

SECTION 1 GENERAL



Group 1 Safety Hints	1-1
Group 2 Specifications	1-9

SECTION 1 GENERAL

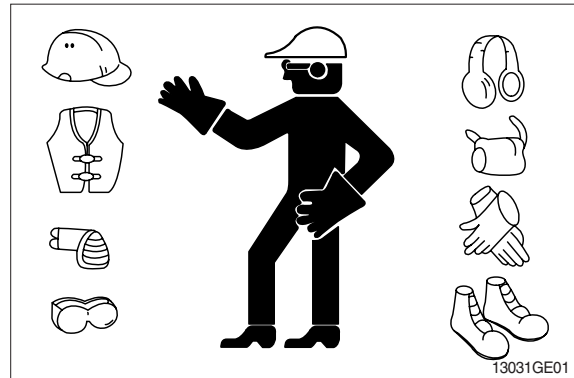
GROUP 1 SAFETY

FOLLOW SAFE PROCEDURE

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

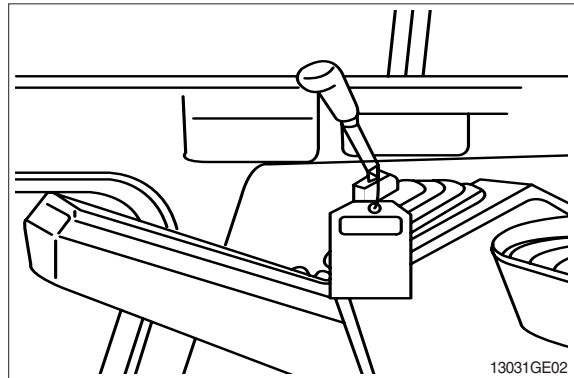
WEAR PROTECTIVE CLOTHING

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



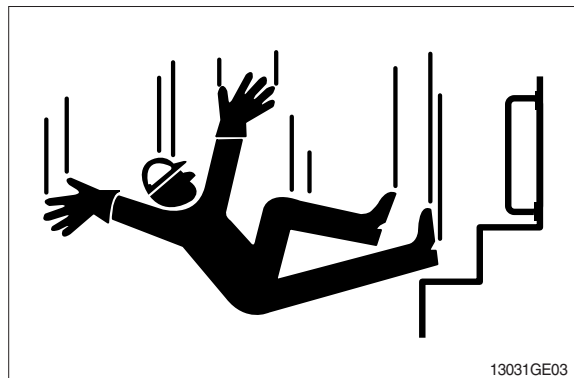
WARN OTHERS OF SERVICE WORK

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

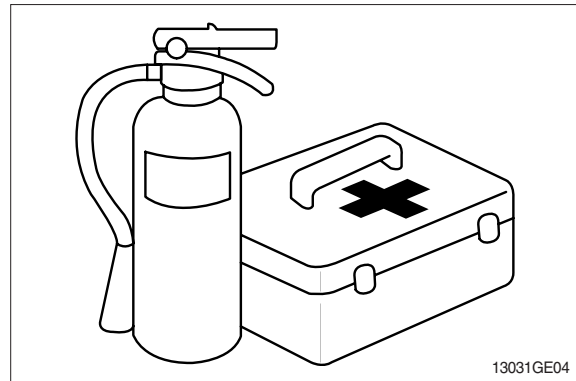


PREPARE FOR EMERGENCIES

Be prepared if a fire starts.

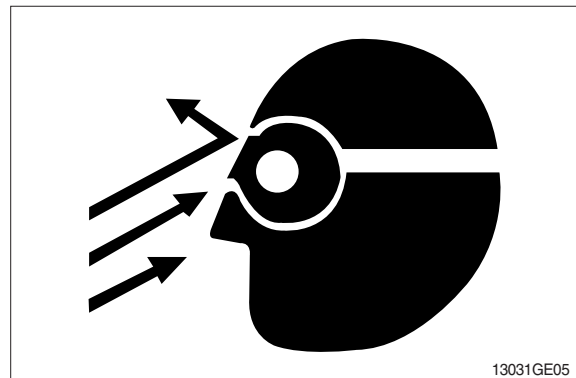
Keep a first aid kit and fire extinguisher handy.

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



PROTECT AGAINST FLYING DEBRIS

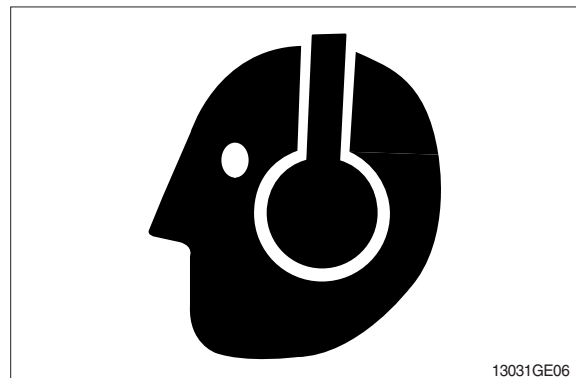
Guard against injury from flying pieces of metal or debris; Wear goggles or safety glasses.



PROTECT AGAINST NOISE

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

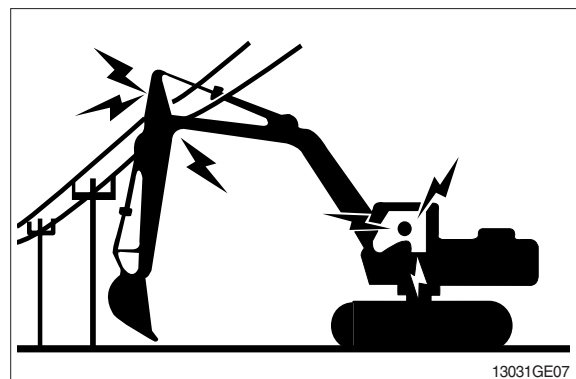
Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortable loud noises.



AVOID POWER LINES

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

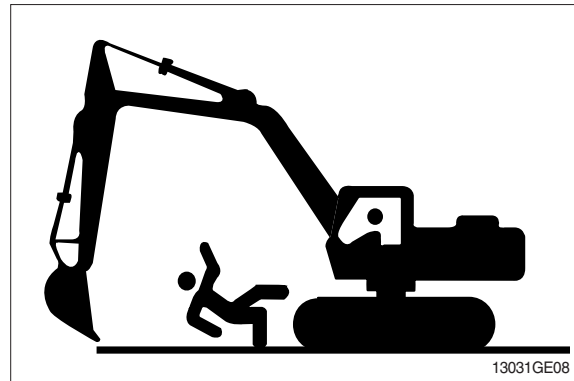
Never move any part of the machine or load closer to electric line than 3m(10ft) plus twice the line insulator length.



KEEP RIDERS OFF EXCAVATOR

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

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

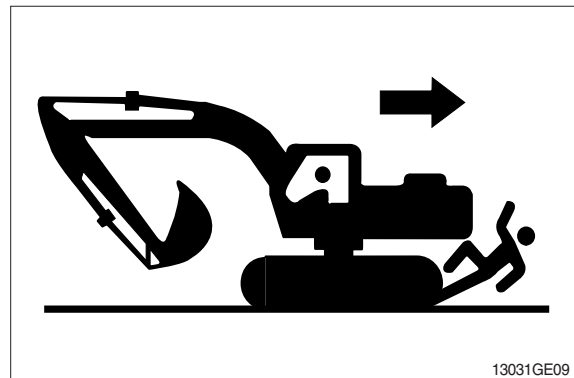


MOVE AND OPERATE MACHINE SAFELY

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

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

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



OPERATE ONLY FROM OPERATOR'S SEAT

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

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



PARK MACHINE SAFELY

Before working on the machine:

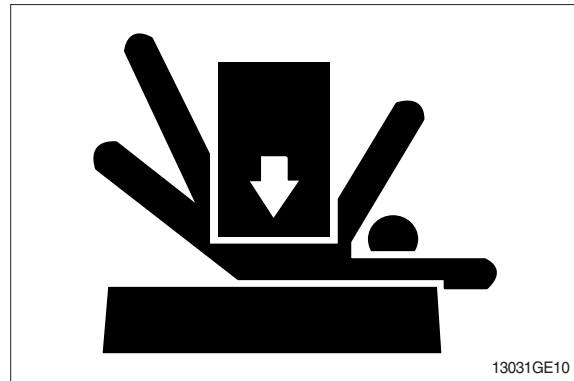
- Park machine on a level surface.
- Lower bucket to the ground.
- Turn auto idle switch off.
- Run engine at 1/2 speed without load for 2 minutes.
- Turn key switch to OFF to stop engine.
Remove key from switch.
- Move pilot control shutoff lever to locked position.
- Allow engine to cool.

SUPPORT MACHINE PROPERLY

Always lower the attachment or implement to the ground before you work on the machine. If you must 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.

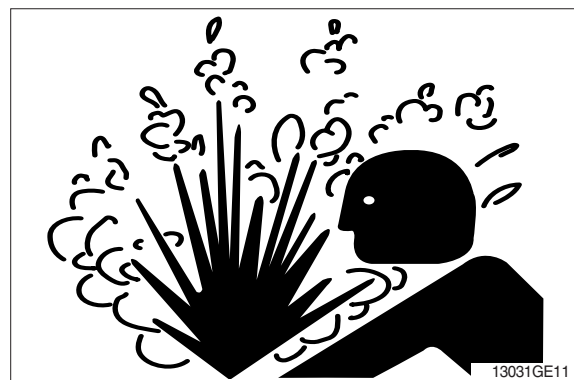
Do not work under a machine that is supported solely by a jack. Follow recommended procedures in this manual.



SERVICE COOLING SYSTEM SAFELY

Explosive release of fluids from pressurized cooling system can cause serious burns.

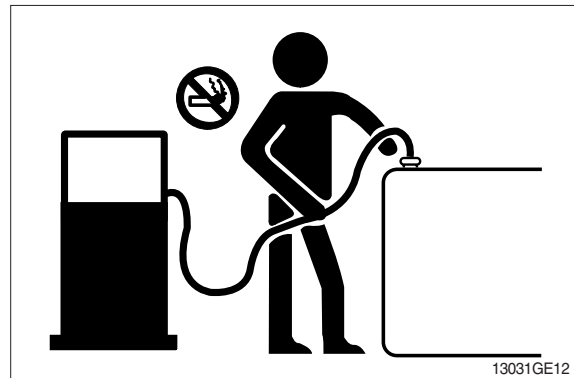
Shut off engine. Only remove filler cap when cool enough to touch with bare hands.



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 you must operate in a building, be positive there is 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

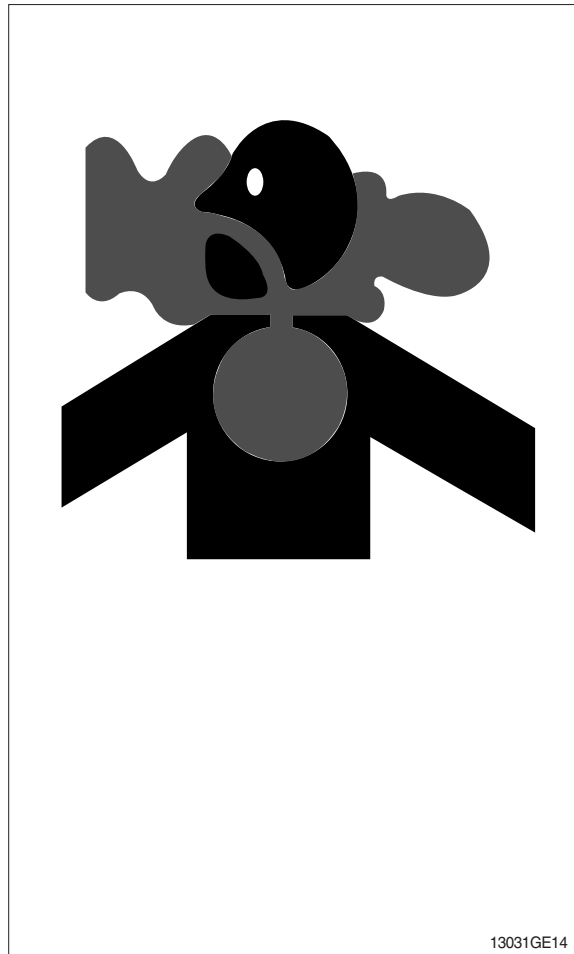
Avoid potentially toxic fumes and dust.

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.

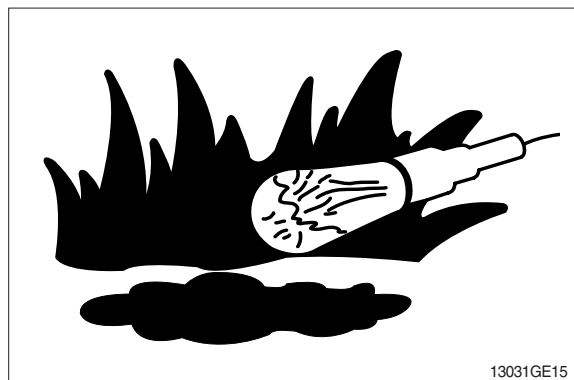
Remove paint before welding or heating:

- 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

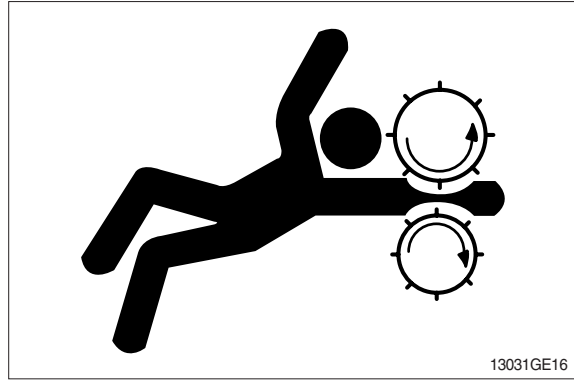
Illuminate your work area adequately but safely. Use a portable safety light for working inside or under the machine. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.



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.

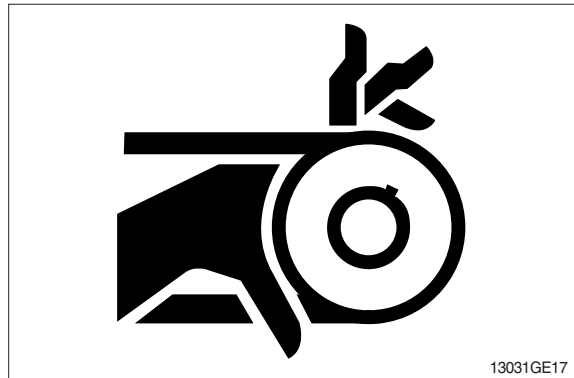
Remove rings and other jewelry to prevent electrical shorts and entanglement in moving parts.



STAY CLEAR OF MOVING PARTS

Entanglements in moving parts can cause serious injury.

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



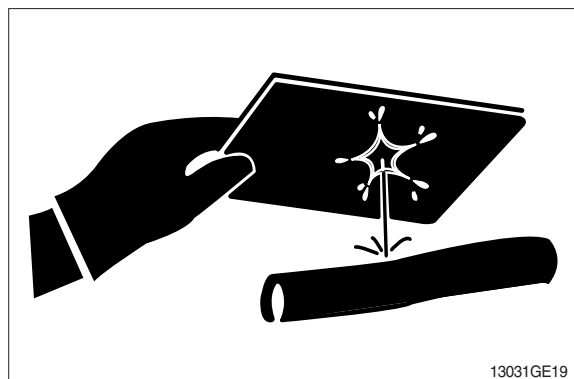
AVOID HIGH PRESSURE FLUIDS

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 the skin must be surgically removed within a few hours or 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).



PREVENT ACID BURNS

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

Avoid the hazard by:

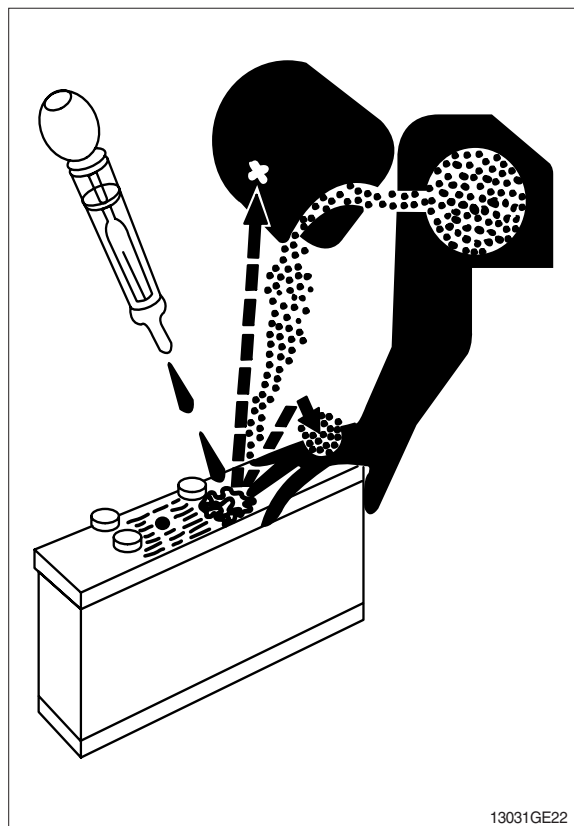
1. Filling batteries in a well-ventilated area.
2. Wearing eye protection and rubber gloves.
3. Avoiding breathing fumes when electrolyte is added.
4. Avoiding spilling or dripping electrolyte.
5. Use proper jump start procedure.

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.



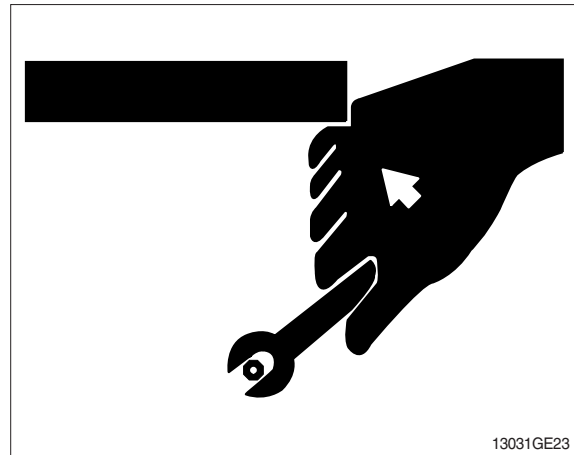
USE TOOLS PROPERLY

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 recommended replacement parts. (See Parts catalogue.)

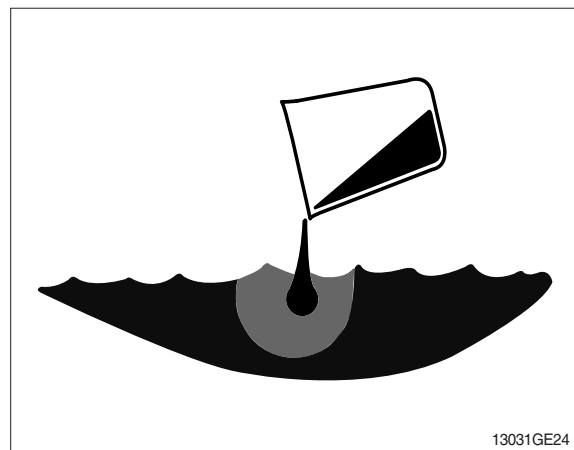


DISPOSE OF FLUIDS PROPERLY

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.

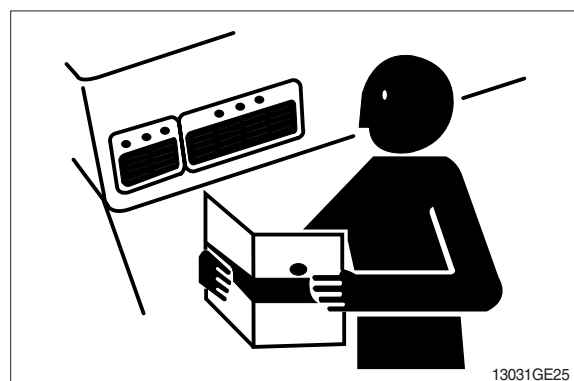
Use proper containers when draining fluids. Do not use food or beverage containers that may mislead someone into drinking from them.

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.

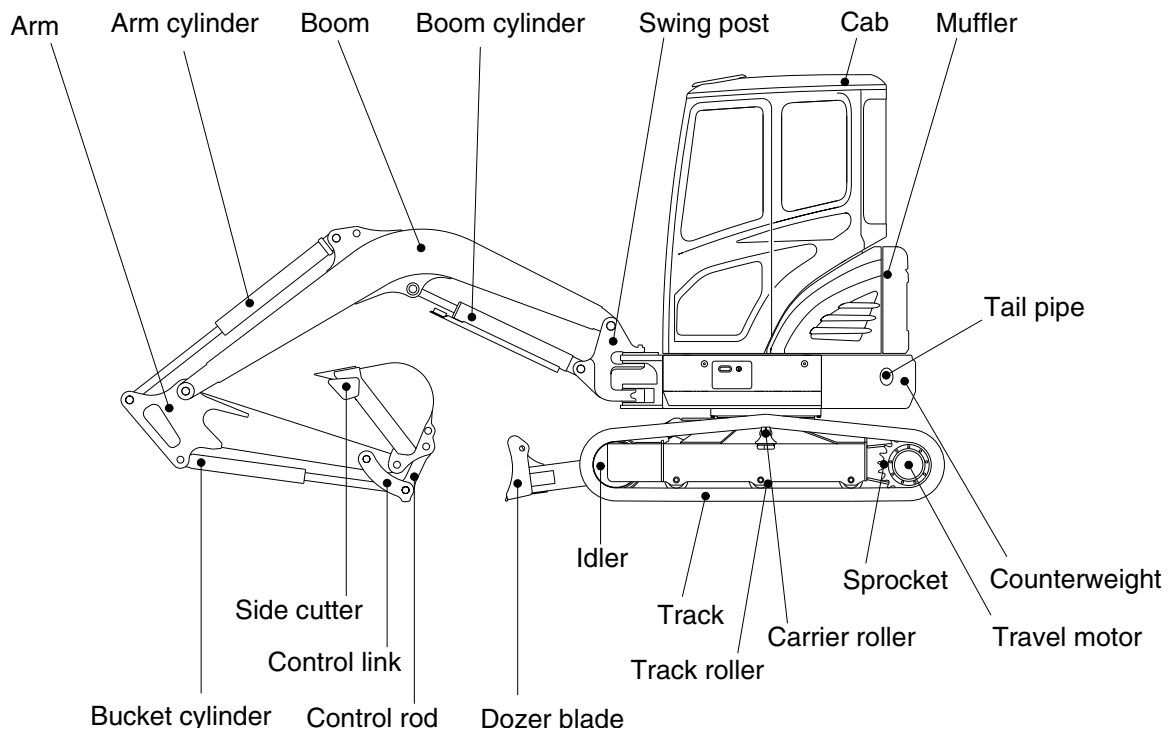
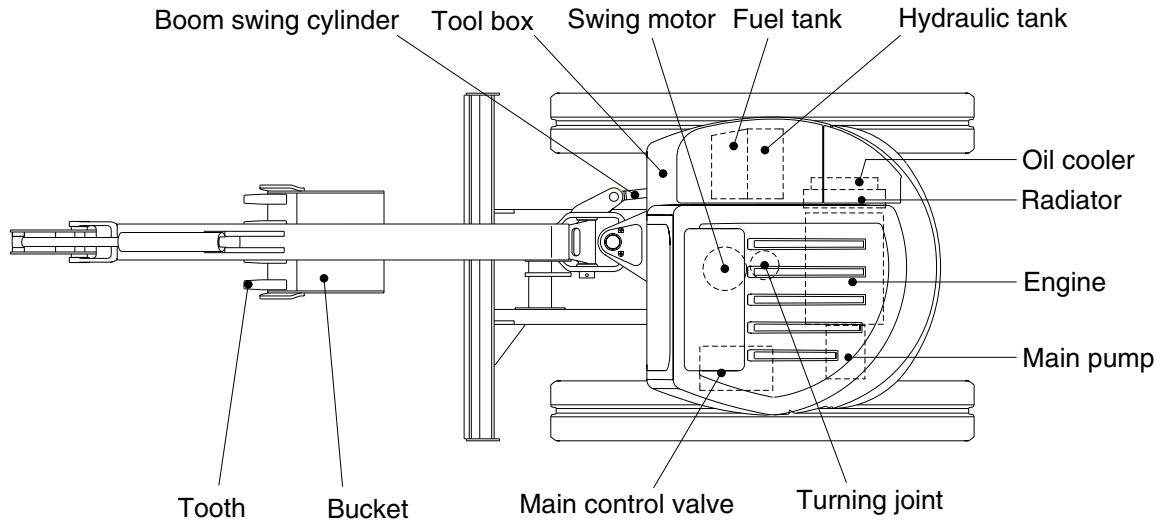


LIVE WITH SAFETY

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

GROUP 2 SPECIFICATIONS

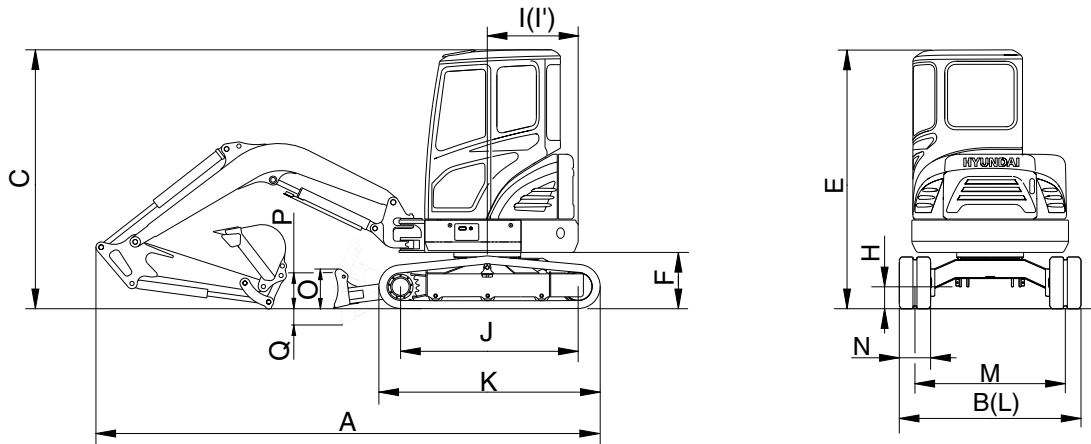
1. MAJOR COMPONENT



R27Z92SP01

2. SPECIFICATIONS

1) 2.03 m (6' 8") MONO BOOM, 1.12 m (3' 8") ARM, WITH BOOM SWING POST

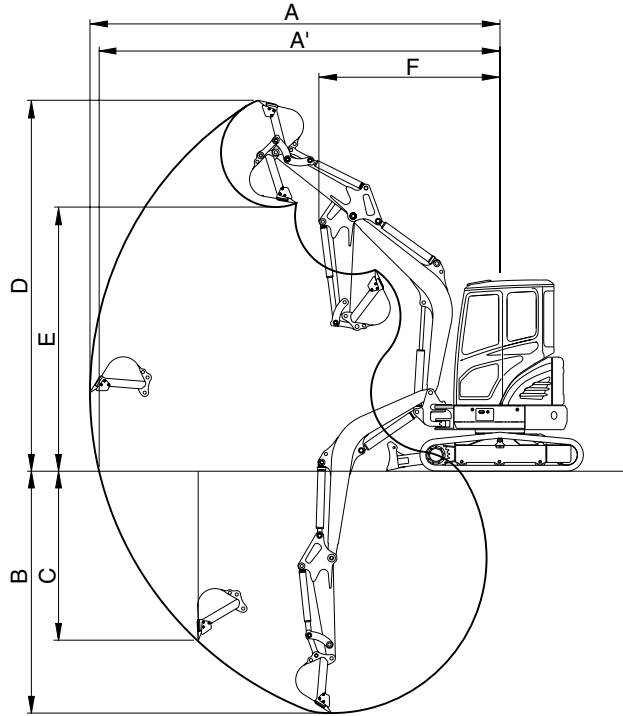


R27Z92SP02

Description		Unit	Specification
Operating weight (cabin / canopy)		kg (lb)	2880 (6350) / 2730 (6020)
Bucket capacity (SAE heaped), standard		m ³ (yd ³)	0.08 (0.10)
Overall length	A	mm (ft-in)	4180 (13' 9")
Overall width, with 300 mm shoe	B		1550 (5' 1")
Overall height	C		2500 (8' 2")
Overall height of cab	E		2500 (8' 2")
Ground clearance of counterweight	F		540 (1' 9")
Minimum ground clearance	H		290 (0' 11")
Rear-end distance	I		775 (2' 7")
Rear-end swing radius	I'		775 (2' 7")
Distance between tumbler rollers	J		1550 (5' 1")
Undercarriage length	K		1970 (6' 6")
Undercarriage width	L		1550 (5' 1")
Track gauge	M		1250 (4' 1")
Track shoe width, standard	N		300 (12")
Height of blade	O		300 (1' 0")
Ground clearance of blade up	P		370 (1' 3")
Depth of blade down	Q		450 (1' 6")
Travel speed (low/high)		km/hr (mph)	2.4/4.4 (1.5/2.7)
Swing speed		rpm	9.0
Gradeability		Degree (%)	30 (58)
Ground pressure 300 mm rubber shoe (cab / canopy)		kgf/cm ² (psi)	0.29 (4.12) / 0.27 (3.84)

3. WORKING RANGE

1) 2.03 m (6' 8") MONO BOOM WITH BOOM SWING POST



R27Z92SP03

Description		1.12 m (3' 8") Arm	
Max digging reach	A	4650 mm (15' 3")	
Max digging reach on ground	A'	4515 mm (14'10")	
Max digging depth	B	2500 mm (8' 2")	
Max vertical wall digging depth	C	2085 mm (6'10")	
Max digging height	D	4270 mm (14'10")	
Max dumping height	E	2890 mm (9' 6")	
Min swing radius	F	2055 mm (6' 9")	
Boom swing radius (left/right)		75°/50°	
Bucket digging force	SAE	17.9 kN	
		1830 kgf	
		4030 lbf	
	ISO	20.1 kN	
		2050 kgf	
		4520 lbf	
Arm crowd force	SAE	13.1 kN	
		1340 kgf	
		2950 lbf	
	ISO	13.7 kN	
		1400 kgf	
		3090 lbf	

4. WEIGHT











Item	kg	lb
Upperstructure assembly	1640	3615
Main frame weld assembly	360	795
Engine assembly	136	300
Main pump assembly	19	42
Main control valve assembly	25	55
Swing motor assembly	34	75
Hydraulic oil tank assembly	50	110
Fuel tank assembly	30	70
Boom swing post	80	180
Counterweight	220	485
Cab assembly	210	460
Lower chassis assembly	910	2010
Track frame weld assembly	400	880
Swing bearing	50	110
Travel motor assembly	36	80
Turning joint	10	22
Track recoil spring	16	35
Idler	19	42
Carrier roller	3	7
Track roller	6	13
Sprocket	7	15
Rubber track (300 mm)	118	260
Dozer blade assembly	125	275
Front attachment assembly	330	730
(2.03 m boom, 1.12 m arm, 0.08 m ³ SAE heaped bucket)	140	310
2.5 m boom assembly	100	220
1.12 m arm assembly	50	110
0.08 m ³ SAE heaped bucket	60	130
Boom cylinder assembly	31	68
Arm cylinder assembly	25	55
Bucket cylinder assembly	18	40
Bucket control link assembly	20	45
Dozer cylinder assembly	24	53
Boom swing cylinder assembly	23	51

5. LIFTING CAPACITIES

1) 2.03 m (6' 8") boom, 1.12 m (3' 8") arm equipped with 0.08 m³ (SAE heaped) bucket and 300 mm (12") rubber track, the dozer blade up with 220 kg (485 lb) counterweight.



•  : Rating over-front











•  : Rating over-side or 360 degree

Load point height		Load radius								At max. reach		
		2.0 m (6.6 ft)		2.5 m (8.2 ft)		3.0 m (10.0 ft)		3.5 m (11.5 ft)		Capacity		Reach
												m (ft)
3.5 m (11.5 ft)	kg lb									610 1340	460 1010	3.07 (10.1)
3.0 m (10.0 ft)	kg lb					610 1340	450 990			460 1010	340 750	3.63 (11.9)
2.5 m (8.2 ft)	kg lb					610 1340	450 990	460 1010	340 750	380 840	290 640	3.99 (13.1)
2.0 m (6.6 ft)	kg lb			830 1830	610 1340	600 1320	450 990	460 1010	340 750	350 770	250 550	4.22 (13.8)
1.5 m (5.0 ft)	kg lb			800 1760	590 1300	590 1300	440 970	460 1010	340 750	320 710	240 530	4.35 (14.3)
1.0 m (3.3 ft)	kg lb			770 1700	560 1230	580 1280	420 930	450 990	330 730	320 710	230 510	4.39 (14.4)
0.5 m (1.6 ft)	kg lb			750 1650	540 1190	570 1260	410 900	440 970	320 710	320 710	230 510	4.35 (14.3)
Ground Line	kg lb	1080 2380	750 1650	740 1630	530 1170	560 1230	400 880	440 970	320 710	330 730	240 530	4.22 (13.8)
-0.5 m (-1.6 ft)	kg lb	1080 2380	750 1650	740 1630	530 1170	550 1210	400 880	440 970	320 710	360 790	260 570	4.00 (13.1)
-1.0 m (-3.3 ft)	kg lb	1090 2400	760 1680	740 1630	530 1170	560 1230	400 880			420 930	300 660	3.64 (11.9)
-1.5 m (-5.0 ft)	kg lb	1110 2450	780 1720	760 1680	550 1210					550 1210	400 880	3.09 (10.1)
-2.5 m (-8.2 ft)	kg lb									570 1260	420 930	3.06 (10.0)

- Note
1. Lifting capacity are based on SAE J1097 and ISO 10567.
 2. Lifting capacity of the ROBEX series does not exceed 75% of tipping load with the machine on firm, level ground or 87% of full hydraulic capacity.
 3. The load point is a hook located on the back of the bucket.
 4. *indicates load limited by hydraulic capacity.

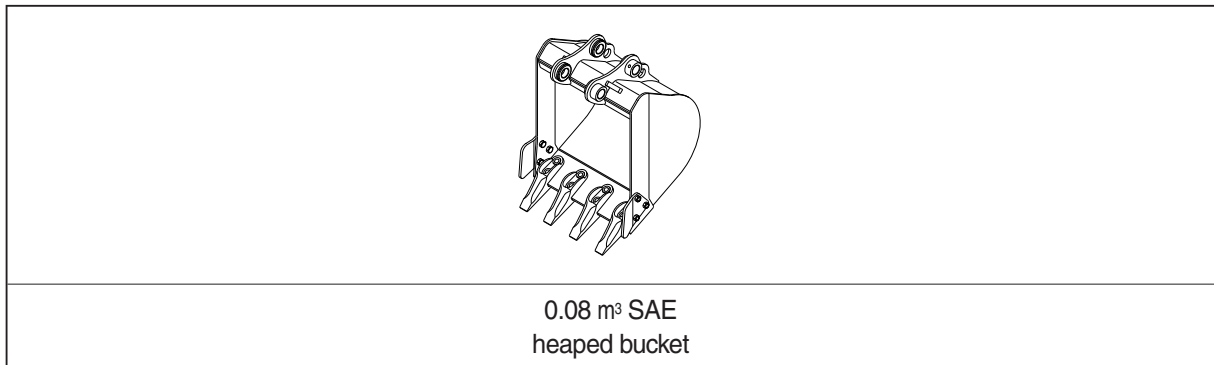
2) 2.03 m (6' 8") boom, 1.12 m (3' 8") arm equipped with 0.08 m³ (SAE heaped) bucket and 300 mm (12") rubber track, the dozer blade down with 220 kg (485 lb) counterweight.

-  : Rating over-front
-  : Rating over-side or 360 degree

Load point height		Load radius								At max. reach		
		2.0 m (6.6 ft)		2.5 m (8.2 ft)		3.0 m (10.0 ft)		3.5 m (11.5 ft)		Capacity		Reach m (ft)
												
3.5 m (11.5 ft)	kg lb									*670 *1480	490 1080	3.07 (10.1)
3.0 m (10.0 ft)	kg lb					*760 *1680	480 1060			*600 *1320	360 790	3.63 (11.9)
2.5 m (8.2 ft)	kg lb					*970 *2140	490 1080	*570 *1260	370 820	*570 *1260	310 680	3.99 (13.1)
2.0 m (6.6 ft)	kg lb			*1270 *2800	650 1430	*1170 *2580	480 1060	*900 *1980	370 820	*570 *1260	270 600	4.22 (13.8)
1.5 m (5.0 ft)	kg lb			*2200 *4850	630 1390	*1640 *3620	470 1040	*1140 *2510	360 790	*570 *1260	260 570	4.35 (14.3)
1.0 m (3.3 ft)	kg lb			*2710 *5970	600 1320	1880 4140	450 990	1380 3040	350 770	*600 *1320	250 550	4.39 (14.4)
0.5 m (1.6 ft)	kg lb			2840 6260	580 1280	1860 4100	440 970	1370 3020	350 770	*630 *1390	250 550	4.35 (14.3)
Ground Line	kg lb	*1490 *3280	810 1790	2820 6220	570 1260	1850 4080	430 950	1360 3000	340 750	*690 *1520	260 570	4.22 (13.8)
-0.5 m (-1.6 ft)	kg lb	*2090 *4610	810 1790	2810 6190	570 1260	1840 4060	430 950	*1070 *2360	340 750	*790 *1740	280 620	4.00 (13.1)
-1.0 m (-3.3 ft)	kg lb	*3030 *6680	820 1810	*2750 *6060	570 1260	1850 4080	440 970			*950 *2090	330 730	3.64 (11.9)
-1.5 m (-5.0 ft)	kg lb	*2850 *6280	840 1850	*2040 *4500	590 1300					*1320 *2910	430 950	3.09 (10.1)
-2.5 m (-8.2 ft)	kg lb									*1040 *2290	450 990	3.06 (10.0)

- Note
1. Lifting capacity are based on SAE J1097 and ISO 10567.
 2. Lifting capacity of the ROBEX series does not exceed 75% of tipping load with the machine on firm, level ground or 87% of full hydraulic capacity.
 3. The load point is a hook located on the back of the bucket.
 4. *indicates load limited by hydraulic capacity.

6. BUCKET SELECTION GUIDE



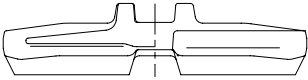
Capacity		Width		Weight	Recommendation
SAE heaped	CECE heaped	Without side cutter	With side cutter		2.03 m (6' 8") boom
					1.12 m (3' 8") arm
0.08m ³ (0.10 yd ³)	0.09 m ³ (0.12 yd ³)	450 mm (17.7")	510 mm (20")	80 kg (176 lb)	Applicable for materials with density of 1600 kgf/m ³ (2700 lb /yd ³) or less

7. UNDERCARRIAGE

(1) TRACKS

X-leg type center frame is integrally welded with reinforced box-section track frames. The design includes dry tracks, lubricated rollers, idlers, sprockets, hydraulic track adjusters with shock absorbing springs and assembled track-type tractor shoes with triple grousers.

(2) TYPES OF SHOES

Model	Shapes		Rubber track
			
R27Z-9	Shoe width	mm (in)	300 (12")
	Operating weight	kg (lb)	2880 (6350)
	Ground pressure	kgf/cm ² (psi)	0.29 (4.12)
	Overall width	mm (ft-in)	1550 (5' 1")

(3) NUMBER OF ROLLERS AND SHOES ON EACH SIDE

Item	Quantity
Carrier rollers	1 EA
Track rollers	3 EA

8. SPECIFICATIONS FOR MAJOR COMPONENTS

1) ENGINE

Item	Specification
Model	Mitsubishi S3L2
Type	4-cycle vertical overhead valve, diesel fuel
Cooling method	Water cooling
Number of cylinders and arrangement	3 cylinders, in-line
Firing order	1-3-2
Combustion chamber type	Swirl chamber type
Cylinder bore × stroke	78 × 92 mm (3.07" × 3.62")
Piston displacement	1318 cc (80.4 cu in)
Compression ratio	22 : 1
Rated gross horse power (SAE J1995)	24.7 Hp at 2300 rpm (18.4 kW at 2300 rpm)
Maximum torque at 1800 rpm	8 kgf · m (57.8 lbf · ft)
Engine oil quantity	5.9 l (1.6 U.S. gal)
Dry weight	136 kg (300 lb)
High idling speed	2500+ 30 rpm
Low idling speed	1160 ± 25 rpm
Rated fuel consumption	198 g/Hp · hr at 2300 rpm (265 g/kW · hr at 2300 rpm)
Starting motor	12V-1.7 kW
Alternator	12V-40 A
Battery	1 × 12 V × 58 Ah (5h rating)

2) MAIN PUMP

Item	Specification
Type	Variable displacement tandem axis piston pumps
Capacity	2 × 12 cc/rev
Rated oil flow	2 × 27.6 l /min (7.3 U.S. gpm / 6.1 U.K. gpm)
Rated speed	2300 rpm

3) GEAR PUMP

Item	Specification
Type	Fixed displacement gear pump single stage
Capacity	8.5/4.5 cc/rev
Rated oil flow	19.6/10.4 l /min (5.2/2.7 U.S. gpm / 4.3/2.3 U.K. gpm)

4) MAIN CONTROL VALVE

Item	Specification
Type	Sectional, 9 spools (12 blocks)
Operating method	Hydraulic pilot system
Main relief valve pressure	220 kgf/cm ² (3130 psi)
Overload relief valve pressure	240 kgf/cm ² (3410 psi)

5) SWING MOTOR

Item	Specification
Type	Fixed displacement axial piston motor
Capacity	12.5 cc/rev
Relief pressure	170 kgf/cm ² (2420 psi)
Braking system	Automatic, spring applied hydraulic released
Braking torque	7.0 kgf · m (50.6 lbf · ft)
Brake release pressure	25~50 kgf/cm ² (356~710 psi)
Reduction gear type	2 - stage planetary

6) TRAVEL MOTOR

Item	Specification
Type	Variable displacement axial piston motor
Relief pressure	220 kgf/cm ² (3130 psi)
Reduction gear type	2-stage planetary
Braking system	Automatic, spring applied hydraulic released
Brake release pressure	19 kgf/cm ² (270 psi)
Braking torque	5.7 kgf · m (41 lbf · ft)

7) CYLINDER

Item		Specification
Boom cylinder	Bore dia × Rod dia × Stroke	∅ 75 × ∅ 45 × 565 mm
	Cushion	Extend only
Arm cylinder	Bore dia × Rod dia × Stroke	∅ 65 × ∅ 40 × 500 mm
	Cushion	Extend and retract
Bucket cylinder	Bore dia × Rod dia × Stroke	∅ 60 × ∅ 35 × 420 mm
	Cushion	-
Boom swing cylinder	Bore dia × Rod dia × Stroke	∅ 85 × ∅ 45 × 140 mm
	Cushion	-
Dozer cylinder	Bore dia × Rod dia × Stroke	∅ 70 × ∅ 40 × 400 mm
	Cushion	-

※ Discoloration of cylinder rod can occur when the friction reduction additive of lubrication oil spreads on the rod surface.

※ Discoloration does not cause any harmful effect on the cylinder performance.

8) BUCKET

Item	Capacity		Tooth quantity	Width	
	SAE heaped	CECE heaped		Without side cutter	With side cutter
Standard	0.08 m ³ (0.10 yd ³)	0.09 m ³ (0.12 yd ³)	4	450 mm (17.7")	510 mm (20")

9. RECOMMENDED OILS

Use only oils listed below or equivalent.
Do not mix different brand oil.

Service point	Kind 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	5.9 (1.6)				SAE 30					
			SAE 10W								
			SAE 10W-30								
						SAE 15W-40					
Final drive	Gear oil	0.6×2 (0.16×2)	SAE 85W-140								
Hydraulic tank	Hydraulic oil	Tank: 32 (8.5) System: 60 (15.9)	ISO VG 32								
			ISO VG 46								
			ISO VG 68								
Fuel tank	Diesel fuel	31 (8.2)	ASTM D975 NO.1								
			ASTM D975 NO.2								
Fitting (Grease nipple)	Grease	As required	NLGI NO.1								
			NLGI NO.2								
Radiator (Reservoir tank)	Mixture of antifreeze and water 50 : 50	5 (1.3)	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