

SECTION 1 GENERAL



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SECTION 1 GENERAL

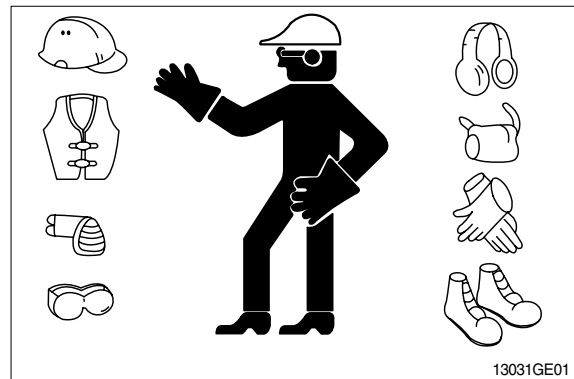
GROUP 1 SAFETY HINTS

FOLLOW SAFE PROCEDURE

Unsafe work practices are dangerous. Understand service procedure before doing work; do not attempt shortcuts.

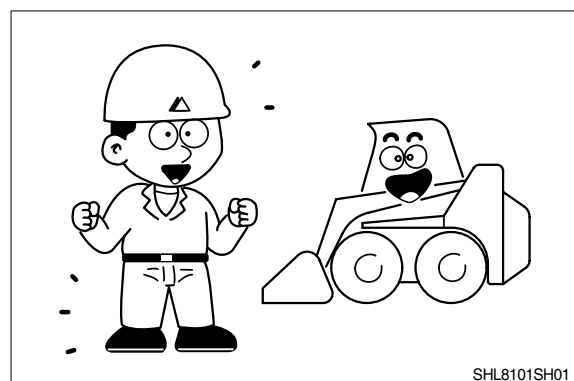
WEAR PROTECTIVE CLOTHING

Wear close fitting clothing and safety equipment appropriate to the job.



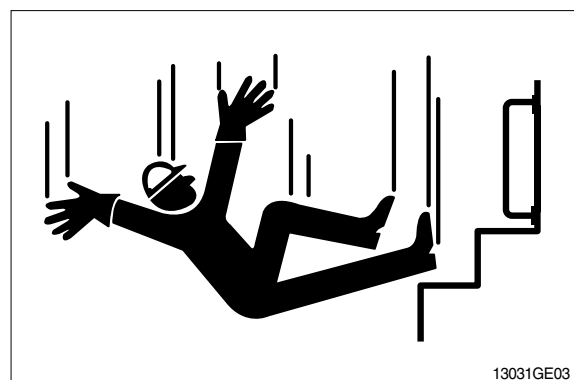
WARN OTHERS OF SERVICE WORK

Unexpected machine movement can cause serious injury. Before performing any work on the machine, attach a 「Do Not Operate」 tag on the right side steering control lever.



USE HANDHOLDS AND STEPS

Falling is one of the major causes of personal injury. When you get on and off the machine, always maintain a three point contact with the steps and handrails and face the machine. Do not use any controls as handholds. Never jump on or off the machine. Never mount or dismount a moving machine. Be careful of slippery conditions on platforms, steps, and handrails when leaving the machine.

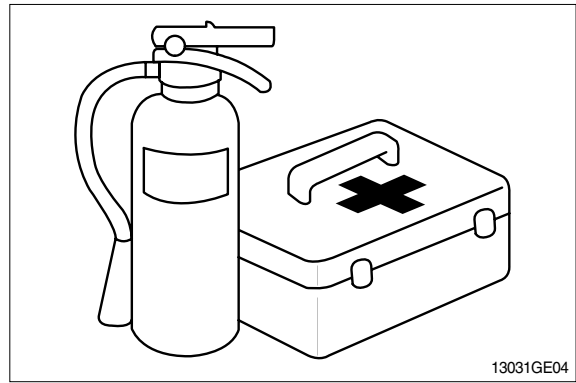


PREPARE FOR EMERGENCIES

Be prepared if a fire starts.

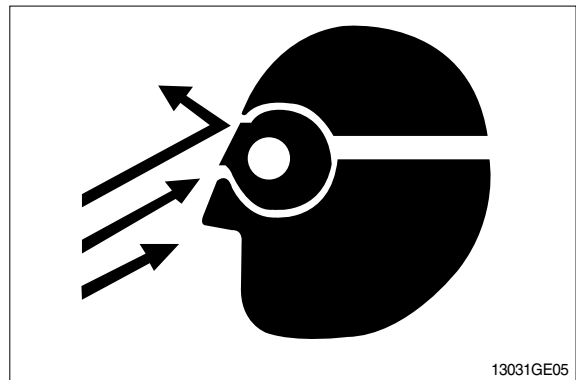
Keep a first aid kit and fire extinguisher handy.

Keep emergency numbers for doctors, ambulance service, hospital, and fire department near your telephone.



PROTECT AGAINST FLYING DEBRIS

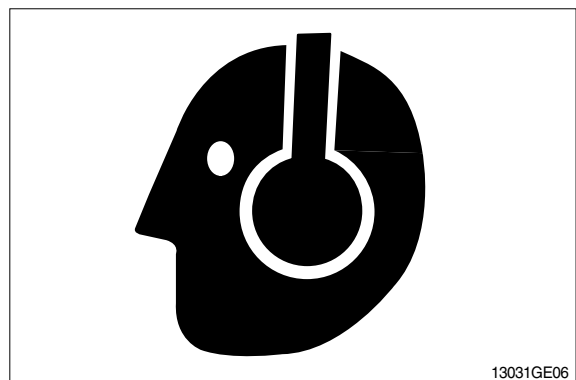
Guard against injury from flying pieces of metal or debris; wear goggles or safety glasses.



PROTECT AGAINST NOISE

Prolonged exposure to loud noise can cause impairment or loss of hearing.

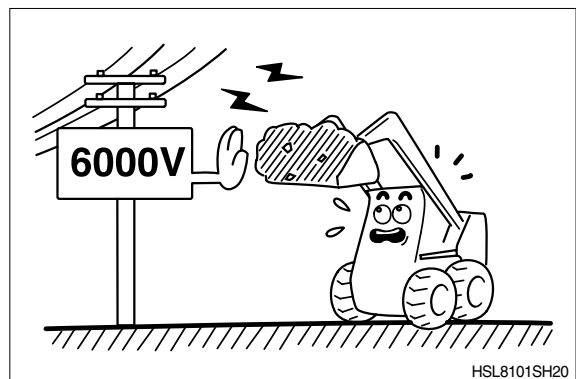
Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortable loud noises.



AVOID POWER LINES

Serious injury or death can result from contact with electric lines.

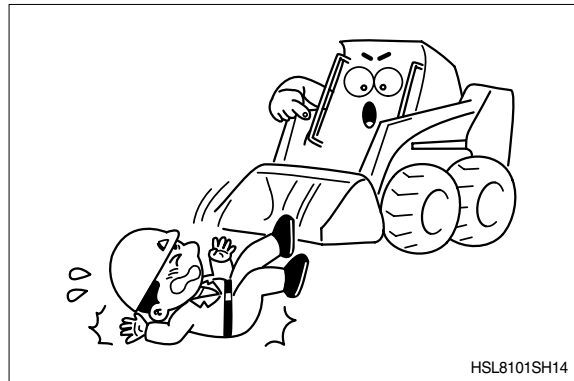
Never move any part of the machine or load closer to electric line than 3m(10ft) plus twice the line insulator length.



KEEP RIDERS OFF MACHINE

Only allow the operator on the machine. Keep riders off.

Riders on machine are subject to injury such as being struck by foreign objects and being thrown off the machine. Riders also obstruct the operator's view resulting in the machine being operated in an unsafe manner.

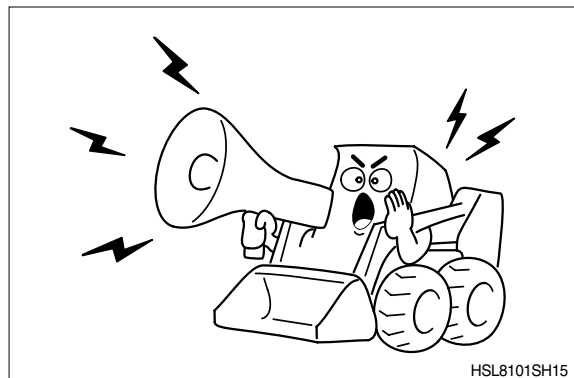


MOVE AND OPERATE MACHINE SAFELY

Bystanders can be run over. Know the location of bystanders before moving, steering, or operating the machine.

Always keep the travel alarm in working condition. It warns people when the machine starts to move.

Use a signal person when moving, turning, or operating the machine in congested areas. Coordinate hand signals before starting the machine.



OPERATE ONLY ON OPERATOR'S SEAT

Avoid possible injury and machine damage. Do not start engine by shorting across starter terminals.

NEVER start engine while standing on ground. Start engine only on operator's seat.

PARK MACHINE SAFELY

Before working on the machine:

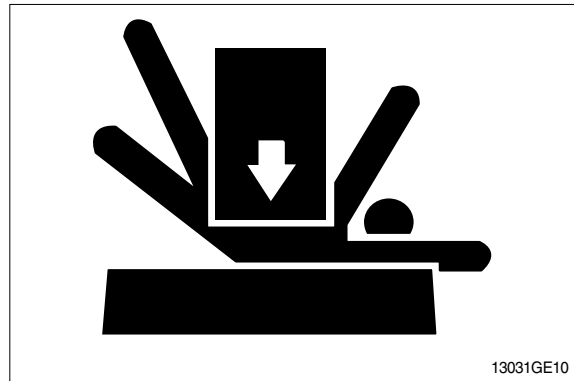
- Park machine on a level surface.
- Lower bucket to the ground.
- Run engine at 1/2 speed without load for 2 minutes.
- Turn key switch to OFF to stop engine. Remove key from switch.
- Allow engine to cool.
- Raise seat bar and chock the wheels.
- Put jackstands under the rear frame.

SUPPORT MACHINE PROPERLY

Always lower the attachment or implement to the ground before you work on the machine. If it is necessary to work on a lifted machine or attachment, securely support the machine or attachment.

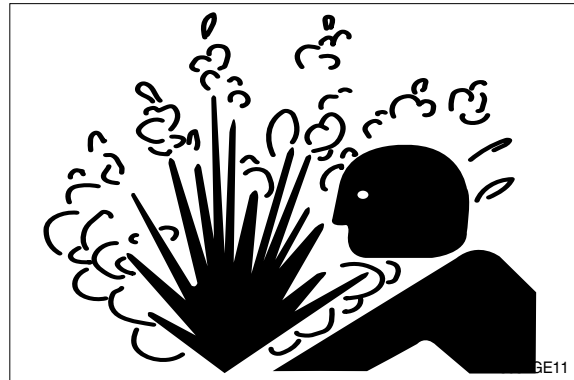
Do not support the machine on cinder blocks, hollow tiles, or props that may crumble under continuous load.

Do not work under a machine that is supported solely by a jack. Follow recommended procedures in this manual.



SERVICE COOLING SYSTEM SAFELY

Do not remove the radiator cap from a hot engine to avoid personal injury from heated coolant spray or steam, shut off the engine and wait until the temperatures is below 50°C(120°F) before removing the cap.



HANDLE FLUIDS SAFELY-AVOID FIRES

Handle fuel with care; it is highly flammable. Do not refuel the machine while smoking or when near open flame or sparks. Always stop engine before refueling machine.

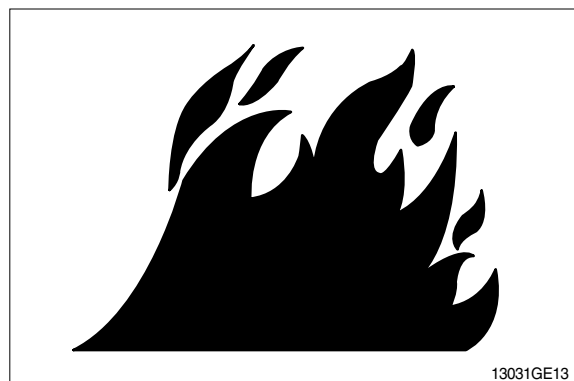
Fill fuel tank outdoors.



Store flammable fluids away from fire hazards. Do not incinerate or puncture pressurized containers.

Make sure machine is clean of trash, grease, and debris.

Do not store oily rags ; they can ignite and burn spontaneously.



BEWARE OF EXHAUST FUMES

Prevent asphyxiation. Engine exhaust fumes can cause sickness or death.

If it is necessary to operate the machine in a building, provide adequate ventilation. Either use an exhaust pipe extension to remove the exhaust fumes or open doors and windows to bring enough outside air into the area.

REMOVE PAINT BEFORE WELDING OR HEATING

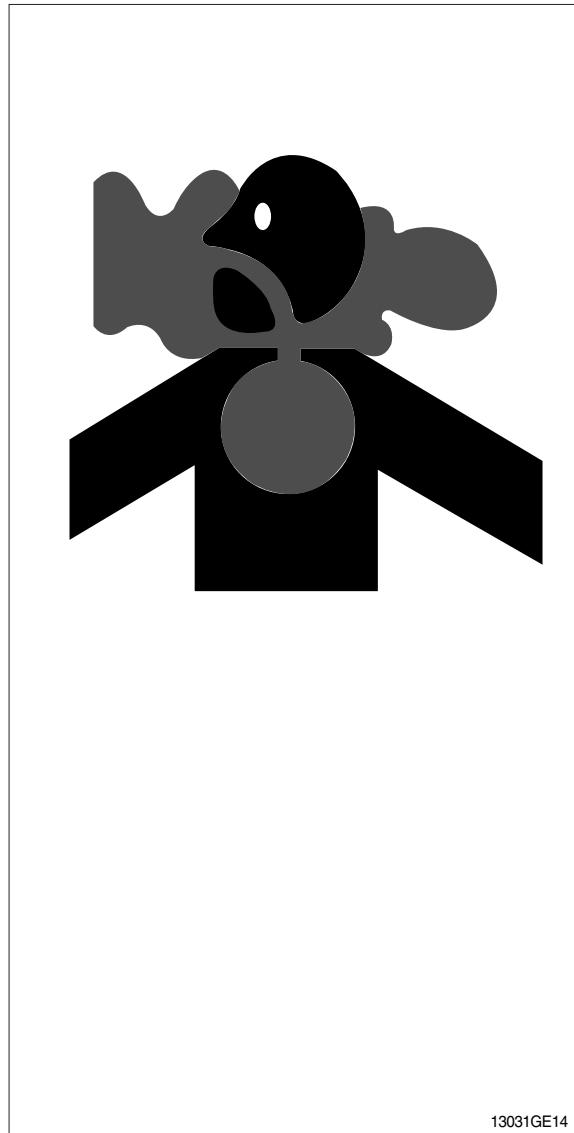
Avoid potentially toxic fumes and dust.

Hazardous fumes can be generated when paint is heated by welding, soldering, or using a torch.

Do all work outside or in a well ventilated area. Dispose of paint and solvent properly.

Remove paint before welding or heating:

- If you sand or grind paint, avoid breathing the dust.
Wear an approved respirator.
- If you use solvent or paint stripper, remove stripper with soap and water before welding. Remove solvent or paint stripper containers and other flammable material from area. Allow fumes to disperse at least 15 minutes before welding or heating.



ILLUMINATE WORK AREA SAFELY

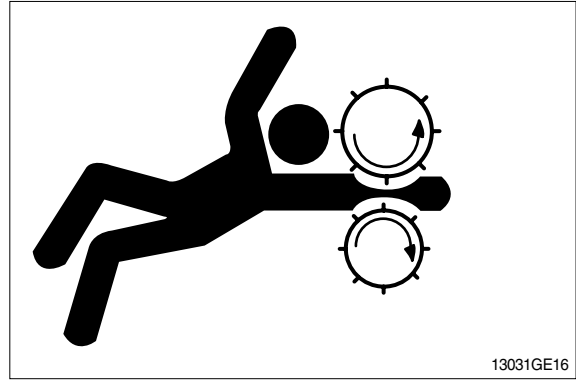
Illuminate your work area adequately and safely. Use a portable safety light for working inside or under the machine. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.



SERVICE MACHINE SAFELY

Tie long hair behind your head. Do not wear a necktie, scarf, loose clothing or necklace when you work near machine tools or moving parts. If these items were to get caught, severe injury could result.

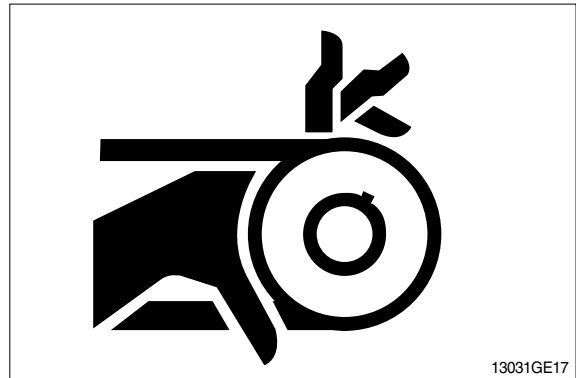
Remove rings and other jewelry to prevent electrical shorts and entanglement in moving parts.



STAY CLEAR OF MOVING PARTS

Entanglements in moving parts can cause serious injury.

To prevent accidents, use care when working around rotating parts.



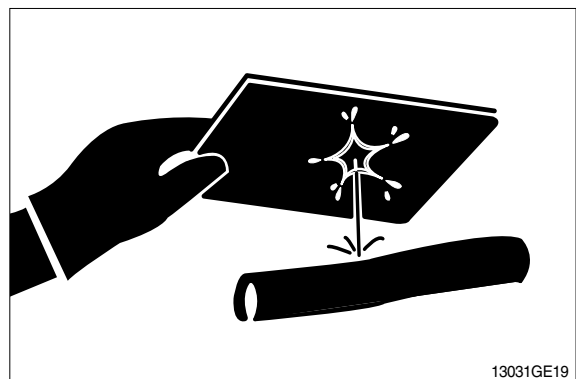
AVOID HIGH PRESSURE FLUIDS

Escaping fluid under pressure can penetrate the skin causing serious injury.

Avoid the hazard by relieving pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure.

Search for leaks with a piece of cardboard. Protect hands and body from high pressure fluids.

If an accident occurs, see a doctor immediately. Any fluid injected into your skin, fluid must be surgically removed within a few hours otherwise gangrene may result.



AVOID HEATING NEAR PRESSURIZED FLUID LINES

Flammable spray can be generated by heating near pressurized fluid lines, resulting in severe burns to yourself and bystanders. Do not heat by welding, soldering, or using a torch near pressurized fluid lines or other flammable materials.

Pressurized lines can be accidentally cut when heat goes beyond the immediate flame area. Install fire resisting guards to protect hoses or other materials.



PREVENT BATTERY EXPLOSIONS

Keep sparks, lighted matches, and flame away from the top of battery.

Battery gas can explode.

Never check battery charge by placing a metal object across the posts. Use a volt-meter or hydrometer.

Do not charge a frozen battery; it may explode. Warm battery to 16°C (60°F), before charging.



PREVENT ACID BURNS

Sulfuric acid in battery electrolyte is poisonous. It is strong enough to burn skin, eat holes in clothing, and could cause blindness if splashed into the eyes.

Avoid the hazard by:

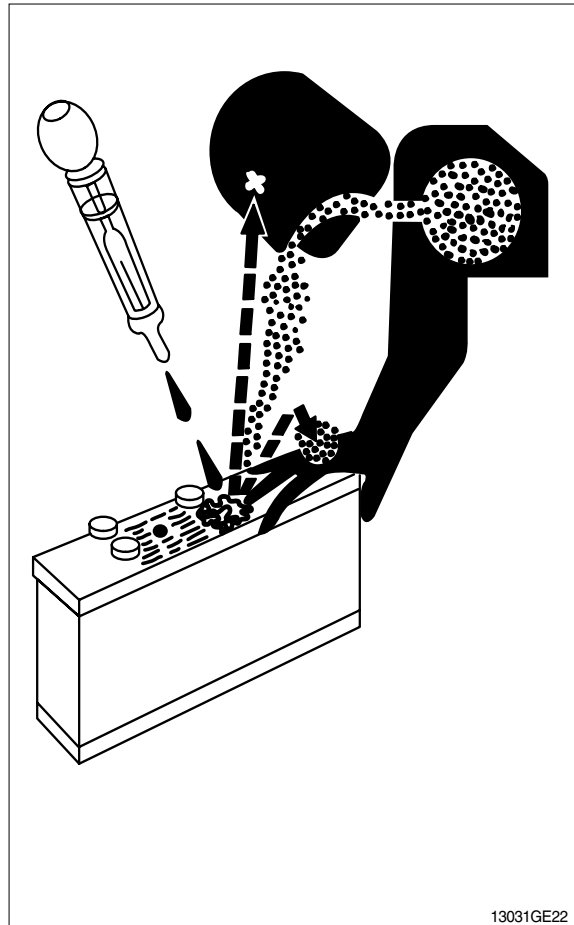
1. Filling batteries in a well-ventilated area.
2. Wearing eye protection and rubber gloves.
3. Avoiding breathing fumes when electrolyte is added.
4. Avoiding spilling or dripping electrolyte.
5. Use proper jump start procedure.

If you spill acid on yourself:

1. Flush your skin with water.
2. Apply baking soda or lime to help neutralize the acid.
3. Flush your eyes with water for 10-15 minutes. Get medical attention immediately.

If acid is swallowed:

1. Drink large amounts of water or milk.
2. Then drink milk of magnesia, beaten eggs, or vegetable oil.
3. Get medical attention immediately.



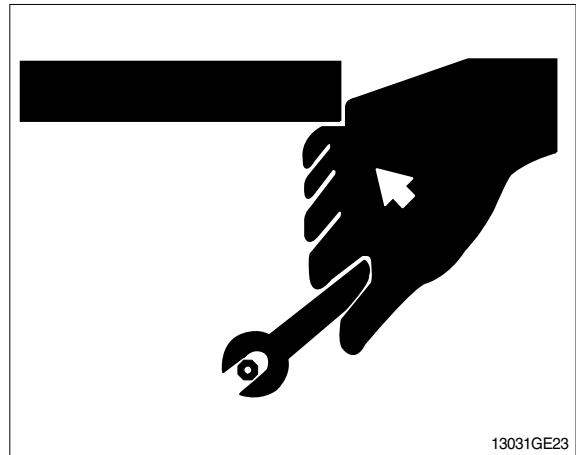
USE TOOLS PROPERLY

Use tools appropriate to the work. Makeshift tools, parts, and procedures can create safety hazards.

Use power tools only to loosen threaded tools and fasteners.

For loosening and tightening hardware, use the correct size tools. **DO NOT** use U.S. measurement tools on metric fasteners. Avoid bodily injury caused by slipping wrenches.

Use only genuine parts.(See Parts manual.)

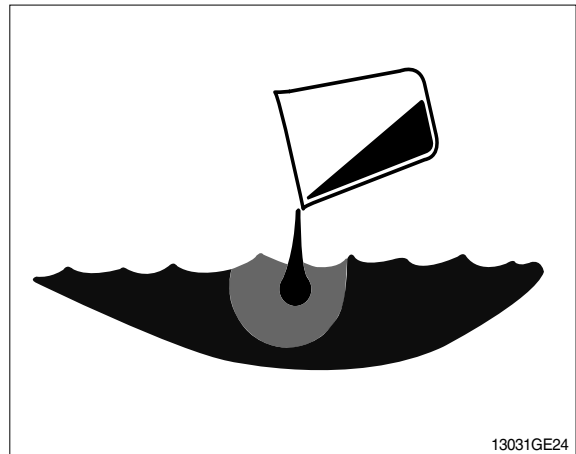


DISPOSE OF FLUIDS PROPERLY

Improperly disposing of fluids can harm the environment and ecology. Before draining any fluids, find out the proper way to dispose of waste from your local environmental agency.

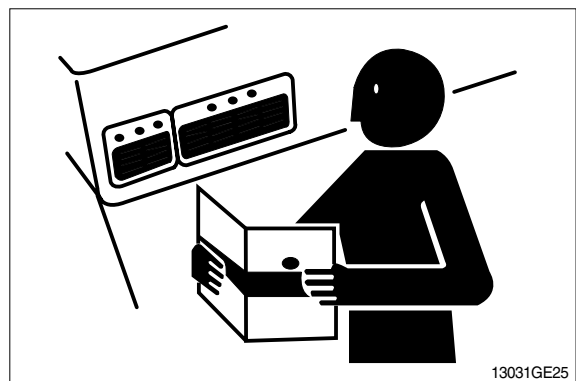
Use proper containers when draining fluids. Do not use food or beverage containers that may mislead someone into drinking from them.

DO NOT pour oil into the ground, down a drain, or into a stream, pond, or lake. Observe relevant environmental protection regulations when disposing of oil, fuel, coolant, brake fluid, filters, batteries, and other harmful waste.



REPLACE SAFETY SIGNS

Replace missing or damaged safety signs. See the machine operator's manual for correct safety sign placement.

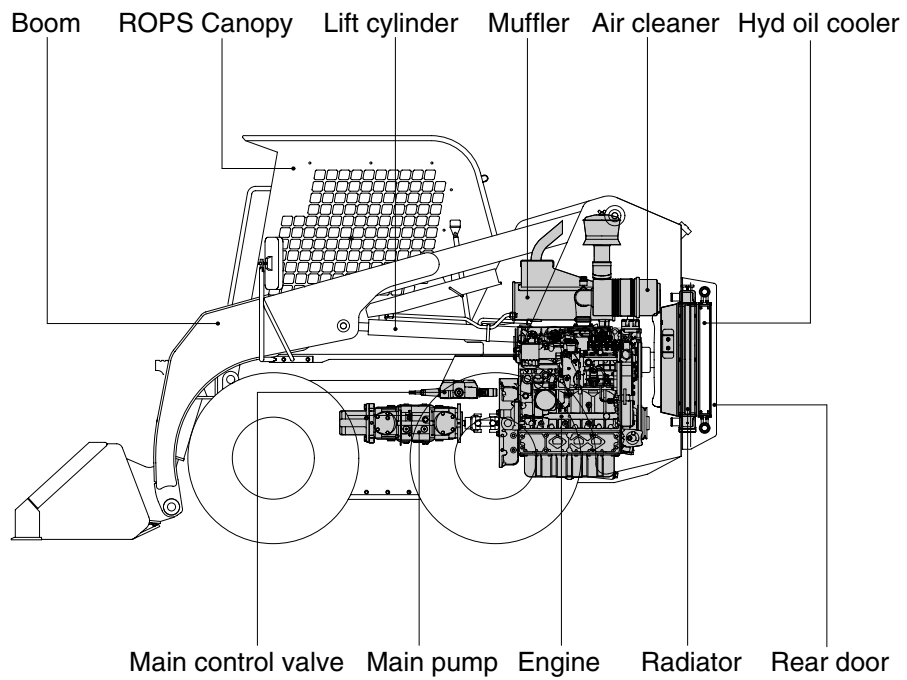
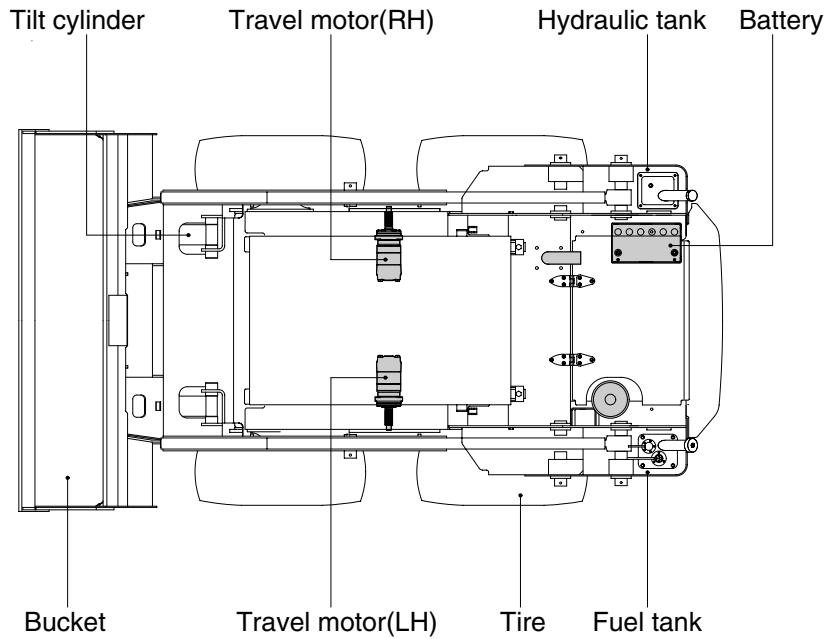


LIVE WITH SAFETY

Before returning machine to customer, make sure machine is functioning properly, especially the safety systems. Install all guards and shields.

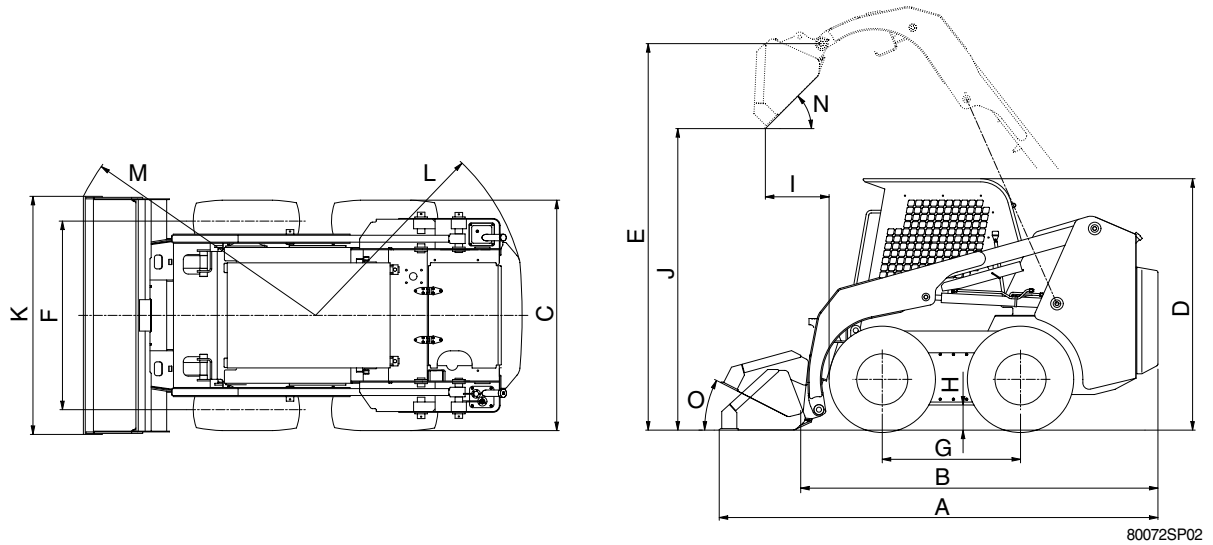
GROUP 2 SPECIFICATIONS

1. MAJOR COMPONENTS



2. SPECIFICATIONS

· WITH STANDARD BUCKET AND CANOPY



Description		Unit	Specification	
Operating weight		kg(lb)	3290(7250)	
Bucket capacity	Struck	m ³ (yd ³)	0.29(0.38)	
	Heaped		0.37(0.48)	
Overall length	A	mm(ft-in)	3470(11' 5")	
Overall length(Less bucket)	B		2840(9' 4")	
Overall width(Except bucket)	C		1830(6' 0")	
Overall height	D		2000(6' 7")	
Overall height(To hinge pin)	E		3080(10' 1")	
Tread	F		1500(4' 11")	
Wheelbase	G		1100(3' 7")	
Ground clearance	H		205(8.1 ")	
Dump reach	I		510(1' 10")	
Dump height	J		2410(7' 11")	
Width bucket	K		1894(6' 3")	
Clearance circle(Rear)	L		1660(5' 5")	
Clearance circle(Front / bucket)	M		2055(6' 9")	
Dump angle	N		Degree(°)	45
Roll back angle(Carry position)	O	27		
Cycle time	Boom	Up	sec	4.1
		Down		2.5
	Tilt	Dump		2.8
		Roll back		2.0
Maximum travel speed		km/hr(mph)	11.6(7.2)	
Minimum turning radius(Without bucket)		mm(ft-in)	1350(4' 5")	
Gradeability		Degree(°)	20	

3. WEIGHT

Item	HSL850-7	
	kg	lb
Frame assembly	1050	2310
Canopy	128	282
Engine assembly	246	542
Main pump assembly	65	143
Main control valve	29	64
Travel motor	48	106
Boom	380	838
Bucket	190	419
Tire(12 × 16.5-12PR) with rim	59	130
Boom cylinder	24	53
Bucket cylinder	18	40
Seat	10	22
Battery	20	44

4. SPECIFICATION FOR MAJOR COMPONENTS

1) ENGINE

Item	Specification
Model	Kubota V3300DI
Type	4-cycle diesel engine
Cooling method	Water cooling
Number of cylinders and arrangement	4 cylinders, in-line
Combustion chamber type	Direct injection type
Cylinder bore × stroke	98 × 110mm
Piston displacement	3318cc
Compression ratio	20 : 1
Rated gross horse power	68ps at 2400rpm
Maximum gross torque	24kgf · m at 1400rpm
Engine oil quantity	13.2 l
Dry weight	246kg
High idling speed	2600 ± 50rpm
Low idling speed	1050 ± 25rpm
Rated fuel consumption	178g/Ps · hr
Starting motor	12-2.5kW
Alternator	12V-60AMP
Battery	1 × 12V × 90Ah

2) MAIN PUMP ASSY

Item	Specification	
	Main pump	Auxiliary pump
Type	Axial tandem piston pump	Fixed gear pump
Capacity	2 × 46cc/rev	28cc/rev
Maximum operation pressure	250kgf/cm ² (3560psi)	220kgf/cm ² (3130psi)
Rated speed	2400rpm	2400rpm

3) MAIN CONTROL VALVE

Item	Specification
Type	3 spool(Mono block)
Main relief valve pressure	175kgf/cm ² (2490psi)

4) TRAVEL MOTOR

Item	Specification
Type	Fixed gear motor
Capacity	523.6cc/rev

5) CYLINDER

Item	Specification
Boom cylinder	Bore dia × Rod dia × Stroke ø 63 × ø 40 × 746mm
Bucket cylinder	Bore dia × Rod dia × Stroke ø 75 × ø 40 × 351mm

6) WHEELS

Item	Specification	
Tire	Tubeless type	12 × 16.5 - 12PR
	Tube type	8.25 × 16 - 16PR
	Solid type	8.25 × 15

5. RECOMMENDED OILS

Use only oils listed below or equivalent.

Do not mix different brand oil.

Service point	OKind of fluid	Capacity l (U.S. gal)	Ambient temperature °C(°F)						
			-20 (-4)	-10 (14)	0 (32)	10 (50)	20 (68)	30 (86)	40 (104)
Engine oil pan	Engine oil	13.2(3.5)	SAE 15W-40						
			SAE 30						
			SAE 10W						
			SAE 10W-30						
Chain case	Engine oil	Right : 9.2(2.4) Left : 9.2(2.4)	SAE 15W-40						
Hydraulic tank	Hydraulic oil	Tank; 56(14.8) System; 68(18.0)	ISO VG 32						
			ISO VG 46						
			ISO VG 68						
Fuel tank	Diesel fuel	83(21.9)	ASTM D975 NO.1						
			ASTM D975 NO.2						
Fitting (Grease nipple)	Grease	As required	NLGI NO.1						
			NLGI NO.2						
Radiator	Mixture of antifreeze and water 50 : 50	10.3(2.7)	Ethylene glycol base permanent type						

SAE : Society of Automotive Engineers

API : American Petroleum Institute

ISO : International Organization for Standardization

NLGI : National Lubricating Grease Institute

ASTM : American Society of Testing and Material

GROUP 3 MAINTENANCE

1. CLEANING

Clean outer parts before repairing. Dust and impurities shorten not only the life span of equipments and parts but also the exchanging periods of them. Flush the parts with clean solvent. Using other kinds of treated oil but solvent may cause damages to rubber goods and skin.

Must follow the steps to clean the hydraulic parts.

- 1) After washing the hose and tube with solvent, blow away with compression air.
- 2) Keep fitting and screw undamaged until protective cap should be put on them.
- 3) Put protective caps on the hose and tube.
- 4) Flush oil tank, fuel tank and inner part of gear housing with solvent to remove the metal filings and welding wastes.
- 5) When you finish with the cleaning, stuff up all the holes to keep them uncontaminated.(Cylinder, valve, tank, pump and motor)
- 6) When you fill up oil, must use clearly filtered oil.
- 7) The purity level in the hydraulic system goes more than ISO CODE 19/16 to the minimum.

2. PARTS REPLACEMENT

Replace rubber goods such as O-ring, seal and gaskets by brand new ones. Never mind the conditions of the parts and must not mix used ones in replacement.

3. HOSE, TUBE

1) INSPECTION

- (1) Replace the hose and tube if damages are found in coupling areas of both ends of the hose(Crushed, dent and oil leakage).
- (2) Surface of the hose should be washed clean without a flaw and replace the hose if any abnormality is found in swaging area.
- (3) Replace the hose if one of the followings is found.
 - Surface damaged or abraded
 - Rust in auxiliary wire
 - Swelled up(Requires immediate replacement)
 - Twisted, crushed, loose or transformed

2) MOUNTING

- (1) When you mount a hose, connect loosely both of the ends and hold the hose toward proper direction and tighten the connections. To prevent damages out of friction, fix it with cramp or tie-wrap not so far as it gets crushed.
- (2) In case of replacing a hose connected to moving parts such as cylinder, be careful not to make it damage from those parts.
- (3) After you finish with mounting, be careful not to make it twisted or wrenched.
- (4) For the hose which is not fixed and is movable in operation, be careful not to make it contacted with other parts around it. Abrasion by contacts shortens the life span of the hose.

4. BEARING

1) REMOVAL

When removing or mounting the bearings or bushings, check for discoloration, flaws, abrasion and overheated marks. Replace any that are not functional.

2) WASHING

For a usable bearing, wash it with solvent and soak it in lubricant for a while.

3) MOUNTING

- (1) Mount the bearing carefully in the prescribed position in accordance with the maintenance procedures.
- (2) The followings show the ways of positioning the bearing.
 - Press it into the rotary equipments such as shaft or gear.
 - Push it into the fixed equipments such as reduction gear and housing.
- (3) When mounting a bearing, assemble in rotary equipment first.
- (4) When mounting a bearing and bushing, use suitable tools and presses.
- (5) If no suitable tools and presses, put the bearing and casing in hot oil so that it gets not enough to be mounted.

5. PRESSURE TEST

Be fore pressure test, check the hose and the connections.

Use a pressure gauge capable of marking the standard pressure. Follow the testing steps correctly, or you may cause damages to the equipments and hydraulic system and accidents as well.

6. TORQUE

1) FASTENER

All fasteners should be in the same class with SAE GR5(PC8.8) unless receiving special regulations. Use the fastener with a gold plating treatment.

2) BOLT, NUT

Unless separate regulations, the permitted limit of torques of bolt and nut is allowed within $\pm 10\%$ of the torques of GR5.(PC8.8)

Standard	Torque		Standard	Torque	
	kgf · m	lbf · ft		mm	kgf · m
1/4	1.3	9.4	6.0	1.0	7.2
5/16	2.5	18.1	8.0	2.5	18.1
3/8	5.3	38.3	10.0	5.0	36.2
7/16	8.1	58.6	-	-	-
1/2	12.1	87.5	12.0	8.1	58.6
9/16	16.8	122	14.0	13.0	94.0
5/8	22.8	165	16.0	20.0	145
3/4	41.0	297	20.0	36.0	260
7/8	60.0	434	22.0	51.0	369
1.0	88.0	637	24.0	65.0	470

3) FLARE TYPE FITTING(37°C still)

(1) Set tube and fitting in a straight line.

(2) Tighten nuts by following values of the torque.

SAE size	Torque	
	kgf · m	lbf · ft
4	1.1 - 1.6	8.3 - 11.7
6	2.6 - 3.1	18.8 - 22.9
8	5.1 - 6.3	37.5 - 45.8
10	6.9 - 8.0	50.0 - 58.3
12	11.6 - 12.6	83.3 - 91.7
14	13.8 - 14.9	100 - 108
16	16.1 - 17.8	117 - 129
20	24.2 - 27.6	175 - 200
24	34.5 - 39.1	250 - 283

4) STRAIGHT SCREW O-RING FITTING(Inadjustable)

- (1) Check for scratches, groove, sharp burr, dents or alien substances on the surface of both screws and the sealing.
- (2) Lubricate the O-ring.
- (3) Value of the torque follow the table below.

SAE size	Torque	
	kgf · m	lbf · ft
4	1.1 - 1.6	8.3 - 11.7
6	2.6 - 3.1	18.8 - 22.9
8	5.1 - 6.3	37.5 - 45.8
10	6.9 - 8.0	50.0 - 58.3
12	11.6 - 12.6	83.3 - 91.7
14	13.8 - 14.9	100 - 108
16	16.1 - 17.8	117 - 129
20	24.2 - 27.6	175 - 200
24	34.5 - 39.1	250 - 283

5) STRAIGHT SCREW O-RING FITTING(Adjustable)

- (1) Check for defects and alien substances in both of the contact surfaces.
- (2) Lubricate the O-ring.
- (3) Full the fitting into the port and turn the back-up washer until it comes in contact with the port to let the back-up washer and O-ring pushed toward the lock nut.
- (4) Turn the fitting a little bit reversely to set it at the prescribed position. At this time, must not turn the fitting more than a round.
- (5) Set the fitting at the prescribed position to tighten the lock nut by following values of the torque.

SAE size	Torque	
	kgf · m	lbf · ft
4	1.1 - 1.6	8.3 - 11.7
6	2.6 - 3.1	18.8 - 22.9
8	5.1 - 6.3	37.5 - 45.8
10	6.9 - 8.0	50.0 - 58.3
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24	34.5 - 39.1	250 - 283

7. HOW TO START NEW EQUIPMENT

When starting new equipments, must take the following steps to prevent each part and system from damages.

1) Check for quantity of oil and leakage.

The fluid level of oil in the tank should be on top of the sight plug, if it's new equipment.

2) Prop the wheels off the ground.

3) Check if the hose, wiring and tubing twisted too much and be in contact with the rotary parts.

4) Check mountings of the equipments(Engine, pump, valve and radiator).

5) Check if the control linkage should move freely and keep in neutral.

6) Pull the throttle lever full backward and crank the starter for 15 seconds and pause for 30 seconds. Try it again.

7) Push throttle lever forward about 1/3 or 1/2 of the way.(Idling position)

8) Turn the start switch to ON position, and wait the preheater pilot lamp OFF.

When the preheater pilot lamp is turned ON, the control unit starts counting the specified time while the heater lamp is lit. After 5~20 seconds of preheating, the control unit turns OFF the preheater lamp to indicate that preheating is completed.

9) When the preheater pilot lamp goes out, turn the start switch to START position.

If the engine does not start within 15 seconds, repeat preheater operation.

※ **Do not use the starter motor continuously more than 15 seconds.**

10) As soon as it comes to normal operation, return the start switch to ON position.

▲ This diesel engine uses air heater for starting. Do not use any auxiliary fuel to help starting. It may cause explosions or accidents.

11) Check the engine oil pressure warning lamp and battery charging warning lamp. They should light during engine starting and turn OFF when the engine running.

※ **The battery charge warning lamp is turned ON when the alternator is not producing sufficient current. The engine oil pressure warning lamp indicated low engine oil pressure. The hydraulic oil temperature warning lamp is turned ON when the hydraulic oil in the reservoir is overheated. If any of these warning lamp turn ON while the engine is running, shut off the engine immediately and determine the cause.**

12) Once the engine is running, release the start switch. The switch will return to the ON position

13) Push the control lever all the way forward and pull it backward. Try it three times.

14) If necessary, adjust the linkage of the control lever.

15) Push the throttle lever full forward and operate the control lever for three minutes at an interval of 3 seconds to raise the hydraulic oil temperature.

16) Stop the engine and check for oil leakage.

17) Fill up the oil until you can see the fluid level on top of the sight gauge.

8. QUANTITY OF OIL AND LUBRICATION

1) CHAIN SPROCKET CASE

Put the loader at a flat place and remove the check/fill plug between the two wheels to check oil level. If oil can be detected by inserting a finger through the check/fill plug opening, the level is satisfactory. If not, add 15W-40(API CH-4) oil as required through the same plug opening.

2) OIL TANK

Put the loader at a flat place and check the sight gauge plug after oil cools. If the fluid level of oil can be seen on plug nothing is abnormal. If it is not seen on the plug fill up the oil immediately.

3) ENGINE OIL

The fluid level of oil should be on top of the deep stick.

4) COOLING SYSTEM

To check coolant level open the rear door. Check to see that the coolant level lies between FULL and LOW.

5) SPLINE

Paint molybdenum disulfide compound to the splines in the operating motor and pump.

6) GREASE FITTING

(1) Inject grease into these parts.

- Rear boom pivot pin(2)
- Implement pivot pin(2)
- Boom and tilt cylinder(8)

(2) Remove the extra grease.

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Our service email:

manuals007@hotmail.com