SECTION 1 GENERAL

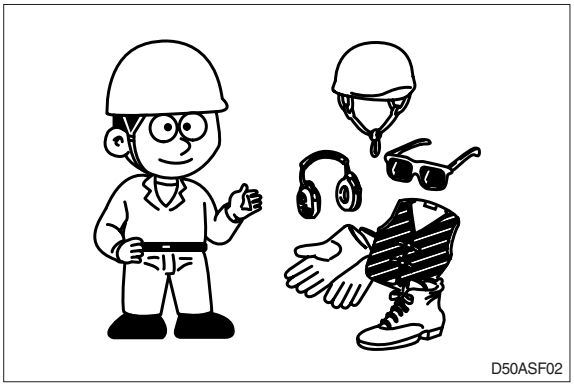
GROUP 1 SAFETY HINTS

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

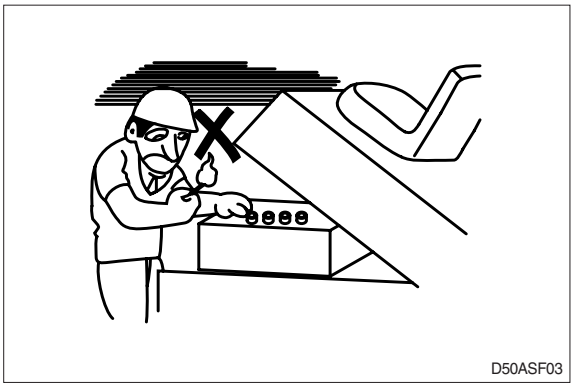
- Oil is a dangerous substance. Never handle oil, grease or oily clothes in places where there is any fire of flame.
  As preparation in case of fire, always know the location and directions for use of fire extinguishers and other fire fighting equipment.


D50ASF01

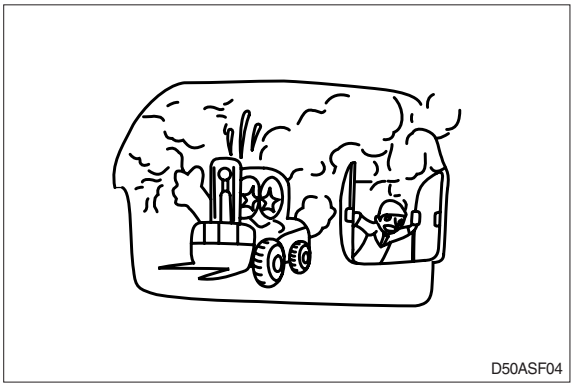
- Wear well-fitting helmet, safety shoes and working clothes. When drilling, grinding or hammering, always wear protective goggles.
  Always do up safety clothes properly so that they do not catch on protruding parts of machines. Do not wear oily clothes.
  When checking, always release battery plug.


D50ASF02

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

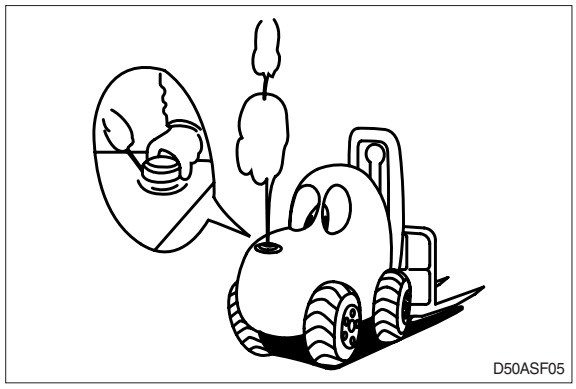

D50ASF03

- Exhaust gas is dangerous. Provide adequate ventilation when working a closed space.


D50ASF04

⚠ **Be particularly careful when removing the radiator cap and the hydraulic oil tank filler cap, if this is done immediately after using the machine, there is a danger that boiled oil may spurt out.**

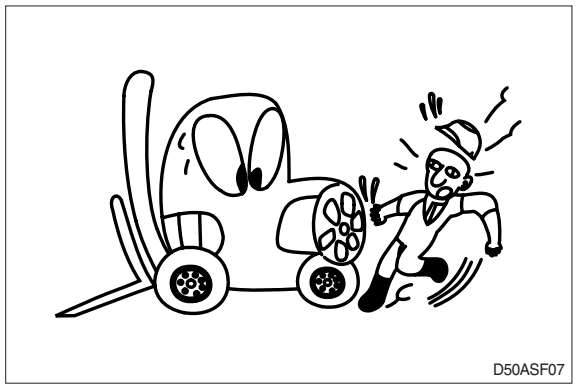
- The procedure for releasing the hydraulic pressure is as follows : lower the fork to the ground, and stop the engine(Motor), move the control levers to each position two or three times.


D50ASF05

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

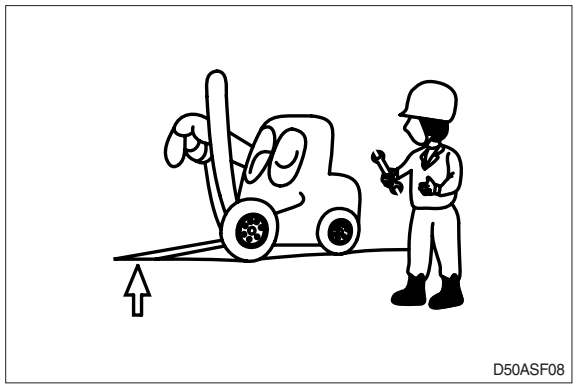

D50ASF06

- Hand 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.

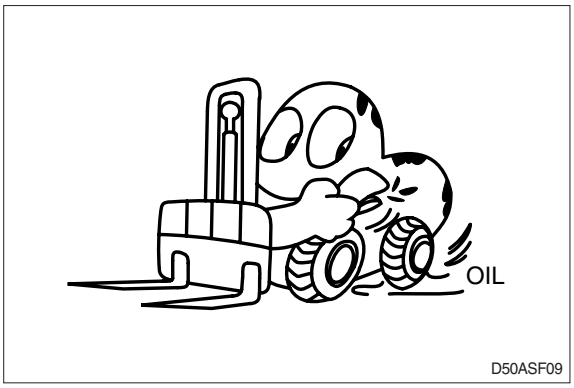

D50ASF07

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.

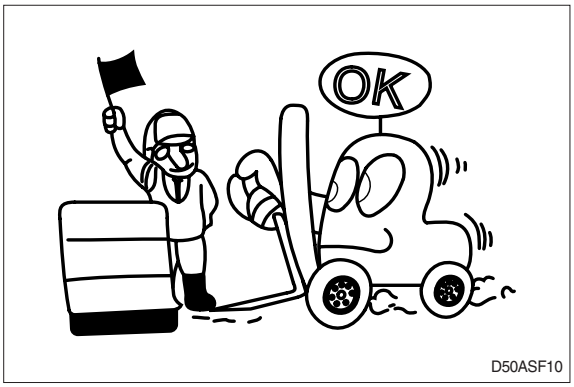
- Park the machine on firm, flat ground.
  Lower the fork to the ground and stop the engine.
  Return each lever to **NEUTRAL** and apply the brake lock.


D50ASF08

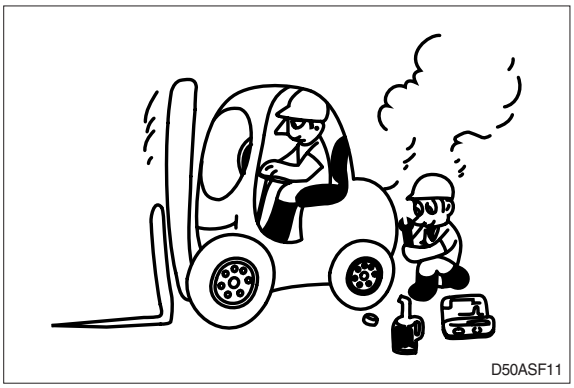
· Immediately remove any oil or grease on the floor of the operator's compartment, or on the handrail. It is very dangerous if someone slips while on the machine.



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



· Unless you have special instructions to the contrary, maintenance should always be carried out with the engine stopped. If maintenance is carried out with the engine 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.



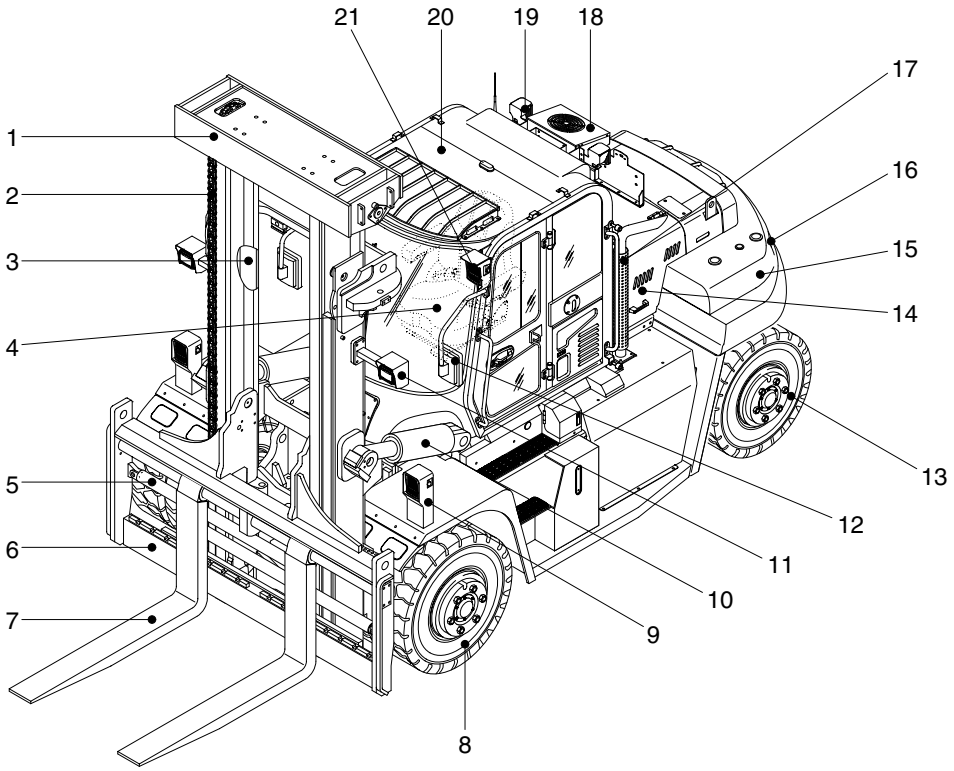
· Always remember that the hydraulic oil circuit is under pressure. When feeding or draining the oil or carrying out inspection and maintenance, release the pressure first.

- 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 HYUNDAI Forklift genuine parts for replacement.
- Always use the grades of grease and oil recommended by HYUNDAI Forklift.
  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 40° C.
- 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. Before removing the covers to inspect such cases, empty everything from your pockets. 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 HYUNDAI Forklift distributor to carry out it.

GROUP 2 SPECIFICATIONS

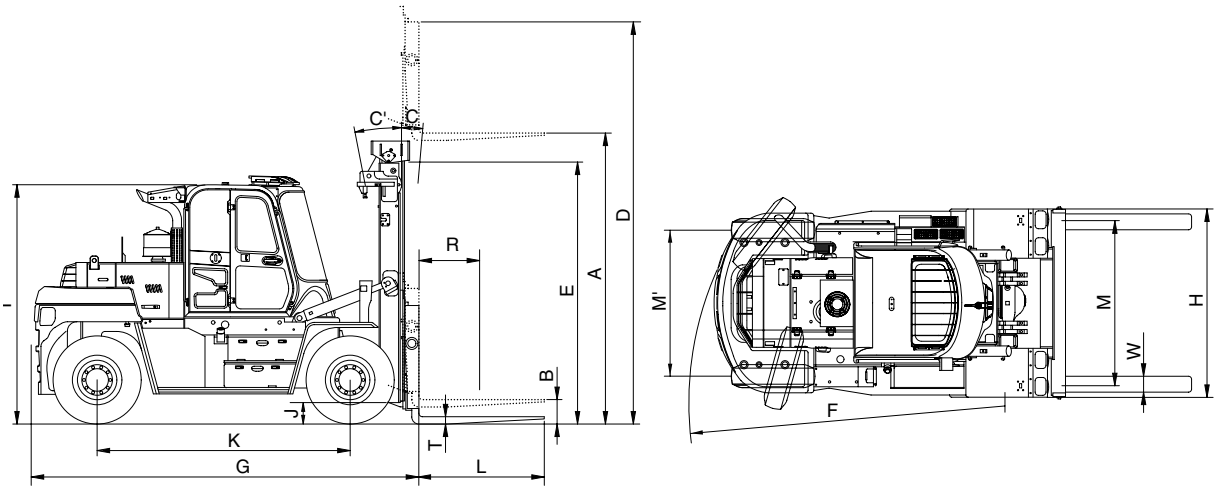
1. GENERAL LOCATIONS



110D9OM54

1	Mast	8	Front wheel	15	Counterweight
2	Lift chain	9	Head lamp-fender	16	Rear combination lamp
3	Lift cylinder	10	Tilt cylinder	17	Silencer
4	Operator's seat	11	Work lamp-mast	18	Air conditioner (opt)
5	Fork positioner cylinder	12	Rear view mirror	19	Rear work lamp
6	Carriage	13	Rear wheel	20	Cabin
7	Forks	14	Bonnet	21	Work lamp-cabin

2. SPECIFICATIONS



110D9SP011

Model			Unit	110D-9	130D-9	160D-9
Capacity			kg (lb)	11,000 (25000)	13,000 (29000)	16,000 (36000)
Load center		R	mm (in)	600 (24")	←	←
Weight(Unloaded)			kg	16274 (35880)	16991 (37460)	19842 (43740)
Fork	Lifting height	A	mm (ft·in)	3005 (9' 10")	3000 (9' 10")	3010 (9' 11")
	Free lift	B	mm (in)	0	←	←
	Lifting speed (Unload/Load)		mm/sec	510/440	510/430	450/350
	Lowering speed (Unload/Load)		mm/sec	460/510	←	410/430
	L×W×T	L,W,T	mm (in)	1350×200×75 (53.1×7.9×3.0)	1350×200×85 (53.1×7.9×3.3)	1350×200×90 (53.1×7.9×3.5)
Mast	Tilt angle (forward/backward)	C/C'	degree	15/12	←	←
	Max height	D	mm (ft·in)	4465 (14' 8")	←	4710 (15' 5")
	Min height	E	mm (ft·in)	3000 (9' 10")	←	3250 (10' 0")
Body	Travel speed (Unload)		km/h	39.5	←	33.3
	Gradeability (Load)		%	45.3	41.0	40.2
	Min turning radius (Outside)	F	mm (ft·in)	4350 (14' 3")	←	4895 (16' 1")
ETC	Max hydraulic pressure		kgf/cm²	210	←	←
	Hydraulic oil tank		ℓ (USgal)	115 (30.4)	←	124.3 (32.8)
	Fuel tank		ℓ (USgal)	195 (51.5)	←	260 (68.7)
Overall length		G	mm (ft·in)	4570 (15' 0")	4580 (15' 0")	5080 (16' 8")
Overall width		H	mm (ft·in)	2777 (9' 1")	←	2497 (8' 2")
Cabin height		I	mm (ft·in)	2890 (9' 6")	←	2930 (9' 7")
Ground clearance		J	mm (in)	250 (9.8")	←	←
Wheel base		K	mm (ft·in)	3050 (10' 0")	←	3450 (11' 4")
Wheel tread front/rear		M/M'	mm (ft·in)	1842 / 1910 (6' 1" / 6' 3")	←	1842 / 1960 (6' 1" / 6' 5")
Drawbar pull			kg (lb)	12356 (27240)	12500 (27560)	13243 (29200)

3. SPECIFICATION FOR MAJOR COMPONENTS

1) 110/130D-9

(1) ENGINE

Item	Unit	Specification
Model	-	Cummins QSB6.7
Type	-	4 cycle turbocharged, Tier 4 final diesel engine
Cooling Method	-	Water cooling
Number of cylinders and arrangement	-	6 cylinders, In-line
Firing order	-	1-5-3-6-2-4
Combustion chamber type	-	Direct injection
Cylinder bore × stroke	mm (in)	107 × 124 mm (4.21" × 4.88")
Piston displacement	cc (cu in)	6690 (409)
Compression ratio	-	17.3 : 1
Rated gross horse power	ps/rpm	165.8/2300
Maximum gross torque at rpm	kgf · m/rpm	74.7/1500
Engine oil quantity	ℓ (U.S.gal)	14.2 (3.8)
Dry weight	kg (lb)	520 (1146)
High idling speed	rpm	2250 ± 50
Low idling speed	rpm	600~1200
Rated fuel consumption	g/ps.hr	168
Starting motor	V-kW	DENSO, 24-3.7
Alternator	V-A	24-70
Battery	V-AH	24-100

2) MAIN PUMP

Item	Unit	Specification
Type	-	Variable displacement axial piston pump
Capacity	cc/rev	74+63
Maximum operating pressure	bar	300
Rated speed (Max/Min)	rpm	2800/300

3) MAIN CONTROL VALVE

Item	Unit	Specification
Type	-	Sectional
Operating method	-	Hydraulic pilot
Main relief valve pressure	bar	210/165
Flow capacity	lpm	180

(4) STEERING UNIT

Item	Unit	Specification
Type	-	Load sensing/Non load reaction/Dynamic signal
Capacity	cc/rev	369
Rated flow	lpm	45.4

(5) POWER TRAIN DEVICES

Item			Specification		
Torque converter	Model		05 W 340 (ZF SACH)		
	Type		3 Element, 1 stage, 2 phase		
	Stall ratio		2.362 : 1		
Transmission	Type		Full auto, power shift		
	Gear shift (FR/RR)		3/3		
	Adjustment		Electrical single lever type		
	Overhaul ratio	FR	1 : 5.630	2 : 2.396	3 : 0.994
		RR	1 : 5.647	2 : 2.404	3 : 0.997
Axle	Type		Front-wheel drive type, fixed location		
	Gear ratio		11.73 : 1		
	Gear		Ring & Pinion gear type		
Wheels	Q'ty (FR/RR)		Double : 4/2		
	Front (drive)		10.00-20-16 PR		
	Rear (steer)		10.00-20-16 PR		
Brakes	Travel		Front wheel, wet disc brake		
	Parking		Axle pinion, Caliper brake, hydraulic released		
Steering	Type		Full hydraulic, power steering		
	Steering angle		76˚ to both right and left angle, respectively		

2) 160D-9

(1) ENGINE

Item	Unit	Specification
Model	-	Cummins QSB6.7
Type	-	4 cycle turbocharged, Tier 4 final diesel engine
Cooling Method	-	Water cooling
Number of cylinders and arrangement	-	6 cylinders, In-line
Firing order	-	1-5-3-6-2-4
Combustion chamber type	-	Direct injection
Cylinder bore × stroke	mm (in)	107 × 124 mm (4.21" × 4.88")
Piston displacement	cc (cu in)	6690 (409)
Compression ratio	-	17.3 : 1
Rated gross horse power	ps/rpm	165.8/2300
Maximum gross torque at rpm	kgf · m/rpm	74.7/1500
Engine oil quantity	ℓ (U.S.gal)	14.2 (3.8)
Dry weight	kg (lb)	520 (1146)
High idling speed	rpm	2250 ± 50
Low idling speed	rpm	600~1200
Rated fuel consumption	g/ps.hr	168
Starting motor	V-kW	DENSO, 24-3.7
Alternator	V-A	24-70
Battery	V-AH	24-100

2) MAIN PUMP

Item	Unit	Specification
Type	-	Variable displacement axial piston pump
Capacity	cc/rev	74+63
Maximum operating pressure	bar	300
Rated speed (Max/Min)	rpm	2800/300

3) MAIN CONTROL VALVE

Item	Unit	Specification
Type	-	Sectional
Operating method	-	Hydraulic pilot
Main relief valve pressure	bar	210/165
Flow capacity	lpm	180

(4) STEERING UNIT

Item	Unit	Specification
Type	-	Load sensing / Non load reaction / Dynamic signal
Capacity	cc/rev	369
Rated flow	lpm	45.4

(5) POWER TRAIN DEVICES

Item			Specification		
Torque converter	Model		05 W 340 (ZF SACH)		
	Type		3 Element, 1 stage, 2 phase		
	Stall ratio		2.362 : 1		
Transmission	Type		Full auto, Power shift		
	Gear shift (FR / RR)		3/3		
	Adjustment		Electrical single lever type		
	Overhaul ratio	FR	1 : 5.630	2 : 2.396	3 : 0.994
		RR	1 : 5.647	2 : 2.404	3 : 0.997
Axle	Type		Front-wheel drive type, fixed location		
	Gear ratio		12.7 : 1		
	Gear		Ring & pinion gear type		
Wheels	Q'ty (FR / RR)		Double : 4/2		
	Front (drive)		12.00-20-18PR		
	Rear (steer)		12.00-20-18PR		
Brakes	Travel		Front wheel, Wet disk brake		
	Parking		Axle pinion, caliper brake, hydraulic released		
Steering	Type		Full hydraulic, power steering		
	Steering angle		76˚ to both right and left angle, respectively		

4. TIGHTENING TORQUE FOR MAJOR COMPONENTS

NO	Item		Size	kgf · m	lbf · ft
1	Engine	Engine mounting bolt, nut (bracket-frame)	M24 × 3.0	100 ± 15	723 ± 109
2		Engine mounting bolt (engine-bracket)	M12 × 1.75	12.3 ± 2.4	89.0 ± 17.4
3		Radiator mounting bolt, nut	M12 × 1.75	12.8 ± 3.0	92 ± 21.7
4	Hydraulic system	Hydraulic pump mounting bolt	M12 × 1.75	14.7 ± 2.2	106 ± 15.9
5		MCV mounting bolt	M10 × 1.5	6.9 ± 1.4	49.9 ± 10.1
6		Steering unit mounting bolt	M10 × 1.5	6.9 ± 1.4	49.9 ± 10.1
7		Tilt cylinder; rod-end bolt, nut	M20 × 2.5	57.9 ± 10	419 ± 72.3
8		Tilt cylinder pin; mounting bolt	M10 × 1.5	6.9 ± 1.4	50 ± 10.1
9	Power train system	Transmission mounting bolt, nut	M16 × 2.0	100 ± 15	723 ± 109
10		Torque converter mounting bolt	M10 × 1.5	4.5 ± 0.6	32.5 ± 4.3
11		Drive axle mounting bolt, nut	M24 × 2.0	100 ± 15	723 ± 109
12		Steering axle mounting bolt, nut	M24 × 3.0	100 ± 15	723 ± 109
13		Front and rear wheel mounting nut	M22 × 1.5	83.2 ± 10	602 ± 72.3
14		Propeller shaft (to T/M and D/Axle)	1/2-20UNF	15.0 ± 2.0	108 ± 14.5
15	Others	Counterweight mounting bolt 1	M30 × 3.5	199 ± 29.9	1440 ± 216
		Counterweight mounting bolt 2	M24 × 3.0	100 ± 15	723 ± 109
16		Operator's seat mounting nut	M8 × 1.25	3.4 ± 0.7	24.6 ± 5.1
17		Cabin mounting bolt	M16 × 2.0	7.5	54.2
18		Mast mounting bolt	M12 × 1.75	12.5 ± 1.3	90.4 ± 9.4

5. TORQUE CHART

Use following table for unspecified torque.

1) BOLT AND NUT

(1) Coarse thread

Bolt size	8T		10T	
	kg · m	lb · ft	kg · m	lb · ft
M 6 × 1.0	0.85 ~ 1.25	6.15 ~ 9.04	1.14 ~ 1.74	8.2 ~ 12.6
M 8 × 1.25	2.0 ~ 3.0	14.5 ~ 21.7	2.73 ~ 4.12	19.5 ~ 29.8
M10 × 1.5	4.0 ~ 6.0	28.9 ~ 43.4	5.5 ~ 8.3	39.8 ~ 60
M12 × 1.75	7.4 ~ 11.2	53.5 ~ 79.5	9.8 ~ 15.8	71 ~ 114
M14 × 2.0	12.2 ~ 16.6	88.2 ~ 120	16.7 ~ 22.5	121 ~ 167
M16 × 2.0	18.6 ~ 25.2	135 ~ 182	25.2 ~ 34.2	182 ~ 247
M18 × 2.5	25.8 ~ 35.0	187 ~ 253	35.1 ~ 47.5	254 ~ 343
M20 × 2.5	36.2 ~ 49.0	262 ~ 354	49.2 ~ 66.6	356 ~ 482
M22 × 2.5	48.3 ~ 63.3	350 ~ 457	65.8 ~ 98.0	476 ~ 709
M24 × 3.0	62.5 ~ 84.5	452 ~ 611	85.0 ~ 115	615 ~ 832
M30 × 3.0	124 ~ 168	898 ~ 1214	169 ~ 229	1223 ~ 1655
M36 × 4.0	174 ~ 236	1261 ~ 1703	250 ~ 310	1808 ~ 2242

(2) Fine thread

Bolt size	8T		10T	
	kg · m	lb · ft	kg · m	lb · ft
M 8 × 1.0	2.17 ~ 3.37	15.7 ~ 24.3	3.04 ~ 4.44	22.0 ~ 32.0
M10 × 1.25	4.46 ~ 6.66	32.3 ~ 48.2	5.93 ~ 8.93	42.9 ~ 64.6
M12 × 1.25	7.78 ~ 11.58	76.3 ~ 83.7	10.6 ~ 16.0	76.6 ~ 115
M14 × 1.5	13.3 ~ 18.1	96.2 ~ 130	17.9 ~ 24.1	130 ~ 174
M16 × 1.5	19.9 ~ 26.9	144 ~ 194	26.6 ~ 36.0	193 ~ 260
M18 × 1.5	28.6 ~ 43.6	207 ~ 315	38.4 ~ 52.0	278 ~ 376
M20 × 1.5	40.0 ~ 54.0	289 ~ 390	53.4 ~ 72.2	386 ~ 522
M22 × 1.5	52.7 ~ 71.3	381 ~ 515	70.7 ~ 95.7	512 ~ 692
M24 × 2.0	67.9 ~ 91.9	491 ~ 664	90.9 ~ 123	658 ~ 890
M30 × 2.0	137 ~ 185	990 ~ 1338	182 ~ 248	1314 ~ 1795
M36 × 3.0	192 ~ 260	1389 ~ 1879	262 ~ 354	1893 ~ 2561

2) PIPE AND HOSE (FLARE type)

Thread size	Width across flat (mm)	kgf · m	lbf · ft
1/4"	19	4	28.9
3/8"	22	5	36.2
1/2"	27	9.5	68.7
3/4"	36	18	130
1"	41	21	152
1-1/4"	50	35	253

3) PIPE AND HOSE (ORFS type)

Thread size	Width across flat (mm)	kgf · m	lbf · ft
9/16-18	19	4	28.9
11/16-16	22	5	36.2
13/16-16	27	9.5	68.7
1-3/16-12	36	18	130
1-7/16-12	41	21	152
1-11/16-12	50	35	253

4) FITTING

Thread size	Width across flat (mm)	kgf · m	lbf · ft
1/4"	19	4	28.9
3/8"	22	5	36.2
1/2"	27	9.5	68.7
3/4"	36	18	130
1"	41	21	152
1-1/4"	50	35	253

6. RECOMMENDED LUBRICANTS

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)
		110D-9 130D-9	160D-9	-50 (-58) -30 (-22) -20 (-4) -10 (14) 0 (32) 10 (50) 20 (68) 30 (86) 40 (104)
Engine oil pan	Engine oil	14.2 (3.8)	14.2 (3.8)	★SAE 5W-40 SAE 30 SAE 10W SAE 10W-30 SAE 15W-40
DEF/ AdBlue® tank	Mixture of urea and deionized water	37.8 (10.0)	37.8 (10.0)	ISO 22241 (High-purity urea + deionized water (32.5:67.5))
Torque converter transmission	Engine oil	16 (4.2)	16 (4.2)	SAE 10W-30 SAE 15W-40
Axle brake	Gear oil	19 (5.0)	19 (5.0)	SAE 80W-90/API GL-5
	Cooling oil	22 (5.8)	22 (5.8)	DONAX TD
Hydraulic tank	Hydraulic oil	115 (30.4)	124.3 (32.8)	★ISO VG 15 ISO VG 46
Cabin tilt hand pump	Hydraulic oil	0.7 (0.2)	0.7 (0.2)	ISO VG 68
Fuel tank	Diesel fuel★1	195 (51.5)	260 (68.7)	★ASTM D975 NO.1 ASTM D975 NO.2
Fitting (Grease nipple)	Grease	-	-	★NLGI NO.1 NLGI NO.2
Radiator	Antifreeze:Water 50:50	30 (7.9)	30 (7.9)	Ethylene glycol base permanent type ★Ethylene glycol base permanent type (60 : 40)

NOTES :

① SAE numbers given to engine oil should be selected according to ambient temperature.

② For engine oil used in engine oil pan, use SAE 10W oil when the temperature at the time of engine start up is below 0˚C, even if the ambient temperature in daytime is expected to rise to 10˚C or more.

③ Use engine oil of API service class CJ-4.

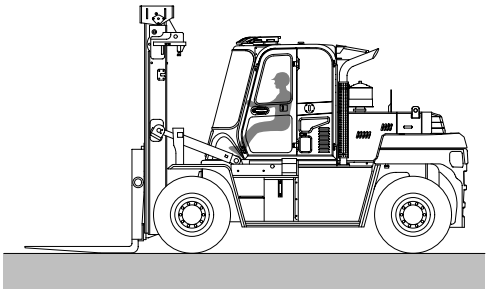
★1 : Ultra low sulfur diesel
- sulfur content ≤ 15 ppm

★ : Cold region
Russia, CIS, Mongolia

GROUP 3 OPERATIONAL CHECKOUT RECORD SHEET

- Owner :
- Date :
- Hours :
- Serial No. :
- Technician :

※ Use this sheet to record operational checkout results.
Perform the operational check before installing any test equipment.



110D9GE02

Item	OK	NOT OK	Comments

1. Monitor indicator and gauge checks (Engine OFF)

- Hour meter and gauge check _____
- Battery check _____
- Monitor indicator circuit check _____
- Monitor turn signals and warning indicator check _____

2. Transmission, axle and engine linkages, neutral start switch and reverse warning alarm switch checks

- Transmission control lever and neutral _____
- Neutral start and reverse warning _____
- Alarm circuit checks _____
- Engine speed control linkage check _____

3. Monitor indicator and gauge checks (Engine running)

- Monitor display and alternator output checks _____
- Monitor bypass circuit and seat belt indicator check _____
- Monitor primary and secondary level check _____
- Transmission oil warm up procedure _____
- Transmission temperature gauge check _____

4. Brake system and clutch cut off checks

- Park brake capacity check _____
- Park brake transmission lockout check _____
- Service brake pump flow check _____
- Service brake capacity check _____
- Brake accumulator precharge check _____
- Brake system leakage check _____
- Service brake pedal check _____
- Service and park brake system drag check _____
- Clutch cut off check _____

5. Driving checks

- Transmission oil warm up procedure _____
- Transmission noise check _____
- Speedometer check _____
- Transmission kick down system check _____
- 1st, 2nd and 3rd speed clutch pack drag check _____
- Transmission pressure, pump flow and leakage check _____
- Transmission shift modulation check _____
- Torque converter check _____
- Engine power check _____

6. Hydraulic system checks

- Hydraulic system warm up procedure _____
- Hydraulic pump performance check _____
- Mast lift and lower check _____
- Control valve lift check _____
- Mast tilt check _____
- Fork positioner check _____
- Down safety valve leakage check _____
- Lift, tilt and steering cylinder check _____
- Side shift piping leakage check _____
- Hydraulic oil cleanliness check _____

7. Steering system checks

- Steering valve check _____
- Steering system leakage check _____
- Priority valve (built in MCV) _____
  Low check pressure _____
  High check pressure _____

8. Accessory checks

- Operating lights check _____
- Work light check _____
- Brake light check _____
- Cab light check _____
- Horn circuit check _____
- Windshield washer and wiper check _____
- Heater/Air conditioner blower check _____
- Heater functional check _____
- Air conditioner functional check _____
- Start aid system check _____

9. Cab components and vandal protection checks

- Cab door latch check _____
- Cab door hold open latch check _____
- Cab door release button check _____
- Cab door lock check _____
- Cab door window check _____
- Cab window latch check _____
- Steering column adjustment check _____
- Seat and seat belt check _____
- Air intake filter door check _____
- Engine side panels check _____
- Radiator cap access door check _____
- Service decal check _____