John Deere Agriculture

5620, 5720 and 5820 Tractors

DIAGNOSIS AND TESTS SERVICE MANUAL

Covered models: 5620, 5720, 5820

tm4791, April 2006

Table of contents

Foreword

This “Operation and Tests” manual applies to the following tractor types:

5620, 5720 and 5820

This manual is written for an experienced technician. Special 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 initial section of this manual and the cautions presented throughout the text of the manual.

CAUTION:

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

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.

Version Date

01 May 2007

Section 210 - GENERAL INFORMATION

Table of contents

Group 05 - Safety Measures

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.

”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 instructions without being directly connected to them.

Prevent Machine Runaway

Machinery Runaway

Avoid possible injury or death from machinery runaway.

Do not start engine by shorting across starter terminals. Machine will start in gear if normal circuitry is bypassed.

NEVER start engine while standing on ground. Start engine only from operator's seat, with transmission in neutral or park.

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

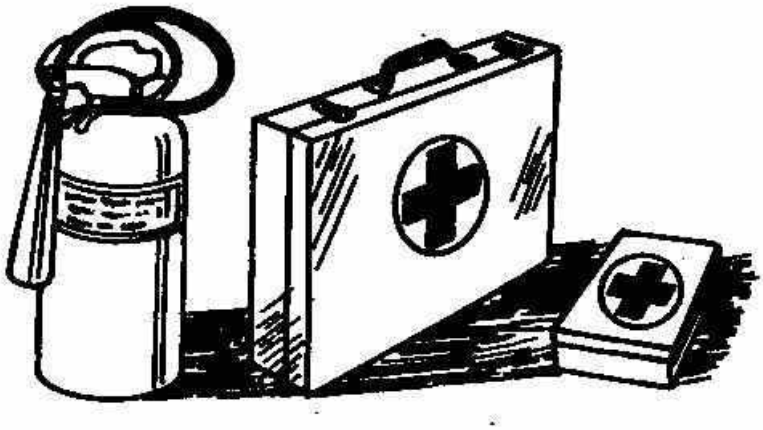
Battery Explosions

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



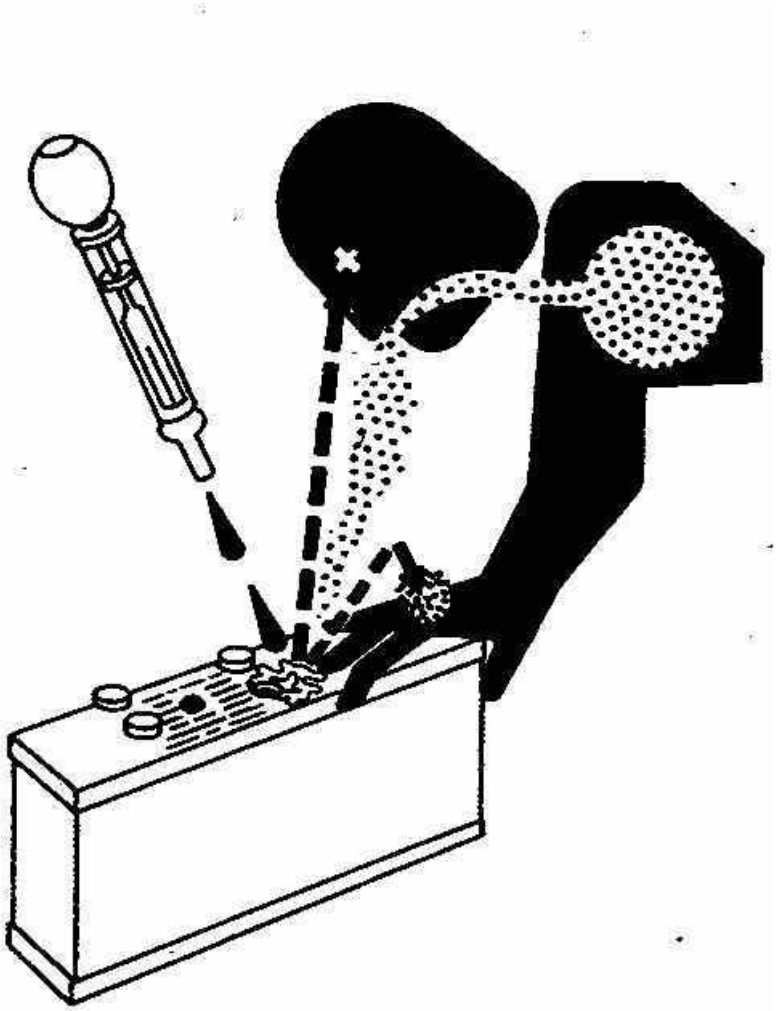
First Aid Kit

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.

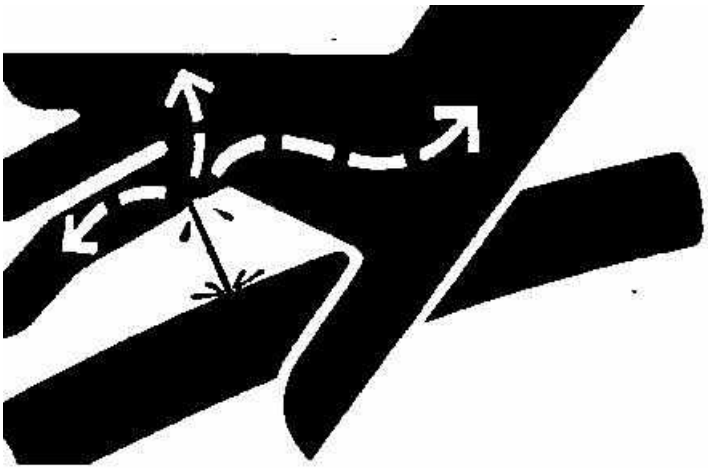
If you spill acid on yourself:

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.

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.

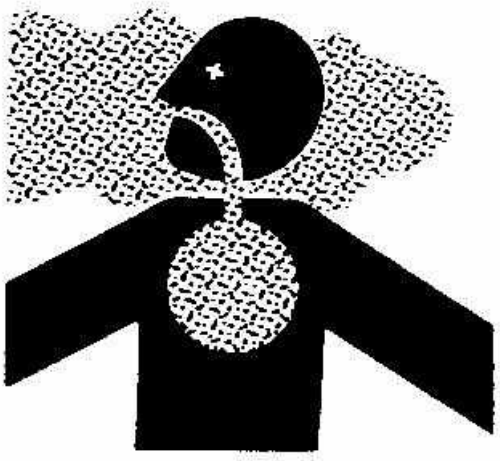
Service Cooling System Safely

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 first stop to relieve pressure before removing completely.

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.

Remove paint before heating:

- Remove paint a minimum of 100 mm (4 in.) from area to be affected by heating. If paint cannot be removed, wear an approved respirator before heating or welding.
- 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.

Do not use a chlorinated solvent in areas where welding will take place.

Do all work in an area that is well ventilated to carry toxic fumes and dust away.

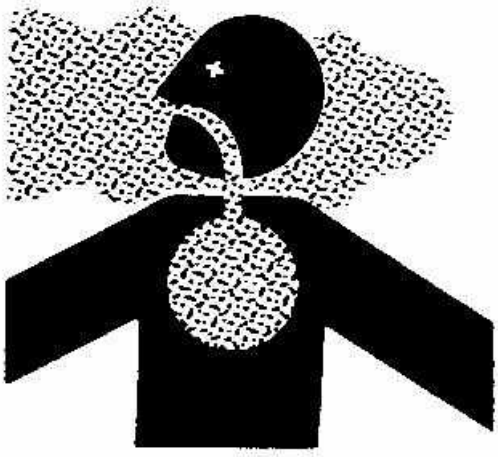
Dispose of paint and solvent properly.

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 accidentally burst when heat goes beyond the immediate flame area.

Work In Ventilated Area

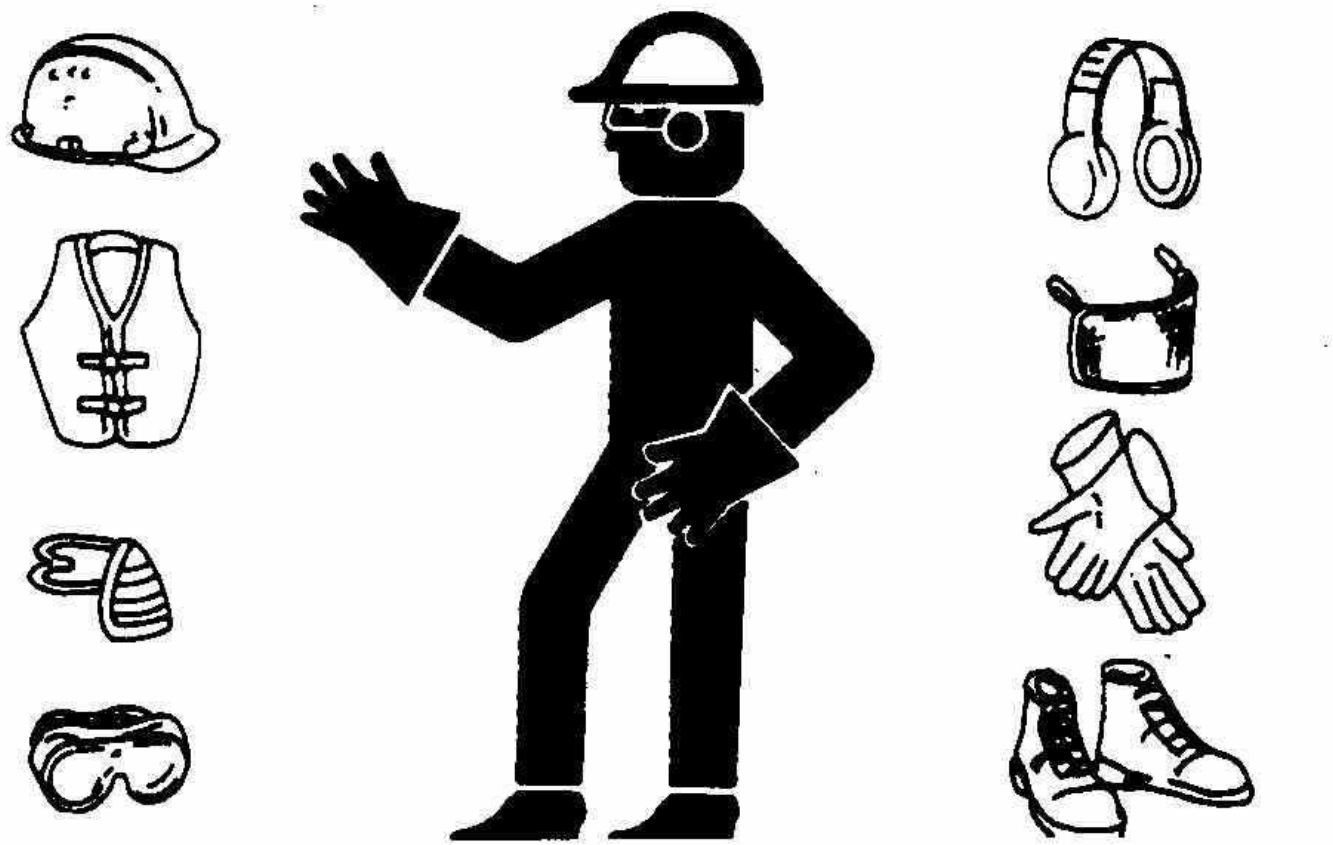


Engine exhaust fumes

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 an exhaust pipe extension, open the doors and get outside air into the area

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.

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.

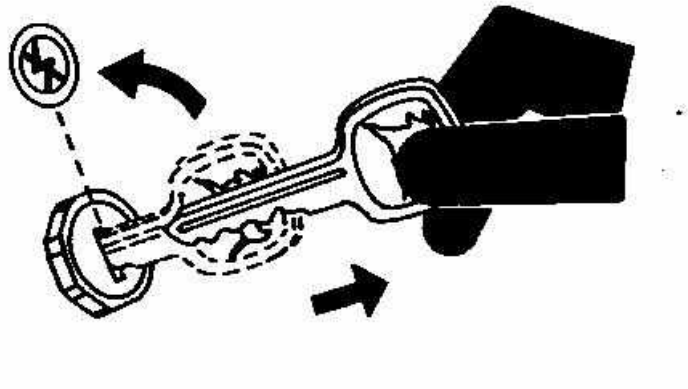
Securely support any machine elements that must be raised for service work.

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.

On self-propelled equipment, disconnect battery ground cable (-) before making adjustments on electrical systems or welding on machine.

On towed implements, disconnect wiring harnesses from tractor before servicing electrical system components or welding on machine.

Park Machine Safely

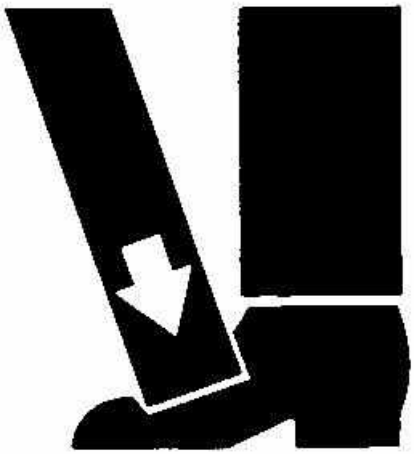


Remove the Key

Before working on the machine:

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

Use Proper Lifting Equipment

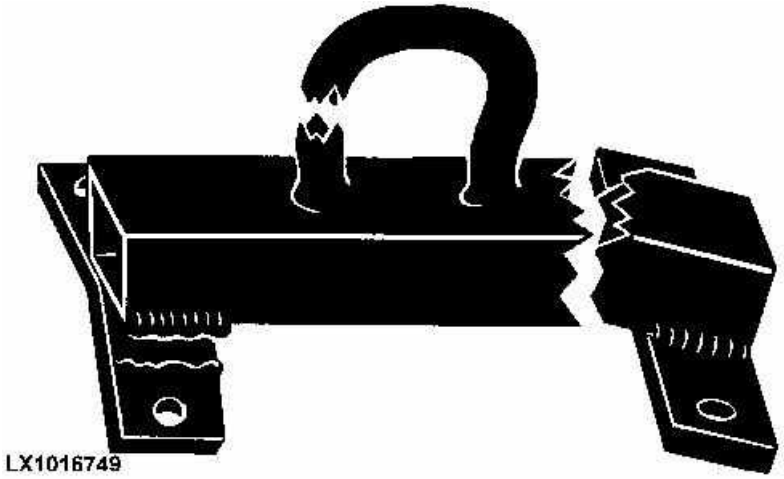


Proper Lifting Equipment

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

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

Construct Dealer-Made Tools Safely

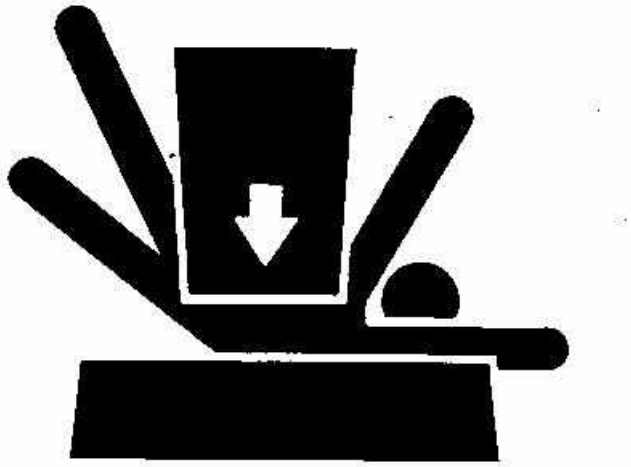


Construct Dealer-Made Tools Safely

Faulty or broken tools can result in serious injury. When constructing tools, use proper, quality materials, and good workmanship.

Do not weld tools unless you have the proper equipment and experience to perform the job.

Support Machine Properly



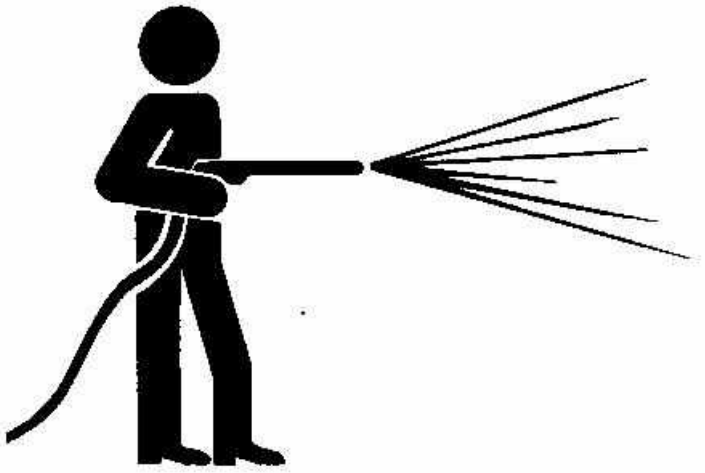
Support Properly

Always lower the attachment or implement to the ground before you work on the machine. If the work requires that the machine or attachment be lifted, provide secure support for them. If left in a raised position, hydraulically supported devices can settle or leak down.

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.

When implements or attachments are used with a machine, always follow safety precautions listed in the implement or attachment operator′s manual.

Work in Clean Area



Clean Work Area

Before starting a job:

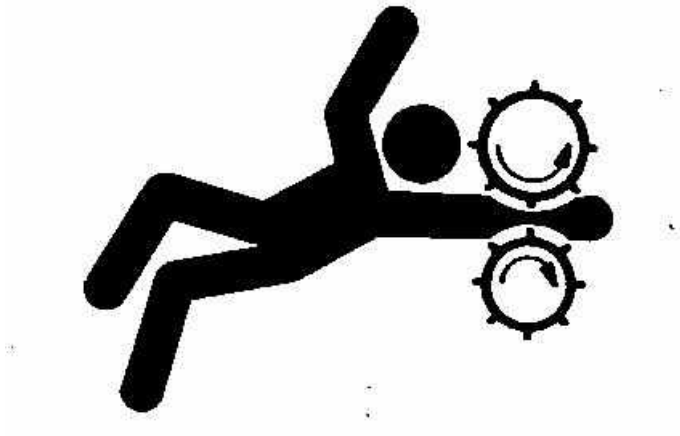
- Clean work area and machine.
- Make sure you have all necessary tools to do your job.
- Have the right parts on hand.
- Read all instructions thoroughly; do not attempt shortcuts.

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.

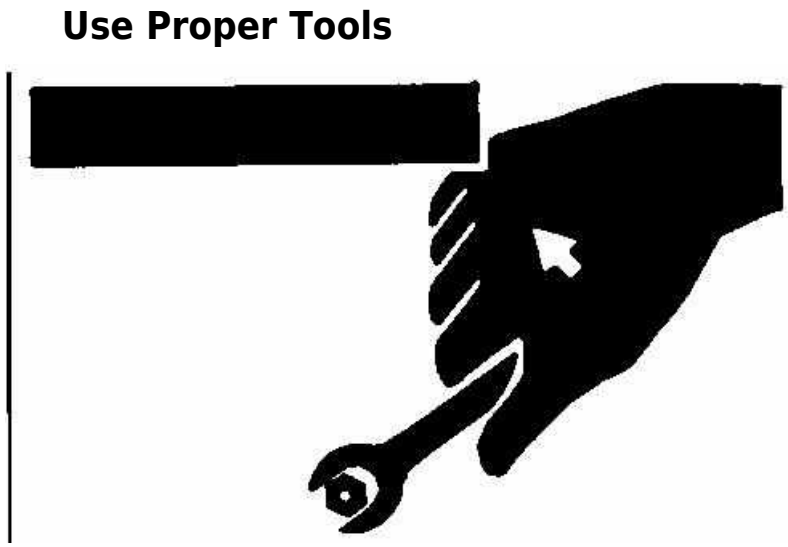
Service Machines Safely



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.



Proper Tools

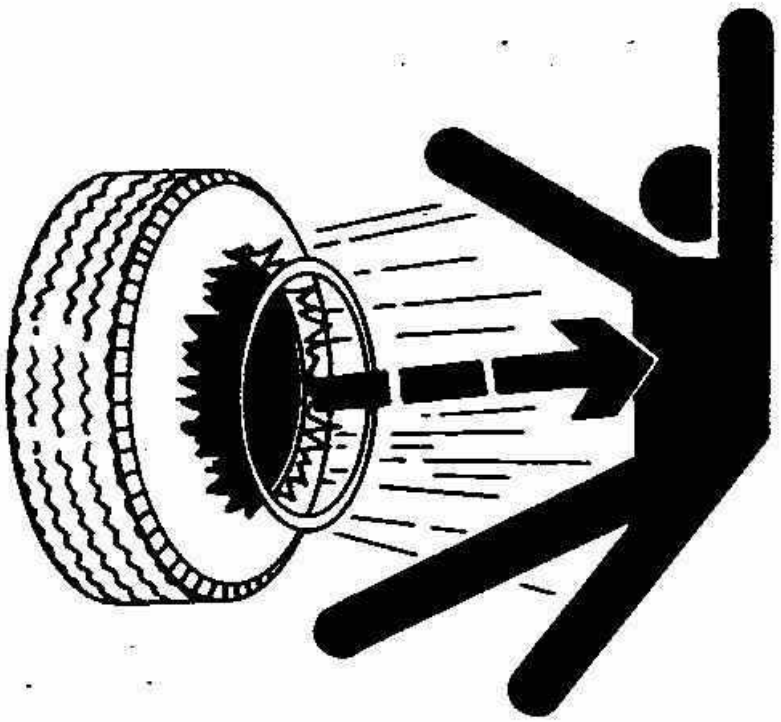
Use tools appropriate to the work. Makeshift tools and procedures can create safety hazards.

Use power tools only to loosen threaded parts and fasteners.

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

Use only service parts meeting John Deere specifications.

Service Tires Safely



Explosive Tire and Rim Parts

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

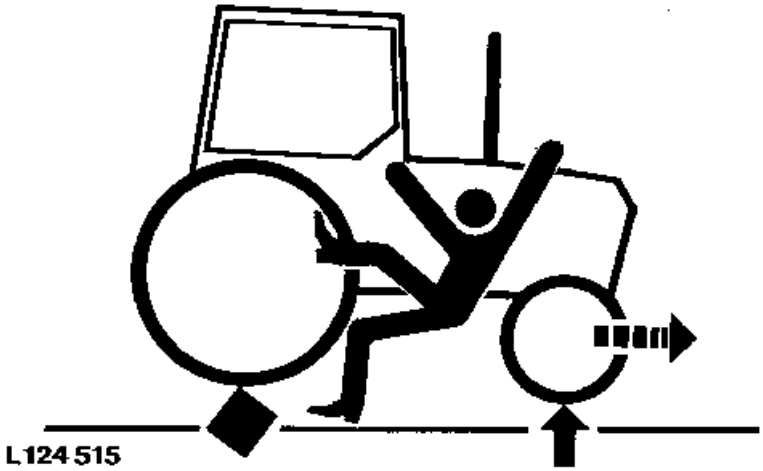
Do not attempt to mount a tire unless you have the proper equipment and experience to perform the job.

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.

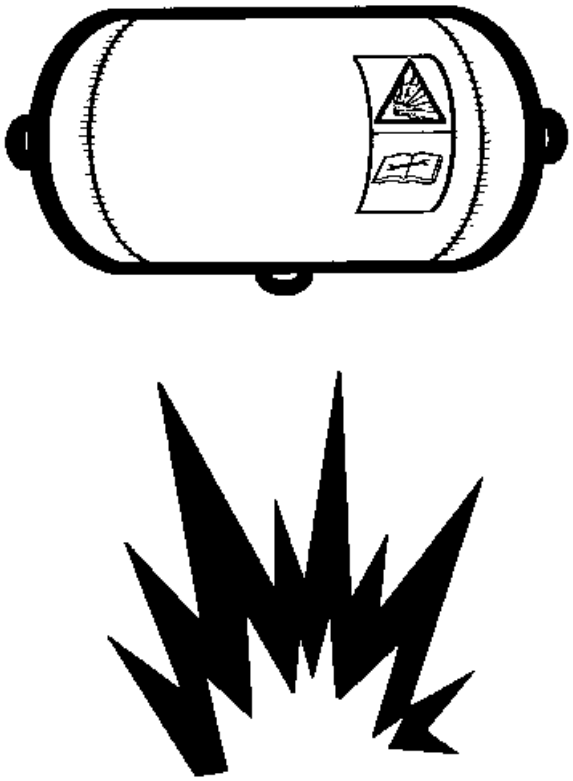
Service Front-Wheel Drive Tractor Safely



Support Front and Rear Wheels

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.

Safety Information - Air Brake System



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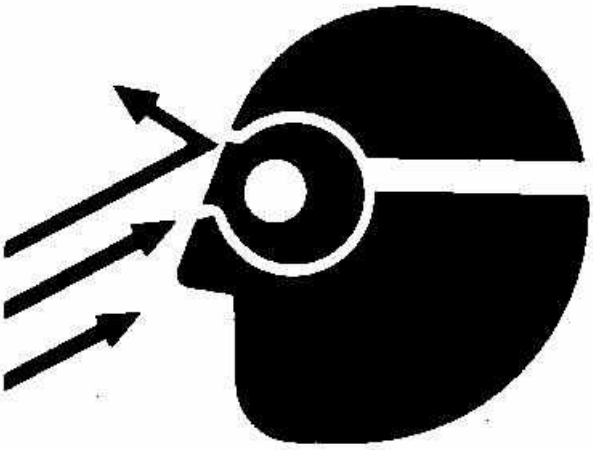
Compressed air tank

CAUTION:

Compressed air tank is pressurized!

Always relieve pressure before working on the air brake system. Do not carry out any welding jobs on the air brake system.

Avoid Eye Contact With Radar

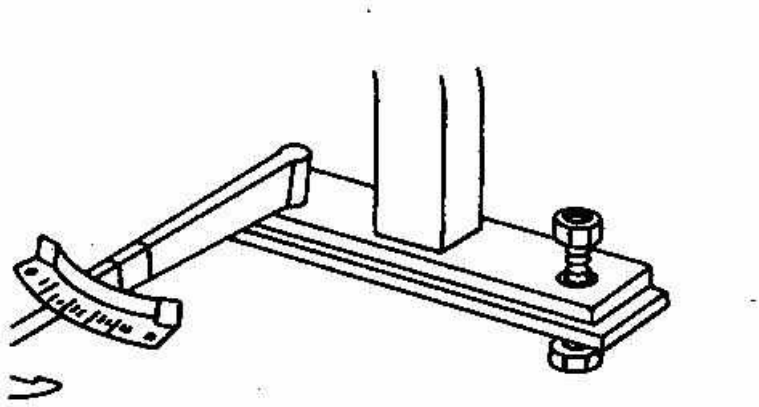


Avoid Eye Contact With Radar

Radar ground speed sensor emits a very low intensity microwave signal. It will not cause any ill effects during normal use.

Although intensity is low, DO NOT look directly into face of sensor while in operation, to avoid any possible eye damage.

Keep ROPS Installed Properly

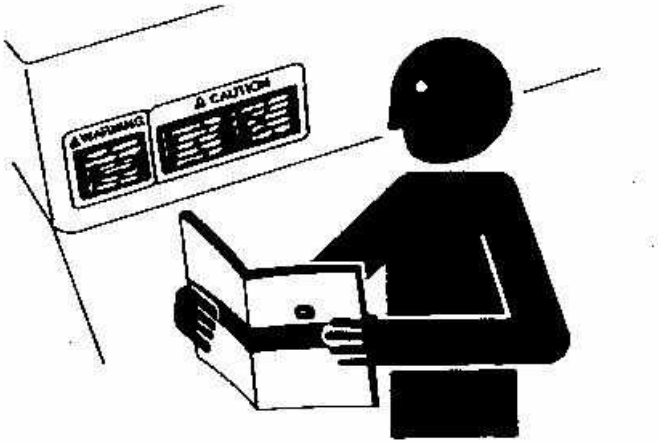


Roll-Over Protective Structure

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.

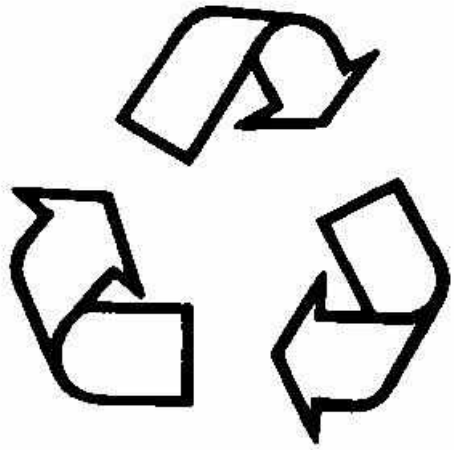
Replace Safety Signs



Safety Signs

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

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.

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.

Safety Measures on Electronic Control Units

CAUTION:

Before installing test equipment on tractor, always shut off the engine and turn off key switch.

CAUTION:

Always engage the park lock when performing tests with the engine running.

CAUTION:

When testing is performed with the engine running, there is a risk of injury from rotating parts.

IMPORTANT:

Do not use a test lamp on any control unit. Only use a multimeter (JT05791A/JDG1478).

IMPORTANT:

To protect electronic circuits, disconnect the battery and alternator before performing any welding on the tractor.

Group 15 - General References

Reference 210-15-001, General References—Summary

The following list contains additional references which may be helpful when diagnosing the machine.

General Information

- Reference 210-15-010 , Unified Inch Bolt and Cap Screw Torque Values
- Reference 210-15-015 , Metric Bolt and Cap Screw Torque Values
- Reference 210-15-020 , Hydraulic System Inch Fitting Torques
- Reference 210-15-025 , Hydraulic System Metric Fitting Torques

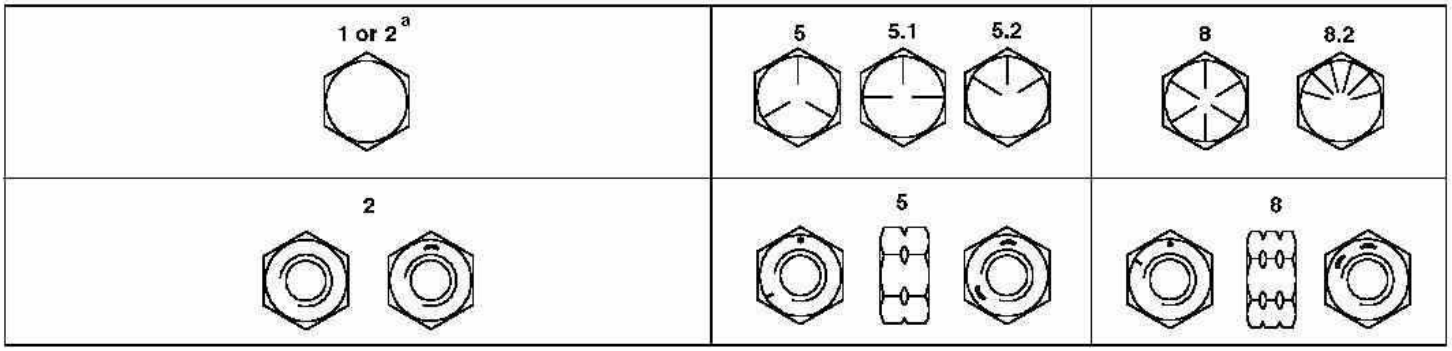
Electrical System

- Reference 210-15-030, Component identification table
- Reference 210-15-035, How to read a functional schematic
- Reference 210-15-040, How to read a diagnostic schematic
- Reference 210-15-042, Wire numbers and color codes
- Reference 210-15-045, Schematic, wiring and harness symbols
- Reference 210-15-050, Electrical system visual check
- Reference 210-15-055, Electrical circuit malfunctions
- Reference 210-15-060, Seven-step electrical test procedure

Hydraulic System

- Reference 210-15-065 , Hydraulic circuit symbols

Reference 210-15-010, Unified Inch Bolt and Cap Screw Torque Values



Top, SAE Grade and Head Markings; Bottom, SAE Grade and Nut Markings

Unified Inch Bolt and Cap Screw Torque Values, 1 of 2

	Grade 1 (No Mark)		Grade 2 [a] (No Mark)		Grade 5, 5.1 or 5.2		Grade 8 or 8.2	
Size	**Lubricated [b] N˙m(lb-ft)**	**Dry [c] N˙m(lb-ft)**	**Lubricated [b] N˙m(lb-ft)**	**Dry [c] N˙m(lb-ft)**	**Lubricated [b] N˙m(lb-ft)**	**Dry [c] N˙m(lb-ft)**	**Lubricated [b] N˙m(lb-ft)**	**Dry [c] N˙m(lb-ft)**
1/4	3.8 (2.8)	4.7 (3.5)	6 (4.4)	7.5 (5.5)	9.5 (7)	12 (9)	13.5 (10)	17 (12.5)
5/16	7.7 (5.7)	9.8 (7.2)	12 (9)	15.5 (11.5)	19.5 (14.5)	25 (18.5)	28 (20.5)	35 (26)
3/8	13.5 (10)	17.5 (13)	22 (16)	27.5 (20)	35 (26)	44 (32.5)	49 (36)	63 (46)
7/16	22 (16)	28 (20.5)	35 (26)	44 (32.5)	56 (41)	70 (52)	80 (59)	100 (74)
1/2	34 (25)	42 (31)	53 (39)	67 (49)	85 (63)	110 (80)	120 (88)	155 (115)
9/16	48 (35.5)	60 (45)	76 (56)	95 (70)	125 (92)	155 (115)	175 (130)	220 (165)
5/8	67 (49)	85 (63)	105 (77)	135 (100)	170 (125)	215 (160)	240 (175)	305 (225)
3/4	120 (88)	150 (110)	190 (140)	240 (175)	300 (220)	380 (280)	425 (315)	540 (400)
7/8	190 (140)	240 (175)	190 (140)	240 (175)	490 (360)	615 (455)	690 (510)	870 (640)
1	285 (210)	360 (265)	285 (210)	360 (265)	730 (540)	920 (680)	1030 (760)	1300 (960)
1-1/8	400 (300)	510 (375)	400 (300)	510 (375)	910 (670)	1150 (850)	1450 (1075)	1850 (1350)
1-1/4	570 (420)	725 (535)	570 (420)	725 (535)	1280 (945)	1630 (1200)	2050 (1500)	2600 (1920)
1-3/8	750 (550)	950 (700)	750 (550)	950 (700)	1700 (1250)	2140 (1580)	2700 (2000)	3400 (2500)
1-1/2	990 (730)	1250 (930)	990 (730)	1250 (930)	2250 (1650)	2850 (2100)	3600 (2650)	4550 (3350)

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

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

[c] "Dry" means plain or zinc plated without any lubrication.

Unified Inch Bolt and Cap Screw Torque Values, 2 of 2

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. Torque values listed are for general use only.

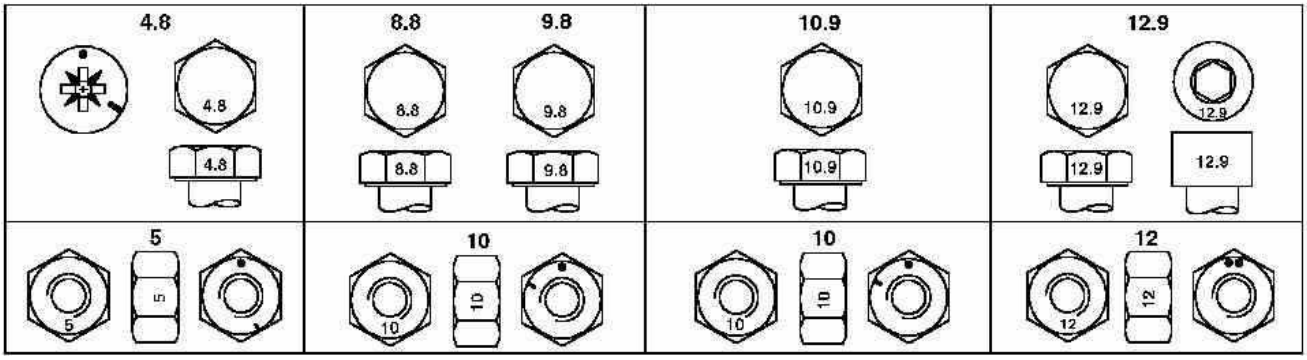
Check tightness of fasteners periodically. Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical grade.

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 fastener 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.

Reference 210-15-015, Metric Bolt and Cap Screw Torque Values



Top, Property Class and Head Markings; Bottom, Property Class and Nut Markings

Metric Bolt and Cap Screw Torque Values, 1 of 2

	Class 4.8		Class 8.8 or 9.8		Class 10.9		Class 12.9	
Size	**Lubricated [a] N˙m(lb-ft)**	**Dry [b] N˙m(lb-ft)**	**Lubricated [a] N˙m(lb-ft)**	**Dry [b] N˙m(lb-ft)**	**Lubricated [a] N˙m(lb-ft)**	**Dry [b] N˙m(lb-ft)**	**Lubricated [a] N˙m(lb-ft)**	**Dry [b] N˙m(lb-ft)**
M6	4.7 (3.5)	6 (4.4)	9 (6.6)	11.5 (8.5)	13 (9.5)	16.5 (12.2)	15.5 (11.5)	19.5 (14.5)
M8	11.5 (8.5)	14.5 (10.7)	22 (16)	28 (20.5)	32 (23.5)	40 (29.5)	37 (27.5)	47 (35)
M10	23 (17)	29 (21)	43 (32)	55 (40)	63 (46)	80 (59)	75 (55)	95 (70)
M12	40 (29.5)	50 (37)	75 (55)	95 (70)	110 (80)	140 (105)	130 (95)	165 (120)
M14	63 (46)	80 (59)	120 (88)	150 (110)	175 (130)	220 (165)	205 (150)	260 (190)
M16	100 (74)	125 (92)	190 (140)	240 (175)	275 (200)	350 (255)	320 (235)	400 (300)
M18	135 (100)	170 (125)	265 (195)	330 (245)	375 (275)	475 (350)	440 (325)	560 (410)
M20	190 (140)	245 (180)	375 (275)	475 (350)	530 (390)	675 (500)	625 (460)	790 (580)
M22	265 (195)	330 (245)	510 (375)	650 (480)	725 (535)	920 (680)	850 (625)	1080 (800)
M24	330 (245)	425 (315)	650 (480)	820 (600)	920 (680)	1150 (850)	1080 (800)	1350 (1000)
M27	490 (360)	625 (460)	950 (700)	1200 (885)	1350 (1000)	1700 (1250)	1580 (1160)	2000 (1475)
M30	660 (490)	850 (625)	1290 (950)	1630 (1200)	1850 (1350)	2300 (1700)	2140 (1580)	2700 (2000)
M33	900 (665)	1150 (850)	1750 (1300)	2200 (1625)	2500 (1850)	3150 (2325)	2900 (2150)	3700 (2730)
M36	1150 (850)	1450 (1075)	2250 (1650)	2850 (2100)	3200 (2350)	4050 (3000)	3750 (2770)	4750 (3500)

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

[b] "Dry" means plain or zinc plated without any lubrication.

Metric Bolt and Cap Screw Torque Values, 2 of 2

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. Torque values listed are for general use only.

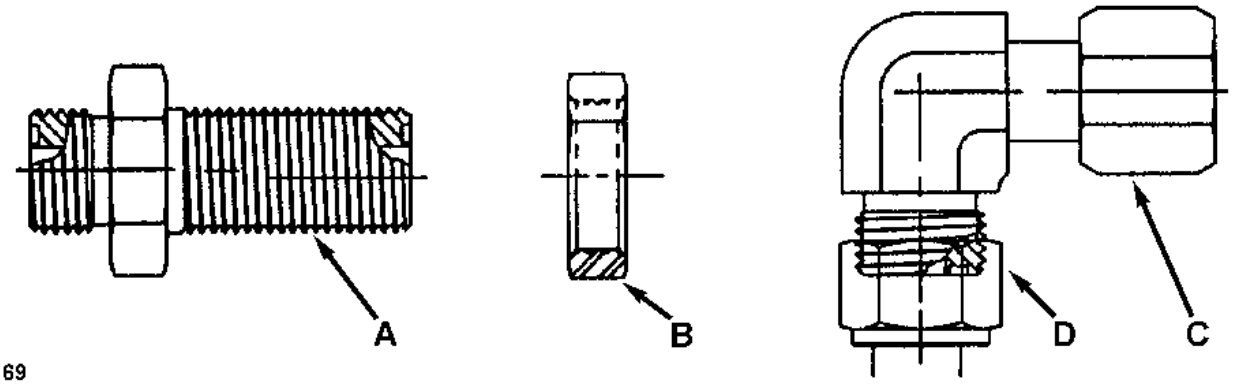
Check tightness of fasteners periodically. Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical grade.

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 fastener 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.

210-15-020, Hydraulic System Inch Fitting Torques



Torques values in hydraulic system

LEGEND:

A	Bulkhead fitting
B	Lock nut
C	Union nut
D	Union nut

Torque values in hydraulic system

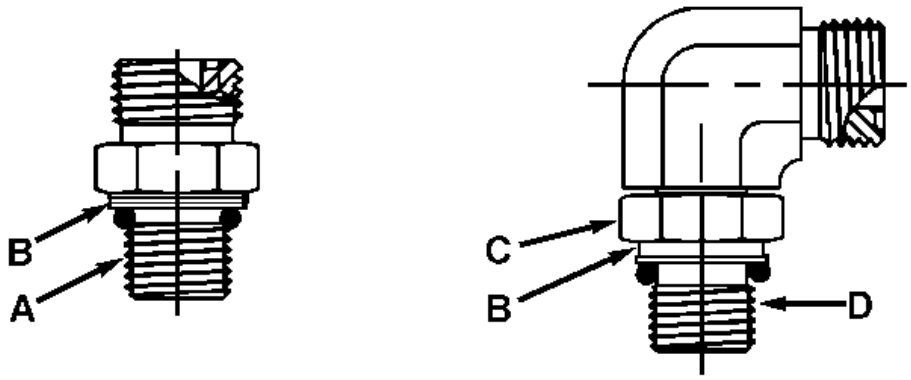
	Fittings with flat-faced ring seal			
	Union nut		Lock nut for bulkhead fitting	
Thread size	**N˙m**	**lb-ft**	N˙m	**lb-ft**
9/16—18	16	12	5	3.5
11/16—16	24	18	9	6.5
13/16—16	50	37	17	12.5
1—14	69	51	17	12.5
1-3/16—12	102	75	17	12.5
1-7/16—12	142	105	17	12.5
1-11/16—12	190	140	17	12.5
2—12	217	160	17	12.5

The torques in the table above are intended only as approximate values and do NOT apply if a different torque value is listed for specific fittings at other points in this manual. Check fittings regularly to make sure they are seated properly.

When replacing fittings, be sure to use parts with an equal or higher grade to the parts you are replacing. Items of hardware (e.g. union nuts) that are of a higher grade should be tightened to the same torque value as the parts they replace.

It is vitally important to make sure that the sealing faces are clean and that the O-rings have been inserted properly.

210-15-025, Hydraulic System Metric Fitting Torques



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Torque values in hydraulic system

LEGEND:

A	Stud-end fitting
B	Groove for metric thread
C	Lock nut
D	Adjustable stud-end fitting

Torque values in hydraulic system

	Stud-end fitting and lock nut for adjustable stud-end fitting			
	Steel or grey-cast iron		Aluminium	
Thread size	**N˙m**	**lb-ft**	**N˙m**	**lb-ft**
M12x1,5	21	15.5	9	6.6
M14x1,5	33	24	15	11
M16x1,5	41	30	18	13
M18x1,5	50	37	21	15
M22x1,5	69	51	28	21
M27x2	102	75	46	34
M33x2	158	116	71	52
M38x2	176	130	79	58
M42x2	190	140	85	63
M48x2	217	160	98	72

The torques in the table above are intended only as approximate values and do NOT apply if a different torque value is listed for specific fittings at other points in this manual. Check fittings regularly to make sure they are seated properly.

When replacing fittings, be sure to use parts with an equal or higher grade to the parts you are replacing. Items of hardware (e.g. union nuts) that are of a higher grade should be tightened to the same torque value as the parts they replace.

It is vitally important to make sure that the sealing faces are clean and that the O-rings have been inserted properly.

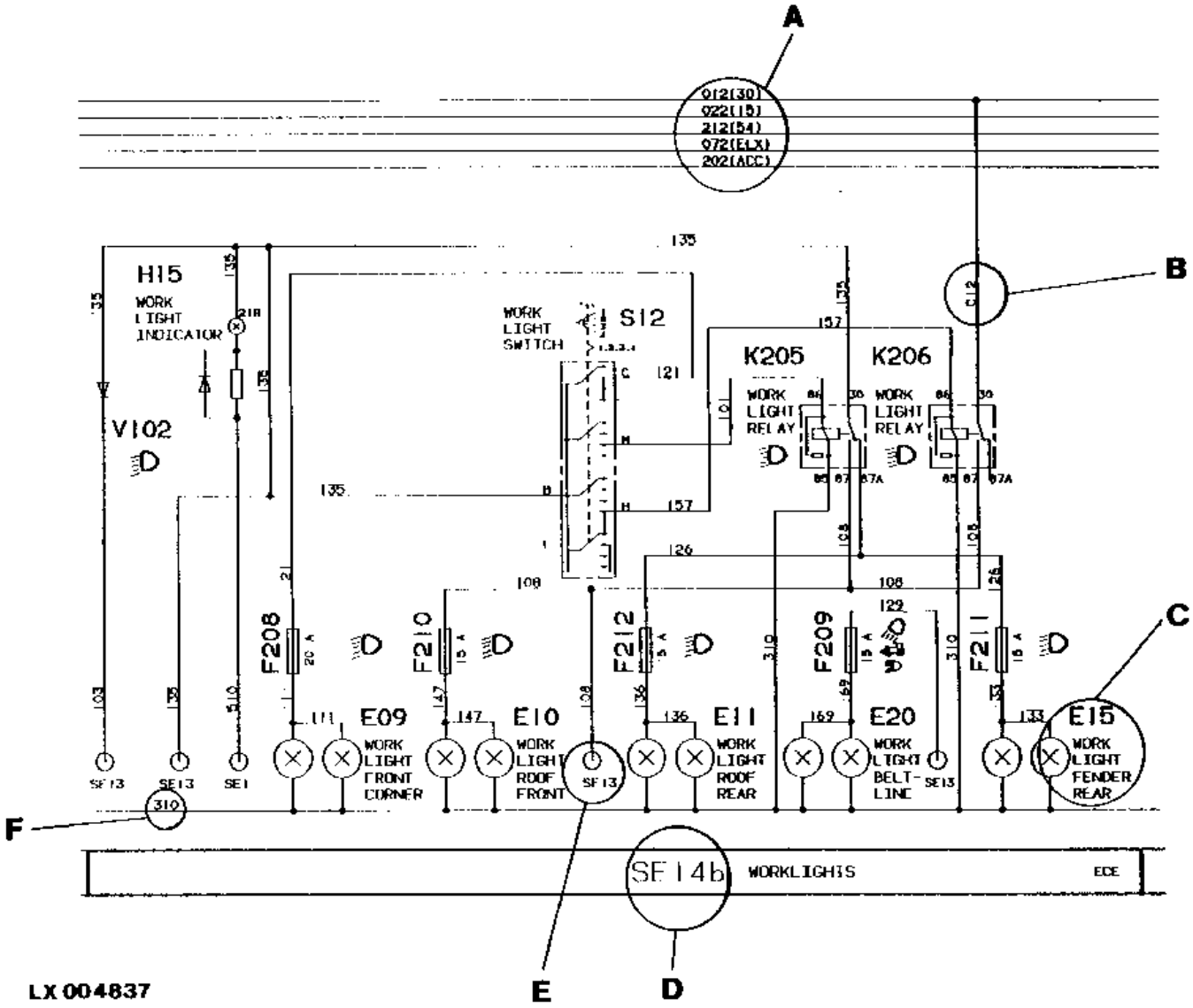
210-15-030, Component Identification Table

Each component (electrical device) and main connector will have an identification letter assigned to it. A number is added to the letter to separate and indicate all components within that letter group.

Component Identification Table

Identification Letter	Type	Examples
A	System, subassembly, parts group	Electronic control units, trigger boxes, two-way radios, logic module, FNR logic module
B	Transducer for conversion of non-electrical variables to electrical and vice versa	Speed senders, pressure senders, pressure switch horns, sensors, pickups, limit-value sensors, pulse generators, loudspeakers, inductive pickups, probes, air-flow sensors, oil-pressure switches, temperature senders, ignition-voltage pickups
C	Condenser	Condensers and capacitors, general
D	Binary device, memory	Digital devices, integrated circuits, pulse counters, magnetic tape recorders
E	Various devices and equipment	Heating devices, air conditioners, light, headlights, spark plugs, ignition distributors
F	Guard	Release mechanisms, polarity protection devices, fuses, current protection circuits
G	Power supply, generator	Batteries, generators, alternators, charging units
H	Monitor, alarm, signalling device	Audible alarms, indicator lights, turn-signal lights, brake lights, alarms, warning lights, buzzers
K	Relay	Battery relays, turn signal relays, solenoids, starting relays, warning flashers
L	Inductor	Choke coils, coils, windings
M	Engine	Blower motors, fan motors, starter motors
N	Regulator, amplifier	Regulators (electronic or electromechanical), voltage stabilizers
P	Measuring instrument	Ammeter, diagnostic connectors, tachometers, fuel gauge, pressure gauges, measuring points, test points, speedometers
R	Resistance	Flame glow plugs, sheathed-element flame glow plugs, glow plugs, heating resistors, NTC resistors, PTC resistors, potentiometers, regulating resistors
S	Switch	Switches and pushbuttons, general key switch, light switch, horn switch, flasher switch
T	Transformer	Ignition coil, ignition transformer
U	Modulator, converter	DC transformers
V	Semiconductor, electron tubes	Transistors, diodes, electron tubes, rectifiers, semiconductors, thyristors, zener diodes
W	Transmission path, conductor, antenna	Antennas, shielding components, shielded conductors, cable harnesses, conductors, ground conductors
X	Terminal, plug, plug-and-socket connection	Terminal studs, electrical connections, connectors for electrical line couplers, line connectors, sockets, plugs, terminals, plug-and-socket connections
Y	Electrically actuated mechanical device	Permanent magnets, injection valves (solenoid-operated), electromagnetic clutches and brakes, air valves, fuel pumps, solenoids, switching valves, start valves, locking systems
Z	Electrical filter	Interference suppression filters

Reference 210-15-035, How to Read a Functional Schematic



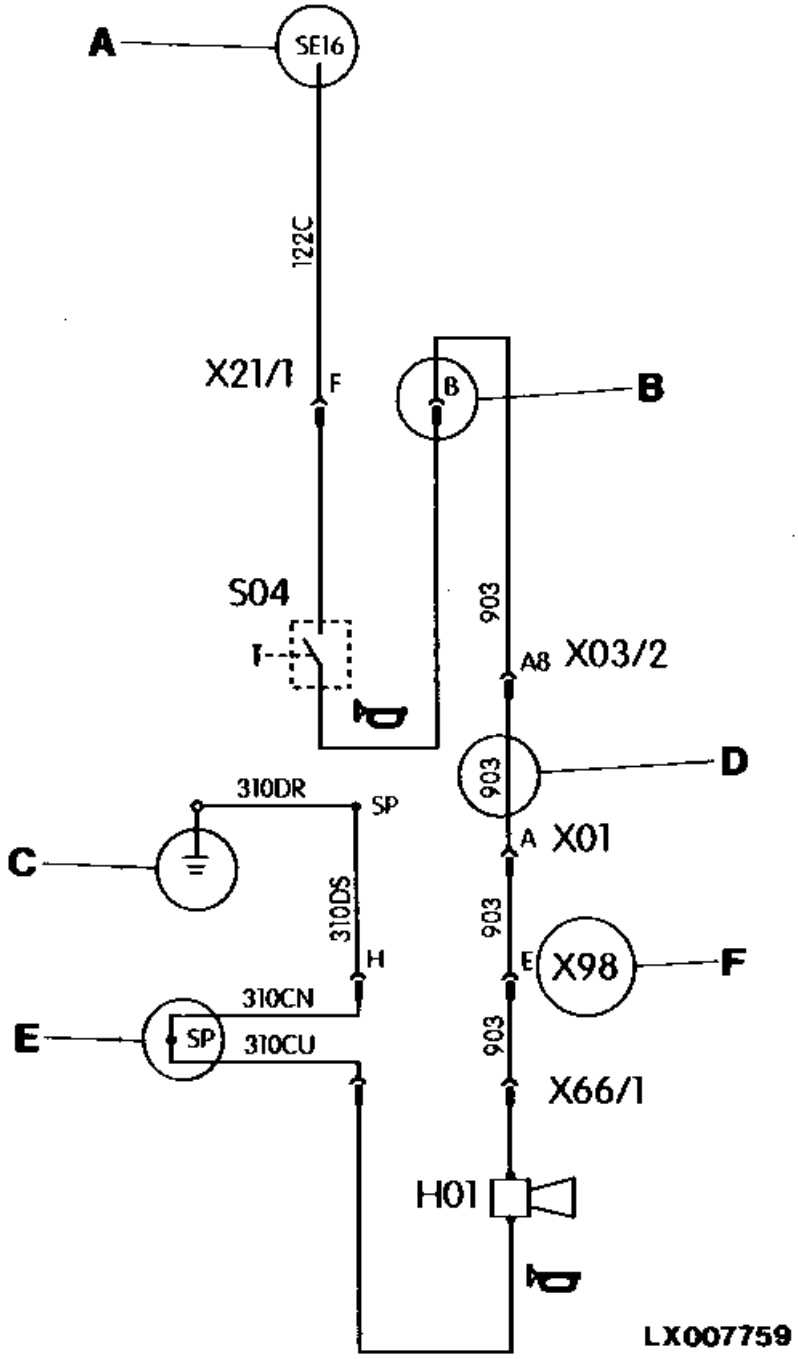
Functional schematic

LEGEND:

A Power supply wires:
Wire 012 (terminal 30), battery
Wire 022 (terminal 15), ignition
Wire 212 (terminal 54), not supplied with power during engine starting
Wire 072 (ELX), power supply for electronics
Wire 202 (ACC), power supply for accessories
B Wire number
C Part designation
D Section designation
E Section to which cable is routed
F Wire 310 (terminal 31), ground

The functional schematic is divided into functional sections. The part designations, wire numbers and symbols are identical with the corresponding data in the wiring and harness diagram. Switches and relays are shown in “OFF”position.

210-15-040, How to Read a Diagnostic Schematic



Diagnostic schematic

LEGEND:

A	Current supply from section (SE)
B	Symbol (connector)
C	Symbol (ground)
D	Wire number
E	Splice point (SP)
F	Plug designation (X)

Like the functional schematic, the diagnostic schematic is divided into functional sections. It contains information about plugs (X) and connectors. Each wire is identified by a number that also indicates the cable color and the relevant circuit. The letter at the end of a wire number indicates that there are several wires with the same number but different letters.

210-15-042, Wire Numbers and Color Codes

Wire number

Schematic wire numbers

Wire no.	Electrical circuit
000—099	Power supply
100—199	Lighting system
200—299	Accessories
300—499	Motor
500—699	Transmission
700—799	Hydraulic system
800—899	Rockshaft
900—999	Miscellaneous

Color code

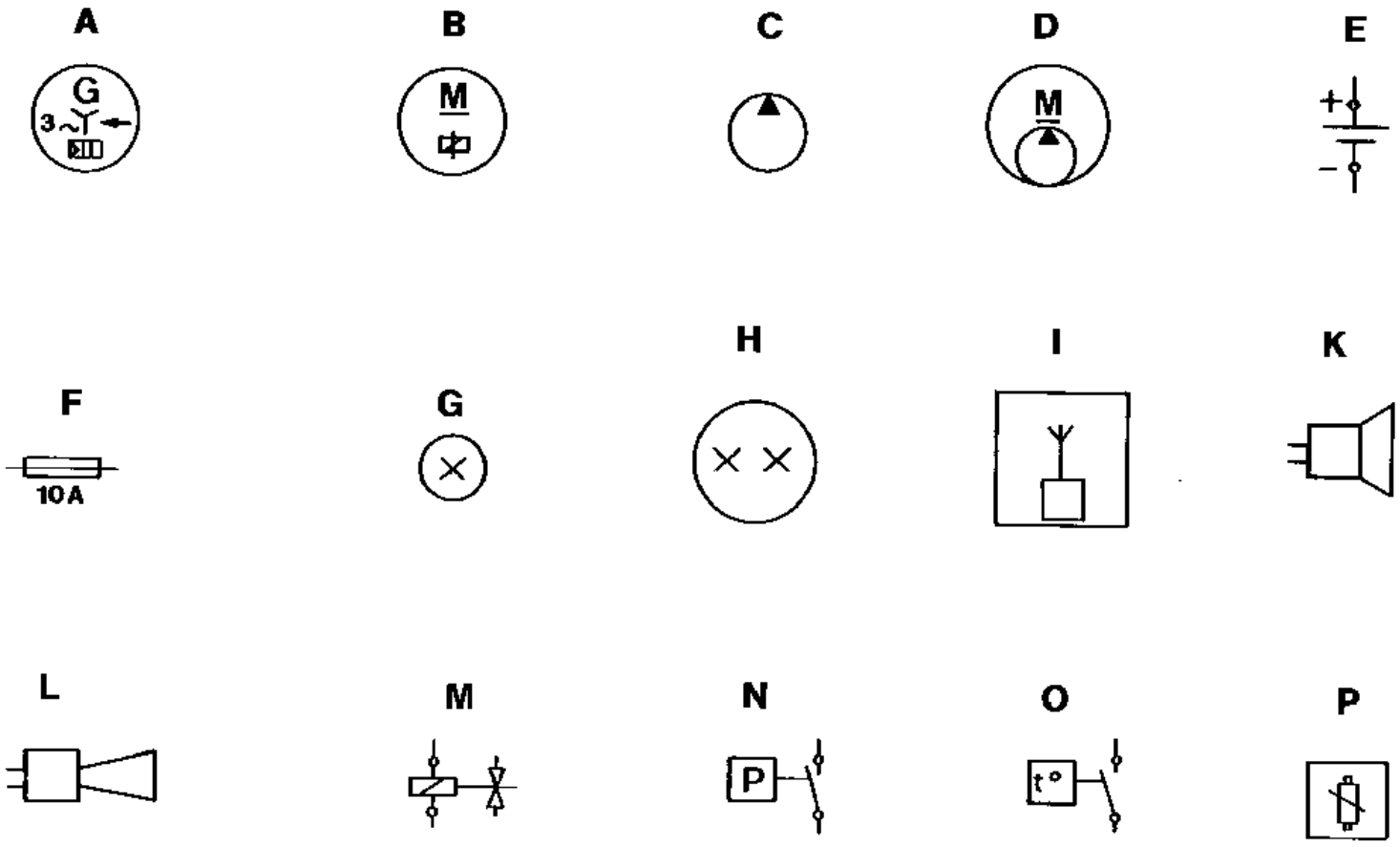
→NOTE:

The last digit of the wire number indicates the color.

Schematic wire color code

Wire no.	Color	Application
x50	Black	Battery ground
xx0	Black	Ground
xx1	Brown	Not used
xx2	Red	Power supply
xx3	Orange	Not used
xx4	Yellow	"
xx5	Dark green	"
xx6	Light blue	"
xx7	Pale purple	"
xx8	Grey	"
xx9	White	"

210-15-045, Schematic, Wiring and Harness Symbols



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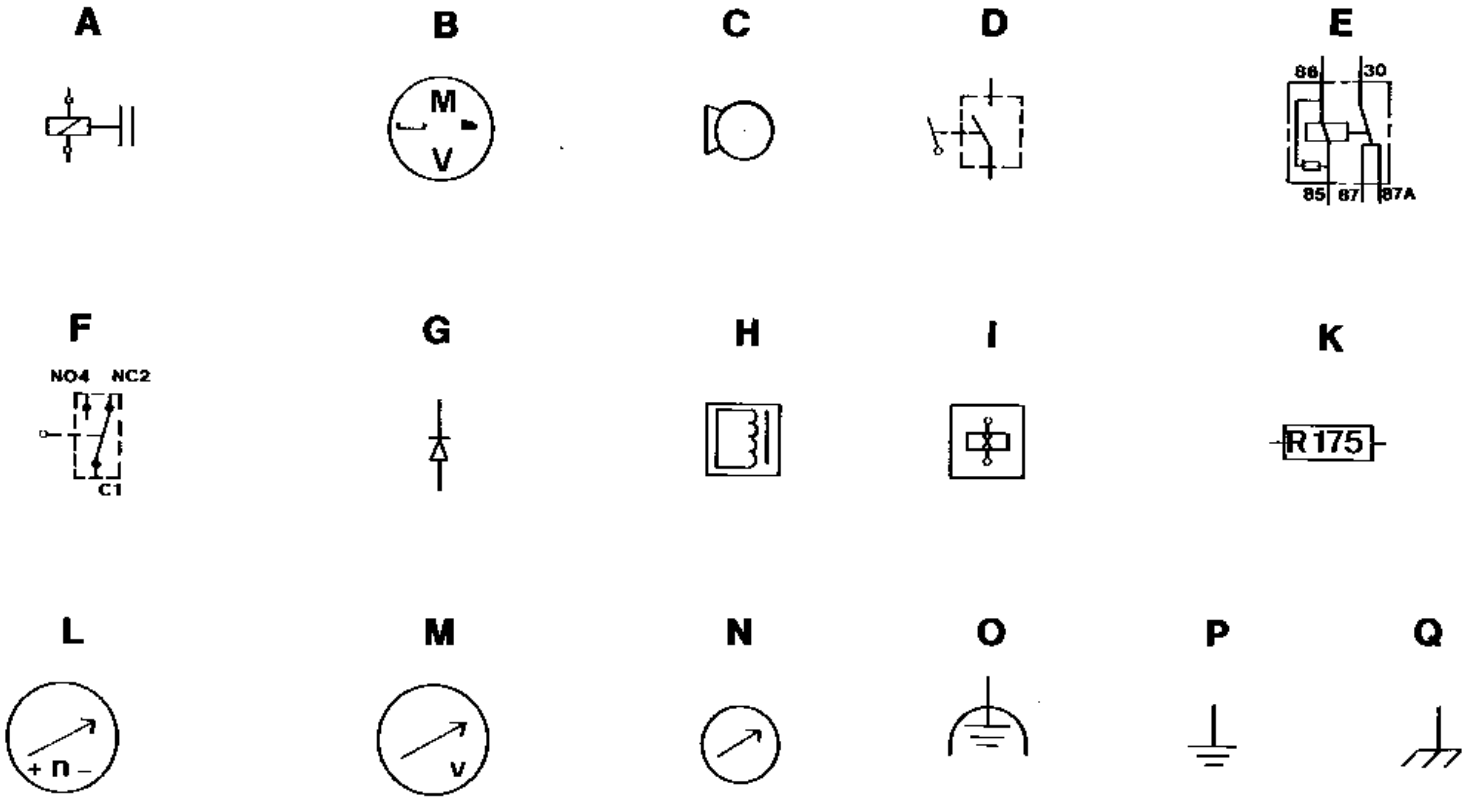
Symbols in functional schematic, wiring and harness diagrams

LEGEND:

A	Alternator with rectifier and regulator
B	Starting motor with solenoid
C	Fuel pump
D	Compressor
E	Battery
F	Fuse
G	Bulb with one luminous element
H	Bulb with two luminous elements
I	Radio
K	Loudspeaker
L	Horn
M	Valve, operated electro-mechanically
N	Switch, actuated by pressure
O	Switch, actuated by temperature
P	Variable resistor



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Symbols in functional schematic, wiring and harness diagrams

LEGEND:

A	Electric clutch
B	Wiper motor
C	Buzzer
D	Mechanical switch
E	Center-zero relay
F	Mechanical switch (microswitch)
G	Diode
H	Sensor
I	Hall sending unit
K	Resistor
L	Tachometer
M	Tachometer
N	Control unit
O	Battery ground
P	Cable ground
Q	Vehicle ground

Reference 210-15-046, Troubleshooting Unsolved Problems

→NOTE:

This reference deals with the troubleshooting of problems that persist after standard diagnosis has been carried out. These problems are usually caused by certain operating conditions, by intermittent malfunctions, or, in rare cases by a failed controller. Depending on the situation, some or all of the following information may be of importance.

[1] - Problems caused by certain operating conditions:

Check all recorded diagnostic trouble codes and ask the operator for operating and vehicle conditions at the time the problem occurred. Write down details.

- Does the diagnostic trouble code/problem appear together with other problems?
- Does the diagnostic trouble code/problem appear when the machine is at operating temperature or when the machine is cold?
- Does the diagnostic trouble code/problem appear during field operation or during transport?
- Does the diagnostic trouble code/problem appear when certain operational procedures are carried out (e.g. shifting, turning, braking or operating certain hydraulic functions)?
- When did the diagnostic trouble code/problem appear first? Has service work been carried out recently? If yes, check areas where service work was performed for damage and improperly installed parts.

Try to generate the diagnostic trouble code/problem again by creating the same conditions. If possible, repeat the operational, system relevant, electric, hydraulic or mechanic tests under these conditions.

[2] - Problems caused by intermittent electric failures:

→NOTE:

Intermittent electrical failures are usually caused by wiring harness, terminal or connector problems.

- Check all connectors and terminals of the electric circuits associated with the malfunction.
- Check if harnesses or connectors are obstructed by mechanical parts.
- Check harnesses for missing or poor fasteners or tie bands. Wiring harnesses that are too loose or too tight may lead to worn or damaged cables.
- Check that mechanical parts are in good working condition.

210-15-050, Visual Check of the Electrical System

If a customer reports a problem, perform a visual check of the electrical system before starting the tractor.

[1] - Check for frayed leads.

[2] - Check for missing or worn insulation; this can point to a conductor problem.

[3] - Check for loose or broken connections and wiring leads.

[4] - Check battery for:

- Corroded terminal connections
- Loose cable clamps or battery posts
- Dirty batteries
- Wet batteries

- Cracked case
- Correct electrolyte level

[5] - Check the alternator belt tension.

[6] - Check for overheated components five minutes after the engine has been shut off. Often there will be the smell of burnt insulation. Place your hand on the alternator. The presence of heat after the engine has been off for some time is a sure sign of a charging circuit problem.

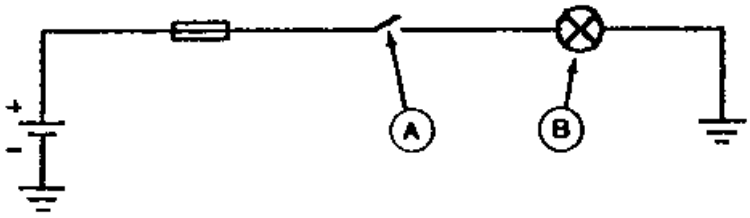
[7] - If the visual check does not isolate a possible problem, but the results do not indicate the engine should not be started, turn the ignition key to the IGN position. Check the accessory circuits, indicator lights, etc. How are these individual components working? Look for sparks or smoke as signs of shorts.

[8] - Start the engine. Check all indicators for proper operation; determine if the system is charging or discharging.

[9] - In short, check for any abnormal conditions.

Many electrical faults cannot be identified even if the engine is started. For this reason the electrical system should be systematically and completely checked.

Reference 210-15-055, Electrical Circuit Malfunctions



Electrical circuit malfunction areas

Malfunctions

There are only four circuit malfunctions.

- High-Resistance Circuit (GO TO 1).
- Open Circuit (GO TO 1).
- Grounded Circuit (GO TO 2).
- Shorted Circuit (GO TO 3).

There are only three sections in a simple circuit where these malfunctions occur: Before the controlling switch (A), between the controlling switch (A) and the load (B), and after load (B).

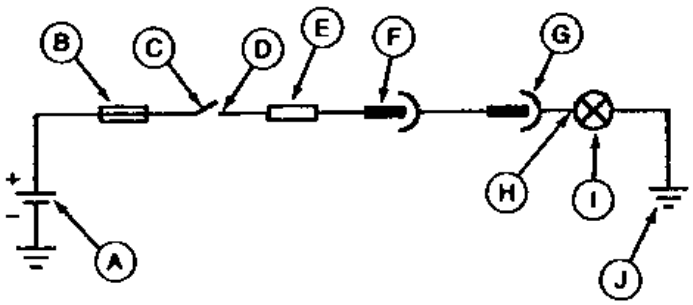
Component malfunctions can easily be confused with circuit malfunctions. Therefore, care must be exercised when isolating the cause of the problem.

Example: A component may not operate before disconnecting an electrical connection, but it operates after reconnecting the connector. Cause: High resistance created a voltage drop at the connector terminals which prevented the proper amount of current from flowing to the component.

Types of fault

(1) High resistance or open circuit

Action:



LEGEND:

A	Battery
B	Fuse
C	Switch
D	Component terminal
E	Circuit resistor
F	Circuit connector
G	Circuit connector
H	Component terminal
I	Lamp
J	Ground

High resistance or open circuit

A high resistance circuit can result in slow, dim or no component operation (e.g. loose, corroded, dirty or oily terminal, also if

the gauge of the wire is too small or broken strands exist).

An open circuit results in no component operation because the circuit is incomplete (e.g. broken wire, terminals disconnected, open protective device on switch).

To isolate the location of a “high resistance” or “open circuit”:

[1] - With the controlling switch (C) ON and the load (I) connected into the circuit, check for proper voltage at a location easily accessible between (D) and (H).

If voltage is low, move toward voltage source (A) to locate point of voltage drop.

→NOTE:

The example shows high resistance between (D) and (F) and open circuit between (F) and (G).

If voltage is correct, move toward load (I) and ground terminal (J) to locate voltage drop.

[2] - Repair circuit as required.

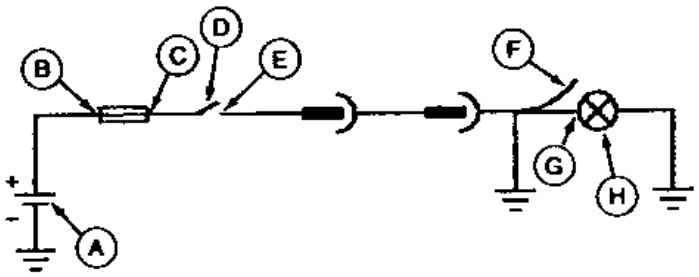
Result:

NO: Repeat check-out procedure after repair.

YES: See procedure for “Grounded Circuit”: GO TO 2 ..See procedure for “Shorted Circuit”: GO TO 3 .

(2) Grounded circuit

Action:



LEGEND:

A	Battery
B	Fuse terminal
C	Fuse terminal
D	Switch
E	Component terminal
F	Grounded circuit
G	Component terminal
H	Lamp

Grounded Circuit

A grounded circuit results in no component operation and the fuse or circuit breaker open (e.g. power wire contacting ground).

To isolate the location of a grounded circuit:

[1] - With controlling switch (D) OFF, check for continuity to ground between (C) and (D).

If there is continuity, there is a grounded circuit between (C) and (D). Repair circuit.

No continuity, go to 2.

[2] - Disconnect load (H) at (G).

[3] - With controlling switch (D) OFF, check continuity to ground between (D and F).

If there is continuity, there is a grounded circuit between (E) and (F). Repair circuit.

→NOTE:

The example is grounded between (E) and (F).

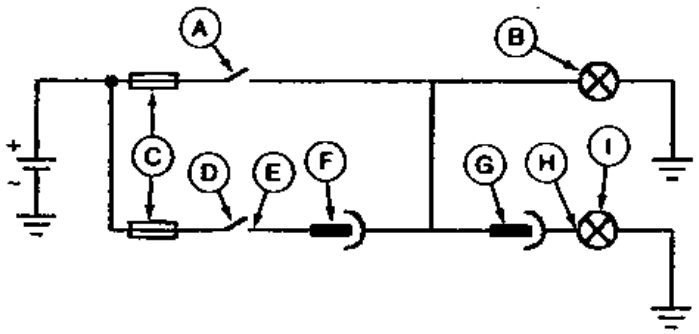
Result:

NO: Repeat check-out procedure after repair.

YES: See procedure for “Shorted Circuit”: GO TO 3 .

(3) Shorted circuit

Action:



LEGEND:

A	Switch
B	Lamp
C	Fuse
D	Switch
E	Component terminal
F	Circuit connector
G	Circuit connector
H	Component terminal
I	Lamp

Shorted circuit

A shorted circuit usually results in two components operating when one of two switches is turned on (e.g. improper wire-to-wire contact). Components can also become shorted. However, shorted components will usually open the circuit protection device.

To isolate the location of a shorted circuit:

[1] - Turn switch (A) ON for correct lamp (B) to operate.

[2] - Start at controlling switch (D) of lamp (I) that should not be operating and disconnect the wire at terminal (E).

[3] - Follow circuit and disconnect wire at connectors (F, G or H) until the extra lamp (I) stops operating.

[4] - The short or improper connection will be between the last two locations where the wire was disconnected. In our example, it is between (F) and (G).

[5] - Repair circuit as follows:

Wires not in a loom: Wrap individual wire with electrical tape or replace the damaged wire and band as required.

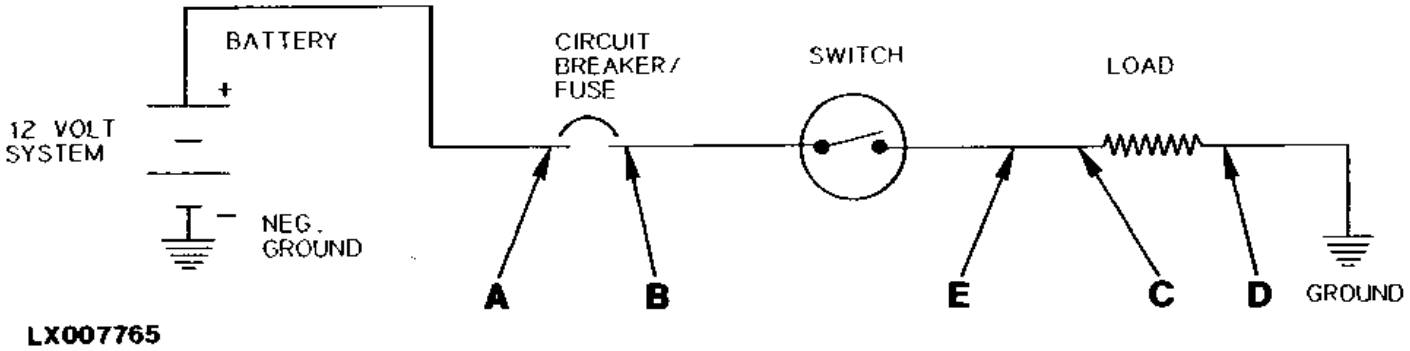
Wires in a loom: If hot spots exist in shorted area of loom, replace harness. If hot spots are not noticeable, install a new wire of

proper gauge between the last two connections. Band wire to outside of harness.

Result:

NO: Repeat check-out procedure after repair.

Reference 210-15-060, Seven Step Electrical Test Procedure



Electrical test procedure

LEGEND:

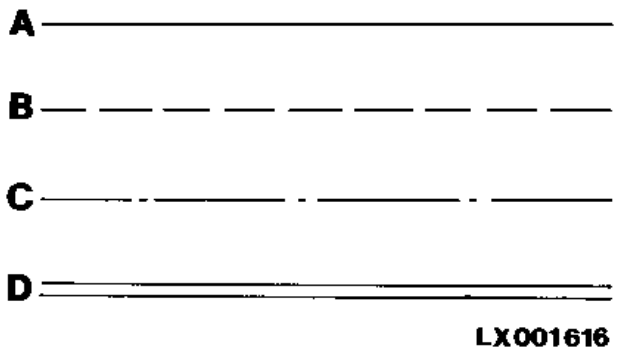
A	Component terminal
B	Component terminal
C	Component terminal
D	Component terminal
E	Wire

Electrical test procedure

Step 1—Switch ON	
Check battery side of circuit breaker (A) for battery voltage	Battery voltage normal. Go to step 2.
	Low voltage, repair high resistance or open circuit from battery.
Step 2—Switch OFF	
Check load side of circuit breaker (B) for battery voltage	Battery voltage normal. Go to step 4.
	Low voltage, replace circuit breaker.
	No voltage. Go to step 3.
Step 3—Switch OFF	
Check load side of circuit breaker (B) for continuity to ground. Clip at battery voltage (A)	Continuity to ground. Repair grounded circuit at or before switch.
	No continuity to ground, replace circuit breaker.
Step 4—Switch ON	
Check load side of circuit breaker (B) for battery voltage	Battery voltage normal. Go to step 6.
	Low voltage, replace circuit breaker.
	No voltage. Go to step 5.
Step 5 [A multimeter will not apply a load to the circtuit at step 5. The multimeter result is tested as a voltage condition in the result column.]	
Disconnect lead to component at (C). Switch ON. Check lead (E) for battery voltage	Battery voltage, repair component.
	No voltage, repair grounded circuit at or after switch.
Step 6—Switch ON	
Check lead to component at (C) for battery voltage	Battery voltage normal. Go to step 7.
	Low voltage, repair high resistance in circuit between fuse and component.
	No voltage, repair high resistance or open circuit between fuse and component.
Step 7—Switch ON	
Check ground lead of component at (D) for voltage	No voltage, good continuity to ground. Repair component.
	Voltage, poor continuity to ground. Repair high resistance or open ground circuit.

210-15-065, Hydraulic System — Circuit Symbols

Lines

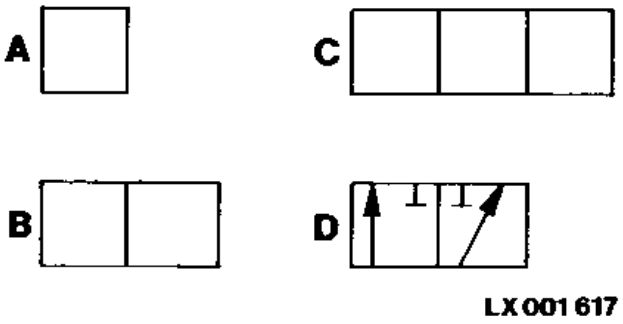


LEGEND:

A	Oil line or passage
B	Pilot (control) line
C	Sub-assembly enclosure
D	Mech. connections (e.g. shafts)

Hydraulic symbols—lines

Valves



LEGEND:

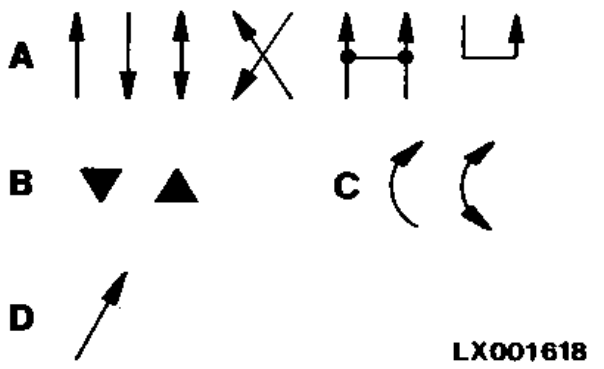
A	With one operating position
B	With two operating positions
C	With three operating positions
D	3/2 directional control valve

Hydraulic Symbols—Valves

→NOTE:

When designating a valve such as the 3/2 directional control valve (D), the first figure indicates the number of connections, and the second the number of operating positions.

Arrows

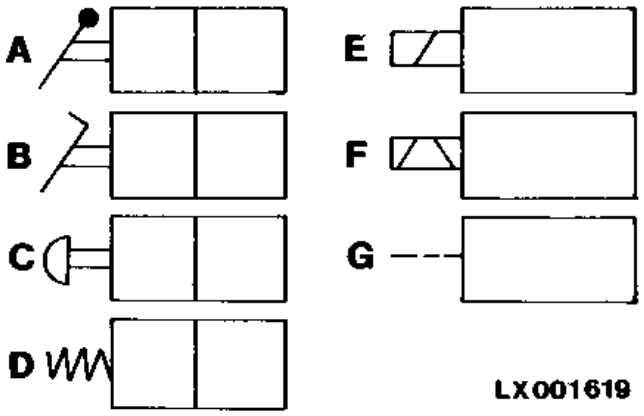


LEGEND:

A Direction of throughflow (in valves)
B Direction of flow (in lines)
C Direction of rotation (at component)
D Adjustable or variable components

Hydraulic Symbols—Arrows

Valve actuation



LEGEND:

A Lever
B Pedal
C Button
D Spring
E Electro-magnet (with one coil)
F Electro-magnet (with two coils)
G Pressure

Hydraulic symbols—Valve actuation

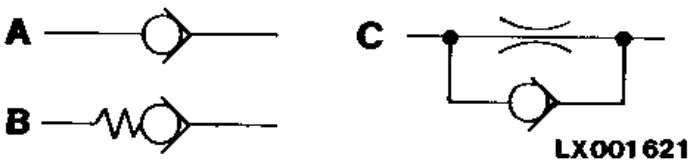
Detent Valves

LEGEND:

A With one detent position
B With two detent positions

Hydraulic symbols—detent valves

Check Valves



LEGEND:

A Check valve without spring
B Spring-loaded check valve
C With restricting effect in closed position

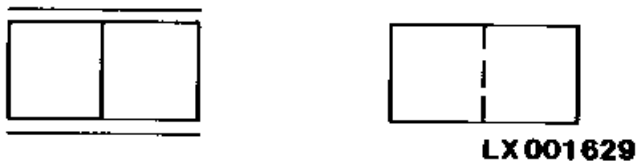
Hydraulic symbols—check valves

Pressure Relief Valves

LEGEND:
A Pilot pressure preset by a spring
B Pilot pressure controlled by pilot line

Hydraulic symbols—pressure relief valves

Proportional Valves (with Transition)



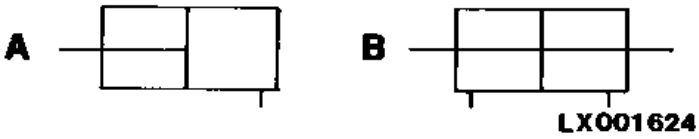
Hydraulic symbols—directional control valves with restricting effect

Restrictors

LEGEND:
A Constant
B Variable

Hydraulic symbols—restrictors

Hydraulic Cylinders



LEGEND:
A Single-acting
B Double-acting

Hydraulic symbols—hydraulic cylinders

Pumps

LEGEND:
A Constant
B Variable

Hydraulic Symbols—Pumps

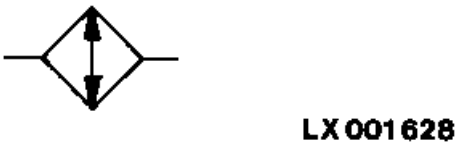
Hydraulic Motor

Hydraulic symbols—hydraulic motor

Filter or Screen

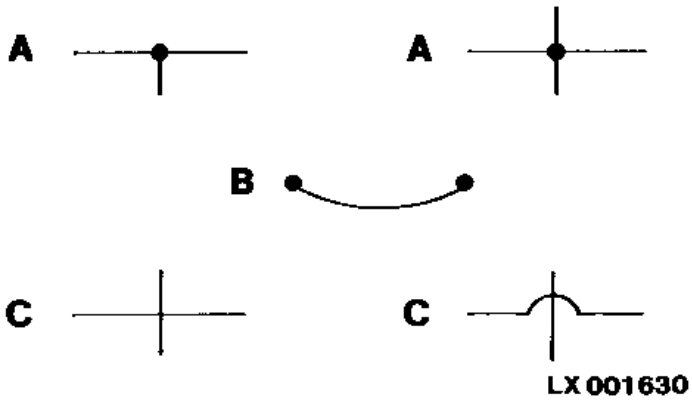
Hydraulic symbols—filter or screen

Cooler



Hydraulic symbols—cooler

Line Connections and Junctions



LEGEND:

A	Line connections
B	Hose
C	Line junctions

Hydraulic symbols—connections & junctions

Connections

LEGEND:

A	Quick coupler
B	Test port

Hydraulic symbols—connections

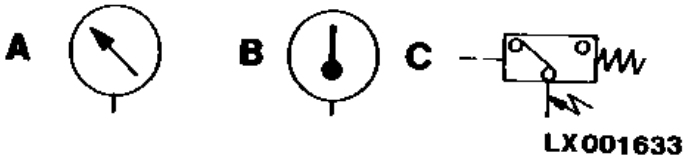
Reservoirs/Tanks

LEGEND:

A	Open (sump)
B	Under pressure

Hydraulic symbols—reservoirs/tanks

Sensors

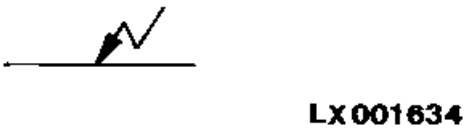


LEGEND:

A	Pressure sensor
B	Temperature sensor
C	Pressure switch

Hydraulic symbols—sensors

Electrical Lines



Hydraulic symbols—electrical lines

Section 220 - ENGINE

Table of contents