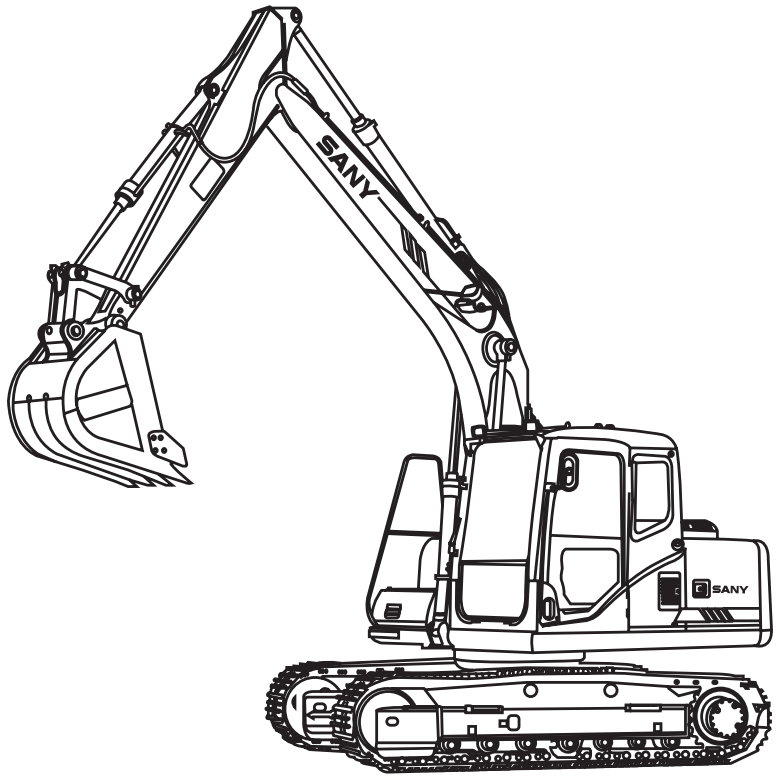
Quality Changes the World

Crawler Hydraulic Excavator

SY365H-9
SY365BH-9



Shop Manual

SANY

SY365(B)H-9
Crawler Hydraulic Excavator

Shop Manual

⚠ WARNING

- **Read and follow the safety precautions and instructions in this manual and on the machine decals. Failure to do can cause serious injury, death or property damage. Keep this manual with the machine for reading and future reference.**

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SANY

Introduction

1 Introduction

1 INTRODUCTION

1.1 How to Read the Manual

- Some attachments and optional parts in this shop manual may not be delivered to certain areas. If one of them is required, consult Sany distributors.
- Materials and specifications are subject to change without notice.

1.1.1 Shop manual organization

This shop manual contains the necessary technical information for services performed in a workshop. For ease of understanding, the manual is divided into the following sections.

Introduction

This section provides an overview of what is covered in the rest of this manual and how to use this manual,.

Shop Safety

This section covers basic shop safety information relating to this equipment. It also describes what the hazard alerts mean that are used throughout the manual.

Specifications

Technical specification of work equipment and optional parts are given in this section.

Structure and functions

This section explains the structure and function of each component. It helps the reader to get a better understanding of the machine structure, and also serves as a reference for troubleshooting.

Standard Values

This section explains the standard values for a new machine and judgement criteria for testing, adjusting, and troubleshooting. This standard value table is used to check the standard values in testing and adjusting and to judge parts in troubleshooting.

Testing and adjusting

This section details the inspection before and after repair work as well as the adjustment during inspection and repair work. Troubleshooting table that involves "Fault" and "Cause" are also included in this section.

Troubleshooting

This section explains the way to detect faulty parts and the method to repair them. This section is divided into the following parts: Electrical system, Engine, Hydraulic and mechanical system and Monitoring system.

Disassembly and assembly

This section explains the procedures as well as precautions for removing, installing, disassembling and assembling of each component.

Engine

This section provides information the cooling system, lubricating system, electrical system and alternator in addition to disassembly and reassembly of the engine.

System Schematics

This section provides hydraulic circuit diagrams and electrical circuit diagrams.

1.1.2 Revision and distribution

Any complements, revisions, or other change of notices will be sent to Sany distributors. Get the most up-to-date information before you start any work.

1.1.3 Symbols

Important safety and quality portions are marked with the following symbols so that the shop manual will be used practically.

Symbol	Item	Remarks
	Safety	Special safety precautions are necessary when performing work.
★	Caution	Special technical precautions or other precautions for pre-serving standards are necessary when performing work.
	Weight	Weight of parts of component or parts. Caution necessary when selecting hoisting wire, or when working posture is important, etc.
	Tightening torque	Places that require special attention for tightening torque during assembly.
	Coat	Places to be coated with adhesives, etc. during assembly.
	Oil, Coolant	Places where oil, etc. must be added, and capacity.
	Drain	Places where oil, etc. must be drained, and quantity to be drained.

1.1.4 Units

In this shop manual, the units are indicated with International System of units (SI). For reference, conventionally used Gravitational System of units is indicated in parentheses { }.

1.2 Technical Terms

The maintenance standard values necessary for judgment of products and parts are described by the following terms.

1.2.1 Standard size and tolerance

- To be accurate, the finishing size of parts is a little different from one to another.
- To specify a finishing size of a part, a temporary standard size is set and an allowable difference from that size is indicated.
- The above size set temporarily is called the "standard size" and the range of difference from the standard size is called the "tolerance".
- The tolerance with the symbols of + or – is indicated on the right side of the standard size.

Example

Standard size	Tolerance
120	–0.022 –0.126

★ The tolerance may be indicated in the text and a table as [standard size (upper limit of tolerance/lower limit of tolerance)]. Example) 120 (–0.022/–0.126)

- Usually, the size of a hole and the size of the shaft to be fitted to that hole are indicated by the same standard size and different tolerances of the hole and shaft. The tightness of fit is decided by the tolerance.
- Indication of size of rotating shaft and hole and relationship drawing of them.

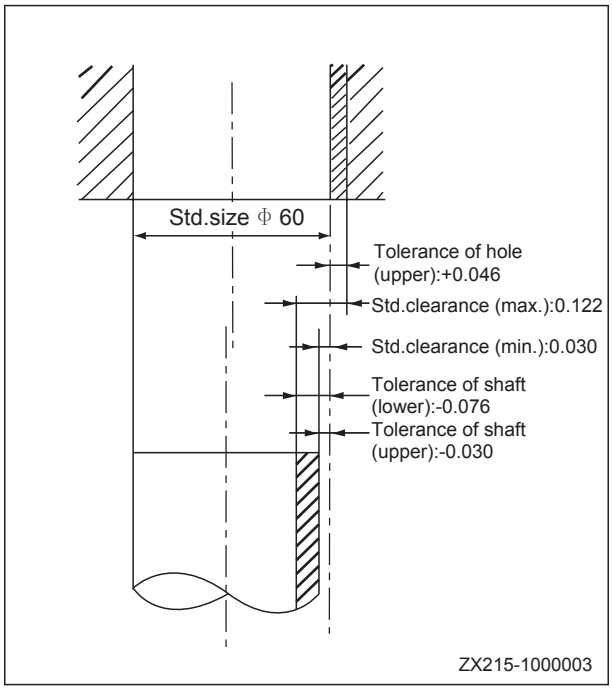

Fig. 1-1

Example

Standard size	Tolerance	
	Shaft	Hole
Φ60	-0.030 -0.076	+0.046 0

1.2.2 Standard clearance and value

- The clearance made when new parts are assembled is called the "standard clearance", which is indicated by the range from the minimum clearance to the maximum clearance.
- When some parts are repaired, the clearance is generally adjusted to the standard clearance.
- A value of performance and function of new products or equivalent is called the "standard value", which is indicated by a range or a target value.
- When some parts are repaired, the value of performance/function is set to the standard value.

1.2.3 Standard interference

- When the size of a hole is smaller than the size of a shaft because of the standard size and tolerance, the difference between these sizes is called the "interference".
- The range (A – B) from the difference (A) between the minimum size of the shaft and the maximum size of the shaft to the difference (B) between the maximum size of the shaft and the minimum size of the hole is the "standard interference".
- After repairing or replacing some parts, measure the size of their hole and shaft and check that the interference is in the standard range.

1.2.4 Repair limit and allowable value

- The size of a part changes due to wear and deformation while it is used. The limit of changed size is called the "repair limit".
- If a part is worn to the repair limit must be replaced or repaired.
- The performance and function of a product lowers while it is used. A value below which the product can be used without causing a problem is called the "allowable value".
- If a product is worn to the allowable value, it must be checked or repaired. Since the permissible value is estimated from various tests or experiences in most cases, however, it must be judged after considering the operating condition and customer's requirement.

1.2.5 Clearance limit

- Parts can be used until the clearance between them is increased to a certain limit. The limit at which those parts cannot be used is called the "clearance limit".
- If the clearance between the parts exceeds the clearance limit, they must be replaced or repaired.

1.2.6 Interference limit

- The allowable maximum interference between the hole of a part and the shaft of another part to be assembled is called the "interference limit".
- The interference limit shows the repair limit of the part of smaller tolerance.
- If the interference between the parts exceeds the interference limit, they must be replaced or repaired.

1.3 Handling Electrical and Hydraulic Components

To maintain the performance of the machine over a long period, and to prevent failures or other troubles before they occur, correct "operation", "maintenance and inspection", "troubleshooting", and "repairs" must be carried out. This section deals particularly with correct repair procedures for mechatronics and is aimed at improving the quality of repairs. For this purpose, it gives sections on "Handling electric components" and "Handling hydraulic equipment" (particularly gear oil and hydraulic oil).

1.3.1 Points to remember when handling electric components

1.3.1.1 Handling wiring harnesses and connectors

Wiring harnesses consist of wiring connecting one component to another component, connectors used for connecting and disconnecting one wire from another wire, and protectors or tubes used for protecting the wiring.

Compared with other electrical components fitted in boxes or cases, wiring harnesses are more likely to be affected by the direct effects of rain, water, heat, or vibration. Furthermore, during inspection and repair operations, they are frequently removed and installed again, so they are likely to suffer deformation or damage. For this reason, it is necessary to be extremely careful when handling wiring harnesses.

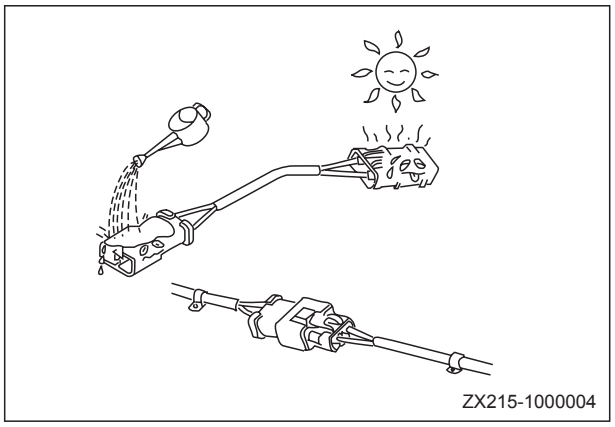

Fig. 1-2

1.3.1.2 Main failures occurring in wiring harness

1. Defective contact of connectors (defective contact between male and female)

   Problems with defective contact are likely to occur because the male connector is not properly inserted into the female connector, or because one or both of the connectors is deformed or the position is not correctly aligned, or because there is corrosion or oxidation of the contact surfaces.

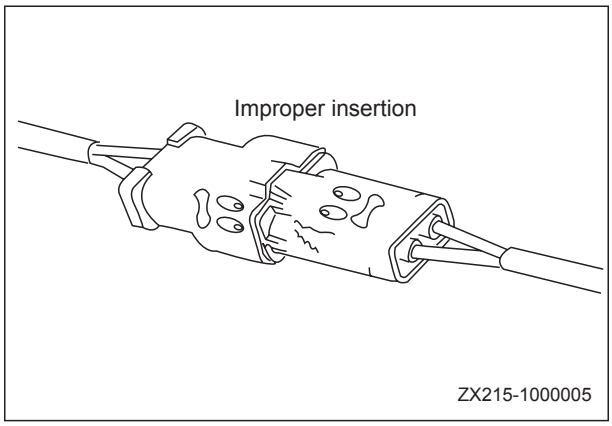

Fig. 1-3

2. Defective crimping or soldering of connectors

   The pins of the male and female connectors are in contact at the crimped terminal or soldered portion, but if there is excessive force brought to bear on the wiring, the plating at the joint will peel and cause improper connection or breakage.

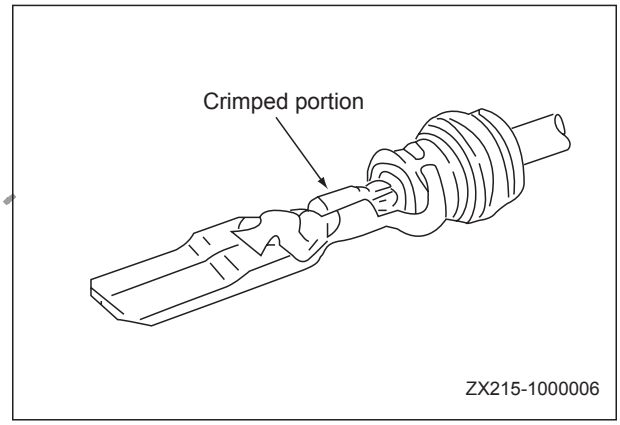

Fig. 1-4

3. Disconnections in wiring

   If the wiring is held and the connectors are pulled apart, or components are lifted with a crane with the wiring still connected, or a heavy object hits the wiring, the crimping of the connector may separate, or the soldering may be damaged, or the wiring may be broken.

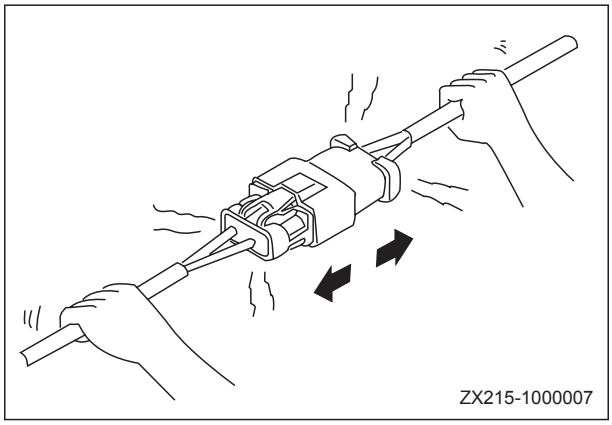

Fig. 1-5

4. High-pressure water entering connector

   The connector is designed to make it difficult for water to enter (drip-proof structure), but if high-pressure water is sprayed directly on the connector, water may enter the connector, depending on the direction of the water jet. Accordingly, take care not splash water over the connector. The connector is designed to prevent water from entering, but at the same time, if water does enter, it is difficult for it to be drained. Therefore, if water should get into the connector, the pins will be short-circuited by the water, so if any water gets in, immediately dry the connector or take other appropriate action before passing electricity through it.

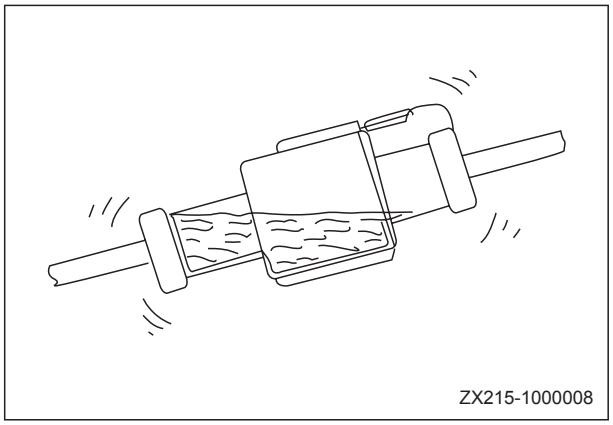

Fig. 1-6

5. Oil or dirt stuck to connector

   If oil or grease are stuck to the connector and an oil film is formed on the mating surface between the male and female pins, the oil will not let the electricity pass, so there will be defective contact. If there is oil or grease stuck to the connector, wipe it off with a dry cloth or blow it dry with compressed air and spray it with a contact restorer.

   ★ When wiping the mating portion of the connector, be careful not to use excessive force or deform the pins.

   ★ If there is oil or water in the compressed air, the contacts will become even dirtier, so remove the oil and water from the compressed air completely before cleaning with compressed air.

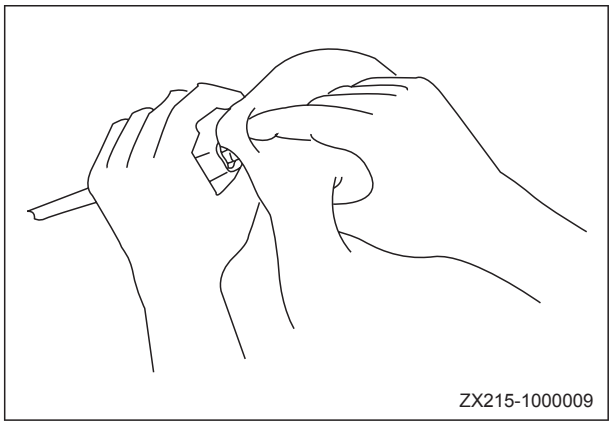

Fig. 1-7

1.3.1.3 Removing, installing, and drying connectors and wiring harnesses

1. Disconnecting connectors

   A. Hold the connectors when disconnecting.

   When disconnecting the connectors, hold the connectors. For connectors held by a screw, loosen the screw fully, then hold the male and female connectors in each hand and pull apart. For connectors which have a lock stopper, press down the stopper with your thumb and pull the connectors apart.

   ★ Never pull with one hand.

   B. When removing from clips

   - Both of the connector and clip have stoppers, which are engaged with each other when the connector is installed.

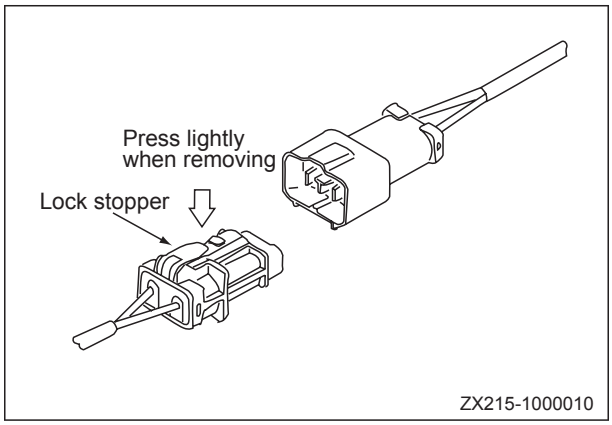

Fig. 1-8

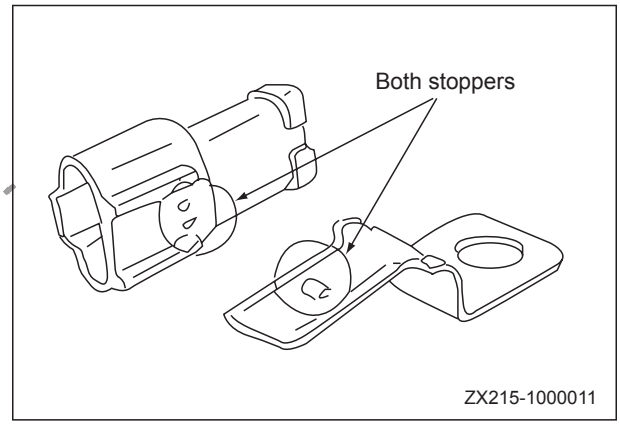

Fig. 1-9

   - When removing a connector from a clip, pull the connector in a parallel direction to the clip for removing stoppers.

   ★ If the connector is twisted up and down or to the left or right, the housing may break.

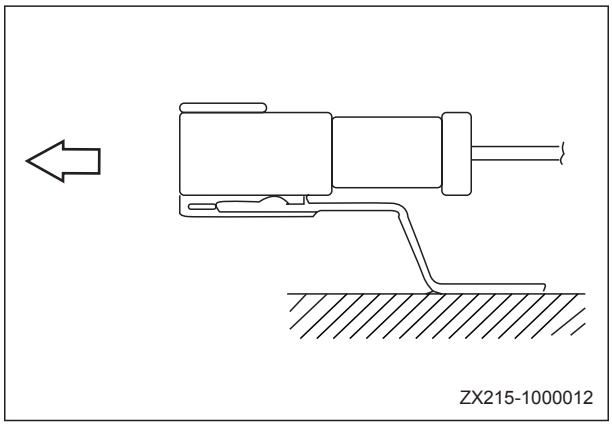

Fig. 1-10

C. Action to take after removing connectors

After removing any connector, cover it with a vinyl bag to prevent any dust, dirt, oil, or water from getting in the connector portion.

★ If the machine is left disassembled for a long time, it is particularly easy for improper contact to occur, so always cover the connector.

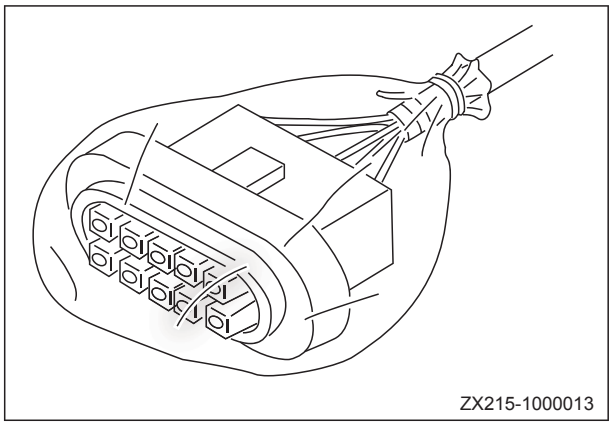

Fig. 1-11

2. Connecting connectors

A. Check the connector visually

Check that there is no oil, dirt, or water stuck to the connector pins (mating portion).

Check that there is no deformation, defective contact, corrosion, or damage to the connector pins.

Check that there is no damage or breakage to the outside of the connector.

★ If there is any oil, water, or dirt stuck to the connector, wipe it off with a dry cloth. If any water has got inside the connector, warm the inside of the wiring with a dryer, but be careful not to make it too hot as this will cause short circuits.

★ If there is any damage or breakage, replace the connector.

B. Fix the connector securely.

Align the position of the connector cor-

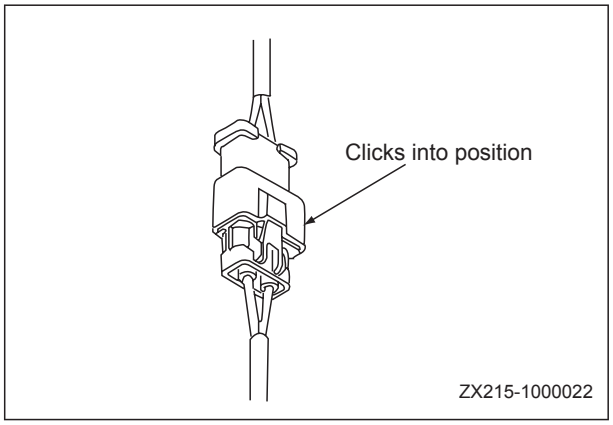

Fig. 1-12

rectly, and then insert it securely. For connectors with lock stopper, push in the connector until the stopper clicks into position.

C. Correct any protrusion of the boot and any misalignment of the wiring harness.

For connectors fitted with boots, correct any protrusion of the boot. In addition, if the wiring harness is misaligned, or the clamp is out of position, adjust it to its correct position.

★ If the connector cannot be corrected easily, remove the clamp and adjust the position.

- If the connector clamp has been removed, be sure to return it to its original position. Check also that there are no loose clamps.

3. Connecting DT connectors

Since the DT 8-pin and 12-pin heavy duty wire connectors have 2 latches respectively, push them in until they click 2 times.

- Male connector: 1
- Female connector: 2
- Normal locking state (Horizontal): a, b, d
- Incomplete locking state (Diagonal): c

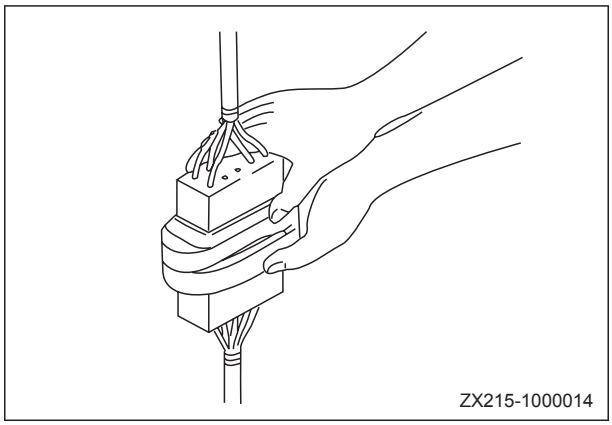

Fig. 1-13

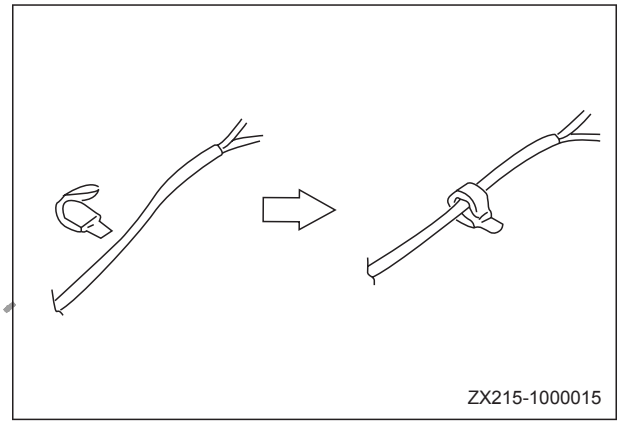

Fig. 1-14

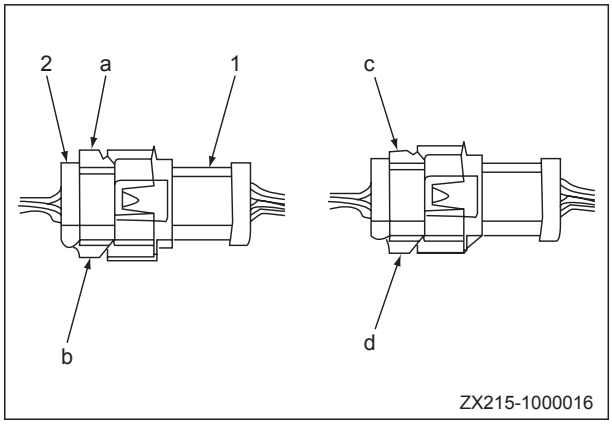

Fig. 1-15

4. Drying wiring harness

   If there is any oil or dirt on the wiring harness, wipe it off with a dry cloth. Avoid washing it in water or using steam. If the connector must be washed in water, do not use high-pressure water or steam directly on the wiring harness. If water gets directly on the connector, do as follows.

   A. Disconnect the connector and wipe off the water with a dry cloth.

      ★ If the connector is blown dry with compressed air, there is the risk that oil in the air may cause defective contact, so remove all oil and water from the compressed air before blowing with air.

   B. Dry the connector with a dryer.

      If water gets inside the connector, use a dryer to dry the connector.

      ★ Hot air from the dryer can be used, but regulate the time that the hot air is used in order not to make the connector or related parts too hot, as this will cause deformation or damage to the connector.

   C. Carry out a continuity test on the connector.

      After drying, leave the wiring harness disconnected and carry out a continuity test to check for any short circuits between pins caused by water.

      ★ After completely drying the connector, blow it with contact restorer and reassemble.

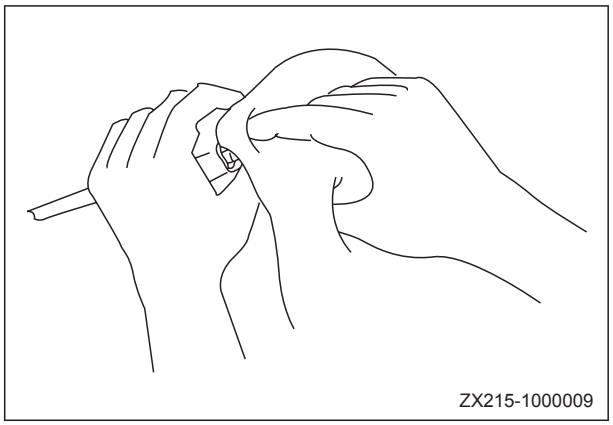

Fig. 1-16

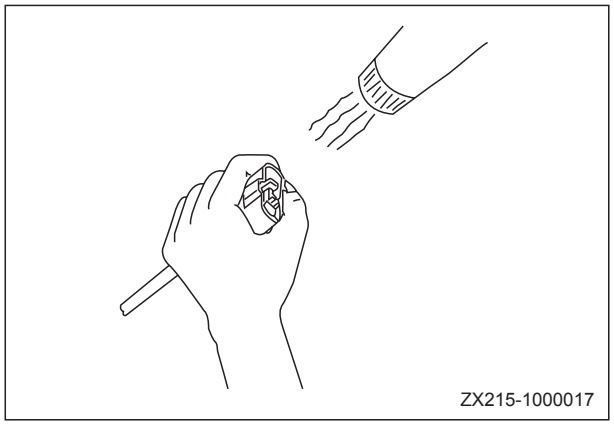

Fig. 1-17

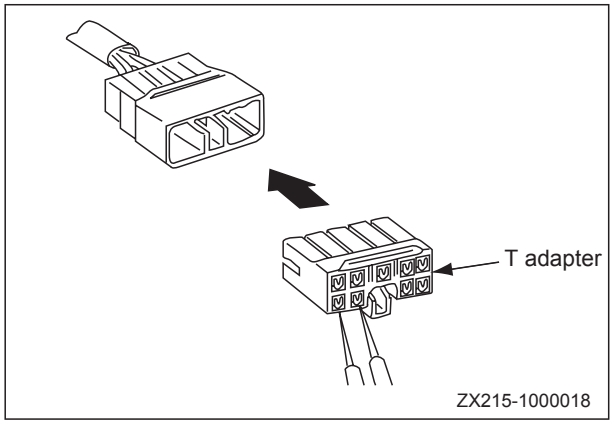

Fig. 1-18

1.3.1.4 Handling the integrated control monitor

1. The integrated control monitor contains a microcomputer, an electronic control circuits, an LCD monitor and GPS positioning circuit. They control all of the electronic circuits on the machine, so be extremely careful when handling the integrated control monitor.
2. Do not place objects on the integrated control monitor.
3. Cover the control connectors with tape or a vinyl bag. Never touch the connector contacts with your hand.
4. Do not leave it where it may be exposed to rain.
5. Do not place the integrated control monitor on oil, water, or soil, or in any hot place, even for a short time.
6. Precautions for arc welding

   When welding on the controller, disconnect all wiring harness connectors connected to the controller. Fit an arc welding ground close to the welding point.

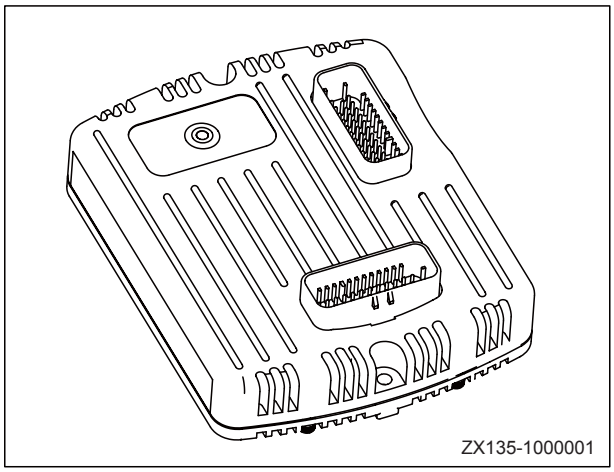

Fig. 1-19

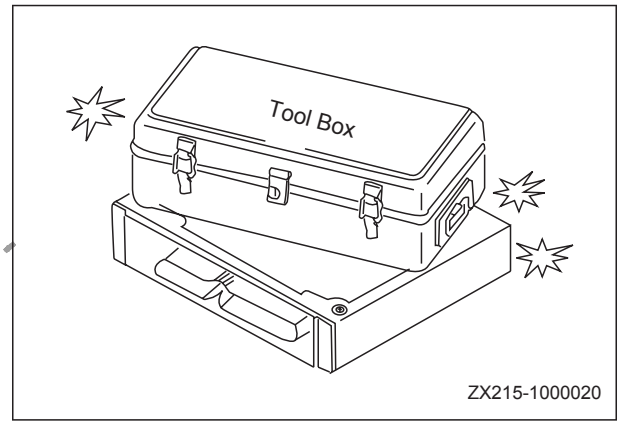

Fig. 1-20

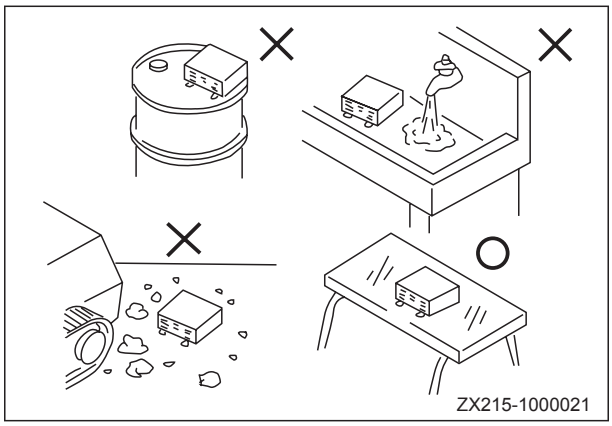

Fig. 1-21

1.3.1.5 Electric circuits troubleshooting precautions

1. Always turn the power OFF before disconnecting or connecting connectors.
2. Before carrying out troubleshooting, check that all the related connectors are properly inserted.

   ★ Disconnect and connect the related connectors several times to check.
3. Always connect any disconnected connectors before going on to the next step.

   ★ If the power is turned ON with the connectors still disconnected, unnecessary abnormality displays will be generated.
4. When carrying out troubleshooting of circuits (measuring the voltage, resistance, continuity, or current), move the related wiring and connectors several times and check that there is no change in the reading of the tester.

   ★ If there is any change, there is probably defective contact in that circuit.

1.3.2 Points to remember when handling hydraulic equipment

With the increase in pressure and precision of hydraulic equipment, the most common cause of failure is dirt (foreign material) in the hydraulic circuit. When adding hydraulic oil, or when disassembling or assembling hydraulic equipment, it is necessary to be particularly careful.

1.3.2.1 Be careful of the operating environment

Avoid adding hydraulic oil, replacing filters, or repairing the machine in rain or high winds, or places where there is a lot of dust.

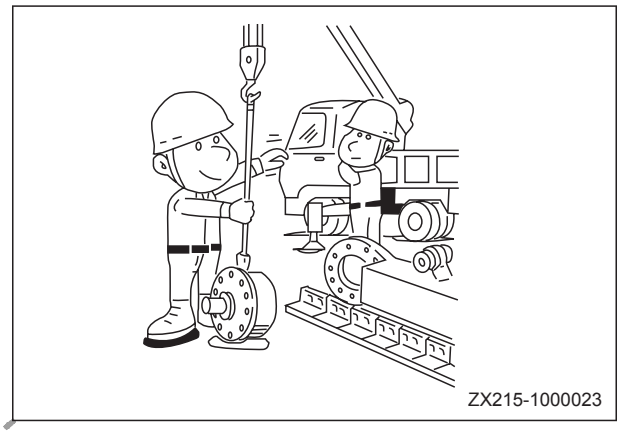

Fig. 1-22

1.3.2.2 Disassembly and maintenance work in the field

If disassembly or maintenance work is carried out on hydraulic equipment in the field, there is danger of dust entering the equipment. It is also difficult to check the performance after repairs, so it is desirable to use unit exchange. Disassembly and maintenance of hydraulic equipment should be carried out in a specially prepared dust-proof workshop, and the performance should be checked with special test equipment.

1.3.2.3 Sealing openings

After any piping or equipment is removed, the openings should be sealed with caps, tapes, or vinyl bags to prevent any dirt or dust from entering. If the opening is left open or is blocked with a rag, there is danger of dirt entering or of the surrounding area being made dirty by leaking oil so never do this. Do not simply drain oil out onto the ground, but collect it and ask the customer to dispose of it, or take it back with you for disposal.

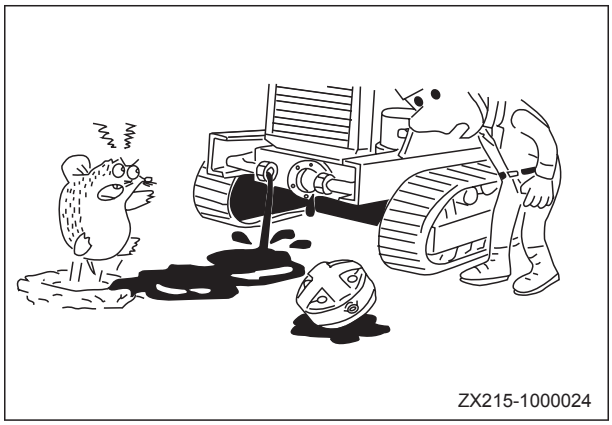

Fig. 1-23

1.3.2.4 Do not let any dirt or dust get in during refilling operations

Be careful not to let any dirt or dust get in when refilling with hydraulic oil. Always keep the oil filler and the area around it clean, and also use clean pumps and oil containers. If an oil cleaning device is used, it is possible to filter out the dirt that has collected during storage, so this is an even more effective method.

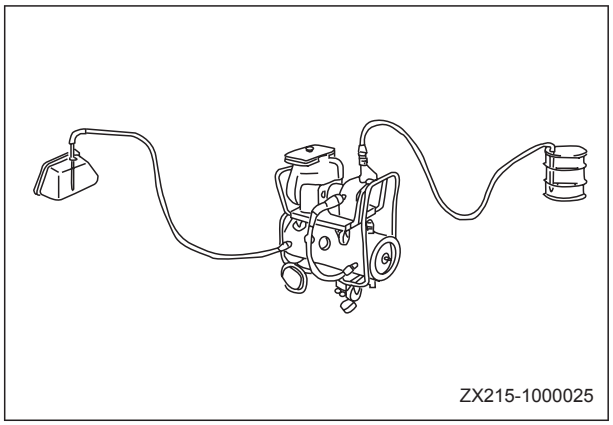

Fig. 1-24

1.3.2.5 Change hydraulic oil when the temperature is high

When hydraulic oil or other oil is warm, it flows easily. In addition, the sludge can also be drained out easily from the circuit together with the oil, so it is best to change the oil when it is still warm. When changing the oil, as much as possible of the old hydraulic oil must be drained out. (Drain the oil from the hydraulic tank; also drain the oil from the filter and from the drain plug in the circuit.) If any old oil is left, the contaminants and sludge in it will mix with the new oil and will shorten the life of the hydraulic oil.

1.3.2.6 Flushing operations

After disassembling and assembling the equipment, or changing the oil, use flushing oil to remove the contaminants, sludge, and old oil from the hydraulic circuit. Normally, flushing is carried out twice: primary flushing is carried out with flushing oil, and secondary flushing is carried out with the specified hydraulic oil.

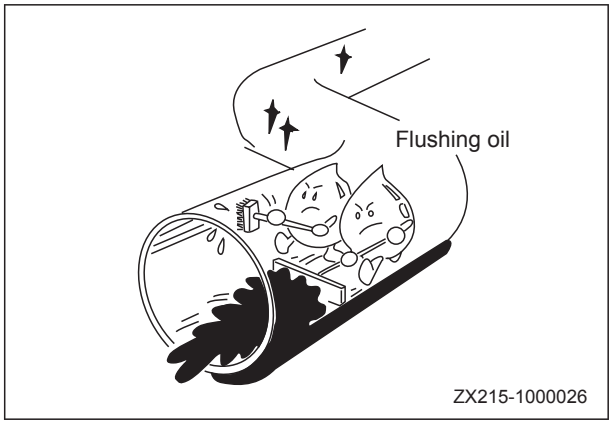

Fig. 1-25

1.3.2.7 Cleaning operations

After repairing the hydraulic equipment (pump, control valve, etc.) or when running the machine, carry out oil cleaning to remove the sludge or contaminants in the hydraulic oil circuit. The oil cleaning equipment is used to remove the ultra fine (about 3 μ) particles that the filter built in the hydraulic equipment cannot remove, so it is an extremely effective device.

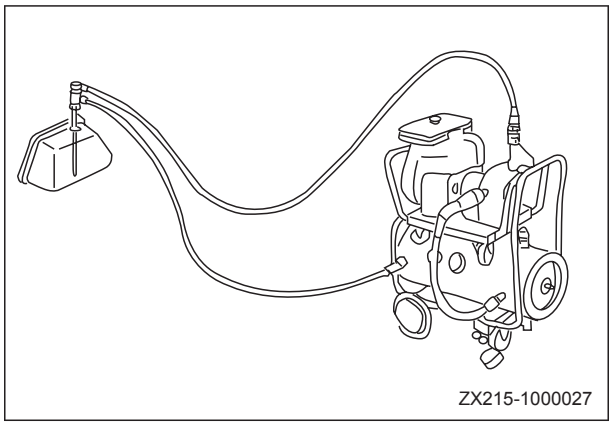

Fig. 1-26

1.4 Hose Connector

Hose connector is used to connect hoses with a small diameter. The metal sealing surface (4) of the joint (1) must be in close contact with the metal sealing surface (5) of the hose (2) to seal pressurized oil.

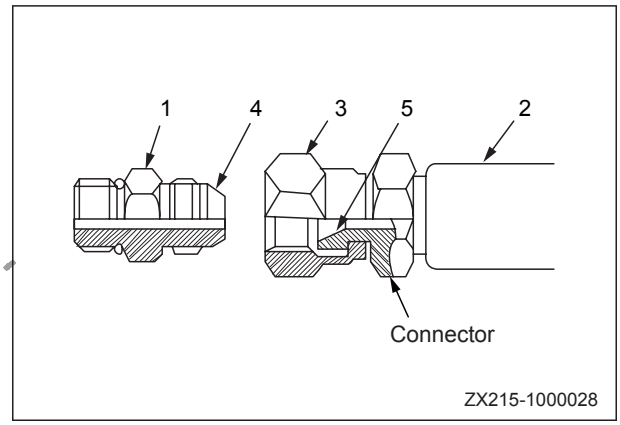

Fig. 1-27

NOTICE

- **Do not over-tighten the nut (3). Excessive force applied on the metal sealing surface (4) and (5) may cause the joint (1) to break. Be sure to tighten nut (3) according to technical specifications.**
- **Scratches or other damages on sealing surface (4) and (5) may cause leaks at the joint. Be extremely careful not to damage the sealing surfaces during connecting and disconnecting work.**

1.4.1 Type of hose connector

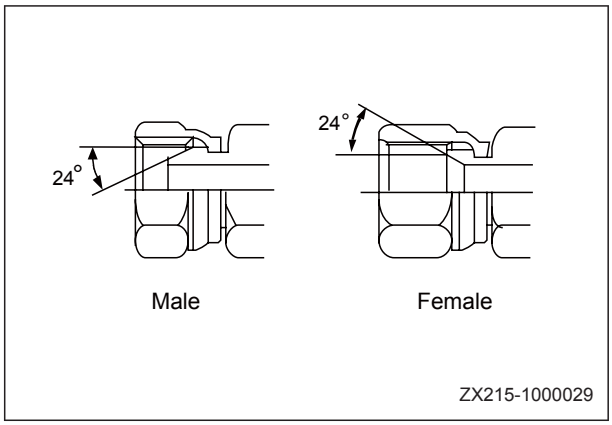

Fig. 1-28

1.4.2 Hose connector tightening torque table

Type	Wrench size mm	Wrench size mm	Tightening torque
	Connecting nut	Hose joint	N·m(kgf·m,lbf·ft)
24° Male	19	19	59(6,44)
	22	22	98(10,72)
	27	27	118(12,87)
	36	36	235(24,173)
	41	41	295(30,218)
	50	50	490(50,361)
	60	60	670(68,494)
	70	70	980(100,723)
24° Female	19	17	44(4.5,32)
	22	19	59(6,44)
	27	22	118(12,87)
	36	30, 32	235(24,173)
	41	36	295(30,218)
	50	46	490(50,361)

NOTICE

- **The torque values listed in the table are intended for general application.**
- **Do not use torque values listed in this table when different torque values are specified for a special purpose.**

1.4.3 Connection of O-rings

Place O-ring (6) in contact with the contact surface of the joint (7) to seal the pressurized oil.

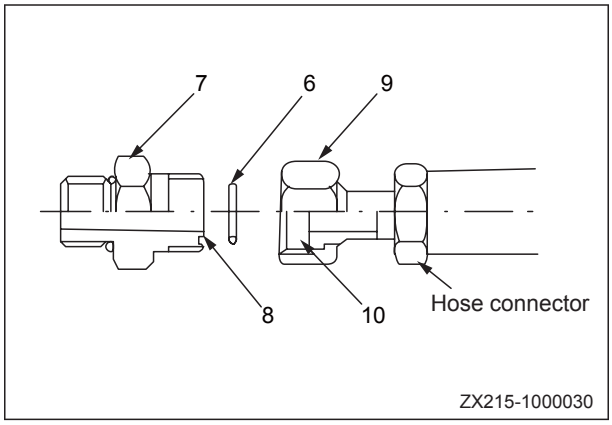

Fig. 1-29

NOTICE

- **Replace o-rings (6) with new ones when re-connecting hoses.**
- **Before tightening nut (9), make sure the o-ring (6) has been placed into the o-ring seat (8).Displacement of the o-ring may have it damaged and cause leaks.**
- **Be careful not to damage the o-ring seat (8) or the sealing surface (10). Damaged o-ring (6) may cause oil leakage.**
- **If oil leakage due to loosened nut (9) is detected, do not try to stop the leakage by tightening nut (9). Instead, replace o-ring (6) with a new one and make sure it is well positioned, and tighten nut (9).**

Wrench size mm	Wrench size mm	Tightening torque
Connecting nut	Hose joint	N·m (kgf·m,lbf·ft)
19	17	44(4.5,32)
22	19	59(6,44)
27	22	118(12,87)
36	30, 32	235(24,173)
41	36	295(30,218)
50	46	490(50,361)

1.5 Table of Standard Tightening Torques

Table of tightening torques for bolts and nuts

★ Unless specified otherwise, tighten metric nuts and bolts to the torque below. (When using torque wrench)

Bolt diameter	Bolt grade	Wrench size	Hex wrench size	Hexagonal bolt			Hexagonal socket head bolt		
				N·m	kgf·m	lbf·ft	N·m	kgf·m	lbf·ft
M6	10.9	10	4	13.2	1.37	9.74	13.2	1.37	9.74
M8	10.9	13	6	31	3.16	22.87	31	3.16	22.87
M10	10.9	17	8	66	6.73	48.7	66	6.73	48.7
M12	10.9	19	10	113	11.53	83.39	113	11.53	83.39
M14	10.9	22	12	177	18.06	130.6	177	18.06	130.6
M16	10.9	24	14	279	28.47	205.9	279	28.47	205.9
M18	10.9	27	14	382	38.98	281.9	382	38.98	281.9
M20	10.9	30	17	549	56.02	405.16	549	56.02	405.16
M27	10.9	41	19	1320	134.7	974.16	1320	134.7	974.16
M10	12.9	17	6	78	7.96	57.76	78	7.96	57.76
M12	12.9	19	8	137	13.98	101.1	137	13.98	101.1
M16	12.9	24	14	339	34.6	250.18	339	34.6	250.18
M20	12.9	30	17	664	67.75	490	664	67.75	490

NOTICE

The following items apply to fine thread and coarse thread.

- **Apply grease (zinc white B dissolved in spindle oil) onto the nuts and bolts to reduce the friction coefficient. Thrust bolts do not require greasing.**
- **Torque tolerance is ±10%.**
- **Always use bolts of correct length. The tip of bolts with excessive length may contact the bottom of the bolt hole, resulting in under-tightening. Bolts with inadequate length may result in insufficient fastening.**
- **The torque values listed in the table are intended for general application. If different torque values are specified for a special purpose, the torque values in this table are not applicable any more.**
- **Make sure the threads are free of dirt or rusts before installation of nuts and bolts.**

1.6 Type of Bolts

Tighten nuts and bolts properly to specified torque values. The type and grade of bolts are illustrated on the right.

Use correct bolts and tighten them properly when assembling machines or components.

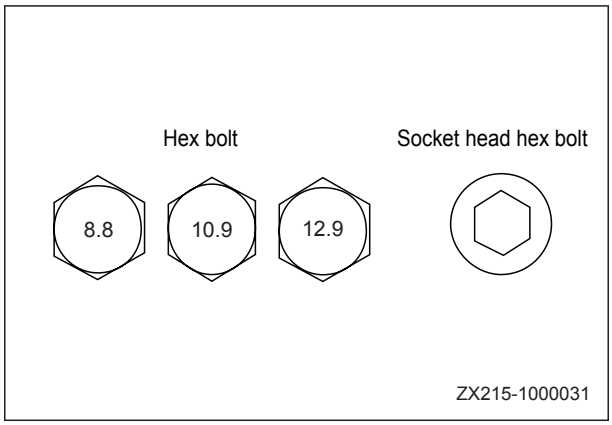

Fig. 1-30

1.7 Tightening Sequence

When two or more bolts are being tightened, follow the tightening sequence shown on the right to ensure even tightening.

CAUTION

- **Always use suitable tools for specific work. Use of improper tools and methods may cause a hazardous situation.**
- **Use tools of correct sizes when loosening or tightening the nuts or bolts. Otherwise, the tools may slide and cause personal injury.**

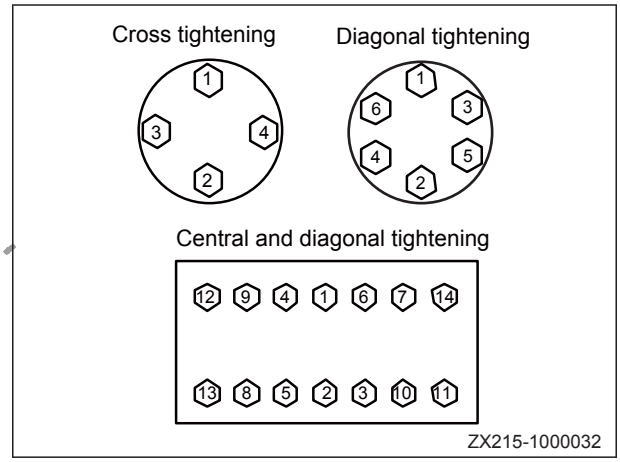

Fig. 1-31

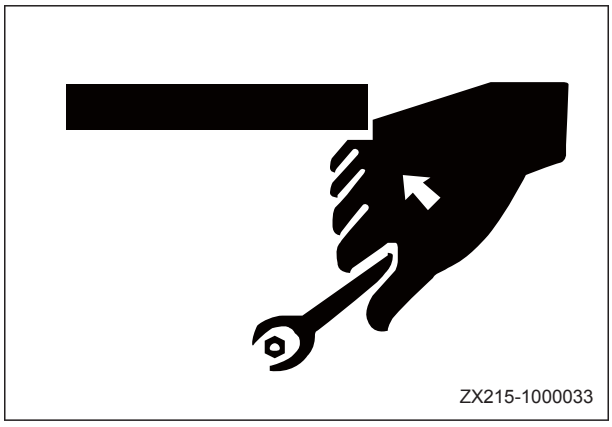

Fig. 1-32

1.8 Maintenance of Half Flanges

1. Clean the sealing surface of the flange and check it carefully. Scratches and coarseness cause leaks or abrasion of seals. Uneven surface may squeeze the seal out. If these faults are not corrected properly, parts may have to be replaced.

2. Always use specified O-rings. Check that the O-rings are not damaged. Do not file the surface of the O-ring. Apply grease onto the O-ring to locate it.

3. Tighten the half flanges carefully. Locate the opening at the center so that it is perpendicular to the oil opening. Tighten the bolt manually to maintain the location of the components.

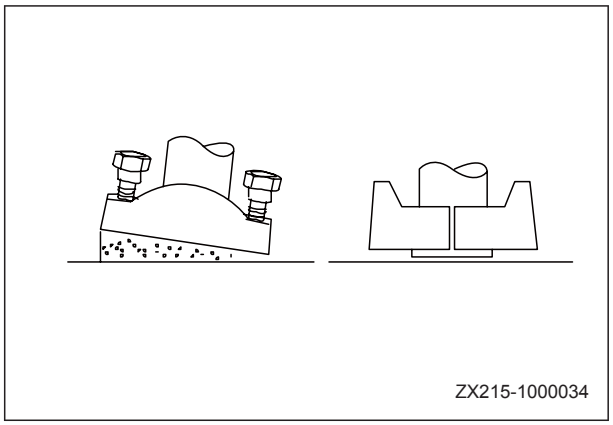

Fig. 1-33

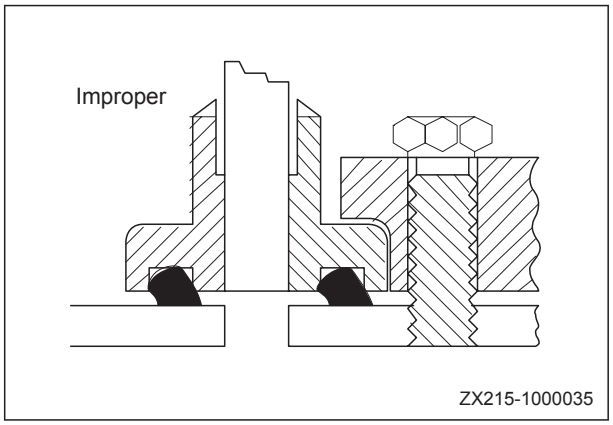

Fig. 1-34

1.8.1 Table of tightening torques for half flange bolts

★ Unless specified otherwise, tighten the half flange bolts to the torques below.

Thread diameter of bolt	Width across flats	Tightening torque	
mm	mm	Nm	kgm
10	14	59~74	6.0~7.5
12	17	98~123	10.0~12.5
16	22	235~285	23.5~29.5