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.
  MKS system units and English units are also indicated in parenthheses just behind SI units.

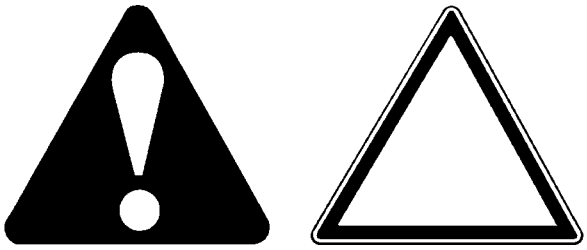
  Example : 24.5 MPa (250 kgf/cm^2, 3560 psi)

  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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SA-688

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.

SA-1223

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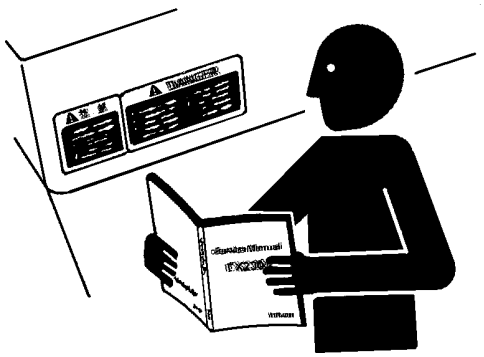
FOLLOW SAFETY INSTRUCTIONS

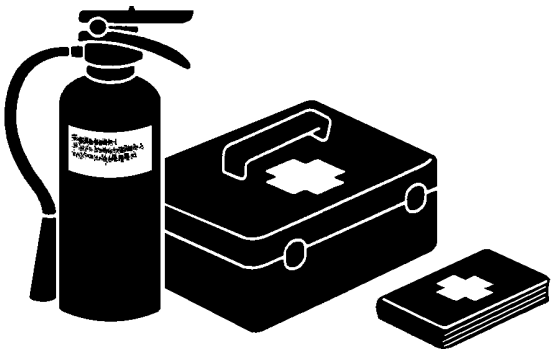


SA-003

- 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.

003-E01B-0003

PREPARE FOR EMERGENCIES



SA-437

- 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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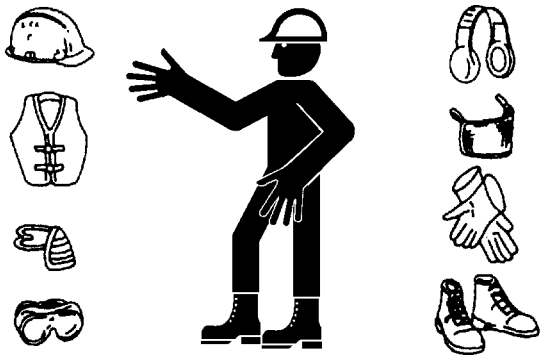
WEAR PROTECTIVE CLOTHING



SA-438

- 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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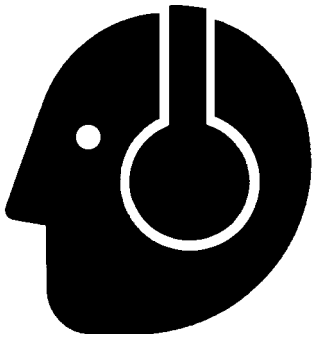
PROTECT AGAINST NOISE



SA-434

- 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

SA-435

- 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.

S007-E01A-0435

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.

524-E01A-0000

SECTION 1
GENERAL IMFORMATION

—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 disassembling /assembling procedures beforehand, to help avoid incorrect disassembling of components as well as personal injury.
  Check 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 it 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 it.
  - 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.
  - Be sure 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 tools are missing.

Bleeding Air from Hydraulic System

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

- Bleeding Air from Hydraulic Pump

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

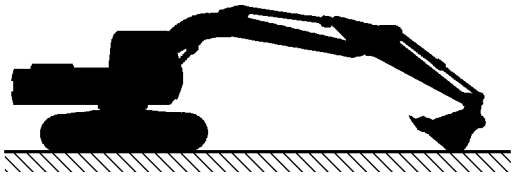
- Remove the air bleeding plug from the top of the pump and fill the pump housing with hydraulic oil.
- After the pump housing is filled with hydraulic oil, temporarily tighten the plug. Then, start the engine and run at slow idle speed.
- Slightly loosen the plug to bleed air from the pump housing until 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.
   If the floating 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 seal ring face (C) for scuffing, scoring, corrosion, deformation or uneven wear.

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

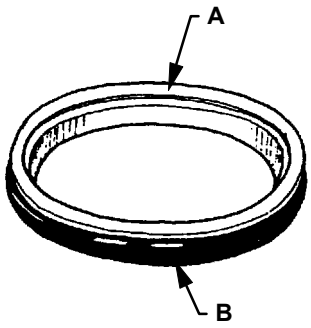
2. If incorrectly assembled, oil leakage or damage will occur. Be sure to do the following, to prevent trouble.

   (1) Clean floating seal (A) 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, as dust on them tends to enter the floating seal when installing it.

   (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 face (C) is parallel with seal mounting bores ring face (D) by measuring the distances (C) and (D) at point (a) and (b), as illustrated. If these distances differ, correct the O-ring seating.



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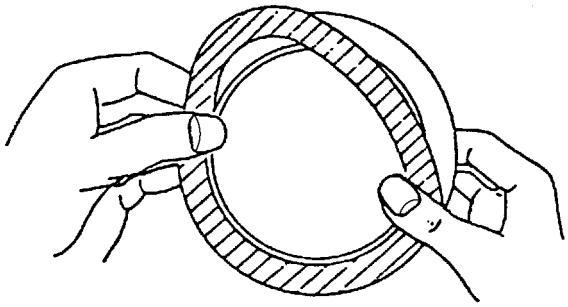

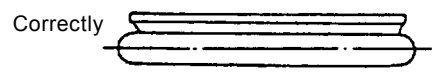

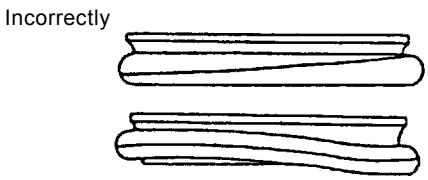

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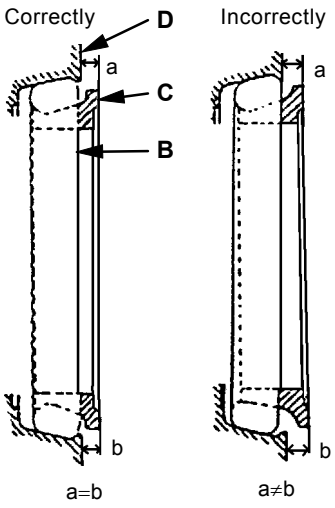

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MAINTENANCE STANDARD TERMINOLOGY

"Standard"

1. Dimension for parts on a new machine.

2. Dimension of components or assemblies adjusted to specification.

Both dimensions are shown with tolerances as necessary.

"Allowable Limit"

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

2. Repair or replacement is required before reaching this limit.

Machine performance will decrease, and maintenance and down time expense will increase as machine operating hours accumulate. It is recommended that parts are repaired or replaced before reaching the **"Allowable Limit"**.

TIGHTENING TORQUE SPECIFICATIONS

No.	Descriptions			Bolt Dia	Q'ty	Wrench Size	Torque		
				mm		(mm)	N·m	kgf·m	lbf·ft
1	Engine cushion rubber mounting bolt	Front	Engine cushion rubber	16	2	24	265	27	195
			Cushion rubber-machine	16	2	24	265	27	195
		Rear	Engine cushion rubber	24	2	36	690	70	510
			Cushion rubber-machine	18	4	27	390	40	290
2	Muffler bracket mounting bolt			UNC 1/2 UNC 3/8	4 6	19 14	88 49	9 5	65 36
3	Radiator mounting bolt			24	4	36	690	70	510
4	Hydraulic oil tank mounting bolt			18	8	27	295	30	215
5	Fuel tank mounting bolt			18	4	27	295	30	215
6	ORS fittings for hydraulic hoses and piping			1- $\frac{7}{16}$ -12UNF		41	205	21	152
7	Pump transmission mounting bolt			UNC $\frac{7}{16}$	14	16	69	7	51
8	Pump device mounting bolt			24	4	36	690	70	510
9	Control valve mounting bolt			20	4	30	390	40	290
10	Swing device mounting bolt			24	28	36	930	95	690
11	Swing motor mounting bolt (hexagonal wrench)			20	24	30	390	40	290
12	Battery mounting bolt			12	2	19	34	3.5	25.5
13	Cab mounting bolt		STD	16	4	24	205	21	152
			H	16	6	24	205	21	152
14	Swing bearing mounting bolt to upperstructure Swing bearing mounting bolt to undercarriage			33 33 30	36 4 40	50 50 46	2160 2160 1720	220 220 175	1590 1590 1270
15	Travel device mounting bolt Travel motor mounting bolt Sprocket mounting bolt			27 18 27	40 8 48	41 27 41	1370 295 1370	140 30 140	1010 215 1010
16	Upper roller mounting			20	24	30	540	55	400
17	Lower roller mounting bolt	STD, H		24	72	36	930	95	690
18	Track shoe bolt	STD, H		27	408	41	1960	200	1450
19	Track guard mounting bolt	STD, H		27	16	41	1370	140	1010
20	Track frame mounting bolt			36	44	55	2750	280	2030
21	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		$\frac{1}{4}$ -28UNF		11	5.9	0.6	4.3
22	Counterweight mounting bolt Counterweight retaining bolt			45 24	2 4	65 36	2750 690	280 70	2030 510
23	Front pin-retaining bolt			20	30	30	390	40	290

NOTE: (1) Apply lubricant (e.g. white Zinc B dissolved into spindle oil) to bolts and nuts to stabilize friction coefficient of them.

(2) Make sure bolt and nut threads are clean before installing.

(3) Apply LOCTITE to threads before installing and tightening swing bearing mounting bolts.

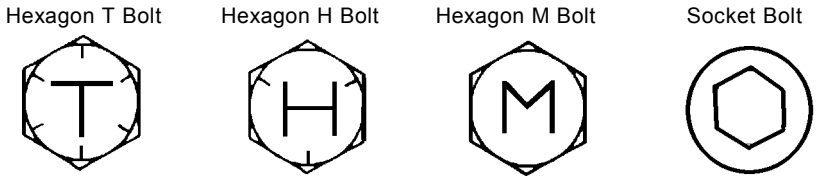
TORQUE CHART

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 the correct tools. Avoid bodily injury caused by slipping wrenches.

SA-040

Bolt Types

Tighten nuts or bolts correctly to torque specifications. Four kinds of bolts, hexagon bolts T, H, M and socket bolt, each made of different material, are used. Make sure to employ the correct bolts and tighten them to specification when assembling the machine or components.



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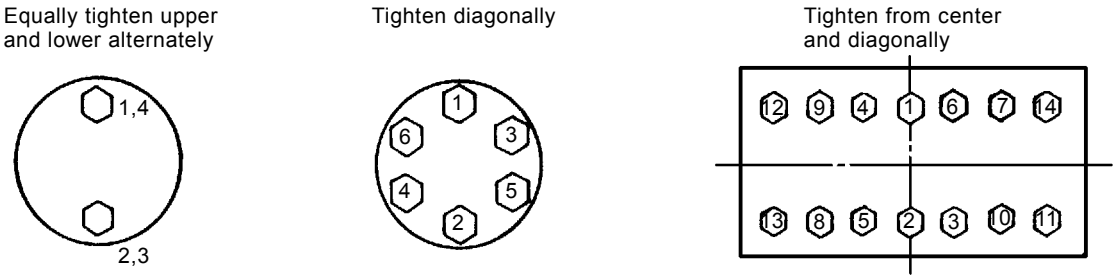
Specified Tightening Torque Chart

Bolt Dia.	Wrench Size	Hexagon Wrench Size	T Bolt, Socket bolt			H Bolt			M Bolt		
			N·m	kgf·m	lbf·ft	N·m	kgf·m	lbf·ft	N·m	kgf·m	lbf·ft
M 8	13	6	29.5	3	22	19.5	2	14.5	9.8	1	7.2
M 10	17	8	64	6.5	47	49	5	36	19.5	2	14.5
M 12	19	10	108	11	80	88	9	65	34	3.5	25.5
M 14	22	12	175	18	130	137	14	101	54	5.5	40
M 16	24	14	265	27	195	205	21	152	78	8	58
M 18	27	14	390	40	290	295	30	220	118	12	87
M 20	30	17	540	55	400	390	40	290	167	17	123
M 22	32	17	740	75	540	540	55	400	215	22	159
M 24	36	19	930	95	690	690	70	505	275	28	205
M 27	41	19	1370	140	1010	1030	105	760	390	40	290
M 30	46	22	1910	195	1410	1420	145	1050	540	55	400
M 33	50	24	2550	260	1880	1910	195	1410	740	75	540
M 36	55	27	3140	320	2310	2400	245	1770	930	95	690

IMPORTANT:
(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 ±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.



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Service Recommendations for Split Flange

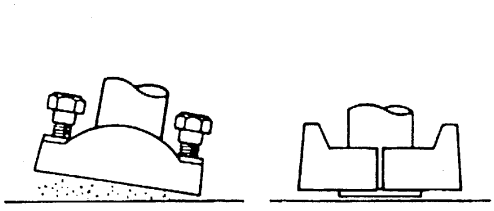
IMPORTANT: (1) Be sure to clean and inspect sealing surfaces. Scratches/ roughness cause leaks and seal wear. Unevenness causes seal extrusion. If defects cannot be polished out, replace the component.

(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.



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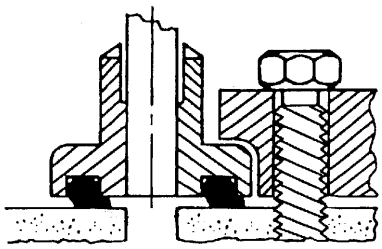
WRONG



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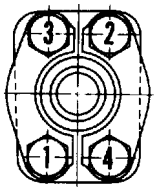

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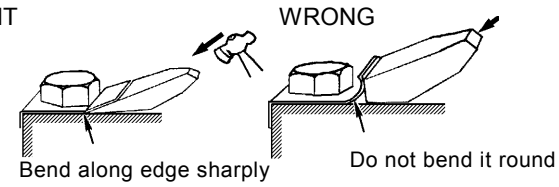
Nut and Bolt Lockings

• Lock Plate

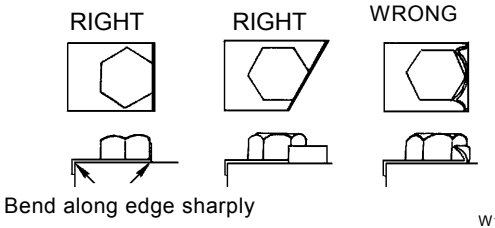
IMPORTANT: Do not reuse lock plates. Do not try to bend the same point twice.

RIGHT WRONG



• Cotter Pin

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



• Lock Wire

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

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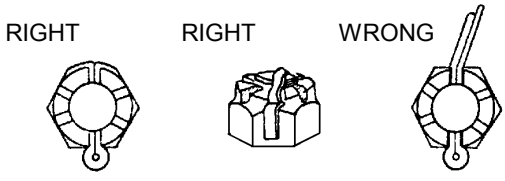
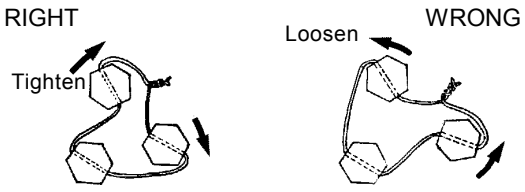


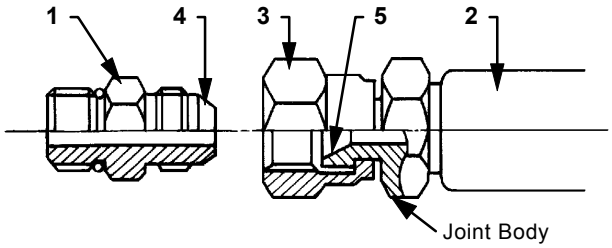


W105-01-01-010

PIPING JOINT

Pipe Thread Connection/Union Joint Tightening Torque Specifications

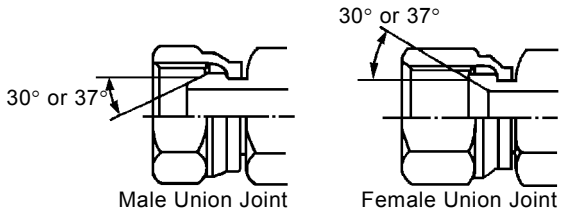
Union Joint
Metal sealing faces (4) and (5) of adaptor (1) and hose (2) fit together to seal pressure oil. Union joints are used to join small-diameter lines.



M202-07-051

IMPORTANT: (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.



W105-01-01-017

Type	Wrench Size		Tightening Torque		
	Union Nut	Joint Body	N·m	kgf·m	lbf·ft
30° Male Union Joint	19	19	59	6	43
	22	22	98	10	72
	27	27	118	12	87
	36	36	235	24	134
	41	41	295	30	215
	50	50	490	50	360
	60	60	670	68	490
	70	70	980	100	720
37° Female Union Joint	19	17	44	4.5	32.5
	22	19	59	6	43
	27	22	118	12	87
	36	30, 32	235	24	134
	41	36	295	30	215
	50	46	490	50	360

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

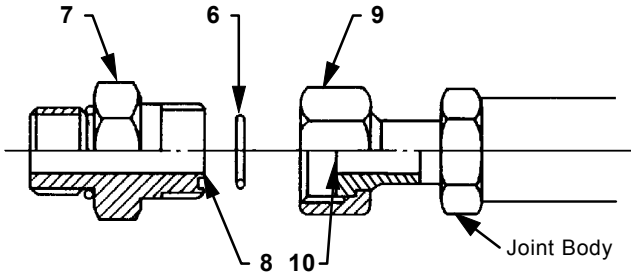
O-ring Seal Joint
O-ring (6) seats against the end face of adaptor (7) to seal pressure oil.

IMPORTANT: (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 (6), 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.

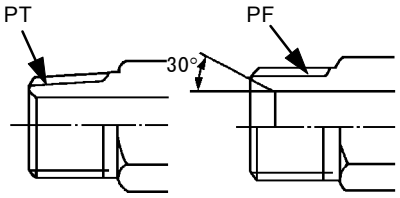


M104-07-033

Wrench Size		Tightening Torque		
Union Nut	Joint Body	N·m	kgf·m	lbf·ft
19	17	59	6	43
22	19	98	10	72
27	22	118	12	87
36	30, 32	235	24	134
41	36	295	30	215
50	46	490	50	360

Screwed-In Connection

IMPORTANT: 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.



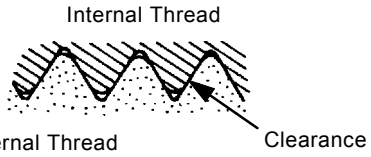
Male Tapered Thread Male Straight Thread

W105-01-01-018

Male Tapered Thread			
Wrench Size	Tightening Torque		
Joint Body	N·m	kgf·m	lbf·ft
17, 19	59	6	43
19, 22	98	10	72
27, 22	118	12	87
36, 32	235	24	134
41	295	30	215
50	490	50	360
60	670	68	490
70	980	100	720

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.

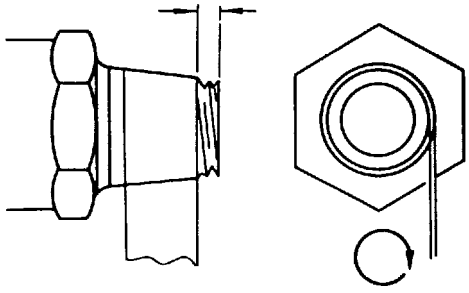


W105-01-01-019

- 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.

Leave one to two pitch threads uncovered



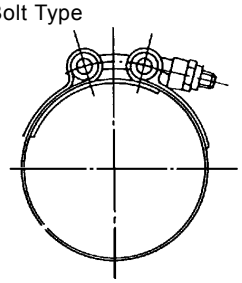
M114-07-041

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.

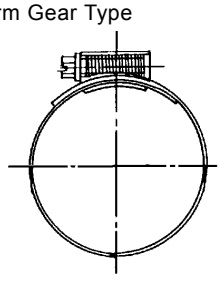
T-Bolt Type Band Clamp:
4.4 N·m (0.45 kgf·m, 3.25 lbf·ft)
Worm Gear Type Band Clamp:
5.9 to 6.9 N·m (0.6 to 0.7 kgf·m, 4.3 to 5.1 lbf·ft)

T-Bolt Type



M114-07-042

Worm Gear Type



M114-07-043

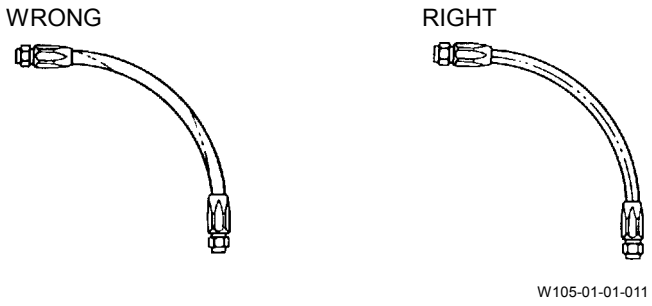
Connecting Hose

CAUTION:

(1) When replacing hoses, be sure to use only genuine Hitachi service parts. Using hoses other than genuine Hitachi 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.



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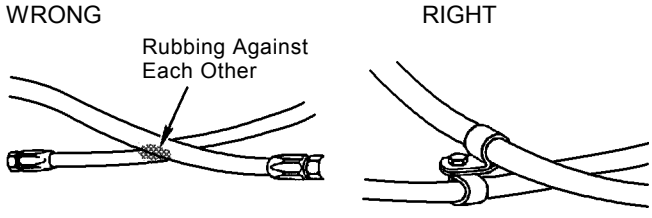

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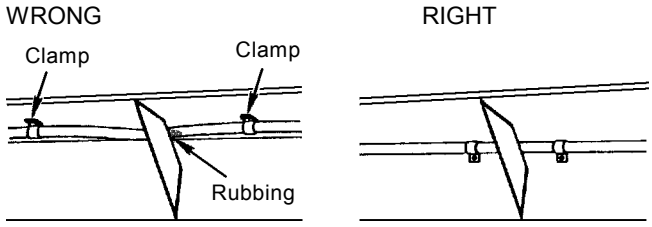

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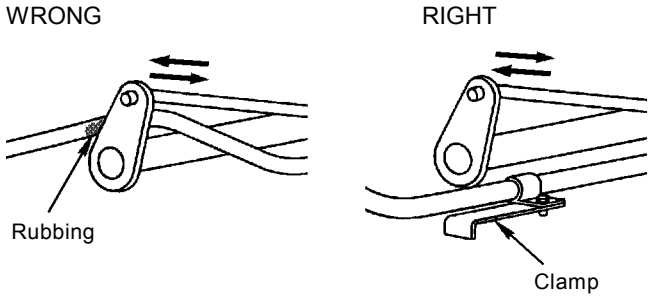

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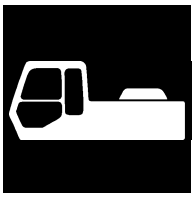
MEMO

MEMO

SECTION 2
UPPERSTRUCTURE



—CONTENTS—

Group 6 Pilot Valve

Group 7 Pilot Shut-Off Valve

Group 8 Shockless Valve

Group 9 Solenoid Valve