

Alternators and Starter Motors

TECHNICAL MANUAL
Alternators and Starter Motors
CTM77 18JUL05 (ENGLISH)

Introduction

Foreword

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

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



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

This Component Technical Manual (CTM) contains the latest available instructions necessary to repair engine alternators and starter motors. It includes theory of operation, and diagnostic and testing procedures to help troubleshoot and understand potential failure modes.

The information is organized in sections and groups by various suppliers. At the beginning of each repair 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.

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

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

This manual covers alternator and starter motor applications for all John Deere diesel engines—both older 300/400/500-Series and newer POWERTECH® and PowerTech Plus™ 2.4 L—13.5 L engines. This manual covers components for both Deere OEM engines and Deere machine engine applications.

NOTE: Remanufactured alternators and starter motors are available for replacement on most applications listed in this manual. Refer to John Deere's "Remanufactured Components" catalogs PC2344 (Ag), PC2345 (CE) and PC2346 (C&CE) to cross-reference your original equipment part number and obtain a suitable remanufactured replacement starter or alternator.

John Deere Dealers

IMPORTANT: Please copy this page listing changes and route it through your service department.

This CTM is a complete revision of CTM77, Alternators and Starter Motors, dated 25 Sep 02. **Discard CTM77 dated 25 Sep 02 and replace it with this new manual.**

This manual covers alternators and starter motors on all John Deere and OEM applications manufactured since 1972, except 40, 50 and 55 Series Utility Tractors.

Revised information includes:

1. Updated test specifications for all current alternators and starter motors, including those adopted since the 25 Sep 02 edition.
2. Added new applications for all current alternators and starter motors.
3. Added new Bosch alternator pulley removal procedure to Section 30, Group 10.
4. Updated torque charts in Section 05, Group 10.

OURGP11,0000053 -19-15JUL05-1/1

Contents

SECTION 05—Introduction and Safety Information

- Group 05—Safety
- Group 10—General Information
- Group 15—Electrical System Basic Information and Wiring Diagrams

SECTION 10—Delco-Remy Alternators

- Group 05—Delco-Remy Alternator Theory of Operation
- Group 10—Delco-Remy (Delcotron) 10SI, 12SI and 15SI Alternator Repair
- Group 15—Delco-Remy (Delcotron) 21SI Alternator Repair

SECTION 15—Motorola Alternators

- Group 05—Motorola Alternator Theory of Operation
- Group 10—Motorola 8E-Series Alternator Repair
- Group 15—Motorola HC-, MA-, MR-Series Alternator Repair
- Group 20—Motorola A-, RA-, 8AR-Series Alternator Repair
- Group 25—Motorola SA-Series Alternator Repair
- Group 30—Motorola TA-Series Alternator Repair

SECTION 20—Nihoff Alternators

- Group 05—Nihoff Alternator Theory of Operation
- Group 10—Nihoff 12-Volt, 110-Amp Alternator Repair
- Group 15—Nihoff 24-Volt, 50-Amp Alternator Repair

SECTION 25—Denso Alternators

- Group 05—Denso Alternator Theory of Operation
- Group 10—Denso Alternator with Add-On Regulator Repair
- Group 15—Denso Alternator with Built-In Regulator Repair

SECTION 30—Bosch Alternators

- Group 05—Bosch Alternator Theory of Operation
- Group 10—Bosch Alternator Repair

SECTION 35—Valeo Alternators

- Group 05—Valeo Alternator Theory of Operation
- Group 10—Valeo Alternator Repair
- Group 15—Valeo A13N-Series Alternator Repair

SECTION 40—Magnetron Alternators

- Group 05—Magnetron Alternator Theory of Operation
- Group 10—Magnetron Alternator Repair

SECTION 45—Leece-Neville Alternators

- Group 05—Leece-Neville Alternator Theory of Operation
- Group 10—Leece-Neville Alternator Repair

SECTION 50—Prestolite Alternators

- Group 05—Prestolite Alternator Theory of Operation
- Group 10—Prestolite Alternator Repair

SECTION 55—Iskra Alternators

- Group 05—Iskra Alternator Theory of Operation
- Group 10—Iskra Alternator Repair

SECTION 60—Delco-Remy Starter Motors

- Group 05—Starting Circuit Theory of Operation
- Group 10—Delco-Remy 10/20/22/25/27/28MT Starter Motor Repair
- Group 15—Delco-Remy 30MT, 35MT, 37MT Starter Motor Repair
- Group 20—Delco-Remy 40MT, 41MT, 42MT, 50MT Starter Motor Repair

SECTION 65—John Deere/Denso Starter Motors

- Group 05—Starting Circuit Theory of Operation
- Group 10—John Deere/Denso Conventional Starter Motor Repair
- Group 15—John Deere/Denso Gear Reduction Starter Motor Repair
- Group 20—John Deere/Denso Planetary Starter Motor Repair

SECTION 70—Bosch Starter Motors

- Group 05—Starting Circuit Theory of Operation
- Group 10—Bosch Conventional Starter Motor Repair
- Group 15—Bosch Planetary Gear Starter Motor Repair

Continued on next page

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05

SECTION 75—Iskra Starter Motors

Group 05—Starting Circuit Theory of Operation

Group 10—Iskra AZE/AZF/AZJ-Type Starter Motor
Repair

Group 15—Iskra AZE-Type Starter Motor Repair

10

SECTION 80—Valeo Starter Motors

Group 05—Starting Circuit Theory of Operation

Group 10—Valeo Starter Motor Repair

15

SECTION 85—Magnetron Starter Motors

Group 05—Starting Circuit Theory of Operation

Group 10—Magnetron Starter Motor Repair

20

25

30

35

40

45

50

Contents

55

60

65

70

75

80

85

INDX

Contents

55

60

65

70

75

80

85

INDX

Section 05

Introduction and Safety Information

Contents

	Page
Group 05—Safety	05-05-1
Group 10—General Information	
Unified Inch Bolt and Screw Torque Values . . .	05-10-1
Metric Bolt and Screw Torque Values	05-10-2
Group 15—Electrical System Basic Information and Wiring Diagrams	
Electrical Circuit Malfunctions	05-15-1
High Resistance Circuit	05-15-2
Open Circuit	05-15-3
Grounded Circuit	05-15-5
Shorted Circuit	05-15-7
Seven Step Electrical Test Procedure	05-15-8
Multimeter	05-15-10

Handle Fluids Safely—Avoid Fires

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

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

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

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



TS227 -UN-23AUG88

DX,FLAME -19-29SEP98-1/1

Prevent Battery Explosions

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

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

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



TS204 -UN-23AUG88

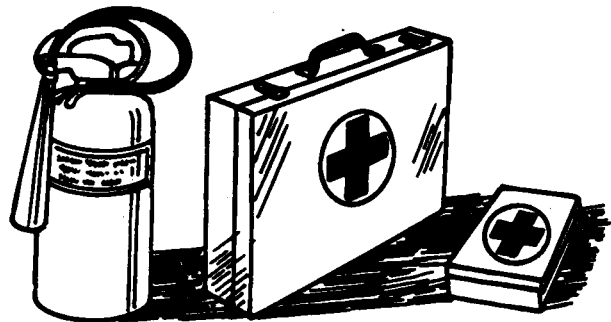
DX,SPARKS -19-03MAR93-1/1

Prepare for Emergencies

Be prepared if a fire starts.

Keep a first aid kit and fire extinguisher handy.

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



TS291 -UN-23AUG88

DX,FIRE2 -19-03MAR93-1/1

Handling Batteries Safely

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

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

Always remove grounded (—) battery clamp first and replace it last.

! **CAUTION:** 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. Using 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.

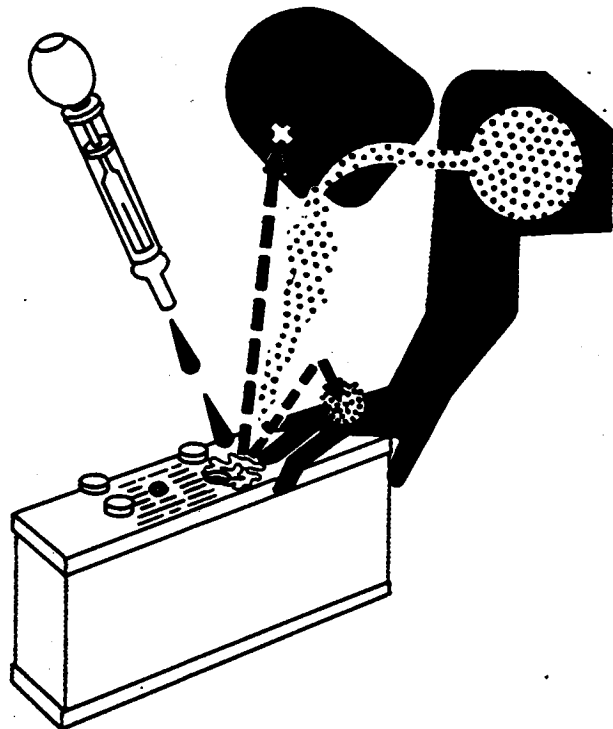
If acid is swallowed:

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.

WARNING: Battery posts, terminals, and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm. **Wash hands after handling.**



TS204 -UN-23AUG88



TS203 -UN-23AUG88

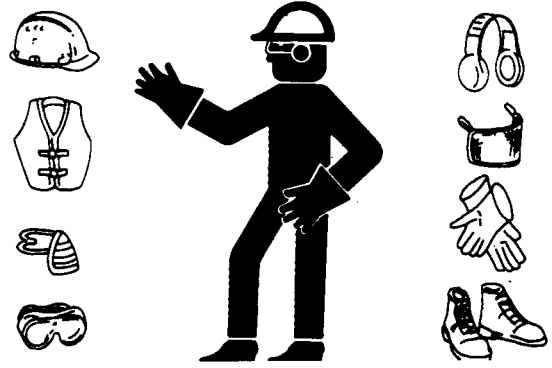
Wear Protective Clothing

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

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

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

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



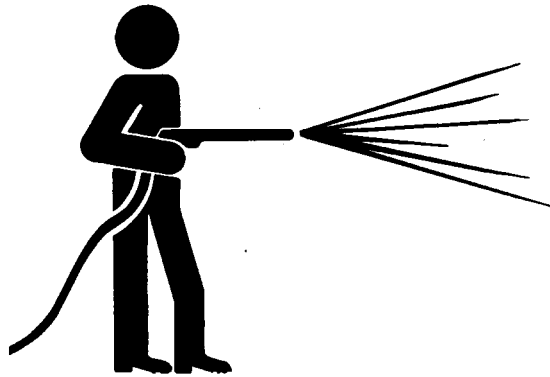
TS206 -UN-23AUG88

DX,WEAR -19-10SEP90-1/1

Work in Clean Area

Before starting a job:

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



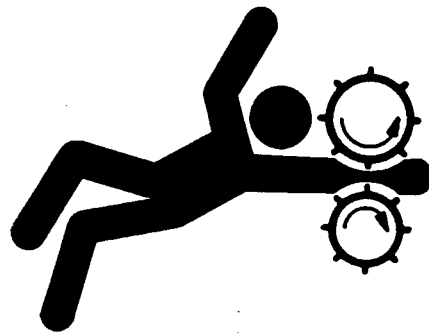
T6642EJ -UN-18OCT88

DX,CLEAN -19-04JUN90-1/1

Service Machines Safely

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

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



TS228 -UN-23AUG88

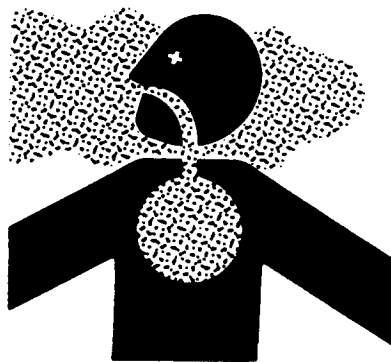
DX,LOOSE -19-04JUN90-1/1

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05
4

Work In Ventilated Area

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

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

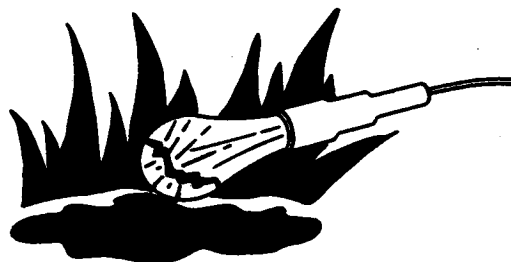


TS220 -UN-23AUG88

DX,AIR -19-17FEB99-1/1

Illuminate Work Area Safely

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



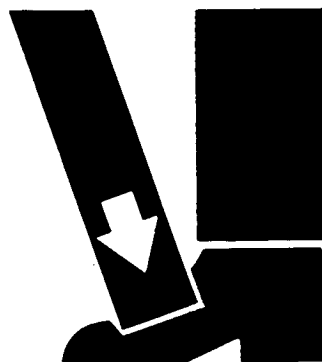
TS223 -UN-23AUG88

DX,LIGHT -19-04JUN90-1/1

Use Proper Lifting Equipment

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

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



TS226 -UN-23AUG88

DX,LIFT -19-04JUN90-1/1

Remove Paint Before Welding or Heating

Avoid potentially toxic fumes and dust.

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

Remove paint before heating:

- Remove paint a minimum of 76 mm (3 in.) from area to be affected by 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.

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.



TSS20 -JUN-23AUG88

DX,PAINT -19-19JUL01-1/1

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Practice Safe Maintenance

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.



TS218 -UN-23AUG88

DX,SERV -19-17FEB99-1/1

Use Proper Tools

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

Use power tools only to loosen threaded parts and fasteners.

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

Use only service parts meeting John Deere specifications.



TS779 -UN-08NOV89

DX,REPAIR -19-17FEB99-1/1

Dispose of Waste Properly

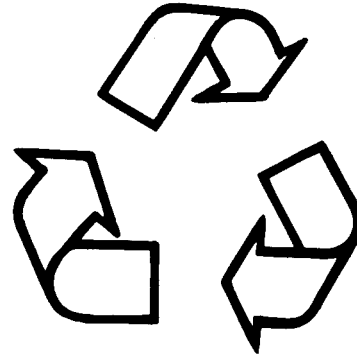
Improperly disposing of waste can threaten the environment and ecology. Potentially harmful waste used with John Deere equipment include such items as oil, fuel, coolant, brake fluid, filters, and batteries.

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.



TSS1133 -UN-26NOV90

DX,DRAIN -19-03MAR93-1/1

Prevent Machine 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.



TS177 -UN-11JAN89

DX,BYPAS1 -19-29SEP98-1/1

Live With Safety

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

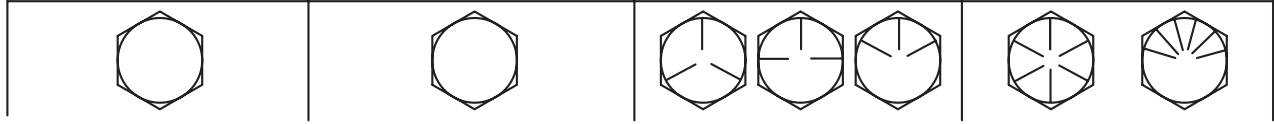


TS231 -19-07OCT88

DX,LIVE -19-25SEP92-1/1

Unified Inch Bolt and Screw Torque Values

TS1671 -UN-01MAY03



Bolt or Screw	SAE Grade 1				SAE Grade 2 ^a				SAE Grade 5, 5.1 or 5.2				SAE Grade 8 or 8.2			
	Lubricated ^b		Dry ^c		Lubricated ^b		Dry ^c		Lubricated ^b		Dry ^c		Lubricated ^b		Dry ^c	
Size	N•m	lb-in	N•m	lb-in	N•m	lb-in	N•m	lb-in	N•m	lb-in	N•m	lb-in	N•m	lb-in	N•m	lb-in
1/4	3.7	33	4.7	42	6	53	7.5	66	9.5	84	12	106	13.5	120	17	150
													N•m	lb-ft	N•m	lb-ft
5/16	7.7	68	9.8	86	12	106	15.5	137	19.5	172	25	221	28	20.5	35	26
									N•m	lb-ft	N•m	lb-ft				
3/8	13.5	120	17.5	155	22	194	27	240	35	26	44	32.5	49	36	63	46
			N•m	lb-ft	N•m	lb-ft	N•m	lb-ft								
7/16	22	194	28	20.5	35	26	44	32.5	56	41	70	52	80	59	100	74
	N•m	lb-ft														
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

Torque values listed are for general use only, based on the strength of the bolt or screw. DO NOT use these values if a different torque value or tightening procedure is given for a specific application. For plastic insert or crimped steel type lock nuts, for stainless steel fasteners, or for nuts on U-bolts, see the tightening instructions for the specific application. Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical grade.

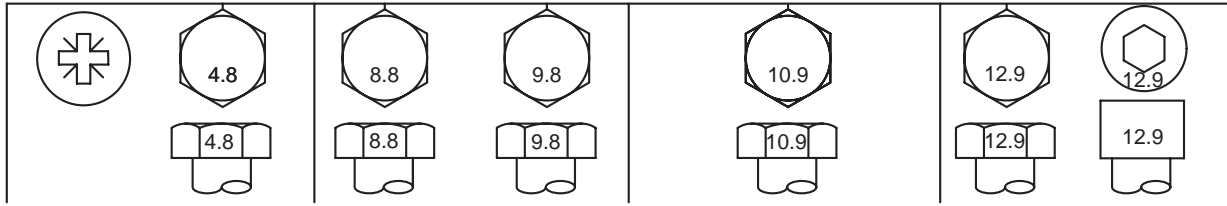
Replace fasteners with the same or higher grade. If higher grade fasteners are used, tighten these to the strength of the original. Make sure fastener threads are clean and that you properly start thread engagement. When possible, lubricate plain or zinc plated fasteners other than lock nuts, wheel bolts or wheel nuts, unless different instructions are given for the specific application.

^aGrade 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, fasteners with phosphate and oil coatings, or 7/8 in. and larger fasteners with JDM F13C zinc flake coating.

^c"Dry" means plain or zinc plated without any lubrication, or 1/4 to 3/4 in. fasteners with JDM F13B zinc flake coating.

Metric Bolt and Screw Torque Values



TS1670 -UN-01MAY03

Bolt or Screw	Class 4.8				Class 8.8 or 9.8				Class 10.9				Class 12.9			
	Lubricated ^a		Dry ^b		Lubricated ^a		Dry ^b		Lubricated ^a		Dry ^b		Lubricated ^a		Dry ^b	
Size	N•m	lb-in	N•m	lb-in	N•m	lb-in	N•m	lb-in	N•m	lb-in	N•m	lb-in	N•m	lb-in	N•m	lb-in
M6	4.7	42	6	53	8.9	79	11.3	100	13	115	16.5	146	15.5	137	19.5	172
									N•m	lb-ft	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft
M8	11.5	102	14.5	128	22	194	27.5	243	32	23.5	40	29.5	37	27.5	47	35
			N•m	lb-ft	N•m	lb-ft	N•m	lb-ft								
M10	23	204	29	21	43	32	55	40	63	46	80	59	75	55	95	70
	N•m	lb-ft														
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

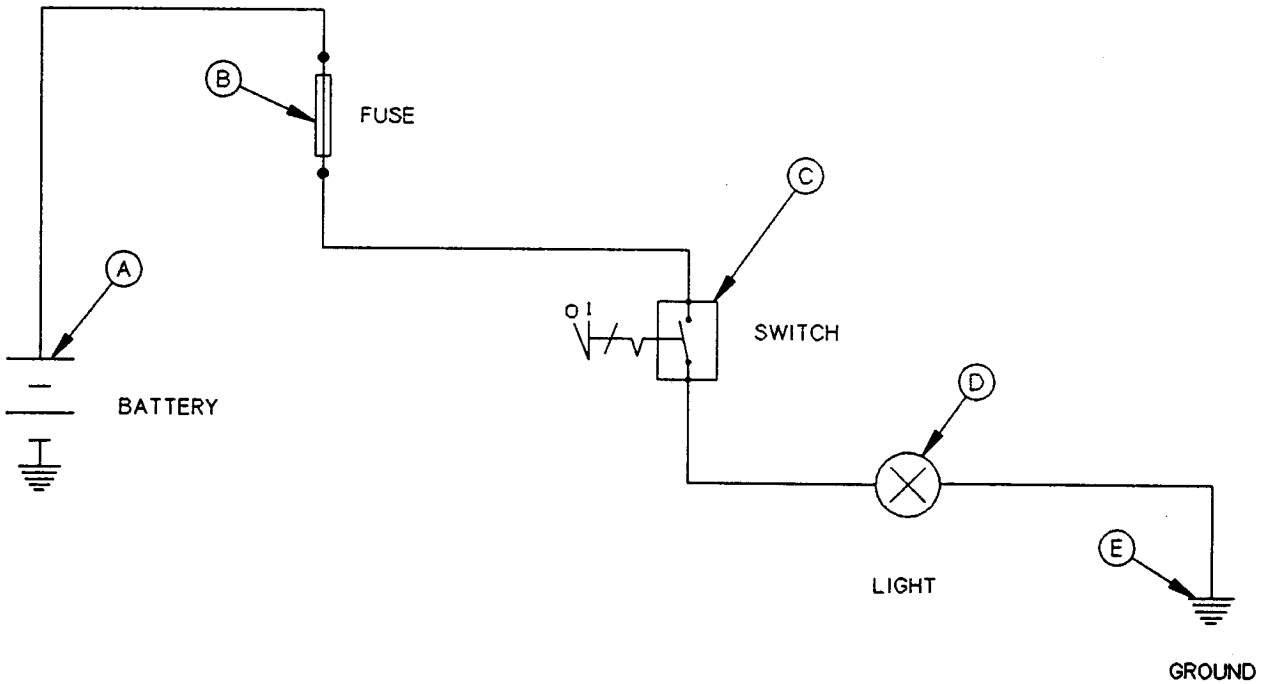
Torque values listed are for general use only, based on the strength of the bolt or screw. DO NOT use these values if a different torque value or tightening procedure is given for a specific application. For stainless steel fasteners or for nuts on U-bolts, see the tightening instructions for the specific application. Tighten plastic insert or crimped steel type lock nuts by turning the nut to the dry torque shown in the chart, unless different instructions are given for the specific application.

Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical property class. Replace fasteners with the same or higher property class. If higher property class fasteners are used, tighten these to the strength of the original. Make sure fastener threads are clean and that you properly start thread engagement. When possible, lubricate plain or zinc plated fasteners other than lock nuts, wheel bolts or wheel nuts, unless different instructions are given for the specific application.

^a“Lubricated” means coated with a lubricant such as engine oil, fasteners with phosphate and oil coatings, or M20 and larger fasteners with JDM F13C zinc flake coating.

^b“Dry” means plain or zinc plated without any lubrication, or M6 to M18 fasteners with JDM F13B zinc flake coating.

Electrical Circuit Malfunctions



T7713AD (CV)

T7713AD -19-27FEB92

A—Battery
B—Fuse

C—Switch

D—Light

E—Ground

1. There are four common circuit malfunctions.

- High-Resistance Circuit
- Open Circuit
- Grounded Circuit
- Shorted Circuit

2. Three sections in a simple circuit where these malfunctions can occur:

- Before the controlling switch (C).
- Between the controlling switch and before the component, light (D).

- After the component.

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

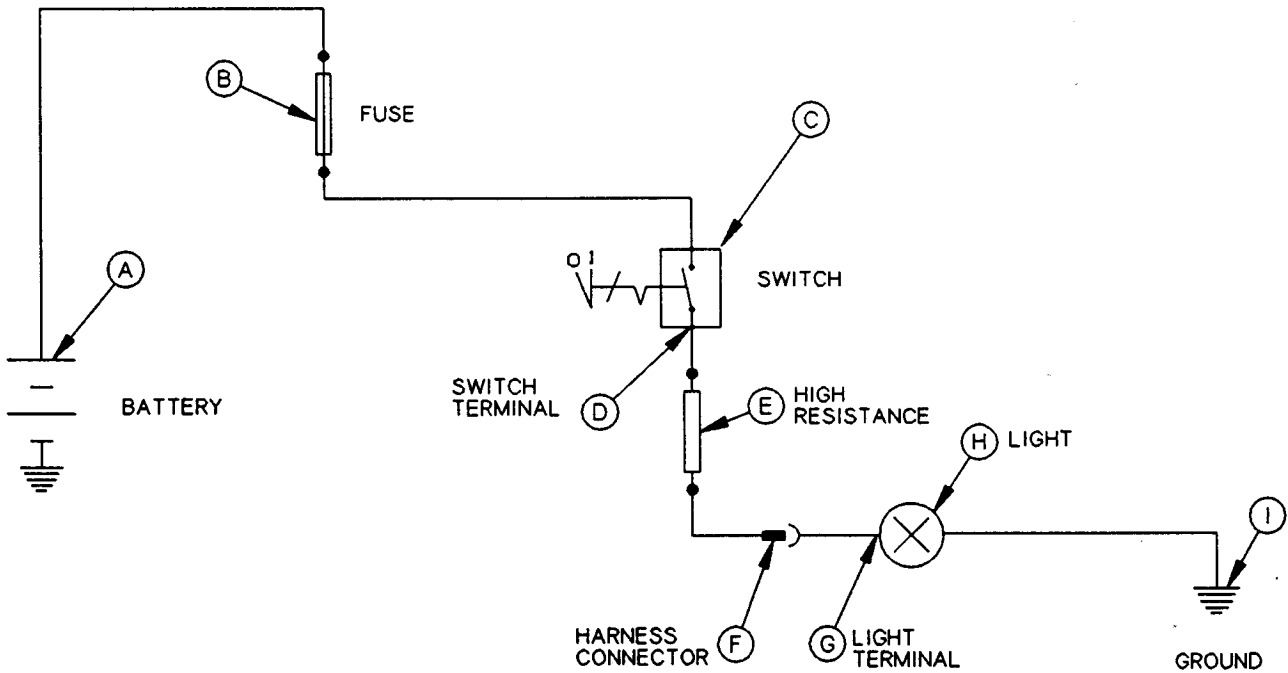
Example: Light does not operate or is dim when switch is turned ON, until switch connector is disconnected and reconnected.

Reason: High resistance caused by a dirty switch connector, caused a voltage drop which prevented the proper amount of current from flowing to the light.

DPSG.OU01004,785 -19-19APR99-1/1

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15
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High Resistance Circuit



T7713AG (CV)

T7713AG -19-26FEB92

A—Battery
B—Fuse
C—Switch

D—Switch Terminal
E—High Resistance

F—Harness Connector
G—Light Terminal

H—Light
I—Ground

A high resistance circuit can result in slow, dim or no component operation.

Examples: Loose, corroded, dirty or oily terminals.
Wire size too small. Strands broken inside the wire.
Poor ground connection to frame.

To locate the cause of high resistance:

With switch (C) ON, check for battery voltage between switch and ground (I) at an easily accessible location, like harness connector (F).

If less than battery voltage is indicated, check again closer to switch.

If battery voltage is indicated, check closer to ground to locate point of voltage drop. The example shows high resistance (E) between switch and harness connector.

Repair circuit as required. In the example, strands were broken inside the wire. Replace that section of wire.

Repeat check-out procedure after repair.