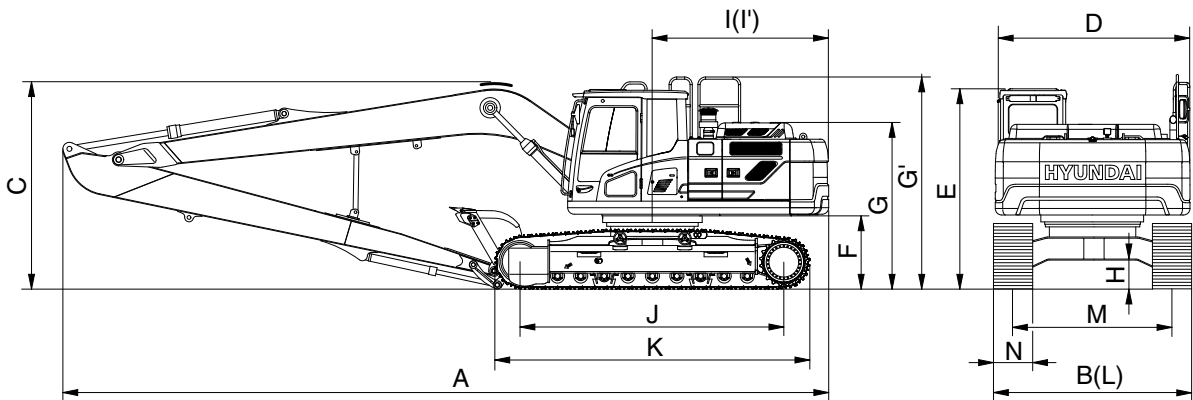


2) HX220 L LONG REACH

- 8.2 m (26' 11") BOOM and 6.3 m (20' 8") ARM

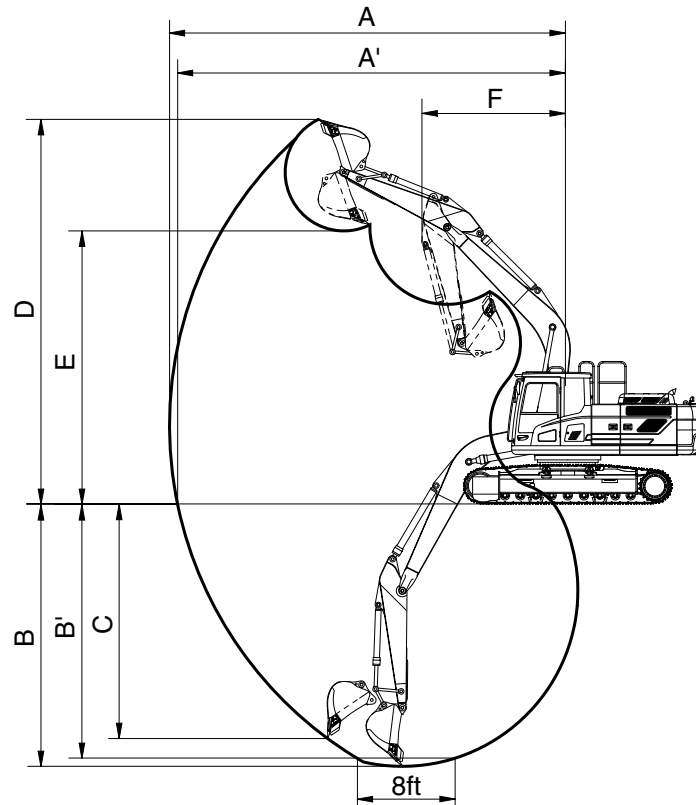


220F2SP03

Description		Unit	Specification
Operating weight		kg (lb)	24820 (54720)
Bucket capacity (SAE heaped), standard		m ³ (yd ³)	0.52 (0.68)
Overall length	A	mm (ft-in)	12030 (39' 6")
Overall width, with 800 mm shoe	B		3190 (10' 6")
Overall height	C		3280 (10' 9")
Superstructure width	D		2740 (9' 0")
Overall height of cab	E		2920 (9' 7")
Ground clearance of counterweight	F		1060 (3' 6")
Engine cover height	G		2469 (8' 1")
Overall height of handrail	G'		3211 (10' 6")
Minimum ground clearance	H		480 (1' 7")
Rear-end distance	I		2770 (9' 1")
Rear-end swing radius	I'		2840 (9' 4")
Distance between tumblers	J		3650 (12' 0")
Undercarriage length	K		4440 (14' 7")
Undercarriage width	L		3190 (10' 6")
Track gauge	M		2390 (7' 10")
Track shoe width	N		800 (32")
Travel speed (low/high)		km/hr (mph)	3.5/5.5 (2.2/3.4)
Swing speed		rpm	10.8
Gradeability		Degree (%)	35 (70)
Ground pressure (800 mm shoe)		kgf/cm ² (psi)	0.39 (5.55)
Max traction force		kg (lb)	20200 (44530)

2) HX220 L LONG REACH

· 8.2 m (26' 11") BOOM



220F2SP05

Description		6.3 m (20' 8") Arm	
Max digging reach	A	15220 (50' 0")	
Max digging reach on ground	A'	15120 (49' 7")	
Max digging depth	B	11760 (38' 7")	
Max digging depth (8 ft level)	B'	11650 (38' 3")	
Max vertical wall digging depth	C	9610 (31' 6")	
Max digging height	D	12550 (41' 2")	
Max dumping height	E	10280 (33' 8")	
Min swing radius	F	4870 (16' 0")	
Bucket digging force	SAE	72.6 kN	
		7400 kgf	
		16310 lbf	
	ISO	83.4 kN	
		8500 kgf	
		18740 lbf	
Arm crowd force	SAE	49.0 kN	
		5000 kgf	
		11020 lbf	
	ISO	50.0 kN	
		5100 kgf	
		11240 lbf	

2) HX220 L LONG REACH

















Item	HX220 L LONG REACH	
	kg	lb
Upperstructure assembly	10900	24030
Main frame weld assembly	1880	4140
Engine assembly	520	1150
Main pump assembly	140	310
Main control valve assembly	220	485
Swing motor assembly	240	530
Hydraulic oil tank assembly	240	530
Fuel tank assembly	195	430
Counterweight	5300	11680
Cab assembly	490	1080
Lower chassis assembly	8700	19180
Track frame weld assembly	2720	6000
Swing bearing	290	640
Travel motor assembly	300	660
Turning joint	55	120
Sprocket	55	120
Track recoil spring	130	290
Idler	155	340
Carrier roller	20	45
Track roller	48	106
Track-chain assembly (800 mm standard triple grouser shoe)	1735	3820
Front attachment assembly (8.2 m boom, 6.3 m arm, 0.52 m ³ SAE heaped bucket)	4600	10140
8.2 m boom assembly	2105	4640
6.3 m arm assembly	1100	2430
0.52 m ³ SAE heaped bucket	460	1010
Boom cylinder assembly	180	400
Arm cylinder assembly	270	600
Bucket cylinder assembly	130	290
Bucket control linkage total	170	370

2) HX220 L LONG REACH

(1) 8.2 m (26' 11") boom, 6.3 m (20' 8") arm equipped with 0.52 m³ (SAE heaped) bucket and 800 mm (32") triple grouser shoe.

·  : Rating over-front

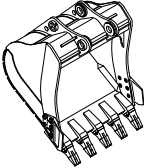
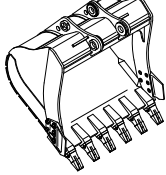
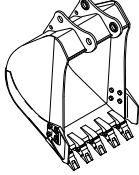
·  : Rating over-side or 360 degree

Load point height		Load radius														At max. reach			
		4.5 m (15 ft)		6.0 m (20 ft)		7.5 m (25 ft)		9.0 m (30 ft)		10.5 m (35 ft)		12.0 m (40 ft)		13.5 m (45 ft)		Capacity	Reach		
																		m (ft)	
10.5 m	kg																*1470	*1470	12.11
	lb																*3240	*3240	(39.7)
9.0 m	kg											*930	*930				*1490	*1490	13.11
	lb											*2050	*2050				*3280	*3280	(43.0)
7.5 m	kg											*1540	*1540				*1530	1350	13.84
	lb											*3400	*3400				*3370	2980	(45.4)
6.0 m	kg									*1590	*1590	*1600	*1600				*1580	1190	14.37
	lb									*3510	*3510	*3530	*3530				*3480	2620	(47.1)
4.5 m	kg									*1770	*1770	*1710	*1710	*1260	*1260		*1630	1080	14.72
	lb									*3900	*3900	*3770	*3770	*2780	*2780		*3590	2380	(48.3)
3.0 m	kg					*2500	*2500	*2200	*2200	*2000	*2000	*1860	1670	*1590	1260		*1700	1010	14.89
	lb					*5510	*5510	*4850	*4850	*4410	*4410	*4100	3680	*3510	2780		*3750	2230	(48.9)
1.5 m	kg	*5570	*5570	*3900	*3900	*3060	*3060	*2560	*2560	*2240	2050	*2030	1570	*1790	1200		*1780	970	14.90
	lb	*12280	*12280	*8600	*8600	*6750	*6750	*5640	*5640	*4940	4520	*4480	3460	*3950	2650		*3920	2140	(48.9)
Ground	kg	*6930	6870	*4720	4590	*3580	3320	*2910	2490	*2490	1910	*2200	1480	*1820	1140		*1860	960	14.75
Line	lb	*15280	15150	*10410	10120	*7890	7320	*6420	5490	*5490	4210	*4850	3260	*4010	2510		*4100	2120	(48.4)
-1.5 m	kg	*7750	6340	*5330	4220	*4020	3060	*3220	2320	*2700	1790	*2350	1400	*1570	1100		*1960	990	14.42
	lb	*17090	13980	*11750	9300	*8860	6750	*7100	5110	*5950	3950	*5180	3090	*3460	2430		*4320	2180	(47.3)
-3.0 m	kg	*8150	6120	*5720	4000	*4330	2890	*3450	2190	*2870	1700	*2460	1340				*2060	1050	13.92
	lb	*17970	13490	*12610	8820	*9550	6370	*7610	4830	*6330	3750	*5420	2950				*4540	2310	(45.7)
-4.5 m	kg	*8220	6060	*5890	3910	*4490	2810	*3590	2120	*2960	1660	*2490	1330				*2180	1170	13.20
	lb	*18120	13360	*12990	8620	*9900	6190	*7910	4670	*6530	3660	*5490	2930				*4810	2580	(43.3)
-6.0 m	kg	*8020	6130	*5840	3920	*4500	2790	*3600	2110	*2940	1660						*2310	1370	12.25
	lb	*17680	13510	*12870	8640	*9920	6150	*7940	4650	*6480	3660						*5090	3020	(40.2)
-7.5 m	kg	*7500	6310	*5550	4010	*4300	2850	*3420	2170	*2700	1730						*2430	1710	10.97
	lb	*16530	13910	*12240	8840	*9480	6280	*7540	4780	*5950	3810						*5360	3770	(36.0)
-9.0 m	kg	*6570	*6570	*4920	4200	*3790	3000	*2890	2320										
	lb	*14480	*14480	*10850	9260	*8360	6610	*6370	5110										
-10.5 m	kg	*4970	*4970	*3680	*3680														
	lb	*10960	*10960	*8110	*8110														

- 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

1) GENERAL BUCKET

		
0.80, 0.92, 1.10, 1.20 m ³ SAE heaped bucket	1.34 m ³ SAE heaped bucket	★0.52 m ³ SAE heaped bucket

Capacity		Width		Weight	Recommendation				
					5.68 m (18' 8") boom				8.2 m (26' 11") boom
SAE heaped	CECE heaped	Without side cutter	With side cutter		2.0 m arm (6' 7")	2.4 m arm (7' 10")	2.92 m arm (9' 7")	3.90 m arm (12' 10")	6.3 m arm (20' 8")
0.80 m ³ (1.05 yd ³)	0.70 m ³ (0.92 yd ³)	1070 mm (42.1")	1160 mm (45.7")	770 kg (1700 lb)	○	○	○	●	
0.92 m ³ (1.20 yd ³)	0.80 m ³ (1.05 yd ³)	1190 mm (46.9")	1280 mm (50.4")	820 kg (1810 lb)	○	○	○	●	
1.10 m ³ (1.44 yd ³)	0.96 m ³ (1.26 yd ³)	1375 mm (54.1")	1465 mm (57.7")		○	○	⊙	●	
1.20 m ³ (1.57 yd ³)	1.05 m ³ (1.37 yd ³)	1390 mm (54.7")	1480 mm (58.3")		○	⊙	●		
1.34 m ³ (1.75 yd ³)	1.17 m ³ (1.53 yd ³)	1525 mm (60.0")	1615 mm (63.6")		⊙	⊙	●		
★0.52 m ³ (0.68 yd ³)	0.45 m ³ (0.59 yd ³)	945 mm (37.2")	1020 mm (40.2")	460 kg (1010 lb)					⊙

★ : Long reach bucket/Amphibious bucket

○ Applicable for materials with density of 2000 kgf/m³ (3370 lbf/yd³) or less

⊙ Applicable for materials with density of 1600 kgf/m³ (2700 lbf/yd³) or less

● Applicable for materials with density of 1100 kgf/m³ (1850 lbf/yd³) or less

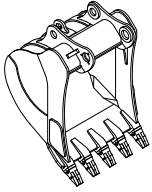
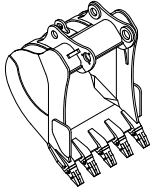
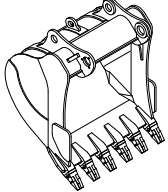
※ These recommendations are for general conditions and average use.

Work tools and ground conditions have effects on machine performance.

Select an optimum combination according to the working conditions and the type of work that is being done.

Consult your Hyundai dealer for information on selecting the correct boom–arm–bucket combination.

2) HEAVY DUTY AND ROCK-HEAVY DUTY BUCKET

		
◆ 0.90, 1.05 m ³ SAE heaped bucket	◆ 0.87 m ³ SAE heaped bucket	◆ 1.20m ³ SAE heaped bucket

Capacity		Width		Weight	Recommendation			
SAE heaped	CECE heaped	Without side cutter	With side cutter		5.85 m (19' 2") boom			
					2.0 m arm (6' 7")	2.4 m arm (7' 10")	2.92 m arm (9' 7")	3.90 m arm (12' 10")
◆ 0.90 m ³ (1.18 yd ³)	0.79 m ³ (1.03 yd ³)	1210 mm (47.6")	-		○	○	○	●
◆ 1.05 m ³ (1.37 yd ³)	0.92 m ³ (1.20 yd ³)	1355 mm (53.3")	-		○	○	⊙	●
◆ 0.87 m ³ (1.14 yd ³)	0.77 m ³ (1.01 yd ³)	1195 mm (47.0")	-		○	○	○	●
◆ 1.20 m ³ (1.57 yd ³)	1.05 m ³ (1.37 yd ³)	1520 mm (59.8")	-		⊙	●		

◆ : Heavy duty bucket ◆ : Rock-Heavy duty bucket

○ Applicable for materials with density of 2000 kgf/m³ (3370 lbf/yd³) or less

⊙ Applicable for materials with density of 1600 kgf/m³ (2700 lbf/yd³) or less

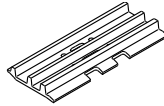
● Applicable for materials with density of 1100 kgf/m³ (1850 lbf/yd³) or less

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		Triple grouser			
						
HX220 L	Shoe width	mm (in)	600 (24)	700 (28)	800 (32)	900 (36)
	Operating weight	kg (lb)	22100 (48720)	22570 (49760)	22850 (50380)	23130 (50990)
	Ground pressure	kgf/cm ² (psi)	0.47 (6.68)	0.41 (5.83)	0.37 (5.26)	0.33 (4.69)
	Overall width	mm (ft-in)	2990 (9' 10")	3090 (10' 2")	3190 (10' 6")	3290 (10' 10")
HX220 L LONG REACH	Shoe width	mm (in)	-	-	800 (32)	-
	Operating weight	kg (lb)	-	-	24820 (54720)	-
	Ground pressure	kgf/cm ² (psi)	-	-	0.39 (5.55)	-
	Overall width	mm (ft-in)	-	-	3190 (10' 6")	-
HX220 L HIGH WALKER	Shoe width	mm (in)	600 (24)	700 (28)	800 (32)	710 (28)*
	Operating weight	kg (lb)	23560 (51940)	24030 (52980)	24310 (53590)	24040 (53000)
	Ground pressure	kgf/cm ² (psi)	0.50 (7.11)	0.44 (6.26)	0.39 (5.55)	0.43 (6.11)
	Overall width	mm (ft-in)	3395 (11' 2")	3495 (11' 6")	3595 (11' 10")	3505 (11' 6")

* : Double grouser

3) NUMBER OF ROLLERS AND SHOES ON EACH SIDE

Item	Quantity
Carrier rollers	2 EA
Track rollers	9 EA
Track shoes	49 EA

4) SELECTION OF TRACK SHOE

Suitable track shoes should be selected according to operating conditions.

Method of selecting shoes

Confirm the category from the list of applications in **table 2**, then use **table 1** to select the shoe. Wide shoes (categories B and C) have limitations on applications. Before using wide shoes, check the precautions, then investigate and study the operating conditions to confirm if these shoes are suitable.

Select the narrowest shoe possible to meet the required flotation and ground pressure. Application of wider shoes than recommendations will cause unexpected problem such as bending of shoes, crack of link, breakage of pin, loosening of shoe bolts and the other various problems.

※ **Table 1**

Track shoe	Specification	Category
600 mm triple grouser	Standard	A
700 mm triple grouser	Option	B
710 mm double grouser ★1	Option	B
800 mm triple grouser	Option	C
800 mm triple grouser (long reach)	Standard	C
900 mm triple grouser	Option	C

★1 : HIGH WALKER ONLY

※ **Table 2**

Category	Applications	Precautions
A	Rocky ground, river beds, normal soil	<ul style="list-style-type: none"> Travel at low speed on rough ground with large obstacles such as boulders or fallen trees
B	Normal soil, soft ground	<ul style="list-style-type: none"> These shoes cannot be used on rough ground with large obstacles such as boulders or fallen trees Travel at high speed only on flat ground Travel slowly at low speed if it is impossible to avoid going over obstacles
C	Extremely soft ground (swampy ground)	<ul style="list-style-type: none"> Use the shoes only in the conditions that the machine sinks and it is impossible to use the shoes of category A or B These shoes cannot be used on rough ground with large obstacles such as boulders or fallen trees Travel at high speed only on flat ground Travel slowly at low speed if it is impossible to avoid going over obstacles

8. SPECIFICATIONS FOR MAJOR COMPONENTS

1) ENGINE

Item	Specification
Model	Cummins QSB6.7
Type	4-cycle turbocharged, charger air cooled 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 type
Cylinder bore × stroke	107 × 124 mm (4.2" × 4.9")
Piston displacement	6700 cc (409cu in)
Compression ratio	17.3 : 1
Rated net horse power (SAE J1349)	173 Hp at 1950 rpm (129 kW at 1950 rpm)
Rated gross horse power (SAE J1995)	182.6 Hp at 1950 rpm (136 kW at 1950 rpm)
Maximum torque at 1500 rpm	81.6 kgf · m (590 lbf · ft)
Engine oil quantity	23.1 l (6.1 U.S. gal)
Wet weight	520 kg (1146 lb)
High idling speed	1900 ± 50 rpm
Low idling speed	850 ± 100 rpm
Rated fuel consumption	158.5 g/Hp · hr at 1950 rpm
Starting motor	Nippon denso (24 V-4.8 kW)
Alternator	Delco Remy (24 V-95 A)
Battery	2 × 12 V × 100 Ah

2) MAIN PUMP

Item	Specification
Type	Variable displacement tandem axis piston pumps
Capacity	2 × 117cc/rev
Maximum pressure	350kgf/cm ² (4980psi) [380 kgf/cm ² (5400 psi)]
Rated oil flow	2 × 222 l /min (58.6U.S. gpm/ 48.8U.K. gpm)
Rated speed	1900 rpm

[] : Power boost

3) GEAR PUMP

Item	Specification
Type	Fixed displacement gear pump single stage
Capacity	15 cc/rev
Maximum pressure	40 kgf/cm ² (570 psi)
Rated oil flow	28.5 l /min (7.5 U.S. gpm/6.3 U.K. gpm)

4) MAIN CONTROL VALVE

Item	Specification	
	HX220 L	HX220 L Long reach
Type	9 spools two-block	
Operating method	Hydraulic pilot system	
Main relief valve pressure	350 kgf/cm ² (4980 psi) [380 kgf/cm ² (5400 psi)]	
Port relief valve pressure	Boom	400 kgf/cm ² (5690 psi)
	Arm	400 kgf/cm ² (5690 psi) 300 kgf/cm ² (4270 psi)
	Bucket	400 kgf/cm ² (5690 psi) 280 kgf/cm ² (3980 psi)

[]: Power boost

5) SWING MOTOR

Item	Specification
Type	Two fixed displacement axial piston motor
Capacity	142.8 cc/rev
Relief pressure	265 kgf/cm ² (3770 psi)
Braking system	Automatic, spring applied hydraulic released
Braking torque	58 kgf/cm ² (420 psi)
Brake release pressure	21.3~35.6 kgf · m (154~257 lbf · ft)
Reduction gear type	2 - stage planetary

6) TRAVEL MOTOR

Item	Specification
Type	Variable displacement axial piston motor
Relief pressure	350 kgf/cm ² (4980 psi)
Reduction gear type	2-stage planetary
Braking system	Automatic, spring applied hydraulic released
Brake release pressure	15.2 kgf/cm ² (216 psi)
Braking torque	65.4 kgf · m (473 lbf · ft)

7) REMOTE CONTROL VALVE

Item		Specification
Type		Pressure reducing type
Operating pressure	Minimum	6.5 kgf/cm ² (92 psi)
	Maximum	25 kgf/cm ² (356 psi)
Single operation stroke	Lever	90 mm (3.5 in)
	Pedal	130 mm (4.4 in)

8) CYLINDER

Item		Specification
Boom cylinder	Bore dia × Rod dia × Stroke	∅ 120 × ∅ 85 × 1290 mm
	Cushion	Extend only
Arm cylinder	Bore dia × Rod dia × Stroke	∅ 140 × ∅ 100 × 1510 mm # ∅ 140 × ∅ 100 × 1460 mm
	Cushion	Extend and retract
Bucket cylinder	Bore dia × Rod dia × Stroke	∅ 120 × ∅ 85 × 1055 mm # ∅ 100 × ∅ 70 × 870 mm
	Cushion	Extend only

※ 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.

: LONG REACH

9) SHOE

Item		Width	Ground pressure	Link quantity	Overall width
HX220 L	Standard	600 mm (24")	0.47 kgf/cm ² (6.68 psi)	49	2990 mm (9' 10")
	Option	700 mm (28")	0.41 kgf/cm ² (5.83 psi)	49	3090 mm (10' 2")
		800 mm (32")	0.37 kgf/cm ² (5.26 psi)	49	3190 mm (10' 6")
		900 mm (36")	0.33 kgf/cm ² (4.69 psi)	49	3290 mm (10' 10")
HX220 L LONG REACH	Standard	800 mm (32")	0.39 kgf/cm ² (5.55 psi)	49	3190 mm (10' 6")
HX220 L HIGH WALKER	Standard	600 mm (24")	0.50 kgf/cm ² (7.11 psi)	49	3395 mm (11' 2")
	Option	700 mm (28")	0.44 kgf/cm ² (6.26 psi)	49	3495 mm (11' 6")
		800 mm (32")	0.39 kgf/cm ² (5.55 psi)	49	3595 mm (11' 10")
		※ 710 mm (28")	0.43 kgf/cm ² (6.11 psi)	49	3505 mm (11' 6")

※ : Double grouser

10) BUCKET

Item	Capacity		Tooth quantity	Width	
	SAE heaped	CECE heaped		Without side cutter	With side cutter
HX220 L	0.80 m ³ (1.05 yd ³)	0.70 m ³ (0.92 yd ³)	5	1070 mm (42.1")	1160 mm (45.7")
	0.92 m ³ (1.20 yd ³)	0.80 m ³ (1.05 yd ³)	5	1190 mm (46.9")	1280 mm (50.4")
	1.10 m ³ (1.44 yd ³)	0.96 m ³ (1.26 yd ³)	5	1375 mm (54.1")	1465 mm (57.7")
	1.20 m ³ (1.57 yd ³)	1.05 m ³ (1.37 yd ³)	5	1390 mm (54.7")	1480 mm (58.3")
	1.34 m ³ (1.75 yd ³)	1.17 m ³ (1.53 yd ³)	6	1525 mm (60.0")	1615 mm (63.6")
	★0.52 m ³ (0.68 yd ³)	0.45 m ³ (0.59 yd ³)	5	945 mm (37.2")	1020 mm (40.2")
	◆0.90 m ³ (1.18 yd ³)	0.79 m ³ (1.03 yd ³)	5	1210 mm (47.6")	-
	◆1.05 m ³ (1.37 yd ³)	0.92 m ³ (1.20 yd ³)	5	1355 mm (53.3")	-
	◎0.87 m ³ (1.14 yd ³)	0.77 m ³ (1.01 yd ³)	5	1195 mm (47.0")	-
	◎1.20 m ³ (1.57 yd ³)	1.05 m ³ (1.37 yd ³)	6	1520 mm (59.8")	-

★ : Long reach bucket

◆ : Heavy duty bucket

◎ : Rock-heavy duty bucket

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)						
			-50 (-58)	-30 (-22)	-20 (-4)	-10 (14)	0 (32)	10 (50)	20 (68)
Engine oil pan	Engine oil	23.1 (6.1)	★SAE 5W-40						
			SAE 30						
			SAE 10W						
			SAE 10W-30						
			SAE 15W-40						
DEF/ AdBlue® tank	Mixture of urea and deionized water	27.0 (7.1)	ISO 22241, High-purity urea + deionized water (32.5:67.5)						
Swing drive	Gear oil	7.0 (1.8)	★SAE 75W-90						
Final drive		6.0×2 (1.6×2)	SAE 85W-140						
Hydraulic tank	Hydraulic oil	Tank : 160 (42.3) System : 275 (72.6)	★ISO VG 15						
			ISO VG 32						
			ISO VG 46						
			ISO VG 68						
Fuel tank	Diesel fuel★1	400 (106)	★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 soft water★2	40 (10.6)	Ethylene glycol base permanent type (50 : 50)						
			★Ethylene glycol base permanent type (60 : 40)						

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

DEF : Diesel Exhaust Fluid

DEF compatible with AdBlue®

★ : Cold region

Russia, CIS, Mongolia

★1 : Ultra low sulfur diesel

- sulfur content ≤ 15 ppm

★2 : Soft water

City water or distilled water