

SECTION 1 GENERAL

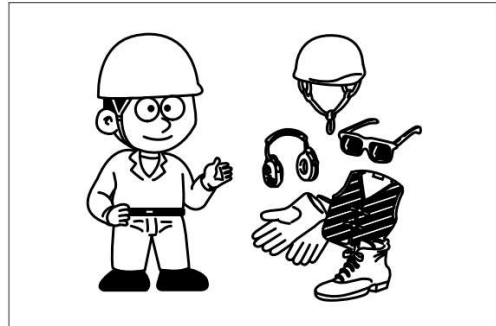
GROUP 1 SAFETY HINTS

Careless performing of the easy work may cause injuries. Take care to always perform work safely, at least observing the following.

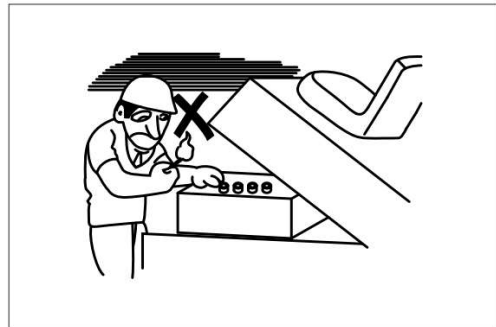
- Oil is a dangerous substance. Never handle oil, grease or oily clothes in places where there is any fire or flame. As preparation in case of fire, always know the location and directions for use of fire extinguishers and other fire-fighting equipment.



- Wear well-fitting helmet, safety shoes and working clothes. When drilling, grinding or hammering, always wear protective goggles. Always wear safety clothes properly so that they do not catch on protruding parts of truck. Do not wear oily clothes. When checking, always release battery plug.



Flames should never be used instead of lamps. Never use a naked flame to check leaks or the level of oil or electrolyte.



When working on top of the machine, be careful not to lose your balance and fall.



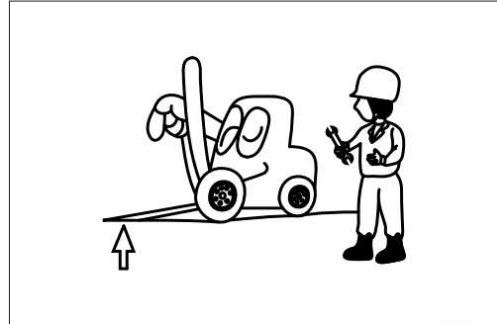
- Place a caution sign in the operator's compartment (For example: Do not start or Maintenance in progress).
This will prevent anyone from starting or moving the machine by mistake.



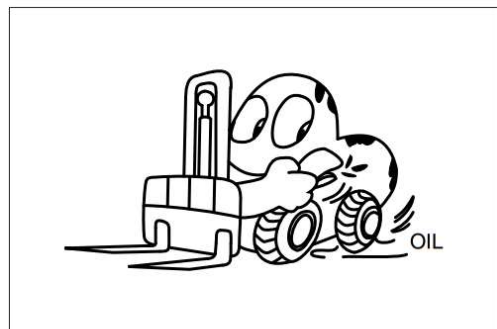
When inspecting running parts or near such parts, always stop the machine first.

Before checking or servicing accumulator or piping, depress brake pedal repeatedly to release pressure.

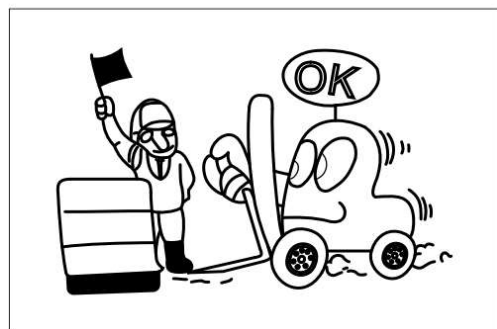
- Park the machine on firm, flat ground. Lower the fork to the ground and stop the engine. Return each lever to NEUTRAL and apply the brake lock.



- Immediately remove any oil or grease on the floor of the operator's compartment, or on the handrail. It is very dangerous if someone slips while on the machine.



- When working with others, choose a group leader and work according to his instructions. Do not perform any maintenance beyond the agreed work.



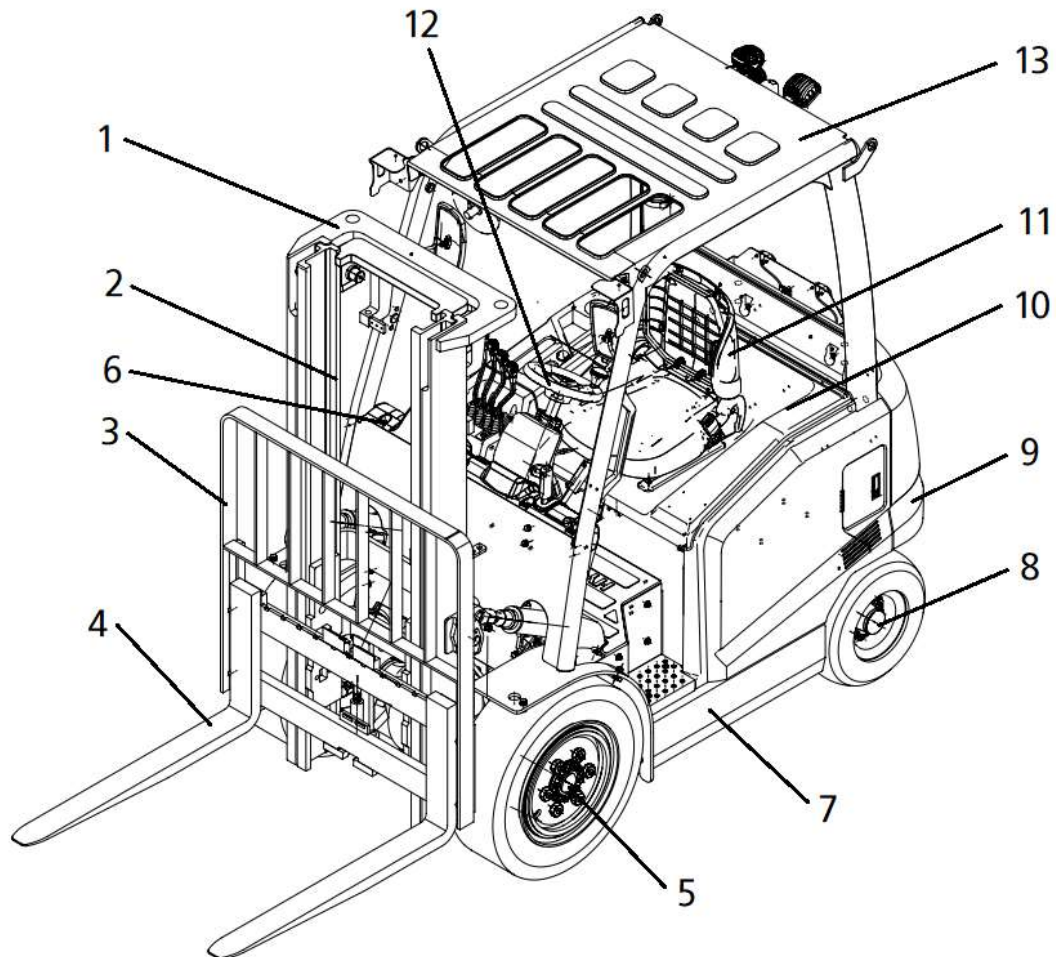
- Always remember that the hydraulic oil circuit is under pressure. When feeding or draining the oil or carrying out inspection and maintenance, release the pressure first.



- Unless you have special instructions to the contrary, maintenance should always be carried out with the machine stopped. If maintenance is carried out with the machine running, there must be two men present: one sitting in the operator's seat and the other one performing the maintenance. In such a case, never touch any moving part.
- Thoroughly clean the machine. In particular, be careful to clean the filler caps, grease fittings and the area around the dipsticks. Be careful not to let any dirt or dust into the system.
- Always use HD HYUNDAI Forklift genuine parts for replacement.
- Always use the grades of grease and oil recommended by HD HYUNDAI.
- Choose the viscosity specified for the ambient temperature.
- Always use pure oil or grease, and be sure to use clean containers.
- When checking or changing the oil, do it in a place free of dust, and prevent any dirt from getting into the oil.
- Before draining the oil, warm it up to a temperature of 30 to 40C.
- After replacing oil, filter element or strainer, bleed the air from circuit.
- When the strainer is located in the oil filler, the strainer must not be removed while adding oil
- When changing the oil filter, check the drained oil and filter for any signs of excessive metal particles or other foreign materials.
- When removing parts containing O-ring, gaskets or seals, clean the mounting surface and replace with new sealing parts.
- After injecting grease, always wipe off the oil grease that was forced out.
- Do not handle electrical equipment while wearing wet places, as this can cause electric shock.
- During maintenance do not allow any unauthorized person to stand near the machine.
- Be sure you fully understand the contents of the operation. It is important to prepare necessary tools and parts and to keep the operating area clean.
- When checking an open gear case there is a risk of dropping things in. Empty everything from your pockets before removing the covers to inspect such cases. Be particularly careful to remove wrenches and nuts
- Way to use dipstick
- Push the dipstick fully into the guide, and then pull out.
- Carrying out other difficult maintenance work carelessly can cause unexpected accidents. If you consider the maintenance is too difficult, always request the HD HYUNDAI Forklift distributor for help.

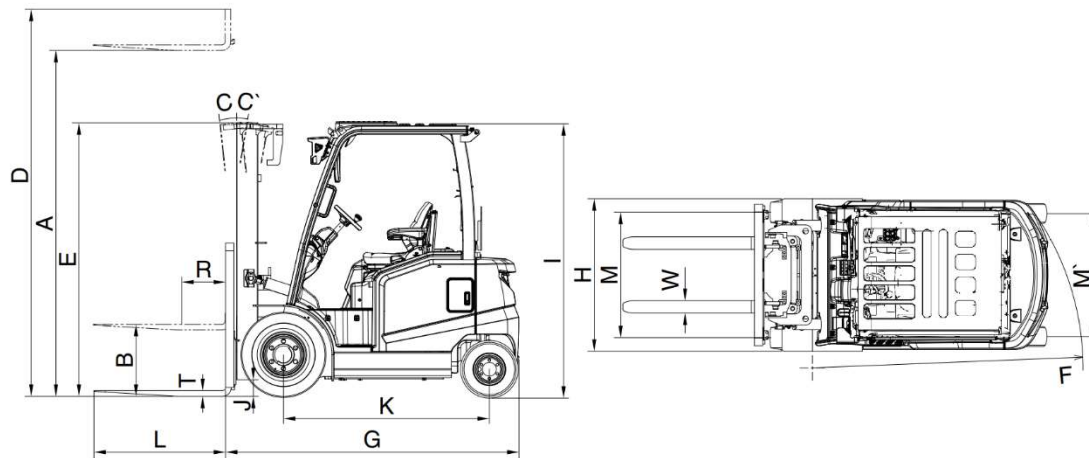
GROUP 2 SPECIFICATIONS

1. GENERAL LOCATIONS



- | | | |
|-------------------------|------------------|--------------------|
| 1 Mast | 6 Cluster | 11 Operator's seat |
| 2 Lift Cylinder | 7 Frame | 12 Steering wheel |
| 3 Carriage and backrest | 8 Steering | 13 Overhead guard |
| 4 Forks | 9 Counterweight | |
| 5 Drive axle | 10 Battery cover | |

2. SPECIFICATIONS



Item			Unit	16BE-X	20BE-X
Rated load			kg	1600	2000
Center of gravity	R		mm	500	←
Weight			kg	3323	3678
Forks	Lifting height	A	mm	3000	←
	Free lift	B	mm	35	←
	Lifting speed (load/non-load)		mm/sec	330/500	←
	Lowering speed (load/non-load)		mm/sec	500/450	←
	Length × width × thickness		mm	900 × 100 × 40	←
Mast	Tilt angle(F/R)	C/C'	Degree	5/7	←
	Max. height	D	mm	4020	←
	Min. height	E	mm	1977	←
Others	Travel speed (load/non-load)		km/h	14/15	←
	Max. gradeability (load)		%	16	←
	Min. turning radius (outside)	F	mm	1890	1910
	Max. hydraulic force		MPa	19.0	←
	Hydraulic oil tank		l	33	←
Overall length		G	mm	3000	3020
Overall width		H	mm	1185	←
Overhead guard height		I	mm	2125	←
Ground clearance (mast)		J	mm	110	←
Distance between axles		K	mm	1370	←
Distance between wheels		M/M'	mm	980/945	←

3. SPECIFICATION FOR MAJOR COMPONENTS

1) CONTROLLER

Item	Unit	16/20BE-X	
Controller	-	Drive	Pump
Model	-	ZAPI ACE2 NEWGEN	←
Type	-	AC	←
Current limit	V-A	48-400	←
Communication	-	CAN	←

2) MOTOR

Item	Unit	16/20BE-X	
Motor	-	Drive	Pump
Type	-	YST8H4-9-001	YSP5H4-13-001
Rated voltage	Vac	29.5	29.5
Output	kW	9	13
Insulator	-	H	H

3) BATTERY

Item	Unit	16BE-X	20BE-X
Type	-	Plumbic acid	←
Rated voltage	V	48	←
Capacity	AH/hr	420/5	←
Electrolyte	-	Wet	←
Dimensions (W×L×H)	mm	826×422×744	←
Connector	-	SB350	←
Weight	kg	727	←

LITHIUM ION BATTERY (OPT)

Item	Unit	16BE-X	20BE-X
Rated voltage	V	51.2	←
Capacity	AH	300	←
Dimensions (W×L×H)	mm	826×422×744	←
Weight	kg	727	←
Connector	-	DIN 320	←

4) CHARGER

Item	Unit	16BE-X	20BE-X
Capacity of battery for charging	V-AH	48V/420-450	←
AC input	V	3-Phase,220	←
		3-Phase,380	←
		3-Phase,440	←
DC output	V	68±0.5	←
Charging time	hr	8±1	←
Connector	-	SB 350	←

LITHIUM ION CHARGER (OPT)

Item	Unit	16BE-X	20BE-X
Capacity of battery for charging	V-AH	51.2-300	←
AC input	V	3-Phase, 380-440	←
DC output	V	57.5-58	←
Charging time	hr	2.5	←
Connector	-	DIN 320	←

5) GEAR PUMP

Item	Unit	16BE-X	20BE-X
Type	-	Out gear pump	←
Capacity	cc/rev	21	←
Max. working pressure	bar	206	←
Rated rotation rate (max/min)	rpm	3000/500	←

6) MAIN CONTROL VALVE

Item	Unit	16/20BE-X
Type	-	2/3/4 spools
Operating mode	-	Mechanical
Primary relief valve pressure	bar	195
Secondary relief valve pressure	bar	160

7) T/M

Item	Unit	16/20BE-X
Type	-	Integrated
Stage	-	1/1
Transmission ratio	-	25.047
Noise (Rated input speed)	dB(a)	86
Transmission efficiency	-	≥90%

8) WHEEL

Item	16BE-X	20BE-X
Type (front/rear)	Solid (opt: pneumatic, no-marking)	←
Quantity (front/rear)	2/2	←
Front-wheel drive	21*8-9-16PR	28*9-15-16PR
Rear-wheel drive	18*7-8-14PR	←

9) BRAKE AND STEERING SYSTEMS

Item		16/20BE-X
Brake	Traveling	Front-wheel mounted, dry disk mode
	Parking	Mechanical
Steering	Type	Hydraulic steering

4. TIGHTENING TORQUE FOR MAJOR COMPONENTS

Sequences	Item		Screw specifications	kgf·m
1	Electric systems	hydraulic pump motor mounting nut	M10 × 1.5	5.0 ± 0.7
2		Drive motor mounting bolt	M14 × 1.5	15.7 ± 3.0
3	Hydraulic systems	hydraulic pump mounting bolt	M10 × 1.5	6.9 ± 0.5
4		MCV mounting bolt, nut	M10 × 1.5	6.9 ± 0.5
5		Steering unit mounting bolt	M10 × 1.5	5.0 ± 0.5
6		Tilt cylinder rod-end bolt, nut	M12 × 1.75	9.5 ± 0.5
7		Tilt cylinder pin mounting bolt	M10 × 1.5	6.9 ± 0.5
8	Powertrain system	Drive axle mounting bolt, nut	M16 × 2.0	29.5 ± 0.5
9		Steering axle mounting bolt, nut	M20 × 2.5	57.5 ± 8.0
10		Transmission mounting bolt, nut	M10 × 1.25	7.5 ± 0.5
11		Front wheel mounting nut	M16 × 1.5	30 ± 3.0
12		Rear wheel mounting nut	M14 × 1.5	21 ± 1.5
13	Others	Counterweight mounting bolt	M24 × 3.0	73.5 ± 15
14		Mast mounting bolt	M16 × 2.0	36.5 ± 7.0
15		Operator's seat mounting nut	M8 × 1.25	3.4 ± 0.7
16		Overhead guard mounting bolt (front)	M12 × 1.75	12.0 ± 0.5
17		Overhead guard mounting bolt (rear)	M12 × 1.75	12.0 ± 0.5

5. TORQUE CHART

Use following table for unspecified torque

1) BOLT AND NUT

① Coarse thread

Bolt size	8.8T	10.9T	12.9T
	kgf·m	kgf·m	kgf·m
M 6 × 1.0	0.8 ~ 1.2	1.2 ~ 1.8	1.5 ~ 2.1
M 8 × 1.25	2.0 ~ 3.0	2.8 ~ 4.2	3.4 ~ 5.0
M10 × 1.5	4.0 ~ 6.0	5.6 ~ 8.4	6.8 ~ 10.0
M12 × 1.75	6.8 ~ 10.2	9.6 ~ 14.4	12.3 ~ 16.5
M14 × 2.0	10.9 ~ 16.3	16.3 ~ 21.9	19.5 ~ 26.3
M16 × 2.0	17.9 ~ 24.1	25.1 ~ 33.9	30.2 ~ 40.8
M18 × 2.5	24.8 ~ 33.4	34.8 ~ 47.0	41.8 ~ 56.4
M20 × 2.5	34.9 ~ 47.1	49.1 ~ 66.3	58.9 ~ 79.5
M22 × 2.5	46.8 ~ 63.2	65.8 ~ 88.8	78.9 ~ 106
M24 × 3.0	60.2 ~ 81.4	84.6 ~ 114	102 ~ 137
M30 × 3.5	120 ~ 161	168 ~ 227	202 ~ 272

② Fine thread

Bolt size	8.8T	10.9T	12.9T
	kgf·m	kgf·m	kgf·m
M 8 × 1.0	2.1 ~ 3.1	3.0 ~ 4.4	3.6 ~ 5.4
M10 × 1.25	4.2 ~ 6.2	5.9 ~ 8.7	7.0 ~ 10.4
M12 × 1.25	7.3 ~ 10.9	10.3 ~ 15.3	13.1 ~ 17.7
M14 × 1.5	12.4 ~ 16.6	17.4 ~ 23.4	20.8 ~ 28.0
M16 × 1.5	18.7 ~ 25.3	26.3 ~ 35.5	31.6 ~ 42.6
M18 × 1.5	27.1 ~ 36.5	38.0 ~ 51.4	45.7 ~ 61.7
M20 × 1.5	37.7 ~ 50.9	53.1 ~ 71.7	63.6 ~ 86.0
M22 × 1.5	51.2 ~ 69.2	72.0 ~ 97.2	86.4 ~ 116
M24 × 2.0	64.1 ~ 86.5	90.1 ~ 121	108 ~ 146
M30 × 2.0	129 ~ 174	181 ~ 245	217 ~ 294

2) PIPE AND HOSE (FLARE TYPE)

Thread (PF)	Hex. across flat (mm)	kgf·m
1/4"	19	4
3/8"	22	5
1/2"	27	9.5
3/4"	36	18
1"	41	21
1-1/4"	50	35

3) PIPE AND HOSE (ORFS TYPE)

Thread (UNF)	Hex. across flat (mm)	kgf·m
9/16-18	19	3
11/16-16	22	5
13/16-16	24	7
1-14	30	12
1-3/16-12	36	18
1-7/16-12	41	23
1-11/16-12	50	28
2-12	58	32

4) FITTING

Thread	Hex. across flat (mm)	kgf·m
1/4"	17	2
3/8"	19	3
1/2"	22	4
	24	6
5/8"	27	10
	30	12
3/4"	32	15
	36	18
1"	41	23
1-1/4"	50	28
1-1/2"	55	32

5) BAND CLAMP

Tag. No.	Hose size (mm)	Band width (mm)	kgf·m
S20-15	8 ~ 14	9	0.3
S20-17	11 ~ 17		
S20-22	13 ~ 20		0.35
S20-25	15 ~ 24		
S20-28	19 ~ 28		
S20-32	22 ~ 32	12	0.42
S20-40	26 ~ 38	9	
S20-45	32 ~ 44		

6) BAND CLAMP (IDEAL, FLEX-GEAR TYPE)

Tag. No.	Hose size (mm)	Band width (mm)	kgf·m
41-212	32 ~ 54	15.9	1.1
41-262	45 ~ 67		
41-312	57 ~ 79		
41-362	40 ~ 92		
41-412	83 ~ 105		
41-462	95 ~ 117		
41-512	108 ~ 130		

6. WRENCH AND SPANEER CHART

No.	Wrench & Spanner			Specification			Pipe and Hose	
	inch		mm	UNF/UN	M	PF/G	ORFS (UNF/UN)	FLARE (PF)
1	-	0.050	1.3	-	-	-	-	-
2	-	0.059	1.5	-	-	-	-	-
3	1/16	0.063	1.6	-	-	-	-	-
4	5/64	0.078	2	-	-	-	-	-
5	3/32	0.094	2.4	-	-	-	-	-
6	-	0.098	2.5	-	-	-	-	-
7	7/64	0.109	2.8	-	-	-	-	-
8	-	0.118	3	-	-	-	-	-
9	1/8	0.125	3.2	-	-	-	-	-
10	9/64	0.141	3.5	-	-	-	-	-
11	5/32	0.156	4	-	-	-	-	-
12	-	0.177	4.5	-	-	-	-	-
13	3/16	0.188	4.8	-	-	-	-	-
14	-	0.197	5	-	-	-	-	-
15	13/64	0.203	5.2	-	-	-	-	-
16	7/32	0.219	5.5	-	-	-	-	-
17	15/64	0.234	6	-	-	-	-	-
18	1/4	0.250	6.4	-	-	-	-	-
19	17/64	0.266	6.8	-	-	-	-	-
20	9/32	0.281	7	-	-	-	-	-
21	5/16	0.313	8	-	-	-	-	-
22	11/32	0.344	8.7	-	-	-	-	-
23	-	0.354	9	-	-	-	-	-
24	3/8	0.375	9.5	-	-	-	-	-
25	-	0.394	10	-	-	-	-	-
26	-	-	11	-	-	-	-	-
27	7/16	0.438	11.1	-	-	-	-	-
28	15/32	0.469	12	-	-	-	-	-
29	1/2	0.500	12.7	-	-	-	-	-
30	-	-	13	-	-	-	-	-
31	17/32	0.53	13.5	-	-	-	-	-
32	-	0.55	14	7/16-20	-	-	-	-
33	9/16	0.56	14.3	-	-	-	-	-
34	19/32	0.59	15	-	-	-	-	-
35	5/8	0.63	15.9	-	-	-	-	-
36	-	-	16	-	-	-	-	-
37	21/32	0.66	16.7	-	-	-	-	-
38	-	-	17	-	M12	-	-	-

No.	Wrench & Spanner			Specification			Pipe and Hose	
	inch		mm	UNF/UN	M	PF/G	ORFS (UNF/UN)	FLARE (PF)
39	11/16	0.69	17.5	-	-	-	-	-
40	-	-	18	-	-	-	-	-
41	3/4	0.75	19	9/16-18	M14	G1/4	9/16-18	PF1/4
42	25/32	0.78	19.8	-	-	-	-	-
43	-	-	20	-	-	-	-	-
44	13/16	0.81	20.6	-	-	-	-	-
45	-	-	21	-	-	-	-	-
46	-	-	22	-	M16	G3/8	11/16-16	PF3/8
47	7/8	0.88	22.2	-	-	-	-	-
48	29/32	0.91	23	-	-	-	-	-
49	15/16	0.94	23.8	-	-	-	-	-
50	-	-	24	3/4-16	M18	-	13/16-16	-
51	31/32	0.97	26.4	-	-	-	-	-
52	-	-	25	-	-	-	-	-
53	1	1.00	25.4	-	-	-	-	-
54	-	-	26	-	-	-	-	-
55	1 1/16	1.06	27	7/8-14	M22	G1/2	-	PF1/2
56	-	-	28	-	-	-	-	-
57	1 1/8	1.13	28.6	-	-	-	-	-
58	-	-	29	-	-	-	-	-
59	-	-	30	-	-	-	1-14	-
60	1 3/16	1.19	30.2	-	-	-	-	-
61	-	-	31	-	-	-	-	-
62	1 1/4	1.25	31.8	-	-	-	-	-
63	-	-	32	1-1/16-12	M24	G3/4	-	-
64	-	-	33	-	-	-	-	-
65	1 5/16	1.31	33.3	-	-	-	-	-
66	-	-	34	-	-	-	-	-
67	1 3/8	1.38	35	-	-	-	-	-
68	-	-	36	1-3/16-12	M27	G3/4	1-3/16-12	PF3/4
69	1 7/16	1.44	37	-	-	-	-	-
70	1 1/2	1.50	38	-	-	-	-	-
71	-	-	39	-	-	-	-	-
72	1 9/16	1.56	39.7	-	-	-	-	-
73	-	-	40	-	-	-	-	-
74	-	-	41	1-5/16-12	M33	G1	1-7/16-12	PF1
75	1 5/8	1.63	41.3	-	-	-	-	-
76	1 11/16	1.69	43	-	-	-	-	-

No.	Wrench & Spanner			Specification			Pipe and Hose	
	inch	mm		UNF/UN	M	PF/G	ORFS (UNF/UN)	FLARE (PF)
77	1 3/4	1.75	44	-	-	-	-	-
78	1 13/16	1.81	46	-	-	-	-	-
79	1 7/8	1.88	47.6	-	-	-	-	-
80	-	-	48	-	-	-	1-11/16-12	-
81	1 15/16	1.94	49.2	-	-	-	-	-
82	-	-	50	1-5/8-12	-	G1-1/4	-	PF1-1/4
83	2	2.00	50.8	-	-	-	-	-
84	-	-	51	-	-	-	-	-
85	2 1/8	2.13	54	-	-	-	-	-
86	-	-	55	1-7-8-12	-	G1-1/2	-	PF1-1/2
87	-	-	57	-	-	-	2-12	-
88	2 1/4	2.25	57.2	-	-	-	-	-
89	-	-	60	-	-	-	-	-

7. RECOMMENDED LUBRICANTS

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

Item	Lubricant type	Capacity (L)	Ambient temperature ° C (° F)								
			-50	-30	-20	-10	0	10	20	30	40
			(-58)	(-22)	(-4)	(14)	(32)	(50)	(68)	(86)	(104)
Axle	Gear oil	3.5	★85W90 GL5								
Hydraulic oil tank	Hydraulic oil	33	★ISO VG 15								
			ISO VG 32								
			ISO VG 46								
			ISO VG 68								
Brake system	Brake oil	0.25	★DOT3								
Fitting (Grease nipple)	Grease	0.1	★NLGI No.1								
			NLGI No.2								

★: Regions of cold climate (Russia, CIS, Mongolia)

GROUP 3 PERIODIC REPLACEMENT

For operation safety, never fail to perform periodic maintenance or make periodic replacement of the consumable parts listed in the following. These parts may deteriorate in time and are susceptible to wear.

It is difficult to estimate the degree of wear at time of periodic maintenance; therefore, even if no apparent wear is found, always replace with new parts within the prescribed period of replacement (Or earlier if trouble is found).

Note that periodic replacement has nothing to do with guarantee service.

※ Replacement of consumable service parts is not covered under warranty.

No.	Name	Replacement cycle
1	Master cylinder and wheel cylinder caps dust seals	Every 1 year
2	Lift cylinder hose	Every 1 year (harsh operation) Every 2 years (normal operation)
3	Tilt cylinder hose	
4	Side shift cylinder hose	
5	Brake hose or tube	Every 2 years
6	Hydraulic pump hose	
7	Power steering hose	
8	Coolant hose and clamps	Every 2 years (harsh operation) Every 4 years (normal operation)
9	Packing, seal, and O-ring of steering cylinder	
10	Lift chain	
11	Brake oil tank tube	Every 3 years
12	Hydraulic pump seal kit	
13	Pressure sensor	Every 5 years

※ Replace the O-ring and gasket at the same time when replacing the hose.

※ Replace clamp at the same time if the hose clamp is cracked when checking and replacing hose.

※ Normal operation

Eight hours material handling, mostly in buildings or in clean, open air on clean paved surfaces.

※ Harsh operation

- 1) All harsh working environment
- 2) Long term heavy load operation
- 3) High and low temperature working environment
- 4) Sudden change in temperature
- 5) Dusty or sandy working environment
- 6) Highly corrosive chemical working environment
- 7) Damp working environment