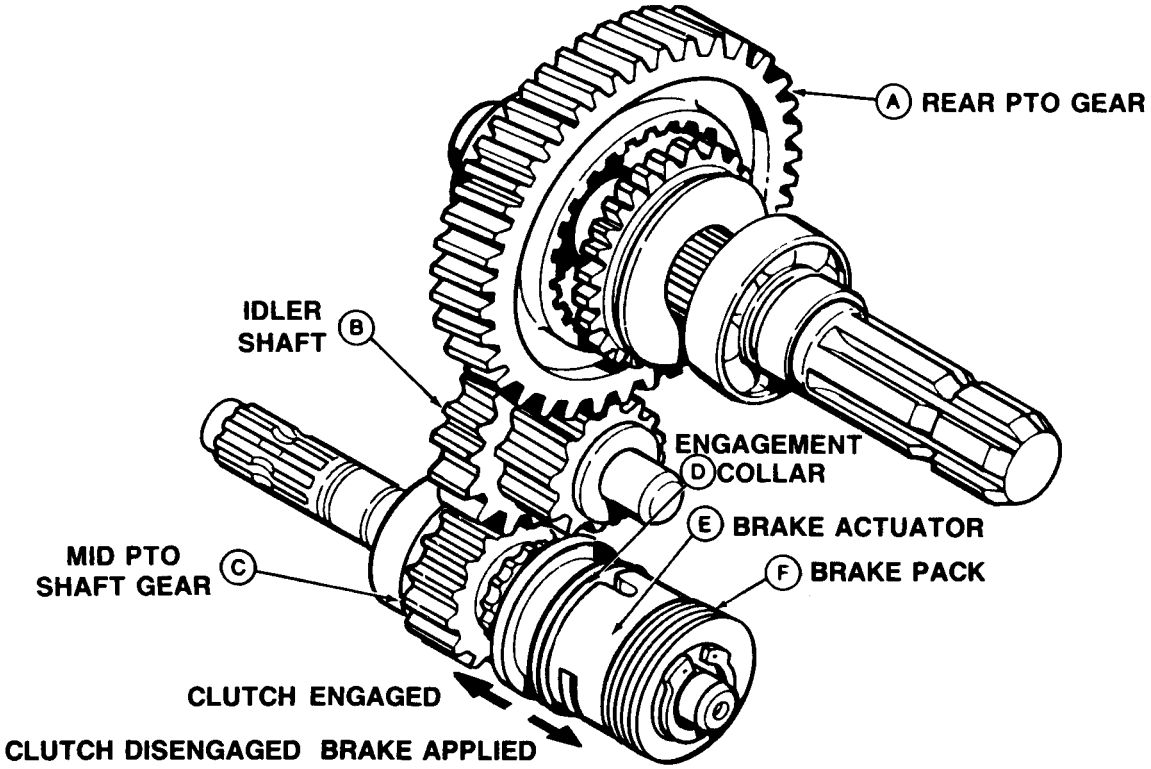
A—Engaged **B—Disengaged** **C—PTO Lever** **D—Engagement Collar**

To engage the rear PTO a lever is pulled up. The linkage controls a fork which surrounds a collar on the PTO shaft. The PTO drive gear and driven gear are in constant mesh.

Moving the collar forward connects the driven gear to the PTO shaft.


REAR PTO POWER FLOW
A ENGAGED
PTO LEVER C
ENGAGEMENT COLLAR D
C PTO LEVER
B DISENGAGED
D ENGAGEMENT COLLAR
M70939

MID PTO OPERATION



MID PTO OPERATION

A—Rear PTO Gear
B—Idler Shaft
C—Mid PTO Shaft Gear
D—Engagement Collar
E—Brake Actuator
F—Brake Pack

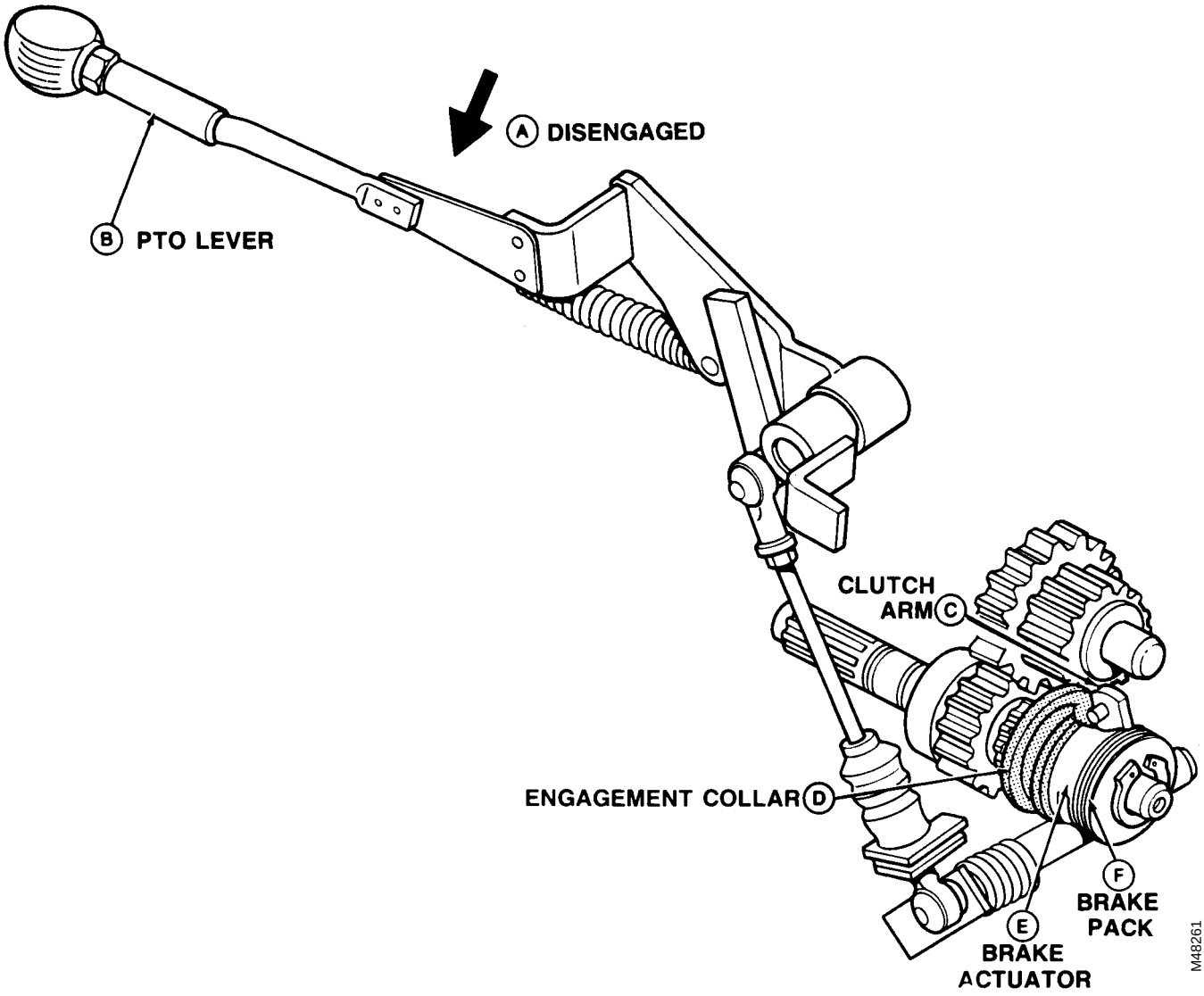
The mid PTO idler shaft is in constant mesh with the rear PTO Gear and mid PTO shaft gear.

The mid PTO shaft also contains an engagement collar and brake pack.

Moving the collar forward engages the mid PTO shaft gear to the shaft. Moving the collar rearward disengaged the gear.

Moving the brake block rearward compresses the brake washers against the brake disks which are splined to the mid PTO shaft. Applying the brake causes the shaft to stop turning.

MID PTO LINKAGE OPERATION—LEVER DISENGAGED



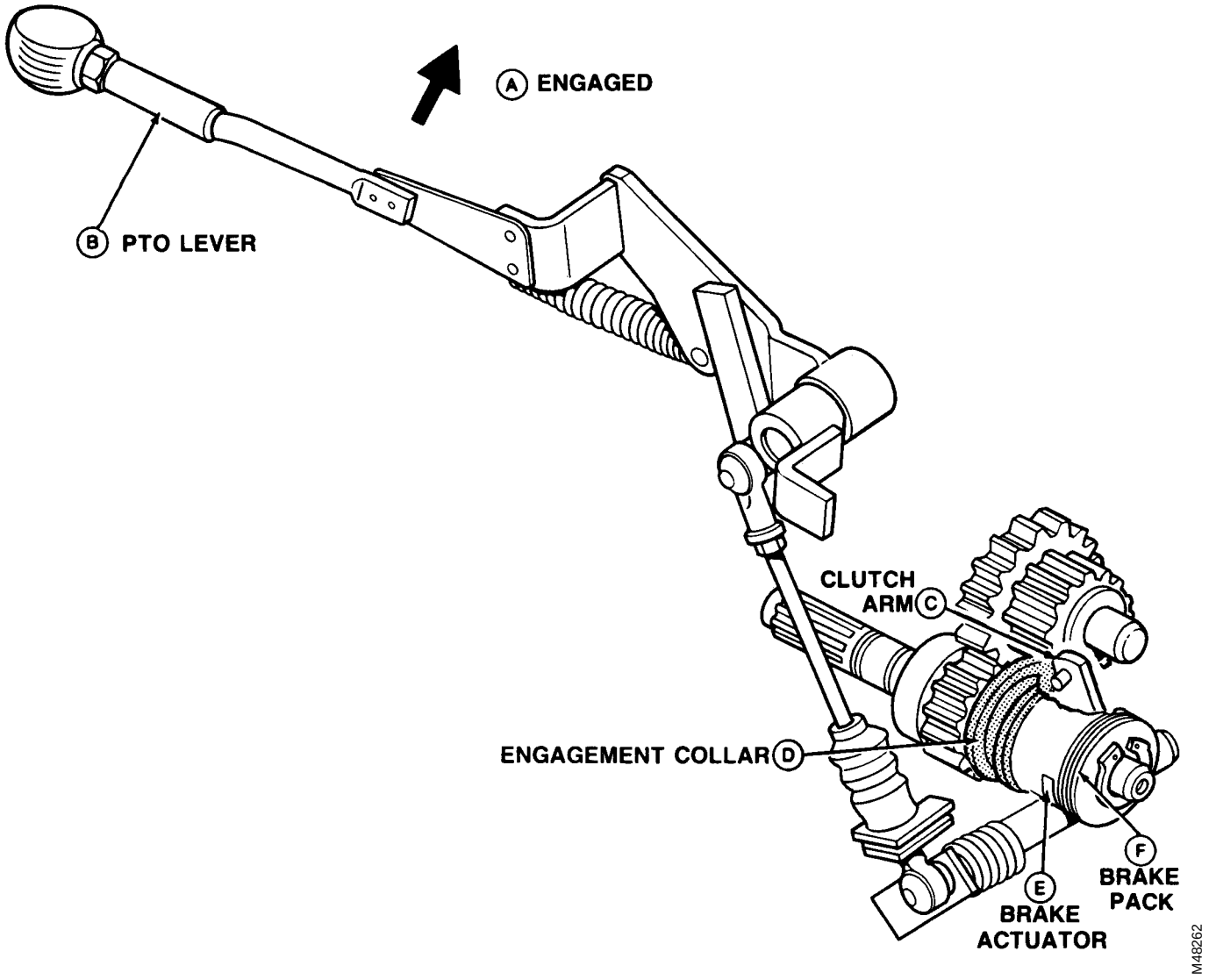
MID PTO LEVER DISENGAGED

A—Disengaged
B—PTO Lever
C—Clutch Arm
D—Engagement Collar
E—Brake Actuator
F—Brake Pack

When the PTO lever is in the disengaged position the clutch arm connected to the engagement collar moves the collar back to disengage the gear from the shaft.

It also applies force against the brake block to apply the brake.

MID PTO LINKAGE OPERATION—LEVER ENGAGED



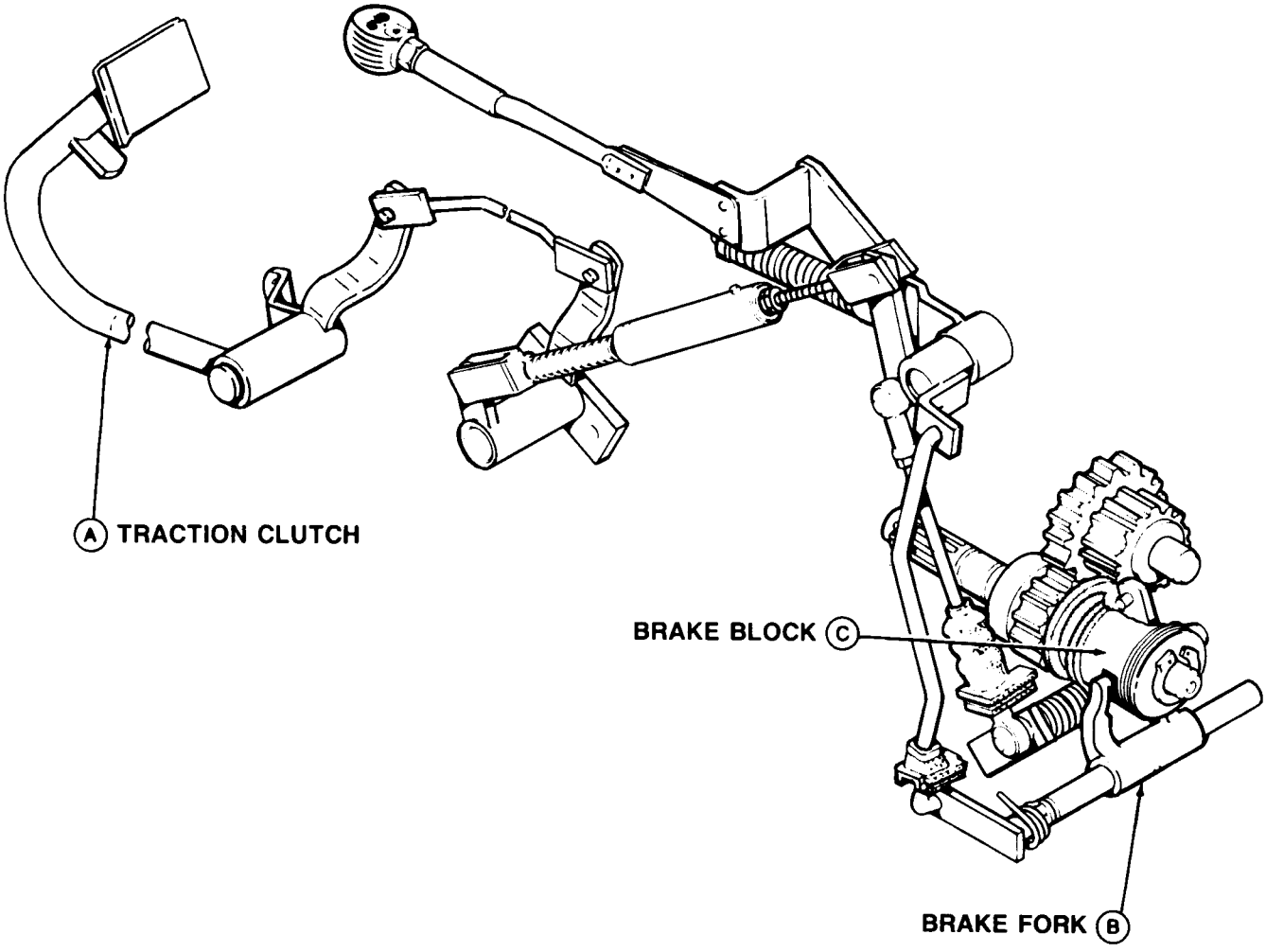
MID PTO LEVER ENGAGED

A—Engaged
B—PTO Lever
C—Clutch Arm
D—Engagement Collar
E—Brake Actuator
F—Brake Pack

Moving the PTO lever to the engaged position causes the engagement collar to move forward and engage the gear to the shaft.

This also releases the pressure on the brake block so that the brake is released before the PTO is engaged.

MID PTO LINKAGE OPERATION—CLUTCH DEPRESSED—PTO ENGAGED



MID PTO LINKAGE OPERATION
CLUTCH PEDAL DEPRESSED
PTO ENGAGED

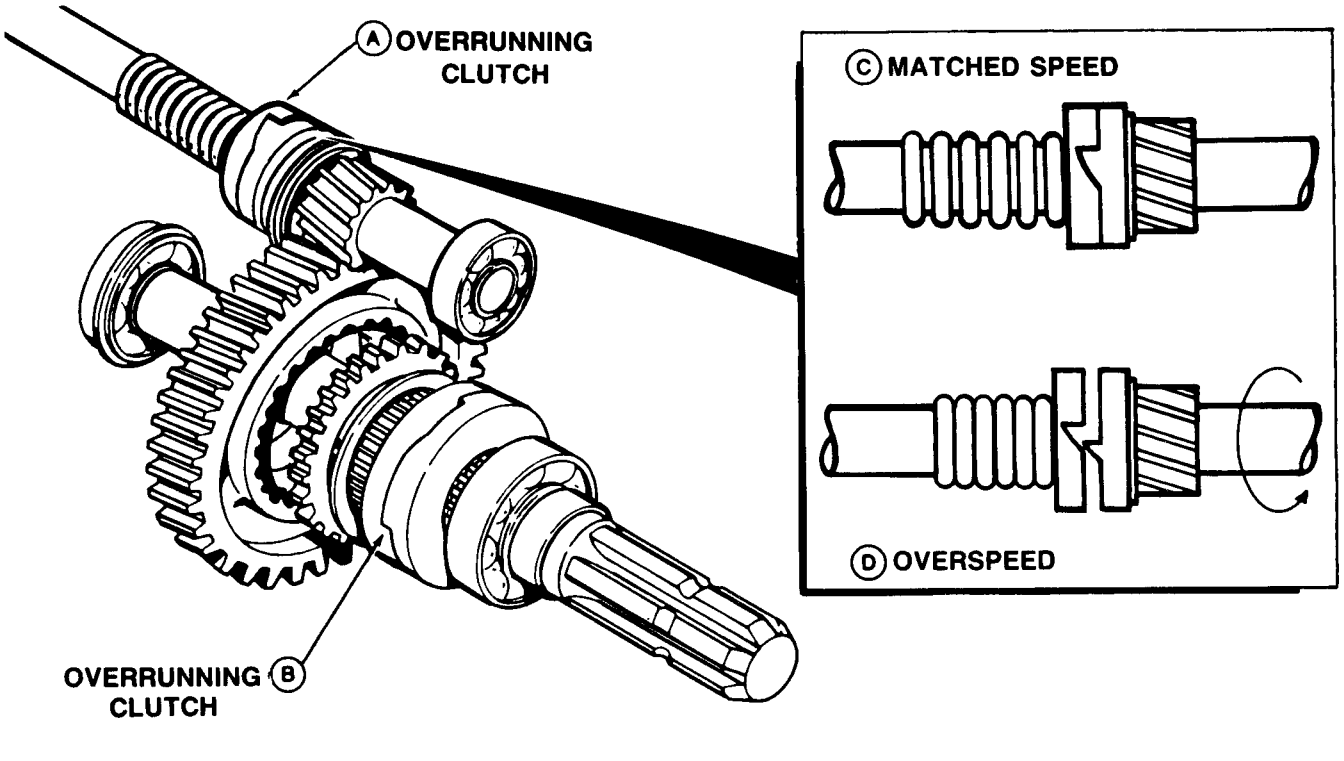
A—Traction Clutch **B—Brake Fork** **C—Brake Block**

If the traction clutch is disengaged the power to the mid PTO is stopped from the engine.

The linkage connected to the clutch pedal will also rotate the fork connected to the brake block in the mid PTO.

The results will be that the mid PTO brake is applied to stop the mid PTO shaft rotation after the power to the PTO has been stopped.

OVERRUNNING CLUTCHES



A—Overrunning Clutch **B—Overrunning Clutch**

Overrunning clutches are used on tractors with single stage traction. They are located between the PTO drive shaft and PTO output shafts.

They protect the transmission and engine by permitting the PTO shaft to overspeed without transmitting power back through the transmission and engine. This could occur during traction clutch disengagement or sudden acceleration, particularly when operating a heavy PTO driven attachment.

Clutch (A) protects the power train when the rear or mid PTO is engaged.

Clutch (B) protects the power train when only the rear PTO is engaged.

The rear half of the clutch (rear drum) is connected to the output shaft. The front half is connected to the input shaft. If over speeding occurs the rear drum rides up the ramp on the front drum, this compresses the clutch spring and allows the rear drum to slip into the next cog on the front drum.

This ratcheting causes a noise that can be heard when the engine is decelerated.

ABOUT THIS GROUP

Follow the steps in this procedure in order to isolate the problem area in the power train.

In general the problems you will be looking for are oil leakage, noise or lack of power to the driven components. Following this procedure will help you determine the cause of the problem before disassembly.

ISOLATE THE PROBLEM AREA (SINGLE STAGE CLUTCH)

TEST CONDITIONS:

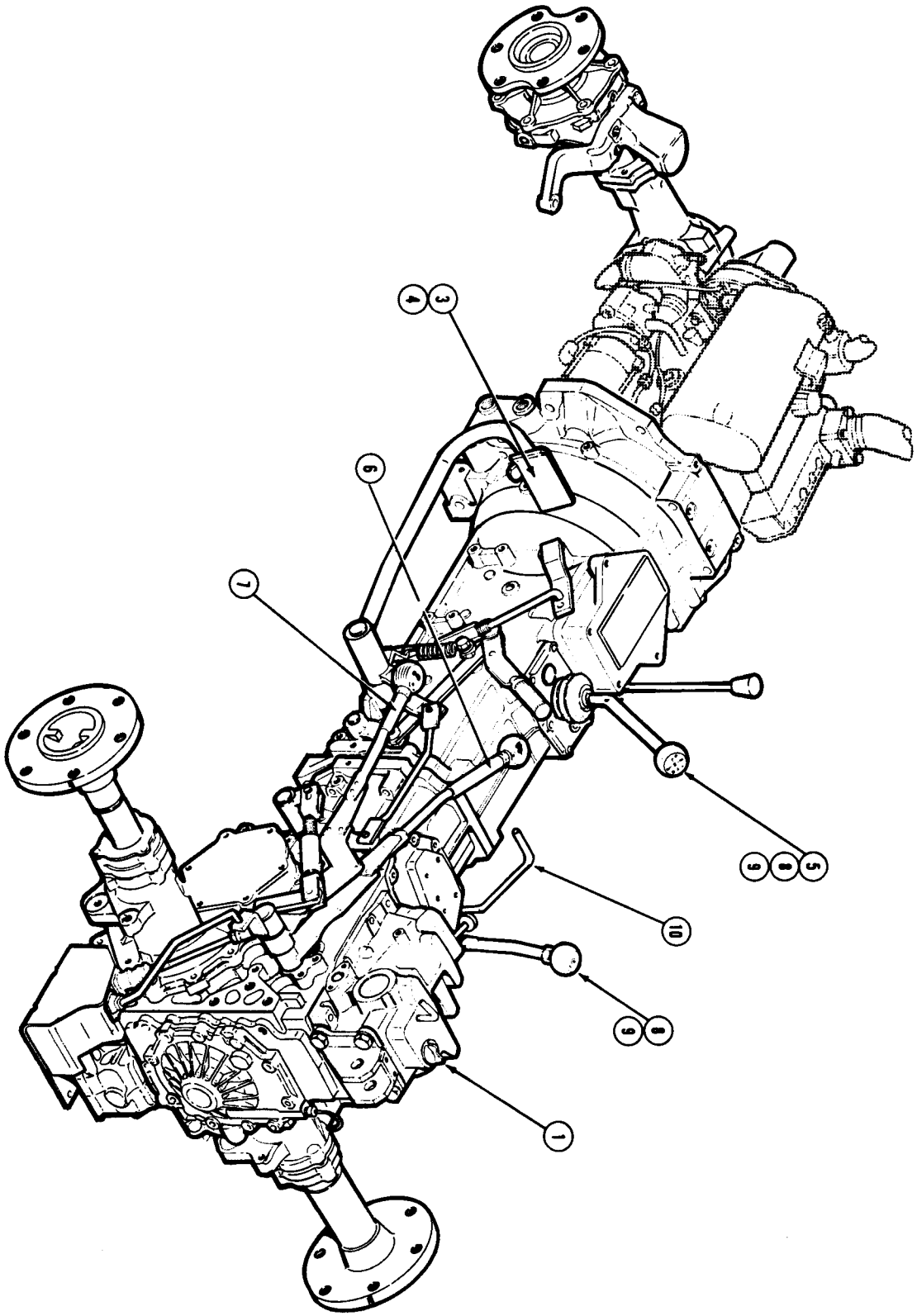
•Before starting inspect the entire tractor for oil leakage. Locate the source of leakage, determine the cause and make the necessary repairs.

•During the tests you will be looking for abnormal noises. A mechanics stethoscope may be helpful.

•Begin the test procedure with the speed selector and two speed in neutral, MFWD disengaged and both PTO off.

Test Check Point	Normal	If Not Normal
1. Check Transmission Oil	Level not too low	Check for leakage and refill.
	Level not too high	Drain oil to proper level.
	Oil not contaminated with metal fragments or debris	Drain oil to proper level. Clean screen and determine cause of contamination.
	Oil not foamy or discolored	Make sure type of oil is correct. Check for hydraulic cause of over heating.
2. Check All Linkage Operation and Return it to Neutral	No damage or binding.	Repair linkage.
3. Run Engine With Clutch Disengaged	No noise or vibration	Inspect engine.
4. Engage Clutch and vary Engine rpm.	No noise vibration	Inspect clutch. Inspect transmission, drive shaft and bearings. Inspect PTO drive shaft and bearing.
5. Place speed selector in each forward gear and reverse. Leave two speed in neutral. Engage clutch and vary engine rpm in each gear.	No noise or vibration	Inspect gear mesh for speed selected when noise or vibration occurred. Inspect differential drive shaft, gears and bearing if noise occurred in all speeds. Inspect reverse idler shaft and bearing if problem changes in reverse.

ISOLATE THE PROBLEM (SINGLE STAGE CLUTCH)



ISOLATE THE PROBLEM AREA (SINGLE STAGE CLUTCH)—CONTINUED

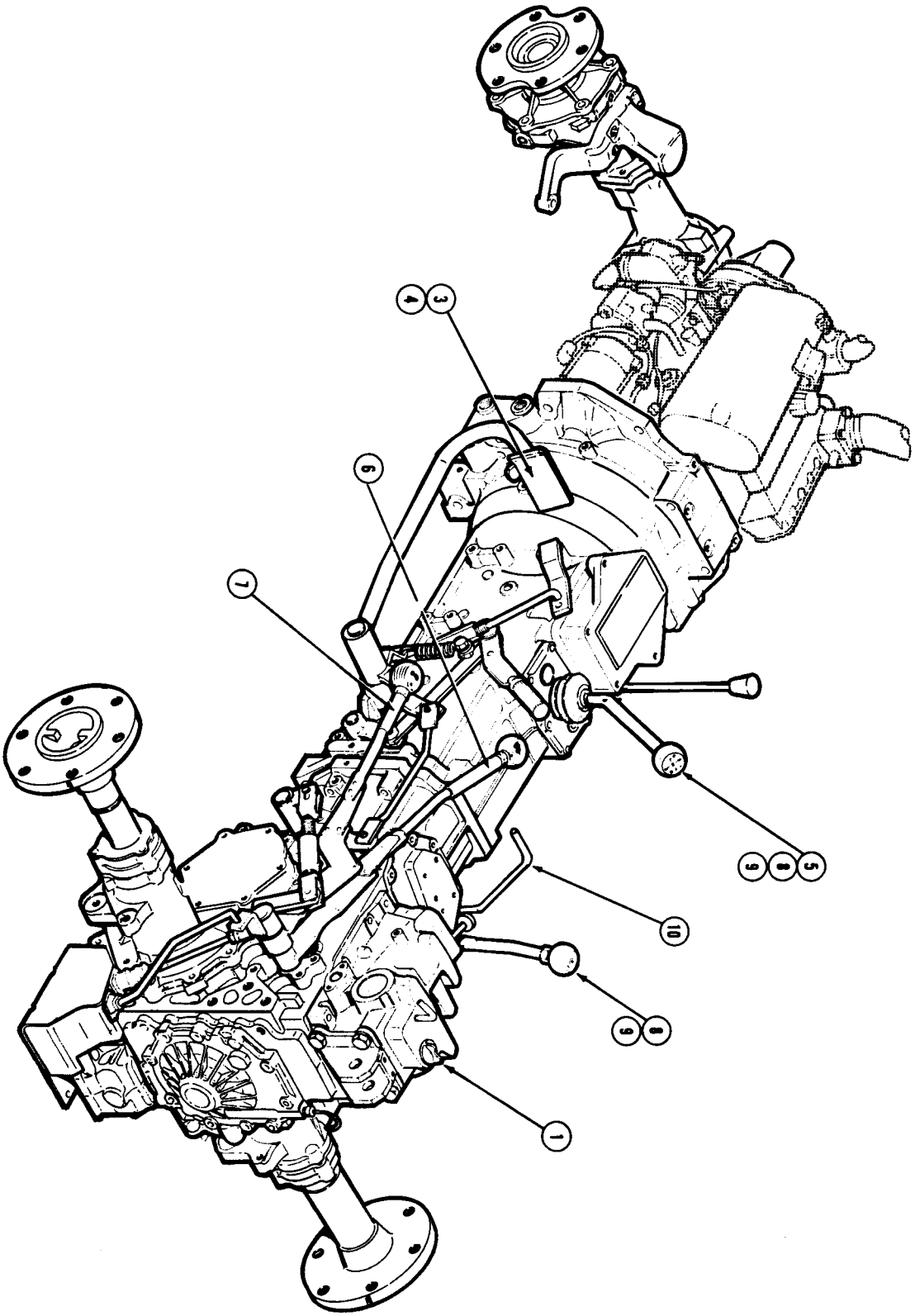
NOTE: When performing steps 6 and 7 a ratcheting noise may be heard while throttling engine down or disengaging the PTO. This noise is normal, caused by the overrunning clutches.

Test Check Point	Normal	If Not Normal
6. Place transmission in neutral and engage rear PTO. Engage clutch and vary engine rpm.	No noise or vibration.	Inspect rear PTO shaft, gears and bearings.
7. Engage mid PTO (if equipped). Transmission in neutral and rear PTO off. Engage clutch vary engine rpm.	PTO shaft turns no noise or vibration.	Inspect mid PTO shafts, gears and bearings.
Observe mid PTO output shaft when disengaging the mid PTO.	Shaft stops within 3 seconds.	Inspect mid PTO brake adjustment or brake pack.

NOTE: From this point on you will be driving the tractor. Operate in an open level area and turn sharply from left to right periodically to observe any change in noise as you turn.

8. Place transmission in 2nd gear and two speed in high. Operate tractor.	Tractor moves smoothly going straight.	Inspect high range gear mesh or differential.
9. Place transmission in 4th gear and two speed in low. Operate tractor.	Tractor moves smoothly going straight.	Inspect low range gear mesh or differential.
	No change when making turns.	Inspect final drive and differential bevel pinions.
10. Leave transmission in 4th Lo gear and engage differential lock while operating at low engine rpm. Turn from left to right.	•Tractor resists turning •Differential lock stays engaged •No noise	Inspect different lock and linkage.

ISOLATE THE PROBLEM (SINGLE STAGE CLUTCH)



ISOLATE THE PROBLEM AREA (DUAL STAGE CLUTCH)

TEST CONDITIONS:

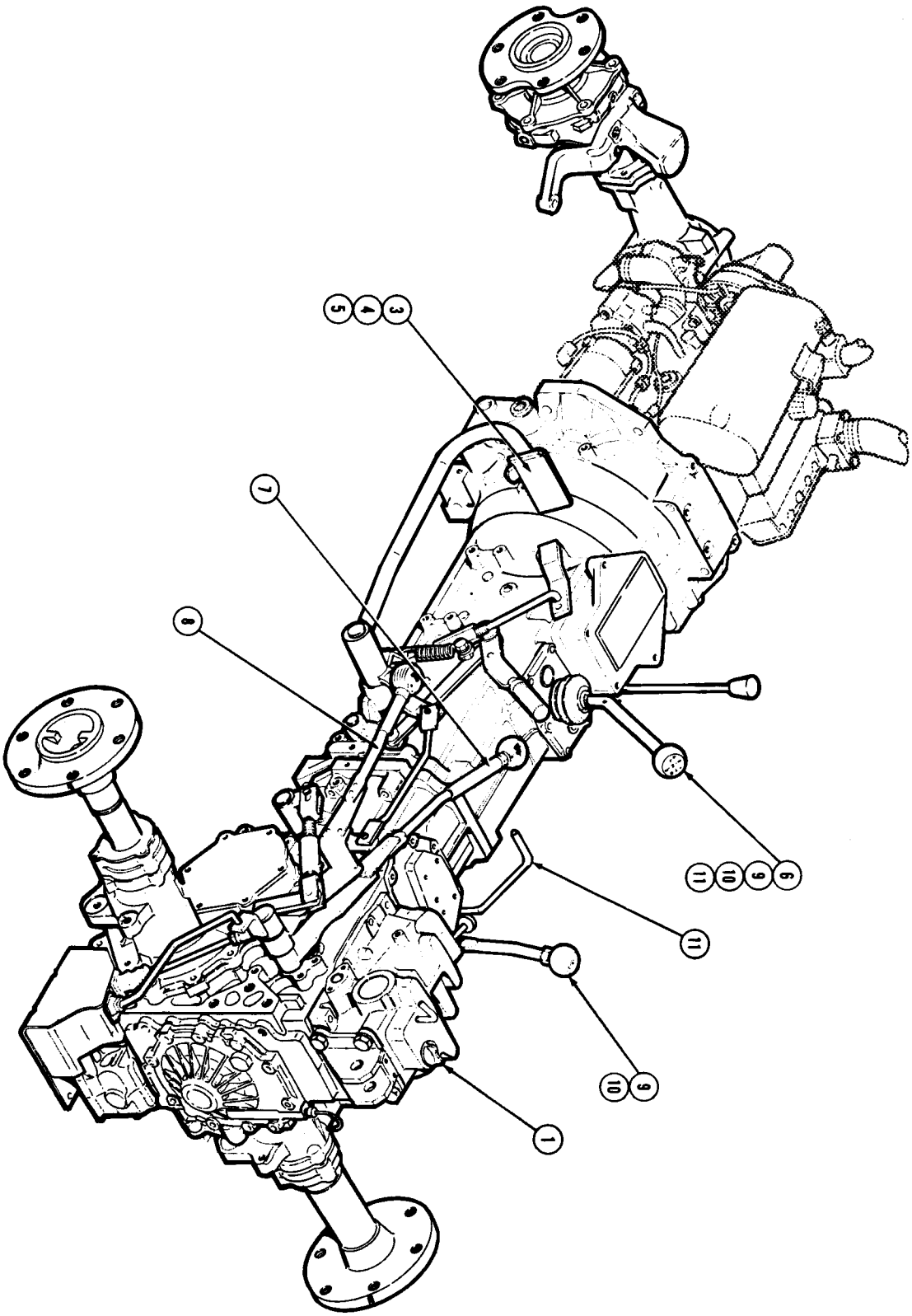
•Before starting, inspect the entire tractor for oil leakage. Locate the source of leakage, determine the cause and make the necessary repairs.

•During the tests you will be looking for abnormal noises. A mechanics stethoscope may be helpful.

•Begin the test procedure with the speed selector and two speed in neutral, MFWD disengaged and both PTO off.

Test Check Point	Normal	If Not Normal
1. Check Transmission Oil.	Level not too low.	Check for leakage and refill.
	Level not too high.	Drain oil to proper level.
	Oil not contaminated with metal fragments or debris.	Drain oil replace filter. Clean screen and determine cause of contamination.
	Oil not foamy or discolored.	Make sure type of oil is correct. Check hydraulic system for cause of over heating.
2. Check all linkage operation and return it to neutral.	No damage or binding.	Repair linkage.
3. Run engine with clutch disengaged.	No damage or vibration.	Inspect engine.
4. Partially engage clutch and vary engine rpm.	No noise or vibration.	Inspect clutch. Inspect PTO drive shaft, bearings and drive gears.
5. Fully engage clutch and vary engine rpm.	No noise or vibration.	Inspect clutch. Inspect traction drive shaft.
6. Place speed selector in each forward gear and reverse. Leave two speed in neutral. Engaged clutch and vary engine rpm in each gear.	No noise or vibration.	Inspect gear mesh for speed selected when noise or vibration occurred. Inspect differential drive shaft, gears and bearing if noise occurred in all speeds. Inspect reverse idle shaft and bearing if problem changes in reverse.
7. Place transmission in neutral and engage rear PTO. Engage clutch and vary engine rpm.	No noise or vibration.	Inspect rear PTO shaft, gears and bearings.

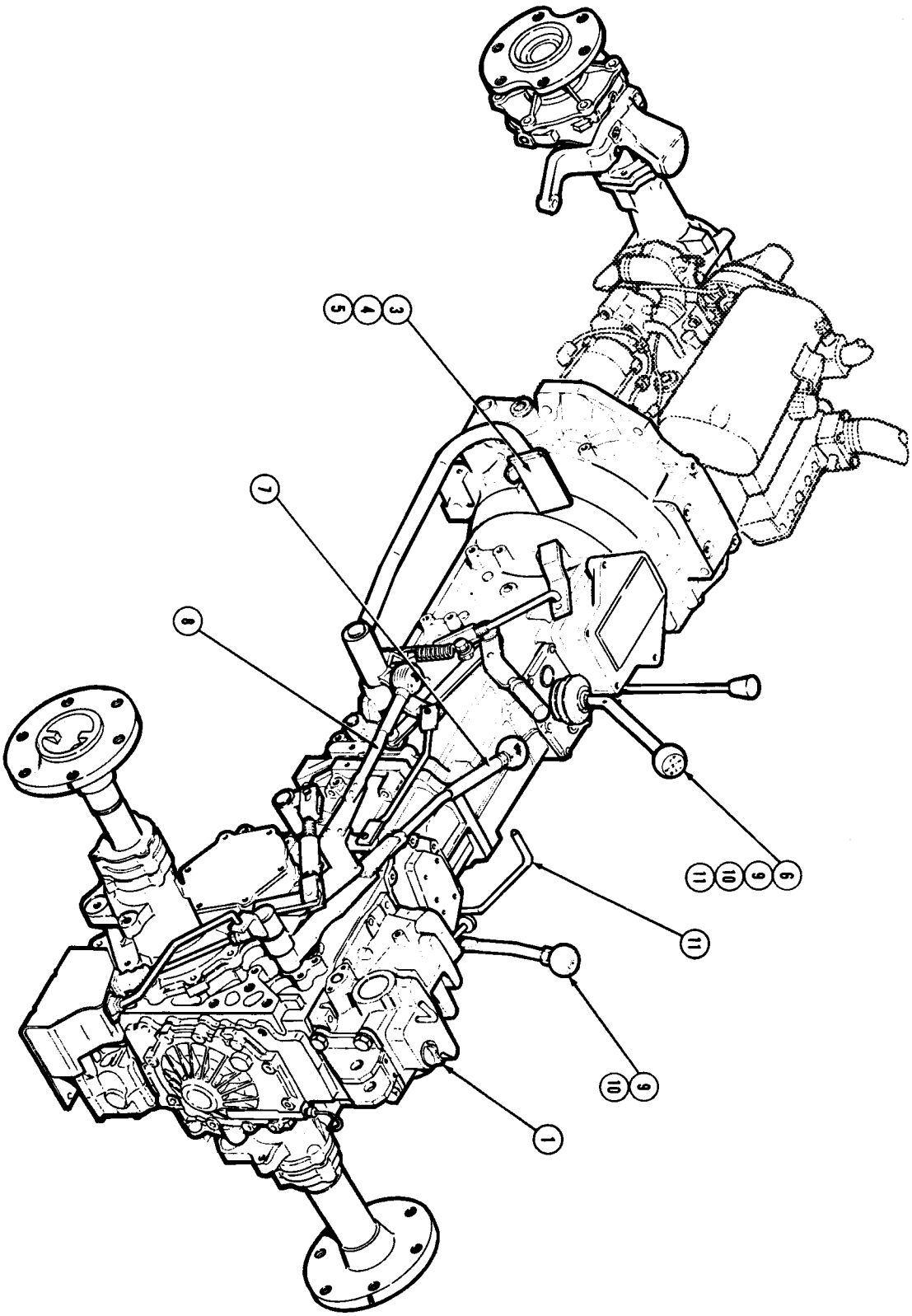
ISOLATE THE PROBLEM (DUAL STAGE CLUTCH)



ISOLATE THE PROBLEM AREA (DUAL STAGE CLUTCH)—CONTINUED

Test Check Point	Normal	If Not Normal
8. Engage mid PTO (if equipped). Transmission in neutral and rear PTO off. Engage clutch and vary engine rpm.	PTO shaft turns no noise or vibration.	Inspect mid PTO shafts, gears and bearings.
NOTE: From this point on you will be driving the tractor. Operate in an open level area and turn sharply from left to right periodically to observe any change in noise as you turn.		
9. Place transmission in 2nd gear and two speed in high. Operate tractor.	Tractor moves smoothly going straight.	Inspect high range gear mesh or differential.
	No change when making turns.	Inspect differential.
10. Place transmission in 4th gear and two speed in low. Operate tractor.	Tractor moves smoothly going straight.	Inspect low range gear mesh or differential.
	No change when making turns.	Inspect final drive and differential bevel gears.
11. Leave transmission in 4th Lo gear and engage differential lock while operating at low engine rpm. Turn from left to right.	•Tractor resists turning. •Differential lock stays engaged. •No noise.	Inspect different lock and linkage.

ISOLATE THE PROBLEM (DUAL STAGE CLUTCH)



ADJUST MID PTO LINKAGE

A—Control Lever
B—Adjusting Nut
C—Engagement Spring
D—Ball Joint
E—Brake Rod
F—Adjusting Nut
G—Spring Capsule
H—Clutch Link
I—Brake Link
J—Clutch Pedal

ENGAGEMENT SPRING (C)

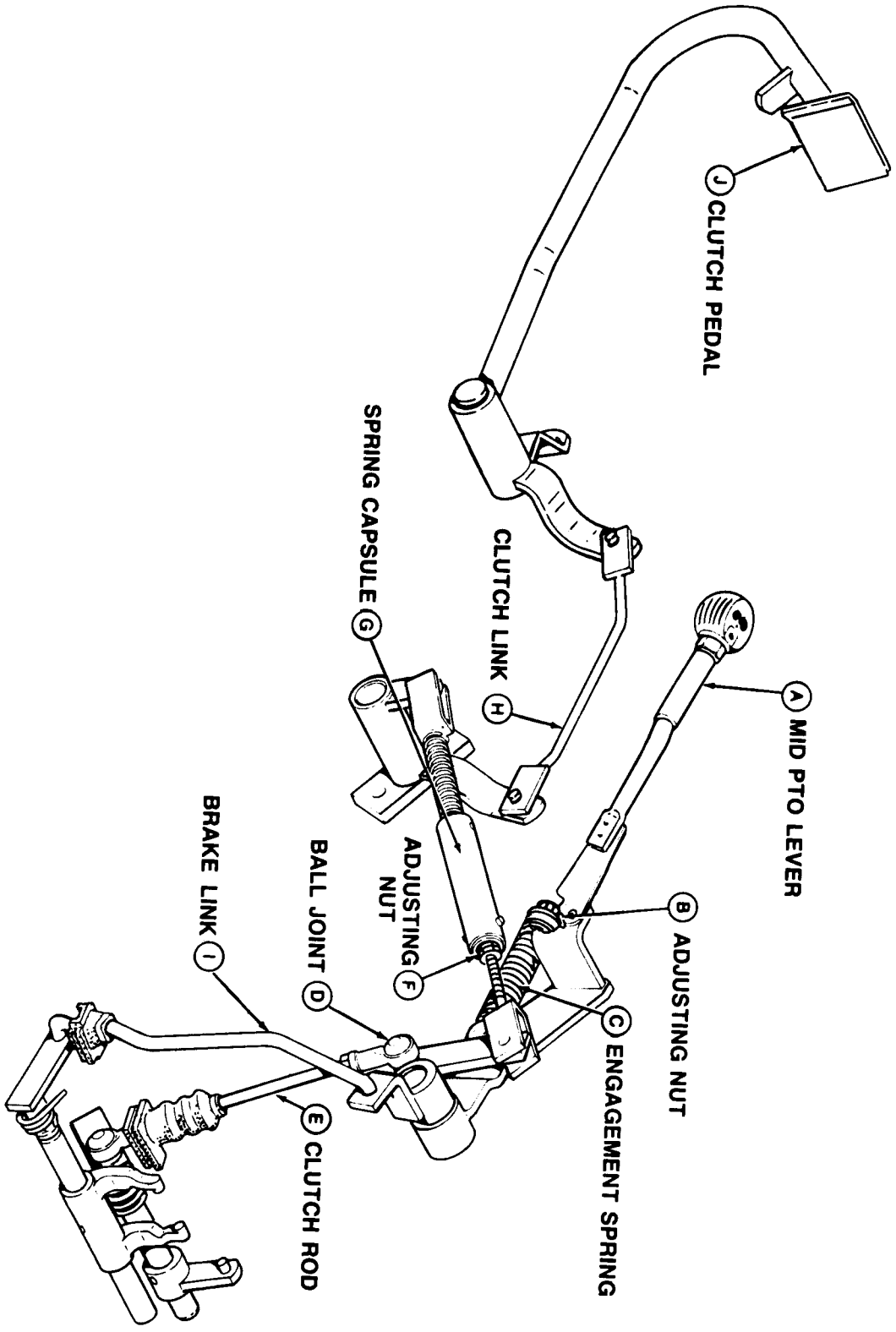
Use adjusting nut (B) to adjust engagement spring (C) to a length of 59 mm (2-3/8 in.) with the lever (A) in the off position.

CLUTCH ROD (E)

Use ball joints (D) to adjust clutch rod (E). Clutch rod is the correct length if the control lever (A) does not contact the top of the slot when engaged or bottom of the slot when disengaged.

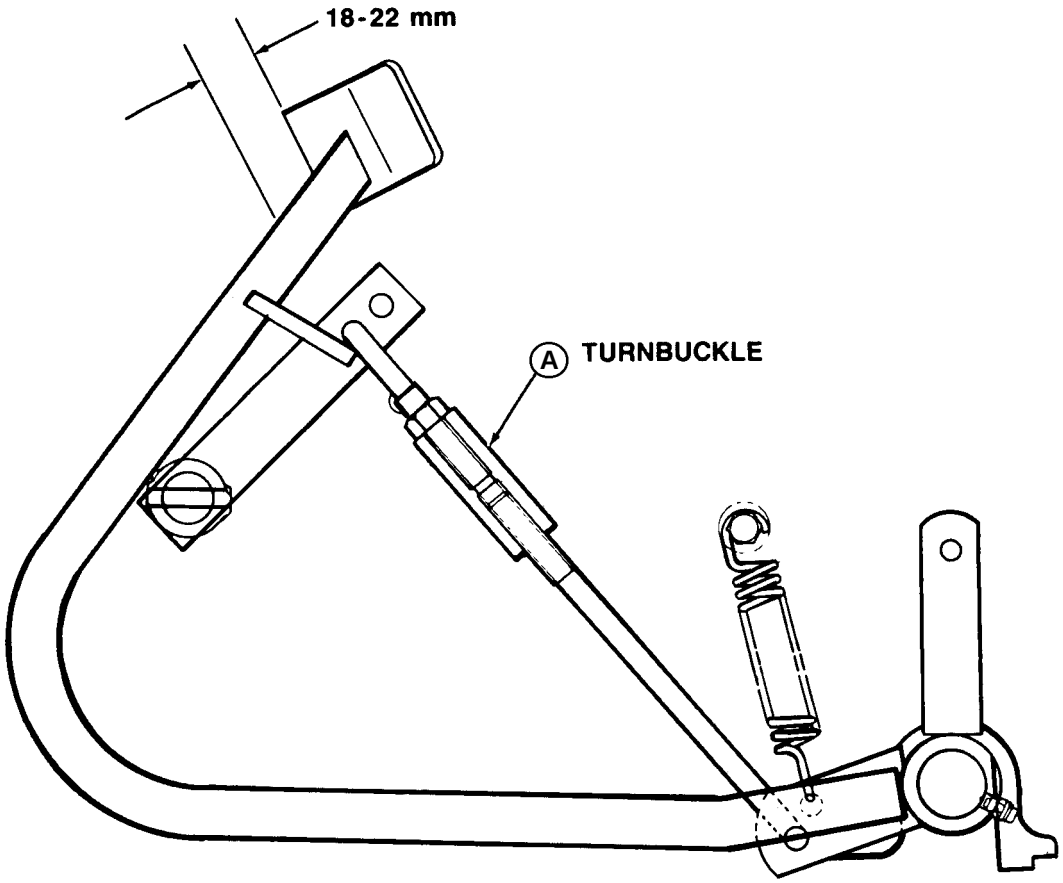
SPRING CAPSULE (G)

Use adjusting nut (F) to adjust spring capsule (G) to the length required to fit between clutch link (H) and brake link (I) when the control lever is engaged and clutch pedal (J) is engaged.



MID PTO LINKAGE ADJUSTMENT

ADJUST CLUTCH PEDAL FREE TRAVEL



CLUTCH PEDAL FREEPLAY ADJUSTMENT

REASON FOR ADJUSTMENT

To make sure that the traction clutch is fully engaged when the pedal is released and fully disengaged when the pedal is depressed.

ADJUSTMENT PROCEDURE

1. Depress the clutch pedal by hand to feel how far the pedal travels before resistance is felt. The amount of travel should be 18 to 22 mm (3/4—7/8 in.).

2. If free travel is too much or to little, adjust the turnbuckle (A) to correct it.

Section 255
POWER TRAIN 870/970/1070

Contents

Page

Group 05—Power Train Component Location—870/970/1070

About the Train 255-05-1
Power Train Component Location 255-05-2
Clutch Component Location 255-05-4
Collar Shift Transmission Component Location 255-05-6
Synchronized Transmission Component Location 255-05-8
Synchronizer Component Location 255-05-10
Speed Selector Linkage Component Locations 255-05-11
Range Selector Linkage Component Location 255-05-12
Final Drive Component Location 255-05-14
Mechanical Front Wheel Drive Component Location (870) 255-05-16
Mechanical Front Wheel Drive Component Location (970-1070) 255-05-18
Rear PTO Component Location 255-05-20
Mid PTO Component Location 255-05-21
Mid PTO Linkage Component Location . 255-05-22

Group 10—Power Train Theory of Operation—870/970/1070

About This Group 255-10-1
Dual Stage Clutch Engaged 255-10-2
Dual Stage Clutch Transmission Disengaged PTO Engaged 255-10-4
Dual Stage Clutch Transmission and PTO Disengaged 255-10-6
Clutch Ventilation and Drainage 255-10-8
Collar Shift Transmission Power Flow . . . 255-10-9
Synchronized Transmission Power Flow . 255-10-10
Range Selection Power Flow 255-10-11
Synchronizer Operation 255-10-12
Differential Power Flow 255-10-15
Differential Lock Operation 255-10-16
Final Drive 255-10-18
Mechanical Front Wheel Drive Power Flow 255-10-20
Rear PTO Operation 255-10-22
Mid PTO Operation 255-10-24

Page

Mid PTo Linkage Operation—Lever Disengaged 255-10-26
Mid PTO Linkage Operation—Lever Engaged 255-10-27
Mid PTO Linkage Operation—Clutch Depressed 255-10-28

Group 15—Power Train Diagnosis and Test—870/970/1070

About this Group 255-15-1
Isolate the Problem Area 255-15-2
Adjusting Mid PTO Linkage 255-15-6
Adjust Clutch Pedal Free Travel 255-15-7
Adjust Range Selector 255-15-8

ABOUT THE POWER TRAIN

Standard transmission on the 870 and 970 tractors is a collar shift 3 speed transmission with a collar shift 3 speed range selection.

Optional on the 870 and 970 and standard on the 1070 is a synchronized 3 speed gear transmission with a collar shift 3 speed range selection.

A dual stage clutch provides continuous live PTO.

Mechanical front wheel drive is a factory option.

Rear 540 rpm PTO is standard and 2100 rpm Mid PTO is optional.

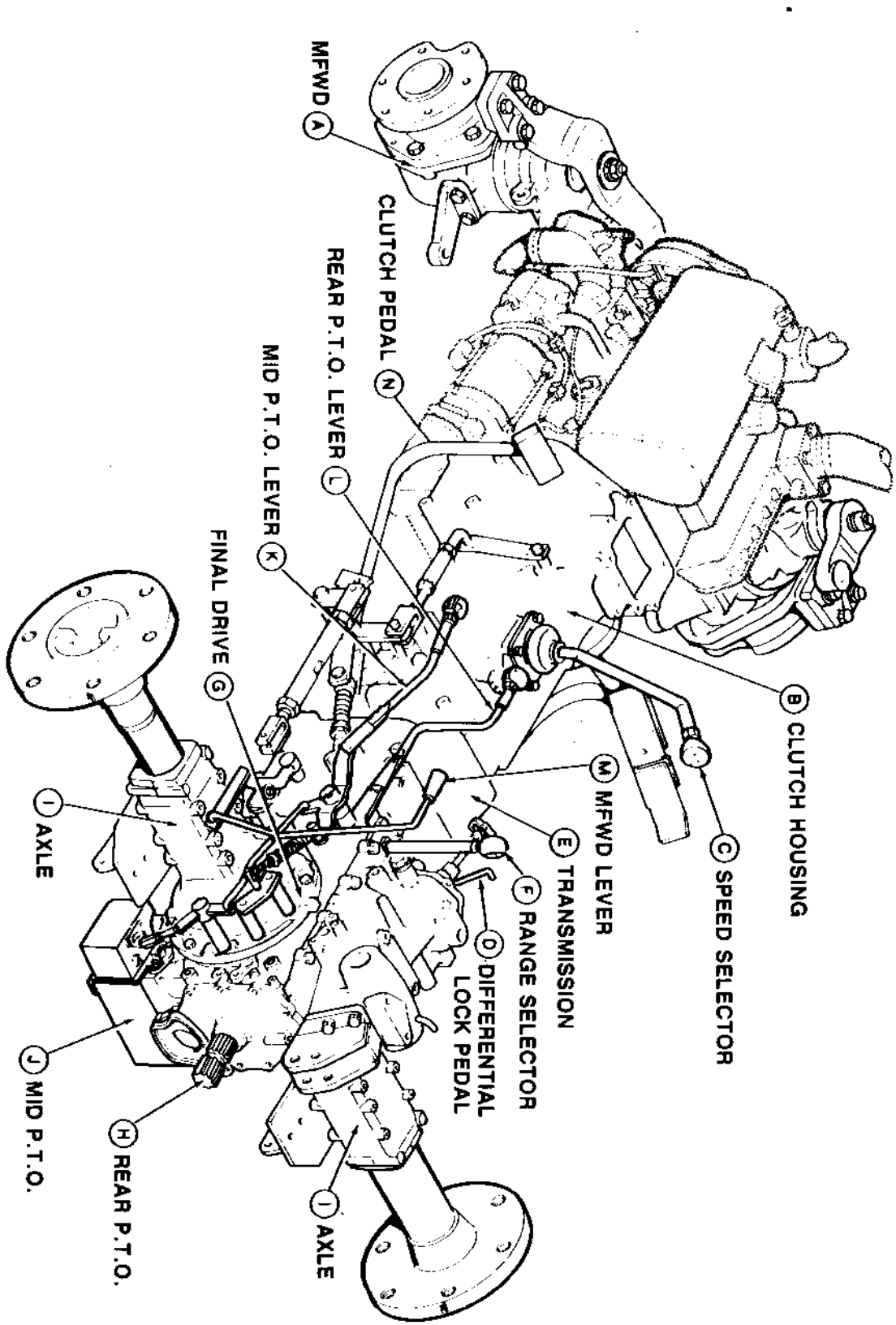
MX,25505DG,A1 -19-18OCT89

POWER TRAIN COMPONENT LOCATION

A—MFWD (Optional)
B—Clutch Housing
C—Speed Selector
D—Differential Lock Pedal
E—Transmission
F—Two Speed Range Selector
G—Final Drive
H—Rear PTO
I—Axle
J—Mid PTO (Optional)
K—Mid PTO Lever
L—Rear PTO Lever
M—MFWD Lever
N—Clutch Pedal

MX,25505DG,A2 -19-18OCT89

POWERTRAIN COMPONENT LOCATION



M48321 -19-09JAN90

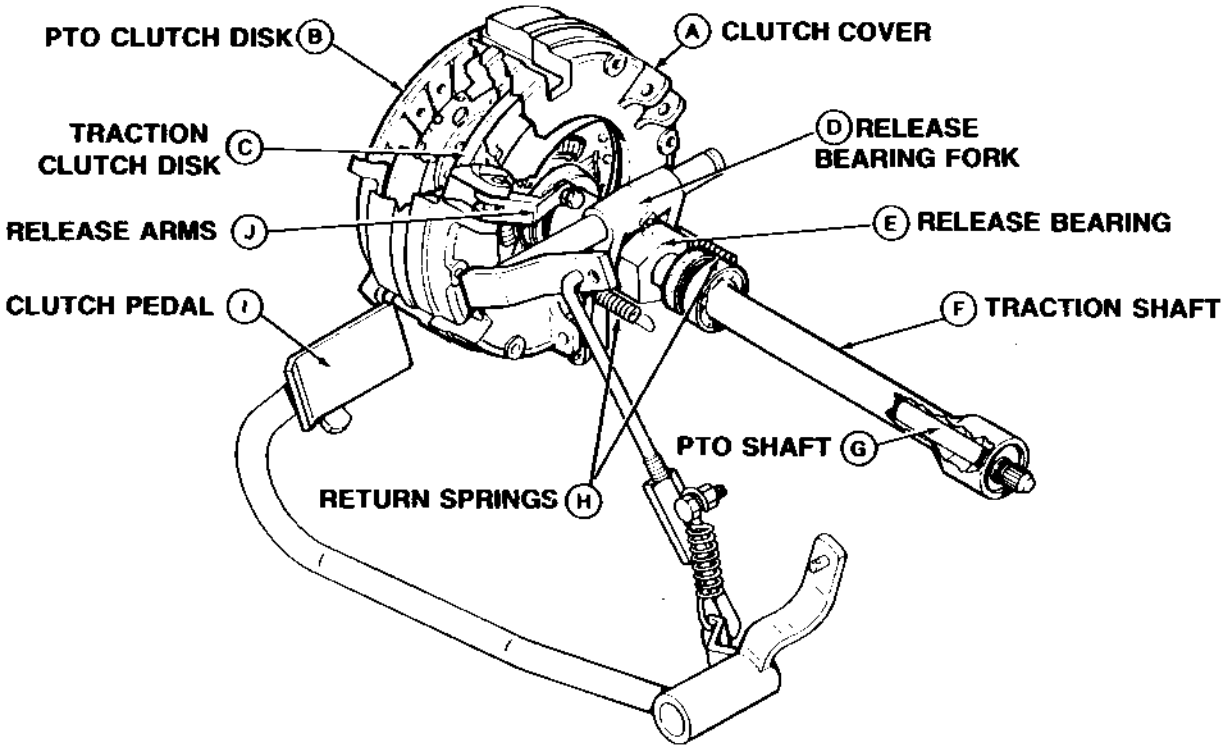
Slide No. 160

MX,25505DG,A3 -19-18OCT89

CLUTCH COMPONENT LOCATION

A—Clutch Housing
B—PTO Clutch Disks
C—Traction Clutch Disks
D—Release Bearing Fork
E—Release Bearing
F—Traction Shaft
G—PTO Shaft
H—Return Springs
I—Clutch Pedal
J—Release Arms

MX,25505DG,A4 -19-18OCT89



DUAL STAGE CLUTCH COMPONENTS

Slide No. 127

MX,25505DG,A4A -19-24OCT89

255 05 5

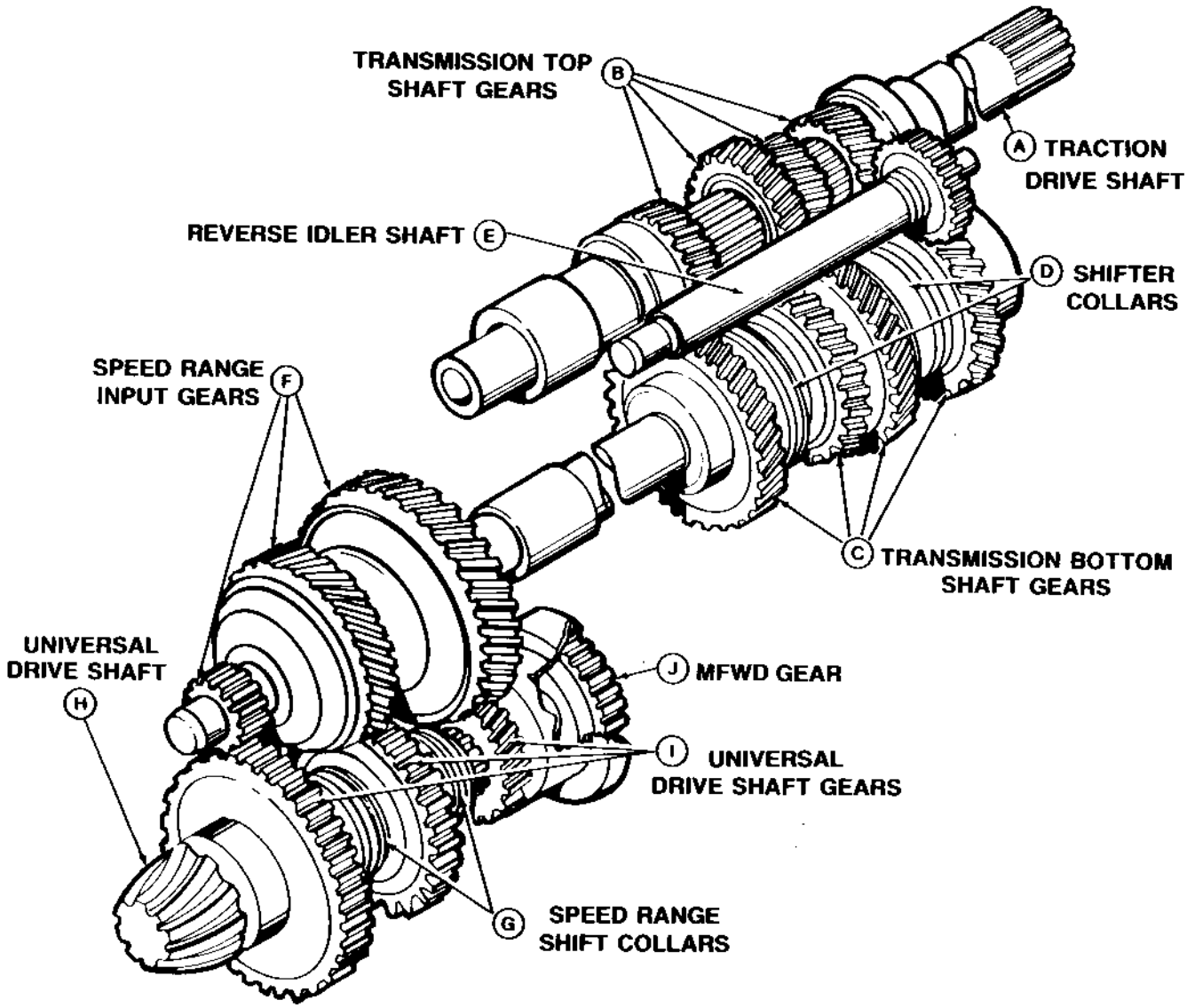
-19-09JAN90

M70928

COLLAR SHIFT TRANSMISSION COMPONENT LOCATION (SHOWN FROM RIGHT HAND SIDE)

A—Traction Drive Shaft
B—Transmission Top Shaft Gears
C—Transmission Bottom Shaft and Gears
D—Shifter Collars
E—Reverse Idler Shaft
F—Speed Range Input Gears
G—Speed Range Shift Collars
H—Universal Drive Shaft
I—Universal Drive Shaft Gears
J—MFWD Gear

MX,25505DG,A5 -19-18OCT89



COLLAR SHIFT TRANSMISSION COMPONENTS (SHOWN FROM R.H. SIDE)

M48323 -19-09JAN90

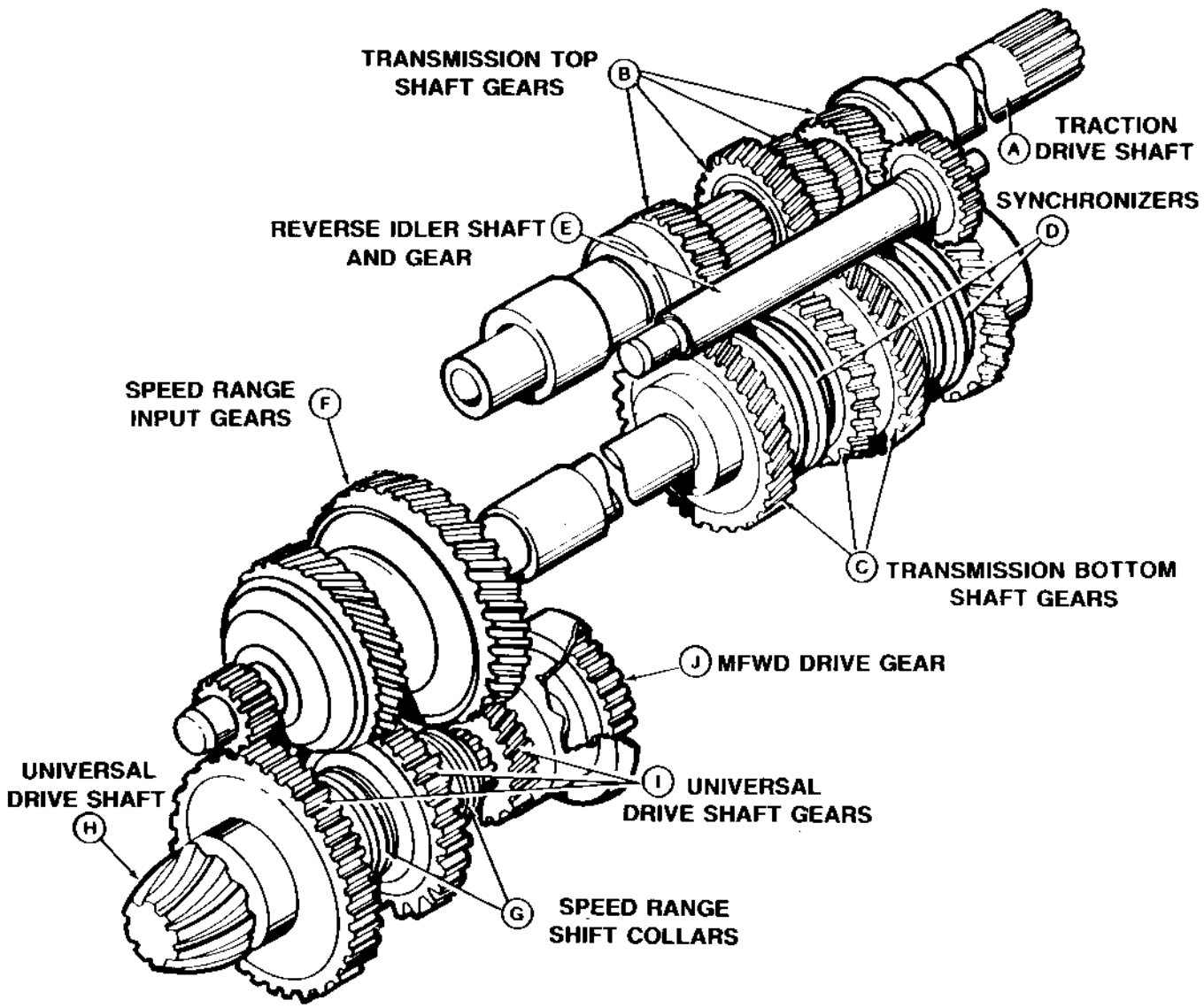
Slide No. 161

MX,25505DG,A19 -19-13DEC89

SYNCHRONIZED TRANSMISSION COMPONENT LOCATION (SHOWN FROM RIGHT HAND SIDE)

A—Traction Drive Shaft
B—Transmission Top Shaft Gears
C—Transmission Bottom Shaft Gears
D—Synchronizers
E—Reverse Idler Shaft and Gear
F—Speed Range Input Gears
G—Speed Range Shift Collars
H—Universal Drive Shaft
I—Universal Drive Shaft Gears
J—MFWD Drive Gear

MX,25505DG,A6 -19-18OCT89



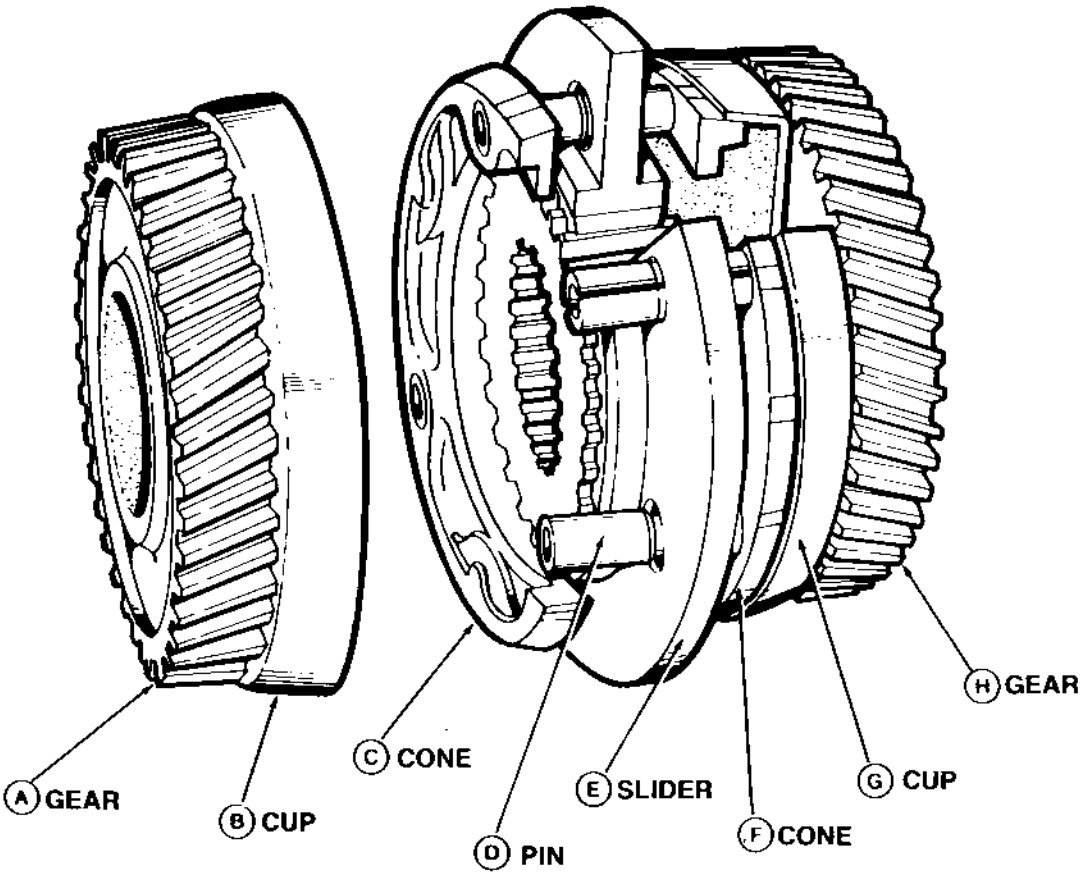
SYNCHRONIZED TRANSMISSION COMPONENT LOCATION (SHOWN FROM R.H. SIDE)

M48322 -19-22DEC89

Slide No. 162

MX,25505DG,A20 -19-13DEC89

SYNCHRONIZER COMPONENT LOCATION



M48324 -19-09JAN90

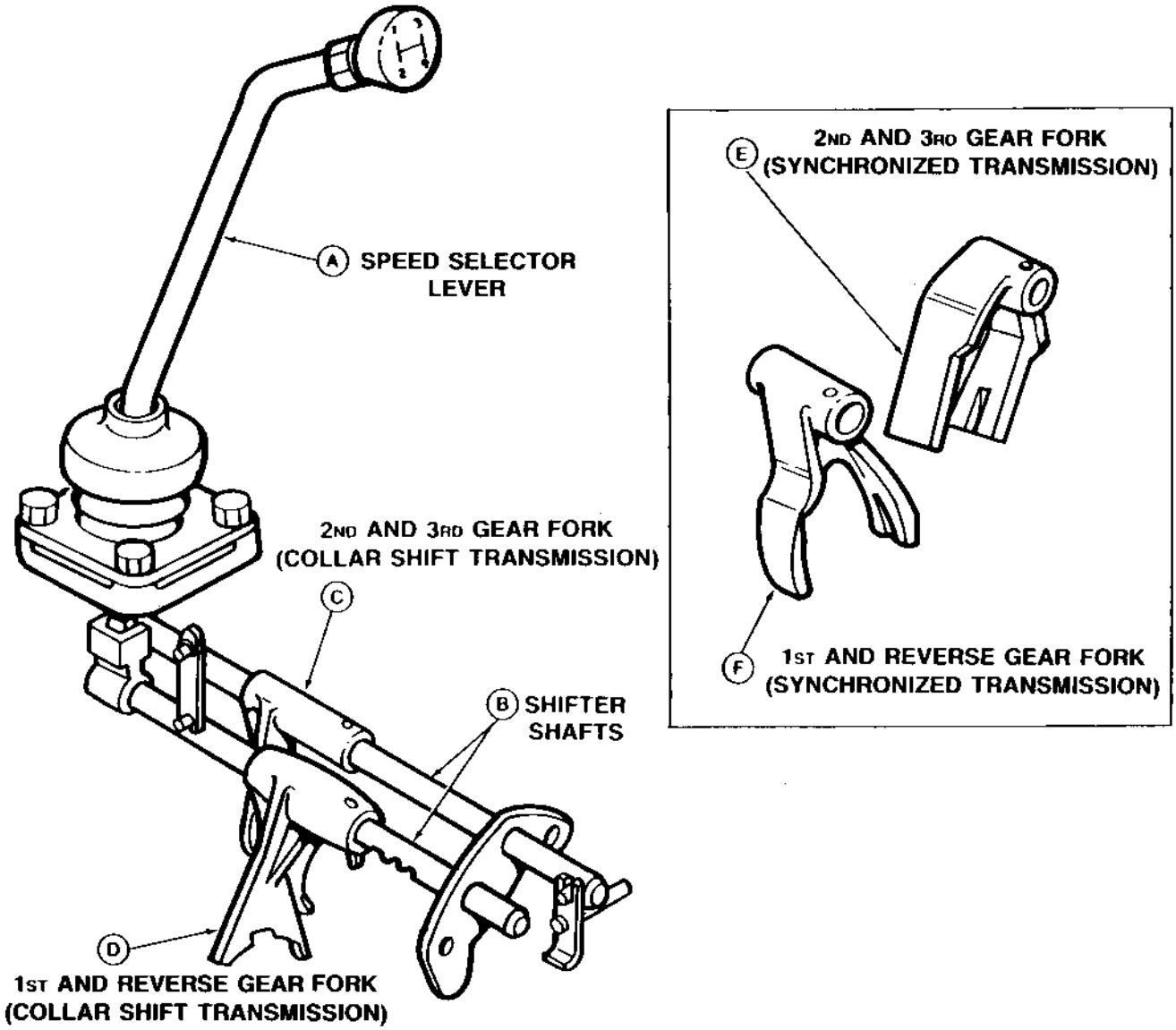
SYNCHRONIZER COMPONENT LOCATION

A—Gear	**C—Cone**	**E—Slider**	**G—Cup**
B—Cup	**D—Pin**	**F—Cone**	**H—Gear**

Slide No. 163

MX,25505DG,A7 -19-18OCT89

SPEED SELECTOR LINKAGE COMPONENT LOCATIONS



SPEED SELECTOR LINKAGE COMPONENTS LOCATIONS

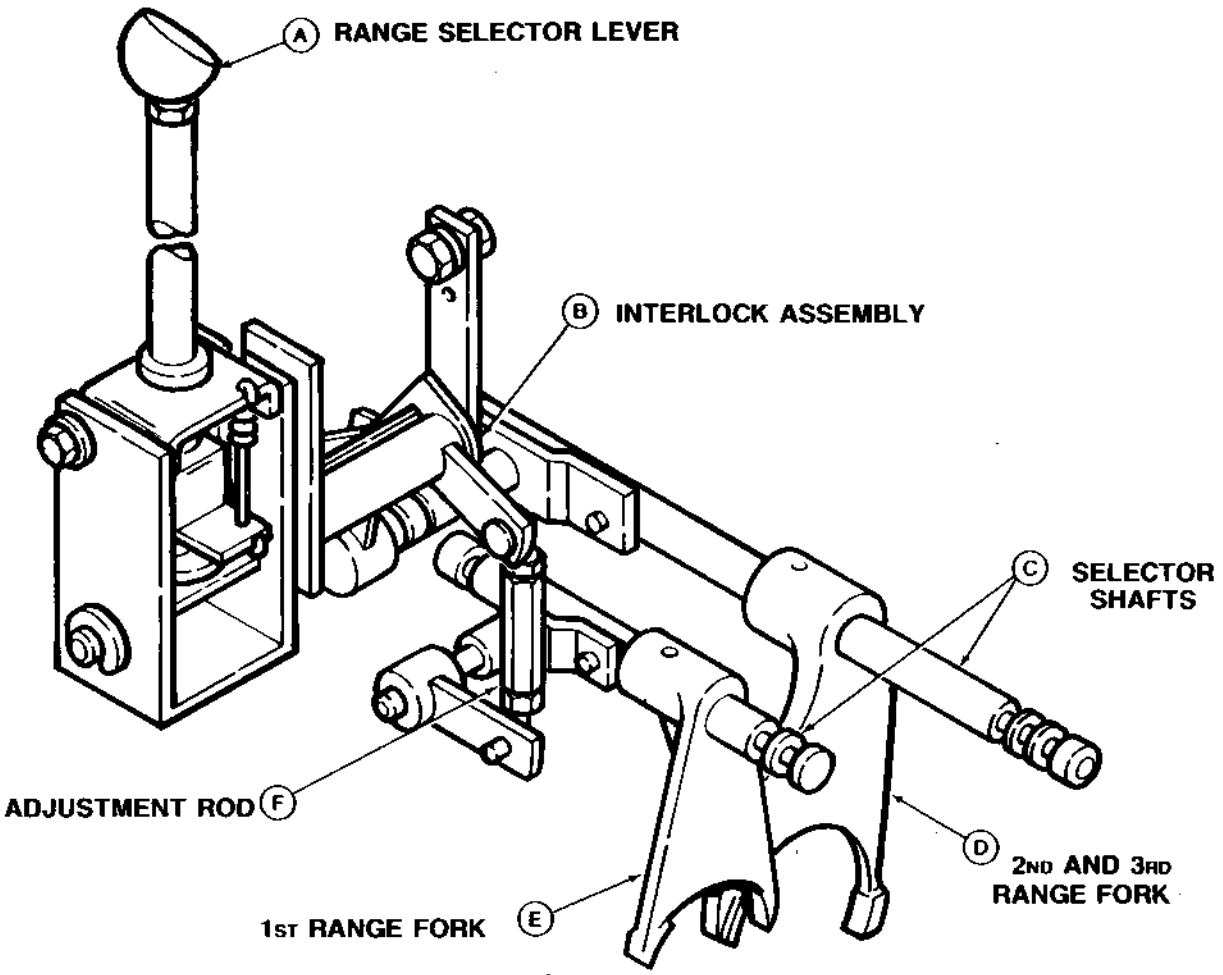
A—Speed Selector Lever
B—Shifter Shafts
C—2nd and 3rd Gear Fork (Collar Shift Transmission)
D—1st and Reverse Gear Fork (Collar Shift Transmission)
E—2nd and 3rd Gear Fork (Synchronized Transmission)
F—1st and Reverse Gear Fork (Synchronized Transmission)

Slide No. 164

M48325 -19-22DEC89

MX,25505DG,A8 -19-18OCT89

RANGE SELECTOR LINKAGE COMPONENT LOCATION



M48326 -19-09JAN90

RANGE SELECTOR LINKAGE COMPONENT LOCATION

A—Range Selector Lever
B—Interlock Assembly
C—Selector Shafts
D—2nd and 3rd Range Fork
E—1st Range Fork
F—Adjustment Rod

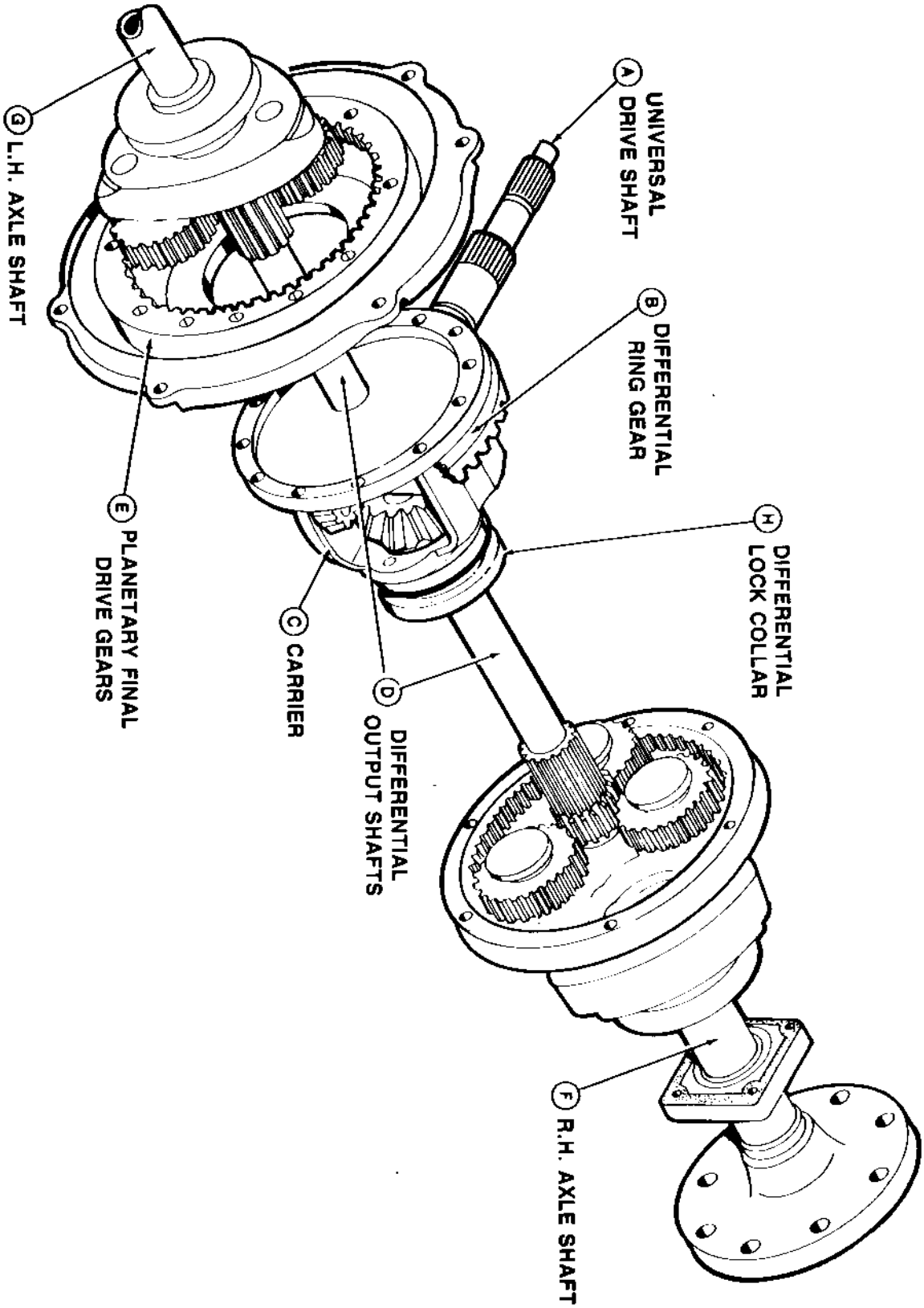
Slide No. 165

MX,25505DG,A9 -19-19OCT89

FINAL DRIVE COMPONENT LOCATION

A—Universal Drive Shaft
B—Differential Ring Gear
C—Carrier
D—Differential Output Shafts
E—Planetary Final Drive Gears
F—R.H. Axle Shaft
G—L.H. Axle Shaft
H—Differential Lock Collar

MX,25505DG,A10 -19-19OCT89



FINAL DRIVE COMPONENTS

M48327 -19-09JAN90

255 05 15

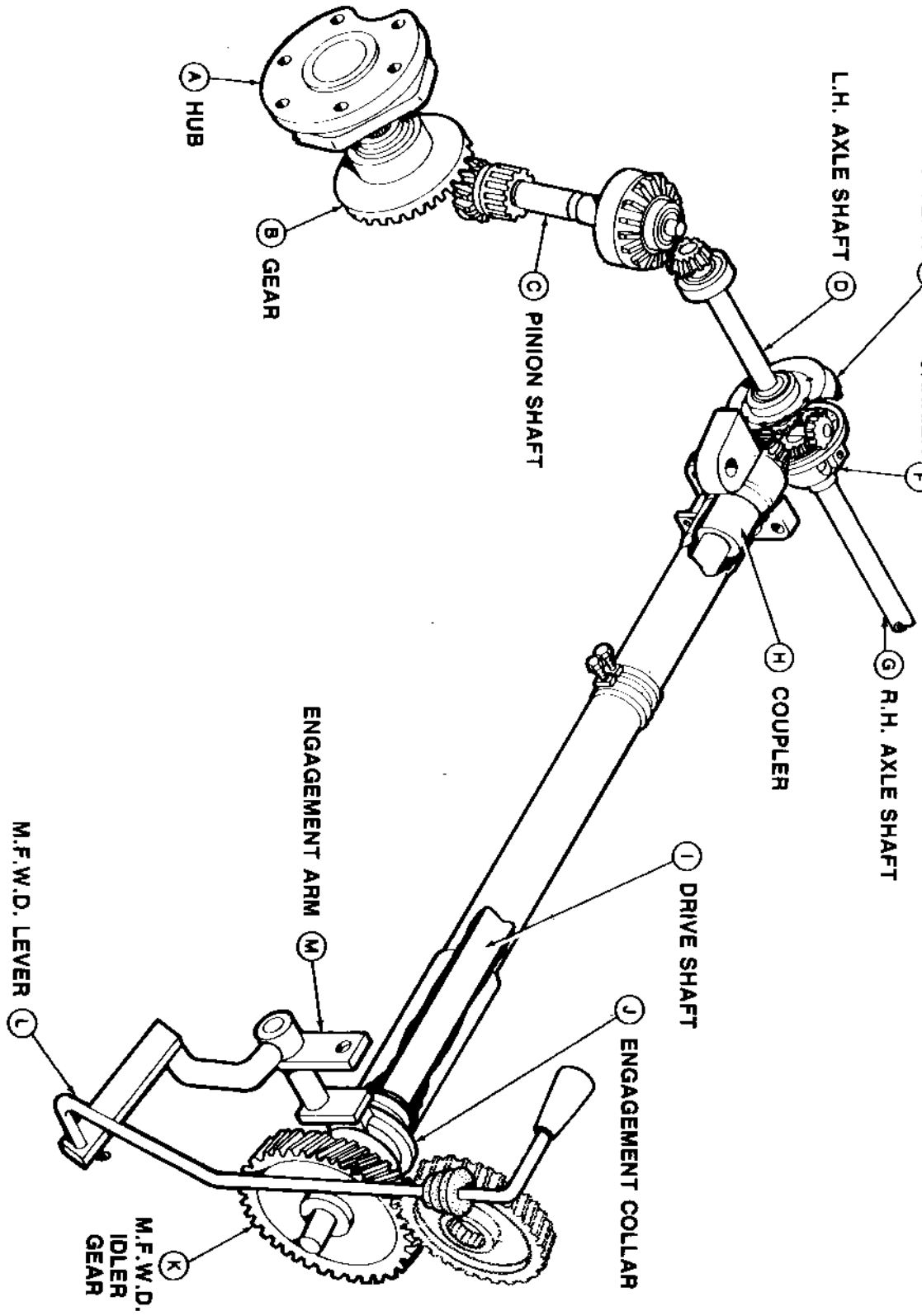
Slide No. 166

MX,25505DG,A11 -19-19OCT89

MECHANICAL FRONT WHEEL DRIVE COMPONENT LOCATION (870)

A—Hub
B—Gear
C—Shaft
D—L.H. Axle Shaft
E—Ring Gear
F—Differential Carrier
G—R.H. Axle Shaft
H—Coupler
I—Drive Shaft
J—Engagement Collar
K—MFWD Idler Gear
L—MFWD Lever
M—Engagement Arm

MX,25505DG,A12 -19-19OCT89



MECHANICAL FRONT WHEEL DRIVE COMPONENTS (870)

M48328 -19-09JAN90

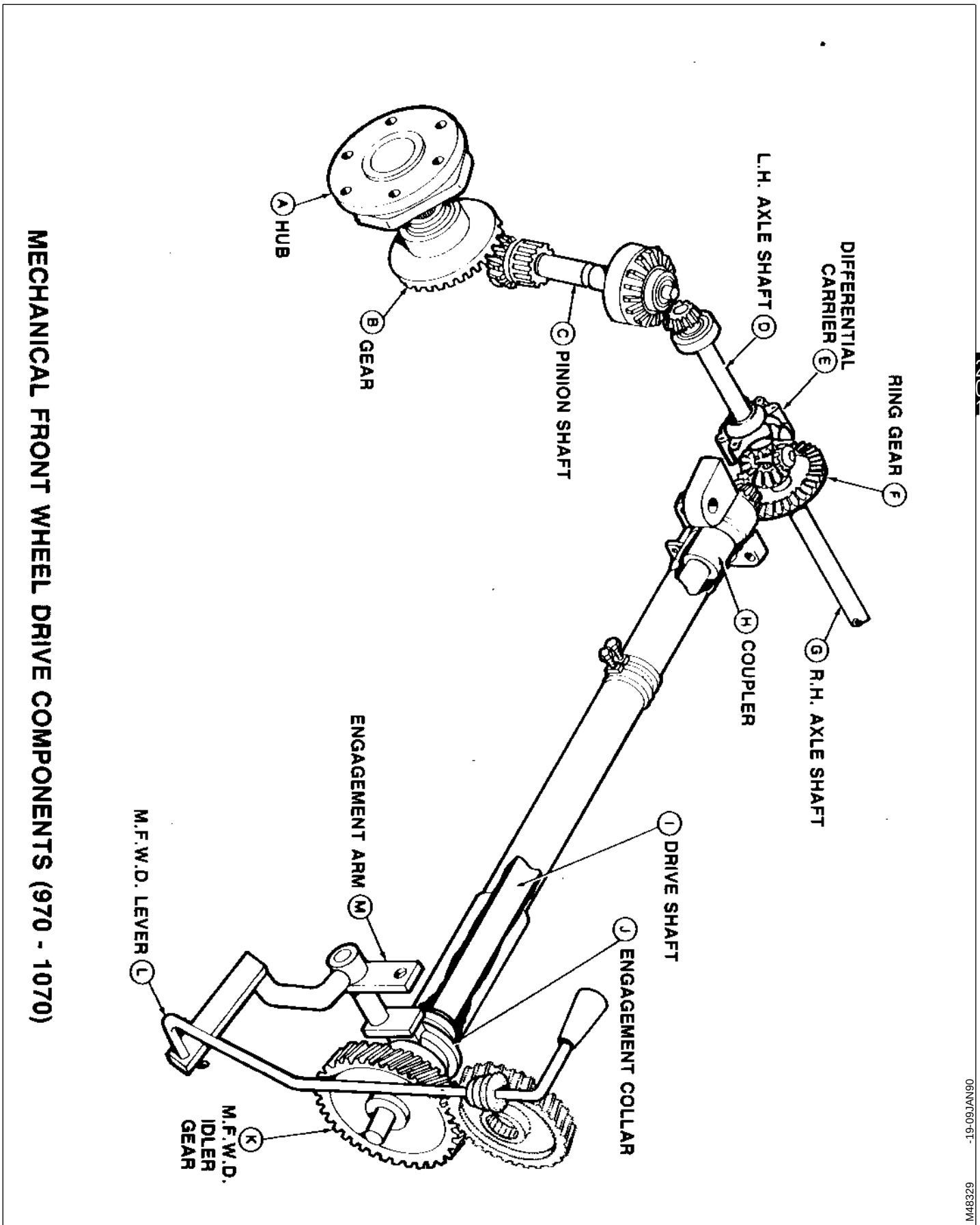
Slide No. 167

MX,25505DG,A13 -19-19OCT89

MECHANICAL FRONT WHEEL DRIVE COMPONENT LOCATION (970-1070)

A—Hub
B—Gear
C—Pinion Shaft
D—L.H. Axle Shaft
E—Differential Carrier
F—Ring Gear
G—R.H. Axle Shaft
H—Coupler
I—Drive Shaft
J—Engagement Collar
K—MFWD Idler Gear
L—MFWD Lever
M—Engagement Arm

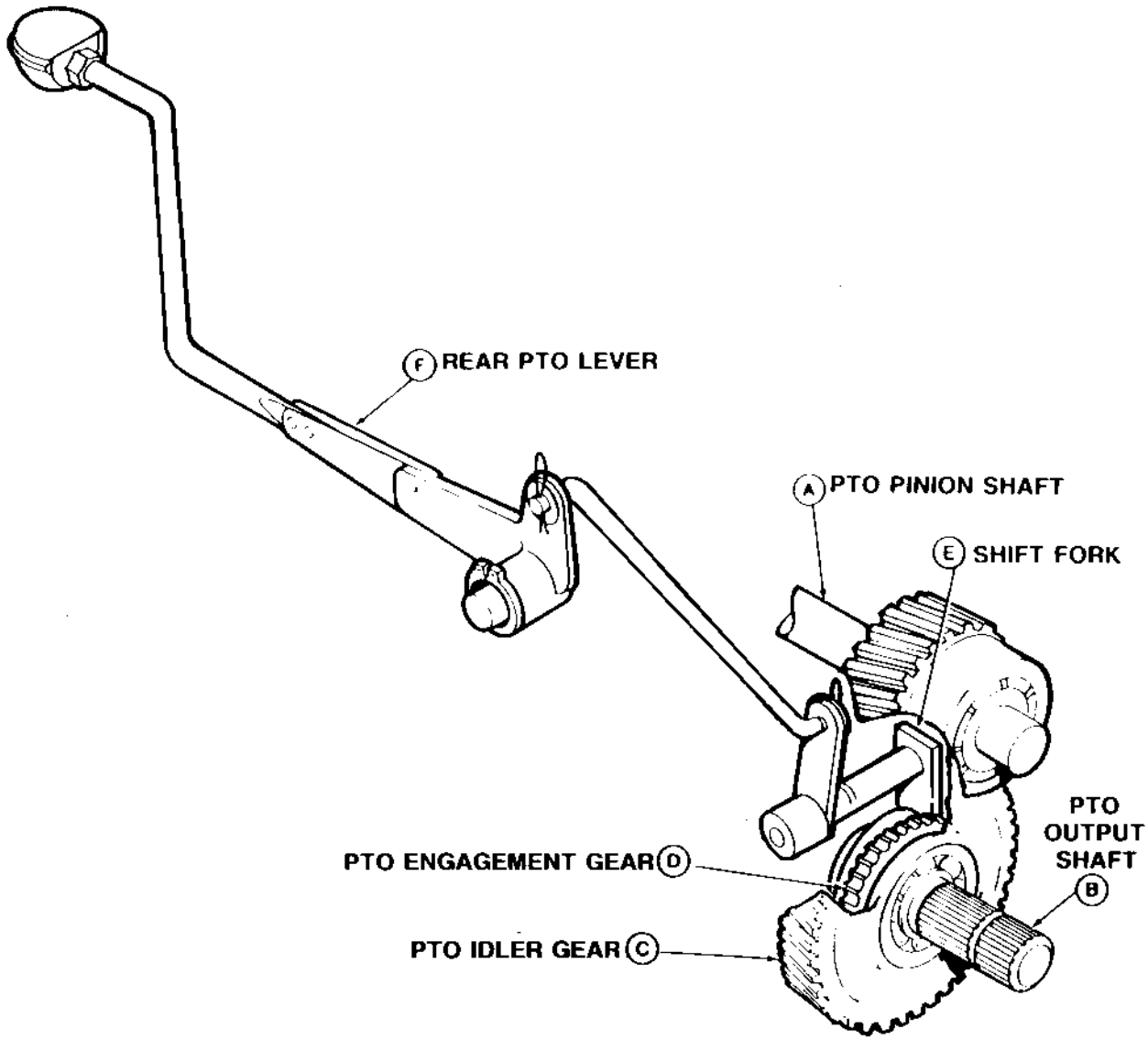
MX,25505DG,A14 -19-19OCT89



Slide No. 168

MX,25505DG,A15 -19-19OCT89

REAR PTO COMPONENT LOCATION



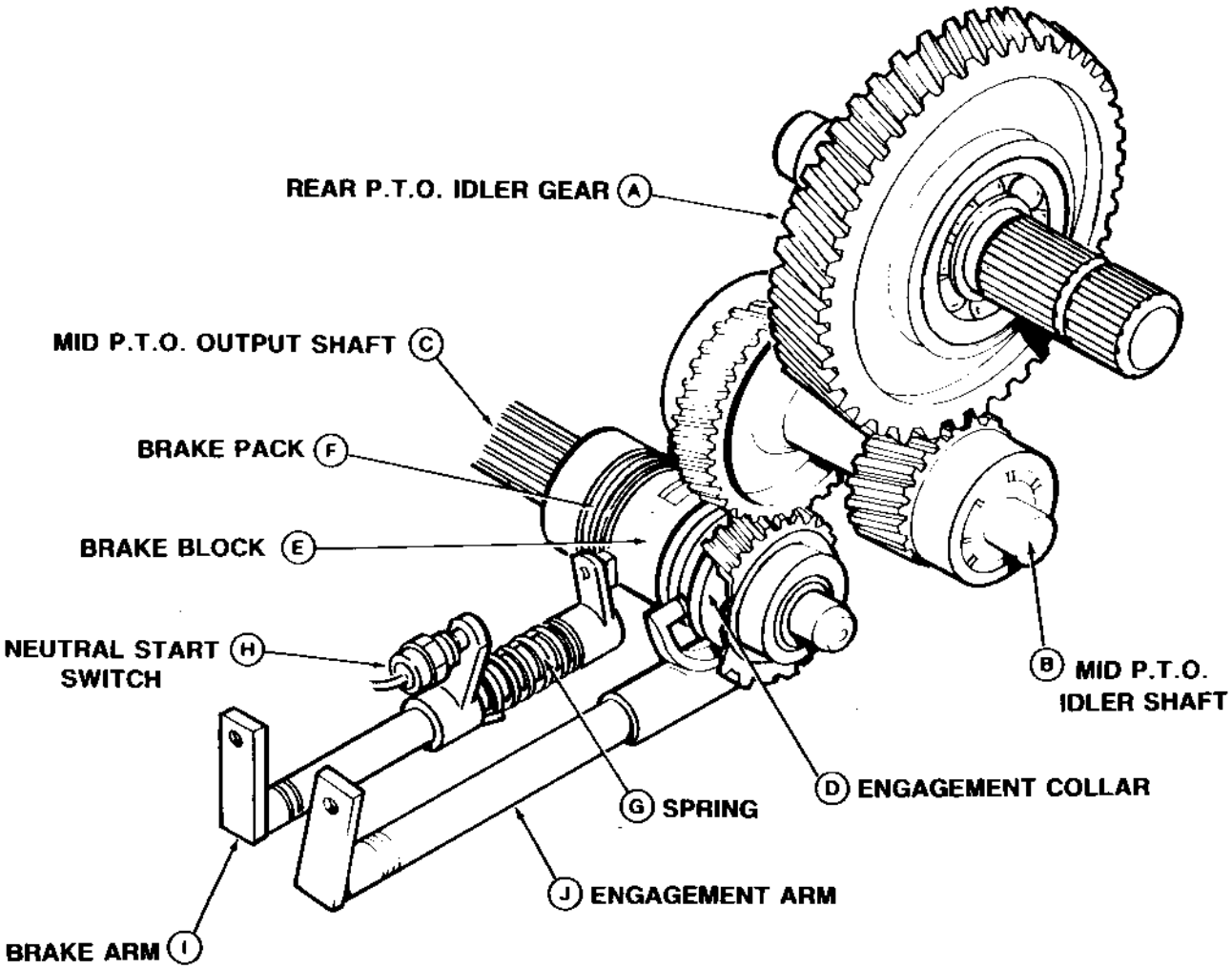
REAR PTO COMPONENT LOCATION

A—PTO Pinion Shaft
B—PTO Output Shaft
C—PTO Idler Gear
D—PTO Engagement Gear
E—Shift Fork
F—Rear PTO Lever

Slide No. 169

MX,25505DG,A16 -19-19OCT89

MID PTO COMPONENT LOCATION



MID PTO COMPONENT LOCATION

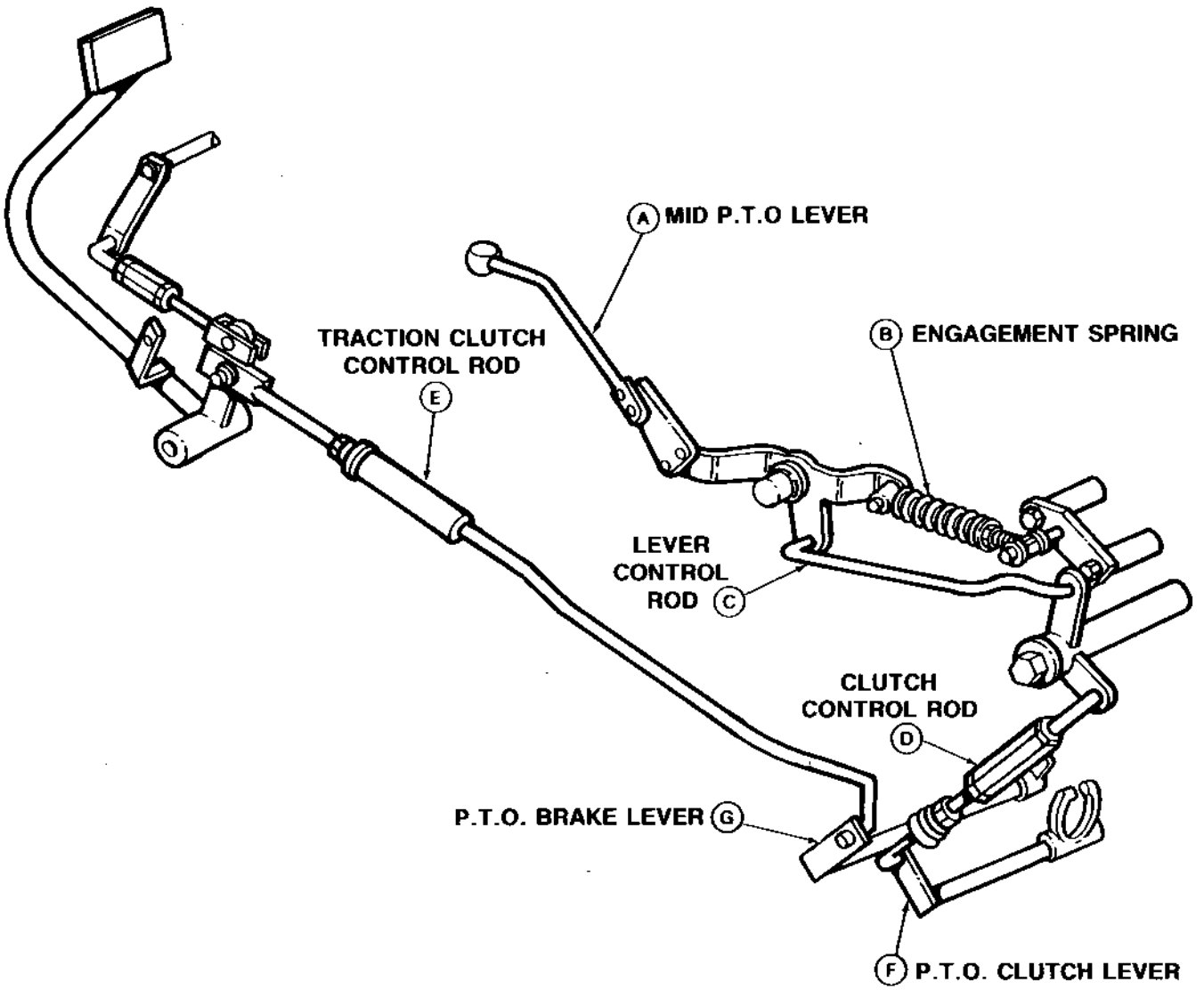
M48331 -19-09JAN90

A—Rear PTO Idler Gear
B—Mid PTO Idler Shaft
C—Mid PTO Output Shaft
D—Engagement Collar
E—Brake Block
F—Brake Pack
G—Spring
H—Neutral Start Switch
I—Brake Arm
J—Engagement Arm

Slide No. 170

MX,25505DG,A17 -19-19OCT89

MID PTO LINKAGE COMPONENT LOCATION



M48332 -19-09JAN90

MID PTO LINKAGE COMPONENT LOCATION

A—Mid PTO Lever
B—Engagement Spring
C—Lever Control Rod
D—Clutch Control Rod
E—Traction Clutch Control Rod
F—PTO Engagement Lever
G—PTO Brake Lever

Slide No. 171

MX,25505DG,A18 -19-19OCT89

ABOUT THIS GROUP

This group contains theory of operation for the power train components on the 870, 970, 1070 size compact utility tractors.

MX,25510DG,A1 -19-19OCT89

DUAL STAGE CLUTCH ENGAGED

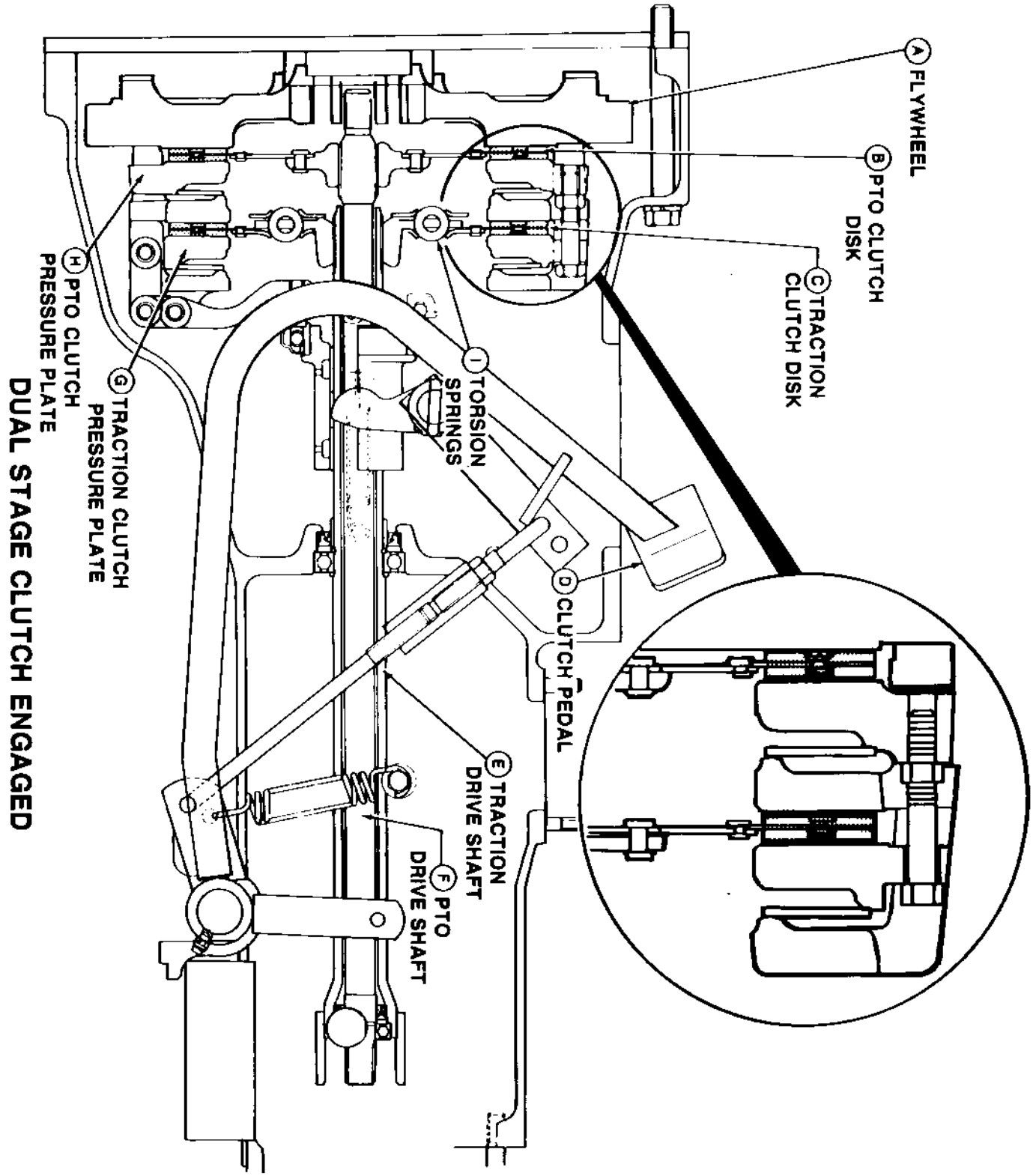
A—Flywheel
B—PTO Clutch Disks
C—Traction Clutch Disks
D—Clutch Pedal
E—Traction Drive Shaft
F—PTO Drive Shaft
G—Traction Clutch Pressure Plate
H—PTO Clutch Pressure Plate
I—Torsion Springs

The dual stage clutch has two clutch assemblies, the PTO clutch which is attached to the PTO drive shaft and the traction clutch which is attached to the traction drive shaft. In the engaged position the clutch pedal is released. The pressure plate is applying pressure against the clutch disks which forces them in contact with the flywheel.

Power flow is from the engine flywheel through the PTO clutch to the PTO drive shaft. The same is occurring from the engine flywheel through the traction clutch to the traction drive shaft. The traction clutch has torsion springs to dampen the disk facings during engagement.

255
10
2

MX,25510DG,A2 -19-19OCT89



DUAL STAGE CLUTCH ENGAGED

M70934 -19-22DEC89

255 10 3

Slide No. 141

MX,25510DG,A3 -19-19OCT89

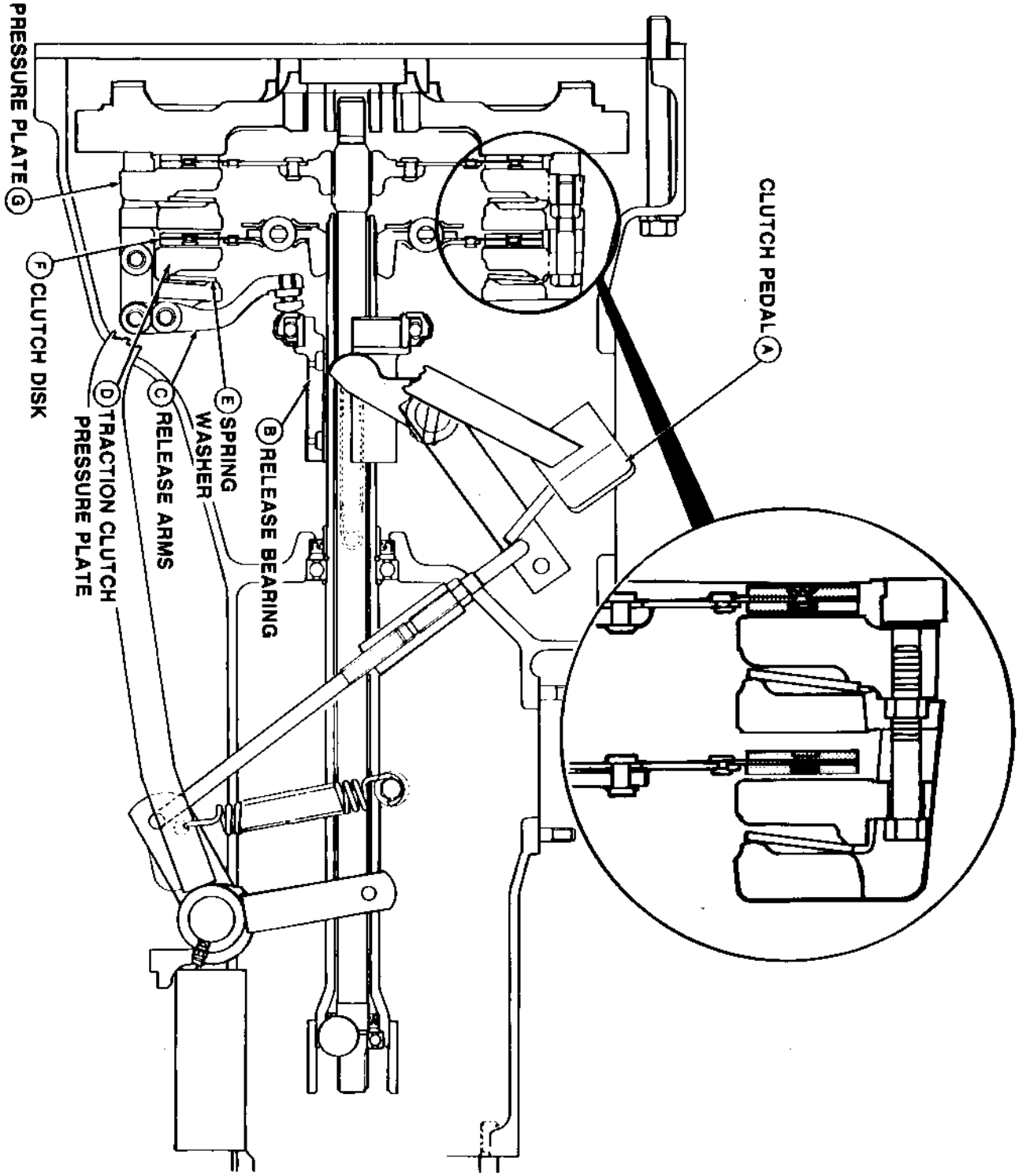
DUAL STAGE CLUTCH TRANSMISSION DISENGAGED PTO ENGAGED

A—Clutch Pedal
B—Release Bearing
C—Operating Fingers
D—Traction Clutch Pressure Plate
E—Spring Washer
F—Clutch Disk
G—PTO Pressure Plate

When the clutch pedal is partially depressed the transmission is disengaged. The pedal linkage forces the release bearing against three operating fingers and pivots them forward. The fingers act as levers to force the traction clutch pressure plate rearward and compress the spring washers. This releases the clamping action of the spring washers which was holding the clutch disk against back surface of the PTO pressure plate.

MX,25510DG,A4 -19-19OCT89

255
10
4



DUAL STAGE CLUTCH TRANSMISSION DISENGAGED/PTO ENGAGED

M70948 -19-09JAN90

Slide No. 142

MX,25510DG,A5 -19-19OCT89

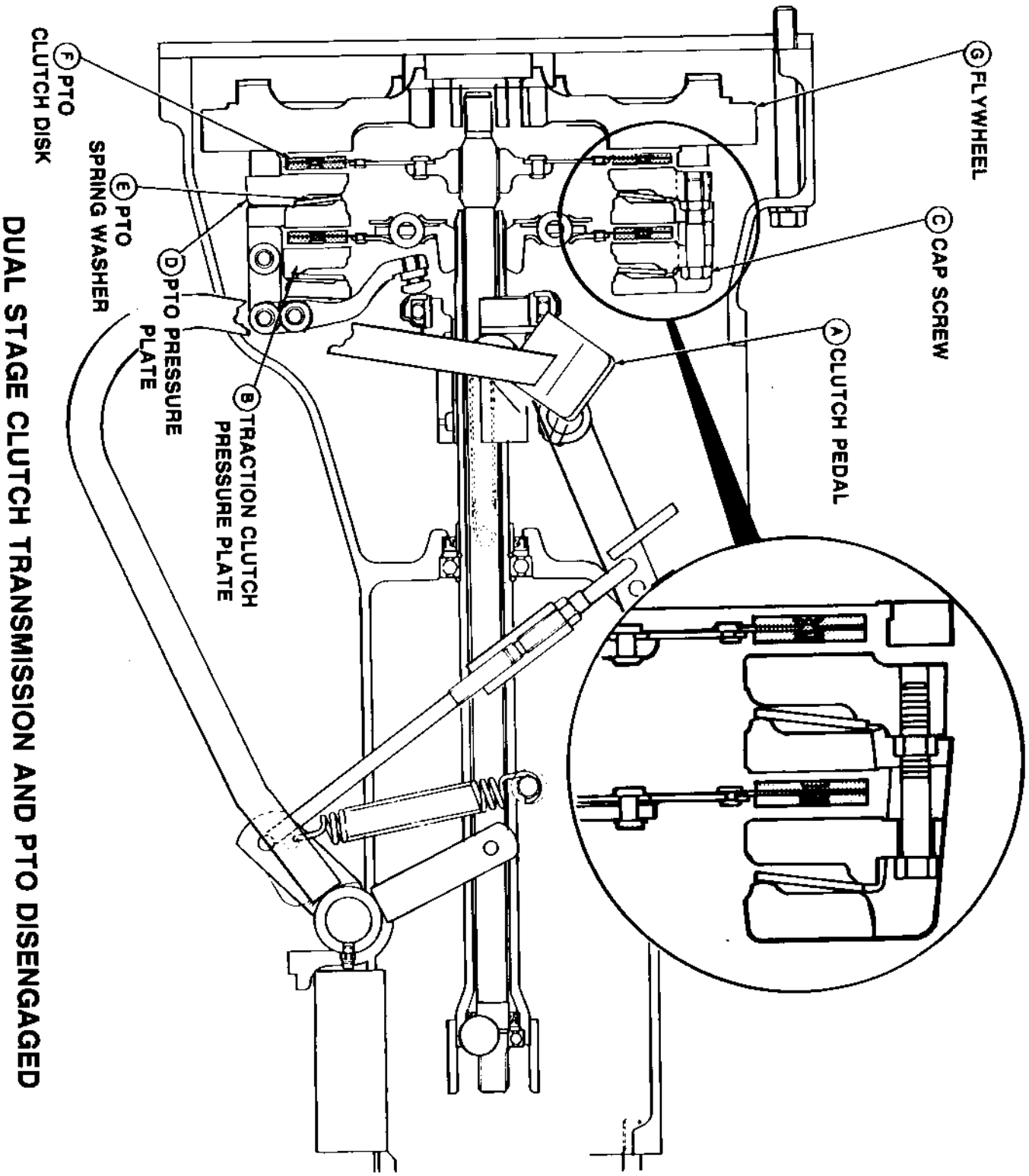
DUAL STAGE CLUTCH TRANSMISSION AND PTO DISENGAGED

A—Clutch Pedal
B—Traction Clutch Pressure Plate
C—Cap Screw
D—PTO Pressure Plate
E—PTO Spring Washer
F—PTO Clutch Disk
G—Flywheel

When the clutch pedal is fully depressed the transmission and PTO are disengaged. The traction clutch is disengaged as described on the previous page. Continuing to depress the pedal moves the traction clutch pressure plate rearward farther. When it contacts the cap screw connected to the PTO clutch pressure plate it pulls the cap screw and PTO clutch pressure plate back. This compresses the PTO spring washer which wash holding the PTO clutch disk against the flywheel.

MX,25510DG,A6 -19-19OCT89

255
10
6

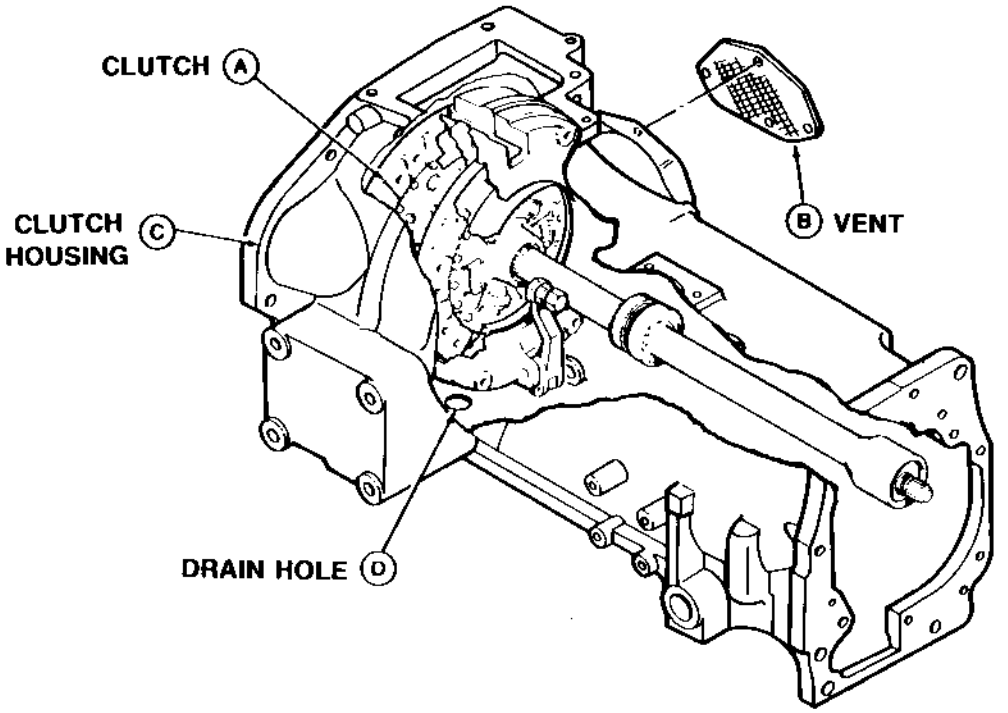


DUAL STAGE CLUTCH TRANSMISSION AND PTO DISENGAGED

Slide No. 143

MX,25510DG,A7 -19-19OCT89

CLUTCH VENTILATION AND DRAIN



CLUTCH VENTILATION AND DRAINAGE

M48485 -19-09JAN90

A—Clutch **B—Vent** **C—Clutch Housing** **D—Drain Hole**

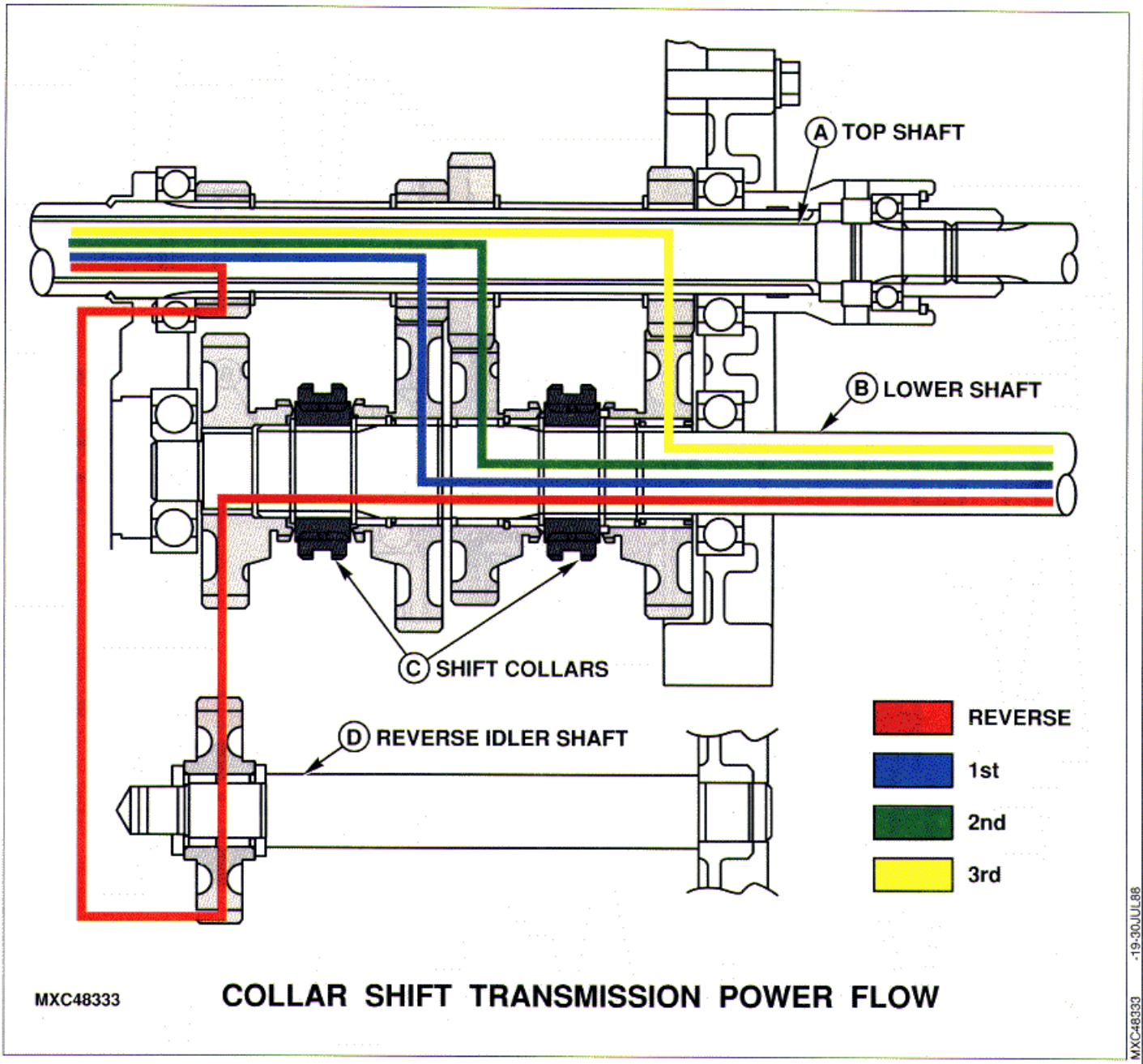
Slide No. 172

A vent in the side of the clutch housing allows air flow within the housing. As the engine is running the clutch rotation provides air movement. This vent allows cool air to enter the housing while the engine is running and provide a way for warm air to escape after the engine is shut off. This will reduce condensation.

A drain hole allows any moisture that has accumulated in the clutch housing to escape.

MX,25510DG,A24 -19-13DEC89

COLLAR SHIFT TRANSMISSION POWER FLOW



Slide No. 173

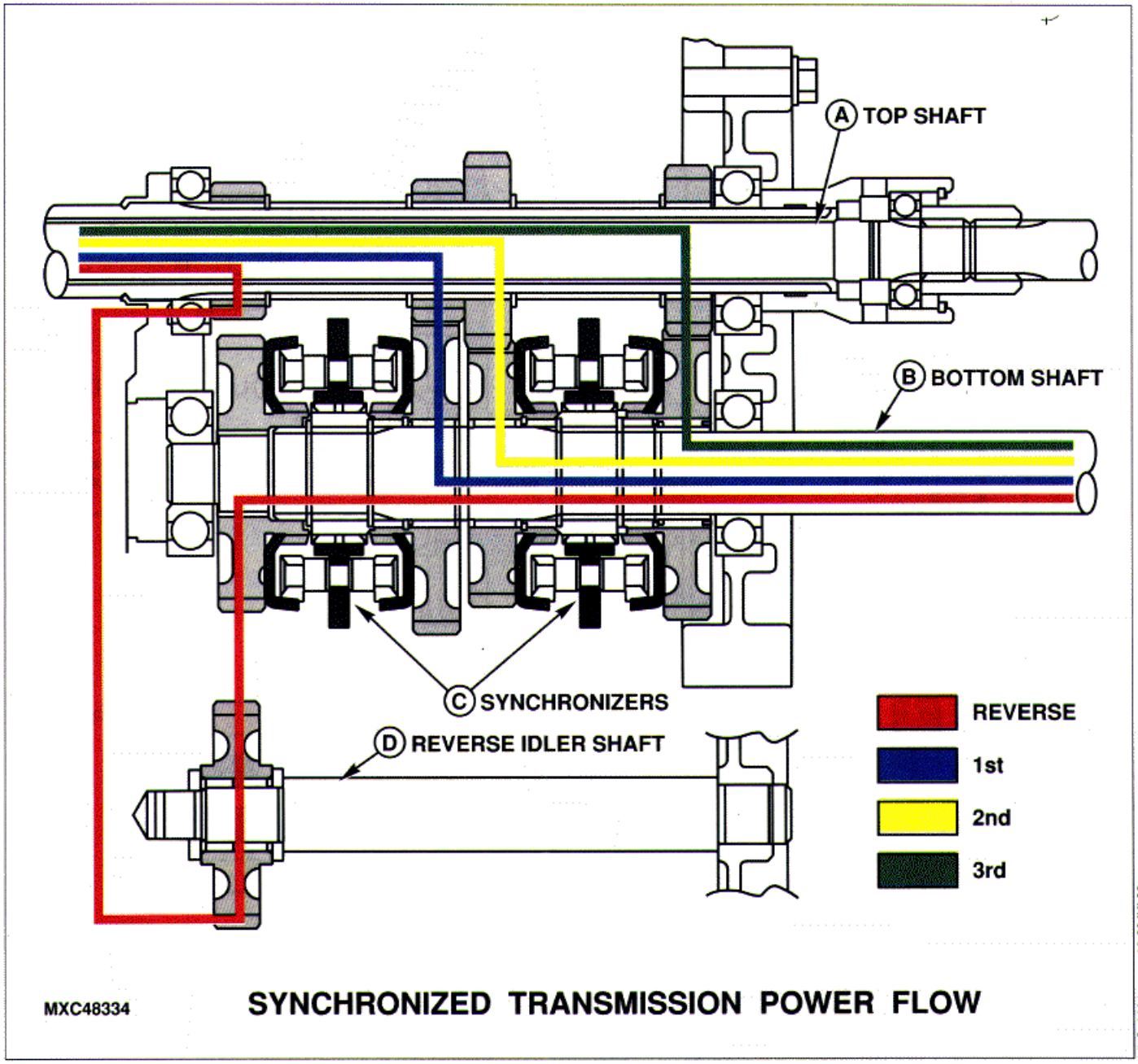
A—Top Shaft **B—Lower Shaft** **C—Shift Collars** **D—Reverse Idler Shaft**

The transmission gears are constantly in mesh. The top shaft (A) gears are splined to the shaft. The lower shaft (B) gears float free until the shift collar (C) is moved toward it. This engages the gear to the lower shaft through the collar.

Power will then flow from the top shaft through the gears selected out the lower shaft to the range selection gears.

MX,25510DG,A8 -19-19OCT89

SYNCHRONIZED TRANSMISSION POWER FLOW



Slide No. 174

A—Top Shaft **B—Lower Shaft** **C—Synchronizer** **D—Reverse Idler Shaft**

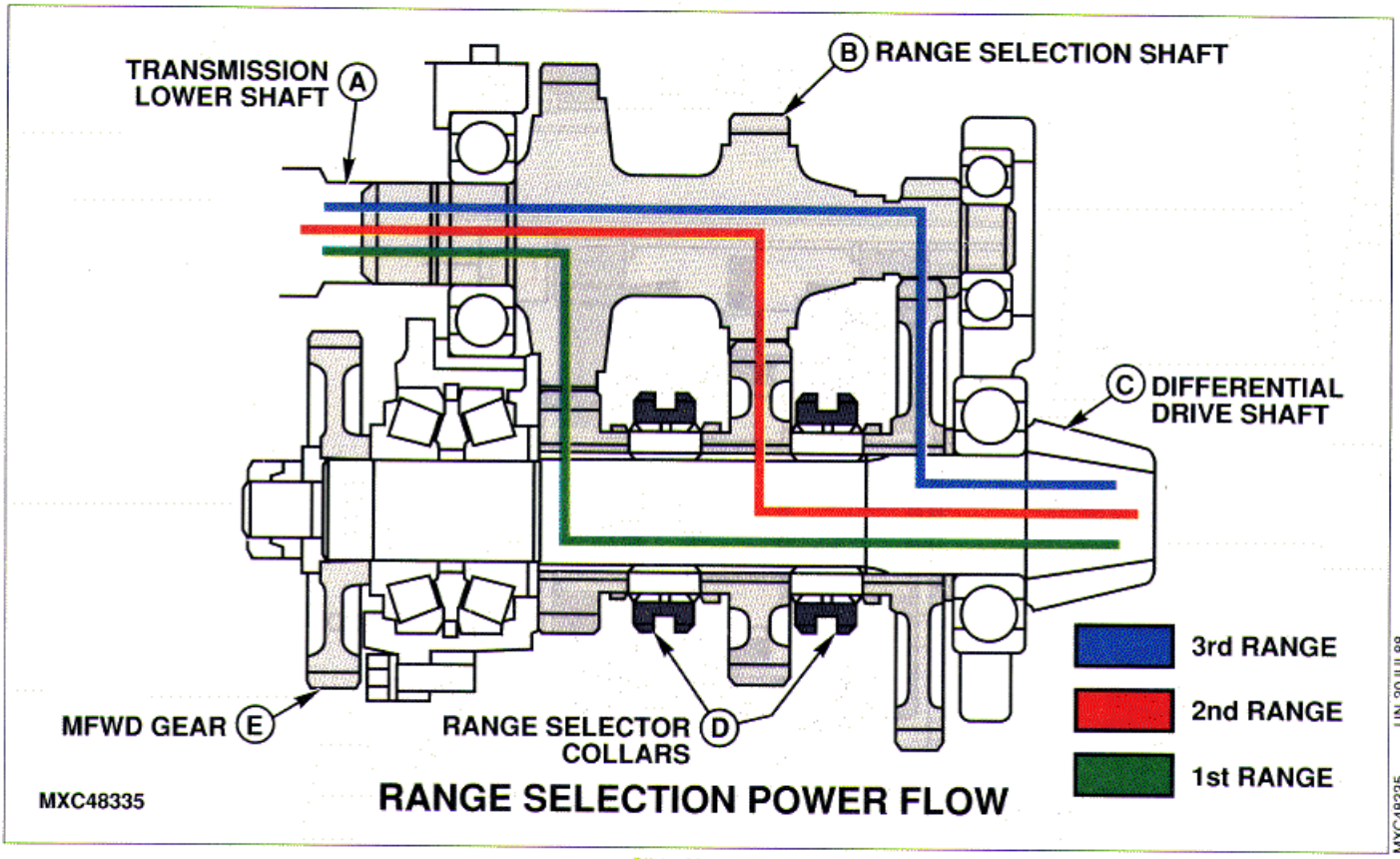
The transmission gears are constantly in mesh. The gears on the top shaft (A) are splined to the shaft. The gears on the lower shaft (B) float free until the synchronizer (C) is moved toward it. This engages the gear to the lower shaft through the synchronizer.

Power will then flow from the top shaft through the gears selected out the lower shaft to the range selection gears.

MX,25510DG,A9 -19-19OCT89

160290

RANGE SELECTION POWER FLOW



Slide No. 175

A—Transmission Lower Shaft **B—Range Selection Shaft** **C—Differential Drive Shaft** **D—Range Selector Collar**

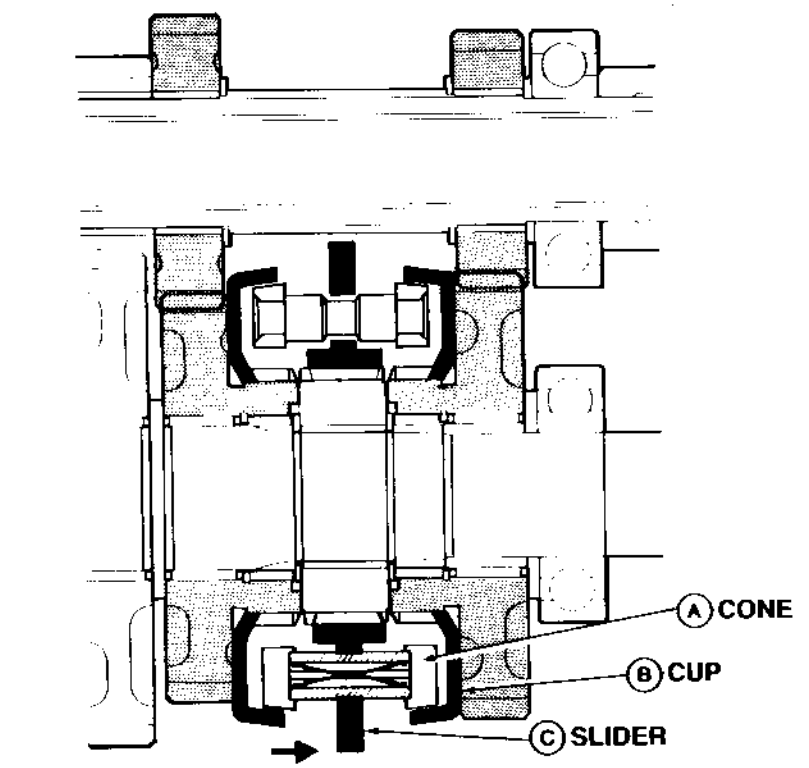
The range selection gears are constantly in mesh. The gears on the range selection shaft (B) are splined to the shaft. The gears on the differential drive shaft (C) float free until the range selector collar (D) is moved toward it. This engages the gear to the differential drive shaft.

Power from the transmission lower shaft (A) will then flow through the gears selected to the differential drive shaft.

NOTE: A lock out link prevents the linkage from engaging into reverse in third range.

MX,25510DG,A10 -19-19OCT89

SYNCHRONIZER OPERATION—BEGINNING OF SHIFT



SYNCHRONIZER (BEGINNING OF SHIFT)

M48336 -19-09JAN90

A—Cone **B—Cup** **C—Slider**

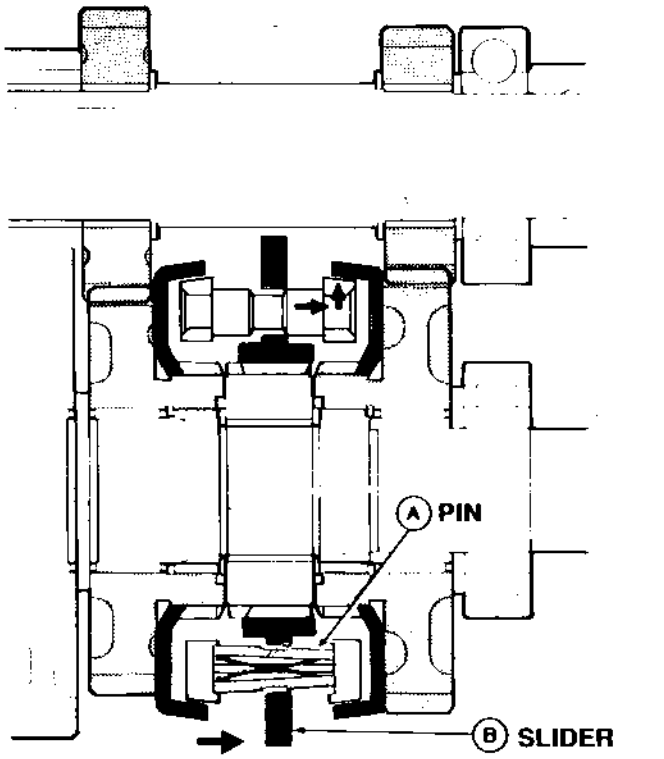
Slide No. 176

At the beginning of a shift the slider is moved to the right. As this happens the cone (A) contacts the cup (B) on the gear being shifted into.

The will slow down or speed up the gear to match the speed of the synchronizer.

MX,25510DG,A11 -19-19OCT89

SYNCHONIZER—MIDWAY THROUGH SHIFT



SYNCHRONIZER (MIDWAY THRU SHIFT)

M48337 -19-22FEB90

A—Pin **B—Slider**

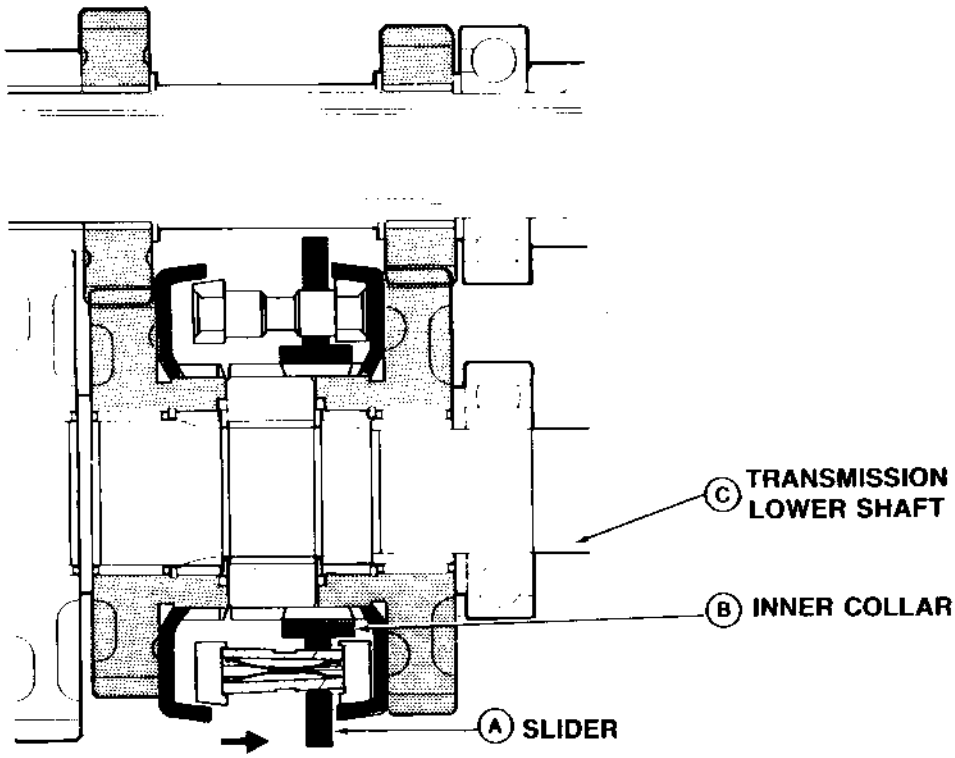
Slide No. 177

Continued force on the slider (B) begins to move the slider over the pins (A) in the direction of the gear.

The pins now put spring tension on the slider to assist in forcing the slider and inner collar toward the gear.

MX,25510DG,A12 -19-19OCT89

SYNCHONIZER—END OF SHIFT



SYNCHRONIZER (END OF SHIFT)

-19-09JAN90

M48338

A—Slider **B—Inner Collar** **C—Transmission Lower Shaft**

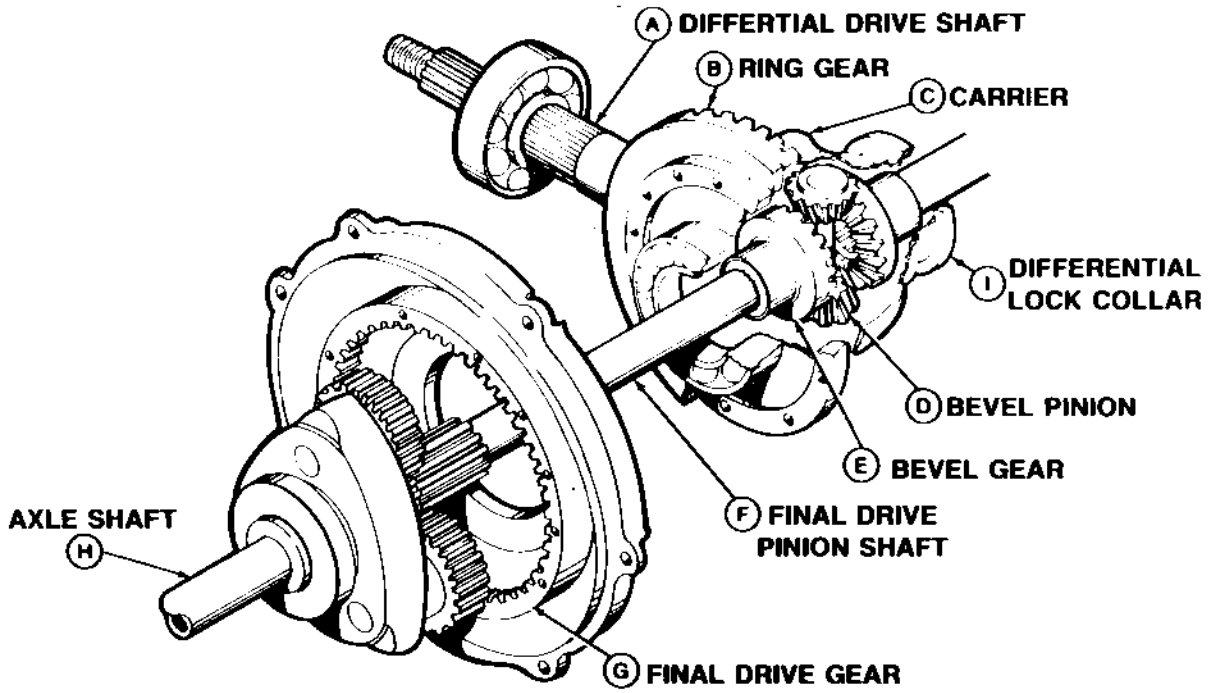
Slide No. 178

After the gear and the synchronizer have matched speeds (beginning of shift) and the pins have put force on the slider (midway through shift) the inner collar (B) of the synchronizer can easily and smoothly engage with the splines on the gear.

When this happens the slider (A) and inner collar (B) move completely toward the gear. Power flow is now from the gear through the inner collar to the lower transmission shaft (C).

MX,25510DG,A13 -19-19OCT89

DIFFERENTIAL POWER FLOW



DIFFERENTIAL POWER FLOW

255 10 15

-19-09JAN90

M48339

A—Differential Drive Shaft Pinion
B—Ring Gear
C—Carrier
D—Bevel Pinion
E—Bevel Gear
F—Final Drive Pinion Shaft
G—Final Drive Gear
H—Axle Shaft
I—Differential Lock Collar

Slide No. 179

Power from the differential drive shaft (A) is transmitted through the differential assembly to the final drive pinion shaft (F). The final drive pinion shaft is in mesh with the three small gears on the planetary final drive gear assembly (G). These small gears walk around the inside of the large gear and rotate the planetary assembly. The result is rotation of the axle shaft (H).

The differential assembly is a ring gear (B) bolted to the carrier (C). Inside the carrier is two bevel gears (E) and two bevel pinions (D).

When the tractor turns sharply one axle is held stationary. The result is that the bevel pinions rotate on their own axis and walk around the stationary bevel gears. The turning ring gear transmits power through the pinion to the opposite bevel gear.

MX,25510DG,A14 -19-19OCT89

DIFFERENTIAL LOCK OPERATION

A—Pedal
B—Fork
C—Spring
D—Pin
E—Differential Lock Collar
F—Axle Shaft
G—Differential Output Shaft

Engaging the differential lock locks the two differential output shafts together and keeps an equal amount of power to both axles (eliminates differential action).

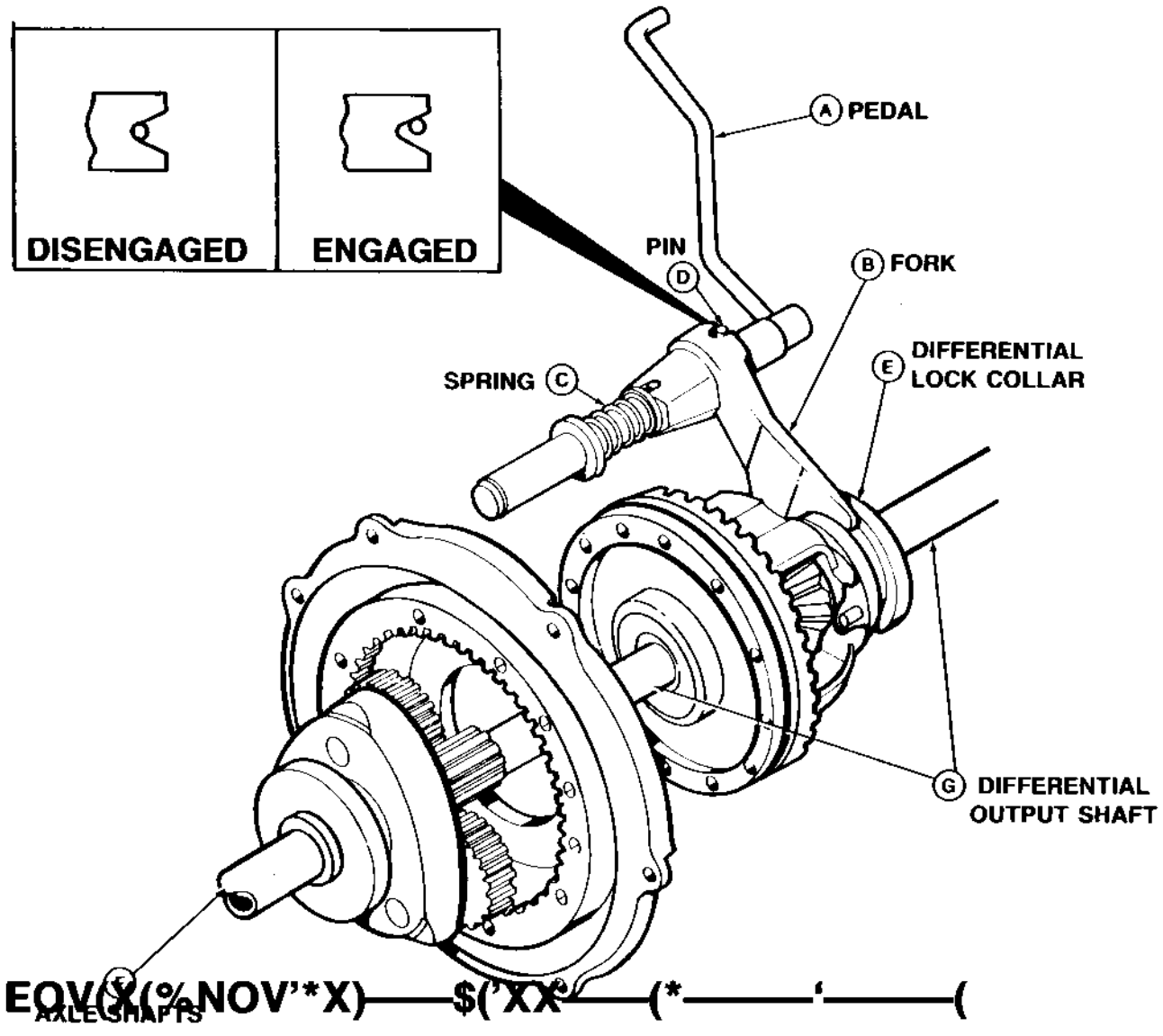
Depressing the pedal (A) rotates a pin (D) that sets in the ramp on fork (B). As the pin rotates it forces the fork to the left. This compresses the spring (C) and forces the differential lock collar (E) toward the differential carrier.

When the pins on the collar align with the holes in the carrier the pins will slip into the holes. Since the collar is splined to the right differential output shaft no differential action will take place and both output shafts turn equally.

When the pedal is released the spring will disengaged the differential lock once the torsional forces on the axles is reduced.

255
10
16

MX,25510DG,A15 -19-19OCT89



DIFFERENTIAL LOCK OPERATION

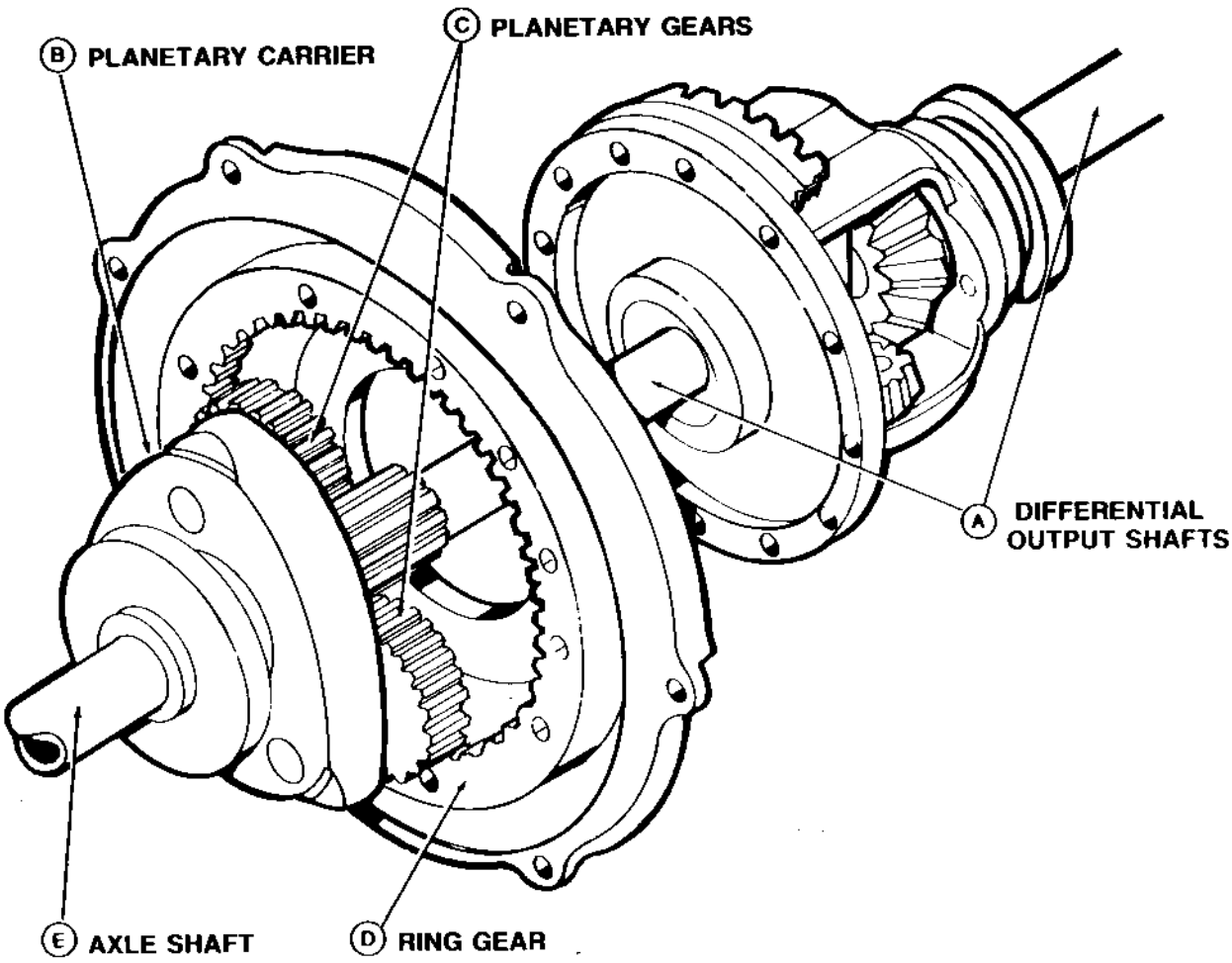
M48340 -19-09JAN90

Slide No. 180

MX,25510DG,A15A-19-24OCT89

255 10 17

FINAL DRIVE



M48341 -19-09JAN90

FINAL DRIVE

A—Differential Output Shafts **C—Planetary Gears** **D—Ring Gear** **E—Axle Shaft**
B—Planetary Carrier

Slide No. 181

The final drive is a planetary ring gear type system. The differential output shafts (A) are in mesh with the planetary gears (C) attached to the planetary carrier (B) and ride inside the ring gear. The axle shafts (E) are splined to the planetary carrier. Power from the differential output shafts turn the planetary assembly which rotates the planetary assembly and therefore the axle shafts. This provides the proper gear reduction and high torque load capabilities required.

MX,25510DG,A16 -19-19OCT89

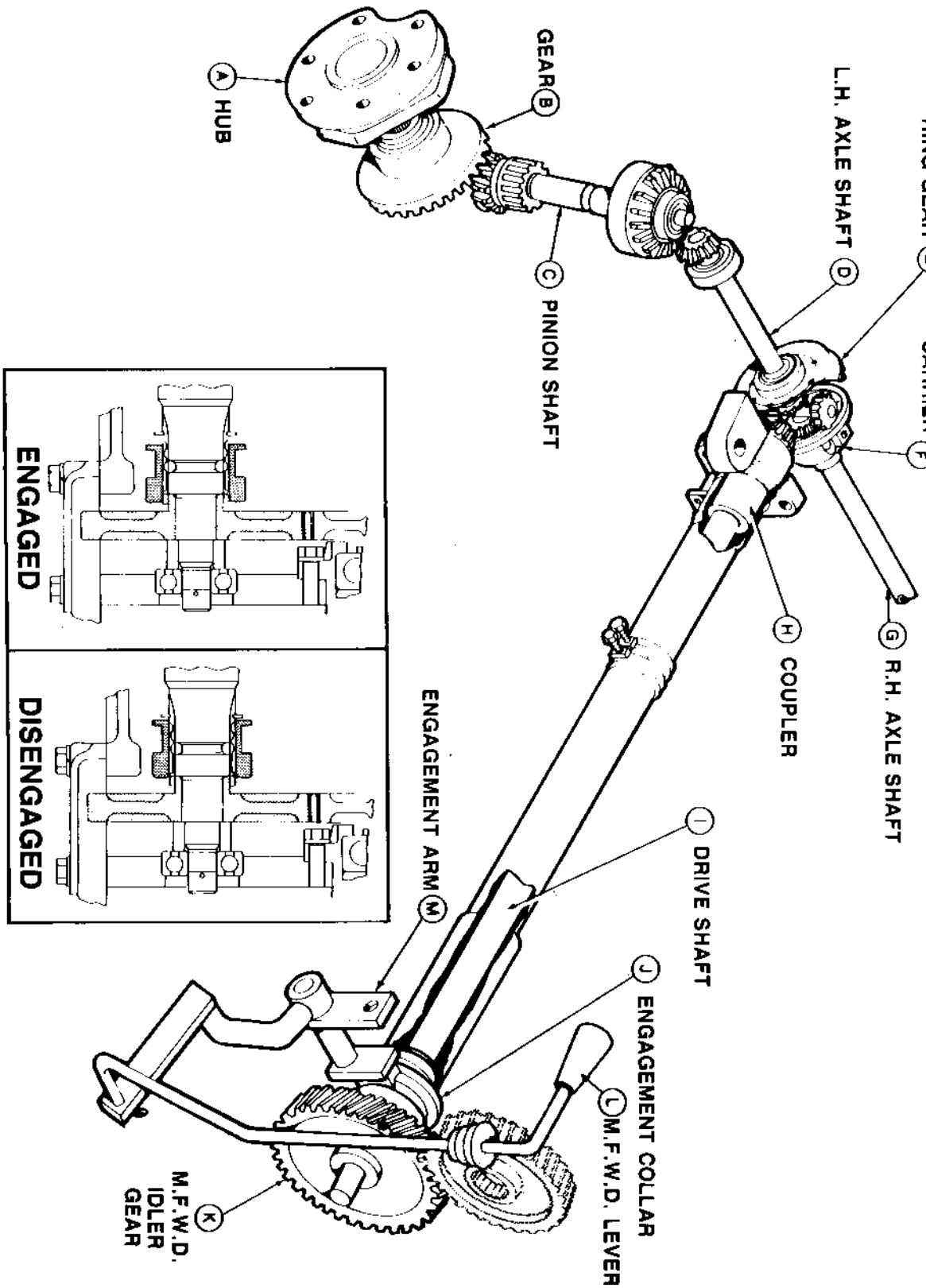
MECHANICAL FRONT WHEEL DRIVE POWER FLOW

A—Hub
B—Gear
C—Pinion Shaft
D—L.H. Axle Shaft
E—Ring Gear
F—Differential Carrier
G—R.H. Axle Shaft
H—Coupler
I—Drive Shaft
J—Engagement Collar
K—MFWD Idler Gear
L—MFWD Lever
M—Engagement Arm

The MFWD is engaged by pushing the lever down. The block on the engagement arm moves the shift collar back to engage the idler gear with the drive shaft.

Power is then transmitted through the MFWD drive shaft, the front axle differential, axles and pinions to the hubs.

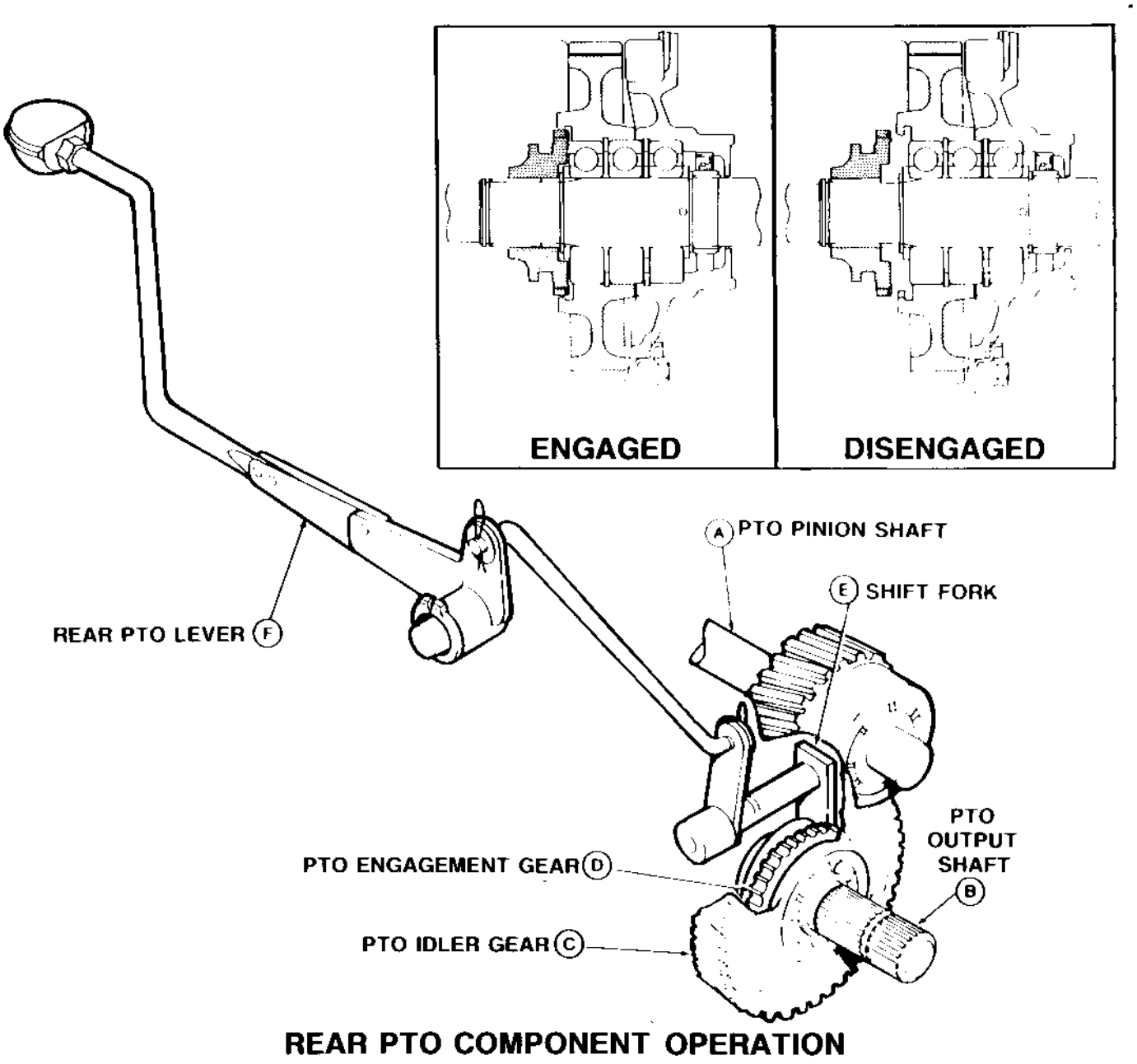
MX,25510DG,A17 -19-19OCT89



Slide No. 182

MX,25510DG,A18 -19-19OCT89

REAR PTO OPERATION



REAR PTO COMPONENT OPERATION

A—PTO Pinion Shaft
B—PTO Output Shaft
C—PTO Idler Gear
D—PTO Engagement Gear
E—Shift Fork
F—Rear PTO Lever

Slide No. 183

Power to the rear PTO is provided by the PTO pinion shaft. The PTO idler gear is splined to the PTO output shaft. The idler gear is in constant mesh with the pinion shaft. The PTO engagement gear connects the idler gear to the output shaft when engaged.

To engage the PTO the PTO lever is pushed down. This moves the shift fork rearward to force the PTO engagement gear into mesh with the PTO idler gear. Disengagement is done by moving the PTO lever up.

MX,25510DG,A19 -19-19OCT89

MID PTO OPERATION

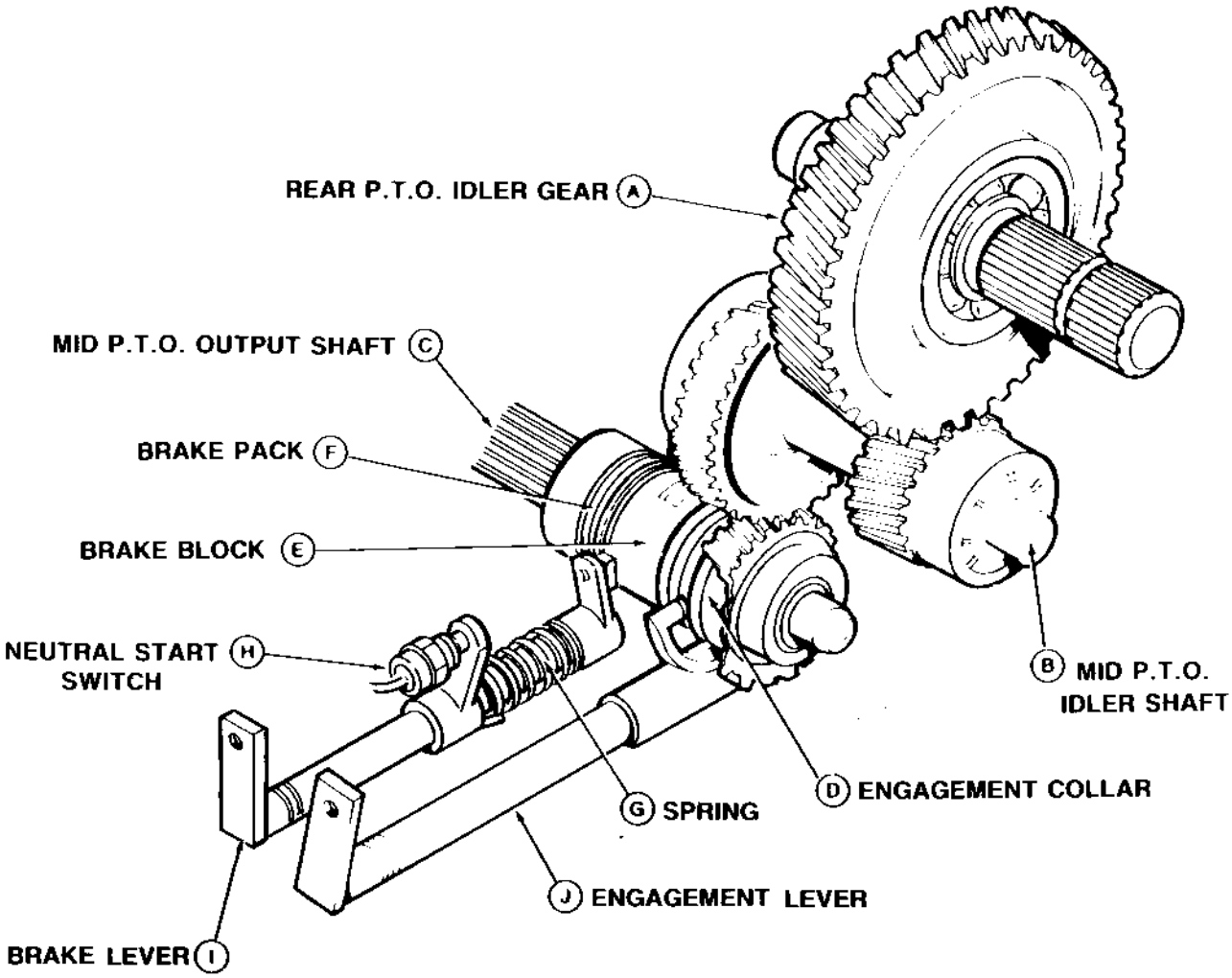
A—Rear PTO Idler Gear
B—Mid PTO Idler Shaft
C—Mid PTO Output Shaft
D—Engagement Collar
E—Brake Block
F—Brake Pack
G—Spring
H—Neutral Start Switch
I—Brake Lever
J—Engagement lever

The small gear on the mid PTO idler shaft is in constant mesh with the rear PTO idler gear. The large gear is in constant mesh with the gear on the mid PTO output shaft. To connect the gear to the shaft the engagement collar must be moved rearward to engage the gear. This is controlled by the engagment lever.

When the engagement collar is moved forward to disengage position it also applies a force against the brake block. This engages the brake pack to stop rotation of the mid PTO.

The brake lever which is controlled by the tractor traction clutch can also engage the brake while the mid PTO engagement collar remains engaged to stop the mid PTO when the tractor clutch is fully disengaged. The spring keeps the brake arm in the disengaged position whenever the traction clutch is not engaged. The neutral start switch is closed by the engagement lever whenever the mid PTO is in the disengaged position.

MX,25510DG,A20A-19-19OCT89

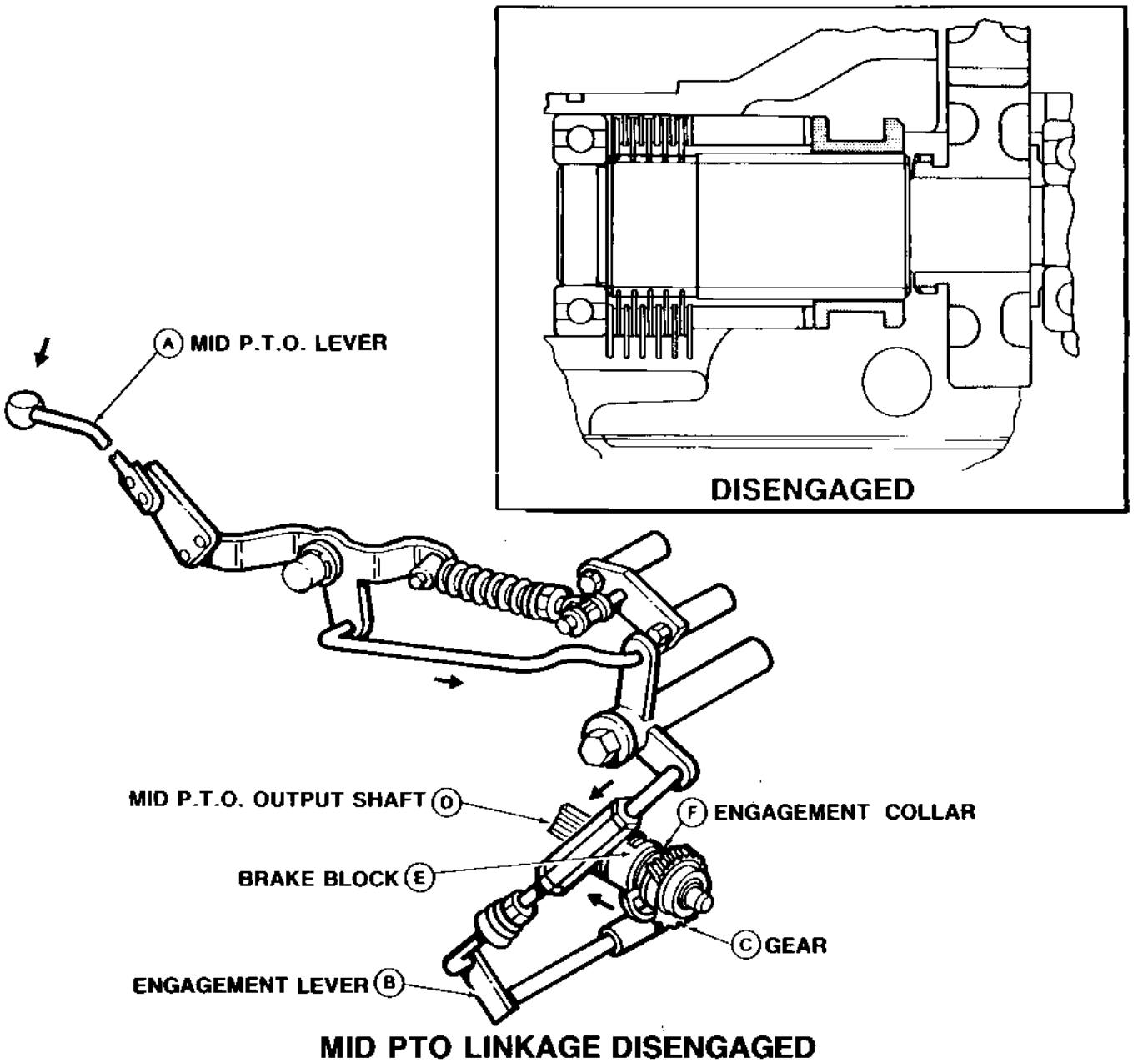


MID PTO COMPONENT OPERATION

Slide No. 184

MX,25510DG,A20B-19-19OCT89

MID PTO LINKAGE OPERATION—LEVER DISENGAGED



MID PTO LINKAGE DISENGAGED

M48345 -19-22DEC89

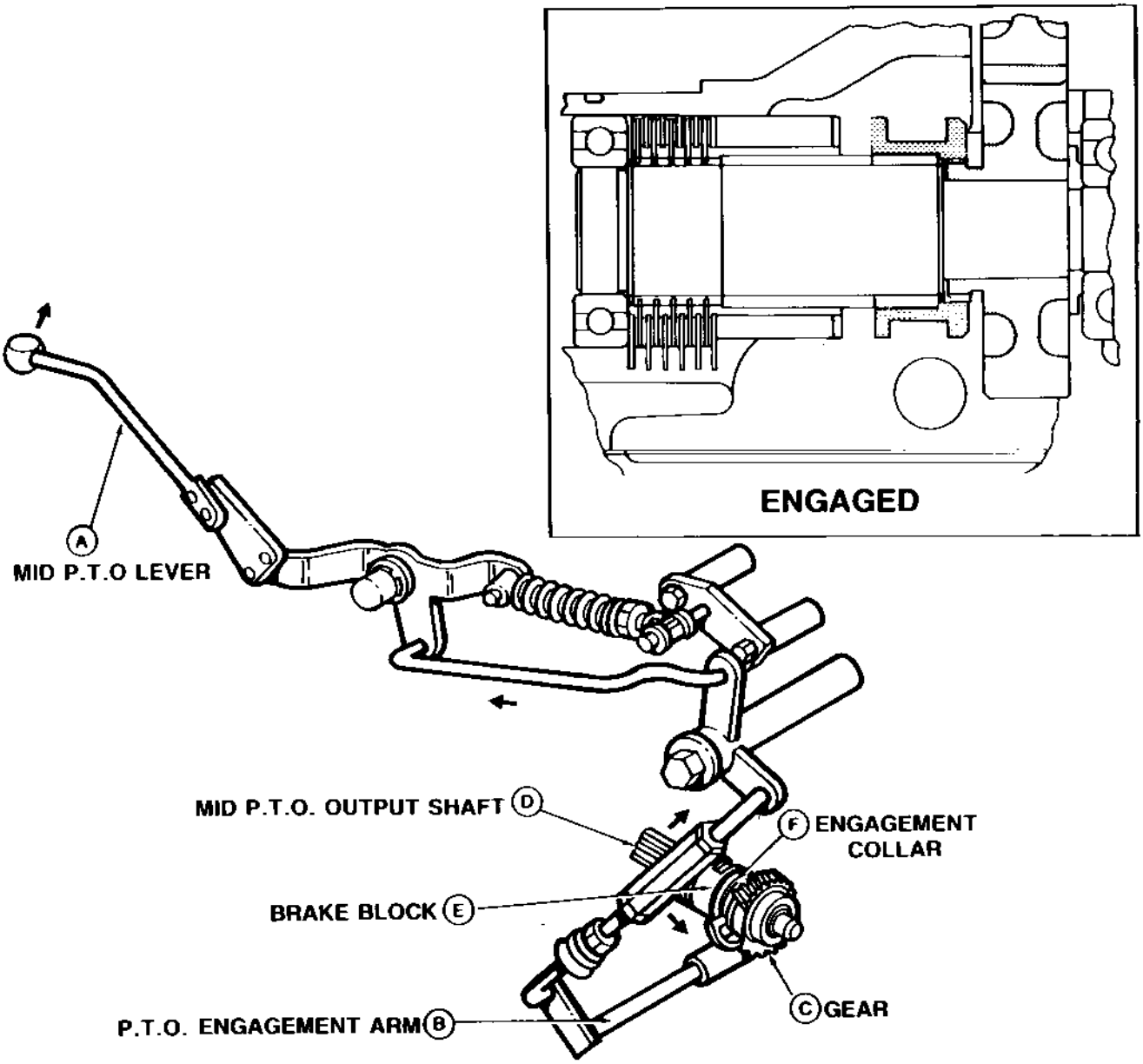
A—Mid PTO Lever **C—Gear** **E—Brake Block** **F—Engagement Collar**
B—Engagement Lever **D—Mid PTO Output Shaft**

Slide No. 185

When the PTO lever is pushed down the engagement lever moves the collar forward to disengage the gear from the shaft. It also applies force against the brake block to apply the brake.

MX,25510DG,A21 -19-19OCT89

MID PTO LINKAGE OPERATION—LEVER ENGAGED



MID P.T.O. LINKAGE ENGAGED

M48346 -19-22DEC89

A—Mid PTO Lever
B—PTO Engagement Arm
C—Gear
D—Mid PTO Output Shaft
E—Brake Block
F—Engagement Collar

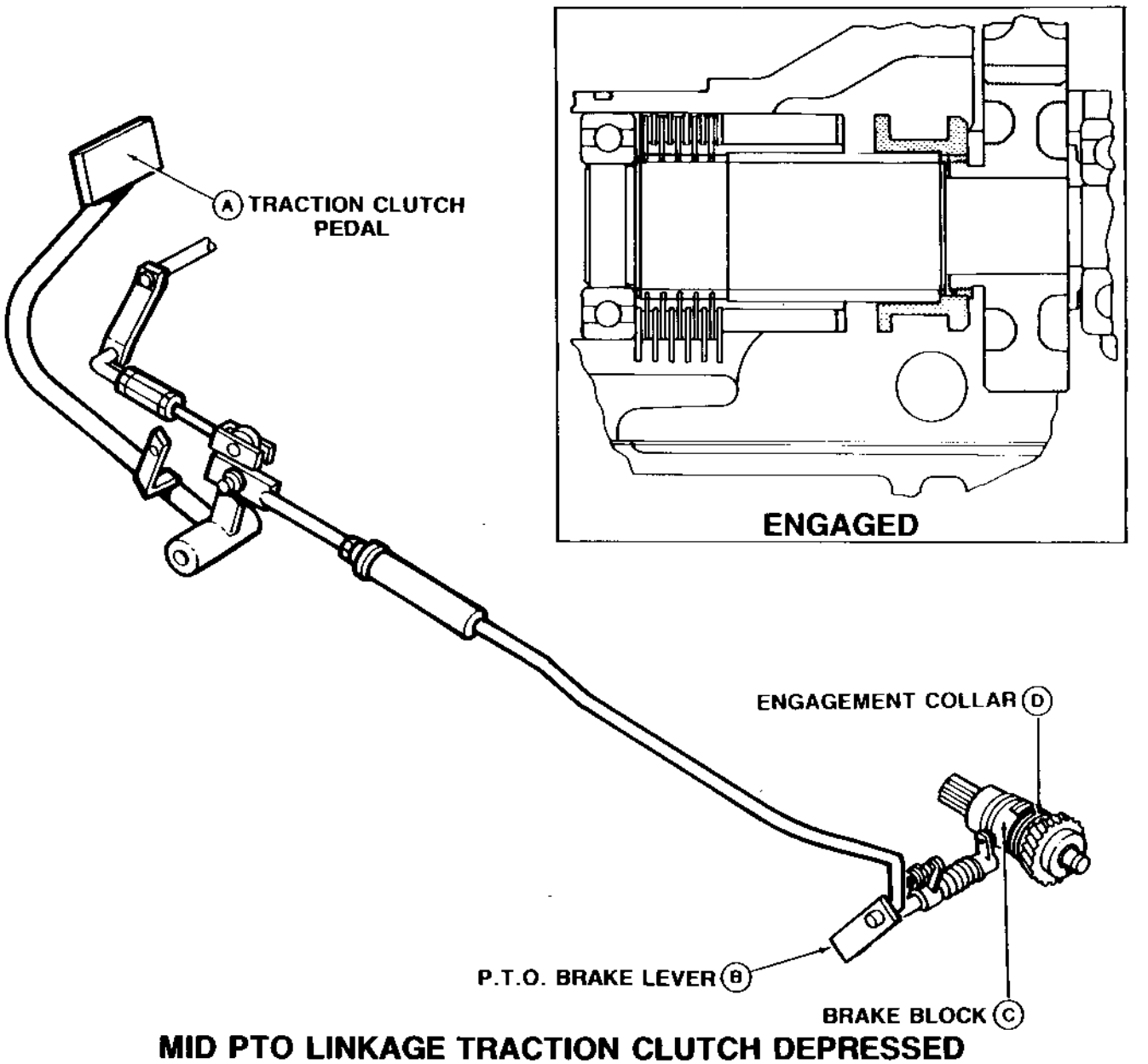
Slide No. 186

Moving the PTO lever to the engaged position causes the clutch collar to move forward and engage the gear to the shaft.

This also releases the pressure on the brake block so that the brake is released before the clutch is engaged.

MX,25510DG,A22 -19-19OCT89

MID PTO LINKAGE OPERATION—TRACTION CLUTCH DEPRESSED



MID PTO LINKAGE TRACTION CLUTCH DEPRESSED

A—Traction Clutch Pedal **B—PTO Brake Lever** **C—Brake Block** **D—Engagement Collar**

Slide No. 187

If the traction clutch is disengaged the power to the mid PTO is stopped from the engine.

The linkage connected to the clutch pedal will also rotate the brake lever connected to the brake block in the mid PTO.

The results will be that the mid PTO brake is applied to stop the mid PTO shaft rotation after the power to the PTO has been stopped.

MX,25510DG,A23 -19-19OCT89

ABOUT THIS GROUP

Follow the steps in this procedure in order to isolate the problem area in the power train.

In general the problems you will be looking for are oil leakage, noise or lack of power to the driven component. Following this procedure will help you determine the cause of the problem before disassembly.

MX,25015DG,A1 -19-25SEP89

ISOLATE THE PROBLEM AREA

TEST CONDITIONS:

• Before starting inspect the entire tractor for oil leakage. Locate the source of leakage, determine the cause and make the necessary repairs.

• During the tests you will be looking for abnormal noises. A mechanics stethoscope may be helpful.

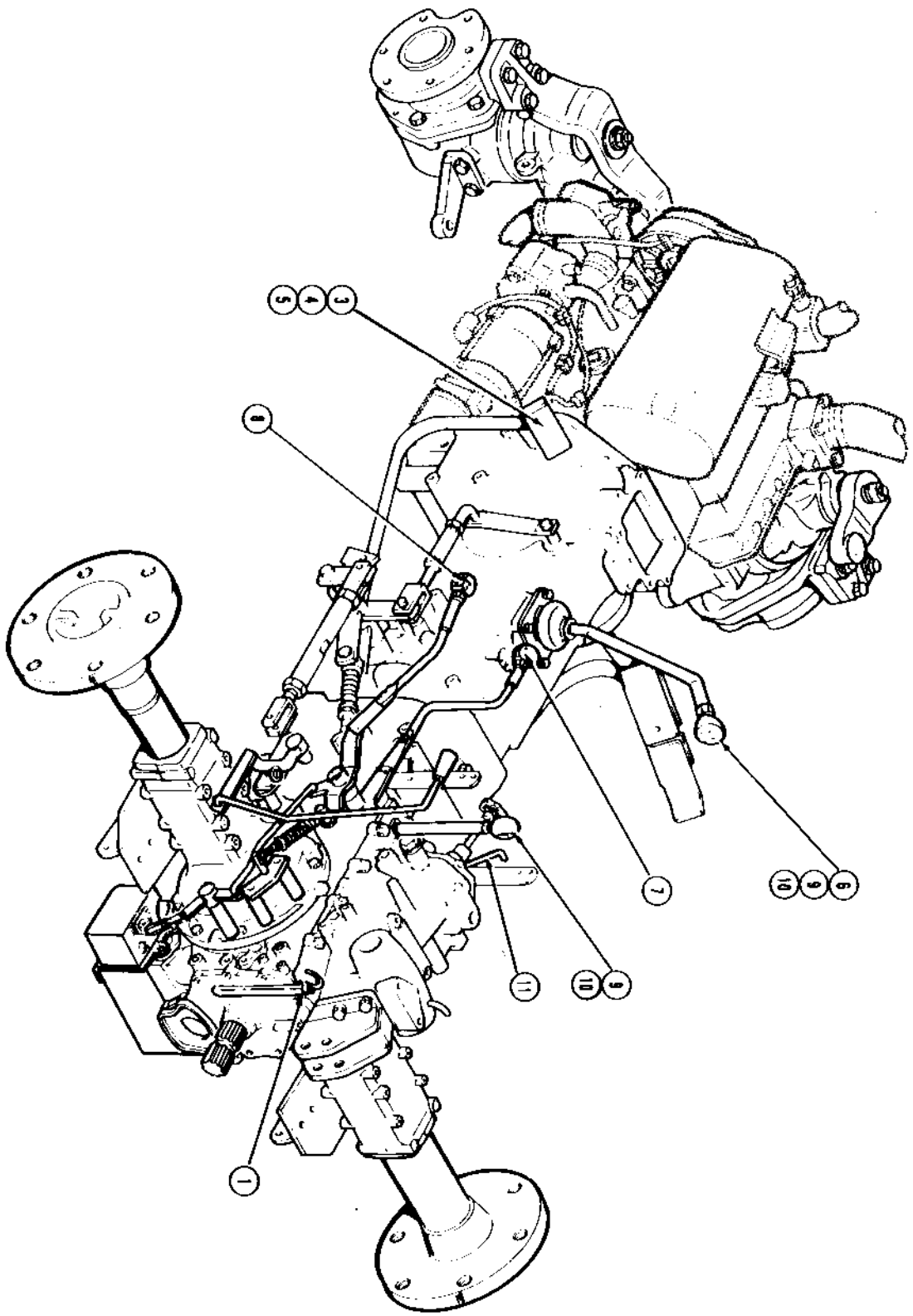
• Begin the test procedure with the speed selector and two speed in neutral, MFWD disengaged and both PTO off.

255 15 2

Test Check Point	Normal	If Not Normal
1. Check Transmission Oil.	Level not too low	Check for leakage and refill
	Level not too high	Drain oil to proper level.
	Oil not contaminated with metal fragments or debris.	Drain oil replace filter Clean screen and determine cause of contamination.
	Oil not foamy or discolored	Make sure type of oil is correct. Check for hydraulic cause of over heating.
2. Check all linkage operation and return it to neutral.	No damage or binding	Repair linkage
3. Run engine with clutch disengaged.	No noise or vibration	Inspect engine
4. Partially engage clutch and vary engine rpm.	No noise or vibration	Inspect clutch Inspect PTO drive shaft and bearings.
5. Fully engage clutch and vary engine rpm.	No noise or vibration	Inspect clutch Inspect traction drive shaft.
6. Place speed selector in each forward gear and reverse. Leave range selector in neutral. Engage clutch and vary engine rpm in each gear.	No noise or vibration	Inspect gear mesh for range selected when noise or vibration occurred. Inspect differential shaft and bearing if noise occurred in all speeds. Inspect reverse idle shaft and bearing if problem occurred. only in reverse.
7. Place transmission in neutral and engage rear PTO. Engage clutch and vary engine rpm.	No noise or vibration	Inspect rear PTO shaft, gears and bearings.

MX,25515DG,A1 -19-19OCT89

ISOLATE THE PROBLEM



M48348 -19-09JAN90

Slide No. 188

MX,25515DG,A2 -19-19OCT89

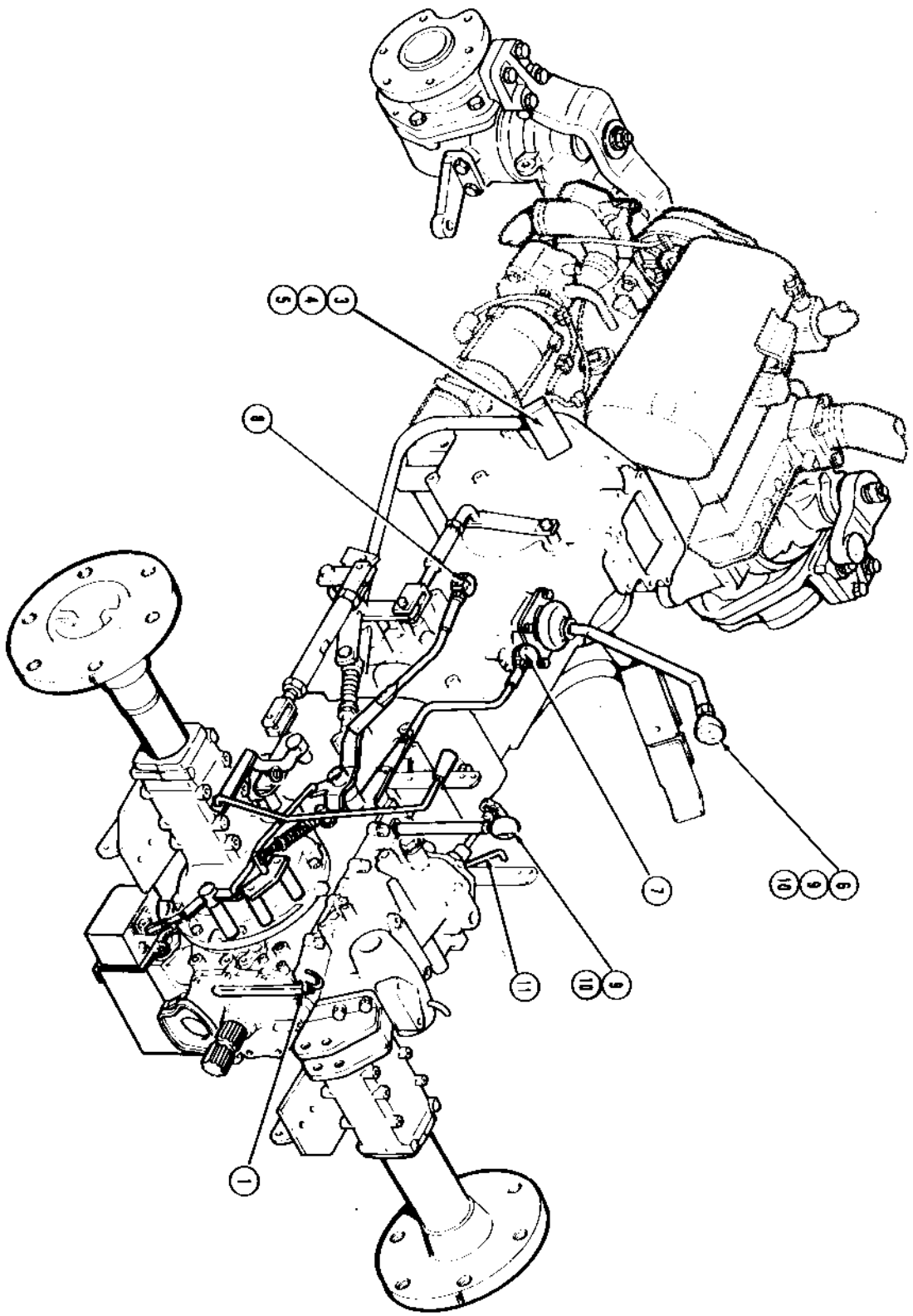
ISOLATE THE PROBLEM AREA—CONTINUED

NOTE: From this point on you will be driving the tractor. Operate in an open level area and turn sharply from left to right periodically to observe any change in noise as you turn.

Test Check Point	Normal	If Not Normal
8. Engage mid PTO (if equipped). Transmission in neutral and rear PTO off. Engage clutch and vary engine rpm.	PTO shaft turns no noise or vibration.	Inspect mid PTO shafts, gears and bearings.
9. Place transmission in 2nd gear. Operate tractor in each range.	Tractor moves smoothly going straight.	Inspect gear mesh in range where problem was evident.
		Inspect final drive if problem was evident in all ranges.
	No change when making turns	Inspect differential.
10. Place transmission in 3rd gear and two speed in low. Operate tractor.	Tractor moves smoothly going straight.	Inspect low range gear mesh or differential.
	No change when making turns.	Inspect differential.
11. Leave transmission in 3rd low and engage differential lock while operating at low engine rpm. Turn from left to right.	•Tractor resists turning •Differential lock stays engaged •No noise	Inspect different lock and linkage

MX,25515DG,A3 -19-19OCT89

ISOLATE THE PROBLEM

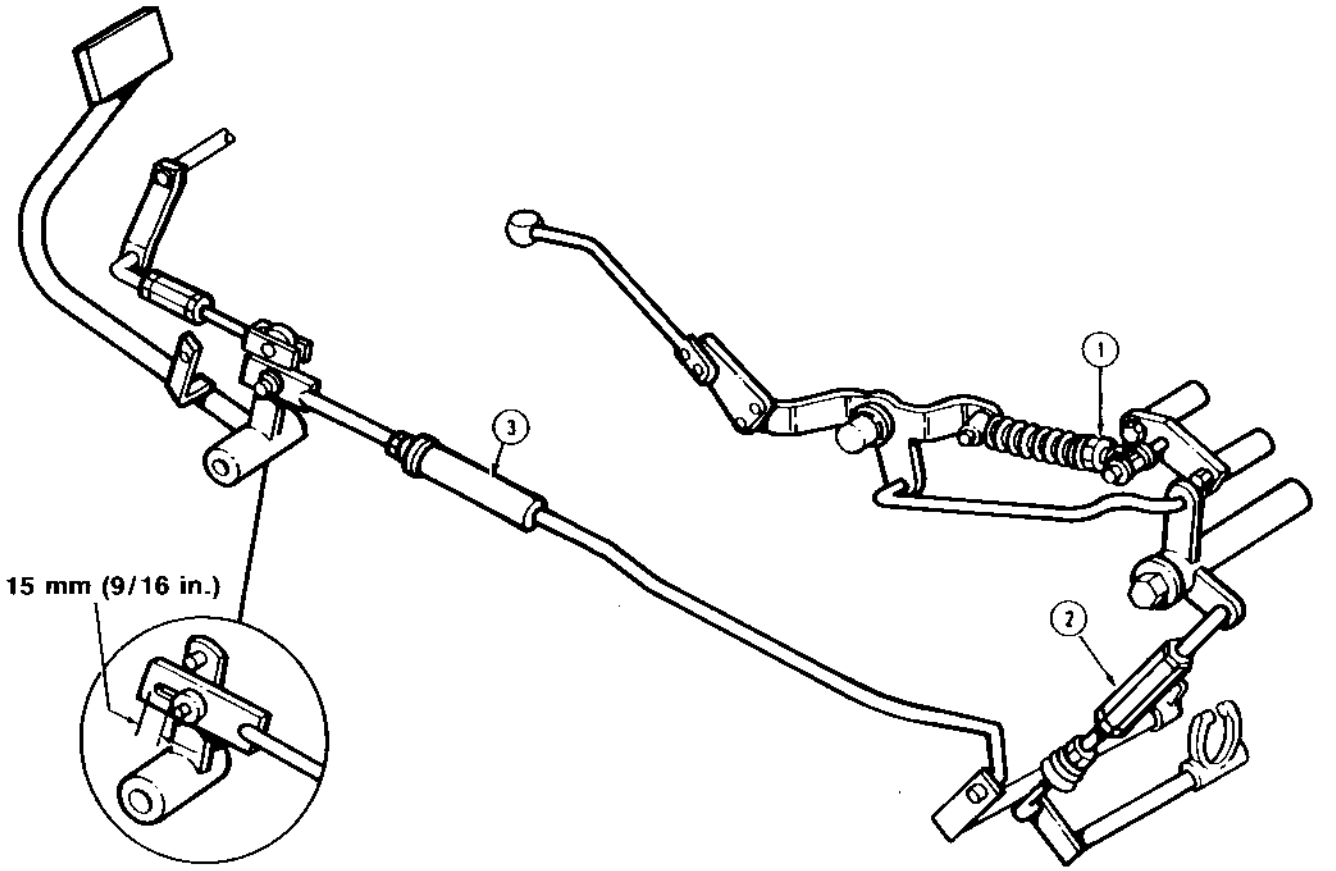


M48348 -19-09JAN90

Slide No. 188

MX,25515DG,A2 -19-19OCT89

MID PTO LINKAGE ADJUSTMENT



M48349 -19-22DEC89

MID P.T.O. LINKAGE ADJUSTMENT

Slide No. 189

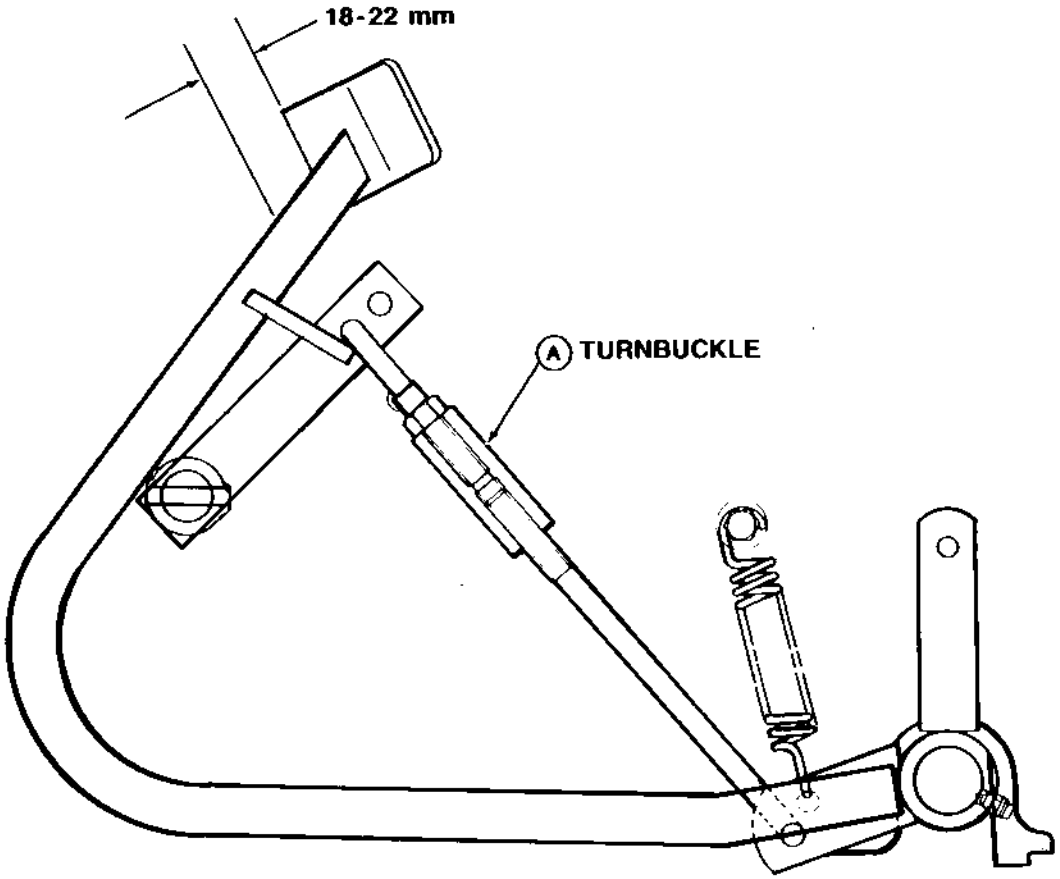
1. ENGAGEMENT SPRING
   Use adjusting nut to adjust engagement spring to a length of 59 mm (2-3/8 in.) with control lever in off position.

2. ENGAGEMENT ROD
   Use turnbuckle to adjust brake rod. Brake rod is correct length if control lever does not contact the end of the slot with the lever engaged or disengaged.

3. SPRING CAPSULE
   Adjust nut on spring capsule so that 15 mm (9/16 in.) gap exists with traction clutch fully engaged.

MX,25515DG,A4 -19-19OCT89

ADJUST CLUTCH PEDAL FREE TRAVEL



CLUTCH PEDAL FREEPLAY ADJUSTMENT

Slide No. 159

REASON FOR ADJUSTMENT:

To make sure that the traction clutch is fully engaged when the clutch pedal is released and fully disengaged when the pedal is depressed.

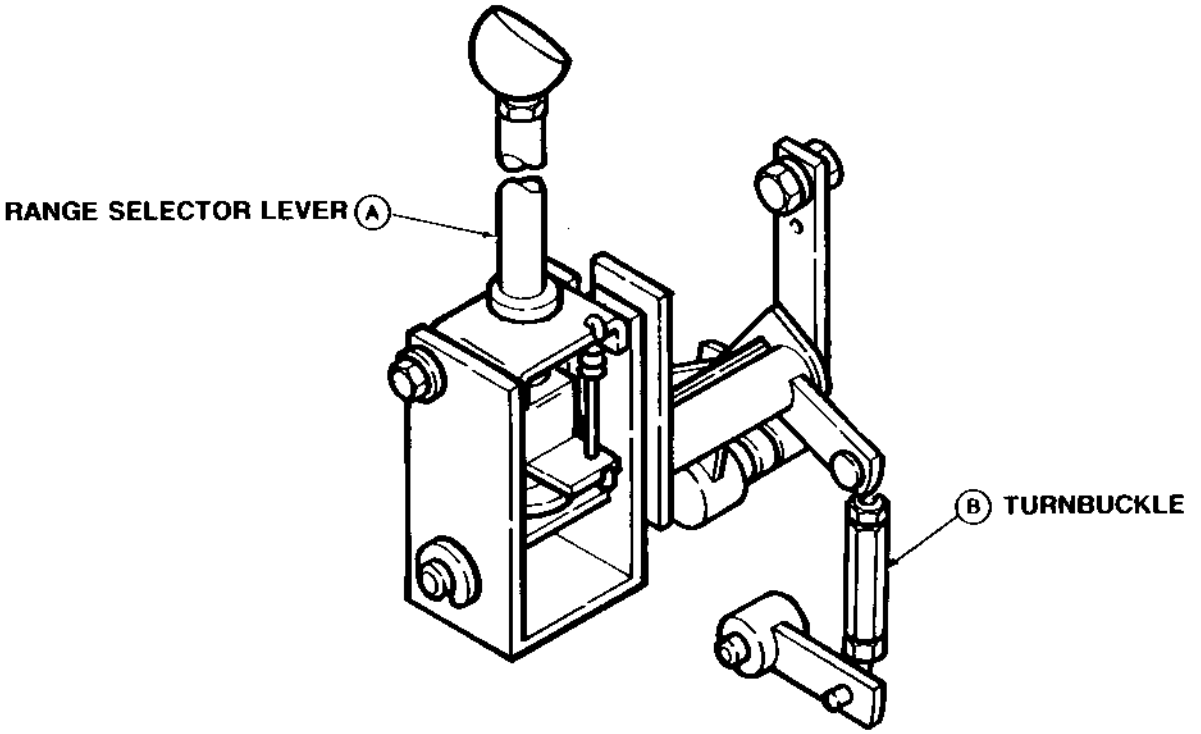
ADJUSTMENT PROCEDURE:

1. Depress the clutch pedal by hand to feel how far the pedal travels before resistance is felt. The amount of travel should be 18 to 22 mm.

2. If too much or too little free travel exists adjust the turnbuckle (A) to correct it.

MX,25515DG,A5 -19-19OCT89

RANGE SELECTOR LINKAGE ADJUSTMENT



RANGE SELECTOR LINKAGE ADJUSTMENT

A—Range Selector Lever **B—Turnbuckle**

Slide No. 190

REASON FOR ADJUSTMENT:

To provide smooth movement of the range selector lever between 1st, 2nd and 3rd range.

ADJUSTMENT PROCEDURE:

1. Place the range selector lever in the center (neutral) position.

2. Push down on the lever. It should move down freely and the spring should force it back up quickly.

3. If any binding is evident adjust turnbuckle (B) to align the slot and the pin on the two straps on the right side of the range selector assembly. When the range selector lever moves up and down freely in neutral the adjustment is correct.

NOTE: It is not recommended to lubricate the moving portion of the range selector lever. The lubrication tends to accumulate dust and cause binding in this area.

MX,25515DG,A6 -19-24OCT89

Section 260
STEERING AND BRAKES

Contents

Page

Group 05—Steering and Brake Component Location

About This Group 260-05-1
Standard Front Axle and Mechanical Steering-670/770/790. 260-05-2
Standard Front Axle and Power Steering-670/770/790. 260-05-4
MFWD and Power Steering (670, 770 and 790) 260-05-6
Standard Front Axle and Mechanical Steering-870/970. 260-05-8
Standard Front Axle and Power Steering-870/970/1070 260-05-10
MFWD Axle and Power Steering (870) . .260-05-12
MFWD Axle and Power Steering (970 and 1070) 260-05-14
Brake System
670/770/790. 260-05-16
870/970/1070. 260-05-18

Group 10—Steering and Brakes Theory of Operation

Manual Steering Gear Operation 260-10-1
Power Steering Operation. 260-10-2
Drum Brake Operation (670/770/790) 260-10-4
Disk Brake Operation (870/970/1070) 260-10-5
Park Brake Lock Operation 260-10-6

Group 15—Steering and Brake Diagnosis and Test

About This Group 260-15-1
Isolate the Problem
Manual Steering 260-15-2
Power Steering 260-15-4
Brakes 260-15-6
Manual Steering Drag Link Adjustment (870/970/1070) 260-15-8
Toe-In Adjustment 260-15-9
Checking Manual Steering Gearbox Freeplay. 260-15-10
Manual Steering Gearbox Backlash Adjustment. 260-15-11
Power Steering Cylinder Leakage Test . .260-15-12
Steering Valve Relief Test 260-15-13

Page

Power Steering Valve Leakage Test 260-15-14
Power Steering Pump Flow Test. 260-15-16
Brake Pedal Freeplay Adjustment. 260-15-18

ABOUT THIS GROUP

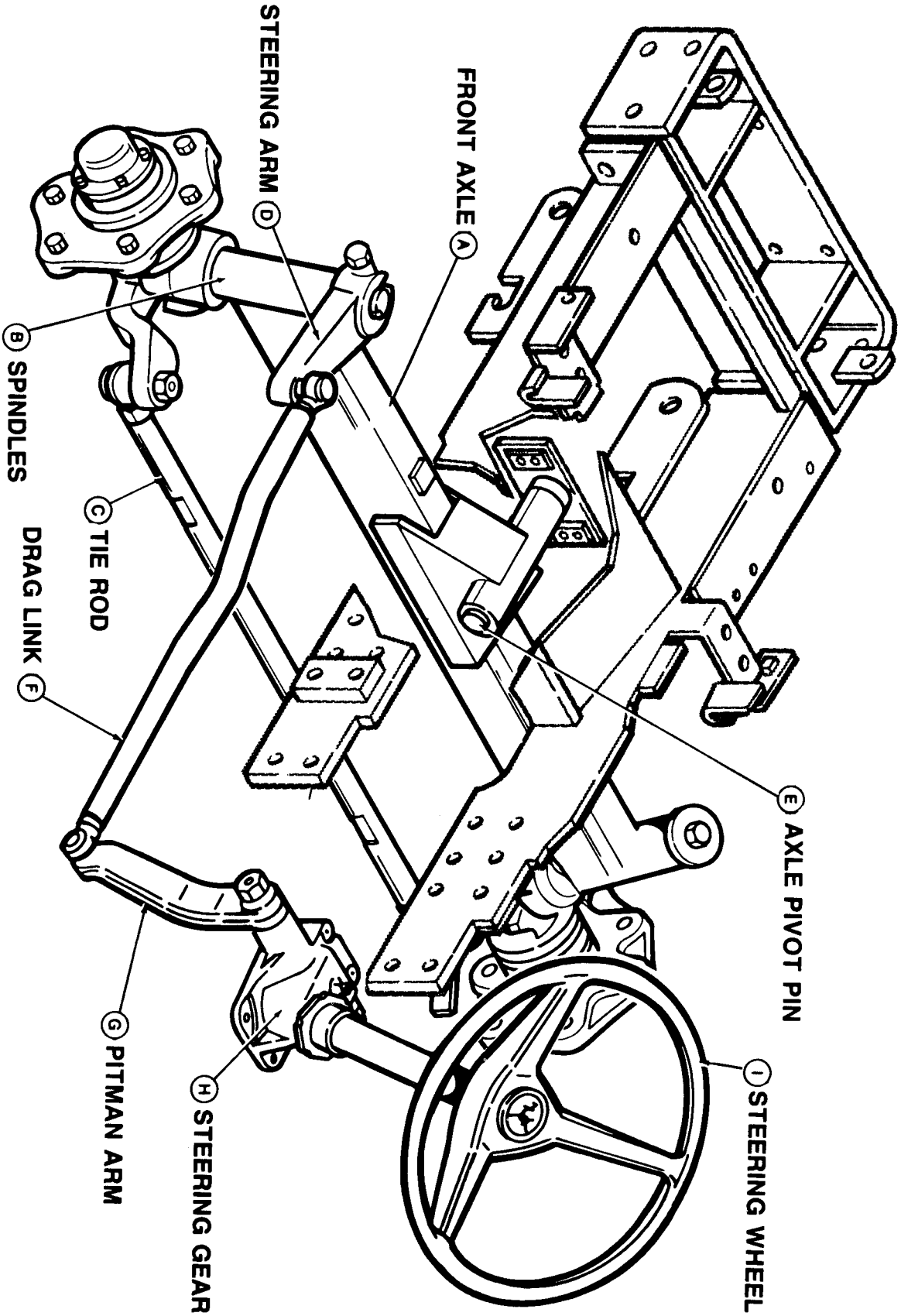
Standard tractors 670/770/790/870/970 have manual steering. Power steering is a factory option on these models and standard equipment on the 1070.

Mechanical front wheel drive axles are optional on all models. The standard front axle is adjustable for width on the 870, 970 and 1070.

Brakes are drum type on the 670, 770 and 790. Wet disk brakes are used on the 870, 970 and 1070.

STANDARD FRONT AXLE AND MECHANICAL STEERING (670,770 AND 790)

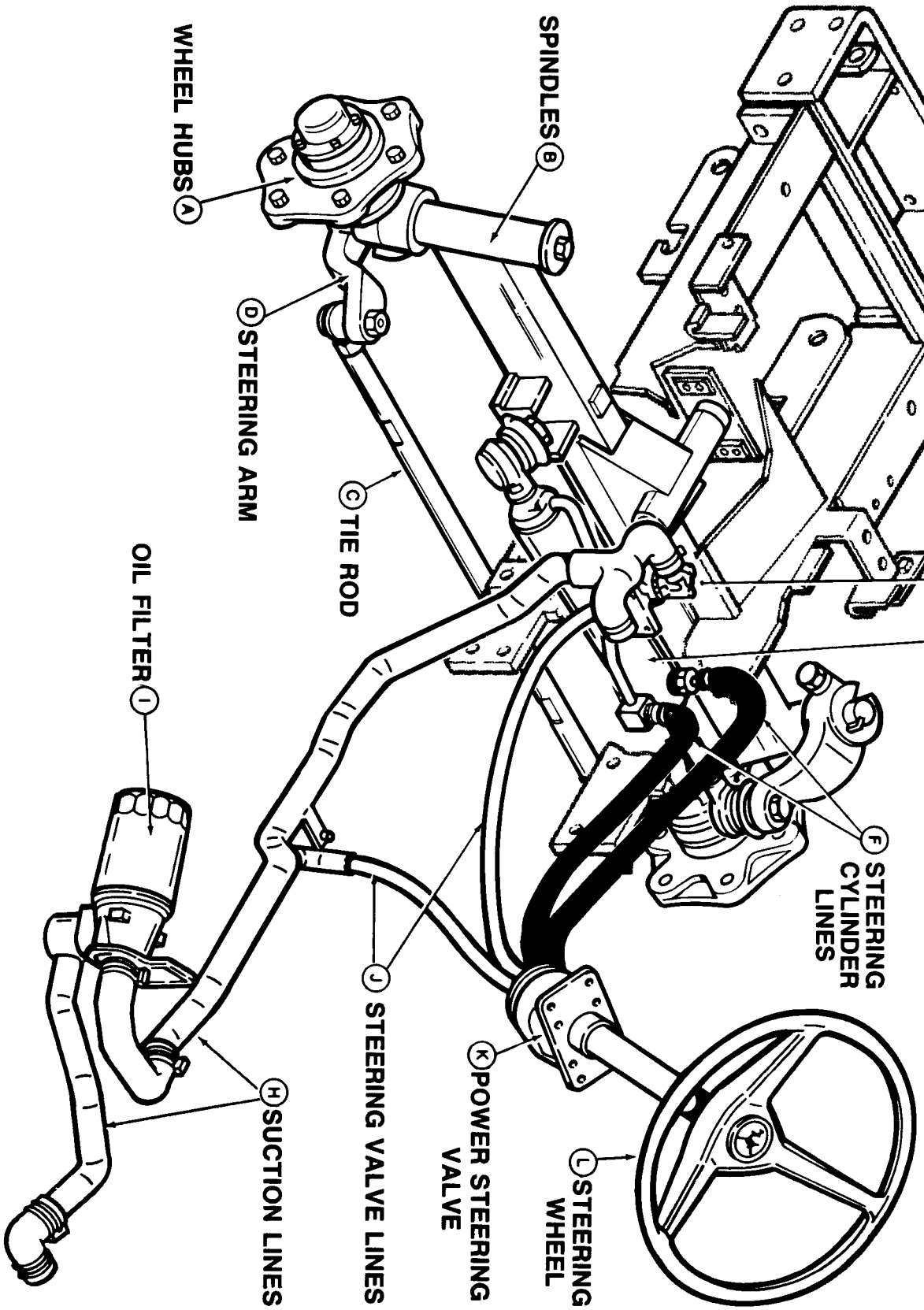
A—Front Axle
B—Spindles
C—Tie Rod
D—Steering Arm
E—Axle Pivot Pin
F—Drag Link
G—Pitman Arm
H—Steering Gear
I—Steering Wheel



STANDARD FRONT AXLE AND MECHANICAL STEERING (670/770 AND 790)

STANDARD FRONT AXLE AND POWER STEERING (670, 770 AND 790)

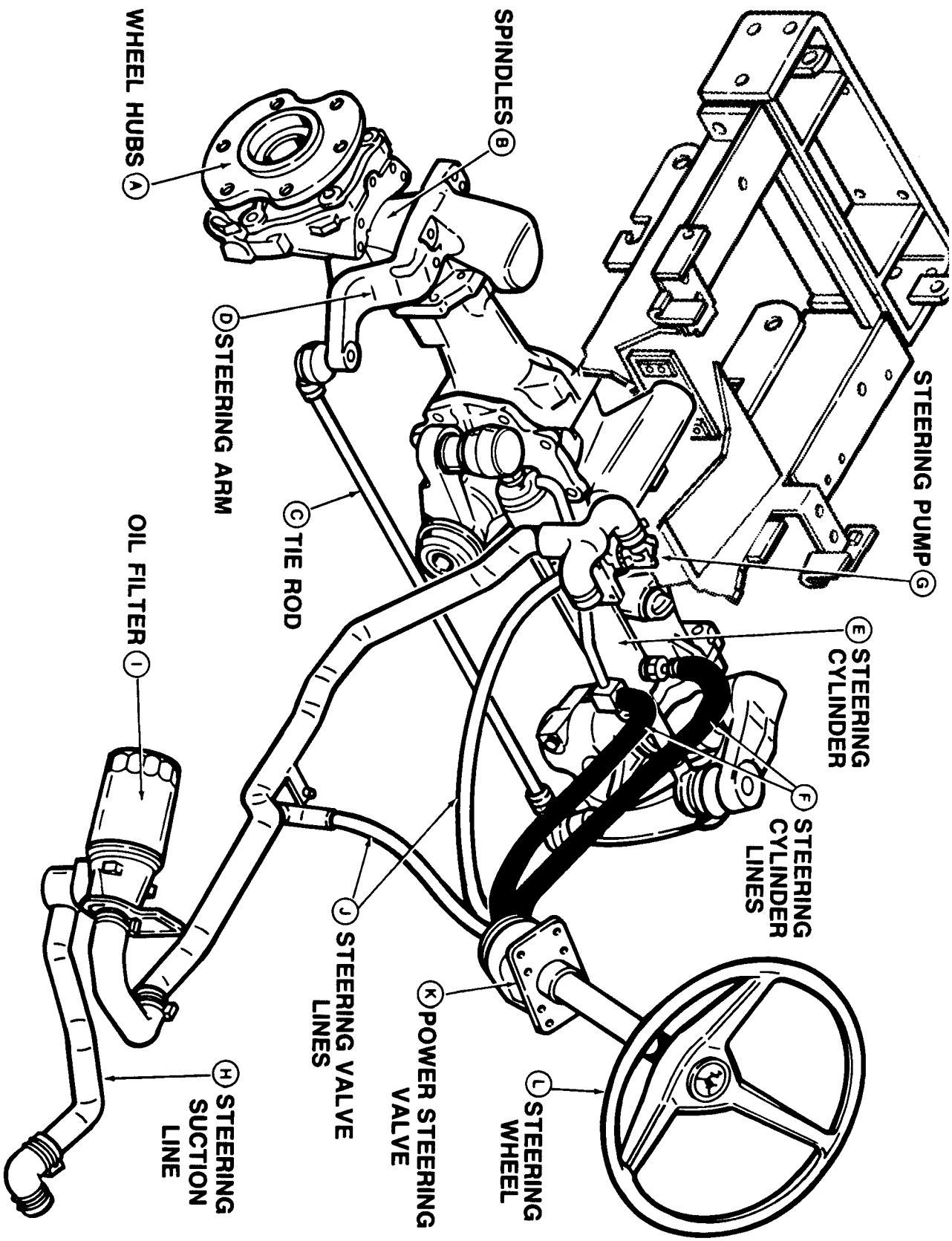
A—Wheel Hubs
B—Spindles
C—Tie Rod
D—Steering Arm
E—Steering Cylinder
F—Steering Cylinder Lines
G—Steering Pump
H—Steering Suction Line
I—Oil Filter
J—Steering Valve Lines
K—Power Steering Valve
L—Steering Wheel



STANDARD FRONT AXLE AND POWER STEERING (670, 770 AND 790)

MECHANICAL FRONT WHEEL DRIVE AND POWER STEERING (670, 770 AND 790)

A—Wheel Hubs
B—Spindles
C—Tie Rod
D—Steering Arm
E—Steering Cylinder
F—Steering Cylinder Lines
G—Steering Pump
H—Steering Suction Line
I—Oil Filter
J—Steering Valve Lines
K—Power Steering Valve
L—Steering Wheel

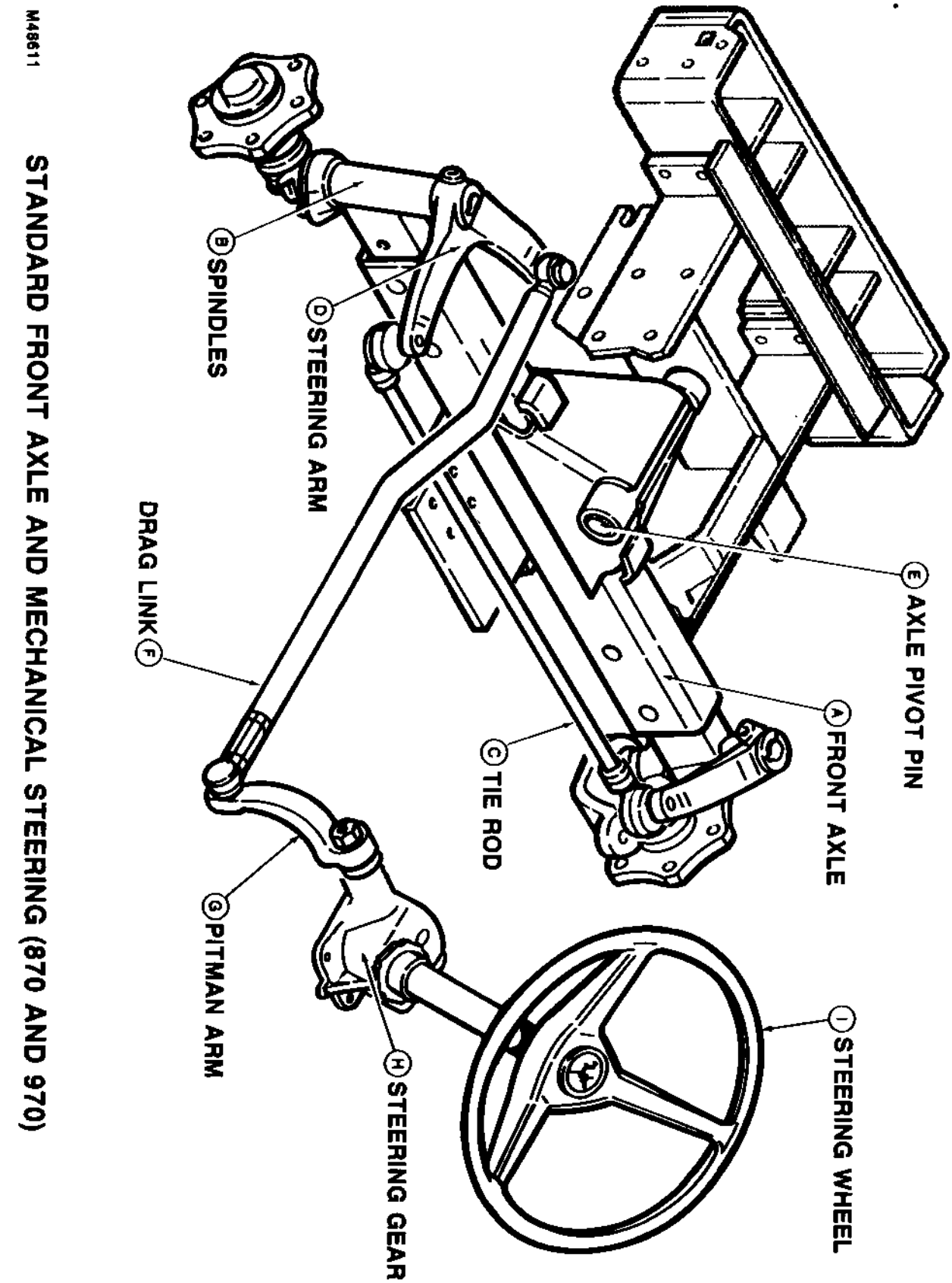


MECHANICAL FRONT WHEEL DRIVE AND POWER STEERING (670, 770 AND 790)

STANDARD FRONT AXLE AND MECHANICAL STEERING (870 AND 970)

A—Front Axle
B—Spindles
C—Tie Rod
D—Steering Arm
E—Axle Pivot Pin
F—Drag Link
G—Pitman Arm
H—Steering Gear
I—Steering Wheel

MX,26005DG,A8 -19-18DEC85



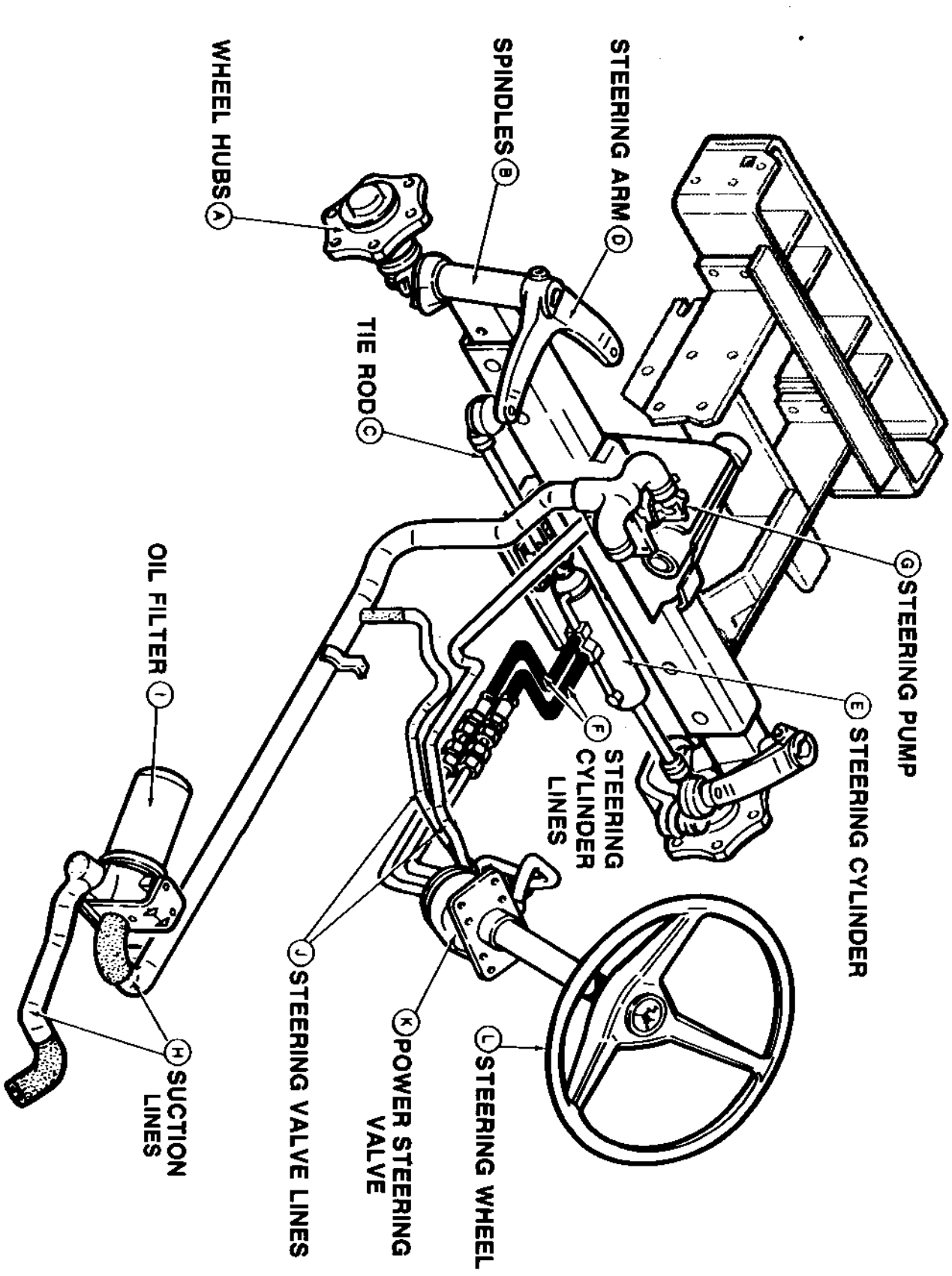
Slide No. 267

MX,26005DG,A9 -19-18DEC85

STANDARD FRONT AXLE AND POWER STEERING (870/970/1070)

A—Wheel Hubs
B—Spindles
C—Tie Rod
D—Steering Arm
E—Steering Cylinder
F—Steering Cylinder Lines
G—Steering Pump
H—Steering Suction Line
I—Oil Filter
J—Steering Valve Lines
K—Power Steering Valve
L—Steering Wheel

MX,26005DG,A10 -19-18DEC85



Slide No. 268

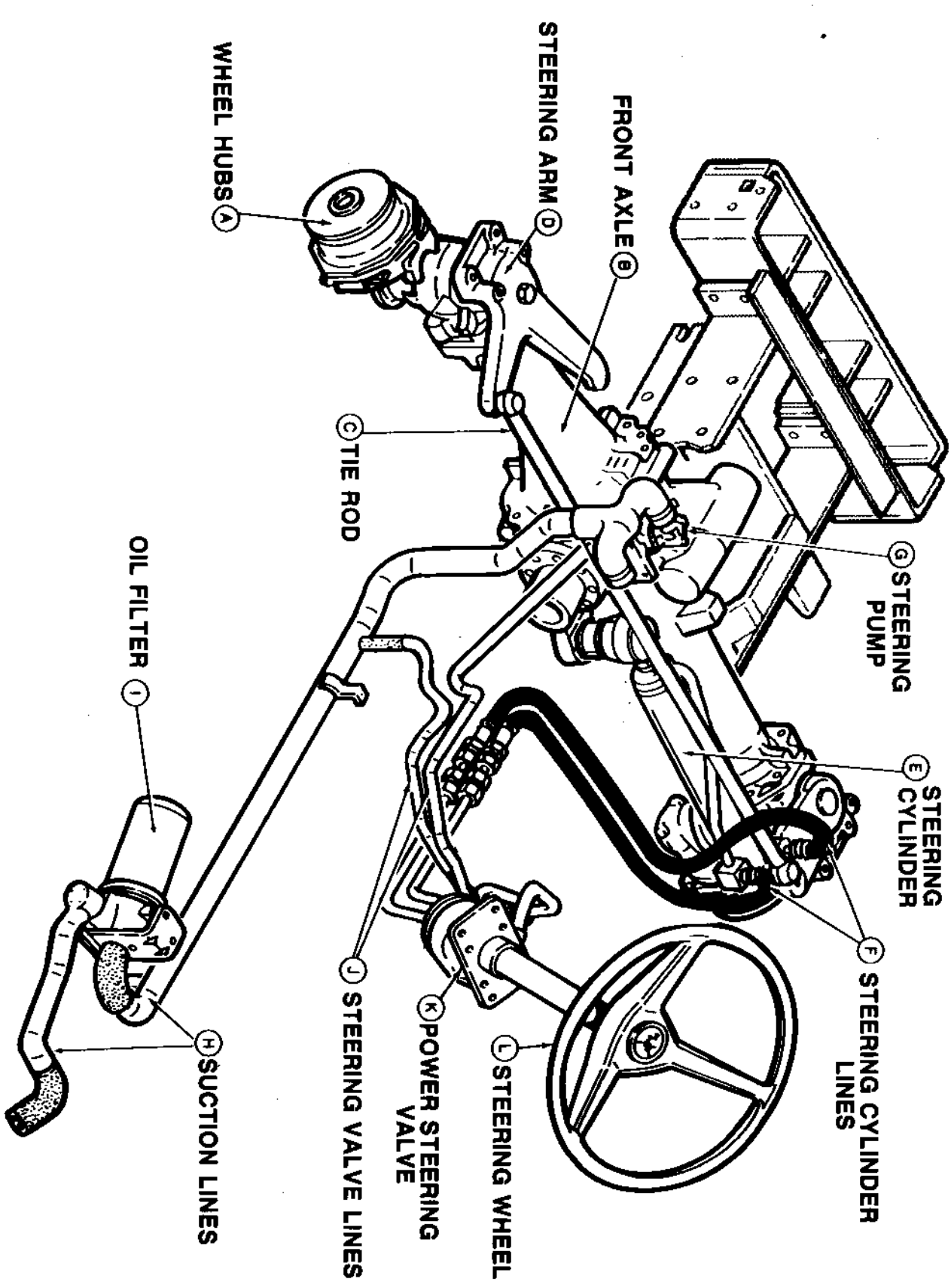
MX,26005DG,A11 -19-18DEC85

260 05 11

MECHANICAL FRONT WHEEL DRIVE AXLE AND POWER STEERING (870)

A—Wheel Hubs
B—Front Axle
C—Tie Rod
D—Steering Arm
E—Steering Cylinder
F—Steering Cylinder Lines
G—Steering Pump
H—Steering Suction Line
I—Oil Filter
J—Steering Valve Lines
K—Power Steering Valve
L—Steering Wheel

MX,26005DG,A12 -19-18DEC85



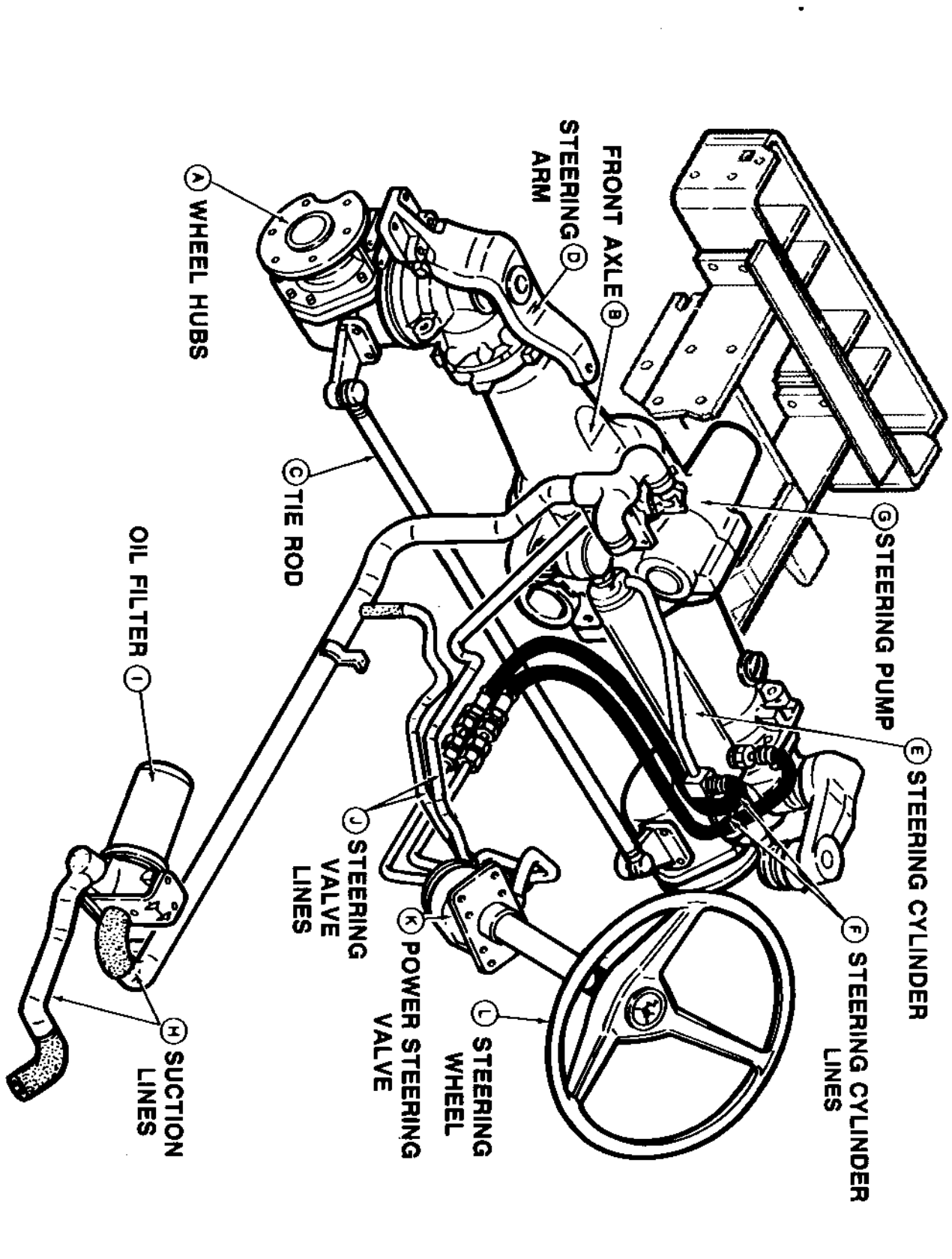
Slide No. 269

MX,26005DG,A13 -19-18DEC85

MECHANICAL FRONT WHEEL DRIVE AXLE AND POWER STEERING (970 AND 1070)

A—Wheel Hubs
B—Front Axle
C—Tie Rod
D—Steering Arm
E—Steering Cylinder
F—Steering Cylinder Lines
G—Steering Pump
H—Suction Lines
I—Oil Filter
J—Steering Valve Lines
K—Power Steering Valve
L—Steering Wheel

MX,26005DG,A14 -19-18DEC85

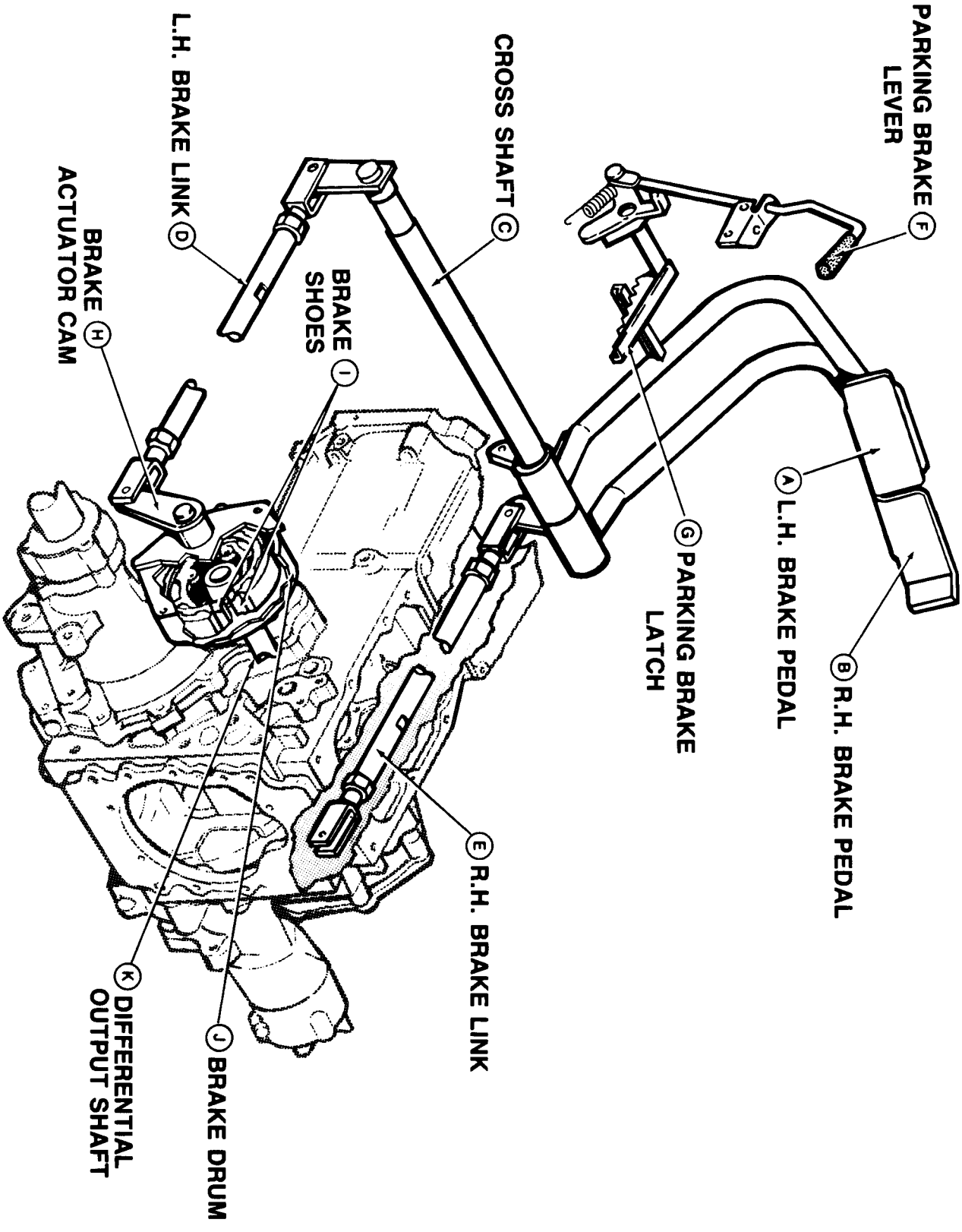


Slide No. 270

MX,26005DG,A15 -19-18DEC85

BRAKE SYSTEM (670, 770 AND 790)

A—L.H. Brake Pedal
B—R.H. Brake Pedal
C—Cross Shaft
D—L.H. Brake Link
E—R.H. Brake Link
F—Parking Brake Lever
G—Parking Brake Latch
H—Brake Actuator Cam
I—Brake Shoes
J—Brake Drum
K—Differential Output Shaft

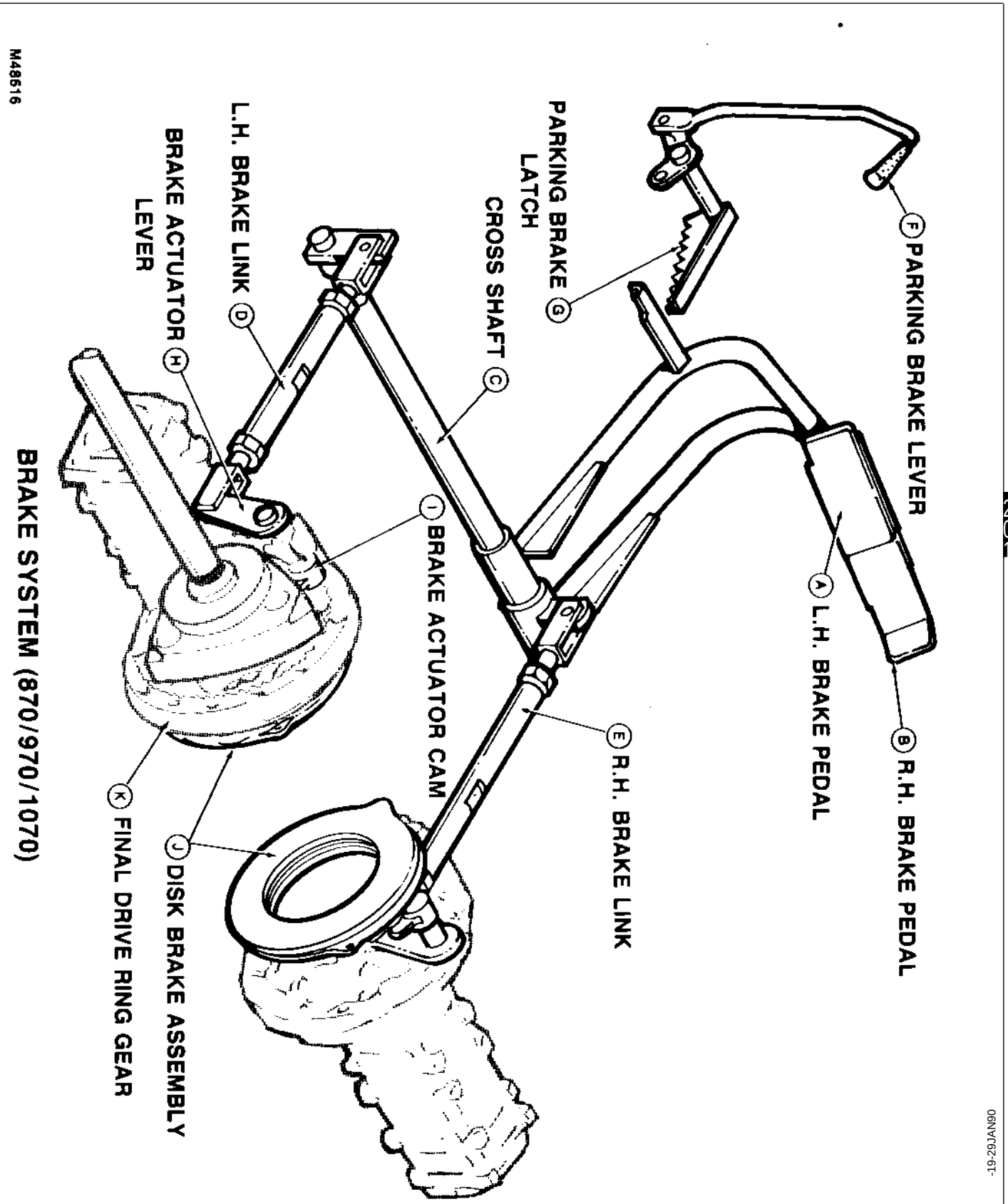


BRAKE SYSTEM (670, 770 AND 790)

BRAKE SYSTEM (870/970/1070)

A—L. H. Brake Pedal
B—R.H. Brake Pedal
C—Cross Shaft
D—L.H. Brake Link
E—R.H. Brake Link
F—Parking Brake Lever
G—Parking Brake Latch
H—Brake Actuator Lever
I—Brake Actuator Cam
J—Disk Brake Assembly
K—Final Drive Ring Gear

MX,26005DG,A18 -19-18DEC85

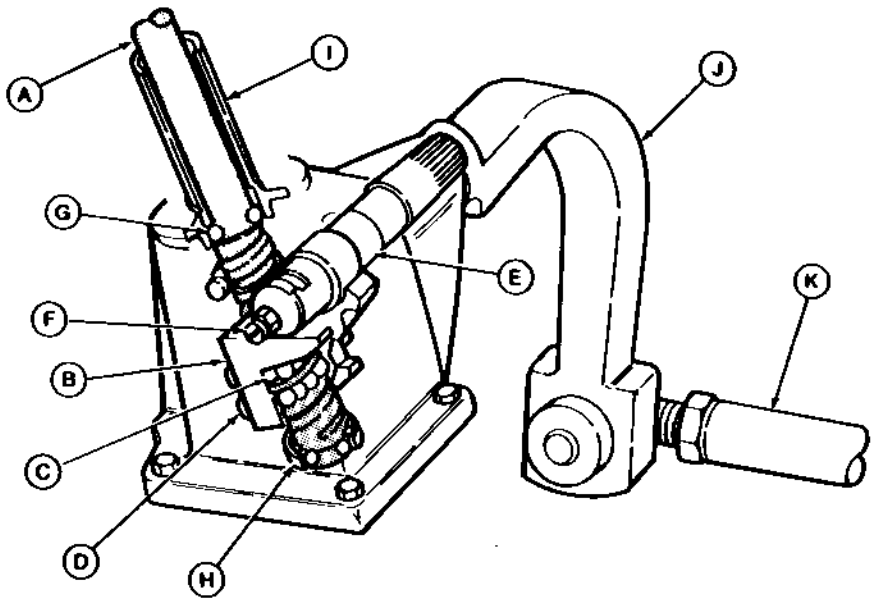


260 05 19

Slide No. 272

MX,26005DG,A19 -19-18DEC85

MANUAL STEERING GEAR OPERATION



M48617

MANUAL STEERING GEAR OPERATION

M48617

A—Steering Shaft
B—Ball Nut
C—Recirculating Balls
D—Ball Return Guides
E—Cross Shaft
F—Adjusting Screw
G—Upper Ball Bearing
H—Lower Ball Bearing
I—Steering Column
J—Pitman Arm
K—Drag Link

Slide No. 273

Manual steering is of the recirculating ball bearing, ball-nut type. The ball nut is threaded over the worm portion of the shaft.

The bore of the nut (B) had helical grooves corresponding to grooves in the steering shaft worm (A). These grooves within the ball nut (B) are filled with steel balls (C), making up two separate circuits of recirculating balls. To complete each circuit and to keep the balls from running out at the ends, the ball nut is provided with guides (D). Each guide deflects the balls from their helical path when they reach the end of the ball nut; thus returning the balls to the helical path in the ball nut at the start of a circuit.

The steering shaft (A) is supported by a bearing at the bottom of the steering column (I) and one in the bottom of the steering sector (G, H).

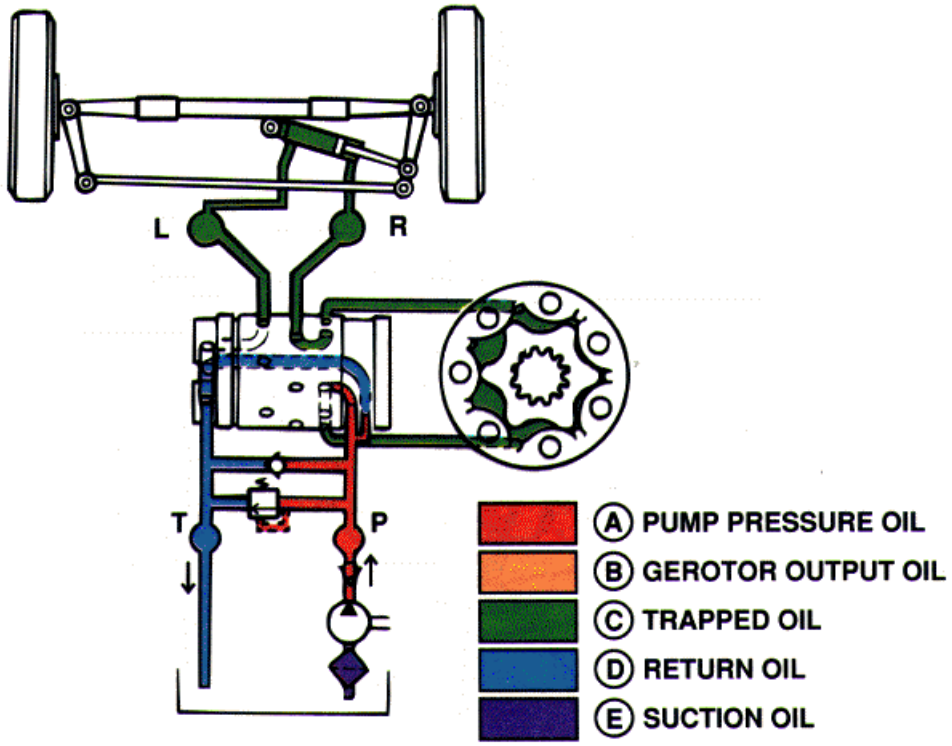
As the steering wheel is turned to the right, the ball nut (B) is threaded upward by the steering shaft worm (A). The gear teeth on the ball nut are in mesh with the gear teeth on the cross shaft (E) therefore, as the ball nut moves upward, the sector shaft is rotated moving the pittman arm (J), which is connected to the drag link, turning the wheels to the right.

Turning the wheel to the left threads the ball nut downward, rotating the sector shaft the opposite direction, turning the wheels to the right.

The steering motion is transmitted by the steering wheel shaft (A) and the ball nut (D) to the steering cross shaft (E) which is connected to the steering linkage leading to the front wheels.

MX,26010DG,A1 -19-18DEC85

POWER STEERING OPERATION



MXC48618

POWER STEERING (NEUTRAL)

MXC48618 -UN-30JUL88

Slide No. 274

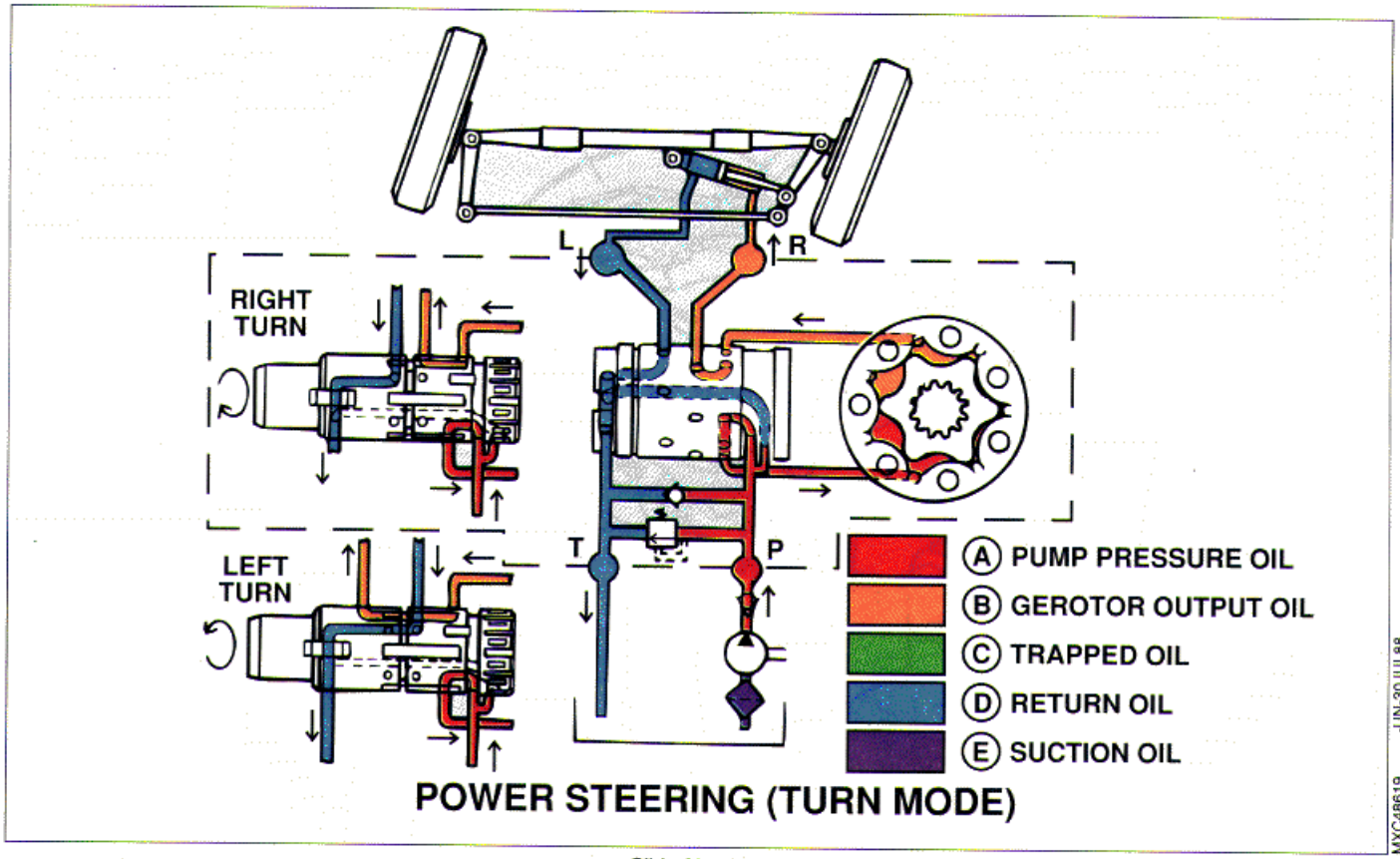
A—Pump Pressure Oil
B—Gerotor Output Oil
C—Trapped Oil
D—Return Oil
E—Suction Oil

In neutral suction oil (E) is drawn from sump, pump pressure oil (A) is routed to the valve assembly and return oil (D) is directed back to sump.

Trapped oil (C) is contained in the metering area of the valve, the steering lines and steering cylinder.

MX,26010DG,A2 -19-18DEC85

POWER STEERING OPERATION



POWER STEERING (TURN MODE)

Slide No. 275

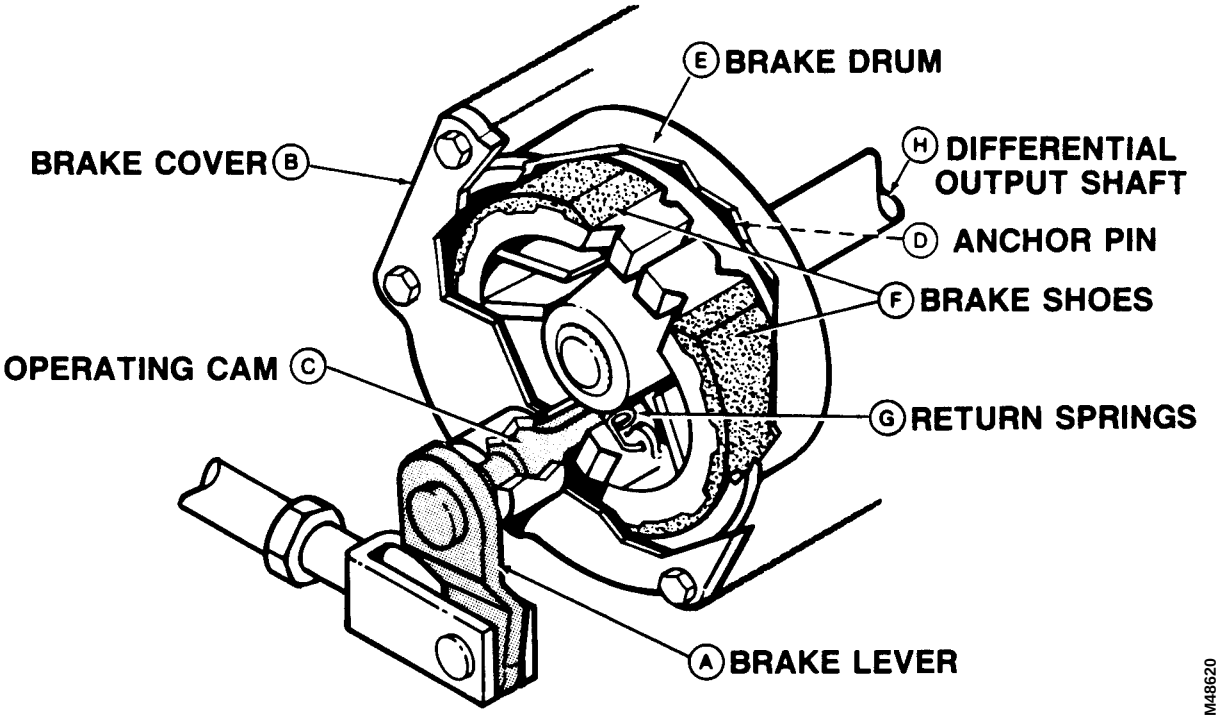
A—Pump Pressure Oil **C—Trapped Oil** **D—Return Oil** **E—Suction Oil**
B—Gerotor Output Oil

When making a turn suction oil (E) is drawn through the filter to the pump. Pump pressure oil (A) is routed through the metering valve to the gerotor. Gerotor output oil (B) is routed through the metering valve to the rod side of the cylinder when making a right turn or the piston side of the cylinder when making a left turn. Return oil (D) from the cylinder is routed through the metering valve back to the hydraulic pump suction line.

A pilot operated relief valve in the steering valve routes pump pressure oil to the return line if steering pressure becomes too high.

MX,26010DG,A3 -19-18DEC85

DRUM BRAKE OPERATION (670/770/790)



DRUM BRAKE OPERATION (670/770/790)

A—Brake Lever **C—Operating Cam** **E—Brake Drum** **G—Return Springs**
B—Brake Cover **D—Anchor Pin** **F—Brake Shoes** **H—Differential Output Shaft**

The brakes on the 670, 770 and 790 are mechanical internal expansion type. The brake drum (E) is splined onto the differential output shaft (H) on each side.

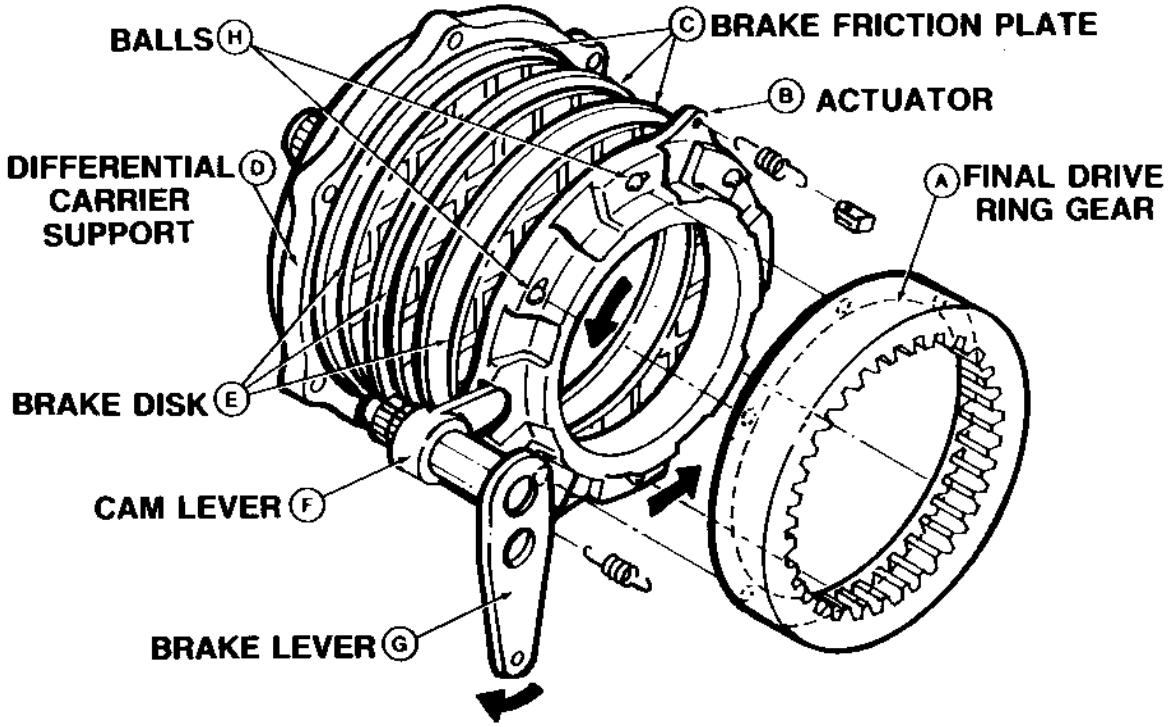
When the brake pedal is applied the brake rod rotates the operating cam (C). Rotation of the cam causes the brake shoes (F) to separate or expand against the drum. The result is that braking effect occurs on the differential output shafts.

When the brake is released the return springs pull the shoes back together.

The braking force is equal whether the brakes are applied for forward or reverse motion. The brakes operate independently since there is a linkage on both sides.

Park brake operation is a locking device to hold the brake linkage in the brake position. This is explained on page 260-10-6.

DISK BRAKE OPERATION (870/970/1070)



A—Final Drive Ring Gear
B—Actuator
C—Brake Friction Plates
D—Differential Carrier Support
E—Brake Disks
F—Cam Lever
G—Brake Lever
H—Balls

Slide No. 277

The brakes on the 870, 970 and 1070 are mechanical wet disk type.

The differential carrier support and final drive ring gear are both secured in the final drive housing. The brake friction plates are held in place by tabs. The only rotating components are the brake disks since they are splined onto the differential output shafts. There are two disks on the 870 and 970 and three disks on the 1070.

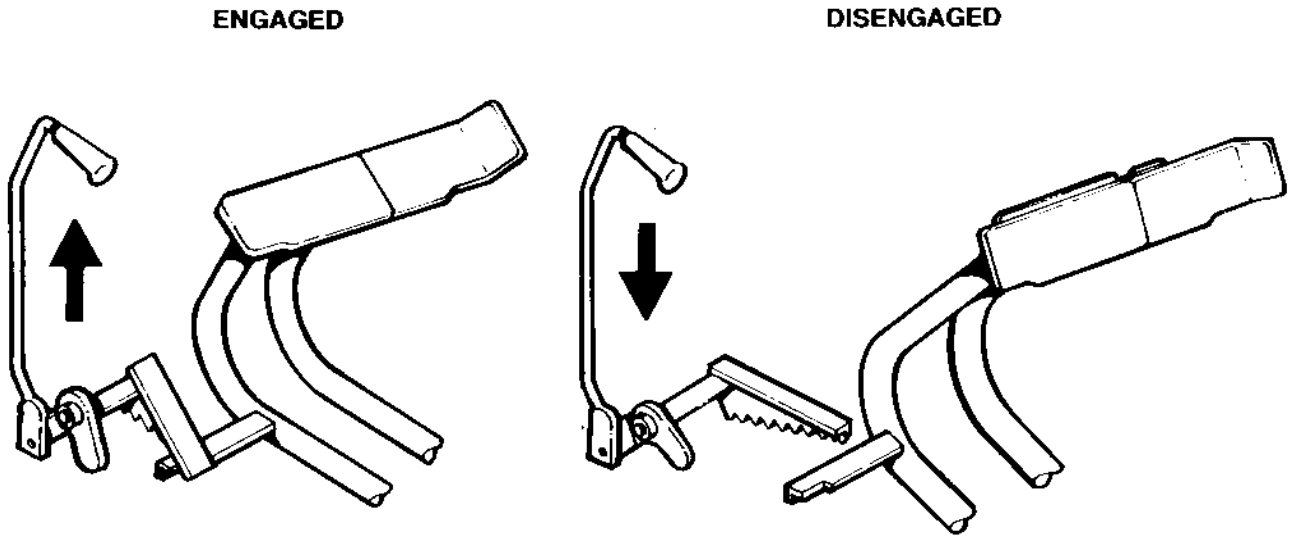
When the brake pedal is applied the brake rod pulls the brake lever forward. This rotates the cam lever which rotates the actuator. The balls stay stationary in the socket on the final drive ring gear. The slot that the balls sit in on the actuator are ramped. As the actuator rotates the balls force it toward the carrier support. This compresses the disks between the friction plates and stops rotation of the differential output shaft.

When the brake pedal is released the return springs help pull the actuator back toward the ring gear.

Park brake operation is a locking device to hold the brake linkage in the brake position. This is explained on page 260-10-6.

MX,26010DG,A5 -19-18DEC85

PARK BRAKE LOCK OPERATION



M48622

PARK BRAKE LOCK OPERATION

-19-29JAN90

M48622

Slide No. 278

The park brake linkage locks against a catch on the left brake pedal. For park brake operation the two brake pedals should be locked together so that both brakes are applied.

To engage the park brake the brake pedal must be applied. By lifting up on the park brake lever the park lock is pivoted down to hold the brake pedal. A series of pawls on the park lock allow the park lock to catch on the brake pedal in several positions. This allows park brake operation regardless of how hard the pedal is depressed or the brake pedal freeplay adjustment.

To disengage the park brake the brake pedal must be pushed down slightly before the park brake lever released. This allows the brake pedal to release from the pawl on the park lock and freeing it to be raised out of position.

The spring for the park brake indicator switch is connected to the hole in the park lock. The indicator warns the operator that the brakes are locked. The switch is adjustable see section 240.

MX,26010DG,A6 -19-18DEC85

ABOUT THIS GROUP

Follow the steps in this procedure in order to isolate the problem area.

MX,26015DG,A1 -19-18DEC85

ISOLATE THE PROBLEM (MANUAL STEERING)

TEST CONDITIONS:

• Make sure that tire inflation is correct, front ballasting is not excessive and implements are properly fitted and adjusted.

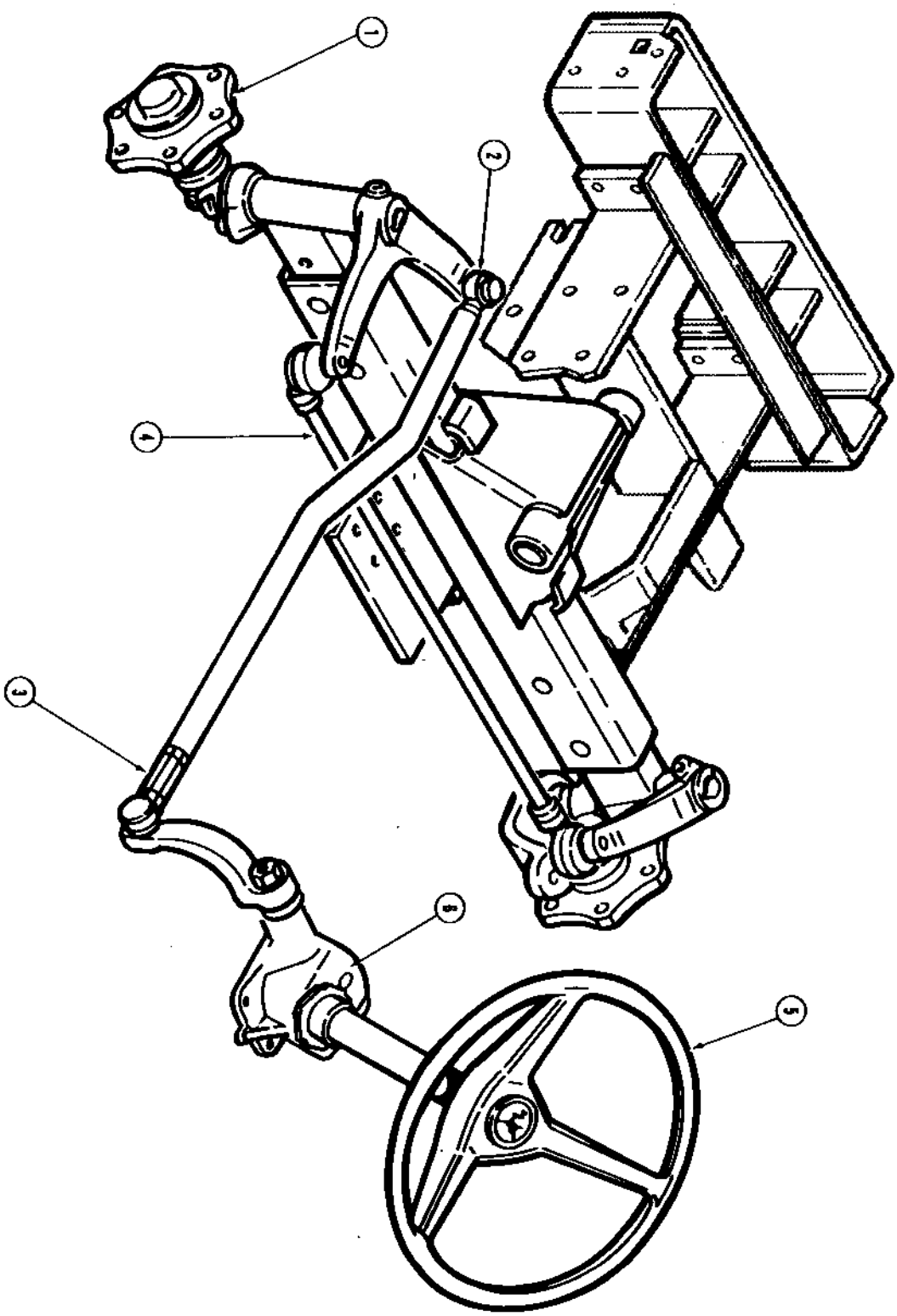
• On tractors with MFWD operate the tractor with MFWD engaged and disengaged. If a difference in steering is observed inspect the MFWD.

TEST/CHECK POINT	NORMAL	IF NOT NORMAL
NOTE: Perform tests 1 through 3 with front end blocked up.		
1. Rotate front wheels.	Wheels rotate freely (no rough areas)	Inspect front wheel bearings.
2. Disconnect drag link and turn axle by hand.	Axle turns easily by hand.	Inspect spindle bearings.
3. Check that full left and full right turns are equal.	Equal both directions	Adjust drag link
NOTE: Lower front end to ground.		
4. Check toe-in	1/8 to 3/8 inch (3 to 9 mm)	Adjust tie rod
5. Check steering wheel freeplay at outer rim.	Less than 2 inches (50 mm)	Adjust gear box backlash.
6. Disconnect drag link and check operation of gearbox.	Smooth with no rough spots.	Inspect gear box.

MX,26015DG,A2 -19-18DEC85

M48623

MANUAL STEERING PROBLEM ISOLATION



M48623 -19-17JAN90

Slide No. 279

MX,26015DG,A3 -19-18DEC85

ISOLATE THE PROBLEM (POWER STEERING)

TEST CONDITIONS

- Make sure tire inflation is correct, front ballasting is not excessive and implements are properly fitted and adjusted.
- On tractors with MFWD operate the tractor with MFWD engaged and disengaged. If a difference in steering is notice with the MFWD engaged inspect the front axle.
- Inspect complete system for leakage. Locate the source of leakage and make any necessary repairs.
- Make sure hydrostatic oil level is correct.

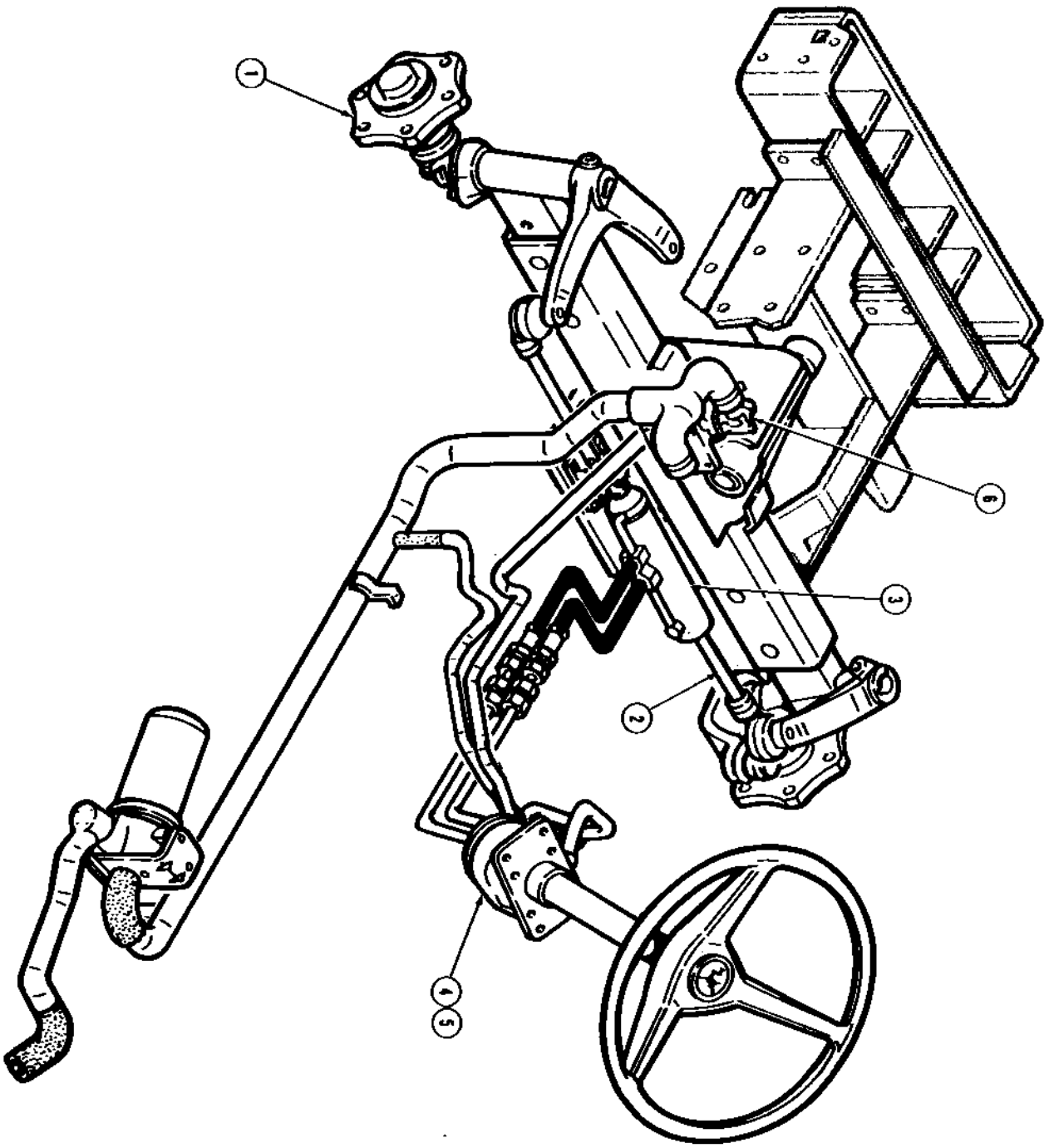
TEST/CHECK POINT	NORMAL	IF NOT NORMAL
NOTE: Perform tests 1 and 2 with front end blocked up.		
1. Rotate front wheels.	Wheels rotate freely (no rough areas)	Inspect front wheel bearings.
2. Disconnect steering cylinder and turn axle by hand.	Axle turns easily by hand.	Inspect spindle bearings.
NOTE: Lower front of tractor to ground. Warm up hydraulic oil to 43˚C (110˚F).		
3. Check steering cylinder for leakage.	No leakage	Replace cylinder
4. Check steering relief valve pressure.	8274—9653 kPa (1200 to 1400 PSI)	Replace valve
5. Check steering valve leakage.	Less than 5 rpm	Repair or replace valve
6. Check steering pump flow.	15.1 L/m @ 2600 rpm (4 gpm @ 2600 rpm)	Clean sump screen. Inspect sump line. Replace filter. Repair pump.

260 15 4

MX,26015DG,A4 -19-18DEC85

M48624

POWER STEERING PROBLEM ISOLATION



M48624 -19-17JAN90

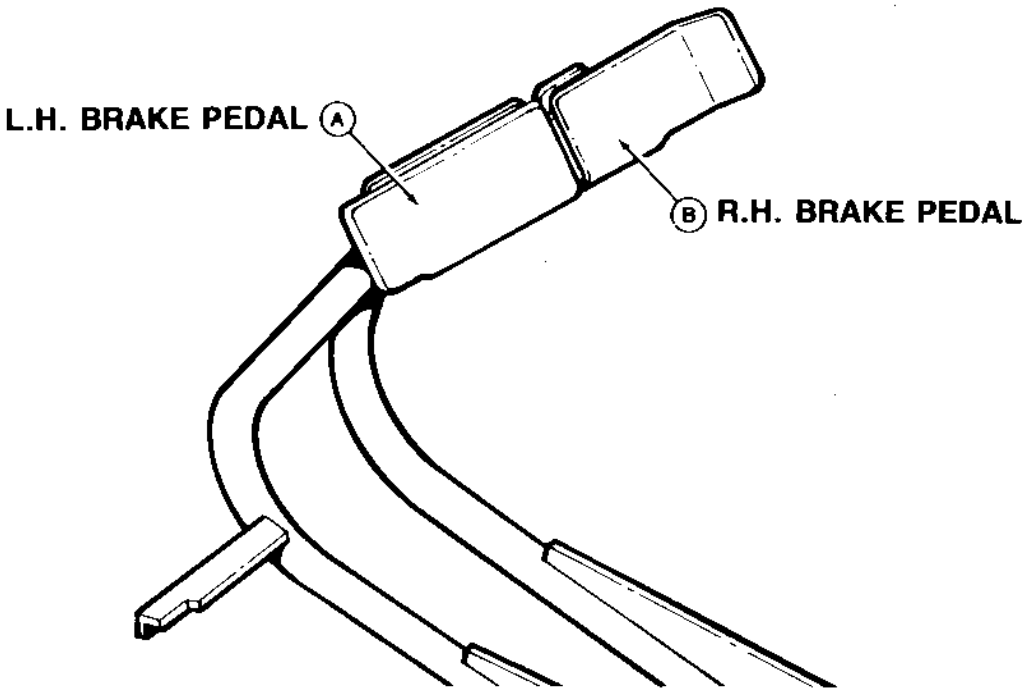
Slide No. 280

MX,26015DG,A5 -19-18DEC85

ISOLATE THE PROBLEM (BRAKES)

TEST/CHECK POINT	NORMAL	IF NOT NORMAL
1. Apply each brake individually to check pedal freeplay.	35 mm (1-3/8 in.) on each side.	Adjust freeplay
2. Apply and release each brake individually to check pedal return.	Both pedals return smoothly.	Inspect return springs. Inspect linkage for damage or binding. Inspect internal brake components.
3. Operate tractor on flat surface. Allow it to roll with clutch depressed.	Tractor does not pull to one side.	Inspect internal brake components on side tractor pulls toward.
4. Operate tractor on flat surface. Allow it to roll with clutch depressed and apply both brakes evenly.	Tractor stops without pulling to one side.	Inspect internal brake components on side opposite the direction the tractor pulled to.
5. Operate tractor on flat surface. Allow it to roll with clutch depressed and apply each brake separately.	Tractor slows and pulls slightly to one side without noise or vibration.	Inspect internal components on side indicating noise or vibration.

MX,26015DG,A6 -19-18DEC85



M48625

ISOLATE BRAKE PROBLEMS

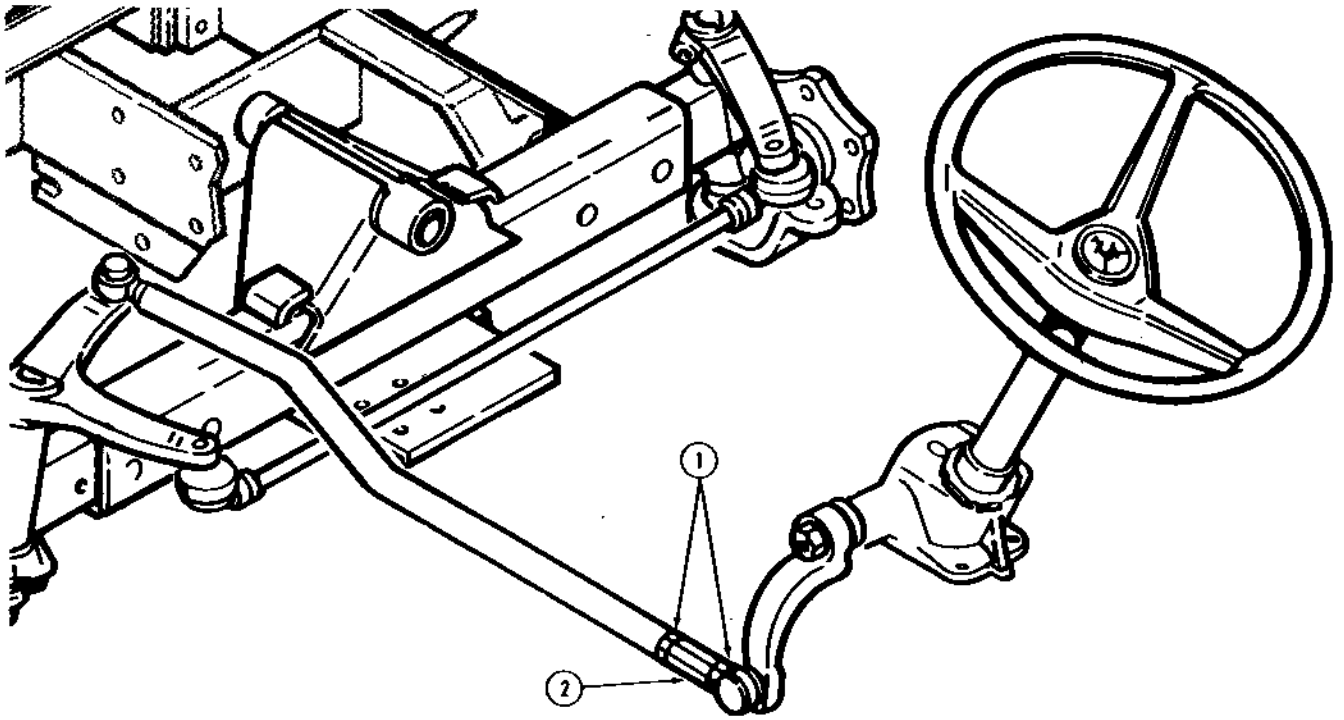
Slide No. 281

MX,26015DG,A7 -19-18DEC85

-19-29JAN90

M48625

MANUAL STEERING DRAG LINK ADJUSTMENT (870/970/1070)



M48626

DRAG LINK ADJUSTMENT

Slide No. 282

-19-17JAN90
M48626

REASON FOR ADJUSTMENT:

If the number of turns at the steering wheel from straight to full left and straight to full right are not equal.

ADJUSTMENT PROCEDURE:

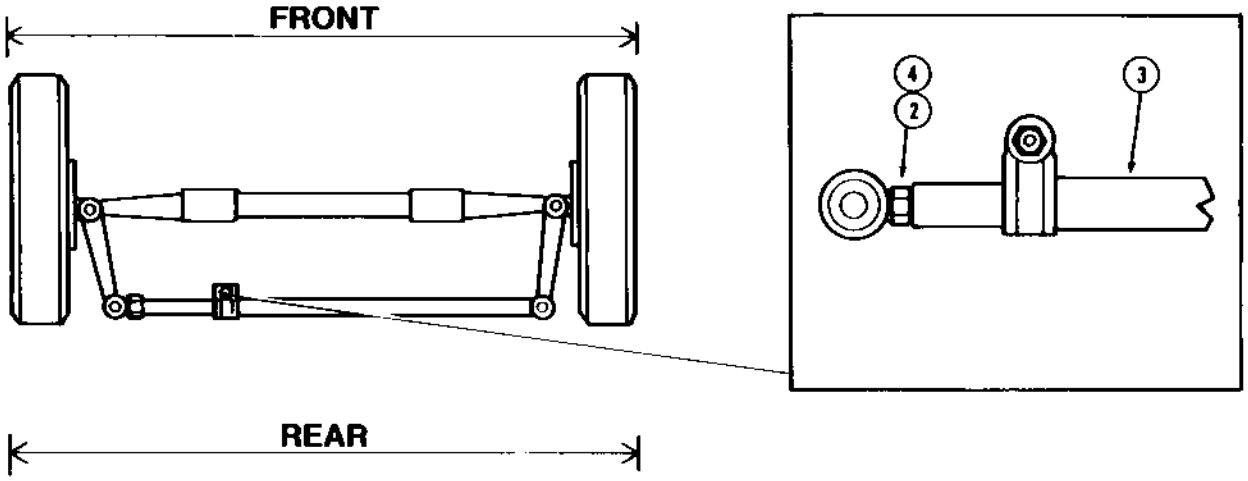
1. Loosen lock nuts.

2. Use turnbuckle to lengthen or shorten drag link until left turn and right turn are equal.

3. Tighten lock nuts.

MX,26015DG,A8 -19-18DEC85

TOE-IN ADJUSTMENT



M48627

M48627

TOE-IN ADJUSTMENT

Slide No. 283

REASON FOR ADJUSTMENT:

To reduce tire wear and drag set the front of the tire slightly narrower than the rear.

ADJUSTMENT PROCEDURE

1. Measure distance between front edge and rear edge of tires.

2. Loosen lock nut on left and right sides.

3. Lengthen or shorten tie rod until rear dimension is 3—9 mm (1/8 to 3/8 in.) wider than the front.

4. Tighten lock nuts.

MX,26015DG,A9 -19-18DEC85

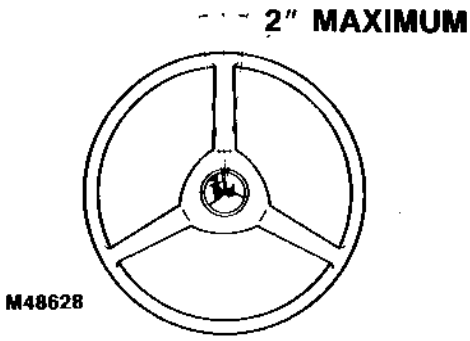
CHECKING MANUAL STEERING GEARBOX FREEPLAY

1. Position front wheels straight so that gearbox is at center of travel.

2. Rotate steering wheel right and left to check freeplay.

3. Less than 50 mm (2 in.) of freeplay at out rim of steering wheel should exist.

4. If excessive adjust gearbox backlash.



Slide No. 284

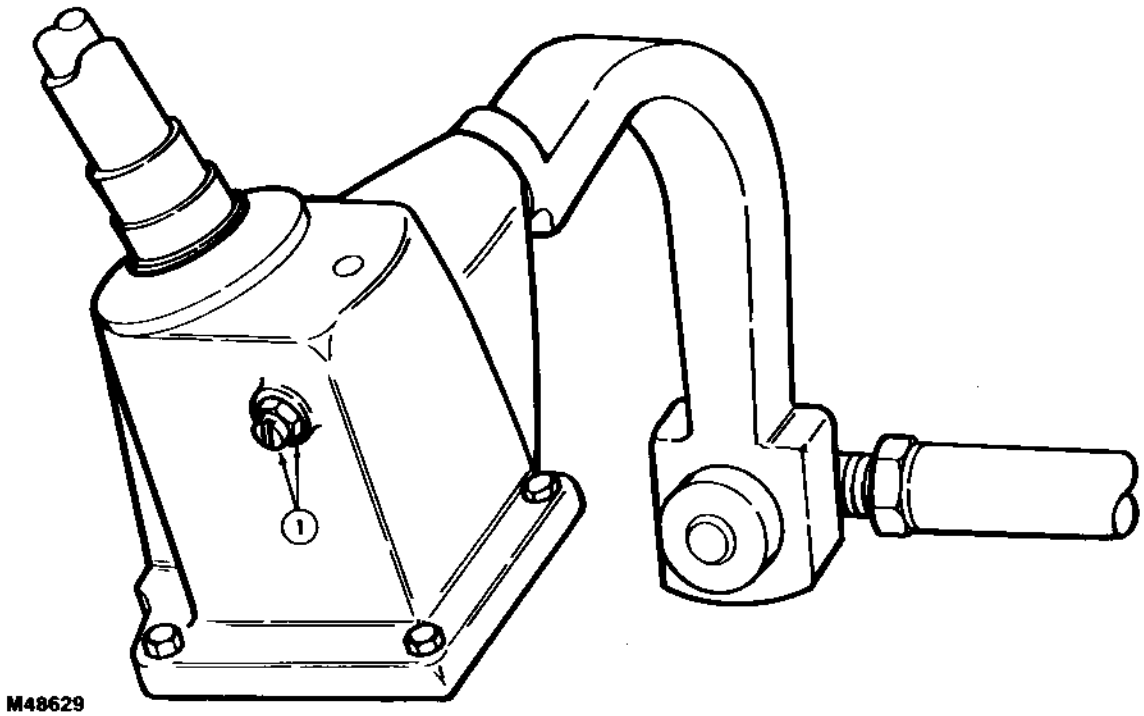
-19-17JAN90

M48628

MX,26015DG,A10 -19-18DEC85

260
15
10

MANUAL STEERING GEARBOX BACKLASH ADJUSTMENT



MANUAL STEERING GEARBOX BACKLASH ADJUSTMENT

M48629

Slide No. 285

1. Make sure that gearbox is in the center of travel by turning the steering wheel full left, full right then halfway.

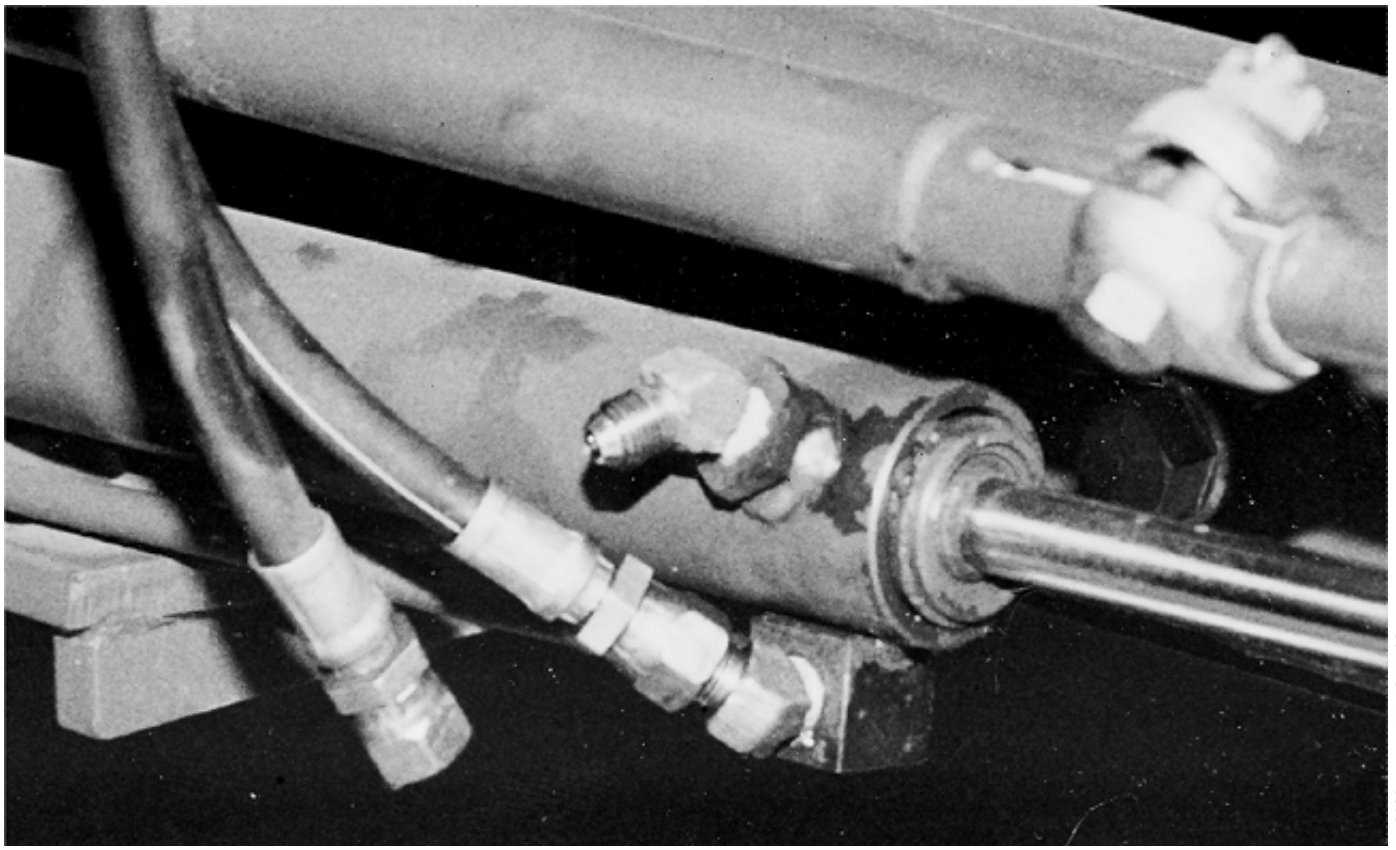
2. Loosen the lock nut on the gearbox adjusting screw.

3. Turn adjusting screw in until steering wheel becomes difficult to turn. Then back adjusting screw out 1/4 turn.

4. Tighten lock nut.

MX,26015DG,A11 -19-18DEC85

POWER STEERING CYLINDER LEAKAGE TEST



Slide No. 286

REASON FOR TEST:

To determine if internal leakage in the steering cylinder is the cause for the steering to be sluggish or allowing the steering to wander.

TEST PROCEDURE:

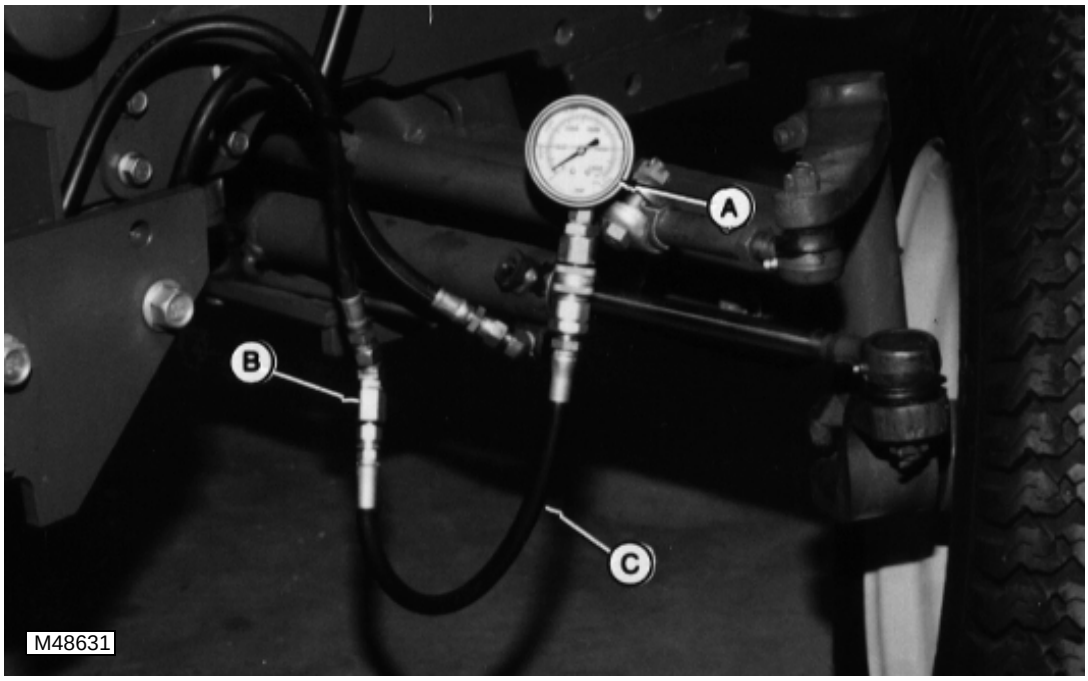
- Turn steering wheel to a full left to fully extend the cylinder.
- Shut engine off.
- Remove the line to rod end of cylinder.
- Start engine and run at high idle.
- Continue to turn steering wheel to left.
- Watch for any flow of oil out of cylinder.

TEST RESULTS:

If any flow of oil out of the return side of cylinder occurred there is internal leakage in that cylinder. Repair or replace the cylinder.

MX,26015DG,A12 -19-18DEC85

STEERING VALVE RELIEF TEST



REASON FOR TEST:

To determine if steering relief valve is set at the correct pressure or is leaking. Low relief pressure or leakage will cause hard steering and wander. Leakage or high pressure can possibly overheat the oil.

TEST PREPARATION:

Heat the hydraulic oil to 110°F as described on page 270-15-6.

TEST EQUIPMENT REQUIRED:

A-JTO 3345 3000 PSI gauge w/coupler

B-JTO 3017 Hose assembly

C-JTO 3018 Adaptor 7/16-20 M 37° x 1/4 FNPT

TEST CONNECTIONS:

- Remove line to rod end of steering cylinder.
- Install JTO 3018 Adaptor in end of cylinder line.
- Connect JTO 3017 hose and JTO 3345 gauge.

TEST PROCEDURE:

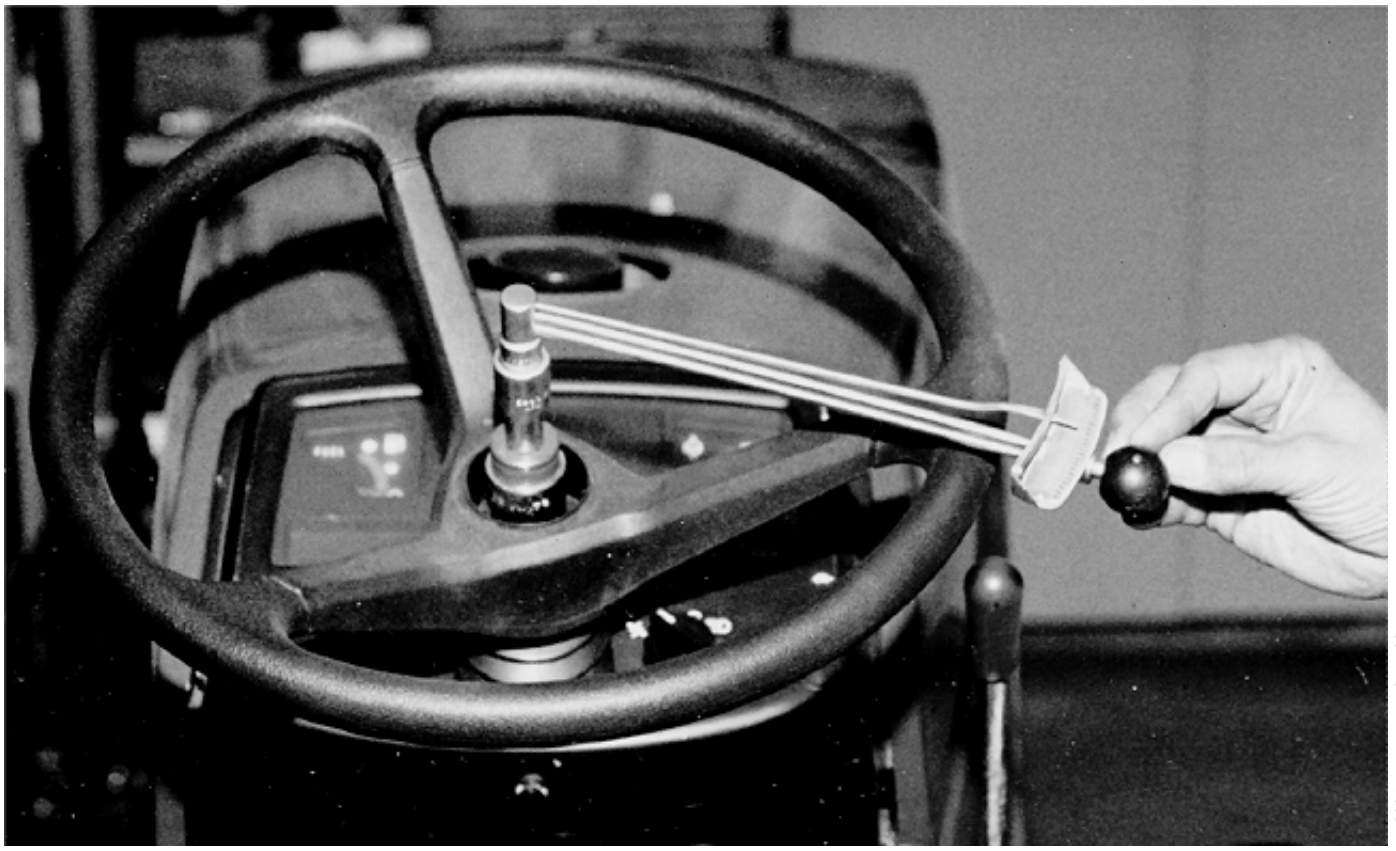
- Run engine at high idle.
- Turn steering wheel full right and continue turning while observing gauge.

TEST RESULTS:

Gauge reading should be 8274—9653 kPa (1200—1400 psi).

If reading is not within above range, replace the relief valve.

POWER STEERING VALVE LEAKAGE TEST



Slide No. 288

REASON FOR TEST:

To determine if leakage with the steering valve itself is causing hard steering or wander.

TEST PREPARATION:

• Heat the hydraulic oil to 160˚F as described on page 270-15-6.

TEST PROCEDURE:

• Remove the steering wheel cap.
• Turn the steering wheel to full right.
• Run engine at high idle.
• With a torque wrench turn the steering wheel nut in the same direction maintaining 60 in. lbs. torque.
• Observe number of rotations of the steering wheel occurs in one minute.

TEST EQUIPMENT REQUIRED:

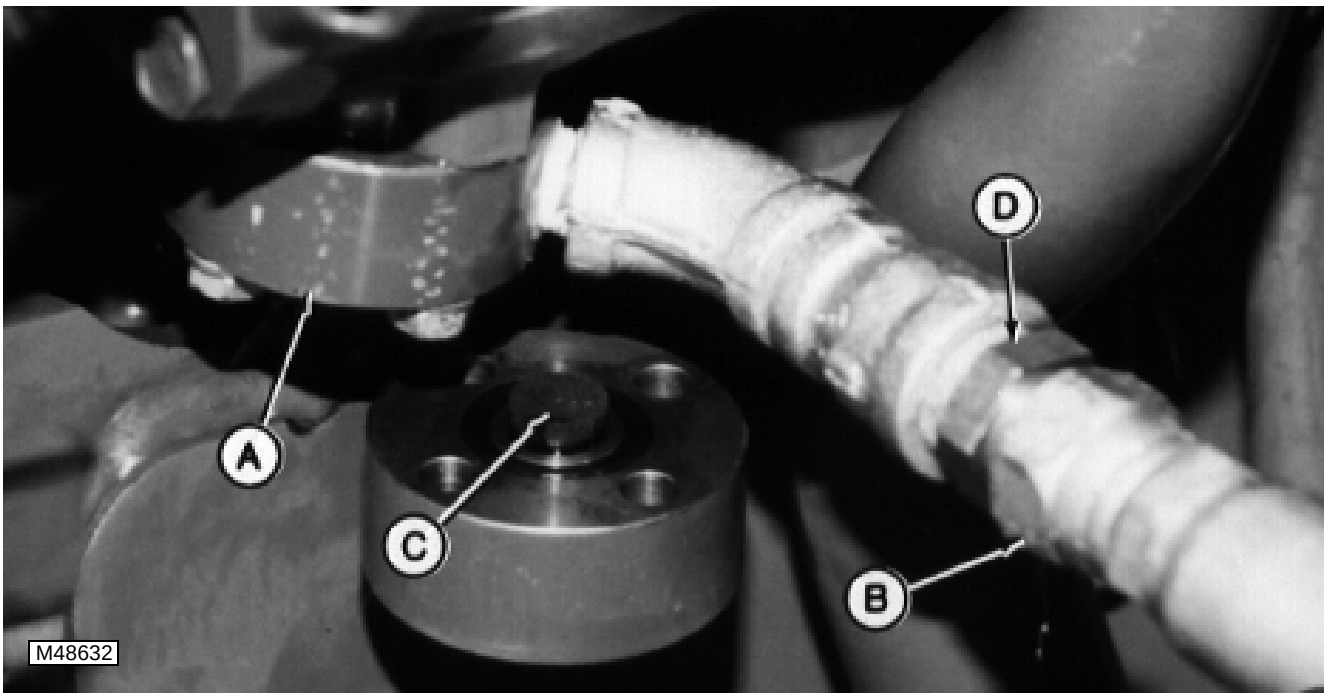
Torque Wrench

TEST RESULTS:

If steering wheel turns more than 5 revolutions in one minute there is excessive internal leakage in the steering valve.

NOTE: Make sure that you have confirmed that the steering cylinder is not leaking and the steering system did not go over relief during the test.

MX,26015DG,A14 -19-18DEC85



POWER STEERING PUMP FLOW TEST

REASON FOR TEST:

To determine if power steering pump is providing adequate flow under pressure.

TEST EQUIPMENT REQUIRED:

A. JDG 694 Pump Test Fitting.

B. JTO 5469 Flowmeter Hose.

C. AHT 8740-F12 Rubber Plug #000.

D. If flowmeter with 3/4" 37° flare is being used you will also need JTO 3049 adaptor (3/4-16 M ORB X 3/4-16 M 37°).

TEST CONNECTION:

1. Disconnect pump line.
2. Bolt pump test fitting (A) to pump.
3. Install adaptor (D) if flowmeter has 3/4" 37° flare end.
4. Connect flowmeter (B) to fitting.
5. Insert return end of flowmeter in hydraulic oil fill hole.
6. Insert plug (C) in pump line to prevent air from being drawn through steering valve during test.

TEST PROCEDURE:

- Fully open flowmeter control valve.
- Start tractor and run at 2600 rpm.
- Slowly close control valve until gauge reads 1600 psi.
- Observe flow than release pressure.

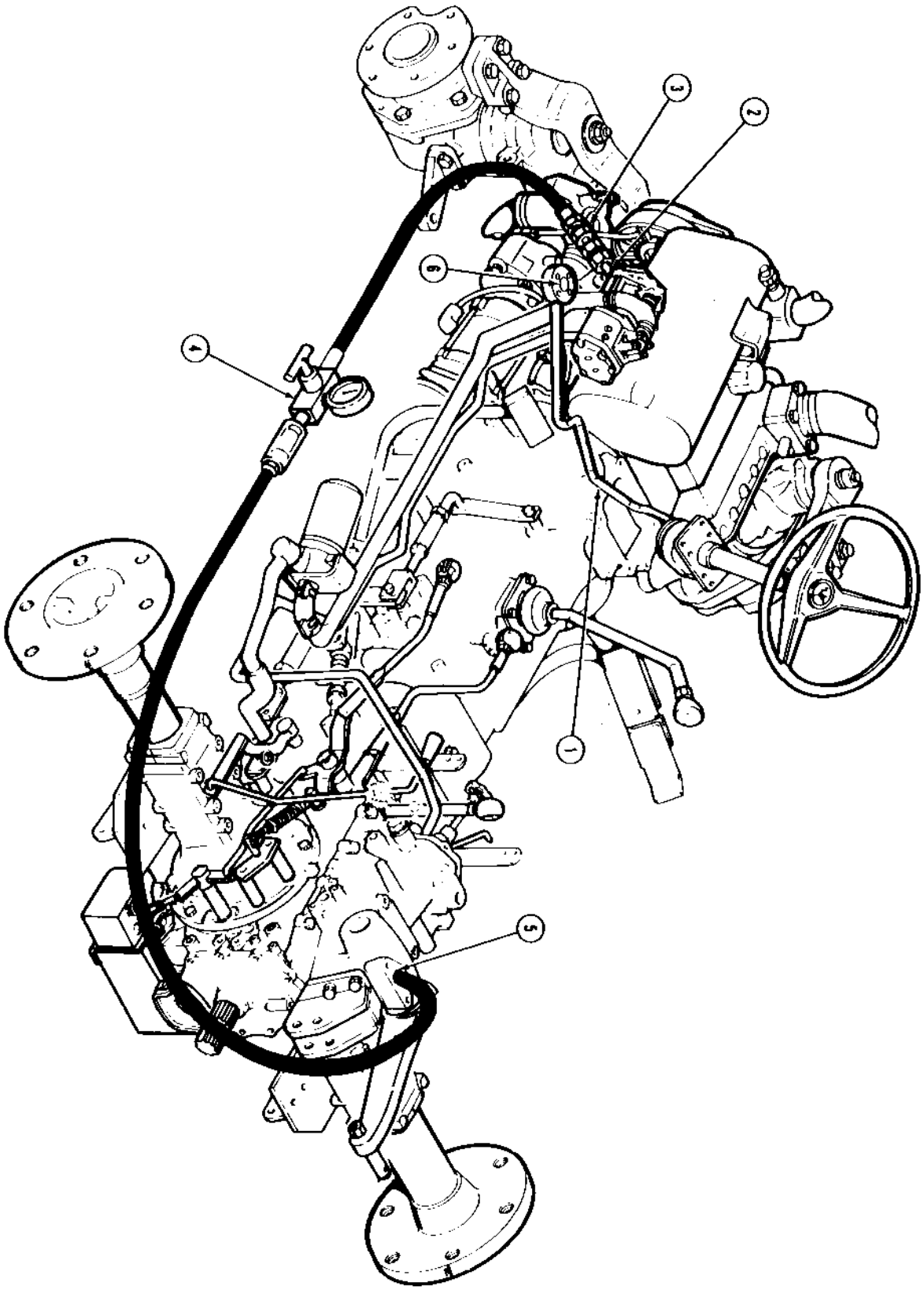
TEST RESULTS:

If flow was less than 4 GPM:

- The sump screen may be plugged not allowing full flow.
- The sump line may be restricted or leaking air
- The optional filter may be restricted.
- The pump is worn or damaged.

M48633

POWER STEERING PUMP FLOW TEST

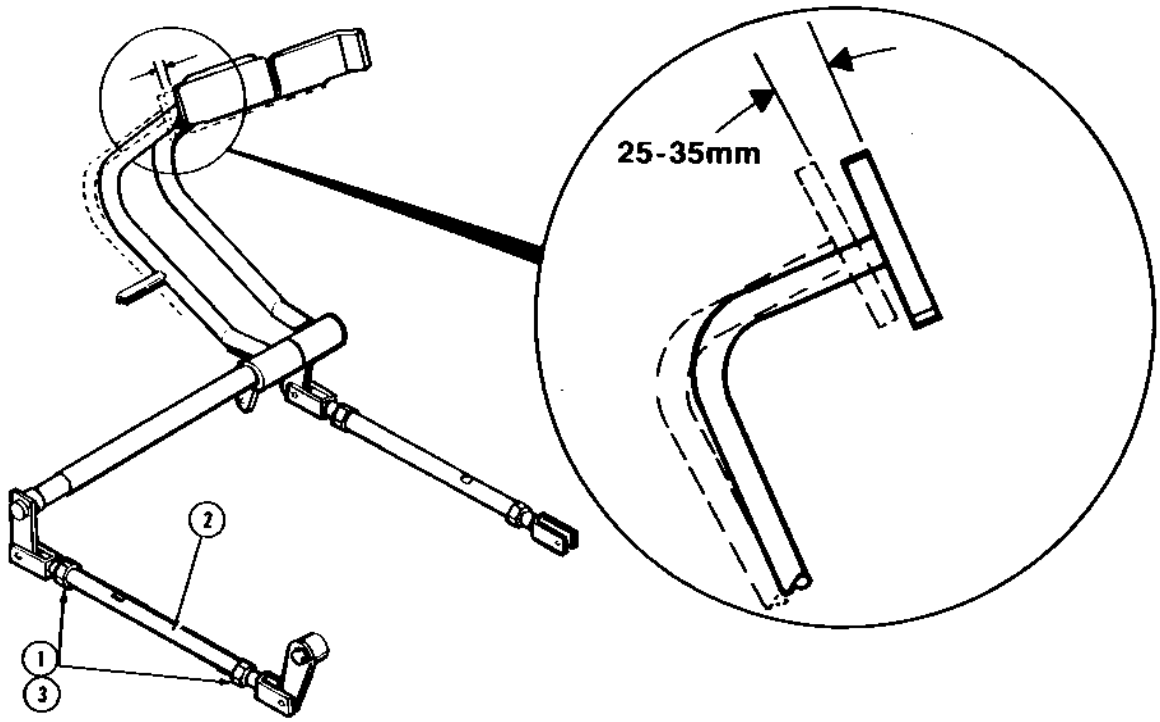


M48633 -19-29JAN90

Slide No. 290

MX,26015DG,A16 -19-18DEC85

BRAKE PEDAL FREEPLAY ADJUSTMENT



M48635

BRAKE PEDAL FREEPLAY ADJUSTMENT

Slide No. 291

M48635

REASON FOR ADJUSTMENT:

To make sure that the brakes are not dragging depressed together.

CHECK ADJUSTMENT:

Depress each pedal separately to check freeplay. The pedal should travel 25 mm to 35 mm before you feel resistance.

ADJUSTMENT PROCEDURE:

1. Loosen locknuts on brake rod.
2. Use the turnbuckle to lengthen or shorten the brake rod until pedal travel is correct.
3. Tighten locknuts.

MX,26015DG,A17 -19-18DEC85

Section 270
HYDRAULIC SYSTEM

Contents

Page

Group 05—Hydraulic Component Location

About the Hydraulic System 270-05-1
Hydraulic System Component Location . . . 270-05-2
670/770/790 Rockshaft Housing
Component Location 270-05-4
870/970/1070 Rockshaft Housing
Component Location 270-05-6
Rockshaft Valve
670/770/790 270-05-8
870/970/1070 270-05-9
Rockshaft Control Linkage
670/770/790 270-05-10
870/970/1070 270-05-12
1070 Rockshaft Feedback Linkage 270-05-14
Selective Control Valve
Component Location
670/770/790 270-05-16
870/970/1070 270-05-18
Rear Outlets
Without SCV
670/770/790 270-05-21
870/970/1070 270-05-23
With SCV
870/970/1070 270-05-24

Group 10—Theory of Operation

About this Group 270-10-1
Hydraulic System Oil Supply 270-10-2
670/770/790 Rockshaft Housing Oil Flow
Without SCV
Neutral 270-10-4
Raise 270-10-6
Lower 270-10-8
With SCV 270-10-9a
870/970/1070 Rockshaft Housing
Without SCV
Neutral 270-10-10
Raise 270-10-12
Lower 270-10-14
With SCV 270-10-15a
Rockshaft Valve Oil Flow
Neutral 270-10-16
Feathered Raise 270-10-17
Full Raise 270-10-18
Lower 270-10-19

Page

System Relief Valve Operation
670/770/790 270-10-20
870/970/1070 270-10-21
Rockshaft Relief Valve Operation
670/770/790 270-10-22
870/970/1070 270-10-23
670/770/790 Rate of Drop/Stop
Valve Operation
Rockshaft Raise 270-10-24
Rockshaft Lower 270-10-25
870/970/1070 Rate of Drop/Stop
Valve Operation
Rockshaft Raise 270-10-26
Rockshaft Lower 270-10-27
Rockshaft Valve Position
Control Linkage Operation
670/770/790 270-10-28
870/970/1070 270-10-30
1070 Rockshaft Valve Draft
Sensing Linkage Operation 270-10-32
Selective Control Valve Oil Supply
670/770/790 270-10-34
870/970/1070 270-10-36
Selective Control Valve Oil Flow
Neutral 270-10-38
Boom Spool Raise 270-10-39
Boom Lower 270-10-40
Boom Spool Float 270-10-41
Bucket Curl 270-10-42
Bucket Dump 270-10-43
Bucket Regenerative 270-10-44
Rear Outlet Oil Supply
Without SCV 270-10-45
With SCV 270-10-46
Hydraulic Oil Filter Operation 270-10-47

Continued on next page

Page

Group 15—Diagnosis and Test
Preliminary Hydraulic
System Inspection 270-15-1
Without SCV 270-15-2
With SCV 270-15-4
Heating Hydraulic Oil 270-15-6
System Relief Valve Test
Without SCV
670/770/790 270-15-7
870/970/1070 270-15-8
With SCV 270-15-9
Pump Flow Test
Without SCV 270-15-10
With SCV 270-15-12
Test Rockshaft Leakage 270-15-14
Rockshaft Lift Cycle Test 270-15-16
Rockshaft Sensing Linkage Adjustments
Position Control Feedback Linkage . . . 270-15-17
Rockshaft Draft Control Feedback Linkage
Lever Neutral Adjustment. 270-15-18
Neutral Stop Adjustment 270-15-18
Adjust System Relief Valve. 270-15-19
Adjust Rockshaft Relief Valve. 270-15-20

Group 15—Hydraulic Schematic
670/770/790 Schematic 270-20-1
870/970/1070 Schematic 270-20-2

Hydraulic System Component Locations

ABOUT THE HYDRAULIC SYSTEM

Rockshaft hydraulics is standard on all models. Position sensing linkage controls the rockshaft hydraulics. The 1070 also has draft sensing linkage to control depth automatically at different implement loads.

An oil filter is available as a field installed option or comes with the tractor if it is ordered with power steering.

The hydraulic pump sizes vary by model.

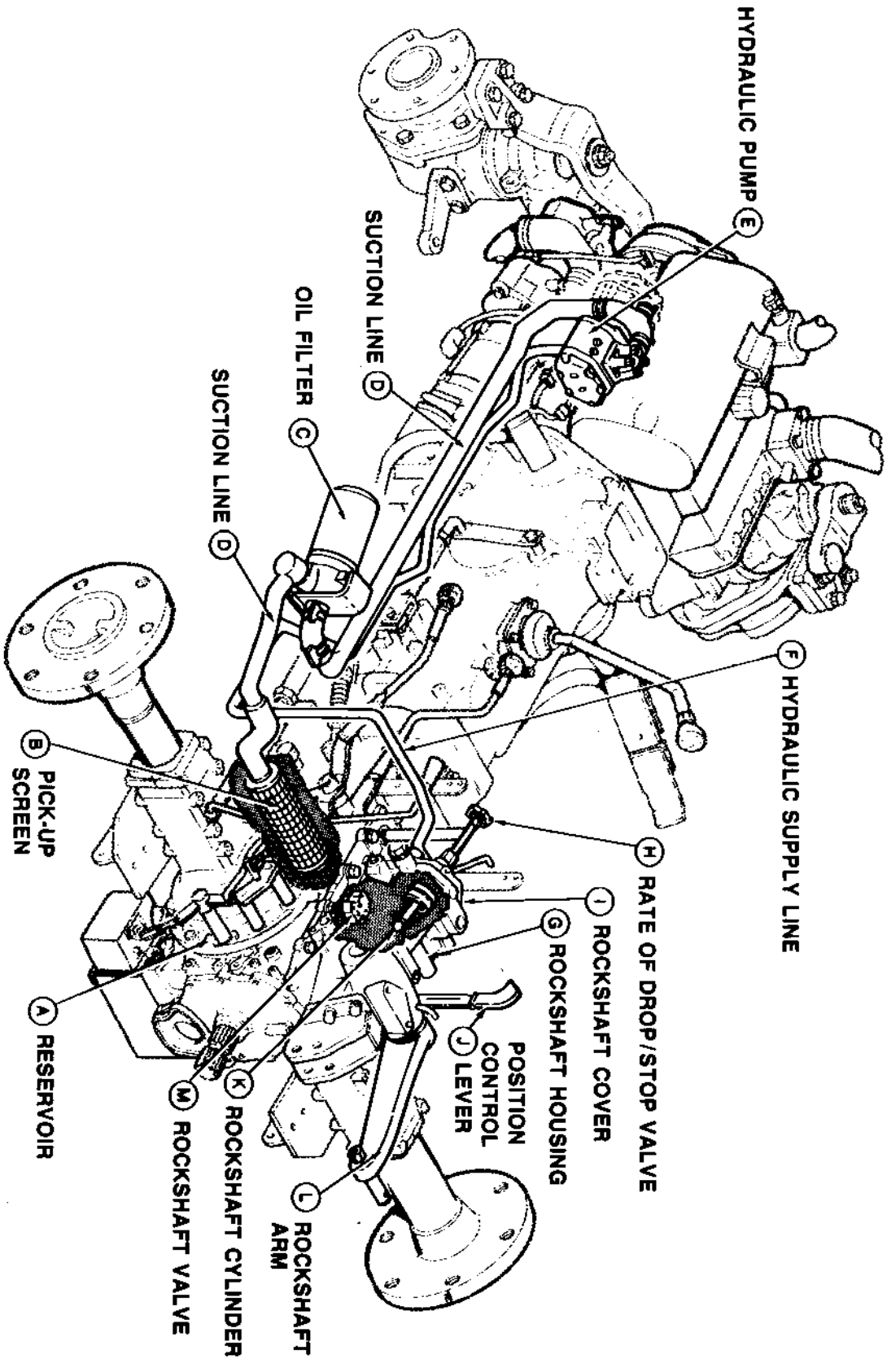
Dual SCV is an option on all models. It is a single lever dual spool control valve with four forward hydraulic outlets which are numbered and color coded for easy identification.

Rear hydraulic outlets are available as an option for tractors with or without SCV.

HYDRAULIC SYSTEM COMPONENT LOCATION

A—Hydraulic Reservoir
B—Pick-up Screen
C—Oil Filter (Optional)
D—Suction Line
E—Hydraulic Pump
F—Hydraulic Supply Line
G—Rockshaft Housing
H—Rate of Drop/Stop Valve
I—Rockshaft Cover
J—Position Control Lever
K—Rockshaft Cylinder
L—Rockshaft Arm
M—Rockshaft Valve

MX,27005DG,A2 -19-19DEC89



HYDRAULIC SYSTEM COMPONENT LOCATION

M48399 -19-09JAN90

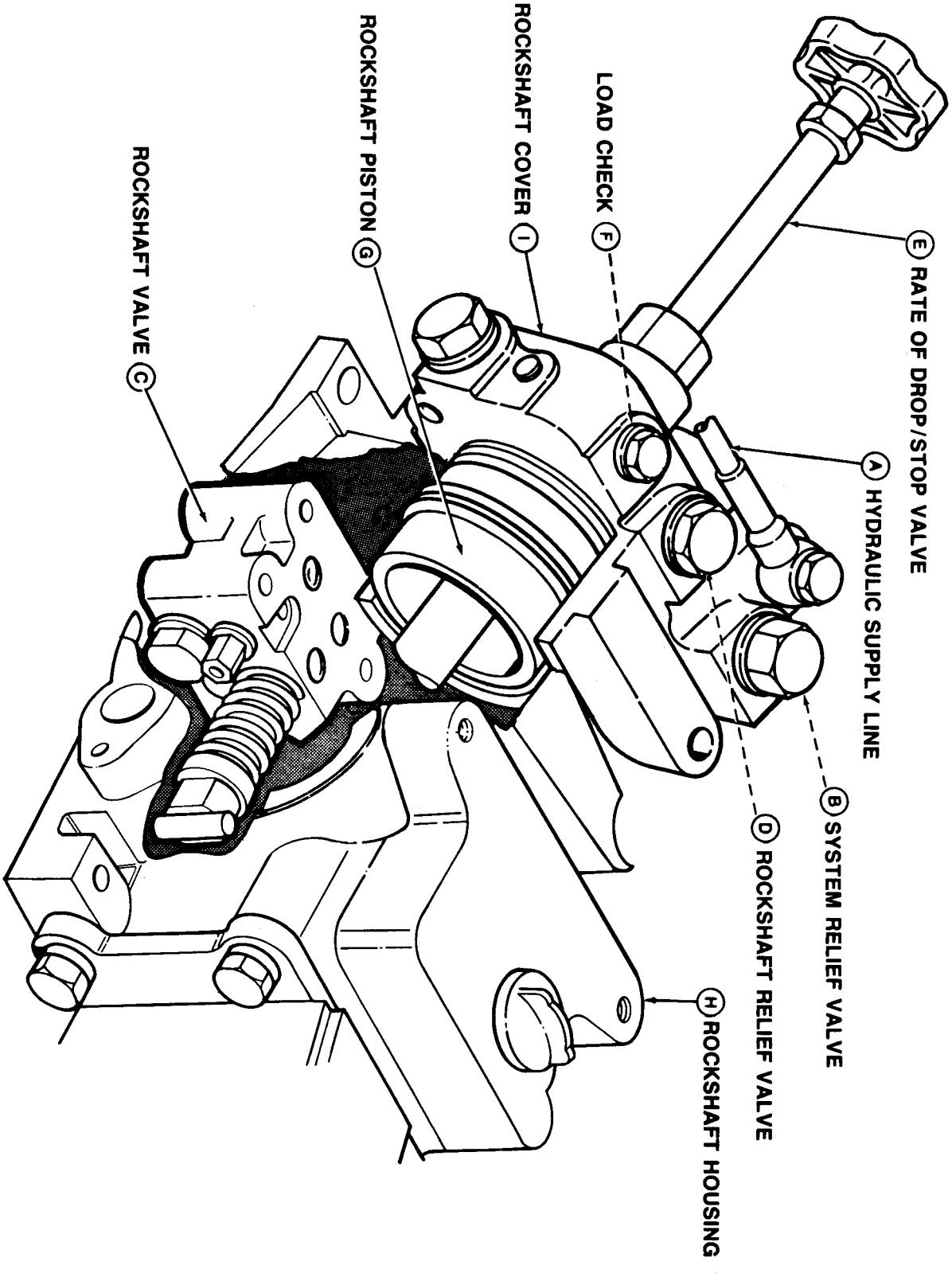
270 05 3

Slide No. 191

MX,27005DG,A3 -19-19DEC89

670/770/790 ROCKSHAFT HOUSING COMPONENT LOCATION

A—Hydraulic Supply Line
B—System Relief Valve
C—Rockshaft Valve
D—Rockshaft Relief Valve
E—Rate of Drop/Stop Valve
F—Load Check
G—Rockshaft Piston
H—Rockshaft Housing
I—Rockshaft Cover

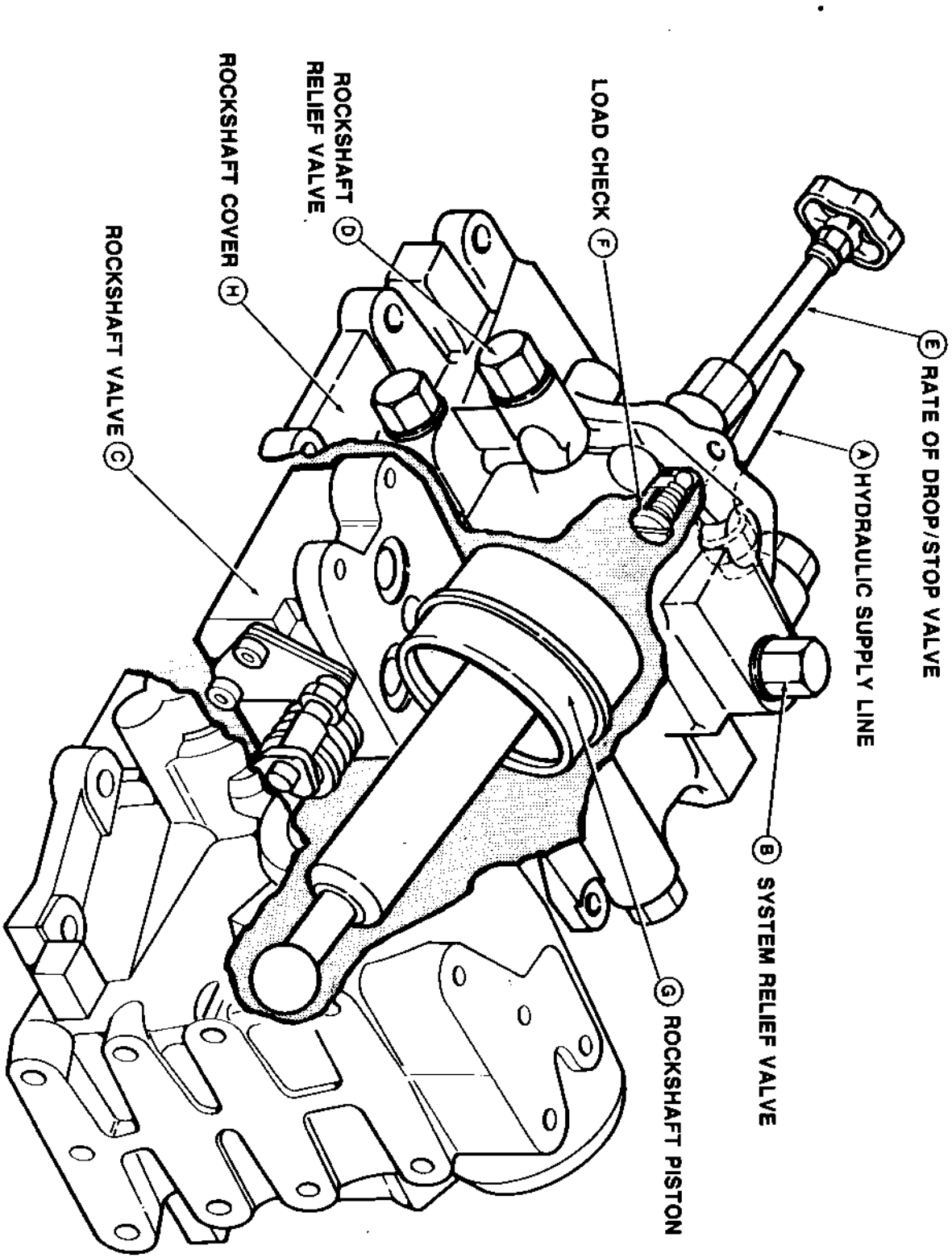


670/770/790 ROCKSHAFT HOUSING COMPONENT LOCATION

870/970/1070 ROCKSHAFT HOUSING COMPONENT LOCATION

A—Hydraulic Supply Line
B—System Relief Valve
C—Rockshaft Valve
D—Rockshaft Relief Valve
E—Rate of Drop/Stop Valve
F—Load Check
G—Rockshaft Piston
H—Rockshaft Cover

MX,27005DG,A6 -19-19DEC89

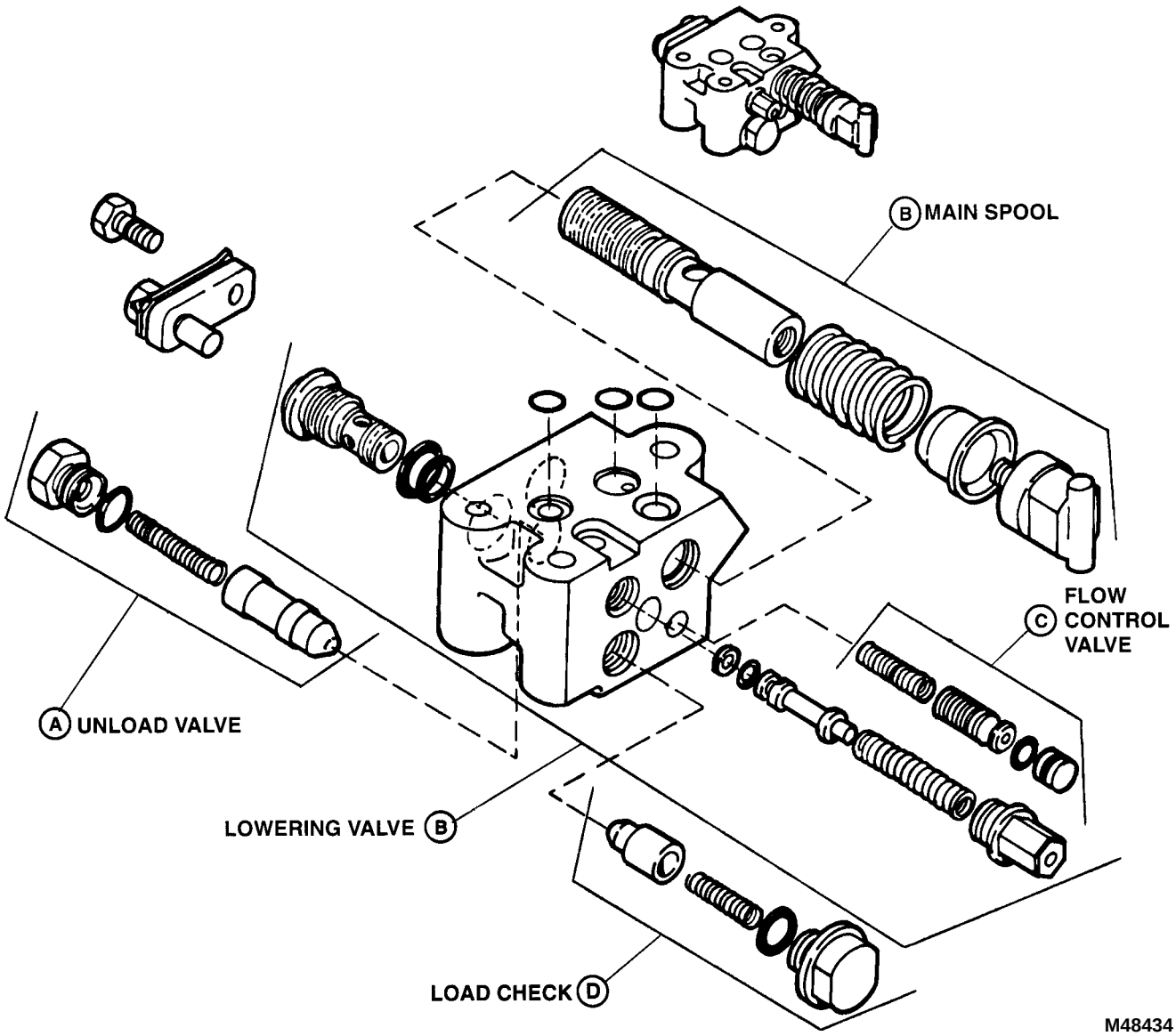


870-970-1070 ROCKSHAFT HOUSING COMPONENTS

M48401 -19-09JAN90

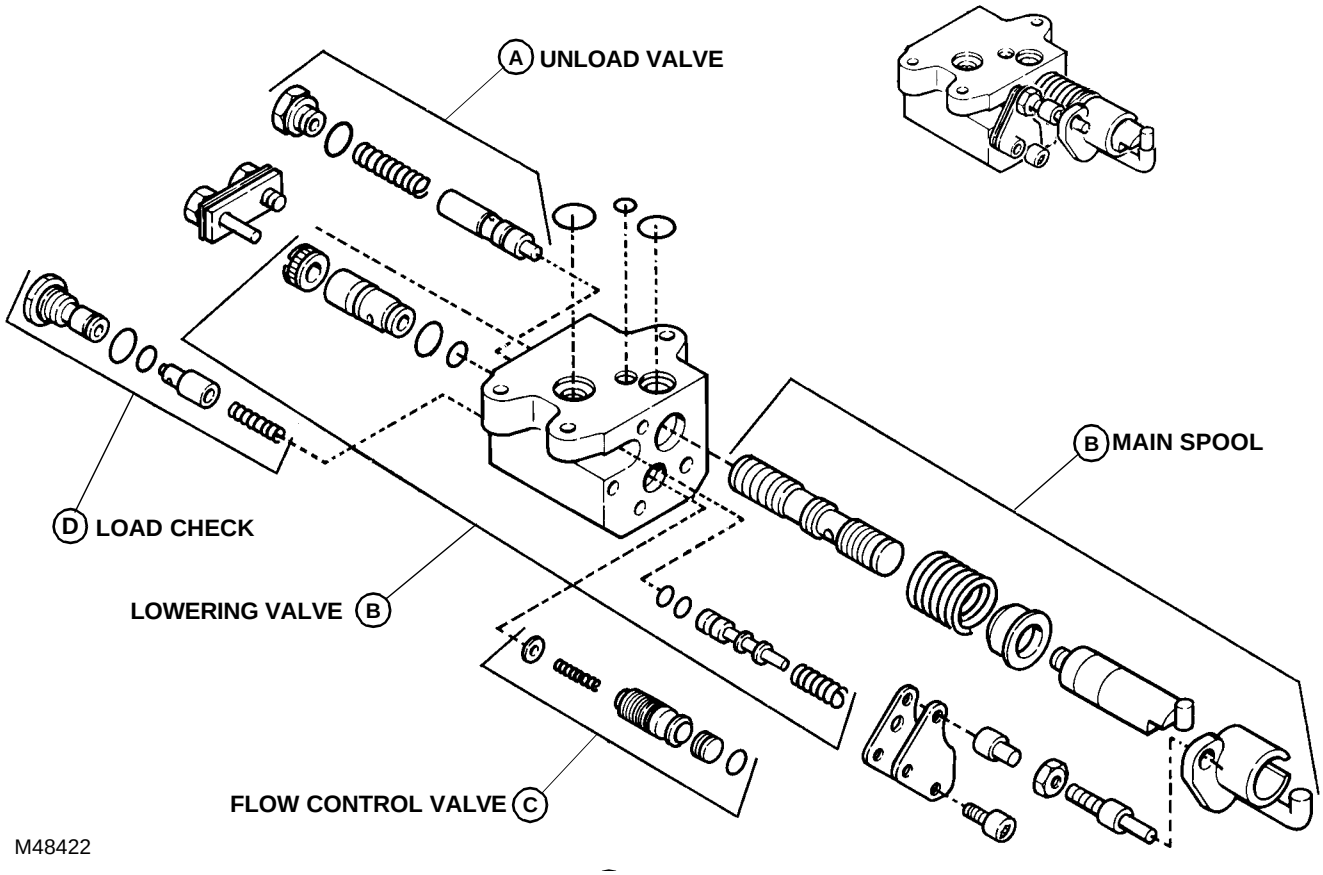
Slide No. 193

MX,27005DG,A7 -19-19DEC89



670-770-790 ROCKSHAFT VALVE COMPONENTS

A—Unload Valve **C—Flow Control Valve** **D—Load Check** **E—Lowering Valve**
B—Main Spool

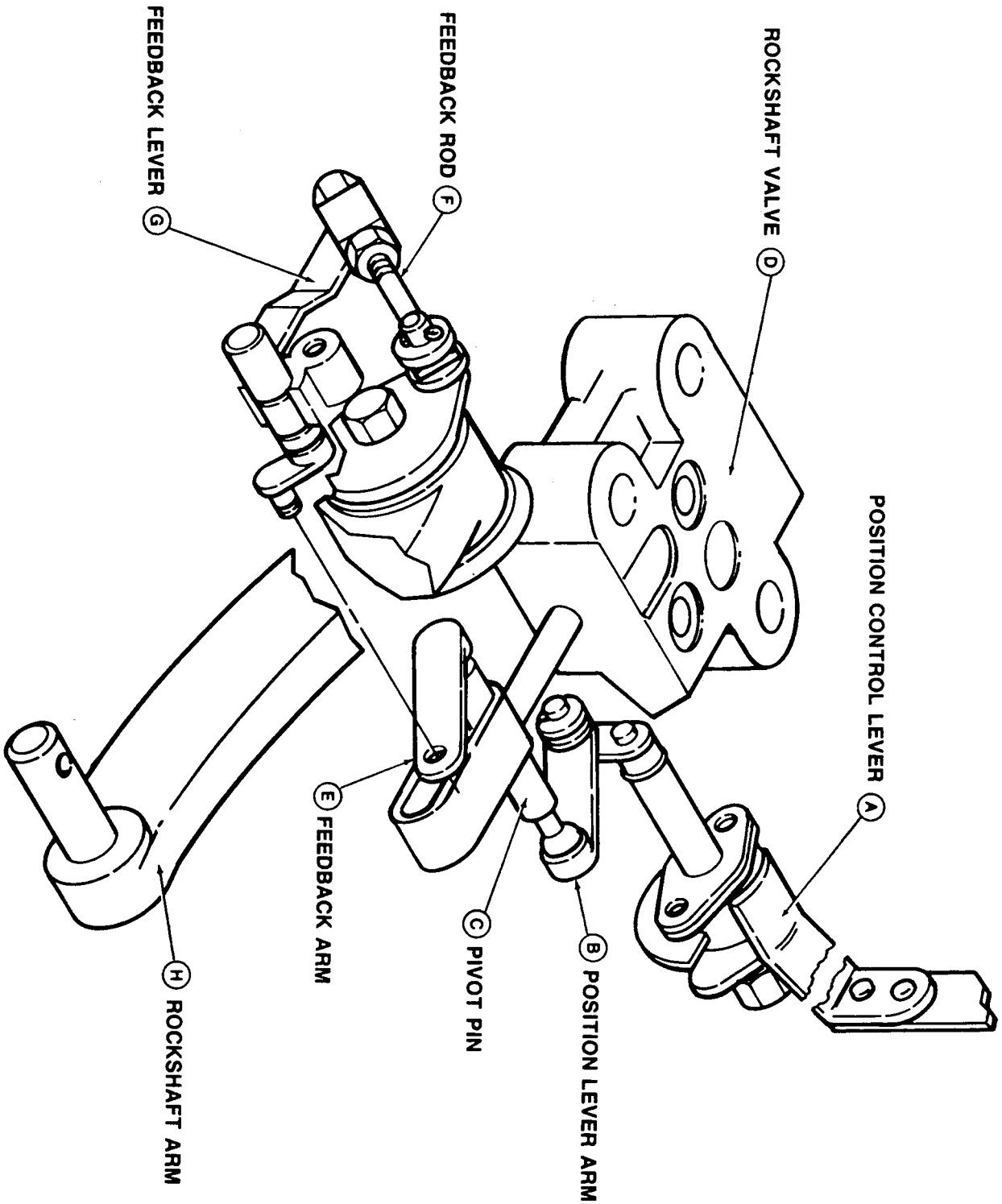


870-970-1070 ROCKSHAFT VALVE COMPONENTS

N-Unload Valve
O-Main Spool
P-Flow Control Valve
Q-Load Check
R-Lowering Valve

670/770/790 ROCKSHAFT CONTROL LINKAGE

A—Position Control Lever
B—Position Lever Arm
C—Pivot Pin
D—Rockshaft Valve
E—Feedback Arm
F—Feedback Rod
G—Feedback Lever
H—Rockshaft Arm

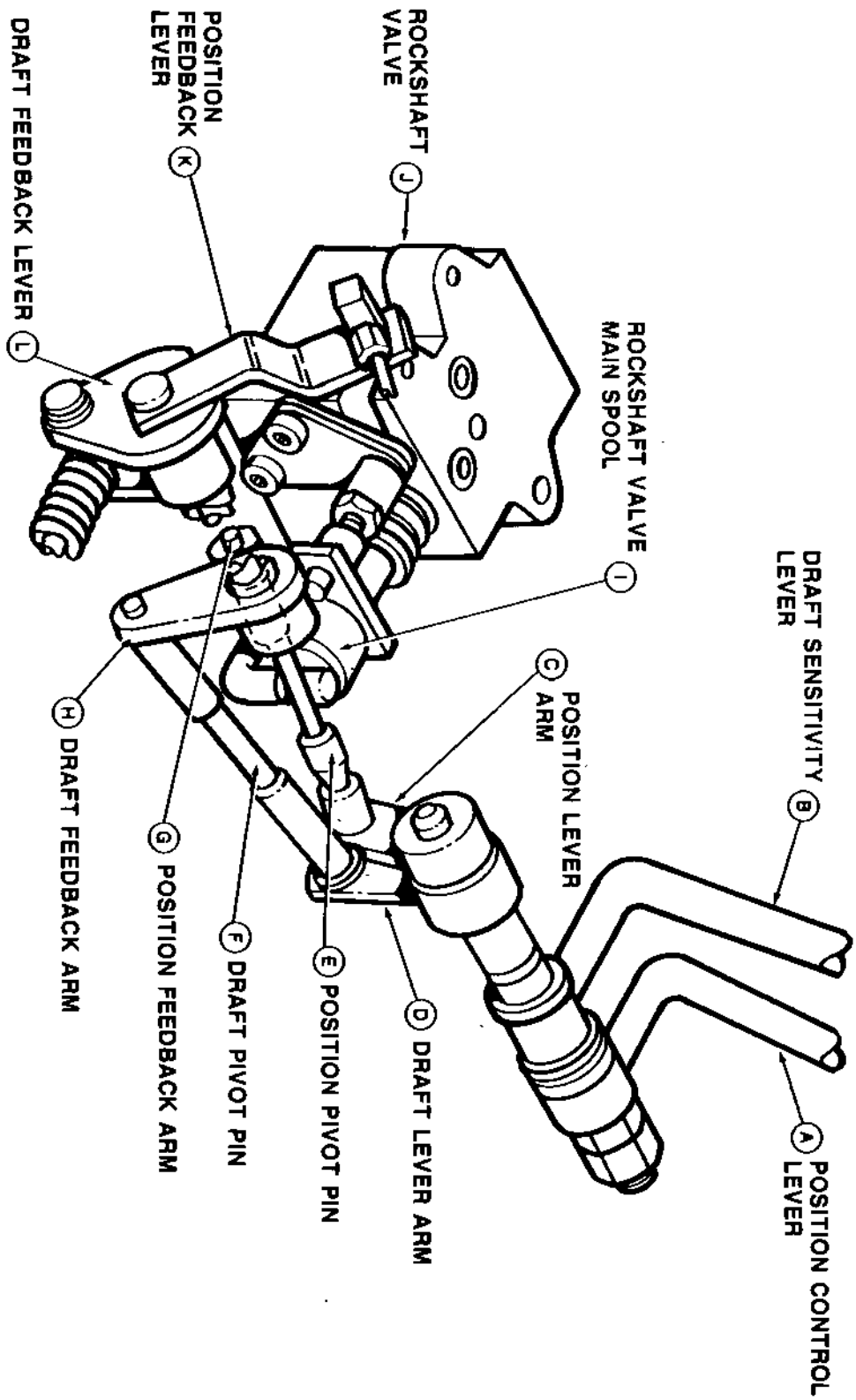


670/770/790 ROCKSHAFT CONTROL LINKAGE

870/970/1070 ROCKSHAFT CONTROL LINKAGE

A—Position Control Lever
B—Draft Sensitivity Lever (1070)
C—Position Lever Arm
D—Draft Lever Arm (1070)
E—Position Pivot Pin
F—Draft Pivot Pin (1070)
G—Position Feedback Arm
H—Draft Feedback Arm (1070)
I—Rockshaft Valve Main Spool
J—Rockshaft Valve
K—Position Feedback Lever
L—Draft Feedback Lever (1070)

MX,27005DG,A12 -19-19DEC89



ROCKSHAFT CONTROL LINKAGE COMPONENTS

M48403 -19-09JAN90

270 05 13

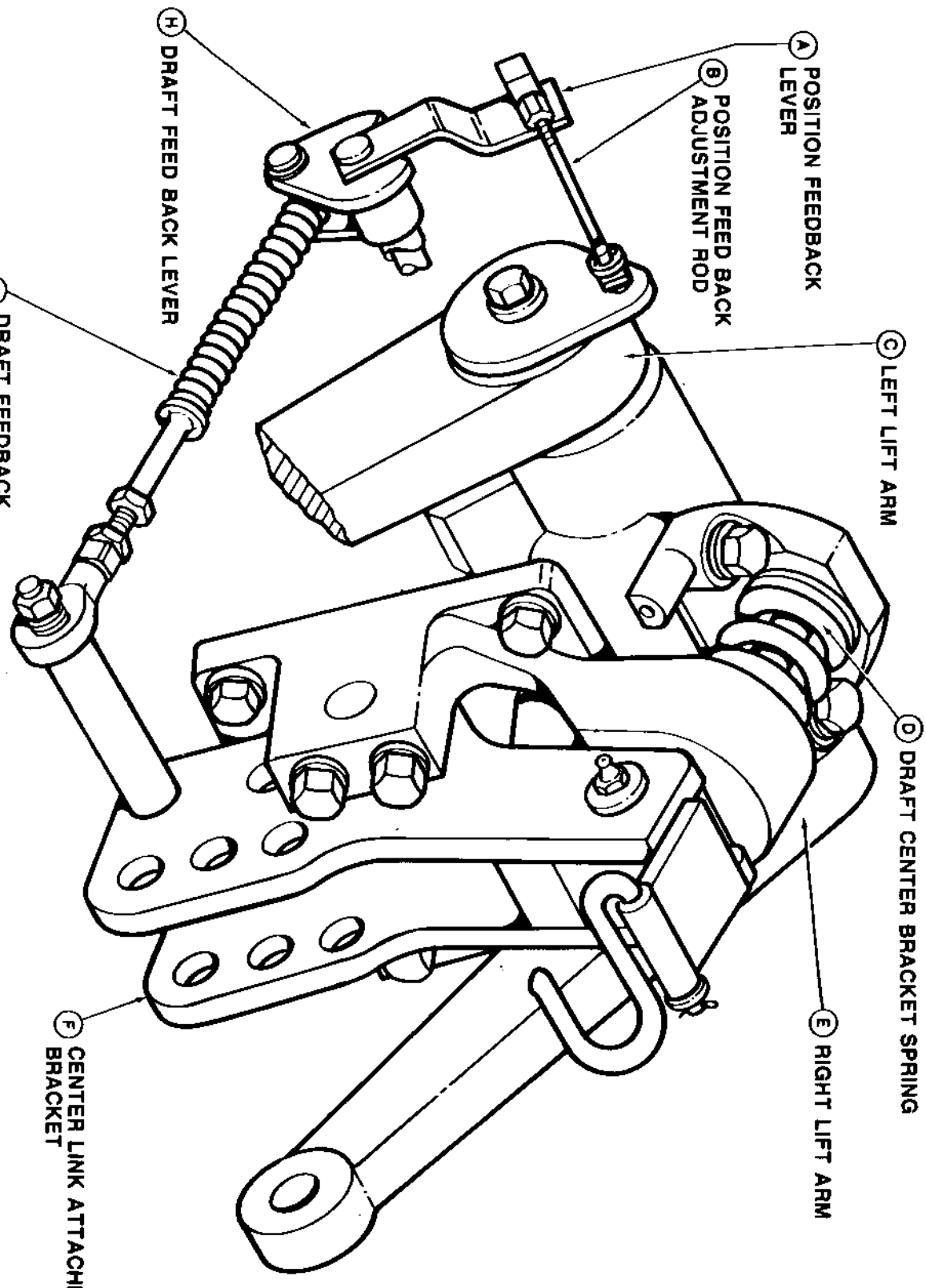
Slide No. 197

MX,27005DG,A13 -19-19DEC89

1070 ROCKSHAFT FEEDBACK LINKAGE

A—Position Feedback Lever
B—Position Feedback Adjustment Rod
C—Left Lift Arm
D—Draft Center Bracket Spring
E—Right Lift Arm
F—Center Link Attaching Bracket
G—Draft Feedback Adjustable Linkage
H—Draft Feedback Lever

MX,27005DG,A14 -19-19DEC89



ROCKSHAFT FEEDBACK LINKAGE COMPONENTS

M48404 -19-09JAN90

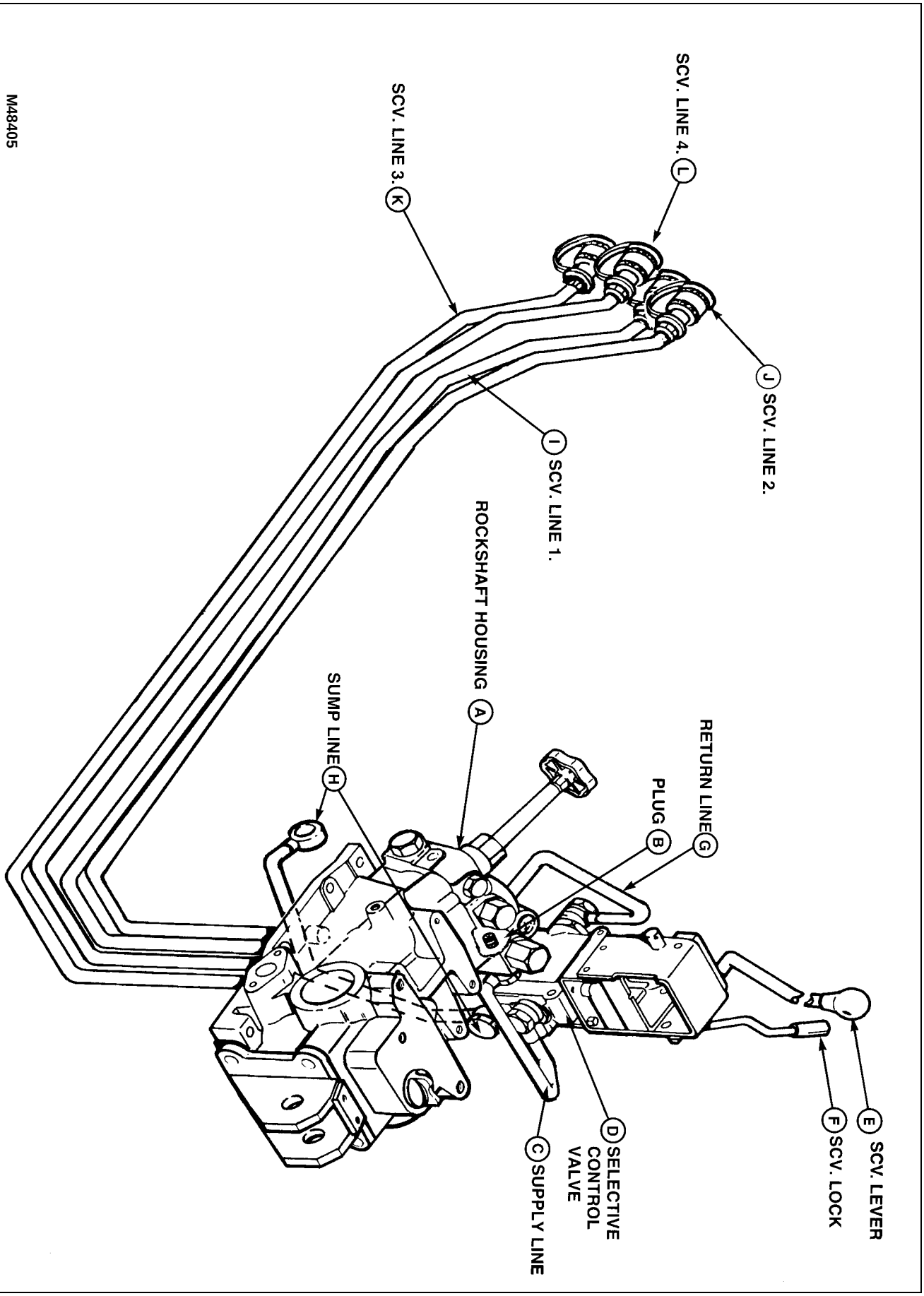
270 05 15

Slide No. 198

MX,27005DG,A15 -19-19DEC89

670/770/790 SELECTIVE CONTROL VALVE COMPONENT LOCATION

A—Rockshaft Cover
B—Plug
C—Supply Line
D—Selective Control Valve
E—SCV Lever
F—SCV Lock
G—Return Line
H—Sump Line
I—SCV Line #1
J—SCV Line #2
K—SCV Line #3
L—SCV Line #4



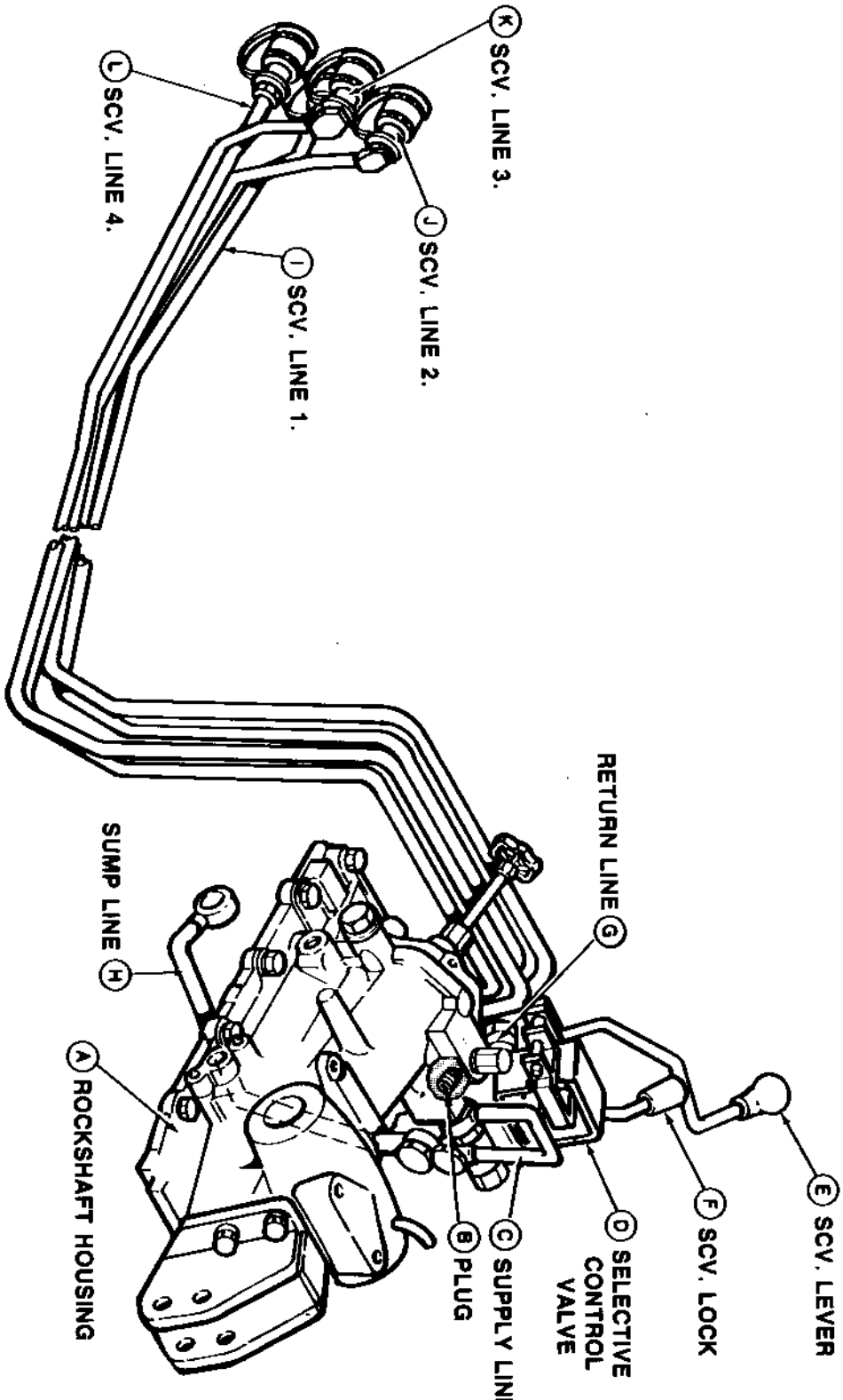
670-770-790 SELECTIVE CONTROL VALVE COMPONENTS

870/970/1070 SELECTIVE CONTROL VALVE COMPONENT LOCATION

A-Rockshaft Housing
B-Plug
C-Supply Line
D-Selective Control Valve
E--SCV Lever
F-SCV Lock
G-Return Line
H-Sump Line
I-SCV Line #1
J-SCV Line #2
K-SCV Line #3
L-SCV Line #4

M48406

870-970-1070 SELECTIVE CONTROL VALVE COMPONENTS

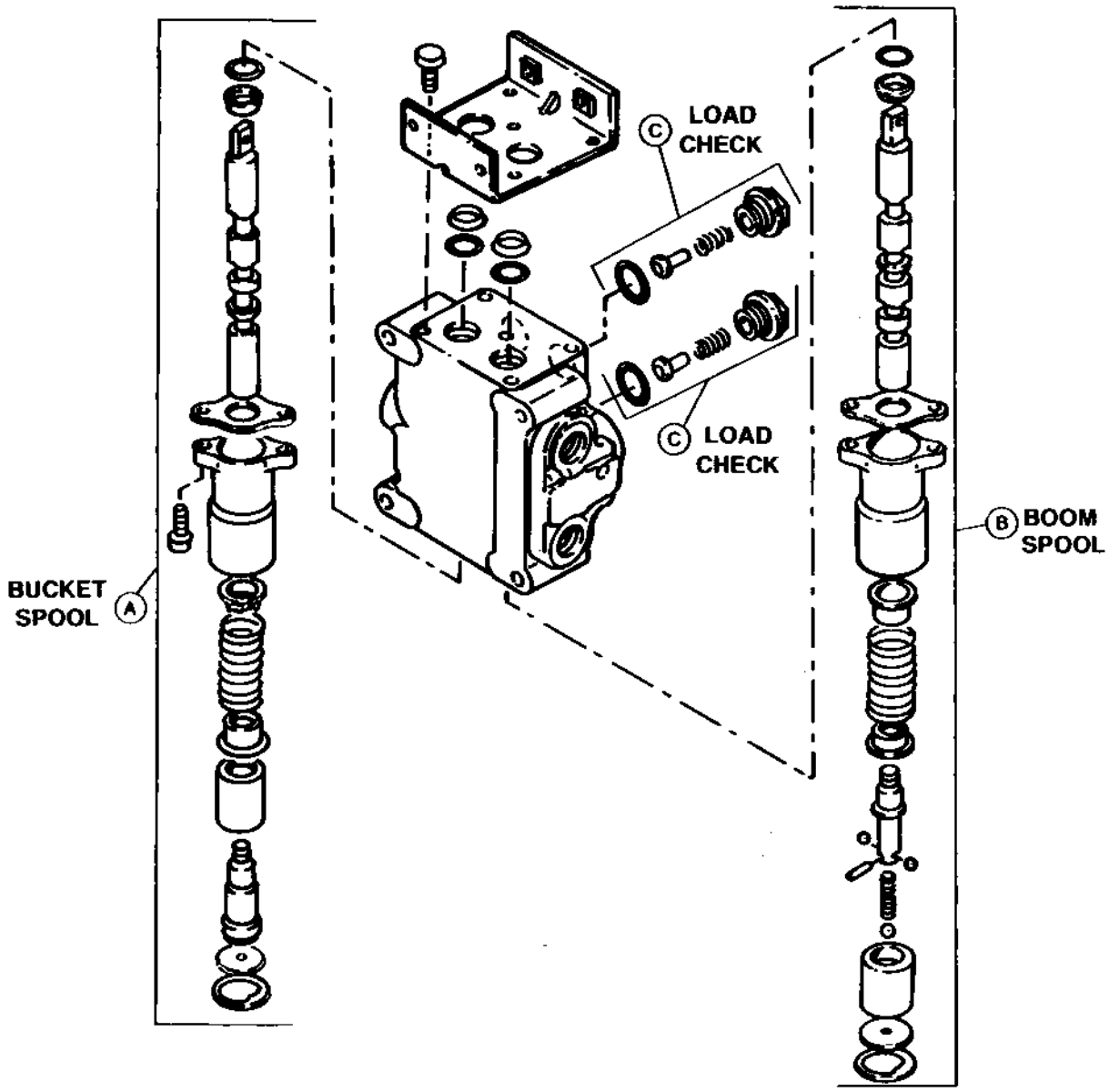


M48406 -19-09JAN90

Slide No. 200

MX,27005DG,A19 -19-19DEC89

SELECTIVE CONTROL VALVE COMPONENTS



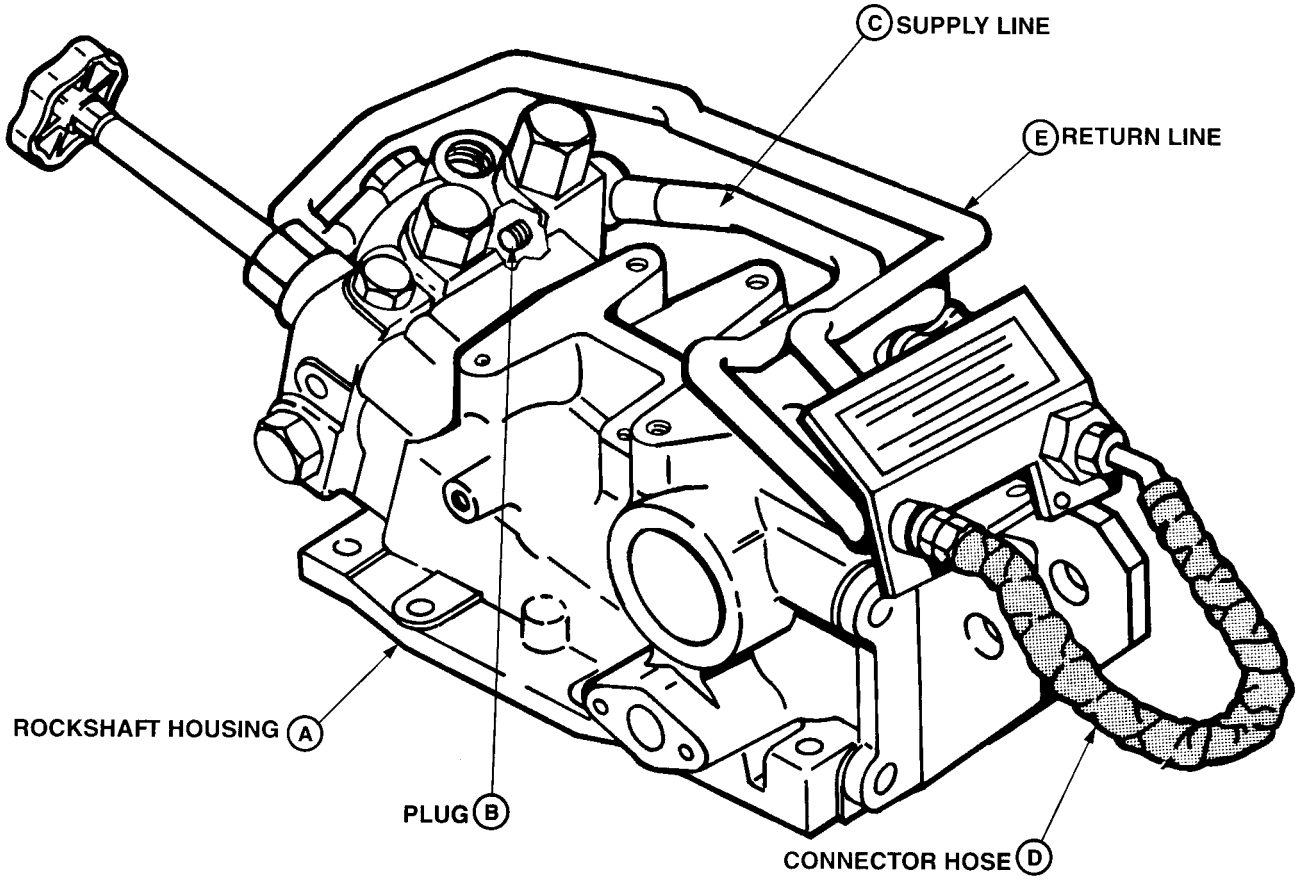
SELECTIVE CONTROL VALVE COMPONENTS

M48437 -19-09JAN90

A—Bucket Spool **B—Boom Spool** **C—Load Checks**

Slide No. 201

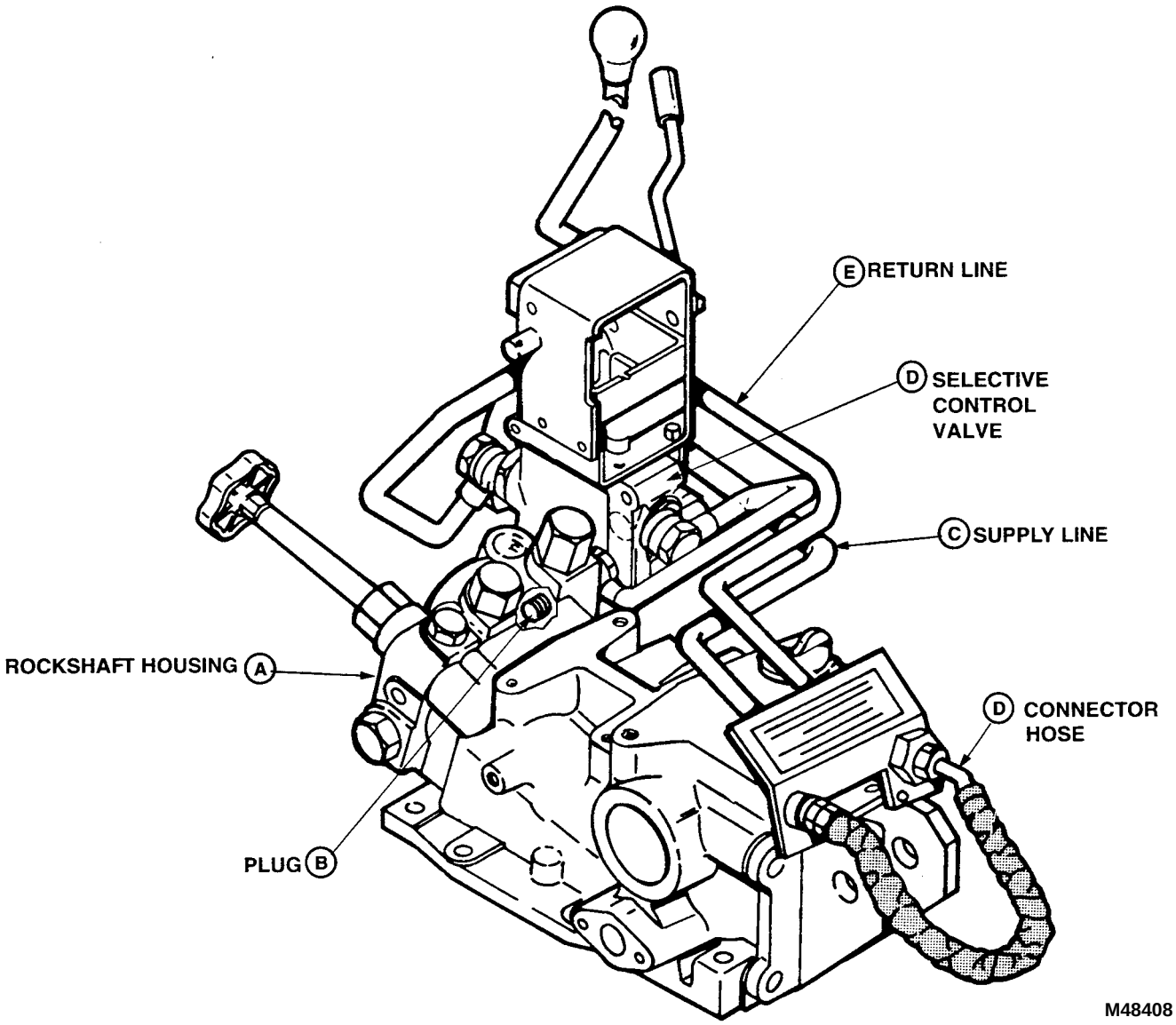
MX,27005DG,A20 -19-19DEC89



M48407

670-770-790 REAR OUTLETS (WITHOUT SCV)

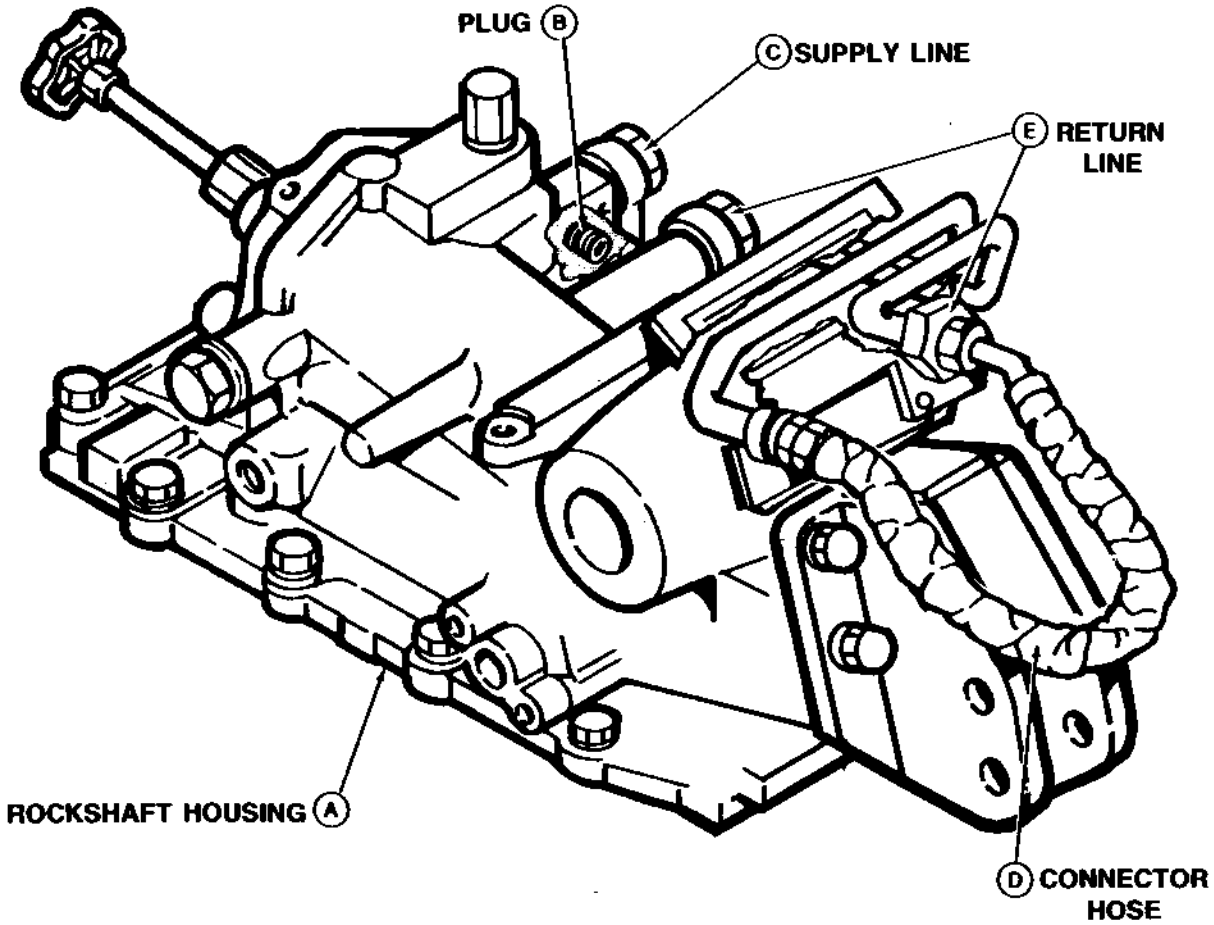
A—Rockshaft Housing **C—Supply Line** **D—Connector Hose** **E—Return Line**
B—Plug



670-770-790 REAR OUTLETS (WITH SCV)

A—Rockshaft Housing
B—Selective Control Valve
C—Supply Line
D—Connector Hose
E—Return Line

870/970/1070 REAR OUTLETS (WITHOUT SCV)



M48409

870-970-1070 REAR OUTLETS (WITHOUT SCV)

-19-09JAN90

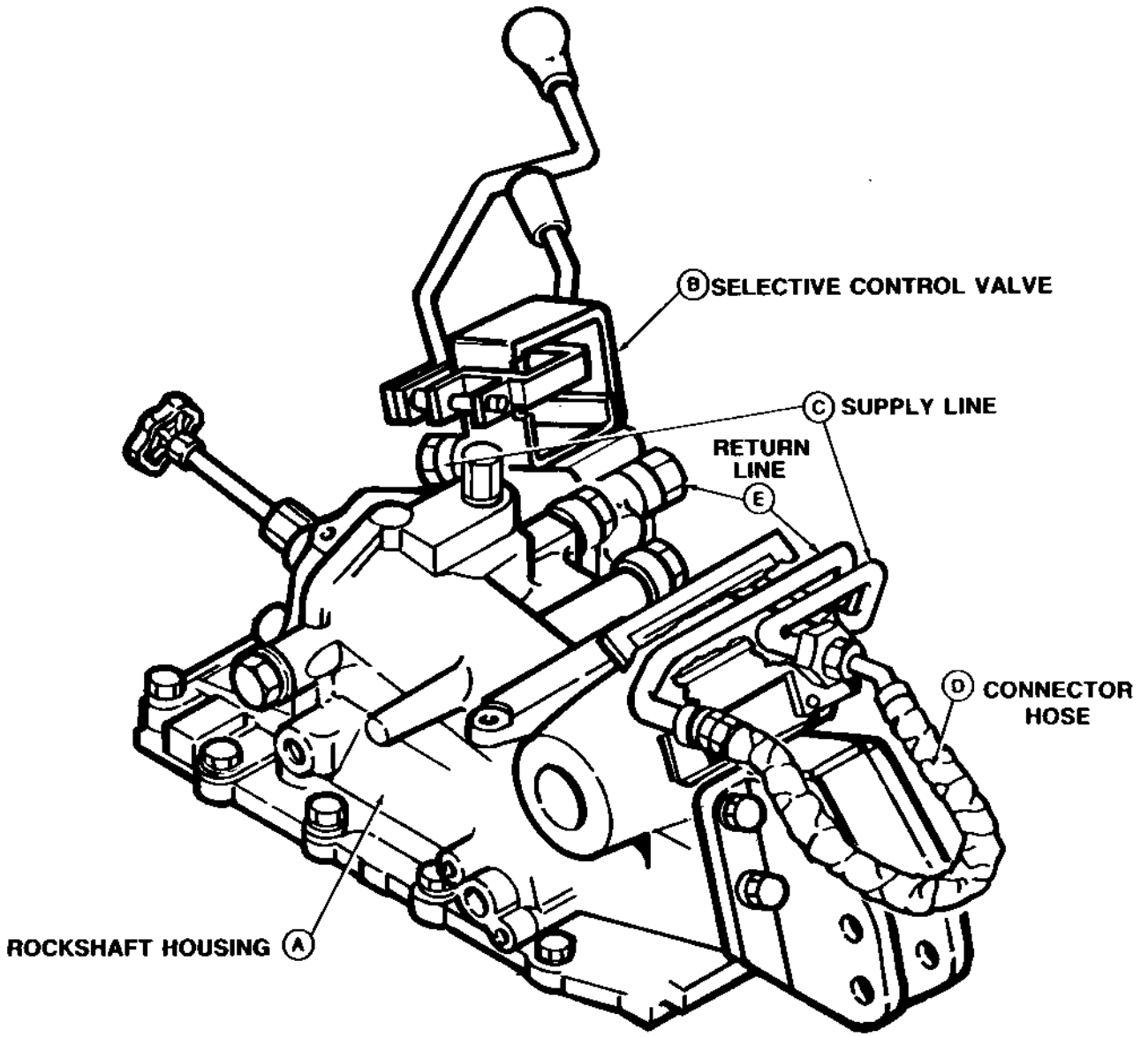
M48409

A—Rockshaft Housing
B—Plug
C—Supply Line
D—Connector Hose
E—Return Line

Slide No. 204

MX,27005DG,A23 -19-19DEC89

870/970/1070 REAR OUTLETS (WITH SCV)



M48410

870-970-1070 REAR OUTLETS (WITH SCV)

M48410 -19-09JAN90

A—Rockshaft Housing
B—Selective Control Valve
C—Supply Line
D—Connector Hose
E—Return Line

Slide No. 205

MX,27005DG,A24 -19-19DEC89

ABOUT THIS GROUP

This group contains illustrations and descriptions of oil flow through the entire hydraulic system as well as details describing operation of the individual components.

All models are discussed; where necessary the differences between models are shown separately.

MX,27010DG,A1 -19-19DEC89

HYDRAULIC SYSTEM OIL SUPPLY

A—Suction Oil
B—Pump Pressure Oil
C—Return Oil
D—Filter
E—Hydraulic Pump
F—Rockshaft Housing
G—Rockshaft Valve

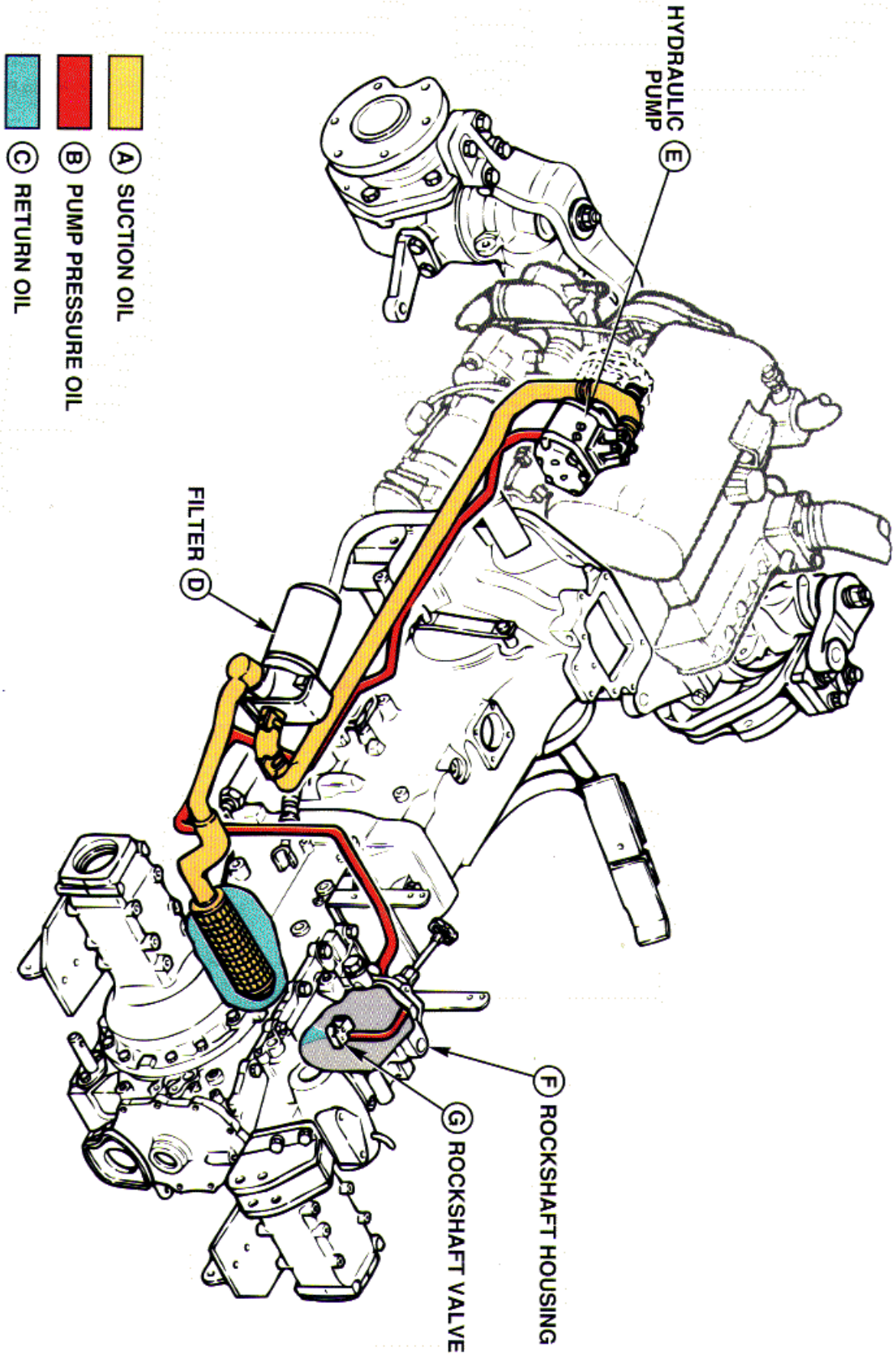
In neutral the suction oil (A) is drawn out of the reservoir through a pick-up screen routed through the optional oil filter (D) to the hydraulic pump (E).

Pump pressure oil (B) is directed through the rockshaft housing to the rockshaft valve.

Since the valve is in neutral return oil (C) is dumped through the rockshaft valve directly into the hydraulic reservoir (sump).

MX,27010DG,A2 -19-19DEC89

270
10
2



MXC48411

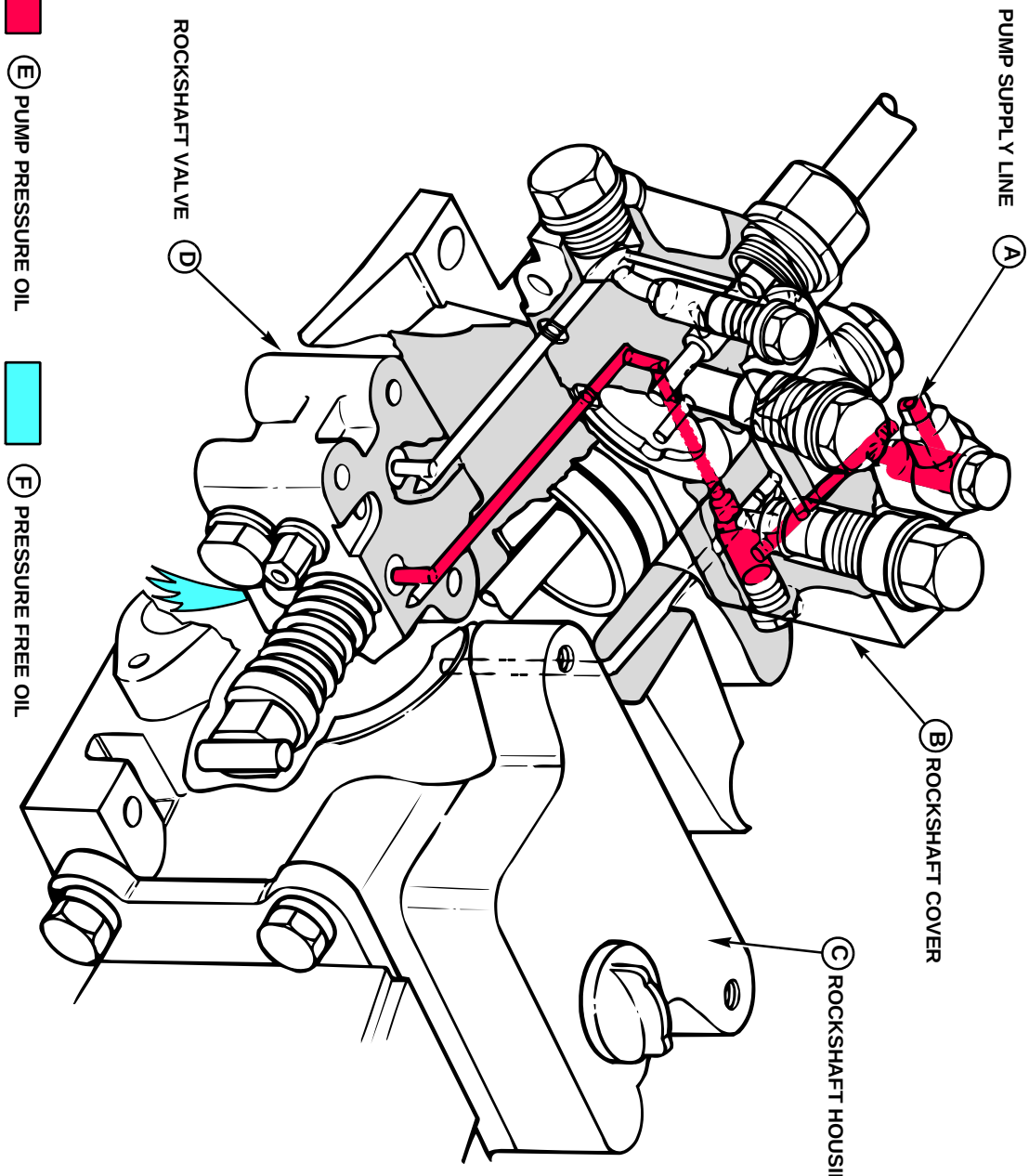
HYDRAULIC SYSTEM OIL SUPPLY

670/770/790 ROCKSHAFT HOUSING OIL FLOW (NEUTRAL) WITHOUT SCV

A—Pump Supply Line
B—Rockshaft Cover
C—Rockshaft Housing
D—Rockshaft Valve
E—Pump Pressure Oil
F—Pressure Free Oil

In neutral, pump pressure oil is directed through the passage in the rockshaft housing to the rockshaft valve.

Since no hydraulic function is occurring, the rockshaft control valve directs all oil as return oil back to sump.



MXC48412

670-770-790 ROCKSHAFT HOUSING OIL FLOW (NEUTRAL) (WITHOUT SCV)

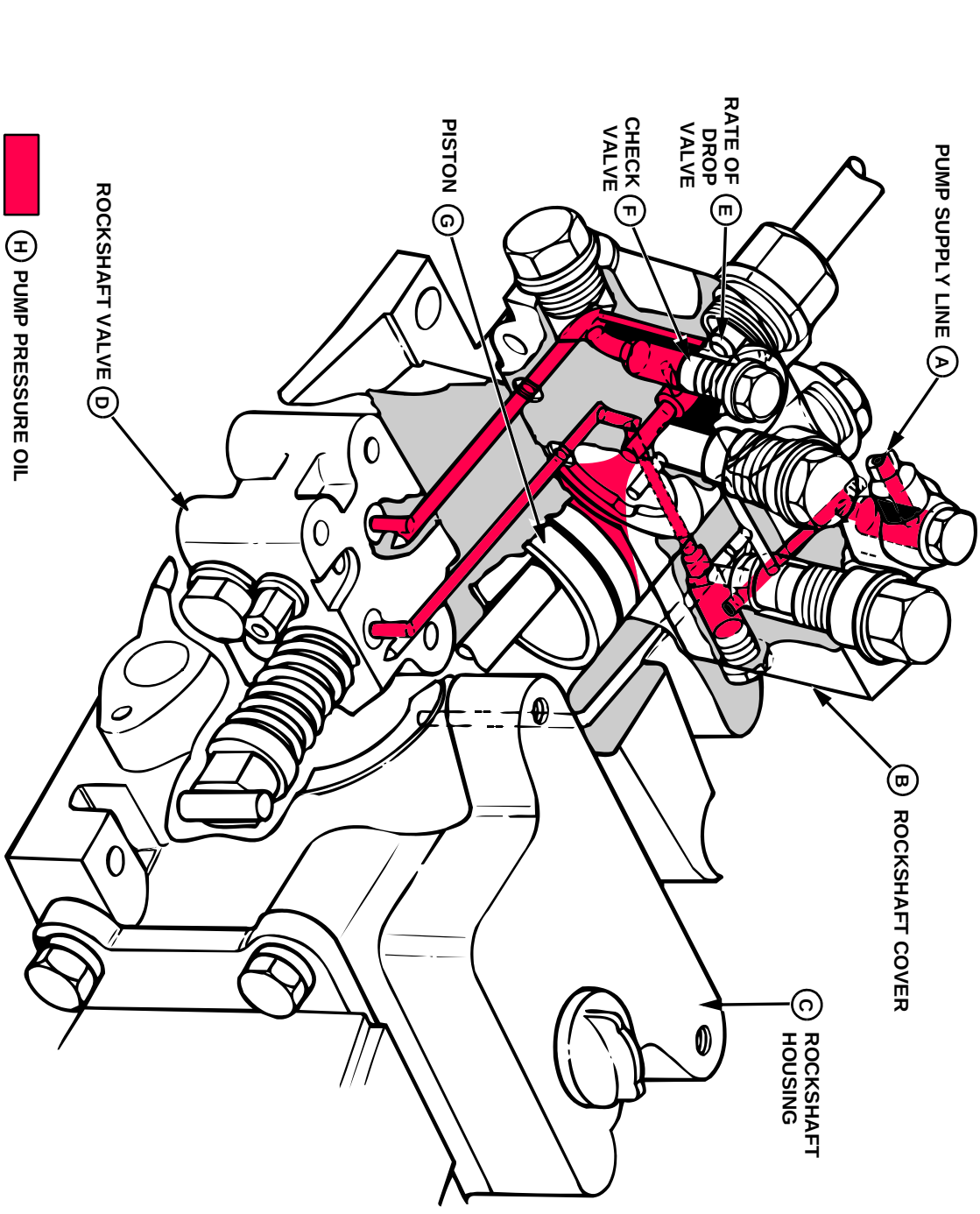
670/770/790 ROCKSHAFT HOUSING OIL FLOW (RAISE) WITHOUT SCV

A—Pump Supply Line
B—Rockshaft Cover
C—Rockshaft Housing
D—Rockshaft Valve
E—Rate of Drop Valve
F—Check Valve
G—Piston
H—Pump Pressure Oil

In the raise position, the position lever is pulled back which extends the rockshaft valve spool.

Pump pressure oil is directed through the rockshaft valve into the rockshaft cover. Oil flows to the rate of drop valve. If the valve is partially closed, pressure builds and opens the check valve to allow oil to flow into the rockshaft cylinder.

The pressure oil moves the piston back which raises the rockshaft arms.



670-770-790 ROCKSHAFT HOUSING OIL FLOW (RAISE) (WITHOUT SCV)

670/770/790 ROCKSHAFT HOUSING OIL FLOW (LOWER) WITHOUT SCV

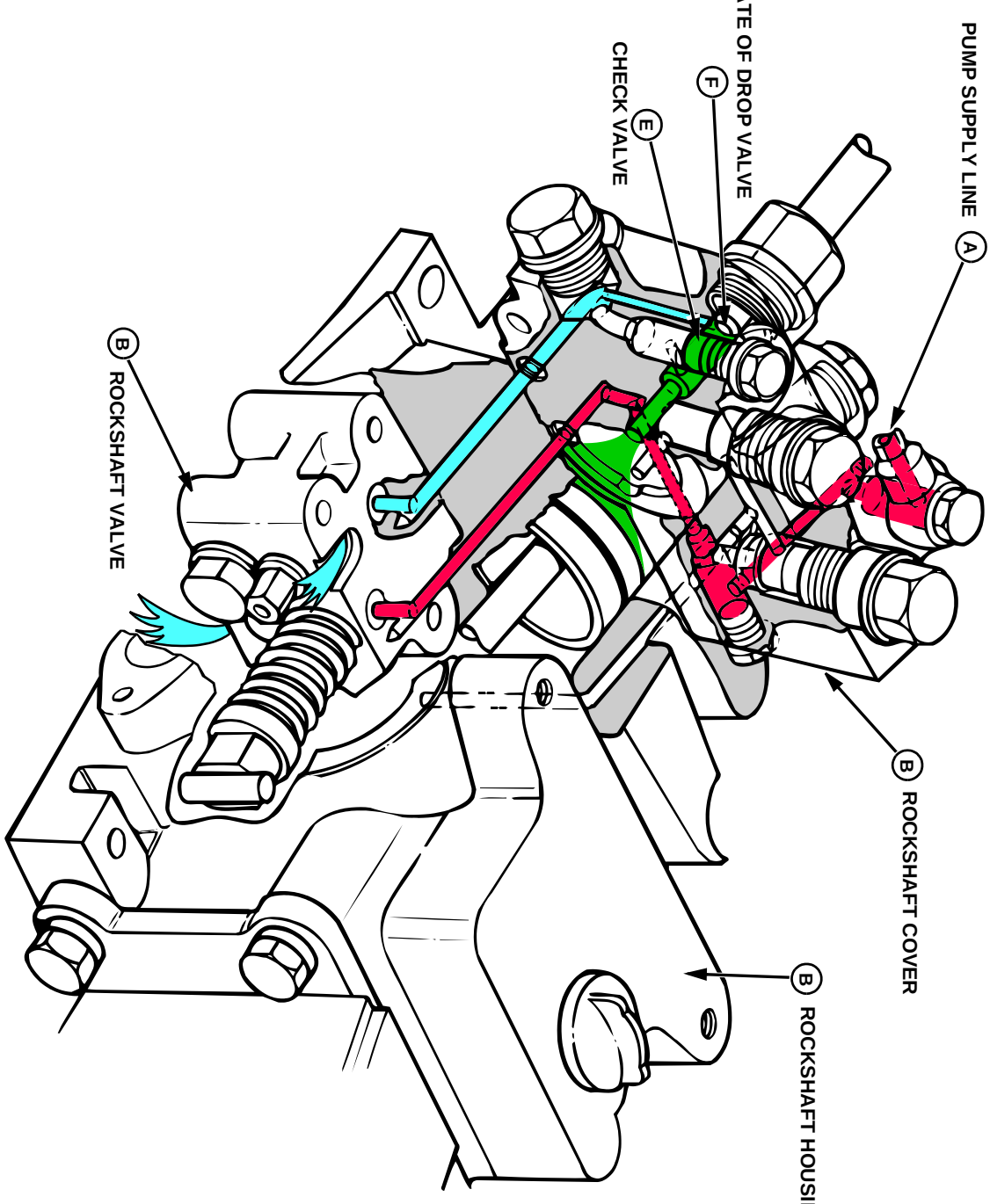
A—Pump Supply Line
B—Rockshaft Cover
C—Rockshaft Housing
D—Rockshaft Valve
E—Check Valve
F—Rate of Drop Valve
G—Pump Pressure Oil
H—Restricted Oil
I—Pressure Free Oil

In the lower position the position sensing lever is pushed forward which retracts the rockshaft valve spool.

Pump pressure oil is directed through the rockshaft valve to sump.

Return oil from the cylinder cannot unseat the check valve so it is forced to go past the rate of drop valve (the rate of drop valve opening will determine how fast the oil can return), through the cylinder cover and rockshaft valve to sump.

This allows the cylinder to retract and the rockshaft arms to lower.



MXC48414

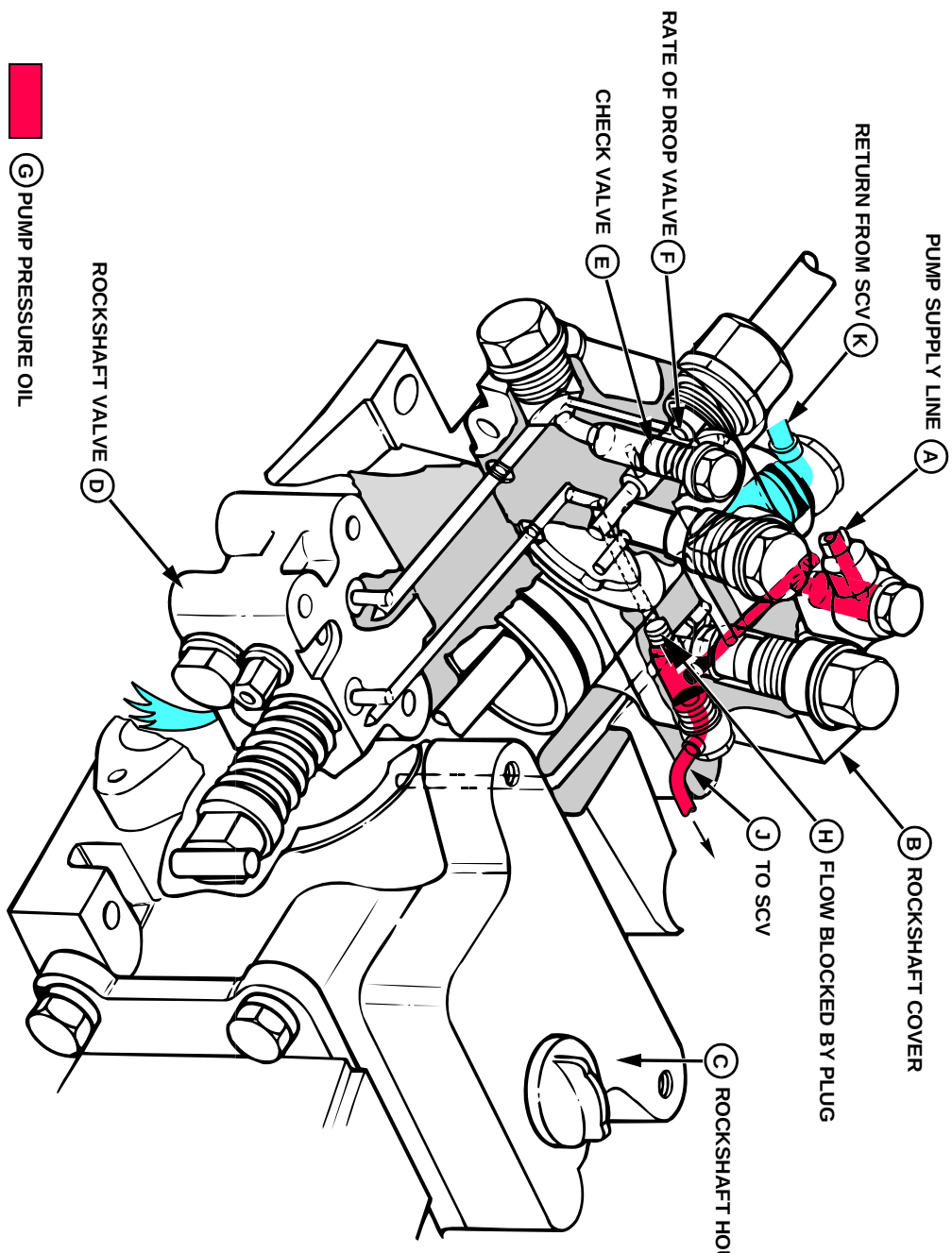
670-770-790 ROCKSHAFT HOUSING OIL FLOW (LOWER) (WITHOUT SCV)

670/770/790 ROCKSHAFT HOUSING OIL FLOW (WITH SCV)

A—Pump Supply Line
B—Rockshaft Cover
C—Rockshaft Housing
D—Rockshaft Valve
E—Check Valve
F—Rate of Drop Valve
G—Pump Pressure Oil
H—Plug
I—Pressure Free Oil
J—Oil line to SCV
K—Return oil line from SCV

The pump supply line (A) provide pump pressure oil to the rockshaft cover which routes it to the SCV oil line (J) by a plug (H) that is installed with the Selective Control Valve kit.

Pressure free oil (I) is returned from the SCV via the (K) oil line and is routed to sump through the rockshaft valve (D).



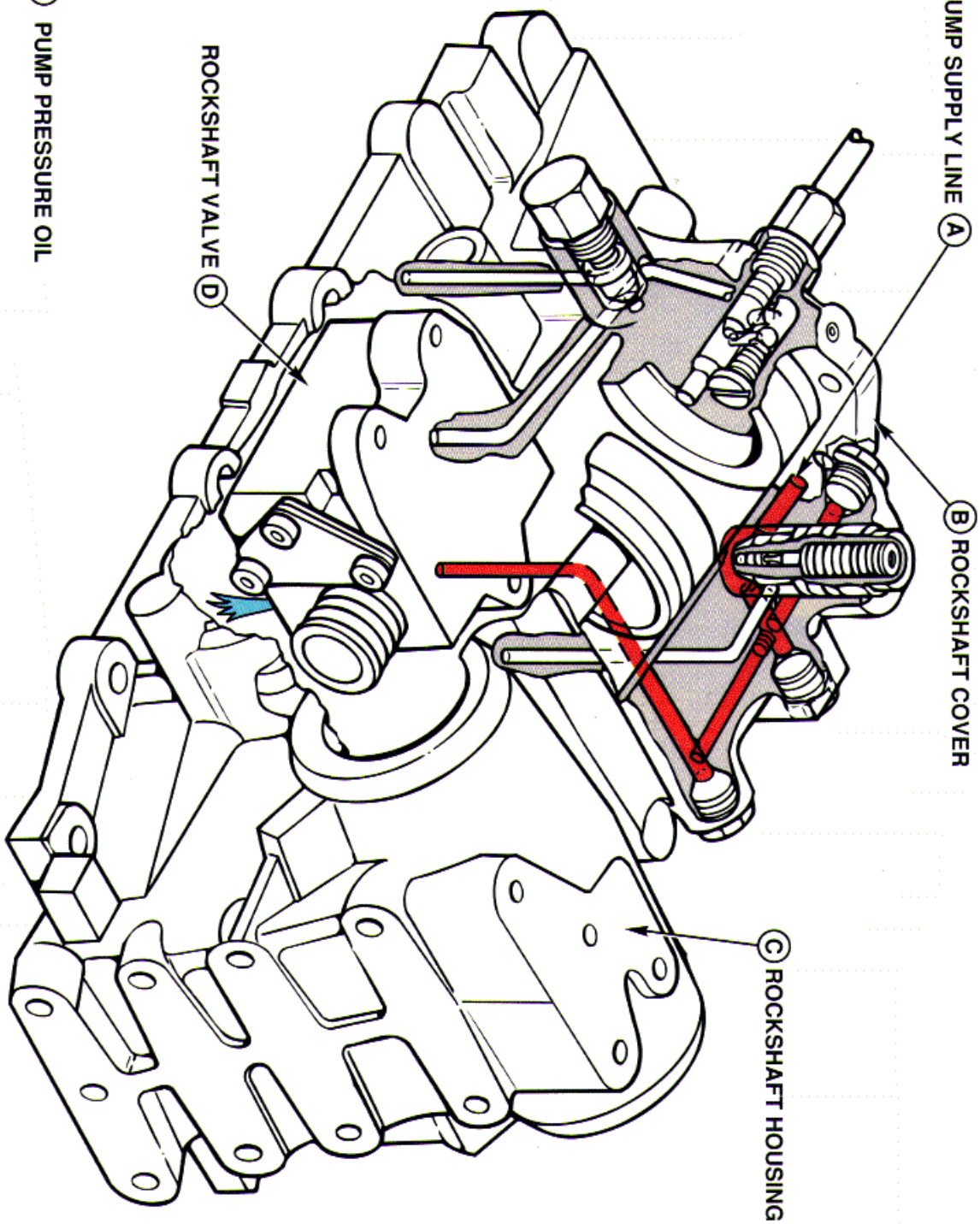
670-770-790 ROCKSHAFT HOUSING OIL FLOW (WITH SCV)

870/970/1070 ROCKSHAFT HOUSING OIL FLOW (NEUTRAL) WITHOUT SCV

A—Pump Supply Line
B—Rockshaft Cover
C—Rockshaft Housing
D—Rockshaft Valve
E—Pump Pressure Oil
F—Sump Oil

In neutral pump pressure oil (E) is directed through the passage in the rockshaft housing to the rockshaft valve.

Since no hydraulic function is occurring, the rockshaft control valve directs all the oil as return oil (G) back to sump.



8-9-1070 ROCKSHAFT HOUSING OIL FLOW (NEUTRAL) (WITHOUT SCV)

870/970/1070 ROCKSHAFT HOUSING OIL FLOW (RAISE) WITHOUT SCV

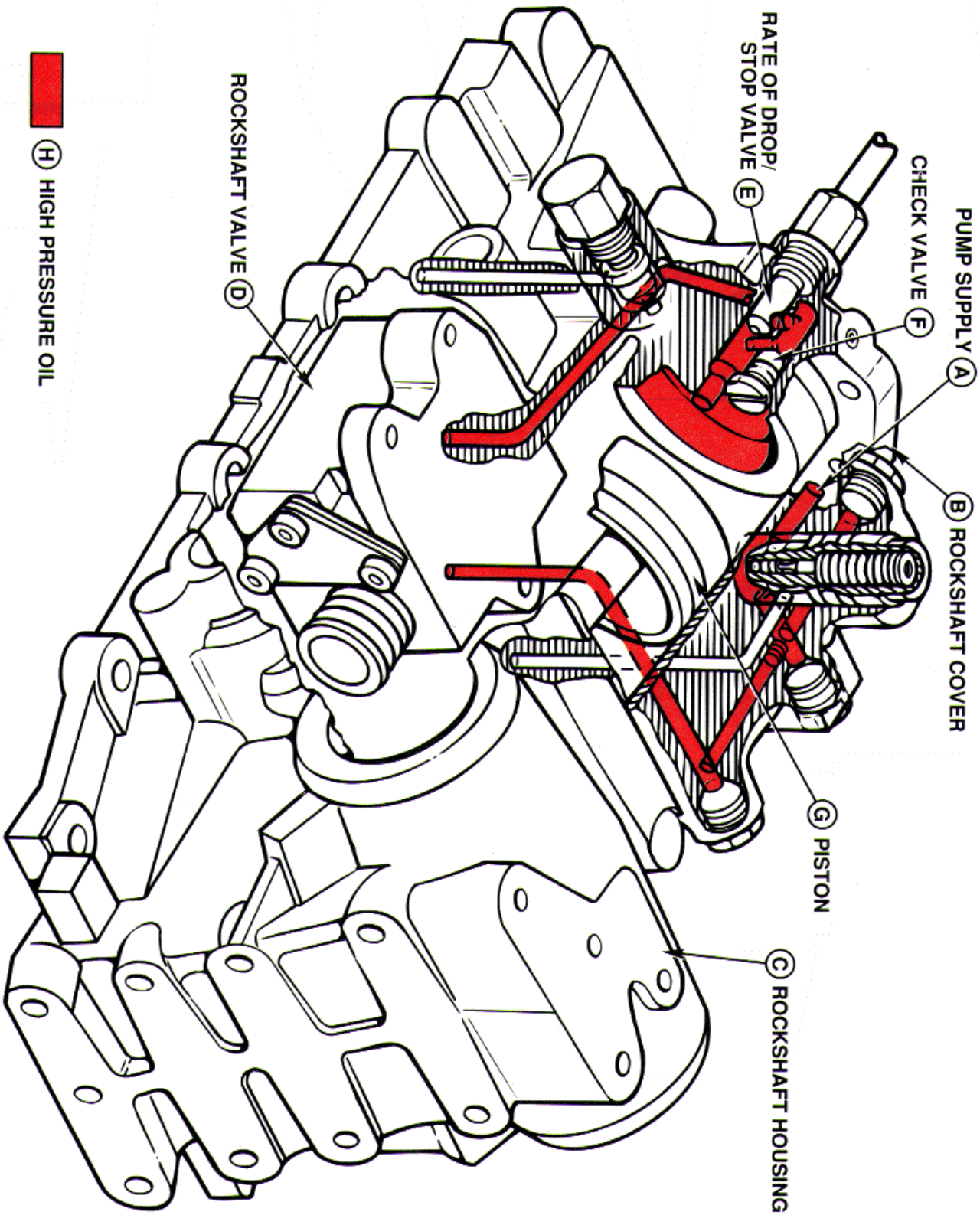
A-Pump Supply Line
B-Rockshaft Cover
C-Rockshaft Housing
D-Rockshaft Valve
E-Rate of Drop Valve
F-Load Check Valve
G-Piston
H-High Pressure Oil

In the raise position, the position lever is pulled back which extends the rockshaft valve spool.

Pump pressure oil is directed through the rockshaft valve into the rockshaft cover.

Oil flows to the rate of drop valve. If the valve is partially closed, pressure builds and opens the check valve to allow oil to flow into the rockshaft cylinder.

The pressure oil moves the cylinder back which raises the rockshaft arms.



8-9-1070 ROCKSHAFT HOUSING OIL FLOW (RAISE) (WITHOUT SCV)

870/970/1070 ROCKSHAFT HOUSING OIL FLOW (LOWER) WITHOUT SCV

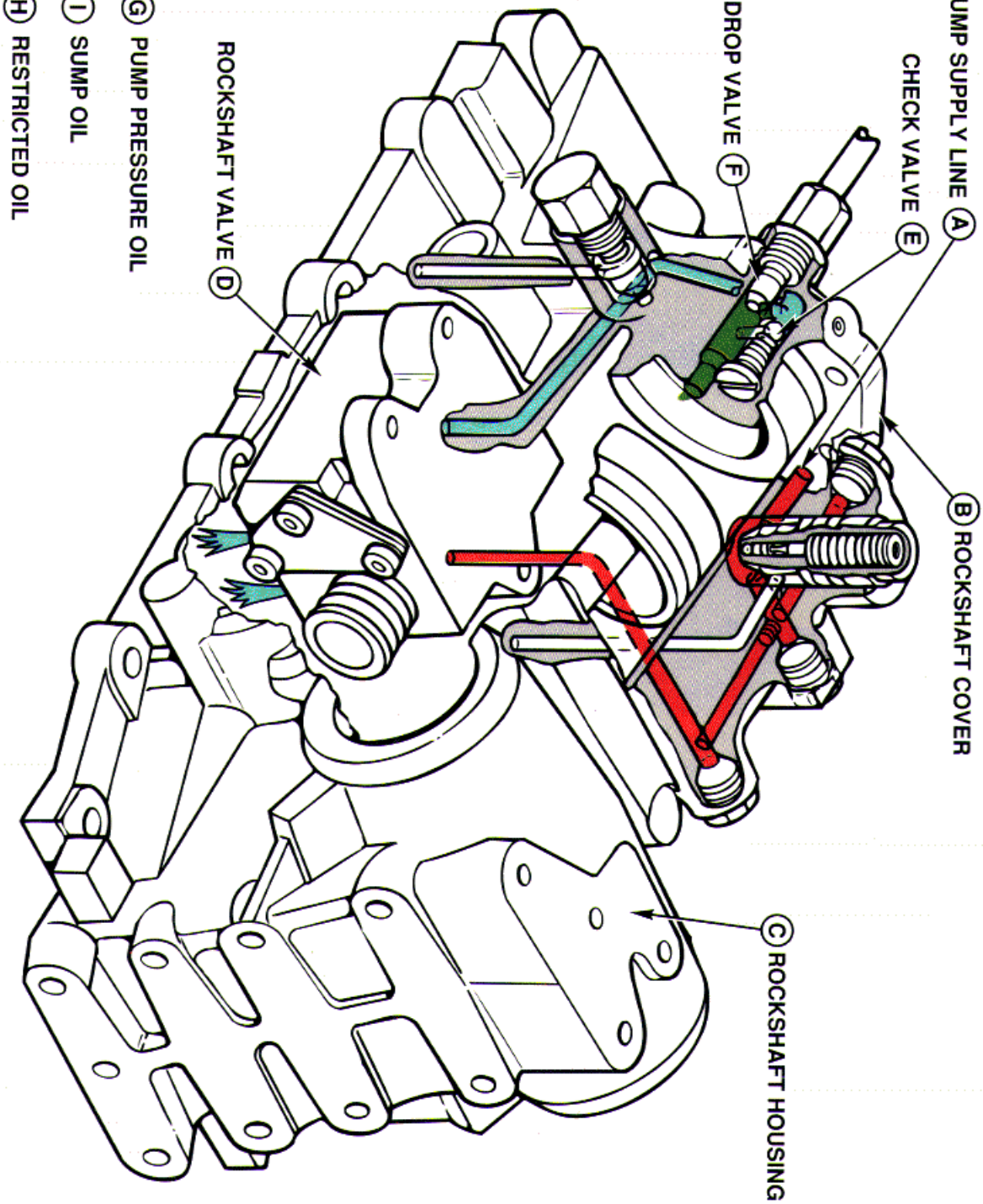
A-Pump Supply Line
B-Rockshaft Cover
C-Rockshaft Housing
D-Rockshaft Valve
E-Check Valve
F-Rate of Drop Valve
G-Pump Pressure Oil
H-Restricted Oil
I-Pressure Free Oil

In the lower position, the position lever is pushed forward which moves the rockshaft valve spool forward.

Pump pressure oil is directed through the rockshaft valve to sump.

Return oil from the cylinder cannot unseat the load check valve, so it is forced to go past the rate of drop valve (the rate of drop valve opening will determine how fast the oil can return) through the cylinder cover, rockshaft valve and to sump.

This allows the cylinder to retract and the rockshaft arms to lower.



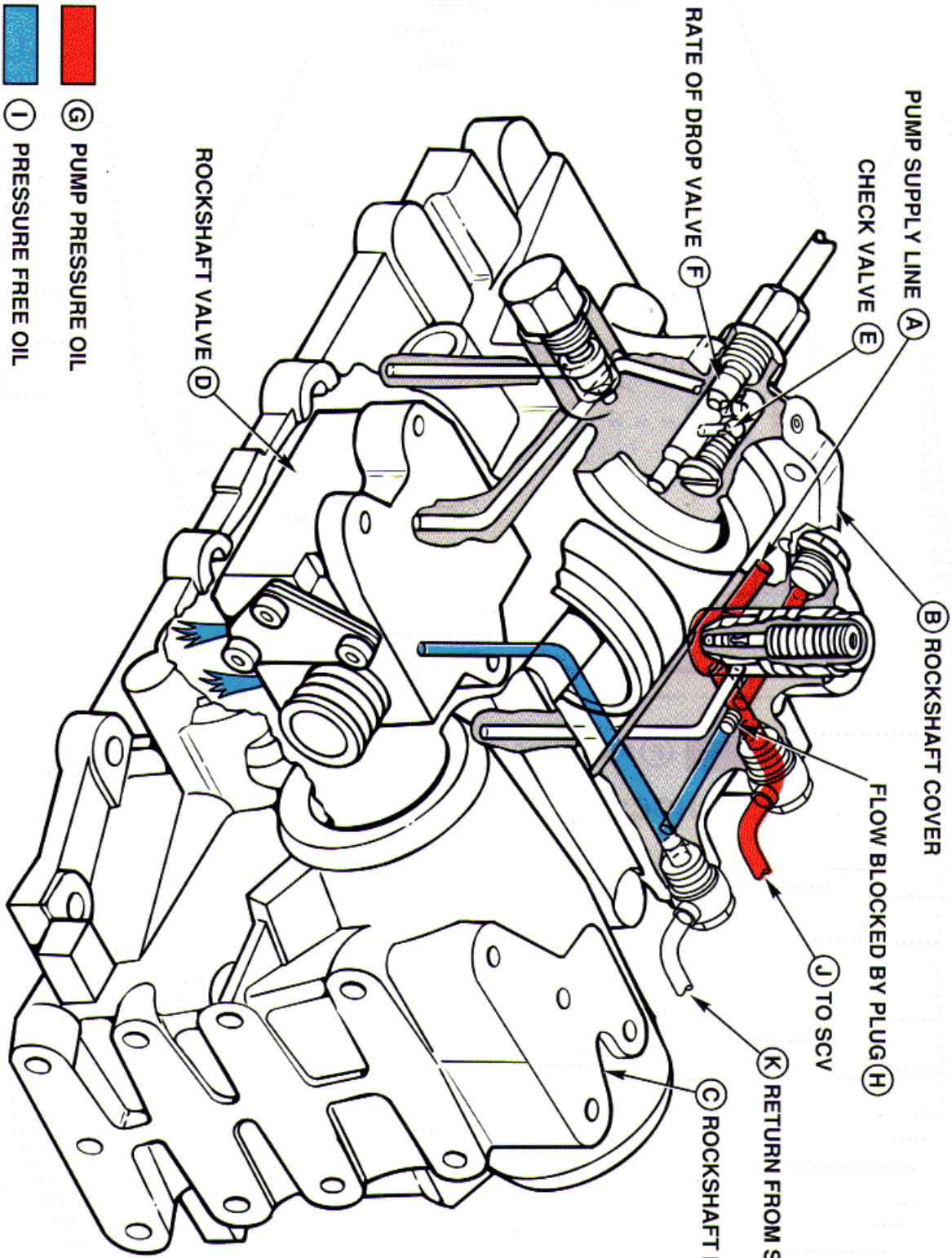
8-9-1070 ROCKSHAFT HOUSING OIL FLOW (LOWER) (WITHOUT SCV)

870/970/1070 ROCKSHAFT HOUSING OIL FLOW WITH SCV

A-Pump Supply Line
B-Rockshaft Cover
C-Rockshaft Housing
D-Rockshaft Valve
E-Check Valve
F-Rate of Drop Valve
G-Pump Pressure Oil
H-Plug
I-Pressure Free Oil
J-To SCV
K-Return from SCV

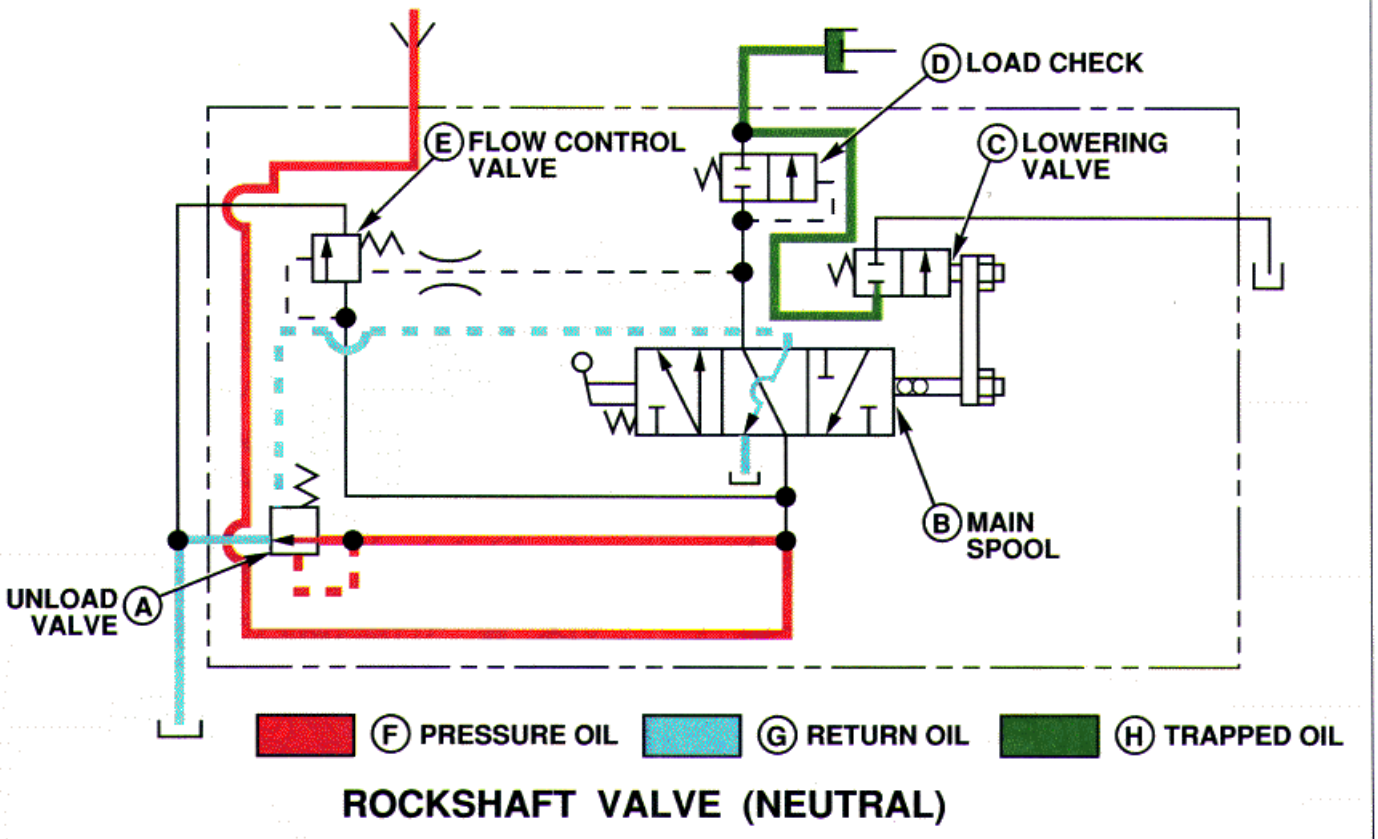
The pump supply line (A) provides pump pressure oil to the rockshaft cover which routes it to the SCV oil line (J) by a plug (H) that is installed with the Selective Control Valve kit.

Pressure free oil (I) is returned from the SCV via the (K) oil line and is routed to sump through the rockshaft valve (D).



8-9-1070 ROCKSHAFT HOUSING OIL FLOW (WITH SCV)

ROCKSHAFT VALVE OIL FLOW (NEUTRAL)



ROCKSHAFT VALVE (NEUTRAL)

MXC48418 -UN-30JUL88

A—Unload Valve
B—Main Spool
C—Lowering Valve
D—Load Check
E—Flow Control Valve
F—Pump Pressure Oil
G—Return Oil
H—Trapped Oil

Slide No. 213

In neutral the main spool is in the center position. Pump pressure oil passing across the main spool holds the flow control valve closed. Since the spring behind the unload valve is weaker than the spring and trapped oil pressure on the load check the pump pressure oil opens the unload valve and dumps pump supply oil direct to sump.

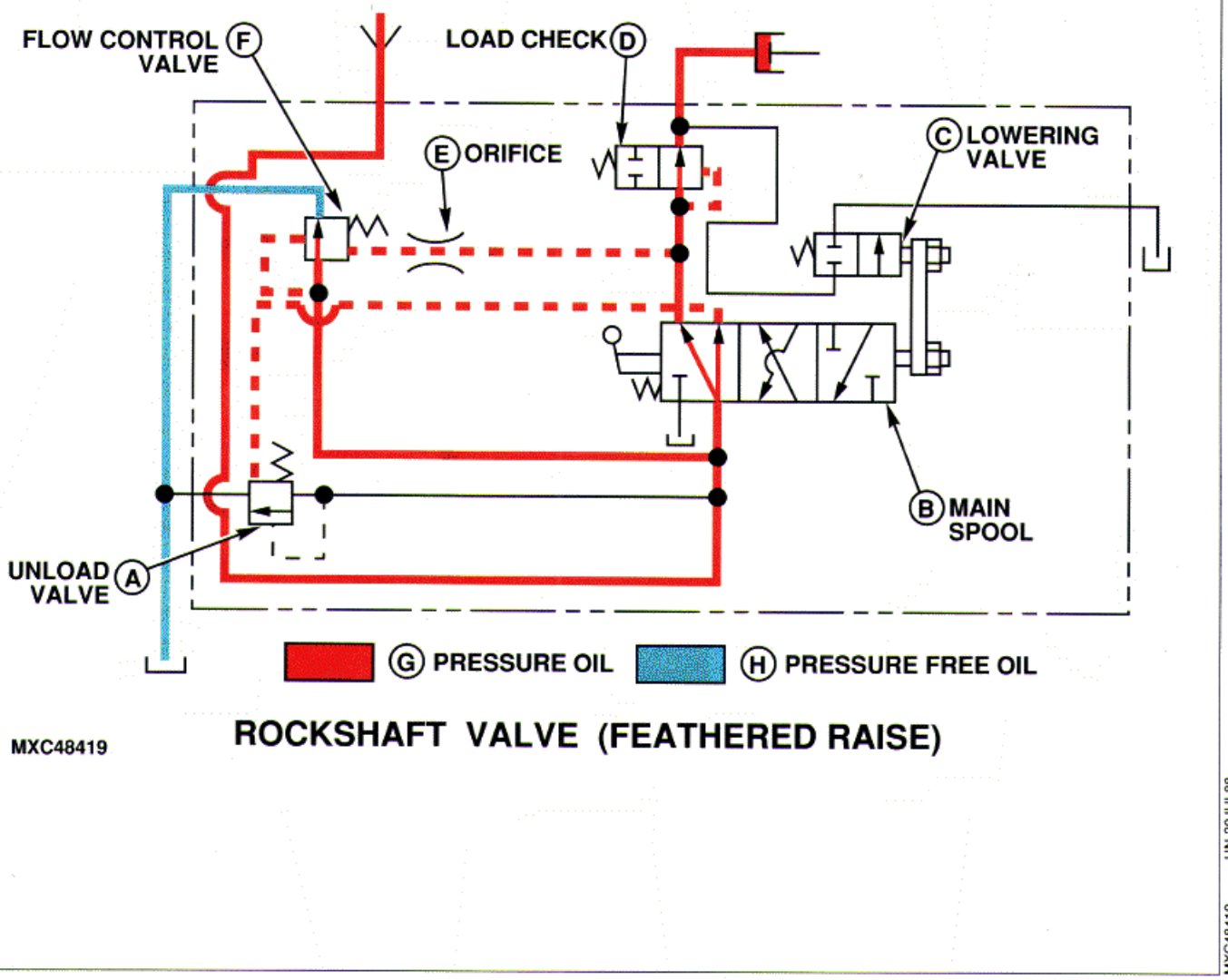
The lowering valve, load check and flow control valve all remain seated in neutral.

The slow raise position allows the operator to smoothly lift the 3-point hitch.

MX,27010DG,A16 -19-19DEC89

160290

ROCKSHAFT VALVE OIL FLOW (FEATHERED RAISE)



A—Unload Valve
B—Main Spool
C—Lowering Valve
D—Load Check
E—Orifice
F—Flow Control Valve
G—Pressure Oil
H—Pressure Free Oil

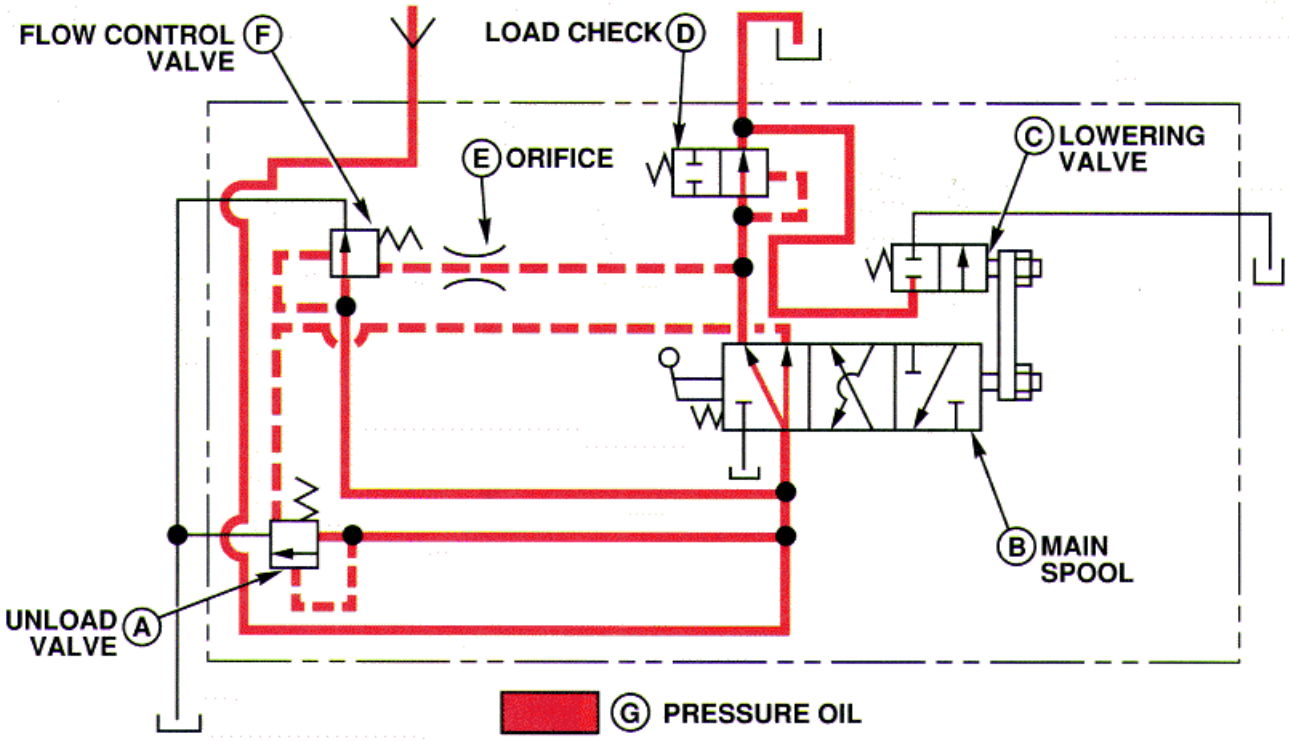
Slide No. 214

When the main spool is first moved to the raise position oil directed to the spring side of the flow control valve is slowed by the orifice in the line. This means that flow is reduced because the flow control valve is opened until the pressure behind the flow control valve equalizes and the spring closes it again.

The unloader valve is closed because oil pressure is directed to the spring side.

MX,27010DG,A17 -19-19DEC89

ROCKSHAFT VALVE OIL FLOW (FULL RAISE)



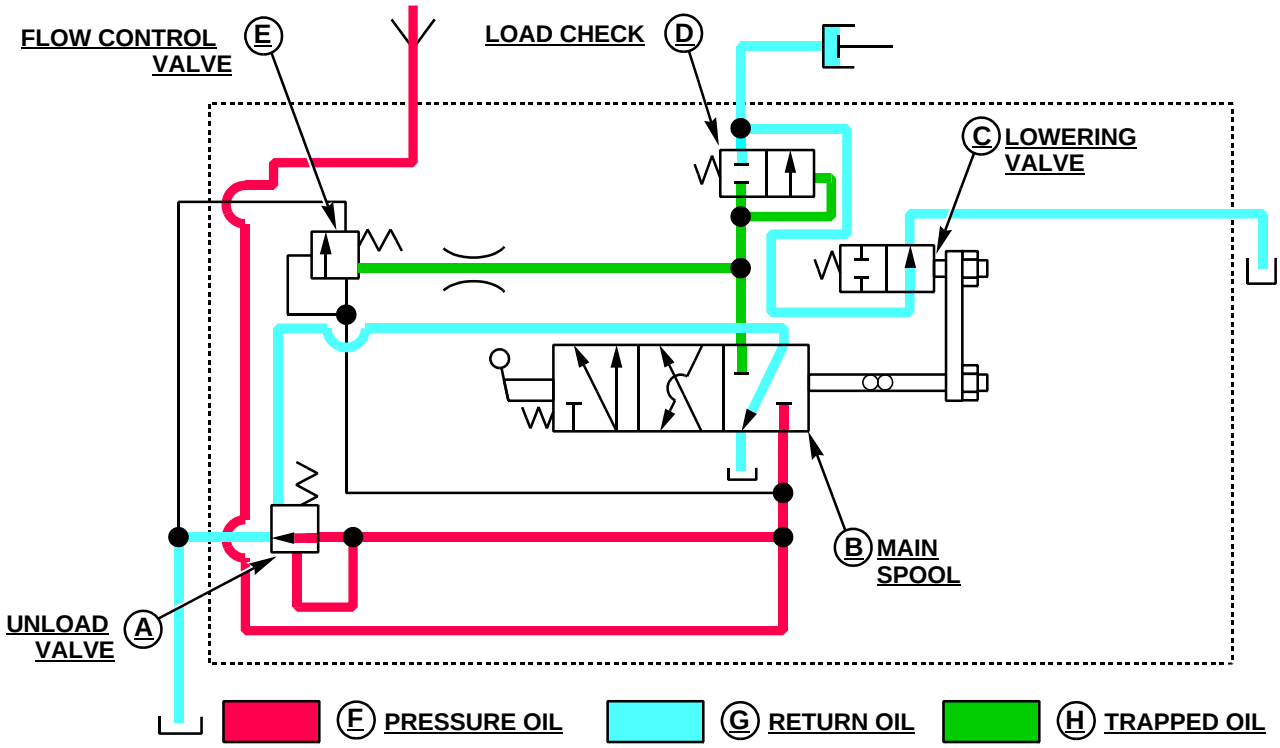
A—Unload Valve
B—Main Spool
C—Lowering Valve
D—Load Check
E—Orifice
F—Flow Control Valve
G—Pump Pressure Oil

Slide No. 215

With the main spool in the raise position after the spring side of the flow control valve equalizes with the pilot side the flow control valve closes off the path to sump. At this time all the oil from the pump is directed across the load check to the cylinder. The results are that the 3-point hitch will raise quickly.

MX,27010DG,A18 -19-19DEC89

ROCKSHAFT VALVE OIL FLOW (LOWER)



MXC48421

ROCKSHAFT VALVE (LOWER)

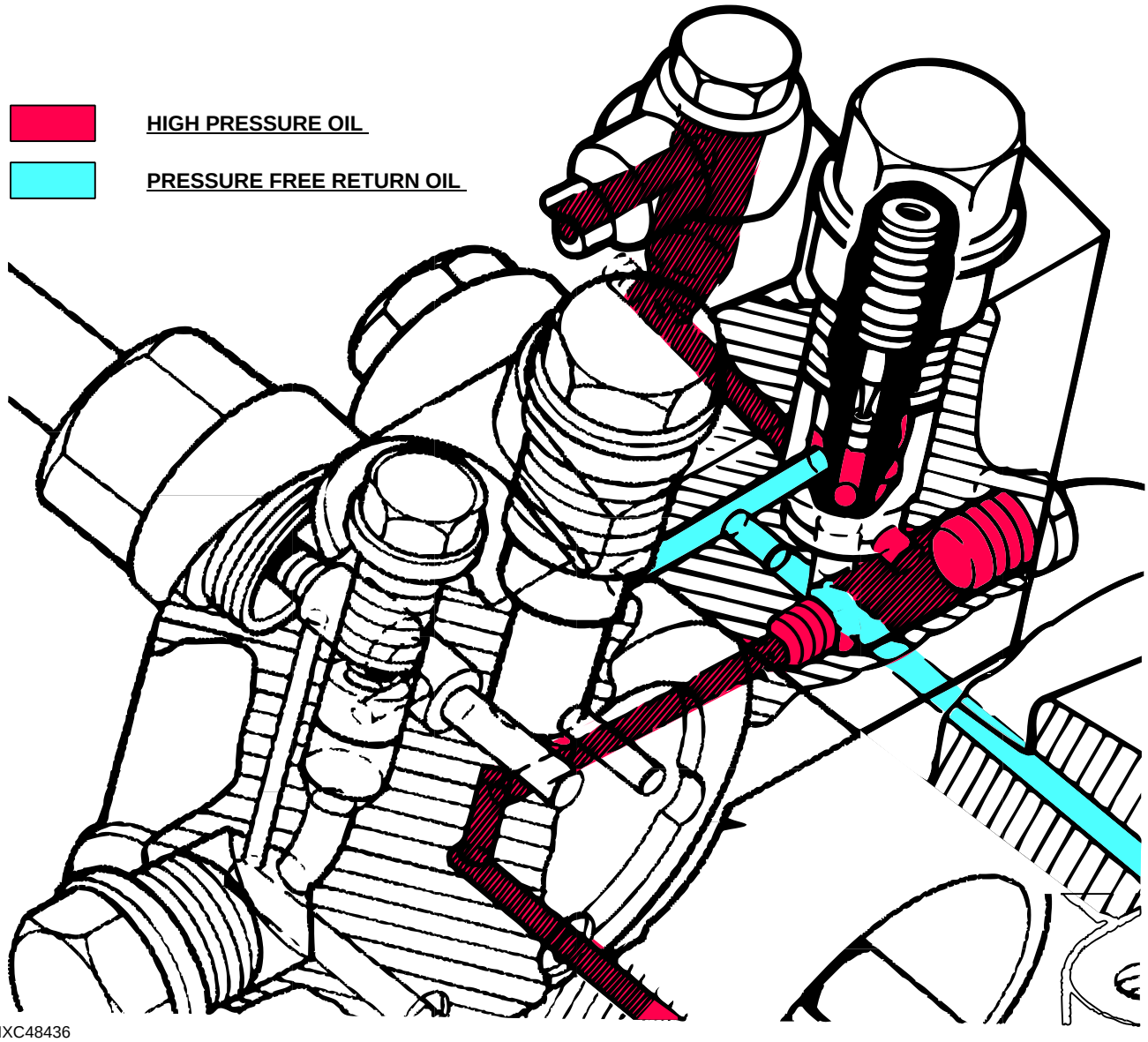
A—Unload Valve
B—Main Spool
C—Lowering Valve
D—Load Check
E—Flow Control Valve
F—Pump Pressure Oil
G—Return Oil
H—Trapped Oil

Moving the main spool to the lower position shuts off oil flow to the flow control valve, load check and cylinder.

The spring side of the unload valve is opened to sump so the unload valve again directs pump pressure oil to sump.

A mechanical link attached to the end of the main spool forces the lowering valve open to route cylinder oil to sump.

The rockshaft arms will not lower.



MXC48436

670 - 770 - 790 SYSTEM RELIEF VALVE

The purpose of the system relief valve is to:

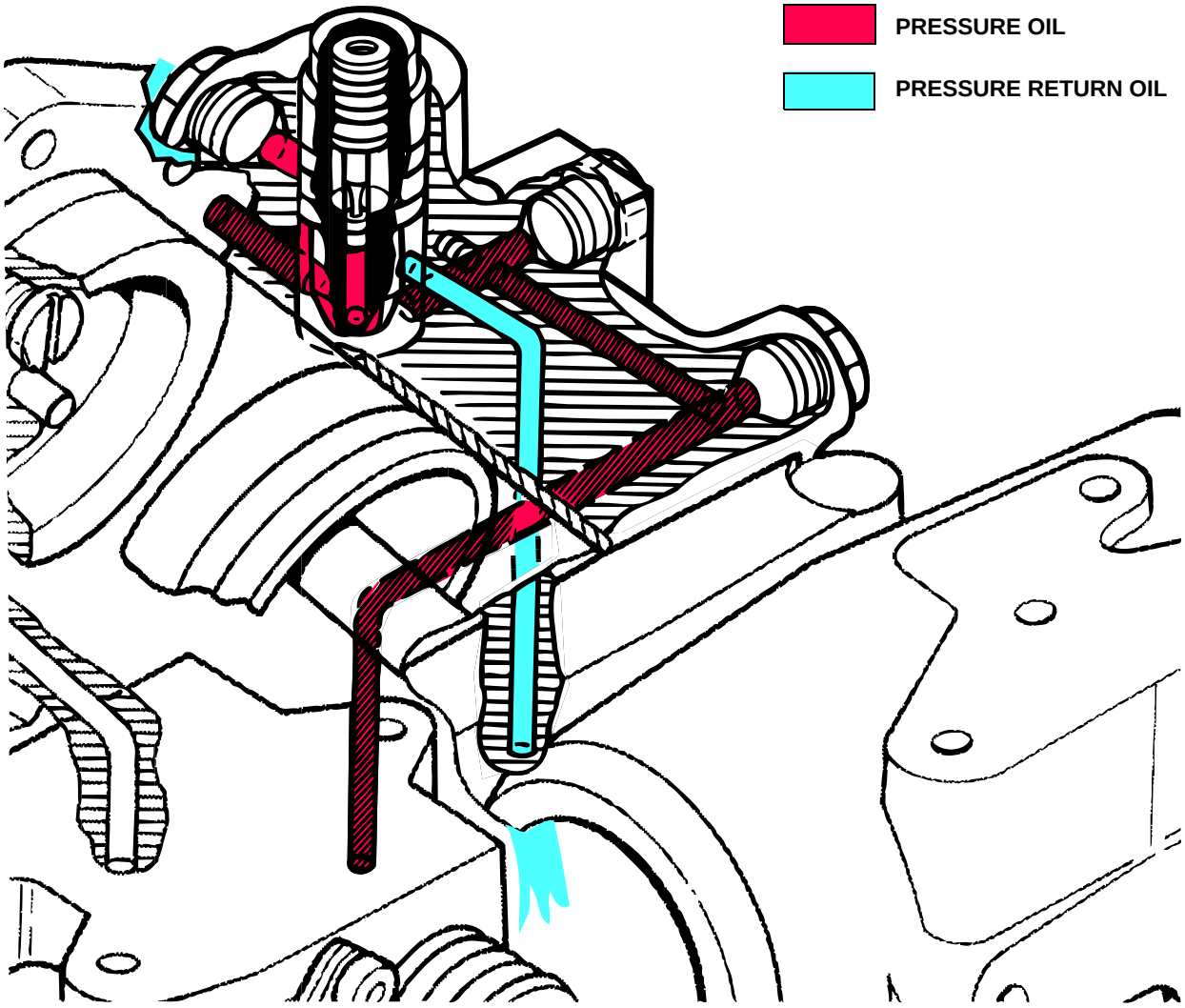
1. Protect the hydraulic system components from damage caused by too high of pressure.

2. Prevent the operator from lifting more than the tractor is stable enough to handle.

If for some reason the hydraulic system pressure becomes excessive the relief valve will unseat and dump the high pressure oil directly to sump.

The system relief valve protects the rockshaft system, selective control system and rear outlets.

870/970/1070 ROCKSHAFT RELIEF VALVE OPERATION



MXC48440

870 - 970 - 1070 ROCKSHAFT RELIEF VALVE OPERATION

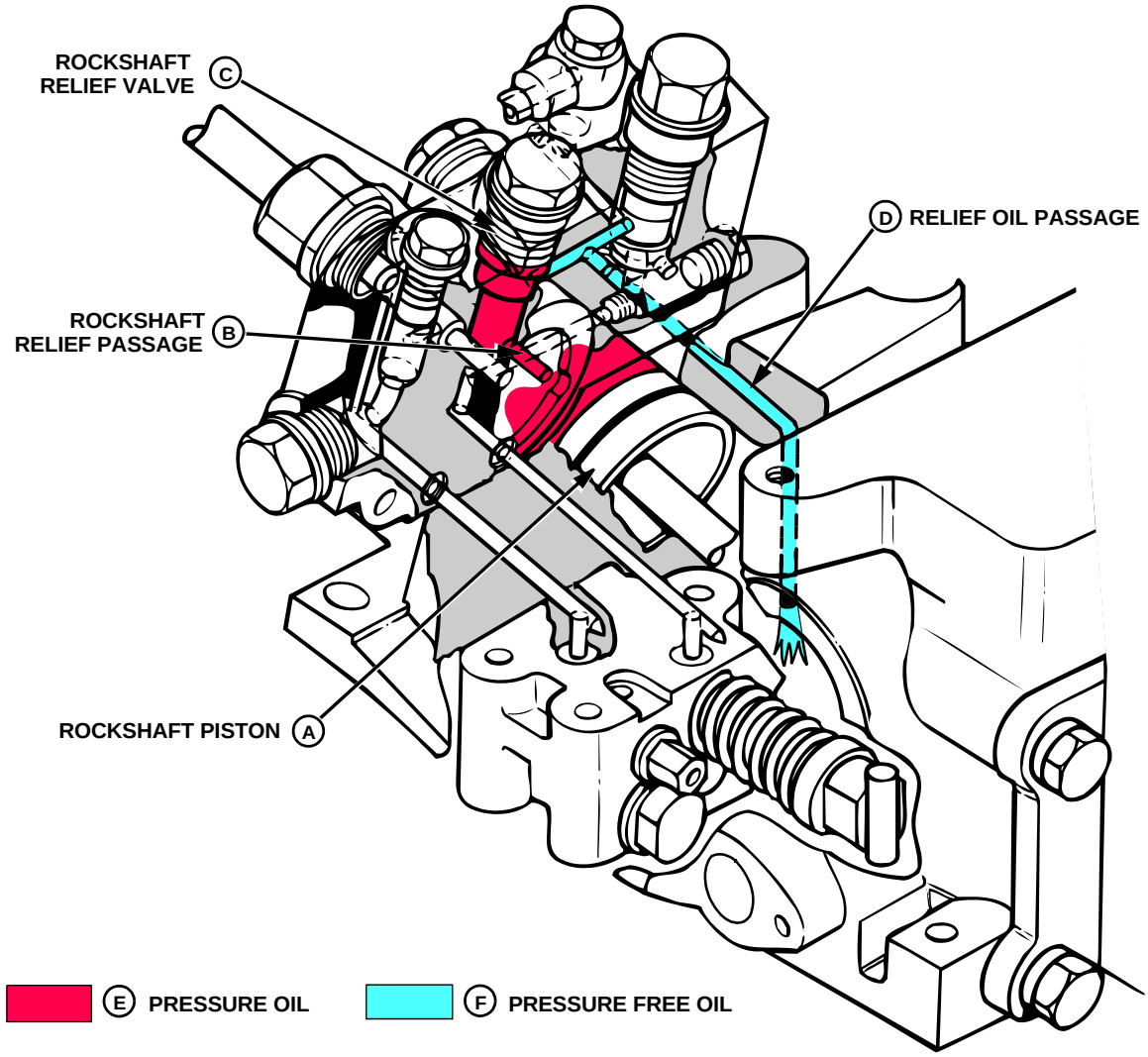
The purpose of the system relief valve is to:
1. Protect the hydraulic system components from damage caused by too high of pressure.

2. Prevent the operator from lifting more than the tractor is able to handle.

If for some reason the hydraulic system pressure becomes excessive the relief valve will unseat and dump the high pressure oil directly to sump.

The system relief valve protects the rockshaft system, selective control valve system and rear outlets.

670/770/790 ROCKSHAFT RELIEF VALVE OPERATION



MXC48423

670/770/790 ROCKSHAFT RELIEF VALVE OPERATION (WITHOUT SCV)

A—Rockshaft Piston **B—Rockshaft Relief Passage** **C—Rockshaft Relief Valve** **D—Relief Oil Passage**

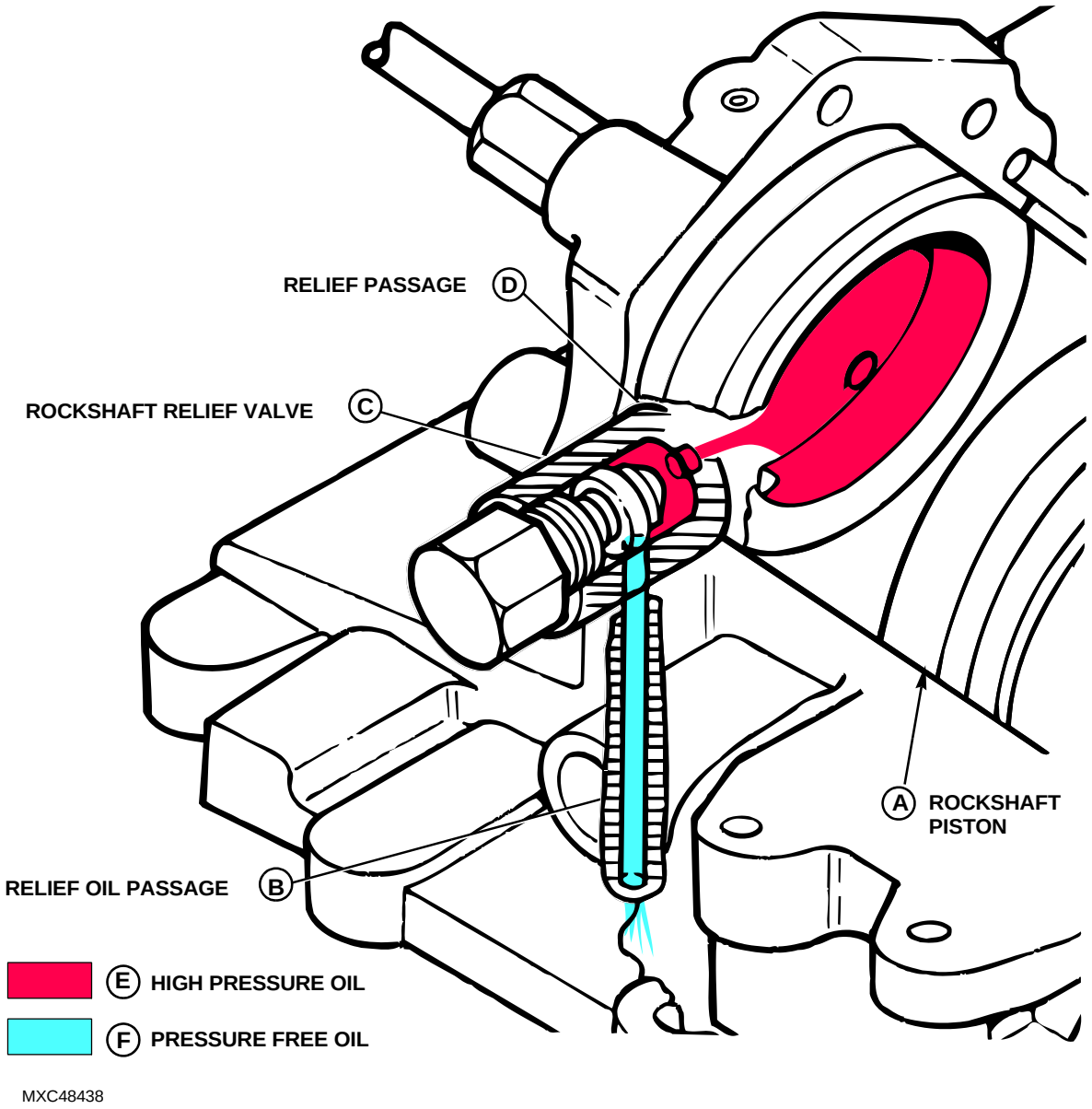
The purpose of the rockshaft relief valve is to:

1. To relieve oil from the cylinder that has expanded because of thermal expansion.

2. To relieve oil from the cylinder that has been compressed because of shock load caused by implement bounce.

If for some reason thermal expansion or oil compression occurs the rockshaft relief valve will unseat and dump the high pressure oil directly to the sump.

870/970/1070 ROCKSHAFT RELIEF VALVE OPERATION



8-9-1070 ROCKSHAFT RELIEF VALVE OPERATION (WITHOUT SCV)

A—Rockshaft Piston
B—Rockshaft Relief Passage
C—Rockshaft Relief Valve
D—Relief Oil Passage
E—High Pressure Oil
F—Pressure Free Oil

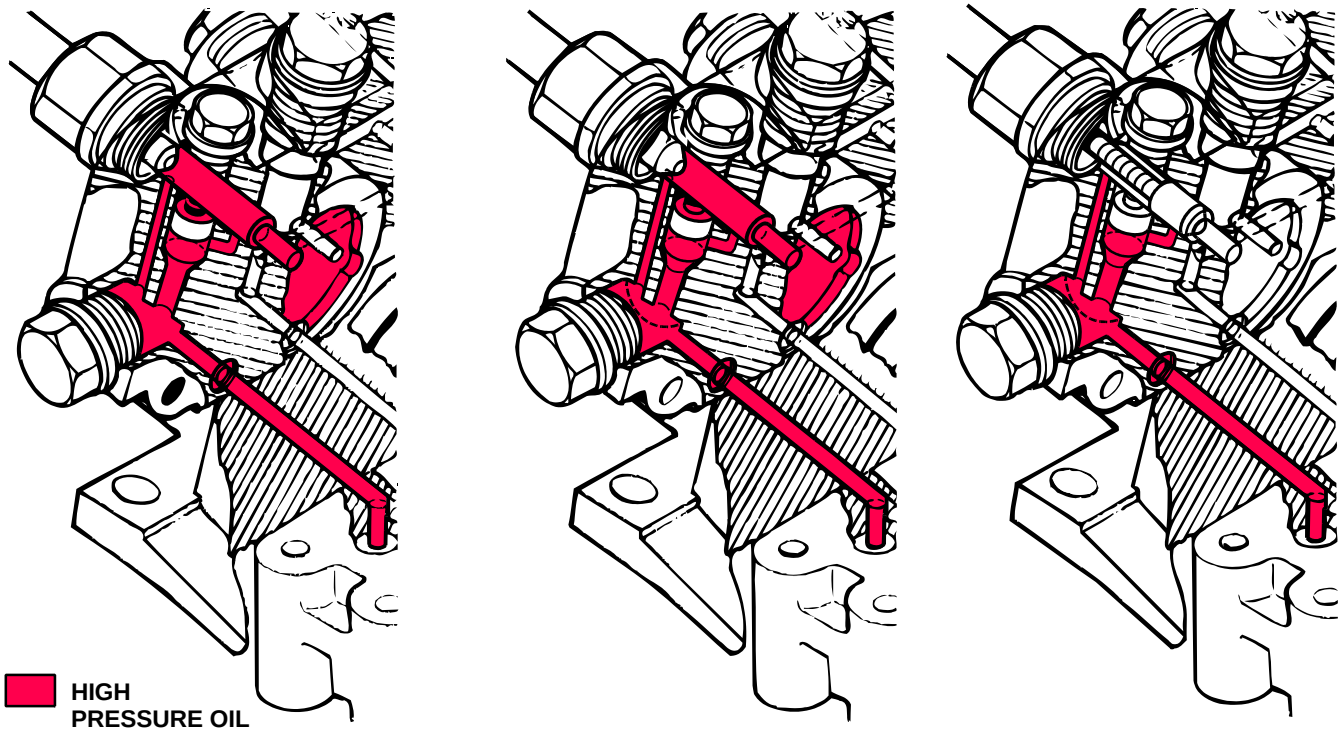
The purpose of the rockshaft relief valve is to:

1. To relieve oil from the cylinder that has expanded because of thermal expansion.

2. To relieve oil from the cylinder that has been compressed because of shock load caused by implement bounce.

If for some reason thermal expansion or oil compression occurs the rockshaft relief valve will unseat and dump the high pressure oil directly to the sump.

670/770/790 RATE OF DROP/STOP VALVE OPERATION (ROCKSHAFT RAISE)



MXC48553

In the rockshaft raise position the rate of drop/stop valve does not affect oil flow unless it is fully closed. Oil flow to the cylinder is as follows:

Full Open

The rate of drop/stop valve does not affect the forward passage therefore oil from the rockshaft valve unseats the load check valve and flows directly through both passages into the cylinder.

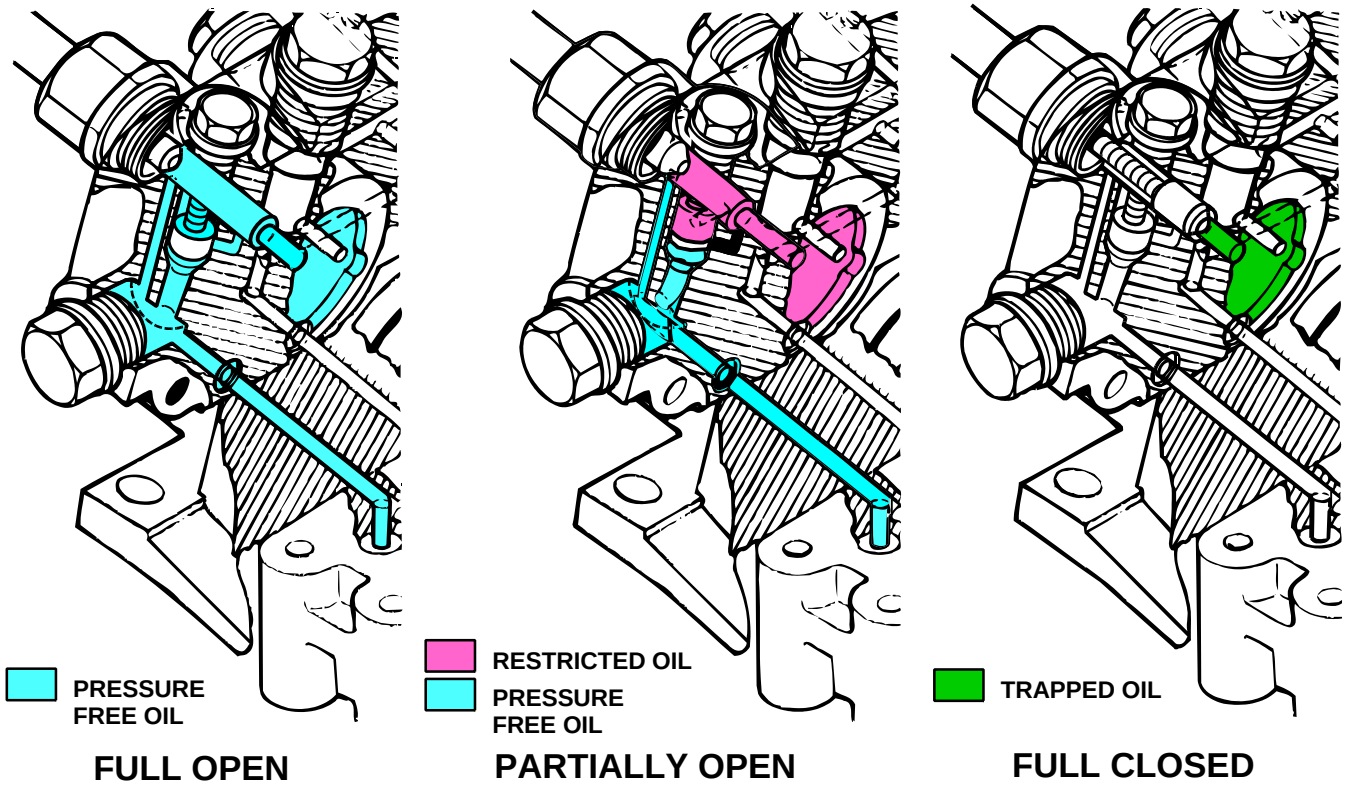
Partially Open

The rate of drop/stop valve is partially blocking off the froward passage causing a restriction. (See rate of drop/stop valve operation - rockshaft lower, later in this group).

Fully Closed

The rate of drop/stop valve is completely seated with no oil entering the cylinder. If the rockshaft valve is moved to the raise position, the system will go into relief.

670/770/790 RATE OF DROP/STOP VALVE OPERATION (ROCKSHAFT LOWER)



MXC48424

In the rockshaft lower position the rate of drop/stop valve controls how fast the implement will lower or completely locks the cylinder in the position it is at. Return oil flow is as follows:

Full Open

The rate of drop/stop valve does not affect the forward passage therefore oil from the cylinder can flow unrestricted through the rockshaft valve to sump.

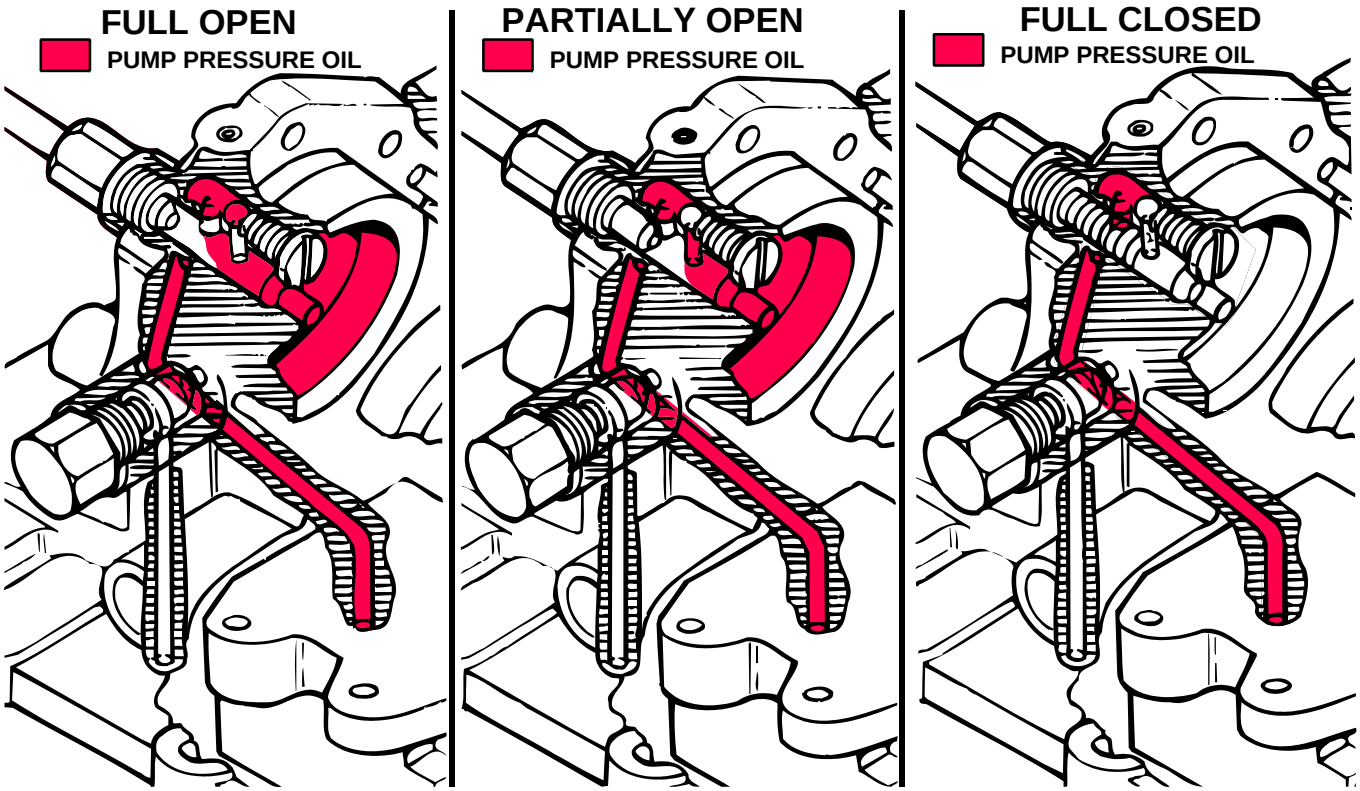
Partially Open

The rate of drop/stop valve is partially blocking off the forward passage. Return oil can not unseat the load check so oil flow from the cylinder must go through the restricted forward passage to the rockshaft valve and sump.

Fully Closed

The rate of drop/stop valve is completely seated not allowing oil to leave the cylinder at all. The implement will stay in the position even if the rockshaft valve is moved to lower.

870/970/1070 RATE OF DROP/STOP VALVE OPERATION (ROCKSHAFT RAISE)



MXC48554

In the rockshaft raise position the rate of drop/stop valve does not affect oil flow unless it is fully closed. Oil flow to the cylinder is as follows:

Full Open

The rate of drop/stop valve does not affect the forward passage therefore oil from the rockshaft valve, will unseat the load check valve and can flow through both passages directly into the cylinder.

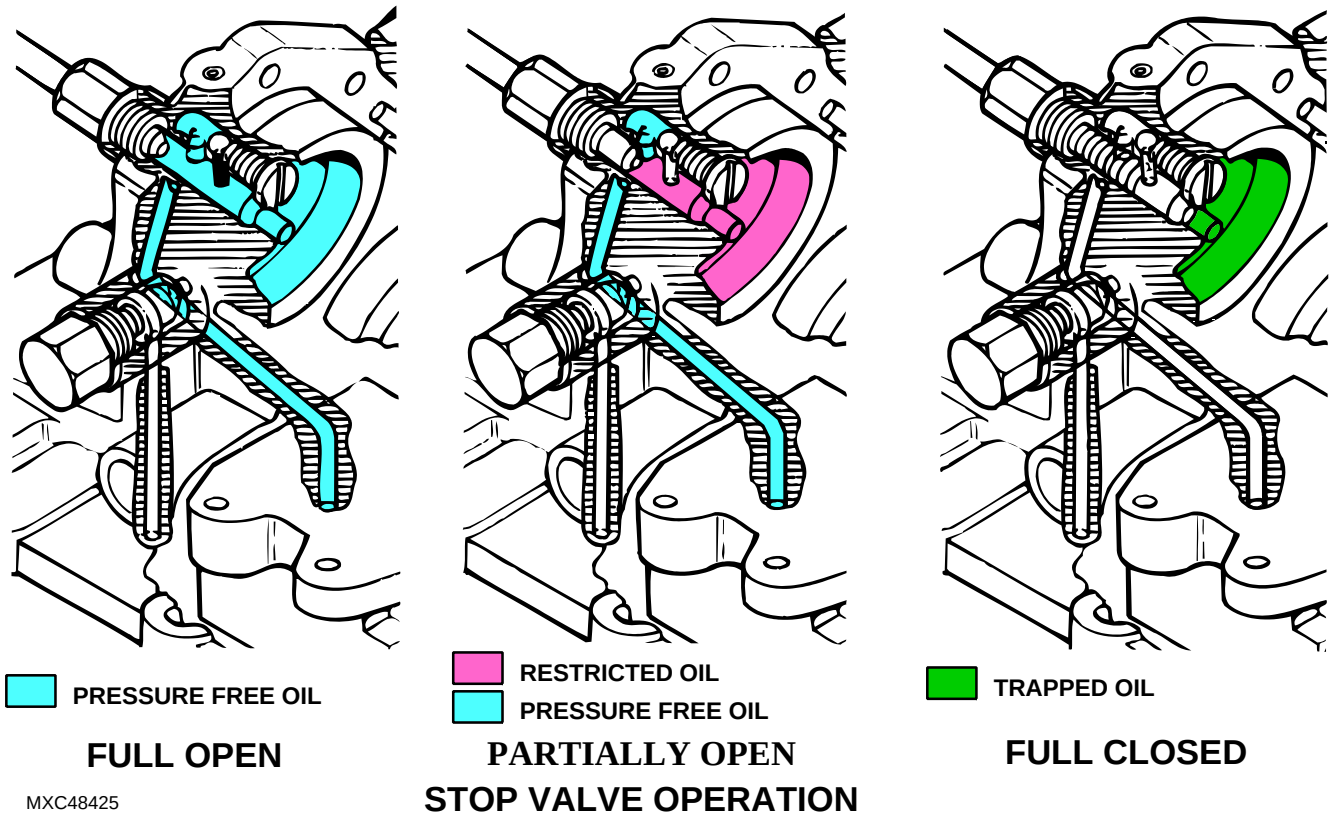
Partially Open

The rate of drop/stop valve is partially blocking off the forward passage causing a restriction. Oil from the rockshaft valve will unseat the load check valve and enter the cylinder through the rear passage.

Fully Closed

The rate of drop/stop valve is completely seated not allowing oil to leave the cylinder. If the rockshaft valve is used the system will go into relief.

870/970/1070 RATE OF DROP/STOP VALVE OPERATION (ROCKSHAFT LOWER)



STOP VALVE OPERATION

In the rockshaft lower position the rate of drop/stop valve controls how fast the implement will lower or completely locks the cylinder in the position it is at. Return oil flow is as follows:

Full Open

The rate of drop/stop valve does not affect the forward passage therefore oil from the cylinder can flow unrestricted through the rockshaft valve to sump.

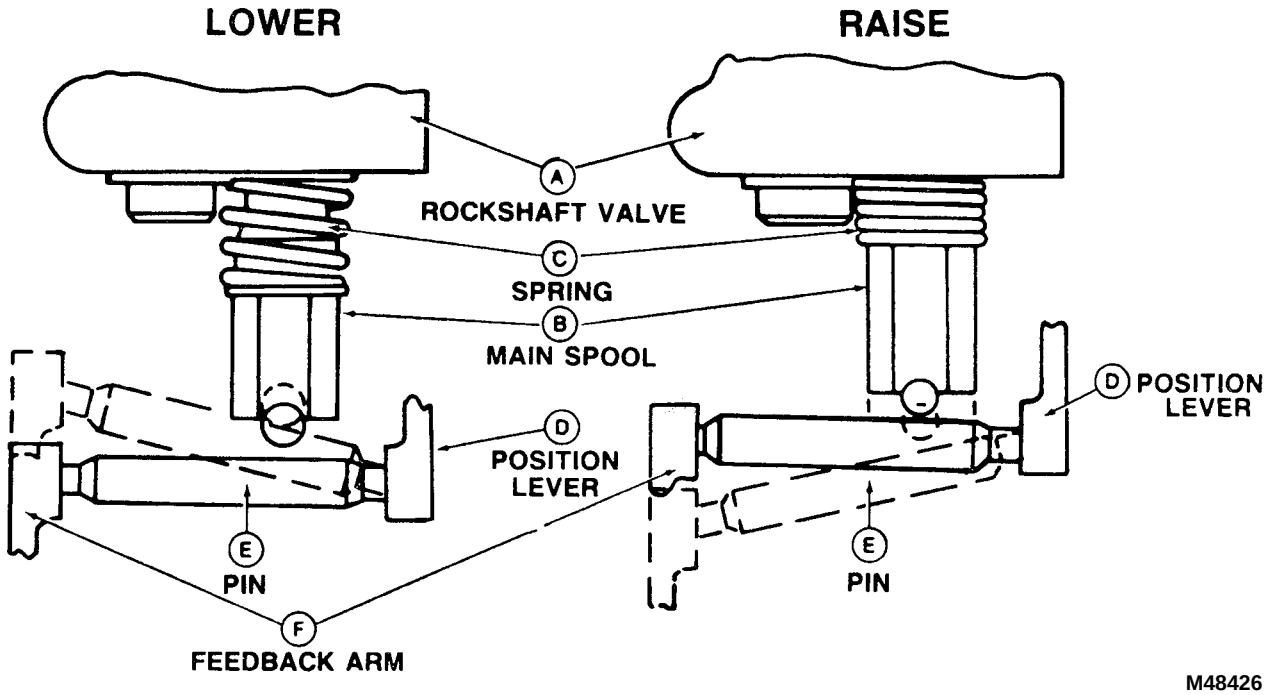
Partially Open

The rate of drop/stop valve is partially blocking off the forward passage. Return oil can not unseat the load check so oil flow from the cylinder must go through the restricted forward passage to the rockshaft valve and sump.

Fully Closed

The rate of drop/stop valve is completely seated not allowing oil to leave the cylinder at all. The implement will stay in the position even if the rockshaft valve is moved to lower.

670-770-790 ROCKSHAFT CONTROL LINKAGE



670-770-790 ROCKSHAFT CONTROL LINKAGE

A—Rockshaft Piston	**C—Spring**	**E—Pivot Pin**	**G—Position Control Lever**
B—Main Spool	**D—Position Lever Arm**	**F—Feedback Arm**	**H—Rockshaft Arm**

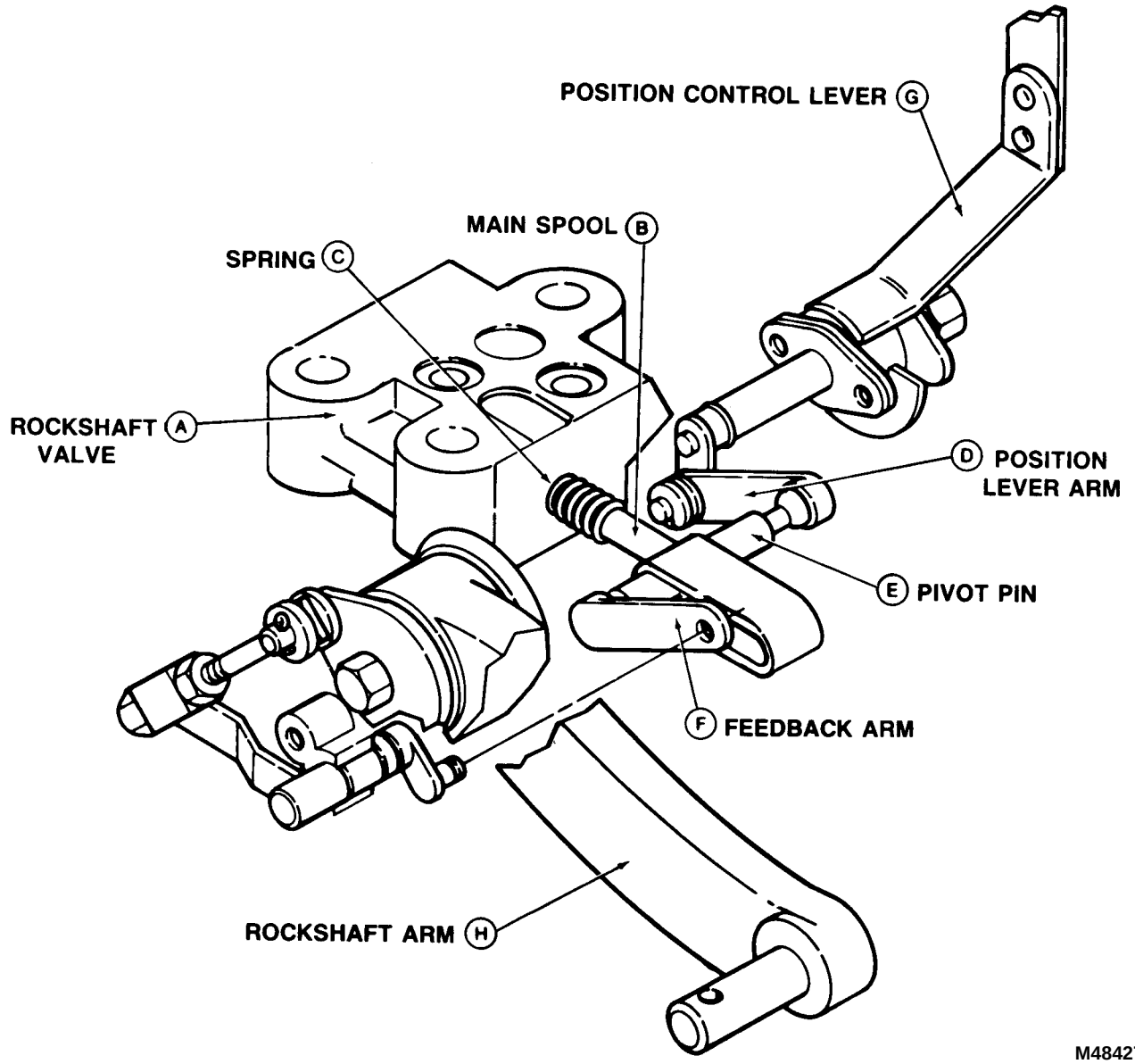
The rockshaft valve is controlled by the position control lever and the rockshaft arm feedback linkage.

When the operator pulls the control lever back to raise the 3-point hitch the position lever arm (D) moves the right side of pivot pin (E) forward. The pivot pin forces the main spool into the valve which directs oil to the rockshaft cylinder.

As the 3-point hitch raises the feedback arm (F) moves back which pulls the left side of pivot pin (E) back. Valve spring (C) forces the main spool to follow the pivot pin.

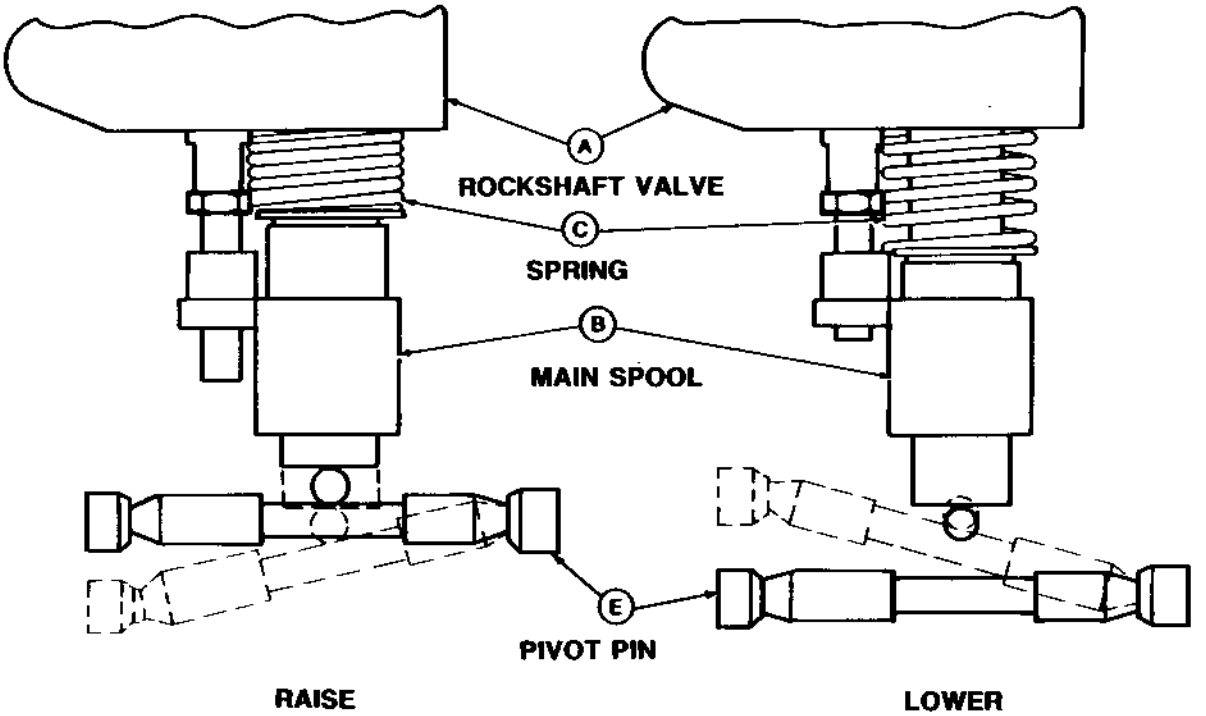
When the main spool reaches neutral oil flow stops and the 3-point hitch remains in that position.

When the operator moves the position control lever forward to lower the 3-point hitch the right side of the pivot pin is moved rearward. The spring forces the main spool back causing rockshaft oil to dump to sump. As the hitch lowers the feedback arm forces the left side of the pivot pin forward. When the main spool reaches neutral the path to sump is closed and the 3-point hitch remains in that position.



670-770-790 ROCKSHAFT VALVE POSITION CONTROL LINKAGE

870/970/1070 ROCKSHAFT VALVE POSITION CONTROL LINKAGE OPERATION



-19-09JAN90

M48428

ROCKSHAFT VALVE POSITION CONTROL LINKAGE

270
10
30

A—Rockshaft Valve
B—Main Spool
C—Spring
D—Position Lever Arm
E—Pivot Pin
F—Feedback Arm
G—Position Control Lever
H—Rockshaft Arm

Slide No. 227

The rockshaft valve is controlled by the position control lever and the rockshaft arm feedback linkage.

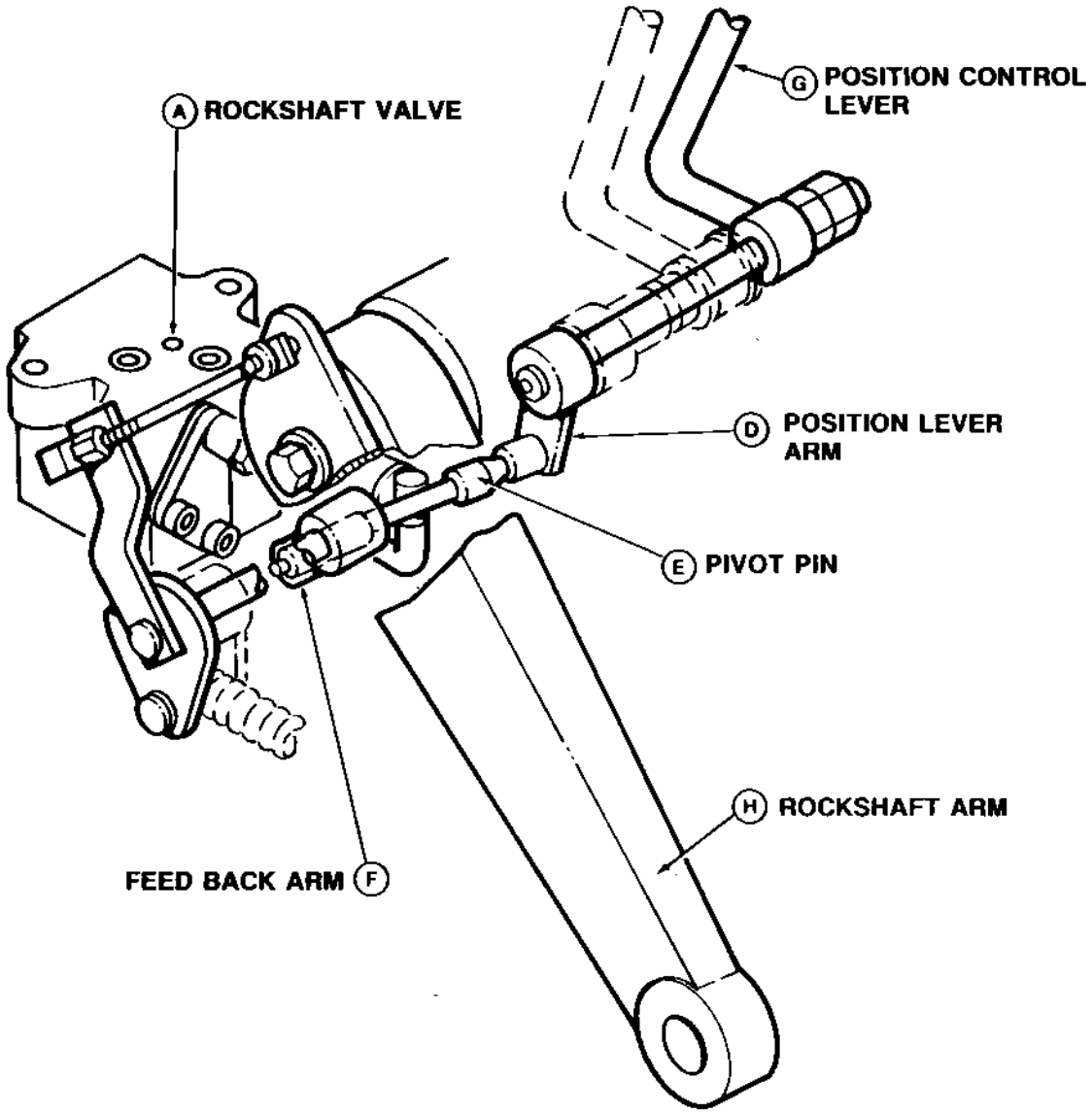
When the operator pulls the control lever back to raise the 3-point hitch the position lever arm (D) moves the right side of pivot pin (E) forward. The pivot pin forces the main spool into the valve which directs oil to the rockshaft cylinder.

As the 3-point hitch raises the feedback arm (F) moves back which pulls the left side of pivot pin (E) back. Valve spring (C) forces the main spool to follow the pivot pin.

When the main spool reaches neutral, oil flow stops and the 3-point hitch remains in that position.

When the operator moves the position control lever forward to lower the 3-point hitch the right side of the pivot pin is moved rearward. The spring forces the main spool back causing rockshaft oil to dump to sump. As the hitch lowers the feedback arm forces the left side of the pivot pin forward. When the main spool reaches neutral the path to sump is closed and the 3-point hitch remains in that position.

MX,27010DG,A30 -19-19DEC89



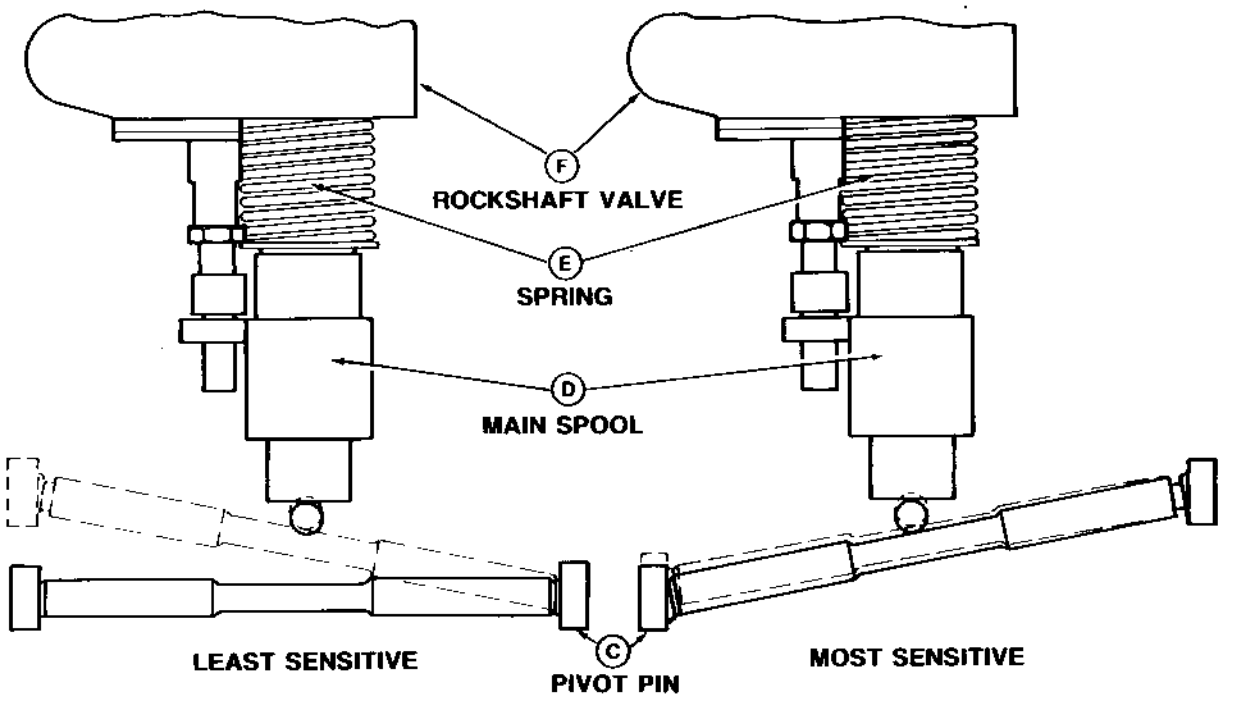
ROCKSHAFT VALVE POSITION CONTROL LINKAGE

M48429 -19-29JAN90

Slide No. 228

MX,27010DG,A31 -19-19DEC89

1070 ROCKSHAFT VALVE DRAFT SENSING LINKAGE OPERATION



-19-09JAN90

M48430

DRAFT SENSING PIVOT PIN

270
10
32

A—Draft Senstivity Lever
B—Draft Lever Arm
C—Pivot Pin
D—Main Spool
E—Spring
F—Rockshaft Valve
G—Feedback Arm
H—Draft Feedback Linkage
I—Center Link Attaching Bracket
J—Bracket Spring

Slide No. 229

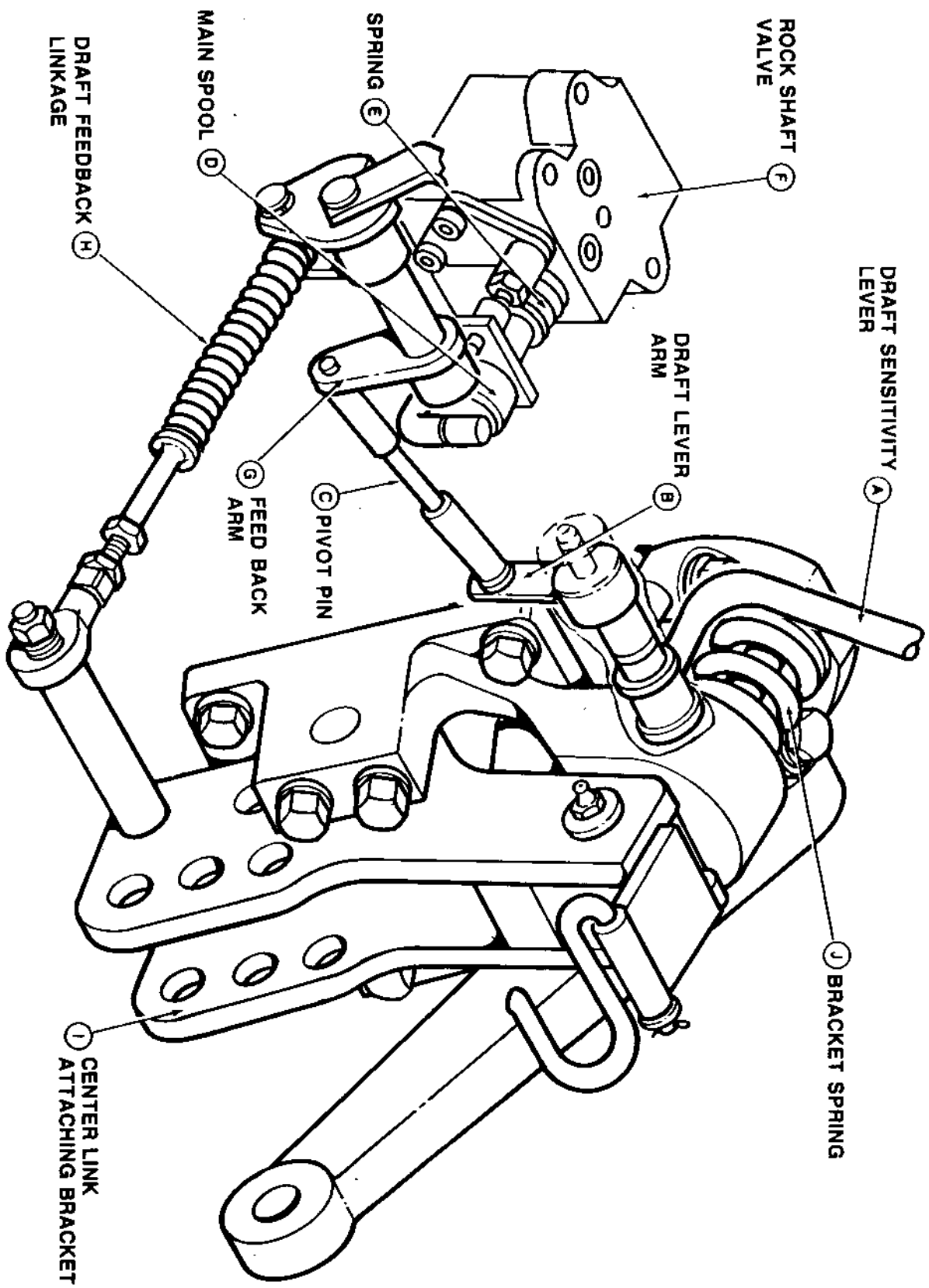
The draft sensing linkage is used to automatically lift the implement if a heavy draft load is sensed on the 3-point hitch. The operator uses the draft sensing lever to determine how sensitive the system should be to change in draft load.

In the least sensitive position the draft control arm is moved rearward which positions the pivot pin a distance away from the draft feedback arm. If a force is felt at the center link the feedback linkage must move that distance before the pivot pin is moved. Once the feedback arm moves the left side of the pivot pin forward the valve main spool is forced forward. The rockshaft valve directs oil to the rockshaft cylinder and lifts the 3-point hitch.

The result is a reduced load on the center link because the implement is not operating as deep. If the draft load is reduced the feedback linkage allows the left side of the pivot pin to move rearward. The spring will force the main spool back dumping some rockshaft cylinder oil to sump and lowering the 3-point hitch back to the depth determined by the operator with the position sensing linkage.

In the more sensitive position this will occur with less draft load because the pivot pin is closed to the valve spool.

MX,27010DG,A32 -19-19DEC89



DRAFT SENSING LINKAGE

M48431 -19-09JAN90

Slide No. 230

MX,27010DG,A33 -19-19DEC89

670/770/790 SELECTIVE CONTROL VALVE OIL SUPPLY

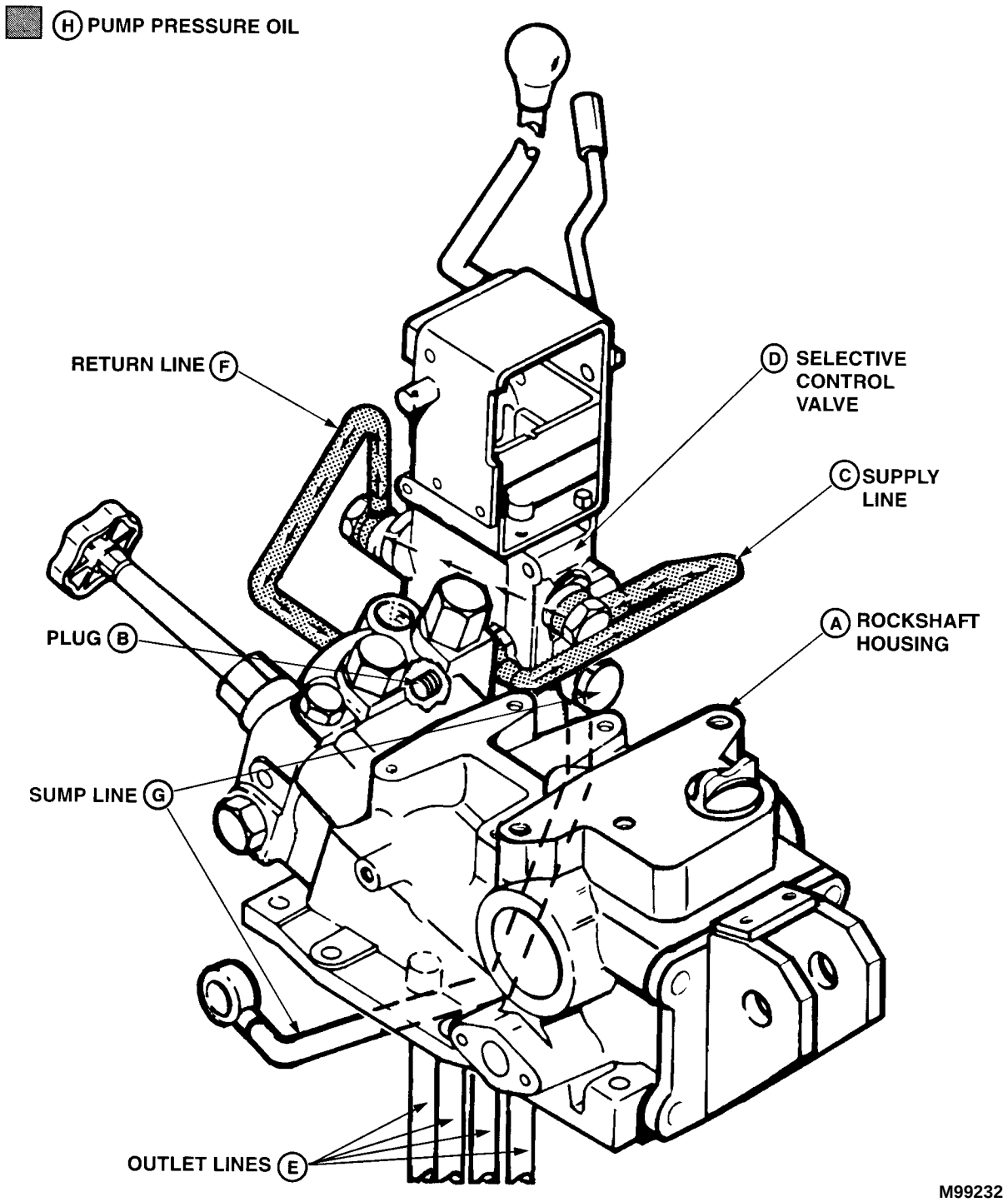
A—Rockshaft Housing
B—Plug
C—Supply Line
D—Selective Control Valve
E—Outlet Lines
F—Return Line
G—Sump Line
H—Pump Pressure Oil

Pump pressure oil (H) is directed from the rockshaft housing (A) by a plug (B) that is installed with the selective control valve kit.

Oil flows from the rockshaft valve through the supply line (C) the selective control valve (D) and return line (F) back to the rockshaft housing passage.

The sump line (G) is used only to dump cylinder return oil directly to sump when the valve is in operation.

The system relief valve in the rockshaft housing protects the selective control valve.



670-770-790 SELECTIVE CONTROL VALVE OIL SUPPLY

870/970/1070 SELECTIVE CONTROL VALVE OIL SUPPLY

A—Rockshaft Housing
B—Plug
C—Supply Line
D—Selective Control Valve
E—Outlet Lines
F—Return Line
G—Sump Line
H—Pump Pressure Oil

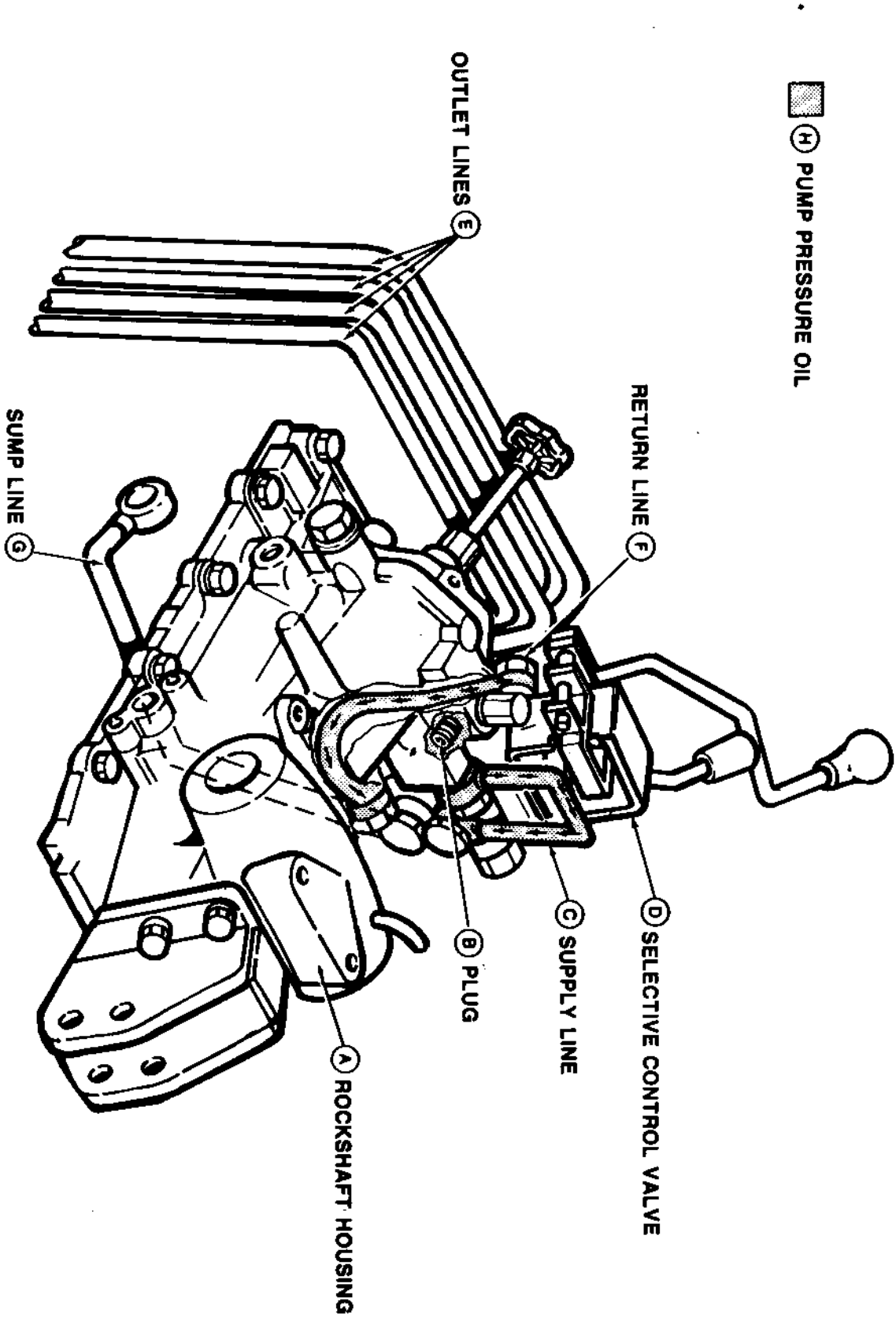
Pump pressure oil (H) is directed from the rockshaft housing (A) by a plug (B) that is installed with the selective control valve kit.

Oil flows from the rockshaft valve through the supply line (C) the selective control valve (D) and return line (F) back to the rockshaft housing passage.

The sump line (G) is used only to dump cylinder return oil directly to sump when the valve is in operation.

The system relief valve in the rockshaft housing protects the selective control valve.

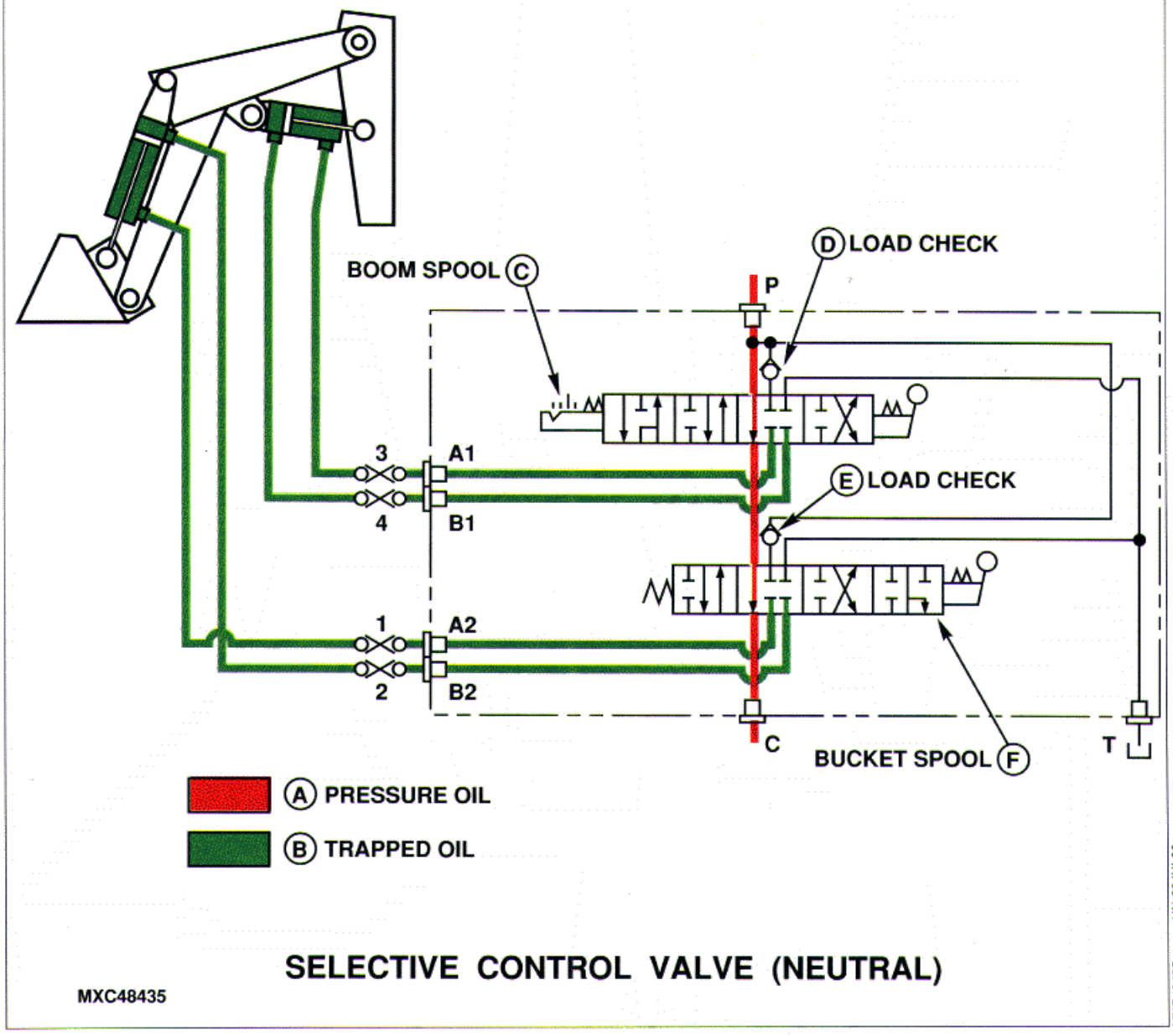
MX,27010DG,A36 -19-19DEC89



Slide No. 232

MX,27010DG,A37 -19-19DEC89

SELECTIVE CONTROL VALVE OIL FLOW (NEUTRAL)



A—Pressure Oil
B—Trapped Oil
C—Boom Spool
D—Load Check
E—Load Check
F—Bucket Spool

Slide No. 233

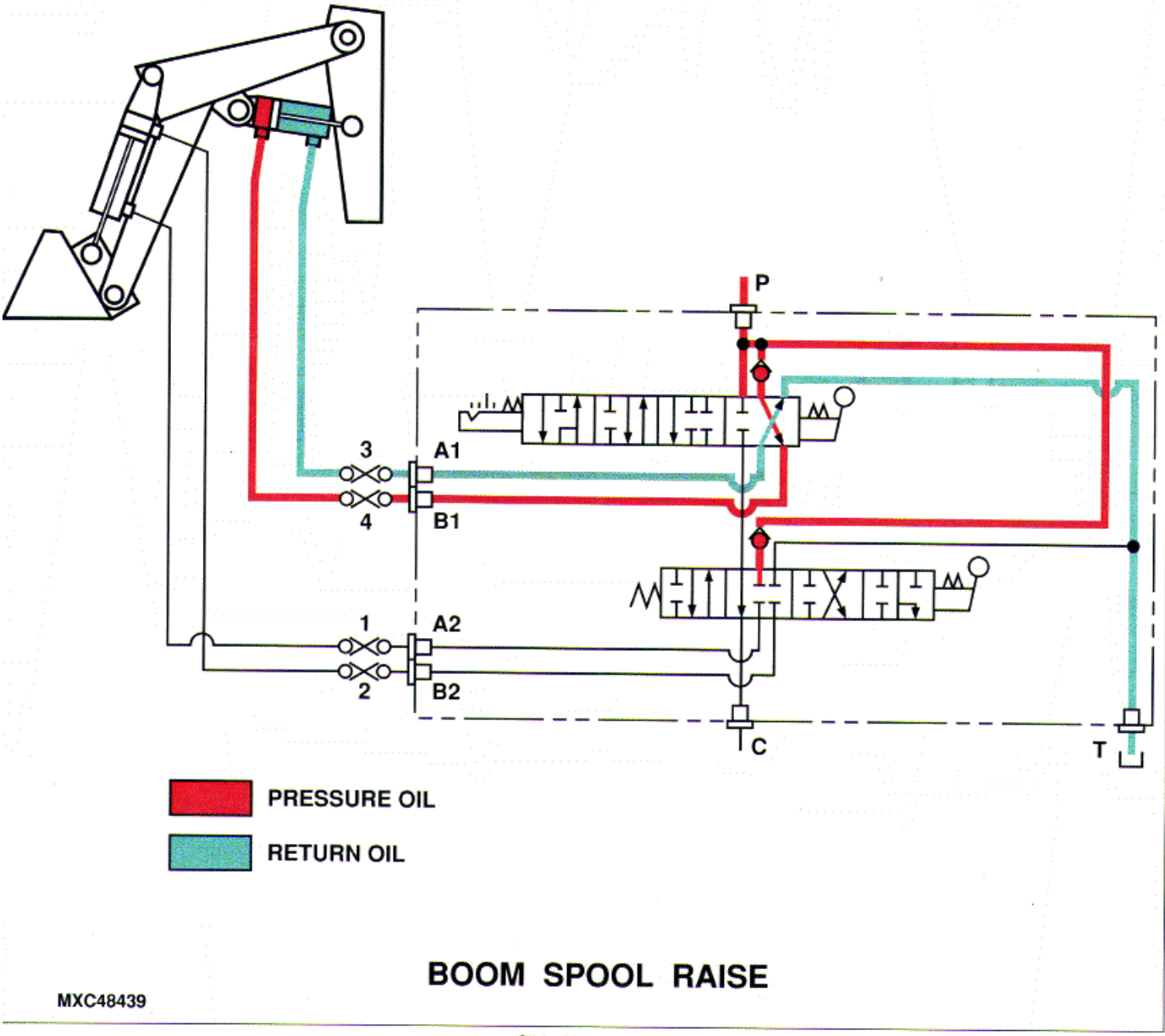
The selective control valve (SCV) is an open center type valve with four position spools. When the spools are in neutral, oil flows around the spools through an open center passage and out the "C" port to the rockshaft inlet. The boom spool positions are: raise, lower, neutral, and float. The bucket spool positions are: dump, curl, neutral, and regenerative. Each spool also has a load check valve to prevent the load from dropping when the spool is first activated.

The SCV spools are connected in a parallel circuit so both spools receive pressure oil and can be activated at the same time to increase productivity.

MX,27010DG,A38 -19-19DEC89

160290

SELECTIVE CONTROL VALVE OIL FLOW (BOOM SPOOL RAISE)



BOOM SPOOL RAISE

Slide No. 234

With the spool moved to raise position, the open center passage is blocked. As pressure increases in the inlet passage and overcomes load check valve spring pressure, the load check valve opens. Pressure oil flows out port "B1" to head end of boom cylinder. Pressure will build until pressure oil overcomes the load at the boom cylinder and extends the cylinder. If the load at the boom cylinder is too great or the cylinder is dead-headed, the main relief valve will open, diverting oil to sump.

Return oil from the rod end of cylinder flows to transmission sump.

MX,27010DG,A39 -19-19DEC89

160290

SELECTIVE CONTROL VALVE OIL FLOW (BOOM LOWER)

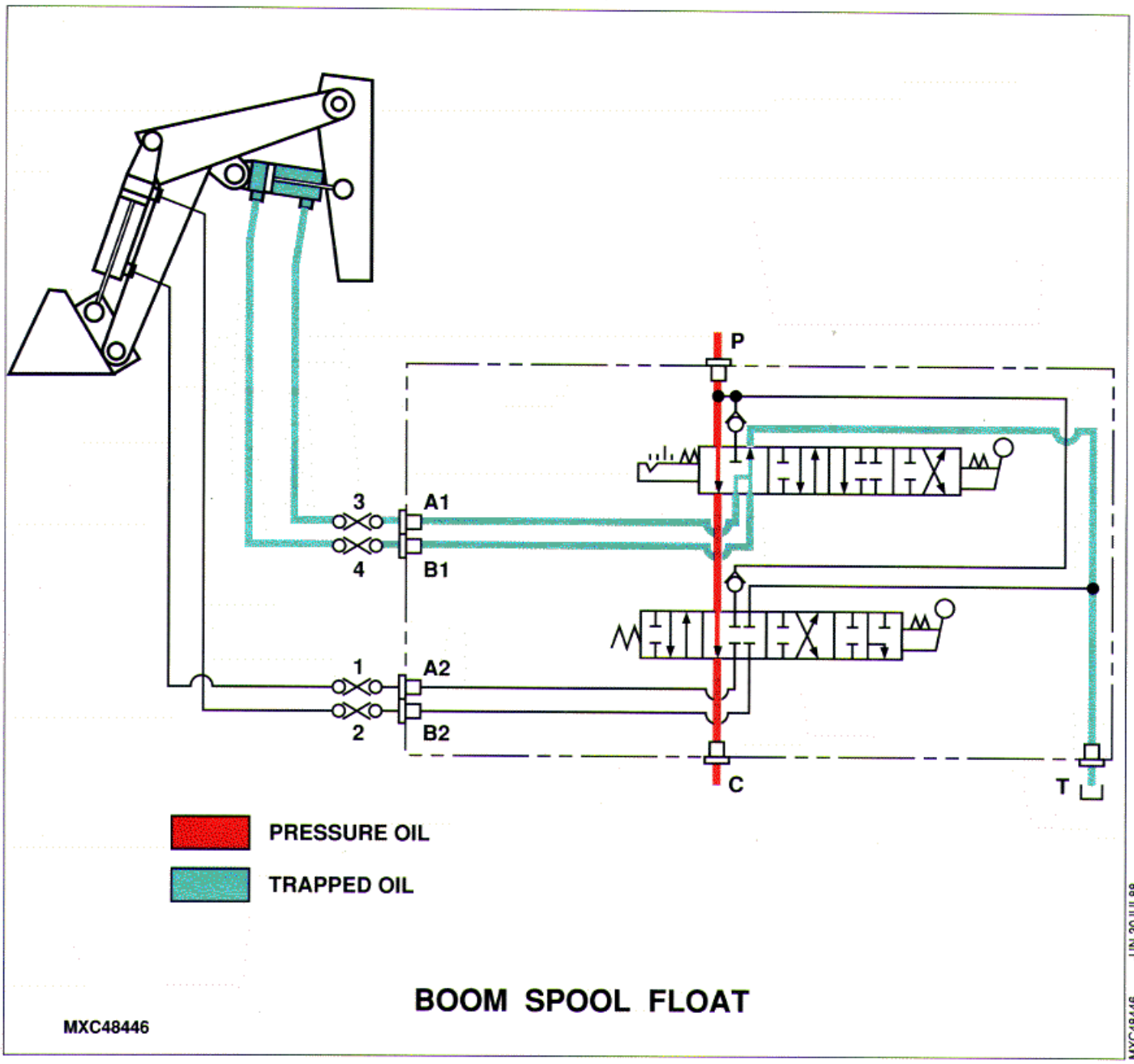
MXC48441 -UN-

Slide No. 235

With the spool moved to lower position, the pressure oil flows out “A1” port to rod end of cylinder. Return oil from head end of cylinder flows to “B1” port.

MX,27010DG,A40 -19-19DEC89

SELECTIVE CONTROL VALVE OIL FLOW (BOOM SPOOL FLOAT)

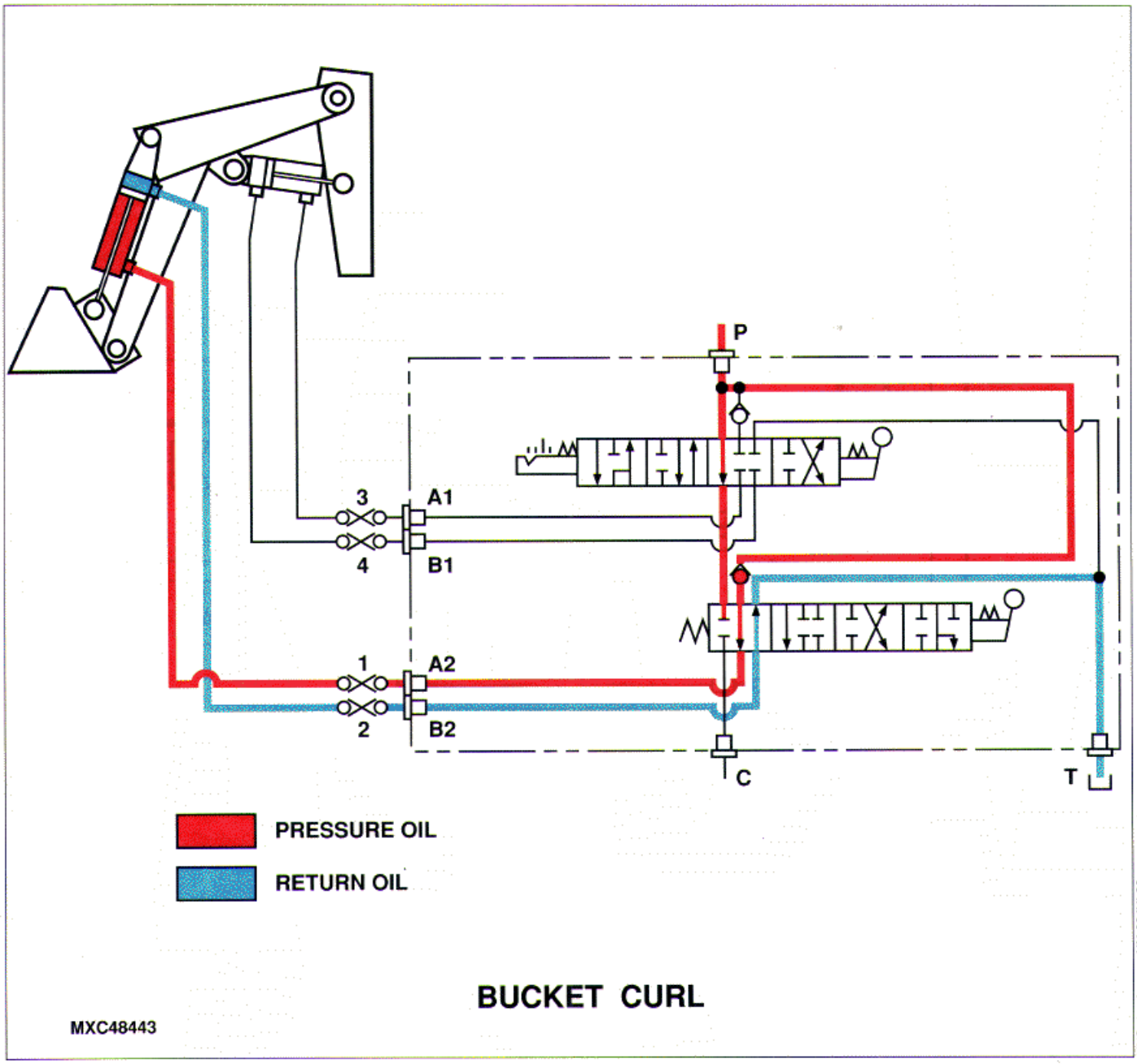


Slide No. 236

With the spool moved fully outward to float position, the spool blocks pressure oil from entering either port and opens the open center passage. Pressure oil now flows through the open center passage, out the bypass port "C" to the rockshaft. Both cylinder ports are connected to sump. Since no pressure is available to either end of the cylinder, the cylinder is free to follow ground contour. The spool is held in float position by a detent ball and spring and must be manually taken out of float.

MX,27010DG,A41 -19-19DEC89

SELECTIVE CONTROL VALVE OIL FLOW (BUCKET CURL)



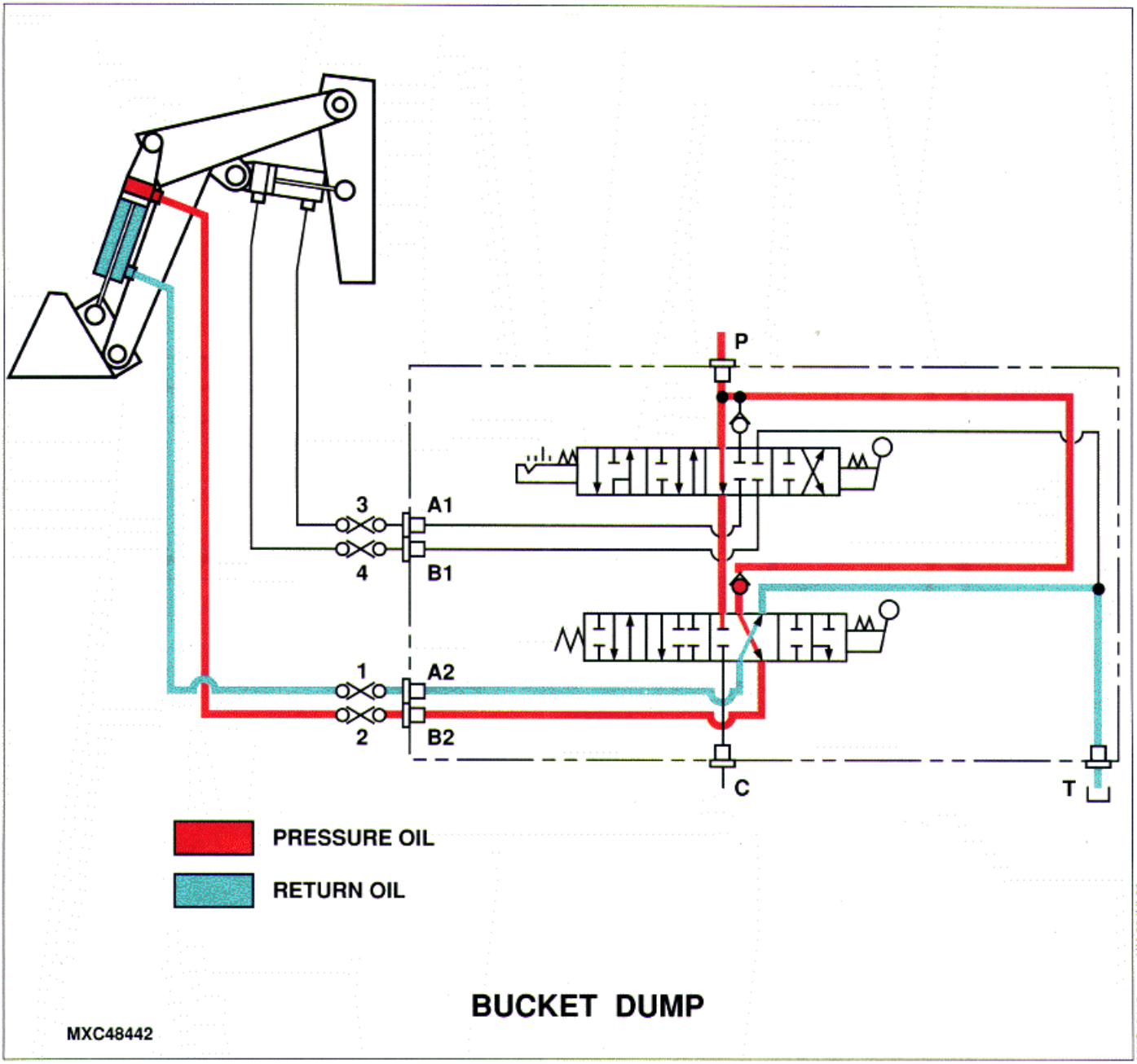
Slide No. 237

With the spool moved to curl position, the open center passage is blocked. As pressure increases in the inlet passage and overcomes load check valve spring pressure, the load check valve opens. Pressure oil flows out port "A2" to head end of boom cylinder. Pressure will build until pressure oil overcomes the load at the bucket cylinder and extends the cylinder. If the load at the bucket cylinder is too great or the cylinder is dead-headed, the main relief valve will open, diverting oil to sump.

Return oil from the rod end of cylinder flows to transmission sump.

MX,27010DG,A42 -19-19DEC89

SELECTIVE CONTROL VALVE OIL FLOW (BUCKET DUMP)

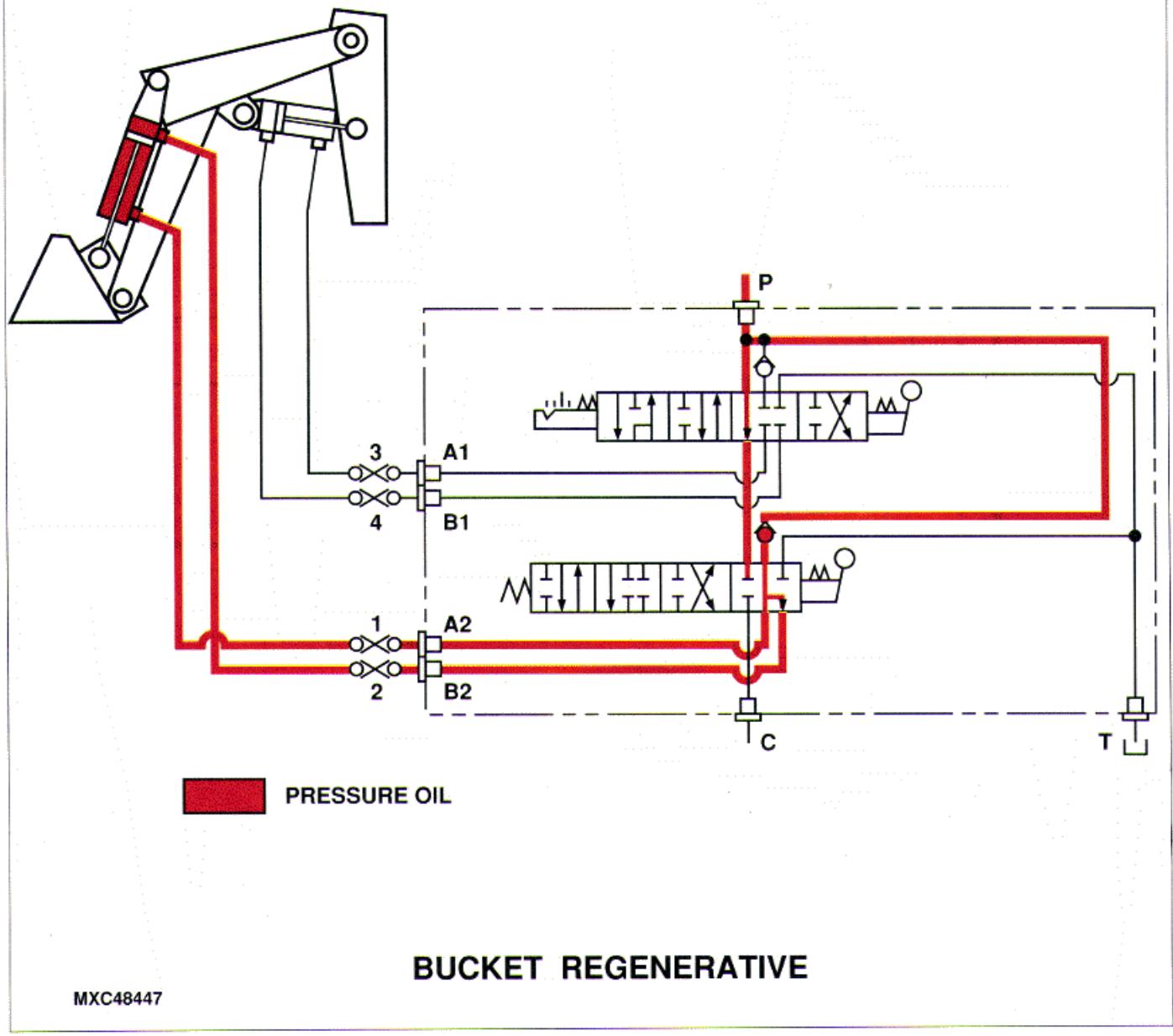


Slide No. 238

With the spool moved to dump position, the pressure oil flows out "A2" port to rod end of cylinder. Return oil from head end of cylinder flows to "B2" port.

MX,27010DG,A43 -19-19DEC89

SELECTIVE CONTROL VALVE OIL FLOW (BUCKET REGENERATIVE)



Slide No. 239

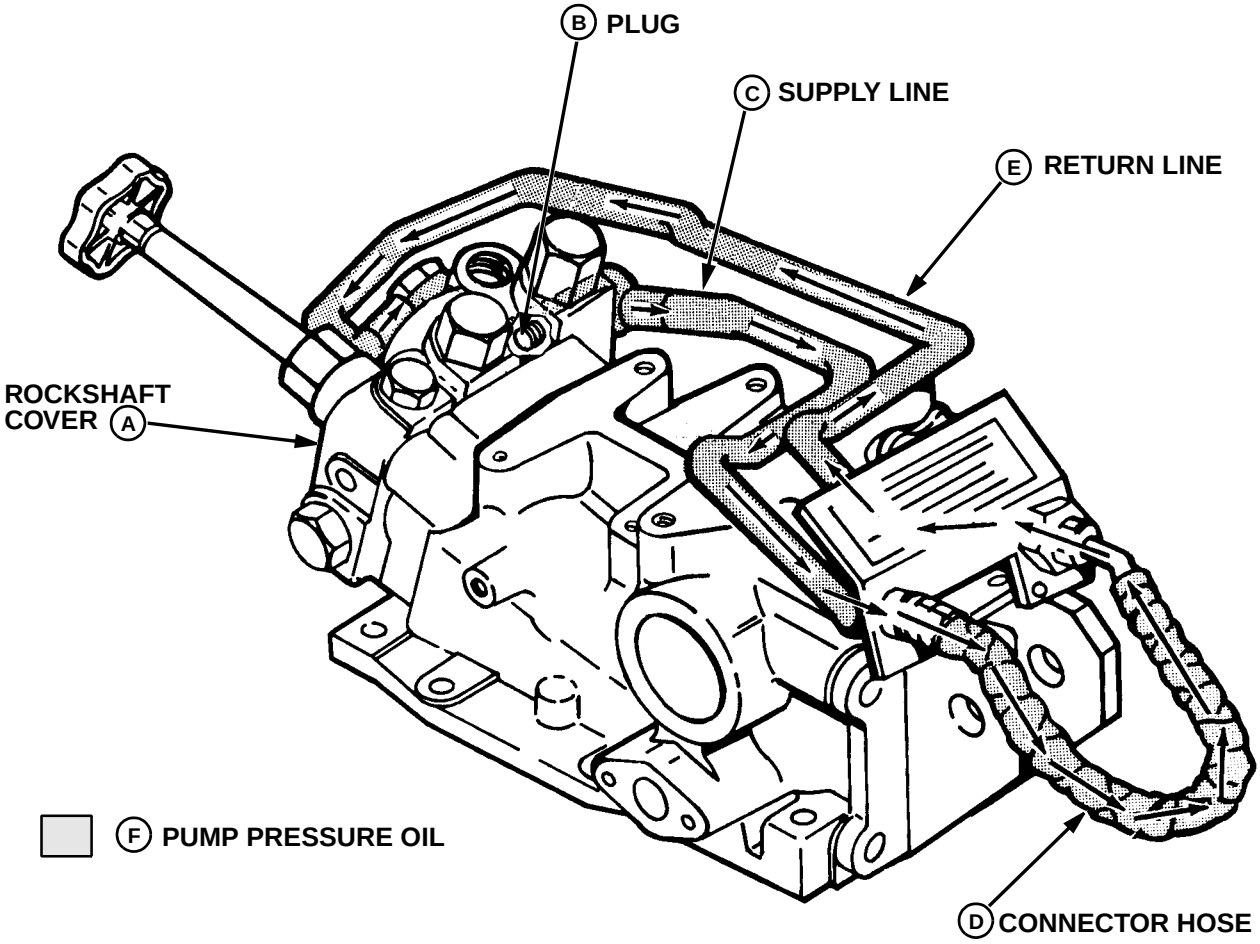
With the spool moved inward to regenerative dump position, the open center passage is blocked. As pressure increases in the inlet passage and overcomes the load check valve spring pressure, the load check valve opens. Pressure oil flows out port "B2" to the head end of bucket cylinder.

Low pressure oil returning from the rod end of the cylinder flows to port "A2" passage, to port "B2" passage, and to head end of bucket cylinder. The additional oil added to the dump circuit allows the bucket to dump faster.

The return passage to transmission case sump is blocked by the spool.

MX,27010DG,A44 -19-19DEC89

160290



M48448

670-770-790 REAR OUTLET OIL SUPPLY (WITHOUT SCV)

A—Rockshaft Housing **C—Supply Line** **E—Return Lines** **H—Pump Pressure Oil**
B—Plug **D—Connector Hose**

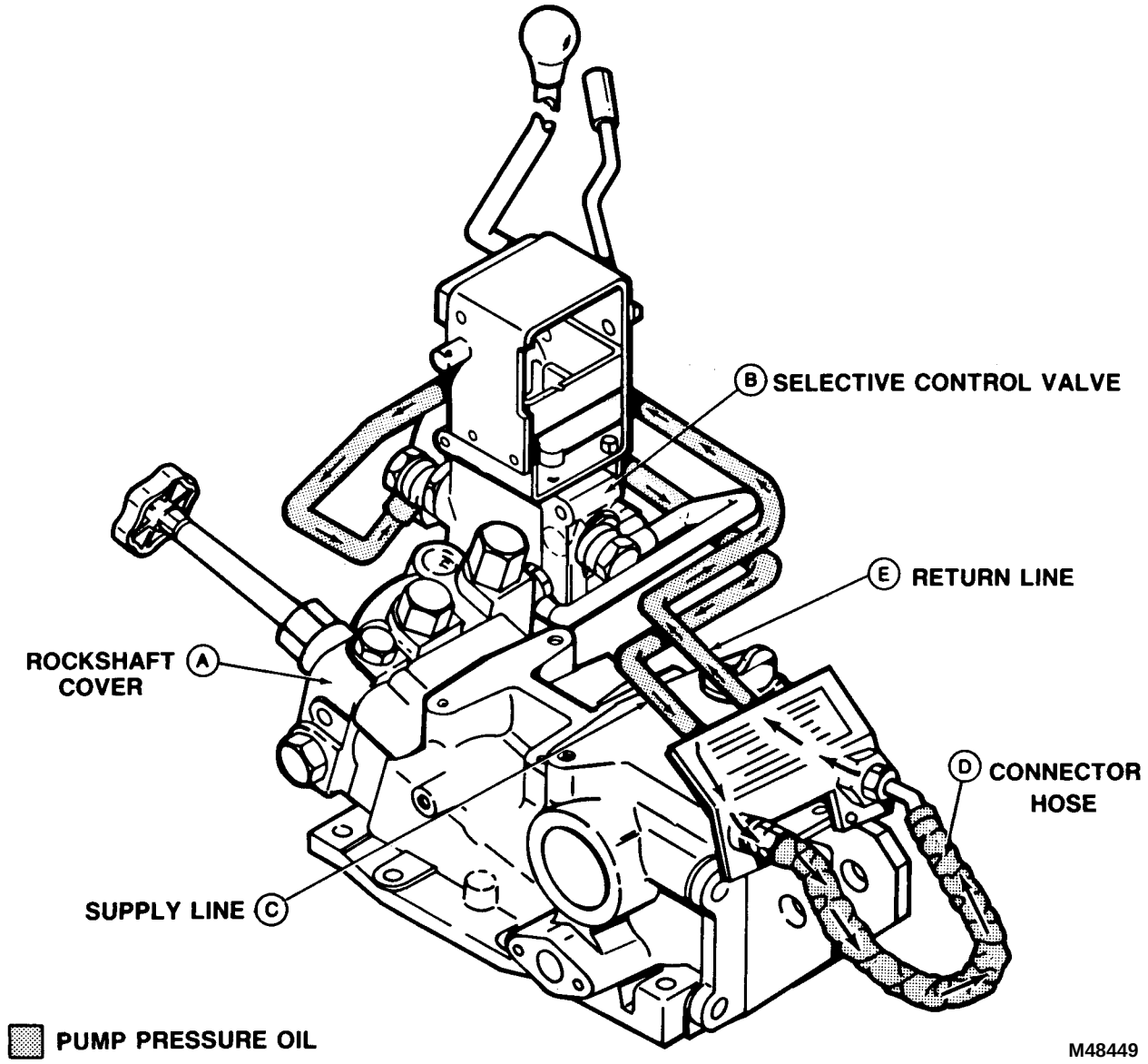
The rear outlet kit on tractors without SCV receives pump pressure oil (F) directly from the rockshaft housing (A).

The plug (B) installed with the kit directs the oil through the supply line (C), connector hose (D), return line (E), and back to the rockshaft housing (A) for rockshaft use.

When not in use, the connector hose (D) must be installed to allow oil flow or the hydraulic system will be in relief constantly.

An open center valve must be used with the outlet kit to make it functional.

REAR OUTLET OIL SUPPLY (WITH SCV)



670-770-790 REAR OUTLET OIL SUPPLY (WITH SCV)

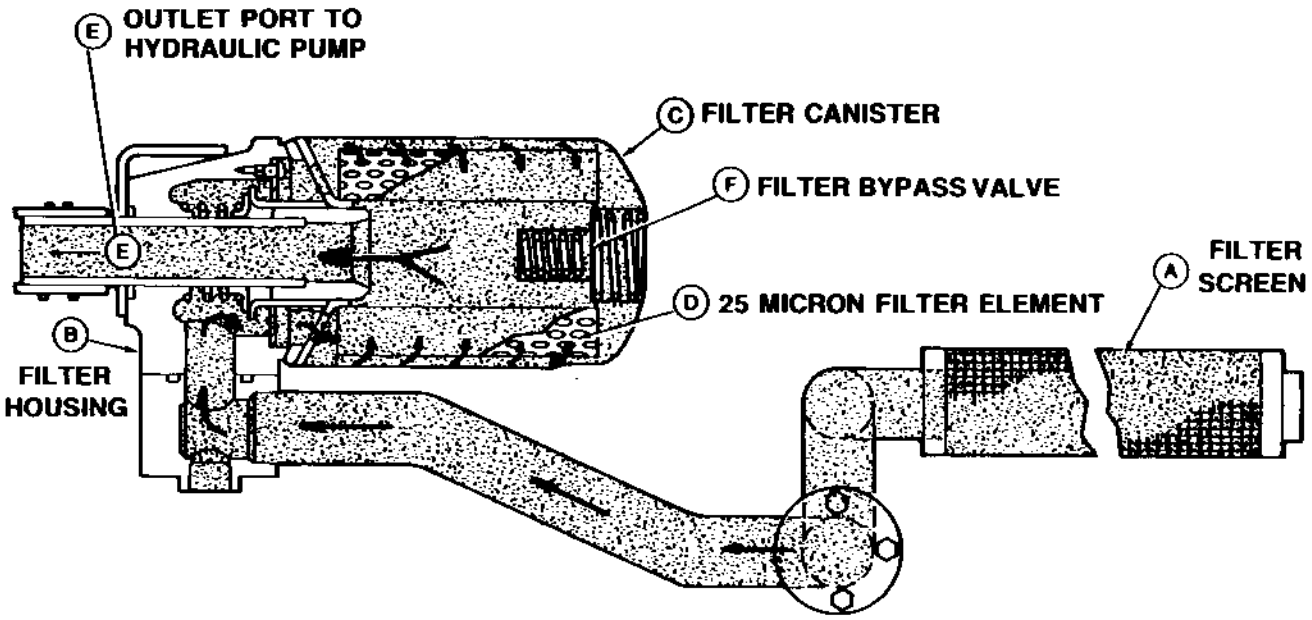
A—Rockshaft Cover **C—Supply Line** **D—Connector Hose** **E—Return Line**
B—Selective Control Valve

The rear outlet kit on tractors with SCV receives pump pressure oil directly from the selective control valve (B).

When the kit is not being used the connector hose must be installed to allow oil flow or the hydraulic system will be in relief constantly.

An open center valve must be used with the outlet kit to make it functional.

HYDRAULIC OIL FILTER OPERATION



270 10 47

-19-09JAN90

M48450

HYDRAULIC FILTER OPERATION

A—Filter Screen
B—Filter Housing
C—Filter Canister
D—25 Micron Filter Element
E—Outlet Port to Hydraulic Pump
F—Filter Bypass Valve

Slide No. 242

Oil is drawn through a 150 mesh wire screen (A) before it leaves the transmission case. Oil then enters filter housing (B) and is routed to the outside of filter canister (C). The oil is drawn through the 25 micron filter (D) then out port (E) to the hydraulic pumps.

If the hydraulic filter should become plugged and there is more than a 55 kPa (8 psi) pressure differential, the filter bypass valve (F) will open sending unfiltered oil to the hydraulic pumps.

MX,27010DG,A47 -19-19DEC89

PRELIMINARY HYDRAULIC SYSTEM INSPECTION

TEST CONDITIONS:

• Operate the tractor and make checks with the hydraulic oil warm.

TEST/CHECK POINTS	NORMAL	IF NOT NORMAL
1. Check entire machine for signs of hydraulic oil leakage.	No leaks	Repair cause of leakage.
2. Check oil level.	Level between marks on dipstick	Add oil.
3. Check oil appearance and smell.	Not milky	Check for water in oil.
	Not dirty	Change filter and oil.
	No metal particles	Change oil, filter and check for mechanical failure.
	Not discolored	Check for causes of overheating.
4. Operate all hydraulic functions.	All functions should be equally smooth and quick.	Change filter.
		Check sump screen.
		Make sure correct oil is being used.

NOTE: If the tractor is equipped with SCV, power steering or rear outlets operate each function to determine if the problem exists for complete system or only one option.

MX,27015DG,A1 -19-19DEC89

HYDRAULIC SYSTEM TEST PROCEDURE (TRACTORS WITHOUT SCV)

TEST CONDITIONS

•Make sure the hydraulic oil is the correct type, clean and at the proper level.

•Repair any external hydraulic oil leaks

•Replace oil filter to make sure it is functioning properly

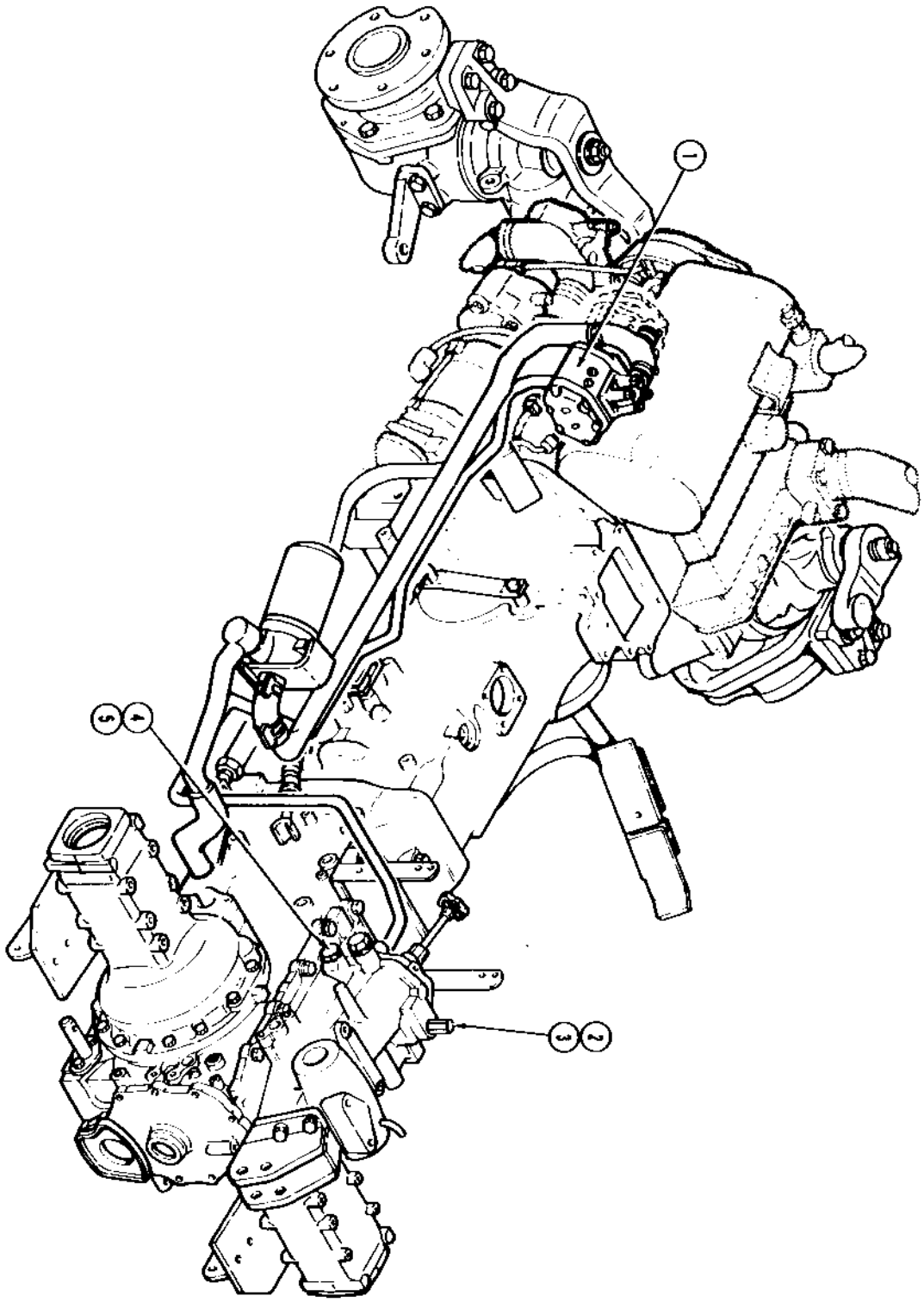
•Check that rockshaft feedback linkage is properly adjusted

•Heat hydraulic oil to approximately 110°F.

TEST/CHECK POINTS	NORMAL	IF NOT NORMAL
1. Check pump flow (at pump). Run engine at 2600 rpm and turn flowmeter restriction to 1500 psi.	670-770-790—4.5 GPM Minimum 870-970-1090—7.0 GPM Minimum	Inspect •Sump Screen •Suction Line •Pump
2. Check main relief valve pressure (at Rockshaft housing).	670-770-790—2000 to 2100 psi 870-970-1090—2200 to 2300 psi	High Reading •Adjust valve Low Reading •Perform Step 3
3. If reading was low at Step 2 check main relief valve pressure with plug in Rockshaft housing.	670-770-790—2000 to 2100 psi 870-970-1090—2200 to 2300 psi	Inspect relief valve for leakage.
4. Pressure Test Rockshaft with stop valve closed.	Pressure builds to relief pressure. Does not drop more than 100 psi in 1 minute.	Inspect rockshaft valve: •Seal •Lowering valve •Load check valve
5. Pressure test rockshaft with stop valve open.	Pressure builds to relief pressure. Does not drop more than 200 psi in 1 minute.	Low Reading or Leakage •Inspect Rockshaft relief valve for leakage •Inspect Rockshaft cylinder for leakage

M48451

HYDRAULIC SYSTEM TESTS (TRACTORS WITHOUT SCV)



M48451 -19-09JAN90

Slide No. 243

MX,27015DG,A3 -19-19DEC89

HYDRAULIC SYSTEM TEST PROCEDURE (TRACTORS WITH SCV)

TEST CONDITIONS

•Make sure the hydraulic oil is the correct type, clean and at the proper level.

•Repair any external hydraulic oil leaks

•Replace oil filter to make sure it is functioning properly

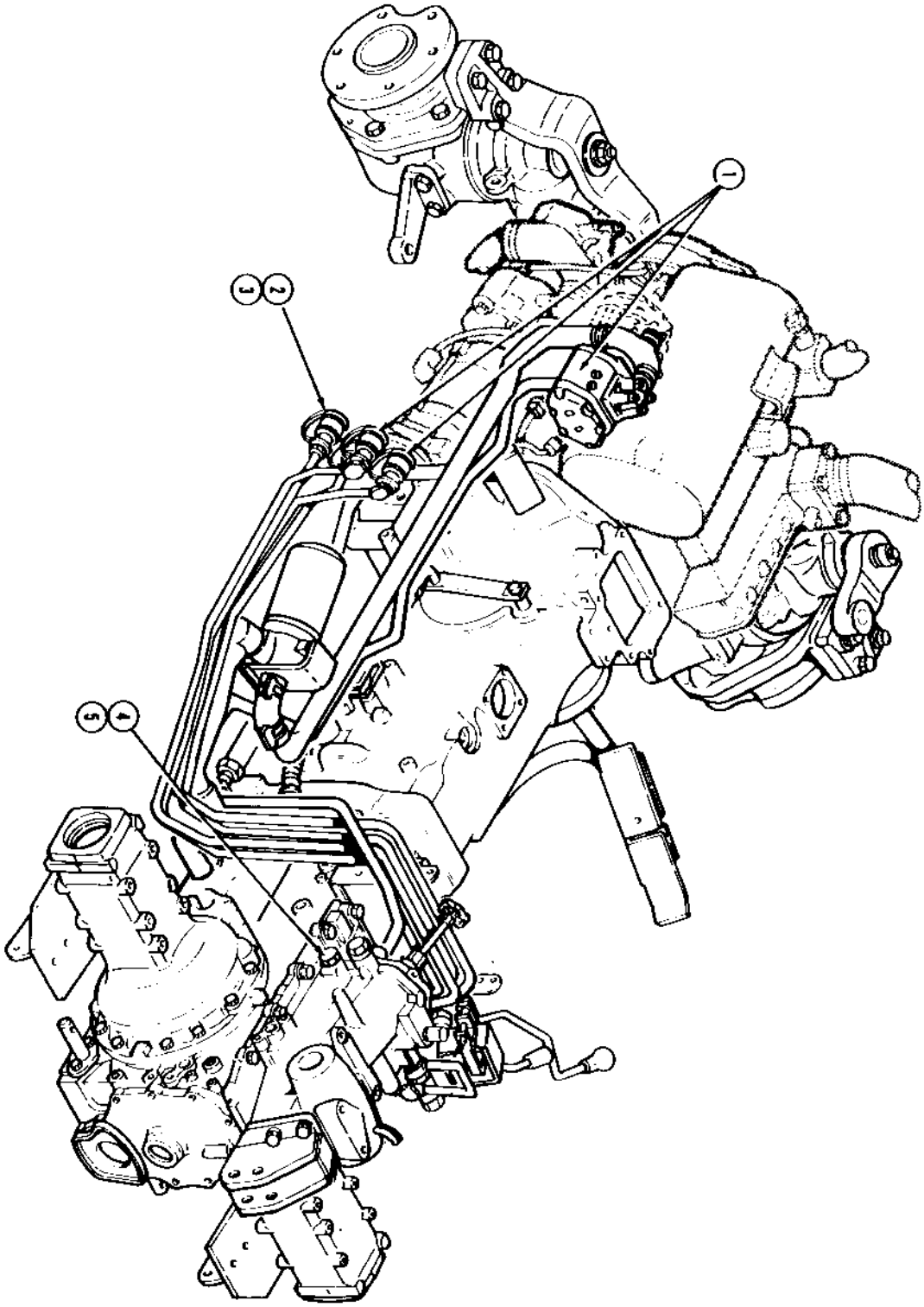
•Check that rockshaft feedback linkage is properly adjusted

•Heat hydraulic oil to approximately 110°F.

TEST/CHECK POINTS	NORMAL	IF NOT NORMAL
1. Check pump flow (at front outlet). Run engine at 2600 rpm and turn flowmeter restriction to 1500 psi.	670-770-790—4.5 GPM Minimum 870-970-1090—7.0 GPM Minimum	Perform test 2
2. Check main relief valve pressure (at front outlets).	670-770-790—2000 to 2100 psi 870-970-1090—2200 to 2300 psi	Reading low (test 1 and 2) •Check for leakage at SCV Plug in Rockshaft housing. •Check main relief for leakage. Reading Low (test 1 only) •Inspect sump screen •Inspect suction line •Inspect pump
3. Test SCV Leakage (at each front outlet).	Pressure builds to 2000 psi and does not drop below 500 psi in less than 5 seconds.	Outlet 3 or 4 leaks •Repair boom spool Outlet 1 or 2 leaks •Repair bucket spool
4. Pressure Test Rockshaft with stop valve closed.	Pressure builds to relief pressure. Does not drop more than 100 psi in 1 minute.	Inspect rockshaft valve for leakage at: •Seal •Lowering valve •Load check valve
5. Pressure test rockshaft with stop valve open.	Pressure builds to relief pressure. Does not drop more than 200 psi in 1 minute.	High Reading •Adjust Rockshaft relief valve Low Reading or Leakage •Inspect Rockshaft relief valve for leakage •Inspect Rockshaft cylinder for leakage

M48452

HYDRAULIC SYSTEM TESTS (TRACTORS WITH SCV)

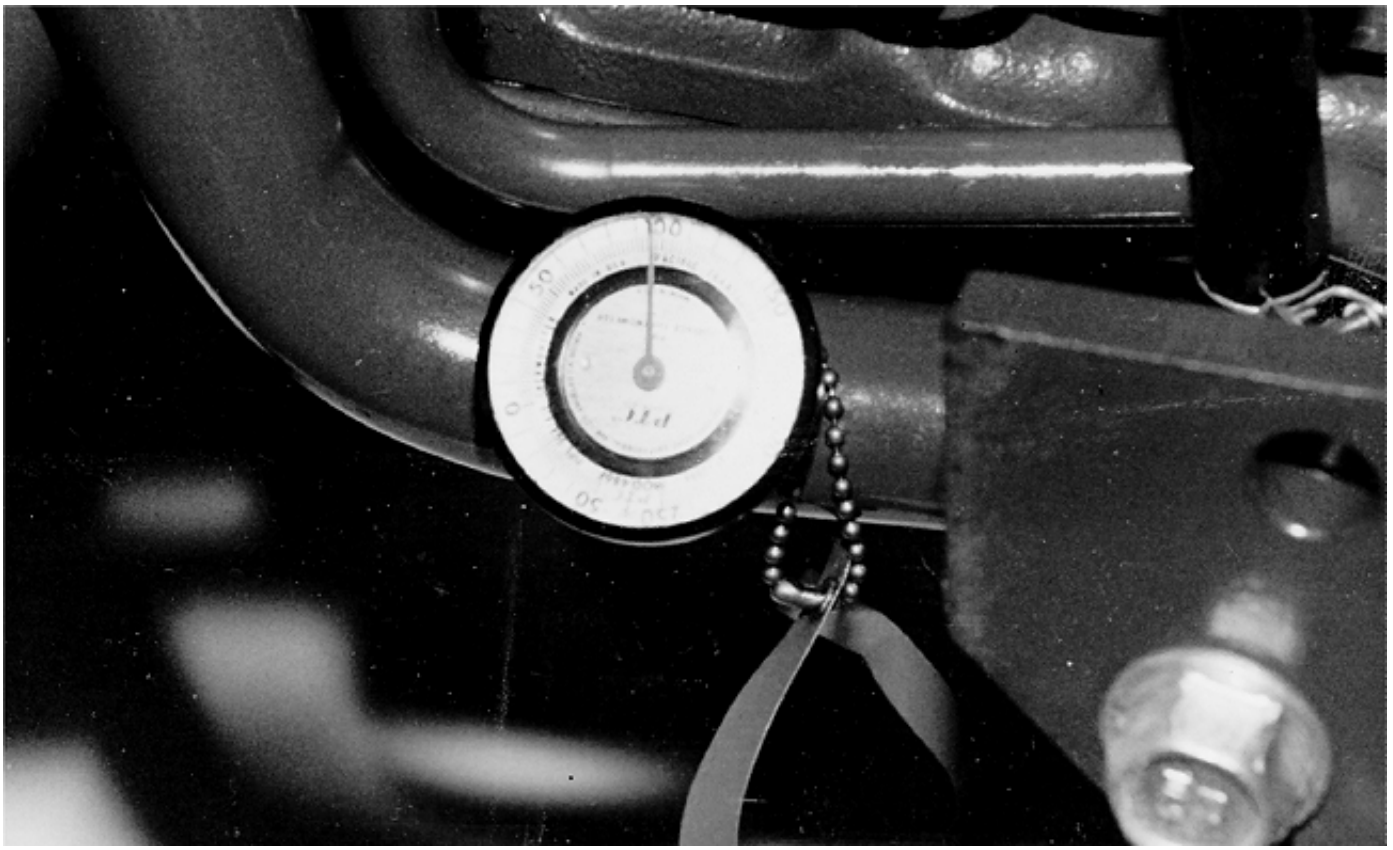


M48452 -19-09JAN90

Slide No. 244

MX,27015DG,A5 -19-19DEC89

HEATING HYDRAULIC OIL



Slide No. 245

When making hydraulic tests the oil must be heated to approximately 120˚F for the tests to be accurate.

1. Lower the rockshaft.

2. Completely close the rate of drop/stop valve.

3. Run engine at fast idle.

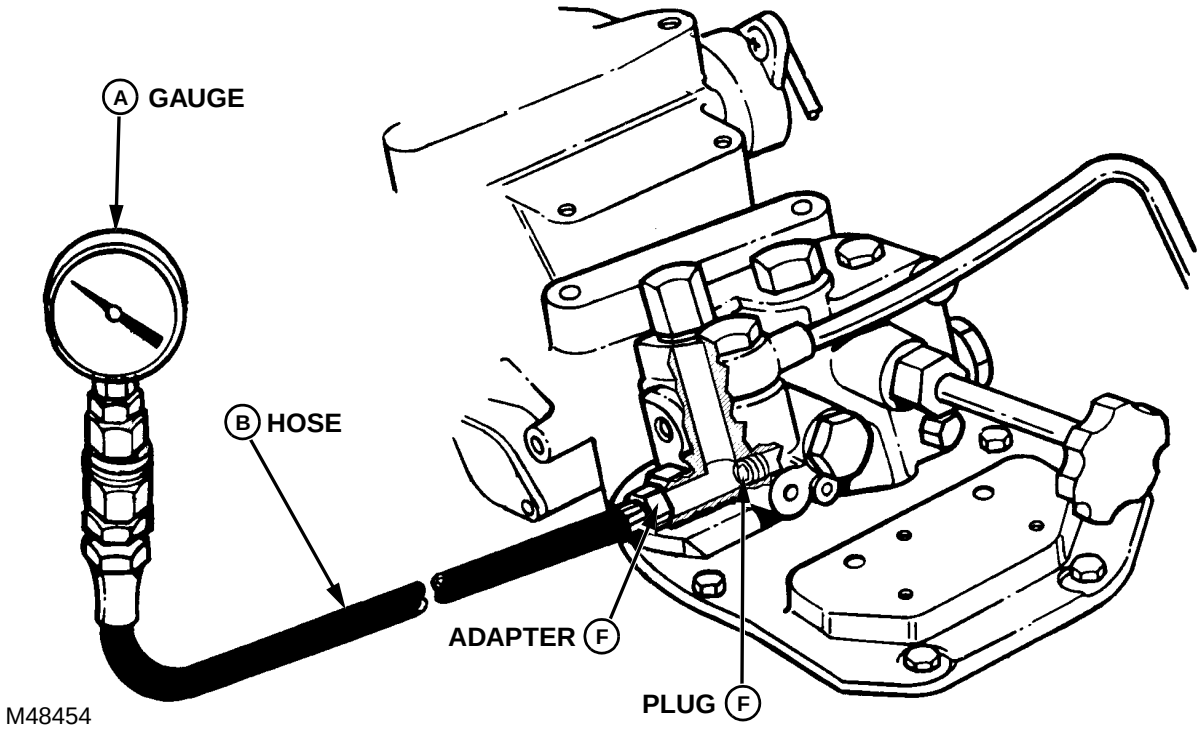
4. Move rockshaft position lever back to cause the system to go over relief.

5. Hold the lever back until the suction line is uncomfortable to hold.

At this point the oil temperature should be approximately 100 to 110˚F. Temperature gauges are available that can be strapped around the pipe or filter to accurately check oil temperature. The temperature gauge shown is JDG-282.

MX,27015DG,A6 -19-19DEC89

SYSTEM RELIEF VALVE TEST (670-770-790 TRACTORS WITHOUT SCV)



REASON FOR TEST:

To determine if the system relief valve is adjusted to the correct pressure.

TEST EQUIPMENT REQUIRED:

A. JTO 3345—3000 psi Gauge

B. JTO 3017—Hose with Coupler

C. JTO 5494—Adapter 3/4-16mm ORB

TEST PROCEDURE:

1. Install adaptor in Rockshaft housing.
2. Connect hose and gauge to adaptor.
3. Lower Rockshaft.
4. Run engine at high idle.
5. Close rate of drop/stop valve.
6. Pull Rockshaft position lever back to cause system to go over relief.
7. Check pressure reading on gauge.

TEST SPECIFICATIONS:

2000 to 2100 PSI

TEST RESULTS:

Pressure too high—adjust system relief valve

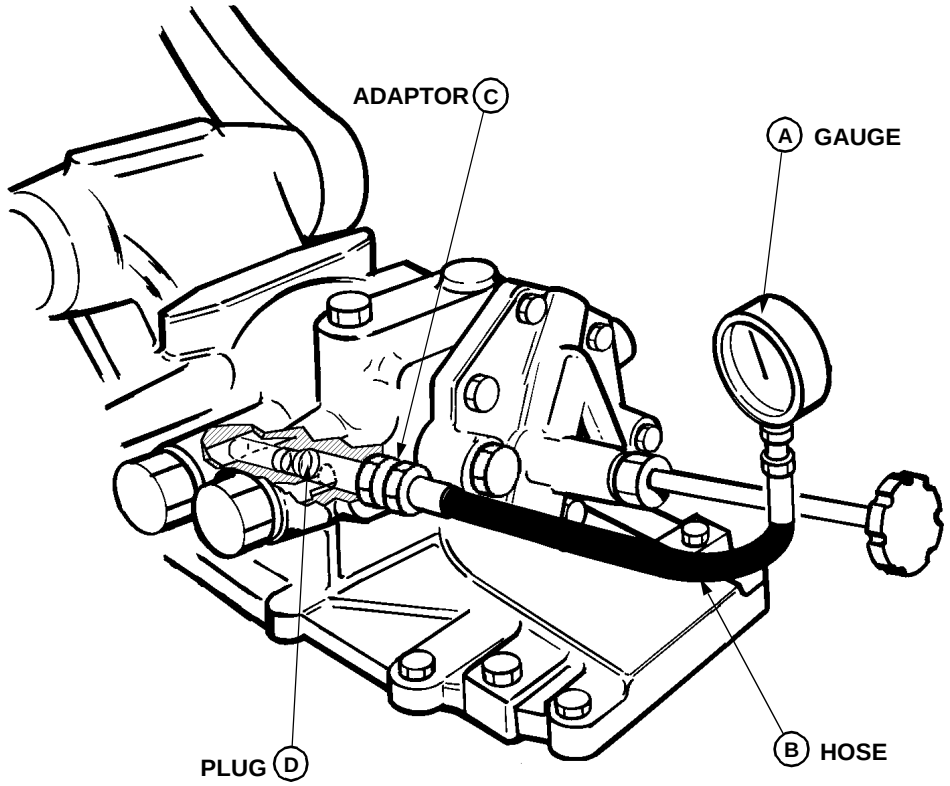
Pressure too low—Install 15H275 1/4 NPT Plug (D) in rockshaft housing and check pressure again.

Pressure still low—System relief valve adjusted too low or leakage past the relief valve is occurring.

Pressure comes up to specification—Leakage is occurring in the rockshaft valve.

IMPORTANT: If 15H275 plug was installed, remove it after test is completed.

SYSTEM RELIEF VALVE TEST (870-970-1070) TRACTORS WITHOUT SCV



REASON FOR TEST:

To determine if the relief valve is adjusted to correct pressure.

TEST EQUIPMENT REQUIRED:

A. JTO 3345—3000 psi Gauge

B. JTO 3017—Hose With Coupler

C. JTO 5494—Adaptor 3/4-16mm ORB

TEST PROCEDURE:

1. Install adaptor in Rockshaft housing.
2. Connect hose and gauge to adaptor.
3. Lower rockshaft.
4. Run engine at high idle.
5. Close rate of drop/stop valve.
6. Pull rockshaft position control lever back to cause system to go into relief.
7. Check pressure reading on gauge.

TEST SPECIFICATIONS:

2200 to 2300 psi

TEST RESULTS:

Pressure too high—Adjust relief valve.

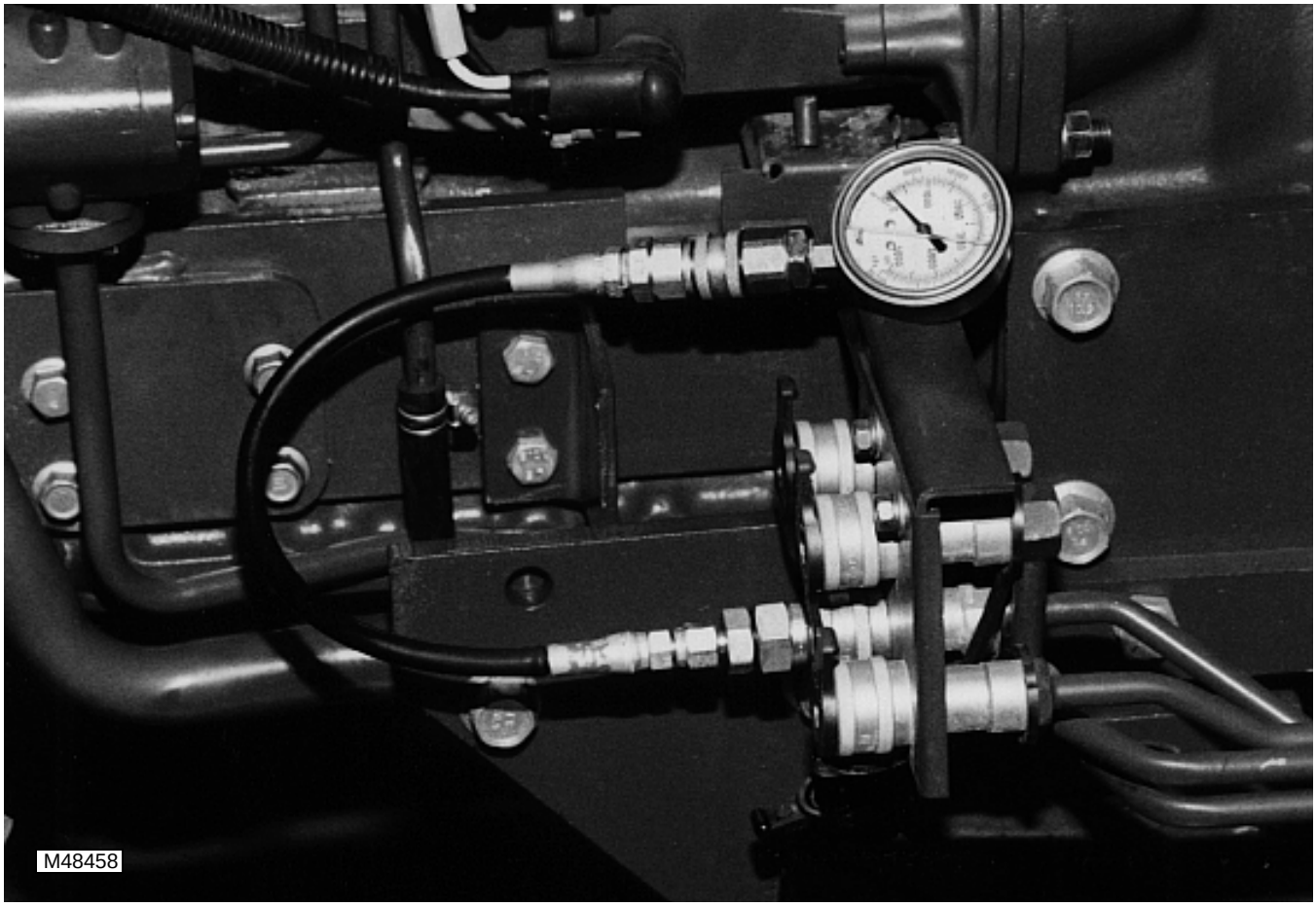
Pressure too low—Install 15H275 1/4 NPT plug (D) in Rockshaft housing and check pressure again.

Pressure still low—Relief valve adjusted too low or leakage past the relief valve.

Pressure comes up to specifications—Leakage is occurring in rockshaft valve.

IMPORTANT: If 15H275 plug was installed, remove it after test is completed.

SYSTEM RELIEF VALVE TEST (TRACTORS WITH SCV)



REASON FOR TEST:

To determine if the system relief valve is adjusted to the correct pressure. It will also indicate if leakage is occurring past the SCV plug.

TEST EQUIPMENT REQUIRED:

A. JTO 3345—3000 psi Gauge

B. JTO 3364—Hose with Coupler

C. (670-770-790) JTO 5486—Adapter 1/4” M NPT x 7/16-20 M 37°
(870-970-1070) JTO 5494—Adapter 3/4-16 M ORB x 7/16-20 M 37°

D. (670-770-790) Internal half of AM 102420 Coupler
(870-970-1070) Internal half of AM 105467 Coupler.

TEST PROCEDURE:

1. Connect test equipment into front outlet.
2. Run engine at fast idle.
3. Operate SCV lever to pressurize front outlet being used.
4. Check pressure reading on gauge.

TEST SPECIFICATIONS:

670-770-790—2000 to 2100 psi

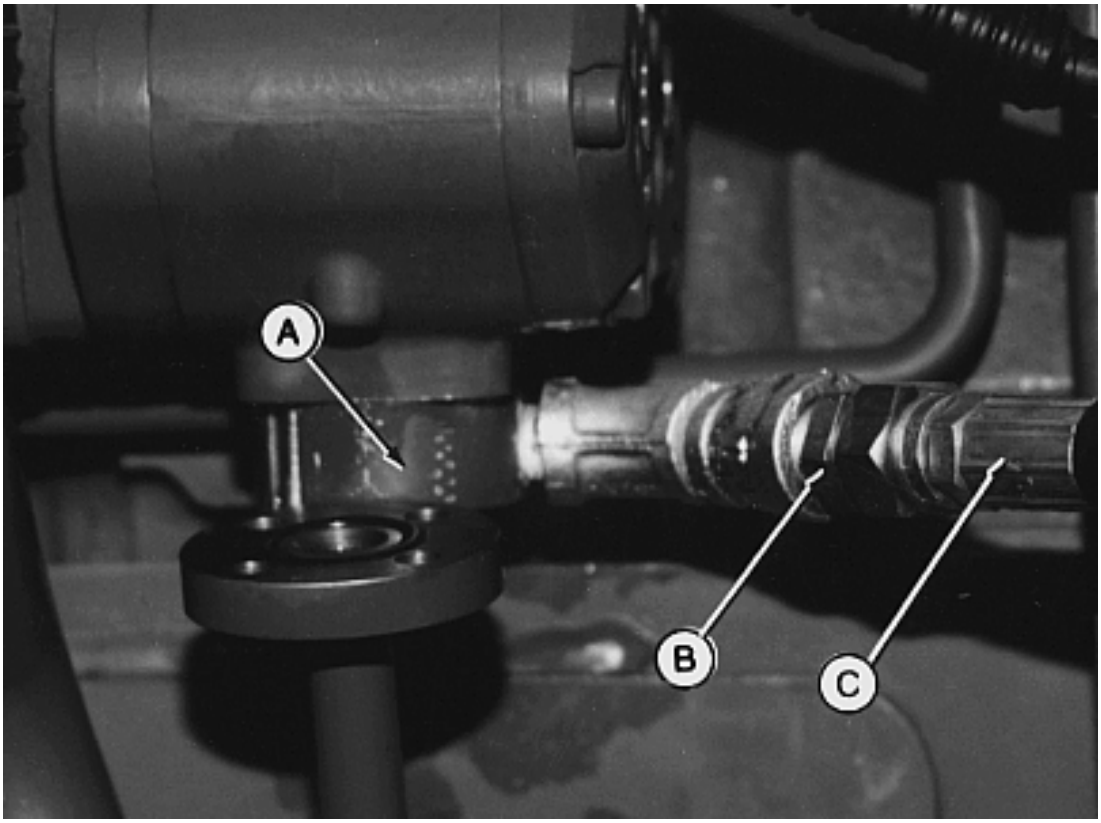
870-970-1070—2200 to 2300 psi

TEST RESULTS:

Pressure too high—adjust system relief valve

Pressure too low—Relief valve is adjusted too low, leakage is occurring past relief valve or past SCV plug.

PUMP FLOW TEST (TRACTORS WITHOUT SCV)



M48455

REASON FOR TEST:

To determine if the hydraulic pump is providing adequate flow under pressure.

TEST EQUIPMENT REQUIRED:

A. JTG694—Pump Test Fitting

B. (flowmeter with 37° flare hose) JTO 3129—Adaptor 3/8 M NPT x 3/4-16 M 37° flare.

(flowmeter with 3/4-16 M ORB hose) JTO 3041—Adaptor 1/2 M NPT x 3/4-16 F ORB.

C. JTO 5469 Flowmeter

TEST CONNECTION:

1. Disconnect pump line
2. Bolt pump test fitting to pump.
3. Install adaptor to connector and attach flowmeter.
4. Insert return end of flowmeter into hydraulic oil fill hole.

TEST PROCEDURE:

1. Fully open flowmeter control valve.
2. Start tractor and run at 2600 rpm.
3. Slowly close flowmeter control valve until 1500 psi is read on gauge.
4. Observe flow then release pressure.

TEST SPECIFICATIONS:

670-770-790—4.5 GPM Minimum

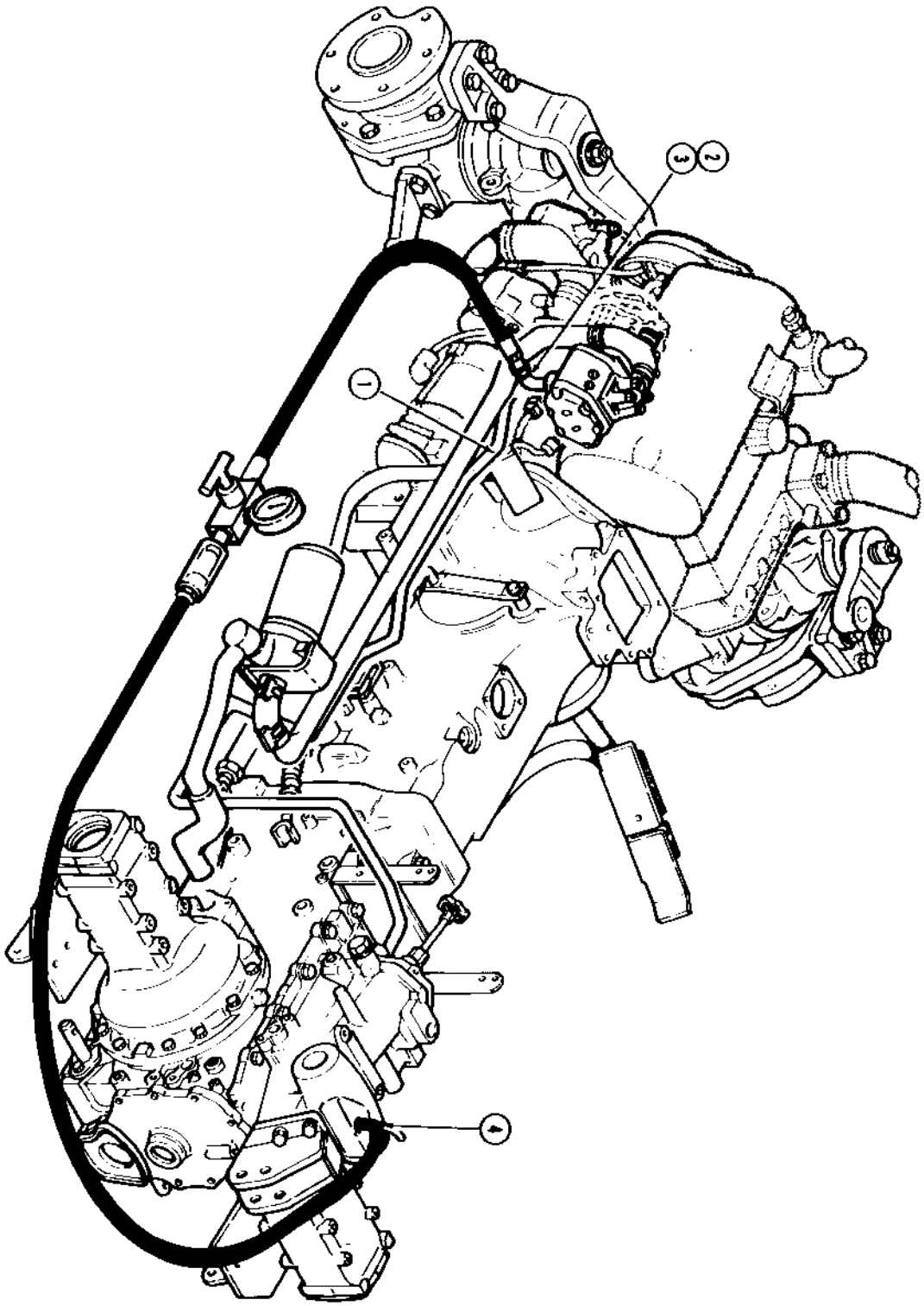
870-970-1070—7.0 GPM Minimum

TEST RESULTS:

If flow is less than minimum:
- The sump screen may be plugged not allowing full flow to pump.
- The sump line may be restricted or leaking air in.
- The optional filter may be restricted.
- The pump is worn or damaged requiring repair or replacement.

M48456

PUMP FLOW TEST (TRACTORS WITHOUT SCV)

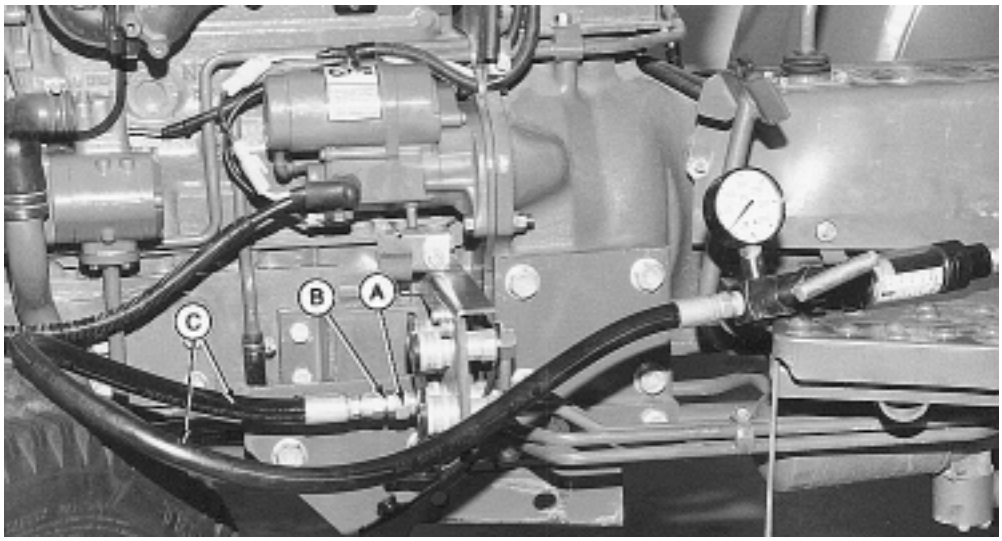


M48456 -19-09JAN90

Slide No. 250

MX,27015DG,A11 -19-19DEC89

PUMP FLOW TEST (TRACTORS WITH SCV)



REASON FOR TEST:

To determine if the hydraulic pump is providing adequate flow under pressure.

TEST EQUIPMENT REQUIRED 670/770/790/870/970/1070:

A. AM102420 Coupler (Internal half).

B. JTO 3041 Adaptor 1/2 M NPT x 3/4-16 F ORB (flowmeter that uses 37° flare hose also requires JTO 3049 Adaptor 3/4-16 M ORB x 3/4-16 M 37°).

C. JTO 5469 Flowmeter

TEST EQUIPMENT REQUIRED 670/770/790:

A. AM105467 Coupler (Internal half).

B. JTO 3129 Adaptor 3/8” M NPT x 3/4-16 M 37° (flowmeter that uses 37° flare hose also requires JTO 3049 Adaptor 3/4-16 M ORB x 3/4-16 M 37°).

C. JTO 5469 Flowmeter

TEST CONNECTION:

1. Assemble required test equipment.
2. Connect equipment to front.
3. Insert return end of flowmeter into hydraulic oil fill hole.

TEST PROCEDURE:

1. Fully open flowmeter control valve.
2. Start tractor and run at 2600 rpm.
3. Slowly close flowmeter control valve until 1500 psi is read on gauge.
4. Observe flow then release pressure.

TEST SPECIFICATIONS:

670-770-790—4.5 GPM Minimum

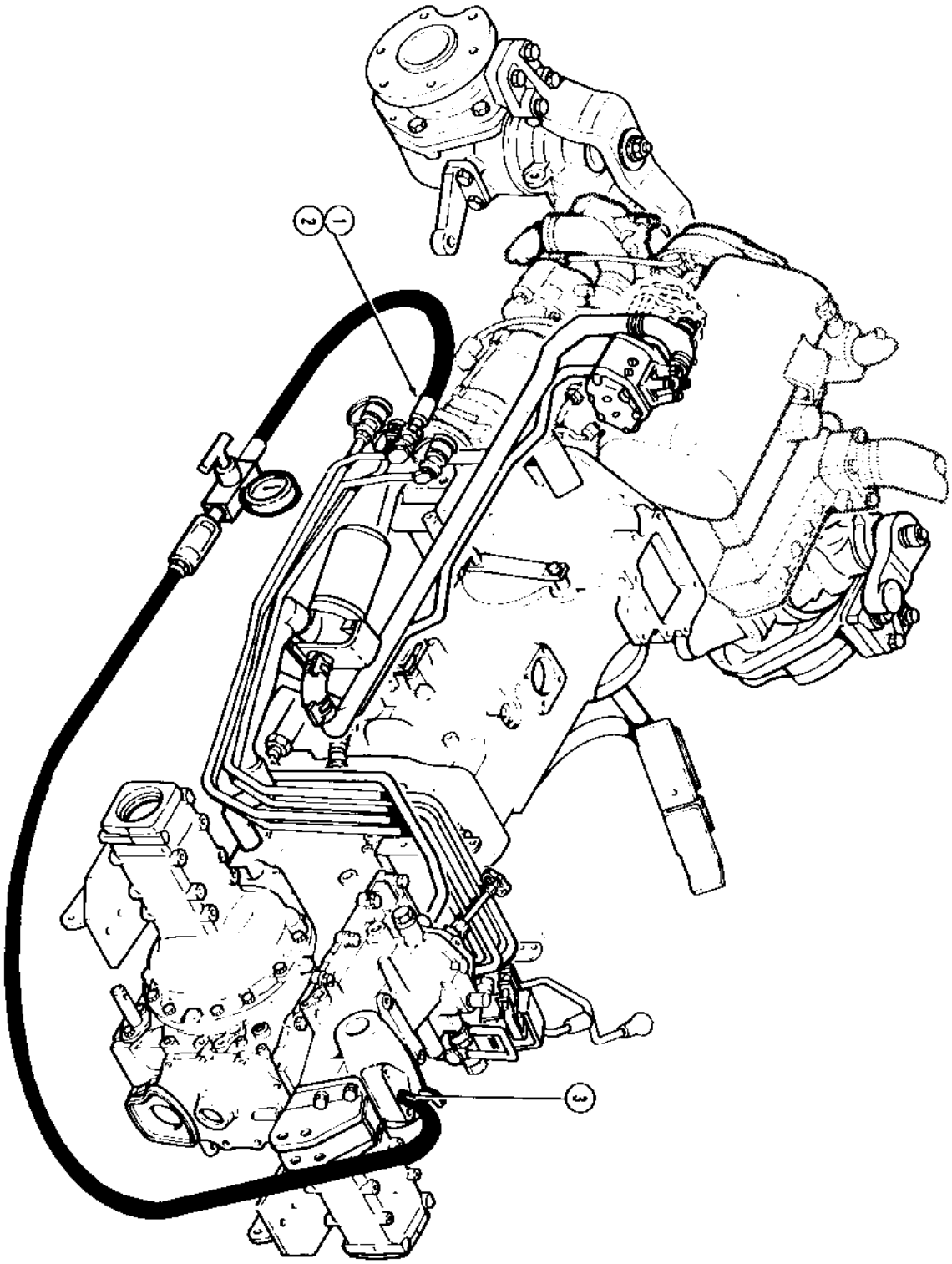
870-970-1070—7.0 GPM Minimum

TEST RESULTS:

If flow is less than minimum:
•The sump screen may be plugged not allowing full flow to pump.
•The sump line may be restricted or leaking air in.
•The optional filter may be restricted.
•The pump is worn or damaged requiring repair or replacement.

M48457

PUMP FLOW TEST (TRACTORS WITH SCV)



M48457 -19-09JAN90

Slide No. 252

MX,27015DG,A13 -19-19DEC89

TEST ROCKSHAFT LEAKAGE

REASON FOR TEST:

To determine if leakage exists in Rockshaft housing, rockshaft cylinder or rockshaft valve.

TEST EQUIPMENT REQUIRED:

A. AU 13611 Elbow 3/4-16 M ORB x 3/8 NPTF

B. JTO 3017—Hose With Coupler

C. JTO 3345—3000 psi Gauge

TEST CONNECTIONS:

• Install AU 13611 elbow in port next to rockshaft relief valve.

• Connect hose and gauge to elbow

TEST PROCEDURE:

1. Lower rockshaft.

2. Close rate of drop/stop valve.

3. Run engine at fast idle.

4. Move rockshaft position lever back to put system into relief.

5. Shut engine off.

6. Observe gauge reading:
Pressure should not drop more than 100 psi in 1 minute.

7. Open rate of drop/stop valve.

8. Run engine at fast idle.

9. Adjust Rockshaft position sensing feedback linkage until system goes into relief.

10. Shut engine off.

11. Observe gauge reading:
Pressure should not drop more than 200 psi in 1 minute.

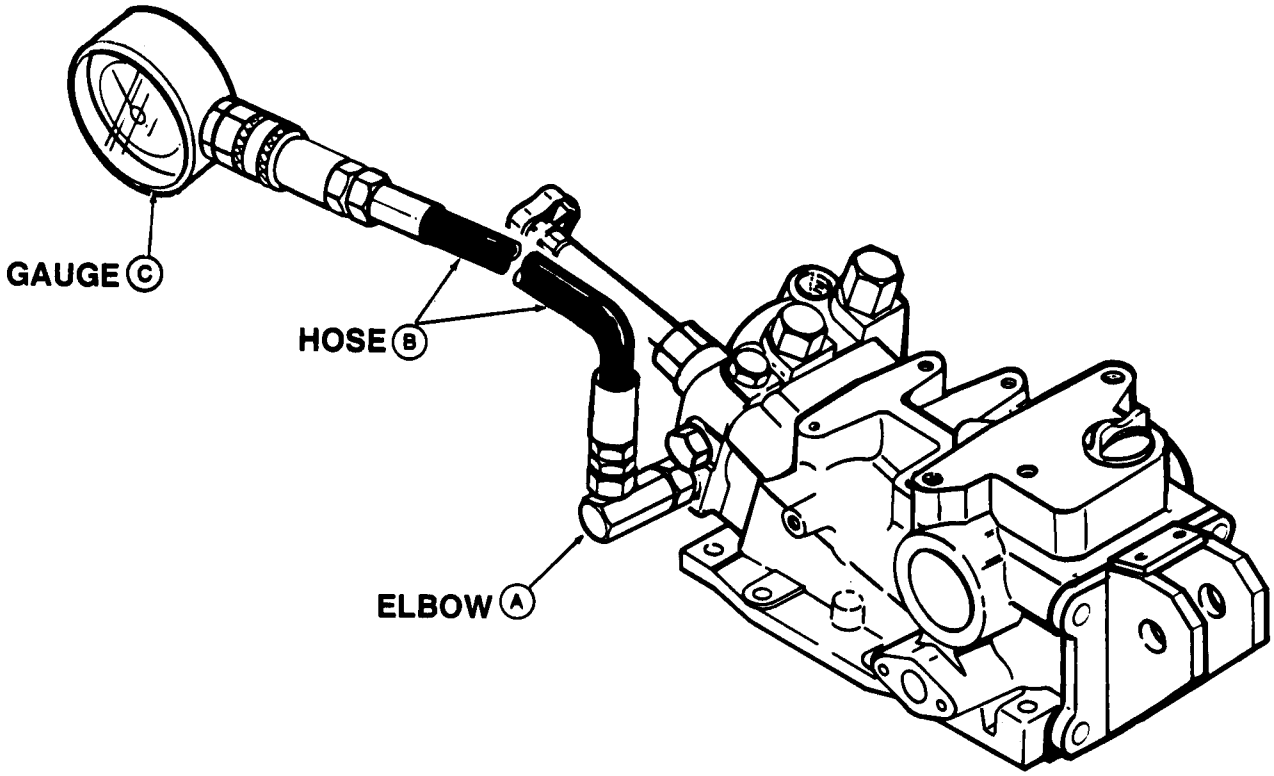
12. Readjust feed back linkage.

TEST RESULTS:

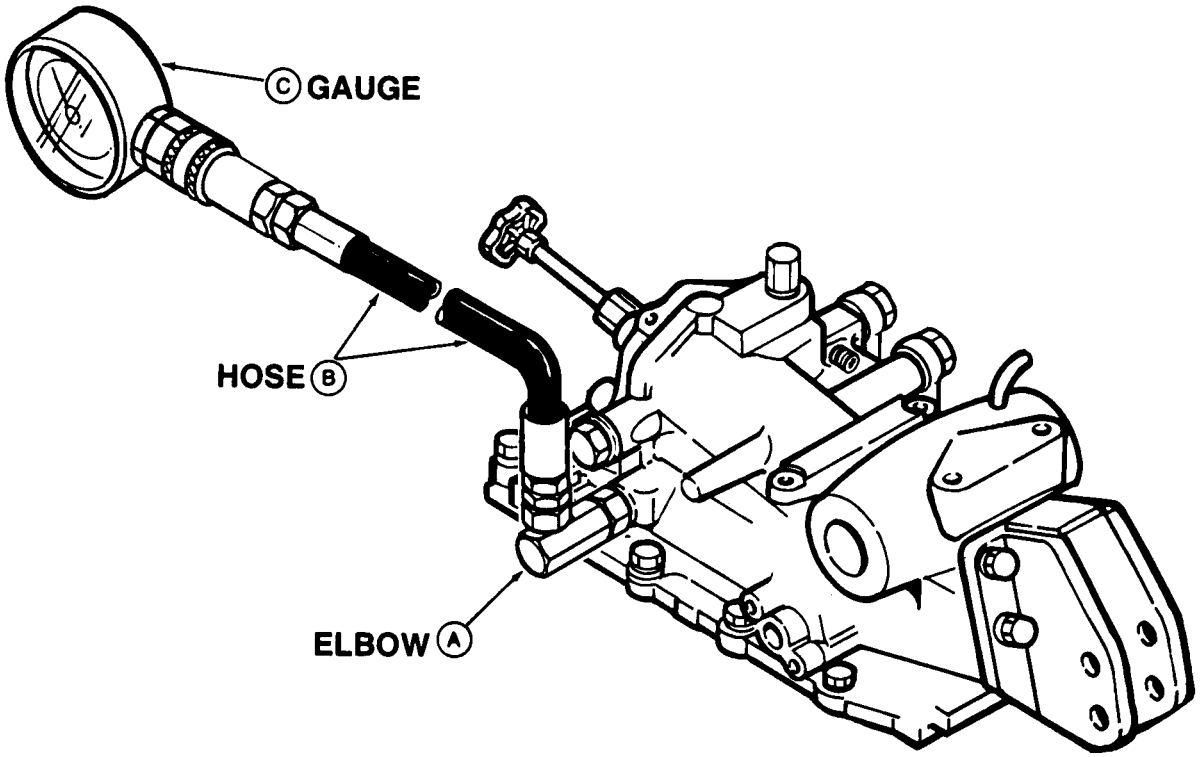
If pressure dropped more than 100 psi with the rate of drop/stop valve closed there is leakage at the seal between the rockshaft valve and housing or internal rockshaft valve leakage around the lowering valve or load check valve.

If pressure dropped with the rate of drop/stop valve open there is leakage past the rockshaft relief valve or in the rockshaft cylinder.

MX,27015DG,A14 -19-19DEC89



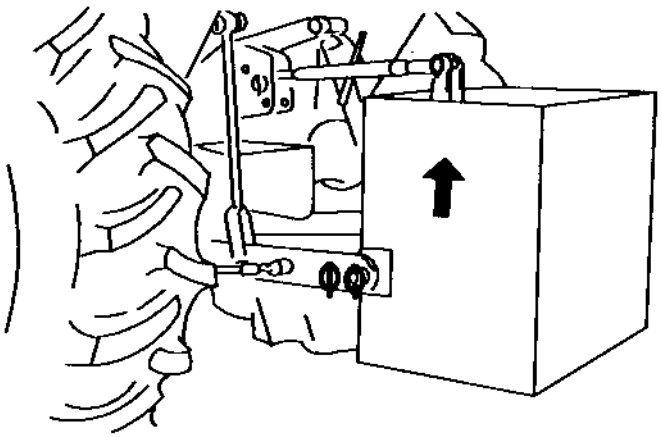
670-770-790 ROCKSHAFT LEAKAGE TEST



M48461

870-970-1070 ROCKSHAFT LEAKAGE TEST

ROCKSHAFT LIFT CYCLE TEST



-UN-12FEB90

M48462

Slide No. 255

REASON FOR TEST:

To determine if hydraulic flow is lifting the 3-point hitch arms as quickly as they were designed to.

TEST PROCEDURE:

1. Install approximately 227 kg (500 lb) rear weight or implement.

NOTE: BW13586 Ballast Box could be used.

2. Open rate of drop/stop valve completely.

3. Lower 3-point hitch completely.

4. Run engine at fast idle.

5. Observe the time that it takes for the 3-point hitch arms to completely raise after you pull the position lever all the way back.

TEST SPECIFICATION:

Full lower to full raise in 2 1/2 to 3 seconds.

TEST RESULTS:

If the raise time is excessive, leakage is occurring.

Perform the rockshaft leakage drop test, pump flow test and main relief valve test. If these tests read correct, the problem is in the rockshaft valve itself, a leaking seal, main spool, unloader valve or flow control valve.

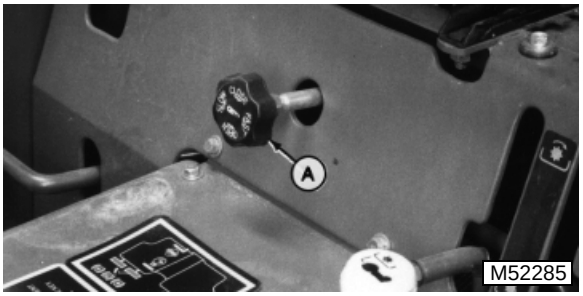
MX,27015DG,A16 -19-19DEC89

ROCKSHAFT POSITION CONTROL FEEDBACK LINKAGE ADJUSTMENT—1070

IMPORTANT: Remove 3 point attachment before performing following adjustments.

•Rockshaft lift arms "must" have free travel when completely raised.

•Without free travel, the hydraulic oil will overheat and cause damage.



ADJUSTMENT PROCEDURE:

1. Fully open the rockshaft stop valve by rotating knob (A).

2. Move the (B) draft control (inner) lever forward to the "MAX" (D) location on the lever guide (against stop).

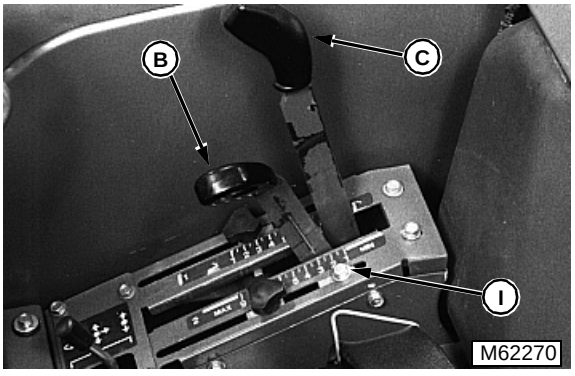
3. Lower the hitch by moving the (C) position control (outer) lever forward to the lowest location on the lever guide (against stop).

4. Start and run engine at 2000 rpm.

5. Raise the hitch by moving the position control lever rearward to the highest location on the lever guide (against stop).

6. "Stop" the engine.

7. Check the rockshaft lift arms (E) for free travel by manually lifting one of the arms to the upper (highest) position and measuring (at the upper tip of the arms) the distance that the arms moved.





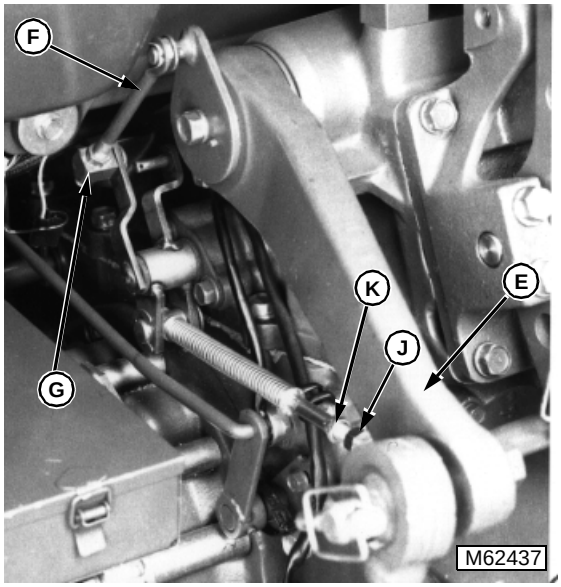
*NOTE: The free travel specification is **5—9 mm**.*

8. If required, adjust free travel to within specification.

9. To increase free travel, "lengthen" the position control linkage rod (F).

10. To decrease free travel, "shorten" the position control linkage rod (F).

NOTE: Lengthening or shortening the position control rod (F) is accomplished by adjusting two jam nuts fore and aft on the rod. The nuts are located in front of and behind the rod adjuster (G).



ROCKSHAFT DRAFT CONTROL LEVER NEUTRAL ADJUSTMENT—1070

ADJUSTMENT PROCEDURE:

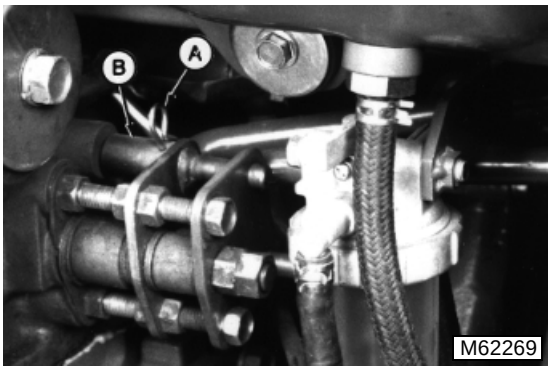
NOTE: The callouts used in this procedure are referring to the Position Control art located on the previous page.

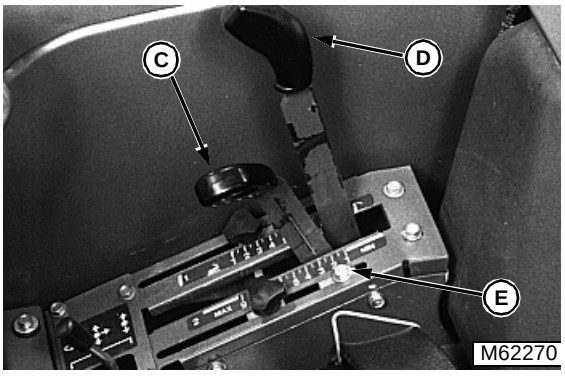
1. Move draft control lever (B) rearward as far as possible past “MIN” (H) and neutral stop (I).
2. Lower the hitch by moving the (C) position control (outer) lever forward to the lowest location on the lever guide (against stop).
3. Fully close the rockshaft stop valve by rotating knob (A).
4. Start and run engine at slow idle.
5. Loosen lock nut (J) located on draft control feedback linkage rod (K).
6. Lengthen (K) rod (turnbuckle) until the relief valve opens to sump (you should hear a change in the hydraulic oil noise).
7. Shorten (K) rod until the relief valve closes off the oil flow to sump (you should again hear a change in the hydraulic oil noise).
8. Shorten (K) rod 3 additional turns and lock (K) rod (turnbuckle) by tightening lock nut (J).
9. Fully open the rockshaft stop valve by rotating knob (A).

ROCKSHAFT DRAFT CONTROL NEUTRAL STOP ADJUSTMENT —1070

ADJUSTMENT PROCEDURE:

1. Remove spring pin (A) and rotate bushing (B) so that the “flat” side of the bushing faces to the rear.
2. Move the (C) draft control (inner) lever rearward until the “rod” contacts bushing (B).
3. Adjust neutral stop (E) until it contacts draft control lever (C).
4. Rotate bushing (B) forward approximately 180 degrees until the “flat” side contacts the draft control lever “rod”.
5. Install spring pin (A).





ADJUST SYSTEM RELIEF VALVE

REASON FOR ADJUSTMENT

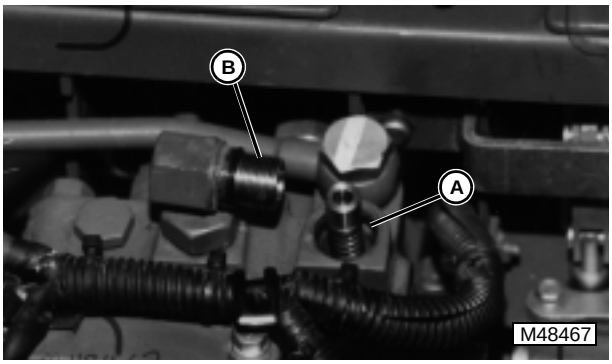
If system relief pressure was found to be too high or low.

ADJUSTMENT PROCEDURE:

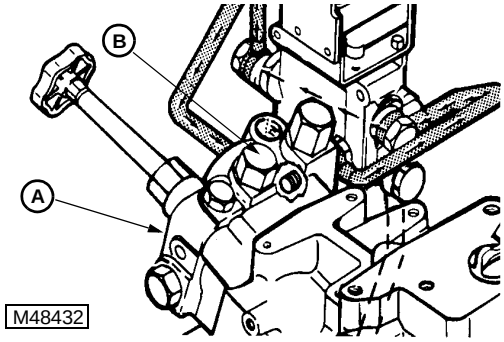
1. Remove plug (B) from top side of Rockshaft Housing (A).
2. Add shims to increase pressure, remove shims to decrease pressure.
3. Install plug (B).

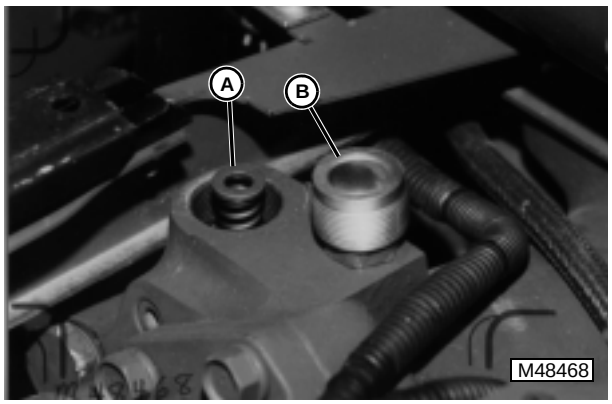
ADJUSTMENT RESULTS:

System relief valve pressure should change. If not, inspect the valve for a damaged spring or leakage past the valve seat.

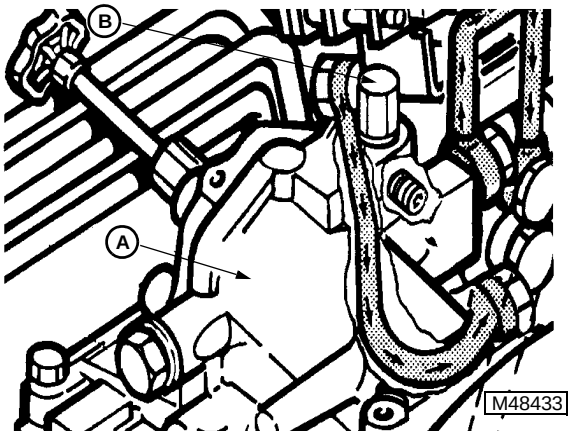


670-770-790





870-970-1070

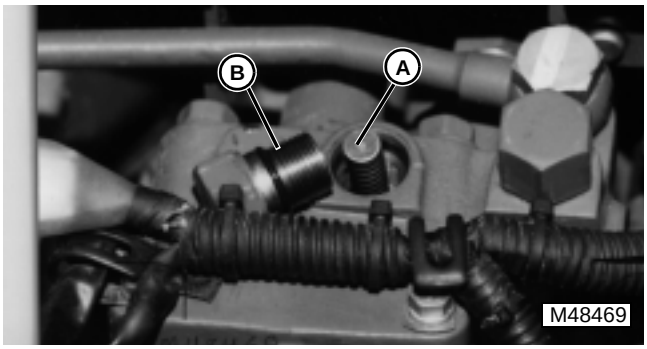


ADJUST ROCKSHAFT RELIEF VALVE

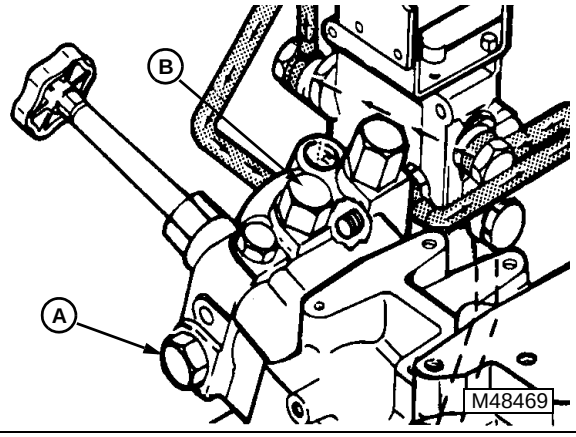
REASON FOR ADJUSTMENT:

If rockshaft relief pressure was found to be too high or low.

ADJUSTMENT PROCEDURE:
1. 670/770/790—Remove plug (B) from top side of rockshaft housing (A).



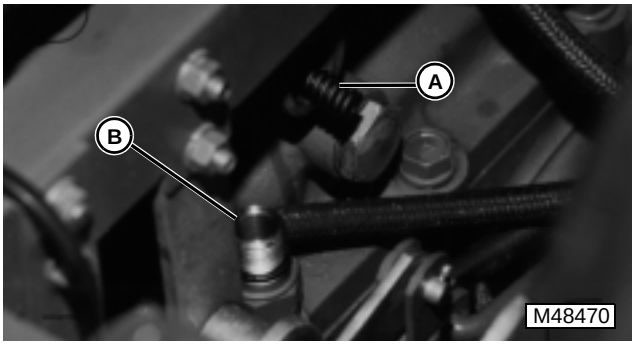
670-770-790



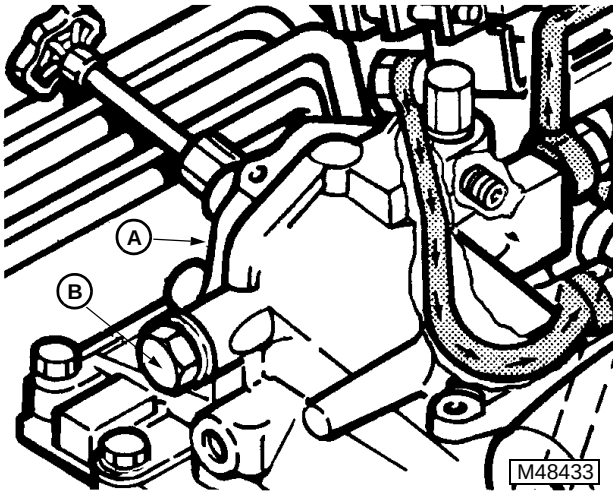
1. 870/970/1070—Remove plug (B) from left side of rockshaft housing (A).
2. Add shims to increase pressure, remove shims to decrease pressure.
3. Install plug (B).

ADJUSTMENT RESULTS

System relief valve pressure should change. If not, inspect the valve for a damaged spring or leakage past the valve seat.

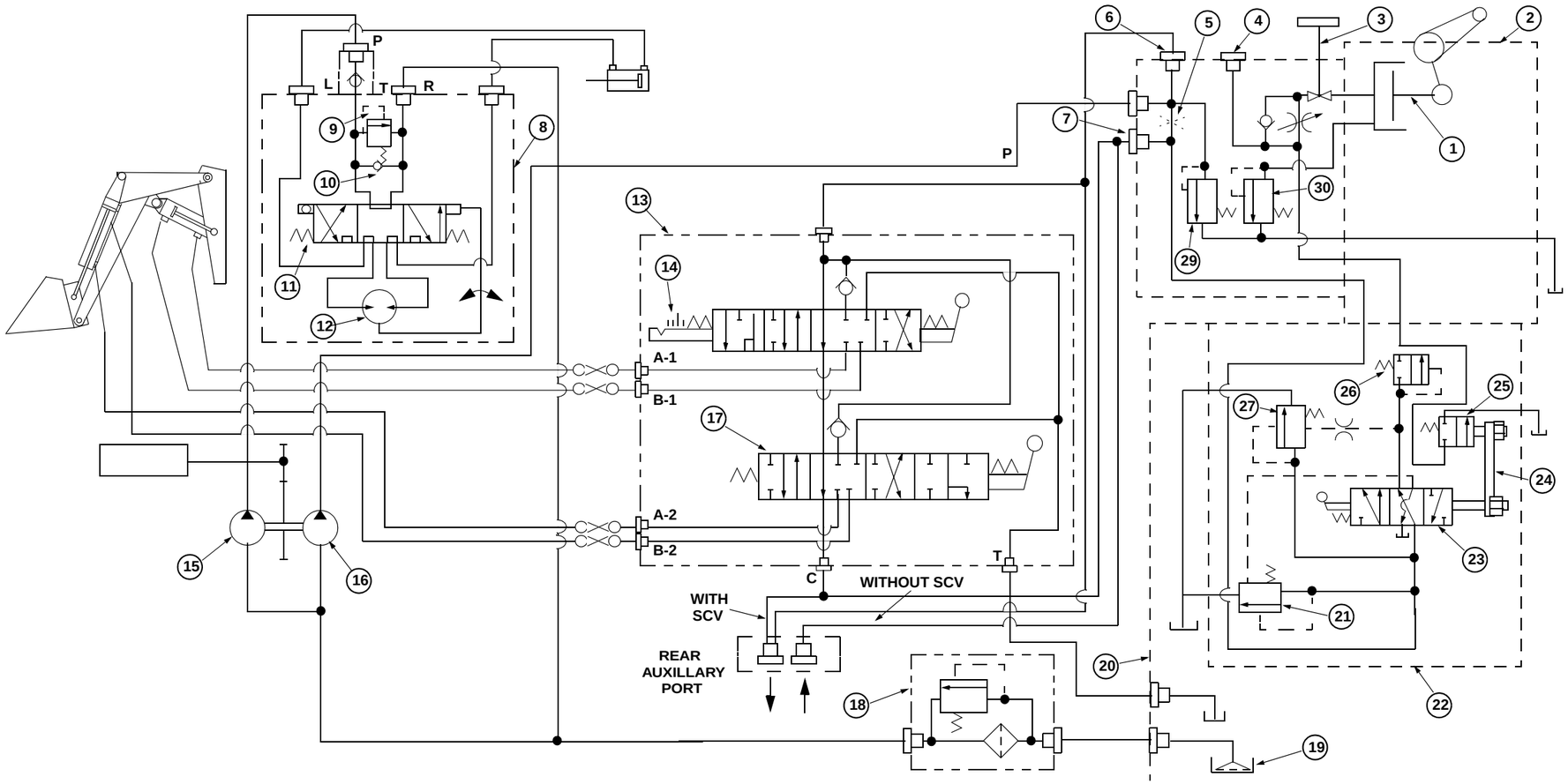


870-970-1070



Hydraulic Schematic

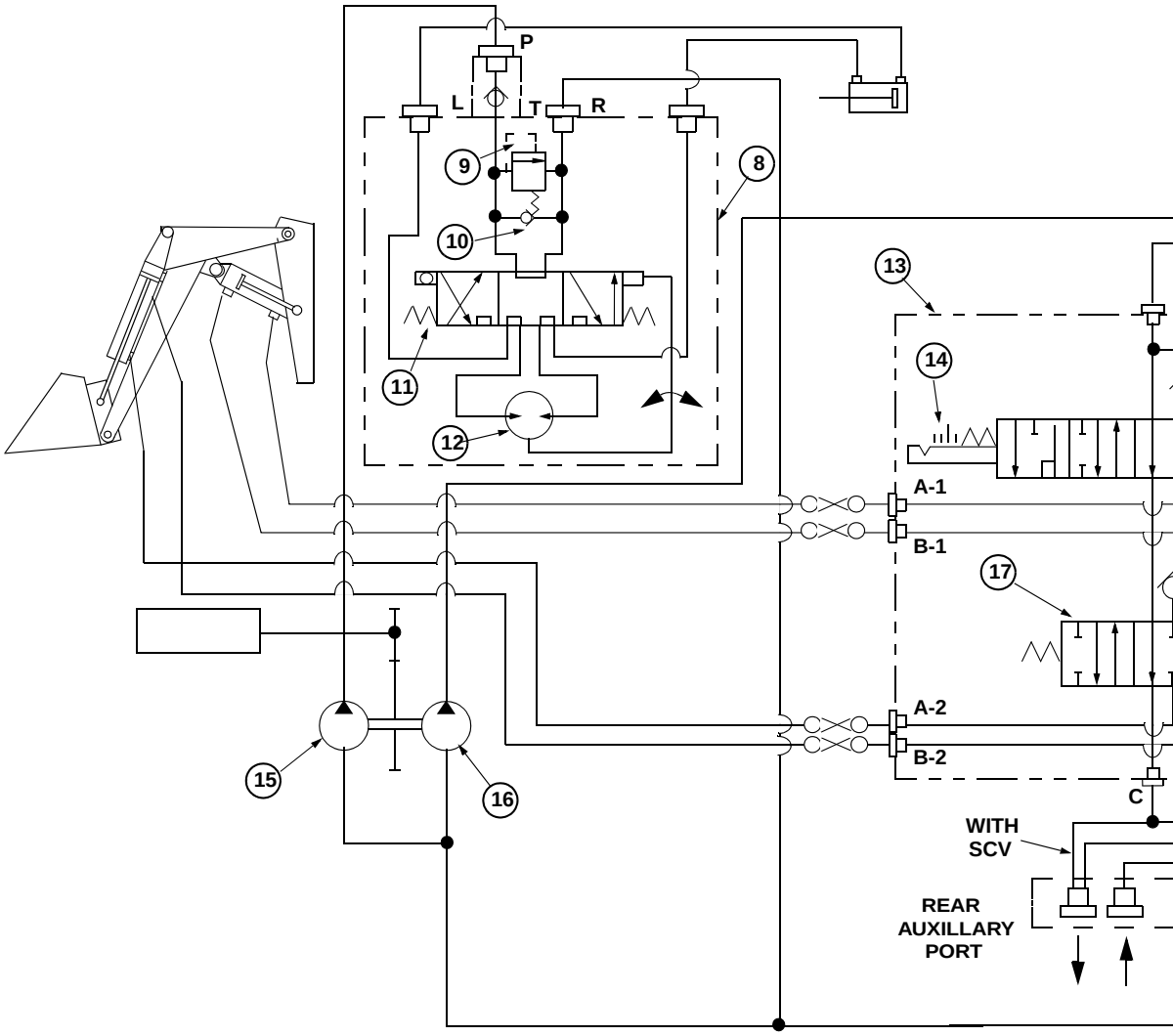
670-770-790 HYDRAULIC SCHEMATIC



1—Rockshaft Cylinder
2—Rockshaft Housing
3—Stop Valve
4—Test Port
5—Plug for SCV or Rear Port
6—Outlet Port (SCV or Rear Hydraulics)
7—Inlet Port (SCV or Rear Hydraulics)
8—Power Steering Valve
9—Relief Valve
10—Check Ball
11—Spool and Sleeve
12—Gerotor Gear
13—Selective Control Valve
14—Boom Spool
15—Gear Pump for Power Steering
16—Gear Pump for Rockshaft
17—Bucket Spool
18—Filter with Bypass
19—Strainer
20—Transmission Case
21—Unloader Valve
22—Rockshaft Control Valve
23—Main Spool
24—Mechanical Link
25—Lowering Valve
26—Load Check Valve
27—Flow Control Valve
28—Rockshaft Front Cover

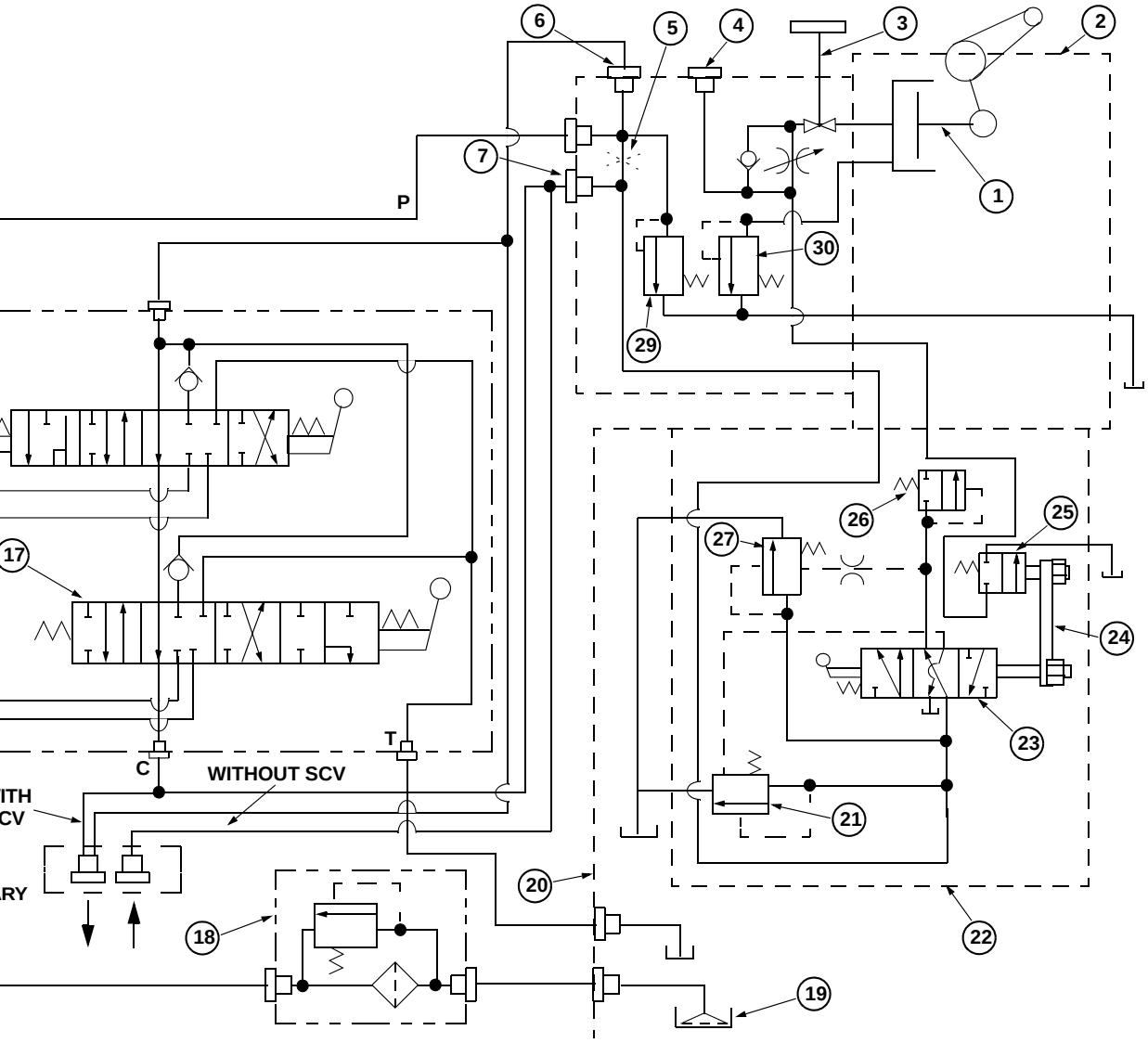
Hydraulic Schematic

670-770-790 HYDRAULIC



1—Rockshaft Cylinder
2—Rockshaft Housing
3—Stop Valve
4—Test Port
5—Plug for SCV or Rear Port
6—Outlet Port (SCV or Rear Hydraulics)
7—Inlet Port (SCV or Rear Hydraulics)
8—Power Steering Valve
9—Relief Valve
10—Check Ball
11—Spool and Sleeve
12—Gerotor Gear
13—Selective Control Val
14—Boom Spool
15—Gear Pump for Power
16—Gear Pump for Rocks
17—Bucket Spool

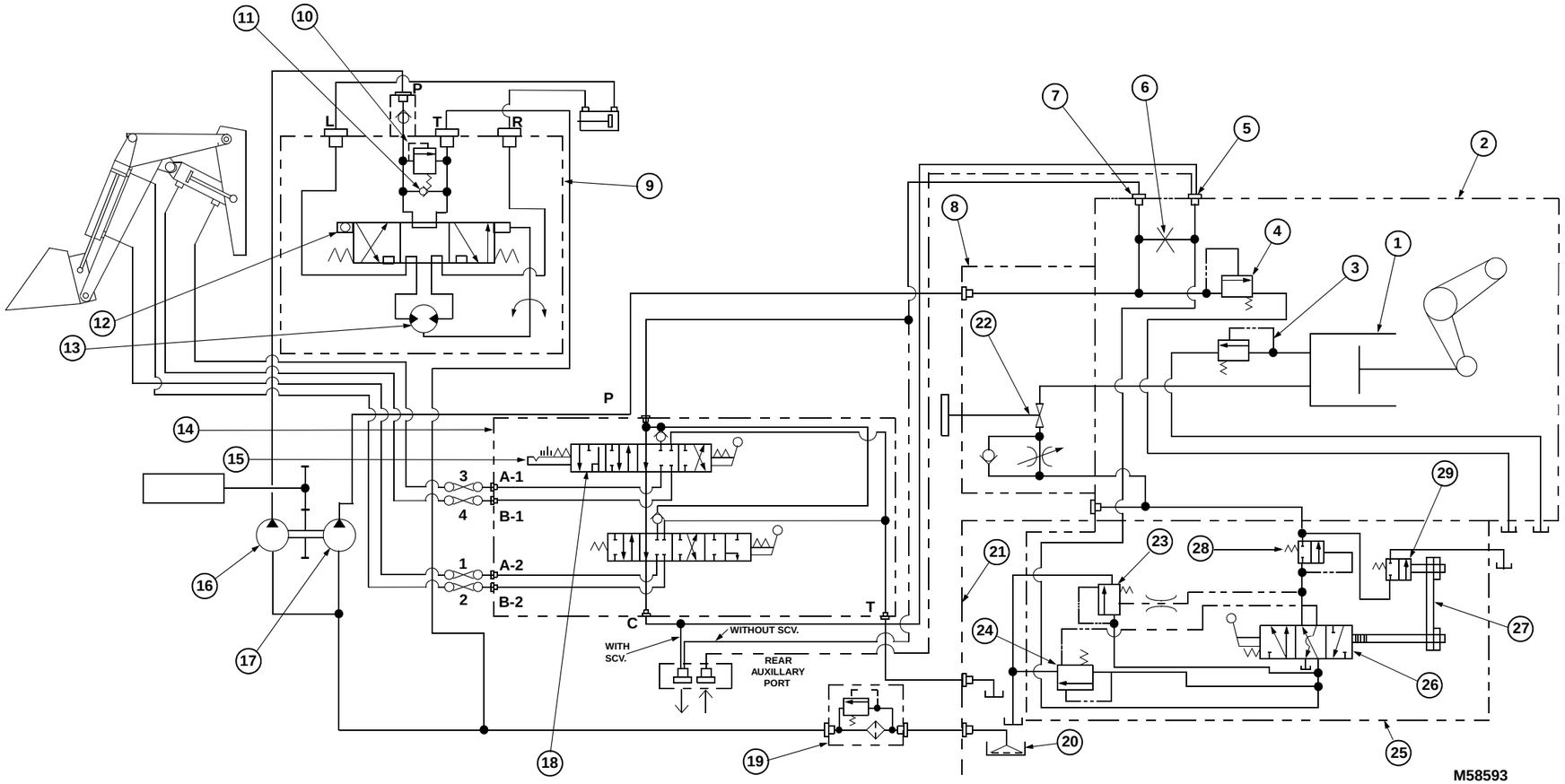
0 HYDRAULIC SCHEMATIC



elective Control Valve
oom Spool
ear Pump for Power Steering
ear Pump for Rockshaft
ucket Spool

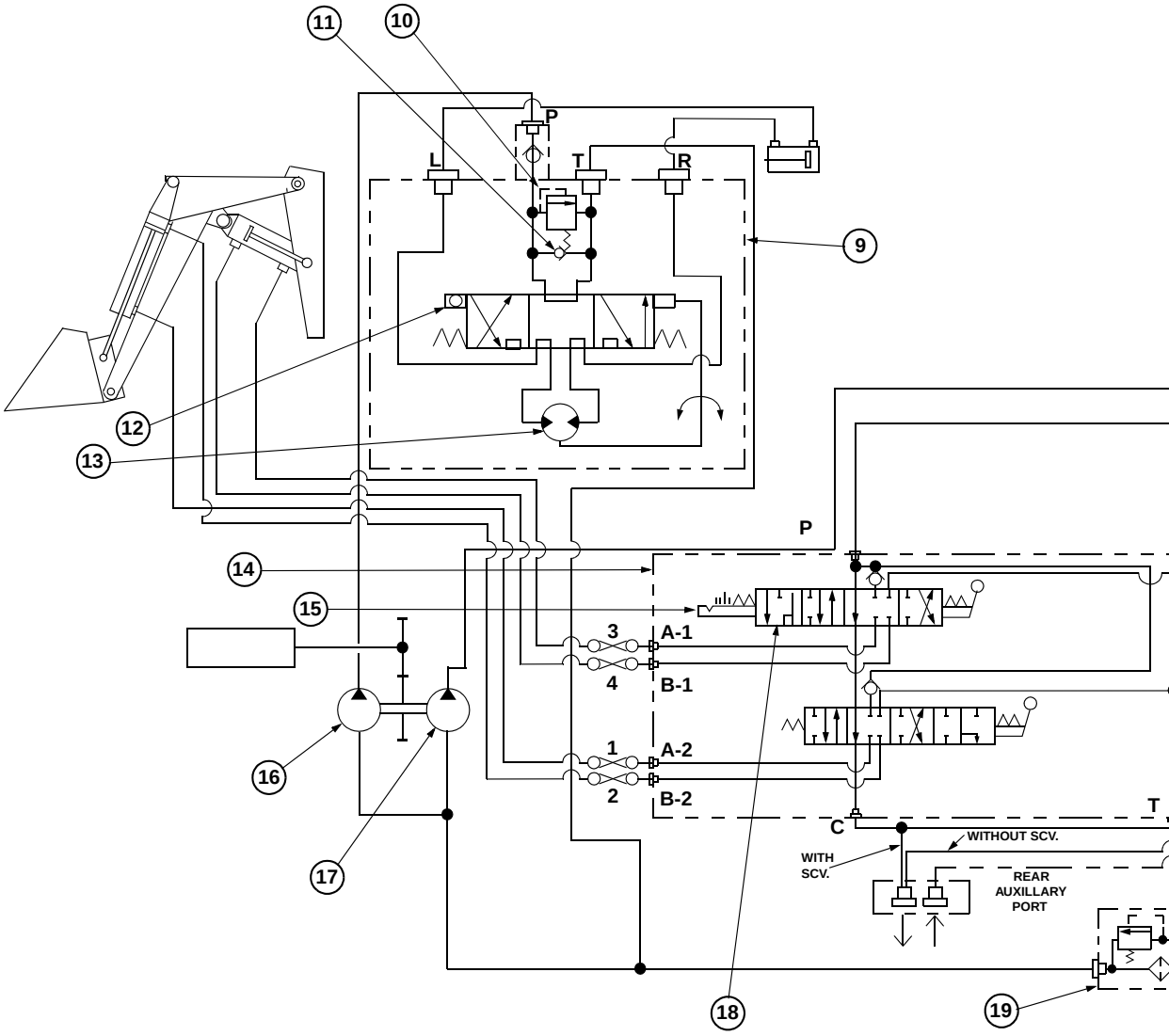
18—Filter with Bypass
19—Strainer
20—Transmission Case
21—Unloader Valve
22—Rockshaft Control Valve
23—Main Spool
24—Mechanical Link
25—Lowering Valve
26—Load Check Valve
27—Flow Control Valve
28—Rockshaft Front Cover

870-970-1070 HYDRAULIC SCHEMATIC



1—Rockshaft Cylinder	7—Outlet Port (SCV or Rear Hydraulics)	13—Gerotor Gear	18—Bucket Spool	24—Unloader Valve
2—Rockshaft Housing	8—Rockshaft Front Cover	14—Selective Control Valve	19—Filter with Bypass	25—Rockshaft Control Valve
3—Thermo Relief	9—Power Steering Valve	15—Boom Spool	20—150 Mesh Strainer	26—Main Spool
4—System Relief	10—Relief Valve	16—Gear Pump for Power Steering	21—Transmission Case	27—Mechanical Link
5—Inlet Port (SCV or Rear Hydraulics)	11—Check Ball	17—Gear Pump for Rockshaft	22—Drop Valve	28—Load Check Valve
6—Plug for SCV or Rear Port	12—Spool and Sleeve		23—Flow Control Valve	29—Lowering Valve

870-970-1070 HYDRAULIC S



1—Rockshaft Cylinder

2—Rockshaft Housing

3—Thermo Relief

4—System Relief

5—Inlet Port (SCV or Rear Hydraulics)

6—Plug for SCV or Rear Port

7—Outlet Port (SCV or Rear Hydraulics)

8—Rockshaft Front Cover

9—Power Steering Valve

10—Relief Valve

11—Check Ball

12—Spool and Sleeve

13—Gerotor Gear

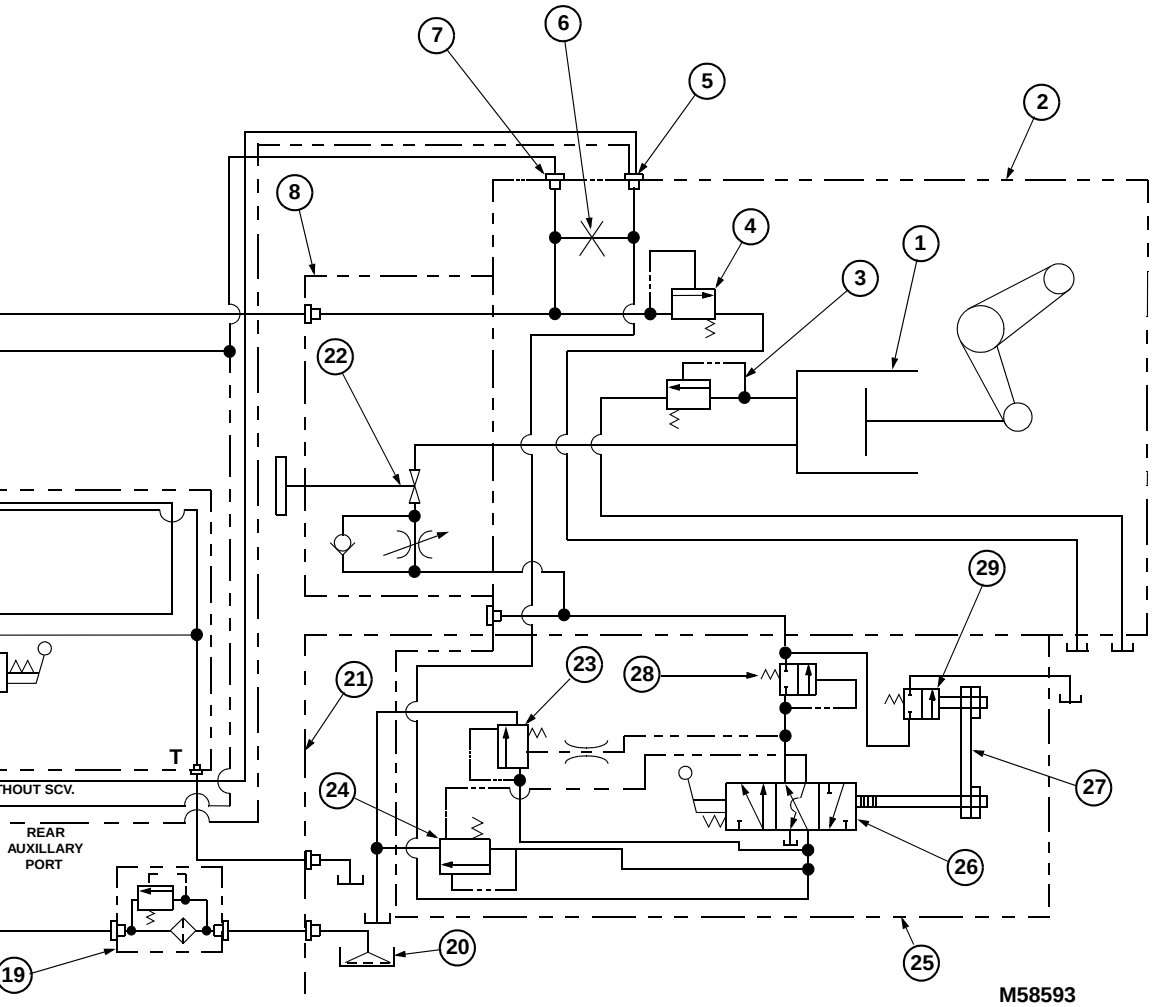
14—Selective Control Valve

15—Boom Spool

16—Gear Pump for Power Ste

17—Gear Pump for Rockshaf

HYDRAULIC SCHEMATIC



or Gear
tive Control Valve
Spool
Pump for Power Steering
Pump for Rockshaft

18—Bucket Spool
19—Filter with Bypass
20—150 Mesh Strainer
21—Transmission Case
22—Drop Valve
23—Flow Control Valve

24—Unloader Valve
25—Rockshaft Control Valve
26—Main Spool
27—Mechanical Link
28—Load Check Valve
29—Lowering Valve

Index

Page

C

Cold weather operating 10-20-6
Coolant, engine 10-20-4

E

Engine coolant 10-20-4
Engine oil, diesel 10-20-3

G

Gear oil 10-20-5
Grease 10-20-5

I

Inch cap screw torque values 10-15-11

L

Lubricant alternatives 10-20-6
Lubricant storage 10-20-6

M

Metric cap screw torque values 10-15-10

O

Oil, engine, diesel 10-20-3
Oil, gear 10-20-5
Oil, hydraulic 10-20-4
Oil, transmission, anti-chatter 10-20-4

T

Torque values, inch cap screw 10-15-11
Torque values, metric cap screw 10-15-10
Transmission, oil, anti-chatter 10-20-4