WORKSHOP MANUAL

TB235

Serial No.123500004~

Book No. CG7E003

MINI EXCAVATOR

TAKEUCHI

FOREWORD

This manual, which is written for engineers who service the machine, describes procedures for disassembly and assembly, inspection and maintenance, and troubleshooting, as well as maintenance reference values and an outline of the specifications. Refer to this manual during daily work to improve your services. Note that the information is subject to change without notice due to design modifications made to the machine from time to time by the manufacturer.

Directional terms: front, rear, left, right

In this manual, the “front” refers to the end of the machine where the blade is mounted, while the “rear” refers to the other end where the travel motor is mounted. The “right” or “left” refers to the side viewed by a person sitting in the operator’s seat.

Machine serial number

The machine serial number is stamped on the identification plate. Be sure to include this number when sending a report or inquiry or when ordering parts.

Control of manual

Appoint a person in charge of keeping the manuals up to date in your company and inform us of the person’s name for our records. Any revisions or additions to this manual will be sent to the person.

Symbols used in this manual

The symbols used in this manual have the following meanings.

S/N Indicates the machine serial number.
☞ Means “Refer to the section quoted.”
kg Indicates the mass of the equipment or machine.
Means “Tighten to the torque specified here.”
Indicates the use of thread-locking compound.
Indicates the use of grease.

Manual structure

This manual consists of the following parts.

1. Safety
2. Service data
3. Function
4. Disassembly and assembly
5. Troubleshooting
6. Engine

SAFETY 1

Safety alert symbol 1-2
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SAFETY ALERT SYMBOL

This symbol represents the safety alert. The message that follows the symbol contains important information regarding human safety.
Read and understand the message to avoid personal injury or death.

Safety label

Safety labels are used to alert operators or other people exposed to the risks of injury or damage. There are the following three types of labels.
Read the labels carefully as they are important for your safety.

⚠ DANGER

The word "DANGER" indicates an imminently hazardous situation which, if not avoided, is likely to result in serious injury or death.

⚠ WARNING

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

⚠ CAUTION

The word "CAUTION" indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

IMPORTANT: The word "IMPORTANT" is used to alert operators and maintenance personnel about situations which could result in damage to the machine and its components.

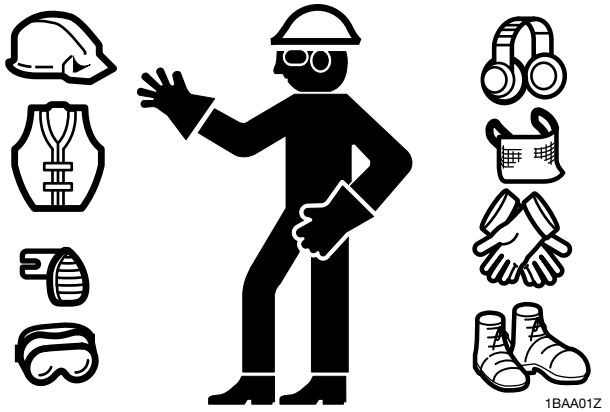
This manual is intended for trained and qualified personnel only. Warnings or cautions described in this manual do not necessarily cover all safety measures. It is also impossible to cover all hazards and risks which may be associated with the maintenance of the machine in every environment. For maintenance work, each person must take adequate safety precautions against possible hazards in the respective working environment.

SAFETY PRECAUTIONS

Observe all safety rules

- Operation, inspection and maintenance of this machine must be performed only by a trained and qualified person.
- All rules, regulations, precautions and safety procedures must be understood and followed when performing operation, inspection and maintenance of this machine.
- Do not perform any operation, inspection or maintenance of this machine when under the influence of alcohol, drugs, medication, fatigue or insufficient sleep.

Wear safe clothing and protective gear



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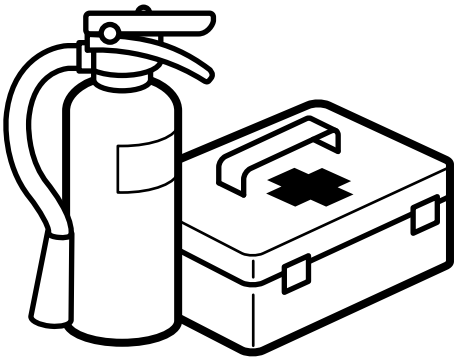
- Do not wear loose clothing or any accessory that can catch on the controls or the moving parts of the machine.
- Do not wear clothing stained with oil or grease that can easily catch fire.
- Wear protective gear such as helmet, safety shoes, protective goggles, respirator, gloves and earmuffs, as appropriate, depending on the work involved. Especially make sure to wear protective eye-wear and mask when working with a grinding/polishing/sanding machine, hammer or compressed air, as metal fragments or other objects could scatter in such an environment.
- Wear hearing protectors when operating the machine. Loud and prolonged noise can damage or destroy your hearing.

Install an extinguisher and a first aid kit



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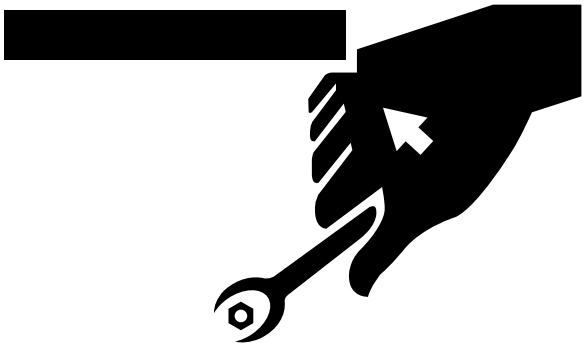
- Install an extinguisher to fight a fire, and learn how to use it.
- Prepare a first aid kit and keep it at a designated place.
- Decide on the procedures to be used in case of fire or other hazards.
- Decide on and take note of the contact(s) in case of emergency.

Place a “Do not operate” alert sign

Serious injury or death may result if an unauthorized person starts the engine or touches the controls during inspection or maintenance.

- Before performing maintenance, stop the engine, remove the key and store it in a safe place.
- Prominently display a “Do not operate” alert sign on places such as the starter switch and the control lever. Place another sign outside of the machine as necessary.

Use the correct tools



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Do not use damaged or weakened tools or tools designed for other purposes. Use only the correct tools for the work involved.

Regularly replace the safety-critical parts

- Regularly replace fuel hoses to prevent a fire hazard. Hoses wear out over time, even if they do not show any symptom of wear.
- Regardless of the replacement schedule, replace immediately if a symptom of wear is found.

Explosionproof lighting

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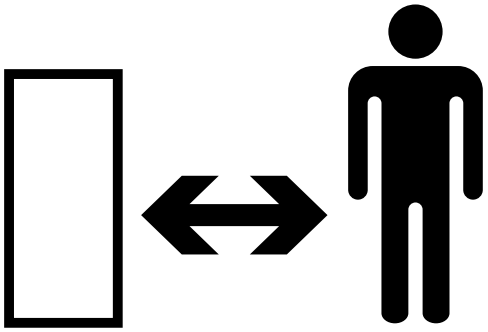
To prevent an ignition or explosion, use explosion-proof lights when inspecting fuel, oil, coolant or battery fluid.

Prohibit access by unauthorized persons



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Do not allow unauthorized personnel in the work area while working.
Take particular care that no unauthorized person is present when grinding, welding or using a hammer.

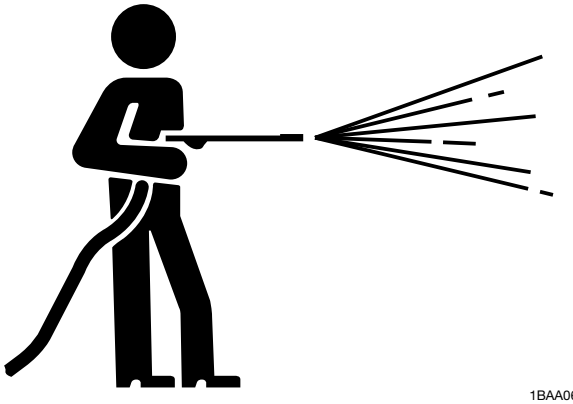
Prepare the work area

- Select a level and firm ground on which to perform maintenance work. Make sure that the work area is light enough and well ventilated.
- Straighten any obstacle or dangerous object, remove any spill of oil or grease and clean the work area.

When the canopy is tilted up

- If the canopy is raised or lowered while the engine is moving, the machine may accidentally start moving, resulting in severe injury to the maintenance personnel. Make sure that the working equipment has been lowered to the ground and the engine has been turned off before raising/lowering the canopy.
- When the canopy is tilted up, firmly secure the canopy with a stopper to prevent it from falling.

Keep the machine clean



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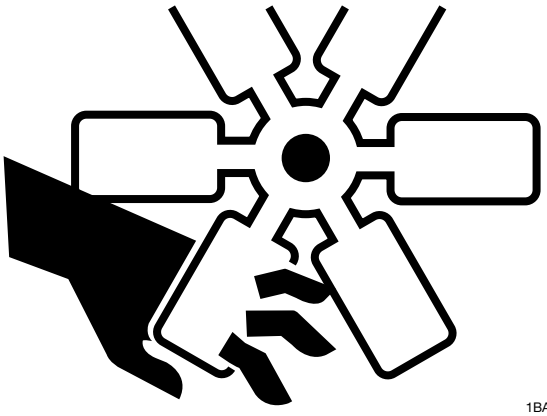
- Clean the machine before performing maintenance and try to keep it clean.
- Before washing, cover the electrical parts with vinyl to prevent water from entering, as this could cause a short-circuit or malfunction. Do not use water or steam to wash the battery, sensors, connectors or the operator's seat area.

Stop the engine before performing maintenance

Make sure the engine is stopped before starting inspection or maintenance. If maintenance must be performed with the engine running, always work as a 2-person team, communicating with each other.

- One of them must sit at the operator's seat and stop the engine whenever necessary. He/she must take care not to touch the lever or pedal unless necessary.
- The one who performs maintenance must make sure to keep his/her body or clothing away from the moving part of the machine.

Keep clear of the moving fan and belt



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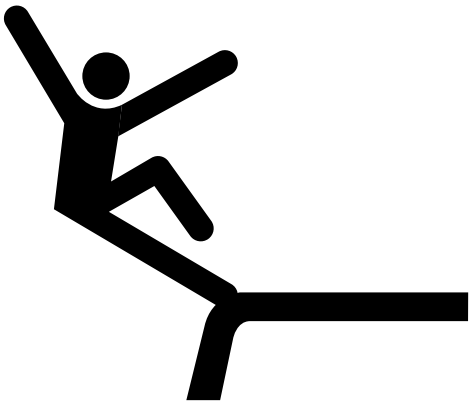
- Any object that can be easily caught in moving parts must be kept away.
- If a hand or tool becomes trapped in the fan or fan belt, you could lose your finger. Do not touch the fan or belt while they are moving.

When working under the machine

1BAA08Z

- Before performing maintenance or repairs under the machine, set all movable equipment against the ground or in the lowermost position.
- Place chocks under the crawler tracks to secure the machine.
- If it is unavoidably necessary to work under the raised machine or working equipment, be sure to firmly support it by using an arm stopper, wooden block, stand or safety brace. Never go under the raised machine or working equipment without such protection measures.

When working on the machine



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- To prevent slipping/falling from machine, clear the footing and observe the following:
  a. Do not spill oil or grease on the machine.
  b. Keep the machine tidy and clean.
  c. Be careful when walking around the machine.
- Never jump down from the machine. Climb up/down the ladder (steps) holding the handrail to support your weight in a three point secure stance (hand and feet).
- Wear protective gear according to the work involved.

Securing the working equipment

When replacing/repairing the bucket teeth or side cutter, secure the relevant equipment to prevent any accidental movement.

Secure the engine hood and guard when they are open

Firmly secure the machine when the engine hood or guard is left open. Do not keep the hood or guard open on a windy day or if the machine is parked on a slope.

Place heavy components in a stable position

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When it is necessary to temporally place a heavy component, such as the hoe attachment, on the ground during removal or installation, be sure to place it in a stable position.

Caution when filling with fuel or oil

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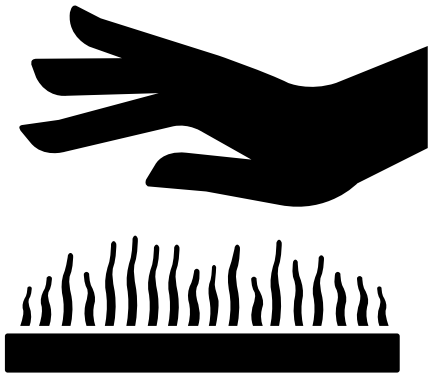
- Keep away from heat, sparks and flame while filling with fuel or oil.
- Never remove the fuel cap or try to fuel when the engine is running or still hot.
- Maintain control of the fuel filler nozzle when filling the tank.
- Refill with fuel or oil outdoors or in a well ventilated place, with the engine turned off.
- Clean up spilled fuel or oil immediately.
- Do not overfill the tank.
- Firmly tighten the fuel cap or oil cap. If the fuel cap is lost, replace it only with the original manufacturer's approved cap. Use of a non-approved cap without proper venting may result in pressurization of the tank.
- Never use fuel for cleaning.
- Use the correct grade of fuel for the operating season.

Handling of hoses

Oil leak or fuel leak can cause a fire.

- Do not twist, bend or hit the hoses.
- Never use twisted, bent or cracked pipes, tubes or hoses; otherwise, they may burst.
- Retighten loose connections.

Be careful with hot and pressurized components



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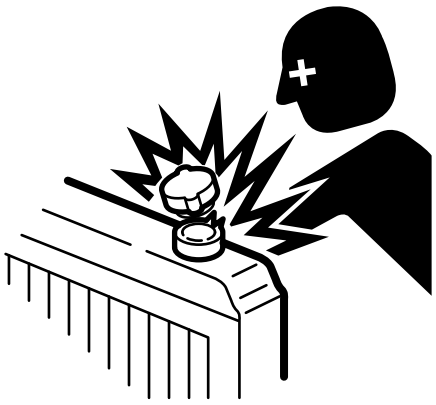
Before performing inspection and maintenance, stop the engine and allow the machine to cool down.

- The engine, muffler, radiator, hydraulic lines, sliding parts and many other parts of the machine are hot immediately after the engine is stopped. Wait until it cools before making any inspection or adjustments.
- The engine coolant, hydraulic oil and other oils are also hot and under high pressure. Touching these liquids will cause burns.

Handling of radiator



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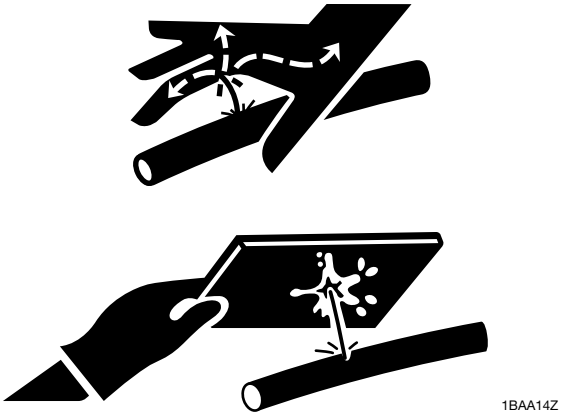
Do not remove the radiator cap when the coolant is hot. Wait until it cools down, and then remove the radiator cap by loosening it slowly to release the internal pressure.

Be careful with oils under pressure



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Pressure is maintained in the hydraulic circuit long after the engine has been shut down.

- Do not fill with, dispose of fuel/oil, or perform the inspection and maintenance until the internal pressure is completely released.
- The hydraulic oil escaping from a small hole can be hazardous if contacted. It is under high enough pressure to penetrate the skin or eyes and cause serious injury. If leak is suspected, protect your eyes and skin by wearing protective glasses and thick gloves to search for a leak. Also use a paperboard or plywood to keep your skin from oil spurting. If oil penetrates the skin, it must be surgically removed within a few hours by a doctor familiar with this type of injury.

Release internal pressure before working on the hydraulic system

Oil may spurt out if caps or filters are removed or pipes are disconnected before releasing the pressure in the hydraulic system.

- Gradually loosen the vent plug to release the internal pressure of the hydraulic oil tank.
- Move all the control levers and pedals several times in all directions to release the pressure from the circuit of the working equipment (for link type controls).
- When removing plugs or screws, or when disconnecting hoses, stand to the side and loosen them slowly to gradually release the internal pressure before removing.

Be careful with grease under pressure

1BAA15Z

In the track adjuster, the grease has been injected under high pressure. If the tension is adjusted without following the prescribed procedure, the grease discharge valve may fly off, resulting in injury.

- Loosen the grease discharge valve slowly.
- Do not put your face, arms, legs or body in front of the grease discharge valve.

Handling of the accumulator

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Be sure to handle the high-pressure nitrogen gas enclosed in the accumulator with care according to procedure. If handled incorrectly, it could explode and cause serious injury. Strictly observe the following precautions:

- Do not disassemble.
- Do not allow flame near it or throw it into a fire.
- Do not drill, weld or fuse.
- Do not subject it to physical shock such as hitting, rolling or dropping.
- Before disposing of the unit, the sealed gas must be drained. Contact your sales or service dealer for help with this.

Disconnect the battery

Disconnect the wiring from the both terminals (+ and -) on the battery before working on the electrical system or doing electric welding. Otherwise, short-circuit and explosion of the battery can result.

Use caution when handling batteries

1BAA17Z

- Batteries contain sulfuric acid which will damage eyes or skin if contacted.
  - If eye contact occurs, flush immediately with clean water and get prompt medical attention.
  - If accidentally swallowed, drink large quantities of water or milk and call a physician immediately.
  - If acid contacts skin or clothing, wash off immediately with a lot of water.
- Wear protective glasses and gloves when working with batteries.
- Batteries generate flammable hydrogen gas which may explode. Keep away from flame and sparks.
- Do not use or charge the battery when the electrolyte level is lower than the lower limit: otherwise, it could cause an explosion.
- Be sure to stop the engine by turning off the starter switch before inspecting or handling the battery.
- Be careful not to let metal tools (or any metal objects) such as a hammer or spanner come into contact with the battery terminals.
- When disconnecting the battery wiring, always disconnect it from the earth side (-). When connecting, connect the earth side last.
- Loose battery terminals may result in sparks. Be sure to fasten terminals tightly.
- Make sure the battery caps are tightened securely.
- Do not charge a battery or jump-start the engine if the battery is frozen; otherwise it may explode.
  Warm the frozen battery to 15°C (60°F) before use.

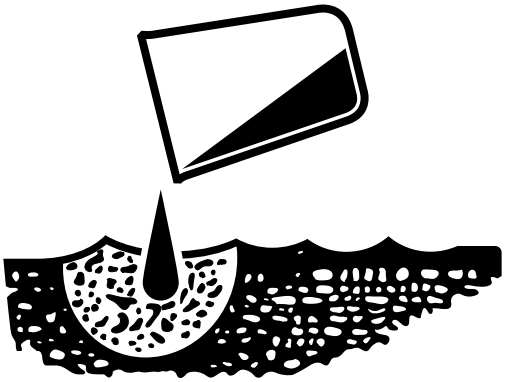
Have a service agent repair welding cracks or other damage

Ask a service agent to make any repairs that require welding. If the agent is unavailable, make sure the welding is done by a qualified person in a properly equipped workplace.

Checks after maintenance

- Gradually raise the engine speed from low idle to maximum and check that no oil or water is leaking from the parts serviced.
- Move the controls and check that the machine is operating properly.

Disposing of wastes



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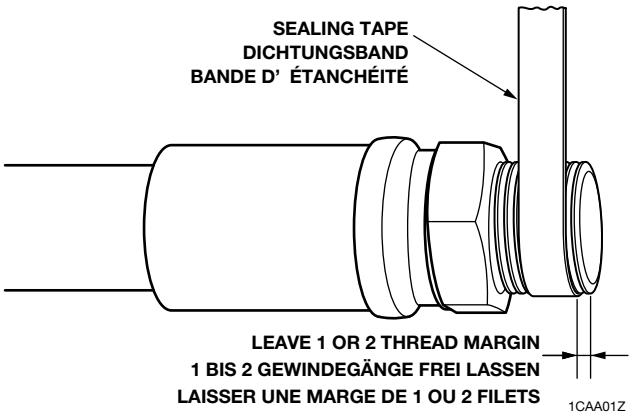
- Always collect oil that is drained from the machine in containers. Improperly disposed waste oil can cause environmental harm.
- Follow appropriate laws and regulations when disposing of harmful objects such as oil, fuel, coolant, solvent, filters and batteries.

CAUTIONS WHEN WORKING

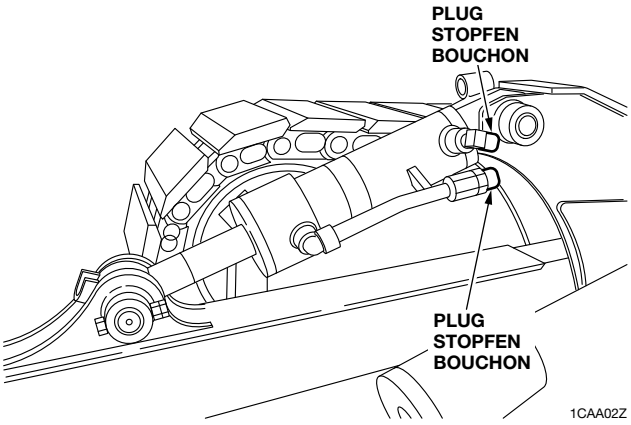
When disassembling or assembling

- Clean the machine before disassembly.
- Check the following items and record the results:
  a. Model, machine serial number, hour meter.
  b. Reason for repair, repair history.
  c. Are the filters dirty?
  d. The conditions of the fuel and oil.
  e. Any damage or looseness to any part?
- Where necessary, draw alignment indicators to avoid assembly errors. To avoid misconnection, place indicators such as reference tags on pipes.
- Clean all disassembled parts and new parts, arrange them neatly, and place indicators as necessary.
- Be sure to replace all seals and cotter pins with new ones.
- Keep those parts that should not come in contact with water or oil away from those with oil on the surface.
- When installing bearings, bushings and oil seals, a press tool should be used. If a hammer is used, use a cushioning material to avoid damage.
- Wipe all joining surfaces clean until there is no dirt or dust adhering to them.
- Wrap the thread tight with seal tape starting 1 or 2 threads away from the thread end. The tape should be overlapped by about 10 mm.



When removing/installing the hydraulic unit

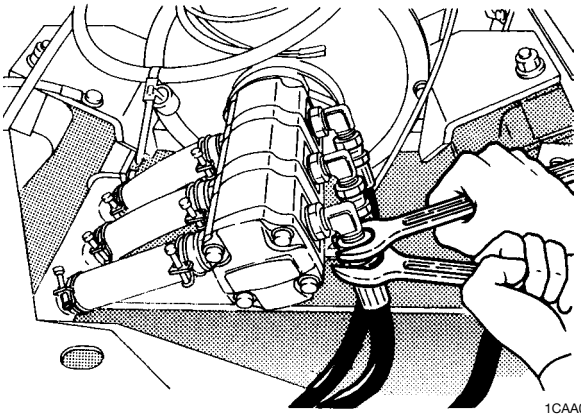
- Make sure that the temperature of the hydraulic oil has dropped and is cool enough to work with.
- To prevent the hydraulic oil from escaping under pressure, release the residual pressure in the piping.
- Be sure to install caps or plugs on all openings in the hydraulic unit to prevent dirt from getting into the unit through them.



- The hydraulic oil adhering to the unit is often mistaken for an oil leak, so wipe off the unit thoroughly.
- Be sure that no damage is caused to the plating on the rod in the hydraulic cylinder.
- Removal and installation of the hydraulic cylinder should be done with the rod fully retracted.
- Be sure to bleed the air after installing the hydraulic cylinder. (☞ "4. Disassembly and assembly: Cylinder")
- Always bleed the air when hydraulic oil is changed or a hydraulic device is replaced.(☞ "4. Disassembly and assembly: Drive system")

When connecting/disconnecting the hoses or pipes

- When hydraulic hoses or pipes are connected, tighten them once to the prescribed torque, then loosen them slightly and retighten them to the prescribed torque.
  a. Tighten the fittings after the installation surfaces fit snugly together.
  b. The above procedures do not apply to fittings with seal tape.
- Use two spanners, one to tighten/loosen and the other to secure the mating hose/pipe to ensure that the hose is not twisted.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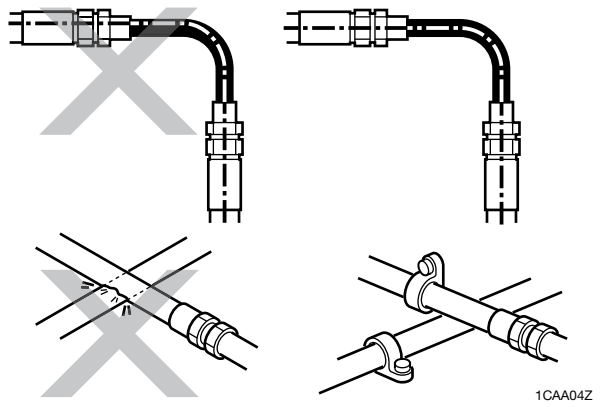
- After connecting the hydraulic hoses or pipes, apply the maximum working pressure five or six times to check for leakage.
- If high pressure, vibration or shock is applied to a twisted hose, oil leak, hose breakage or damage to the hose fitting can result.
- Be sure that the hydraulic hoses are not contacting sharp objects or each other. This could cause surface flaws on the hoses, resulting in breakage.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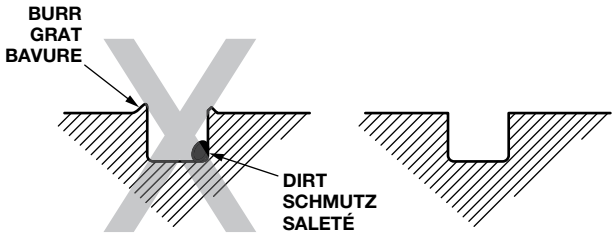
Handling of seals

- Clean the grooves for O-rings and remove any burrs.



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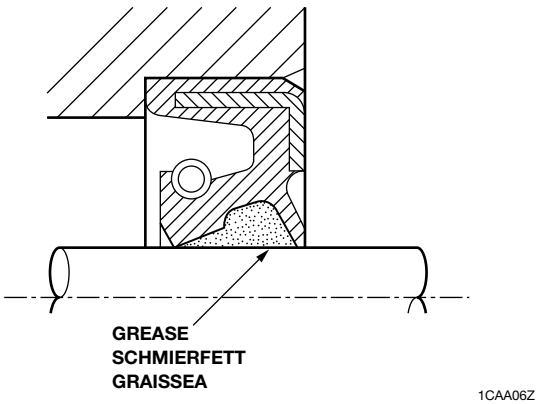
- Be careful not to twist the O-rings. If twisted, remove it with your fingertips.
- When inserting, be careful not to damage the seal.
- Handling of the floating seal
  a. After removal, wipe all oil off the O-ring and housing of the floating seal.
  b. When assembling, apply a thin coating of gear oil to the contact surface of the housing,
  c. After assembly, turn the seal two or three times to get it to fit snugly.
- Apply grease to the lip of the oil seal.
  a. This is to prevent wear from occurring upon first start up after assembly.



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SERVICE DATA 2

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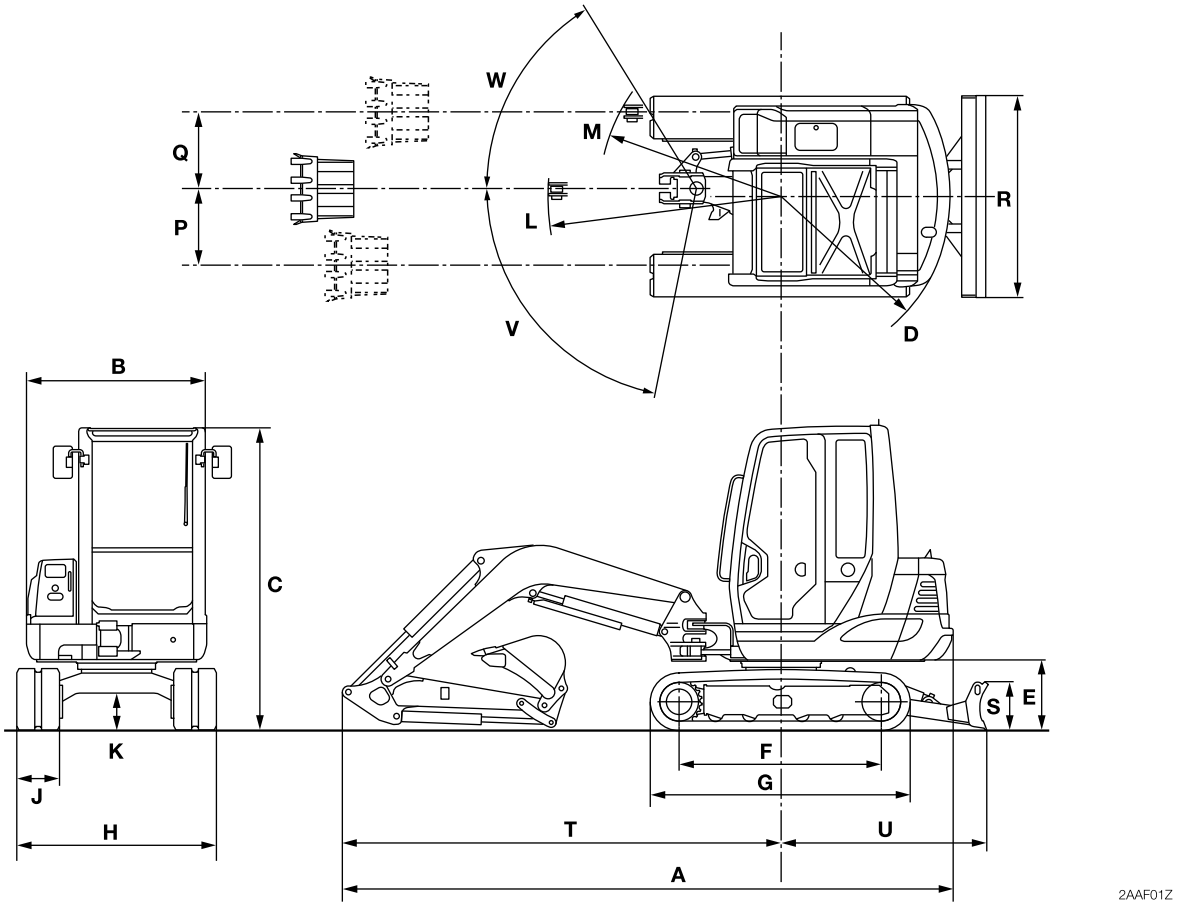
DIMENSIONAL DRAWING

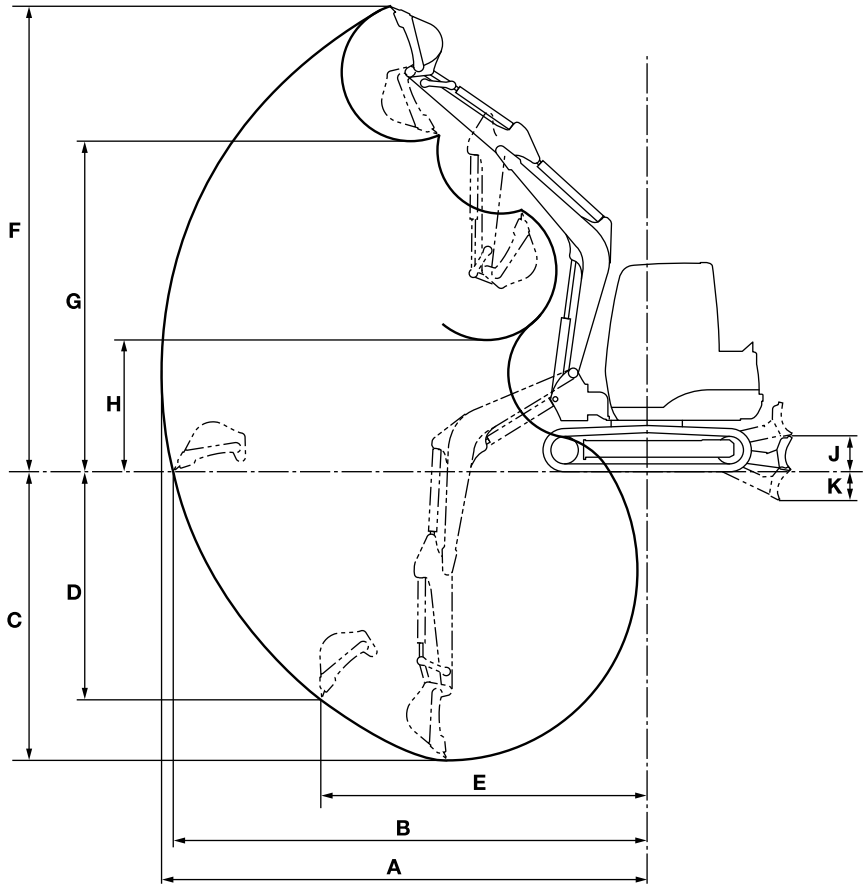
Machine dimensions



Unit: mm

	Standard arm		Middle arm	Long arm
	Rubber crawlers	Steel crawlers	Rubber crawlers	Rubber crawlers
A	4950	4950	4995	5020
B	1470	1470	1470	1470
C	2450	2465	2450	2450
D	1395	1395	1395	1395
E	570	565	570	570
F	1655	1610	1655	1655
G	2110	2080	2110	2110
H	1630	1630	1630	1630
J	350	350	350	350
K	295	290	295	295
L	1890	1890	1930	1950
M	1470	1470	1515	1535
P	615	615	615	615
Q	620	620	620	620
R	1630	1630	1630	1630
S	395	395	395	395
T	3550	3545	3600	3625
U	1655	1655	1655	1655
V	80°	80°	80°	80°
W	60°	60°	60°	60°

Operating range



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Unit: mm

	Standard arm	Middle arm	Long arm
	Rubber crawlers	Rubber crawlers	Rubber crawlers
A	5180	5325	5465
B	5045	5195	5345
C	3090	3250	3400
D	2330	2460	2600
E	3565	3630	3680
F	5040	5135	5240
G	3620	3715	3815
H	1455	1300	1150
J	390	390	390
K	405	405	405

SPECIFICATIONS TABLES

Operating mass	Cab	kg	3605
	Canopy	kg	3465
Rated horse power		kW	21.52
		min^{-1}	2400
Bucket capacity	Heaped capacity	m^3	0.105
	Struck capacity	m^3	0.078

Performance

Standard loading mass		kg	141
Slew speed		min^{-1}	10
Travel speed	1st	km/h	2.6
	2nd	km/h	5.0
Maximum tractive force		kN	39.5
Gradeability		%	58
		degree	30
Ground Pressure	Cab	kPa	27.9
	Canopy	kPa	26.8
Noise Level	Sound-power level	dB(A)	LWA 95
	Sound-pressure level	dB(A)	LPA 75

Machine dimensions

Overall length in transport condition		mm	4950
Overall width		mm	1630
Overall width	Track retracted	mm	—
Overall working equipment height in transept position	Cab	mm	2450
	Canopy	mm	2450

Dimensions of base machine

Overall length of base machine		mm	2710
Overall width of base machine		mm	1630
Overall width of base machine	Track retracted	mm	—
Upper structure overall width		mm	1470
Upper structure overall width	Left	mm	735
	Right	mm	735
Cab overall length		mm	1030
Overall height of base machine		mm	—
Slew radius		mm	1395
Upper structure rearmost distance from axis of rotation		mm	1395
Clearance height under upper structure		mm	570
Crawler base		mm	1655
Crawler overall length		mm	2110
Undercarriage overall width		mm	1630
Undercarriage overall width	Track retracted	mm	—
Track gauge		mm	1280
Track gauge	Track retracted	mm	—
Track shoe width		mm	350
Ground clearance of undercarriage		mm	295

Engine

Model			YANMAR 3TNV88
Type			4-cycle, vertical, water-cooled, in-line, 3-cylinder diesel engine
Number of cylinders -bore×stroke		mm	3–88×90
Total displacement		mL	1642
Maximum torque		N·m	98.6 to 107.4
		min-1	1440
Specific fuel consumption (at rated output)		g/kW·h	250
Fuel/air washer			Centrifugal, filter paper
Cooling system type	Fan		Suction type
	Radiator		Pressure type
Starter motor	Voltage	V	12
	Output	kw	1.7
Generator	Voltage	V	12
	Output	kw	0.48
Battery	Voltage	V	12
	Capacity	A·h	64
	Qty.		1

Hydraulic system

Hydraulic pump drive system			Engine direct coupling
Hydraulic pump	Type		Variable displacement type double axial piston plus double gear
	Qty.		1
	Delivery	L/min	38.9×2+22.8+10.8
	Hydraulic pump control system		All horsepower control
Main relief valve pressure setting		MPa	21.0×2+19.6+3.4
Hydraulic tank pressure			Pressure tank
Control valve	Type		Directional control valve, 10 valves in series (standard spec.)
	Operation type		—
Hydraulic oil filter	Type		Glass fiber filter type
	Filter precision		BETA10=6
	Installing position		Return Circuit (In Hydraulic tank)
Hydraulic oil cooler	Cooling system type		Air cooling
	Radiation of heat area	m^2	10.6

Operating equipment

Cab	Position		Left side
	Construction		Suspension seat, adjustable
Cab or canopy	Construction		Steel enclosed cabin with all glass doors tempered glass, Steel posts canopy
Operating lever and pedals	Shifting operation		Second travel speed switch
	Travel operation		Pilot operated (2 levers)
	Slew operation		Pilot operated
	Arm operation		Pilot operated
	Bucket operation		Pilot operated
	Boom operation		Pilot operated
	Boom swing operation		Mechanics, Pedal
	Others		Auxiliary hydraulics operating: Pilot operated and pedal
Instrument, switches	Cluster gauge		Water temperature gauge, Fuel gauge, Hour meter, Charge, Oil, Water temperature, Decel, Air cleaner, 2nd-speed pilot
Lighting installation	Head ligh	V-W	12V-55W H3-Halogen
	Boom light	V-W	12V-55W H3-Halogen
Warning, safety device			12V,110dB(A)
Others			Cab: Wiper, Heater, With defroster

Slew equipment

Slew bearing	Type	Ball bearing
Slew motor	Type	Variable displacement piston motor
	Qty.	1
Reduction gears	Type	Epicycle reduction gear
Slew brake	Type	Brake valve with a shockless relief
	Qty.	1
Slew parking brake parking	Type	Wet friction plate type
Slew lock	Type	—

Lower Machinery

Power transmission device				
Travel motor	Type		Variable displacement type double axial piston motor, With counterbalance valve	
	Qty.		2	
Reduction gears	Type		Epicycle reduction gear	
Travel brake	Type		Operation delay with a counter balance valve	
Parking brake	Type		Wet friction plate type	
Undercarriage				
Track shoe	Type		Rubber track	Double grouser Steel crawler with double grouser
	Number of shoes (One side)	Qty.	86	43
	Shoe width	mm	350	350
	Grouser height	mm	25	—
	Rug height	mm	—	16.5
Roller	Carrier roller (One side)	Qty.	1	
	Track roller (One side)	Qty.	4	
Track adjuster	Type		Grease cylinder type (with cushion springs)	
Track gauge extension mechanism			—	

Working equipment

Hoe attachment			
Bucket capacity	Heaped	m^3	0.105
	Struck	m^3	0.078
Bucket width	Standard	mm	535
	With side cutter	mm	570
Bucket mass		kg	73
Boom length		mm	2500
Arm length		mm	1290
Bucket wrist radius		mm	725
Bucket wrist angle		degree	186
Boom swing angle	Left	degree	79
	Right	degree	58
Eccentric quantity of boom swing pivot		mm	65

Working dimensions

Maximum reach		mm	5180
Maximum reach at ground reference plane		mm	5045
Minimum level floor radius		mm	1645
Maximum digging depth		mm	3090
Reach at maximum digging depth		mm	2060
Maximum vertical digging depth		mm	2330
Maximum height of cutting edge		mm	5040
Reach at maximum height		mm	2650
Maximum dumping height		mm	3620
Reach at maximum dumping height		mm	2460
Minimum dumping height		mm	1455
Minimum radius of equipment and attachment		mm	1890
Minimum radius of equipment at maximum front offset		mm	1470
Overall height at minimum radius of equipment and attachment		mm	3820
Overall height of equipment at maximum front offset		mm	3820
Offset distance of bucket	Left	mm	615
	Right	mm	620

Main structure

Bucket	Type		—
	Number of teeth	Qty.	4

Hydraulic Cylinder

Boom cylinder	Number of cylinders	Qty.	1
	Bore	mm	85
	Stroke	mm	590
Arm cylinder	Number of cylinders	Qty.	1
	Bore	mm	80
	Stroke	mm	600
Bucket cylinder	Number of cylinders	Qty.	1
	Bore	mm	70
	Stroke	mm	490
Swing cylinder	Number of cylinders	Qty.	1
	Bore	mm	80
	Stroke	mm	470

Digging force

Maximum digging force	Bucket cylinder	kN	27.0
	Arm cylinder	kN	18.3
Maximum lifting force	Boom cylinder	kN	18.0
Other attachment (Option)			Long arm, Middle arm

Dozer blade

Type			Straight type
Operation type			Hydraulic lifting type
Dozer blade cylinder	Number of cylinders	Qty.	1
	Bore	mm	100
	Stroke	mm	140
Dimensions			
Dozer blade dimensions	Width	mm	1630
	Height	mm	395
Cutting angle		degree	69
Distance between the front end of dozer blade and the axis of rotation		mm	1655
Dozer blade maximum lifting		mm	390
Dozer blade maximum lowering		mm	405
Dozer blade approach angle		degree	26

LUBRICANT AND FUEL CHART

Select the appropriate fuel, lubricant and grease according to the temperature by referring to the table below.

- Regardless of the specified time, change the oil if it becomes too dirty or degraded.
- When refilling, never mix oils of different brands. If a brand is to be changed, replace the whole fuel/oil.

Part	Type	Type by air temperature -20 -10 0 10 20 30 40°C	When to change/ replenish	Capacity
Engine oil pan	Diesel engine oil API: CD class ACEA-E3, E-4 or E-5	SAE 10W-30 SAE 15W-40	Every 250 hrs after the first 50 hrs	Upper limit 4.7 L Lower limit 2.9 L
Hydraulic oil tank	Takeuchi genuine hydraulic oil 46	ISO VG46	Every 4000 hrs***	Total amount of oil: 67 L Tank capacity: 35 L
	Anti-wear hydraulic oil	ISO VG32 ISO VG46 ISO VG68	Every 2000 hrs	
Engine cooling system	Cooling water (water + coolant)** SAE-J814C, J1941, J1034 or J2036 ASTM-D6210 or D4985 (USA)	Mixture of 50% coolant Mixture of 30% coolant	Every 1000 hrs	8.7 L
Travel reduction gear	Gear oil API: GL-4	SAE 90	Every 1000 hrs after the first 250 hrs*	0.6 L
Carrier roller	Gear oil API: GL-4	SAE 90	—	0.045 L
Track roller	Gear oil API: GL-4	SAE 90	—	0.070 L
Idler	Gear oil API: GL-4	SAE 90	—	0.040 L
Slew bearing	Lithium grease EP-2 NLGI No.2	—	Every 50 hrs	As required
Working equipment			Daily or every 10 hrs	
Levers			When required	

* If the ratio of traveling time to total operating time is high, replace the gear oil earlier than the specified time.

** For water, use tap water (soft). Do not use well or river water.
When the ambient temperature drops below 0°C, add coolant (antifreeze). Follow the coolant manufacturer's instructions to determine the mixture ratio.

*** The replacement interval for hydraulic oil depends on the oil type being used. New machines are shipped from the factory with the Takeuchi genuine hydraulic oil 46. This manual describes when to replace the hydraulic oil assuming that this Takeuchi oil 46 is used. When a conventional antiwear hydraulic oil is used, replace it every 2000 hours.

Diesel fuel standards

Use the diesel fuel that is compliant with any of the standards below. The table below shows the standards from the various countries.

Diesel fuel standards	Region
No. 2-D, No. 1-D, ASTM D975-94	USA
EN590:96	EU
ISO 8217 DMX	International standard
BS 2869-A1 (or A2)	UK
JIS K2204 Grade, 2-go	Japan
KSM-2610	Korea
GB252	China

Part	Type		Capacity
Fuel tank	Desel fuel	To keep the performance and service life of the engine, always use the clean and high-quality fuel. • To avoid freezing in cold climates, use a light oil that still functions when the temperature is at least 12°C below the lowest expected ambient temperature. • Use a light oil that has a cetane number of 45 or higher. When operating at a very low temperature or at a high altitude, a higher cetane number fuel will be required. • The sulfur content must be less than 0.5% by volume. he recommended value, however, is less than 0.05%. The electronically-controlled engine with an EGR system should use fuel containing less than 0.05% sulfur. Fuel containing a high content of sulfur may cause sulfuric acid corrosion inside the cylinder. • Do not mix diesel fuel with any kerosene, used engine oil or leftover fuel. • Poor quality fuel can degrade the engine performance. It also can damage the engine. • Avoid using additives to fuel. Some fuel additives can degrade the engine performance.	53 L

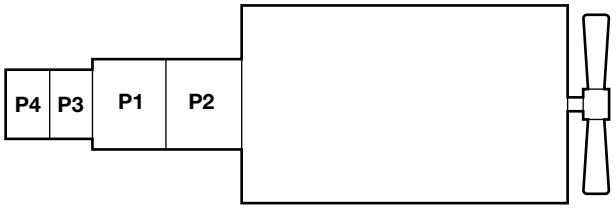
PERFORMANCE CRITERIA

Standard values table

Item				Standard values	Allowable value
Engine speed	Idling		min^{-1}		—
	Maximum R. P. M		min^{-1}		—
Hydraulic oil pressure	Boom		MPa	$21.0\ ^{+1.4}_{-0.3}$	—
	Arm		MPa	$21.0\ ^{+1.4}_{-0.3}$	—
	Dozer blade		MPa	$19.6\ ^{+2.0}_{-0.2}$	—
	Slew		MPa	$19.6\ ^{+2.0}_{-0.2}$	—
	Pilot pressure		MPa	3.9 ±0.3	—
Cylinder speed	Boom cylinder	Retracted	s	2.9 ±0.5	3.7
		Extended	s	2.7 ±0.5	3.5
		Retracted	s		
		Extended	s		
	Arm cylinder	Retracted	s	3.4 ±0.5	4.2
		Extended	s	3.5 ±0.5	4.4
	Bucket cylinder	Retracted	s	2.3 ±0.4	2.9
		Extended	s	3.1 ±0.4	3.8
	Swing cylinder	Retracted	s	5.2 ±0.7	6.4
		Extended	s	5.3 ±0.7	6.5
		Retracted	s		
		Extended	s		
	Dozer blade cylinder	Retracted	s	3.6 ±0.4	4.4
		Extended	s	3.0 ±0.4	3.7
		Retracted	s		
		Extended	s		
Slew time		Normal speed	s	11.9 ±1.0	14.1
		Slow speed	s		
Overrun when slewing stops			mm	90 ±55	184
Natural slew drop	Slew bearing		mm	0	
	Swing cylinder		mm	$5\ ^{0}_{-5}$	
Travel speed (10m)	Low speed	Rubber	s	14.3 ±1.0	16.7
		Steel	s	14.8 ±1.5	17.8
	Hight speed	Rubber	s	8.1 ±1.0	10.2
		Steel	s	8.4 ±1.5	11.1
Travel speed (5 rev.)	Low speed	Rubber	s	32.6 ±1.5	37.4
		Steel	s	32.8 ±1.8	37.9
	Hight speed	Rubber	s	16.6 ±1.0	19.9
		Steel	s	16.8 ±1.8	21
Straight travel			mm	$125\ ^{0}_{-125}$	500
Straight travel function check	Bucket			Straightness should be remained when operated at the same time	
	Arm				
	Boom				
	Blade				
Bucket cylinder speed		Retracted	s	5.8 ±1.1	7.5

Item				Standard values	Allowable value
Natural cylinder drop	Boom		mm	6^{0}_{-6}	12
	Arm		mm	8^{0}_{-8}	16
	Arm (With emergency shut-off valve)		mm	4^{0}_{-4}	8
	Bucket		mm	5^{0}_{-5}	10
	Dozer blade		mm	5^{0}_{-5}	10
	Bucket tip		mm	110^{0}_{-110}	220
	Bucket tip (With emergency shut-off valve)		mm	100^{0}_{-100}	200
Backlash			mm	21 ±10	42
Lever play	Right operating lever		mm	4^{0}_{-4}	—
	Left operating lever		mm	4^{0}_{-4}	—
	Travel		mm	5^{0}_{-5}	—
	Dozer blade		mm	33^{0}_{-33}	—
Lever operating force	Swing		N	53 ±15	—
	Dozer blade		N	28 ±10	—
Track tension		Rubber	mm	77 to 87	—
		Rubber pads		144 to 154	
		Steel		144 to 154	

Hydraulic pump assignment table



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P1	Left travel, Arm, Swing, Auxiliary line	38.9 L/min
P2	Right travel, Boom, Bucket	38.9 L/min
P3	Slew, Dozer Blade, Second auxiliary line	22.8 L/min
P4	Pilot pressure	10.8 L/min

Pump P1

Left travel	Pressure: 21.0 MPa	Test port P1
Arm	Pressure: 21.0 MPa	Test port P1
Swing	Pressure: 21.0 MPa	Test port P1
Auxiliary line	Pressure: 21.0 MPa	Test port P1

Pump P2

Right travel	Pressure: 21.0 MPa	Test port P2
Boom	Pressure: 21.0 MPa	Test port P2
Bucket	Pressure: 21.0 MPa	Test port P2

Pump P3

Slew	Pressure: 19.6 MPa	Test port P3
Dozer Blade	Pressure: 19.6 MPa	Test port P3
Auxiliary	Pressure: 19.6 MPa	Test port P3

Pump P4

Pilot pressure	Pressure: 3.4 MPa	Test port P4

Methods for inspecting performance

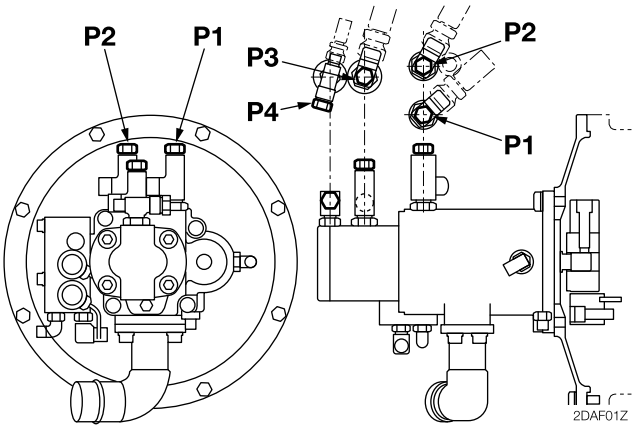
Hydraulic oil pressure (Main relief valve set pressure)

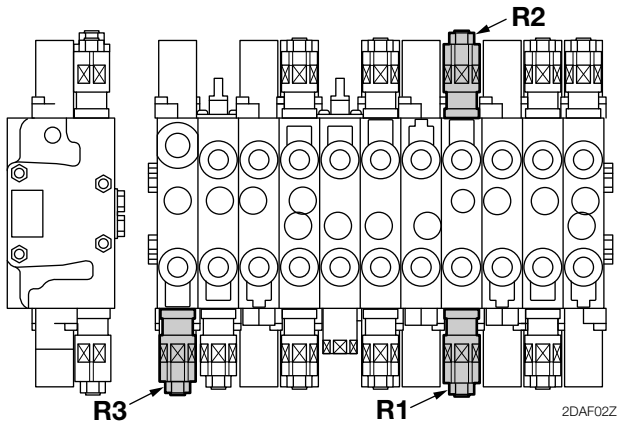
Boom, Arm, Dozer Blade

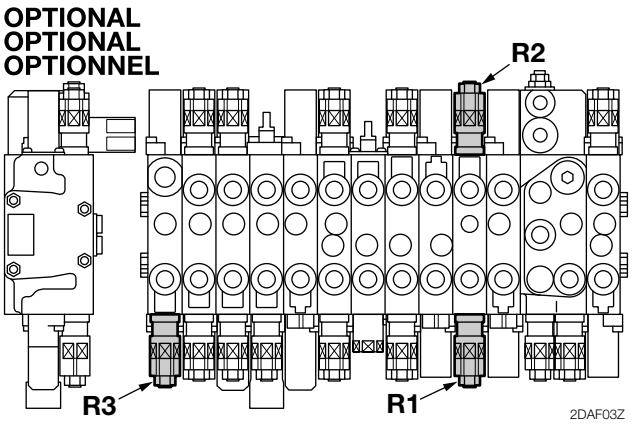
Measuring Method

- Engine: Maximum R. P. M.
- Hydraulic oil temp.: 50~60°C
- Mount the pressure gauge on the pressure detection port, operate the desired hydraulic circuit and measure the relief pressure.

Circuit	Relief valve	Pressure detection port	
		Port location	Size
Arm	R1	P1	G1/4
Boom	R2	P2	
Blade	R3	P3	

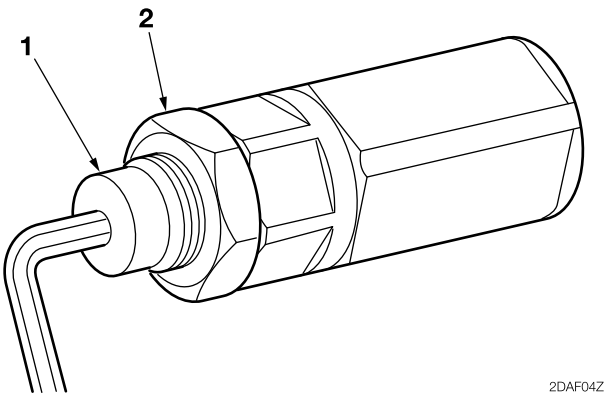






Adjusting method

1. Loosen the locknut (2), and turn the setscrew (1) to adjust the set pressure.
   - To increase the set pressure, turn the setscrew clockwise.
   - To decrease the set pressure, turn the setscrew counterclockwise.
2. Upon completion of the adjustment, tighten the lock nut (2) by holding the setscrew (1) to prevent it from turning.
3. Operate the relief valve again to confirm that the newly set pressure is stabilized.

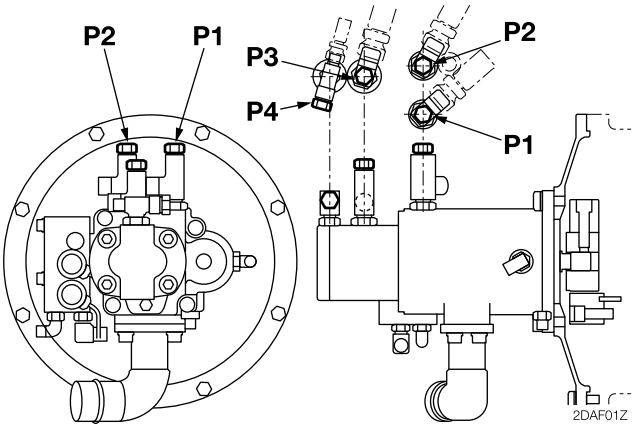


Hydraulic oil pressure (Slewing relief valve set pressure)

Measuring method

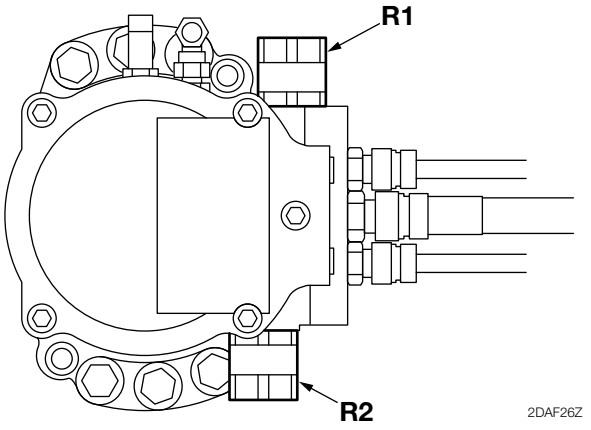
- Engine: Maximum R. P. M.
- Hydraulic oil temp.: 50~60°C
- Mount the pressure gauge on the pressure detection port and set a solid obstacle so that the upperstructure cannot slew in the direction to be measured. Next, operate the circuit to be measured and measure the relief pressure.

Circuit	Relief valve	Pressure detection port	
		Port location	Size
Right slew	R1	P3	G1/4
Left slew	R2		



Adjusting method

It is not possible to adjust the set pressure with the relief valve on the slew motor. If adjustment is required, replace the relief valve assembly.

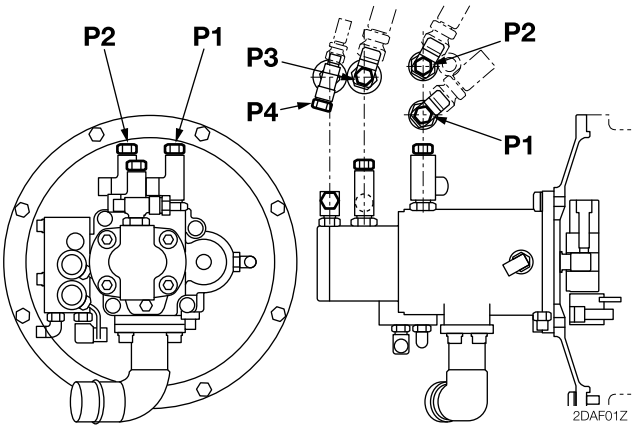


Hydraulic oil pressure (Pilot pressure)

Measuring method

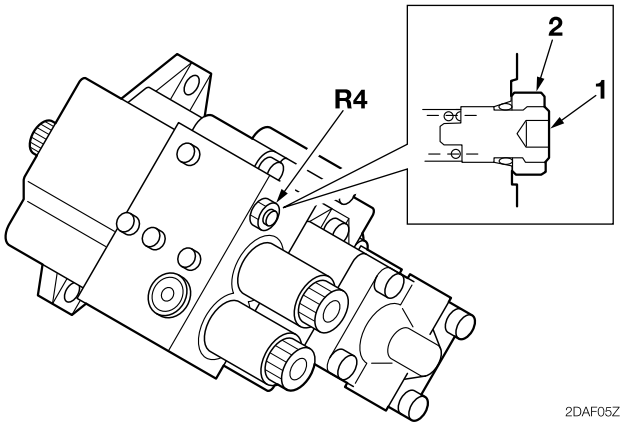
- Engine: Maximum R. P. M.
- Hydraulic oil temp.: 50~60°C
- Mount pressure gauge on the pressure detection port and measure the pilot relief pressure.

Relief valve	Pressure detection port	
	Port location	Size
R4	P4	G1/4



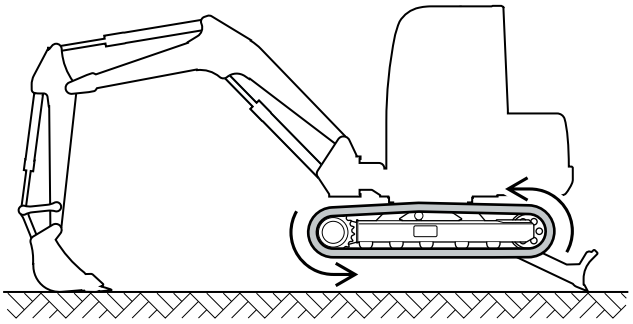
Adjusting Method

1. Loosen the locknut (2), and turn the setscrew (1) to adjust the set pressure.
   - To increase the set pressure, turn the setscrew clockwise.
   - To decrease the set pressure, turn the setscrew counterclockwise.
2. Upon completion of the adjustment, tighten the lock nut (2) by holding the setscrew (1) to prevent it from turning.
3. Operate the relief valve again to confirm that the newly set pressure is stabilized.



Travel speed (5 revolutions)

- Engine: Maximum R. P. M.
- Hydraulic oil temp.: 50~60°C
- Measurement posture: Excavator body raised using both hoe attachment and dozer blade.
- Set crawler belts in motion. Starting after one full revolution, measure the time required for 5 revolutions. (To measure speed after it has stabilized.)



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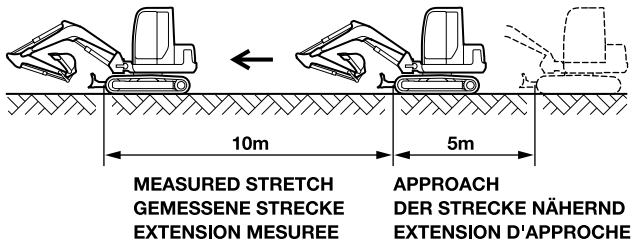
Travel speed (10m)

- Engine: Maximum R. P. M.
- Hydraulic oil temp.: 50~60°C
- Measurement posture: Travel posture
- Set excavator in motion. Starting after a distance of 5 meters, measure the time required to travel 10 meters. Do this on level ground.



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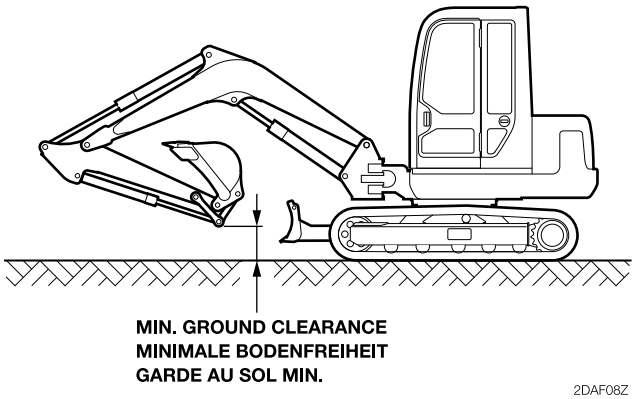
■ Travel posture

Fully extend the arm and bucket cylinders and adjust the hoe attachment so that its lowest part is even with the excavator's minimum ground clearance level. The hoe attachment, of course, should be in a no-load state and the dozer blade should not be touching the ground.



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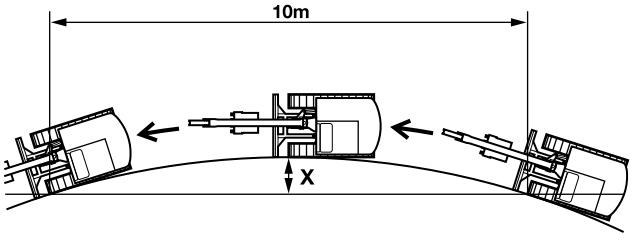
Straight-ahead travering

- Engine: Maximum R. P. M.
- Hydraulic oil temp.: 50~60°C
- Measurement posture: Travel posture
- Starting after an approach of 5 meters, drive the excavator in a turn for 10 meters, then measure the distance of X (5 m point). Do this on level ground.



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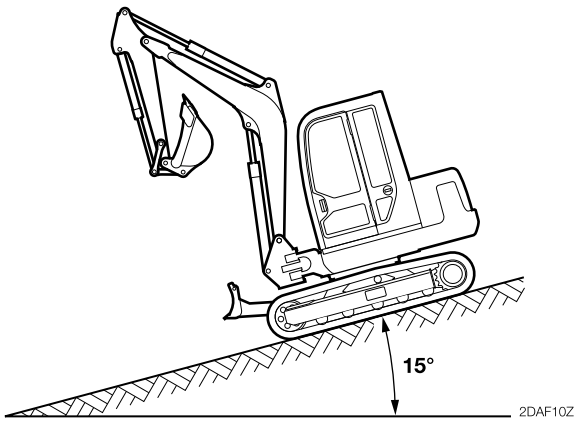
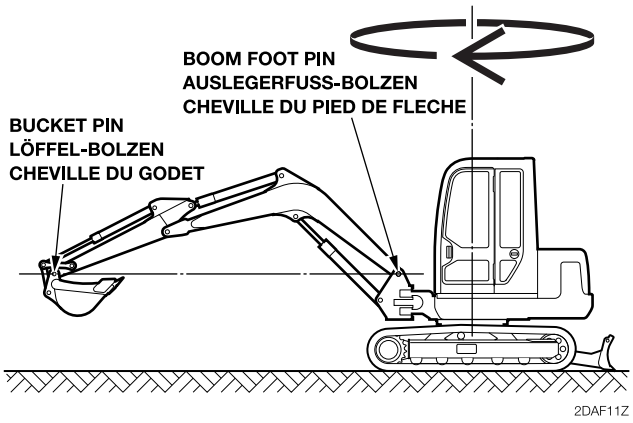
Natural travel drop

- Engine: Stopped
- Hydraulic oil temp.: 50~60°C
- Gradient: 15°
- Measurement posture: Fully extend the boom, arm and bucket cylinders and completely retract the dozer blade cylinder.
- With the excavator parked at angle for 5 minutes, measure the extent of natural drop.



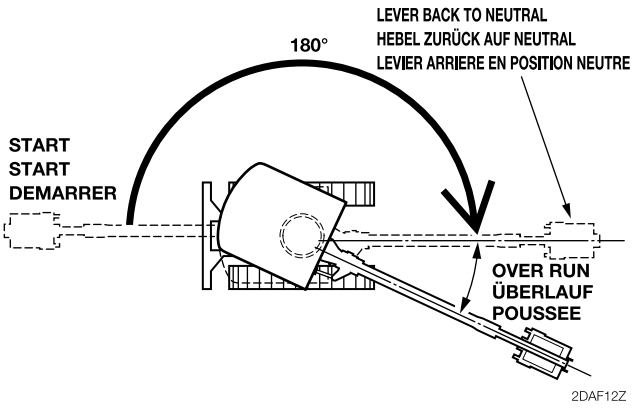
Slew time

- Engine: Maximum R. P. M.
- Hydraulic oil temp.: 50~60°C
- Measurement posture: Completely retract the arm cylinder, fully extend the bucket cylinder and adjust so that boom foot pin and bucket pin are at matching height. Rest the dozer blade on the ground.
- With the hoe attachment in a no-load state, wait 1 rotation, then measure the time required for the next 2 rotations.



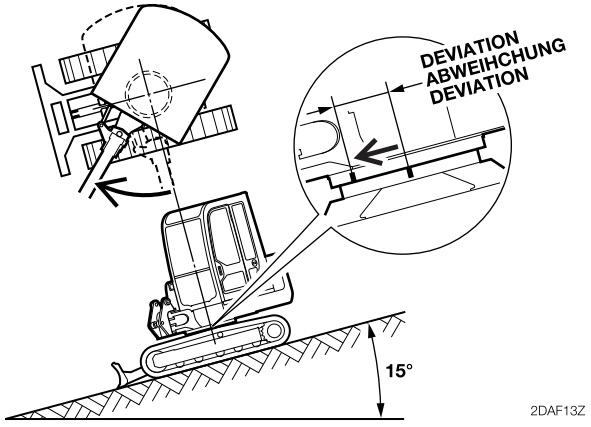
Overrun when slewing stops

- Engine: Maximum R. P. M.
- Hydraulic oil temp.: 50~60°C
- Measurement posture: Same as that for measuring slew time.
- Draw matching marks on the outer race of the slew bearing and lower frame at an exactly 180 degrees rotation from the starting point. With the hoe attachment in a no-load state, rotate 180 degrees at, which point return the operation lever to neutral. Measure the differential between the position marks and the point the hoe attachment stops.



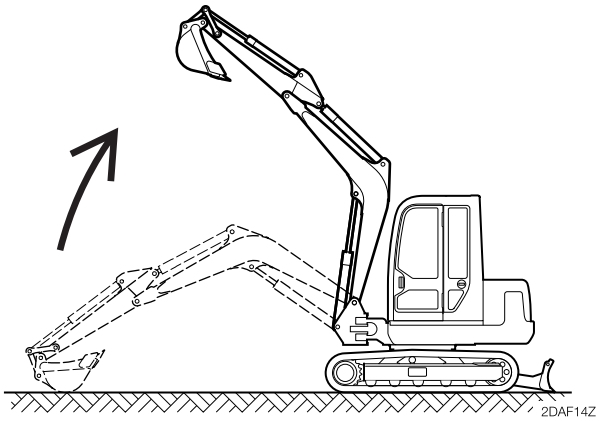
Natural slew drop

- Engine: Stopped
- Hydraulic oil temp.: 50~60°C
- Gradient: 15°
- Measurement posture: Same as that for measuring slew time.
- Rotate the upper machinery so that it is directly abeam of the grade, then draw positional marks on the slew bearing's outer race and the lower frame. Then measure the distance that develops between the marks after 5 minutes.



Boom cylinder speed

- Engine: Maximum R. P. M.
- Hydraulic oil temp.: 50~60°C
- Measurement posture: Completely retract the arm cylinder, fully extend the bucket cylinder and rest the dozer blade on the ground.
- Then measure the time required for the bucket to reach its highest elevation point (lowest point) from its lowest point (highest point) resting on the ground. (Do not include the cushioning time.)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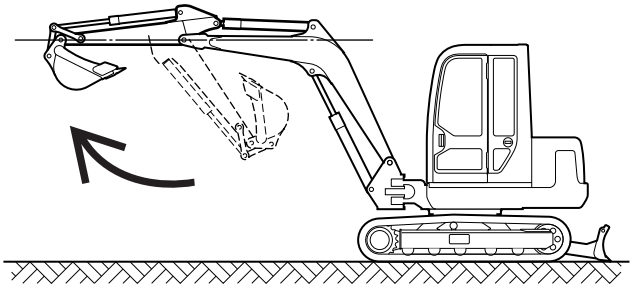
Arm cylinder speed

- Engine: Maximum R. P. M.
- Hydraulic oil temp.: 50~60°C
- Measurement posture: Completely retract the arm cylinder, fully extend the bucket cylinder, position the arm horizontally and rest the dozer blade on the ground.
- Then measure the time required for the arm cylinder to completely retract (extend) from a fully extended state (retracted state).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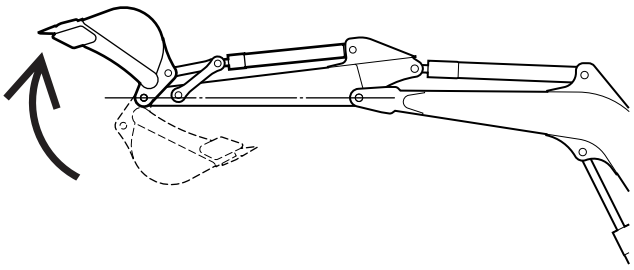
Bucket cylinder speed

- Engine: Maximum R. P. M.
- Hydraulic Oil Temp.: 50~60°C
- Measurement posture: Completely retract the arm cylinder, position the arm horizontally and rest the dozer blade on the ground.
- Then measure the time required for the bucket cylinder to completely retract (extend) from a fully extended state (retracted state).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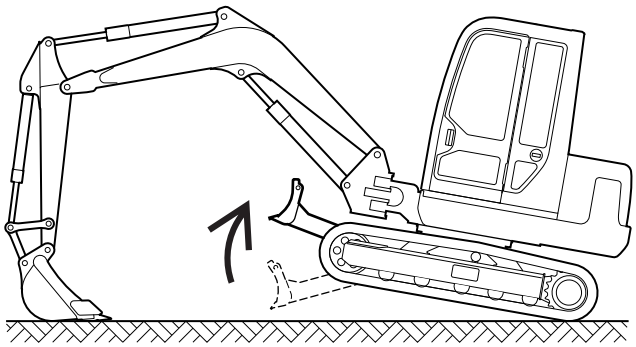
Dozer blade cylinder speed

- Engine: Maximum R. P. M.
- Hydraulic oil temp.: 50~60°C
- Measurement Posture: Using the hoe attachment, lift up the dozer blade end of the excavator.
- Then, raising and lowering the dozer blade full stroke, measure the time required per stroke in each direction.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