

SERVICE MANUAL

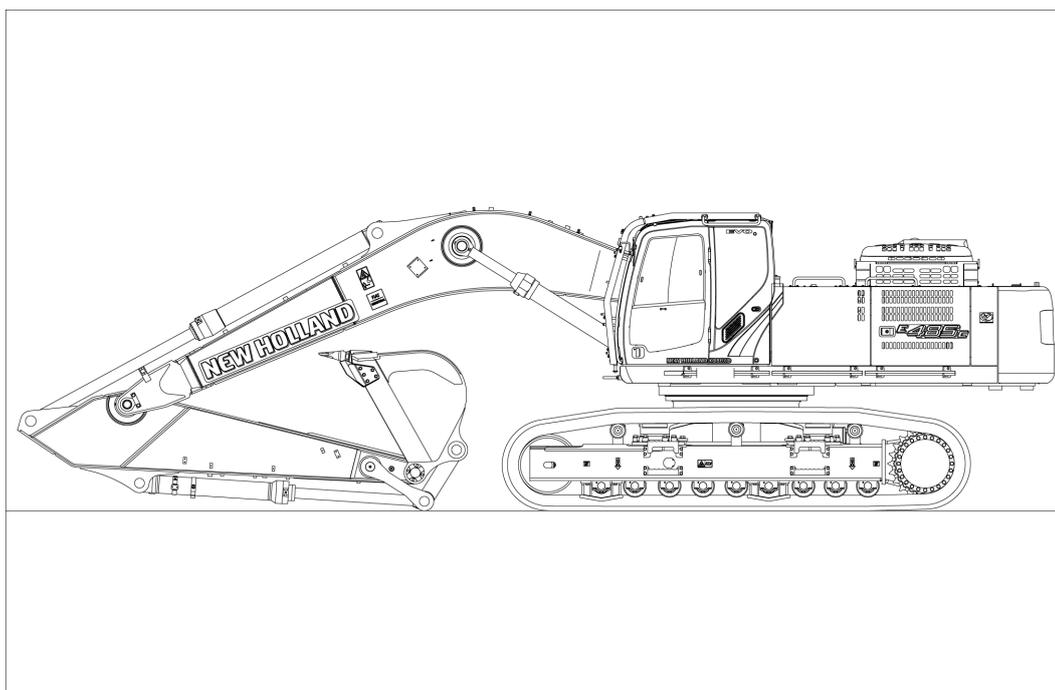
E485C Crawler Excavator

Part number 47483341A
English
January 2013





SERVICE MANUAL



E485C

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INTRODUCTION

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Safety rules

Personal safety



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible death or injury.

Throughout this manual you will find the signal words DANGER, WARNING, and CAUTION followed by special instructions. These precautions are intended for the personal safety of you and those working with you.

Read and understand all the safety messages in this manual before you operate or service the machine.

 DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.

 WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.

 CAUTION, used with the safety alert symbol, indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

FAILURE TO FOLLOW DANGER, WARNING, AND CAUTION MESSAGES COULD RESULT IN DEATH OR SERIOUS INJURY.

Machine safety

NOTICE: Notice indicates a situation which, if not avoided, could result in machine or property damage.

Throughout this manual you will find the signal word Notice followed by special instructions to prevent machine or property damage. The word Notice is used to address practices not related to personal safety.

Information

NOTE: Note indicates additional information which clarifies steps, procedures, or other information in this manual.

Throughout this manual you will find the word Note followed by additional information about a step, procedure, or other information in the manual. The word Note is not intended to address personal safety or property damage.

Personal safety

Carefully read this Manual before proceeding with maintenance, repairs, refuelling or other machine operations.

Repairs have to be carried out only by authorized and instructed staff; specific precautions have to be taken when grinding, welding or when using mallets or heavy hammers.

Not authorized persons are not allowed to repair or carry out maintenance on this machine. Do not carry out any work on the equipment without prior authorization.

Ask your employer about the safety instructions in force and safety equipment.

Nobody is allowed to seat on the operator's place during machine maintenance unless he is a qualified operator helping with the maintenance work.

If it is necessary to move the equipment to carry out repairs or maintenance, do not lift or lower the equipment from any other position than the operator's seat.

Never carry out any operation on the machine when the engine is running, except when specifically indicated.

Stop the engine and ensure that all pressure is relieved from hydraulic circuits before removing caps, covers, valves, etc.

All repair and maintenance operations should be carried out with the greatest care and attention.

Service stairs and platforms used in a workshop or in the field should be built in compliance with the safety rules in force.

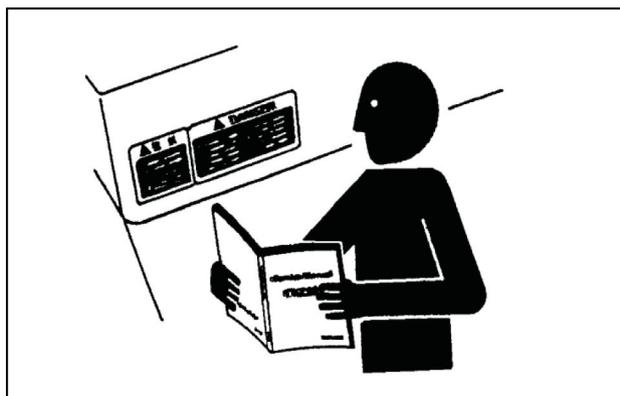
Any functional disorders, especially those affecting the safety of the machine, should therefore be rectified immediately.

⚠ DANGER

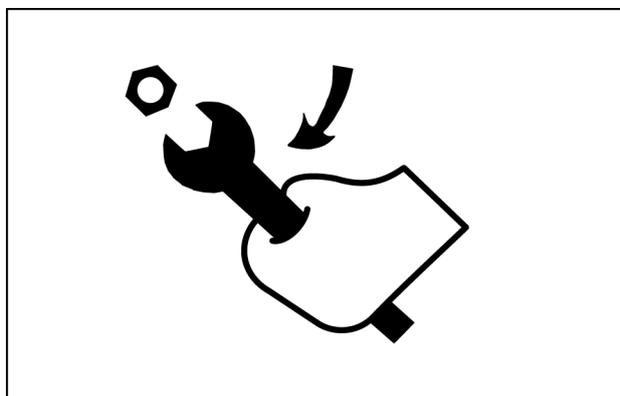
Unexpected movement!
Make sure parking brake is applied. Secure machine with wheel chocks.
Failure to comply will result in death or serious injury.

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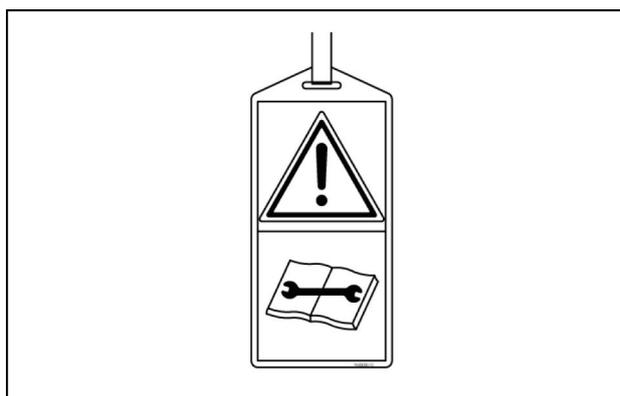
Before performing any work on the machine, attach a maintenance in progress tag. This tag can be applied on the left-hand control lever, safety lever or cab door.



TULI12WEX2004AA 1



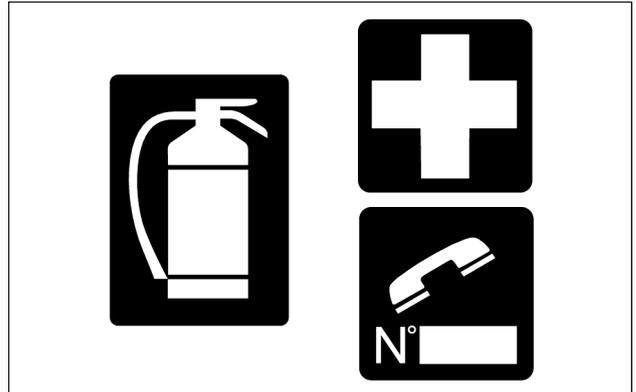
TULI12WEX2005AA 2



TULI12WEX2006AA 3

Emergency

Be prepared for emergencies. Always keep at disposal on the machine a first aid kit and a fire extinguisher. Make sure that the fire extinguisher is serviced in accordance with the manufacturer's instructions.



SML12WEX0174AA 4

Equipment

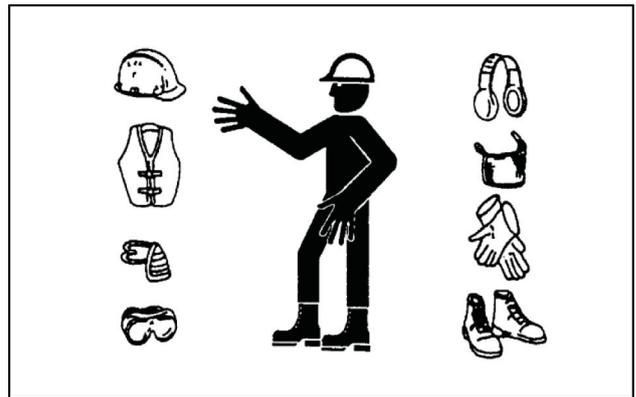
Wear close fitting clothing and safety equipment appropriate for the job:

- Safety helmet
- Safety shoes
- Heavy gloves
- Reflective clothing
- Wet weather clothing

If environment condition require it following personal safety equipment should be at hand:

- Respirators (or dust proof masks)
- Ear plugs or acoustic ears protections
- Goggles with lateral shield or masks for eyes protection

Do not wear rings, wristwatches, jewels, unbuttoned or flapping clothing such as ties, torn clothes, scarves, open jackets or shirts with open zips which could get caught into moving parts.



TULI12WEX2008AA 5

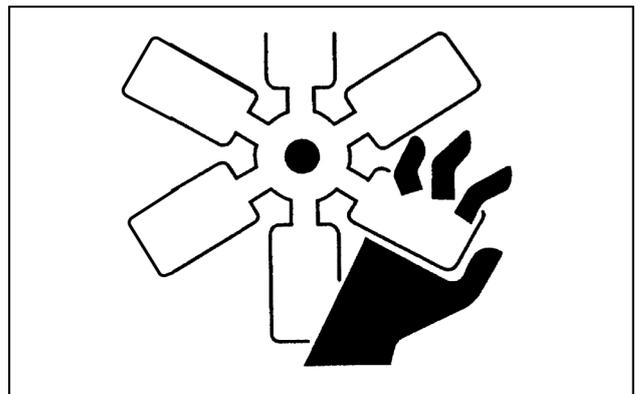
Engine - Radiator

Never leave the engine run in closed spaces without ventilation and not able to evacuate toxic exhaust gases. Keep the exhaust manifold and tube free from combustion materials.

Do not refuel with the engine running, especially if hot, as this increases fire hazard in case of fuel spillage.

Never attempt to check or adjust the belts when the engine is running.

Never lubricate the machine with the engine running.



TULI12WEX2009AA 6

Pay attention to rotary pieces and do not allow to anyone to approach to avoid becoming entangled.

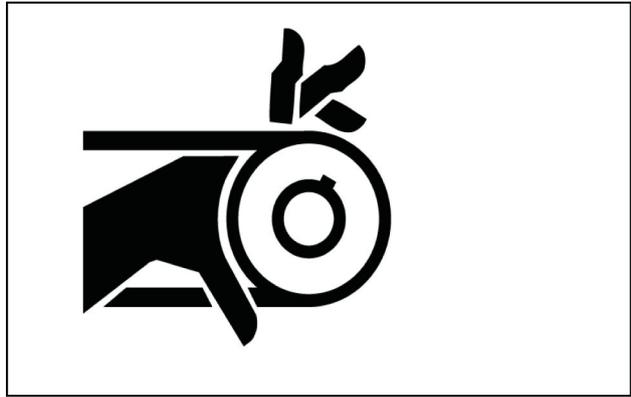
If hands, clothes or tools get caught in the fan blades or in the transmission belt, this can cause amputations, violent tears and generate condition of serious danger; for this reason avoid touching or to come close to all rotary or moving parts.

A violent jet of the coolant from the radiator can cause damages and scalds.

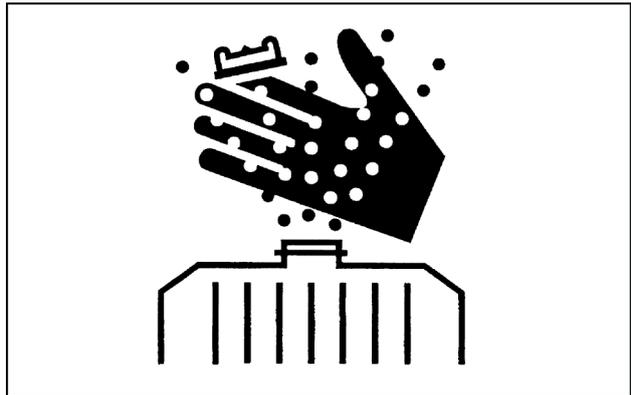
If you are to check the coolant level, you have to shut-off the engine previously and to let cool down the radiator and its pipes. Slowly unscrew the cap to release the inside pressure.

If necessary, remove the cap with hot engine, wear safety clothes and equipment, then loosen the cap slowly to relieve the pressure gradually.

When checking the fuel, oil and coolant levels, use exclusively explosion proof classified lamps. If this kind of lamps are not used fires or explosions may occur.



TULI12WEX2010AA 7



TULI12WEX2011AA 8

Hydraulic systems

Splashes of fluids under pressure can penetrate the skin causing serious injuries.

Avoid this hazard by relieving pressure before disconnecting hydraulic or other lines.

Relieve the residual pressure by moving the hydraulic control levers several times.

Tighten all connections before applying pressure.

To protect the eyes wear a facial shield or safety goggles.

Protect your hands and body from possible splashes of fluids under pressure.

Swallowing hydraulic oil is a severe health hazard.



TULI12WEX2012AA 9

INTRODUCTION

When hydraulic oil has been swallowed, avoid vomiting, but consult a doctor or go to a hospital.

If an accident occurs, see a doctor familiar with this type of injury immediately.

Any fluid penetrating the skin must be removed within few hours to avoid serious infections.

Flammable splashes may originate because of the heat near pipes with fluids under pressure, with the result of serious scalds for the persons hit. Do not weld or use torches near pipes containing fluids or other flammable materials.

Pipes under pressure can accidentally be pierced when the heat expands beyond the area immediately heated.

Arrange for fire resistant temporary shields to protect hoses or other components during welding.

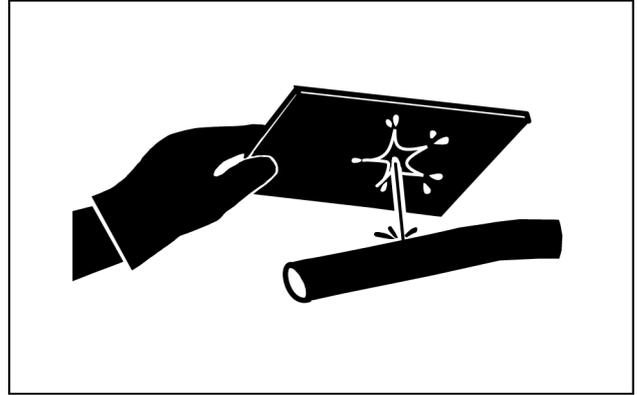
Have any visible leakage repaired immediately.

Escaping oil pollutes the environment. Soak up any oil that has escaped with a proper binding agent. Sweep up binding agent and dispose of it separately from other waste.

Never search for leakages with the fingers, but use a piece of cardboard and always wear goggles.

Never repair damaged piping; always replace it. Replace hydraulic hoses immediately on detecting any damage or moist areas.

Always store hydraulic oil in the original containers.



TULI12WEX2013AA 10

Hoses and tubes

Always replace hoses and tubes if the cone end or the end connections on the hose are damaged.

When installing a new hose, loosely connect each end and make sure the hose takes up the correct position before tightening the connections. Clamps should be tightened sufficiently to hold the hose without crushing and to prevent chafing.

After hose replacement to a moving component, check that the hose does not foul by moving the component through the complete range of travel. Be sure any hose which has been installed is not kinked or twisted.

Hose connections which are damaged, dented, crushed or leaking, restrict oil flow and the productivity of the components being served. Connectors which show signs of movement from the original position have failed and will ultimately separate completely.

A hose with a frayed outer sheath will allow the water penetration. Concealed corrosion of the wire reinforcement will subsequently occur along the hose length with resultant hose failure.

Ballooning of the hose indicates an internal leakage due to structural failure. This condition rapidly deteriorates and total hose failure soon occurs.

Kinked, crushed, stretched or deformed hoses generally suffer internal structural damage which can result in oil restriction, a reduction in the speed of operation and ultimate hose failure.

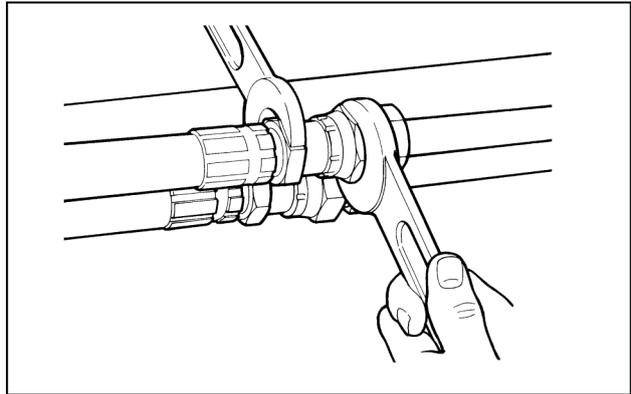
Free-moving, unsupported hoses must never be allowed to touch each other or related working surfaces. This causes chafing which reduces hose life.

O-rings

Replace O-rings, seal rings and gaskets whenever they are disassembled.

Never mix new and old seals or O-rings, regardless of condition. Always lubricate new seal rings and O-rings with hydraulic oil before installation to relevant seats.

This will prevent the O-rings from rolling over and twisting during mounting which will jeopardize sealing.



TUL112WEX2014AA 11

Battery

Batteries give off explosive gases.

Never handle naked flames and unshielded light sources near batteries, never smoke.

To prevent any risk of explosion, observe the following instructions:

- When disconnecting the battery cables, always disconnect the negative (-) cable first.
- To reconnect the battery cables, always connect the negative (-) cable last.
- Never short-circuit the battery terminals with metal objects.
- Do not weld, grind or smoke near a battery.

Battery electrolyte causes severe burns. The battery contains sulphuric acid. Avoid any contact with the skin, eyes or clothing.

Antidote:

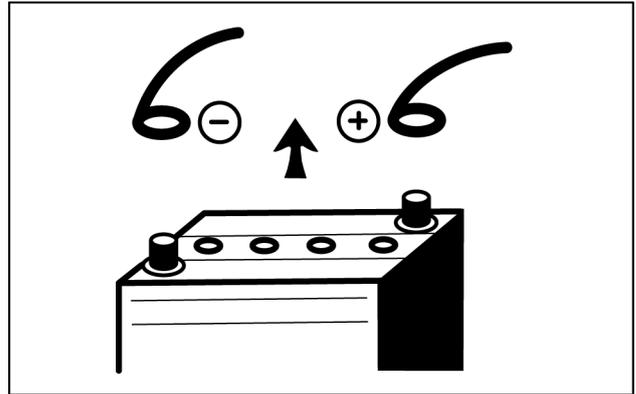
- EXTERNAL: Rinse well with water, removing any soiled clothing.
- INTERNAL: Avoid vomiting. Drink water to rinse your mouth. Consult a doctor.
- EYES: Rinse abundantly with water for **15 min** and consult a doctor.
- When the electrolyte of a battery is frozen, it can explode if you attempt to charge the battery or if you try to start the engine using a booster battery. Always keep the battery charged to prevent the electrolyte freezing.

Provide good ventilation when changing a battery or using a battery in an enclosed space. Always protect your eyes when working near a battery.

Never set tools down on the battery. They may induce a short circuit, causing irreparable damage to the battery and injuring persons.

Never wear metal necklaces, bracelets or watch straps when working on the battery. The metal parts may induce a short circuit resulting in burns.

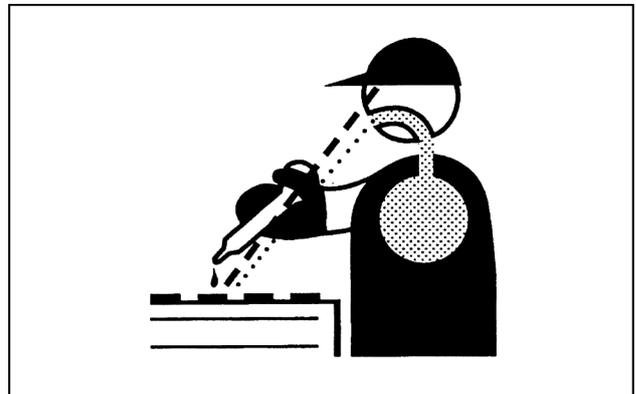
Dispose of used batteries separately from other waste in the interests of environmental protection.



TUL112WEX2015AA 12



TUL112WEX2016AA 13



TUL112WEX2017AA 14

Flammable liquids

When handling flammable liquids:

- Do not smoke.
- Keep away from unshielded light sources and naked flames.

Fuels often have a low flash point and are readily ignited.

Never attempt to extinguish burning liquids with water. Use:

- Dry powder
- With carbon dioxide
- With foam

Water used for extinguishing purposes would vaporize instantaneously on contact with burning substances and spread burning oil, for example, over a wide area. Water generates short circuits in the electrical system, possibly producing new hazards.

Stay away from open flames during refilling of hydraulic oil or fuel.

Fuel or oil splashes can cause slipping and therefore accidents; clean immediately and accurately the areas eventually smeared.

Always tighten the safety plugs of fuel tank and hydraulic oil tank firmly.

Never use fuel to clean the machine parts eventually smeared with oil or dust.

Use a non-inflammable product for cleaning parts.

Always perform fuel or oil refilling in well aired and ventilated areas.

During refuelling hold the pistol firmly and keep it always in contact with the filler neck until the end of the refuelling, to avoid sparkles due to static electricity.

Do not overfill the tank but leave a space for fuel expansion.

Never refuel when the engine is running.

Take all the necessary safety measures when welding, grinding or when working near a naked flame.



TUL112WEX2016AA 15



TUL112WEX2018AA 16



TUL112WEX2019AA 17

Cleaning

Clean the exterior of all components before carrying out any form of repair. Dirt and dust can reduce the efficient working life of a component and lead to costly replacement.

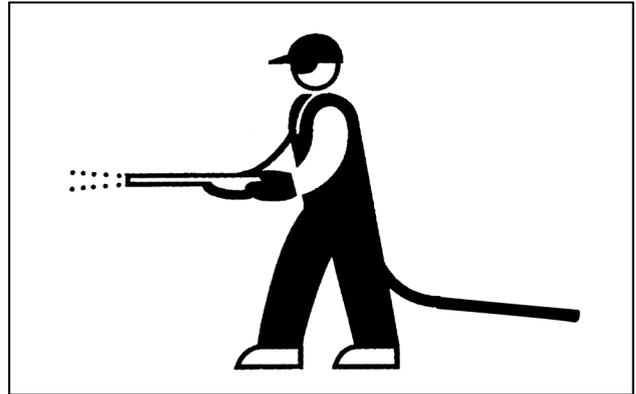
Solvents should be checked that they are suitable for the cleaning of components and also that they do not risk the personal safety of the user.

Dirt from oil or grease and scattered tools or faulty pieces are dangerous for persons, because they can generate slipping or falls.

For the machine cleaning, use a jet of warm water or steam under pressure and commercial detergents. Never use fuel, petroleum or solvents, because the first ones leave an oily layer that favours the sticking of dust, while solvents (even if weak) damage the paint and favour the formation of rust.

Never use water jets or steam on sensors, connectors or other electric components.

Prevent that the water jet penetrates inside the cab.



TUL112WEX2021AA 18

Waste disposal

Improperly disposing of waste can threaten the environment.

Each country has its own Regulations on this subject. It is therefore advisable to prepare suitable containers to collect and store momentarily all solid and fluid materials that must not be scattered in the environment to avoid pollution.

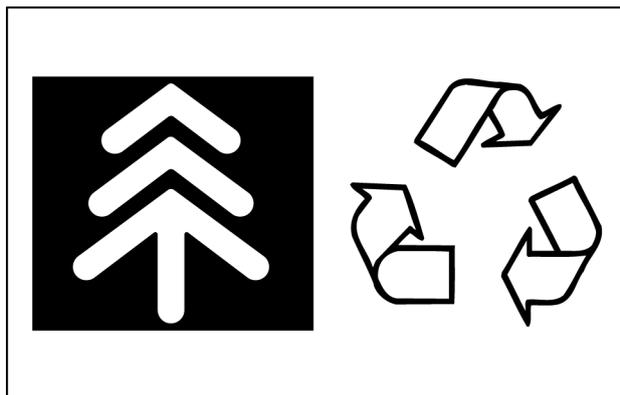
At preset intervals these products will be delivered to disposal stations legally recognized and present in this Country.

Hereunder are listed some products of the machine requiring disposal:

- Lubricating oil
- Brake system oil
- Coolant mixture, condensation rests and pure antifreeze
- Fuel
- Filter elements, oil and fuel filters
- Filter elements, air filters
- Battery

Also polluting rags, paper, sawdust and gloves must be disposed in compliance with the same procedures.

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 centre to recover and recycle used air conditioning refrigerants. Obtain information on the proper way to recycle or dispose of waste from your local environmental or recycling centre, or from your Dealer.

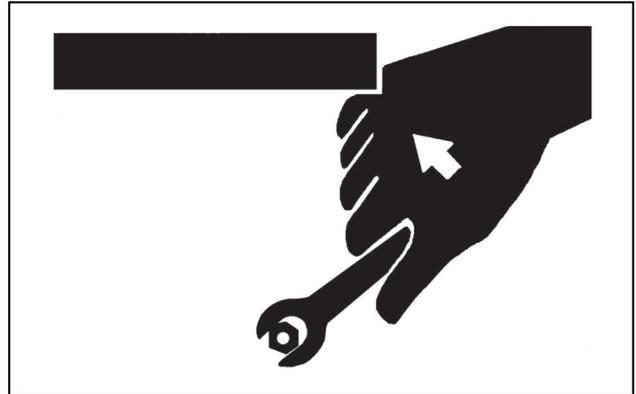


TUL112WEX2022AA 19

Torque

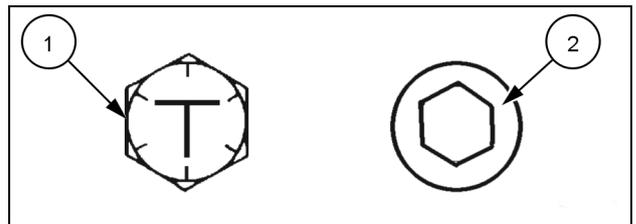
Bolt types

NOTICE: Use tools appropriate for the work to be done. Makeshift tools and procedures can create safety hazards. For loosening and tightening nuts and bolts, use the correct tools. Avoid bodily injury caused by slipping wrenches.



TULI12ECX0475AA 1

Tighten nuts or bolts to torque specifications. There are two kinds of bolts; hexagon T bolts (1) and socket bolts (2). The two types of bolts are made from different materials. The correct type of bolt must be used when assembling the machine and/or components.



RAPH12CEX1320AA 2

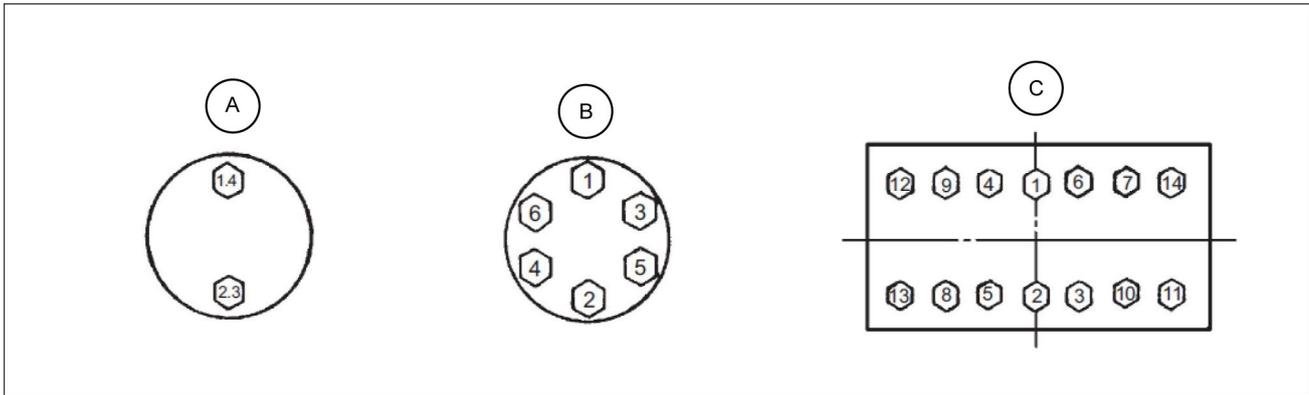
Specified tightening torque chart

Bolt dia.	Wrench size	Hexagon wrench size	T bolt, socket bolt
M8	13 mm	6 mm	29.5 N·m (22 lb ft)
M10	17 mm	8 mm	64 N·m (47 lb ft)
M12	19 mm	10 mm	108 N·m (80 lb ft)
M14	22 mm	12 mm	175 N·m (129 lb ft)
M16	24 mm	14 mm	265 N·m (195 lb ft)
M18	27 mm	14 mm	390 N·m (288 lb ft)
M20	30 mm	17 mm	540 N·m (398 lb ft)
M22	32 mm	17 mm	740 N·m (546 lb ft)
M24	36 mm	19 mm	930 N·m (686 lb ft)
M27	41 mm	19 mm	1370 N·m (1010 lb ft)
M30	46 mm	22 mm	1910 N·m (1409 lb ft)
M33	50 mm	24 mm	2550 N·m (1881 lb ft)
M36	55 mm	27 mm	3140 N·m (2316 lb ft)

1. Apply lubricant (i.e. white zinc B dissolved into spindle oil) to nuts and bolts to stabilize their friction coefficients.
2. Torque tolerance is $\pm 10\%$.
3. Be sure to use bolts of correct length. Bolts that are too long cannot be tightened, as the bolt tip comes into contact with the bottom of the bolt hole. Bolts that are too short cannot develop sufficient tightening force.
4. The torques given in the chart 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 nut and bolt threads are clean before installing. Remove dirt or corrosion, if any.

Bolt tightening order

When tightening two or more bolts, tighten them alternately, as shown, to ensure even tightening.



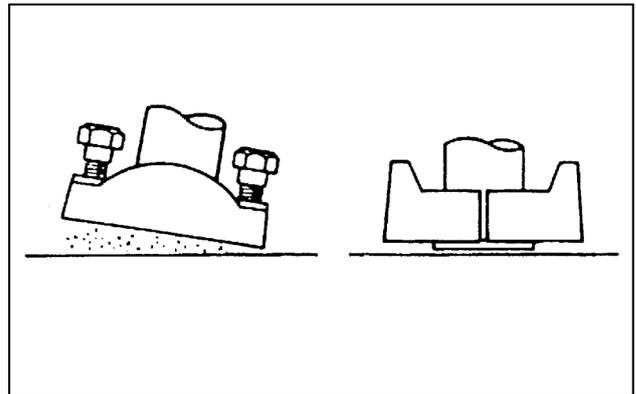
SMIL13CEX0149EA 3

- A Equally tighten upper and lower alternately
- B Tighten diagonally
- C Tighten from center and diagonally

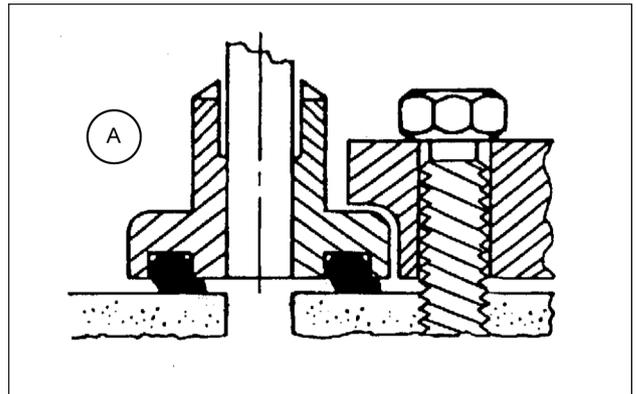
Service recommendations for split flange

1. Be sure to clean and inspect sealing surfaces. Scratches/roughness cause leaks and seal wear. Unevenness causes seal extrusion. If defects cannot be polished out, replace the component.
2. Be sure to use only specified O-rings. Inspect O-rings for any damage. Take care not to file O-ring surfaces. When installing an O-ring into a groove, use grease to hold it in place.
3. Loosely assemble split flange halves. Make sure that the split is centrally located and perpendicular to the port. Hand-tighten the bolts to hold the parts in place. Take care not to pinch the O-ring.
4. Tighten bolts alternately and diagonally, as shown, to ensure even tightening.
5. Do not use air wrenches. Using an air wrench often causes tightening of one bolt fully before tighten the others, resulting in damage to O-rings or uneven tightening of bolts.

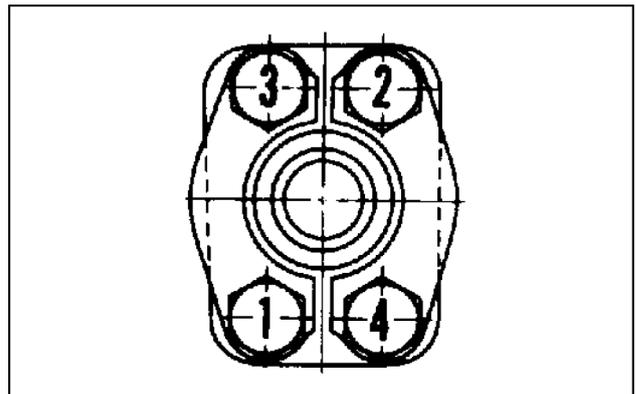
A - WRONG



TULI12ECX0802AA 4



SML13CEX0150AA 5



TULI12ECX0804AA 6

Nut and bolt lockings

Lock plate

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

Cotter pin

NOTICE: Do not reuse cotter pins. Match the holes in the bolt and nut while tightening, not while loosening.

Lock wire

NOTICE: Apply wire to bolts in the bolt tightening direction, not in the bolt-loosening direction.

A - RIGHT

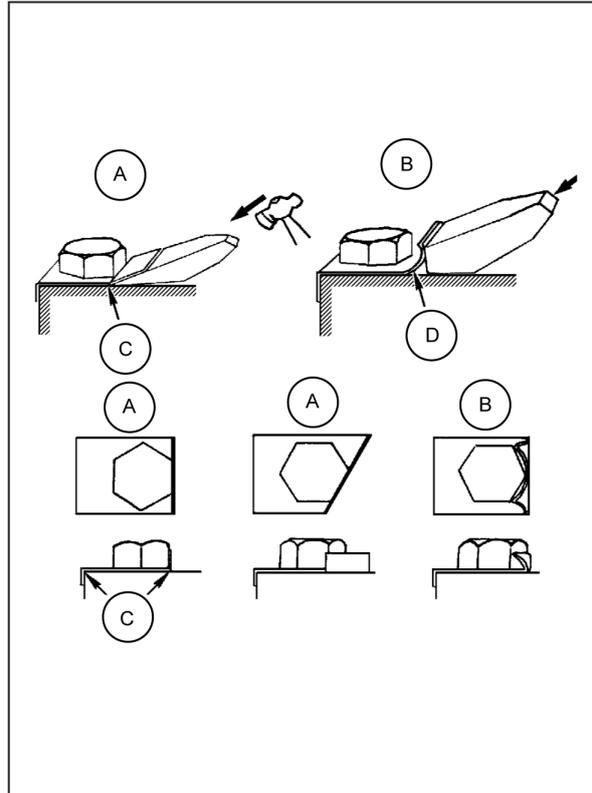
B - WRONG

C - Bend along edge sharply

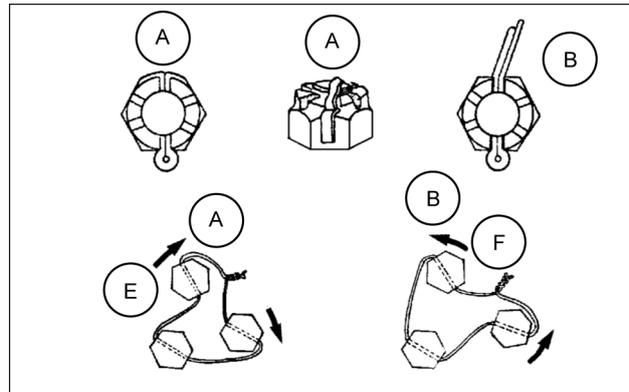
D - Do not bend it round

E - Tighten

F - Loosen



SMIL13CEX0151BA 7



SMIL13CEX0152AA 8

Piping joint

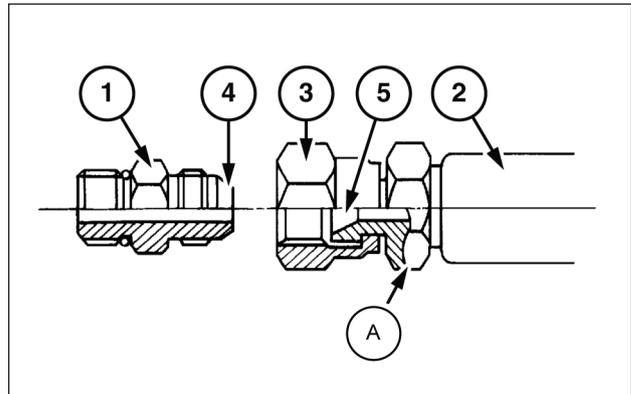
Pipe thread connection/Union joint tightening torque specifications

Union joint

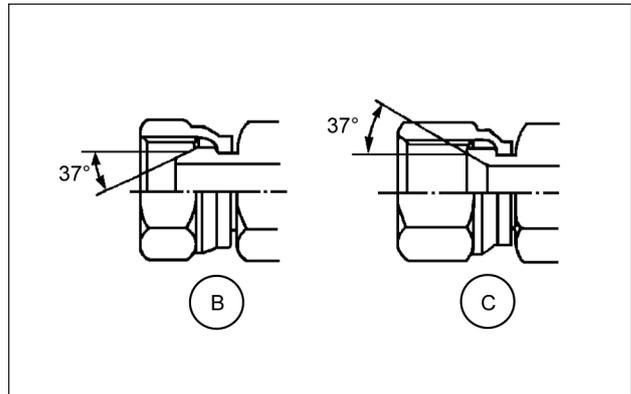
Metal sealing faces (4) and (5) of adaptor (1) and hose (2) fit together to seal pressure oil. Union joints are used to join small-diameter lines.

1. Do not over tighten union nut (3). Excessive force will be applied to metal sealing surfaces (4) and (5), possibly cracking adaptor (1). Be sure to tighten union nut (3) to specifications.
2. Scratches or other damage to sealing surfaces (4) or (5) will cause oil leakage at the joint. Take care not to damage them when connecting/disconnecting.

- A - Joint body
- B - Male Union Joint
- C - Female Union Joint



SML13CEX0153AB 9



SML13CEX0154AA 10

Type	Wrench size		Tightening torque
	Union nut	Joint body	
37° Union joint	19 mm	17 mm	29 N·m (21 lb ft)
	22 mm	19 mm	39 N·m (29 lb ft)
	27 mm	22 mm	78.5 N·m (58 lb ft)
	36 mm	30 mm, 32 mm	157 N·m (116 lb ft)
	41 mm	36 mm	205 N·m (151 lb ft)
	50 mm	46 mm	323.6 N·m (239 lb ft)

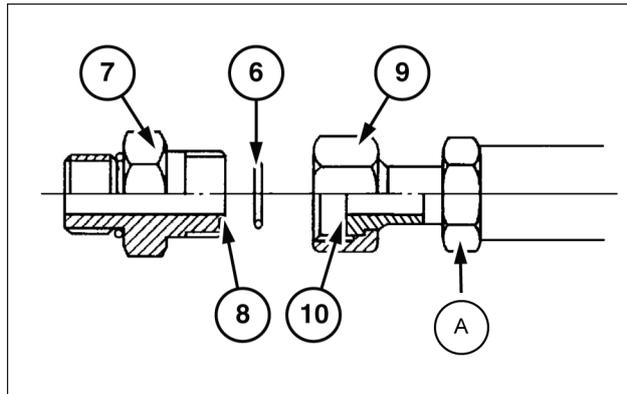
NOTE: Tightening torque for the non union type 37° male joint is the same as the 37° female union joint.

O-ring seal joint

O-ring (6) seats against the end face of adaptor (7) to seal pressure oil.

O-ring procedures:

1. Be sure to replace O-ring (6) with a new one when reconnecting.
2. Before tightening union nut (9), confirm that O-ring (6) is seated correctly in O-ring groove (8). Tightening union nut (9) with O-ring (6) displaced will damage O-ring, resulting in oil leakage.
3. Take care not to damage O-ring groove (8) or sealing face (10). Damage to O-ring (6) will cause oil leakage.
4. If union nut (9) is found to be loose, causing oil leakage, do not tighten it to stop the leak. Instead, replace O-ring (6) with a new one, then tighten union nut (9) after confirming that O-ring (6) is securely seated in place.



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A Joint body

Wrench size		Tightening torque
Union nut	Joint body	
19 mm	17 mm	29.4 N·m (22 lb ft)
22 mm	19 mm	68.6 N·m (51 lb ft)
27 mm	22 mm	93 N·m (69 lb ft)
30 mm	27 mm	137.3 N·m (101 lb ft)
36 mm	30 mm	175 N·m (129 lb ft)
41 mm	36 mm	205 N·m (151 lb ft)
50 mm	46 mm	320 N·m (236 lb ft)

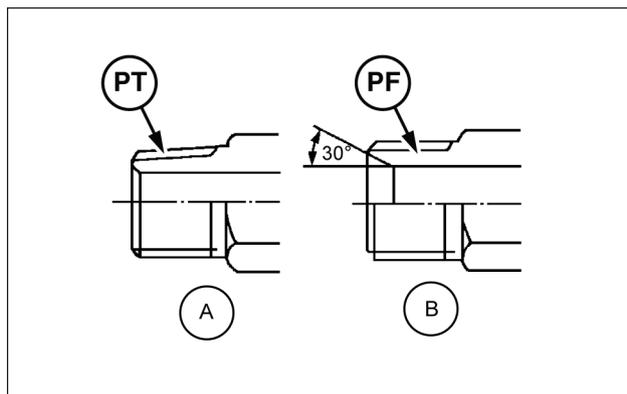
Screwed-in connection

NOTICE: Many types of screwed-in connections are used for hose connections.

Be sure to confirm that the thread pitch and thread type (tapered or straight) are the correct type before using any screw-in connection.

A - Male Tapered Thread

B - Female Straight Thread



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Male tapered thread	
Wrench joint body	Tightening torque
17 mm, 19 mm	34 N·m (25 lb ft)
22 mm	49 N·m (36 lb ft)
27 mm	93 N·m (69 lb ft)
32 mm, 36 mm	157 N·m (116 lb ft)
41 mm	205 N·m (151 lb ft)
50 mm	320 N·m (236 lb ft)
60 mm	410 N·m (302 lb ft)

Seal tape application

Seal tape is used to seal clearances between male and female threads, so as to prevent any leakage between threads.

Be sure to apply just enough seal tape to fill up thread clearances. Do not overwrap.

- Application procedure

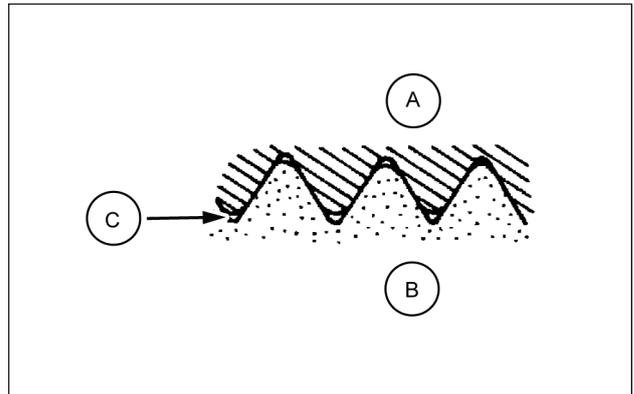
Confirm that the thread surface is clean, free of dirt or damage.

Apply seal tape around threads as shown. Wrap seal tape in the same direction as the threads.

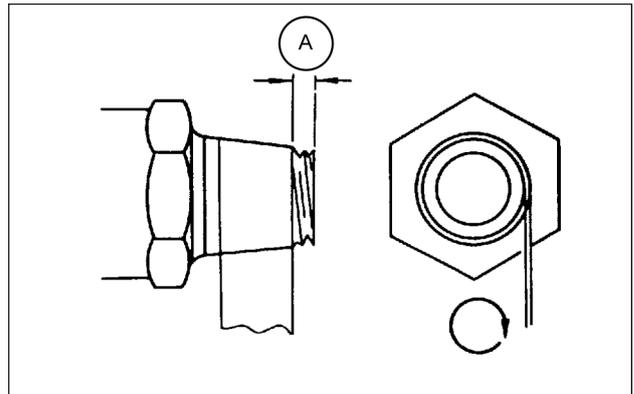
A - Internal Thread

B - External Thread

C - Clearance



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A Leave one to two pitch threads uncovered

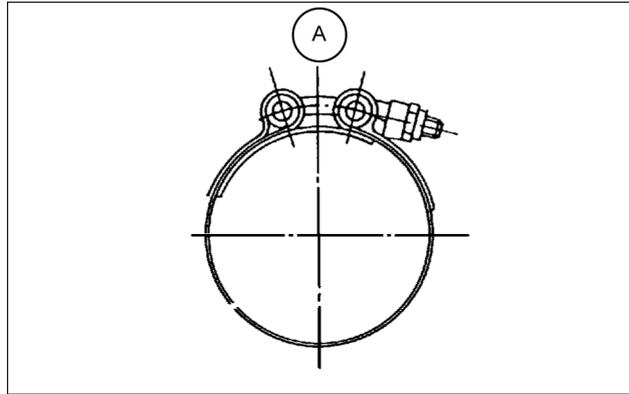
Low-pressure-hose clamp tightening torque

Low-pressure-hose clamp tightening torque differs depending on the type of clamp.

See below for correct tightening torque of each type of low-pressure-hose clamp.

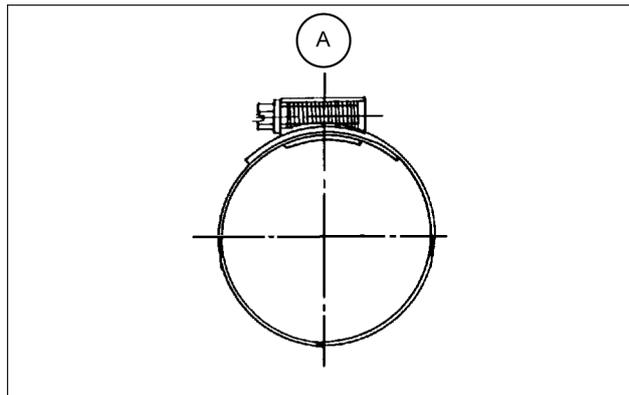
T-bolt type band clamp: **4.4 N·m (3.25 lb ft)**

Worm gear type band clamp: **5.9 - 6.9 N·m (4.4 - 5.1 lb ft)**



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A - T-Bolt Type



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A - Worm Gear Type

Connecting hose

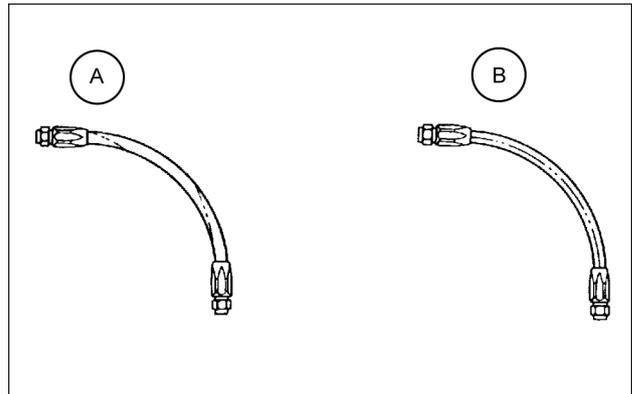
1. When replacing hoses, be sure to use only genuine parts. Using hoses other than genuine hoses may cause oil leakage, hose rupture or separation of fitting, possibly resulting in a fire on the machine.
2. Do not install hoses kinked. Application of high oil pressure, vibration, or an impact to a kinked hose may result in oil leakage, hose rupture or separation of fitting.

Utilize print marks on hoses when installing hoses to prevent hose from being installed kinked.

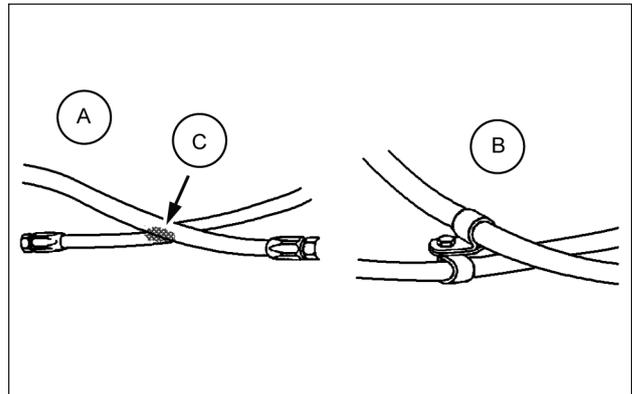
3. If hoses rub against each other, wear to the hoses will result, leading to hose rupture. Take necessary measures to protect hoses from rubbing against each other.

Take care that hoses do not come into contact with moving parts or sharp objects.

- A - WRONG
- B - RIGHT
- C - Rubbing Against Each Other

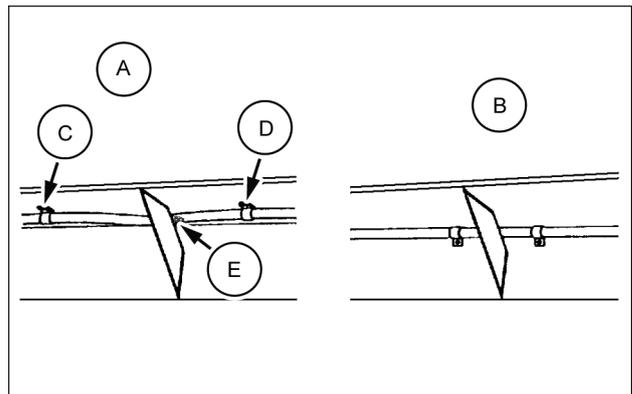


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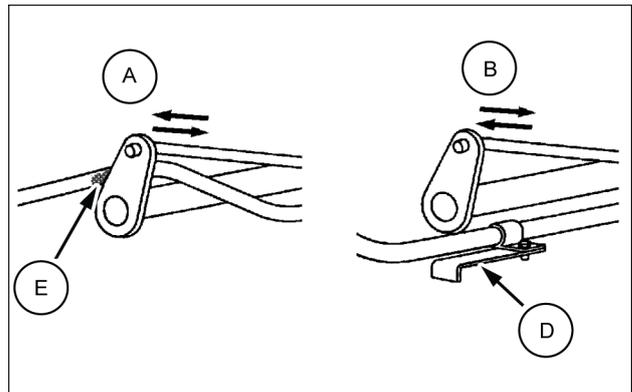


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- A - WRONG
- B - RIGHT
- C - Clamp
- D - Clamp
- E - Rubbing



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SMIL13CEX0164AB 20

Basic instructions - 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 NEW HOLLAND CONSTRUCTION Sales and Service Networks.

Basic instructions - How to use the maintenance standard and precautions

Application

WHEN THE MACHINE IS NEW

Confirm that the performances are in accordance with standard specifications as compared to the performance standards.

AT SPECIFIC SELF INSPECTION (RULE BY COUNTRY)

Use the data for the criterion, for the purpose of correction, adjustment and replacement.

WHEN PERFORMANCES ARE DETERIORATED

Determine whether it is caused by a fault or end of service life after long hours of operation, to be used for safety and economical considerations.

WHEN MAIN COMPONENTS ARE REPLACED

For example, use data to restore performances of pumps and others.

Terminology

STANDARD VALUES

Values to be used to condition or assemble a new machine. Where special notes are not given, these values represent standard specifications (machine with standard attachments and standard shoes).

REFERENCE VALUES FOR REMEDY

Values at which readjustment is required. In order to ensure performance and safety it is strictly prohibited to use the machine over the specified values.

SERVICE LIMIT

This is the limit value at which reconditioning is impossible without replacement of parts. If the value is expected to exceed the service limit before next inspection and correction are performed, replace the parts immediately. The operation over the specified values causes increase of damage and requires the down time of machine, and also causes safety problems.

Cautions to be exercised at judgment

EVALUATION OF MEASURED DATA

Disagreement of measuring conditions, variations of data peculiar to a new machine, and measuring errors are to be evaluated. Determine generally at what levels measured values are located, instead of determining whether or not values fall within or run out of the reference values.

DETERMINING CORRECTION, ADJUSTMENT OR REPLACEMENT

Machine performances deteriorate with time as parts wear and some deteriorated performances may be restored to new levels. Therefore, determine correction, adjustment or replacement, depending upon the operating hours, kind of work and circumstances in which the machine is placed, and condition the machine performances to its most desirable levels.

Other cautions to be exercised

PARTS LIABLE TO DEGRADE

Rubber products, such as, hydraulic hoses, O-rings, and oil seals deteriorate with time; replace them at regular intervals or at overhauls.

PARTS REQUIRING REGULAR REPLACEMENT

Out of critical hoses that are necessary to secure safety, we designate Very Important Parts (V.I.P) and recommend that they should be replaced regularly.

INSPECTION AND REPLACEMENT OF OILS AND GREASES

In performing maintenance, it is necessary for the user to familiarize himself with how to handle the machine safely, cautions to be exercised and inspection/lubrication procedures. Refer to the Operators Manuals as well.

Basic instructions - Preparation for performance tests

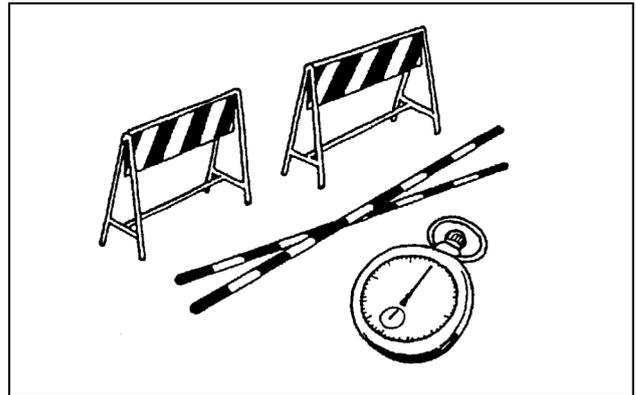
Observe the following rules in order to carry out performance tests accurately and safely.

The machine

1. Repair any defects and damage found, such as oil or water leaks, loose bolts, cracks and so on, before starting to test.

Test area

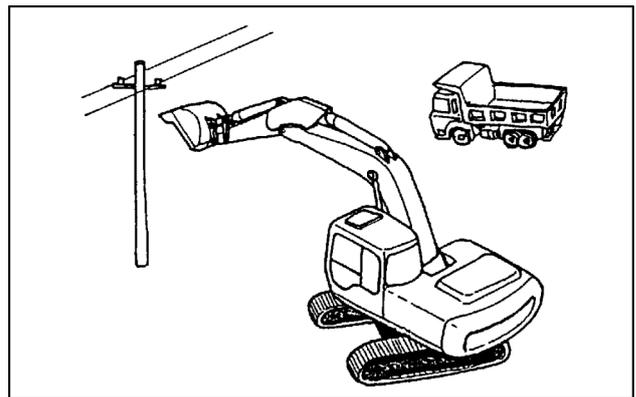
1. Select a hard and flat surface.
2. Secure enough space to allow the machine to run straight more than **20 m (787.4 in)**, and to make a full swing with the front attachment extended.
3. If required, rope off the test area and provide sign-boards to keep unauthorized personnel away.



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Precautions

1. Before starting to test, agree upon the signals to be employed for communication among coworkers. Once the test is started, be sure to communicate with each other using these signals, and to follow them without fail.
2. Operate the machine carefully and always give first priority to safety.
3. While testing, always take care to avoid accidents due to landslides or contact with high-voltage power lines. Always confirm that there is sufficient space for full swings.
4. Avoid polluting the machine and the ground with leaking oil. Use oil pans to catch escaping oil. Pay special attention to this when removing hydraulic pipings.



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Make precise measurement

1. Accurately calibrate test instruments in advance to obtain correct data.
2. Carry out tests under the exact test conditions prescribed for each test item.
3. Repeat the same test and confirm that the test data obtained can be produced repeatedly. Use mean values of measurements if necessary.