SERVICE MANUAL

E215C
E245C ME
Hydraulic Excavator

Part Number
71114552
1st Edition
English 03/2015

NEW HOLLAND CONSTRUCTION

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CONSTRUCTION

SERVICE MANUAL

E215C Standard model
E245C Mass excavator model

Link Product / Engine

Product	Market Product	Engine
E215C Modelo padrão	Latin America	F4GE9684E*J615
E245C Modelo Mass excavator	Latin America	F4GE9684E*J615

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INTRODUCTION

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INTRODUCTION

Advice - Important notice regarding equipment servicing

All repair and maintenance work listed in this manual must be carried out only by qualified dealership personnel, strictly complying with the instructions given, and using, whenever possible, the special tools.

Anyone who performs repair and maintenance operations without complying with the procedures provided herein shall be responsible for any subsequent damages.

The manufacturer and all the organizations of its distribution chain, including - without limitation - national, regional, or local dealers, reject any responsibility for damages caused by parts and/or components not approved by the manufacturer, including those used for the servicing or repair of the product manufactured or marketed by the manufacturer. In any case, no warranty is given or attributed on the product manufactured or marketed by the manufacturer in case of damages caused by parts and/or components not approved by the manufacturer.

The information in this manual is up-to-date at the date of the publication. It is the policy of the manufacturer for continuous improvement. Some information could not be updated due to modifications of a technical or commercial type, or changes to the laws and regulations of different countries.

In case of questions, refer to your Sales and Service Networks.

Foreword - Ecology and the environment

Soil, air, and water are vital factors of agriculture and life in general. When legislation does not yet rule the treatment of some of the substances required by advanced technology, sound judgment should govern the use and disposal of products of a chemical and petrochemical nature.

NOTE: *The following are recommendations that may be of assistance:*

- Become acquainted with and ensure that you understand the relative legislation applicable to your country.
- Where no legislation exists, obtain information from suppliers of oils, filters, batteries, fuels, antifreeze, cleaning agents, etc., with regard to their effect on man and nature and how to safely store, use, and dispose of these substances.
- Agricultural consultants will, in many cases, be able to help you as well.

Helpful hints

- Avoid filling tanks using cans or inappropriate pressurized fuel delivery systems that may cause considerable spillage.
- In general, avoid skin contact with all fuels, oils, acids, solvents, etc. Most of them contain substances that may be harmful to your health.
- Modern oils contain additives. Do not burn contaminated fuels and or waste oils in ordinary heating systems.
- Avoid spillage when draining off used engine coolant mixtures, engine, gearbox and hydraulic oils, brake fluids, etc. Do not mix drained brake fluids or fuels with lubricants. Store them safely until they can be disposed of in a proper way to comply with local legislation and available resources.
- Modern coolant mixtures, i.e. antifreeze and other additives, should be replaced every two years. They should not be allowed to get into the soil, but should be collected and disposed of properly.
- Do not open the air-conditioning system yourself. It contains gases that should not be released into the atmosphere. Your NEW HOLLAND CONSTRUCTION dealer or air conditioning specialist has a special extractor for this purpose and will have to recharge the system properly.
- Repair any leaks or defects in the engine cooling or hydraulic system immediately.
- Do not increase the pressure in a pressurized circuit as this may lead to a component failure.
- Protect hoses during welding as penetrating weld splatter may burn a hole or weaken them, allowing the loss of oils, coolant, etc.

Safety rules

⚠ DANGER

Improper operation or service of this machine can result in an accident.
Do not operate this machine or perform any lubrication, maintenance, or repair on it until you have read and understood the operation, lubrication, maintenance, and repair information.
Failure to comply will result in death or serious injury.

D0010A

⚠ WARNING

Maintenance hazard!
Always perform all service procedures punctually at the intervals stated in this manual. This ensures optimum performance levels and maximum safety during machine operation.
Failure to comply could result in death or serious injury.

W0132A

⚠ WARNING

Pressurized system!
Before attempting any service procedure, it is your responsibility to know the number of accumulators on the machine, and the correct procedure for releasing the pressure of each accumulator.
Failure to comply could result in death or serious injury.

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NOTICE: *Extreme working and environmental conditions require shortened service intervals.*

Use Case fluids, lubricants, and filters for the best protection and performance of your machine. All fluids, lubricants, and filters must be disposed of in compliance with environmental standards and regulations. Contact your dealer with any questions regarding the service and maintenance of this machine.

Read the safety decals and information decals on the machine. Read the Operator's Manual and safety manual. Understand the operation of the machine before you start any service.

Before you service the machine, put a 'Do Not Operate' tag on the steering wheel or over the key switch. Ensure the tag is at a location where everyone who might operate or service the machine may see clearly. One tag is included with your new machine. Additional tags are available from your dealer.

Plastic and resin parts

- Avoid using gasoline, paint thinner, etc. when cleaning plastic parts, console, instrument cluster, etc.
- Use only water, mild soap, and a soft cloth when you clean these parts.
- Using gasoline, thinners, etc. can cause discoloration, cracking, or deformation of the part being cleaned.

Safety rules

Standard safety precautions

Be informed and notify personnel of the laws in force regulating safety, and provide documentation available for consultation.

- Keep working areas as clean as possible.
- Ensure that working areas are provided with emergency boxes. They must be clearly visible and always contain adequate sanitary equipment.
- Fire extinguishers must be properly identified and always be clear of obstructions. Their efficiency must be checked on a regular basis and personnel must be trained on proper interventions and priorities.
- Keep all emergency exits free of obstructions and clearly marked.
- Smoking in working areas subject to fire danger must be strictly prohibited.

Prevention of injury

- Wear suitable work attire and safety glasses with no jewelry such as rings and chains when working close to engines and equipment in motion.
- Wear safety gloves and goggles when performing the following operations:
  - Topping off or changing lubrication oils.
  - Using compressed air or liquids at a pressure greater than **2 bar** (**29 psi**).
- Wear a safety helmet when working close to hanging loads or equipment working at head level.
- Always wear safety shoes and fitting clothes.
- Use protection cream for hands.
- Change wet clothes as soon as possible.
- In the presence of voltages exceeding **48 - 60 V**, verify the efficiency of the ground and mass electrical connections. Ensure that hands and feet are dry and use isolating foot boards. Workers should be properly trained to work with electricity.
- Do not smoke or start an open flame close to batteries and any fuel material.
- Place soiled rags with oil, diesel fuel or solvents in specially provided anti-fire containers.
- Do not use any tool or equipment for any use other than what it was originally intended for. Serious injury may occur.
- If running an engine indoors, make sure there is a sufficient exhaust fan in use to eliminate exhaust fumes.

During maintenance

- Never open the filler cap of the cooling system when the engine is hot. High temperature liquid at operating pressure could result in serious danger and risk of burn. Wait until the temperature decreases under **50 °C** (**122 °F**).
- Never add coolant to an overheated engine and use only appropriate liquids.
- Always work when the engine is turned off. Certain circumstances require maintenance on a running engine. Be aware of all the risks involved with such an operation.
- Always use adequate and safe containers for engine fluids and used oil.
- Keep engine clean of any spilled fluids such as oil, diesel fuel, and or chemical solvents.
- Use of solvents or detergents during maintenance may emit toxic vapors. Always keep working areas aerated. Wear a safety mask if necessary.
- Do not leave soiled rags that may contain any flammable substances close to the engine.
- Always use caution when starting an engine after any work has been performed. Be prepared to cut off intake air in case of engine runaway.
- Never disconnect the batteries while the engine is running.
- Disconnect the batteries prior to performing any work on the equipment.

- Disconnect the batteries to place a load on them with a load tester.
- After any work is performed, verify that the battery clamp polarity is correct and that the clamps are tight and safe from accidental short circuit and oxidation.
- Before disconnecting any pipelines (pneumatic, hydraulic, fuel pipes, etc.), verify that all pressure has been released. Take all necessary precautions bleeding and draining residual pressure. Always wear the proper safety equipment.
- Do not alter the lengths of any wires.
- Do not connect any electronic service tool to the engine electrical equipment unless specifically approved by NEW HOLLAND CONSTRUCTION.
- Do not modify the fuel system or hydraulic system unless approved by NEW HOLLAND CONSTRUCTION. Any unauthorized modification will compromise warranty assistance and may affect engine operation and life span.

For engine equipped with an electronic control unit

- Do not weld on any part of the equipment without removing the control unit.
- Remove the in case of work requiring heating over **80 °C** (**176 °F**).
- Do not paint the components and the electronic connections.
- Do not alter any data filed in the electronic control unit driving the engine. Any manipulation or alteration of electronic components will void engine warranty assistance and may affect the correct working order and life span of the engine.

Respect of the Environment

- Respect of the environment should be of primary importance. Take all necessary precautions to ensure personnel's safety and health.
- Inform the personnel of the laws regarding the dispensing of used engine fluids.
- Handle batteries with care, storing them in a well ventilated environment and within anti-acid container.

Personal safety

Safety precautions

- Before servicing an air conditioning system, read and comply with the following safety precautions. Make sure that any repairs are performed by duly trained and skilled personnel only.
- Never attempt to remove the air conditioning system. Refrigerant leaks can cause serious burns to the eyes and hands.
- The refrigerant must always be handled very carefully in order to avoid accidents.
- Keep the refrigerant packaging as well as the air conditioning system away from flames or heat sources, as the resulting increase in pressure may cause the package or system to explode.
- If there is direct contact with naked flames or heated metal surfaces, the refrigerant will decompose and will produce toxic products and acids.
- Never discharge refrigerant into the atmosphere. A certified refrigerant recovery unit operated by a technician should be used to repair air conditioning units.
- When discharging the refrigerant in the system, do so in a well-ventilated area with perfect air circulation and away from naked flames.
- When charging or discharging the system, always wear safety goggles and take adequate precautions to protect the face in general and the eyes in particular, in case of accidental refrigerant spillage.
- The refrigerant and oil mixture inside the air conditioning system is pressurised. Because of this, never loosen the joints or work with the tubes without first depressurising the system.
- Before loosening any connector, cover it with a thick rag and use goggles and gloves to prevent the refrigerant from coming into contact with the skin or eyes.
  If an accident does happen, proceed as follows:
- If refrigerant gets into the eyes, wash immediately with copious amounts of distilled or tap water, and take the victim to hospital for specialist medical care.
- If refrigerant comes into contact with the skin, wash with cold water and seek medical assistance immediately at a hospital.

Personal safety — Do not operate tag

⚠ WARNING

Maintenance hazard!
Before you start servicing the machine, attach a DO NOT OPERATE warning tag to the machine in a visible area.
Failure to comply could result in death or serious injury.

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Attach a DO NOT OPERATE (TAG) to the machine in an area that is clearly visible whenever the machine is not operating properly and/or requires service.
Complete the tag information for the "REASON" the tag is attached by describing the malfunction or service required.
Validate the reason for attaching the tag by signing your name in the designated area on the tag.
The tag should only be removed by the person who signed and attached the tag, after validating the repairs or services have been completed.

Tag Components

A. DO NOT REMOVE THIS TAG! - (Warning) The tag should only be removed by the person who signed and attached the tag, after validating the repairs or services have been completed.

B. See Other Side - (Reference to additional information on opposite side of the tag.)

C. CNH Part Number - (Request this part number from you Service Parts Dealer to obtain this DO NOT OPERATE tag.)

D. DO NOT OPERATE - (Warning!)

E. REASON - (Area for describing malfunction or service required before operation.)

F. Signed by - (Signature area - to be signed by the person validating the reason for installation of the tag.)

Basic instructions

Maintenance standards

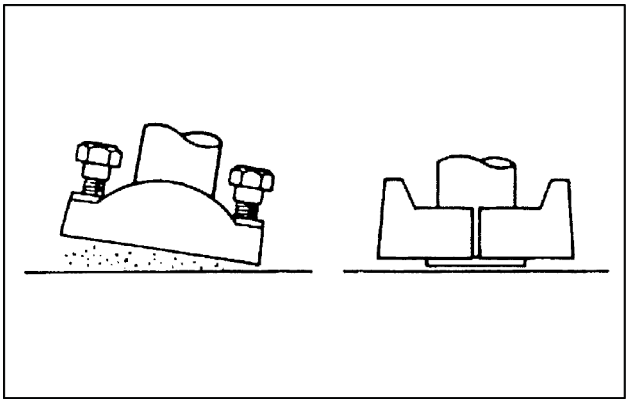
Inspection of components

Part name	Inspection item	Criterion and remedy
Casing	Check for scratches, rust, and corrosion.	If any part is damaged, replace the housing. • The sliding parts of the hole in the housing and the spool, especially the outer circumference, to which the holding pressure is applied. • Area of the sealing part that is in contact with the O-ring. • Sealing and seating parts of the main relief valve or the overload relief valve. • Sealing part of the plug. • Defects in other parts that may prevent normal function.
Spool	Check for scratches, abrasions, rust, and corrosion.	If any defect can be detected by running a fingernail over the sliding surface of the outer circumference, replace the spool.
	Install the spool by turning the spool in the hole in the housing.	If the spool damages the O-ring and does not move smoothly, repair or replace the spool.
Needle	Check the needle and the spring for signs of damage.	If spring is damaged, replace it. If the seat of the needle or the spring are damaged, replace the seat of the needle or the spring.
	Insert the needle in the housing. Move the needle.	If the needle moves smoothly without
Spring and related parts	Check for rust, corrosion, deformation, and breakage of the spring, spring seat, stop, spacer bolt, and cover.	Replace if heavily damaged.
Main relief valve, orifice relief valve, by-pass cut valve.	Check for rust and damage on the outer surface.	Replace.
	Inspect the contact face of the valve seat.	Replace if damaged.
	Inspect the O-ring, thrust ring, and seal.	As a general rule, replace all with new ones. (Between the housing and the seal)

Service recommendations for split flange

NOTICE:

1. Clean and inspect the sealing surfaces. Scratches and roughness cause leaks and wear of the seals. Not being level causes extrusion of the seals. If the defects cannot be corrected, replace the components.
2. Always use specified O-rings. Inspect the O-rings for any damage. Be careful not to scratch the O-rings. When installing an O-ring into a groove, use grease to hold the O-ring in place.



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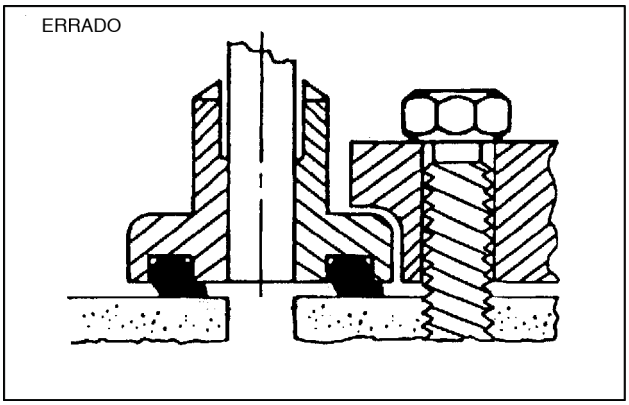
3. Loosely assemble halves of the split flange. Ensure that the slot is centrally located and perpendicular to the orifice. Tighten the bolts by hand to secure the parts in place. Be careful not to crush the O-ring.
4. Tighten the bolts alternately and diagonally, as shown, to assure a uniform tightness.
5. Do not use pneumatic wrenches. Pneumatic wrenches often fully tighten one bolt before tightening the others, resulting in damage to the O-rings and uneven tightening of the bolts.



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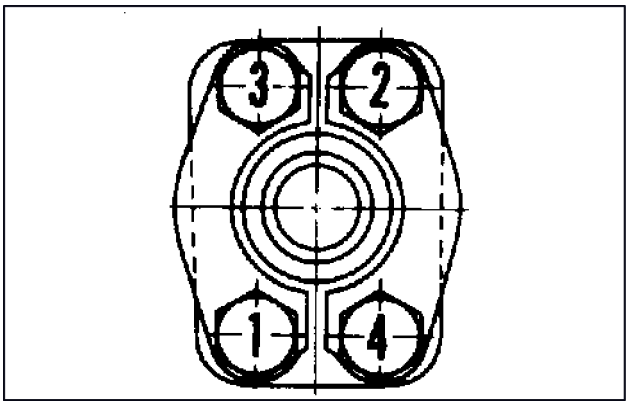

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Locking the nuts and bolts

- Lock plate

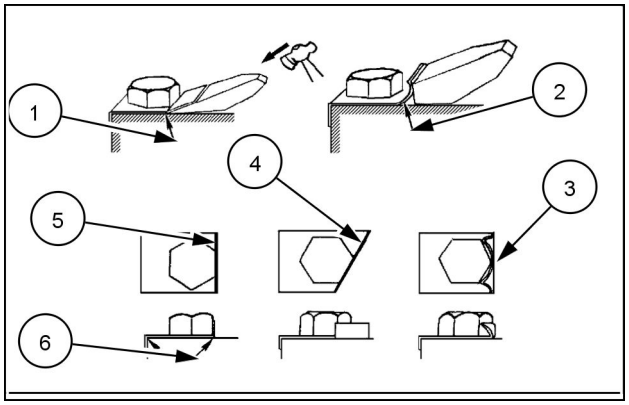
NOTICE: *Do not reuse the removed lock plates. Do not try to bend the same point twice.*

- Cotter pin

NOTICE: *Do not reuse the removed cotter pins. Align the localized holes during tightening, not when loosening.*

- Lock Wire

NOTICE: *Apply the wire to the bolts in the direction of tightening, not in the direction of loosening.*



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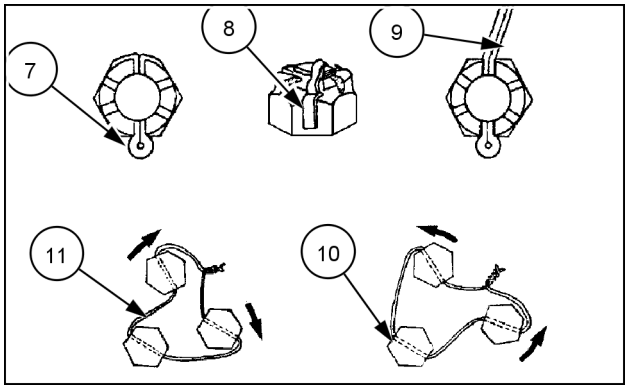
(1) –Correct=Bend along the sharp edge
(2) –INCORRECT = Do not bend rounded
(3) –INCORRECT
(4) –CORRECT
(5)–CORRECT
(6) –Bend along the sharp edge
(7) –CORRECT
(8) –CORRECT
(9) –INCORRECT
(10) –INCORRECT TIGHTEN
(11) –CORRECT LOOSEN



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Torque – Bolt types

Correctly tighten the nuts and bolts according to the torque specifications. There are two types used of bolts, hexagon T bolt and socket bolt (Allen), each made of different material. During the assembly of the machine or the components, ensure that you use the correct bolts. Ensure that you tighten them to the specifications.

(1) Hexagon T Bolt.
(2) Socket bolt (Allen)

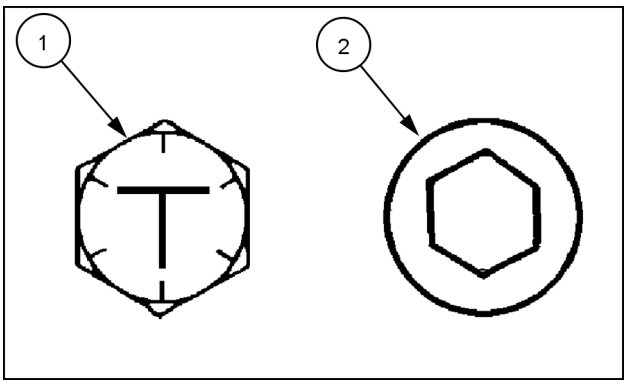

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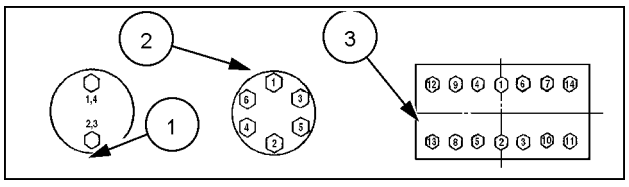
Table of specified tightening torque

Bolt diameter	Wrench size	Hexagon Wrench Size	T bolt, socket bolt
M8	13	6	**29.5 N·m**
M10	17	8	**64 N·m**
M12	19	10	**108 N·m**
M14	22	12	**175 N·m**
M16	24	14	**265 N·m**
M18	27	14	**390 N·m**
M20	30	17	**540 N·m**
M22	32	17	**740 N·m**
M24	36	19	**930 N·m**
M27	41	19	**1370 N·m**
M30	46	22	**1910 N·m**
M33	50	24	**2550 N·m**
M36	55	27	**3140 N·m**

1. Apply lubricant (i.e., white zinc B dissolved in bearing oil) to the bolts and nuts to stabilize their coefficient of friction.
2. Torque tolerance is ±10%.
3. Make sure that you are using correct length bolts. Bolts that are too long cannot be tightened, since their tip comes into contact with the bottom of the hole. Bolts that are too short cannot develop enough tightening force.
4. The torques presented in the table are for general use only. Do not use these torques if a different torque is given for a specific application.
5. Make sure that the threads of the nuts and bolts are clean before installing them. Remove the dirt or corrosion, if any.

Bolts tightening sequence

When tightening two or more bolts, tighten the bolts alternately, as shown, to ensure a uniform tightening.



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(1) Uniformly tighten the upper and the lower, alternately. (2) Tighten diagonally. (3) Tighten from center and diagonally.

Basic instructions - Shop and Assembly

SHIMS

For each adjustment operation, select adjusting shims and measure separately with a micrometer. Then add up the recorded values. Do not rely on measuring the entire shimming set, which may be incorrect. Do not rely on the rated value on each shim.

ROTATING SHAFT SEALS

For correct rotating shaft seal installation, proceed as follows:

- before assembly, allow the seal to soak for at least thirty minutes in the oil that it will seal.
- thoroughly clean the shaft and check that the working surface on the shaft is not damaged.
- position the sealing lip facing the fluid; with hydrodynamic lips, take into consideration the shaft rotation direction and position the grooves so that they will deviate the fluid towards the inner side of the seal.
- coat the sealing lip with a thin layer of lubricant (use oil rather than grease). Fill the gap between the sealing lip and the dust lip on double lip seals with grease
- insert the seal in its seat and press down using a flat punch or seal installation tool. Do not tap the seal with a hammer or mallet.
- while you insert the seal, check that the seal is perpendicular to the seat. Once the seal is in place, make sure that the seal makes contact with the thrust element, if required.
- to prevent damage to the seal lip on the shaft, position a protective guard during installation operations.

O-RING SEALS

Lubricate the O-ring seals before you insert them in the seats. This will prevent overturning and twisting, which would jeopardize sealing efficiency.

SEALING COMPOUNDS

Apply one of the following sealing compounds on the mating surfaces when specified: SILMATE® RTV1473, or **LOCTITE® RTV 598™** or **LOCTITE® INSTANT GASKET 587 BLUE**. Before you apply the sealing compound, prepare the surfaces as directed on product container or as follows:

- remove any deposits with a wire brush
- thoroughly de-grease the surfaces using a locally-approved cleaning agent such as safety solvent or brake parts cleaner.

SPARE PARTS

Only use "CNH Original Parts" or " NEW HOLLAND CONSTRUCTION Parts".

Only genuine spare parts guarantee the same quality, duration and safety as original parts, as they are the same parts that are assembled during standard production. Only "CNH Original Parts" or " NEW HOLLAND CONSTRUCTION Parts" can offer this guarantee.
When you order spare parts, always provide the following information:

- machine model (commercial name) and serial number
- part number of the ordered part, which can be found in the "Microfiches" or the "Spare Parts Catalogue", used to process orders

PROCEDURE TO PROTECT THE ELECTRONIC SYSTEMS AND ELECTRICAL SYSTEMS DURING CHARGING OPERATIONS OR WELDING OPERATIONS

⚠ DANGER

Battery acid causes burns. Batteries contain sulfuric acid.
Avoid contact with skin, eyes or clothing. Antidote (external): Flush with water. Antidote (eyes): flush with water for 15 minutes and seek medical attention immediately. Antidote (internal): Drink large quantities of water or milk. Do not induce vomiting. Seek medical attention immediately.
Failure to comply will result in death or serious injury.

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To avoid damage to the electronic systems and electrical systems, always observe the following:

1. Never connect or disconnect any part of the charging circuit, including the battery connections, when the engine is running.
2. Never short any of the charging components to earth.
3. Always disconnect the battery ground cable before you perform arc welding operations or on any attached header on the combine.
   - position the welder ground clamp as close to the welding area as possible
   - if you perform welding operations in close proximity to a computer module, you should remove the computer module
   - never allow welding cables to lay on, near or across any electrical wiring or electronic component while you perform welding operations
4. Always disconnect the negative battery cable when you charge the battery with a battery charger.

NOTICE: *if you need to perform welding operations on the unit or on the header (if connected), you must disconnect the battery ground cable from the battery. The electronic monitoring system and charging system will incur damage if you do not disconnect the battery ground cable from the battery.*

Remove the battery ground cable. Reconnect the cable when welding operations are complete.

TOOLS

The tools that NEW HOLLAND CONSTRUCTION suggests and illustrated in this manual have been:

- specifically researched and designed for use with NEW HOLLAND CONSTRUCTION machines
- essential for reliable repair operations
- accurately built and rigorously tested so as to offer efficient and long-lasting operation

If Repair Personnel use these tools, they will be able to:

- operate in optimal technical conditions
- obtain the best results
- save time and effort
- work in safe conditions

NOTE: *You should interpret the terms "front", "rear", "right-hand" and "left-hand" (when you refer to different parts) from the rear, while you face in the direction of travel of the machine during operation.*

Torque — Minimum tightening torques for normal assembly

Decimal hardware

Grade 5 bolts, nuts and studs

Size	Nm	lb in/lb ft
1/4 in	12 - 15 Nm	108 - 132 lb in
5/16 in	23 - 28 Nm	204 - 252 lb in
3/8 in	48 - 57 Nm	420 - 504 lb in
7/16 in	73 - 87 Nm	54 - 64 lb ft
1/2 in	109 - 130 Nm	80 - 96 lb ft
9/16 in	149 - 179 Nm	110 - 132 lb ft
5/8 in	203 - 244 Nm	150 - 180 lb ft
3/4 in	366 - 439 Nm	270 - 324 lb ft
7/8 in	542 - 651 Nm	400 - 480 lb ft
1 in	787 - 944 Nm	580 - 696 lb ft
1-1/8 in	1085 - 1193 Nm	800 - 880 lb ft
1-1/4 in	1519 - 1681 Nm	1120 - 1240 lb ft
1-3/8 in	1980 - 2278 Nm	1460 - 1680 lb ft
1-1/2 in	2631 - 2983 Nm	1940 - 2200 lb ft

Grade 8 bolts, nuts and studs

Size	Nm	lb in/lb ft
1/4 in	16 - 20 Nm	144 - 180 lb in
5/16 in	33 - 39 Nm	288 - 348 lb in
3/8 in	61 - 73 Nm	540 - 648 lb in
7/16 in	95 - 114 Nm	70 - 84 lb ft
1/2 in	149 - 179 Nm	110 - 132 lb ft
9/16 in	217 - 260 Nm	160 - 192 lb ft
5/8 in	298 - 358 Nm	220 - 264 lb ft
3/4 in	515 - 618 Nm	380 - 456 lb ft
7/8 in	814 - 976 Nm	600 - 720 lb ft
1 in	1220 - 1465 Nm	900 - 1080 lb ft
1-1/8 in	1736 - 1953 Nm	1280 - 1440 lb ft
1-1/4 in	2468 - 2712 Nm	1820 - 2000 lb ft
1-3/8 in	3227 - 3688 Nm	2380 - 2720 lb ft
1-1/2 in	4285 - 4827 Nm	3160 - 3560 lb ft

NOTE: *Use thick nuts with Grade 8 bolts.*

Metric hardware

Grade 8.8 bolts, nuts and studs

Size	Nm	lb in/lb ft
4 mm	3 - 4 Nm	24 - 36 lb in
5 mm	7 - 8 Nm	60 - 72 lb in
6 mm	11 - 12 Nm	96 - 108 lb in
8 mm	26 - 31 Nm	228 - 276 lb in
10 mm	52 - 61 Nm	456 - 540 lb in
12 mm	90 - 107 Nm	66 - 79 lb ft
14 mm	144 - 172 Nm	106 - 127 lb ft
16 mm	217 - 271 Nm	160 - 200 lb ft
20 mm	434 - 515 Nm	320 - 380 lb ft
24 mm	675 - 815 Nm	500 - 600 lb ft
30 mm	1250 - 1500 Nm	920 - 1100 lb ft
36 mm	2175 - 2600 Nm	1600 - 1950 lb ft

Grade 10.9 bolts, nuts and studs

Size	Nm	lb in/lb ft
4 mm	4 - 5 Nm	36 - 48 lb in
5 mm	9 - 11 Nm	84 - 96 lb in
6 mm	15 - 18 Nm	132 - 156 lb in
8 mm	37 - 43 Nm	324 - 384 lb in
10 mm	73 - 87 Nm	54 - 64 lb ft
12 mm	125 - 150 Nm	93 - 112 lb ft
14 mm	200 - 245 Nm	149 - 179 lb ft
16 mm	310 - 380 Nm	230 - 280 lb ft
20 mm	610 - 730 Nm	450 - 540 lb ft
24 mm	1050 - 1275 Nm	780 - 940 lb ft
30 mm	2000 - 2400 Nm	1470 - 1770 lb ft
36 mm	3500 - 4200 Nm	2580 - 3090 lb ft

Grade 12.9 bolts, nuts and studs

Size	Nm	lb in/lb ft
Typically the torque values specified for grade 10.9 hardware can be used satisfactorily on grade 12.9 hardware.		

Steel hydraulic fittings

37° flare fitting

Tube outside diameter/Hose inside diameter		Thread size	Nm	lb in/lb ft
mm	inch			
6.4 mm	1/4 in	7/16-20 in	8 - 16 Nm	72 - 144 lb in
7.9 mm	5/16 in	1/2-20 in	11 - 22 Nm	96 - 192 lb in
9.5 mm	3/8 in	9/16-18 in	14 - 34 Nm	120 - 300 lb in
12.7 mm	1/2 in	3/4-16 in	20 - 57 Nm	180 - 504 lb in
15.9 mm	5/6 in	7/8-14 in	34 - 79 Nm	300 - 696 lb in
19.0 mm	3/4 in	1-1/16-12 in	54 - 108 Nm	40 - 80 lb ft
22.2 mm	7/8 in	1-3/16-12 in	81 - 135 Nm	60 - 100 lb ft
25.4 mm	1 in	1-5/16-12 in	102 - 158 Nm	75 - 117 lb ft
31.8 mm	1-1/4 in	1-5/8-12 in	169 - 223 Nm	125 - 165 lb ft
38.1 mm	1-1/2 in	1-7/8-12 in	285 - 338 Nm	210 - 250 lb ft

Straight threads with O-ring

Tube outside diameter/Hose inside diameter		Thread size	Nm	lb in/lb ft
mm	inch			
6.4 mm	1/4 in	7/16-20 in	16 - 26 Nm	144 - 228 lb in
7.9 mm	5/16 in	1/2-20 in	22 - 34 Nm	192 - 300 lb in
9.5 mm	3/8 in	9/16-18 in	34 - 54 Nm	300 - 480 lb in
12.7 mm	1/2 in	3/4-16 in	57 - 91 Nm	540 - 804 lb in
15.9 mm	5/6 in	7/8-14 in	79 - 124 Nm	58 - 92 lb ft
19.0 mm	3/4 in	1-1/16-12 in	108 - 174 Nm	80 - 128 lb ft
22.2 mm	7/8 in	1-3/16-12 in	136 - 216 Nm	100 - 160 lb ft
25.4 mm	1 in	1-5/16-12 in	159 - 253 Nm	117 - 187 lb ft
31.8 mm	1-1/4 in	1-5/8-12 in	224 - 357 Nm	165 - 264 lb ft
38.1 mm	1-1/2 in	1-7/8-12 in	339 - 542 Nm	250 - 400 lb ft

Split flange mounting bolts

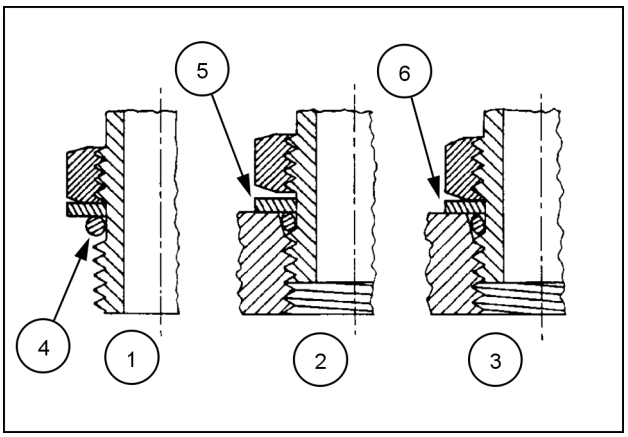
Size	Nm	lb in/lb ft
5/16-18 in	20 - 27 Nm	180 - 240 lb in
3/8-16 in	27 - 34 Nm	240 - 300 lb in
7/16-14 in	47 - 61 Nm	420 - 540 lb in
1/2-13 in	74 - 88 Nm	55 - 65 lb ft

Size	Nm	lb in/lb ft
5/8-11 in	**190 - 203 Nm**	**140 - 150 lb ft**

O-ring face seal end						O-ring boss end fitting or lock nut		
Nominal SAE dash size	Tube outside diameter		Thread size	Nm	lb in/lb ft	Thread size	Nm	lb in/lb ft
	mm	in						
-4	**6.4 mm**	**1/4 in**	**9/16-18 in**	**14 - 16 Nm**	**120 - 144 lb in**	**7/16-20 in**	**23 - 27 Nm**	**204 - 240 lb in**
-6	**9.5 mm**	**3/8 in**	**11/16-16 in**	**24 - 27 Nm**	**216 - 240 lb in**	**9/16-18 in**	**34 - 41 Nm**	**300 - 360 lb in**
-8	**12.7 mm**	**1/2 in**	**13/16-16 in**	**43 - 54 Nm**	**384 - 480 lb in**	**3/4-16 in**	**61 - 68 Nm**	**540 - 600 lb in**
-10	**15.9 mm**	**5/8 in**	**1-14 in**	**62 - 76 Nm**	**552 - 672 lb in**	**7/8-14 in**	**81 - 88 Nm**	**60 - 65 lb ft**
-12	**19.0 mm**	**3/4 in**	**1-3/ 16-12 in**	**90 - 110 Nm**	**65 - 80 lb ft**	**1-1/ 16-12 in**	**115 - 122 Nm**	**85 - 90 lb ft**
-14	**22.2 mm**	**7/8 in**	**1-3/ 16-12 in**	**90 - 110 Nm**	**65 - 80 lb ft**	**1-13/ 16-12 in**	**129 - 136 Nm**	**95 - 100 lb ft**
-16	**25.41 mm**	**1.0 in**	**1-7/ 16-12 in**	**125 - 140 Nm**	**92 - 105 lb ft**	**1-5/ 16-12 in**	**156 - 169 Nm**	**115 - 125 lb ft**
-20	**31.8 mm**	**1-1/4 in**	**1-11/ 16-12 in**	**170 - 190 Nm**	**125 - 140 lb ft**	**1`-5/ 6-12 in**	**201 - 217 Nm**	**150 - 160 lb ft**
-24	**38.1 mm**	**1-1/2 in**	**2-12 in**	**200 - 254 Nm**	**150 - 180 lb ft**	**1-7/8-12 in**	**258 - 271 Nm**	**190 - 200 lb ft**

Torque - Standard torque data for hydraulics

INSTALLATION OF ADJUSTABLE FITTINGS IN STRAIGHT THREAD O RING BOSSES



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1. Lubricate the O-ring by coating it with a light oil or petroleum. Install the O-ring in the groove adjacent to the metal backup washer which is assembled at the extreme end of the groove **(4)**.
2. Install the fitting into the SAE straight thread boss until the metal backup washer contacts the face of the boss **(5)**.

   NOTE: *Do not over tighten and distort the metal backup washer.*
3. Position the fitting by turning out (counterclockwise) up to a maximum of one turn. Holding the pad of the fitting with a wrench, tighten the locknut and washer against the face of the boss **(6)**.

STANDARD TORQUE DATA FOR HYDRAULIC TUBES AND FITTINGS

TUBE NUTS FOR 37° FLARED FITTINGS				O-RING BOSS PLUGS ADJUSTABLE FITTING LOCKNUTS, SWIVEL JIC- 37° SEATS
SIZE	**TUBING OD**	**THREAD SIZE**	**TORQUE**	**TORQUE**
4	**6.4 mm** (**1/4 in**)	7/16-20	**12 - 16 N·m** (**9 - 12 lb ft**)	**8 - 14 N·m** (**6 - 10 lb ft**)
5	**7.9 mm** (**5/16 in**)	1/2-20	**16 - 20 N·m** (**12 - 15 lb ft**)	**14 - 20 N·m** (**10 - 15 lb ft**)
6	**9.5 mm** (**3/8 in**)	9/16-18	**29 - 33 N·m** (**21 - 24 lb ft**)	**20 - 27 N·m** (**15 - 20 lb ft**)
8	**12.7 mm** (**1/2 in**)	3/4-16	**47 - 54 N·m** (**35 - 40 lb ft**)	**34 - 41 N·m** (**25 - 30 lb ft**)
10	**15.9 mm** (**5/8 in**)	7/8-14	**72 - 79 N·m** (**53 - 58 lb ft**)	**47 - 54 N·m** (**35 - 40 lb ft**)
12	**19.1 mm** (**3/4 in**)	1-1/16-12	**104 - 111 N·m** (**77 - 82 lb ft**)	**81 - 95 N·m** (**60 - 70 lb ft**)
14	**22.2 mm** (**7/8 in**)	1-3/16-12	**122 - 136 N·m** (**90 - 100 lb ft**)	**95 - 109 N·m** (**70 - 80 lb ft**)
16	**25.4 mm** (**1 in**)	1-5/16-12	**149 - 163 N·m** (**110 - 120 lb ft**)	**108 - 122 N·m** (**80 - 90 lb ft**)
20	**31.8 mm** (**1-1/4 in**)	1-5/8-12	**190 - 204 N·m** (**140 - 150 lb ft**)	**129 - 158 N·m** (**95 - 115 lb ft**)
24	**38.1 mm** (**1-1/2 in**)	1-7/8-12	**217 - 237 N·m** (**160 - 175 lb ft**)	**163 - 190 N·m** (**120 - 140 lb ft**)
32	**50.8 mm** (**2 in**)	2-1/2-12	**305 - 325 N·m** (**225 - 240 lb ft**)	**339 - 407 N·m** (**250 - 300 lb ft**)

These torques are not recommended for tubes of **12.7 mm** (**1/2 in**) OD and larger with wall thickness of **0.889 mm** (**0.035 in**) or less. The torque is specified for **0.889 mm** (**0.035 in**) wall tubes on each application individually.

Before installing and torquing **37 °** flared fittings, clean the face of the flare and threads with a clean solvent or Loctite cleaner and apply hydraulic sealant **LOCTITE® 569** to the **37 °** flare and the threads.

Install fitting and torque to specified torque, loosen fitting and retorque to specifications.

PIPE THREAD FITTING TORQUE

Before installing and tightening pipe fittings, clean the threads with a clean solvent or Loctite cleaner and apply sealant **LOCTITE® 567 PST PIPE SEALANT** for all fittings including stainless steel or **LOCTITE® 565 PST** for most metal fittings. For high filtration/zero contamination systems use **LOCTITE® 545**.

PIPE THREAD FITTING	
Thread Size	**Torque (Maximum)**
1/8-27	**13 N·m** (**10 lb ft**)
1/4-18	**16 N·m** (**12 lb ft**)
3/8-18	**22 N·m** (**16 lb ft**)
1/2-14	**41 N·m** (**30 lb ft**)
3/4-14	**54 N·m** (**40 lb ft**)

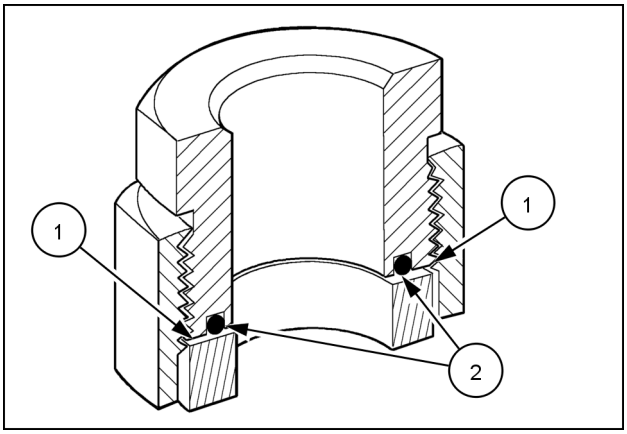
INSTALLATION OF ORFS (O-RING FLAT FACED) FITTINGS

When installing ORFS fittings thoroughly clean both flat surfaces of the fittings **(1)** and lubricate the O-ring **(2)** with light oil. Make sure both surfaces are aligned properly. Torque the fitting to specified torque listed throughout the repair manual.

NOTICE: *If the fitting surfaces are not properly cleaned, the O-ring will not seal properly. If the fitting surfaces are not properly aligned, the fittings may be damaged and will not seal properly.*

NOTICE: *Always use genuine factory replacement oils and filters to ensure proper lubrication and filtration of engine and hydraulic system oils.*

The use of proper oils, grease, and keeping the hydraulic system clean will extend machine and component life.



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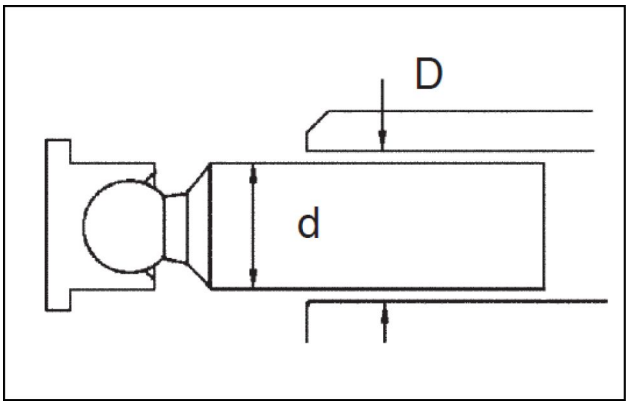
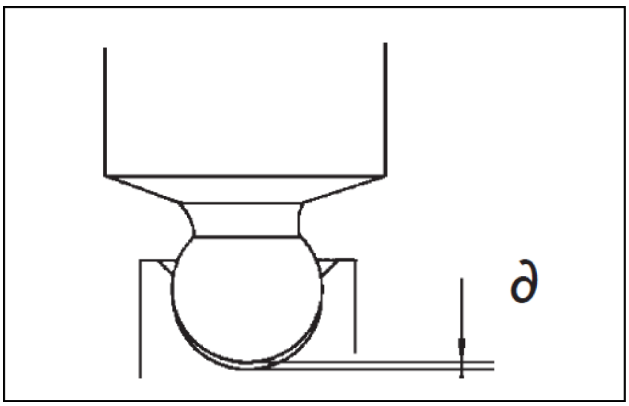
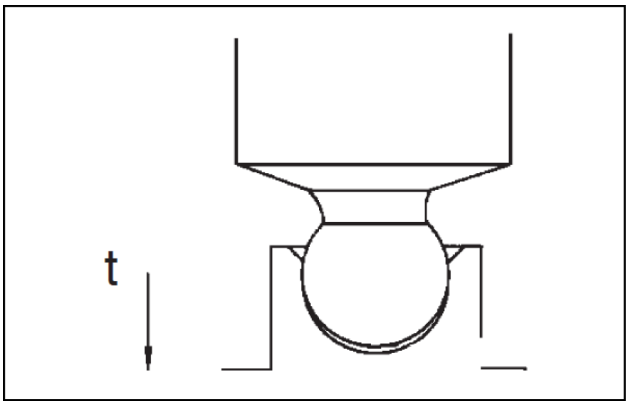
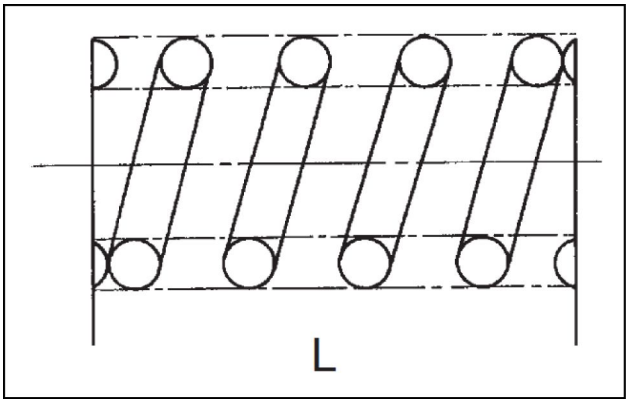
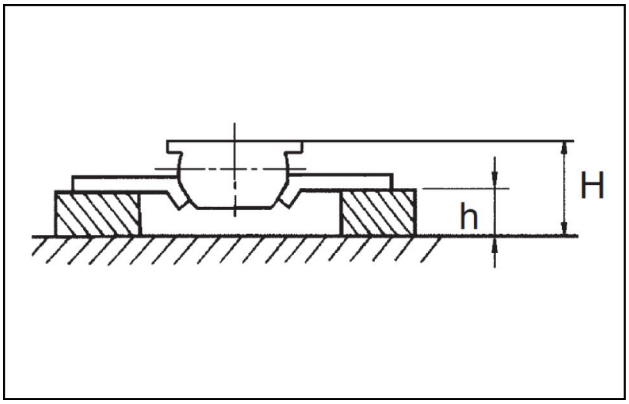
General specification

Part name and inspection item	Standard dimension	Recommended value for replacement	Action to be taken
Clearance between plunger and cylinder bore “D-d”  LAIL11CX0017A0A 1	**0.039 mm**	**0.067 mm**	Replace the plunger or cylinder.
Clearance between the plunger and the caulked part of shoe "*∂*"  LAIL11CX0018A0A 2	**0 ~ 0.1 mm**	**0.3 mm**	Replace the plunger shoe assembly.
Thickness of shoe “t”  LAIL11CX0019A0A 3	**4.9 mm**	**4.7 mm**	Replace the plunger shoe assembly.

Part name and inspection item	Standard dimension	Recommended value for replacement	Action to be taken
Free height of cylinder spring "L"  LAIL11CX0020A0A 4	**41.1 mm**	**40.3 mm**	Replace cylinder spring.
Combined height of the retainer plate and spherical bushing "H-h"  LAIL11CX0021A0A 5	**23.0 mm**	**22.0 mm**	Replace a set of spherical bushings or the retaining plate.

Repair standards for the cylinder, valve plate, and tilt plate (shoe plate face)

Distribution plate (sliding section). Swash plate (shoe plate face). Cylinder (sliding section). Roughness of each surface.	Roughness of the surface requiring correction.	3 Z
	Standard surface roughness (correction value).	Less than 0.4 Z (lapping)

Conversion factors – Units used

SI Units (International System of Units) are used in this manual.

MKSA system units and English are also indicated in parentheses just after the SI units.

Example: **24.5 MPa** (**3554 psi**)

A table for conversion from SI units to other system units is shown below for reference purposes.

Quantity	Convert from (SI)	To (Others)	Multiply by	Quantity	Convert from (SI)	To (Others)	Multiply by
Length	mm	in	0.03937	Push Off	MPa	kgf/cm^2	10.197
	mm	ft	0.003281		MPa	psi	145.0
Volume	l	US gal	0.2642	Horsepower	kW	CV-PS	1.360
	l	US qt	1.057		kW	HP	1.341
	m^3	yd^3	1.308	Engine coolant	°C	°F	°C x 1.8 + 32
The decals indicate the approximate speeds and all of the speeds at the three different engine speeds: , (engine speed at which of the Power Take-Off (PTO) is reached, marked by a white spot on the center of each black bar on the decals) and , the maximum engine speed.	kg	lb	2.205	Revolution	Km/h	mph	0.6214
Force	N	kgf	0.10197		min^{-1}	RPM	1.0
	N	lbf	0.2248	flow rate	l/min	US gpm	0.2642
Torque	N·m	kgf·m	0.10197		ml/rev	cc/rev	1.0
	N·m	lbf·ft	0.7375				

SERVICE MANUAL

Engine

E215C Standard model
E245C Mass excavator model