John Deere Agriculture

5300, 5400 and 5500 Tractors

DIAGNOSIS AND TESTS SERVICE MANUAL

Covered models: 5300, 5400, 5500 (worldwide)

tm4542, July 2001

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Foreword

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

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


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

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

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

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

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

Section 05 - SAFETY

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Group 05 - Safety

Recognize Safety Information

Safety-Alert Symbol

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

Follow recommended precautions and safe operating practices.

Understand Signal Words

Signal Words

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

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

“Important” Information

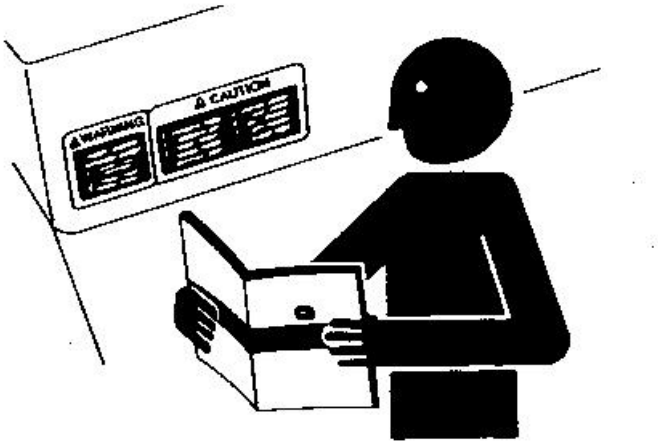
Information marked as IMPORTANT points out problems that may lead to machine damage. By following the directions given, these problems can be avoided.

“Note” Information

When marked with NOTE the information given is more detailed or contains restrictions to directions given previously. On the

other hand useful information may be given belonging to certain instruction without being directly connected to them.

Follow Safety Instructions



Safety Messages

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

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

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

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

Handle Fluids Safely-Avoid Fires

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.

Prevent Battery Explosions

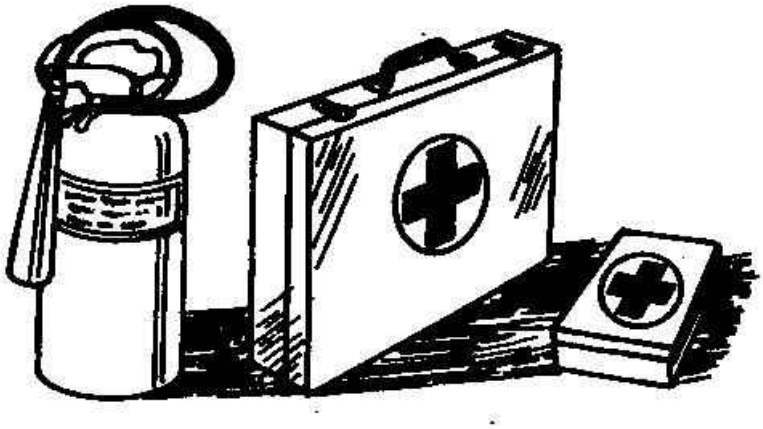
Battery Explosions

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).

Prepare for Emergencies



First Aid Kit

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.

Prevent Acid Burns

Acid Burns

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

Avoid the hazard by:

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

If you spill acid on yourself:

1. Flush your skin with water.
2. Apply baking soda or lime to help neutralize the acid.
3. Flush your eyes with water for 15-30 minutes. Get medical attention immediately.

If acid is swallowed:

1. Do not induce vomiting.
2. Drink large amounts of water or milk, but do not exceed 2 L (2 quarts).
3. Get medical attention immediately.

Service Cooling System Safely

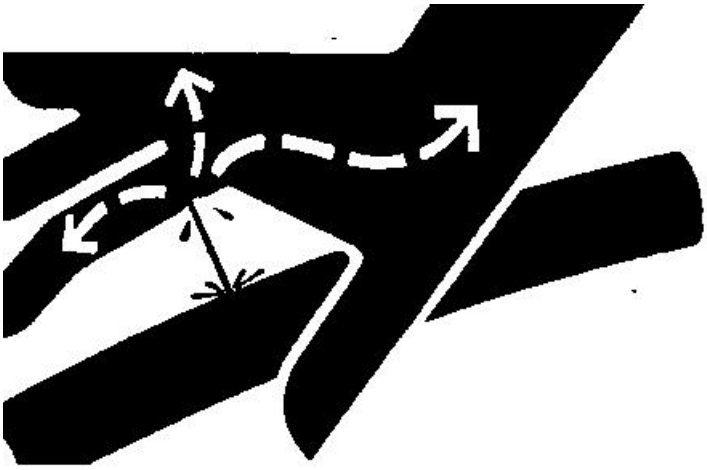
Service Cooling System

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 relieve pressure before removing completely.

Add coolant only when the engine is shut off.

Avoid High-Pressure Fluids



High-Pressure Fluids

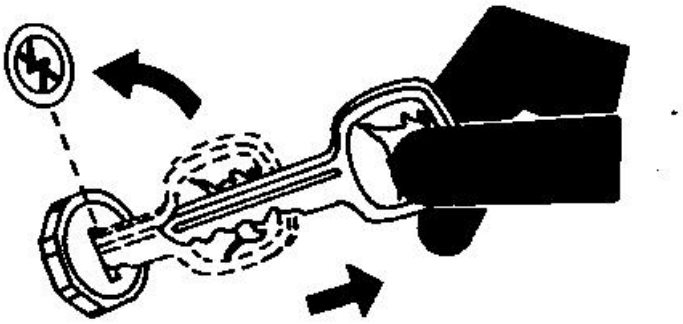
Escaping fluid under pressure can penetrate the skin causing serious injury.

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

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

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

Park Machine Safely

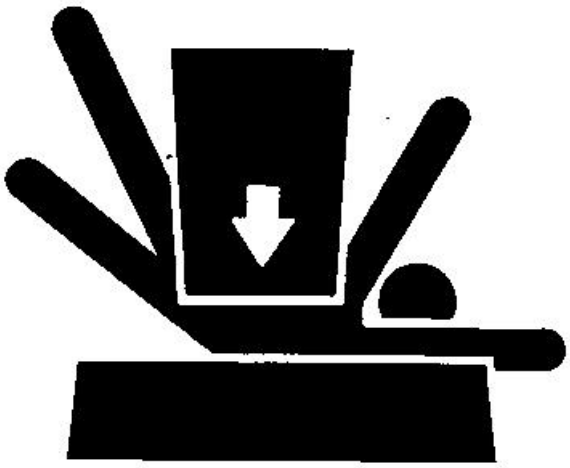


Remove the Key

Before working on the machine:

- Lower all equipment to the ground
- Apply handbrake
- Stop the engine and remove the key
- Disconnect the battery ground strap
- Hang a “DO NOT OPERATE” tag in operator station

Support Machine Properly

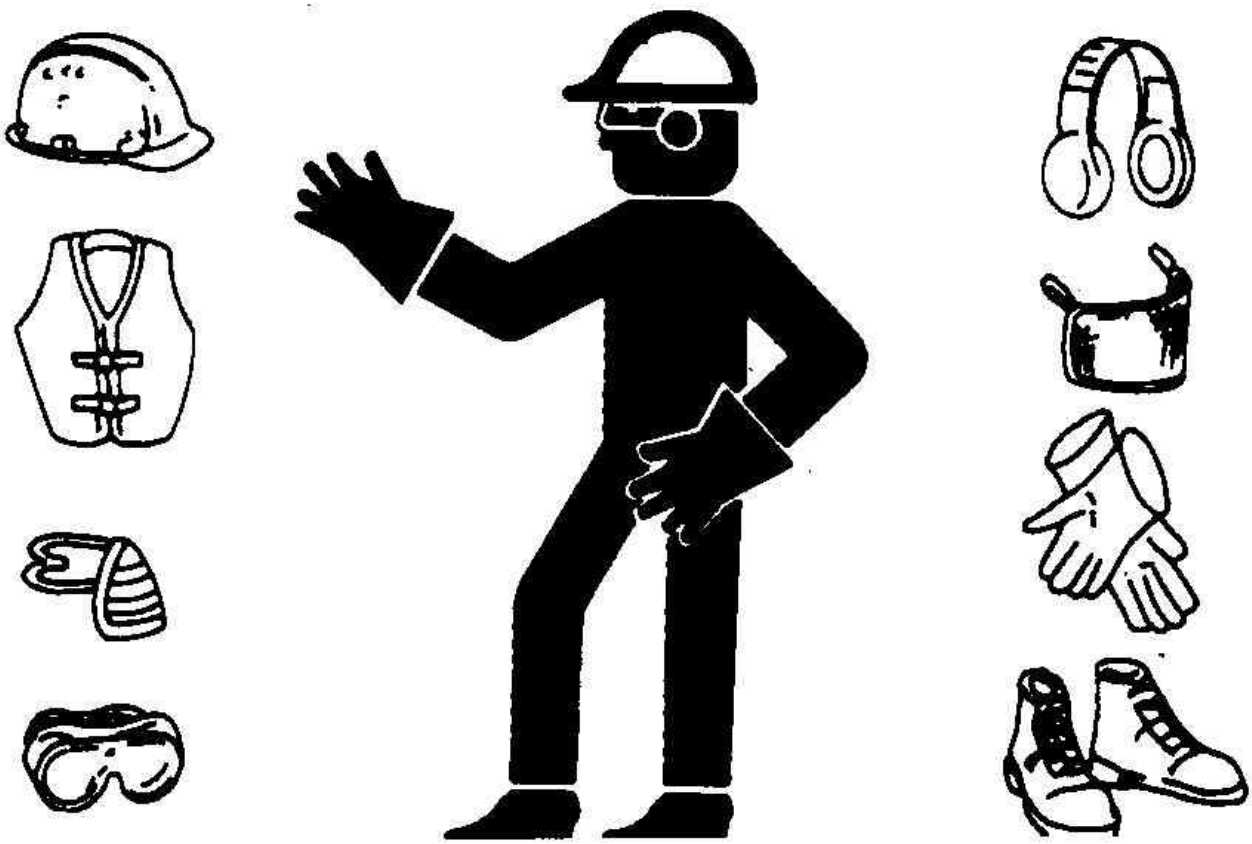


Support Properly

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.

Wear Protective Clothing



Protective Clothing

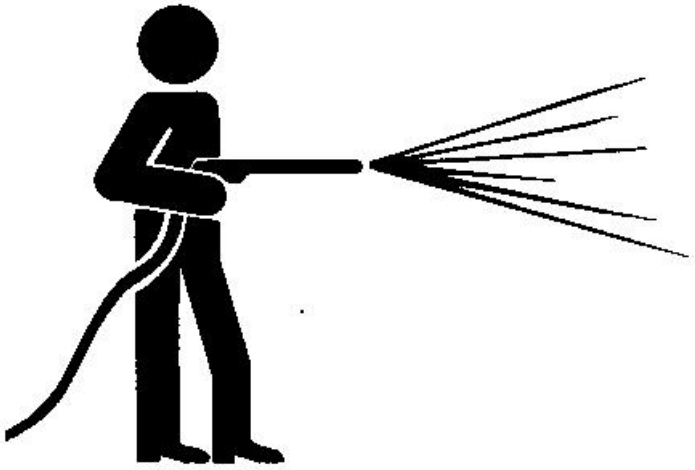
Wear close fitting clothing and safety equipment appropriate to the job.

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

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

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

Work in Clean Area

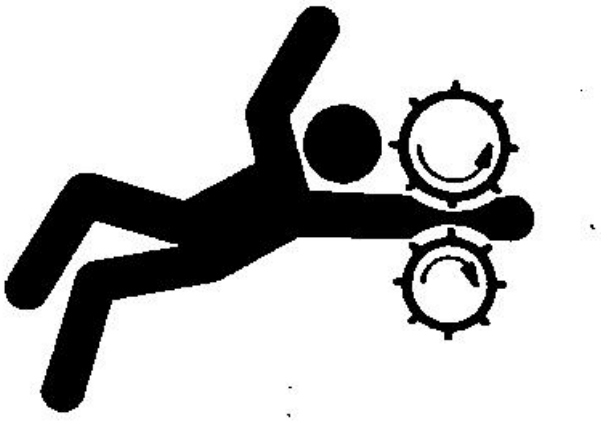


Clean Work Area

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.

Service Machines Safely

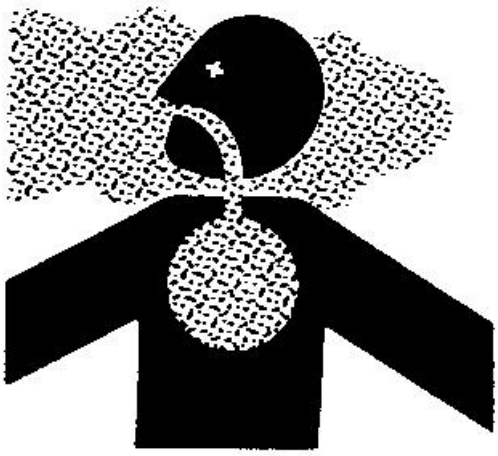


Moving Parts

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.

Work In Ventilated Area



Engine Exhaust Fumes

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.

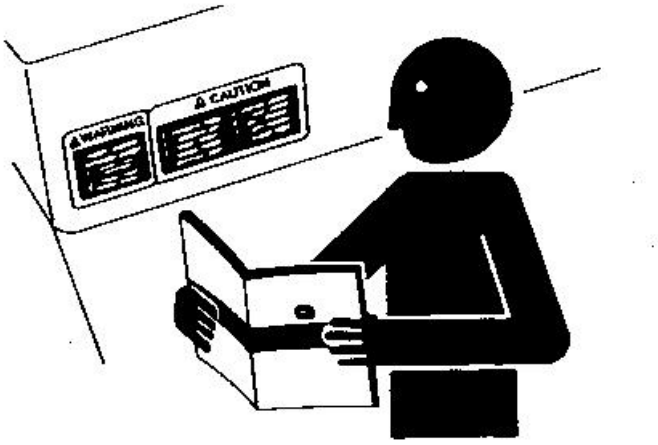
If you do not have exhaust pipe extension, open the doors and get outside air into the area

Illuminate Work Area Safely

Work Area Safely

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

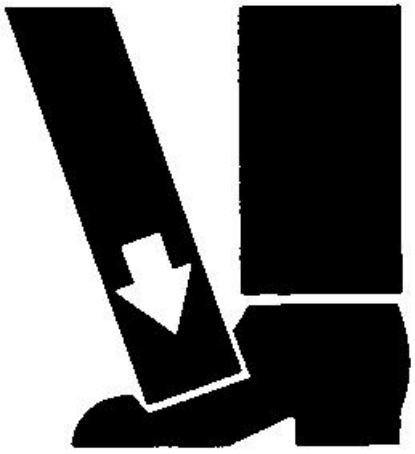
Replace Safety Signs



Safety Signs

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

Use Proper Lifting Equipment

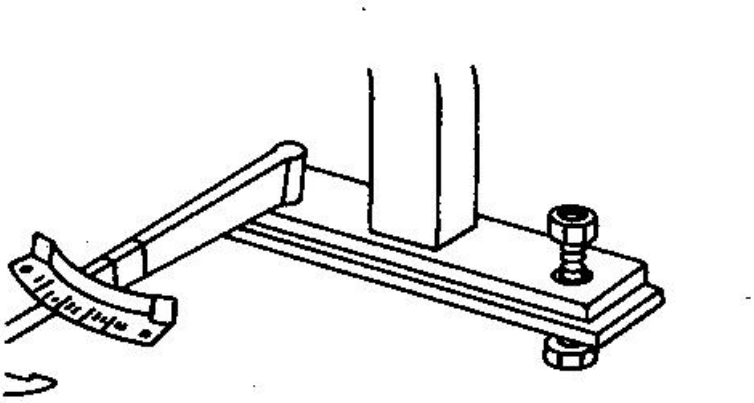


Proper Lifting Equipment

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

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

Keep ROPS Installed Properly

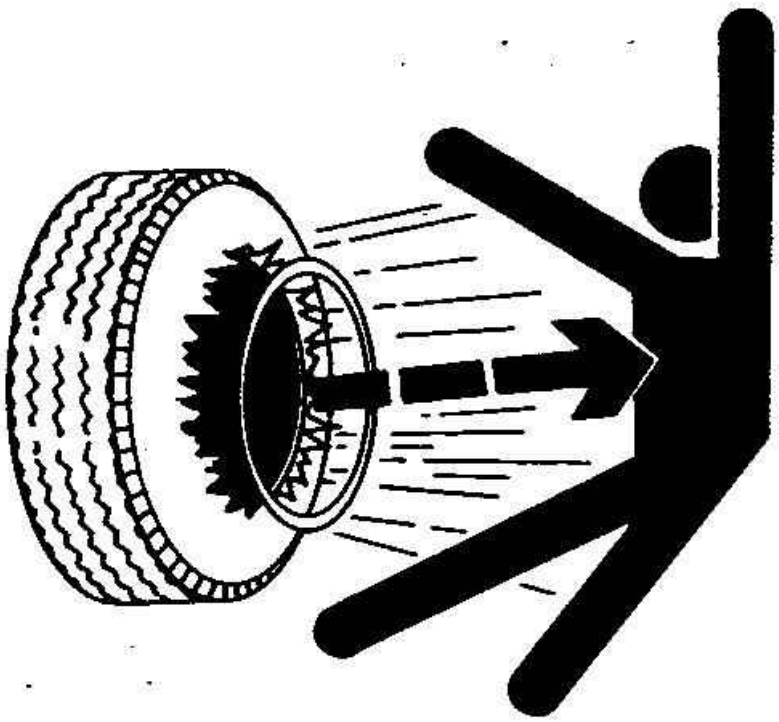


Roll-Over Protective Structure

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.

Service Tires Safely



Explosive Tire and Rim Parts

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

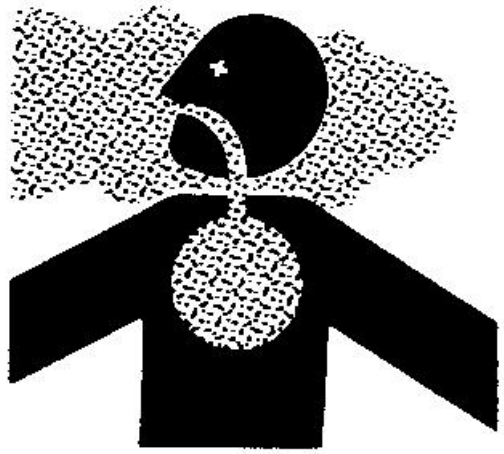
Do not attempt to mount a tire unless you have the proper equipment and experience to perform the job.

Always maintain the correct tire pressure. Do not inflate the tires above the recommended pressure. Never weld or heat a wheel and tire assembly. The heat can cause an increase in air pressure resulting in a tire explosion. Welding can structurally weaken or deform the wheel.

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

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

Avoid Harmful Asbestos Dust



Asbestos Dust

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

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

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

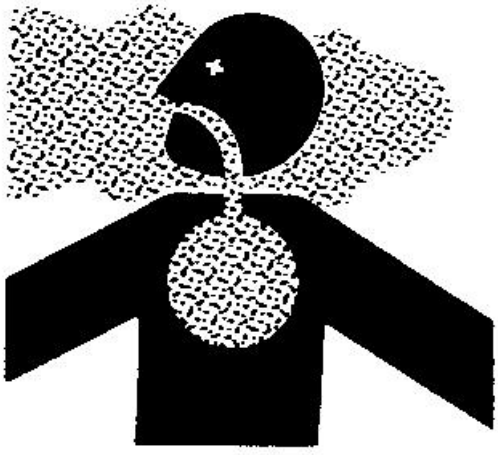
Keep bystanders away from the area.

Avoid Heating Near Pressurized Fluid Lines

Flammable Spray

Flammable spray can be generated by heating near pressurized fluid lines, resulting in severe burns to yourself and bystanders. Do not heat by welding, soldering, or using a torch near pressurized fluid lines or other flammable materials. Pressurized lines can be accidentally cut when heat goes beyond the immediate flame area.

Remove Paint Before Welding or Heating



Toxic Fumes

Avoid potentially toxic fumes and dust.

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

Do all work outside or in a well ventilated area. Dispose of paint and solvent properly.

Remove paint before welding or heating:

- If you sand or grind paint, avoid breathing the dust. Wear an approved respirator.
- If you use solvent or paint stripper, remove stripper with soap and water before welding. Remove solvent or paint stripper containers and other flammable material from area. Allow fumes to disperse at least 15 minutes before welding or heating.

Use Proper Tools

Proper Tools

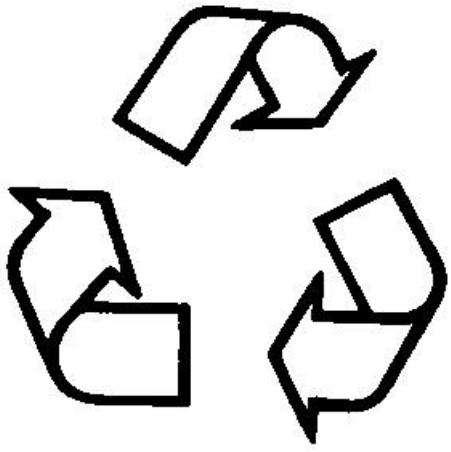
Use tools appropriate to the work. Makeshift tools and procedures can create safety hazards.

Use power tools only to loosen threaded parts and fasteners.

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

Use only service parts meeting John Deere specifications.

Dispose of Waste Properly



Recycle Waste

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

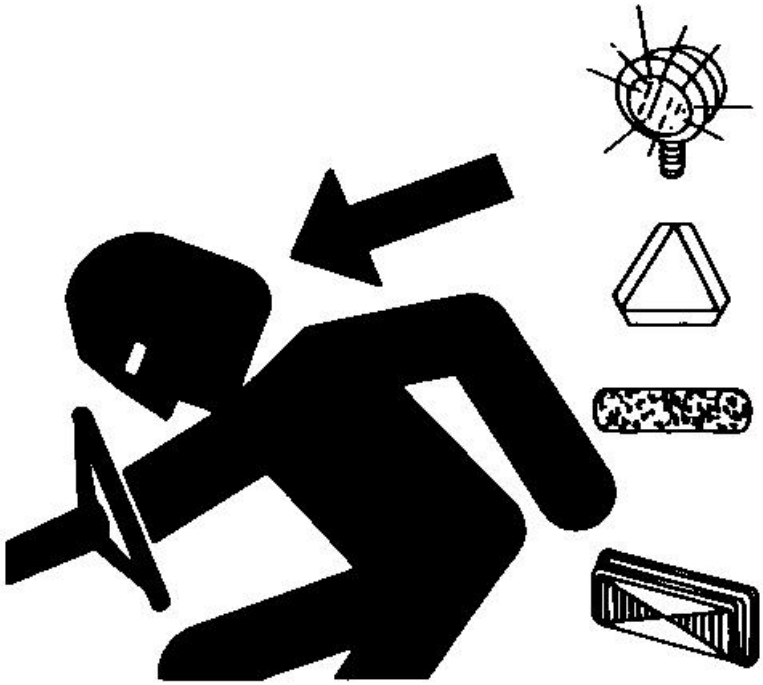
Use leakproof containers when draining fluids. Do not use food or beverage containers that may mislead someone into drinking from them.

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

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

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

Use Safety Lights and Devices



Prevent Collisions

Prevent collisions between other road users, slow moving tractors with attachments or towed equipment, and self-propelled machines on public roads. Frequently check for traffic from the rear, especially in turns, and use hand signals or turn signal lights.

Use headlights, flashing warning lights, and turn signals day and night. Follow local regulations for equipment lighting and marking. Keep lighting and marking visible and in good working order. Replace or repair lighting and marking that has been damaged or lost. An implement safety lighting kit is available from your John Deere dealer.

Practice Safe Maintenance

Keep Area Clean

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

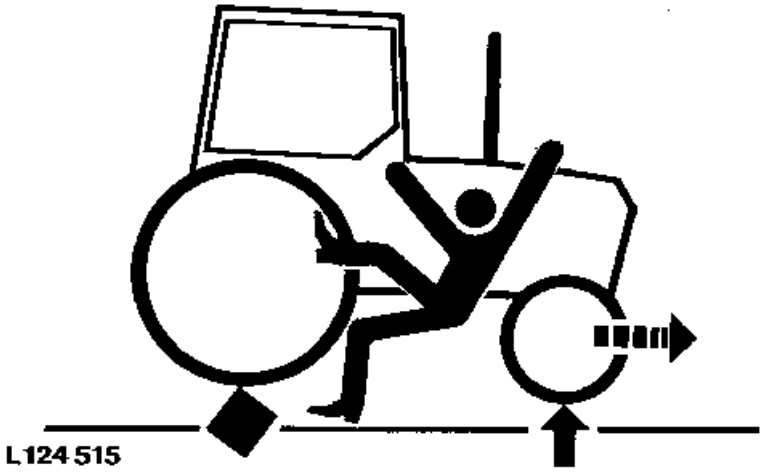
Never lubricate, service, or adjust machine while it is moving. Keep hands, feet , and clothing from power-driven parts. Disengage all power and operate controls to relieve pressure. Lower equipment to the ground. Stop the engine. Remove the key. Allow machine to cool.

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

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

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

Service Front-Wheel Drive Tractor Safely



Service Safely

When servicing front-wheel drive tractor with the rear wheels supported off the ground and rotating wheels by engine power, always support front wheels in a similar manner. Loss of electrical power or transmission/ hydraulic system pressure will engage the front driving wheels, pulling the rear wheels off the support if front wheels are not raised. Under these conditions, front drive wheels can engage even with switch in disengaged position.

Live With Safety

Safety Systems

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

Section 10 - GENERAL SPECIFICATIONS

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Group 05 - Machine Specifications

Machine Specifications

[(Specifications and design subject to change without notice.)]

Engine

	5300	5400	5500
ENGINE			
Make	John Deere	John Deere	John Deere
Type	Diesel	Diesel	Diesel
Model	3029DAT01	3029TAT02	4039TAT01
Aspiration	Natural	Turbocharged	Turbocharged
Horsepower	40 kW (55 hp)	52 kW (70 hp)	59 kW (80 hp)
Rated Engine Speed	2400 rpm	2400 rpm	2400 rpm
Operating Range	1400-2400 rpm	1600-2400 rpm	1500-2400 rpm
Number of Cylinders	3	3	4
Displacement	2.9 Liters (176.9 cu.in.)	2.9 Liters (176.9 cu.in.)	3.9 Liters (239 cu.in.)
Bore x Stroke	106.5 x 110 mm (4.19 x 4.33 in.)	106.5 x 110 mm (4.19 x 4.33 in.)	106.5 x 110 mm (4.19 x 4.33 in.)
Compression Ratio	17.8:1	17.8:1	17.8:1
Fast Idle	2570 - 2620 rpm	2570 - 2620 rpm	2570 - 2620 rpm
Slow Idle	750 - 800 rpm	750 - 800 rpm	750 - 850 rpm
Start Aid	Air Heater	Air Heater	Air Heater
Firing Order	1-2-3	1-2-3	1-3-4-2
Intake valve clearance	0.35 mm (0.014 in.)	0.35 mm (0.014 in.)	0.35 mm (0.014 in.)
Exhaust valve clearance	0.45 mm (0.018 in.)	0.45 mm (0.018 in.)	0.45 mm (0.018 in.)
Lubrication	Pressurized	Pressurized	Pressurized
Cooling	Liquid Cooled	Liquid Cooled	Liquid Cooled
Air Cleaner	Dry Type w/Safety Element	Dry Type w/Safety Element	Dry Type w/Safety Element
Engine Shut-off	Key Switch	Key Switch	Key Switch

Fuel System

	5300	5400	5500
FUEL SYSTEM			
Type	Direct Injection	Direct Injection	Direct Injection
Injection Pump Type	Rotary with el. shut-off	Rotary with el. shut-off	Rotary with el. shut-off
Fuel Filter	Fuel Gard	Fuel Gard	Fuel Gard

Drive Train

	5300	5400	5500
DRIVE TRAIN			
Transmission Type			
Standard	BSS With Creeper	BSS With Creeper	BSS With Creeper
Number of Speeds	12 Forward, 12 Reverse	12 Forward, 12 Reverse	12 Forward, 12 Reverse
Optional	Synchr. Splitter	Synchr. Splitter	Synchr. Splitter
Number of Speeds	24 Forward, 24 Reverse	24 Forward, 24 Reverse	24 Forward, 24 Reverse
Final Drive	Planetary	Planetary	Planetary
Clutch	Dual, dry	Dual, dry	Dual, dry

Steering and Brakes

	5300	5400	5500
STEERING AND BRAKES			
Steering	Hydrostatic Power	Hydrostatic Power	Hydrostatic Power
Brakes	4 discs per side in oil bath	4 discs per side in oil bath	4 discs per side in oil bath

Electrical System

	5300	5400	5500
ELECTRICAL SYSTEM			
Type	12 Volt	12 Volt	12 Volt
Battery Size	100 Ah 400 Cold cranking Amps at -18°C (0°F)	400 Cold cranking Amps at - 18°C (0°F)	100 Ah 400 Cold cranking Amps at -18°C (0°F)
Alternator/Regulator	40 amps (60 amps with cab) min. at 2575 rpm	40 amps (60 amps with cab) min. at 2575 rpm	40 amps (60 amps with cab) min. at 2575 rpm
Regulated voltage	14,2 to 14,8 V at 10 amps or less, 2400 rpm and 25°C (77°F)	14.2 to 14.8 V at 10 amps or less, 2400 rpm and 25°C (77°F)	14,2 to 14,8 V at 10 amps or less, 2400 rpm and 25°C (77°F)
Starting Motor	2,5 kW	2,5 kW	2,5 kW
On Bench Current Draw	513 amps max. at 1439 rpm	513 amps max. at 1439 rpm	513 amps max. at 1439 rpm
Tachometer Magnetic Sensor Output	1 V AC min. at slow idle	1 V AC min. at slow idle	1 V AC min. at slow idle
Fuel Level Sending Unit Resistance	Full tank: 4.5 to 12 ohms Empty tank: 90 to 97.5 ohms	Full tank: 4.5 to 12 ohms Empty tank: 90 to 97.5 ohms	Full tank: 4.5 to 12 ohms Empty tank: 90 to 97.5 ohms
Coolant Temperature Sending Unit Resistance	at 60°C (140°F): 134 ± 13.5 ohms at 90°C (194°F): 51.2 ± 4.3 ohms at 100°C (212°F): 38.5 ± 3 ohms	at 60°C (140°F): 134 ± 13.5 ohms at 90°C (194°F): 51.2 ± 4.3 ohms at 100°C (212°F): 38.5 ± 3 ohms	at 60°C (140°F): 134 ± 13.5 ohms at 90°C (194°F): 51.2 ± 4.3 ohms at 100°C (212°F): 38.5 ± 3 ohms
Engine Oil Pressure Switch	opens at 38 to 72 kPa (0.38 to 0.72 bar; 5.5 to 10.5 psi) oil pressure	opens at 38 to 72 kPa (0.38 to 0.72 bar; 5.5 to 10.5 psi) oil pressure	opens at 38 to 72 kPa (0.38 to 0.72 bar; 5.5 to 10.5 psi) oil pressure
Air Filter Restriction Switch	closes at a vacuum of 4.98 to 7.48 kPa (0,0498 to 0.748 bar; 20 to 30 in. water column)	closes at a vacuum of 4.98 to 7.48 kPa (0,0498 to 0.748 bar; 20 to 30 in. water column)	closes at a vacuum of 4.98 to 7.48 kPa (0,0498 to 0.748 bar; 20 to 30 in. water column)

Hydraulic System

	5300	5400	5500
HYDRAULIC SYSTEM			
Type	Open Center	Open Center	Open Center
Working Pressure			
Implement	18000 - 18500 kPa (180 - 185 bar; 2610 - 2680 psi)	18000 - 18500 kPa (180-185 bar; 2610-2680 psi)	18000 - 18500 kPa (180-185 bar; 2610-2680 psi)
Steering	13000 - 13500 kPa (130 - 135 bar; 1885 - 1958 psi)	13000 - 13500 kPa (130-135 bar; 1885-1958 psi)	13000 - 13500 kPa (130-135 bar; 1885-1958 psi)
Hitch Lift Capacity at 610 mm (24 in.)			
Behind Hitch Balls	1550 kg (3415 lb)	1550 kg (3415 lb)	1550 kg (3415 lb)
Lift Control Type	Position and Depth	Position and Depth	Position and Depth

Hydraulic Pump

	5300	5400	5500
HYDRAULIC PUMP			
Type	Tandem Gear	Tandem Gear	Tandem Gear
Flow Rate			
Implement	43.2 L/min. (11.4 gpm)	43.2 L/min. (11.4 gpm)	43.2 L/min. (11.4 gpm)
Steering	25.7 L/min. (7.0 gpm)	25.7 L/min. (7.0 gpm)	25.7 L/min. (7.0 gpm)

Rear PTO

	5300	5400	5500
PTO			
Type	Fully Independent	Fully Independent	Fully Independent
Speed (PTO rpm at Rated Engine rpm)			
Rear PTO	540/540E rpm shiftable	540/540E rpm shiftable or 540/1000 rpm shiftable	540/540E rpm shiftable or 540/1000 rpm shiftable

Capacities

	5300	5400	5500
CAPACITIES			
FUEL TANK	72 L (19 U.S. gal)	72 L (19 U.S. gal)	72 L (19 U.S. gal)
COOLING SYSTEM			
Without Cab	9.5 L (10 U.S. qt)	9.5 L (10 U.S. qt)	12 L (12.7 U.S. qt)
With Cab	10.5 L (11.1 U.S. qt)	10.5 L (11.1 U.S. qt)	13 L (13.7 U.S. qt)
ENGINE CRANKCASE (with Filter)	6 L (6.3 U.S. qt)	8.5 L (9 U.S. qt)	8.5 L (9 U.S. qt)
HYDRAULIC SYSTEM	2WD - 36 L (9.5 U.S. gal) 4WD - 38 L (10 U.S. gal) HI-LO - 43 L (11.3 U.S. gal)	2WD - 36 L (9.5 U.S. gal) 4WD - 38 L (10 U.S. gal) HI-LO - 43 L (11.3 U.S. gal)	2WD - 36 L (9.5 U.S. gal) 4WD - 38 L (10 U.S. gal) HI-LO - 43 L (11.3 U.S. gal)
FRONT WHEEL DRIVE			
Wheel Hubs Axle Housing	0.6 L (0.63 U.S. qt) 5 L (5.3 U.S. qt)	0.6 L (0.63 U.S. qt) 5 L (5.3 U.S. qt)	0.6 L (0.63 U.S. qt) 5 L (5.3 U.S. qt)

Tires

	5300	5400	5500
TIRES (Standard Equipment)			
2WD			
Front Rear	7.50 - 16 6PR 14.9 - R30 129 A8	7.50 - 16 6PR 16.9 - R30 137 A8	7.50 - 16 6PR 16.9 - R30 137 A8
MFWD			
Front Rear	9.5 - R24 6PR 14.9 - R30 129 A8	11.2 - R24 114 A8 16.9 - R30 137 A8	11.2 - R24 114 A8 16.9 - R30 137 A8

Overall Dimensions

	5300	5400	5500
OVERALL DIMENSIONS (Standard Equipment)			
Ground Clearance			
Drawbar	365 mm (14.5 in.)	395 mm (15.7 in.)	395 mm (15.7 in.)
Front Axle			
2WD MFWD	465 mm (18.5 in.) 370 mm (14.7 in.)	465 mm (18.5 in.) 390 mm (15.5 in.)	465 mm (18.5 in.) 390 mm (15.5 in.)
Overall Lenght without Ballast Weights	3670 mm (146.5 in.)	3670 mm (146.5 in.)	3798 mm (149.5 in.)
Overall Width (max.) [Widths are in relation to thread settings]	2380 mm (95 in.)	2380 mm (95 in.)	2380 mm (95 in.)
Overall Height			
To Top of CAB	2335 mm (92 in.)	2365 mm (93.1 in.)	2415 mm (95.1 in.)
To Top of ROPS	2306 mm (90.8 in.)	2336 mm (92 in.)	2386 mm (94 in.)
Approximate Weight [Weights will vary slightly with optional tires]			
Without CAB 2WD MFWD	2200 kg (4850 lb) 2400 kg (5290 lb)	2250 kg (4960 lb) 2480 kg (5470 lb)	2420 kg (5340 lb) 2570 kg (5670 lb)

	5300	5400	5500
With CAB 2WD MFWD	 2400 kg (5290 lb) 2600 kg (5730 lb)	 2450 kg (5400 lb) 2680 kg (5910 lb)	 2620 kg (5780 lb) 2770 kg (6110 lb)

Metric Cap Screw Torque Values-Grade 7

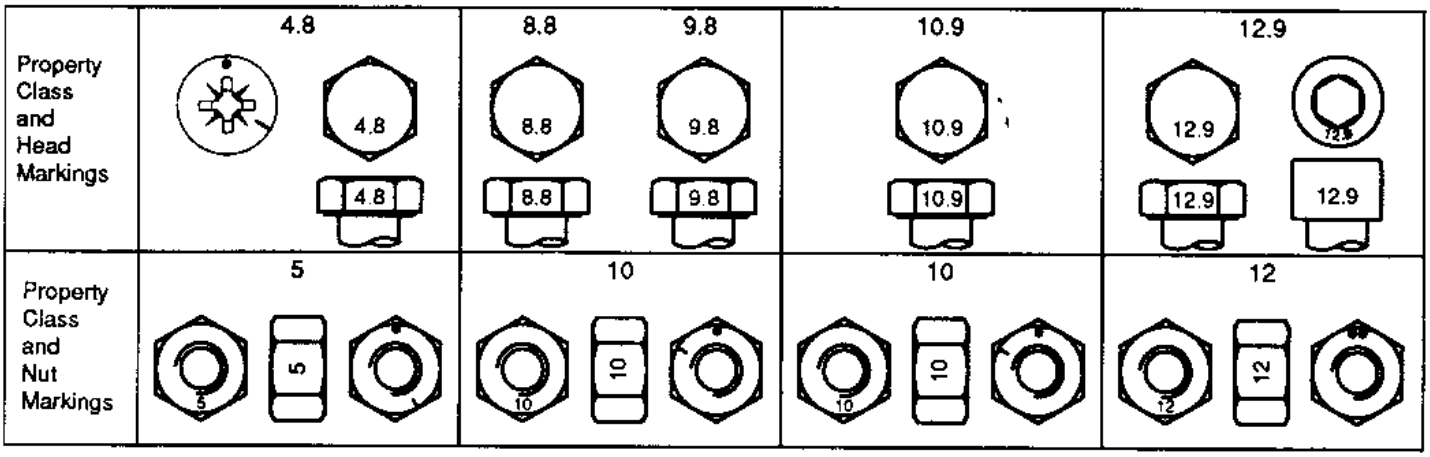
→NOTE:

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

Torque Values

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

Metric Bolt and Cap Screw Torque Values



Size	Class 4.8				Class 8.8 or 9.8				Class 10.9				Class 12.9			
	Lubricated[a]		Dry[a]		Lubricated[a]		Dry[a]		Lubricated[a]		Dry[a]		Lubricated[a]		Dry[a]	
	N·m	lb-ft	N·m	lb-ft	N·m	lb-ft	N·m	lb-ft	N·m	lb-ft	N·m	lb-ft	N·m	lb-ft	N·m	lb-ft
M6	4.8	3.5	6	4.5	9	6.5	11	8.5	13	9.5	17	12	15	11.5	19	14.5
M8	12	8.5	15	11	22	16	28	20	32	24	40	30	37	28	47	35
M10	23	17	29	21	43	32	55	40	63	47	80	60	75	55	95	70
M12	40	29	50	37	75	55	95	70	110	80	140	105	130	95	165	120
M14	63	47	80	60	120	88	150	110	175	130	225	165	205	150	260	190
M16	100	73	125	92	190	140	240	175	275	200	350	255	320	240	400	300
M18	135	100	175	125	260	195	330	250	375	275	475	350	440	325	560	410
M20	190	140	240	180	375	275	475	350	530	400	675	500	625	460	800	580
M22	260	190	330	250	510	375	650	475	725	540	925	675	850	625	1075	800
M24	330	250	425	310	650	475	825	600	925	675	1150	850	1075	800	1350	1000
M27	490	360	625	450	950	700	1200	875	1350	1000	1700	1250	1600	1150	2000	1500
M30	675	490	850	625	1300	950	1650	1200	1850	1350	2300	1700	2150	1600	2700	2000
M33	900	675	1150	850	1750	1300	2200	1650	2500	1850	3150	2350	2900	2150	3700	2750
M36	1150	850	1450	1075	2250	1650	2850	2100	3200	2350	4050	3000	3750	2750	4750	3500

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

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

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

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

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

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

Metric Torque Values

Unified Inch Bolt and Cap Screw Torque Values

SAE Grade and Head Markings	NO MARK	1 or 2[b]	5 5.1 5.2	8 8.2
SAE Grade and Nut Markings	NO MARK	2	5	8

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

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

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

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

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

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

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

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

Inch Torque Values

Group 10 - Fuel, Lubricants and Coolant

Diesel Fuel

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

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

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

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

Cetane number of 40 minimum. Cetane number greater than 50 is preferred, especially for temperatures below -20°C (-4°F) or elevations above 1500 m (5,000 ft).

Cold Filter Plugging Point (CFPP) below the expected low temperature OR**Cloud Point** at least 5°C (9°F) below the expected low temperature.

Fuel lubricity should pass a minimum of 3100 gram load level as measured by the BOCLE scuffing test.

Sulfur content:

- Sulfur content should not exceed 0.5%. Sulfur content less than 0.05% is preferred.
- If diesel fuel with sulfur content greater than 0.5% sulfur content is used, reduce the service interval for engine oil and filter by 50%.
- DO NOT use diesel fuel with sulfur content greater than 1.0%.

Bio-diesel fuels with properties and meeting DIN 51606 or equivalent specification may be used.

DO NOT mix used engine oil or any other type of lubricant with diesel fuel.

Storing Fuel

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

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.

Fill Fuel Tank

Handle Fuel Carefully

Fuel Tank Filler Cap

CAUTION:

Handle fuel carefully. Do not refuel the machine while smoking or when near open flame or sparks.

Always stop engine before refueling machine.

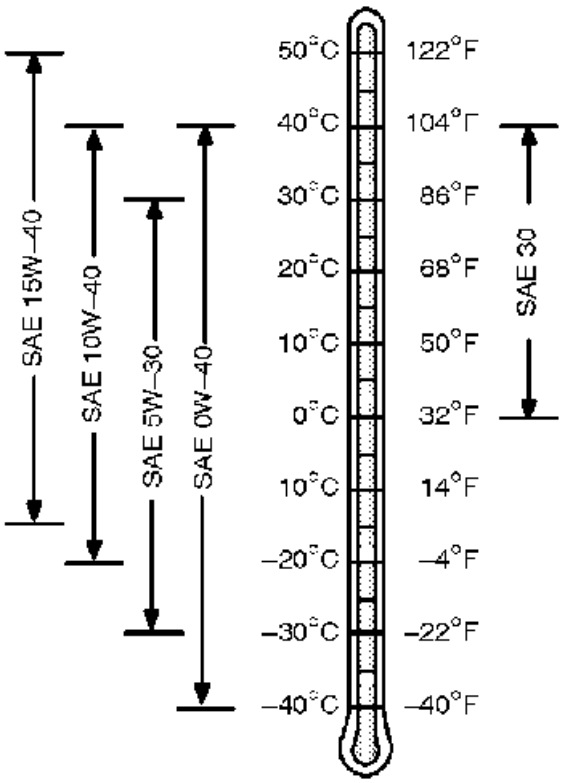
Fill fuel tank at end of each days operation. Fill fuel tank only to bottom of filler neck.

Item	Measurement	Specification
Fuel Tank	Capacity	72L (19 U.S. gal)

IMPORTANT:

The fuel tank is vented through the filler cap. If a new filler cap is required, always replace it with an original vented cap.

Diesel Engine Oil



Diesel Engine Oil

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

The following oil is preferred:

- John Deere PLUS-50 ™

The following oil is also recommended:

- John Deere TORQ-GARD SUPREME ™

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

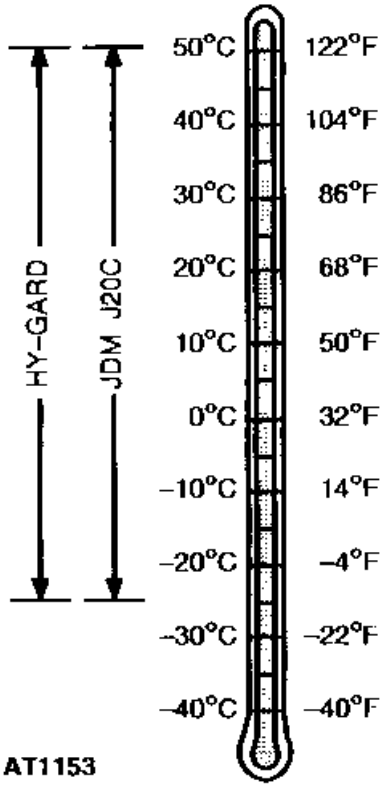
- API Service Classification CH-4
- API Service Classification CG-4
- API Service Classification CF-4
- ACEA Specification E3
- ACEA Specification E2

Multi-viscosity diesel engine oils are preferred.

If diesel fuel with sulfur content greater than 0.5% is used, reduce the service interval by 50%.

Extended service intervals may apply when John Deere preferred engine oils are used. Consult your John Deere dealer for more information.

Transmission-/Hydraulic- and Front Wheel Drive Axle Oil



Axle Oil

The following oil is preferred:

John Deere HY-GARD ™

Other oils may be used if they meet the following:

John Deere Standard JDM J20C

Oil Filters

Filtration of oils is critical to proper operation and lubrication.

Always change filters regularly as specified in this manual.

Use filters meeting John Deere performance specifications.

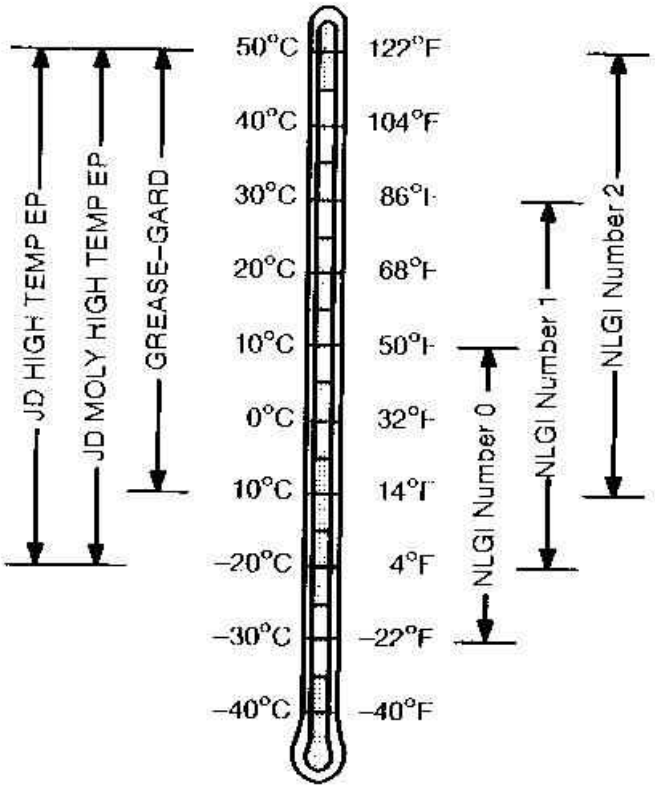
Mixing of Lubricants

In general, avoid mixing different brands or types of oil. Oil manufacturers blend additives in their oils to meet certain specifications and performance requirements.

Mixing different oils can interfere with the proper functioning of these additives and degrade lubricant performance.

Consult your John Deere dealer to obtain specific information and recommendations.

Grease



Grease

Use grease based on NLGI consistency numbers and the expected air temperature range during the service interval.

The following grease is preferred:

- John Deere SD POLYUREA GREASE

The following greases are also recommended:

- John Deere HD MOLY GREASE
- John Deere HD LITHIUM COMPLEX GREASE
- John Deere HD WATER RESISTANT GREASE
- John Deere GREASE-GARD ™

Other greases may be used if they meet NLGI Performance Classification GC-LB.

IMPORTANT:

Some types of grease thickener are not compatible with others.

Alternative and Synthetic Lubricants

Conditions in certain geographical areas may require lubricant recommendations different from those printed in this manual.

Some John Deere brand coolants and lubricants may not be available in your location.

Consult your John Deere dealer to obtain information and recommendations.

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

The temperature limits and service intervals shown in this manual apply to both conventional and synthetic oils.

Re-refined base stock products may be used if the finished lubricant meets the performance requirements.

Lubricant Storage

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

Use clean containers to handle all lubricants.

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

Make certain that all containers are properly marked to identify their contents.

Properly dispose of all old containers and any residual lubricant they may contain.

Diesel Engine Coolant

The engine cooling system is filled to provide year-round protection against corrosion and cylinder liner pitting, and winter freeze protection to -37°C (-34°F).

John Deere COOL-GARD is preferred for service.

If John Deere COOL-GARD ™ is not available, use a low silicate ethylene glycol base coolant concentrate in a 50% mixture of concentrate with quality water.

The coolant concentrate shall be of a quality that provides cavitation protection to cast iron and aluminium parts in the cooling system. John Deere COOL-GARD meets this requirement.

A 50% mixture of ethylene glycol engine coolant in water provides freeze protection to -37°C (-34°F). If protection at lower temperatures is required, consult your John Deere dealer for recommendations.

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

IMPORTANT:

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

Coolant Drain Intervals

Drain the factory fill engine coolant, flush the cooling system and refill with new coolant after the first 3 years or 3000 hours of operation. Subsequent drain intervals are determined by the coolant used for service. At each interval, drain the coolant, flush the cooling system and refill with new coolant.

When John Deere COOL-GARD is used, the coolant drain interval may be increased to 3 years or 3000 hours of operation.

If COOL-GARD is not used, the drain interval is reduced to 2 years or 2000 hours of operation.

Operating in Warm Temperature Climates

John Deere engines are designed to operate using glycol base engine coolants.

Always use a recommended glycol base engine coolant, even when operating in geographical areas where freeze protection is not required.

IMPORTANT:

Water may be used as coolantin emergency situations only.

Foaming, hot surface aluminum and iron corrosion, scaling, and cavitation will occur when water is used as the coolant, even when coolant conditioners are added.

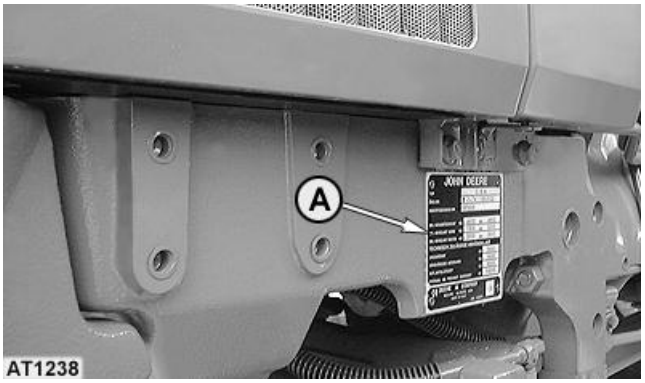
Drain cooling system and refill with recommended glycol base engine coolant as soon as possible.

Group 15 - Serial Number Locations

Serial Number Plates

On the following illustrations the serial number plates of the various tractor parts are shown. The letters and numbers on the plates are necessary for warranty claims and spare part orders.

Product Identification Number Location



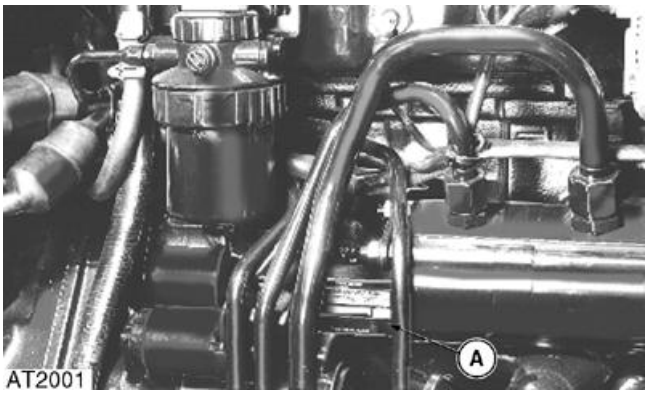
Product ID Number

The machine's product identification number plate (A) is located on the left-hand side of the front support.

→NOTE:

Due to different regulations in some countries, location and dimension of the identification plate can vary.

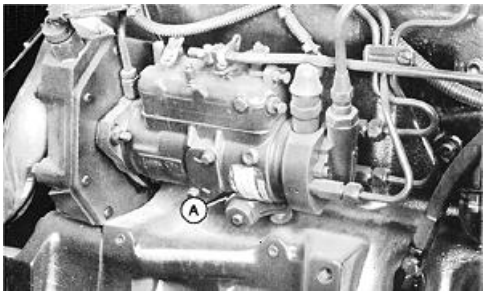
Engine Serial Number



Engine Serial Number Plate

The engine serial number plate (A) is located on the right-hand side of the engine block between the starting motor and the hydraulic pump.

Fuel Injection Pump Serial Number Location



Fuel Injection Pump Serial Number Plate

The fuel injection pump serial number plate (A) is located on the side of the pump.

Alternator Serial Number Location

Alternator Serial Number Plate

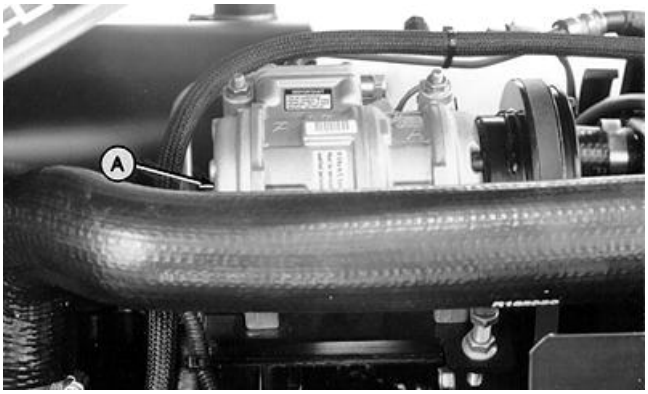
The alternator serial number plate (A) is located on the side of the housing.

Power Steering Valve Serial Number Location

Power Steering Valve Serial Number Plate

The power steering valve serial number plate (A) is located on the bottom of the valve.

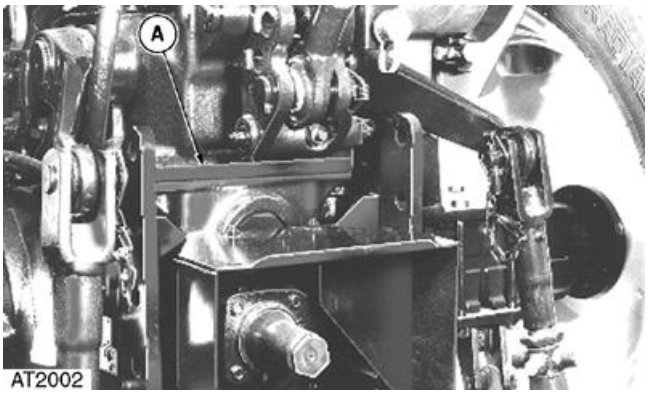
Air Conditioning Compressor Serial Number Location



A/C Compressor Serial Number Plate

The air conditioning compressor serial number plate (A) is located on the rear of the housing.

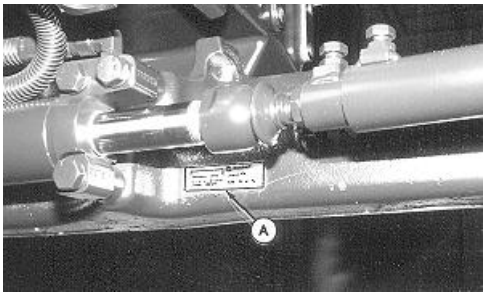
Transmission Serial Number Location



Transmission Serial Number Plate

The transmission (drive train) serial number (A) is located at the rear of the machine on the bottom left-hand corner of the differential housing.

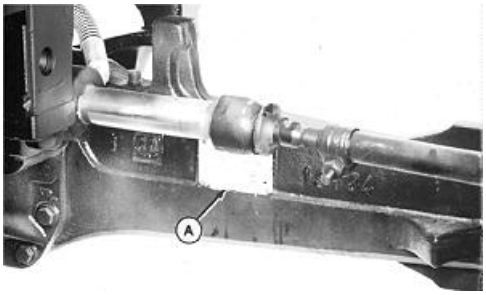
Front Axle (2WD) Serial Number Location



2WD Front Axle Serial Number Plate

The 2WD front axle serial number plate (A) is located on the rear right-hand side of the axle.

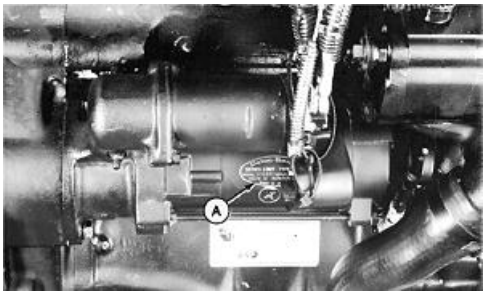
Front Wheel Drive Serial Number



Front Wheel Drive Serial Number Plate

The front wheel drive serial number plate (A) is located on the rear side of the right-hand axle housing.

Starter Serial Number Location



Starter Serial Number Plate

The starter serial number plate (A) is located on the side of the starter housing.

Section 20 - ENGINE - REPAIR

Table of contents

Group 00 - Removal and Installation of Engine Components

Engine Repair

Component Technical Manual

For complete engine repair information refer to CTM Engines (Component Technical Manual) in conjunction with this manual.

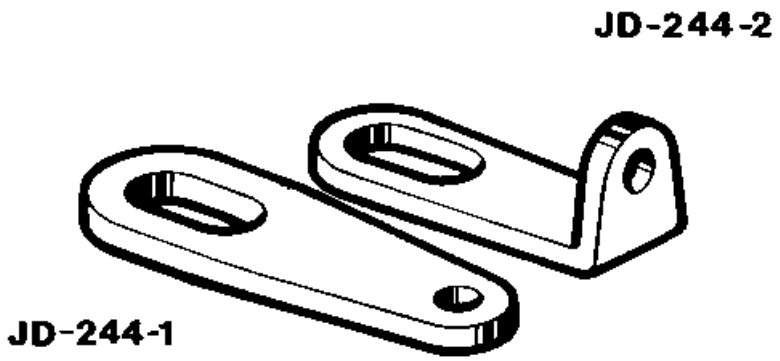
Special or Essential Tools

→NOTE:

Order tools according to information given in the U.S. SERVICEGARD ™ Catalog or in the European Microfiche Tool Catalog (MTC).

Lifting Eyes

JD-244



JD-244

Use to lift engine or to remove cylinder head from engine.

Flywheel Turning Tool

JDE83

JDE83

Turning engine flywheel; to be used together with JDE81-4 timing pin

Specifications

Item	Measurement	Specification
Engine-to-Clutch Housing Cap Screw	Torque	240 N·m (178 lb-ft)
Engine-to-Front Support Cap Screw and/or Nut	Torque	318 N·m (235 lb-ft)
Engine-to-Front Support (Dowel Hole) Cap Screw	Torque	176 N·m (130 lb-ft)
Top of Dipstick Tube to Oil Pan Rail	Distance	156 mm (6.150 in.)

Remove Engine

[1] - Remove radiator as described in this Group.

[2] - Remove battery (see procedure in Section 40).

[3] - Remove fuel filter (see procedure in Section 30).

[4] - Remove drive shaft, if equipped (see procedure in Section 50).

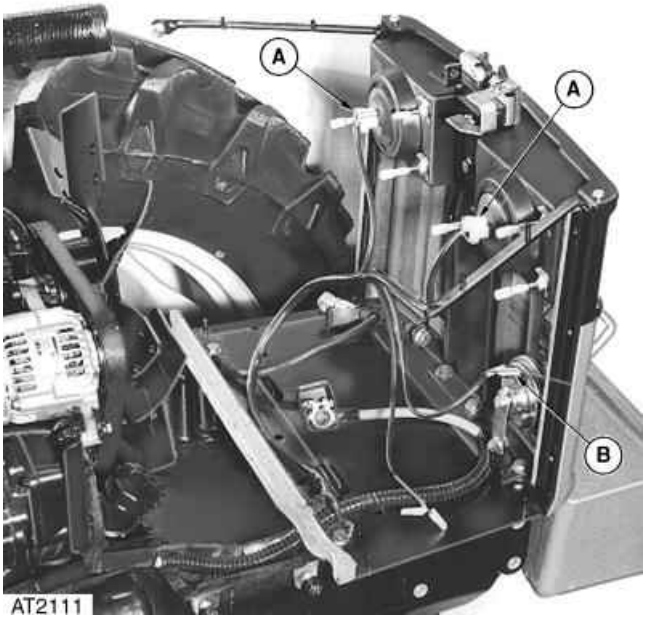
→NOTE:

Close all openings using caps and plugs.

[5] - Drain transmission.

[6] - Disconnect engine from clutch housing (see procedure in Section 50, Group 00)

[7] -



Disconnect Wiring Connectors

Disconnect wiring connectors (A) and (B).

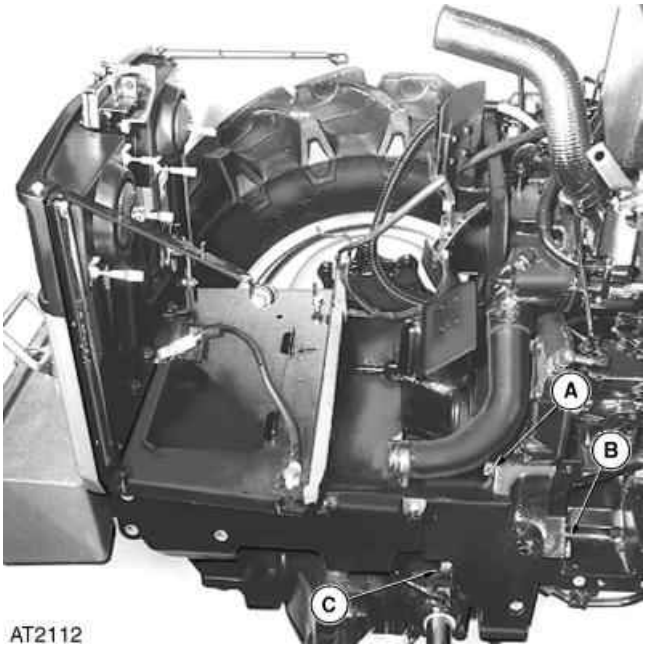
[8] - Remove wiring harness from front end of tractor.

[9] - Install two lifting brackets to the cylinder head.

[10] - Attach a hoist to engine.

[11] - Install a support stand under the front end of tractor.

[12] -



Cap Screws and Nut

Remove cap screw (A) and (B) and nut (C) from each side of frame.

[13] - Take away engine from front end of tractor.

[14] - Place engine to a service stand.

[15] - Remove clutch (see relevant CTM, Engines).

[16] - Make repairs as necessary (see relevant CTM, Engines).

Install Engine

[1] - Move transmission shift levers in neutral to ease clutch shaft alignment with engine.

[2] - Apply multipurpose grease to end of PTO clutch shaft.

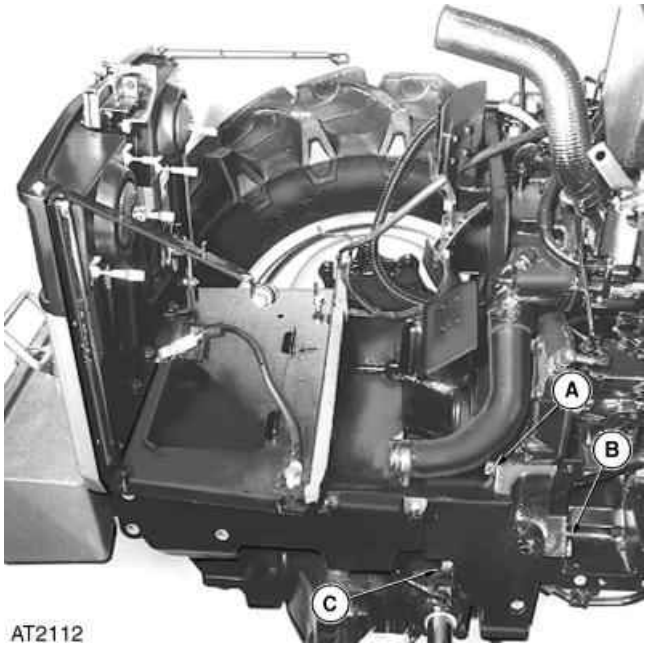
[3] - Install engine to clutch housing (see procedure in Section 50, Group 00).

→NOTE:

Turning PTO shaft at rear of tractor during engine installation will aid in alignment of PTO clutch and shaft.

[4] -

→NOTE:



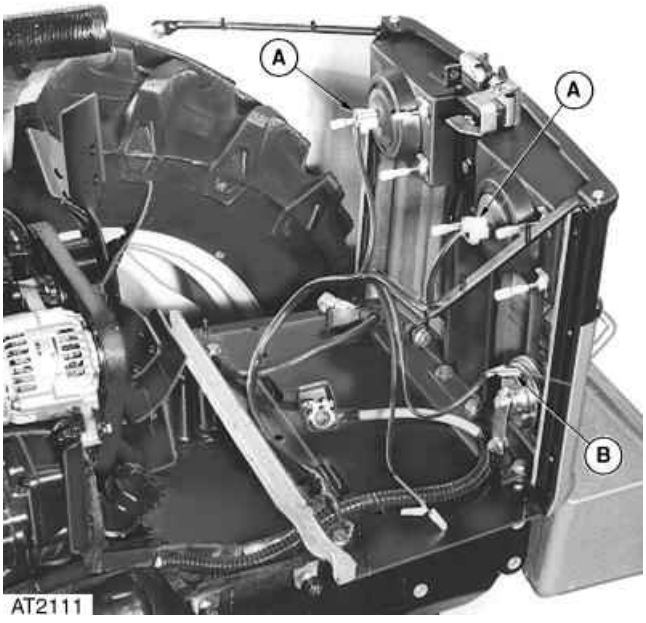
Tighten Cap Screws and Nut

Hollow dowels are installed in bores of cap screws (B).

Align studs in engine with front end. Install front end to tractor. Tighten cap screws (A), (B) and nuts (C) to specifications.

Item	Measurement	Specification
Cap Screws (A) and Nuts (C)	Torque	318 N·m
		235 lb-ft
Cap Screws (B)	Torque	176 N·m
		130 lb-ft

[5] -



Connect Wiring Connectors

Install wiring harness on front end of tractor.

[6] - Connect wiring connectors (A) and (B).

[7] - Install batterie and radiator (see this Section).

Water Pump Repair

Component Technical Manual

For complete water pump repair information refer to CTM Engines (Component Technical Manual) in conjunction with this manual.

Remove and Inspect Radiator

[1] - Remove engine side shields and grilles.

[2] -

Removing the hood

Remove cap screws (A) and plates with nuts from each side of the hood hinge.

[3] - Release the hood prop rod from hood latch and secure the rod in the stored position.

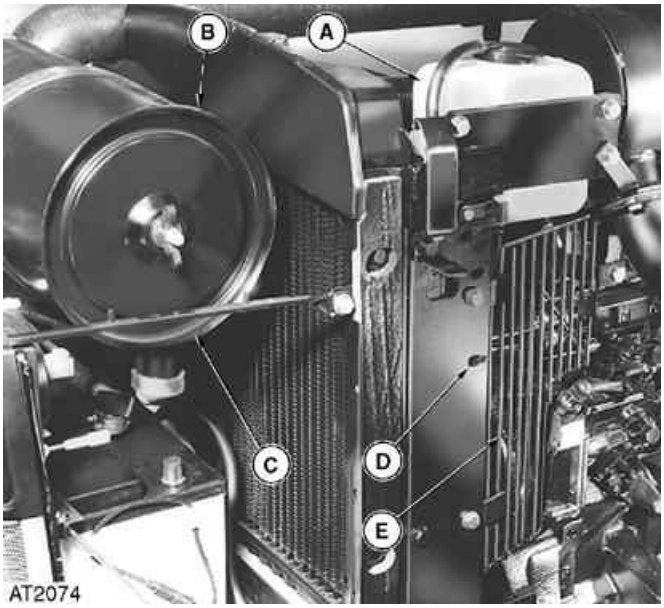
[4] - Remove hood from tractor.

[5] -

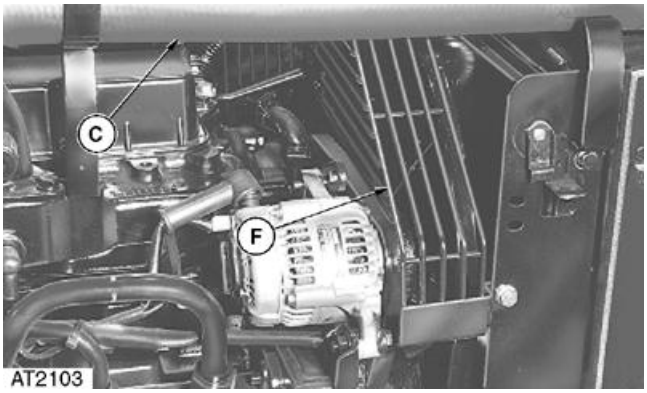
High-Pressure Fluids

LEGEND:

A	Coolant Recovery Tank
B	Air Cleaner Bracket
C	Air Cleaner / Intake Hose Assembly
D	Tie Strap
E	Left-Hand Fan Guard
F	Right-Hand Fan Guard



Radiator Components



Right-Hand Fan Guard

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:

For cooling system capacity, see list below.

High-Pressure Fluids

LEGEND:

A	Coolant Recovery Tank
B	Air Cleaner Bracket
C	Air Cleaner Intake Hose Assembly
D	Tie Strap
E	Left-Hand Fan Guard
F	Right-Hand Fan Guard

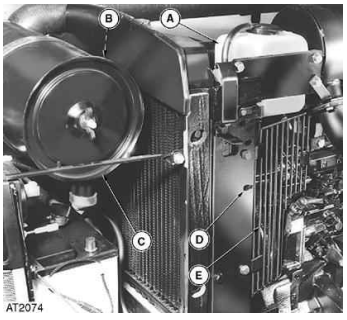
Specification
9.5 L
(10 U.S. qt)
10.5 L
(11.1 U.S. qt)
12 L
(12.7 U.S. qt)
13 L
(13.7 U.S. qt)

CAUTION:

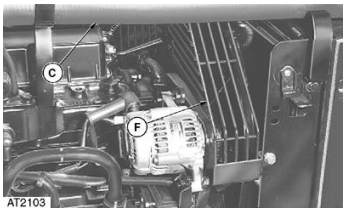
High-Pressure Fluids

LEGEND:

A	Coolant Recovery Tank
B	Air Cleaner Bracket
C	Air Cleaner / Intake Hose Assembly
D	Tie Strap
E	Left-Hand Fan Guard
F	Right-Hand Fan Guard



Radiator Components



Right-Hand Fan Guard

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:

For cooling system capacity, see list below.

Item	Measurement	Specification
capacity of coolant		
5300 and 5400 without cab	Capacity	9.5 L (10 U.S. qt)
5300 and 5400 with cab	Capacity	10.5 L (11.1 U.S. qt)
5500 without cab	Capacity	12 L (12.7 U.S. qt)
5500 with cab	Capacity	13 L (13.7 U.S. qt)

Drain coolant.

[6] - Remove fan guards (E and F).

[7] - Remove air cleaner/intake hose assembly (C).

[8] - Remove bracket (B).

[9] - Remove recovery tank (A). Remove overflow hose from strap (D).

→NOTE:

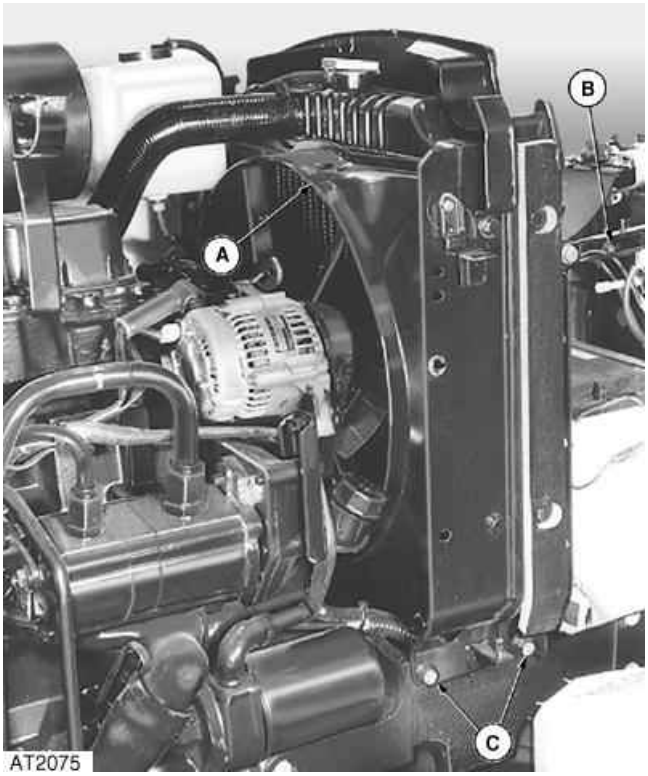
If equipped, remove oil cooler (see procedure in this Section).

→NOTE:

If equipped, remove condenser

[Tractors with air conditioning system only.]
(see procedure in in Section 90).

[10] -



Cap Screws, Bracket, Fan Shroud

Remove cap screws (C).

[11] - Disconnect brackets (B) from radiator support.

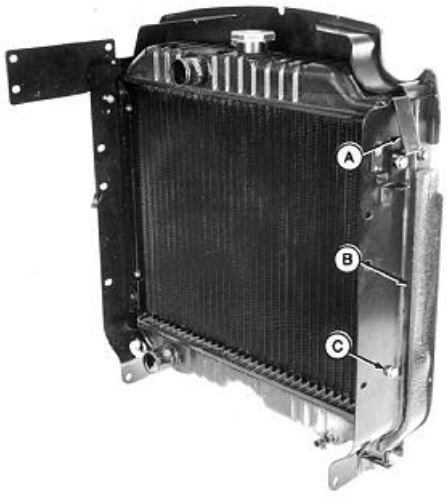
[12] - Remove upper and lower radiator hoses. Close all openings using caps and plugs.

[13] - Remove fan shroud (A).

[14] - Remove radiator and support assembly.

[15] -

→NOTE:



Remove Cap Screws and Hood Guides

Two lower cap screws are located under pad (B).

Remove eight cap screws (C) and hood guides (A).

[16] - Remove radiator from support.

[17] -

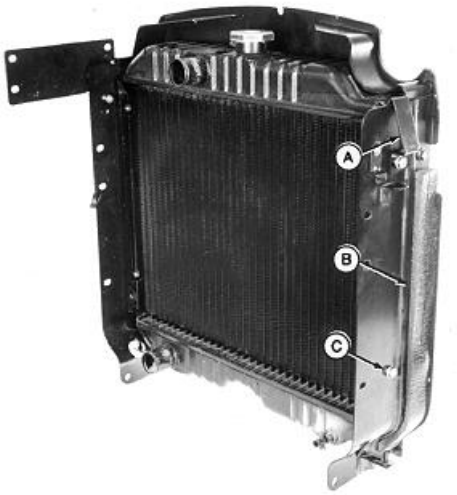
CAUTION:

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.

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

[18] - Inspect radiator for bent fins, cracks and damaged seams. Repair as necessary.

Install Radiator



Cap Screws and Guides

[1] - Install radiator in support.

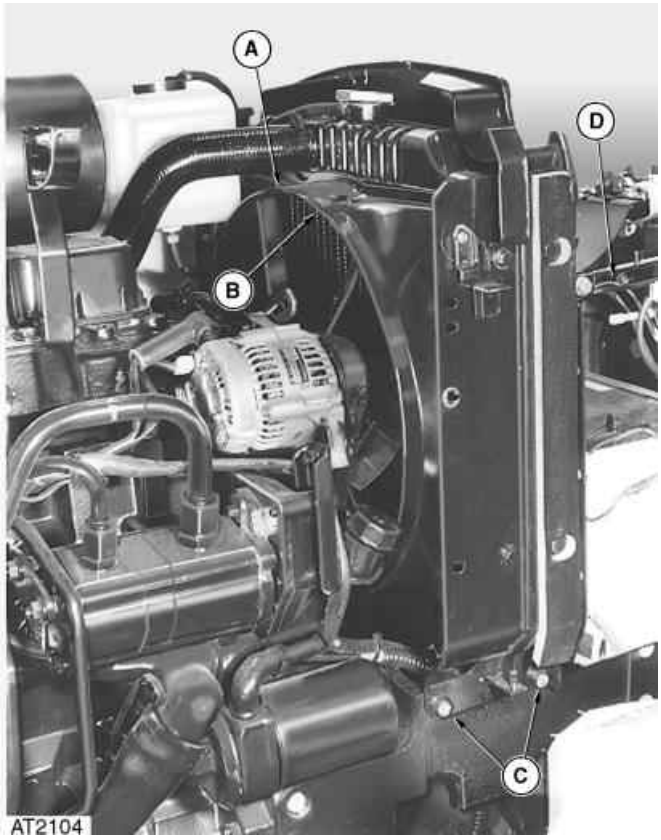
[2] -

→NOTE:

Two cap screws are installed under pad (B).

Install eight cap screws (C) and guides (A).

[3] -



LEGEND:

A	Hose Notch
B	Fan Shroud
C	Radiator Support Bracket
D	Cap Screws (4 used)

Install Radiator Components

Place fan shroud (B) over cooling fan, with hose notch (A) at top.

[4] - Install radiator and support assembly.

[5] - Install fan shroud. Adjust shroud for fan clearance.

[6] - Install upper and lower radiator hoses.

[7] - Connect brackets (C).

[8] - Install cap screws (D).

→NOTE:

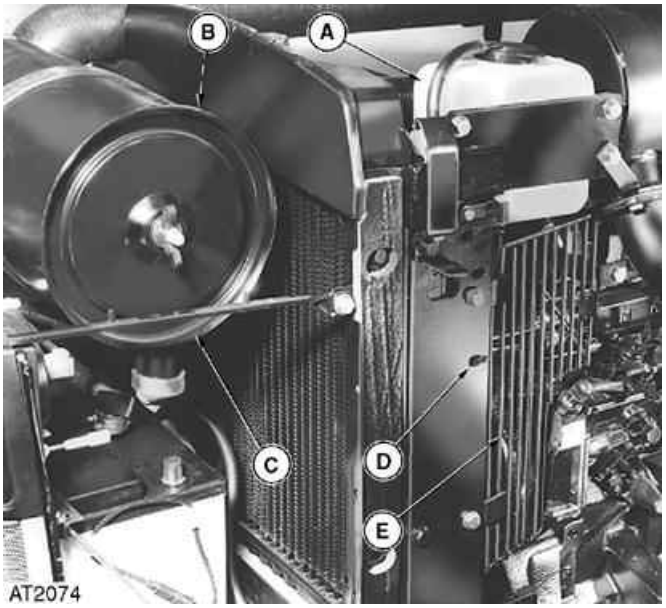
If equipped, install oil cooler (see procedure in this Section).

→NOTE:

If equipped, install condensor

[Tractors with air conditioning system only.]
(see procedure in in Section 90).

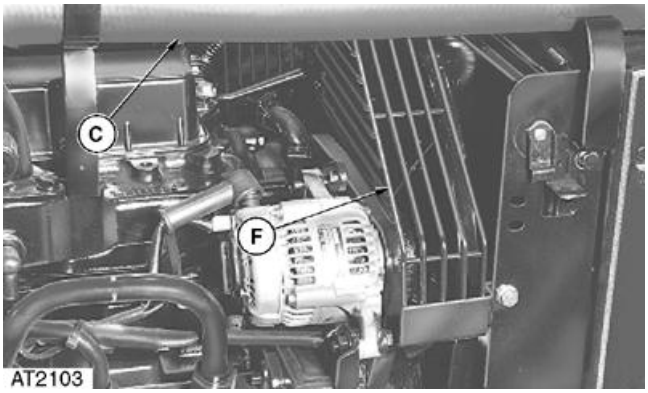
[9] -



LEGEND:

A	Coolant Recovery Tank
B	Air Cleaner Bracket
C	Air Cleaner / Intake Hose Assembly
D	Tie Strap
E	Left-Hand Fan Guard
F	Right-Hand Fan Guard

Install Radiator



Right-Hand Fan Guard

Install recovery tank (A). Check that overflow hose is in strap (D).

[10] - Install bracket (B).

[11] - Install air cleaner/intake hose assembly (C).

[12] - Install fan guards (E) and (F).

[13] - Close drain valve and fill radiator with proper coolant to top of filler neck.

→NOTE:

For cooling system capacity, see list below.

Item	Measurement	Specification
capacity of coolant		
5300 and 5400 without cab	Capacity	9.5 L (10 U.S. qt)
5300 and 5400 with cab	Capacity	10.5 L (11.1 U.S. qt)
5500 without cab	Capacity	12 L (12.7 U.S. qt)
5500 with cab	Capacity	13 L (13.7 U.S. qt)

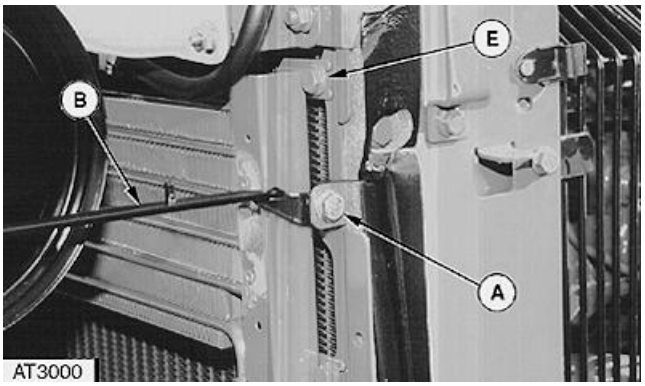
[14] - Start engine and allow it to reach proper operating temperature. Check radiator, hoses and connections for leaks. Adjust coolant level in recovery tank.

[15] - Install hood and dash side panels.

Remove and Install Oil Cooler

[1] - Remove engine side shields and grilles.

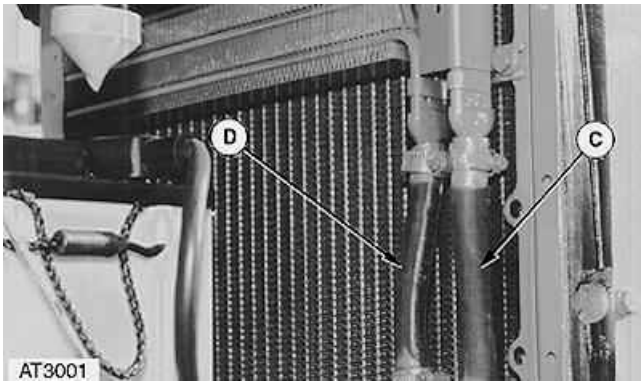
[2] -



LEGEND:

A	Bolts (2 used)
B	Bracket (2 used)
C	Pipe (from steering valve)
D	Pipe (to brake valve)
E	Oil cooler fixing bolt

Oil cooler removal



Cooler pipes

Loosen bolts (A) and remove bracket (B) (carry out this on both sides)

[3] - Disconnect pipe (C) and (D).

[4] - Loosen bolts (E) and remove oil cooler.

[5] - Check radiator for debris lodged in fins. Clean radiator using compressed air or pressure washer.

CAUTION:

Protect eyes and skin when using pressed air or water.

IMPORTANT:

High pressure cleaning can damage the radiator if the pressure nozzle is held to close.

[6] - Inspect radiator for bent fins, cracks and damaged seams. Repair or replace as necessary.

[7] - Install oil cooler and tighten fixing bolt (E).

[8] - Connect pipes (C) and (D).

[9] - Install brackets (B).

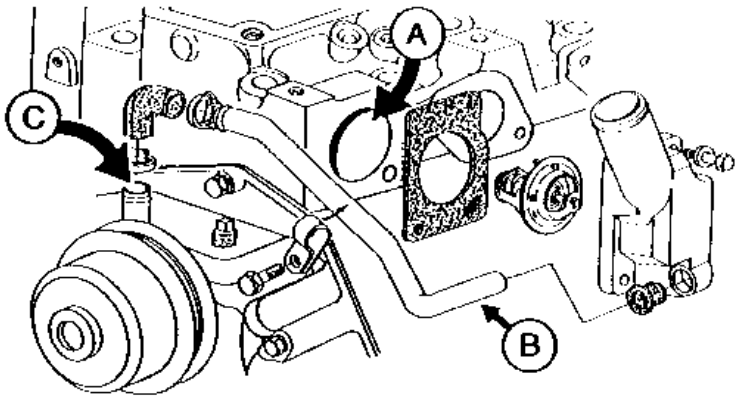
[10] - Install engine side shields and grilles.

Replace Thermostat

High-Pressure Fluids

LEGEND:

A	Cylinder Head
B	Tube
C	Water pump



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Head, Tube, and Water Pump

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.

Thermostat is directly installed in cylinder head (A).

[1] - Partially drain radiator.

[2] - Disconnect tube (B) between thermostat cover and water pump (C).

[3] - Remove thermostat cover.

[4] - Replace sealing. Install thermostat with jiggle pin on top for a proper filling.

[5] - Install cover and tube (B). Tighten cover cap screws to 50 N·m (37 lb-ft).

[6] - Fill radiator with proper coolant to top of filler neck (see “Fuel, Lubricants and Coolant” in Section 10). Check for leaks.

IMPORTANT:

Air must be expelled from cooling system when filling. Loosen temperature sending unit fitting at rear of cylinder head or plug in the thermostat housing to allow air to escape when filling system. Tighten fitting or plug when all air has been expelled.

Section 30 - FUEL AND AIR INTAKE SYSTEMS - REPAIR

Table of contents

Group 05 - Fuel System

Injection Pump, Nozzle and Governor Repair

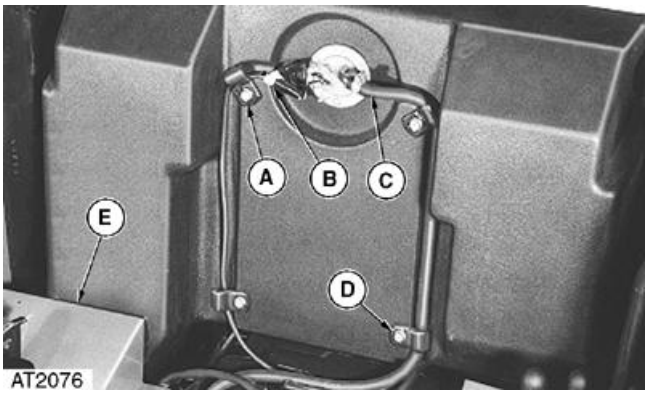
Component Technical Manual

For complete injection pump, nozzle and governor repair information refer to CTM Engines (Component Technical Manual) in conjunction with this manual.

Specifications

Item	Measurement	Specification
Fuel Tank Retaining Straps-to-ROPS Support L-bolt	Torque	57 N·m (42 lb-ft)
Turbocharger		
Oil Drain Line	Torque	80 N·m (59 lb-ft)
Oil Inlet Line	Torque	27 N·m (20 lb-ft)
Mounting Nuts	Torque	47 N·m (35 lb-ft)

Remove, Inspect and Install Fuel Tank



LEGEND:

A	Clamp (2 used)
B	Wiring Leads
C	Fuel Hose
D	Clamp (2 used)
E	Panel

Access Fuel Tank

[1] - Remove seat and support (see procedure in Section 90).

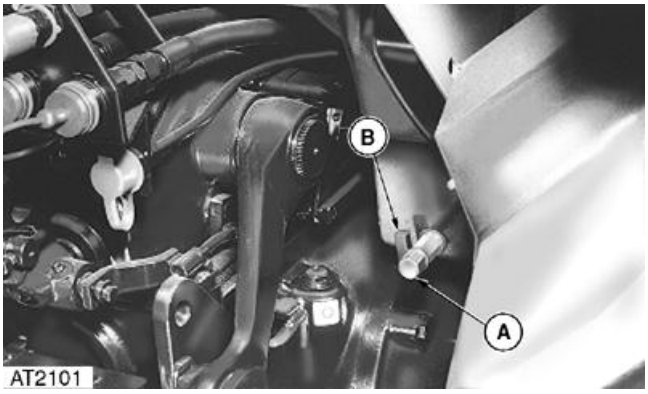
[2] - Remove panel (E).

[3] - Disconnect fuel hose (C). Close all openings using caps and plugs.

[4] - Loosen clamps (A) and (D).

[5] - Disconnect wiring connectors (B).

[6] - Remove plug (A).



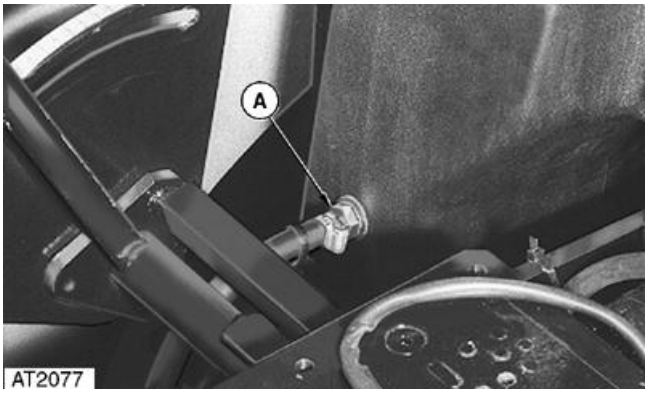
Plug and Valve

[7] - Drain fuel tank.

→NOTE:

Fuel tank capacity is approximately 72 L (19 U.S. gal).

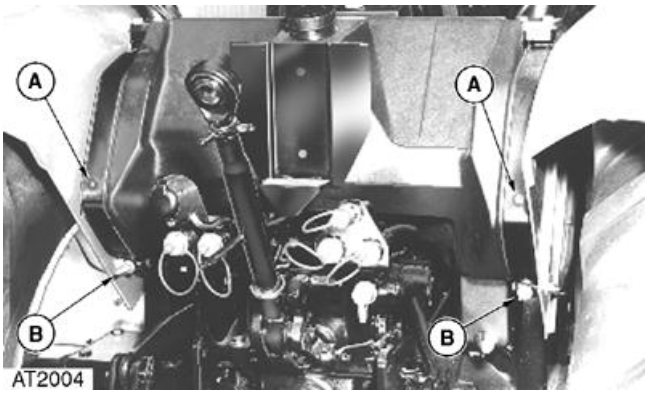
[8] -



Disconnect Fuel Hose

Disconnect fuel hose (A). Close all openings using caps and plugs.

[9] -



Remove Screws and Nuts

Remove two screws (A) and nuts (B) to remove retaining straps.

[10] - Remove fuel tank.

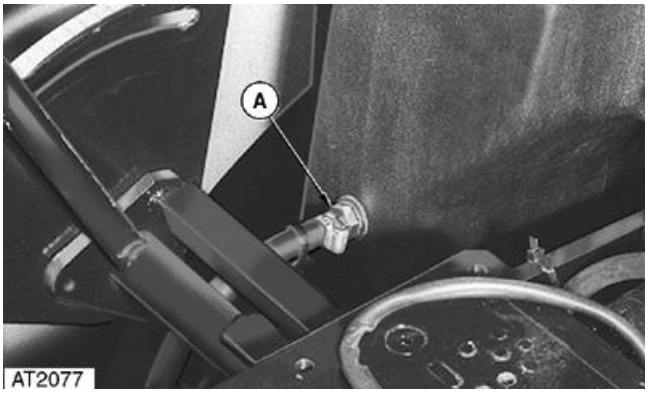
[11] - Inspect fuel tank for damage. Replace if necessary.

[12] - Wash tank out with a small amount of fuel to remove any debris.

[13] - Inspect rubber isolator, located between bottom of tank and rockshaft case for excessive wear or damage. Replace if necessary.

[14] - Install fuel tank, retaining straps, screws and nuts. Tighten nuts to 35 N·m (26 lb-ft).

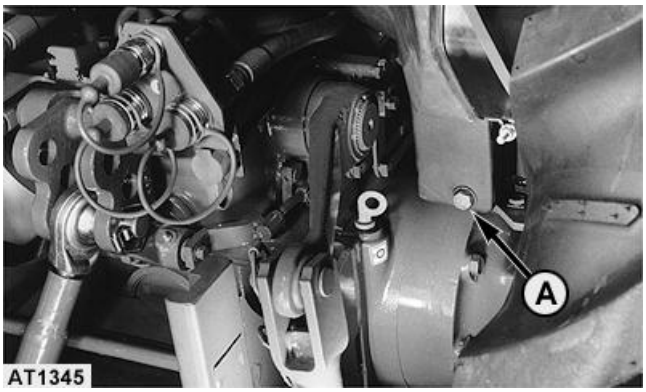
[15] -



Connect Fuel Hose

Connect fuel hose (A).

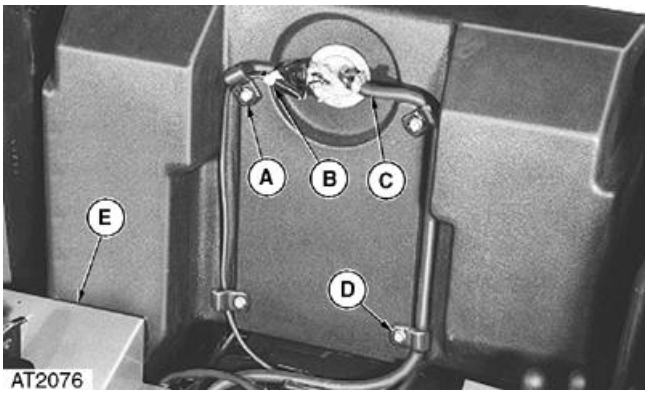
[16] -



Plug, Fuel Tank

Install plug (A).

[17] -



LEGEND:

A	Clamp (2 used)
B	Wiring Leads
C	Fuel Hose
D	Clamp (2 used)
E	Panel

Connect Clamps and Hose

Connect wiring connectors (B).

[18] - Tighten clamps (A) and (D).

[19] - Connect fuel hose (C).

[20] - Install panel (E).

[21] - Install seat and support (see procedure in Section 90).

[22] - Fill fuel tank with proper fuel (see “Fuel, Lubricants and Coolant” in Section 10).

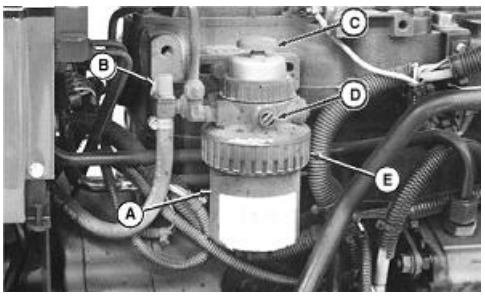
[23] - Bleed the fuel system (see CTM Engines).

→NOTE:

For tractors equipped with cab install linings, installed under fuel tank and between tank and seat (see procedure in Section 90).

Replace Fuel Filter

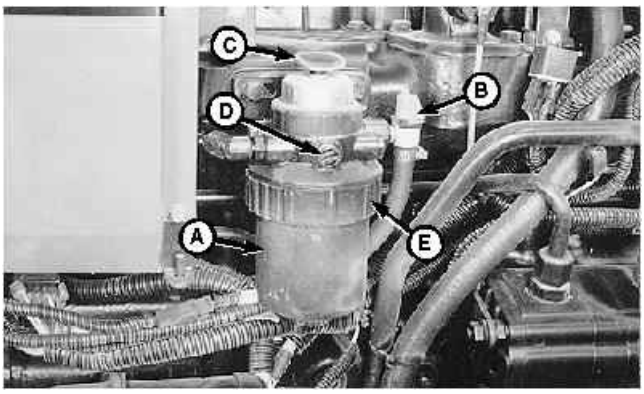
[1] - Close fuel shut-off valve (B).



LEGEND:

A	Fuel filter element
B	Fuel shut-off valve
C	Priming pump
D	Bleed screw
E	Retaining ring

5300/5400



5500

[2] - Remove retaining ring (E) and filter (A).

[3] - Install new filter with retaining ring, hand tight.

[4] - Open fuel shut-off valve (B).

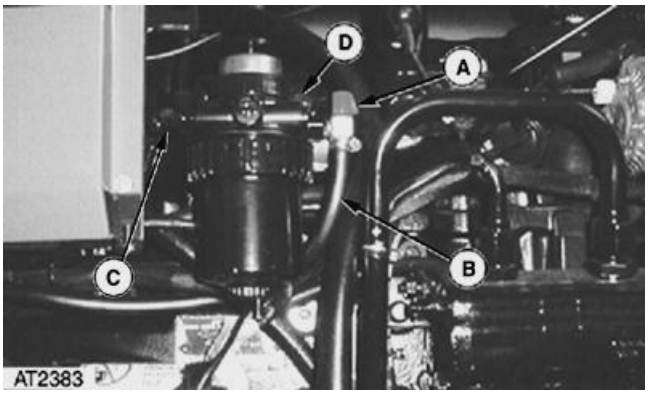
[5] - Open bleed screw (D).

[6] - Operate priming pump (C) until fuel flows.

[7] - Close bleed screw (D).

[8] - Bleed the fuel system (see CTM Engines).

Remove and Install Fuel Filter / Primer Pump Assembly



LEGEND:

A	Fuel filter shut-off valve
B	Fuel line
C	Fuel line
D	Cap screw (2 used)

Fuel Filter, removal of lines

[1] - Remove right engine side shield.

[2] - Close fuel shut-off valve

[3] - Disconnect fuel line (B) and (C). Close all openings using caps and plugs.

[4] - Remove cap screws (D). Remove fuel filter/primer pump assembly.

[5] - Reinstall fuel filter/primer pump assembly.

[6] - Connect fuel line (B) and (C).

[7] - Open fuel shut-off valve (A).

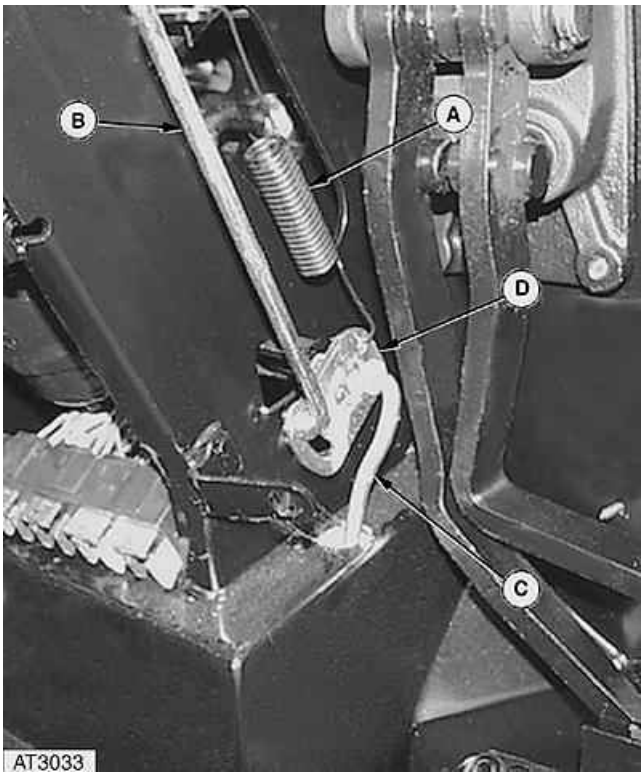
[8] - Bleed fuel system (see CTM engines).

[9] - Install right engine side shield.

Group 10 - Speed Control Linkage

Remove and Install Speed Control Linkage

[1] - Remove dash side panel.



LEGEND:

A	Spring
B	Rod
C	Rod
D	Support

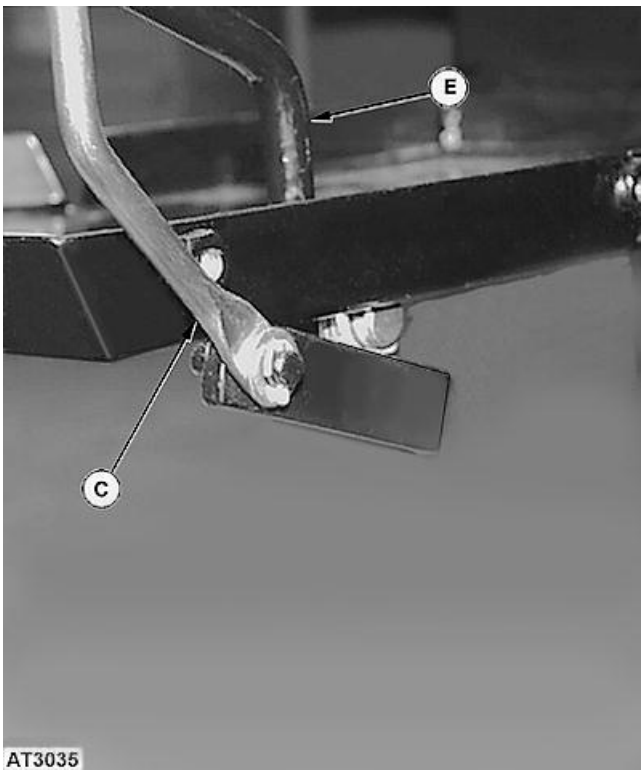
Speed-ctrl-linkage, rod and support

[2] - Remove right-hand step plate (tractors without cab).

[3] - Remove spring (A) and rod (B).

[4] - Remove rod (C) and support (D).

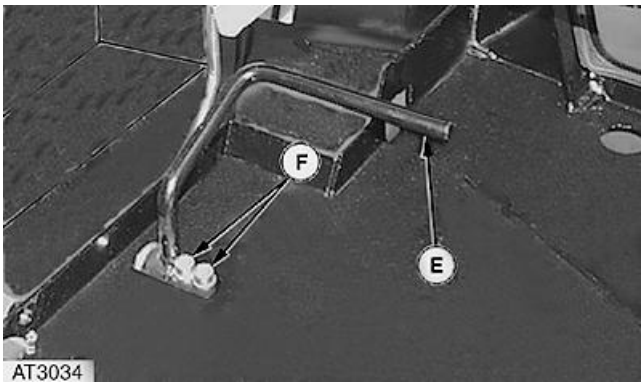
[5] -



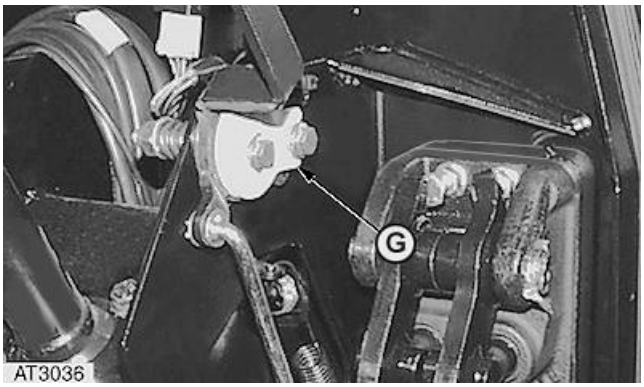
LEGEND:

C	Rod
E	Speed control pedal
F	Screw
G	Bracket

Rod under support



Speed ctrl. pedal



Speed ctrl bracket

Remove footboard.

[6] - Remove speed control pedal (E) loosening two screws (F).

[7] - Inspect all parts for wear or damage. Replace as necessary.

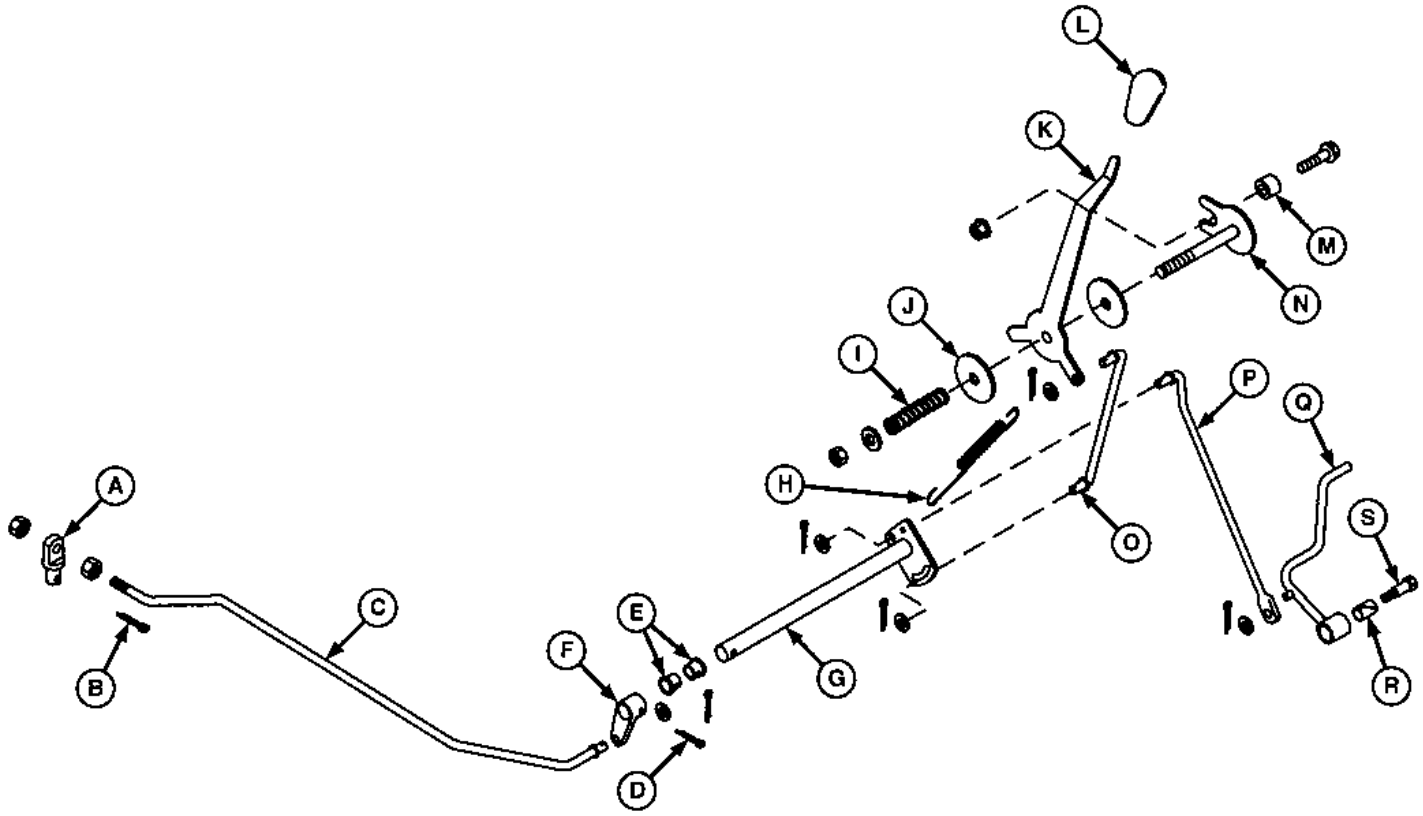
[8] - Reinstall all parts.

[9] - Adjust spring tension and the position of bracket (G).

Inspect and Repair Speed Control Linkage

For tractors without cab:

[1] -



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Speed Control Linkage for Tractors without Cab

LEGEND:

A	Swivel
B	Cotter Pin (6 used)
C	Linkage Rod
D	Spring Pin
E	Nylon Split Bushings
F	Lever
G	Rod
H	Extension Spring
I	Adjustment Spring
J	Washer (2 used)
K	Throttle Lever
L	Knob
M	Bushing
N	Plate
O	Linkage Rod
P	Linkage Rod
Q	Foot Pedal
R	Nylon Split Bushing
S	Shoulder Bolt

Remove dash side panels

[2] - Remove right-hand step plate.

[3] - Inspect parts for wear or damage. Replace as necessary.

[4] - Adjust throttle lever as described in this Group.

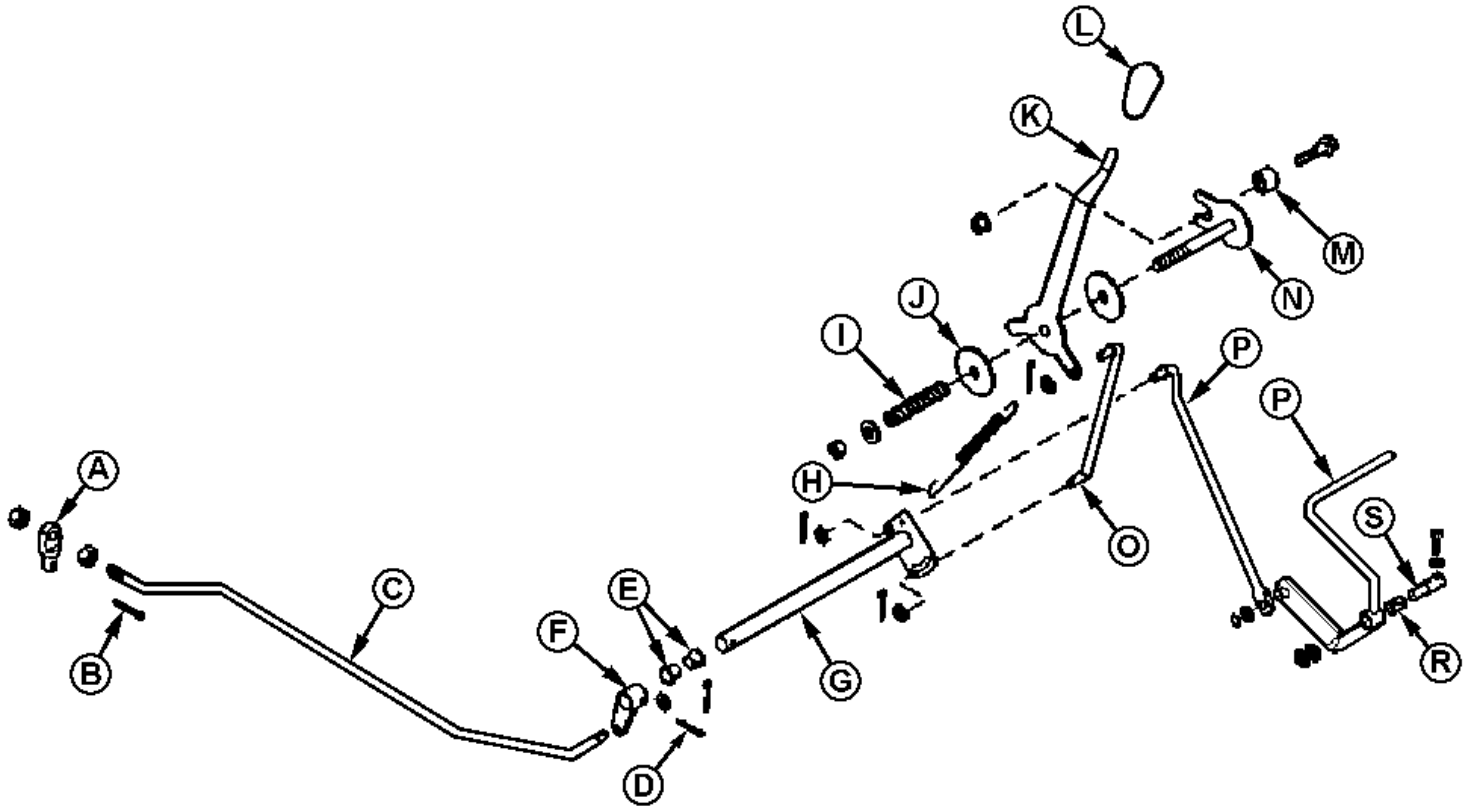
[5] - Install step plate, if equipped.

[6] - Install dash side panels.

[7] - Adjust slow and fast idle (see CTM Engines).

For tractors with cab:

[1] -



AT3258

Speed Control Linkage for Tractors with Cab

LEGEND:

A	Swivel
B	Cotter Pin (6 used)
C	Linkage Rod
D	Spring Pin
E	Nylon Split Bushings
F	Lever
G	Rod
H	Extension Spring
I	Adjustment Spring
J	Washer (2 used)
K	Throttle Lever
L	Knob

M	Bushing
N	Plate
O	Linkage Rod
P	Linkage Rod
Q	Foot Pedal
R	Nylon Split Bushing
S	Shoulder Bolt

Remove dash side panels

[2] - Remove right-hand step plate.

[3] - Inspect parts for wear or damage. Replace as necessary.

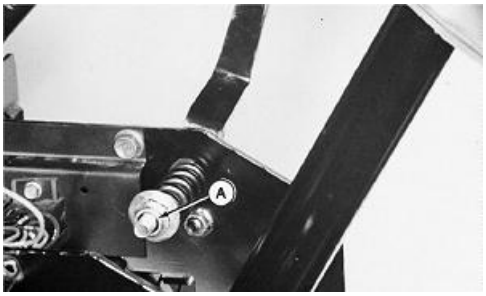
[4] - Adjust throttle lever as described in this Group.

[5] - Install step plate, if equipped.

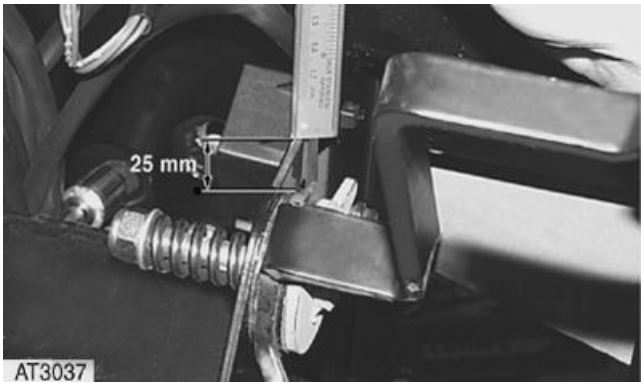
[6] - Install dash side panels.

[7] - Adjust slow and fast idle (see CTM Engines).

Throttle Lever Adjustment



Lock Nut



Throttle adjustment

[1] - Remove key switch panel.

[2] - Adjust spring tension by loosening or tightening lock nut (A) until throttle lever movement is smooth throughout range of travel with only slight drag.

IMPORTANT:

After completing the adjustment make sure that throttle linkage does not interfere with any electrical cables

IMPORTANT:

The lever must be 25 mm (1 in.) from upper part of right side as shown.

Group 15 - Air Intake System

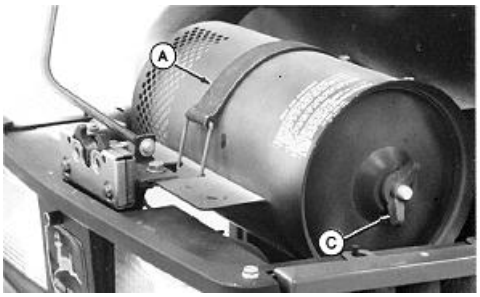
Turbocharger Repair

Component Technical Manual

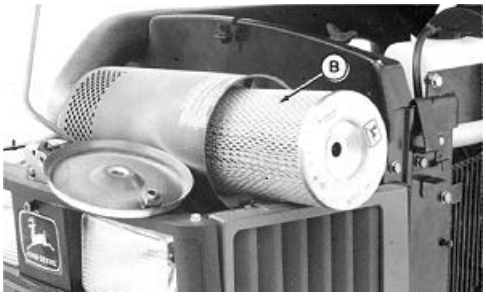
For complete turbocharger repair information refer to CTM Engines (Component Technical Manual) in conjunction with this manual.

Remove, Inspect and Install Air Cleaner Elements

[1] -



Air cleaner housing



Primary element

Open hood.

→NOTE:

Tractor without cab shown.

[2] - Disconnect rubber strap (A).

[3] - Remove primary element (B) by removing wing nut (C).

[4] - Clean out any dirt in canister, taking care not to damage the secondary filter element.

[5] -

IMPORTANT:

Remove secondary safety element ONLY if it is to be replaced. Do not attempt to clean secondary element.

IMPORTANT:

If secondary element is replaced, install new element immediately to prevent dust from entering air intake system.

IMPORTANT:

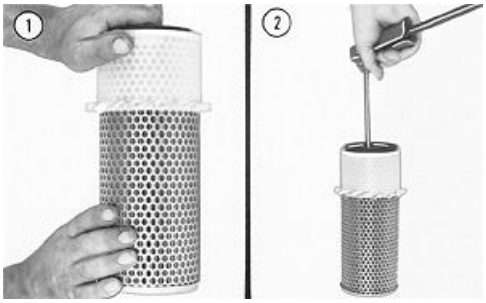
Dust can damage internal engine components and turbocharger, if equipped.

Removal of the secondary element is similar to removal of the primary element.

→NOTE:

When replacing the air cleaner canister, make sure that the dust cup/ejector hose is facing downward.

Cleaning Primary Element



Clean Primary Element

[1] - Pat sides of element gently to loosen dirt. DO NOT tap element against a hard surface.

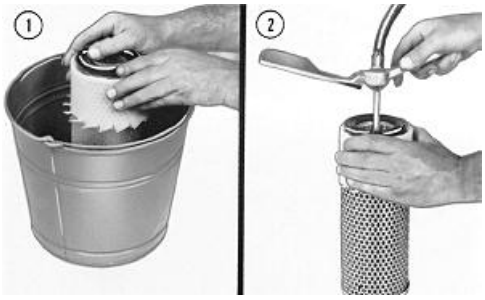
[2] - Use compressed air (below 690 kPa; 6.9 bar; 100 psi) to clean element. Hold nozzle next to inner surface, and move up and down pleats.

IMPORTANT:

DO NOT direct air against outside of element, as it might force dirt through to inside.

[3] - Inspect element before reinstalling.

Washing Primary Element



Wash Primary Element

IMPORTANT:

Never wash element in gasoline or any solvent. Never use compressed air on a wet element. Do not oil element.

[1] - If element is coated with oil or soot, wash in a solution of warm water and John Deere Filter Element Cleaner or its equivalent. Let element soak at least 15 minutes, then agitate gently to flush out dirt.

[2] - Rinse element thoroughly from inside with clean water. Keep water pressure low (below 280 kPa; 2.8 bar; 40 psi) to avoid damaging element.

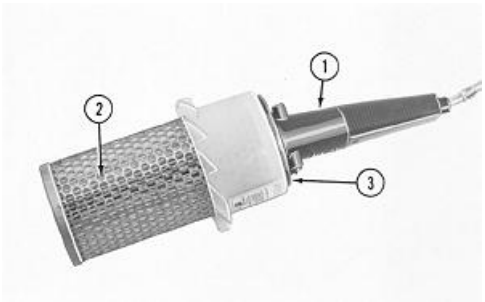
[3] - Allow element to dry completely before using. This usually takes from one to three days. DO NOT oven dry or use drying agents. Protect element from freezing until dry.

[4] - Inspect element before installing.

→NOTE:

Primary element can be washed up to six times.

Inspecting Element



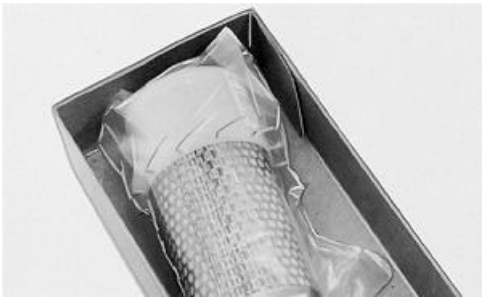
Inspect Element

[1] - Hold a bright light inside element and check carefully for holes. Discard any element which shows the slightest hole.

[2] - Be sure outer screen is not dented. Vibration would quickly wear a hole in filter.

[3] - Be sure rubber sealing surfaces are in good condition on both ends. If damaged, replace element.

Storing Element



Storing filter element

If element is not installed on tractor, seal element in a plastic bag and store in its original shipping container to protect against dust and damage.

Section 40 - ELECTRICAL SYSTEM - REPAIR

Table of contents

Group 05 - Battery, Starting Motor and Alternator

Starting Motor Repair

Component Technical Manual

For complete starting motor repair information refer to relevant Component Technical Manual (CTM) in conjunction with this manual.

Special or Essential Tools

→NOTE:

Order tools according to information given in the U.S. SERVICEGARD ™ Catalog or in the European Microfiche Tool Catalog (MTC).

Remove and Install Battery

Exploding Battery

CAUTION:

Keep all sparks and flames away from batteries, as gas given off by electrolyte is explosive. To avoid sparks, connect ground cable last and disconnect it first.

To avoid shocks and burns, disconnect battery ground cable before servicing any part of electrical system.

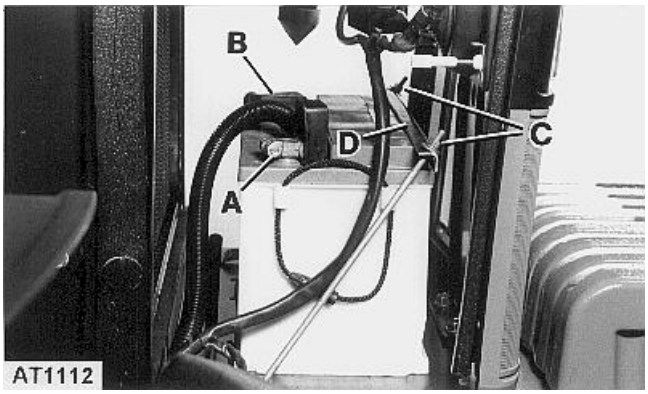
→NOTE:

Depending on battery type, arrangement of terminals may differ from that shown. Refer to the relevant battery identification.

[1] - Remove side grille panels.

[2] - Disconnect negative cable (B) first, then the positive one.

[3] -



disconnect battery

Loosen nuts (C) and rotate hold-down bracket (D) away from battery.

[4] - Remove battery. Clean and service as necessary.

[5] - Install battery.

[6] - Install hold-down bracket and tighten nuts.

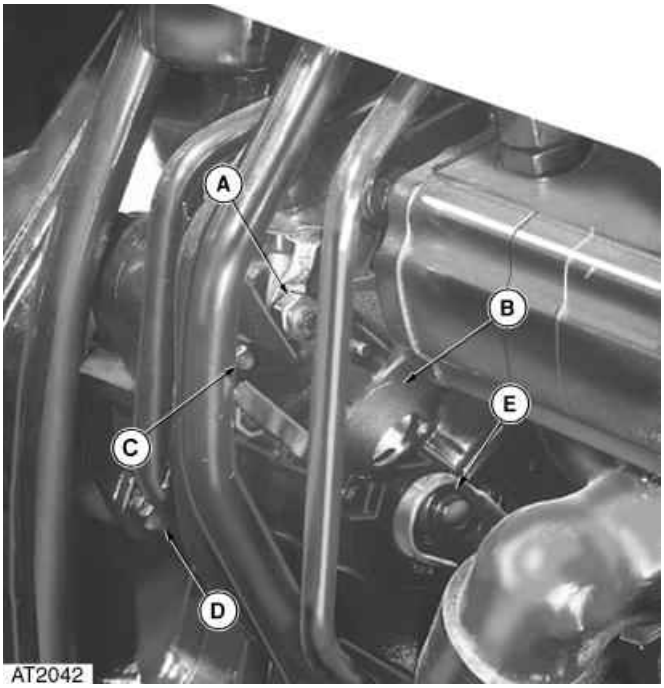
[7] - Connect positive cable (B), then the negative one (A).

[8] - Apply petroleum jelly on battery terminals.

[9] - Install grille panels.

Remove and Install Starting Motor

5300 and 5400 tractors



LEGEND:

A	Start Solenoid “B” Stud
B	Cover
C	Starter Solenoid “S” Stud
D	Cap Screw and Lock Washer
E	Dipstick

5300 and 5400

[1] - Disconnect battery negative (-) cable.

[2] - Remove cover (B).

[3] - Disconnect three cables at stud (A).

[4] - Disconnect wiring lead at stud (C).

[5] - Remove dipstick (E).

[6] - Remove cap screws and lock washers (D).

[7] - Remove starter.

[8] - Make repairs as necessary (see Component Technical Manual).

[9] - Install starter and cap screws.

[10] - Connect wiring lead to stud (C).

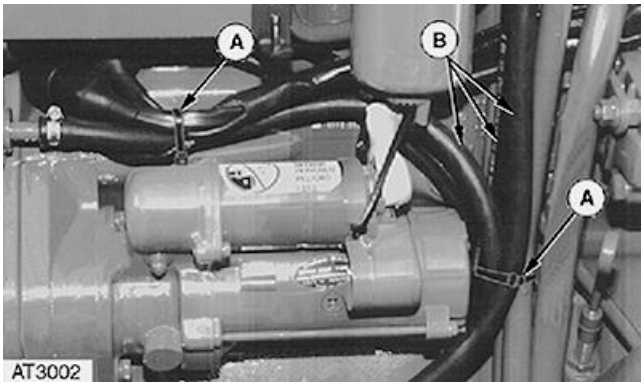
[11] - Connect cables at stud (A).

[12] - Install cover (B).

[13] - Install dipstick (E).

[14] - Connect battery negative (-) cable.

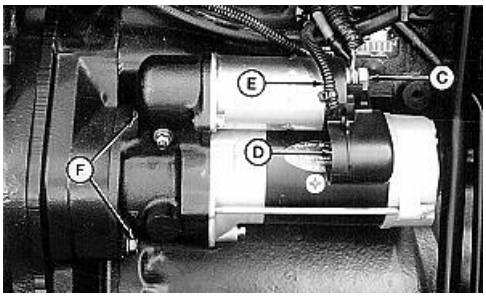
5500 tractors



LEGEND:

A	Tie Straps
B	Air Conditioning Lines
C	Starter Solenoid “B” Stud
D	Cover
E	Starter Solenoid “S” Stud
F	Cap Screw and Lock Washer

Starter Motor 5500



Starter Motor 5500

[1] - Disconnect battery negative (-) cable.

[2] - Remove right-hand engine side shield.

[3] - If tractor is equipped with air conditioning system, cut tie straps (A) as necessary and move A/C lines (B) away from starting motor.

[4] - Disconnect three cables at stud (C).

[5] - Remove cover (D).

[6] - Disconnect wiring lead at stud (E).

[7] - Remove cap screws and lock washers (F).

[8] - Remove starting motor.

[9] - Make repairs as necessary (see Component Technical Manual).

[10] - Install starting motor using cap screws and lock washers (F).

[11] - Connect wiring lead to stud (E) and cables at stud (C).

[12] - Install cover (D).

[13] - Connect battery negative (-) cable.

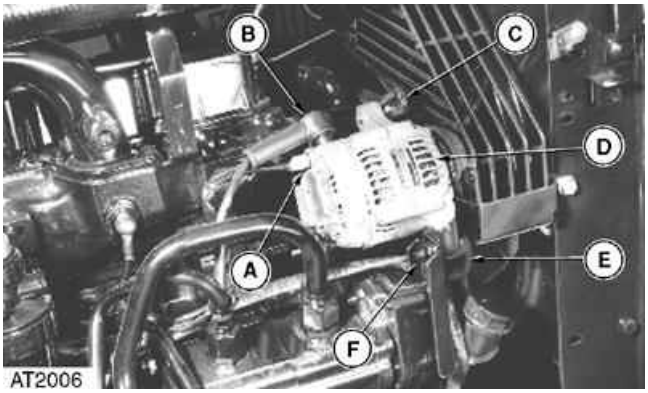
[14] - Install right-hand engine side shield.

Alternator/Regulator Repair

Component Technical Manual

For complete alternator/regulator repair information refer to relevant Component Technical Manual (CTM) in conjunction with this manual.

Replace Alternator / Regulator



LEGEND:

A	Wiring Connector
B	Cable
C	Adjusting Screw
D	Alternator/Regulator
E	Belt
F	Pivot Cap Screw

Alternator / Regulator

[1] - Remove right-hand engine shield.

[2] - Disconnect negative (-) cable at battery.

[3] - Disconnect wiring connector (A) and cable (B).

[4] - Loosen cap screws (C and F).

[5] - Move alternator / regulator (D) towards engine. Lift belt (E) off pulley.

[6] - Remove adjustment and pivot cap screws.

[7] - Replace alternator / regulator.

[8] - Install cap screws.

[9] - Adjust belt tension (see procedure in Operator′s Manual).

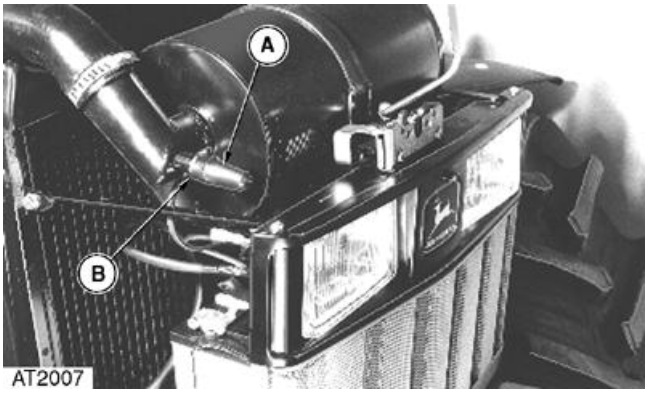
[10] - Connect wiring connector and cable.

[11] - Connect negative (-) cable at battery.

[12] - Install right-hand engine shield.

Group 10 - Switches and Sending Units

Replace Air Filter Restriction Switch



Boot and O-Ring

→NOTE:

Right-hand grill panel removed for clarity of photo.

[1] - Remove boot (A).

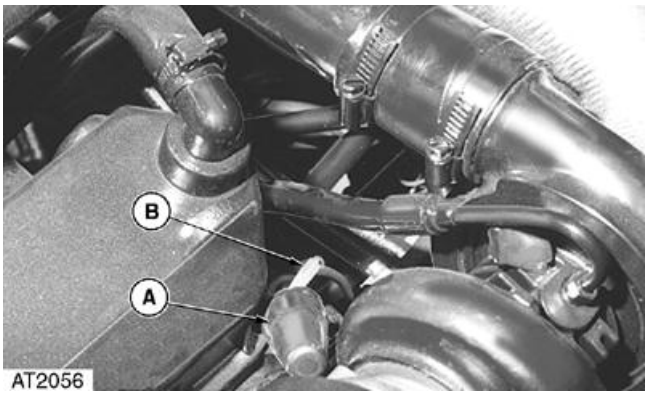
[2] - Disconnect wiring connector.

[3] - Replace air filter restriction switch and O-ring (B).

[4] - Connect wiring connector.

[5] - Install boot.

Replace Coolant Temperature Sender



Boot and Wiring Connector

[1] - Remove boot (A).

[2] - Disconnect wiring connector (B).

[3] - Remove coolant temperature sender.

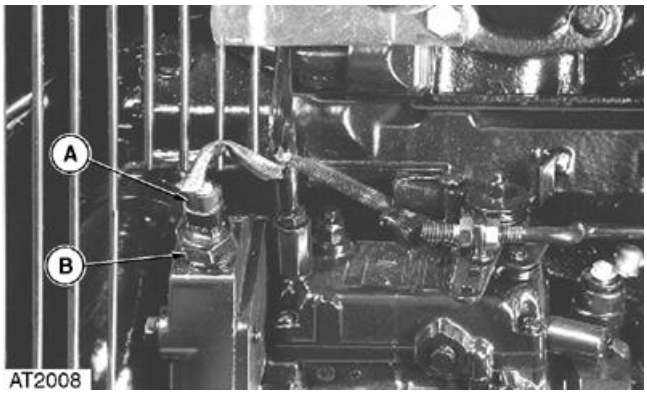
[4] - Apply John Deere Pipe Sealant with TEFLON ™ , or an equivalent to threads of new temperature sender.

[5] - Install temperature sender.

[6] - Connect wiring connector.

[7] - Install boot.

Replace Engine Speed Sensor



Wiring Connector and O-Ring

[1] - Disconnect wiring connector (A).

[2] -

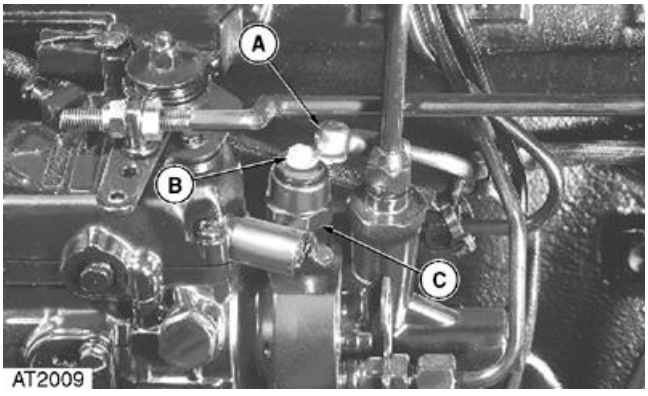
IMPORTANT:

Speed sensor is plastic. Do not overtighten or sensor will be damaged.

Replace speed sensor and O-ring (B).

[3] - Connect wiring connector.

Replace Fuel Shut-Off Solenoid



Fuel Shut-Off Solenoid

→NOTE:

It may be necessary to remove injection pump inlet fitting for clearance, to replace solenoid.

[1] - Remove boot (A).

[2] - Disconnect wiring lead (B).

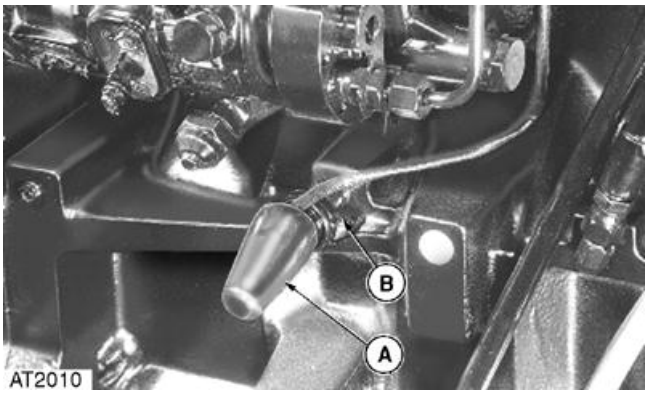
[3] - Replace shut-off solenoid and O-ring (C).

[4] - Connect wiring lead.

[5] - Install boot.

[6] - Connect injection pump inlet fitting, if removed, and bleed fuel system (see CTM Engines).

Replace Engine Oil Pressure Switch



Remove Boot and Oil Pressure Switch

[1] - Remove boot (A).

[2] - Disconnect wiring connector.

[3] - Remove oil pressure switch (B).

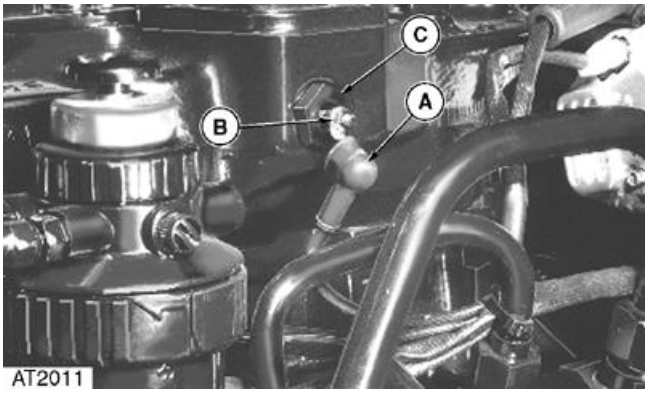
[4] - Apply thread lock and sealer (medium strength) to threads of new oil pressure switch.

[5] - Install switch.

[6] - Connect wiring connector.

[7] - Install boot.

Replace Manifold Heater



Replace Manifold Heater

[1] - Remove boot (A).

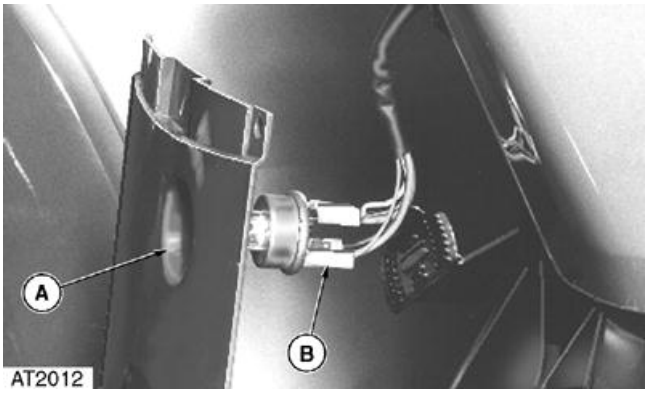
[2] - Disconnect wiring lead (B).

[3] - Replace manifold heater (C).

[4] - Connect wiring lead.

[5] - Install boot.

Replace Key Switch



Replace Key Switch

[1] - Disconnect battery negative (-) cable.

[2] - Remove key switch.

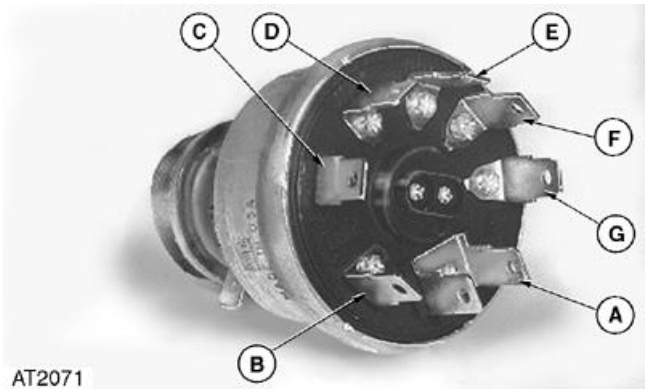
[3] - Disconnect wiring connectors (B).

[4] - Remove nut (A).

[5] - Replace key switch.

[6] - Install nut.

[7] -



LEGEND:

A	BAT Terminal Red Wire Lead
B	GND Terminal Not Used
C	AID Terminal White Wire Lead
D	ST Terminal Blue Wire Lead
E	IGN Terminal Orange Wire Lead
F	ELX Terminal Not Used
G	ACC Terminal Brown Wire Lead

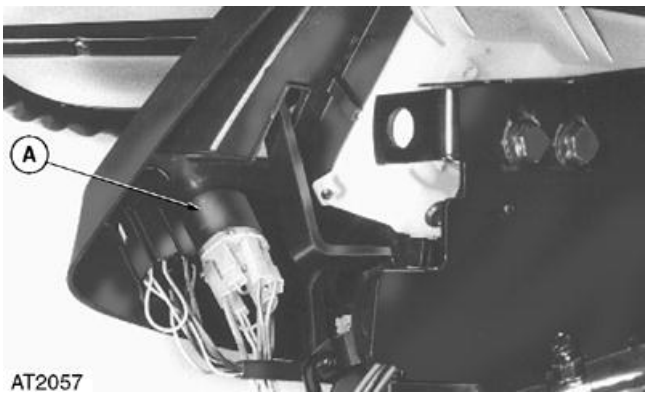
Terminals and Leads

Connect wiring leads (A - G).

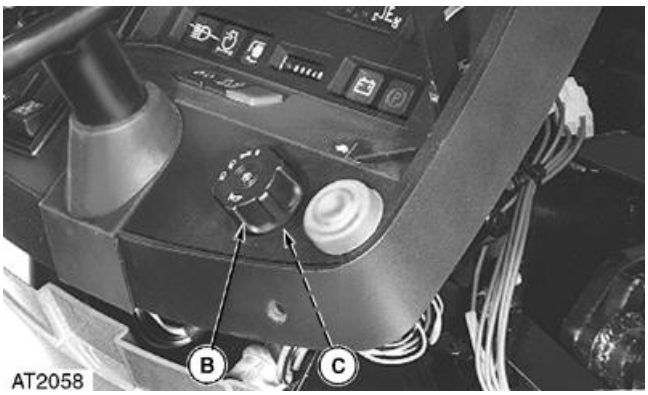
[8] - Install key switch.

[9] - Connect battery negative (-) cable.

Replace Light Switch



Disconnect Wiring Connectors



Remove Hardware

[1] - Disconnect battery negative (-) cable.

[2] - Remove right-hand dash panel.

[3] - Disconnect wiring connectors (A).

[4] - Remove cap screw and knob (B).

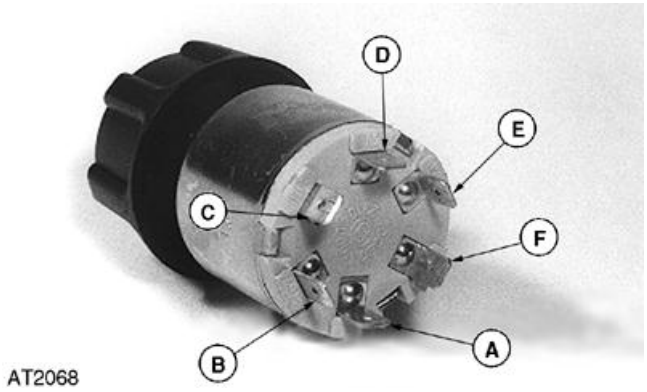
[5] - Remove nut and lock washer (C).

[6] - Replace light switch.

[7] - Install lock washer and nut.

[8] - Install knob and cap screw.

[9] -



LEGEND:

A	30 Orange Lead
B	49/a Violet Lead
C	56/b Grey Lead
D	49 Orange Lead
E	56/a Green Lead
F	57/58 Yellow Lead

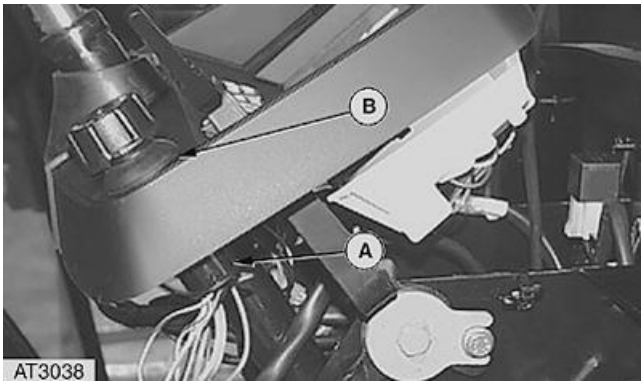
Wiring Leads

Connect wiring leads (A) to (F).

[10] - Install right-hand dash panel.

[11] - Connect battery negative (-) cable.

Replace Hazard Warning Light Switch



warning light switch and nut

[1] - Disconnect battery negative (-) cable.

[2] - Remove right-hand dash panel

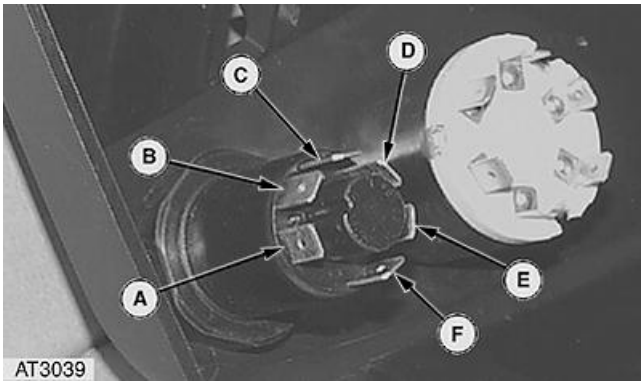
[3] - Disconnect wiring connectors (A).

[4] - Remove nut (B).

[5] - Replace hazard warning light switch.

[6] - Install nut.

[7] -



LEGEND:

A	31 Black Lead.
B	49a White-Black Wire Lead.
C	49 White-Brown Wire Lead.
D	30b White-Brown Wire Lead.
E	R Blue-Black Wire Lead.
F	30 Red-Green Wire Lead.
G	15 Brown Wire Lead.
H	L Azure Wire Lead.

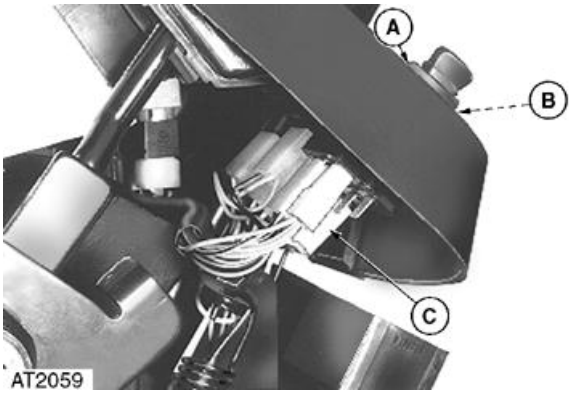
connect leads of warning light switch

Connect wiring leads (A) to (H).

[8] - Install right-hand dash panel.

[9] - Connect battery negative (-) cable.

Replace Turn Signal Controller



Wiring Connector, Boot and Nut

[1] - Disconnect battery negative (-) cable.

[2] - Remove left-hand dash panel.

[3] - Disconnect wiring connector (C).

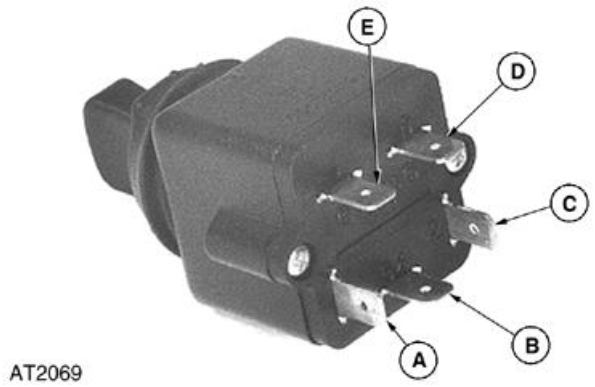
[4] - Remove boot (A).

[5] - Remove nut (B) and controller.

[6] - Install new controller and nut.

[7] - Install boot.

[8] -



LEGEND:

A	1 Azure Wire Lead
B	54 Black-White Wire Lead
C	2 Blue-Black Wire Lead
D	B Not Used
E	A Not Used

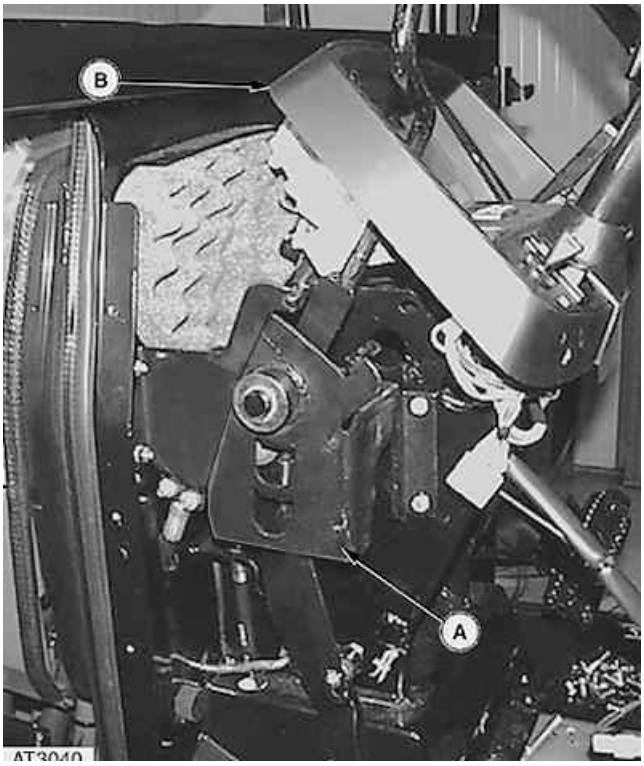
Wiring Leads

Connect wiring leads (A) to (C).

[9] - Install dash panel.

[10] - Connect battery negative (-) cable.

Replace Instrument Panel



Tractor with cab shown

[1] - Remove steering wheel and side panels.

[2] - Remove all connecting wiring.

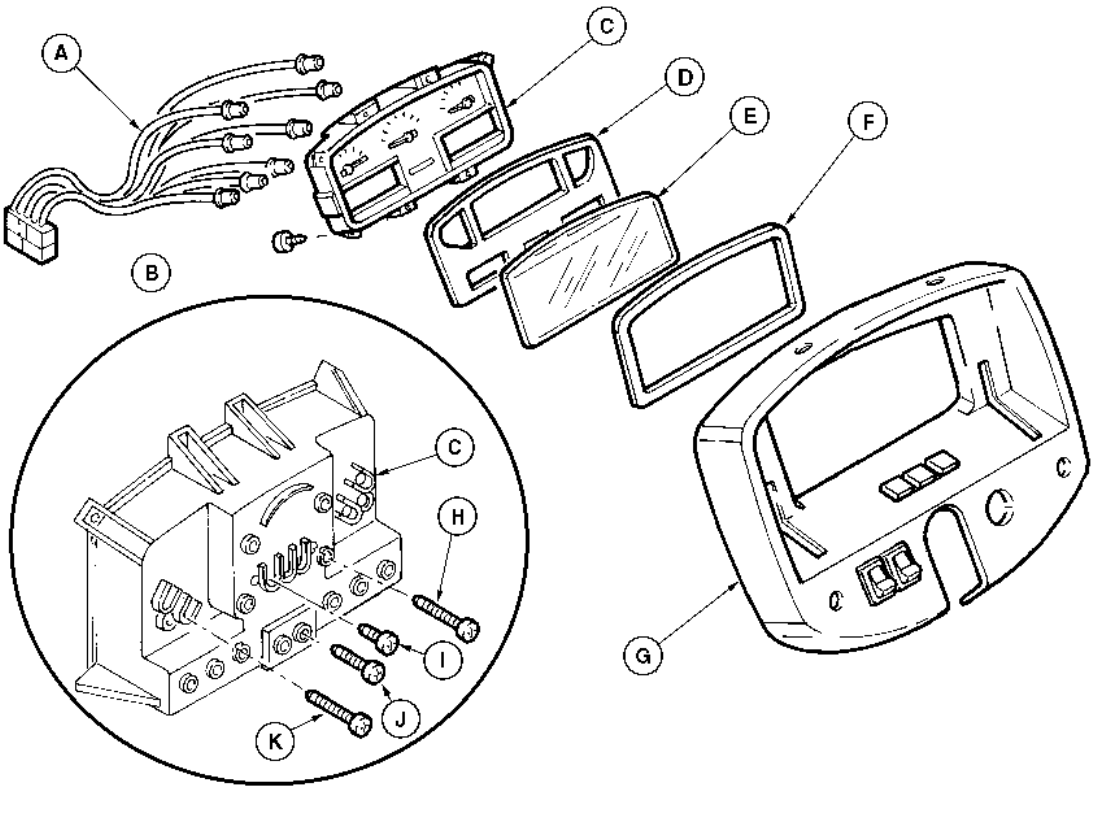
[3] - Remove knobs and steering wheel.

[4] - Remove forward-reverse lever assembly (A).

[5] - Remove instrument panel assembly (B).

[6] -

→NOTE:



Instrument Panel-Exploded View

LEGEND:

A	Wiring Harness
B	Instrument Cluster
C	Bulb (8 used)
D	Reflector
E	Glass
F	Gasket
G	Instrument Panel
H	Phillips Head Cap Screw (2 used)
I	Phillips Head Cap Screw (3 used)
J	Phillips Head Cap Screw (2 used)
K	Phillips Head Cap Screw (6 used)

Wiring harness colors are marked at connection locations on back of instrument cluster to aid in assembly.

Inspect and replace parts (A) to (K) as necessary.

[7] - Install instrument panel assembly.

[8] - Install forward-reverse lever.

[9] - Connect wiring connectors.

[10] - Install throttle and forward/reverse lever knobs.

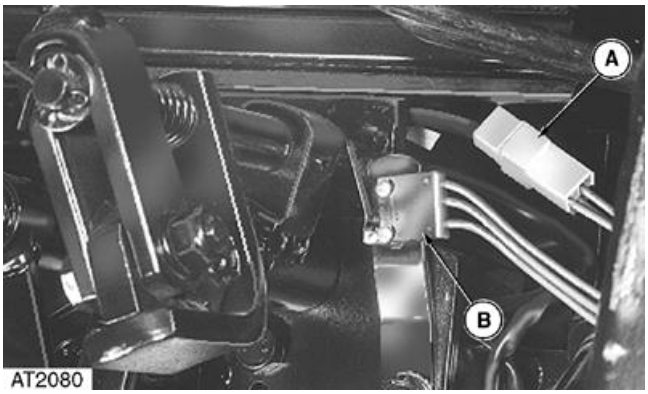
Replace Rear PTO Switch

Tractors without cab

→NOTE:

Operator′s seat removed for clarity of photo.

[1] - Disconnect wiring connector (A).



PTO switch, tractors w/o cab

[2] - Replace rear PTO switch (B).

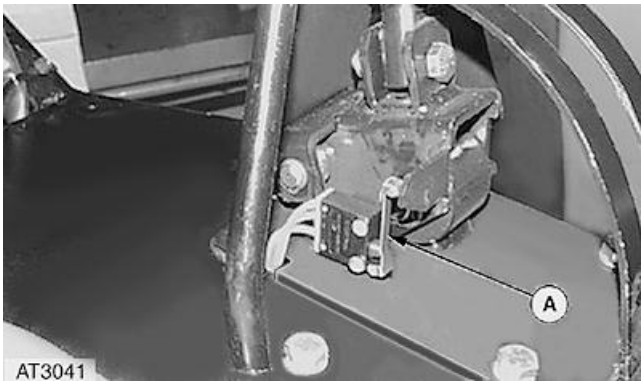
[3] - Connect wiring connector.

Tractors with cab

→NOTE:

Operator′s seat removed for clarity of photo.

[1] - Disconnect wiring connector.

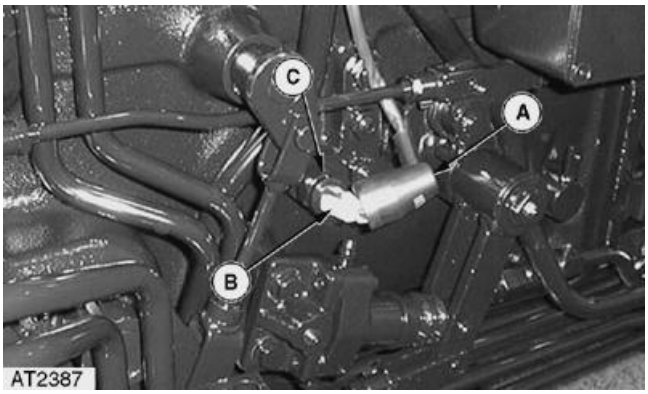


PTO switch, tractors w cab

[2] - Replace rear PTO switch (A)

[3] - Connect wiring connector.

Replace Neutral Start Switch



replace neutral start switch

→NOTE:

Right-hand wheel and fender removed for clarity of photo.

[1] - Remove boot (A) .

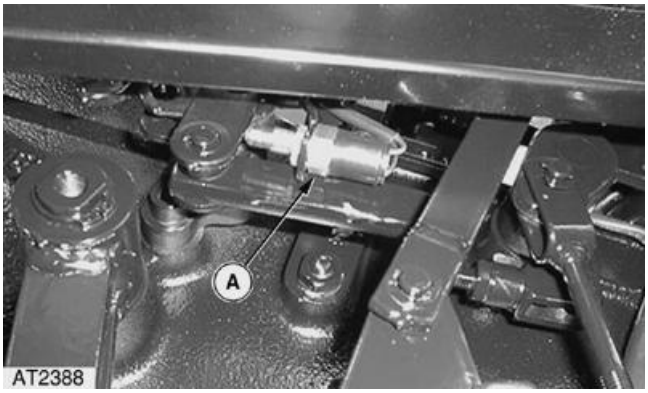
[2] - Disconnect wiring connector (B).

[3] - Replace neutral start switch (C).

[4] - Connect wiring connector.

[5] - Install boot.

Replace Parking Brake Switch



replace parking brake switch

→NOTE:

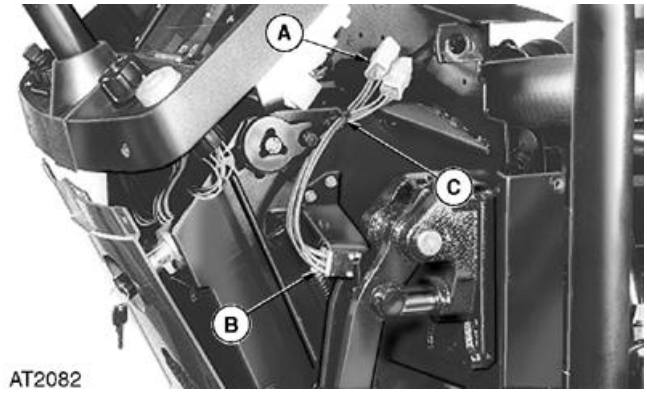
Left-hand wheel and fender removed for clarity of photo.

[1] - Disconnect wiring connector.

[2] - Replace parking brake switch (A).

[3] - Connect wiring connector.

Replace Brake Pedal Switches



Replace Brake Pedal Switches

[1] - Remove right-hand dash panel.

[2] - Disconnect wiring connectors (A).

[3] - Cut tie strap (C).

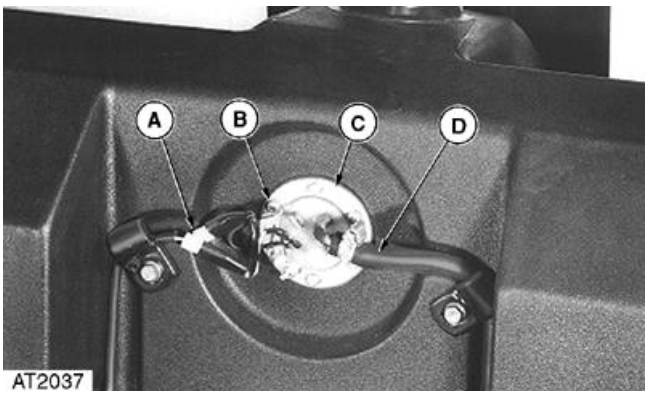
[4] - Replace brake pedal switches (B).

[5] - Connect wiring connectors.

[6] - Install tie strap.

[7] - Install dash panel.

Replace Fuel Level Sender



Replace Fuel Level Sender

[1] - Disconnect wiring connectors (A).

[2] - Disconnect fuel return hose (D).

[3] - Remove screws (B).

[4] - Replace fuel level sender and gasket (C).

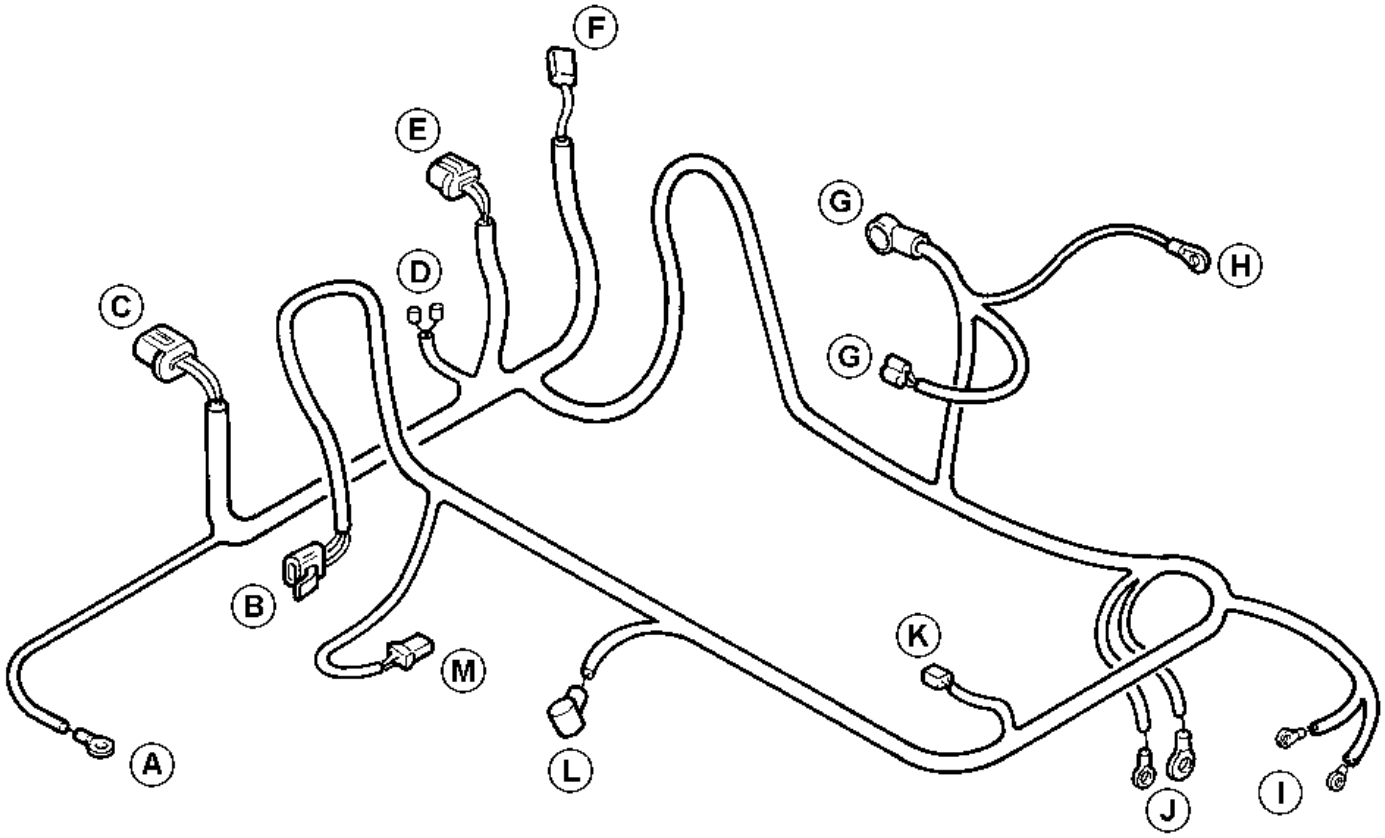
[5] - Install screws.

[6] - Connect fuel return hose.

[7] - Connect wiring connectors.

Group 15 - Wiring Harnesses

Replace Engine Wiring Harness



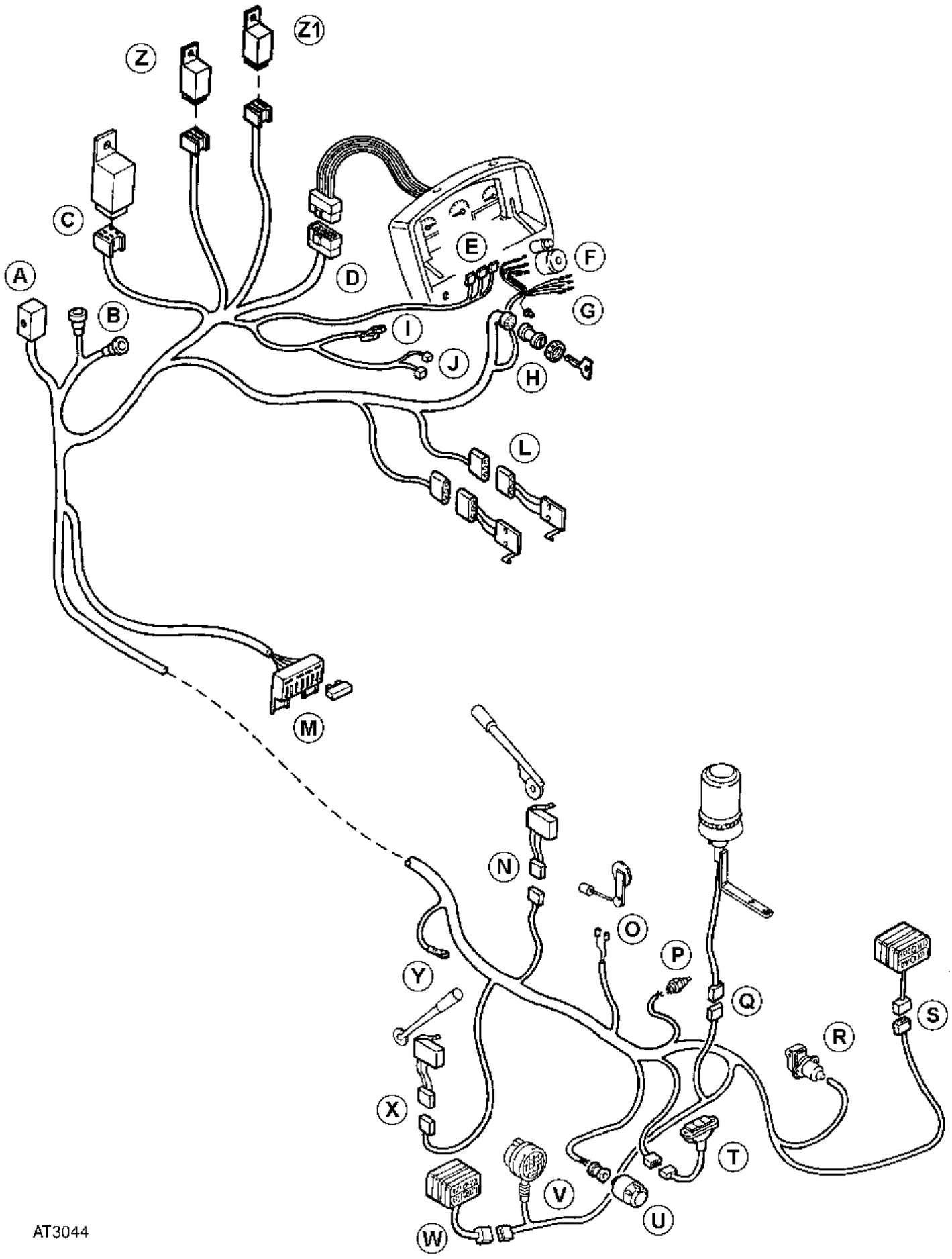
AT3042

engine wiring harness

LEGEND:

A	Ground
B	Engine Speed Sensor
C	Left-Hand Headlight
D	Horn
E	Right-Hand Headlight
F	Air Filter Restriction Sensor
G	Alternator/Regulator
H	Manifold Heater
I	To Rear Wiring Harness
J	Starter
K	Coolant Temperature Sender
L	Fuel Shut-off Solenoid
M	Oil Pressure Switch

Replace Instrument Panel/Transmission Wiring Harness



transm. wiring harness

LEGEND:

A	FWD Solenoid
B	To Front Wiring Harness
C	Flasher
D	Instrument Panel
E	Indicator Light
F	Light/Horn Switch
G	Hazard Warning Light Switch
H	Key Switch
I	Turn Signal Controller
J	FWD Switch
K	Beacon Light Switch
L	Brake Pedal Switch
M	Fuse Block
N	Parking Brake Switch
O	Fuel Level Sender
P	Neutral Start Switch
Q	Beacon Light
R	Three Terminal Socket
S	Tail / Right Warn / Turn Light
T	License Plate Light
U	Seven-Terminal-Socket
V	Rear Work Light
W	Tail / Left Warn / Turn Light
X	Rear PTO Switch
Y	Ground
Z	MFWD relay
Z1	Safety relay

[1] - Remove engine side shields.

[2] - Remove hood.

[3] - Remove instrument panel (see “Replace instrument panel” in this Section).

[4] - Remove dash covers.

[5] - Remove seat and support (see procedure in Section 90).

[6] - Remove center and left-hand plates from base of instrument panel console.

[7] - Cut all tie straps.

[8] - Remove fuse block (M) from support bracket.

[9] - Disconnect wiring connectors and leads.

[10] - Remove wiring harness.

[11] - Install new harness and connect all wiring connectors and leads.

[12] - Install fuse block.

[13] - Install tie straps as necessary.

[14] - Install center and left-hand plates.

[15] - Install seat and support.

[16] - Install dash covers.

[17] - Install instrument panel.

[18] - Install hood.

[19] - Install engine side shields.

Section 50 - POWER TRAIN - REPAIR

Table of contents

Group 00 - Removal and Installation of Power Train Components

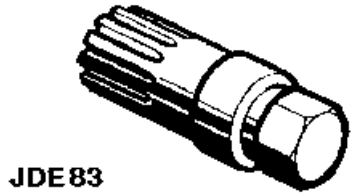
Essential Tools

→NOTE:

Order tools according to information given in the U.S. SERVICEGARD ™ Catalog or from the European Microfiche Tool Catalog (MTC).

Flywheel Turning Tool

JDE83

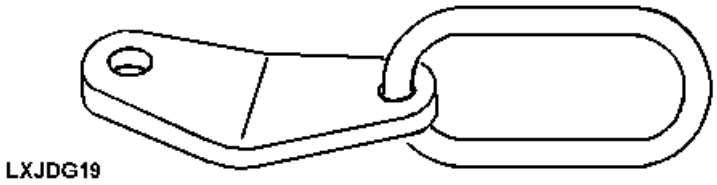


Flywheel turning tool

To rotate the flywheel and the PTO shaft

Lifting Bracket

JDG19

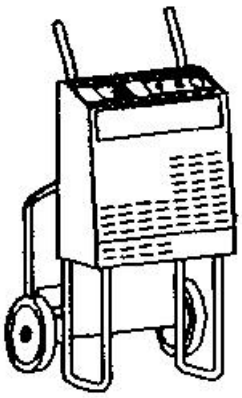


Lifting Bracket

Removal and installation of tractor components

Recovery/Recycling, and Charging Station

JT02047



Recovery/Recycling, and Charging Station

Servicing air conditioning system using R134a refrigerant

Specifications

Item	Measurement	Specification
Cap screws and nuts, engine to clutch housing	Torque	318 N·m
		235 lb-ft
Cap screws, clutch housing to transmission housing	Torque	190 N·m
		141 lb-ft

→NOTE:

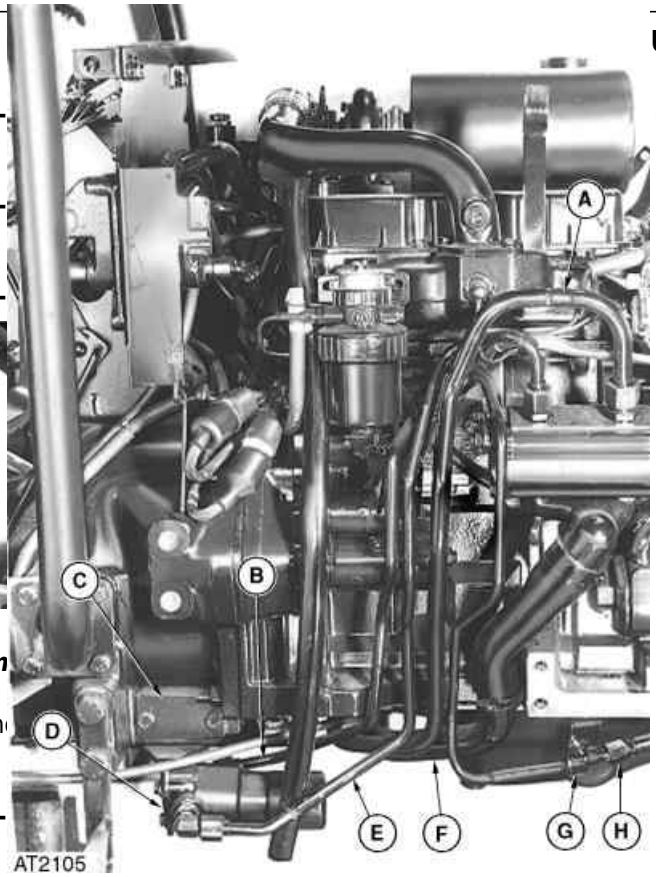
using (Tractors without Cab)

[1] -

[2] -

[3] -

in this Section).



LEGEND:

A	Hydraulic Pump to Inlet Housing Line
B	Filter-to-Steering Valve Line
C	Inspection Cover
D	Filter
E	Hydraulic Pump-to-Filter Line
F	Suction Line
G	Clamp
H	Hydraulic Steering Line

Rem

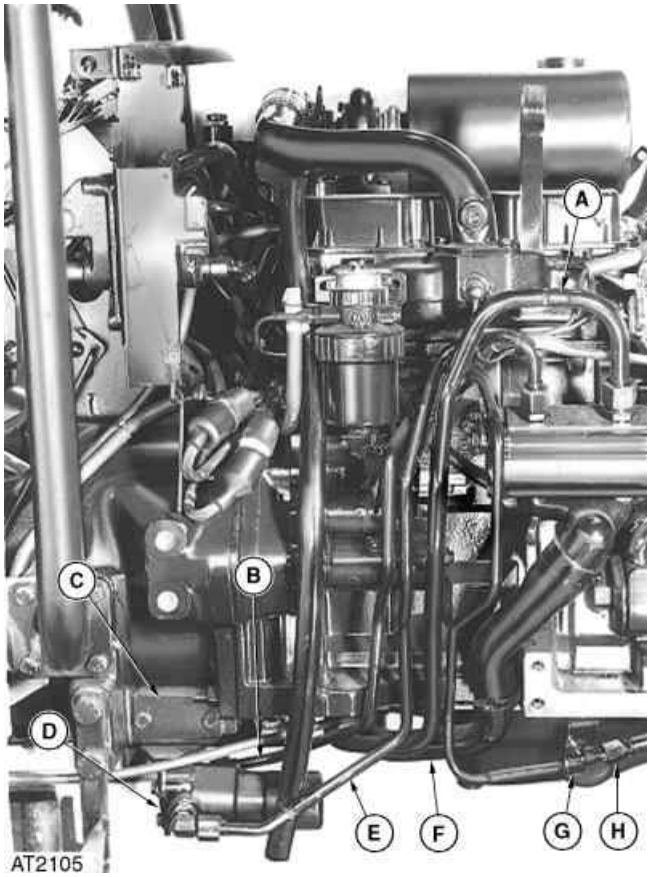
Rem

[4] -

[5] - Disconnect battery negative (-) cable from battery.

Disconnect Hydraulic Lines

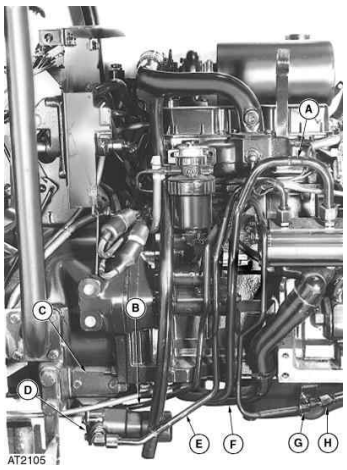
[6] - Close all openings using caps and plugs.



LEGEND:

A	Hydraulic Pump to Inlet Housing Line
B	Filter-to-Steering Valve Line
C	Inspection Cover
D	Filter
E	Hydraulic Pump-to-Filter Line
F	Suction Line
G	Clamp
H	Hydraulic Steering Line

Disconnect Hydraulic Lines



LEGEND:

A	Hydraulic Pump to Inlet Housing Line
B	Filter-to-Steering Valve Line
C	Inspection Cover
D	Filter
E	Hydraulic Pump-to-Filter Line
F	Suction Line
G	Clamp
H	Hydraulic Steering Line

Disconnect Hydraulic Lines

Close all openings using caps and plugs.

Remove fuel filter / primer pump assembly (see procedure in Section 30).

[7] - Drain transmission oil.

[8] - Disconnect hydraulic lines (A), (B), (F) and (H).

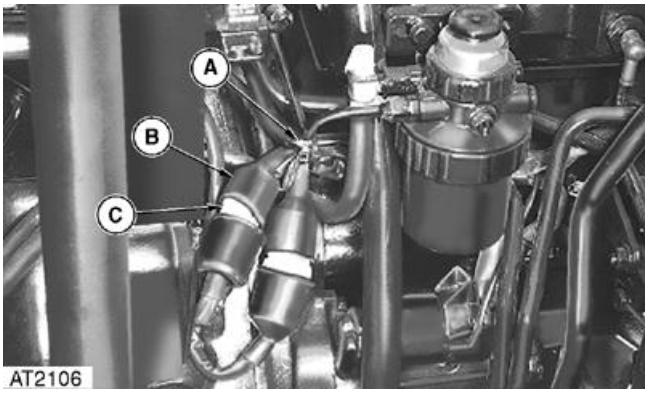
[9] - Remove clamp (G).

[10] - Remove hydraulic line (E).

[11] - Remove filter assembly (D).

[12] - Remove inspection cover (C).

[13] -



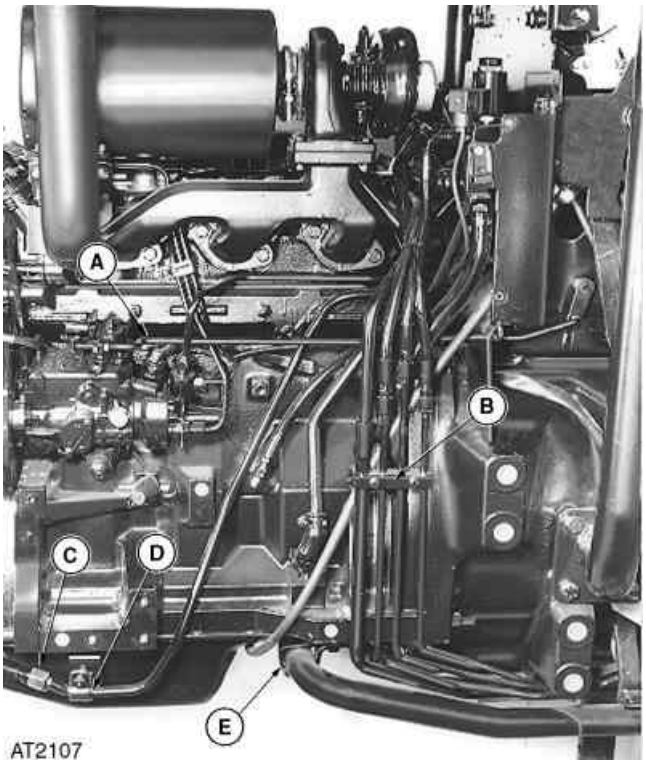
Tie Strap, Boots and Connectors

Remove tie strap (A).

[14] - Remove boots (B).

[15] - Disconnect two wiring harness connectors (C).

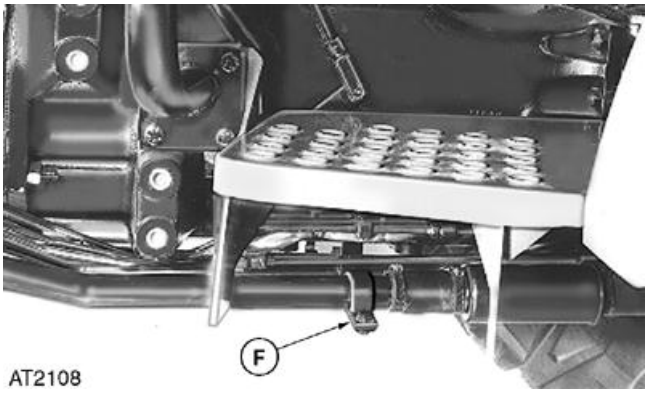
[16] -



LEGEND:

A	Throttle Linkage Rod
B	Clamp
C	Hydraulic Steering Line
D	Clamp
E	Clamp
F	Clamp and Bracket

Remove Components



Clamp and Bracket

Remove exhaust pipe.

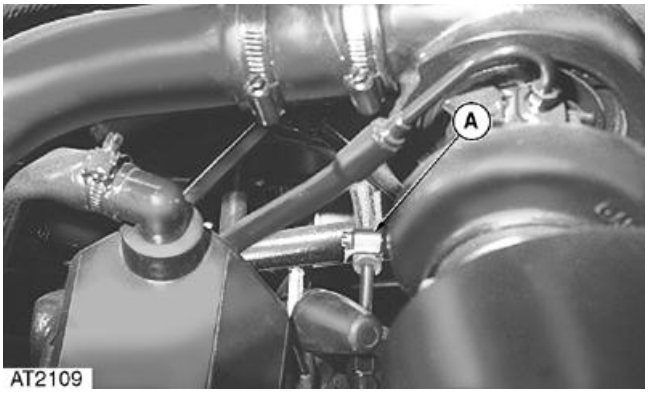
[17] - Disconnect hydraulic line (C).

[18] - Remove clamps (B), (D) and (E).

[19] - Remove rod (A).

[20] - Remove clamp and bracket (F) and (G).

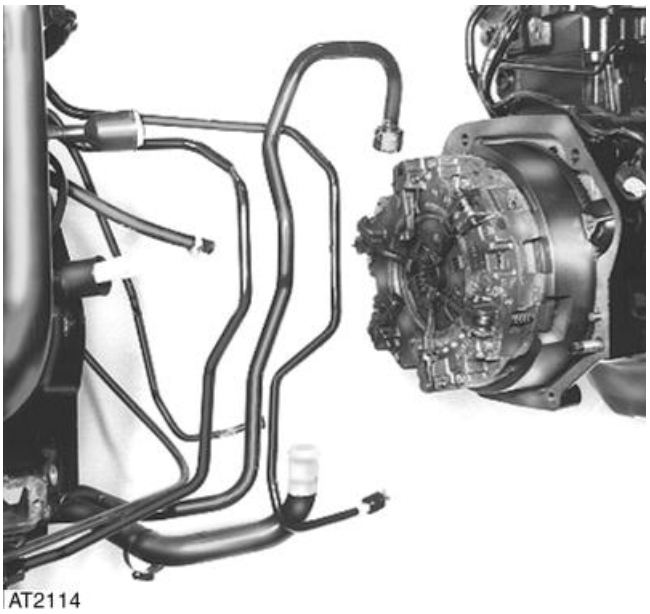
[21] -



Fuel Return Hose

Disconnect fuel return hose (A).

[22] -



Install Hardware

Install lifting brackets to the rear section of engine cylinder head.

[23] - Attach a hoist to engine.

[24] - Install a floor jack under clutch housing.

[25] - Drive wooden wedges between front axle pivot stops and frame.

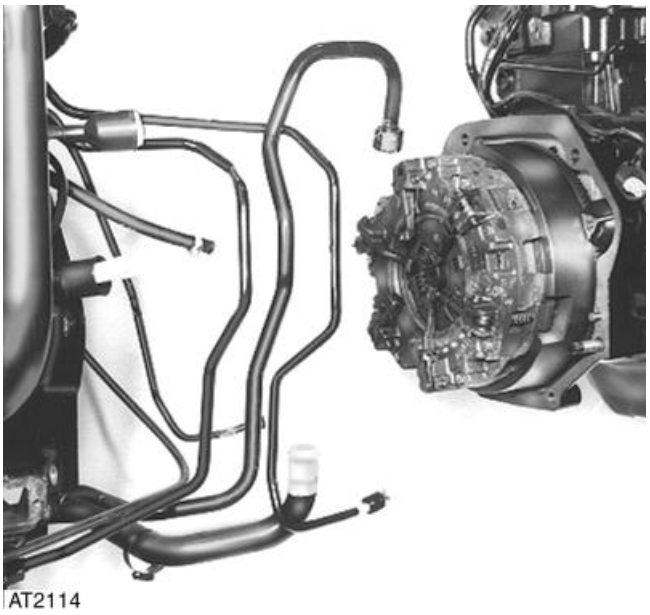
[26] - Remove four cap screws and two nuts. Roll front section (engine/front axle assembly) away from tractor rear section.

→NOTE:

Ensure disconnected hydraulic lines do not entangle with engine components or electrical wiring during engine/clutch housing separation.

[27] - Install a support stand under the flywheel housing of engine.

Install Engine to Clutch Housing (Tractors without Cab)



Install Engine to Clutch Housing

[1] - Clean mating surfaces of clutch housing and engine.

[2] -

→NOTE:

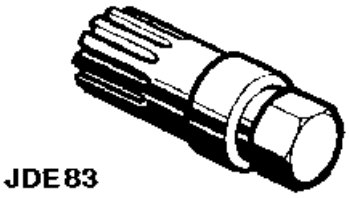
Ensure disconnected hydraulic lines do not entangle with engine components or electrical wiring during engine / clutch housing installation.

It may be necessary to rotate the PTO shaft and / or engine flywheel so the clutch shafts mesh with the clutch discs. Rotate the PTO shaft by manually turning the PTO at rear of tractor.

Rotate the engine flywheel using Flywheel Turning Tool JDE83.

Flywheel Turning Tool

JDE83



Flywheel turning tool

To rotate the flywheel and the PTO shaft

Apply Moly High Temperature EP Grease to traction and PTO clutch shafts.

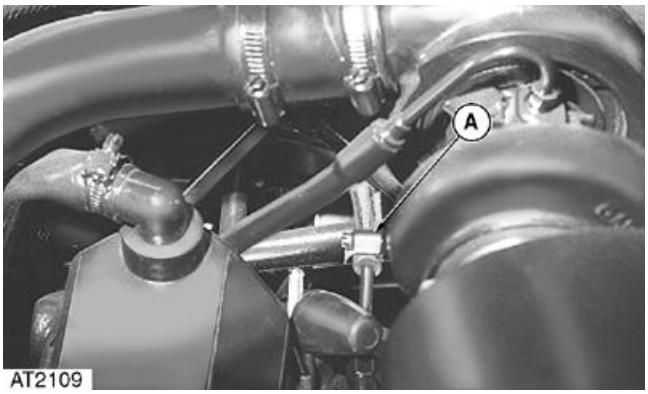
[3] - Install engine to clutch housing. Tighten cap screws and nuts to specified torque.

Item	Measurement	Specification
Cap screws and nuts, engine to clutch housing	Torque	318 N·m 235 lb-ft

[4] - Remove wood blocks and floor jack.

[5] - Remove lifting brackets.

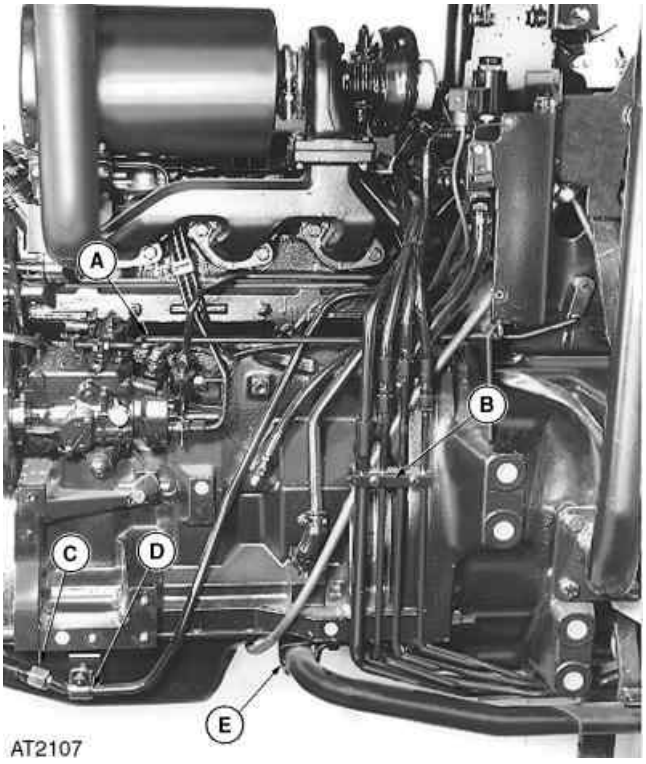
[6] -



Fuel Return Hose

Connect fuel return hose (A).

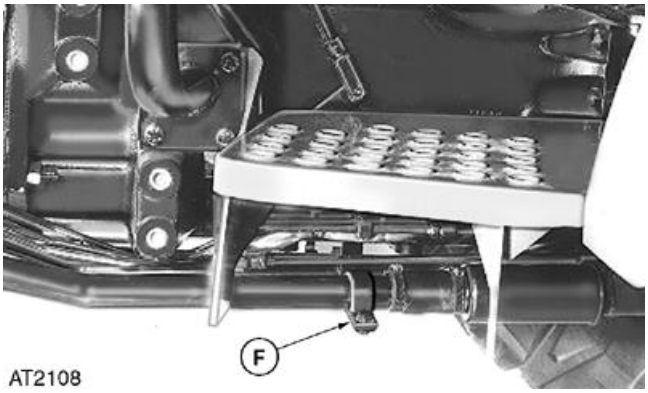
[7] -



LEGEND:

A	Throttle Linkage Rod
B	Clamp
C	Hydraulic Steering Line
D	Clamp
E	Clamp
F	Clamp and Bracket

Install Components



Bracket and Clamp

Install clamp and bracket , (F) and (G).

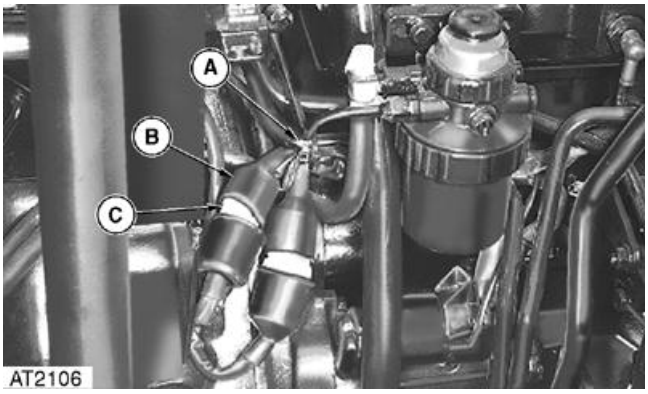
[8] - Install rod (A).

[9] - Connect hydraulic line (C).

[10] - Install clamps (B), (D) and (E).

[11] - Install exhaust pipe.

[12] -



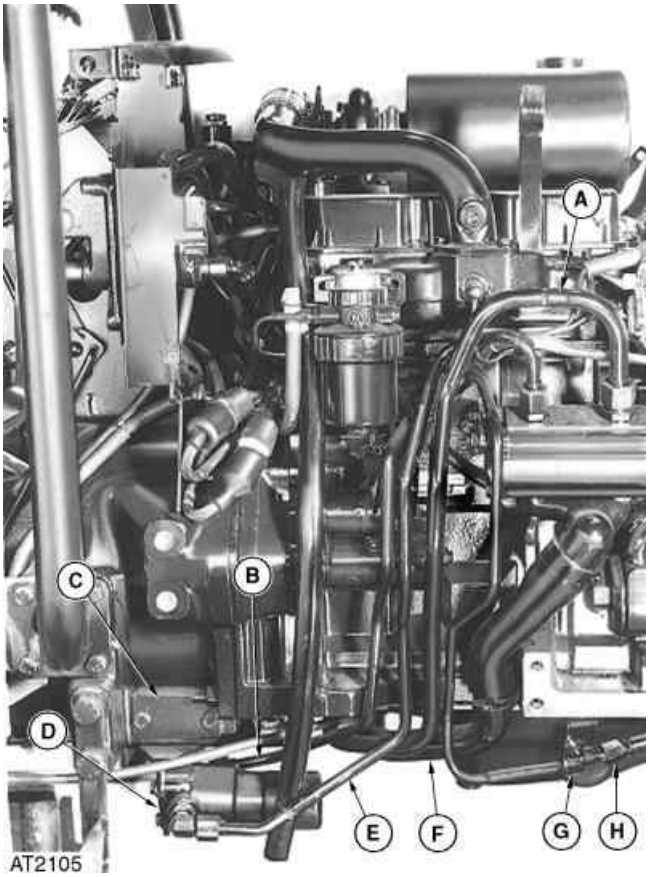
Connect Harness Wiring Connectors

Connect two harness wiring connectors (C).

[13] - Install boots (B).

[14] - Install tie strap (A).

[15] -



LEGEND:

A	Hydraulic Pump-to-Inlet Housing Line.
B	Filter-to-Steering Valve Line.
C	Inspection Cover
D	Filter
E	Hydraulic Pump-to-Filter Line.
F	Suction Line
G	Clamp
H	Hydraulic Steering Line

Install Hydraulic Lines

Install inspection cover (C).

[16] - Install filter assembly (D).

[17] - Install hydraulic line (E).

[18] - Install clamp (G).

[19] - Connect hydraulic lines (A), (B), (F) and (H).

[20] - Install fuel filter / primer pump assembly (see procedure in Section 30).

[21] - Fill transmission with proper oil (see “Fuel, Lubricants and Coolant” in Section 10).

[22] - Connect battery negative (-) cable to battery.

[23] - Install hood.

[24] -

Install hood cap screws

Install cap screws (A), three to each hinge.

[25] - Install left and right-hand dash panels.

[26] - Install MFWD drive shaft, if equipped (see procedure in this Section).

[27] - Adjust throttle control rod (see CTM Engines).

Separate Engine From Clutch Housing (Tractors with Cab)

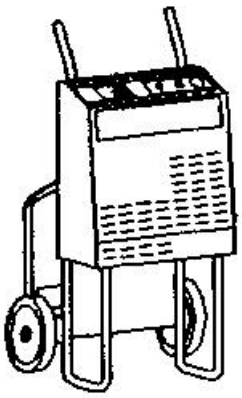
[1] - On tractors with air conditioning, discharge refrigerant. (see procedure in Section 90)

→NOTE:

Preferential use a Recovery/Recycling, and Charging Station (e.g. JT02047).

Recovery/Recycling, and Charging Station

JT02047



Recovery/Recycling, and Charging Station

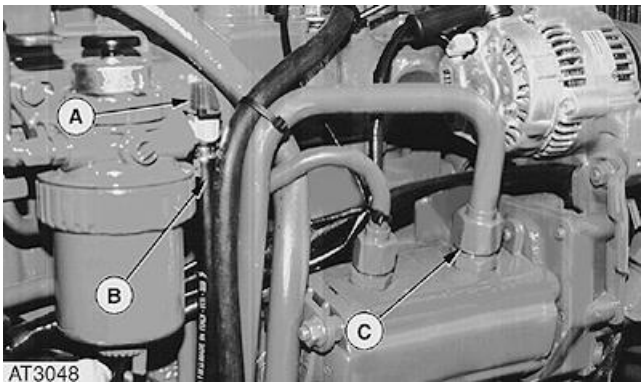
Servicing air conditioning system using R134a refrigerant

[2] - Remove MFWD drive shaft, if equipped. (see procedure in this Section)

[3] - Disconnect battery negative (-) cable from battery.

[4] - Remove Cab. (see procedure in Section 90)

[5] - Close shut-off valve (A) and remove fuel line (B).

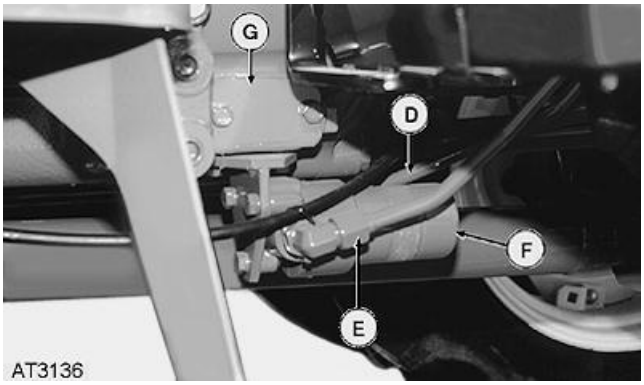


LEGEND:
A Shut-off valve
B Fuel line
C Line, Hydraulic Pump to Inlet Housing

Shut-off valve and fuel line

[6] - Drain transmission oil.

[7] - Disconnect hydraulic lines (C) and (D).



LEGEND:

D	Line, Filter to Steering Valve
E	Line, Hydraulic Pump to Filter
F	Filter
G	Inspection Cover

Inspection cover

[8] - Remove hydraulic line (E).

[9] - Remove filter assembly (F)

[10] - Remove inspection cover (G).

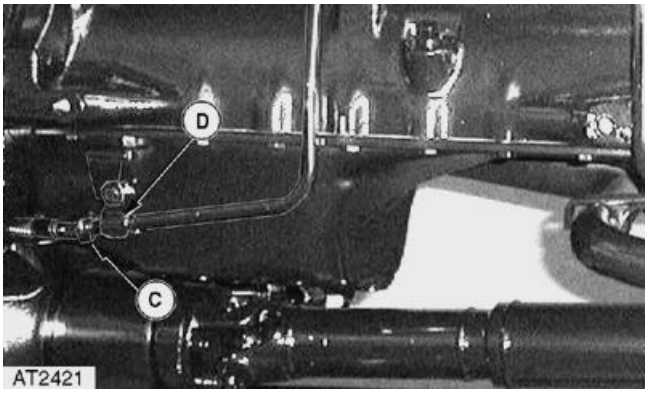
[11] - Remove suction line.

→NOTE:

Close all openings using caps and plugs.

[12] - Remove exhaust pipe

[13] - Loosen clamp (D) of hydraulic line (C).

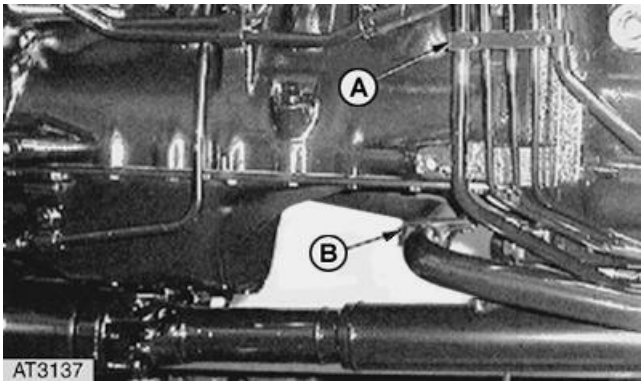


LEGEND:

C	Hydraulic steering line
D	Clamp

loosen clamp of hydraulic line

[14] - Remove clamps (A) and (B).

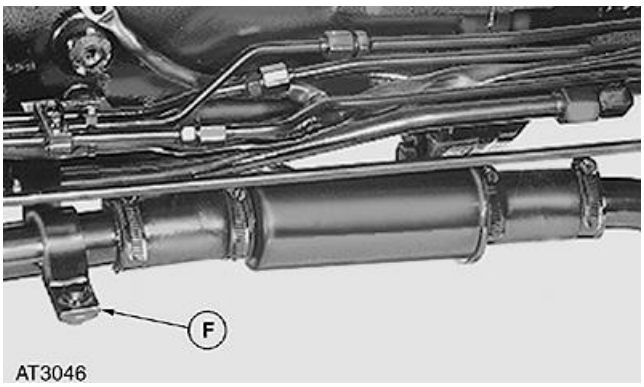


LEGEND:

A	Clamp
B	Clamp

remove clamps

[15] - Remove clamp and bracket (F).

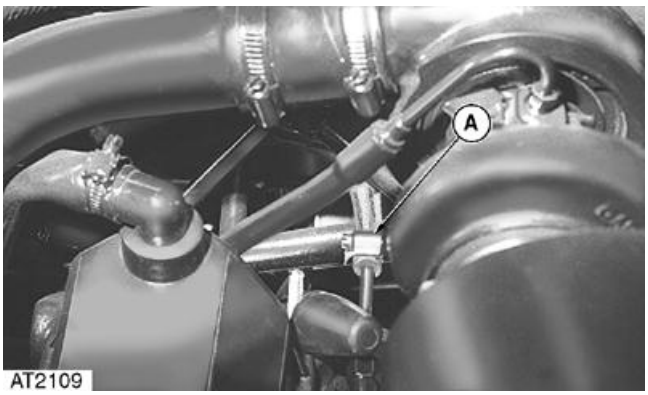


LEGEND:

F	Clamp and bracket

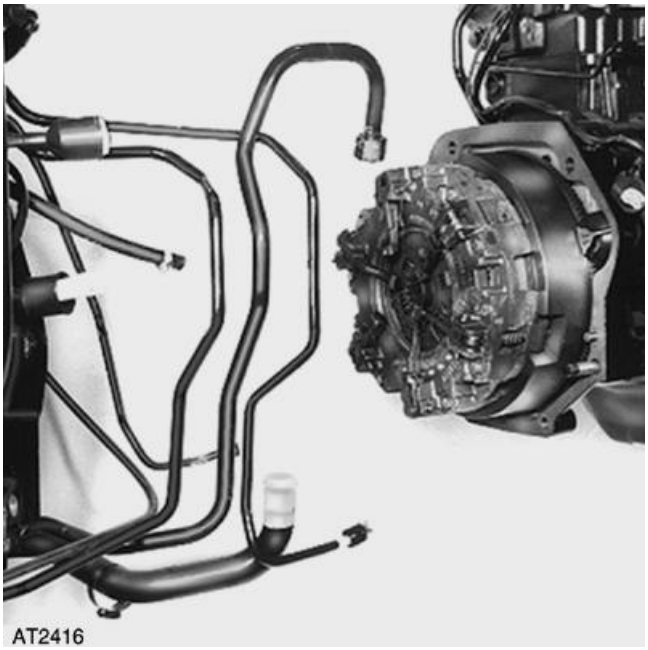
hydraulic line, bracket

[16] - Disconnect fuel return hose (A).



Fuel Return Hose

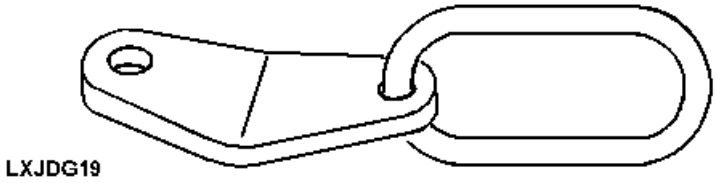
[17] - Install lifting brackets, such as JDG19 or JT1748, to the rear section of engine cylinder head.



Separate Front- and Rear Assembly

Lifting Bracket

JDG19



Lifting Bracket

Removal and installation of tractor components

[18] - Attach a hoist to engine.

[19] - Install a floor jack under clutch housing.

[20] - Drive wooden wedges between front axle pivot stops and frame.

[21] - Remove four cap screws and two nuts. Roll front section (engine/front axle assembly) away from tractor rear section.

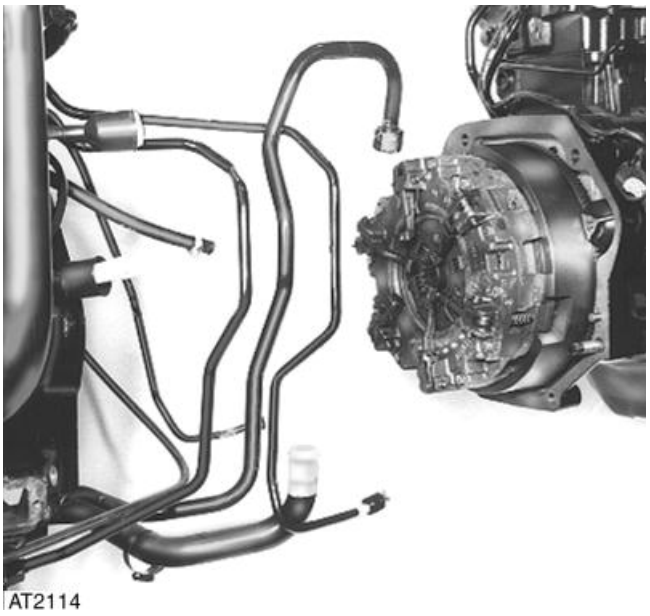
→NOTE:

Ensure disconnected hydraulic lines do not entangle with engine components or electrical wiring, during engine/clutch housing separation.

[22] - Install a support stand under the flywheel housing of engine.

Install Engine to Clutch Housing (Tractors with Cab)

[1] - Clean mating surfaces of clutch housing and engine.



Install engine to clutch housing

[2] - Apply Moly High Temperature EP Grease to traction and PTO clutch shafts.

[3] - Install engine to clutch housing. Tighten cap screws and nuts to specified torque.

Item	Measurement	Specification
Cap screws and nuts, engine to clutch housing	Torque	318 N·m
		235 lb-ft

→NOTE:

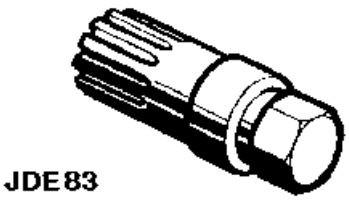
Ensure disconnected hydraulic lines do not entangle with engine components or electrical wiring during engine / clutch housing installation.

It may be necessary to rotate the PTO shaft and / or engine flywheel so the clutch shafts mesh with the clutch discs. Rotate the PTO shaft by manually turning the PTO at rear of tractor.

Rotate the engine flywheel using Flywheel Turning Tool JDE83.

Flywheel Turning Tool

JDE83

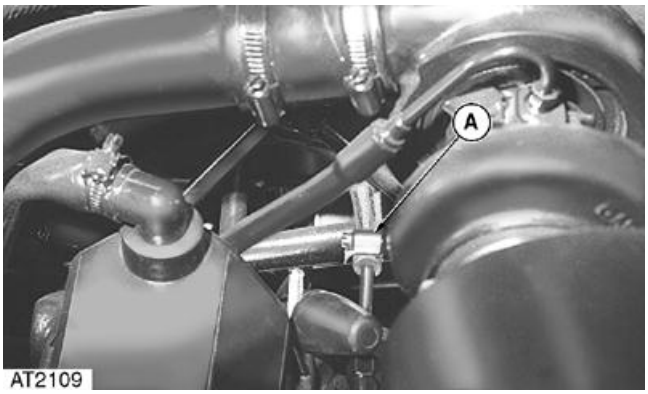


Flywheel turning tool

To rotate the flywheel and the PTO shaft

[4] - Remove wedges floor jack and lifting brackets.

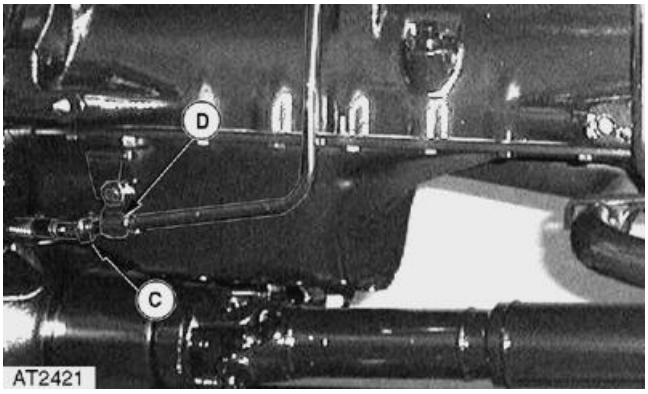
[5] - Connect fuel return hose (A).



Fuel return hose

[6] - Install exhaust pipe.

[7] - Install clamp (D) of hydraulic line (C).

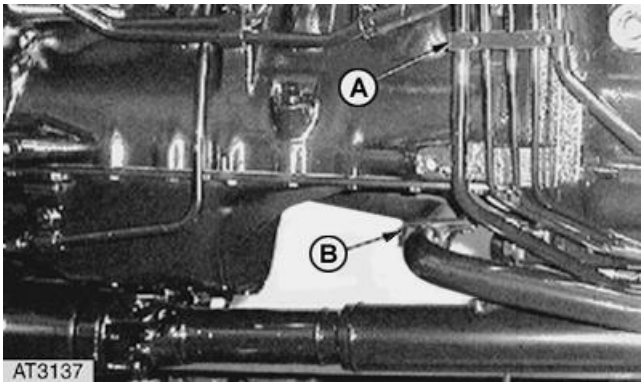


LEGEND:

C	Hydraulic steering line
D	Clamp

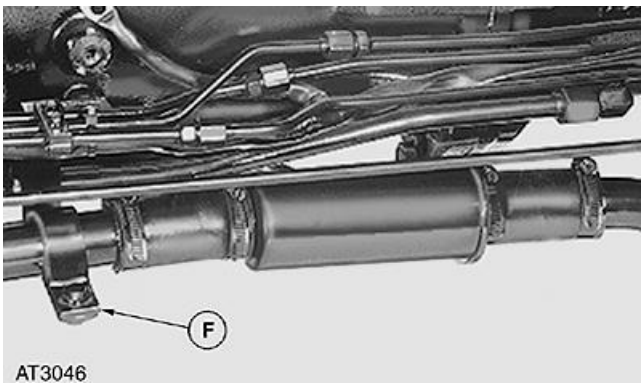
Install hydraulic line

[8] - Install clamps (A) and (B).



Install clamps

[9] - Install clamp and bracket (F).

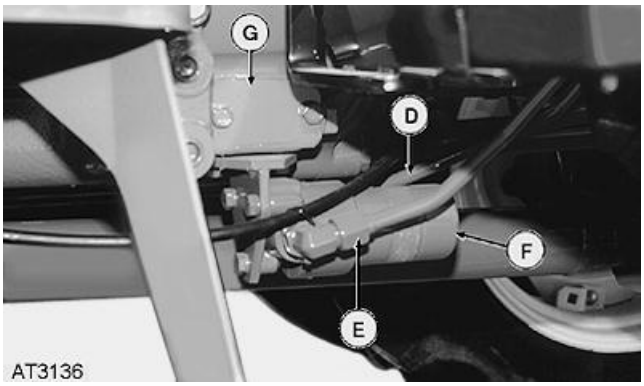


LEGEND:
F Clamp and bracket

Clamp and bracket

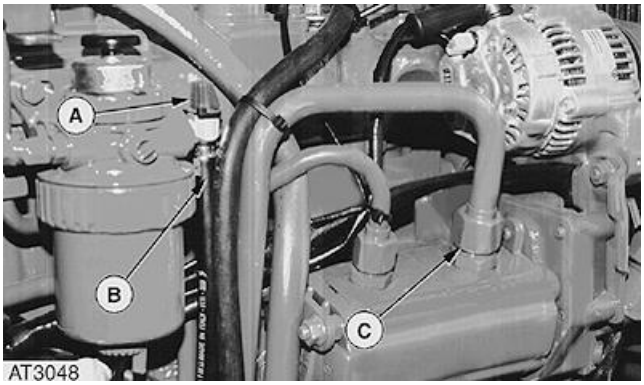
[10] - Install suction line.

[11] - Install inspection cover (G) and filter assembly (F).



LEGEND:
A Shut-off Valve
B Fuel line
C Line, Hydraulic Pump to Inlet Housing
D Line, Filter to Steering Valve
E Line, Hydraulic Pump to Filter
F Oil Filter
G Inspection Cover

Inspection cover and filter assembly



Shut-off valve and fuel line

[12] - Install hydraulic lines (C) and (D).

[13] - Filling hydraulic tank.

[14] - Install fuel line (B).

[15] - Install cab (see procedure in Section 90).

[16] - Connect battery.

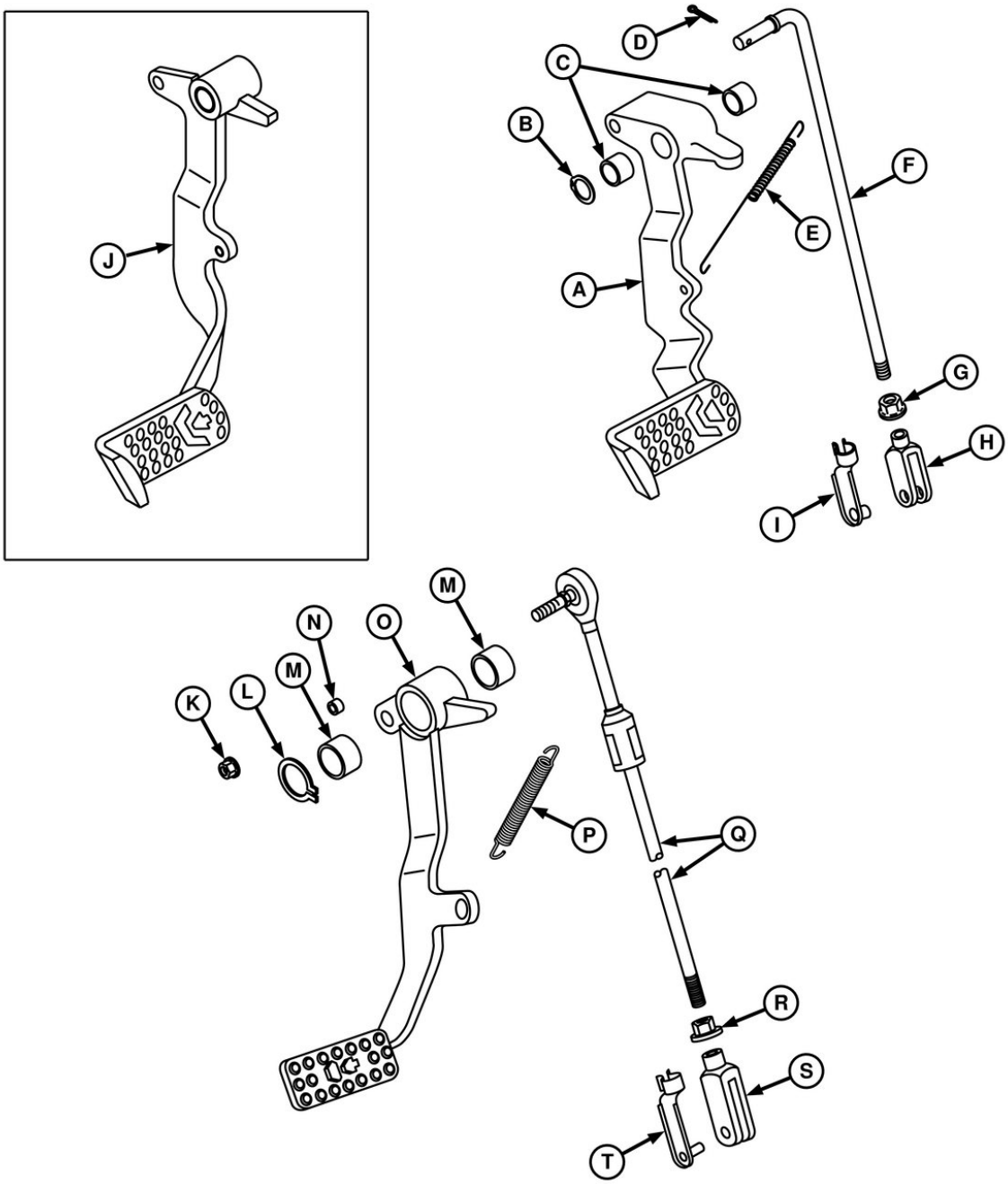
[17] - Install MFWD drive shaft (see procedure in this Section).

[18] - Filling air conditioning system (see procedure in Section 90).

[19] - Filling fuel tank.

[20] - Drain air from hydraulic- and fuel system.

Inspect and Repair Clutch Pedal and Linkage (Tractor without Cab)



Clutch Pedal and Linkage

LEGEND:

A	Clutch Pedal
B	Snap Ring
C	Bushings
D	Cotter Pin
E	Extension Spring
F	Rod
G	Flange Nut
H	Yoke
I	Pin

[1] - Remove left-hand engine side shield.

[2] - Remove left-hand dash cover.

[3] - Inspect all parts for wear or damage. Replace as necessary.

[4] -

→NOTE:

Remove bushings only if replacement is necessary.

Inspect bushings (C) for wear or damage. Replace if necessary.

Replace bushings using a bearing, bushing and seal driver set. Install bushings flush with pedal surface.

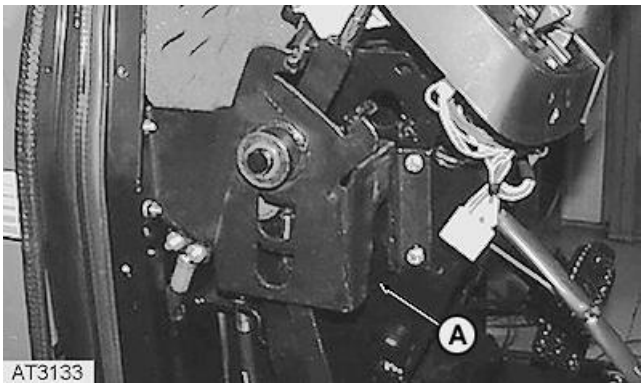
[5] - Apply Moly High Temperature EP Grease to inner side of bushings.

[6] - Install left-hand dash cover and engine side shield.

[7] - Adjust clutch pedal free-play (see procedure in Section 250).

Inspect and Repair Clutch Pedal and Linkage (Tractor with Cab)

[1] -

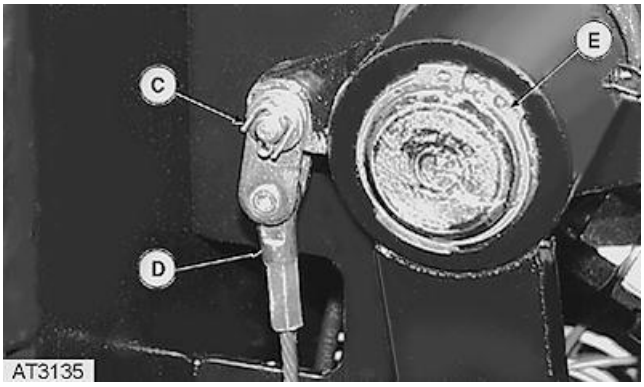


LEGEND:

A	Forward/reverse lever assembly
B	Bracket
C	Cotter pin
D	Control cable
E	Snap ring

Forward/reverse lever assembly

Spring and bracket



Cotter pin and control cable

Remove left hand instrument panel side shield.

[2] - Remove forward/reverse lever assembly (A).

[3] - Remove spring and bracket (B).

[4] - Remove cotter pin (C) and pin.

[5] - Remove control cable (D).

[6] - Remove snap ring (E).

[7] - Remove clutch pedal.

[8] - Check all parts for wear or damage. Replace as necessary.

→NOTE:

Remove bushing only if replacement is necessary.

[9] - Check bushing for wear or damage. Replace if necessary.

Replace bushing using a bushing driver set.

Install bushing flush with pedal surface.

[10] - Apply Moly High Temperature EP Grease to ID of bushing.

[11] - Install clutch pedal.

[12] - Install spring, bracket (B) and control cable (D).

[13] - Install forward/reverse lever assembly (A).

[14] - Install left hand instrument panel side shield.

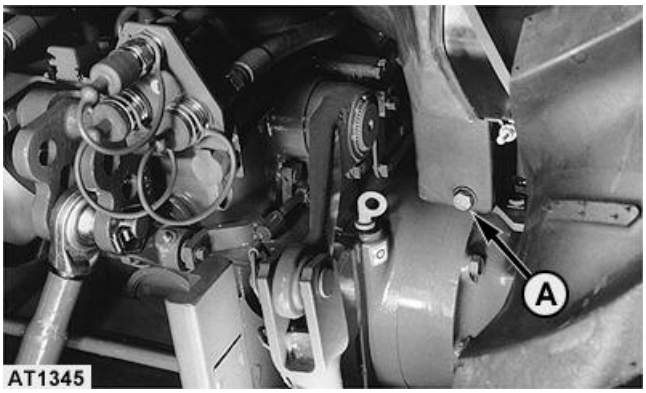
[15] - Adjust clutch pedal free play (see procedure in Section 250).

Separate Clutch Housing from Transmission

→NOTE:

Fuel tank capacity is approximately 72 L (19 U.S. gal).

[1] - Remove plug (A) and drain fuel tank.



Drain plug, fuel tank

[2] - Drain transmission oil.

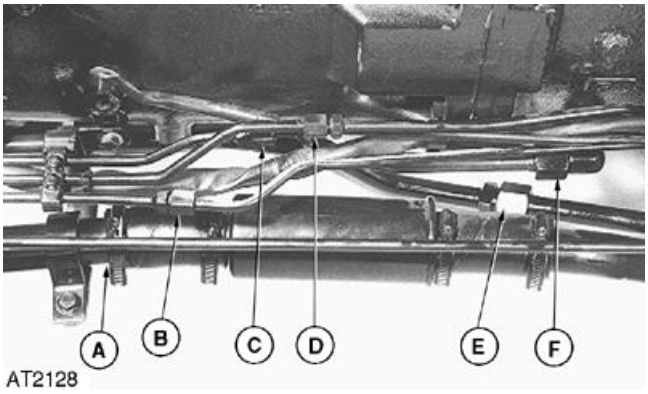
[3] - Disconnect fuel hoses.

[4] - Remove plate from each side of tractor (see procedure in this Section)..

[5] - Remove MFWD drive shaft, if equipped (see procedure in this Section).

[6] - Remove wiring harness from rear section of tractor.

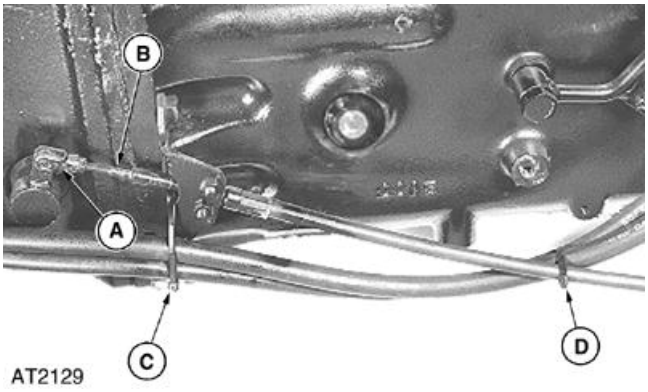
[7] -



Hydraulic Lines (Left Side of Tractor)

Remove hydraulic lines (A) to (F) on left side of tractor.

[8] -



Locking Pin, Control Cable and Tie Straps

Remove locking pin (A) to disconnect forward/reverse control cable (B).

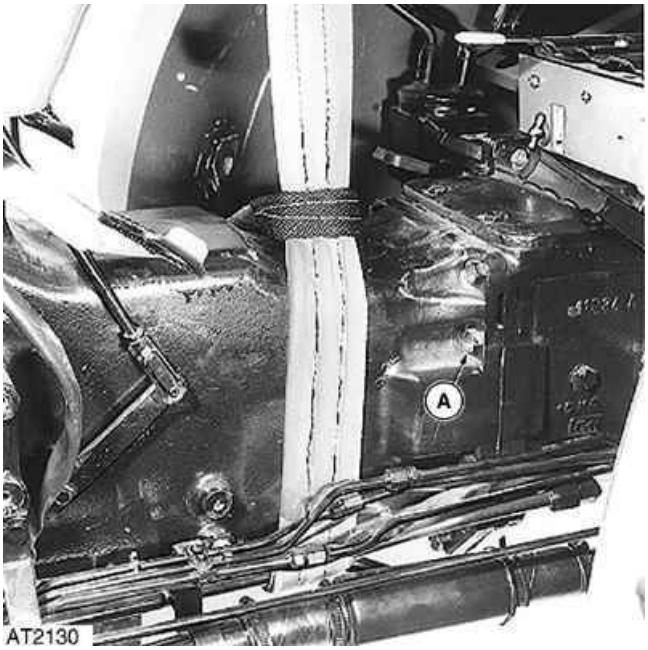
[9] - Cut tie straps (C) and (D).

[10] - Drive wooden wedges between the front axle pivot stops and tractor frame.

[11] - Chock front and back of rear wheels.

[12] - Position a floor jack under the transmission and a support stand under end of drawbar.

[13] -



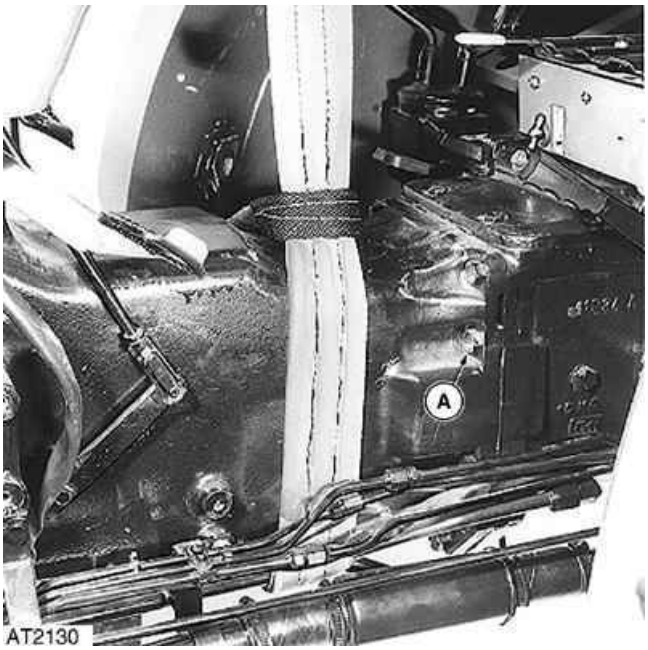
Remove Cap Screws

Install lifting chains or strap around clutch housing and attach to a hoist.

[14] - Remove ten cap screws (A). Roll front section of tractor (clutch housing) away from rear section (transmission).

[15] - Install a support stand under clutch housing.

Install Clutch Housing to Transmission



Install Clutch Housing

[1] - Clean mating surfaces of transmission and clutch housings.

[2] - Apply sealing compound to mating surfaces of housings.

[3] -

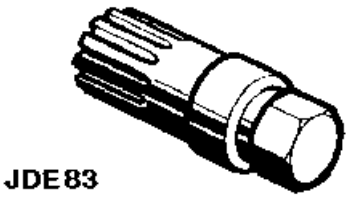
→NOTE:

Rotate the PTO shaft by manually turning the PTO at rear of tractor.

Rotate the traction shaft by turning the flywheel using JDE83 Flywheel Turning Tool.

Flywheel Turning Tool

JDE83



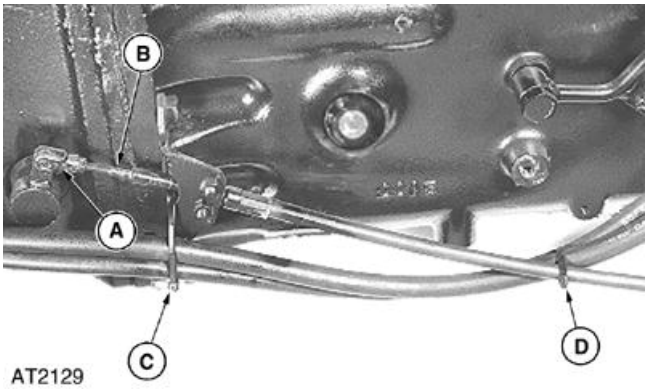
Flywheel turning tool

To rotate the flywheel and the PTO shaft

Install clutch housing to transmission. Tighten cap screws to the specified torque.

Item	Measurement	Specification
Cap screws, Clutch housing to transmission housing	Torque	190 N·m 141 lb-ft

[4] -



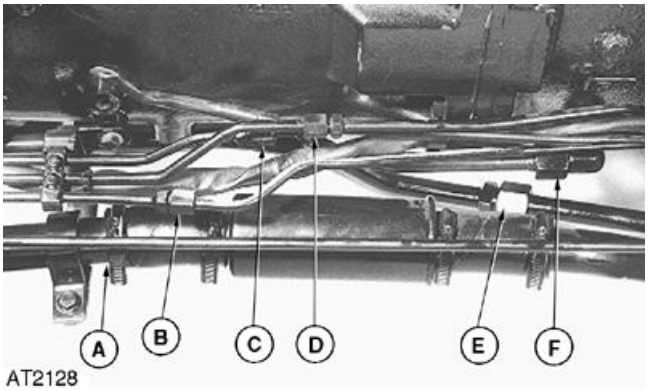
Control Cable, Locking Pin and Tie Straps

Install forward-reverse control cable (B).

[5] - Install locking pin (A).

[6] - Install tie strap (C) and (D).

[7] -



Hydraulic Lines (Left Side of Tractor)

Connect all hydraulic lines on left side of tractor.

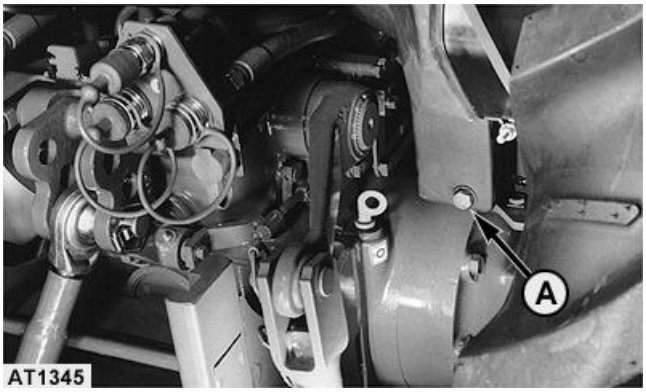
[8] - Connect wiring harness.

[9] - Install plate

[10] - Install MFWD drive shaft, if equipped (see procedure in this Section).

[11] - Connect fuel hoses.

[12] -

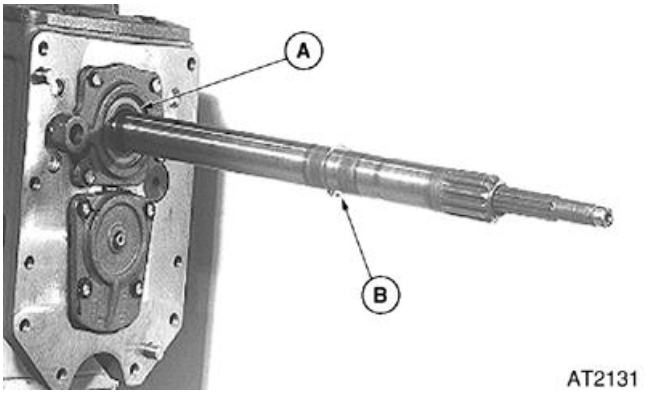


Drain plug, fuel tank

Install plug (A). Fill fuel tank with proper fuel (see “Fuel, Lubricants and Coolant” in Section 10).

[13] - Fill transmission with proper oil (see “Fuel, Lubricants and Coolant” in Section 10).

Replace Clutch Housing Seal (12/12 - Speed Transmission)



Clutch Housing Seal (12/12 Speed Transmission)

[1] - Separate clutch housing from transmission (see procedure in this group).

[2] - Remove snap ring (B).

[3] - Pry out seal (A).

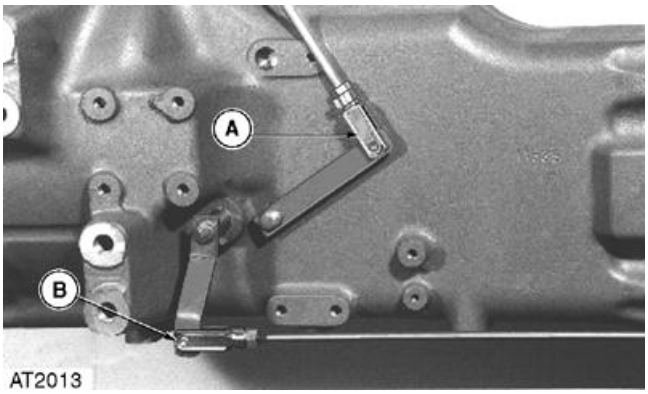
[4] - Apply multipurpose grease to the lips of new seal.

[5] - Install seal with lips facing away from clutch housing using a brass drift and hammer. Install seal until it stops.

[6] - Install snap ring (B).

[7] - Install clutch housing to transmission (see procedure in this Group).

Replace Clutch Housing Seal (24/24 - Speed Transmission)

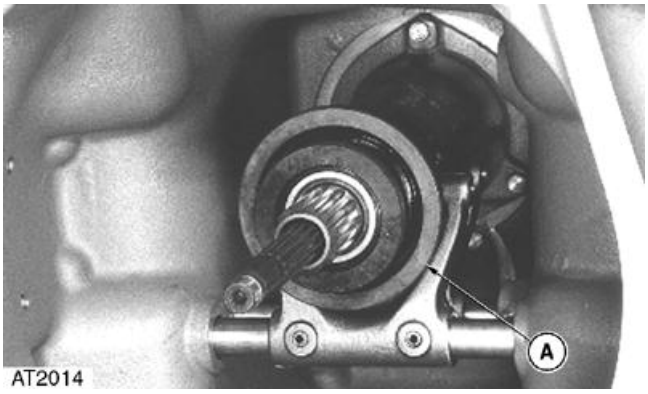


Clutch Housing Seal (24/24 Speed Transmission)

[1] - Separate engine from clutch housing as described in this Section.

[2] - Disconnect traction clutch rod (A) and PTO clutch rod (B).

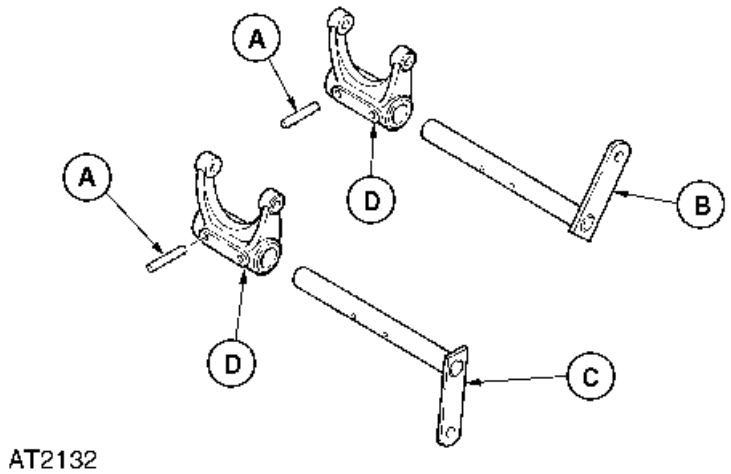
[3] -



Clutch Release Bearing Assembly

Remove clutch release bearing assembly (A).

[4] -

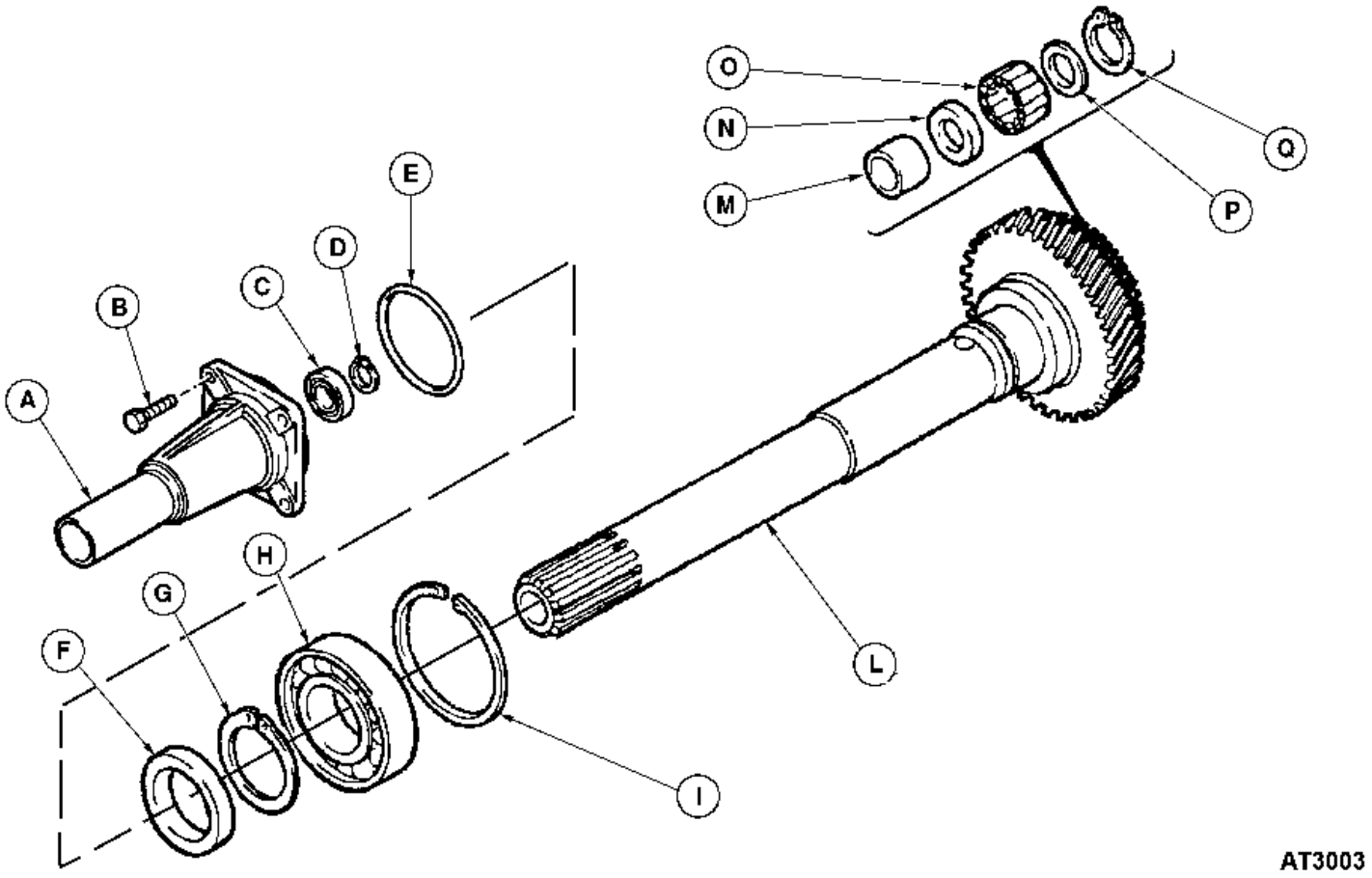


Remove Spring Pins

Remove spring pins (A).

[5] - Slide shaft (B) and (C) from clutch housing to remove parts (D).

[6] -



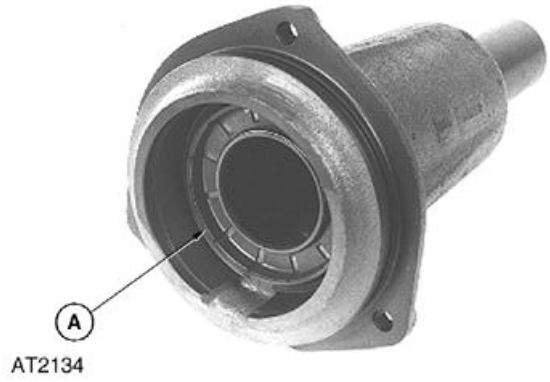
Transmission Shaft Assembly

LEGEND:	
A	Guide
B	Cap Screw (3 used)
C	Seal
D	Snap Ring
E	O-Ring
F	Seal
G	Snap ring
H	Bearing
I	Snap ring
L	Transmission shaft
M	Bushing
N	Seal
O	Bearing
P	Seal
Q	Snap ring

Remove three cap screws (B) to remove transmission shaft assembly.

[7] - Remove snap ring (I) to remove guide (A).

[8] -



Pry Out Seal

Pry out seal (A). Install seal into guide bore with lips facing toward the rear of clutch housing, until it stops, using a bushing, bearing and seal driver set.

[9] - Apply multipurpose grease to inside lips of seal.

[10] -

→NOTE:

Text of steps 10 up to 14 are in conversation to the graphic of step 6 (Transmission Shaft Assembly).

Install guide (A) to transmission shaft.

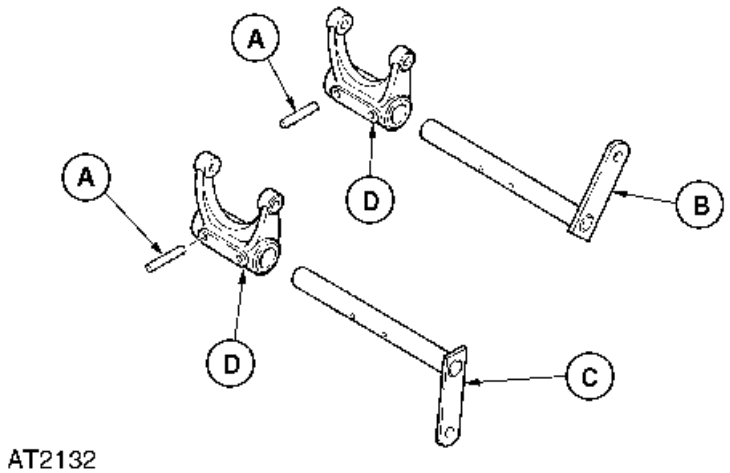
[11] - Install snap ring (I).

[12] - Replace O-ring (E).

[13] - Install transmission shaft assembly.

[14] - Install cap screw (B).

[15] -

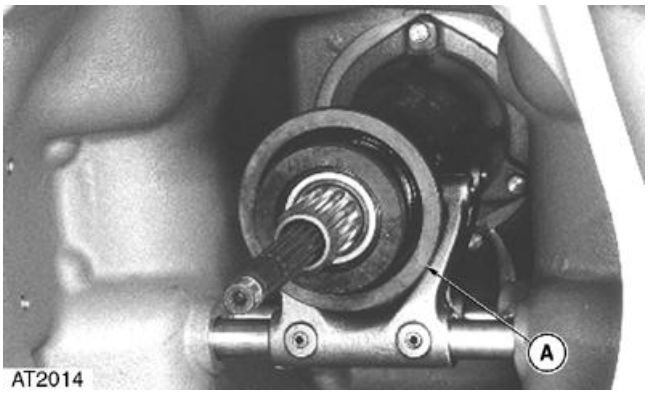


Install Parts and Shafts

Install parts (D) and shafts (B) and (C).

[16] - Install spring pins (A).

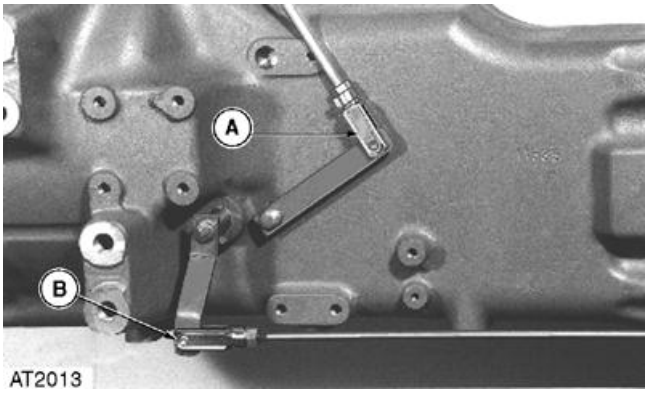
[17] -



Clutch Release Bearing Assembly

Install clutch release bearing assembly (A).

[18] -



Traction and PTO Clutch Rods

Connect traction clutch rod (A) and PTO clutch rod (B).

→NOTE:

For tractors with cab connect traction clutch cable.

[19] - Install engine to clutch housing as described in this Section.

Group 05 - Clutch

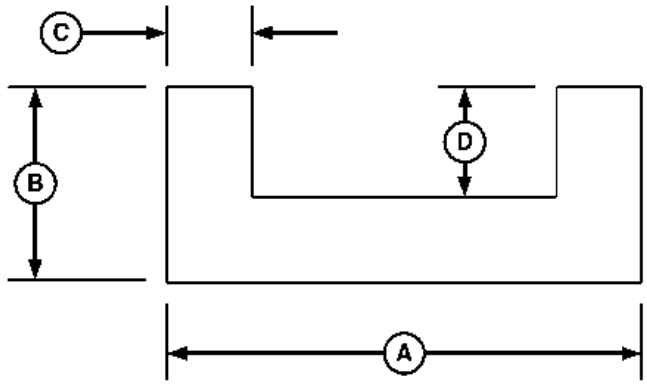
Essential Tools

→NOTE:

Order tools according to information given in the U.S. SERVICEGARD ™ Catalog or from the European Microfiche Tool Catalog (MTC).

Traction Clutch Finger Height Gauge

JDG827



LEGEND:

Plate Minimum Thickness	1.5 mm (0.06 in.)
A	157.2 mm (6.19 in.)
B	35 mm (1.38 in.)
C	19.8 mm (0.78 in.)
D	16 mm (0.63 in.)

Traction Clutch Finger Height Gauge

Measures traction clutch finger height.

Traction Clutch Finger Height Adjustment Tool

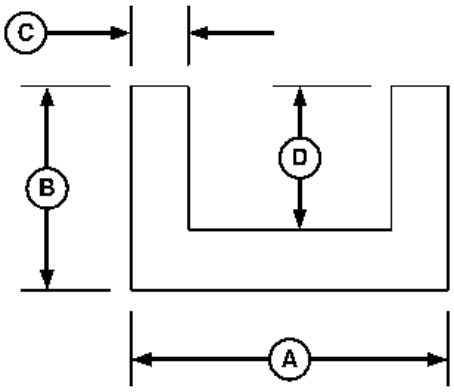
JDG828

Traction Clutch Finger Height Adjustment Tool

Adjusts traction clutch finger height.

PTO Clutch Finger Height Gauge

JDG826



LEGEND:

Plate Minimum Thickness	1.5 mm (0.06 in.)
A	124.6 mm (4.91 in.)
B	65.1 mm (2.56 in.)
C	19.8 mm (0.78 in.)
D	41.3 mm (1.63 in.)

PTO Clutch Finger Height Gauge

Measures PTO clutch finger height.

Repair Specifications

Item	Measurement	Specification
Clutch		
Clutch-to-Flywheel Cap Screw	Torque	23 N·m (17 lb-ft)
Traction Clutch Disc	Minimum Thickness	6.50 mm (0.260 in.)
Traction Clutch Front Pressure Plate	Minimum Thickness	30.00 mm (1.181 in.)
Traction Clutch rear Pressure Plate	Minimum Thickness	17.00 mm (0.669 in.)
PTO Clutch Disc	Minimum Thickness	5.50 mm (0.220 in.)
PTO Clutch Front Pressure Plate	Minimum Thickness	17.30 mm (0.680 in.)
PTO Clutch Rear Pressure Plate	Minimum Thickness	18.80 mm (0.740 in.)

Remove and Install Clutch Assembly

→NOTE:

Clutch assembly can be removed and installed without any alignment or finger adjustment procedures.

If clutch assembly has been disassembled for inspection or repair (see “PTO Clutch Finger Adjustment” and “Traction Clutch Finger Adjustment” in this Group).

[1] - Separate engine from clutch housing as described in this Section.

[2] -

CAUTION:

Clutch assembly is heavy. Support clutch before removing cap screws to prevent personal injury.

Remove Cap Screws

Remove 12 cap screws (A) and clutch assembly.

[3] - Make repairs as necessary (see procedures in this group).

[4] - Install clutch assembly and cap screws. Evenly tighten cap screws in a criss-cross pattern to 36 N·m (27 lb-ft).

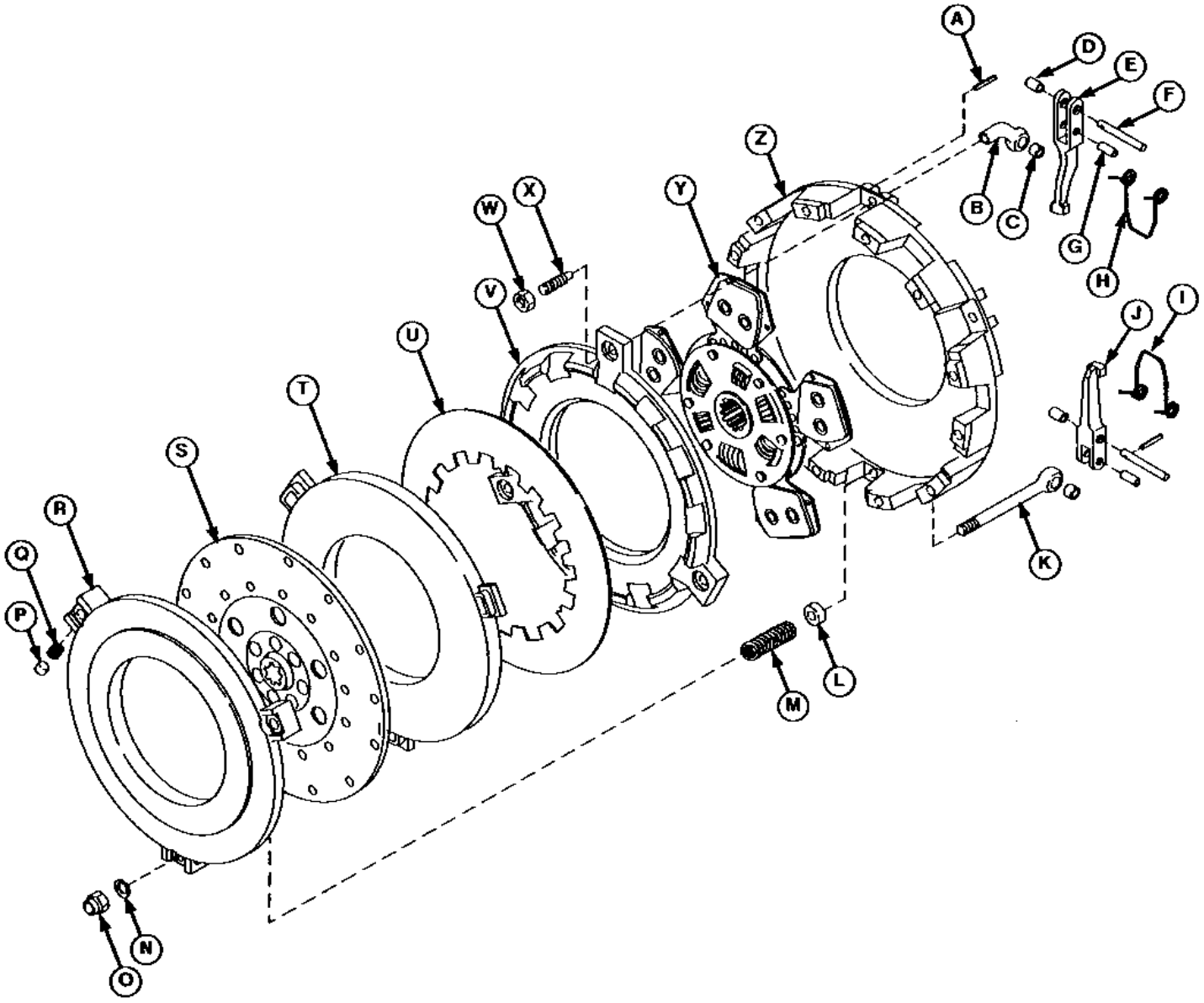
[5] - Install engine to clutch housing.

Disassemble and Inspect Clutch Assembly

Index Marks on Pressure Plates

[1] - Put index marks (A) on pressure plates to aid in assembly.

[2] -



Clutch Assembly

LEGEND:

A	Spring Pin (6 used)
B	Adjuster Cap (3 used)

C	Bushing (6 used)
D	Bushing (6 used)
E	Traction Clutch Finger (3 used)
F	Pin (6 used)
G	Pin (6 used)
H	Spring (3 used)
I	Spring (3 used)
J	PTO Clutch Finger (3 used)
K	Adjuster (3 used)
L	Spacer (3 used)
M	Spring (3 used)
N	Conical Washer (3 used)
O	Lock Nut (3 used)
P	Spacer (3 used)
Q	Spring (3 used)
R	PTO Clutch Front Pressure Plate
S	PTO Clutch Disk
T	PTO Clutch Rear Pressure Plate
U	Belleville Spring
V	Traction Clutch Front Pressure Plate
W	Nut
X	Adjuster Stud
Y	Traction Clutch Disk
Z	Traction Clutch Rear Pressure Plate

→NOTE:

Spring pins (A) must be pulled from bore to remove.

PTO clutch and traction clutch finger assemblies are serviced as separate kits. Kits are available through the parts catalog.

Disassemble parts (A) to (Z).

[3] - Inspect all parts for wear or damage. Replace as necessary.

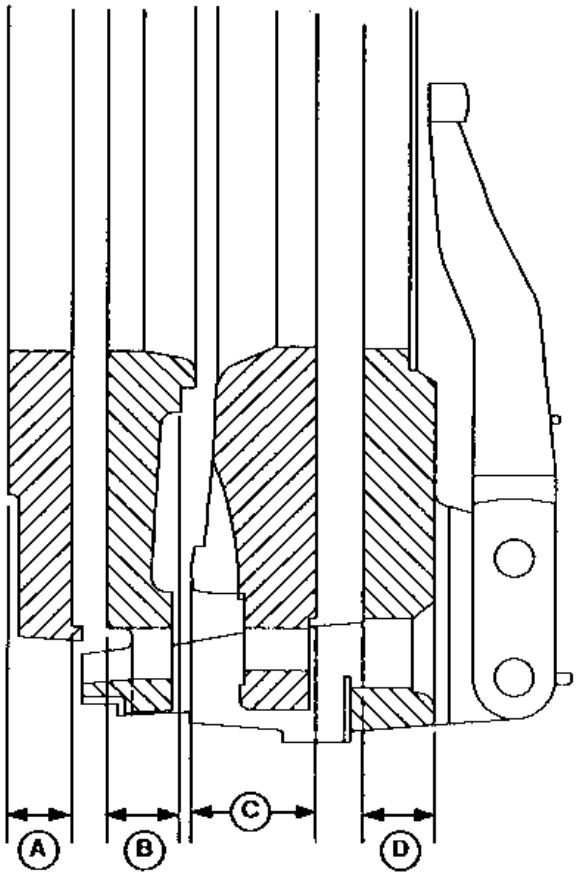
[4] - Replace lock nuts (O).

[5] - Clean any rust or oil from drive surfaces of plates (R), (T), (V) and (Z). Inspect drive surfaces for distortion, checking cracks and heat damage.

[6] - Replace clutch disks if friction surfaces are contaminated with grease or oil or if thickness of disk is not within specifications.

Item	Measurement	Specification
Traction Clutch Disk	Minimum Thickness	6.5 mm
		0.26 in.
PTO Clutch Disk	Minimum Thickness	5.5 mm
		0.22 in.

[7] -



LEGEND:

A PTO Clutch Front Pressure Plate
B PTO Clutch Rear Pressure Plate
C Traction Clutch Front Pressure Plate
D Traction Clutch Rear Pressure Plate

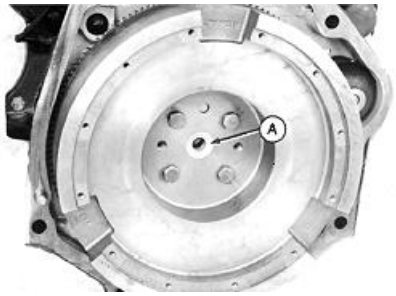
Measure Pressure Plate Thickness

Machine drive surfaces of pressure plates, if necessary, until surface is free of scores, cracks and heat discoloration.

[8] - Measure thickness of pressure plates at dimensions (A) to (D). Replace parts that are not within specifications.

Item	Measurement	Specification
Pressure Plate Minimum Thickness	Dimension (A)	17.3 mm
		0.680 in.
	Dimension (B)	18.8 mm
		0.740 in.
	Dimension (C)	30.0 mm
		1.181 in.
	Dimension (D)	17.0 mm
		0.669 in.

[9] -



Inspect Pilot Bearing

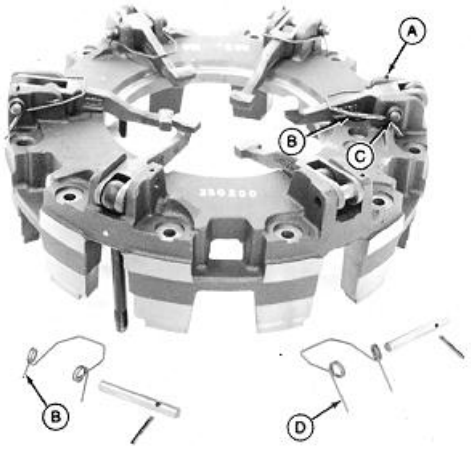
Inspect pilot bearing (A) for wear or damage. Replace if necessary (see CTM Engines).

Assemble Clutch

Clutch Fingers and Pins

[1] - Install adjusters in PTO clutch fingers (B) and traction clutch fingers (C). Install pins (A) using a press. Adjusters should pivot freely.

[2] -



LEGEND:

A	Spring Pin (6 used)
B	PTO Clutch Finger Spring (3 used)
C	Pin (6 used)
D	Traction Clutch Finger Spring (3 used)

Install Pins and Springs

Install clutch finger assemblies in traction clutch rear pressure plate.

[3] -

→NOTE:

PTO finger spring (B) has shorter tang than traction finger spring (D).

Install springs (B and D) and pins (C).

[4] - Install spring pins (A) until seated.

[5] -

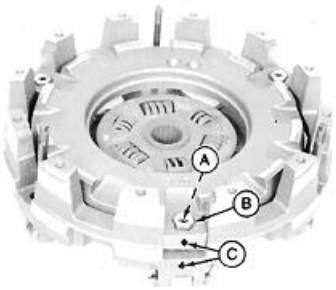
Traction Clutch Disk

IMPORTANT:

Wide edge (B) of pad must face clockwise direction.

Install traction clutch disk (A) in pressure plate with wide edge (B) of pads facing clockwise direction.

[6] -



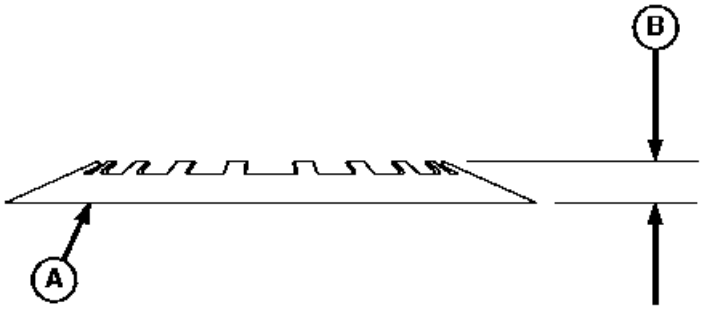
Adjuster Studs and Lock Nuts

Install traction clutch front pressure plate with index marks (C) aligned.

[7] - Install adjuster studs (A) and lock nuts (B). Check that adjuster studs are seated in adjusters.

[8] -

Belleville Spring

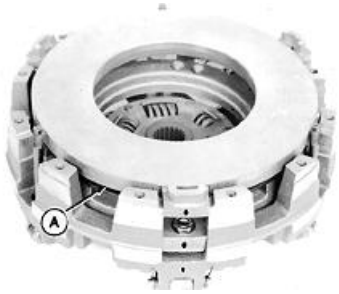


Measure Free Height Dimension

Place Belleville spring (A) on a work bench or any flat surface and measure free height dimension (B). If less then 13.3 mm (0.523 in.) replace Belleville spring.

[9] - Install Belleville spring (A) with concave side toward traction clutch pressure plate. Center spring on traction clutch pressure plate.

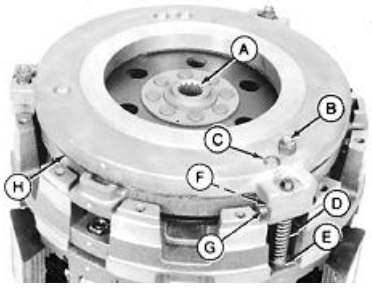
[10] -



PTO Clutch Rear Pressure Plate

Install PTO clutch rear pressure plate (A) with index marks aligned. Check that spring washer remains centered on traction clutch pressure plate and is seated in recess of PTO clutch rear pressure plate.

[11] -



LEGEND:

A	Short Hub of Clutch Disk
B	Special Nut (3 used)
C	Conical Washer (3 used)
D	Spring (3 used)
E	Spacer (3 used)
F	Spring (3 used)
G	Pin (3 used)
H	PTO Clutch Pressure Plate

Install Components

Install PTO clutch disk with short hub (A) facing out.

[12] - Install spacers (E) and springs (D) on adjusters.

[13] - Install pressure plate (H) with index marks aligned.

[14] - Install spring (F) and pin (G) in pressure plate.

[15] -

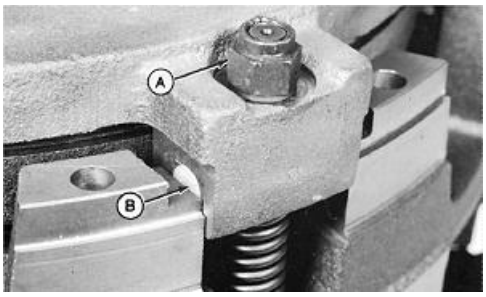
→NOTE:

Raise clutch assembly on blocks and pull PTO lever down to install special nuts.

Install washer (C) and new special nuts (B) loosely.

[16] - Align clutch discs using JDG689 Universal Clutch Alignment Tool.

[17] -



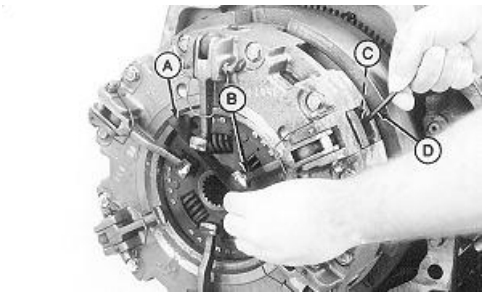
Tighten Nut and Depress Pin

→NOTE:

Conical washer must be seated in special nut before tightening.

Tighten special nut (A) while depressing pin (B), until button is in channel.

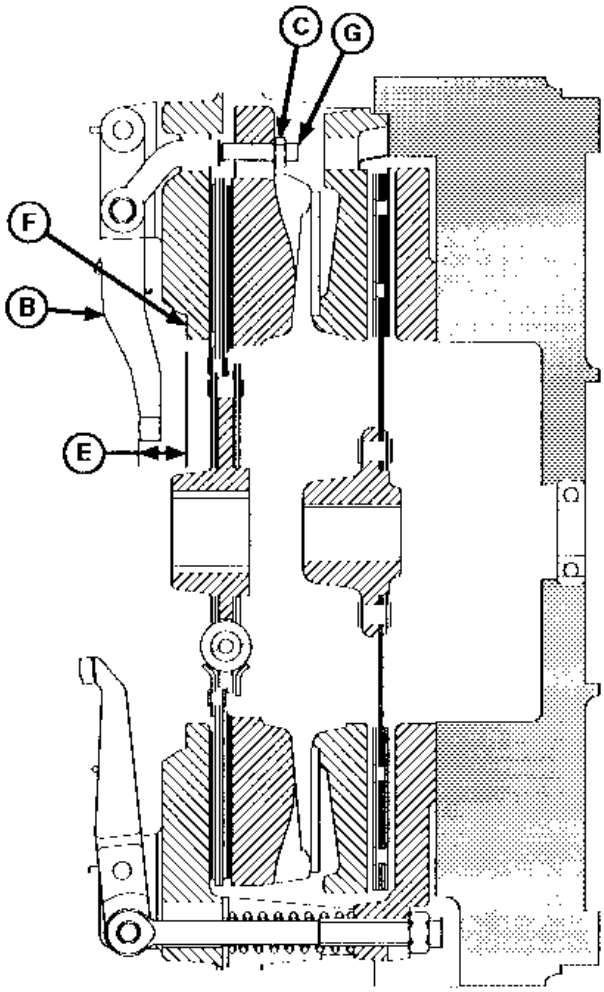
Traction Clutch Finger Adjustment



LEGEND:

A JDG827 Traction Clutch Finger Height Gauge
B Traction Clutch Finger
C Lock Nut
D JDG828 Traction Clutch Finger Height Adjustment Tool
E Distance
F Pressure Plate
G Adjuster

Traction Clutch Finger Adjustment Tool



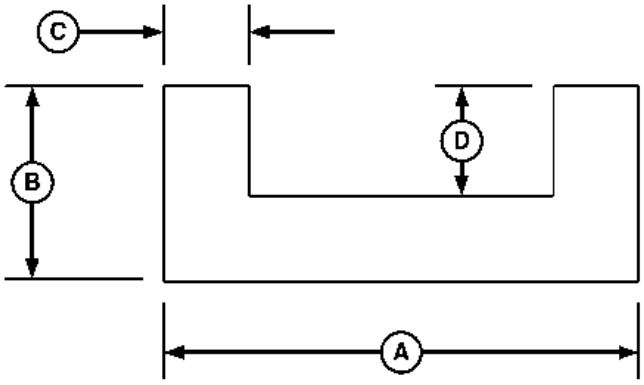
Traction Clutch Finger Adjustment

[1] - Separate engine from clutch housing as described in this Section.

[2] - Check finger height (E) from pressure plate (F) to traction clutch finger (B) using JDG827 Traction Clutch Finger Height Gauge (A).

Traction Clutch Finger Height Gauge

JDG827



LEGEND:

Plate Minimum Thickness	1.5 mm (0.06 in.)
A	157.2 mm (6.19 in.)
B	35 mm (1.38 in.)
C	19.8 mm (0.78 in.)
D	16 mm (0.63 in.)

Traction Clutch Finger Height Gauge

Measures traction clutch finger height.

[3] - Loosen jam nut (C). Turn adjuster (G) in or out until clutch finger touches gauge, using JDG828 Traction Clutch Finger Height Adjustment Tool (D).

Traction Clutch Finger Height Adjustment Tool

JDG828

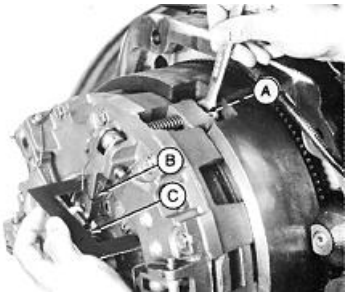
Traction Clutch Finger Height Adjustment Tool

Adjusts traction clutch finger height.

[4] - Tighten lock nut.

[5] - Repeat procedures for two remaining fingers.

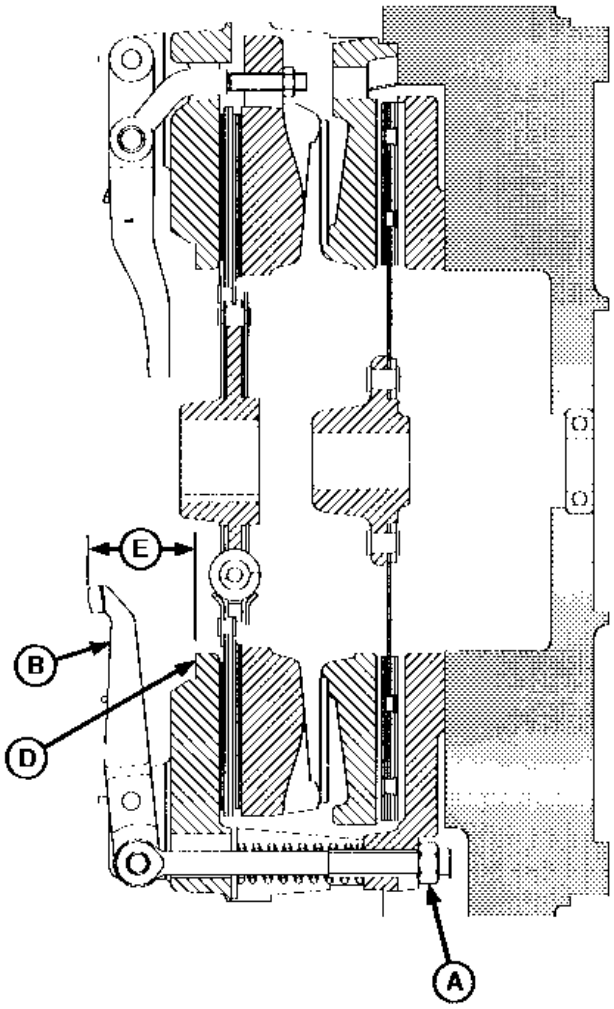
PTO Clutch Finger Adjustment



LEGEND:

A	Special Nut
B	PTO Clutch Finger
C	JDG826 PTO Clutch Finger Height Gauge
D	Pressure Plate
E	Distance

Turn Special Nut



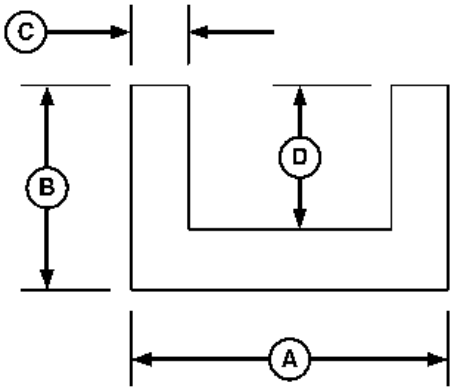
PTO Clutch Finger Adjustment

[1] - Separate engine from clutch housing as described in this Section.

[2] - Check finger height (E) from pressure plate (D) to PTO clutch finger (B) using JDG826 PTO Clutch Finger Height Gauge (C).

PTO Clutch Finger Height Gauge

JDG826



LEGEND:

Plate Minimum Thickness	1.5 mm (0.06 in.)
A	124.6 mm (4.91 in.)
B	65.1 mm (2.56 in.)
C	19.8 mm (0.78 in.)
D	41.3 mm (1.63 in.)

PTO Clutch Finger Height Gauge

Measures PTO clutch finger height.

[3] - Turn special nut (A) in or out until clutch finger touches gauge.

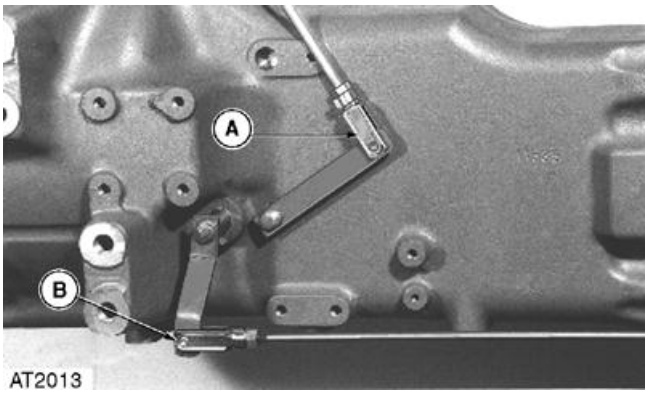
[4] - Using pliers, crimp the top of special nut to flats on finger adjusting rod.

[5] - Repeat procedures for two remaining fingers.

Remove and Inspect Clutch Release Mechanism

[1] - Separate engine from clutch housing as described in this Section.

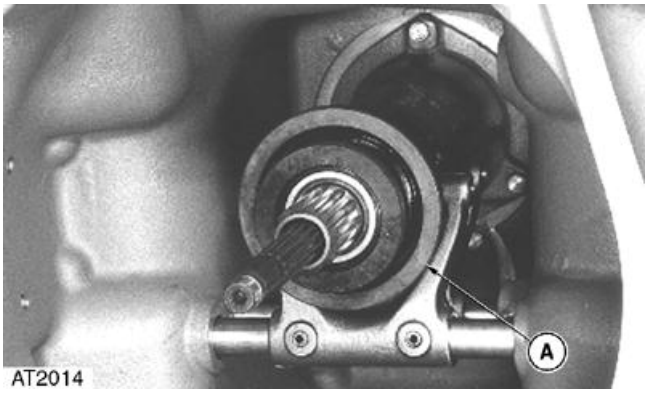
[2] -



Traction and PTO Clutch Rods

Disconnect traction clutch rod (A) and PTO clutch rod (B).

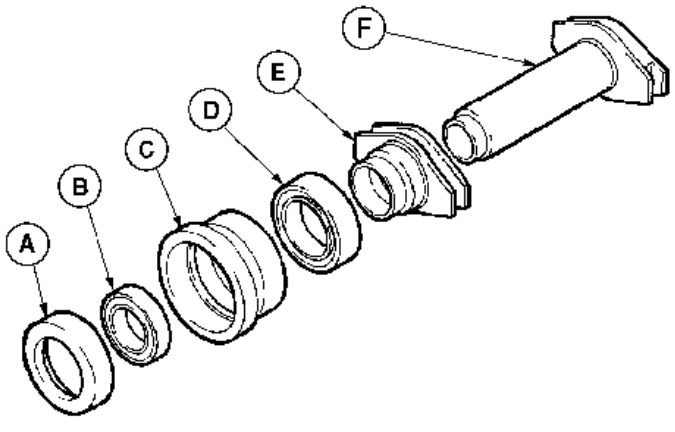
[3] -



Clutch Release Bearing Assembly

Remove clutch release bearing assembly (A).

[4] -



LEGEND:

A	Traction Clutch Collar
B	Bearing
C	PTO Clutch Collar
D	Bearing
E	PTO Clutch Sleeve
F	Traction Clutch Sleeve

Inspect Parts for Wear

Inspect parts (A) to (F) for wear or damage. Replace as necessary.

→NOTE:

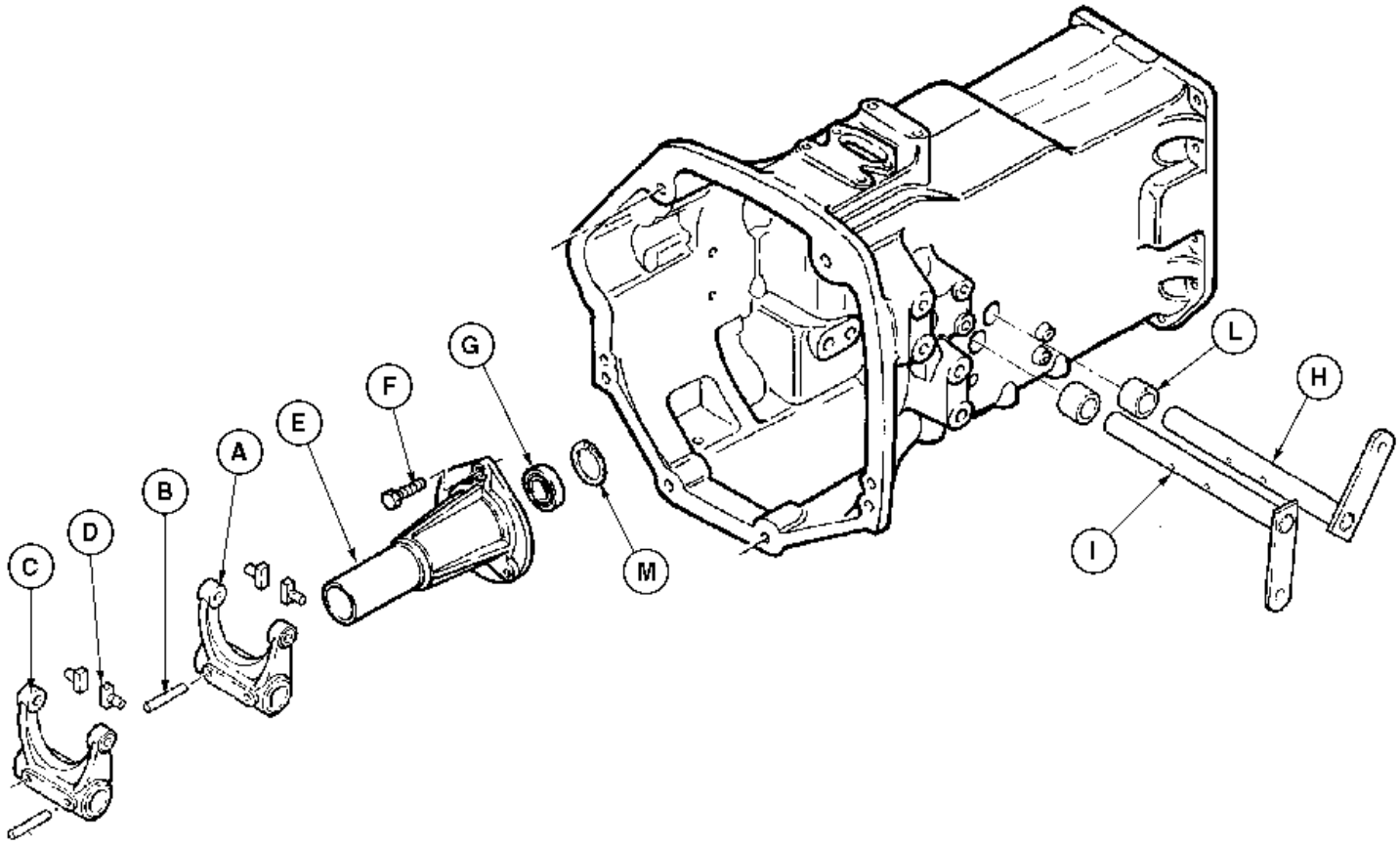
Collars (A) and (C) and bearings (B) and (D) are press fit.

Remove collars and bearings only if replacement is necessary.

Disassemble parts (A) to (F) using a knife edged puller and a press.

Assemble parts using a press.

[5] -



AT3005

Clutch Release Mechanism, Exploded View

LEGEND:

A	Traction Clutch Yoke
B	Split Pin (4 used)
C	PTO Clutch Yoke
D	Shoe (4 used)

E	Guide
F	Cap Screw (3 used)
G	Bearing
H	Traction Clutch Armshaft
I	PTO Clutch Armshaft
L	Bushing (4 used)
M	Snap Ring

Remove left-hand platform.

[6] - Remove parts (A) to (I).

→NOTE:

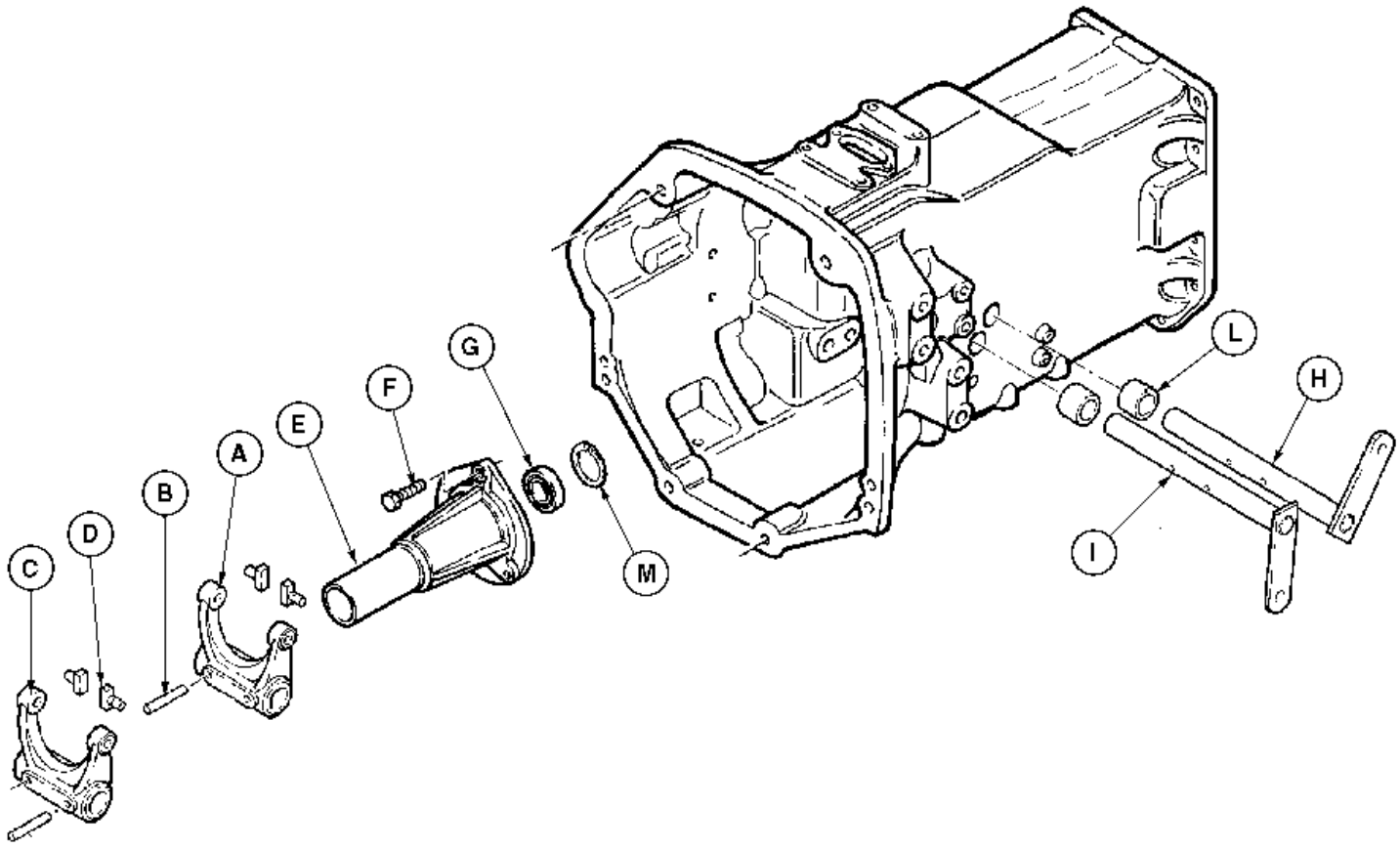
Bearing (G) and bushings (L) are press fit. Remove only if replacement is necessary.

Replace bearing (G) using a press. Replace bushings (L) using a bushing, bearing and seal driver set. Install bushings flush with clutch housing.

[7] - Inspect parts for wear or damage. Replace as necessary.

Install Clutch Release Mechanism

[1] -



AT3005

Clutch Release Mechanism

LEGEND:	
A	Traction Clutch Yoke
B	Split Pin (4 used)
C	PTO Clutch Yoke
D	Shoe (4 used)
E	Guide
F	Cap Screw (3 used)
G	Bearing
H	Traction Clutch Armshaft
I	PTO Clutch Armshaft
L	Bushing (4 used)
M	Snap Ring

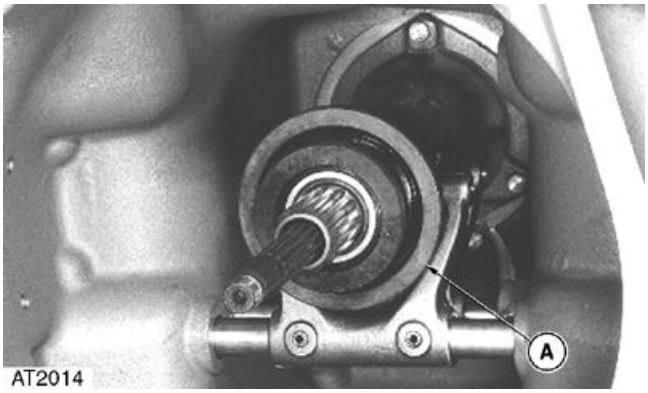
Apply Moly High Temperature EP Grease to armshafts (H) and (I), shoes (D) and shaft end of guide (E).

[2] - Install parts (A) to (I).

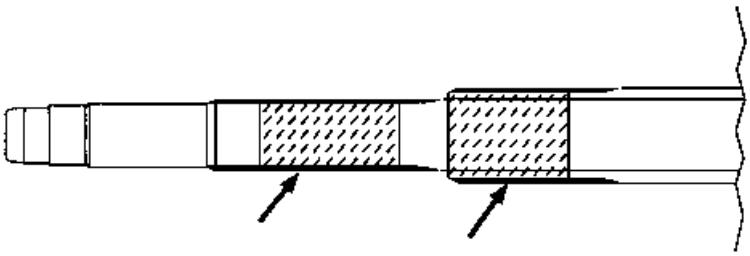
[3] - Install split pin (B).

[4] - Install left-hand platform.

[5] -



Clutch Release Bearing Assembly



AT1199

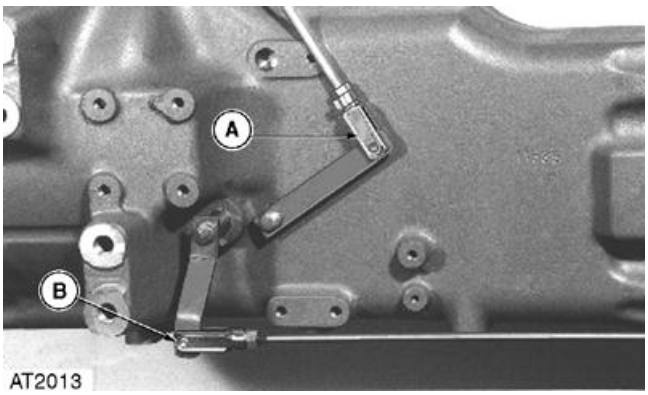
Apply Grease

Apply Moly High Temperature EP Grease to sliding surfaces of clutch release bearing assembly (A).

[6] - Install clutch release bearing assembly.

[7] - Apply Moly High Temperature EP Grease to splined ends of PTO and traction clutch shafts (hatched areas on drawing).

[8] -



PTO and Traction Clutch Rods

Connect PTO clutch rod (B) and traction clutch rod (A).

→NOTE:

For tractors with cab connect traction clutch cable.

[9] - Install engine to clutch housing as described in this Section.

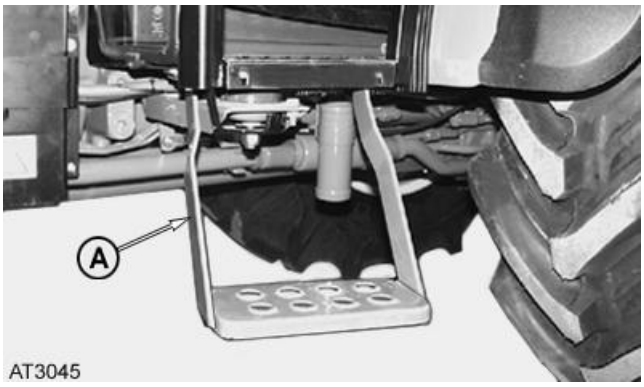
[10] - Adjust clutch pedal free-play (see procedure in Section 250).

Group 10 - Hi-Lo System (24/24-Speed Transmission)

Disassemble and Inspect Hi-Lo System

[1] - Separate engine from clutch housing as described in this Section.

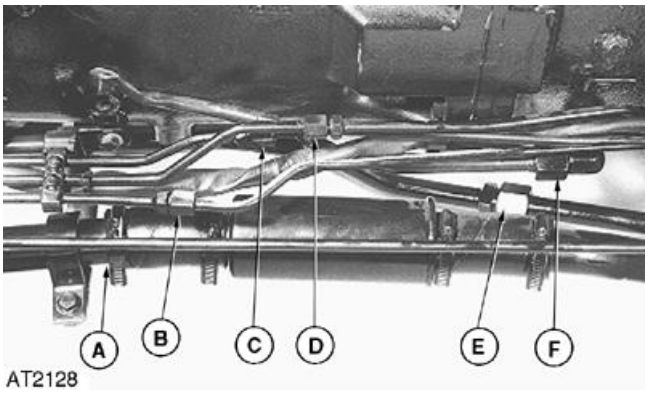
[2] -



Remove step

Remove step (A) from each side of tractor (see procedure in Section 90).

[3] -

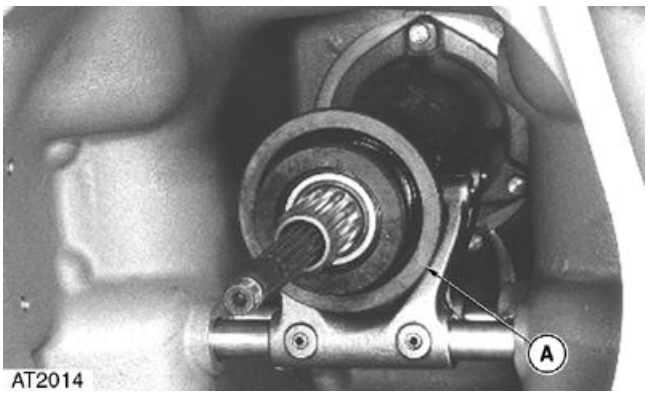


Hydraulic Lines

Disconnect hydraulic lines (A) to (F) on left side of tractor.

[4] - Remove wiring harness from rear section of tractor.

[5] -

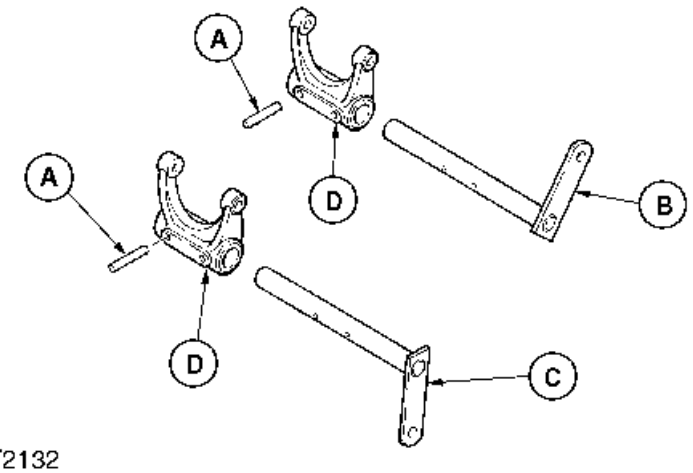


Clutch Release Bearing Assembly

Disconnect traction clutch rod and PTO clutch rod.

[6] - Remove clutch release bearing assembly (A).

[7] -



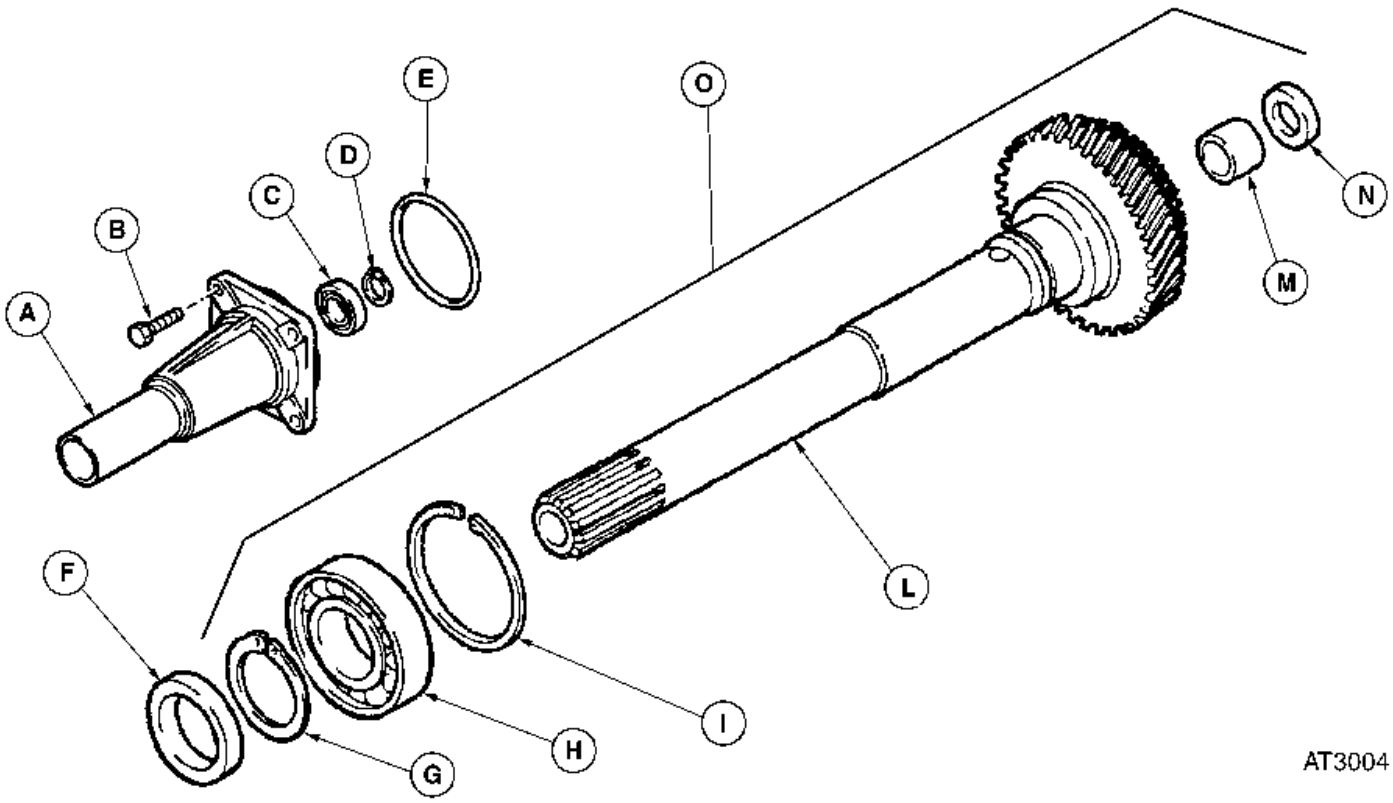
AT2132

Remove Parts

Remove spring pins (A).

[8] - Slide shaft (B) and (C) from clutch housing to remove parts (D).

[9] -



AT3004

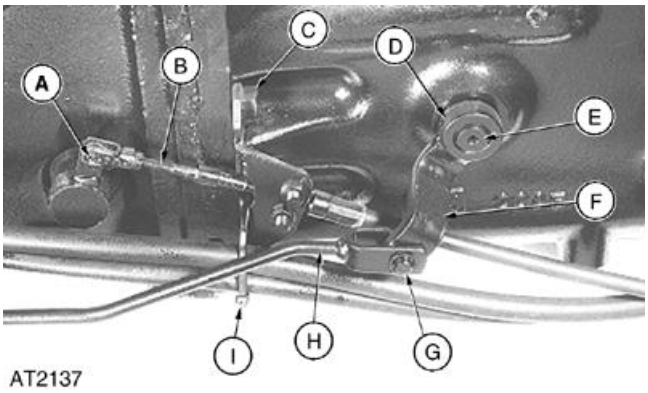
Remove Transmission Shaft Assembly

LEGEND:

A	Guide
B	Cap Screw (3 used)
C	O-Ring
D	Snap Ring
E	O-Ring
F	Seal
G	Snap Ring
H	Bearing
I	Snap Ring
L	Transmission Shaft
M	Bushing
N	Seal
O	Transmission Shaft Assembly

Remove three cap screws (B) to remove transmission shaft assembly.

[10] -



Remove Components

Remove locking pin (A) to disconnect forward-reverse control cable (B).

[11] - Remove snap ring and pin (G) to remove Hi-Lo control lever (H).

[12] - Cut tie strap (I).

[13] - Remove spring pin (D) to remove lever (F).

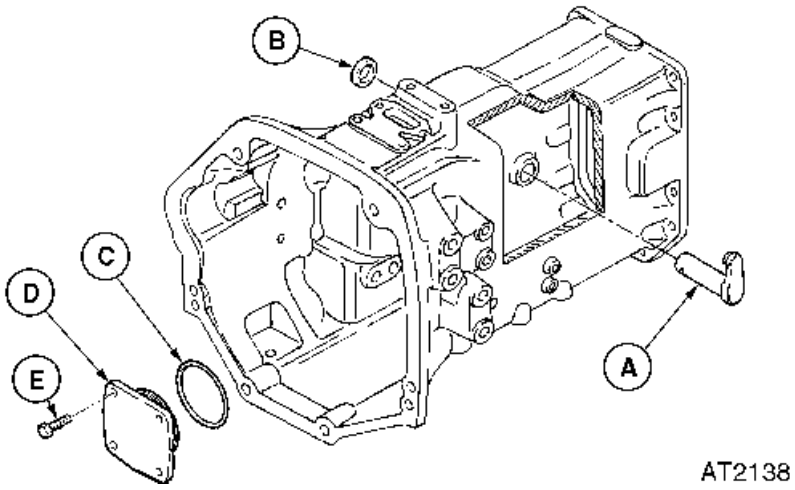
[14] - Move shift arm (E) 10 mm (0.4 in) inwards to disengage from gear shift yoke.

[15] - Install lifting chains or strap around clutch housing and attach to a hoist.

[16] - Install a support stand under transmission housing.

[17] - Remove ten cap screws (C) to remove clutch housing from transmission.

[18] -



Remove Parts

Remove shift arm (A).

[19] -

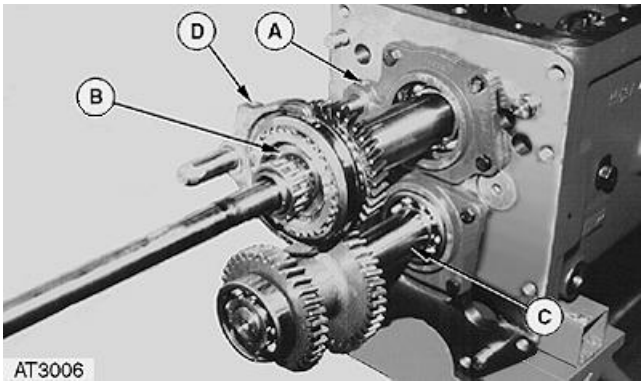
IMPORTANT:

Replace all seals and O-rings. Damaged or used seals and O-rings will leak.

Pry out seal (B). Install seal into housing bore until it stops, using a bushing, bearing and seal driver set.

[20] - Remove screw (E) and cover (D) to install new O-ring (C).

[21] -



Spring Pin, Snap Ring and Shift Fork

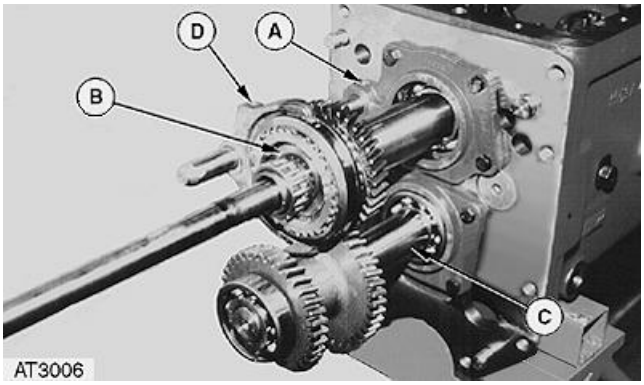
Remove spring pin (A).

[22] - Remove snap ring (B).

[23] - Remove shift fork (D) with synchronizer assembly and shaft assembly (C).

[24] - Disassemble and inspect parts as necessary (see procedure in this Group).

Assemble Hi-Lo System



Assemble Hi-Lo System

IMPORTANT:

Use new seals and O-rings during assembly. Damaged or used seals or O-rings will leak.

→NOTE:

Lubricate all internal parts with clean transmission/hydraulic oil during assembly.

→NOTE:

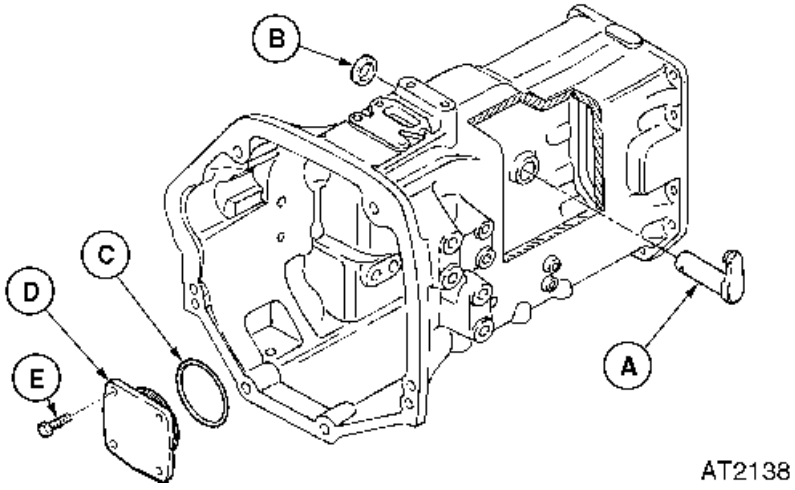
5300 - 5400 Tractors shown.

[1] - Install shaft assembly (C) with synchronizer assembly and shift fork (D).

[2] - Install spring pin (A).

[3] - Install snap ring (B).

[4] -



Install Parts

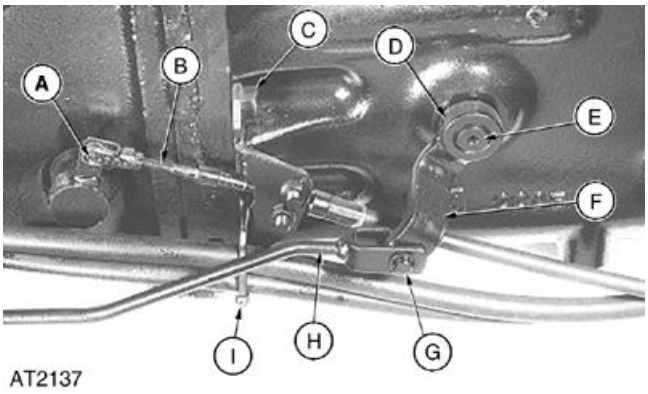
Install parts (C) to (E).

[5] - Apply multipurpose grease to inside lips of seal (B).

[6] - Install shift arm (A).

[7] - Clean mating surface of housing. Apply sealing compound to mating surface of housings.

[8] -



Install Clutch Housing

Install clutch housing to transmission. Tighten cap screws (C) to specified torque.

Item	Measurement	Specification
Screws, clutch housing to transmission housing	Torque	190 N·m 140 lb-ft

[9] - Remove lifting chain or strap.

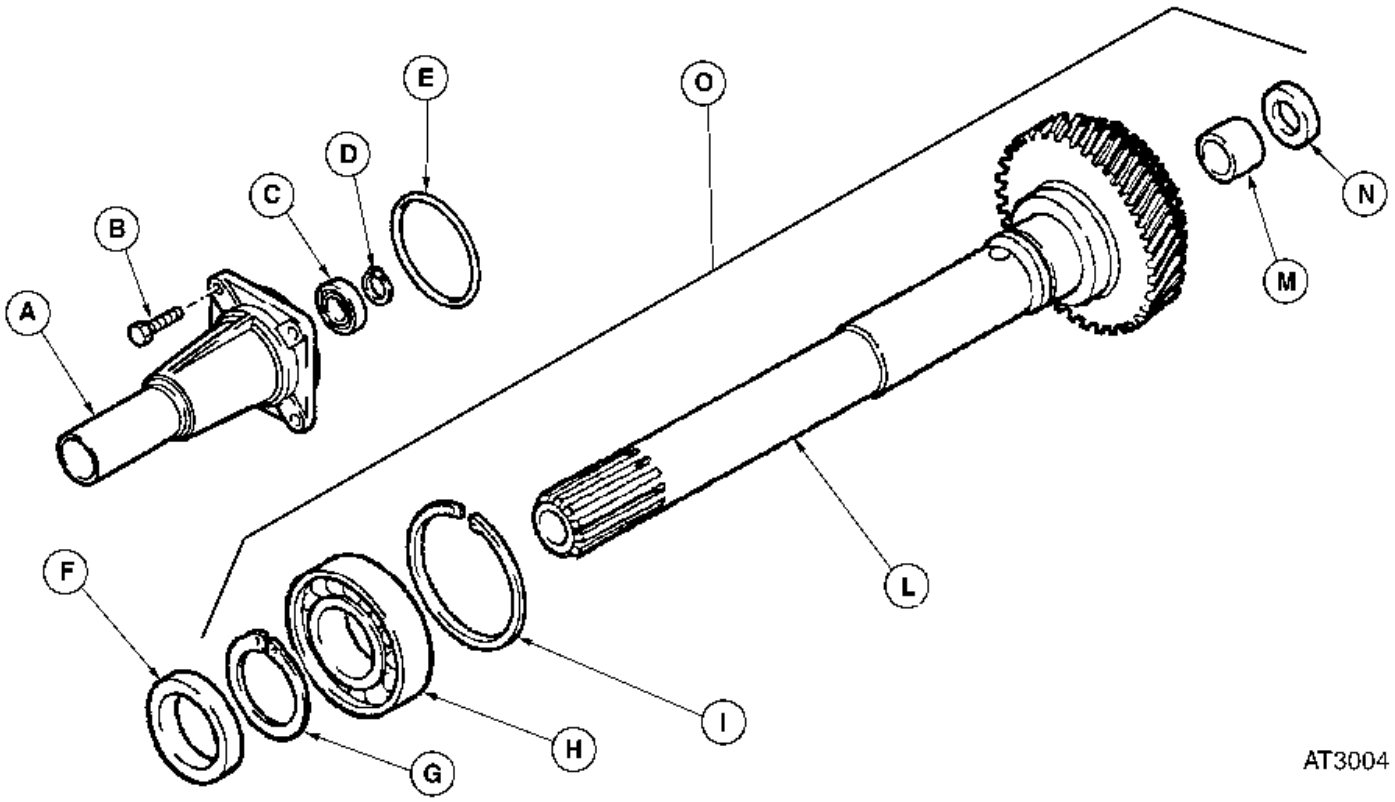
[10] - Install lever (F) and spring pin (D).

[11] - Install parts (H) and (G).

[12] - Install parts (B) and (A).

[13] - Install tie strap as necessary.

[14] -



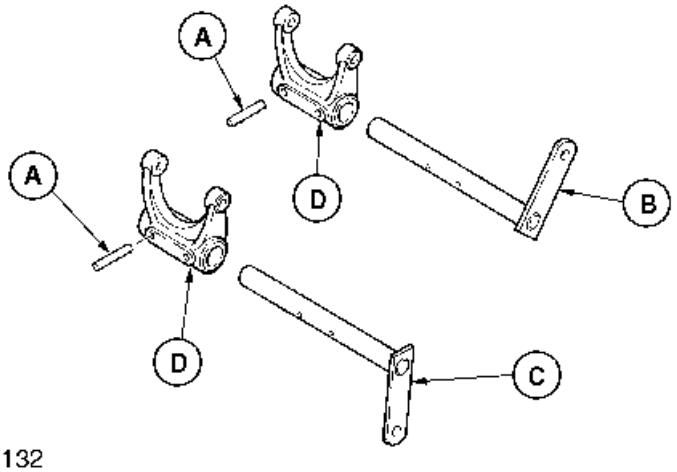
Install Transmission Shaft Assembly

LEGEND:

A	Guide
B	Cap Screw (3 used)
C	O-Ring
D	Snap Ring
E	O-Ring
F	Seal
G	Snap Ring
H	Bearing
I	Snap Ring
L	Transmission Shaft
M	Bushing
N	Seal
O	Transmission Shaft Assembly

Install transmission shaft assembly.

[15] -

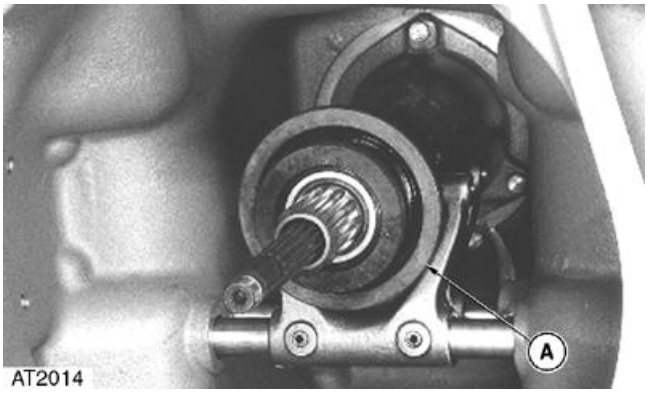


Install Parts and Shafts

Install parts (D) and shafts (B) and (C).

[16] - Install spring pin (A).

[17] -

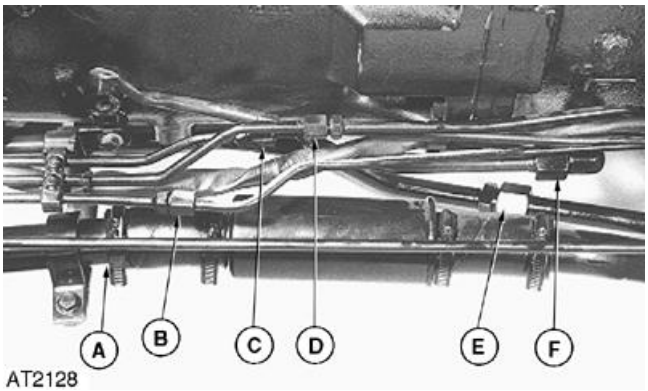


Clutch Release Bearing Assembly

Install clutch release bearing assembly (A).

[18] - Connect PTO clutch rod and traction clutch rod.

[19] -

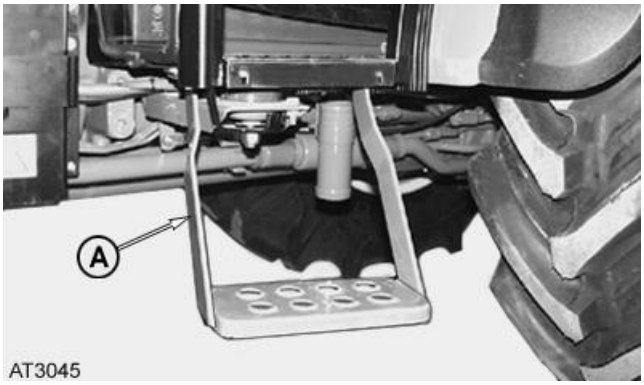


Connect Hydraulic Lines

Install wiring harness to rear section of tractor.

[20] - Connect hydraulic lines (A) to (F) on left side of tractor.

[21] -



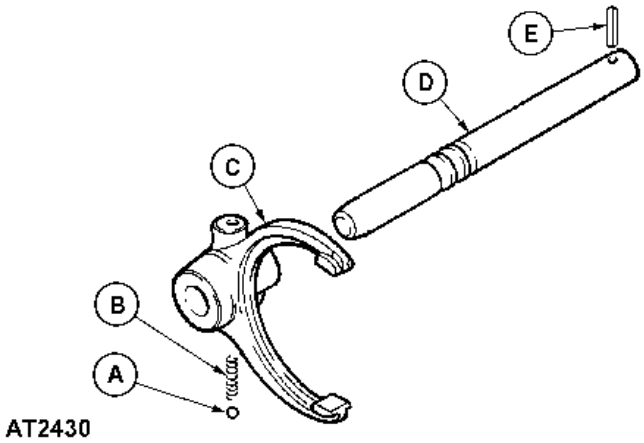
Install Plate

Install plate (A) to each side of tractor.

[22] - Install engine to clutch housing as described in this Section.

Disassemble, Inspect and Assemble Hi-Lo Shift Shaft Assembly

[1] -



LEGEND:

A	Ball
B	Spring
C	Shift Fork
D	O-Ring
E	Shift Shaft

Hi-Lo Shift Shaft Assembly

Remove shift shaft assembly from transmission as described in this Section.

[2] - Disassemble parts (A) to (E).

[3] - Inspect parts for wear or damage. Replace as necessary.

→NOTE:

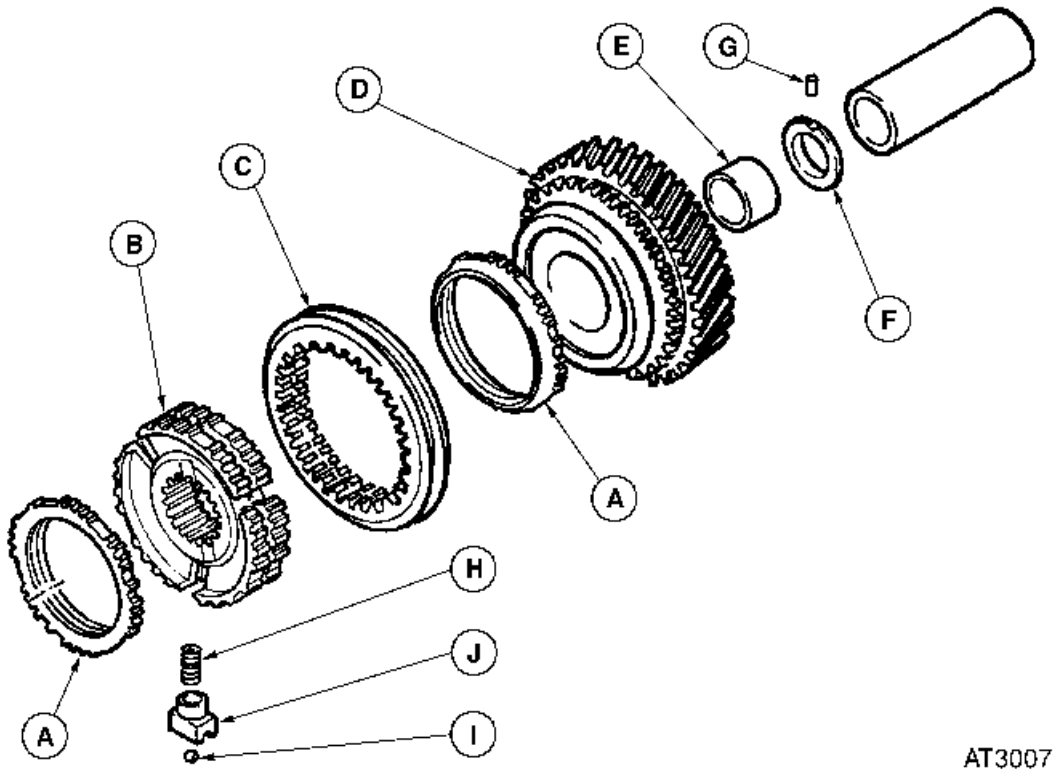
Lubricate all parts with clean transmission/hydraulic oil during assembly.

[4] - Assemble all parts.

[5] - Install shift shaft assembly to transmission as described in this Section.

Disassemble, Inspect and Assemble Hi-Lo Synchronizer

[1] -



Hi-Lo Synchronizer

LEGEND:

A	Synchronizer Ring (2 used)
B	Hub
C	Shift Collar
D	Gear
E	Bushing
F	Thrust Washer
G	Pin
H	Spring (3 used)
I	Ball (3 used)
J	Insert (3 used)

Remove Hi-Lo synchronizer assembly.

[2] - Disassemble parts (A) to (J).

[3] - Inspect parts for wear or damage. Replace as necessary.

[4] -

→NOTE:

Lubricate all parts with clean transmission/hydraulic oil during assembly.

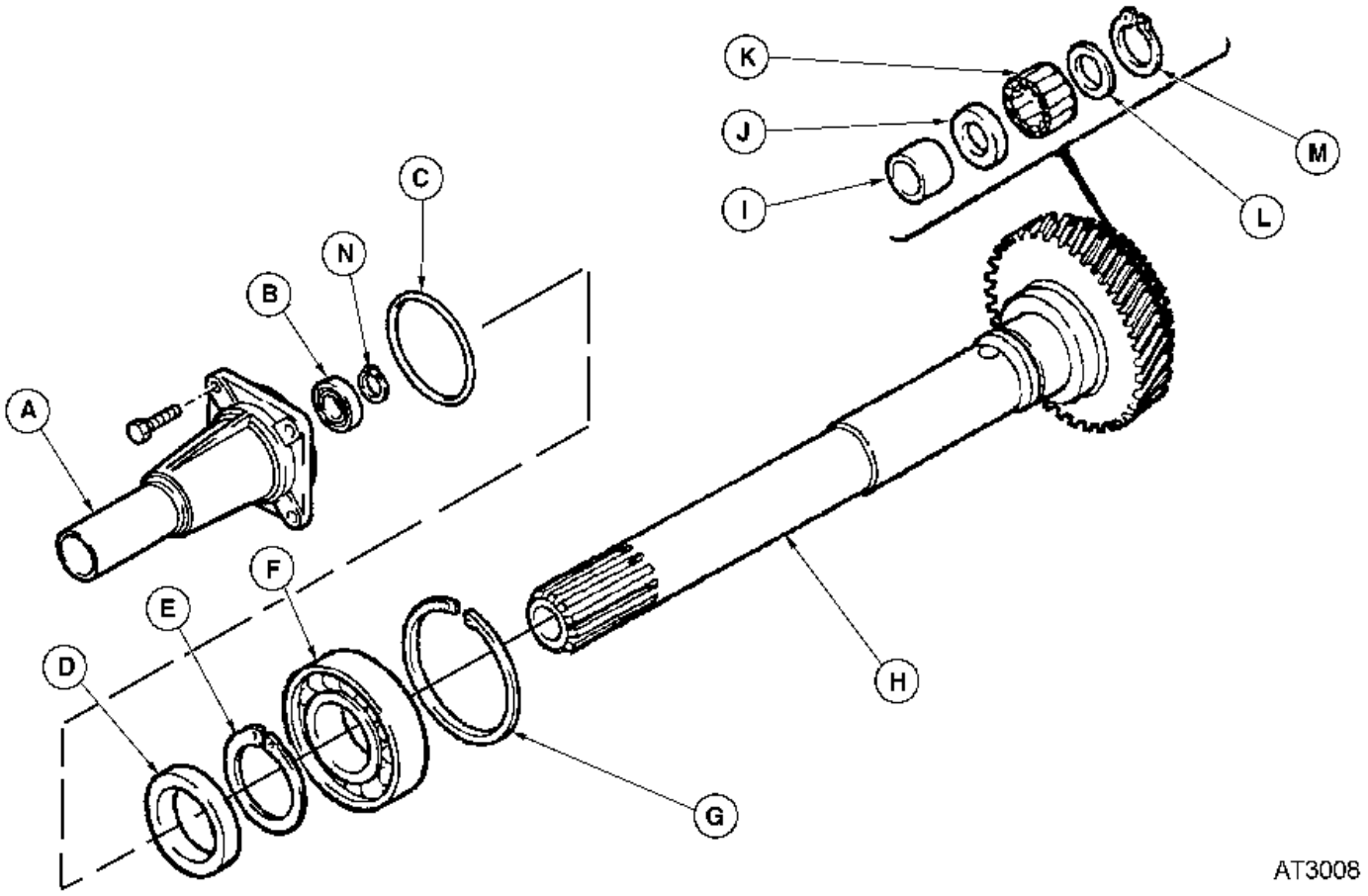
Apply lithium grease with molybdenum disulfide to inner side of gear (D).

[5] - Assemble all parts.

[6] - Install Hi-Lo synchronizer assembly (see procedure in this Group).

Disassemble, Inspect and Assemble Hi-Lo Drive Shaft

[1] -



Hi-Lo Drive Shaft

LEGEND:

A	Guide
B	Bearing
C	O-Ring
D	Seal
E	Snap Ring
F	Bearing
G	Snap Ring
H	Drive Shaft
I	Bushing
J	Seal
K	Roller Bearing
L	Ring
M	Snap Ring
N	Snap Ring

Remove drive shaft assembly (see procedure in this Group).

[2] -

→NOTE:

Bushing (I) is press fit in shaft (H). Remove bushing only if replacement is necessary.

Remove parts (A) to (M).

[3] - Inspect parts for wear or damage. Replace as necessary.

→NOTE:

Lubricate all parts with clean transmission/hydraulic oil during assembly.

[4] -

IMPORTANT:

Replace all seals and O-Rings. Damaged seals and O-rings will leak.

Install parts (B), (N), (C) and seal (D) with lips facing towards the rear of clutch housing.

[5] - Put snap ring (G) to shaft (H) and install parts (E) and (F).

[6] - Install guide assembly (A) to shaft assembly (H).

[7] - Install bushing (I) and seal (J).

→NOTE:

Install seal (J) with lips facing toward the rear of clutch housing.

→NOTE:

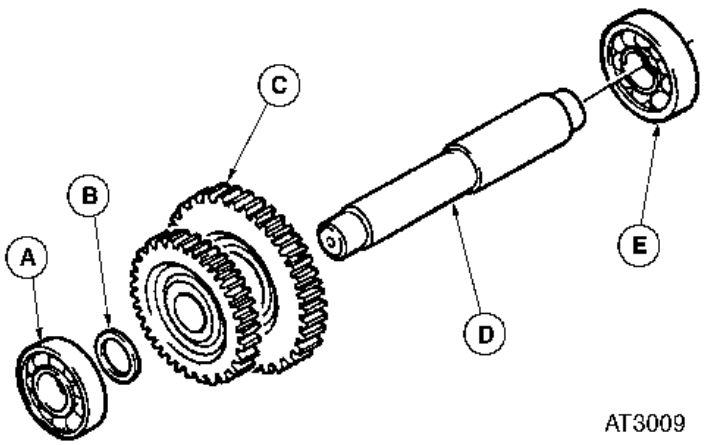
Apply multipurpose grease to inside lips of seals.

[8] - Install parts (K), (L) and snap ring (M).

[9] - Install drive shaft assembly as described in this Group.

Disassemble, Inspect and Assemble Hi-Lo Reduction Shaft

[1] -



LEGEND:

A	Bearing
B	Spacer
C	Reduction Gear
D	Shaft
E	Bearing

Hi-Lo Reduction Shaft-Exploded View

5300 and 5400

5000

Remove reduction shaft assembly (see procedure in this Section).

[2] -

→NOTE:

Bearing (A) and (E) are press fit on shaft.

Remove bearings (A) and (E) using a knife-edged puller and a press.

[3] - Remove all parts.

[4] - Inspect all parts for wear or damage. Replace as necessary.

[5] -

→NOTE:

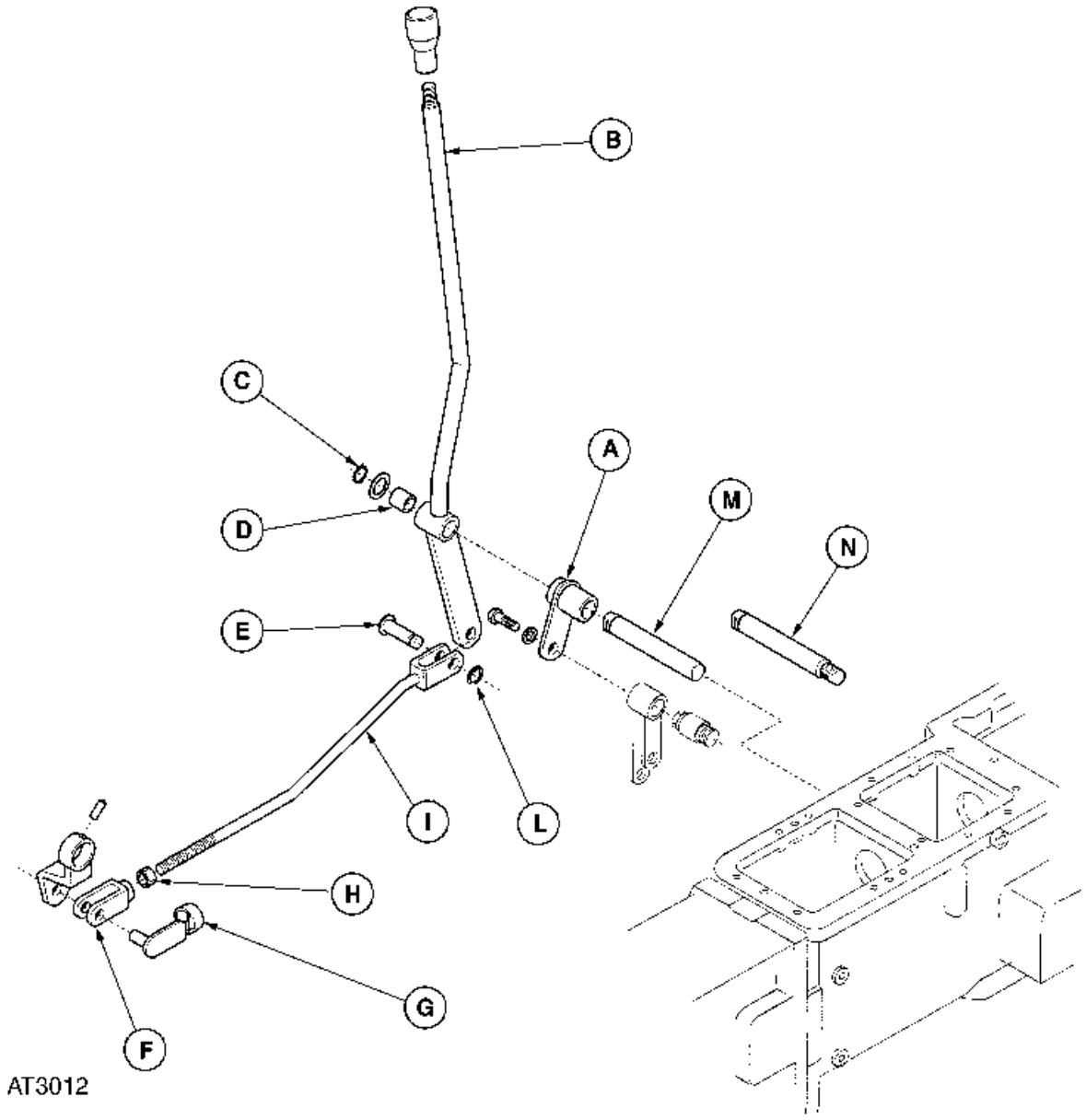
Lubricate all parts with clean transmission/hydraulic oil during assembly.

Install all parts. Install bearings (A) and (E) using a bearing, bushing and seal driver set and a press.

[6] - Install reduction shaft assembly (see procedure in this Section).

Inspect and Repair Hi-Lo Shift Lever (For Tractors Without Cab)

[1] -



HI-LO Shift Lever, exploded view

LEGEND:

A	Support
B	Lever
C	Snap Ring
D	Bushing
E	Pin
F	Yoke
G	Locking Pin
H	Nut
I	Rod
L	Snap Ring
M	Fixing Pin (old version)
N	Fixing Pin (new version)

Remove right-hand rear wheel and fender

→NOTE:

Shaft (F) is press fit in transmission housing.

→NOTE:

Bushing (G) is press fit. Remove bushing only if replacement is necessary.

Replace bushing (G) using a bearing, bushing and seal driver set.

[2] - Remove seat and right-hand lever cover (see procedure in Section 90).

[3] - Remove right-hand plate and foot board.

[4] - Remove snap ring (C).

[5] - Remove snap ring (L) and pin (E).

[6] - Replace Hi-Lo shift lever assembly (with bushing D).

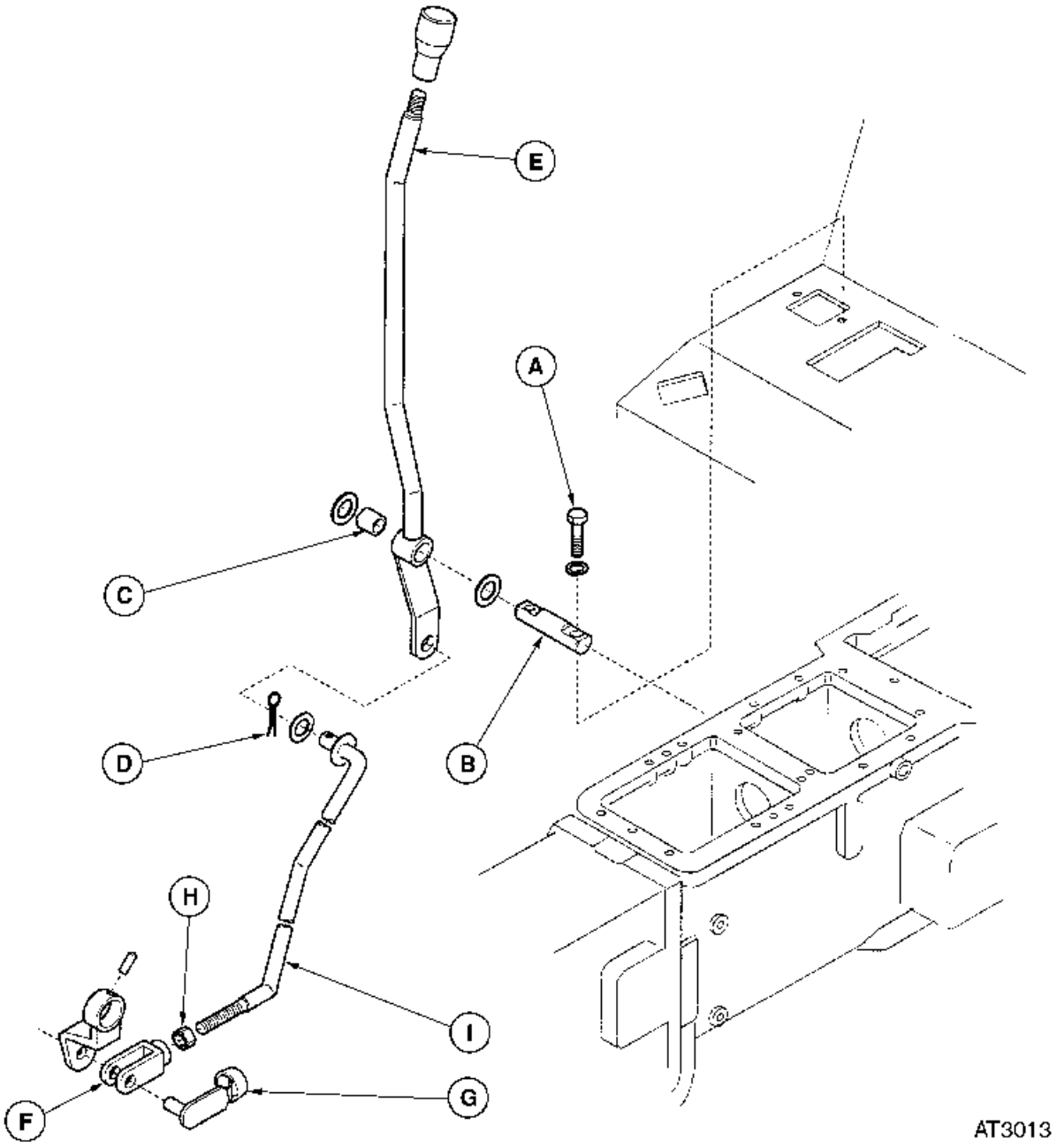
[7] - Inspect all parts for wear or damage. Replace as necessary.

[8] - Install all cover, plate and foot board.

[9] - Install right-hand rear wheel and fender.

Inspect and Repair Hi-Lo Shift Lever (For Tractors With Cab)

[1] -



HI-LO Shift Lever, exploded view

LEGEND:	
A	Fixing Screws
B	Pin
C	Bushing
D	Cotter Pin
E	Lever
F	Yoke
G	Locking Pin
H	Nut
I	Rod

Remove right plastic covering.

[2] - Remove cap screws (A).

[3] - Remove seat and right-hand lever cover (see procedure in Section 90).

[4] - Remove cotter pin.

[5] - Replace Hi-Lo shift lever assembly (with bushing C).

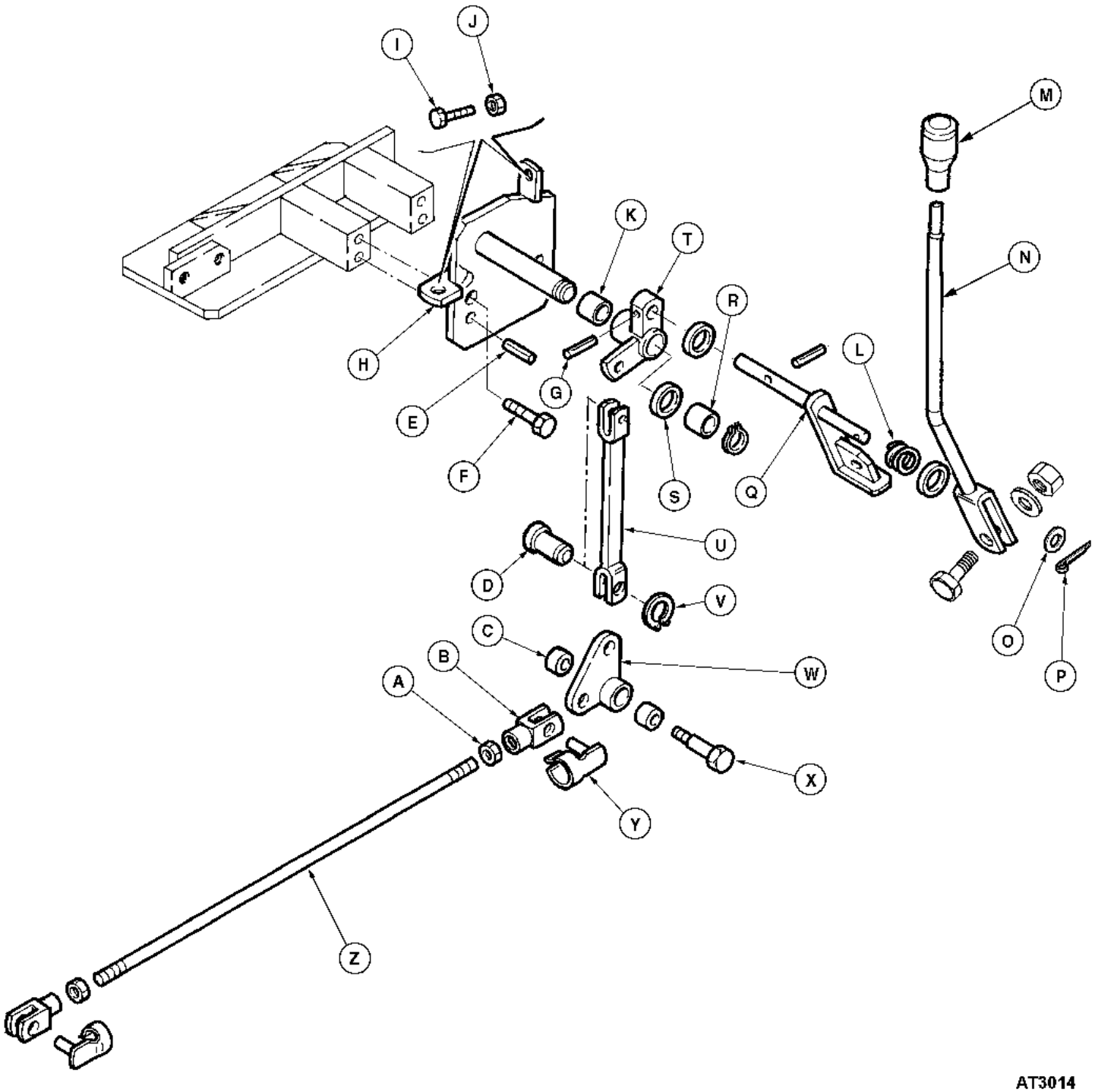
[6] - Inspect all parts for wear or damage. Replace as necessary.

[7] - Install right-hand lever cover, fixing screws (A) and its plastic covering.

Group 15 - Power Take-Off

Inspect and Repair Rear PTO Clutch Lever and Linkage (For Tractors without Cab)

[1] -



Rear PTO Clutch Lever and Linkage

Remove left-hand rear wheel and fender.

→NOTE:

Bushings (C) and (K) are press fit. Remove bushings only if replacement is necessary.

Replace bushing (C) or (K) using a bearing, bushing and seal driver set.

[2] - Inspect all parts for wear or damage. Replace as necessary.

[3] - Replace bushing (C) or (K) using a bearing, bushing and seal driver set.

[4] - Inspect all parts for wear or damage. Replace as necessary.

[5] - Apply Moly High Temperature EP Grease to shaft of bolt (X) and to shaft of support (H).

[6] - Install left-hand fender wheel.

[7] - Install rear wheel and tighten wheel nuts to specified torque.

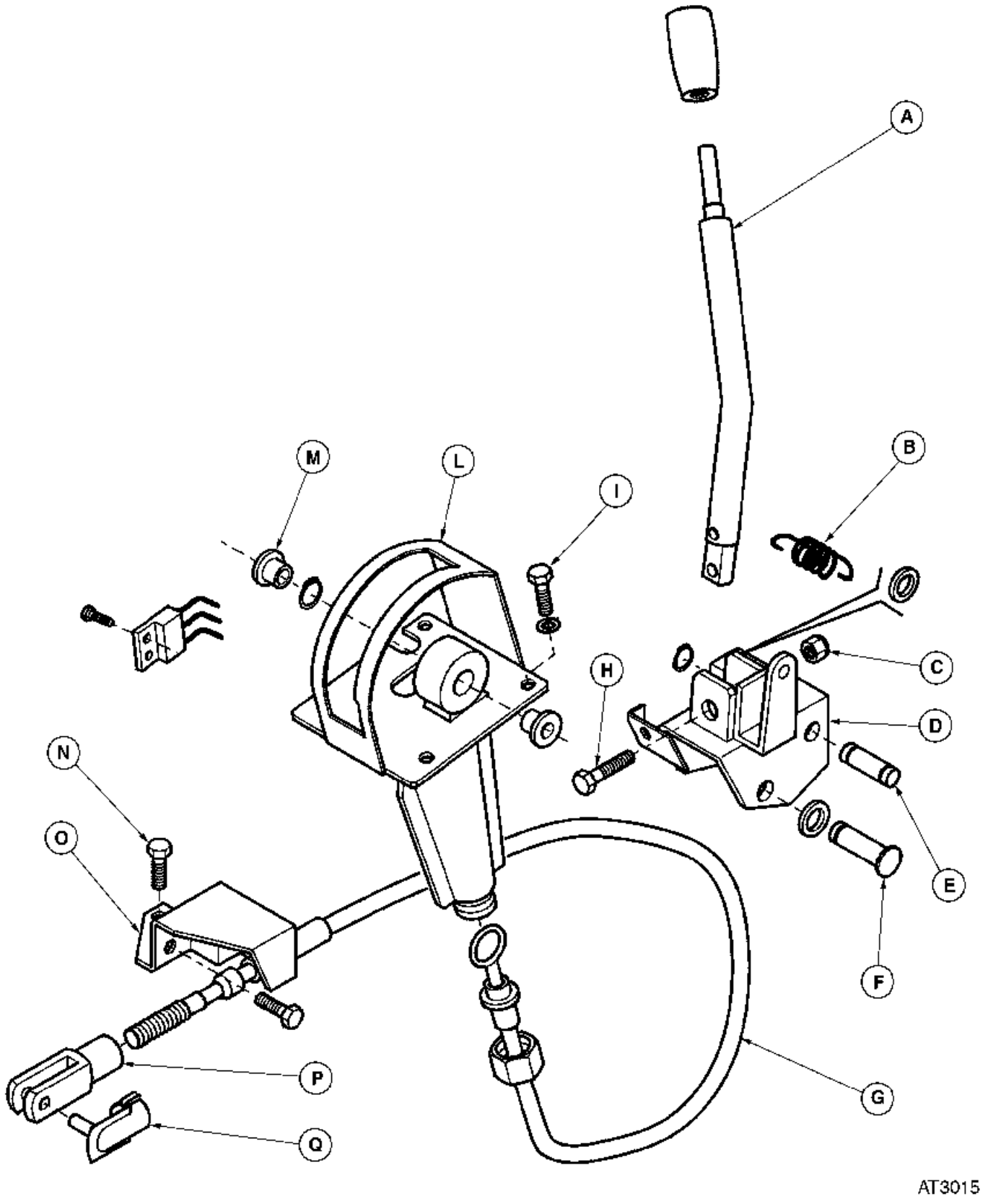
Item	Measurement	Specification
Cap screws, rear wheel to axle flange	Torque	400 N·m
		300 lb-ft

[8] - Adjust PTO clutch lever (see procedure in Section 250).

[9] - Adjust clutch lever free play (see procedure in Section 250).

Inspect and Repair Rear PTO Clutch Lever and Linkage (For Tractors with Cab)

[1] -



Rear PTO Clutch Lever and Linkage

LEGEND:

A	PTO Clutch Control Lever
B	Spring

C	Nut
D	Support
E	Pin
F	Pin
G	Control Cable
H	Fixing Bolt
I	Bolt
L	Support
M	Bushing
N	Cap Screw
O	Support
P	Yoke
Q	Locking Pin

Remove seat and left-hand lever cover (see procedure in Section 90).

[2] - Remove left-hand plate and foot board.

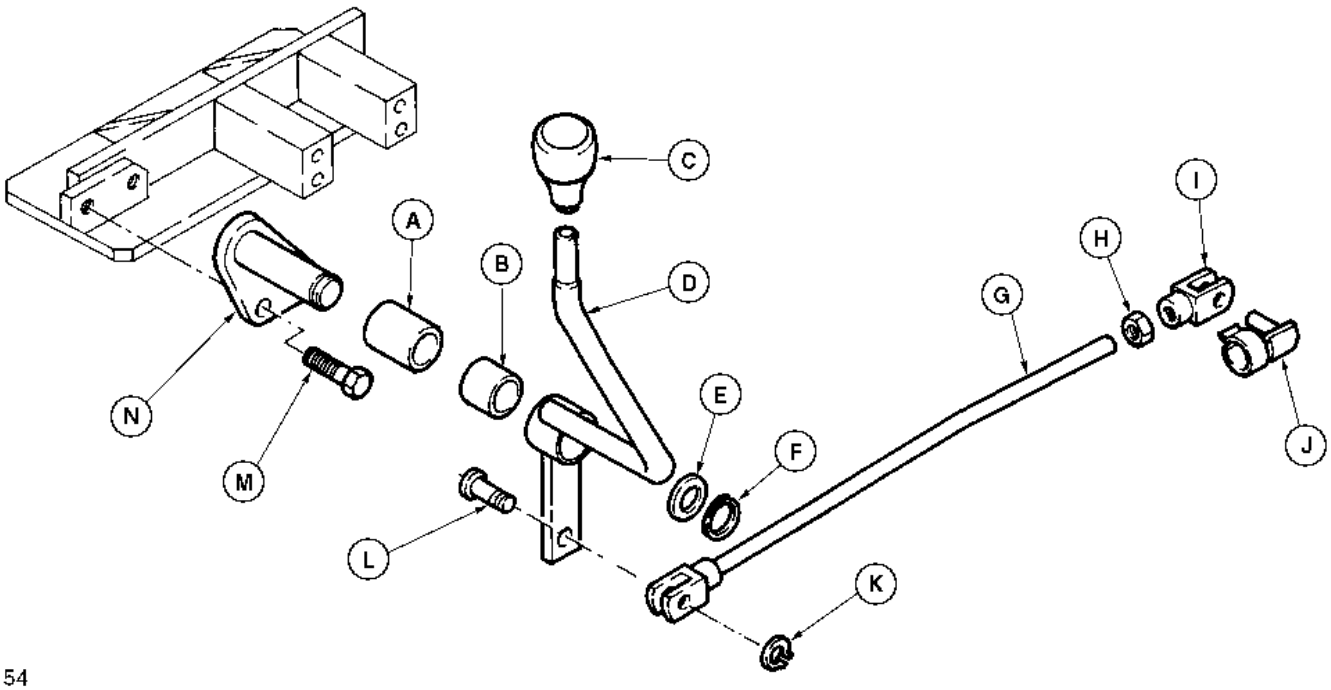
[3] - Remove fixing bolt (H) and spring (B).

[4] - Inspect all parts for wear or damage. Replace as necessary.

[5] - Apply Moly High Temperature EP Grease to fixing bolt (H).

[6] - Install left-hand lever cover, seat, plate and foot board.

Inspect and Repair Rear PTO Selector Lever and Linkage (For Tractors without Cab)



AT2154

Rear PTO Selector Lever and Linkage

LEGEND:

A	Collar
B	Bushing
C	Knob
D	Engagement Lever
E	Washer
F	Snap Ring
G	Rod
H	Lock Nut
I	Yoke
J	Locking Pin
K	Snap Ring
L	Pin
M	Cap Screw (2 used)
N	Support

[1] - Remove left-hand rear wheel and fender.

→NOTE:

Bushing (B) is press fit. Remove bushing only if replacement is necessary.

Replace bushing (B) using a bearing, bushing and seal driver set.

[2] - Inspect all parts for wear or damage. Replace as necessary.

[3] - Apply Moly High Temperature EP Grease to shaft of support (N).

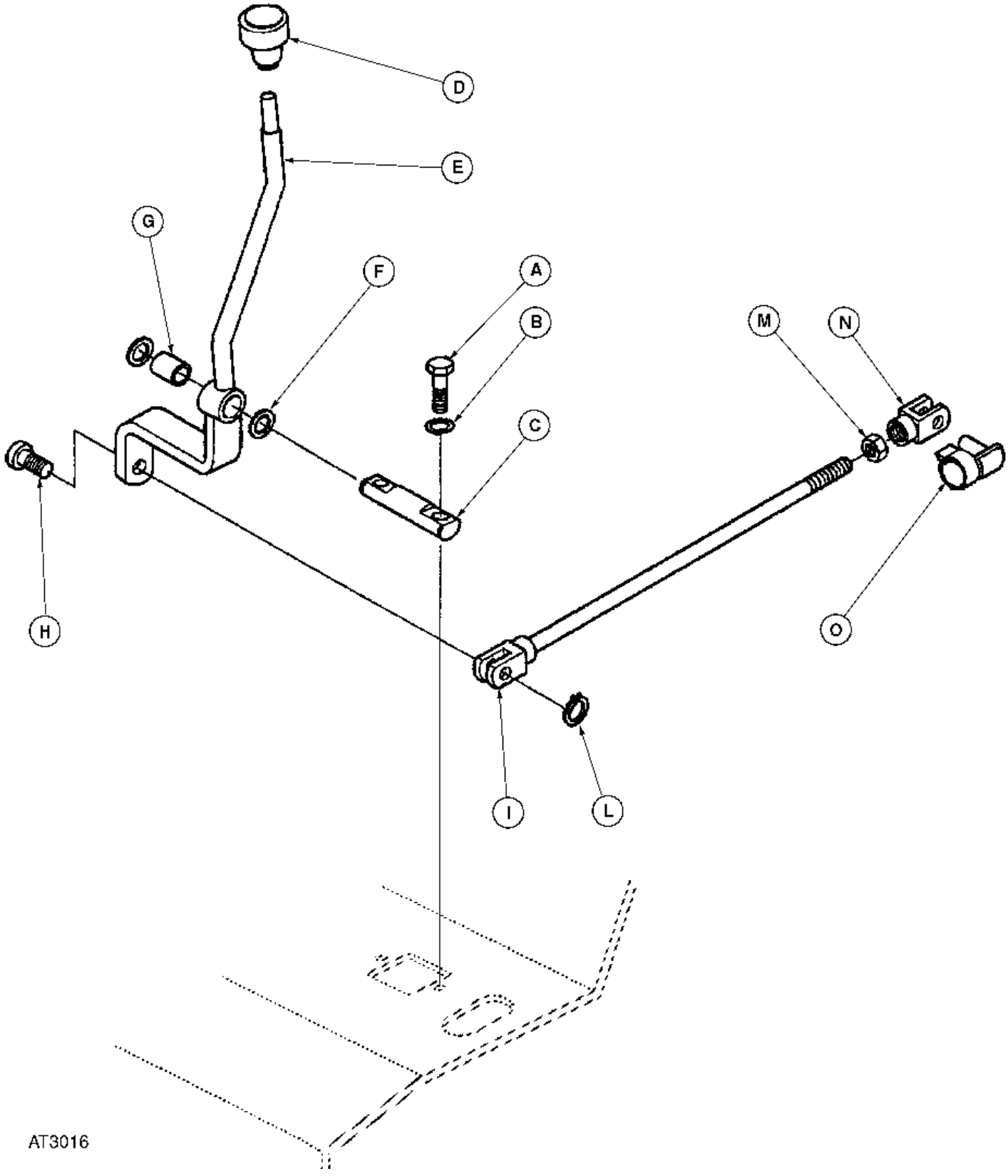
[4] - Install left-hand fender and wheel.

[5] - Install rear wheel and tighten wheel nuts to specified torque.

Item	Measurement	Specification
Cap screws, rear wheel to axle flange	Torque	400 N·m 300 lb-ft

Inspect and Repair Rear PTO Selector Lever and Linkage (For Tractors with Cab)

[1] -



Rear PTO Selector Lever and Linkage

LEGEND:

A	Cap Screw (2 used)
B	Washer
C	Pin

D	Knob
E	Rear PTO Selector
F	Washer (2 used)
G	Bushing
H	Pin
I	Rod
L	Snap Ring
M	Nut
N	Yoke
O	Locking Pin

Remove left plastic covering (see procedure in Section 90).

[2] - Remove seat.

[3] - Remove fixing bolts (A) and washers (B).

[4] - Remove left-hand lever cover (see procedure in Section 90).

[5] - Remove pin (L).

[6] - Replace rear PTO selector lever.

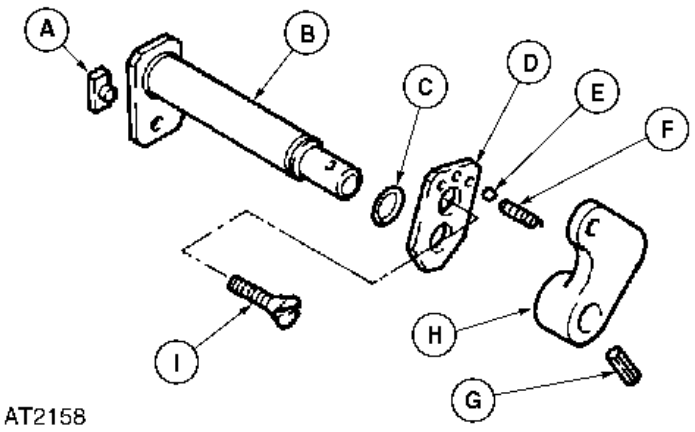
[7] - Inspect all parts for wear and damage. Replace as necessary.

[8] - Apply Moly High Temperature EP Grease to fixing bolt (H).

[9] - Install left-hand lever cover, seat and left plastic covering.

Disassemble, Inspect and Assemble Rear PTO Engagement Control

[1] -



LEGEND:

A	Pad
B	Shaft
C	O-Ring
D	Plate
E	Ball
F	Spring
G	Spring Pin
H	Lever
I	Screw

Exploded View, Rear PTO Engagement Control

Remove rockschaft case (see procedure in Section 70).

[2] - Remove spring pin (G) to remove lever (H), spring (F) and ball (E).

[3] - Remove screw (I) and plate (D).

[4] - Remove engagement sleeve (see procedure in this Group).

[5] - Remove shaft (B) from housing.

[6] -

IMPORTANT:

Replace O-Ring. Damaged or used O-Rings will leak.

Install O-ring into shaft groove.

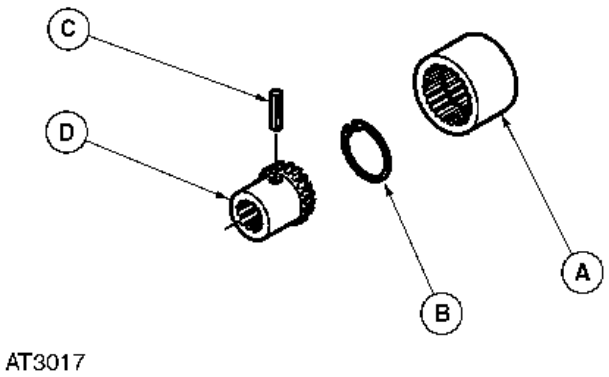
[7] - Inspect all parts for wear or damage. Replace as necessary.

[8] - Assemble all parts.

[9] - Install rockshaft case (see procedure in Section 70).

Disassemble, Inspect and Assemble Rear PTO Engagement Sleeve (Models without Ground Speed PTO)

[1] -



AT3017

LEGEND:

A	Sleeve
B	Snap Ring
C	Spring Pin
D	Sleeve

Exploded View, Rear PTO Engagement Sleeve

Remove rockshaft case (see procedure in Section 70).

[2] - Remove differential lock shaft (see procedure in this Group).

[3] - Remove engagement control (see procedure in this Group).

[4] - Remove sleeve (A) and snap ring (B).

[5] - Remove spring pin (C) to remove sleeve (D).

[6] - Inspect all parts for wear or damage. Replace as necessary.

[7] - Lubricate all parts with clean transmission/hydraulic oil.

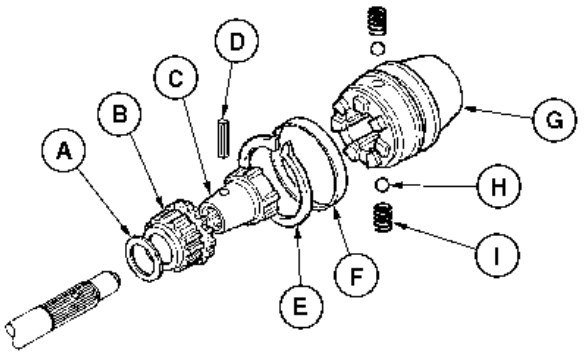
[8] - Assemble all parts.

[9] - Install engagement control and differential lock shaft.

[10] - Install rockshaft case.

Disassemble, Inspect and Assemble Rear PTO Engagement Sleeve (Models with Ground Speed PTO)

[1] -



AT2159

LEGEND:

A	Washer
B	Sleeve
C	Hub
D	Spring Pin
E	Snap Ring
F	Ring
G	Sleeve
H	Ball
I	Spring

Exploded View, Rear PTO Engagement Sleeve

Remove rockshaft case (see procedure in Section 70).

[2] - Remove differential lock shaft (see procedure in this Section).

[3] - Remove engagement control (see procedure in this Group)

[4] - Remove snap ring (E) and ring (F) to remove spring (I) and ball (H).

[5] - Remove sleeve (G).

[6] - Remove spring pin (D) to remove parts (C), (B) and (A).

[7] - Inspect all parts for wear or damage. Replace as necessary.

[8] - Lubricate all parts with clean transmission/hydraulic oil.

[9] - Assemble all parts.

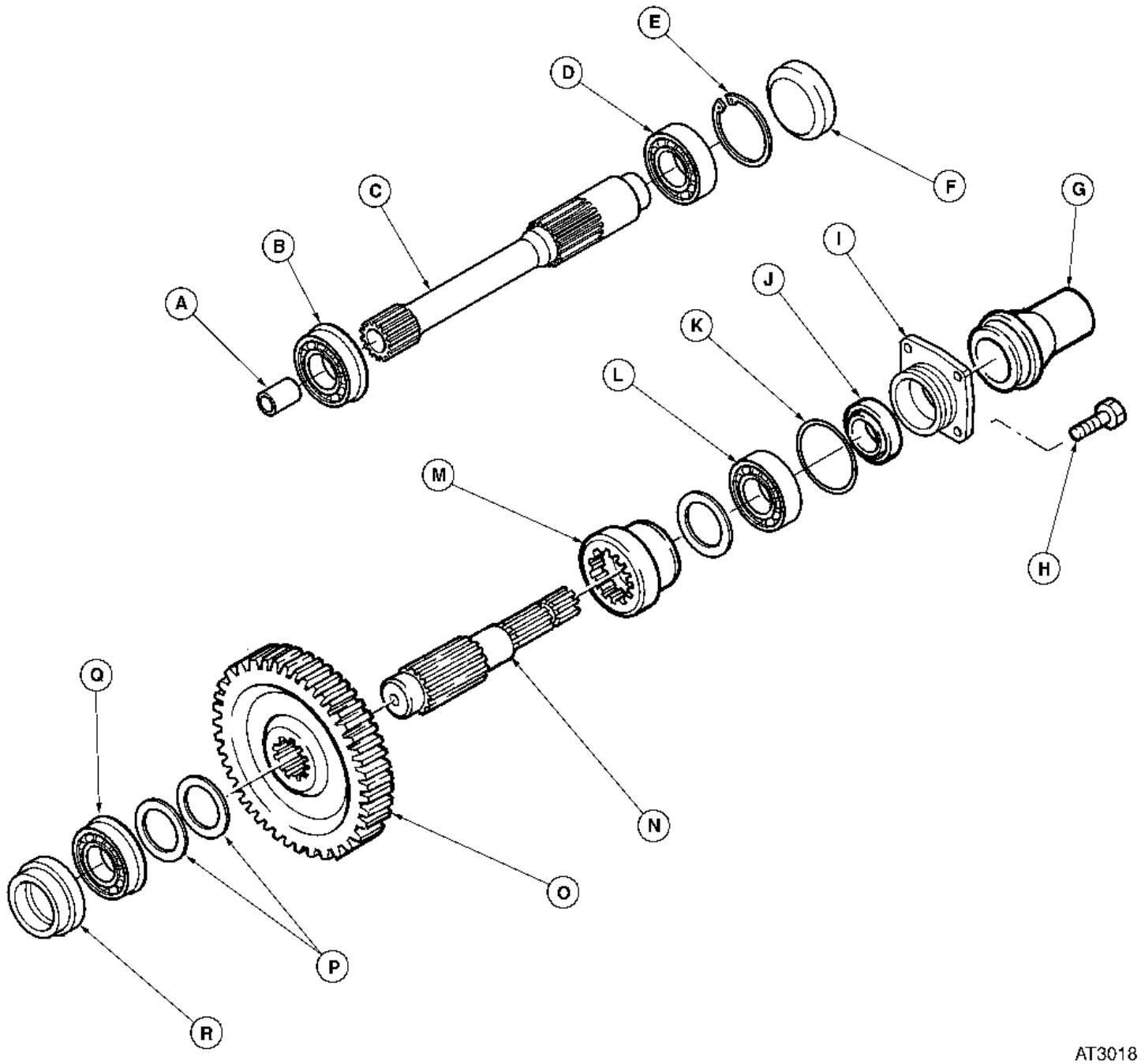
[10] - Install engagement control.

[11] - Install differential lock shaft.

[12] - Install rockshaft case.

Disassemble, Inspect and Assemble Rear PTO Drive Shaft Assembly (540 rpm)

[1] -



Rear PTO Drive Shaft Assembly (540 rpm)

LEGEND:

A	Bushing
B	Bearing
C	Pinion Shaft
D	Bearing
E	Snap Ring
F	Plug
G	Booth
H	Cap Screw (4 used)
I	Quill
J	Seal
K	O-Ring
L	Bearing

M	Collar
N	Output Shaft
O	Gear
P	Washer (3 used)
Q	Bearing
R	Bushing

Drain transmission/hydraulic oil.

→NOTE:

The approximate capacity of transmission/differential is 45 L (11.9 U.S. gal)

[2] - Remove rockshaft case (see procedure in Section 70).

[3] - Remove plug (F) and snap ring (E).

[4] - Remove pinion shaft (C) using a soft metal drift and hammer.

[5] -

→NOTE:

Bushing (A) is press fit. Remove bushing only if replacement is necessary.

Remove booth (G).

[6] - Remove four cap screws (H) to remove quill (I).

[7] -

IMPORTANT:

Replace seal and O-ring. Damaged or used seals and O-rings will leak.

Replace seal (J) using a bushing, bearing and seal driver set. Install seal flush with quill (I).

[8] - Remove parts (L) to (R) using a soft metal drift and hammer.

[9] - Inspect all parts for wear or damage. Replace as necessary.

[10] - Apply multipurpose grease to lips of seal.

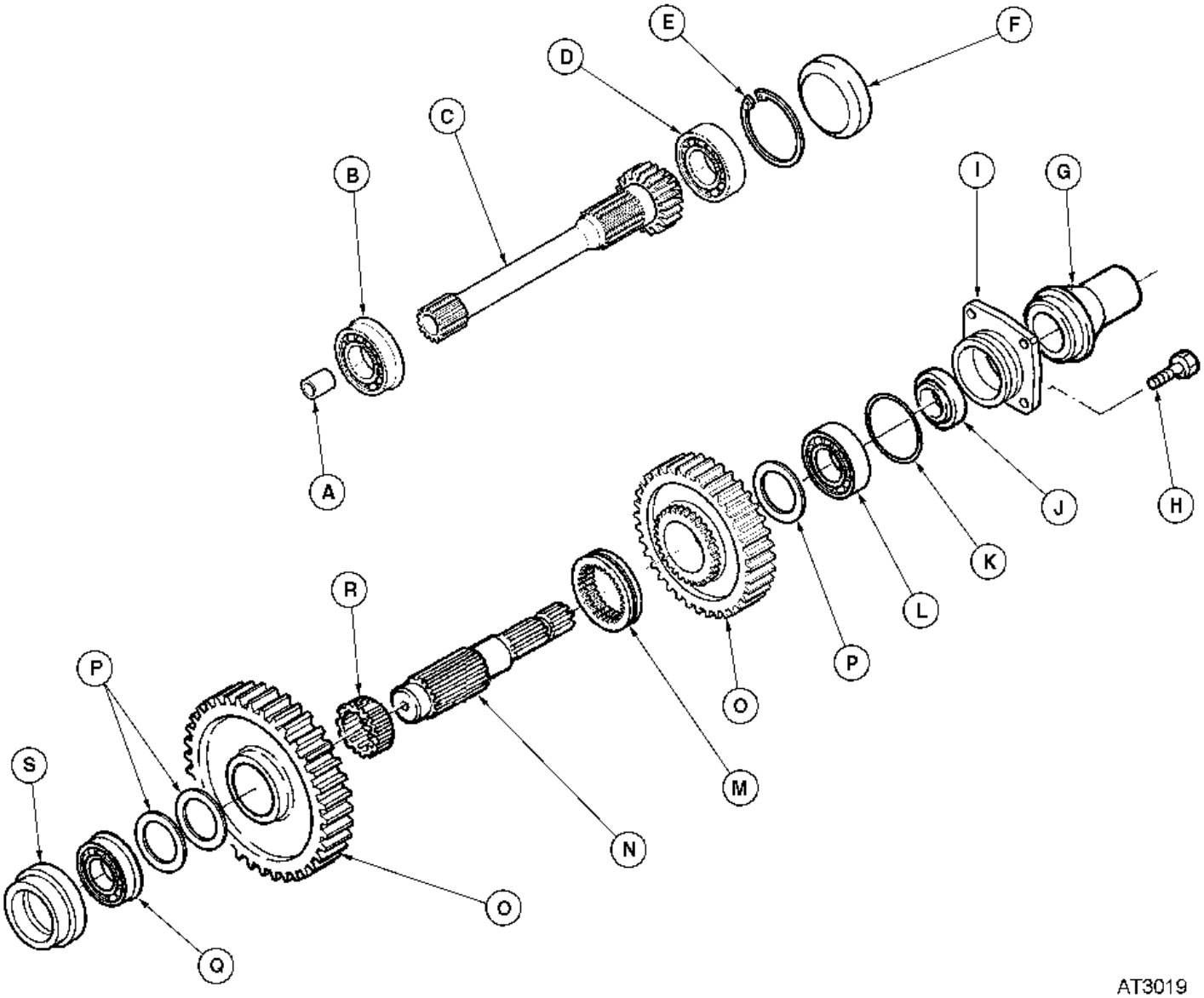
[11] - Lubricate all parts with clean transmission/hydraulic oil.

[12] - Assemble all parts.

[13] - Install rockshaft case.

[14] - Fill transmission/differential with proper oil (see “Fuel, Lubricants and Coolant” in Section 10)

Disassemble, Inspect and Assemble Rear PTO Drive Shaft Assembly (540/540E rpm)and (540/1000 rpm)



Rear PTO Drive Shaft Assembly (540/540E/1000 rpm)

LEGEND:

A	Bushing
B	Bearing
C	Pinion Shaft
D	Bearing
E	Snap Ring
F	Plug
G	Booth
H	Cap Screw (4 used)
I	Quill
J	Seal
K	O-Ring
L	Bearing
M	Collar
N	Output Shaft
O	Gear
P	Washer (3 used)
Q	Bearing
R	Gear
S	Bushing

[1] - Drain transmission/hydraulic oil.

Item	Measurement	Specification
Approximate capacity of Transmission/hydraulic oil:		
Tractors without MFWD	Capacity	36 L (9.5 U.S. gal.)
Tractors with MFWD	Capacity	38 L (10 U.S. gal.)
Tractors with Hi-Lo & MFWD	Capacity	43 L (11.3 U.S. gal.)

[2] - Remove rockshaft case (see procedure in Section 70).

[3] - Remove plug (F) and snap ring (E).

[4] - Remove pinion shaft (C), using a soft metal drift and hammer.

→NOTE:

Bushing (A) is press fit. Remove bushing only if replacement is necessary.

[5] - Remove booth.

[6] - Remove four cap screws (H) to remove quill (I).

[7] -

IMPORTANT:

Replace seal. Damaged or used seals will leak.

Replace seal (J), using a bushing, bearing and seal driver set. Install seal flush with quill (I).

[8] - Remove parts (L) to (Q), using a soft metal drift and hammer.

[9] - Inspect all parts for wear or damage. Replace as necessary.

[10] - Apply multipurpose grease to lips of seal.

[11] - Lubricate all internal parts with clean transmission/hydraulic oil during assembly.

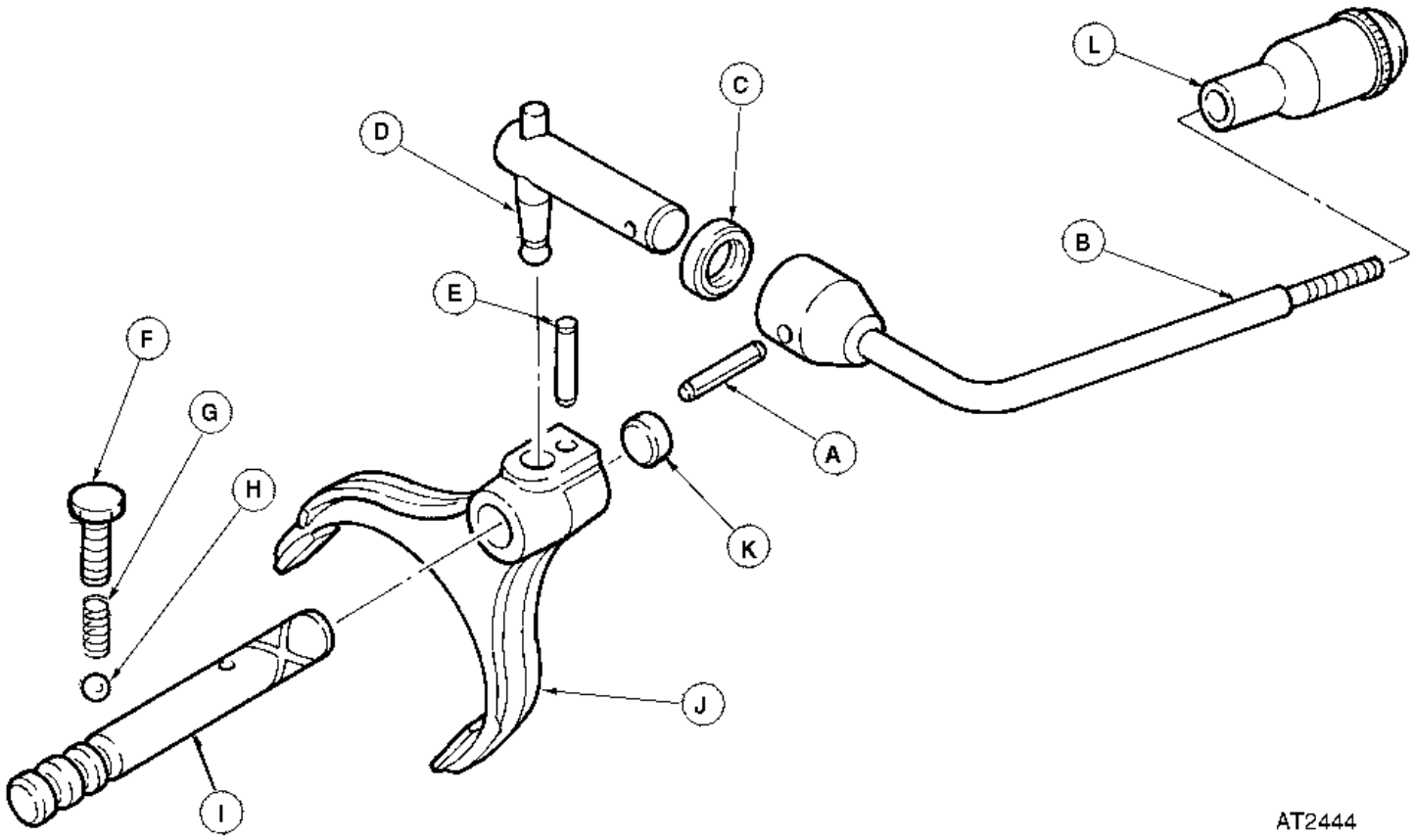
[12] - Assemble all parts.

[13] - Install rockshaft case.

[14] - Fill transmission/differential with proper oil (see “Fuel, Lubrications and Coolant” in Section 10).

Disassemble, Inspect and Assemble Rear PTO Shift Leverage Assembly

[1] -



PTO shift leverage assembly

LEGEND:	
A	Spring Pin
B	Selector Lever
C	Seal
D	Shift Arm
E	Spring Pin
F	Cap Screw
G	Spring
H	Ball
I	Shift Shaft
J	Shift Fork
K	Plug
L	Knob

Remove rockshaft case (see procedure in Section 70).

[2] - Remove pinion shaft (see procedure in this Group).

[3] - Remove spring pin (A) to remove selector lever (B).

[4] - Remove spring pin (E), cap screw (F), plug (K) and shift shaft (I).

[5] - Remove shift fork (J) and shift arm (D).

[6] -

IMPORTANT:

Replace seal. Damaged or used seals will leak.

Pry out seal (C). Install seal into housing bore until it stops, using a bushing, bearing and seal driver set.

[7] - Inspect all parts for wear or damage. Replace as necessary.

[8] - Apply multipurpose grease to lips of seal.

→NOTE:

Lubricate all internal parts with clean transmission/hydraulic oil during assembly.

[9] - Assemble all parts.

[10] - Install drive shaft.

[11] - Install rockshaft case.

Group 20 - Differential

Essential Tools

→NOTE:

Order tools according to information given in the U.S. SERVICEGARD ™ Catalog or from the European Microfiche Tool Catalog (MTC).

Spring Scale

JDT42

Spring scale

For measuring the initial turning force.

Specifications

Item	Measurement	Specification
Cap screws, differential quill to differential case	Torque	58 N·m
		43 lb-ft
Cap screws, brake housing (and quill) to differential case	Torque	87 N·m
		64lb-ft
Differential, initial turning force	Force	19 to 29 N
		4 to 7 lb
Differential ring gear	Backlash	0.15 to 0.25 mm
		0.006 to 0.010 in.

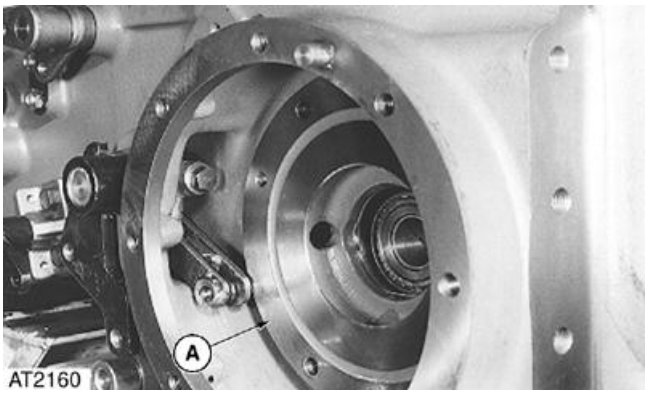
Remove and Install Differential Assembly

[1] - Remove differential lock assembly (see procedure in this Group).

[2] - Remove brake assemblies (see procedure in Section 60).

[3] - Remove rear PTO drive shaft assembly as described in this Section.

[4] -



Cap Screws to Draw Out Quill

Install cap screws in the two threaded holes. Use cap screws to draw out quill (A).

[5] - Remove differential assembly.

[6] - Make repairs as necessary as described in this Group.

[7] - Install differential assembly.

[8] - Install differential quill, cap screws and shims. Tighten cap screws to specified torque.

Item	Measurement	Specification
Cap screws, differential quill to differential case	Torque	58 N·m 43 lb-ft

[9] -

→NOTE:

Adjustment of backlash is not necessary unless the ring gear or differential drive shaft were replaced or cone point adjustment was made.

Adjust differential backlash as described in this Group.

[10] -

→NOTE:

Adjustment of bearing pre-load is not necessary unless the bearings or differential housing were replaced.

Adjust bearings pre-load (see procedure in Group).

[11] - Install brake assemblies.

[12] - Install rear PTO drive gear shaft assembly.

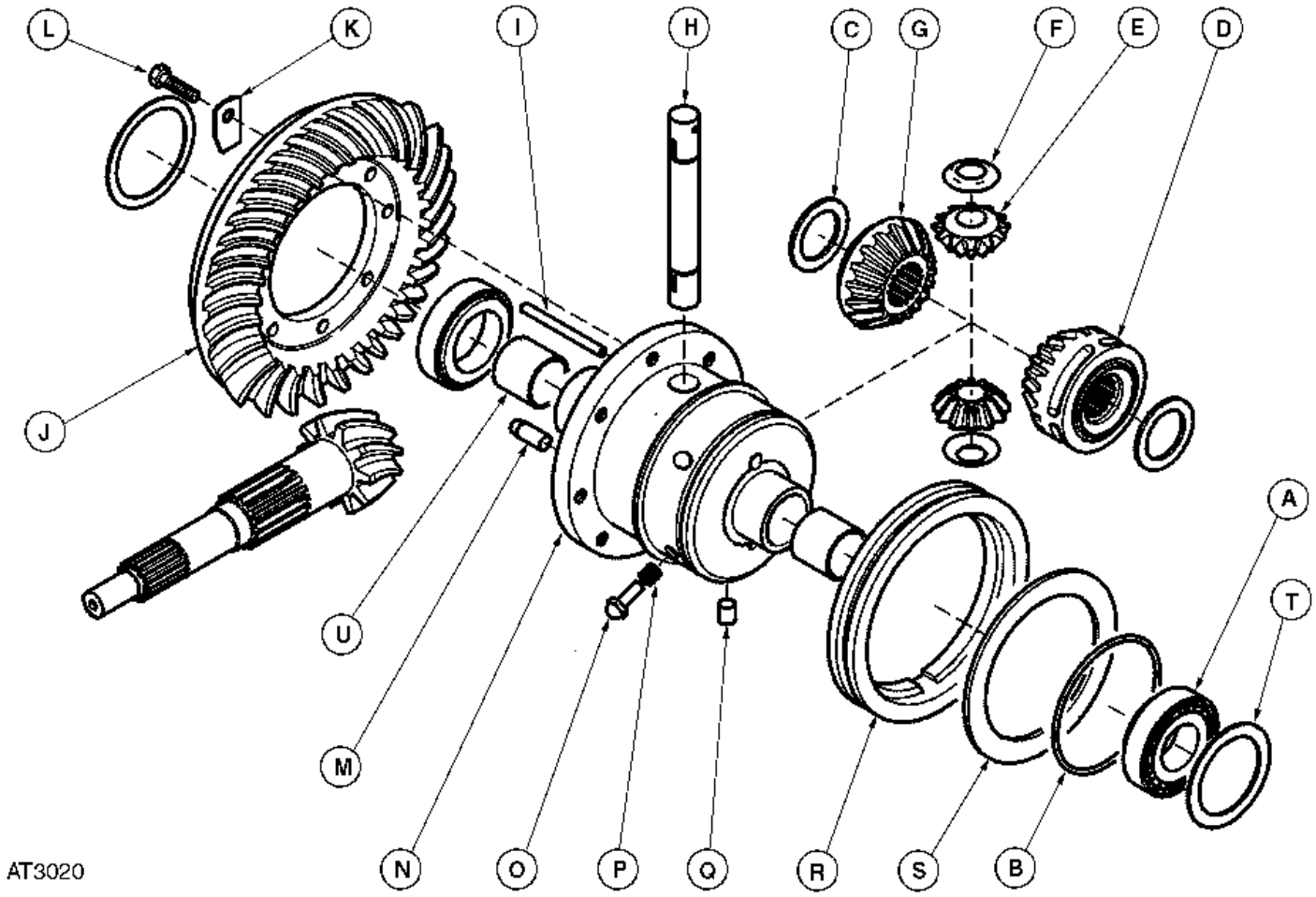
[13] - Install differential lock assembly.

Disassemble, Inspect and Assemble Differential Assembly

[1] -

→NOTE:

Bearings (A) are press fit. Remove bearings only if replacement is necessary



Differential Assembly

LEGEND:

A	Bearing (2 used)
B	Snap Ring
C	Thrust Washer (2 used)
D	Bevel Gear
E	Bevel Pinion (2 used)
F	Thrust Washer (2 used)
G	Bevel Gear
H	Pinion Shaft
I	Pin
J	Ring Gear
K	Plate
L	Cap Screw (8 used)
M	Dowel Pin
N	Differential Housing
O	Differential Lock Pin (4 used)
P	Spring (4 used)
Q	Dowel Pin
R	Collar
S	Washer
T	Shim (2 used)

U Bushing (2 used)

Remove bearings (A) using a knife edge puller and a press.

[2] - Remove snap ring (B), washer (S), collar (R), differential lock pins (O) and springs (P).

[3] - Remove cap screws (L), plate (K) and ring gear (J).

[4] - Remove pin (I) to remove pinion shaft (H).

[5] - Remove parts (C) to (G).

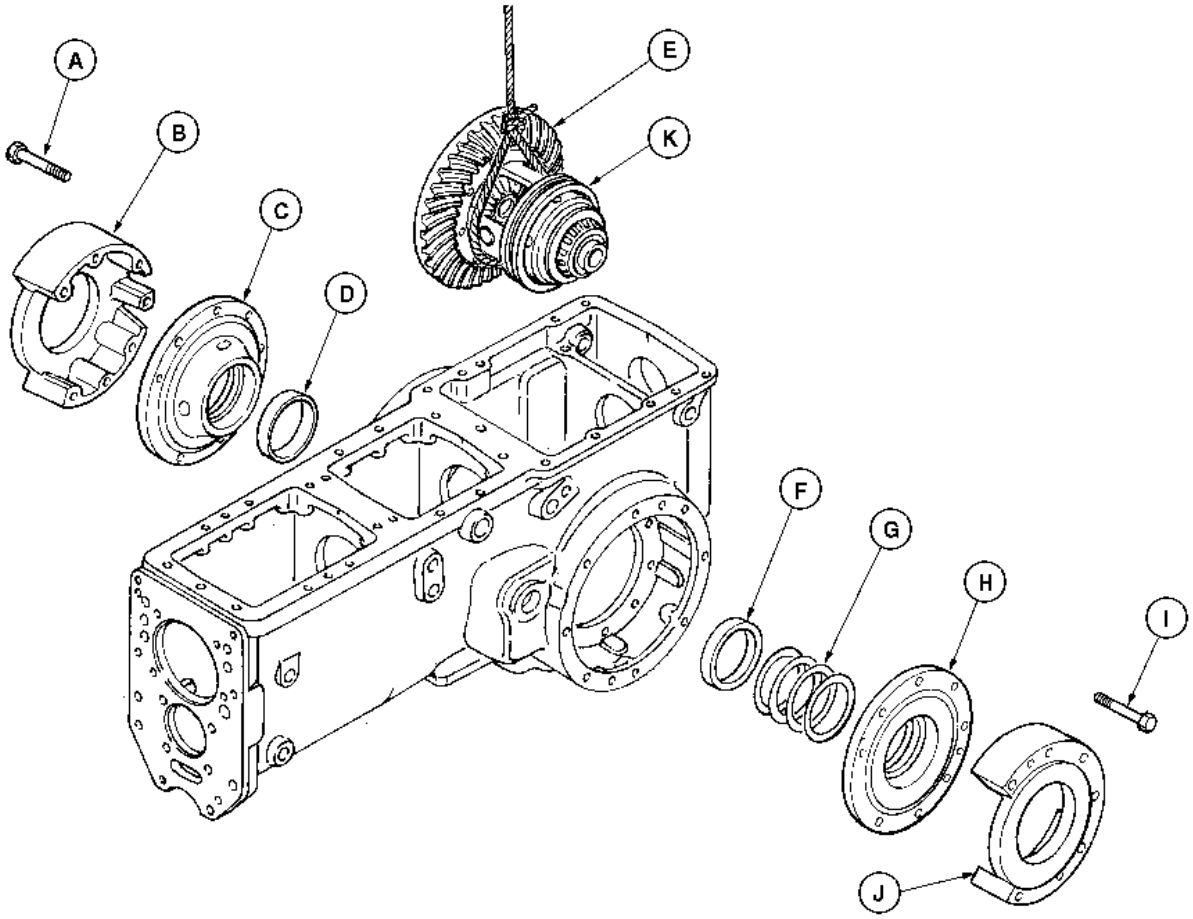
[6] - Inspect parts for wear or damage. Replace if necessary.

[7] - Apply thread lock and sealer (medium strength) to threads of cap screws (L).

[8] - Apply clean transmission/hydraulic oil to all parts during assembly.

[9] - Assemble all parts.

Differential Bearing Pre-Load Adjustment (without Differential Drive Shaft)



AT2164

Differential Bearing Pre-Load Adjustment

LEGEND:

A	Cap Screw (5 used)
B	R.H. Brake Housing
C	R.H. Quill
D	R.H. Bearing Cup
E	Differential Assembly
F	L.H. Bearing Cup
G	Shims
H	L.H. Quill
I	Cap Screw (5 used)
J	L.H. Brake Housing
K	Collar

IMPORTANT:

Always check and adjust bearing pre-load after bearings or differential housing have been replaced.

[1] - Install differential assembly (E) into transmission case.

[2] - Install all removed shims (G) into recess of left-hand quill (H).

[3] - Install bearing cup (F) using a bearing, bushing and seal driver set.

[4] - Install quill assembly (H), brake housing (J) and cap screw (I).

[5] - Install bearing cup (D) into right-hand quill (C).

[6] - Install quill assembly (C), brake housing (B) and cap screw (A).

[7] - Rotate differential and evenly tighten cap screws (A) and (I) to specified torque.

Item	Measurement	Specification
Cap screws, brake housing (and quill) to differential case	Torque	87 N·m 64lb-ft

[8] - Wrap a string around the collar (K) and attach spring scale JDT42.

Spring Scale

JDT42

Spring scale

For measuring the initial turning force.

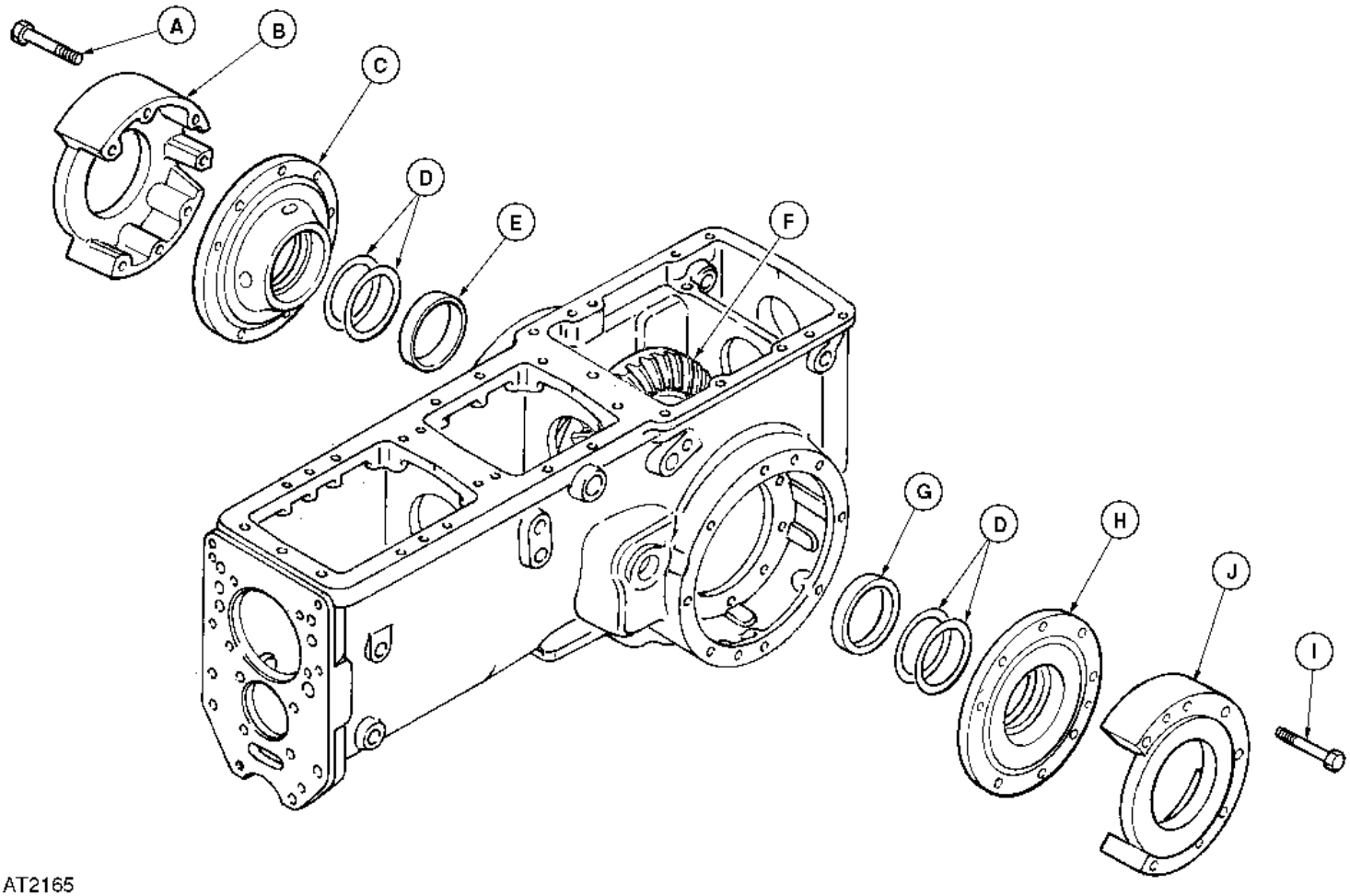
[9] - Raise the spring scale noting the force required to rotate the differential.

Item	Measurement	Specification
Differential, initial turning force	Force	19 to 29 N 4 to 7 lb

Force should be within specification. If the measured force is more than specified, remove some of the shims and check again. Add shim thickness if the force is less than specified.

[10] - Tighten cap screws (A) and (I) to 87 N·m (64 lb-ft).

Differential Backlash Adjustment



AT2165

Differential Backlash Adjustment

LEGEND:

A	Cap Screw (5 used)
B	R.H. Brake Housing
C	R.H. Quill
D	Shims
E	R.H. Bearing Cup
F	Differential Assembly
G	L.H. Bearing Cup
H	L.H. Quill
I	Cap Screw (5 used)
J	L.H. Brake Housing

IMPORTANT:

Always check and adjust backlash after cone point adjustment has been made.

[1] - Remove cap screws (A) and (I), brake housings (B) and (J) and quills (C) and (H).

[2] - Remove bearing cups (E) and (G).

[3] -

→NOTE:

Total shim thickness has been determinated during differential bearing pre-load adjustment operation.

Install half shim thickness (D) into each of quill recess.

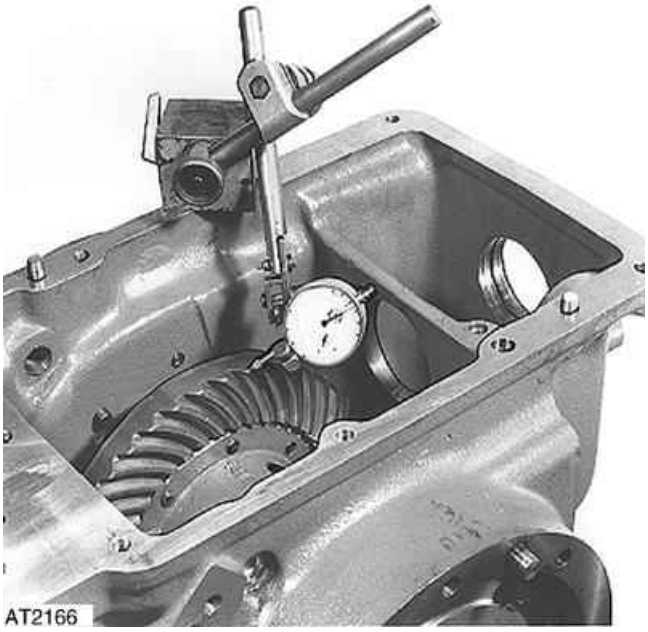
[4] - Install bearing cups (E) and (G).

[5] - Install quills (C) and (H), brake housings (B) and (J), cap screws (A) and (I).

[6] - Rotate differential and evenly tighten cap screws (A) and (I) to specified torque.

Item	Measurement	Specification
Cap screws, brake housing (and quill) to differential case	Torque	87 N·m
		64lb-ft

[7] -



Dial Indicator

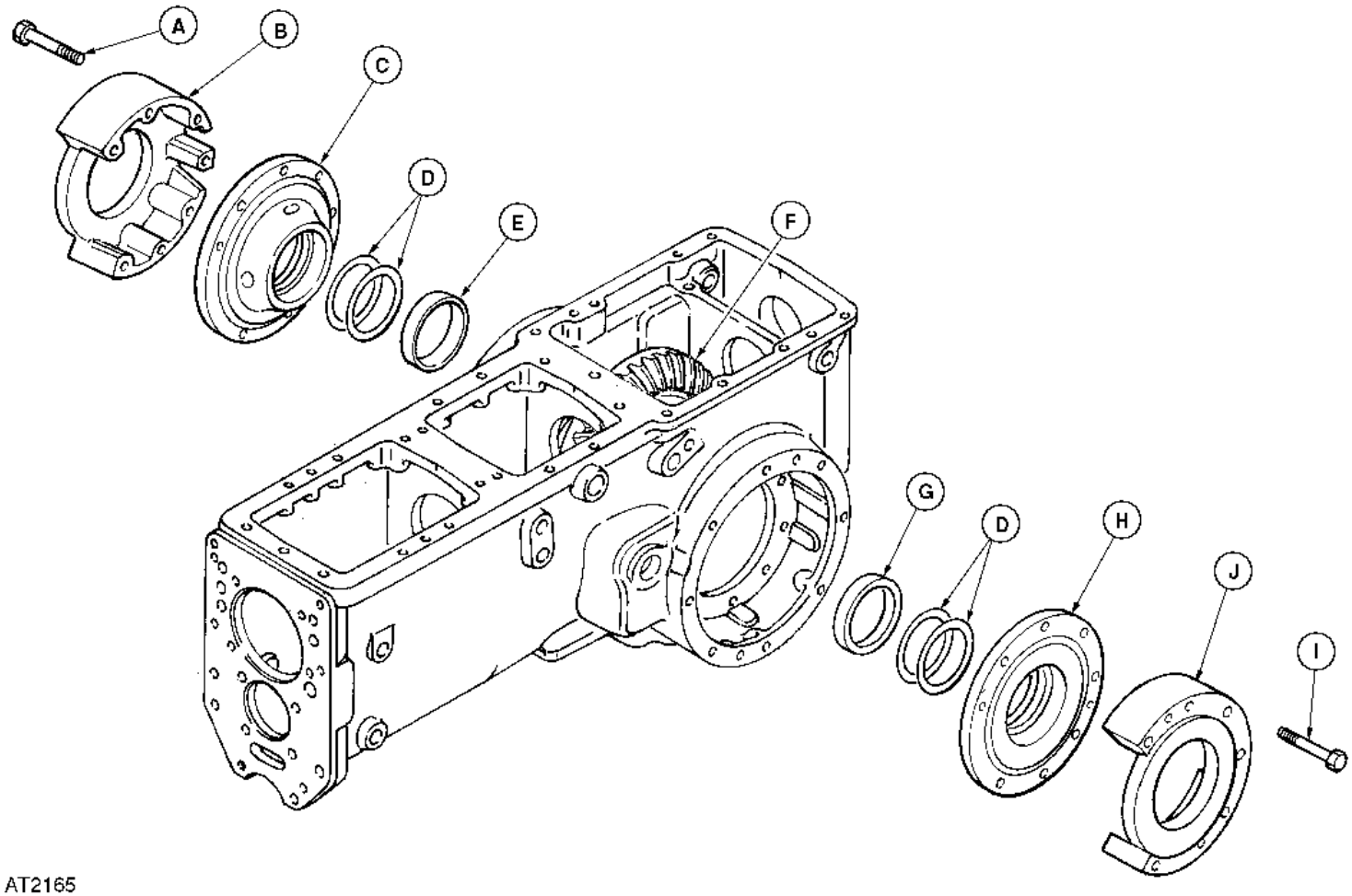
Attach a dial indicator to housing as shown with contact point at 90 degrees to a surface of ring gear teeth.

[8] - While holding input shaft, move ring gear to determine backlash. Backlash should be within the specified values.

Item	Measurement	Specification
Differential ring gear	Backlash	0.15 to 0.25 mm
		0.006 to 0.010 in.

[9] - Check backlash on two more teeth at equal distances around ring gear.

[10] -



AT2165

Differential Components

LEGEND:

A	Cap Screw (5 used)
B	R.H. Brake Housing
C	R.H. Quill
D	Shims
E	R.H. Bearing Cup
F	Differential Assembly
G	L.H. Bearing Cup
H	L.H. Quill
I	Cap Screw (5 used)
J	L.H. Brake Housing

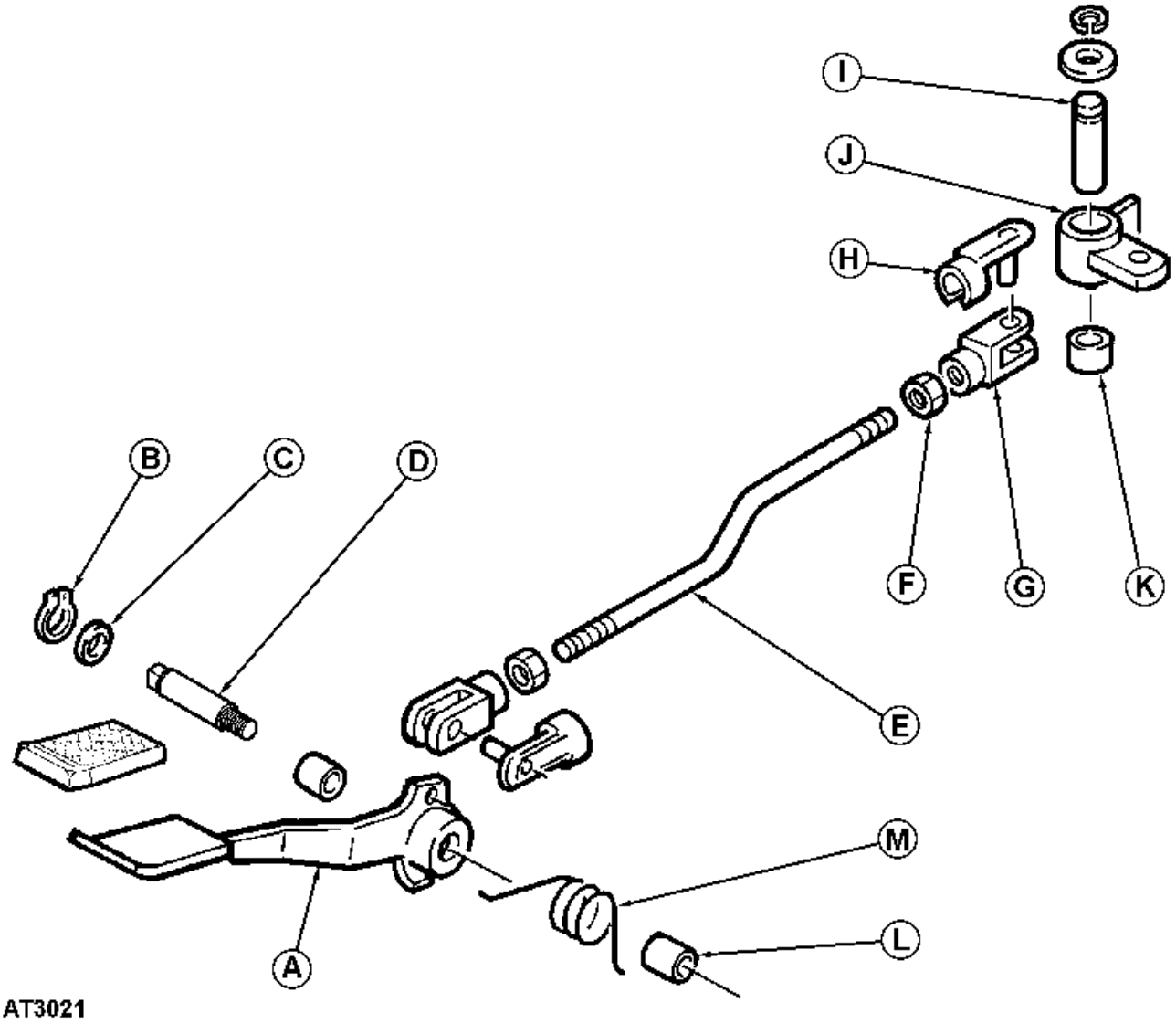
If backlash is more than specified, transfer shims (D) from left-hand quill (H) to right-hand quill (C) without changing the total shim pack thickness. If backlash is less than specified, transfer shims (D) from right-hand quill (C) to left-hand quill (H) without changing the total shim pack thickness.

[11] - Tighten cap screws (A) and (I) to specified torque.

Item	Measurement	Specification
Cap screws, brake housing (and quill) to differential case	Torque	87 N·m 64lb-ft

Inspect and Repair Differential Lock Pedal and Linkage

[1] -



Differential Lock Pedal and Linkage

LEGEND:

A	Pedal
B	Snap Ring (2 used)
C	Washer (2 used)
D	Shaft
E	Rod
F	Lock Nut (2 used)
G	Yoke (2 used)
H	Locking Pin (2 used)
I	Shaft
J	Lever
K	Bushing
L	Bushing
M	Return Spring

Remove right-hand rear wheel, fenders and plate.

→NOTE:

Shaft (D) and (I) are press fit in transmission housing.

Bushings (K) and (L) are press fit. Remove bushings only if replacement is necessary.

Remove bushings (K) and (L) using a bearing, bushing and seal driver set.

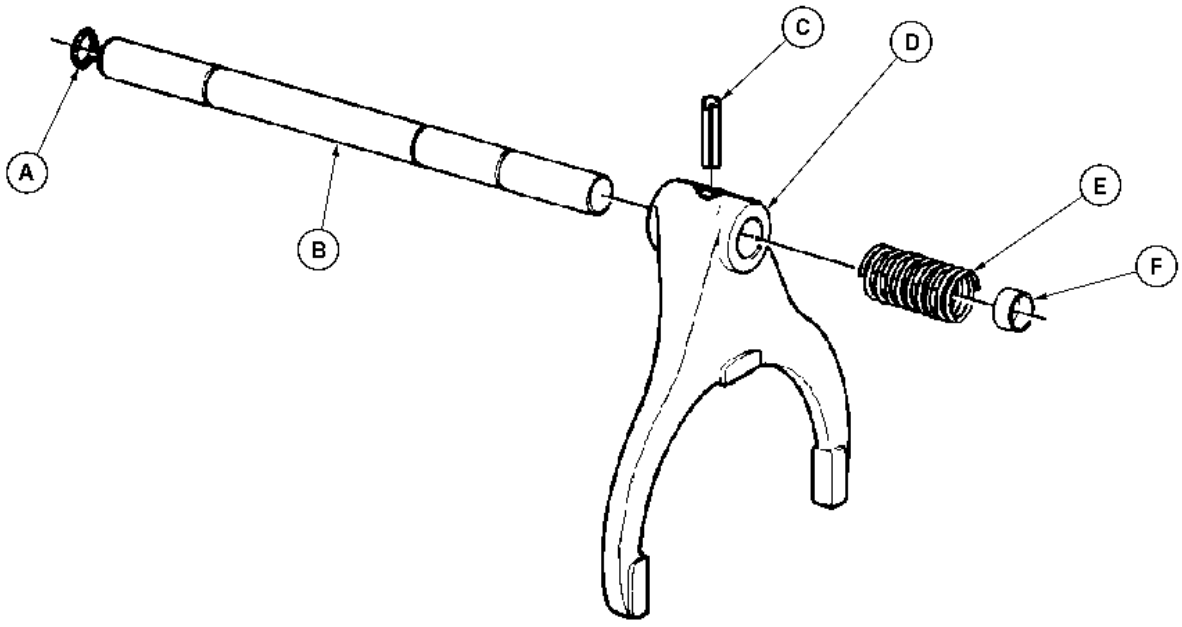
[2] - Inspect all parts for wear or damage. Replace as necessary.

[3] - Apply Moly High Temperature EP Grease to shafts (D) and (I).

[4] - Install right-hand wheel, fenders and plate.

[5] - Tighten wheel nuts to 400 N·m (300 lb-ft).

Remove, Inspect and Install Differential Lock Assembly



AT2163

Differential Lock Assembly

LEGEND:

A	O-Ring
B	Differential Lock Shaft
C	Spring Pin
D	Fork
E	Spring
F	End Cap

[1] - Remove rockshaft case (see procedure in Section 70).

[2] - Remove differential lock linkage (see procedure in this Group).

[3] - Remove spring pin (C).

[4] - Remove shaft (B) from transmission housing.

[5] - Remove spring (E) and fork (D).

[6] - Inspect all parts for wear or damage. Replace as necessary.

[7] -

IMPORTANT:

Replace O-ring (A). Damaged or used O-rings will leak.

Apply multipurpose grease to O-ring.

[8] - Install all parts.

[9] - Install differential lock linkage.

[10] - Install rockshaft case.

Group 25 - Final Drives

Specifications

Item	Measurement	Specification
Cap screws, Final Drive to Differential Case	Torque	190 N·m
		140 lb-ft
Rear Axle Drive Shaft	Maximum End Play	0.5 mm (0.02 in.)
	Minimum End Play	0.5 mm (0.02 in.)
Cap Screw, Planetary Carrier Assembly to Drive Shaft**(5300 & 5400)**	Torque	360 N·m
		266 lb-ft
Cap Screw, Planet Carrier Assembly to Drive Shaft**(5500)**	Torque	275 N·m
		200 lb-ft
Screw, Planetary Gear to Planetary Carrier	Torque	37 N·m
		30 lb-ft

Remove and Install Final Drive Assembly

[1] -

Remove Cap Screws

Remove ROLL-GARD ™ (see procedure in Section 90).

[2] -

→NOTE:

The approximate capacity of transmission/differential is 45 L (11.9 U.S. gal).

Drain transmission/differential oil.

[3] - Attach lifting chains or strap to final drive housing.

[4] - Remove twelve cap screws (A).

[5] - Remove final drive assembly.

[6] -

→NOTE:

To inspect or replace final drive pinion shaft, brakes must be removed (see procedure in Section 60).

Make repairs as necessary.

[7] - Clean mating surfaces of final drive and differential casings. Apply a coat of sealing compound to mating surfaces.

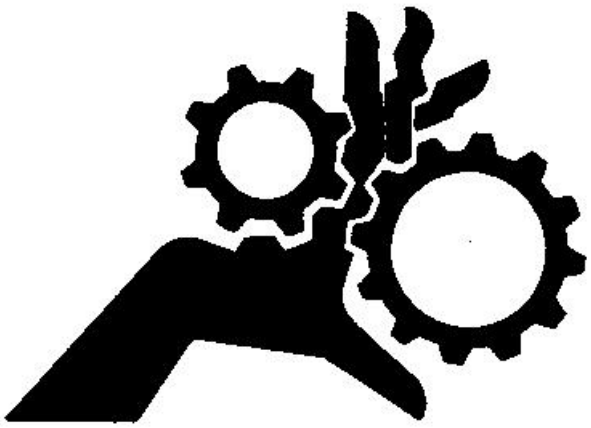
[8] - Install final drive assembly. Tighten cap screws to specified torque.

Item	Measurement	Specification
Cap screws, Final Drive to Differential Case	Torque	190 N·m 140 lb-ft

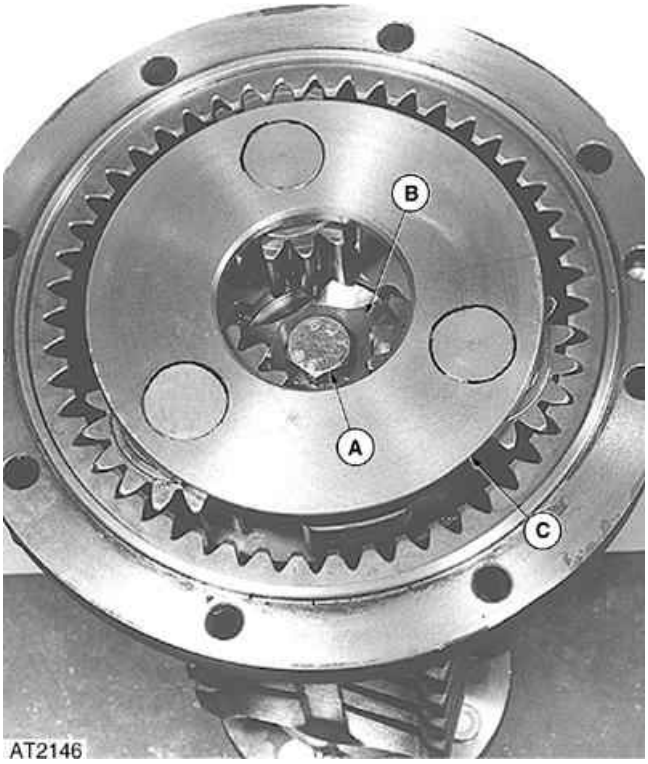
[9] - Fill transmission with specified transmission/hydraulic oil (see “Fuel, Lubricants and Coolant” in Section 10).

[10] - Install ROLL-GARD ™ .

Remove and Inspect Planetary Drive Assembly (Tractors 5300 and 5400)



Keep Fingers Away from Planetary Gears



Planetary Carrier Assembly

CAUTION:

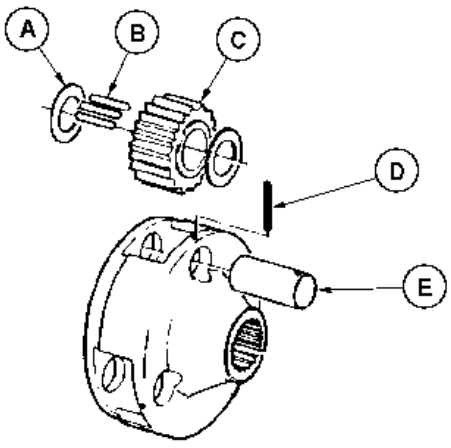
Gears may turn. Keep fingers away from planetary gears.

[1] - Remove lock plate (B).

[2] - Remove cap screw (A).

[3] - Remove planetary carrier assembly (C).

[1] -



LEGEND:

A	Thrust Washer
B	Roller (15 used)
C	Planetary Gear
D	Pin
E	Planetary Shaft

Planetary Drive Assembly Components


AT2148

Planetary Drive Assembly

Remove pin (D) using punch and hammer.

[2] - Remove planetary shaft (E) to remove parts (A) to (C).

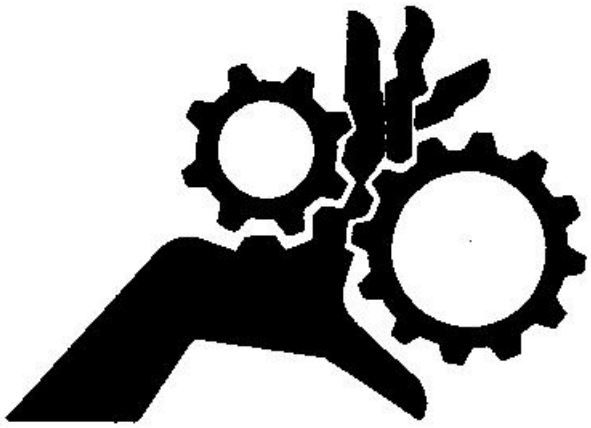
[3] - Inspect all parts for wear or damage. Replace as necessary.

Remove and Inspect Planetary Drive Assembly (Tractors 5500)

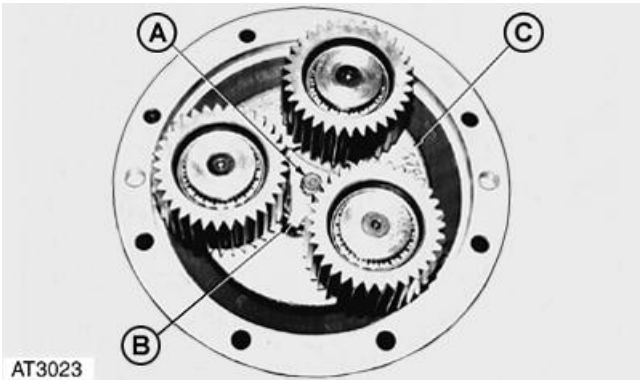
[1] -

CAUTION:

Gears may turn. Keep fingers away from planetary gears.



logo, keep fingers away



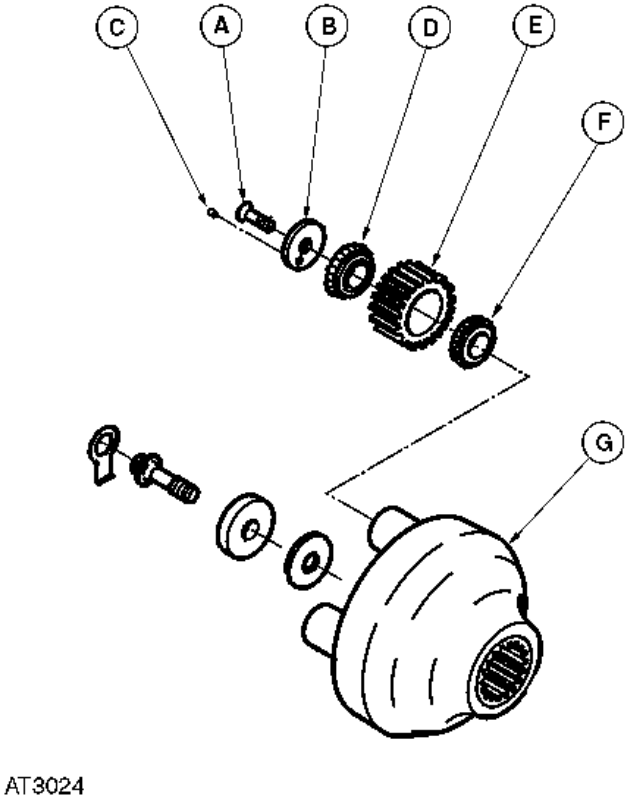
Final drive, top view

Remove lock plate (B).

[2] - Remove cap screw (A).

[3] - Remove planetary carrier assembly (C).

[4] -



LEGEND:

A	Fixing Bolt
B	Washer
C	Guide Pin
D	Bearing
E	Planetary Gear
F	Bearing
G	Planetary Carrier

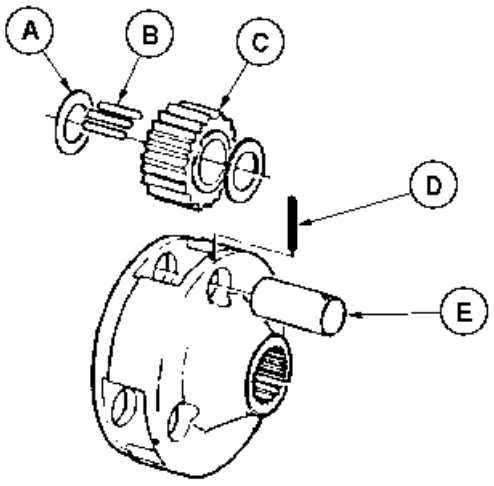
Planet carrier assembly expl. view

Remove fixing bolt (A) and washer (B).

[5] - Remove parts (C) to (E).

[6] - Inspect all parts for wear or damage. Replace as necessary.

Install Planetary Drive Assembly (Tractors 5300 and 5400)



AT2147

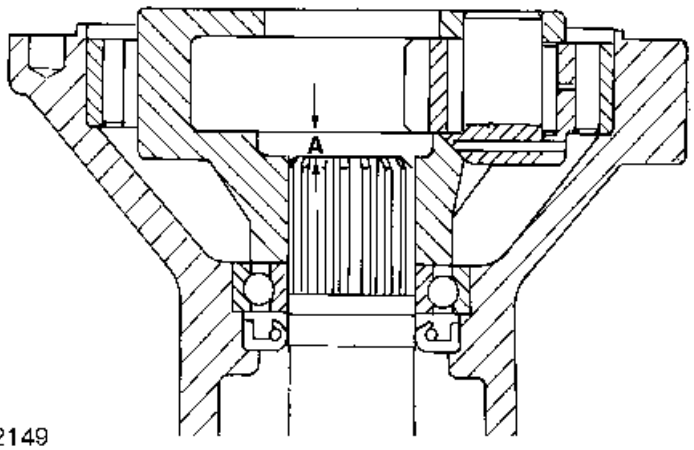
Assembly Parts

→NOTE:

Lubricate all internal parts with clean transmission/hydraulic oil during assembly.

[1] - Assemble parts (A) to (E).

[2] -



AT2149

Measure Distance

Install planetary carrier assembly.

[3] - Use a depth micrometer to measure distance “A” between the end of the drive shaft and the inner face of planetary gear carrier. Use the measurement to calculate the required shim pack as follows:

Measurement

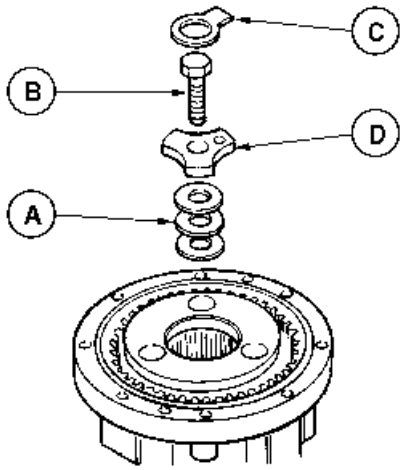
Measurement A	0.6 mm (0.024 in)
plus	
minimum drive shaft end play	0.1 mm (0.004 in)
equals	
Required shim pack	0.7 mm (0.028 in)

Measurement A	0.6 mm (0.024 in)
plus	
maximum drive shaft end play	0.5 mm (0.020 in)
equals	
Required shim pack	1.1 mm (0.044 in)

Select a shim pack between 0.7 to 1.1 mm (0.028 to 0.044 in) thickness. The shims are available in thicknesses of 0.1, 0.3 and 0.5 mm (0.004, 0.012 and 0.020 in).

Item	Measurement	Specification
Rear Axle Drive Shaft	Maximum End Play	0.5 mm (0.02 in.)
	Minimum End Play	0.5 mm (0.02 in.)

[4] -



AT2150

Install Parts

Install shim pack (A), spacer (D) and cap screw (B). Tighten cap screw to specified torque.

Item	Measurement	Specification
Cap Screw, Planetary Carrier Assembly to Drive Shaft**(5300 & 5400)**	Torque	360 N·m
		266 lb-ft

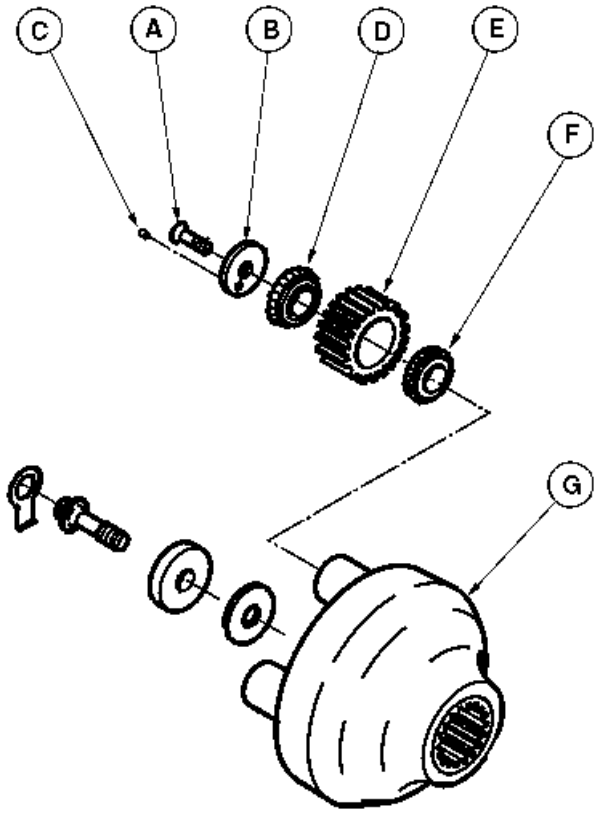
[5] - Install lock plate (C).

Install Planetary Drive Assembly (Tractors 5500)

[1] -

→NOTE:

Lubricate all internal parts with clean transmission/hydraulic oil during assembly.

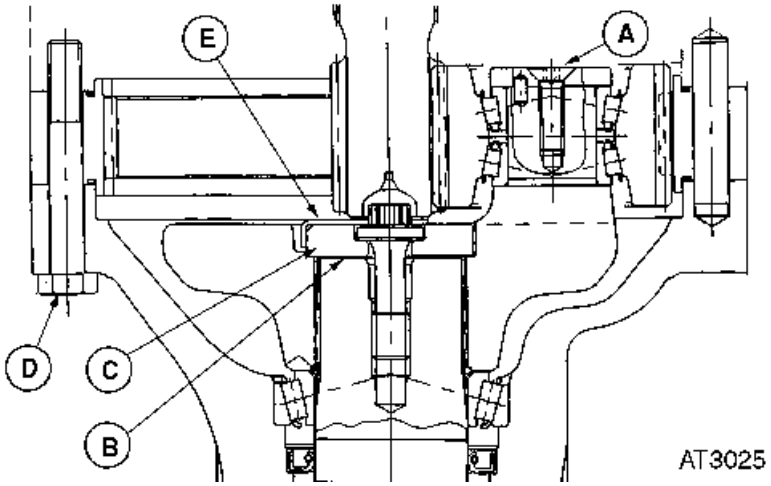


AT3024

Planet carrier assembly expl. view

Assembly all parts (A) to (G).

[2] -



AT3025

Planet carrier assembly, installation

Install planet carrier assembly.

[3] - Tighten screws (A) to specified torque.

Item	Measurement	Specification
Screw, Planetary Gear to Planetary Carrier	Torque	37 N·m
		30 lb-ft

[4] - Install shim pack (B), spacer (C) and cap screw (D) with new washer and pin.

Tighten cap screw to specified torque.

Item	Measurement	Specification
Cap Screw, Planet Carrier Assembly to Drive Shaft**(5500)**	Torque	275 N·m
		200 lb-ft

[5] - Install lock plate (E).

[6] -

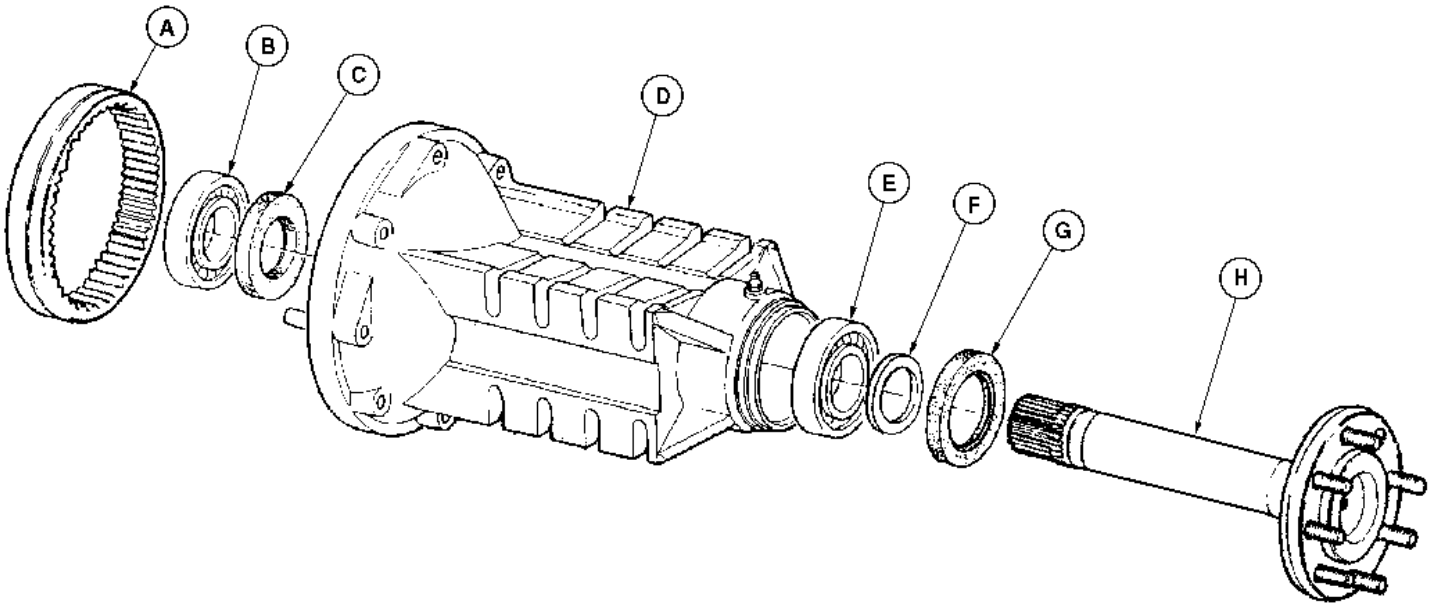
Tapered bearing preload

Tapered bearing preload:

P = 1.3÷ 2

"P" is the actual preload measured on the diameter of axle shaft = 254 mm (9.8 in.)

Remove, Inspect and Install Axle Shaft Assembly (Tractors 5300 and 5400)



AT2151

Axle Shaft Assembly

LEGEND:

A	Ring Gear
B	Bearing
C	Seal
D	Final Drive Housing
E	Bearing
F	Spacer
G	Seal
H	Axle Shaft

[1] - Remove planetary drive assembly as described in this Group).

[2] - Remove axle (H) using a lead hammer on splined end of shaft.

[3] -

→NOTE:

Bearing (E) is press fit on axle shaft.

Remove bearing (E) using knife-edge puller and a press.

[4] - Remove spacer (F) and seal (G).

[5] - Remove bearing (B).

[6] - Pry out seal (C).

[7] -

→NOTE:

Ring gear (A) is press fit on final drive housing (D). Remove ring gear only if replacement is necessary.

Remove ring gear (A) if necessary, using a two-jaw inside puller.

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

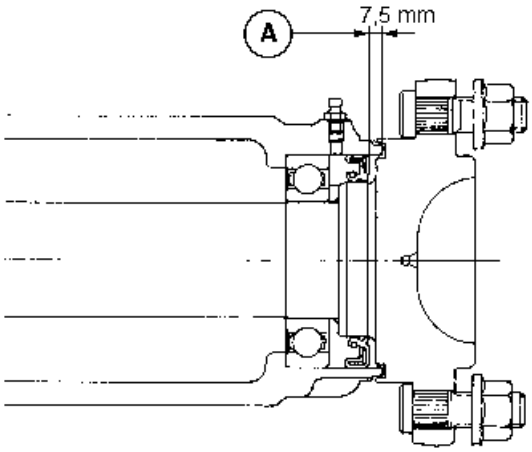
[9] - Install ring gear (A) using a press.

[10] - Install bearing (E) and spacer (F) in final drive housing.

[11] -

IMPORTANT:

Replace all seals. Damaged or used seals will leak.



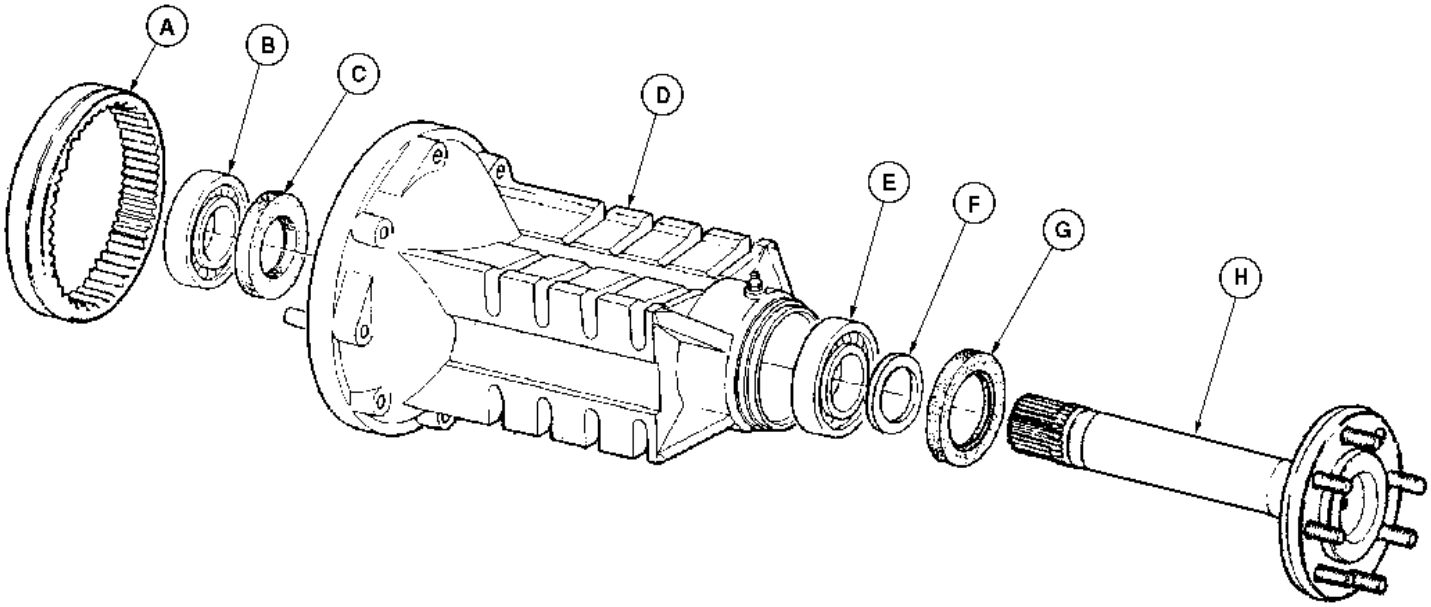
AT2152

7.5 mm (0.3 in.)

Install seal with lips facing planetary drive assembly to 7.5 mm (0.3 in.) depth (A).

[12] - Apply multipurpose grease to lips of seal.

[13] -



AT2151

Axle Shaft Assembly

LEGEND:

A	Ring Gear
B	Bearing
C	Seal
D	Final Drive Housing
E	Bearing
F	Spacer
G	Seal
H	Axle Shaft

Install seal (C) with lips facing planetary drive assembly.

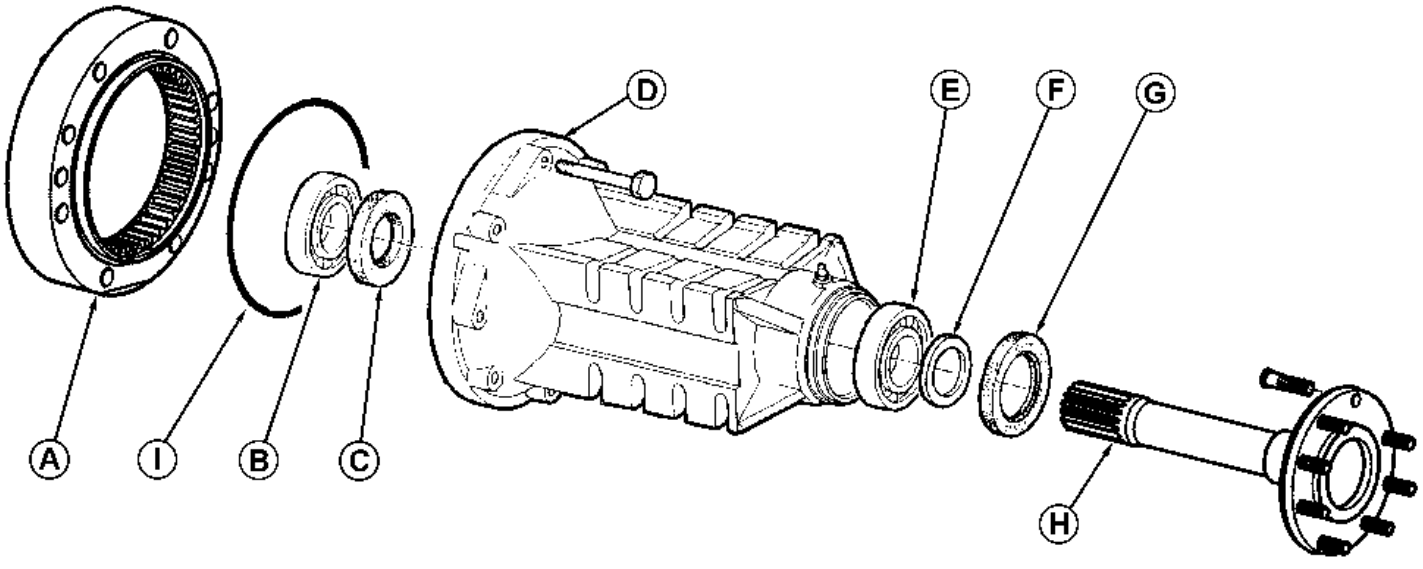
[14] - Apply multipurpose grease to lips of seal.

[15] - Install axle shaft (H) and bearing (B) in final drive housing.

[16] - Install planetary drive assembly.

Remove, Inspect and Install Axle Shaft Assembly (Tractors 5500)

[1] -



AT3026

Axle shaft assembly

LEGEND:	
A	Ring Gear
B	Bearing
C	Seal
D	Final Drive Housing
E	Bearing
F	Lock Ring
G	Seal
H	Axle Shaft
I	Seal

Remove planetary drive assembly (see procedure in this Group).

[2] - Remove axle (H) using a lead hammer on splined end of shaft.

[3] - Remove bearing (E) using knife-edge puller and a press.

→NOTE:

Bearing (E) is press fit on axle shaft.

[4] - Remove lock ring (F) and seal (G).

[5] - Remove bearing (B).

[6] - Pry out seal (C).

[7] - Remove ring gear (A).

→NOTE:

Ring gear (A) is press fit on final drive housing (D).

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

[9] - Install ring gear (A).

[10] - Install bearing (E) in final drive housing.

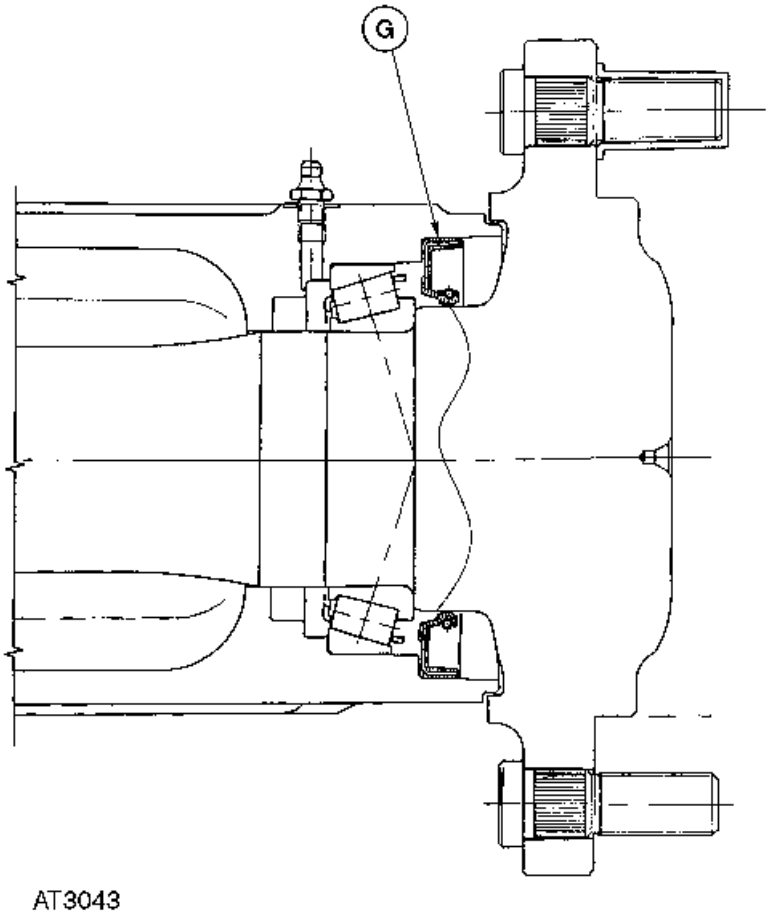
→NOTE:

Apply multipurpose grease to bearing and its area.

[11] -

IMPORTANT:

Replace all seals. Damaged or used seals will leak.

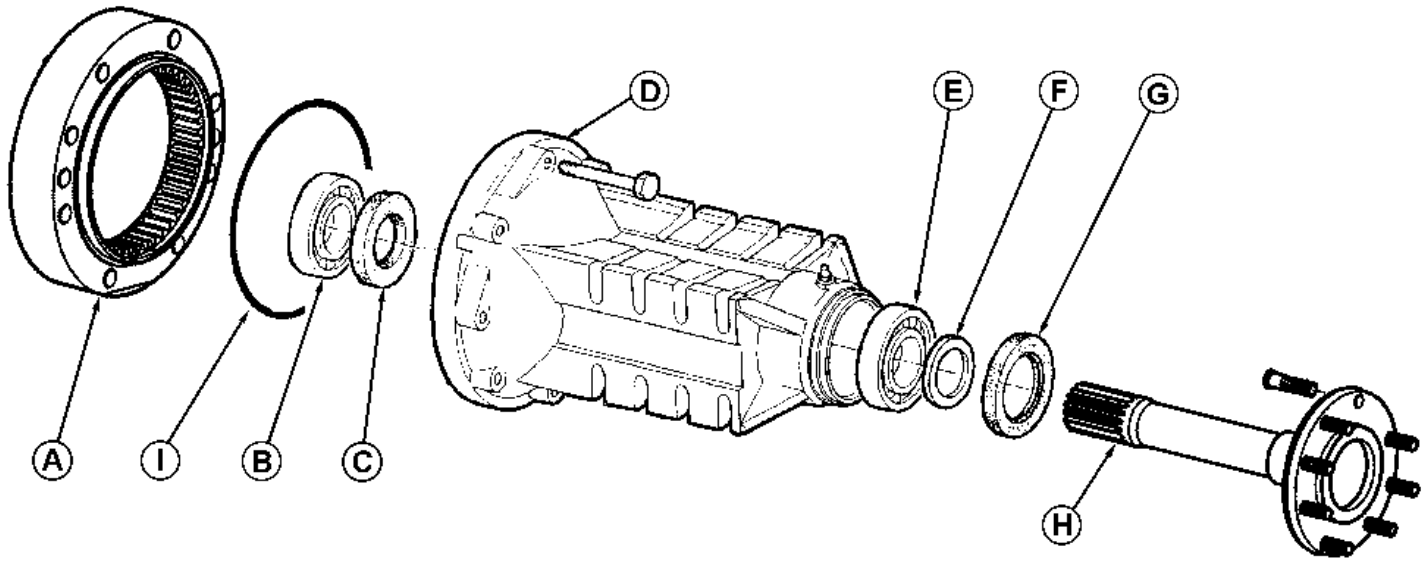


Drive shaft bearing and seal, drawing

Install seal (G) in its seat.

[12] - Apply multipurpose grease to lips of seal.

[13] -



AT3026

Planetary drive assembly

LEGEND:

A	Ring Gear
B	Bearing
C	Seal
D	Final Drive Housing
E	Bearing
F	Lock Ring
G	Seal
H	Axle Shaft
I	Seal

Install seal (C) with lips facing planetary drive assembly.

[14] - Apply multipurpose grease to lips of seal.

[15] - Install axle shaft (H) and bearing (B) in final drive housing.

[16] - Install planetary drive assembly.

Group 30 - Mechanical Front Wheel Drive

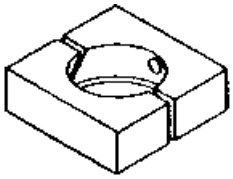
Essential Tools

→NOTE:

Order tools according to information given in the U.S. SERVICEGARD ™ Catalog or from the European Microfiche Tool Catalog (MTC).

Pinion Shaft Holding Fixture

JDG486



JDG486

Holds differential drive shaft when removing or torquing nut.

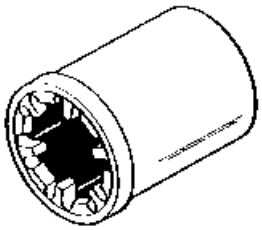
Socket

JDG736

To remove and install MFWD pinion shaft nut.

Spanner Wrench

JDG736



Spanner Wrench

Tighten the MFWD pinion nut.

Spring Scale

JDT42

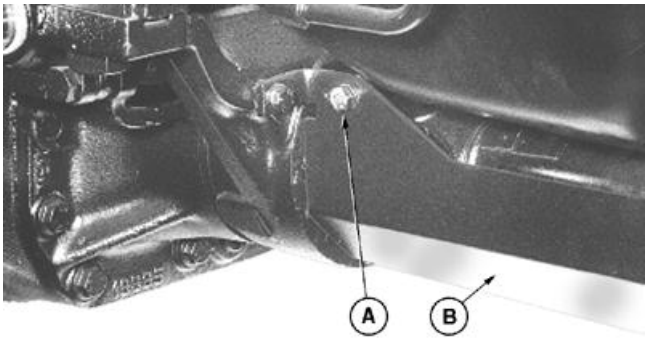
Spring scale

For measuring the initial turning force.

Specifications

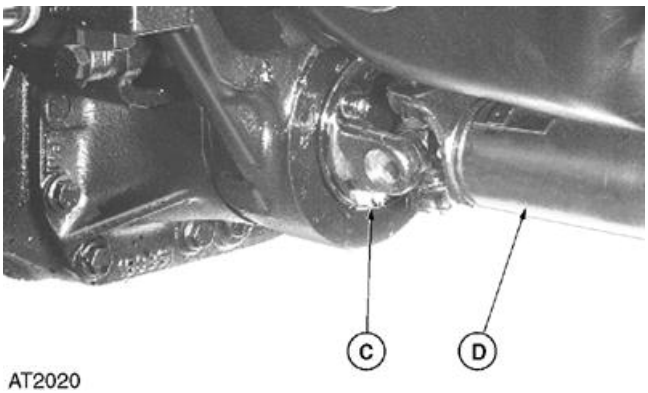
Item	Measurement	Specification
Cap Screws, Axle to Frame	Torque	650 N·m
		480 lb-ft
Front Wheel Nuts	Torque	300 N·m
		220 lb-ft
Cap Screws, Ring Gear Plate to Swivel Housing	Torque	78 N·m
		58 lb-ft
Studs to Hub	Torque	70 N·m
		50 lb-ft
Socket Screws, Planet Pinion Carrier	Torque	25 N·m
		19 lb-ft
Drain Plug, MFWD Final Drive	Torque	80 N·m
		60 lb-ft
Fill Plug, MFWD Axle Housing	Torque	70 N·m
		50 lb-ft
Cap Screws, Swivel Pin to Swivel Housing	Torque	120 N·m
		90 lb-ft
Nut, Tie Rod to Swivel Housing	Torque	165 N·m
		120 lb-ft
Socket Screws, Planet Pinion Carrier	Torque	25 N·m
		18 lb-ft
Cap Screws, Differential Carrier to Axle Housing	Torque	170 N·m
		125 lb-ft
Cap Screws, differential side bearing end caps	Torque	266 N·m
		196 lb-ft
Cap Screws, Ring Gear to Differential Housing	Torque	78 N·m
		58 lb-ft
Ring Gear to Pinion Gear, MFWD Differential	Backlash	0.16 to 0.21 mm
		0.006 to 0.008 in.
MFWD Pinion Shaft	Rolling resistance	142 to 213 N
		32 to 48 lb force
Wheel Hub	Capacity	0.6 L
		0.63 U.S. qt
MFWD Axle Housing	Capacity	5 L
		5.3 U.S.qt

Remove, Inspect and Install MFWD Drive Shaft



AT2019

Cap Screw and Guard



AT2020

Cap Screw and Drive Shaft Assembly

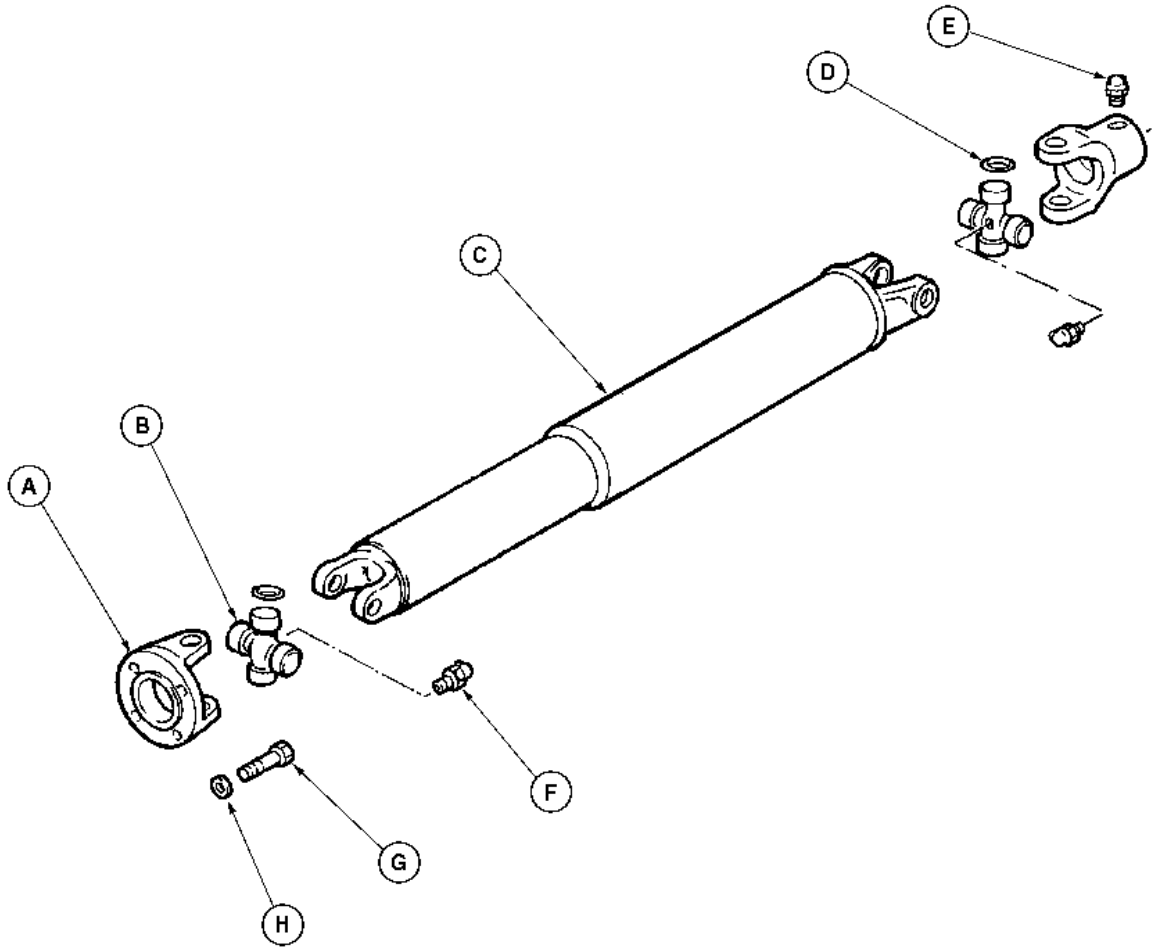
[1] - Remove cap screw (A) at front and rear sides.

[2] - Remove guard (B).

[3] - Remove cap screw (C).

[4] - Slide drive shaft (D) toward front side and remove drive shaft assembly.

[5] -



AT2021

Inspect Parts for Wear

LEGEND:

A	Flange

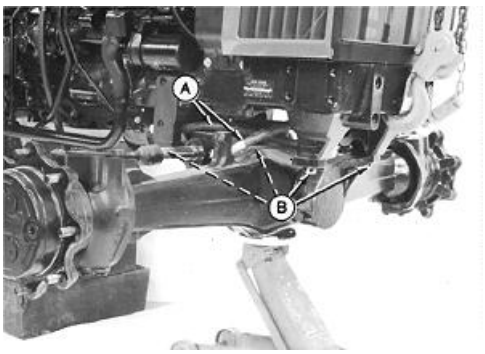
B	Cross and Bearing Assembly (2 used)
C	Drive Shaft
D	Retaining Ring (8 used)
E	Grease Fitting
F	Grease Fitting (2 used)
G	Cap Screw (4 used)
H	Spring Washer (4 used)

Inspect parts (A) to (H) for wear or damage. Replace as necessary.

[6] - Apply Moly High Temperature EP Grease to splines of coupler (E).

[7] - Install drive shaft assembly and guard.

Remove and Install MFWD Axle Housing Assembly



Hydraulic Hoses and Cap Screws

[1] - Remove drive shaft. (See procedure in this Group.)

[2] - Raise front of tractor. Securely support tractor below the engine/transmission junction.

[3] -

CAUTION:

Axle will pivot to one side when one wheel is removed. Install wooden blocks between the axle stops and frame to prevent axle from tipping.

Install wooden blocks between axle and frame.

[4] - Remove front wheels.

[5] - Position a transmission jack or floor jack under center of axle as shown. Ensure axle will be stable on the floor jack when cap screws (B) are removed.

[6] - Disconnect hydraulic hoses (A). Close all openings using caps and plugs.

[7] - Remove cap screws (B) and lower axle.

[8] - Make repairs as necessary. (See procedures in this Group.)

[9] - Raise axle into position and install cap screws. Tighten cap screws to specifications.

[10] - Connect hydraulic hoses.

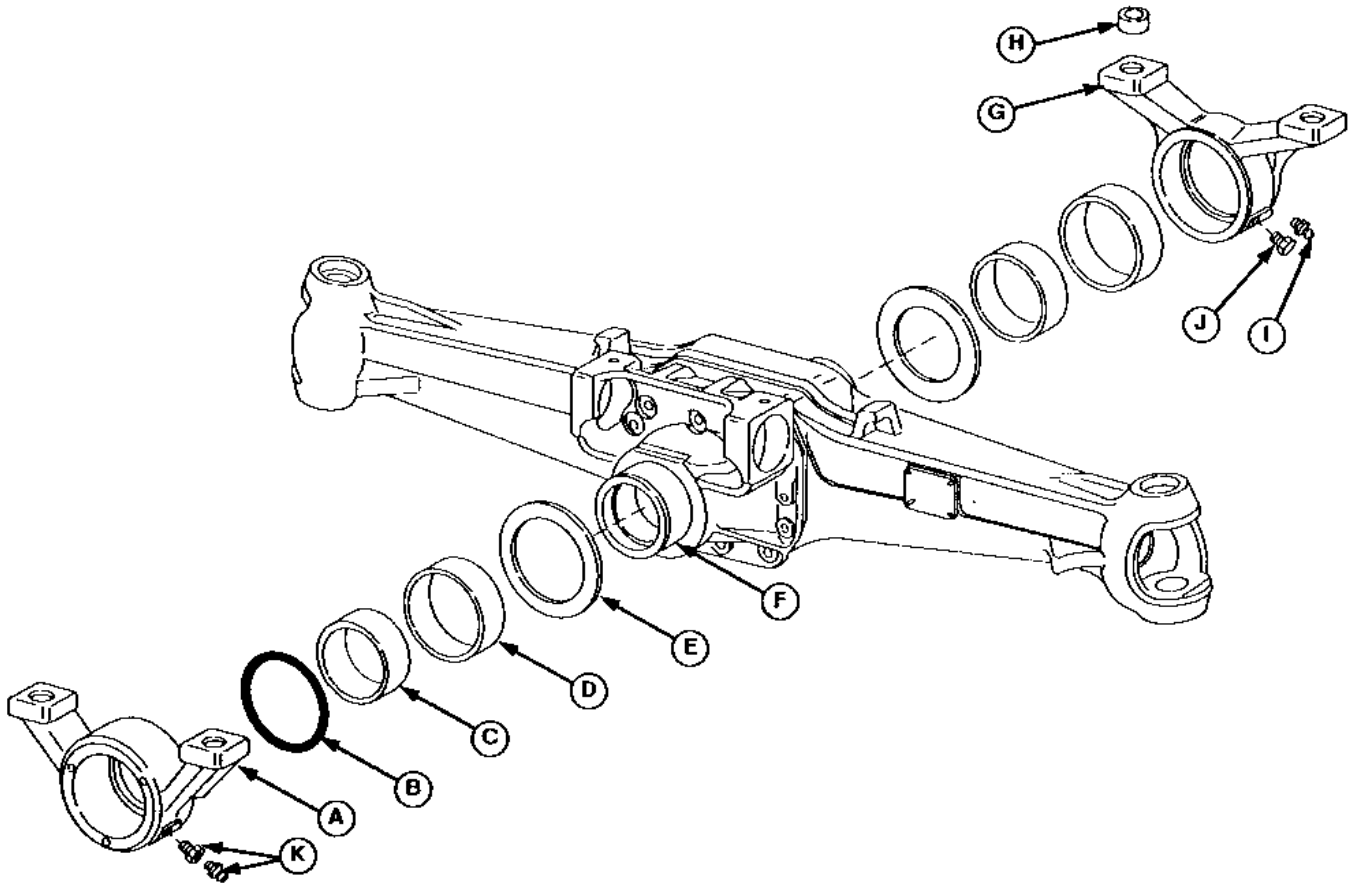
[11] - Install front wheels. Tighten wheel nuts to specifications.

[12] - Remove all supports and lower tractor.

[13] - Install drive shaft.

Item	Measurement	Specification
Axle-to-Frame Cap Screws (B)	Torque	650 N·m
		480 lb-ft
Front Wheel Nuts	Torque	300 N·m
		220 lb-ft

Remove, Inspect and Install MFWD Axle Supports



MFWD Axle Supports

LEGEND:

A	Rear Support
B	O-Ring
C	Trunnion Bushing (2 used)
D	Support Bushing (2 used)
E	Thrust Washer (2 used)
F	Axle Trunnion
G	Front Support
H	Bushing (4 used)
I	Lubrication Fitting
J	Locating Bolt
K	Lubrication Fitting Assembly

[1] - Remove MFWD axle as described in this group.

[2] - Remove supports (A) and (G).

[3] - Remove O-ring (B).

[4] - Clean supports and axle trunnions. Do not remove bushings (C) and (D).

[5] - Install supports on axle trunnions (F). Rock supports from side-to-side. Replace bushings (C) and (D) if excessive play is noted.

[6] - Inspect all parts for wear or damage. Replace as necessary.

→NOTE:

The inner and outer bushings (C) and (D) are a matched set. Always replace both if replacement is necessary.

Bushings (D) are press fit inside supports (A) and (G). Bushings (C) are press fit on trunnions (F). Remove bushings only if replacement is necessary.

[7] - Remove parts (I) to (K).

[8] - Cut bushings to remove.

[9] - Install bushings using a press or a brass drift and hammer.

[10] - Install parts (I) to (K).

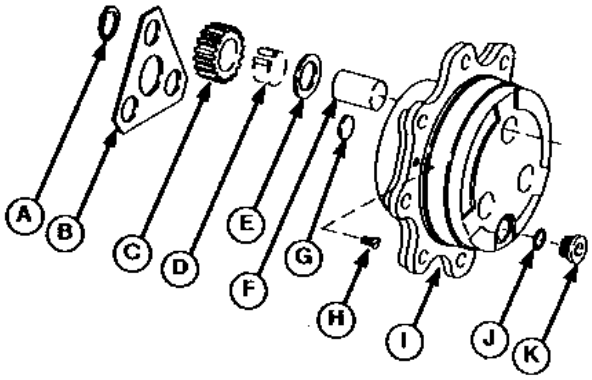
[11] - Apply multipurpose grease to all bushings.

[12] - Install new O-ring (B) in support (A). Install supports on axle trunnions.

[13] - Install MFWD axle as described in this Group).

[14] - Apply multipurpose grease to fittings (I) and (K).

IMPORTANT:



LEGEND:
A Snap Ring (3 used)
B Pinion Plate
C Planet Pinion (3 used)
D Needle Bearings (30 needles per gear)
E Thrust Washer (3 used)
F Pinion Shaft (3 used)
G Thrust Pad
H Socket Head Screw (2 used)
I Planet Pinion Carrier
J O-Ring
K Filler/Drain Plug

MFWD Final Drive

Remove Parts From Planet Pinion Carrier

NOTE:

Keep each planet gear assembly together as a set.

Final drive assembly can be serviced without removing axle.

[1] - Raise and support MFWD axle.

[2] - Remove front wheel.

[3] - Turn final drive until filler/drain plug (C) is at the lowest position.

[4] -

→NOTE:

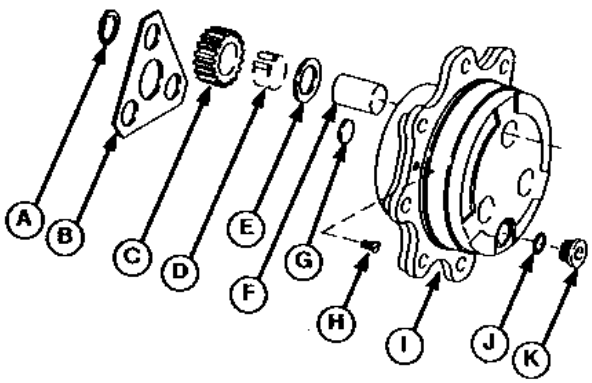
For the approximate capacity of wheel hub, see specification below.

Remove plug (C) to drain wheel hub.

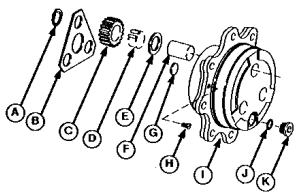
Item	Measurement	Specification
Wheel Hub	Capacity	0.6 L 0.63 U.S. qt

[5] - Remove two socket head screws (A).

[6] - Remove planet pinion carrier (B).



LEGEND:
A Snap Ring (3 used)
B Pinion Plate
C Planet Pinion (3 used)
D Needle Bearings (30 needles per gear)
E Thrust Washer (3 used)
F Pinion Shaft (3 used)
G Thrust Pad
H Socket Head Screw (2 used)
I Planet Pinion Carrier
J O-Ring
K Filler/Drain Plug



Remove Parts From Planet Pinion Carrier

LEGEND:

A	Snap Ring (3 used)
B	Pinion Plate
C	Planet Pinion (3 used)
D	Needle Bearings (30 needles per gear)
E	Thrust Washer (3 used)
F	Pinion Shaft (3 used)
G	Thrust Pad
H	Socket Head Screw (2 used)
I	Planet Pinion Carrier
J	O-Ring
K	Filler/Drain Plug

Keep each planet gear assembly together as a set.

[7] - Remove parts (A) to (E) from planet pinion carrier (I).

[8] -

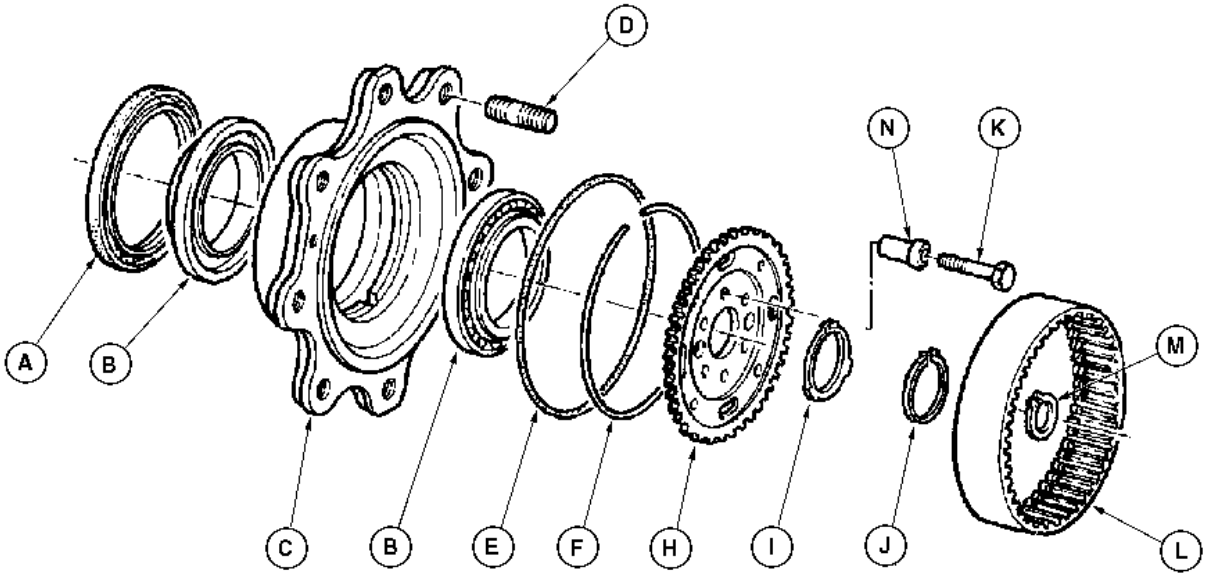
→NOTE:

Pad (G) is held with adhesive to carrier (I). Replace only if necessary.

Shaft (F) and carrier (I) are interference fit and are a matched set. If shafts or carrier are worn or damaged, replace as one unit.

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

[9] -



AT2022

Inspect Parts for Wear

LEGEND:

A	Seal
B	Bearing (2 used)
C	Hub

D	Stud (8 used)
E	O-Ring
F	Retaining Ring
H	Ring Gear Plate
I	Thrust Washer
J	Spacer
K	Cap Screw (4 used)
L	Ring Gear
M	Snap Ring
N	Bushing (4 used)

Remove snap ring (M) and washers (I) and (J).

[10] - Remove cap screws (K).

[11] - Install two of the cap screws (K) in the threaded jacking holes located in plate (H). Tighten cap screws evenly to remove ring gear assembly.

[12] -

→NOTE:

Bushings (N) are press fit. Remove only if replacement is necessary.

Remove retaining ring (F) to separate plate (H) from ring gear (L).

[13] -

IMPORTANT:

The cone and cup of bearings (B) are matched sets. Tag bearing cones to identify each cone with its respective bearing cup to aid in assembly.

Replace all seals. Damaged or used seals will leak.

→NOTE:

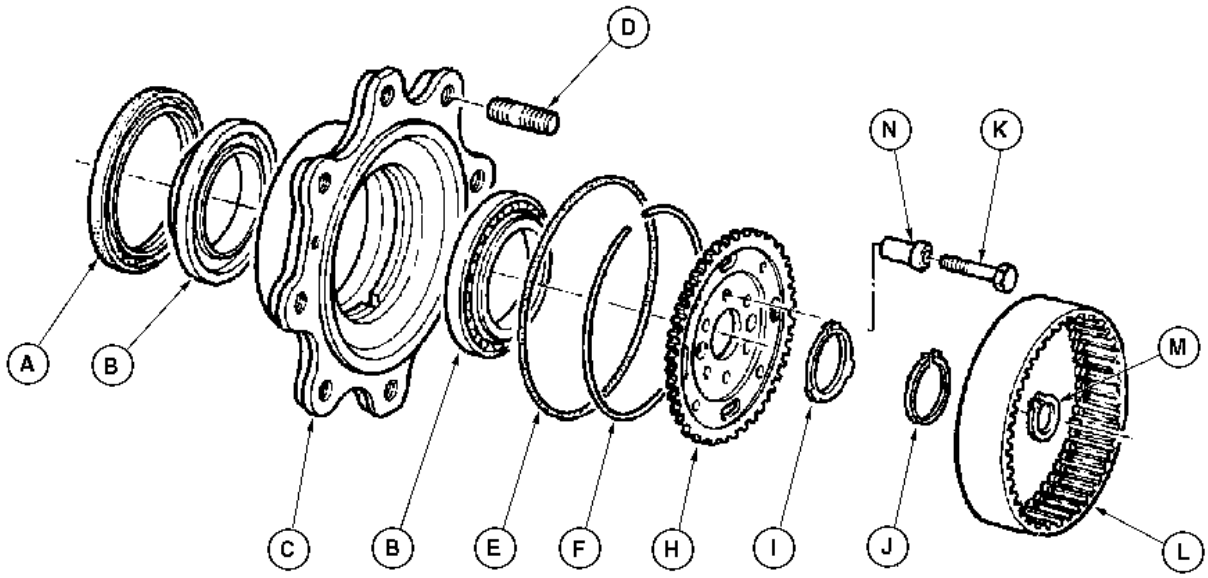
Bearing cups are press fit in hub (C). Remove cups only if replacing bearings.

Remove studs (D) only if replacement is necessary.

Remove parts (A) to (E).

[14] - Inspect all parts for wear or damage. Replace as necessary.

Assemble MFWD Final Drive



AT20022

MFWD Final Drive

LEGEND:

A	Seal
B	Bearing (2 used)
C	Hub
D	Stud (8 used)
E	O-Ring
F	Retaining Ring
H	Ring Gear Plate
I	Thrust Washer
J	Spacer
K	Cap Screw (4 used)
L	Ring Gear
M	Snap Ring
N	Bushing (4 used)

IMPORTANT:

Use new O-rings during assembly. Damaged or used O-rings will leak.

Lubricate all internal parts with clean oil during assembly.

[1] - Apply multipurpose grease to lips of seal (A).

[2] - Install bearing cone (B) on swivel housing.

[3] - Install hub (C), remaining bearing cone and new O-ring (E).

[4] - Assemble parts (F), (H) and (L).

[5] - Press bushings (N) into bores of plate (H).

[6] - Apply thread lock and sealer (medium strength) to threads of cap screws (K).

[7] - Install ring assembly and cap screws. Tighten cap screws to specifications.

Item	Measurement	Specification
Cap Screws, Ring Gear Plate to Swivel Housing	Torque	78 N·m
		58 lb-ft

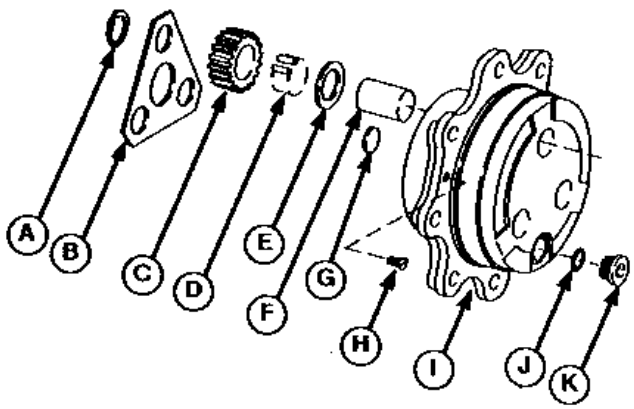
[8] - Install washers (I) and (J) and snap ring (M).

[9] - If studs (D) were removed:

a. Apply thread lock and sealer (medium strength) to threads of studs.
b. Install studs and tighten to specifications.

Item	Measurement	Specification
Studs to Hub	Torque	70 N·m
		50 lb-ft

[10] -



LEGEND:

A	Snap Ring (3 used)
B	Pinion Plate
C	Planet Pinion (3 used)
D	Needle Bearings (30 needles per gear)
E	Thrust Washer (3 used)
F	Pinion Shaft (3 used)
G	Thrust Pad
H	Socket Screw (2 used)
I	Planet Pinion Carrier
J	O-Ring
K	Filler/Drain Plug

MFWD Final Drive Components

If thrust pad (G) was removed:

a. Clean with solvent, thrust pad and surface of carrier housing where pad contacts housing. Allow to air dry.
b. Apply retaining compound to pad.
c. Install pad in carrier housing.

[11] - Install parts (A) to (E) into carrier (I). Install needle bearings (D) using grease to hold the individual bearings in position.

[12] - Install carrier assembly to hub.

[13] - Install two socket head screws (H). Tighten to specifications.

Item	Measurement	Specification
Socket Screws, Planet Pinion Carrier	Torque	25 N·m
		19 lb-ft

[14] - Rotate final drive until filler/drain plug hole is approximately at the 3 o’clock position and oil level line is horizontal (parallel to ground). Fill to level line with specified gear oil (see “Fuel, Lubricants and Coolant” in Section 10).

[15] - Install O-ring (J) and plug (K). Tighten plug to specifications.

Item	Measurement	Specification
Drain Plug, MFWD Final Drive	Torque	80 N·m
		60 lb-ft

[16] - Install wheel. Tighten wheel nuts to specifications.

Item	Measurement	Specification
Wheel Nuts	Torque	300 N·m
		220 lb-ft

Remove, Inspect and Install MFWD Swivel Housing

Plug, Screws and Planet Pinion Carrier

[1] - Raise and support MFWD axle.

[2] - Remove front wheel.

[3] - Turn final drive so that filter/drain plug (C) is at the lowest position.

[4] -

→NOTE:

For the approximate capacity of wheel hub, see specification below.

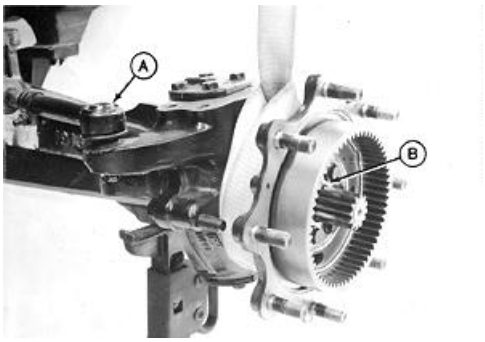
Remove plug (C) to drain wheel hub.

Item	Measurement	Specification
Wheel Hub	Capacity	0.6 L 0.63 U.S. qt

[5] - Remove two socket head screws (A).

[6] - Remove planet pinion carrier (B).

[7] -



Disconnect Tie Rod End

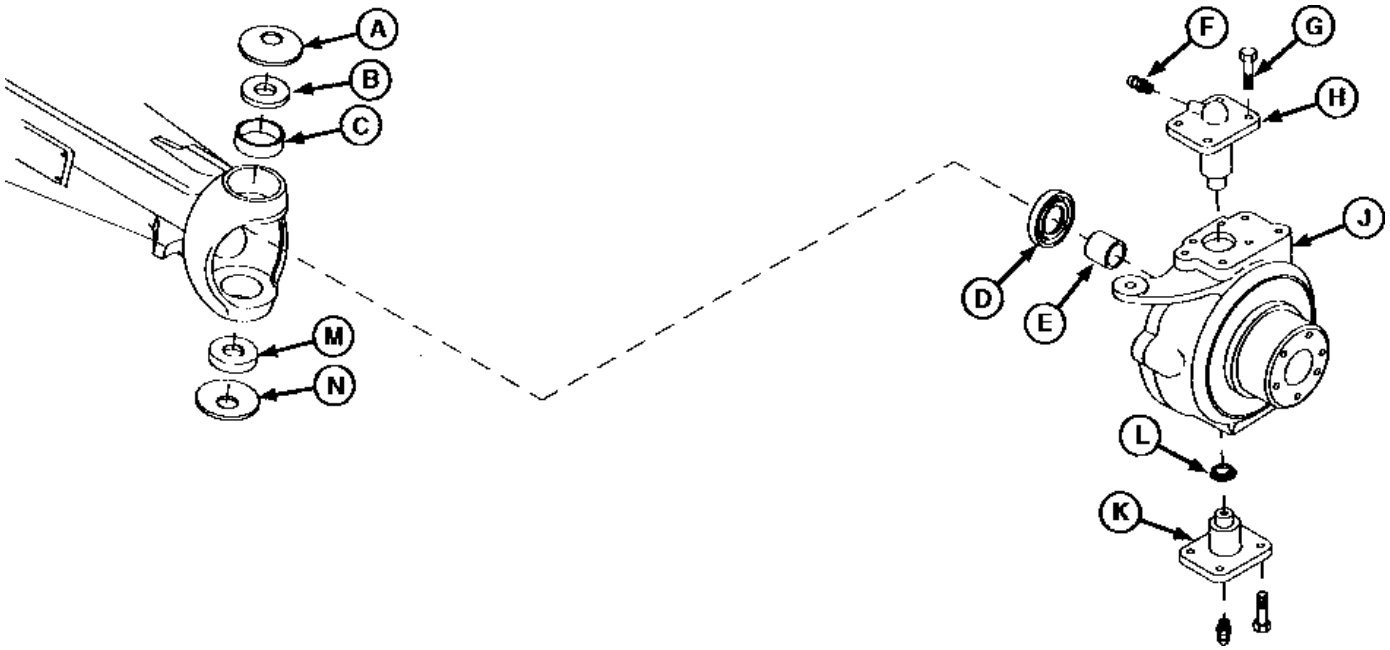
Attach lifting chain or sling around swivel housing.

[8] - Disconnect tie rod end (A).

[9] - Remove snap ring and washers (B) from axle shaft.

[10] -

→NOTE:



MFWD Swivel Housing-Exploded View

LEGEND:

A	Belleville Washer
B	Spacer
C	Bushing
D	Seal
E	Bushing
F	Lubrication Fitting (2 used)
G	Cap Screw (8 used)
H	Upper Swivel Pin
J	Swivel Housing
K	Lower Swivel Pin
L	Bearing Cone
M	Bearing Cup
N	Belleville Washer

When removing swivel housing (J), keep axle shaft with axle housing. Hold shaft in position while pulling swivel housing away from axle housing.

Remove parts (H) to (K).

[11] -

→NOTE:

All bushings and bearings are press fit. Remove only if replacement is necessary.

If replacing bushing (E) and cone (L), it may be necessary to heat the axle housing and chill the bushing and cone to aid in installation.

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

[12] -

IMPORTANT:

Replace all seals. Damaged or used seals will leak.

Remove burrs from mating surfaces of parts (H), (J) and (K). Raised imperfections on these surfaces will affect swivel pin bearing preload.

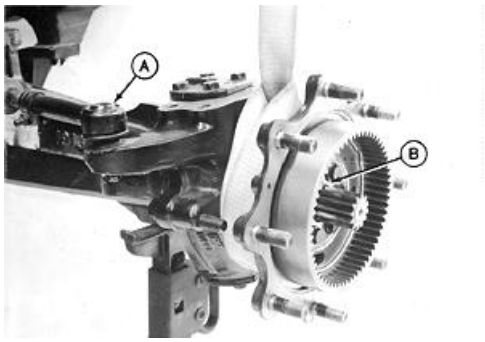
Install all parts using the following instructions:

a. Install seals using a bearing, bushing and seal driver set. Install seal (D) with lips toward swivel housing.
b. Apply multipurpose grease to inside lips of seals.
c. Apply Moly High Temperature EP Grease to shaft of pins (H) and (K).
d. Belleville washers (A) and (N) are used to preload the swivel pin bearings. No adjustment is necessary.
e. Tighten cap screws (G) to specified torque.

Item	Measurement	Specification
Cap Screws, Swivel Pin to Swivel Housing	Torque	120 N·m 90 lb-ft

[13] -

→NOTE:



Install Washers and Snap Ring

Washer with tangs on its outer edge goes against ring gear plate.

Install washers and snap ring (B).

[14] - Connect tie rod end (A) to swivel housing. Tighten nut to specified torque.

Item	Measurement	Specification
Nut, Tie Rod to Swivel Housing	Torque	165 N·m 120 lb-ft

[15] -

IMPORTANT:

Install Parts

Replace all O-rings. Damaged or used O-rings will leak.

Install planet pinion carrier (B) with new O-ring.

[16] - Install two socket head screws (A). Tighten to specifications.

[17] - Turn final drive until filler/drain plug hole is approximately at the 3 o′clock position and oil level line is horizontal (parallel to ground). Fill with specified gear oil (see “Fuel, Lubricants and Coolant” in Section 10).

[18] - Install plug (C) with new O-ring. Tighten plug to specifications.

[19] - Install wheel. Tighten wheel nuts to specifications.

Item	Measurement	Specification
Socket Screws, Planet Pinion Carrier	Torque	25 N·m
		18 lb-ft
Drain Plug, MFWD Final Drive	Torque	80 N·m
		60 lb-ft
Wheel Nuts	Torque	300 N·m
		220 lb-ft

Remove, Inspect and Install MFWD Axle Shaft

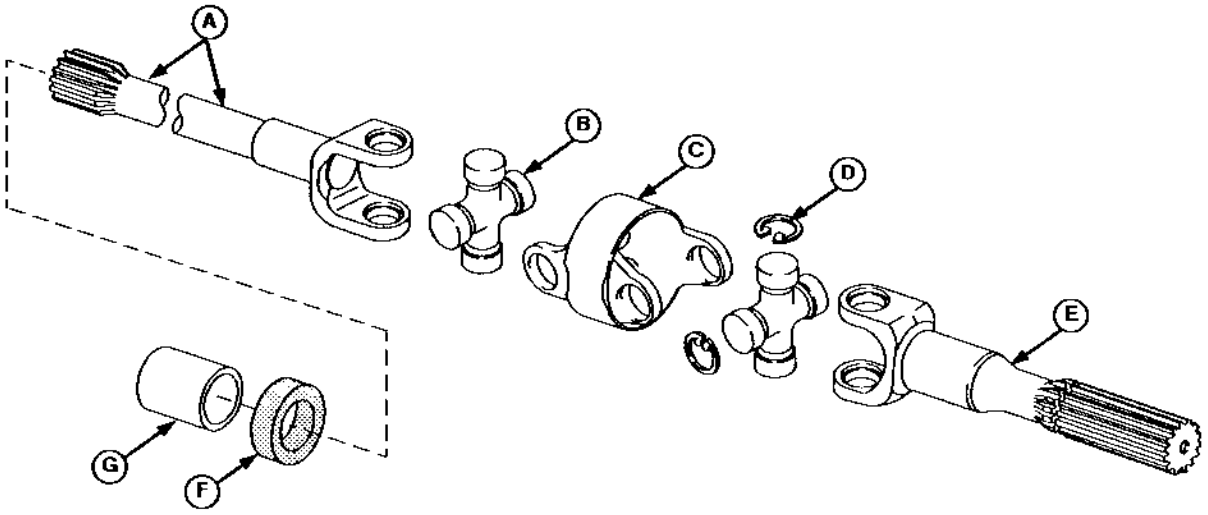
[1] - Remove swivel housing (see procedure in this group).

[2] -

Axle Shaft Assembly

Remove axle shaft assembly (A). Support shaft as its removed from housing so as not to damage axle housing oil seal.

→NOTE:



MFWD Axle Shaft-Exploded View

LEGEND:

A	Long Axle Shaft
B	Cross and Bearing Assembly (2 used)
C	Center Yoke
D	Retaining Ring (8 used)
E	Short Axle Shaft
F	Seal
G	Bushing

Bushing (G) is press fit in MFWD axle housing. Remove bushing only if replacement is necessary.

[3] - Inspect parts (A-G) for wear or damage. Replace as necessary.

[4] -

IMPORTANT:

Replace all seals. Damaged or used seals will leak.

Pry out seal (F) out of axle housing. Install new seal with lips facing bushing (G), using a bearing, bushing and seal driver set. Install seal into axle bore until tight against shoulder in bore.

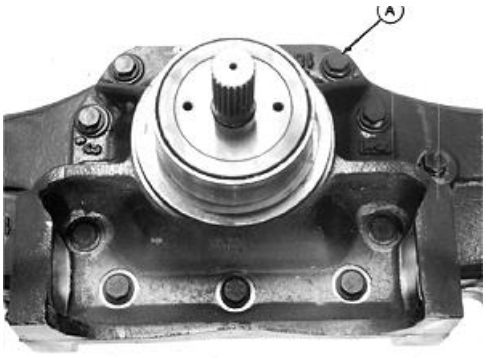
[5] - Apply multipurpose grease to lips of seal.

[6] - Install axle shaft assembly.

[7] - Install swivel housing (see procedure in this Group).

Remove and Install MFWD Differential Carrier Assembly

[1] -



Remove Cap Screws

Remove steering cylinder (see procedure in Section 60).

[2] - Remove axle supports.

[3] - Remove MFWD axle shafts (see procedure in this Group).

[4] -

→NOTE:

For the approximate capacity of axle housing, see specification below.

Drain axle housing.

Item	Measurement	Specification
MFWD Axle Housing	Capacity	5 L
		5.3 U.S.qt

[5] - Remove ten cap screws (A) to remove carrier housing.

[6] - Make repairs as necessary as described in this Group.

[7] - Clean mating surfaces of housing using. Apply sealing compound to mating surfaces of housings.

[8] - Install differential carrier housing.

[9] - Install cap screws and tighten to specification

[10] - Install steering cylinder (see procedure Section 60).

[11] - Install MFWD axle shafts as described in this Group).

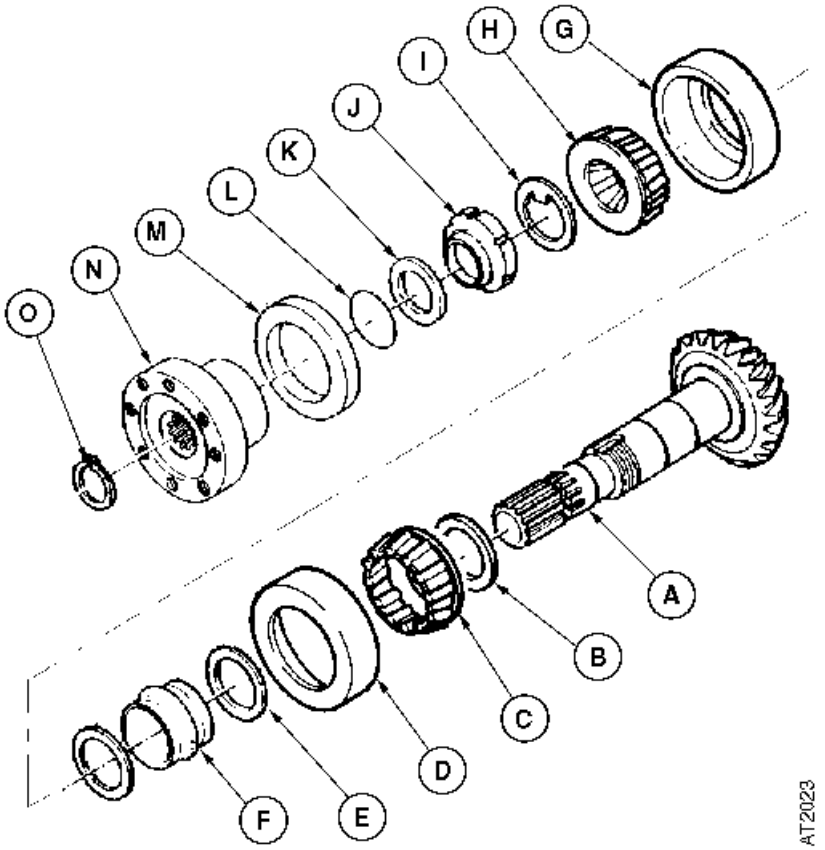
[12] - Install MFWD axle and supports (see procedure in this Group).

[13] - Fill axle housing with specified gear oil (see “Fuel, Lubricants and Coolant” in Section 10).

[14] - Tighten axle housing fill plug to specification.

Item	Measurement	Specification
Cap Screws, Differential Carrier to Axle Housing	Torque	170 N·m
		125 lb-ft
MFWD Axle Housing Fill Plug	Torque	70 N·m
		50 lb-ft

Disassemble and Inspect MFWD Differential Carrier Assembly



MFWD Differential Carrier Assembly

LEGEND:

A	Pinion Shaft
B	Shim
C	Bearing Cone
D	Bearing Cup
E	Washer (2 used)
F	Collapsible Spacer
G	Bearing Cup
H	Bearing Cone
I	Washer
J	Nut
K	Thrust Washer
L	O-Ring
M	Seal
N	Flange
O	Snap Ring

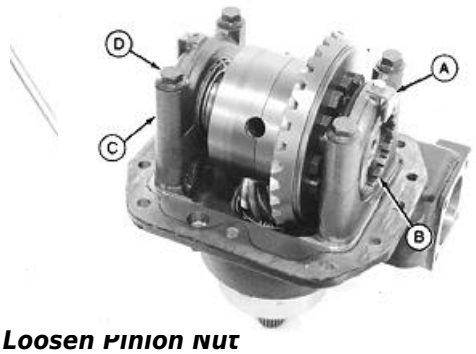
[1] - Remove MFWD differential carrier assembly as described in this Group).

[2] - Remove snap ring (O), flange (N), O-ring (L) and thrust washer (K).

[3] - Pry out seal (M) from differential housing.

[4] -

IMPORTANT:



LEGEND:

A	Lock Plate (2 used)
B	Ring Nut (2 used)
C	Bearing Cap (2 used)
D	Cap Screw (4 used)

Loosen Pinion Nut

Plates, Nuts, Caps and Screws

Straighten locking tabs on collar of nut using a small punch.

Ring nut (B), bearing cap (C) and the related bearing boss on each side of carrier housing are matched sets. Do not interchange parts.

[5] - Wedge a brass drift (B) or piece of hard wood between ring gear and pinion shaft.

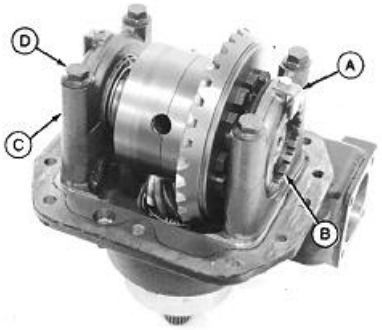
[6] - Loosen pinion nut using JDG736 socket (A).

Socket

JDG736

To remove and install MFWD pinion shaft nut.

[7] -

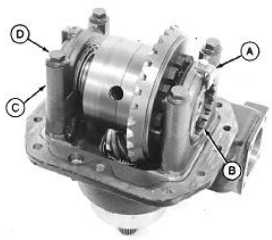


LEGEND:

A	Lock Plate (2 used)
B	Ring Nut (2 used)
C	Bearing Cap (2 used)
D	Cap Screw (4 used)

Plates, Nuts, Caps and Screws

Ring nut (B), bearing cap (C) and the related bearing [illegible] are matched sets. Do not interchange parts.



LEGEND:

A	Lock Plate (2 used)
B	Ring Nut (2 used)
C	Bearing Cap (2 used)
D	Cap Screw (4 used)

Plates, Nuts, Caps and Screws

Ring nut (B), bearing cap (C) and the related bearing boss on each side of carrier housing are matched sets. Do not interchange parts.

Mark each bearing cap (C) and related bearing boss to identify for assembly purposes.

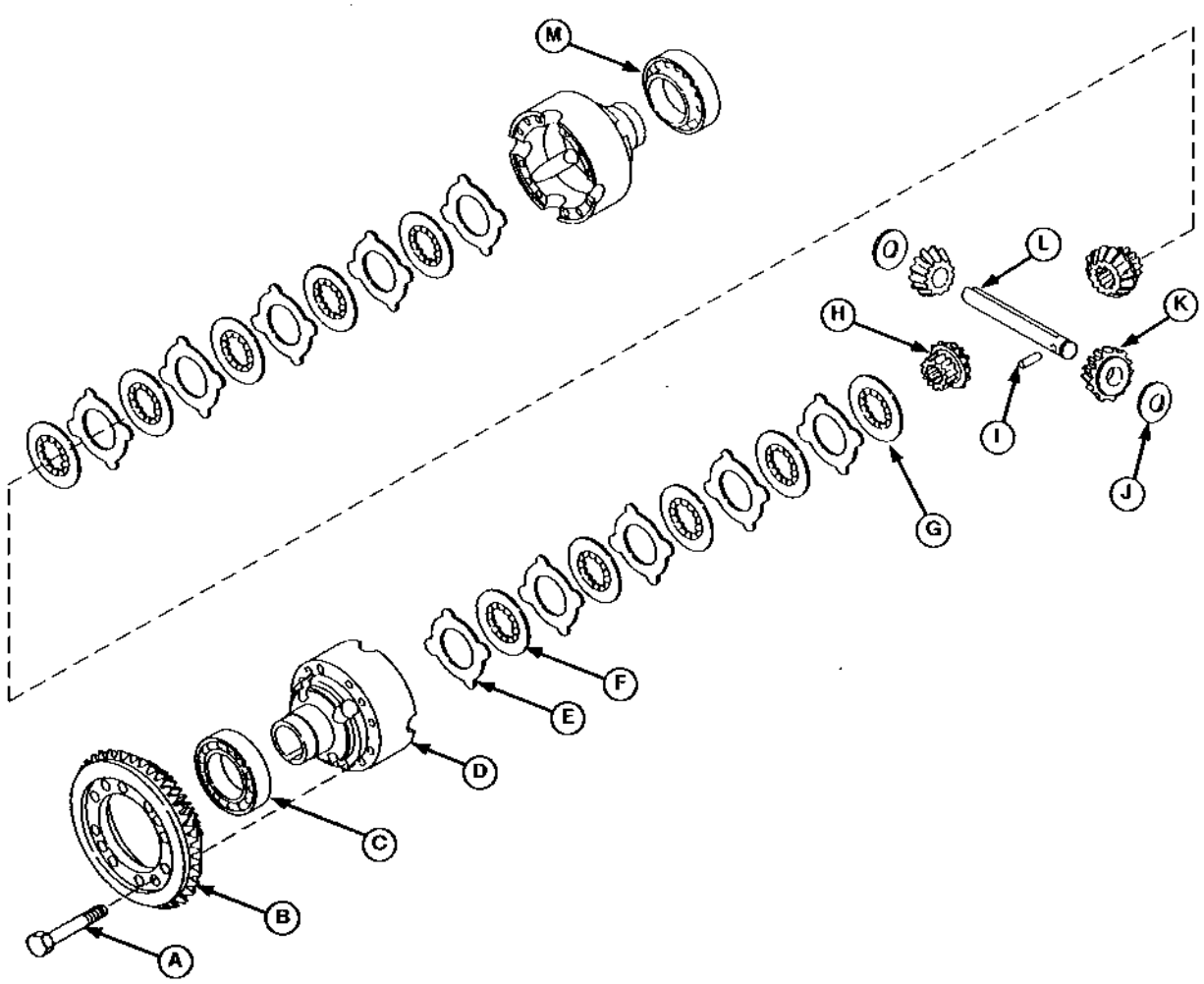
[8] - Mark position of each ring nut (B) in respect to the bearing cap and related bearing boss to aid in assembly.

[9] - Remove parts (A) to (D).

[10] - Remove differential and ring gear assembly from carrier housing.

[11] -

IMPORTANT:



Disassemble Parts

LEGEND:

A	Cap Screw (12 used)
B	Ring Gear
C	Roller Bearing
D	Differential Housing (2 halves used)
E	Drive Plate (10 used)
F	Friction Plate (8 used)
G	Inner Thrust Plate (2 used)
H	Bevel Gear (2 used)
I	Spring Pin
J	Thrust Washer (2 used)
K	Bevel Pinion (2 used)
L	Pinion Shaft
M	Roller Bearing

Keep plates (E) to (G) together and in sequence removed to aid in assembly.

Keep cup and cone of each bearing (C) and (M) together as a set.

Disassemble parts (A) to (M). Remove bearing cones of bearings (C) and (M) only if replacement is necessary.

[12] - Inspect all parts for wear or damage. Replace as necessary.

[13] - Measure thickness of plates (E) to (G). Replace if not to specification.

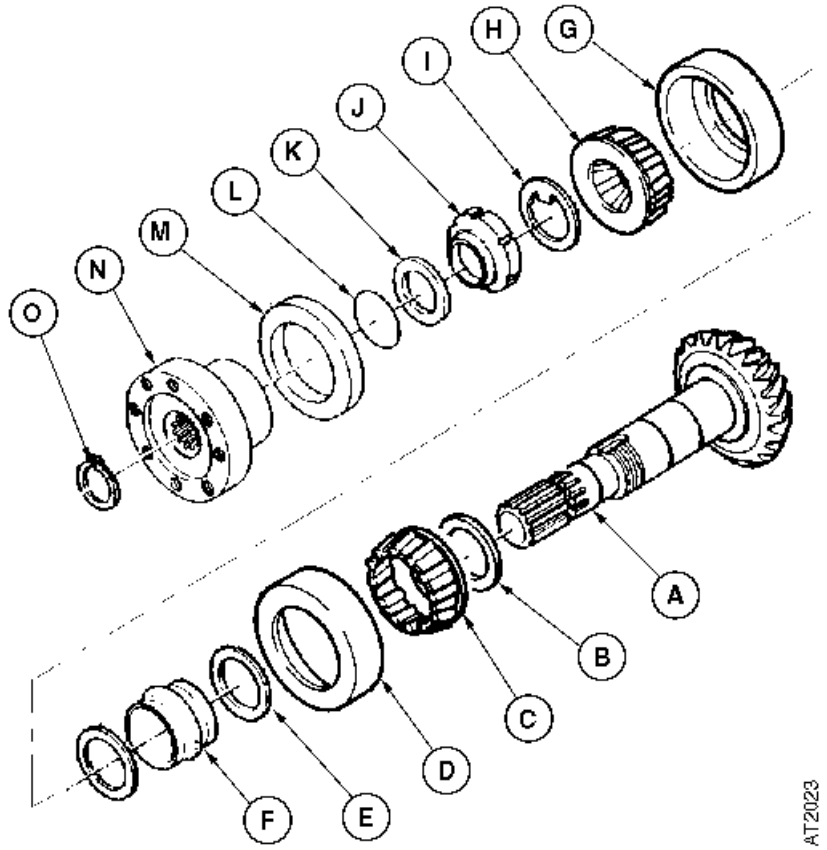
Plate Thickness

PLATE THICKNESS SPECIFICATIONS

Plate	Minimum	New
Friction (F)	1.30 mm (0.051 in.)	1.60 mm (0.063 in.)
Drive (E)	1.47 mm (0.058 in.)	1.53 mm (0.060 in.)
Inner Thrust (G)	2.73 mm (0.107 in.)	2.83 mm (0.110 in.)

[14] -

IMPORTANT:



Inspect Parts for Wear

LEGEND:

A	Pinion Shaft
B	Shim
C	Bearing Cone
D	Bearing Cup
E	Washer (2 used)
F	Collapsible Spacer
G	Bearing Cup
H	Bearing Cone
I	Washer
J	Nut
K	Thrust Washer
L	O-Ring
M	Seal
N	Flange
O	Snap Ring

If either ring gear or pinion shaft is worn or damaged, both components must be replaced as a matched set.

Replace all seals. Damaged or used seals will leak.

DO NOT use old collapsible spacer (F) and pinion nut (J). If removed, always install new spacer and nut.

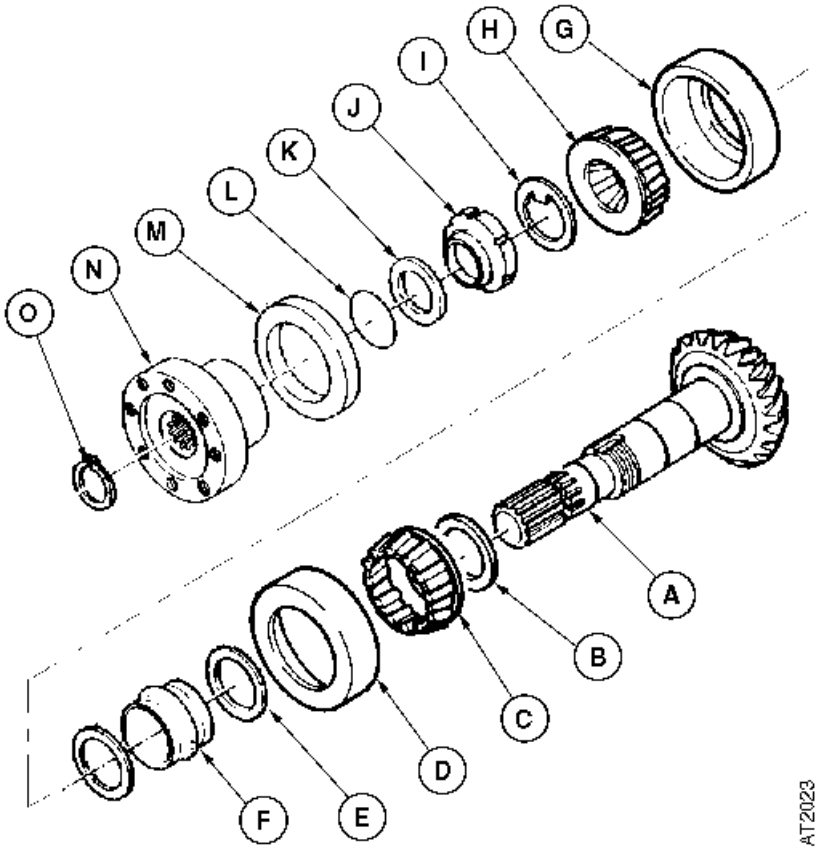
→NOTE:

Bearing cone (C) and bearing cups (D) and (G) are press fit. Remove only if replacement is necessary.

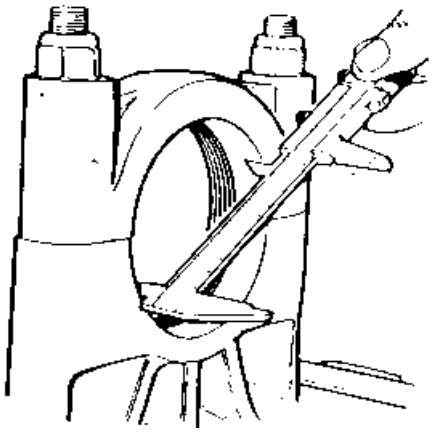
Remove parts (A) to (J). Remove bearing cone (C) and shim (B) using a knife-edged puller and a press.

[15] - Inspect all parts for wear or damage. Replace as necessary.

Assemble MFWD Differential Carrier Assembly



MFWD Differential Carrier Assembly



Measure Side Bearing Bore

LEGEND:

A	Pinion Shaft
B	Shim
C	Bearing Cone
D	Bearing Cup
E	Washer (2 used)
F	Collapsible Spacer
G	Bearing Cup
H	Bearing Cone
I	Washer
J	Nut
K	Thrust Washer
L	O-Ring
M	Seal
N	Flange

O Snap Ring

IMPORTANT:

If the ring gear and pinion assembly, pinion bearings or the differential carrier housing have been replaced, it will be necessary to calculate for thickness of shim (B) to adjust cone point.

[1] - If either the ring gear and pinion assembly, pinion bearings or carrier housing are replaced, cone point will require adjusting. Continue to step 2.

If all the components are reused, no adjustment is required. Go to step 10. Use original shim value.

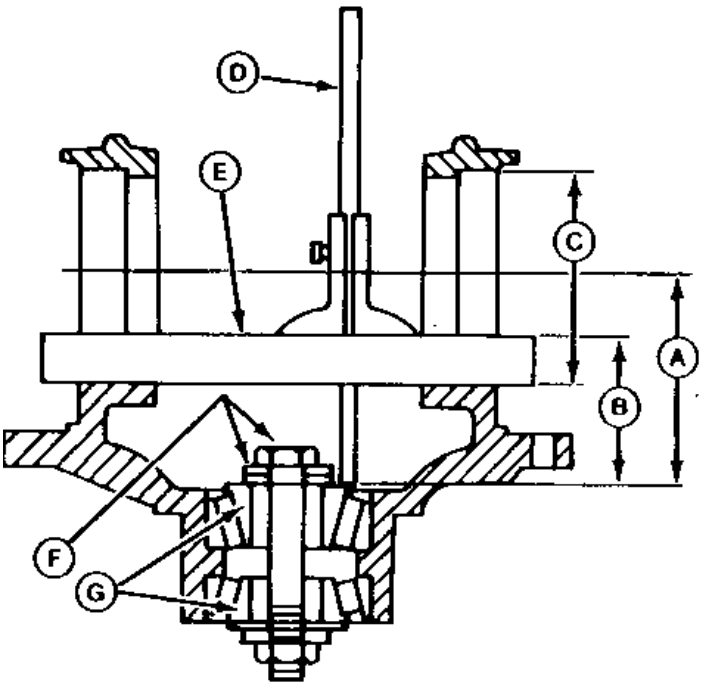
[2] - Install side bearing end caps. Tighten cap screws to specified torque.

Item	Measurement	Specification
Cap Screws, differential side bearing end caps	Torque	266 N·m 196 lb-ft

[3] - Measure the side bearing bore using an internal micrometer or vernier gauge. Record the reading obtained.

[4] - Remove end caps.

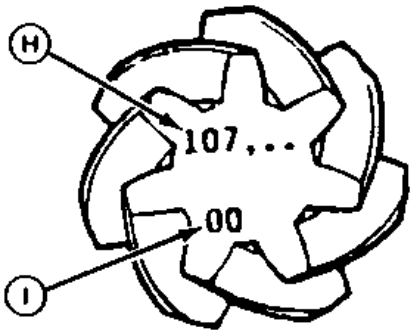
[5] -



LEGEND:

A	Dimension (bore center to bearing)
B	Dimension (rod to bearing)
C	Bore Diameter (from step 3)
D	Depth Gauge
E	Circular Bar
F	M12 Cap Screw, Nut and Washers
G	Bearing (2 used)
H	Pinion Dimension
I	Ring Gear/Pinion Mating Number

Calculate Dimensions



Pinion Dimension

If pinion bearing cups were removed, install new cups in carrier housing with large ID of taper facing outward from housing. Press cups tight against shoulder in housing bore.

[6] - Install and clamp bearing cones (G) into carrier housing using an M12 x 110 mm cap screw, nut and washers (F).

Tighten the cap screw so that bearing cones can just be turned by hand. DO NOT overtighten.

[7] - Lay a 25 x 228 mm (0.984 x 8.976 in.) circular bar (E) across the inside surface of the two side bearing bores. Measure for dimension (B) using a depth gauge (D).

[8] - Calculate:

Dimension (A) = dimension (B) minus diameter of bar (E) [25 mm (0.984 in.)] plus [1/2 diameter of bore (C)] recorded in step 3.

→NOTE:

Dimension (H) is etched on the head of the pinion gear.

Actual shim thickness = dimension (A) minus dimension (H).

EXAMPLE (calculated in metric):

Dimension (A) = 104.1 - 25 + [1/2 (90) = 45] = 124.1

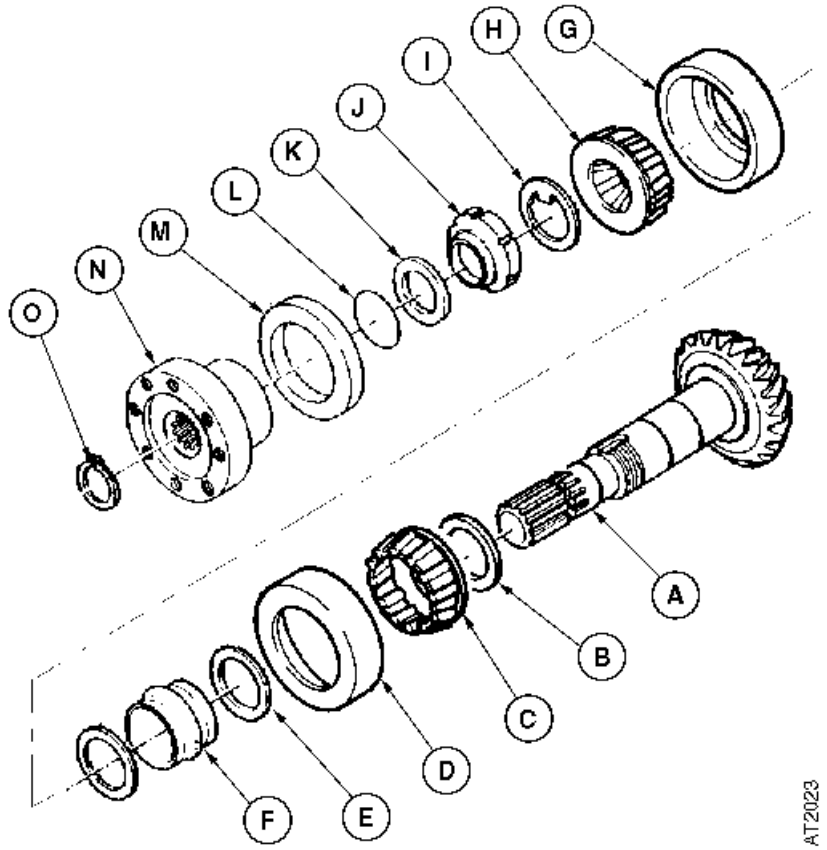
Etched on the head of the pinion is 121.0

124.1 - 121.0 = 3.1 mm (shim thickness)

[9] - Remove items (E-G).

[10] -

IMPORTANT:



Install MFWD Differential Carrier Parts

LEGEND:

A	Pinion Shaft
B	Shim
C	Bearing Cone
D	Bearing Cup
E	Washer (2 used)
F	Collapsible Spacer
G	Bearing Cup
H	Bearing Cone
I	Washer
J	Nut
K	Thrust Washer
L	O-Ring
M	Seal
N	Flange
O	Snap Ring

DO NOT use old collapsible spacer (F) and pinion nut (J). Always install new spacer and nut.

To prevent damaging bearing (C), apply force only to inner race of bearing cone during installation.

Lubricate all internal parts with clean gear oil during assembly.

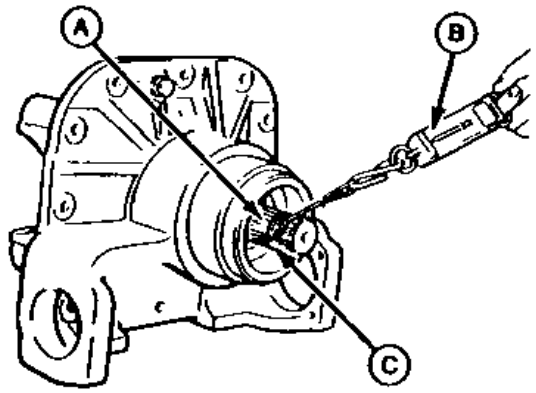
Install parts (A) to (J) using the following instructions:

a. Install shim (B) with the chamfer adjacent to the pinion gear.
b. Install bearing cone (C) with large diameter of taper toward pinion gear. Install bearing tight against shoulder of pinion shaft using a piece of pipe and a press.
c. Tighten nut (J) by hand using JDG736 socket.
   Socket
   JDG736
   To remove and install MFWD pinion shaft nut.

Apply only enough force needed to just remove free- play from bearings.

d. DO NOT install seal (K) at this time.

[11] -



LEGEND:

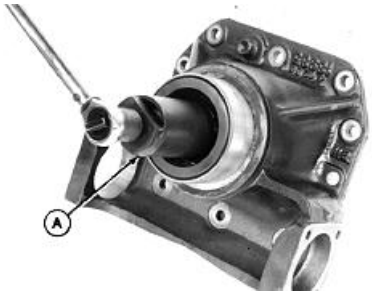
A	Input Shaft
B	Spring Scale
C	String

Shaft, Scale, and String

Measure pinion bearing preload using the following method:

a. Wrap a length of string (C) evenly (do not overlap) around the exposed input shaft (A).
b. Attatch a spring scale (B) to string. Pull scale firmly and evenly to measure the force required to rotate the pinion shaft.
c. Read scale during rotation of the pinion. Do not read scale at the point where rotation starts.
d. Record the reading obtained.

[12] -

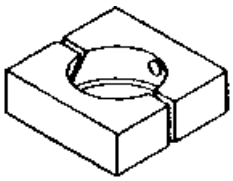


JDG736 Spanner Wrench

Attach JDG486 Pinion Shaft Holding Fixture to pinion gear and install assembly in a vise.

Pinion Shaft Holding Fixture

JDG486



JDG486

Holds differential drive shaft when removing or torquing nut.

[13] -

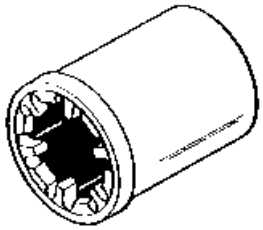
IMPORTANT:

Over-tightening the pinion nut may damage the collapsible spacer.

Tighten the pinion nut using JDG736 Spanner Wrench (A) until a rotational pull of 105-157 N (24-35 lb force) is achieved.

Spanner Wrench

JDG736



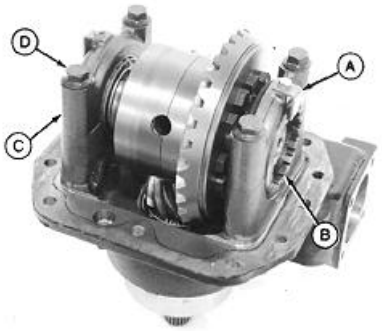
Spanner Wrench

Tighten the MFWD pinion nut.

[14] - Lock the pinion nut to the shaft by peening collar of nut into the slot on pinion shaft.

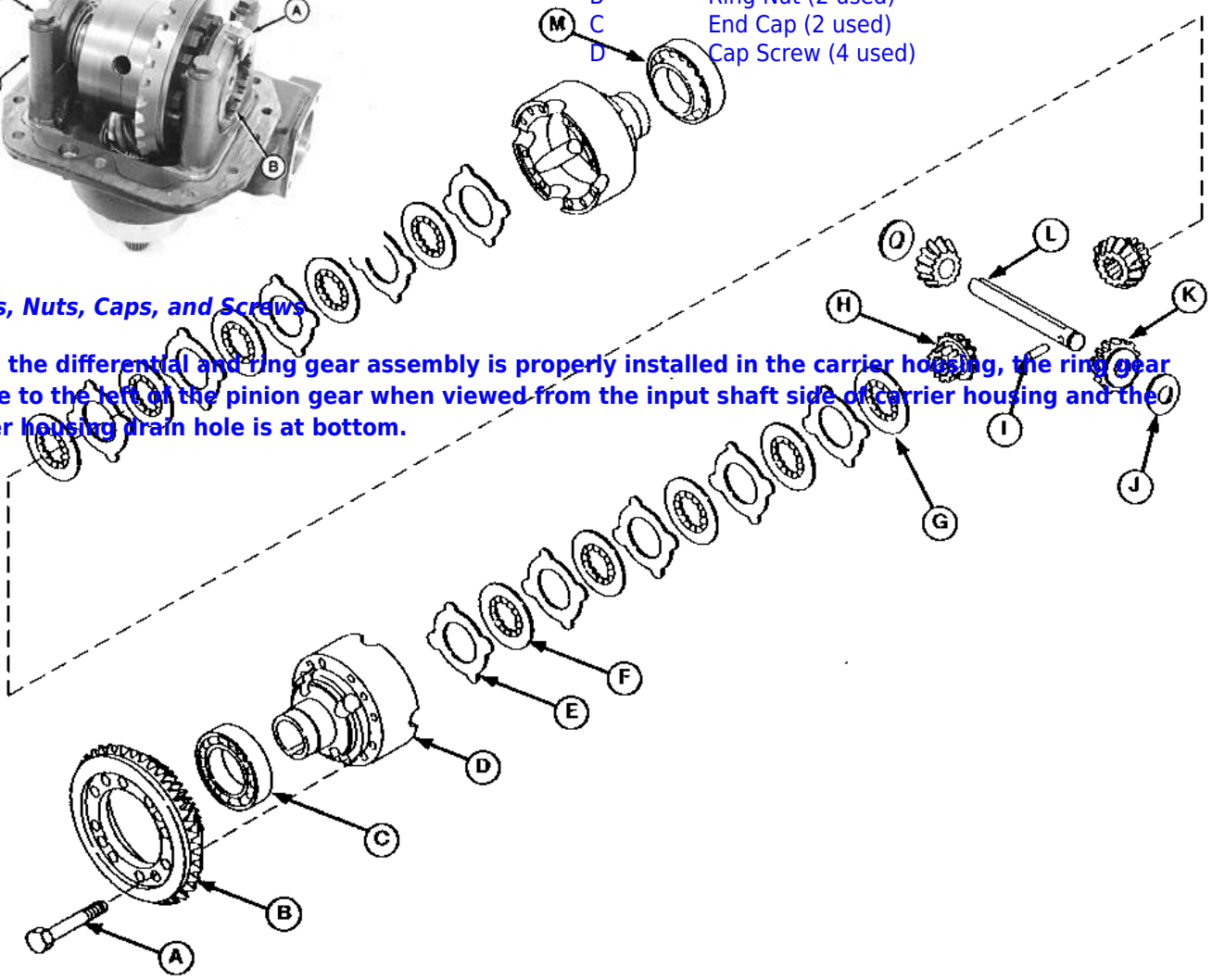
[15] -

→NOTE:



LEGEND:

A	Lock Plate (2 used)
B	Ring Nut (2 used)
C	End Cap (2 used)
D	Cap Screw (4 used)



Plates, Nuts, Caps, and Screws

When the differential and ring gear assembly is properly installed in the carrier housing, the ring gear will be to the left of the pinion gear when viewed from the input shaft side of carrier housing and the carrier housing drain hole is at bottom.

Assemble Parts

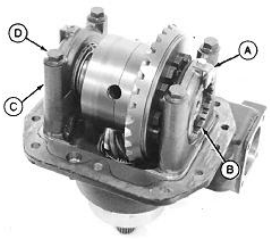
LEGEND:

A	Cap Screw (12 used)
B	Ring Gear
C	Roller Bearing
D	Differential Housing (2 halves used)
E	Drive Plate (10 used)
F	Friction Plate (8 used)
G	Inner Thrust Plate (2 used)
H	Bevel Gear (2 used)
I	Spring Pin
J	Thrust Washer (2 used)
K	Bevel Pinion (2 used)
L	Pinion Shaft
M	Roller Bearing

Assemble parts (A) to (M). Apply thread lock and sealer (medium strength) to threads of cap screws (A) and tighten cap screws to specification.

Item	Measurement	Specification
Cap Screws, Ring Gear to Differential Housing	Torque	78 N·m 58 lb-ft

[16] -



LEGEND:

A	Lock Plate (2 used)
B	Ring Nut (2 used)
C	End Cap (2 used)
D	Cap Screw (4 used)

Plates, Nuts, Caps, and Screws

When the differential and ring gear assembly is properly installed in the carrier housing, the ring gear will be to the left of the pinion gear when viewed from the input shaft side of carrier housing and the carrier housing drain hole is at bottom.

Install differential and ring gear assembly in the carrier housing.

[17] - Install end caps (C) and ring nuts (B).

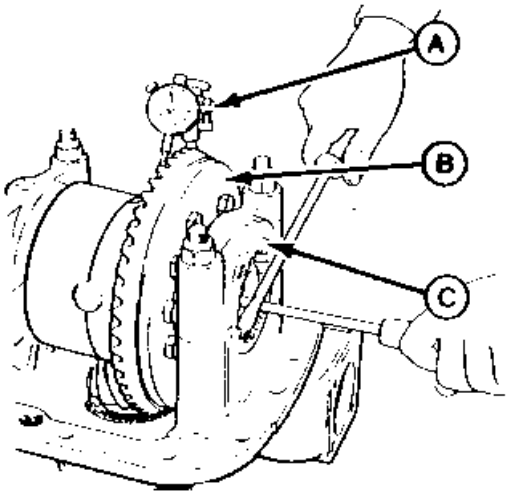
[18] -

IMPORTANT:

When tightening cap screws (D), be careful not to force the ring gear against the pinion gear. This could seriously damage the gear set.

Install cap screws (D) and tighten cap screws until the end caps just hold ring nuts and bearing cups in position. At the same time, carefully adjust the ring nuts to ensure the ring gear is not forced against the pinion gear.

[19] -



Ring Nuts and Gear

Adjust both ring nuts (C) to remove all side bearing free play.

[20] - Move ring gear (B) inward toward the pinion gear by turning the left ring nut (ring gear side) clockwise while turning the right ring nut the same amount counterclockwise. Continue moving ring gear inward until the ring gear fully meshes with the pinion gear (do not force the ring nuts). At the same time, keep bearings aligned by lightly hitting the end caps with a soft faced hammer.

[21] - Install a dial indicator (A) with its stylus in contact with and 90° to a tooth on the ring gear.

[22] - Adjust the ring nuts equally, moving the ring gear towards or away from the pinion gear until a reading of 0.16 to 0.21 mm (0.006 to 0.008 in.) is achieved.

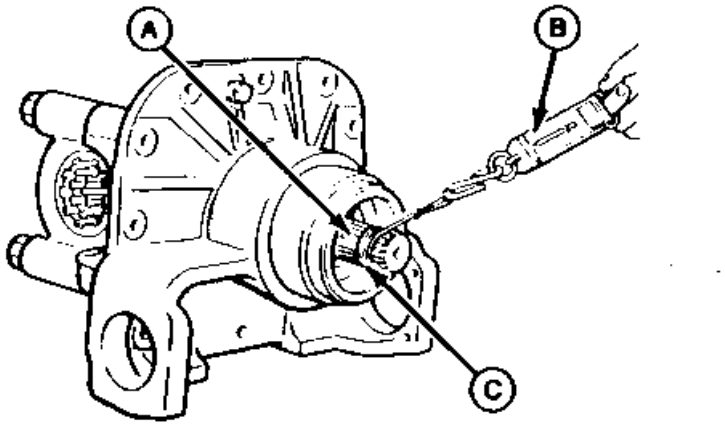
Item	Measurement	Specification
Ring Gear to Pinion Gear, MFWD Differential	Backlash	0.16 to 0.21 mm
		0.006 to 0.008 in.

[23] - Tap each end cap with a soft faced hammer to make sure end caps and bearings remain correctly positioned during the procedure.

[24] - Repeat steps 21 to 23 at two or more locations on ring gear that are equal distance from each other.

[25] -

→NOTE:



Input Shaft

Before adjusting differential side bearing preload, the pinion bearing preload and pinion-to-ring gear backlash must be to specification.

Measure differential side bearing preload using the following method:

a. Wrap a length of string (C) evenly (do not overlap) around the exposed input shaft (A).
b. Attach a spring scale (B) to string. Pull scale firmly and evenly to measure the force required to rotate the pinion shaft.
   Spring Scale
   JDT42

Spring scale

For measuring the initial turning force.

c. Read scale during rotation of the pinion. DO NOT read scale at the point where rotation starts.
d. Record the reading obtained.

→NOTE:

The differential side bearing preload specification is the sum of the pinion bearing preload specification and the differential rolling resistance.

[26] - Tighten both ring nuts equally to retain the backlash adjustment until the specified rolling resistance is achieved.

Item	Measurement	Specification
MFWD Pinion Shaft	Rolling resistance	142 to 213 N 32 to 48 lb force

[27] - Tighten the end cap screws to 266 N·m (196 lb-ft).

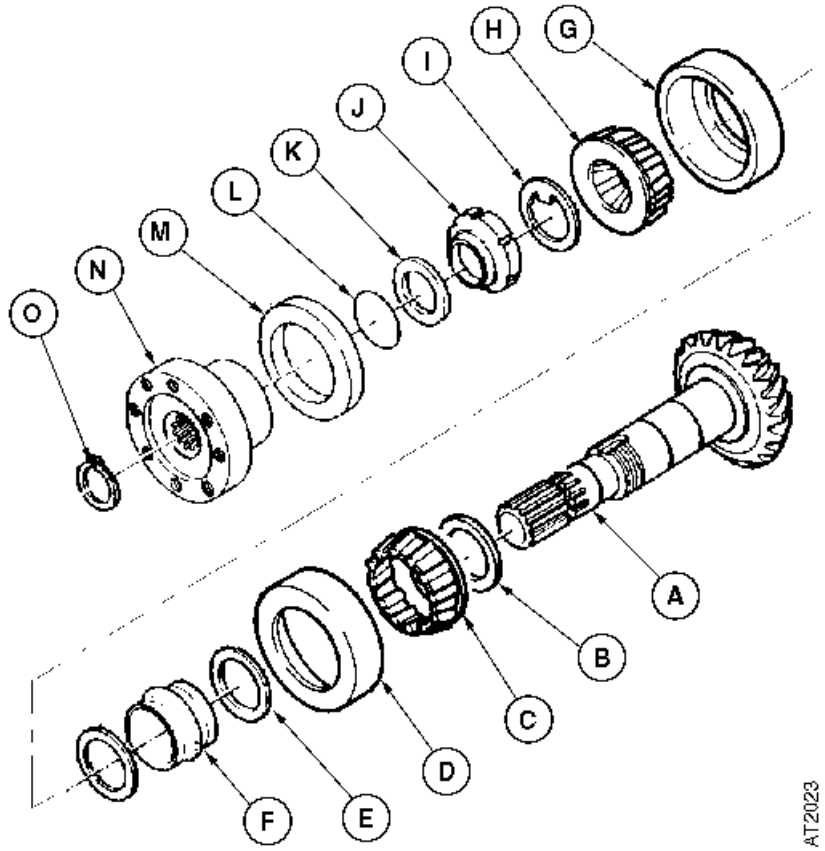
[28] - Recheck the backlash.

[29] - Install ring nut locking tabs. If nearest slot in the ring nut does not align with tab, tighten ring nut until slot aligns.

[30] - Recheck side bearing rolling resistance.

[31] -

→NOTE:



Install Differential Carrier

LEGEND:

A	Pinion Shaft
B	Shim
C	Bearing Cone
D	Bearing Cup
E	Washer (2 used)
F	Collapsible Spacer
G	Bearing Cup
H	Bearing Cone
I	Washer
J	Nut
K	Thrust Washer
L	O-Ring
M	Seal
N	Flange
O	Snap Ring

Lips of seal (M) must face toward differential.

Install oil seal (M) into differential housing. Apply multipurpose grease to lips of seal.

[32] - Install thrust washer (K), O-ring (L), flange (N) and snap ring (O).

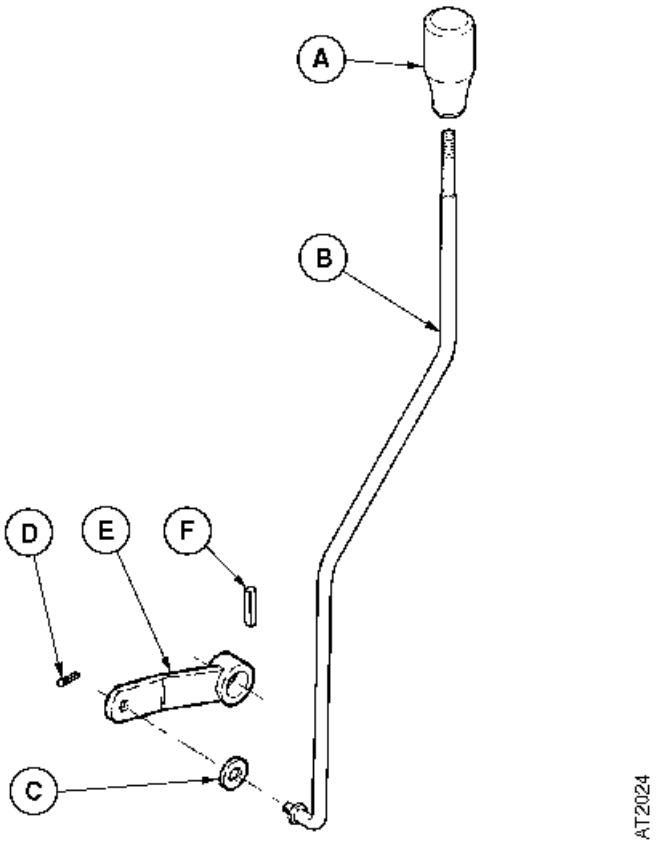
[33] - Install differential carrier as described in this Group.

Group 35 - MFWD Clutch - 12/12-Speed Transmission

Repair Specifications

Item	Measurement	Specification
MFWD Drop Gearbox		
Gearbox-to-Transmission Case Cap Screw	Torque	120 N·m (89 lb-ft)
Cover-to-Gearbox Cap Screw	Torque	35 N·m (310 lb-in.)

Inspect and Repair MFWD Lever



MFWD Lever

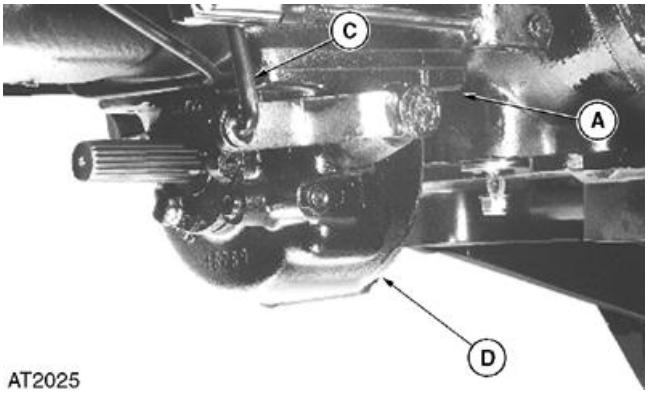
LEGEND:	
A	Knob
B	MFWD Lever
C	Washer
D	Cotter Pin
E	Arm
F	Spring Pin

[1] - Remove knob (A), MFWD lever (B) and arm (C).

[2] - Inspect all parts for wear or damage. Replace as necessary.

[3] - Install arm (C), MFWD lever (B) and knob (A).

Remove and Install MFWD Clutch



MFWD Clutch

→NOTE:

The approximate capacity of transmission is 45 L (11.9 U.S.gal).

[1] - Remove plug (D) and drain transmission/hydraulic oil.

[2] - Remove MFWD drive shaft as described in this Section.

[3] - Disconnect link (C).

[4] -

CAUTION:

Approximate weight of clutch is 20 kg (45 lbs).

Remove four cap screws (A) to remove clutch.

[5] - Make repairs as necessary as described in this Group.

[6] - Clean mating surfaces of housing. Apply sealing compound to mating surfaces of housings.

[7] - Install clutch.

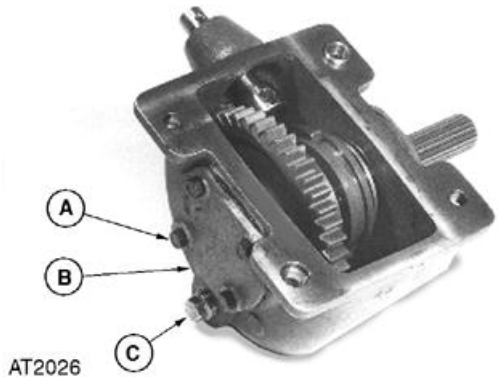
[8] - Install cap screws and tighten to 120 N·m (89 lb-ft).

[9] - Connect shift link.

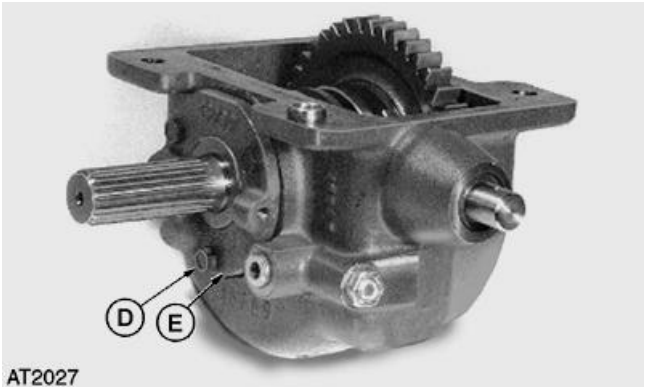
[10] - Install drive shaft.

[11] - Install plug (B). Fill transmission with proper oil (see “Fuel, Lubricants and Coolant” in Section 10).

Disassemble and Inspect MFWD Clutch



Access Clutch



Remove Cap Screw and Cover

[1] - Remove MFWD lever (see procedure in this group).

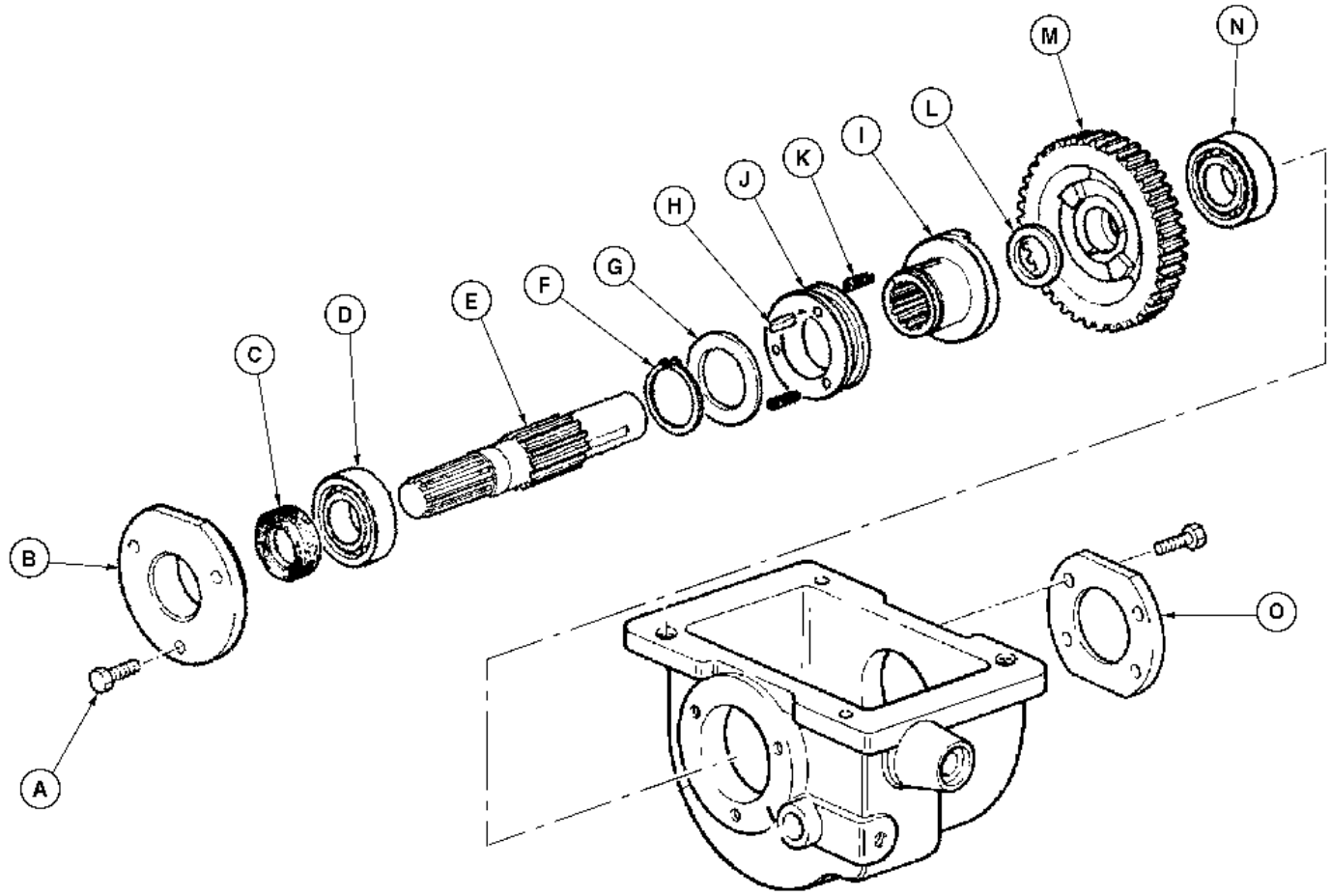
[2] - Remove cap screw (A).

[3] - Remove cover (B).

[4] - Remove cap screw (D).

[5] - Remove cover (E)

[6] -



AT2028

MFWD Clutch-Exploded View

LEGEND:

A	Cap Screw (7 used)
B	Cover
C	Seal
D	Bearing
E	Output Shaft
F	Snap Ring
G	Washer
H	Key
I	Clutch half
J	Sleeve
K	Spring (6 used)
L	Washer
M	Driven Gear with clutch half
N	Bearing
O	Cover

Slide shaft (E) toward front axle using a brass drift and hammer.

[7] - Remove parts (L) and (M).

[8] - Remove parts (F) to (I) as assembly.

[9] - Remove bearing (D) using a knife-edged puller.

[10] -

CAUTION:

Washer (G), sleeve (J) and spring (K) will shoot out of clutch half (I) when removing snap ring (F). Use care when removing snap ring.

Disassemble parts (F) to (I).

[11] - Inspect all parts for wear or damage. Replace as necessary.

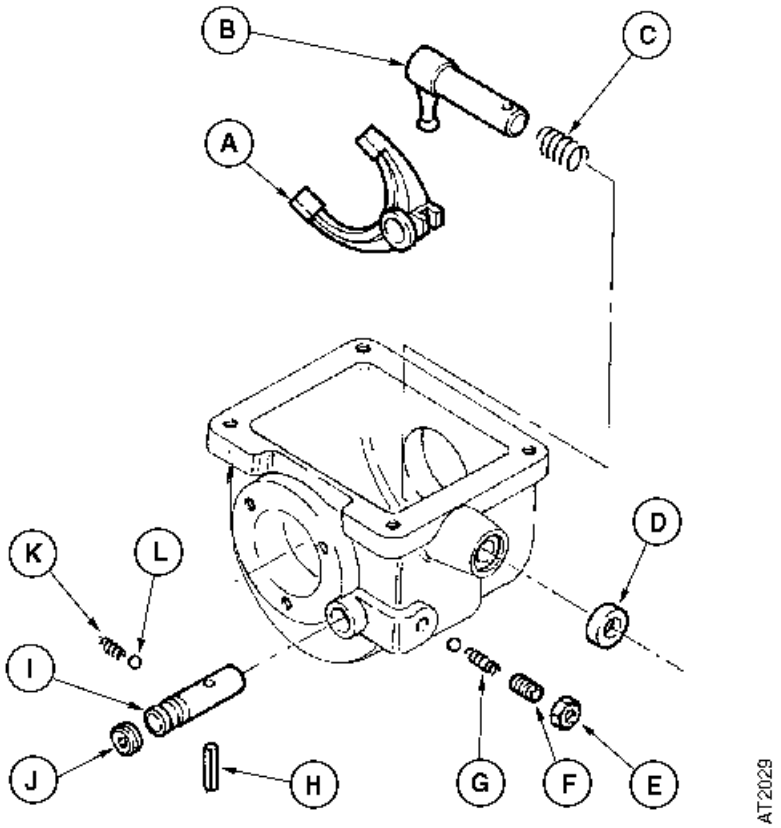
[12] -

IMPORTANT:

Replace all seals. Damaged or used seals will leak.

Remove seal (C) using a screwdriver. Install a new seal, with lips facing toward shaft assembly and flush with inside part of cover, using a bearing, bushing and seal driver set.

[13] -



Inspect Parts for Wear

LEGEND:

A	Shift fork
B	Shift Lever
C	Spring
D	Seal
E	Lock Nut
F	Screw
G	Spring

H	Spring Pin
I	Shaft
J	Plug
K	Spring
L	Ball (2 used)

Remove parts (E) to (G).

[14] - Remove parts (H) to (J) and shift fork (A).

[15] - Remove parts (K) and (L).

[16] - Remove parts (B) and (C).

[17] - Inspect all parts for wear or damage. Replace as necessary.

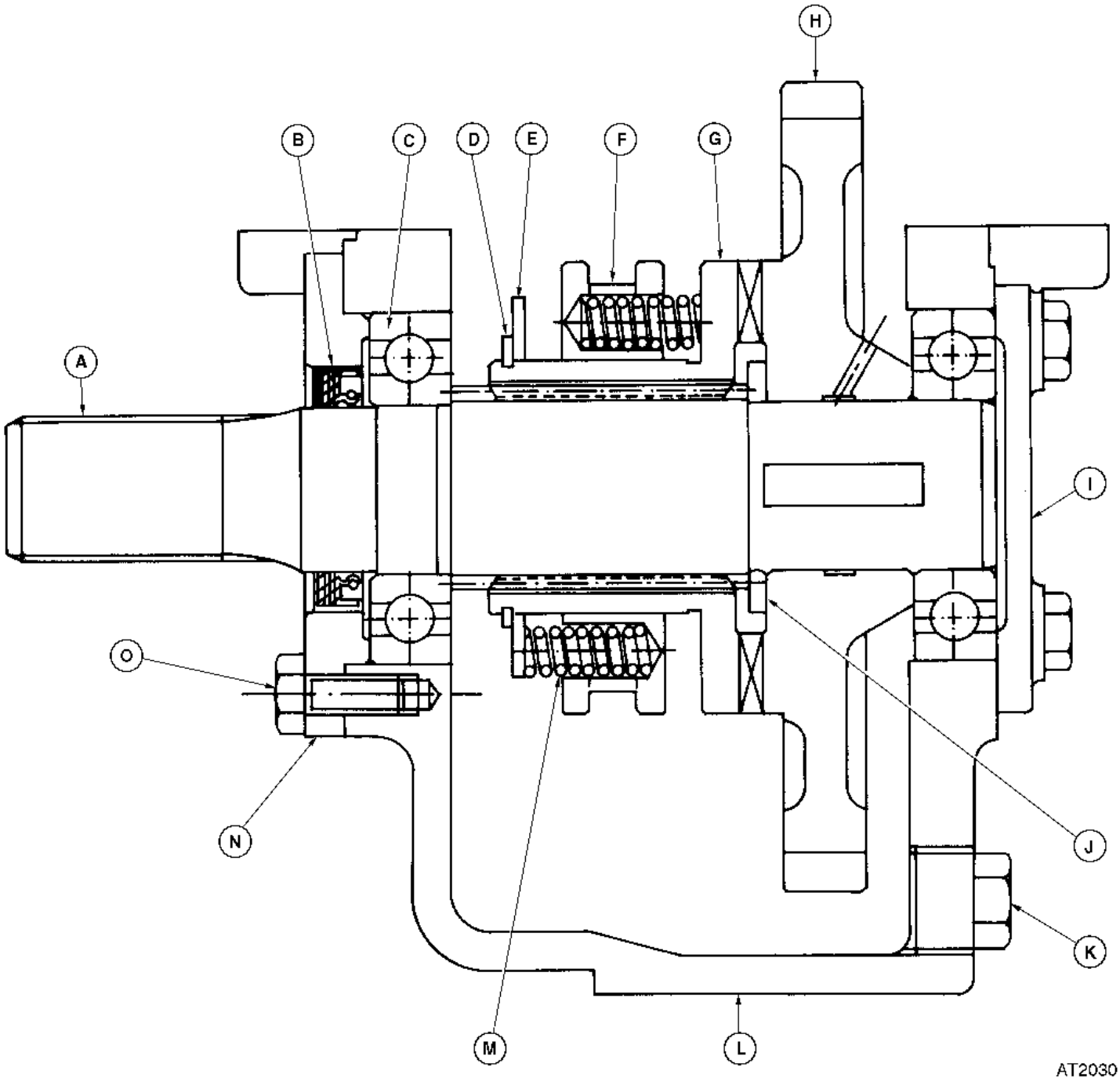
[18] -

IMPORTANT:

Replace all seals. Damaged or used seals will leak.

Remove seal (D) using a screwdriver. Install new seal, with lips facing toward shift fork, into gearbox housing bore until it stops, using a bearing, bushing and seal driver set.

MFWD Clutch Cross Section

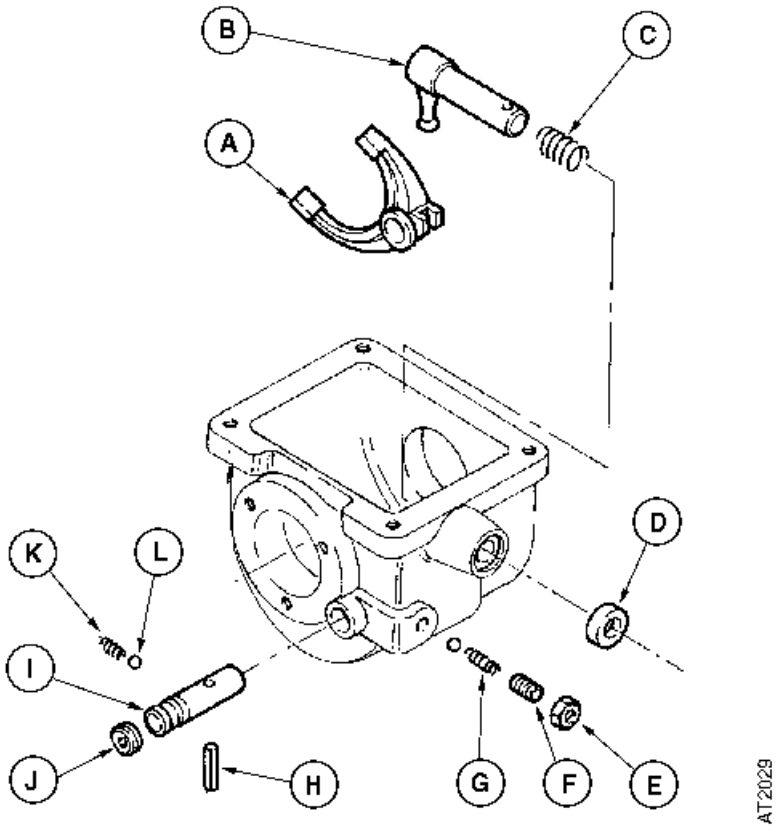


MFWD Clutch Cross Section

LEGEND:

A	Output Shaft
B	Seal
C	Bearing (2 used)
D	Snap Ring
E	Washer
F	Sleeve
G	Clutch half
H	Driven Gear
I	Cover
J	Washer
K	Drain Plug
L	Clutch
M	Spring (6 used)
N	Cover
O	Cap Screw (7 used)

Assemble MFWD Clutch



Assemble MFWD Clutch

LEGEND:

A	Shift fork
B	Shift Lever
C	Spring
D	Seal
E	Lock Nut
F	Screw
G	Spring
H	Spring Pin
I	Shaft
J	Plug
K	Spring
L	Ball (2 used)

IMPORTANT:

Use new seals during assembly. Damaged or used seals will leak.

→NOTE:

Lubricate all internal parts with clean transmission/hydraulic oil during assembly.

[1] - Apply multipurpose grease to inside lips of seal (D).

[2] - Install spring (C) and shift lever (B).

[3] - Install spring (K) and ball (L) in hole in housing.

[4] - Install shaft (I) and shift fork (A).

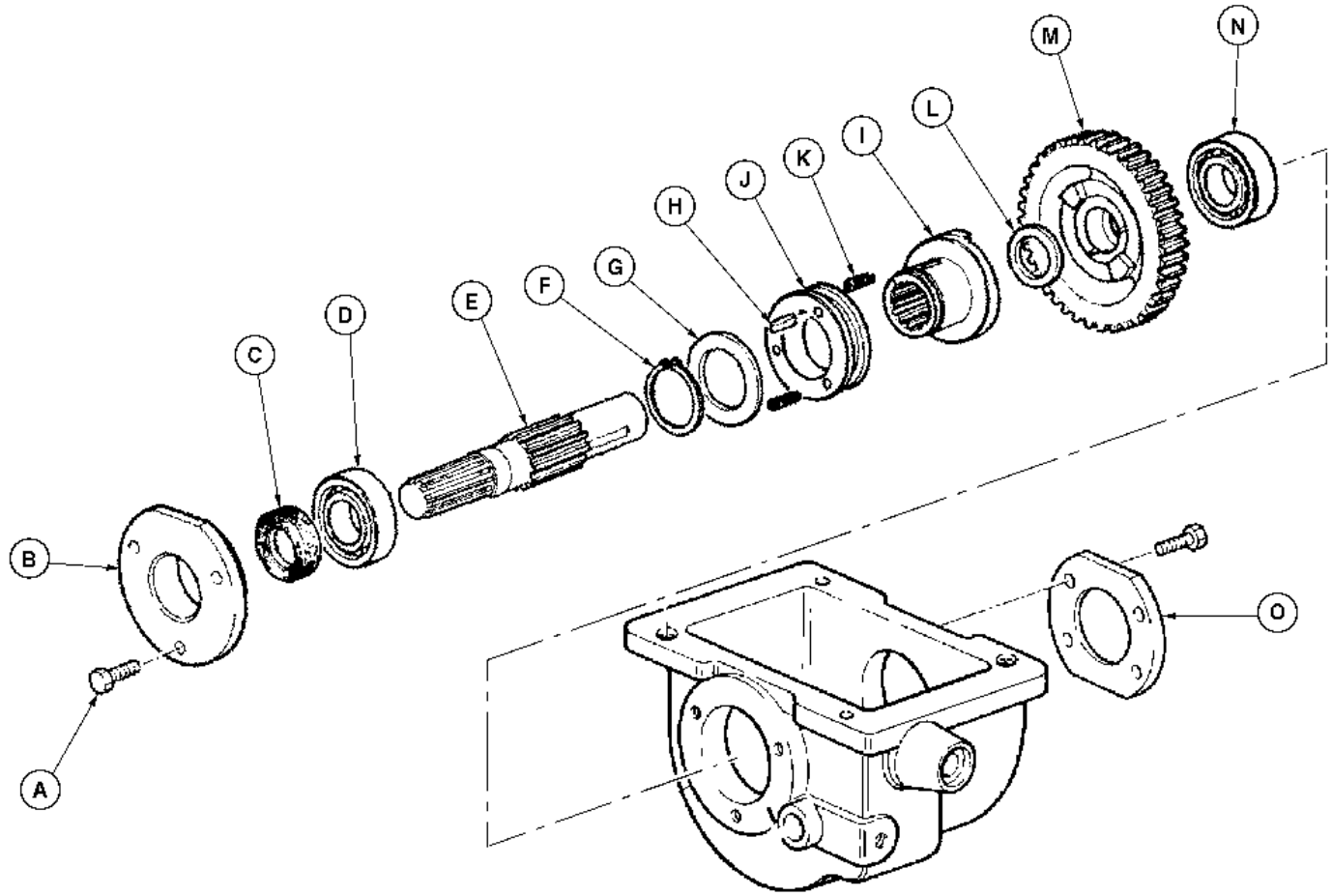
[5] - Apply thread lock sealer (medium strength) to threads of plug (J). Tighten plug to 38 N·m (28 lb-ft).

[6] - Install spring (G) and ball in hole in housing.

[7] - Apply lock sealer (medium strength) to threads of screw (F). Tighten screw (F) until shifting load reaches 12 kg (26.5 lb) measured with a shift arm length of 289 mm (11.5 in.).

[8] - Tighten lock nut (E) to 86 N·m (64 lb-ft).

[9] -



AT2028

MFWD Clutch-Exploded View

LEGEND:

A	Cap Screw (7 used)
B	Cover
C	Seal
D	Bearing
E	Output Shaft
F	Snap Ring
G	Washer
H	Key
I	Clutch half
J	Sleeve
K	Spring (6 used)
L	Washer
M	Driven Gear with clutch half
N	Bearing
O	Cover

Install key (H), spring (K), sleeve (J), washer (G) and snap ring (F) in clutch half (I).

[10] - Install bearing (N).

[11] -

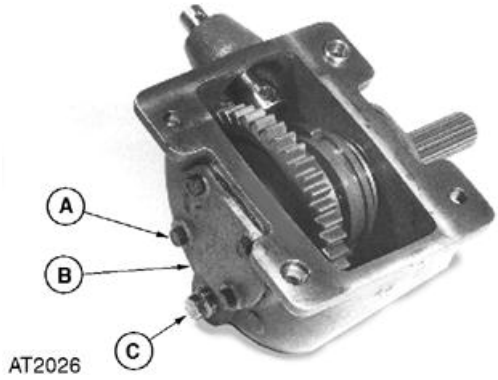
IMPORTANT:

Jaws in gear (M) must face the other clutch half.

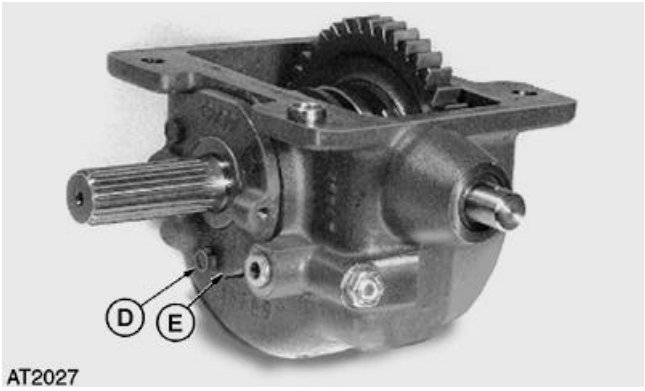
Install gear (M), washer (L), clutch half assembly (F) to (I) and shaft (E).

[12] - Install bearing (D) using a piece of pipe and a press.

[13] -



Clean Mating Surfaces of Covers



Install Covers

Clean mating surface of covers (B) and (E) and clutch. Apply sealing compound to mating surfaces.

[14] - Apply multipurpose grease to inside lips of cover seal.

[15] - Install covers (B) and (E).

[16] - Install seven cap screw and tighten to 35 N·m (26 lb-ft).

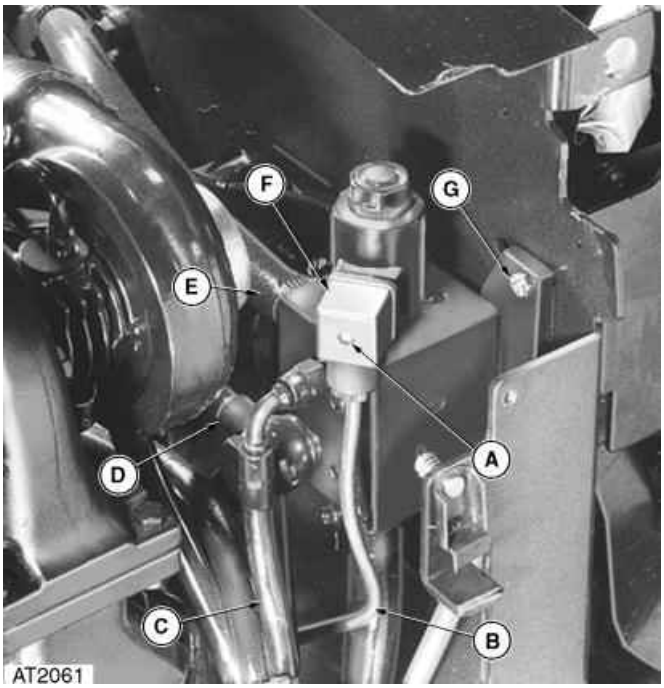
[17] - Install plug (C) and tighten to 60 N·m (45 lb-ft).

Group 40 - MFWD Clutch - 24/24-Speed Transmission

Specifications

Item	Measurement	Specification
Cap Screws, Clutch Housing to Transmission Housing	Torque	120 N·m
		90 lb-ft
Cap Screws, Cover to Clutch Housing	Torque	35 N·m
		26 lb-ft
Drain Plug to Clutch Housing	Torque	60 N·m
		45 lb-ft

Remove and Install Solenoid Control Valve



Access Solenoid Control Valve

[1] - Remove cap screw (A).

[2] - Remove electric connection (F).

[3] - Disconnect hydraulic lines (B) to (E).

[4] - Remove cap screws (G) to remove solenoid control valve.

[5] - Make repairs as necessary as described in this Group.

[6] - Install solenoid control valve.

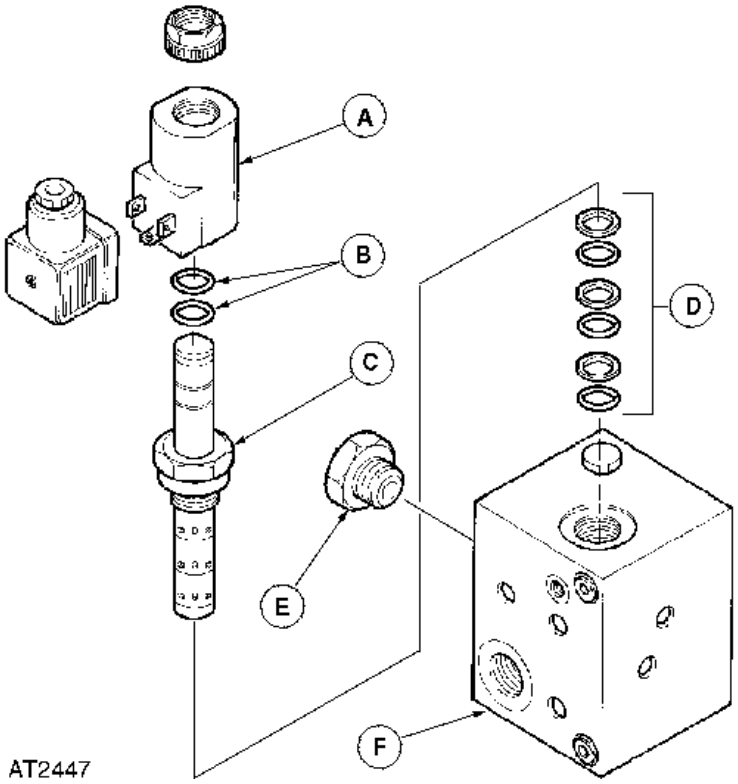
[7] - Install cap screws (G).

[8] - Connect hydraulic lines (B) to (E).

[9] - Install electric connection (F).

[10] - Install cap screw (A).

Inspect and Repair Solenoid Control Valve



LEGEND:

A	Solenoid
B	Gaskets
C	Spool
D	Gaskets
E	Plug
F	Valve Block

Solenoid control valve

[1] - Remove solenoid (A).

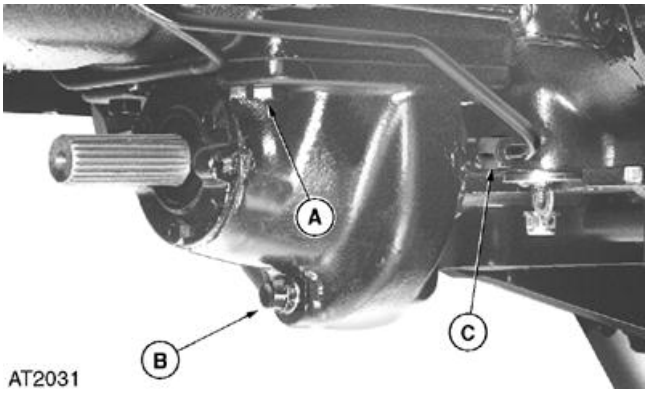
[2] - Disassemble parts (B) to (E).

[3] - Inspect all parts for wear or damage. Replace as necessary.

[4] - Assemble parts (B) to (E).

[5] - Install solenoid (A).

Remove and Install MFWD Clutch



Cap Screws, Plug and Hydraulic Line

→NOTE:

The approximate capacity of transmission is 45 L (11.9 U.S.gal.).

[1] - Remove plug (B) and drain transmission/hydraulic oil.

[2] - Remove MFWD drive shaft (see “Remove, Inspect and Install MFWD Drive Shaft” in this Section).

[3] - Disconnect hydraulic line (C).

[4] -

CAUTION:

Approximate weight of MFWD clutch is 20 Kg (45 lbs) .

Remove four cap screws (A) to remove clutch.

[5] - Make necessary repairs as described in this Group.

[6] - Clean mating surfaces of housing. Apply sealing compound to mating surfaces of housings.

[7] - Install MFWD clutch.

[8] - Install cap screws and tighten to specified torque.

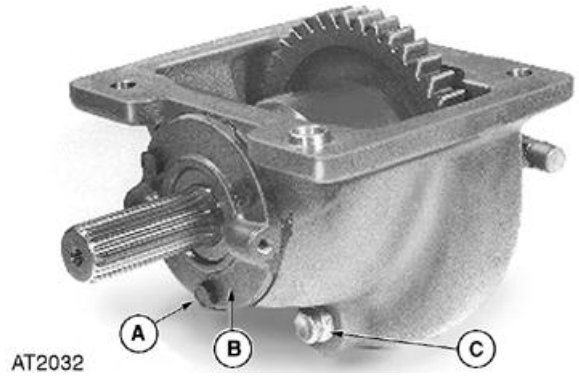
Item	Measurement	Specification
Cap Screws, Clutch Housing to Transmission Housing	Torque	120 N·m 90 lb-ft

[9] - Connect hydraulic line (C).

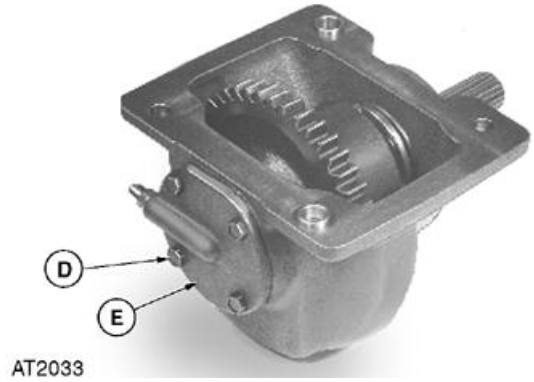
[10] - Install drive shaft.

[11] - Install plug (B). Fill transmission with proper oil (see “Fuel, Lubricants and Coolant” in Section 10).

Disassemble and Inspect MFWD Clutch



Access Clutch



Remove Cap Screw and Cover

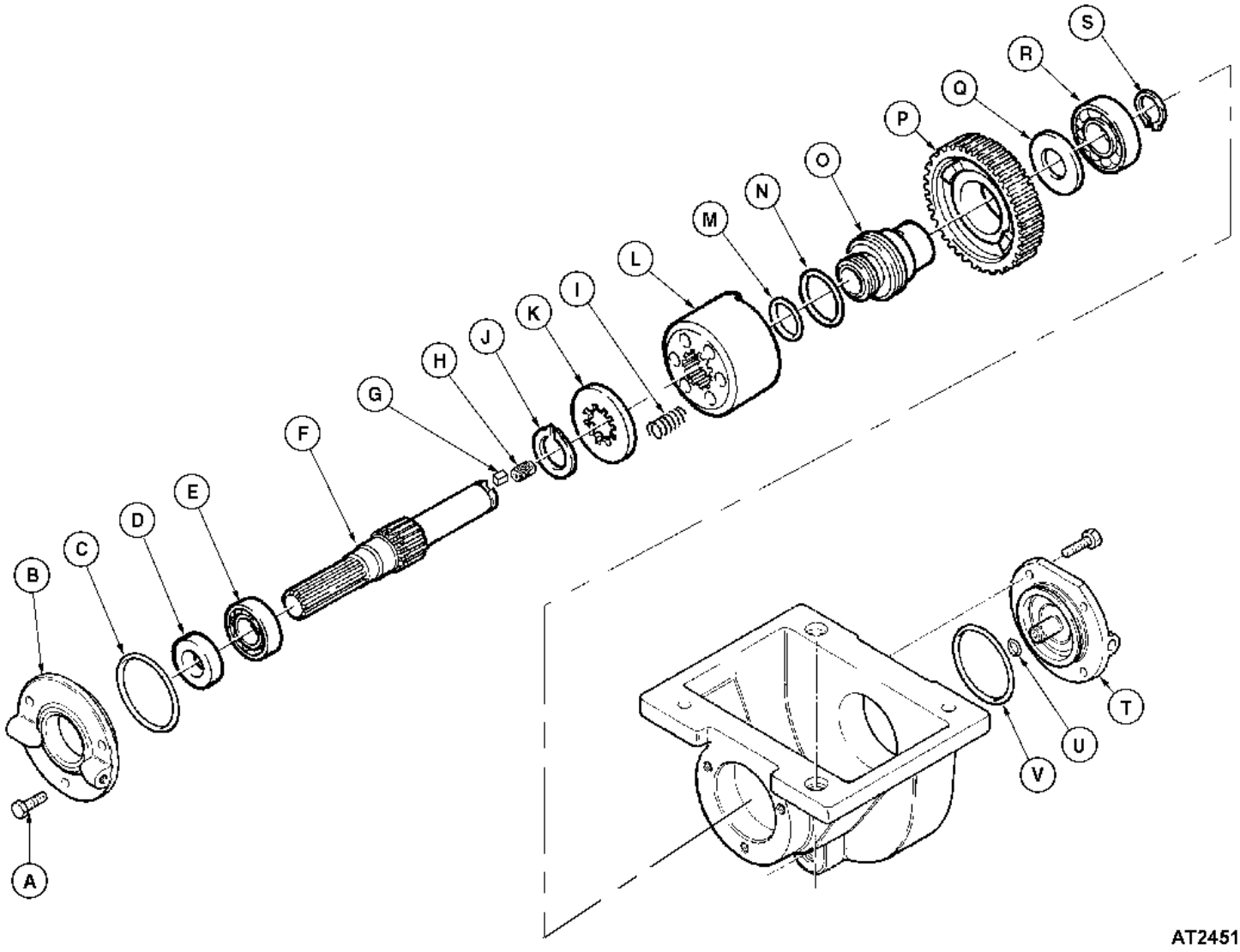
[1] - Remove cap screw (A).

[2] - Remove cover (B).

[3] - Remove cap screw (D).

[4] - Remove cover (E).

[5] -



MFWD clutch assembly, exploded view

LEGEND:

A	Screw (7 used)
B	Cover
C	O-Ring
D	Seal
E	Bearing
F	Output Shaft
G	Key
H	Check Valve
I	Spring (6 used)
J	Snap Ring
K	Washer
L	Clutch Half
M	O-Ring
N	O-Ring
O	Bushing
P	Driven Gear with Clutch Half
Q	Washer
R	Bearing
S	Snap Ring
T	Cover
U	O-Ring
V	O-Ring

Remove snap ring (S).

[6] - Slide shaft (F) toward front axle using a brass drift and hammer.

[7] - Remove parts (K) to (Q).

[8] - Remove bearing (E) using a knife-edged puller.

[9] - Remove parts (G) to (J).

[10] - Inspect all parts for wear or damage. Replace as necessary.

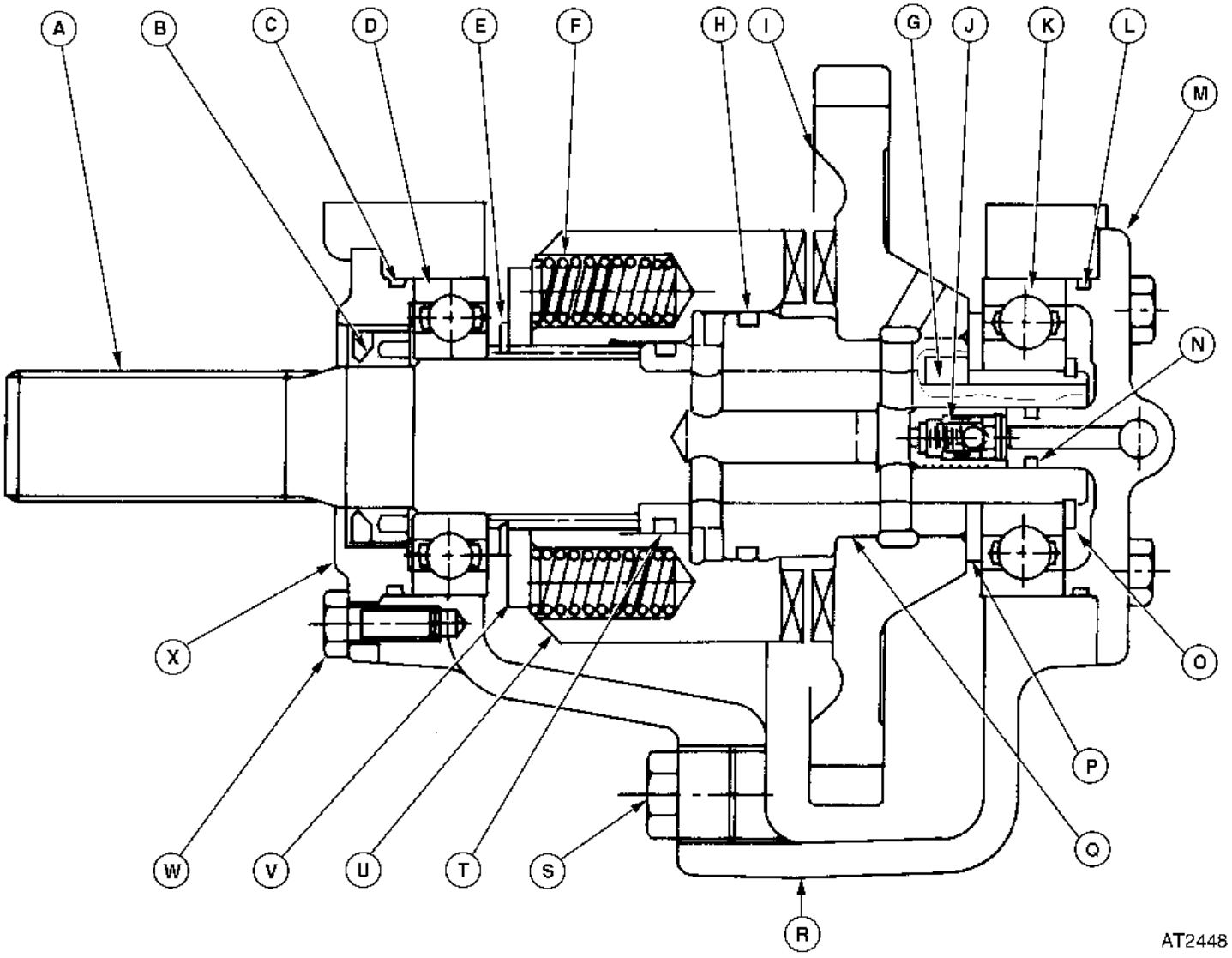
[11] -

IMPORTANT:

Use new seals and O-rings during assembly. Damaged or used seals and O-rings will leak.

Remove seal (D) using a screwdriver. Install new seal, with lips facing toward shaft assembly and flush with inside part of cover, using a bearing, bushing and seal driver set.

MFWD Clutch Cross Section

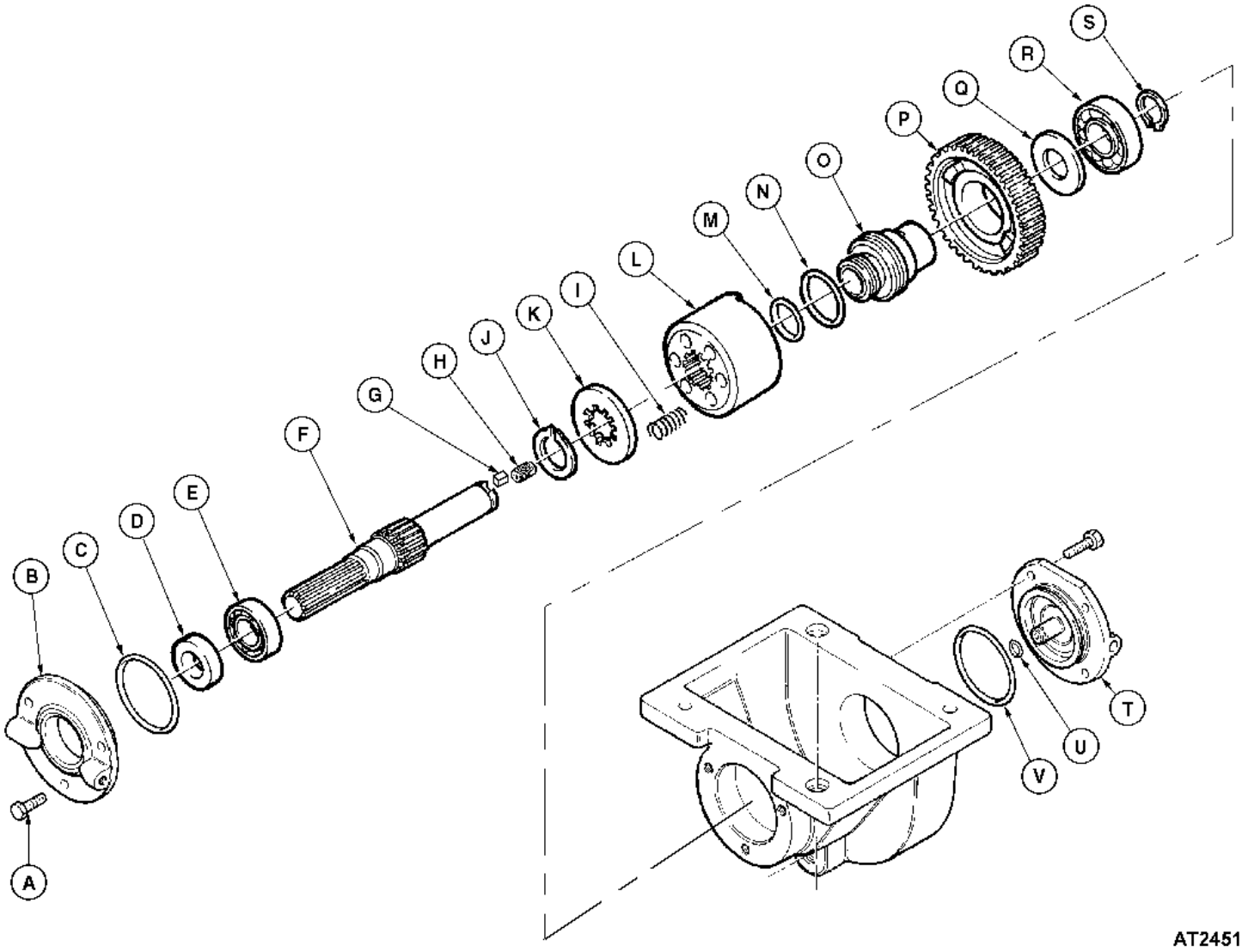


MFWD Clutch Cross Section

LEGEND:

A	Output Shaft
B	Seal
C	O-Ring
D	Bearing
E	Snap Ring
F	Spring (6 used)
G	Key
H	O-Ring
I	Driven Gear
J	Check Valve
K	Bearing
L	O-Ring
M	Cover
N	O-Ring
O	Snap Ring
P	Washer
Q	Bushing
R	Clutch
S	Drain Plug
T	O-Ring
U	Clutch Half
V	Washer
W	Cap Screw (7 used)
X	Cover

Assemble MFWD Clutch



MFWD clutch, exploded view

LEGEND:

A	Screw (7 used)
B	Cover
C	O-Ring
D	Seal
E	Bearing
F	Output Shaft
G	Key
H	Check Valve
I	Spring (6 used)
J	Snap Ring
K	Washer
L	Clutch Half
M	O-Ring
N	O-Ring
O	Bushing
P	Driven Gear with Clutch Half
Q	Washer
R	Bearing
S	Snap Ring
T	Cover
U	O-Ring
V	O-Ring

IMPORTANT:

Use new seals and O-rings during assembly. Damaged or used seals and O-rings will leak.

→NOTE:

Lubricate all internal parts with clean transmission/hydraulic oil during assembly.

[1] - Install check valve (H), key (G) and snap ring (J) in output shaft (F).

[2] - Install O-rings (M) and (N) in bushing (O).

[3] - Install clutch half (L) in bushing (O).

[4] -

IMPORTANT:

Slot in bushing (O) must align with pin (G).

Front teeth in gear (P) must face teeth in clutch half (L).

Install gear (P), clutch half assembly (L) to (O), spring (I) and washer (K).

[5] - Install output shaft (F) and washer (Q).

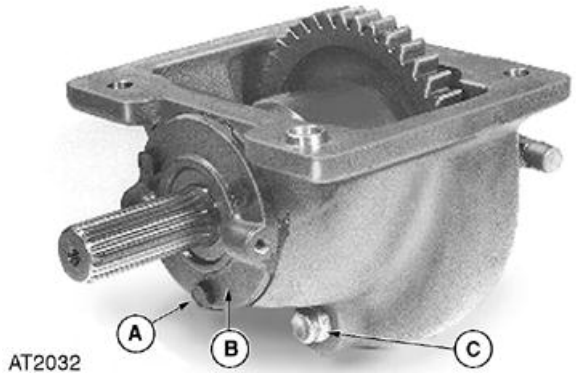
[6] - Install bearings (E) and (R) using a piece of pipe and a press.

[7] - Install snap ring (S).

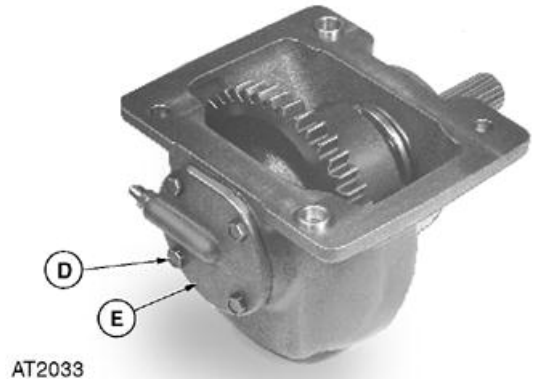
[8] - Install O-rings (U) and (V) in cover (T).

[9] - Install O-ring (C) in cover (B).

[10] -



Install Covers and Plug



Install Cover and Cap Screw

Install covers (B) and (E).

[11] - Install cap screw (A) and (D) and tighten to specified torque.

Item	Measurement	Specification
Cap Screws, Cover to Clutch Housing	Torque	35 N·m
		26 lb-ft

[12] - Install plug (C) and tighten to specified torque.

Item	Measurement	Specification
Drain Plug to Clutch Housing	Torque	60 N·m
		45 lb-ft

Group 45 - Transmission

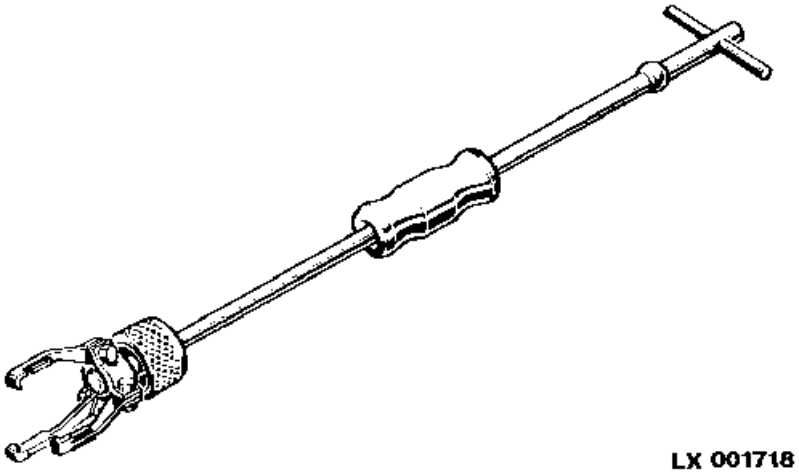
Special or Essential Tools

→NOTE:

Order tools according to information given in the U.S. SERVICEGARD ™ Catalog or in the European Microfiche Tool Catalog (MTC).

Slide Hammer Puller

D01210AA



D01210AA

Removal of range shaft

Spring Scale

JDT42

JDT42

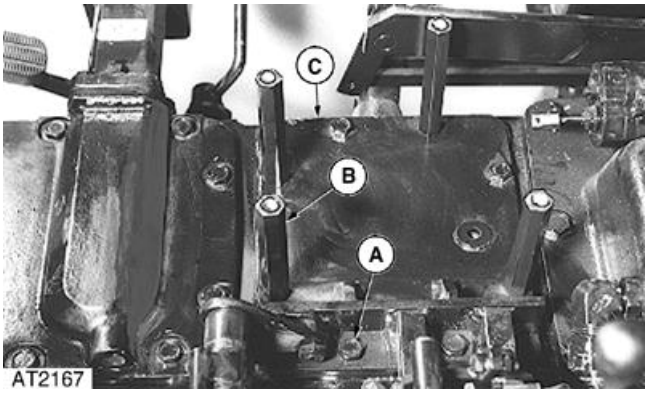
Measures rolling drag torque.

Specifications

Item	Measurement	Specification
Cap Screws, Transmission Cover to Transmission Housing	Torque	50 N·m
		37 lb-ft
Studs, Transmission Cover to Transmission Housing	Torque	50 N·m
		37 lb-ft
Cap Screws, Brake Housing & Quill to Differential Case	Torque	90 N·m
		65 lb-ft
Pinion Nut	Torque	25 N·m
		18 lb-ft

Item	Measurement	Specification
Cap Screws, Front Cover of Secondary Shaft to Transmission Housing	Torque	35 N·m
		26 lb-ft

Remove and Install Transmission



Remove Top Cover

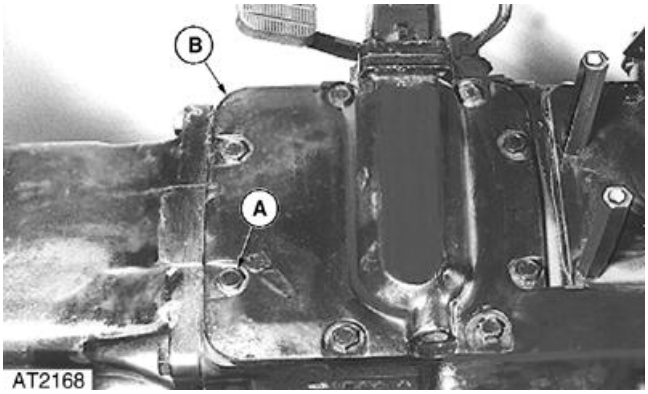
[1] - Remove ROLL-GARD ™ (see procedure in Section 90).

[2] - Remove clutch housing (see “Separate Clutch Housing from Transmission” in this Section).

[3] - Remove seat and support (see procedure in Section 90).

[4] - Remove four cap screws (A) and stud (B) to remove top cover (C).

[5] -



Remove Cover and Shifter Assemblies

Remove eight cap screws (A) to remove cover and shifter assemblies (B).

[6] - Remove rockshaft case (see procedure in Section 70).

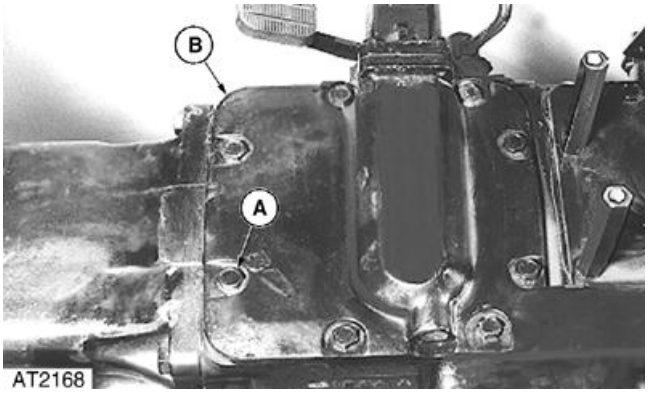
[7] - Remove final drives (see “Remove and Install Final Drive Assembly” in this Section).

[8] - Remove MFWD clutch, if equipped (see “Remove and Install MFWD Clutch” in this Section).

[9] - Remove differential (see “Remove and Install Differential Assembly” in this Section).

[10] - Make necessary repairs as described in this Group.

[11] -



Install Cover and Shifter Assemblies

Install differential.

[12] - Install MFWD clutch if equipped.

[13] - Install final drives.

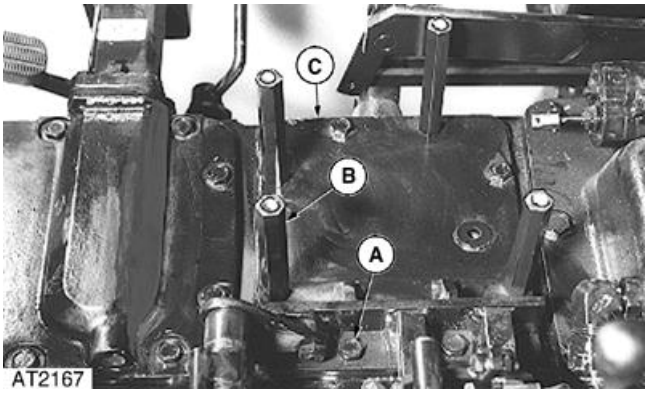
[14] - Install rockshaft case.

[15] - Clean mating surface of cover (B) and transmission housing. Apply sealing compound to mating surfaces.

[16] - Install cover (B) and shifter assemblies. Tighten cap screws (A) to specified torque.

Item	Measurement	Specification
Cap Screws, Transmission Cover to Transmission Housing	Torque	50 N·m
		37 lb-ft

[17] -



Install Cover and Transmission Housing

Clean mating surface of cover (C) and transmission housing. Apply sealing compound to mating surfaces.

[18] - Install cover (C). Tighten cap screw (A) and stud (B) to specified torque.

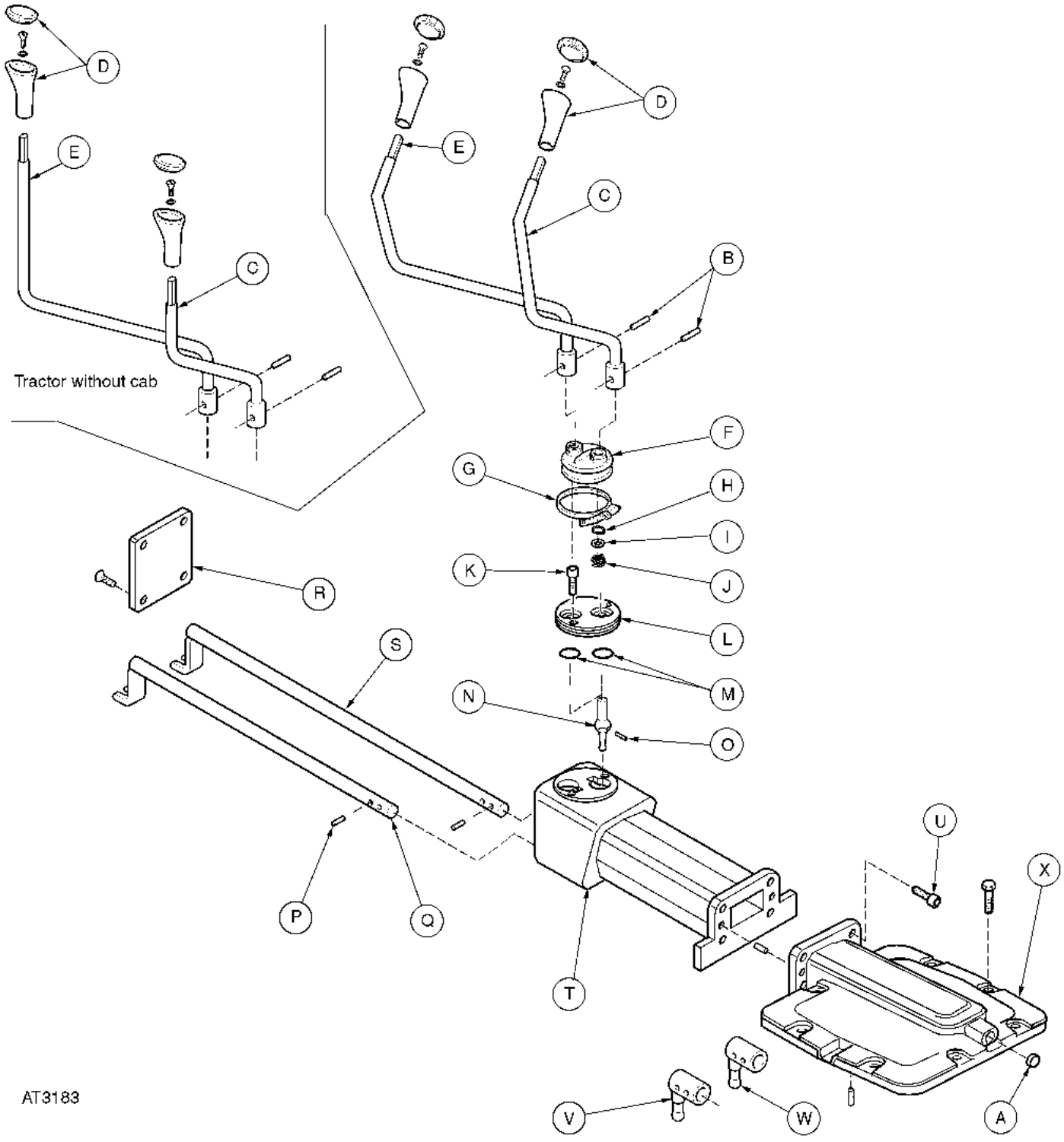
Item	Measurement	Specification
Studs, Transmission Cover to Transmission Housing	Torque	50 N·m
		37 lb-ft

[19] - Install seat and support.

[20] - Install clutch housing.

[21] - Install ROLL-GARD ™ .

Inspect and Repair Gear and Range Shift Levers



Gear and Range Shift Levers

LEGEND:

A	Plug
B	Spring Pin (2 used)
C	Range Shift Lever
D	Knob (2 used)
E	Gear Shift Lever
F	Boot
G	Clamp
H	Snap Ring (2 used)
I	Washer (2 used)
J	Spring (2 used)
K	Socket Screw (2 used)

L	Cover
M	O-Ring (2 used)
N	Arm (2 used)
O	Pin (2 used)
P	Spring Pin (4 used)
Q	Gear Shift Shaft
R	Cover
S	Range Shift Shaft
T	Case
U	Socket Screw (4 used)
V	Gear Shift Arm
W	Range Shift Arm
X	Transmission Cover

[1] - Remove seat and support (see procedure in Section 90, Group 05).

[2] - Remove transmission cover (X) and shifter assemblies.

[3] - Remove spring pins (B) to remove range shift lever (C) and gear shift lever (E).

[4] - Remove parts (F) to (O).

[5] - Remove spring pins (P) to remove shift arms (V) and (W).

[6] - Remove cover (R) to remove shift shafts (Q) and (S).

[7] - Remove socket screw (U) to remove case (T) from cover.

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

[9] -

IMPORTANT:

Replace all O-rings. Damaged or used O-rings will leak.

Install new O-Rings into groove of arms (N).

[10] - Clean mating surfaces of cover (R), case (T) and transmission cover (X). Apply sealing compound to mating surface.

[11] - Install all parts.

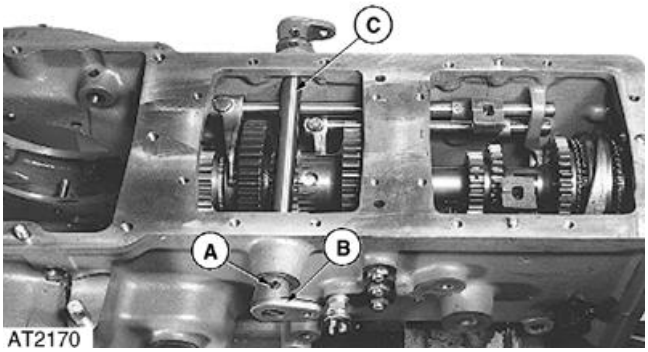
[12] - Install transmission cover (X) and shifter assemblies.

[13] - Install seat and support.

Remove, Inspect and Install Range Shaft

[1] - Remove transmission (see procedure in this Group).

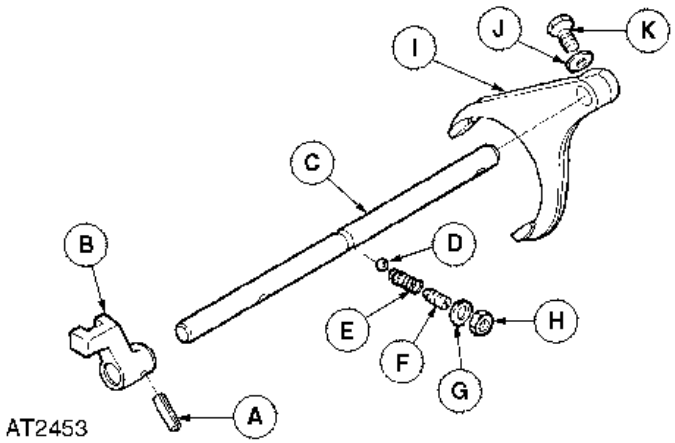
[2] -



Remove Spring Pin, Arm, and Shaft

Remove spring pin (A), arm (B) and shaft (C).

[3] -



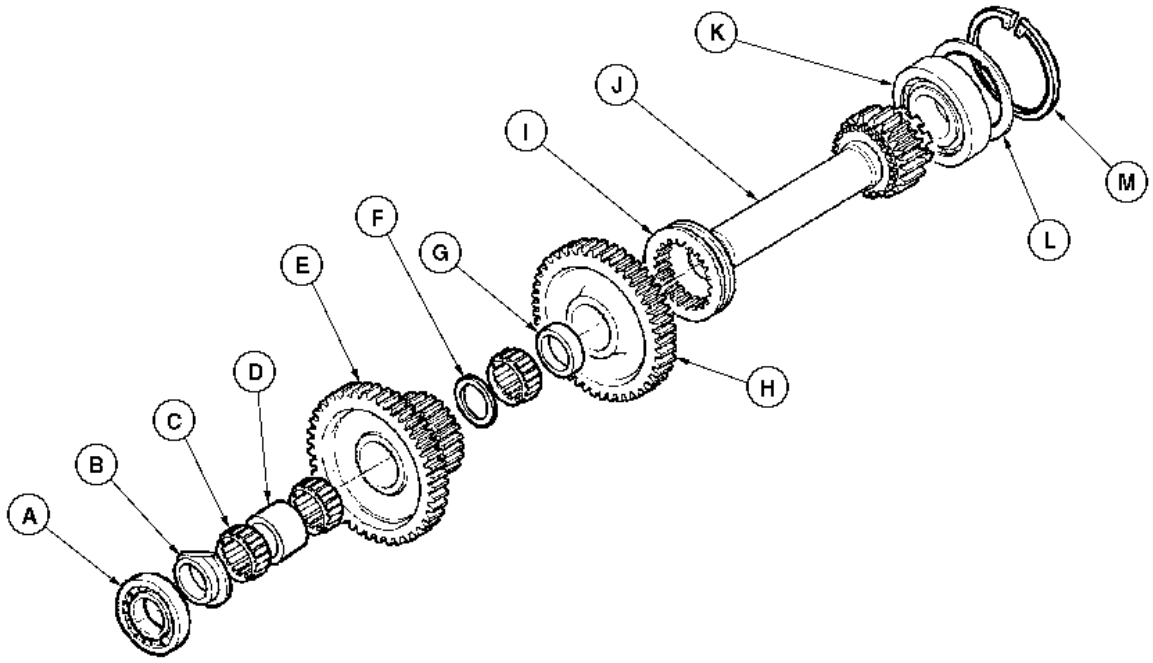
LEGEND:

A	Spring Pin
B	Yoke
C	Shaft
D	Ball
E	Spring
F	Detent Adjuster
G	Sealing Washer
H	Lock Nut
I	Shift Fork
J	Washer
K	Cap Screw

Range shift assembly

Remove parts (A) to (L) on left-hand side of transmission case.

[4] -



AT2171

Remove Snap Ring

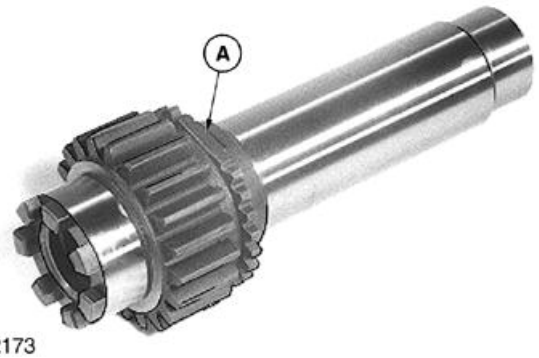
LEGEND:

A	Bearing
B	Special Washer
C	Bearing
D	Spacer
E	Gear
F	Spacer
G	Spacer
H	Gear
I	Collar
J	Range Shaft
K	Bearing
L	Shim
M	Snap Ring

Remove snap ring (M).

[5] -

IMPORTANT:

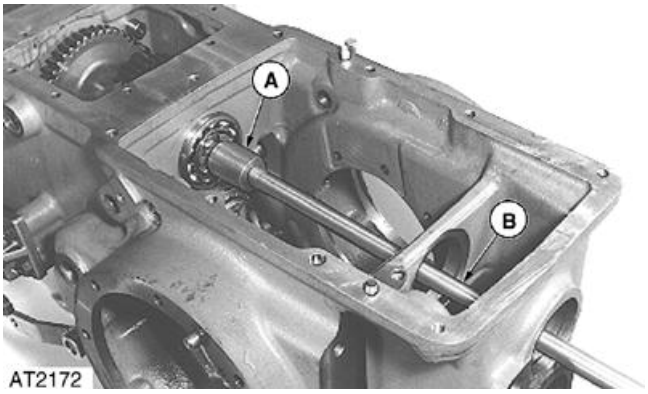


AT2173

Flat Side of Range Shaft

During removal and installation flat side (A) of range shaft must be downward.

[6] -

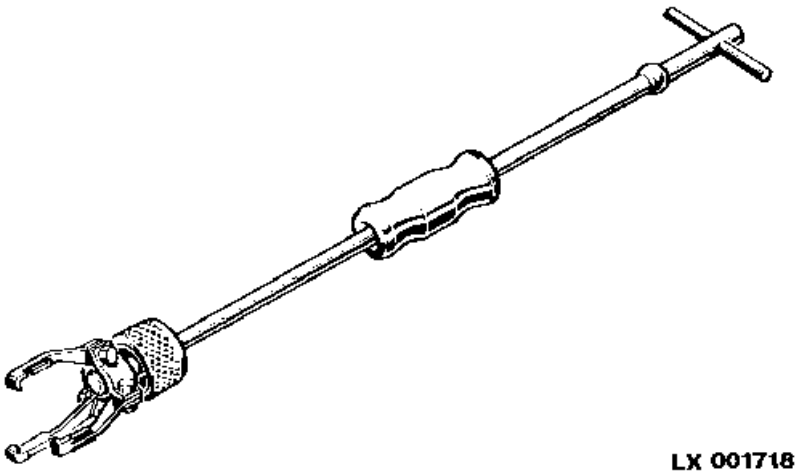


Adapter and Slide Hammer

Remove range shaft using adapter (A) and slide hammer D01210AA (B)

Slide Hammer Puller

D01210AA



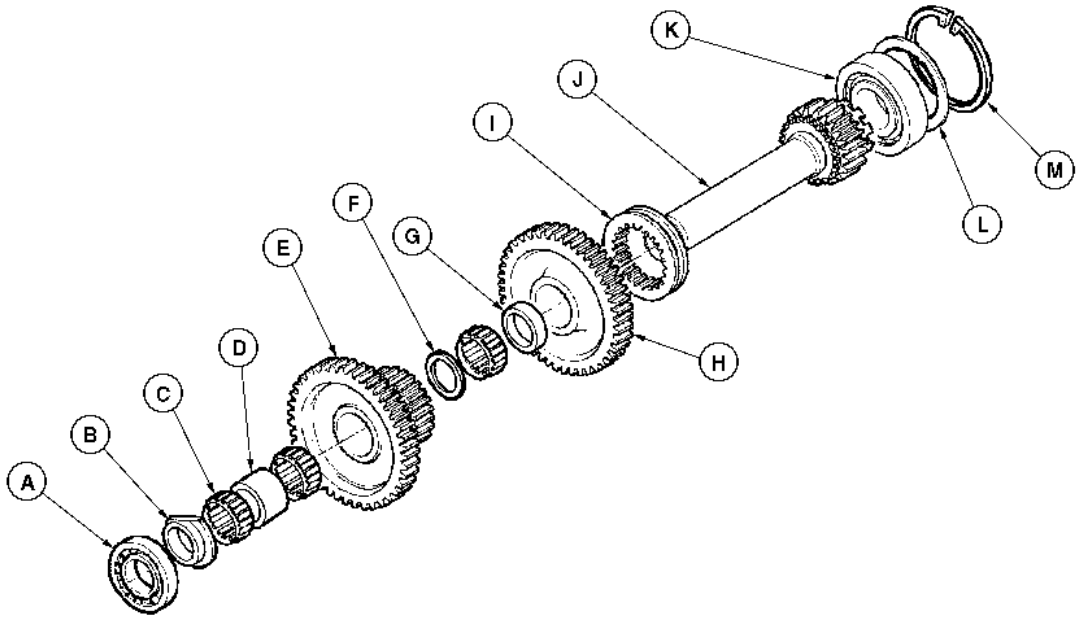
D01210AA

Removal of range shaft

[7] - Inspect all parts for wear or damage. Replace as necessary.

[8] -

→NOTE:



AT2171

Lubricate Parts

LEGEND:

A	Bearing
B	Special Washer
C	Bearing
D	Spacer
E	Gear
F	Spacer
G	Spacer
H	Gear
I	Collar
J	Range Shaft
K	Bearing
L	Shim
M	Snap Ring

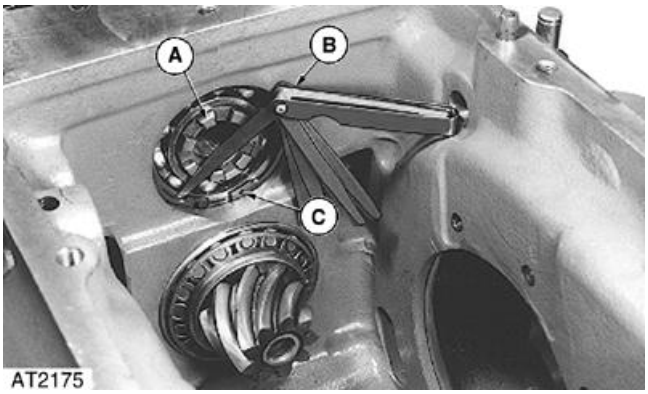
Lubricate all parts with clean transmission/hydraulic oil during assembly.

Apply lithium grease with molybdenum disulfide to inner side of gears (E) and (H).

[9] - Install all parts.

[10] - Install transmission as described in this Group.

Range Shaft End Play Adjustment



Adjust Range Shaft End Play

[1] - Push range shaft (A) fully forward.

[2] - Measure clearance between bearing and snap ring using feeler gauges (B).

[3] - Use reading on feeler gauges as dimension A in shim thickness calculation.

Use the following example to find the required shim thickness.

EXAMPLE:

A - B = C, the required shim thickness

Shim Thickness

Dimension (snap ring to bearing);	A = 1.3 mm (0.051 in)
minus	
Maximum end play;	B = 0.3 mm (0.012 in)
equals	
Required shim thickness;	C = 1.0 mm (0.039 in)
Dimension (snap ring to bearing);	A = 1.3 mm (0.051 in)
minus	
Minimum end play;	B = 0.1 mm (0.004 in)
equals	
Required shim thickness;	C = 1.2 mm (0.047 in)

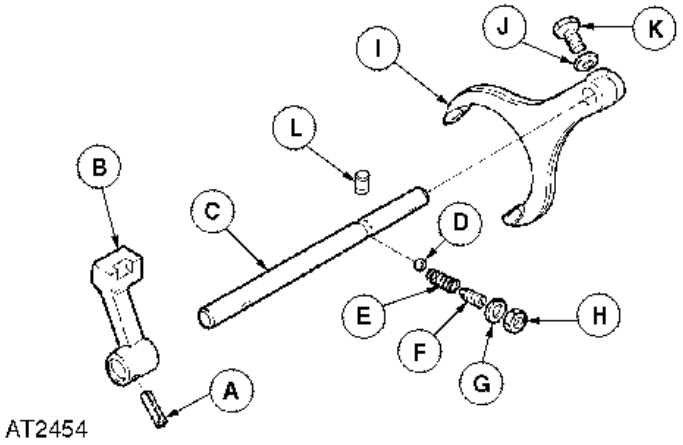
→NOTE:

Shims are available with a thickness of 0.1 mm, 0.3 mm and 0.5 mm (0.004, 0.012 and 0.020 in).

[4] - Remove snap ring (C) to install required shim pack.

[5] - Install snap ring (C).

Remove Inspect and Install Primary and Reverse Shafts



LEGEND:

A	Spring Pin
B	Yoke
C	Shaft
D	Ball
E	Spring
F	Detent Adjuster
G	Sealing Washer
H	Lock Nut
I	Shift Fork
J	Washer
K	Cap Screw
L	Pin

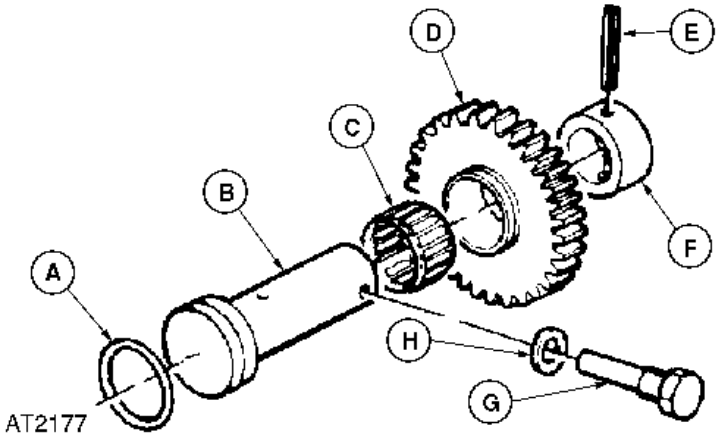
Range shift assembly

[1] - Remove transmission (see procedure in this Group).

[2] - Remove range shaft (see procedure in this Group).

[3] - Remove parts (A) to (M) on left-hand side of transmission case.

[4] -



LEGEND:

A	O-Ring
B	Reverse Shaft
C	Bearing
D	Gear
E	Spring Pin
F	Spacer
G	Locating Bolt
H	Sealing Washer

Access Reverse Shaft

Remove locating bolt (G) and spring pin (E) to remove reverse shaft (B), bearing (C), gear (D) and spacer (F).

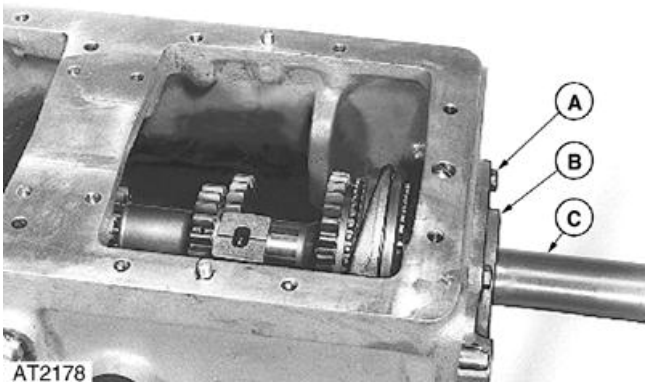
[5] -

IMPORTANT:

Replace O-ring. Damaged or used O-rings will leak.

Install new O-ring into groove of shaft (B).

[6] -

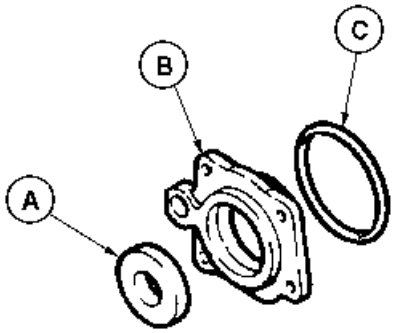


Remove Transmission Shaft Assembly

Remove four cap screws (A) to remove cover (B).

[7] - Remove transmission shaft assembly (C).

[8] -



AT2179

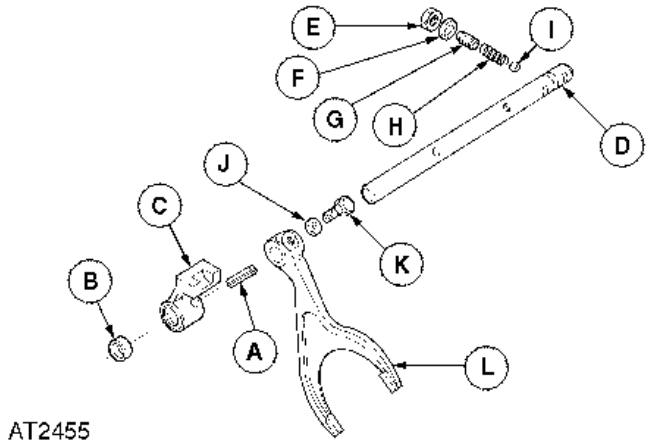
IMPORTANT:

Replace seal and O-ring. Damaged or used seals and O-rings will leak.

Install O-ring (C) into groove of cover.

[9] - Install seal (A) into cover bore (B) using a bushing, bearing and seal driver set.

[10] -



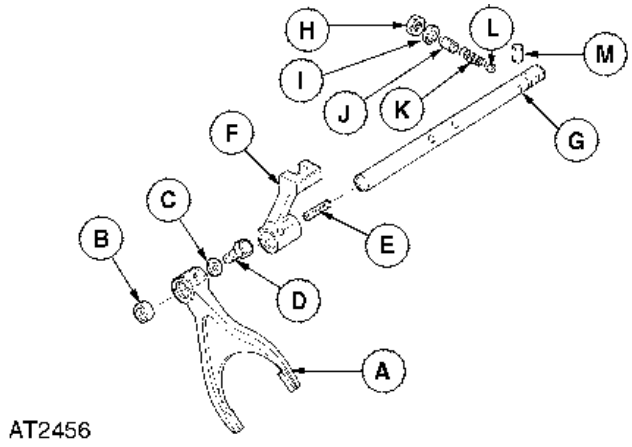
LEGEND:

A	Spring Pin
B	Plug
C	Yoke
D	Shaft
E	Lock Nut
F	Sealing Washer
G	Detent Adjuster
H	Spring
I	Ball
J	Washer
K	Cap Screw
L	Shift Fork

Remove Parts (RH Side of Transmission Case)

Remove parts (A) to (K) on right-hand side of transmission case.

[11] -



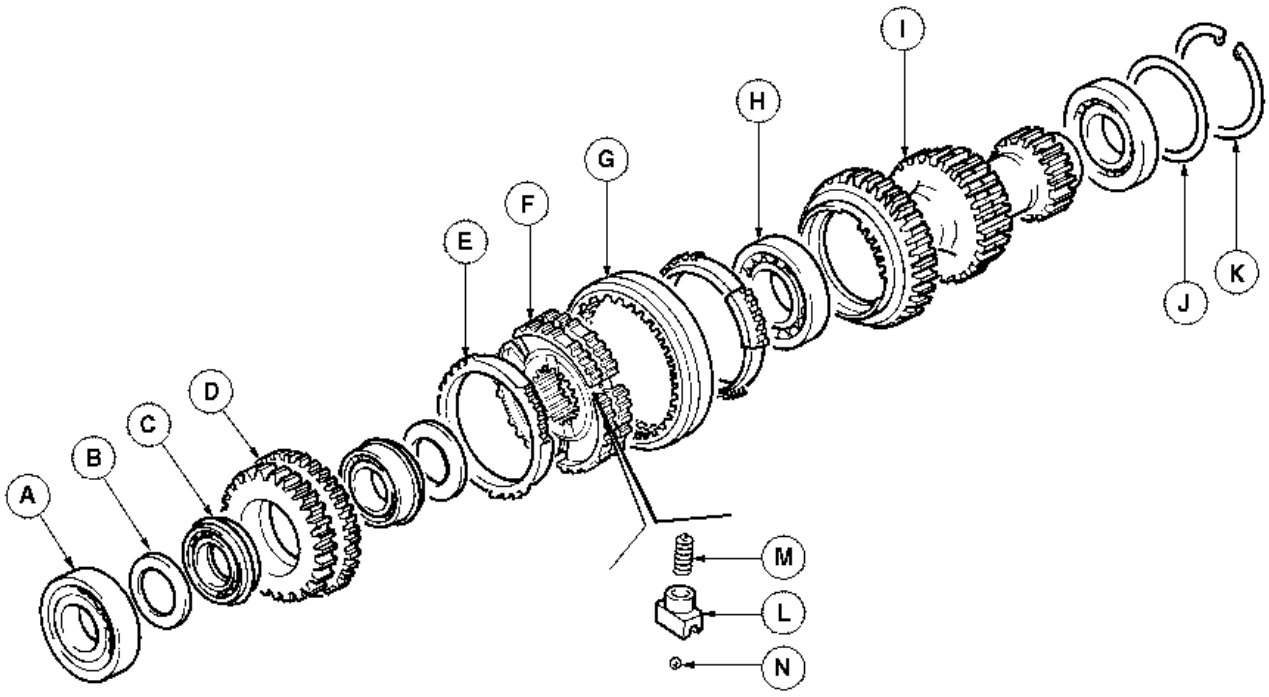
LEGEND:

A	Shift Fork
B	Plug
C	Washer
D	Cap Screw
E	Spring Pin
F	Yoke
G	Shaft
H	Lock Nut
I	Sealing Washer
J	Detent Adjuster
K	Spring
L	Ball
M	Pin

Remove Parts (RH Side of Transmission Case)

Remove parts (B) to (M) on right-hand side of transmission case.

[12] -



AT2457

Transmission , exploded view

LEGEND:

A	Bearing
B	Washer (2 used)
C	Bearing (2 used)
D	Gear
E	Synchronizer Ring (2 used)
F	Hub
G	Shift Collar
H	Bearing (2 used)
I	Gear
J	Shim
K	Snap Ring
L	Insert (3 used)
M	Spring Ball (3 used)

Remove parts (A) to (M).

[13] - Inspect all parts for wear or damage. Replace as necessary.

[14] -

→NOTE:

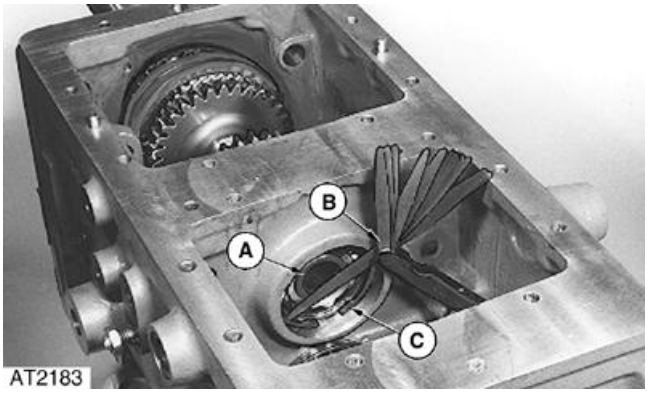
Lubricate all parts with clean transmission/hydraulic oil during assembly

Install all parts.

[15] - Install range shaft (see procedure in this Group).

[16] - Install transmission (see procedure in this Group).

Primary Shaft End Play Adjustment



Adjust Primary Shaft End Play

[1] - Push primary shaft (A) fully forward.

[2] - Measure clearance between bearing and snap ring using feeler gauges (B).

[3] - Use reading on feeler gauges as dimension A in shim thickness calculation. Use the following example to find the required shim thickness.

EXAMPLE:

A - B = C, the required shim thickness

Shim Thickness

Dimension (snap ring to bearing);	A = 1.1 mm (0.043 in)
minus	
Maximum end play;	B = 0.3 mm (0.012 in)
equals	
Required shim thickness;	C = 0.8 mm (0.031 in)
Dimension (snap ring to bearing);	A = 1.1 mm (0.043 in)
minus	
Minimum end play;	B = 0.1 mm (0.004 in)
equals	
Required shim thickness;	C = 1.0 mm (0.039 in)

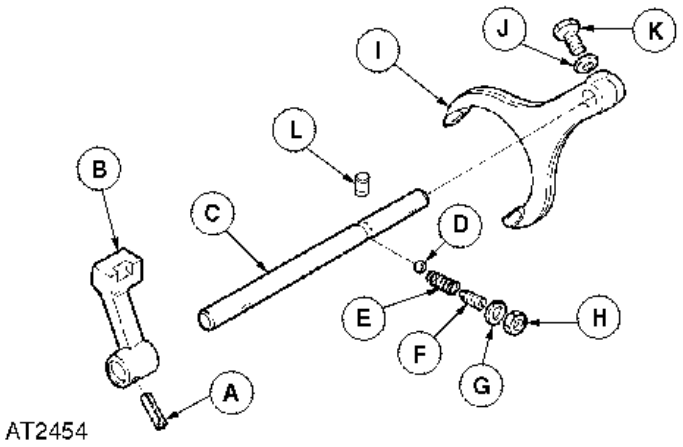
→NOTE:

Shims are available with a thickness of 0.1 mm, 0.3 mm and 0.5 mm (0.004, 0.012 and 0.020 in).

[4] - Remove snap ring (C) to install required shim pack.

[5] - Install snap ring (C).

Remove, Inspect and Install Pinion Shaft



AT2454

LEGEND:

A	Spring Pin
B	Yoke
C	Shaft
D	Ball
E	Spring
F	Detent Adjuster
G	Sealing Washer
H	Lock Nut
I	Shift Fork
J	Washer
K	Cap Screw
L	Pin

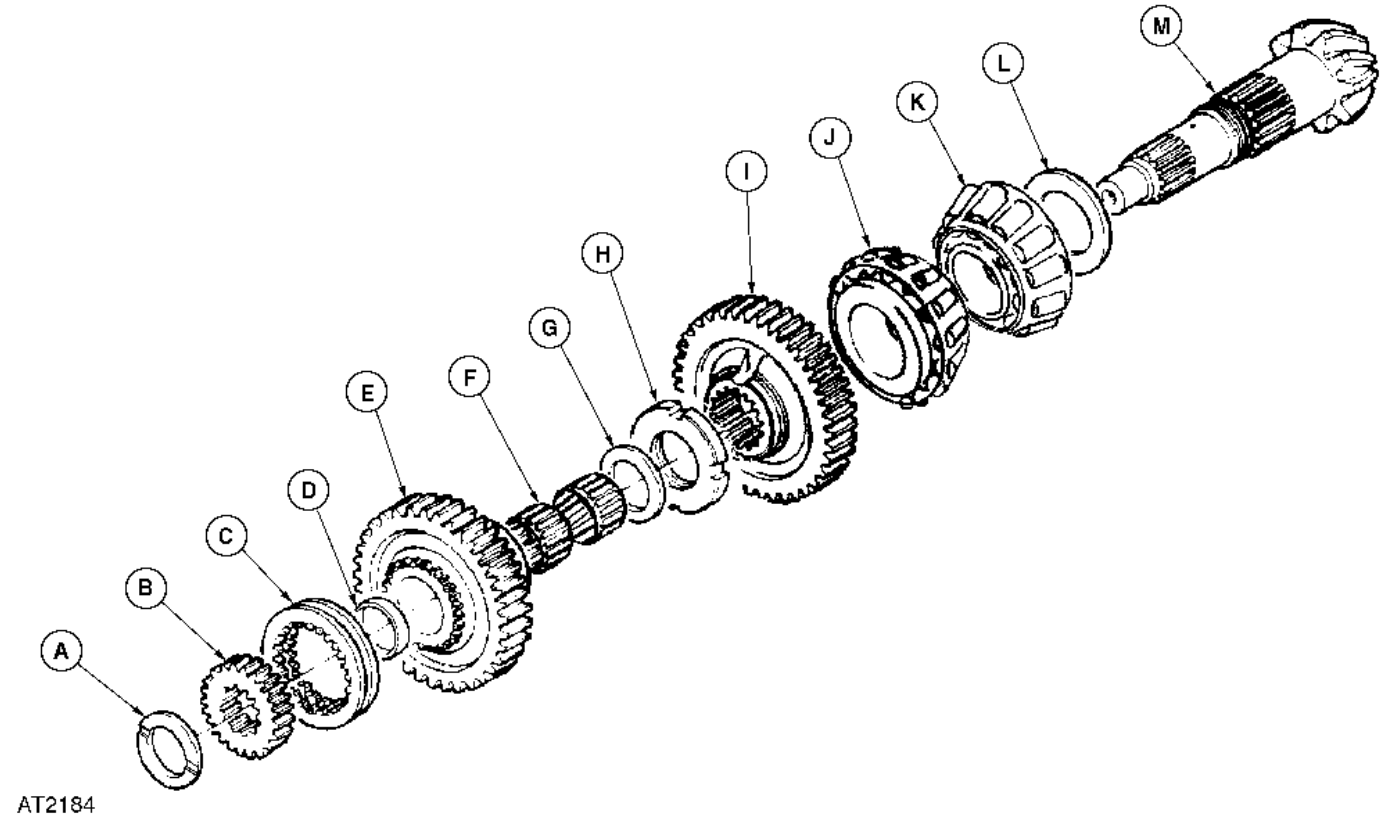
Shifting assembly

[1] - Remove transmission as described in this Group.

[2] - Remove range shaft as described in this Group.

[3] - Remove parts (A) to (L) on left-hand side of transmission case.

[4] -



AT2184

Pinion Shaft-Exploded View

LEGEND:

A	Thrust Washer
B	Hub
C	Shift Collar
D	Spacer
E	Gear
F	Bearing (2 used)

G	Thrust Washer
H	Nut
I	Gear
J	Bearing
K	Bearing
L	Shim
M	Pinion Shaft

Loosen pinion nut (H).

IMPORTANT:

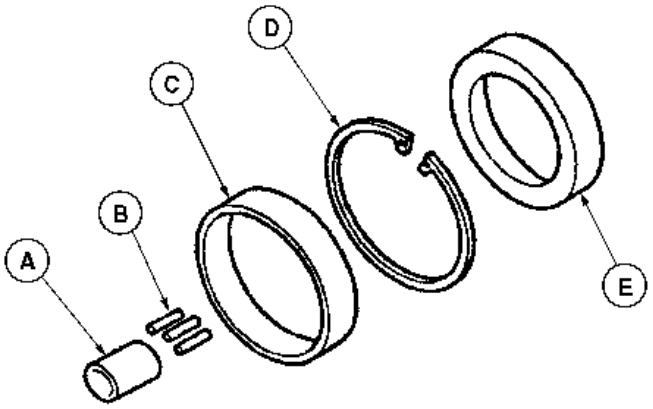
Always use a new nut when assembling pinion shaft.

[5] - Move pinion shaft (M) rearwards.

[6] - Remove parts (A) to (J).

[7] - Remove bearing (K) and shim (L) from pinion shaft (M).

[8] -



AT2185

LEGEND:

A	Spacer
B	Bearing Rollers
C	Bearing Cup
D	Snap Ring
E	Bearing Cup

Spacer, Rollers, Cups, and Ring

Remove bearing cups (C) and (E) using a soft metal drift and hammer.

[9] - Remove snap ring (D).

[10] - Remove bearing rollers (B) and spacer (A) from secondary shaft bore.

[11] - Inspect all parts for wear or damage. Replace as necessary.

[12] -

→NOTE:

For bearings pre-load adjustment and cone point adjustment see procedure in this Group.

Lubricate all parts with clean transmission/hydraulic oil during assembly.

Apply multipurpose grease to bearing rollers (B) and spacer (A) to keep bearing rollers in position.

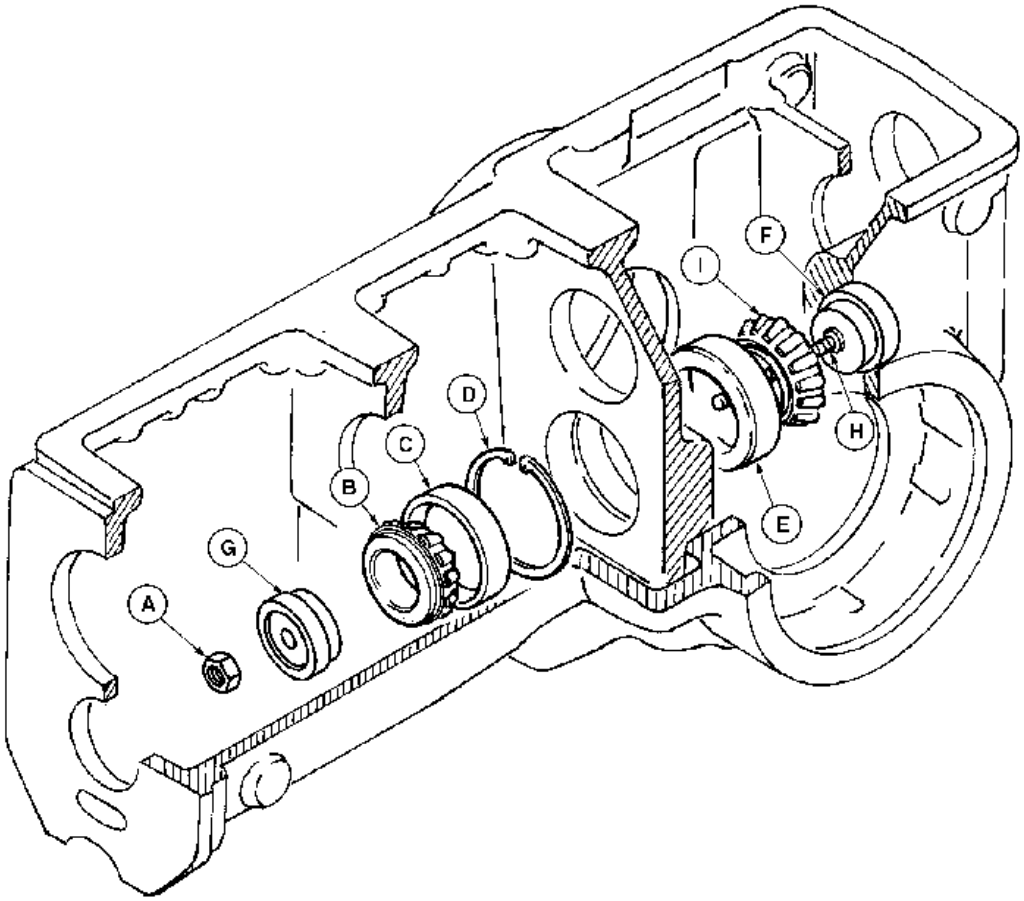
Install bearing rollers (B) and spacer (A) into secondary shaft-bore.

[13] - Install all parts.

[14] - Install range shaft.

[15] - Install transmission.

Pinion Shaft Cone Point Adjustment



AT2319

Pinion Shaft Cone Adjustment

LEGEND:

A	Nut (tool)
B	Bearing Cone
C	Bearing Cup
D	Snap Ring
E	Bearing Cup
F	Steel Disk (tool)
G	Steel Disk (tool)
H	Cap Screw (tool)
I	Bearing Cone

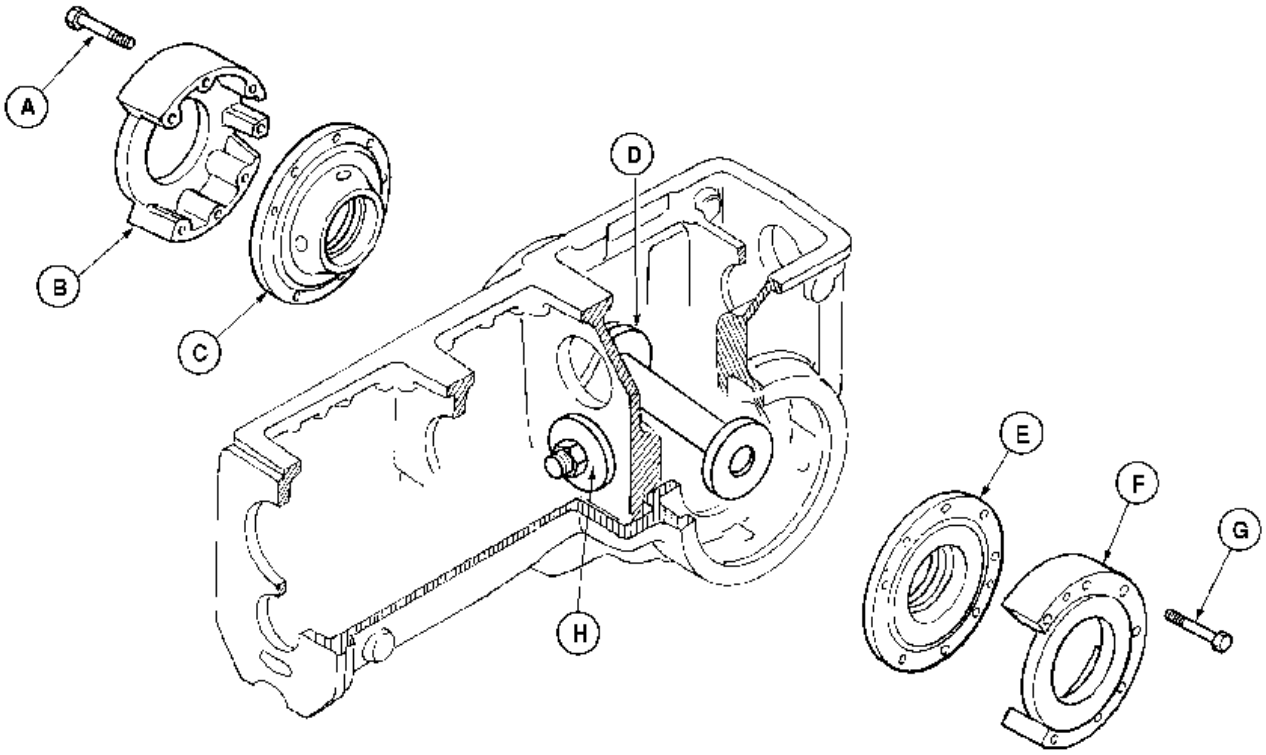
[1] - Install snap ring (D).

[2] - Install bearing cups (C) and (E) using a bearing, bushing and seal driver set.

[3] - Install bearing cones (B) and (I) and keep them in position using tool made of nut (A), steel disks (F) and (G) and cap screw (H). For manufacturing this tool refer to Section 299.

[4] - Tighten cap screw (A) until bearing cones can just be turned by hand. Do not overtighten.

[5] -



AT2320

Pinion Shaft Components

LEGEND:

A	Cap Screw (5 used)
B	right-hand Brake Housing
C	right-hand Quill
D	Special Tool
E	left-hand Quill
F	left-hand Brake Housing
G	Cap Screw (5 used)
H	Special Tool

Remove bearing cones from quills (C) and (E).

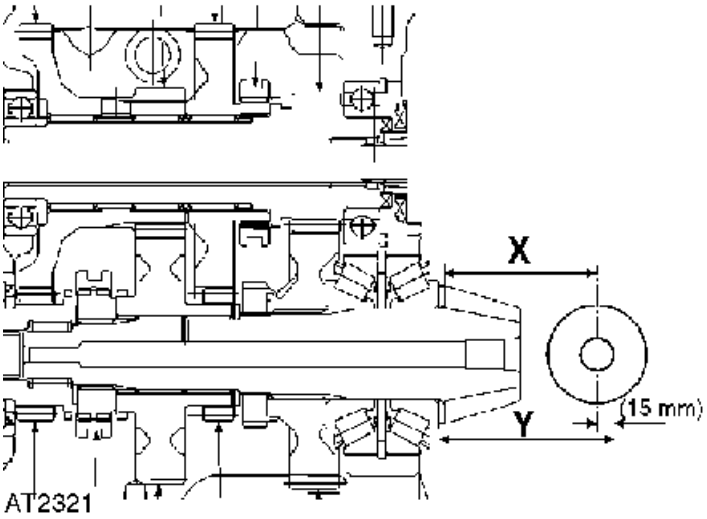
[6] - Install right-hand quill (C), special tool (D) (see Section 299) and left-hand quill.

[7] - Install right-hand brake housing (B) and left-hand brake housing (F).

[8] - Evenly tighten cap screws (A) and (G) to specified torque.

Item	Measurement	Specification
Cap Screws, Brake Housing & Quill to Differential Case	Torque	90 N·m 65 lb-ft

Two numbers can be found on the end face of the bevel pinion. One is the match number for the ring gear and the other is the setting distance X (in mm) for cone point adjustment. Use the self-manufactured special tool (see Section 299) to measure the distance Y between special tool shaft and bearing cone. Subtract the radius of the tool shaft (15 mm; 0.591 in) from Y. From the difference subtract value X to obtain the required thickness of the shims to be added.



Measured Distance

Example:

Measured Distance

Distance X (from face of bevel pinion) ..... 134.3 mm (5.287 in)

Measured distance Y ..... 152.2 mm (5.992 in)

Measured distance Y ..... 152.2 mm (5.992 in)

minus

Tool shaft radius ..... 15.0 mm (0.591 in.)

equals ..... 137.2 mm (5.401 in)

minus

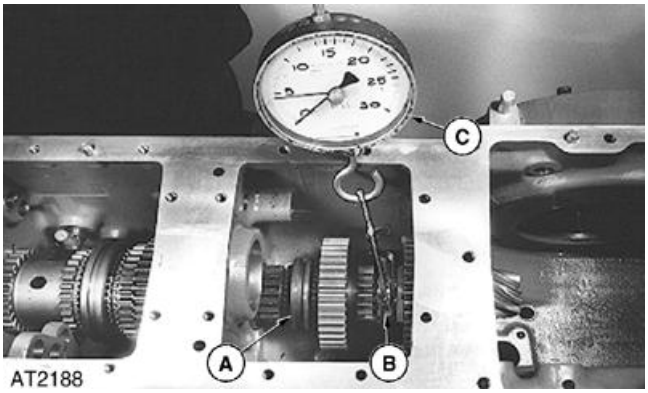
Distance X ..... 134.3 mm (5.287 in)

equals shim thickness of ..... 2.9 mm (0.114 in)

→NOTE:

Shims are available from 2.5 to 3.5 mm (0.098 to 0.138 in) in steps of 0.05 mm (0.002 in).

Pinion Bearing Pre-Load Adjustment



Pinion Bearing Pre-Load Adjustment

[1] - Tighten pinion nut (B) to specified torque.

Item	Measurement	Specification
Pinion Nut	Torque	25 N·m

Item	Measurement	Specification
		18 lb-ft

[2] - Move collar (A) rearward to disengage the secondary shaft.

[3] - Wrap a string around the nut (B) and attach a spring scale (C).

Spring Scale

JDT42

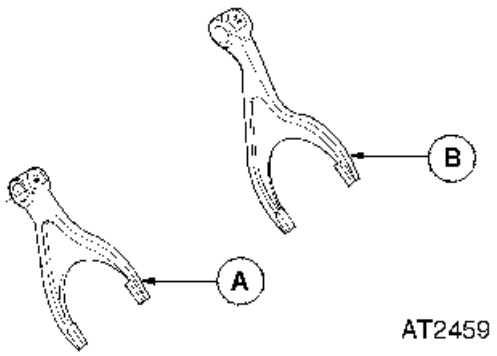
Spring scale

For measuring the initial turning force.

[4] - Raise the spring scale noting the force required to rotate the pinion shaft. Force should be 40-60 N (9-14 lb-force). If the required force is more than specified, loosen the pinion nut and check again. Tighten the pinion nut if the required force is less than specified. When the figure is correct, use a suitable drift to lock the pinion nut into the gear.

Remove, Inspect and Install Secondary Shaft

[1] -



Removal of shift forks

Remove transmission (see procedure in this Group).

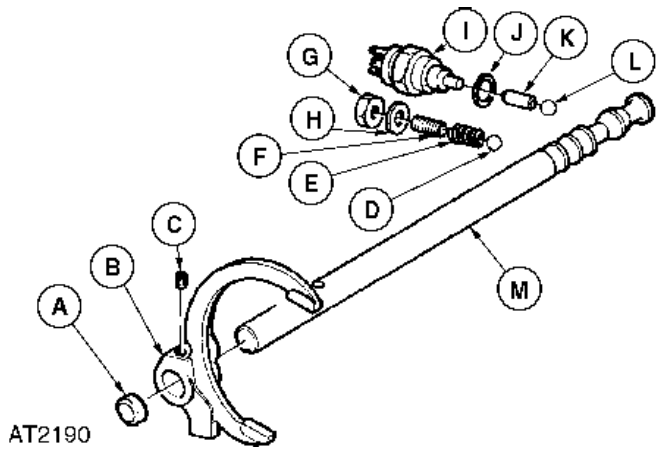
[2] - Remove range shaft (see procedure in this Group).

[3] - Remove primary shaft (see procedure in this Group).

[4] - Remove pinion shaft (see procedure in this Group).

[5] - Remove shift forks (A) and (B).

[6] -



LEGEND:

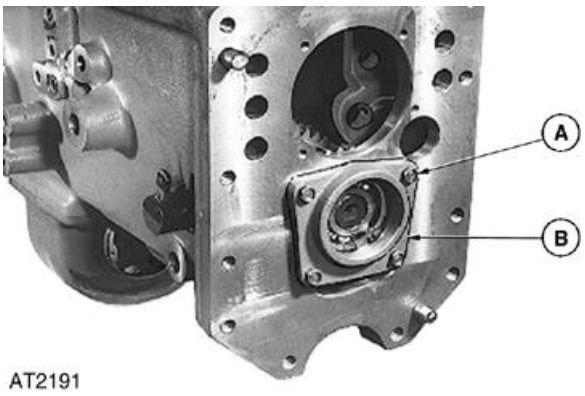
A	Plug
B	Shift Fork
C	Allen Screw
D	Ball
E	Spring
F	Detent Adjuster
G	Lock Nut
H	Sealing Washer
I	Neutral Start Switch
J	Sealing Washer
K	Pin
L	Ball
M	Shaft

Remove Parts (RH Side of Transmission)

Remove parts (D) to (L) on right-hand side of transmission case.

[7] - Remove Allen screw (C) to remove shaft (M), plug (A) and shift fork (B).

[8] -



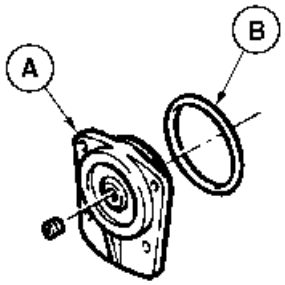
AT2191

Remove Cap Screws and Cover

Remove four cap screws (A) to remove cover (B).

[9] -

IMPORTANT:



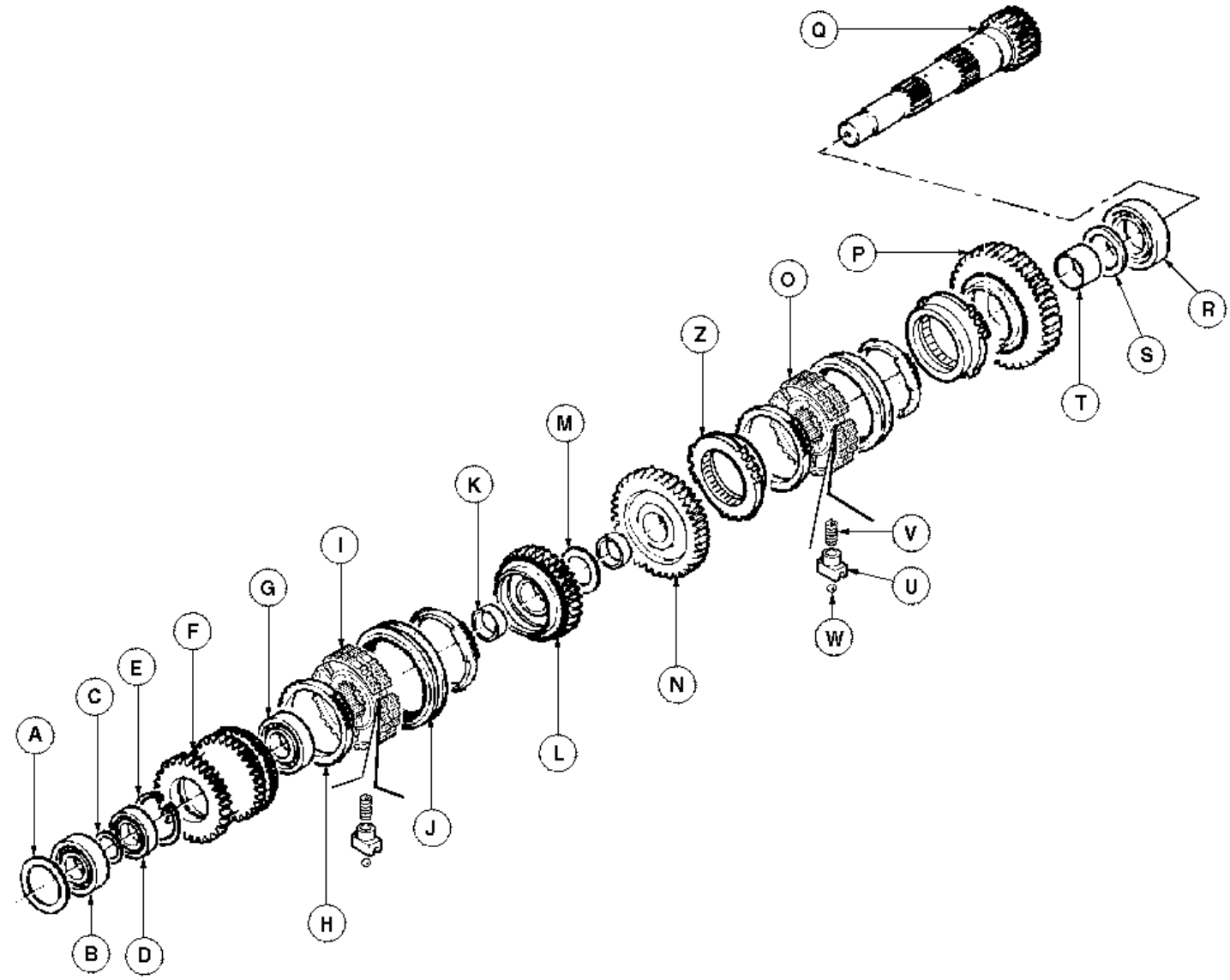
AT2192

Install O-Ring into Groove

Replace O-ring. Damaged or used O-rings will leak.

Install O-ring (B) into groove of cover (A).

[10] -



AT2458

Secondary shaft assembly, exploded view

LEGEND:

A	Shim
B	Bearing
C	Spacer
D	Bearing
E	Snap Ring
F	Gear
G	Bearing
H	Synchronizer Ring (4 used)
I	Hub
J	Shift Collar (2 used)
K	Bushing (2 used)
L	Gear
M	Thrust Washer
N	Gear
O	Hub
P	Gear
Q	Shaft
R	Bearing
S	Thrust Washer
T	Bushing
U	Insert (6 used)
V	Spring (6 used)
W	Ball (6 used)
Z	Synchronizing Ring

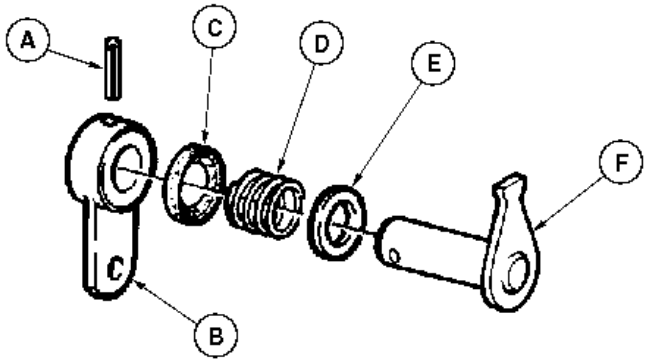
Remove shaft (Q) using soft drift and hammer.

[11] - Remove parts (A) to (P) and (R) to (Z).

→NOTE:

Apply lithium grease with molybdenum disulfide to inner side of gears (L), (N) and (P) during assembly.

[12] -



AT2194

LEGEND:

A	Spring Pin
B	Shift Lever
C	Seal
D	Spring
E	Washer
F	Shift Arm

Pinion Shaft

Remove spring pin (A) to remove shift lever (B).

[13] - Remove parts (D) to (F).

[14] -

IMPORTANT:

Replace seal. Damaged or used seals will leak.

Pry out seal (C). Install seal into housing bore until it stops, using a bushing, bearing and seal drive set.

[15] - Inspect all parts for wear or damage. Replace as necessary.

[16] -

→NOTE:

Lubricate all parts with clean transmission/hydraulic oil during assembly.

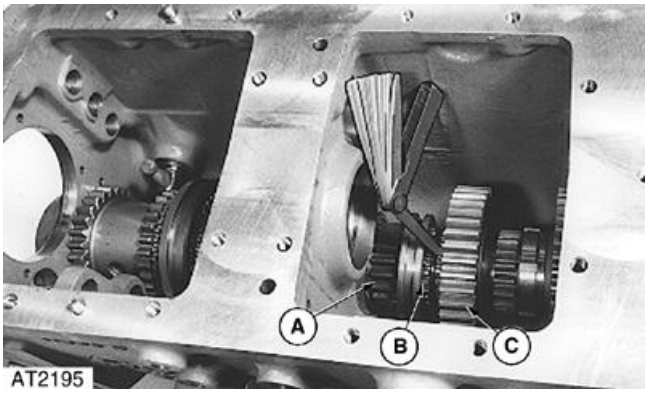
Install all parts.

[17] - Install pinion shaft (see procedure in this Group).

[18] - Install range shaft (see procedure in this Group).

[19] - Install transmission (see procedure in this Group).

Secondary Shaft End Play Adjustment



Adjust Secondary Shaft End Play

→NOTE:

Before adjusting end play on secondary shaft, pinion shaft must be installed.

[1] - Push secondary shaft (A) fully forward.

[2] - Measure clearance between hub (B) and gear (C).

[3] - Use reading on feeler gauges as dimension A in shim thickness calculation. Use the following example to find the required shim thickness.

EXAMPLE:

A - B = C, the required shim thickness

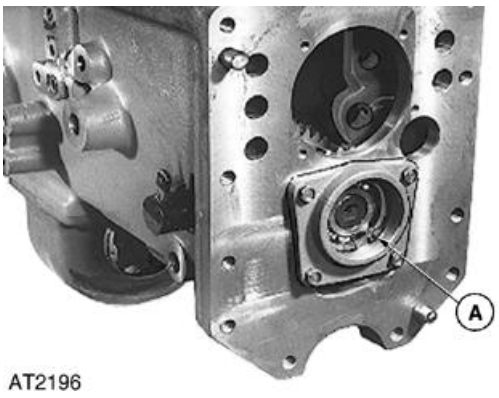
Shim Thickness

Dimension (hub to gear);	A = 1.1 mm (0.043 in)
minus	
Maximum end play;	B = 0.3 mm (0.012 in)
equals	
Required shim thickness;	C = 0.8 mm (0.031 in)
Dimension (hub to gear);	A = 1.1 mm (0.043 in)
minus	
Minimum end play;	B = 0.1 mm (0.004 in)
equals	
Required shim thickness;	C = 1.0 mm (0.039 in)

→NOTE:

Shims are available with a thickness of 0.1 mm, 0.3 mm and 0.5 mm (0.004, 0.012 and 0.020 in).

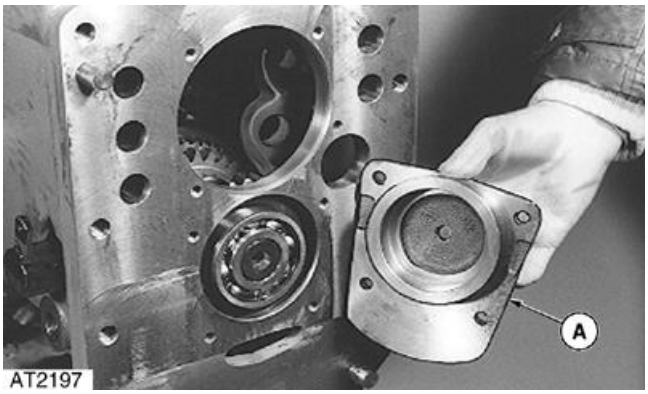
[4] -



Snap Ring

Remove snap ring (A) to install required shim pack.

[5] - Install snap ring (A).



Install Cover

[6] - Install cover (A) and tighten cap screws to specified torque.

Item	Measurement	Specification
Cap Screws, Front Cover of Secondary Shaft to Transmission Housing	Torque	35 N·m 26 lb-ft

Section 60 - STEERING AND BRAKE SYSTEMS - REPAIR

Table of contents

Group 05 - Steering System

Special or Essential Tools

→NOTE:

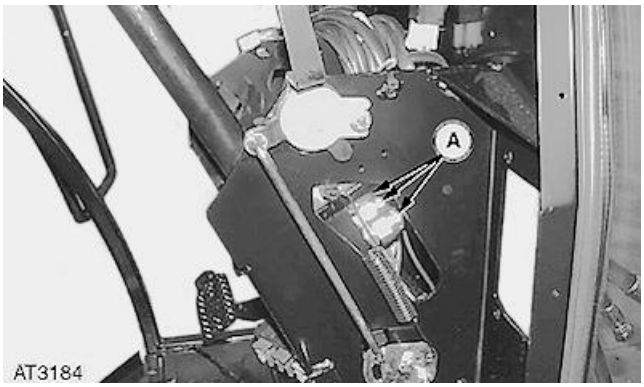
Order tools according to information given in the U.S. SERVICEGARD ™ Catalog or in the European Microfiche Tool Catalog (MTC).

Specifications

Item	Measurement	Specification
Cap Screws, Steering Valve and Column to Support	Torque	71 N·m
		52 lb-ft
Steering Wheel Nut	Torque	68 N·m
		50 lb-ft
Cap Screws, Steering Valve Cover to Steering Valve.	Torque	30 N·m
		22 lb-ft
Cap Screws, End Plate to Steering Cylinder	Torque	95 N·m
		70 lb-ft
Ball Joint to Steering Piston Rod	Torque	300 N·m
		220 lb-ft
Cap Screws, Inner Sleeve to Tie Rod End	Torque	90 N·m
		66 lb-ft
Tie Rod Lock Nut	Torque	165 N·m
		122 lb-ft
Nut, Ball Joint to Tie Rod End	Torque	120 N·m
		89 lb-ft

Remove and Install Steering Column and Valve

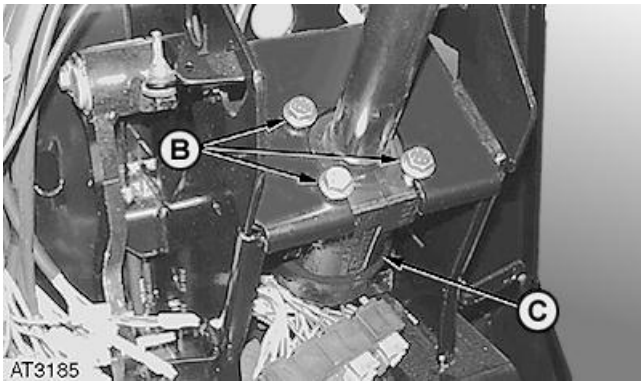
[1] -



LEGEND:

A	Hydraulic Lines
B	Cap Screws
C	Steering Valve

Steering Column and Valve



Steering valve and support

Remove steering wheel.

[2] - Remove instrument panel (see “Replace Instrument Panel” in Section 90).

[3] - Disconnect hydraulic lines (A).

[4] -

IMPORTANT:

Support steering valve before removing mounting cap screws. Remove fuse box from its seat.

Remove four cap screws (B), and remove steering valve (C) with steering column.

[5] - Inspect all parts for wear or damage. Replace if necessary. Straight steering column is non-serviceable. For repair of tilt steering column see procedure in this Group.

[6] - Make repairs as necessary to steering valve (see procedures in this Group).

[7] -

IMPORTANT:

Always use new O-rings. Damaged or used O-rings will leak.

Install steering valve (C) with steering column and cap screws. Do not tighten cap screws at this time.

[8] - Connect hydraulic lines (A).

[9] - Tighten cap screws (B) to specified torque.

Item	Measurement	Specification
Cap Screws, Steering Valve and Column to Support	Torque	71 N·m
		52 lb-ft

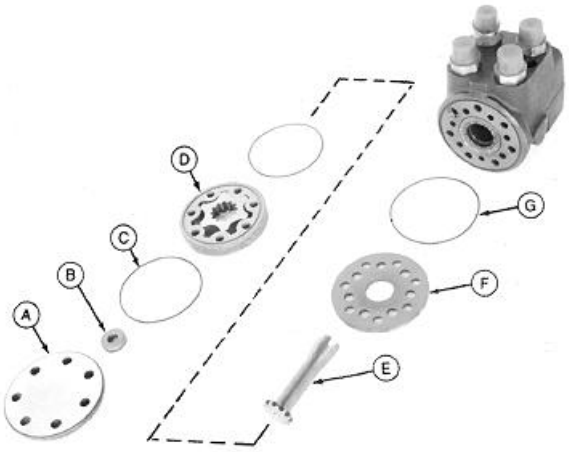
[10] - Install instrument panel (see procedure in Section 90)..

[11] - Install steering wheel. Tighten steering wheel nut to specified torque.

Item	Measurement	Specification
Steering Wheel Nut	Torque	68 N·m
		50 lb-ft

→NOTE:

ng Valve



LEGEND:

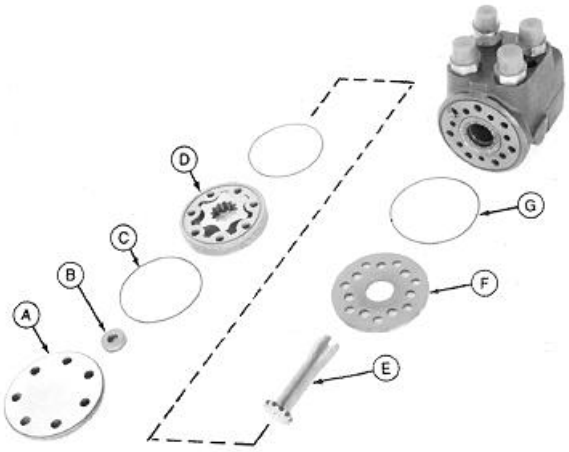
A	Cover
B	Spacer
C	O-Ring
D	Gerotor Set
E	Drive Shaft
F	Distributing Plate
G	O-Ring

Spec

Remove Steering Valve Components

Slide cover (A) sideways to remove, so not to lose spacer (B).

[1] - Remove six cap screws (A) and washers and special cap screw (B) and washer.

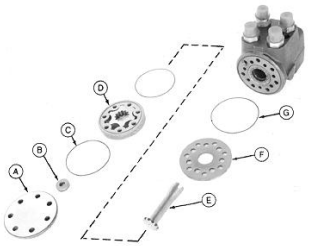


LEGEND:

A	Cover
B	Spacer
C	O-Ring
D	Gerotor Set
E	Drive Shaft
F	Distributing Plate
G	O-Ring

Remove Steering Valve Components

Slide cover (A) sideways to remove, so not to lose spa



LEGEND:

A	Cover
B	Spacer
C	O-Ring
D	Gerotor Set
E	Drive Shaft
F	Distributing Plate
G	O-Ring

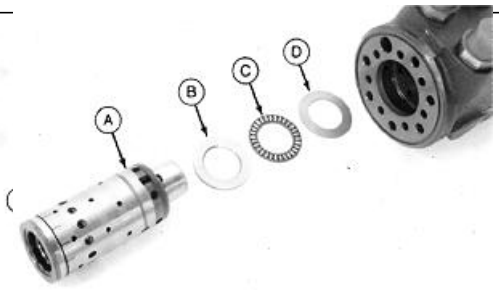
Remove Steering Valve Components

Slide cover (A) sideways to remove, so not to lose spacer (B).

[2] - Remove parts (A to G).

[3] -

IMPORTANT:



LEGEND:

A	Spool and Sleeve Assembly
B	Thick Bearing Race
C	Needle Bearing
D	Thin Bearing Race

Spool and Sleeve Assembly

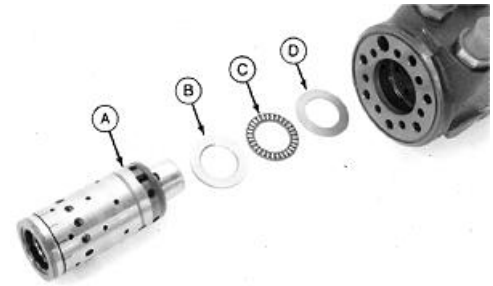
Threaded Bushing and Ball

If spool and sleeve assembly must be removed from valve body for cleaning, handle parts with care. Tolerances on these parts are very close. When replacement is necessary, the spool, sleeve, and valve body must be replaced as a set.

Remove threaded bushing (A) and ball (B).

[4] -

Use care so not to drop or lose parts when removing sleeve and spool assembly. Keep cross pin in assembly horizontal.



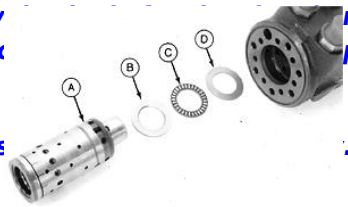
LEGEND:

A	Spool and Sleeve Assembly
B	Thick Bearing Race
C	Needle Bearing
D	Thin Bearing Race

Spool and Sleeve Assembly

If spool and sleeve assembly must be removed from v nd le parts with care. Tolerances on these parts are very close. When repla pool, sleeve, and valve body must be replaced as a set.

Use care so not to drop or lose parts when removing s . Keep cross pin in assembly horizontal.



LEGEND:

A	Spool and Sleeve Assembly
B	Thick Bearing Race
C	Needle Bearing
D	Thin Bearing Race

Spool and Sleeve Assembly

If spool and sleeve assembly must be removed from valve body for cleaning, handle parts with care. Tolerances on these parts are very close. When replacement is necessary, the spool, sleeve, and valve body must be replaced as a set.

Use care so not to drop or lose parts when removing sleeve and spool assembly. Keep cross pin in assembly horizontal.

Push and turn sleeve and spool assembly (A) to remove from valve body.

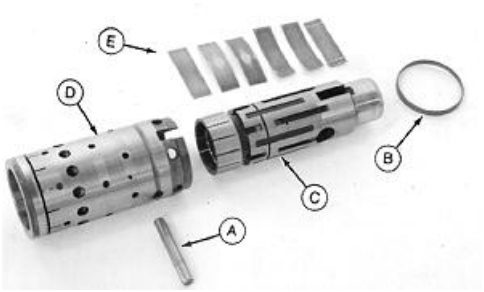
[5] -

→NOTE:

Thin bearing race may remain in valve body.

Remove parts (B to D).

[6] -



LEGEND:

A	Cross Pin
B	Ring
C	Spool
D	Sleeve
E	Spring Set

Spring Set

Remove cross pin (A) and ring (B).

[7] - Carefully, slide spool (C) from sleeve (D).

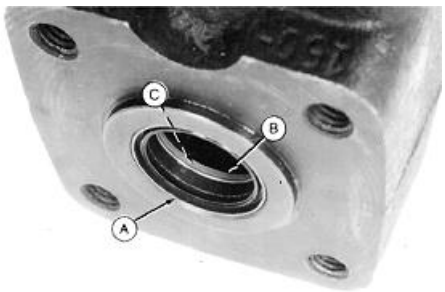
[8] -

→NOTE:

Spring set consists of two flat and four curved leafs.

Push spring set (E) from spool.

[9] -



Dust Seal, Kin-Ring, and O-Ring

Remove dust seal (A), kin-ring (B), and O-ring (C).

[10] -

LEGEND:

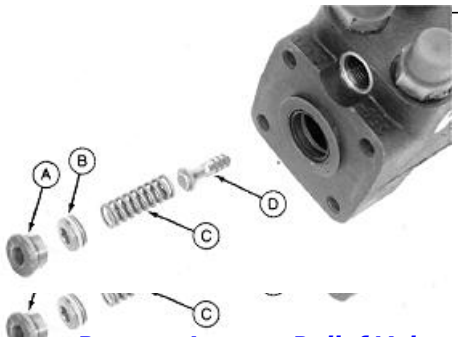
A	Plug and O-Ring
B	Adjustable Plug
C	Spring
D	Piston

Remove Parts to Inspect Relief Valve

If relief valve is removed, steering relief valve pressure must be checked and adjusted.

Relief valve seat in valve body is not serviceable. Valve body, spool, and sleeve must be replaced as a set if relief valve seat is damaged.

IMPORTANT:



LEGEND:

A	Plug and O-Ring
B	Adjustable Plug
C	Spring
D	Piston

LEGEND:

A	Plug and O-Ring
B	Adjustable Plug
C	Spring
D	Piston

Remove Parts to Inspect Relief Valve

Remove Parts to Inspect Relief Valve

If relief valve is removed, steering relief valve pressure must be checked and adjusted.

If relief valve is removed, steering relief valve pressure must be checked and adjusted.

Relief valve seat in valve body is not serviceable. Valve body, spool, and sleeve must be replaced as a set if relief valve seat is damaged.

Relief valve seat in valve body is not serviceable. Valve body, spool, and sleeve must be replaced as a set if relief valve seat is damaged.

→NOTE:

Count the number of turns needed to remove plug (B). This will help to initially set relief valve pressure at assembly.

Remove parts (A to D) to inspect and clean relief valve. Be sure orifice in piston (D) is free of obstruction.

[11] -

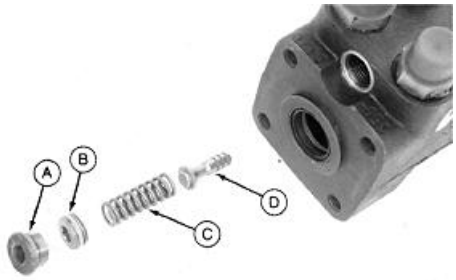
Inspect Check Valve

Remove hydraulic fitting from inlet port to inspect check valve (A). Remove any obstructions from check valve. If check valve is worn or damaged, valve body, spool, and sleeve must be replaced as a set.

[12] - Install and tighten hydraulic fitting.

[13] - Inspect all parts for scoring, wear, or damage. Replace as necessary.

Assemble Steering Valve



LEGEND:

A	Plug and O-Ring
B	Adjustable Plug
C	Spring
D	Piston

Steering Valve

IMPORTANT:

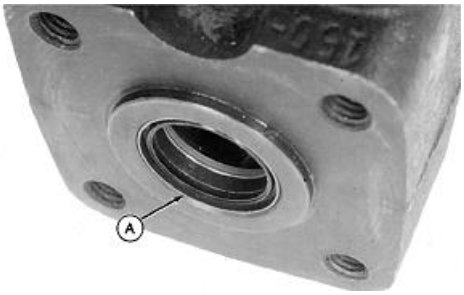
Always replace all O-rings and seals. Damaged or used parts will leak.

→NOTE:

Apply clean transmission/hydraulic oil to all internal parts.

[1] - Install parts (A to D). Install plug (B) the same number of turns as needed to remove the plug.

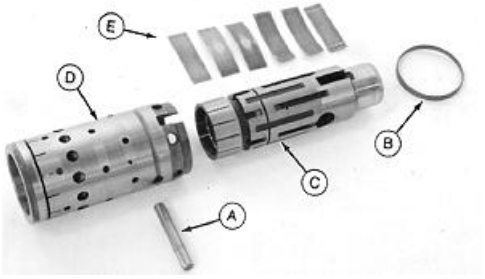
[2] -



Install Dust Seal

Install dust seal (A) with seal lip away from valve body and to bottom of bore.

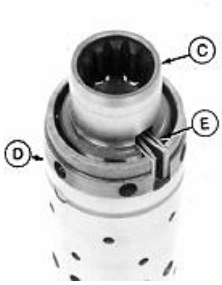
[3] -



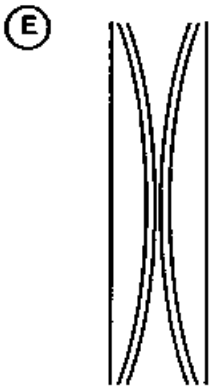
LEGEND:

A	Cross Pin
B	Ring
C	Spool
D	Sleeve
E	Spring Set

Steering Valve Parts



Assemble Parts



Spring Set

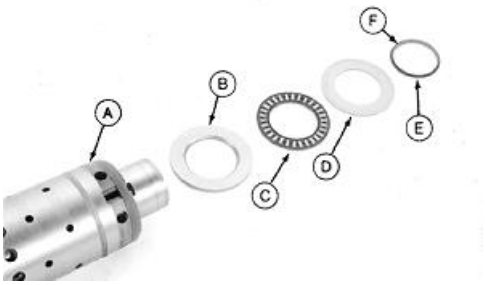
Install two flat leafs of spring set (E) in slot of spool (C). Install curved leafs so their centers touch and curved leafs fit between the flat leafs.

[4] - Slide spool and springs into sleeve (D). Squeeze spring ends together so springs fit into slot of sleeve. Make sure leaf ends are aligned and centered.

[5] - Install ring (B) with rounded end away from sleeve. Ring must rotate freely on sleeve.

[6] - Install pin (A).

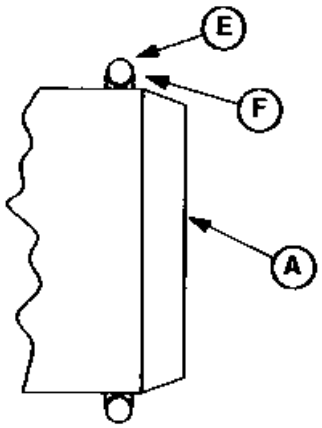
[7] -



LEGEND:

A	Spool and Sleeve Assembly
B	Thick Bearing Race
C	Needle Bearing Race
D	Thin Bearing Race
E	O-Ring
F	Kin-Ring

Install on Spool and Sleeve Assembly



Push Assembly into Body

Install parts (B to D) on spool and sleeve assembly (A). Inner chamfer of thick bearing race (B) must be towards spool.

[8] - Put O-ring (E) on kin-ring (F). Install O-ring and kin-ring on spool just past spool chamfer.

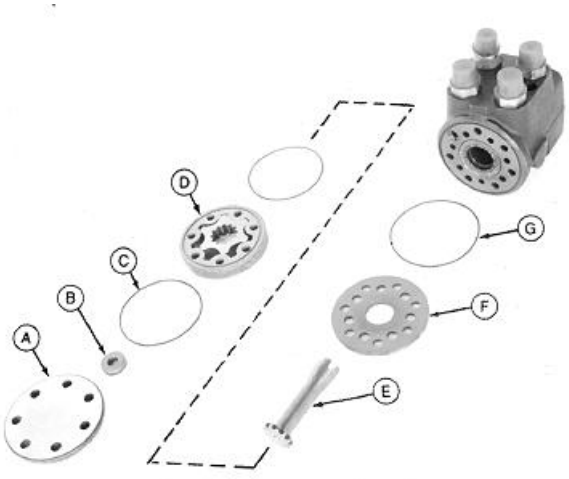
[9] - Put spool and sleeve assembly in valve body using a turning motion. Position the cross pin so it is parallel to surface of the valve body with the hose connections. Push assembly into body until end of assembly is even with machined surface of valve body.

[10] -

Ball and Threaded Bushing

Install ball (B) and threaded bushing (A). Top of bushing must be below surface of valve body.

[11] -



LEGEND:

A	Cover
B	Spacer
C	O-Ring (2 used)
D	Gerotor Set
E	Drive Shaft
F	Distributing Plate
G	O-Ring

Install Steering Valve Parts

Install parts (C-G).

[12] -

IMPORTANT:

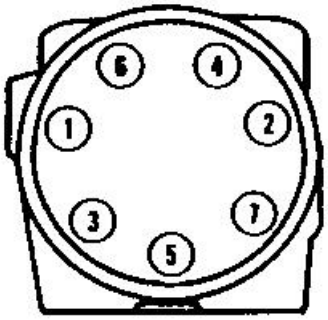
Violent steering wheel oscillation can occur if gerotor is not timed correctly.

Make sure gerotor is timed. Install inner rotor of gerotor so that the center of a valley of the rotor is aligned with the center line of the cross pin. Turn outer gear of gerotor until holes are aligned.

[13] - Install spacer (B) and cover (A).

[14] -

Cap Screws



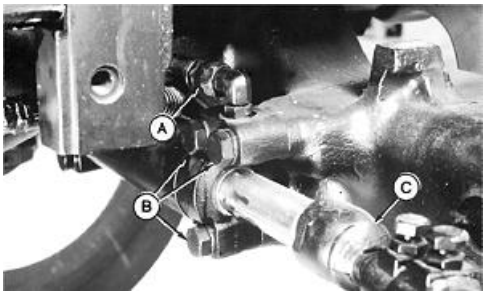
Tighten in Crisscross Sequence

Install six washers and cap screws (A) and washer and special cap screw (B). Tighten cap screws in crisscross sequence as indicated to the specified torque.

Item	Measurement	Specification
Cap Screws, Steering Valve Cover to Steering Valve.	Torque	30 N·m
		22 lb-ft

[15] - If relief valve was removed, relief valve pressure must be checked and adjusted after installing steering valve on tractor (see procedure in Section 260).

Remove and Install Steering Cylinder-2WD Axle



Right-Hand Side Shown

[1] - Remove tie rod ends (C), (see procedure in this Group).

[2] - Disconnect hoses (A). Close all openings using caps and plugs.

[3] - Remove cap screws and lock washers (B) from both ends of cylinder. Remove cylinder.

[4] - Make repairs as necessary (see procedure in this Group).

[5] - Apply thread lock and sealer (medium strength) to threads of cap screws.

[6] - Install steering cylinder, lock washers and cap screws. Tighten cap screws to 200 N·m (147 lb-ft).

[7] -

IMPORTANT:

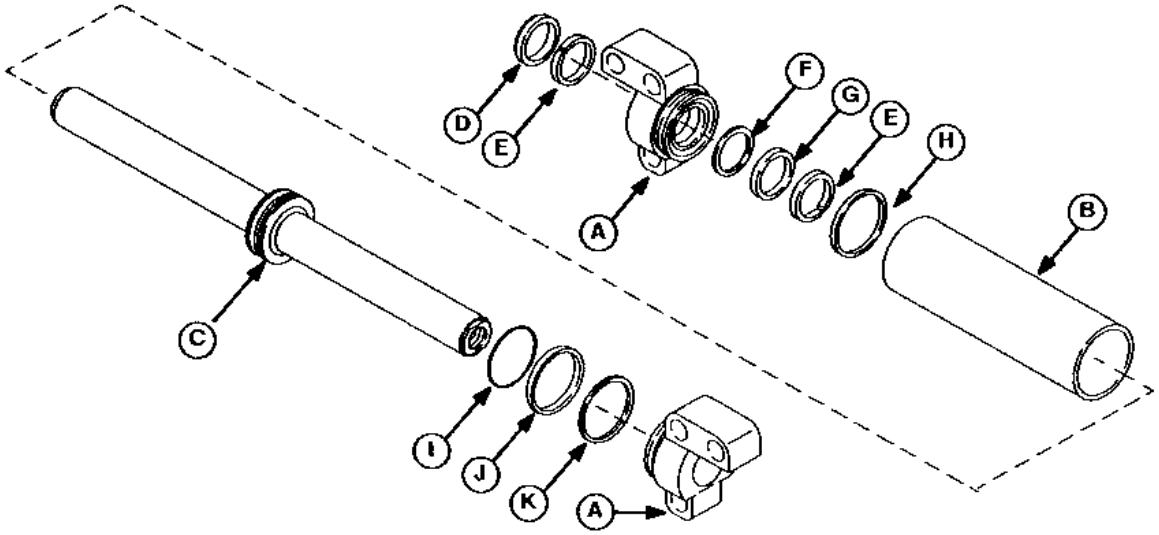
Always replace all O-rings. Damaged or used O-rings will leak.

Install new O-rings and connect hydraulic hoses.

[8] - Install tie rod ends.

[9] - Start engine. Operate steering and check for hydraulic leaks.

Disassemble, Inspect and Assemble Steering Cylinder-2WD Axle



Steering Cylinder-2WD Axle

LEGEND:

A	Rod Guide (2 used)
B	Cylinder Barrel
C	Rod and Piston Assembly
D	Wiper Seal (2 used)
E	Split Wear Ring (4 used)
F	Backup Ring (2 used)
G	Seal (2 used)
H	Ring Seal (2 used)
I	O-Ring
J	Split Wear Ring
K	Piston Seal

→NOTE:

Ball joints must be removed from steering cylinder rod for cylinder disassembly.

[1] - Pull rod guides (A) from cylinder barrel (B) and remove from rod and piston assembly (C).

[2] - Pull rod and piston assembly from barrel.

[3] - Remove two wear rings (E), seal (G), backup ring (F), wiper seal (D), and ring seal (H) from each guide.

[4] - Remove piston seal (K), wear ring (J) and O-ring (I).

[5] - Inspect rod and barrel for scoring, wear, or damage. Replace cylinder if necessary.

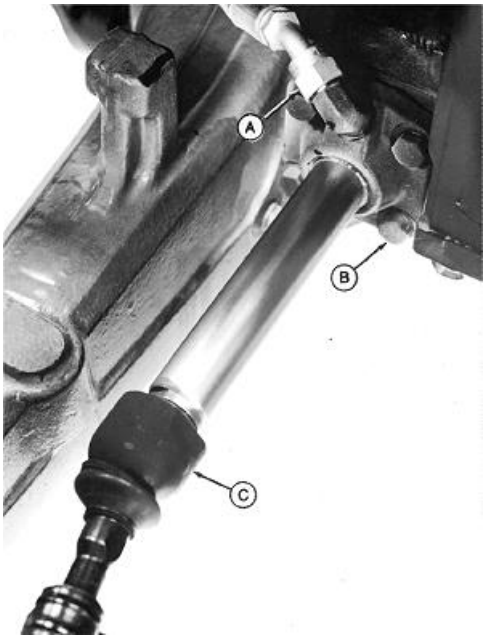
[6] - Install new seals and wear rings.

[7] - Apply clean transmission/hydraulic oil to all internal parts during assembly.

[8] - Install rod and piston assembly into barrel.

[9] - Carefully install rod guides on rod and in barrel so not to damage seals.

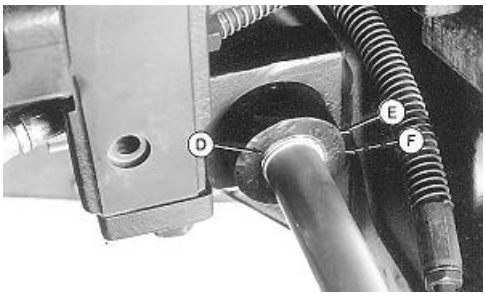
Remove and Install Steering Cylinder-MFWD Axle



LEGEND:

A	Steering Hoses
B	Cap Screws (4 used)
C	Tie Rod Ends
D	Cylinder Inner Edge
E	Cylinder Outer Edge
F	Hydraulic Fitting Port

Steering Cylinder-MFWD Axle



Cylinder and Hydraulic Fitting Port

[1] - Turn the front wheels all the way to the right. This will allow room for removal of steering assembly.

[2] - Loosen cap screws (B) by two turns each.

[3] - Turn the steering wheel to left. This will unseat the end cap and cylinder from the differential casing.

[4] - Disconnect hoses (A). Close all openings using caps and plugs.

[5] - Remove tie rod ends (C), (see procedure in this Group).

[6] - Remove hydraulic fitting on right-hand side of cylinder.

[7] - Remove cap screws.

[8] -

IMPORTANT:

Steering cylinder may be seized to differential case. Do not strike cylinder end near edges (D and E). Striking at these points can distort wiper seal area or cause distortion of outer edge, preventing removal of cylinder. Use a brass drift and hammer to remove cylinder.

Remove steering cylinder assembly using a brass drift and hammer, if necessary.

[9] - Make repairs as necessary, (see procedure in this Group).

[10] - Apply Moly High Temperature EP Grease to mating surfaces of steering cylinder and differential case. Install cylinder with hydraulic fitting port (F) facing front of machine.

[11] - Install the steering cylinder assembly.

[12] - Install cap screws and tighten to specified torque.

Item	Measurement	Specification
Cap Screws, End Plate to Steering Cylinder	Torque	95 N·m
		70 lb-ft

[13] -

IMPORTANT:

Always replace all O-rings. Damaged or used O-rings will leak.

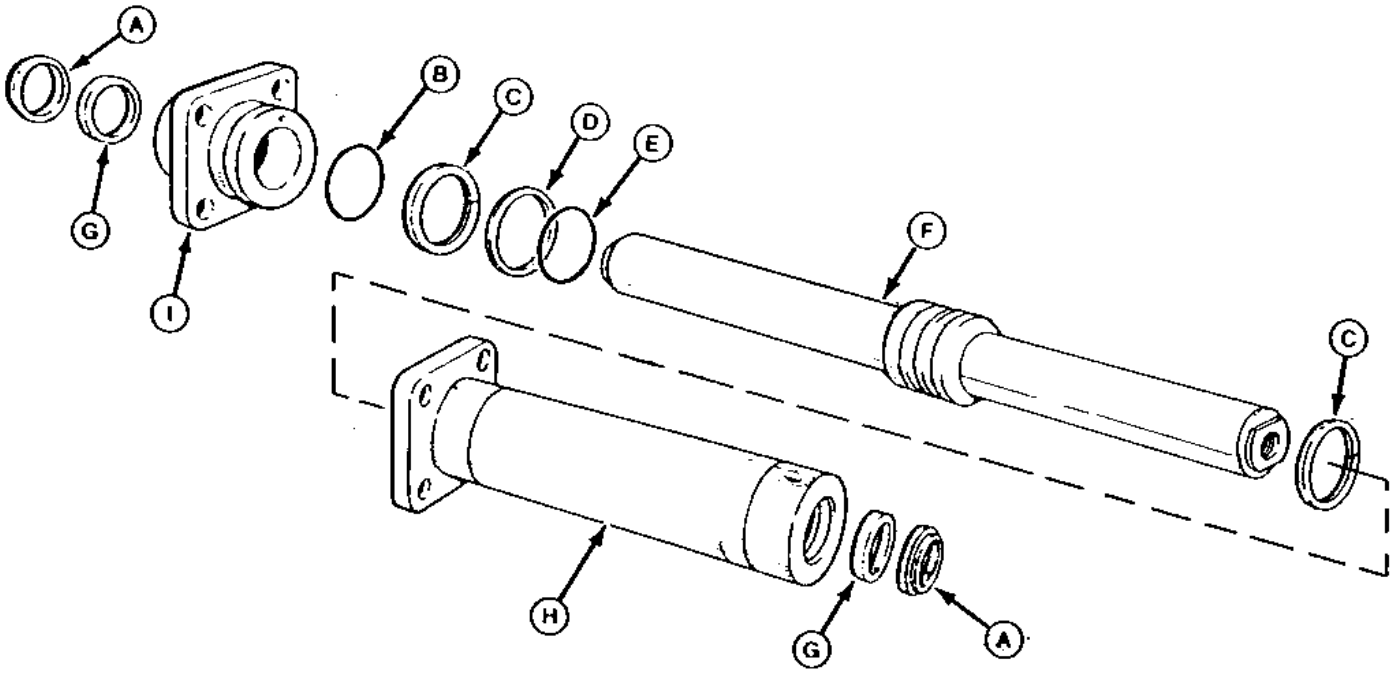
Install new O-ring and hydraulic fitting.

[14] - Install the tie rod ends.

[15] - Install new O-rings and connect hydraulic hoses.

[16] - Start engine. Operate steering and check for hydraulic leaks.

Disassemble, Inspect and Assemble Steering Cylinder-MFWD Axle



Steering Cylinder-MFWD Axle

LEGEND:	
A	Wiper Seal (2 used)
B	O-Ring
C	Wear Ring (2 used)
D	Piston Seal
E	O-Ring
F	Rod and Piston Assembly
G	Oil Seal (2 used)
H	Cylinder Barrel
I	End Plate

[1] - Remove parts (A to I).

[2] - Inspect rod and barrel for wear or damage. Replace as necessary.

[3] - Install new seals and wear rings.

[4] - Apply clean transmission/hydraulic oil to all parts during assembly.

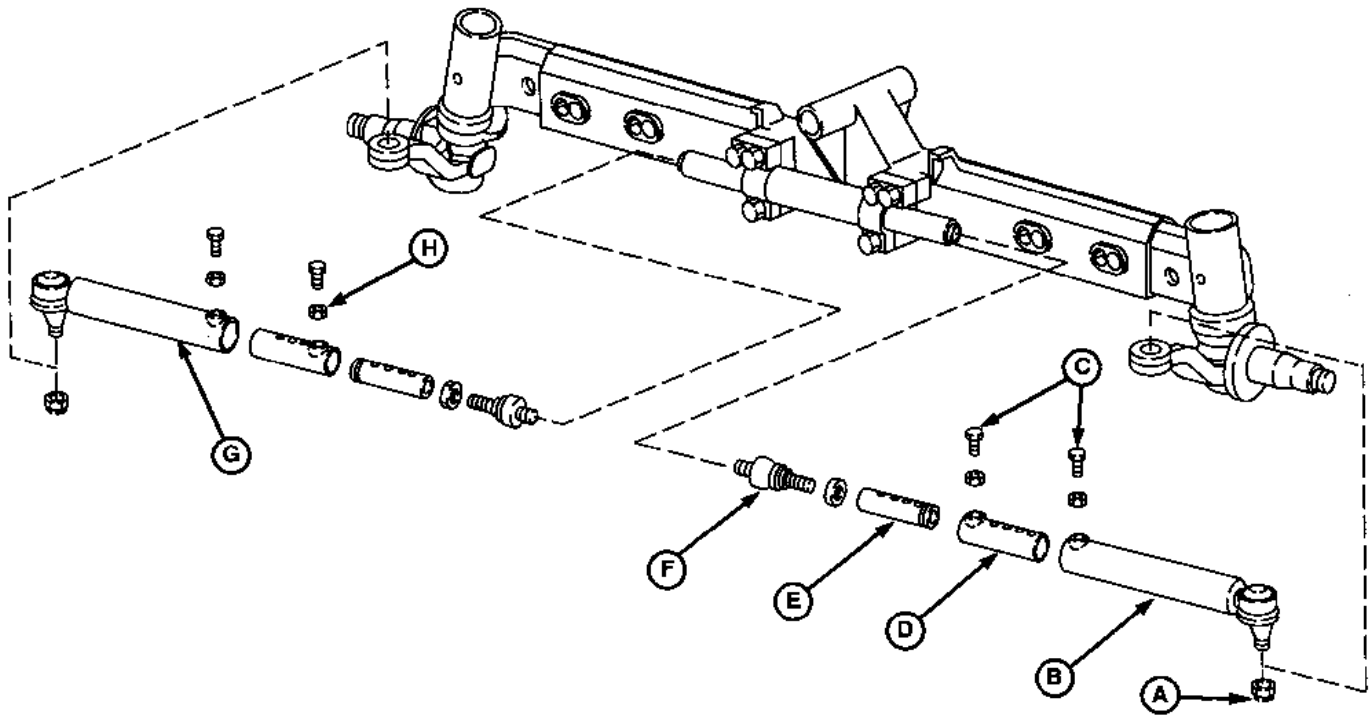
[5] -

→NOTE:

Allow the center piston seal to contract naturally on top of the O-ring before installing the piston and rod assembly into the cylinder barrel.

Install all parts.

Remove, Inspect and Install Tie Rod Assembly-2WD Axle



Tie Rod Assembly-2WD Axle

LEGEND:

A	Lock Nut (2 used)
B	Right Tie Rod End
C	Cap Screw and Nut (4 used)
D	Inner Sleeve (2 used)
E	Rod (2 used)
F	Ball Joint (2 used)
G	Left Tie Rod End

→NOTE:

Tie rod end is a tapered bore fit. Use a ball joint fork or puller to ease removal.

[1] - Remove lock nut (A). Remove tie rod end from spindle arm.

[2] - Inspect parts (A) to (G) for wear or damage.

[3] -

→NOTE:

To replace ball joints (F), use a standard 46 mm wrench on flats on both ball joints. Turn one side while holding the other.

Remove parts (B) to (G) as necessary for replacement.

[4] - Apply a small amount of Moly High Temperature EP Grease to outer surface of rod (E) and inner sleeve (D).

[5] - Install parts (B) to (G).

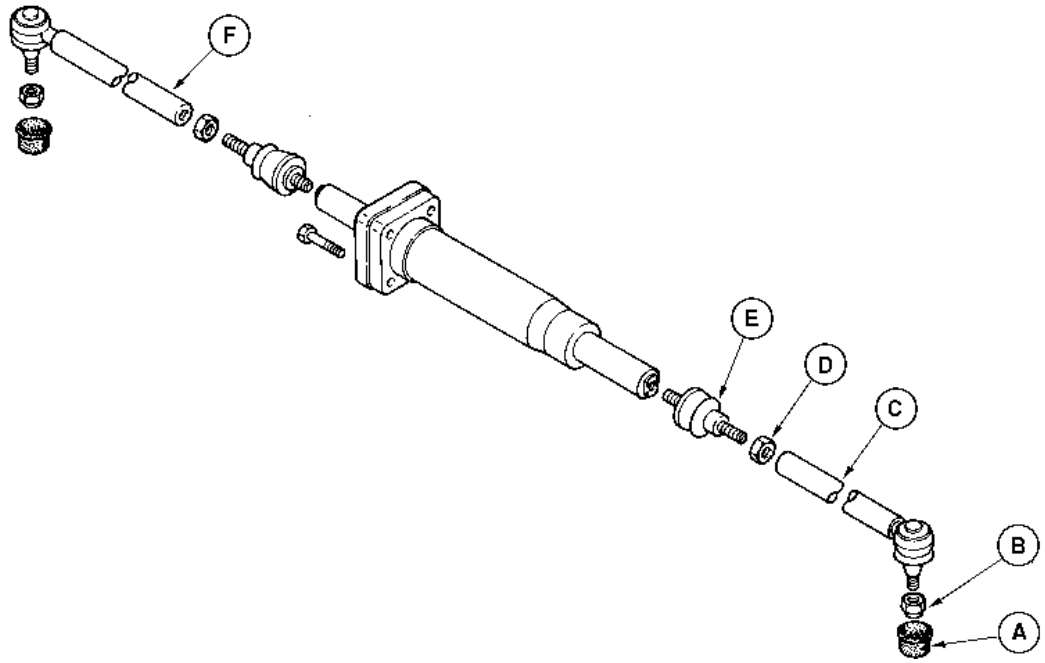
[6] - Adjust length of tie rod assembly by positioning sleeves (D) and (E) so wheel is approximately straight forward when steering cylinder is centered and tie rod end fits into arm of spindle. Tighten cap screws and nuts (C) to specifications.

[7] - Install and tighten lock nut (A) to specifications.

[8] - Adjust front axle toe-in (see Operator's Manual).

Item	Measurement	Specification
Ball Joint to Steering Piston Rod	Torque	300 N·m
		220 lb-ft
Cap Screws, Inner Sleeve to Tie Rod End	Torque	90 N·m
		66 lb-ft
Tie Rod Lock Nut	Torque	165 N·m
		122 lb-ft

Remove, Inspect and Install Tie Rod Assembly - MFWD Axle



Tie Rod Assembly - MFWD Axle

LEGEND:

A	Boot (2 used)
B	Lock Nut (2 used)
C	Right Tie Rod End
D	Nut (2 used)
E	Ball Joint (2 used)
F	Left Tie Rod End

→NOTE:

Tie rod end is a tapered bore fit. Use a ball joint fork or puller to ease removal specifications.

[1] - Remove lock nut (B). Remove tie rod end from spindle arm.

[2] - Inspect parts (A) to (F) for wear or damage.

[3] -

→NOTE:

To replace ball joints (E), use a standard 46 mm wrench on flats on both ball joints. Turn one side while holding the other.

Remove parts (C) and (D) as necessary for replacement.

[4] - Install parts (C) and (D). Tighten ball joint (E) to specifications.

[5] - Adjust length of tie rod assembly by turning tie rod end (C) so wheel is approximately straight forward when steering cylinder is centered and tie rod end fits into arm of spindle. Tighten nut (D) to specifications.

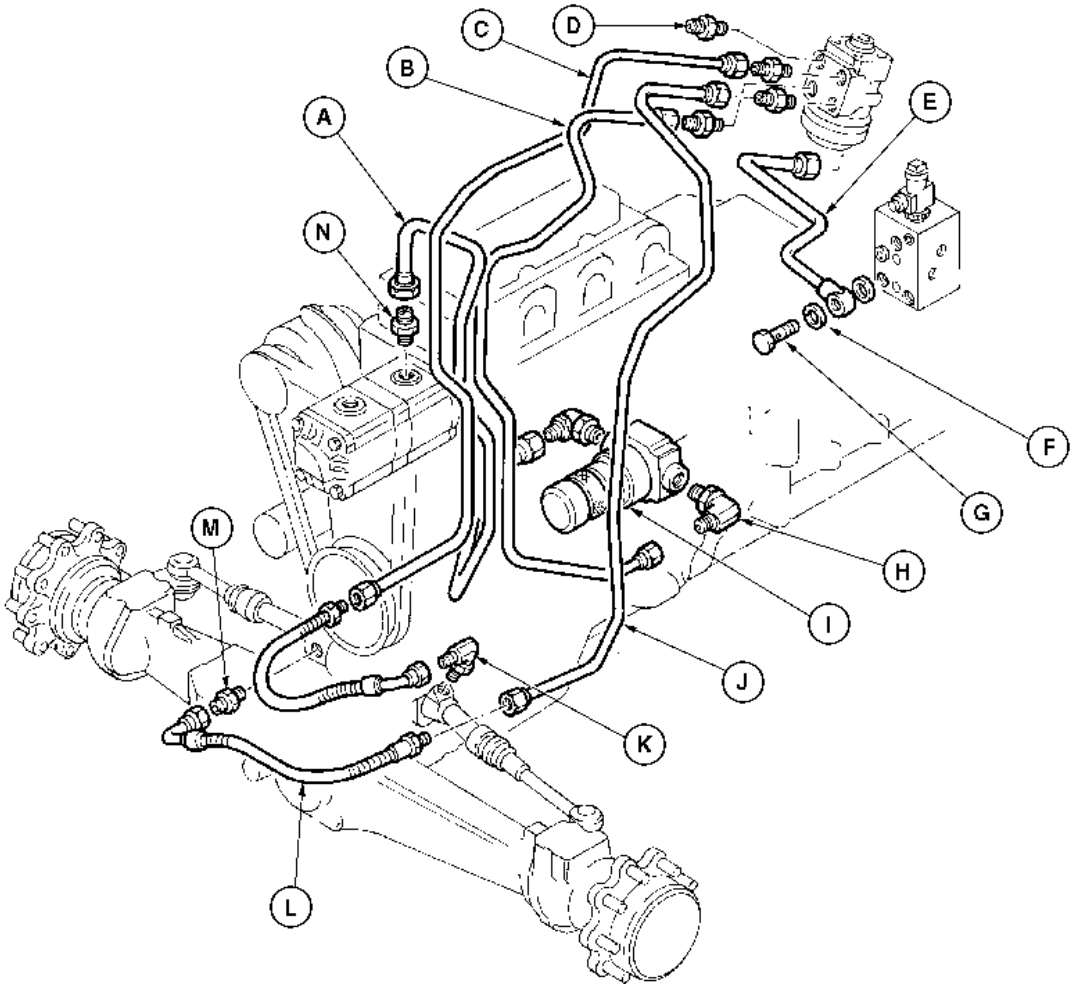
[6] - Install and tighten lock nut (B) to specifications.

[7] - Adjust front axle toe-in (see Operator´s Manual).

Item	Measurement	Specification
Ball Joint to Steering Piston Rod	Torque	300 N·m
		220 lb-ft
Tie Rod Lock Nut	Torque	165 N·m
		122 lb-ft
Nut, Ball Joint to Tie Rod End	Torque	120 N·m
		89 lb-ft

Inspect and Replace Steering Hydraulic Lines

For Tractors without Cab



Steering Hydraulic Lines

LEGEND:

A	Hydraulic Pump-to-Filter Supply Line
B	Filter-to-Steering Valve Supply Line
C	Pressure Line-to-Steering Cylinder
D	Fitting (4 used)
E	Steering Valve Return Line
F	Sealing Washer (2 used)
G	Fitting
H	Fitting (2 used)
I	Filter
J	Pressure Line-to Steering Cylinder
K	Fitting
L	Steering Valve-to-Cylinder Hose (2 used)
M	Connector
N	Connector

[1] - Remove dash and engine side panels.

[2] -

→NOTE:

Remove brake pedals to replace hydraulic lines (C) and (J).

Remove fuel filter and disconnect brake lines to replace hydraulic line (B).

Inspect hydraulic lines and hoses for wear or damage. Replace as necessary.

IMPORTANT:

Replace all O-rings. Damaged or used O-rings will leak.

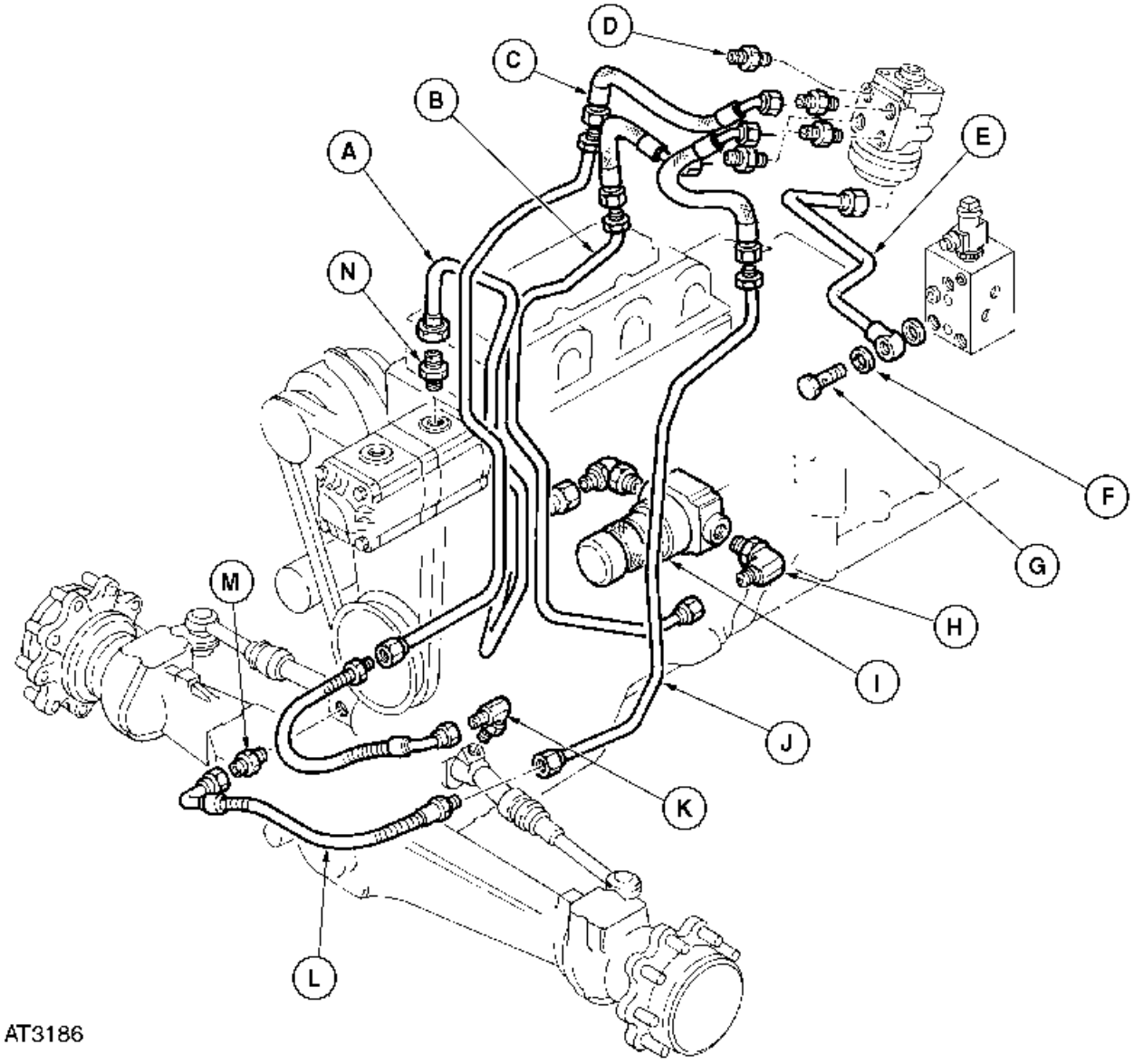
[3] - Install side panels.

[4] - Adjust hydraulic oil level to full mark with proper oil (see “Fuel, Lubricants and Coolant” in Section 10).

CAUTION:

Before operating the tractor, bleed and check brakes.

For Tractors with Cab



Steering Hydraulic Lines

LEGEND:

A	Hydraulic Pump-to-Filter Supply Line
B	Filter-to-Steering Valve Supply Line
C	Pressure Line-to-Steering Cylinder
D	Fitting (4 used)
E	Steering Valve Return Line
F	Sealing Washer (2 used)
G	Fitting
H	Fitting (2 used)
I	Filter
J	Pressure Line-to Steering Cylinder
K	Fitting
L	Steering Valve-to-Cylinder Hose (2 used)
M	Connector

[1] -

→NOTE:

Tractors equipped with cab.

Remove dash covers, instrument panel and engine side panels.

→NOTE:

Because of limited access, it may be necessary to remove the brake pedals, to disconnect the hydraulic lines (C) and (J) from steering valve.

To remove the hydraulic line (B), it is necessary to remove the fuel filter and disconnect the brake lines from brake valve.

[2] - Inspect hydraulic lines and hoses for wear or damage. Replace as necessary.

IMPORTANT:

Replace all O-rings. Damaged or used seals will leak.

[3] - Install engine side panels and dash covers.

[4] - Start engine. Operate steering and check for oil leaks. Note any leaks and make repair as necessary.

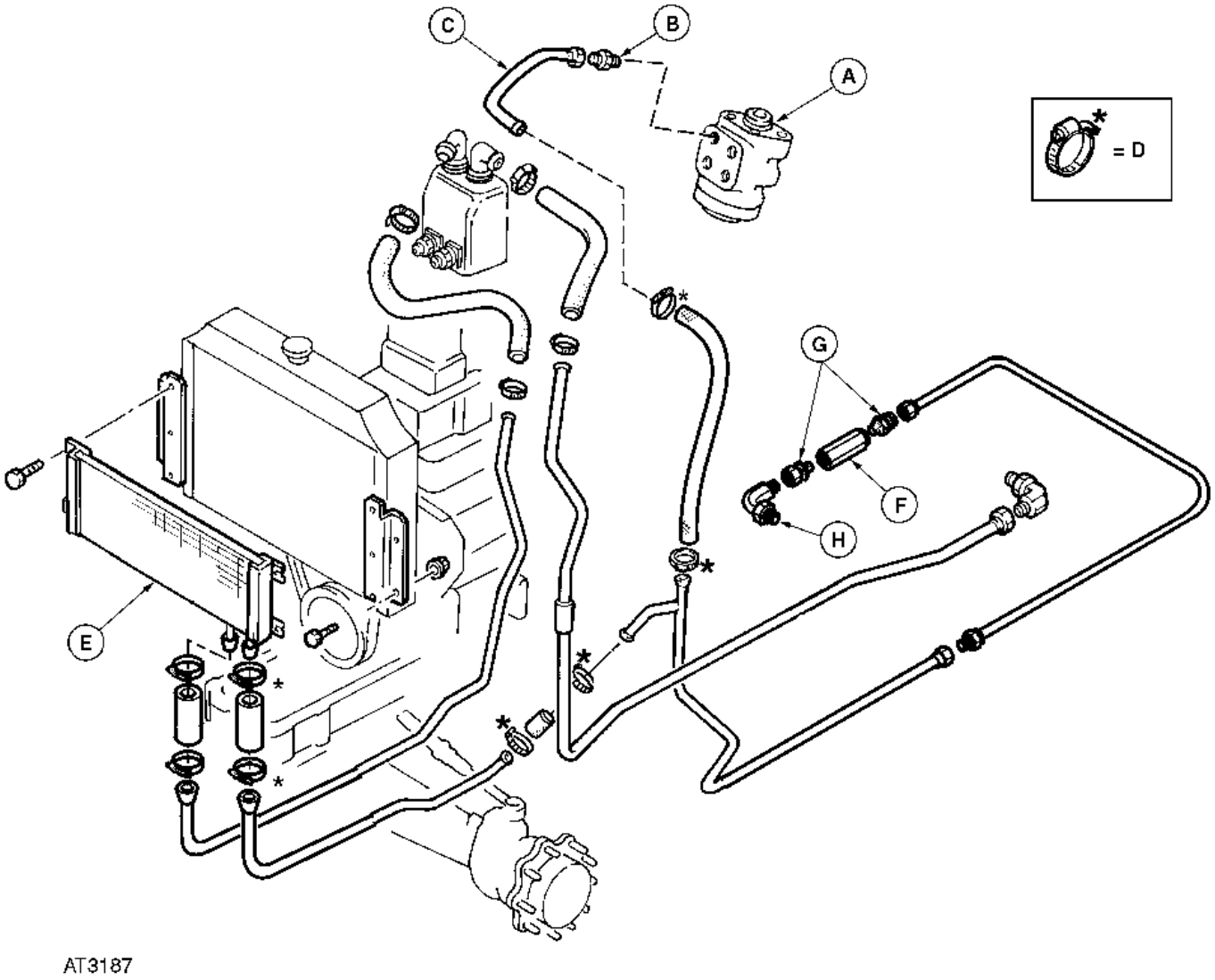
[5] - Stop engine and check hydraulic oil level. Fill to full mark with specified oil (see “Fuel, Lubricants and Coolant” in Section 10).

CAUTION:

Before operating the tractor, bleed and check brakes.

Inspect and Replace Steering Hydraulic Lines (For Tractors with Oil Cooler and Pipes)

For 30 km/h Tractors

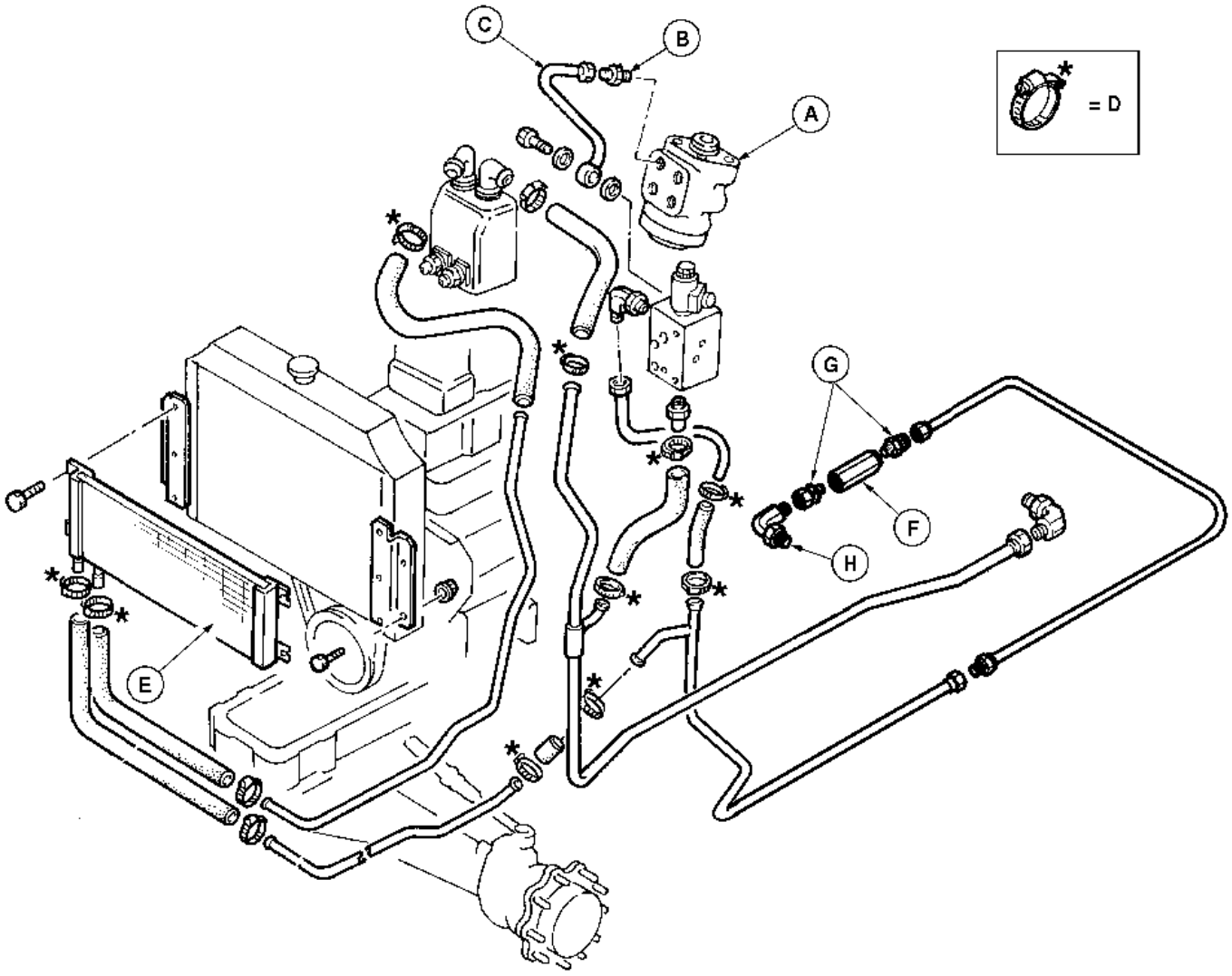


Steering hydraulic lines

LEGEND:

A	Steering Valve
B	Fitting
C	Steering Line to Oil Cooler
D	Clamp
E	Oil Cooler
F	Relief Valve
G	Fittings
H	Elbow

For 40 km/h Tractors



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Steering hydraulic lines

LEGEND:

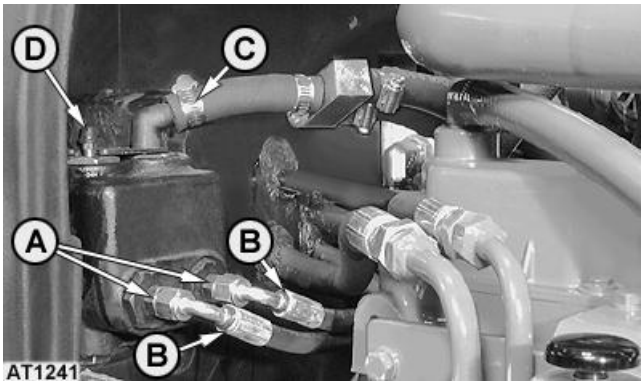
A	Steering Valve
B	Fitting
C	Steering Line to Oil Cooler
D	Clamp
E	Oil Cooler
F	Relief Valve
G	Fittings
H	Elbow

Group 10 - Brake System

Specifications

Item	Measurement	Specification
Outlet Fittings to Brake Valve	Torque	11 N·m
		8 lb-ft
Mounting Cap Screws of Brake Valve	Torque	70 N·m
		52 lb-ft
Inlet Check Valve Seat	Torque	73 N·m
		54 lb-ft
Plug to Brake Valve	Torque	37 N·m
		27 lb-ft
Spring Seat to Brake Valve	Torque	92 N·m
		68 lb-ft
Mounting Screw, Parking Brake Ratchet to Transmission Housing	Torque	32 N·m
		24 lb-ft
Cap Screw, Valve to Bracket	Torque	23 N·m
		17 lb-ft
Cap Screw, Trailer Brake Valve to Bracket	Torque	23 N·m
		17 lb-ft
Rear Wheel Nuts	Torque	400 N·m
		300 lb-ft

Remove and Install Brake Valve and Pedals



LEGEND:

A	Outlet Fittings
B	Outlet Lines
C	Fill Hose
D	Bleed Screw

Depend on tractor model the routing of lines may differ

→NOTE:

If equipped with cab, lower front windows must be removed before removing dash covers.

[1] - Remove right-hand dash cover.

[2] - Disconnect hose (C).

[3] - Disconnect lines (B).

[4] - Remove outlet fittings (A).

→NOTE:

Outlet fittings are removed to allow clearance for brake valve removal.

Use care during valve removal to prevent loss of check balls and springs from outlet fitting ports.

Close all openings with caps and plugs.

[5] - Remove four cap screws and brake valve.

[6] - Make repairs as necessary as described in this Group.

[7] - Install brake valve. Tighten cap screws to specifications.

Item	Measurement	Specification
Mounting Cap Screws of Brake Valve	Torque	70 N·m
		52 lb-ft

[8] -

IMPORTANT:

Replace O-rings. Damaged or used O-rings will leak.

Install outlet fittings (A) with new O-rings. Tighten fittings to specified torque.

Item	Measurement	Specification
Outlet Fittings to Brake Valve	Torque	11 N·m 8 lb-ft

[9] - Connect hoses and lines.

[10] - Install right-hand dash cover.

[11] - Start engine. Run at idle speed for several minutes to fill brake valve with transmission/hydraulic oil. Shut off engine.

[12] - Apply pressure to both brake pedals and loosen brake lines (B) slightly, to bleed air from brake valve and lines.

[13] - Repeat as necessary.

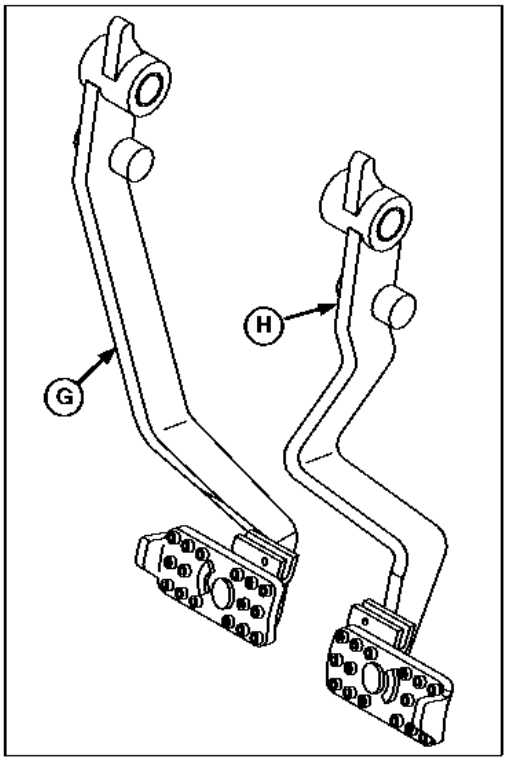
[14] -

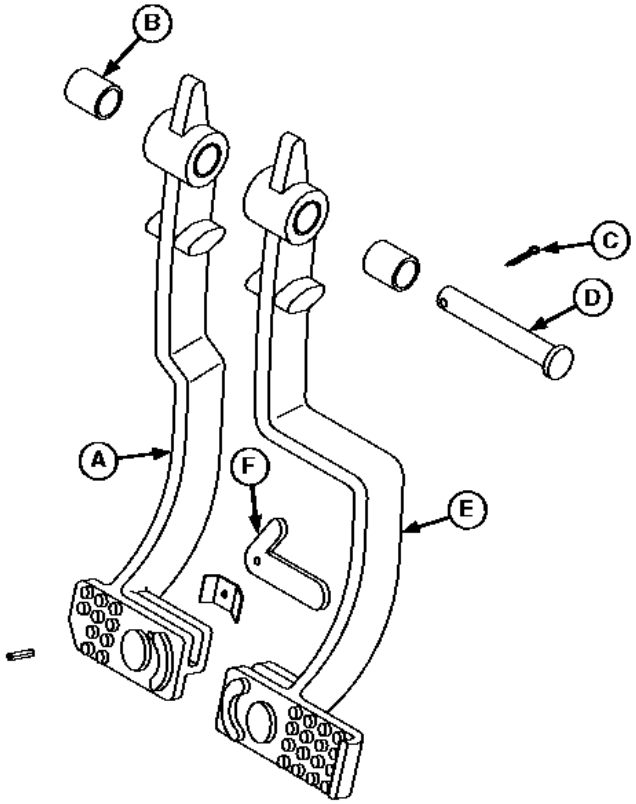
IMPORTANT:

Bleed brake system, see Section 260, Group 15.

[15] - Check and adjust transmission/hydraulic oil level.

Disassemble and Inspect Brake Pedals





Brake Pedals

LEGEND:

A	Left Brake Pedal
B	Bushing (2 used)
C	Cotter Pin
D	Pivot Shaft
E	Right Brake Pedal
F	Lock Plate
G	Left Brake Pedal (Cab Tractors Only)
H	Right Brake Pedal (Cab Tractors Only)

→NOTE:

If equipped with cab, lower front windows and support must be removed before removing dash covers.

[1] - Remove right-hand engine side shield.

[2] - Remove right-hand dash cover.

[3] -

→NOTE:

Cab tractors are equipped with brake pedals (G) and (H) in place of brake pedals (A) and (E).

Disengage lock plate (F).

[4] - Remove cotter pin (C) to remove shaft (D) and pedals (A) and (E).

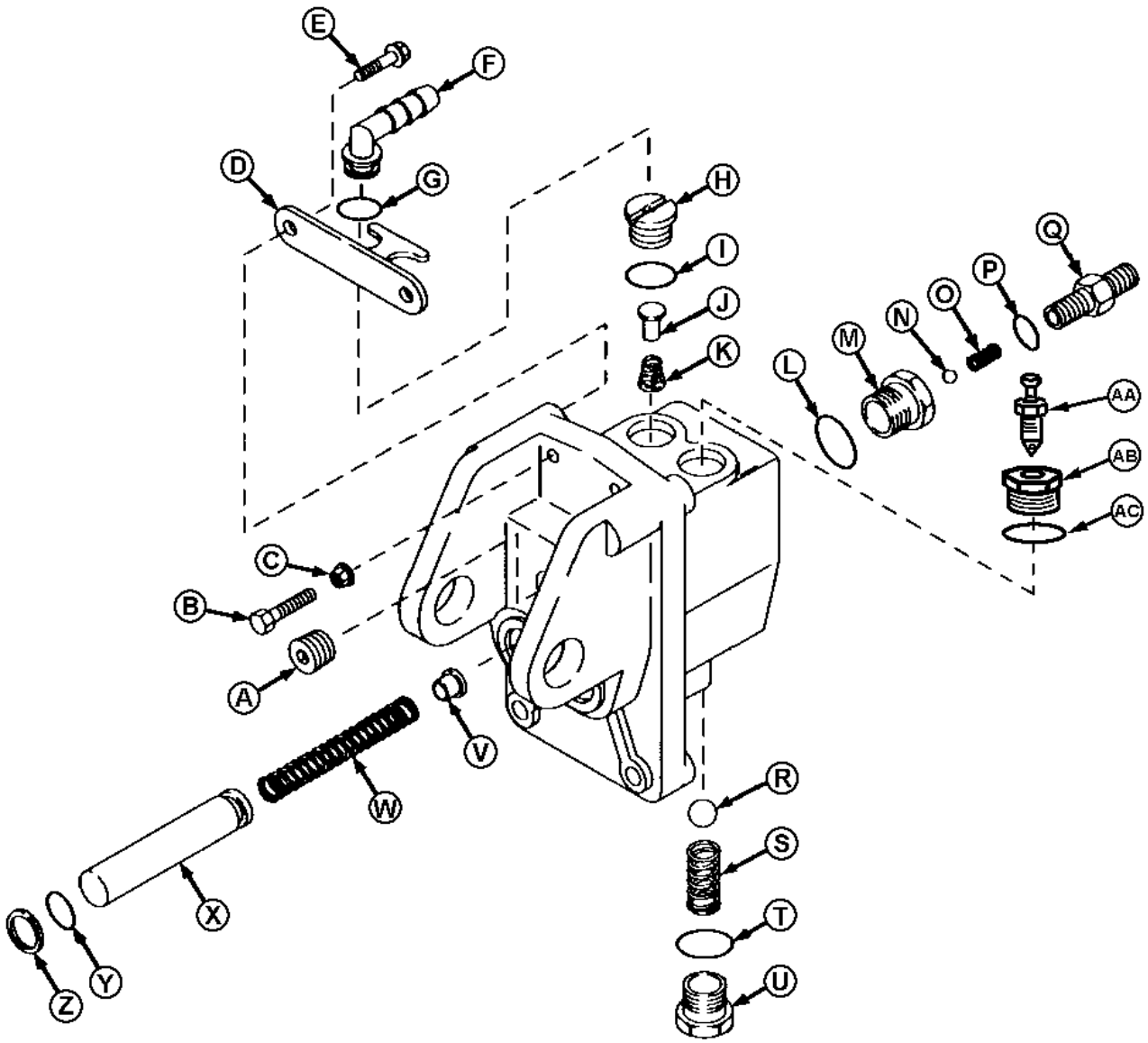
[5] -

→NOTE:

Bushings (B) are press fit in pedals. Remove bushings only if replacement is necessary.

Inspect parts for wear or damage. Replace as necessary.

Disassemble Brake Valve



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Brake Valve

LEGEND:

A	Plug
B	Cap Screw (2 used)
C	Nut (2 used)
D	Bracket
E	Cap Screw (4 used)
F	Elbow Fitting (2 used)
G	O-Ring (2 used)
H	Inlet Check Valve Seat (2 used)
I	O-Ring (2 used)
J	Inlet Check Valve (2 used)
K	Spring (2 used)
L	O-Ring (2 used)
M	Spring Seat (2 used)
N	Outlet Check Ball (2 used)
O	Spring (2 used)
P	O-Ring (2 used)
Q	Outlet Fitting (2 used)
R	Pressure Equalizing Ball (2 used)
S	Spring (2 used)
T	O-Ring (2 used)

U	Plug (2 used)
V	Outlet Check Valve (2 used)
W	Spring (2 used)
X	Brake Piston (2 used)
Y	O-Ring (2 used)
Z	Seal (2 used)
AA	Bleed Screw
AB	Plug
AC	O-Ring

[1] - Remove parts (F) to (K).

[2] - Remove parts (R) to (U) and Plug (AB).

→NOTE:

Parts (D), (E), (P) and (Q) were removed during brake valve removal.

[3] -

CAUTION:

Spring seats (M) are under spring pressure. Hold seat firmly while removing.

Remove parts (L) to (O) and (V) to (Y).

[4] -

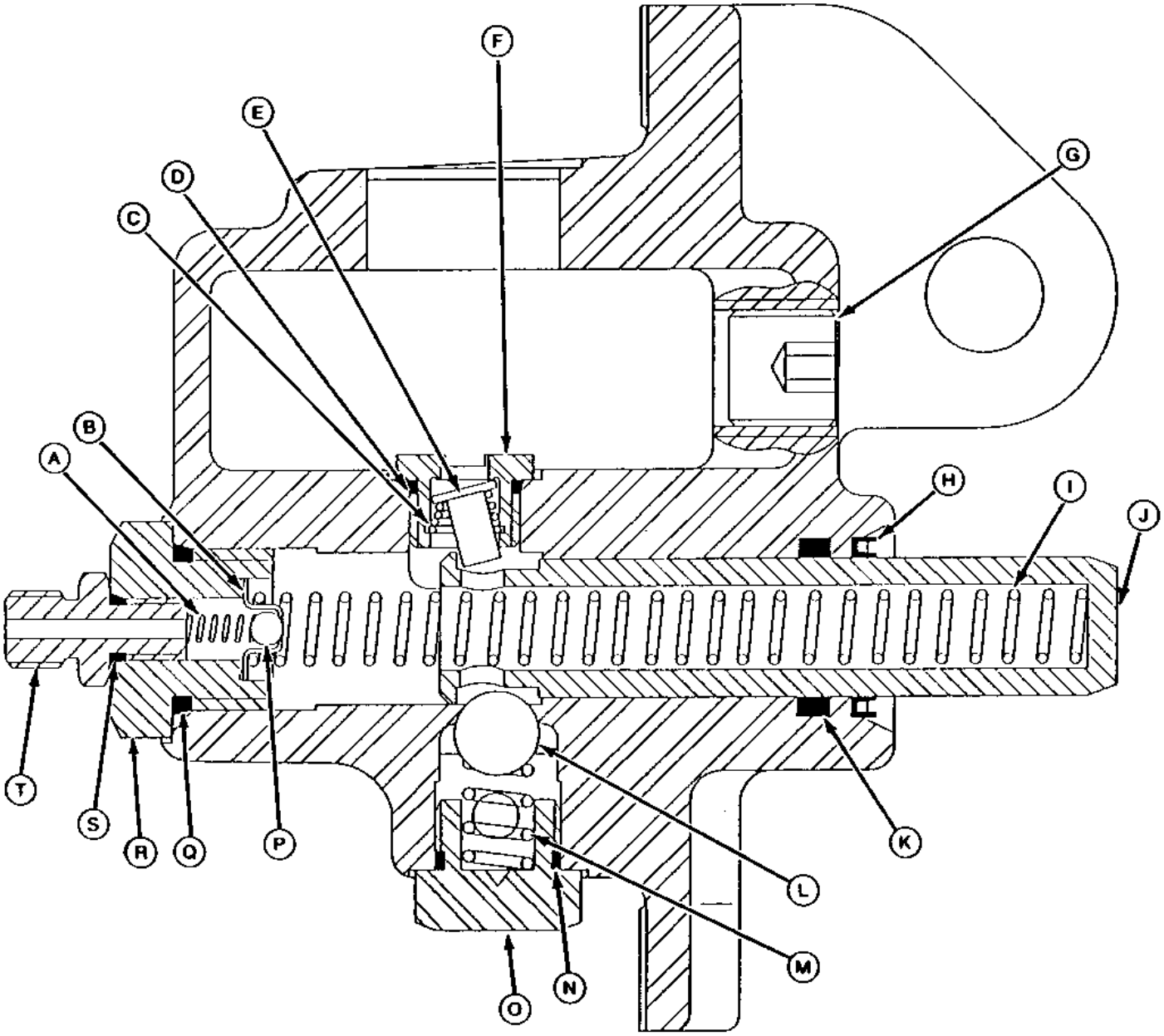
IMPORTANT:

Replace all seals. Damaged or used seals will leak.

Pry out seals (Z). Install new seals with lips facing away from valve using a bearing, bushing and seal driver set.

[5] - Inspect all parts for wear or damage. Replace as necessary.

Brake Valve Cross Section



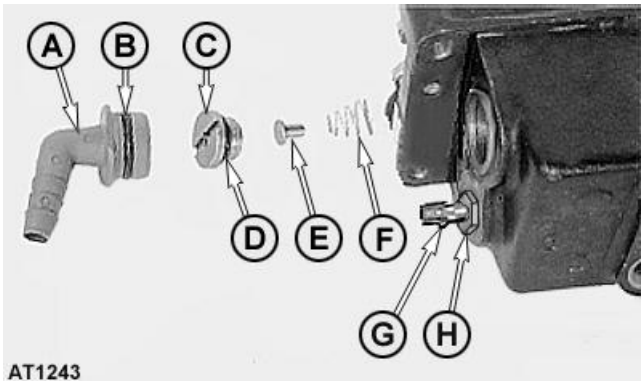
Brake Valve Cross Section

LEGEND:

A	Spring (2 used)
B	Outlet Check Valve (2 used)
C	Spring (2 used)
D	O-Ring (2 used)
E	Inlet Check Valve (2 used)
F	Inlet Check Valve Seat (2 used)
G	Plug
H	Seal (2 used)
I	Spring (2 used)
J	Brake Piston (2 used)
K	O-Ring (2 used)
L	Pressure Equalizing Ball (2 used)
M	Spring (2 used)
N	O-Ring (2 used)
O	Plug (2 used)
P	Outlet Check Ball (2 used)

Q	O-Ring (2 used)
R	Spring Seat (2 used)
S	O-Ring (2 used)
T	Fitting (2 used)

Assemble Brake Valve



LEGEND:

A	Elbow Fitting (2 used)
B	O-Ring (2 used)
C	Inlet Check Valve Seat (2 used)
D	O-Ring (2 used)
E	Inlet Check Valve (2 used)
F	Spring (2 used)
G	Bleed Screw
H	Plug

Brake valve, install check valve

[1] -

IMPORTANT:

Replace all O-rings. Damaged or used O-rings will leak.

Inlet check valves must be installed before brake pistons to ensure proper position of check valve in relation to piston.

→NOTE:

Lubricate all internal parts with clean transmission/hydraulic oil during assembly.

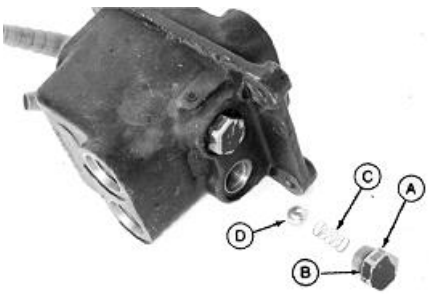
Install new O-rings (B and D).

[2] - Install spring (F) and check valve (E). Tighten valve seat (C) to specified torque.

Item	Measurement	Specification
Inlet Check Valve Seat	Torque	73 N·m
		54 lb-ft

[3] - Install fitting (A), plug (H) and bleed screw (G).

[4] -



LEGEND:

A	Plug (2 used)
B	O-Ring (2 used)
C	Spring (2 used)
D	Pressure Equalizing Ball (2 used)

O-Ring, Ball, Spring and Plug

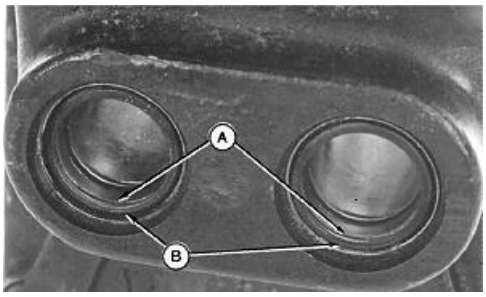
Install new O-ring (B).

[5] - Install ball (D) and spring (C). Tighten plug (A) to specified torque.

Item	Measurement	Specification
Plug to Brake Valve	Torque	37 N·m

Item	Measurement	Specification
		27 lb-ft

[6] -

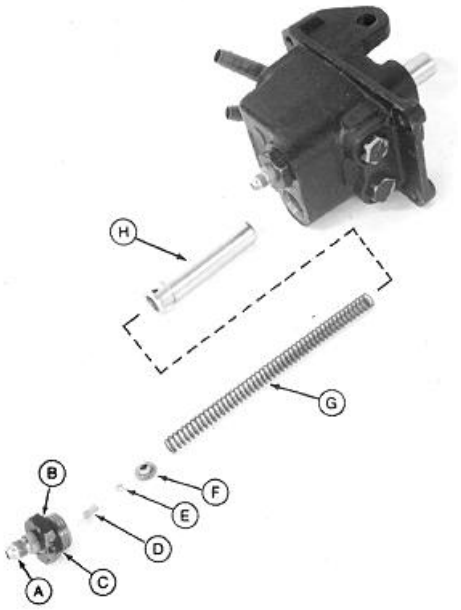


O-Rings and Seals

Install new O-rings (A).

[7] - Apply multipurpose grease to lips of seals (B).

[8] -



LEGEND:

A	Outlet Fitting (2 used)
B	O-Ring (2 used)
C	Spring Seat (2 used)
D	Spring (2 used)
E	Outlet Check Ball (2 used)
F	Outlet Check Valve (2 used)
G	Spring (2 used)
H	Brake Piston (2 used)

Install Brakes

Install new O-ring (B).

[9] - Install parts (C) to (H). Tighten spring seat (C) to specified torque.

Item	Measurement	Specification
Spring Seat to Brake Valve	Torque	92 N·m
		68 lb-ft

[10] -

→NOTE:

Install fittings (A) loosely. Fittings are removed for brake valve installation.

Install new O-ring and fitting (A). Tighten fitting finger tight.

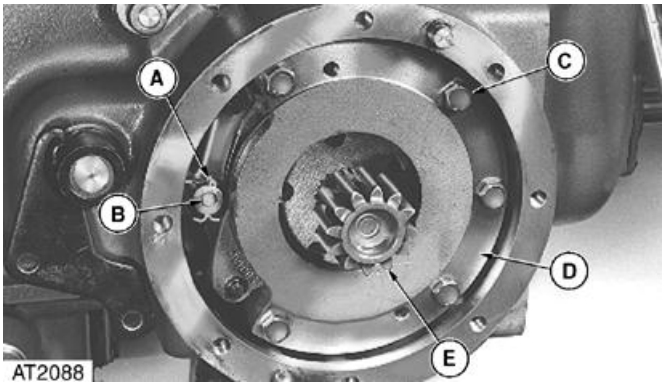
[11] - Install brake pedals, pivot shaft and cotter pin.

[12] - Adjust brake pedals (see procedure in Section 260).

IMPORTANT:

Bleed brake system, see Section 260, Group 15.

Remove and Inspect Brakes



LEGEND:

A	Cotter Pin
B	Pivot pin
C	Cap Screw
D	Brake housing
E	Sun Shaft

Remove and Inspect Brakes

[1] - Remove final drive assembly (see procedure in Section 50).

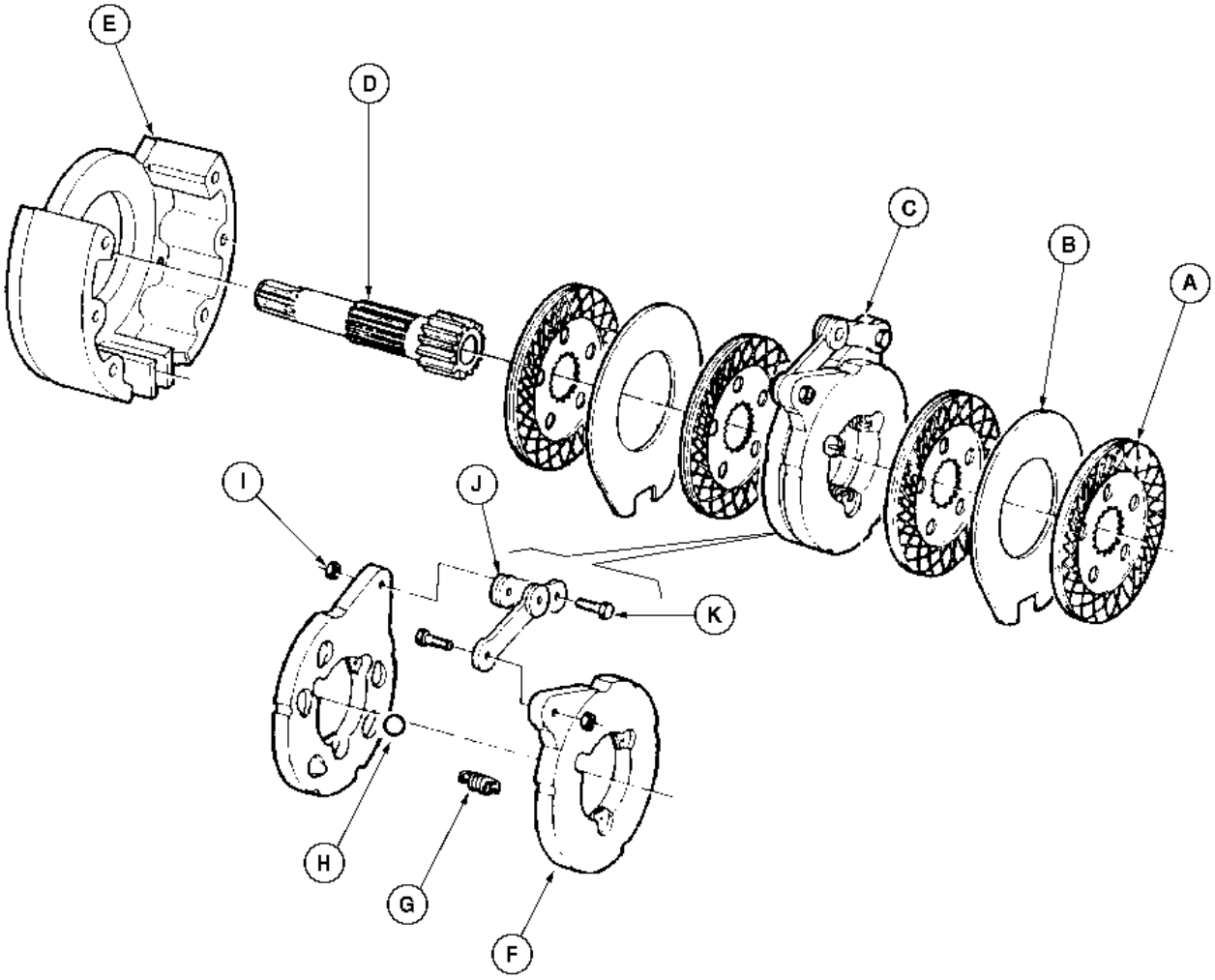
[2] - Remove cotter pin (A) and pivot pin (B).

[3] - Remove five cap screws (C).

[4] - Install two 10x100 mm bolts into the brake housing (D). Evenly tighten the bolts to loosen the brake housing on the dowel pins.

[5] - Remove the brake assembly and sun shaft (E) together.

[6] -



Brake Components

LEGEND:

A	Friction Plate (4 used)
B	Steel Plate (2 used)
C	Actuator Assembly
D	Sun Shaft
E	Brake Housing
F	Actuator Plate (2 used)
G	Spring (3 used)
H	Steel Ball (5 used)
I	Lock Nut (2 used)
J	Actuator Lever (2 used)
K	Cap Screw (2 used)

Hold sun shaft (D).

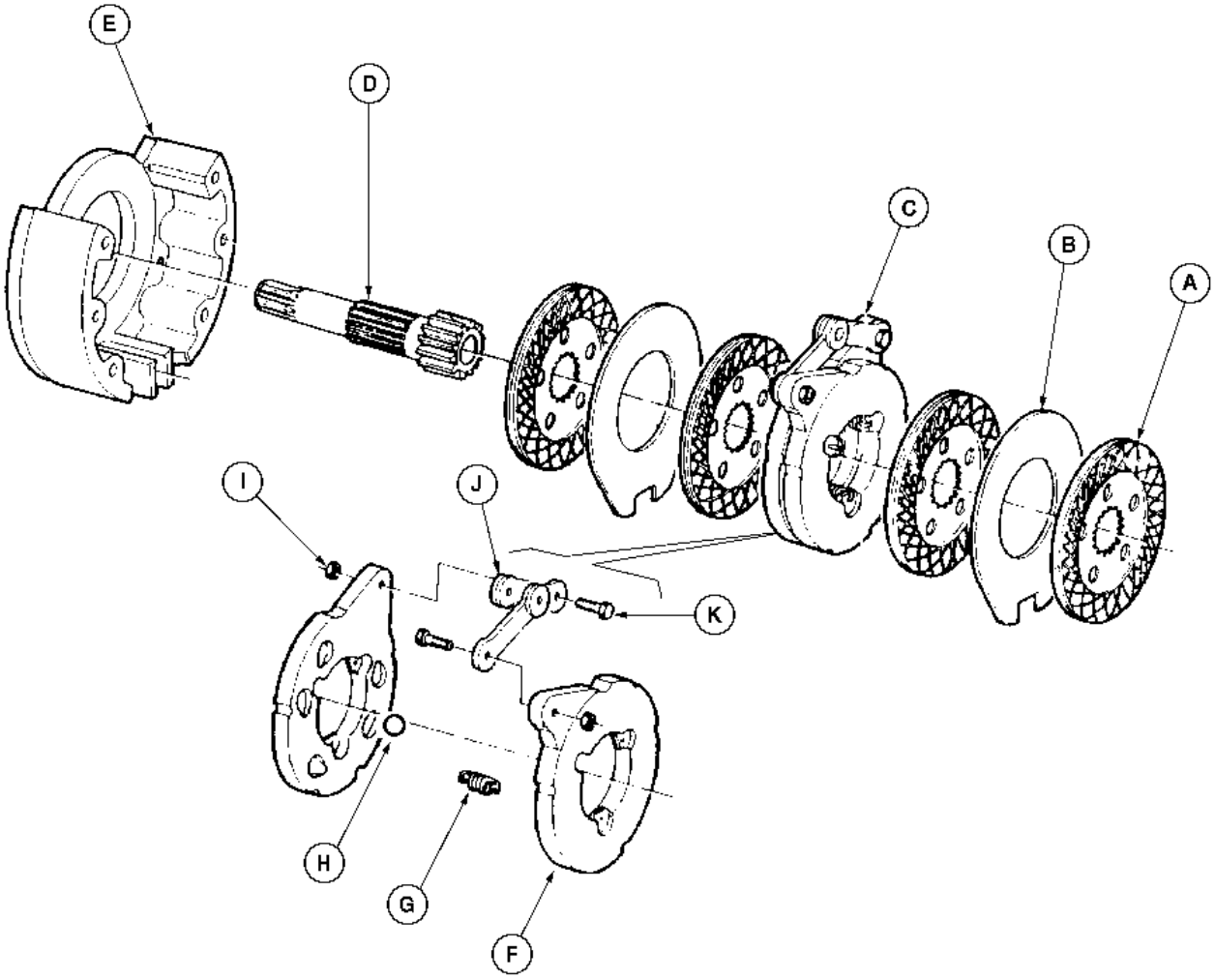
[7] - Remove parts (A) to (D).

[8] - Remove Spring (G).

[9] - Remove parts (I) to (K).

[10] - Inspect parts for wear or damage. Replace parts as necessary.

Install Brakes



Install Brakes

LEGEND:

A	Friction Plate (4 used)
B	Steel Plate (2 used)
C	Actuator Assembly
D	Sun Shaft
E	Brake Housing
F	Actuator Plate (2 used)
G	Spring (3 used)
H	Steel Ball (5 used)
I	Lock Nut (2 used)
J	Actuator Lever (2 used)
K	Cap Screw (2 used)

→NOTE:

Lubricate all parts with clean transmission/ hydraulic oil during assembly.

[1] - Install actuator levers (J), cap screw (K) and lock nut (I) in actuator plates (F).

[2] -

→NOTE:

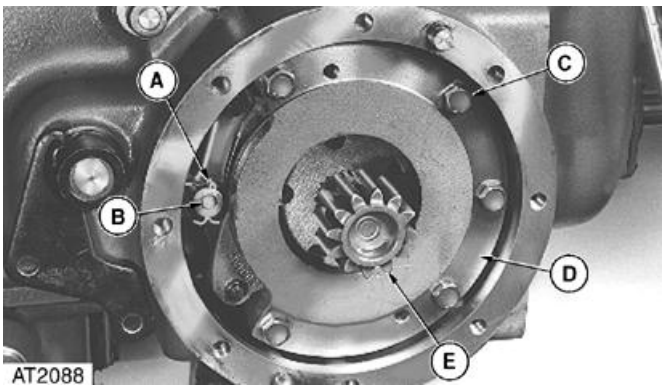
Use multipurpose grease to hold steel balls in position while engaging the springs.

Install steel balls (H) and engage springs (G).

[3] - Hold sun shaft (D) in brake housing (E).

[4] - Install plates (A) and (B) and brake actuator assembly (C).

[5] -



LEGEND:

A	Cotter Pin
B	Pivot pin
C	Cap Screw
D	Brake housing
E	Sun Shaft

Install Brake Assembly

Install brake assembly and sun shaft (E) together.

[6] - Install cap screw (C) and tighten to 120 N·m (89 lb-ft).

[7] - Install pivot pin (B) and new cotter pin (A).

[8] - Install final drive assembly (see procedure in Section 50, Group 30).

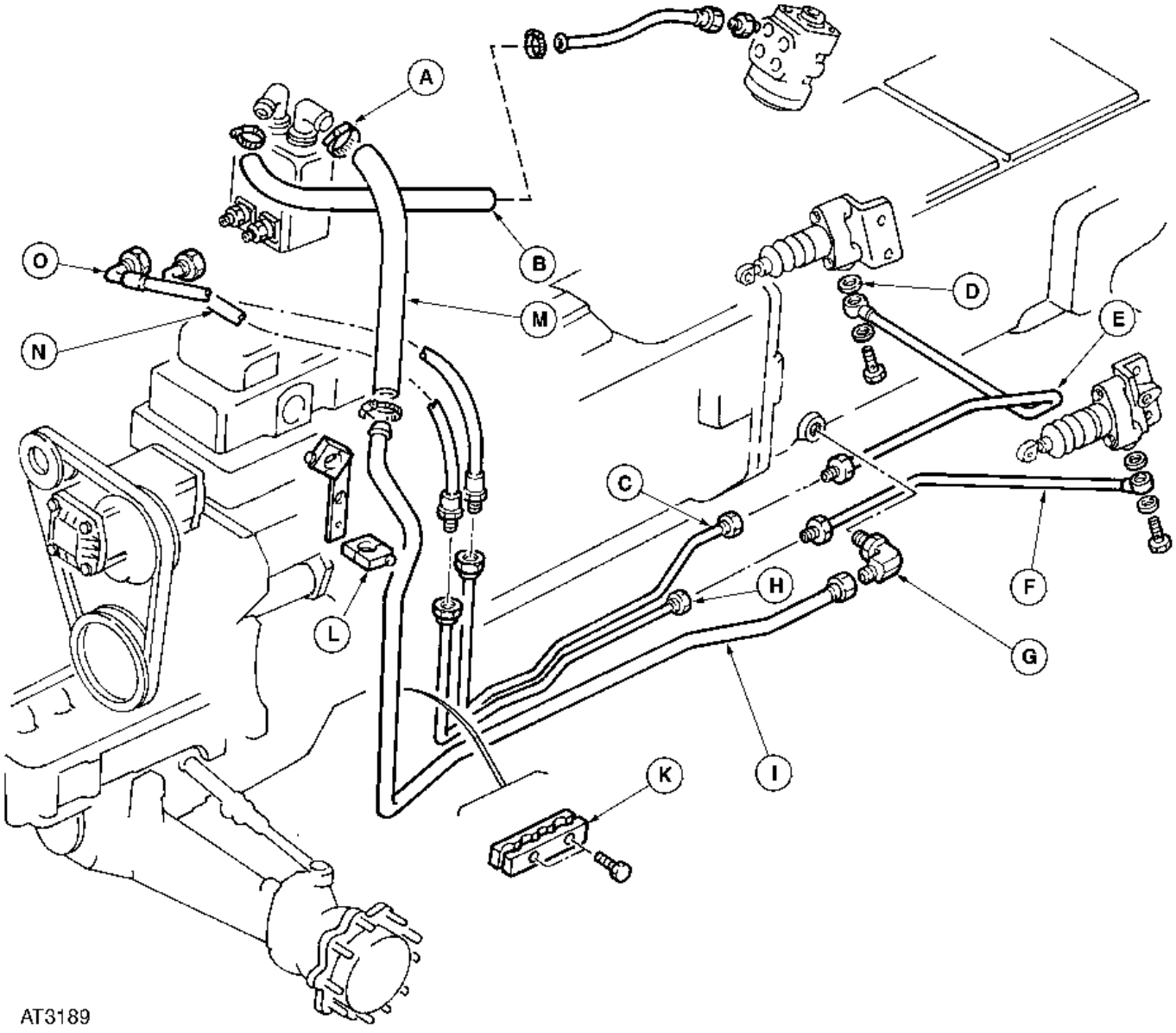
Inspect and Replace Brake Hydraulic Lines

[1] - Remove engine side panels.

[2] - Remove dash side panels.

[3] - Remove left-hand plate (see procedure in Section 90).

[4] -



30 km/h version shown

LEGEND:

A	Hose Clamps (4 used)
B	Steering Valve Return-to-Brake Valve Supply Hose
C	Pressure Line
D	Sealing Washer (4 used)
E	Pressure Line-to-Right-Hand Brakes
F	Pressure Line-to-Left-Hand Brakes
G	Fitting
H	Pressure line

I	Brake Valve Return Line
K	Line Clamp
L	Line Clamp
M	Brake Valve Return Hose
N	Pressure Hose from Brake Valve
O	Pressure Hose from Brake Valve

Inspect hydraulic lines and hoses for wear or damage. Replace as necessary.

IMPORTANT:

Replace all seals. Damaged or used seals will leak.

[5] - Install all panels.

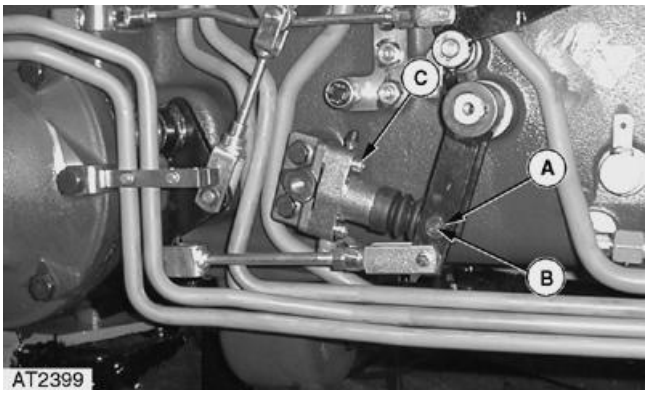
[6] - Bleed brakes (see procedure in Section 260).

[7] - Adjust transmission/hydraulic oil level to full mark with proper oil (see “Fuel, Lubricants and Coolant” in Section 10).

→NOTE:

Brake lines can be some different if tractor is equipped with MFWD solenoid valve or oil cooler.

Remove, Inspect and Install Hydraulic Actuator



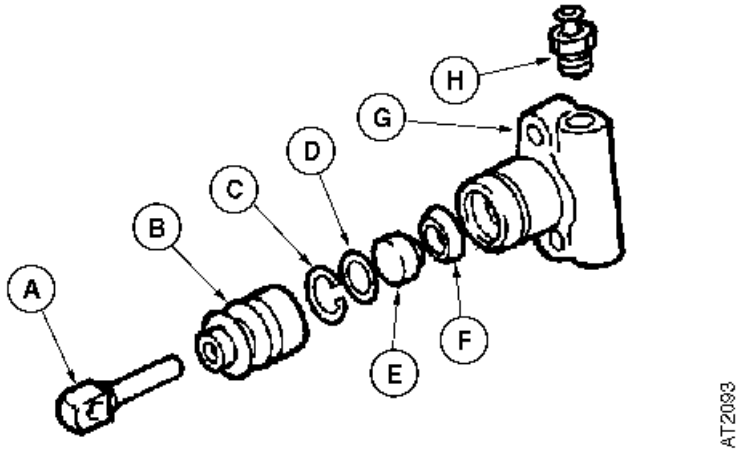
Snap Ring, Pin, and Screw

[1] - Disconnect hydraulic line.

[2] - Remove snap ring (A) and pin (B).

[3] - Remove screw (C).

[4] -



Remove Hydraulic Actuator Components

LEGEND:	
A	Push Rod
B	Boot
C	Snap Ring
D	Washer
E	Piston
F	Gasket
G	Actuator housing
H	Bleed Screw

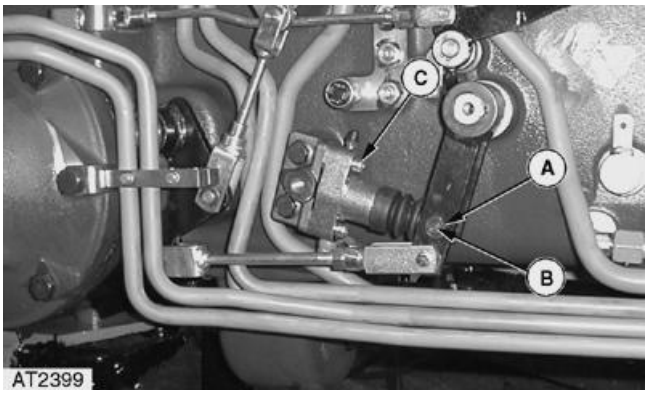
Remove parts (A) to (F).

[5] - Inspect parts for wear or damage. Replace as necessary.

[6] - Apply multipurpose grease to inner circumference of actuator housing (G).

[7] - Install parts (F) to (A).

[8] -



Install Screw, Pin, and Snap Ring

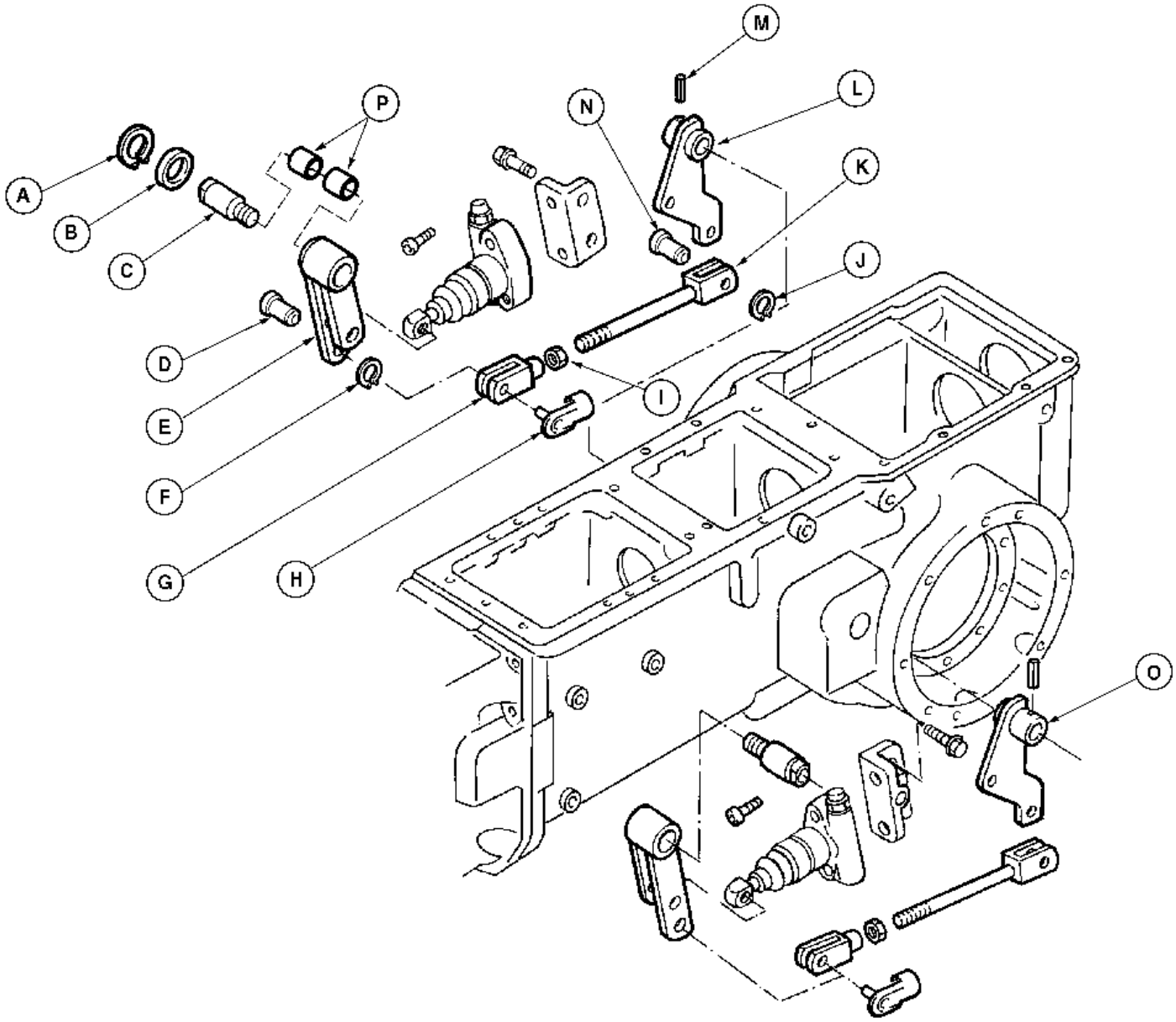
Install screw (C).

[9] - Install pin (B) and snap ring (A).

[10] - Connect hydraulic line.

[11] - Bleed brakes (see procedure in Section 260).

Remove, Inspect and Install Brake Linkage



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Brake Linkage-Exploded View

LEGEND:

A	Snap Ring (2 used)
B	Washer (2 used)
C	Linkage Shaft (2 used)
D	Pin (2 used)
E	Lever (2 used)
F	Snap Ring (2 used)
G	Fork (2 used)
H	Locking Pin (2 used)
I	Lock Nut (2 used)
J	Snap Ring (2 used)

K	Rod (2 used)
L	R.h. Lever
M	Spring pin (2 used)
N	Pin (2 used)
O	L.h. Lever
P	Bushing (4 used)

[1] - Remove rear wheels and fenders.

[2] - Remove parts (A) and (B).

[3] -

→NOTE:

Remove linkage shaft (C) only if replacement is necessary.

Remove linkage shaft (C).

[4] - Remove parts (D) to (N).

[5] - Inspect all parts for wear or damage. Replace as necessary.

[6] - Apply thread lock and sealer (high strength) to threads of linkage shaft (C).

[7] - Apply Moly High Temperature EP Grease to Linkage shaft (C), Pin (D) and (N).

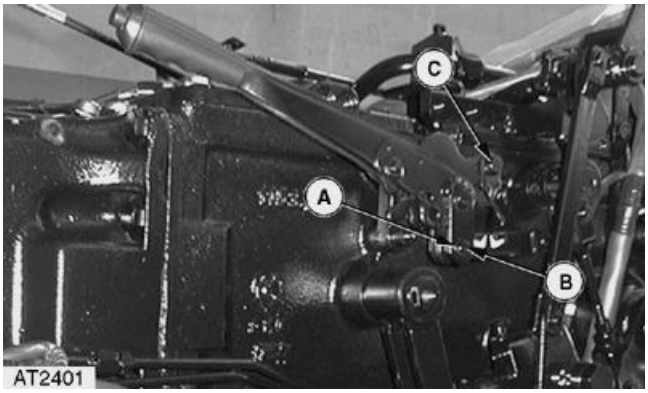
[8] - Install parts (N) to (A).

[9] - Install fenders and wheels.

[10] - Tighten wheel nuts to specified torque.

Item	Measurement	Specification
Rear Wheel Nuts	Torque	400 N·m
		300 lb-ft

Remove, Inspect and Install Parking Brake Lever



Snap Ring, Pin and Cap Screw

[1] - Remove left-hand rear wheel and fender.

[2] - Remove left-hand control console.

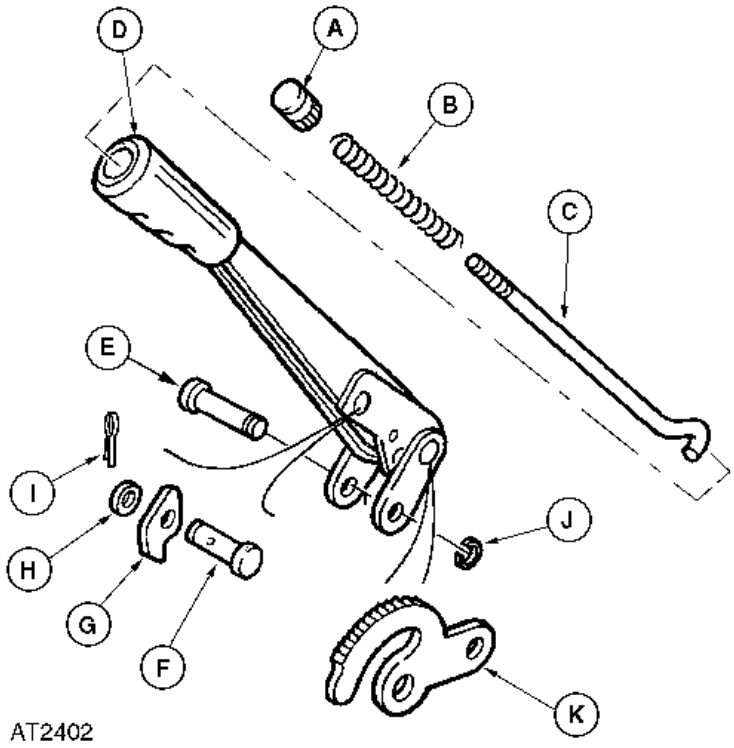
[3] - Remove snap ring (A).

[4] - Remove pin (B).

[5] - Remove cap screw (C).

[6] - Remove parking brake lever assembly.

[7] -



LEGEND:

A	Knob
B	Spring
C	Rod
D	Lever
E	Pin
F	Pin
G	Locking Pawl
H	Washer
I	Cotter Pin
J	Snap Ring
K	Ratchet

Parking Brake Lever Assembly

Remove snap ring (J) and pin (E).

[8] - Remove ratchet (K).

[9] - Remove parts (A) to (C).

[10] - Remove cotter pin (I).

[11] - Remove parts (F) to (H).

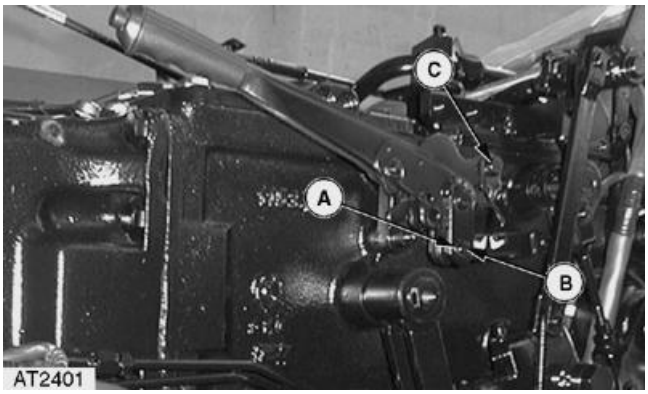
[12] - Inspect all parts for wear or damage. Replace as necessary.

[13] - Install locking pawl (G), pin (F), washer (H) and cotter pin (I).

[14] - Install rod (C), spring (B) and knob (A).

[15] - Install ratchet (K), pin (E) and snap ring (J).

[16] -



Install Pin and Snap Ring

Install parking brake lever assembly.

[17] - Install cap screw (C) and tighten to specified torque.

Item	Measurement	Specification
Mounting Screw, Parking Brake Ratchet to Transmission Housing	Torque	32 N·m 24 lb-ft

[18] - Apply Moly High Temperature EP Grease to pin (B).

[19] - Install pin (B) and snap ring (A).

[20] - Adjust parking brake (see procedure in Section 260).

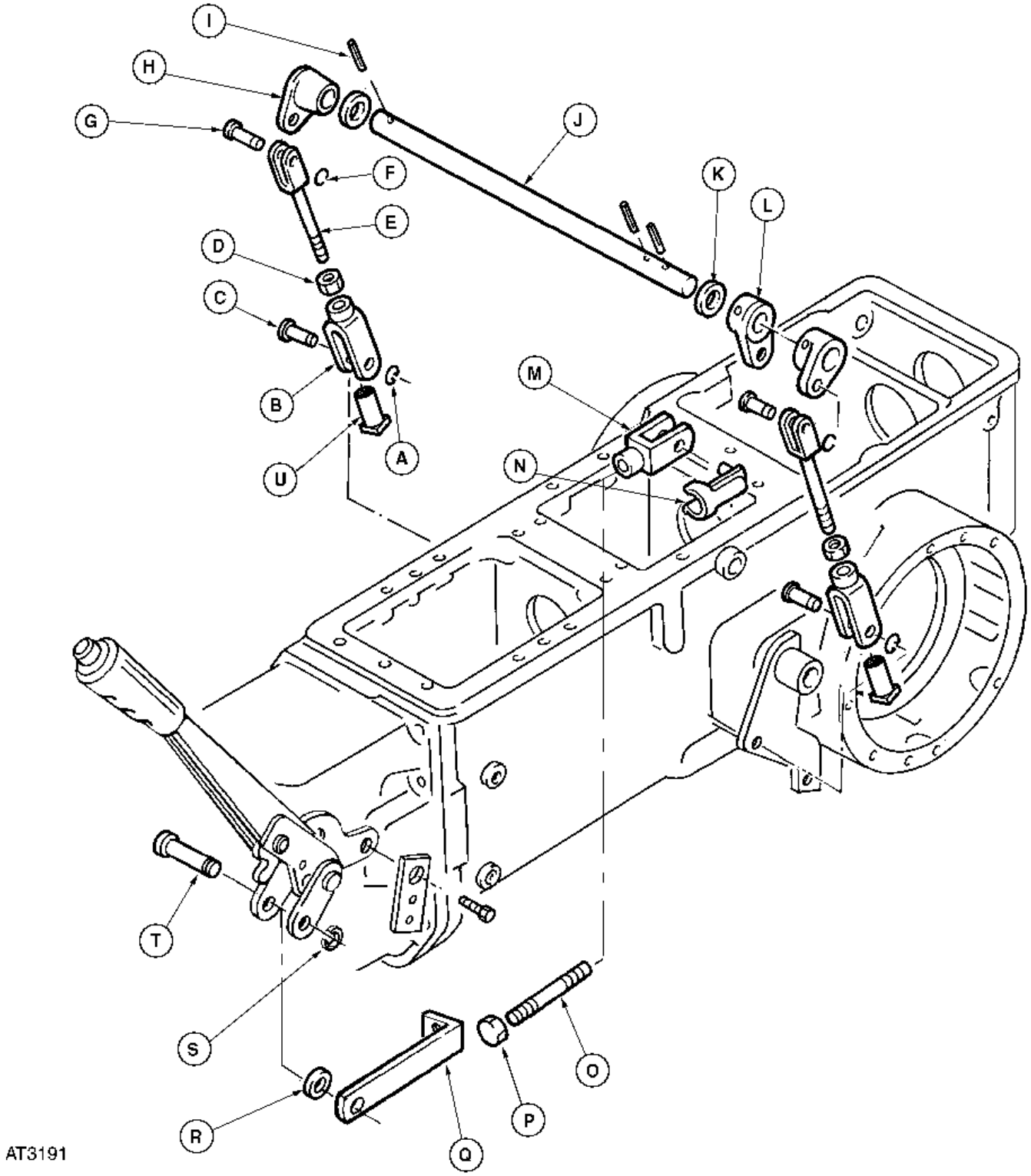
[21] - Install control console.

[22] - Install fender and wheel. Tighten wheel nuts to specified torque.

Item	Measurement	Specification
Rear Wheel Nuts	Torque	400 N·m

Item	Measurement	Specification
		300 lb-ft

Remove, Inspect and Install Parking Brake Linkage



Parking Brake Linkage

LEGEND:

A	Snap Ring (2 used)
B	Fork (2 used)
C	Pin (2 used)
D	Lock Nut (2 used)
E	Rod (2 used)
F	Snap Ring (2 used)
G	Pin (2 used)
H	Lever (2 used)
I	Spring Pin (3 used)
J	Shaft

K	Seal (2 used)
L	Lever
M	Fork
N	Locking Pin
O	Rod
P	Lock Nut
Q	Link
R	Spacer
S	Snap Ring
T	Pin
U	Nut

[1] - Remove rear wheels and fenders.

[2] - Remove parts (M) to (T).

[3] - Remove parts (A) to (G) and (U).

[4] - Remove spring pins (I), levers (H) and (L).

[5] - Remove shaft (J) from transmission housing.

[6] - Remove seals (K) using a screw driver.

[7] - Inspect all parts for wear or damage. Replace as necessary.

[8] -

IMPORTANT:

Replace seal. Damaged or used seals will leak.

Install seals (K) into transmission housing bore until it stops, using a bushing, bearing and seal driver set.

[9] - Apply multipurpose grease to lips of seals.

[10] - Install shaft (J).

[11] - Install levers (L) and (H).

[12] - Apply Moly High Temperature EP Grease to pins (G), (C), and (T).

[13] - Install all other parts.

[14] - Adjust parking brake (see procedure in Section 260).

[15] - Install fenders and wheels. Tighten wheel nuts to specified torque.

Item	Measurement	Specification
Rear Wheel Nuts	Torque	400 N·m 300 lb-ft

Remove and Inspect Trailer Brake Valve Lines

CAUTION:

Before removing lines, make sure that the hydraulic/transmission oil has ambient temperature to avoid damage or personal injury.

[1] -

→NOTE:

Remove cab, if equipped (see procedure in Section 90).

[2] - Support rear left-hand final drive and remove the rear left-hand wheel.

[3] - Disconnect rear work light and left-hand tail light cables.

[4] - Remove left-hand fender and rear support of operators station.

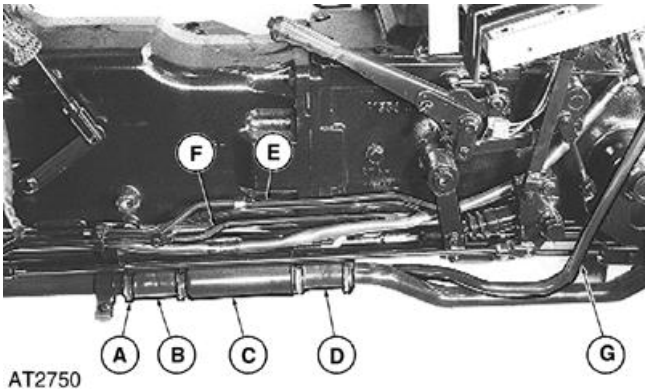
[5] - Remove seat assembly.

[6] - Drain hydraulic/transmission oil.

[7] - Cap all openings to prevent dirt from entering the system.

[8] - Place a suitable container under final drive and gearbox to collect any oil draining from rockshaft line during disassembly.

[9] -



LEGEND:

A	Clamps
B	Hoses
C	Strainer
D	Hoses
E	Brake Line
F	Brake Line
G	Rockshaft Line

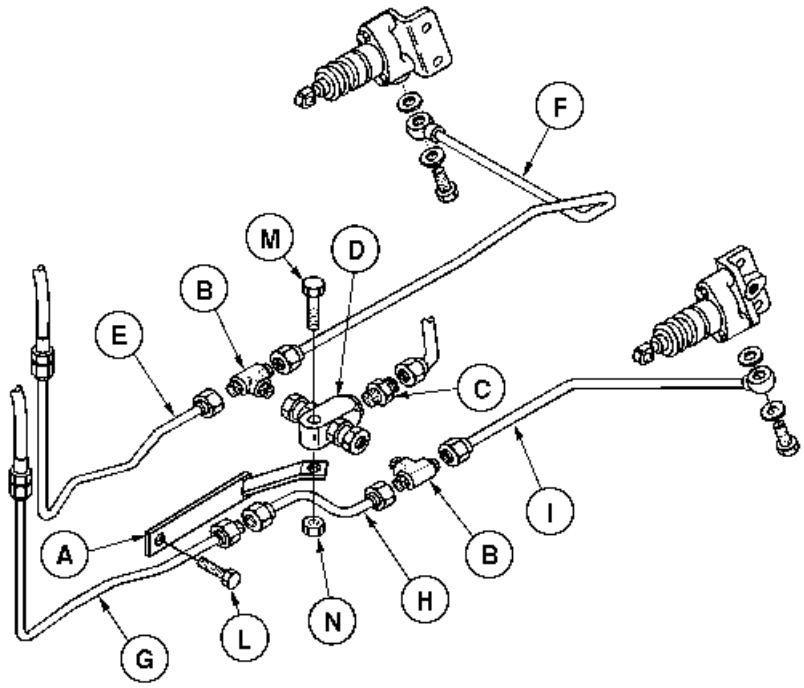
Brake lines and hoses

Remove the four hose clamps (A), hoses (B) and (D).

[10] - Recover the strainer (C) before disassembling brake lines (E) and (F).

[11] - Remove Rockshaft line (G).

[12] -



AT2910

Exploded view

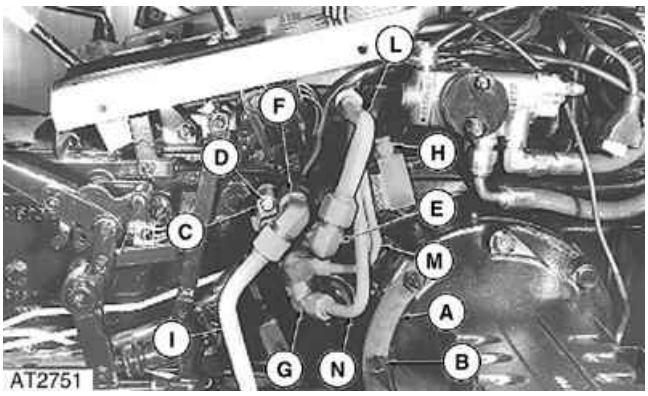
LEGEND:

A	Bracket
B	T-fitting (2 used)
C	Fitting
D	Valve
E	R.h. Brake Line
F	Brake Line from T-fitting to brake cylinder
G	L.h. Brake Line
H	Brake Line
I	Brake Line from T-fitting to brake cylinder

Disconnect T-fittings (B) and adapter (C) from valve (D), loosen bolt (M) and remove valve (D) from bracket (A).

[13] - Disconnect brake lines (E), (F), (G), (H) and (I) from corresponding tractor brake slave cylinders.

[14] -

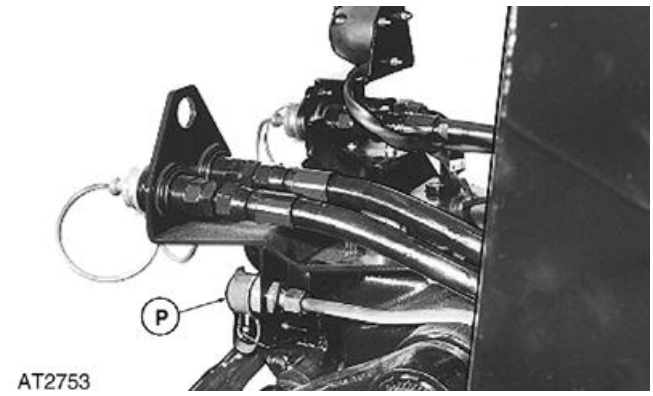


AT2751

LEGEND:

A	Support
B	Bolt
C	Trailer Brake Valve
D	Bolt
E	Elbow
F	Elbow
G	Elbow
H	Brake Pressure Line
I	Inlet Pressure Line
L	Outlet to Rockshaft Line
M	Trailer Brake Coupler Line
N	Return Line to Sump
P	Trailer Brake Coupler

Trailer brake valve



Trailer brake coupler

Disconnect following lines from tractor Trailer Brake Valve (C):

a. Tractor brake pressure line (H)
b. Inlet pressure line (I) from pump
c. Outlet to rockshaft line (L)
d. Trailer brake coupler line (M)
e. Return line to sump (N)

[15] - Remove trailer brake valve support (A) loosening bolt (B).

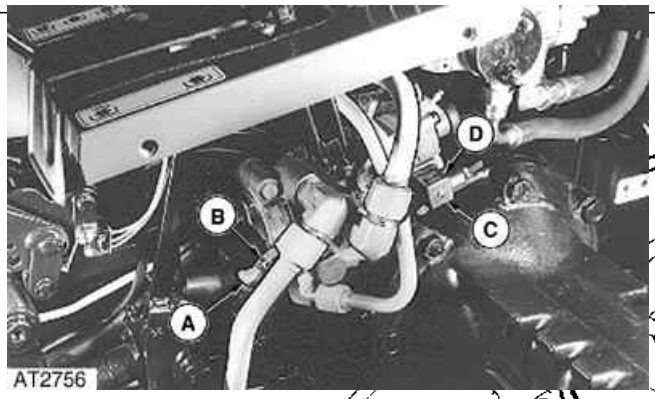
[16] - Unscrew bolts (D) and remove valve (C).

[17] - Remove coupler (P) from rear support.

[18] -

→NOTE:

→NOTE:



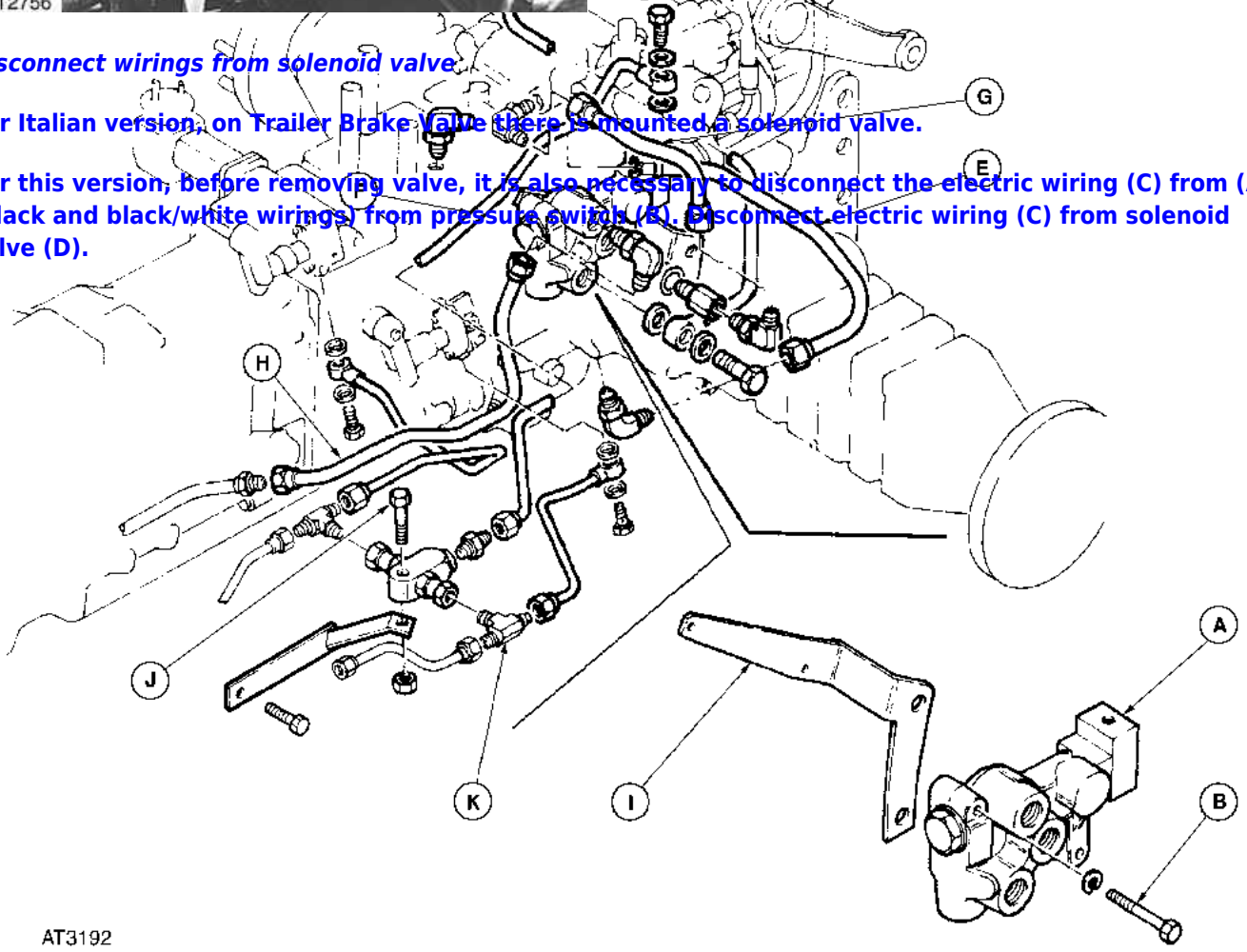
LEGEND:

A Electric wiring (black and black/white wirings)
B Pressure Switch
C Electric Wiring
D Solenoid Valve

Disconnect wirings from solenoid valve

For Italian version, on Trailer Brake Valve there is mounted a solenoid valve.

For this version, before removing valve, it is also necessary to disconnect the electric wiring (C) from (A) (black and black/white wirings) from pressure switch (B). Disconnect electric wiring (C) from solenoid valve (D).

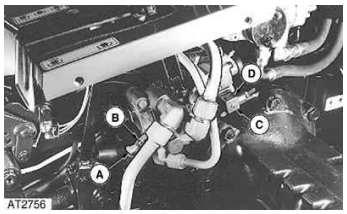


Trailer brake assembly, exploded view

Before installation, replace all seals. Damaged seals will leak.

Inspect hydraulic lines and hoses for wear or damage. Replace as necessary.

[19] -



LEGEND:

- A Electric wiring (black and black/white wirings)
- B Pressure Switch
- C Electric Wiring
- D Solenoid Valve

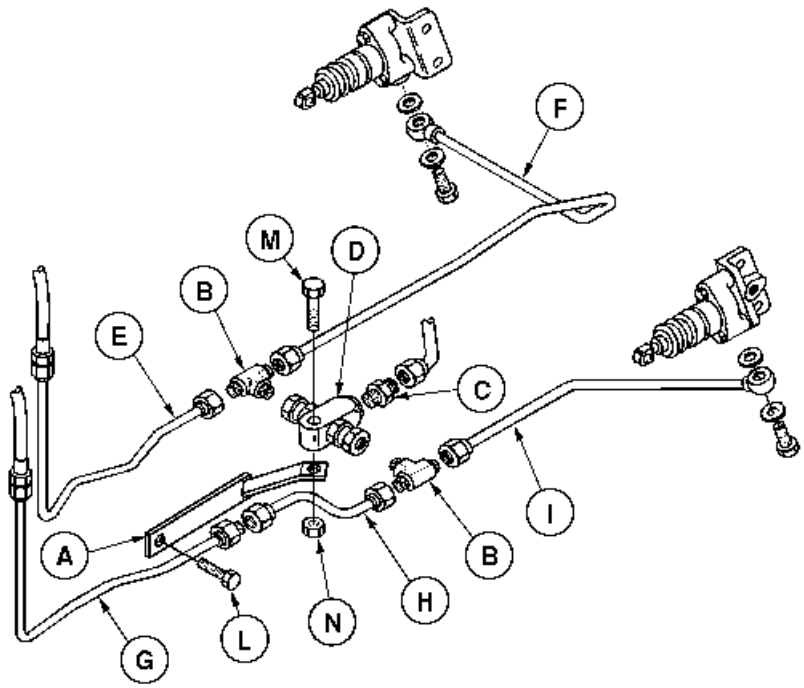
Disconnect wirings from solenoid valve

For Italian version, on Trailer Brake Valve there is mounted a solenoid valve.

For this version, before removing valve, it is also necessary to disconnect the electric wiring (C) from (A) (black and black/white wirings) from pressure switch (B). Disconnect electric wiring (C) from solenoid valve (D).

Install Trailer Brake Valve Lines

[1] -



AT2910

Brake valve lines, exploded view

LEGEND:

A	Bracket
B	T-fitting (2 used)
C	Fitting
D	Valve
E	R.h. Brake Line
F	Brake Line from T-fitting to brake cylinder
G	L.h. Brake Line
H	Brake Line
I	Brake Line from T-fitting to brake cylinder

Install valve (D) on its bracket (A). Tighten screw to specified torque.

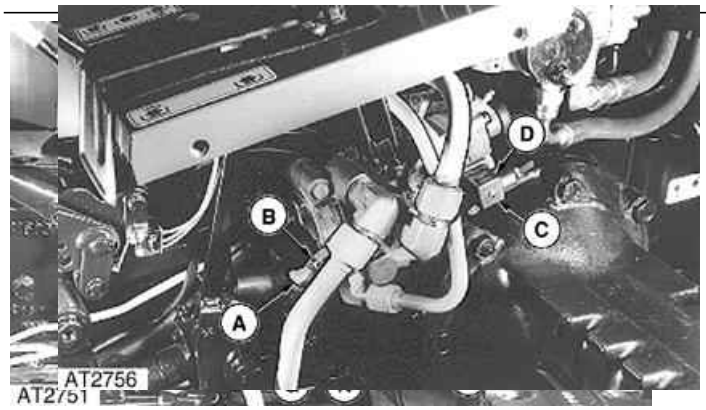
Item	Measurement	Specification
Cap Screw, Valve to Bracket	Torque	23 N·m 17 lb-ft

[2] - Connect T-fittings (B) and fittings (C).

[3] - Connect brake lines (E), (F), (G), (H) and (I).

[4] -

→**NOTE:**



LEGEND:

A	Electric wiring (black and black/white wirings)
B	Pressure Switch
C	Electric Wiring
D	Solenoid Valve
D	Bolt
E	Elbow
F	Elbow
G	Elbow
H	Brake Pressure Line
I	Inlet Pressure Line
L	Outlet to Rockshaft Line
M	Trailer Brake Coupler Line
N	Return Line to Sump

Connect wirings to solenoid valve

Trailer brake valve, installation

For Italian version, on Trailer Brake Valve there is mounted a solenoid valve.

Install trailer brake valve (C) with elbow (E), (F) and (G). Tighten cap screw to specified torque.

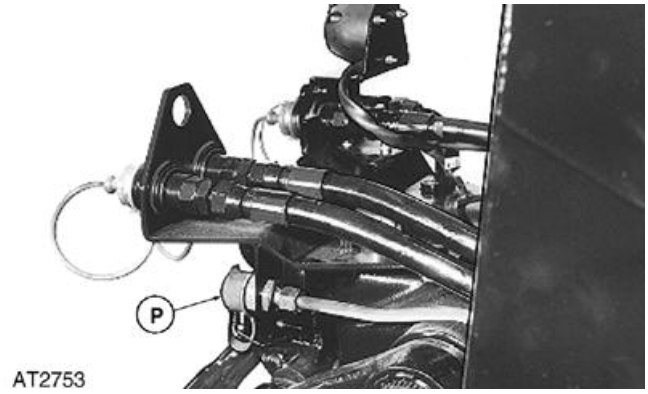
For this version, connect the electric wirings (A) (black and black/white wirings) to pressure switch (B). Connect the electric wiring (C) to solenoid valve (D).

Item	Measurement	Specification
Cap Screw, Trailer Brake Valve to Bracket	Torque	23 N·m 17 lb-ft

[5] - Connect the following lines to Trailer Brake Valve (C):

a. Tractor brake pressure line (H)
b. Inlet pressure line (I) to pump
c. Outlet to rockshaft line (L)
d. Trailer brake coupler line (L)
e. Return line to sump (N)

[6] -



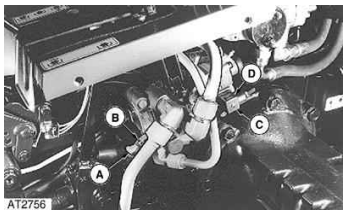
LEGEND:

P	Trailer Brake Coupler

Trailer brake coupler

Install trailer brake coupler to rear support.

[7] -



LEGEND:

A	Electric wiring (black and black/white wirings)
B	Pressure Switch
C	Electric Wiring
D	Solenoid Valve

Connect wirings to solenoid valve

For Italian version, on Trailer Brake Valve there is mounted a solenoid valve.

For this version, connect the electric wirings (A) (black and black/white wirings) to pressure switch (B). Connect the electric wiring (C) to solenoid valve (D).

[8] - Reinstall the strainer on suction line with hoses and clamps.

[9] - Refill transmission with specific oil.

[10] - Connect cables of left-hand tail light and work light.

[11] - Reinstall left-hand fender and seat.

[12] - Reinstall rear wheel.

[13] - Remove support of left-hand final drive.

[14] - Bleed brakes (see procedure in Section 260).

[15] - Run engine for a few minutes and check Trailer Brake Valve for correct operation and for leaks.

Section 70 - HYDRAULIC SYSTEM - REPAIR

Table of contents

Group 05 - Hydraulic Pump and Filter

Special or Essential Tools

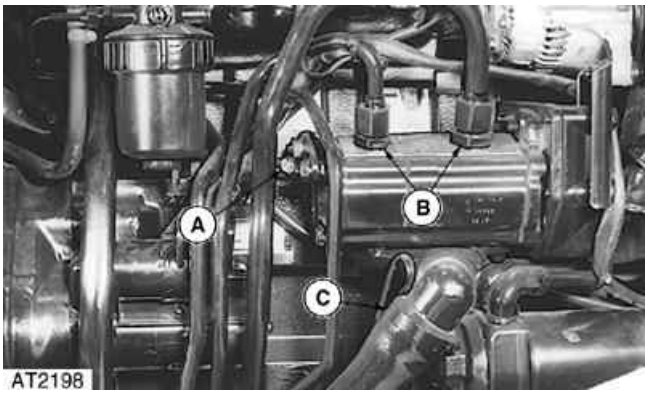
→NOTE:

Order tools according to information given in the U.S. SERVICEGARD ™ Catalog or in the European Microfiche Tool Catalog (MTC).

Specifications

Item	Measurement	Specification
Cap Screws, Hydraulic Pump to front Support	Torque	50 N·m
		37 lb-ft
Cap Screws, rear Pump Support to Engine	Torque	50 N·m
		37 lb-ft
Cap Screws and Bolts, End Plate to Pump Housing	Torque	50 N·m
		37 lb-ft
Rear Fitting to Hydraulic Pump (outlet)	Torque	28 N·m
		21 lb-ft
Front Fitting to Hydraulic Pump (inlet)	Torque	46 N·m
		34 lb-ft
Nut, Gear to Pump Drive Shaft	Torque	55 N·m
		41 lb-ft
Nuts, Hydraulic Pump to rear Support	Torque	50 N·m
		37 lb-ft
Transmission/hydraulic oil, 2WD	Capacity	36 L
		9.5 U.S.gal.
Transmission/hydraulic oil, 4WD	Capacity	38 L
		10.0 U.S.gal.
Transmission/hydraulic oil, Hi-Lo Models	Capacity	43 L
		11.3 U.S.gal.

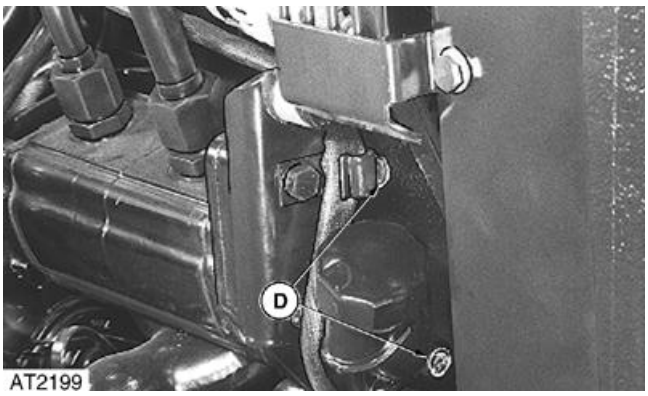
Remove and Install Hydraulic Pump



LEGEND:

A	Bracket Cap Screws
B	Outlet Lines
C	Suction Hose
D	Mounting Cap Screws

Disconnect Lines and Hose



Mounting Cap Screws

[1] - Disconnect negative (-) cable at battery.

[2] - Remove right-hand engine shield.

[3] -

→NOTE:

Close all openings with caps and plugs.

Disconnect lines (B) and hose (C).

[4] - Remove cap screws (A) and (D).

[5] - Remove hydraulic pump and O-ring.

[6] - Make repairs as necessary (see procedure in this Group).

[7] -

IMPORTANT:

Always use new O-rings. Damaged or used O-rings will leak.

Place new O-ring on pump flange. Install pump on engine.

[8] - Install cap screws. Tighten to specified torque

Item	Measurement	Specification
Cap Screws, Hydraulic Pump to front Support	Torque	50 N·m
		37 lb-ft
Cap Screws, rear Pump Support to Engine	Torque	50 N·m
		37 lb-ft

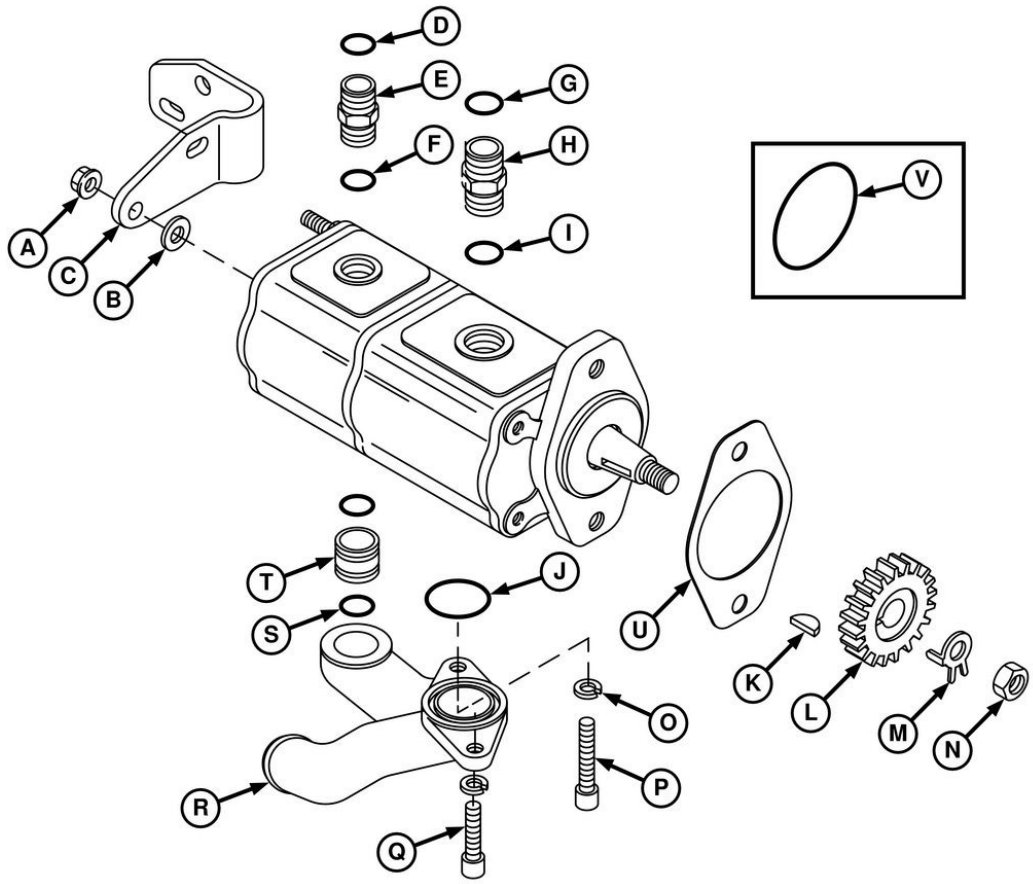
[9] - Connect hydraulic lines and hose.

[10] - Install right-hand engine shield.

[11] - Connect negative (-) cable to battery.

[12] - Start engine and operate machine hydraulics. Check and adjust transmission/hydraulic oil level.

Remove Hydraulic Pump External Components



Hydraulic Pump External Components

LEGEND:

A	Nut (2 used)
B	Lock Washer (2 used)
C	Bracket
D	O-Ring
E	Rear Fitting
F	O-Ring
G	O-Ring
H	Front Fitting
I	O-Ring
J	O-Ring
K	Woodruff Key
L	Gear
M	Tab Washer
N	Nut
O	Lock Washer (2 used)
P	Socket Head Cap Screw
Q	Socket Head Cap Screw
R	Manifold
S	O-Ring (2 used)
T	Tube

[1] - Remove parts (A) to (C).

[2] - Remove manifold (R) and tube (T). Remove O-rings (J) and (S).

[3] - Flatten tabs of washer (M) with hammer and punch.

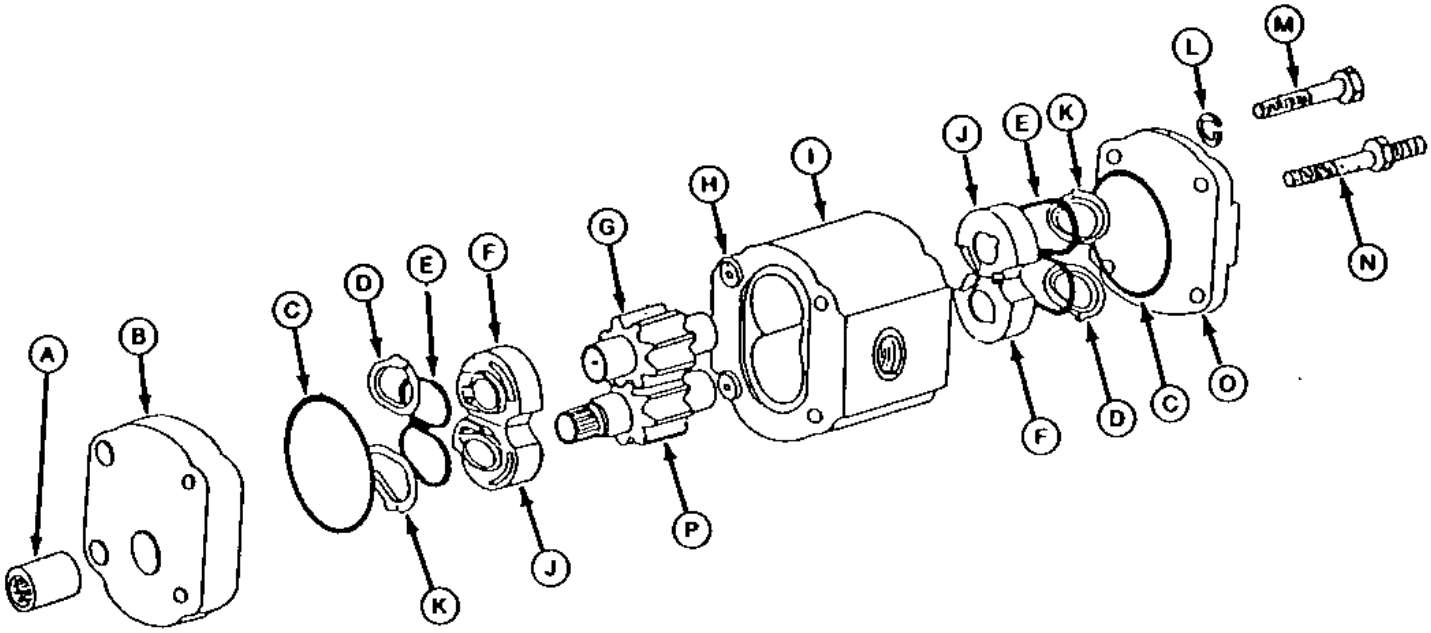
[4] - Remove nut (N) and tab washer.

[5] - Remove gear (L) using a two-jaw puller.

[6] - Remove woodruff key (K).

[7] - Remove fittings (E) and (H) and O-rings (D), (F), (G) and (I).

Disassemble and Inspect Hydraulic Pump



Rear Pump Section

LEGEND:

A	Coupling
B	Plate
C	Body Seal
D	Packing Ring
E	O-Ring Seal
F	Bushing
G	Driven Gear
H	Dowel (2 used)
I	Housing
J	Bushing
K	Packing Ring
L	Lock Washer (4 used)
M	Cap Screw (2 used)
N	Bolt (2 used)
O	End Plate
P	Drive Gear

→NOTE:

Hydraulic pump components are not serviceable. Replace complete pump if any part, other than seals, are worn or damaged.

[1] - Thoroughly clean and dry outside of pump.

[2] -

IMPORTANT:

Separate pump sections carefully. Do not allow parts to fall out. Keep individual pump components together as matched sets.

Mark or number pump sections to aid assembly.

[3] - Mount pump in a vise and remove cap screws and bolts (M) and (N).

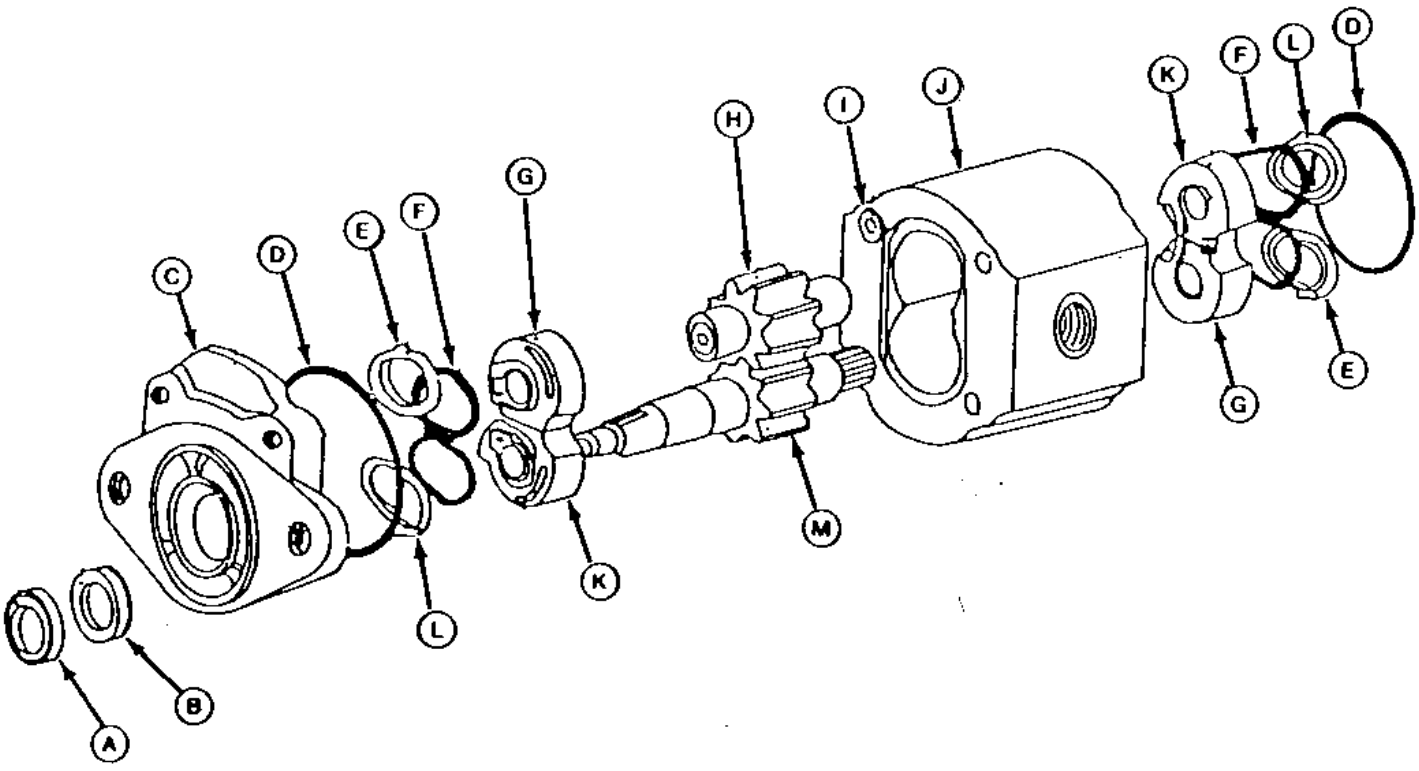
[4] - Remove end plate (O) and parts (C), (D), (E) and (K).

[5] - Mark teeth of pump gears (G) and (P) to aid reassembly.

[6] - Remove remaining parts of rear pump. If bushings (F) and (J) do not come out easily, push on shaft of drive gear (P).

[7] - Clean and dry parts. Inspect parts for wear or damage. Replace complete pump if necessary.

[8] -



Front Pump Section

LEGEND:

A	Oil Seal
B	Oil Seal
C	Mounting Flange
D	Body Seal
E	Packing Ring
F	O-Ring Seal
G	Bushing
H	Driven Gear

I	Dowel (2 used)
J	Housing
K	Bushing
L	Packing Ring
M	Drive Gear

Separate mounting flange (C) from housing (J).

[9] - Remove parts (D, E, F and L).

[10] - Mark teeth of pump gears (H and M) to aid reassembly.

[11] - Remove remaining parts of front pump. If bushings (G and K) do not come out easily, push on shaft of drive gear (M).

[12] -

IMPORTANT:

Always replace seals. Damaged or used seals will leak.

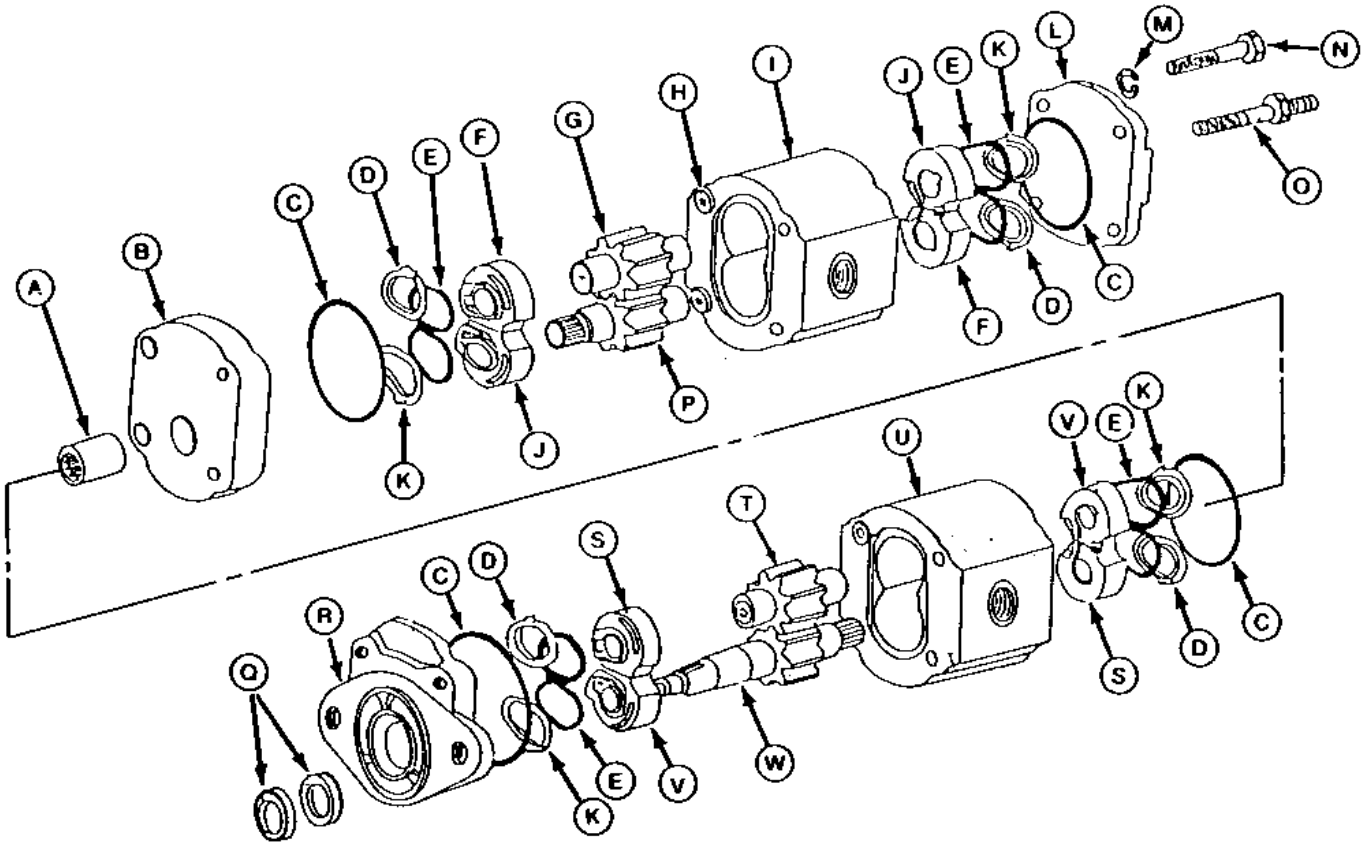
→NOTE:

Install seals with lips facing away from each other.

Pry out seals (A and B). Install seals using a bearing, bushing and seal driver set. Install seal (B) with lips toward pump gears. Install seal (A) with lips away from pump gears.

[13] - Clean and dry parts. Inspect parts for wear or damage. Replace complete pump if necessary.

Assemble Hydraulic Pump



Hydraulic Pump

LEGEND:

A	Coupling
B	Plate
C	Body Seal
D	Packing Ring
E	O-Ring Seal
F	Bushing
G	Driven Gear
H	Dowel (4 used)
I	Housing
J	Bushing
K	Packing Ring
L	End Plate
M	Lock Washer (4 used)
N	Cap Screw (2 used)
O	Bolt (2 used)
P	Drive Gear
Q	Oil Seals
R	Mounting Flange
S	Bushing
T	Driven Gear
U	Housing
V	Bushing
W	Drive Gear

IMPORTANT:

Always use new seals and O-rings. Damaged or used seals and O-rings will leak.

Apply clean hydraulic oil to all internal parts before assembly. Premature pump failure can result if pump is assembled dry.

[1] - Apply multipurpose grease to inside lips of seals (Q).

[2] - Assemble pump sections with new seals and O-rings, aligning all marks made during disassembly.

[3] -

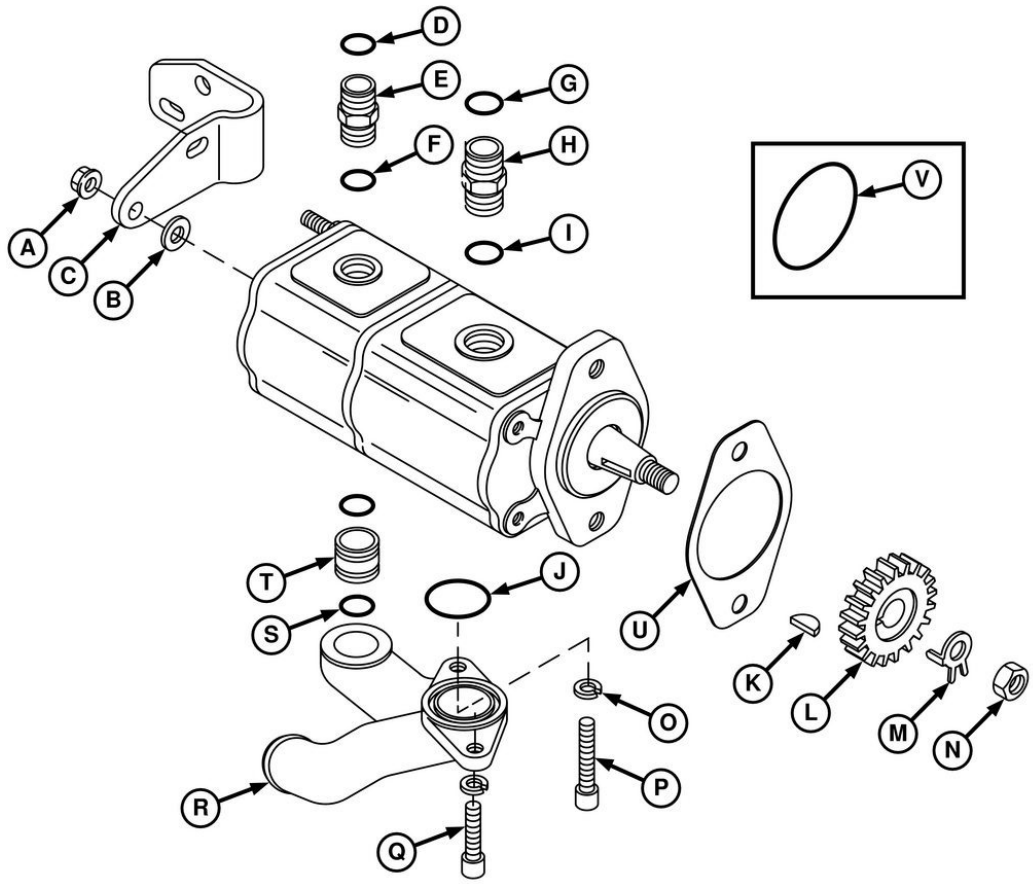
IMPORTANT:

Make sure that pump shaft can be turned with a pair of pliers when tightening bolts. A seized shaft indicates misaligned components. Disassemble pump to determine cause.

Tighten cap screws (N) and bolts (O) to specified torque.

Item	Measurement	Specification
Cap Screws and Bolts, End Plate to Pump Housing	Torque	50 N·m 37 lb-ft

Install Hydraulic Pump External Components



Hydraulic Pump External Components

LEGEND:

A	Nut (2 used)
B	Lock Washer (2 used)
C	Bracket
D	O-Ring
E	Rear Fitting
F	O-Ring
G	O-Ring
H	Front Fitting
I	O-Ring
J	O-Ring
K	Woodruff Key
L	Gear
M	Tab Washer
N	Nut
O	Lock Washer (2 used)
P	Socket Head Cap Screw
Q	Socket Head Cap Screw
R	Manifold
S	O-Ring (2 used)
T	Tube

[1] -

IMPORTANT:

Always use new O-rings. Damaged or used O-rings will leak.

Install new O-rings (D), (F), (G) and (I).

[2] - Install fittings (E) and (H). Tighten fittings to specifications.

Item	Measurement	Specification
Rear Fitting to Hydraulic Pump (outlet)	Torque	28 N·m
		21 lb-ft
Front Fitting to Hydraulic Pump (inlet)	Torque	46 N·m
		34 lb-ft

[3] - Install parts (L) to (N). Tighten nut to specifications. Bend tabs of washer up against nut.

Item	Measurement	Specification
Nut, Gear to Pump Drive Shaft	Torque	55 N·m
		41 lb-ft

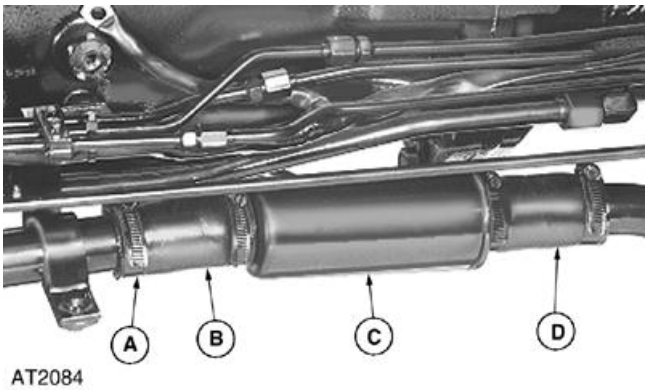
[4] - Install new O-rings (S) and tube (T).

[5] - Install new O-ring (J) and manifold (R).

[6] - Install parts (A) to (C). Tighten nuts (A) to specifications after pump is installed on engine.

Item	Measurement	Specification
Nuts, Hydraulic Pump to rear Support	Torque	50 N·m
		37 lb-ft

Remove and Install Hydraulic Filter/Manifold



Hydraulic Filter/Manifold

→NOTE:

The approximate capacity of transmission is:

Item	Measurement	Specification
Transmission/hydraulic oil, 2WD	Capacity	36 L
		9.5 U.S.gal.
Transmission/hydraulic oil, 4WD	Capacity	38 L
		10.0 U.S.gal.
Transmission/hydraulic oil, Hi-Lo Models	Capacity	43 L
		11.3 U.S.gal.

[1] - Drain transmission/hydraulic oil.

[2] -

→NOTE:

Close all openings using caps and plugs.

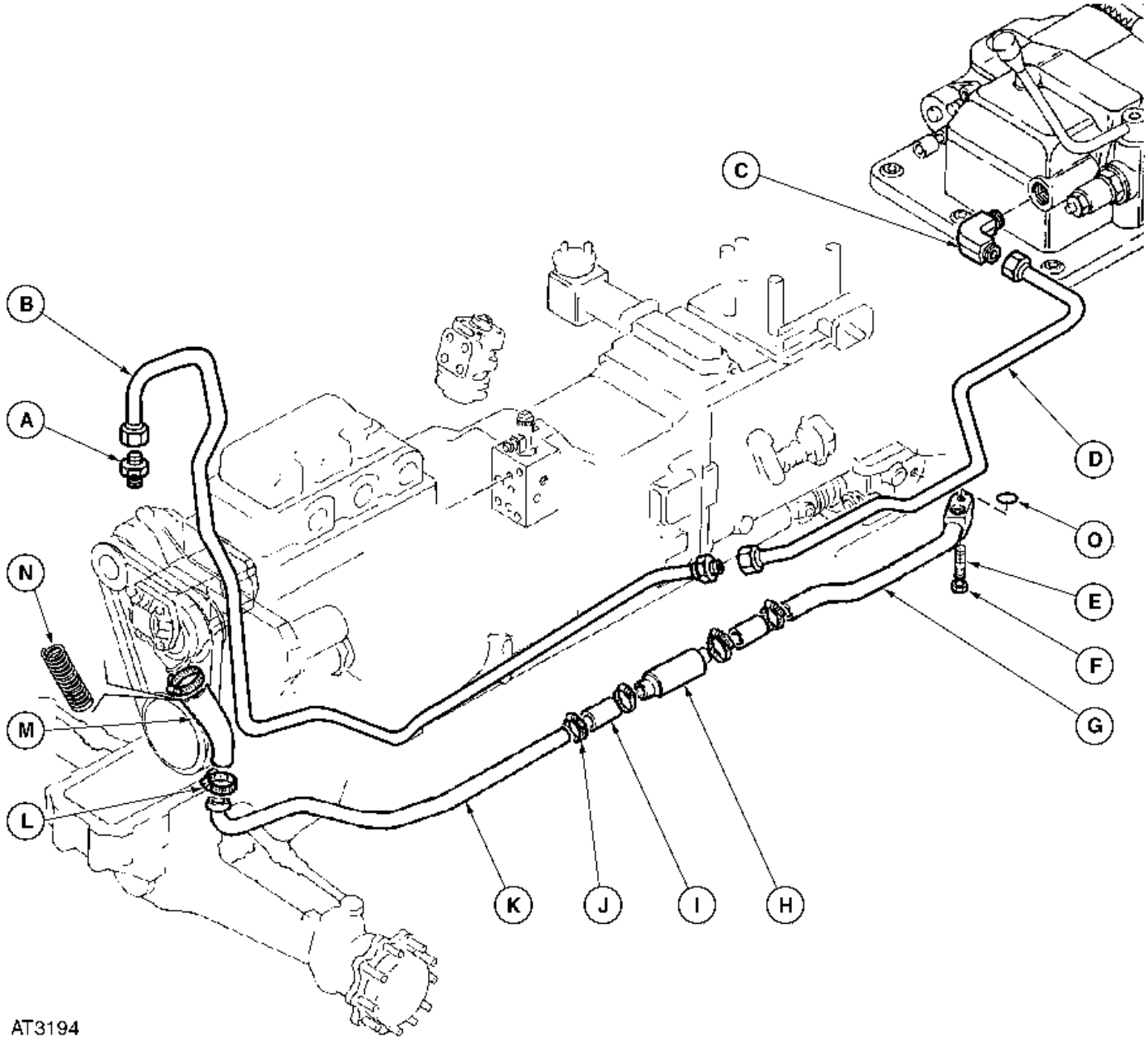
Remove four clamps (A).

[3] - Slide hose (B) forward and hose (D) rearward to remove oil filter (C).

[4] - Install oil filter, hoses and clamps.

[5] - Fill transmission with proper oil. (see “Fuel, Lubricants and Coolant” in Section 10).

Inspect and Replace Hydraulic Supply/Return Lines



Hydraulic Supply/Return Lines

LEGEND:	
A	Fitting
B	Supply Line
C	Fitting
D	Supply Line
E	Stud
F	Nut
G	Suction Line
H	Filter
I	Hose (2 used)
J	Clamp (4 used)
K	Suction Line
L	Clamp (2 used)
M	Hose
N	O-ring
O	Spring

[1] - Remove seat and support (see “Operator’s Seat” in Section 90).

[2] - Remove left side floor plates.

[3] - Inspect hydraulic lines and hoses for wear or damage. Replace as necessary.

[4] - Install left side floor plates.

[5] - Install seat and support.

[6] - Adjust transmission/hydraulic oil level to full mark with proper oil (see “Fuel, Lubricants and Coolant” in Section 10).

Group 10 - Rockshaft

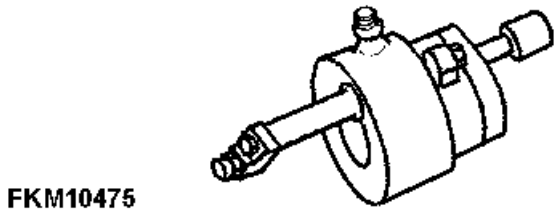
Essential Tools

→NOTE:

Order tools according to information given in the U.S. SERVICEGARD ™ Catalog or from the European Microfiche Tool Catalog (MTC).

Adjusting tool (with M14 x 1.5 fitting for hand pump connection)

FKM10475

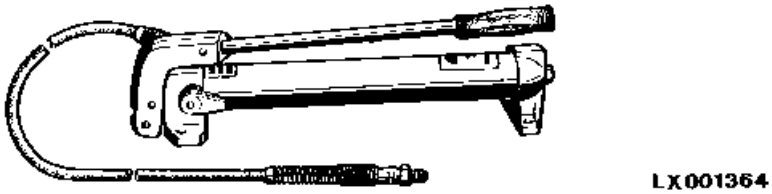


FKM10475

Rockshaft safety and relief valve adjustment

Hydraulic Hand-Operated Pump

D01019AA



hand pump

Rockshaft safety and relief valve adjustment

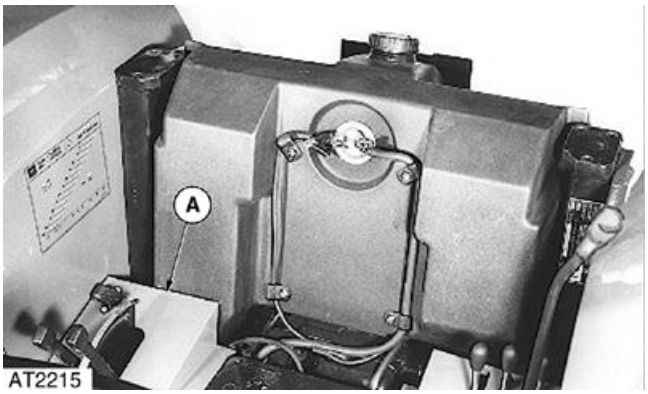
Specifications

Item	Measurement	Specification
Rear Wheel Nuts	Torque	400 N·m
		300 lb-ft
Safety Valve Adjustment	Pressure	20000 to 20500 kPa
		200 to 205 bar
		2900 to 2970 psi
Relief Valve Adjustment	Pressure	18000 to 18500 kPa
		180 to 185 bar
		2610 to 2680 psi
Cap Screws, Rockshaft Case to Transmission Housing	Torque	120 N·m
		90 lb-ft

Inspect and Repair Rockshaft Control Lever and Linkage

[1] - Remove seat and support (see “Operator’s Seat” in Section 90).

[2] -

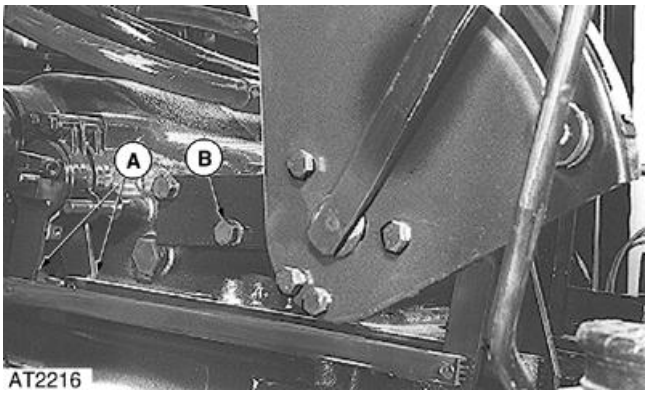


Remove Panel

Remove panel (A).

[3] - Remove right-hand rear wheel and fender.

[4] -

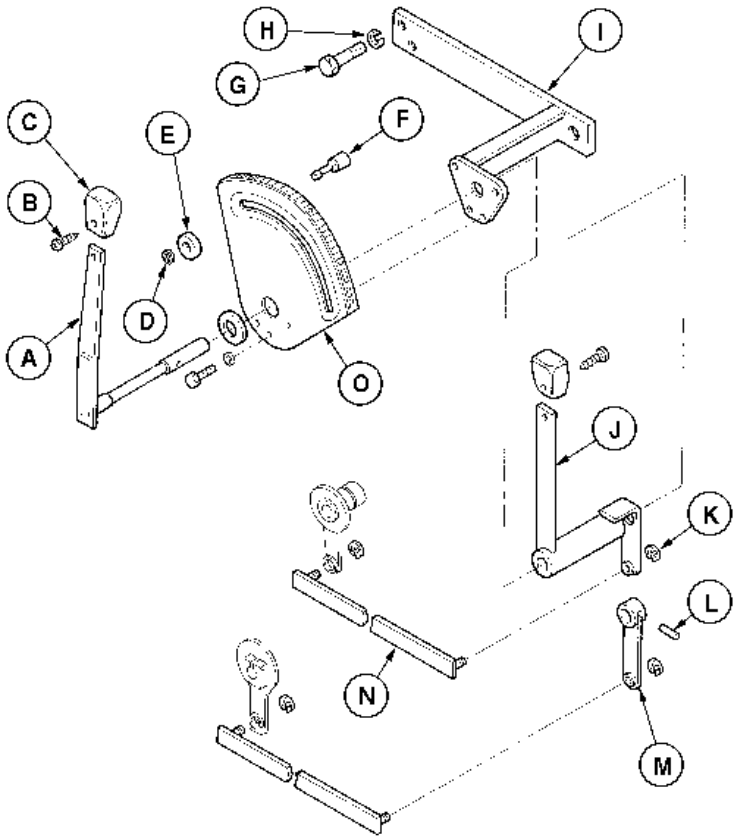


Snap Rings and Cap Screws

Remove snap rings (A).

[5] - Remove two cap screws (B) to remove control lever assembly.

[6] -



AT2217

LEGEND:

A	Position Control Lever
B	Countersunk screw (2 used)
C	Knob (2 used)
D	Snap Ring
E	Washer
F	Stop-Pin
G	Cap Screw (2 used)
H	Spring Washer (2 used)
I	Support
J	Draft Control Lever
K	Snap Ring (4 used)
L	Pin
M	Arm
N	Rod (2 used)
O	Sector

Control Lever and Linkage

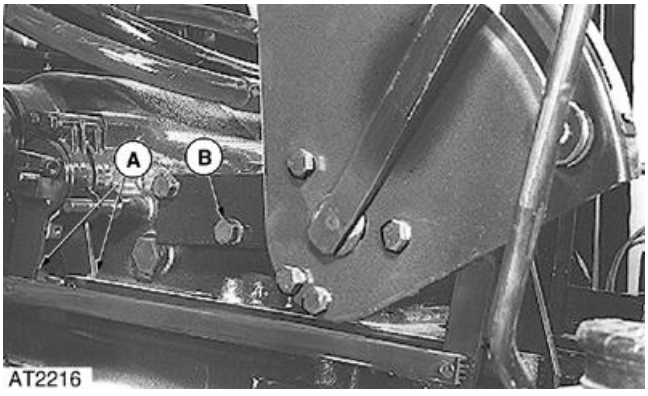
Remove parts (A) to (N).

[7] - Inspect all parts for wear or damage. Replace as necessary.

[8] - Apply multipurpose grease to shaft of lever (A).

[9] - Install all parts.

[10] -



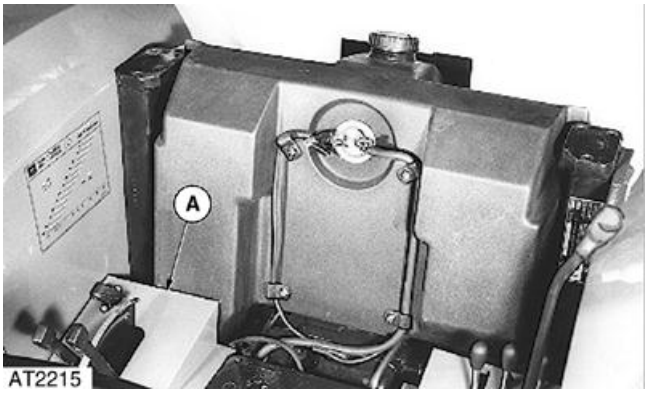
AT2216

Cap Screw and Snap Rings

Install and tighten cap screw (B).

[11] - Connect rods and install snap rings (A).

[12] -



Install Panel

Install right-hand fender and wheel.

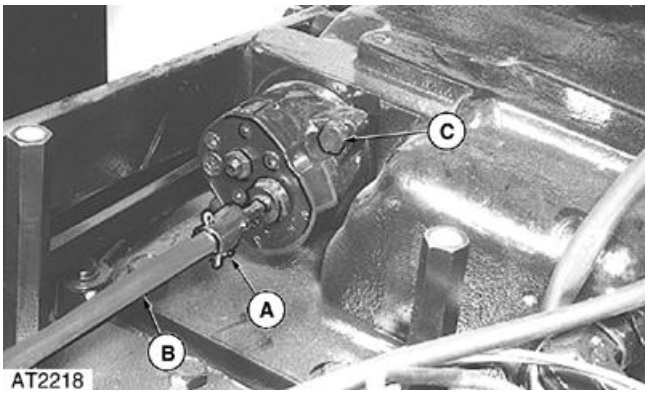
[13] - Tighten wheel nuts to specified torque.

Item	Measurement	Specification
Rear Wheel Nuts	Torque	400 N·m
		300 lb-ft

[14] - Install panel (A).

[15] - Install seat and support (see “Operator’s Seat” in Section 90).

Remove, Inspect and Install Rockshaft Control Valve



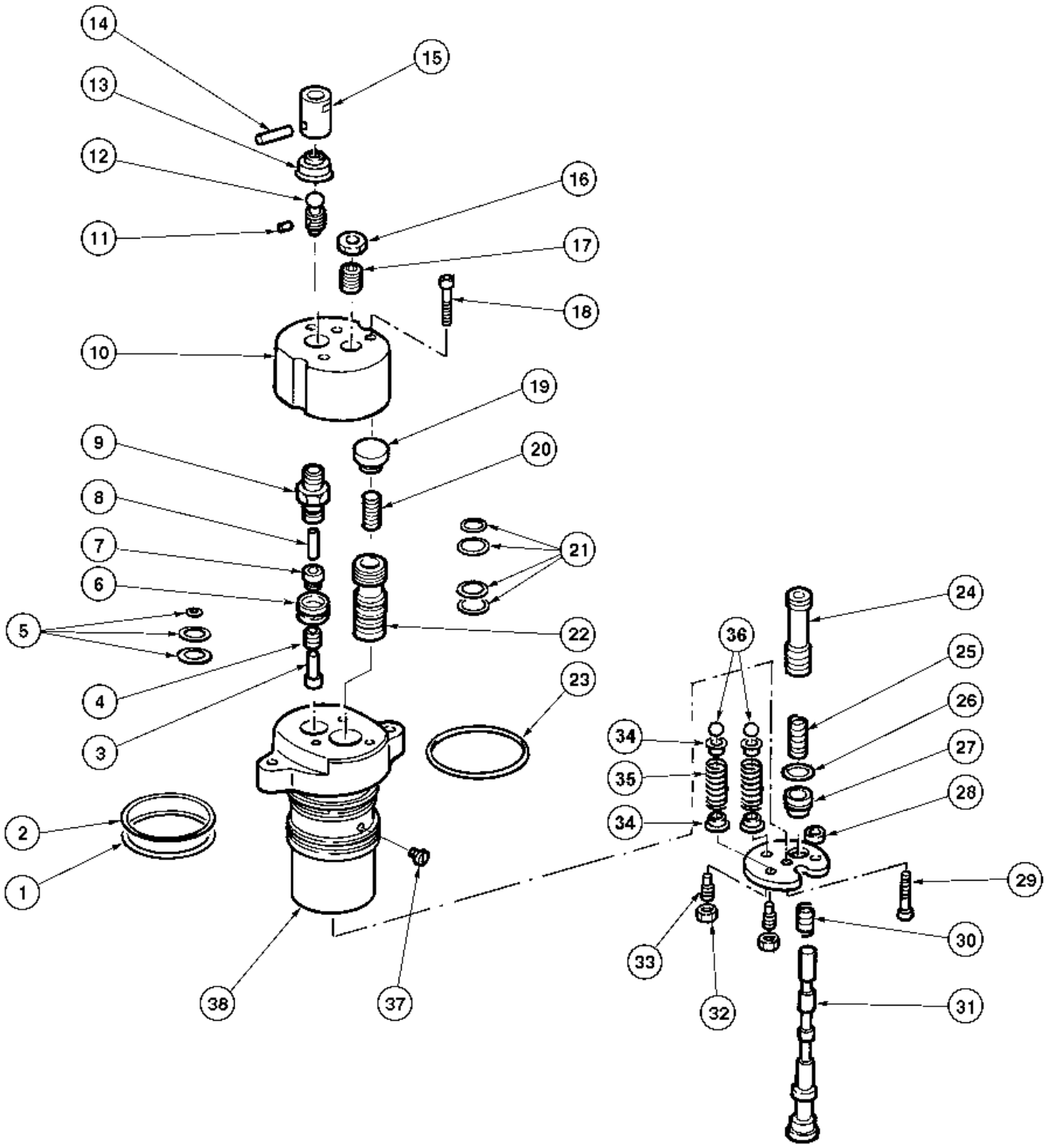
Rockshaft Control Valve

[1] - Remove seat and support (see “Operator′s Seat” in Section 90).

[2] - Remove split pin (A) to remove control rod (B).

[3] - Remove two cap screws (C) to remove rockshaft control valve assembly.

[4] -



AT3193

Rockshaft Control Valve Assembly

LEGEND:

1	Back-up Ring

2	O-Ring
3	Check Valve
4	Spring
5	O-Ring
6	Bushing
7	Lowering Rate Valve
8	Pin
9	Bushing
10	End Cover
11	Lock Pin
12	Adjuster
13	Boot
14	Spring Pin
15	Joint
16	Lock Nut
17	Adjuster
18	Allen Screw (2 used)
19	Plug
20	Spring
21	O-Ring
22	Discharge Valve
23	O-Ring
24	Differential Valve
25	Spring
26	O-Ring
27	Plug
28	Spacer (2 used)
29	Allen Screw (2 used)
30	Spring
31	Control Spool
32	Lock Nut (2 used)
33	Adjuster (2 used)
34	Spring Holder (4 used)
35	Spring (2 used)
36	Ball (2 used)
37	Restriction Screw
38	Control Valve housing

Remove points (1) to (37).

[5] - Inspect all parts for wear or damage. Replace as necessary.

[6] - Lubricate all internal parts with clean transmission/hydraulic oil during assembly.

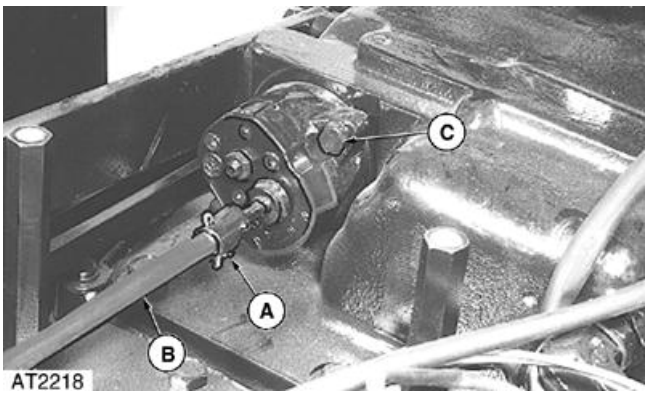
IMPORTANT:

Replace all O-rings. Damaged or used O-rings will leak.

[7] - Install all parts.

[8] - Adjust safety and relief valve (see procedure in this Group).

[9] -



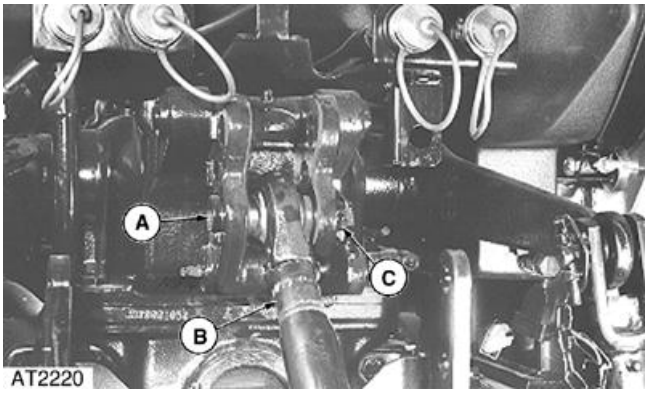
Install Rockshaft Control Valve Assembly

Install rockshaft control valve assembly and tighten cap screw (C).

[10] - Install control rod (B) and split pin (A).

[11] - Install seat and support.

Remove, Inspect and Install Sensing Linkage

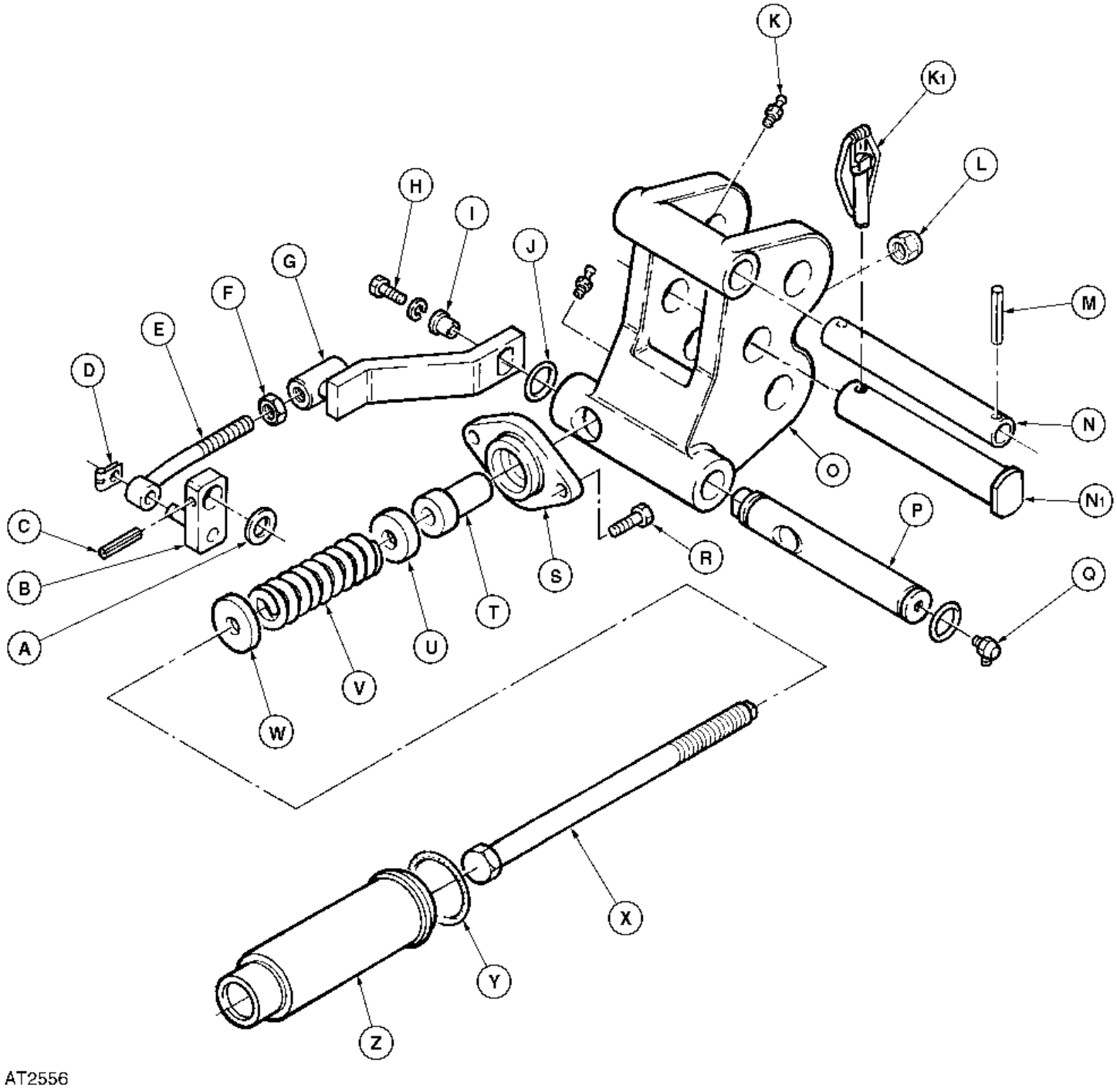


Remove Pins and Center Link

[1] - Remove quick lock pin (C).

[2] - Remove pin (A) to remove center link (B).

[3] -



AT2556

Sensing Linkage

LEGEND:

A	Washer
B	Arm
C	Spring Pin
D	Clip
E	Rod
F	Lock Nut
G	Plate
H	Cap Screw
I	Bushing
J	O-Ring (2 used)
K	Grease Fitting (2 used)
K1	Lock Pin
L	Self Locking Nut
M	Spring Pin (2 used)
N	Shaft

N1	Shaft
O	Bracket
P	Shaft
Q	Grease Fitting
R	Cap Screw (2 used)
S	Flange
T	Bushing
U	Spacer
V	Spring
W	Washer
X	Bolt
Y	O-Ring
Z	Tube

Remove parts (A) to (I).

[4] - Remove self locking nut (L).

[5] - Remove spring pins (M) to remove shaft (N).

[6] - Remove parts (O) to (Z).

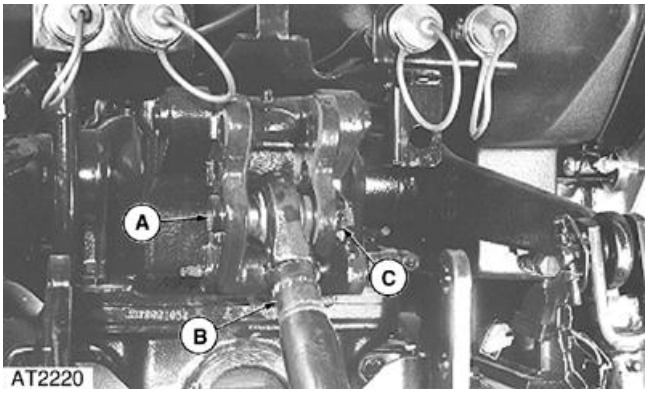
[7] - Inspect all parts for wear or damage. Replace as necessary.

[8] - Adjust sensing spring preload as described in this Group).

[9] - Apply multipurpose grease to shafts (N) and (P).

[10] - Fill tube (Z) with multipurpose grease.

[11] -

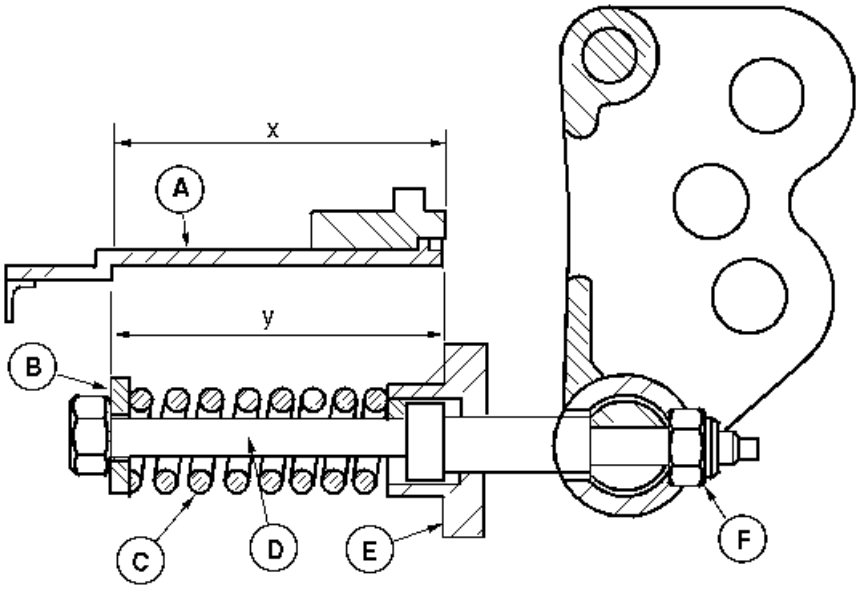


Install Center Link and Pins

Install center link (B) and pin (A).

[12] - Install quick lock pin (C).

Sensing Spring Adjustment



AT2222

Adjust Sensing Spring

→NOTE:

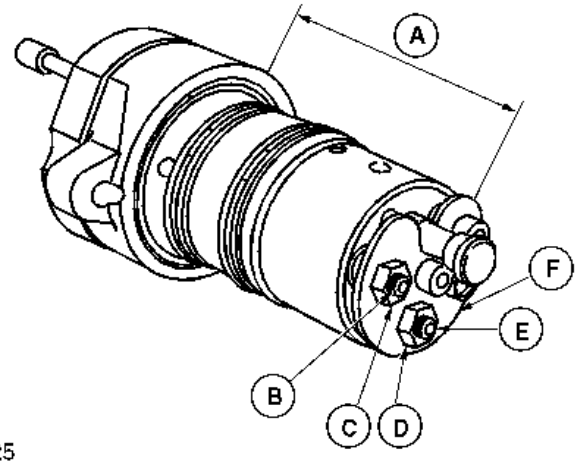
The sensing spring (C) must be able to turn on the bolt (D) but not have axial movement. Adjust nut (F) if necessary.

[1] - Use a depth micrometer to measure the distance X in the tube (A). Make a record of dimension X.

[2] - Measure the distance Y between the inside face of flange (E) and outside face of washer (B). Make a record of dimension Y.

[3] - Dimension Y must be the same as dimension X. Change washer (B) with another one with adequate thickness if dimension is not correct.

Safety and Relief Valve Adjustment

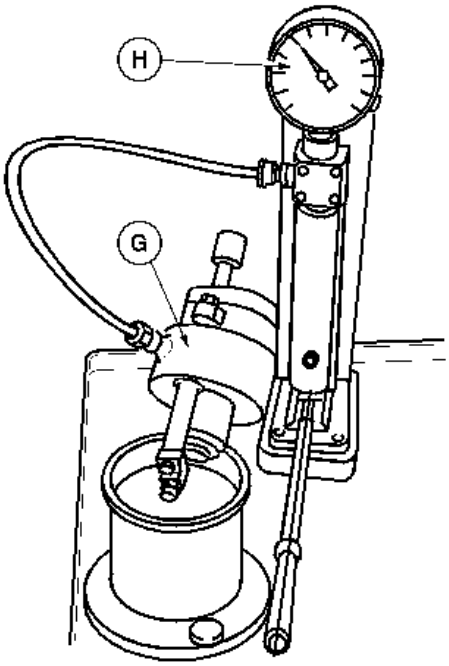


AT2225

LEGEND:

A	104 mm (4.16 in)
B	Adjuster
C	Lock Nut
D	Lock Nut
E	Adjuster
F	Cover
G	FKM10475 Adjusting Tool
H	Hand Pump

Relief Valve Adjustment



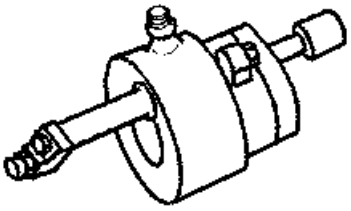
AT2226

Adjusting Tool and Hand Pump

[1] - Install rockshaft control valve to adjusting tool (G).

Adjusting tool (with M14 x 1.5 fitting for hand pump connection)

FKM10475



FKM10475

FKM10475

Rockshaft safety and relief valve adjustment

[2] - Adjust tool (G) to obtain dimension (A) of 104 mm (4.16 in).

[3] - Connect tool (G) to hand pump (H).

→NOTE:

Fill hand pump with transmission/hydraulic oil.

[4] - Remove lock nuts (C) and (D).

[5] - Screw in adjuster (E) flush with cover (F).

[6] - Operate hand pump

[For this the hydraulic hand-operated pump D01019AA can be used, (see ESSENTIAL TOOLS in this Group)]
(H) and adjust safety valve to specifications by turning adjuster (B).

Hydraulic Hand-Operated Pump

D01019AA

Hydraulic hand pump

For adjusting the Safety and Relief Valve

Item	Measurement	Specification
Safety Valve Adjustment	Pressure	20000 to 20500 kPa 200 to 205 bar 2900 to 2970 psi

[7] - Install and tighten lock nut (C).

[8] - Operate with hand pump (H) and adjust relief valve to specifications by turning adjuster (E).

Item	Measurement	Specification
Relief Valve Adjustment	Pressure	18000 to 18500 kPa 180 to 185 bar 2610 to 2680 psi

[9] - Install and tighten lock nut (D).

Remove and Install Rockshaft Case

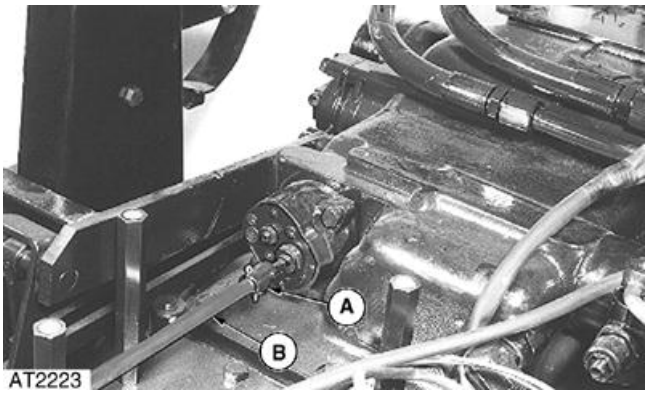
[1] - Lower rockshaft completely.

[2] - Remove seat and support (see “Operator’s Seat” in Section 90).

[3] - Remove fuel tank (see procedure in Section 30).

[4] - Disconnect wiring harness as necessary to allow lifting of rockshaft case.

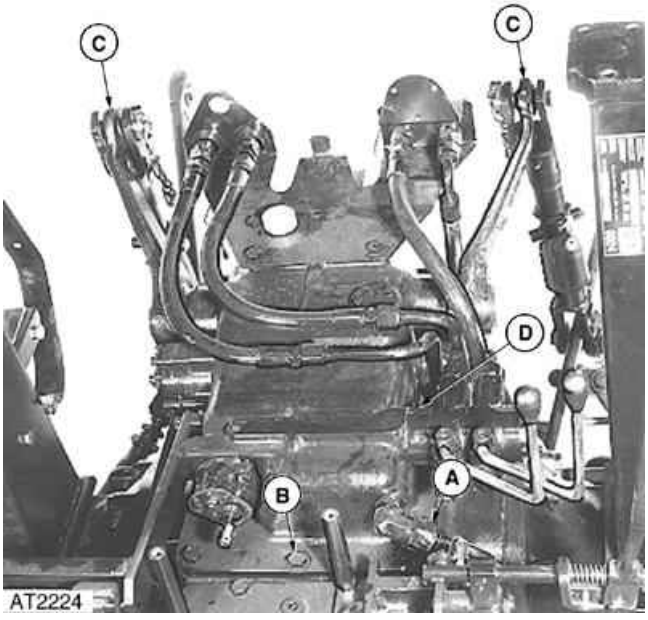
[5] -



Split Pin and Lowering Rate Control Rod

Remove split pin (A) to remove lowering rate control rod (B).

[6] -



Remove Rockshaft Case

Remove hydraulic line (A). Close all openings with caps and plugs.

[7] - Remove center link and lift links (C).

[8] -

CAUTION:

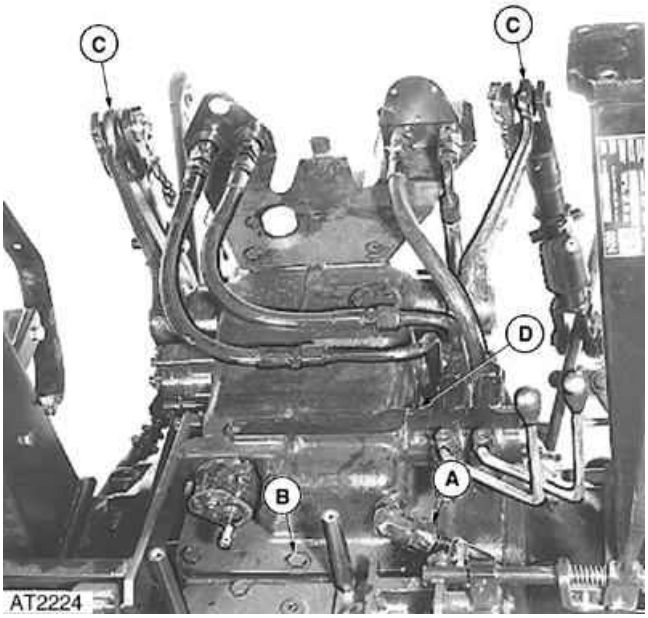
The approximate weight of rockshaft case assembly is 82 kg (180 lbs).

Remove nine cap screws (B) and rockshaft case assembly (D).

[9] - Make repairs as necessary (see procedure in this Group).

[10] - Clean mating surfaces of rockshaft case and differential housing. Apply a coat of sealing compound to mating surfaces.

[11] -



Install Rockshaft Case

Install rockshaft case (D). Install and tighten cap screws (B) to specified torque.

Item	Measurement	Specification
Cap Screws, Rockshaft Case to Transmission Housing	Torque	120 N·m 90 lb-ft

[12] - Install center link and lift links (C).

[13] - Connect hydraulic line (A).

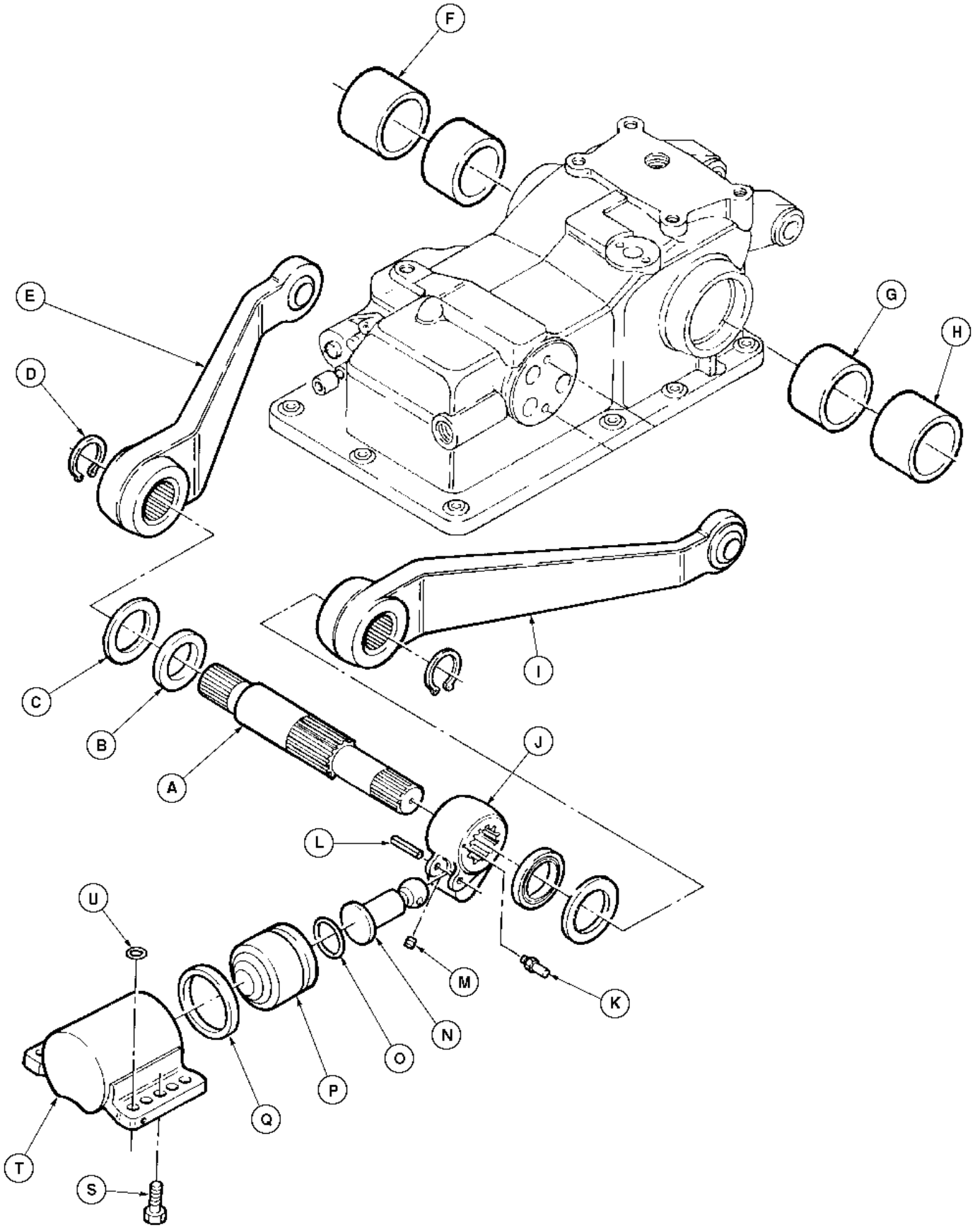
[14] - Install lowering rate control rod.

[15] - Connect wiring harness.

[16] - Install fuel tank.

[17] - Install seat and support.

Remove, Inspect and Install Rockshaft Lift Arms and Cylinder



AT2227

Rockshaft Lift Arms and Cylinder

LEGEND:

A	Rockshaft
B	Seal (2 used)

C	Washer (2 used)
D	Snap Ring (2 used)
E	R.h. Lift Arm
F	Bushing (2 used)
G	Bushing
H	Bushing
I	L.h. Lift Arm
J	Arm
K	Pin
L	Spring Pin
M	Allen Screw
N	Push Rod
O	O-Ring
P	Piston
Q	Seal
S	Cap Screw (2 used)
T	Cylinder
U	O-Ring

[1] - Remove rockshaft case as described in this Group.

[2] -

→NOTE:

Make an alignment mark on lift arms (E) and (I) and rockshaft (A) before disassembly.

Remove cap screws (S) to remove cylinder (T), piston (P), seal (Q) and O-ring (U).

[3] - Remove snap rings (D) to remove lift arms (E) and (I) and washers (C).

[4] - Remove allen screw (M) and slide out rockshaft (A) from r.h. side.

[5] - Remove parts (J), (L), (N) and (O).

[6] - Remove seals (B).

[7] -

→NOTE:

Bushings (F), (G) and (H) are press fit. Remove bushings only if replacement is necessary.

Remove bushings (F), (G) and (H) using slide hammer puller.

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

[9] -

IMPORTANT:

Replace seals and O-rings. Damaged or used seals and O-rings will leak.

Install bushings (F), (G) and (H) and seal (B) using a bearing, bushing and seal driver set.

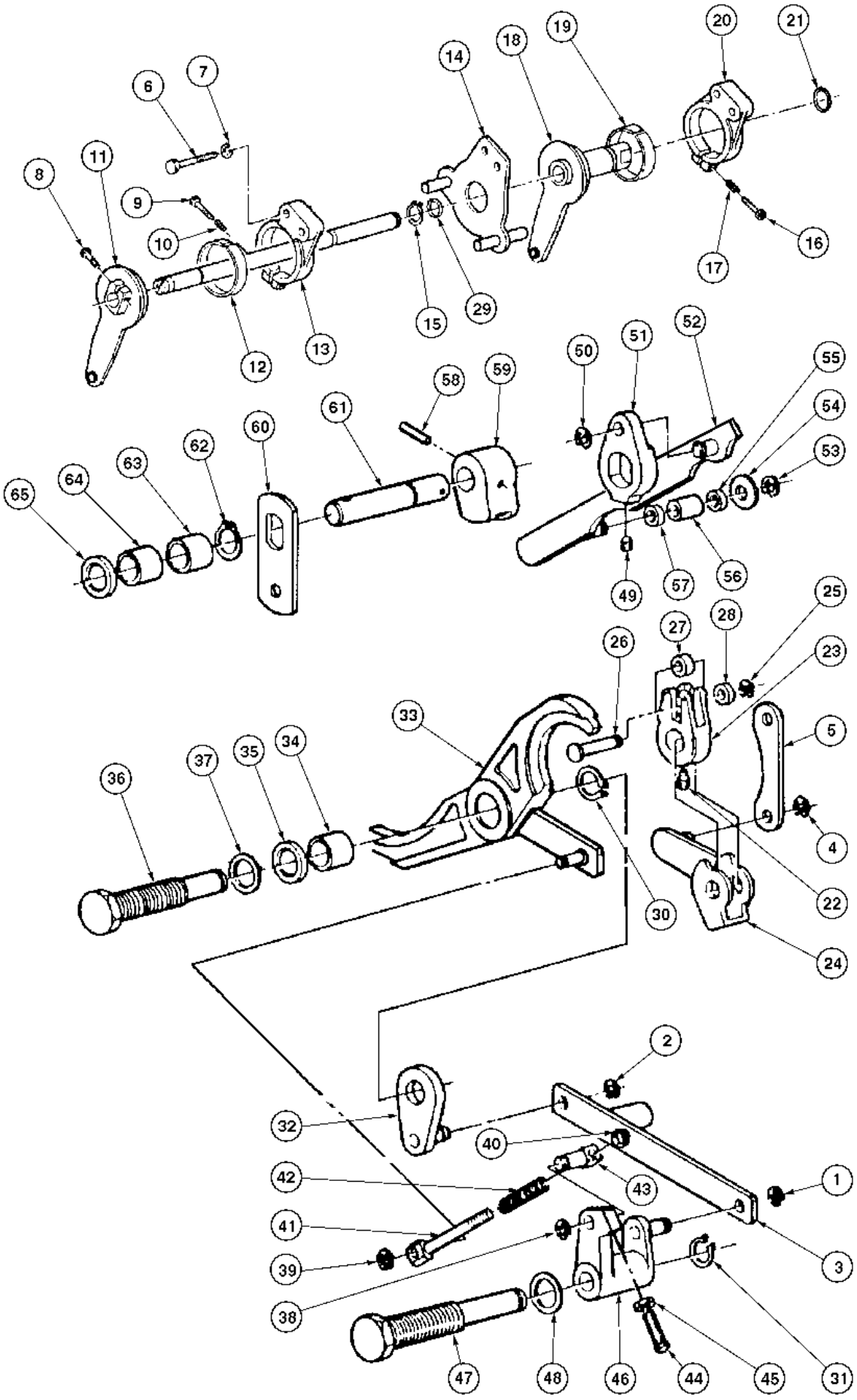
[10] - Apply multipurpose grease to lips of seals.

[11] - Lubricate all internal parts with clean transmission/hydraulic oil.

[12] - Assemble all parts.

[13] - Install rockshaft case.

Inspect and Repair Rockshaft Control Linkage



Rockshaft Control Linkage

LEGEND:

1	Snap Ring
2	Snap Ring
3	Lever
4	Snap Ring
5	Lever
6	Screw
7	Spring Washer
8	Allen Screw
9	Allen Screw
10	Spring
11	Lever
12	Plastic Ring
13	Mounting Ring
14	Plate
15	Snap Ring
16	Allen Screw
17	Spring
18	Lever
19	Plastic Ring
20	Mounting Ring
21	O-Ring
22	Allen Screw
23	Lever
24	Lever
25	Snap Ring
26	Pin
27	Spacer
28	Spacer
29	O-Ring
30	Snap Ring
31	Snap Ring
32	Lever
33	Balance Link
34	Bearing
35	Spacer
36	Pivot Bolt
37	Copper Washer
38	Snap Ring
39	Snap Ring
40	Nut
41	Shock Absorber
42	Spring
43	Collector
44	Contact pin
45	Lock Nut
46	Return Lever
47	Pivot Bolt
48	Copper Washer
49	Allen Screw
50	Snap Ring
51	Support Plate
52	Link Arm
53	Snap Ring
54	Washer
55	Spacer
56	Spacer
57	Spacer
58	Spacer Pin
59	Sensing Cam
60	Plate
61	Shaft
62	Snap Ring
63	Bushing
64	Bushing
65	Seal

[1] - Remove rockshaft case (see procedure in this Group).

[2] - Remove rockshaft cylinder (see procedure in this Group).

[3] - Remove rockshaft sensing linkage assembly as described in this Group.

[4] - Disassemble all parts in the order shown.

[5] -

IMPORTANT:

Replace seals and O-rings. Damaged or used seals and O-rings will leak.

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

[6] - Lubricate all internal parts with clean transmission/hydraulic oil.

[7] - Assemble all parts.

→NOTE:

For shock absorber (41) and contact pin (44) adjustment see procedure in this Group.

[8] - Install rockshaft sensing linkage assembly.

[9] - Install rockshaft cylinder.

[10] - Install rockshaft case.

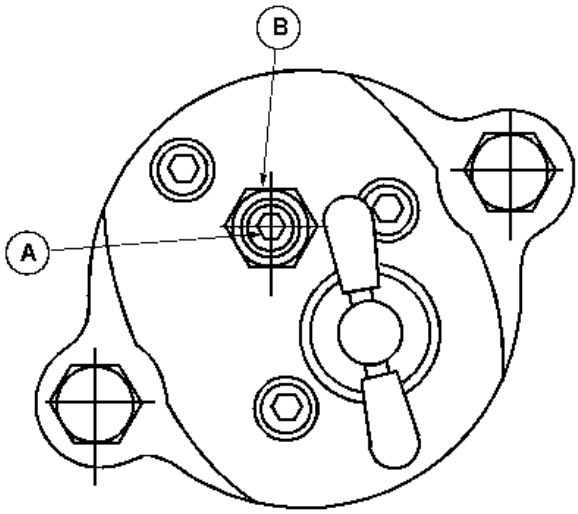
→NOTE:

Item numbers are in order of disassembly.

Rockshaft Sensitivity Adjustment

LEGEND:

A	Sensitivity Adjuster
B	Lock Nut



AT2229

Rockshaft Sensitivity Adjustment

[1] - Attach a suitable weight to the lift arms equivalent to the weight of an implement.

[2] - Using position control lever, raise the lift arms to the middle of the travel.

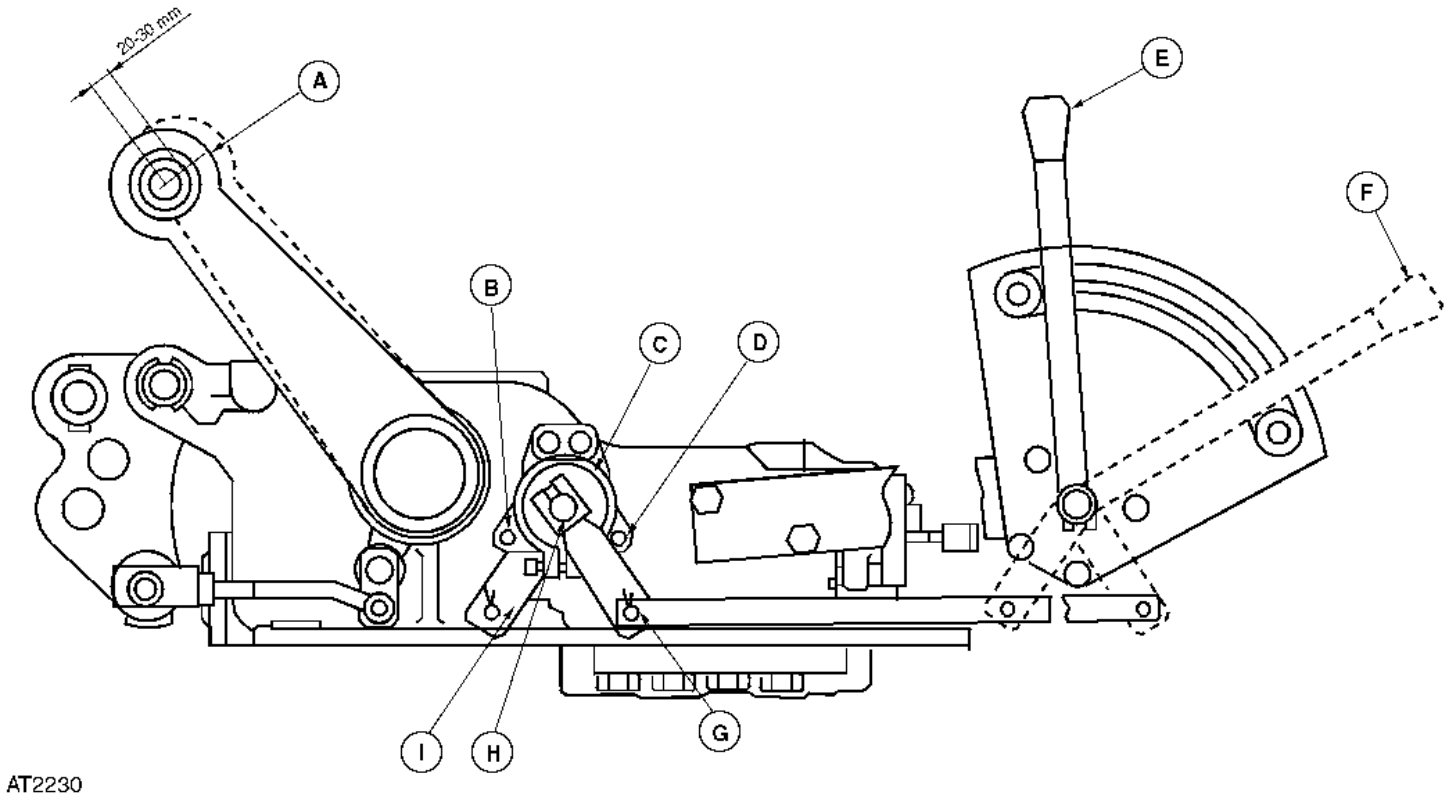
[3] - Loosen lock nut (B).

[4] - Turn sensitivity adjuster (A) counterclockwise until lift arms begin to vibrate.

[5] - At the point where the lift arms begin to vibrate, slowly turn sensitivity adjuster (A) clockwise until the movement stops and then a further 1/4 turn.

[6] - Tighten lock nut (B).

Rockshaft Position Control Lever Adjustment



Rockshaft Position Control Lever Adjustment

[1] - Attach a weight to the lift arms.

[2] - Loosen the allen screw (C).

[3] - Raise the position control lever (E) until lever (G) touches the stop (D).

[4] - Move down the draft control lever (F) until lever (I) touches the stop (B).

[5] - Start the engine and run at low idle.

[6] - Without moving the two control levers, use a wrench to turn the position control shaft (H) slowly counterclockwise. Do this until lift arms (A) raise to the end of their travel.

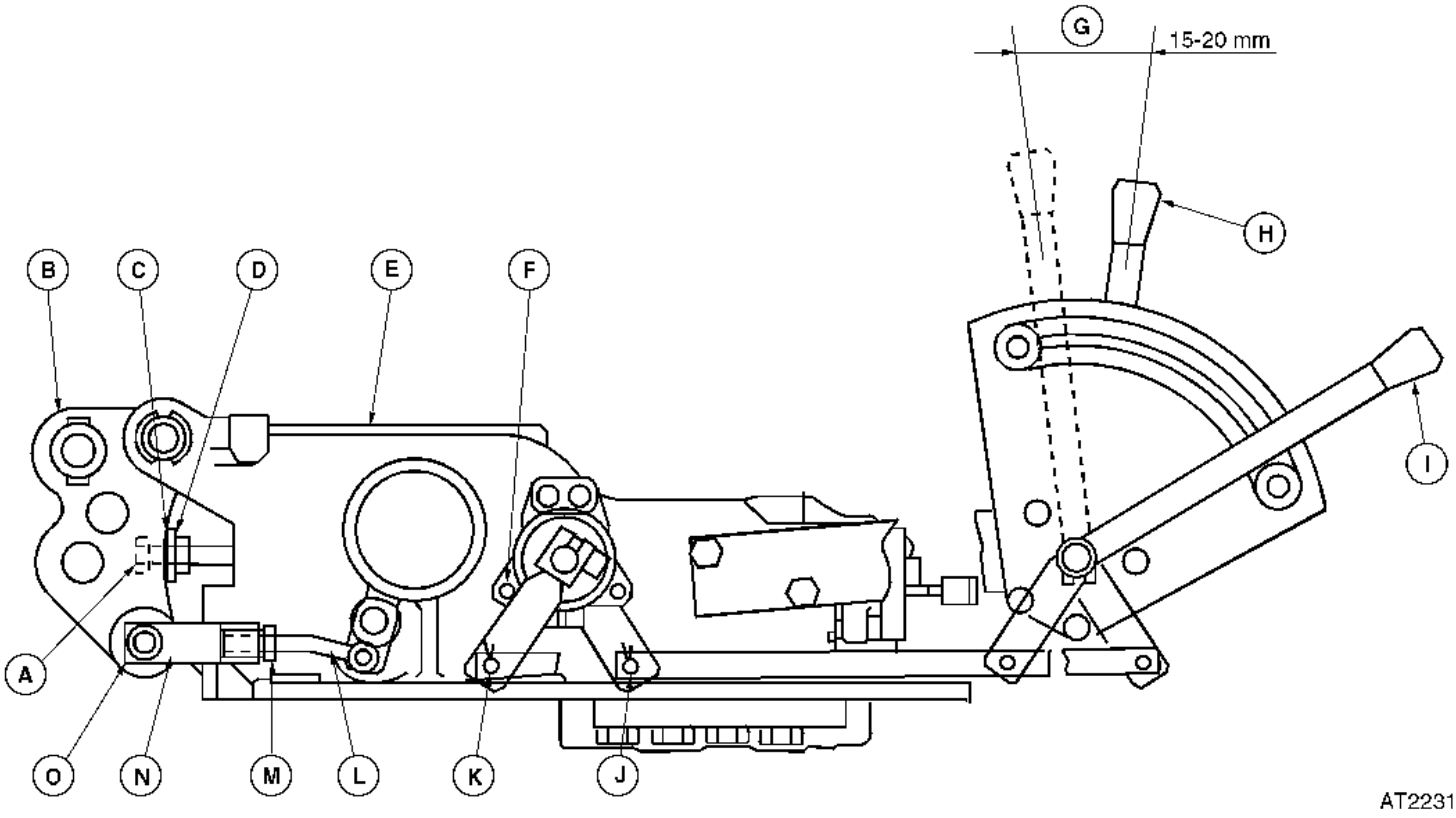
[7] - Turn the position control shaft (H) clockwise until lift arms (A) lower by 20 to 30 mm (0.8 to 1.2 in) at the ball ends.

[8] - Check that lever (G) is touching the stop (D) then tighten allen screw (C).

[9] - With position control lever (E) raise and lower lift arms (A) several time.

[10] - Check that the free play at the top of the travel of the lift arms (A) is still 20 to 30 mm (0.8 to 1.2 in), adjust again if necessary.

Rockshaft Draft Control Lever Adjustment



Rockshaft Draft Control Lever Adjustment

[1] - To make a negative draft force, install a bolt (A), plate (C) and nut (D) between the hydraulic housing (E) and the center link mounting bracket (B); refer to Section 299. “Dealer Fabricated Tools”.

[2] - With engine stopped move draft control level (H) and position control lever (I) downward against the lower stop. Check that the levers (J) and (K) are touching the stop (F).

[3] - Turn the bolt (A) and nut (D) to move mounting bracket (B) away from hydraulic housing (E) until the internal linkage is against the negative limit stop.

[4] - Start and run the engine at low idle speed. Slowly move the draft control lever (H) upward until the lift arms start to raise. At this point, the distance (G) between the draft control lever and the upper stop must be 15 to 20 mm (0.6 to 0.8 in).

[5] - If the distance (G) at the draft control lever is not correct the length of the tension rod (L) must be changed.

[6] -

CAUTION:

For safety reasons this adjustment must only be made when the engine is stopped.

Loosen the lock nut (M) then remove the bolt (O). Turn the adjusting block (N) to shorten or lengthen the tension rod (L) using the following procedure:

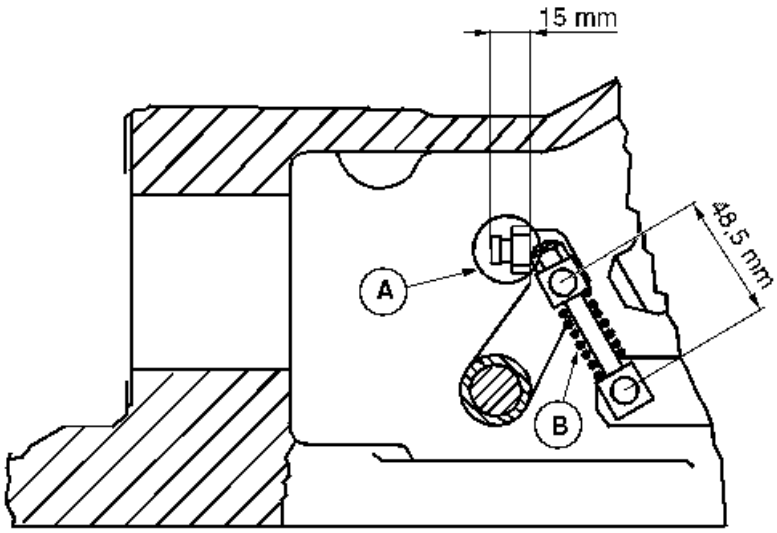
Shorten the tension rod (L) if the lift arms raise when the distance (G) is more than 20 mm (0.8 in).

Lengthen the tension rod (L) if the lift arms do not raise before the distance (G) is less than 15 mm (0.6 in).

[7] - After adjustment, tighten the lock nut (M). Raise and lower the lift arms to check the distance (G).

[8] - When the adjustment is correct, stop the engine and then remove bolt (A), plate (C) and nut (D).

Distributor Control Valve Adjustment



AT2232

Distributor Control Valve Adjustment

→NOTE:

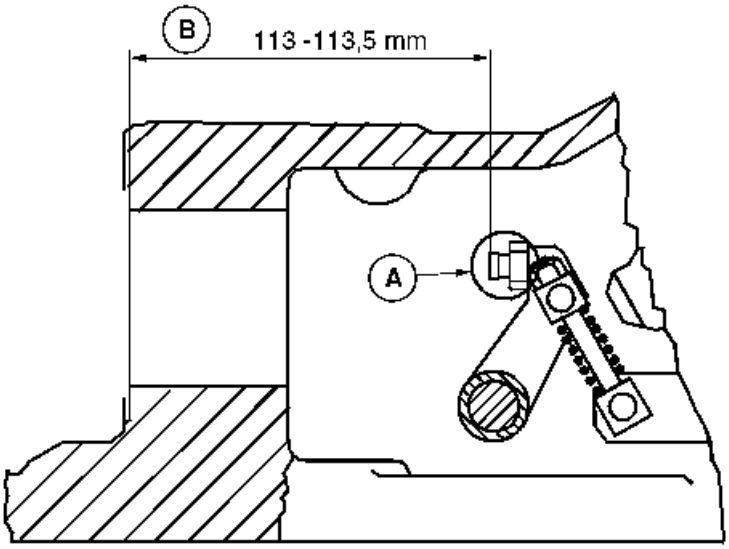
When contact pin (A) and shock absorber (B) have been disassembled, adjust cap (A) to 15 mm (0.6 in) and shock absorber (B) to 48,5 mm (1.94 in).

The contact pin adjustment (A) can only be checked when the position and draft control levers have been correctly adjusted and there is no weight on the lift arms.

[1] - Move the position and draft control levers fully downward against the lower stop.

[2] - Remove rockshaft control valve.

[3] -



AT2233

Measure Distance

Using a depth gauge measure the distance (B) between the cap (A) and the control valve mounting face on the rockshaft housing. Distance (B) must be 113 to 113.5 mm (4.52 to 4.54 in).

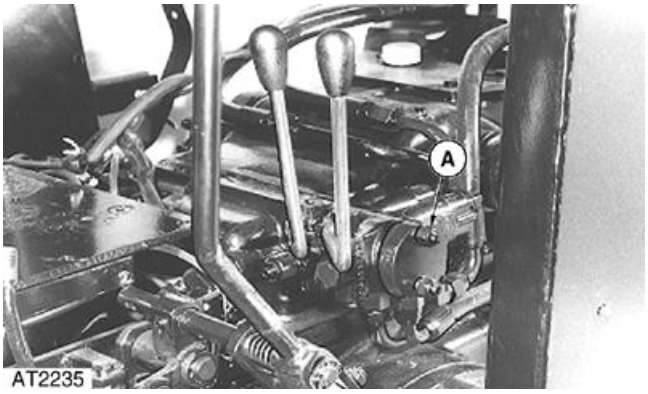
[4] - If necessary, adjust the dimension by turning the contact pin (A).

→NOTE:

If the contact pin adjustment (A) is changed, the position and draft control lever adjustments must be repeated.

Group 15 - Selective Control Valves

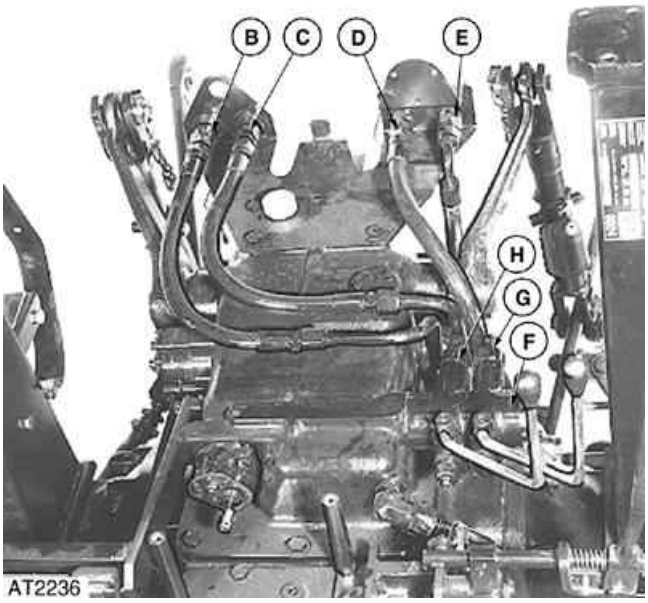
Remove and Install Selective Control Valves (SCV)



LEGEND:

A	Nuts
B	Hydraulic hose
C	Hydraulic hose
D	Hydraulic hose
E	Hydraulic hose
F	Cover
G	Control valve
H	Control valve

Nuts



Hydraulic Hoses, Cover, and Valves

[1] - Remove seat and support (see “Operator′s Seat” in Section 90).

[2] - Remove fuel tank (see procedure in Section 30).

[3] - Remove left-hand console.

[4] - Remove two nuts (A).

[5] - Disconnect hoses (B) to (E).

[6] - Remove end plate (F), control valve (G) and control valve (H).

[7] - Make repairs as necessary (see procedure in this Group).

[8] -

IMPORTANT:

Always use new O-rings and seals. Damaged or used parts will leak.

Replace O-rings.

[9] - Install control valves and end plate.

[10] - Install nuts (A) and tighten.

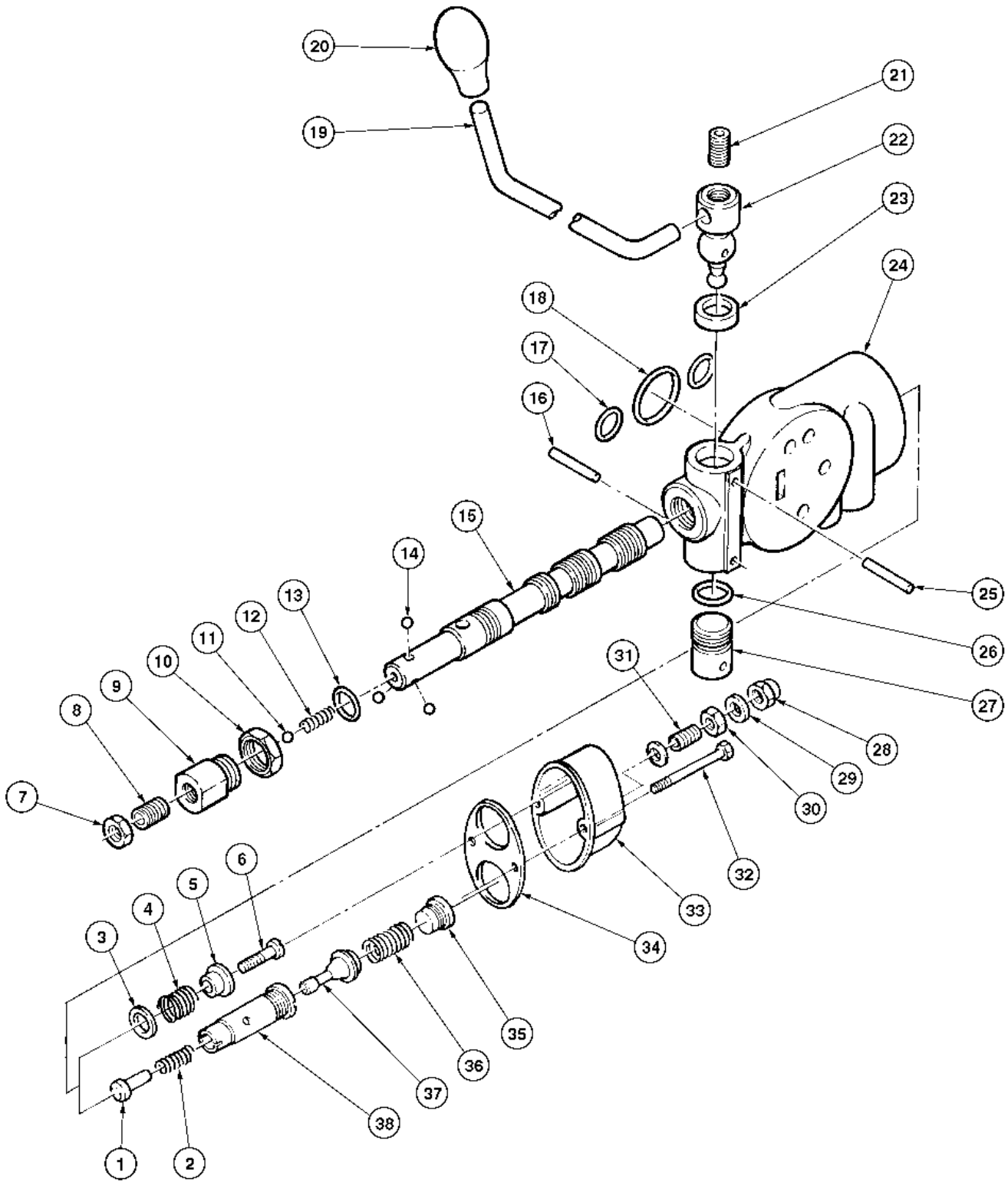
[11] - Connect hoses.

[12] - Install console.

[13] - Install fuel tank.

[14] - Install seat and support.

Disassemble, Inspect and Assemble Selective Control Valve (With Locking Position)



Selective Control Valve (With Locking Position)

LEGEND:

1	Check Valve
2	Spring
3	Washer
4	Spring
5	Retainer

6	Screw
7	Lock Nut
8	Adjuster
9	Cover
10	Lock Nut
11	Ball
12	Spring
13	O-Ring
14	Ball (3 used)
15	Spool
16	Spring Pin
17	O-Ring (2 used)
18	O-Ring
19	Control Lever
20	Knob
21	Allen Screw
22	Arm
23	Seal
24	Housing
25	Pin
26	O-Ring
27	Plug
28	Cap Nut
29	Copper Washer (2 used)
30	Lock Nut
31	Adjuster
32	Screw (2 used)
33	Cover
34	Gasket
35	Spring Holder
36	Spring
37	Relief Valve
38	Valve Seat

[1] - Remove selective control valve from rockshaft case as described in this Group.

[2] - Remove parts (1) to (38).

[3] - Inspect all parts for wear or damage. Replace as necessary.

IMPORTANT:

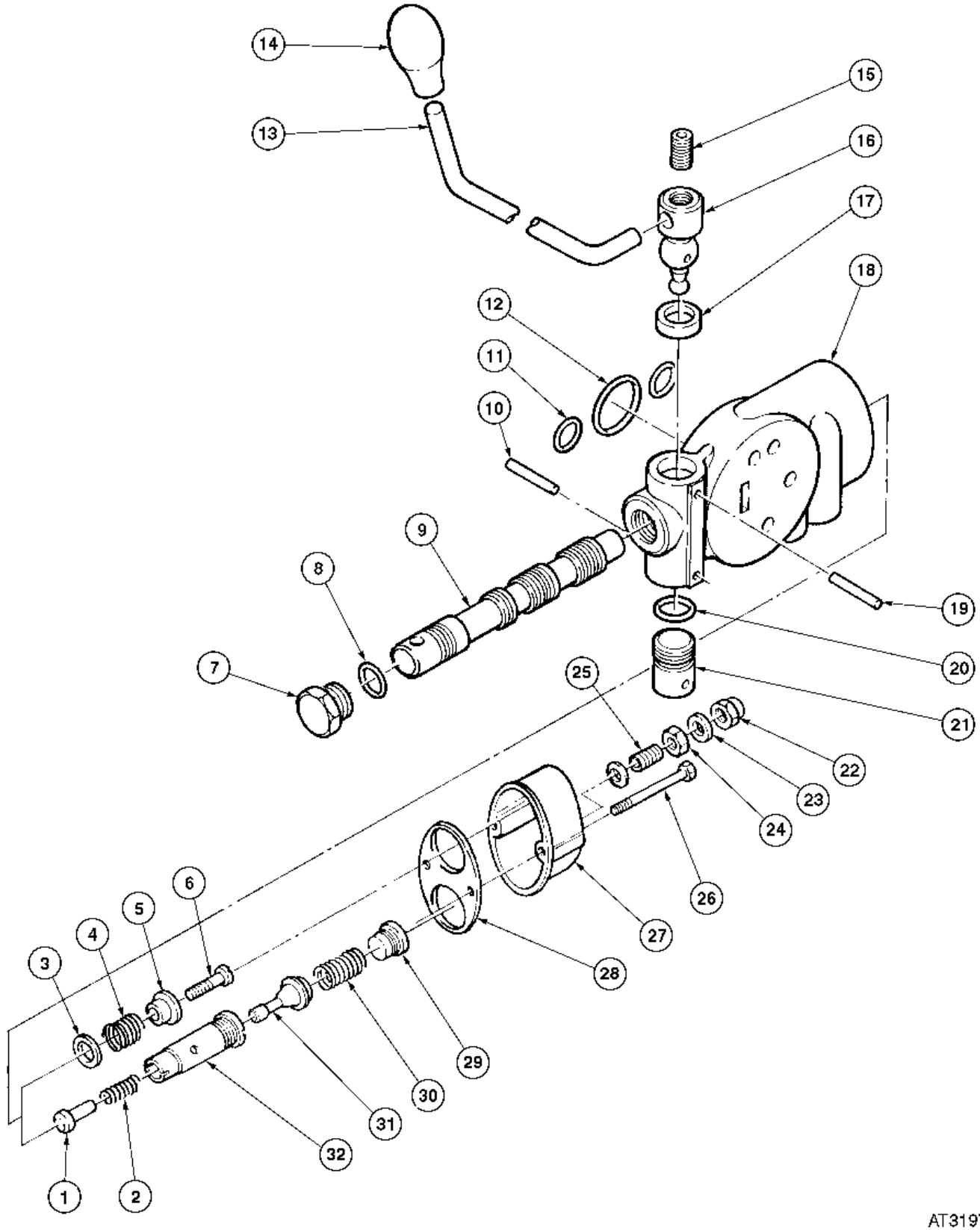
Spools and housing are matched and must be replaced as a unit. Use new O-rings and seals during assembly. Damaged or used O-rings and seals will leak.

[4] - Lubricate all internal parts with clean transmission/hydraulic oil during assembly.

[5] - Install all parts.

[6] - Install selective control valve to rockshaft case.

Disassemble, Inspect and Assemble Selective Control Valve (Double Acting SCV)



drawing, double acting SCV

LEGEND:

1	Check valve
2	Spring

3	Washer
4	Spring
5	Retainer
6	Screw
7	Plug
8	O-ring
9	Spool
10	Spring pin
11	O-ring (2 used)
12	O-ring
13	Control lever
14	Knob
15	Allen screw
16	Arm
17	Seal
18	Housing
19	Pin
20	O-ring
21	Plug
22	Cap nut
23	Copper washer (2 used)
24	Jam nut
25	Adjuster
26	Screw (2 used)
27	Cover
28	Gasket
29	Spring holder
30	Spring
31	Relief valve
32	Valve seat

[1] - Remove SCV from rockshaft case (see procedure in this group).

[2] - Remove parts (1 - 32).

[3] - Inspect all parts for wear or damage. Replace as necessary.

IMPORTANT:

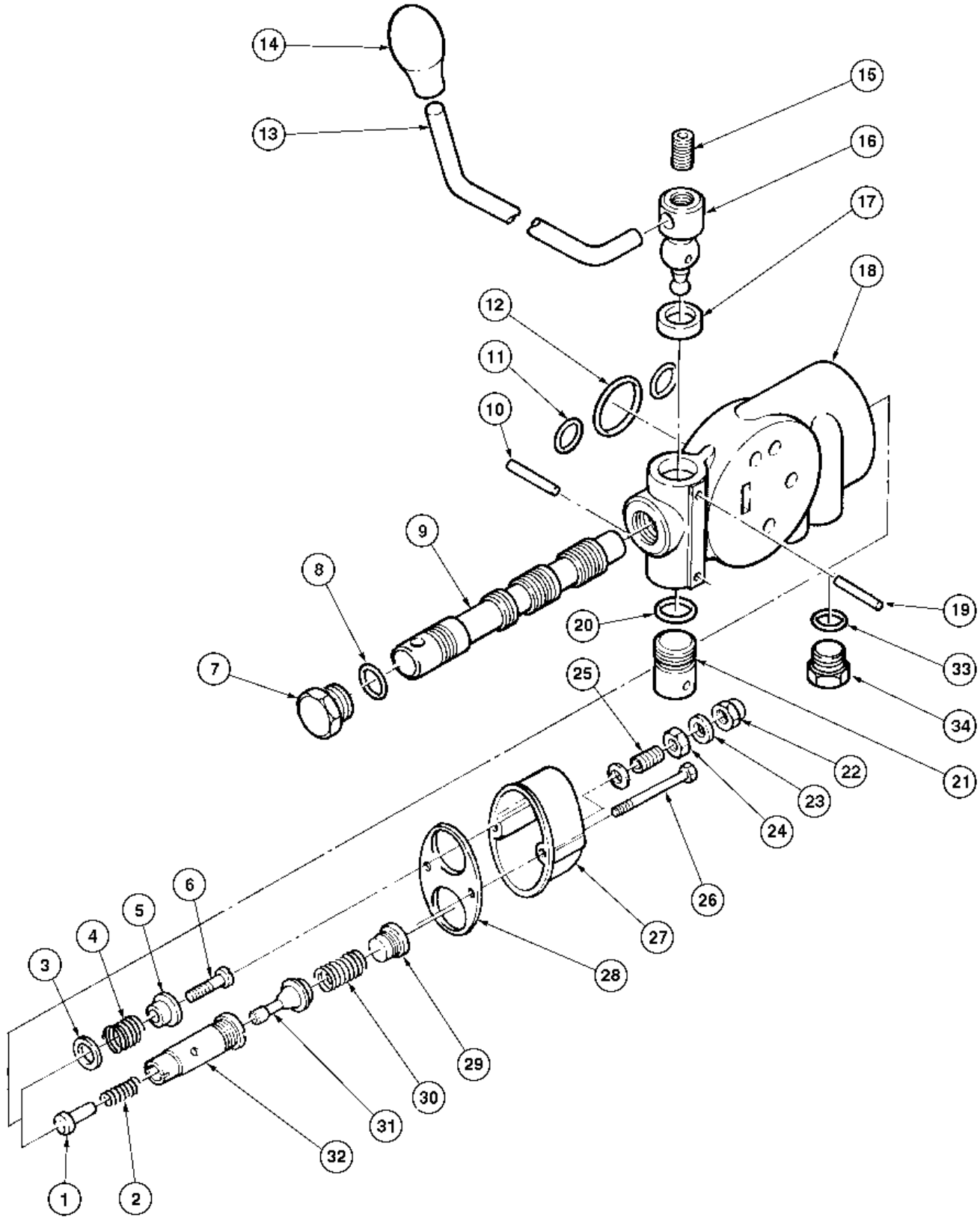
Spools and housings are matched and must be replaced as a unit. Use new O-rings and seals during assembly. Damaged or used O-rings and seals will leak.

[4] - Lubricate all internal parts with clean transmission/hydraulic oil during assembly.

[5] - Install all parts.

[6] - Install SCV to rockshaft case.

Disassemble, Inspect and Assemble Selective Control Valve (Single Acting SCV)



Drawing, single acting SCV

LEGEND:

1	Check valve
2	Spring

3	Washer
4	Spring
5	Retainer
6	Screw
7	Plug
8	O-ring
9	Spool
10	Spring pin
11	O-ring (2 used)
12	O-ring
13	Control lever
14	Knob
15	Allen screw
16	Arm
17	Seal
18	Housing
19	Pin
20	O-ring
21	Plug
22	Cap nut
23	Copper washer (2 used)
24	Jam nut
25	Adjuster
26	Screw (2 used)
27	Cover
28	Gasket
29	Spring holder
30	Spring
31	Relief valve
32	Valve seat
33	O-ring
34	Plug

[1] - Remove SCV from rockshaft case (see procedure in this group).

[2] - Remove parts (1 - 34).

[3] - Inspect all parts for wear or damage. Replace as necessary.

IMPORTANT:

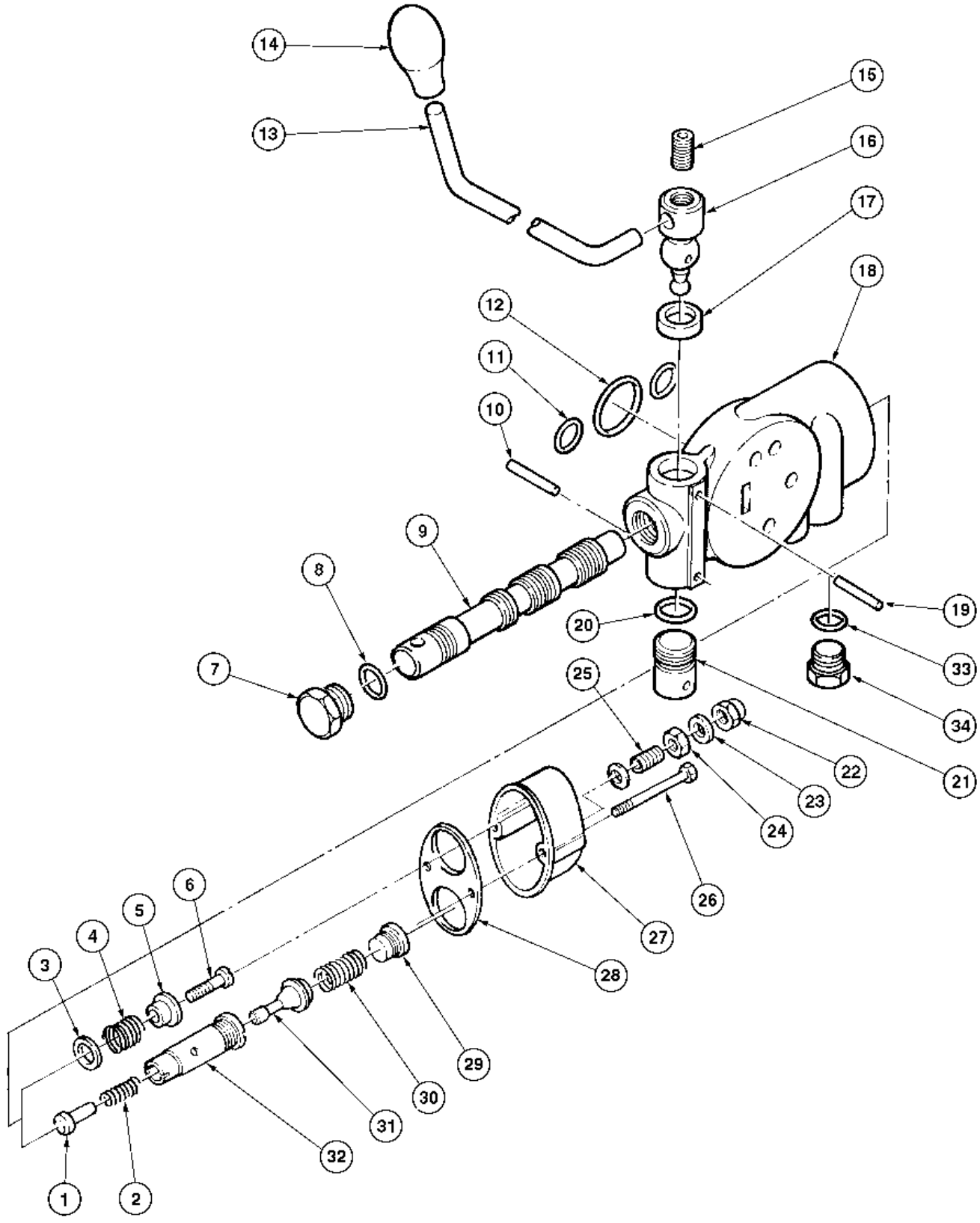
Spools and housings are matched and must be replaced as a unit. Use new O-rings and seals during assembly. Damaged or used O-rings and seals will leak.

[4] - Lubricate all internal parts with clean transmission/hydraulic oil during assembly.

[5] - Install all parts.

[6] - Install SCV to rockshaft case.

Disassemble, Inspect and Assemble Selective Control Valve (With Floating Position)



Drawing, single acting SCV

LEGEND:

1	Check valve
2	Spring

3	Washer
4	Spring
5	Retainer
6	Screw
7	Lock nut
8	Adjuster
9	Cover
10	Adjuster
11	Lock nut
12	Ball (2 used)
13	Inner spring
14	Outer spring
15	O-ring
16	Ball (6 used)
17	Spool
18	Spring pin
19	O-ring (2 used)
20	O-ring
21	Control lever
22	Knob
23	Allen screw
24	Arm
25	Seal
26	Housing
27	Pin
28	O-ring
29	Plug
30	Cup nut
31	Copper washer (2 used)
32	Lock nut
33	Adjuster
34	Screw (2 used)
35	Cover
36	Gasket
37	Spring holder
38	Spring
39	Relief valve

[1] - Remove SCV from rockshaft case (see procedure in this group).

[2] - Remove parts (1 - 39).

[3] - Inspect all parts for wear or damage. Replace as necessary.

IMPORTANT:

Spools and housings are matched and must be replaced as a unit. Use new O-rings and seals during assembly. Damaged or used O-rings and seals will leak.

[4] - Lubricate all internal parts with clean transmission/hydraulic oil during assembly.

[5] - Install all parts.

[6] - Install SCV to rockshaft case.

Inspect and Replace Hydraulic Hoses (SCV)

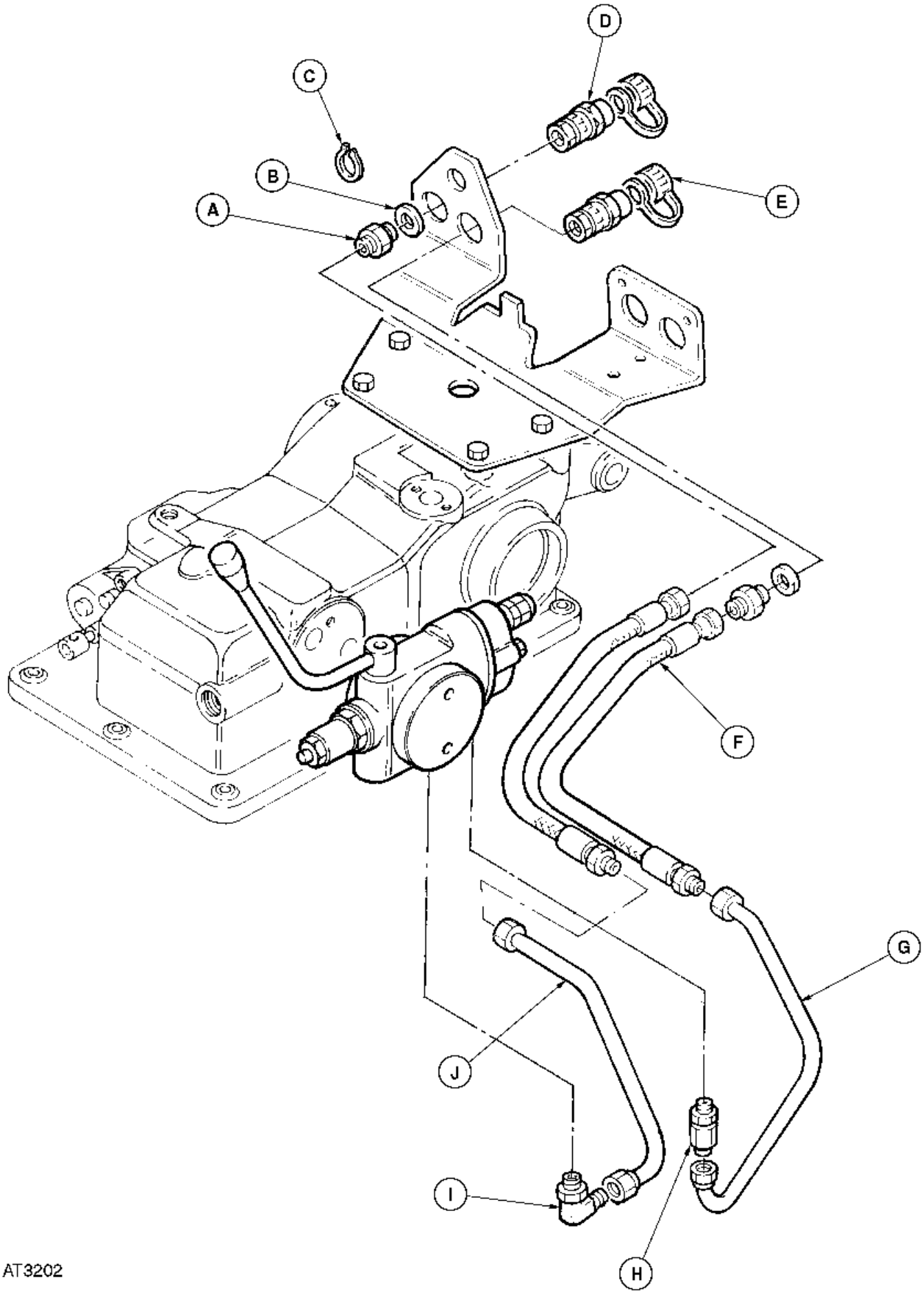
[1] - Operate SCV lever to relieve any pressure in the system.

[2] - Inspect hoses and fittings. Replace worn or damaged parts. Replace hoses that are cracked, soft or swollen.

[3] - Start engine. Operate SCV lever. Check for leaks and correct hose routing.

[4] - Adjust transmission/hydraulic oil to correct level with proper oil (see “Fuel, Lubricants and Coolant” in Section 10).

Routing of SCV hydraulic hoses



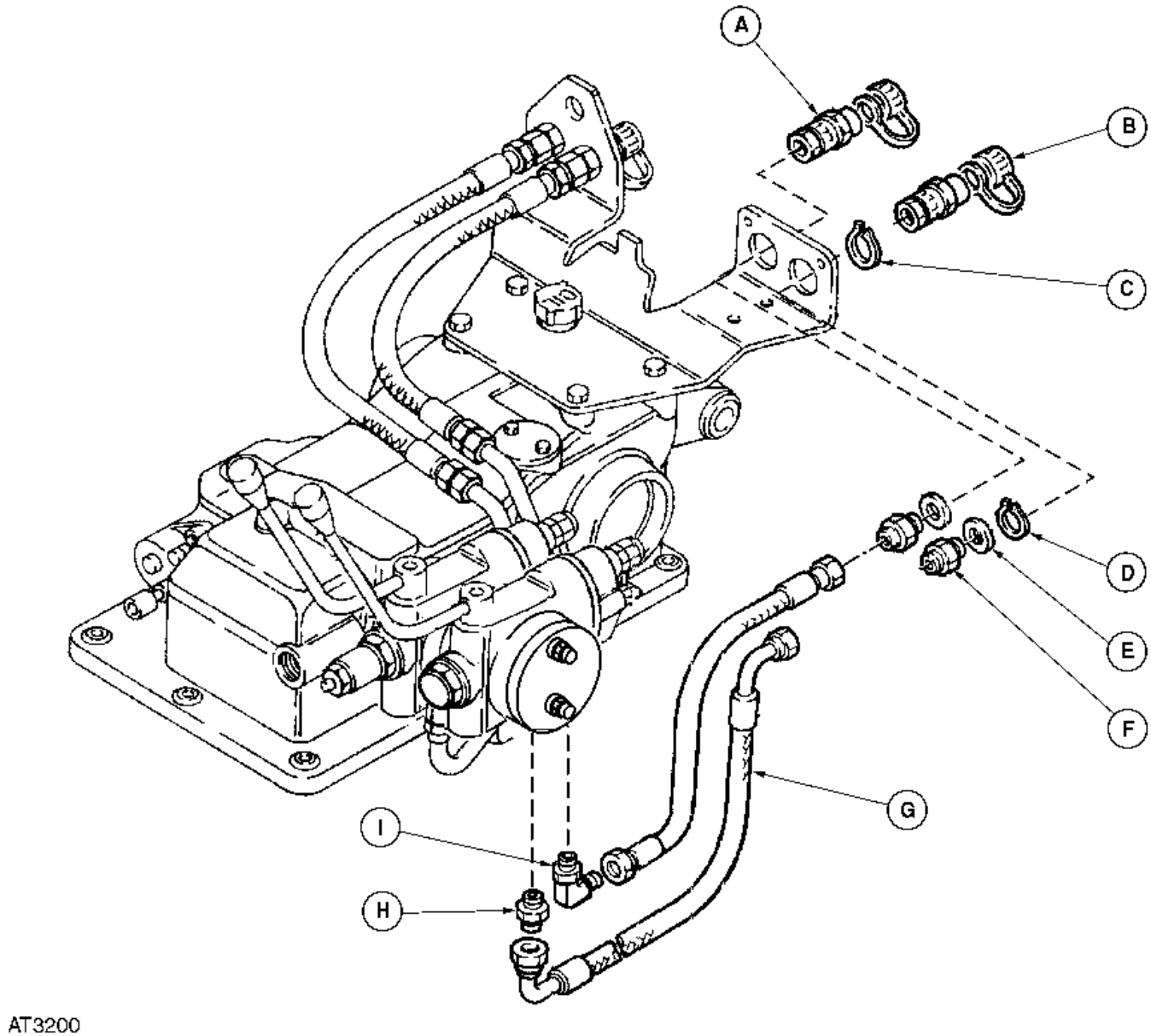
Routing of SCV hydraulic hoses

LEGEND:

A	Fitting (2 used)

B	Spacer (2 used)
C	Snap Ring (4 used)
D	Push-Pull Coupler (2 used)
E	Plug (2 used)
F	Hoses (2 used)
G	Hydraulic Line
H	Fitting
I	Fitting
J	Hydraulic Line

Routing of Double Acting SCV hydraulic hoses (Pos. 2)



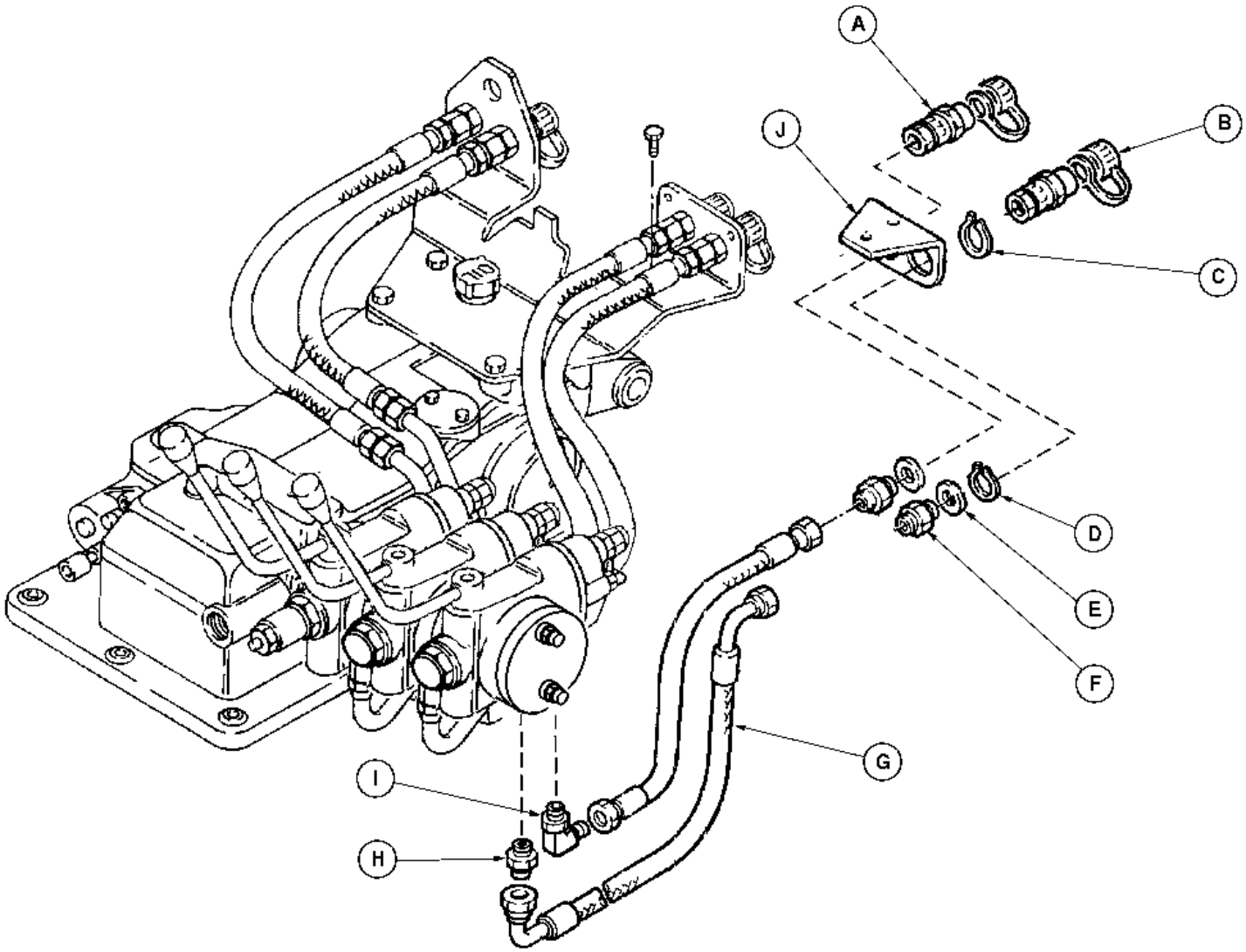
AT3200

Routing of Double Acting SCV hydraulic hoses (Pos. 2)

LEGEND:

A	Push-Pull Coupler (2 used)
B	Plug (2 used)
C	Snap Ring (2 used)
D	Snap Ring (2 used)
E	Spacer (2 used)
F	Fitting (2 used)
G	Hoses (2 used)
H	Fitting
I	Fitting

Routing of Double Acting SCV hydraulic hoses (Pos. 3)



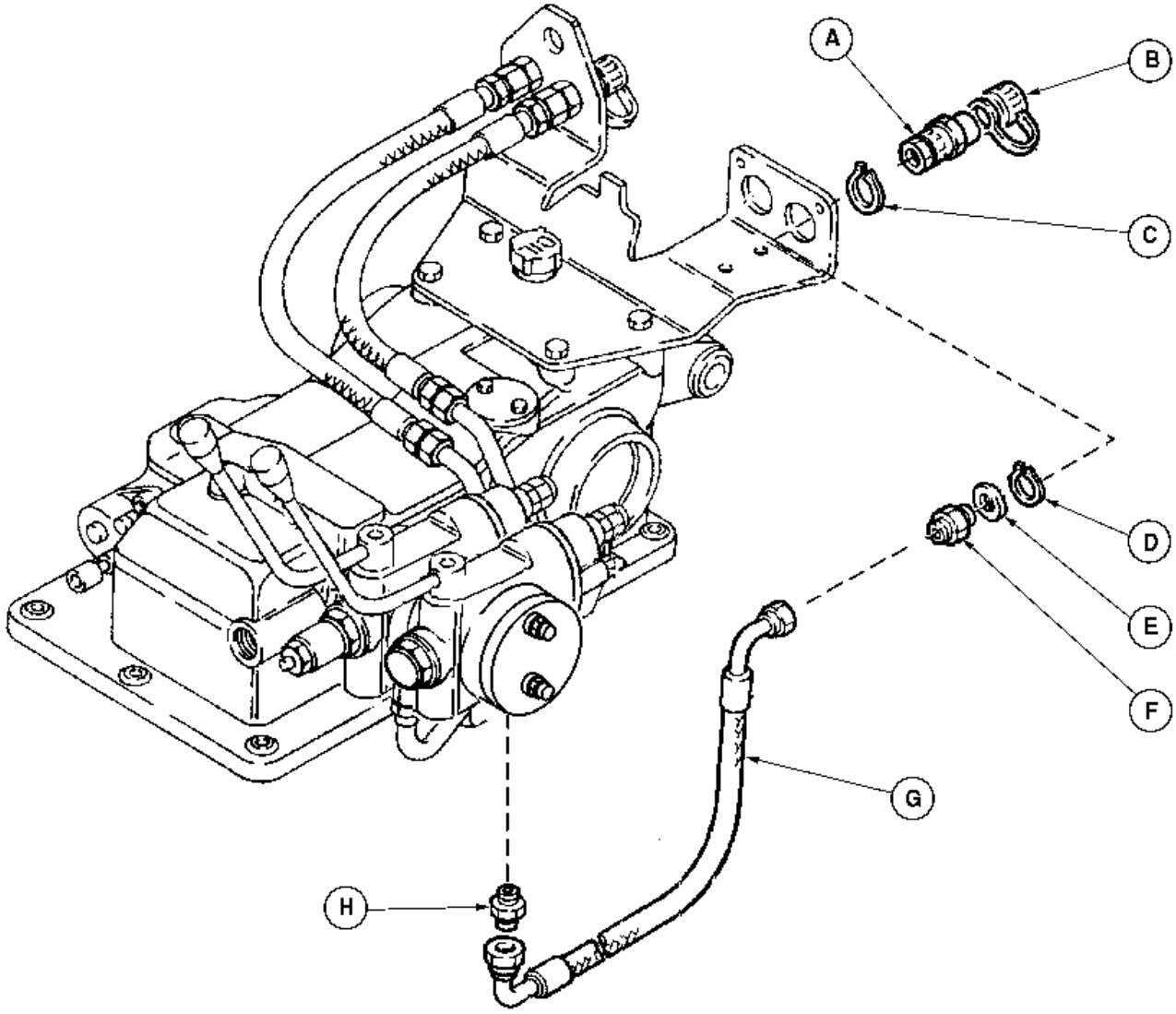
AT3201

Routing of Single Acting SCV hydraulic hoses (Pos. 2)

LEGEND:

A	Push-Pull Coupler (2 used)
B	Plug (2 used)
C	Snap Ring (2 used)
D	Snap Ring (2 used)
E	Spacer (2 used)
F	Fitting (2 used)
G	Hoses (2 used)
H	Fitting
I	Fitting
J	Bracket

Routing of Single Acting SCV hydraulic hoses (Pos. 2)



AT3199

Routing of Single Acting SCV hydraulic hoses (Pos. 2)

LEGEND:

A	Push-Pull Coupler
B	Plug
C	Snap Ring
D	Snap Ring
E	Spacer
F	Fitting
G	Hoses
H	Fitting

Section 80 - MISCELLANEOUS - REPAIR

Table of contents

Group 05 - Front Axle (Without MFWD)

Special or Essential Tools

→NOTE:

Order tools according to information given in the U.S. SERVICEGARD ™ Catalog or in the European Microfiche Tool Catalog (MTC).

Specifications

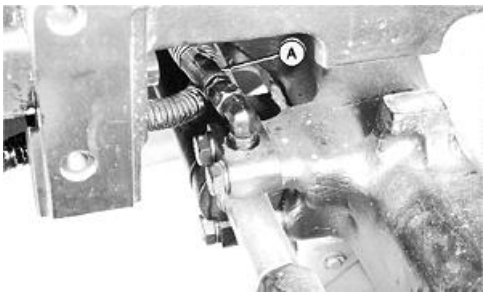
Item	Measurement	Specification
Spindle Nut	Torque	320 N·m
		236 lb-ft
Tie Rod End Nut	Torque	165 N·m
		122 lb-ft
Front Wheel Cap Screws	Torque	175 N·m
		130 lb-ft

Remove and Install Front Axle-2WD

[1] - Raise front of tractor and remove front wheels.

[2] - Install support stands under front of clutch housing.

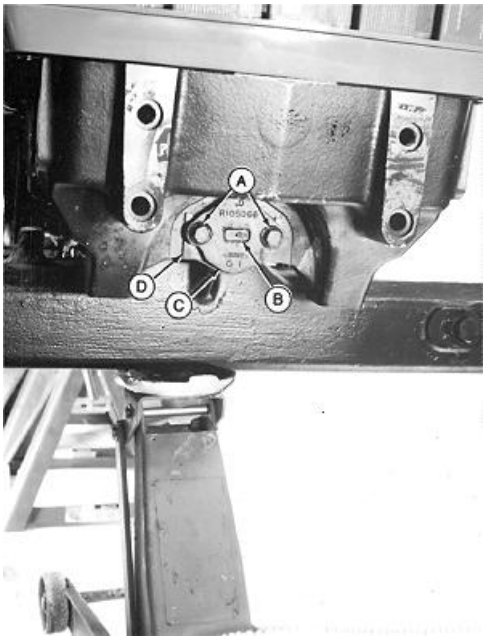
[3] -



Hydraulic Hose

Disconnect hydraulic hose (A) from both ends of steering cylinder. Close all openings using caps and plugs.

[4] -



LEGEND:

A	Cap Screws (2 used)
B	Pivot Pin
C	Retainer
D	Shims (3 used)

Access Front Axle-2WD

Place a floor jack under center of axle.

[5] - Remove cap screws (A).

[6] - Remove retainer (C) and shims (D).

[7] - Remove pivot pin (B).

[8] - Remove axle.

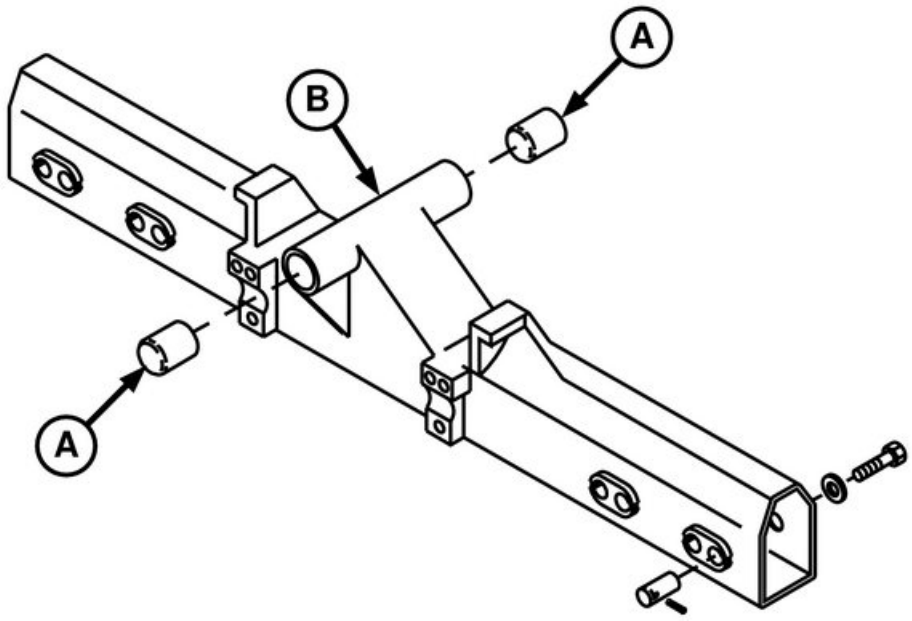
[9] - Inspect axle, pivot pin and bushings. Make repairs as necessary (see procedure in this group).

[10] - Install axle. Lift axle into place and align axle housing hole with pivot pin hole.

[11] - Install pivot pin.

[12] - Install retainer (C), shims (D) and cap screws (A). Before tightening cap screws, check axle end play.

Inspect and Replace Pivot Pin and Bushings-2WD Axle



Bushings and Axle Pivot

[1] - Inspect pivot pin and bushings for wear or damage. Replace if necessary.

[2] - Remove bushings (A) from axle using a blind hole puller set.

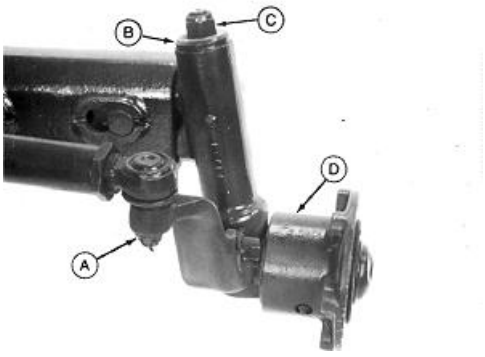
[3] -

→NOTE:

Make sure lubrication holes in bushings (A) align with lubrication holes in axle pivot (B).

Install new bushings flush with axle surface using a bushing, bearing and seal driver set.

Remove and Install Spindle Assembly-2WD Axle



LEGEND:

A	Lock Nut
B	Washer
C	Nut
D	Spindle Assembly

Spindle Assembly-2WD Axle

CAUTION:

Block pivoting front axle to prevent pinching and personal injury.

[1] - Install a small block of wood between front axle and tractor frame on both sides.

[2] - Lift and support front of tractor. Remove wheel.

[3] -

→NOTE:

Tie rod end is a tapered bore fit. Use a ball joint fork or puller to ease removal.

Remove lock nut (A). Remove tie rod end from spindle arm.

[4] - Remove nut (C) and washer (B) to remove spindle assembly (D).

[5] - Inspect spindle shaft for wear or damage. Replace if necessary.

[6] - Inspect spindle shaft bushings for wear or damage (see procedure in this group).

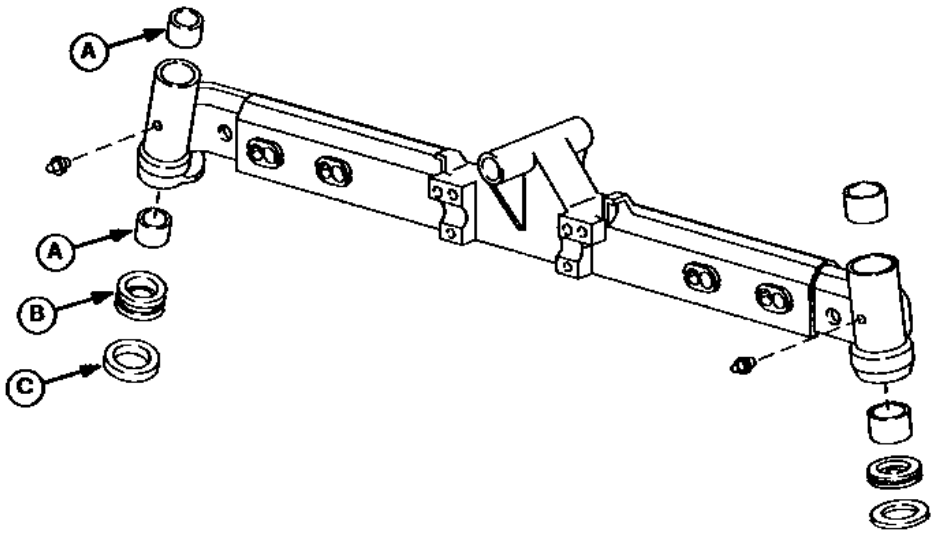
[7] - Install spindle, washer, and nut. Tighten nut to specification.

[8] - Connect tie rod end. Install and tighten nut to specification.

[9] - Install wheel and tighten wheel cap screws to specification.

Item	Measurement	Specification
Spindle Nut (C)	Torque	320 N·m
		236 lb-ft
Tie Rod End Nut (A)	Torque	165 N·m
		122 lb-ft
Wheel Cap Screws	Torque	175 N·m
		130 lb-ft

Inspect and Replace Spindle Shaft Bushings-2WD Axle



Spindle Shaft Bushings-2WD Axle

[1] - Inspect bearings (B) for wear or damage. Bearings must rotate smoothly and freely. Replace if necessary.

[2] - Inspect spindle shaft and bushings (A) for scoring or damage. Replace if necessary.

[3] - Remove bushings from axle using a blind hole puller set.

[4] - Install new bushings and seals (C) using a bushing, bearing and seal driver set. Install seals with seal lips away from axle.

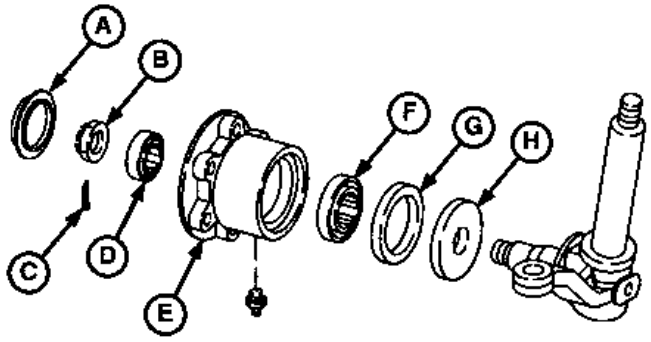
[5] - Apply multipurpose grease to all parts and assemble.

Group 10 - Front Wheel Bearings

Specifications

Item	Measurement	Specification
Cap screws, Wheel to Wheel Hub	Torque	175 N·m
		130 lb-ft

Inspect and Replace Front Wheel Bearings



LEGEND:

A	Cover
B	Retaining Nut
C	Cotter Pin
D	Outer Bearing Cup and Cone
E	Wheel Hub
F	Inner Bearing Cup and Cone
G	Seal
H	Spacer

Front Wheel Bearings

[1] - Remove wheel.

[2] - Remove cover (A), cotter pin (C), and nut (B) to remove wheel hub (E).

[3] - Remove bearing cones and cups (D and F) and seal (G) using a brass drift and hammer or puller.

[4] - Remove spacer (H) using a puller.

[5] - Clean all parts and allow to air dry.

[6] - Inspect parts for wear or damage. Replace as necessary.

[7] - Pack bearing cones with multipurpose grease.

[8] - Install inner and outer bearing cups into hub using a bearing, bushing and seal driver set.

[9] - Position the inner bearing cone on the inner cup. Install seal (G) with lips of seal toward the inner bearing. Install using a bearing, bushing and seal driver set.

[10] - Install spacer (H) onto spindle with the small OD of spacer facing outwards, away from spindle.

11 Install hub assembly, outer bearing cone, washer, and nut. Tighten nut until a slight drag is felt while turning hub. Back off nut just enough to install cotter pin in hole of spindle.

[11] - Apply flexible sealant to mating surfaces of cover (A) and hub (E). Install cover.

[12] - Install wheel. Tighten cap screws to the specified toque.

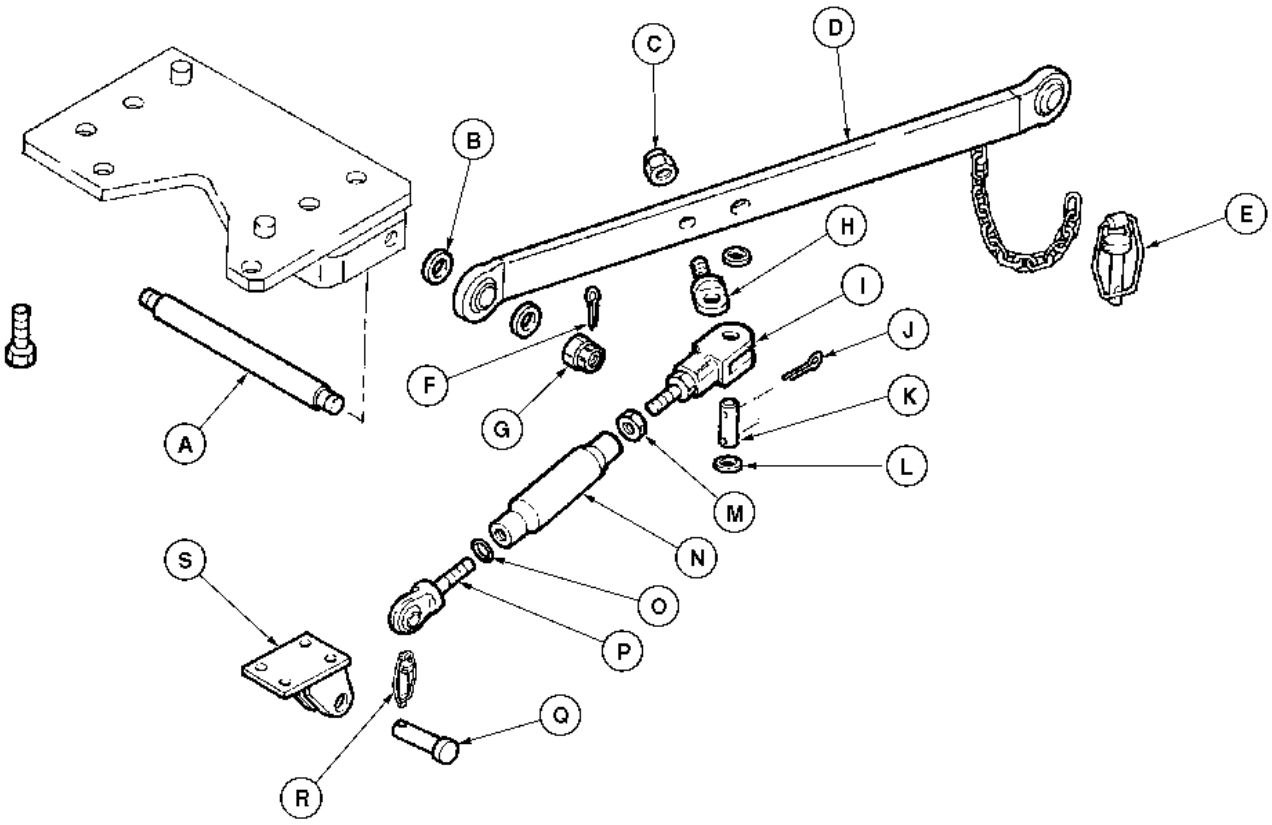
Item	Measurement	Specification
Cap screws, Wheel to Wheel Hub	Torque	175 N·m 130 lb-ft

Group 15 - Three-Point Hitch

Inspect and Repair Draft Links

Inspect draft assembly for wear or damage. Replace as necessary.

Draft Links



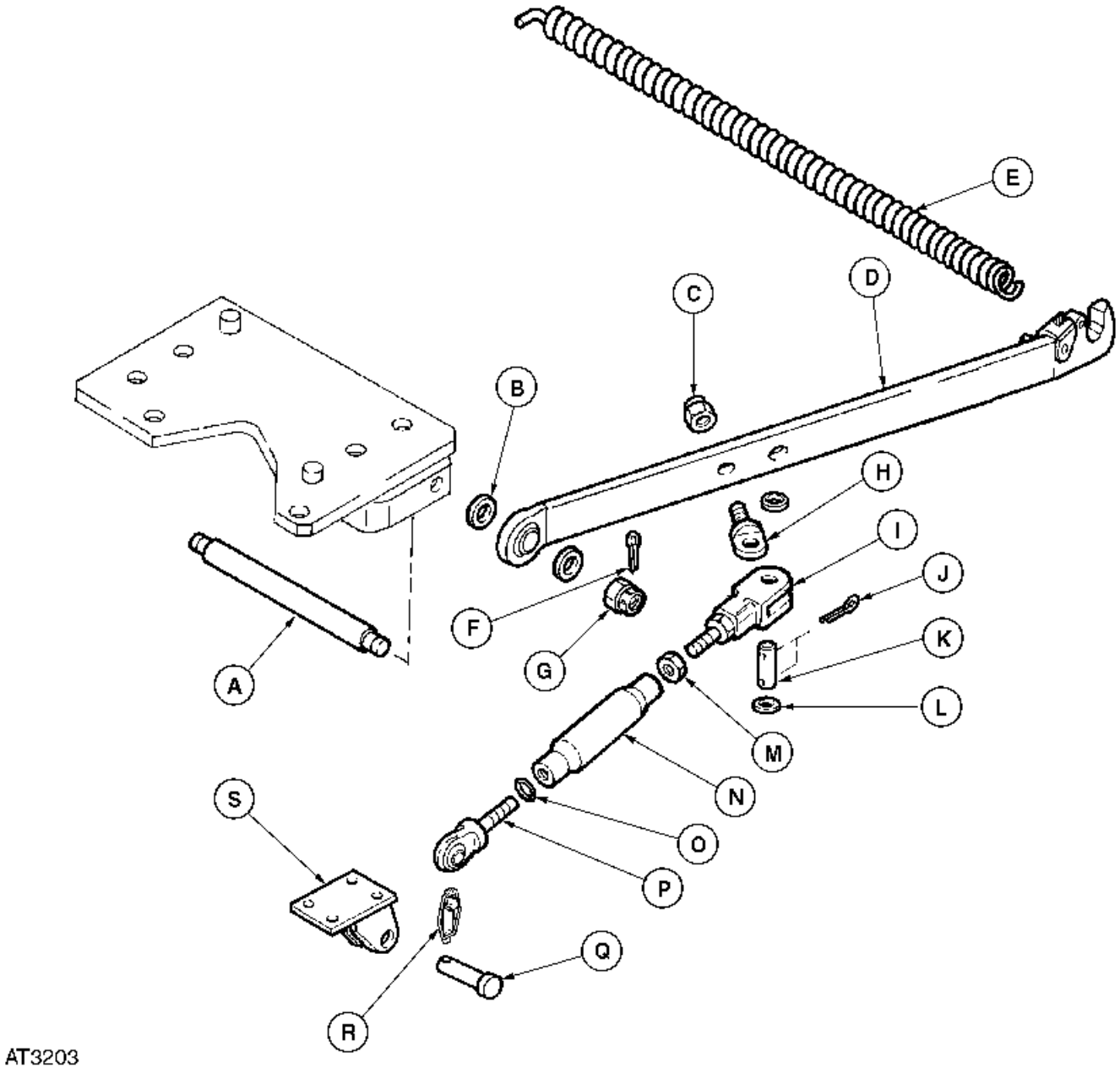
AT2125

Draft Links

LEGEND:

A	Cross Shaft
B	Washer (2 used)
C	Nut
D	Draft Arm
E	Quick-Lock Pin
F	Cotter Pin
G	Nut
H	Screw
I	Sway Link End
J	Cotter Pin (2 used)
K	Pin
L	Washer (2 used)
M	Lock Nut
N	Sway Link Body
O	Ring
P	Sway Link End
Q	Pin
R	Quick-Lock Pin
S	Support

Draft Links with Hook



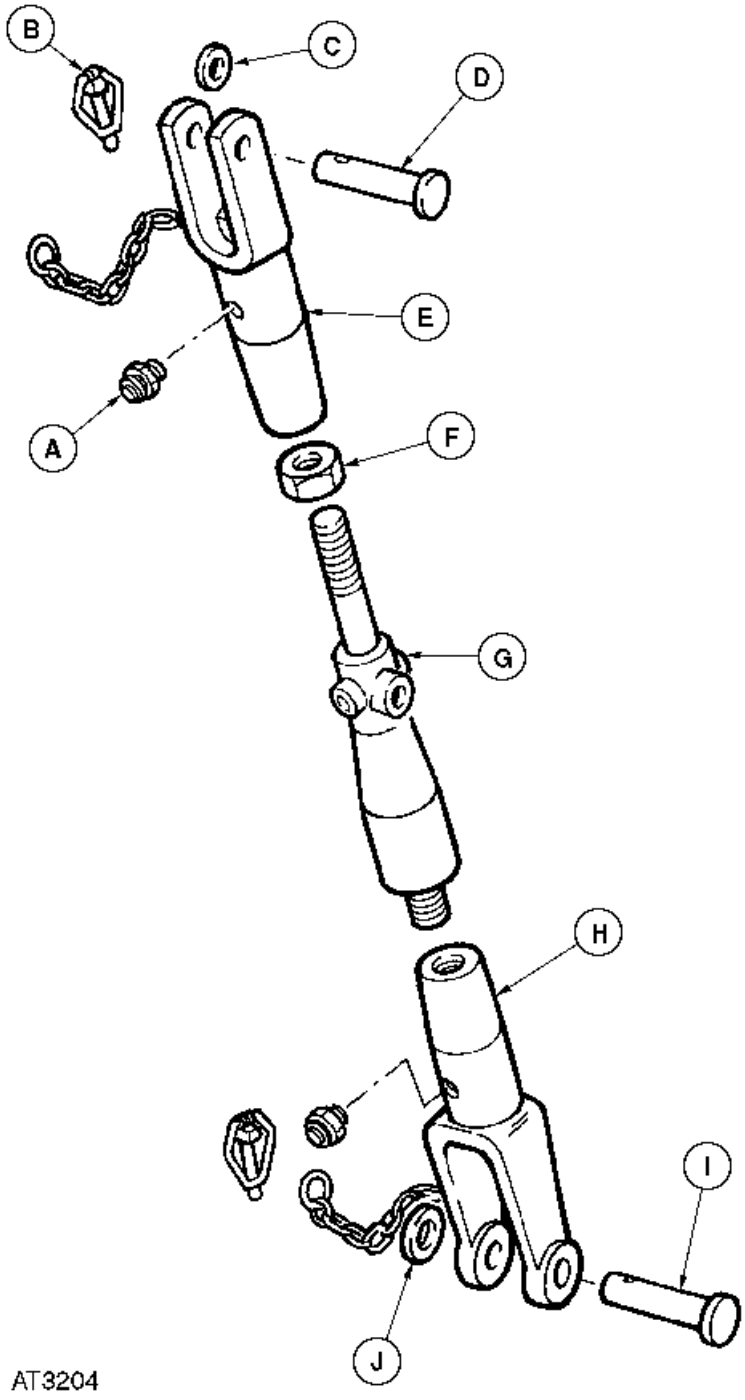
Draft Links with Hook

LEGEND:

A	Cross Shaft
B	Washer (2 used)
C	Nut
D	Draft
E	Spring
F	Cotter Pin
G	Nut
H	Screw
I	Sway Link End
J	Cotter Pin (2 used)
K	Pin
L	Washer (2 used)
M	Lock Nut
N	Sway Link Body
O	Ring
P	Sway Link End
Q	Pin
R	Quick-Lock Pin

S	Support

Inspect and Repair Adjustable Lift Link



Adjustable Lift Link

LEGEND:	
A	Lubrication Fitting (2 used)
B	Quick-Lock Pin (2 used)
C	Washer
D	Pin
E	Lift Link End
F	Lock Nut
G	Link Rod
H	Lift Link End
I	Pin
J	Washer

[1] - Inspect adjustable lift link assembly for wear or damage. Replace as necessary.

[2] - Lubricate lift link assembly at fittings (A) using multipurpose grease.

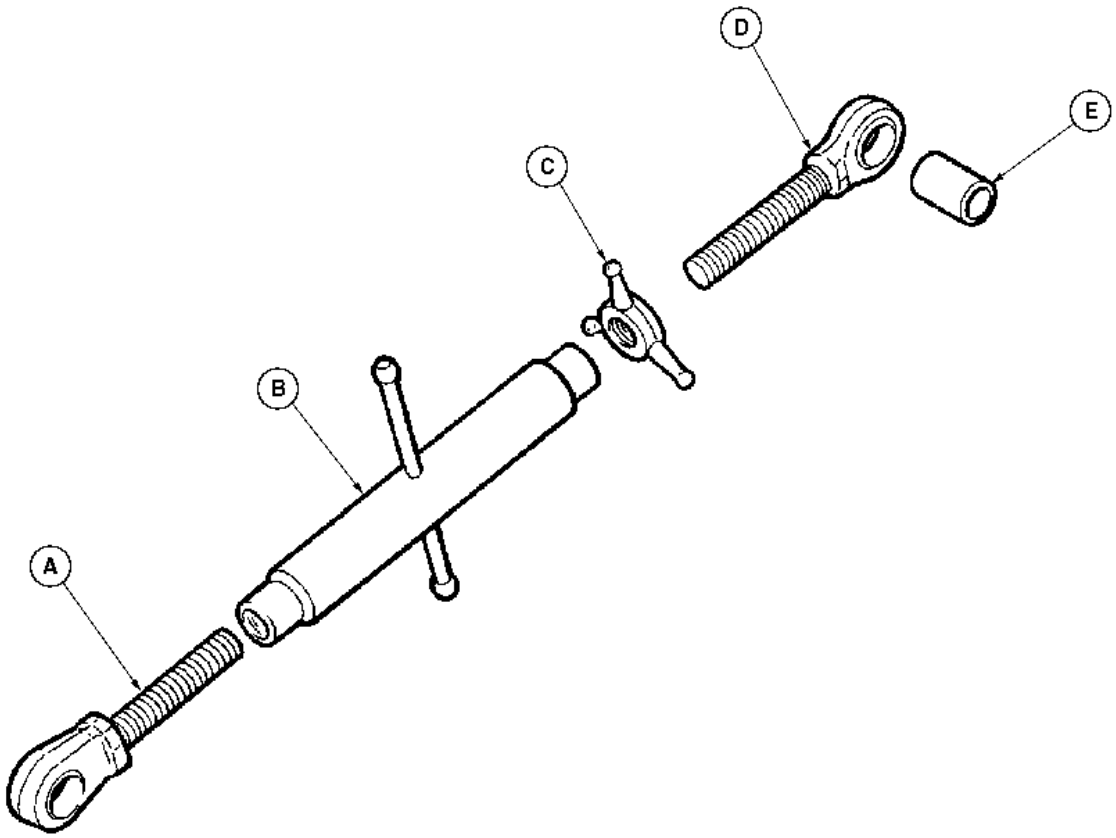
Inspect and Repair Center Link

[1] - Disassemble all parts.

[2] - Inspect all parts for wear or damage. Replace as necessary.

[3] - Apply multipurpose grease to inner circumference at both ends of body (B).

[4] - Assemble all parts.

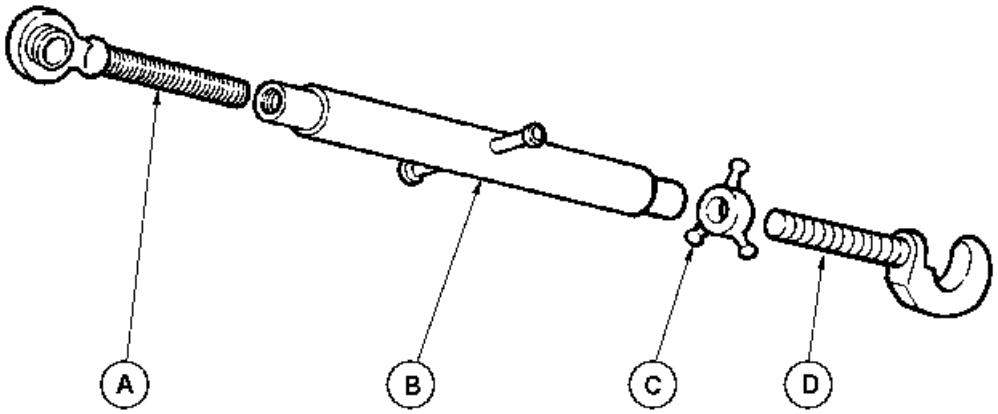


AT2127

Center Link

LEGEND:

A	Center Link End
B	Center Link Body
C	Ring Nut
D	Center Link End
E	Bushing



AT3205

Center Link with Hook

LEGEND:

A	Center link end
B	Center link body
C	Ring nut
D	Center link end

Section 90 - OPERATOR'S CAB AND OPEN OPERATOR'S STATION - REPAIR

Table of contents

Group 00 - Removing and Installing the Operator′s Cab

Service Equipment and Tools

→NOTE:

Order tools according to information given in the U.S. SERVICEGARD ™ Catalog or from the European Microfiche Tool Catalog (MTC). Some tools may be available from a local supplier.

Specifications

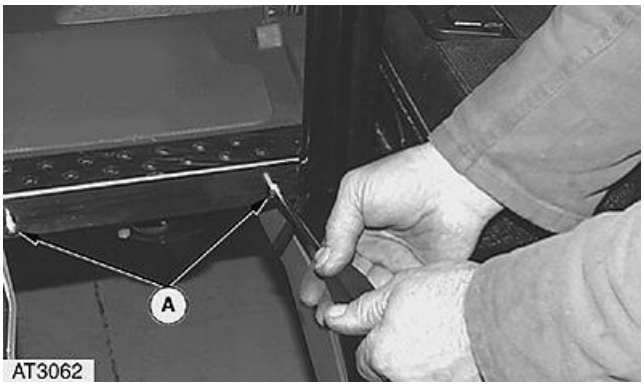
Item	Measurement	Specification
Nuts, cab silent blocks to cab supports	Torque	220 N·m
		165 lb-ft
Bolts, rear wheel to axle flange	Torque	400 N·m
		300 lb-ft
Bolts, front wheel to axle flange (MFWD)	Torque	300 N·m
		220 lb-ft

Removing the Operator's Cab

→NOTE:

5500 tractor with air conditioning and oil cooler shown.

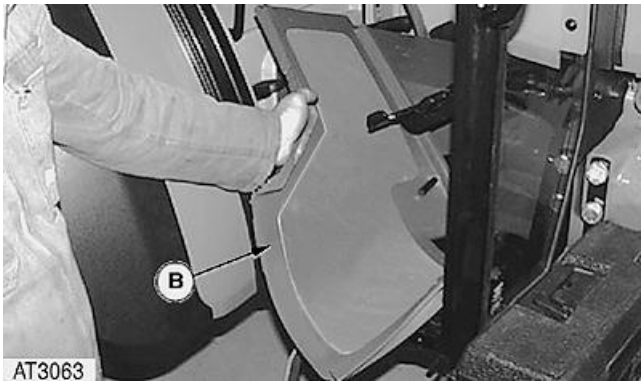
[1] - Disconnect battery.



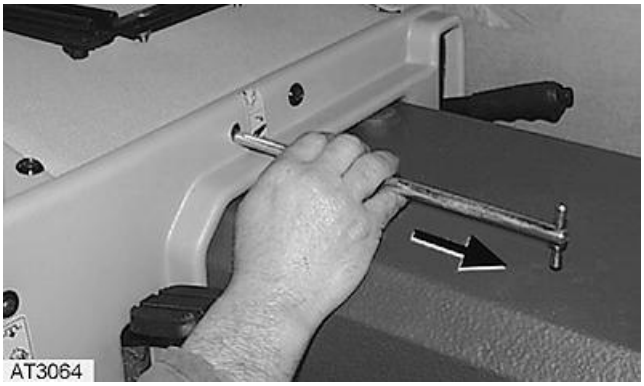
LEGEND:

A	Screws
B	Footboard
C	Wallboard
D	Rubber cover

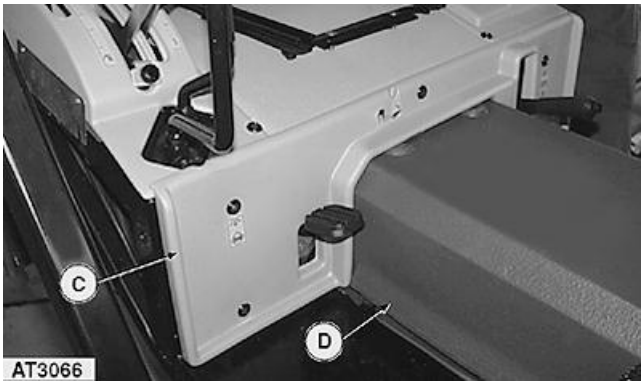
Remove screws



Remove footboard



Remove cotter pin



Remove wallboard and rubber cover

[2] - Evacuate air conditioning system.

[3] - Drain fuel tank.

[4] - Remove both rear wheels.

[5] - Remove rear fenders. (See in this Section)

[6] - Remove operator′s seat. (See in this Section)

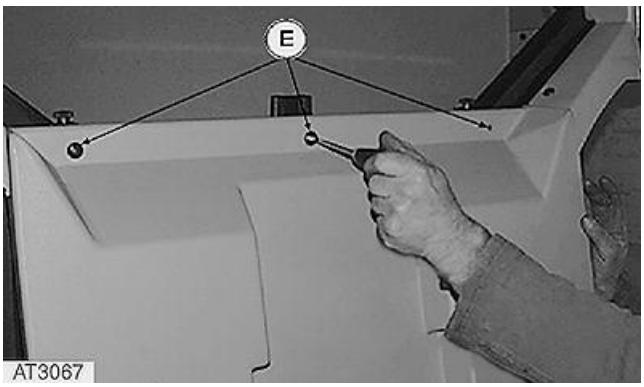
[7] - Unscrew screws (A) and remove footboard (B) from each side.

[8] - Remove cotter pin and slid out rockshaft rate-of-drop valve.

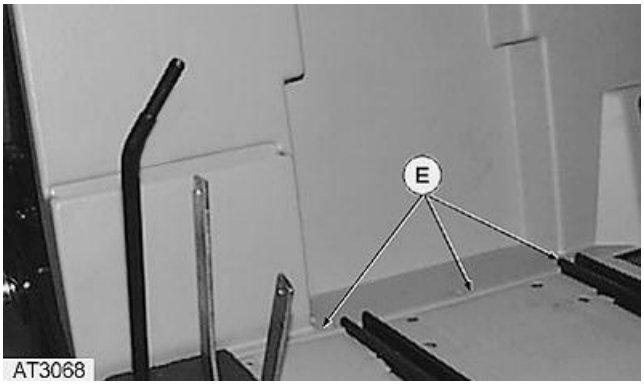
[9] - Remove wallboard (C), foam pad and rubber cover(D).

[10] - Remove molding of control lever (see procedure in this Section).

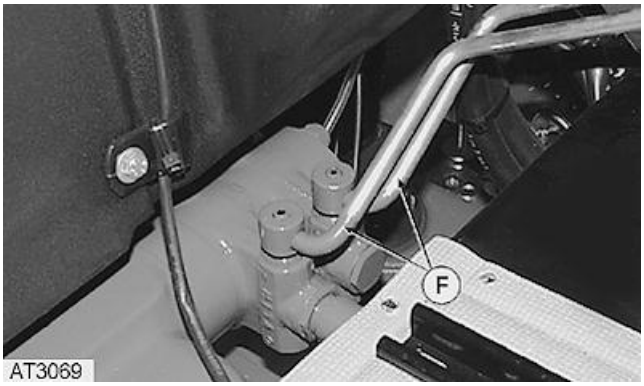
[11] - Unscrew fixing screws (E) (6 used) and remove wallboard of fuel tank.



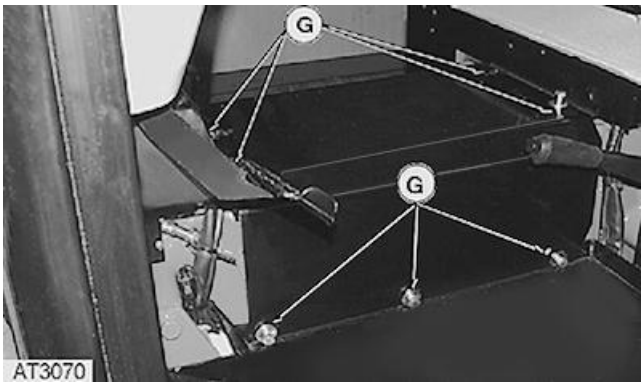
Unscrew fixing screws



Unscrew fixing screws



Remove SCV levers

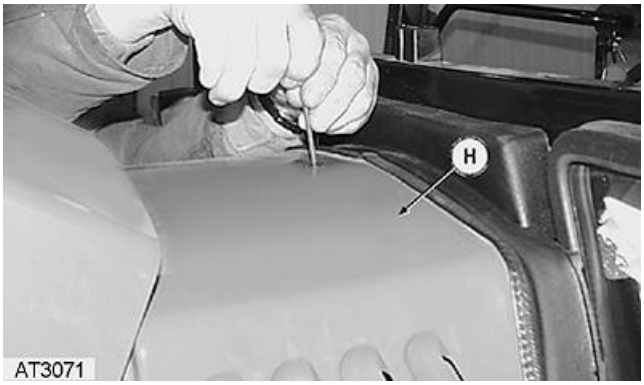


Unscrew fixing bolts

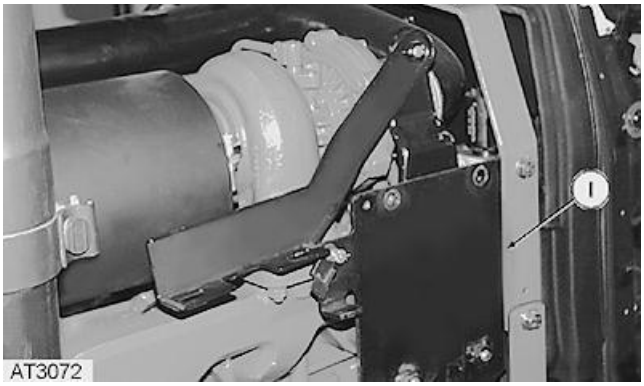
[12] - Remove SCV levers (F).

[13] - Unscrew fixing bolts (G) (10 used) and remove footboard with its foam pad.

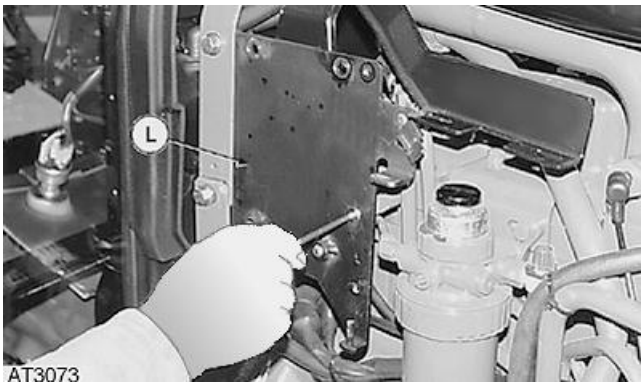
[14] - Remove instrument panel and front side shields (see procedure in this Section).



Remove instrument panel



Remove plates



Remove plates

[15] - Remove motor side shields (H) and hood.

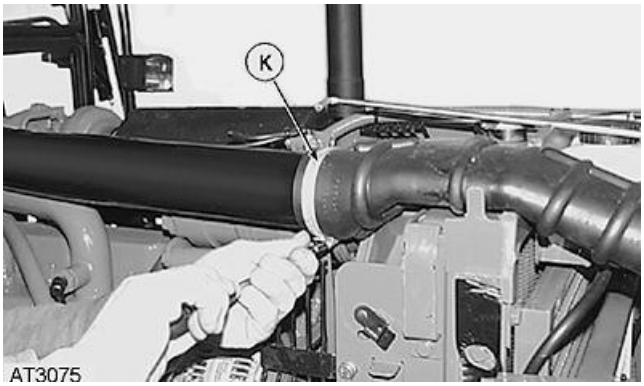
[16] - Remove plates (I) and (L) from each side of tractor.

[17] - Loosen clamps (J) and (K) and remove inlet pipe to turbocharger.

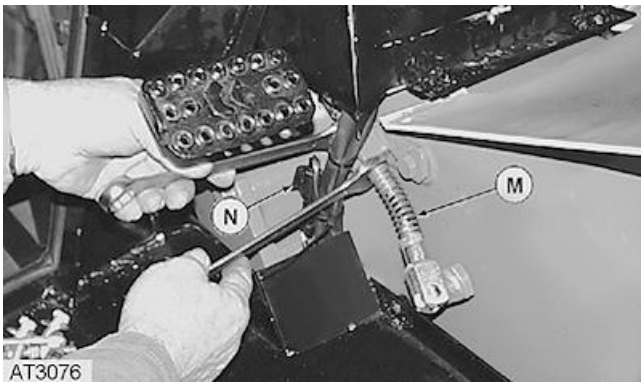
LEGEND:

J	Clamps
K	Clamps
M	Clutch control cable
N	Connector
O	PTO control cable
P	Bracket

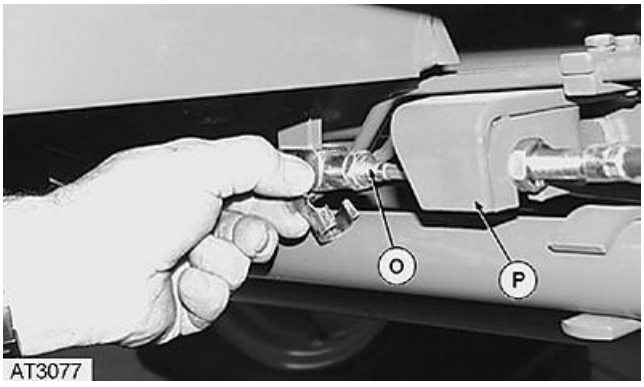
Remove inlet pipe



Remove clutch control cable



Disconnect connector



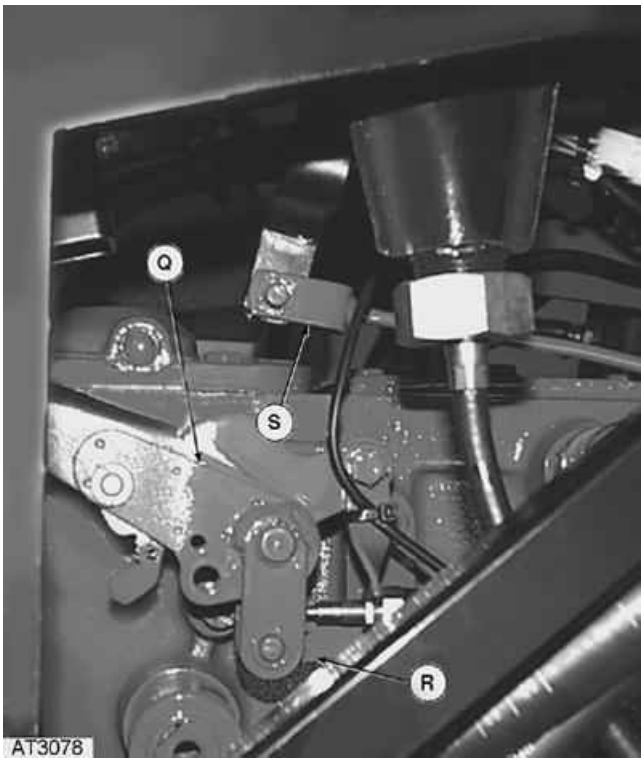
Remove PTO clutch control cable

[18] - Remove pin from the end of clutch control cable. Remove clutch control cable (M) from clutch housing bracket.

[19] - Disconnect connector (N).

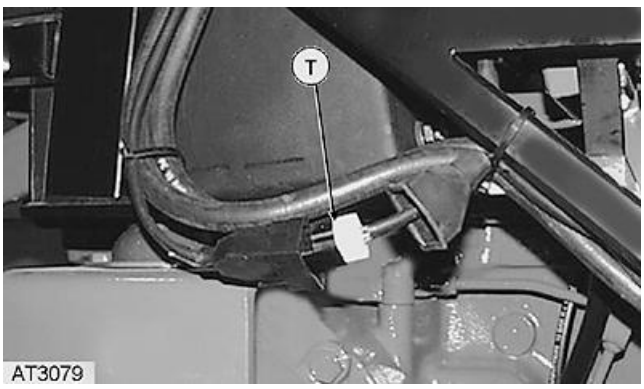
[20] - Remove clutch power take off control cable (O). Remove PTO clutch control cable from bracket (P).

[21] - Remove handbrake (Q) with control rod (R) and its switch.



[22] - Remove selector lever (PTO) control rod (S).

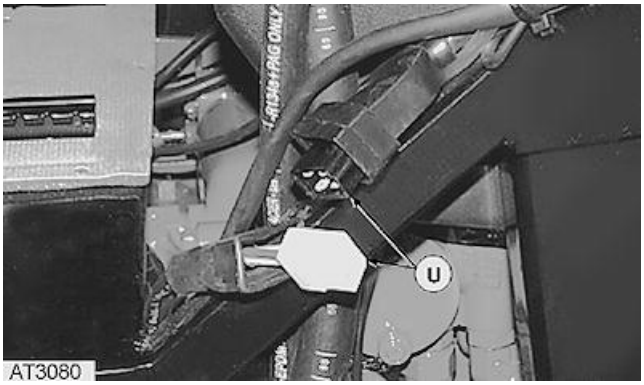
[23] - Disconnect wiring connector (T) on left side and wiring connector (U) on right side.



LEGEND:

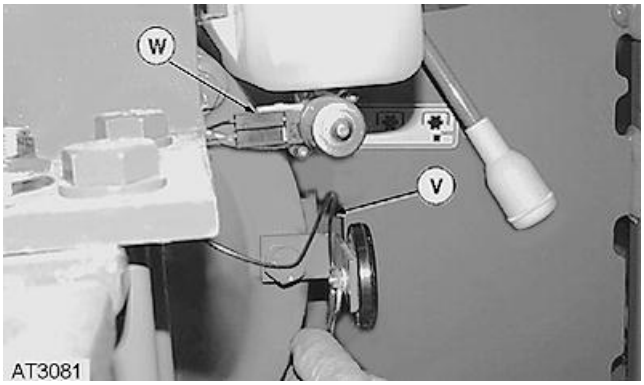
Q	Handbrake
R	Control rod
S	Control rod
T	Wiring connector
U	Wiring connector

Disconnect wiring connector

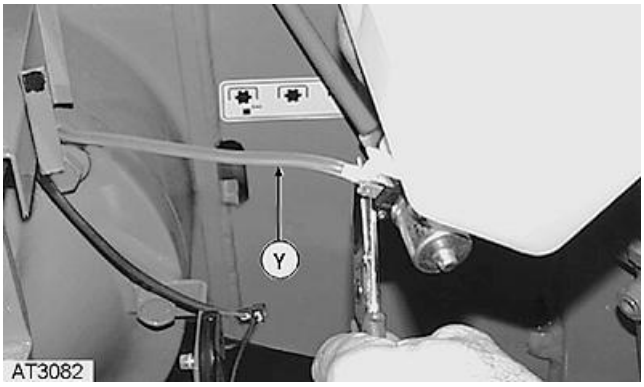


Wiring connector

[24] - Disconnect ground cable (V).



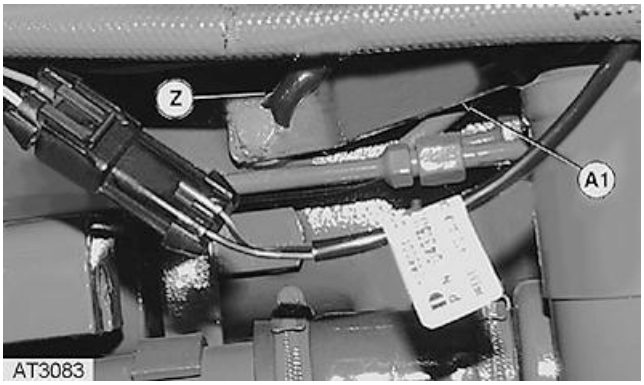
Disconnect ground cable



Remove pipe

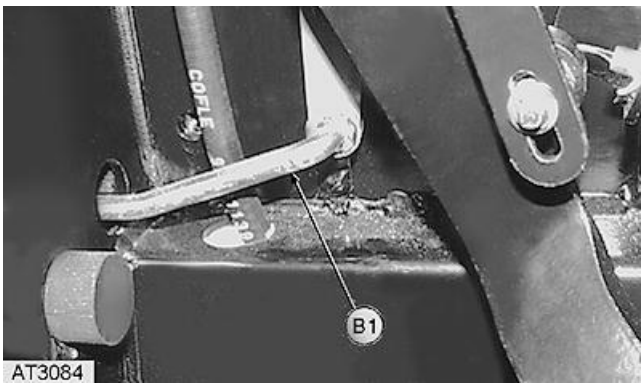
[25] - Drain and remove washer reservoir: Disconnect wiring connectors (W), remove pipe (Y) and slide washer reservoir.

[26] - Remove ground cable (Z) on dryer filter bracket (A1) (if equipped).



Remove ground cable and filter bracket

[27] - Remove throttle linkage rod (B1).

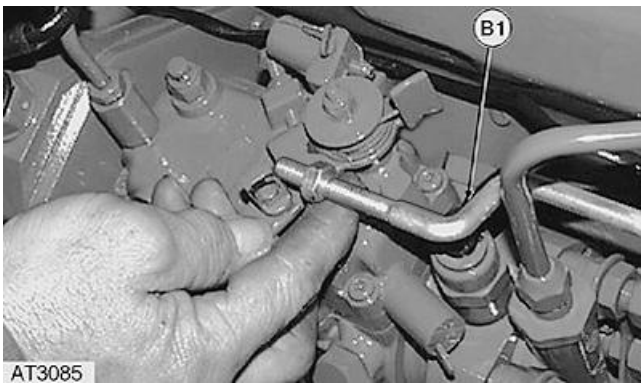


LEGEND:

V	Ground cable
W	Wiring connector
Y	Pipe
Z	Ground cable
A1	Dryer filter bracket
B1	Dryer filter bracket

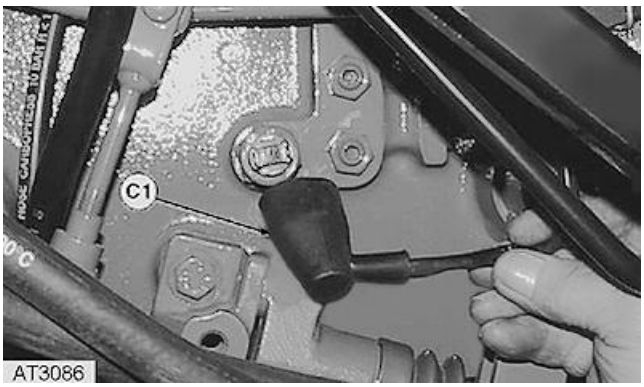
Remove throttle linkage rod

[28] - Remove throttle linkage rod (B1) from fuel injection pump.



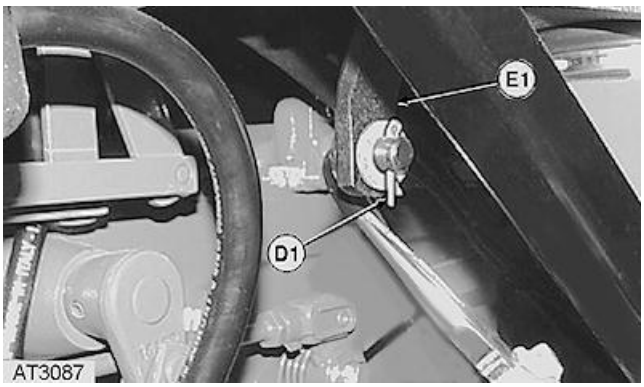
Remove throttle linkage rod

[29] - On right side of tractor disconnect neutral start switch (C1).



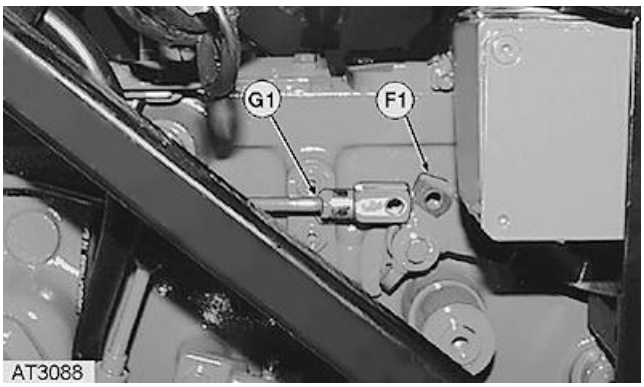
Disconnect neutral start switch

[30] - Remove split pin (D1) and slide out HI-LO control lever (E1).



Slide out HI-LO control lever

[31] - Remove differential lock pedal (F1) from control rod (G1).

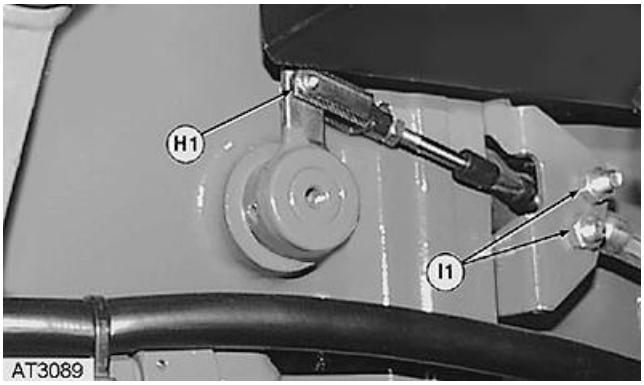


LEGEND:

B1	Throttle linkage rod
C1	Neutral start switch
D1	Split pin
E1	HI-LO control lever
F1	Differential lock pedal
G1	Control rod

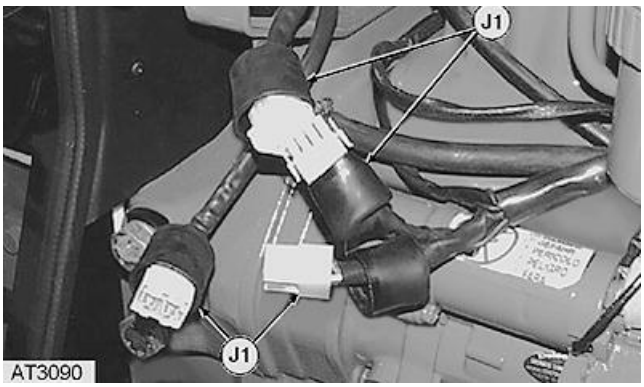
Remove differential lock pedal

[32] - Remove pin (H1). Loosen nut (I1) and slide forward/reverse cable.



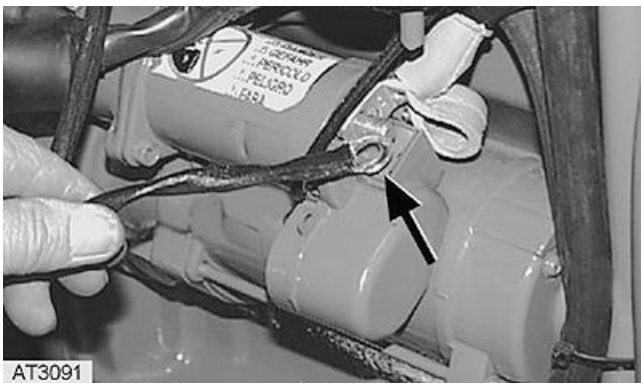
Remove pin

[33] - Disconnect main connectors (J1).



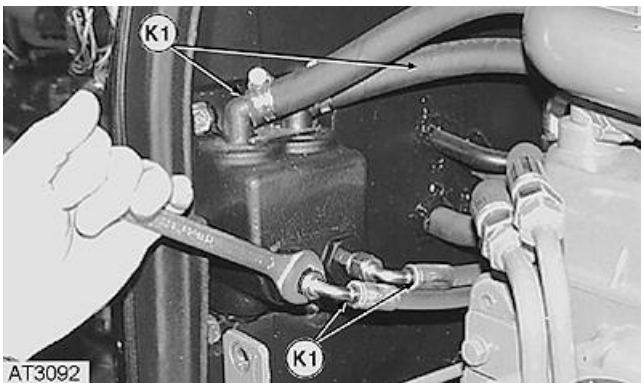
Disconnect main connectors

[34] - Disconnect wiring cable from starting motor.



Starting motor

[35] - Remove hydraulic lines (K1) from brake valve.

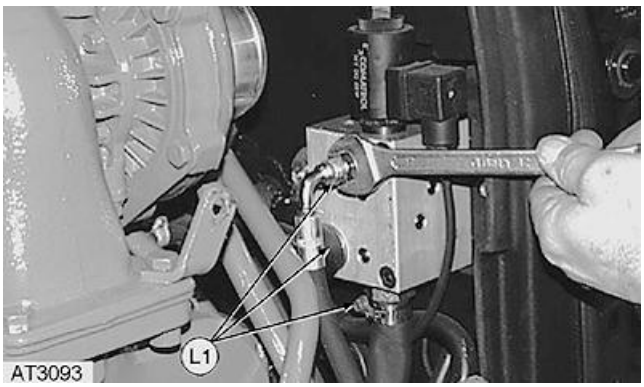


LEGEND:

H1	Pin
I1	Nuts
J1	Connectors
K1	Brake hydraulic lines

Brake valve

[36] - Remove hydraulic lines (L1) from MFWD solenoid valve.

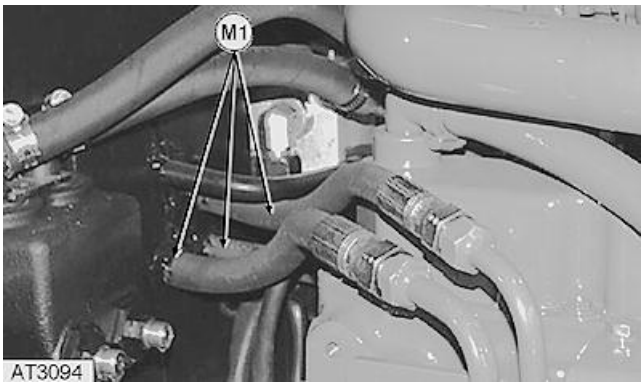


Remove hydraulic lines

→NOTE:

Hydraulic lines (K1 and L1) can be different for different versions. Tractor with 4 cylinder, with oil cooler shown.

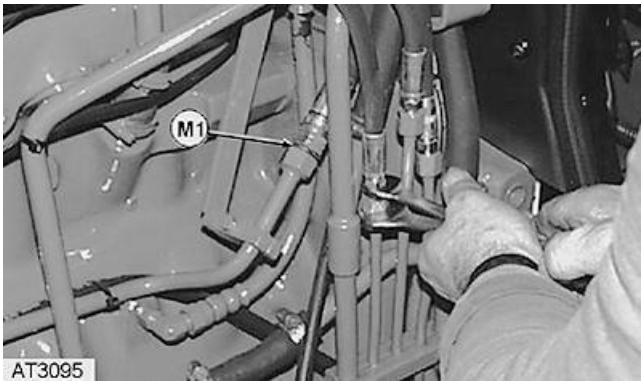
[37] - Remove steering hydraulic lines (M1).



LEGEND:

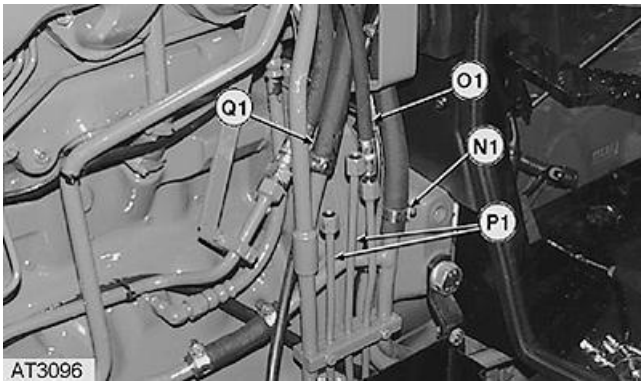
L1	MFWD solenoid valve hydraulic lines
M1	Steering hydraulic line
N1	Steering hydraulic line to cooler
O1	MFWD solenoid valve hydraulic line to MFWD clutch
P1	hydraulic lines to brake cylinder
Q1	hydraulic line to tank

Steering hydraulic lines



Steering hydraulic lines

[38] -



Remove hydraulic lines from L.H. side

Remove hydraulic lines:

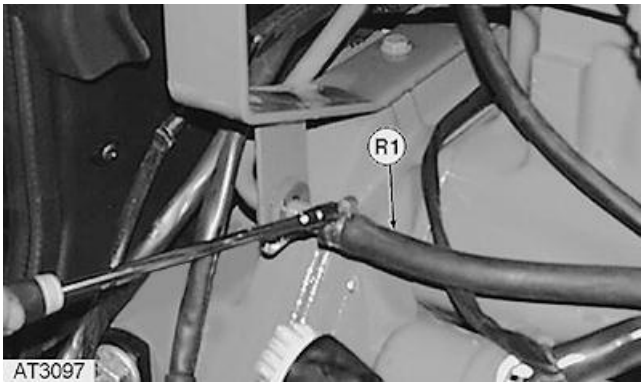
(N1) - from steering valve to cooler

(O1) - from MFWD valve to MFWD clutch

(P1) - from brake valve to brake cylinder

(Q1) - from MFWD to tank

[39] - Remove pipe (R1).

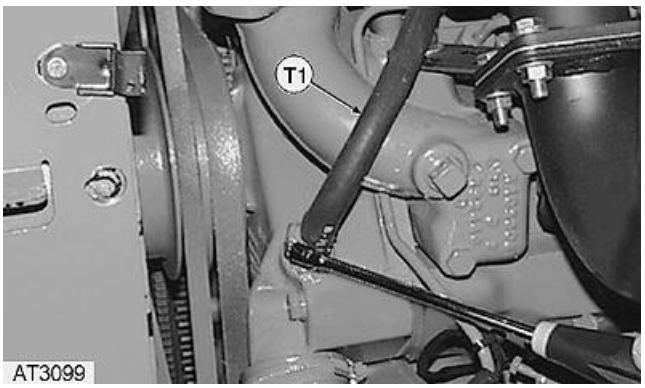


[40] - Remove left-hand fan guard (S1) and remove cab heater pipe (T1).

LEGEND:

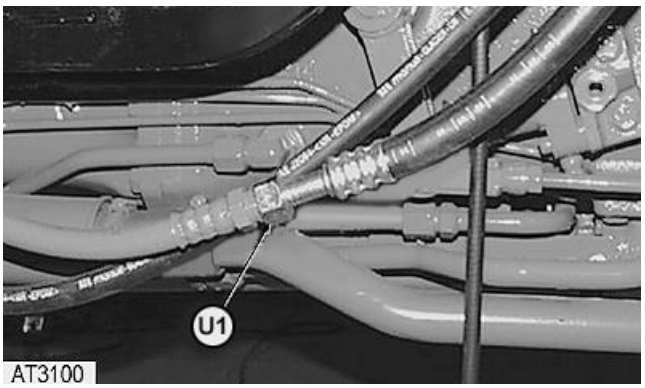
R1	Pipe
S1	Fan guard
T1	Cab heater pipe

Fan guard



Cab heater pipe

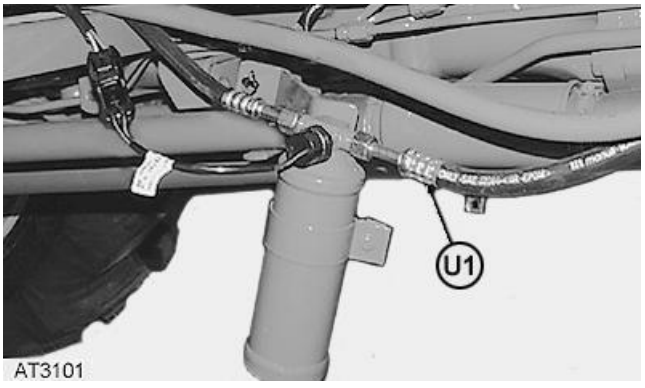
[41] - Remove air conditioning lines (U1) (if equipped).



LEGEND:

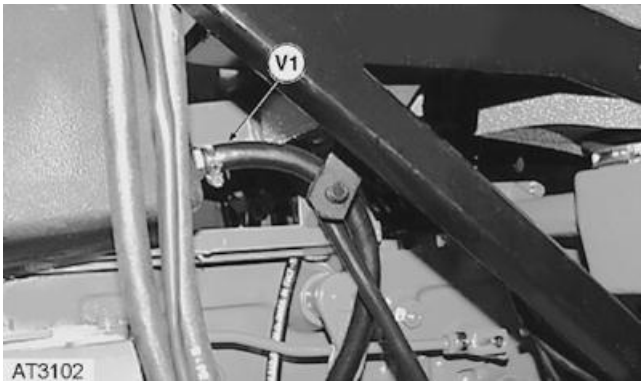
U1	Air conditioning line

Air conditioning lines



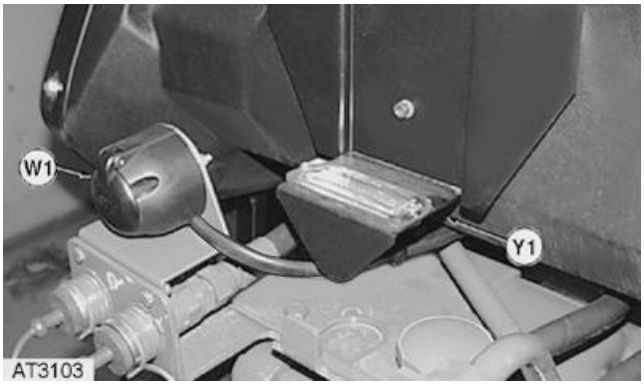
Air conditioning lines

[42] - Remove fuel pipe (V1) from fuel tank.



Remove fuel pipe

[43] - Remove seven pins connector (W1) and license plate light connector(Y1).



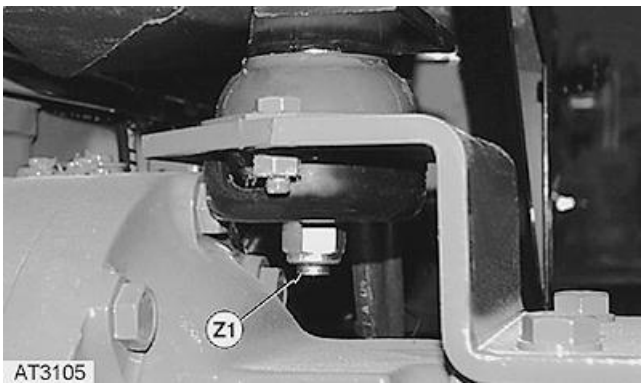
LEGEND:

V1	Air conditioning line
W1	Fuel pipe
Y1	License plate light connector

Seven pins connector

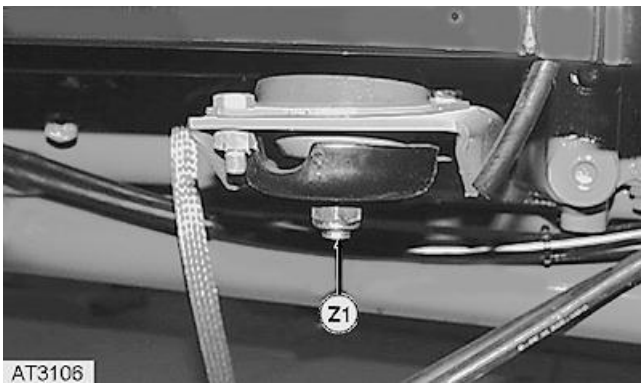
[44] - Attach a suitable hoist so as shown.

Attach a suitable hoist



Silent blocks

[45] - Unscrew front and rear silent blocks (Z1).



LEGEND:
Z1 Silent blocks

Silent blocks

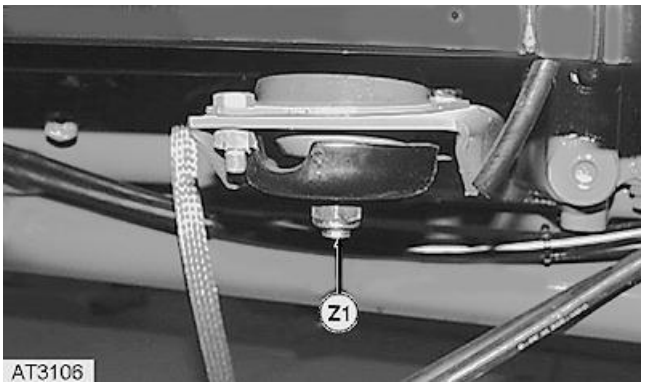
[46] - Remove cab slowly from chassis.

Installing the Operator´s Cab

[1] - Install cab slowly to chassis

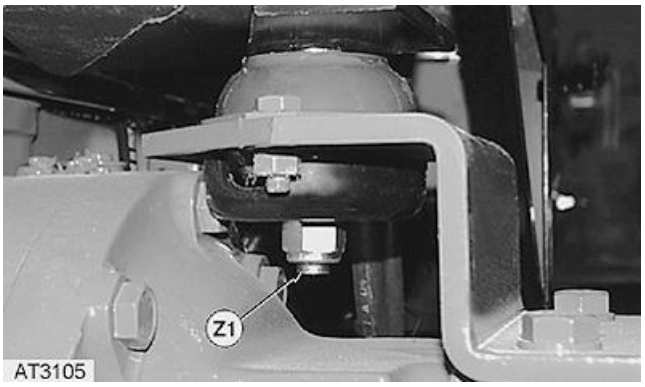
[2] - Tighten front and rear silent blocks (Z1) to the specified torque.

Item	Measurement	Specification
Nuts, cab silent blocks to cab supports	Torque	220 N·m
		165 lb-ft



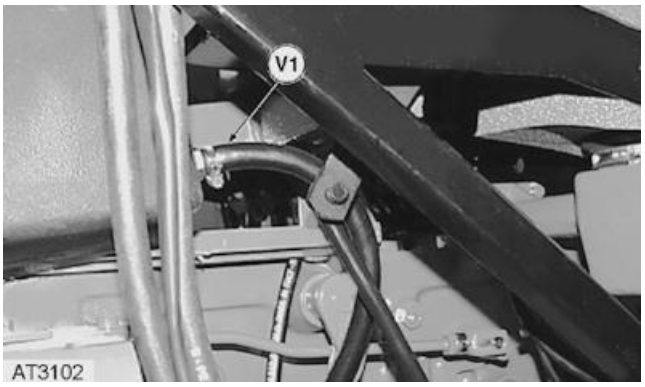
LEGEND:
Z1 Silent block

Silent blocks, front



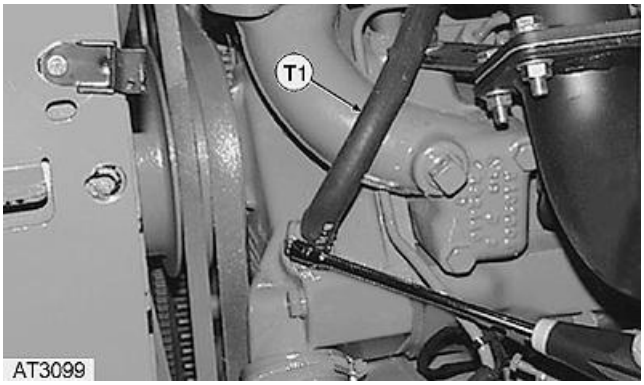
Silent blocks, rear

[3] - Install seven pins connector and license plate light connector.



LEGEND:
V1 Fuel pipe
T1 Heater pipe

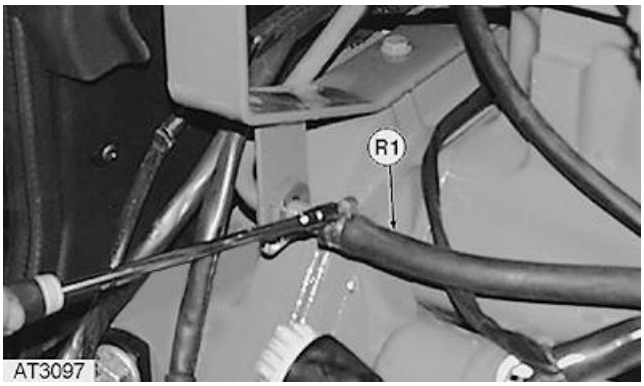
Fuel pipe



Heater pipe

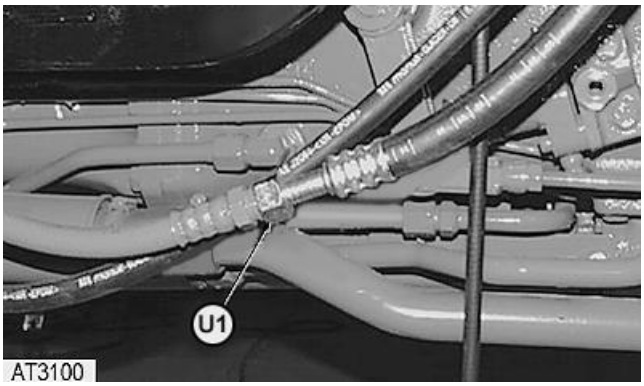
[4] - Install fuel pipe (V1), heater pipe (T1) and left-hand fan guard.

[5] - Install pipe (R1).



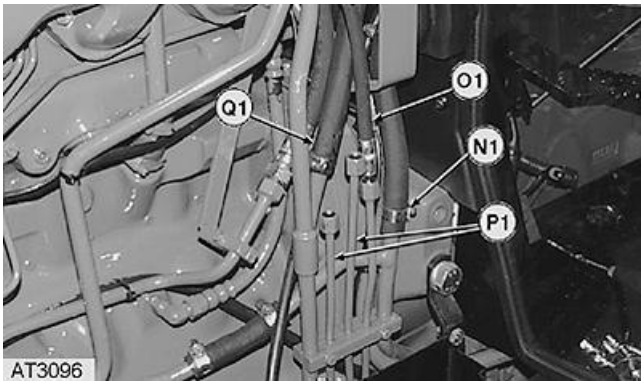
Install pipe

[6] - Install air conditioning lines (U1), install drier filter bracket and ground cable.



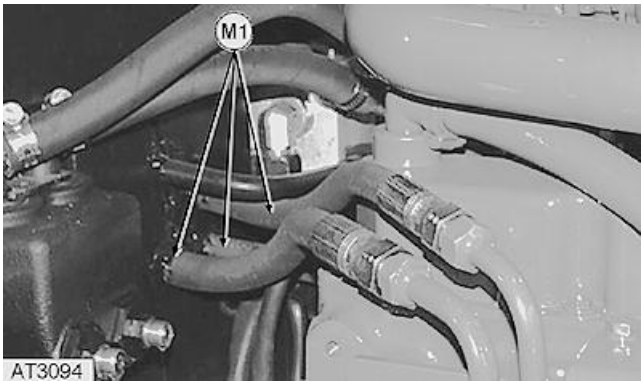
Drier filter bracket

[7] - Install hydraulic lines (N1 to Q1).

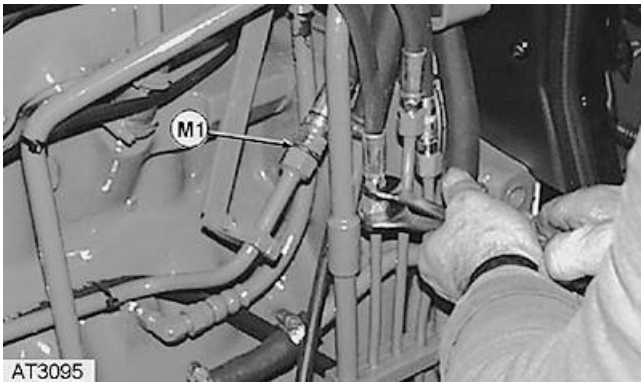


Hydraulic lines

[8] - Install steering lines (M1).

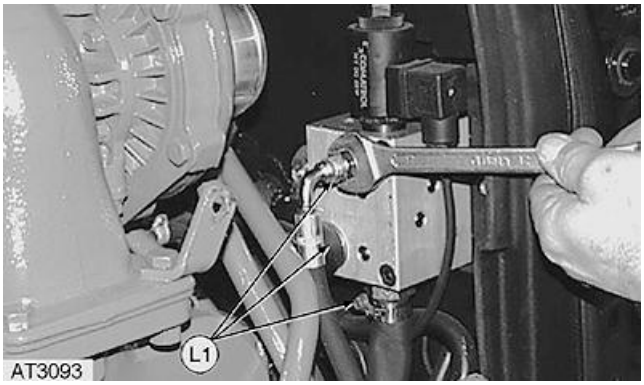


Steering lines

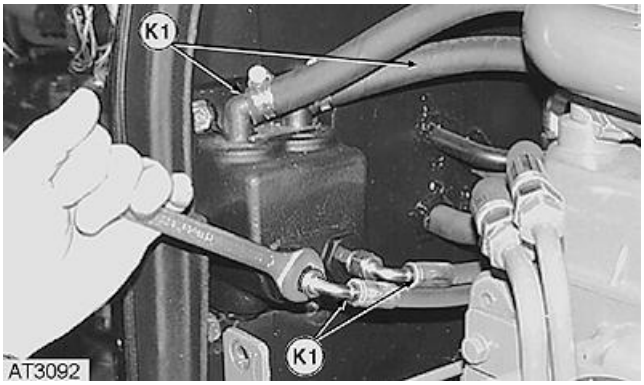


Steering lines

[9] - Install hydraulic lines (L1 and K1).

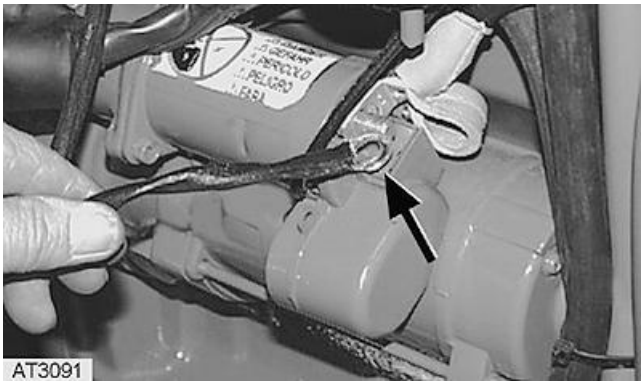


Install hydraulic lines



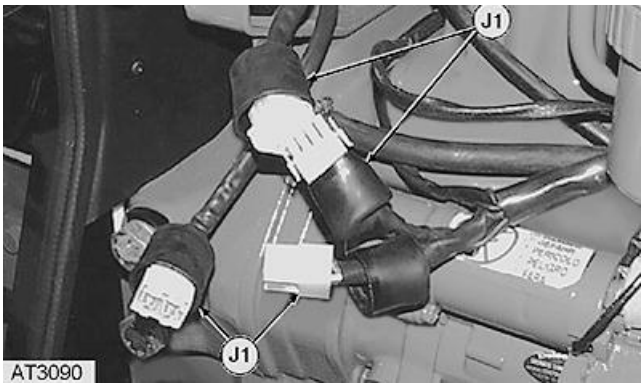
Install brake lines

[10] - Connect wiring cable to starting motor.



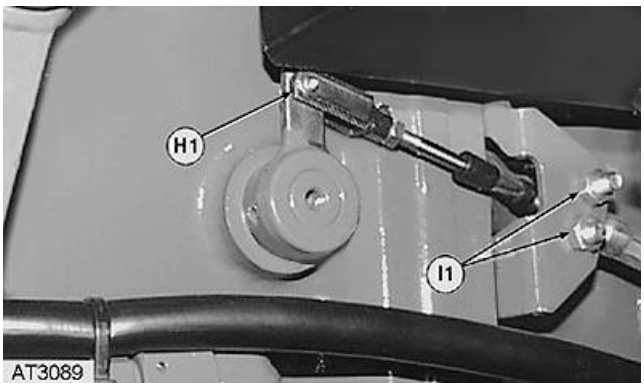
Starting motor

[11] - Connect main connectors (J1).



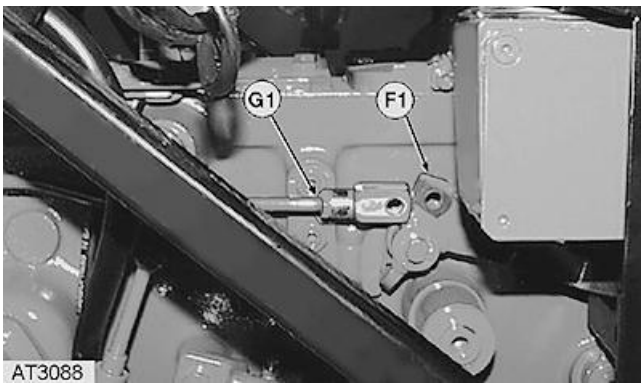
Connect main connectors

[12] - Install pin (H1) and tighten nuts (I1).



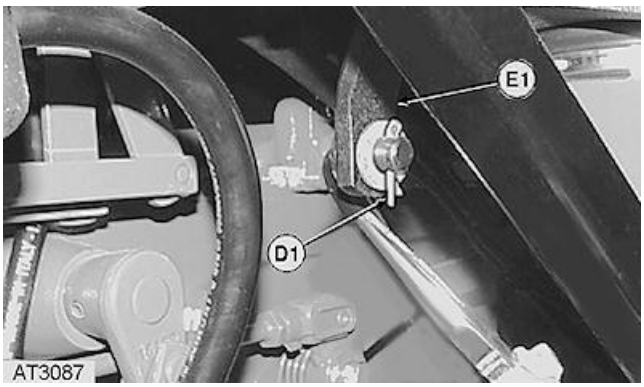
Install pin

[13] - Install differential pedal (F1) to control rod (G1).



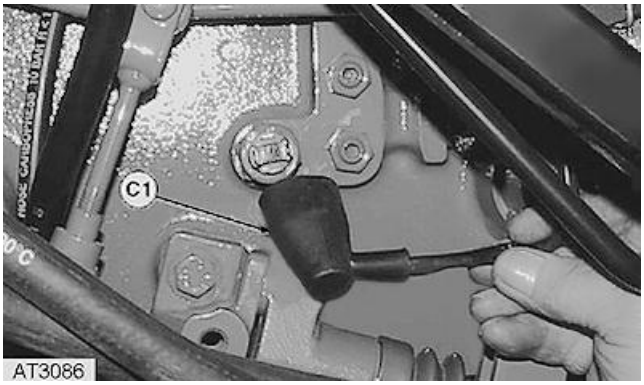
Install differential pedal

[14] - Install HI-LO control lever (E1).



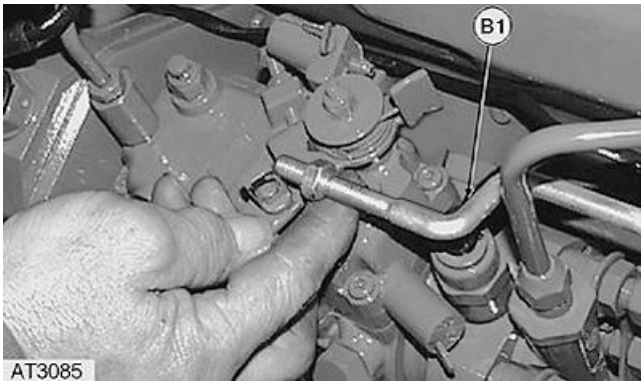
HI-LO control lever

[15] - On right side of tractor connect neutral start switch (C1).



Neutral start switch

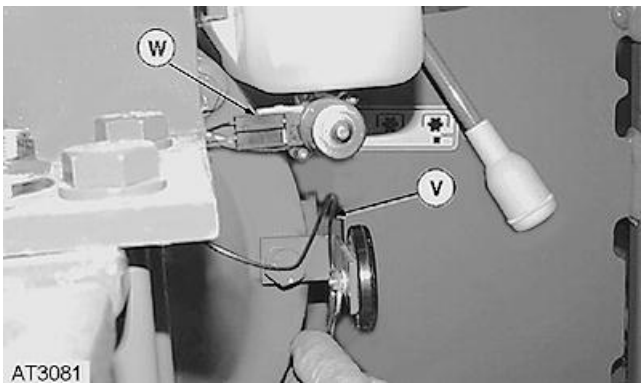
[16] - Install throttle linkage rod (B1).



Throttle linkage rod

[17] - Install washer reservoir: Install pipe (Y) and connect wiring connectors (W).

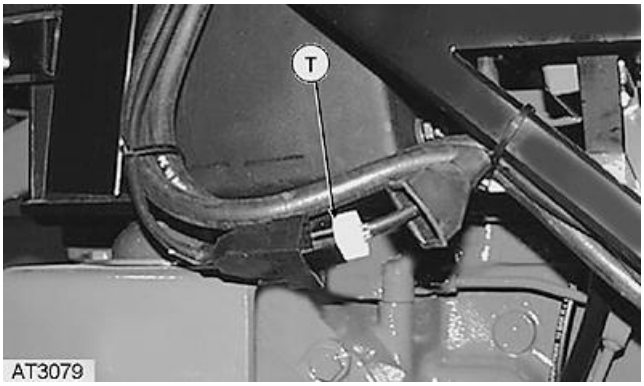
Install pipe



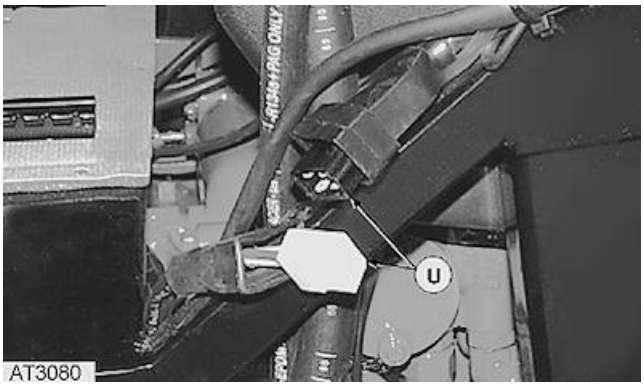
Connect wiring connectors and ground cable

[18] - Install ground cable (V).

[19] - Connect wiring connectors (T and U).

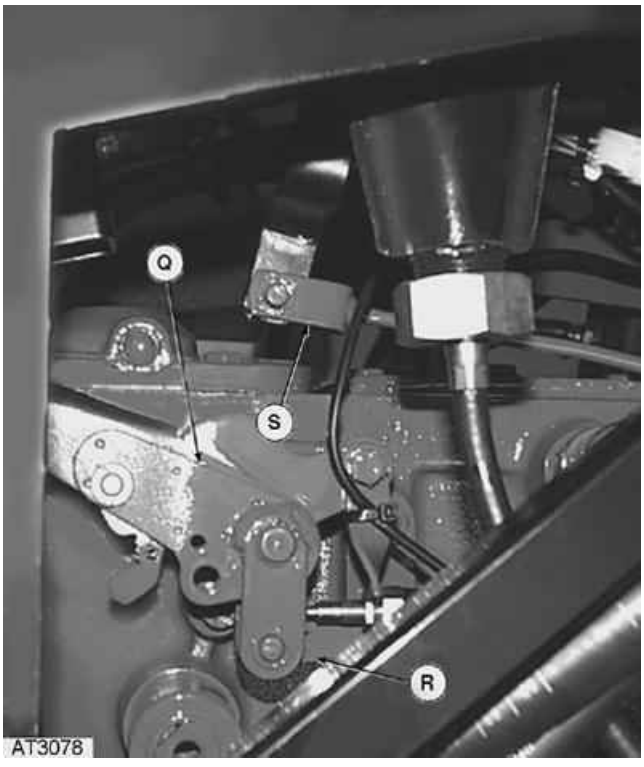


Connect wiring connector



Connect wiring connector

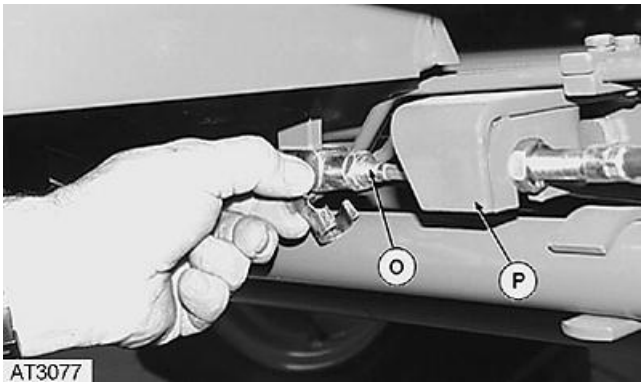
[20] - Install selector lever (PTO) control rod (S).



Control rod, handbrake,

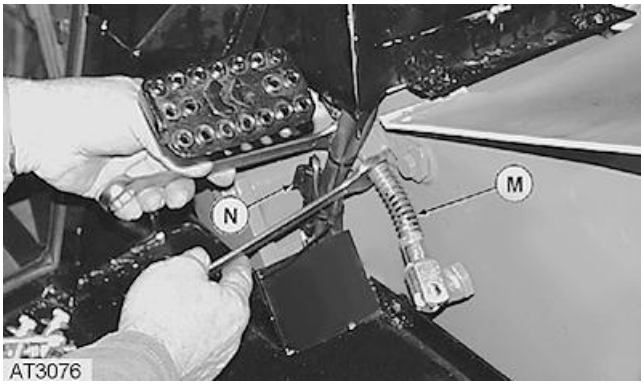
[21] - Install handbrake (Q) with control rod (R).

[22] - Install PTO clutch control cable (O) to bracket (P).



PTO Clutch control cable

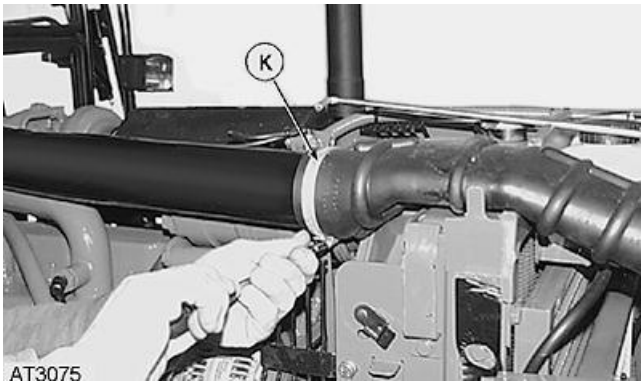
[23] - Install clutch control cable (M) to clutch housing and connect wiring connector (N).



Clutch control cable and wiring connector

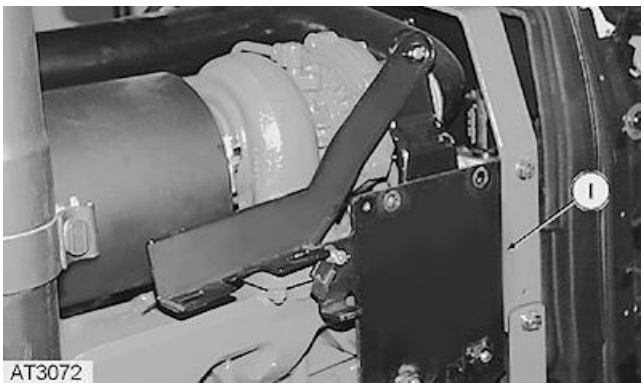
[24] - Install inlet pipe to turbocharger: Tighten clambs (J) and (K).

Install inlet pipe to turbocharger

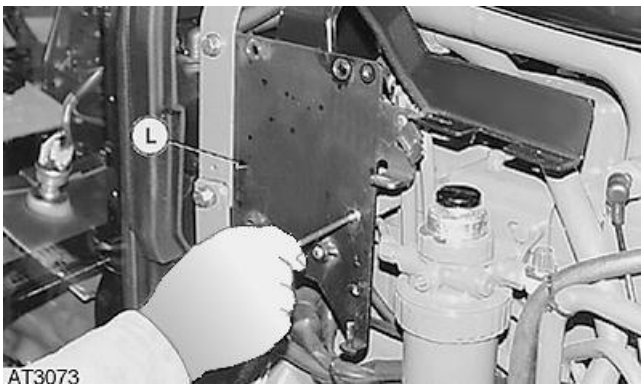


Tighten clambs

[25] - Install plates (I) and (L) from each side of tractors.

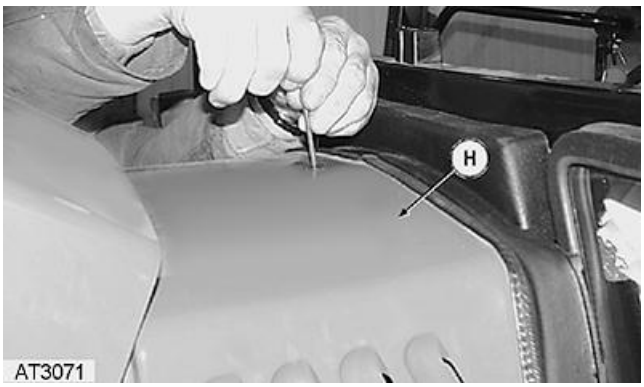


Install plates (left-hand)



Install plates (right-hand)

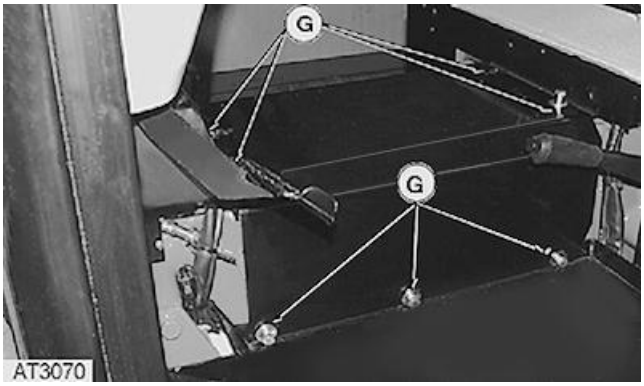
[26] - Install motor side shield (H) and hood.



Install motor side shield

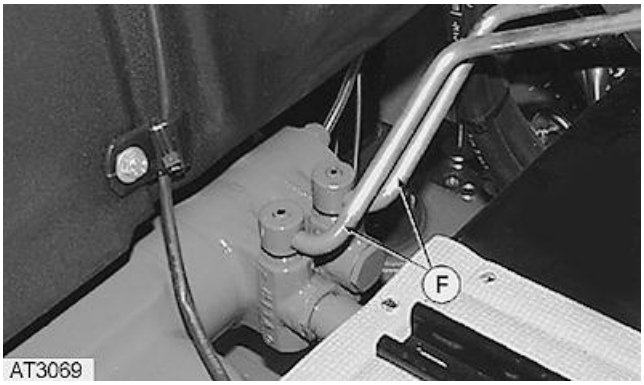
[27] - Install instrument panel and front side shields.

[28] - Install foam pad and footboard. Tighten fixing bolts (G).



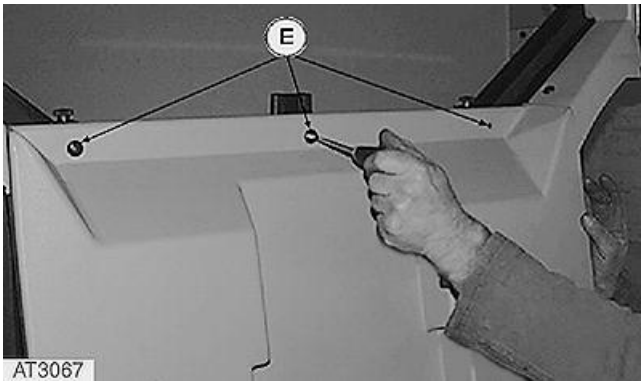
Tighten fixing bolts

[29] - Install SCV levers (F).

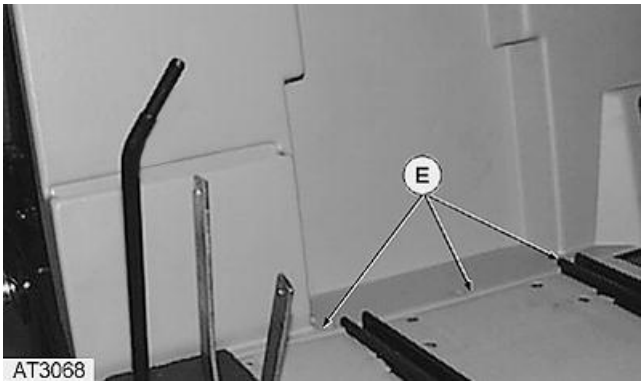


Install SCV levers

[30] - Install wallboard of fuel tank and tighten fixing screws (E).



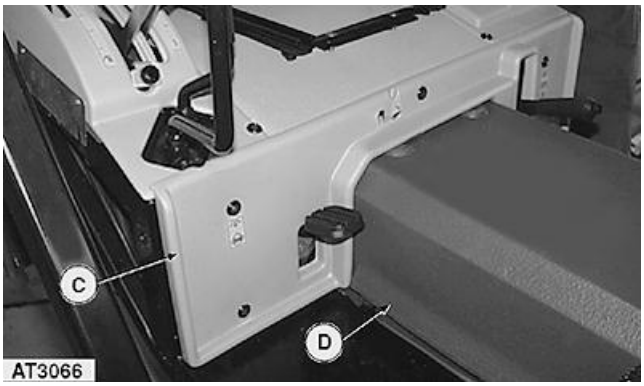
Install wallboard of fuel tank



Fixing screws

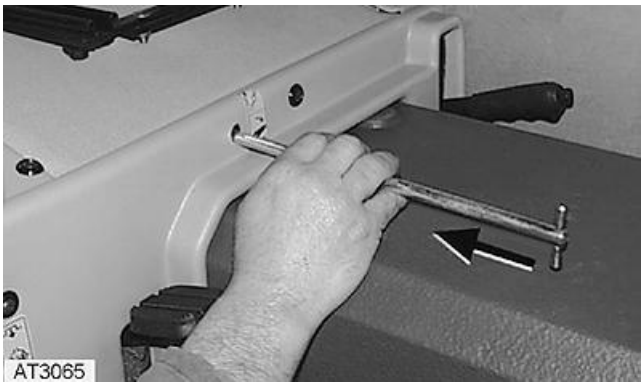
[31] - Install molding of control lever.

[32] - Install foam pad, rubber cover (D) and wallboard (C).



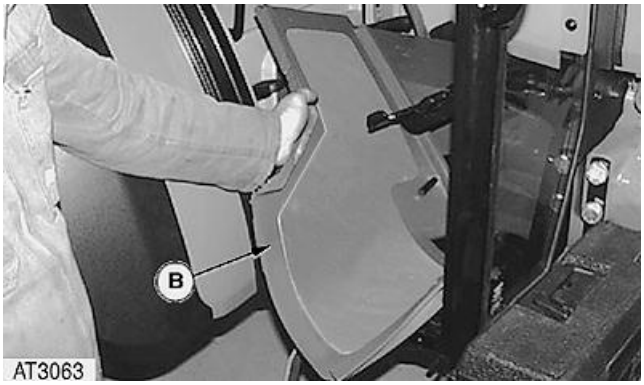
Foam pad and wallboard

[33] - Install rockshaft rate-of-drop valve.

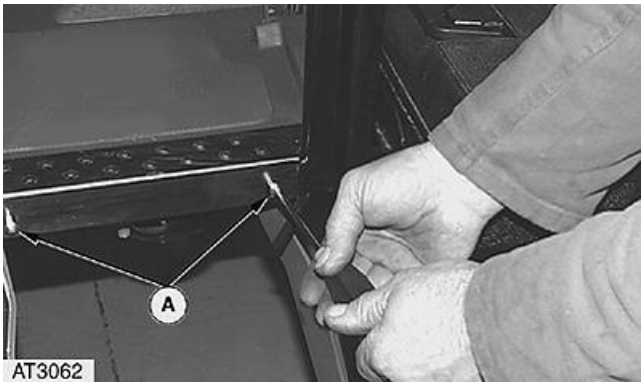


Install rockshaft rate-of-drop valve

[34] - Install footboard (B) from each side and tighten screws (A).



Footboard



Tighten screws

[35] - Install operators seat (see in this section).

[36] - Install rear fenders (see in this section).

[37] - Install wheels and tighten bolts to the specified torque.

Item	Measurement	Specification
Bolts, rear wheel to axle flange	Torque	400 N·m
		300 lb-ft
Bolts, front wheel to axle flange (MFWD)	Torque	300 N·m
		220 lb-ft

Group 01 - Removing and Installing the Open Operator´s Station

Service Equipment and Tools

→NOTE:

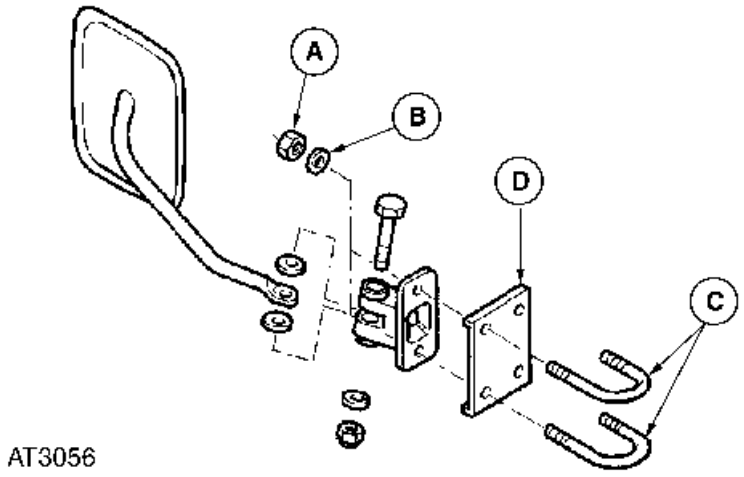
Order tools according to information given in the U.S. SERVICEGARD ™ Catalog or from the European Microfiche Tool Catalog (MTC). Some tools may be available from a local supplier.

Specifications

Item	Measurement	Specification
Cap screws, roll-gard post to final drive housing	Torque	220 N·m
		163 lb-ft
Cap screw, roll-gard to fender	Torque	96 N·m
		71 lb-ft

Removing the Open Operator′s Station

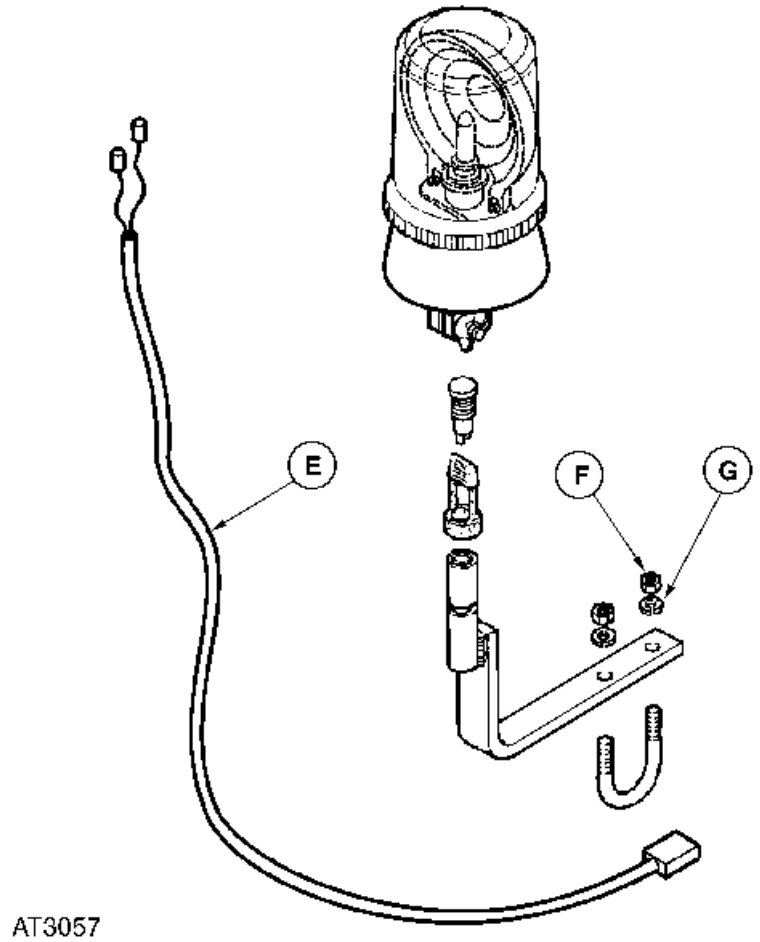
[1] -



Rear-view mirror

Remove rear-view mirror and beacon light (if equipped). Unscrew nuts (A) and remove spring washer (B). Remove U-bolt (C) and plate (D).

[2] -

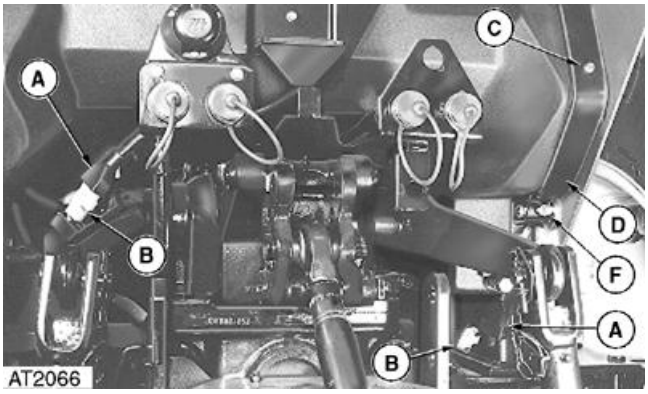


Beacon light

For beacon light, disconnect wiring connectors (E).

[3] - Unscrew nuts (F) and remove spring washer (G).

[4] -



Access Roll-Gard

Remove rear wheels.

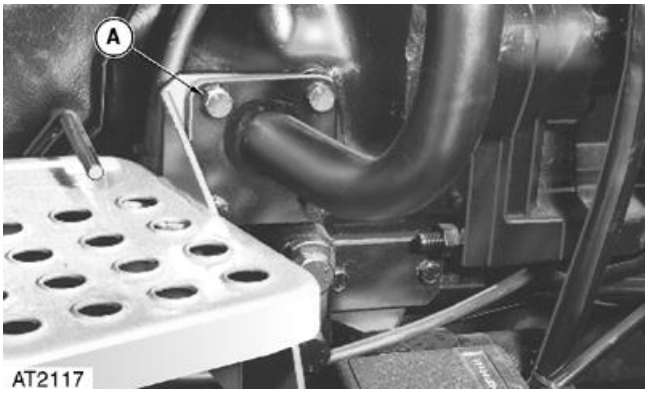
[5] - Remove fenders.

[6] - Remove boots (A).

[7] - Disconnect wiring connectors (B).

[8] - Remove screws (C) and nuts (F) to remove fuel tank retaining strap (D).

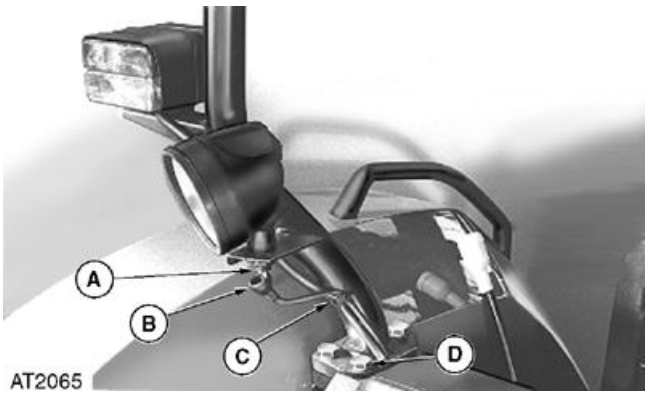
[9] -



Remove Cap Screws

Remove four cap screws (A) at each side of tractor.

[10] -



Remove Roll-Gard

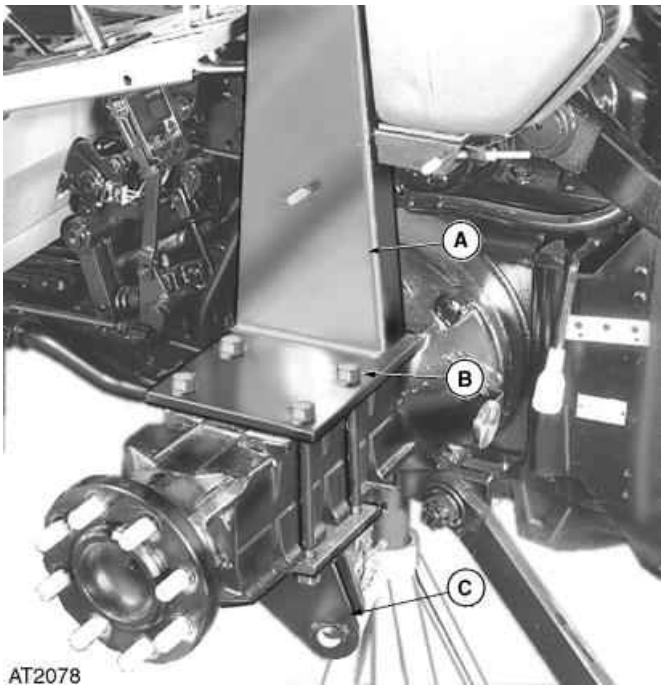
Cut tie strap (C).

[11] - Remove boot (B).

[12] - Disconnect wiring connector (A).

[13] - Remove three cap screws (D) at each side of tractor to remove roll-gard.

[14] -



LEGEND:

A	Post
B	Cap Screw (4 used)
C	Stabilizer

Remove Post

Remove four cap screws (B) and stabilizer (C) to remove post (A).

[15] - Repeat procedures to remove post on other side.

→NOTE:

Remove lights if roll-gard repair or replacement is necessary.

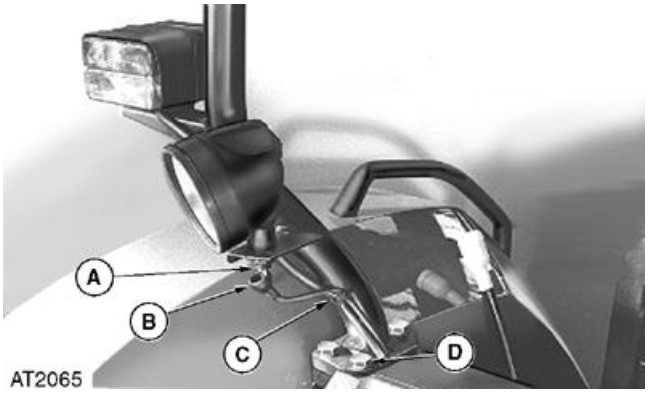
[16] - Inspect all parts for damage. Replace as necessary.

Installing the Open Operator's Station

[1] - Install post, stabilizer and cap screw. Tighten cap screw to the specified torque.

Item	Measurement	Specification
Cap screws, roll-gard post to final drive housing	Torque	220 N·m 163 lb-ft

[2] -



Install Roll-Gard

Install roll-gard and cap screw (D). Tighten cap screw to the specified torque.

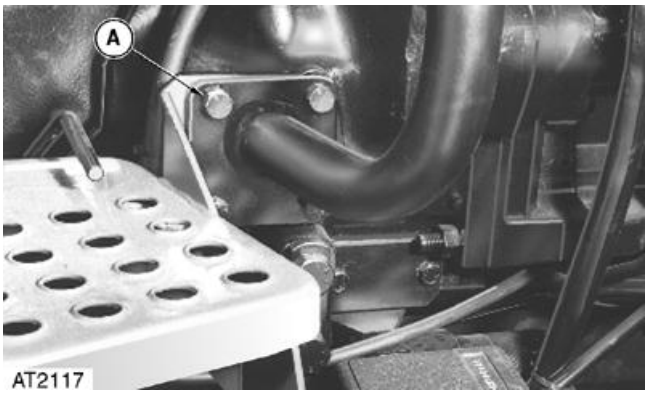
Item	Measurement	Specification
Cap screw, roll-gard to fender	Torque	96 N·m 71 lb-ft

[3] - Connect wiring connector (A).

[4] - Install boot (B).

[5] - Install tie strap (C).

[6] -

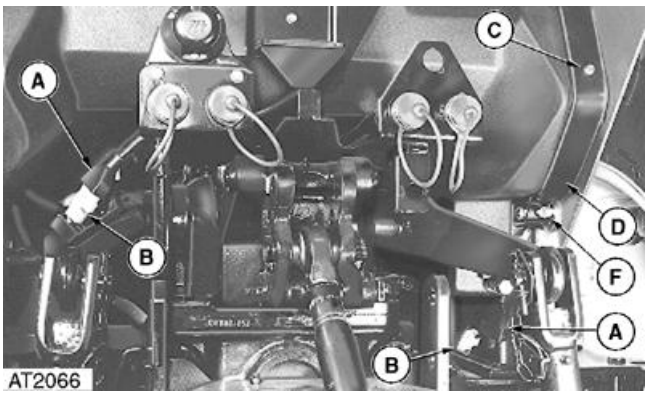


Install Cap Screw

Install cap screw (A) and tighten to the specified torque.

Item	Measurement	Specification
Cap screw (A)	Torque	96 N·m 71 lb-ft

[7] -



Install Retaining Strap, Nut, and Screw

Install retaining strap (D), nut (F) and screw (C).

[8] - Connect wiring connectors (B).

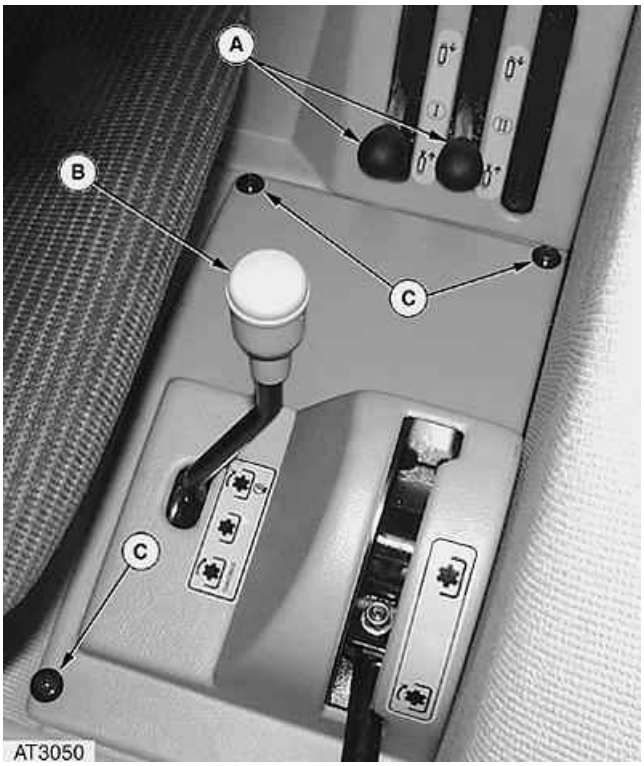
[9] - Install boots (A).

[10] - Install fenders and wheels. Tighten wheel nuts to 400 N·m (300 lb-ft).

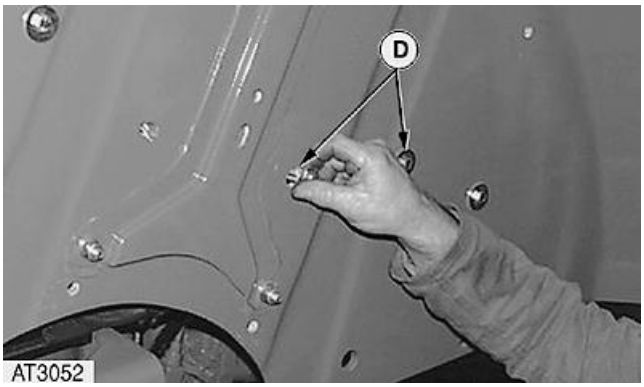
Group 05 - Controls and Instruments

Remove Molding of Control Lever (Tractor with Cab)

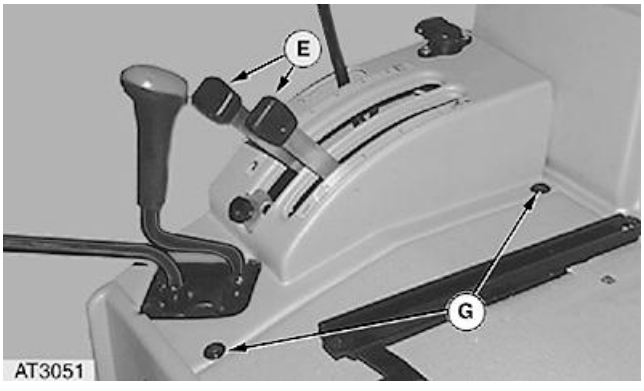
[1] - Remove operator´s seat.



Extract knob of PTO and SCV selector levers



Fixing screws



Knobs of rockshaft control lever

[2] - On right side, unscrew the knobs (A) (SCV levers).

[3] - Extract the knob (B) of PTO selector lever and the knob of PTO clutch lever (this lever is engaged for clarity of photo).

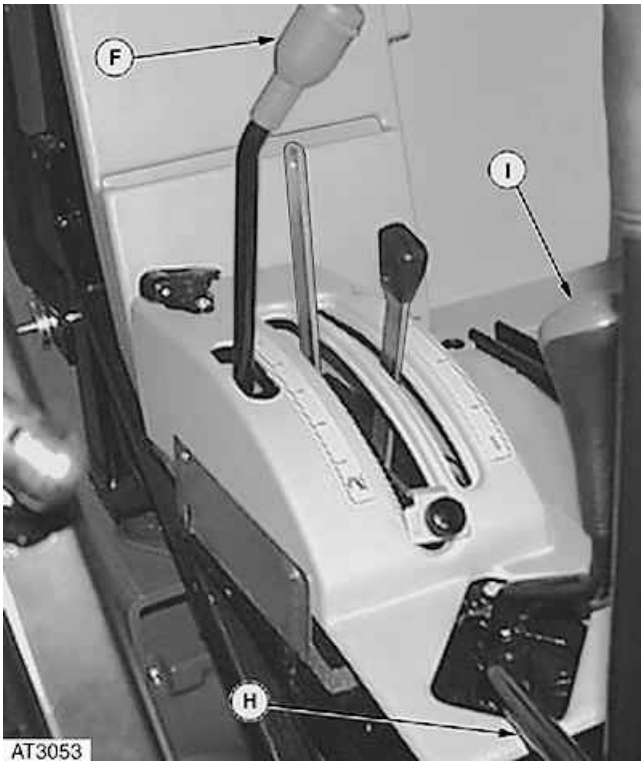
[4] - Unscrew the three fixing bolts (C).

[5] - Remove the right side molding.

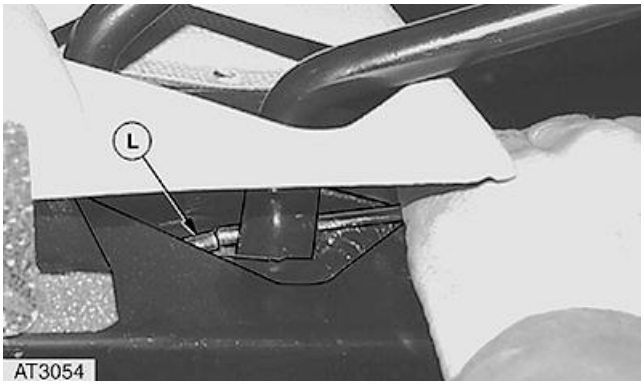
[6] - On left side remove wheel and fixing screws (D).

[7] - Extract the knobs (E) of rockshaft control lever.

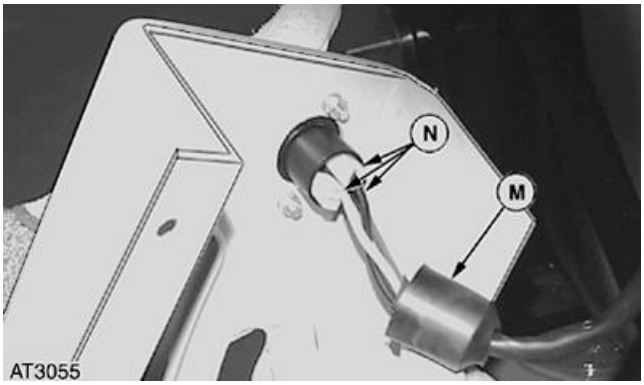
[8] -



Gear shift lever and range shift lever



Pin springs



Boot and wiring connectors

Extract the knob (F) of high-low shift lever. Unscrew fixing bolt (G).

[9] - Remove gear shift lever (H) and range shift lever (I). Remove the two pin springs (L) from each lever as shown with a punch and hammer.

→NOTE:

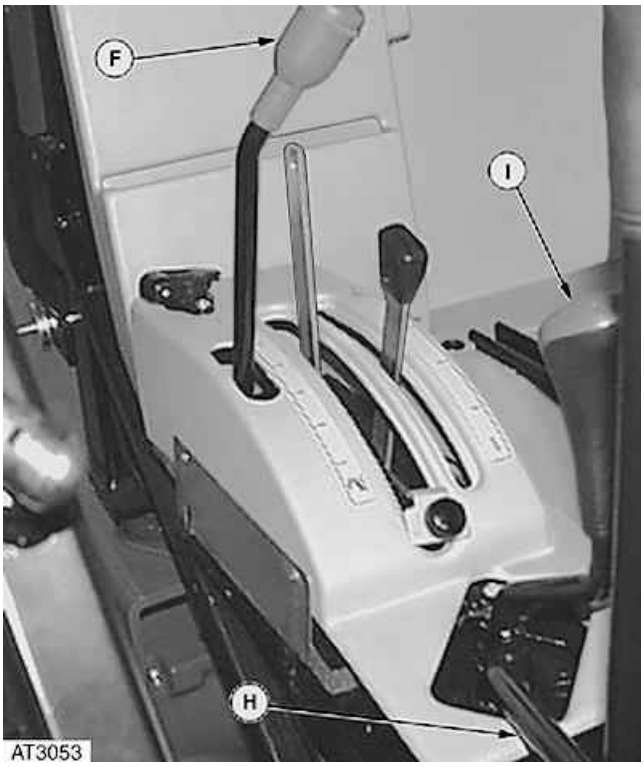
Right hand fender removed for clarify of photo.

[10] - Remove boot (M), and wiring connectors (N).

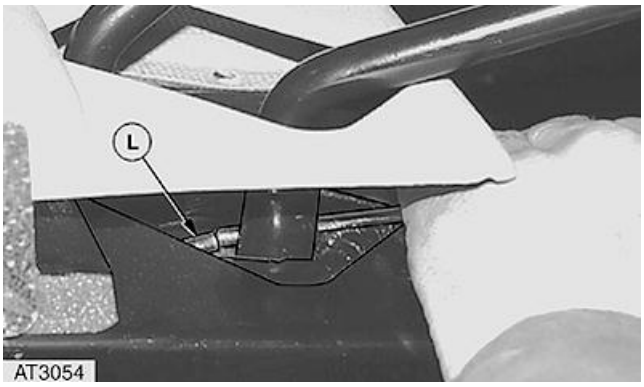
[11] - Remove the left side molding.

Install Molding of Control Lever

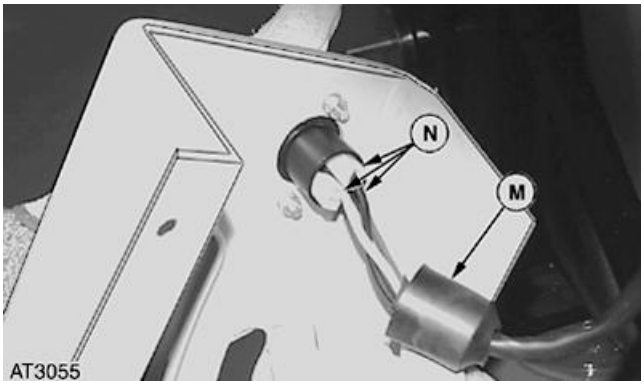
[1] -



Gear shift lever and range shift lever



Pin springs



Boot and wiring connectors

Install left side molding.

[2] - Install wiring connectors (N) and boot (M).

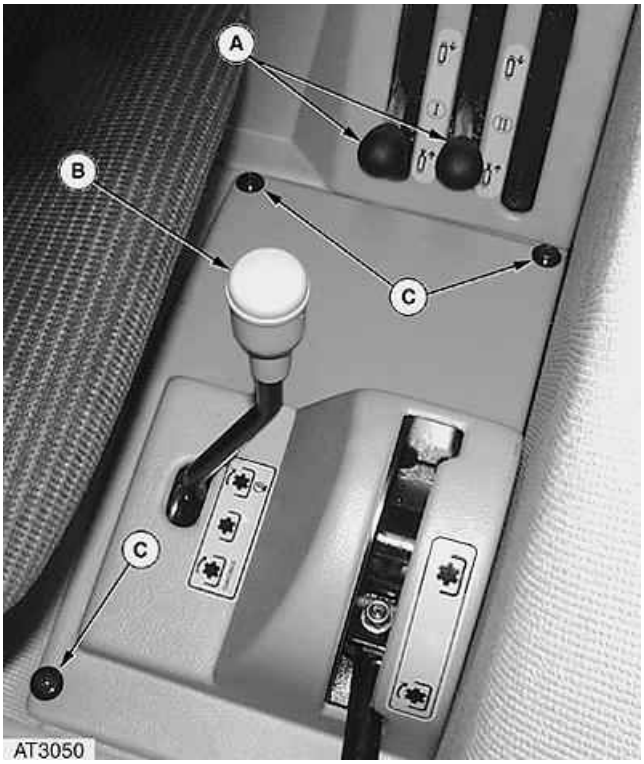
[3] - Install gear shift lever (H) and range shift lever (I). Insert two pin springs (L) to each lever as shown with a punch and hammer.

[4] - Insert the knob (F) of high-low shift lever. Tighten fixing bolt (G).

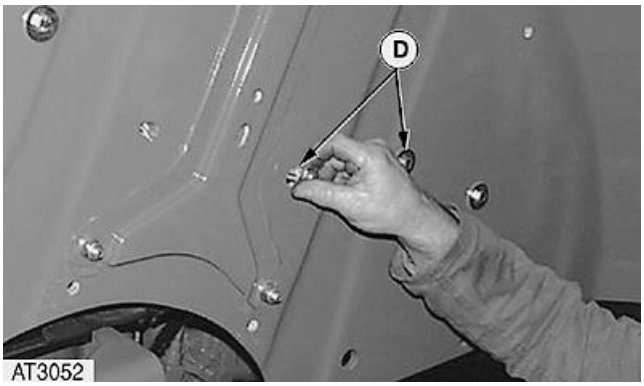
→NOTE:

Use LOCTITE ™ for fixing the knobs.

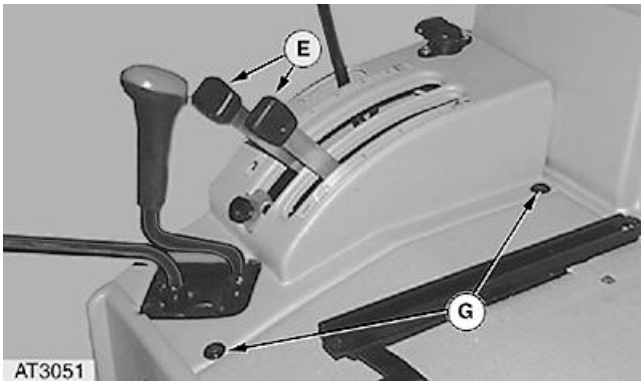
[5] -



PTO selector lever and the knob of PTO clutch lever



Fixing screws



Rockshaft control lever

Install the knobs (E) of rockshaft control lever.

[6] - Tighten fixing screws (D) and install rear left side wheel.

[7] - Install the right side molding.

[8] - Tighten the three fixing bolts (C).

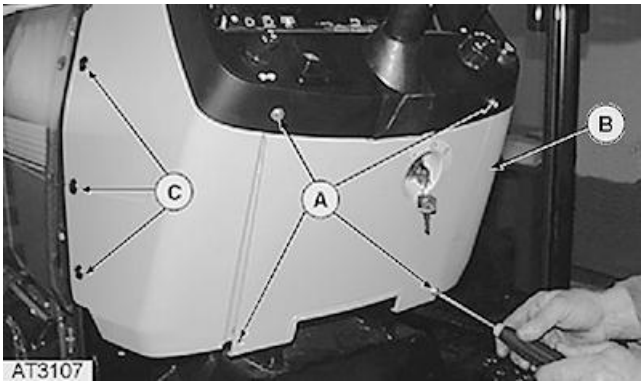
[9] - Insert the knob (B) of PTO selector lever and the knob of PTO clutch lever.

[10] - Tighten the knobs (A) (SCV levers).

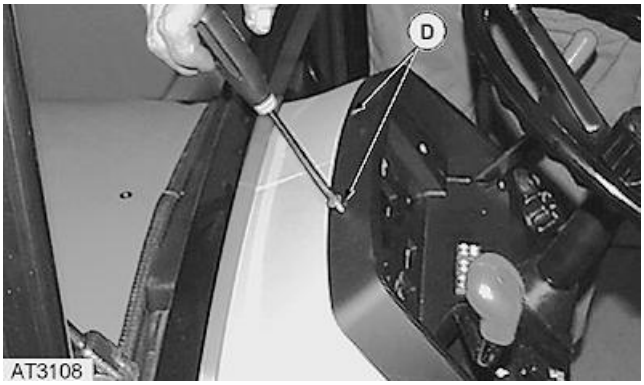
[11] - Install operator's seat.

Remove Instrument Panel

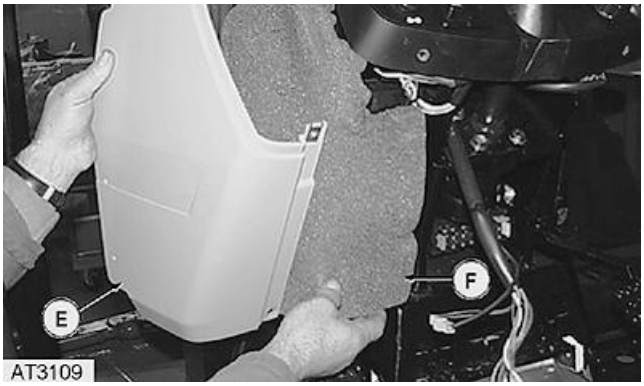
[1] -



Front shield



Fixing screws



Side shield and foam pad

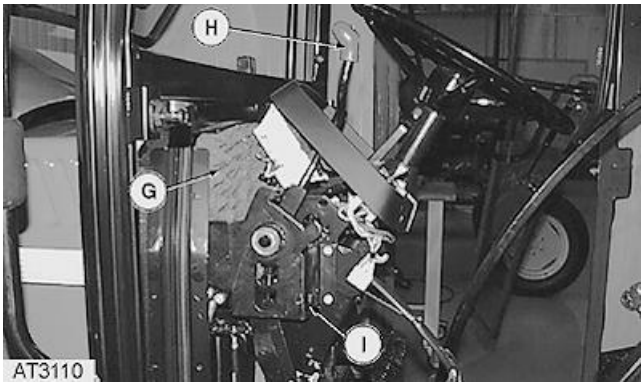
Unscrew fixing screws (A) from front shield (B).

[2] - Unscrew side shield fixing screws (C) from each side.

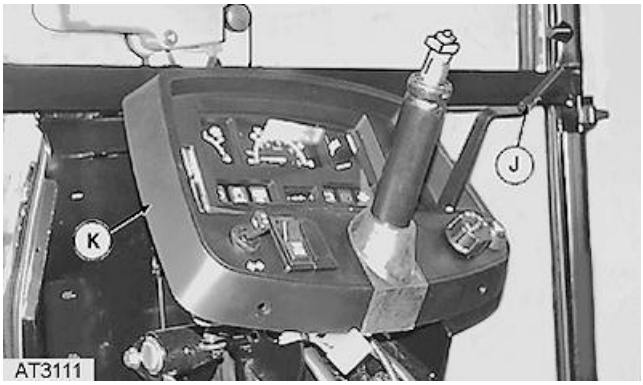
[3] - Unscrew fixing screws (D).

[4] - Remove side shield (E) and foam pad (F).

[5] -



Forward/reverse lever and foam pad



Knob of hand throttle

Remove foam pad (G).

[6] - Remove knob (H) of forward/reverse lever.

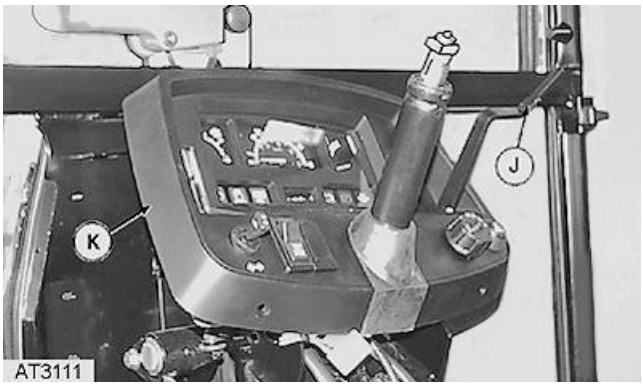
[7] - Remove forward/reverse lever assembly (I).

[8] - Remove knob of hand throttle (J) and the steering wheel.

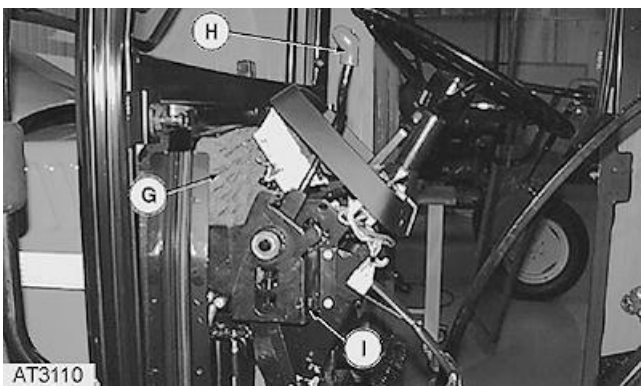
[9] - Disconnect all connectors and slide out instrument panel (K).

Install Instrument Panel

[1] -



Knob of hand throttle



Forward/reverse lever and foam pad

Install Instrument panel and connect all connectors to panel switches.

→NOTE:

Follow cab wiring diagram to find the correct connections. Check all switches.

[2] - Install steering wheel and knob of hand throttle (J).

[3] - Install forward/reverse lever assembly (I), knob (H) and foam pads.

→NOTE:

Use LOCTITE ™ for fixing the knobs.

[4] - Install all foam pads and shields.

Group 15 - Air Conditioning System

Special or Essential Tools

→NOTE:

Order tools according to information given in the U.S. SERVICEGARD ™ Catalog or European Microfiche Tool Catalog (MTC).

Service unit

FKM10478

FKM10478 service unit

Used to discharge, evacuate, fill, clean and check the air conditioning system.

IMPORTANT:

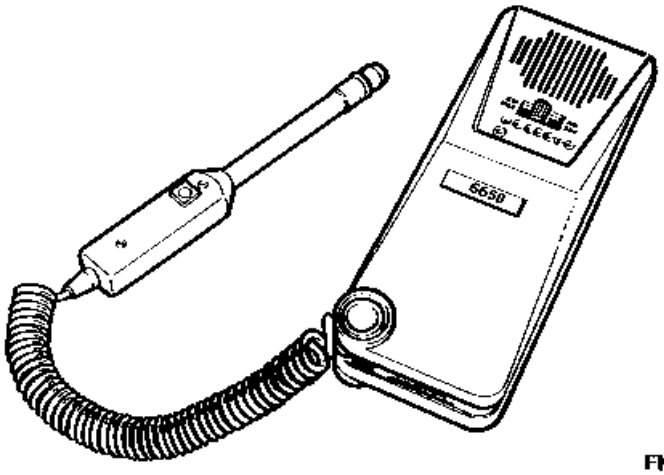
Use only service units suitable for handling R134a refrigerant.

→NOTE:

All work performed with this unit must be carried out in accordance with the service unit operator's manual.

Leak detector

FKM10444



FKM10444

FKM10444

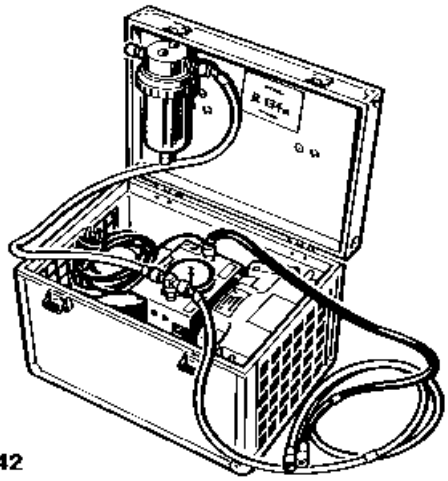
Identifying refrigerant leaks

→NOTE:

Leak detector can be used with R12 as well as R134a refrigerant.

Discharging unit

FKM10442



FKM10442

FKM10442

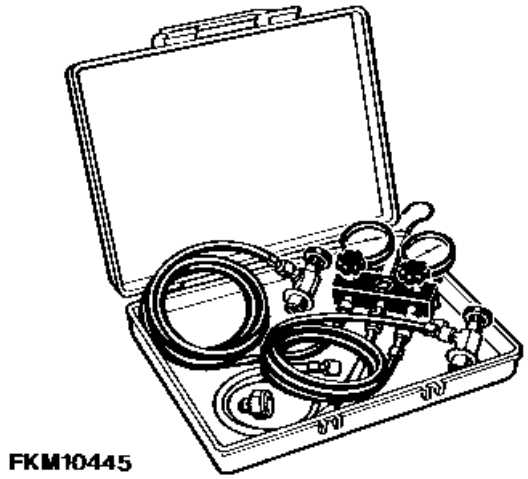
Discharging refrigerant from the system.

IMPORTANT:

Use only service units suitable for handling R134a refrigerant.

Dual gauge set

FKM10445



FKM10445

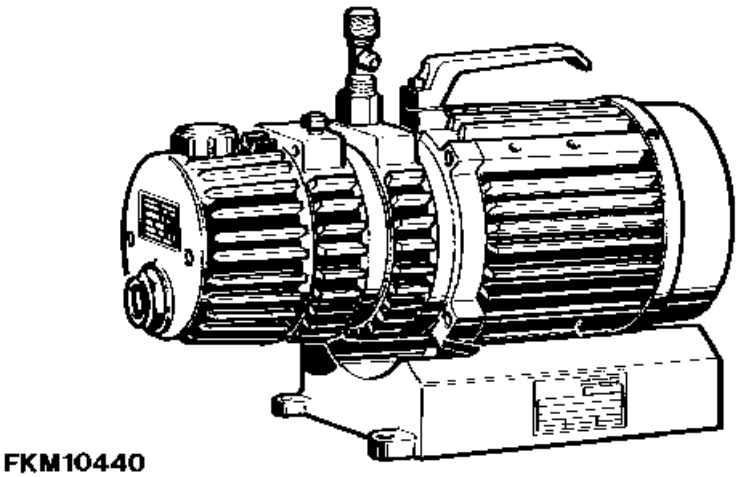
Evacuating, filling and checking the air conditioning system.

IMPORTANT:

Use only service units suitable for handling R134a refrigerant.

Vacuum pump

FKM10440



FKM10440

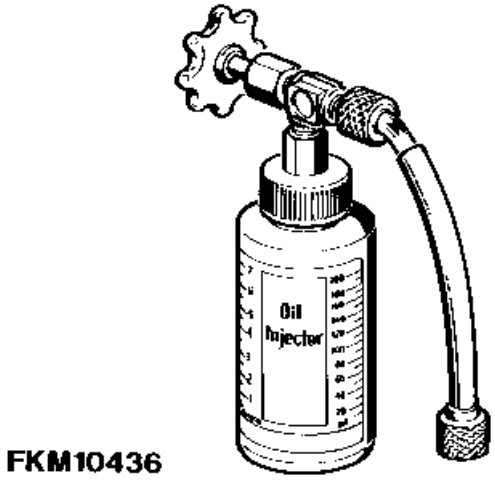
Evacuating the system.

→NOTE:

The vacuum pump is suitable for both R12 and R134a refrigerant.

Oil injector

FKM10436



FKM10436

Filling with refrigerant oil

IMPORTANT:

Use PAG oil (ND-Oil8) only.

Refrigerant can (R134a; 920g; 750 ml)

FKM10447

FKM10447

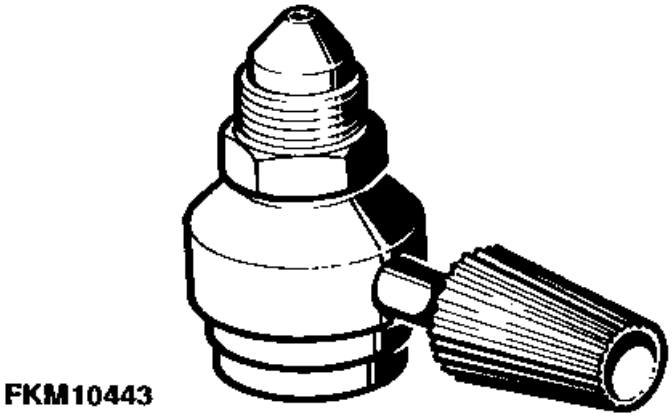
Filling the system.

IMPORTANT:

Use only service units suitable for handling R134a refrigerant.

Charging valve

FKM10443



FKM10443

Filling the system.

IMPORTANT:

Use only service units suitable for handling R134a refrigerant.

PAG refrigerant oil (ND-Oil8; 250 ml)

FKM10446

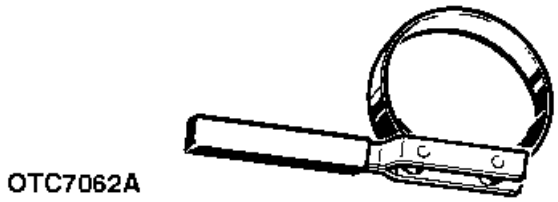
FKM10446

IMPORTANT:

Use PAG oil (ND-Oil8) only.

Clutch hub holding tool

OTC7062A



Clutch hub holding tool

Removing the clutch hub.

Specifications

Item	Measurement	Specification
Discharge pressure	Refrigerant pressure	760-2590 kPa (7,6-25,9 bar; 110-375 psi)
Suction pressure	Refrigerant pressure	7-2000 kPa, (0,07-2 bar; 1-30 psi)
Refrigerant circuit	Oil volume (PAG oil)	255 ml (8.5 fl. oz.)
Air-conditioning system	Refrigerant weight	1400-1600 g (3-3.5 lb)
Hub to pulley	Clearance	0.35-0.65 mm (0.014-0.025 in.)
Compressor clutch coil	Current draw at 12 V, 20°C (68°F)	2.6 amps
Compressor clutch	Resistance	3.5 - 4 Ohm
Clutch hub attaching screw	Torque	14 N·m (10 lb-ft)

Torques for Tightening Refrigerant Hoses

Torques for tightening refrigerant hoses

Screw size	Width across flats	Tightening torque
5/8“	19 mm (3/4”)	17 N·m (13 lb-ft)
3/4“	22 mm (7/8”)	35 N·m (26 lb-ft)
7/8“	27 mm (1 1/16”)	40 N·m (29 lb-ft)

Safety At Work

CAUTION:

Certain basic safety regulations apply when dealing with air conditioning systems, and must be observed at all times. They are backed up by legislation covering safety precautions for air conditioning systems. The following excerpts are particularly important:

Air conditioning systems may be operated, serviced or repaired by authorized, trained personnel only.

Adolescents should not be allowed to carry out service work on air conditioning systems involving the discharge of Category 2 or 3 refrigerants, unless trade training of adolescents over 16 years old requires such work. In this case, the adolescent must be supervised by a trained adult.

Before repairing components carrying refrigerant, remove refrigerant as far as necessary to ensure that the work can be carried out safely.

Refrigerant should be extracted by suction and re-used. When refrigerant is discharged into the air, there is the danger of asphyxiation, especially if work is being performed in an inspection pit, since refrigerant is heavier than air and concentrates at the lowest level. Moreover, refrigerant is odorless and colorless, so small quantities emerging from a leak cannot be detected. In such a case, ensure that there is adequate ventilation at the place of work.

Smoking and naked flames are not permitted in enclosed spaces where refrigerant has been released. High temperatures cause chemical reactions in the refrigerant gas, and highly poisonous substances can form. If inhaled, these substances have serious effects on health.

High temperatures produced by welding and soldering cause very high pressures inside components of the air conditioning system, and these pressures may result in an explosion.

Handling Refrigerant

CAUTION:

When handling refrigerant, always wear safety glasses and leather gloves. Contact with escaping refrigerant may result in serious frostbite, or even blindness if the refrigerant strikes the eye.

Whenever there is the risk of refrigerant encountering high temperatures, wear a suitable breathing mask while working. However, a breathing mask provides no protection against asphyxiation if large quantities of refrigerant escape.

In An Emergency

Rinse eye with cold water; preferably use a 1% boric acid solution.

Wash affected parts of the body with water, or preferably with a solution consisting of one part essence of vinegar and five parts water.

See a doctor as soon as first aid has been administered.

Safety Equipment

LX002150

Safety equipment

This equipment consists of safety glasses, safety gloves and, where appropriate, a breathing mask (if there is the risk of poisonous gases being released).

CAUTION:

A breathing mask provides NO protection against lack of oxygen.

Prepare a 1% boric acid solution for rinsing the eyes and a solution consisting of 1 part essence of vinegar and 5 parts water for washing affected parts of the body. Also provide a first aid kit.

Storage of Refrigerant Containers

CAUTION:

Refrigerant containers are under pressure, and this pressure increases rapidly when the temperature of the container rises. The thin-walled refill containers are particularly at risk in this respect. Refrigerant containers must never be exposed to temperatures over 52°C (120°F).

Never store pressurized containers in the vicinity of heat sources or in places exposed to direct sunlight. Never open pressurized containers by force or damage them in any way. Never open pressurized containers by force or damage them in any way.

R134A Refrigerant

IMPORTANT:

The air conditioning system operates using R134a refrigerant (tetrafluorethane). This substance does not contain any chlorine atoms, so it does not have a detrimental effect on the ozone in the Earth´s atmosphere.

Even so, the refrigerant must never be discharged straight into the air. It must be trapped in a recycling unit. The refrigerant stored in the recycling unit may be re-used at any time.

The recycling unit used to do this must be of a type suitable for handling R134a refrigerant.

The boiling point of R134a is minus 26.5°C (minus 15.7°F) and its freezing point is minus 101°C (minus 149.8°F).

Before replacing any component, it is vital to check whether it is compatible with the type of refrigerant used.

It is still essential to ensure that the correct refrigerant oil is used. R12 systems were lubricated with mineral oil, which is totally unsuitable for R134a systems. The latter require PAG oil, which mixes very well with the refrigerant and provides ideal lubrication throughout the system.

Important

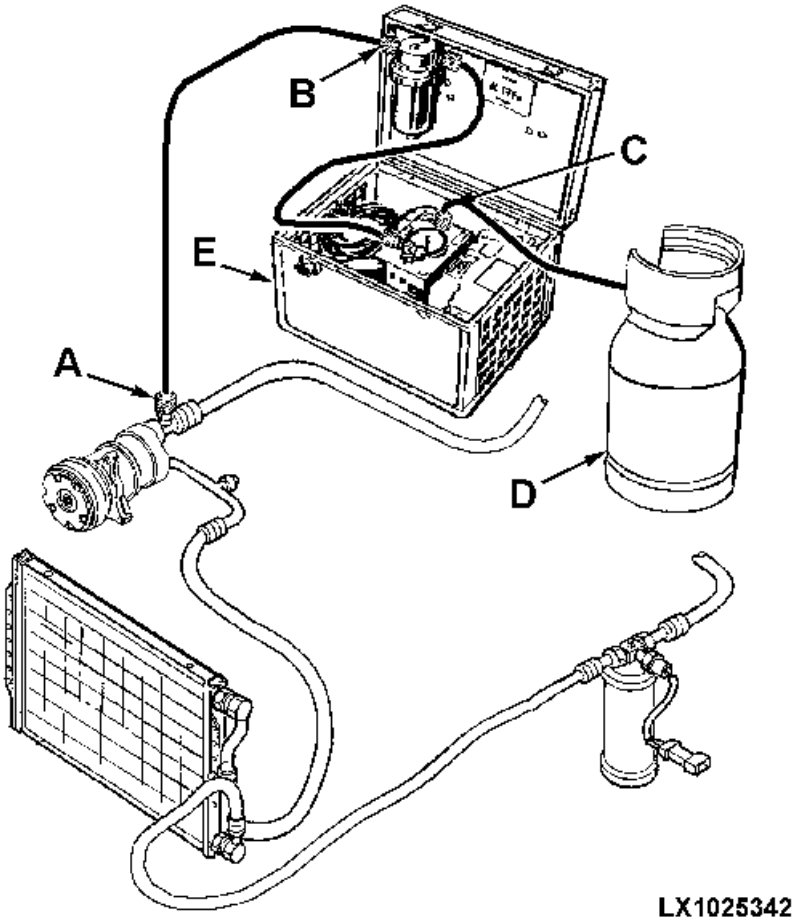
Refrigerant

Use R134a refrigerant only. Any other refrigerant will impair the function of the air-conditioning system and render all claims for damages made against the manufacturer null and void.

PAG refrigerant oil

Use prescribed refrigerant oil only. Failure to do so will result in damage to the compressor.

Discharging the System



Discharging the system

LEGEND:

A	Low-pressure connection
B	Inlet connection (oil separator)
C	Outlet connection (discharging unit)
D	Recycling container
E	Discharging unit FKM10442

CAUTION:

To prevent the risk of injury, always wear protective goggles and gloves when working on the air conditioning system.

Run the tractor at 2000 rpm. Operate the A/C system with compressor on at full cooling output and max. fan speed for approx. 10 min.

→NOTE:

For this task, refer also to the operator´s manual of the relevant discharge unit.

Shut down the tractor and perform the following procedure.

Connect the red hose to the outlet connection (C) and the blue hose to the inlet connection (oil separator) (B) of discharging unit FKM10442 (E).

Connect the other ends of the hoses as follows:

Connect the blue hose from pressure gauge kit FKM10445 to the low-pressure valve (A), and connect the red hose to a commercially available R134a recycling container (D).

→NOTE:

Comply with data on recycling container (e.g. weight when empty, max. weight).

The recycling container must be weighed repeatedly before and during the discharging process to make sure that it is not over-filled.

Tighten all screw connections, switch on the discharge unit and open the valves.

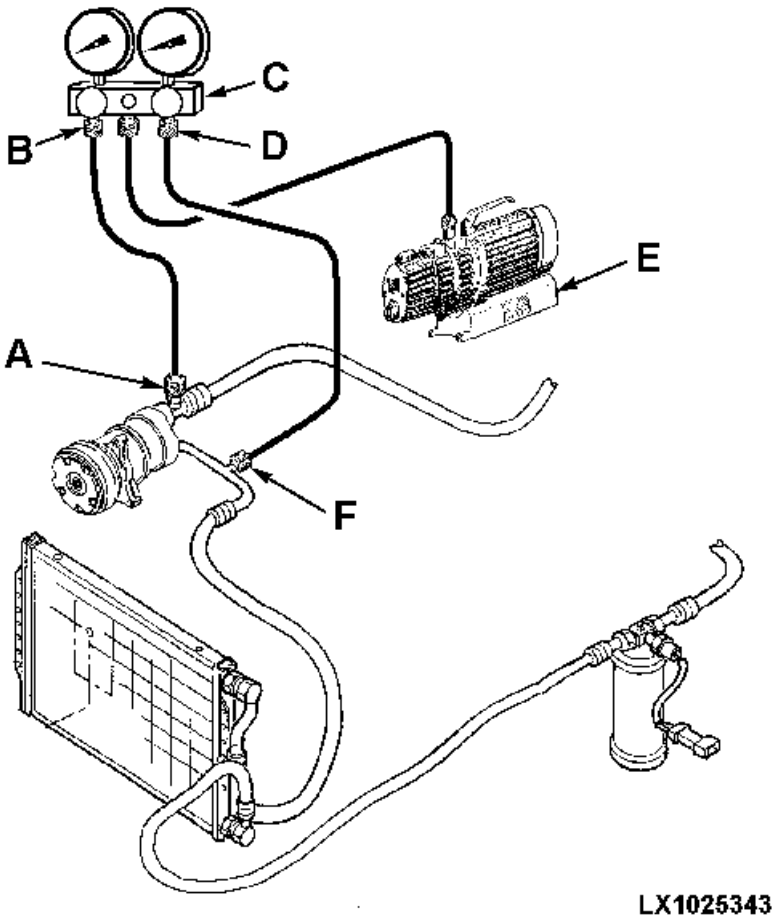
The discharge unit discharges the system until the suction-pressure switch trips and switches the unit off at a pressure of approx. -30 kPa (-0.3 bar; -4.5 psi). Then close the valves.

→NOTE:

If the system is already discharged, do not attempt to discharge the system further. Avoid air ingestion.

At the sight-glass in the oil separator , observe how much oil has been sucked out. When the system is subsequently recharged, remember to top up with the same quantity of fresh oil.

Evacuating the System



Evacuating the system

LEGEND:

A	Low-pressure connection
B	Low-pressure connection
C	Dual gauge set FKM10445
D	High-pressure connection
E	Vacuum pump FKM10440
F	High-pressure connection

CAUTION:

To prevent the risk of injury, always wear protective goggles and gloves when working on the air conditioning system.

→NOTE:

Evacuating the system means sucking all the air out of the system until a vacuum is obtained. Every time the system is discharged, it must then be evacuated, otherwise air and moisture will enter the openings before they can be capped.

Connect dual gauge set FKM10445 (C) as follows:

Open the two manual valves on the test equipment. Connect the red hose to high-pressure valves (D and F) and the blue hose to low-pressure valves (A and B).

Connect the yellow hose to vacuum pump FKM10440 (E) and switch on the pump.

The system should reach a vacuum pressure of 100 kPa; 1 bar; 14.5 psi (1000 mbar; 75 cm QS; 29 in. Hg) within 5 minutes.

→NOTE:

If this vacuum pressure is not reached within 5 minutes, all joints must be checked, and it may be necessary to perform a leak test as well.

Close the valves and switch off the pump. Wait 5 minutes. The gauge should not rise by more than 3.4 kPa; 0.034 bar; 0.5 psi (34 mbar; 2.5 cm QS; 1 in. Hg).

Switch on the pump again and open the valves.

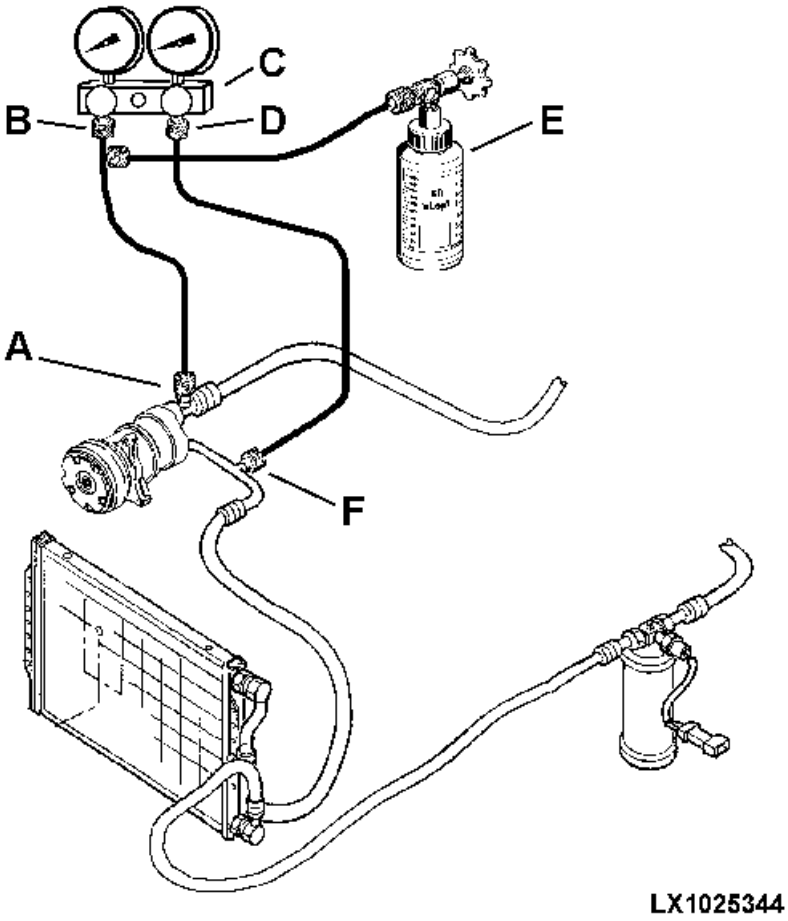
Extract air from the system for at least 30 minutes.

Close the valves and disconnect the pump.

→NOTE:

Do not open the system; the vacuum must remain until the system is filled.

Filling With Refrigerant Oil



Filling with refrigerant oil

LEGEND:

A	Low-pressure connection
B	Low-pressure connection
C	Dual gauge set FKM10445
D	High-pressure connection
E	Refrigerant oil injector FKM10436
F	High-pressure connection

Connect dual gauge set FKM10445 (C) as described in “Evacuating the System”.

Evacuate the system as described in “Evacuating the System”.

Close the valves and disconnect the pump.

Read how much oil is extracted during the evacuation process at the sight-glass in the oil separator. Add the same amount of new oil plus 10 ml to the oil injector. Whenreplacing a sub-assembly, the requisite amount of fresh oil must be added (see “Oil Capacities in Air-Conditioning Components”).

IMPORTANT:

Refrigerant oil is extremely hygroscopic - this means it attracts moisture in large amounts from the atmosphere. For this reason, do not open the system and oil can any longer than necessary.

Connect refrigerant oil injector FKM10436 (E) to the low side of gauge set.

Open charging valve of oil injector. Open low-side valve of dual gauge set.

→NOTE:

The vacuum within the system will draw oil into the system.

Oil Capacities In Air Conditioning Components

If one of the air conditioning components has been removed, the oil drained and the component cleaned (separately), add the following amounts of oil to the cooling circuit.

- Condenser: 40 ml (1.4 fl. oz.)
- Evaporator: 40 ml (1.4 fl. oz.)
- Receiver-drier: 10 ml (0.35 fl. oz.)
- Refrigerant lines: 20 ml (0.7 fl. oz.)
- Compressor: 50 ml (1.7 fl. oz.)

→NOTE:

Hoses = 3 ml per 30 cm (0.1 oz per ft)

If a hose has been damaged, measure length of hose and use the formula to determine correct amount of oil to be added. Determine missing oil of compressor by removing and discharging it. Fill the calculated amount of oil into the compressor.

If only a new compressor must be installed, reduce the compressor charge to 50 ml (1.7 fl. oz.).

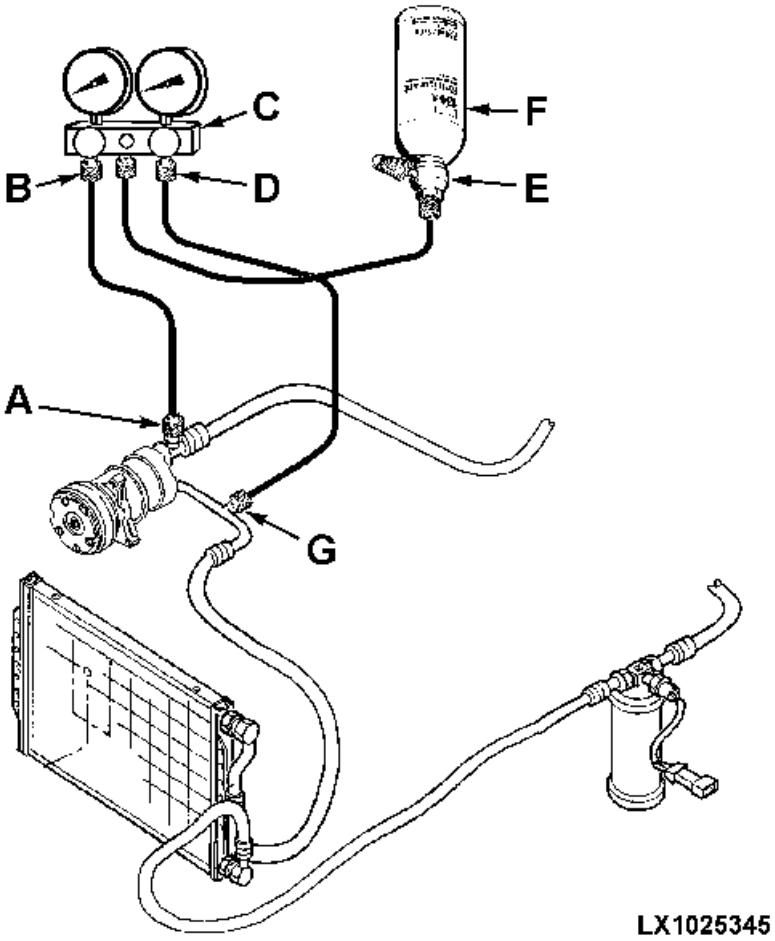
If the entire system is disassembled and all the lines and components (including compressor) are discharged and cleaned individually, add the full capacity of 160 ml (5.4 fl. oz.) to the system after re-assembly.

Add 90 ml (3.0 fl. oz.) to the low-side line (bringing the total amount to 250 ml; 8.5 fl. oz.).

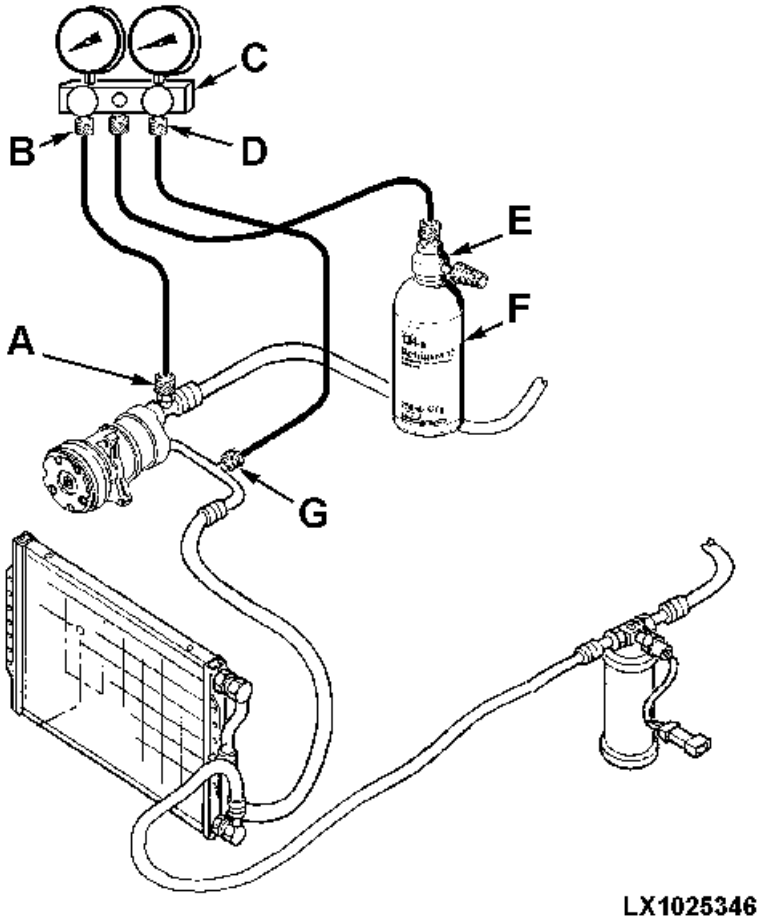
→NOTE:

The extra 30 or 90 ml (1.0 or 3.0 fl.oz.) in the low-side line is used to provide the compressor with lubrication during its start-up phase.

Filling the System



Filling the system (engine off)



Filling the system (engine running)

LEGEND:

A	Low-pressure valve
B	Low-pressure valve
C	Dual gauge set FKM10445
D	High-pressure valve
E	Charging valve FKM10443
F	Refrigerant container FKM10447

CAUTION:

To prevent the risk of injury, always wear protective goggles and gloves when working on the air conditioning system.

CAUTION:

To avoid damaging the compressor while putting refrigerant into the high-side section of the system, it is VITAL to shut off the engine first.

IMPORTANT:

Before filling the system ensure that the system contains the sufficient value of refrigerant oil.

Connect dual gauge set FKM10445 (C) and evacuate the system as described in “Evacuating the System”.

Screw charging valve FKM10443 (E) into refrigerant can FKM10447 (F) and connect the yellow hose to center connection of dual gauge set.

IMPORTANT:

A system using R134a refrigerant must NEVER be filled with R12.

To fill with fluid refrigerant, turn container upside down as shown.

Open charging valve (E) and high-pressure valve (D). Neither of the two gauges should indicate a pressure vacuum.

→NOTE:

If the low-side pressure gauge fails to rise, there must be a blockage in the system. Any blockages must be cleared.

When the pressure has stopped rising, close the high-pressure valve (D).

IMPORTANT:

With air-conditioning switched on, run the tractor for 10 minutes at low idle. See “Engine Specifications” , Section 10, Group 05.

Then run the engine at 2000 rpm with the system set to maximum cooling effect.

CAUTION:

The temperature of the refrigerant must never exceed 50°C (120°F), otherwise the refrigerant can may explode.

Turn the refrigerant container upright and open the low-pressure valve (B) to fill in gaseous refrigerant.

IMPORTANT:

Liquid refrigerant must not enter the compressor. Liquid refrigerant will damage the compressor.

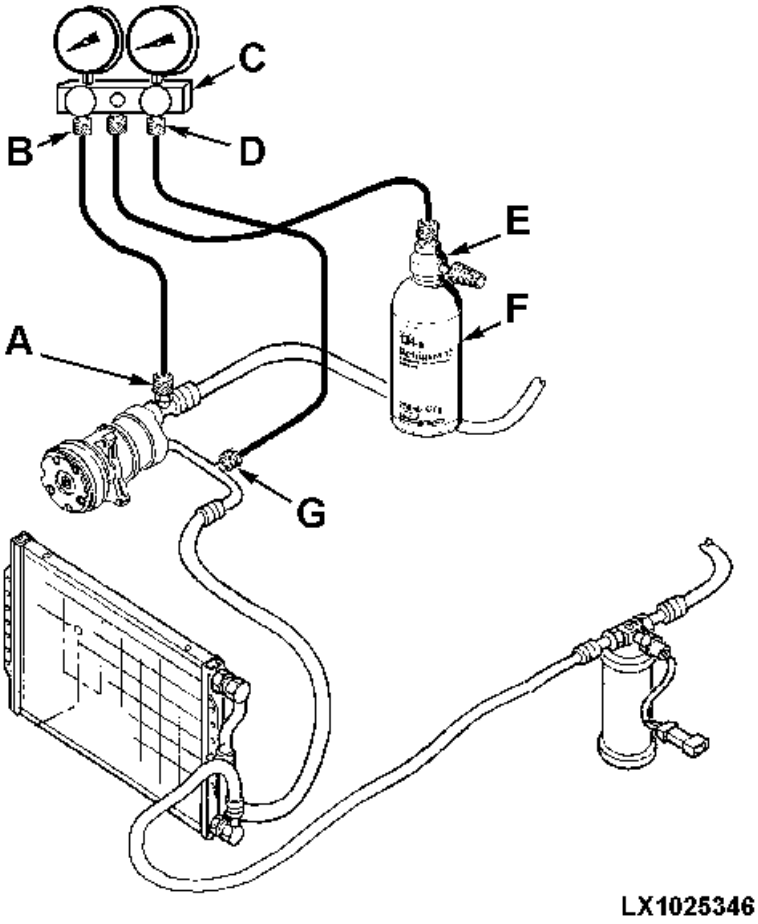
Prescribed capacity:

Item	Measurement	Specification
Refrigerant capacity of A/C system	Refrigerant weight	1450g (3.20 lb)

When the filling process is completed, close valves (B and E).

Check if enough refrigerant is in the system by looking at the sight-glass in the A/C receiver-drier. If bubbles occur, top up with more refrigerant.

Topping Up a Partly Discharged System



Topping up a partly discharged system

LEGEND:

A	Low-pressure valve
B	Low-pressure valve (open)
C	Dual gauge set FKM10445
D	High-pressure valve (closed)
E	Charging valve FKM10443 (open)
F	Refrigerant container FKM10447

It may become necessary to top up the system with small amounts of refrigerant in order to compensate for refrigerant lost through leakage or service work.

Connect dual gauge set FKM10445 as described in "Filling the System".

Use charging valve FKM10443 (E) to connect the yellow hose to refrigerant can FKM10447 (F).

IMPORTANT:

A system using R134a refrigerant must NEVER be filled with R12.

Unfasten the hose connection at the pressure gauge kit. Briefly open the discharge valve, so that air can escape from the yellow hose. Tighten the hose connection.

Run the engine at not more than 2000 rpm and set the system to maximum cooling effect.

Hold the refrigerant can upright and open the low-pressure valve (B).

Observe the sight-glass at the receiver-drier. When no more air bubbles are visible, add a further 0.2 to 0.4 kg (7 to 14 oz.) of refrigerant.

CAUTION:

The temperature of the refrigerant must never exceed 50°C (120°F), otherwise the refrigerant can may explode.

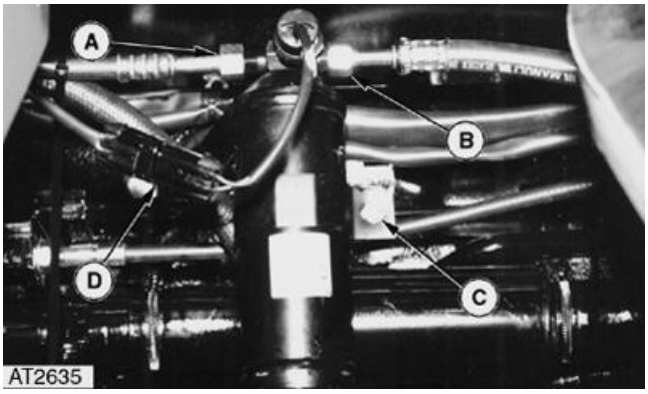
Replace Air Conditioning Receiver-Drier

→NOTE:

The receiver-drier is not serviceable. If malfunktion is suspected, install new receiver-drier.

If the air conditioning system is discharged for servicing and the receiver-drier is two years old or older, it should be replaced. If receiver- drier is less then two years old, it should be replaced only if the system was contaminated.

[1] -



Replace receiver-drier

Discharge air conditioning refrigerant (see procedure in this Group).

[2] - Disconnect lines (A and B) and connection (D) from receiver-drier.

[3] - Remove nut (C) and replace receiver-drier. Cap or plug all lines to prevent contamination.

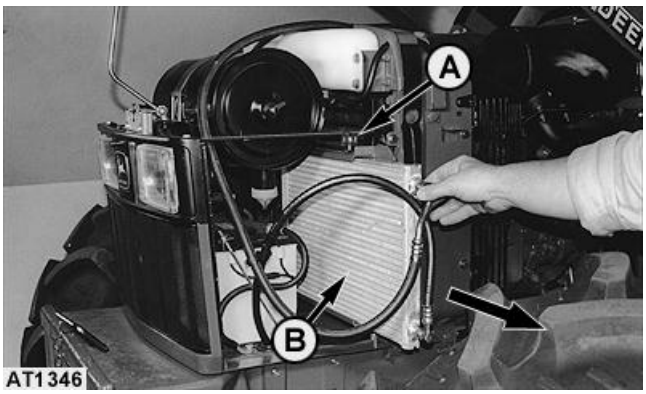
[4] - Install receiver-drier marked**"TOP"** in up position. Tighten lines (A and B).

[5] - Install and tighten nut (C).

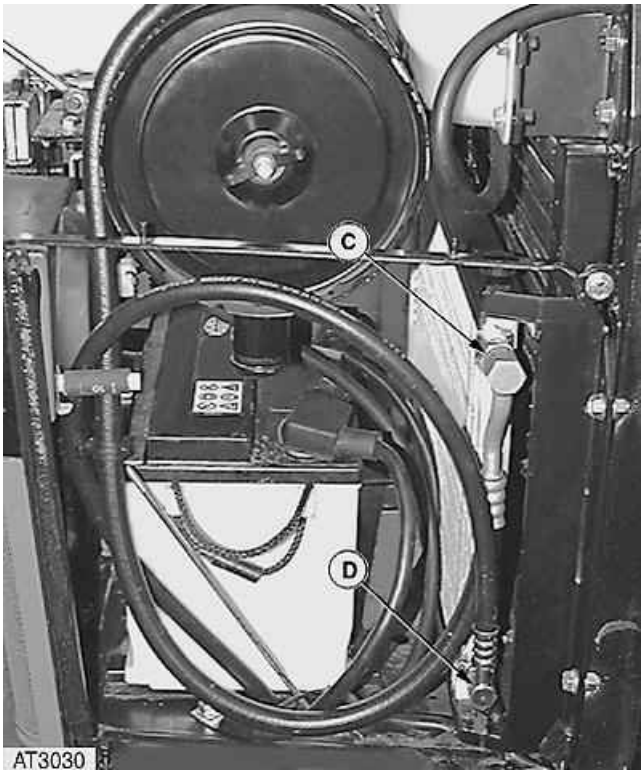
[6] - Evacuate and charge the system (see procedures in this Group).

Inspect Clean and Remove the Air Conditioning Condenser

[1] - Remove right and left side grille panel.



Clean condenser



Replace condenser

[2] - Unscrew knob (A) on each side. Now the condenser can be slid out for easier cleaning.

[3] - Check condenser for debris lodged in fins. Clean condenser using compressed air or pressure washer. Inspect the condenser bent fins, cracks and damaged seams.

IMPORTANT:

Reduce compressed air to less than 210 kPa; 2 bar (30 psi) when using for cleaning purposed between fins. Clean area of bystanders, guard against flying chips, and wear personal protection equipment including eye protection.

[4] -

→NOTE:

If necessary continue with the next steps to replace the air conditioning condenser.

Discharge the A/C system (see procedure in this Group).

[5] - Remove line (C and D).

IMPORTANT:

Cap or plug all lines to prevent contamination.

[6] - Cap or plug the outlet tube on the condenser.

[7] - Apply 690 kPa ; 7 bar (100 psi) of air pressure to the inlet tube and check for leak.

→NOTE:

Test condenser for leaks by spraying the surface using a 50-50 mixture of liquid soap and water.

Minor leak may be repaired, but condenser should be replaced if there is a major leak or restriction.

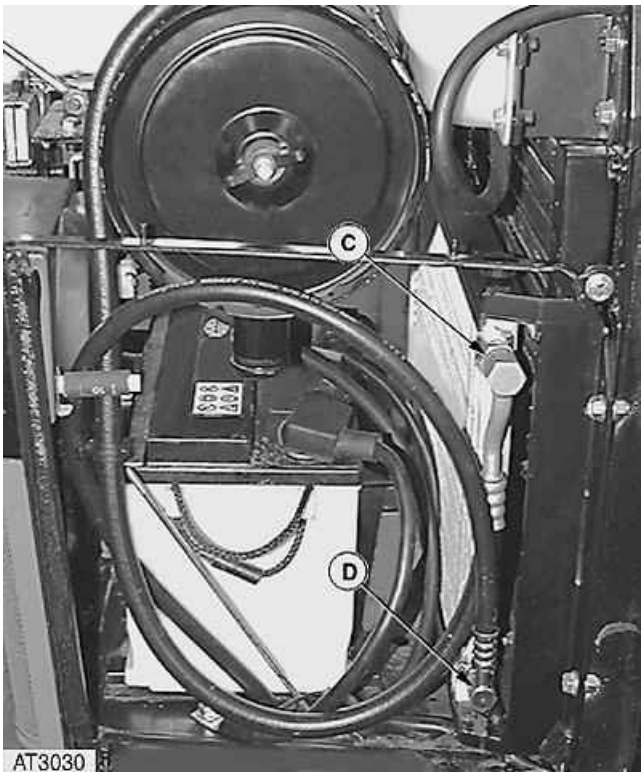
Install Air Conditioning Condenser

[1] -

IMPORTANT:

Always use new O-rings and seals. Damaged or used O-rings and seals will leak.

Install air conditioning condenser.



Install condenser

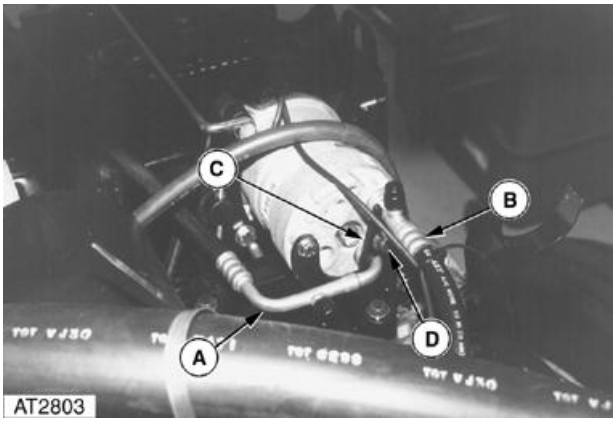
[2] - Connect condenser lines (C and D).

[3] - Install right and left grille panels.

[4] - Evacuate the A/C sytem and fill with refrigerant (see procedures in this Group).

Remove, Inspect and Install Air Conditioning Compressor

[1] - Discharge air conditioning refrigerant (see procedure in this Group).



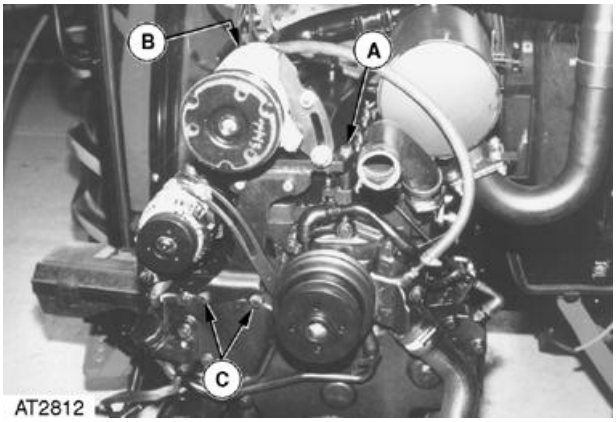
Remove compressor lines

[2] - Remove compressor belt.

[3] - Remove line (A) from compressor to condenser and line (B) from compressor to rear right side bracket. The lines (A) and (B) are attached to the compressor with plate (C) and bolt (D).

[4] - Remove electrical connection.

[5] - Loosen bolts (A), (B) and (C).



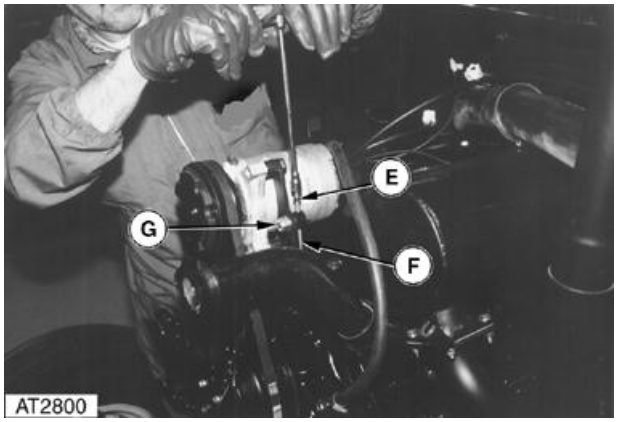
Remove compressor

[6] - Remove the compressor. Replace as necessary.

[7] - Install new compressor and it's belt (replace old belt as necessary).

→NOTE:

After the installation of the belt a first belt tension adjustment has to be carried out.

a. 

Belt tension adjustment

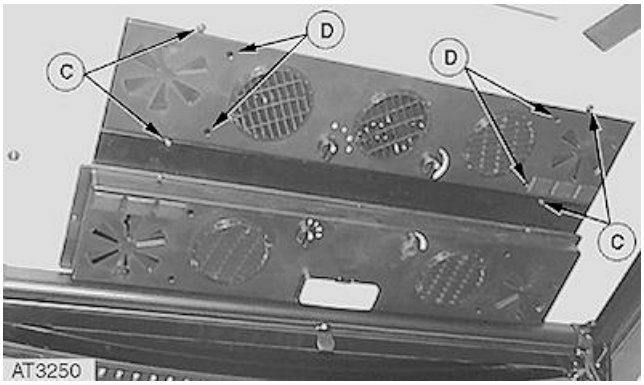
Adjust compressor belt tension by means of adjusting screw (E) and lock nut (F).

b. If a major adjustment is necessary, use nut (G) to move the appropiate pin up or down.

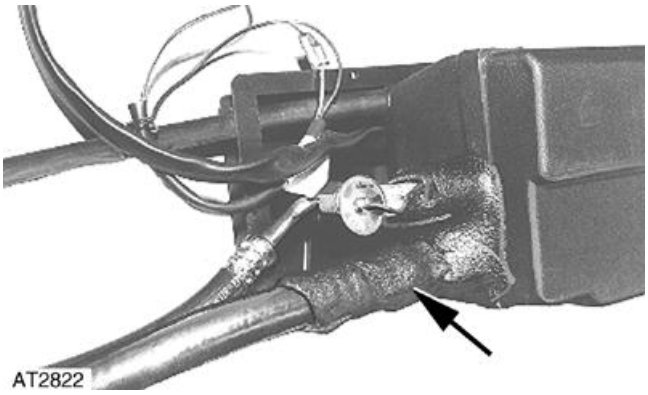
c. The final tension adjustment is done after the installation is completed and the engine has been run for 10 minutes.

Remove and Install Air Conditioning Evaporator

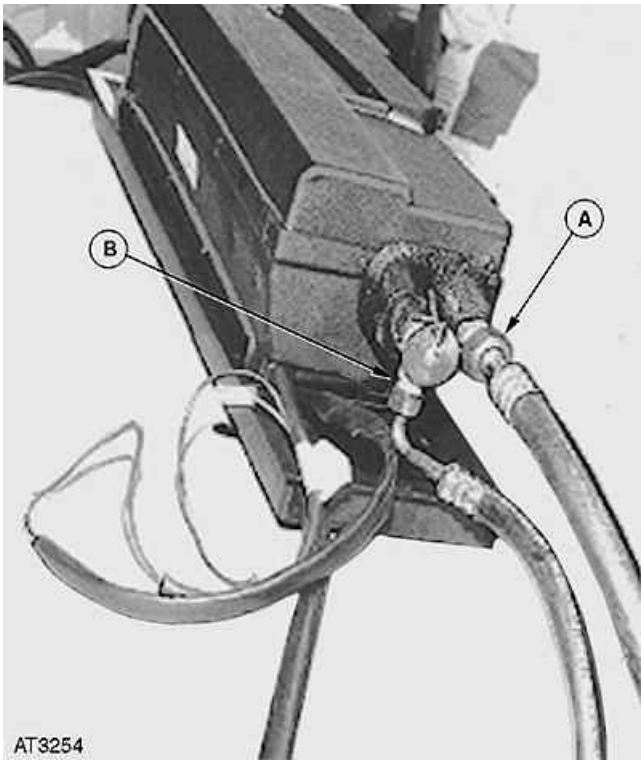
[1] -



Remove fan and controls



Disconnect hoses



Expansions valve

Disconnect batterie.

[2] - Discharge air conditioning refrigerant (see procedure in this Group).

[3] - Unscrew screws (C) and remove fan and air conditioning controls.

[4] - Disconnect evaporator´s electric connectors.

[5] - Remove the anti condensation material and disconnect hoses (A and B).

[6] - Unscrew screws (D).

[7] - Replace air conditioning evaporator.

[8] - Connect hoses (A) to new evaporator and hose (B) to expansions valve.

→NOTE:

Install anti condensation material.

[9] - Install fan and air conditioning controls and tighten screws (C).

[10] - Evacuate and charge A/C system (see procedure in this Group).

[11] - Run the engine and set A/C system to maximum cooling. Check for leak (see Fan, Heater and Air Conditioning System Controls on Operator´s Manual).

Group 25 - Operators's Cab

Service Equipment and Tools

→NOTE:

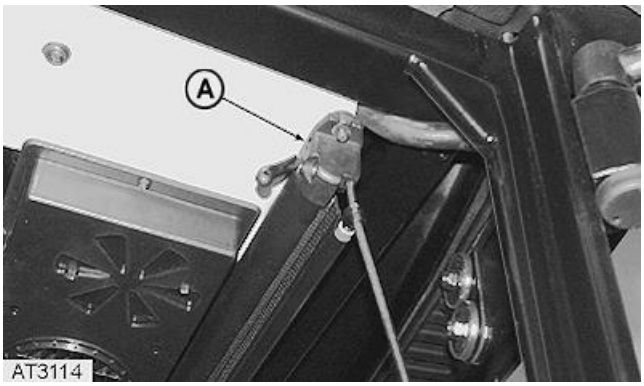
Order tools according to information given in the U.S. SERVICEGARD ™ Catalog or from the European Microfiche Tool Catalog (MTC). Some tools may be available from a local supplier.

Specifications

Item	Measurement	Specification
Lock nut, cab windows to hinges	Torque	18.3 N·m 13.5 lb-ft

Remove Front Windshield

[1] - Remove front sun visor (A).

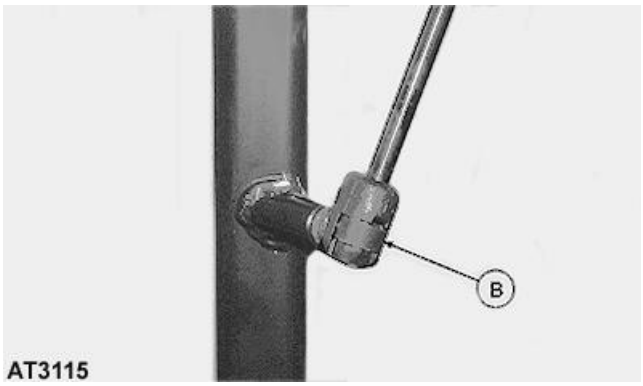


Remove front sun visor

[2] - Support the windshield.

[3] - Open front windshield for extend cylinder.

[4] - Remove the clamp (B). Repeat procedure for the second cylinder.

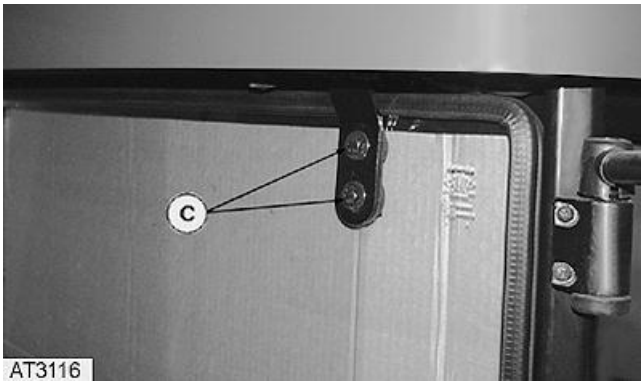


Remove the clamp

[5] - Disconnect the wiring of windshield wiper.

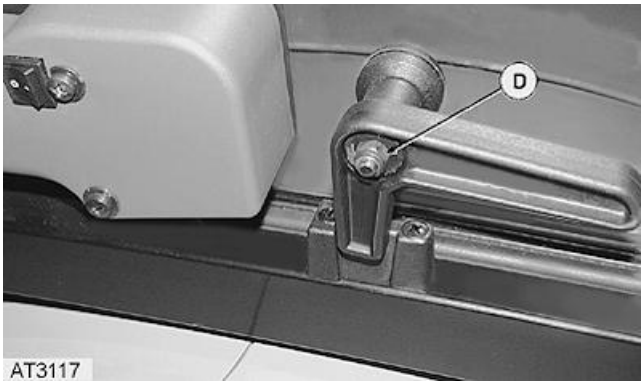
[6] - Install two suction cups on windshield surface.

[7] - Remove nut and screws (C).

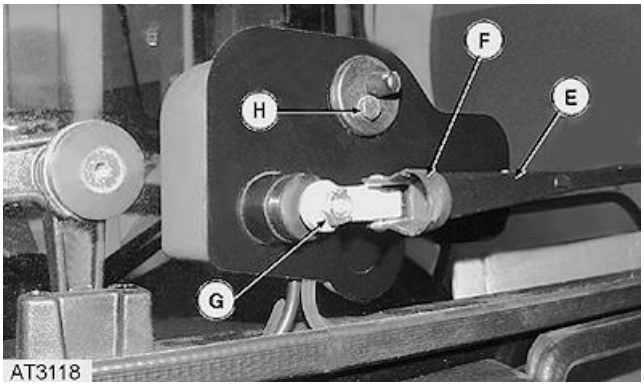


Upper windshield bracket

[8] - Remove windshield with windshield wiper, stop handle and cylinders.



Remove windshield (nut)



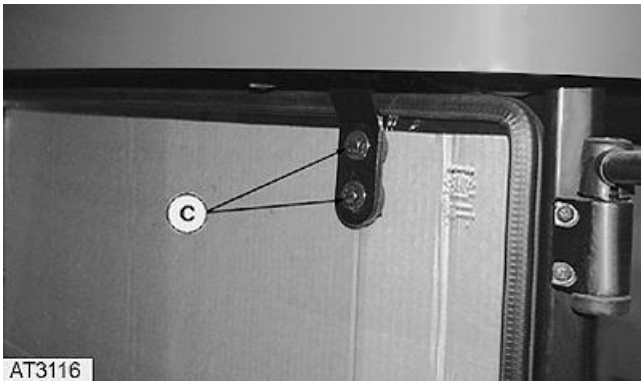
Remove windshield (wiper)

→NOTE:

To remove the stop handle, loosen nut (D). To remove windshield wiper, remove blade (E) of lifting protection (F) and unscrew nut (G). Windshield wiper housing can be removed by unscrewing bolt (H).

Install Front Windshield

[1] - Install on windshield the stop handle and windshield wiper.



Upper windshield bracket

[2] - Install cylinder on windshield.

[3] - Lift the windshield and install the cylinder on cab frame support.

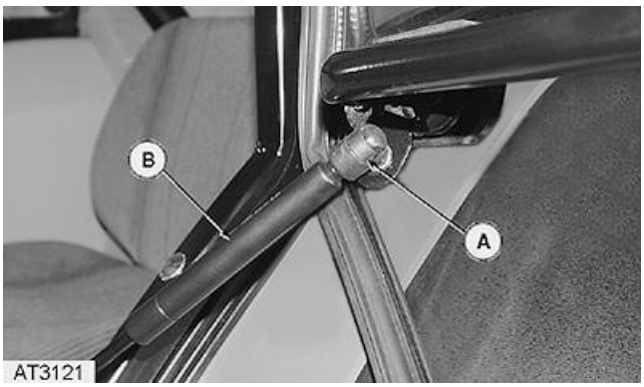
[4] - Tighten screws (C) and connect wiring to windshield wiper.

IMPORTANT:

Do not over tighten screws with lock nut (C) securing windshield to cab frame. Over tighten of mounting hardware will cause breakage.

Remove and Install Cab Door

[1] - Open the door.

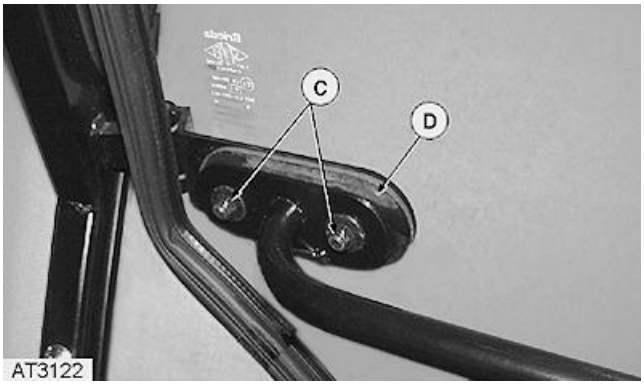


Disconnect cylinder

[2] - Attach a suitable lifting device to cab door.

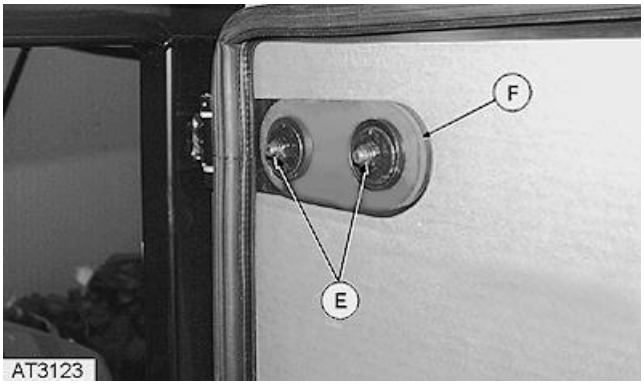
[3] - Remove the clamp (A) and disconnect cylinder (B).

[4] - Remove cap screws and washers (C) and plate (D).



Remove cap screws and washers (handle)

[5] - Remove cap screws and washers (E) and plate (F).



Remove cap screws and washers (upper)

[6] - Remove door, repair or replace as necessary.

[7] - Position door on hinges and install plate (E), screws and washers (C).

[8] - Install plate (E), screws and washers (F).

[9] - Gently close cab door and check alignment of door latch and seal. Align if necessary. Tighten cap screws (C and E).

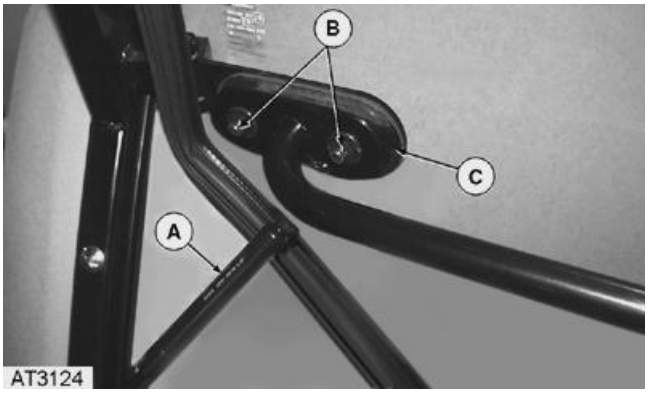
[10] - Open door and install cylinder (B).

IMPORTANT:

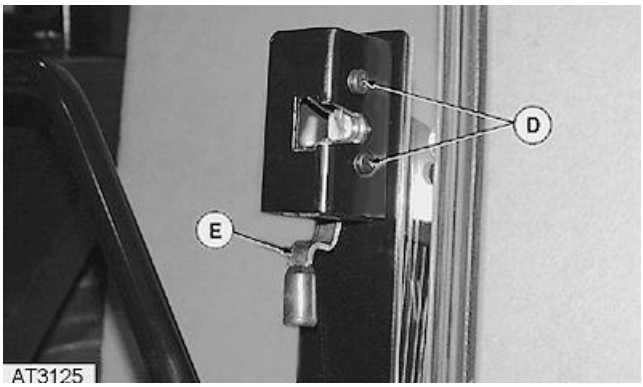
Do not over tighten screws with lock nut (B) securing door to cab frame. Over tighten of mounting hardware will cause breakage.

Remove and Install Inner Handle

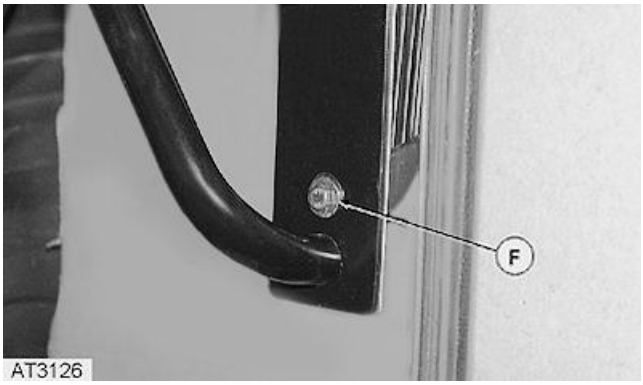
[1] - Open the door.



Disconnect cylinder



Unscrew lock screws



Remove screw and washer

[2] - Attach a suitable lifting device to cab door.

[3] - Disconnect cylinder (A).

[4] - Remove cap screws and washers (B) and plate (C).

[5] - Unscrew lock screws (D) and remove lock (E).

[6] - Inside lock seat unscrew the screw.

[7] - Remove screw and washer (F) and remove handle.

[8] - Install new handle using screws washers and plates.

IMPORTANT:

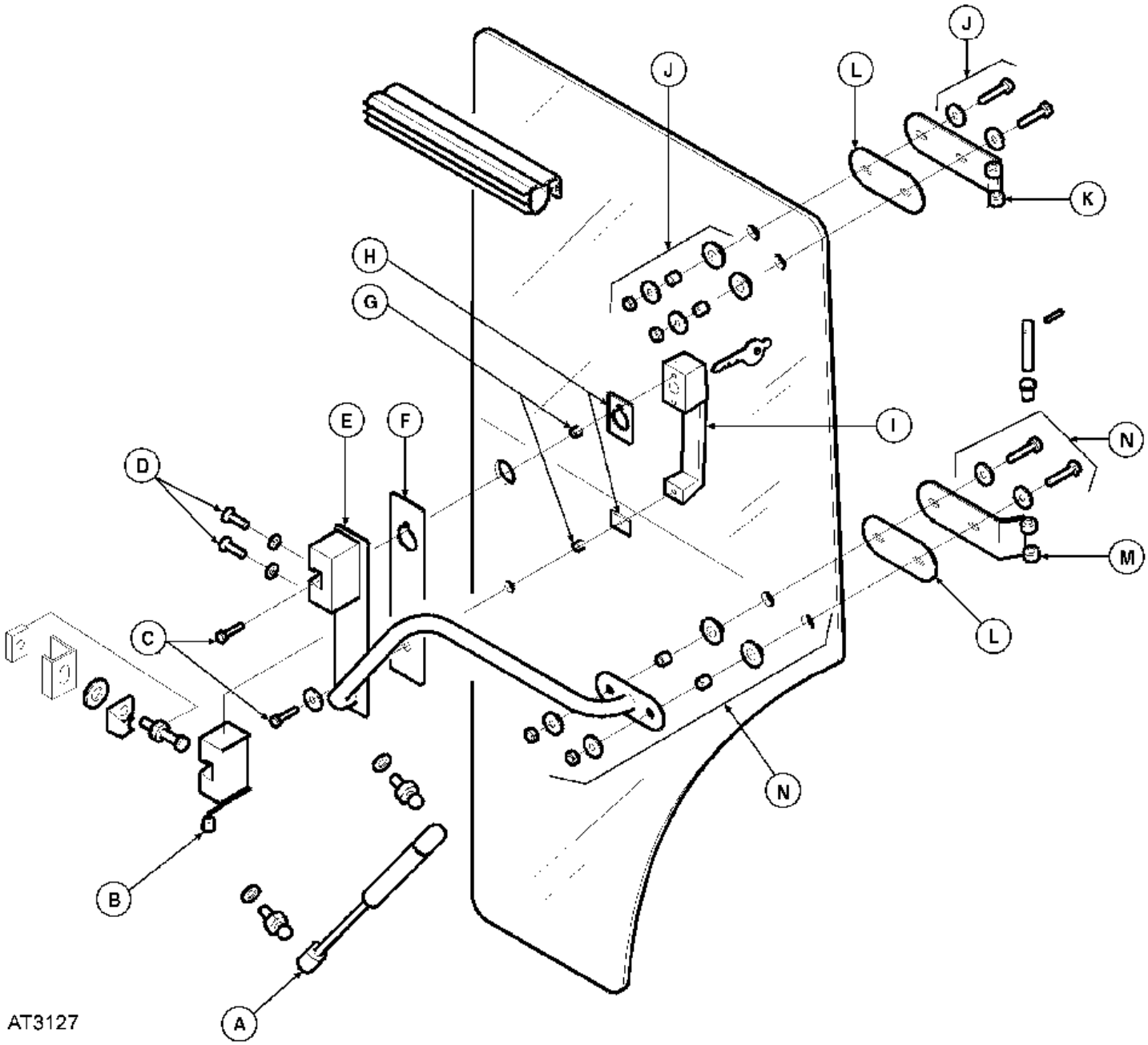
Do not over tighten screws with lock nut (B) securing handle to door. Over tighten of mounting hardware will cause breakage.

[9] - Install lock (E).

[10] - Install cylinder (A).

[11] - Gently close cab door and check alignment of door latch and seal. Align if necessary.

Cab Door, Exploded View



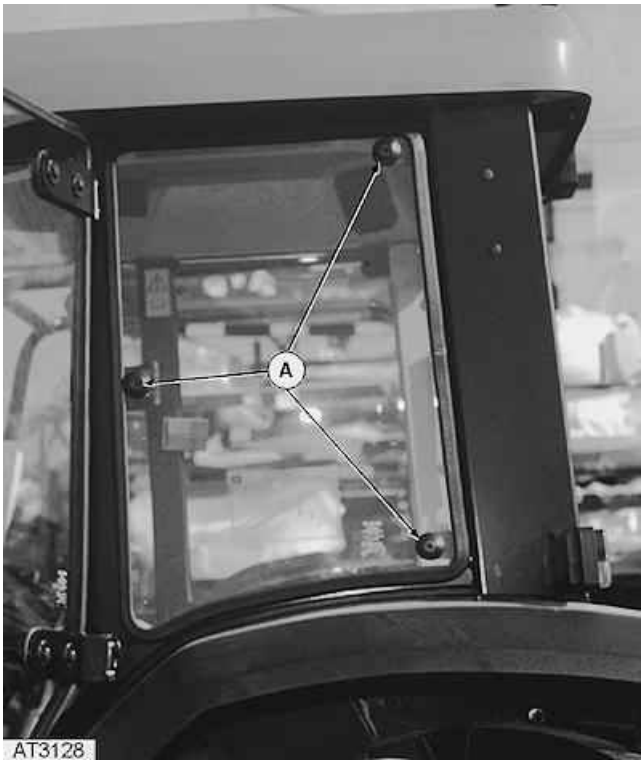
Cab Door, Exploded View

LEGEND:

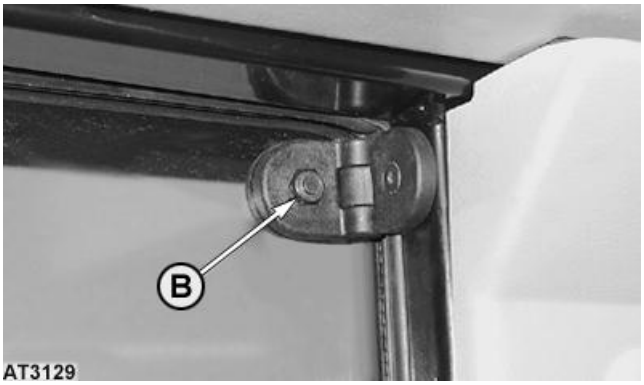
A	Cylinder
B	Lock
C	Inner handle screws
D	Lock screws
E	Inner handle
F	Plate
G	Rubber bush
H	Rubber gasket
I	Handle
J	Fixing of upper hinge
K	Upper hinge
L	Plate
M	Lower hinge
N	Fixing of lower hinge

Remove and Install Rear Side Cab Windows

[1] - Unscrew screws (A) with lock nut (B).



Attaching screws of side cab window



Lock nut

[2] - Replace rear side window if necessary. Repeat procedure for opposite side of cab.

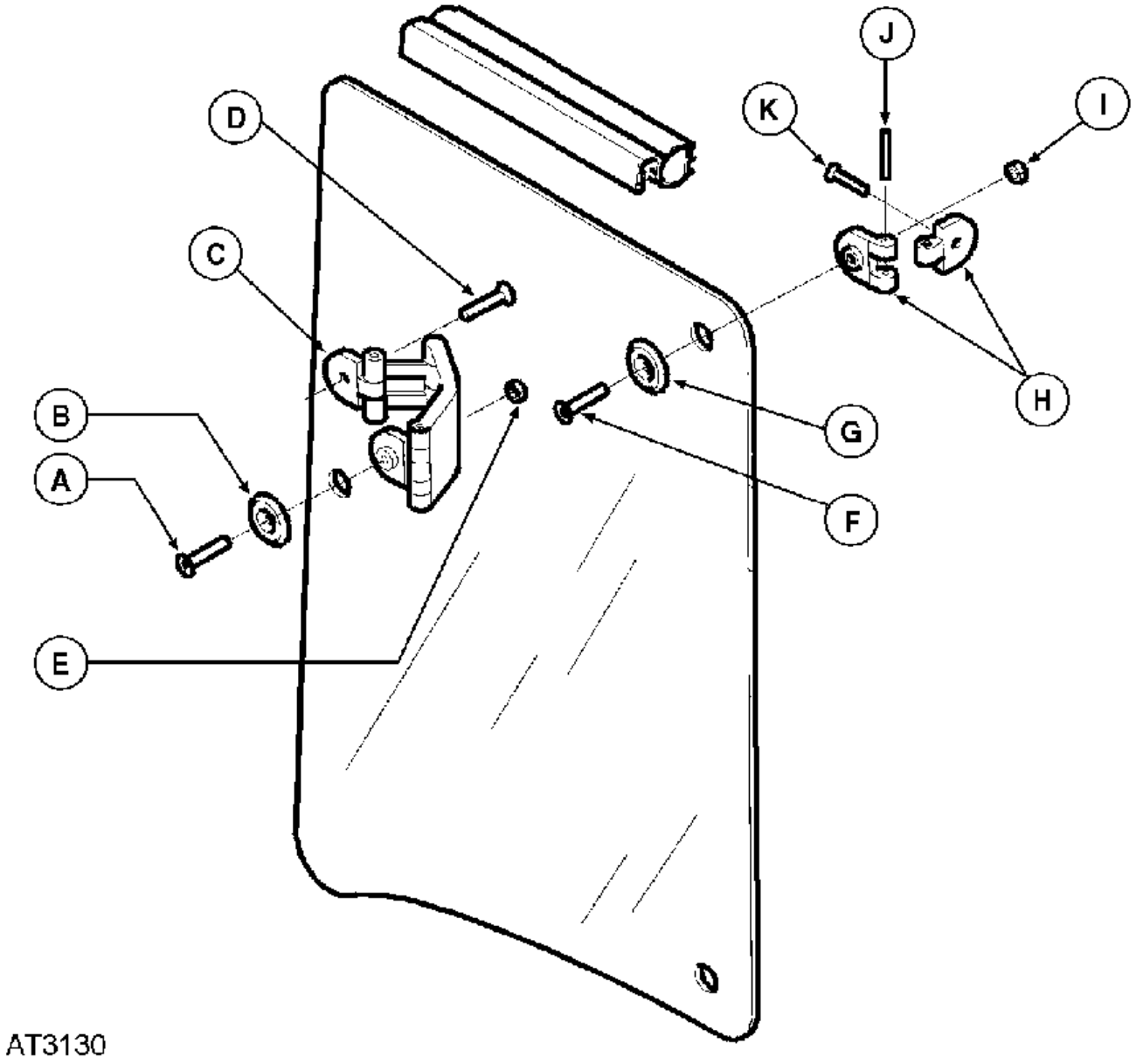
IMPORTANT:

Do not over tighten screws with lock nut (B) securing handle to door. Over tighten of mounting hardware will cause breakage.

[3] - Install window using screws (A) with lock nut (B). Tighten lock nut to specified torque.

Item	Measurement	Specification
Lock nut, cab side window to hinge	Torque	18.3 N·m 13.5 lb-ft

Rear Side Cab Windows, Exploded View



Rear Side Cab Windows, Exploded View

LEGEND:

A	Screw
B	Nylon washer
C	Elbow handle
D	Screw
E	Lock nut
F	Screw
G	Nylon washer
H	Hinge (2 used)
I	Lock nut
J	Pin for hinge
K	Screw

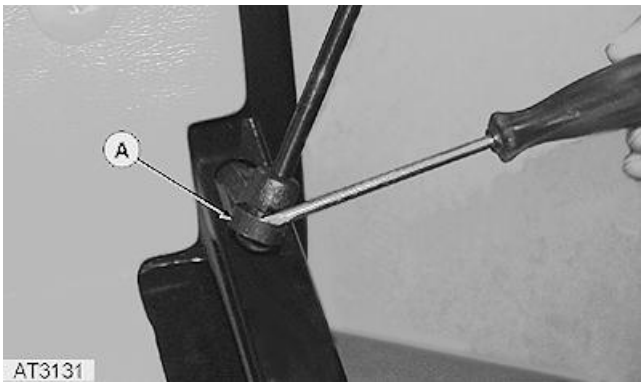
Remove Rear Window

[1] - Relief cylinders by opening the rear window and disconnect them.

[2] - Install two suction cups on rear window surface.

[3] - Support the rear window.

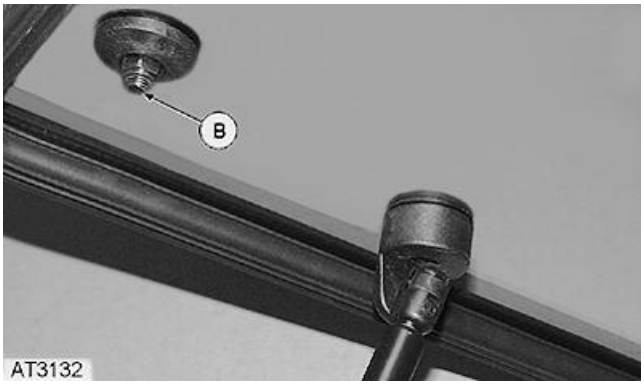
[4] - Remove the clamps (A). Repeat procedure for the second cylinder.



Remove the clamps

[5] - Disconnect the wiring of rear wiper (if equipped).

[6] - Remove lock nut (B) and screws.



Remove lock nut

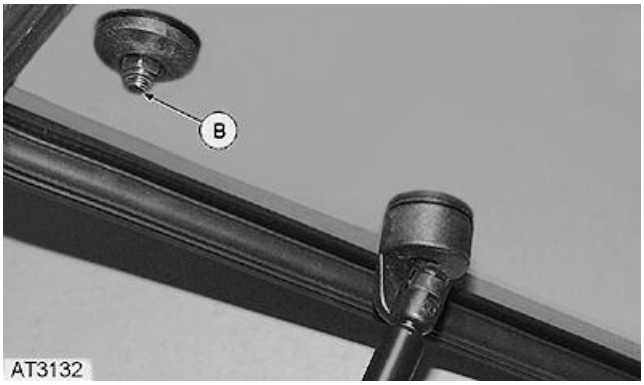
[7] - Remove rear window with wiper, stop handle and cylinders.

Install Rear Window

[1] - Install stop handle and rear wiper on rear window.

[2] - Install cylinders on rear window.

[3] - Attach rear window, tighten lock nuts (B) and screws and connect wiring to wiper.



Tighten lock nuts

IMPORTANT:

Do not over tighten screws with lock nut (B) securing rear window to cab frame. Over tighten of mounting hardware will cause breakage.

[4] - Install cylinders to cab frame support.

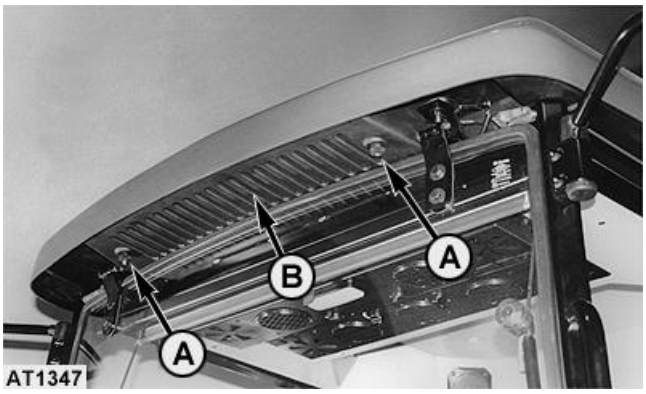
Remove and Install Cab Recirculating/Fresh Air Filter

[1] -

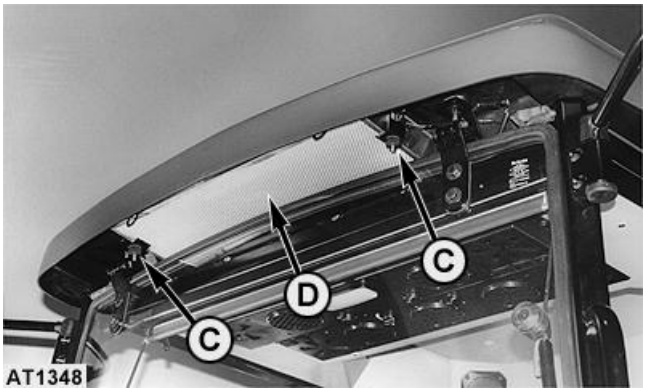
CAUTION:

The cab air filter is not designed to clean the air of harmful chemicals. Follow the instructions given in the implement operator´s manual and those given by the manufacturer of the chemicals used.

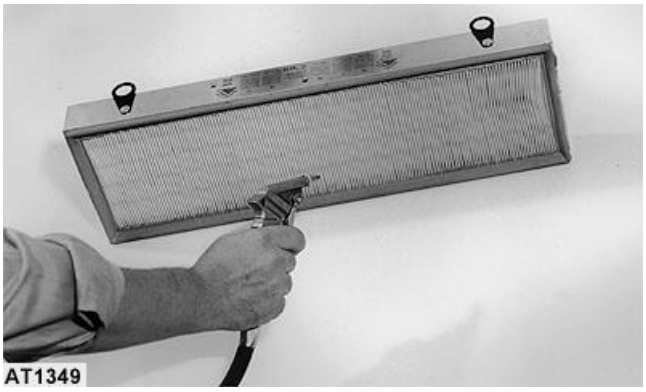
Remove the two screws (A) and filter cover (B).



Remove filter cover



Remove air filter element



Cleaning the filter element with compressed air

[2] - Remove the two screws (C) and air filter element (D). Note the position of element for re-installation.

[3] - Clean element with compressed air following the instructions on the filter.

→NOTE:

When working in dusty conditions clean filter element frequently. After the filter has been cleaned several times it has to be replaced when it starts to be ineffective.

[4] - Install air filter element (D).

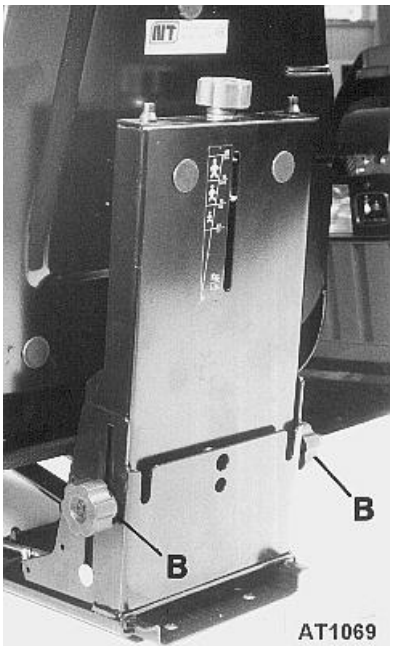
[5] - Install filter cover (B) and tighten screws (A).

Group 30 - Operator′s Seat

Remove and Install Operator′s Seat

[1] -

Seat, front view



Seat, back view

Loosen handwheel (B) and grip seat between seat cushion and backrest. When seat is at max. height, tighten handwheel (B).

[2] - Move lever (A) and slide out operator′s seat.

Section 240 - ELECTRICAL SYSTEM - OPERATION AND TESTS

Table of contents

Group 05 - Component Location

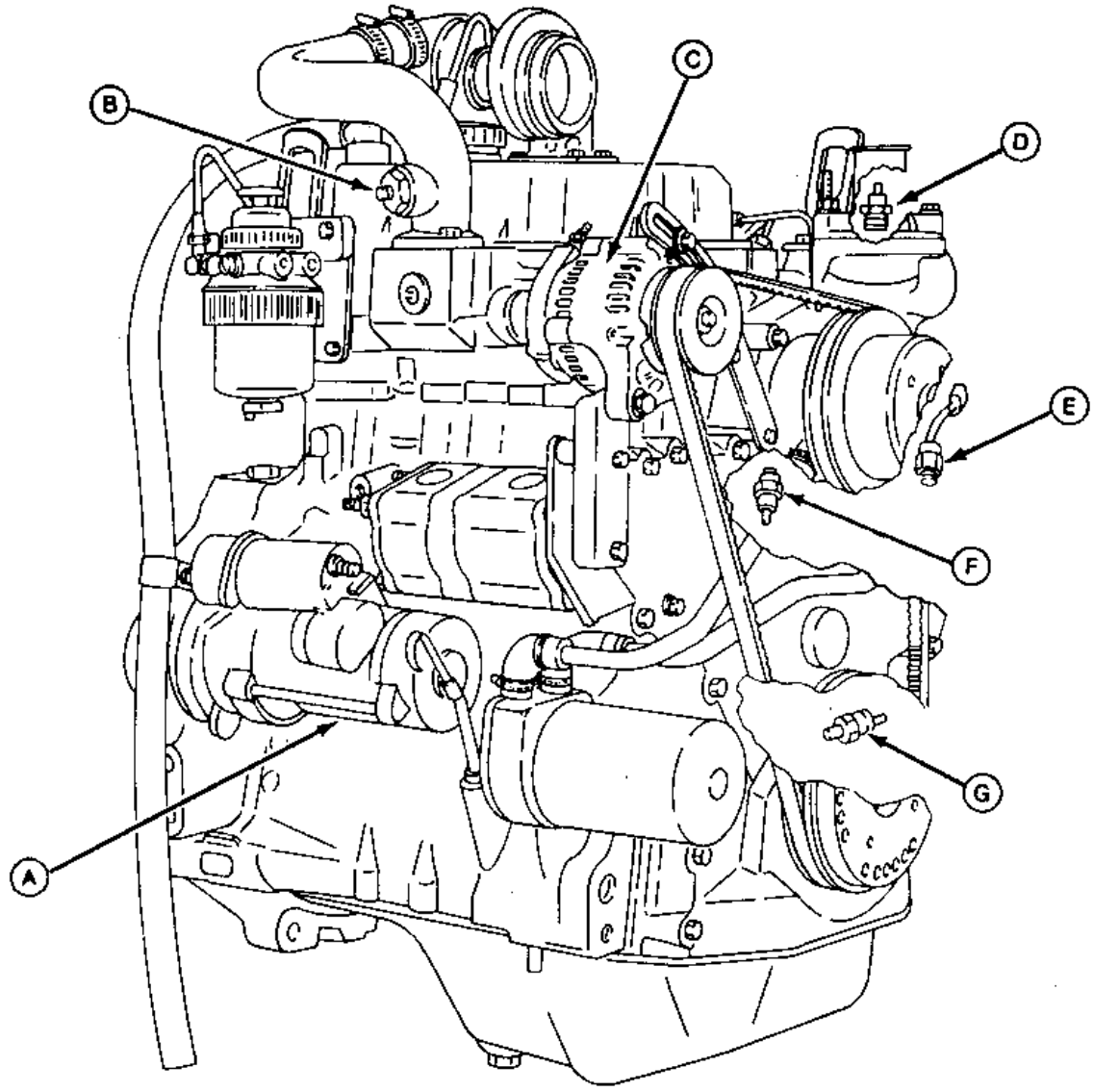
Component Location Information

This group contains component location drawings for the following electrical components:

- Engine Components
- Dashboard Components
- Machine Components

Use the drawings when troubleshooting an electrical problem to help locate the components to be tested.

Engine Electrical Components



AT1200

Engine Electrical Components

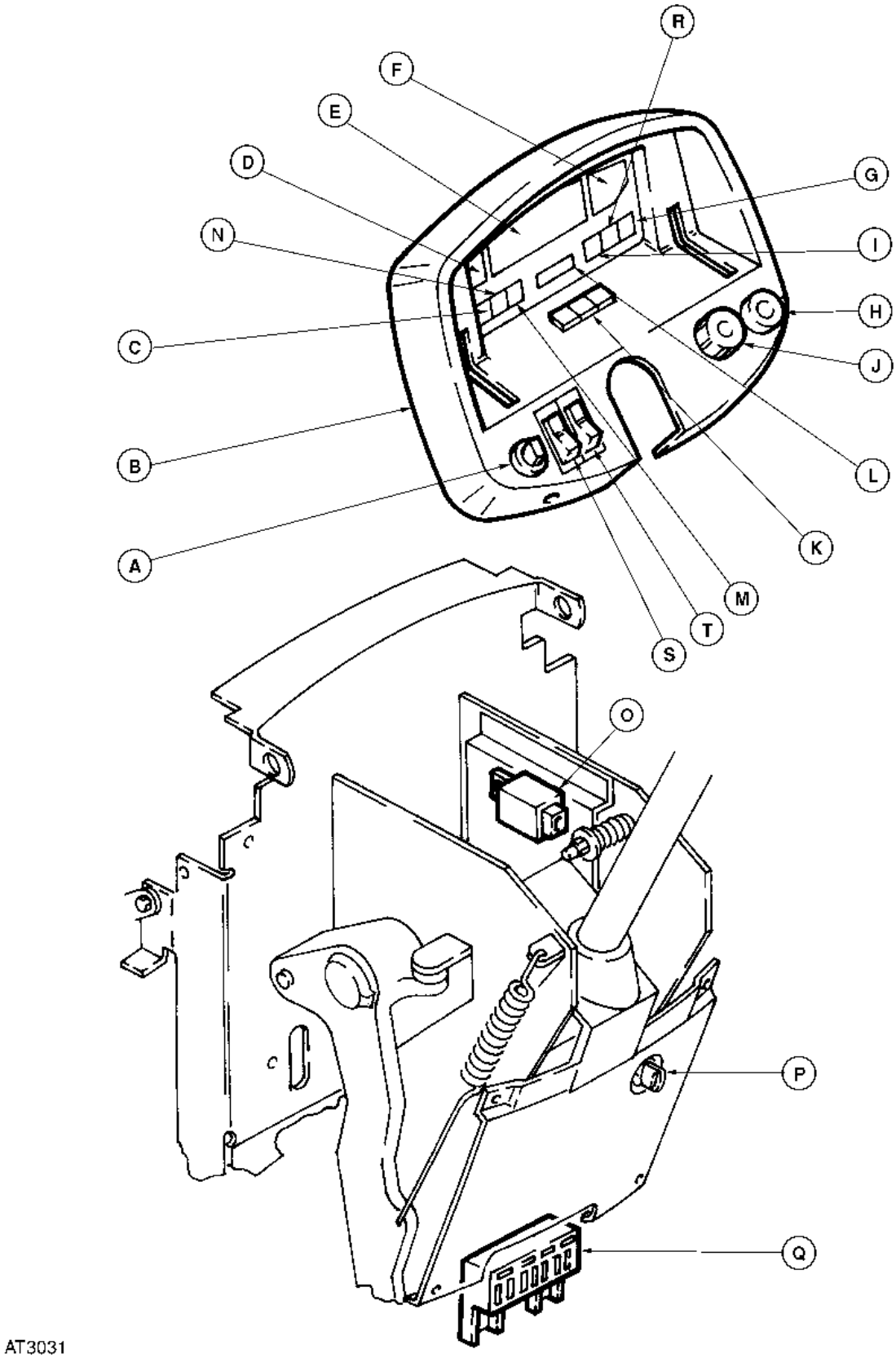
LEGEND:

A	Starting Motor
B	Manifold Heater
C	Alternator/Regulator
D	Coolant Temperature Sender
E	Engine Speed Sensor
F	Fuel Shut-Off Solenoid
G	Oil Pressure Switch

→NOTE:

Manifold heater (B) is located in intake manifold, on right-hand side of cylinder head.

Dashboard Electrical Components



Dashboard Electrical Components

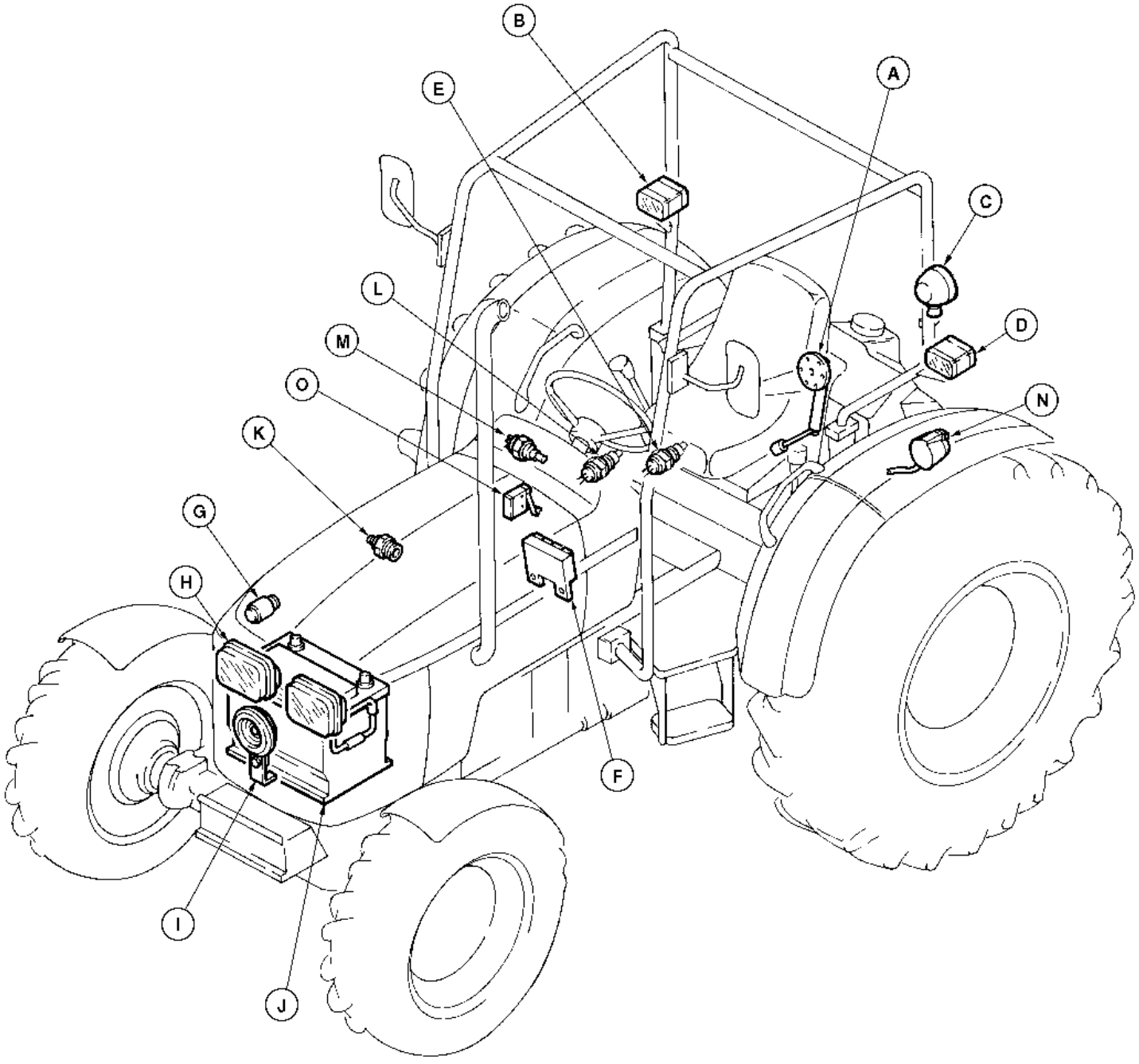
LEGEND:

A	Turn signal controller
B	Instrument panel
C	High beam indicator light
D	Fuel gauge
E	Tachometer

F	Engine coolant temperature gauge
G	Engine oil pressure indicator light
H	Hazard warning light switch
I	Charge indicator light
J	Light switch
K	Turn signal indicator
L	Hour meter
M	PTO indicator light
N	Air filter restriction indicator light
O	Turn signal Flasher
P	Key switch
Q	Fuse block
R	Parking brake indicator light
S	Front-wheel drive switch
T	Beacon light switch

Machine Electrical Components

Tractors With Open Operator′s Station



AT3179

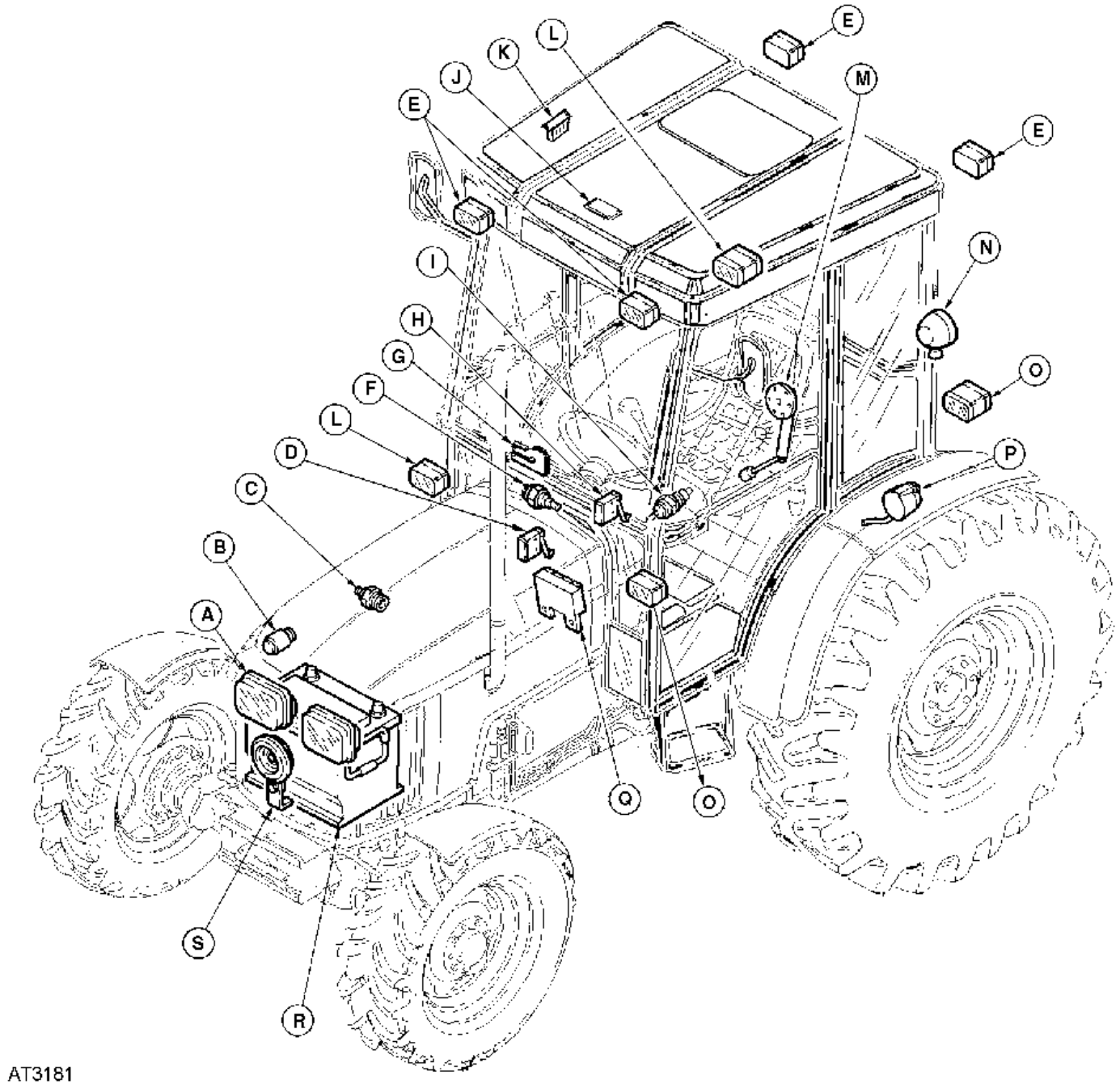
Machine Electrical Components, Tractors with OOS

LEGEND:

A	Fuel level sending unit
B	Right parking/warn/turn light
C	Rear work light
D	Left parking/warn/turn light
E	Parking brake switch
F	Fuse box
G	Air filter restriction switch
H	Head lights
I	Horn
J	Battery

K	Manifold heater
L	Rear PTO switch
M	Neutral start switch
N	7-pin trailer connector
O	Brake pedal switch

Tractors With Cab



Machine Electrical Components, Tractors with Cab

LEGEND:

A	Head lights
B	Air filter restriction switch
C	Manifold heater
D	Brake pedal switch
E	Front and rear work lights
F	Neutral start switch
G	Front wiper/washer
H	Rear PTO switch
I	Parking brake switch
J	Dome lights

K	Fuse box
L	Right parking/warn/turn light
M	Fuel level sending unit
N	Rear work light
O	Left parking/warn/turn light
P	7-pin trailer connector
Q	Fuse box
R	Battery
S	Horn

Group 10 - Theory of Operation

General Information

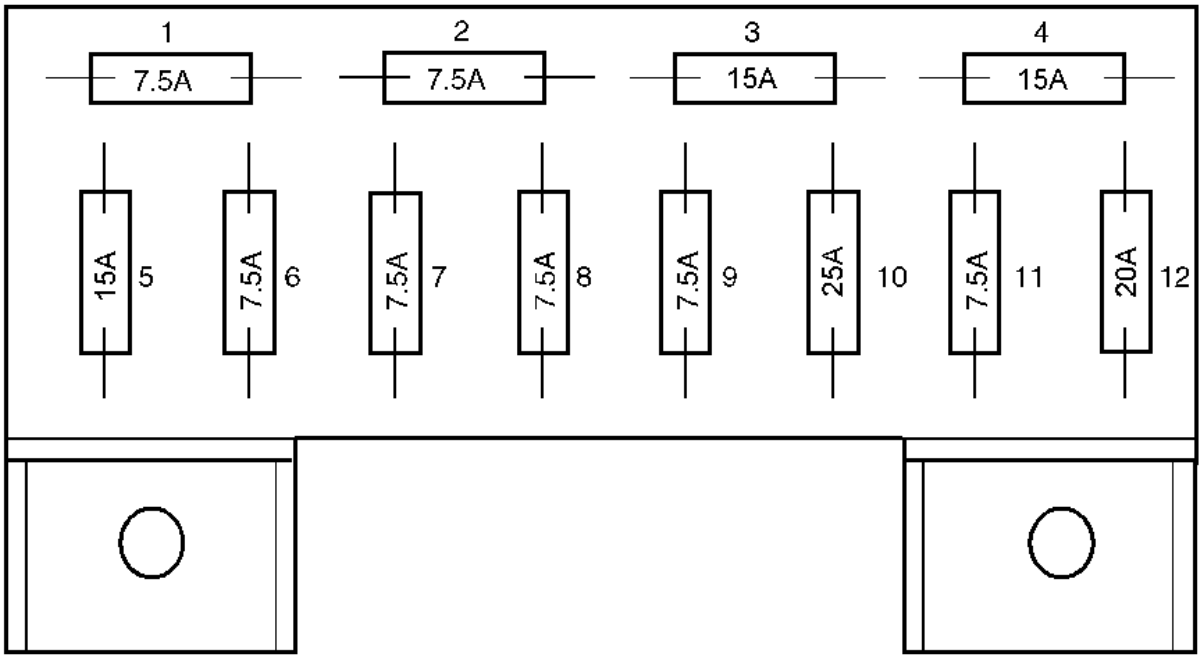
This Group divides the electrical system into individual circuits by function. Each circuit has been isolated from the main wiring schematic and only shows the components that are used in that circuit. The theory of operation story explains: function of the circuit, operating conditions, components used, and current flow.

The circuit schematic that accompanies each theory story shows the operating condition with the battery or power circuit on top and the ground circuit on the bottom.

The following systems or components are covered:

- Fuse Box
- Starting Systems
- Manifold Heater System
- Charging System
- Lighting System
  - Turn Signals
  - Warning Lights
  - Parking Lights
  - Headlights
  - Instrument Lights
  - Rear Work Light
- Instrument Panel System
  - Fuel Gauge
  - Temperature Gauge
  - Hourmeter
- PTO Warning System
- Air Filter Restriction Indicator
- Horn
- Trailer Connector

Fuse Box and Fuses



AT2208

Fuse Box and Fuses

Function

Protect circuits from electrical overload.

Major Components

- Fuse Box
- Fuses

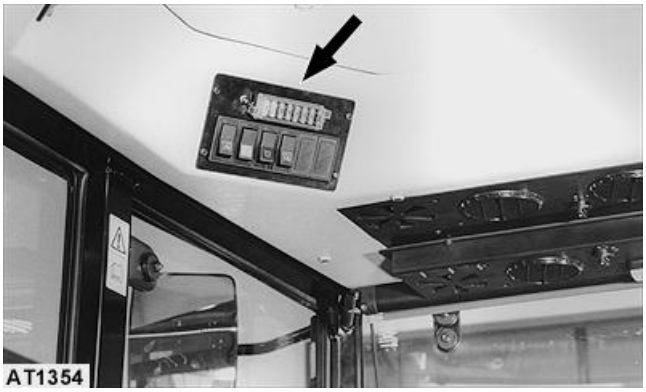
Theory of Operation

Fuse box uses push-in, blade-type fuses to limit current flow in their respective circuits. When flow exceeds rating on fuse, its conductor melts, thus preventing circuit damage.

A total of twelve fuses are used. Fuse ratings and the circuits they protect are as follows:

1. 7.5 amp: R.h. low beam headlight
2. 7.5 amp: L.h. low beam headlight
3. 15 amp: Horn
4. 15 amp: Beacon and hazard warning lights
5. 15 amp: Full beam headlights
6. 7.5 amp: R.h. front and rear parking lights, seven pin trailer connector and license plate lights
7. 7.5 amp: L.h. front and rear parking lights, seven pin trailer connector, work and instrument panel lights
8. 7.5 amp: L.h. stop lights and seven pin trailer connector lights
9. 7.5 amp: Pneumatic engine for operator′s seat
10. 25 amp: Three pin connector.
11. 7.5 amp: PTO switch, fuel shut-off solenoid, instrument panel and alternator
12. 20 amp: Stop switches, three pin connector, front-wheel drive switch and hazard warning light switch

Cab Fuses, Size and Function



Cab Fuses

The cab fuses are located in the cab roof on the left-hand side.

From left to right the fuses protect the following circuits:

- 20 amp - Air conditioning system
- 20 amp - Fan
- 7.5 amp - Rear wiper and radio
- 7.5 amp - Windshield wiper and washer
- 10 amp - Cab lighting and beacon light
- 10 amp - Front work lights
- 10 amp - Rear work lights
- 7.5 amp - Not used

Main Fuse

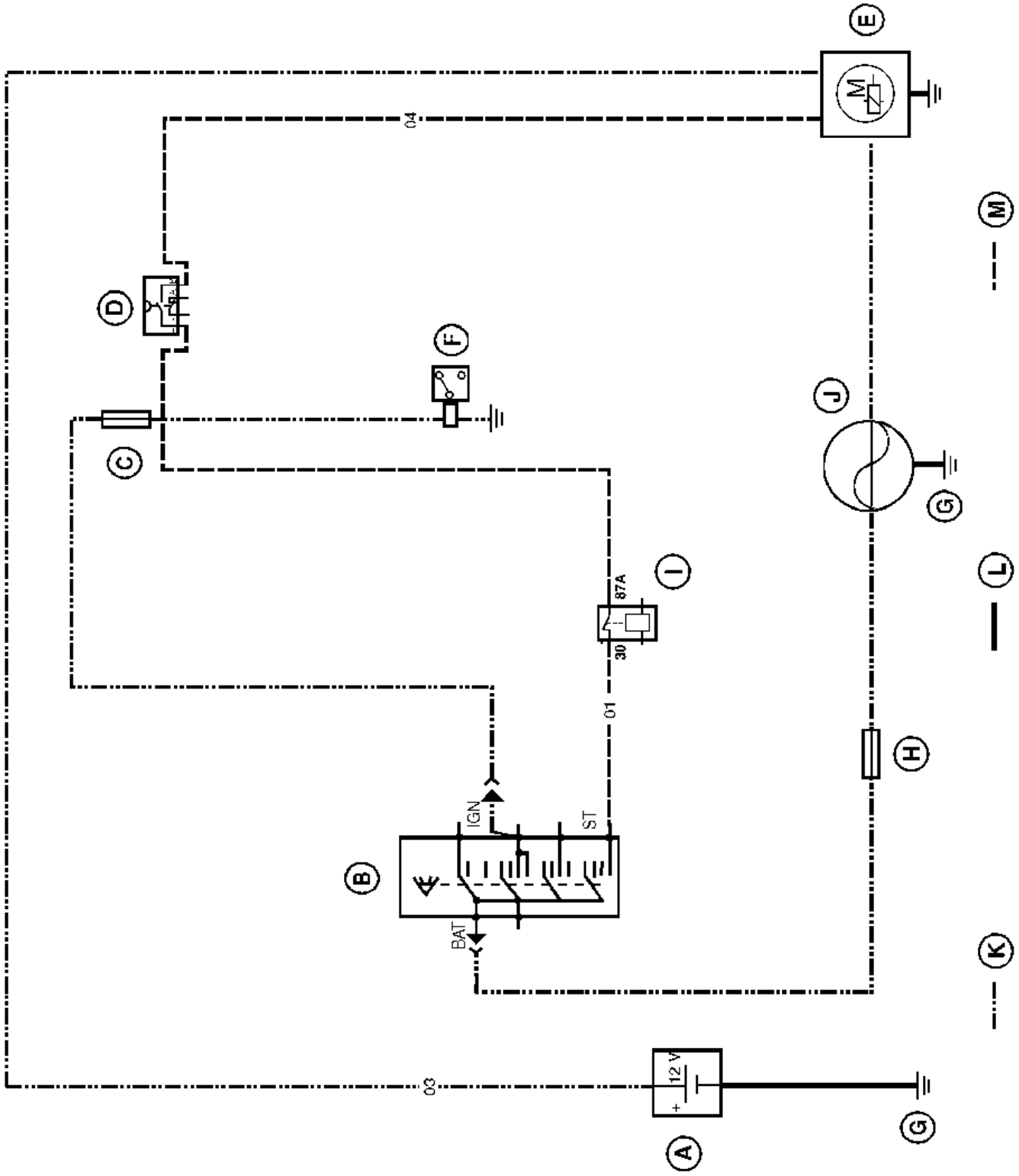
The main fuse is located in the motor seat, on alternator/regulator.

This fuse limits current flow in all circuits of tractor.

Value of main fuse:**50 amp** .

Starting System Operation - Normal

Layout:



AT3138

Starting System Operation - Normal

LEGEND:

A	Battery
B	Key switch
C	Fuse 11, 7.5 amp
D	Neutral start switch
E	Starter
F	Fuel shut-off solenoid
G	Ground
H	Main fuse
I	Neutral start relay
J	Alternator/regulator
K	Power circuit
L	Ground circuit
M	Energizing circuit

Function:

The starting system converts electrical energy into the mechanical force necessary to crank the engine.

Major Components:

- Main fuse, 50 amp
- Starter
- Alternator/regulator
- Fuse 11, 7.5 amp
- Key switch
- Neutral start switch
- Neutral start relay
- Fuel shut-off solenoid

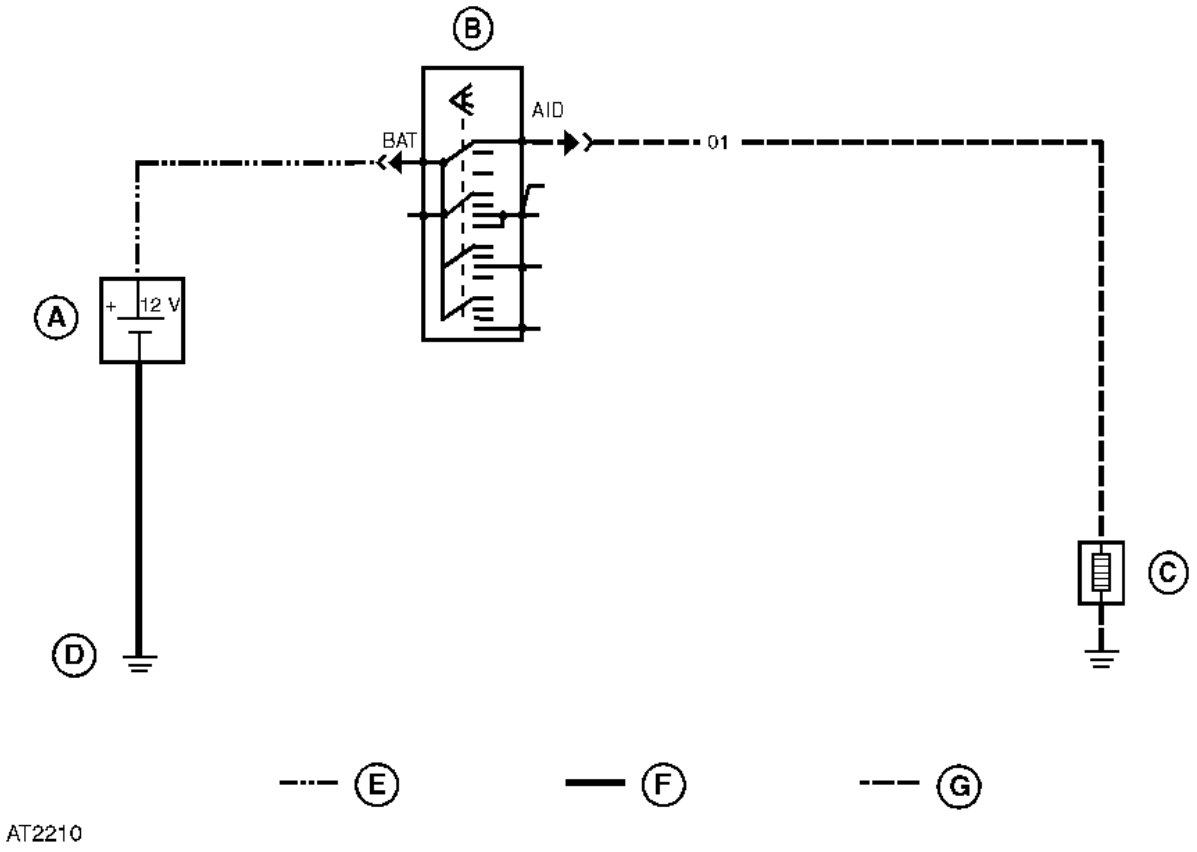
Theory Of Operation:

When key switch**(B)** is turned to start position, current from battery and main fuse flows through contacts of key switch and out circuit**01** . Current then flows through neutral start relay**(I)** and through neutral start switch**(D)** . Current leaving the neutral start switch travels to the starting motor which then cranks the engine.

→NOTE:

The engine will not start if PTO clutch lever is in engaged position.

Manifold Heater System Operation



Manifold Heater System

LEGEND:	
A	Battery
B	Key Switch
C	Manifold Heater
D	Ground
E	Power Circuit
F	Ground Circuit
G	Energizing Circuit

Function

Heats air entering engine to aid cold-weather starting.

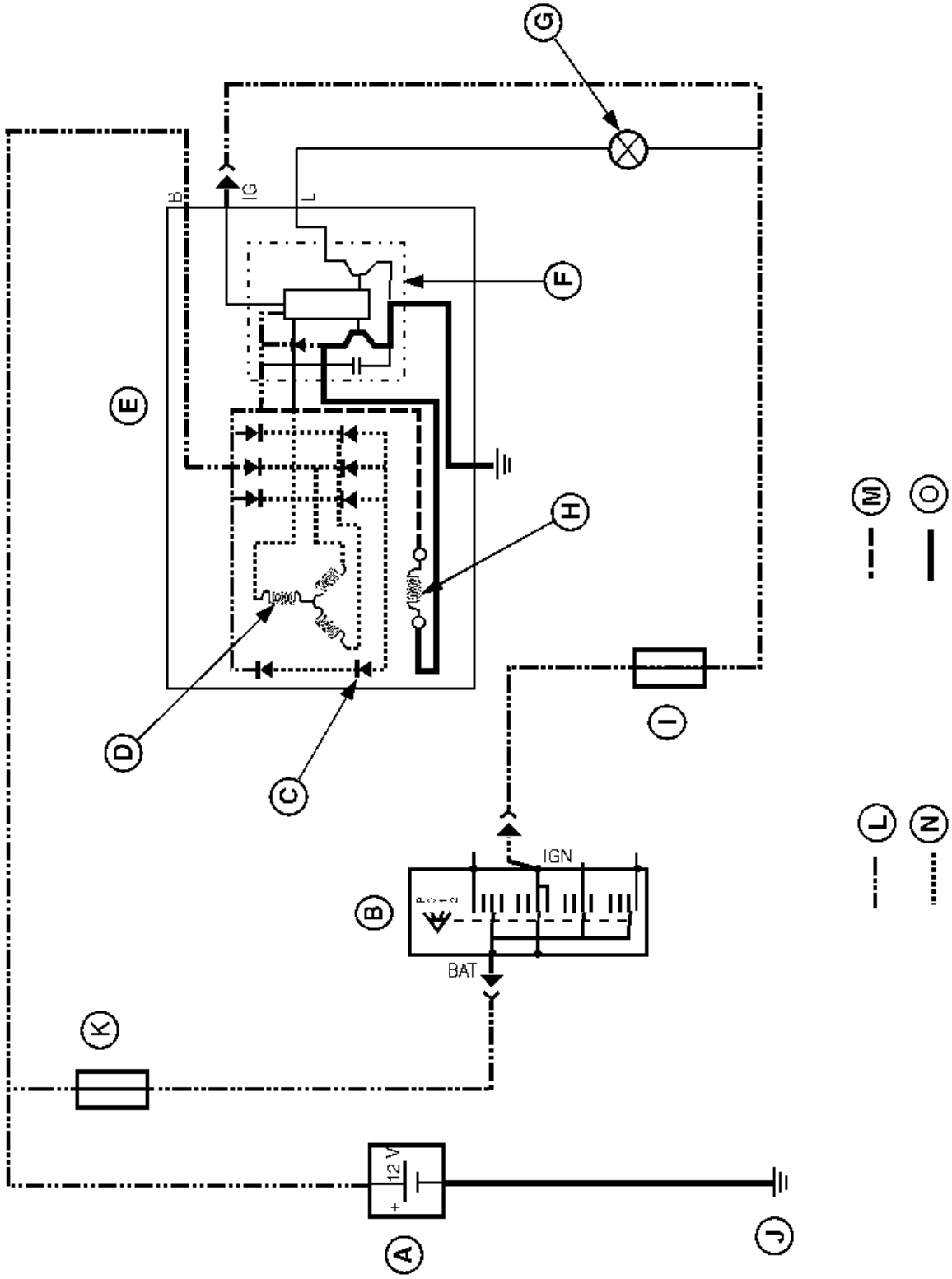
Major Components

- Key Switch
- Manifold Heater

Theory of Operation

System is controlled by operator only. No automatic control is used. When operator pushes in on key in heater position, current flows and across starting contacts of key switch (B). Current exits key switch on circuit 01 and flows to manifold heater (C). Hold the key in for 10 to 15 seconds with temperatures down to— 18°C (— 0.4°F), for 30 seconds with temperatures down to— 23°C (— 9.4°F) and up to 45 seconds with temperatures below— 23°C (— 9.4°F).

Charging System Operation



AT3139

Charging System Operation

LEGEND:

A	Battery
B	Key Switch

C	Rectifier Diode
D	Stator
E	Alternator/Regulator
F	Voltage Regulator
G	Charge Indicator
H	Rotor
I	Fuse, 7.5 amp
J	Ground
K	Main fuse, 50 amp
L	Direct Current
M	Field Current
N	Alternating Current
O	Ground Circuit

Function

Recharges battery after discharge from starter or other electrical load. Also supplies current for electrical accessories with tractor running.

Major Components

- Battery
- Alternator
- Voltage Regulator
- Main fuse, 50 amp

Theory of Operation

Alternator stator (D) consists of three separate sets of windings connected in a Y configuration. Field current passes from voltage regulator to rotor (H). Rotor spins inside stator windings, inducing an alternating current into the stator.

Alternating current cannot be used for charging battery or operating accessories. Rectifier diodes (C) change alternating current to direct current. Current flows through rectifier diodes to terminal B of alternator and to battery.

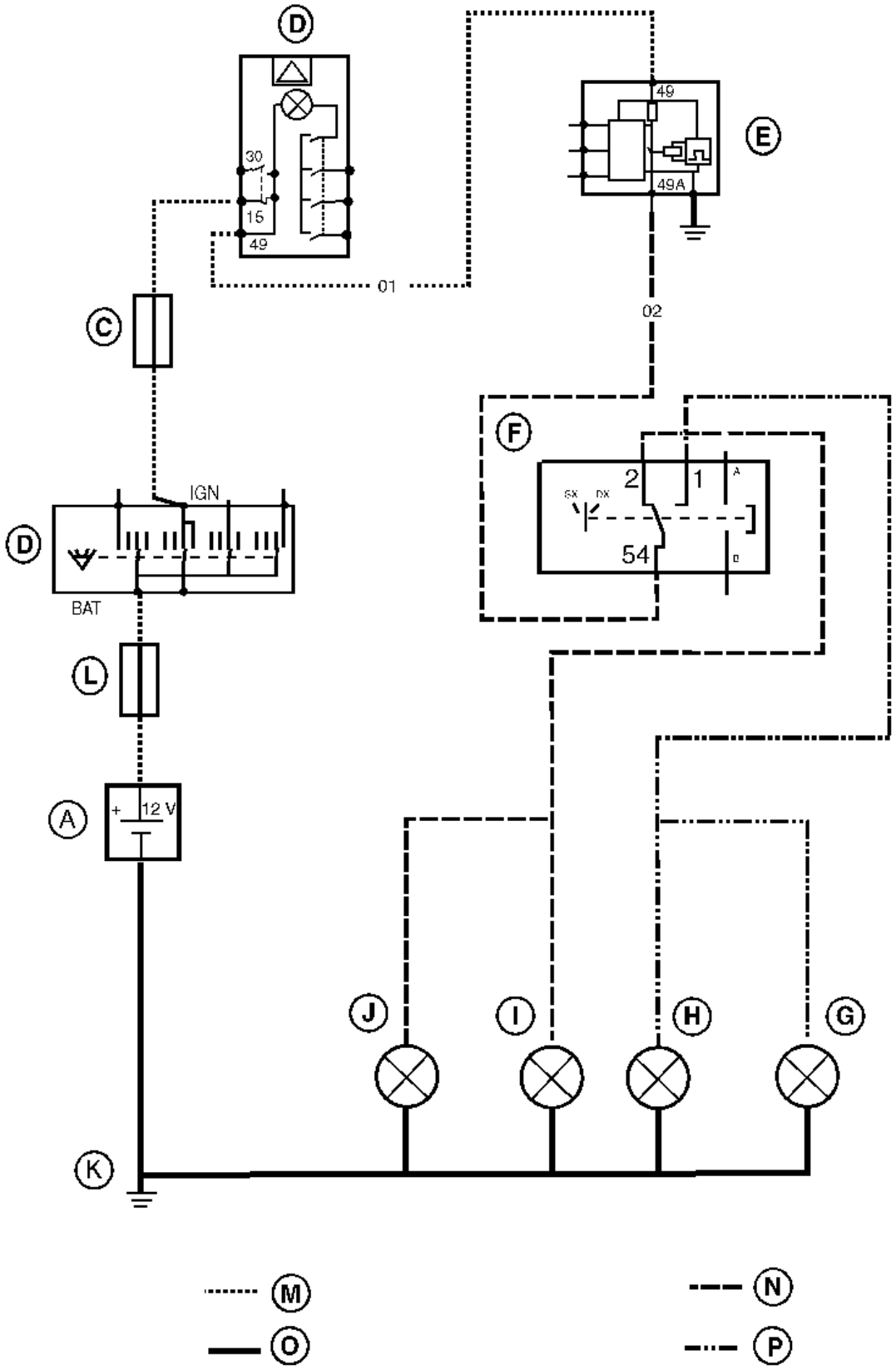
Voltage regulator controls ground side of rotor as a means of limiting field current flow. Increasing the duration of field current flow boosts alternator output. Decreasing the duration of field current flow reduces alternator output. Voltage regulator controls field current based on system voltage.

Regulator is a non-adjustable, integrated-circuit type located inside alternator. Voltage is regulated at 14.2-14.8 volts at 25°C (77°F), 5000 rpm (1/min) and 10 amps, but varies depending on a number of factors.

Charge indicator (G) alerts operator of low or no charging system output. Under normal conditions, voltage at both sides of indicator is the same. No current flows through light, therefore, light stays off.

When no or low charging system output occurs, voltage on one side of light drops. This causes current to flow trough light, thus causing it to light.

Lighting System Operation - Turn Signals



AT3140

Lighting System Operation-Turn Signals

LEGEND:

A	Battery
B	Key Switch
C	Fuse, 20 amp

D	Hazard Warning Light Switch
E	Flasher
F	Turn Signal Controller
G	Right Turn Indicator
H	Right Warn / Turn Light
I	Left Warn / Turn Light
J	Left Turn Indicator
K	Ground
L	Main fuse, 50 amp
M	Power Circuit
N	Flashing Current
O	Ground Circuit
P	Steady Current

Function

Alerts approaching traffic of operator's intent to turn.

Major Components

- Key Switch
- Hazard Warning Light Switch
- Flasher
- Fuse, 20 amp
- Turn Signal Controller
- Right Warn/Turn Light
- Left Warn/Turn Light
- Right Turn Indicator
- Left Turn Indicator
- Main fuse, 50 amp

Theory of Operation

→NOTE:

Left turn mode operation shown.

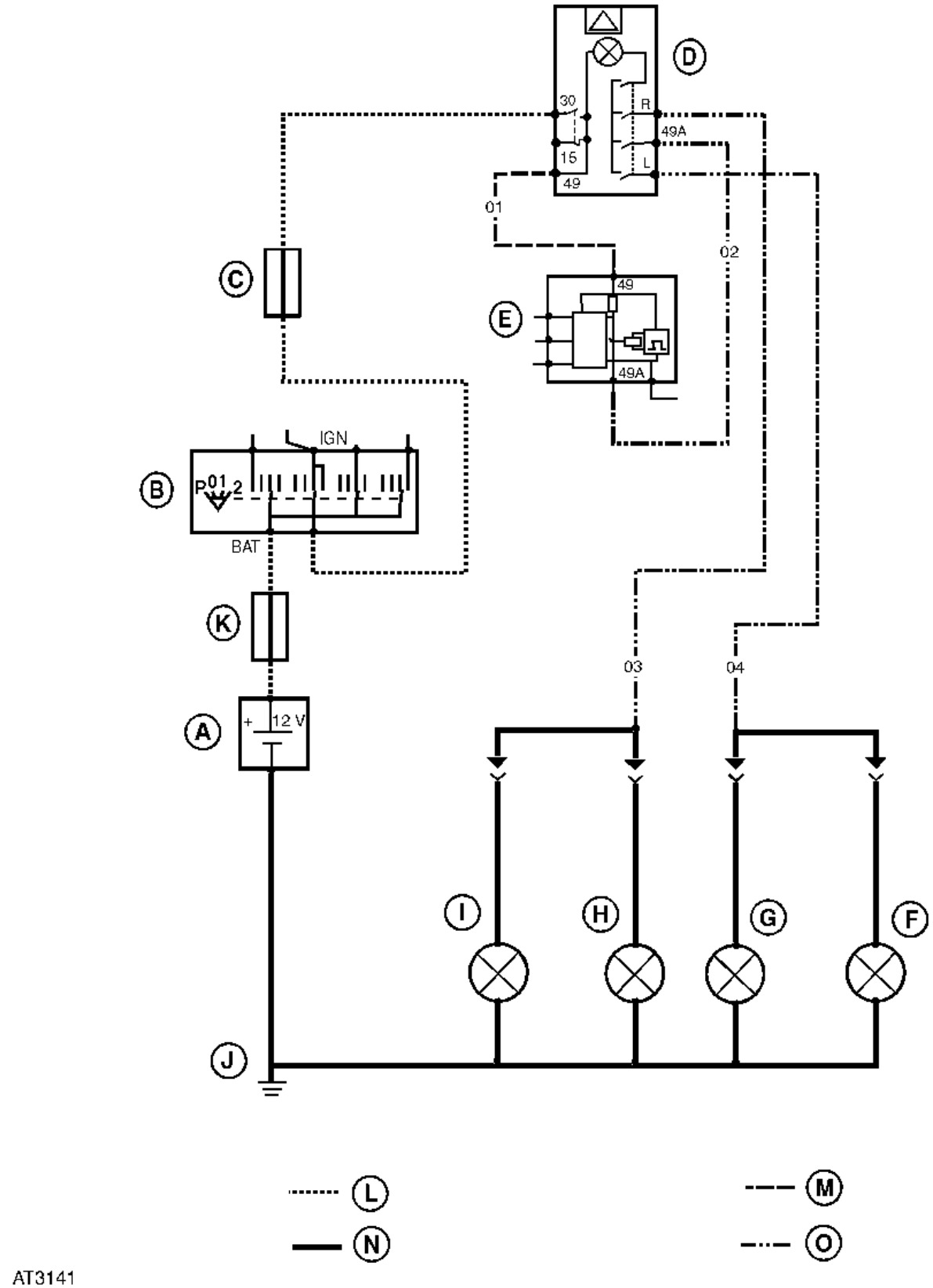
Turn signal controller is connected directly to battery. Turn signals will operate any time controller (F) is activated.

With turn signal lever in left-turn position, current moves from battery (A) through key switch (B) and to 20 amp fuse (C). The flow of current continues across hazard warning light switch contacts (D) and out circuit 01 to flasher (E).

Flasher turns current on and off and connects it to circuit 02. Current reaches turn signal controller (F) then flows to left warn/turn light and left indicator.

During right-turn operation, current flow through terminal 1 to right warn/turn light and right turn indicator.

Lighting System Operation - Hazard Warning Lights



AT3141

Lighting System Operation-Hazard Warning Lights

LEGEND:

A	Battery
B	Key Switch
C	Fuse 4, 15 amp
D	Hazard Warning Light Switch
E	Flasher

F	Right Turn Indicator
G	Right Warn/Turn Light
H	Left Warn/Turn Light
I	Left Turn Indicator
J	Ground
K	Main fuse, 50 amp
L	Power Circuit
M	Energizing Circuit
N	Ground Circuit
O	Flashing Current

Function

Alerts approaching traffic of tractor's presence.

Major Components

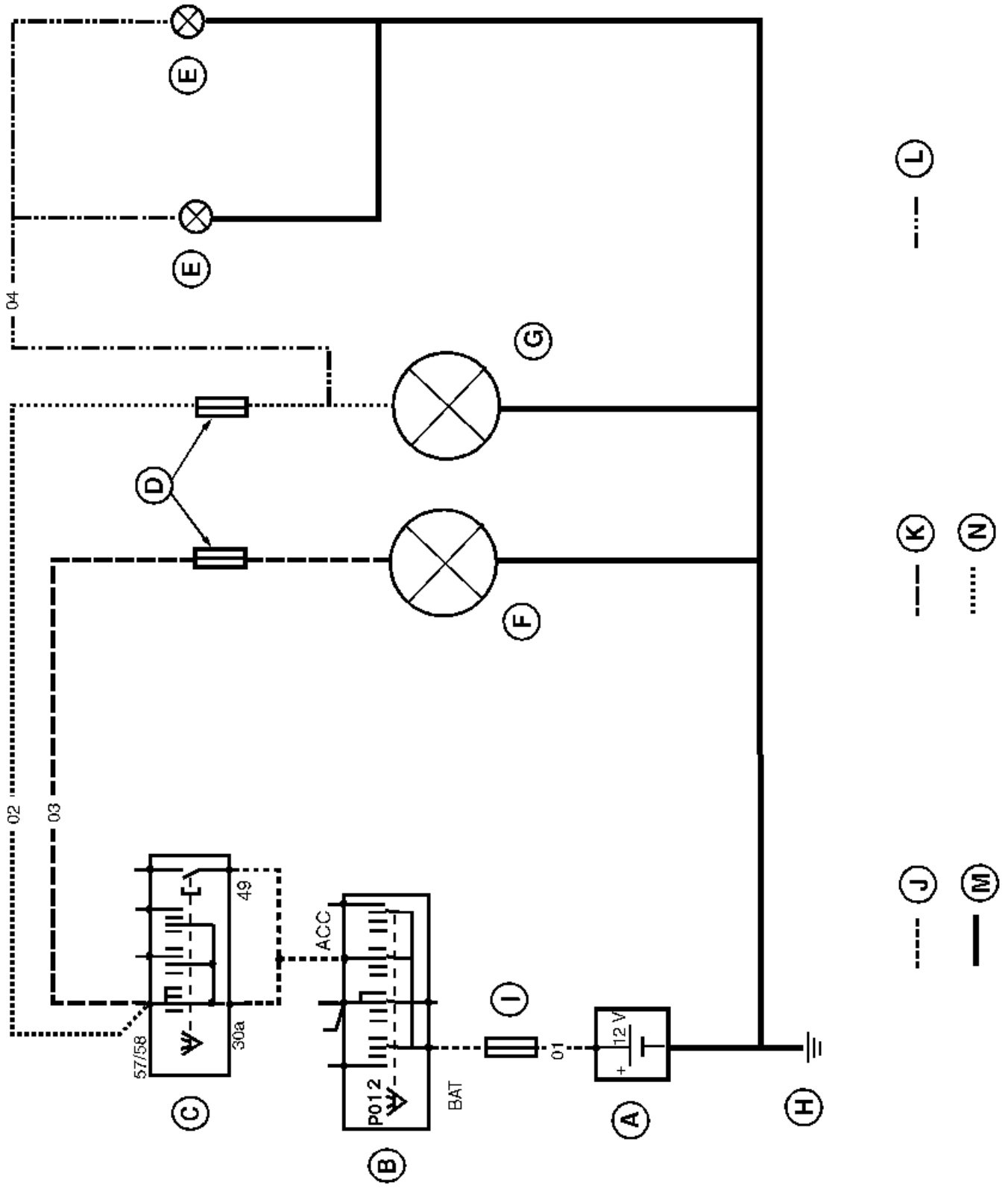
- Fuse 4, 15 amp
- Light Switch
- Hazard Warning Light Switch
- Flasher
- Right Warn/Turn Light
- Left Warn/Turn Light
- Right Turn Indicator
- Left Turn Indicator
- Main fuse, 50 amp

Theory of Operation

Pressing the hazard warning light switch will activate warning lights on both sides since warning lights are connected directly to the battery.

Current moves from battery (A), through key switch (B) and 15 amp fuse (C). The flow of current continues across light hazard warning switch contacts (30). Circuit 01 continues to pass current to flasher (E). Flasher turns current on and off and connects it to circuit 02. Flashing current returns to terminal 49A of hazard warning light switch (D). Current then flows simultaneously on circuits 03 and 04, flashing both left and right warning lights and their respective indicator lights on dash.

Lighting System Operation - Parking And Instrument Lights



AT3142

Parking And Instrument Lights

LEGEND:

A	Battery
B	Key switch
C	Light switch

D	7.5 amp fuses
E	Instrument lights
F	Left parking light (front and rear)
G	Right parking light (front and rear)
H	Ground
I	Main circuit, 50 amp
J	Power circuit
K	Right parking light current
L	Instrument light current
M	Ground circuit
N	Left parking light current

Function

Alerts approaching traffic of tractor's presence.

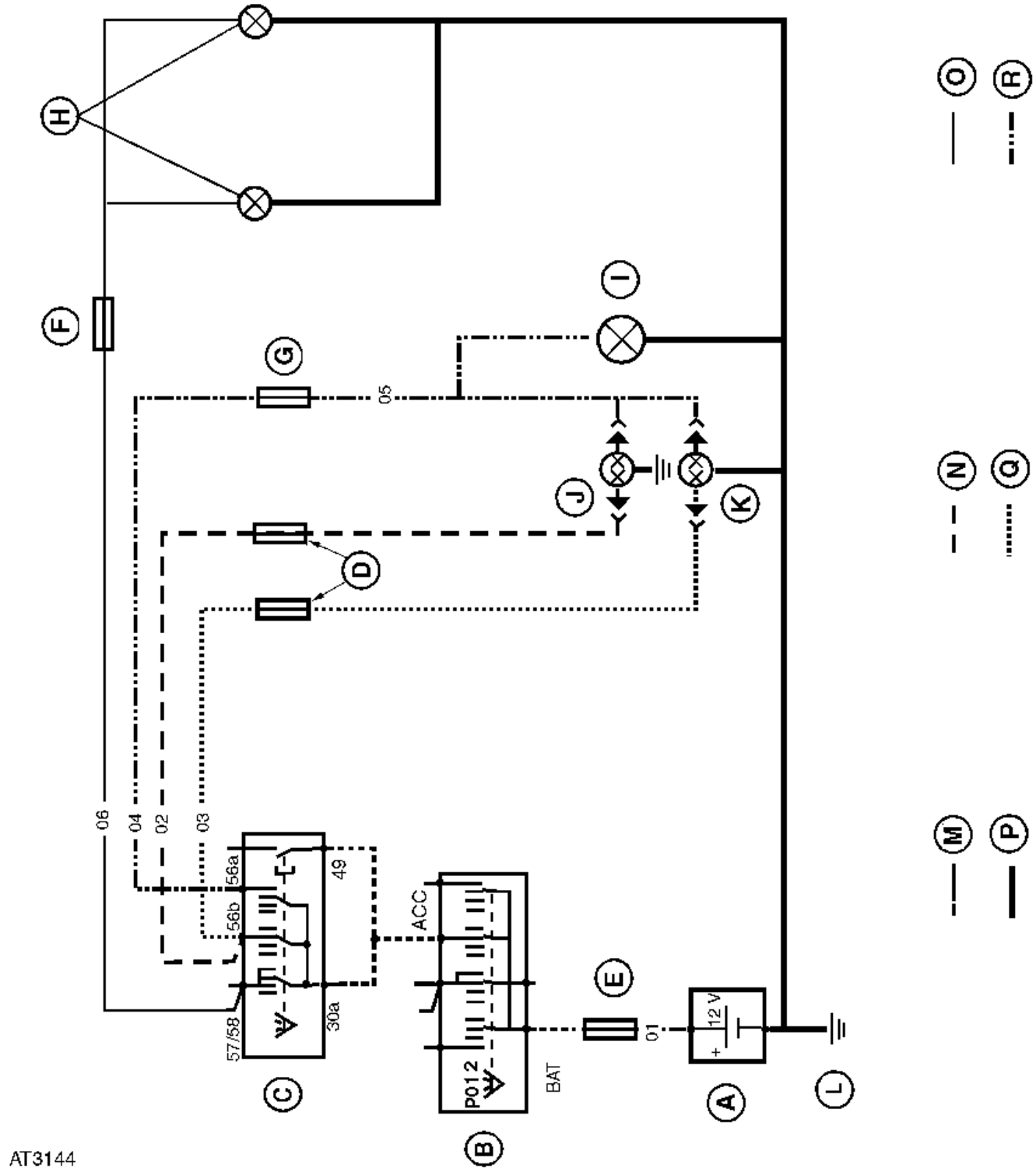
Major Components

- Fuses 6 and 7, 7.5 amp
- Light switch
- Key switch
- Right parking light
- Left Parking light
- Instrument light
- Main fuse, 50 amp

Theory of Operation

When switch is in parking light 1 position, current flows on circuit 01 from battery (A), through main fuse (I) and through key switch (B), then through light switch contacts (C) and out circuits 02 and 03, current flows to 7.5 amp fuses. Flow continues through filament of left (F) and right (G) parking light bulbs. Current also flows through circuit 04 to instrument lights (E).

Lighting System Operation - Headlights and Instrument Lights



Headlights and Instrument Lights

LEGEND:

A	Battery
B	Key switch
C	Light switch
D	Fuses 1 and 2. 7.5 amp

E	Main fuse, 50 amp
F	Fuse 7, 7.5 amp
G	Fuse 5, 15 amp
H	Instrument lights
I	High beam indicator
J	Right headlight
K	Left headlight
L	Ground
M	Power circuit
N	Right low beam current
O	Instrument light current
P	Ground circuit
Q	Left low beam current
R	High beam current

Function

Provide low and high beam illumination for visibility at night. Also provide illumination for gauges in instrument panel.

Major Components

- Fuse 5, 15 amp
- Fuse 1, 2 and 7, 7.5 amp
- Main fuse, 50 amp
- Light Switch
- Key Switch
- Right Headlight
- Left Headlight
- Instrument Light

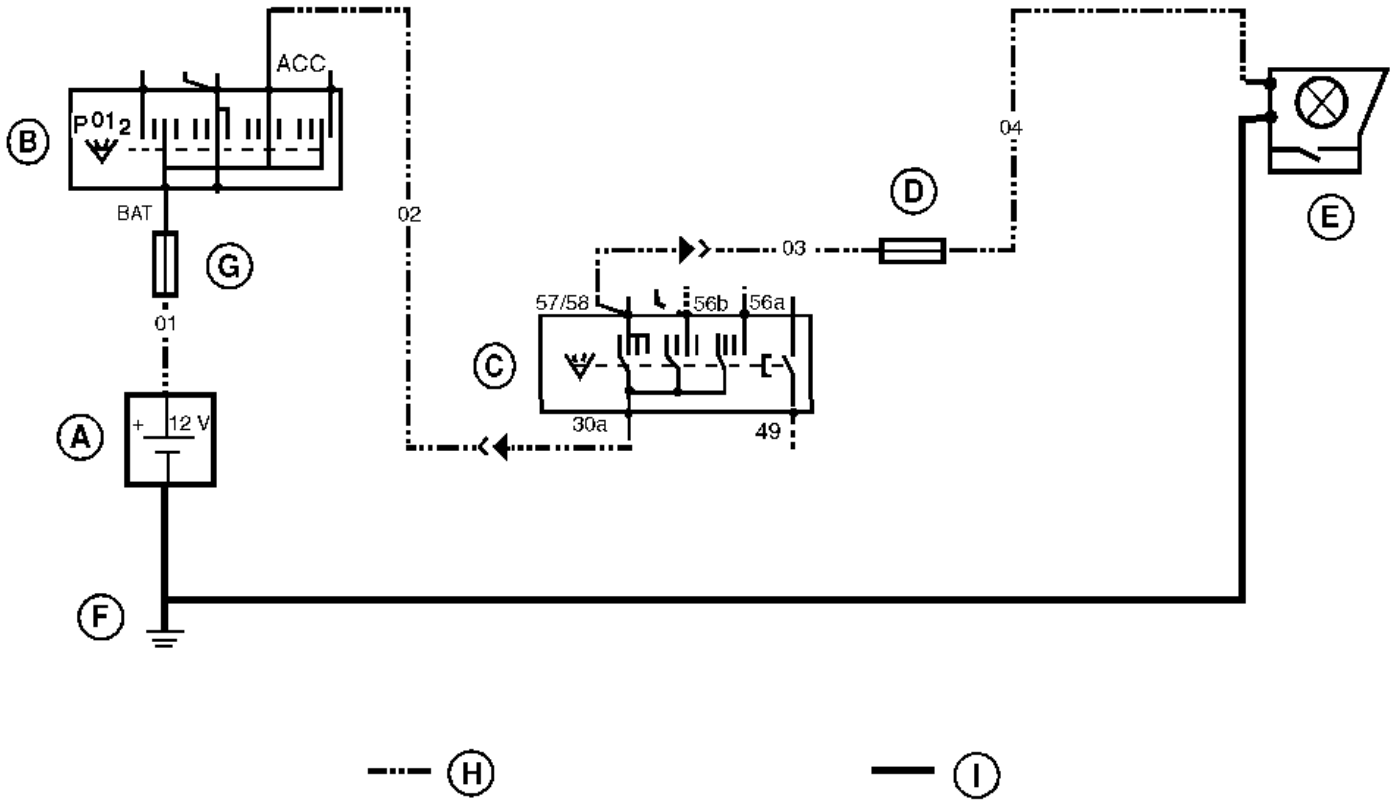
Theory of Operation

When switch is in headlight 2 (low beam) position, current flows on circuit 01 from battery, through main fuse and key switch, then through switch contacts (C) and out circuits 02 and 03. Flow continues through 7.5 amp fuses (D) and the low beam filament of the headlight bulbs.

When switch is moved to headlight 3 (high beam) position, current passes from switch on circuit 04 and passes through 15 amp fuse (G). Current moves on circuit 05 to high beam filament of both headlight bulbs and high beam indicator light.

Instrument lights operate light switch in either headlight position, or in parking light position 1. Current flows out of switch on circuit 06 and through fuse (F) flow continues to instrument lights.

Lighting System Operation - Rear Work Light



AT3145

Rear Work Light Operation

LEGEND:	
A	Battery
B	Key switch
C	Light switch
D	Fuse 7, 7.5 amp
E	Rear work light
F	Ground
G	Main fuse, 50 amp
H	Power circuit
I	Ground circuit

Function

Lights work area at rear of tractor.

Major Components

- Fuse 7, 7.5 amp
- Light Switch
- Rear Work Light
- Key Switch
- Main fuse, 50 amp

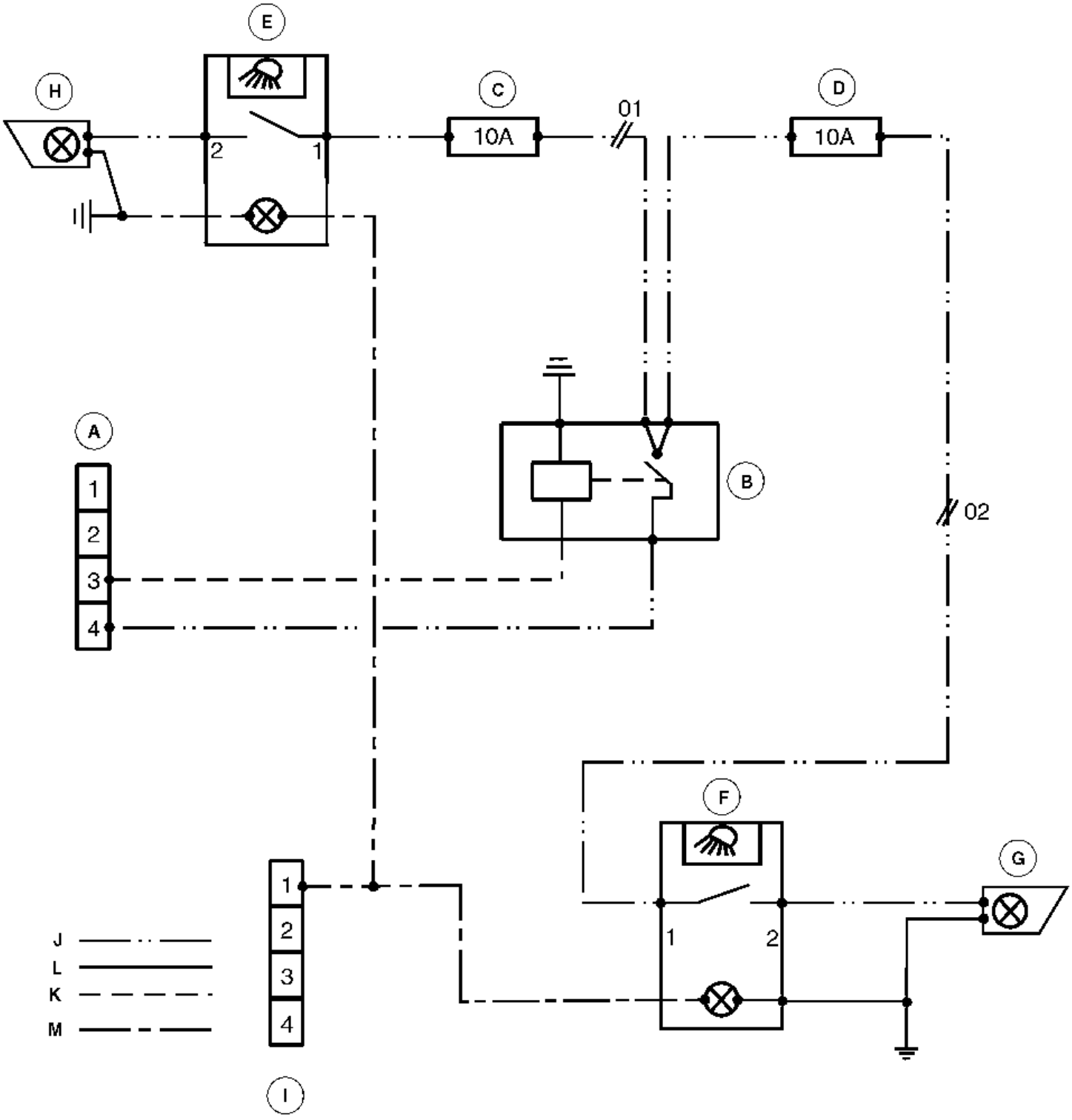
Theory of Operation

With light switch (C) in position 1, current flows from battery (A) through circuit 01 through main fuse (G), then through key switch (B) and circuit 02 to light switch. Current passes across switch contacts, out circuit 03, through 7.5 amp fuse (D) to circuit 04 and on to rear work light.

Current also flows to high beam headlights with light switch in 2 position. See “Lighting System Operation - Headlights and

Instrument Lights” in Section 240, Group 10.

Lighting System Operation - Front And Rear Work Lights (Cab Tractors Only)



Front and Rear Work Lights Operation

LEGEND:

A	4-way connector
B	Work light relay
C	10 amp fuse
D	10 amp fuse

E	Front work light switch
F	Rear work light switch
G	Rear work light
H	Front work light
I	4-way connectors
J	Power circuit
K	Energizing circuit
L	Ground circuit
M	Power circuit to indicators light

Function

Controls operation of front and rear work light.

Major Components

- 4-way connector
- Work light relay
- Front and rear work light indicators
- Front and rear work light switches
- Fuses 6 and 7, 10 amp

Theory of Operation

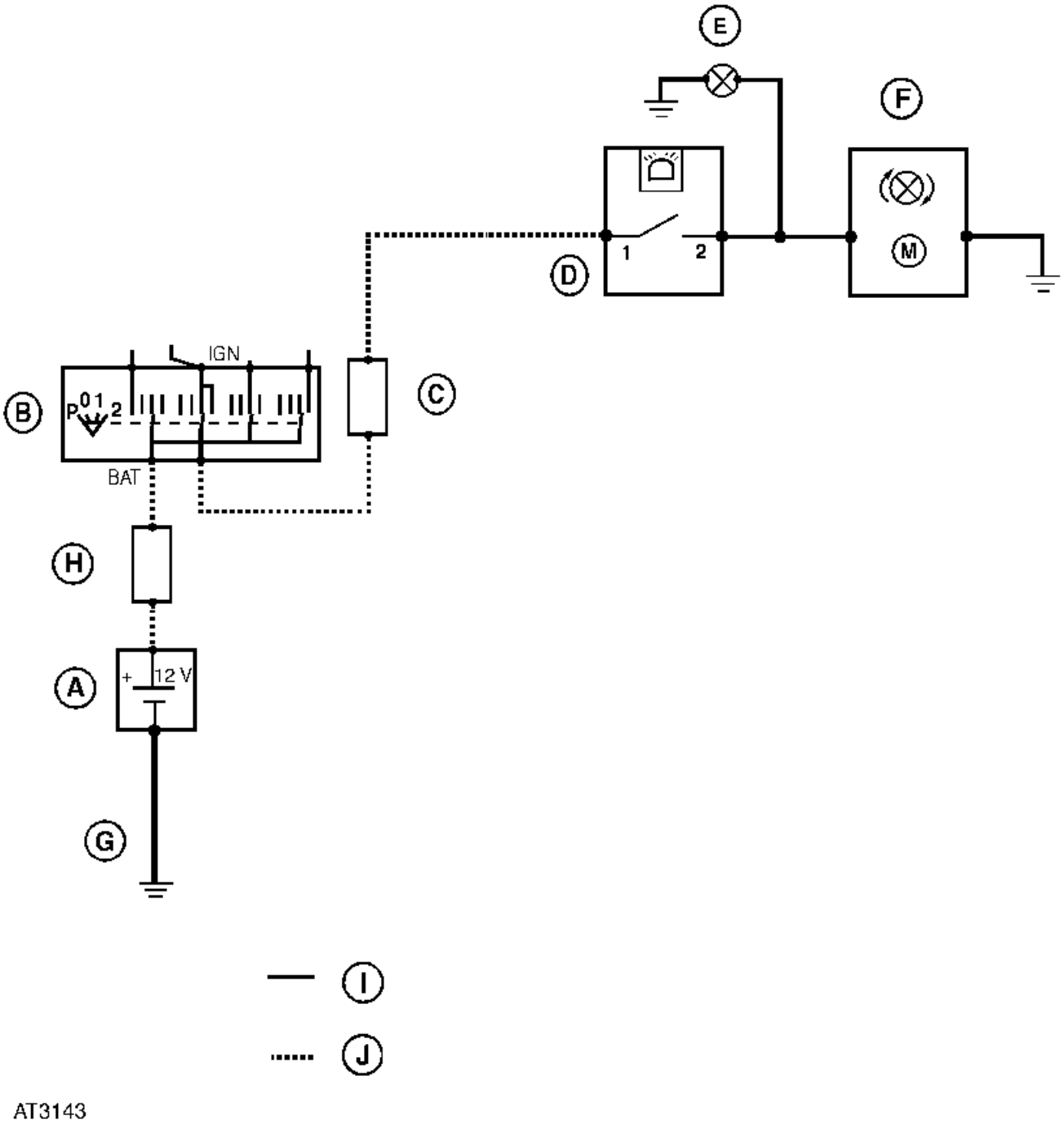
Current flows through the 4-way connector (A) to the work light relay (B). When the key switch is rotated on “ACC” or “RUN” position, work light relay (B) is energized and current flows to front work light (H) through the 10 amp fuse (C).

When the work light switch (E) is operated the front work light is turned on.

In the circuit 02 the current flows to rear work light through 10 amp fuse (M). Rear work light turned to on when the switch (F) is operated.

When work light switches (E) and (F) are operated, indicator light is on.

Lighting System Operation - Beacon Lights



AT3143

Lighting System Operation - Beacon Lights

LEGEND:

A	Battery
B	Key switch
C	Fuse 4, 15 amp
D	Beacon light switch
E	Beacon light indicator
F	Beacon light
G	Ground
H	Main fuse, 50 amp
I	Power circuit
J	Ground circuit

Function

Alerts approaching traffic of tractor's presence.

Major Components

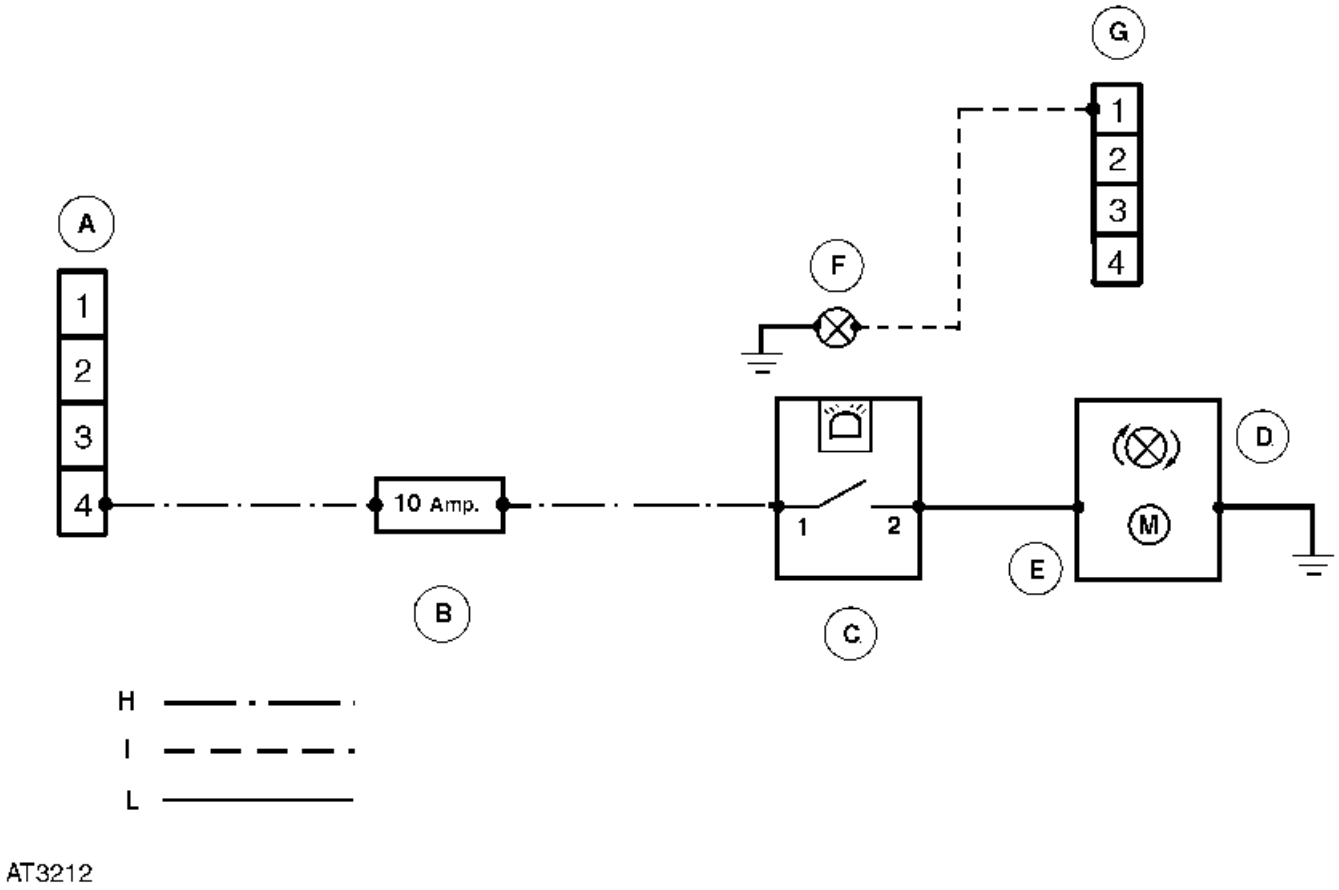
- Fuse 4, 15 amp
- Main fuse, 50 amp
- Light switch
- Beacon light switch
- Beacon light indicator
- Beacon Light

Theory of Operation

The beacon light is activated when the beacon light switch is pushed. It is not depending from the key switch as it received current directly from the battery.

Current moves from battery (A), through main fuse and through key switch (B), than through 15 amp fuse (C). The flow of current continues across light beacon switch contacts (D). Circuit 01 continues to pass current to beacon light (F).

Lighting System Operation - Beacon Light Operation (Cab Tractors Only)



AT3212

Beacon Light Operation

LEGEND:

A	4-way connector
B	Fuse 5, 10 amp
C	Beacon light switch
D	Beacon light
E	Beacon light motor
F	Beacon light indicator
G	4-way connector to beacon light indicator
H	Power circuit
I	Beacon light indicator circuit
L	Ground circuit

Function

Alerts approaching traffic of tractor's presence.

Major Components

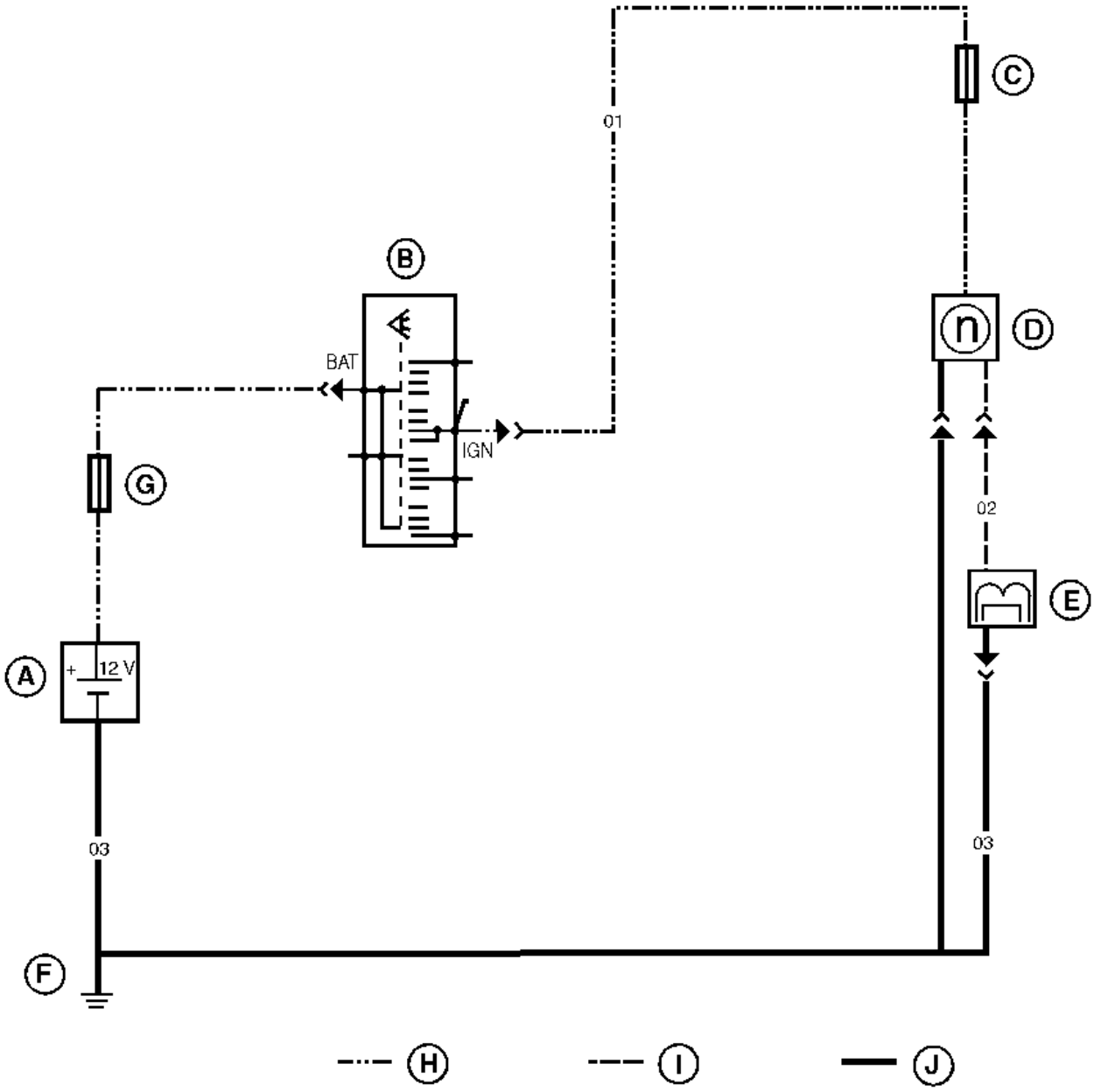
- 4-way connector
- Fuse 5, 10 amp
- Beacon light
- Beacon light switch
- Beacon light motor
- Beacon light indicator
- 4-way connector to beacon light indicator

Theory of Operation

The beacon light is activated when the beacon light switch is pushed. It is not depending from the key switch. Current flows from 4-way connector (A) to 10 amp fuse (B).

When beacon light switch is pushed, current flows to beacon light (D) and beacon light motor (E). When beacon light switch (C) is pressed, the indicator (F) light up.

Instrument Panel System Operation - Tachometer



AT3147

Tachometer

LEGEND:

A	Battery
B	Key switch
C	Fuse 11, 7.5 amp
D	Tachometer
E	Engine speed sensor
F	Ground
G	Main fuse, 50 amp
H	Power circuit
I	Sensor circuit
J	Ground circuit

Function

Informs operator of engine speed.

Major Components

- Fuse 11, 7.5 amp
- Main fuse, 50 amp
- Tachometer
- Engine speed sensor
- Key switch

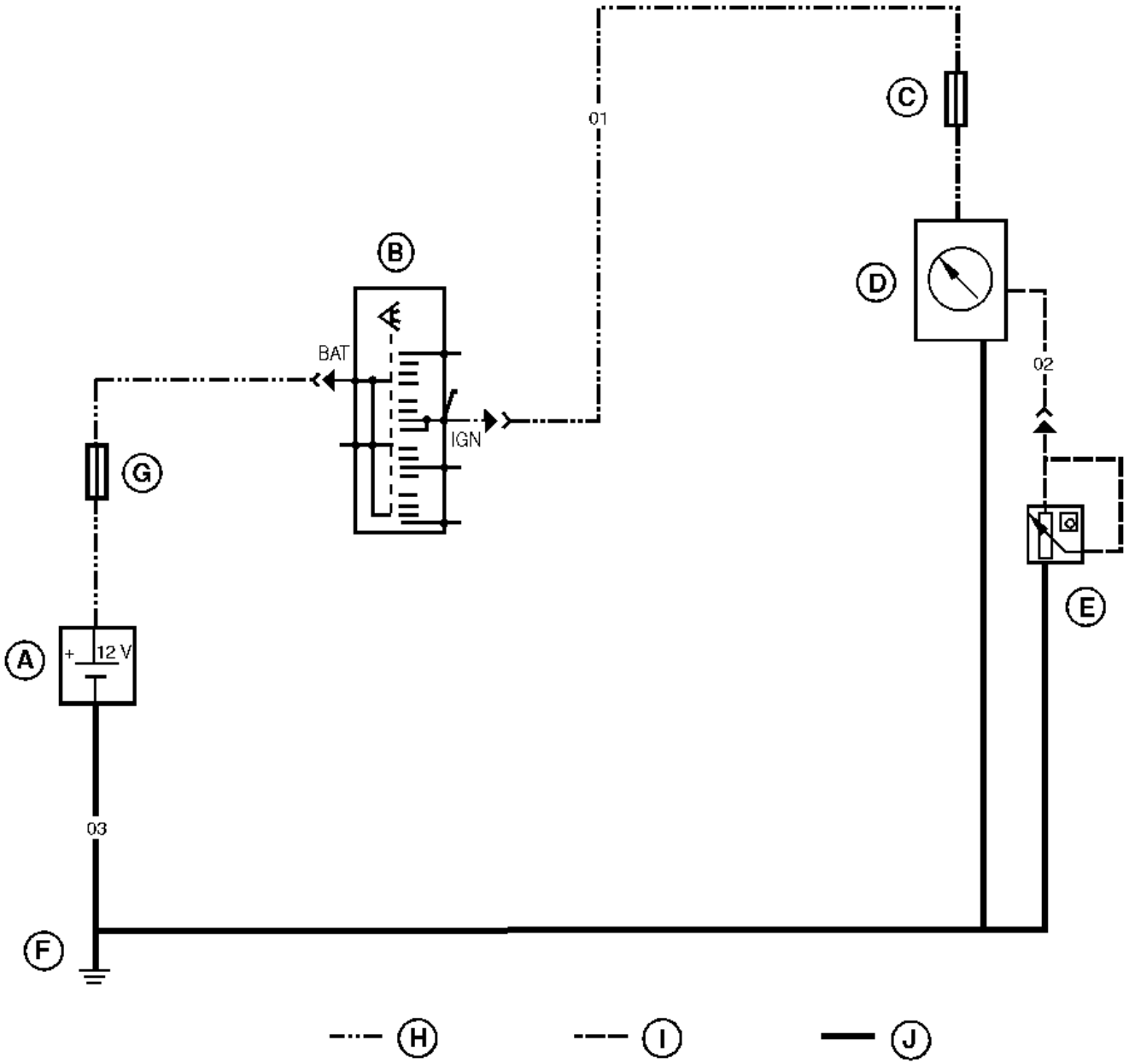
Theory of Operation

Current passes through closed contacts of key switch (B) to circuit 01, then through 7.5 amp fuse to tachometer (D).

Engine speed sensor (E) contains a permanent magnet and a set of windings. The sensor is mounted close to the gear teeth of fuel injection pump. As gear turns, its moving teeth induce a small amount of alternating current in the sensor. Voltage leaving sensor travels through circuit 02 to tachometer and 03 to ground.

Sensor output voltage depends on engine speed. Low revolution produces low voltage. As the engine speed increases, the voltage output increases accordingly. Tachometer reads strength of voltage signal and displays it as revolutions per minute, rpm (1/min).

Instrument Panel System Operation - Fuel Gauge



AT3148

Fuel Gauge

LEGEND:

A	Battery
B	Key switch
C	Fuse 11, 7.5 amp
D	Fuel gauge
E	Fuel level sender
F	Ground
G	Main fuse, 50 amp
H	Power circuit
I	Sensing circuit
J	Ground circuit

Function

Informs operator of fuel level.

Major Components

- Fuse 11, 15 amp
- Main fuse, 50 amp
- Fuel gauge
- Fuel gauge sender
- Key switch

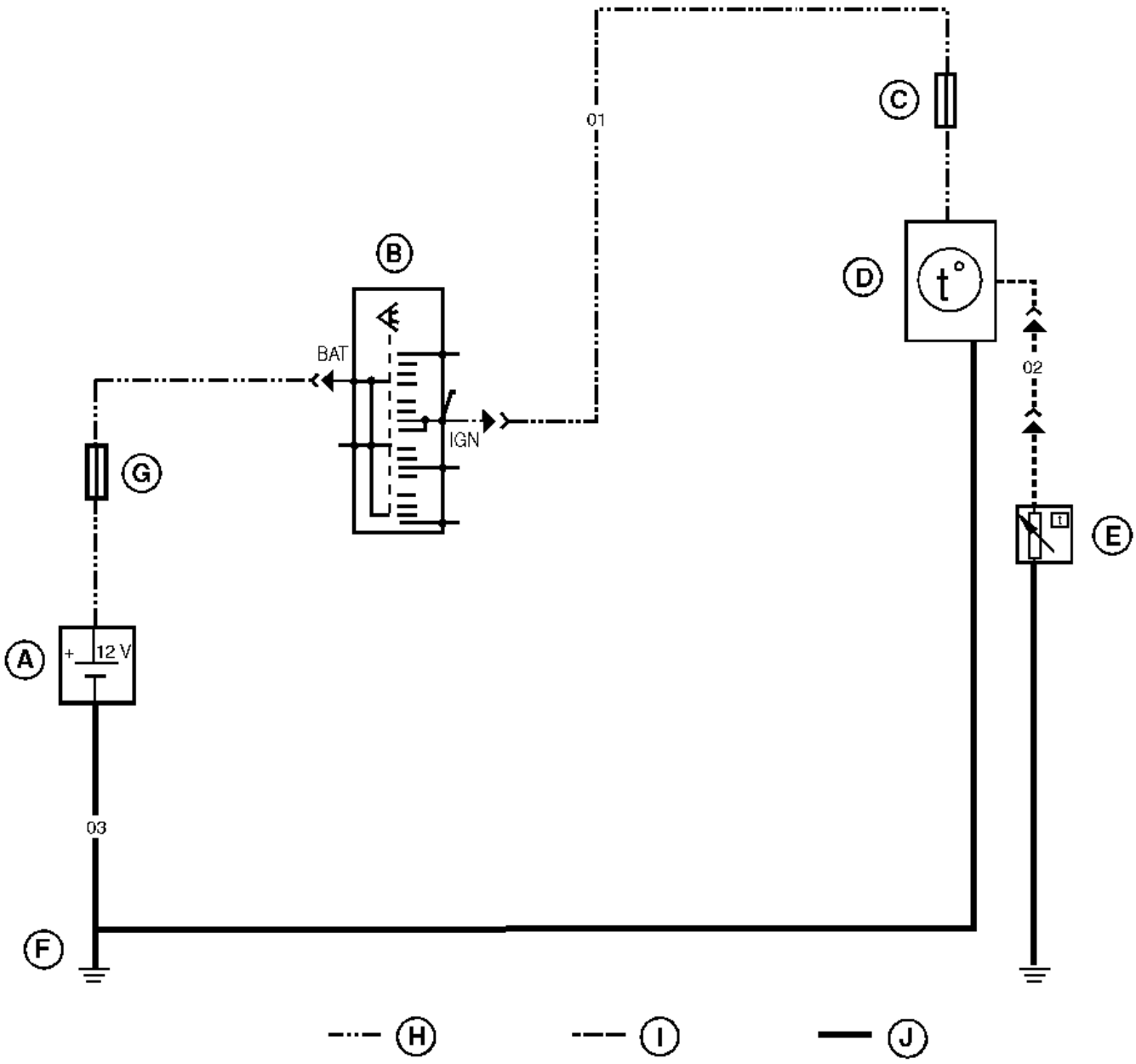
Theory of Operation

Current passes through closed contacts of key switch (B) to circuit 01, then through 7.5 amp fuse to fuel gauge (D). Sensing terminal of gauge connects to fuel level sender (E) through circuit 02.

Sender assembly consists of a movable float mounted to a variable resistor (potentiometer). Resistance of potentiometer on gauge sensing circuit controls the fuel level shown on gauge.

As float moves up or down with changes in fuel level, electrical resistance of potentiometer changes accordingly. When tank is full, resistance is low and gauge needle moves to full position. When tank is empty, resistance is high, and gauge needle moves to empty position. Potentiometer resistance between these two positions varies in direct proportion to changes in fuel level. This allows gauge to accurately display the quantity of fuel in tank regardless of its level.

Instrument Panel System Operation - Temperature Gauge



AT3149

Temperature Gauge

LEGEND:

A	Battery
B	Key switch
C	Fuse 11, 7.5 amp
D	Temperature gauge
E	Coolant temperature sender
F	Ground
G	Main fuse, 50 amp
H	Power circuit
I	Sensing circuit
J	Ground circuit

Function

Informs operator of engine coolant temperature.

Major Components

- Fuse 11, 7.5 amp
- Main fuse, 50 amp
- Temperature gauge
- Coolant temperature sender
- Key switch

Theory of Operation

Current passes through closed contacts of key switch (B) to circuit 01, then through 7.5 amp fuse to temperature gauge (D). Sensing terminal of gauge connects to coolant temperature sender (E) through circuit 02.

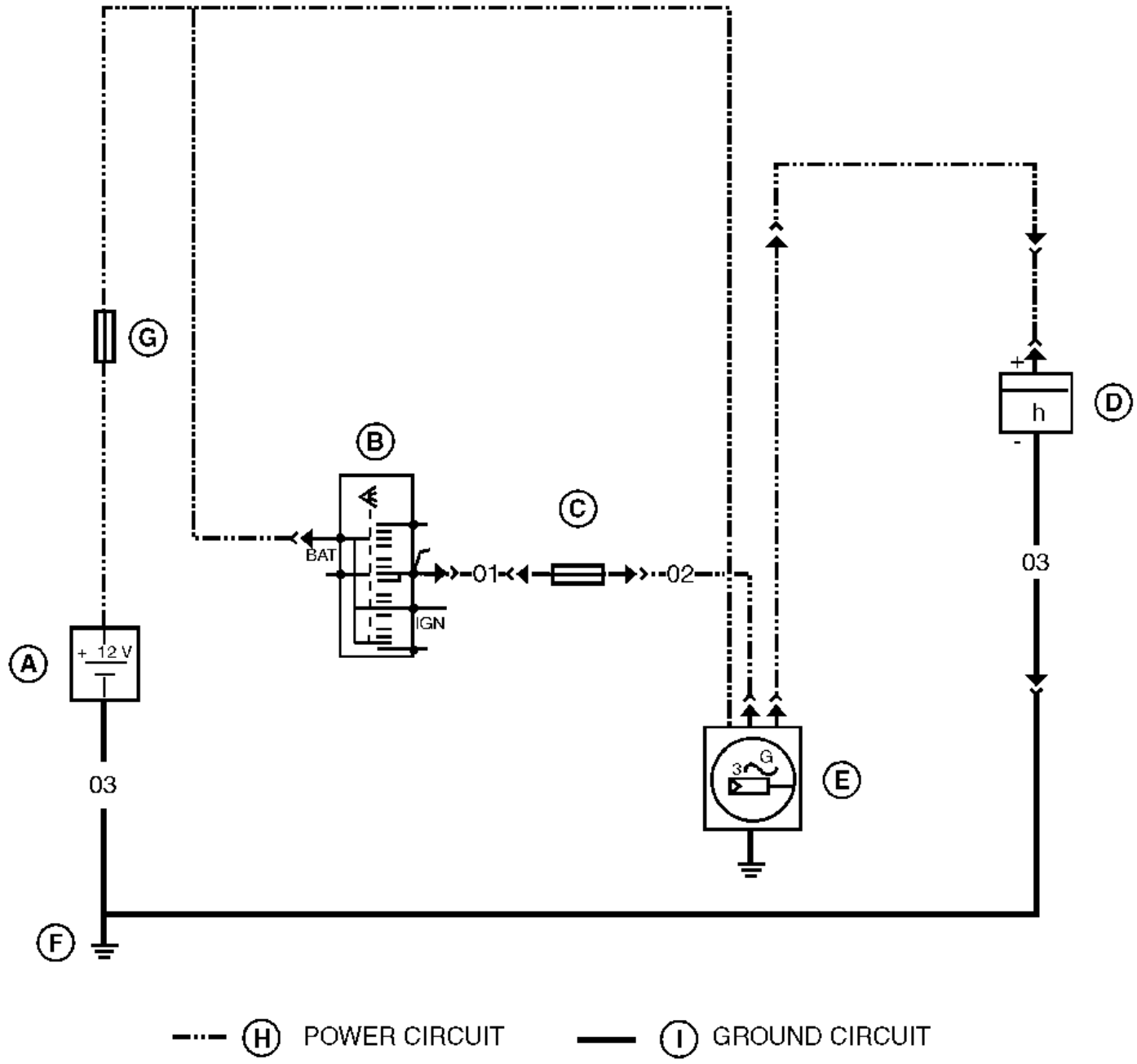
Temperature sender is a variable resistor that responds to changes in coolant temperature. Low coolant temperatures cause high resistance. High temperatures causes low resistance.

Current attempts to flow back to ground from gauge. If resistance of sender is high (low temperatures), only a slight amount of current passes to ground. This results in little or no movement of the gauge needle. A low temperature reading results.

If resistance of sender is low (high temperatures), current flows readily through sensor back to ground. Needle movement increases and the gauge displays a reading that corresponds with the warmer temperature.

Sensor resistance between these two positions varies in proportion to changes in coolant temperature. Therefore, gauge can display accurate reading for any engine temperature.

Instrument Panel System Operation - Hourmeter



AT3150

Hourmeter

LEGEND:

A	Battery
B	Key switch
C	Fuse 11, 7.5 amp
D	Hourmeter
E	Alternator/Regulator
F	Ground
G	Main fuse, 50 amp
H	Power circuit
I	Ground circuit

Function

Displays operating hours.

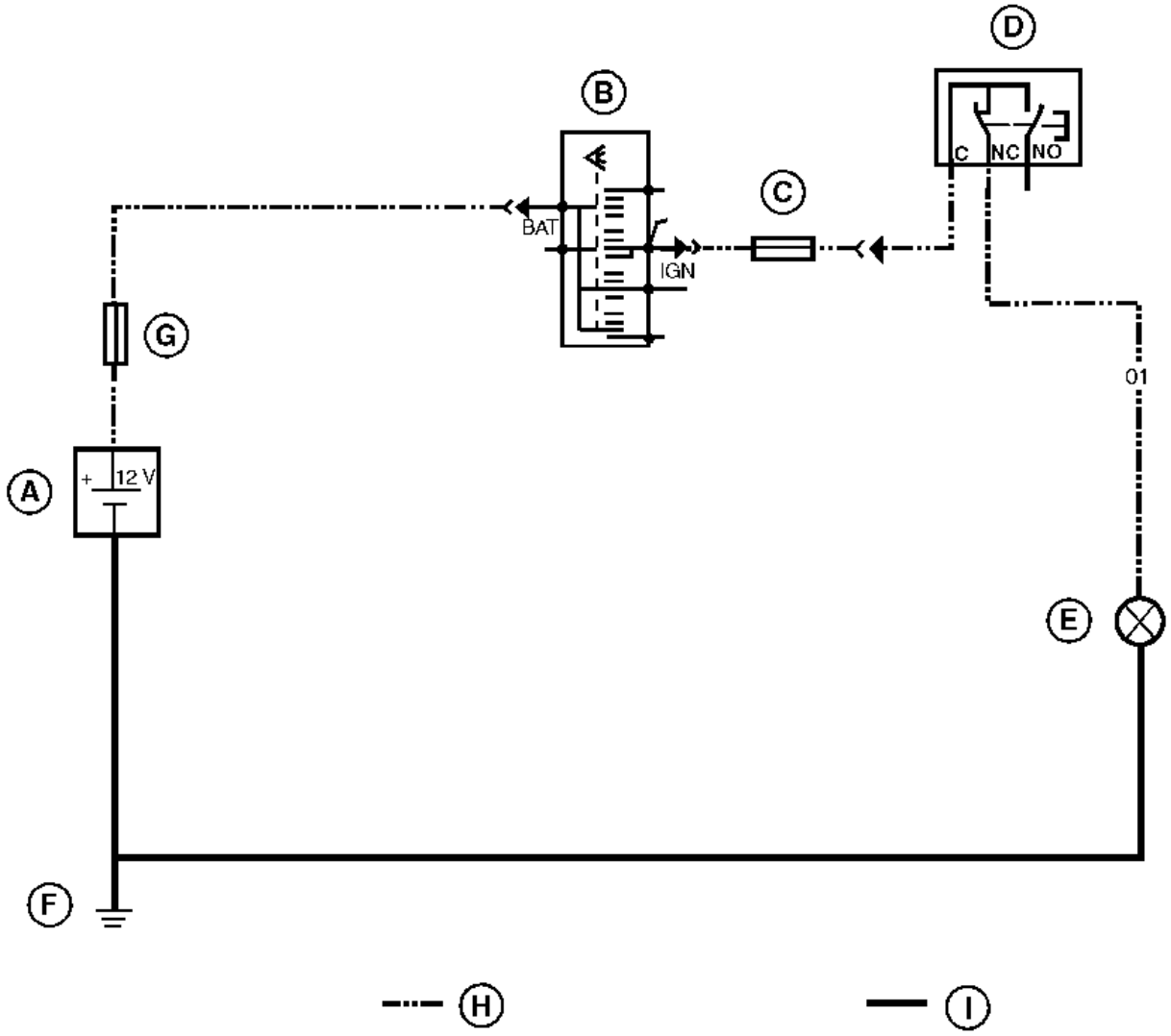
Major Components

- Fuse 11, 7.5 amp
- Main fuse, 50 amp
- Hourmeter
- Key Switch

Theory of Operation

Current flows from battery (A), through main fuse (G) across closed contacts of key switch (B) and out circuit 01. Flow continues through 7.5 amp fuse (C) to circuit 02 and to alternator/regulator and hourmeter positive side. Negative side of hourmeter connects to ground through circuit 03. Hourmeter runs whenever engine is running.

Instrument Panel System Operation - PTO Warning System Operation



AT3151

PTO Warning System Operation

LEGEND:	
A	Battery
B	Key switch
C	Fuse 11, 7.5 amp
D	Rear PTO switch
E	PTO indicator
F	Ground
G	Main fuse, 50 amp
H	Power Circuit
I	Ground Circuit

Function

Alerts operator that PTO is engaged.

Major Components

- Fuse 11, 7.5 amp
- Main fuse, 50 amp

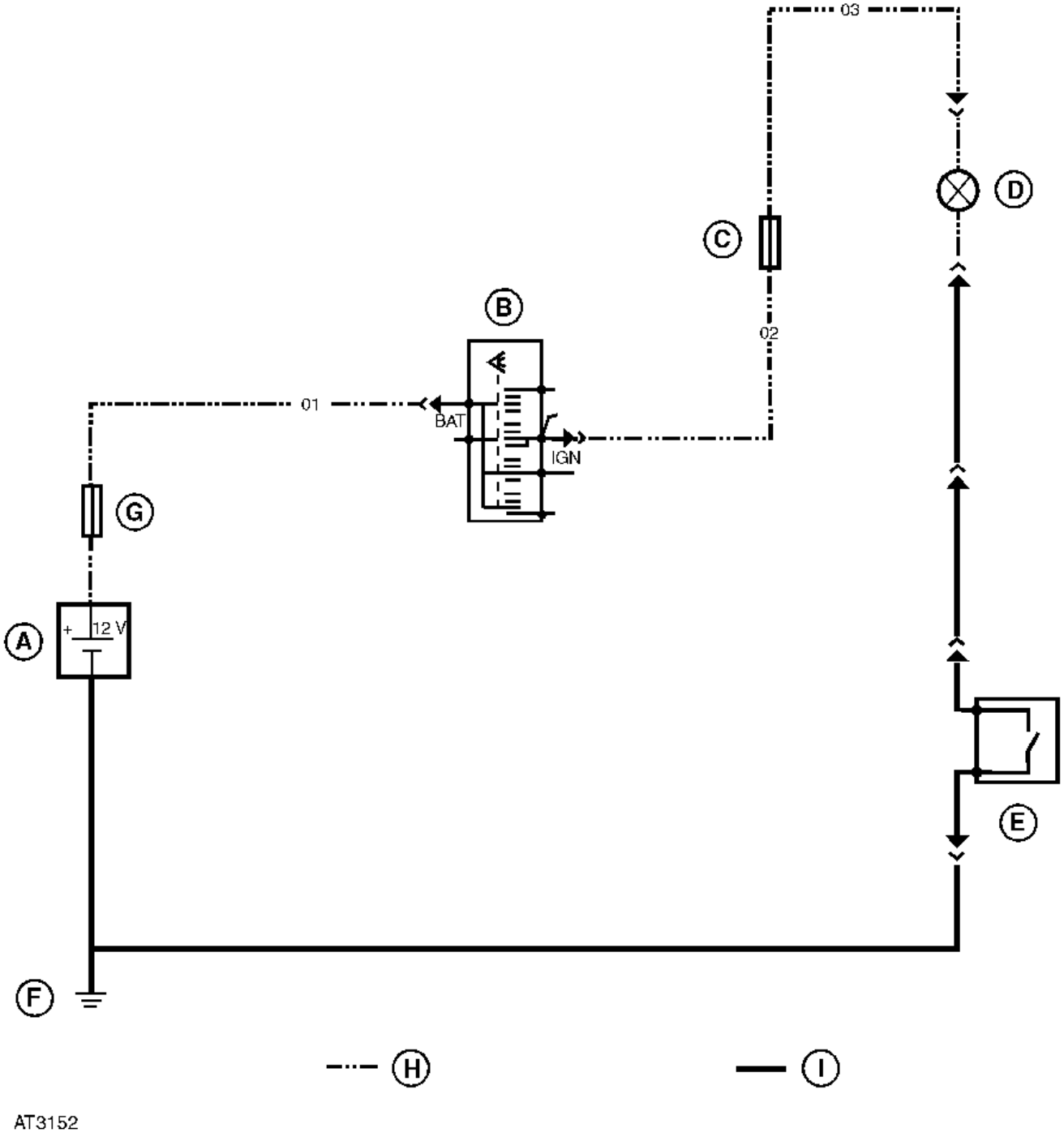
- Key switch
- Rear PTO switch
- PTO indicator light

Theory of Operation

When PTO is engaged and key switch (B) is in the run or start position, current travels through key switch contacts, 7.5 amp fuse and one side of rear PTO switch (D).

PTO indicator (E) lights as current continues to flow through circuit 01, through bulb, then to ground.

Instrument Panel System Operation - Air Filter Restriction Indicator Operation



Air Filter Restriction Indicator

LEGEND:

A	Battery
B	Key switch
C	Fuse 11, 7.5 amp
D	Air filter restriction indicator
E	Air filter restriction switch
F	Ground
G	Main fuse, 50 amp
H	Power circuit
I	Ground circuit

Function

Alerts operator of the need to service air filter.

Major Components

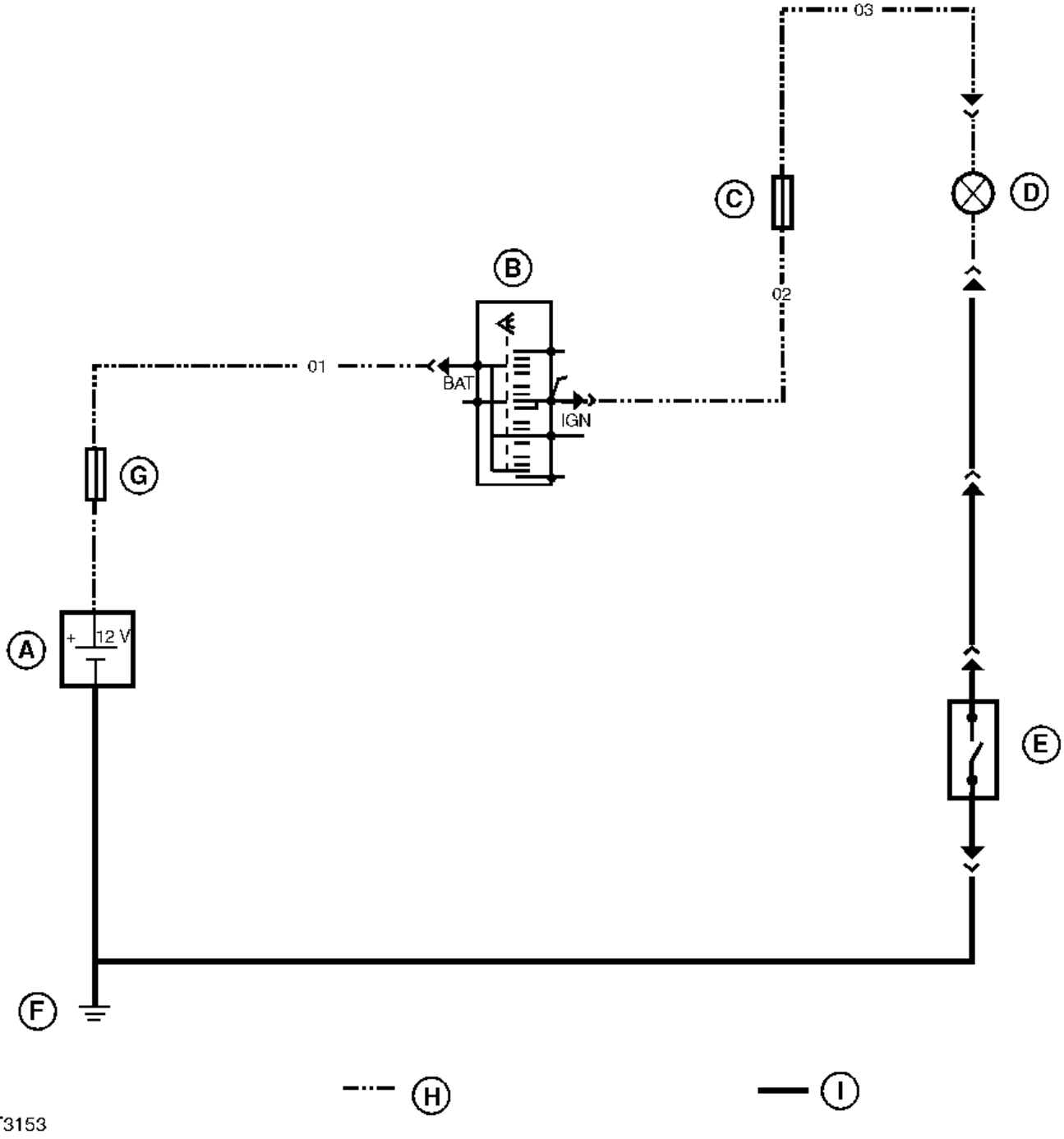
- Air filter restriction switch
- Restriction indicator light
- Fuse 11, 7.5 amp
- Main fuse, 50 amp
- Key switch

Theory of Operation

Voltage is applied to one side of air filter restriction indicator (D) at all times when key switch is on. Supply path from battery includes circuit 01, key switch (B), circuit 02, 7.5 amp fuse, and circuit 03.

Air filter restriction switch (E) contains a set of normally-open, vacuum-activated contacts. One contact connects to other side of restriction indicator light, other contact connects with ground. During normal operation, contacts remain open and indicator light stays off. When air filter becomes restricted, vacuum builds in air filter housing. This causes contacts to close and current flows through light.

Instrument Panel System Operation - Engine Oil Pressure Indicator Operation



Engine Oil Pressure Indicator Operation

LEGEND:

A	Battery
B	Key switch
C	Fuse 11, 7.5 amp
D	Engine oil pressure indicator
E	Engine oil pressure switch
F	Ground
G	Main fuse, 50 amp
H	Power circuit
I	Ground circuit

Function

Alerts operator when engine oil pressure is low.

Major Components

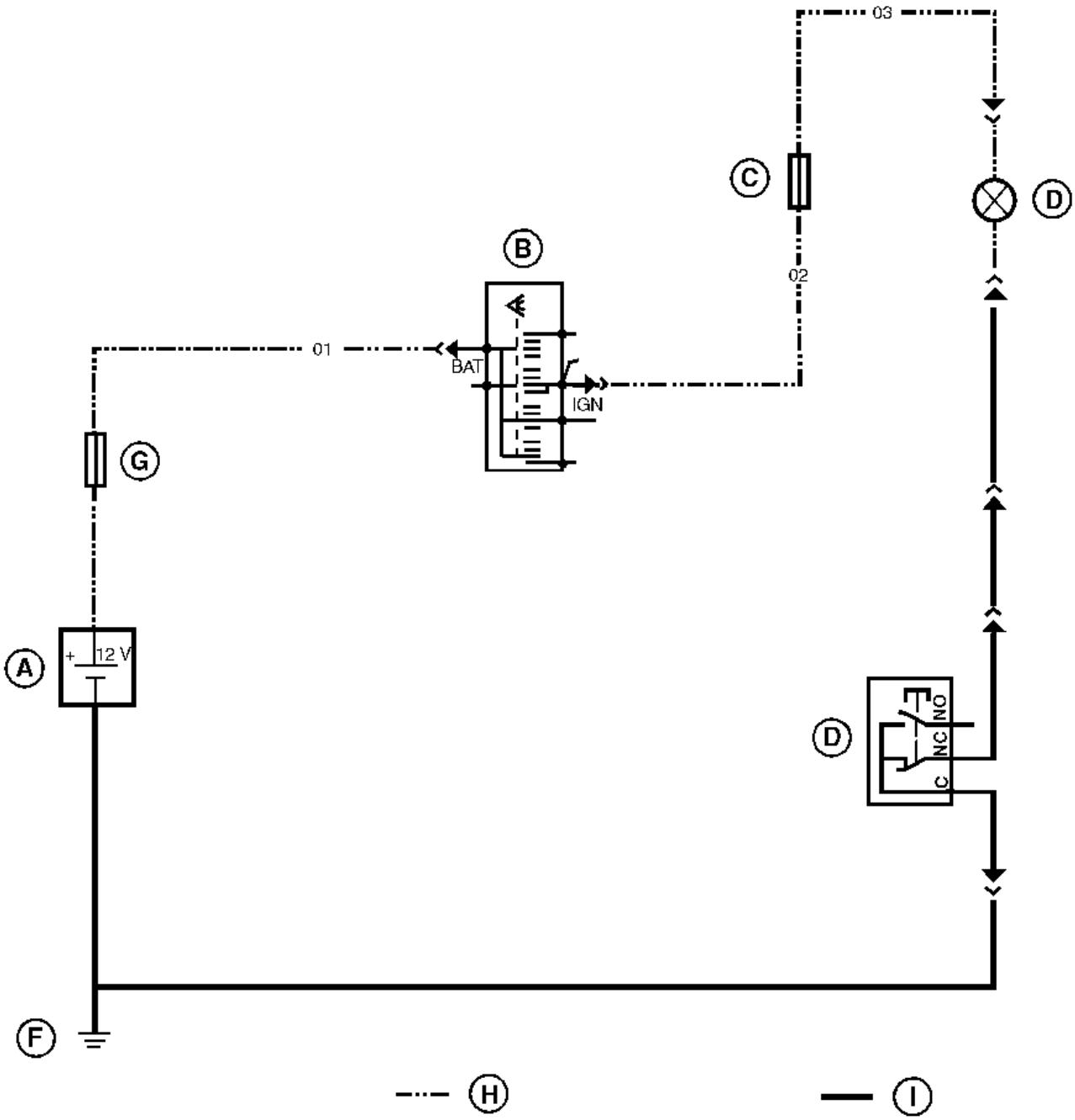
- Engine oil pressure switch
- Engine oil pressure indicator
- Fuse 11, 7.5 amp
- Main fuse, 50 amp
- Key switch

Theory of Operation

Voltage is applied to one side of engine oil pressure indicator (D) at all times when key switch is on. Supply path from battery includes circuit 01, key switch (B), circuit 02, 7.5 amp fuse, and circuit 03.

Engine oil pressure switch (E) contains a set of normally-open, vacuum-activated contacts. One contact connects to other side of pressure indicator light. Other contact connects with ground. During normal operation, contacts remain open and indicator light stays off. When oil pressure is low, the contact closes and current flows through light.

Instrument Panel System Operation - Handbrake Indicator Operation



AT3154

Handbrake Indicator Operation

LEGEND:

A	Battery
B	Key switch
C	Fuse 11, 7.5 amp
D	Handbrake indicator
E	Handbrake switch
F	Ground
G	Main fuse, 50 amp
H	Power circuit
I	Ground circuit

Function

Alerts operator when handbrake is engaged.

Major Components

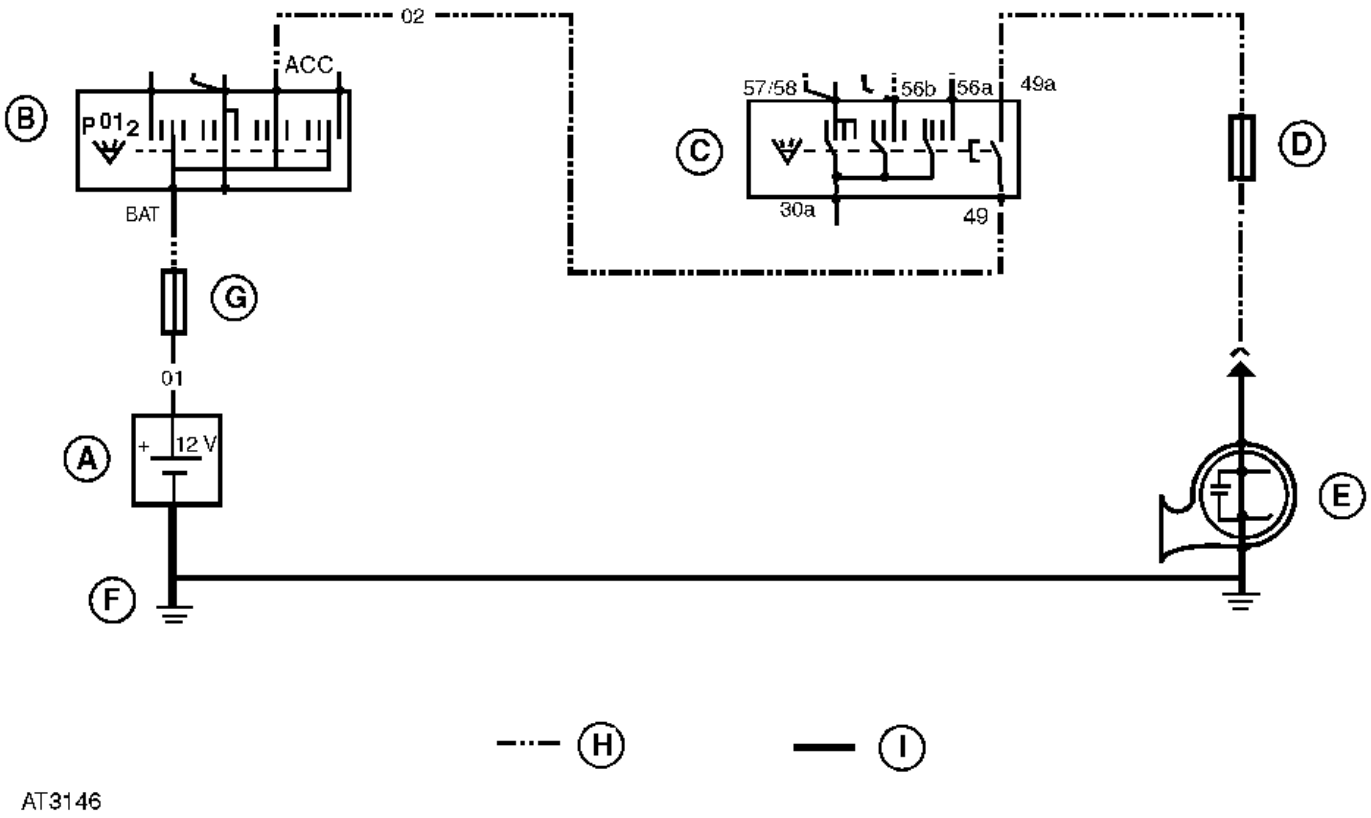
- Handbrake switch
- Handbrake indicator light
- Fuse 11, 7.5 amp
- Main fuse, 50 amp
- Key switch

Theory of Operation

Voltage is applied to one side of handbrake indicator light (D) at all times when key switch is on. Supply path from battery includes circuit 01, key switch (B), circuit 02, 7.5 amp fuse, and circuit 03.

Handbrake switch (E) is a mechanical contact. One contact connects to other side of handbrake light. Other contact connects with ground. During normal operation, contacts remain open and indicator light stays off. When handbrake is engaged, indicator on instrument panel lights up.

Horn Operation



Horn Operation

LEGEND:	
A	Battery
B	Key switch
C	Horn switch
D	Fuse, 15 amp
E	Horn
F	Ground
G	Main fuse, 50 amp
H	Power circuit
I	Ground circuit

Function

Operates as a warning device to traffic.

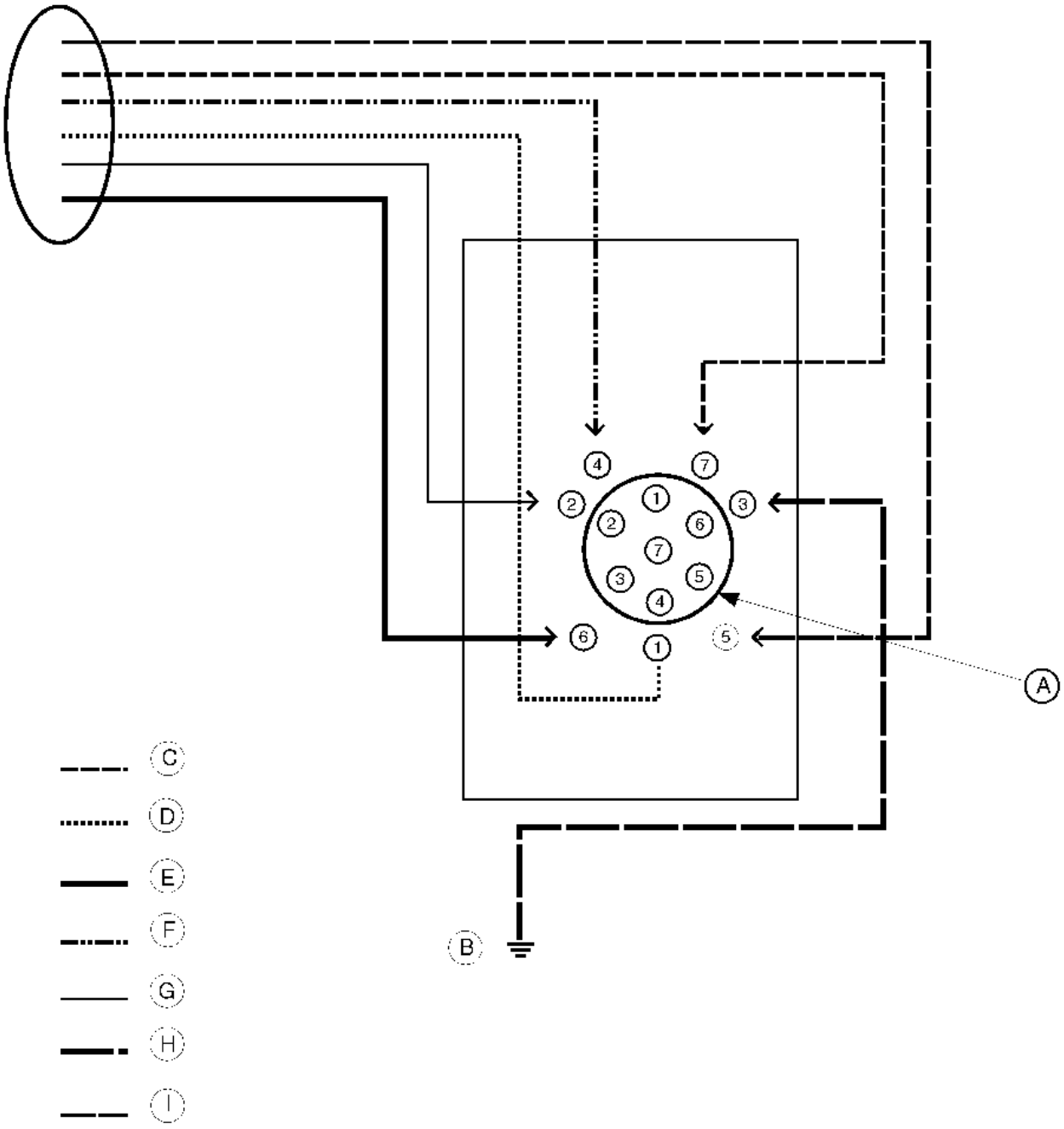
Major Components

- Fuse, 15 amp
- Main fuse, 50 amp
- Horn
- Horn Switch

Theory of Operation

When operator pushes horn switch, current flows from battery (A) on circuit 01 through main fuse (G) to key switch (B). Flow continues on circuit 02 to horn switch, to 15 amp fuse (D) and to horn (E). Horn mounting brackets complete the horn circuit by providing a connection with chassis ground.

7-Pin Trailer Connector Operation



AT2248

7-Pin Trailer Connector Operation

LEGEND:

A	Connector
B	Ground
C	Left parking light circuit
D	Left turn circuit
E	Left stop light circuit

F	Right turn circuit
G	Right stop light circuit
H	Ground circuit
I	Right parking light circuit

Function

Provides light connections for trailer.

Major Components

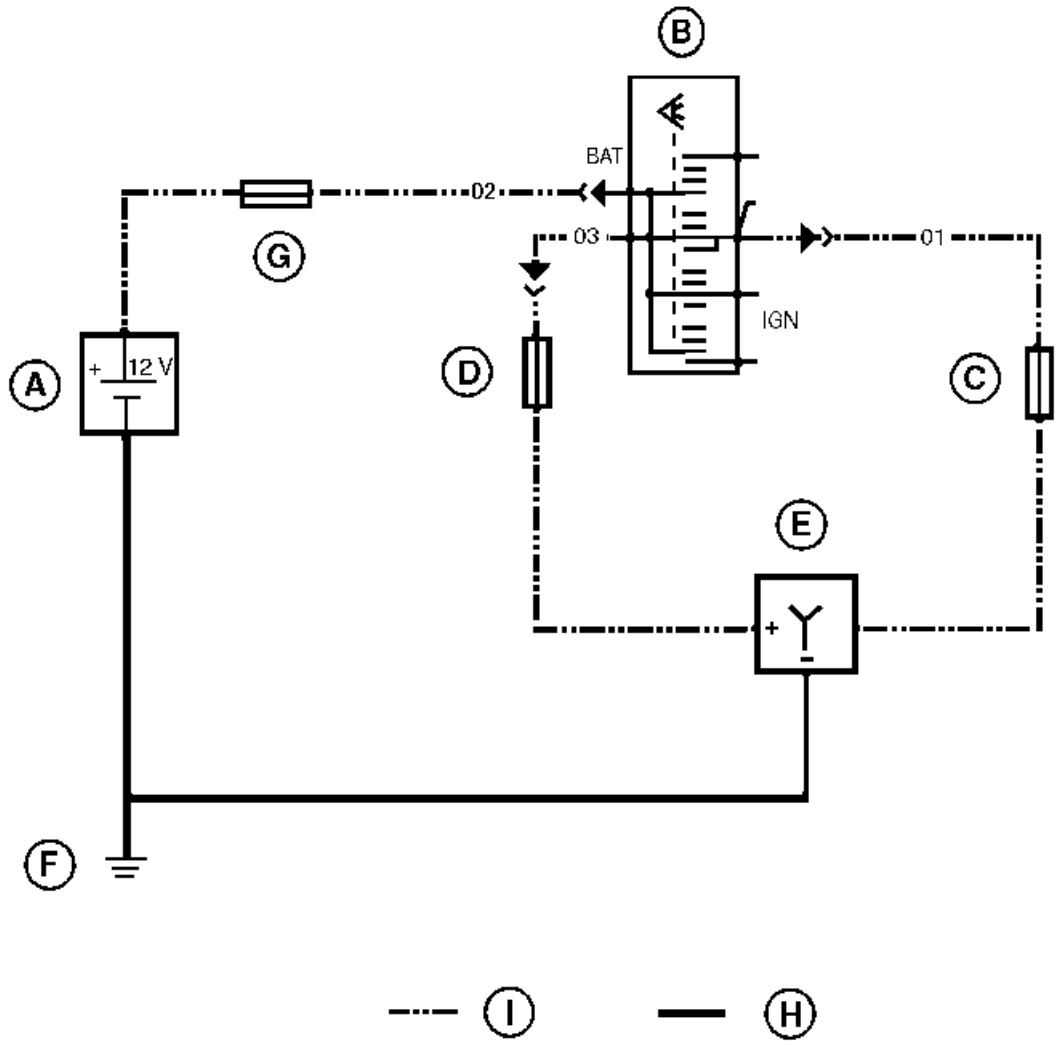
- 7-Pin Trailer Connector

Theory of Operation

Trailer connector terminals are connected as follows:

- No. 1 - Left turn circuit.
- No. 2 - Right stop light circuit.
- No. 3 - Ground Circuit.
- No. 4 - Right turn circuit.
- No. 5 - Right parking light circuit and license plate light.
- No. 6 - Left stop light circuit.
- No. 7 - Left parking light circuit.

3-Pin Optional Connector Operation



3-Pin Optional Connector Operation

LEGEND:	
A	Battery
B	Key switch
C	Fuse 12, 20 amp
D	Fuse 10, 25 amp
E	3-pin connector
F	Ground
G	Main fuse, 50 amp
H	Ground circuit
I	Power circuit

Function

Provides light connections for trailer.

Major Components

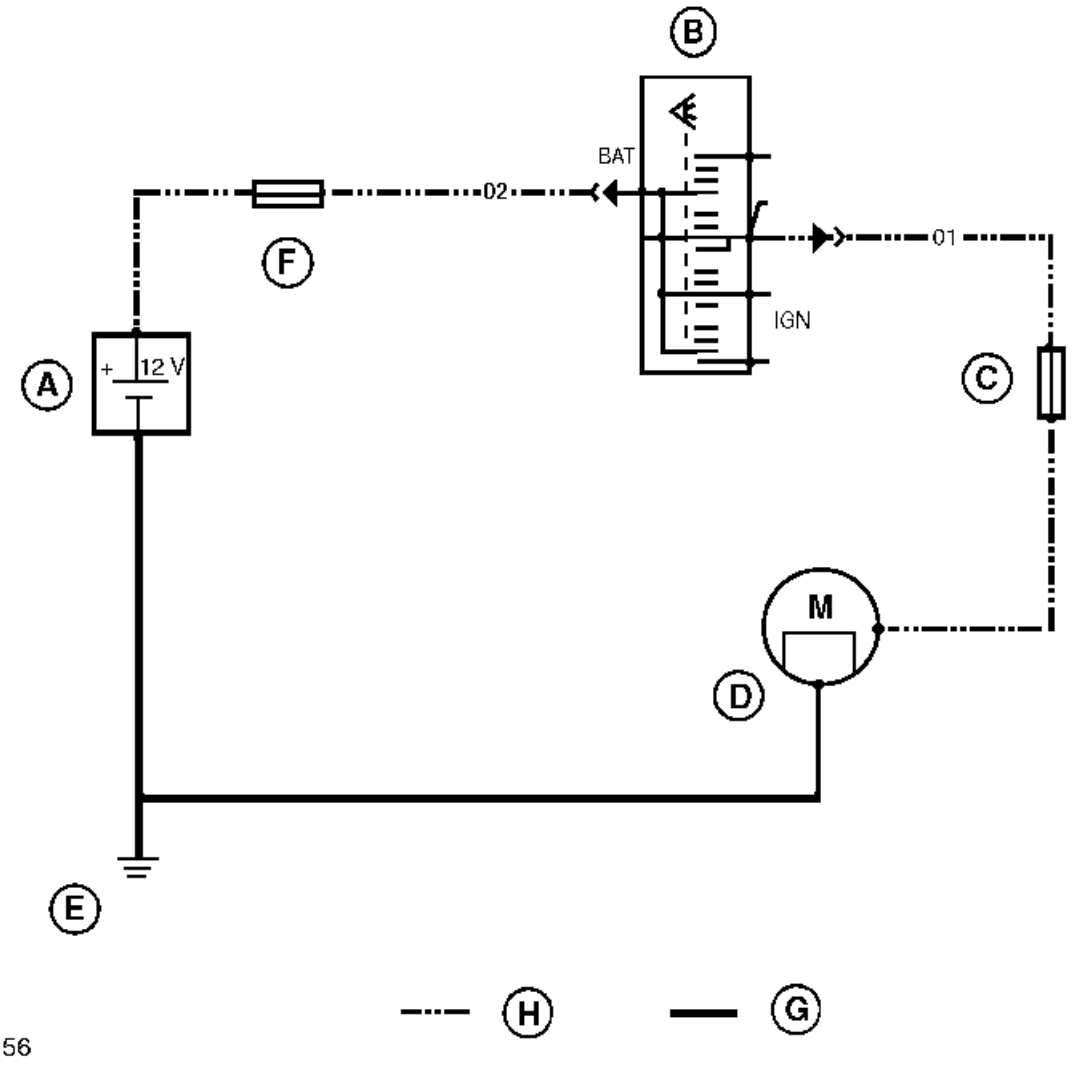
- 3-pin trailer connector
- Fuse 12, 20 amp
- Fuse 10, 25 amp
- Main fuse, 50 amp
- Key switch

Theory of Operation

Current flows from battery (A), through main fuse (G) across closed contact of key switch (B) and out circuit 01. Flows continues through 20 amp fuse (C) to 3-pin optional connector.

3-pin optional connector also receives current directly from battery. In circuit 03 current flows from key switch through 25 amp fuse (D) to 3-pin optional connector.

Pneumatic Seat Operation



Pneumatic Seat

LEGEND:	
A	Battery
B	Key switch
C	Fuse 9, 15 amp
D	Pneumatic motor
E	Ground
F	Main fuse, 50 amp
G	Ground circuit
H	Power circuit

Function

Adjusting of operator´s seat position (optional seat).

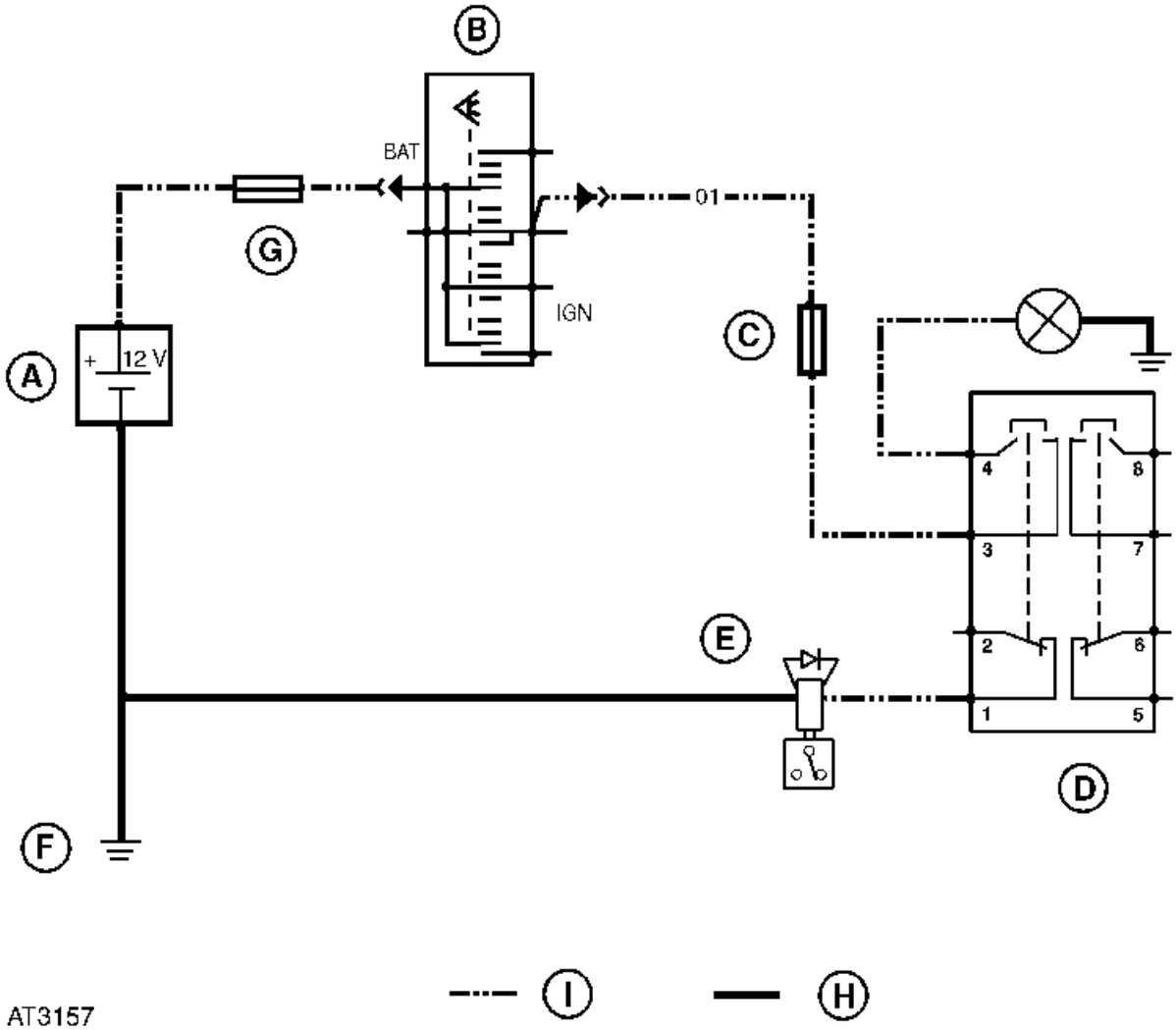
Major Components

- Pneumatic motor
- Fuse 9, 15 amp
- Main fuse, 50 amp
- Key switch

Theory of Operation

Current flows from battery (A), through main fuse (F) across closed contact of key switch (B) and out circuit 01. Flows continues through 15 amp fuse (C) to pneumatic motor (D).

Front Wheel Drive Operation



Front Wheel Drive Operation

LEGEND:

A	Battery
B	Key switch
C	Fuse 12, 20 amp
D	Front wheel drive switch
E	Front wheel drive solenoid valve
F	Ground
G	Main fuse, 50 amp
H	Ground circuit
I	Power circuit

Function

When is necessary a better traction.

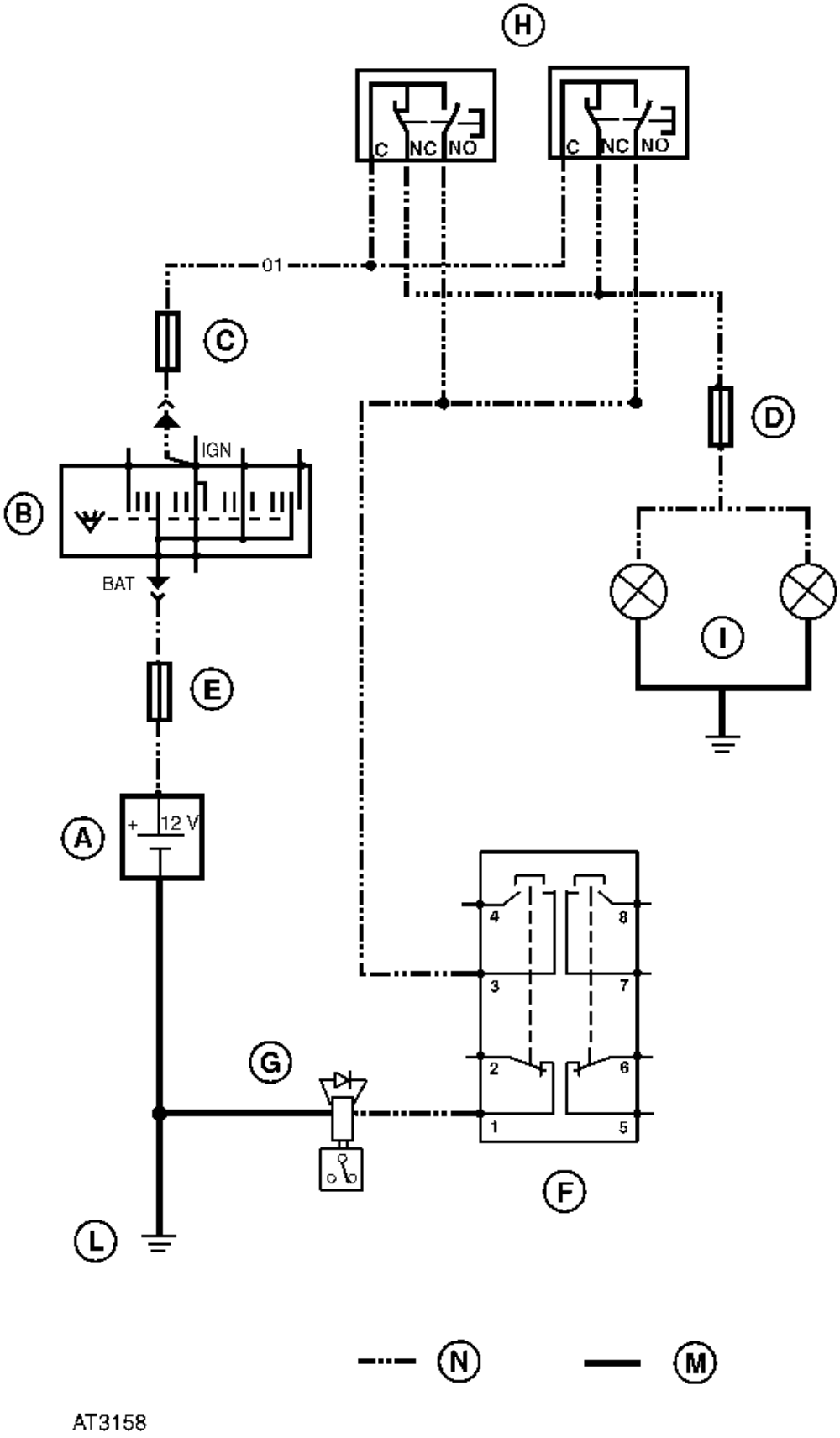
Major Components

- Front wheel drive switch
- Front wheel drive solenoid valve
- Fuse 12, 20 amp
- Main fuse, 50 amp
- Key switch

Theory of Operation

Current flows from battery (A), through main fuse (F) across closed contact of key switch (B). Flows continues through 20 amp fuse (C) to front wheel drive switch (D). When operator pushes the switch, flows continues to solenoid valve. The switch lights up.

Brake Pedal Operation



Brake Pedal Operation

LEGEND:

A	Battery
B	Key switch
C	Fuse 12, 20 amp

D	Fuse 8, 15 amp
E	Main fuse, 50 amp
F	Front wheel drive switch
G	Front wheel drive solenoid valve
H	Brake pedal switches
I	Stop lights
L	Ground
M	Ground circuit
N	Power circuit

Function

Brake pedal operation and alerts approaching traffic of tractor braking.

Major Components

- Front wheel drive switch
- Front wheel drive solenoid valve
- Brake pedal switches
- Fuse 12, 20 amp
- Fuse 8, 15 amp
- Main fuse, 50 amp
- Key switch
- Stop lights

Theory of Operation

Current flows from battery (A), through main fuse (F) across closed contact of key switch (B). Flow continues (circuit 01) through 20 amp fuse (C) to brake pedal switches (H).

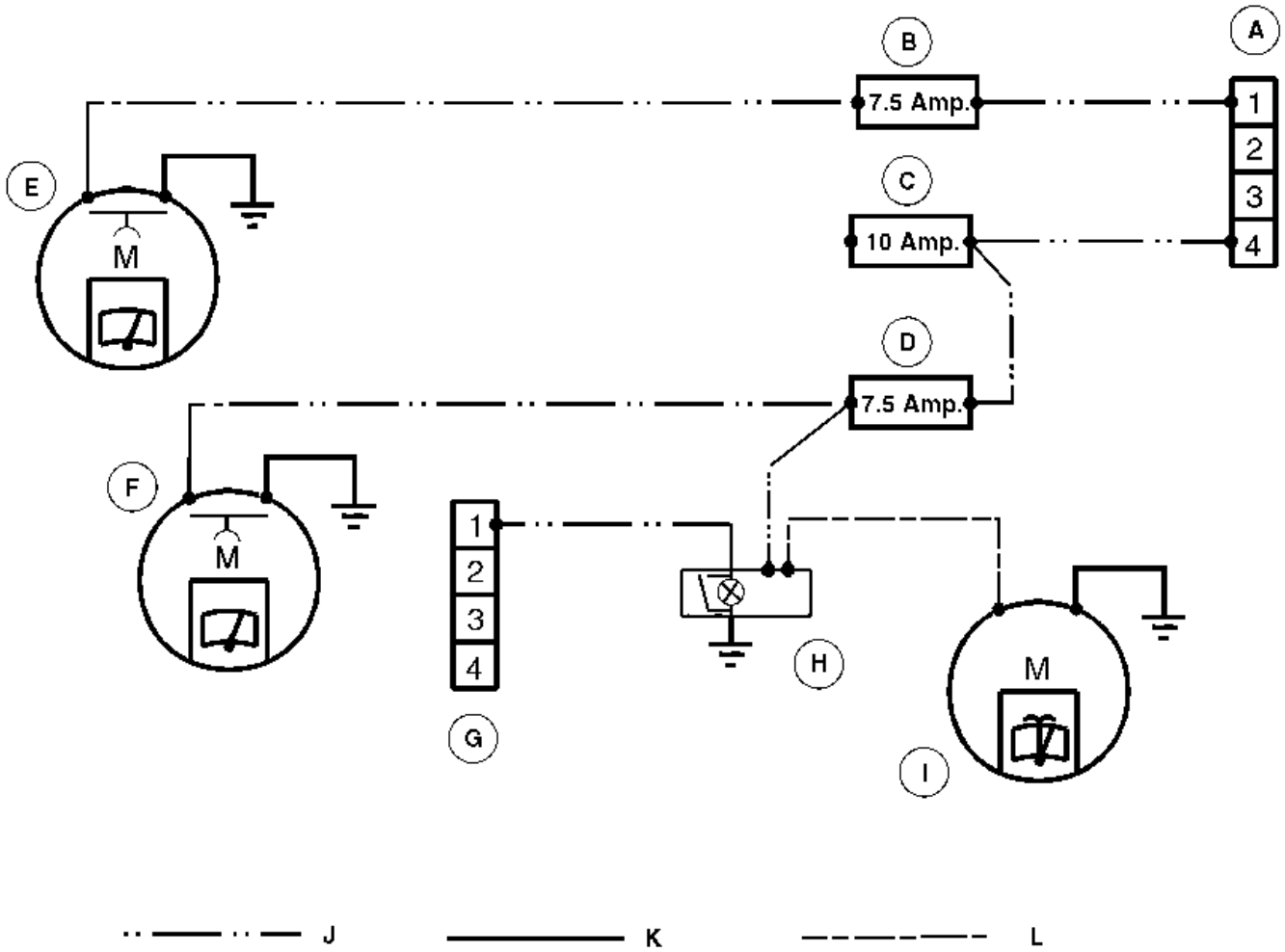
When operator pushes on brake pedal flow continues through 15 amp fuse to left and right stop lights (circuit 03). When operator pushes on brake pedal, flows continues through circuit 02 to front wheel drive switch.

From front wheel drive switch flows continues to front wheel drive solenoid for the automatic front wheel drive operation.

→NOTE:

When the brake is applied, front wheel drive cuts in automatically regardless of the position selected at the front wheel drive switch. In this case the indicator light does not come on.

Front And Rear Wiper/Washer Operation (Cab Tractors Only)



AT3206

Front and rear wiper/washer operation

LEGEND:

A	4-way connectors
B	Fuse 3, 7.5 amp
C	Fuse 5, 10 amp
D	Fuse 4, 7.5 amp
E	Rear wiper motor
F	Front wiper motor
G	4-way connectors
H	Washer switch
I	Front/rear washer pump
J	Power circuit
K	Ground circuit
L	Washer circuit

Function

Control operation of front and rear windshield wiper and washer pump.

Major Components

- Washer switch
- Front wiper motor
- Rear wiper motor
- Front/rear washer pump
- 4-way connector

- Fuses 3 and 4, 7.5 amp
- Fuse 5, 10 amp

Theory of Operation

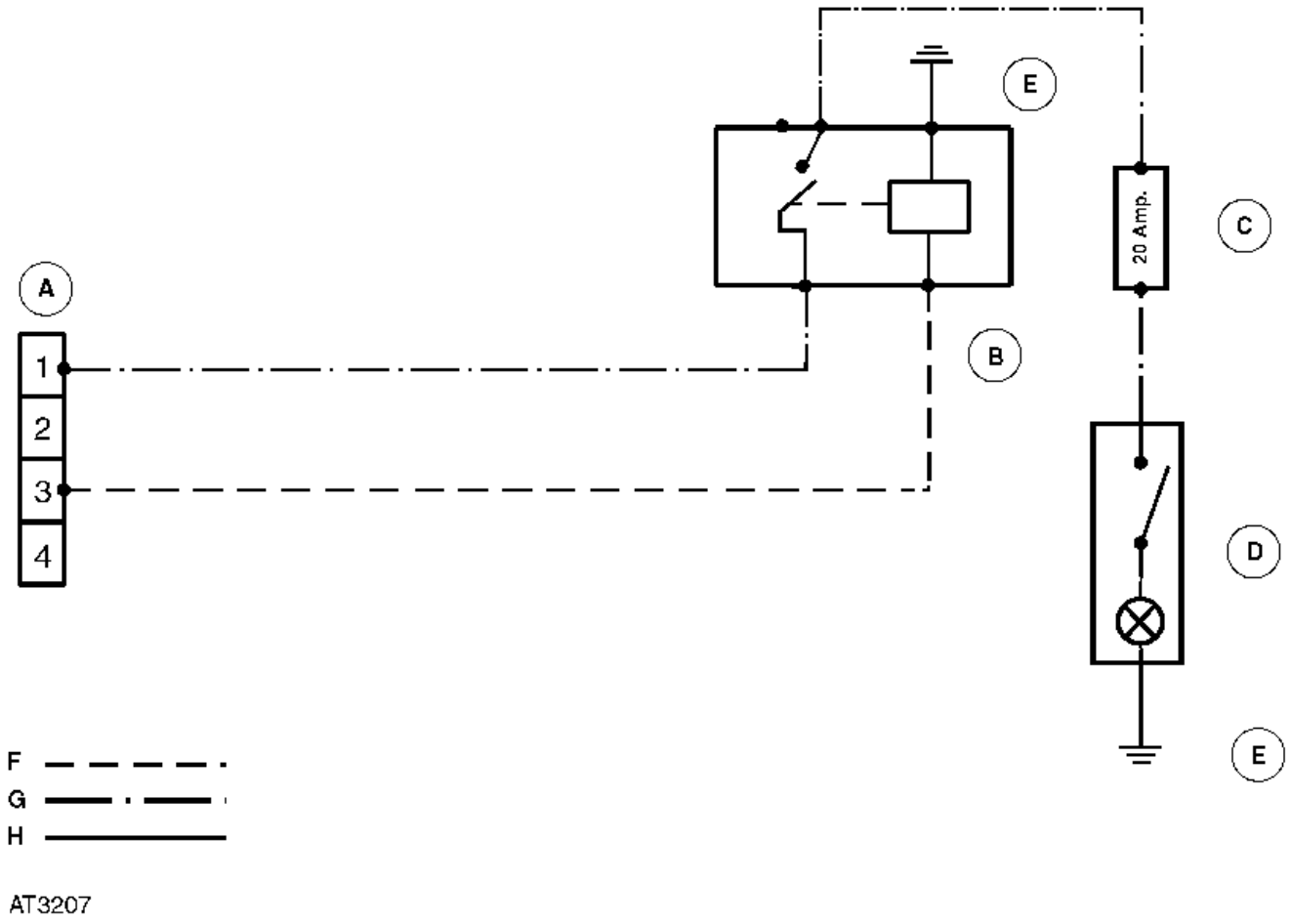
When key switch is in accessory or run position current flows through 4-way connector (A), to 7.5 amp fuse (B) and to 10 and 7.5 amp fuses (C) and (D).

When the switch on rear wiper motor is pressed, current flows through 7.5 amp fuse (B) to rear wiper motor (E).

When the switch on front wiper motor is pressed, current flows through 7.5 amp fuse (D) to front wiper motor (F).

When the washer pump switch is pressed, current flows through circuit 03 from 4-way connector (G) and activates the washer pump.

Dome Light Operation (Cab Tractors Only)



Dome Light Operation

LEGEND:	
A	4-way connector
B	Blower relay
C	Fuse 2, 20 amp
D	Dome light
E	Ground
F	Energizing circuit
G	Power circuit
H	Ground circuit

Function

Dome light illuminates interior of cab.

Major Components

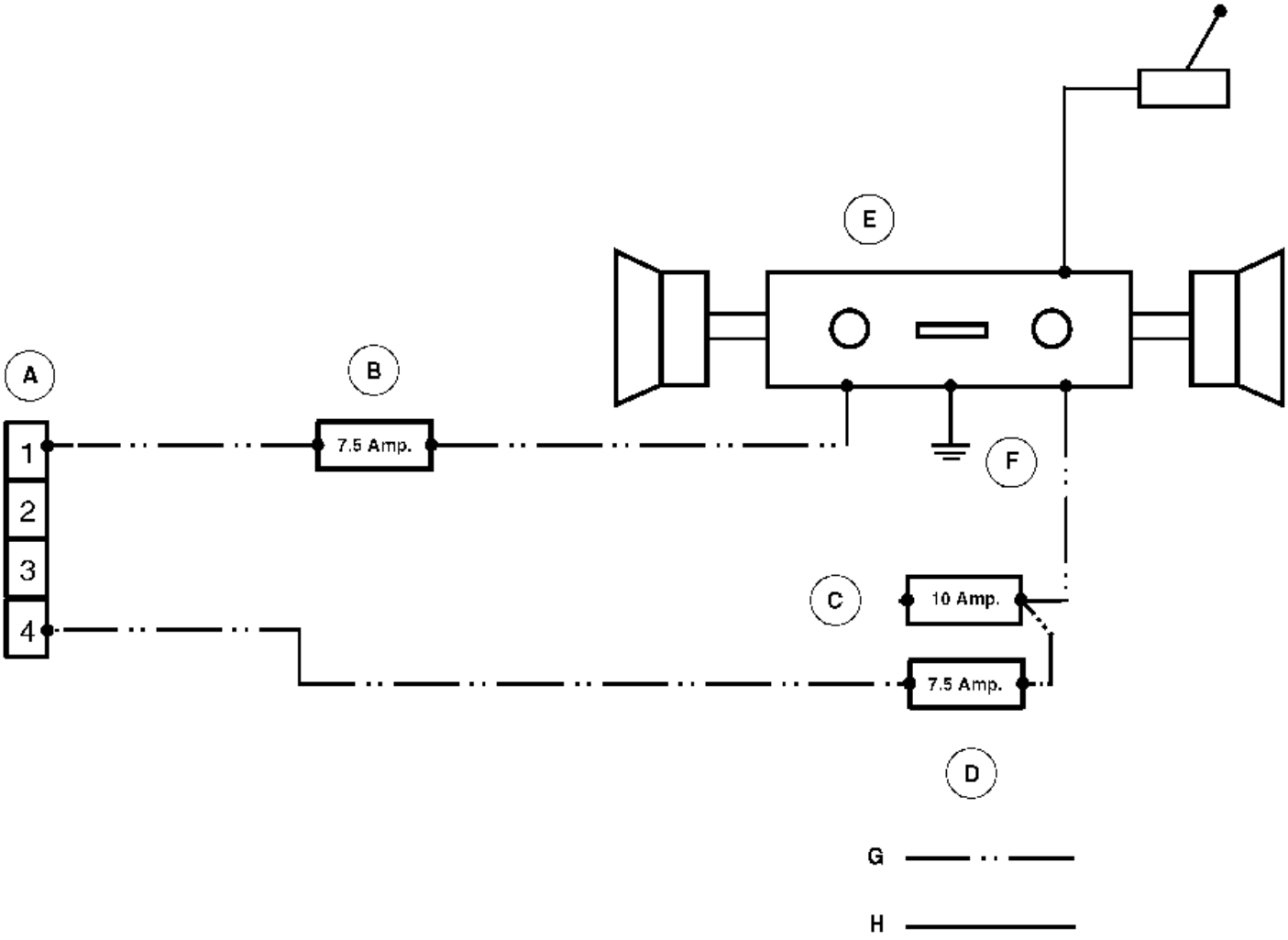
- Dome light
- Dome light switch
- Fuse 2, 20 amp
- 4-way connector
- Blower relay

Theory of Operation

From 4-way connection, through power circuit, current flows to blower relay (B). When dome light switch is pressed, current

flows through 20 amp fuse (C) to dome light (D).

Radio Operation (Cab Tractors Only)



Radio Operation

LEGEND:	
A	4-way connectors
B	Fuse 3, 7.5 amp
C	Fuse 4, 7.5 amp
D	Fuse 5, 10 amp
E	Radio
F	Ground
G	Power circuit
H	Ground circuit

Function

Optional circuit.

Major Components

- 4-way connectors
- Fuse 3, 7.5 amp
- Fuse 4, 7.5 amp
- Fuse 5, 10 amp

Theory of Operation

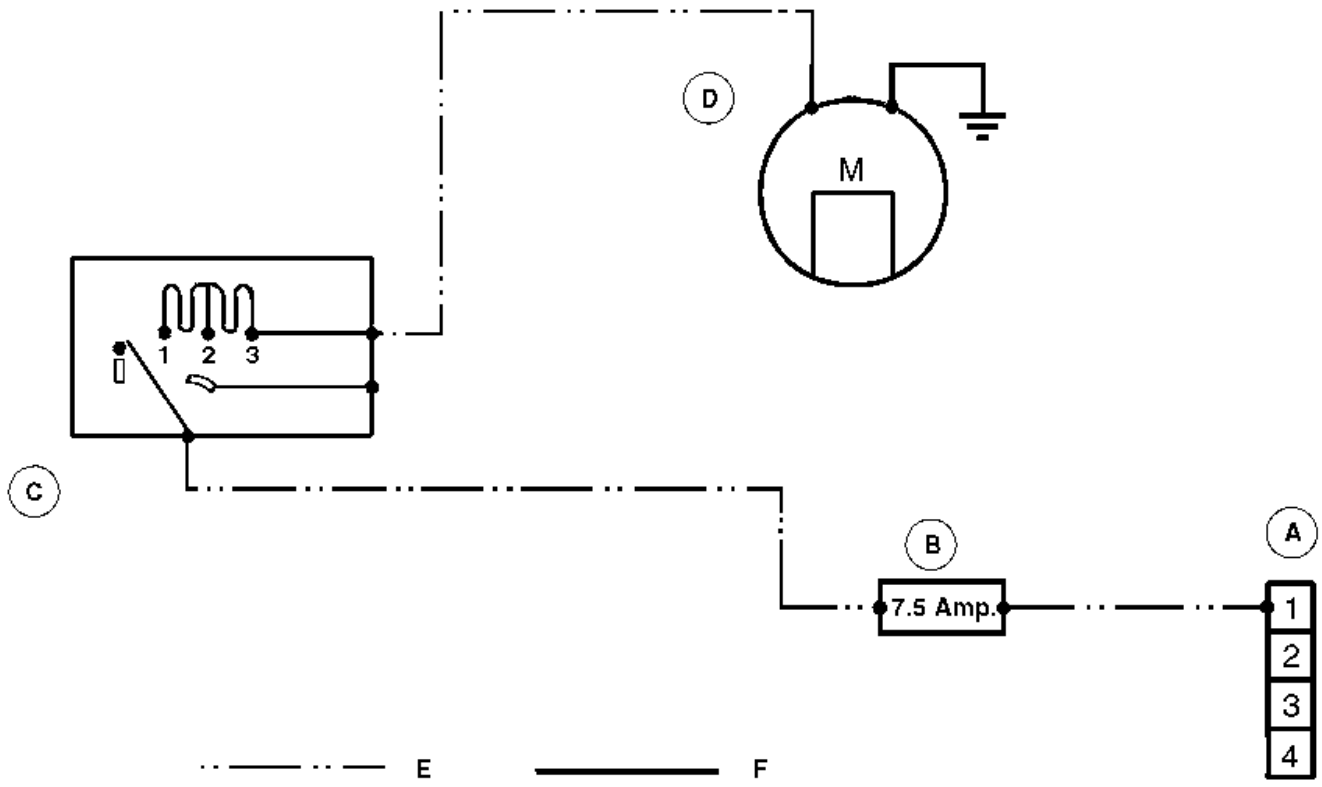
Current flows from 4-way connector (A) to 7.5 amp fuse (B) through power circuit. From 7.5 amp fuse (B), current flows to radio (E).

Another power circuit flows from 4-way connector (A) to 7.5 amp fuse (C). From 7.5 amp fuse (C) current flows through 10 amp fuse (D) to radio (E).

→NOTE:

Radio can be switched on if the key switch is inACC orRUN position.

Blower Motor Operation (Cab Tractors Only)



AT3210

Blower Motor Operation

LEGEND:	
A	4-way connectors
B	Fuse 5, 10 amp
C	Three speed fan switch
D	Blower motor
E	Power circuit
F	Ground circuit

Function

The blower motor is located in the cab roof. Three fans force external or heater air in the cab.

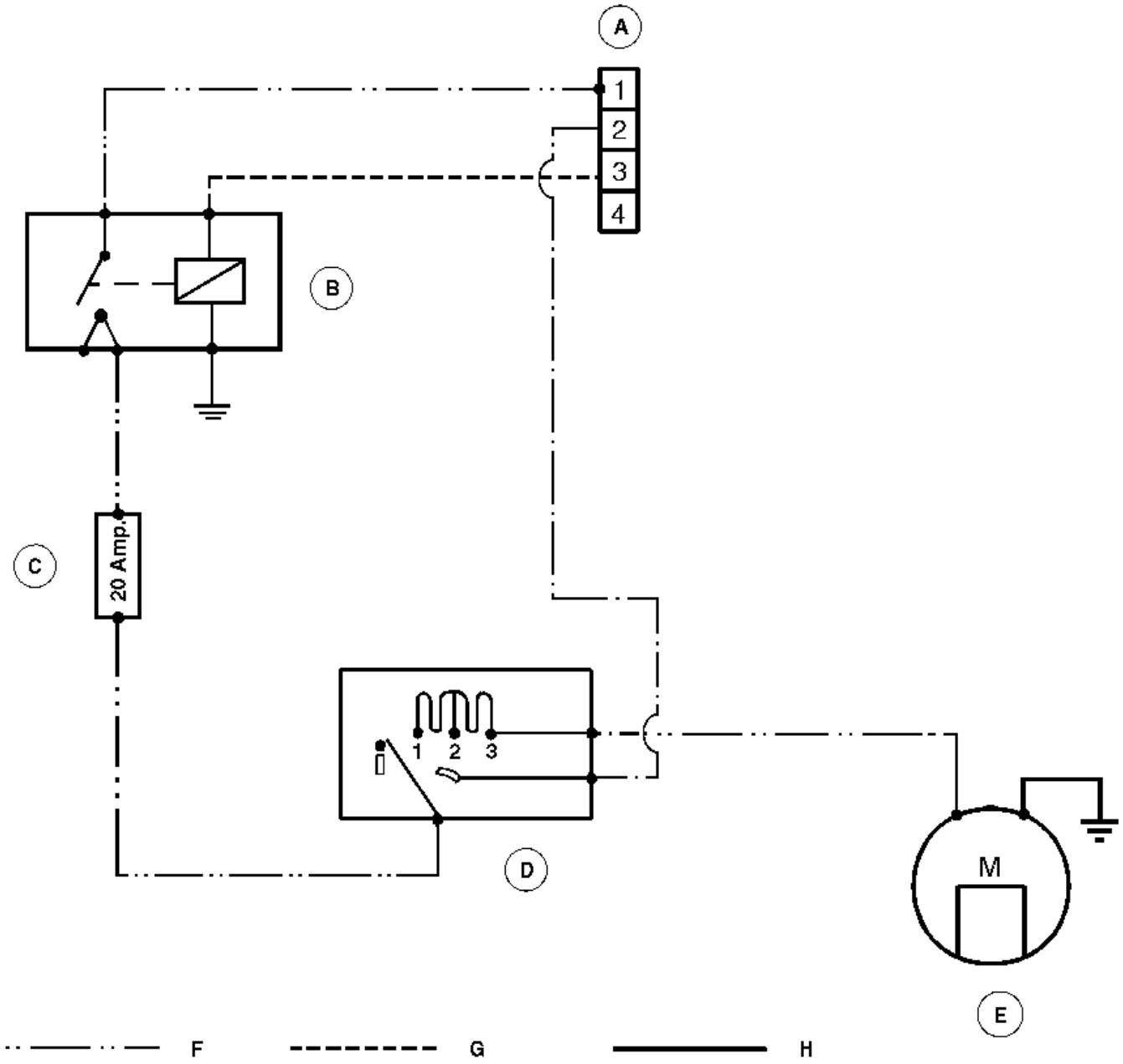
Major Components

- 4-way connector
- Fuse 5, 10 amp
- Three speed fan switch
- Blower motor

Theory of Operation

Current flows from 4-way connector (A) to 10 amp fuse (B). When fan switch (C) is turned on (three position), the current flows to blower motor (D).

Air Conditioning Operation (Cab Tractors Only)



AT3211

Air Conditioning Operation

LEGEND:

A	4-way connector
B	Blower relay
C	Three speed air conditioning switch
D	Fuse 1, 20 amp
E	Air conditioning compressor clutch
F	Power circuit
G	Energizing circuit
H	Ground circuit

Function

For adjusting the temperature of fresh air.

Major Components

- 4-way connection

- Fuse 1, 20 amp
- Three speed air conditioning switch
- Air conditioning compressor clutch
- Blower relay

Theory of Operation

Current flows from 4-way connection (A) to blower relay (B). When blower relay is energized, current flows to 20 amp fuse (C). When fan switch (D) is turned on (three position), the current flows to air conditioning compressor clutch and engages it.

Group 15 - Diagnosis, Tests and Adjustments

Special or Essential Tools

→NOTE:

Order tools according to information given in the U.S. SERVICEGARD ™ Catalog or in the European Microfiche Tool Catalog (MTC).

Battery Load Tester

JT05685

Battery voltage test

Digital Tachometer

JT05719

Measuring starting motor rpm

Diagnostic Information

The diagnostic information in this Group is used to test components related to a specific problem or system. Select a symptom or system from the list and follow the test procedures under that heading. The symptom or system headings are:

- Starting System
- Manifold Heater
- Charging System
- Instrument Panel System - Fuel Gauge
- Instrument Panel System - Temperature Gauge
- Instrument Panel System - Tachometer
- Instrument Panel System - Hourmeter
- Oil Pressure
- Air Filter Restriction
- PTO Warning System
- Parking Brake
- Lighting System - Headlight
- Lighting System - Left Tail Light, Rear Work Light and Instrument Panel Light
- Lighting System - Right Tail Light and License Plate Light
- Lighting System - Turn Signals
- Lighting System - Warning Light
- Beacon Light
- Stop Light and Front Wheel Drive
- Horn
- Trailer Connector
- Three-Pin Connector

The diagnostic procedure lists:

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

When performing the test or check, be sure to set your machine up to the test conditions listed and follow the sequence carefully. The middle “Normal” column gives the reading or conditions that should be obtained when performing the test or check. If the results of the test or check are not normal, perform the tests, check, or adjustment listed in the third “If Not Normal” column to repair the malfunction. The detailed tests or adjustments referred to in the “If Not Normal” column are

located at the end of this group.

The system diagram that accompanies each test procedure is drawn to resemble machine components. The key number on the art matches the number in the “Test Location” column and the arrow points to the exact test point.

Wire Color Chart

Wire Color Chart

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

Part Designations in Wiring Diagrams

DEFINITIONS:

B01	Neutral start switch
B02	Sending unit, tachometer
B03	Sending unit, coolant temperature
B04	Sending unit, fuel gauge
B05	Sending unit, air filter restriction
B06	Sending unit, engine oil pressure
B07	Sending unit, handbrake
B08	Brake switch
B09	MFWD shut-off switch

DEFINITIONS:

E01	Headlight, right
E02	Headlight, left
E03	Instrument lighting
E04	Tail light, left (front)
E05	Tail light, left (rear)
E06	Tail light, right (front)
E07	Tail light, right (rear)
E08	Work light
E09	Licence plate light
E10	Beacon light
E11	Rear work light (cab)
E12	Front work light (cab)

DEFINITIONS:

F01	Fuse 7,5 A
F02	Fuse 7,5 A
F03	Fuse 15 A
F04	Fuse 15 A
F05	Fuse 15 A
F06	Fuse 7,5 A
F07	Fuse 7,5 A
F08	Fuse 7,5 A
F09	Fuse 15 A
F10	Fuse 25 A
F11	Fuse 7,5 A
F12	Fuse 20 A
F13	Fuse 50 A (main fuse)

DEFINITIONS:

G01	Battery
G02	Alternator

DEFINITIONS:

H01	Alternator (charge) indicator light
H02	Air filter restriction indicator light
H03	Oil pressure indicator light
H04	Handbrake indicator light
H05	Rear PTO indicator light
H06	High beam indicator light
H07	Turn signal, front left
H08	Turn signal, rear left
H09	Turn signal, front right
H10	Turn signal, rear right
H11	Turn signal indicator, left
H12	Turn signal indicator, right
H13	Turn signal indicator, tractor
H14	Turn signal indicator, first trailer
H15	Turn signal indicator, second trailer
H16	Brake light, left
H17	Brake light, right
H18	Horn
H19	Front/rear washer switch indicator (cab)
H20	Dome light (cab)
H21	Rear work light indicator (cab)
H22	Front work light indicator (cab)
H23	Beacon light indicator (cab)

DEFINITIONS:

K01	Starter relay

DEFINITIONS:

K02 Turn/warn signal relay
K03 Neutral start relay
K04 Blower relay (cab)
K05 Work light relay (cab)

DEFINITIONS:

M01 Starting motor
M02 Rear wiper motor (cab)
M03 Front wiper motor (cab)
M04 Front/rear washer motor (cab)
M05 Blower motor (cab)
M06 Air conditioning compressor (-clutch) (cab)
M07 Beacon light motor (cab)

DEFINITIONS:

P01 Fuel gauge
P02 Tachometer
P03 Coolant temperature gauge
P04 Hourmeter

DEFINITIONS:

R01 Manifold heater
R02 Radio (cab)
R03 Loudspeaker (cab)

DEFINITIONS:

S01 Main switch
S02 Light switch
S03 Hazard warning light switch
S04 Turn signal control (switch)
S05 Beacon light switch
S06 Horn push button
S07 Rear PTO switch
S08 Front and rear washer switch (cab)
S09 Dome light switch (cab)
S10 Rear work light switch (cab)
S11 Front work light switch (cab)

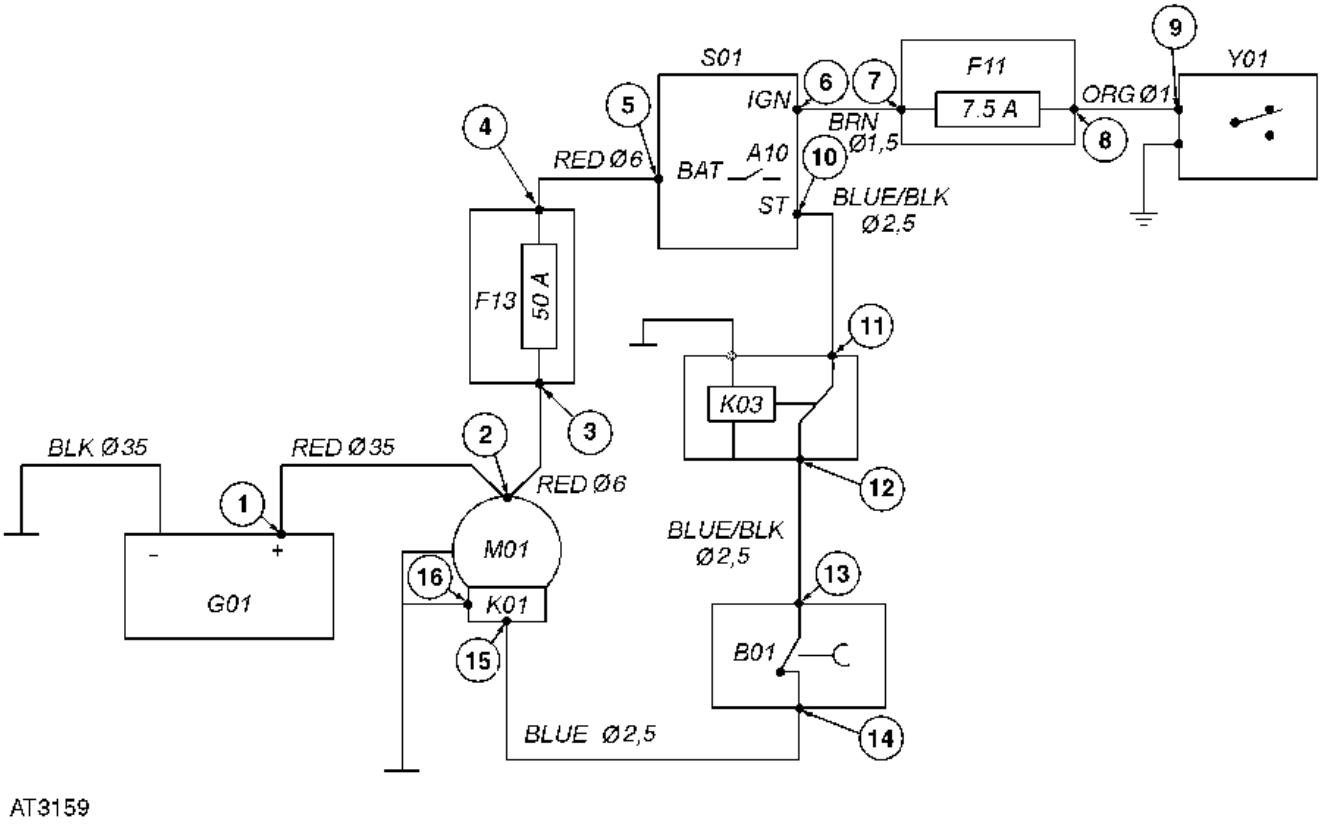
DEFINITIONS:

X01 Instrument panel connector

DEFINITIONS:

Y01 Fuel shut-off solenoid valve
Y02 MFWD solenoid valve

Starting System Test Points



AT3159

Starting System Test Points

Meet following requirements:

- Key switch in RUN position
- Gear shift lever in neutral position
- PTO disengaged
- Meter positive lead on numbered test points
- Meter negative lead on numbered test points
- Meter on DC volts

Starting System Test

(1) Check voltage at battery post.

Action:

Result must be minimum 11.8 V direct-current

Result:

YES: GO TO 2

NO: Test and charge batterie (replace as necessary)

(2) Check voltage at starter terminal.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 3

NO: Check for corroded connections or broken wires between battery and main fuse.

(3) Check voltage at 50 A main fuse input (F13), located on alternator/regulator.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 4

NO: Check for corroded connections or break in red wire between starting motor and fuse box on alternator/regulator.

(4) Check voltage at 50 A main fuse output (F13), located on alternator/regulator.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 5

NO: Check fuse F13 and replace if necessary. If fuse is good, check for corroded or loose terminals.

(5) Check voltage at “BAT” terminal of key switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 6

NO: Check for corroded connections or broken wires between main fuse and key switch.

(6) Check voltage at “IGN” terminal of key switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 7

NO: Check if key switch is in “RUN” position. If yes, replace the key switch.

(7) Check voltage at 7.5 A fuse input (F11 fuse of fuse box).

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 8

NO: Check for corroded connections or break in brown wire between key switch and fuse box.

(8) Check voltage at 7.5 A fuse output (F11 fuse of fuse box).

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 9

NO: Check fuse F11 and replace if necessary. If fuse is good, check for corroded or loose terminals.

(9) Check voltage at orange wire terminal of fuel shut-off solenoid.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 10

NO: Check for corroded connections or break in orange wire between fuse box (F11 fuse terminal) and fuel shut-off solenoid. If connections are good, replace solenoid.

(10) Check voltage at terminal “ST” of key switch.(hold key switch in START position).

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 11

NO: Test key switch and replace if necessary.

(11) Check voltage at blue/black wire terminal of neutral start relay.

Action:

(hold key switch in START position).

Result must be same as battery voltage.

Result:

YES: GO TO 12

NO: Check for corroded connections or break in blue/black wire between key switch and neutral start relay.

(12) Check voltage at blue/black wire terminal of neutral start relay.

Action:

(hold key switch in START position).

Result must be same as battery voltage.

Result:

YES: GO TO 13

NO: Check for corroded or loose connections. Test neutral start relay and replace if necessary.

(13) Check voltage at blue/black wire terminal of neutral start switch.

Action:

(hold key switch in START position).

Result must be same as battery voltage.

Result:

YES: GO TO 14

NO: Check for corroded connections or break in blue/black wire between neutral start relay and neutral start switch.

(14) Check voltage at blue wire terminal of neutral start switch.

Action:

(hold key switch in START position).

Result must be same as battery voltage.

Result:

YES: GO TO 15

NO: Check for corroded connections or loose connections. Test neutral start switch and replace if necessary.

(15) Check voltage at blue wire terminal of start relay

Action:

(hold key switch in START position).

Result must be same as battery voltage.

Result:

YES: GO TO 16

NO: Check for corroded connections or break in blue/black wire between neutral start relay and neutral start switch.

(16) Check voltage at blue wire terminal of start relay

Action:

(hold key switch in START position).

Result must be same as battery voltage.

Result:

YES: GO TO 17

NO: Check for corroded connections or break in blue wire between neutral start switch and start relay.

(17) Check voltage at black wire terminal of start relay

Action:

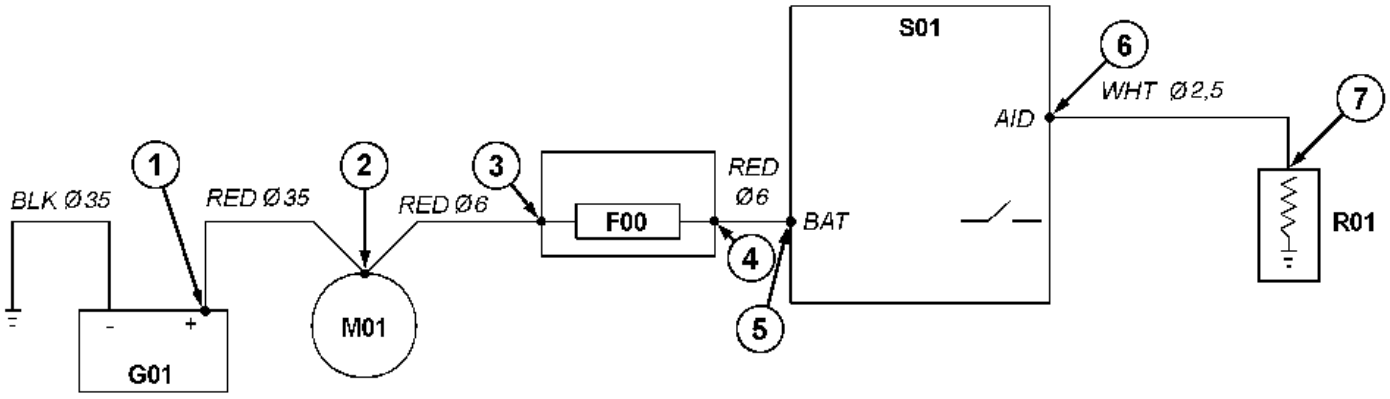
(hold key switch in START position).

Result must be less than 0.2 volt.

Result:

NO: Check continuity to ground of black wire. If all connections are good, test start relay and replace if necessary.

Manifold Heater Test Points



AT3160

Manifold Heater Test Points

Meet following requirements:

- Key switch in “RUN” or “START” position.
- Gear shift lever in neutral position.
- PTO disengaged.
- Meter positive lead on numbered test points.
- Meter negative lead on numbered test points.
- Meter on DC volts

Manifold Heater Test

(1) Check voltage at battery post.

Action:

Result must be minimum 11.8 V direct-current.

Result:

YES: GO TO 2

NO: Test and charge batterie (replace as necessary)

(2) Check voltage at starter terminal.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 3

NO: Check for corroded connections or broken wires between battery and main fuse.

(3) Check voltage at 50 A main fuse input (F13), located on alternator/regulator.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 4

NO: Check for corroded connections or break in red wire between starting motor and fuse box on alternator/regulator.

(4) Check voltage at 50 A main fuse output (F13), located on alternator/regulator.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 5

NO: Check fuse F13 and replace if necessary. If fuse is good, check for corroded or loose terminals.

(5) Check voltage at “BAT” terminal of key switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 6

NO: Check for corroded connections or broken wires between main fuse and key switch.

(6) Check voltage at “AID” terminal of key switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 7

NO: Check if key switch is in “RUN” or “START” position. If yes, replace the key switch.

(7) Check voltage at white wire terminal of manifold heater.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 8

NO: Check for corroded connections or break in white wire between key switch and manifold heater.

(8) Check voltage at black wire terminal of manifold heater.

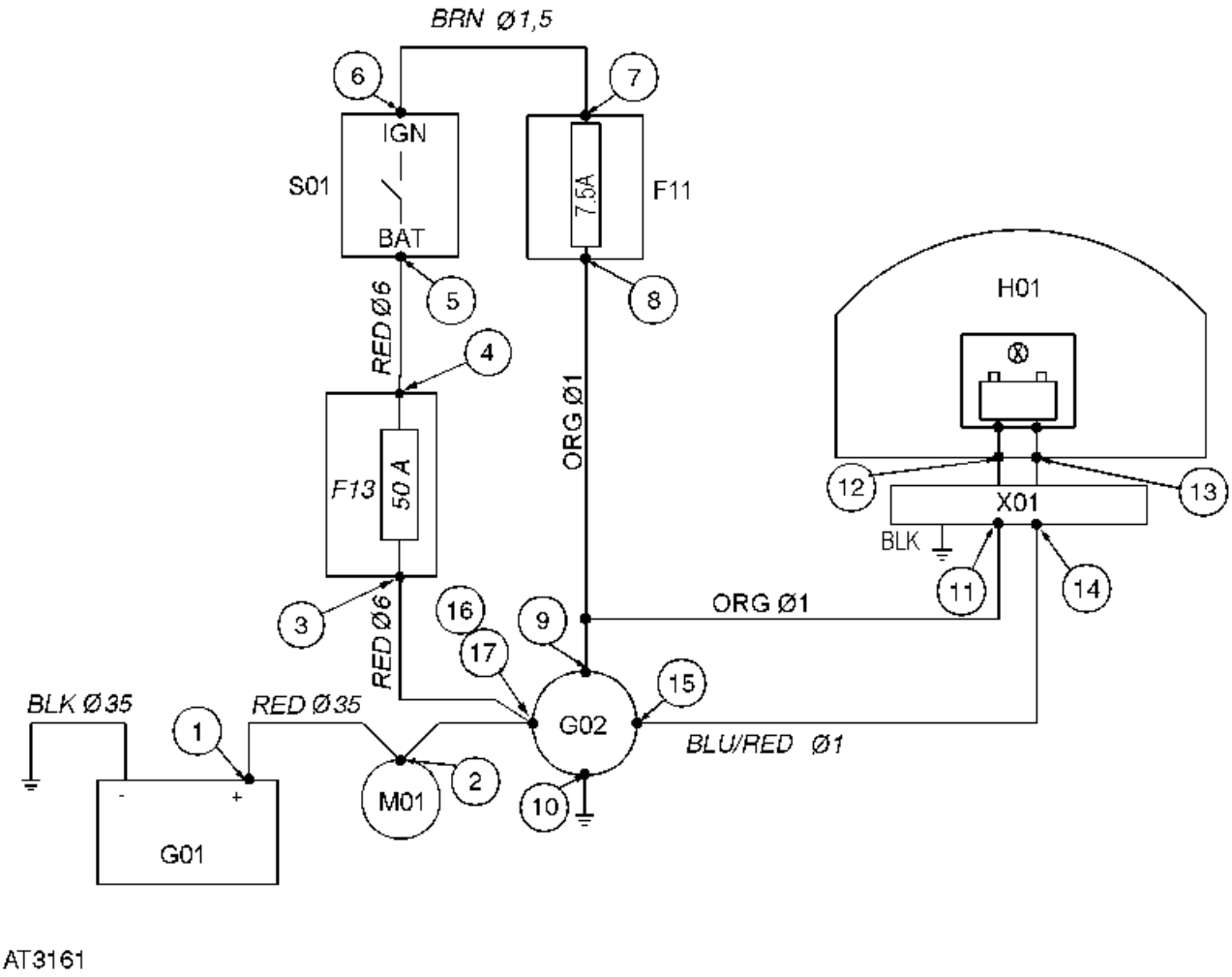
Action:

Result must be less than 0.2 volt.

Result:

NO: Check continuity to ground of black wire. If all connections are good, test manifold heater and replace if necessary.

Charging System Test Points



Charging System Test Points

Meet following requirements:

- Key switch in “RUN” position.
- Gear shift lever in neutral position.
- PTO disengaged.
- Meter positive lead on numbered test points.
- Meter negative lead on numbered test points.
- Meter on DC volts

Charging System Test

(1) Check voltage at battery post.

Action:

Result must be minimum 11.8 V direct-current.

Result:

YES: GO TO 2

NO: Test and charge batterie (replace as necessary).

(2) Check voltage at starter terminal.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 3

NO: Check for corroded connections or broken wires between battery and main fuse.

(3) Check voltage at 50 A main fuse input (F13), located on alternator/regulator.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 4

NO: Check for corroded connections or break in red wire between starting motor and fuse box on alternator/regulator.

(4) Check voltage at 50 A main fuse output (F13), located on alternator/regulator.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 5

NO: Check fuse F13 and replace if necessary. If fuse is good, check for corroded or loose terminals.

(5) Check voltage at “BAT” terminal of key switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 6

NO: Check for corroded connections or broken wires between main fuse and key switch.

(6) Check voltage at “IGN” terminal of key switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 7

NO: Check if key switch is in “RUN” position. If yes, replace the key switch.

(7) Check voltage at 7.5 A fuse input (F11 fuse of fuse box).

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 8

NO: Check for corroded connections or break in brown wire between key switch and fuse box.

(8) Check voltage at 7.5 A fuse output (F11 fuse of fuse box).

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 9

NO: Check fuse F11 and replace if necessary. If fuse is good, check for corroded or loose terminals.

(9) Check voltage at orange wire terminal of alternator.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 10

NO: Check for corroded connections or break in orange wire between fuse box (F11 fuse terminal) and alternator.

(10) Check voltage at alternator case.

Action:

Result must be less than 0.2 volt.

Result:

YES: GO TO 11

NO: Check alternator mounts for good ground contact to engine.

(11) Check voltage at orange wire of instrument panel connector.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 12

NO: Check for corroded connections or break in orange wire between fuse box/alternator case and instrument panel connector.

(12) Check voltage at orange wire of charge indicator bulb.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 13

NO: Check for corroded connections or break in splice of orange wire between instrument panel connector and bulb socket.

(13) Check voltage at blue/red wire terminal of charge indicator bulb.

Action:

Result must be less than 0.2 volt.

Result:

YES: GO TO 14

NO: Check indicator bulb and replace if necessary. Check indicator circuit from alternator using test points 4 - 7.

(14) Check voltage at blue/red wire terminal of instrument panel connector.

Action:

Result must be less than 0.2 volt.

Result:

YES: GO TO 15

NO: Check for corroded connections or break in blue/red wire between instrument panel connector and charge indicator bulb.

(15) Check voltage at blue/red wire terminal of alternator.

Action:

Result must be less than 0.2 volt.

Result:

YES: GO TO 16

NO: Check for corroded connections or break in blue/red wire between instrument panel connector and alternator.

(16) Check voltage at output terminal (red wire) of alternator.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 17

NO: Check for corroded connections or break in red wire between starter and alternator.

(17) Check voltage at output terminal (red wire) of alternator.

Action:

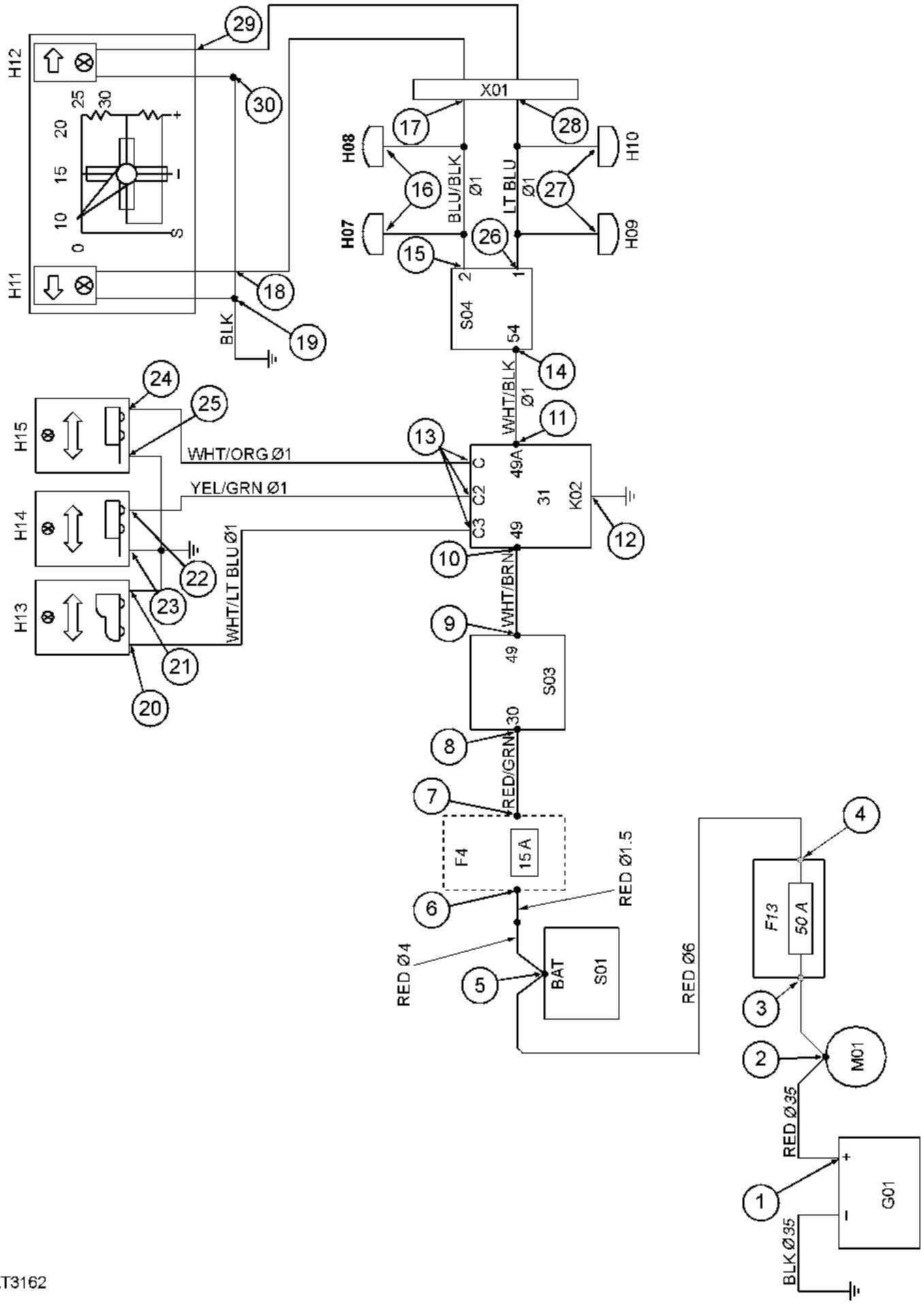
Start engine and operate at fast idle.

Result must be between 14.2 and 14.8 volt.

Result:

NO: Check belt tension and test alternator.

Lighting System Test Points - Turn Signals



Lighting System Test Points - Turn Signals

Meet following requirements:

- Key switch off.
- Hazard warning light switch off.
- Gear shift lever in neutral position.
- Meter positive lead on numbered test points.
- Meter negative lead on numbered test points.
- Meter on DC volts

Lighting System Test - Turn Signals

(1) Check voltage at battery post.

Action:

Result must be minimum 11.8 V direct-current

Result:

YES: GO TO 2

NO: Test and charge batterie (replace as necessary)

(2) Check voltage at starter terminal.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 3

NO: Check for corroded connections or broken wires between battery and main fuse.

(3) Check voltage at 50 A main fuse input (F13), located on alternator/regulator.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 4

NO: Check for corroded connections or break in red wire between starting motor and fuse box on alternator/regulator.

(4) Check voltage at 50 A main fuse output (F13), located on alternator/regulator.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 5

NO: Check fuse F13 and replace if necessary. If fuse is good, check for corroded or loose terminals.

(5) Check voltage at “BAT” terminal of key switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 6

NO: Check for corroded connections or broken wires between main fuse and key switch.

(6) Check voltage at 15 A fuse (F4) input of fuse box.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 7

NO: Check for corroded connections or break in red wire between key switch and fuse box.

(7) Check voltage at 15 A fuse (F4) output of fuse box.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 8

NO: Check fuse and replace if necessary. If fuse is good, check for corroded or loose terminals.

(8) Check voltage at terminal 30 of hazard warning light switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 9

NO: Check for corroded connections or break in red/green wire between fuse box and hazard warning light switch.

(9) Check voltage at terminal 49 of hazard warning light switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 10

NO: Check that hazard warning light switch is in OFF position. If switch is in OFF position, the switch is bad an has to be replaced.

(10) Check voltage at white/brown wire terminal of turn/warn signal relay.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 11

NO: Check for corroded connections or break in white/brown wire between hazard warning light switch and relay.

(11) Check voltage at white/black wire terminal of turn/warn signal relay .

Action:

(Turn controller moved to left turn position)

Result must be same as battery voltage (pulsing).

Result:

YES: GO TO 12

NO: Check for failed turn/warn signal relay. Check continuity to ground of black wire to tractor frame.

(12) Check voltage at black wire terminal of turn/warn signal relay.

Action:

(Turn controller moved to left turn position)

Result must be less than 0.2 volt.

Result:

YES: GO TO 13

NO: If wire is good to ground, replace relay.

(13) Check voltage at terminals C, C2 and C3 of turn/warn signal relay.

Action:

(Turn controller moved to left turn position)

Result must be same as battery voltage.

Result:

YES: GO TO 14

NO: Replace turn/warn signal relay.

(14) Check voltage at white/black wire terminal of turn signal controller.

Action:

(Turn controller moved to left turn position)

Result must be same as battery voltage (pulsing).

Result:

YES: GO TO 15

NO: Check for corroded connections or break in white/black wire between relay and turn signal controller.

(15) Check voltage at blue/black wire terminal of turn signal controller.

Action:

(Turn controller moved to left turn position)

Result must be same as battery voltage (pulsing).

Result:

YES: GO TO 16

NO: Replace turn signal controller.

(16) Check voltage at blue/black wire terminal of left turn signals.

Action:

(Turn controller moved to left turn position)

Result must be same as battery voltage (pulsing).

Result:

YES: GO TO 17

NO: Check for corroded connections or break in blue/black wire between turn signal controller and left turn signals. If wires and connections are good, replace bulb.

(17) Check voltage at blue/black wire terminal of instrument panel connector.

Action:

(Turn controller moved to left turn position)

Result must be same as battery voltage (pulsing).

Result:

YES: GO TO 18

NO: Check for corroded connections or break in blue/black wire between turn signal controller and instrument panel connector.

(18) Check voltage at blue/black wire terminal of instrument panel.

Action:

Result must be same as battery voltage (pulsing).

Result:

YES: GO TO 19

NO: Check for corroded connections or break in blue/black wire between instrument panel connector and instrument panel.

(19) Check voltage at black wire terminal of instrument panel.

Action:

(Turn controller moved to left turn position)

Result must be less than 0.2 volt.

Result:

YES: GO TO 20

NO: Check continuity to ground of black wire. If wire is good to ground, replace left turn indicator by replacing the instrument panel.

(20) Check voltage at white/light blue wire terminal of tractor turn indicator.

Action:

(Turn controller moved to left turn position)

Result must be same as battery voltage (pulsing).

Result:

YES: GO TO 21

NO: Check for corroded connections or break in white/light blue wire between turn/warn signal relay and tractor turn indicator connector.

(21) Check voltage at black wire terminal of tractor turn indicator.

Action:

(Turn controller moved to left turn position)

Result must be less than 0.2 volt.

Result:

YES: GO TO 22

NO: Check for failed tractor turn indicator. Check continuity to ground of black wire to tractor frame. If wire is good to ground, replace tractor turn indicator.

(22) Check voltage at yellow/green wire terminal of first trailer turn indicator.

Action:

(Turn controller moved to left turn position)

Result must be same as battery voltage (pulsing).

Result:

YES: GO TO 23

NO: Check for corroded connections or break in yellow/green wire between turn/warn signal relay and first trailer turn indicator connector.

(23) Check voltage at black wire terminal of first trailer turn indicator.

Action:

(Turn controller moved to left turn position)

Result must be less than 0.2 volt.

Result:

YES: GO TO 24

NO: Check for failed first trailer turn indicator. Check continuity to ground of black wire to tractor frame. If wire is good to ground, replace first trailer turn indicator.

(24) Check voltage at white/orange wire terminal of second trailer turn indicator.

Action:

(Turn controller moved to left turn position)

Result must be same as battery voltage (pulsing).

Result:

YES: GO TO 25

NO: Check for corroded connections or break in white/orange wire between turn/warn signal relay and second trailer turn indicator connector.

(25) Check voltage at black wire terminal of second trailer turn indicator.

Action:

(Turn controller moved to left turn position)

Result must be less than 0.2 volt.

Result:

YES: GO TO 26

NO: Check for failed first trailer turn indicator. Check continuity to ground of black wire to tractor frame. If wire is good to ground, replace second trailer turn indicator.

(26) (Turn controller moved to right turn position)
Check voltage at light blue wire terminal of turn signal controller.

Action:

Result must be same as battery voltage (pulsing).

Result:

YES: GO TO 27

NO: Replace turn signal controller.

(27) Check voltage at light blue wire terminal of right turn signals.

Action:

(Turn controller moved to right turn position)

Result must be same as battery voltage (pulsing).

Result:

YES: GO TO 28

NO: Check for corroded connections or break in light blue wire between turn signal controller and right turn signals. If wires and connections are good, replace bulb.

(28) Check voltage at light blue wire terminal of instrument panel connector.

Action:

(Turn controller moved to right turn position)

Result must be same as battery voltage (pulsing).

Result:

YES: GO TO 29

NO: Check for corroded connection or break in light blue wire between turn signal controller and instrument panel connector.

(29) Check voltage at light blue wire terminal of instrument panel.

Action:

(Turn controller moved to right turn position)

Result must be same as battery voltage (pulsing).

Result:

YES: GO TO 30

NO: Check for corroded connection or break in light blue wire between instrument panel connector and instrument panel.

(30) Check voltage at black wire terminal of instrument panel.

Action:

(Turn controller moved to right turn position)

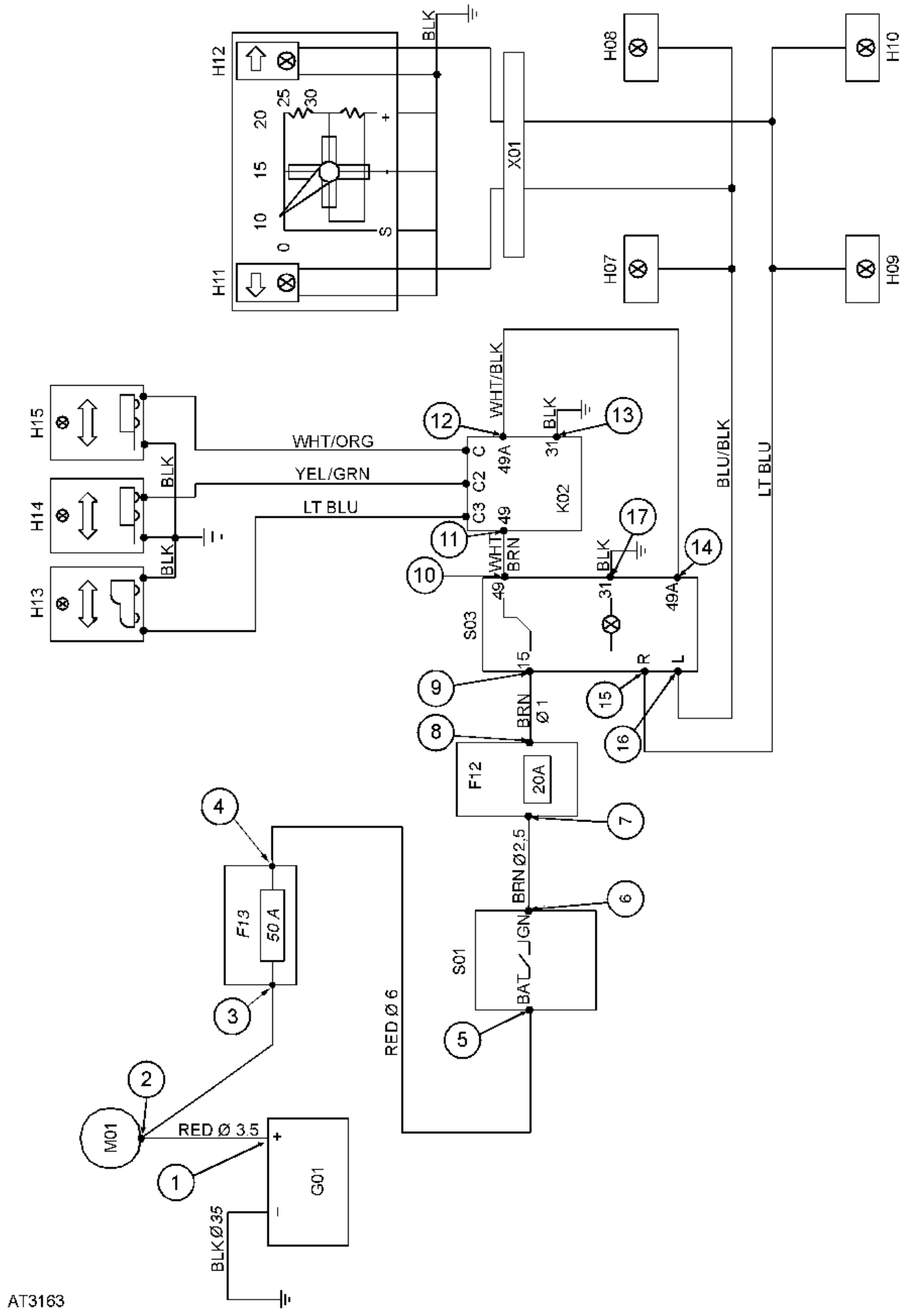
Result must be less than 0.2 volt.

Result:

YES:GO TO 31

NO: Check continuity to ground of black wire to tractor frame. If wire is good to ground, replace right turn indicator by replacing the instrument panel.

Lighting System Test Points - Warning Lights



Lighting System Test Points - Warning Lights

Meet following requirements:

- Key switch in run (1) position.
- Gear shift lever in neutral position.
- Meter positive lead on numbered test points.
- Meter negative lead on numbered test points.
- Meter on DC volts
- Electrical tests & adjustments in this Section and Group

Lighting System Test - Warning Lights

(1) Check voltage at battery post.

Action:

Result must be minimum 11.8 V direct-current

Result:

YES: GO TO 2

NO: Test and charge batterie (replace as necessary)

(2) Check voltage at starter terminal.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 3

NO: Check for corroded connections or broken wires between battery and main fuse.

(3) Check voltage at 50 A main fuse input (F13), located on alternator/regulator.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 4

NO: Check for corroded connections or break in red wire between starting motor and fuse box on alternator/regulator.

(4) Check voltage at 50 A main fuse output (F13) , located on alternator/regulator.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 5

NO: Check fuse F13 and replace if necessary. If fuse is good, check for corroded or loose terminals.

(5) Check voltage at “BAT” terminal of key switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 6

NO: Check for corroded connections or broken wires between main fuse and key switch.

(6) Check voltage at “IGN” terminal of key switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 7

NO: Check if key switch is in “RUN” position. If yes, replace the key switch.

(7) Check voltage at 20 A fuse (F12) input of fuse box.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 8

NO: Check for corroded connections or break in orange wire between key switch and fuse box.

(8) Check voltage at 20 A fuse (F12) output of fuse box.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 9

NO: Check for failed fuse F12 and replace if necessary. If fuse is good, check for corroded or loose terminals.

(9) Check voltage at terminal 15 of hazard warning light switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 10

NO: Check for corroded connections or break in brown wire between fuse box and hazard switch.

(10) Check voltage at terminal 49 of hazard warning light switch .

Action:

(Turn on the hazard warning light)

Result must be same as battery voltage.

Result:

YES: GO TO 11

NO: Check that hazard warning light switch is in ON position. If switch is in ON position, the switch has to be replaced.

(11) Check voltage at white/brown wire terminal of turn/warn signal relay .

Action:

(Turn on the hazard warning light)

Result must be same as battery voltage.

Result:

YES: GO TO 12

NO: Check for corroded connections or break in white/brown wire between hazard warning light switch and relay.

(12) Check voltage at white/black wire terminal of turn/warn signal relay .

Action:

(Turn on the hazard warning light)

Result must be same as battery voltage (pulsing).

Result:

YES: GO TO 13

NO: Check for failed relay. Check continuity to ground of black wire to tractor frame.

(13) Check voltage at black wire terminal of turn/warn signal relay .

Action:

(Turn on the hazard warning light)

Result must be less than 0.2 volt.

Result:

YES: GO TO 14

NO: If wire is good to ground, replace relay.

(14) Check voltage at black wire terminal of hazard warning light switch .

Action:

(Turn on the hazard warning light)

Result must be same as battery voltage (pulsing).

Result:

YES: GO TO 15

NO: Check for corroded connections or break in white/black wire between hazard warning light switch and relay.

(15) Check voltage at light blue wire terminal of hazard warning light switch .

Action:

(Turn on the hazard warning light)

Result must be same as battery voltage (pulsing).

Result:

YES: GO TO 16

NO: Check that hazard warning light switch is in ON position. If switch is in ON position, the switch has to be replaced.

(16) Check voltage at blue/black wire terminal of hazard warning light switch .

Action:

(Turn on the hazard warning light)

Result must be same as battery voltage (pulsing).

Result:

YES: GO TO 17

NO: Check that hazard warning light switch is in ON position. If switch is in ON position, the switch has to be replaced.

(17) Check voltage at black wire terminal of hazard warning light switch .

Action:

(Turn on the hazard warning light)

Result must be less than 0.2 volt.

Result:

YES:GO TO 18

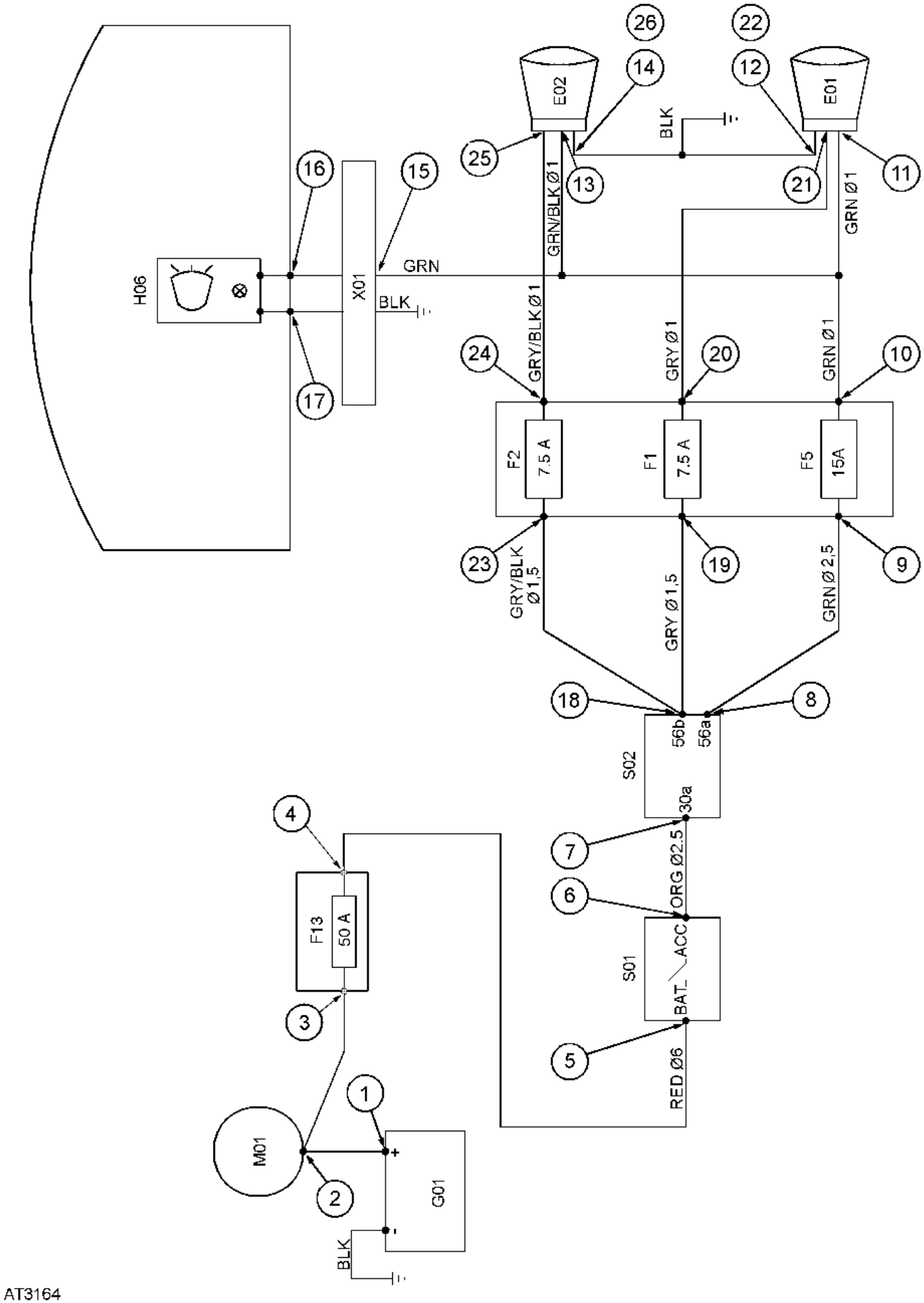
NO: Check that the lamp of hazard warning light switch is flashing. If no flashing, lamp is bad and has to be replaced.

Remaining Circuit

→NOTE:

The remaining circuit is same as turn signal circuit. Refer to turn signals diagnosis steps 11 to 30 if further diagnosis is required. When warning lights function, both right and left sides flash.

Lighting System Test Points - Headlights



Lighting System Test Points - Headlights

Meet following requirements:

- Key switch in run (1) position.
- Meter negative lead on numbered test points.
- Gear shift lever in neutral position.
- Meter on DC volts
- Light switch in position 3.
- Meter positive lead on numbered test points.

Lighting System Test - Headlights

High Beam Headlight Circuit

(1) Check voltage at battery post.

Action:

Result must be minimum 11.8 V direct-current

Result:

YES: GO TO 2

NO: Test and charge batterie (replace as necessary)

(2) Check voltage at starter terminal.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 3

NO: Check for corroded connections or broken wires between battery and main fuse.

(3) Check voltage at 50 A main fuse input (F13), located on alternator/regulator.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 4

NO: Check for corroded connections or break in red wire between starting motor and fuse box on alternator/regulator.

(4) Check voltage at 50 A main fuse output (F13) , located on alternator/regulator.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 5

NO: Check fuse F13 and replace if necessary. If fuse is good, check for corroded or loose terminals.

(5) Check voltage at “BAT” terminal of key switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 6

NO: Check for corroded connections or broken wires between main fuse and key switch.

(6) Check voltage at “ACC” terminal of key switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 7

NO: Check that key switch is in run position. If switch is in run, switch is bad. Replace if necessary.

(7) Check voltage at terminal 30a of light switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 8

NO: Check for corroded connections or break in orange wire between key switch and light switch.

(8) Check voltage at terminal 56a of light switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 9

NO: Check that light switch is in position 3. If switch is in position 3, switch is bad. Replace if necessary.

(9) Check voltage at 15 A fuse (F5 fuse) input of fuse box.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 10

NO: Check for corroded connections or break in green wire between light switch and fuse box.

(10) Check voltage at 15 A fuse (F5 fuse) output of fuse box.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 11

NO: Check for failed fuse F5. Replace fuse if it is failed. If fuse is good, check for corroded or loose terminals.

(11) Check voltage at green wire terminal of right headlight connector.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 12

NO: Check for corroded connections or break in green wire between fuse box (F5 fuse terminal) and right headlight connector.

(12) Check voltage at black wire terminal of right headlight connector

Action:

Result must be less than 0.2 volt.

Result:

YES: GO TO 13

NO: Check for failed bulb. Replace bulb if it is failed. Check continuity to ground of black wire to tractor frame.

(13) Check voltage at green/black wire terminal of left headlight connector.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 14

NO: Check for corroded connections or break in green wire between fuse box (F5 fuse terminal) and headlight connector.

(14) Check voltage at black wire terminal of left headlight connector.

Action:

Result must be less than 0.2 volt.

Result:

YES: GO TO 15

NO: Check for failed bulb. Replace bulb if it is failed. Check continuity to ground of black wire to tractor frame.

(15) Check voltage at green wire terminal of instrument panel connector.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 16

NO: Check for corroded connections or break in green wire between instrument panel connector and fuse box.

(16) Check voltage at green wire terminal of instrument panel.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 17

NO: Check for corroded connections or break in green wire between instrument panel connector and instrument panel.

(17) Check voltage at black wire terminal of instrument panel.

Action:

Result must be less than 0.2 volt.

Result:

YES: GO TO 18

NO: Check continuity to ground of black wire. If wire is good to ground, replace high beam indicator by replacing instrument panel.

(18) Low Beam Headlight Circuit:
Check voltage at terminal 56b of light switch.

Action:

(Key switch in run (1) position)

(Light switch in position (2))

Result must be same as battery voltage.

Result:

YES: GO TO 19

NO: Check that light switch is in position 2. If switch is in position 2, switch is bad. Replace if necessary.

(19) Check voltage at 5 A fuse input (F1 fuse) of fuse box.

Action:

(Key switch in run (1) position)

(Light switch in position (2))

Result must be same as battery voltage.

Result:

YES: GO TO 20

NO: Check for corroded connections or break in green wire between light switch and fuse box.

(20) Check voltage at 5 A fuse output (F1 fuse) of fuse box.

Action:

(Key switch in run (1) position)

(Light switch in position (2))

Result must be same as battery voltage.

Result:

YES: GO TO 21

NO: Check for failed fuse F1. Replace fuse if it is failed. If fuse is good, check for corroded or loose terminals.

(21) Check voltage at grey wire terminal of right headlight connector.

Action:

(Key switch in run (1) position)

(Light switch in position (2))

Result must be same as battery voltage.

Result:

YES: GO TO 22

NO: Check for corroded connections or break in grey wire between fuse box (F1 fuse terminal) and right headlight connector.

(22) Check voltage at black wire terminal of right headlight connector.

Action:

(Key switch in run (1) position)

(Light switch in position (2))

Result must be less than 0.2 volt.

Result:

YES: GO TO 23

NO: Check for failed bulb. Replace bulb if it is failed. Check continuity to ground of black wire to tractor frame.

(23) Check voltage at 7.5 A fuse input (F2 fuse) of fuse box.

Action:

(Key switch in run (1) position)

(Light switch in position (2))

Result must be same as battery voltage.

Result:

YES: GO TO 24

NO: Check for corroded connections or break in green wire between light switch and fuse box.

(24) Check voltage at 7.5 A fuse output (F2 fuse) of fuse box.

Action:

(Key switch in run (1) position)

(Light switch in position (2))

Result must be same as battery voltage.

Result:

YES: GO TO 25

NO: Check for failed fuse F2. Replace fuse if it is failed. If fuse is good, check for corroded or loose terminals.

(25) Check voltage at grey/black wire terminal of left headlight connector.

Action:

(Key switch in run (1) position)

(Light switch in position (2))

Result must be same as battery voltage.

Result:

YES: GO TO 26

NO: Check for corroded connections or break in grey/black wire between fuse box (F2 fuse terminal) and left headlight connector.

(26) Check voltage at black wire terminal of left headlight connector.

Action:

(Key switch in run (1) position)

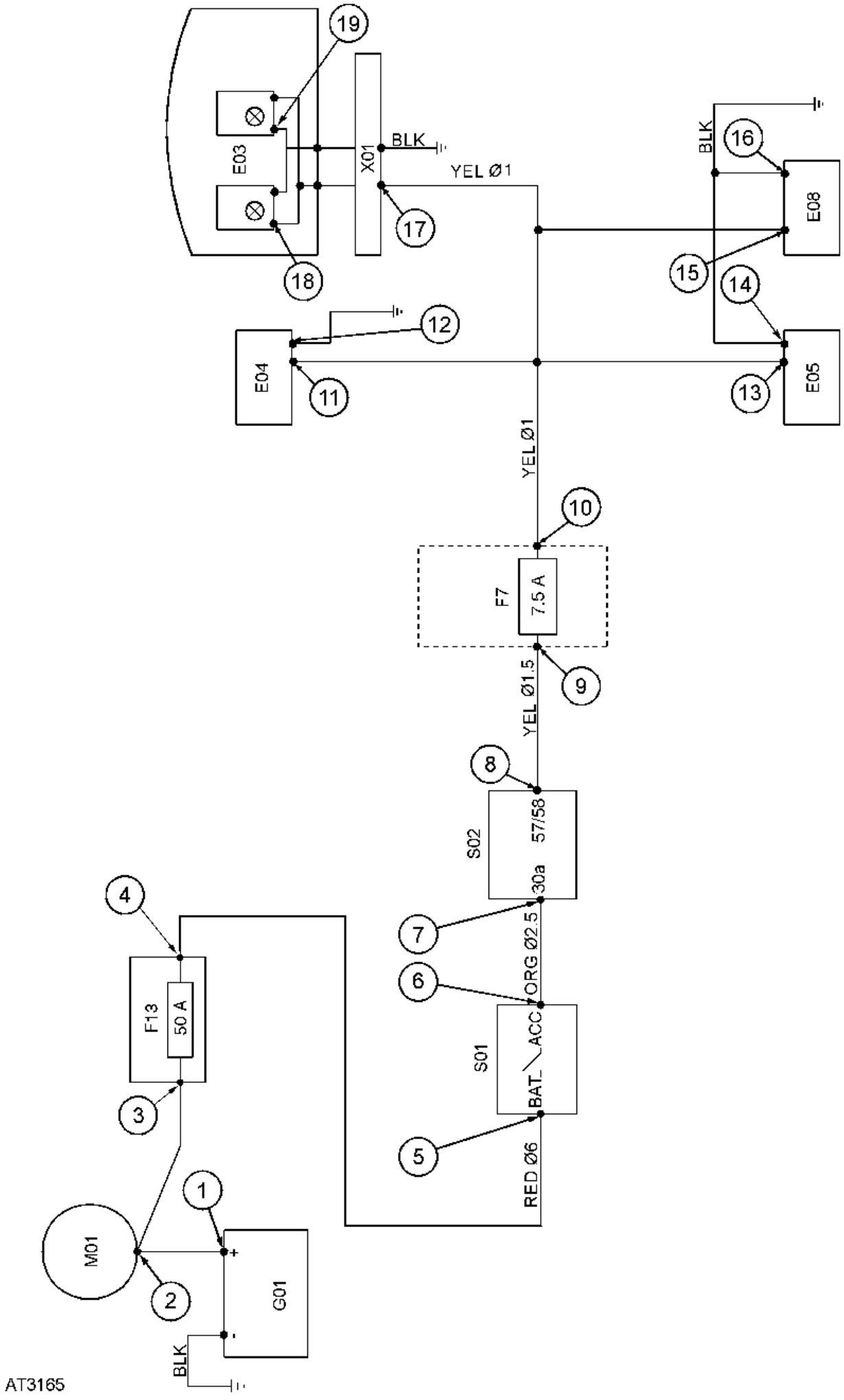
(Light switch in position (2))

Result must be less than 0.2 volt.

Result:

NO: Check for failed bulb. Replace bulb if it is failed. Check continuity to ground of black wire to tractor frame.

Lighting System Test Points - Left Tail Light, Rear Work Light and Instrument Panel Light


19
E03
X01
BLK
YEL Ø1
17
18
BLK
16
E08
15
14
12
E04
11
E05
13
YEL Ø1
10
F7
7.5 A
9
YEL Ø1.5
8
S02
57/58
30a
4
7
6
ORG Ø2.5
F13
50 A
S01
ACC
BAT
3
5
RED Ø6
1
M01
+
G01
2
-
BLK
AT3165

Meet following requirements:

- Key switch in run (1) position.
- Gear shift lever in neutral position.
- Light switch in position 1.
- Meter positive lead on numbered test points.
- Meter negative lead on numbered test points.
- Meter on DC volts.

Lighting System Test - Left Tail Light, Rear Work Light and Instrument Panel Light

(1) Left Tail Light Circuit:
Check voltage at battery post.

Action:

Result must be minimum 11.8 V direct-current

Result:

YES: GO TO 2

NO: Test and charge batterie (replace as necessary)

(2) Check voltage at starter terminal.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 3

NO: Check for corroded connections or broken wires between battery and main fuse.

(3) Check voltage at 50 A main fuse input (F13), located on alternator/regulator.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 4

NO: Check for corroded connections or break in red wire between starting motor and fuse box on alternator/regulator.

(4) Check voltage at 50 A main fuse output (F13) , located on alternator/regulator.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 5

NO: Check fuse F13 and replace if necessary. If fuse is good, check for corroded or loose terminals.

(5) Check voltage at “BAT” terminal of key switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 6

NO: Check for corroded connections or broken wires between main fuse and key switch.

(6) Check voltage at “ACC” terminal of key switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 7

NO: Check that key switch is in run position. If switch is in run, switch is bad. Replace if necessary.

(7) Check voltage at Terminal 30a of light switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 8

NO: Check for corroded connections or break in orange wire between key switch and light switch.

(8) Check voltage at Terminal 57/58 of light switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 9

NO: Check that light switch is in position 1 or 2 or 3. If switch is in one of these positions, switch is bad. Replace if necessary.

(9) Check voltage at 7.5 A fuse input (F7 fuse) of fuse box.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 10

NO: Check for corroded connections or break in yellow wire between light switch and fuse box.

(10) Check voltage at 7.5 A fuse output (F7 fuse) of fuse box.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 11

NO: Check for failed fuse F7. Replace fuse if it is failed. If fuse is good, check for corroded or loose terminals.

(11) Check voltage at yellow wire terminal of left tail light (front) connector.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 12

NO: Check for corroded connections or break in yellow wire between fuse box (F7 fuse terminal) and left tail light connector.

(12) Check voltage at black wire terminal of left tail light (front) connector.

Action:

Result must be less than 2 volt.

Result:

YES: GO TO 13

NO: Check for failed bulb. Replace bulb if it is failed. Check continuity to ground of black wire to tractor frame.

(13) Check voltage at yellow wire terminal of left tail light (rear) connector.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 14

NO: Check for corroded connections or break in yellow wire between fuse box (F7 fuse terminal) and left tail light connector.

(14) Check voltage at black wire terminal of left tail light (rear) connector.

Action:

Result must be less than 2 volt.

Result:

YES: GO TO 15

NO: Check for failed bulb. Replace bulb if it is failed. Check continuity to ground of black wire to tractor frame.

(15) Rear Work Light Circuit:

Check voltage at yellow wire terminal of rear work light connector

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 16

NO: Check for corroded connections or break in yellow wire between fuse box (F7 fuse terminal) and rear work light connector.

(16) Check voltage at black wire terminal of rear work light connector.

Action:

Result must be less than 2 volt.

Result:

YES: GO TO 17

NO: Check for failed bulb. Replace bulb if it is failed. If bulb is good, replace switch of rear work light. Check continuity to ground of black wire to tractor frame.

(17) Instrument Panel Light Circuit:
Check voltage at yellow wire terminal of instrument panel connector.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 18

NO: Check for corroded connections or break in yellow wire between fuse box (F7 fuse terminal) and instrument panel connector.

(18) Check voltage at yellow wire terminal of instrument panel.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 19

NO: Check for corroded connections or break in yellow wire between instrument panel connector and instrument panel.

(19) Check voltage at black wire terminal of instrument panel.

Action:

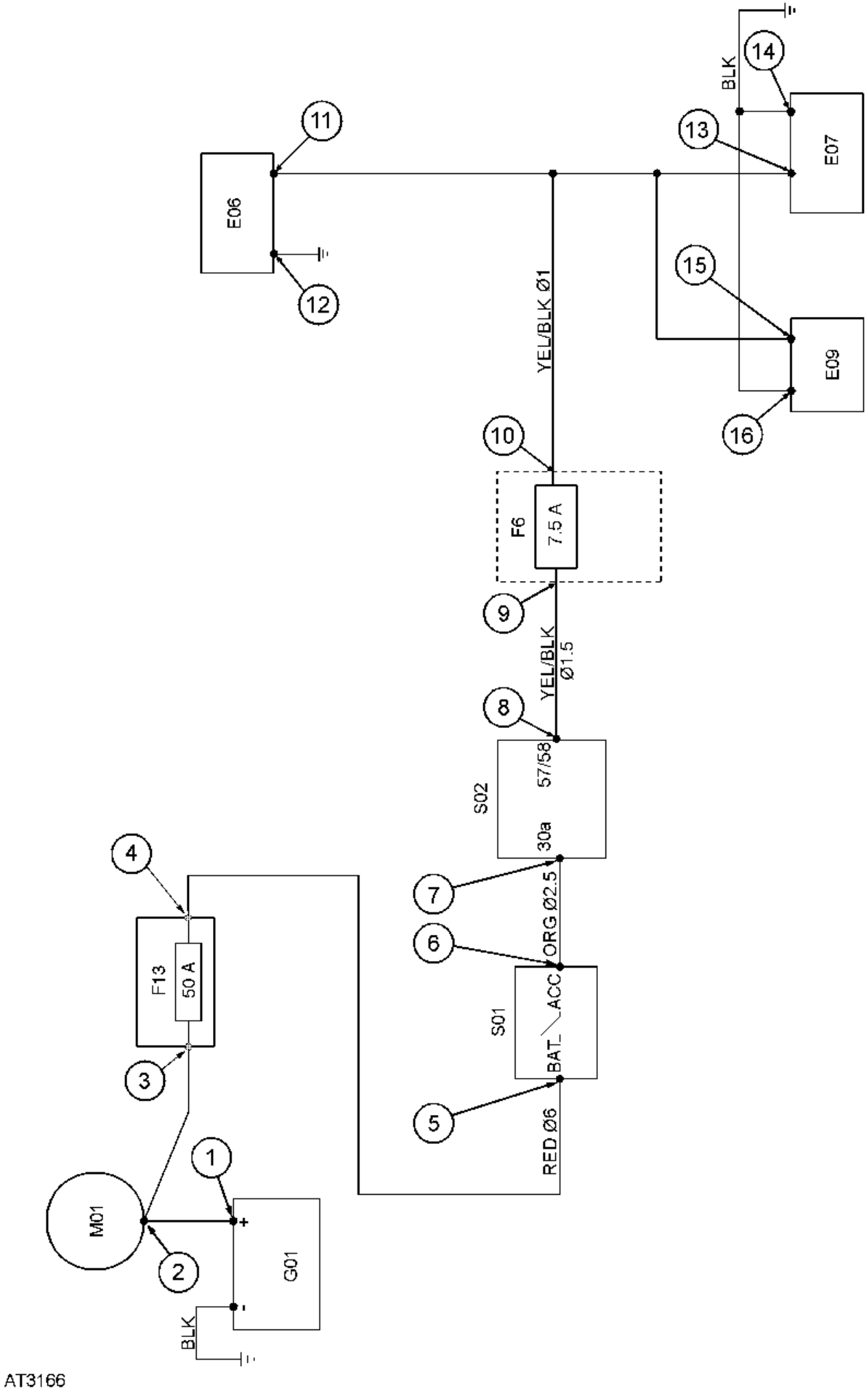
Result must be less than 2 volt.

Result:

NO: Check continuity to ground of black wire. If wire is good to ground, replace high beam indicators by replacing instrument

panel.

Lighting System Test Points - Right Tail Light and License PlateLight


BLK
14
13
E07
11
E06
12
15
E09
16
YEL/BLK Ø1
10
F6
7.5 A
9
YEL/BLK
Ø1.5
8
S02
57/58
30a
4
7
6
ORG Ø2.5
F13
50 A
S01
ACC
BAT
3
5
RED Ø6
1
M01
+
G01
2
-
BLK
AT3166

Lighting System Test Points - Right Tail Light and License Plate Light

Meet following requirements:

- Key switch in run (1) position.
- Gear shift lever in neutral position.
- Light switch in position 1.
- Meter positive lead on numbered test points.
- Meter negative lead on numbered test points.
- Meter on DC volts

Lighting System Test - Right Tail Light and License Plate Light

(1) Right Tail Light Circuit:
Check voltage at battery post.

Action:

Result must be minimum 11.8 V direct-current

Result:

YES: GO TO 2

NO: Test and charge batterie (replace as necessary)

(2) Check voltage at starter terminal.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 3

NO: Check for corroded connections or broken wires between battery and main fuse.

(3) Check voltage at 50 A main fuse input (F13), located on alternator/regulator.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 4

NO: Check for corroded connections or break in red wire between starting motor and fuse box on alternator/regulator.

(4) Check voltage at 50 A main fuse output (F13) , located on alternator/regulator.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 5

NO: Check fuse F13 and replace if necessary. If fuse is good, check for corroded or loose terminals.

(5) Check voltage at “BAT” terminal of key switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 6

NO: Check for corroded connections or broken wires between main fuse and key switch.

(6) Check voltage at “ACC” terminal of key switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 7

NO: Check that key switch is in run position. If switch is in run, switch is bad. Replace if necessary.

(7) Check voltage at Terminal 30a of light switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 8

NO: Check for corroded connections or break in orange wire between key switch and light switch.

(8) Check voltage at Terminal 57/58 of light switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 9

NO: Check that light switch is in position 1 or 2 or 3. If switch is in one of these positions, switch is bad. Replace if necessary.

(9) Check voltage at 7.5 A fuse input (F6 fuse) of fuse box.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 10

NO: Check for corroded connections or break in yellow/black wire between light switch and fuse box.

(10) Check voltage at 7.5 A fuse output (F6 fuse) of fuse box.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 11

NO: Check for failed fuse F6. Replace fuse if it is failed. If fuse is good, check for corroded or loose terminals.

(11) Check voltage at yellow/black wire terminal of right tail light (front) connector.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 12

NO: Check for corroded connections or break in yellow/black wire between fuse box (F6 fuse terminal) and right tail light connector.

(12) Check voltage at black wire terminal of right tail light (front) connector.

Action:

Result must be less than 0.2 volt.

Result:

YES: GO TO 13

NO: Check for failed bulb. Replace bulb if it is failed. Check continuity to ground of black wire to tractor frame.

(13) Check voltage at yellow/black wire terminal of right tail light (rear) connector.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 14

NO: Check for corroded connections or break in wire between fuse box (F6 fuse terminal) and right tail light connector.

(14) Check voltage at black wire terminal of right tail light (rear) connector.

Action:

Result must be less than 0.2 volt.

Result:

YES: GO TO 15

NO: Check for failed bulb. Replace bulb if it is failed. Check continuity to ground of black wire to tractor frame.

(15) License Plate Light Circuit:

Check voltage at yellow/black wire terminal of license plate light connector.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 16

NO: Check for corroded connections or break in wire between fuse box and licence plate light connector.

(16) Check voltage at black wire terminal of license plate light connector.

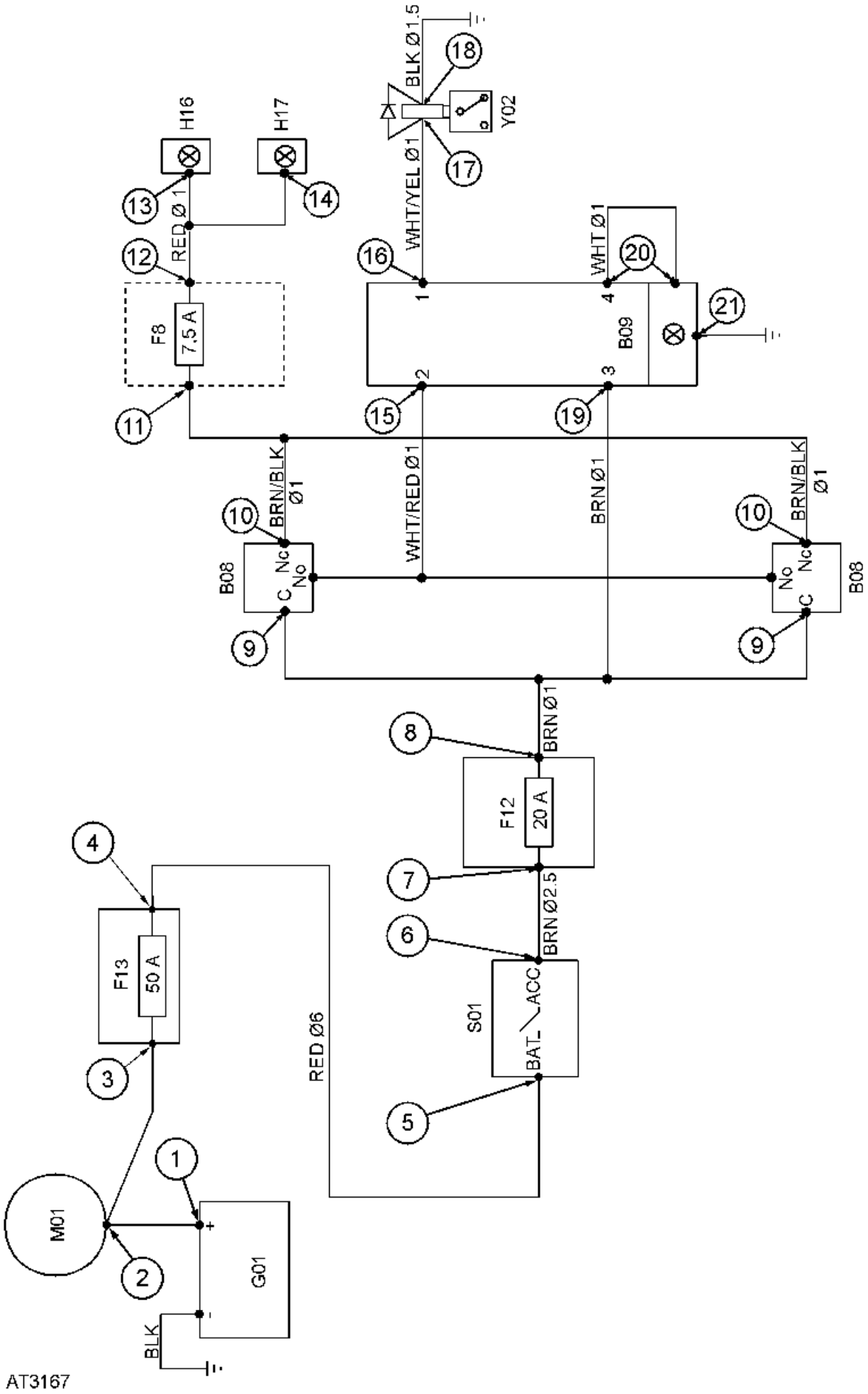
Action:

Result must be less than 0.2 volt.

Result:

NO: Check for failed bulb. Replace bulb if it is failed. Check continuity to ground of black wire to tractor frame.

Stop Lights and Front Wheel Drive Circuit



Meet following requirements:

- Key switch in run position.
- Gear shift lever in neutral position.
- PTO disengaged.
- Meter positive lead on numbered test points.
- Meter negative lead on numbered test points.
- Meter on DC volts

Electrical System Test - Stop Lights and Front Wheel Drive Circuit

(1) Stop Light Circuit:
Check voltage at battery post.

Action:

Result must be minimum 11.8 V direct-current

Result:

YES: GO TO 2

NO: Test and charge batterie (replace as necessary)

(2) Check voltage at starter terminal.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 3

NO: Check for corroded connections or broken wires between battery and main fuse.

(3) Check voltage at 50 A main fuse input (F13), located on alternator/regulator.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 4

NO: Check for corroded connections or break in red wire between starting motor and fuse box on alternator/regulator.

(4) Check voltage at 50 A main fuse output (F13) , located on alternator/regulator.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 5

NO: Check fuse F13 and replace if necessary. If fuse is good, check for corroded or loose terminals.

(5) Check voltage at “BAT” terminal of key switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 6

NO: Check for corroded connections or broken wires between main fuse and key switch.

(6) Check voltage at “ACC” terminal of key switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 7

NO: Check that key switch is in run position. If switch is in run, switch is bad. Replace if necessary.

(7) Check voltage at 20 A fuse input (F12 fuse) of fuse box.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 8

NO: Check for corroded connections or break in orange wire between key switch and fuse box.

(8) Check voltage at 20 A fuse output (F12 fuse) of fuse box.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 9

NO: Check for failed fuse F12. If fuse is good, check for corroded or loose terminals.

(9) Check voltage at brown wire terminal of stop switch (terminal C).

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 10

NO: Check for corroded connections or break in brown wire between fuse box and stop switch.

(10) Check voltage at brown/black wire terminal of stop switch.

Action:

(Push brake pedal and hold)

Result must be same as battery voltage.

Result:

YES: GO TO 11

NO: Check for corroded or loose terminals. Replace stop switch if necessary.

(11) Check voltage at 7.5 A fuse input (F8 fuse) of fuse box.

Action:

(Push brake pedal and hold)

Result must be same as battery voltage.

Result:

YES: GO TO 12

NO: Check for corroded connections or break in purple wire between stop switch and fuse box.

(12) Check voltage at 7.5 A fuse output (F8 fuse) of fuse box.

Action:

(Push brake pedal and hold)

Result must be same as battery voltage.

Result:

YES: GO TO 13

NO: Check for failed fuse. If fuse is good, check for corroded or loose terminals.

(13) Check voltage at red wire terminal of left stop light connector.

Action:

(Push brake pedal and hold)

Result must be same as battery voltage.

Result:

YES: GO TO 14

NO: Check for corroded connections or break in red wire between fuse box and left stop light connector. If connections or wire are good, bulb is bad. Replace bulb.

(14) Check voltage at red wire terminal of right stop light connector.

Action:

(Push brake pedal and hold)

Result must be same as battery voltage.

Result:

YES: GO TO 15

NO: Check for corroded connections or break in red/black wire between fuse box and right stop light connector. If connections or wire are good bulb is bad. Replace bulb.

(15) MFWD Solenoid Valve Circuit: Check voltage at white/red wire terminal of MFWD switch.

Action:

(Disengage MFWD)

Result must be same as battery voltage.

Result:

YES: GO TO 16

NO: Check for corroded connections or break in white/red wire between stop switch and MFWD switch. If connections or wire are good stop switch is bad and has to be replaced.

(16) Check voltage at white/yellow wire terminal of MFWD switch.

Action:

(Disengage MFWD)

Result must be same as battery voltage.

Result:

YES: GO TO 17

NO: Check for corroded or loose terminals. Replace MFWD switch.

(17) Check voltage at white/yellow wire terminal of MFWD solenoid valve.

Action:

(Disengage MFWD)

Result must be same as battery voltage.

Result:

YES: GO TO 18

NO: Check for corroded connections or break in white/yellow wire between MFWD switch and MFWD solenoid valve.

(18) Check voltage at black wire terminal of MFWD solenoid valve.

Action:

(Disengage MFWD)

Result must be less than 0.2 volt.

Result:

YES: GO TO 19

NO: Check continuity to ground of black wire to tractor frame. If connections or wires are good MFWD solenoid valve is bad. Replace if necessary.

(19) Check voltage at brown wire terminal of MFWD switch.

Action:

(Disengage MFWD)

Result must be same as battery voltage.

Result:

YES: GO TO 20

NO: Check for corroded connections or break in brown wire between fuse box (F12 fuse) and MFWD switch.

(20) Check voltage at white wire terminal of MFWD switch.

Action:

(Disengage MFWD)

Result must be same as battery voltage.

Result:

YES: GO TO 21

NO: Check for corroded connections or break in white wire of MFWD switch.

(21) Check voltage at black wire terminal of MFWD switch.

Action:

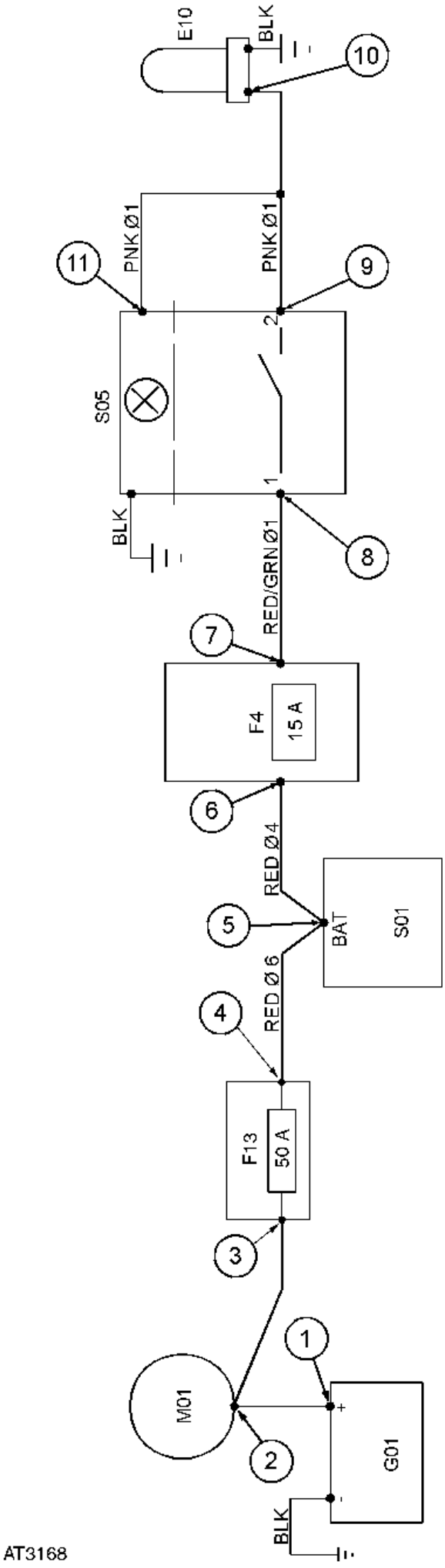
(Disengage MFWD)

Result must be less than 0.2 volt.

Result:

NO: Check continuity to ground of black wire to tractor frame. If connections or wires are good MFWD indicator lamp is bad. Replace if necessary.

Beacon Light Test Points


E10
BLK
10
PNK Ø1
PNK Ø1
11
9
2
S05
1
BLK
RED/GRN Ø1
8
7
F4
15 A
6
RED Ø4
5
BAT
S01
RED Ø 6
4
F13
50 A
3
1
M01
2
G01
BLK
AT3168

Beacon Light Electrical Circuit, Test Points

Meet following requirements:

- Gear shift lever in neutral position.
- PTO disengaged.
- Remove jacks from the beacon light.
- Meter positive lead on numbered test points.
- Meter negative lead on numbered test points.
- Meter on DC volts

Electrical System Test - Beacon Light

(1) Check voltage at battery post.

Action:

Result must be minimum 11.8 V direct-current

Result:

YES: GO TO 2

NO: Test and charge batterie (replace as necessary)

(2) Check voltage at starter terminal.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 3

NO: Check for corroded connections or broken wires between battery and main fuse.

(3) Check voltage at 50 A main fuse input (F13), located on alternator/regulator.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 4

NO: Check for corroded connections or break in red wire between starting motor and fuse box on alternator/regulator.

(4) Check voltage at 50 A main fuse output (F13) , located on alternator/regulator.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 5

NO: Check fuse F13 and replace if necessary. If fuse is good, check for corroded or loose terminals.

(5) Check voltage at “BAT” terminal of key switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 6

NO: Check for corroded connections or broken wires between main fuse and key switch.

(6) Check voltage at 15 A fuse input (F4 fuse) of fuse box.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 7

NO: Check for corroded connections or break in red wire between key switch and fuse box.

(7) Check voltage at 15 A fuse output (F4 fuse) of fuse box.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 8

NO: Check for failed fuse F4. If fuse is good, check for corroded or loose terminals.

(8) Check voltage at terminal 1 (red/green wire terminal) of beacon switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 9

NO: Check for corroded connections or break in red/green wire between fuse box and beacon switch.

(9) Check voltage at terminal 2 (pink wire terminal) of beacon switch.

Action:

(Beacon light switch in ON position)

Result must be same as battery voltage.

Result:

YES: GO TO 10

NO: Check for corroded or loose terminals. Replace beacon switch.

(10) Check voltage at pink wire terminal of beacon bulb.

Action:

(Beacon light switch in ON position)

Result must be same as battery voltage.

Result:

YES: GO TO 11

NO: Check for corroded connections or break in wire between beacon switch and beacon bulb socket. If connections or wire are good, bulb is bad. Replace beacon bulb.

(11) Check voltage at pink wire terminal of beacon switch bulb.

Action:

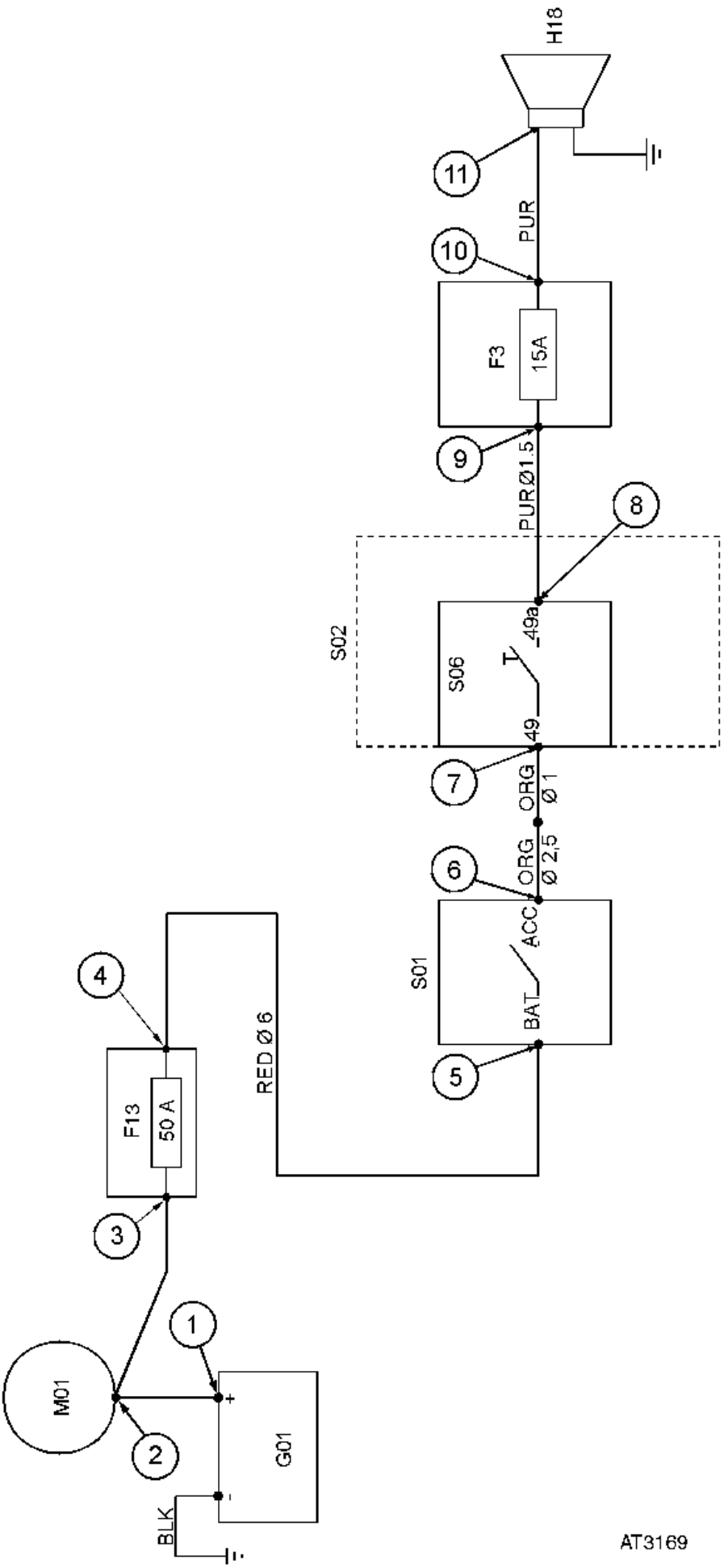
(Beacon light switch in ON position)

Result must be same as battery voltage.

Result:

NO: Check for corroded connections or break in wire between beacon switch and beacon switch bulb. If connections or wire are good lamp is bad. Replace beacon switch bulb.

Horn Test Points


H18
11
PUR
10
F3
15A
9
PUR Ø1.5
8
S02
S06
49a
49
7
ORG
Ø 1
ORG
Ø 2,5
6
ACC
S01
BAT
5
4
F13
50 A
RED Ø 6
3
1
M01
2
G01
BLK
AT3169

Horn Test Points

Meet following requirements:

- Key switch in run (1) position.
- Gear shift lever in neutral position.
- PTO disengaged.
- Remove jacks from the horn.
- Meter positive lead on numbered test points.
- Meter negative lead on numbered test points.
- Meter on DC volts.

Electrical System Test - Horn

(1) Check voltage at battery post.

Action:

Result must be minimum 11.8 V direct-current

Result:

YES: GO TO 2

NO: Test and charge batterie (replace as necessary)

(2) Check voltage at starter terminal.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 3

NO: Check for corroded connections or broken wires between battery and main fuse.

(3) Check voltage at 50 A main fuse input (F13), located on alternator/regulator.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 4

NO: Check for corroded connections or break in red wire between starting motor and fuse box on alternator/regulator.

(4) Check voltage at 50 A main fuse output (F13) , located on alternator/regulator.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 5

NO: Check fuse F13 and replace if necessary. If fuse is good, check for corroded or loose terminals.

(5) Check voltage at “BAT” terminal of key switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 6

NO: Check for corroded connections or broken wires between main fuse and key switch.

(6) Check voltage at “ACC” terminal of key switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 7

NO: Check that key switch is in run position. If switch is in run, switch is bad. Replace if necessary.

(7) Check voltage at orange wire terminal of horn switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 8

NO: Check for corroded connections or break in wire between key switch and horn switch.

(8) Check voltage at purple wire terminal of horn switch.

Action:

(Push horn button and hold)

Result must be same as battery voltage.

Result:

YES: GO TO 9

NO: Check for corroded or loose terminals. Replace horn switch.

(9) Check voltage at 15 A fuse input (F3 fuse) of fuse box.

Action:

(Push horn button and hold)

Result must be same as battery voltage.

Result:

YES: GO TO 10

NO: Check for corroded connections or break in purple wire between horn switch and fuse box.

(10) Check voltage at 15 A fuse output (F3 fuse) of fuse box.

Action:

(Push horn button and hold)

Result must be same as battery voltage.

Result:

YES: GO TO 11

NO: Check for failed fuse F3. If fuse is good, check for corroded or loose terminals.

(11) Check voltage at purple wire terminal of horn.

Action:

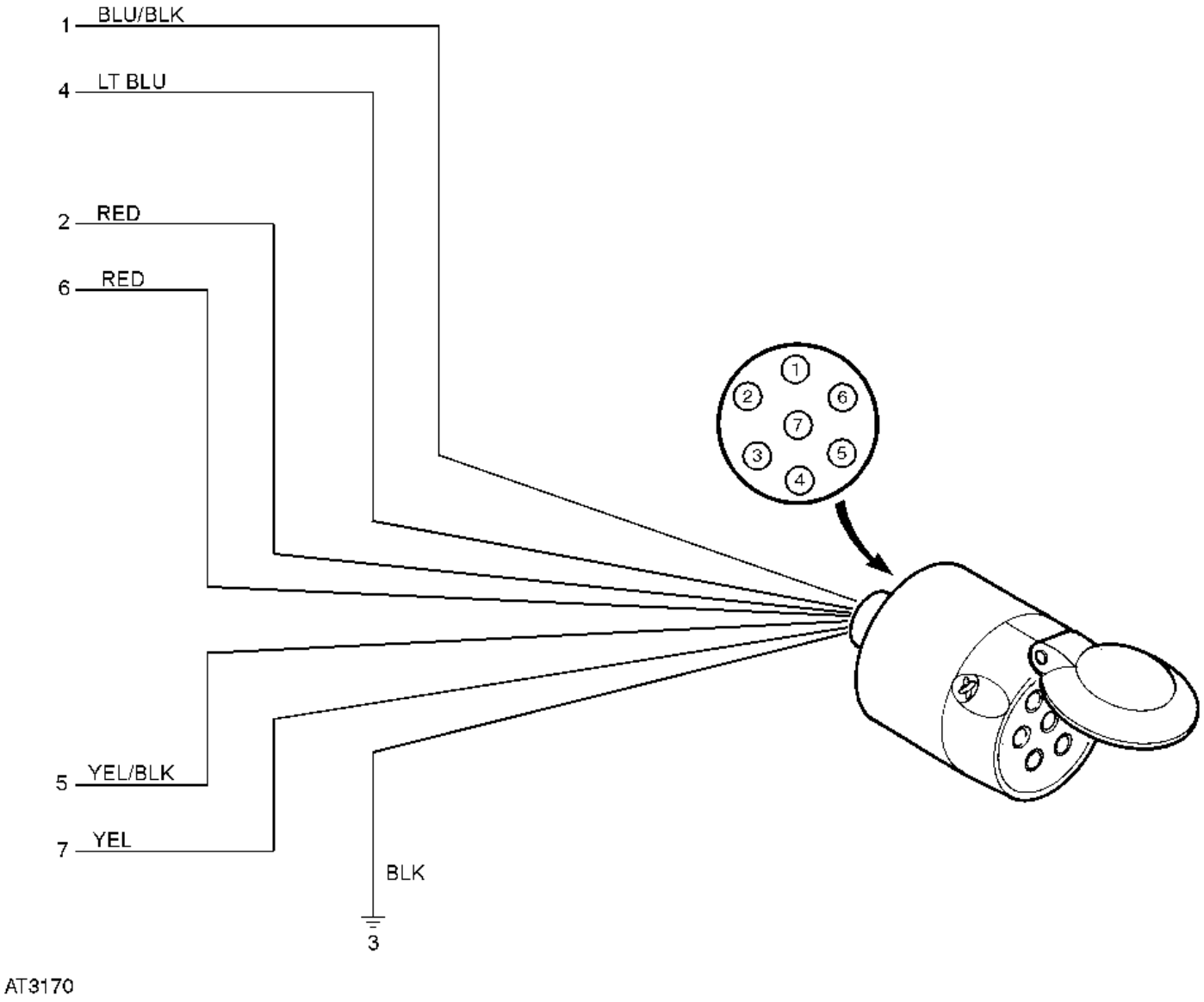
(Push horn button and hold)

Result must be same as battery voltage.

Result:

NO: Check for corroded connections or break in purple wire between fuse box and horn wire terminals. If connections or wire are good horn is bad and has to be replaced.

Trailer Connector Test Points



Trailer Connector Test Points

Meet following requirements:

- Key switch in run position.
- Gear shift lever in neutral position.
- PTO disengaged.
- Meter positive lead on numbered test points.
- Meter negative lead on numbered test points.
- Meter on DC volts.

Trailer Connector Test

(1) Check voltage at terminal 7 of trailer connector.

Action:

(Light switch in position 1, 2 or 3)

Result must be same as battery voltage.

Result:

YES: GO TO 2

NO: Refer to Left Tail Light diagnosis steps 1 - 10 if further diagnosis is required. Check for corroded connections or break in wire between fuse box (F7 fuse) and trailer connector (yellow wire).

(2) Check voltage at terminal 5 of trailer connector.

Action:

(Light switch in position 1, 2 or 3)

Result must be same as battery voltage.

Result:

YES: GO TO 3

NO: Refer to Right Tail Light diagnosis steps 1 - 10 if further diagnosis is required. Check for corroded connections or break in wire between fuse box (F6 fuse) and trailer connector (yellow/black wire).

(3) Check voltage at terminals 2 and 6 of trailer connector.

Action:

(Push brake pedal and hold)

Result must be same as battery voltage.

Result:

YES: GO TO 4

NO: Refer to Stop Light diagnosis steps 1 - 12 if further diagnosis is required. Check for corroded connections or break in wire between fuse box (F8 fuses) and trailer connector (red wire).

(4) Check voltage at terminal 1 of trailer connector.

Action:

(Release brake pedal)

Result must be same as battery voltage.

Result:

YES: GO TO 5

NO: Refer to Turn Signal diagnosis steps 1 - 15 if further diagnosis is required. Check for corroded connections or break in wire between turn signal controller and trailer connector (blue/black wire).

(5) Check voltage at terminal 4 of trailer connector.

Action:

(Turn signal controller moved to left turn position)

Result must be same as battery voltage.

Result:

YES: GO TO 6

NO: Refer to Turn Signals diagnosis steps 1 - 15 if further diagnosis is required. Check for corroded connections or break in wire between turn signal controller and trailer connector (light blue wire).

(6) Check resistance at terminal terminal 4 of trailer connector.

Action:

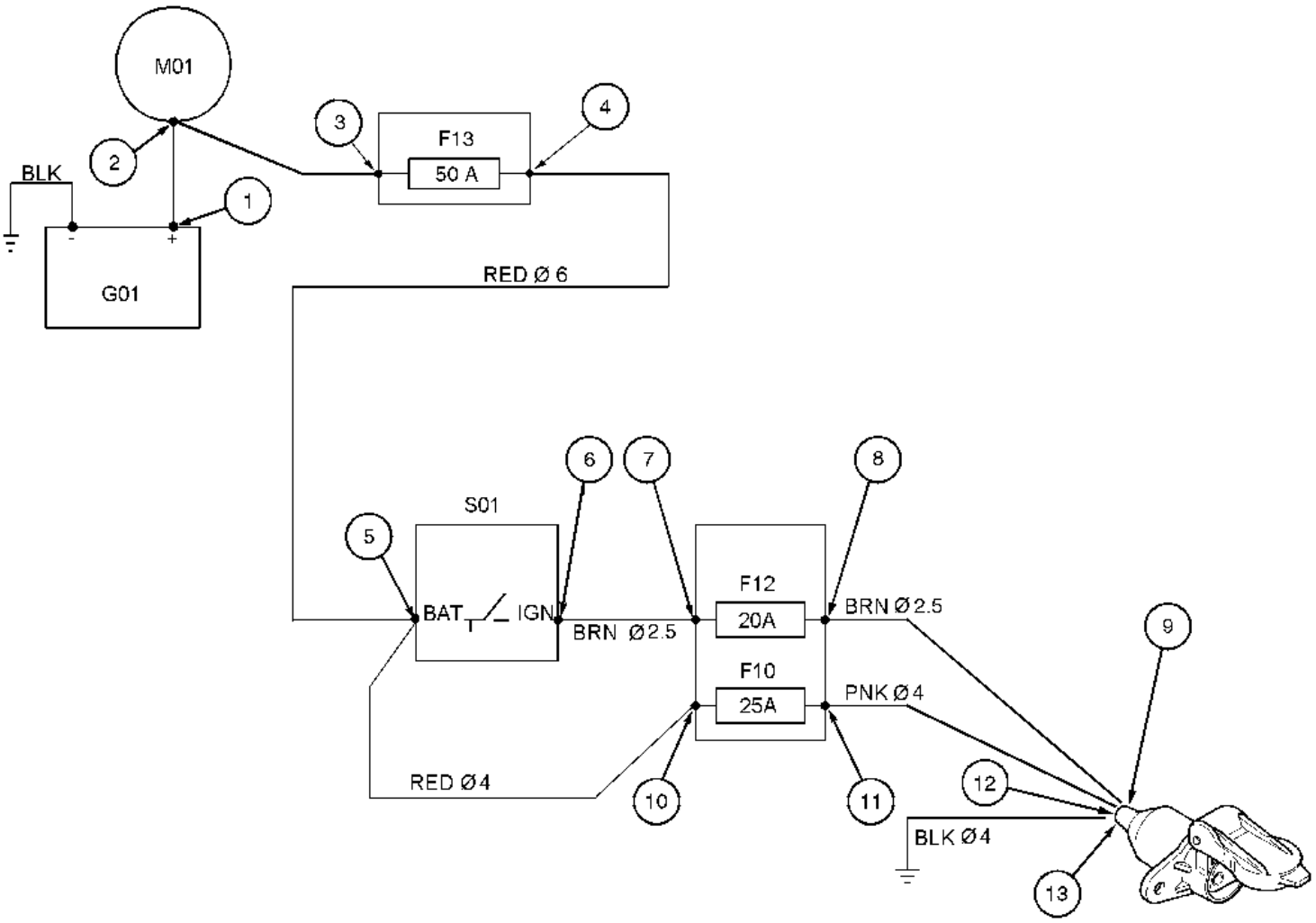
(Meter on 1 ohm scale)

Resistance must be maximum 0.5 ohm.

Result:

NO: Check for corroded connections or break in wire between trailer connector terminal 3 and connector mounting hardware.

Three-Pin Connector Test Points



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Three-Pin Connector Test Points

Meet following requirements:

- Key switch in run position.
- Gear shift lever in neutral position.
- PTO disengaged.
- Meter positive lead on numbered test points.
- Meter negative lead on numbered test points.
- Meter on DC volts

Three-Pin Connector Test

(1) Check voltage at battery post.

Action:

Result must be minimum 11.8 V direct-current.

Result:

YES: GO TO 2

NO: Test and charge batterie (replace as necessary).

(2) Check voltage at starter terminal.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 3

NO: Check for corroded connections or broken wires between battery and main fuse.

(3) Check voltage at 50 A main fuse input (F13), located on alternator/regulator.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 4

NO: Check for corroded connections or break in red wire between starting motor and fuse box on alternator/regulator.

(4) Check voltage at 50 A main fuse output (F13), located on alternator/regulator.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 5

NO: Check fuse F13 and replace if necessary. If fuse is good, check for corroded or loose terminals.

(5) Check voltage at “BAT” terminal of key switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 6

NO: Check for corroded connections or broken wires between main fuse and key switch.

(6) Check voltage at “IGN” and “ACC” terminals of key switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 7

NO: Check if key switch is in “RUN” position. If yes, replace the key switch.

(7) Check voltage at 20 A fuse input (F12 fuse) of fuse box.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 8

NO: Check for corroded connections or break in orange wire between key switch and fuse box.

(8) Check voltage at 20 A fuse output (F12 fuse) of fuse box.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 9

NO: Check for failed fuse F12. If fuse is good, check for corroded or loose terminals.

(9) Check voltage at brown wire terminal of three-pin connector.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 10

NO: Check for corroded connections or break in brown wire between fuse box and three-pin connector.

(10) Check voltage at 25 A fuse input (F10 fuse) of fuse box.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 11

NO: Check for corroded connections or break in brown wire between key switch and fuse box.

(11) Check voltage at 25 A fuse output (F10 fuse) of fuse box.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 12

NO: Check for failed fuse F10. If fuse is good, check for corroded or loose terminals.

(12) Check voltage at pink wire terminal of three-pin connector.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 13

NO: Check for corroded connections or break in pink wire between fuse box and three-pin connector.

(13) Check resistance at black wire terminal of three-pin connector.

Action:

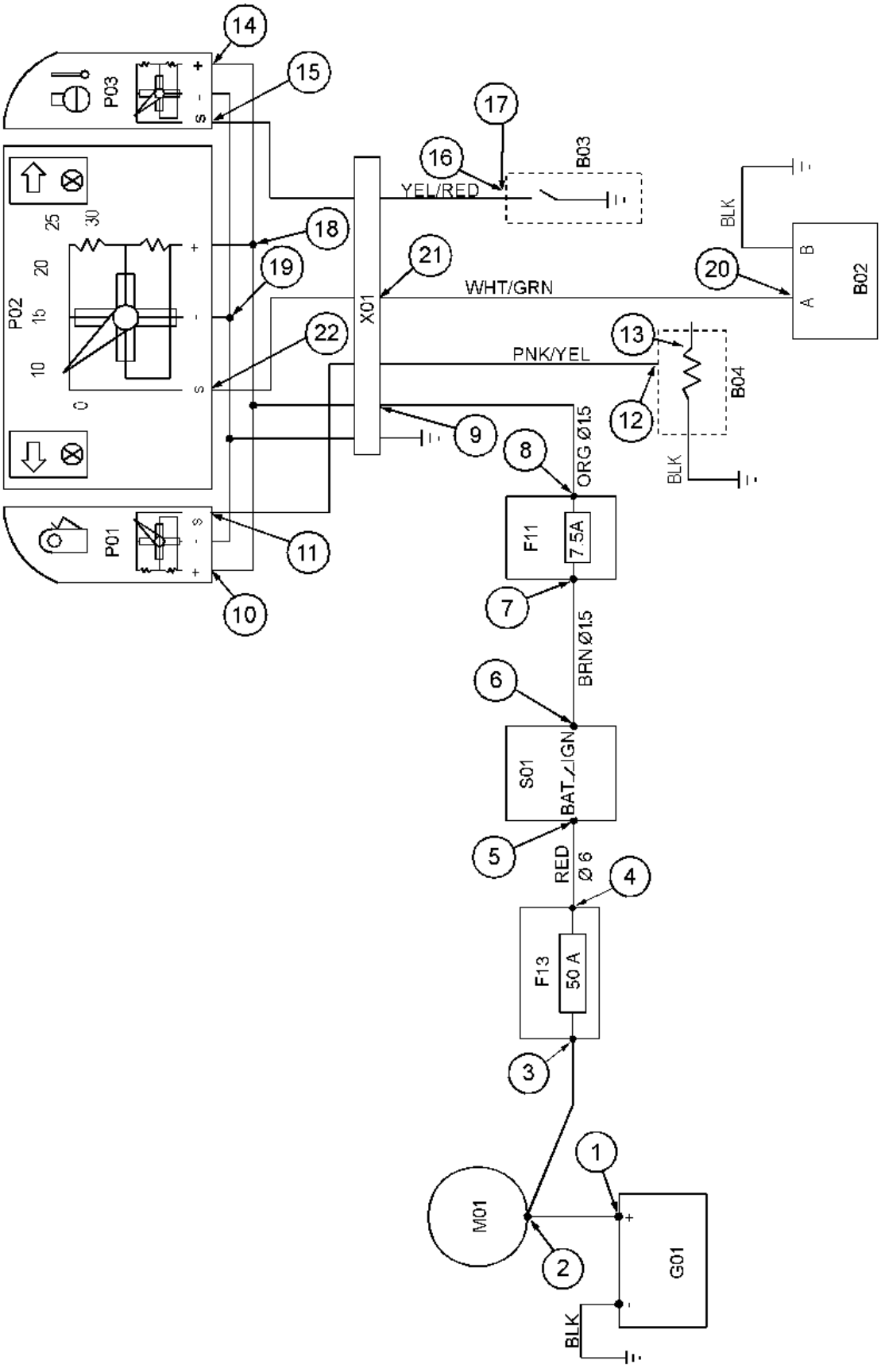
(Meter on 1 ohm scale)

Resistance must be maximum 0.5 ohm.

Result:

NO: Check for corroded connections or break in wire between three-pin connector terminal and connector mounting hardware.

Instrument Panel Test Points - Fuel Gauge, Temperature Gauge, Tachometer



Instrument Panel Test Points - Fuel Gauge, Temperature Gauge, Tachometer

Meet following requirements:

- Gear shift lever in neutral position.
- PTO disengaged.
- Key switch in run (1) position.
- Meter positive lead on numbered test points.
- Meter negative lead on numbered test points.
- Meter on DC volts.

Instrument Panel Test - Fuel Gauge, Temperature Gauge and Tachometer

(1) Power Supply Circuit:
Check voltage at battery post.

Action:

Result must be minimum 11.8 V direct-current

Result:

YES: GO TO 2

NO: Test and charge batterie (replace as necessary)

(2) Check voltage at starter terminal.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 3

NO: Check for corroded connections or broken wires between battery and main fuse.

(3) Check voltage at 50 A main fuse input (F13), located on alternator/regulator.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 4

NO: Check for corroded connections or break in red wire between starting motor and fuse box on alternator/regulator.

(4) Check voltage at 50 A main fuse output (F13) , located on alternator/regulator.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 5

NO: Check fuse F13 and replace if necessary. If fuse is good, check for corroded or loose terminals.

(5) Check voltage at “BAT” terminal of key switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 6

NO: Check for corroded connections or broken wires between main fuse and key switch.

(6) Check voltage at “IGN” terminal of key switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 7

NO: Check that key switch is in run position. If switch is in run, switch is bad. Replace if necessary.

(7) Check voltage at 7.5 A fuse input (F11 fuse) of fuse box.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 8

NO: Check for corroded connections or break in brown wire between key switch and fuse box.

(8) Check voltage at 7.5 A fuse output (F11 fuse) of fuse box.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 9

NO: Check for failed fuse F11. Replace fuse if it is failed. If fuse is good, check for corroded or loose terminals.

(9) Check voltage at orange wire terminal of instrument panel connector.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 10

NO: Check for corroded connections or break in orange wire between fuse box and instrument panel connector.

(10) Fuel Gauge Circuit:

Check voltage at orange wire terminal of fuel gauge instrument.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 11

NO: Check for corroded connections or break in splice of orange wire between instrument panel connector and fuel gauge instrument.

(11) Read the fuel gauge instrument.

Action:

(Remove wire from center terminal)

Gauge indicates empty.

Result:

YES: GO TO 12

NO: Replace instrument panel.

(12) Read the fuel gauge instrument.

Action:

(Connect wire from center terminal on sender plate)

Gauge indicates full.

Result:

YES: GO TO 13

NO: Check for corroded connections or break in pink/yellow wire between sender and instrument panel connector, or in pink/yellow wire between instrument panel connector and fuel gauge instrument terminal. Check for continuity to ground through black wire to cap screw on rockshaft cover. Replace instrument panel.

(13) Measure resistance at fuel gauge sender (B04).

Action:

(Key switch in “OFF” position)

(Use a long wire to raise and lower sender float)

Resistance smoothly increases/decreases between 4.5 and 97.5 ohms as float is raised and lowered.

Result:

YES: GO TO 14

NO: Replace fuel gauge sender.

(14) Temperature Gauge Circuit:
Check voltage at orange wire terminal of temperature gauge instrument.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 15

NO: Check for corroded connections or break in splice or orange wire between instrument panel connector and temperature gauge instrument terminal.

(15) Read the temperature gauge instrument.

Action:

(Remove wire from temperature sender B03)

Gauge indicates COLD.

Result:

YES: GO TO 16

NO: Replace instrument panel.

(16) Read the temperature gauge instrument.

Action:

(Connect the wire from temperature sender B03 to ground)

Gauge indicates HOT

Result:

YES: GO TO 17

NO: Check for corroded connections or break in yellow/red wire between sender and instrument panel connector, or in yellow/red wire between instrument panel connector and temperature gauge instrument terminal. Replace instrument panel.

(17) Measure resistance at fuel gauge sender (B04).

Action:

(Remove wire from temperature sender B03)

→NOTE:

Remove temperature sender to check resistance at various temperatures. Put in water heated to a specified temperature.

60°C (140°F) - 134 ±13.5 ohms
90°C (194°F) - 51.2 ±4.3 ohms
100°C (212°F) - 38.5 ±3 ohms

Result:

YES: GO TO 18

NO: Replace temperature sender.

(18) Tachometer Circuit:
Check voltage at orange wire terminal of tachometer.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 19

NO: Check for corroded connections or break in splice of orange wire between instrument panel connector and tachometer terminal.

(19) Check voltage at black wire terminal of tachometer.

Action:

Result must be less than 0.2 volt.

Result:

YES: GO TO 20

NO: Check continuity to ground. If black wire is good to ground, replace tachometer by replacing instrument panel.

(20) Check voltage at white/green wire terminal of magnetic pickup sensor B02.

Action:

(Engine operating at slow idle)

Sensor output voltage - 1 volt alternating current.

→NOTE:

Sensor coil must have 475 ±75 ohms across the terminals and a minimum output of 1 volt.

Result:

YES: GO TO 21

NO: Check continuity to ground. If black wires are good to ground, check or replace magnetic pickup sensor.

(21) Check voltage at white/green wire terminal of instrument panel connector X01.

Action:

(Engine operating at slow idle)

Sensor output voltage - 1 volt alternating current.

Result:

YES: GO TO 22

NO: Check for corroded connection or break in wire between pickup sensor and instrument panel connector.

(22) Check voltage at white/green wire terminal of tachometer.

Action:

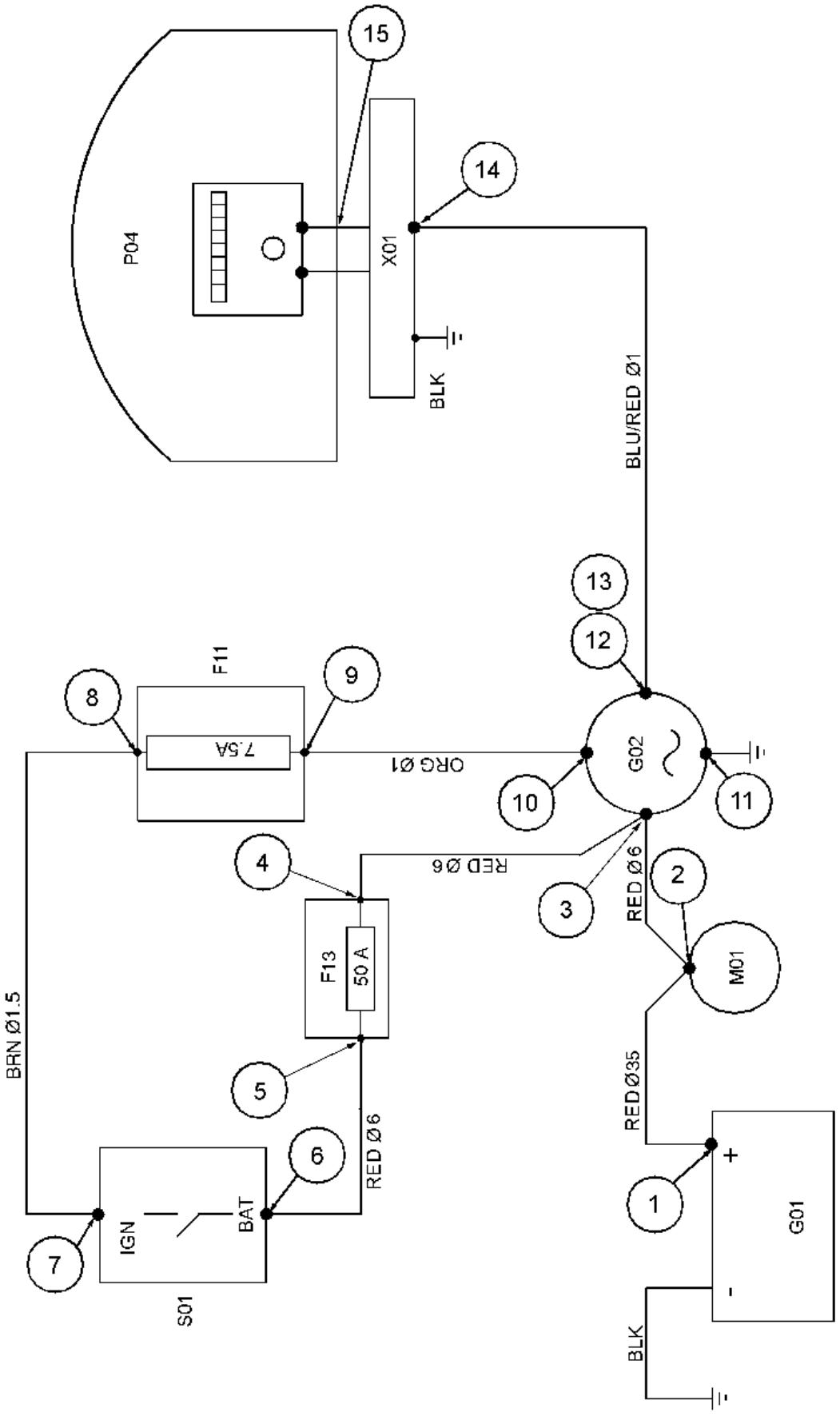
(Engine operating at slow idle)

Sensor output voltage - 1 volt alternating current.

Result:

NO: Check for corroded connection or break in wire between instrument panel connector and tachometer. If tachometer does not function, replace tachometer by replacing instrument panel.

Instrument Panel Test Points - Hourmeter



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Instrument Panel Test Points - Hourmeter

Meet following requirements:

- Key switch in run (1) position.
- Gear shift lever in neutral position.
- PTO disengaged.
- Meter positive lead on numbered test points.
- Meter negative lead on numbered test points.
- Meter on DC volts

Instrument Panel Test - Hourmeter

(1) Check voltage at battery post.

Action:

Result must be minimum 11.8 V direct-current

Result:

YES: GO TO 2

NO: Test and charge batterie (replace as necessary)

(2) Check voltage at starter terminal.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 3

NO: Check for corroded connections or broken wires between battery and main fuse.

(3) Check voltage at red wire terminal of alternator.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 4

NO: Check for corroded connections or break in red wire between starter and alternator.

(4) Check voltage at 50 A main fuse input (F13), located on alternator/regulator.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 5

NO: Check for corroded connections or break in red wire between starting motor and fuse box on alternator/regulator.

(5) Check voltage at 50 A main fuse output (F13) , located on alternator/regulator.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 6

NO: Check fuse F13 and replace if necessary. If fuse is good, check for corroded or loose terminals.

(6) Check voltage at “BAT” terminal of key switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 7

NO: Check for corroded connections or broken wires between main fuse and key switch.

(7) Check voltage at “IGN” terminal of key switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 8

NO: Check that key switch is in run position. If switch is in run, switch is bad. Replace if necessary.

(8) Check voltage at 7.5 A fuse input (F11 fuse) of fuse box.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 9

NO: Check for corroded connections or break in brown wire between key switch and fuse box.

(9) Check voltage at 7.5 A fuse output (F11 fuse) of fuse box.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 10

NO: Check for failed fuse F11. Replace fuse if it is failed. If fuse is good, check for corroded or loose terminals.

(10) Check voltage at orange wire terminal of alternator.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 11

NO: Check for corroded connections or break in orange wire between fuse box (F11 fuse terminal) and alternator.

(11) Check voltage at alternator case.

Action:

Result must be less than 0.2 volt.

Result:

YES: GO TO 12

NO: Check alternator mounts for good ground contact to engine.

(12) Check voltage at output terminal of alternator (red wire terminal).

Action:

Result must be less than 0.2 volt.

Result:

YES: GO TO 13

NO: Check for corroded connections or break in red wire between instrument panel connector and alternator.

(13) Check voltage at blue/red wire terminal of alternator.

Action:

(Start engine and operate at slow idle)

Result: Battery voltage to 1.5 volts less than battery voltage.

Result:

YES: GO TO 14

NO: Failure in voltage regulator, replace alternator.

(14) Check voltage at blue/red wire terminal of instrument panel connector.

Action:

(Start engine and operate at slow idle)

Result: Up to 1.5 volts less than battery voltage.

Result:

YES: GO TO 15

NO: Check for corroded connections or break in blue/red wire between instrument panel connector and alternator.

(15) Check voltage at blue/red wire terminal of instrument panel.

Action:

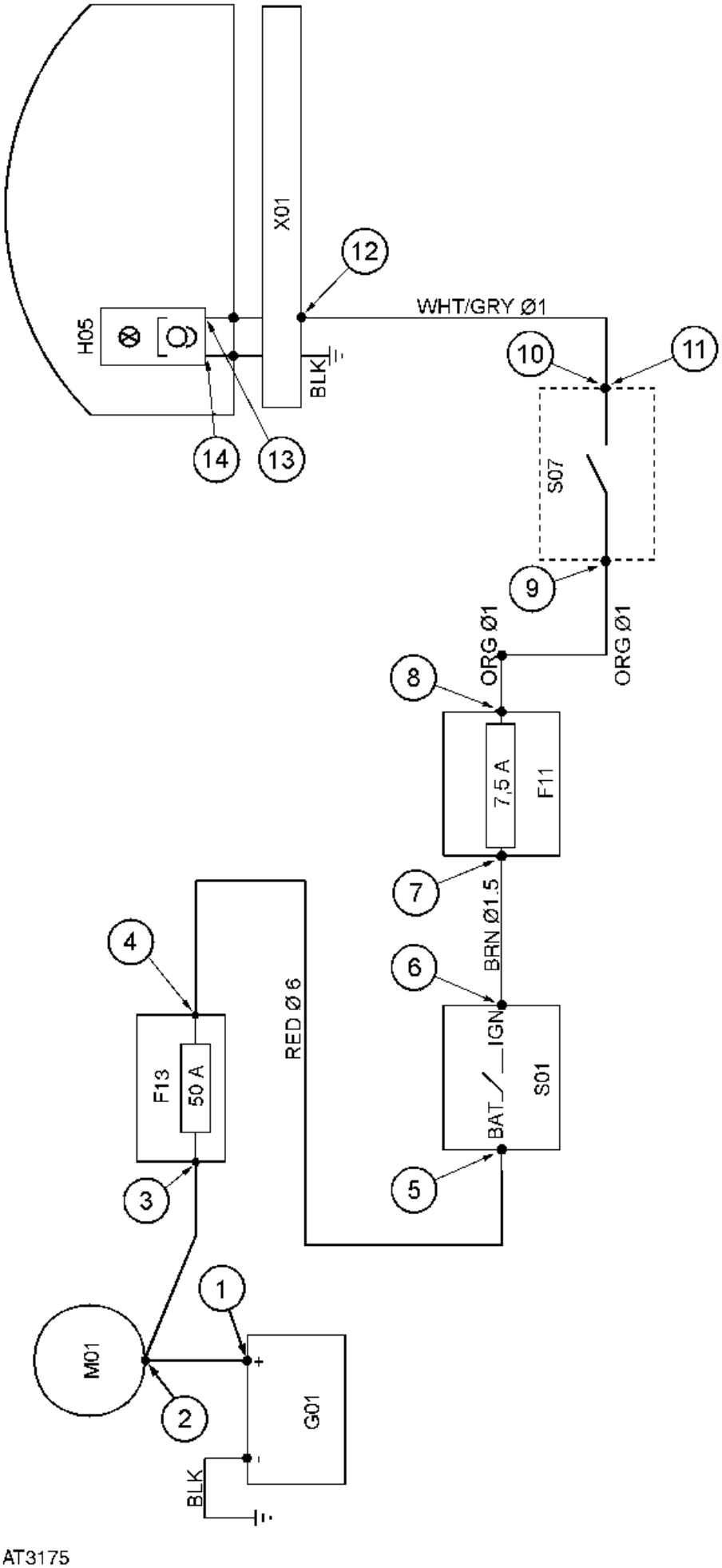
(Start engine and operate at slow idle)

Result: Up to 1.5 volts less than battery voltage.

Result:

NO: Check continuity to ground of black wire. If wire is good to ground, replace hourmeter by replacing instrument panel.

Instrument Panel Test Points - PTO Warning System


X01
12
WHT/GRY Ø1
H05
BLK
10
11
14
13
S07
9
ORG Ø1
ORG Ø1
8
7,5 A
F11
7
BRN Ø1.5
4
RED Ø 6
6
F13
50 A
IGN
S01
BAT
3
5
1
M01
2
G01
BLK

AT3175

Meet following requirements:

- Key switch in run (1) position.
- PTO disengaged.
- Gear shift lever in neutral position.
- Meter positive lead on numbered test points.
- Meter negative lead on numbered test points.
- Meter on DC volts.

Instrument Panel Test - PTO Warning System

(1) Check voltage at battery post.

Action:

Result must be minimum 11.8 V direct-current

Result:

YES: GO TO 2

NO: Test and charge batterie (replace as necessary)

(2) Check voltage at starter terminal.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 3

NO: Check for corroded connections or broken wires between battery and main fuse.

(3) Check voltage at 50 A main fuse input (F13), located on alternator/regulator.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 4

NO: Check for corroded connections or break in red wire between starting motor and fuse box on alternator/regulator.

(4) Check voltage at 50 A main fuse output (F13) , located on alternator/regulator.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 5

NO: Check fuse F13 and replace if necessary. If fuse is good, check for corroded or loose terminals.

(5) Check voltage at “BAT” terminal of key switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 6

NO: Check for corroded connections or broken wires between main fuse and key switch.

(6) Check voltage at “IGN” terminal of key switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 7

NO: Check that key switch is in run position. If switch is in run, switch is bad. Replace if necessary.

(7) Check voltage at 7.5 A fuse input (F11 fuse) of fuse box.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 8

NO: Check for corroded connections or break in brown wire between key switch and fuse box.

(8) Check voltage at 7.5 A fuse output (F11 fuse) of fuse box.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 9

NO: Check for failed fuse F11. Replace fuse if it is failed. If fuse is good, check for corroded or loose terminals.

(9) Check voltage at orange wire terminal of PTO switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 10

NO: Check for corroded connections or break in orange wire between fuse box and PTO switch.

(10) Check voltage at white/grey wire terminal of PTO switch.

Action:

Result: No voltage.

Result:

YES: GO TO 11

NO: Make sure connector is fully pushed together and PTO lever is in disengaged position. Check for corroded or damaged terminals. Replace switch if damaged or defective.

(11) Check voltage at white/grey wire terminal of PTO switch.

Action:

(Operator in seat)

(Move PTO lever to engaged position)

Result must be same as battery voltage.

Result:

YES: GO TO 12

NO: Make sure connector is fully pushed together and PTO lever is in engaged position. Check for corroded or damaged terminals. Replace switch if damaged or defective.

(12) Check voltage at white/grey wire terminal of instrument panel connector.

Action:

(Operator in seat)

(Move PTO lever to engaged position)

Result must be same as battery voltage.

Result:

YES: GO TO 13

NO: Check for corroded connections or break in white/grey wire between PTO switch and instrument panel connector.

(13) Check voltage at white/grey wire terminal of instrument panel.

Action:

(Operator in seat)

(Move PTO lever to engaged position)

Result must be same as battery voltage.

Result:

YES: GO TO 14

NO: Check for corroded connections or break in white/grey wire between instrument panel connector and instrument panel. Repair or replace connector.

(14) Check voltage at black wire terminal of instrument panel.

Action:

(Operator in seat)

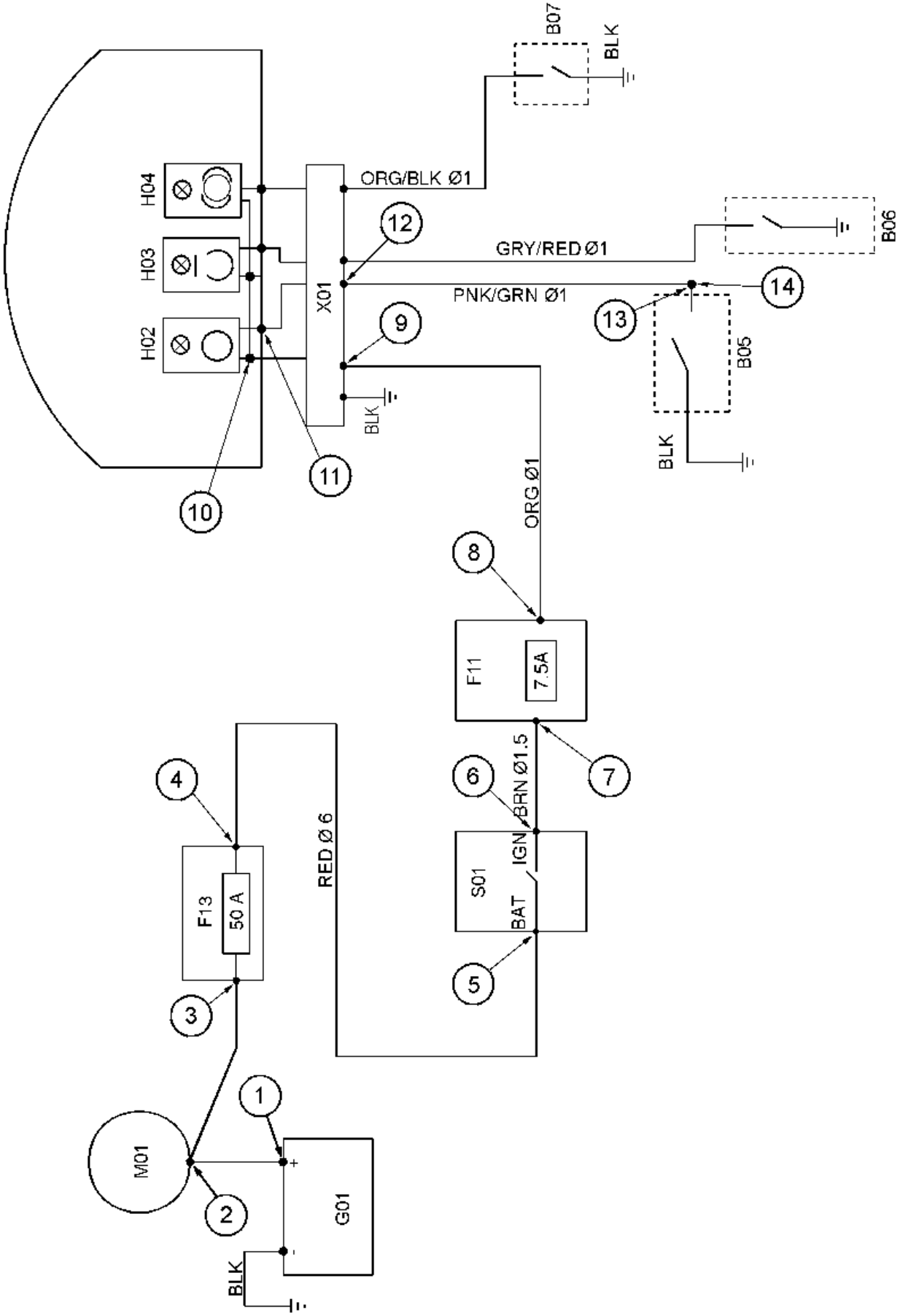
(Move PTO lever to engaged position)

Result must be less than 0.2 volt.

Result:

NO: Check or replace bulb. Check ground connections of black wire, from instrument panel through instrument panel connector to ground connection on tractor frame, behind instrument panel.

Instrument Panel Test Points - Air Filter Restriction Indicator


B07
BLK
H04
H03
H02
X01
ORG/BLK Ø1
12
GRY/RED Ø1
B06
PNK/GRN Ø1
14
13
9
B05
BLK
BLK
11
10
ORG Ø1
8
F11
7.5A
4
RED Ø 6
6
BRN Ø1.5
7
F13
50 A
S01
IGN
BAT
3
5
1
M01
2
G01
+
-
BLK

AT3176

Meet following requirements:

- Key switch in run (1) position.
- PTO disengaged.
- Gear shift lever in neutral position.
- Meter positive lead on numbered test points.
- Meter negative lead on numbered test points.
- Meter on DC volts.

Instrument Panel Test - Air Filter Restriction Indicator

(1) Check voltage at battery post.

Action:

Result must be minimum 11.8 V direct-current

Result:

YES: GO TO 2

NO: Test and charge batterie (replace as necessary)

(2) Check voltage at starter terminal.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 3

NO: Check for corroded connections or broken wires between battery and main fuse.

(3) Check voltage at 50 A main fuse input (F13), located on alternator/regulator.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 4

NO: Check for corroded connections or break in red wire between starting motor and fuse box on alternator/regulator.

(4) Check voltage at 50 A main fuse output (F13) , located on alternator/regulator.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 5

NO: Check fuse F13 and replace if necessary. If fuse is good, check for corroded or loose terminals.

(5) Check voltage at “BAT” terminal of key switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 6

NO: Check for corroded connections or broken wires between main fuse and key switch.

(6) Check voltage at “IGN” terminal of key switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 7

NO: Check that key switch is in run position. If switch is in run, switch is bad. Replace if necessary.

(7) Check voltage at 7.5 A fuse input (F11 fuse) of fuse box.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 8

NO: Check for corroded connections or break in brown wire between key switch and fuse box.

(8) Check voltage at 7.5 A fuse output (F11 fuse) of fuse box.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 9

NO: Check for failed fuse F11. Replace fuse if it is failed. If fuse is good, check for corroded or loose terminals.

(9) Check voltage at orange wire terminal of instrument panel connector.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 10

NO: Check for corroded connections or break in orange wire between fuse box and instrument panel connector.

(10) Check voltage at orange wire terminal of instrument panel.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 11

NO: Check for corroded connections or break in orange wire between instrument panel connector and instrument panel.

(11) Check voltage at pink/green wire terminal of instrument panel.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 12

NO: Check for bad indicator bulb, socket, or corroded terminals.

(12) Check voltage at pink/grey wire terminal of instrument panel connector.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 13

NO: Check for corroded connections or break in pink/grey wire between air restriction indicator socket and instrument panel connector.

(13) Check voltage at terminal A of connector of air restriction switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 14

NO: Check for corroded connections or break in pink/grey wire between instrument panel connector and air restriction switch. Repair or replace connector.

(14) Measure resistance at air restriction switch terminals.

Action:

(Remove connector from air restriction switch)

(Meter on 1 ohm scale)

(Meter test leads on terminals of air restriction switch)

Result: No continuity (switch contacts open).

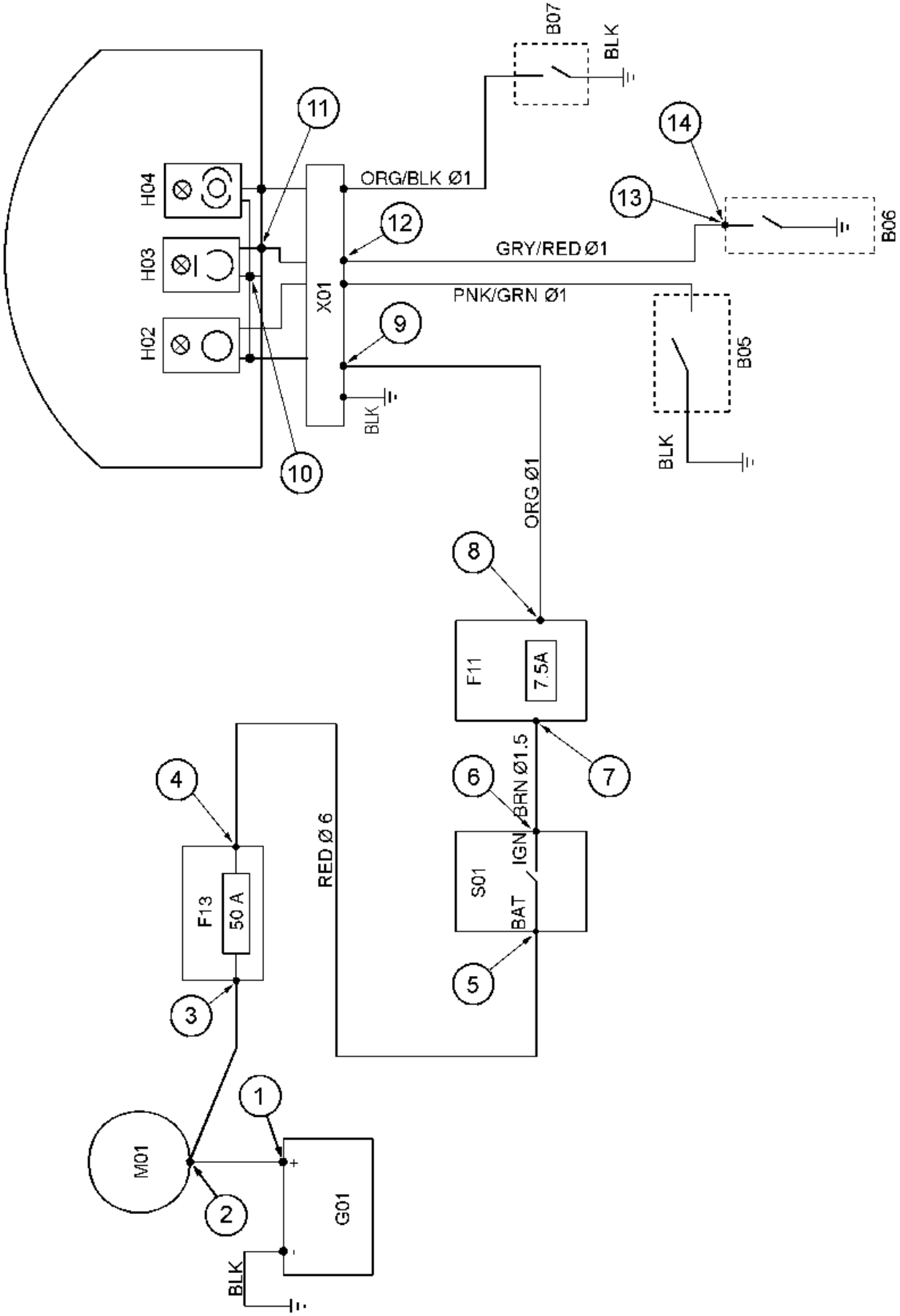
→NOTE:

Air restriction switch contacts close when a vacuum of 4.98 to 7.48 kPa (29 - 30 in. H2O) is present at switch port.

Result:

NO: Replace switch.

Instrument Panel Test Points - Oil Pressure Indicator


B07
BLK
11
14
H04
ORG/BLK Ø1
13
B06
12
H03
GRY/RED Ø1
X01
PNK/GRN Ø1
H02
9
B05
BLK
BLK
10
ORG Ø1
8
F11
7.5A
4
RED Ø 6
6
BRN Ø1.5
7
F13
50 A
S01
IGN
BAT
3
5
1
M01
+
2
G01
-
BLK

AT3177

Meet following requirements:

- Key switch in run (1) position.
- PTO disengaged.
- Gear shift lever in neutral position.
- Connector removed from oil pressure switch.
- Meter positive lead on numbered test points.
- Meter negative lead on numbered test points.
- Meter on DC volts.

Instrument Panel Test - Oil Pressure Indicator

(1) Check voltage at battery post.

Action:

Result must be minimum 11.8 V direct-current

Result:

YES: GO TO 2

NO: Test and charge batterie (replace as necessary)

(2) Check voltage at starter terminal.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 3

NO: Check for corroded connections or broken wires between battery and main fuse.

(3) Check voltage at 50 A main fuse input (F13), located on alternator/regulator.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 4

NO: Check for corroded connections or break in red wire between starting motor and fuse box on alternator/regulator.

(4) Check voltage at 50 A main fuse output (F13) , located on alternator/regulator.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 5

NO: Check fuse F13 and replace if necessary. If fuse is good, check for corroded or loose terminals.

(5) Check voltage at “BAT” terminal of key switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 6

NO: Check for corroded connections or broken wires between main fuse and key switch.

(6) Check voltage at “IGN” terminal of key switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 7

NO: Check that key switch is in run position. If switch is in run, switch is bad. Replace if necessary.

(7) Check voltage at 7.5 A fuse input (F11 fuse) of fuse box.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 8

NO: Check for corroded connections or break in brown wire between key switch and fuse box.

(8) Check voltage at 7.5 A fuse output (F11 fuse) of fuse box.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 9

NO: Check for failed fuse F11. Replace fuse if it is failed. If fuse is good, check for corroded or loose terminals.

(9) Check voltage at orange wire terminal of instrument panel connector.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 10

NO: Check for corroded connections or break in orange wire between fuse box and instrument panel connector.

(10) Check voltage at orange wire terminal of instrument panel.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 11

NO: Check for corroded connections or break in orange wire between instrument panel connector and instrument panel.

(11) Check voltage at grey/red wire terminal of instrument panel.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 12

NO: Check for bad indicator bulb, socket or corroded terminals.

(12) Check voltage at grey/red wire terminal of instrument panel connector.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 13

NO: Check for corroded connections or break in grey/red wire between oil pressure indicator socket and instrument panel connector.

(13) Check voltage at connector of pressure switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 14

NO: Check for corroded connections or break in grey/red wire between instrument panel connector and oil pressure switch connector. Repair or replace connector.

(14) Measure resistance at terminal of oil pressure switch.

Action:

(Meter on 1 ohm scale)

Result: Maximum 0.5 ohm resistance (switch contacts closed)

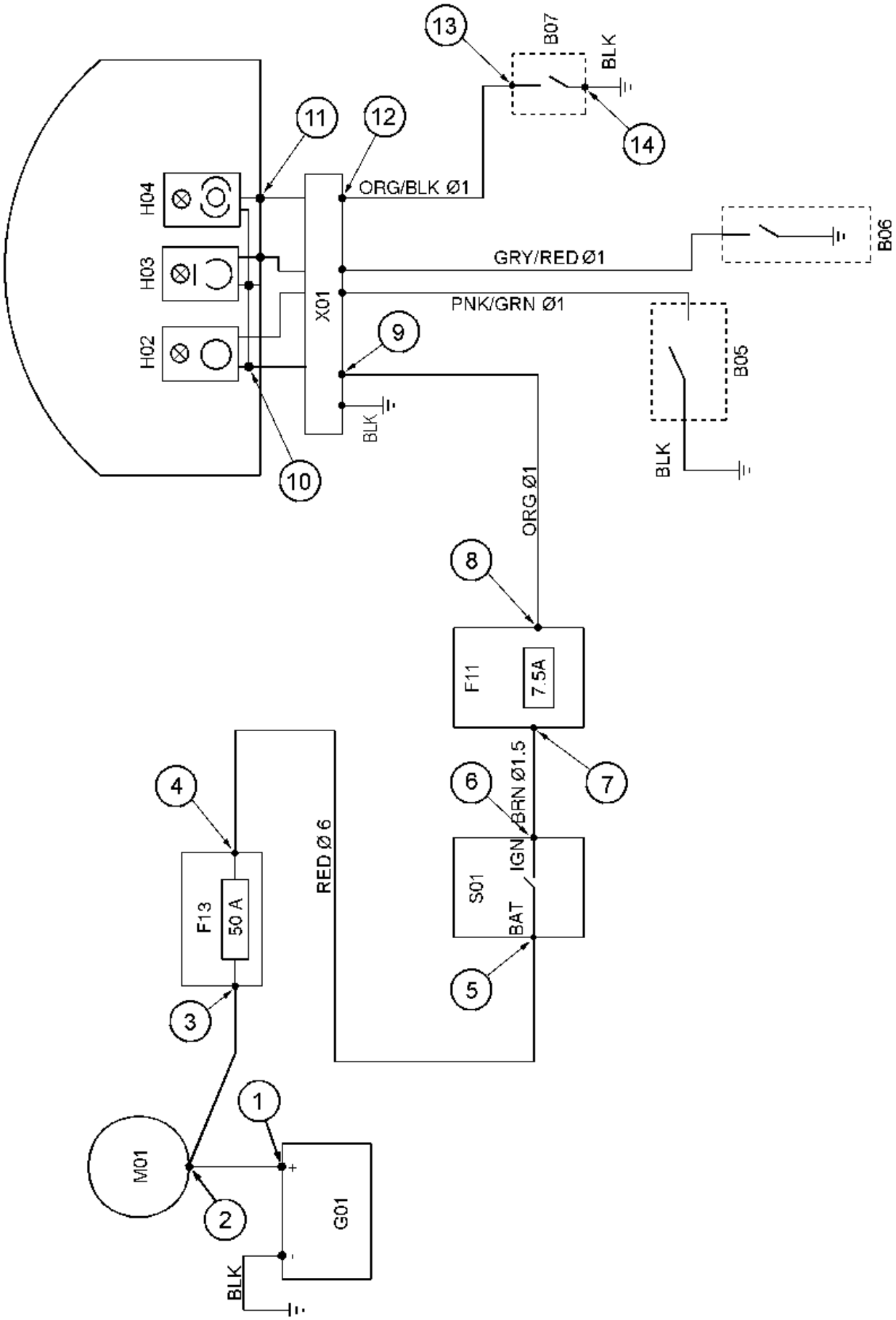
→NOTE:

Oil pressure switch contacts open when engine oil pressure reaches 38 to 72 kPa, 0.38 to 0.72 bar (5.5 to 10.5 psi)

Result:

NO: Replace oil pressure switch.

Instrument Panel Test Points - Parking Brake


13
B07
BLK
14
11
12
H04
H03
H02
X01
ORG/BLK Ø1
GRY/RED Ø1
B06
PNK/GRN Ø1
9
B05
BLK
BLK
10
ORG Ø1
8
F11
7.5A
4
RED Ø 6
6
BRN Ø1.5
7
F13
50 A
S01
IGN
BAT
3
5
1
M01
2
G01
+
-
BLK

AT3178

Instrument Panel Test Points - Parking Brake

Meet following requirements:

- Key switch in run (1) position.
- PTO disengaged.
- Gear shift lever in neutral position.
- Meter positive lead on numbered test points.
- Meter on DC volts.

Instrument Panel Test - Parking Brake

(1) Check voltage at battery post.

Action:

Result must be minimum 11.8 V direct-current

Result:

YES: GO TO 2

NO: Test and charge batterie (replace as necessary)

(2) Check voltage at starter terminal.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 3

NO: Check for corroded connections or broken wires between battery and main fuse.

(3) Check voltage at 50 A main fuse input (F13), located on alternator/regulator.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 4

NO: Check for corroded connections or break in red wire between starting motor and fuse box on alternator/regulator.

(4) Check voltage at 50 A main fuse output (F13) , located on alternator/regulator.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 5

NO: Check fuse F13 and replace if necessary. If fuse is good, check for corroded or loose terminals.

(5) Check voltage at “BAT” terminal of key switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 6

NO: Check for corroded connections or broken wires between main fuse and key switch.

(6) Check voltage at “IGN” terminal of key switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 7

NO: Check that key switch is in run position. If switch is in run, switch is bad. Replace if necessary.

(7) Check voltage at 7.5 A fuse input (F11 fuse) of fuse box.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 8

NO: Check for corroded connections or break in brown wire between key switch and fuse box.

(8) Check voltage at 7.5 A fuse output (F11 fuse) of fuse box.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 9

NO: Check for failed fuse F11. Replace fuse if it is failed. If fuse is good, check for corroded or loose terminals.

(9) Check voltage at orange wire terminal of instrument panel connector.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 10

NO: Check for corroded connections or break in orange wire between fuse box and instrument panel connector.

(10) Check voltage at orange wire terminal of instrument panel.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 11

NO: Check for corroded connections or break in orange wire between instrument panel connector and instrument panel.

(11) Check voltage at orange/black wire terminal of parking brake indicator socket.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 12

NO: Check for bad indicator bulb, socket, or corroded terminals.

(12) Check voltage at orange/black wire terminal of instrument panel connector.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 13

NO: Check for corroded connections or break in orange/black wire between parking brake indicator socket and instrument panel connector.

(13) Check voltage at orange/black wire terminal of parking brake switch.

Action:

(Move parking brake lever to engaged position)

Result must be less than 0.2 volt.

Result:

YES: GO TO 14

NO: Make sure connector is fully pushed together and parking brake lever is in engaged position. Check for corroded or damaged terminals. Replace switch if damaged or defective.

(14) Check voltage at black wire terminal of parking brake switch.

Action:

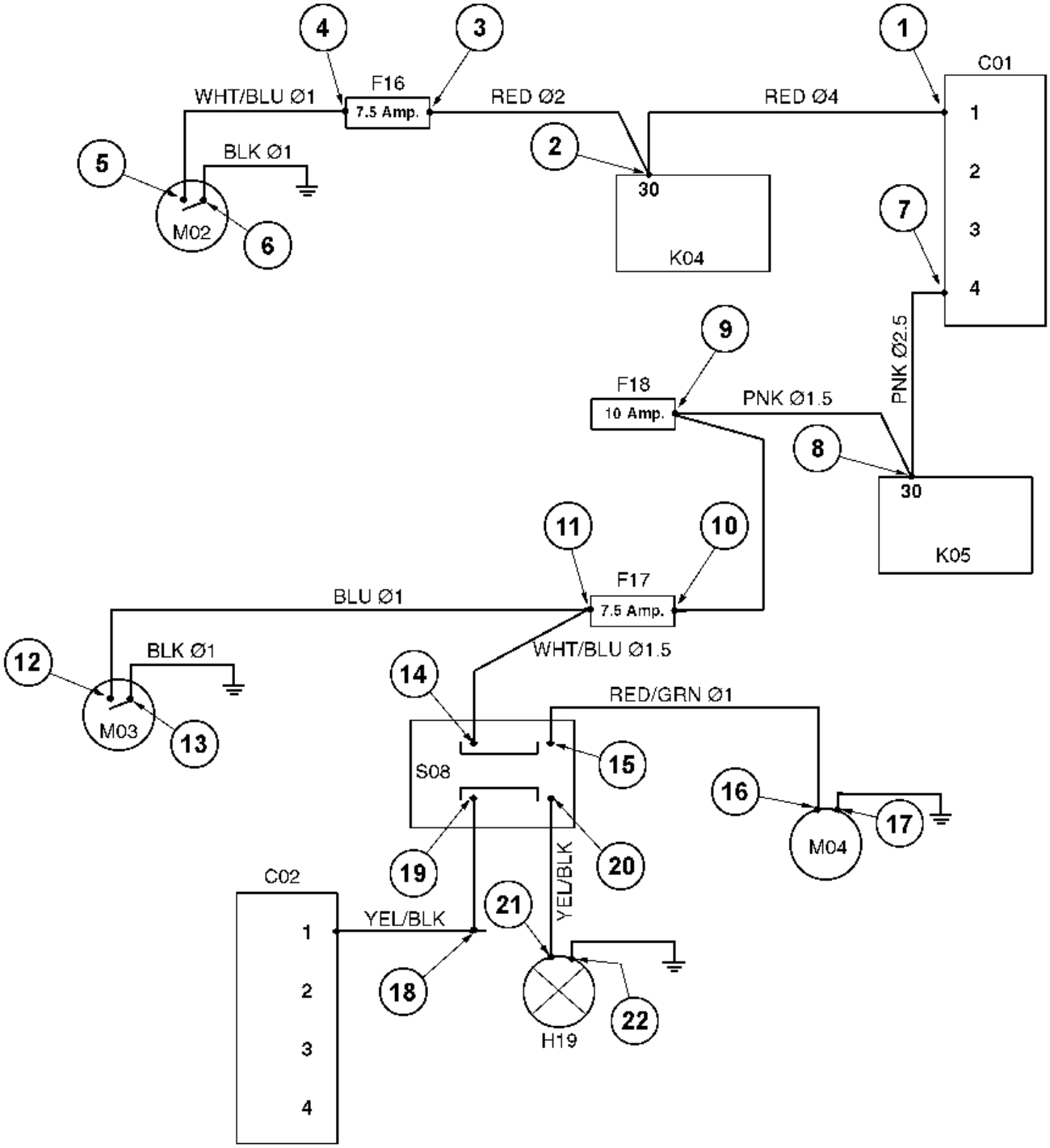
(Move parking brake lever to engaged position)

Result must be less than 0.2 volt.

Result:

NO: Check ground connections of black wire, from parking brake switch to ground connection on tractor frame.

(Cab) Front and Rear Wiper/Washer Test Points



AT3213

Front and Rear Wiper/Washer Test Points

Meet following requirements:

- Key switch in ACC or RUN position.
- Meter positive lead on numbered test points.
- Meter negative lead on numbered test points.
- Meter on DC volts.

Front and Rear Wiper/Washer Test

(1) Check voltage at red wire terminal of 4-way connector.

Action:

Result must be same as battery voltage (minimum 11.8 V direct-current).

Result:

YES: GO TO 2

NO: Test main wiring and replace if necessary.

(2) Check voltage at terminal 30 of blower relay.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 3

NO: Check for corroded connections or break in wire between 4-way connector and blower relay.

(3) Check voltage at 7.5 A fuse input (F16 fuse) of cab fuse box, located in the cab roof.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 4

NO: Check for corroded connections or break in wire between blower relay and 7.5 A fuse.

(4) Check voltage at 7.5 A fuse output (F16 fuse) of cab fuse box, located in the cab roof.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 5

NO: Check for failed fuse F16. Replace fuse if it is failed. If fuse is good, check for corroded or loose terminals.

(5) Check voltage at white/blue wire terminal of rear wiper motor.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 6

NO: Check for corroded connections or break in white/blue wire between 7.5 A fuse and front wiper motor.

(6) Check voltage at black wire terminal of rear wiper motor.

Action:

Result:
- No voltage if switch is in off position.
- Battery voltage if switch is in on position.

Result:

YES: GO TO 7

NO: Check for failed switch. Replace switch if it is failed. If switch is good, check for corroded or loose terminals.

(7) Check voltage at pink wire terminal of 4-way connector.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 8

NO: Test main wiring and replace if necessary.

(8) Check voltage at terminal 30 of work light relay (K05).

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 9

NO: Check for corroded connections or break in wire between 4-way connector and work light relay.

(9) Check voltage at 10 A fuse input (F18 fuse) of cab fuse box, located in the cab roof.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 10

NO: Check for corroded connections or break in wire between work light relay and 10 A fuse.

(10) Check voltage at 7.5 A fuse input (F17 fuse) of cab fuse box, located in the cab roof.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 11

NO: Check for corroded connections or break in wire between work light relay and 7.5 A fuse.

(11) Check voltage at 7.5 A fuse output (F17 fuse) of cab fuse box, located in the cab roof.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 12

NO: Check for failed fuse F17. Replace fuse if it is failed. If fuse is good, check for corroded or loose terminals.

(12) Check voltage at blue wire terminal of front wiper motor.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 13

NO: Check for corroded connections or break in wire between 7.5 A fuse and front wiper motor.

(13) Check voltage at black wire terminal of front wiper motor.

Action:

Result:
- No voltage if switch is in off position.
- Battery voltage if switch is in on position.

Result:

YES: GO TO 14

NO: Check for failed switch and replace if necessary. If switch is good, check for corroded or loose terminals.

(14) Check voltage at white/blue wire terminal of front/rear washer switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 15

NO: Check for corroded connections or break in white/blue wire between 7.5 A fuse and front/rear washer switch.

(15) Check voltage at red/green wire terminal of front/rear washer switch.

Action:

Result:
- No voltage if switch is in off position.
- Battery voltage if switch is in on position.

Result:

YES: GO TO 16

NO: Check for corroded connections or break in red/green wire.

(16) Check voltage at red/green wire terminal of washer motor.

Action:

Result:
- No voltage if switch is in off position.
- Battery voltage if switch is in on position.

Result:

YES: GO TO 17

NO: Check for corroded connections or break in red/green wire between front/rear washer switch and washer motor.

(17) Check voltage at black wire terminal of washer motor.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 18

NO: Check for failed motor and replace if necessary. If motor is good, check for corroded or loose terminals.

(18) Check voltage at yellow/black wire terminal at 4-way connector of left lamp.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 19

NO: Check for corroded connections or break in yellow/black wire from 4-way connector.

(19) Check voltage at yellow/black wire terminal of front/rear washer switch to 4-way connector (C02).

Action:

Result:
- No voltage if switch is in off position.
- Battery voltage if switch is in on position.

Result:

YES: GO TO 20

NO: Check for failed switch and replace if necessary. If switch is good, check for corroded connections or break in yellow/black wire between 4-way connector and front/rear washer switch.

(20) Check voltage at yellow/black wire terminal of front/rear washer switch to indicator bulb (H19).

Action:

Result:
- No voltage if switch is in off position.
- Battery voltage if switch is in on position.

Result:

YES: GO TO 21

NO: Check for failed switch and replace if necessary.

(21) Check voltage at yellow/black wire terminal of front/rear washer switch indicator (H19).

Action:

Result:
- No voltage if switch is in off position.
- Battery voltage if switch is in on position.

Result:

YES: GO TO 22

NO: Check for corroded connections or break in yellow/black wire of front/rear washer switch indicator.

(22) Check voltage at black wire terminal of washer switch indicator (H19).

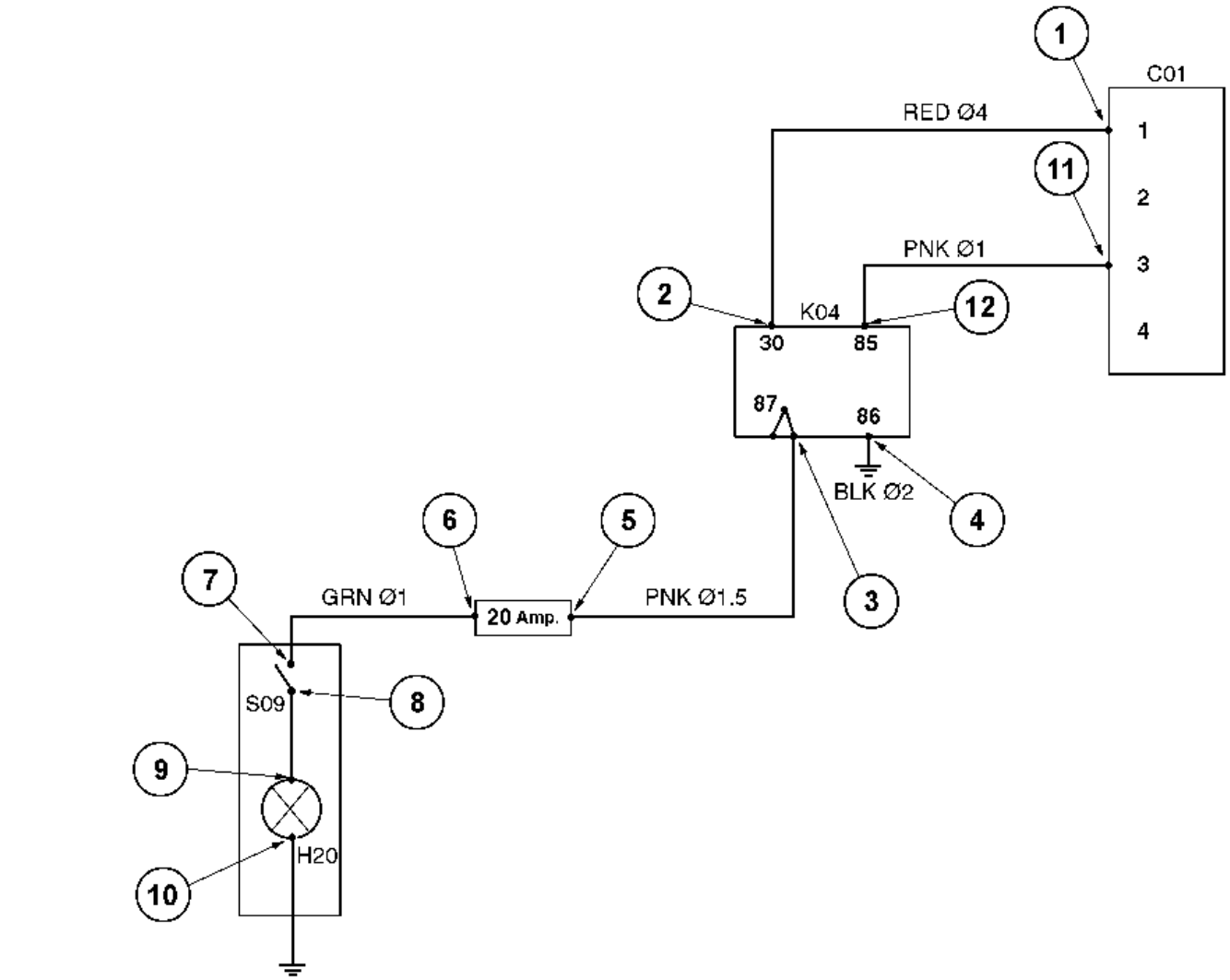
Action:

Result:
- No voltage if switch is in off position.
- Battery voltage if switch is in on position.

Result:

NO: Check for failed indicator and replace if necessary. If indicator is good, check for corroded connections or break in black wire between washer switch indicator and ground connection.

(Cab) Dome Light Test Points



AT3215

Dome Light Test Points

Meet following requirements:

- Key switch in ACC or RUN position.
- Dome light on.
- Meter positive lead on numbered test points.
- Meter negative lead on numbered test points.
- Meter on DC volts.

Dome Light Test

(1) Check voltage at red wire terminal of 4-way connector.

Action:

Result must be same as battery voltage (minimum 11.8 V direct-current).

Result:

YES: GO TO 2

NO: Test main wiring and replace if necessary.

(2) Check voltage at terminal 30 of blower relay.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 3

NO: Check for corroded connections or break in red wire between 4-way connector and blower relay.

(3) Check voltage at terminal 87 of blower relay.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 4

NO: Check for failed relay and replace if necessary. If relay is good, check for corroded or loose terminals.

(4) Check voltage at black wire terminal 86 of blower relay.

Action:

Result must be less than 0.2 volt.

Result:

YES: GO TO 5

NO: Check continuity to ground of black wire. If all connections are good, test blower relay and replace if necessary.

(5) Check voltage at 20 A fuse input (F14 fuse) of cab fuse box, located in the cab roof.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 6

NO: Check for corroded connections or break in wire between blower relay and 20 A fuse.

(6) Check voltage at 20 A fuse output (F14 fuse) of cab fuse box, located in the cab roof.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 7

NO: Check for failed fuse F14 and replace if necessary. If fuse is good, check for corroded or loose terminals.

(7) Check voltage at green wire terminal of dome light switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 8

NO: Check for corroded connections or break in green wire between 20 A fuse and dome light switch.

(8) Check voltage at terminal of dome light switch.

Action:

Result:
- No voltage if switch is in off position.
- Battery voltage if switch is in on position.

Result:

YES: GO TO 9

NO: Check for failed switch and replace if necessary. If switch is good, check for corroded or loose terminals.

(9) Check voltage at terminal of dome light.

Action:

Result:
- No voltage if switch is in off position.
- Battery voltage if switch is in on position.

Result:

YES: GO TO 10

NO: Check for corroded connections or breake in wire between dome light switch and dome light.

(10) Check voltage at ground terminal of dome light.

Action:

Result:
- No voltage if switch is in off position.
- Battery voltage if switch is in on position.

Result:

YES: GO TO 11

NO: Check for failed light and replace if necessary. If light is good, check for corroded or loose terminals.

(11) Check voltage at pink wire terminal of 4-way connector.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 12

NO: Test main wiring and replace if necessary.

(12) Check voltage at pink wire terminal 85 of blower relay.

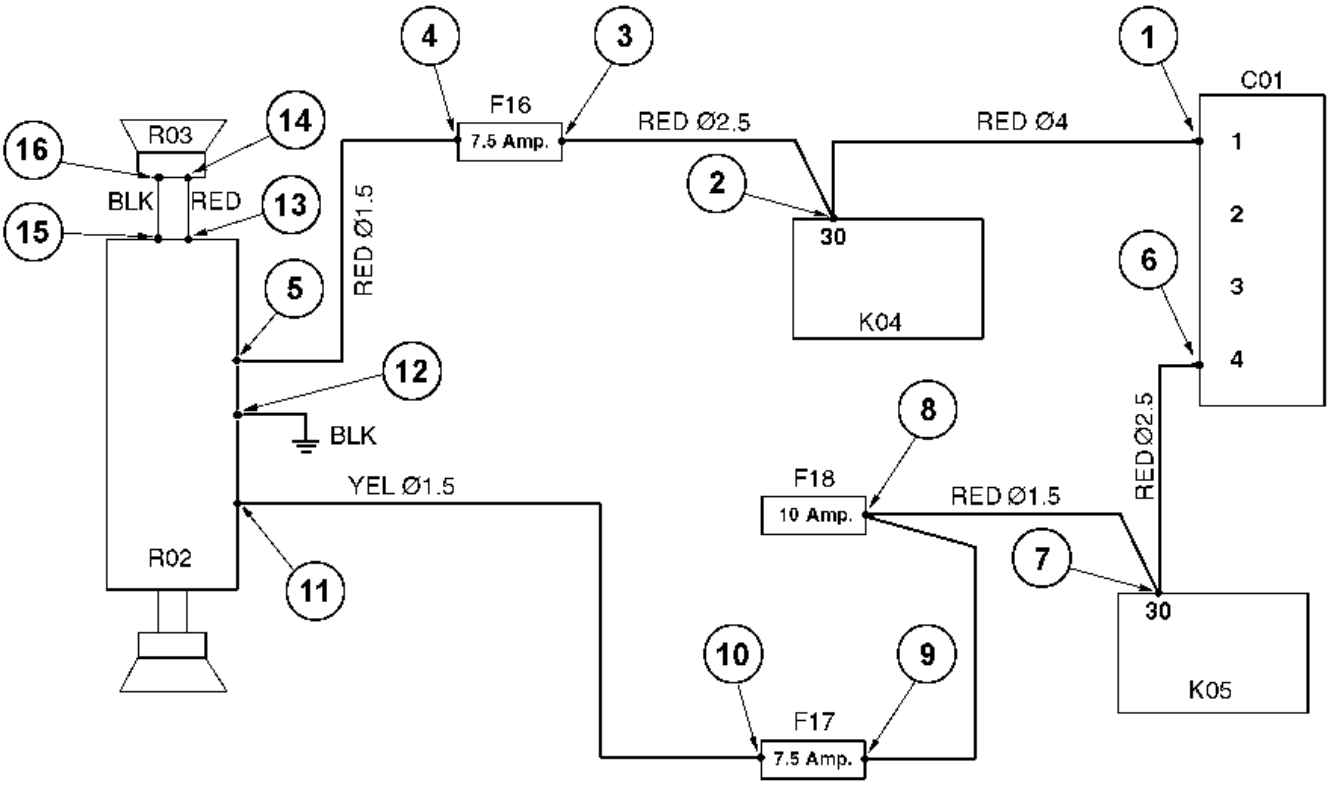
Action:

Result must be same as battery voltage.

Result:

NO: Check for corroded connections or break in pink wire between 4-way connector and blower relay.

(Cab) Radio Test Points



AT3214

Radio Test Points

Meet following requirements:

- Key switch in ACC or RUN positions.
- Meter positive lead on numbered test points.
- Meter negative lead on numbered test points.
- Meter on DC volts.

Radio Test

(1) Check voltage at terminal (1) of 4-way connector.

Action:

Result must be same as battery voltage.

Result:

YES:GO TO 2

NO: Test main wiring and replace if necessary.

(2) Check voltage at terminal 30 of blower relay.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 3

NO: Check for corroded connections or break in red wire between 4-way connector and blower relay.

(3) Check voltage at 7.5 A fuse input (Fl6 fuse) of cab fuse box located in the cab roof.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 4

NO: Check for corroded connections or break in wire between blower relay and 7.5 A fuse.

(4) Check voltage at 7.5 A fuse input (Fl6 fuse) of cab fuse box located in the cab roof.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 5

NO: Check for failed fuse F16. Replace fuse if it is failed. If fuse is good, check for corroded or loose terminals.

(5) Check voltage at red wire terminal of radio.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 6

NO: Check for corroded connections or break in red wire between 7.5 A fuse and radio.

(6) Check voltage at terminal (4) of 4-way connector.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 7

NO: Test main wiring and replace if necessary.

(7) Check voltage at terminal 30 of work light relay (KO5).

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 8

NO: Check for corroded connections or break in wire between 4-way connector and work light relay.

(8) Check voltage at 10 A fuse input (Fl 8 fuse) of cab fuse box, located in the cab roof.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 9

NO: Check for corroded connections or break in wire between work light relay and 10 A fuse.

(9) Check voltage at 7.5 A fuse input (Fl 7 fuse) of cab fuse box, located in the cab roof.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 10

NO: Check for failed fuse F17. Replace fuse if it is failed. If fuse is good, check for corroded or loose terminals.

(10) Check voltage at 7.5 A fuse output (Fl 7 fuse) of cab fuse box, located in the cab roof.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 11

NO: Check for failed fuse F17. Replace fuse if it is failed. If fuse is good, check for corroded or loose terminals.

(11) Check voltage at yellow wire terminal of radio.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 12

NO: Check for corroded connections or break in wire between 7.5 A fuse and radio.

(12) Check voltage at black wire terminal of radio.

Action:

Result must be less than 0.2 volt.

Result:

YES: GO TO 13

NO: Check continuity to ground of black wire. If all connection are good, test the radio. Replace if is bad.

(13) Check continuity of red wire between radio output and loudspeaker.

Action:

Continuity is OK.

→NOTE:

No current should be measured at this terminals.

Result:

YES: GO TO 14

NO: Replace wire and check conductivity of all terminals.

(14) Check resistance between both terminals of loudspeaker.

Action:

Most used loudspeakers:

4 ohm

6 ohm

8 ohm

→NOTE:

Observe loudspeaker for a label with specifications. Make sure that connections are not corroded.

Result:

YES: GO TO 15

NO: Replace loudspeaker.

(15) Check continuity of black wire between radio output and loudspeaker.

Action:

Continuity is OK.

Result:

YES: Check radio and replace if necessary.

NO: Replace wire and check conductivity of all terminals.

(16) Check resistance between both terminals of loudspeaker.

Action:

→NOTE:

Don´t perform this step when the result of step 14 was OK.

Most used loudspeakers:

4 ohm

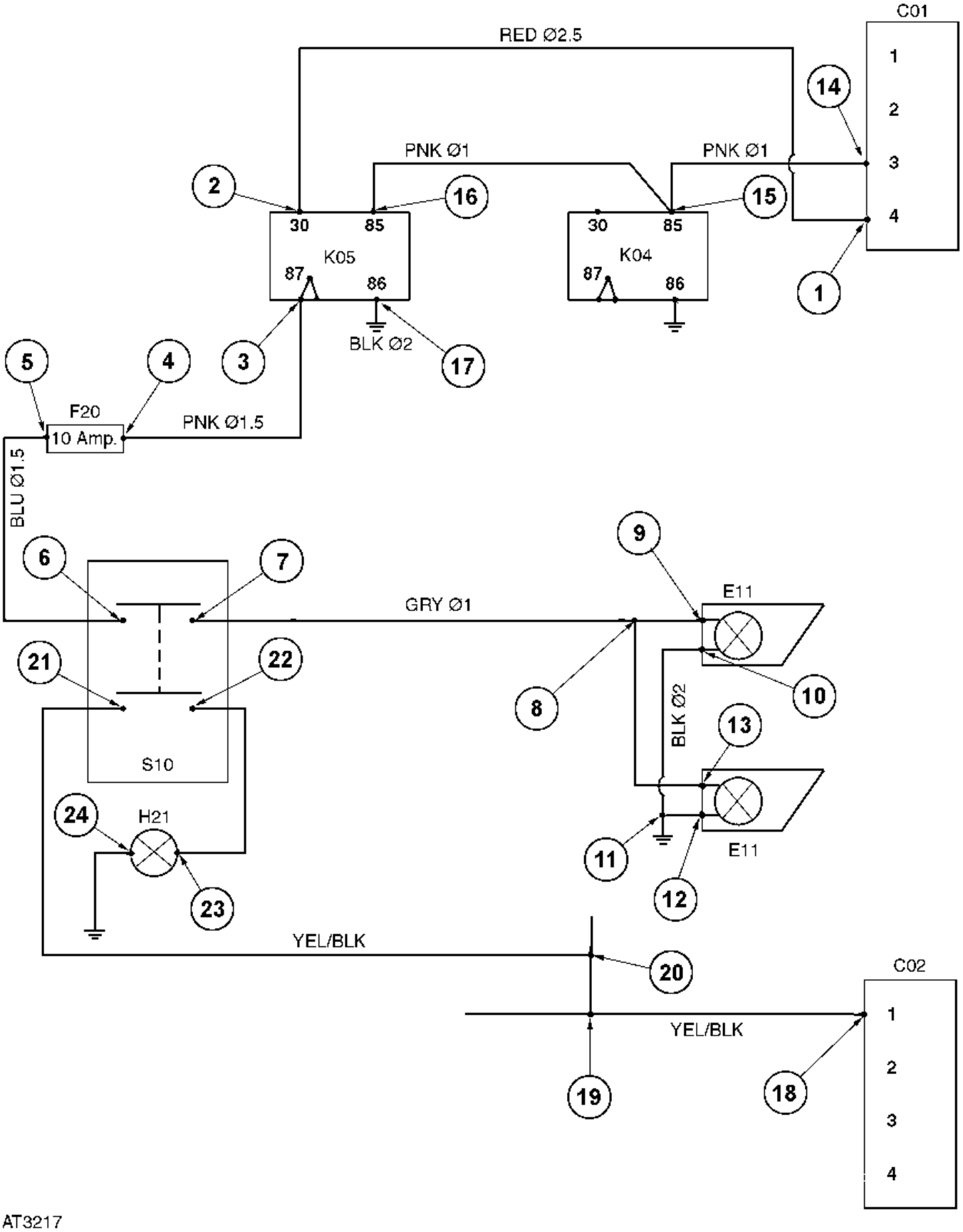
6 ohm

8 ohm

Result:

OK: End of test.

(Cab) Rear Work Light Test Points



(Cab) Rear Work Light Test Points

Meet following requirements:

- Key switch in ACC or RUN position.
- Rear work light switch in on position.

- Meter positive lead on numbered test points.
- Meter negative lead on numbered test points
- Meter on DC volts.

(Cab) Rear Work Light Test

(1) Check voltage at red wire terminal of 4-way connector.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 2

NO: Test main wiring and replace if necessary.

(2) Check voltage at terminal 30 of work light relay.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 3

NO: Check for corroded connections or break in wire between 4-way connector and work light relay.

(3) Check voltage at terminal 87 of work light relay.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 4

NO: Check for failed work light relay. Replace relay if it is failed. If relay is good, check for corroded or loose terminals.

(4) Check voltage at 10 A fuse input (F20 fuse) of cab fuse box, located in the cab roof.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 5

NO: Check for corroded connections or break in wire between work light relay and 10 A fuse.

(5) Check voltage at 10 A fuse output (F20 fuse) of cab fuse box, located in the cab roof.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 6

NO: Check for failed fuse F20. Replace fuse if it is failed. If fuse is good, check for corroded or loose terminals.

(6) Check voltage at blue wire terminal of rear work light switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 7

NO: Check for corroded connections or break in wire between 10 A fuse and rear work light switch.

(7) Check voltage at grey wire terminal of rear work light switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 8

NO: Check for failed rear work light switch. Replace switch if it is failed. If switch is good, check for corroded or loose terminals.

(8) Check voltage at connection to right work light.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 9

NO: Check for corroded connections or break in wire between rear work light switch and right work light.

(9) Check voltage at terminal of left work light.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 10

NO: Check for corroded connections or break in wire between connection (point 8) and left work light.

(10) Check voltage at black wire terminal of left work light.

Action:

Result must be less than 0.2 volt.

Result:

YES: GO TO 11

NO: Check for failed lamp. Replace if it is failed. Check continuity to ground of black wire.

(11) Check voltage at black wire connection of work light.

Action:

Result must be less than 0.2 volt.

Result:

YES: GO TO 12

NO: Check continuity to ground of black wire.

(12) Check voltage at black wire terminal of work light.

Action:

Result must be less than 0.2 volt.

Result:

YES: GO TO 13

NO: Check continuity to ground of black wire.

(13) Check voltage at grey wire terminal of right work light.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 14

NO: Check for corroded connections or break in wire between connection (point 8) and right work light.

(14) Check voltage at pink wire terminal of 4-way connector.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 15

NO: Test main wiring and replace if necessary.

(15) Check voltage at terminal 85 of blower relay.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 16

NO: Check for corroded connections or break in pink wire.

(16) Check voltage at terminal 85 of work light relay.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 17

NO: Check for corroded connections or break in pink wire between blower relay and work light relay.

(17) Check voltage at black wire terminal of work light relay.

Action:

Result must be less than 0.2 volt.

Result:

YES: GO TO 18

NO: Check for failed relay. Replace relay if it is failed. If relay is good, check for corroded or loose terminals.

(18) Check voltage at yellow/black wire terminal of 4-way connector for left lamp.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 19

NO: Test main wiring. Replace bad main wiring.

(19) Check voltage at connection on yellow/black wire.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 20

NO: Check for corroded connections or break in yellow/black wire between 4-way connector for left lamp and work light switch.

(20) Check voltage at connection on yellow/black wire.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 21

NO: Check for corroded connections or break in yellow/black wire between 4-way connector for left lamp and work light switch.

(21) Check voltage at yellow/black wire terminal of rear work light switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 22

NO: Check for corroded connections or break in yellow/black wire between connection (point 20) and work light switch.

(22) Check voltage at connector of rear work light switch to indicator light.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 23

NO: Check for failed switch. Replace switch if it is failed. Check for corroded connections or break in the wire to indicator light.

(23) Check voltage at connector to indicator light.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 24

NO: Check for corroded connections or break in the wire between rear work light switch and indicator light.

(24) Check voltage at black wire terminal of rear work light indicator.

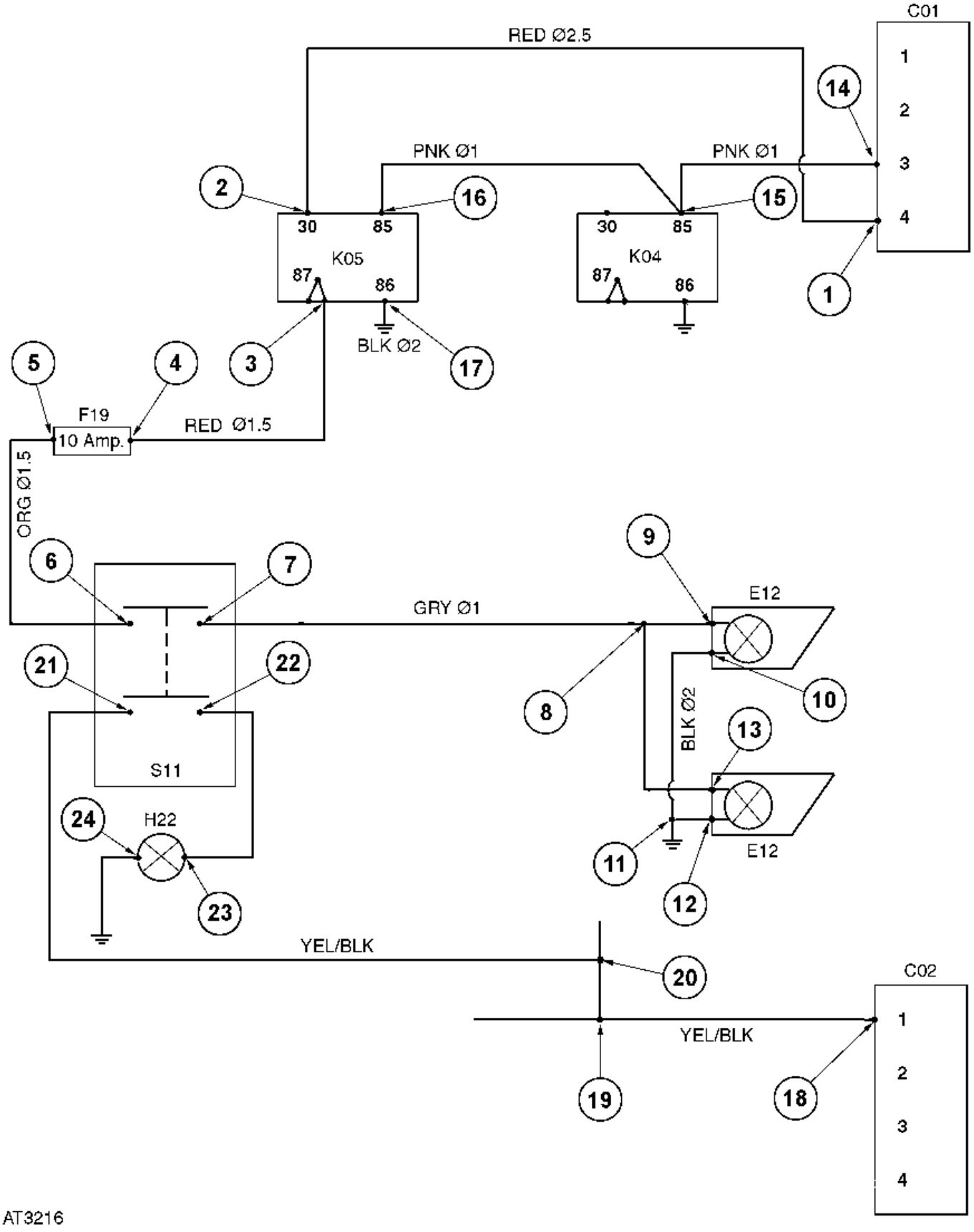
Action:

Result must be less than 0.2 volt.

Result:

NO: Check for failed indicator. Replace if it is failed. Check continuity to ground of black wire.

(Cab) Front Work Light Test Points



(Cab) Front Work Light Test Points

Meet following requirements:

- Key switch in ACC or RUN position.
- Front work light switch in on position.

- Meter positive lead on numbered test points.
- Meter negative lead on numbered test points.
- Meter on DC volts.

(Cab) Front Work Light Test

(1) Check voltage at red wire terminal of 4-way connector.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 2

NO: Test main wiring. Replace bad main wiring.

(2) Check voltage at terminal 30 of work light relay.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 3

NO: Check for corroded connections or break in wire between 4-way connector and work light relay.

(3) Check voltage at terminal 87 of work light .

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 4

NO: Check for failed work light relay. Replace relay if it is failed. If relay is good, check for corroded or loose terminals.

(4) Check voltage at 10 A fuse input (F19 fuse) of cab fuse box, located in the cab roof.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 5

NO: Check for corroded connections or break in wire between work light relay and 10 A fuse.

(5) Check voltage at 10 A fuse output (F19 fuse) of cab fuse box, located in the cab roof.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 6

NO: Check for failed fuse F19. Replace fuse if it is failed. If fuse is good, check for corroded or loose terminals.

(6) Check voltage at orange wire terminal of front work light switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 7

NO: Check for corroded connections or break in wire between 10 A fuse and front work light switch.

(7) Check voltage at grey wire terminal of front work light switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 8

NO: Check for failed front work light switch. Replace switch if it is failed. If switch is good, check for corroded or loose terminals.

(8) Check voltage at connection to right work light.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 9

NO: Check for corroded connections or break in wire between front work light switch and right work light.

(9) Check voltage at grey wire terminal of left work light.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 10

NO: Check for corroded connections or break in wire between connection (point 8) and left work light.

(10) Check voltage at black wire terminal of left work light.

Action:

Result must be less than 0.2 volt.

Result:

YES: GO TO 11

NO: Check for failed lamp. Replace if it is failed. Check continuity to ground of black wire.

(11) Check voltage at black wire connection of work lights.

Action:

Result must be less than 0.2 volt.

Result:

YES: GO TO 12

NO: Check continuity to ground of black wire.

(12) Check voltage at black wire terminal of right work light.

Action:

Result must be less than 0.2 volt.

Result:

YES: GO TO 13

NO: Check continuity to ground of black wire.

(13) Check voltage at grey wire terminal of right work light.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 14

NO: Check for corroded connections or break in wire between connection (point 8) and right work light.

(14) Check voltage at pink wire terminal of 4-way connector.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 15

NO: Test main wiring. Replace bad main wiring.

(15) Check voltage at terminal 85 of blower relay.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 16

NO: Check for corroded connections or break in pink wire.

(16) Check voltage at Terminal 85 of work light relay.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 17

NO: Check for corroded connections or break in pink wire between blower relay and work light relay.

(17) Check voltage at black wire terminal of work light relay.

Action:

Result must be less than 0.2 volt.

Result:

YES: GO TO 18

NO: Check for failed relay. Replace relay if it is failed. If relay is good, check for corroded or loose terminals.

(18) Check voltage at yellow/black wire terminal of 4-way connector (left lamp) C02.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 19

NO: Test main wiring. Replace bad main wiring.

(19) Check voltage at connection on yellow/black wire.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 20

NO: Check for corroded connections or break in yellow/black wire between 4-way connector for left lamp and work light switch.

(20) Check voltage at connection on yellow/black wire.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 21

NO: Check for corroded connections or break in yellow/black wire between 4-way connector for left lamp and work light switch.

(21) Check voltage at yellow/black wire terminal of front work light switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 22

NO: Check for corroded connections or break in yellow/black wire between connection (point 20) and work light switch.

(22) Check voltage at connector of front work light switch to indicator light.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 23

NO: Check for failed switch. Replace switch if it is failed.Check for corroded connections or break in the wire to indicator light.

(23) Check voltage at connector to indicator light.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 24

NO: Check for corroded connections or break in the wire between front work light switch and indicator light.

(24) Check voltage at black wire terminal of front work light indicator.

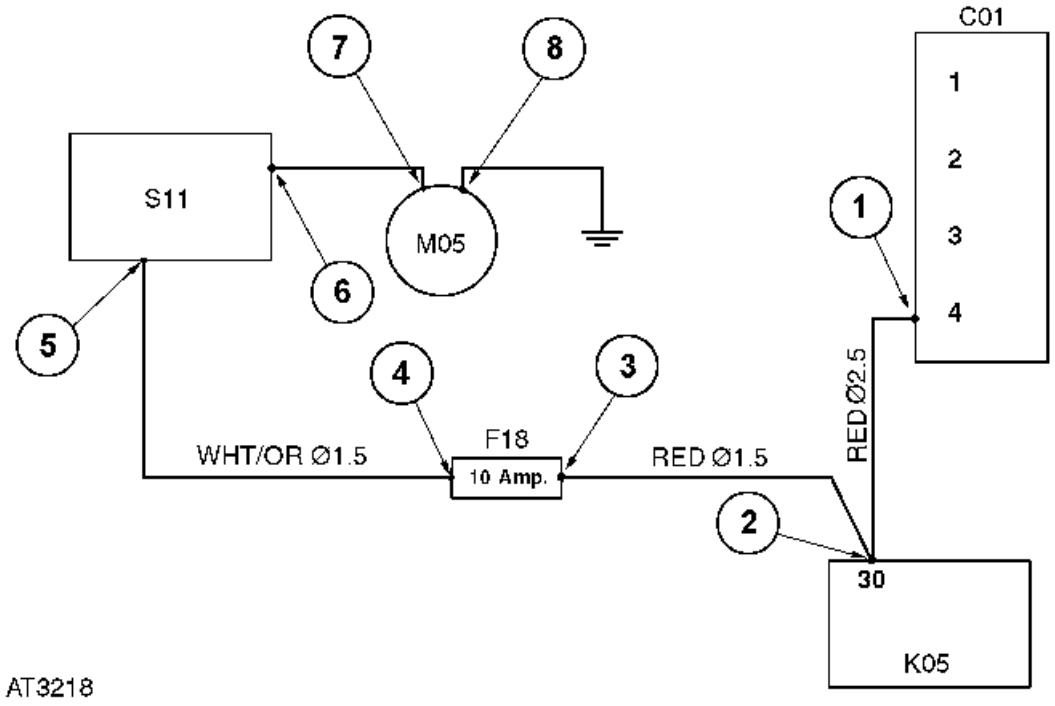
Action:

Result must be less than 0.2 volt.

Result:

NO: Check for failed indicator. Replace if it is failed. Check continuity to ground of black wire.

(Cab) Blower Circuit Test Points



(Cab) Blower Circuit Test Points

Meet following requirements:

- Key switch in ACC or RUN position.
- Meter positive lead on numbered test points.
- Meter negative lead on numbered test points.
- Meter on DC volts.

(Cab) Blower Circuit Test

(1) Check voltage at red wire terminal of 4-way connector.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 2

NO: Test main wiring. Replace bad main wiring.

(2) Check voltage at terminal 30 of blower relay.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 3

NO: Check for corroded connections or break in wire between 4-way connector and blower relay.

(3) Check voltage at 10 A fuse input (F18 fuse) of cab fuse box, located in the cab roof.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 4

NO: Check for corroded connections or break in wire between blower relay and 10 A fuse.

(4) Check voltage at 10 A fuse output (F18 fuse) of cab fuse box, located in the cab roof.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 5

NO: Check for failed fuse F18. Replace fuse if it is failed. If fuse is good, check for corroded or loose terminals.

(5) Check voltage at white/orange wire terminal of three speeds fan switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 6

NO: Check for corroded connections or break in white/orange wire between 10 A fuse and the switch.

(6) Check voltage at the switch connector to blower motor.

Action:

No voltage if switch is in off position.

Battery voltage if switch is in on position.

Result:

YES: GO TO 7

NO: Check if the switch is in on or off position (1st, 2nd or 3rd position is engaged). Replace switch if it is failed. If switch is good, check for corroded or loose terminals.

(7) Check voltage at Terminal of blower motor.

Action:

No voltage if switch is in off position.

Battery voltage if switch is in on position.

Result:

YES: GO TO 8

NO: Check if the switch is in on or off position (1st, 2nd or 3rd position - engaged).Check for corroded connections or break in wire between three speeds fan switch connector and blower motor.

(8) Check voltage at black wire terminal of blower motor.

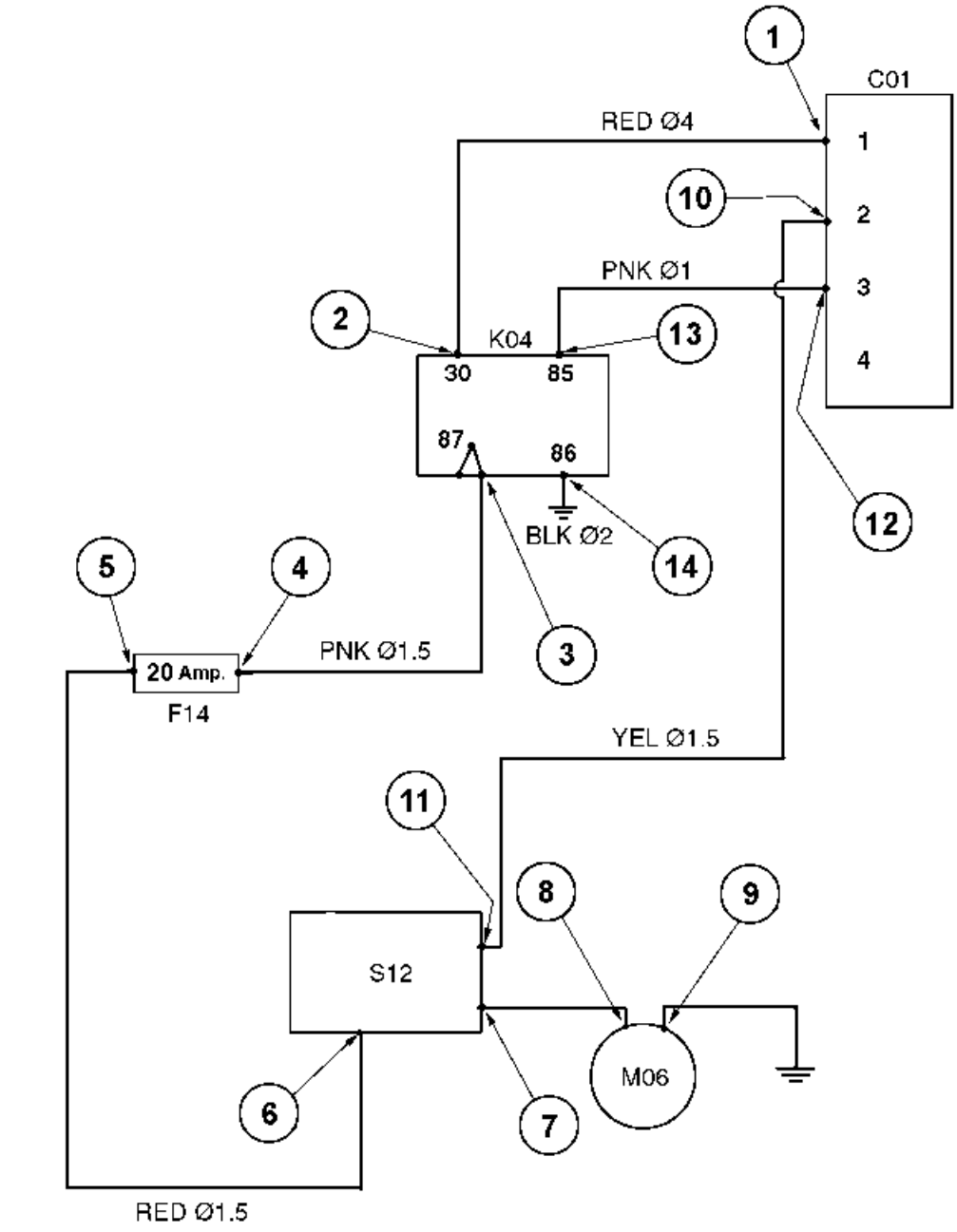
Action:

Result must be less than 0.2 volt.

Result:

NO: Check continuity to ground of black wire. If all connection are good, test the blower motor. Replace if is bad.

(Cab) Air Conditioning System Test Points



AT3219

(Cab) Air Conditioning System Test Points

Meet following requirements:

- Key switch in ACC or RUN position.
- Meter positive lead on numbered test points.
- Meter negative lead on numbered test points.
- Meter on DC volts.

Air Conditioning System Test

(1) Check voltage at red wire terminal of 4-way connector.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 2

NO: Test main wiring. Replace bad main wiring.

(2) Check voltage at terminal 30 of blower relay.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 3

NO: Check for corroded connections or break in wire between 4-way connector and blower relay.

(3) Check voltage at terminal 87 of blower relay.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 4

NO: Check for failed relay. Replace relay if it is failed. If relay is good, check for corroded or loose terminals.

(4) Check voltage at 20 A fuse input (F14 fuse) of cab fuse box, located in the cab roof.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 5

NO: Check for corroded connections or break in wire between blower relay and 20 A fuse.

(5) Check voltage at 20 A fuse output (F14 fuse) of cab fuse box, located in the cab roof.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 6

NO: Check for failed fuse F14. Replace fuse if it is failed. If fuse is good, check for corroded or loose terminals.

(6) Check voltage at red wire terminal of three speeds fan air conditioning switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 7

NO: Check for corroded connections or break in wire between 20 A fuse and the switch.

(7) Check voltage at terminal of three speeds fan air conditioning compressor.

Action:

No voltage if switch is in off position.

Battery voltage if the switch is in on position.

Result:

YES: GO TO 8

NO: Check if the switch is in off position (1st, 2nd or 3rd position not engaged). Replace switch if it is failed. If switch is good, check for corroded or loose terminals.Check if the switch is in on position (1st, 2nd or 3rd position engaged). Replace switch if it is failed. If switch is good, check for corroded or loose terminals.

(8) Check voltage at wire to terminal of air conditioning compressor.

Action:

No voltage if switch is in off position.

Battery voltage if the switch is in on position.

Result:

YES: GO TO 9

NO: Check for corroded connections or break in wire between three speeds fan air conditioning switch connector and the compressor.

(9) Check voltage at black wire terminal of air conditioning compressor.

Action:

Result must be less than 0.2 volt.

Result:

YES: GO TO 10

NO: Check continuity to ground of black wire. If all connection are good, test the blower motor. Replace if is bad.

(10) Check voltage at yellow wire terminal of 4-way connector

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 11

NO: Test main wiring. Replace bad main wiring.

(11) Check voltage at yellow terminal of three speeds fan air conditioning switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 12

NO: Check for corroded connections or break in wire between 4-way connector and the switch.

(12) Check voltage at pink wire terminal of 4-way connector.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 13

NO: Test main wiring. Replace bad main wiring.

(13) Check voltage at pink terminal of blower relay.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 14

NO: Check for corroded connections or break in wire between 4-way connector and blower relay.

(14) Check voltage at black wire terminal of blower relay.

Action:

Result must be less than 0.2 volt.

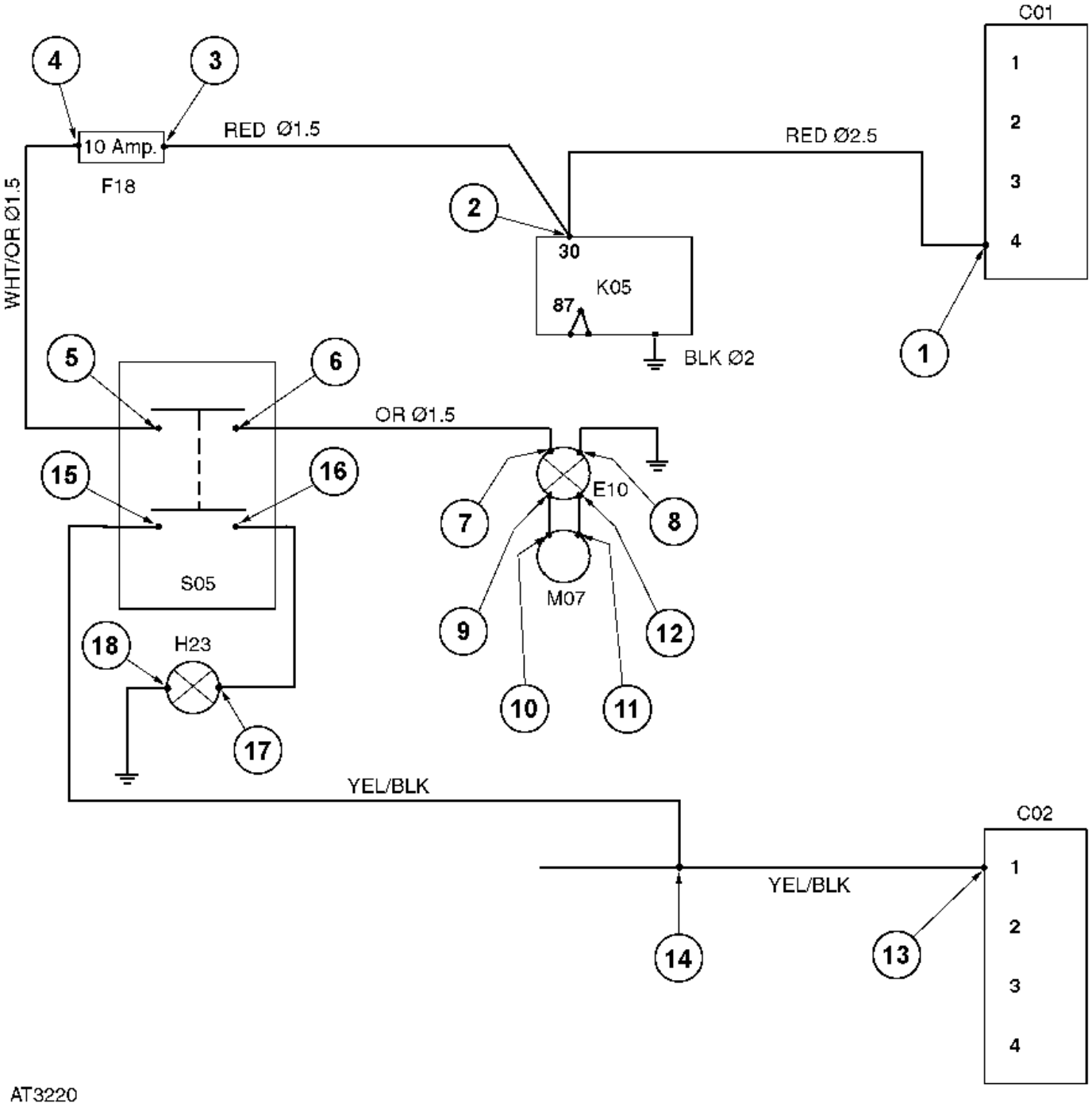
Result:

NO: Check continuity to ground of black wire. If all connection are good, test the motor. Replace if is bad.

(Cab) Beacon Light Test Points

Meet following requirements:

- Key switch in ACC or RUN position.
- Meter positive lead on numbered test points.
- Meter negative lead on numbered test points.
- Meter on DC volts.



Beacon Light Test Points (Cab)

Beacon Light Test (Cab)

(1) Check voltage at red wire terminal of 4-way connector.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 2

NO: Test main wiring. Replace bad main wiring.

(2) Check voltage at terminal 30 of work light relay.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 3

NO: Check for corroded connections or break in wire between 4-way connector and work light relay.

(3) Check voltage at 10 A fuse input (Fl8 fuse) of cab fuse box, located in the cab roof.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 4

NO: Check for corroded connections or break in wire between work light relay and 10 A fuse.

(4) Check voltage at 10 A fuse output (Fl8 fuse) of cab fuse box, located in the cab roof.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 5

NO: Check for failed fuse F18. Replace fuse if it is failed. If fuse is good, check for corroded or loose terminals.

(5) Check voltage at white/orange wire terminal of front work light switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 6

NO: Check for corroded connections or break in wire between 10 A fuse and beacon light switch.

(6) Check voltage at orange wire terminal of beacon light switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 7

NO: Check for failed beacon light switch. Replace switch if it is failed. If switch is good, check for corroded or loose terminals.

(7) Check voltage at orange wire connection of beacon light.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 8

NO: Check for corroded connections or break in wire between beacon light switch and beacon light.

(8) Check voltage at black wire connection of beacon light.

Action:

Result must be less than 0.2 volt.

Result:

YES: GO TO 9

NO: Check for failed lamp. Replace if it is failed. Check continuity to ground of black wire.

(9) Check voltage at terminal to beacon light.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 10

NO: Check for corroded connections or break in wire between beacon light and beacon light.

(10) Check voltage at terminal (+) to beacon light motor.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 11

NO: Check for corroded connections or break in wire between beacon light and beacon light motor.

(11) Check voltage at black wire terminal of beacon light motor.

Action:

Result must be less than 0.2 volt.

Result:

YES: GO TO 12

NO: Check for failed motor. Replace if it's failed. Check continuity to ground of black wire.

(12) Check voltage at black wire terminal of beacon light.

Action:

Result must be less than 0.2 volt.

Result:

YES: GO TO 13

NO: Check for failed lamp. Replace if it is failed. Check continuity to ground of black wire.

(13) Check voltage at yellow/black wire terminal of 4-way connector.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 14

NO: Test main wiring. Replace bad main wiring.

(14) Check voltage at connection of yellow/black wire.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 15

NO: Check for corroded connections or break in yellow/black wire between 4-way connector for left lamp and beacon light switch.

(15) Check voltage at yellow/black wire connection of beacon light switch.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 16

NO: Check for corroded connections or break in yellow/black wire between 4-way connector for left lamp and work light switch.

(16) Check voltage at wire terminal to beacon light switch indicator.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 17

NO: Check for corroded connections or break on wire between beacon light switch and the indicator.

(17) Check voltage at wire terminal on beacon light switch indicator.

Action:

Result must be same as battery voltage.

Result:

YES: GO TO 18

NO: Check for corroded connections or break on beacon light switch indicator.

(18) Check voltage at black wire terminal of beacon light indicator.

Action:

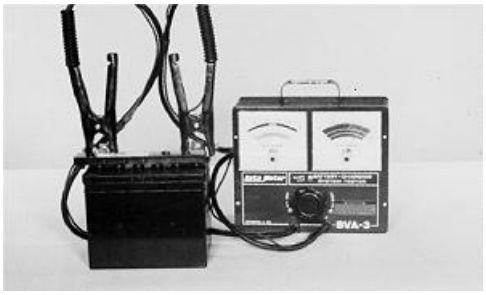
Result must be less than 0.2 volt.

Result:

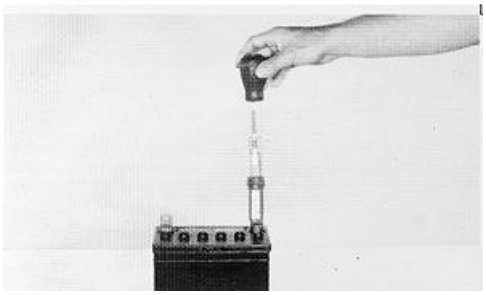
YES:GO TO 19

NO: Check for failed indicator. Replace if it is failed. Check continuity to ground of black wire.

Battery Voltage and Specific Gravity Tests



Voltage and Specific Gravity Tests



Voltage and Specific Gravity Tests

REASON:

To determine condition of battery.

EQUIPMENT:

- Voltmeter or JT05685 Load Tester
- Hydrometer

PROCEDURE:

[1] - Clean battery terminals and top of battery.

[2] - Inspect battery terminals and case for breakage or cracks.

[3] - Check electrolyte level in each battery cell. Add distilled water as needed. If water is added, charge battery for 20 minutes at 10 amps.

→NOTE:

On maintenance free batteries it is necessary to remove the cover from battery top for access to the filler necks.

[4] - If battery has been charged, remove surface charge by turning load knob of tester clockwise until ammeter reads 100 amps. Hold for 15 seconds then turn load knob to off.

[5] - Check battery voltage with voltmeter or Load Tester.

[6] - Check and record specific gravity of each cell with a hydrometer.

SPECIFICATIONS:

- Minimum battery voltage 12.4 volts.
- Minimum specific gravity 1.225 with less than 0.050 variation.

RESULTS:

Battery voltage less than 12.4 V DC, charge battery and test again (see “Charge Battery” in this Group).

Battery voltage more than 12.4 V DC, load test battery

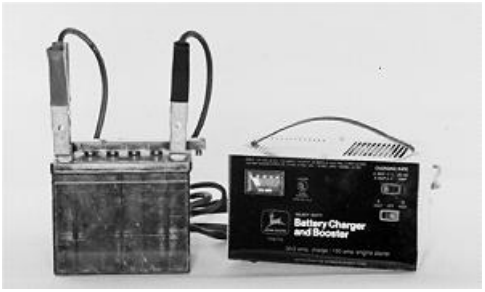
All cells less than 1.225 with less than 0.050 variation, charge battery at 10 amp rate and test again (see “Charge Battery” in this Group).

All cells more than 1.225 with less than 0.050 variation, load test battery (see “Load Test Battery” in this Group).

More than 0.050 variation: replace battery.

If battery fails voltage or specific gravity test after charging, replace battery.

Charge Battery



Charge Battery

REASON:

To increase battery charge after battery has been discharged.

EQUIPMENT:

- Battery charger (variable rate)

PROCEDURE:

→NOTE:

See “Battery Voltage and Specific Gravity Tests” in this Group before charging battery.

[1] - Connect variable rate charger to battery.

[2] - Start charger at slow rate. Increase charge rate one setting at a time. Check charger ammeter after one minute at each setting. Maintain 10 amp charge rate.

[3] - Check if battery is accepting a 10 amp charge after 10 minutes.

Battery will not accept 10 amp charge after 10 minutes: replace battery.

Battery is accepting 10 amp charge after 10 minutes, and battery did not need water: go to steps 6 and 7.

Battery is accepting 10 amp charge after 10 minutes, but battery needed water or all cells were below 1.225: go to steps 4 and

5.

[4] - Set charger at 15-25 amps.

IMPORTANT:

Decrease charge rate if battery gases or bubbles excessively or becomes too warm to touch.

[5] - Check specific gravity after 30 minutes (60 minutes for maintenance-free battery).

More than 0.050 variation between cells: replace battery.

Less than 0.050 variation between cells: go to steps 6 and 7.

[6] -

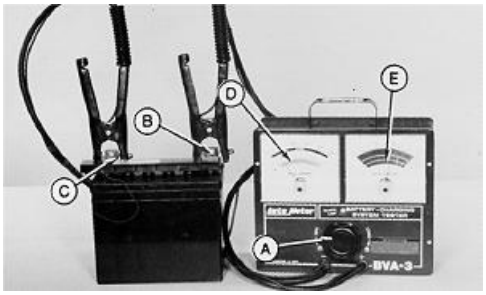
→NOTE:

If battery was discharged at a slow or unknown rate, charge at 10-15 amps for 6-12 hours (maintenance-free battery: 12-24 hours). If battery was discharged at fast rate, charge at 20-25 amps for 2-4 hours (maintenance-free battery: 4-8 hours).

Continue charging battery until specific gravity is 1.225-1.265.

[7] - Load test of battery (see “Battery Load Test” in this Group).

Battery Load Test



LEGEND:

A	Tester Load Knob
B	Tester Red Cable
C	Tester Black Cable
D	Amperage
E	Voltage

Battery Load Test

REASON:

To determine battery’s ability to withstand a load.

EQUIPMENT:

- JT05685 Load Tester

CONNECTIONS:

[1] - Turn load knob (A) of tester counterclockwise to OFF.

[2] - Connect tester red cable (B) to battery positive post.

[3] - Connect tester black cable (C) to battery negative post.

PROCEDURE:

[1] - Make sure battery passes voltage and specific gravity tests before load testing (see “Battery Voltage and Specific Gravity Tests” in this Group).

[2] - Turn load knob of tester clockwise until amperage reading (D) is equal to:

1. Cold cranking amperage rating (blue scale).-OR-
2. Three times ampere hour rating (black scale).

[3] - Hold for 15 seconds, note voltage reading, and turn load knob of tester to off.

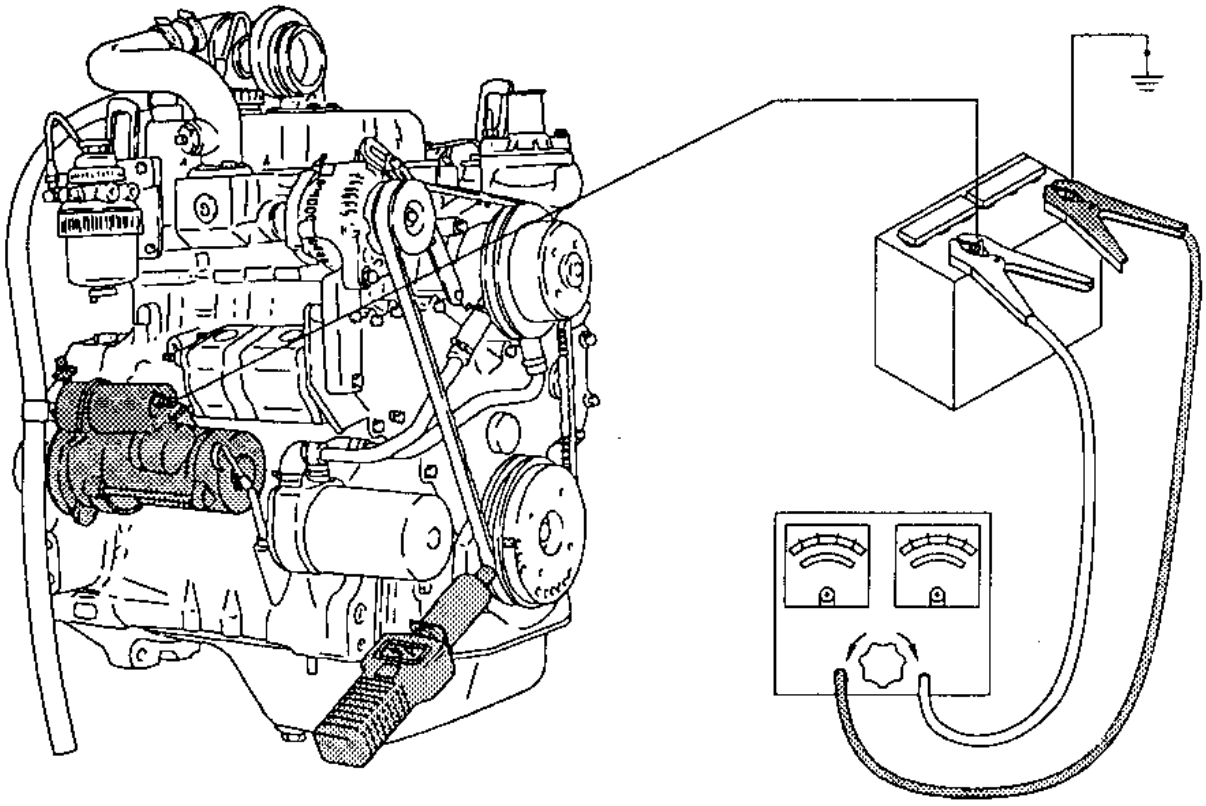
SPECIFICATION:

- Minimum battery voltage under load - 9.6 volts.

RESULTS:

- If the battery passes the test, battery is good.
- If the battery does not pass the test, replace battery.

Starting Motor Amp Draw/RPM Test



AT1201

Starting Motor Amp Draw/RPM Test

REASON:

To determine condition of starter.

EQUIPMENT:

- JT05685 Load Tester
- JT05719 Tachometer

CAUTION:

Disconnect fuel shutoff solenoid wiring to prevent engine from starting.

IMPORTANT:

Turn load knob fully counterclock- wise before making connections.

→NOTE:

Engine should be at normal operating temperature when performing this test.

CONNECTIONS:

1. Turn load knob fully counterclockwise.
2. Connect load tester red cable to positive (+) terminal on battery.
3. Connect load tester black cable to negative (-) terminal.

4. Disconnect fuel shut-off solenoid wire from pump.

PROCEDURE:

[1] - Check system ground connections. Be sure battery is fully charged.

[2] - Crank engine. Read and record voltage at meter.

[3] - Use tachometer to read and record cranking rpm.

[4] - Turn key switch OFF. Adjust load knob until battery voltage is the same as when engine is cranking. Read and record amperage on meter.

[5] - Turn load knob fully counterclockwise.

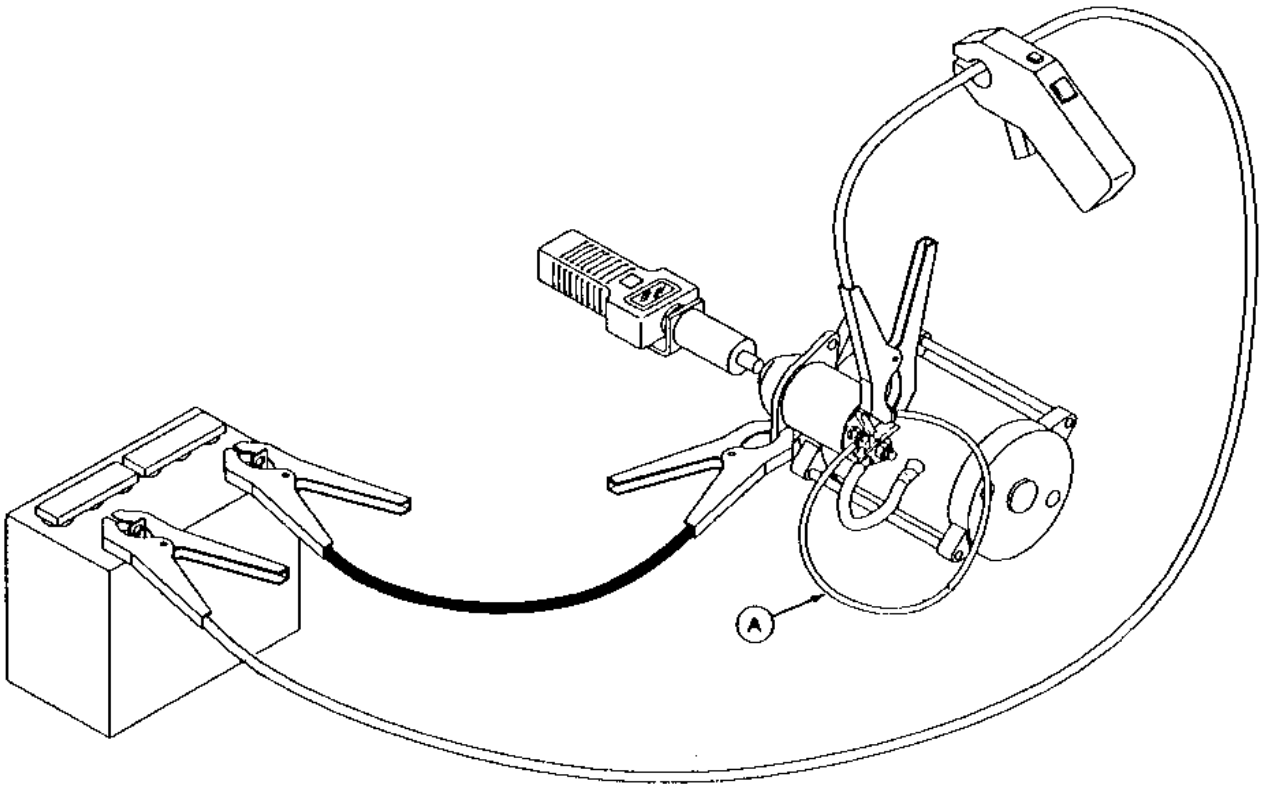
SPECIFICATION:

- Starter amp draw/rpm - 275 amps at 240 rpm.

RESULTS:

- If amp reading is not to specification, or to specification but rpm is low: remove starter and perform Starter No-Load Amp Draw RPM Test (see this Group).

Starting Motor No-Load Amp Draw/RPM Test



Starter No-Load Amp Draw/RPM Test

REASON:

To determine condition of starter.

EQUIPMENT:

- Current Gun
- JT05719 Tachometer

CONNECTIONS:

1. Disconnect battery negative (-) cable and remove starter from engine.

→NOTE: Check that battery is fully charged to ensure accuracy of test.

Connect positive (+) cable to positive (battery) terminal on starter.

3. Connect negative (-) cable to starter body.
4. Connect jumper cables to battery.
5. Attach current gun to positive cable.

PROCEDURE:

IMPORTANT:

Complete this test in 20 seconds or less to prevent starter damage.

[1] - Use jumper wire (A) to connect positive (+) starter terminal to solenoid terminal “S” briefly.

[2] - Read and record starter amperage and rpm.

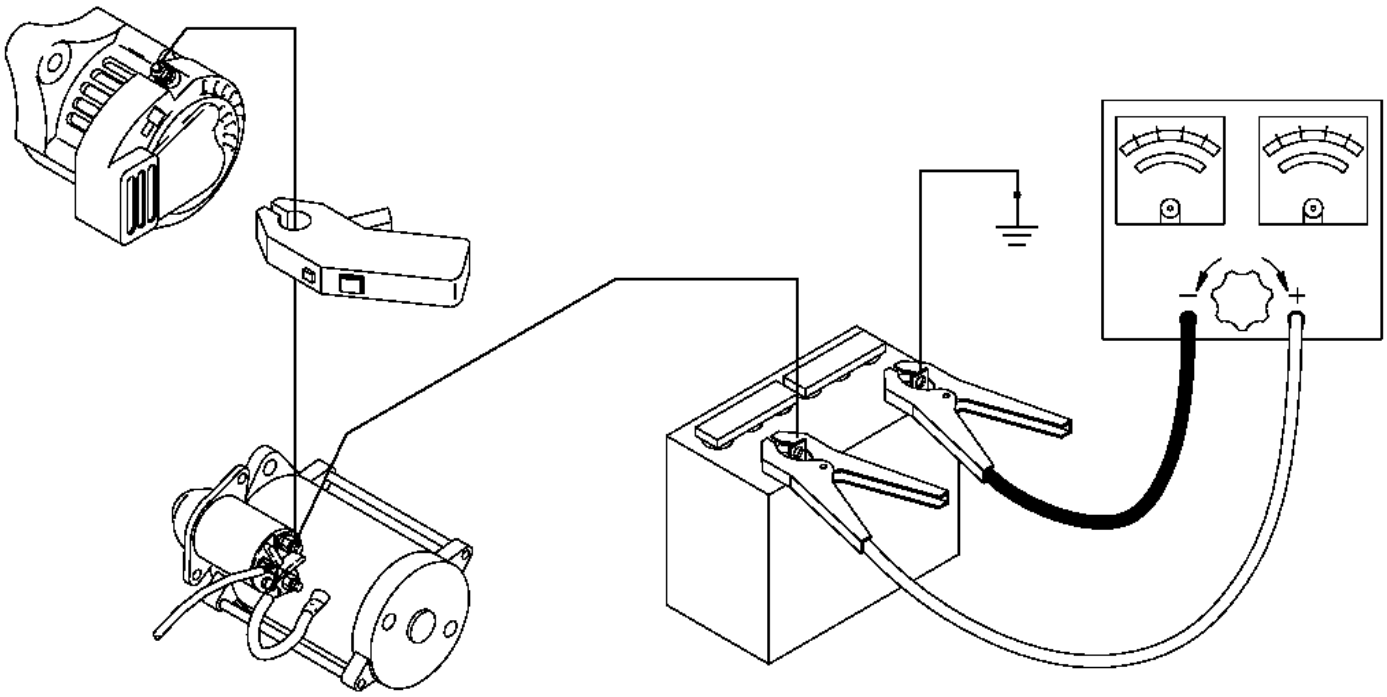
SPECIFICATION:

- Starter no-load draw maximum - 190 amp at 5600 rpm
- Starter no-load draw minimum - 135 amp at 3600 rpm

RESULTS:

If starter amps or rpm are not to specification, repair or replace starter.

Alternator/Regulator Test



Alternator/Regulator Test

REASON:

To determine condition of alternator/regulator.

EQUIPMENT:

- JT05685 Load Tester
- Current Gun

CONNECTIONS:

[1] - Gear shift lever in neutral position.

[2] - Be sure battery is fully charged and all accessories are off.

[3] - Turn load knob of battery tester off (fully counter-clockwise).

[4] - Connect red battery tester clamp to positive (+) post of battery.

[5] - Connect black battery tester clamp to negative (-) post of battery.

[6] - Put current gun over large red cable between alternator and starter.

PROCEDURE:

[1] - Start engine and run at 2400 rpm.

[2] -

IMPORTANT:

Perform this test as quickly as possible to prevent damage to the electrical system components.

Slowly turn load knob clockwise until current gun displays maximum current output. Record reading.

[3] -

IMPORTANT:

Load system only as necessary to obtain maximum current output. Do not reduce system voltage any lower than 11 volts.

Turn load knob off (fully counter-clockwise).

[4] - Let engine run and watch when current gun reading is 10 amps or less.

[5] - Read and record meter voltage.

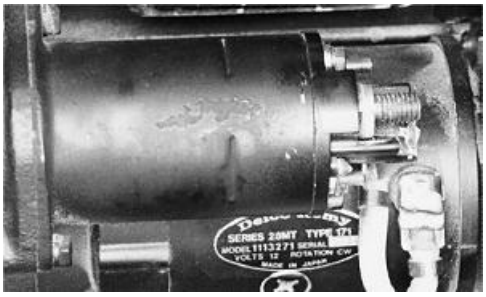
SPECIFICATIONS:

- Current output - Minimum 10 Amps at 2400 rpm.
- Regulated voltage - 14.2-14.8 V DC at 2400 rpm.

RESULTS:

If alternator current output or regulated voltage is not to specifications, replace alternator.

Starting Motor Solenoid Test



Starting Motor Solenoid Test

REASON:

To determine condition of starter solenoid.

PROCEDURE:

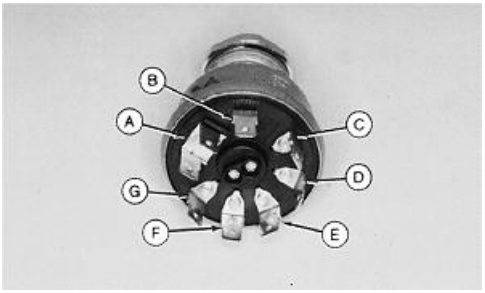
[1] - Test starting system to ensure voltage at solenoid (see procedure in this Group).

[2] - Turn key to start and listen that solenoid engages and stays engaged.

RESULTS:

If solenoid does not engage, chatter or click, check the ground cable near battery or replace solenoid.

Key Switch Test



LEGEND:

A	BAT Terminal (Battery)
B	GND Terminal (Not Used)
C	AID Terminal (Aid)
D	ST Terminal (Start)
E	IGN Terminal (Ignition)
F	ELX Terminal (Not Used)
G	ACC Terminal (Accessory)

Key Switch Test

REASON:

To check operation of key switch.

EQUIPMENT:

- Ohmmeter or continuity tester

PROCEDURE:

[1] - Disconnect key switch connector.

[2] - Use ohmmeter to check continuity between switch terminals (A) to (G) in OFF, RUN, START and AID positions:

Key Switch Continuity

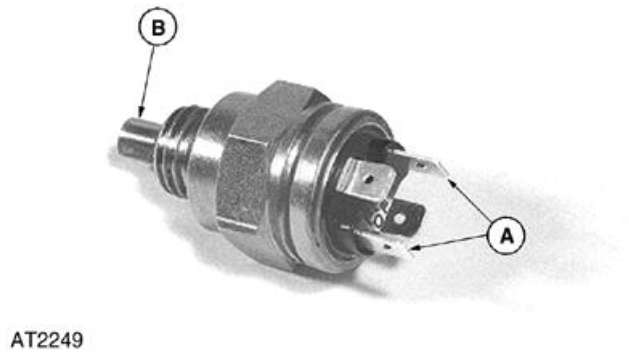
KEY SWITCH CONTINUITY

Switch Position	**Continuity between terminals**
OFF	None
RUN	BAT-IGN-ACC
START	BAT-ST-IGN
AID	BAT-AID

RESULTS:

- If continuity is not present between terminals listed for each switch position, replace key switch.
- If continuity exists between terminals not listed for each switch position, replace switch.

Parking Brake and Neutral Start Switch Test



AT2249

Neutral Start Switch Test

REASON:

To check operation of neutral start switch.

EQUIPMENT:

- Ohmmeter or continuity tester.

PROCEDURE:

→NOTE:

Test can be performed while switch is installed in transmission. Make sure shift lever is in neutral position or in park position and key switch is OFF. Plunger can be depressed by moving shift lever to a gear position.

[1] - Connect test leads to switch terminals (A).

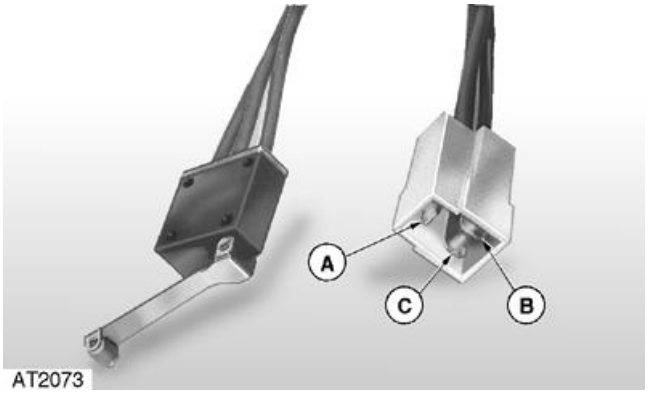
[2] - Check for continuity or closed switch.

[3] - Depress switch plunger (B) and check for no continuity or open switch.

RESULTS:

- If continuity is not correct, replace switch.
- If continuity is correct, check installation of switch or shifter linkage of transmission.

PTO and Brake Pedal Switch Test



AT2073

PTO and Brake Pedal Switches

REASON:

To check operation of PTO and brake pedal switches.

EQUIPMENT:

- Ohmmeter or continuity tester.

PROCEDURE:

[1] - Disconnect switch connector.

[2] -

→NOTE:

Brake pedal switch terminal C is used for 24/24 speed transmission only.

Check continuity between terminals A and B and terminals A and C with switch lever released and depressed.

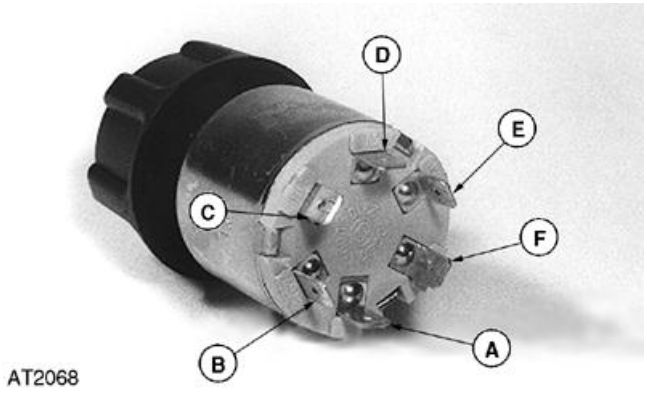
Terminals

Terminals	Switch Arm Position	
	Released	**Depressed**
A-B	Continuity	No Continuity
A-C	No Continuity	Continuity

RESULTS:

- If continuity is not correct replace switch.
- If continuity is correct, check for proper installation or bent switch arm.

Light Switch Test



LEGEND:
A 30 Terminal (Battery)
B 49a Terminal (Horn)
C 56b Terminal (Low Beam)
D 49 Terminal (Battery)
E 56a Terminal (High Beam)
F 57/58 Terminal (Parking)

Light Switch Test

REASON:

To check operation of light switch.

EQUIPMENT:

- Ohmmeter or continuity tester.

PROCEDURE:

[1] - Disconnect light switch connector.

[2] - Check continuity between terminals as shown in table. Move switch knob to indicated position when making checks.

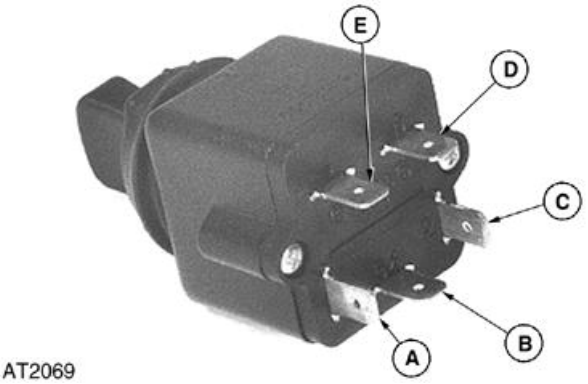
Switch Position

Switch Position	Terminals in Continuity
Off	None
Horn	B-D
1 (Parking)	A-F
2 (Low Beam)	A-F-C
3 (High Beam)	A-F-E

RESULTS:

- If continuity is not correct, replace switch.
- If continuity is correct, check for proper wire connections.

Turn Signal Controller Test



LEGEND:
A 1 Terminal (Right Turn)
B 54 Terminal (Flasher)
C 2 Terminal (Left Turn)
D B Terminal (Not Used)
E A Terminal (Not Used)

Turn Signal Controller Test

REASON:

To check operation of turn signal controller.

EQUIPMENT:

- Ohmmeter or continuity tester.

PROCEDURE:

[1] - Disconnect turn signal controller connector.

[2] - Check continuity between terminals as shown in table. Move switch knob to indicated position when making checks.

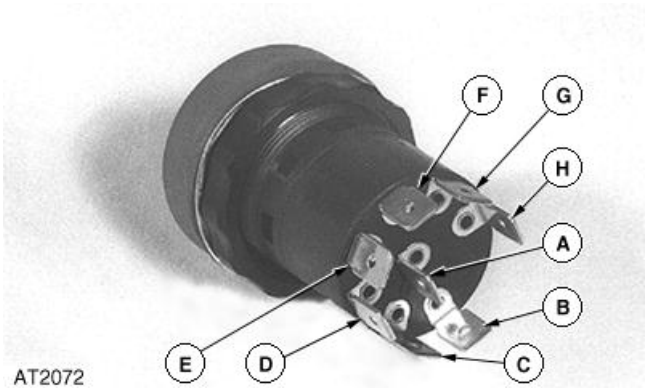
Switch Position

Switch Position	Terminals in Continuity
Off	None
Left Turn	B-C
Right Turn	B-A

RESULTS:

- If continuity is not correct, replace switch.
- If continuity is correct, check for proper wire connections.

Hazard Warning Light Switch Test



LEGEND:

A	31 Terminal (Ground)
B	49a Terminal (Flasher)
C	49 Terminal (Flasher)
D	30b Terminal (Flasher)
E	R Terminal (Left Warning Light)
F	30 Terminal (Battery)
G	15 Terminal (Battery)
H	L Terminal (Right Warning Light)

Hazard Warning Light Switch

REASON:

To check operation of hazard warning light switch

EQUIPMENT:

- Ohmmeter or continuity tester.

PROCEDURE:

[1] - Disconnect light switch connector.

[2] - Check continuity between terminals as shown in table with switch button released and depressed.

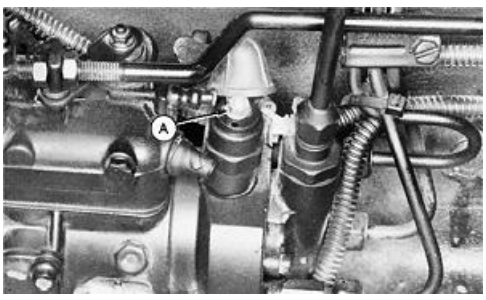
Terminals

Terminals	Switch Button Position	
	Released	**Depressed**
C-G	No Continuity	Continuity
D-F	Continuity	No Continuity
B-E-H	Continuity	No Continuity

RESULTS:

- If continuity is not correct, replace switch.
- If continuity is correct, check for proper wire connections.

Fuel Shut-Off Solenoid Valve Test



Fuel Shut-Off Solenoid Valve Test

REASON:

To check operation of fuel shut-off solenoid.

EQUIPMENT:

- Jumper wire

PROCEDURE:

[1] - Turn key switch off.

[2] - Connect jumper wire to battery positive (+) terminal.

[3] - Touch jumper wire to shut-off solenoid terminal (A). Listen for solenoid “click”.

[4] - Remove jumper wire from shut-off solenoid terminal. Listen for solenoid to “click” again.

RESULTS:

- If solenoid does not “click”, replace fuel shut-off solenoid.

Group 20 - Wiring Diagrams - 5300, 5400 and 5500 Tractors

Legend for 5300, 5400 and 5500 Tractors Wiring Diagram

DEFINITIONS:

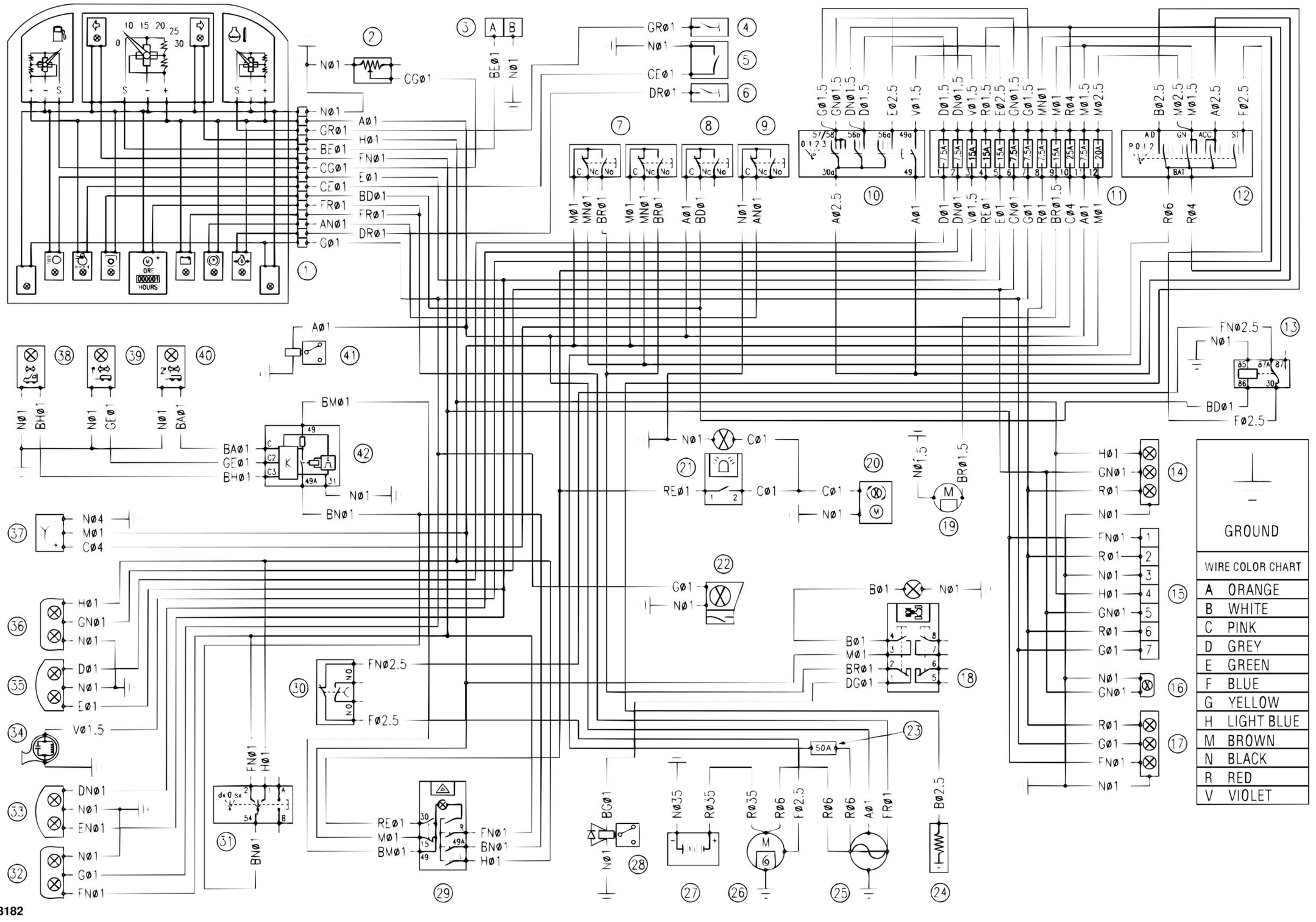
1	Instrument Panel Connector
2	Fuel Level Sender
3	Engine Speed Sensor Connector
4	Coolant Temperature Sender
5	Air Filter Restriction Switch
6	Engine Oil Pressure Switch
7	Stop Light Switch
8	Rear PTO Switch
9	Parking Brake Switch
10	Light Switch
11	Fuse Box
12	Key Switch
13	Neutral Start Switch
14	Right Rear Light
15	Seven Pin Trailer Connector
16	License Plate Light
17	Left Rear Light
18	MFWD Switch
19	Seat Air Compressor
20	Beacon Light
21	Beacon Light Switch
22	Rear Work Light
23	Main Fuse (50 amp)
24	Manifold Heater
25	Alternator/Regulator
26	Starter
27	Battery
28	MFWD Solenoid Valve
29	Hazard Warning Light Switch
30	Rear PTO Relay
31	Turn Signal Controller
32	Left Front Light
33	Left Headlight
34	Horn
35	Right Headlight
36	Right Front Light
37	Three Pin Connector
38	Tractor Turn Light Indicator
39	First Trailer Turn Light Indicator
40	Second Trailer Turn Light Indicator
41	Fuel Shut-off Solenoid
42	Turn Signal Flasher

ABBREVIATIONS OF WIRE COLORS IN WIRING DIAGRAM OPPOSITE

DEFINITIONS:

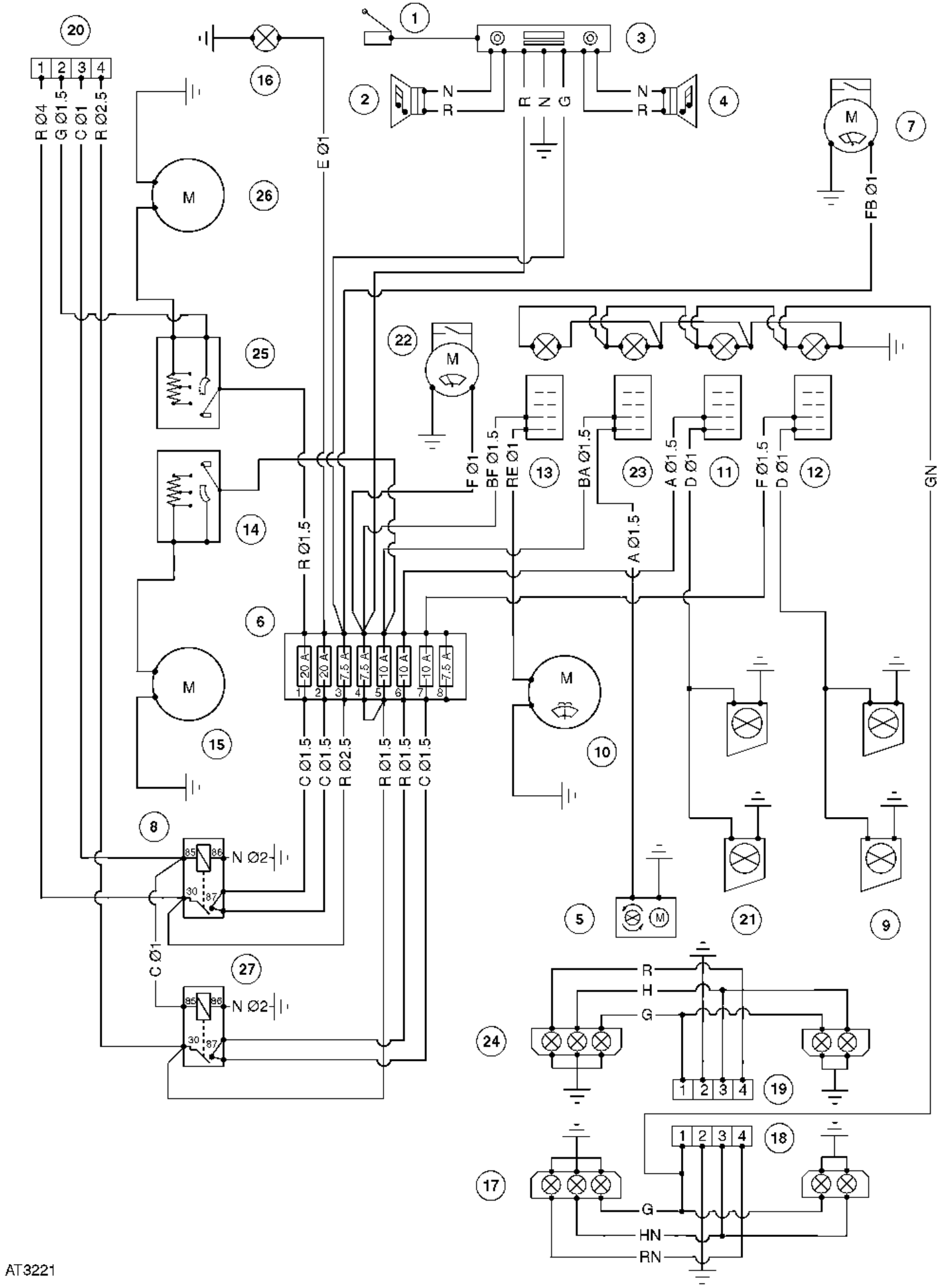
A	orange
B	white
C	pink
D	grey
E	green
F	blue
G	yellow
H	light blue
M	brown
N	black
R	red
V	violet

Wiring Diagram for 5300, 5400 and 5500 Tractors



Wiring Diagram for 5300, 5400 and 5500 Tractors

Wiring Diagram for 5300, 5400 and 5500 Cab Tractors



Wiring Diagram for 5300, 5400 and 5500 Cab Tractors

LEGEND:

1	Aerial Wire (antenna)
2	Left Loudspeaker
3	Radio
4	Right Loudspeaker
5	Beacon Light
6	Fuse Box
7	Rear Wiper Motor
8	Blower Relay
9	Rear Work Light
10	Front/rear Washer Motor
11	Front Work Light Switch
12	Rear Work Light Switch
13	Front Wiper Switch
14	Blower Switch
15	Blower Motor
16	Dome Light
17	Front/Rear Light, Left
18	Left Light Pin Connector
19	Right Light Pin Connector
20	4-Pin Power Connector
21	Front Work Light
22	Front Wiper Motor
23	Beacon Light Switch
24	Front/Rear Light, Right
25	Air Conditioning Switch
26	Air Conditioning Compressor
27	Work Light Relay

ABBREVIATIONS OF WIRE COLORS IN WIRING DIAGRAM OPPOSITE

DEFINITIONS:

A	orange
B	white
C	pink
D	grey
E	green
F	blue
G	yellow
H	light blue
M	brown
N	black
R	red
V	violet

Section 250 - POWER TRAIN - OPERATION AND TESTS

Table of contents

Group 05 - Component Location

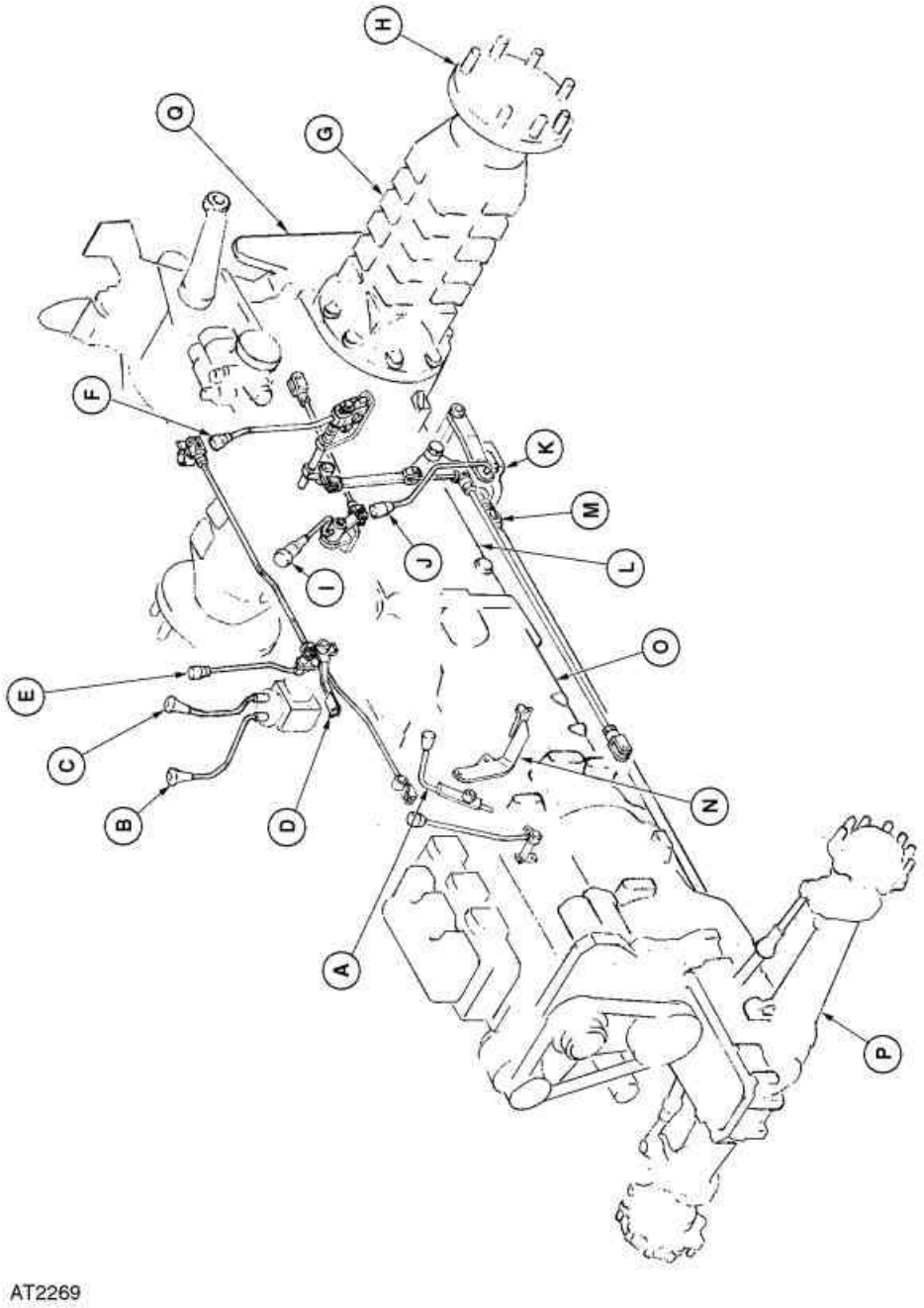
Component Location Information

This group contains component location drawings for the following components:

- Clutch
- Transmission
- Final Drives
- Rear PTO

Use the drawings when diagnosing a power train problem and to help locate the components to be tested.

Power Train Components



AT2269

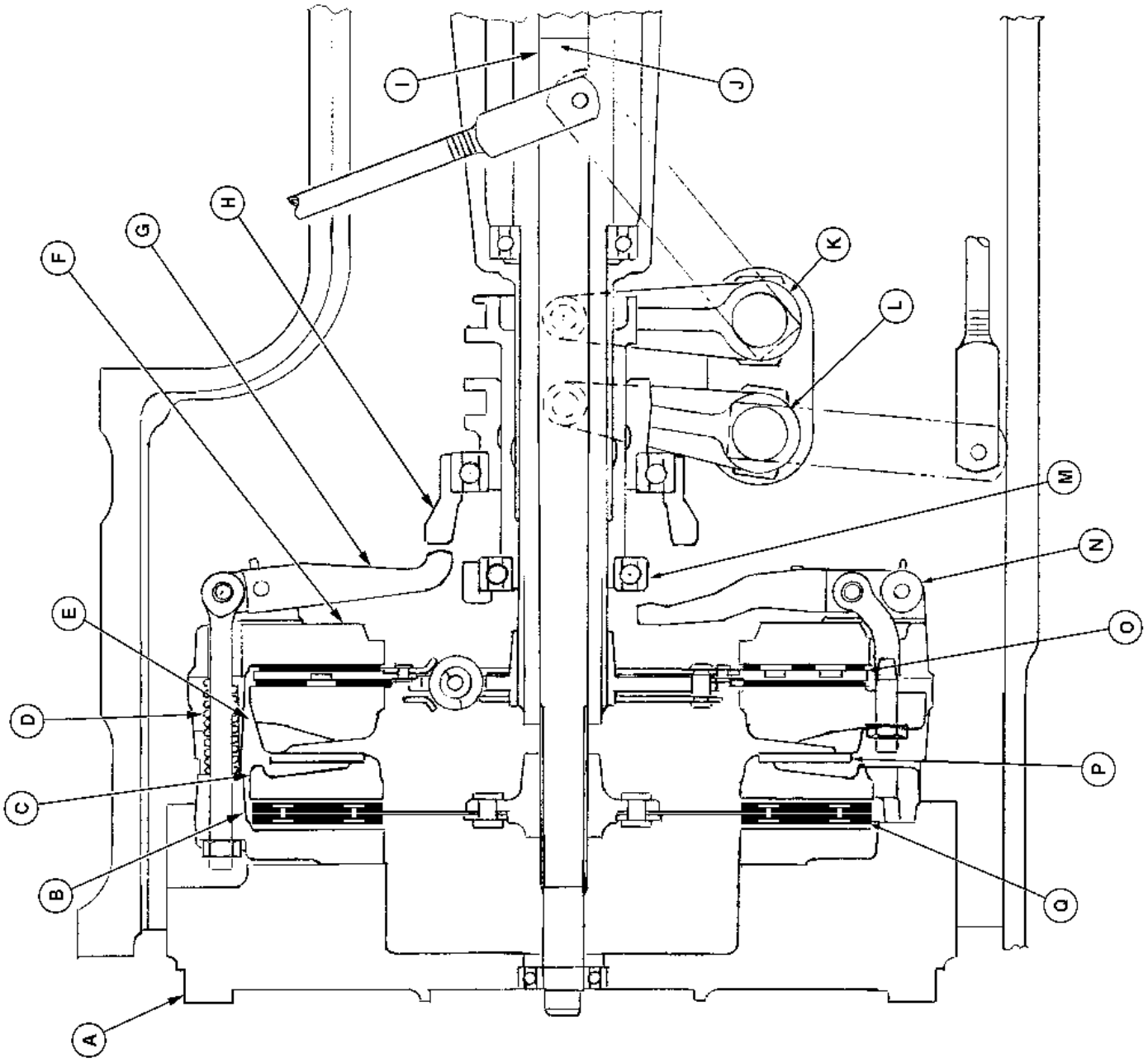
Power Train Components

LEGEND:

A	Forward/Neutral/Reverse Lever
B	Gear Shift Lever
C	Range Shift Lever
D	Differential Lock Pedal
E	High-Low Lever
F	PTO Clutch Lever
G	Final Drive Housing

H	Axle
I	PTO Selective Lever
J	MFWD Lever
K	MFWD Drop Gear Box
L	Transmission
M	Drive Shaft (MFWD)
N	Clutch Pedal
O	Clutch Housing
P	MFWD Axle
Q	PTO Shift Lever
R	Hand Throttle
S	Foot Throttle

Traction and PTO Clutch Components



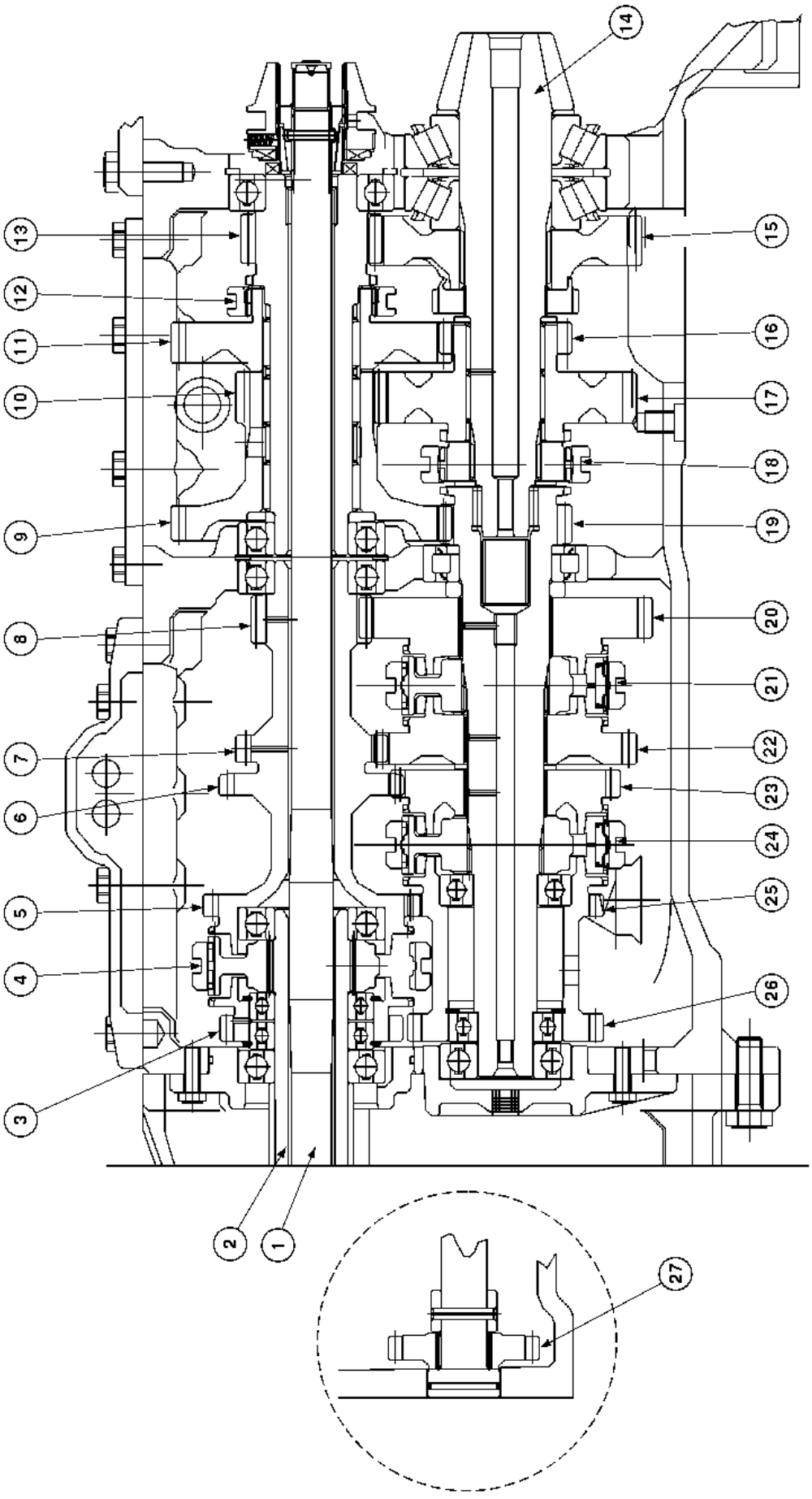
Traction and PTO Clutch Components

LEGEND:

A	Flywheel

B	PTO Clutch Front Pressure Plate
C	PTO Clutch Rear Pressure Plate
D	PTO Clutch Coil Spring
E	Traction Clutch Front Pressure Plate
F	Traction Clutch Rear Pressure Plate
G	PTO Clutch Release Lever
H	PTO Clutch Release Bearing
I	Traction Clutch Shaft
J	PTO Clutch Shaft
K	Traction Clutch Armshaft
L	PTO Clutch Armshaft
M	Traction Clutch Release Bearing
N	Traction Clutch Release Lever
O	Traction Clutch Disk
P	Spring Washer
Q	PTO Clutch Disk

Transmission Components - 12/12 Speed Transmission



AT2273

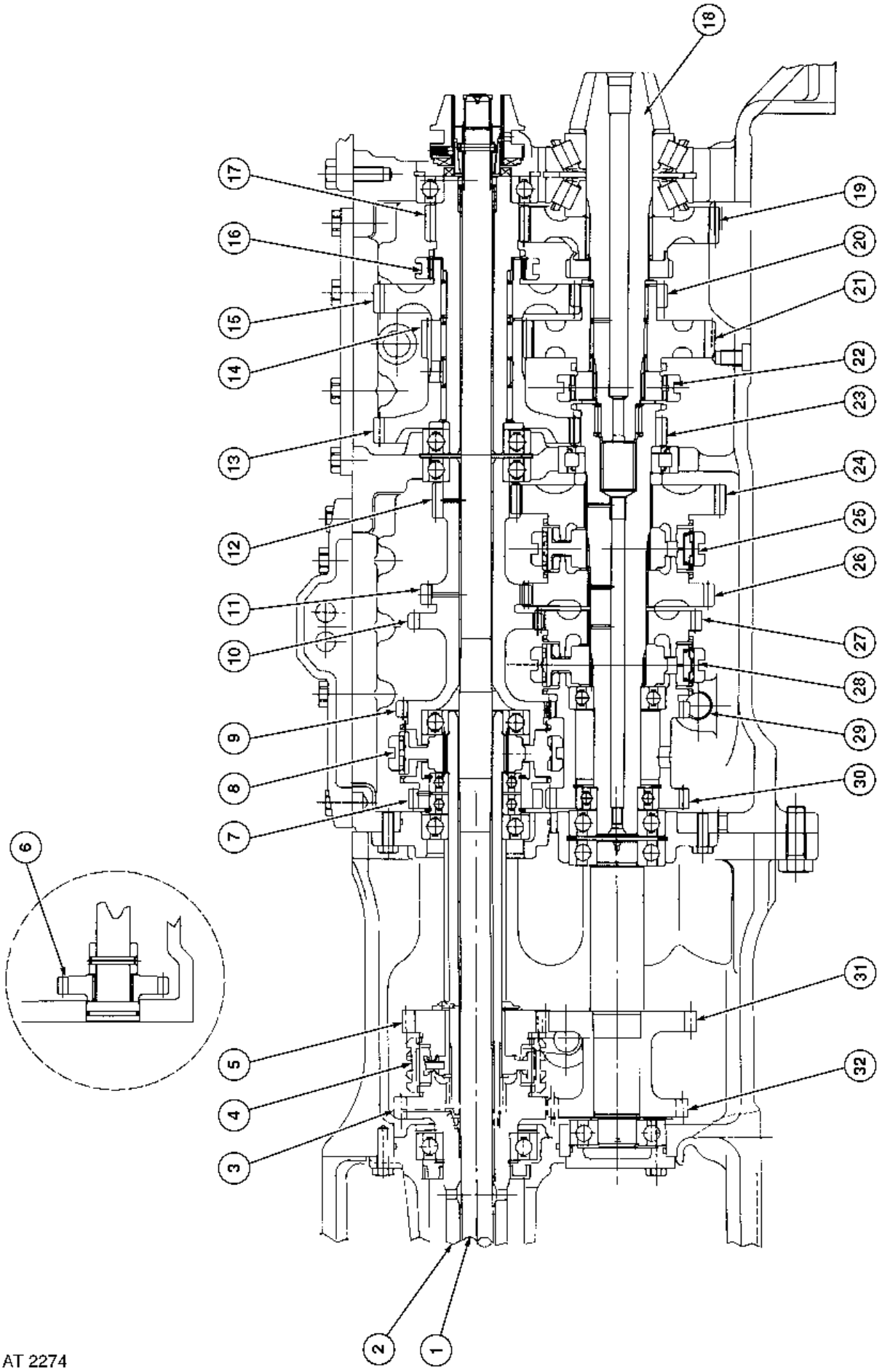
12/12 Speed Transmission

LEGEND:

1 PTO Shaft

2	Traction Clutch Shaft
3	Reverse Drive Gear
4	Forward and Reverse Gear Syncronizer
5	4th Speed Drive Gear
6	3rd Speed Drive Gear
7	2nd Speed Drive Gear
8	1st Speed Drive Gear
9	Range Reduction Driven Gear
10	2nd Range Drive Gear
11	1st Range Reduction Driven Gear
12	1st Range Shift Collar
13	1st Range Drive Gear
14	Differential Drive Shaft
15	1st Range Drive Gear
16	1st Range Reduction Drive Gear
17	2nd Range Driven Gear
18	2nd and 3rd Range Shift Collar
19	Range Reduction Drive Gear
20	1st Speed Driven Gear
21	1st and 2nd Gear Syncronizer
22	2nd Speed Driven Gear
23	3rd Speed Driven Gear
24	3rd and 4th Gear Syncronizer
25	4th Speed Driven Gear
26	Reverse Driven Gear
27	Reverse Idler Gear

Transmission Components - 24/24 Speed Transmission

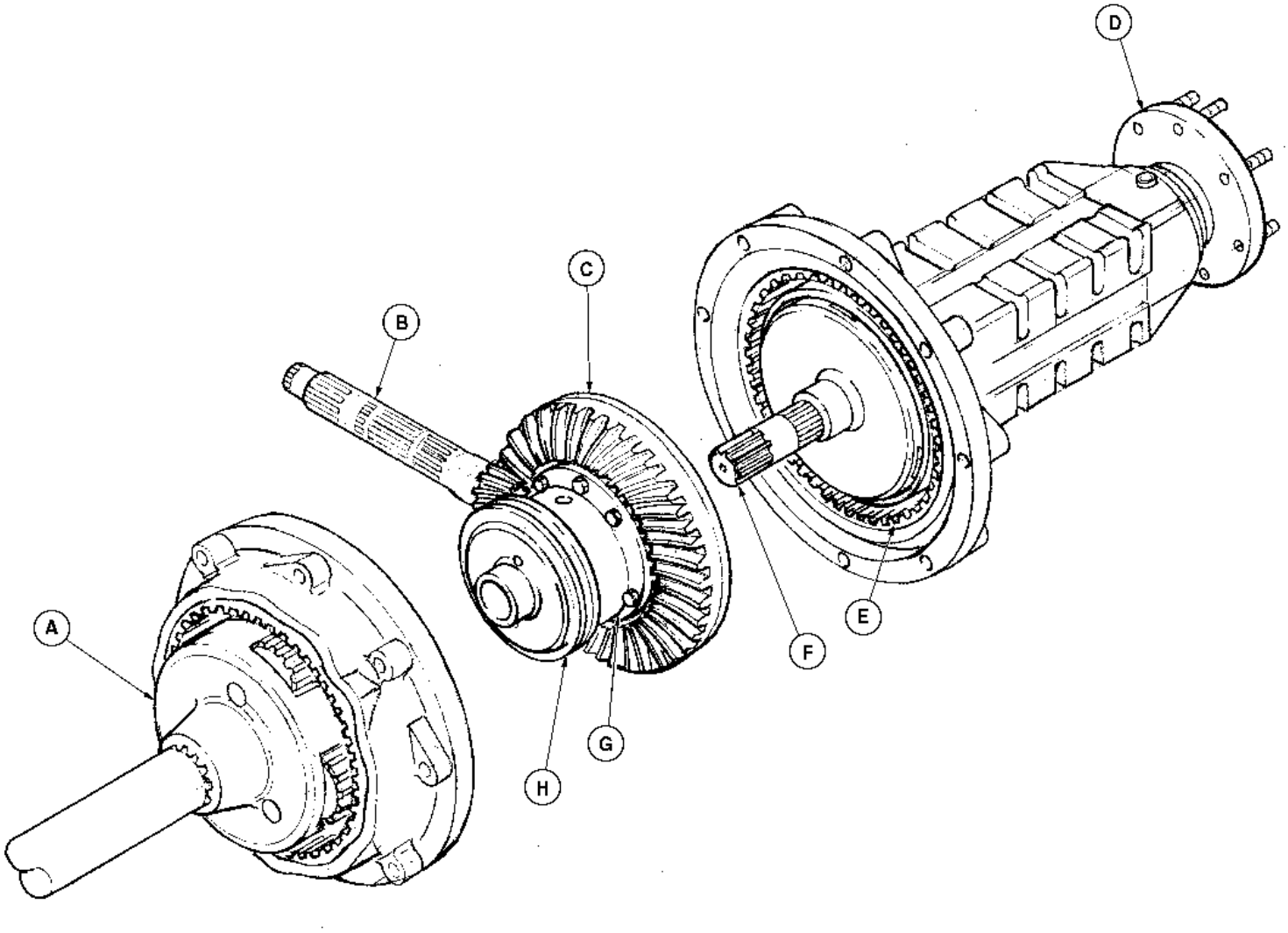


24/24 Speed Transmission

LEGEND:

1	PTO Shaft
2	Traction Clutch Shaft
3	Hi-Lo Drive Gear
4	Hi-Lo Syncronizer
5	Hi-Lo Driven Reduction Gear
6	Reverse Idler Gear
7	Reverse Drive Gear
8	Forward and Reverse Gear Syncronizer
9	4th Speed Drive Gear
10	3rd Speed Drive Gear
11	2nd Speed Drive Gear
12	1st Speed Drive Gear
13	Range Reduction Drive Gear
14	2nd Range Drive Gear
15	1st Range Reduction Driven Gear
16	1st Range Shift Collar
17	1st Range Drive Gear
18	Differential Drive Shaft
19	1st Range Drive Gear
20	1st Range Reduction Drive Gear
21	2nd Range Driven Gear
22	2nd and 3rd Range Shift Collar
23	Range Reduction Drive Gear
24	1st Speed Driven Gear
25	1st and 2nd Gear Syncronizer
26	2nd Speed Driven Gear
27	3rd Speed Driven Gear
28	3rd and 4th Gear Syncronizer
29	4th Speed Driven Gear
30	Reverse Driven Gear
31	Hi-Lo Drive Reduction Gear
32	Hi-Lo Driven Gear

Final Drive Components



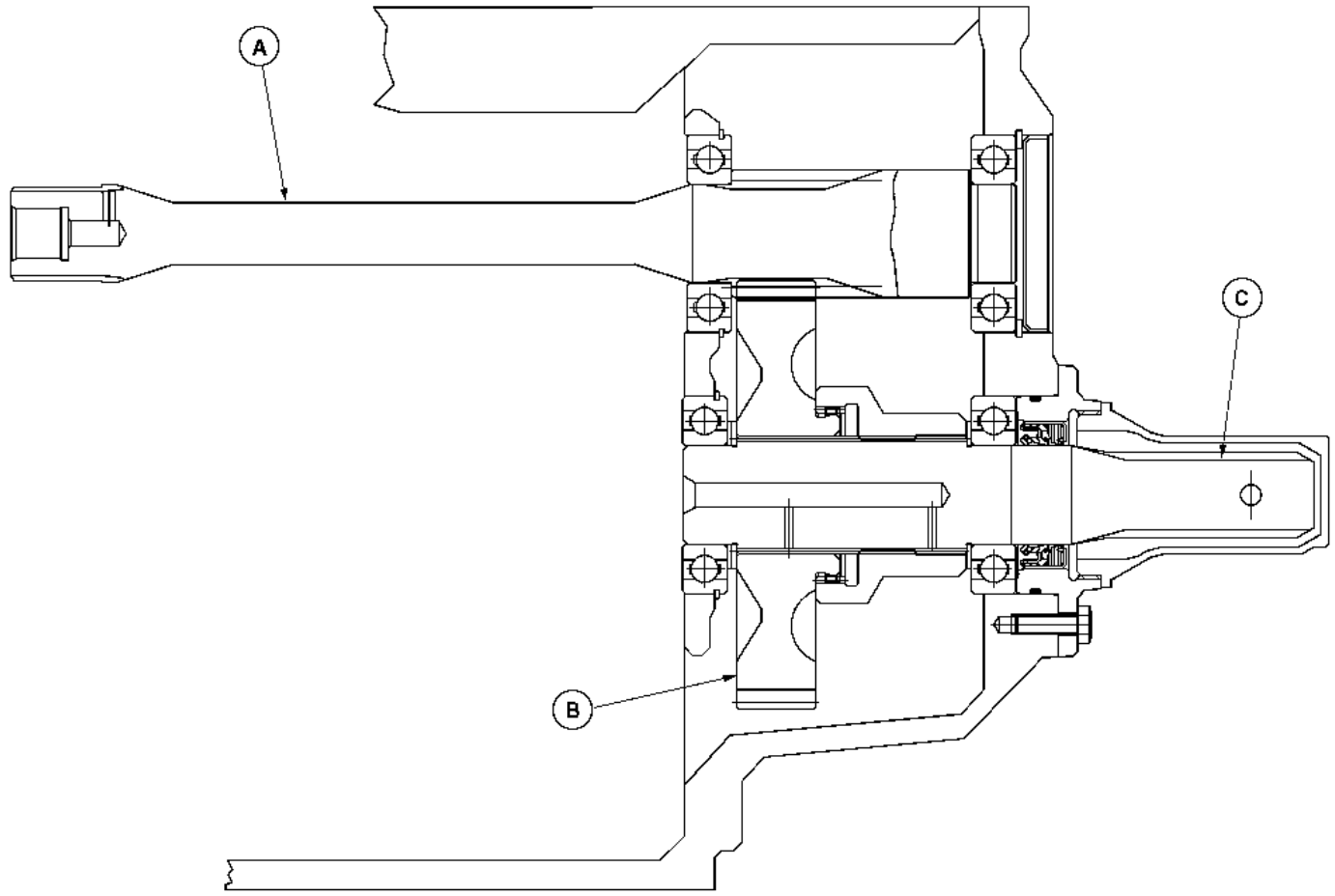
AT2275

Final Drive Components

LEGEND:

A	Planetary Carrier Assembly
B	Differential Drive Shaft
C	Differential Ring Gear
D	Axle Shaft
E	Final Drive Ring Gear
F	Final Drive Pinion Shaft
G	Differential Carrier
H	Differential Lock Collar

Rear PTO Components - 540 RPM



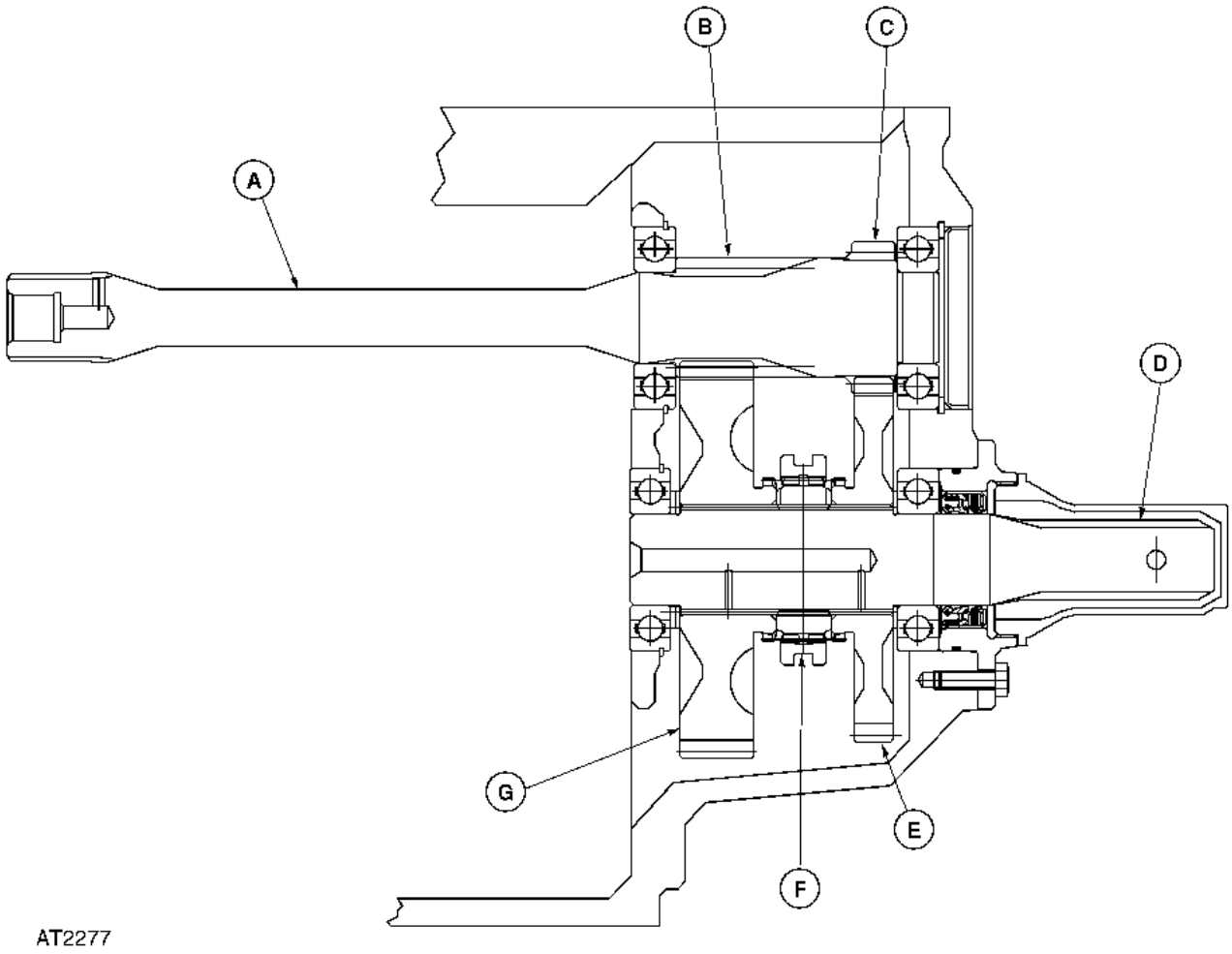
AT2276

Rear PTO Components-540 RPM

LEGEND:

A	PTO Pinion Shaft
B	PTO Driven Gear
C	PTO Output Shaft

Rear PTO Components - 540/540E and 540/1000 RPM



Rear PTO Components-540/540E and 540/1000 RPM

LEGEND:

A	PTO Pinion Shaft
B	540 RPM Drive Gear
C	540E RPM Drive Gear
D	PTO Output Shaft
E	540E RPM Driven Gear
F	540 and 540E RPM Shift Collar
G	540 RPM Driven Gear

Group 10 - Theory of Operation

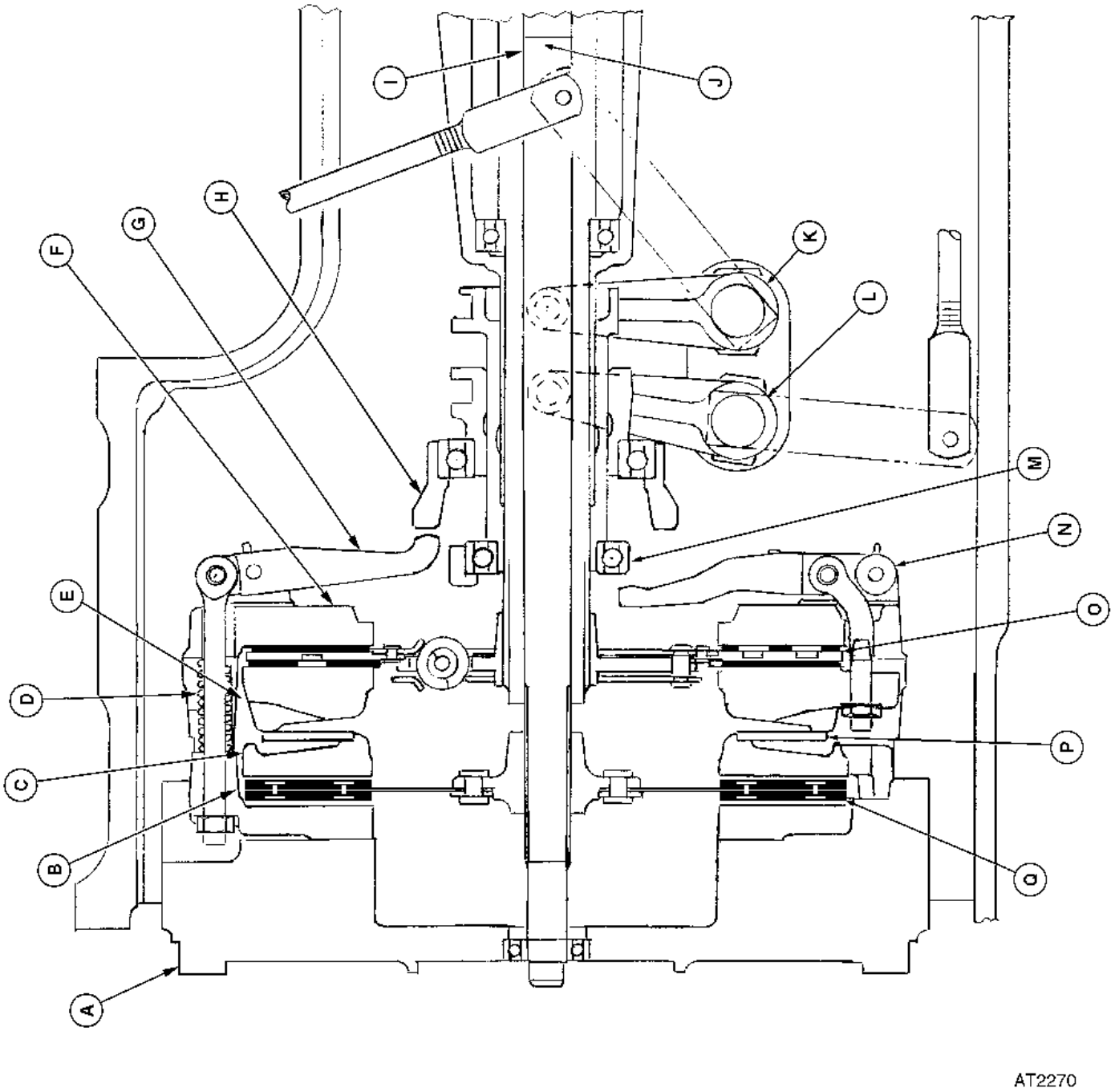
Theory of Operation Information

This group divides the power train into individual components or systems by function. The story contains information on function, component or system identification and theory of operation.

The following systems or components are covered:

- Clutch Operation
  - Traction Clutch Engaged/PTO Clutch Disengaged
  - Traction Clutch Engaged/PTO Clutch Engaged
  - Traction Clutch Disengaged/PTO Clutch Engaged
- Transmission
  - Gear Shift Power Flow
  - Range Shift Power Flow
- Differential Power Flow
- Differential Lock Operation
- Final Drive Operation
- Rear PTO Operation
- Mechanical Front Wheel Drive Operation

Clutch Operation - Traction Clutch Engaged and PTO Clutch Disengaged



Traction Clutch Engaged/PTO Clutch Disengaged

LEGEND:

A	Flywheel

B	PTO Clutch Front Pressure Plate
C	PTO Clutch Rear Pressure Plate
D	PTO Clutch Coil Spring
E	Traction Clutch Front Pressure Plate
F	Traction Clutch Rear Pressure Plate
G	PTO Clutch Release Lever
H	PTO Clutch Release Bearing
I	Traction Clutch Shaft
J	PTO Clutch Shaft
K	Traction Clutch Armshaft
L	PTO Clutch Armshaft
M	Traction Clutch Release Bearing
N	Traction Clutch Release Lever
O	Traction Clutch Disk
P	Spring Washer
Q	PTO Clutch Disk

FUNCTION:

Dry disk clutches provide a positive means of mechanically engaging and disengaging power flow between the engine and the transmission and PTO.

MAJOR COMPONENTS:

- Pressure Plates
- Clutch Disks
- Clutch Release Levers
- Clutch Release Bearings
- Armshafts
- Spring Washer
- Traction Clutch Shaft
- PTO Clutch Shaft

THEORY OF OPERATION:

The clutch assembly is attached to the rear of the engine flywheel (A). The traction (M) and the PTO (H) clutch release bearing mechanisms are operated independently of each other by means of armshafts (K and L). Linkage rods connect the armshafts to the traction clutch pedal and the PTO clutch lever.

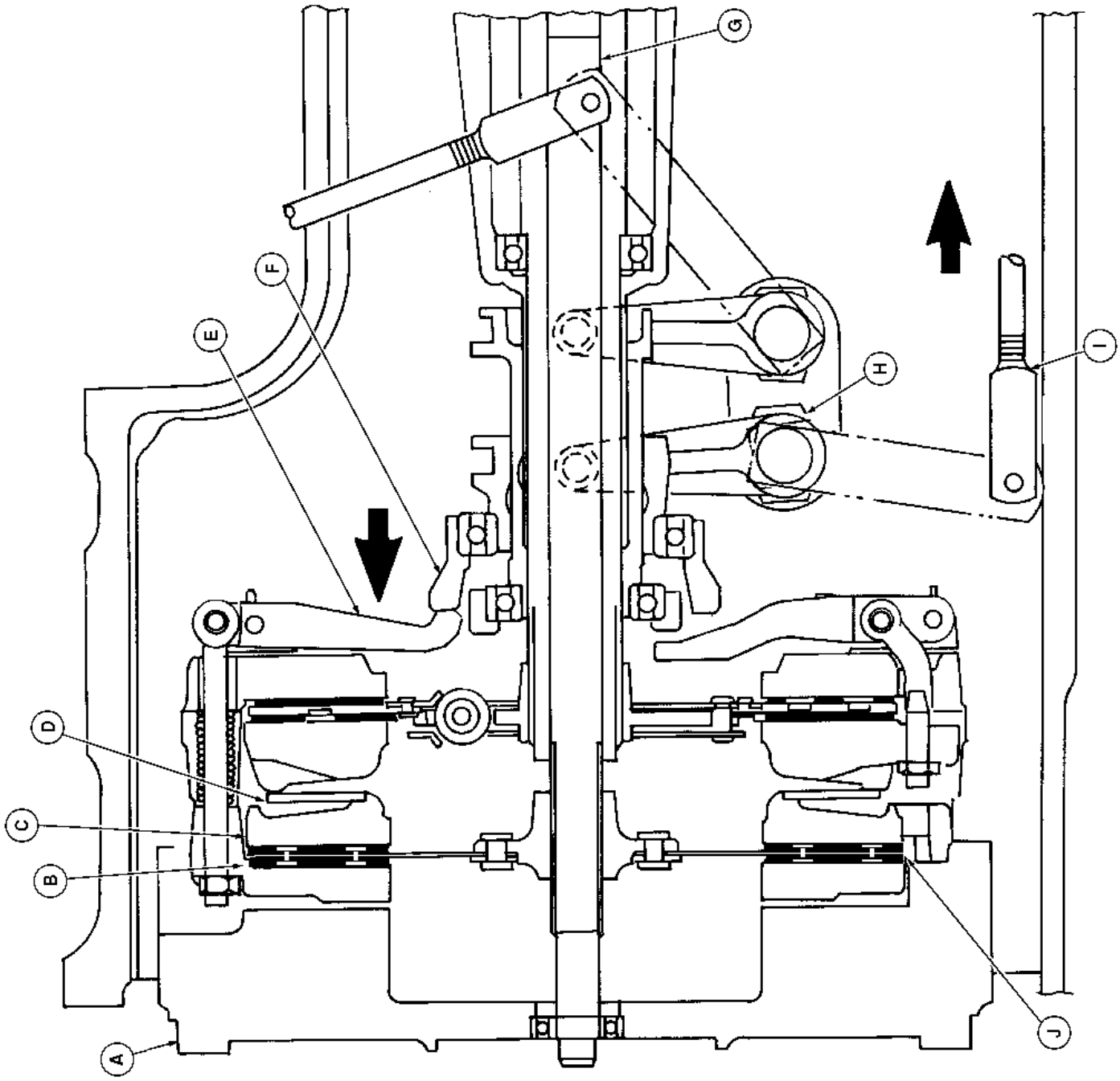
Traction Clutch Engaged

When the traction clutch is engaged (clutch pedal released), spring washer (P) forces pressure plate (E) against traction clutch disk (O), causing the clutch disk to rotate with the flywheel. Because the traction clutch disk is splined to the traction clutch shaft (I), power is transmitted from the traction clutch disk to the traction clutch shaft.

PTO Clutch Disengaged

When the PTO clutch is disengaged (PTO lever released) pressure plate (B) is forced forward by coil springs (D), removing contact between the pressure plate and PTO clutch disk (Q). In this mode, no power will be transmitted from the flywheel to the PTO clutch shaft (J), because the PTO clutch disk does not rotate with flywheel (A).

Clutch Operation - Traction and PTO Clutch Engaged



AT 2278

Traction and PTO Clutch Engaged

LEGEND:

A	Flywheel

B	PTO Clutch Front Pressure Plate
C	PTO Clutch Rear Pressure Plate
D	Spring Washer
E	PTO Clutch Release Finger
F	PTO Clutch Release Bearing
G	PTO Clutch Shaft
H	PTO Clutch Armshaft
I	PTO Lever Linkage
J	PTO Clutch Disk

PTO Clutch Engaged

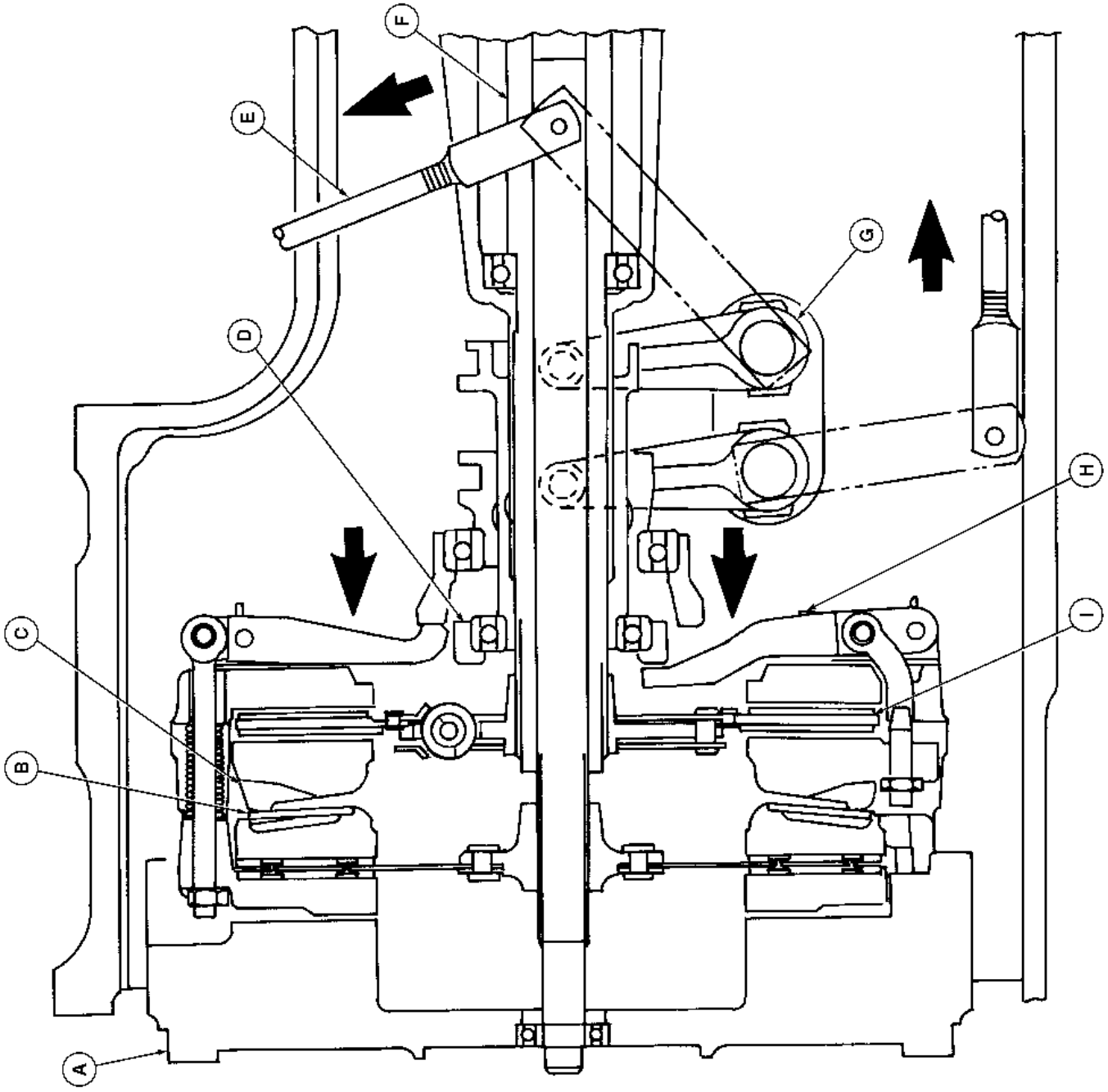
Pushing the PTO clutch lever forward moves linkage (I) rearward, causing PTO clutch armshaft (H) to rotate and force PTO clutch release bearing (F) against PTO clutch release fingers (E). The clutch release bearing depress the release fingers, causing PTO clutch pressure plate (B) to move rearward. Pressure plate (B) is forced against PTO clutch disk (J), clamping the PTO clutch disk between pressure plate (B) and rear plate (C).

This causes the PTO clutch disk to rotate with the flywheel. Because the PTO clutch disk is splined to the PTO clutch shaft (G), power is transmitted from the PTO clutch disk to the PTO clutch shaft and on to the rear PTO shaft.

Traction Clutch Engaged

The traction clutch power transmittal is uninterrupted by the PTO clutch engagement.

Clutch Operation - Traction Clutch Disengaged and PTO Clutch Engaged



AT2279

Traction Clutch Disengaged/PTO Clutch Engaged

LEGEND:

A	Flywheel

B	Spring Washer
C	Traction Clutch Pressure Plate
D	Traction Clutch Release Bearing
E	Clutch Pedal Linkage
F	Traction Clutch Shaft
G	Traction Clutch Armshaft
H	Traction Clutch Release finger
I	Traction Clutch Disk

Traction Clutch Disengaged

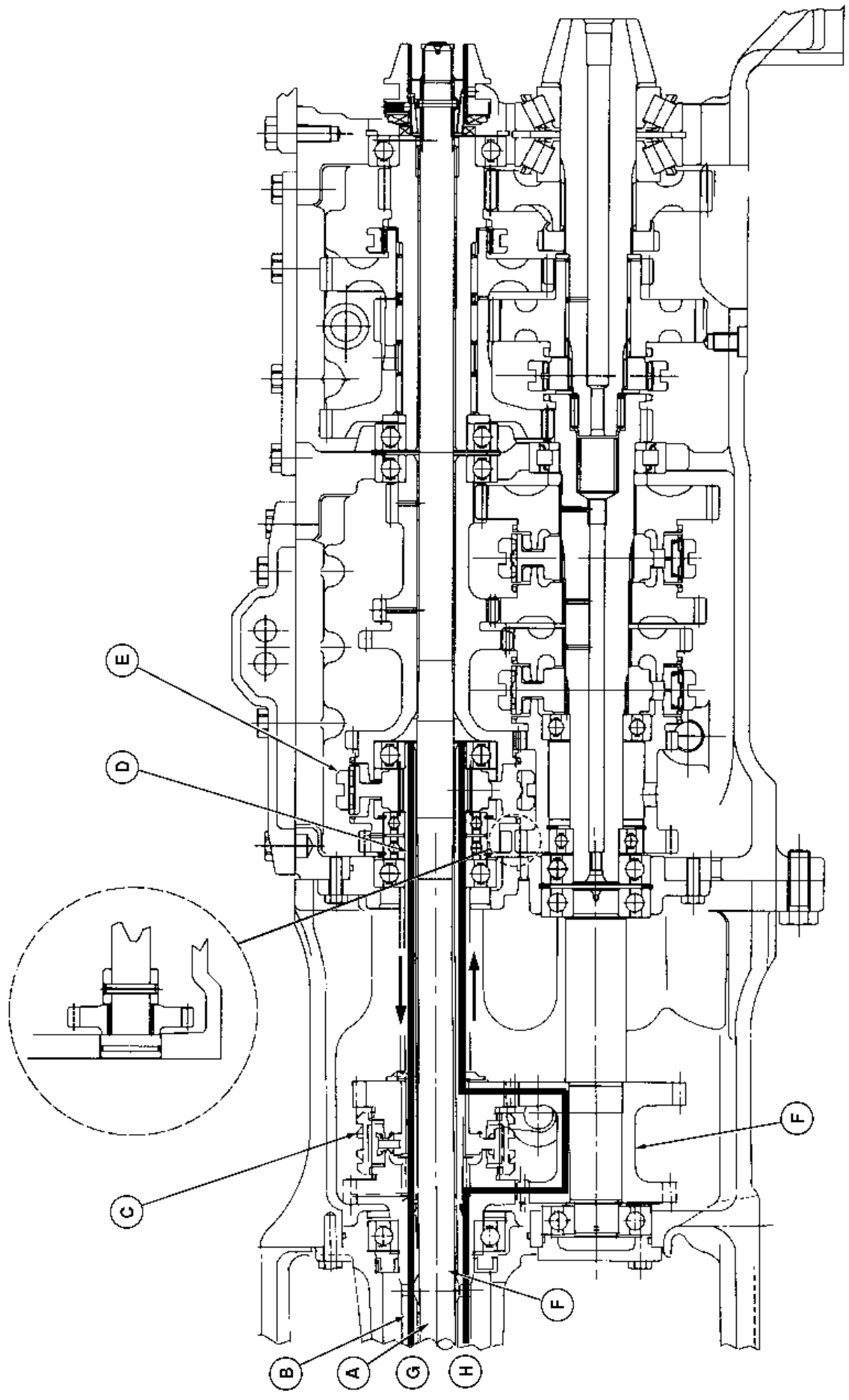
Depressing the clutch pedal moves clutch pedal linkage (E) upward, causing the traction clutch armshaft (G) to rotate and force traction clutch release bearing (D) against traction clutch release fingers (H). The clutch release bearing depress the release fingers, causing traction clutch pressure plate (C) to move rearward against spring washer (B), compressing the spring washer.

Since pressure plate (C) is no longer held against traction clutch disk (I) by the clamping force of spring washer (B), the traction clutch disk is no longer forced to turn with flywheel (A). The traction clutch shaft (F) stops turning.

PTO Clutch Engaged

The PTO clutch power transmittal is uninterrupted by the traction clutch disengagement.

Transmission Power Flow - High-Low Splitter



AT2280

Transmission Power Flow

LEGEND:

A	PTO Clutch Shaft
B	Traction Clutch Shaft
C	High-Low Syncronizer
D	Transmission Shaft
E	Forward - Reverse Syncronizer Hub
F	High-Low Idler
G	Low Gear, Power Flow
H	High Gear, Power Flow

FUNCTION:

Provides a 30% speed improvement for each single gear thus doubling gear number from 12 to 24.

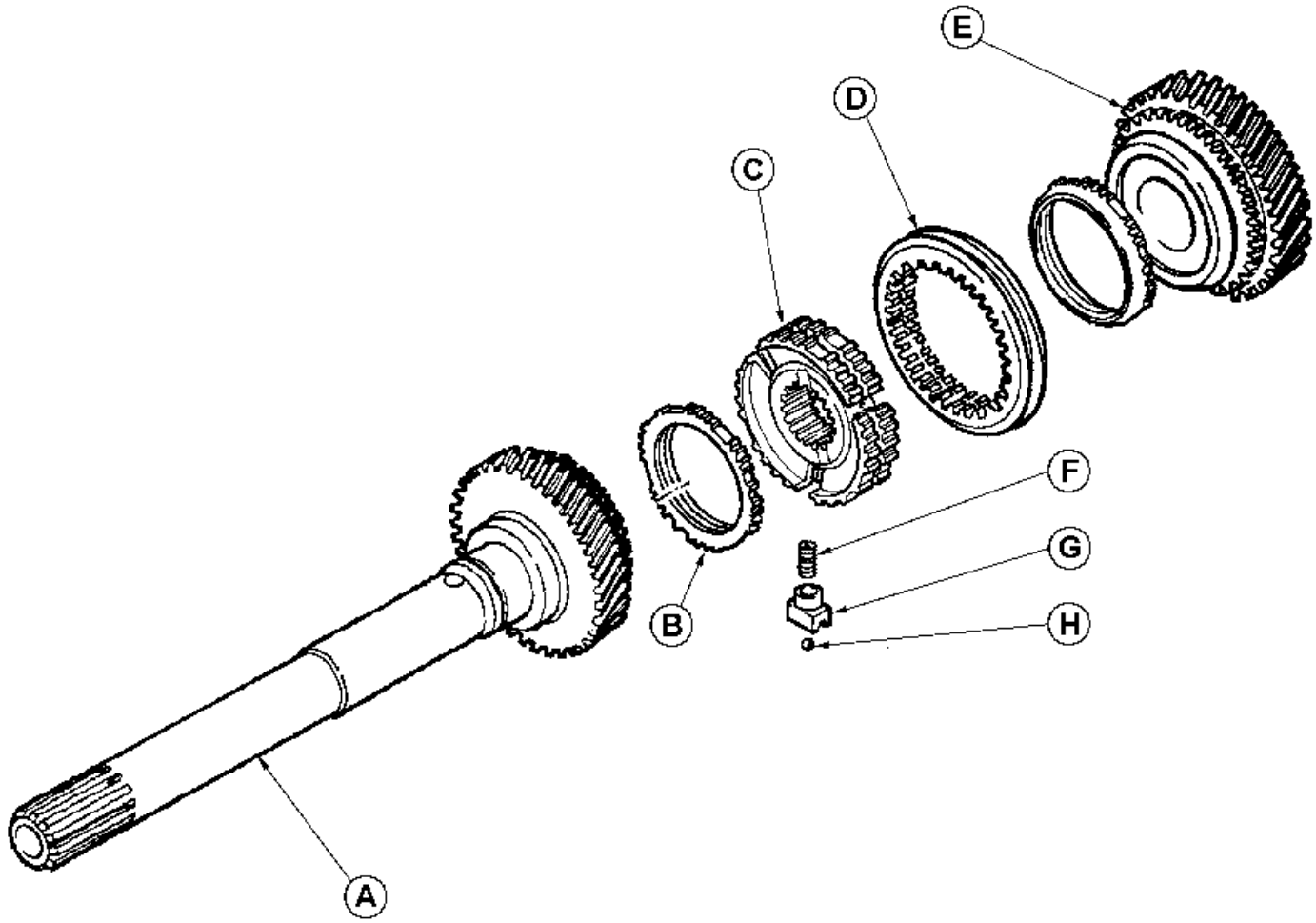
MAJOR COMPONENTS:

- Traction Clutch Shaft
- Transmission Shaft
- High-Low Synchronizer
- High-Low Idler

THEORY OF OPERATION:

High-low splitter gears are constantly in mesh. High-low synchronizer (C) equalizes shaft (B) and (D) speeds before sleeve engaging. Power shall then flow to transmission through forward-reverse synchronizer hub (E).

Transmission Synchronizer Operation - High Low Splitter



AT3222

Transmission Synchronizer Operation

LEGEND:	
A	High Low Drive Gear
B	Synchronizer Ring - (2 used)
C	Hub
D	Shift Collar
E	High Low Driven Gear
F	Spring (3 used)
G	Insert (3 used)
H	Ball (3 used)

FUNCTION:

Synchronizer equalizes speeds of mating gears to allow a clash-free shift while the tractor is in motion.

MAJOR COMPONENTS:

- High Low Drive Gear
- Synchronizer Ring
- Hub
- High Low Driven Gear
- Insert
- Shift Collar

THEORY OF OPERATION

Hub (C) is splined to the transmission shaft and rotates only when the tractor is in motion. To obtain a clash-free shift, drive gear (A), hub (C) and shift collar (D) must be turning at the same rate of speed.

Low Gear Operation

To engage the “Low Gear” position, the shift collar (D) is moved forward by the shift fork.

When moving forward the shift collar, inserts (F) push synchronizer ring (B) against drive gear (A) conical seat and bring hub (C) and drive gear (A) to the same speed.

Synchronizer ring also aligns hub teeth with gear teeth thus facilitating shift collar (D) engaging.

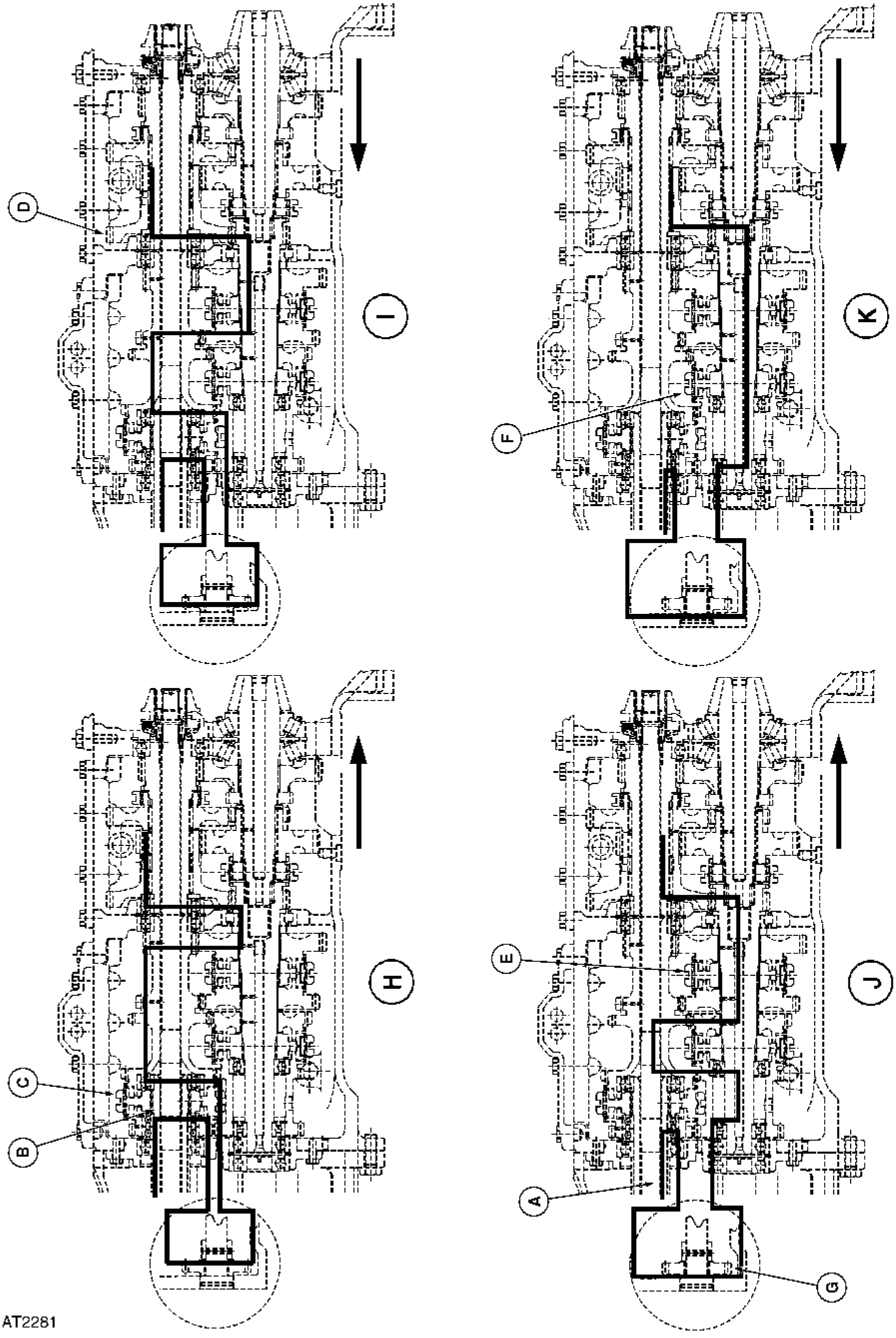
Low gear selection is described and illustrated in Transmission Power Flow - High Low Splitter in this group.

High Gear Operation

The operation of the synchronizer in high gear is the same as low, except the shift collar is moved to the rear.

Power flow for high gear selection is described and illustrated in Transmission Power Flow-High Low Splitter in this group.

Transmission Power Flow - Reverse Gears



Transmission Power Flow - Reverse Gears

LEGEND:

A	PTO Clutch Shaft
B	Traction Clutch Shaft
C	Reverse and Forward Synchronizer
D	Range Reduction Driven Gear
E	1st and 2nd Gear Synchronizer
F	3rd and 4th Gear Synchronizer
G	Reverse Idler Gear
H	1st Gear
I	2nd Gear
J	3rd Gear
K	4th Gear

FUNCTION:

Provides four reverse gears to the range section of the transmission.

MAJOR COMPONENTS:

- Traction Clutch Shaft
- Drive Gears
- Driven Gears
- Reverse Idler
- Reverse and Forward Synchronizer
- 1st and 2nd Gear Synchronizer
- 3rd and 4th Gear Synchronizer
- Range Reduction Driven Gear

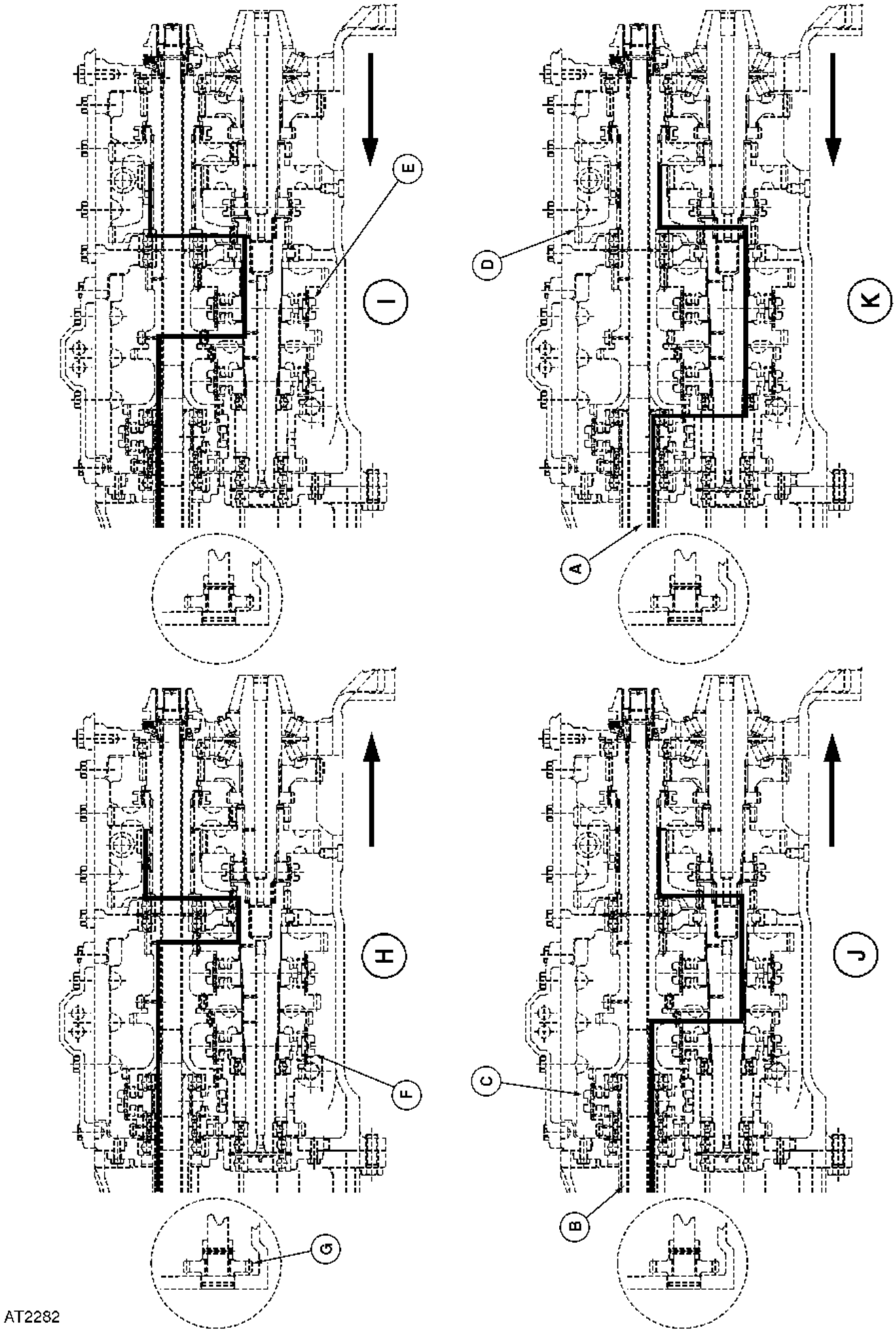
THEORY OF OPERATION:

Reverse gear and speed gears are constantly in mesh.

Synchronizers (C), (E) and (F) equalize the speed of the involved shafts before sleeve engaging.

Power shall then flow to range reduction driven gears.

Transmission Power Flow - Forward Gears



Transmission Power Flow - Forward Gears

LEGEND:

A	PTO Clutch Shaft
B	Traction Clutch Shaft
C	Reverse and Forward Synchronizer
D	Range Reduction Driven Gear
E	1st and 2nd Gear Synchronizer
F	3rd and 4th Gear Synchronizer
G	Reverse Idler Gear
H	1st Gear
I	2nd Gear
J	3rd Gear
K	4th Gear

FUNCTION:

Provides four forward gears to the range section of the transmission.

MAJOR COMPONENTS:

- Traction Clutch Shaft
- Drive Gears
- Driven Gears
- Reverse Idler
- Reverse and Forward Synchronizer
- 1st and 2nd Gear Synchronizer
- 3rd and 4th Gear Synchronizer
- Range Reduction Drive Gear

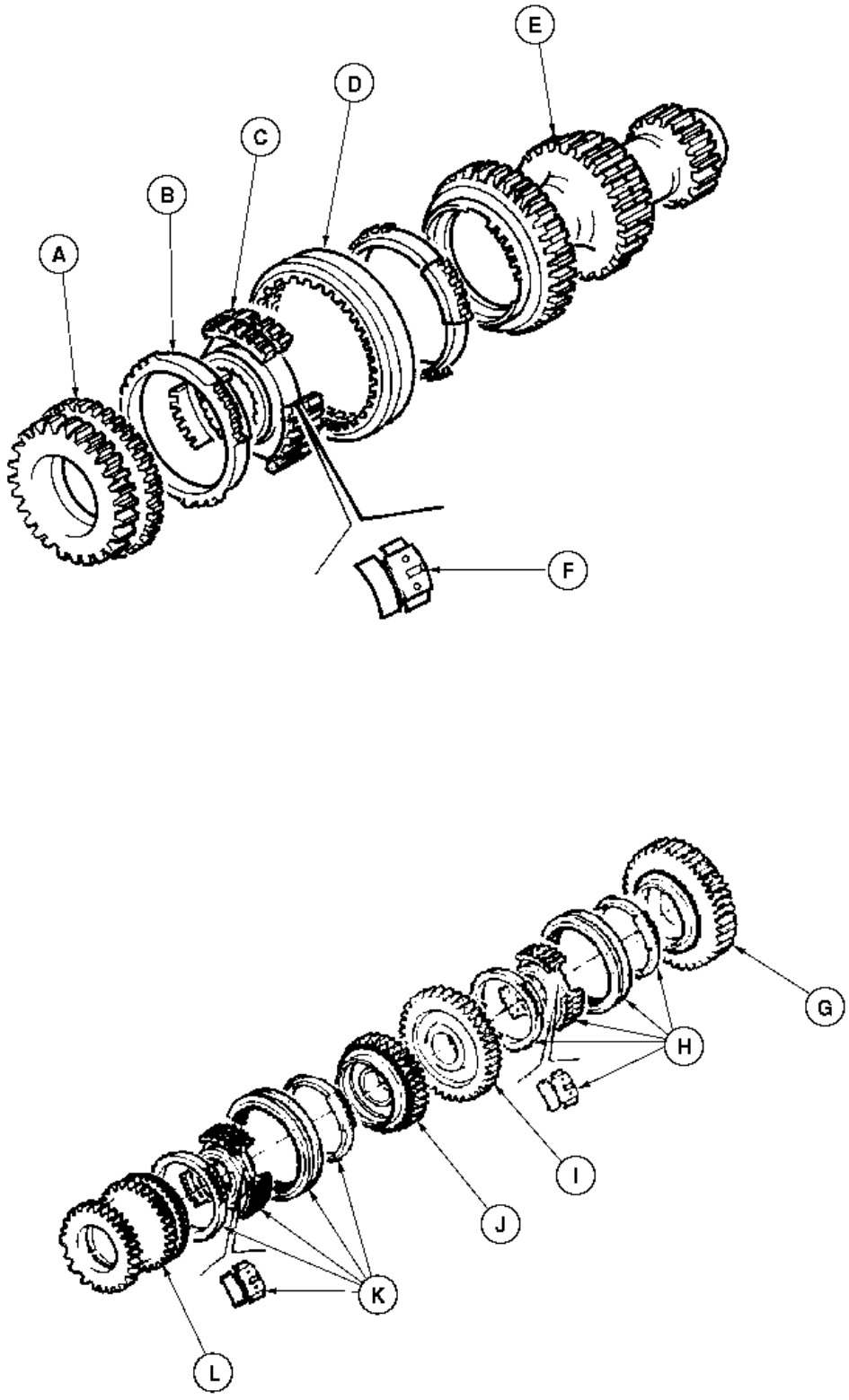
THEORY OF OPERATION:

Reverse gear and speed gears are constantly in mesh.

Synchronizers (C), (E) and (F) equalize the speed of the involved shafts before sleeve engaging.

Power shall then flow to range reduction driven gears.

Transmission Synchronizer Operation - Reverse, Forward, 1st, 2nd, 3rd and 4th Gear



AT2284

Transmission Synchronizer Operation

LEGEND:

A	Reverse Drive Gear
B	Synchronizer Ring
C	Hub
D	Shift Collar
E	Drive Shaft
F	Insert
G	1st Speed Driven Gear
H	1st and 2nd Speed Synchronizer Assembly
I	2nd Speed Driven Gear
J	3rd Speed Driven Gear
K	3rd and 4th Speed Synchronizer Assembly
L	4th Speed Driven Gear

FUNCTION:

Synchronizer equalizes speeds of mating gears to allow a clash-free shift while the tractor is in motion.

MAJOR COMPONENTS:

- Reverse Drive Gear
- Synchronizer Ring
- Hub
- Shift Collar
- Drive Shaft
- Insert
- 1st Speed Driven Gear
- 1st and 2nd Speed Synchronizer Assembly
- 2nd Speed Driven Gear
- 3rd Speed Driven Gear
- 3rd and 4th Speed Synchronizer Assembly
- 4th Speed Driven Gear

THEORY OF OPERATION:

Hub (C) is splined to the clutch shaft and rotates only when clutch is engaged. To obtain a clash-free shift, drive gear (A), hub (C) and shift collar (D) must be turning at the same rate of speed.

Reverse Gear Operation

To engage the Reverse Gear, the shift collar (D) is moved forward by the shift fork. When moving forward the shift collar, inserts (F) push synchronizer ring (B) against drive gear (A) conical seat and bring hub (C) and drive gear (A) to the same speed. Synchronizer ring also aligns hub teeth with gear teeth thus facilitating shift collar (D) engaging.

Power flow for reverse gear selection is described and illustrated in Transmission Power Flow - Reverse Gear, in this group.

Forward Gear Operation

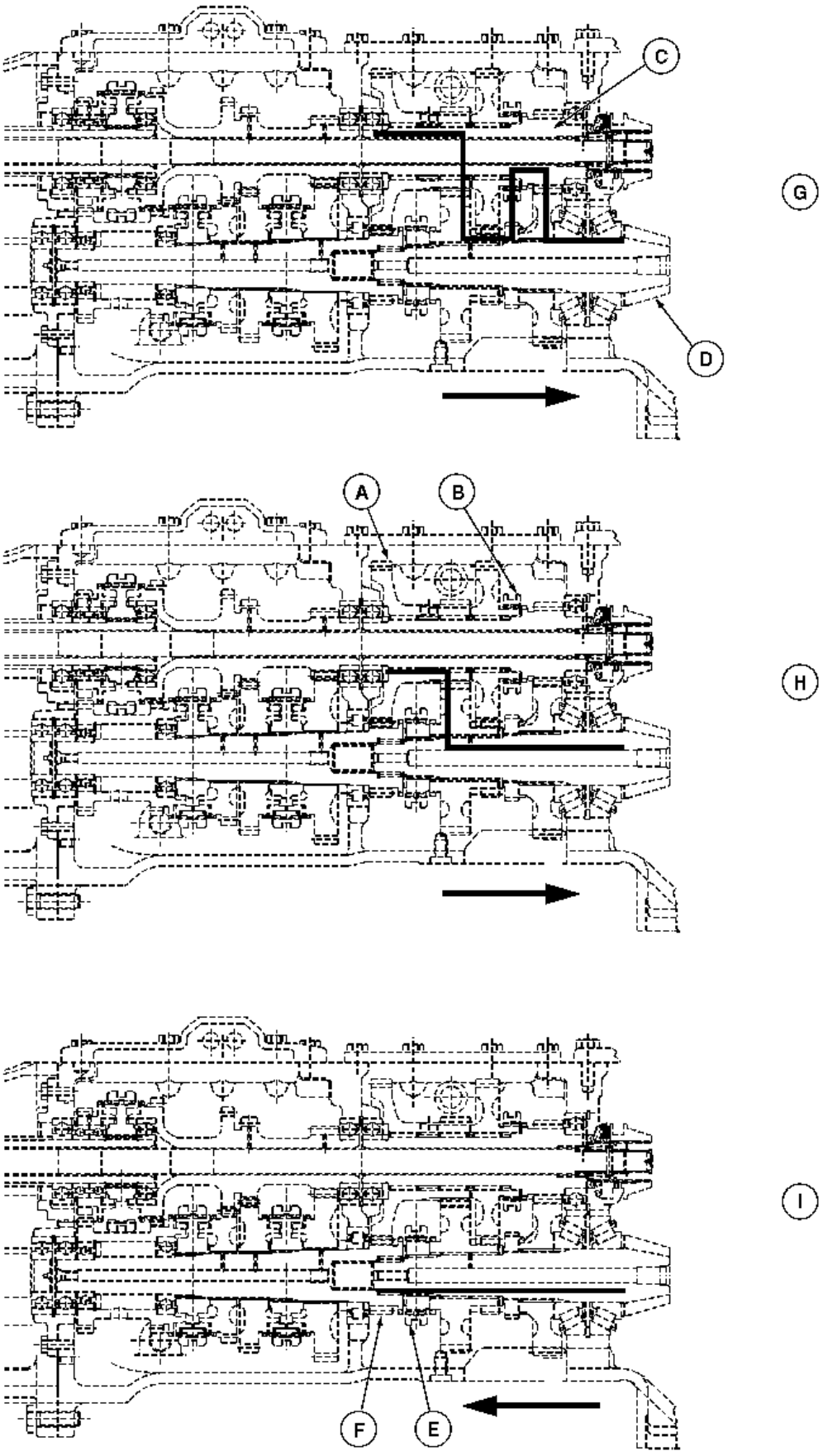
The operation of the synchronizer in forward gear is the same as reverse, except the shift collar is moved to the rear.

Power flow for forward gear selection is described and illustrated in Transmission Power Flow - Forward Gear in this group.

1st, 2nd, 3rd and 4th Gear Operation

The operation of the synchronizer in 1st, 2nd, 3rd and 4th gear is the same as reverse and forward gear. Power flow for 1st, 2nd, 3rd and 4th gear selection is described and illustred in Transmission Power Flow - Reverse and Forward in this group.

Transmission Power Flow - Range Shift



Transmission Power Flow - Range Shift

LEGEND:

A	Range Reduction Gear
B	1st Range Shift Collar
C	Range Reduction Shaft
D	Differential Drive Shaft
E	2nd and 3rd Range Shift Collar
F	Range Reduction Drive Gear
G	1st Range
H	2nd Range
I	3rd Range

FUNCTION:

Provides three range speeds.

MAJOR COMPONENTS:

- Range Reduction Drive Gear
- Range Reduction Shaft
- Drive Gears
- Driven Gears
- 2nd and 3rd Range Shift Collar
- Differential Drive Shaft
- 1st Range Shift Collar

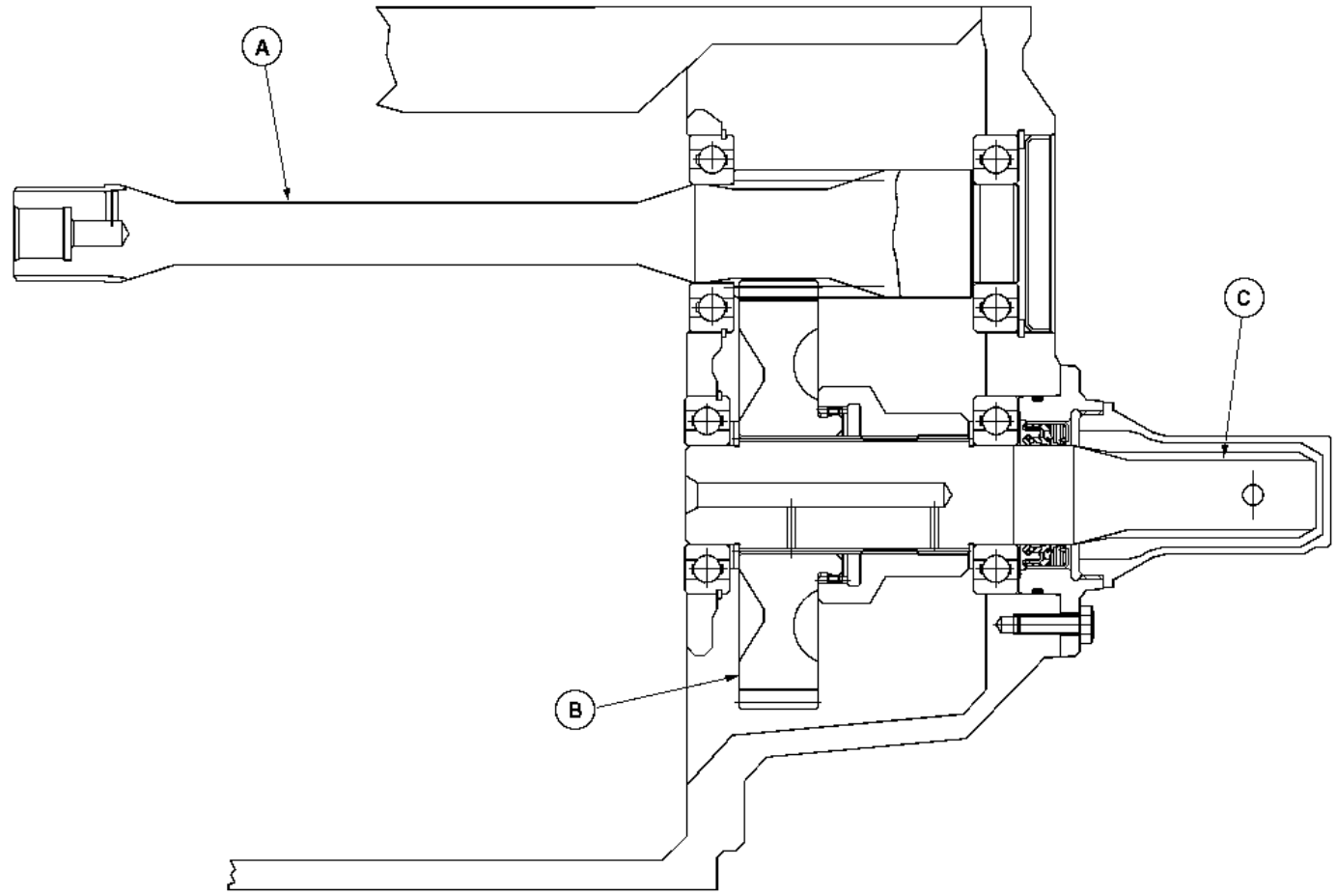
THEORY OF OPERATION:

Range selection is achieved through a combination of the gears on the range reduction shaft (C) and the gears on the differential drive shaft (D).

Range shift is implemented by sliding sleeves.

Power shall then flow to differential pinion.

Rear PTO Operation



AT2276

Rear PTO

LEGEND:

A	PTO Drive Shaft (Short)
B	PTO Driven Gear
C	PTO Output Shaft

FUNCTION:

Transfer of engine power output to drive rear mounted implements or attachments.

MAJOR COMPONENTS:

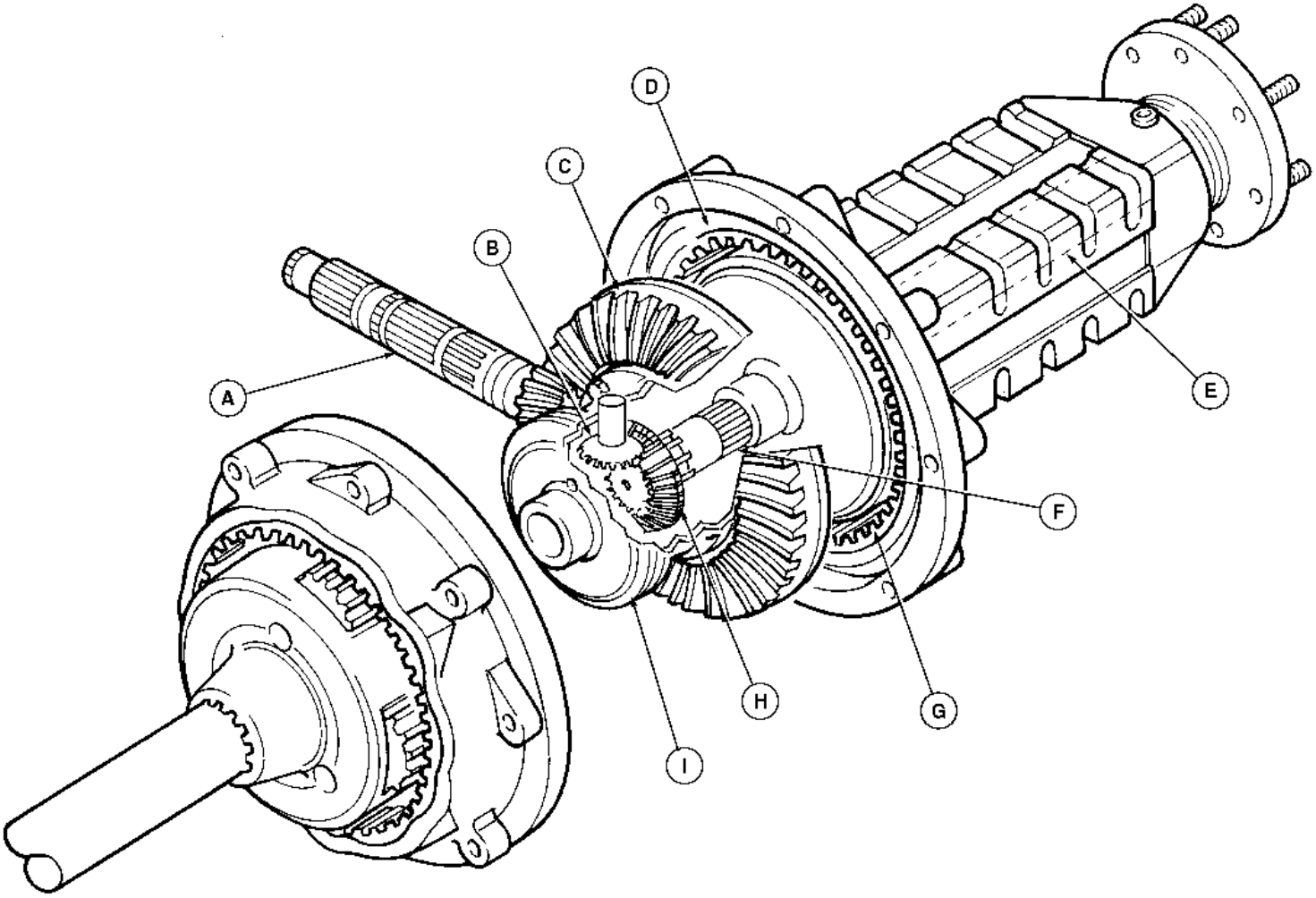
- PTO Clutch Disk
- PTO Drive Shaft (Short)
- PTO Drive Shaft (Long)

- PTO Gear
- PTO Output Shaft

THEORY OF OPERATION:

Pushing the PTO clutch lever forward to the engaged position provides PTO clutch engagement. The PTO clutch disk is splined to the long drive shaft. When the PTO clutch and PTO engagement control are engaged, power from the engine is transmitted through long drive shaft and PTO engagement sleeve to the short drive shaft (A). The short drive shaft turns the PTO driven gear (B) which then turns the PTO output shaft (C). When the PTO lever is pulled to the disengaged position, the PTO clutch disengages and the PTO shaft stops turning.

Differential Power Flow



AT2286

Differential Power Flow

LEGEND:

A	Differential Drive Shaft
B	Bevel Pinion
C	Differential Ring Gear
D	Planetary Carrier Assembly
E	Axle Shaft
F	Final Drive Pinion Shaft
G	Final Drive Ring Gear
H	Bevel Gear
I	Differential Carrier

FUNCTION:

The differential transmits power from the differential drive shaft to the final drive pinion shafts. It allows each wheel to rotate at

varying speeds and still pull its own load.

MAJOR COMPONENTS:

- Differential Drive Shaft
- Differential Ring Gear
- Differential Carrier Assembly
- Final Drive Pinion Shafts
- Final Drive Ring Gear
- Planetary Carrier Assembly
- Axle Shaft

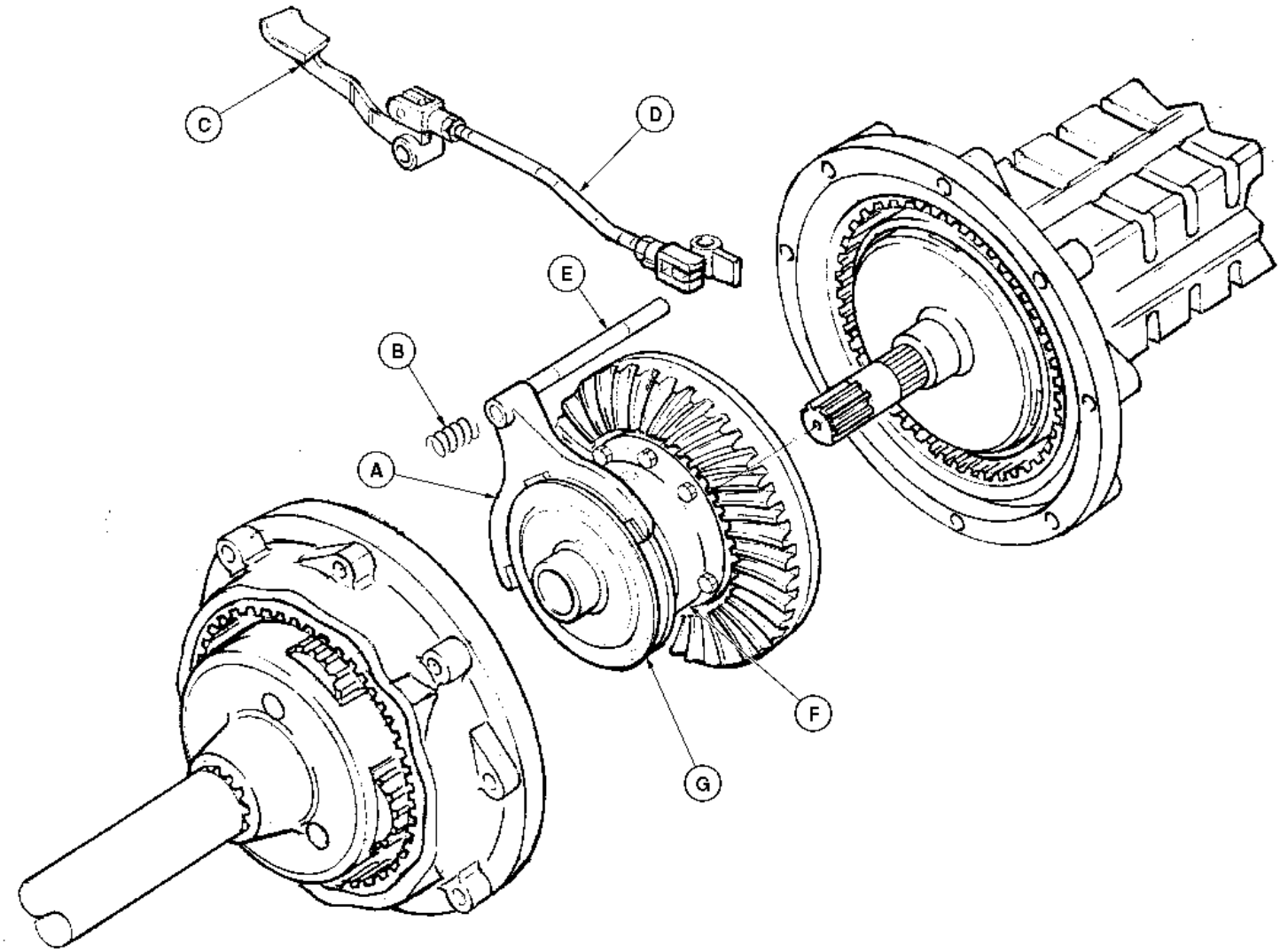
THEORY OF OPERATION:

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 carrier assembly (D). These small gears walk around the inside of final drive ring gear (G). The result is rotation of the axle shaft (E).

The differential assembly is a ring gear (C) bolted to the carrier (I). Inside the carrier is two bevel gears (H) and four bevel pinions (B).

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 Lock Operation



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Differential Lock Operation

LEGEND:

A	Fork
B	Spring Lock Shaft
C	Differential Lock Pedal
D	Differential Lock Linkage
E	Differential Lock Shaft
F	Differential Carrier
G	Differential Lock Collar

FUNCTION:

Engaging the differential lock pedal, locks the two differential output shafts together. This ensures that an equal amount of power is transmitted to both rear axles (eliminating differential action).

MAJOR COMPONENTS:

- Lock Pedal
- Lock Shaft
- Fork
- Lock Collar
- Differential Carrier

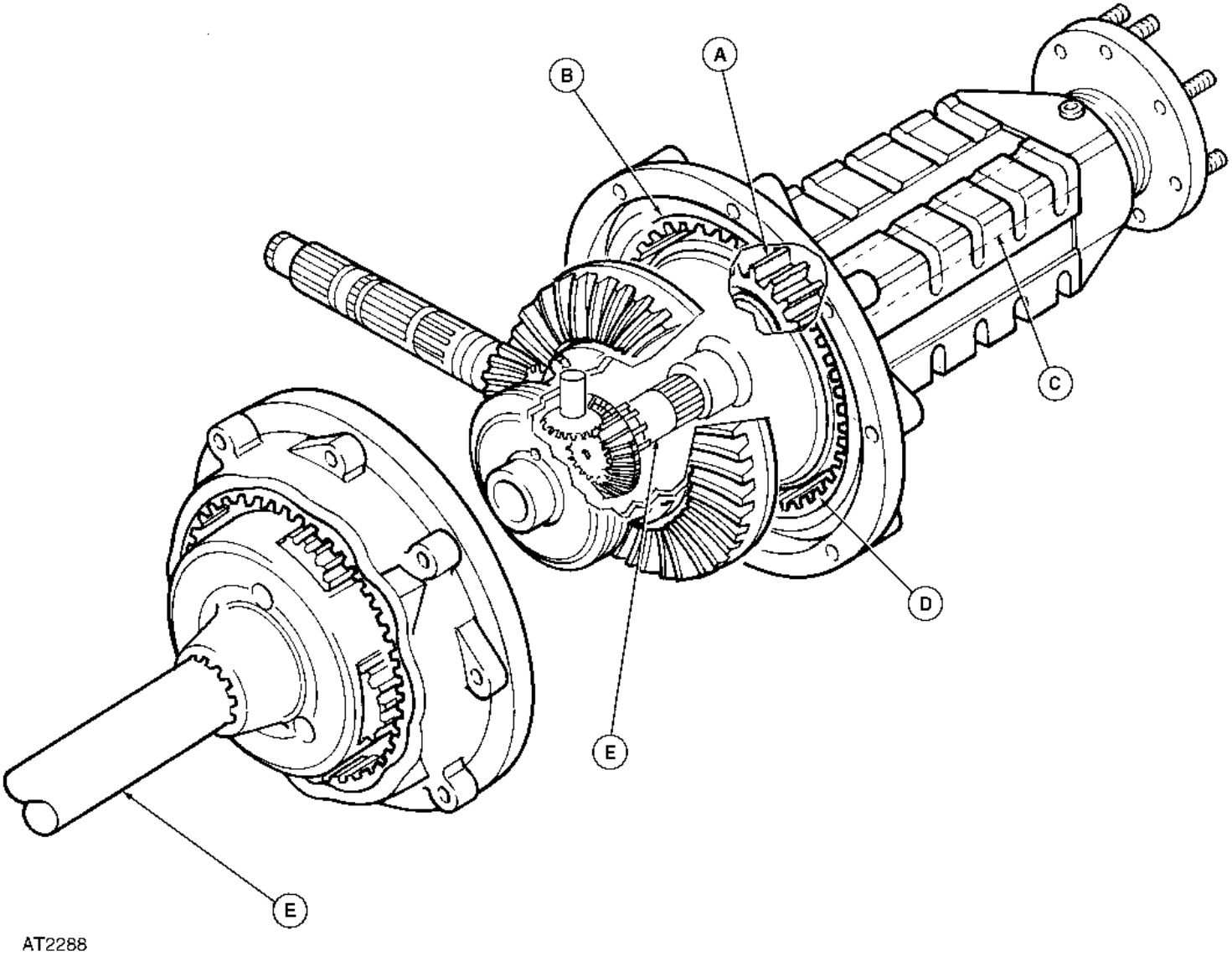
THEORY OF OPERATION:

When the differential lock pedal (C) is pressed downward the differential lock shaft is forced to the left. As the shaft moves, spring (B) is compressed and fork (A) forces the differential lock collar (G) toward left final drive.

When the pins align with the slots in the left bevel gear, the pins will slip into the slots. Since the pins are splined no differential action will take place and both output shafts turn equally.

Unequal traction will keep the lock engaged. When traction equalizes, lock will disengage itself by spring action. If lock does not disengage, depress one brake pedal and then the other.

Final Drive Operation



Final Drive Operation

LEGEND:

A	Planetary Gears
B	Planetary Carrier Assembly
C	Axle Shaft
D	Final Drive Ring Gear
E	Final Drive Pinion Shafts

→NOTE:

Planetary drive assembly of 5300 -5400 tractors shown.

FUNCTION:

The final drive planetary gives the drive wheels a final speed reduction and torque increases.

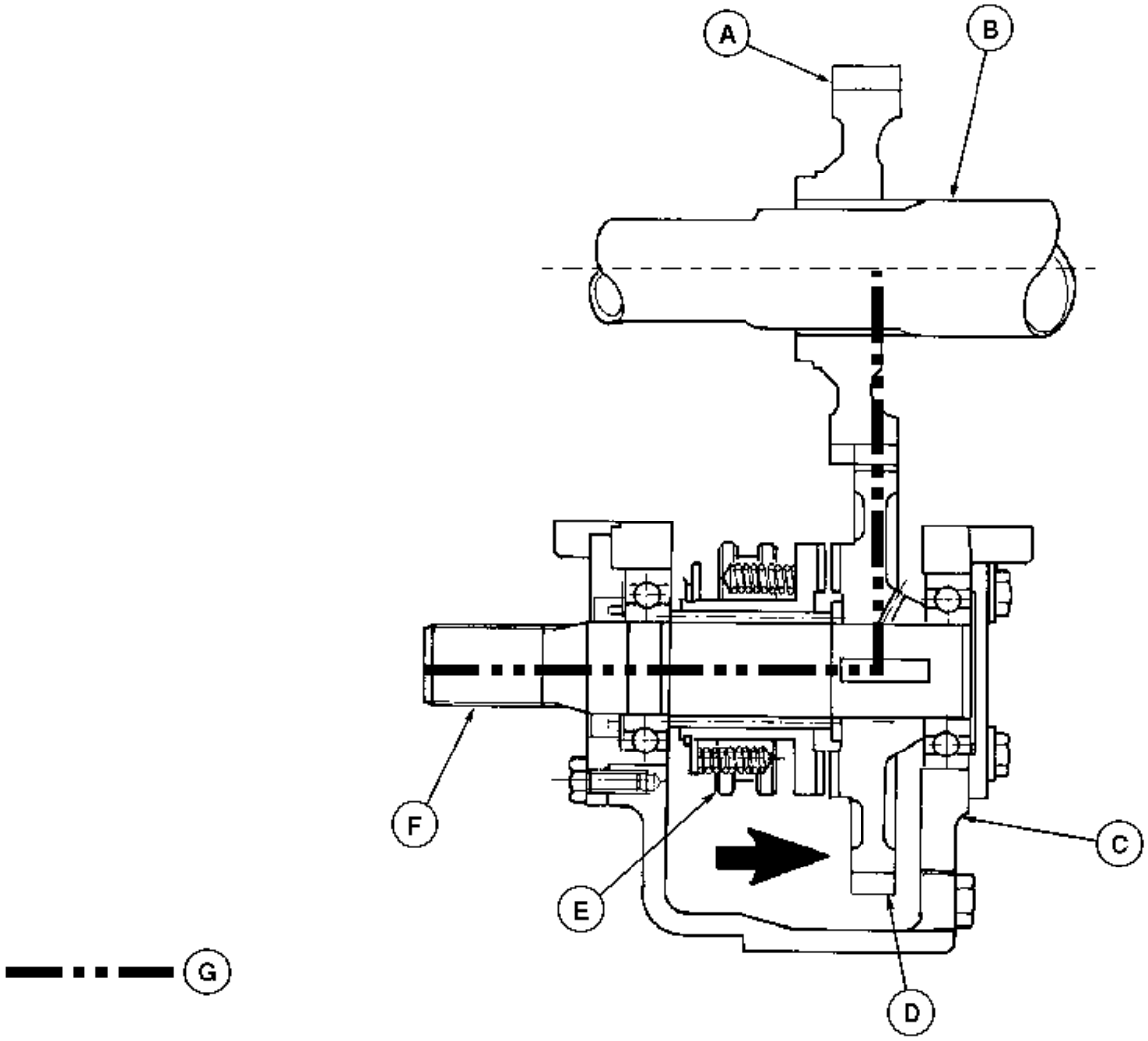
MAJOR COMPONENTS:

- Final Drive Pinion Shafts
- Planetary Carrier Assembly
- Planetary Gears
- Final Drive Ring Gear
- Axle Shaft

THEORY OF OPERATION:

The final drive is a planetary ring gear type system. The final drive pinion shafts (E) are in mesh with the planetary gears (A) attached to the planetary carrier assembly (B) and ride inside final drive ring gear (D). The axle shafts (C) are splined to the planetary carrier. Power from the differential output shafts turns 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.

Mechanical Front Wheel Drive (MFWD) Operation - 12/12 Speed Transmission



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MFWD Operation-12/12 Speed Transmission

LEGEND:

A	MFWD Drive Gear
B	Differential Drive Shaft
C	MFWD Drop Gearbox
D	Idler Gear
E	Shift Collar
F	Output Shaft
G	Power Flow

FUNCTION:

Provides power to the MFWD housing for extra added traction.

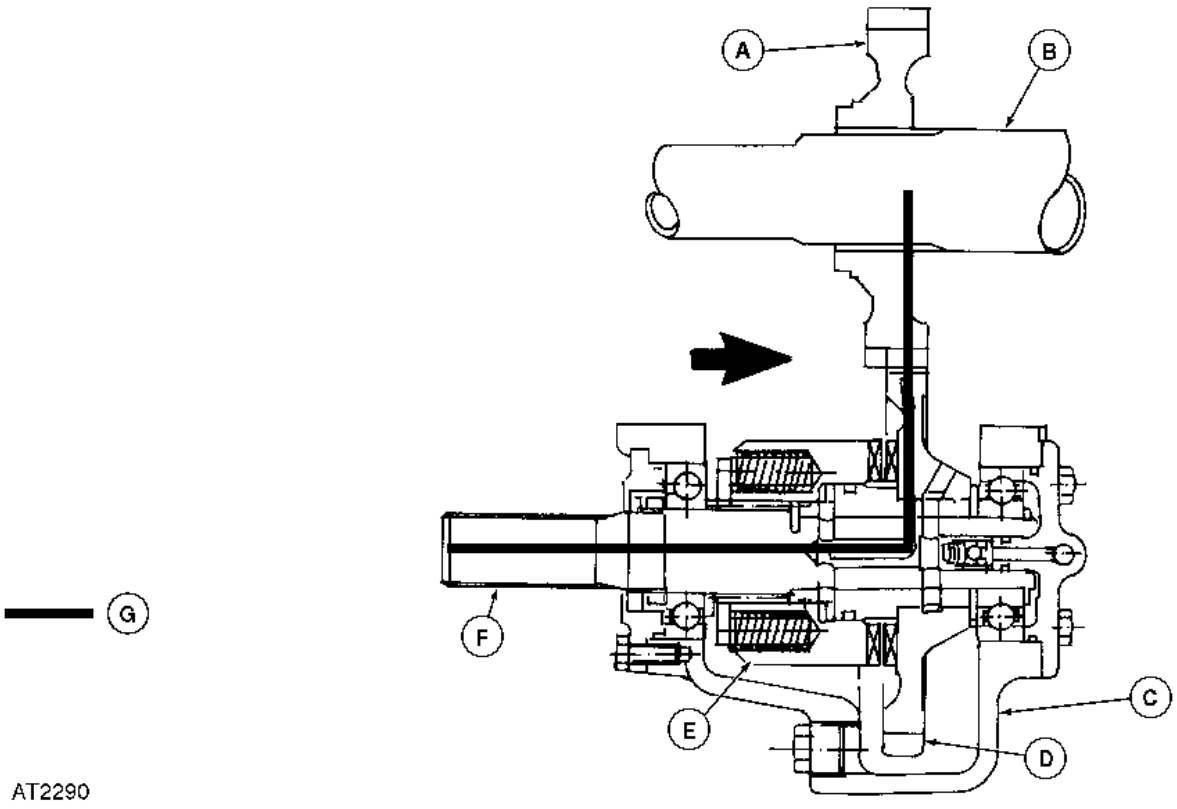
MAJOR COMPONENTS:

- Differential Drive Shaft
- MFWD Gear
- MFWD Drop Gearbox
- Drive Shaft
- MFWD Axle

THEORY OF OPERATION:

The MFWD gear (A) on the differential drive shaft (B) of the transmission is constantly in mesh with idler gear (D) which spins freely on the output shaft (F) until engaged by shift collar (E).

Mechanical Front Wheel Drive (MFWD) Operation - 24/24 Speed Transmission



MFWD Operation-24/24 Speed Transmission

LEGEND:

A	MFWD Drive Gear
B	Differential Drive Shaft
C	MFWD Drop Gearbox
D	Idler Gear
E	Clutch Half
F	Output Shaft
G	Power Flow

FUNCTION:

Provides power to the MFWD housing for extra added traction.

MAJOR COMPONENTS:

- Differential Drive Shaft
- MFWD Gear
- MFWD Drop Gearbox
- Drive Shaft
- MFWD Axle

THEORY OF OPERATION:

The MFWD gear (A) on the differential drive shaft (B) of the transmission is constantly in mesh with idler gear (D) which spins freely on the output shaft (F) until engaged by clutch half (E).

Group 15 - Diagnosis, Tests and Adjustments

Diagnostic Information

The diagnostic information in this Group is used to test components related to a specific problem or system. Select a symptom or system from the list and follow the test procedures under the heading. Begin diagnosis with the Major Transmission Check and isolate the problem area.

The symptom or system headings are:

- Major Transmission Check
- Clutch
- Transmission
- Rear PTO
- Differential and Final Drive
- Mechanical Front Wheel Drive

The diagnostic procedure lists:

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

When performing the test or check, be sure to set your machine up to the test conditions listed and follow the sequence carefully. The middle “Normal” column gives the reading or condition that should be obtained when performing the test or check. If the results of the test or check are not normal, perform the test, check, or adjustment listed in the third “If Not Normal” column to repair the malfunction. The detailed tests or adjustments referred to in the “If Not Normal” column are located at the end of this Group.

Major Transmission Check

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 listening for abnormal noises.

Begin the test procedure with the gear shift lever and range shift lever in neutral, and the MFWD and rear PTO disengaged.

Major Transmission Check

(1) Check transmission oil:

Action:

1.1 Check transmission oil level.

Result:

YES:GO TO 1.2

NO: Correct the oil level. Check for leakage.

Action:

1.2 Check oil for contamination with metal fragments or debris.

Result:

YES:GO TO 1.3

NO: Drain oil and replace filter. Clean screen and determine cause of contamination.

Action:

1.3 Check if oil is foamy or discolored.

Result:

YES: GO TO 2

NO: Make sure type of oil is correct. Check for hydraulic cause of overheating. A milky look can be indicator of water contaminated oil.

(2) Check shifting elements:

Action:

Check all linkage operation and return it to the neutral or disengaged position.

No damage, stuck or binding might appear.

Result:

YES: GO TO 3

NO: Repair damaged parts. Reasons for this sympthoms can also cause in damaged parts from inside the transmission.

(3) Transmission operating test while engine is running:

Action:

3.1 Gears and ranges at neutral, PTO off and clutch disengaged. Pay attention for unusual noise or vibration.

Result:

YES:GO TO 3.2

NO: Check engine.

Action:

3.2 Gears and ranges at neutral, PTO off and partially engage clutch pedal.

Vary engine speed and pay attention for unusual noise or vibration.

Result:

YES:GO TO 3.3

NO: Inspect Clutch, PTO drive shaft and bearings.

Action:

3.3 Gears and ranges at neutral, PTO off and fully engage clutch pedal.

Vary engine speed and pay attention for unusual noise or vibration.

Result:

YES:GO TO 3.4

NO: Inspect Clutch, and traction drive shaft.

Action:

3.4 Place gear shift lever in each forward gear and reverse. Leave range shift lever in neutral. Engage traction clutch pedal and and vary engine rpm in each gear.

Pay attention for unusual noise or vibration.

Result:

YES:GO TO 3.5

NO: Inspect gear mesh for speed selected when noise or vibration occurred.Inspect driven shaft or range reduction shaft bearing if noise occurred in all speeds.Inspect reverse idle shaft and bearing if problem occurred only in reverse.

Action:

3.5 Place transmission in neutral, engage rear PTO and vary engine speed.

Pay attention for unusual noise or vibration.

Result:

YES: GO TO 4

NO: Inspect rear PTO drive shaft, gears and bearings.

(4) Transmission operating test while driving the tractor:

Action:

CAUTION:

From this point on you will be driving the tractor. To prevent injuries operate in an open level area.

4.1 Place transmission in 2nd gear. Operate tractor in each range. Check if tractor moves smoothly when going straight.

Result:

YES:GO TO 4.2

NO: Inspect gear mesh in range where problem was evident.Inspect differential drive shaft if problem was evident in all ranges.

Action:

4.2 Place transmission in 2nd gear. Operate tractor in each range. Check if tractor moves smoothly when making turns. (If equipped with MFWD, do not engage)

Result:

YES:GO TO 4.3

NO: Inspect differential or final drive and axles.

Action:

4.3 Leave transmission in 2nd gear and low range. Engage differential lock while operating at low engine speed. Turn from left to right. (If equipped with MFWD, do not engage)

Check if tractor resists turning.

Differential lock should stay engaged.

No unusual noise may occure.

Result:

YES:GO TO 4.4

NO: Inspect differential lock and linkage.

Action:

4.4 Leave transmission in 2nd gear and low range. Release differential lock. Engage MFWD (if equipped). Drive straight and turn left and right.

Pay attention for unusual noise or vibration.

Result:

YES: End of major transmission test.

NO: Inspect gears and bearings in MFWD drop gearbox if problem was evident at all times.Inspect MFWD axles if problem was evident only when turning.

Traction Clutch Slips

CONDITIONS:

- Adjustments found in this group.
- Repair in Section 50.

Traction Clutch Slips

Test Location	Normal	If Not Normal
1. Clutch pedal.	Free play at correct specification.	Adjust pedal free play.
2. Traction clutch disk.	No oil or grease on facing.	Clean or replace disk.
	No evidence of wear or glazing on facing. No warpage.	Replace disk.
3. Traction clutch pressure plate.	Does not bind on operating bolts.	Clean or replace operating bolts or pressure plate.
	No evidence of warpage.	Replace pressure plate.
4. Traction clutch coil springs.	All springs same length. No evidence of bent or damaged condition.	Replace springs.
5. Traction clutch release fingers.	No binding or sticking.	Clean or replace fingers.
6. Belleville spring under PTO clutch rear pressure plate.	Tractor moves forward and reverse with no clutch slippage.	Replace Belleville spring.

Traction Clutch Dragging

CONDITIONS:

- Adjustments found in this group.
- Repair in Section 50.

Traction Clutch Dragging

Test Location	Normal	If Not Normal
1. Clutch pedal.	Free play at correct specification.	Adjust free play if excessive.
2. Traction clutch release bearing.	Slides freely on shaft.	Clean, lubricate or replace.
3. Traction clutch disk.	Slides freely on shaft splines.	Clean, lubricate or replace.
	No warpage or damage.	Replace disk.
4. Traction clutch pressure plate.	No warpage.	Replace pressure plate.

Traction Clutch Does Not Engage

CONDITIONS:

- Adjustments and repair in Section 50.

Traction Clutch Does Not Engage

Test Location	Normal	If Not Normal
1. Traction clutch release bearing.	Slides freely on shaft.	Clean, lubricate or replace bearing.
2. Traction clutch release levers.	Adjusting screws adjusted for proper clearance.	Adjust screws.
3. Traction clutch disk.	No evidence of wear, scoring or burning on disk faces.	Replace disk.
	No evidence of damage to disk hub.	Replace disk.

Traction Clutch Grabs

CONDITIONS:

- Repair in Section 50.

Traction Clutch Grabs

Test Location	Normal	If Not Normal
1. Clutch pedal linkage and armshaft.	Operates freely with no binding.	Clean, lubricate or adjust.
2. Traction clutch disk.	Slides freely on shaft splines.	Clean, lubricate or replace.
	No oil or grease on disk facing. No evidence of wear or glazing on disk face. No warpage or damage. Rivets at hub are tight.	Clean or replace disk.
3. Traction clutch pressure plate.	No warpage or damage.	Replace pressure plate.

Traction Clutch Squeaks

CONDITIONS:

- Repair in Section 50.

Traction Clutch Squeaks

Test Location	Normal	If Not Normal
1. Flywheel pilot bearing.	Lubricated sufficiently.	Lubricate.
2. Traction clutch release bearing.	Lubricated sufficiently.	Lubricate.
	Bearing spins freely. No evidence of wear or damage.	Replace bearing.

Traction Clutch Does Not Release

CONDITIONS:

- Repair in Section 50.

Traction Clutch Does Not Release

Test Location	Normal	If Not Normal
1. Traction clutch disk and pressure plate.	Disk and pressure plate separate freely with no sticking.	Clean or replace disk and/or pressure plate. If storing tractor, block clutch pedal in disengaged position.

Traction Clutch Chatters

CONDITIONS:

- Clutch repair in Section 50.
- Rear axle repair in Section 50.
- Transmission repair Section 50.

Traction Clutch Chatters

Test Location	Normal	If Not Normal
1. Clutch assembly.	Clean and free of rust.	Clean or replace clutch components or assembly.
2. Traction clutch disk.	No oil or grease on facing.	Clean or replace disk.
	No evidence of wear or glazing on facing. No evidence of warpage.	Replace disk.
3. Traction clutch pressure plate.	Not warped. No evidence of cracks or other damage.	Replace pressure plate.
4. Traction clutch operating levers.	Operate freely with no binding or sticking.	Clean, lubricate or replace operating levers.
5. Traction clutch disk hub and shaft.	Hub slides freely on shaft. No evidence of wear or damage.	Clean, lubricate or replace disk and/or shaft.
6. Traction clutch coil springs.	All springs are same length. No evidence of bent or damaged condition.	Replace springs.
7. Rear axles.	Rotate smoothly with little or no end play.	Lubricate bearings and/or adjust end play. Replace worn or damaged components.
8. Transmission.	Backlash is adjusted properly.	Adjust or repair transmission.
9. Spring washer under PTO clutch rear pressure plate.	Tractor moves forward and reverse with no clutch slippage or chatter.	Replace spring washer.

Traction Clutch Rattles

CONDITIONS:

- Repair and adjustment in Section 50.

Traction Clutch Rattles

Test Location	Normal	If Not Normal
1. Traction clutch release bearing.	Bearing spins freely. No evidence of wear or damage.	Replace bearing.
2. Flywheel pilot bearing.	Bearing spins freely. No evidence of wear or damage.	Replace bearing.
3. Traction clutch release fingers.	Adjusting screws adjusted for proper clearance.	Adjust screws.
4. Clutch shaft.	No evidence of wear, damage or bent condition.	Replace shaft.
5. Traction clutch disk.	Hub is tight on disk. All rivets are tight.	Replace disk.

Traction Clutch Engagement is Noisy

CONDITIONS:

- Repair in Section 50.

Traction Clutch Engagement is Noisy

Test Location	Normal	If Not Normal
1. Clutch shaft.	No evidence of wear, damage or bent condition.	Replace shaft.
2. Traction clutch disk.	Hub is tight on disk. All rivets are tight.	Replace disk.

Excessive Vibration in Traction Clutch

CONDITIONS:

- Repair in Section 50.

Excessive Vibration in Traction Clutch

Test Location	Normal	If Not Normal
1. Clutch assembly.	Clean and free of rust.	Clean or replace clutch.
2. Clutch shaft.	No evidence of wear, damage or bent condition.	Replace shaft.
3. Traction clutch disk.	No evidence of wear or glazing on facing. No warpage.	Replace disk.
4. Traction clutch pressure plate.	No evidence of damage or warpage.	Replace pressure plate.
5. Flywheel pilot bearing.	Bearing spins freely. No evidence of wear or damage.	Replace bearing.

Clutch Pedal Does Not Return

CONDITIONS:

- Repair in Section 50.
- Pedal adjustment in this group.

Clutch Pedal Does Not Return

Test Location	Normal	If Not Normal
1. Clutch pedal linkage.	Operates freely and smoothly in both directions. No evidence of wear or damage.	Adjust or replace linkage components.
	Clutch pedal return spring is connected securely and not distorted or broken.	Connect or replace spring.
2. Traction clutch release bearing.	Bearing and sleeve operate smoothly without binding.	Clean, lubricate or replace sleeve.

Clutch Pedal Loose

CONDITIONS:

- Repair in Section 50.

Clutch Pedal Loose

Test Location	Normal	If Not Normal
1. Clutch pedal linkage.	Yoke and lock nut are tight on rod.	Tighten or replace yoke, nut or rod.
	Pedal shaft bushings are not worn or damaged.	Replace bushings or pedal.
2. Traction clutch release linkage.	No evidence of wear or damage to yoke, shoes, armshaft or bushings.	Replace worn or damaged components.

Clutch Pedal Pulsates

CONDITIONS:

- Clutch repair in Section 50.
- Flywheel repair in CTM Engines.

Clutch Pedal Pulsates

Test Location	Normal	If Not Normal
1. Clutch pedal linkage.	Clutch pedal return spring is connected securely and not distorted or broken.	Connect or replace spring.
2. Clutch shaft.	Shaft is straight.	Replace shaft.
3. Traction clutch release linkage.	No evidence of wear or damage to yoke, shoes, armshaft or bushings.	Replace worn or damaged components.
4. Flywheel.	Flywheel turns evenly. No evidence of warpage or uneven mounting.	Tighten, re-install, or replace flywheel.

Jerky or Rough Transmission of Power

CONDITIONS:

- Repair in Section 50.

Jerky or Rough Transmission

Test Location	Normal	If Not Normal
1. Traction clutch disk and pressure plate.	No evidence of warpage or uneven wear.	Replace disk and/or pressure plate.

Low Transmission Oil Level (Excessive Oil Leakage)

CONDITIONS:

- Repair in Section 50.

Low Transmission Oil Level

Test Location	Normal	If Not Normal
1. Clutch, transmission and differential housings.	Power train housings are clean and dry, with no evidence of leakage from drain plugs, gaskets or seals. All hardware securing housings and covers is tight.	Tighten drain plug(s). Tighten all mounting hardware to correct torque. Replace missing hardware. Replace leaking seals or gaskets.
	Transmission oil has proper viscosity and grade.	Drain and refill.

Gears Clash, Shift Hard, or Will Not Engage

CONDITIONS:

- Clutch adjustment in Section 50.
- Transmission and lever repair in Section 50.

Gears

Test Location	Normal	If Not Normal
1. Clutch.	Clutch operates smoothly. All gears engage freely.	Adjust clutch.
2. Speed and range shifter linkage.	Linkage is adjusted properly.	Adjust.
	Linkage shows no evidence of wear or damage.	Replace worn or damaged components.
3. Speed and range shifter assemblies.	All shafts operate smoothly. No evidence of wear or damage to shifters, arms, forks or detent balls and springs. Shifter forks are not loose on shafts.	Replace worn or damaged components.
4. Transmission.	No evidence of wear or damage to gear teeth or splines.	Clean and lubricate any binding parts. Replace worn or damaged components.
	Gears that are splined to shafts are not loose. Gears that float on shafts turn freely. Shift collars and/or synchronizers slide freely between gears with no binding.	

Two Speeds Engage Together

CONDITIONS:

- Repair in Section 50.

Two Speeds Engage Together

Test Location	Normal	If Not Normal
1. Speed and range shifter assemblies.	All shafts operate smoothly. No wear or damage to shaft detents. Detent ball assemblies installed properly and not worn or damaged. Springs not weak or broken.	Replace worn or damaged components.
2. Transmission.	No evidence of wear or damage to gear teeth or splines. Gears that are splined to shafts are not loose. Gears that float on shafts turn freely.	Replace worn or damaged components.
	All transmission components assembled correctly.	Reassemble.

Transmission Will Not Stay in Gear

CONDITIONS:

- Repair in Section 50.

Transmission Will Not Stay in Gear

Test Location	Normal	If Not Normal
1. Speed and range shifter assemblies.	All shafts operate smoothly. No wear or damage to shaft detents. Detent ball assemblies installed properly and not damaged. Springs not weak or broken.	Replace worn or damaged components.
2. Transmission.	No evidence of wear or damage to gear teeth, splines, shift collars and/or synchronizers or shifter forks.	Replace worn or damaged components.

Transmission Noisy

CONDITIONS:

Repair in Section 50.

Transmission Noisy

Test location	Normal	If not normal
1. Transmission shafts.	Shaft and shaft bearings spin freely and without noise. No evidence of wear or damage to shaft splines or bearings.	Replace worn or damaged components.
2. Transmission gears.	Gears that are splined to shafts are not loose. Gears that float on shafts turn freely. Shift collars and/or synchronizers slide freely between gears with no binding. No evidence of wear or damage to gear teeth or splines.	Clean and lubricate any binding parts. Replace worn or damaged components.
3. Speed and range shift forks.	No evidence of wear, damage or bent condition.	Replace worn or damaged components.

PTO Noisy

CONDITIONS:

- Repair in Section 50.

PTO Noisy

Test Location	Normal	If Not Normal
1. PTO connection.	No noise from PTO, even when implements connected.	Disconnect implement and check for PTO noise.
2. PTO gears.	No evidence of wear or damage to gear teeth or splines.	Replace worn or damaged gears.
3. PTO shafts.	All shafts are straight. No evidence of wear or damage to splines or bearing surfaces.	Replace worn or damaged shafts.
4. PTO bearings.	All bearings spin freely. No wear or damage.	Replace worn or damaged bearings.

PTO Hard to Engage

CONDITIONS:

- Adjustments in this group.
- Repair in Section 50.

PTO Hard to Engage

Test Location	Normal	If Not Normal
1. PTO lever linkage.	Operates freely with no binding. Linkage adjusted properly.	Adjust linkage.
2. PTO gears.	No wear or damage to gear teeth or splines	Replace worn or damaged components.

PTO Will Not Operate

CONDITIONS:

- Repair in Section 50.

PTO Will Not Operate

Test Location	Normal	If Not Normal
1. PTO shafts.	All shafts are straight. No wear or damage to shaft splines or bearing surfaces.	Replace worn or damaged components.
2. PTO assembly.	PTO is assembled correctly.	Reassemble.

PTO Will Not Stay Engaged

CONDITIONS:

- Repair in Section 50.

PTO Will Not Stay Engaged

Test Location	Normal	If Not Normal
1. PTO gears.	No wear or damage to gear teeth or splines.	Replace worn or damaged components.

Excessive Differential Noise

CONDITIONS:

- Adjustments and repair in Section 50.

Excessive Differential Noise

Test Location	Normal	If Not Normal
1. Differential lock assembly.	Lock disengages fully when pedal is replaced.	Repair lock assembly.
2. Differential gears.	Cone point adjustment and backlash adjustment are correct.	Adjust.
	No wear or damage to gears or pinion teeth and splines.	Replace worn or damaged components.
3. Differential bearings.	All bearings spin freely. No evidence of wear or damage.	Replace worn or damaged components.

Differential Does Not Work

CONDITIONS:

- Repair in Section 50.

Differential Does Not Work

Test Location	Normal	If Not Normal
1. Differential lock.	Lock disengages when pedal is released.	Repair lock assembly.
2. Pinion shaft.	Shaft is straight. No wear or damage to teeth or splines.	Replace pinion shaft.
3. Bevel pinions and gears.	No wear or damage to teeth or splines.	Replace pinions and/or gears.
4. Thrust washers.	No wear or damage.	Replace thrust washers.
5. Differential housing.	Housing is not damaged or distorted.	Replace housing.

Differential Lock Does Not Work

CONDITIONS:

Repair in Section 50.

Differential Lock Does Not Work

Test location	Normal	If not normal
1. Pedal.	Movement of pedal causes shaft to move out of housing. Pedal is not worn, bent or damaged	Replace pedal.
2. Lock shaft.	Shaft slides freely and is not worn or damaged.	Replace lock shaft.

Differential Chatters

CONDITIONS:

- Axle repair in Section 50.
- Differential repair in Section 50

Differential Chatters

Test Location	Normal	If Not Normal
1. Axles.	Axles are mounted securely and show no evidence of wear or damage.	Repair axle(s).
2. Differential gears and pinions.	No wear or damage to gear teeth or splines.	Replace gears or pinions.
3. Differential bearings.	Bearings spin freely. No wear or damage.	Replace bearings.

Axle Noise

CONDITIONS:

- Repair in Section 50.

Axle Noise

Test Location	Normal	If Not Normal
1. Final drive pinion shaft.	No wear or damage.	Replace pinion shaft.
2. Planetary pinions.	No wear or damage.	Replace pinions.
3. Ring gear.	Adjusted properly. No wear or damage.	Adjust free play or replace ring gear.
4. Axle bearings.	All bearings spin freely. No wear or damage.	Replace bearings.

Axle Shaft Will Not Turn

CONDITIONS:

- Brake repair in Section 60.
- Axle repair in Section 50.

Axle Shaft Will Not Turn

Test Location	Normal	If Not Normal
1. Brakes.	Brakes disengage fully when pedal is released.	Adjust or repair brakes.
2. Axle shaft.	Axle shaft is not seized or broken.	Repair or replace axle.
3. Planetary unit.	Planetary unit is not seized or broken.	Repair or replace planetary.

MFWD Lever is Hard to Engage

CONDITIONS:

- Repair in Section 50.

MFWD Lever is Hard to Engage

Test Location	Normal	If Not Normal
1. MFWD shift linkage.	Linkage operates smoothly. No evidence of wear, damage or bent condition.	Repair or replace linkage.
2. Shift fork.	No evidence of wear, damage or bent condition.	Replace shift fork.
3. Shift collar.	Collar slides smoothly. No wear or damage to splines.	Clean and lubricate, or replace collar.
4. MFWD Shaft.	No wear or damage to splines.	Replace shaft.

MFWD Lever Will Not Stay in “On” Position

CONDITIONS:

- Repair in Section 50.

MFWD Lever

Test Location	Normal	If Not Normal
1. MFWD shift linkage.	No evidence of wear, damage or bent condition.	Repair or replace linkage.
2. Shift fork.	No evidence of wear, damage or bent condition.	Replace shift fork.

Noisy Front Wheel Drive Operation

CONDITIONS:

- Repair in Section 50.

Noisy Front Wheel Drive Operation

Test Location	Normal	If Not Normal
1. MFWD shafts and gears.	No wear or damage to teeth or splines.	Replace shafts or gears.
2. Bearings.	All bearings spin freely. No wear or damage.	Replace bearings.

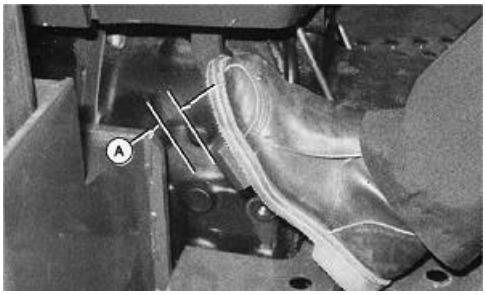
Clutch Pedal Free Play Adjustment

REASON:

To make sure traction clutch is fully engaged when clutch pedal is released and fully disengaged when pedal is depressed.

Tractors Without Cab

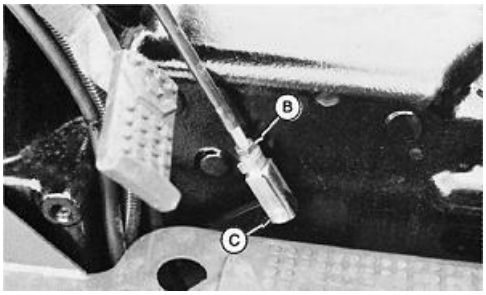
[1] -



Measure Free Play Distance

Depress clutch pedal to feel how far the pedal travels before resistance is felt. Measure free play distance (A).

[2] -



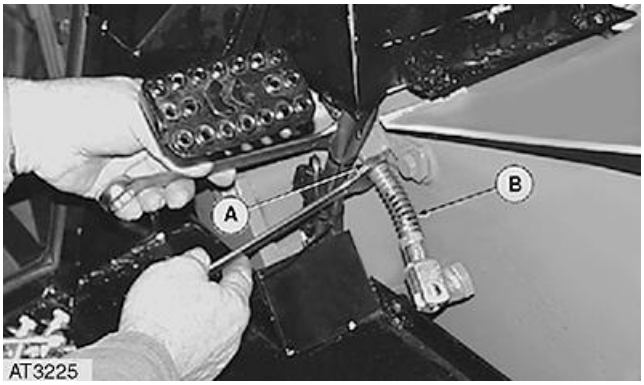
Lock Nut, Clip, and Pin

If not within specifications, loosen lock nut (B), remove clip and pin (C) and rotate turnbuckle as necessary.

Item	Measurement	Specification
Clutch pedal free play	Distance	13 ±3 mm 0.512 ± 0.118 in.

Tractors With Cab

[1] -



Measure Free Play Distance

Depress clutch pedal to feel how far the pedal travels before resistance is felt. Measure free play distance.

[2] - If not within specifications, remove clip pin and adjust free play distance with nut (A) and spring (B).

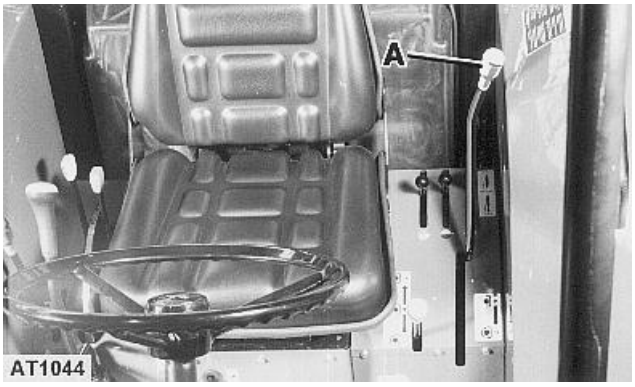
Item	Measurement	Specification
Clutch pedal free play	Distance	13 ±3 mm 0.512 ± 0.118 in.

→NOTE:

See Section 50 for inspect and repair clutch pedal.

PTO Clutch Lever Adjustment

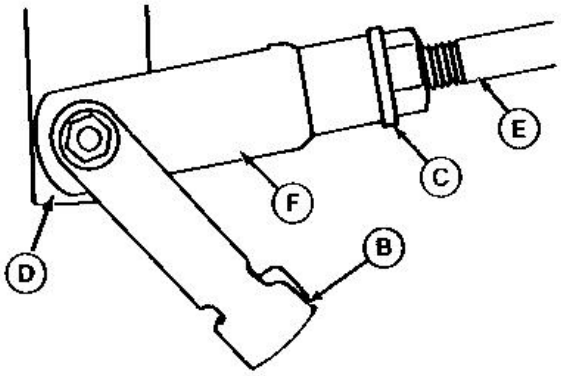
Tractors Witout Cab



LEGEND:

A	PTO clutch lever
B	Clip pin
C	Lock nut
D	Arm
E	Rod
F	Front clevis

PTO Clutch Lever



PTO Clutch Lever Components

REASON:

To make sure PTO clutch is fully engaged when lever is fully forward and fully disengaged when lever is fully rearward.

→NOTE:

PTO lever should be in its rearward (disengaged) position for adjusting PTO clutch linkage.

[1] - Remove clip pin (B) from forward end of PTO clutch lever (A).

[2] - Loosen lock nut (C) from rear of front clevis (F).

[3] - Adjust length of rod (E) so the clip pin (B) can be inserted with the rod pulled forward and the arm pulled rearward to eliminate freeplay. Lengthen rod (E) by 1/2 turn of the clevis (F) to provide a slight amount of lever freeplay.

[4] - Reinstall clip pin (B) in clevis (F) and arm (D).

[5] - Check for equal thread engagement at each end of the PTO clutch rod. Lock nut at the rear (not shown) can be loosened and the rod turned to equalize thread engagement (PTO adjustment is not affected).

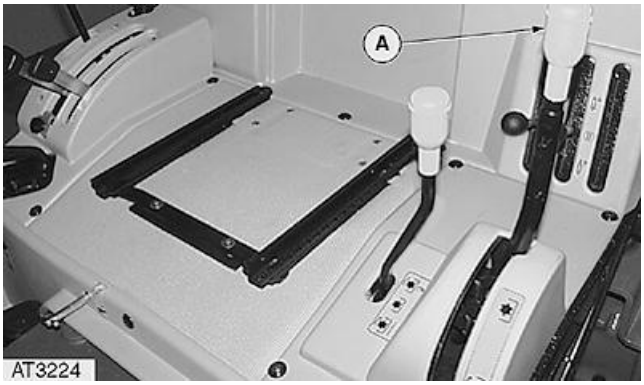
[6] - Retighten lock nuts (C) at each end of rod.

Tractors With Cab

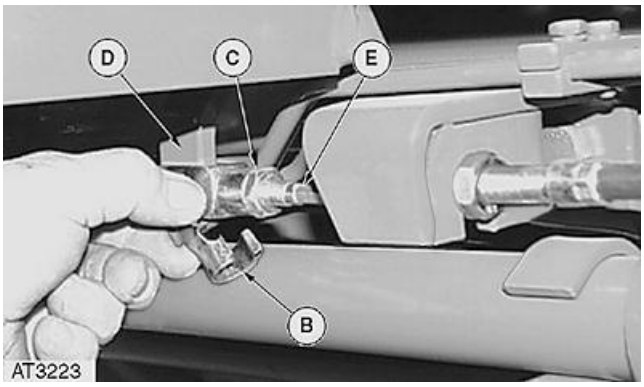
[1] -

→NOTE:

PTO lever should be in its rearward (disengaged) position for adjusting the PTO clutch linkage.



PTO clutch lever



Clip pin, lock nut, arm and cable

Remove clip pin (B) from cable (E).

[2] - Loosen lock nut (C).

[3] - Adjust lenght of cable (E) and its free play.

[4] - Tighten lock nut (C) and reinstall clip pin (B).

[5] - Check freely engagement of PTO lever (A).

Section 260 - STEERING AND BRAKE SYSTEMS - OPERATION AND TESTS

Table of contents

Group 05 - Component Location

General Information

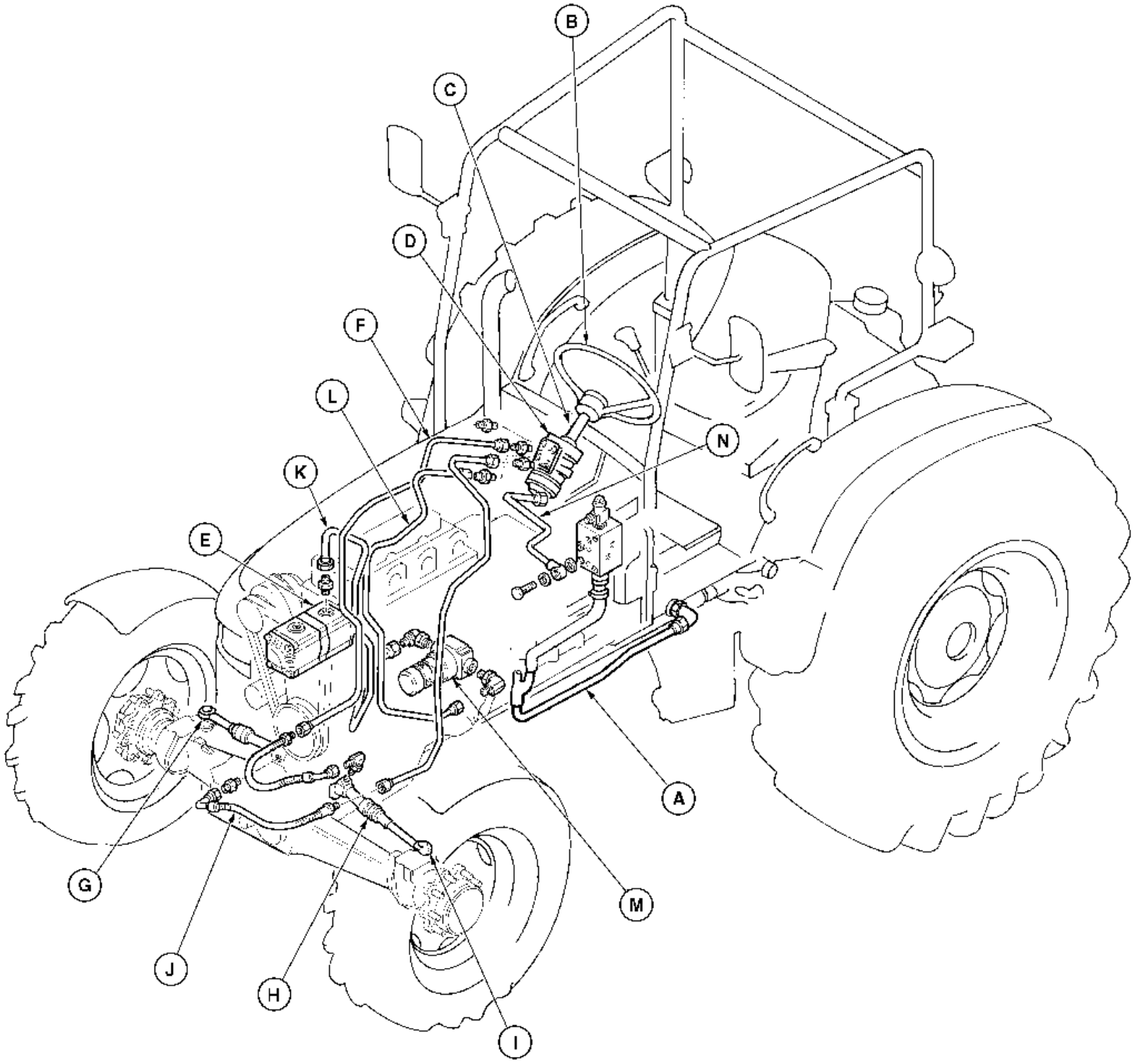
This group contains component location drawings for the following steering and brake system components:

- Steering System
- Brake System

Use the drawings when troubleshooting steering and brake problems to help locate the components to be tested.

Steering System Components

Tractors without cab



AT3226

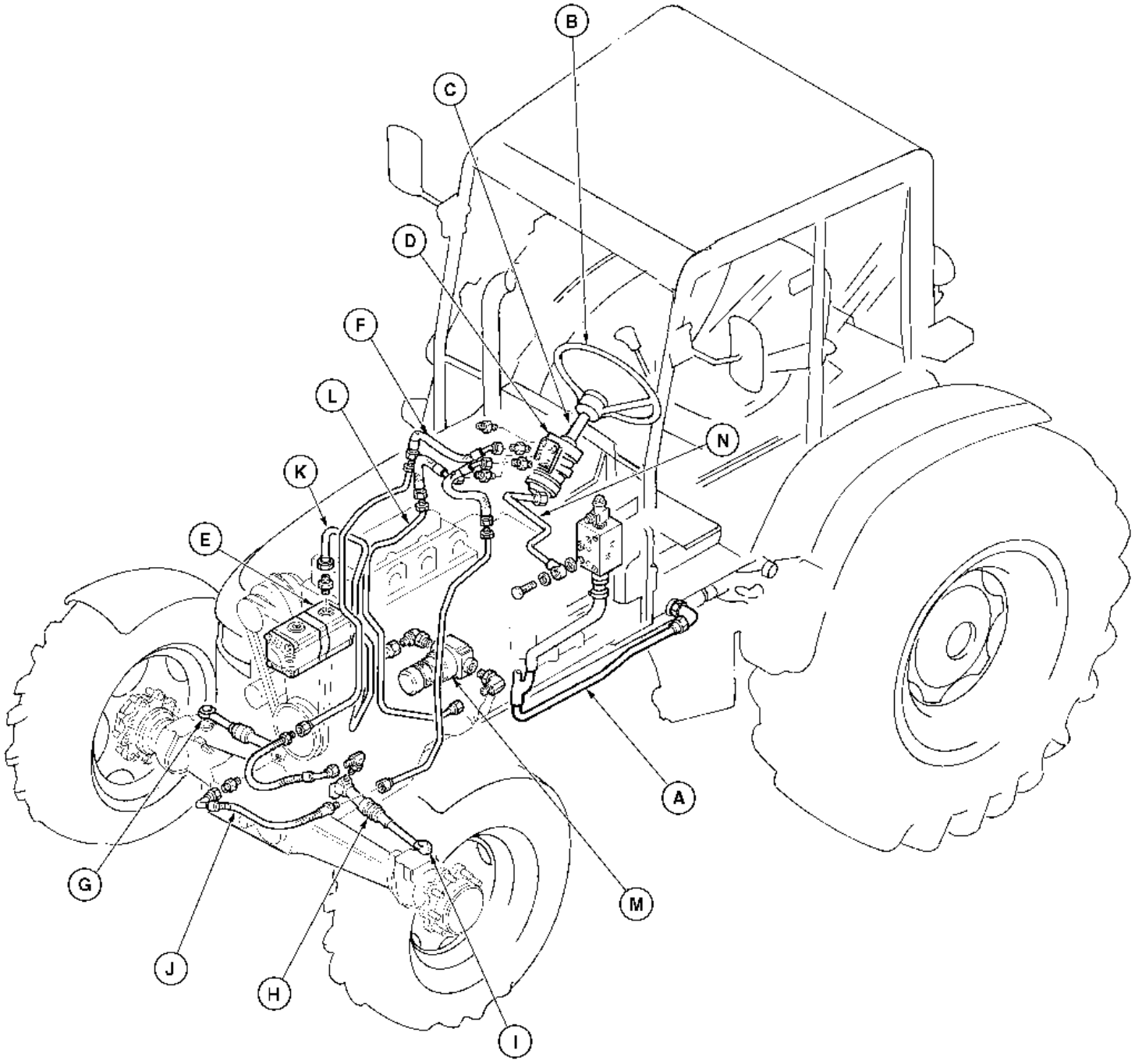
Steering system, tractors without cab

LEGEND:

A	Return Line
B	Steering Wheel
C	Steering Column
D	Steering Valve
E	Hydraulic Pump
F	Pressure Line
G	Tie Rod End
H	Steering Cylinder
I	Tie Rod End

J	Pressure Line
K	Supply Line
L	Suction Line
M	Hydraulic Oil Filter
N	Steering Valve Return Line

Tractors with cab



AT3227

Steering system, tractors with cab

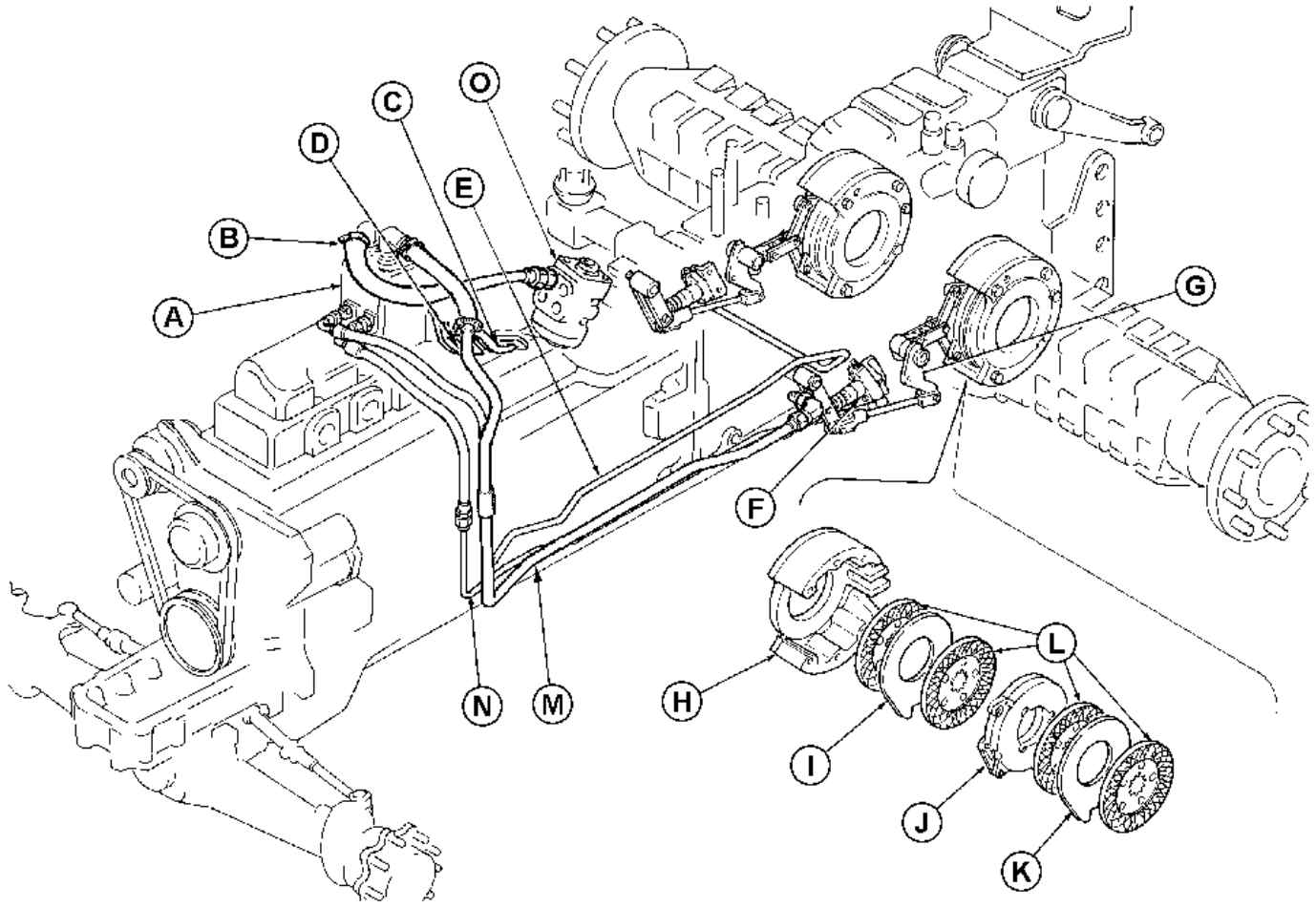
LEGEND:

A	Return Line
B	Steering Wheel
C	Steering Column
D	Steering Valve
E	Hydraulic Pump
F	Pressure Line

G	Tie Rod End
H	Steering Cylinder
I	Tie Rod End
J	Pressure Line
K	Supply Line
L	Suction Line
M	Hydraulic Oil Filter
N	Steering Valve Return Line

Brake System Components

3 cylinder tractors - 30 Km/h



AT3228

Brake system, 3 cylinder tractors - 30 Km/h

LEGEND:

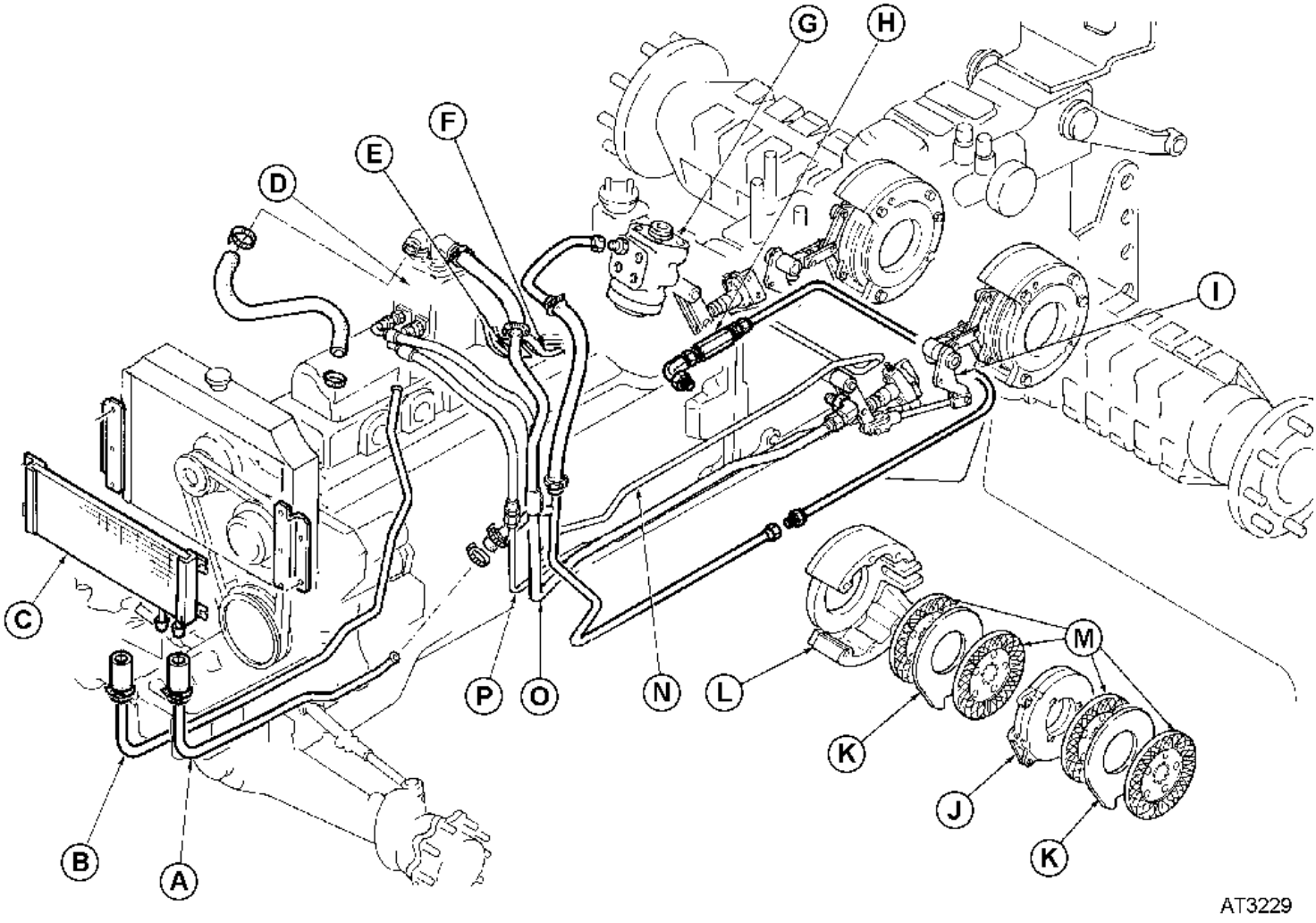
A	Brake Valve
B	Hydraulic Oil Supply Line
C	Left Brake Pedal
D	Right Brake Pedal
E	Right Brake Pressure Line
F	Brake Actuator
G	Brake Linkage
H	Brake Housing
I	Brake Plate
J	Brake Reaction Plate
K	Brake Plate
L	Brake Disks
M	Hydraulic Oil Return Line
N	Left Brake Pressure Line
O	Steering Valve

→NOTE:

Brake valve supply line (B) is connected to steering valve return line.

The tractor is also equipped with a mechanical park brake.

4 cylinder tractors - 30 Km/h

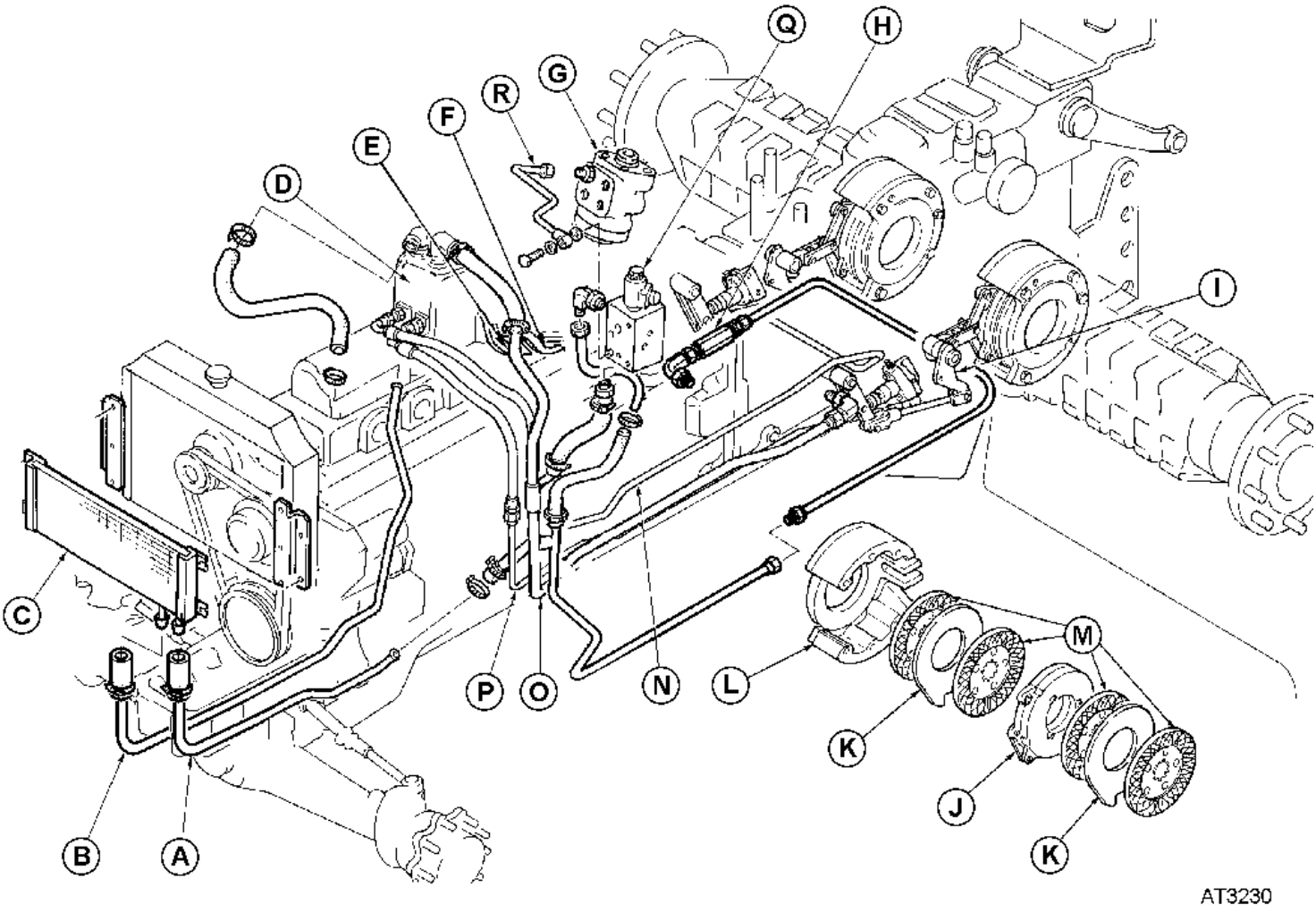


Brake system, 4 cylinder tractors - 30 Km/h

LEGEND:

A	Hydraulic return line from MFWD solenoid valve to oil cooler
B	Oil cooler line to brake valve
C	Oil cooler
D	Brake valve
E	Right Brake pedal
F	Left brake pedal
G	Steering valve
H	Relief valve
I	Brake linkage
J	Brake reaction plate
K	Brake plate
L	Brake housing
M	Brake disks
N	Right pressure line
O	Hydraulic oil return line
P	Left brake pressure line

4 cylinder tractors - 40 Km/h

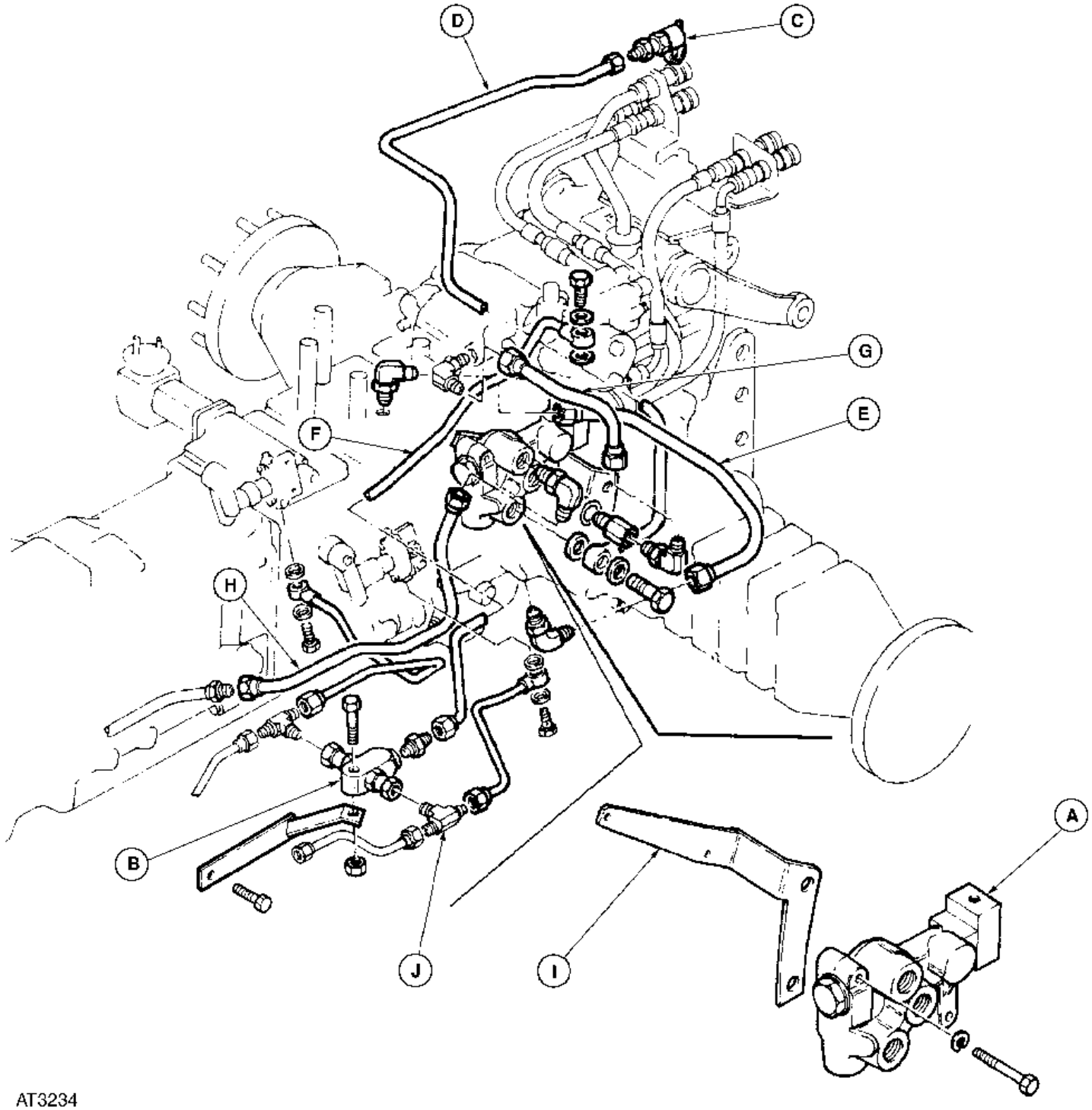


Brake system, 4 cylinder tractors - 40 Km/h

LEGEND:

A	Hydraulic return line from MFWD solenoid valve to oil cooler
B	Oil cooler line to brake valve
C	Oil cooler
D	Brake valve
E	Right Brake pedal
F	Left brake pedal
G	Steering valve
H	Relief valve
I	Brake linkage
J	Brake reaction plate
K	Brake plate
L	Brake housing
M	Brake disks
N	Right pressure line
O	Hydraulic oil return line
P	Left brake pressure line
Q	MFWD solenoid valve
R	Hydraulic return line from steering valve to MFWD solenoid valve

Trailer Brake System Components



AT3234

Trailer brake components

LEGEND:

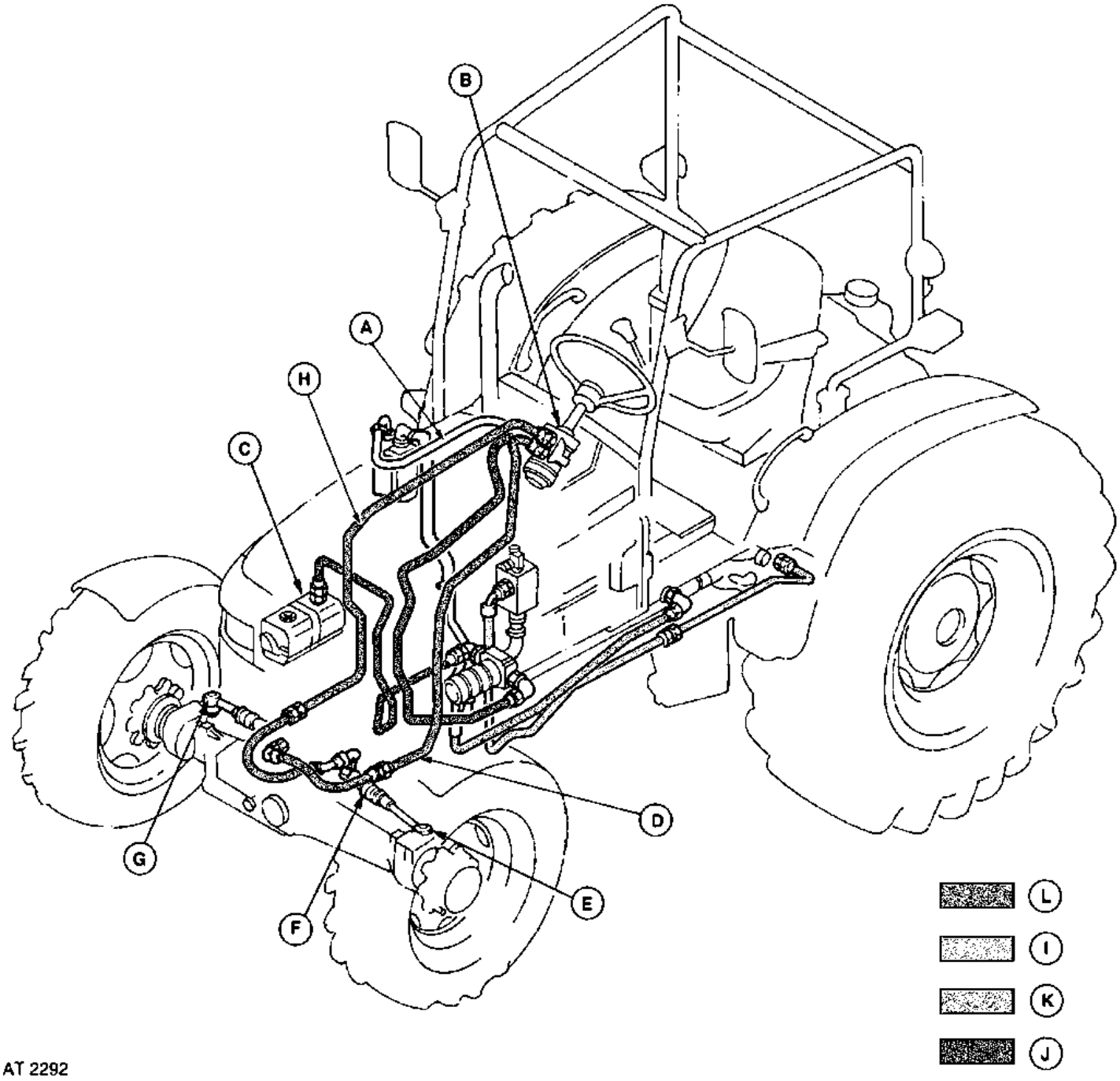
A	Trailer Brake Valve
B	Commutation Valve
C	Joint Connection Coupler
D	Coupler line
E	Return line to sump
F	Tractor brake pressure line
G	Outlet line
H	Pressure line
I	Valve support
J	T-fitting (2 used)

Group 10 - Theory of Operation

Theory of Operation Information

The theory of operation story explains: Function of the component, operating conditions, components used, and system operation.

Steering System Operation



Shown a 3-cylinder tractor without cab - 30 Km/h

LEGEND:

A	Transmission Return Line
B	Steering Valve
C	Hydraulic Pump
D	Pressure Line (Right Turn)
E	Tie Rod
F	Steering Cylinder
G	Tie Rod
H	Pressure Line (Left Turn)
I	Suction Oil
J	Pump Pressure Oil
K	Return Oil
L	Trapped Oil

FUNCTION:

→NOTE:

The theory of operation is similar for all tractors.

Offer hydraulic power steering for ease of operation.

MAJOR COMPONENTS:

- Steering Valve
- Hydraulic Pump
- Steering Cylinder

THEORY OF OPERATION:

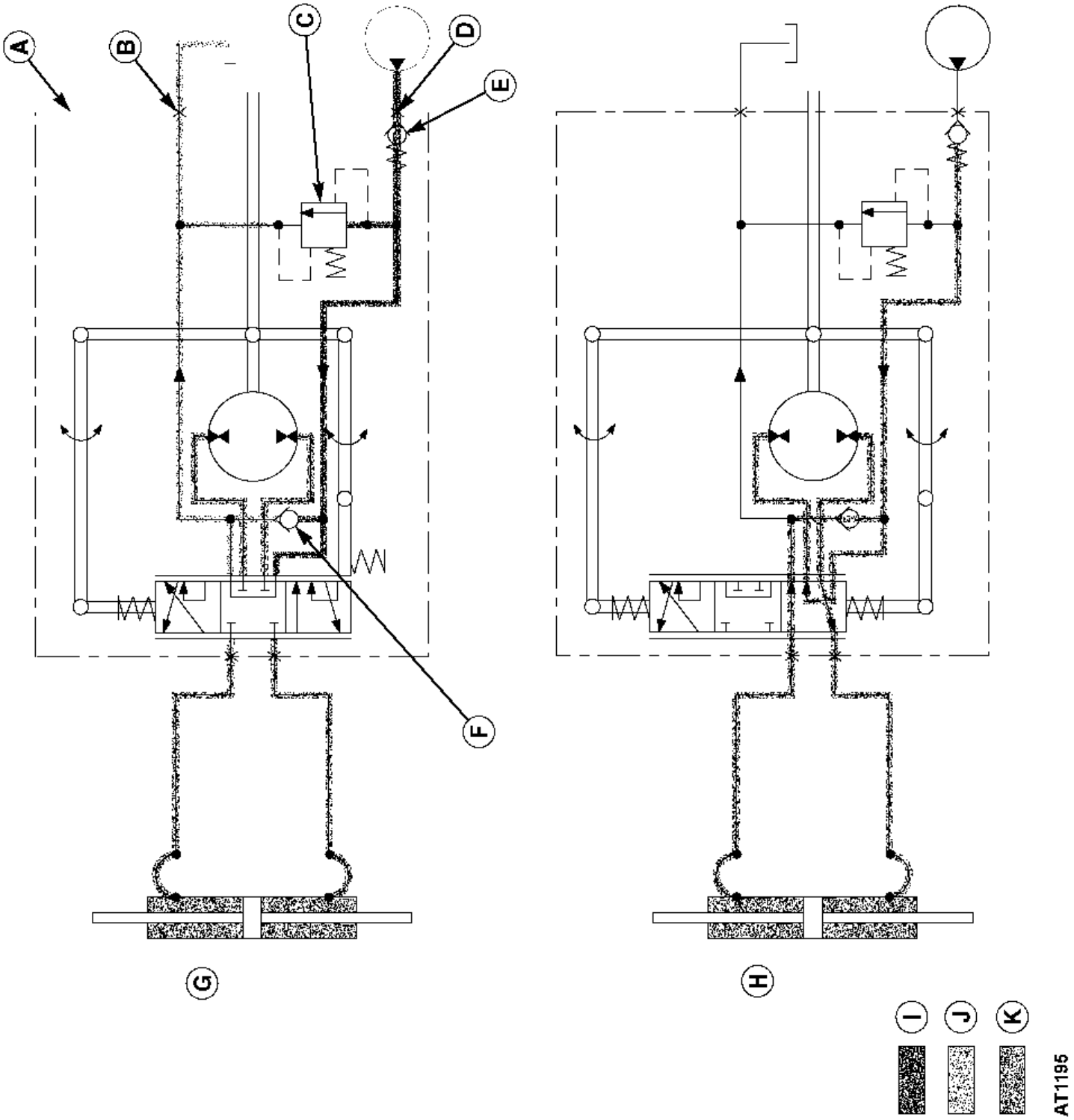
The hydraulic pump (C) takes filtered suction oil (I) from the transmission sump and pressurizes it. Pressure oil (J) is supplied to the steering valve (B). The steering valve distributes oil through pressure lines (D) or (H) to the steering cylinder (F) as needed.

Under neutral steer conditions (no steering wheel movement), the pressure lines and steering cylinder contain trapped oil (L), which maintains steering direction. Turning the steering wheel to the right, even a slight amount, allows pressure oil to enter line (D), pushing the steering cylinder rod and left tie rod (E) outward (and pulling the right tie rod (G) inward). Under these conditions line (H) allows return oil to flow from the steering cylinder to the steering valve and to the transmission return line (A).

When the steering wheel is turned to the left, pressure oil enters line (H) pushing the steering cylinder rod and right tie rod (G) outward (and pulling the left tie rod (E) inward). Retum oil can flow through line (D) from the steering cylinder to the steering valve and the transmission return line.

The steering valve is designed to allow manual steering if the engine is not running or the hydraulic pump fails.

Steering Valve Operation-Neutral and Manual Turning



Neutral and Manual Turning

LEGEND:

A	Valve Body
B	Return Port
C	Steering Relief Valve
D	Inlet Port
E	Inlet Check
F	Manual Steering Check
G	Neutral Mode
H	Manual Turning (Left)

I	Pressure Oil
J	Return Oil
K	Trapped Oil

FUNCTION:

To block pressurized oil flow to the steering cylinder when no turning action is desired. To allow for manual turning of the machine when no power is available.

MAJOR COMPONENTS:

- Inlet Check
- Valve Body
- Manual Steering Check
- Spool
- Sleeve
- Gerotor
- Relief Valve

THEORY OF OPERATION:

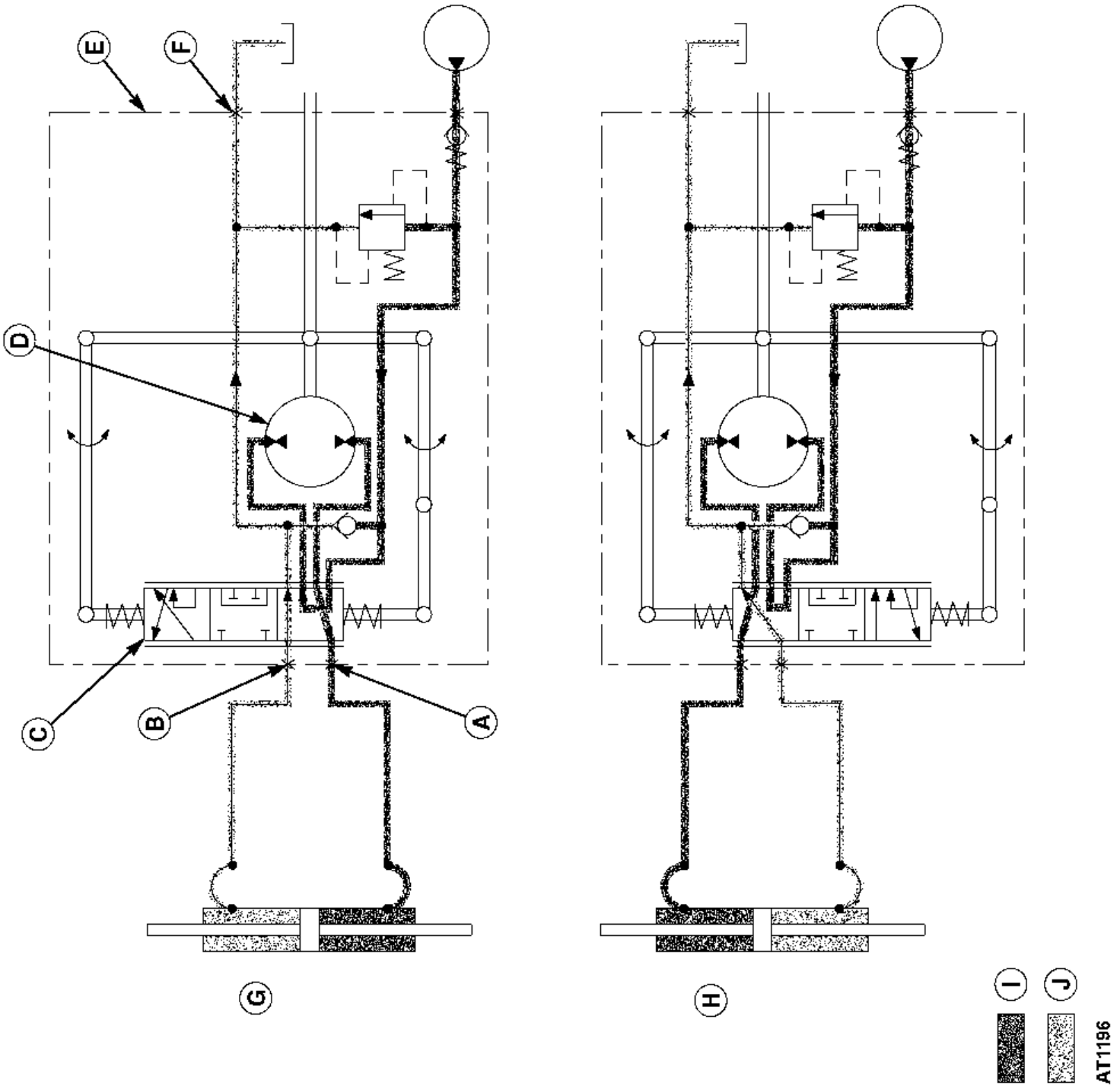
Pressurized oil (I) opens the spring loaded inlet check (E) and flows into the valve body (A) through the inlet port (D). Oil then flows through the inlet passage to close the manual steering check (F) and reach the feed holes. The feed holes direct oil flow through the sleeve inlet groove to the spool inlet.

When the valve is in neutral mode (G) the return oil passages of the sleeve and spool are aligned and open, while the right turn and left turn passages are blocked and closed. The open passage allows return oil (J) to travel through the center of the spool and leave the valve through the return port (B). Blocking the turn passages traps oil (K) in the gerotor cavities, hydraulic lines and the steering cylinder.

Should hydraulic pressure be lost (engine off or pump failure) the inlet check closes and manual steering check opens to create a closed-loop steering system. The closed-loop steering system uses trapped oil to allow for manual steering of the machine (no power). As the steering wheel is turned (right or left) trapped oil is forced from the gerotor cavities through the now aligned turn passages of the sleeve and spool and out of the valve to the pressure side of the steering cylinder piston which moves the front wheels. Movement of the piston forces trapped oil from the non-pressure side of the piston to the return passage of the spool and sleeve and then to the gerotor cavities where it replenishes the system and completes the closed-loop.

To prevent damage to hydraulic system components a relief valve (C) is installed in the valve body. Should the oil flow be blocked and hydraulic pressure rise above relief pressure, the relief valve will open and direct all oil flow to the return port.

Steering Valve Operation-Power Turning



Power Turning

LEGEND:

A	Left Turn Port
B	Right Turn Port
C	Sleeve/Spool (control valve)
D	Gerotor (metering pump)
E	Valve Body
F	Return Port
G	Left Turn
H	Right Turn
I	Pressure Oil
J	Return Oil

FUNCTION:

Supply hydraulic oil to the proper side of the steering cylinder to turn the wheels, when the engine is running.

MAJOR COMPONENTS:

- Valve Body
- Spool Sleeve
- Gerotor

THEORY OF OPERATION:

Pressurized oil (I) is supplied to the sleeve inlet groove and spool inlet following the same path as when the valve is in neutral.

The steering wheel is mechanically connected to the valve spool and gerotor gear by the steering column. Turning the steering wheel (right or left) rotates the valve spool within the sleeve to align pressure and return passages.

Oil flows through the pressure passage to the gerotor where it fills the cavity between the gerotor gear and body.

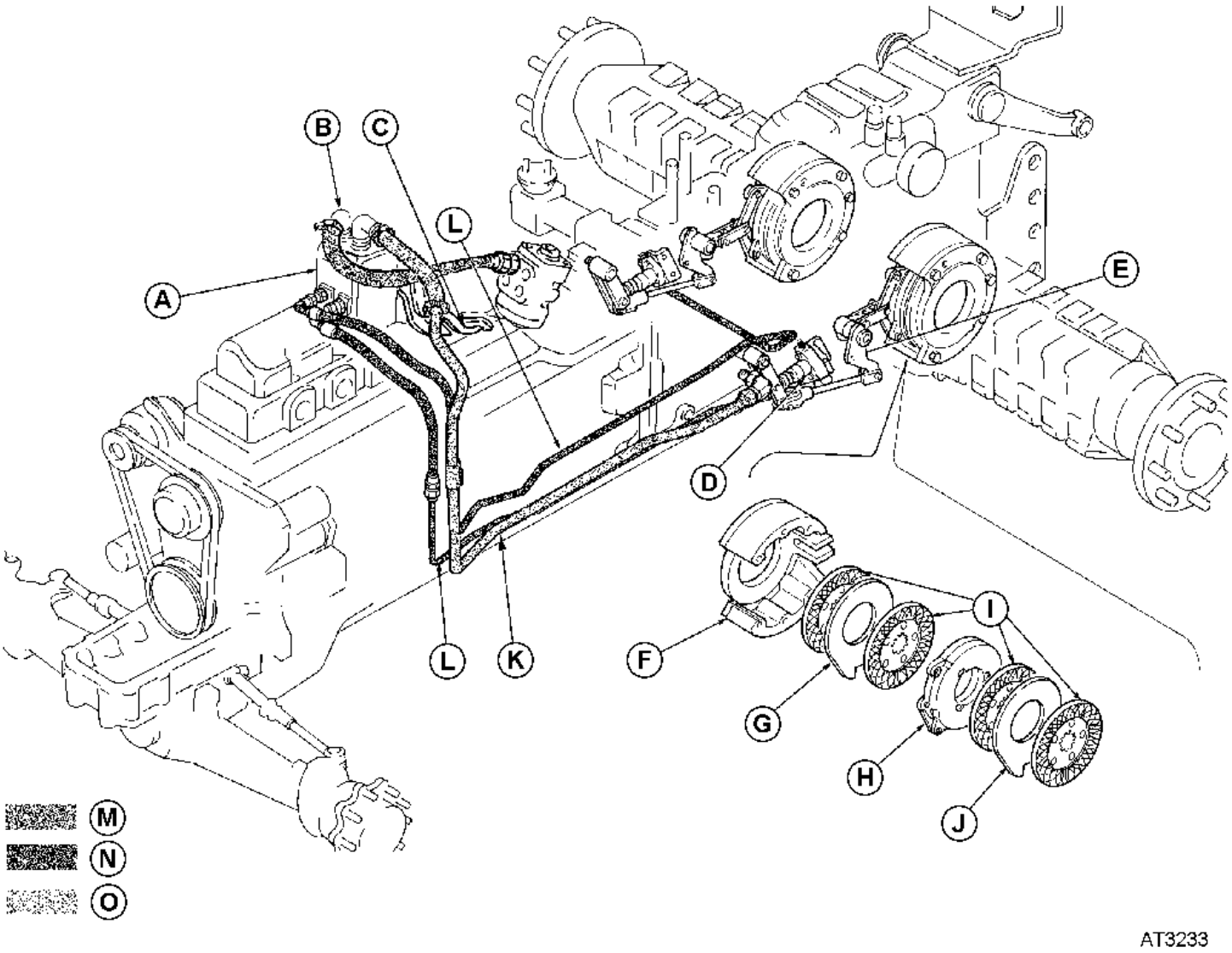
The rotation of the gerotor gear is offset to the body to enlarge and reduce the size of the cavity, as the gear turns. The gerotor gear is timed to the valve body passages so the cavity is filled with oil when it is at its′ largest and emptied when it is smallest. By enlarging and then reducing the size of the gerotor cavities a greater volume of oil is metered to the steering cylinder which improves steering efficiency. The gerotor cavities are filled and emptied 6 times faster when the steering wheel is turned.

Pressurized oil flows from the gerotor back to the sleeve and spool where it is directed out of the valve through the open turn passage and turn port (A). Oil then flows through a hydraulic line to the steering cylinder where it moves the piston which turns the front wheels.

Oil on the opposite side of the piston is forced from the cylinder and returns to the steering valve through a hydraulic line and the opposite turn port (B).

Return oil (J) flows through a valve passage to the open return passages in the sleeve and spool. Oil then flows to a common return passage located at the center of the spool. Oil leaves the valve by the common return passage and port (F).

Brake System Operation



Brake System Operation - 3 cylinder / 30 Km/h version shown

LEGEND:

A	Brake Valve
B	Supply Line
C	Brake Pedals
D	Brake Actuator
E	Brake Linkage
F	Brake Housing
G	Brake Plate
H	Brake Reaction Plates
I	Brake Discs
J	Brake Plate
K	Return Line
L	Brake Pressure Lines
M	System Oil
N	Pressure Oil
O	Pressure-Free/Return Oil

FUNCTION:

To provide a means of stopping the tractor and assist the operator when maneuvering the tractor through tight turns.

MAJOR COMPONENTS:

- Brake Valve
- Brake Actuator
- Brake Plates
- Brake Discs
- Pressure Lines
- Brake Reaction Plates

→NOTE:

3 cylinder tractor, 30 Km/h version is shown.

THEORY OF OPERATION:

Pressing brake pedals (C) activates brake valve (A) which pressurizes the oil in lines (L). Pressurized oil (N) arrives at actuator (D) that by rod (E) rotates reaction plates (H). Reaction plates rotate in opposite directions and cause their expansion thus generating a pressure in brake discs (I) and in brake plates (G) and (J).

The brake plates are keyed to the brake housing and cannot rotate. The brake disc is splined to the axle shaft and rotates with it. When the plates and disc are forced together by the brake reaction plates, the friction surface of the disc causes it to bind against the plates and therefore stop axle shaft rotation. When pressure on the brake pedal is released, system pressure is released and the disc and axle are free to rotate.

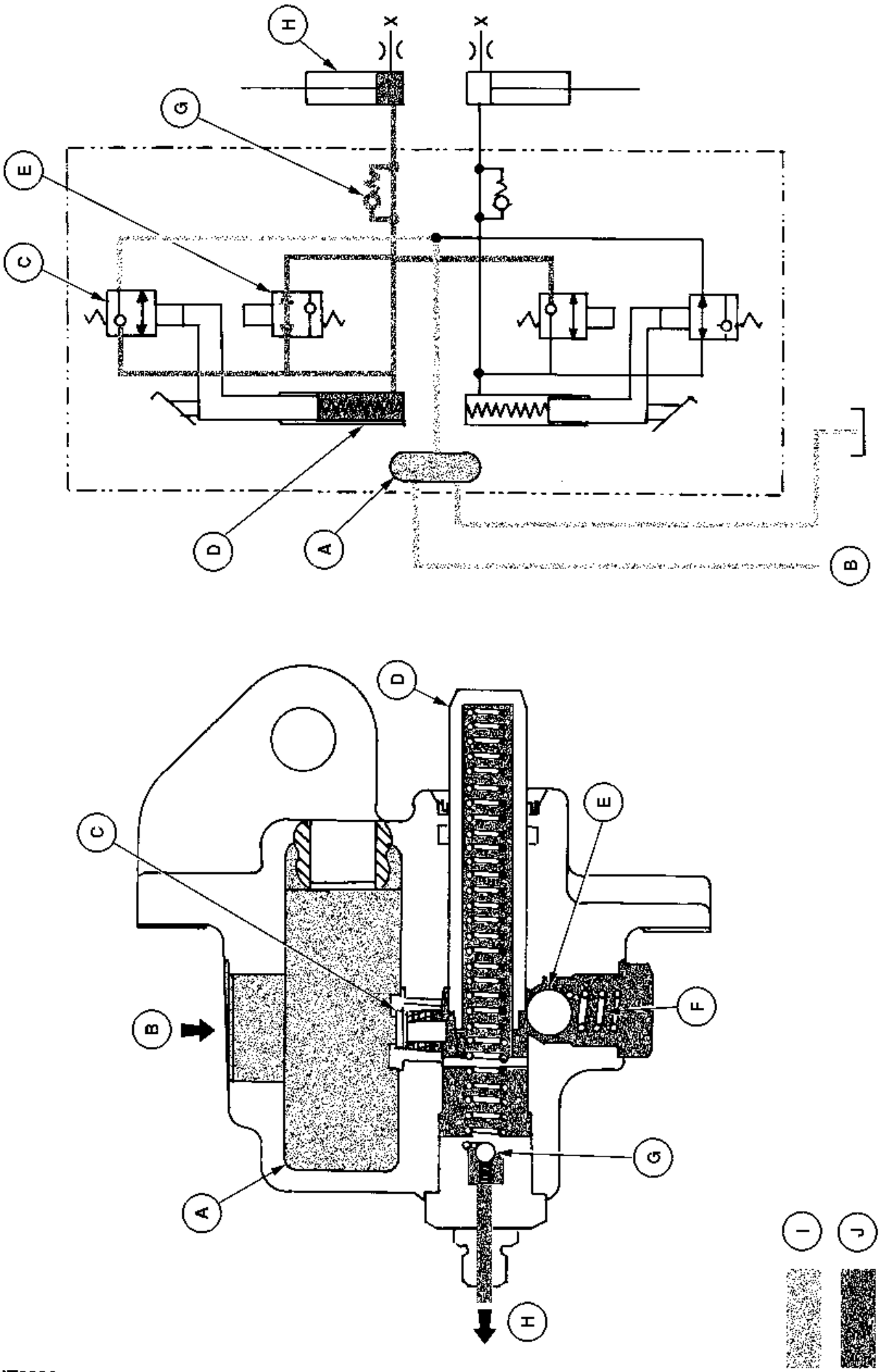
Oil for the brake system is provided via a supply line (B) at the steering valve. Excess system oil (O) is vented to the transmission sump via return line (K).

Brake pedals can be activated individually to assist in turning, or together for equal braking.

→NOTE:

If tractor is equipped with oil cooler, brake system is different. Supply line (B) is coming from oil cooler. The return line from steering valve goes to oil cooler. Oil flows through the oil cooler when it is very hot.

Brake Valve Operation - Brake Pedal Depressed



AT2293

Brake Valve Operation-Brake Pedal Depressed

LEGEND:

A	Reservoir
B	Supply Oil
C	Inlet Check Valve
D	Brake Piston
E	Pressure Equalizing Valve
F	Equalizing Passage
G	Outlet Check Valve
H	To Brake Actuator
I	Pressure-Free Oil
J	Pressure Oil

FUNCTION:

To supply hydraulic oil allowing both individual and dual braking.

MAJOR COMPONENTS:

- Pistons
- Reservoir
- Inlet Check Valves
- Outlet Check Valves
- Equalizing Valves

THEORY OF OPERATION:

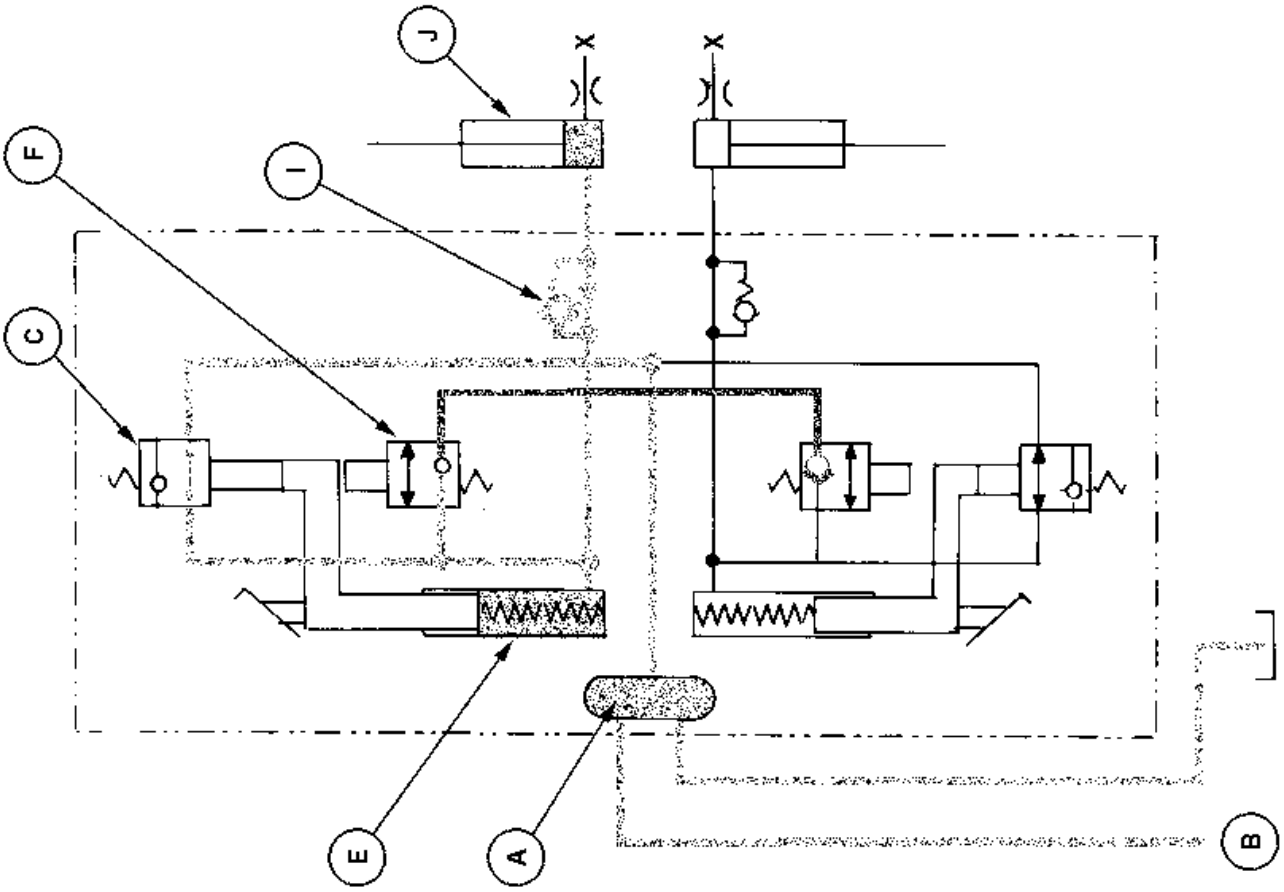
Supply oil is pressure-free oil in a sense, that it circulates through the brake valve acting as supply keeping the reservoir full.

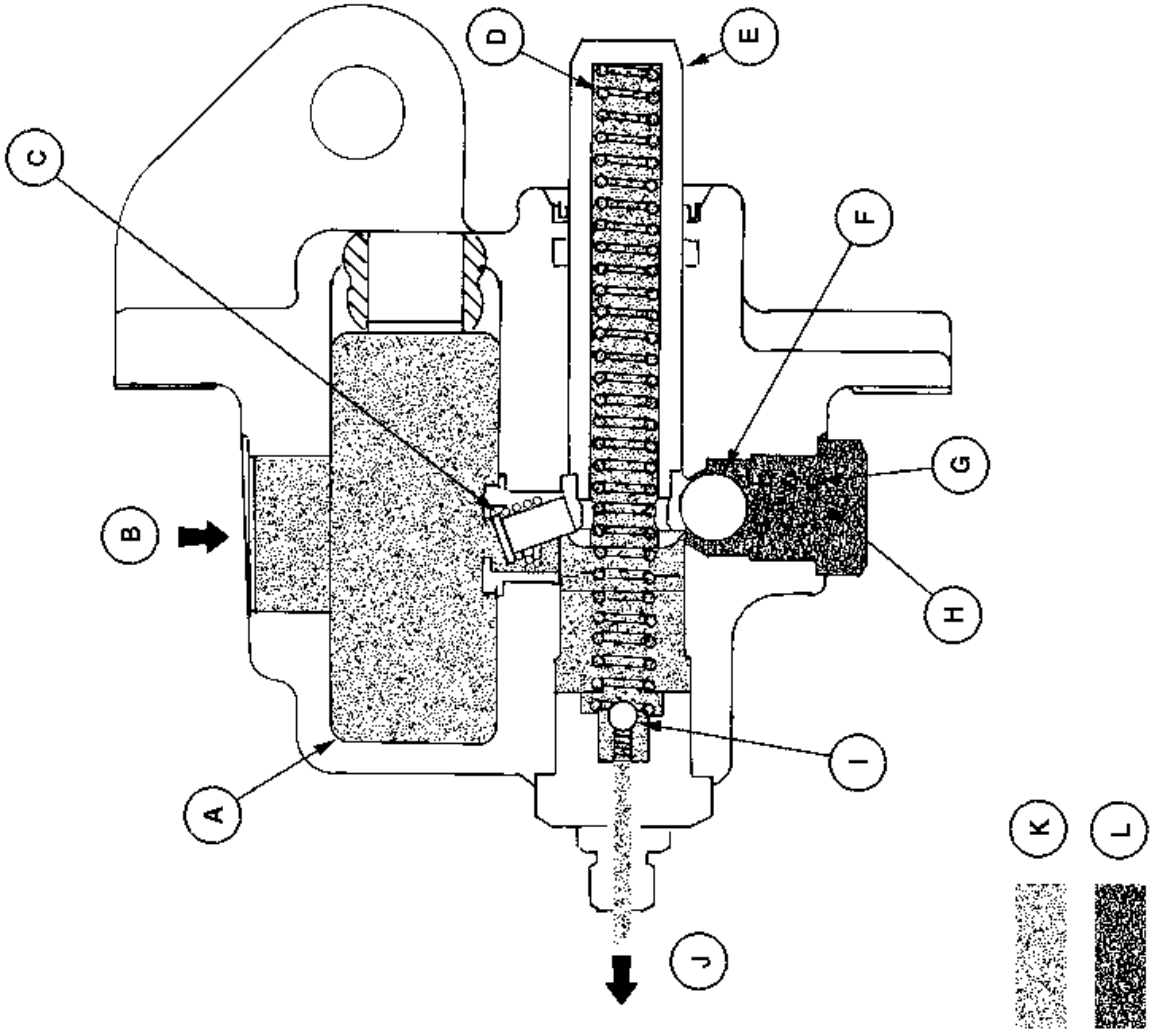
Brake Pedal Depressed

When either brake pedal is pressed, piston (D) is moved to the front, thereby closing inlet check valve (C), which immediately closes brake valve reservoir (A). As it travels further, the piston opens pressure equalizing valve (E), trapping the oil in equalizing passage (F). The increase in pressure causes outlet check valve (G) to open and the oil is forced under pressure to either brake actuator.

When both brake pedals are pressed, pressure oil flows through both outlet check valves to the brake housings causing the pistons to open both pressure equalizing valves (E), and the pressure in both brake cylinders is equalized.

The outlet check valves (G) ensure a simultaneous braking effect. The pressure equalizing valves and outlet check valves ensure equal braking.


J
X
X
F
I
C
E
A
B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E
C
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A
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AT2294

Brake Valve Operation

LEGEND:

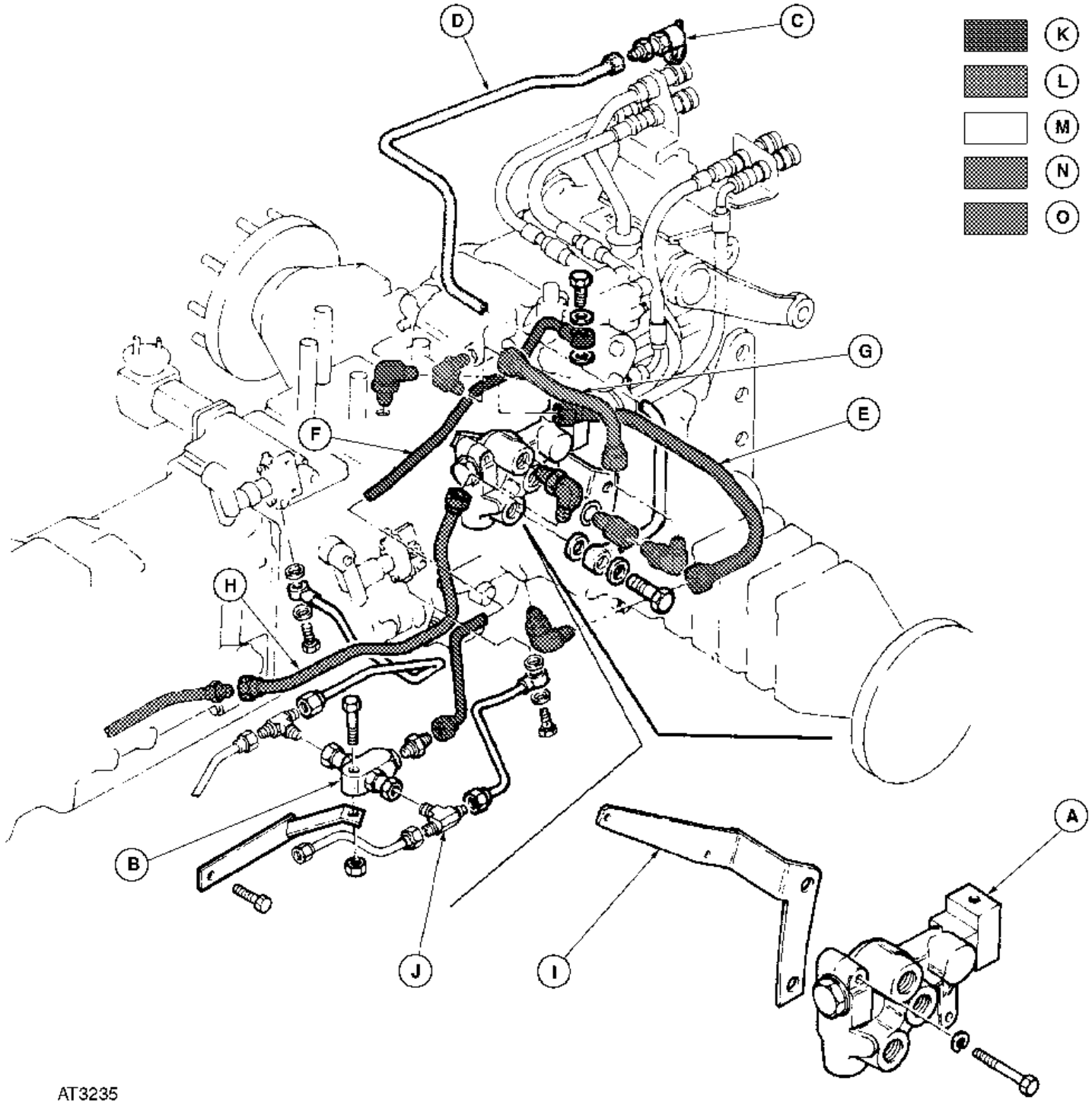
A	Reservoir
B	Supply Oil
C	Inlet Check Valve
D	Spring
E	Brake Piston
F	Pressure Equalizing Valve
G	Spring
H	Equalizing Passage
I	Outlet Check Valve
J	To Brake Actuator
K	Pressure-Free Oil
L	Trapped Oil

Brake Pedal Released

When brake pedals are released, oil in brake actuator is pressure-free and flows back to main brake valve. At the same time brake piston (E) is forced back by spring (D). Just before the pistons reach their final position, inlet check valves (C) open and oil can flow back into the brake valve reservoir (A). The orifice in outlet check valves (I) prevents the oil from returning to the brake valve reservoir too quickly and thus an interruption in the oil flow.

As piston reaches its final position, spring (G) forces equalizing valve (F) to close trapping oil in equalizing passage (H).

Trailer Brake System Operation



Trailer brake system operation

LEGEND:

A	Trailer Brake Valve
B	Commutation Valve
C	Joint Connection Coupler
D	Coupler line
E	Return line to sump
F	Tractor brake pressure line
G	Outlet line
H	Pressure line
I	Valve support
J	T-fitting (2 used)
K	Pilot oil pressure
L	Outlet line to rockshaft

M	Trailer brake circuit to joint connection coupling
N	Pressure line
O	Return line to sump

FUNCTION:

Offering hydraulic power to trailer brakes.

MAJOR COMPONENTS:

- Trailer Brake Valve
- Commutation Valve
- Joint Connection Coupling
- Commutation Coupling

THEORY OF OPERATION:

When the tractor brake pedal is applied, the pressurized pilot oil (K) passes through the commutation valve (B) and moves the internal spool of trailer brake valve (A).

Automatically valve (A) diverts oil from the pump and sends it to the trailer brake circuit through the joint connection coupling (C).

Trailer braking is thus simultaneous with tractor braking and is identical to the tractor.

The brake control valve (A) generally provides service brake only. An optional trailer braking fail-safe device may be fitted to provide emergency braking in the event that the trailer is accidentally unhitched.

Hydraulic Braking for Italian Market

On the trailer, one or two single cylinder are mounted on one of the axles for service braking, while one built-up cylinder is fitted on the other axle for service, parking and emergency braking.

The working pressure in the brake circuit of the trailer controller and operated by the valve fitted on the tractor is as follows:

1. From 8 bar (116 psi.) to 0 bar (0 psi.) the parking and emergency brake are operated.
2. From 10 bar (145 psi.) to 15 bar (217 psi) the free trailer brake is operated.
3. From 18 bar (261 psi.) to 140 bar (2030 psi.) the proportional, graduated, service brake is operated.

The valve is installed in the tractor hydraulic system. Only the necessary amount of hydraulic oil required to pressurize the cylinder of the trailer is taken, according to the command signals received from the tractor brake circuit.

Pilot pressure of 0 bar corresponds to a brake pressure of 10 bar (145 psi.) to 15 bar (217 psi) in the trailer.

Other user units such as the distributor and the hydraulic elevator, may be connected to the valve outlet without creating additional pressure.

The tractor hand brake lever is connected, by means of a electric device to the trailer brake valve to engage the parking brake when necessary.

Engagement of the parking brake is signaled by means of a pressure switch, fitted onto the valve and connected to an indicator lamp on the tractor dashboard. Naturally, the braking system should be applied smoothly on both the tractor and trailer. To achieve this, pilot pistons of varying diameter can be fitted to modulating valve in order to produce the correct braking rate on curves.

The pressure reaches the brake circuit of the trailer by means of coupling standard CUNA 344/4, thus producing the following effects:

In the compound cylinder when the oil pressure is between 8 bar (116 psi.) and 0 bar (0 psi.), the force of the large spring exceeds the hydraulic pressure pushing out the piston rod and thus exerting force on the brake lever.

The lower the pressure in the hydraulic braking system, the greater the force exerted on the lever by the springs. When however the oil is at a pressure between 8 bar (116 psi.) and 18 bar (261 psi.), it is the force of the small spring, which maintains the rod in the rest position (the large spring is compressed at 8 bar, 116 psi.), which prevails.

If oil pressure exceeds 18 bar (261 psi.), the force exerted on the rod by the oil under pressure is greater than that of the small spring and the rod is thrust out at a rate consistent with the degree of pressure.

In the single cylinder, a small spring holds the piston rod in check until the pressure exceeds 18 bar (261 psi.), after which the hand brake is engaged.

The built-up cylinder are equipped with a special automatic clearance recovery system which produces a 55 mm traverse of the 45 mm brake stroke, at 3 mm intervals, thereby maintaining ideal brake settings. The clearance recovery system does not in any way reduce the braking force applied upon engagement.

Group 15 - Diagnosis, Tests and Adjustments

Special or Essential Tools

→NOTE:

Order tools according to information given in the U.S. SERVICEGARD ™ Catalog or in the European Microfiche Tool Catalog (MTC).

Flowmeter

JT05469

Measuring hydraulic pump flow

Pressure Gauge with Coupler

JT03345

Steering valve relief test

Adapter

JT03368

Depending on hose connection, use with JT05469 flowmeter

Adapter

JT03336

Depending on hose connection, use with JT05469 flowmeter

Adapter

JT03123 and JT03041

Depending on hose connection, use with JT05469 flowmeter

Hose with Coupler

JT03364

To be used with JT03345 pressure gauge, JT03110 adapter and JT03367 connector

Adapter

JT03110

To be used with JT03345 pressure gauge, JT03364 hose and JT03367 connector

Connector

JT03367

To be used with JT03345 pressure gauge, JT03364 hose and JT03110 adapter

Diagnostic Information

1. Perform the “Operational Check”
2. Perform the “System Test” when looking for unspecified failure.
3. The symptom headings in this group can be used to test components related to a specific problem or symptom. Select a

symptom from the list and follow the test procedures under the heading.

The symptom headings are:

- Steering Sluggish or Loss of Steering
- Excessive Brake Pedal Leak-Down
- Excessive Brake Chatter

The diagnostic procedure lists:

- Test conditions
- Test sequence
- Test location
- Normal reading or possible result
- Check or test to perform if reading is not normal (Not OK)

When performing the test or check, be sure to follow the test conditions and sequence carefully. The middle, column gives the normal reading or condition that should be obtained when performing the test or check. If the results of the test or check are not normal (Not OK), perform the operation listed in the third, “If Not Normal” (Not OK) column to repair the malfunction.

Steering System Operational Check

1. Make sure tire inflation is correct, front blasting is not excessive and implements are properly fitted and adjusted.
2. Check torque of wheel bolts and rim screws.
3. Inspect complete system for leakage. Locate the source of leakage and make any necessary repairs.
4. Make sure hydraulic oil level is correct.
5. Drive tractor onto a level surface and stop it there
6. Run the engine.
7. Turn the steering wheel several times in each direction.

   →NOTE: It should be easy to turn the steering wheel smoothly in both directions. The steering lock position must be distinct.

8. Drive the tractor and turn the steering wheel several times in each direction.

   →NOTE: There should be no need to correct the position of the steering wheel while tractor is driving straight ahead.

9. On tractors with MFWD operate the tractor with MFWD engaged and disengaged. If a difference in steering is noticed with the MFWD engaged inspect the front axle.

Steering System Diagnosis

Preliminary check

(1) Basic hydraulic functions

Action:

Perform the "Hydraulic System Major Test" , see Section 70, Group 15.

→NOTE:

Perform the Hydraulic System Major Test to ensure the basic functions of the hydraulic system.

Result:

YES:GO TO 2

NO: Repair as needed before beginning with step 2.

(2) Check mechanical components

Action:

2.1 Lift front end of tractor. Engine off.

Rotate both wheels and check for any roughness or free play.

Result:

YES:GO TO 2.2

NO: Inspect front wheel bearings and MFWD final drives , see Section 50, Group 30. Repair failures.

Action:

2.2 Front end of tractor raised. Engine off.

Check free play of swivel bearings and tie rods.

Result:

YES:GO TO 2.3

NO: Inspect Swivel Housings see Section 50, Group 30. Inspect Tie Rods , see Section 60, Group 05.

Action:

2.3 Front end of tractor raised. Engine at low idle.

CAUTION:

Handbrake engaged and Transmission at neutral.

Rotate steering wheel to each direction and check for malfunction.

Result:

YES: GO TO 3

NO:GO TO 2.4

Action:

2.4 Front end of tractor raised. Engine off.

Disconnect hydraulic hoses from steering cylinder. Drain oil from steering cylinder.

Move wheels by hand in each direction and check for sticking or unusual resistance.

Result:

YES:GO TO 2.5

NO: Repair steering cylinder , see Section 60, Group 05.

Action:

2.5 Front end of tractor raised. Engine off.

Hydraulic hoses disconnected from steering cylinder.

Rotate steering wheel in each direction. Check steering column and valve for unusual resistance or stuck.

Result:

YES: GO TO 3

NO: Repair or replace damaged components, see Section 60, Group 05.

(3) Check hydraulic components

Action:

3.1 Release front end of tractor.

Connect hydraulic hoses to steering cylinder and bleed air from system. To do this, run engine and rotate steering wheel at each direction several times.

Check steering valve leakage. See “Steering Valve Leakage Test” in this Group.

Result:

YES:GO TO 3.2

NO: Inspect valve, see “Disassemble and Inspect Steering Valve” in Section 60, Group 05.

Action:

3.2 Check steering relief valve pressure, see “Steering Relief Valve Test” in this Group.

Result:

YES:GO TO 3.3

NO: Measure hydraulic pressure at couplers of SCV to ensure the hydraulic system is OK.

OK: If the hydraulic system pressure is within specification, replace steering relief valve, see Section 60.

Action:

3.3 Check steering cylinder leakage, see "Steering Cylinder Leakage Test" in this Group.

Result:

YES:GO TO 3.4

NO: See "Disassemble, Inspect and Repair Steering Cylinder" in Section 60, Group 05.

Action:

3.4 Check output of steering pump. See "Steering Pump Flow Test" in this Group.

Result:

YES:GO TO 4

NO: See "Disassemble and Inspect Steering Valve" in Section 60, Group 05.

(4) Hydraulic System Diagnosis

Action:

→NOTE:

If no failure was found at this stage but the problem still appears, check complete hydraulic system for malfunctions.

See "Hydraulic System Diagnosis" in Section 270, Group 15.

Result:

YES: Release tractor.

Steering Sluggish or Loss of Steering

CONDITIONS:

- Key switch off (test 1-4).
- Engine running (test 5-7).

Steering

Test Location	Normal	If not normal
1. Transmission oil filter.	Filter passes oil freely.	Replace filter.
2. Dipstick.	Oil level full.	Add oil to full mark.
3. Transmission oil pump.	Oil of correct viscosity.	Replace with correct oil.
4. Pick-up tube.	Tube clear.	Clean tube.
5. Hydraulic pump.	Pump pressure and flow within specifications.	Repair pump.
6. Steering valve.	No excessive internal or external leakage. Valve leakage test within specifications.	Repair steering valve.
7. Steering cylinder.	No excessive internal or external leaks. Cylinder leakage test within specifications.	Repair steering cylinder.
8. Hydraulic lines.	No leaks or kinks in lines.	Replace lines.

Brake System Operational Check

1. Press both brake pedals together.
2. Press each brake pedal separately.

→NOTE: The brake pedals must not sink of their own accord. If the brake pedals do sink excessively, turn to “Brake System Diagnosis” to find the reason.Ignore Step 3 for the time being.

CAUTION:

This test must be performed outdoors. Make sure there is no risk of injuring anybody.

Drive the tractor and actuate the brakes several times.

→NOTE: The brakes should respond safely and in a normal fashion. The tractor must not pull to one side.

- If the brakes should “rattle” in an unusual manner, check the hydraulic oil and change if necessary (see also “Hydraulic System Major Test” in Section 270.
- If the brake effect is insufficient, loud noises occur during braking or the brakes work on one side only (pulling the tractor to one side), the brakes need to be repaired. Inspect internal components on side indicating noise or vibration. See Section 60 for repair or perform the “Brake System Diagnosis” to isolate the problem.
- Check the handbrake.

→NOTE: The handbrake lever must engage in the 4th notch at a force of 100 to 150 N (22 to 34 lb).

In case of malfunctions, adjust handbrake. See “Handbrake Adjustment” in this Group.

Brake System Diagnosis

Preliminary check

(1) Basic hydraulic functions

Action:

Perform the "Hydraulic System Major Test" , see Section 70, Group 15.

→NOTE:

Perform the Hydraulic System Major Test to ensure the basic functions of the hydraulic system.

Result:

YES: GO TO 2

NO: Repair as needed before beginning with step 2.

(2) Pedal pivot

Action:

→NOTE:

Ensure the brake system is bleeded before beginning with this tests.

Apply and release each brake individually to check pedal return. Both pedals must return smoothly.

Result:

YES:GO TO 3

NO: Inspect pedal pivot for damage or binding. Inspect internal brake components. See Section 60, Group 10.

(3) Brake valve internal leak test

Action:

3.1 Plug both brake valve outlets. Depress brake pedals simultaneously to check pedal leak-down.

No pedal leak-down should occure when pedals are pressed.

Result:

YES: GO TO 4

NO: Replace check valves and O-rings.

Action:

3.2 Plug both brake valve outlets. Depress each brake pedal individually to check pedal leak-down.

No pedal leak-down should occure when pedals are pressed.

Result:

YES: GO TO 4

NO: Repair equalizing check valve and replace O-rings.

(4) Rear wheel brake actuator

Action:

Repeat steps 3.1 and 3.2 with outlets unpluged and brake system bleeded.

Result:

NO: Inspect and repair hydraulic actuator of rear wheel brakes. See "Remove, Inspect and Install Hydraulic Actuator" in Section 60, Group 10.

Excessive Brake Pedal Leak-Down

CONDITIONS:

- Operator on seat.
- Problem isolated to either brake valve or brake components.
- Brake repair in Section 60.

Excessive Brake Pedal Leak-Down

Test Location	Normal	If Not Normal
1. Brake valve.	No pedal leak-down when pedals are applied individually or simultaneously.	Pedal leak-down occurs both when pedals applied individually and simultaneously: replace check valves and O-rings. Pedal leak-down occurs when pedals applied individually: repair equalizing check valve. Replace brake piston cylinder O-rings.
2. Pressure ring.	No pedal leak-down when pedal is applied.	Replace pressure ring O-rings.

Excessive Brake Chatter

CONDITIONS:

- Key switch off.
- Bleed brake system as described in this group.
- Brake repair in Section 60.

Excessive Brake Chatter

Test Location	Normal	If not normal
1. Transmission sump.	Clean oil of proper viscosity.	Replace with proper oil.
2. Bleed valves. (Located on top of actuator housing.)	No air in system.	Bleed brake system. Repair brakes.

Trailer Brake Valve Operational Check

1. Apply to trailer brake joint a gauge with minimum full-scale 160 bar (2320 psi.).
2. There exist no special precautions. Just start engine without braking for the time required to fill in piping (10-15 seconds) before depressing brake pedal.

→NOTE: When depressing the brake pedal, pressure will rise from 0 to 130±10 bar (0 to 1885±145 psi.).

Trailer Brake Valve Operational Check (Italian Version)

Check warning pilot lamp:

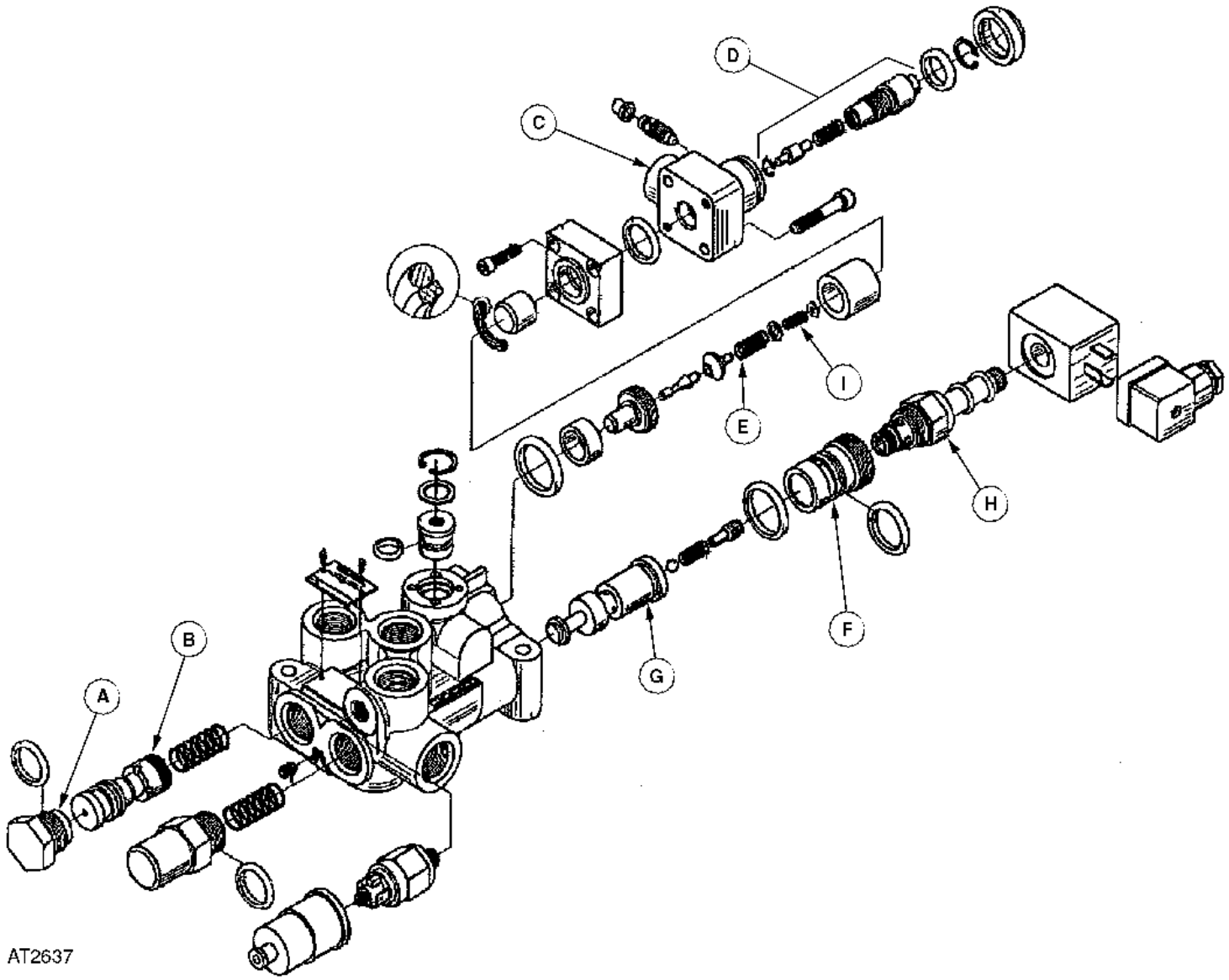
1. The red pilot lamp is on when pressure at trailer brake joint is lower than 10 bar (145 psi.); pilot lamp shall therefore be used as a warning that operation is on.
2. During normal operation, the red pilot lamp shall be off when engine is running, brake pedal is not depressed and hand brake lever is down.
3. Red pilot lamp remains on when hand brake is operated, even if brake pedal is depressed.

4. Red pilot lamp remains on also when the engine under load is stopped, because pressure at trailer brake joint is zeroed.
5. Under normal operation, with hand brake lever down, it is possible to hear the noise of pump increasing pressure when brake pedal is depressed.

Check running pressures:

1. Apply to trailer brake joint a gauge with minimum full-scale 160 bar (2320 psi.) and check pressure.
2. There exist no special precautions. Just start engine without braking for the time required to fill in piping (10 - 15 seconds) before depressing brake pedal.
3. Run engine, hand brake lever down. Normal reading, 10 to 15 bar (145 to 218 psi.).
4. Operate hand brake lever. Normal reading, no pressure.
5. With hand brake lever down and brake pedal depressed, pressure will rise from 12.5 to 130 ±10 bar (181 to 1885 ±145 psi.). “CUNA” standard required pressure limits are 120 to 140 bar (1740 to 2030 psi.).

Trailer Brake Valve Trouble Shooting (Italian Version)



Trailer brake valve (Italian version)

LEGEND:

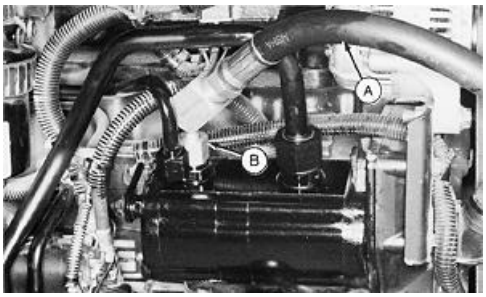
A	Plug
B	Main Piston
C	Piloting Button
D	Adjustment Screw
E	External Spring
F	Adapter
G	Exhaust Piston
H	Solenoid Valve
I	Internal Spring

Symptom	Problem	Solution
Pressure failures	Carry out the following checks.	Check for position of cut-out valve lever which shall be oriented according to valve axis. Check for micro-switch operation (activated when hand brake lever is down) Check for power supply fuse, in general for power supply. Check for connections to coil on the two opposed poles. If coil is powered, it is possible to feel magnet pull when fixing nut is loosened. ***CAUTION:*** ***Coil temperature is very high.***
Valve pressure increases and decreases slowly	Restrictions or squeezed hoses	Clean main piston holes pos. (B) which can be accessed by removing plug pos. (A) on the opposite side to the piloting button pos. (C). Close France type adjustment screw pos. (D) (socket head), turn screw by about 3 turns (do not force). Check for piloting piping cleanliness and dimensions.
Parking brake release is slow	Restrictions	Clean quick exhaust piston holes (wash and blow) pos. (G) which can be disassembled after removing solenoid valve pos. (H) and adapter pos. (F). ***IMPORTANT:*** ***Valve was correctly tested and rated, therefore, to solve pressure problems, clean all piston and solenoid valve holes with suitable cleaner and compressed air, before operating on springs and shims.***
Pressure values are not correct	Pressure adjustment not O.K.	Pressure can be adjusted by shims which can be accessed by removing pilot unit and removing the dia. 26 mm piston. Internal spring (I) adjusts pressure of 12.5 ± 2.5 bar, external spring (E), adjusts pressure of 130±10 bar. Bleed control circuit again, should there be pressure issues on trailer brake valve pilot line, housed on mechanical tie rods of tractor brake.

Trailer Brake Valve Trouble Shooting

Symptom	Problem	Solution
Valve pressure increases and decreases slowly	Restrictions or squeezed hoses	Check piping and remove any excessively sharp hose bends.

Steering Pump Flow Test



Steering Pump Flow Test

REASON:

To determine if steering pump can provide adequate flow under pressure.

CONNECTIONS:

[1] - Remove steering pump outlet line.

[2] - Connect inlet hose (A) of JT05469 flowmeter to adapter (see “Special Tools” in this Group).

[3] - Install adapter (B) and flowmeter assembly.

[4] - Insert flowmeter return hose into hydraulic oil fill hole.

PROCEDURE:

[1] - Fully open flowmeter control valve.

[2] - Start tractor and run at 2400 rpm.

[3] - Slowly close flowmeter control valve until 10345 kPa (103.5 bar; 1500 psi) shows on gauge.

[4] - Observe flow then release pressure.

SPECIFICATIONS:

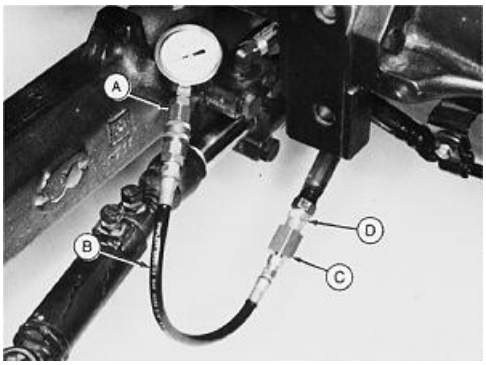
- 25.7 L/min (7 gpm) minimum

RESULTS:

If flow is less than minimum:

- The mesh filter may be restricted.
- The suction line may be restricted or leaking air.
- The pump may be worn or damaged requiring repair or replacement.

Steering Valve Relief Test



LEGEND:

A	Gauge JT03345
B	Hose JT03364
C	Adapter JT03110
D	Connector JT03367

Steering Valve Relief Test

REASON:

To determine if manufacturer setting of relief valve maintains correct pressure or is leaking.

CONNECTIONS:

[1] - Assemble gauge (A), hose (B) and adapter (C) and (D).

[2] - Disconnect hydraulic hose from left-hand side of steering cylinder.

[3] - Connect test equipment to hydraulic hose.

PROCEDURE:

[1] - Run engine at fast idle.

[2] - Turn steering wheel fully left and continue turning while observing gauge.

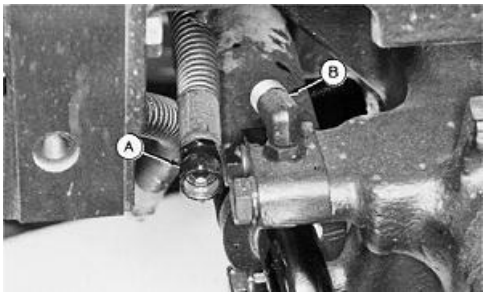
SPECIFICATIONS:

- 12990-13493 kPa (130-135 bar; 1884-1957 psi)

RESULTS:

- If pressure reading is not within specifications, replace relief valve assembly.

Steering Cylinder Leakage Test



Disconnect Hydraulic Hose

REASON:

To determine if leakage exists in steering cylinder.

PROCEDURE:

[1] - Turn steering wheel fully to the left to extend cylinder end fully.

[2] - Shut off engine.

[3] - Disconnect hydraulic hose (A) from right-hand side of steering cylinder (extended end).

[4] - Start engine and run at high idle.

[5] - Continue to turn steering wheel to the left.

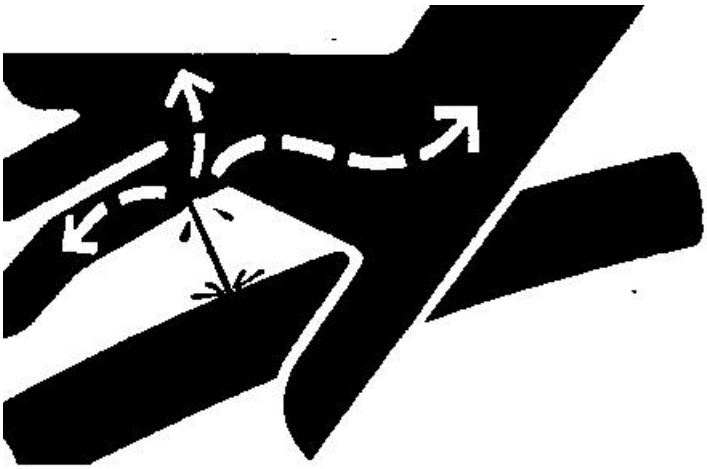
[6] - Watch for any flow of oil out of cylinder at fitting (B).

[7] - Repeat steps 1-6 for right turn and left-hand side of cylinder.

RESULTS:

- If any flow of oil out of cylinder occurred, there is internal leakage in the cylinder. Repair or replace cylinder.

Steering Valve Leakage Test



High-Pressure Fluid

REASON:

To check the steering valve for internal leakage.

IMPORTANT:

O-ring seal (ORS) plugs must be used to plug pressurized hydraulic hoses.

PROCEDURE:

[1] - Stop the engine.

[2] -

CAUTION:

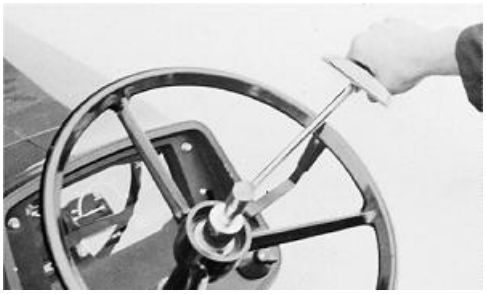
Escaping fluid under pressure can penetrate the skin causing serious injury. Avoid the hazard by relieving pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure. Search for leaks with a piece of cardboard. Protect hands and body from high pressure fluids.

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

Disconnect hoses from steering cylinder. Close all openings using caps and two 13/16-16 MORFS plugs.

[3] - Start engine and run at slow idle.

[4] -



Turn Steering Wheel

Turn steering wheel, to the right, with a constant torque of 7 N·m (60 lb-in.).

[5] - Observe the number of rotations of the steering wheel that occur in one minute.

[6] - Turn steering wheel, to the left, with a constant torque of 7 N·m (60 lb-in.).

[7] - Observe the number of rotations of the steering wheel that occur in one minute.

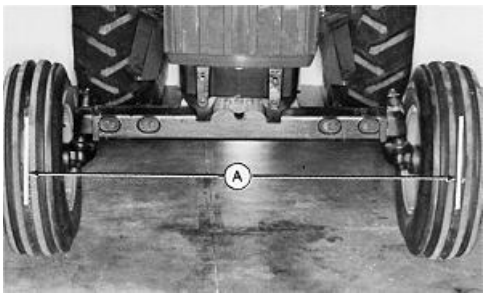
SPECIFICATIONS:

Item	Measurement	Specification
Engine	Slow Idle Speed	750 - 800 rpm
	Maximum Right Turn rpm	5 r/min
	Maximum Left Turn rpm	5 r/min

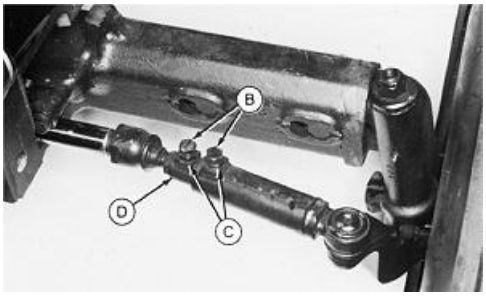
RESULTS:

- If r/min is more than specifications, repair steering valve (see Section 60).

Toe-In Check And Adjustment (Standard Axle)



Toe-in check



Tie rod adjustment

REASON:

To reduce tire wear.

PROCEDURE:

1. Park machine on level surface.
2. Turn steering wheel so front wheels are in the straight-ahead position. Stop engine.
3. Measure distance (A) between tires at hub level in front of axle. Record measurement and mark the tires.
4. Move tractor back about 1 m (3 ft.), so mark is at hub level behind the axle. Again measure distance between tires at same point on tire. Record measurement. Distance (A) at front of tires should be 3-6 mm (1/8-1/4 in.) less than distance measured at rear of tires.

If not according to specifications, loosen lock nuts (C) and back out bolts (B). Adjust tie rods on both sides of tractor equally by turning the inner tube (D) to lengthen or shorten tie rod until toe-in is correct to specifications. Tighten bolts and lock nuts to specifications.

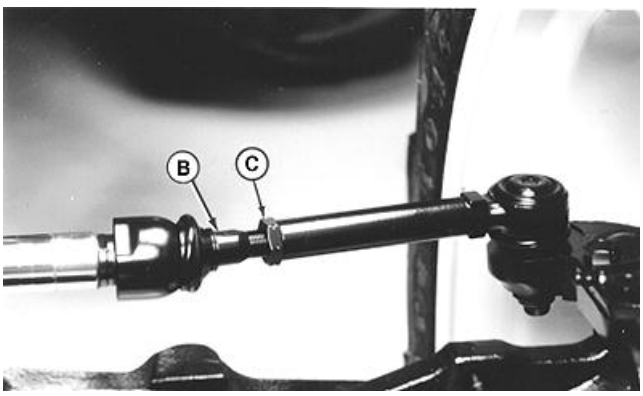
Item	Measurement	Specification
Tie rod bolts	Torque	85 N·m
		62 lb-ft
Tie rod lock nuts	Torque	90 N·m
		66 lb-ft
Toe-in, standard front axle	distance	3-6 mm
		1/8-1/4 in.

→NOTE:

One half turn of tie rod inner tube (D) equals 8 mm (5/6 in.) change of toe-in. One turn of tie rod inner tube (D) equals 16 mm (5/8 in.) change of toe-in.

Toe-In Check And Adjustment (MFWD Axle)

Toe-in adjustment, MFWD axle



Tie rod, MFWD axle

REASON:

To reduce tire wear.

PROCEDURE:

1. Disengage MFWD and park tractor on smooth, level surface. Steer front wheels straight ahead. Stop engine.
2. Measure distance (A) between centerline of tires at hub level in front of axle, using an outside bar of each tire or an inside bar of each tire. Record measurement.
3. Repeat step 2 at rear of axle.

→NOTE: When the front measurement is smaller than the rear measurement, this is called "toe-in". If the front measurement is larger than the rear measurement, this is called "toe-out".

4. Determine the difference between front and rear measurements. The difference may be in either direction (toe-in or toe-out), but should be less than specifications.

If toe-in not within specifications:

1. Loosen jam nuts (C).
2. Turn ball joint stud (B), equally on both sides of tractor, to lengthen or shorten tie rods.
3. Adjust tie rods until toe-in is within specification.

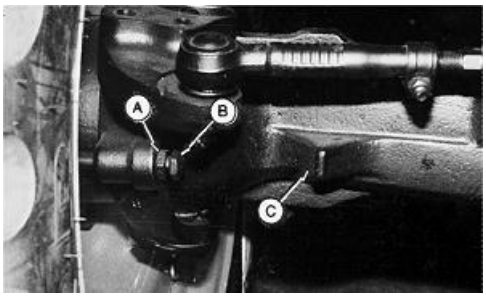
Item	Measurement	Specification
Toe-in	Distance	0 to 3 mm
		0 to 1/8 in.

→NOTE: One eighth turn of ball joint stud (B) equals 4 mm (3/6 in.) change of toe-in or toe-out. One quarter turn of inner rod equals 8 mm (3/8 in.) change of toe-in or toe-out. One half turn of inner rod equals 16 mm (5/8 in.) change of toe-in or toe-out.

4. Tighten jam nuts to specified torque.

Item	Measurement	Specification
Jam nuts at joint studs of MFWD axle.	Torque	120 N·m
		88 lb-ft

Steering Stop Adjustment (MFWD Axle)



MFWD steering stop

REASON:

To prevent interference between tire and tractor.

1. Raise and support the front of the tractor so the axle can be oscillated to its stops.
2. Slowly turn the steering wheel to the left until the steering cylinder travel has reached its limit, the steering stops, or the tires are within 25 mm (1 in.) of the grille screen or the side panels.
3. Raise the left side of the axle against its stop and measure the clearance between the tire and the nearest tractor component. The distance should not be less than specifications.
4. Repeat steps 2 and 3 for the right side.

If not according to specifications, loosen lock nut (A) and adjust stop bolt (B) so it touches stop (C). Tighten lock nut to specifications.

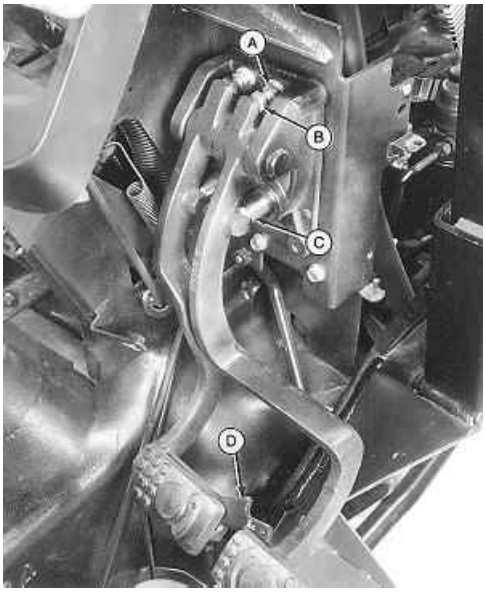
Item	Measurement	Specification
Lock nut, steering stop	Torque	125 N·m 92 lb-ft

Item	Measurement	Specification
Clearance between tire and nearest tractor component	minimum clearance	25 mm 1 in.

→NOTE:

It may be necessary to shorten stop bolt (B) in order to obtain the maximum turning angle. Wide tread settings and large tire sizes will increase turn radius slightly.

Brake Pedal Adjustment



LEGEND:

A	Lock Nut
B	Adjusting Screw
C	Valve Piston
D	Pedal Locking Lever

Brake Pedal Adjustment

REASON:

To make sure brakes are fully engaged when brake pedals are depressed and fully disengaged when pedals are released.

To align slots in pedals for locking lever.

PROCEDURE:

→NOTE:

This procedure can be done with brake valve assembly out of machine or in machine. Procedure is for brake valve assembly mounted in machine.

[1] - Remove right-hand dash cover.

[2] - Remove locking lever (D) from slot.

[3] - Loosen lock nut (A).

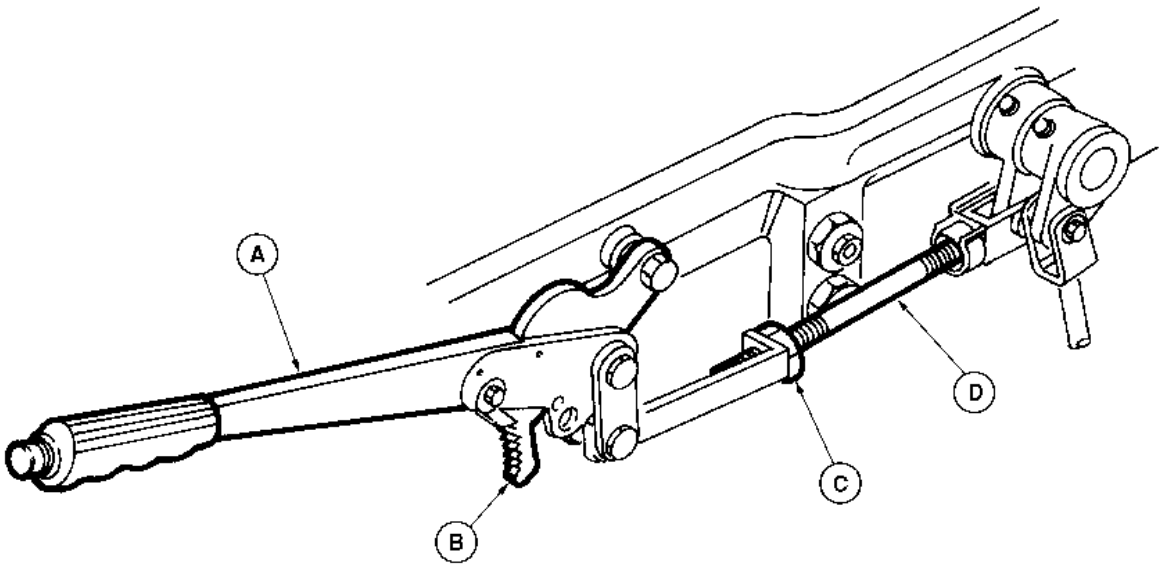
[4] - Turn screw (B) clockwise until pedal rests freely on valve piston (C).

[5] - Turn screw counterclockwise until it contacts brake pedal. Turn screw three additional flats or 1/2 turn counterclockwise and tighten lock nut.

[6] - Repeat procedure for other pedal.

[7] - Install right-hand dash cover.

Handbrake Adjustment



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Handbrake Adjustment

REASON:

To make sure brakes are fully engaged when handbrake lever is pulled and fully disengaged when handbrake lever is disengaged

PROCEDURE:

Engage handbrake lever (A) into the 4th tooth of ratchet (B). In this position the brakes must start to operate.

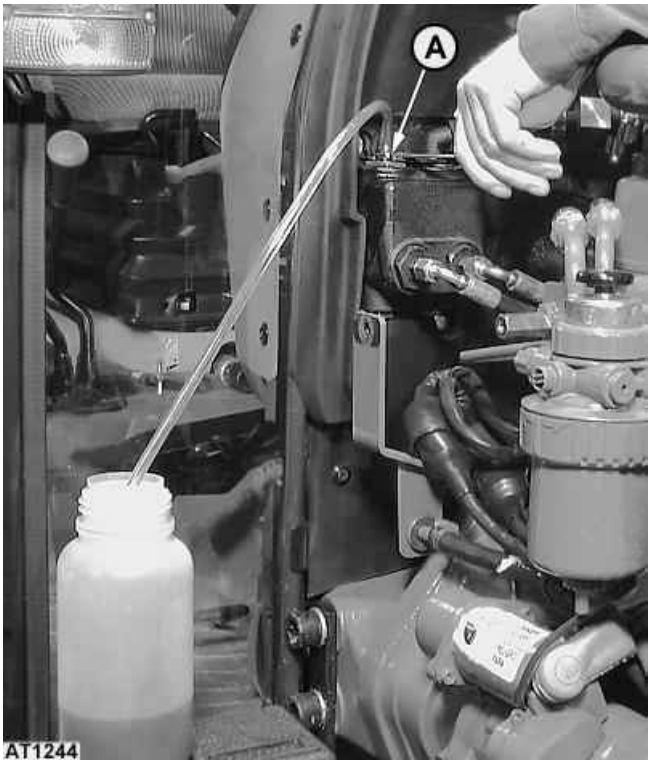
If this is not the case, proceed as follows:

[1] - Loosen lock nut (C).

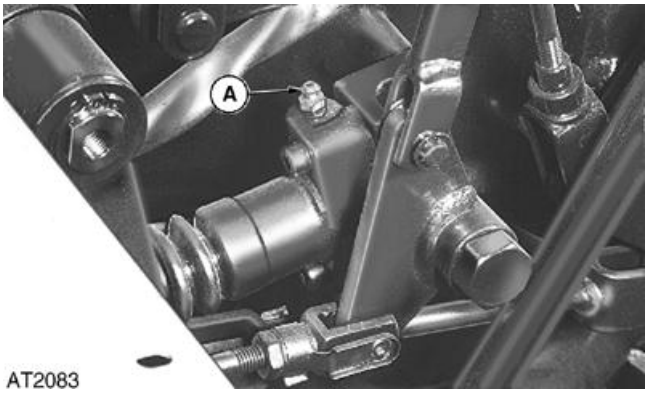
[2] - Turn rod (D) until brakes start to operate.

[3] - Tighten lock nut (C).

Bleed Brake System



Bleed brake valve housing



Bleed Brake System

REASON:

Any time the brake system has been opened up for service (lines disconnected), it will be necessary to bleed air from the system.

CONNECTIONS:

Connect a clear plastic hose to the bleed screws (A). Put the other end of hose into a bucket.

PROCEDURE:

→NOTE:

Two service technicians are needed to bleed the brake system - one to operate the brake pedal an the other to open and close bleed screws.

IMPORTANT:

When bleeding the brake system, pay attention to the correct sequenze.

1. ***Bleed air at brake valve housing***
2. ***Bleed air at left hand actuator***
3. ***Bleed air at right hand actuator***

[1] - Start the engine and run at slow idle to keep brake valve reservoir full of oil.

[2] - Pump brake pedal to obtain highest pedal position and hold. Loosen bleed screw 3/4 turn and slowly push on brake pedal. Before brake pedal completes full pedal travel, tighten bleed screw.

[3] - Let pedal return slowly to the top of its stroke. Continue this operation until the flow of oil in plastic hose is free of air bubbles.

[4] - When flow of oil is free of air bubbles hold the pedal down and tighten bleed screw.

[5] - Remove the plastic hose.

[6] - Repeat brake bleed procedure for each bleed location.

Section 270 - HYDRAULIC SYSTEM - OPERATION AND TESTS

Table of contents

Group 05 - Component Location

Component Location Information

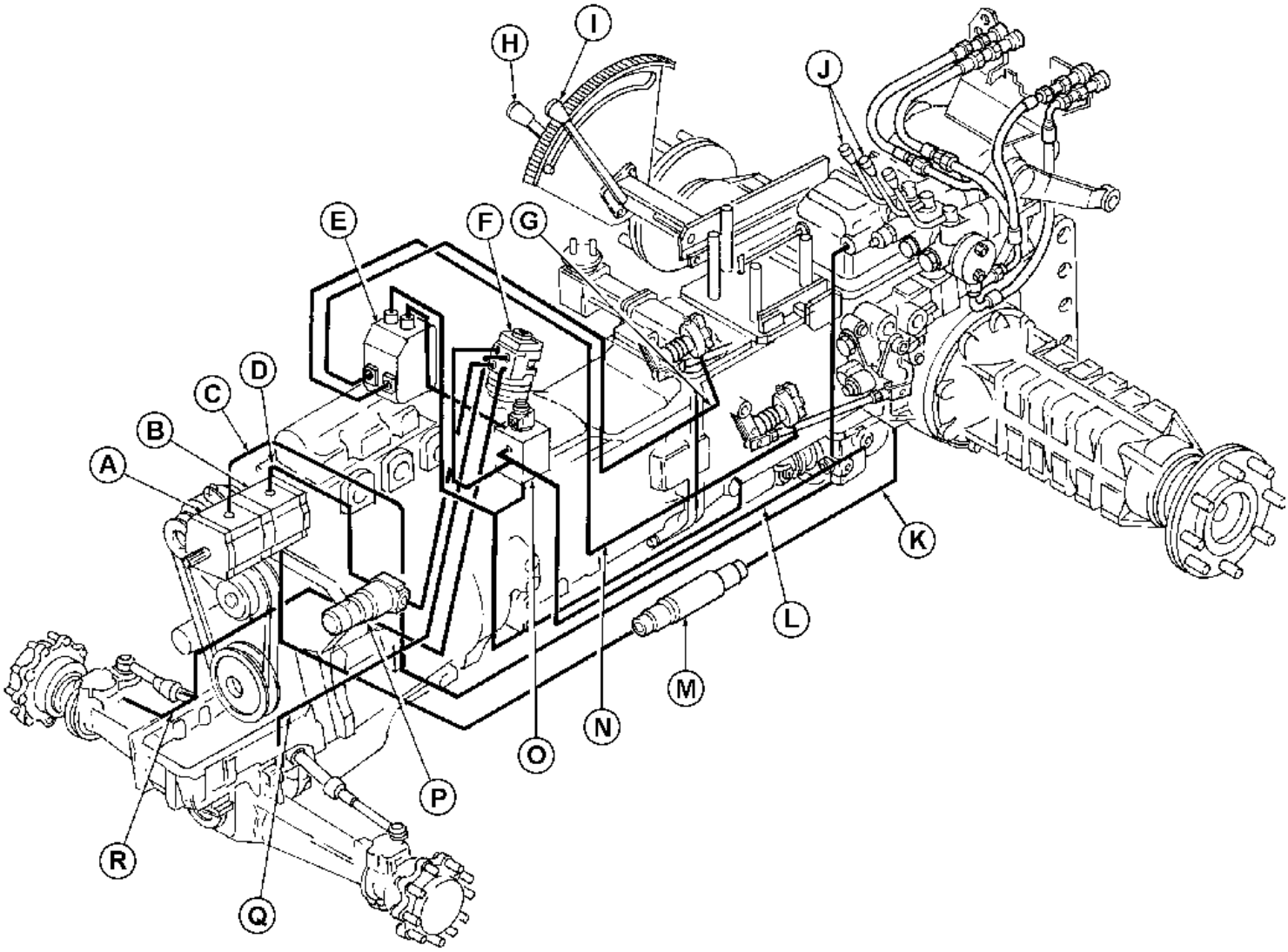
This Group contains drawings about the location of components of:

- Hydraulic system
- Selective control valves

Use the drawings when troubleshooting as help for locating the components to be tested.

Hydraulic System Components

Tractors without oil cooler



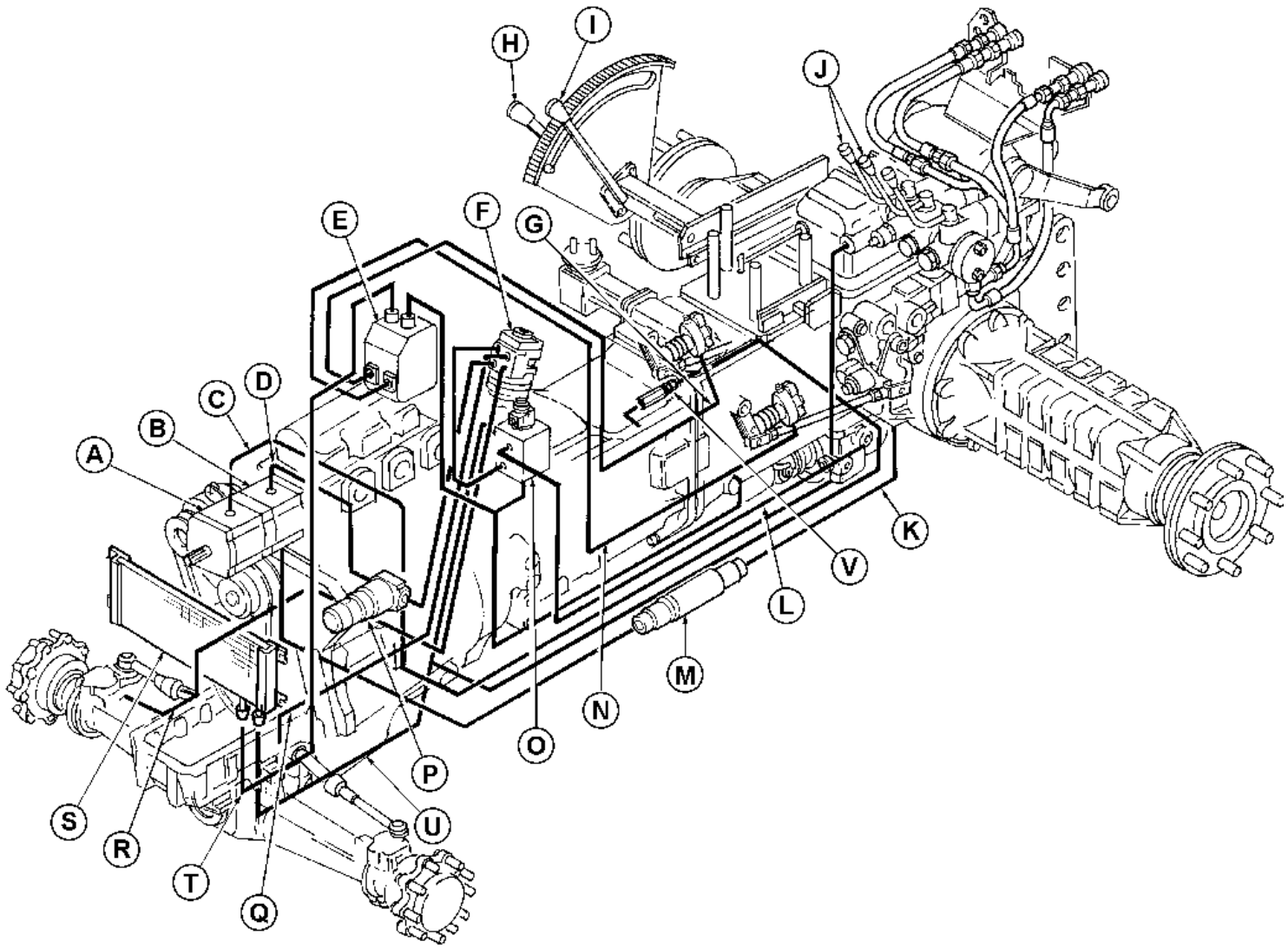
AT3236

Hydraulic System Components

LEGEND:

A	Hydraulic Pump
B	Steering Pump
C	Supply Line to Rockshaft
D	Supply Line to Steering Valve
E	Brake Valve
F	Steering Valve
G	Right Brake Pressure Line
H	Position Control Lever
I	Draft Control Lever
J	SCV Levers
K	Suction Line
L	Return Line to Transmission Case
M	Hydraulic Oil Filter
N	Left Brake Pressure Line
O	MFWD Solenoid Valve (24/24 Speed Transmission)
P	Steering Filter
Q	Left Turn Pressure Line
R	Right Turn Pressure Line

Tractors with oil cooler



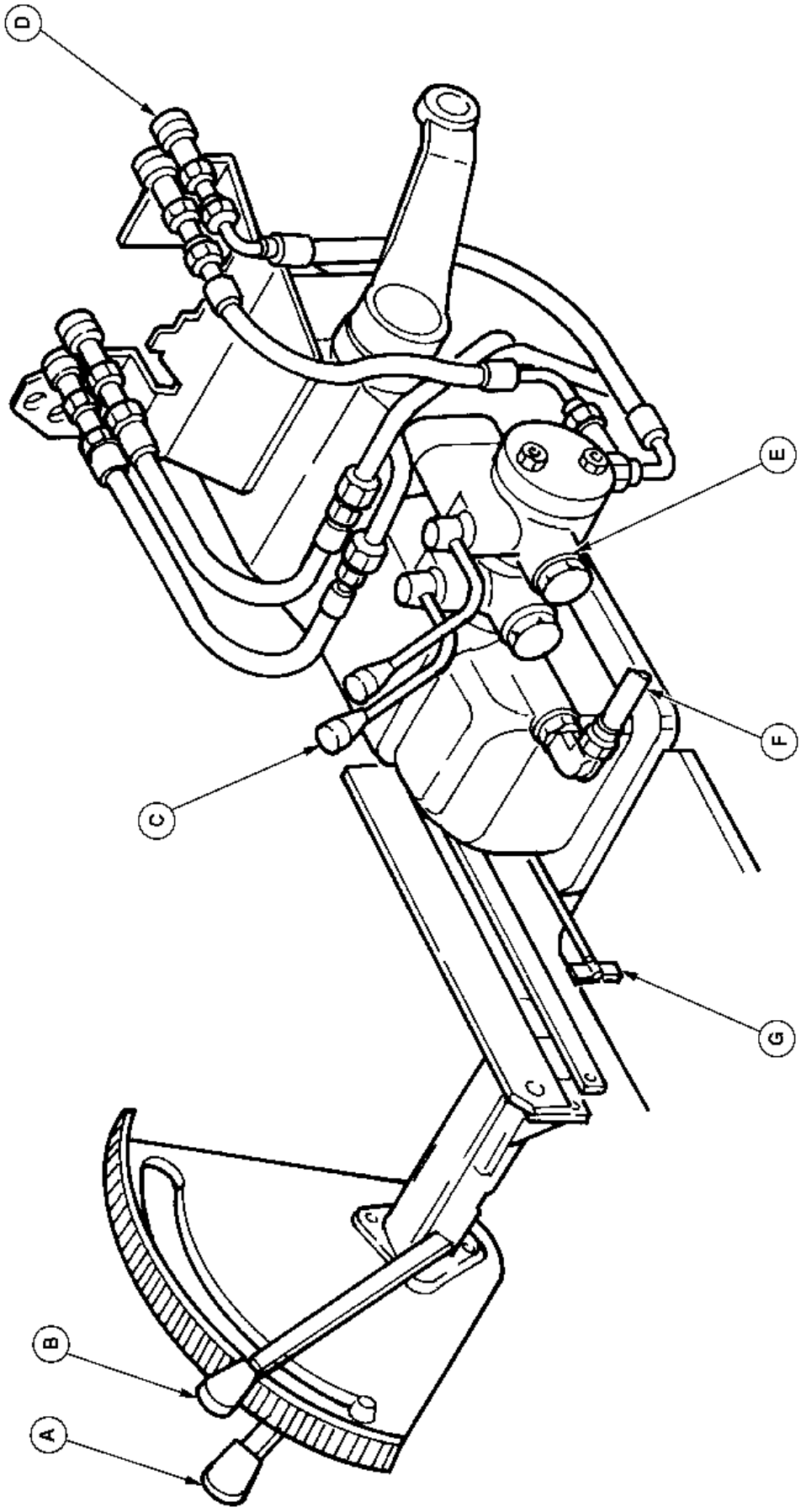
AT3240

Hydraulic System Components

LEGEND:

A	Hydraulic Pump
B	Steering Pump
C	Supply Line to Rockshaft
D	Supply Line to Steering Valve
E	Brake Valve
F	Steering Valve
G	Right Brake Pressure Line
H	Position Control Lever
I	Draft Control Lever
J	SCV Levers
K	Suction Line
L	Return Line to Transmission Case
M	Hydraulic Oil Filter
N	Left Brake Pressure Line
O	MFWD Solenoid Valve (24/24 Speed Transmission)
P	Steering Filter
Q	Left Turn Pressure Line
R	Right Turn Pressure Line
S	Oil Cooler
T	Outlet Cooler Line (from oil cooler to brake valve)
U	Inlet Cooler Line (from MFWD solenoid valve to oil cooler)
V	Relief Valve

Selective Control Valve Components



AT2298

Selective Control Valve Components

LEGEND:

A	Rockshaft Position Control Lever
B	Rockshaft Draft Control Lever
C	SCV Lever
D	Double Acting Sleeve Coupler
E	SCV Housing
F	Supply Line from pump
G	Rate of Drop Valve

Group 10 - Theory of Operation

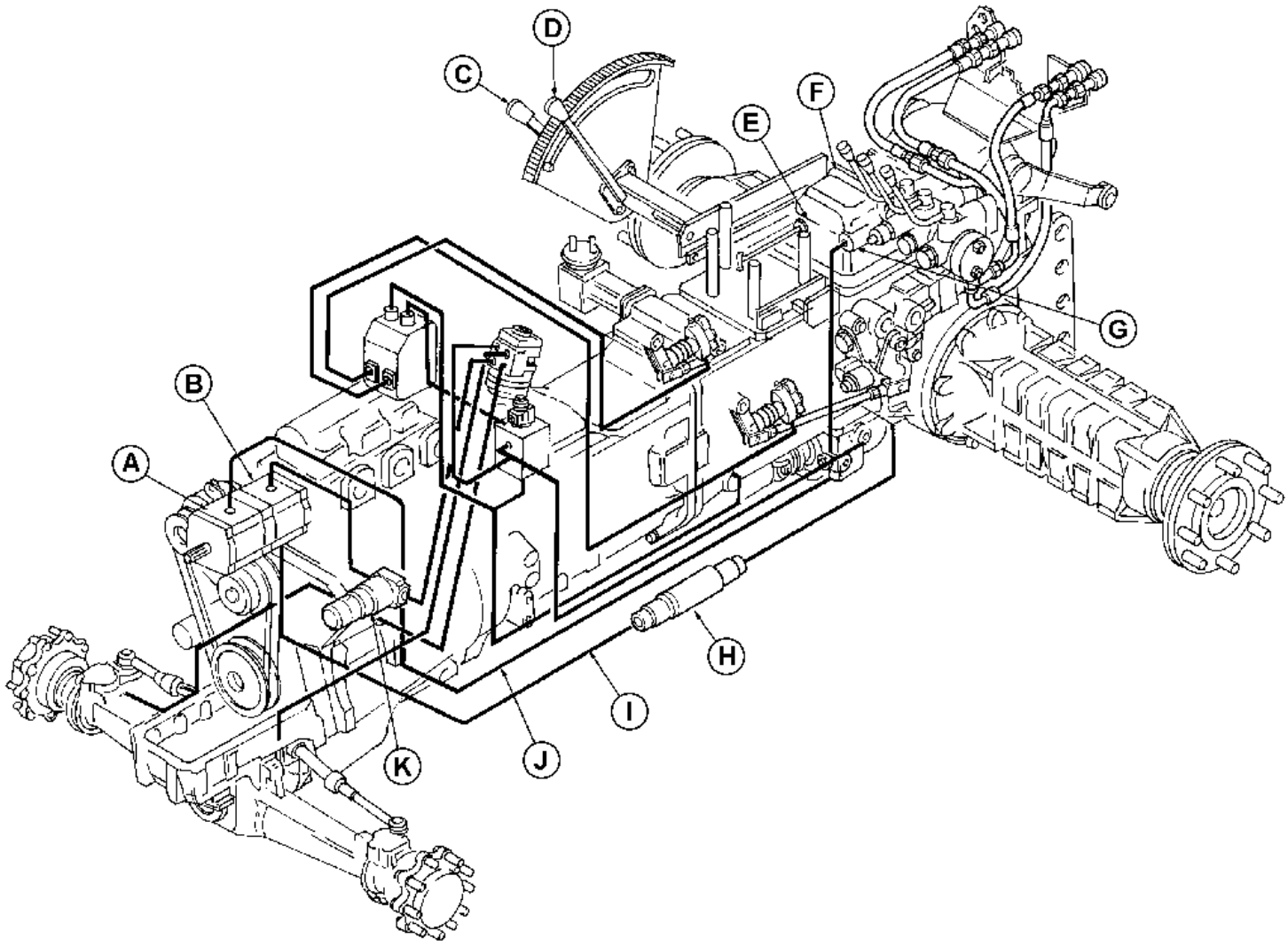
Theory of Operation Information

This group divides the hydraulic system into individual components by function. The story of operation contains information on function, component or system identification and theory of operation.

The following systems or components are covered in this group:

- Hydraulic System
- Hydraulic Filters
- Hydraulic Pump
- Rockshaft Valve
- Draft Sensing Operation
- Selective Control Valves
- Double Acting Sleeve Coupler

Hydraulic System Operation



AT3237

Hydraulic System Operation

LEGEND:	
A	Hydraulic Pump
B	Steering Pump
C	Position Control Lever
D	Draft Control Lever
E	Rockshaft Valve
F	Rockshaft Housing
G	Inlet Port
H	Hydraulic Filter
I	Suction Line
J	Pressure Line
K	Steering Filter

FUNCTION:

The hydraulic system provides:

- Filtered oil to the power steering system.
- Hydraulic power to the rockshaft for hitch operation.
- Hydraulic power to the selective control valves.

MAJOR COMPONENTS:

- Hydraulic Pump

- Hydraulic Filter
- Steering Filter
- Reservoir (Transmission Case)
- Rockshaft
- Rockshaft Valve
- Pressure Lines
- Suction Line
- Rate-of-Drop Valve
- Rockshaft Control Levers

THEORY OF OPERATION:

The hydraulic system is equipped with 12 ccm (0.75 cu.in.) and 20 ccm (1.25 cu.in.), external-gear, constant-displacement pumps. The 12 ccm (0.75 cu.in.) pump (B) provides fluid power to the power steering system and, on the 40 km/h (25 mph) version, the MFWD clutch.

The 20 ccm (1.25 cu.in.) hydraulic pump (A) provides hydraulic power to the rockshaft (F) for hitch operation and to selective control valves, if equipped. The hitch is category I/II with draft sensing through the center link.

The hydraulic system uses an open-center design. This means that pressurized oil flows continuously through the valves and lines as long as the valves are in neutral position. Because of this flow oil there always must be a way for the oil to return to the reservoir.

The transmission case of the tractor serves as a reservoir for the hydraulic oil. Proper level must be maintained for adequate transmissioin lubrication and oil supply to the hydraulic pumps (A) and (B).

The engine drives the hydraulic pump from the camshaft drive gear. As the hydraulic pump turns a low-pressure area develops in the suction line (I). Oil then moves from the transmission case through hydraulic filter (H), then on through suction line (I) to the inlet side of the hydraulic pumps.

Oil flows from the outlet side of the hydraulic pump, through pressure line (J) to inlet port (G). A relief valve limits hydraulic system pressure to a range of 18000 to 18500 kPa (180 to 185 bar; 2610 to 2680 psi). If the system encounters sufficient resistance to oil flow due to a heavy load or restriction, the relief valve opens allowing oil to return to the reservoir.

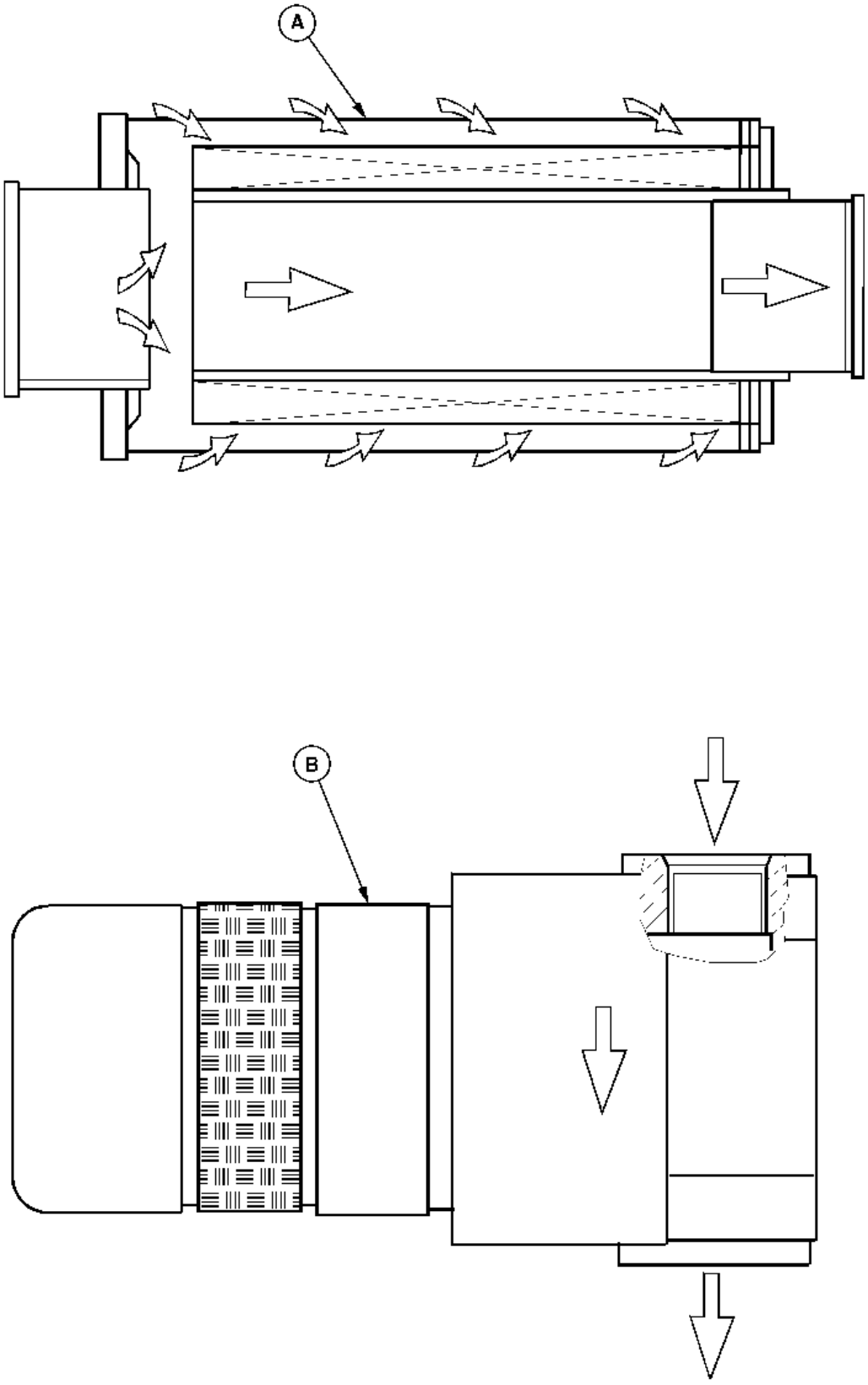
Oil flows from the inlet port to the selective control valves, then to the rockshaft (F).

When in neutral, the rockshaft control valve passes oil to the sump. When control valve is actuated by movement of control lever (C) or by the draft sensing linkage, oil passes to or from the rockshaft cylinder, raising or lowering the 3-point hitch.

→NOTE:

See Section 260 for steering operation and brake operation . See this Group for hydraulic pump operation and rockshaft operation .

Hydraulic Filter Operation



AT 2299

Hydraulic Filters

LEGEND:

A	Suction Line Filter
B	Steering Supply Line Filter

FUNCTION:

Strains particles or contaminants from the oil.

MAJOR COMPONENTS:

- Filter Screen
- Filter Housing
- Filter Canister

THEORY OF OPERATION:

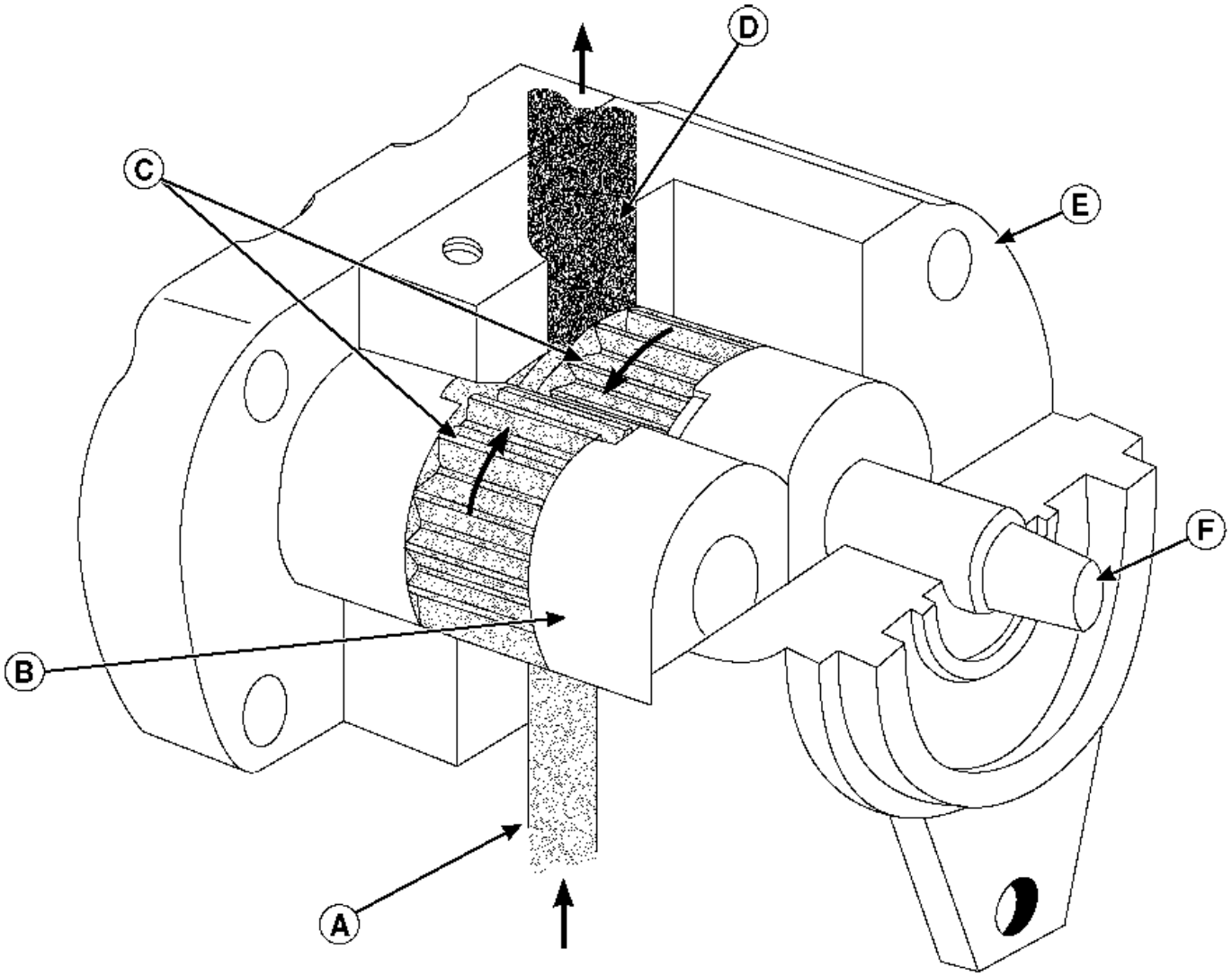
The filter system consists of a suction line filter (A) and a steering supply line filter (B). Hydraulic oil first moves through suction line filter (A) to strain large particles of debris then passes to the hydraulic pumps. The oil delivered by steering pump passes through steering supply line filter (B) then to the steering valve.

If the steering supply line filter should plug and there is more than 340 kPa (3.4 bar; 49 psi) pressure differential, a relief valve opens allowing unfiltered oil to the hydraulic pumps.

IMPORTANT:

Hydraulic filters should be changed according to the maintenance schedule to prevent damage to the hydraulic system.

Hydraulic Pump Operation



AT1197

Hydraulic Pump Operation

LEGEND:	
A	Pump Inlet
B	Bushings
C	Gears
D	Pump Outlet
E	Pump Housing
F	Drive Shaft
G	Suction Oil
H	System Oil

FUNCTION:

Supplies a continuous flow of oil to operate the rockshaft and implements connected to optional selective control valves. Also supplies oil for power steering.

MAJOR COMPONENTS:

- Hydraulic Pump

THEORY OF OPERATION:

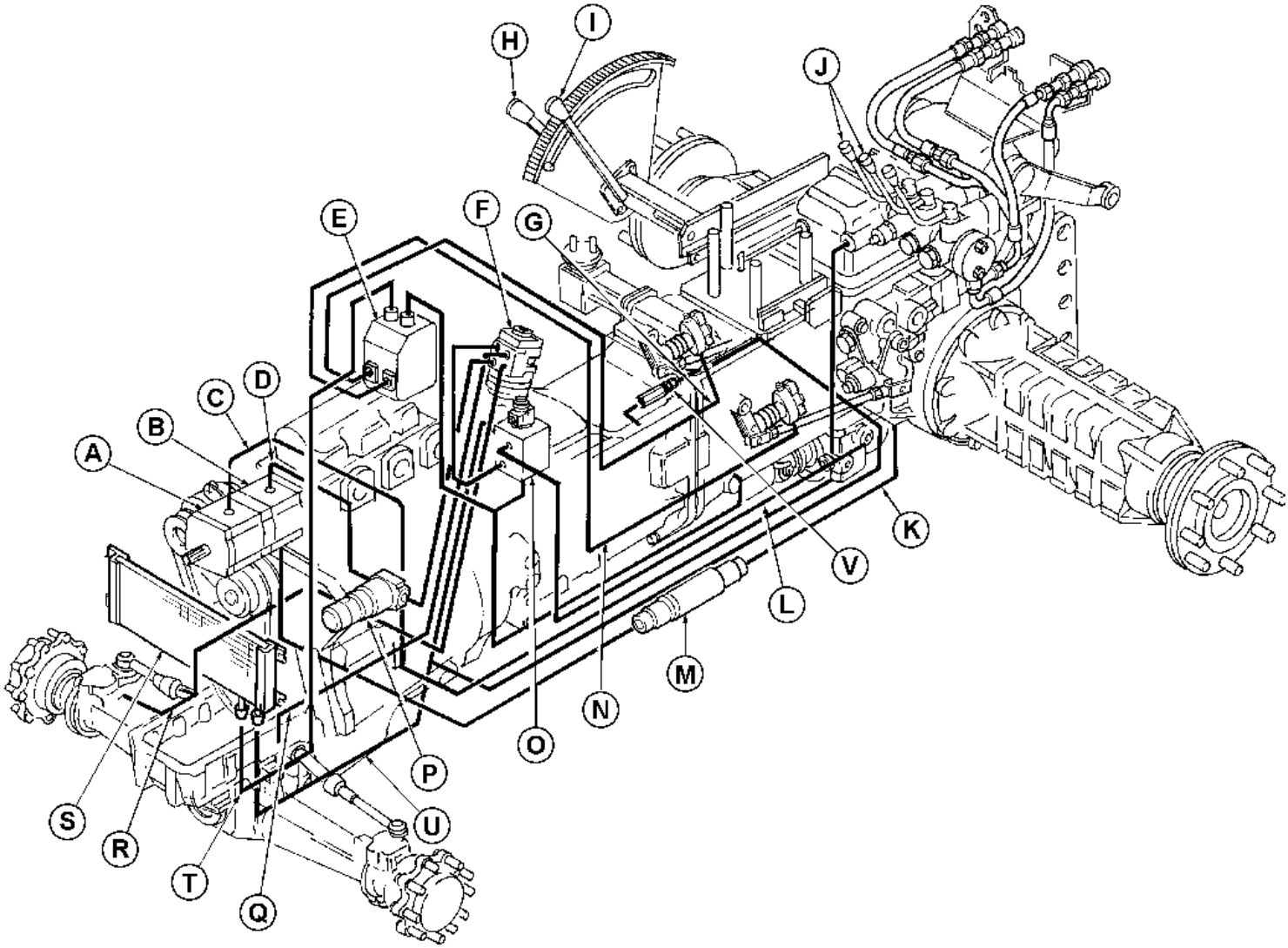
The hydraulic pump assembly contains two pumps, each of different displacements. The 20 ccm (1.25 cu.in.) pump supplies oil for the rockshaft and other tractor hydraulics. The 12 ccm (0.75 cu.in.) pump supplies oil for the steering system and, on the 40 km/h (25 mph) version, the MFWD clutch.

Both pumps operate identically and use a positive-displacement, external-gear design that moves a set volume of fluid with each revolution. Output volume changes only when the speed of the pump changes.

The engine drives the hydraulic pumps from the camshaft drive gear. As the pump gears (C) rotate, they continuously move in and out of mesh with each other. When the gears separate, a vacuum develops which draws oil into the pump inlet (A). The oil continues to move with the gears as they turn.

As the gears come back into mesh, they form a seal which prevents oil from returning to the pump inlet. Further meshing forces oil out the pump outlet (D) and into the hydraulic system. This cycle repeats continuously as long as the pump turns.

Oil Cooler Operation



AT3240

Oil Cooler Operation

LEGEND:

A	Hydraulic Pump
B	Steering Pump
C	Supply Line to Rockshaft
D	Supply Line to Steering Valve
E	Brake Valve
F	Steering Valve
G	Right Brake Pressure Line
H	Position Control Lever
I	Draft Control Lever
J	SCV Levers
K	Suction Line
L	Return Line to Transmission Case
M	Hydraulic Oil Filter
N	Left Brake Pressure Line
O	MFWD Solenoid Valve (24/24 Speed Transmission)
P	Steering Filter
Q	Left Turn Pressure Line
R	Right Turn Pressure Line
S	Oil Cooler
T	Outlet Cooler Line (from oil cooler to brake valve)
U	Inlet Cooler Line (from MFWD solenoid valve to oil cooler)
W	Relief Valve

FUNCTION:

Oil cooling of hydraulic system.

MAJOR COMPONENTS

- Oil Cooler
- Brake Valve
- MFWD Solenoid Valve
- Steering Valve
- Relief Valve

THEORY OF OPERATION

The oil cooler system consists of return line (U) from MFWD solenoid valve (O) to oil cooler (S) and suction line (T) from oil cooler to brake valve (E).

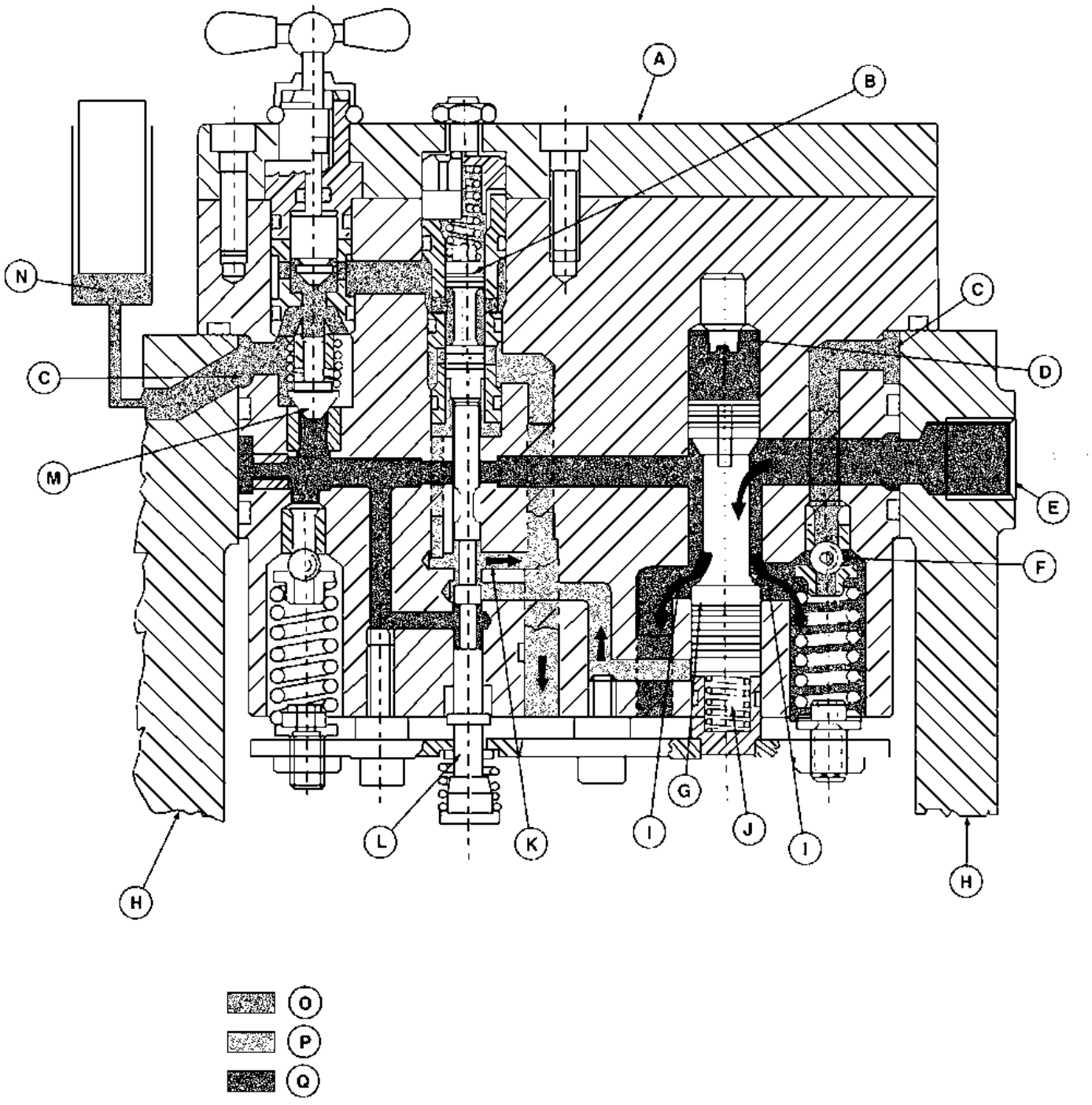
Hydraulic oil moves through return line (U) to relief valve (V).

With cold oil the pressure in the system increases and oil flow forces the relief valve (unidirectional valve) and goes mainly to the sump.

When oil temperature increases the pressure in the system decreases and force on the unidirectional valve is reduced.

Consequently, oil flow is directed mainly through oil cooler and in minor quantity to relief valve and to the sump.

Rockshaft Control Valve Operation - Neutral Position



AT2300

Rockshaft Control Valve-Neutral Position

LEGEND:

A	Rockshaft Valve Housing
B	Discharge Valve

C	Annular Duct
D	Chamber
E	Inlet Port
F	Safety Valve
G	Piston
H	Rockshaft Case
I	Sump Passage
J	Chamber
K	Discharge Passage
L	Control Spool
M	Check Valve
N	Rockshaft Cylinder
O	Trapped Oil
P	Return Oil
Q	System Flow

FUNCTION:

Controls oil flow to the rockshaft cylinder.

MAJOR COMPONENTS:

- Rockshaft Valve Housing
- Rockshaft Valve

THEORY OF OPERATION:

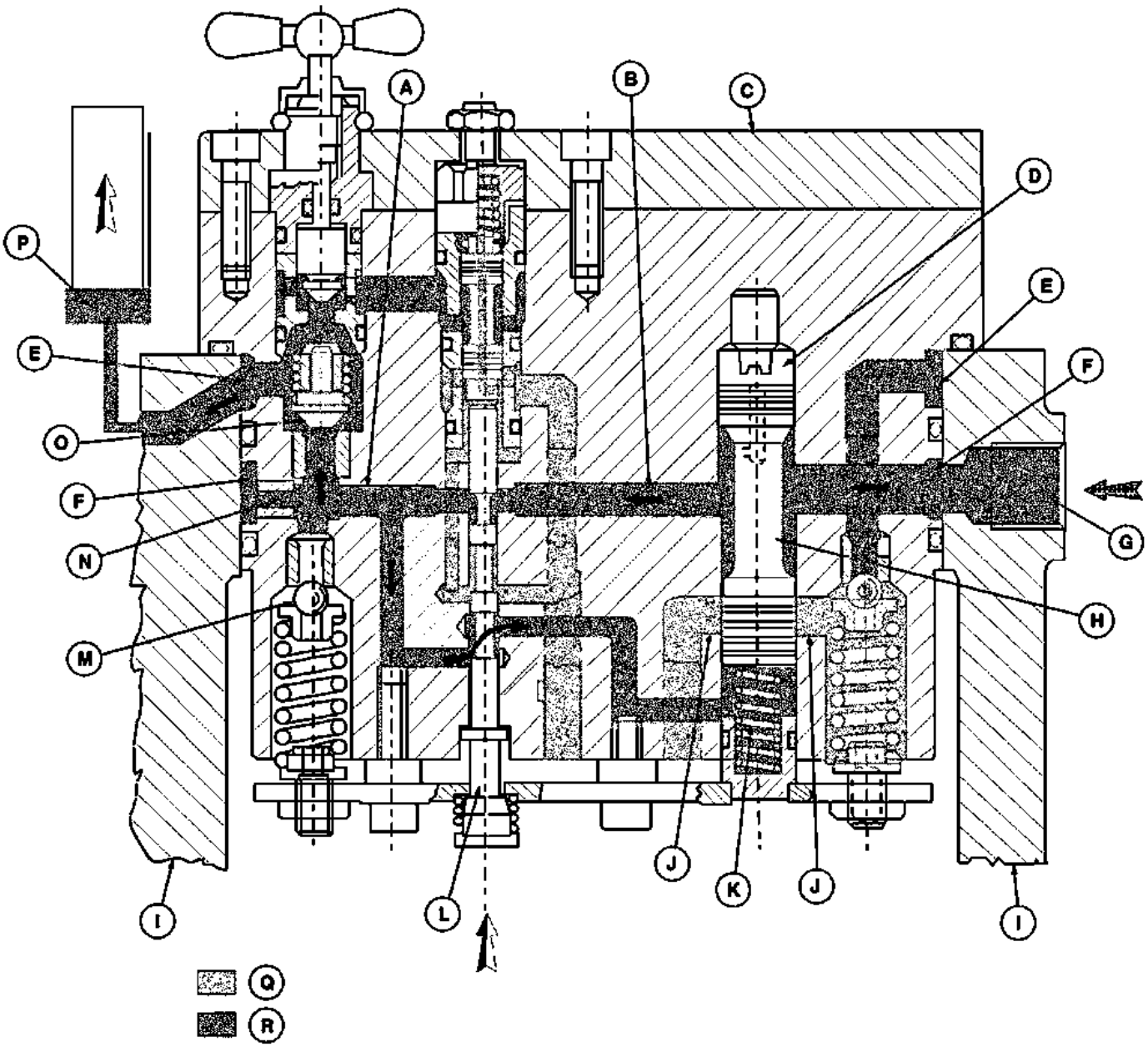
In this phase the control spool (L) is in such a position to connect the chamber (J) directly to the discharge through passage (K).

The oil coming from the pump, through inlet port (E), will thus be able to move downward the small regulator piston (G) and thus flow to the chamber (D) and by opening the passage (I) it will flow to the sump.

The oil contained in the cylinder (N) is kept under pressure by the check valve (M), by the discharge valve (B) and by the safety valve (F) connected to the cylinder by annular duct (C) thus holding the load applied to the lifting arms.

The safety valve (F) secures protection from any possible overpressure.

Rockshaft Control Valve Operation - Raise Position



AT2301

Rockshaft Control Valve-Raise Position

LEGEND:

A	Pressure Passage
B	Pressure Passage

C	Rockshaft Valve Housing
D	Chamber
E	Annular Duct
F	Annular Duct
G	Inlet Port
H	Piston
I	Rockshaft Case
J	Sump Passage
K	Chamber
L	Control Spool
M	Relief Valve
N	Metering Orifice
O	Check Valve
P	Rockshaft Cylinder
Q	Return Oil
R	Pressure Flow

FUNCTION:

Controls oil flow to the rockshaft cylinder with control lever in the raised position.

MAJOR COMPONENTS:

- Rockshaft Valve Housing
- Rockshaft Valve

THEORY OF OPERATION:

The control spool (L) is in such a position to connect the chamber (K) with the oil coming from the pump through annular duct (F) and passages (A) and (B).

In this way chambers (K) and (D) have the same pressure and the small regulator piston (H) closes sump passages (J) due to the upward push of return spring.

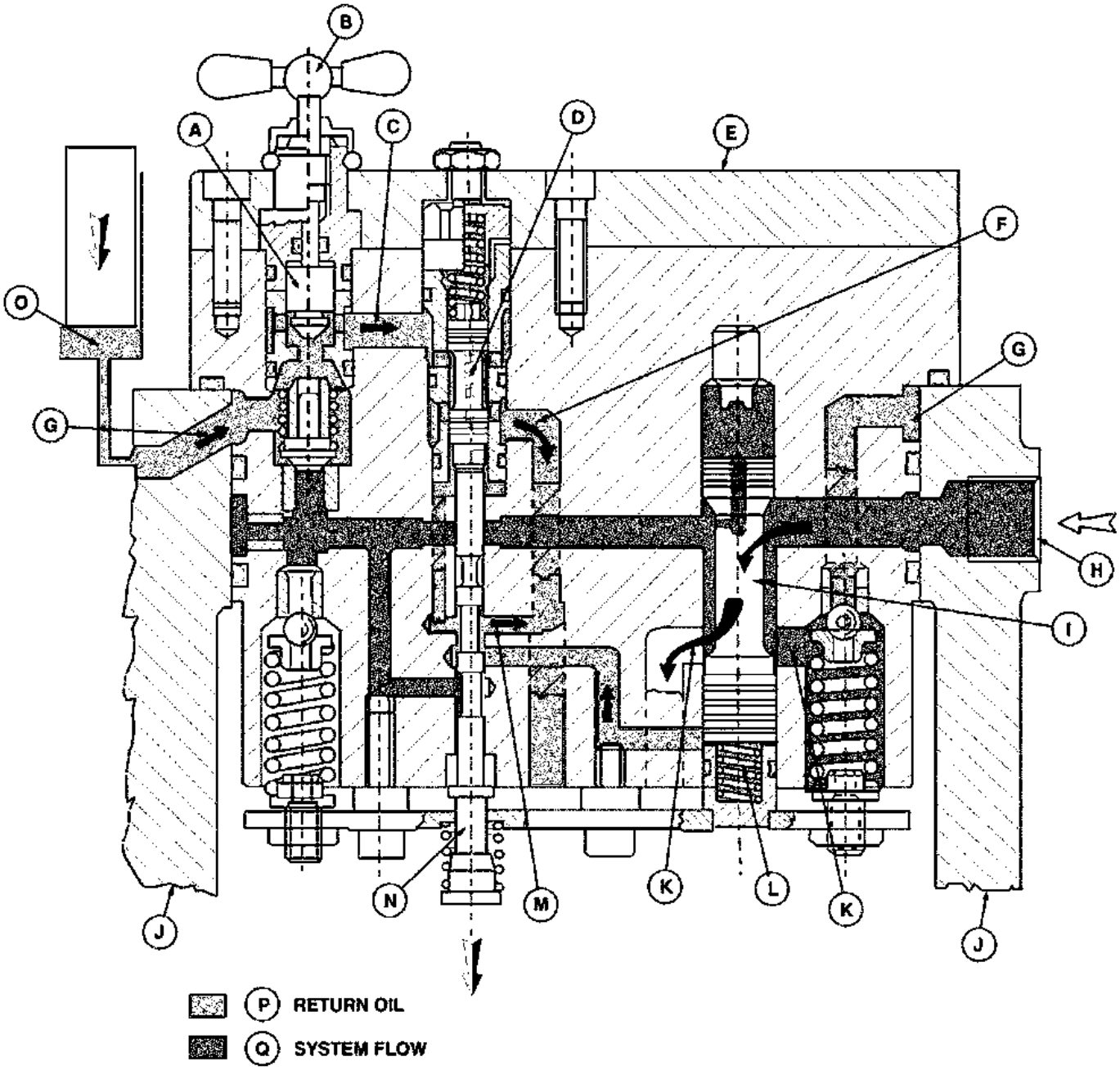
The oil on pressure flows to the cylinder through the annular duct (F), it enters the passage (A) through the metering orifice (N) and the variable passage made by the control spool (L) with passage (B), it opens the check valve (O), it enters annular duct (E) and flows into the cylinder (P).

The small regulator piston (H) adjusts the oil flow to the cylinder because chambers (K) and (D) are subject to the difference of pressure made by the oil passage through the metering orifice (N) and the variable passage made by the control spool (L), depending on its upward movement caused by the internal levers of power lift.

The excessive flow is deviated at the lifting pressure by passages (J), in this way it regulates the maximum lifting speed and allows a slow starting and arrival of arms.

In this phase the maximum lifting pressure is controlled by the relief valve (M) that is connected to the annular duct (F) through passages (A) and (B).

Rockshaft Control Valve Operation - Lower Position



AT2302

Rockshaft Control Valve-Lower Position

LEGEND:

A	Rate of Drop Valve
B	Rate of Drop Knob

C	Discharge Passage
D	Discharge Valve
E	Rockshaft Valve Housing
F	Discharge Passage
G	Annular Duct
H	Inlet Port
I	Piston
J	Rockshaft Case
K	Sump Passage
L	Chamber
M	Discharge Passage
N	Control Spool
O	Rockshaft Cylinder
P	Return Oil
Q	System Flow

FUNCTION:

Controls oil flow from the rockshaft cylinder.

MAJOR COMPONENTS:

- Rockshaft Valve Housing
- Rockshaft Valve

THEORY OF OPERATION:

When the rockshaft control valve is moved forward to the lowering position, the control spool (N) is in such a position to connect chamber (L) directly to the discharge through passage (M).

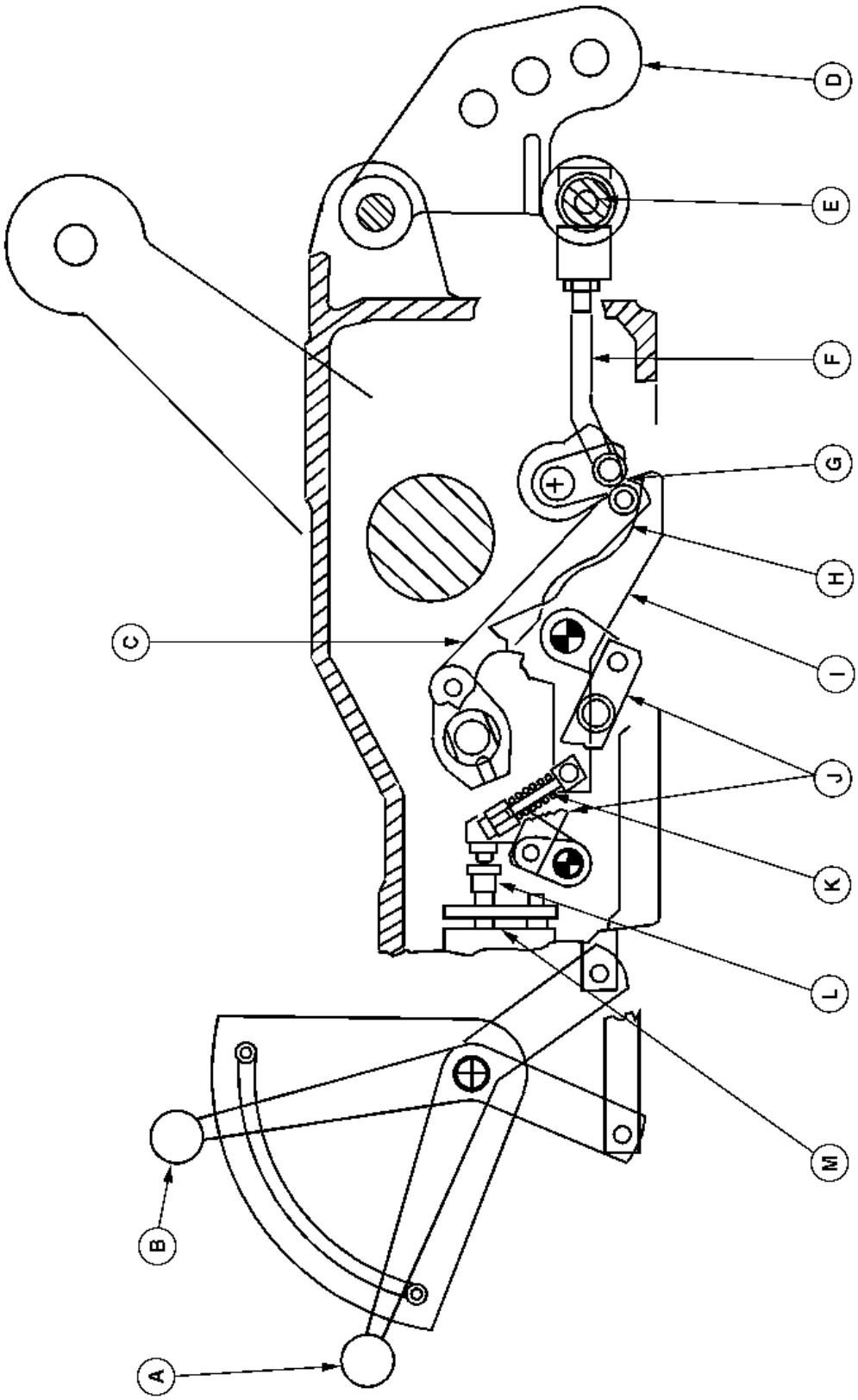
The oil coming from the pump, as in the neutral phase, is able to move downward the small regulator piston (I) and to flow to the discharge through passages (K).

At the same time the oil contained in the cylinder (O) flows from annular duct (G) to the rate of drop valve (A) and through passage (C) it enters the discharge valve (D), flowing to the discharge from passage (F) therefore causing the lowering of arms.

During this phase the lowering speed of the implement can be controlled by the knob (B); by screwing it in the lowering speed is reduced.

In order to avoid accidental movements of power lift control levers when the tractor is moving on the road, the knob (B) has to be completely screwed in so that the block valve (A) is in its seat.

Rockshaft Draft - Sensing Operation



AT 2303

Rockshaft Draft-Sensing Operation

LEGEND:

A	Position Control Lever
B	Draft Control Lever
C	Control Rod
D	Center Link Bracket
E	Rod Bracket
F	Draft Sensing Rod
G	Cam Lever
H	Control Roller
I	Balance Link
J	Limit Stop Rod
K	Valve Link
L	Control Spool
M	Rockshaft Control Valve

FUNCTION:

Senses implement load and triggers rockshaft to raise if draft load is excessive.

MAJOR COMPONENTS:

- Draft-Sensing Linkage
- Rockshaft Valve
- Rockshaft Cylinder

THEORY OF OPERATION:

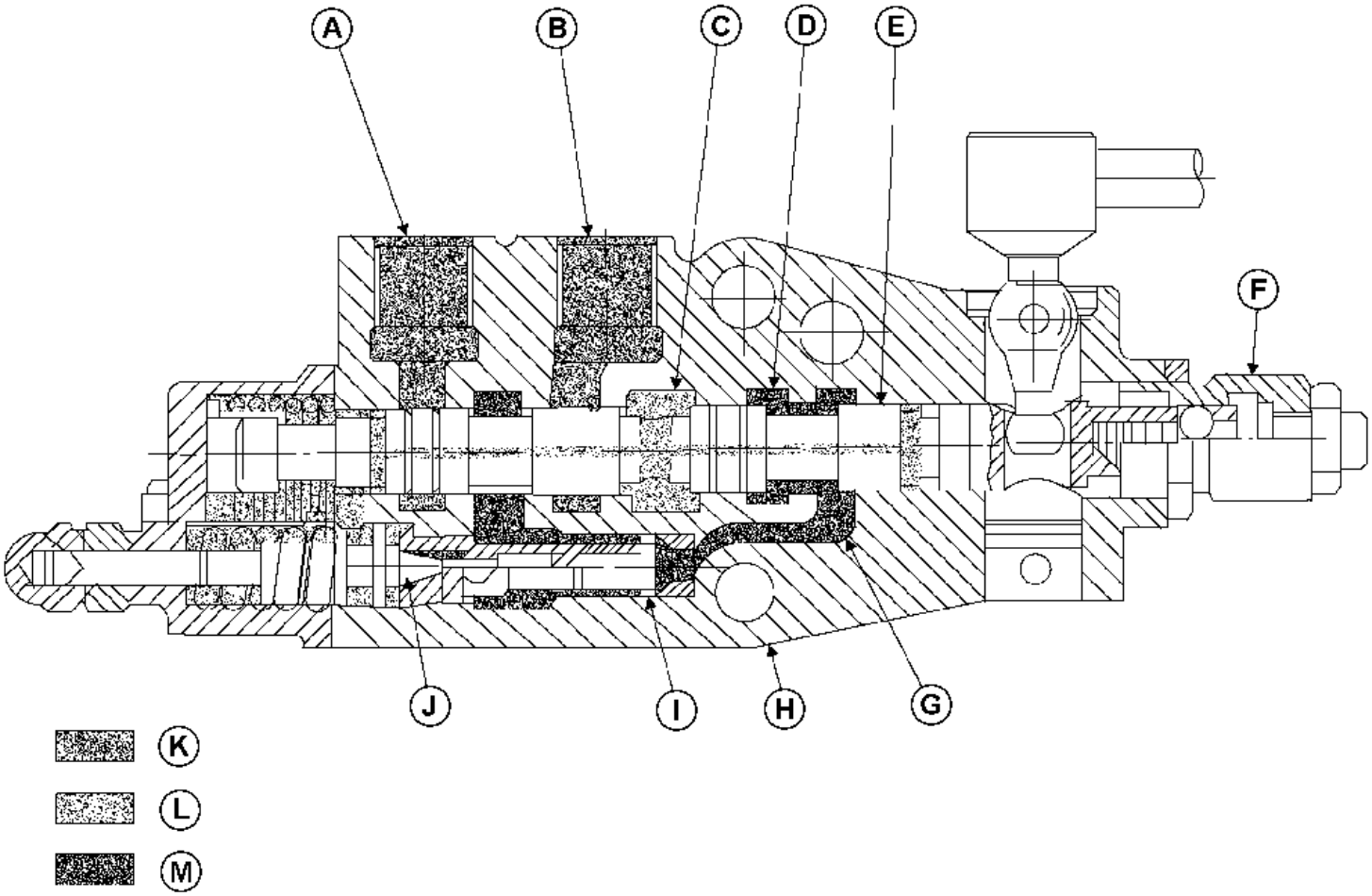
System senses draft load through a linkage arrangement. As implement load increases, it pushes on center link bracket (D). In turn, rod bracket (E) moves draft-sensing rod (F) forward and pushes cam lever (G). Cam lever moves roller (H) and balance link (I), which moves valve link (K). Link moves control spool (L) and lifts the 3-point hitch according to amount of draft load and lever position.

When draft control lever (B) is positioned completely forward, system does not respond to draft sensing. Control rod (C) moves roller (H) to reduce distance between cam lever (G) and balance link (I) and keep control spool (L) in lowering position.

As draft control lever is pulled back, control rod (C) moves roller (H) to increase distance between cam lever (G) and balance link (I).

Movement of the draft-sensing linkage now moves control spool, which directs oil to rockshaft cylinder and lifts the 3-point hitch. Continued lever movement causes further increase of distance between cam lever and balance link, increasing system sensitivity to draft load. The center link can be attached in three different positions. Changing positions affects the draft sensing sensitivity.

Selective Control Valve Operation - Double Acting With Detent Position / Neutral Position



AT3228

Double Acting SCV With Detent Position/ Neutral Position

LEGEND:

A	Return Port
B	Outlet Port
C	Return Passage
D	Outlet Passage
E	Spool
F	Detent Device
G	Inlet Passage
H	Valve Housing
I	Check Valve
J	Relief Valve
K	Trapped Oil
L	Return Oil
M	System Neutral Flow

FUNCTION:

Controls oil supply to cylinders of attached implements.

MAJOR COMPONENTS:

- Selective Control Valves
- Lever

THEORY OF OPERATION:

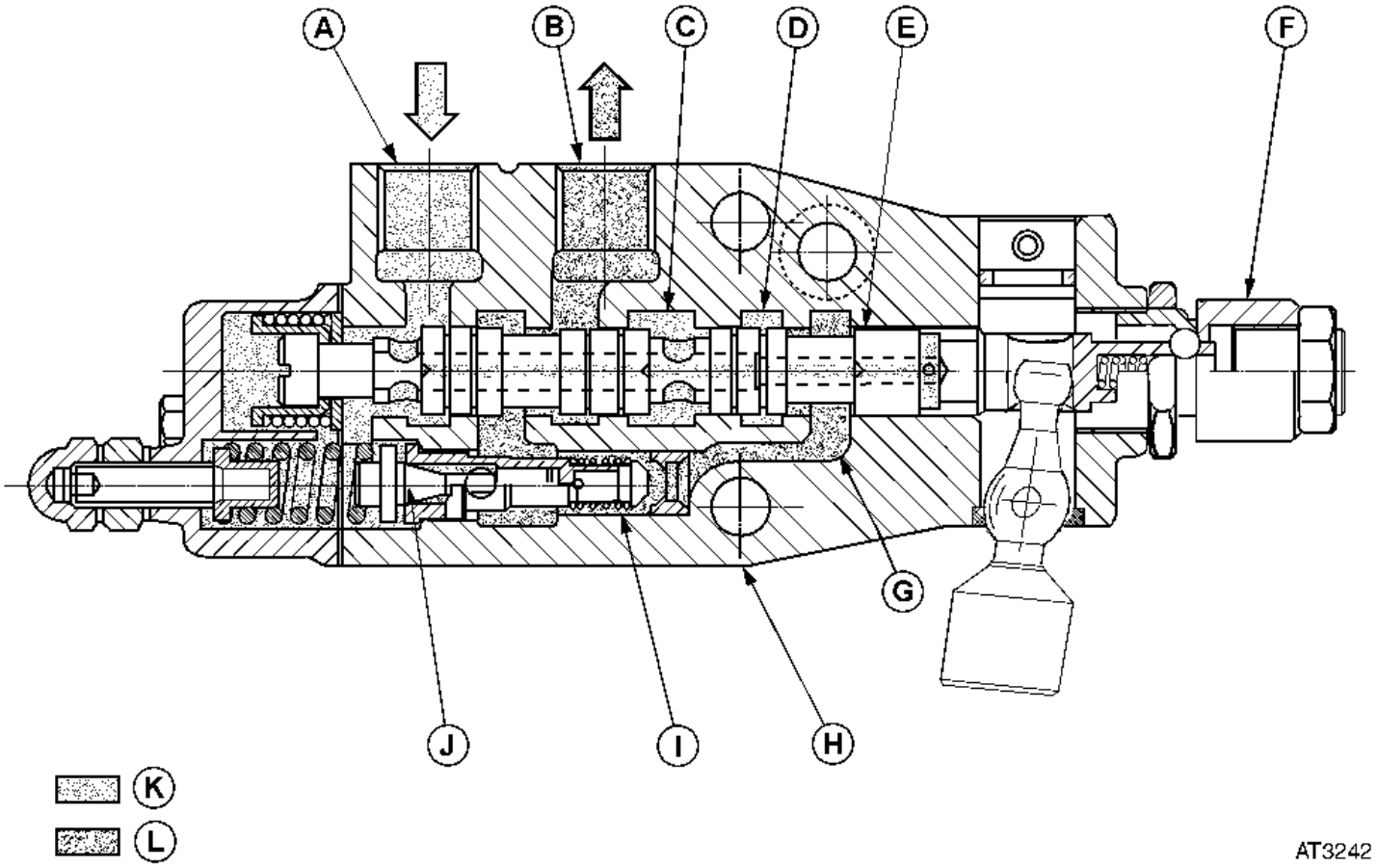
Tractor is supplied with a double acting distributor, coupled in delivery and return position.

One or two further single or double action distributors can be added on request.

In this position the spool (E) is blocking the external outlet port (B) and return port (A) so there is no movement of attached external equipment.

Oil from the pump flows through the selective control valve to the inlet passage (G). Outlet passage (D) is opened by the spool, so oil flows into the second selective control valve on the internal hydraulic system.

Selective Control Valve Operation - Double Acting With Detent Position / Supply Position



Double Acting SCV With Detent Position/ Supply Position

LEGEND:	
A	Return Port
B	Outlet Port
C	Return Passage
D	Outlet Passage
E	Spool
F	Detent Device
G	Inlet Passage
H	Valve Housing
I	Check Valve
J	Relief Valve
K	Return Oil
L	Pressure Flow

FUNCTION:

Controls oil supply to cylinder of attached implements.

MAJOR COMPONENTS:

- Selective Control Valves
- Lever

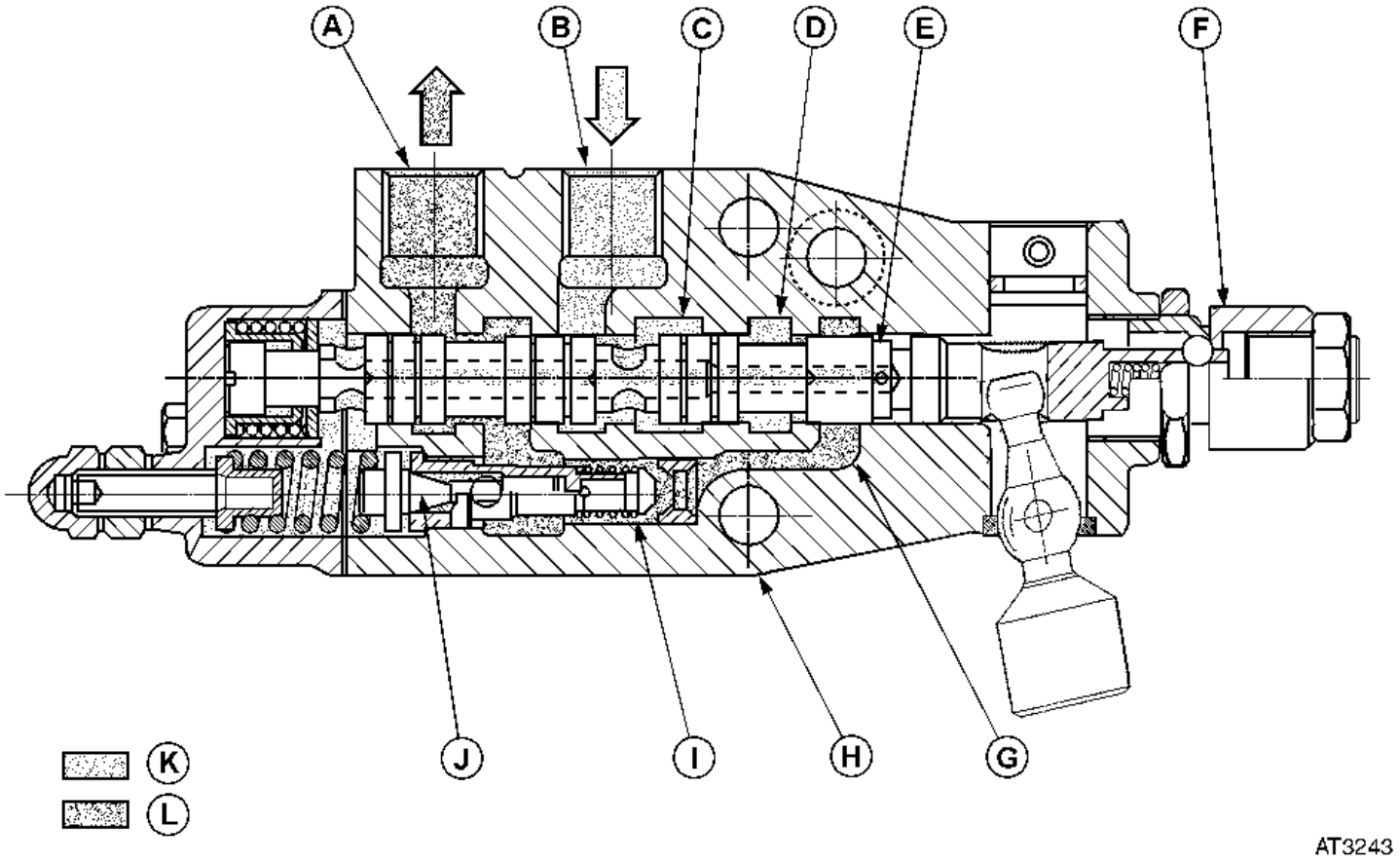
THEORY OF OPERATION:

Pulling the control lever upward on the tractor puts the spool (E) into the position shown, blocking the outlet passage (D).

Oil flows through the inlet passage (G), past the check valve (I) and is directed by the spool to the external port (B). Return oil from the external equipment is permitted to flow into the selective control valve at port (A) and through the hole in the spool,

to the return passage (C).

Selective Control Valve Operation - Double Acting With Detent Position / Return Position



Double Acting SCV With Detent Position/ Return Position

LEGEND:	
A	Outlet Port
B	Return Port
C	Return Passage
D	Outlet Passage
E	Spool
F	Detent Device
G	Inlet Passage
H	Valve Housing
I	Check Valve
J	Relief Valve
K	Return Oil
L	Pressure Flow

FUNCTION:

Controls oil supply to cylinder of attached implements.

MAJOR COMPONENTS:

- Selective Control Valves
- Lever

THEORY OF OPERATION:

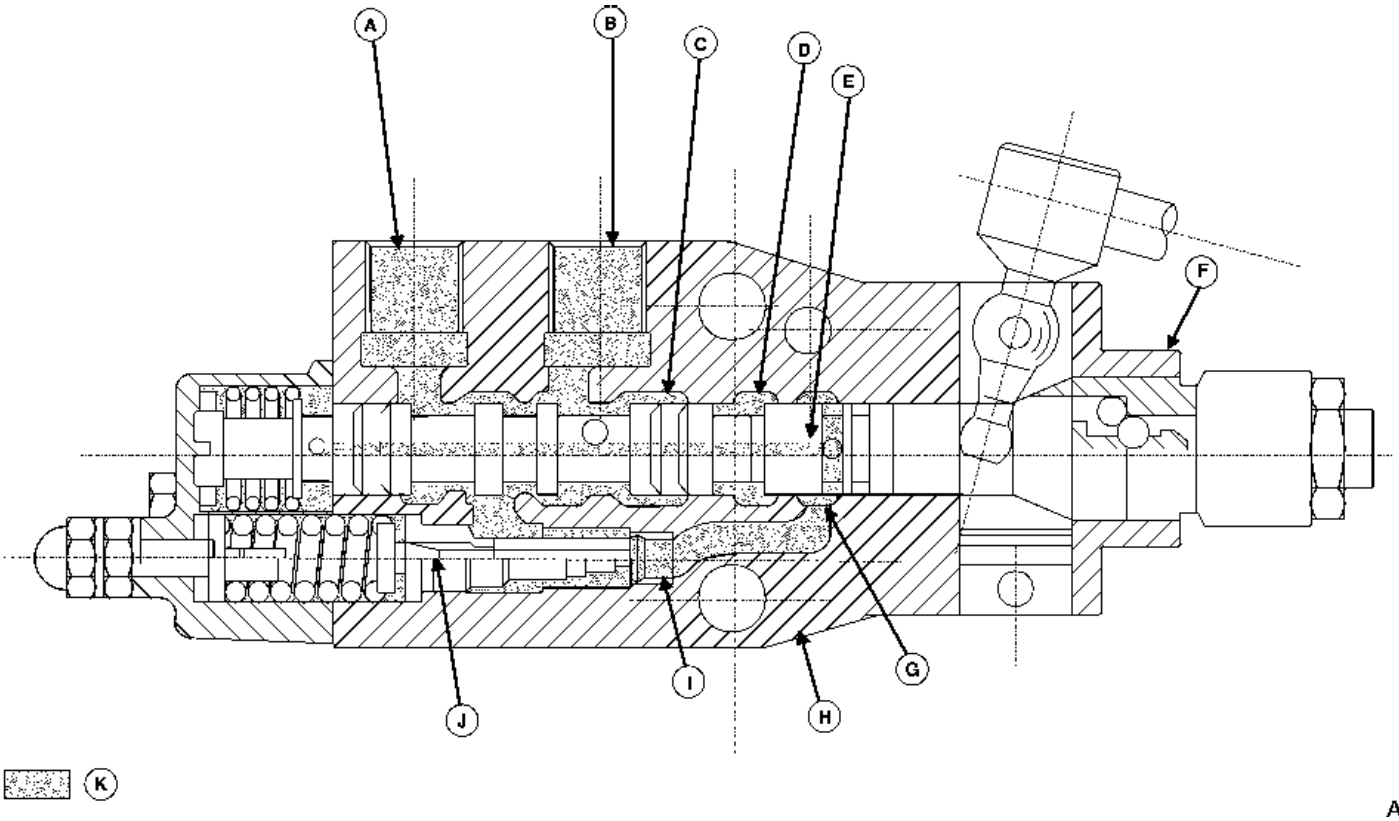
Moving the control lever fully down, reverses oil flow at the external ports.

Port (A) is used to supply oil to external equipment and port (B) to return oil through the return passage (C).

A relief valve (J) controls the maximum external system pressure during either of the supply phases.

Operation for double-action distributors without coupling in delivery and return position is the same as described before. Rod return springs bring distributor back to neutral position when command lever is released.

Selective Control Valve Operation - Double Acting With Detent Position / Float Position



AT2318

Detent Position/ Float Position

LEGEND:	
A	Outlet Port
B	Return Port
C	Return Passage
D	Outlet Passage
E	Spool
F	Detent Device
G	Inlet Passage
H	Valve Housing
I	Check Valve
J	Relief Valve
K	Return Oil

FUNCTION:

Allows implement to follow ground contours.

MAJOR COMPONENTS:

- Selective Control Valves
- Lever

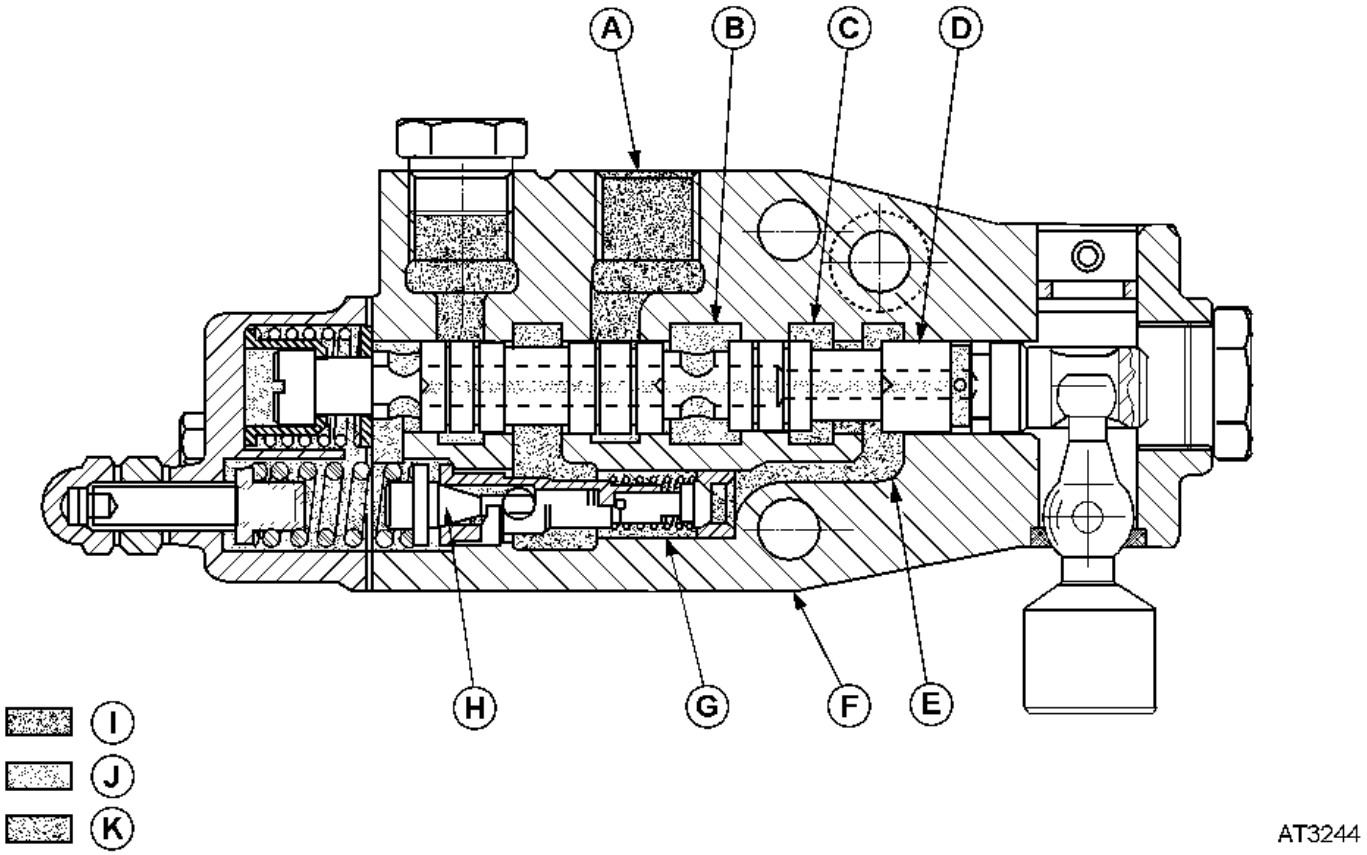
THEORY OF OPERATION:

When spool (E) is moved fully inward, the detent engages it in float position. This isolates system pressure oil from outlet port (A) and return port (B) and connects both ports to their return passages (C). With both ends of implement cylinder connected to sump, oil can pass to sump freely allowing the implement to follow ground contours.

→NOTE:

Spool is locked in float position by the detent. It must be released by the operator.

Selective Control Valve Operation - Single Acting / Neutral Position



Single Acting SCV/ Neutral Position

LEGEND:

A	External Port
B	Return Passage
C	Outlet Passage
D	Spool
E	Inlet Passage
F	Valve Housing
G	Check Valve
H	Relief Valve
I	Trapped oil
J	Return oil
K	System Neutral Flow

FUNCTION:

Controls oil supply to cylinder of attached implements.

MAJOR COMPONENTS:

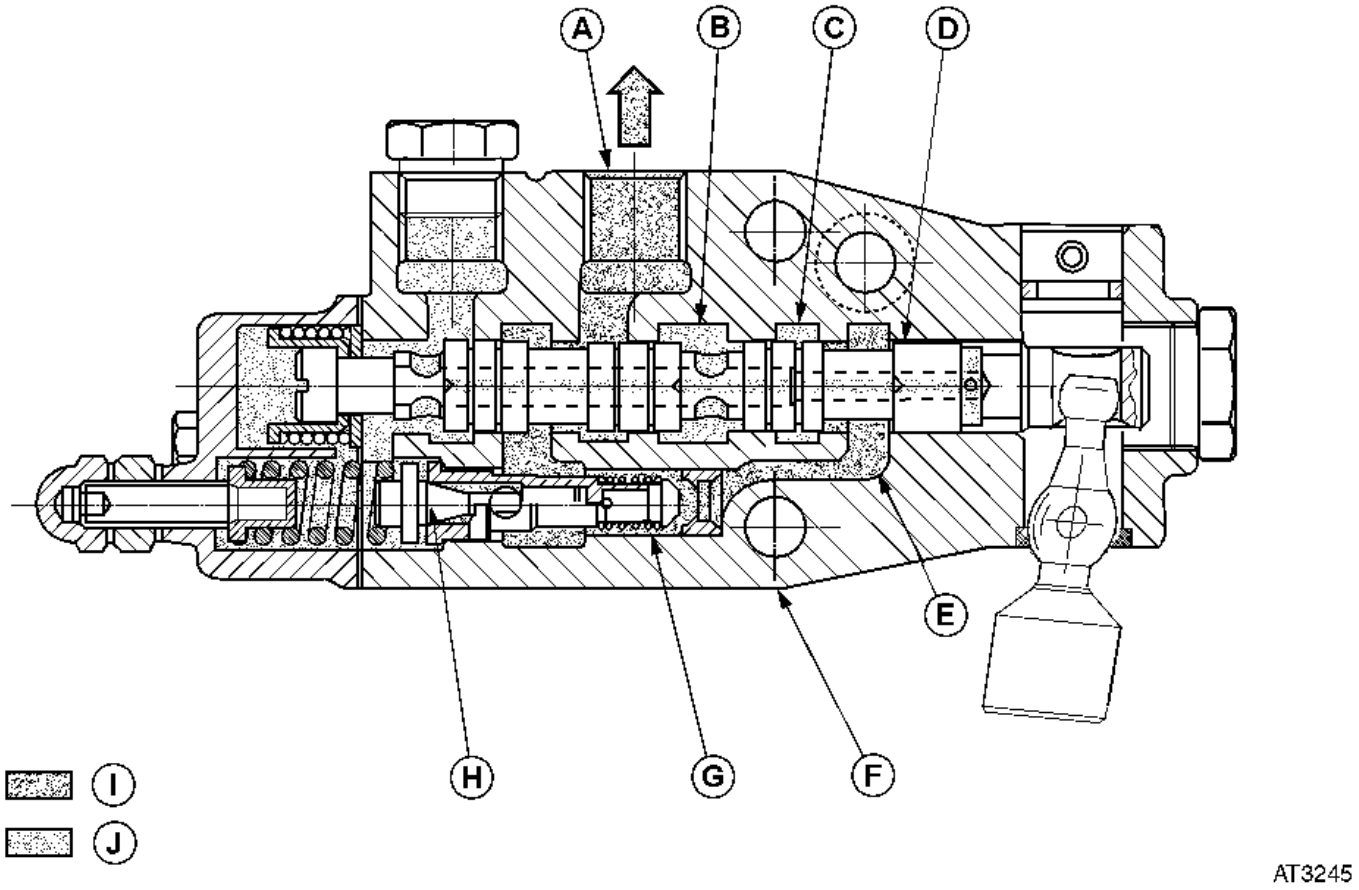
- Selective Control Valves
- Lever

THEORY OF OPERATION:

In this position, the spool (D) is blocking the external outlet port (A), so there is no movement of attached external equipment.

Oil from the pump flows through selective control valve to the inlet passage (E). Outlet passage (C) is opened by the spool, so oil flows into the second selective control valve or back to sump.

Selective Control Valve Operation - Single Acting / Supply Position



Single Acting SCV/ Supply Position

LEGEND:	
A	External Port
B	Return Passage
C	Outlet Passage
D	Spool
E	Inlet Passage
F	Valve Housing
G	Check Valve
H	Relief Valve
I	Return Oil
J	Pressure Oil

FUNCTION:

Controls oil supply to cylinder of attached implements.

MAJOR COMPONENTS:

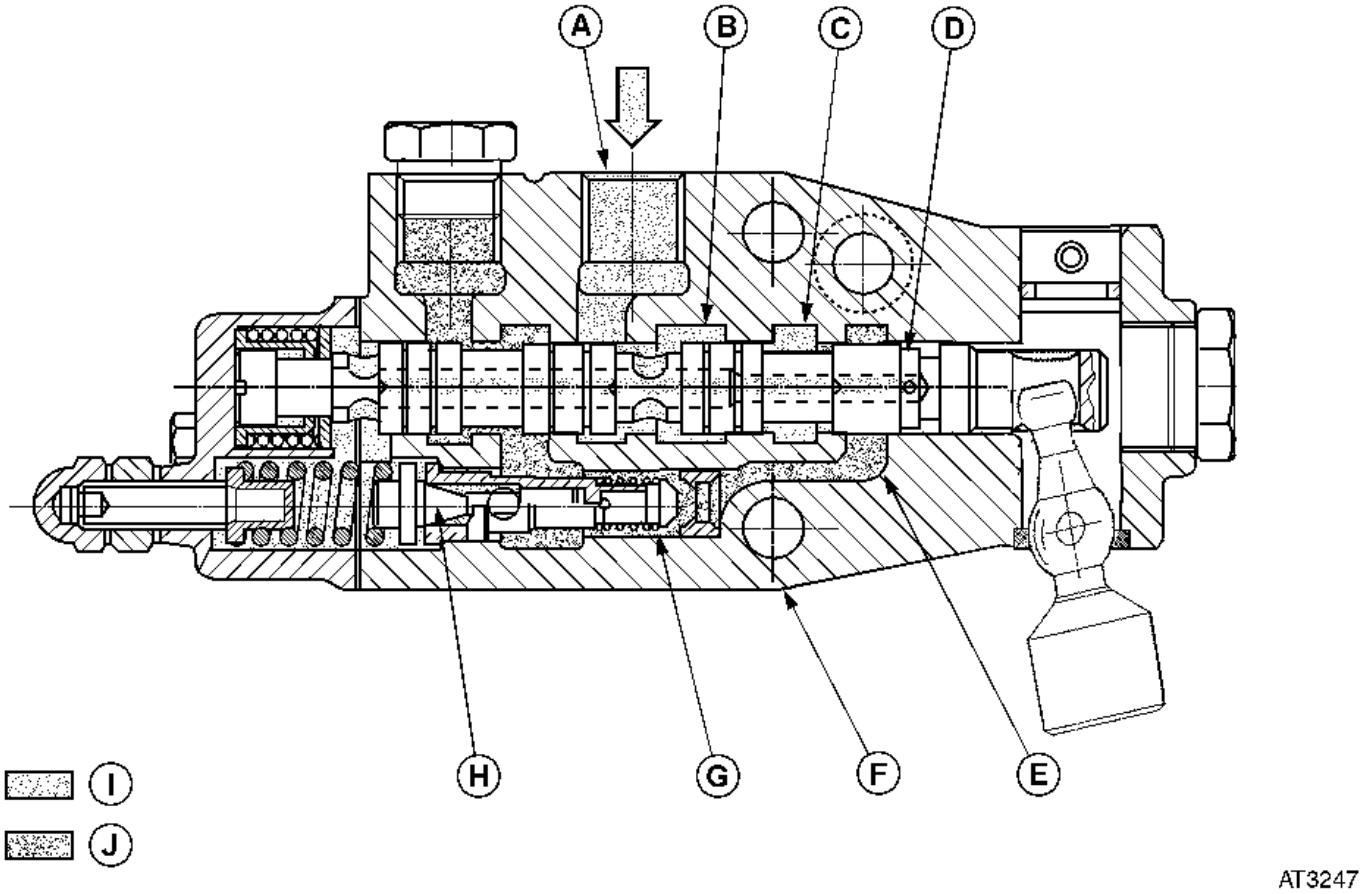
- Selective Control Valves
- Lever

THEORY OF OPERATION:

Pulling the control lever upward on the tractor puts the spool (D) into the position shown, blocking the outlet passage (C). Oil flows through the inlet passage (E) past the check valve (G) and is directed by the spool to the external port (A).

The return spring will move the spool into the neutral position when the control lever is released.

Selective Control Valve Operation - Single Acting / Return Position



Single Acting SCV/ Return Position

LEGEND:	
A	External Port
B	Return Passage
C	Outlet Passage
D	Spool
E	Inlet Passage
F	Valve Housing
G	Check Valve
H	Relief Valve
I	Return Oil
J	System Flow

FUNCTION:

Controls oil supply to cylinder of attached implements.

MAJOR COMPONENTS:

- Selective Control Valves
- Lever

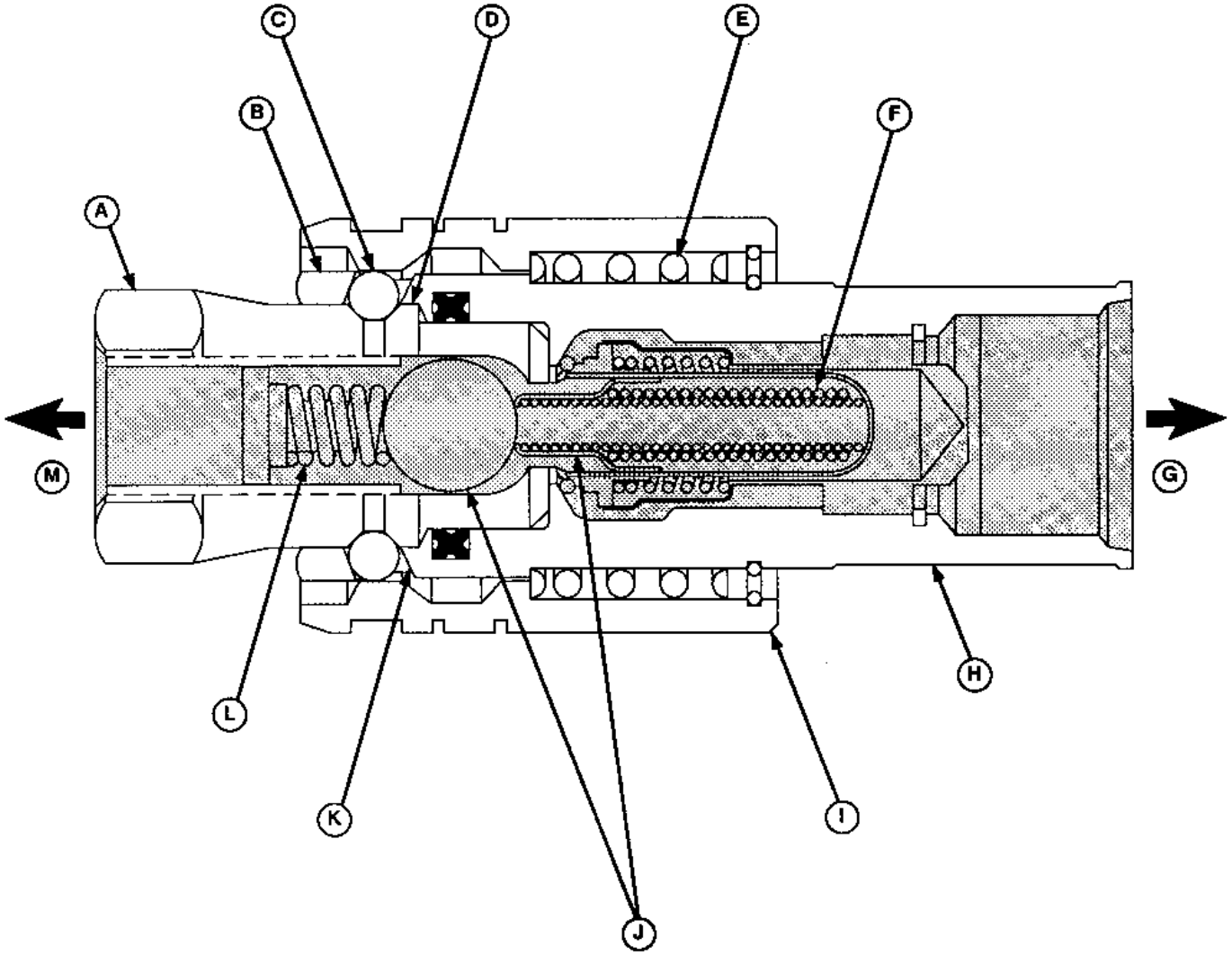
THEORY OF OPERATION:

Moving the control lever downward, the oil held in the external equipment is permitted to flow into the port (A) and out of the return passage (B).

Pump flow is through inlet passage (E) and outlet passage (C) to the second selective control valve or the internal hydraulic system.

The return spring will return the valve spool to the neutral position when the control lever is released.

Double-Acting Sleeve Coupler Operation



AT1202

Double-Acting Sleeve Coupler

LEGEND:

A	Cylinder Hose Plug
B	Rear Ramp
C	Retaining Balls
D	Plug Flange
E	Body Return Spring
F	Check Valve Return Spring
G	To Selective Control Valve
H	Coupler Body
I	Coupler Sleeve
J	Check Valves
K	Front Ramp
L	Check Valve Return Spring
M	To Remote Cylinder
N	Oil Flow

FUNCTION:

Tractors with SCV use double acting sleeve couplers to connect remote cylinder hoses. These couplers are easy to connect and

disconnect even under pressure.

MAJOR COMPONENTS:

- Coupler Sleeve
- Retaining Balls
- Check Valves
- Coupler Body
- Body Return Spring
- Check Valve Return Spring

THEORY OF OPERATION:

To connect remote cylinder hoses, push the cylinder hose plug (A) into coupler. This can be done with or without system pressurized.

As coupler body (H) moves toward front of tractor, retaining balls (C) roll down front ramp (K), allowing flange (D) of plug to move past retaining balls. Upon releasing the cylinder hose plug, body return spring (E) moves coupler rearward, locking retaining balls in plug groove.

Once the mating halves of coupler are connected, both check valves (J) open, allowing oil flow to and from the remote cylinder (M).

Remote cylinder hose plug (A) releases automatically when pulled rearward with sufficient tension. Coupler body (H) moves rearward against spring until retaining balls (C) move into ramp area (B). Retaining balls move outward letting flange (D) pass thus releasing the plug. Check valves (J) then seat under pressure from springs (F) and (L), shutting off oil flow.

Group 15 - Diagnosis

Safety Precautions

CAUTION:

Escaping hydraulic oil under pressure can have sufficient pressure to penetrate the skin, causing serious personal injury. Relieve all pressure before disconnecting hydraulic or other lines. Check and tighten all connections before applying pressure. Hydraulic oil escaping from pin holes is difficult to detect, so use a piece of cardboard to search for leaks. Do not use your hands.

CAUTION:

If injuries are caused by pressurized oil, seek medical attention immediately, otherwise severe infections may result.

CAUTION:

Shut off the engine before checking oil lines close to moving machine parts.

CAUTION:

When checking the hitch, be careful when lift arms are moving. Danger of accidents! Therefore stay outside the working area of lift and draft links.

CAUTION:

If testers are attached to tractor, always shut off engine.

CAUTION:

During tests that involve running the engine, always engage the parking brake.

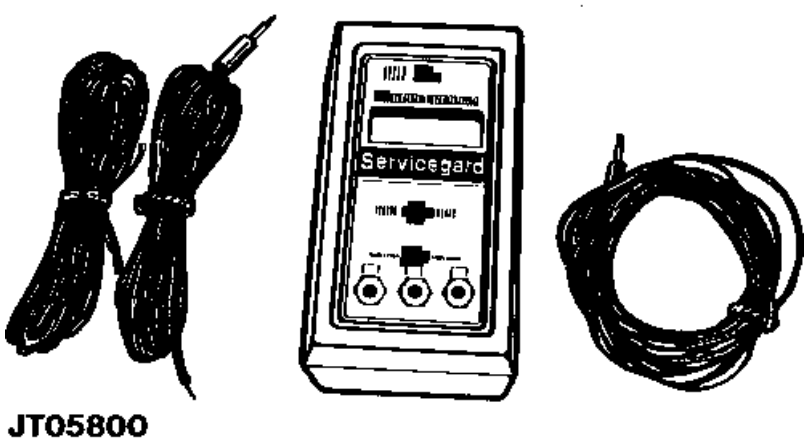
Special or Essential Tools

→NOTE:

Order tools according to information given in the U.S. SERVICEGARD ™ Catalog or from the European Microfiche Tool Catalog (MTC). Some tools may be available from a local supplier.

Digital Thermometer

JT05800



JT05800

For measuring temperatures

Diagnostic Information

When making hydraulic tests the oil must be heated to approximately 43°C (110°F) for accurate test results.

At first perform the “Hydraulic System Major Test” to verify the basic hydraulic functions.

Perform the “Hydraulic System Test” when looking for unspecified failure.

The symptom headings in this group can be used to test components related to a specific problem or symptom. Select a symptom from the list and follow the test procedures under the heading.

The symptom headings are:

- Hydraulic System Major Test
- Hydraulic System Test
- Insufficient Pump Delivery
- Hydraulic Functions Too Slow
- Excessive Pump Pressure
- Slow Hydraulic Pump Response
- Excessive Pump Noise During Operation
- Rockshaft Does Not Lift or Lifts Slowly
- Rockshaft Does Not Lower or Lowers Slowly
- Neutral Position Unstable, Rockshaft Drops After Engine Shut-Down
- SCV Control Lever Does Not Return To Neutral Position
- SCV Does Not Return To Neutral Position
- SCV Does Not Remain In Detent Position
- Remote Cylinder Does Not Extend or Retract
- Remote Cylinder Settles Under Load
- Remote Cylinder Operates Too Fast or Too Slow

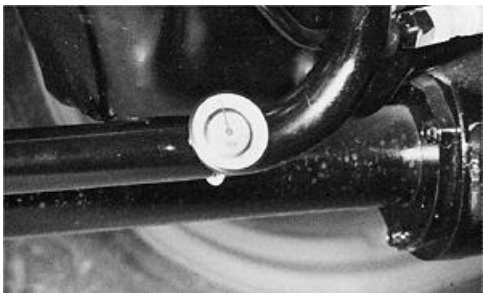
The diagnostic procedure lists:

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

When performing the test or check, be sure to set your machine up to the test conditions listed and follow the sequence carefully. The middle “Normal” column gives the reading or condition that should be obtained when performing the test or check. If the results of the test or check are not normal, perform the tests, check, or adjustment listed in the third “If Not Normal” “Not OK” column to repair the malfunction. The detailed tests or adjustments referred to in the “If Not Normal” “Not

OK" column are located in the Groups 20 and 25.

Hydraulic Oil Warm-Up Procedure



Hydraulic Oil Warm-Up

REASON:

When making hydraulic tests the oil must be heated to approximately 43°C (110°F) for accurate test results.

CONNECTIONS:

1. Install JT05800 temperature gauge on suction line.

PROCEDURE:

[1] - Lower the rockshaft.

[2] - Run engine at fast idle.

[3] - Pull SCV lever back to put system into relief.

[4] - Hold the lever back until the suction line is too warm to hold.

At this point the oil temperature should be approximately 38 to 43°C (100 to 110°F).

Hydraulic System Major Test

Perform this test to verify the basic functions of the hydraulic system.

Major test

(1) Leakage check

Action:

Check entire machine for hydraulic oil leakage.

Result:

YES: GO TO 2

NO: Repair cause of leakage.

(2) Oil level

Action:

Check oil level.

Result:

YES: GO TO 3

NO: Correct oil level.

(3) Oil condition

Action:

3.1 Check for contamination with metal particel.

Result:

YES:GO TO 3.2

NO: Change oil and oil filter. Check for mechanical failure.

Action:

3.2 Check for contamination with water. (milky look)

Result:

YES:GO TO 3.3

NO: Change oil and oil filter. Check for causes (e.g. openings where water can seep in).

Action:

3.3 Check for any other contamination.

Result:

YES:GO TO 3.4

NO: Change oil and oil filter. Check for causes.

Action:

3.4 Check for discolouration.

Result:

YES: GO TO 4

NO: Change oil and oil filter. Check for causes of oil overheating.

(4) Hydraulic functions

Action:

Ensure that all functions operate equally smooth and quick.

→NOTE:

Operate each selective control valve to determine if the problem affects complete system or only one valve.

Result:

YES:GO TO "Hydraulic System Diagnosis" , see in this Group

NO: Change hydraulic oil filter. Change steering valve filter. Ensure oil is correct type. See "Hydraulic Functions Too Slow" in this Group.See Adjustments in Group 25.

Hydraulic System Diagnosis

Preliminary Hydraulic System Test

(1) Check hydraulic oil

Action:

Check condition and level of oil.

Result:

YES: GO TO 2

NO: Correct oil levelChange oil and filter if oil is contaminated. Check for causes of contamination.

(2) Check hydraulic oil filter and suction line

Action:

Check for restriction or squeezed oil lines.

Connect a high pressure hydraulic hose to both couplers of a SCV (short cut). This causes maximum pump flow when SCV is engaged. Engage SCV and run engine at varios speed.

Pay attention for unusual noises.

→NOTE:

Loud noises coming from the hydraulic pump may indicate restrictions on the suction side of pump (e.g. oil filter or damaged oil line from filter to pump).

Result:

YES: GO TO 3

NO: Replace oil filter.Remove restriction.

(3) Check pump drive

Action:

Operate engine at various speed. Engage and disengage a SCV to bring hydraulic pressure alternating to maximum and minimum. Pay attention for unusual noises and vibrations.

Result:

NO: Repair hydraulic pump or pump drive.If necessary replace damaged parts.

(4) Check system pressure

Action:

Perform relief valve check, see “SCV Relief Valve Test” in Group 20.

Result:

YES:GO TO 5

NO: See “Adjust Relief Valve” in Group 25.

(5) Check pump flow

Action:

See "Pump Flow Test" in Group 20.

Result:

YES: End of system check. If no failure was found perform the component tests. See this Group.

NO: Reasons for poor pump flow measurement:- Bad or damaged hydraulic pump- Restricted oil filter or suction line- SCV valve spool scored or leaking (try other SCV)- SCV coupler damaged or restricted (try other couplers)- SCV linkage not correct adjusted

Component test - SCV (At first perform "Preliminary Hydraulic System Test")

(1) SCV lever

Action:

Check for binding, damage and adjustment.

Result:

YES: GO TO 2

NO: Replace damaged parts.Adjust SCV lever.

(2) SCV valve spool

Action:

Move SCV lever in each direction.

Check for to much free play in neutral position.

Check for unusual resistance when engaging.

Check for exact detent lock in each direction (Dual SCV).

Result:

YES: GO TO 3

NO: Replace or repair SCV assembly.

(3) Relief valve

Action:

Run engine at fast idle.

Perform "Relief Valve Check", see Group 20.

Reading must be within specification.

Result:

YES: GO TO 4

NO: Adjust relief valve, see “SCV Relief Valve Adjustment” in Group 25.Check couplers.

(4) SCV leakage

Action:

Perform leakage test, see “SCV Leakage Test” in Group 20.

Result must be within specification.

Result:

YES: End of SCV test.

NO: Excessive drop at outlet 1 or 2 - Repair boom spool.Excessive drop at outlet 3 or 4 - Repair bucket spool.

Component test - Rockshaft (At first perform “Preliminary Hydraulic System Test”)

(1) Rockshaft lift cycling

Action:

Perform “Rockshaft Lift Cycle Test” see Group 20.

Result:

YES:GO TO 2

NO: Check rockshaft valve. Repair or replace if necessary.

(2) Rockshaft leakage test

Action:

2.1 Leak test with pipe plug installed in rockshaft passage.

Rockshaft under load raised up must steady hold when engine is off.

Measure the distancee of lowering at the end of lift arms.

→NOTE:

Lowering of 0.4 mm per minute can be normal.

Result:

YES:GO TO 2.2

NO: Inspect rockshaft cylinder, seals, piston or surge relief valve.

Action:

2.2 Leak test without pipe plug installed in rockshaft passage. Rate-of-drop valve open.

Rockshaft under load raised up must steady hold when engine is off.

Measure the distancee of lowering at the end of lift arms.

→NOTE:

Lowering of 0.4 mm per minute can be normal.

Result:

YES: GO TO 3

NO: Replace rockshaft valve or O-ring seals.

(3) Rockshaft relief valve

Action:

Check adjustment, see "Rockshaft Safety And Relief Valves Adjustment" , described in Group 25.

Result:

YES: End of this test. For more tests see Group 20 or.

Insufficient Pump Delivery

CONDITIONS:

- Machine parked on level surface.
- Engine at 2400 rpm.
- Hydraulic tests and adjustments in this Section.

Insufficient Pump Delivery

Test Location	Normal	If Not Normal
1. Hydraulic oil filter.	Free of restriction.	Replace filter.
2. Steering filter.	Free of restrictions.	Replace filter.
3. Relief valve.	System pressure within specifications.	Adjust relief valve. Repair or replace as needed.
4. Hydraulic pump.	Good condition with minimal wear.	Perform Pump Flow Test. Repair or replace as needed. See in this section.
5. Suction line.	No air leaks.	Repair or replace.

Hydraulic Functions Too Slow

CONDITIONS:

- Machine parked on level surface.
- Hydraulic tests and adjustments in this Section.
- Engine adjustment in CTM Engines.

Hydraulic Functions Too Slow

Test Location	Normal	If Not Normal
1. Hydraulic oil filter.	Free of restriction.	Replace filter.
2. Steering valve filter.	Free of restrictions.	Replace filter.
3. Tachometer.	Reads rated rpm at 2400 at full load.	Check and adjust fast idle.
4. Relief valve.	System pressure within specifications.	Adjust relief valve.
5. Hydraulic pump.	Flow output within specifications.	Perform Pump Flow Test.
6. SCV.	In neutral position.	Move control lever into neutral position. Inspect linkage. Repair or replace parts as necessary.

Excessive Pump Pressure

CONDITIONS:

- Machine parked on level surface.
- Hydraulic tests and adjustments in this Section.

Excessive Pump Pressure

Test Location	Normal	If Not Normal
1. Relief valve.	Pressure within specifications.	Adjust relief valve.
2. Outlet line.	Free of kinks and restrictions.	Replace line.
3. SCV.	Free to return to neutral position.	Operate SCV levers. Check for pressure change. Repair or replace SCV valve.

Slow Hydraulic Pump Response

CONDITIONS:

- Machine parked on level surface.
- Key switch in off position.
- Hydraulic tests and adjustments in this Section.

Slow Hydraulic Pump Response

Test Location	Normal	If Not Normal
1. Hydraulic oil filter.	Free of restrictions.	Replace filter.
2. Steering filter.	Free of restrictions.	Replace filter.
3. Hydraulic oil dipstick.	Oil of the proper type and viscosity. Oil at approximately 43°C (110°F).	Drain and refill with correct oil. Heat hydraulic oil as described in this Group.
4. Pump suction line.	Free of kinks and restrictions.	Repair or replace line.
5. SCV.	Free to return to neutral position. Not leaking internally.	Operate SCV levers. Check for pressure change. Repair or replace SCV valve.
6. Relief Valve.	Pressure within specifications. Not leaking.	Test relief valve.
7. Hydraulic pump.	Flow output within specifications.	Perform Pump Flow Test.
8. Safety valve.	Not leaking.	Perform Rockshaft Leakage Test. Replace valve.

Excessive Pump Noise During Operation

CONDITIONS:

- Machine parked on level surface.
- Key switch in off position.
- Hydraulic tests and adjustments in this Section.

Excessive Pump Noise

Test Location	Normal	If Not Normal
1. Hydraulic oil dipstick.	Oil level between marks. Oil of the proper type.	Add oil as needed. Drain and refill with correct oil.
2. Pump section line.	No kinks and free of air leaks.	Repair or replace line as needed.
3. Relief valve.	Pressure within specifications.	Adjust. Replace if necessary.
4. SCV.	Free to return to neutral position.	Operate SCV levers. Repair or replace valve.
5. Rockshaft valve.	Neutralizing.	Leak test rockshaft.

Rockshaft Does Not Lift or Lifts Slowly

CONDITIONS:

- Machine parked on level surface.
- Hydraulic tests and adjustments in this Section.

Rockshaft Does Not Lift

Test Location	Normal	If Not Normal
1. Hydraulic oil dipstick.	Oil of proper type and viscosity.	Drain and refill hydraulic system.
2. Hydraulic oil filter.	Free of restrictions.	Replace filter.
3. Hydraulic pump.	Flow within specifications.	Perform Pump Flow Test.
4. Relief valve.	System pressure within specifications.	Adjust relief valve.
5.Rockshaft.	Leakage within specifications.	Leak test rockshaft.
6. SCV.	Free to return to neutral position.	Operate SCV levers. Repair or replace valve.

Rockshaft Does Not Lower or Lowers Slowly

CONDITIONS:

- Machine parked on level surface.
- Key switch in off position.
- Hydraulic tests and adjustments in this Section.

Rockshaft Does Not Lower

Test Location	Normal	If Not Normal
1. Rate-of-drop valve.	Backed-out (open).	Open valve.
	Valve and passages clean.	Clean, repair or replace valve as needed.
2. Rockshaft linkage.	Linkage connected and not binding, bent, or worn.	Repair or replace as needed.
3. Draft control linkage.	Linkage connected and not binding, bent, or worn.	Repair, replace or adjust as needed.

Neutral Position Unstable, Rockshaft Drops After Engine Shut-Down

CONDITIONS:

- Machine parked on level surface.
- Hydraulic tests and adjustments in this Section.

Neutral Position

Test Location	Normal	If Not Normal
1. Rockshaft.	Leakage within specifications. Attachment installed correctly.	Replace rockshaft piston O-ring. Install as instructed by Operator´s Manual or Installation Instruction.
2. Rate-of-drop valve.	Closes completely without leaks.	Repair or replace valve as needed.
3. Safety valve.	Not leaking.	Perform Rockshaft Leakage Test. Replace valve.

SCV Control Lever Does Not Return to Neutral Position

CONDITIONS:

- Machine parked on level surface.
- Key switch in off position.
- Hydraulic test and adjustments in this Section.

SCV Control Lever

Test Location	Normal	If Not Normal
1. SCV lever.	Lever not binding, bent, or worn.	Repair or replace as needed.
2. SCV.	Spool encounters spring resistance whether pushed or pulled.	Replace valve assembly.
	Spool slides back and forth through housing without binding.	Replace valve assembly.

SCV Does Not Return to Neutral Position - SCV With Detent Position

CONDITIONS:

- Machine parked on level surface.
- Key switch in off position.
- Hydraulic test and adjustments in this Section.

SCV With Detent Position

Test Location	Normal	If Not Normal
1. SCV	Spool releases when moved opposite of detent.	Replace SCV assembly.

→NOTE:

The above diagnostic routines apply when the control lever binds in the non detent positions.

SCV Does Not Remain In Detent Position - SCV With Detent Position

CONDITIONS:

- Machine parked on level surface.
- Key switch in off position.
- Hydraulic test and adjustments in this Section.

SCV With Detent Position

Test Location	Normal	If Not Normal
1. Dual SCVs.	Detent locks in when valve nears end of travel in forward or rearward direction.	Replace SCV assembly.

Remote Cylinder Does Not Extend or Retract

CONDITIONS:

- Machine parked on level surface.
- Key switch in off position.
- Hydraulic tests and adjustments in this Section

Remote Cylinder

Test Location	Normal	If Not Normal
1. Remote cylinder.	Cylinder piston O-ring in good condition and stop valve free.	Won't extend. Replace piston O-ring.
2. Double-acting sleeve couplers.	Cylinder hose ends fully seated in couplers.	Seat hose ends in couplers.
	Coupler tips not damaged or worn.	Replace couplers.

Remote Cylinder Settles Under Load

CONDITIONS:

- Machine parked on level surface.
- Key switch in off position.
- Hydraulic tests and adjustments in this Section.

Remote Cylinder Settles

Test Location	Normal	If Not Normal
1. Remote cylinder.	Cylinder and piston O-ring in good condition.	Replace O-ring or cylinder if scored.
2. Double-acting sleeve couplers.	Couplers free from leakage.	Repair or replace coupler. If equipped with dual SCV, connect to additional couplers.
	SCV not leaking.	Excessive leakage at SCV. Perform Hydraulic System Tests-With SCV.

Remote Cylinder Operates Too Fast or Too Slow

CONDITIONS:

- Machine parked on level surface.
- Key switch in off position.
- Hydraulic test and adjustments in this Section.

Operates Too Fast or Too Slow

Test Location	Normal	If Not Normal
1. Remote cylinder	Stop valve free.	Repair or replace stop valve.
2. SCV control lever.	Free and moveable throughout range of travel	Repair or replace control lever.

Group 20 - Tests

Special or Essential Tools

→NOTE:

Order tools according to information given in the U.S. SERVICEGARD ™ Catalog or in the European Microfiche Tool Catalog (MTC).

Flowmeter

JT05469

Measuring hydraulic pump flow

Pressure Gauge

JT05473

SCV relief valve test

Coupler

AR94522

To be used with JT05469 flowmeter, JT05473 pressure gauge and JT03082 and JT05494 adapters

Adapter

JT03082

Depending on hose connection, additionally. To be used with JT05469 flowmeter and AR94522 connector.

Adapter

JT03049

Depending on hose connection, additionally. To be used with JT05469 flowmeter and AR94522 connector.

Hose with Coupler

JT03364

To be used with JT05473 pressure gauge, JT05494 adapter and AR94522 connector

Adapter

JT05494

To be used with JT05473 pressure gauge, JT03364 hose and AR94522 connector

Hydraulic System Tests-With SCV

CONDITIONS:

- Hydraulic oil is correct type, clean and at the proper level.
- No external hydraulic oil leaks.
- If oil filter wasn't replaced during preliminary inspection, replace it to ensure proper function.
- Rockshaft feedback linkage is properly adjusted. Refer to Group 25 for procedure.
- Hydraulic oil at approximately 43°C (110°F).

Hydraulic System Tests-With SCV

Test Location	Normal	If Not Normal
1. Check pump flow (at rear couplers) Run engine at 2400 rpm and turn flowmeter restriction to 10345 kPa (103.5 bar) (1500 psi).	43.2 L/min (11.4 gpm)	Perform test 2.
2. Check main relief pressure (at rear outlets). With engine at slow idle.	18000 to 18500 kPa (180 to 185 bar; 2610 to 2680 psi)	Reading low (test 1 and 2). Check main relief valve for leakage.
		Reading low (test 1 only): Inspect mesh filter. Inspect suction line. Inspect pump.
3. Test SCV leakage (at each rear outlet).	Pressure stays above 3448 kPa (34.5 bar; 500 psi) for at least 5 seconds.	Excessive drop at outlet 1 or 2: Repair boom spool.
		Excessive drop at outlet 3 or 4: Repair bucket spool.
		Excessive drop at outlet 5 or 6: Repair #3 SCV spool.
4. Leak test rockshaft with pipe plug installed in rockshaft passage.	Rockshaft holds steady under implement load.	Inspect rockshaft cylinder, seals, piston or surge relief valve.
5. Leak test rockshaft without pipe plug installed in rockshaft passage.	Rockshaft holds steady under implement load.	Replace rockshaft valve or O-ring seals.

Hydraulic System Tests

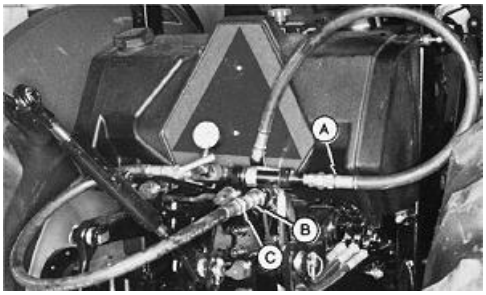
CONDITIONS:

- Hydraulic oil is correct type, clean and at the proper level.
- No external hydraulic oil leaks.
- If oil filter wasn't replaced during preliminary inspection, replace it to ensure proper function.
- Hydraulic oil at approximately 43°C (110°F).

Hydraulic System Tests

Test Location	Normal	If Not Normal
1. Check pump flow (at rear couplers) Run engine at 2400 rpm and turn flowmeter restriction to 10345 kPa (103.5 bar) (1500 psi).	43.2 L/min (11.4 gpm)	Perform test 2.
2. Check SCV relief pressure (at rear outlets).	18000 to 18500 kPa (180 to 185 bar; 2610 to 2680 psi)	Reading low (test 1 and 2): Check SCV relief for leakage. Reading low (test 1 only): Change hydraulic oil filter.
3. Test SCV leakage (at each rear outlet).	Pressure stays above 3448 kPa (34.5 bar; 500 psi) for at least 5 seconds.	Inspect suction line. Inspect pump. Excessive drop at outlets: Repair SCV spool.
4. Leak test rockshaft.	Rockshaft holds steady under implement load.	Inspect rockshaft cylinder, seals, piston or safety valve. Replace rockshaft valve or O-ring seals.

Pump Flow Test



Pump Flow Test

REASON:

To determine if hydraulic pump can provide adequate flow under pressure.

CONNECTIONS:

1. Assemble test equipment, consisting of JT05469 flowmeter (A), AR94522 coupler and JT03082/JT03049 adapter (C).
2. Connect flowmeter inlet hose to one of rear couplers.
3. Insert flowmeter return hose into oil fill hole.

PROCEDURE:

1. Fully open flowmeter control valve.
2. Start tractor and run at 2400 rpm.
3. Move SCV control lever as necessary to pressurize test outlet. Slowly close flowmeter control valve until 10345 kPa (103.5 bar; 1500 psi) shows on gauge.
4. Observe flow then release pressure.

SPECIFICATIONS:

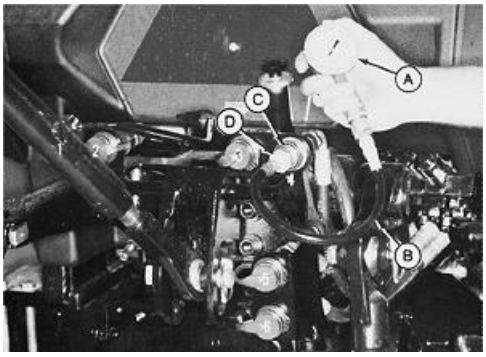
- 43.2 L/min (11.4 gpm) min.

RESULTS:

If flow is below minimum:

- Hydraulic oil filter may be restricted.
- Suction line may be restricted or leaking air.
- Relief valve may be leaking.
- Control lever not allowing full valve opening.
- Coupler damaged. Try other outlets.
- SCV valve spool scored or leaking.
- Pump may be worn or damaged requiring repair or replacement.

SCV Relief Valve Test



SCV Relief Valve Test

REASON:

To determine if factor setting of relief valve maintains correct pressure.

CONNECTIONS:

1. Assemble JT05473 gauge (A), JT03364 hose (B) and AR94522 adapter (C) and JT05494 (D).
2. Connect test equipment into any rear outlet.

PROCEDURE:

1. Run engine at fast idle.
2. Move SCV lever to pressurize test outlet. Hold until you hear system go into relief.
3. Check pressure reading on gauge.

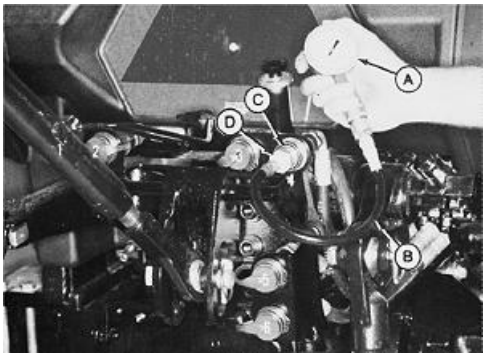
SPECIFICATIONS:

18000 to 18500 kPa (180 to 185 bar; 2610 to 2680 psi)

RESULTS:

Pressure high or low, adjust relief valve (see Group 25 in this Section).

SCV Leakage Test



SCV Leakage Test

REASON:

To determine if excessive leakage exists past spool valves.

CONNECTIONS:

1. Assemble JT05473 gauge (A), JT03364 hose (B) and AR94522 adapter (C) and JT05494 (D).
2. Connect test equipment into any rear outlet.

PROCEDURE:

1. Run engine at fast idle.
2. Move SCV control lever to pressurize test outlet. Hold until system goes into relief.
3. Release control lever and note the time it takes for pressure to drop below 3450 kPa (34.5 bar; 500 psi).

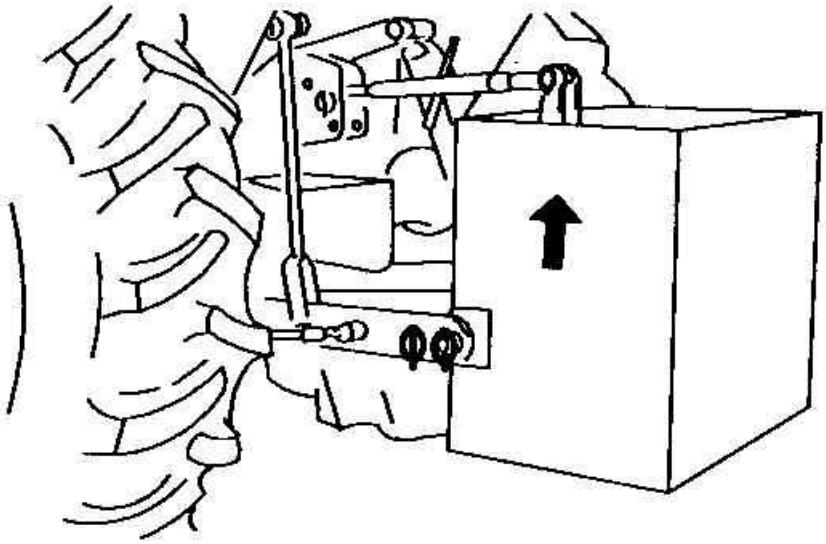
SPECIFICATIONS:

Pressure should stay above 3450 kPa (34.5 bar; 500 psi) for at least 5 seconds.

RESULTS:

- Excessive drop of pressure.
- Service spool concerned.

Rockshaft Lift Cycle Test



Rockshaft Lift Cycle Test

REASON:

To determine if hydraulic flow can provide enough force to lift the 3-point hitch arms as designed.

PROCEDURE:

→NOTE:

Make sure all SCV spool valves are neutralized.

1. Attach approximately 227 kg (500 lb) rear weight or implement.
2. Open rate-of-drop valve completely.
3. Lower 3-point hitch completely.
4. Run engine at fast idle.
5. Observe the time it takes to completely raise the 3-point hitch arms after you pull the position lever all the way back.

SPECIFICATIONS:

Full lower to full raise in 2.5 to 3 seconds.

RESULTS:

If the raise time is excessive, leakage exists.

Perform the rockshaft leakage test, pump flow test and main relief valve test.

If tractor passes these tests, the problem is the rockshaft valve or a leaking seal or O-ring.

Group 25 - Adjustments

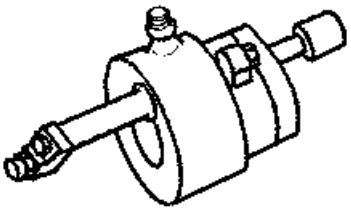
Special or Essential Tools

→NOTE:

Order tools according to information given in the U.S. SERVICEGARD ™ Catalog or in the European Microfiche Tool Catalog (MTC).

Adjusting tool (with M14 x 1.5 fitting for hand pump connection)

FKM10475

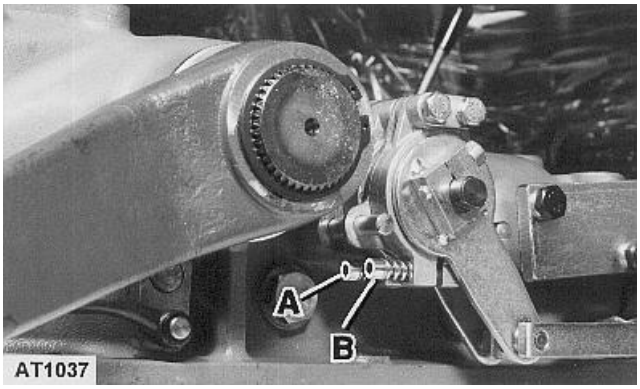


FKM10475

FKM10475

Rockshaft safety and relief valve adjustment

Rockshaft Control Lever Friction Adjustment



Adjusting Screws

REASON:

To keep the rockshaft position and draft control levers in their set positions.

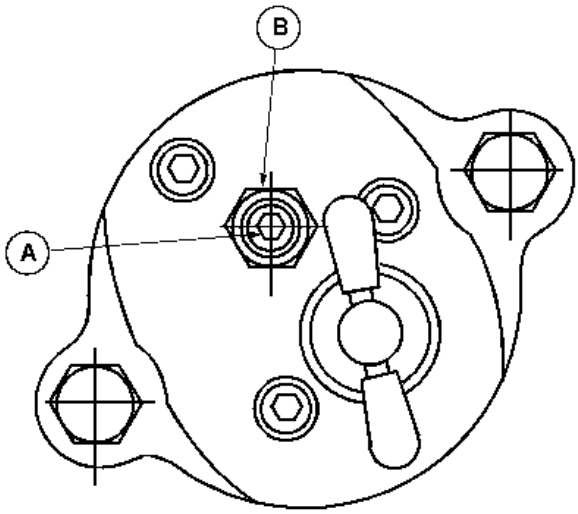
PROCEDURE:

Turn adjusting screws (A) and (B) clockwise to increase friction, counterclockwise to decrease friction.

Rockshaft Sensitivity Adjustment

LEGEND:

A	Sensitivity Adjuster
B	Lock Nut



AT2229

Rockshaft Sensitivity Adjustment

REASON:

To ensure rockshaft a proper amount of implement control.

PROCEDURE:

[1] - Attach a suitable weight to the lift arms equivalent to the weight of an implement.

[2] - Using position control lever raise the lift arms to the middle of the travel.

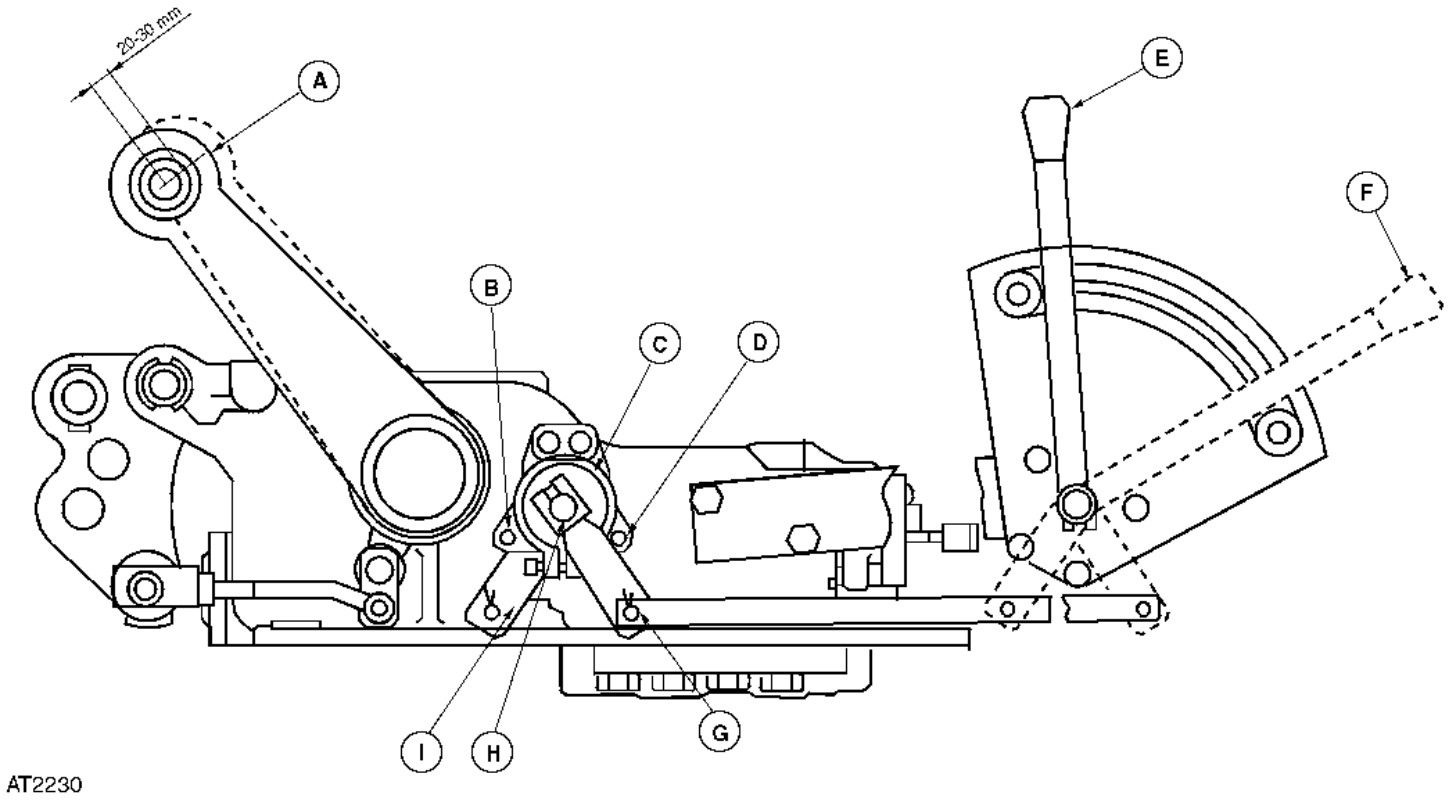
[3] - Loosen lock nut (B).

[4] - Turn sensitivity adjuster (A) counterclockwise until lift arms begin to vibrate.

[5] - At the point where the lift arms begin to vibrate, slowly turn sensitivity adjuster (A) clockwise until the movement stops and then a further 1/4 turn.

[6] - Tighten lock nut (B).

Rockshaft Position Control Adjustment



Position Control Adjustment

REASON:

To ensure rockshaft position control system allows proper amount of implement control.

PROCEDURE:

[1] - Attach a light weight to the lift arms.

[2] - Loosen the allen screw (C).

[3] - Raise the position control lever (E) until lever (G) touches the stop (D).

[4] - Move down the draft control lever (F) until lever (I) touches the stop (B).

[5] - Start the engine and run at low idle.

[6] - Without moving the two control levers, use a 13 mm open wrench to turn the position control shaft (H) slowly counterclockwise. Do this until lift arms (A) raise to the end of their travel.

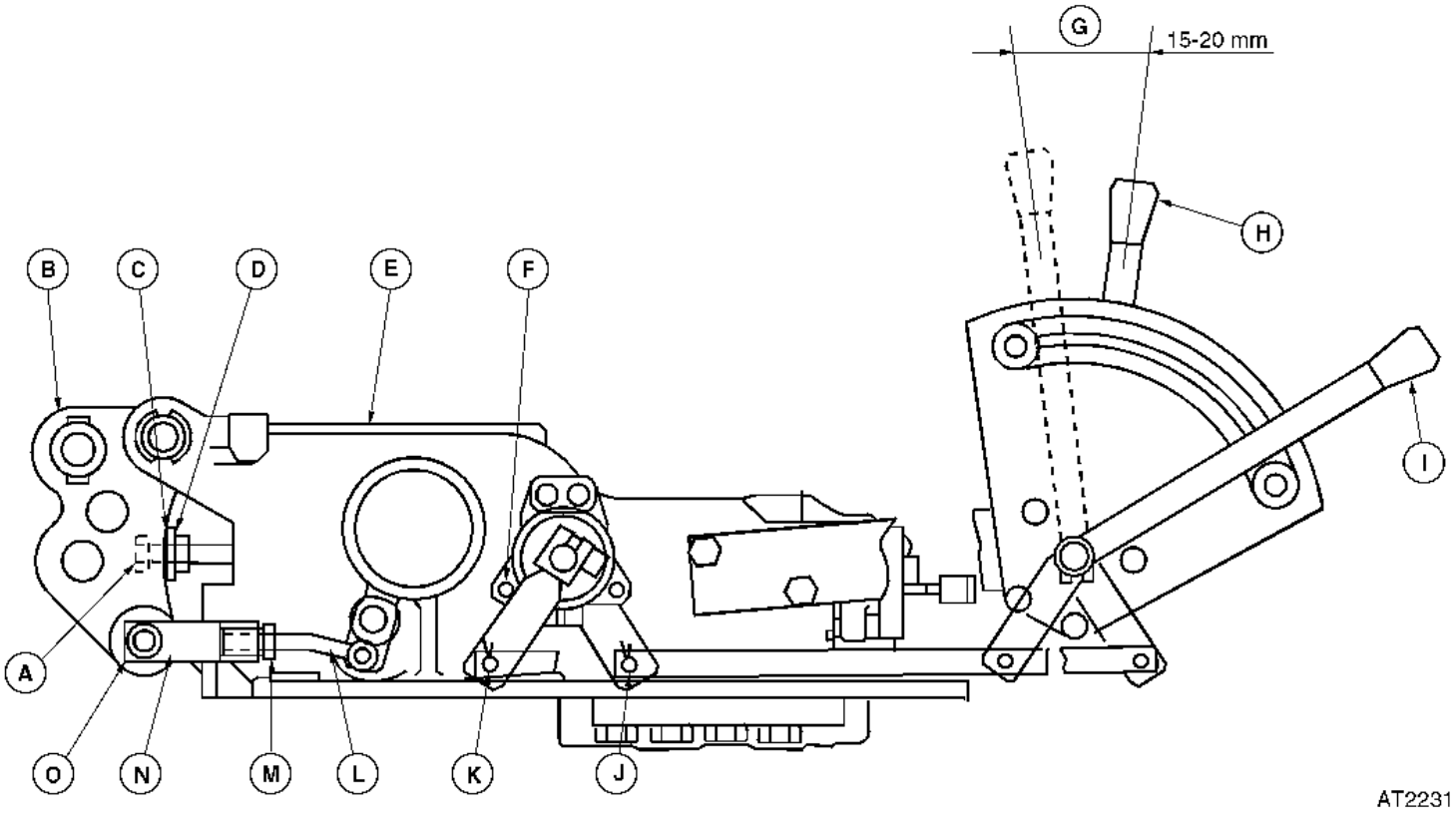
[7] - Turn the position control shaft (H) clockwise until lift arms (A) lower by 20 to 30 mm (0.8 to 1.2 in) at the ball ends.

[8] - Check that lever (G) is touching the stop (D) then tighten allen screw (C).

[9] - With position control lever (E) raise and lower lift arms (A) several time.

[10] - Check that the free play at the top of the travel of the lift arms (A) is still 20 to 30 mm (0.8 to 1.2 in), adjust again if necessary.

Rockshaft Draft Control Adjustment



Draft Control Adjustment

REASON:

To ensure rockshaft draft control system allows proper amount of implement control.

PROCEDURE:

[1] - To make a negative draft force, install a bolt (A), plate (C) and nut (D) between the hydraulic housing (E) and the center link mounting bracket (B) (see “Dealer Fabricated Tools” in Section 299).

[2] - With engine stopped move draft control lever (H) and position control lever (I) downward against the lower stop. Check that the levers (J) and (K) are touching the stop (F).

[3] - Turn the bolt (A) and nut (D) to move mounting bracket (B) away from hydraulic housing (E) until the internal linkage is against the negative limit stop.

[4] - Start and run the engine at low idle speed. Slowly move the draft control lever (H) upward until the lift arms start to raise. At this point, the distance (G) between the draft control lever an the upper stop must be 15 to 20 mm (0.6 to 0.8 in).

[5] - If the distance (G) at the draft control lever is not correct the lenght of the tension rod (L) must be changed.

[6] -

IMPORTANT:

For safety reasons, this adjustment must only be made when the engine is stopped.

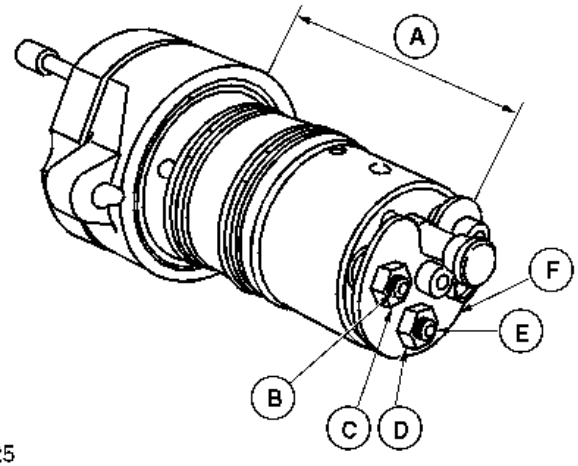
Loosen the lock nut (M) then remove the holt (O). Turn the adjusting block (N) to shorten or lengthen the tension rod (L) using the following procedure:

a. Shorten the tension rod (L) if the arms raise when the distance (G) is more than 20 mm (0.8 in).
b. Lenghten the tension rod (L) if the lift arms do not raise before the distance (G) is less than 15 mm (0.6 in).

[7] - After adjustment, tighten the lock nut (M). Raise and lower the lift arms to check the distance (G).

[8] - When the adjustment is correct, stop the engine and then remove the bolt (A), plate (C) and the nut (D).

Rockshaft Safety and Relief Valves Adjustment

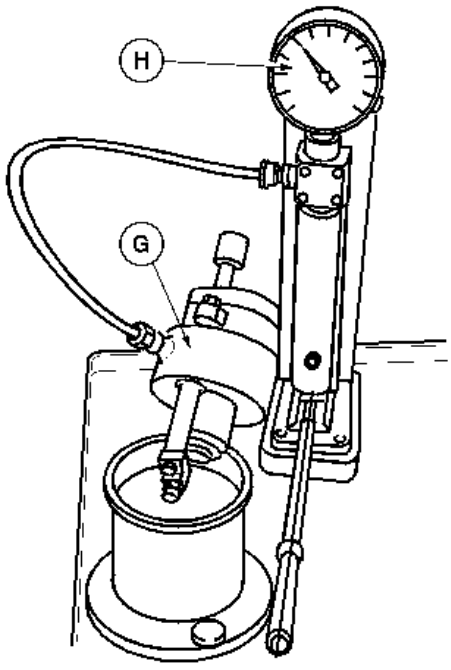


AT2225

LEGEND:

A	104 mm (4.16 in)
B	Adjuster
C	Lock Nut
D	Lock Nut
E	Adjuster
F	Cover
G	FKM10475 Adjusting Tool
H	Hand Pump

104 mm (4.16 in)



AT2226

Use Hand Pump

REASON:

Safety and relief pressure high or low.

PROCEDURE:

[1] - Install rockshaft control valves to special tool (G).

[2] - Adjust special tool (G) to obtain dimension (A) of 104 mm (4.16 in).

[3] -

→NOTE:

Fill hand pump with transmission/hydraulic oil.

Connect special tool (G) to hand pump (H).

[4] - Remove lock nuts (C) and (D).

[5] - Screw in adjuster (E) flush with cover (F).

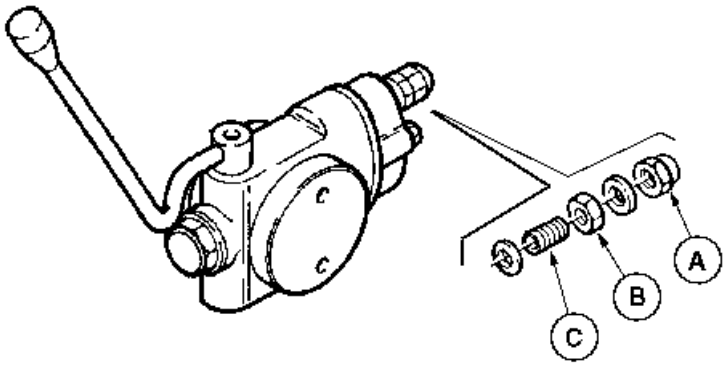
[6] - Operate with hand pump (H) and adjust safety valve to 20000 to 20500 kPa (200 to 205 bar; 2900 to 2970 psi) by turning adjuster (B).

[7] - Install and tighten lock nut (C).

[8] - Operate with hand pump (H) and adjust relief valve to 18000 to 18500 kPa (180 to 185 bar; 2610 to 2680 psi) by turning adjuster (E).

[9] - Install and tighten lock nut (D).

SCV Relief Valve Adjustment



AT2310

SCV Relief Valve Adjustment

REASON:

Relief pressure high or low.

PROCEDURE:

[1] - Remove cap nut (A).

[2] - Loosen lock nut (B) and turn adjustment screw (C) clockwise to increase pressure, counterclockwise to decrease pressure.

[3] - Tighten lock nut.

[4] - Install cap nut.

RESULTS:

SCV relief pressure should change. If not inspect the valve for a damaged spring or leakage past the valve seat.

Group 30 - Hydraulic System Schematics

Hydraulic Symbols

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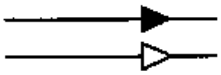
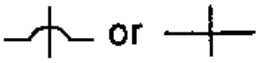
4	
5	
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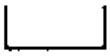
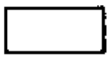
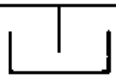
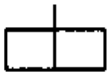
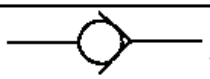
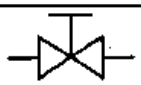
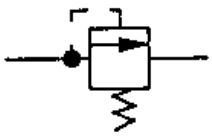
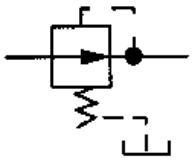
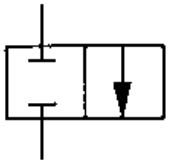
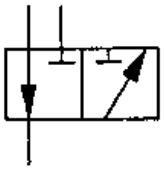
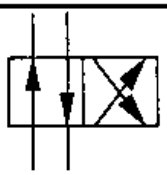
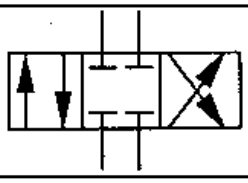
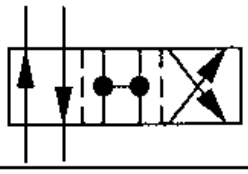
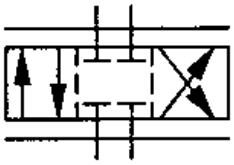
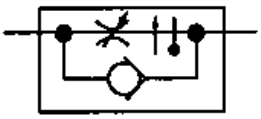
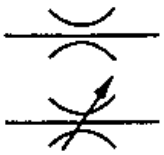
12	
13	
14	
15	
16	
17	
18	
19	
20	

21	
22	
23	
24	
25	
26	
27	
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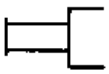
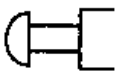
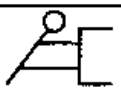
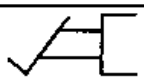
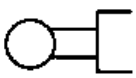
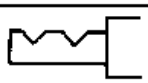
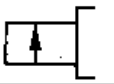
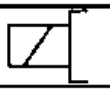
29	
30	
31	
32	
33	
34	
35	
36	

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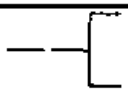
38	
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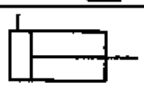
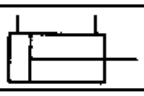
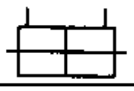
40	
41	
42	
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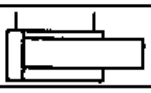
44	
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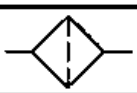
46	
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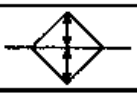
48	
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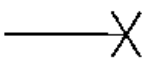
54	
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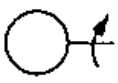
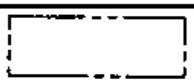
58	
59	

AT1193

Hydraulic Symbols

Hydraulic lines

- 1 - Working (main) line
- 2 - Pilot (control) line
- 3 - Drain line
- 4 - Flow direction
  - hydraulic
  - pneumatic
- 5 - Crossing lines
- 6 - Joining lines
- 7 - Flexible line

Hydraulic pumps

- 8 - Fixed displacement
- 9 - Variable displacement

Hydraulic motors

- 10 - Fixed displacement
- 11 - Variable displacement

Reservoirs

- 12 - Vented
- 13 - Pressurized
- 14 - Return above fluid level
- 15 - Return below fluid level

Valves

- 16 - Check valve
- 17 - Manual on/off valve
- 18 - Pressure relief valve
- 19 - Pressure reduction valve
- 20 - Two position, two connection valve
- 21 - Two position, three connection valve
- 22 - Two position, four connection valve
- 23 - Three position, four connection valve
- 24 - Two position, four connection valve (with transmission)
- 25 - Three position, four connection valve (with infinitive positioning)
- 26 - Adjustable flow control valve (temperature and pressure compensated)
- 27 - Orifices,
  - fixed
  - variable

Valve operation

- 28 - Spring
- 29 - Manual
- 30 - Push button
- 31 - Lever
- 32 - Pedal
- 33 - Mechanical
- 34 - Detent
- 35 - Pressure compensated
- 36 - Solenoid (single winding)
- 37 - Reversing motor
- 38 - Pilot pressure (remote supply)
- 39 - Pilot pressure (internal supply)

Hydraulic cylinders

- 40 - Single acting
- 41 - Double acting (single rod)
- 42 - Double acting (double rod)
- 43 - Double acting (adj. cushion, extend only)
- 44 - Double acting (differential piston)

Miscellaneous

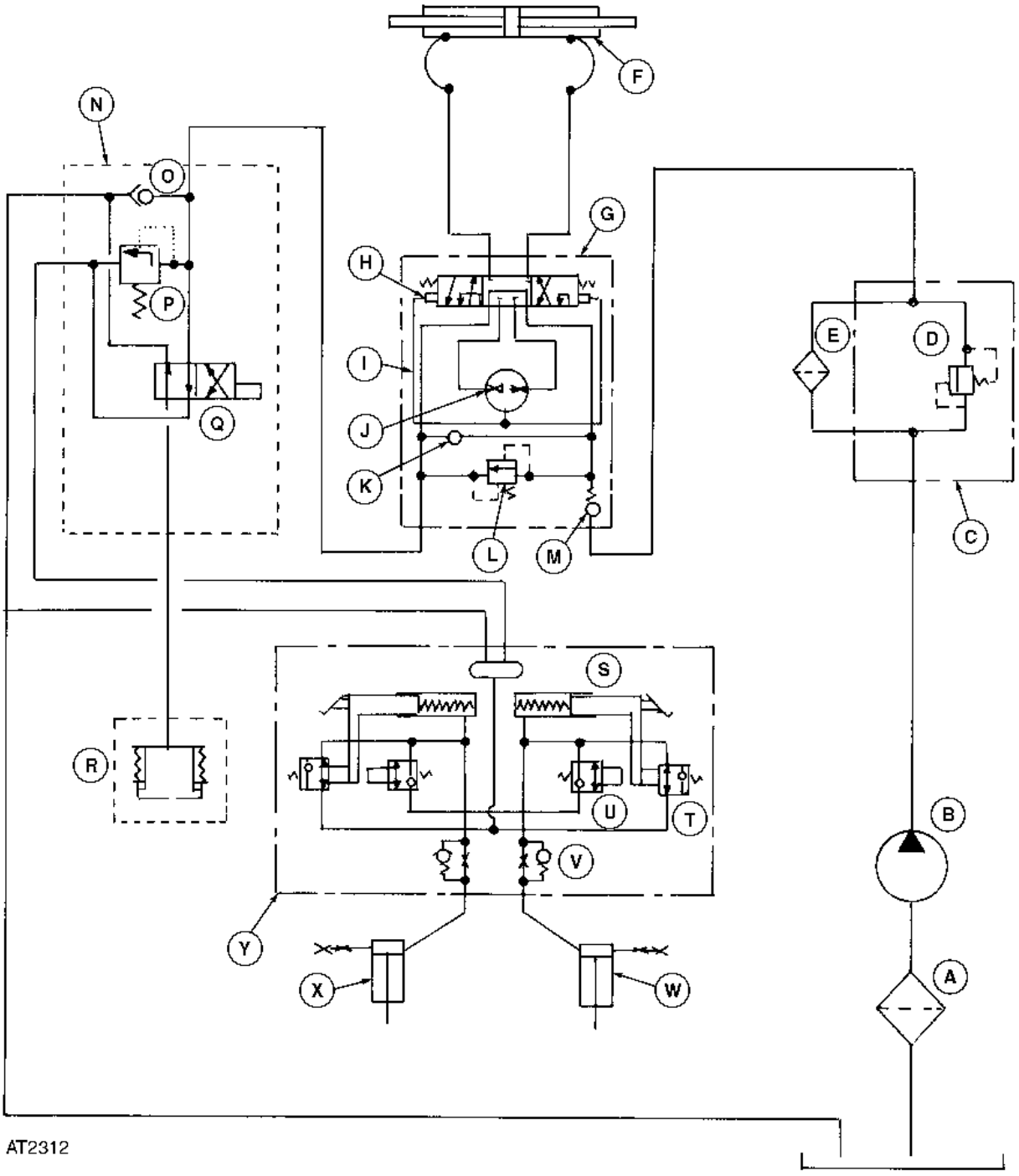
- 45 - Cooler
- 46 - Filter, Strainer
- 47 - Heater
- 48 - Temperature controller
- 49 - Pressure switch
- 50 - Pressure indicator
- 51 - Temperature indicator
- 52 - Pressure compensated
- 53 - Variable component
- 54 - Test port
- 55 - Gas-charged accumulator
- 56 - Spring-loaded accumulator
- 57 - Electric motor
- 58 - Shaft rotation
- 59 - Component outline

Legend for Hydraulic System Schematic-Steering, MFWD and Brake

DEFINITIONS:

A	Hydraulic Oil Filter
B	Steering Pump
C	Steering Valve Filter Housing
D	Bypass Valve
E	Filter Element
F	Steering Cylinder
G	Steering Valve
H	Control Valve
I	Mechanical Link
J	Metering Pump
K	Manual Steering Check Valve
L	Steering Check Valve
M	MFWD Solenoid Valve Housing (24/24 Speed Transmission only)
N	Check Valve
O	MFWD Load Check Valve
P	MFWD Relief Valve
Q	MFWD Solenoid Valve
R	MFWD Hydraulic Clutch
S	Brake Piston
T	Inlet Check Valve
U	Equalizing Valve
V	Outlet Check Valve
W	Right Brake Actuator
X	Left Brake Actuator
Y	Brake Valve Housing

Hydraulic System Schematic-Steering, MFWD and Brake



Steering, MFWD and Brake

Legend for Hydraulic System Schematic-SCV and Rockshaft

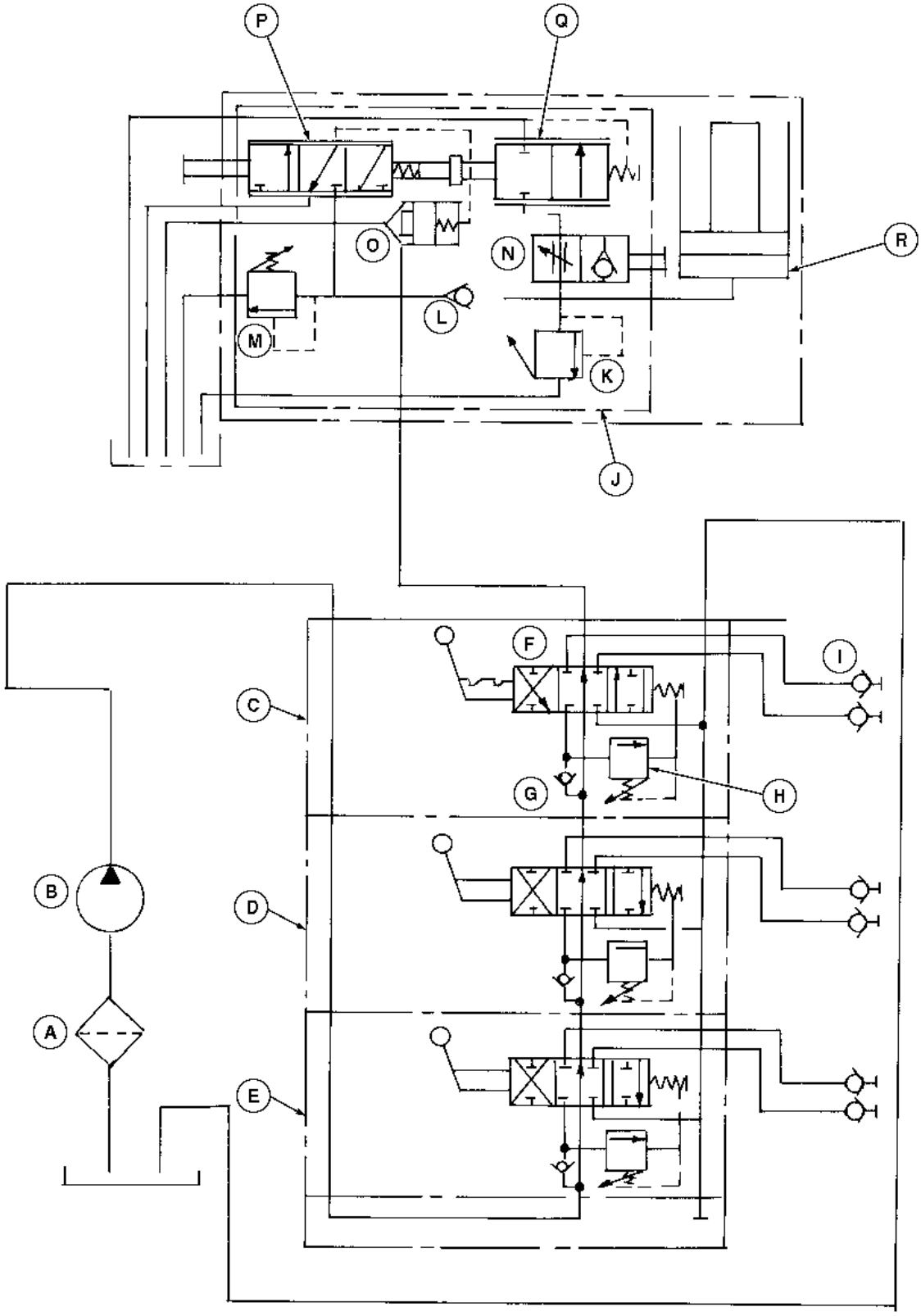
DEFINITIONS:

A	Hydraulic Oil Filter
B	Hydraulic Pump
C	1st SCV Housing

DEFINITIONS:

D	2nd SCV Housing
E	3rd SCV Housing
F	Control Spool
G	Load Check Valve
H	SCV Relief Valve
I	Rear Outlet Couplers
J	Rockshaft Valve Housing
K	Safety Valve
L	Check Valve
M	Relief Valve
N	Rate-of-Drop Valve
O	Differential Valve
P	Control Spool
Q	Discharge Valve
R	Rockshaft Cylinder

Hydraulic System Schematic-SCV and Rockshaft



AT 2313

SCV and Rockshaft

Section 290 - AIR CONDITIONING SYSTEM- OPERATION AND TESTS

Table of contents

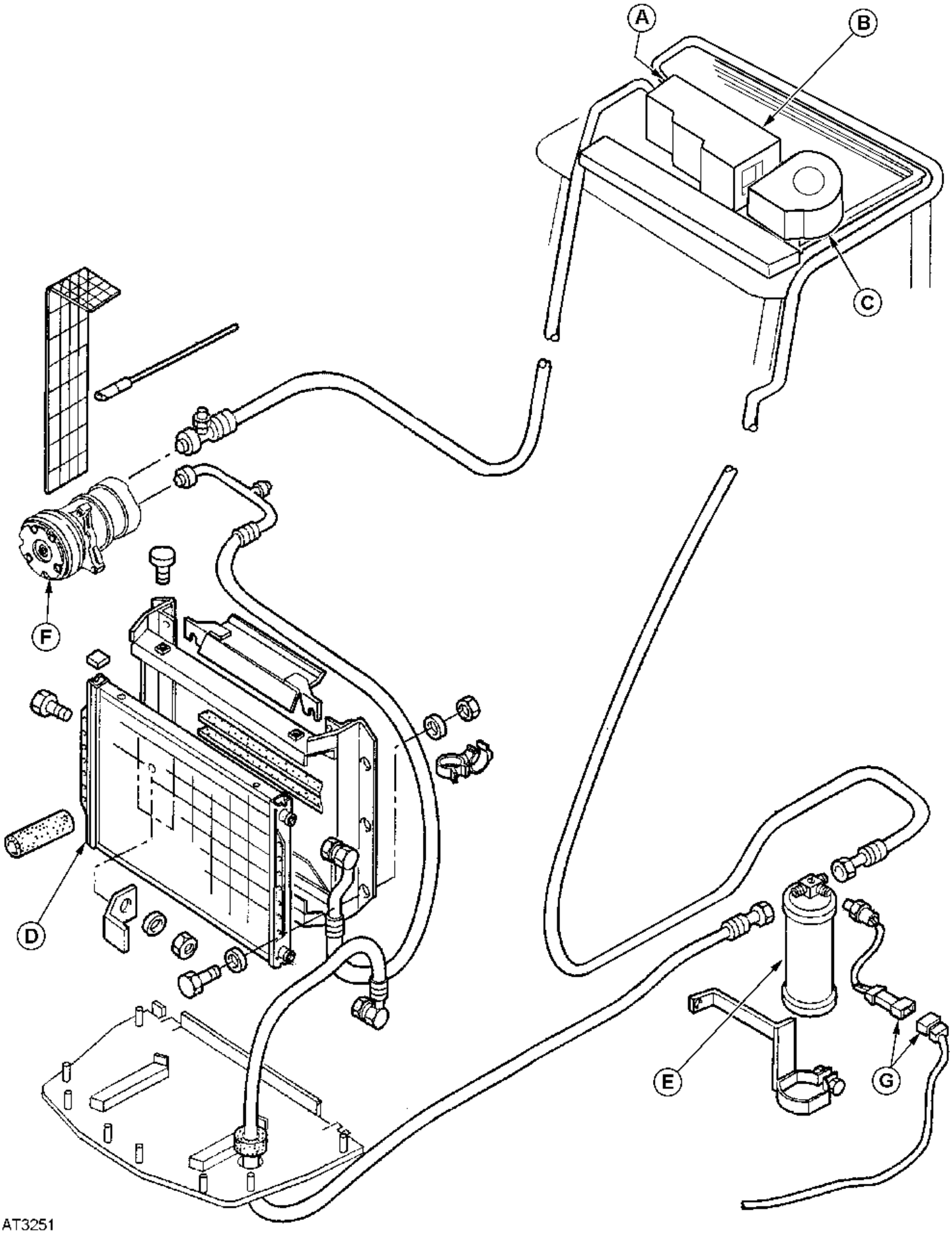
Group 05 - Component Location

General Information

This group contains component location drawings for the air conditioning system components.

Use the drawings when troubleshooting air conditioning system problems to help locate the components to be tested.

Air Conditioning System Components



A/C system components

LEGEND:

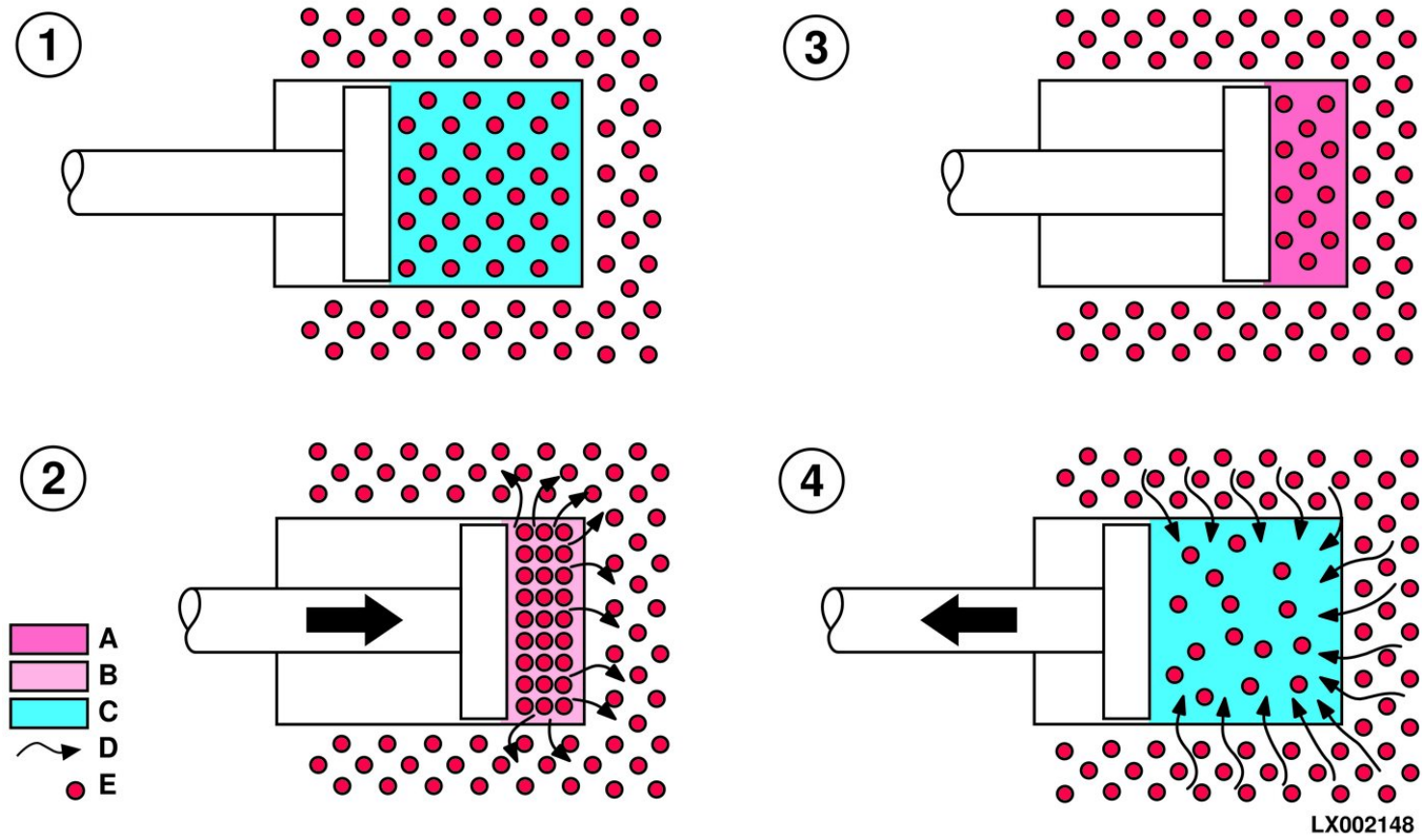
A	Expansion Valve
B	Evaporator/Heater Core
C	Blower Motors
D	Receiver-Dryer
E	Compressor
F	Connectors

Group 10 - Theory of Operation

Theory of Operation Information

The theory of operation story explains: Function of the component, operating conditions, components used, and system operation.

Principle of Heat Exchange



Principle of heat exchange

LEGEND:

A	Liquid refrigerant under high pressure
B	Gaseous refrigerant under high pressure
C	Gaseous refrigerant under low pressure
D	Exchange of heat
E	Energy in the form of heat

The simplified example set out below is intended to show how heat is exchanged in an air conditioning system. Each explanation concludes with the part of the air conditioning system that corresponds to the principle involved.

Fig. 1: Gaseous refrigerant is contained in a cylinder which has a certain reserve of energy (E) in the form of heat. (intake line of compressor).

Fig. 2: A piston reduces the space in which the gaseous refrigerant is trapped. This concentrates the heat (E) in a smaller space. This means that the temperature inside the cylinder is now higher than it was before. Heat is now exchanged, with the surrounding area absorbing the heat of the gas. Heat always moves from a hotter substance to a colder one. (compressor to condenser)

Fig. 3: The pressurized refrigerant condenses on the cylinder wall and becomes a liquid. The gas has transferred its heat through the cylinder wall to the surrounding area. (condenser)

Fig. 4: The space inside the cylinder is increased. This means that the pressure drops rapidly and the liquid refrigerant is free to expand. The refrigerant evaporates and returns to its gaseous state. In consequence, the heat remaining in the gas is free to spread through a larger area. The temperature inside the cylinder drops and heat is exchanged once again. This time the heat is absorbed from the surrounding area by the cold cylinder. (expansion valve and evaporator)

R134A Refrigerant

IMPORTANT:

The air conditioning system operates using R134a refrigerant (tetra- fluorethane). This substance does not contain any chlorine atoms, so it does not have a detrimental effect on the ozone in the Earth´s atmosphere.

Nevertheless, refrigerant should not simply be discharged. It should be captured by a recycling unit. Refrigerant stored in a recycling unit may be re-used at any time.

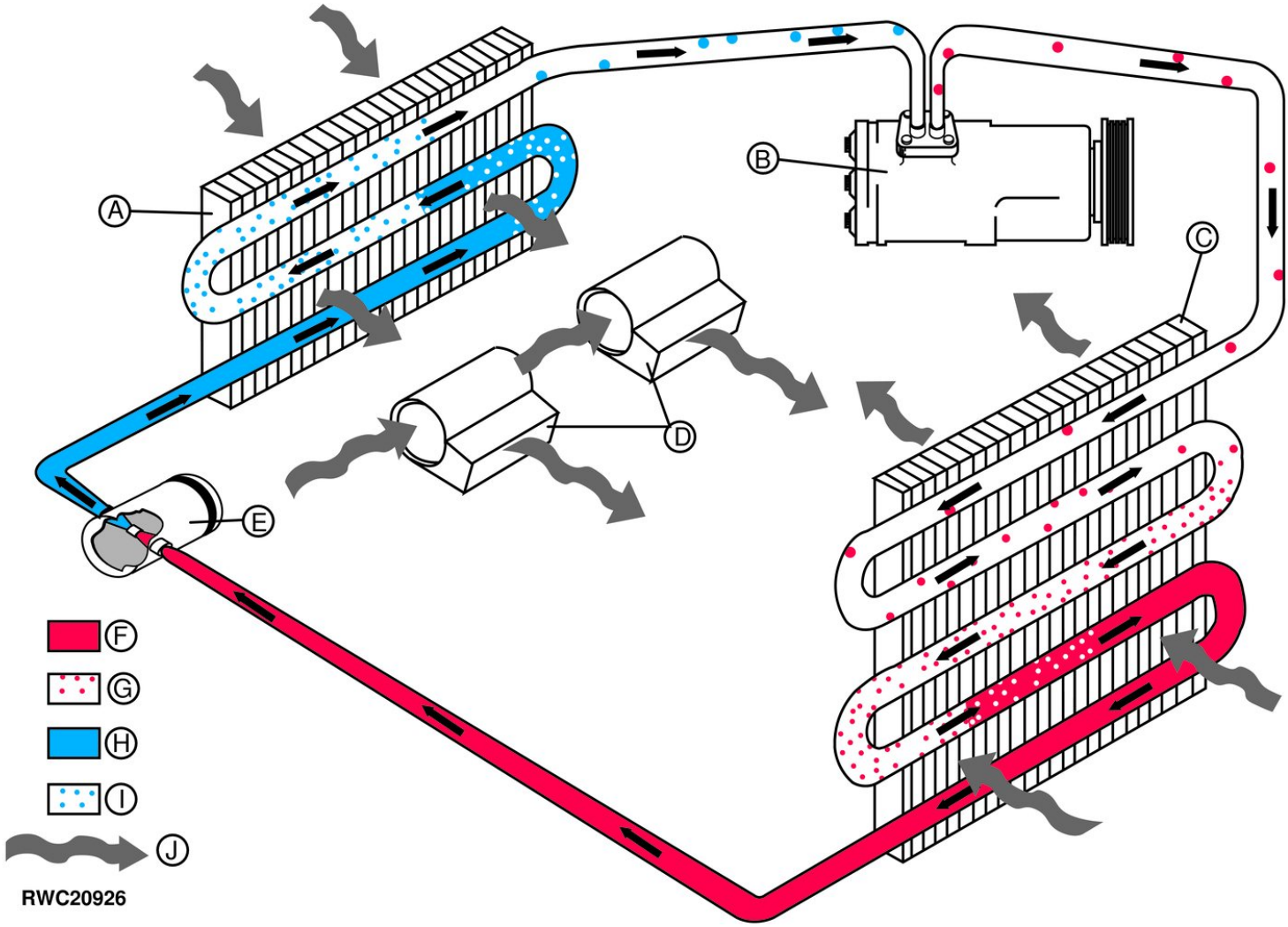
The recycling unit used to do this must be of a type suitable for handling R134a refrigerant.

The boiling point of R134a is minus 26.5°C (minus 15.7°F) and its freezing point is minus 101°C (minus 149.8°F).

Before replacing any component make sure it is compatible with the refrigerant being used.

Additionally, make sure the proper refrigerant oil is being used. R12 systems are lubricated with petroleum oil which should never be used for R134a systems. PAG oil should be used for this purpose as it preferentially binds to the refrigerant and thus assures adequate lubrication of the entire system.

Air Conditioning System Operation



A/C system operation

LEGEND:

A	Evaporator Core
B	Compressor
C	Condenser
D	Circulation Blower Motors
E	Expansion Valve
F	High Pressure Liquid
G	High Pressure Gas
H	Low Pressure Liquid
I	Low Pressure Gas
J	Air Flow

The compressor (B) draws low pressure refrigerant gas (I) from the evaporator (A) and compresses it into a high pressure gas (G). This causes the temperature of the refrigerant to rise higher than that of the outside air. It goes to the condenser (C) as a high pressure gas.

As the high pressure liquid than passes through the condenser, heat is removed and transferred to the outside air being drawn through the condenser core by the engine fan. This cools the gas and condenses it into a liquid, still under high pressure. It goes to the receiver-dryer as a high pressure liquid (F).

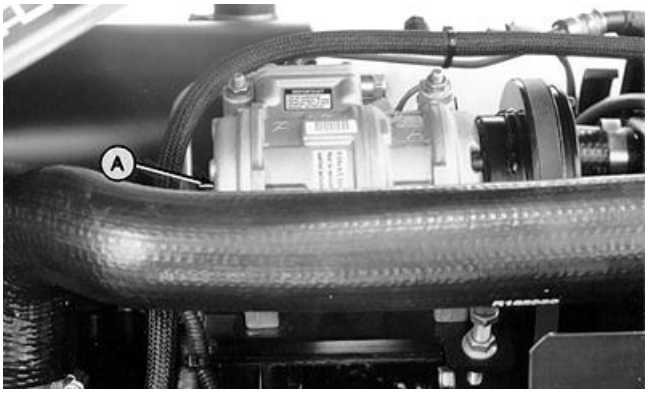
The high pressure liquid then passes through the receiver-dryer where a special filter removes contaminants (moisture, acids, solids, etc.). The receiver-dryer also acts as a reservoir for refrigerant.

The actual cooling and drying of cab air takes place at the evaporator (A). Flow of the high pressure liquid refrigerant through the evaporator is controlled by the expansion valve (E). The expansion valve causes the temperature and pressure of the refrigerant flowing into the evaporator to drop. The expansion valve is a diaphragm-type valve that uses a variable orifice to control the flow of high pressure liquid refrigerant into the evaporator to maintain a constant pressure and temperature.

The circulation blower motors (D) pull a mixture of warm cab and outside air through the evaporator where it is cooled by the refrigerant. The heat absorbed by the evaporator causes the refrigerant to boil and vaporize.

Moisture, from the warm air, is condensed as it contacts the cool evaporator core during the cooling process and is drained away through tubes connected to a drip pan under the evaporator. With the cab air cooled and dehumidified the air conditioning cycle is complete.

Compressor



A/C compressor

The compressor (A) is mounted on the engine and driven by a multiple groove drive belt.

The compressor consists of axial pistons driven by a swashplate.

It draws gaseous refrigerant from the low pressure side, compresses it and sends it to the condenser.

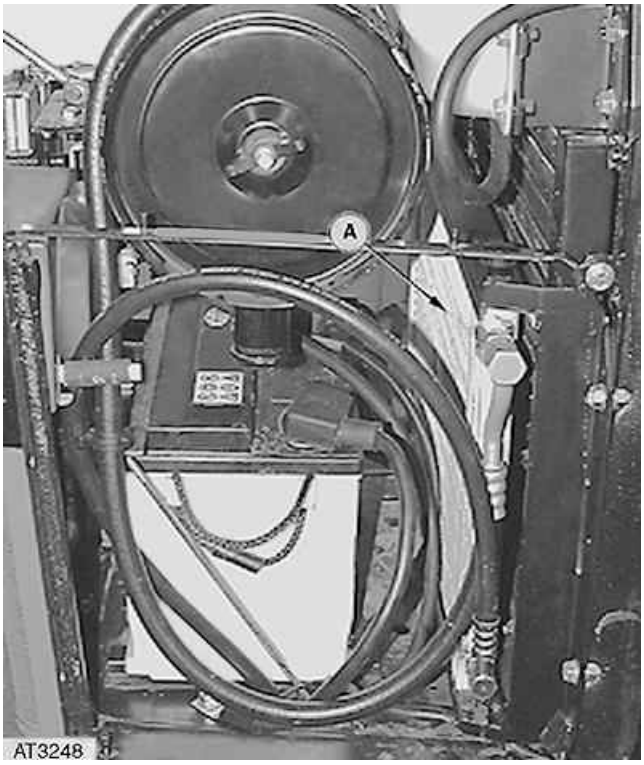
As the low pressure gas volume is decreased the temperature of the refrigerant rises.

The compressor is driven via a magnetic clutch that permits on/off cycling during operation. This is needed in order to maintain a consistent level of cooling performance in the cab.

The compressor housing also acts as a reservoir for refrigerant oil. Compressor cycling is generally controlled by a thermostat switch. The compressor is switched off by the high/low pressure switches if refrigerant pressure is too high or low.

The compressor can also be controlled manually using the compressor switch.

Condenser

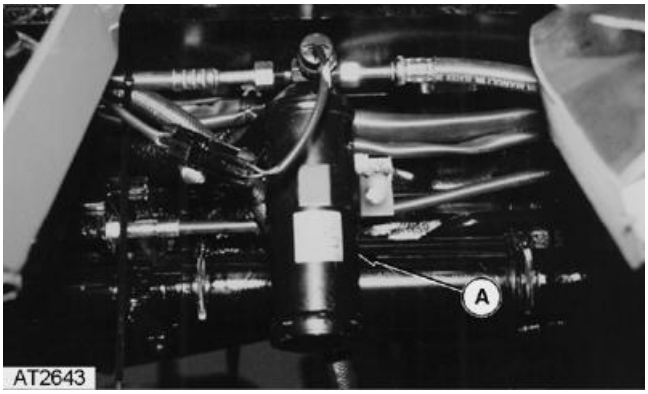


A/C system, condenser

The condenser (A) is located in front of the tractor′s radiator, looking in the direction of travel. The purpose of the condenser is to cool down the pressurized refrigerant gas so that it condenses and leaves the condenser as a liquid. The same component also houses the hydraulic and transmission oil cooler.

The cooling effect is produced by the airflow created by the fan blades. The condenser′s inlet is connected to the compressor′s pressure connection, its return line to the receiver-drier inlet.

Receiver-Dryer



Receiver-Dryer

The receiver-drier (A) performs two functions. Firstly, it receives high pressure refrigerant from the condenser and stores it until it is required by the evaporator. Secondly, it absorbs moisture and acid that would have a detrimental effect on the system′s ability to operate.

Solid foreign bodies are separated out by a special filter element, whereas a desiccant, which fills the space between the filters, absorbs moisture and acid.

The sight glass on the receiver-drier enables the refrigerant to be observed when tests or service work are being performed. The receiver-drier′s inlet is connected to the condenser, and its return line to the expansion valve.

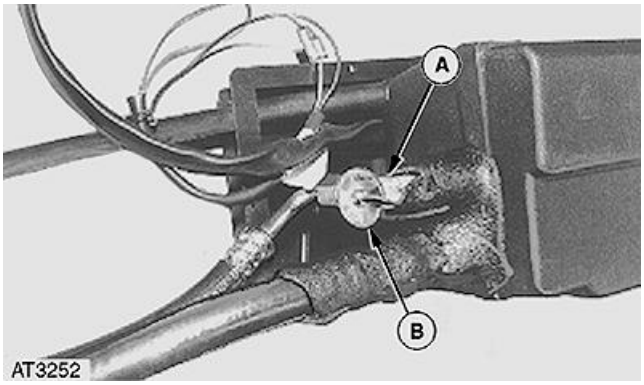
The receiver-drier should be replaced every time the air conditioning system is repaired, as the moisture-absorbing material

becomes less effective as time passes.

IMPORTANT:

If a new receiver-dryer has been stored with unplugged openings, it can no longer be used.

Expansion Valve



Expansion valve

The expansion valve (A) is located in the evaporator/heater core housing in the cab roof. It is connected to the receiver-dryer outlet and to the evaporator inlet. It has two additional connections, one from the evaporator return line and another to the compressor inlet.

The expansion valve is a diaphragm valve with a stainless steel thermal head. Its purpose is to control the throughflow of refrigerant in relation to the return temperature from the evaporator.

If too much refrigerant flows through the evaporator, liquid refrigerant could reach the compressor via the return line, and cause damage to the compressor.

Too much liquid refrigerant is one reason why the system may not be performing well, as the refrigerant does not evaporate completely.

A variable throttle is located in the inlet to the expansion valve. This throttle is formed by valve ball and actuating pin. At this point the pressure of the liquid refrigerant is reduced considerably. This allows the refrigerant to expand and change into its gaseous state in the evaporator, thus bringing down the temperature.

Once the refrigerant has left the evaporator, it has to flow through the expansion valve one again. However, it does not do so through the throttle, but through a passage where the refrigerant temperature can be registered by thermal head.

The thermal head is filled with gas, which expands and contracts as the temperature rises and falls. This process is employed to produce a movement at diaphragm that is passed on to the throttle. This makes it possible to control the throughflow of refrigerant in relation to its temperature.

Group 15 - Diagnosis, Tests and Adjustments

Safety Equipment

LX002150

Safety equipment

This equipment consists of safety glasses, safety gloves and, where appropriate, a breathing mask (if there is the risk of poisonous gases being released).

CAUTION:

A breathing mask provides NO protection against lack of oxygen.

Prepare a 1% boric acid solution for rinsing the eyes and a solution consisting of 1 part essence of vinegar and 5 parts water for washing affected parts of the body. Also provide a first aid kit.

In an Emergency

Rinse eye with cold water; preferably use a 1% boric acid solution.

Wash affected parts of the body with water, or preferably with a solution consisting of one part essence of vinegar and five parts water.

See a doctor as soon as first aid has been administered.

Storage of Refrigerant Containers

CAUTION:

Refrigerant containers are under pressure, and this pressure increases rapidly when the temperature of the container rises. The thin-walled refill containers are particularly at risk in this respect. Refrigerant containers must never be exposed to temperatures over 52°C (120°F).

Never store pressurized containers in the vicinity of heat sources or in places exposed to direct sunlight. Never open pressurized containers by force or damage them in any way.

R134A Refrigerant

IMPORTANT:

The air conditioning system operates using R134a refrigerant (tetra- fluorethane). This substance does not contain any chlorine atoms, so it does not have a detrimental effect on the ozone in the Earth´s atmosphere.

Nevertheless, refrigerant should not simply be discharged. It should be captured by a recycling unit. Refrigerant stored in a recycling unit may be re-used at any time.

The recycling unit used to do this must be of a type suitable for handling R134a refrigerant.

The boiling point of R134a is minus 26.5°C (minus 15.7°F) and its freezing point is minus 101°C (minus 149.8°F).

Before replacing any component make sure it is compatible with the refrigerant being used.

Additionally, make sure the proper refrigerant oil is being used. R12 systems are lubricated with petroleum oil which should never be used for R134a systems. PAG oil should be used for this purpose as it preferentially binds to the refrigerant and thus assures adequate lubrication of the entire system.

Important Note

Refrigerant

Use R134a refrigerant only. Any other refrigerant will impair the function of the air-conditioning system and render all claims for damages made against the manufacturer null and void.

PAG Refrigerant Oil

Use prescribed refrigerant oil only. Failure to do so will result in damage to the compressor.

Special or Essential Tools

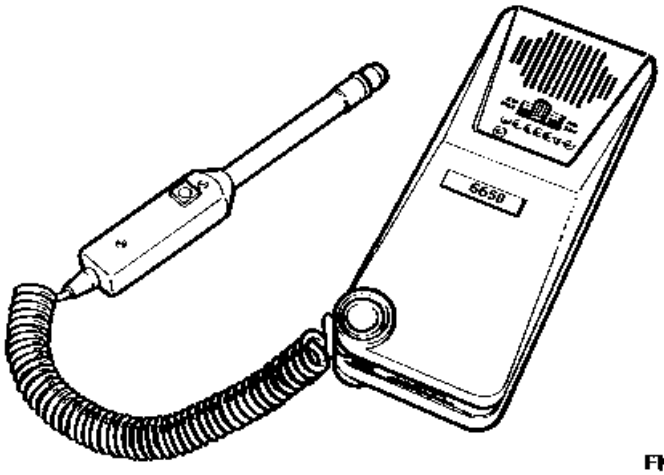
→NOTE:

Order tools according to information given in the U.S. SERVICEGARD ™ Catalog or European Microfiche Tool Catalog (MTC).

Special Tools

Leak detector

FKM10444



FKM10444

FKM10444

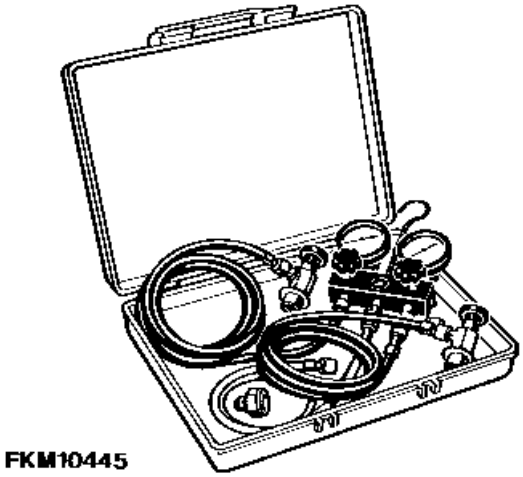
Pinpointing a refrigerant leak.

→NOTE:

Leak detector can be used with R12 as well as with R134a refrigerant.

Dual gauge set

FKM10445



FKM10445

FKM10445

Evacuating, filling and checking the air conditioning system.

IMPORTANT:

Use only service units suitable for handling R134a refrigerant.

Refrigerant can (R134a; 920g; 750 ml)

FKM10447

FKM10447

FKM10447

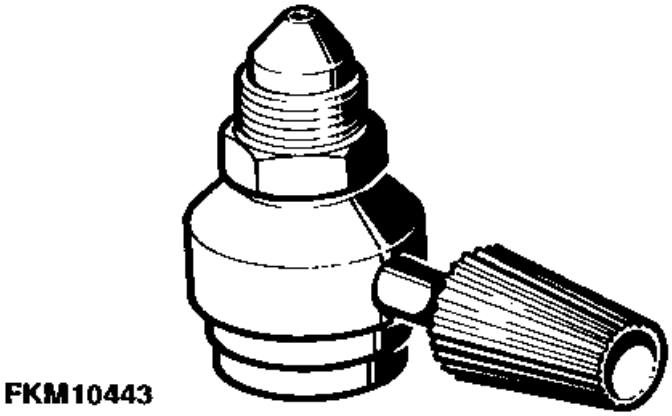
Filling the system.

IMPORTANT:

Use only service units suitable for handling R134a refrigerant.

Charging valve

FKM10443



FKM10443

FKM10443

Filling the system.

IMPORTANT:

Use only service units suitable for handling R134a refrigerant.

Diagnostic Information

The checks on the following pages show how to find an existing fault and then rectify it.

Visual checks are performed first, as this is the simplest way to eliminate possible causes of the fault.

The preliminary checks reveal whether individual components of the air conditioning system are functioning correctly.

Next, the leak tester is used to check if there is a leak at any point in the air conditioning circuit.

Up to this stage, the checks are relatively straightforward and do not involve lots of tools. The subsequent tests, however, may involve repair work or the replacement of major components, depending on the results of the test.

The “Trouble-Shooting” list gives the possebility to test components related to a specific symptom.

If the checks do not produce a clear result, observe the note below.

→NOTE:

A frequent cause of faults in air conditioning systems is too much moisture in the refrigerant circuit. Moisture results in air conditioning components icing up from the inside and functioning incorrectly. Too much moisture can also produce acid, which destroys the air conditioning system from within.

If moisture is suspected, the air conditioning system must be evacuated, cleaned, bled and refilled with new or recycled refrigerant. The refrigerant oil contained in the compressor must be changed.

It is particularly important to replace the receiver-drier, as it gradually loses its ability to absorb moisture. Eventually, it loses this ability altogether.

Air Conditioning System Diagnosis

Air Conditioning System, Checks

(1) Visual Checks

Action:

- Check compressor belt tension.
- Cab filters should be clean.
- Air ducts should be free of obstructions.
- Check lines for damage.
- Hoses should not be kinked or bent.
- Condenser and evaporator should not be dirty.
- All electrical leads should be in good condition.
- Pay attention to unusual noises during operation.
- Check for oil leaks at the condenser, compressor and threaded connections (leak sites).

Result:

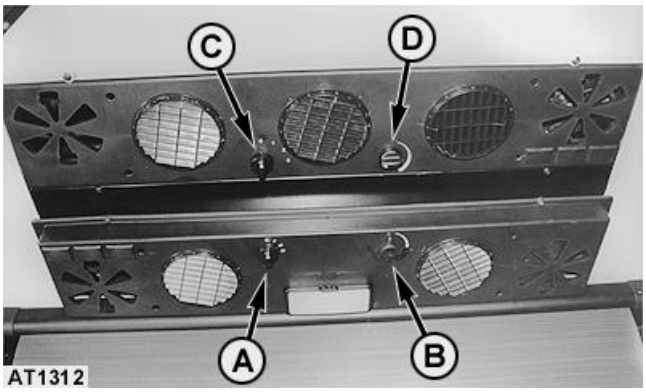
NO: Rectify any faults found.

YES: GO TO 2

(2) Preliminary Checks

Action:

A-Check fan motor



LEGEND:
A 3-Speed Fan Switch
B Heater Control Knob
C 3-Speed Fan Switch an Compressor clutch switch
D Thermostat Control Knob

switches

Heater control knob (B) in OFF position.

Turn on ignition and run the fan with the fan switch (B) in each speed position. Check for uniform air flow at all ducts to make sure motor is operating.

Result:

NO: See "Blower Circuit Test" in Section 240-15, then GO TO step 2B.

YES: GO TO 2 B

Action:

B-Check Compressor Magnetic Clutch Electrical Function

Heater control knob (B) in OFF position.

Turn on the ignition and turn the thermostat control knob (D) to maximum cooling. Turn the fan switch alternating to OFF and low speed.

Note if the click of the magnetic clutch on the compressor can be heard (one additional person required to perform this test).

The following requirements must be met:

-Evaporator housing temperature over 3°C (37°F)

-Static refrigerant pressure over 2.4 bar (35 psi; 240 kPa)

Result:

NO: Check electrical circuit of compressor clutch, see "Air Conditioning System Test" in Section 240-15.

YES: GO TO 2 C

Action:

C-Check Compressor Magnetic Clutch Function

Heater control knob in OFF position.

Run the engine at low idle, turn the thermostat control knob to maximum cooling.

Turn the fan switch alternating to OFF and low speed.

When the fan switch is operated the engine sound should change slightly and the compressor drive pulley hub should rotate.

Result:

NO: Check the operation of the pressure switch, or repair the compressor magnetic clutch. See "Air Conditioning System Test" in Section 240-15 or repair the magnetic clutch.

YES: GO TO 3

(3) Visual Check on Receiver-Drier

Action:

Perform check when ambient temperature is over 21°C.

Run engine at 2000 rpm and set air conditioning to full output. Observe refrigerant flowing past the sight glass at receiver-drier.

After some time, the bubbles in the refrigerant should disappear completely.

Result:

NO: GO TO 4

YES: GO TO 5

(4) System Pressure Check (Static)

Action:

Measure the air temperature in the shade.

DO NOT start the tractor for this test.

Connect a pressure gauge kit, e.g. FKM10445 with closed valves to the test ports.

Open the high and low pressure valve and close both valves after the pressure rise ends.

Read the pressure values and compare them with the values in the table.

Temperature and minimum pressure

Temperature		**Min. pressure**		
°F	°C	kPa	bar	psi
60	15	390	3.9	56
65	18	435	4.35	63
70	21	490	4.9	71
75	24	540	5.4	79
80	27	600	6	88
85	29	650	6.5	94
90	32	700	7	103
95	35	800	8	114
100	38	850	8.5	125
105	41	950	9.5	136
110	43	1000	10	144
115	46	1100	11	157

→NOTE:

A static pressure reading 20-30% greater than the values listed in the chart is an indication that the system has been charged with incorrect refrigerant or with a mix of different refrigerants.

In this case, discharge and refill the system. See“Discharging the System” , Section 90, Group 15 and then see “Filling the System” , Section 90, Group 15.

Result:

NO: If there is no possibility that the refrigerant in the system is incorrect or mixed,GO TO 9 . Then GO TO 4 and GO TO 6 .

YES: GO TO 5 .

(5) System Dynamic Pressure Test

Action:

Cab doors and windows must be closed.

With engine at 2000 rpm and air conditioning at maximum output.

→NOTE:

At cool temperatures, the compressor may have to be connected directly to a battery source for this system check. If necessary, disconnect the lead at the compressor and use a jumper wire to connect the clutch coil to terminal 30 on the alternator.

At ambient temperatures below 21°C (70°F), bubbles may appear in the sight-glass.

Check ambient temperature and pressure. Compare temperature and pressure readings with the figures in the chart below.

→NOTE:

The lower figures are valid at approx. 10% humidity, the higher figures at approx. 90% humidity.

System Pressure Chart

System pressure chart (low pressure)

Temperature		Low pressure		
°C	°F	kPa	bar	psi
11-16	51-60	7-40	0.07-0.4	1-6
16-21	61-70	20-70	0.2-0.7	3-10
22-27	71-80	40-100	0.4-1.0	6-14
27-32	81-90	60-120	0.6-1.2	9-18
33-38	91-100	80-150	0.8-1.5	12-22
39-43	101-110	100-180	1.0-1.8	15-26
44-49	111-120	120-200	1.2-2.0	18-30

System pressure chart (high pressure)

Temperature			High pressure		
°C	°F	kPa	kPa	bar	psi
11-16	51-60	7-40	1000-1400	10.0-14.0	145-205
16-21	61-70	20-70	1100-1550	11.0-15.5	160-225
22-27	71-80	40-100	1250-1750	12.5-17.5	180-250
27-32	81-90	60-120	1400-1950	14.0-19.5	205-280
33-38	91-100	80-150	1600-2200	16.0-22.0	235-315
39-43	101-110	100-180	1900-2450	19.0-24.5	275-355
44-49	111-120	120-200	2150-2800	21.5-28.0	310-400

Result:

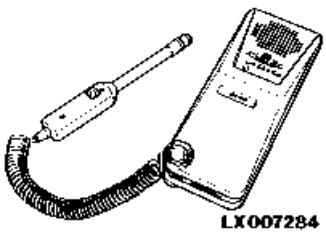
NO: See table of “Pressure Deviations” .

YES: GO TO 6

(6) Leak Test

Action:

A-Leak test



FKM10444 leak detector

Run engine at 1000 rpm and switch on fan and air conditioning system. Using FKM10444 leak detector, check entire refrigerant circuit for leaks. Comply with the manufacturer´s instructions.

CAUTION:

Keep away from moving engine parts at all times. Avoid accidents!

Hold the leak tester at the air vents in the cab to test whether there is a leak in the evaporator housing.

Result:

NO: If a leak is found at part of the system, the leak must be repaired or the leaking component must be replaced.

YES: GO TO 7

(7) Component Checks

Action:

A-Thermostat switch

Open the evaporator housing.

Make sure the thermal sensor is undamaged and installed in the correct position on the evaporator.

Check all thermostat switch electrical contacts.

Result:

NO: Repair as required.

YES: GO TO 8

Action:

B-Evaporator

Remove any dirt and check for signs of damage.

On SE tractors, remove the filter insert.

CAUTION:

Before removing the evaporator, first evacuate the refrigerant from the air conditioning system.

Result:

NO: If the evaporator shows signs of damage, it must be replaced.

YES: GO TO 8

Action:

C-Expansion valve

Make sure the thermal head is not damaged. Check all connections.

Put the gauge set from the service kit close to the cab for easy viewing from inside the cab.

→NOTE:

If the pressure gauge cannot be seen from the cab, two people will be required for this test.

With the engine and compressor running (2000 rpm), activate the heating to heat the evaporator.

Spray the thermal head with refrigerant until the valve closes.

→NOTE:

Any solution that does not contribute to deterioration of the ozone layer and can cool to less than -17°C (1.4°F) is suitable for this test.

Check the pressure gauge for any decrease in pressure.

Pressure should decrease when the thermal head is cold and increase when the head is warm.

→NOTE:

At 24°C (75°F) the suction side normally shows a 10-15 in. Hg vacuum.

Repeat the test 2-3 times to establish the expansion pattern of the thermal head. Replace the valve if the pressure changes very slowly.

CAUTION:

Extract the refrigerant from the air conditioning system before removing the expansion valve.

Result:

NO: Replace the expansion valve.Return to testing.

(8) Replenishing a Partially Empty System or Correcting the Refrigerant Level

Action:

→NOTE:

Refilling the system with small amounts of refrigerant can be necessary to compensate for leaks or losses due to repair work.

→NOTE:

At an ambient temperature under 21°C (70°F) bubbles may be seen in the sight glass even if the system is full. The bubbles dissipate at higher temperatures.

If no bubbles are seen in the sight glass the system could also be overfilled. In this case, refrigerant should be evacuated until bubbles are seen in the sight glass.

Correct the refrigerant level, see “Topping Up a Partly Discharged System” in Section 90, Group 15 .

IMPORTANT:

The container should be held upright when adding refrigerant to the system.

IMPORTANT:

Do not exceed 300 kPa (3 bar; 45 psi) when filling the system.

Result:

YES: End of test.

Pressure Deviations

Symptom	Problem	Solution
Low pressure and high pressure both too high.	System has been over-filled.	Reduce the amount of refrigerant in system.
	Condenser contaminated or plugged.	Clean or unplug condenser. Replace condenser, if necessary.
Low pressure too low and high pressure too high	Condenser plugged.	Unplug condenser or replace, if necessary.
	Receiver-drier plugged.	Unplug receiver-drier or replace, if necessary.
	Expansion valve not functioning correctly.	Replace expansion valve and receiver-drier.
Low pressure too high but high pressure normal	Compressor not functioning correctly.	Repair or replace compressor.
Low pressure and high pressure are the same.	Compressor not functioning.	Check drive belt. Check electrical lines. Check thermostat switch. Check magnetic clutch of compressor.
Low pressure too low but high pressure normal.	Not enough refrigerant in circuit.	Top up system.
	Expansion valve not functioning correctly.	Replace expansion valve.
	Evaporator contaminated or plugged.	Clean evaporator. Unplug evaporator or replace, if necessary.
Low pressure and high pressure both too low.	Not enough refrigerant in circuit.	Top up system.
	Receiver-drier plugged.	Unplug receiver-drier or replace, if necessary.
	Expansion valve not functioning correctly.	Replace expansion valve.
	Too much moisture in circuit, causing components to ice up.	Evacuate system, replace receiver-drier and then refill system.
	Compressor not functioning correctly.	Repair compressor or replace, if necessary.

Air Conditioning System Trouble-Shooting

Symptom	Problem	Solution
All cab electrical switches do not work	Loose, defective or blown fusible link	Check fuses and replace as required. Check electrical system, see "Air Conditioning System Test" in Section 240-15.
Blower malfunction	Blower does not work.	Check fuses and replace as required. See "Blower Circuit Test" in Section 240-15.
Air conditioning does not work	Compressor belt loose or slipping.	Adjust belt tension. Replace as required.
	Blown fuses Defective switch Faulty wiring or loose connections Defective compressor clutch	Check fuses and replace as required. Check electrical system, see "Air Conditioning System Test" in Section 240-15.
Drafts	Poor air distribution	Adjust directional air louvers.
Inadequate air flow	Clogged air filters Evaporator core air flow restricted	Clean or replace filters. Remove restriction.
	Faulty blower fan motors Defective compressor clutch Faulty wiring or loose connections	Check fuses and replace as required. Check electrical system, see "Air Conditioning System Test" in Section 240-15.
Water leaking or dripping from evaporator core compartment	Loose hose clamp A/C drain tubes plugged	Tighten clamp. Clean drain tubes.
Strange odors inside operator's cab	Dirty air filters Evaporator condenser pan dirty	Clean or replace filters. Clean pan and outlet with compressed air.
Partial frosting and sweating of lines combined with poor cooling	Drain tubes plugged	Clean drain tubes.
	Compressor belt slipping	Adjust compressor belt tension.
	Loss of refrigerant	Check system for leaks. Correct refrigerant level, see "Topping Up a Partly Discharged System" in Section 90, Group 15.
	Expansion valve malfunction	Check thermal head of expansion valve for damages. Replace valve as required. **→NOTE:** **This means to evacuate the air conditioning system.**
Ice particles blowing from evaporator	Control dial set to low	Adjust the temperature control to a warmer position.
Failure to cool	Insufficient blower speed	Increase blower speed.
	Dirty air filters	Clean or replace air filters.
	Debris on front grille and side screens	Clean grille and screens.
	Lint or dirt on condenser cooling ribs	Blow out condenser cooling ribs with compressed air. ***IMPORTANT:*** ***Be careful, the cooling ribs can be damaged when air pressure is to high.***
	Refrigerant is to low or to high	Perform "step 8" of "Air Conditioning System Diagnosis" in this Group.
	Compressor drive belt is slipping.	Adjust belt tension.
	Compressor clutch not engaging	Perform "step 2" of "Air Conditioning System Diagnosis" in this Group.
	Expansion valve not functioning	Perform "step 7C" of "Air Conditioning System Diagnosis" in this Group.
	Restriction in refrigerant system	Look for freeced components or lines. **→NOTE:** **Freeze up of components or lines may indicate the point of restriction. Compressor outlet, condenser, receiver-dryer and expansion valve inlet line are normally hot. The evaporator and its return line to compressor are normally cold when the system is operating.** **If no restriction was found GO TO "Air Conditioning System Diagnosis"**
	Faulty wiring or loose electrical connections	Check electrical system, see "Air Conditioning System Test" in Section 240-15.
	Defective temperature control switch	Check or replace control switch.
	Outside temperature is too low (below 21°C, 70°F)	**→NOTE:** **The air conditioning system does not operate if ambient temperature is too low.**
	Condenser is overheating	Clean condenser and radiator screens, cores and cooling ribs.
	Severe restriction in high pressure side Burned out clutch field or faulty field Short circuit or failure of a switch in circuit	See "Electrical System Diagnosis" in Section 240-15 and than perform "Air Conditioning System Diagnosis" in this Group.

Failure Of Mechanical Type

Symptom	Problem	Solution
System noisy	Noises in the system may occure for various causes.	Locate the component which causes the noises. Check if system is operating or not, at the moment when noises occur.
Strange noise when system is operating	Electro-magnetic clutch is not engaging	Perform "step 2" of "Air Conditioning System Diagnosis" in this Group.
	Wrong compressor oil level	Check compressor oil level and correct it.
	Compressor damaged **→NOTE:** **Operating the compressor with insufficient oil, even for a short time, may cause damage.**	Repair or replace the compressor. **→NOTE:** **To do this, the air conditioning system has to be discharged and re-filled. See "Discharging The Air Conditioning System" and "Filling The System" in Section 90-15.**
Strange noise when system is not operating	Compressor belt wear or damage	Replace belt if it is damaged. Correct the belt tension.
	Compressor pulley bearing wear or damage	Replace as required.
	Wrong clearance between front plate and electro-magnetic clutch	Adjust clearance.
	Not proper screws and bolts tightening	Tighten screws and bolts.
Hissing noise at expansion valve or receiver-dryer (system operated)	Loss of refrigerant	Check system for leaks. Correct refrigerant level, see "Topping Up a Partly Discharged System" in Section 90, Group 15.
	Restriction in air conditioning system	Check for kinks in refrigerant hoses. Look for frozen components or lines. **→NOTE:** **Frozen components or lines may indicate the point of restriction. Compressor outlet, condenser, receiver-dryer and expansion valve inlet line are normally hot. The evaporator and its return line to compressor are normally cold.** **If no restriction was found GO TO "Air Conditioning System Diagnosis"**

Section 299 - SPECIAL TOOLS - SELF-MANUFACTURED

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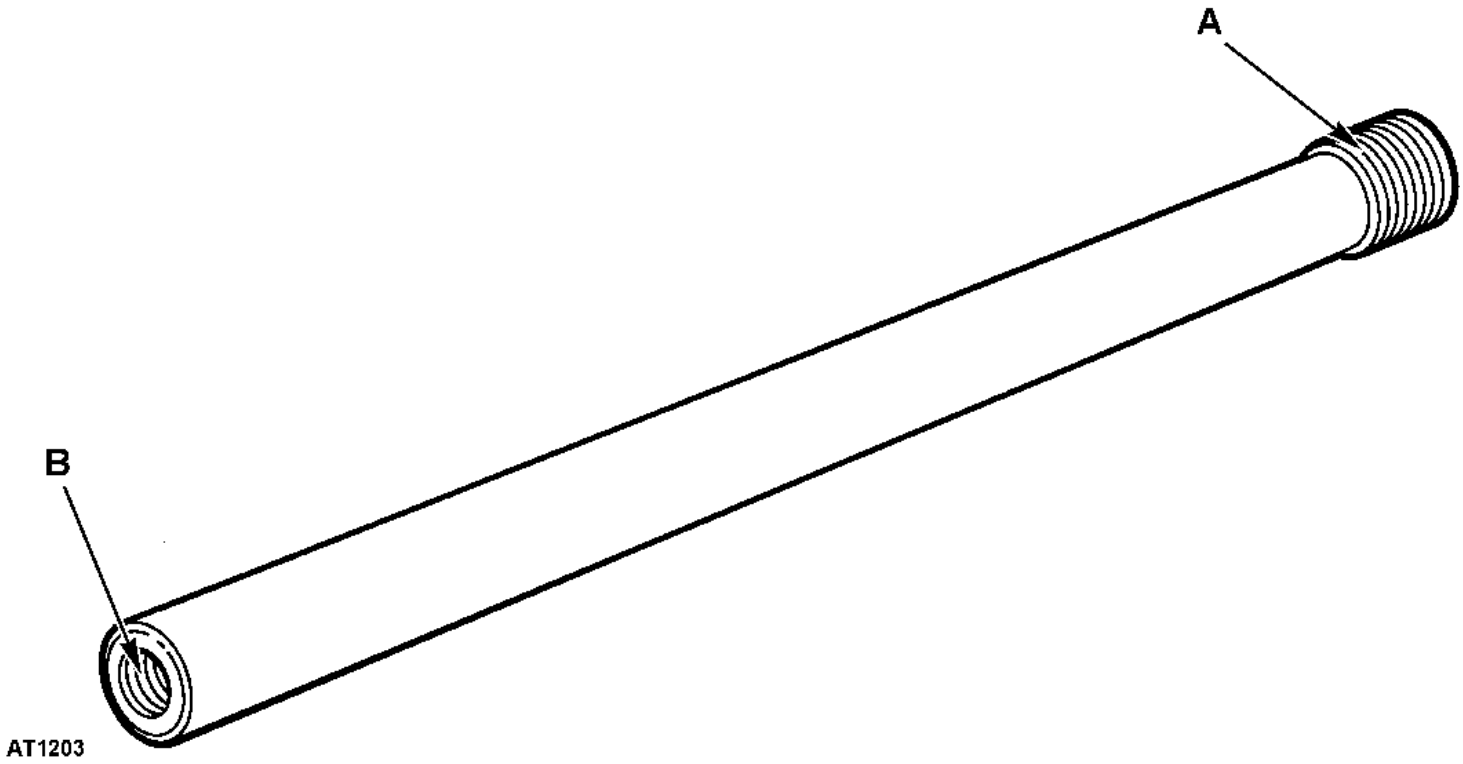
Group 05 - Manufacturing the Tools

Adapter



Adapter

This adapter is used for connecting range shaft to D01210AA slide hammer puller.

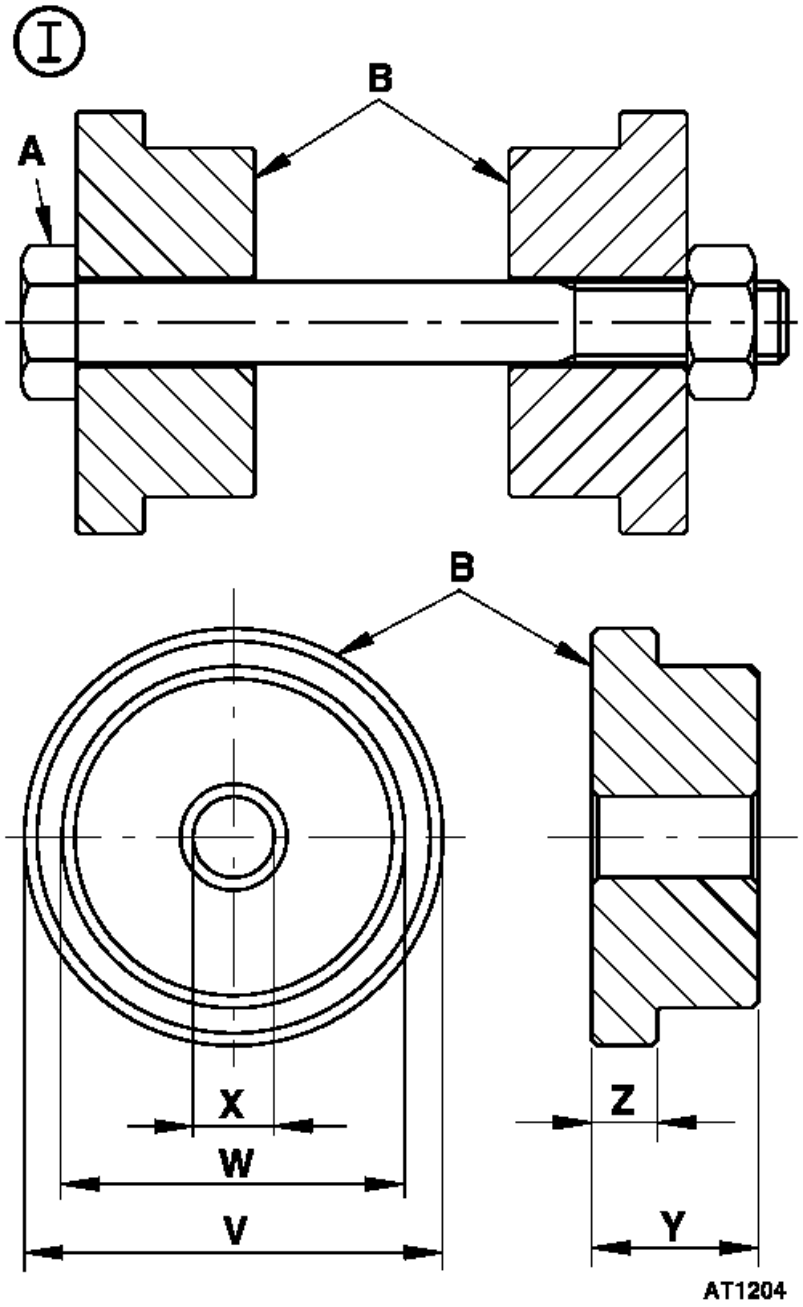
Material required:

Round steel rod, 350 mm (13.8 in) long cut M28x2 external thread (A) at one end and $^{1}/_{2}$ "-20 internal thread (B) at the other

Cone Point Adjustment Tools

These two tools are used for pinion shaft cone point adjustment.

Tool I



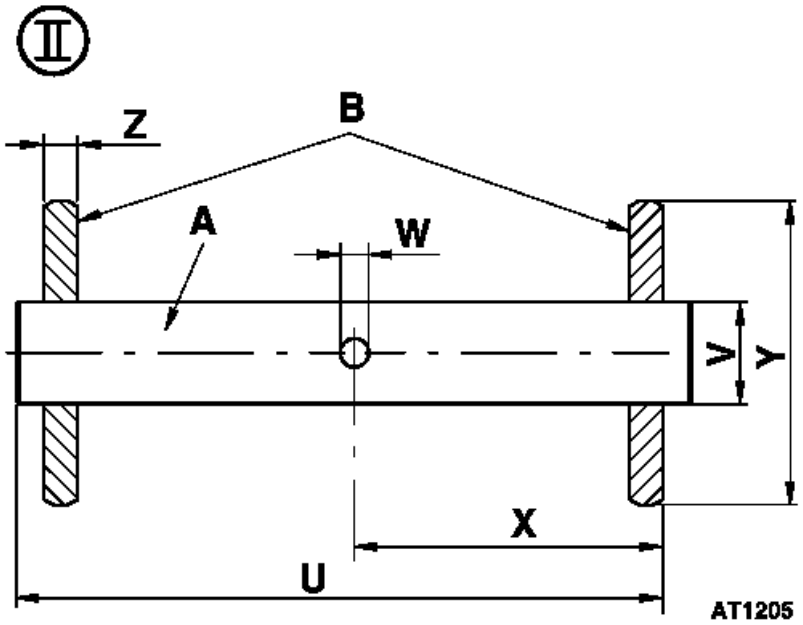
Tool I

Material required:

- A-M12 x 100 cap screw with nut
- B-Two steel disks with the following dimensions:
  - V=60 mm (2.362 in)
  - W=49,6 mm (1.953 in)
  - X=13 mm (0.512 in)
  - Y=25 mm (0.984 in)
  - Z=10 mm (0.394 in)

All edges of steel disks have to be machined to an angle of 45°.

Tool II



Tool II

Material required:

- A-Steel shaft
- B-Steel disks (2 used)

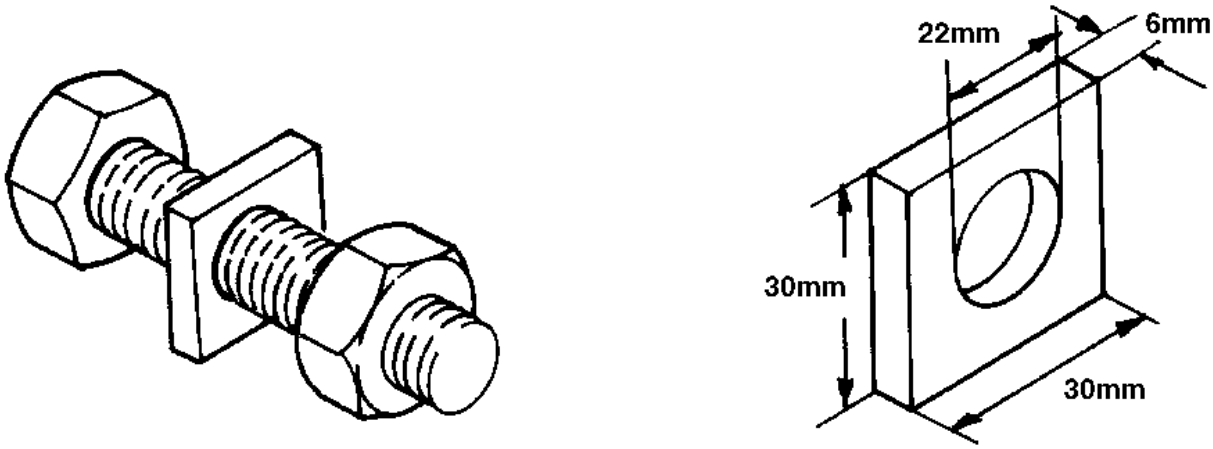
Dimensions

Dimensions	
U=300 mm (12 in)	X=150 mm (6 in)
V=30 mm (1.181 in)	Y=90 mm (3.543 in)
W=8 mm (0.315 in)	Z=10 mm (0.394 in)

Shaft (A) is U=300 mm (12 in) long and has a diameter of V=30 mm (1.181 in), H5 fit. Apply a bore of W=8 mm (0.315 in) diameter in a distance of X=150 mm (6 in) from shaft end.

The steel disks (B) must have a diameter of Y=90 mm (3.543 in) and a thickness of Z=10 mm (0.394 in). Diameter of center bore must be V=30 mm (1.181 in). The disks must fit on shaft (A) with zero clearance. Their edges must be rounded off and surface hardened.

Draft Control Adjusting Tool



AT2311

Draft Control Adjusting Tool

Draft Control Adjusting Tool is used to make a negative draft force to Rockshaft Center Link Bracket.

Material required:

20 x 80 mm Bolt.

30 x 30 x 6 mm Flat Steel

20 mm Nut