

Product: John Deere 690E LC Excavator Operation And Tests Manual
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690E LC Excavator Operation and Tests

TECHNICAL MANUAL 690E LC Excavator Operation and Tests

TM1508 12JUL05 (ENGLISH)

For complete service information also see:

| | |
|---|--------|
| 690E LC Excavator Repair | TM1509 |
| 6068 Engine (Serial No. —559602) | CTM8 |
| 6068 Engine (Serial No. 559603—) | CTM104 |
| Alternators and Starting Motors | CTM77 |
| Undercarriage Appraisal Manual | SP326 |

**Worldwide Construction
And Forestry Division**
LITHO IN U.S.A.

Sample of manual. Download All 764 pages at:
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Introduction

[xcavator-operation-and-tests-manual/](https://www.arepairmanual.com/downloads/john-deere-690e-lc-e-excavator-operation-and-tests-manual/)

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.

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

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All information, illustrations and specifications in this manual are based on the latest information available at the time of publication. The right is reserved to make changes at any time without notice.

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INDX

Section 9000 General Information

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Follow Safe Procedures

Unsafe work practices are dangerous. Understand service procedure before doing work; do not attempt shortcuts.



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TS231 -19-07OCT88

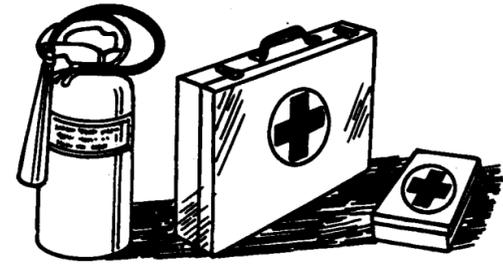
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Prepare for Emergencies

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.



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

TS291 -JUN-23AUG88

Prevent Acid Burns

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

Avoid the hazard by:

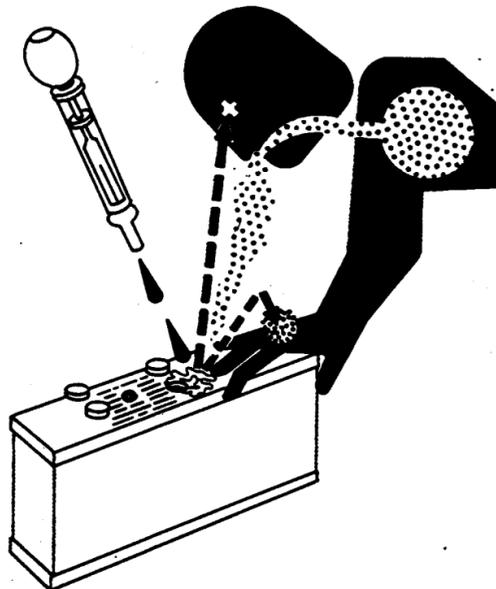
1. Filling batteries in a well-ventilated area.
2. Wearing eye protection and rubber gloves.
3. Avoiding breathing fumes when electrolyte is added.
4. Avoiding spilling or dripping electrolyte.
5. Use proper jump start procedure.

If you spill acid on yourself:

1. Flush your skin with water.
2. Apply baking soda or lime to help neutralize the acid.
3. Flush your eyes with water for 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.



TSS203 -JUN-23AUG88

DX_POISON -19-21APR93-1/1

Handle Chemical Products Safely

Direct exposure to hazardous chemicals can cause serious injury. Potentially hazardous chemicals used with John Deere equipment include such items as lubricants, coolants, paints, and adhesives.

A Material Safety Data Sheet (MSDS) provides specific details on chemical products: physical and health hazards, safety procedures, and emergency response techniques.

Check the MSDS before you start any job using a hazardous chemical. That way you will know exactly what the risks are and how to do the job safely. Then follow procedures and recommended equipment.

(See your John Deere dealer for MSDS's on chemical products used with John Deere equipment.)



TS1132 -JUN-26NOV/90

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DX,MSDS,NA -19-03MAR93-1/1

Handle Fluids Safely—Avoid Fires

Handle fuel with care; it is highly flammable. Do not refuel the machine while smoking or when near open flame or sparks. Always stop engine before refueling machine. Fill fuel tank outdoors.



TS202 -JUN-23AUG88

TX,05,FF1622 -19-14JUN90-1/2

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 -JUN-23AUG88

TX,05,FF1622 -19-14JUN90-2/2

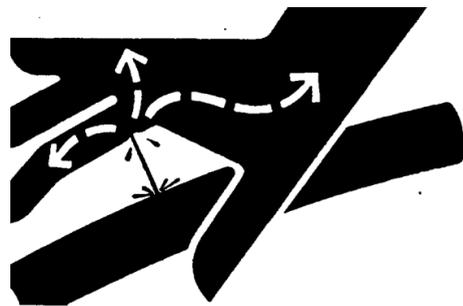
Avoid High-Pressure Fluids

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

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

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

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



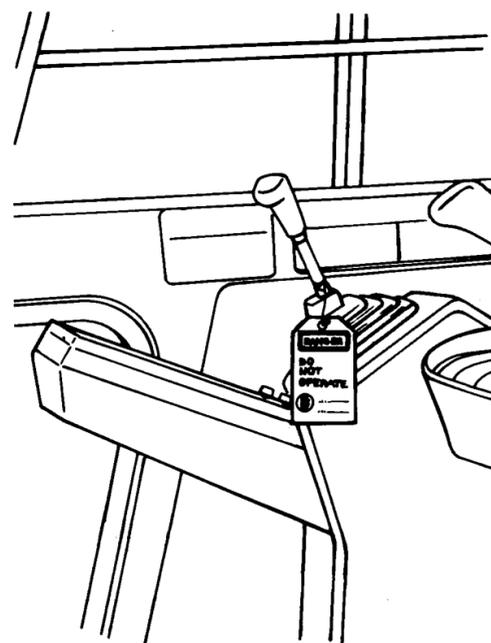
X9811 -UN-23AUG88

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

Warn Others of Service Work

Unexpected machine movement can cause serious injury.

Before performing any work on the machine, attach a "Do Not Operate" tag on the right control lever.



T7273AP -UN-08JUN80

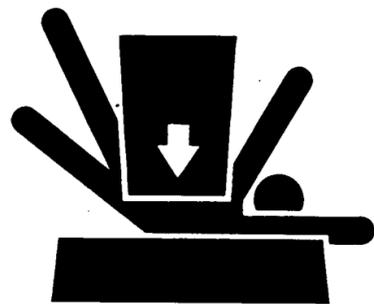
TX,05,RR,566 -19-23JUL91-1/1

Support Machine 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.



TS229 -JUN-23AUG88

DX.LOWER -19-24FEB00-1/1

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Operate Only from Operator's Seat

Avoid possible injury or machine damage. Do not start engine by shorting across starter terminals.

NEVER start engine while standing on ground. Start engine only from operator's seat.



T6607AO -JUN-18OCT88

TX.05.FF1615 -19-14JUN90-1/1

Park Machine Safely

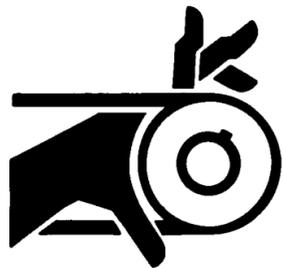
Before working on the machine:

- Park machine on a level surface.
- Lower bucket to the ground.
- Turn auto-idle switch off.
- Run engine in light duty "L" mode without load for 2 minutes.
- Set power mode to low idle "I" and turn key switch to OFF to stop engine. Remove key from switch.
- Pull pilot control shut-off lever to locked position.
- Allow engine to cool.

CED.OUTX782,582 -19-18AUG99-1/1

Stay Clear of Moving Parts

Entanglements in moving parts can cause serious injury.
To prevent accidents, use care when working around rotating parts.



TX,05,RR,572 -19-12JUN90-1/1

T7273AS -JUN-08JUN90

Avoid Power Lines

Serious injury or death can result from contact with electric lines.

Never move any part of the machine or load closer to electric line than 3 m (10 ft) plus twice the line insulator length.



TX,05,RR,594 -19-12JUN90-1/1

T7273AD -JUN-08JUN90

Use Handholds and Steps

Falling is one of the major causes of personal injury.

When you get on and off the machine, always maintain a three point contact with the steps and handrails and face the machine. Do not use any controls as handholds.

Never jump on or off the machine. Never mount or dismount a moving machine.

Be careful of slippery conditions on platforms, steps, and handrails when leaving the machine.



TX,05,DH832 -19-16MAR92-1/1

T6881AN -JUN-15JUN89

Keep Riders Off Machine

Only allow the operator on the machine. Keep riders off.

Riders on machine are subject to injury such as being struck by foreign objects and being thrown off the machine. Riders also obstruct the operator's view resulting in the machine being operated in an unsafe manner.



TX,05,RR,560 -19-05OCT90-1/1

T7273AH -JUN-08JUN90

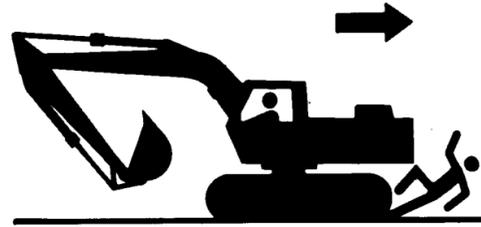
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Move and Operate Machine Safely

Bystanders can be run over. Know the location of bystanders before moving, swinging, or operating the machine.

Always keep the travel alarm in working condition. It warns people when the machine starts to move.

Use a signal person when moving, swinging, or operating the machine in congested areas. Coordinate hand signals before starting the machine.



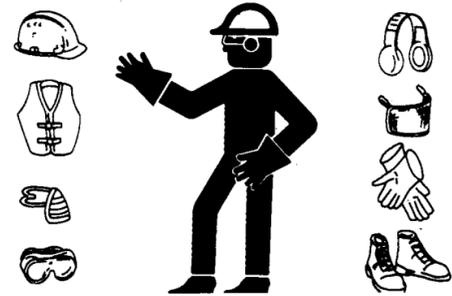
TX,05,FF1806 -19-05OCT90-1/1

T7273AL -JUN-08JUN90

Wear Protective Clothing

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

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

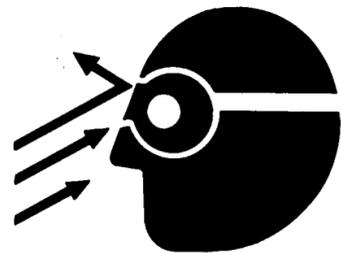


DX,WEAR2 -19-03MAR93-1/1

TS206 -JUN-23AUG88

Protect Against Flying Debris

Guard against injury from flying pieces of metal or debris; wear goggles or safety glasses.



TX,05,FF1613 -19-14JUN90-1/1

T6642DK -JUN-18OCT88

Protect Against Noise

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.



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

TS207 -JUN-23AUG88

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.



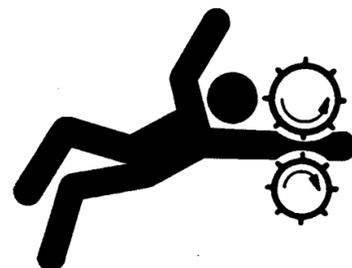
DX,LIGHT -19-04JUN90-1/1

TS223 -JUN-23AUG88

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.



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

TS228 -JUN-23AUG88

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 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.



TS220 -JUN-23AUG88

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DX.PAINT -19-24JUL02-1/1

Avoid Heating Near Pressurized Fluid Lines

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



TS953 -JUN-15MAY90

DX.TORCH -19-10DEC04-1/1

Beware of Exhaust Fumes

Prevent asphyxiation. Engine exhaust fumes can cause sickness or death.

If you must operate in a building, be positive there is adequate ventilation. Either use an exhaust pipe extension to remove the exhaust fumes or open doors and windows to bring enough outside air into the area.



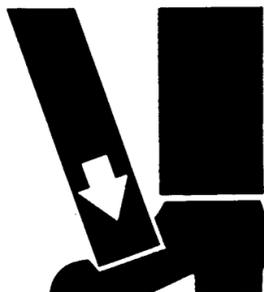
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TS458AO -JUN-18OCT88

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.



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

TS2226 -JUN-23AUG88

Service Cooling System Safely

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

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

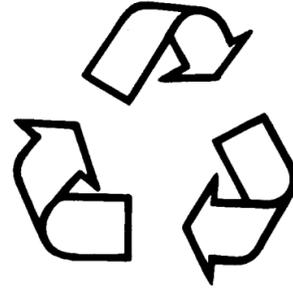


DX,RCAP -19-04JUN90-1/1

TS281 -JUN-23AUG88

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.

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

T51133 -JUN-26NOV/90

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Work in a Clean Area

Before starting a job, clean the work area. Remove objects that may be a safety hazard to the mechanic or bystanders.

TX,05,FF1624 -19-14JUN90-1/1

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Use Tools Properly

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

Use power tools only to loosen threaded tools 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 recommended replacement parts. (See Parts Catalog.)



TS779 -UN-08NOV89

TX.05.FF1614 -19-14JUN90-1/1

Replace Safety Signs

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



TS201 -UN-23AUG88

DX.SIGNS1 -19-04JUN90-1/1

Live With Safety

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



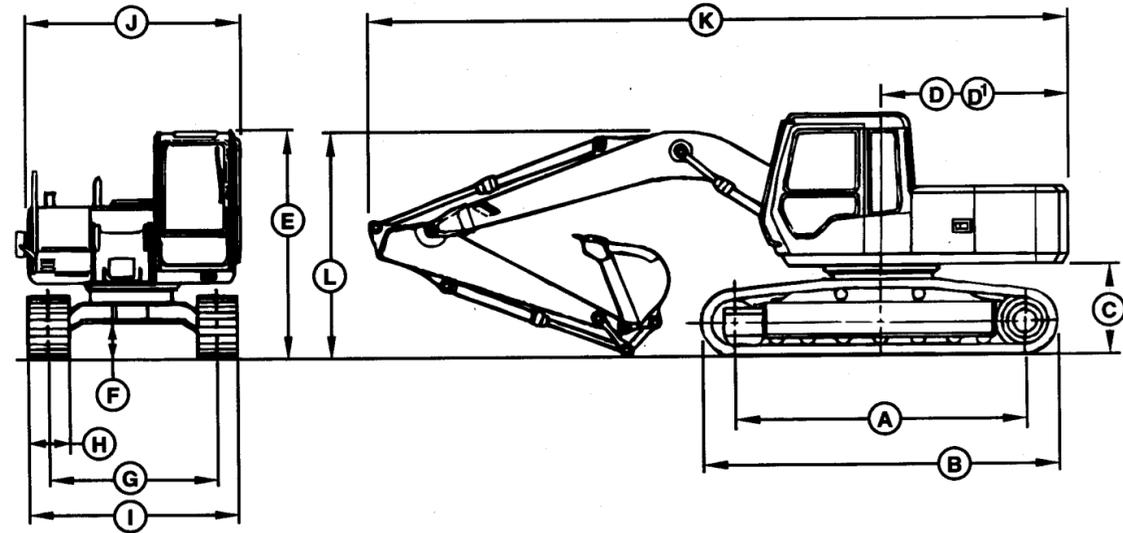
TS231 -19-07OCT88

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

Group 02
General Specifications

690E LC

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T7527DQ -UN-27APR93

Continued on next page

TX,115,FF2461 -19-12MAY93-1/2

General Specifications

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NOTE: Specifications and design subject to change without notice. Wherever applicable,

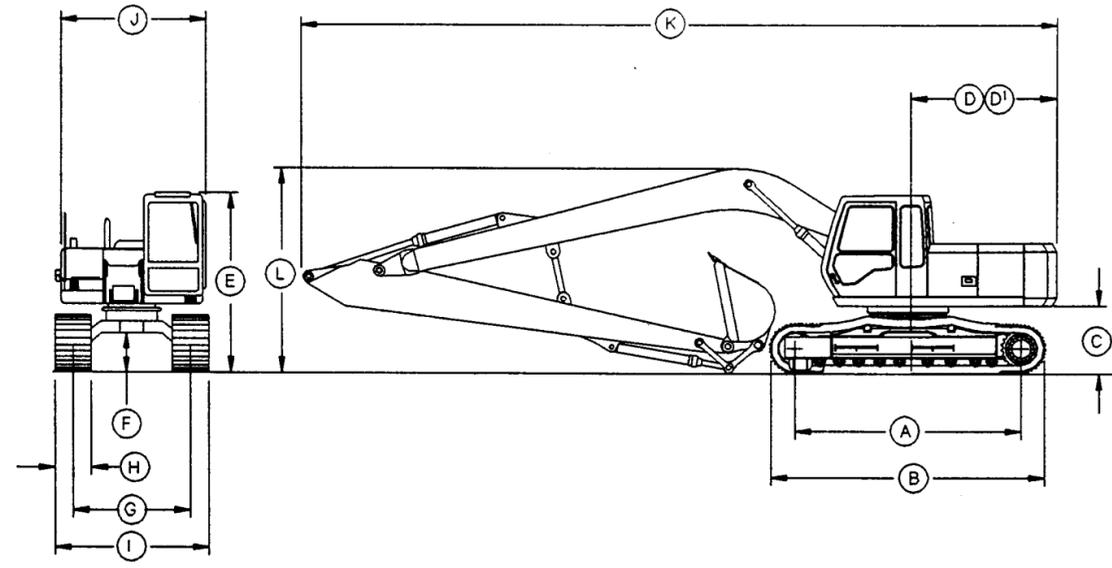
specifications are in accordance with PCSA and SAE standards.

| | |
|--|---|
| A | 3607 mm (11 ft 10 in.) |
| B | 4445 mm (14 ft 7 in.) |
| C | 1090 mm (3 ft 7 in.) |
| D | 2630 mm (8 ft 8 in.) |
| D † Swing Radius | 2740 mm (9 ft 0 in.) |
| E | 2910 mm (9 ft 6 in.) |
| F | 455 mm (1 ft 6 in.) |
| G | 2380 mm (7 ft 10 in.) |
| H | 650 mm (26 in.) or 750 mm (30 in.) or 800 mm (32 in.) |
| I With 2380 mm (7 ft 10 in.) undercarriage and With 650 mm (26 in.) shoes With 750 mm (30 in.) shoes With 800 mm (32 in.) shoes | 3030 mm (9 ft 11 in.) 3130 mm (10 ft 3 in.) 3180 mm (10 ft 5 in.) |
| J | 2780 mm (9 ft 1 in.) |
| K With 2200 mm (7 ft 3 in.) arm With 2900 mm (9 ft 6 in.) arm | 9480 mm (31 ft 1 in.) 9410 mm (30 ft 10 in.) |
| L With 2200 mm (7 ft 3 in.) arm With 2900 mm (9 ft 6 in.) arm | 2910 mm (9 ft 6 in.) 2910 mm (9 ft 6 in.) |

TX,115,FF2461 -19-12MAY93-2/2

690E LC Long Front Specifications

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T7961AE -JUN-02/APR93

Continued on next page

TX.115,FF3345 -19-11JAN95-1/2

General Specifications

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NOTE: Specifications and design subject to change without notice. Wherever applicable, specifications are in accordance with PCSA and SAE Standards. Except where otherwise noted these specifications are based on a unit

equipped with 379 kg (835 lb) bucket, 800 mm (32 in.) track shoes, 4.45 m (14 ft 7 in.) undercarriage, full fuel tank, 80 kg (175 lb) operator, and standard equipment.

| | |
|--|------------------------|
| A | 3.66 m (12 ft 0 in.) |
| B | 4.45 m (14 ft 7 in.) |
| C | 1.09 m (3 ft 7 in.) |
| D | 2.63 m (8 ft 8 in.) |
| D † Tailswing Radius | 2.74 m (9 ft 0 in.) |
| E | 2.84 m (9 ft 4 in.) |
| F | 455 mm (1 ft 6 in.) |
| G | 2.38 m (7 ft 10 in.) |
| H | 800 mm (32 in.) |
| I | 3.18 m (10 ft 5 in.) |
| J | 2.77 m (9 ft 1 in.) |
| K | 11.86 m (38 ft 11 in.) |
| L | 3.15 m (10 ft 4 in.) |
| With 100 mm (4 in.) block under bucket linkage pivot * | 3.25 m (10 ft 8 in.) |

*Lubrication lines at boom cylinder rod ends may extend 100 mm (4 in.) over maximum machine height. If necessary, lines can be tied down to meet height requirements.

TX,115,FF3345 -19-11JAN95-2/2

690E LC And 690E LC Long Front Drain And Refill Capacities

| | Metric | English |
|--------------------------------------|---------|---------|
| Fuel tank (Serial No. —536413) | 322 L | 85 gal |
| Fuel tank (Serial No. 536414—) | 303 L | 80 gal |
| Cooling system (Serial No. —559602) | 34 L | 9 gal |
| Cooling system (Serial No. 559603—) | 41.5 L | 11 gal |
| Engine lubrication, including filter | 19 L | 20 qt |
| Hydraulic tank | 148 L | 39 gal |
| Swing gear | 21.8 kg | 48 lb |
| Propel gearbox (each) | 3.9 L | 4.1 qt |

TX,9000,LG2 -19-27AUG97-1/1

Group 03 Torque Values

Unified Inch Bolt and Screw Torque Values

TS1671 –UN–01MAY03

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| 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.

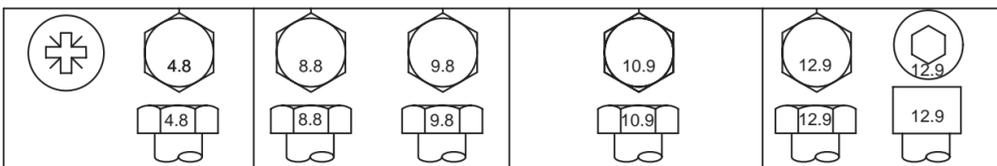
^aGrade 2 applies for hex cap screws (not hex bolts) up to 6. in (152 mm) long. Grade 1 applies for hex cap screws over 6 in. (152 mm) long, and for all other types of bolts and screws of any length.

^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.

DX,TORQ1 –19–24APR03–1/1

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 |
| 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.

Additional Metric Cap Screw Torque Values

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

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

T6873AA



T6873AA -JUN-18OCT88

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

T6873AB



T6873AB -JUN-18OCT88

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

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

T6873AC



T6873AC -JUN-18OCT88

Tighten cap screws having lock nuts to approximately 50 percent of amount shown in chart.

Continued on next page

04T.90.M170 -19-29SEP99-1/2

9000
03
3

Torque Values

9000
03
4

| METRIC CAP SCREW TORQUE VALUES ^a | | | | | | |
|---|--------|-------|--------|-------|--------|-------|
| Nominal Dia | T-Bolt | | H-Bolt | | M-Bolt | |
| | N•m | lb-ft | N•m | lb-ft | N•m | lb-ft |
| 8 | 29 | 21 | 20 | 15 | 10 | 7 |
| 10 | 63 | 46 | 45 | 33 | 20 | 15 |
| 12 | 108 | 80 | 88 | 65 | 34 | 25 |
| 14 | 176 | 130 | 137 | 101 | 54 | 40 |
| 16 | 265 | 195 | 206 | 152 | 78 | 58 |
| 18 | 392 | 289 | 294 | 217 | 118 | 87 |
| 20 | 539 | 398 | 392 | 289 | 167 | 125 |
| 22 | 735 | 542 | 539 | 398 | 216 | 159 |
| 24 | 931 | 687 | 686 | 506 | 274 | 202 |
| 27 | 1372 | 1012 | 1029 | 759 | 392 | 289 |
| 30 | 1911 | 1410 | 1421 | 1049 | 539 | 398 |
| 33 | 2548 | 1890 | 1911 | 1410 | 735 | 542 |
| 36 | 3136 | 2314 | 2401 | 1772 | 931 | 687 |

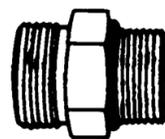
^aTorque tolerance is ±10%.

04T,90,M170 -19-29SEP99-2/2

Service Recommendations for O-Ring Boss Fittings

Straight Fitting

1. Inspect O-ring boss seat for dirt or defects.
2. Lubricate O-ring with petroleum jelly. Place electrical tape over threads to protect O-ring. Slide O-ring over tape and into O-ring groove of fitting. Remove tape.
3. Tighten fitting to torque value shown on chart.



T6243AE -JUN-18OCT88

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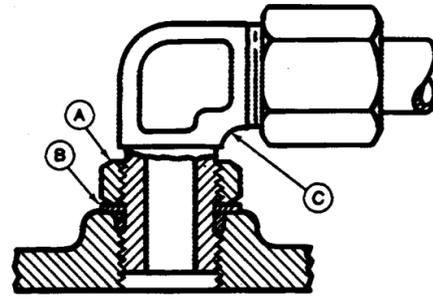
04T,90,K66 -19-29SEP99-1/2

Angle Fitting

1. Back-off lock nut (A) and back-up washer (B) completely to head-end (C) of fitting.
2. Turn fitting into threaded boss until back-up washer contacts face of boss.
3. Turn fitting head-end counterclockwise to proper index (maximum of one turn).

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

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



T6E20AB -UN-18OCT88

9000
03
5

STRAIGHT FITTING OR SPECIAL NUT TORQUE CHART

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

NOTE: Torque tolerance is ± 10%.

04T,90,K66 -19-29SEP99-2/2

Service Recommendations For Flat Face O-Ring Seal Fittings

1. Inspect the fitting sealing surfaces and O-ring. They must be free of dirt or defects. fittings, use backup wrench on straight hose couplings.
2. Lubricate O-rings and install into grove using petroleum jelly to hold in place. **IMPORTANT: Tighten fittings to 150% of listed torque value if indexing is necessary or if fitting is attached to an actuating devise.**
3. Index angle fittings and tighten by hand pressing joint together to insure O-ring remains in place. **Tighten fittings to 50% of listed torque value if used in aluminum housing.**
4. Tighten fitting or nut to torque value shown on the chart. Do not allow hoses to twist when tightening

| FLAT FACE O-RING SEAL FITTING TORQUE* | | | | | | |
|---------------------------------------|-------|-------------|------------|-------|--------------|-------|
| Nomial Tube O.D. | | Thread Size | Swivel Nut | | Bulkhead Nut | |
| mm | in. | in. | N•m | lb-ft | N•m | lb-ft |
| 6.35 | 0.250 | 9/16-18 | 16 | 12 | 12 | 9 |
| 9.52 | 0.375 | 11/16-16 | 24 | 18 | 24 | 18 |
| 12.70 | 0.500 | 13/16-16 | 50 | 37 | 46 | 34 |
| 15.88 | 0.625 | 1-14 | 69 | 51 | 62 | 46 |
| 19.05 | 0.750 | 1 3/16-12 | 102 | 75 | 102 | 75 |
| 22.22 | 0.875 | 1 3/16-12 | 102 | 75 | 102 | 75 |
| 25.40 | 1.000 | 1 7/16-12 | 142 | 105 | 142 | 105 |
| 31.75 | 1.250 | 1 11/16-12 | 190 | 140 | 190 | 140 |
| 38.10 | 1.500 | 2-12 | 217 | 160 | 217 | 160 |

*Torque tolerance is +15 -20% unless otherwise specified.

| Stud End O-ring Seal Torque for Straight and Adjustable Fittings* | | | | |
|---|-------------------|------------------|-----------------------------------|-------|
| Thread Size | Straight Hex Size | Locknut Hex Size | Straight Fitting or Locknut Toque | |
| Inch | Inch | Inch | N•m | lb-ft |
| 3/8-24 | 5/8 | 9/16 | 12 | 9 |
| 7/16-20 | 5/8 | 5/8 | 21 | 15 |
| 1/2-20 | 3/4 | 11/16 | 26 | 19 |
| 9/16-18 | 3/4 | 3/4 | 34 | 25 |
| 3/4-16 | 7/8 | 15/16 | 73 | 55 |
| 7/8-14 | 1 1/16 | 1 1/16 | 104 | 76 |
| 1 1/16-12 | 1 1/4 | 1 3/8 | 176 | 130 |
| 1 3/16-12 | 1 3/8 | 1 1/2 | 230 | 170 |
| 1 5/16-12 | 1 1/2 | 1 5/8 | 285 | 210 |

*Torque tolerance is +15 -20% unless otherwise specified.

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