# Workshop Manual

# ZAXIS450 class

## 450/450H/450LC/450LCH/460LCH

Vol No.: W16J-E-01

## SAFETY ALERT SYMBOL AND HEADLINE NOTATIONS

In this manual, the following safety alert symbol and signal words are used to alert the reader to the potential for personal injury of machine damage.

⚠ This is the safety alert symbol. When you see this symbol, be alert to the potential for personal injury.
Never fail to follow the safety instructions prescribed along with the safety alert symbol.
The safety alert symbol is also used to draw attention to component/part weights.
To avoid injury and damage, be sure to use appropriate lifting techniques and equipment when lifting heavy parts.

- ⚠ **CAUTION:**
  Indicated potentially hazardous situation which could, if not avoided, result in personal injury or death.

- **IMPORTANT:**
  Indicates a situation which, if not conformed to the instructions, could result in damage to the machine.

- *NOTE:*
  Indicates supplementary technical information or know-how.

## UNITS USED

- SI Units (International System of Units) are used in this manual.
  MKSA system units and English units are also indicated in parenthheses just behind SI units.

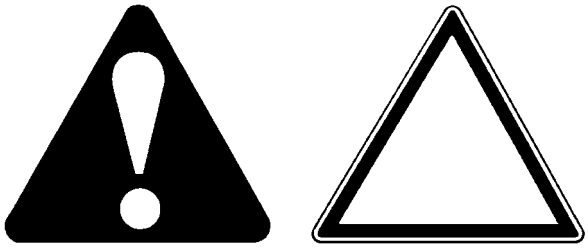
  Example : 24.5 MPa (250 kgf/cm$^2$, 3560 psi)

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

| Quantity | To Convert From | Into | Multiply By | Quantity | To Convert From | Into | Multiply By |
|---|---|---|---|---|---|---|---|
| Length | mm | in | 0.03937 | Pressure | MPa | kgf/cm$^2$ | 10.197 |
| | mm | ft | 0.003281 | | MPa | psi | 145.0 |
| Volume | L | US gal | 0.2642 | Power | kW | PS | 1.360 |
| | L | US qt | 1.057 | | kW | HP | 1.341 |
| | m$^3$ | yd$^3$ | 1.308 | Temperature | °C | °F | °C×1.8+32 |
| Weight | kg | lb | 2.205 | Velocity | 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 | 1.0197 | | mL/rev | cc/rev | 1.0 |
| | N·m | lbf·ft | 0.7375 | | | | |

## RECOGNIZE SAFETY INFORMATION

- This is the **SAFETY ALERT SYMBOL**.
  - When you see this symbol on your machine or in this manual, be alert to the potential for personal injury.
  - Follow recommended precautions and safe operating practices.



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## UNDERSTAND SIGNAL WORDS

- On machine safety signs, signal words designating the degree or level of hazard - DANGER, WARNING, or CAUTION - are used with the safety alert symbol.
  - **DANGER** indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
  - **WARNING** indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
  - **CAUTION** indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.
    **DANGER or WARNING safety signs** are located near specific hazards. General precautions are listed on **CAUTION safety signs**.
  - Some safety signs don't use any of the designated signal words above after the safety alert symbol are occasionally used on this machine.
- **CAUTION** also calls attention to safety messages in this manual.
- To avoid confusing machine protection with personal safety messages, a signal word **IMPORTANT** indicates a situation which, if not avoided, could result in damage to the machine.
- ***NOTE*** indicates an additional explanation for an element of information.


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## FOLLOW SAFETY INSTRUCTIONS

- Carefully read and follow all safety signs on the machine and all safety messages in this manual.
- Safety signs should be installed, maintained and replaced when necessary.
  - If a safety sign or this manual is damaged or missing, order a replacement from your authorized dealer in the same way you order other replacement parts (be sure to state machine model and serial number when ordering).
- Learn how to operate the machine and its controls correctly and safely.
- Allow only trained, qualified, authorized personnel to operate the machine.
- Keep your machine in proper working condition.
  - Unauthorized modifications of the machine may impair its function and/or safety and affect machine life.
- The safety messages in this SAFETY chapter are intended to illustrate basic safety procedures of machines. However it is impossible for these safety messages to cover every hazardous situation you may encounter. If you have any questions, you should first consult your supervisor and/or your authorized dealer before operating or performing maintenance work on the machine.

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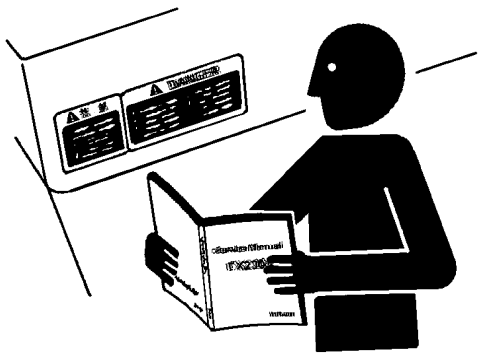

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## PREPARE FOR EMERGENCIES

- Be prepared if a fire starts or if an accident occurs.
  - Keep a first aid kit and fire extinguisher on hand.
  - Thoroughly read and understand the label attached on the fire extinguisher to use it properly.
  - To ensure that a fire-extinguisher can be always used when necessary, check and service the fire-extinguisher at the recommended intervals as specified in the fire-extinguisher manual.
  - Establish emergency procedure guidelines to cope with fires and accidents.
  - Keep emergency numbers for doctors, ambulance service, hospital, and fire department posted near your telephone.

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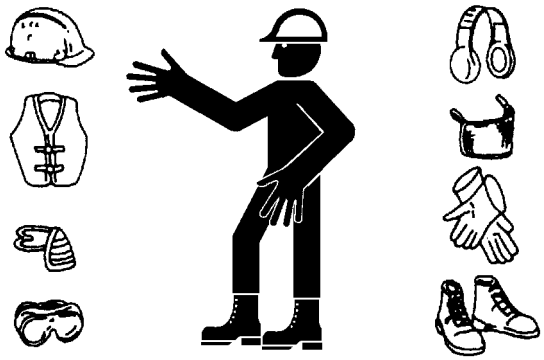
## WEAR PROTECTIVE CLOTHING

- Wear close fitting clothing and safety equipment appropriate to the job.
  You may need:
  A hard hat
  Safety shoes
  Safety glasses, goggles, or face shield
  Heavy gloves
  Hearing protection
  Reflective clothing
  Wet weather gear
  Respirator or filter mask.
  Be sure to wear the correct equipment and clothing for the job. Do not take any chances.
  - Avoid wearing loose clothing, jewelry, or other items that can catch on control levers or other parts of the machine.
- Operating equipment safely requires the full attention of the operator. Do not wear radio or music headphones while operating the machine.



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## 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 uncomfortably loud noises.

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## INSPECT MACHINE

- Inspect your machine carefully each day or shift by walking around it before you start it to avoid personal injury.
  - In the walk-around inspection be sure to cover all points described in the “PRE-START INSPECTION” chapter in the operator’s manual.

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## GENERAL PRECAUTIONS FOR CAB

- Before entering the cab, thoroughly remove all dirt and/or oil from the soles of your work boots. If any controls such as a pedal is operated while with dirt and/or oil on the soles of the operator's work boots the operator's foot may slip off the pedal, possibly resulting in a personal accident.
- Don't leave parts and/or tools lying around the operator's seat. Store them in their specified locations.
- Avoid storing transparent bottles in the cab. Don't attach any transparent type window decorations on the windowpanes as they may focus sunlight, possibly starting a fire.
- Refrain from listening to the radio, or using music headphones or mobile telephones in the cab while operating the machine.
- Keep all flammable objects and/or explosives away from the machine.
- After using the ashtray, always cover it to extinguish the match and/or tobacco.
- Don't leave cigarette lighters in the cab. When the temperature in the cab increases, the lighter may explode.

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**SECTION AND GROUP CONTENTS**

**WORKSHOP MANUAL**

## SECTION 1 GENERAL INFORMATION



## SECTION 2 UPPERSTRUCTURE



## SECTION 3 UNDERCARRIAGE



## SECTION 4 FRONT ATTACHMENT



## SECTION 5 ENGINE

## TECHNICAL MANUAL (Operational Principle)



## TECHNICAL MANUAL (Troubleshooting)

# SECTION 1
# GENERAL

## — CONTENTS —

## PRECAUTIONS FOR DISASSEMBLING AND ASSEMBLING

### Precautions for Disassembling and Assembling

- Clean the Machine

  Thoroughly wash the machine before bringing it into the shop. Bringing a dirty machine into the shop may cause machine components to be contaminated during disassembling/assembling, resulting in damage to machine components, as well as decreased efficiency in service work.

- Inspect the Machine

  Be sure to thoroughly understand all disassem-bling/assembling procedures beforehand, to help avoid incorrect disassembling of components as well as personal injury.
  Be sure to and record the items listed below to prevent problems from occurring in the future.

  - The machine model, machine serial number, and hour meter reading.
  - Reason for disassembly (symptoms, failed parts, and causes).
  - Clogging of filters and oil, water or air leaks, if any.
  - Capacities and condition of lubricants.
  - Loose or damaged parts.

- Prepare and Clean Tools and Disassembly Area

  Prepare the necessary tools to be used and the area for disassembling work.

- Precautions for Disassembling

  - To prevent dirt from entering, cap or plug the removed pipes.
  - Before disassembling, clean the exterior of the components and place on a work bench.
  - Before disassembling, drain gear oil from the reduction gear.
  - Be sure to provide appropriate containers for draining fluids.
  - Use matching marks for easier reassembling.
  - Be sure to use the specified special tools, when instructed.
  - If a part or component cannot be removed after removing its securing nuts and bolts, do not attempt to remove it forcibly. Find the cause(s), then take the appropriate measures to remove it.
  - Orderly arrange disassembled parts. Mark and tag them as necessary.
  - Store common parts, such as bolts and nuts with reference to where they are to be used and in a manner that will prevent loss.
  - Inspect the contact or sliding surfaces of disassembled parts for abnormal wear, sticking, or other damage.
  - Measure and record the degree of wear and clearances.

- Precautions for Assembling

  - Be sure to clean all parts and inspect them for any damage. If any damage is found, repair or replace part.
  - Dirt or debris on the contact or sliding surfaces may shorten the service life of the machine. Take care not to contaminate any contact or sliding surfaces.
  - Be sure to replace O-rings, backup rings, and oil seals with new ones once they are disassembled. Apply a film of grease before installing.
  - Check that liquid-gasket-applied surfaces are clean and dry.
  - If an anti-corrosive agent has been used on a new part, be sure to thoroughly clean the part to remove the agent.
  - Utilize matching marks when assembling.
  - Be sure to use the designated tools to assemble bearings, bushings and oil seals.
  - Keep a record of the number of tools used for disassembly/assembly. After assembling is complete, count the number of tools, so as to make sure that no forgotten tools remain in the assembled machine.

**Bleeding Air from Hydraulic System**

When hydraulic oil is drained, the suction filter or the suction lines are replaced, or the removal and installation of the pump, swing motor, travel motor or cylinder is done, bleed air from the hydraulic system in the following procedures:

**IMPORTANT: If the engine is started with air trapped in the hydraulic pump housing, damage to the pump may result. If the hydraulic motor is operated with air trapped in the hydraulic motor housing, damage to the motor may result. If the cylinder is operated with air trapped in the cylinder tube, damage to the cylinder may result. Be sure to bleed air before starting the engine.**

- Bleeding Air from Hydraulic Pump

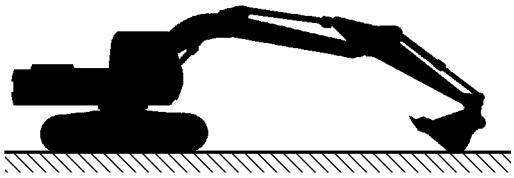
  - Remove the air bleeding plug from the top of the pump and fill the pump housing with hydraulic oil.
  - After the pump housing is filled with hydraulic oil, temporarily tighten the plug. Then, start the engine and run at slow idle speed.
  - Slightly loosen the plug to bleed air from the pump housing until hydraulic oil oozes out.
  - After bleeding all the air, securely tighten the plug.

- Bleeding Air from Travel Motor / Swing Motor

  - With the drain plug / hose on travel motor / swing motor removed, fill the motor case with hydraulic oil.

- Bleeding Air from Hydraulic Circuit

  - After refilling hydraulic oil, start the engine. While operating each cylinder, swing motor and travel motor evenly, operate the machine under light loads for 10 to 15 minutes. Slowly start each operation (never fully stroke the cylinders during initial operation stage). As the pilot oil circuit has an air bleed device, air trapped in the pilot oil circuit will be bled while performing the above operation for approx. 5 minutes.
  - Reposition the front attachment to check hydraulic oil level.
  - Stop the engine. Recheck hydraulic oil level. Replenish oil as necessary.



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**Floating Seal Precautions**

1. In general, replace the floating seal with a new one after disassembling.
   If the floating seal is to be reused, follow these procedures:

   (1) Keep seal rings together as a matched set with seal ring faces together. Insert a piece of cardboard to protect surfaces.

   (2) Check the slide surface on seal ring (A) for scuffing, scoring, corrosion, deformation or uneven wear.

   (3) Check O-ring (B) for tears, breaks, deformation or hardening.

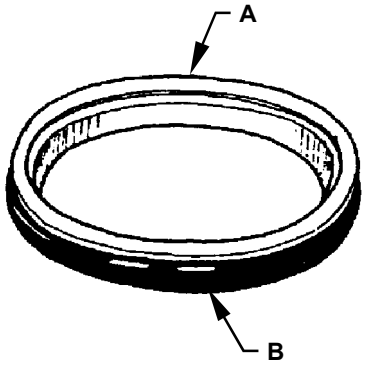
2. If incorrectly assembled, oil leakage or damage will occur. Be sure to do the following, to prevent trouble.

   (1) Clean the floating seal and seal mounting bores with cleaning solvent.
   Use a wire brush to remove mud, rust or dirt.
   After cleaning, thoroughly dry parts with compressed air.

   (2) Clean the floating seal and seal mounting bores. Check the bore surface for scuffing or scoring by touching the surface with touch.

   (3) Check that the O-ring is not twisted, and that it is installed correctly on the seal ring.

   (4) After installing the floating seal, check that seal ring surface (A) is parallel with seal mating face (C) by measuring the distances (A) and (C) at point (a) and (b), as illustrated. If these distances differ, correct the O-ring seating.

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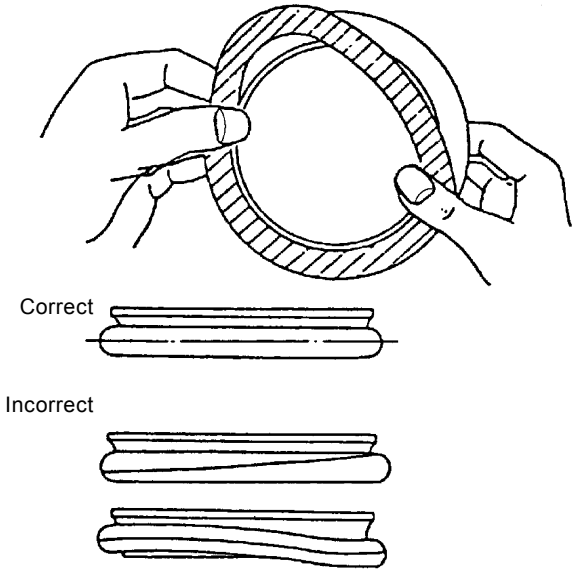


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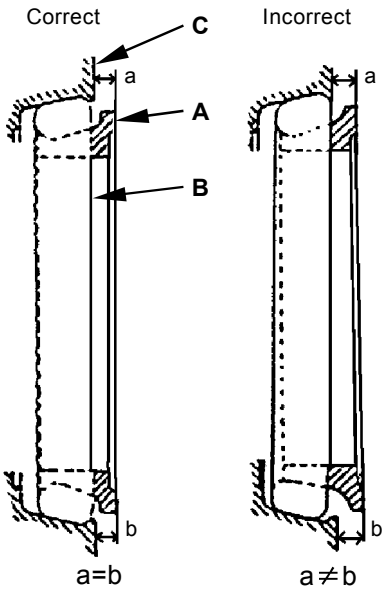


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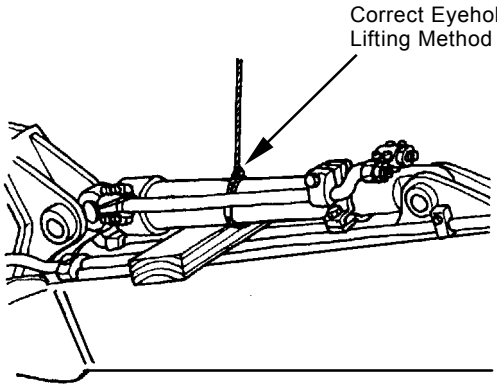
**Precautions for Using Nylon Sling**

1. Follow the precautions below to use nylon slings safely.

- Attach protectors (soft material) on the corners of the load so that the nylon sling does not directly contact the corners. This will prevent the nylon sling from being damaged and the lifted load from slipping.
- Lower the temperature of the lifted load to lower than 100 °C (212 °F). If unavoidably lifting a load with a temperature of 100 °C (212 °F) or more, reduce the load weight.
- Do not lift acid or alkali chemicals.
- Take care not to allow the sling to become wet. The load may slip.
- When required to use more than one sling, use slings with the same width and length to keep the lifted load balanced.
- When lifting a load using an eyehole, be sure to eliminate any gaps between the sling and load. (Refer to the right illustration.) Reduce the load weight so that it is less than 80 % of the sling breaking force.
- Avoid using twisted, bound, connected, or hitched slings.
- Do not place any object on twisted or bent slings. (Refer to the right illustration.)
- When removing the slings from under the load, take care not to damage the nylon slings. Avoid contact with protrusions.
- Avoid dragging slings on the ground, throwing slings or pushing slings with a metal object.
- When using with other types of slings (wire rope) or accessories (shackle), protect the joint so that the nylon sling is not damaged.
- Store the nylon slings indoors so they won't deteriorate with heat, sun light, or chemicals.

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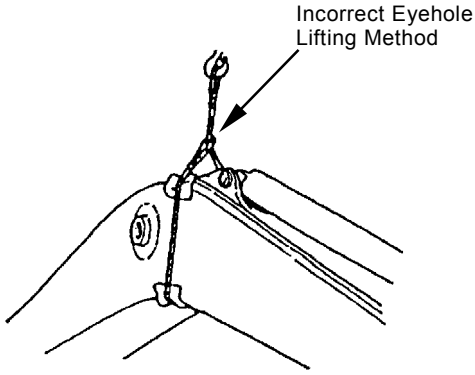


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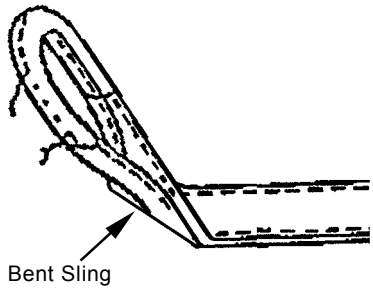


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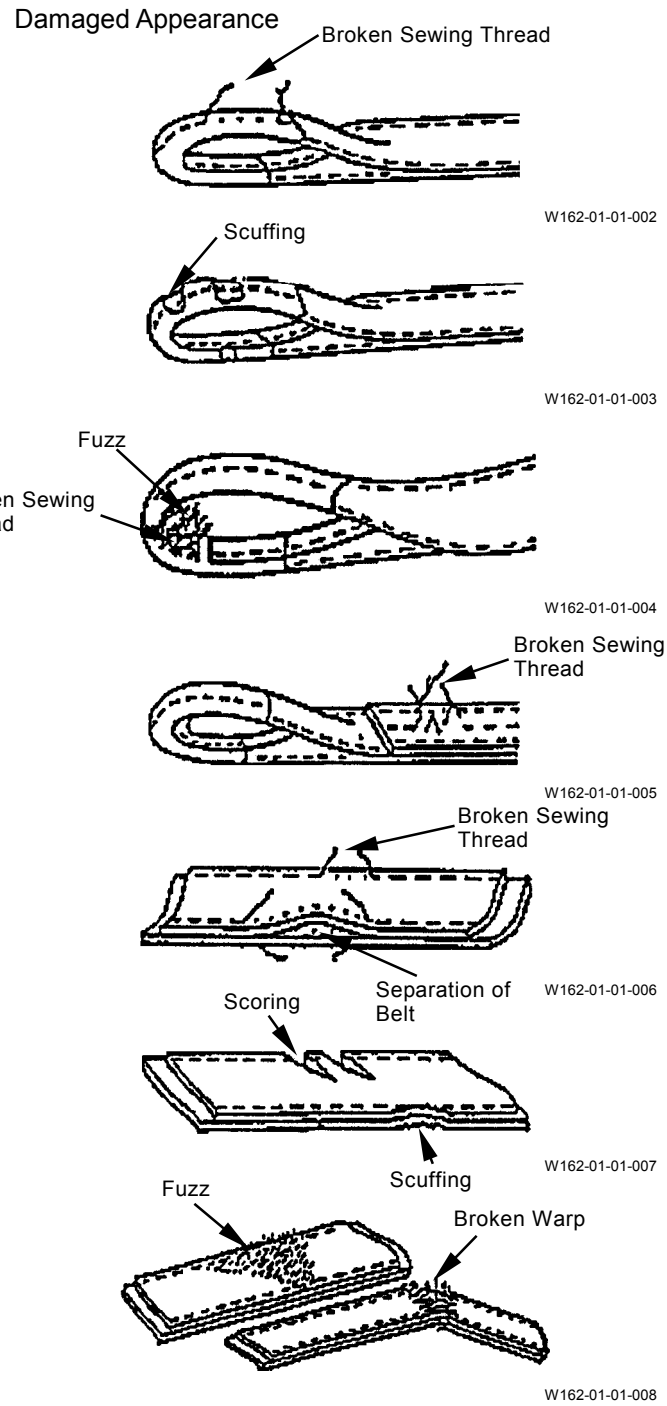
**CAUTION: If a load is lifted with a damaged nylon sling, serious personal injury may result. Be sure to visually check the nylon sling for any damage before using.**

2. Before using a nylon sling, visually check the nylon sling for any damage corresponding to examples shown to the right. If any damage is found, cut and discard the sling. Even if no damage is found, do not use slings older than 7-years.



## MAINTENANCE STANDARD TERMINOLOGY

**"Standard"**

1. Dimension for parts on a new machine.

2. Dimension of new components or assemblies adjusted to specification.

**"Allowable Limit"**

1. Normal machine performance cannot be accomplished after exceeding this limit.

2. Repair or adjustment is impossible after exceeding this limit.

3. Therefore, in consideration of operation efficiency and maintenance expense, proper maintenance shall be carried out before reaching the "Allowable Limit".

(Blank)

## TIGHTENING TORQUE SPECIFICATION

| No. | Descriptions | | | Bolt Dia mm | Q'ty | Wrench Size (mm) | Torque N·m | Torque (kgf·m) | Torque (lbf·ft) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Engine cushion rubber mount-ing bolt | Front | | 22 | 2 | 32 | 750 | (76.5) | (550) |
| | | Rear | Engine cushion rubber | 22 | 2 | 32 | 750 | (76.5) | (550) |
| | | | Cushion rubber-machine | 18 | 4 | 27 | 400 | (41.0) | (295) |
| 2 | Engine bracket mounting bolt | | | 14 | 8 | 22 | 180 | (18.5) | (135) |
| 3 | Radiator mounting bolt | | | 16 | 4 | 24 | 210 | (21.5) | (155) |
| 4 | Hydraulic oil tank mounting bolt | | | 16 | 8 | 24 | 210 | (21.5) | (155) |
| 5 | Fuel tank mounting bolt | | | 16 | 8 | 24 | 210 | (21.5) | (155) |
| 6 | ORS fittings for hydraulic hoses and piping | | | $1-\frac{3}{16}$–12UNF | | 36 | 180 | (18.0) | (135) |
| | | | | $1-\frac{7}{16}$–12UNF | | 41 | 210 | (21.5) | (155) |
| 7 | Pump device mounting bolt | | | 12 | 12 | 19 | 90 | (9.2) | (66) |
| 8 | Control valve mounting bolt (hexagonal wrench) | | | 20 | 4 | 17 | 400 | (41.0) | (295) |
| 9 | Swing device mounting bolt | | | 22 | 26 | 32 | 750 | (76.5) | (550) |
| 10 | Swing motor mounting bolt (hexagonal wrench) | | | 18 | 24 | 14 | 300 | (30.5) | (220) |
| 11 | Battery mounting nut (except ZAXIS460LCH) | | | 8 | 3 | 13 | 20 | (2.0) | (15.0) |
| | Battery mounting nut (ZAXIS460LCH) | | | 12 | 2 | 19 | 35 | (3.5) | (26) |
| 12 | Cab mounting nut | | | 16 | 6 | 24 | 210 | (21.5) | (155) |
| 13 | Swing bearing mounting bolt to upperstructure | | | 27 | 36 | 41 | 1400 | (143) | (1030) |
| | Swing bearing mounting bolt to undercarriage | | | 27 | 36 | 41 | 1400 | (143) | (1030) |
| 14 | Travel device mounting bolt | | | 22 | 40 | 32 | 750 | (76.5) | (550) |
| | Travel motor mounting bolt | | | 18 | 8 | 27 | 300 | (30.5) | (220) |
| | Sprocket mounting bolt | | | 22 | 48 | 32 | 750 | (76.5) | (550) |
| 15 | Upper roller mounting | | STD, H | 18 | 16 | 27 | 400 | (41.0) | (295) |
| | | | LC, LCH | 18 | 24 | 27 | 400 | (41.0) | (295) |
| 16 | Lower roller mounting bolt | | STD, H | 22 | 64 | 32 | 750 | (76.5) | (550) |
| | | | LC, LCH | 22 | 72 | 32 | 750 | (76.5) | (1030) |
| 17 | Track shoe bolt | | STD, H | 24 | 392 | 32 | 1400 | (143) | (1030) |
| | | | LC, LCH | 24 | 424 | 32 | 1400 | (143) | (550) |
| 18 | Track guard mounting bolt | | STD | 22 | 28 | 32 | 750 | (76.5) | (550) |
| | | | LC | 22 | 36 | 32 | 750 | (76.5) | (550) |
| | | | H | 22 | 40 | 32 | 750 | (76.5) | (550) |
| | | | LCH | 22 | 40 | 32 | 750 | (76.5) | (550) |
| 19 | Track mounting bolt | | LC, LCH | 33 | 36 | 50 | 1750 | (178) | (1290) |

| No. | Descriptions | | Bolt Dia mm | Q'ty | Wrench Size (mm) | Torque N·m | Torque (kgf·m) | Torque (lbf·ft) |
|---|---|---|---|---|---|---|---|---|
| 20 | Coupling and clamp of low pressure piping | Coupling | 8 | | 13 | 10.5 to 12.5 | (1.05 to) (1.26) | (7.6 to 9.1) |
| | | Clamp | 1/4-28 UNF | | 11 | 9.8 | (1.0) | (7.2) |
| 21 | Counterweight mounting bolt (RIDE-ON TYPE) | | 36 | 6 | 55 | 2650 | (270) | (1950) |
| | Counterweight mounting bolt (FIT-IN TYPE) | | 45 | 2 | 65 | 2350 | (240) | (1730) |
| | | | 24 | 4 | 36 | 440 | (45.0) | (325) |
| 22 | Shuttle Valve Mounting Bolt | | 10 | 4 | 17 | 50 | (5.1) | (37) |
| 23 | Front pin-retaining bolt (Backhoe) | | 20 | 15 | 30 | 400 | (41.0) | (295) |
| | Front pin-retaining nut (Backhoe) | | 20 | 7 | 30 | 400 | (41.0) | (295) |
| 24 | Front pin retain bolt (Loading Shovel) | | 16 | 36 | 24 | 270 | (27.5) | (200) |
| | | | 20 | 12 | 30 | 550 | (56.0) | (410) |
| | | | 16 | 6 | 24 | 210 | (21.5) | (155) |
| | | | 12 | 4 | 19 | 90 | (9.2) | (60) |

*NOTE: 1. Apply lubricant (e.g. white zinc B dissolved into spindle oil) to bolts and nuts to reduce friction coefficient of them.*
*2. Make sure bolt and nut threads are clean before installing.*

## TORQUE CHART

**CAUTION: 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 correct size tools. Otherwise, tightening tools may slip, potentially causing personal injury.**

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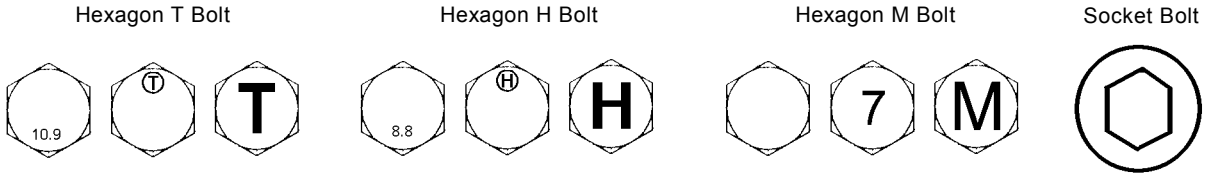
### Bolt Types

Tighten nuts or bolts correctly to torque specifications. Four different types and grades of bolt are employed. Make sure to employ correct bolts and tighten them correctly when assembling the machine or components.

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**Specified Tightening Torque Chart**

| Bolt Dia. | Wrench Size | Hexagon Wrench Size | T Bolt | | | H Bolt, Socket bolt | | | M Bolt | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | N·m | (kgf·m) | (lbf·ft) | N·m | (kgf·m) | (lbf·ft) | N·m | (kgf·m) | (lbf·ft) |
| M8 | 13 | 6 | 30 | (3.1) | (22) | 20 | (2.0) | (15.0) | 10 | (1.0) | (7.4) |
| M10 | 17 | 8 | 65 | (6.6) | (48) | 50 | (5.1) | (37) | 20 | (2.0) | (15.0) |
| M12 | 19 | 10 | 110 | (11.0) | (81) | 90 | (9.2) | (66) | 35 | (3.6) | (26.0) |
| M14 | 22 | 12 | 180 | (18.5) | (135) | 140 | (14.0) | (103) | 55 | (5.6) | (41) |
| M16 | 24 | 14 | 270 | (27.5) | (200) | 210 | (21.5) | (155) | 80 | (8.2) | (59) |
| M18 | 27 | 14 | 400 | (41.0) | (295) | 300 | (30.5) | (220) | 120 | (12.0) | (89) |
| M20 | 30 | 17 | 550 | (56.0) | (410) | 400 | (41.0) | (295) | 170 | (17.0) | (125) |
| M22 | 32 | 17 | 750 | (76.5) | (550) | 550 | (56.0) | (410) | 220 | (22.5) | (162) |
| M24 | 36 | 19 | 950 | (97.0) | (700) | 700 | (71.5) | (520) | 280 | (28.5) | (205) |
| M27 | 41 | 19 | 1400 | (143) | (1030) | 1050 | (107) | (770) | 400 | (41.0) | (295) |
| M30 | 46 | 22 | 1950 | (200) | (1440) | 1450 | (148) | (1070) | 550 | (56.0) | (410) |
| M33 | 50 | 24 | 2600 | (265) | (1920) | 1950 | (200) | (1440) | 750 | (76.5) | (550) |
| M36 | 55 | 27 | 3200 | (325) | (2360) | 2450 | (250) | (1810) | 950 | (97.0) | (700) |

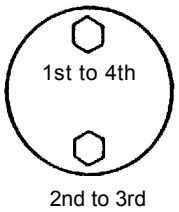
**IMPORTANT: The following items are applied to both fine and coarse pitch threads.**

1. **Apply lubricant (i. e. white zinc B dissolved Into Spindle oil) to nuts and bolts to reduce their friction coefficients.**
   **The plated bolts require no lubricant.**
2. **Torque tolerance is ±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 nut and bolt threads are clean before installing.**
   **Remove dirt or corrosion, if any.**

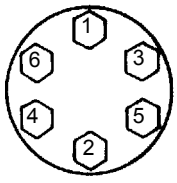
### Bolt Tightening Order

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

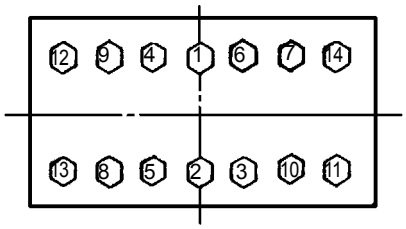
Equally tighten upper and lower alternately




Tighten diagonally




Tighten from center and diagonally

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