

WSM

WORKSHOP MANUAL **KUBOTA EXCAVATOR**

KX61-3, KX71-3

Mechanism Chapter

Kubota

Record of Revisions

Symbol	Date	Main Revised Points & Corrective Measures	Person-in-charge
△1			
△2			
△3			
△4			

KX61-3 EU and KX71-3 EU are for EU(European) - version.
KX71-3 PP is for KTC, KCL and KTA - version.

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I. General

a. Sales feature

Product concept : Comfort in compact

(1) Grade up the basic performance; Digging, filling back and lifting capacity

(2) Grade up product feature to differentiate competitor; Digital meter, hose protection

Workability	Bucket digging force improvement Variable pump adoption Boom and SP simultaneous operation The maximum digging depth priority High level stability
Maintenance	Blade hose division New digital meter adoption
Amenity	Much easier access into cabin Cabin width expansion
Operativity	Straight travel adoption Smoother operation
Safety	Engine safety start Travel lock system ROPS, FOPS standard equipment

b. Difference between KX61-3 and KX71-3

	Differentiation	KX61-3	KX71-3	Remark
No1.	Engine	V1505 (24.8 PS)	V1505 (27.5PS)	
No2.	Bucket digging forth	2190 kgf	2570 kgf	Bucket cylinder is different
No3.	Working area (Arm length)	1300 mm	1350 mm	Boom is different
No4.	New digital meter	Equipped	Equipped	
No5.	Variable track specification	Not adopted	Not adopted	
No6.	Travel speed	Two speed	Two speed	
No7.	Straight travel	Equipped	Equipped	
No8.	Seat grade	High back seat	High back seat	
No9.	Roof window of the cabin	Not equipped	Not equipped	

c. Quick chart for selling points : KX61-3, KX71-3



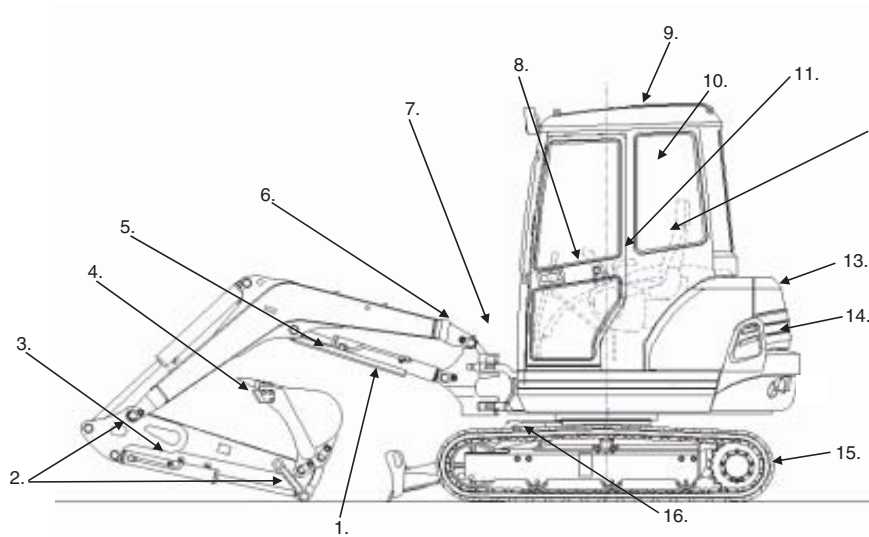
Short stroke operating lever and wrist rest



Digital panel with new navigation system



High speed travel switch on the dozer lever



Best matching of variable displacement hydraulic pump and Kubota new diesel engine

V1505, 24.8HP 2100rpm (KX61-3)
V1505, 27.5HP 2300rpm (KX71-3)

1. Reinforced boom cylinder protector
2. Iron bush
3. Bucket cylinder hoses are inside.
4. Bucket breakout force is No.1 in the class.
5. Upgraded lifting capacity
6. Front hose cover for clear view
7. Front hoses go inside the swing bracket.
8. Travel safety lock system
9. Rops / Fops
10. Low noise level
11. Wrist rest control lever
12. New digital panel (Kubota I.C.S)
13. Double full open bonnet
14. 4-cylinder engine
15. Reinforced rubber track
16. Separate-type dozer cylinder hose

d. Comparison to competitors;EU - version

A:Advantage, B:Equal

■, □ : Salers points

	Advantage	VS Current model		Items	Standard type (2.5 ~ 2.8t class)					Standard type (2.8 ~ 3.0t class)					
		New	Continued		KX61-3	KX61-2α	B25V	Neuson 2503	Bobcat 325	KX71-3	KX71-2α	Takeuchi TB125	Bobcat 328	VOLVO EC25	
Workability	A	■	★	Big displacement, 4 cylinder engine	4	3	3	3	3	4	4	3	3	3	
			★	Variable displacement pump, large discharge	V2	V2	V2	V2	V2	V2	G	V2	V2	V1	
		■	★	Lifting capacity (KN)	4.9	4.3	4.2	3.5	*	5.5	4.2	3.9	3.0	4.3	
		■	★	Bucket digging force (KN) upgraded, reinforced arm	21.5	21.5	20.0	19.3	21.2	25.2	24.6	20.6	21.2	21.8	
			★	Large working space (Long arm)	○	○	×	×	×	○	○	○	×	○	
	B		★	Swivel motor negative brake	○	×	○	○	×	○	×	○	×	○	○
		★	Standard third line	○	×	○	○	○	○	×	○	○	○	×	
Durability	A	□	★	Front hoses in the swing bracket	○	×	×	×	△	○	×	×	△	×	
			★	Rugged boom cylinder protector	○	×	×	×	×	○	×	×	×	×	
		□		★	Swing bracket bush	○	×	○	×	×	○	×	×	×	×
	B			★	Bucket cylinder hose inside	○	○	×	○	×	○	○	○	×	×
				★	Rugged rubber track (300 mm)	○	×	○	×	○	○	×	○	○	○
				★	Line filter in the pilot system	○	×	*	*	*	○	×	*	*	*
Maintenance	A	■	★	Double full open bonnet	○	×	△	○	△	○	×	△	△	○	
				★	Separate-type dozer cylinder hose	○	○	○	×	○	○	○	×	○	×
	B		★	upper roller	○	×	○	○	×	○	×	○	×	○	
				★	Tool box	○	×	*	*	*	○	○	*	*	*
				★	Track frame shape	One angle	Angle	Flat	Angle	Flat	One angle	Angle	Angle	Flat	Angle
Comfortability	A	■	★	New digital panel	○	×	×	×	×	○	×	×	×	×	
	B			★	Noise level at ear (dBA)	78	79	78	74	80	78	79	77	80	80
Operability	A		★	Auto glow, easy start	○	×	*	*	*	○	×	*	*	*	
				★	Wrist rest control	○	×	○	×	○	○	×	○	○	○
	B			★	Smooth control fuling	○	○	○	×	×	○	○	○	×	○
		□	★	Large fuel tank	○ 45	28	29	41	53.3	×	63	51	53.3	49	
Safety	A	□	★	Rops/Fops cab, 4P canopy	○	Tops/Fops	○ (OP)	○	Rops/	○	Tops/Fops	Tops/Fops	Rops/	○	
				★	Front hose cover	○	×	×	×	×	○	×	×	×	×
	B			★	Stability (Front, KN)	4,1	3,2	4,8	4,1	3,5	4,4	4,1	3,9	4,0	3,7
		□	★	Travel safety lock	○	×	○	○	○	○	×	○	○	○	○

e. Components compatibility

							
		Parent	100% compatible	high compatible		low compatible	Original design
No.	Components	U20-3	U25-3	KX71-3(PP)	KX61-3(EU)	KX71-3(EU)	Remark
1	Track frame						
2	Front idler						
3	Track tension						
4	Track roller						
5	Upper roller						KX91-3
6	Track shoe						W=300mm, 80 links
7	Swivel bearing						Different maker
8	Seat						Full suspension seat
9	Swivel frame						
10	Engine mount						V1505
11	Pump mount						Different coupling maker
12	Bonnet						Different maker
13	Control box cover						
14	Canopy						≠ KX71-3
15	Cab						≠ KX71-3
16	Weight						
17	Fuel tank						Different maker
18	Electrical components						
							
							
19	Label						
20	Hydro pump						Fujikoshi
21	Control valve						NA: Nabuco, EU: Hidra control
22	Swivel motor						
23	Travel motor						EU: Transmittel & Kayaba NA: Kubota Seiki
24	Oil tank						
25	Swivel joint						
26	Pilot valve						EU: Joystick type NA = KX121-3
27	Swing bracket						
28	Boom						
29	Arm						
30	Bucket link						
31	Bucket						NA = KX91-3
32	Dozer blade						Different maker
33	Swing cyl.						Different maker
34	Boom cyl.						Different maker
35	Arm cyl.						Different maker
36	Bucket cyl.						Different maker
37	Dozer cyl.						Different maker

f. Machine specifications

		Unit	KX61-3 EU	KX71-3 EU	KX71-3 PP
Engine					
Type			Vertical, water-cooled 4 cycle, 4 cylinders diesel		
Model			V1505-E2-BH-9-EU	V1505-E2-BH-10-EU	V1505-E2-BH-10
Output power (ISO 3406m Gross)		kW PS	18.3 kW/2100rpm 24.9 PS/2100rpm	20.6 kW/2300rpm 28.0 PS/2300rpm	← (SAE-J1349)
Displacement		cc	1498	1498	←
Dimensions					
Overall length	STD/Long	mm (in)	4270 / 4310	4520 / 4550	4550 (179.1)
Overall width		mm (in)	1400	1500	← (59.1)
Overall crawler width		mm (in)	1400	1500	← (59.1)
Overall height	Canopy	mm (in)	2430	2430	← (95.7)
	Cabin	mm (in)	2410	2410	← (94.9)
Min. ground clearance		mm (in)	305	←	← (12.0)
Max. digging depth	STD. Arm	mm (in)	2490	2680	—
	Long Arm	mm (in)	2740	2870	2970 (116.9)
Max. digging height	STD. Arm	mm (in)	4360	4470	—
	Long Arm	mm (in)	4540	4600	4700 (185.0)
Max. digging radius	STD. Arm	mm (in)	4480	4700	—
	Long Arm	mm (in)	4720	4890	4990 (196.5)
Max. dumping height	STD. Arm	mm (in)	3060	3170	—
	Long Arm	mm (in)	3240	3300	3180 (125.2)
Swing angle (left/right)		deg	78 / 57	←	←
Travel speed	Low speed R/L	km/h (m/h)	2.8 / 2.7	2.7 / 2.6	2.6 (1.6) / 2.6 (1.6)
	High speed R/L	km/h (m/h)	4.4 / 4.3	4.6 / 4.5	4.5 (2.8) / 4.4 (2.7)
Swing speed		rpm	9.5	9.4	←
Max. traction force	Low speed	kN (kgf) lbw	20.2 (2060)	22.3 (2275)	22.1 (2250) 4960
	High speed	kN (kgf) lbw	11.7 (1193)	14.6 (1490)	11.1 (1130) 2491
Performance					
Tumbler distance		mm (in)	1560	←	← (61.4)
Tread		mm (in)	1100	1200	← (47.2)
Crawler width × No. of shoe × pitch	Rubber	mm (in)	300 × 53 × 80	←	←
Bucket					
Capacity CECE heaped		m ³ (yd ³)	0.06	0.07	0.08 (0.06)
Width		mm (in)	450	480	450 (17.7)
Dozer					
Width × height		mm (in)	1400 × 300	1500 × 300	← (59.1 × 11.8)
Lift above GL / below GL		mm (in)	350 × 310	370 × 350	340 × 300 (13.4 × 12.2)

Note:Kubota Japan Bucket

g. Machine weight

kgf
(lbs)

	Track	Arm	KX61-3 EU	KX71-3 EU	KX71-3 PP
Canopy	Rubber	STD	2530 (5566)	2720 (5984)	—
		Long	2540 (5588)	2730 (6006)	2780 (6116)
	Iron	STD	2625 (5775)	2815 (6193)	—
		Long	2630 (5786)	2825 (6215)	2875 (6325)
Cab	Rubber	STD	2640 (5808)	2830 (6226)	—
		Long	2650 (5830)	2840 (6248)	2890 (6358)
	Iron	STD	2735 (6017)	2925 (6435)	—
		Long	2745 (6039)	2935 (6457)	2985 (6567)
Cab (Light weight)	Rubber	STD	2580 (5676)	—	—
		Long	2590 (5698)	—	—
	Iron	STD	2675 (5885)	—	—
		Long	2685 (5907)	—	—

(Note : Cab - canopy = 105 kgf, Iron track - rubbertrack = 95 kgf, Long arm - STD arm = 10 kgf)

h. Quality specifications

Machine specifications : Service port, Wrist rest, STD and Long arm, FM-cab or canopy, KBM & KBT bucket

No		Specificatios Items			Unit	KX61-3 EU		KX71-3 EU		KX71-3 PP		Remarks
						Std value	Allowable range	Std value	Allowable range	Std value	Allowable range	
Q1		Main Specs. JIS A8404										
1	1	Machine size	Total length (Transport)		mm	4270.0	4185.0 to 4355.0	4520.0	4430.0 to 4610.0	4550.0	4459.0 to 4641.0	
					inch	168.1	164.8 to 171.5	178.0	174.4 to 181.5	179.1	175.6 to 182.7	
	(Long)			mm	4310.0	4224.0 to 4396.0	4550.0	4459.0 to 4641.0	-	-		
				inch	169.7	166.3 to 173.1	179.1	175.6 to 182.7	-	-		
	Total width			mm	1400.0	1386.0 to 1414.0	1500.0	1485.0 to 1515.0	←	←		
				inch	55.1	54.6 to 55.7	59.1	58.5 to 59.6	←	←		
	Total height (Canopy)			mm	2430.0	2406.0 to 2545.0	←	←	←	←		
				inch	95.7	94.7 to 100.2	←	←	←	←		
	Total height (Cabin)		mm	2410.0	2386.0 to 2434.0	←	←	←	←			
			inch	94.9	93.9 to 95.8	←	←	←	←			
2	1	Weight	Machine weight (Canopy)		kg	2540.0	2515.0 to 2565.0	2730.0	2703.0 to 2757.0	2780.0	2724.0 to 2836.0	Fuel tank,full, lub. oil and water are specified amount.
	lbs				5599.7	5544.6 to 5654.8	6018.6	5959.0 to 6078.1	6128.8	6005.3 to 6252.2		
	Machine weight (Cabin)			kg	2650.0	2624.0 to 2677.0	2840.0	2812.0 to 2868.0	2890.0	2832.0 to 2948.0		
				lbs	5842.2	5784.9 to 5901.7	6261.1	6199.3 to 6322.8	6371.3	6243.4 to 6499.2		
	Machine weight (Light duty cab)			kg	2580.0	2554.0 to 2606.0	-	-	-	-		
				lbs	5687.9	5630.5 to 5745.2	-	-	-	-		
3	1	Performance	Swivel speed	L	rpm	9.5	8.6 to 10.5	9.4	8.5 to 10.3	←	←	
	R			rpm	9.5	8.6 to 10.5	9.4	8.5 to 10.3	←	←		
	Travel speed		Rubber F1	km/h	2.8	2.5 to 3.1	2.7	2.4 to 3.0	2.6	2.3 to 2.9		
				mph	1.7	1.6 to 1.9	1.7	1.5 to 1.9	1.6	1.4 to 1.8		
			Rubber F2	km/h	4.4	4.0 to 4.8	4.6	4.1 to 5.1	4.5	4.1 to 5.0		
				mph	2.7	2.5 to 3.0	2.9	2.5 to 3.2	2.8	2.5 to 3.1		
			Iron F1	km/h	2.7	2.4 to 3.0	2.6	2.3 to 2.9	←	←		
				mph	1.7	1.5 to 1.9	1.6	1.4 to 1.8	←	←		
			Iron F2	km/h	4.3	3.9 to 4.7	4.5	4.1 to 5.0	4.4	4.0 to 4.8		
				mph	2.7	2.4 to 2.9	2.8	2.5 to 3.1	2.7	2.5 to 3.0		
7	Gradeability		deg	30.0	30.0 <	←	←	←	←			





No		Specifications Items			Unit	KX61-3 EU		KX71-3 EU		KX71-3 PP		Remarks	
						Std value	Allowable range	Std value	Allowable range	Std value	Allowable range		
4	1	Rear end min. turning radius			mm	1160.0	1137.0 to 1183.0	1200.0	1176.0 to 1224.0	←	←		
					inch	45.7	44.8 to 46.6	47.2	46.3 to 48.2	←	←		
	2	Swivel frame rear ground clearance			mm	530.0	519.0 to 541.0	←	←	←	←		
					inch	20.9	20.4 to 21.3	←	←	←	←		
	3	Tambler center distance			mm	1560.0	1513.0 to 1607.0	←	←	←	←		
					inch	61.4	59.6 to 63.3	←	←	←	←		
	4	Crawler total length			mm	1990.0	1930.0 to 2050.0	←	←	←	←		
					inch	78.3	76.0 to 80.7	←	←	←	←		
	5	Crawler total width			mm	1400.0	1920.0 to 2000.0	1500.0	1920.0 to 2000.0	←	←		
					inch	55.1	75.6 to 78.7	59.1	75.6 78.7	←	←		
	6	Min. ground clearance			mm	305.0	296.0 to 314.0	←	←	←	←		
					inch	12.0	11.7 to 12.4	←	←	←	←		
M1-10	5	Front attachment	Bucket heaped capacity	CECE	m3	0.040	0.038 to 0.042	0.050	0.048 to 0.052	0.060	0.058 to 0.062		
					yd3	0.052	0.050 to 0.055	0.065	0.063 to 0.068	0.078	0.076 to 0.081		
				SAE, JIS	m3	0.060	0.058 to 0.062	0.070	0.067 to 0.073	0.080	0.077 to 0.083		
					yd3	0.078	0.076 to 0.081	0.092	0.088 to 0.095	0.105	0.101 to 0.109		
			Bucket width		mm	450.0	540.0 to 560.0	480.0	540.0 to 560.0	450.0	540.0 to 560.0	Without side cutter	
					inch	17.7	21.3 to 22.0	18.9	21.3 to 22.0	17.7	21.3 to 22.0		
			Swing angle	L	deg	78.0	76.0 to 80.0	←	←	←	←		
					R	deg	57.0	55.0 to 59.0	←	←	56.0		54.0 to 58.0
			8	Max. digging radius		mm	4480.0	4413.0 to 4547.0	4700.0	4630.0 to 4771.0	4990.0	4915.0 to 5065.0	
						inch	176.4	173.7 to 179.0	185.0	182.3 to 187.8	196.5	193.5 to 199.4	
					(Long)	mm	4720.0	4649.0 to 4791.0	4890.0	4817.0 to 4963.0	-	-	
						inch	185.8	183.0 to 188.6	192.5	189.6 to 195.4	-	-	
	9	Ground level Max. digging radius"		mm	4350.0	4285.0 to 4415.0	4580.0	4511.0 to 4649.0	4880.0	4807.0 to 4953.0			
				inch	171.3	168.7 to 173.8	180.3	177.6 to 183.0	192.1	189.3 to 195.0			
			(Long)	mm	4600.0	4531.0 to 4669.0	4770.0	4698.0 to 4842.0	-	-			
				inch	181.1	178.4 to 183.8	187.8	185.0 to 190.6	-	-			
	10	Ground level Min. finish radius"		mm	1520.0	1474.0 to 1566.0	1550.0	1504.0 to 1597.0	1430.0	1387.0 to 1473.0	Bucket bottom horizontal		
				inch	59.8	58.0 to 61.7	61.0	59.2 to 62.9	56.3	54.6 to 58.0			
			(Long)	mm	1380.0	1339.0 to 1421.0	1430.0	1387.0 to 1473.0	-	-			
				inch	54.3	52.7 to 55.9	56.3	54.6 to 58.0	-	-			

M-I-10

KX61-3, KX71-3 WSM-M

General

No	Specificatio	Items		Unit	KX61-3 EU		KX71-3 EU		KX71-3 PP		Remarks
					Std value	Allowable range	Std value	Allowable range	Std value	Allowable range	
5	11	Max. digging depth	(Long)	mm	2490.0	2440.0 to 2540.0	2680.0	2626.0 to 2734.0	2970.0	2911.0 to 3029.0	
				inch	98.0	96.1 to 100.0	105.5	103.4 to 107.6	116.9	114.6 to 119.3	
				mm	2740.0	2685.0 to 2795.0	2870.0	2813.0 to 2927.0	-	-	
				inch	107.9	105.7 to 110.0	113.0	110.7 to 115.2	-	-	
	12	Max. vertical digging depth	(Long)	mm	2050.0	1989.0 to 2112.0	2260.0	2192.0 to 2328.0	1900.0	1843.0 to 1957.0	
				inch	80.7	78.3 to 83.1	89.0	86.3 to 91.7	74.8	72.6 to 77.0	
				mm	2290.0	2221.0 to 2359.0	2460.0	2386.0 to 2534.0	650.0	631.0 to 670.0	
				inch	90.2	87.4 to 92.9	96.9	93.9 to 99.8	25.6	24.8 to 26.4	
	13	Max. digging height	(Long)	mm	4360.0	4273.0 to 4447.0	4470.0	4381.0 to 4559.0	4700.0	4606.0 to 4794.0	
				inch	171.7	168.2 to 175.1	176.0	172.5 to 179.5	185.0	181.3 to 188.7	
				mm	4540.0	4449.0 to 4631.0	4600.0	4508.0 to 4692.0	4580.0	4488.0 to 4672.0	
				inch	178.7	175.2 to 182.3	181.1	177.5 to 184.7	180.3	176.7 to 183.9	
	15	Max. dump height	(Long)	mm	3060.0	2999.0 to 3121.0	3170.0	3107.0 to 3233.0	3180.0	3116.0 to 3244.0	
				inch	120.5	118.1 to 122.9	124.8	122.3 to 127.3	125.2	122.7 to 127.7	
				mm	3240.0	3175.0 to 3305.0	3300.0	3234.0 to 3366.0	-	-	
				inch	127.6	125.0 to 130.1	129.9	127.3 to 132.5	-	-	
	17	Max. dump height (Arm vertical)	(Long)	mm	1270.0	1232.0 to 1308.0	1280.0	1242.0 to 1318.0	1040.0	1009.0 to 1071.0	
				inch	50.0	48.5 to 51.5	50.4	48.9 to 51.9	40.9	39.7 to 42.2	
				mm	1030.0	999.0 to 1061.0	1080.0	1048.0 to 1112.0	-	-	
				inch	40.6	39.3 to 41.8	42.5	41.3 to 43.8	-	-	
	19	Front straight	(Long)	mm	1830.0	1775.0 to 1885.0	1840.0	1785.0 to 1895.0	1940.0	1882.0 to 1998.0	
				inch	72.0	69.9 to 74.2	72.4	70.3 to 74.6	76.4	74.1 to 78.7	
				mm	1880.0	1824.0 to 1936.0	1870.0	1814.0 to 1926.0	-	-	
				inch	74.0	71.8 to 76.2	73.6	71.4 to 75.8	-	-	
		Full swing position	(Long)	mm	1430.0	1387.0 to 1473.0	1440.0	1397.0 to 1483.0	1580.0	1533.0 to 1627.0	
				inch	56.3	54.6 to 58.0	56.7	55.0 to 58.4	62.2	60.4 to 64.1	
				mm	1480.0	1436.0 to 1524.0	1490.0	1445.0 to 1535.0	-	-	
				inch	58.3	56.5 to 60.0	58.7	56.9 to 60.4	-	-	
6	Dozer	Width		mm	1400.0	1395.0 to 1405.0	1500.0	1495.0 to 1505.0	←	←	
				inch	55.1	54.9 to 55.3	59.1	58.9 to 59.3	←	←	
		Height		mm	300.0	290.0 to 310.0	←	←	←	←	
				inch	11.8	11.4 to 12.2	←	←	←	←	





No		Specificatio s Items			Unit	KX61-3 EU		KX71-3 EU		KX71-3 PP		Remarks
						Std value	Allowable range	Std value	Allowable range	Std value	Allowable range	
6	3		Max. lift above GL		mm	350.0	300.0 to 400.0	370.0	320.0 to 420.0	340.0	290.0 to 390.0	
					inch	13.8	11.8 to 15.7	14.6	12.6 to 16.5	13.4	11.4 to 15.4	
	4		Max. below GL		mm	310.0	260.0 to 360.0	350.0	300.0 to 400.0	310.0	260.0 to 360.0	
					inch	12.2	10.2 to 14.2	13.8	11.8 to 15.7	12.2	10.2 to 14.2	
Q2		Main Specs JIS A8404										
1	1	Bucket tooth slaggish			mm	60.0	73.0 >	←	←	←	←	Pushing force;30kgf
					inch	2.4	2.9 >	←	←	←	←	
	2	Front boom declina- tion			mm	0.0	10.0 >	←	←	←	←	
					inch	0.0	0.4 >	←	←	←	←	
	3	Dozer's declination			mm	3.0	10.0 >	←	←	←	←	
					inch	0.1	0.4 >	←	←	←	←	
2	1	Distance to teeth from boom cylinder			mm	45.0	41.0 to 50.0	35.0	32.0 to 39.0	40.0	36.0 to 44.0	
					inch	1.8	1.6 to 2.0	1.4	1.3 to 1.5	1.6	1.4 to 1.7	
3	1	Approach angle			deg	35.0	32.0 to 39.0	31.5	28.0 to 35.0	30.0	27.0 to 33.0	
4	1	Crawler height			mm	430.0	421.0 to 439.0	←	←	←	←	Include grouser on the spocket
					inch	16.9	16.6 to	←	←	←	←	
	2	Max. crawler height			mm	445.0	436.0 to 454.0	←	←	465.0	456.0 to 474.0	
					inch	17.5	17.2 to 17.9	←	←	18.3	18.0 to 18.7	
Q3		Engine performance										
1	1	Max. engine rpm	no load	rpm	2300.0	2300.0 >	2500.0	2500.0 >	←	←		
	2		1 pump relief	rpm	-	-	-	-	-	-		
	3		2 pump relief	rpm	-	-	-	-	-	-		
	4		3 pump relief	rpm	-	-	-	-	-	-	Boom, arm, swivel	
	5		2 pump relief	rpm	2100.0	2000.0 <	2300.0	2200.0 <	←	←		
	6		Dozer+2 pump relief	rpm	2100.0	2000.0 <	2300.0	2200.0 <	←	←		
2	1	Idler		rpm	1100.0	1050.0 to 1150.0			←	←	Cab:1500rpm	
Q4		Travelling performance										
1	1	Travel motor block performance	L	mm	270.0	300.0 >	280.0	300.0 >	←	←	On the 20 deg. slope, 10 min, engine stop condition, travel stance, oil temp. 50degree centi.	
				inch	10.6	11.8 >	11.0	11.8 >	←	←		
	2		R	mm	270.0	300.0 >	280.0	300.0 >	←	←		
				inch	10.6	11.8 >	11.0	11.8 >	←	←		

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KX61-3, KX71-3 WSM-M

General

No	Specificatio Items				Unit	KX61-3 EU		KX71-3 EU		KX71-3 PP		Remarks
						Std value	Allowable range	Std value	Allowable range	Std value	Allowable range	
2	1	Max. Traction force	F1		kgf	2060.4	1856.4 <	2274.6	2050.2 <	2254.2	2029.8 <	Oil temp. 50 degree centi., travel stance, F1:slip, 70% of absolute traction force, F2:Relief, 60 % of absolute traction force
					kN	20.2	18.2 <	22.3	20.1 <	22.1	19.9 <	
					lbw	4542.4	4092.7 <	5014.6	4519.9 <	4969.7	4474.9 <	
			F2		kgf	1193.4	1071.0 <	1489.2	1336.2 <	1132.2	1020.0 <	
					kN	11.7	10.5 <	14.6	13.1 <	11.1	10.0 <	
					lbw	2631.0	2361.1 <	3283.1	2945.8 <	2496.1	2248.7 <	
3	1	Travel straightness	F1		mm	600.0	600.0 >	←	←	←	←	10m distance, engine max.speed, oil temp.50 degree centi.
					inch	23.6	23.6 >	←	←	←	←	
			F2		mm	600.0	600.0 >	←	←	←	←	
					inch	23.6	23.6 >	←	←	←	←	
			Dozer F1		mm	600.0	600.0 >	←	←	←	←	Dozer up & down 10m distance
					inch	23.6	23.6 >	←	←	←	←	
			Dozer R1		mm	600.0	600.0 >	←	←	←	←	
					inch	23.6	23.6 >	←	←	←	←	
4	1	Track shoe sag distance	Iron		mm	75.0	75.0 to 80.0	←	←	←	←	
					inch	3.0	3.0 to 3.1	←	←	←	←	
			Rubber		mm	10.0	10.0 to 15.0	←	←	←	←	
					inch	0.4	0.4 to 0.6	←	←	←	←	
Q5	Work performance											
1	1	Boom lifting capacity			kgf	499.8	448.8 <	489.6	438.6 <	360.0	326.4 <	Front end, Arm extend bucket crowd, at tooth
					kN	4.9	4.4 <	4.8	4.3 <	3.5	3.2 <	
					lbw	1101.9	989.4 <	1079.4	966.9 <	793.7	719.6 <	
	2	Arm digging force			kgf	1499.4	1428.0 <	1795.2	1703.4 <	1485.0	1407.6 <	Bucket tooth root
					kN	14.7	14.0 <	17.6	16.7 <	14.6	13.8 <	
					lbw	3305.6	3148.2 <	3957.7	3755.3 <	3273.9	3103.2 <	
			(Long)		kgf	1264.8	1203.6 <	1652.4	1570.8 <	-	-	Machine stance to JIS bucket tooth root
					kN	12.4	11.8 <	16.2	15.4 <	-	-	
					lbw	2788.4	2653.5 <	3642.9	3463.0 <	-	-	
	4	Bucket digging force	Crowd	kgf	2193.0	2080.8 <	2570.4	2437.8 <	2160.0	2050.2 <		
				kN	21.5	20.4 <	25.2	23.9 <	21.2	20.1 <		
				lbw	4834.7	4587.4 <	5666.8	5374.4 <	4762.0	4519.9 <		



No		Specificatios Items			Unit	KX61-3 EU		KX71-3 EU		KX71-3 PP		Remarks
						Std value	Allowable range	Std value	Allowable range	Std value	Allowable range	
1	5			Power hole	kgf	-	-	-	-	2880.0	2754.0 <	
					kN	-	-	-	-	28.4	27.0 <	
					lbw	-	-	-	-	6349.3	6071.5 <	
	6	Dozer force		down	kgf	1723.8	1642.2 <	2130.0	2019.6 <	←	←	Cutting edge down force at ground level
					kN	16.9	16.1 <	20.9	19.8 <	←	←	
					lbw	3800.3	3620.4 <	4695.8	4452.5 <	←	←	
2	Boom speed	Canopy	up 1st	sec	2.6	2.3 to 2.9	2.4	2.1 to 2.7	←	←	Oil temp. 50±5°C(122±41°F) Ground to max. height (exculude cushioning)	
			up 2nd	sec	4.2	3.9 to 4.5	4.3	4.0 to 4.6	4.0	3.7 to 4.3		
			down	sec	2.6	2.3 to 2.9	2.3	2.0 to 2.6	2.4	2.1 to 2.7		
			down	sec	4.0	3.7 to 4.3	3.9	3.6 to 4.2	3.8	3.5 to 4.1		
3	Arm speed		crowd	sec	2.6	2.3 to 2.9	3.0	2.7 to 3.3	2.9	2.6 to 3.2		
			extend	sec	2.6	2.3 to 2.9	3.0	2.7 to 3.3	2.9	2.6 to 3.2		
4	Bucket speed		crowd	sec	2.7	2.4 to 3.0	2.8	2.5 to 3.1	←	←	Oil temp. 50±5°C(122±41°F)	
			dump	sec	1.9	1.6 to 2.2	←	←	←	←		
5	Dozer speed		G to up	sec	0.8	0.5 to 1.1	←	←	←	←	Ground to max. up	
			Max up	sec	2.3	2.0 to 2.6	2.2	1.9 to 2.5	←	←	Max. up to max. down	
			G to down	sec	1.0	0.7 to 1.3	←	←	←	←		
			Max. down	sec	3.0	2.7 to 3.3	2.8	2.5 to 3.1	←	←		
6	Arm cylinder cavitation			mm	0.0	5.0 >	←	←	←	←	Oil temp. 95±5°C(203±41°F)	
				inch	0.0	0.2 >	←	←	←	←		←
7	1	Max. digging height radius			mm	2210.0	1989.0 to 2431.0	2490.0	2241.0 to 2739.0	-	- - - -	
					inch	87.0	78.3 to 95.7	98.0	88.2 to 107.8	-	- - - -	
				(Long)	mm	2390.0	2151.0 to 2629.0	2650.0	2385.0 to 2915.0	2650.0	2385.0 to 2915.0	
					inch	94.1	84.7 to 103.5	104.3	93.9 to 114.8	104.3	93.9 to 114.8	
	3	Max. dump height radius			mm	2500.0	2350.0 to 2650.0	2210.0	2077.0 to 2343.0	-	- - - -	at bucket pin
					inch	98.4	92.5 to 104.3	87.0	81.8 to 92.2	-	- - - -	
				(Long)	mm	2670.0	2510.0 to 2830.0	2430.0	2284.0 to 2576.0	2530.0	2378.0 to 2682.0	
					inch	105.1	98.8 to 111.4	95.7	89.9 to 101.4	99.6	93.6 to 105.6	
	5	Bucket bottom height at arm vertical			mm	1550.0	1504.0 to 1597.0	1560.0	1513.0 to 1607.0	-	- - - -	Bucket horizontal
					inch	61.0	59.2 to 62.9	61.4	59.6 to 63.3	-	- - - -	
	6		(Long)		mm	1310.0	1271.0 to 1349.0	1370.0	1329.0 to 1411.0	1320.0	1280.0 to 1360.0	
					inch	51.6	50.0 to 53.1	53.9	52.3 to 55.6	52.0	50.4 to 53.5	
	7	Bucket wrist angle			degree	180.0	177.0 to 183.0	185.0	182.0 to 188.0	←	←	

No		Specificatio s Items			Unit	KX61-3 EU		KX71-3 EU		KX71-3 PP		Remarks
						Std value	Allowable range	Std value	Allowable range	Std value	Allowable range	
Q6		Swivel, swing performance										
1	1	Swivel torque	L	kgf•m	438.6	377.4 <	489.6	418.2 <	420.0	357.0 <	Arm extend,show/ Quick	
				kN.m	4.3	3.7 <	4.8	4.1 <	4.1	3.5 <		
				ft•lbs	3172.4	2729.7 <	3541.3	3024.8 <	3037.9	2582.2 <		
	2		R	kgf•m	438.6	377.4 <	489.6	418.2 <	420.0	357.0 <		
				kN.m	4.3	3.7 <	4.8	4.1 <	4.1	3.5 <		
				ft•lbs	3172.4	2729.7 <	3541.3	3024.8 <	3037.9	2582.2 <		
2	1	Swivel angle	L	deg	21.3	19.0 <	18.8	17.0 <	16.0	14.0 <	Bucket load=JIS heaped×1.8	
			R	deg	21.3	19.0 <	18.8	17.0 <	16.0	14.0 <		
3	1	Swivel block perfor- mance	Engine stop	L	deg	0.0	5.0 >	←	←	←	←	On 20 degree slope, 1 min. bucket heaped capacity
				R	deg	0.0	5.0 >	←	←	←	←	
			Engine idle	L	deg	0.0	30.0 >	←	←	←	←	Lever lock release,
				R	deg	0.0	30.0 >	←	←	←	←	
4	1	Swivel start-up speed	L	sec	2.0	1.7 to 2.3	←	←	2.5	2.2 to 2.8	0 to 90 deg swivel, bucket heaped, engine Max.	
			R	sec	2.0	1.7 to 2.3	←	←	2.5	2.2 to 2.8		
5	1	Swing speed	L	sec	6.5	6.0 to 7.0	6.1	5.6 to 6.6	←	←	Empty bucket load. Engine max.	
			R	sec	6.2	5.7 to 6.7	5.6	5.1 to 6.1	←	←		
6	1	Swing Lock	Cylinder dislocation	Swivel R&L	mm	0.0	10.0 >	←	←	←	←	90 deg-swivel, 100 times actual digging
					inch	0.0	0.4 >	←	←	←	←	
	2	Reciprocating motion	L / R	Swing	mm	0.0	0.0 >	←	←	←	←	90 deg-swivel, 100 times
					inch	0.0	0.0 >	←	←	←	←	
Q7		Hydraulic performance										
1	1	Relief pressure set- ting	P1	kgf/cm ²	230.0	225.4 to 240.7	240.0	234.6 to 249.9	220.0	215.2 to 220.3	At pump delivery 50±5°C	
				MPa	22.6	22.1 to 23.6	23.5	23.0 to 24.5	21.6	21.1 to 21.6		
				bar	2.2	2.2 to 2.3	2.3	2.3 to 2.4	2.1	2.1 to 2.1		
				psi	3271.4	3206.2 to 3423.8	3413.6	3336.8 to 3554.4	3129.1	3061.1 to 3133.7		
	2		P2	kgf/cm ²	230.0	225.4 to 240.7	240.0	234.6 to 249.9	220.0	215.2 to 220.3		
				MPa	22.6	22.1 to 23.6	23.5	23.0 to 24.5	21.6	21.1 to 21.6		
				bar	2.2	2.2 to 2.3	2.3	2.3 to 2.4	2.1	2.1 to 2.1		
				psi	3271.4	3206.2 to 3423.8	3413.6	3336.8 to 3554.4	3129.1	3061.1 to 3133.7		





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No		Specificatio s Items			Unit	KX61-3 EU		KX71-3 EU		KX71-3 PP		Remarks
						Std value	Allowable range	Std value	Allowable range	Std value	Allowable range	
1	3		P3	kgf/cm ²	175.0	170.3 to 180.5	210.0	205.0 to 215.2	210.0	205.0 to 215.2		
				MPa	17.2	16.7 to 17.7	20.6	20.1 to 21.1	20.6	20.1 to 21.1		
				bar	1.7	1.6 to 1.7	2.0	2.0 to 2.1	2.0	2.0 to 2.1		
				psi	2489.1	2422.8 to 2567.9	2986.9	2916.1 to 3061.1	2986.9	2916.1 to 3061.1		
	4		P4	kgf/cm ²	40.0	34.7 to 44.9	←	←	←	←		
				MPa	3.9	3.4 to 4.4	←	←	←	←		
				bar	3.9	3.9 to 5.0	←	←	←	←		
				psi	568.9	493.3 to 638.3	←	←	←	←		
2	1	Cylinder oil sealing capacity	Boom	50±5°C (122±41°F)	mm	1.0	20.0 >	←	←	←	←	Arm extend, bucket
				inch	0.0	0.8 >	←	←	←	←		
	2			95±5°C (203±41°F)	mm	2.0	20.0 >	←	←	←	←	
					inch	0.1	0.8 >	←	←	←	←	
	3		Arm	50±5°C (122±41°F)	mm	1.0	11.0 >	←	←	←	←	height 1m, 10 min.
					inch	0.0	0.4 >	←	←	←	←	
	4	Bucket	50±5°C (122±41°F)	mm	1.0	10.0 >	←	←	←	←	Bucket load=JIS heaped×1.8	
				inch	0.0	0.4 >	←	←	←	←		
	5	Dozer	50±5°C (122±41°F)	mm	2.0	20.0 >	←	←	←	←		
				inch	0.1	0.8 >	←	←	←	←		
3	1	Boom cushioning performance		30°C(86°F)	sec	3.0	3.0 >	←	←	←	←	
					0.4 to1.3	0.4 to 1.3	←	←	←	←		
				50°C(122°F)	sec	0.4 to1.3	0.4 to 1.3	←	←	←	←	
					80°C(176°F)	sec	0.3	0.3 <	←	←	←	
Q8	Lever operating force & stroke											
1	1	Boom lever operat- ing force	up	kgf	1.0	0.5 to 1.5	←	←	1.4	0.9 to 1.9		
				N	10.0	5.0 to 15.0	←	←	14.0	9.0 to 19.0		
				lbw	7.4	3.7 to 11.1	←	←	10.3	6.6 to 14.0		
	2		down	kgf	1.0	0.5 to 1.5	←	←	1.4	0.9 to 1.9		
				N	10.0	5.0 to 15.0	←	←	14.0	9.0 to 19.0		
				lbw	7.4	3.7 to 11.1	←	←	10.3	6.6 to 14.0		
	3	Arm lever	crowd	kgf	1.0	0.5 to 1.5	←	←	1.43	0.9 to 1.9	Extend & crowd	
				N	10.0	5.0 to 15.0	←	←	14.0	9.0 to 19.0		
				lbw	7.4	3.7 to 11.1	←	←	10.3	6.6 to 14.0		

KX61-3, KX71-3 WSM-M

General

M-I-17

No	Specificatio s Items			Unit	KX61-3 EU		KX71-3 EU		KX71-3 PP		Remarks	
					Std value	Allowable range	Std value	Allowable range	Std value	Allowable range		
1	4		extend	kgf	1.0	0.5 to 1.5	←	←	1.43	0.9 to 1.9		
				N	10.0	5.0 to 15.0	←	←	14.0	9.0 to 19.0		
				lbw	7.4	3.7 to 11.1	←	←	10.3	6.6 to 14.0		
	5	Bucket lever	crowd	kgf	1.0	0.5 to 1.5	←	←	1.43	0.9 to 1.9	Dump & crowd	
				N	10.0	5.0 to 15.0	←	←	14.0	9.0 to 19.0		
				lbw	7.4	3.7 to 11.1	←	←	10.3	6.6 to 14.0		
	6		extend	kgf	1.0	0.5 to 1.5	←	←	1.43	0.9 to 1.9		
				N	10.0	5.0 to 15.0	←	←	14.0	9.0 to 19.0		
				lbw	7.4	3.7 to 11.1	←	←	10.3	6.6 to 14.0		
	7	Swivel (Swing) lever	R	kgf	1.0	0.5 to 1.5	←	←	1.43	0.9 to 1.9		Left & right
				N	10.0	5.0 to 15.0	←	←	14.0	9.0 to 19.0		
				lbw	7.4	3.7 to 11.1	←	←	10.3	6.6 to 14.0		
	8		L	kgf	1.0	0.5 to 1.5	←	←	1.43	0.9 to 1.9		
				N	10.0	5.0 to 15.0	←	←	14.0	9.0 to 19.0		
				lbw	7.4	3.7 to 11.1	←	←	10.3	6.6 to 14.0		
	9	Dozer lever	up	kgf	2.6	2.0 to 3.1	←	←	2.4	1.9 to 3.0	Up & down	
				N	25.0	20.0 to 30.0	←	←	24.0	19.0 to 29.0		
				lbw	18.4	14.8 to 22.1	←	←	17.4	14.0 to 21.4		
	10		down	kgf	2.6	2.0 to 3.1	←	←	2.4	1.9 to 3.0		
				N	25.0	20.0 to 30.0	←	←	24.0	19.0 to 29.0		
				lbw	18.4	14.8 to 22.1	←	←	17.4	14.0 to 21.4		
11		L	Forward	kgf	1.6	1.1 to 2.1	←	←	1.6	1.1 to 2.1		
				N	16.0	11.0 to 21.0	←	←	16.0	11.0 to 21.0		
				lbw	11.8	8.1 to 15.5	←	←	11.6	8.1 to 15.5		
12	Travel lever		Back	kgf	1.6	1.1 to 2.1	←	←	1.6	1.1 to 2.1		
				N	16.0	11.0 to 21.0	←	←	16.0	11.0 to 21.0		
				lbw	11.8	8.1 to 15.5	←	←	11.6	8.1 to 15.5		
13		R	Forward	kgf	1.6	1.1 to 2.1	←	←	1.6	1.1 to 2.1		
				N	16.0	11.0 to 21.0	←	←	16.0	11.0 to 21.0		
				lbw	11.8	8.1 to 15.5	←	←	11.6	8.1 to 15.5		
14			Back	kgf	1.6	1.1 to 2.1	←	←	1.6	1.1 to 2.1		
				N	16.0	11.0 to 21.0	←	←	16.0	11.0 to 21.0		
				lbw	11.8	8.1 to 15.5	←	←	11.6	8.1 to 15.5		

KX61-3, KX71-3 WSM-M

General



No		Specificatios Items			Unit	KX61-3 EU		KX71-3 EU		KX71-3 PP		Remarks
						Std value	Allowable range	Std value	Allowable range	Std value	Allowable range	
Q8 												

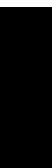
M-I-19

No		Specificatio s Items			Unit	KX61-3 EU		KX71-3 EU		KX71-3 PP		Remarks			
						Std value	Allowable range	Std value	Allowable range	Std value	Allowable range				
Q8	5	Bucket lever stroke		crowd	mm	72.0	62.0 to 82.0	←	←	←	←				
					inch	2.8	2.4 to 3.2	←	←	←	←				
				6		extend	mm	72.0	62.0 to 82.0	←	←		←	←	
							inch	2.8	2.4 to 3.2	←	←		←	←	
	7	Swivel lever stroke		R	mm	72.0	62.0 to 82.0	←	←	←	←				
					inch	2.8	2.4 to 3.2	←	←	←	←				
				8		L	mm	72.0	62.0 to 82.0	←	←		←	←	
							inch	2.8	2.4 to 3.2	←	←		←	←	
	9	Dozer lever stroke		up	mm	51.0	41.0 to 61.0	←	←	58.0	48.0 to 68.0				
					inch	2.0	1.6 to 2.4	←	←	2.3	1.9 to 2.7				
				10		down	mm	51.0	41.0 to 61.0	←	←		58.0	48.0 to 68.0	
							inch	2.0	1.6 to 2.4	←	←		2.3	1.9 to 2.7	
	11	Travel lever stroke	L	Forward	mm	74.0	64.0 to 84.0	←	←	←	←				
					inch	2.9	2.5 to 3.3	←	←	←	←				
				Back	mm	74.0	64.0 to 84.0	←	←	←	←				
					inch	2.9	2.5 to 3.3	←	←	←	←				
			R	Forward	mm	74.0	64.0 to 84.0	←	←	←	←				
					inch	2.9	2.5 to 3.3	←	←	←	←				
				Back	mm	74.0	64.0 to 84.0	←	←	←	←				
					inch	2.9	2.5 to 3.3	←	←	←	←				
Q10	Comfortability														
1	1	Noise level	At operator's ear LPA	Canopy	db(A)	78.0	80.0 >	←	←	79.0	81.0 >				
	Cab			db(A)	78.0	80.0 >	←	←	79.0	81.0 >					
	Noise source;LWA		7m	db(A)	65.0	65.4 >	←	←	←	←					
				db(A)	92.9	92.9 >	←	←	←	←					

KX61-3, KX71-3 WSM-M

General





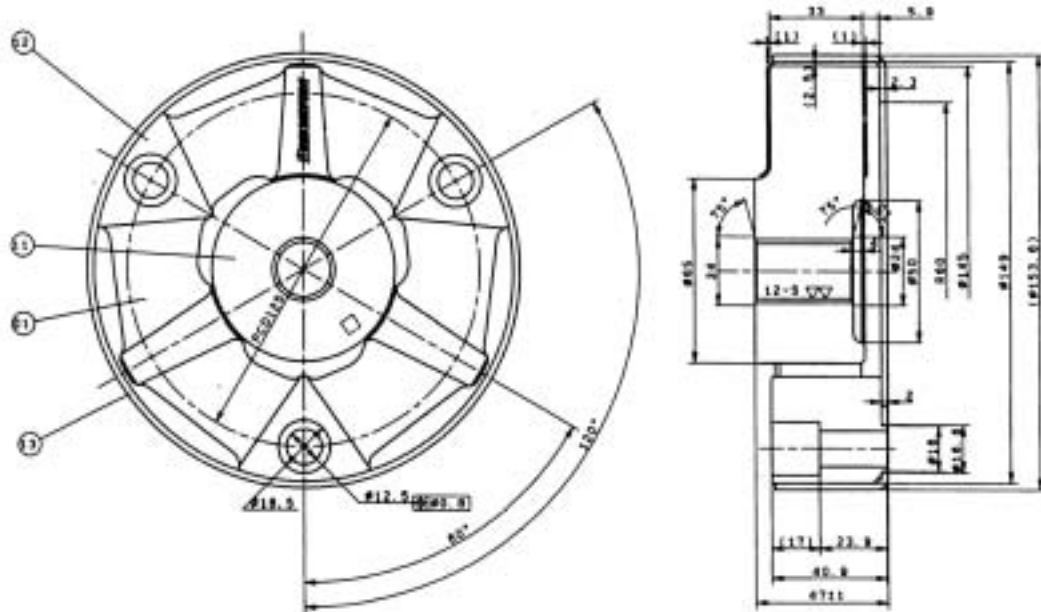
II. Machine Body	M-II-2
a. Main component	M-II-2
b. Water and oil quantity	M-II-14

II. Machine Body

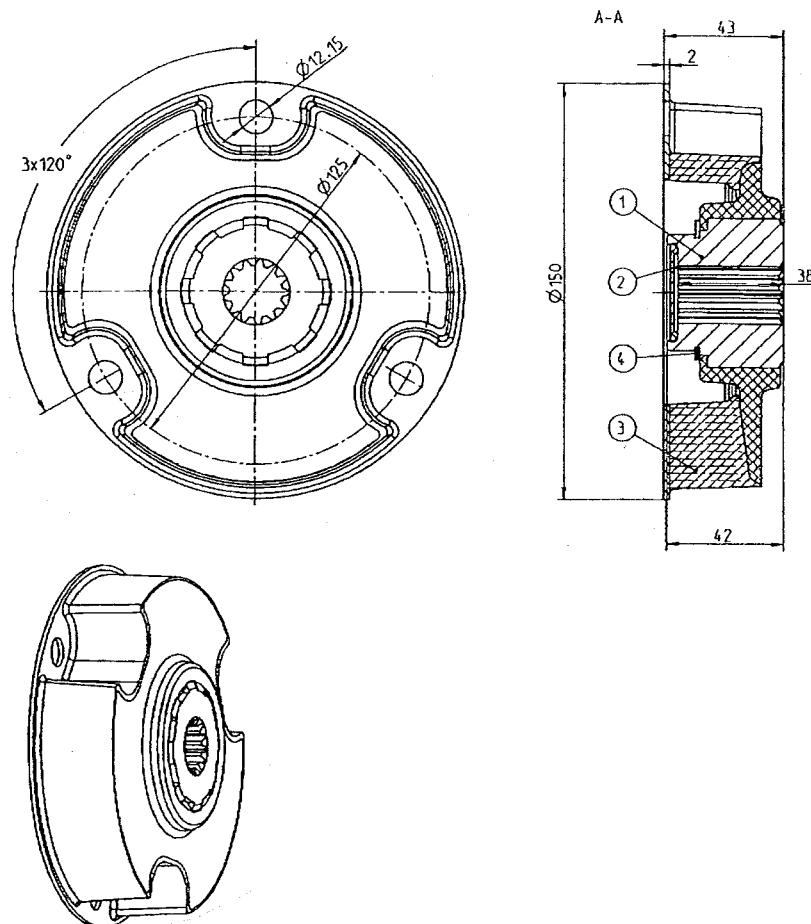
a. Main component

1. Pump coupling

1-1 KX71-3 PP - version

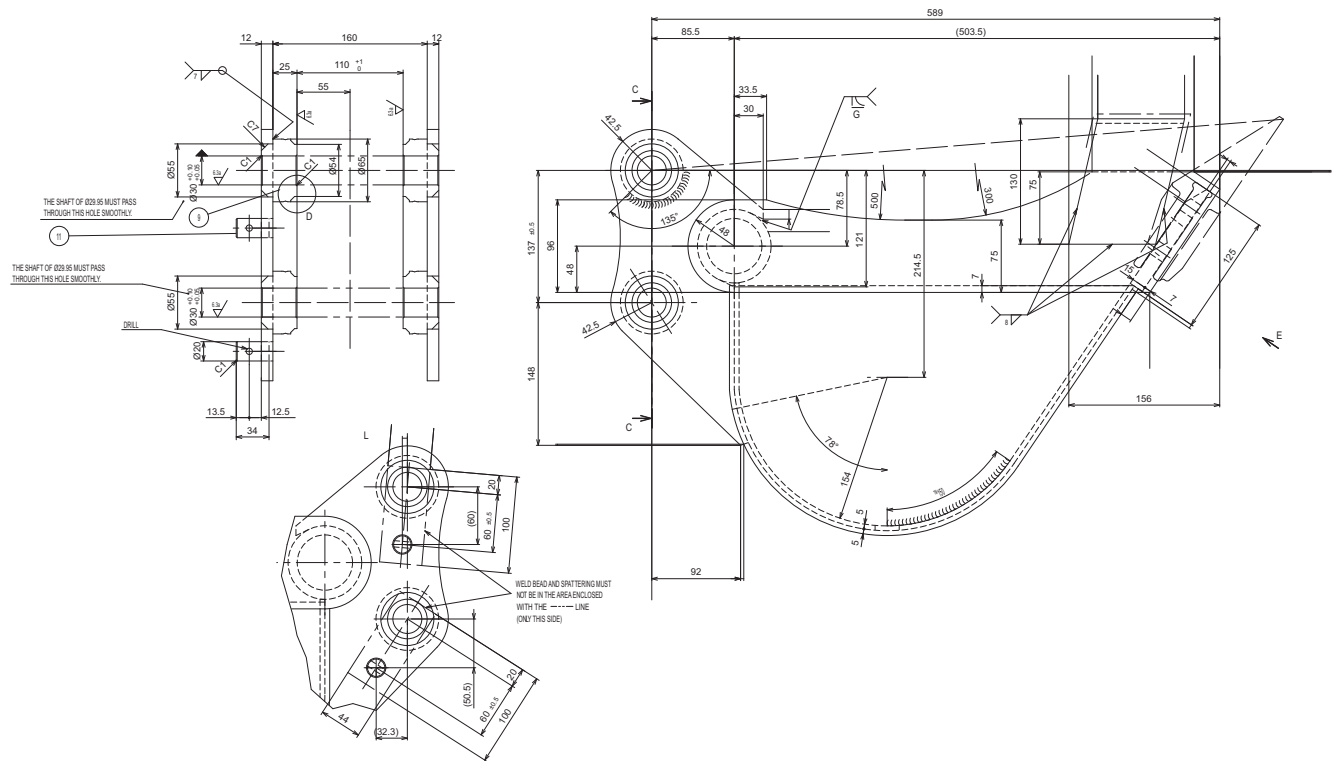


1-2 KX61-3, KX-71-3 EU- version

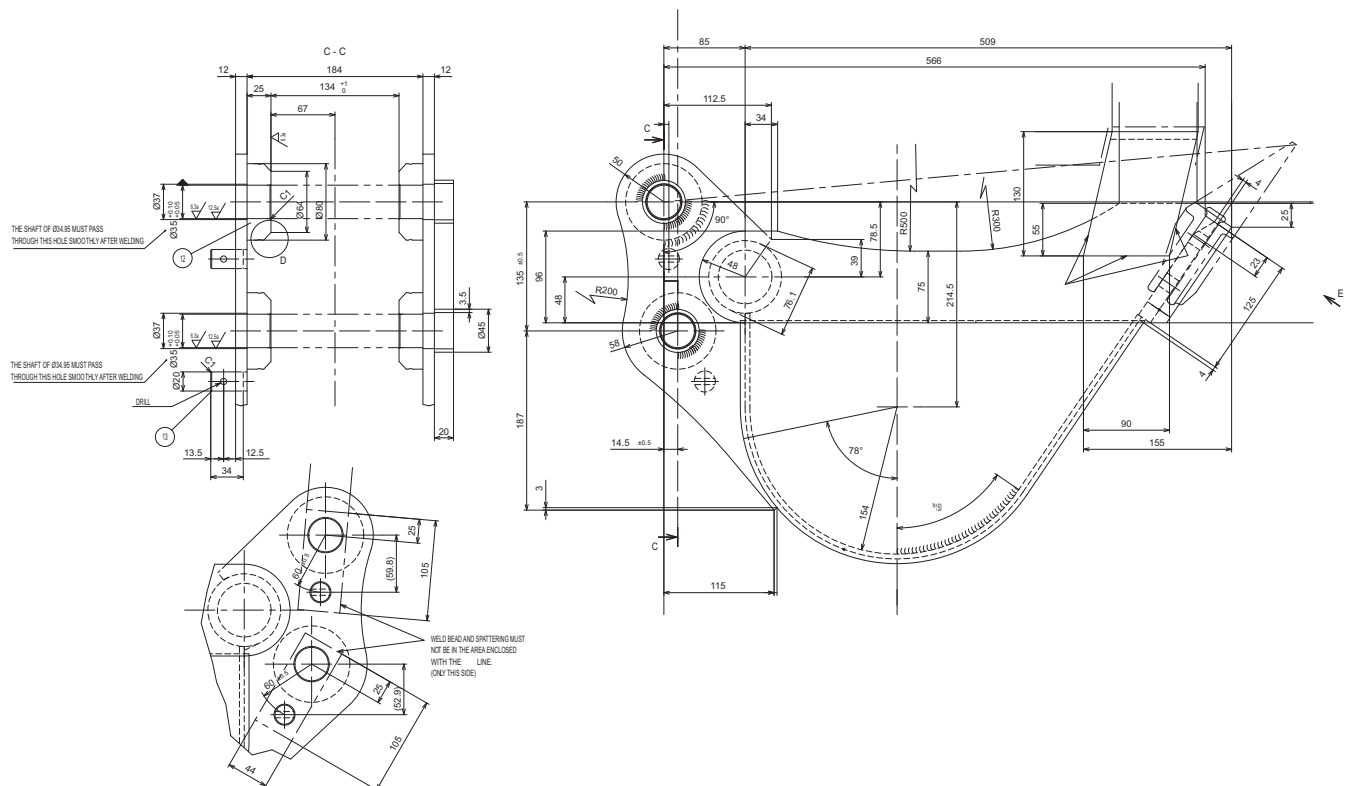


2. Bucket : Kubota standard bucket

2-1 KX-61-3



2-2 KX-71-3

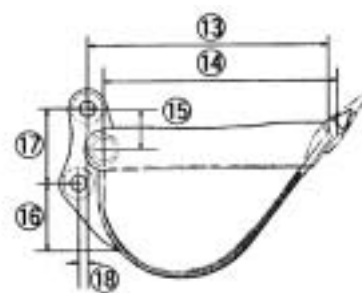
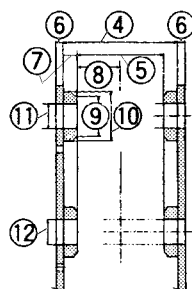
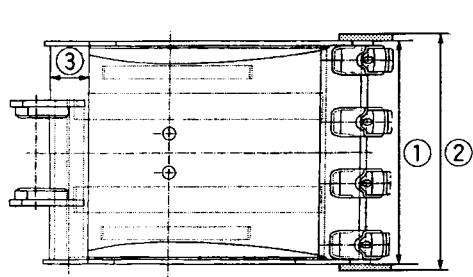


M-II-3

2-3 Bucket dimensions

No.	Unit	KX61-3	KX71-3		Remarks
1	mm in.	448 17.6	480 18.9		
2	mm in.	472 18.6	504 19.8		
3	mm in.	$\phi 76.3 \times t9.5$ $\phi 3.00 \times t0.37$	$\phi 76.1 \times t10$ $\phi 3.00 \times t0.39$		
4	mm in.	184 7.24	←		
5	mm in.	110 4.33	134 5.28		
6	mm in.	12 0.47	←		
7	mm in.	25 0.98	←		
8	mm in.	56 2.20	67 2.64		
9	mm in.	$\phi 54$ $\phi 2.13$	$\phi 64$ $\phi 2.52$		
10	mm in.	$\phi 65$ $\phi 2.56$	$\phi 80$ $\phi 3.15$		
11	mm in.	$\phi 30^{+0.10}_{+0.05}$ $\phi 1.18^{+0.004}_{+0.002}$	$\phi 35^{+0.10}_{+0.05}$ $\phi 1.18^{+0.004}_{+0.002}$		
12	mm in.	$\phi 30^{+0.10}_{+0.05}$ $\phi 1.18^{+0.004}_{+0.002}$	$\phi 35^{+0.10}_{+0.05}$ $\phi 1.18^{+0.004}_{+0.002}$		
13	mm in.	589 23.2	594 23.4		
14	mm in.	503.5 19.8	566 22.3		
15	mm in.	78.5 3.09	←		
16	mm in.	148 5.839	187 7.36		
17	mm in.	137 5.39	135 5.31		
18	mm in.	0 0	14.5 0.57		

NOTE:KUBOTA JAPAN BUCKET



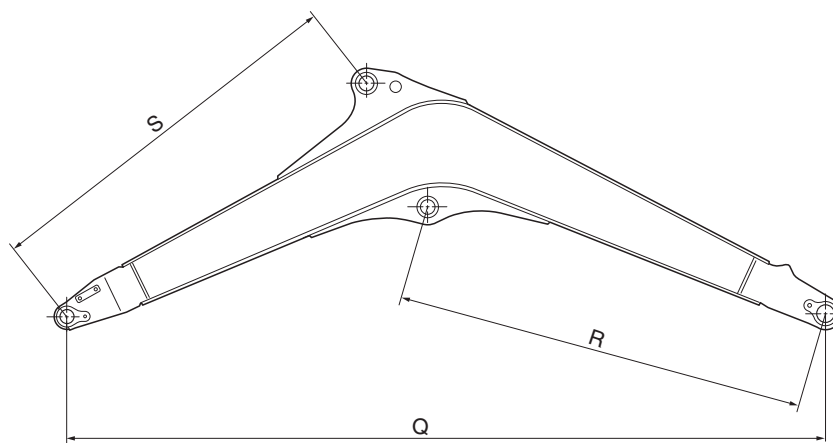
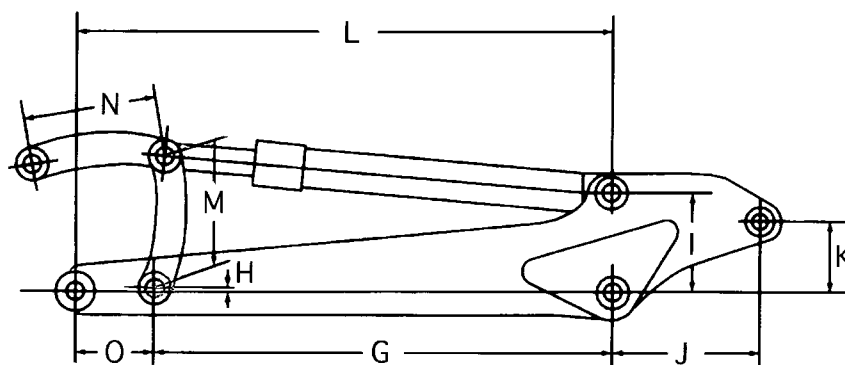
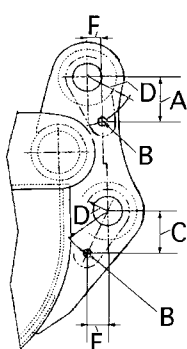
3. Bucket installation relevant dimensions

3-1 Boom, arm, bucket link

Unit : mm (inch)

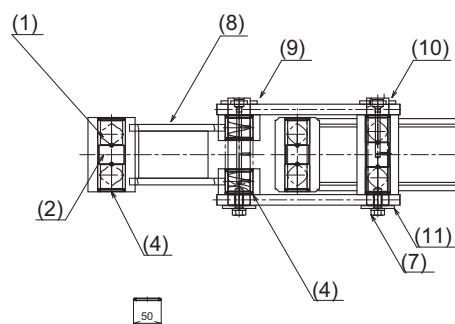
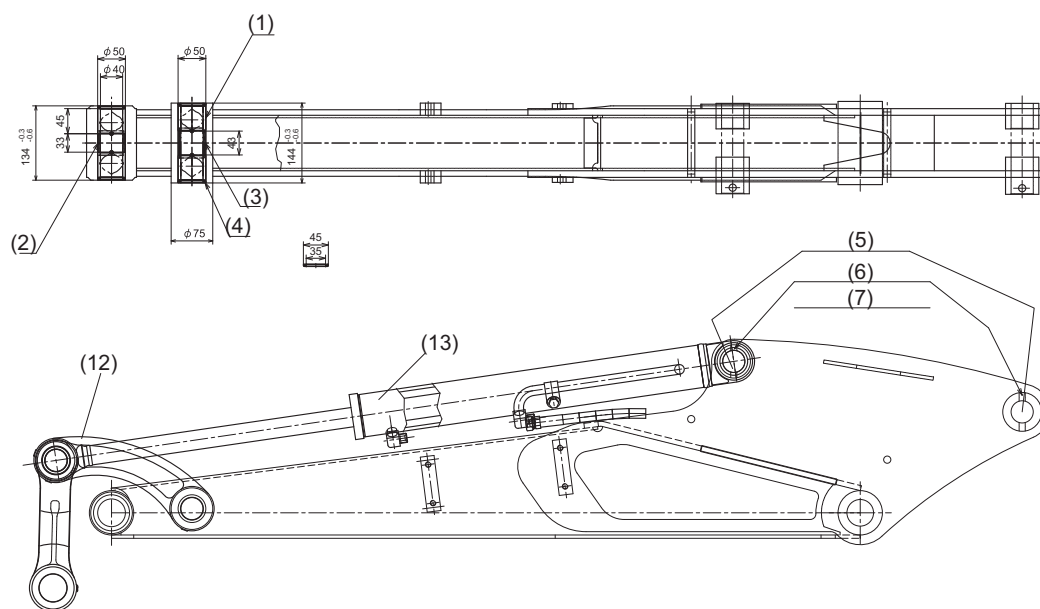
No.	KX61-3	KX71-3		Remarks
A	60 (2.36)	59.8 (2.35)		
B	φ20	←		
C	50.5 (1.99)	52.9 (2.08)		
D	60 (2.36)	60 (2.36)		
E	32.3 (1.27)	14.5 (0.57)		
F	5.0 (0.20)	5.0 (0.20)		
G	905 (35.6) 1155 (45.5)	1005 (39.6) 1205 (47.4)		
H	10.0 (0.39)	7.5 (0.30)		
I	259 (10.2)	273 (10.7)		
J	225.5 (8.88)	292 (11.5)		
K	157 (6.18)	182 (7.17)		
L	1076.5 (42.4)	990.5 (39.0) 1122 (44.2)		
M	240 (9.45)	260 (10.2)		
N	240 (9.45)	230 (9.06)		
O	145 (5.70)	←		
P	1050 (41.3) 1300 (51.2)	1150 (45.3) 1350 (53.1)		
Q	2088 (82.2)	2240 (88.2)		
R	1134 (44.6)	1110 (43.7)		
S	1046 (41.2)	1166 (45.9)		

NOTE: KUBOTA JAPAN BUCKET
STANDARD ARM



M-II-5

3-2 Bushing



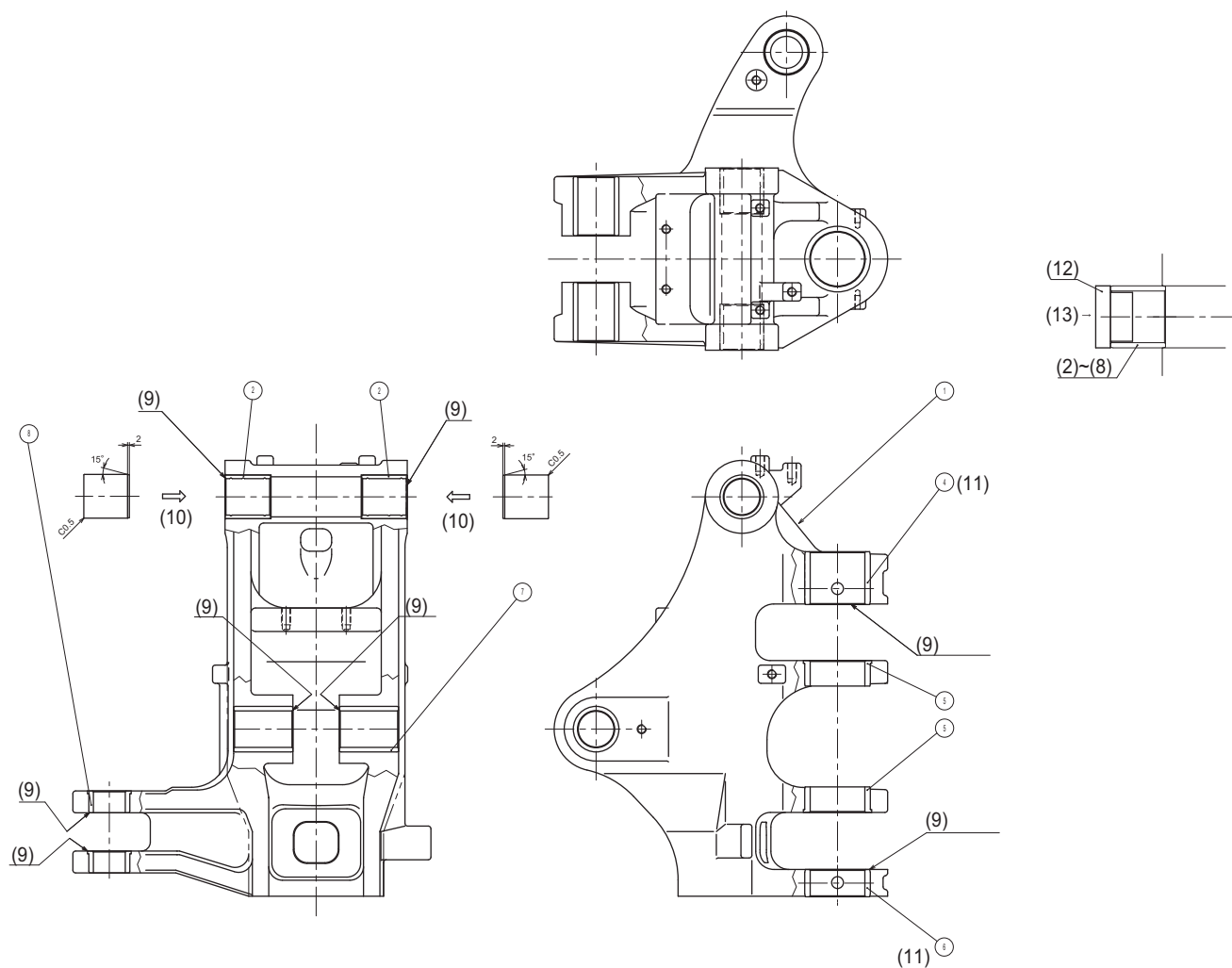
[Unit:mm]

No.	Items	KX61-3 (EU)		KX71-3 (EU)		KX71-3 (PP)	
		Parts No.	Spec.	Parts No.	Spec.	Parts No.	Spec.
(1)	Bush B	RG248-76151	35×45×45	RG248-76151	35×45×45	RC348-76151	40×50×45
(2)	Collar					RC348-66691	33
(3)	Collar					RC348-66651	43
(4)	Dust seal					RC411-66781	
(5)	Pin					RC348-66791	
(8)	Bucket Link1	RG248-66711	120 ••• 34.5	RG448-66711	144 ••• 46.5	RC348-66711	144 ••• 46.5
(9)	Pin					RC348-66771	
(10)	pin B dia	RG248-66781	35	RG448-66781	35	RC348-66781	40
(12)	Bucket Link23	RG248-66721	40-35	RG248-66721	40-35	RC348-66721	40-40
		RG248-66731		RG248-66731		RC348-66731	
(13)	bucket cylinder L/S(stroke)	RG248-67801	Refer to cylinder spec.	RG448-67801	Refer to cylinder spec.	RC348-67801	Refer to cylinder spec.
	BushA	RG248-76141	40×50×34	RG448-76241	35×45×36	RC348-76241	40×50×36
	Pin A dia	RG248-66771	30	RG448-66771	35	RC418-66761	40
	Arm boss	RG248-67111	X145Y10 38×110	RG448-67111	X145Y7.5 45×134	RC348-67111	X145Y7.5 50×134

(7) Bolt (11) Washer

EU: European - version PP: North America & Oceania

4. Swing bracket



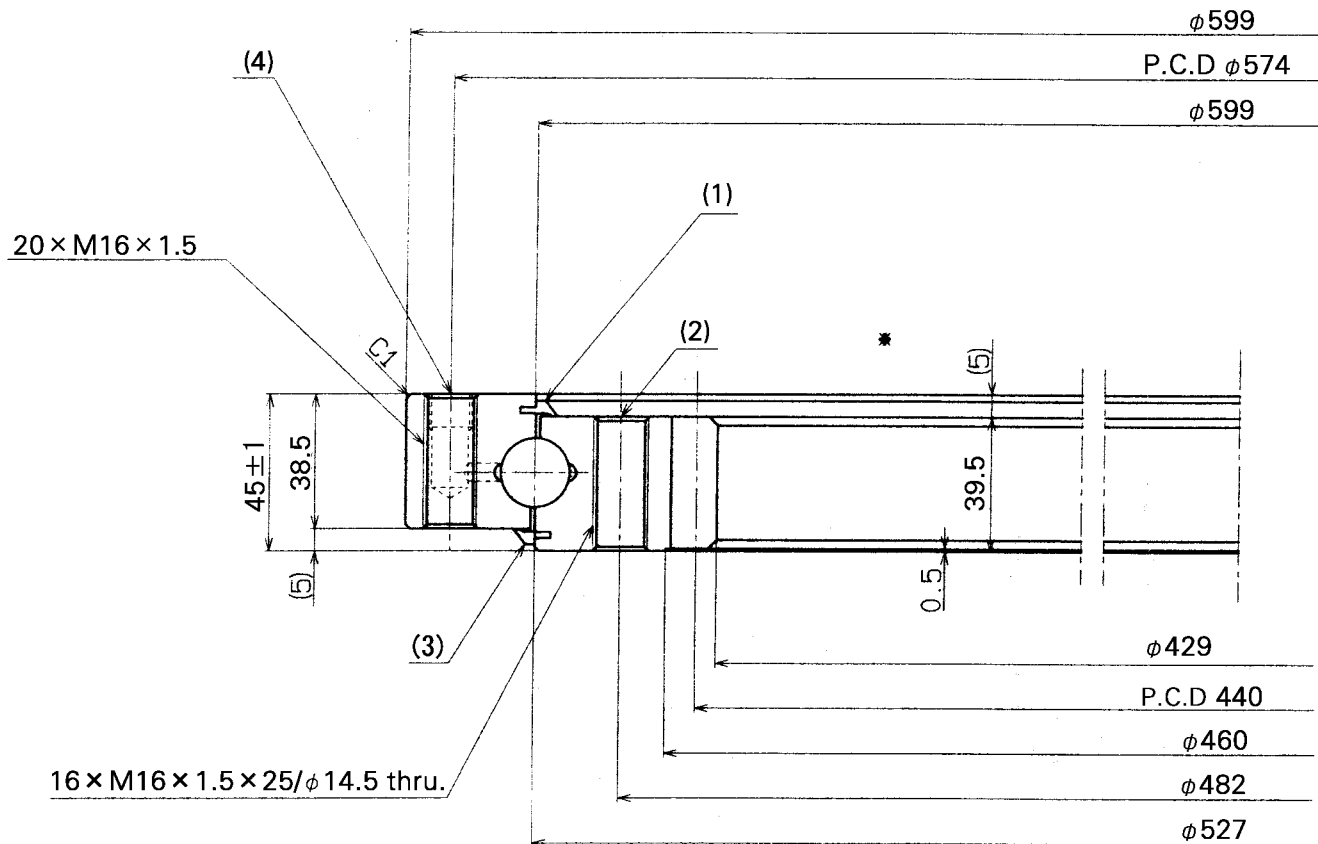
- (1) Swing bracket
- (2) ~ (8) Bushing
- (9) Side of the bush () should flash the face.
- (10) Bush press-fitting direction
- (11) Check the bushing direction.
(Bolt hole should meet.)
- (12) Jig.
- (13) Pressing

Remarks: Service limit of pin and bush wear.

Pin : -1.0mm (-0.01 in.)

Bush : +1.0mm (+0.04 in.)

5. Swivel bearing



- (1) Seal B
- (2) S-mark
- (3) Seal A
- (4) $R_p 1/8$, for grease nipple

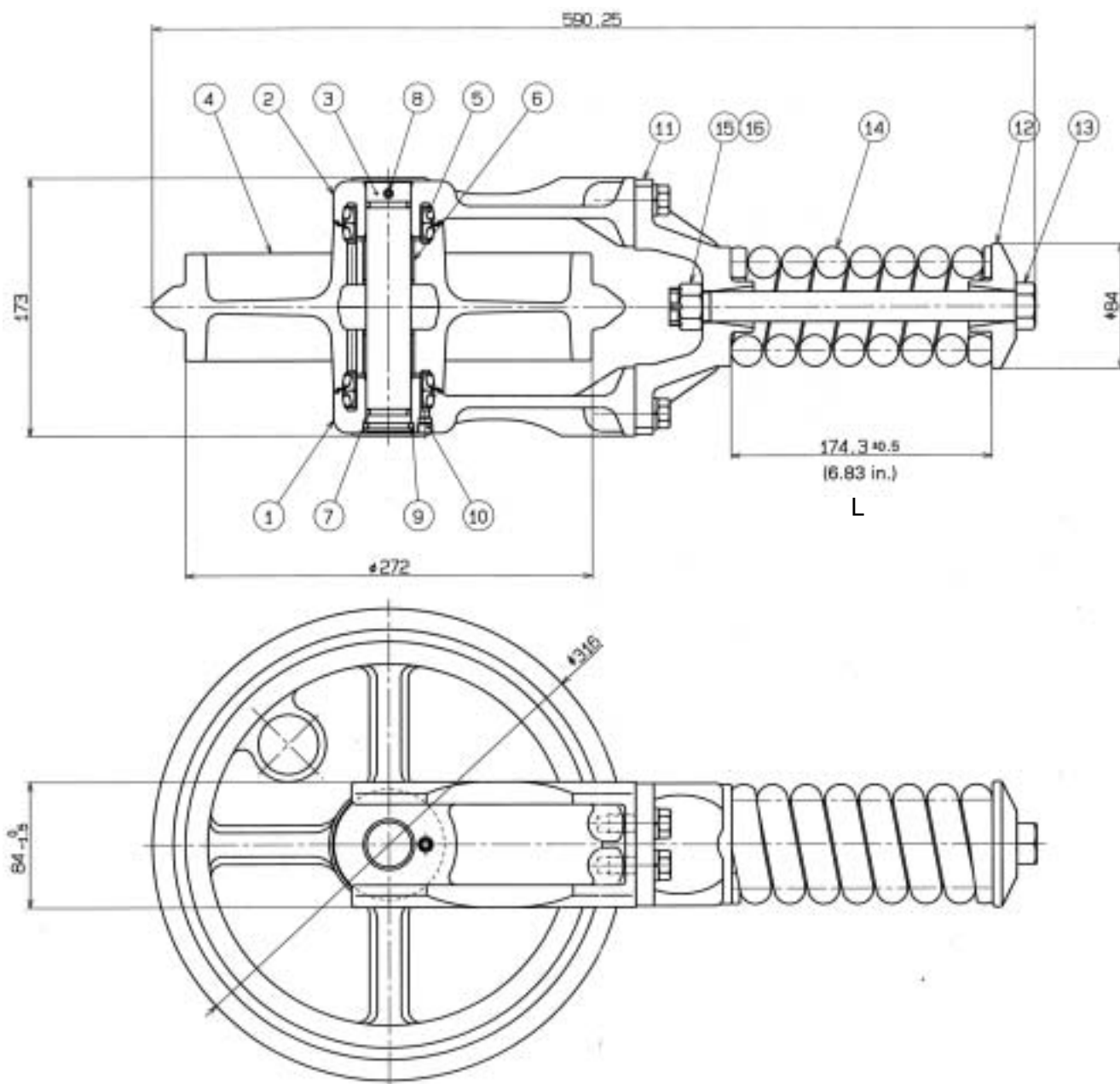
Number of teeth = 80

CLEARANCE (AXIAL) : 0.05~0.12mm (0.002~0.005 in.)

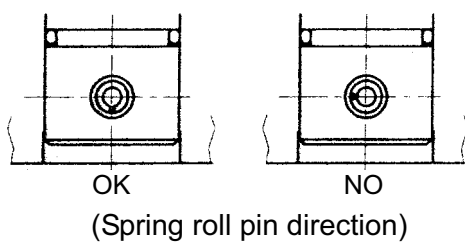
P.C.D. = $\phi 440$

6. Idler and tension spring : Rubber track and iron track

6-1 Structure

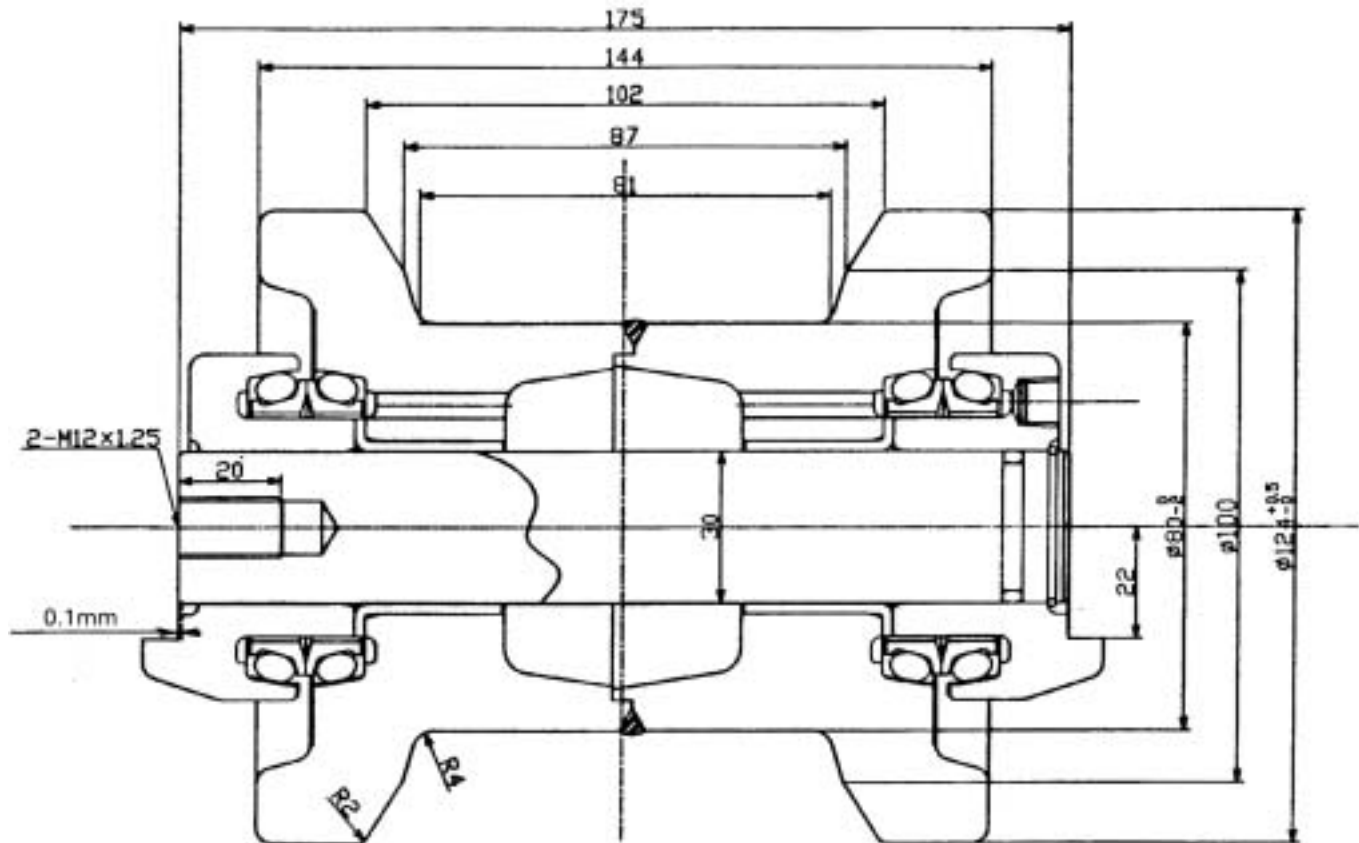


- | | | | |
|---------------|-------------------|------------------|----------------|
| (1) Support 1 | (5) Floating seal | (9) Wire | (13) Bolt |
| (2) Support 2 | (6) Bushing | (10) Plug, R 1/8 | (14) Spring |
| (3) shaft | (7) O-ring | (11) Yoke | (15) Nut |
| (4) Idler | (8) Spring pin | (12) Retainer | (16) Split pin |



Pre-set length of spring : $L = 174.3 \text{ mm (6.83 in.)}$
 Rubber & Iron tracks

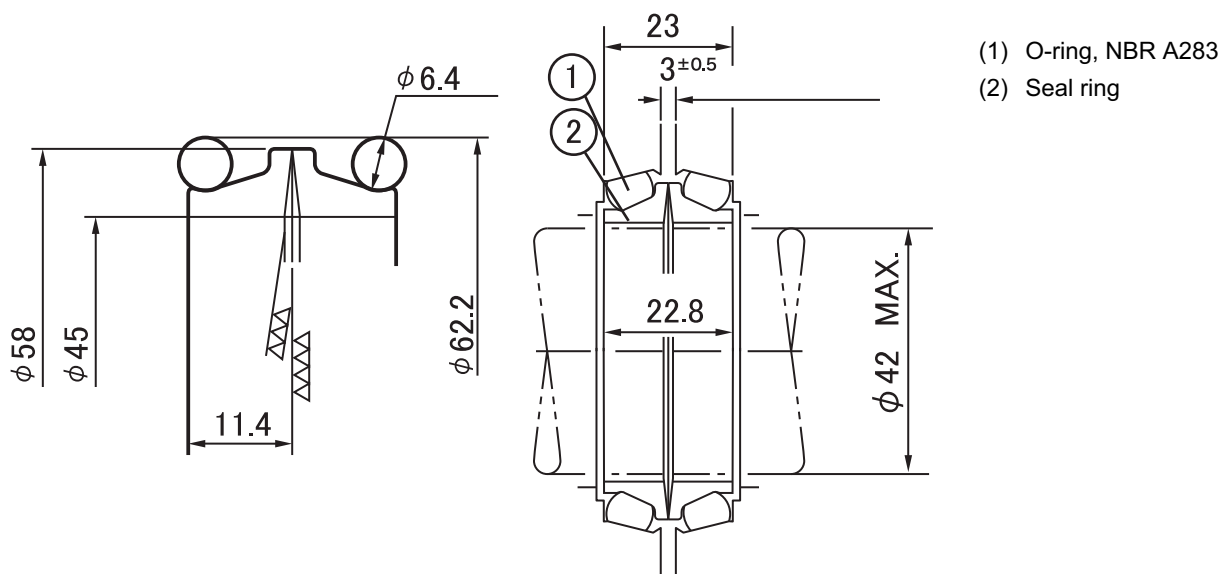
7. Track roller



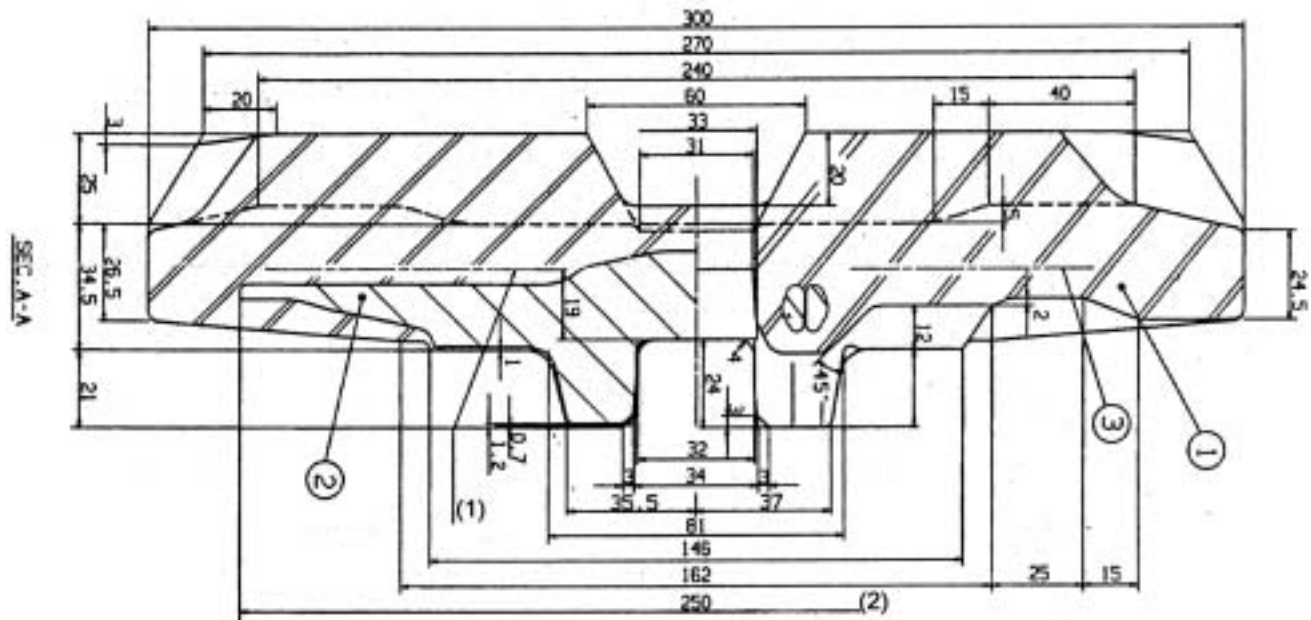
Lub oil : Engine oil SAE #30 CD grade 80 cc

Plug : Apply screw lock agent #503 and tightening torque 1.0 kg·m

Floating seal



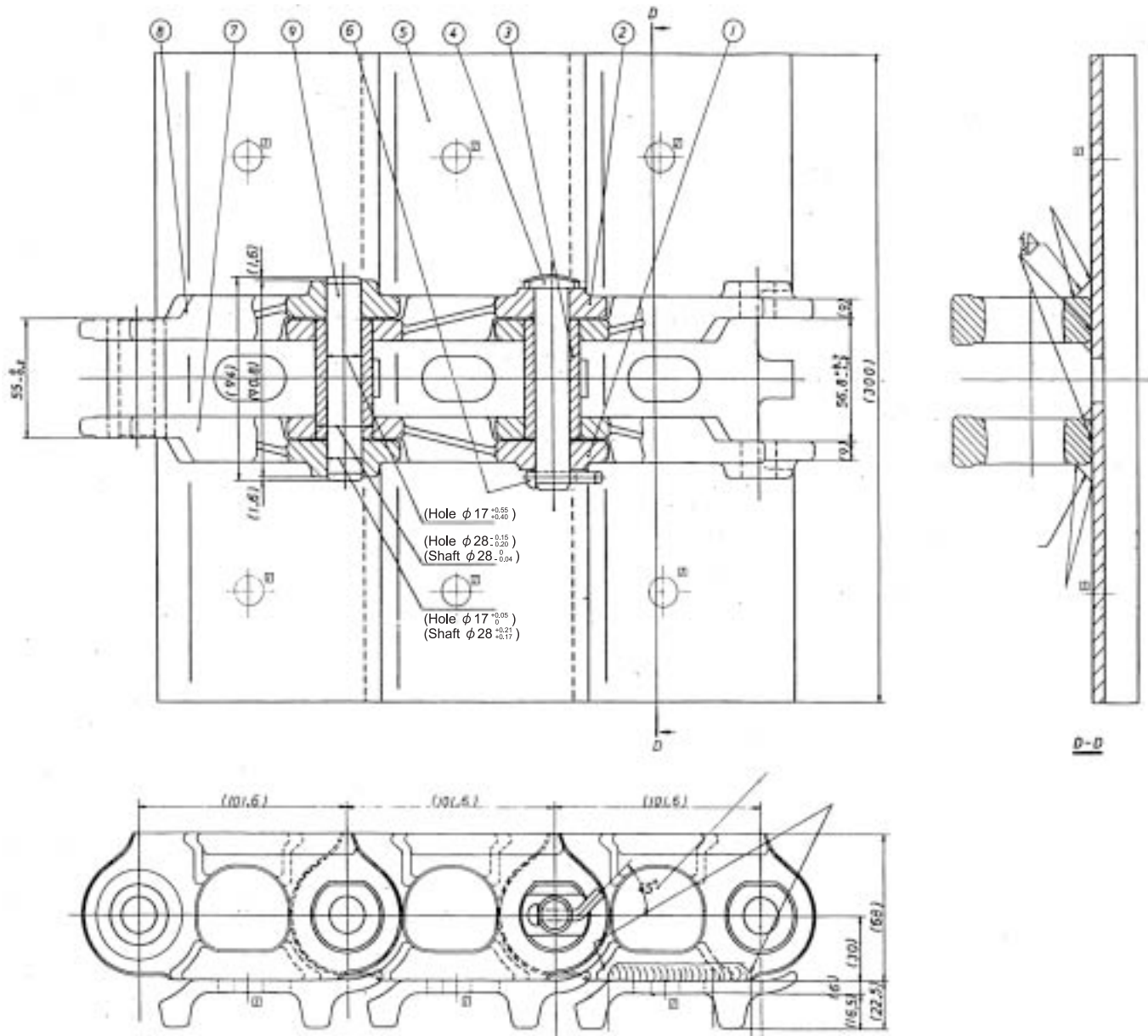
8. Rubber track



- (1) Bending senter
(2) Core lengs

Spec items	KX61-3 EU	KX71-3 EU	KX71-3 PP
Type	300 x 80 x 53	←	←
Circunference	4240 mm	←	←
Number of steel cords	30^{+2}_{-0}	←	←
Thickness of crawler main part	34.5 mm	←	←
Ditto joint parts	37.5 mm	←	←
Core metal	FCD450H		←
Number of core metal (Links)	80	←	←

9. Iron track



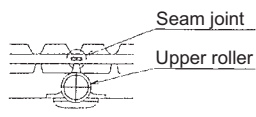
- (1) Master link, L
- (2) Master link, R
- (3) Bush
- (4) Master pin
- (5) Track shoe
- (6) Stop pin
- (7) Track link, L
- (8) Track link,R
- (9) Track pin

10. Track conversion

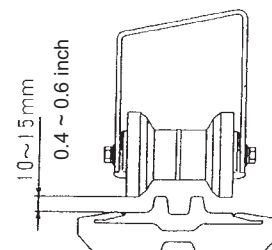
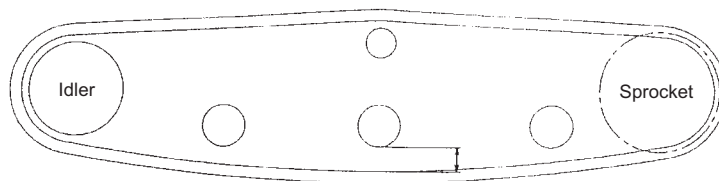
10-1 Iron track → Rubber track

Remove slide plates (080) and track guide (100).

Rubber crawler



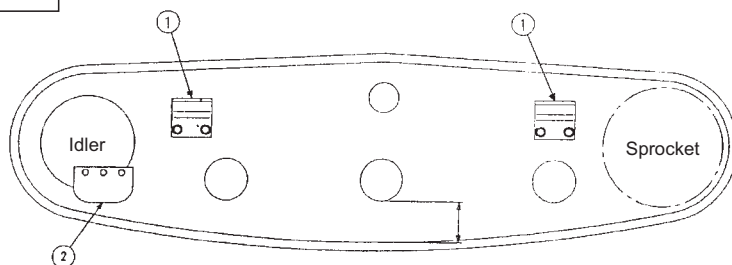
Move the rubber crawler until the joint marking (∞) comes at the top center (see left) and the upper roller comes between the links.



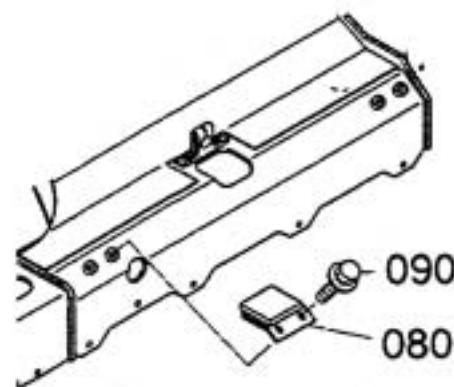
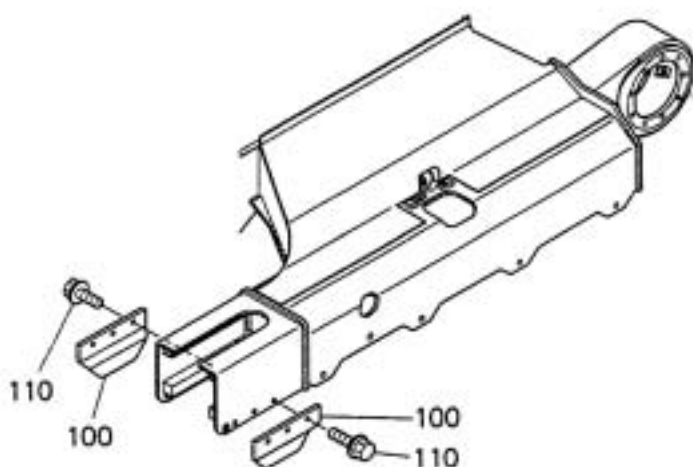
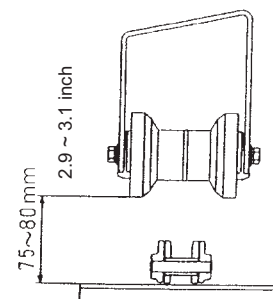
10-2 Rubber track → Iron track

Install slide plates (080) and track guide (100).

Iron crawler



- (1) Slide plate
- (2) Track guide



10-3 Track tension adjustment

Sag distance : Rubber track = 10 ~ 15 mm (0.4 ~ 0.6 inch)

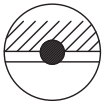
Iron track = 75 ~ 80 mm (2.9 ~ 3.1 inch)

b. Water and oil quantity

	Unit	KX61-3 (EU)	KX71-3 (EU)	KX-71-3 (PP)	Remarks
Radiator	L US gal	5.4 1.42	←	←	Kubota LLC-N-50F 50%
Reserve tank	L US gal	1.1 0.29	←	←	
Engine Crank case Without filter	L US gal	4.5 1.18	←	←	SAE10W30(CD) Gauge center
Hydraulic oil Full	L US gal	53.0 14.0	←	←	ISO 46
Hydraulic oil Tank gauge center	L US gal	38.0 9.35	←	←	ISO 46
Wheel motor	L US gal	0.6 0.16	←	←	SAE90 (API GL-4)
Track roller	cc US gal	80.0 0.02	←	←	SAE30(CD)
Upper roller	cc US gal	60.0 0.02	←	←	SAE30(CD)
Front idler	cc US gal	75.0 0.02	←	←	SAE30(CD)
Fuel tank	L US gal	45.0 0.01	←	←	

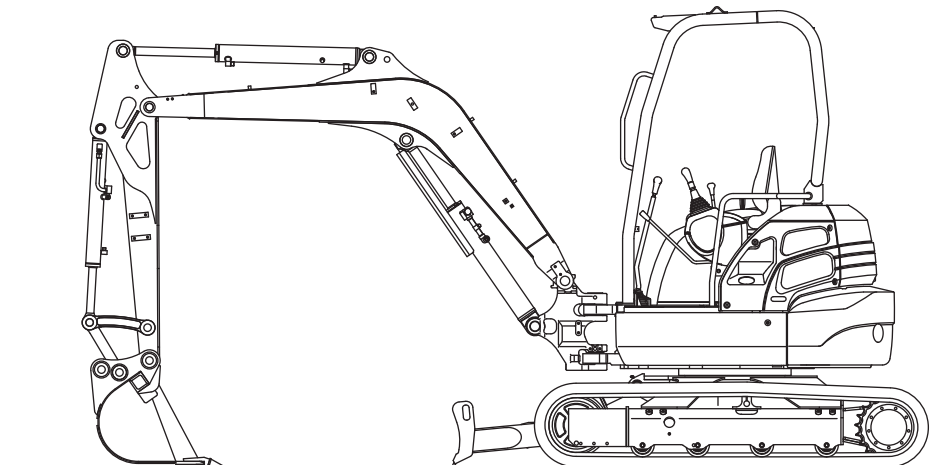
Inspection of hydraulic oil

When checking the hydraulic oil level, satisfy the following conditions and make sure the oil level is above the center the oil gauge.



The oil level is within the shaded area shown in the figure at left.

- 1) Oil temp. should be between 10 ~ 30 °C, 50 ~ 86 °F.
- 2) Stance of front attachment :
 - Swing : Straight forward
 - Arm : Vertical to the ground
 - Bucket : On the ground at its bottom
 - Dozer blade : Down to the ground



- 3) Air breather hose is connected to the oil tank. (Not pressurized type.)

III.Engine	M-III-2
a. Engine Specifications	M-III-2
b. Engine electric components	M-III-2
c. Performance curve : KX61-3 EU, V1505-E2-BH-9-EU	M-III-3
d. Performance curve : KX71-3 EU, V1505-E2-BH-10 EU	M-III-4
e. Performance curve : KX71-3 PP, V1505-E2-BH-10	M-III-5

III.Engine

a. Engine Specifications

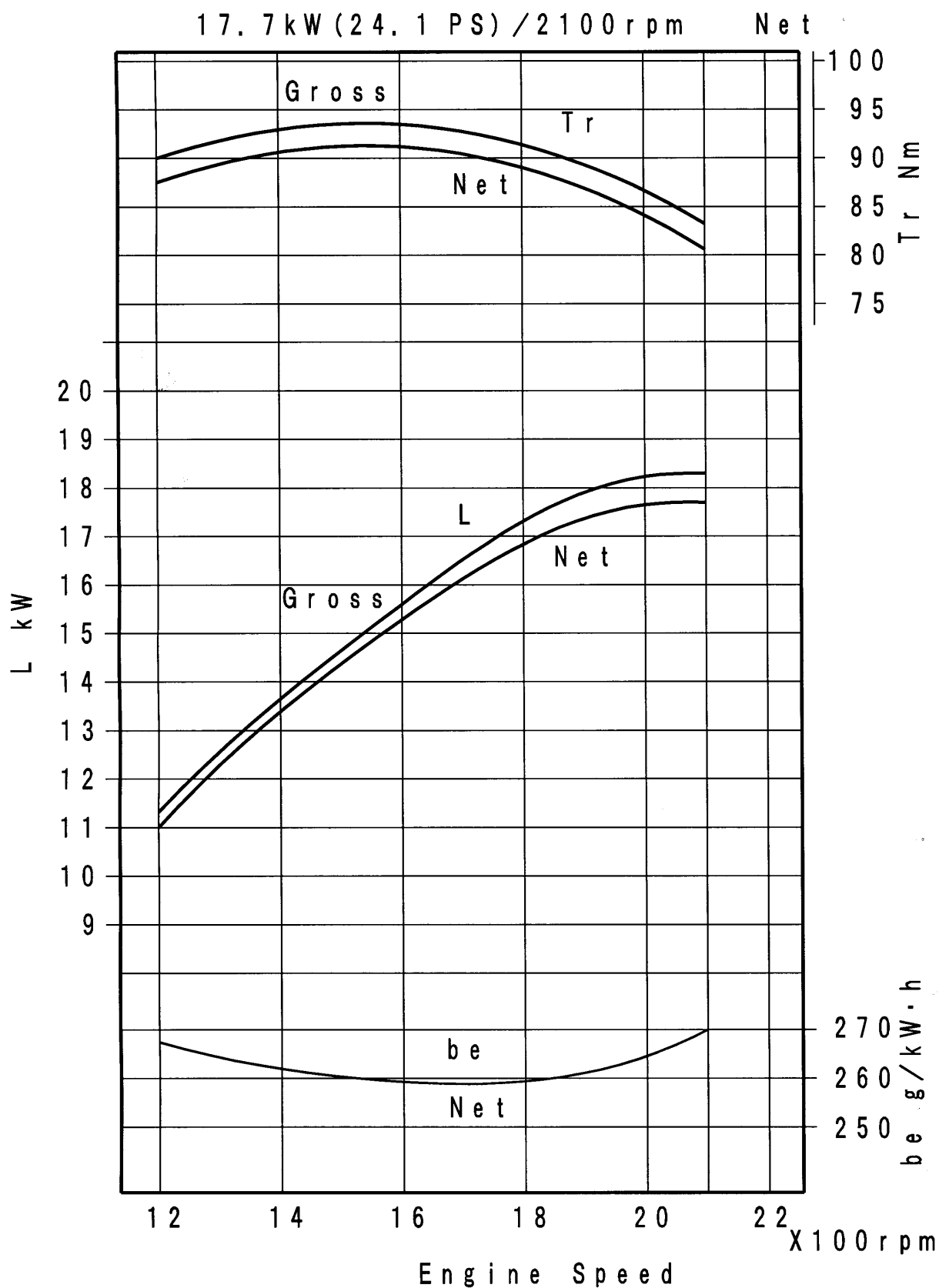
Machine model		KX61-3 EU		KX71-3 EU		KX71-3 PP	
Engine Model		V1505-E2-BH-9-EU		V1505-E2-BH-10-EU		V1505-E2-BH-10	
		Gross	Net	Gross	Net	Gross	Net
No. of cylinder		4		←		←	
Bore × Stroke	mm	78×78.4		←		←	
	in.	3.07×3.09		←		←	
Displacement	cc	1498		←		←	
	in. ³	91.4		←		←	
Max. output/rpm	kW / rpm	18.3/2100	17.7/2100	20.6/2300	19.9/2300	20.6/2300	19.7/2300
	PS / rpm	24.9/2100	24.1/2100	28.0/2300	27.1/2300	28.0/2300	26.8/2300
	HP/rpm	24.5/2100	23.7/2100	27.6/2300	26.7/2300	27.6/2300	26.4/2300
Test code		ISO 3406				SAE-J1349	
Compression ratio		24		←		←	
Max. torque	N · m	93.5/1500 ~ 1700	91.2/1500 ~ 1700	98.3/1500 ~ 1700	95.9/1500 ~ 1700	98.3/1500 ~ 1700	95.5/1500 ~ 1700
	kgf · m	9.5/1500 ~ 1700	9.3/1500 ~ 1700	10.0/1500 ~ 1700	9.8/1500 ~ 1700	10.0/1500 ~ 1700	9.7/1500 ~ 1700
	ft · lbf	69.0/1500 ~ 1700	67.3/1500 ~ 1700	72.5/1500 ~ 1700	70.7/1500 ~ 1700	72.5/1500 ~ 1700	70.4/1500 ~ 1700
Dimensions:L×W×H	mm	584 x 396 x 610		←		←	
	in.	23.0 x 15.6 x 24.0		←		←	
Dry weight	kg	110		←		←	
	lbs	242.5		←		←	
Valve clearance	mm	0.145 ~ 0.185		←		←	
	in.	0.006 ~ 0.007		←		←	
Firing sequence		1-3-4-2		←		←	
Combustion chamber		E-TVCS		←		←	
Compression pressure (A) / (B)	MPa	3.24 ~ 3.63/2.26		←		←	
	kgf / cm ²	33 ~ 37/23		←		←	
	psi	469 ~ 526/327		←		←	
Fan belt		RPF2370		←		←	
Fuel consumption ratio	g/kWh	261	270	261	270	261	273
	g / PSh	192	199	192	199	192	201
	lbs / Hph	0.43	0.44	0.43	0.44	0.43	0.45
Fuel consumption L=100%	l / h	5.8		6.5		6.5	
	gal/h	1.52		1.71		1.71	
Max. speed without load	rpm	2300>=		2500>=		←	
Speed with 2 pumps relief	rpm	2000<=		2200<=		←	
Speed with idling (Canopy) (Cab)	rpm	1050 ~ 1150		←		←	
		1250 ~ 1350		←		←	
Engine oil pressure with rated engine rpm	kPa	196 ~ 441		←		←	
	kgf / cm ²	2.0 ~ 4.5		←		←	
	psi	28.4 ~ 64.0		←		←	
Injection pressure	MPa	13.7 ~ 14.7		←		←	
	kgf / cm ²	140 ~ 150		←		←	
	psi	1991 ~ 2133		←		←	
Cooling system		Pressurized radiator (0.088MPa,0.9kgf / cm ²) ,water pump					
Engine oil consumption ratio	g / kWh	0.95		←		←	
	g / PSh	0.7		←		←	
	lbs / Hph	0.0016		←		←	

b. Engine electric components

Machine model		KX61-3 EU	KX71-3 EU	KX71-3 PP
Engine Model		V1505-E2-BH-9-EU	V1505-E2-BH-10-EU	V1505-E2-BH-10
Fuel injection pump type		Bosch PFR4MD type mini-pump	←	←
Nozzle type		DN4PD mini-nozzle	←	←
Injection pressure	MPa	13.7 ~ 14.7	←	←
	kgf / cm ²	140 ~ 150	←	←
	psi	1991 ~ 2133	←	←
Dynomo		12V 480W	←	←
Manufacturer P/N		101211-1400	←	←
Regulator adjusting voltage	V	14.2 ~ 14.8	←	←
Battery type		80D26R	←	←
Nominal capacity of 5hrs rating	Ah	55	←	←
Specific gravity of electrolite		1.28±0.01(20°C)	←	←
Starter motor		12V 1.4kW	←	←
Manufacturer P/N		228000-0991	←	←
Glow plug	Ω	1.5	←	←

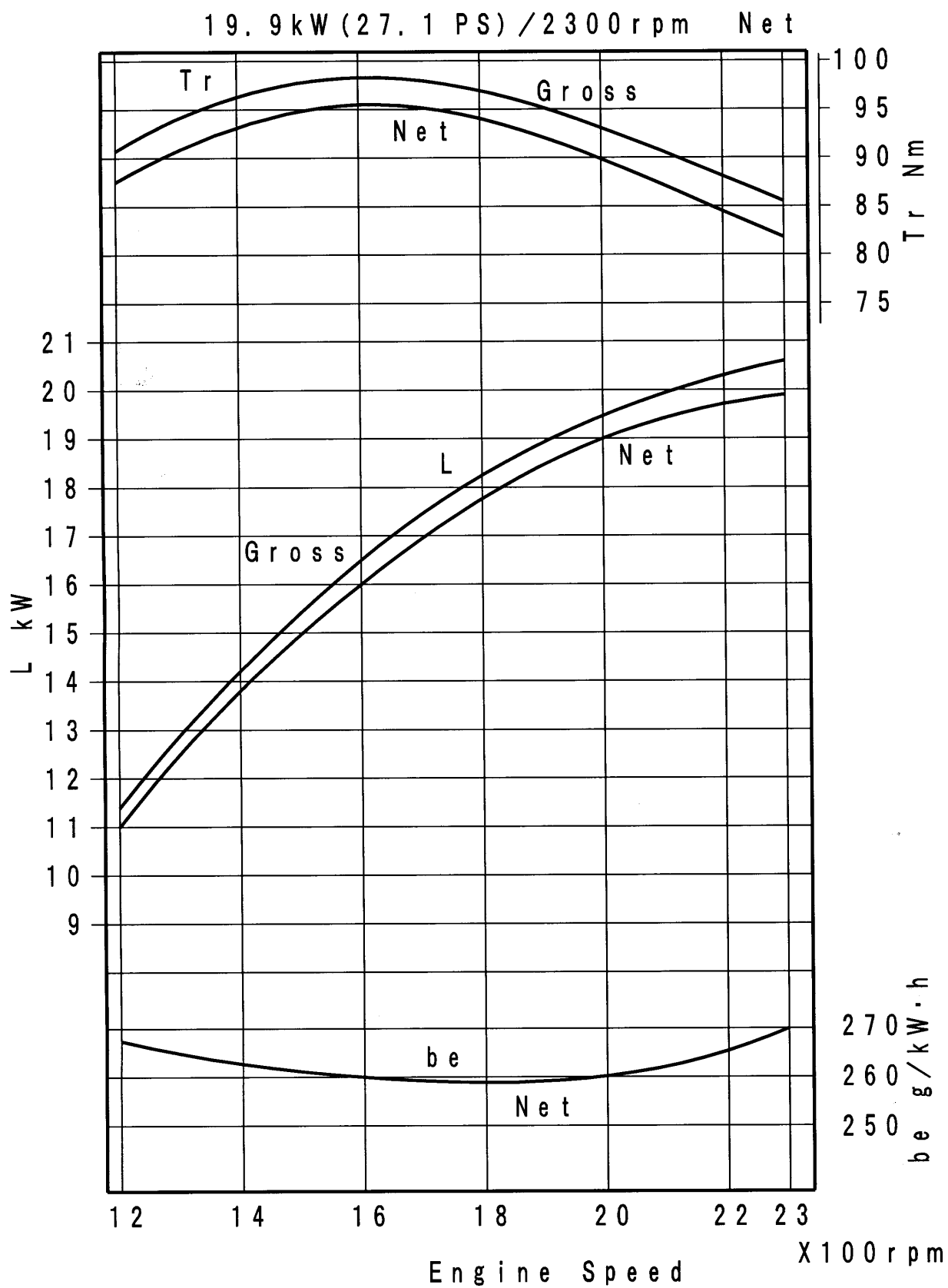
c. Performance curve : KX61-3 EU, V1505-E2-BH-9-EU

ISO 3046



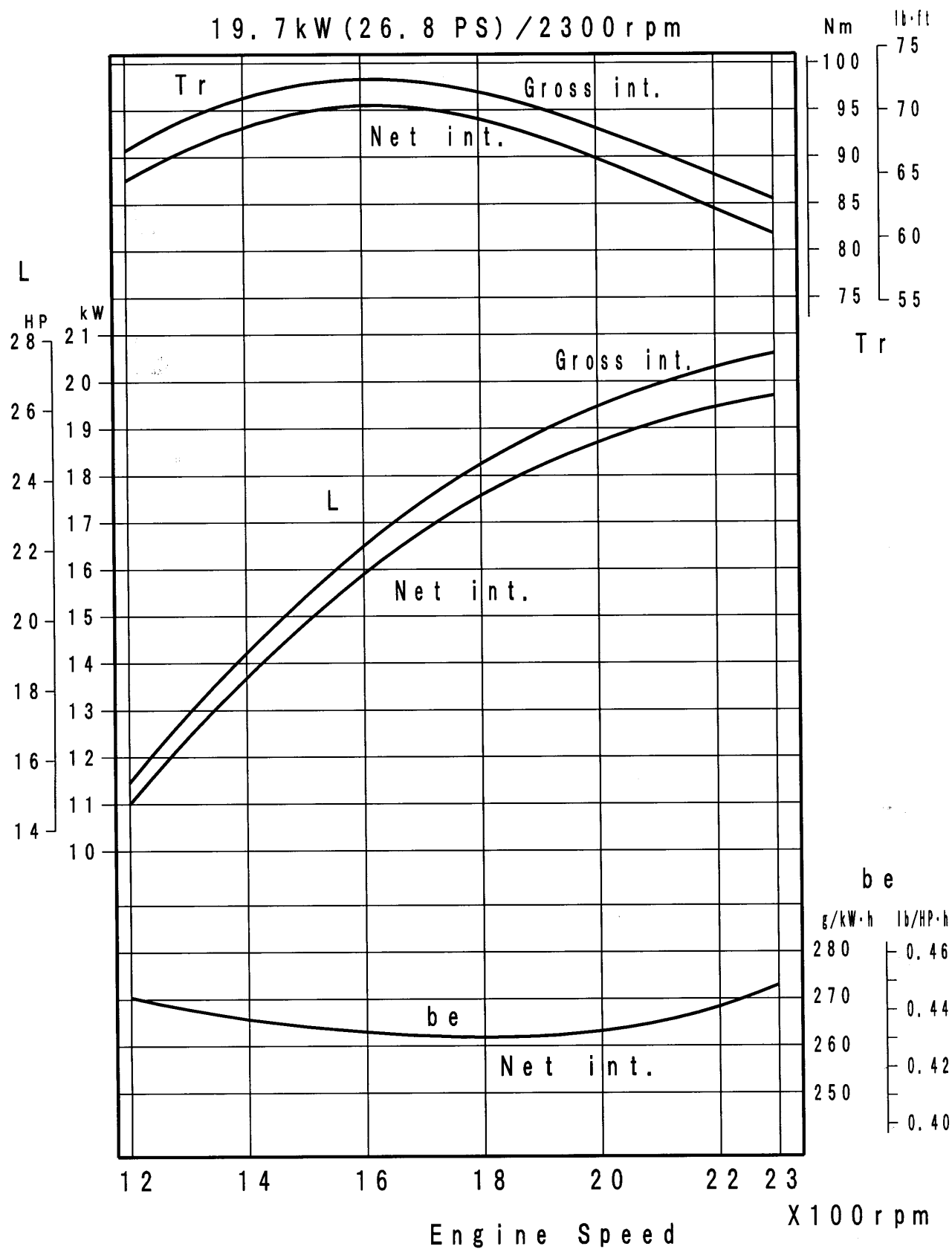
d. Performance curve : KX71-3 EU, V1505-E2-BH-10 EU

ISO 3046



e. Performance curve : KX71-3 PP, V1505-E2-BH-10

SAE-J1349



IV. Hydraulic System M-IV-2

- a. Hydraulic System Feature M-IV-2
- b. Hydraulic circuit diagram M-IV-2
- c. Main pump M-IV-7
- d. Control valve assy. M-IV-11
- e. Pilot valve M-IV-18
- f. Travel motor M-IV-23
- g. Swivel motior M-IV-26
- h. Cylinder M-IV-33
- i. Rotary joint M-IV-34
- j. Accessories of hydraulic components M-IV-35
- k. Maintenance specification M-IV-43

IV. Hydraulic System

a. Hydraulic System Feature

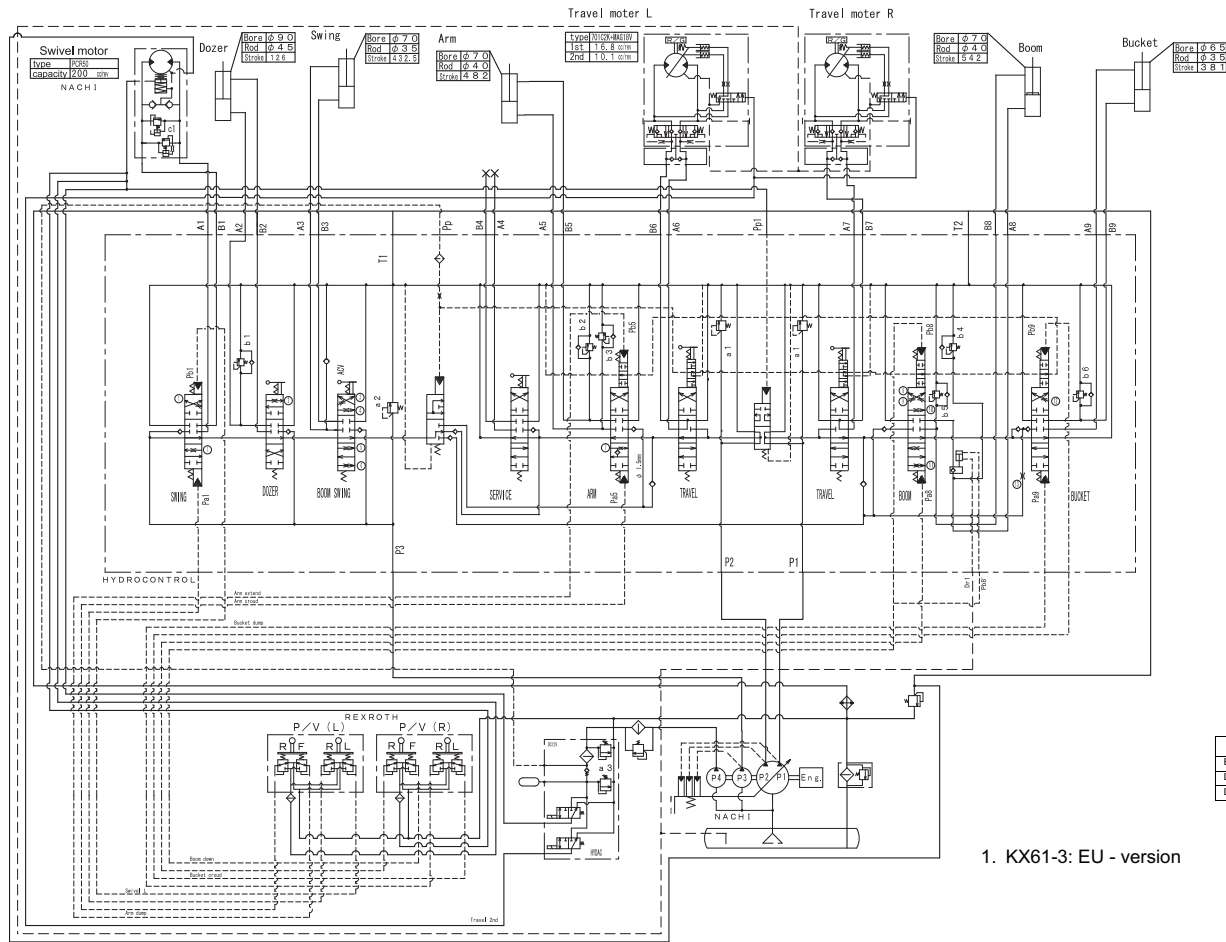
No	Item	KX61-3 EU	KX71-3 EU	KX71-3 PP
1.	Variable displacement piston pump with constant torqrol system	Yes	Yes	Yes
2.	Travel safety pilot line	Yes	Yes	Yes
3.	Main pump (P ₁ , P ₂) unload spool	Yes	Yes	Yes
4.	Travel straight system	Yes	Yes	Yes
5.	Confluence service flow	Yes	Yes	Yes
6.	Swivel motor negative brake	Yes	Yes	Yes
7.	Boom cylinder lock valve	Yes	Yes	Yes
8.				

b. Hydraulic circuit diagram

1. KX61-3 EU-version
2. KX71-3 EU-version
3. KX71-3 PP-version

KX61-3, KX71-3 WSM-M

Hydraulic System



(1)	φ2.7eq.
(2)	φ2.0eq.
(3)	φ2.0eq.
(4)	φ1.0eq.
(5)	φ2.0eq.
(6)	φ1.0eq.
(7)	φ1.5
(8)	φ2.0eq.
(9)	φ2.0eq.
(10)	φ1.2eq.
(11)	φ0.9eq.
(12)	φ2.2eq.
(13)	φ2.0

Relief pressure, bench (MPa)	
a1, a2	22.5
a3	17.2
ap	3.9
b1	26.5
b2	26.5
b3	26.5
b4	26.5
b5	26.5
b6	26.5
c1	17.6

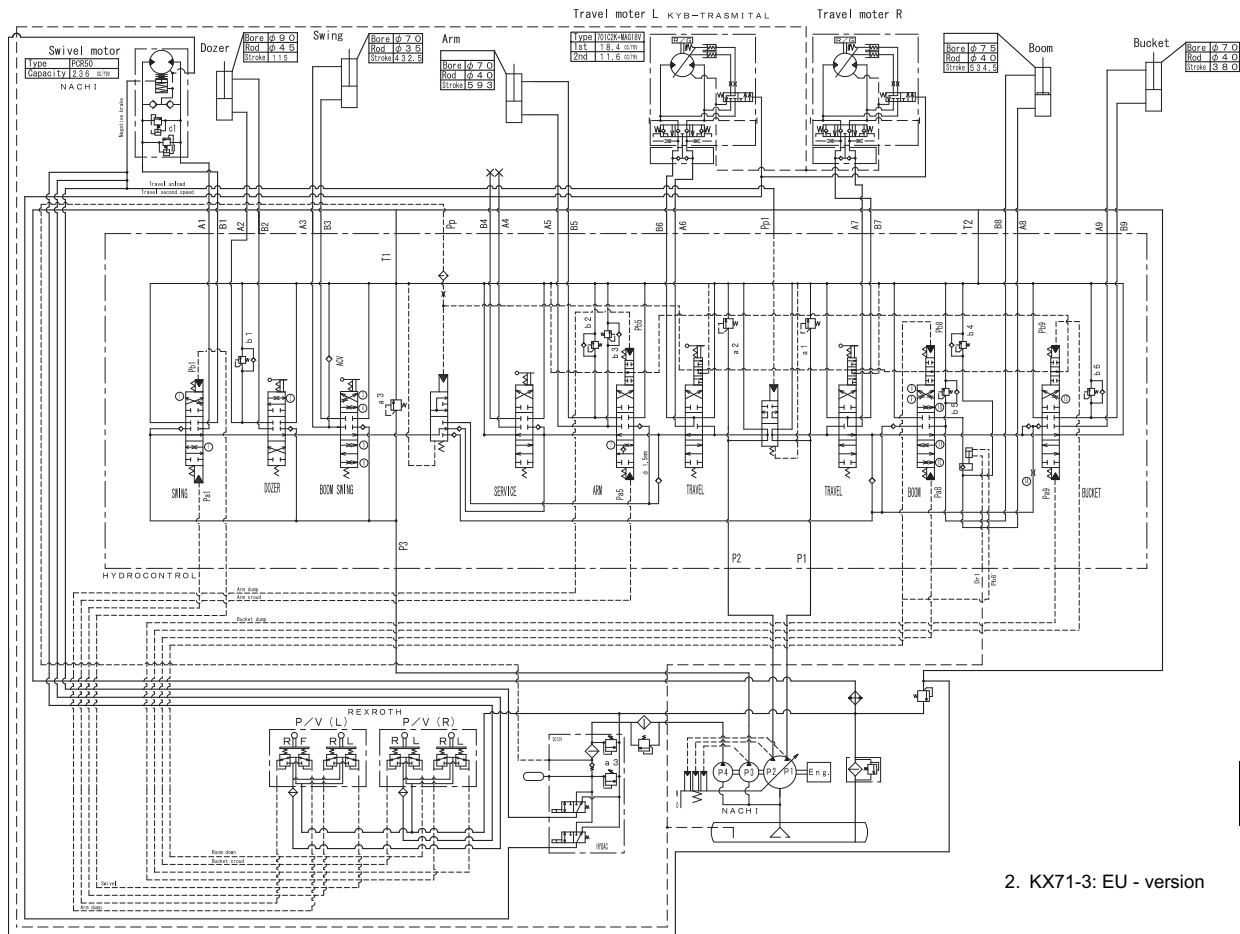
	P1	P2	P3	Pp
E, speed (rpm)	2100	2100	2100	2100
Displacement (cc/rev)	14.0	14.0	8.0	2.7
Discharge(l/min)	29.4	29.4	16.8	5.7

1. KX61-3: EU - version

M-IV-3

KX61-3, KX71-3 WSM-M

Hydraulic System



(1)	Ø2.7eq.
(2)	Ø1.9eq.
(3)	Ø1.5eq.
(4)	Ø0.9eq.
(5)	Ø2.0eq.
(6)	Ø2.0eq.
(7)	Ø1.0eq.
(8)	Ø1.5
(9)	Ø2.0eq.
(10)	Ø2.0eq.
(11)	Ø1.1eq.
(12)	Ø3.6eq.
(13)	Ø0.9eq.
(14)	Ø2.2eq.
(15)	Ø2.0

Relief pressure, bench (MPa)	
a1, a2	23.5
a3	20.6
ap	3.9
b1	26.5
b2	26.5
b3	26.5
b4	26.5
b5	26.5
b6	26.5
c1	17.6

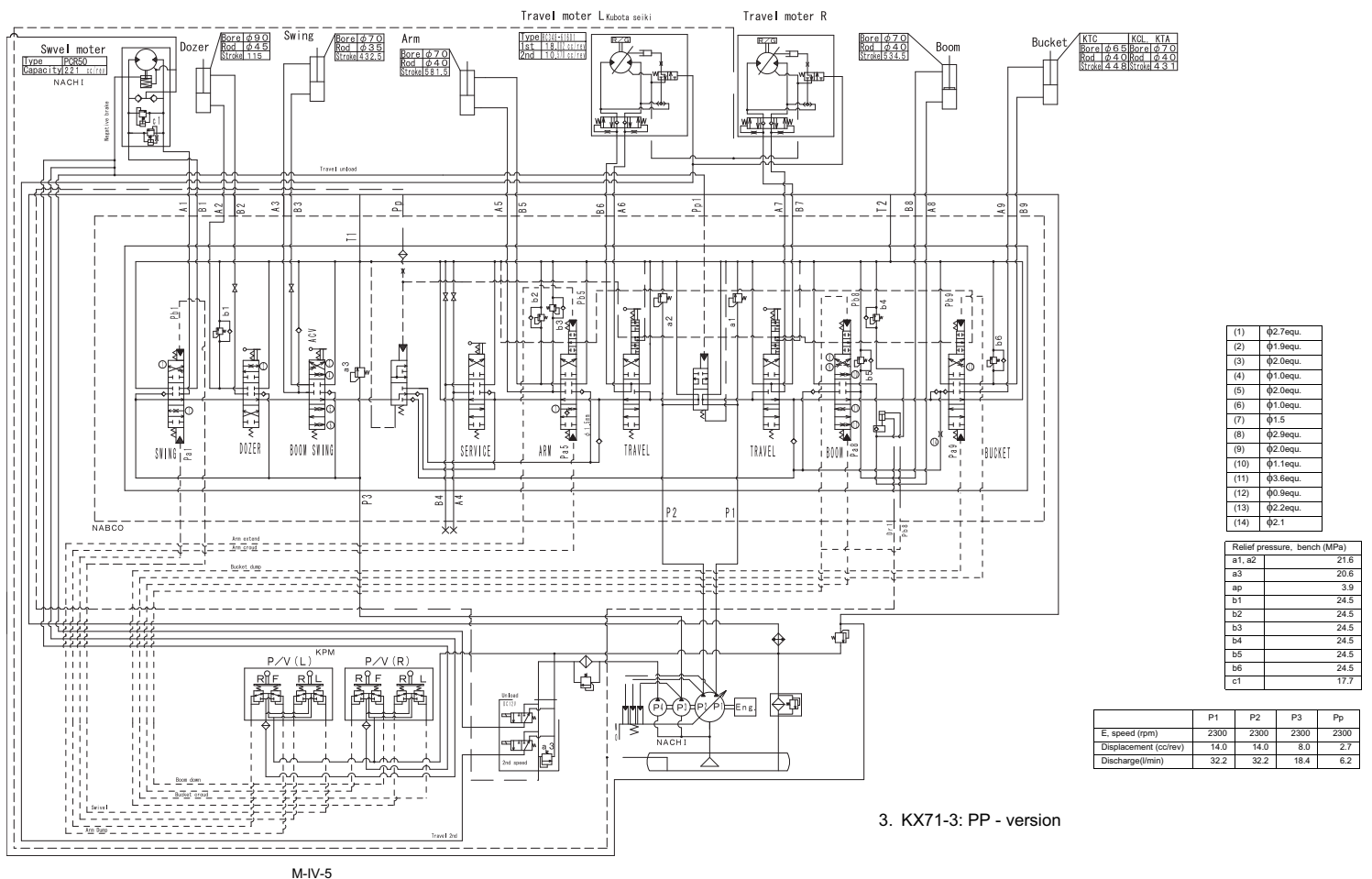
	P1	P2	P3	Pp
E, speed (rpm)	2300	2300	2300	2300
Displacement (cc/rev)	14.0	14.0	6.0	2.7
Discharge(l/min)	32.2	32.2	18.4	6.2

2. KX71-3: EU - version

M-IV-4

KX61-3, KX71-3 WSM-M

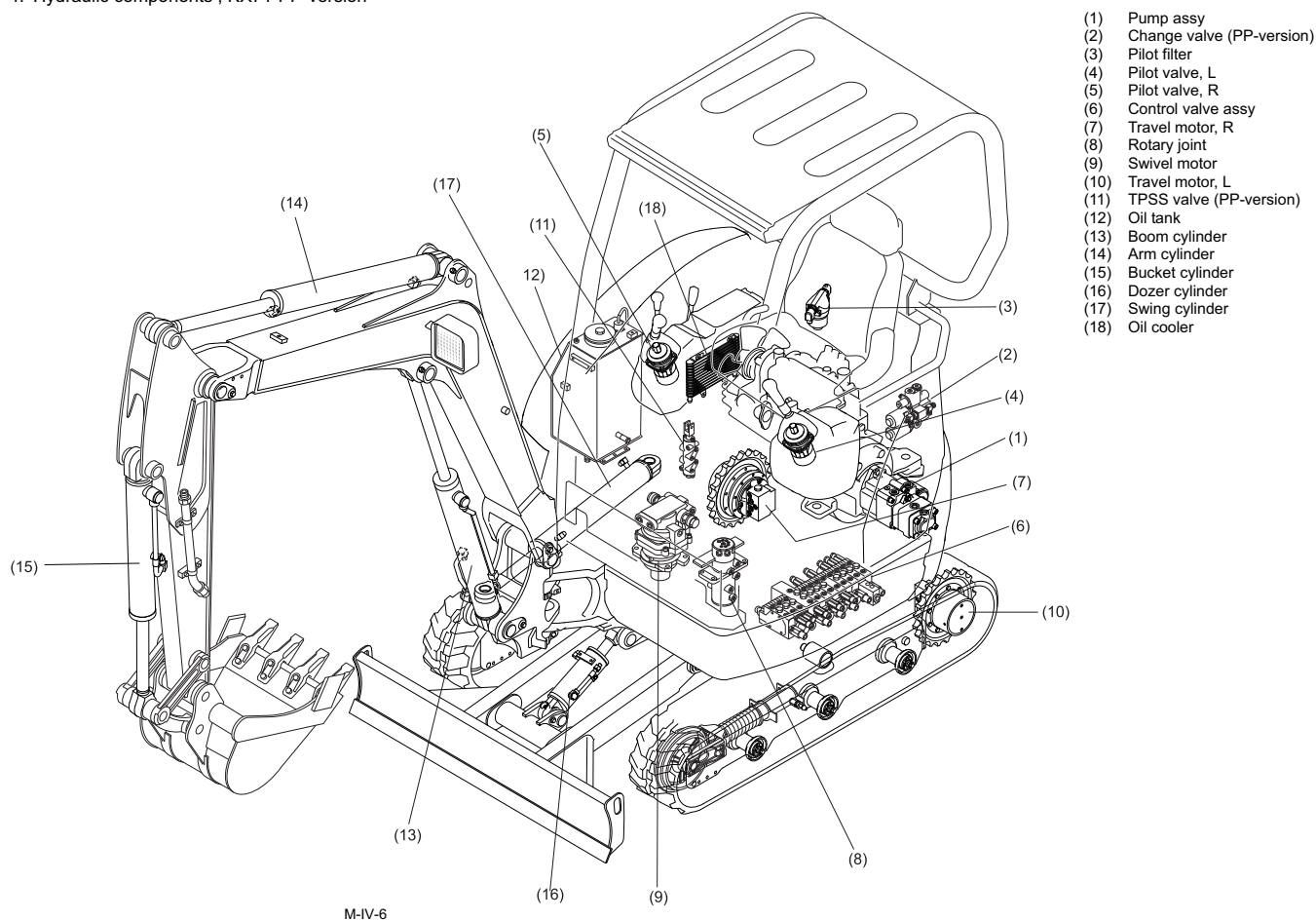
Hydraulic System



M-IV-5

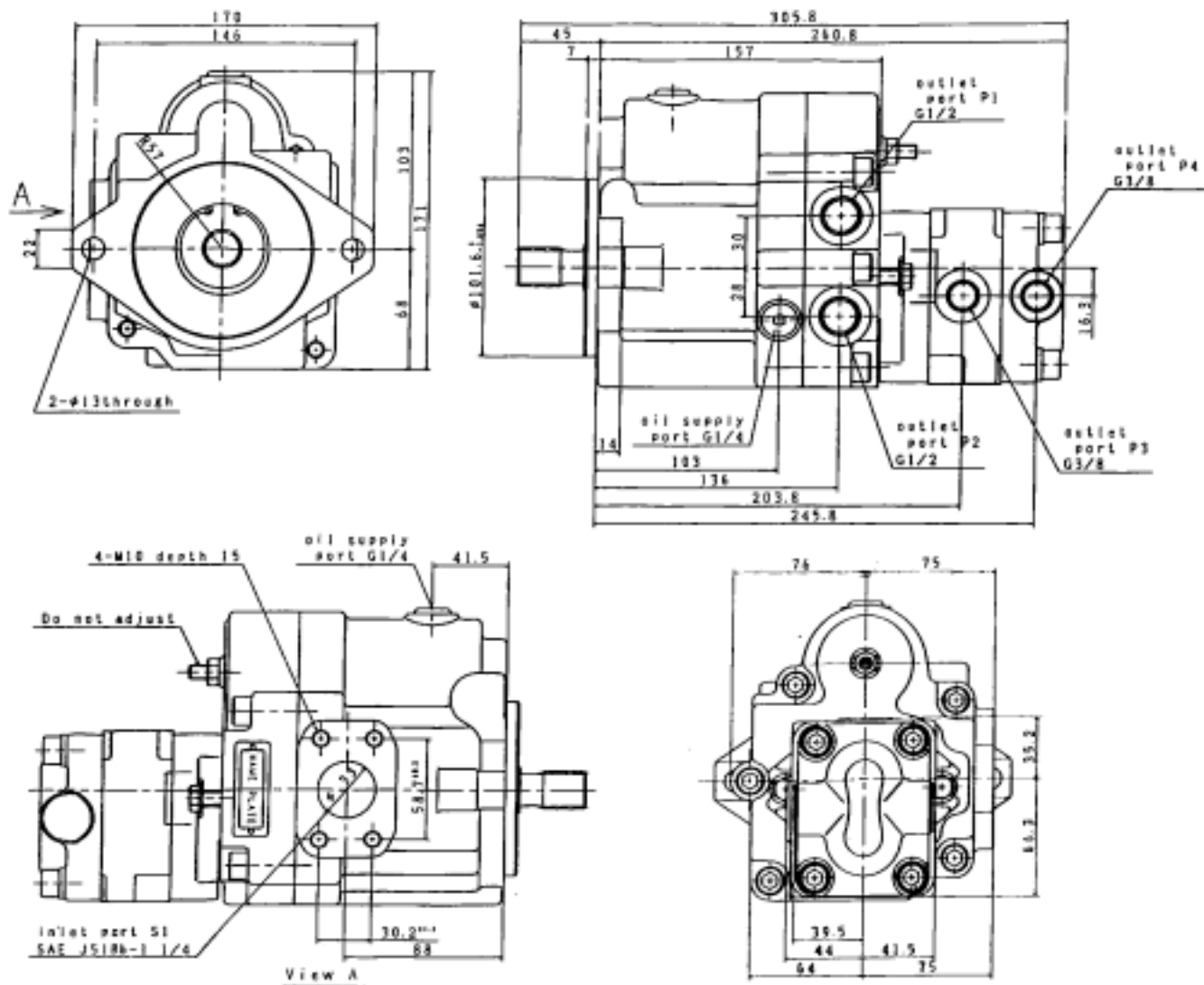
3. KX71-3: PP - version

4. Hydraulic components ; KX71-PP-version



c. Main pump

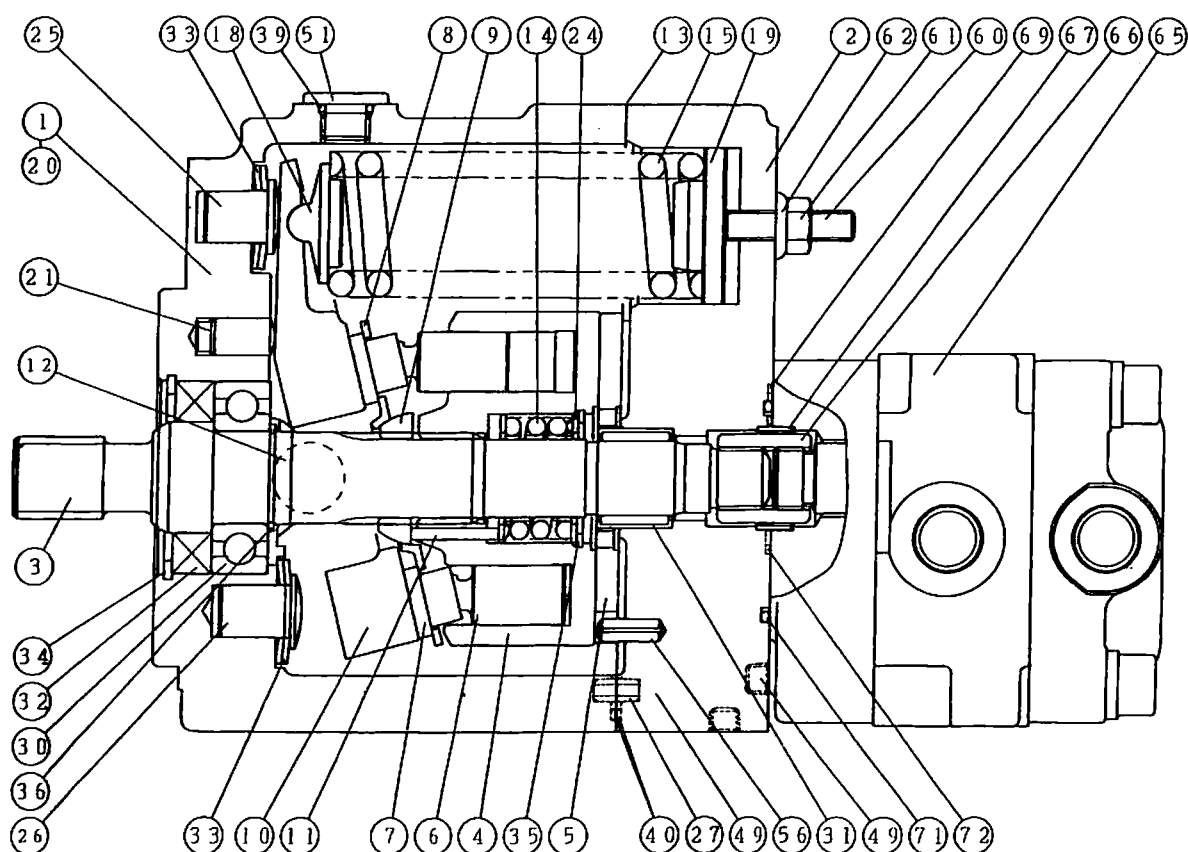
1. Outer view



	KX61-3	KX71-3
Volume	14+14+8+2.7 cm ³ /rev (P1+P2+P3+P4)	
Peak pressure	within P* (Max Pressure) ×1.1	
Drive speed min ⁻¹	2100 (rated) 2500 (Max)	2300 (rated) 2500 (Max)
Control type	Constant torque (P1+P2+P3) ① P1+P2, P3=0.49 MPa (5 Kg/cm ²) ② P1+P2, P3=17.2/20.6 MPa (175/210 Kg/cm ²)	
Rotation direction	Clockwise	
Weight	17 Kg (37.5 lbs)	

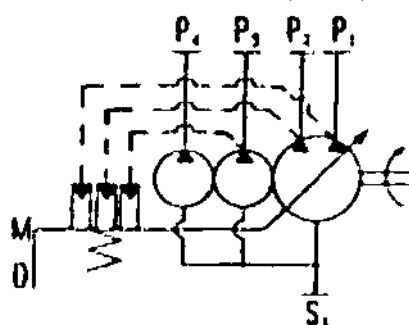
Hydraulic fluid	Anti-wear hydraulic fluid ISO VG 32, 46, 68
Temperature range	-20 ~ 100 °C
Viscosity range	10 ~ 1000 mm ² /s
Contamination	Within NAS grade 11
Suction filter	150 mesh
Return line filter	10 μm
P3, P4 Pump	Gear pump
Oil supply	Before first starting, fill pump case with clean oil.

2. structure

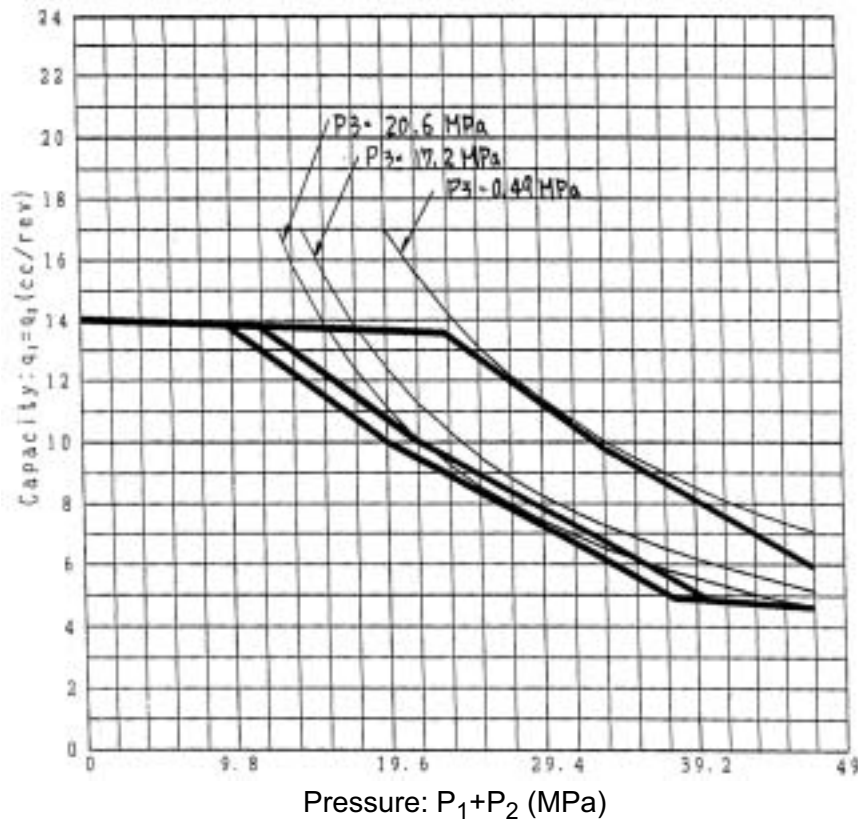


- | | | | | |
|---------------------|--------------------|------------------------|-------------------------|------------------|
| (1) Body S | (11) Needle | (25) Stopper pin A | (39) O - ring | (62) Seal washer |
| (2) Body H | (12) Ball | (27) Stopper pin B | (40) O - ring | (65) Gear pump |
| (3) Shaft | (13) Packing | (30) Ball bearing | (42) Plug (GPF 1/4) | (66) Coupling |
| (4) Cylinder barrel | (14) Spring C | (31) Needle bearing | (43) O - ring | (67) Collar |
| (5) Valve plate | (15) Spring T | (32) Oil seal | (44) Hex bolt | (68) Bolt |
| (6) Piston | (18) Spring holder | (33) Belleville spring | (49) Plug (TPUA - 1/16) | (69) O - ring |
| (7) Shoe | (19) Spring guide | (Coned disk spring) | (51) Plug (GPF 1/4) | (70) Washer |
| (8) Shoe holder | (20) Pin | (34) Snap ring | (56) Spring pin | (71) O - ring |
| (9) Barrel holder | (21) Rod G | (35) Snap ring (RA-25) | (60) Hex screw | (72) O - ring |
| (10) Swash plate | (24) Retainer | (36) Snap ring (RA-35) | (61) Nut | |

Hydraulic symbol



3. P-Q performance curve



Test condition		Test condition	
Oil	ISOVG46	q ₁ , q ₂	14 cc/rev
Oil temp	50 ± 5 °C	q ₃	8 cc/rev
RPM	2100/2300 rpm	q ₄	2.7 cc/rev
Direction	Clockwise	P ₄	40 kgf/cm ²

4. Pump Specifications, Type : PVD-1B-28P-8G3-4575A

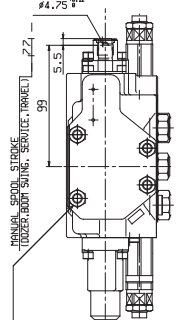
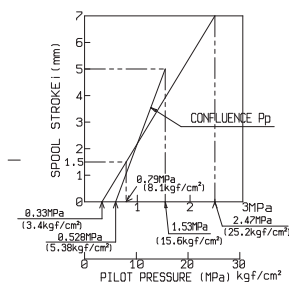
1.Capacity	P ₁ , P ₂ : 14 x 2 cm ³ /rev	P ₃ : 8 cm ³ /rev	P ₄ : 2.7 cm ³ /rev
2.Pressure at bench (KX61-3/71-3 EU/71-3 US)	P ₁ , P ₂ : 22.5/23.5/21.6 MPa (230/240/220 kgf/cm ²)	P ₃ : 17.2/20.6/20.6 MPa (175/210/210 kgf/cm ²)	P ₄ : 3.9 MPa (40 kgf/cm ²)
3.Speed (KX61-3/71-3 EU/71-3 US)	Rated Speed: 2100/2300/2300 min ⁻¹ Rotation Direction: Clockwise Max. Speed: 2500 min ⁻¹		
4.Suction pressure	-0.02 ~ ±0.04 MPa (-0.2 ~ +0.4 kgf/cm ²)		
5.Oil	ISO VG 32, 46, 68 Anti - Wear hydraulic fluid		
6.Oil temp	Temp range : -20 ~ +100 °C		
7.Control	Constant torque control		
8.Torque	at P ₃ = 0.49 MPa T=69.8 N·m at P ₃ = 17.2/20.6 MPa T=75.0 N·m		
9.Pump discharge (KX61-3/71-3 EU/71-3 US)	P ₁ , P ₂ : 29.4/32.2/32.2 l/min x 2 (7.77/8.51/8.51 us gal/minx 2)	P ₃ : 16.8/18.4/18.4 l/min x 2 (4.44/4.86/4.86 us gal/min x 2)	P ₄ : 5.7/6.2/6.2 l/min (1.51/1.64/1.64 us gal/min)

1. KX61-3: EU - version, Code No:RG248-61131, Maker: Hydro control

```

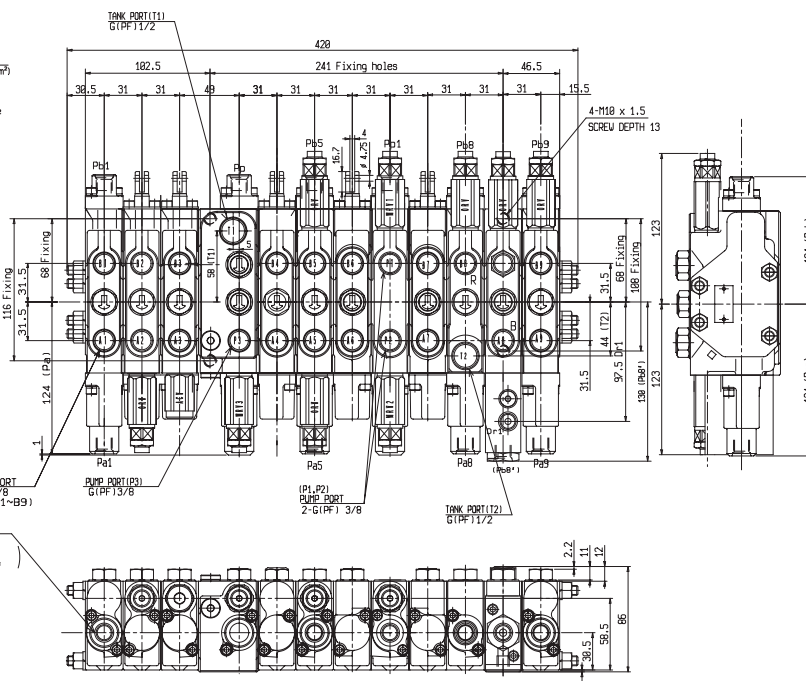
USER'S SPEC
*OPERATING FLOW(MAX)
P1 : 29.4L/min
P2 : 29.4L/min
P3 : 16.8L/min
*RELIEF VALVE SET PRESSURE(37mm/3/32in)
R1/22.5 MPa(328 kgf/cm²) at 29 L/min
R2/22.5 MPa(328 kgf/cm²) at 29 L/min
R3/17.2 MPa(245 kgf/cm²) at 18 L/min
*OVERLOAD RELIEF VALVE SET PRESSURE
R1/15, R2/15, R3/15
R2/6.5 MPa(92 kgf/cm²) at 5 L/min
*PILOT PORT PRESSURE: 3.92MPa(48kgf/cm²)
*HYDRAULIC FLUID : ISO VG46
*OPERATING TEMPERATURE RANGE: 20~50°C(68~130°F)
*RELIEF VALVE ADJUSTABLE RANGE
4.38~24.2 MPa(58~358kgf/cm²)
*ACTION SPRING FORCE(MINIMUM RELIEF VALVE)
NOMINAL POSITION : 68.6N(7kgf)
ACTUATED POSITION : 88.2N(9kgf)
*CONTAMINATION : Less than NIS 9 CLASS

```

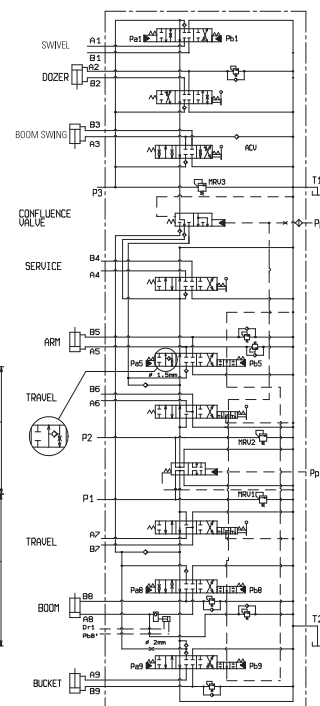


FASTENING TORQUE
16.7~17.7N*m
(1.7~1.8kgf*m)

ACTUATOR PORT
18-G(PF)3/8
(A1~A9,B1~B9)



M-IV-11

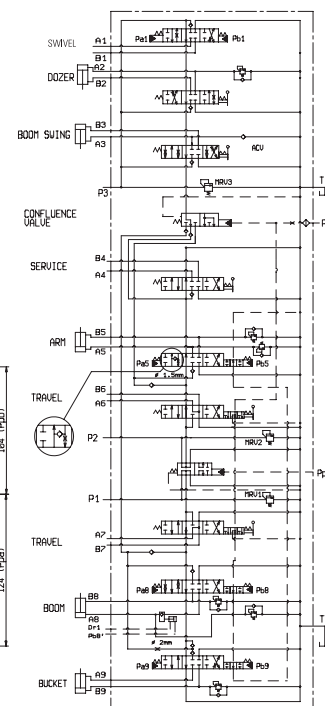
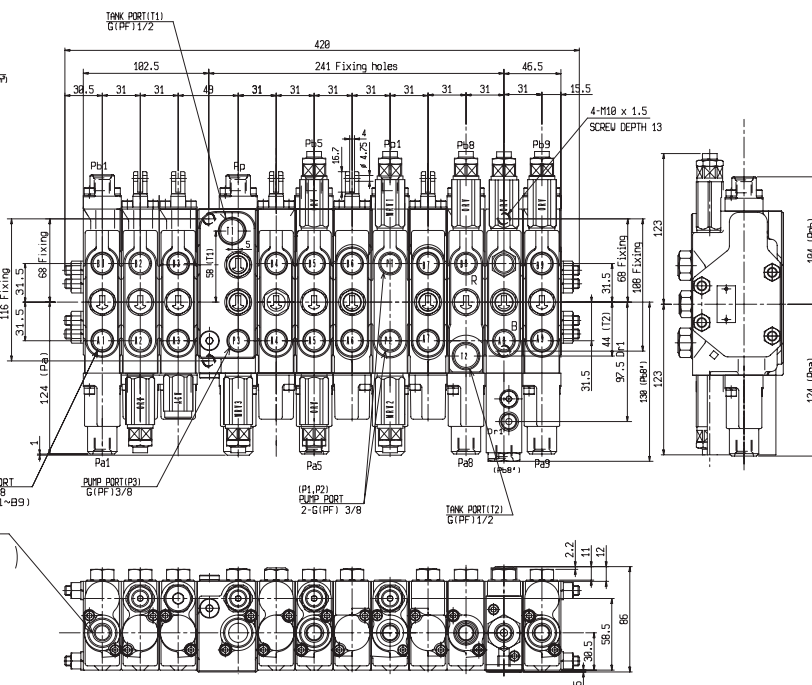
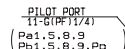
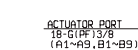
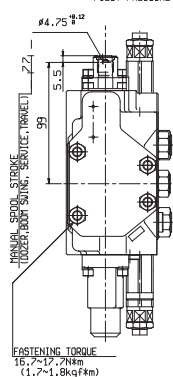
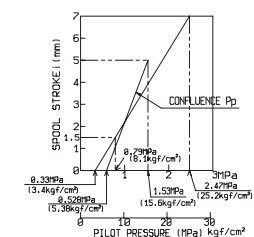


2. KX71-3: EU - version, Code No:RG448-61131, Maker: Hydro control

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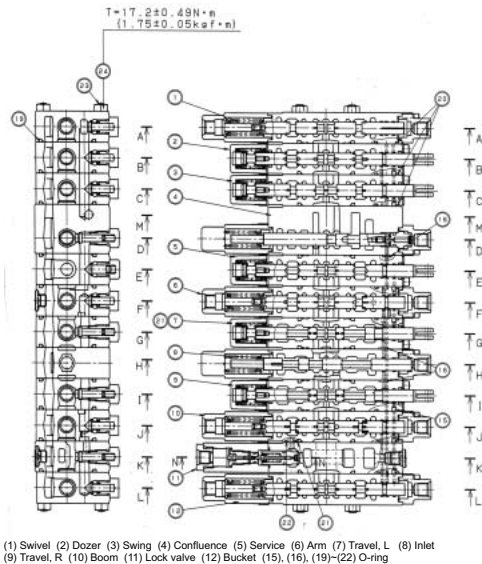
USER'S SPEC
OPERATING FLOW(MAX)
P1 = 32.2L/min                                     *RELIEF VALVE ADJUSTABLE RANGE
P2 = 32.2L/min                                     14.90-24.5Pa(0.25-35kgf/cm²)
P3 = 18.4L/min                                     *RETURN SPRING FORCE(MINIMUM OPERATION VALUE)
RELIEF VALVE SET PRESSURE(3mmφ(3/32in))          ACTUAL POSITION : 68.6N(kgf)
R1Z:23.5 10 10 mPa(218 10 kgf/cm²) at 32 L/min      NEUTRAL POSITION : 88.2N(kgf)
R2Z:23.5 10 10 mPa(218 10 kgf/cm²) at 32 L/min      *CONTAMINATION : LESS THAN NAS 9 CLASS
R3Z:26.6 10 10 mPa(218 10 kgf/cm²) at 18 L/min
NOVALDPORT :RELIEF VALVE SET PRESSURE
A2,A5,A8,B5,B8,B9
:26.5 10 10 mPa(218 10 kgf/cm²) at 5L/min
IN/OUT PORT PRESSURE:3.5mmφ(1/8in)cm
HYDRAULIC FLUID : ISO VG46
WORKING PRESSURE:35MPa(500kgf/cm²)(3500psi)(500C)

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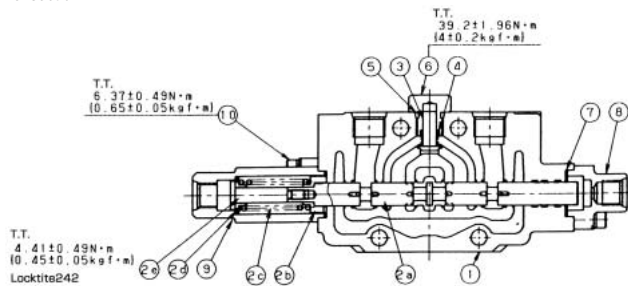




4. Control valve section : KX71-3 PP - version (RB448-61131)

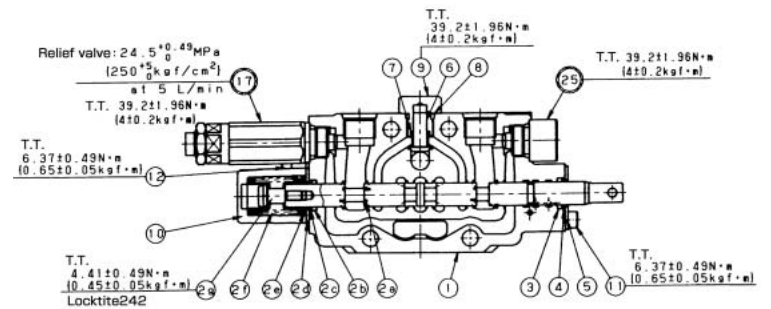


4-1 A-A: Swivel section

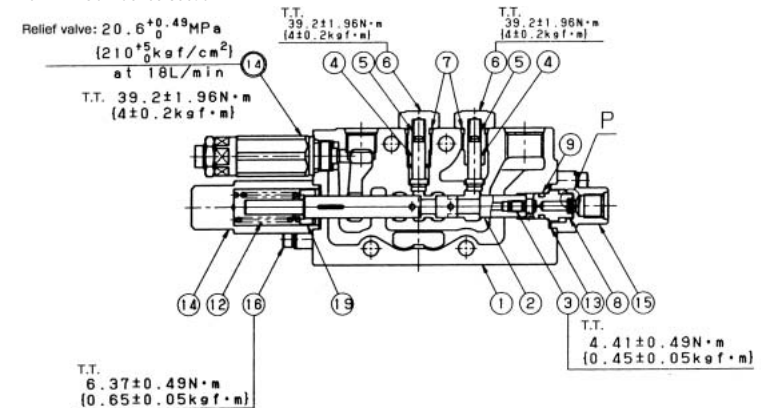


M-IV-14

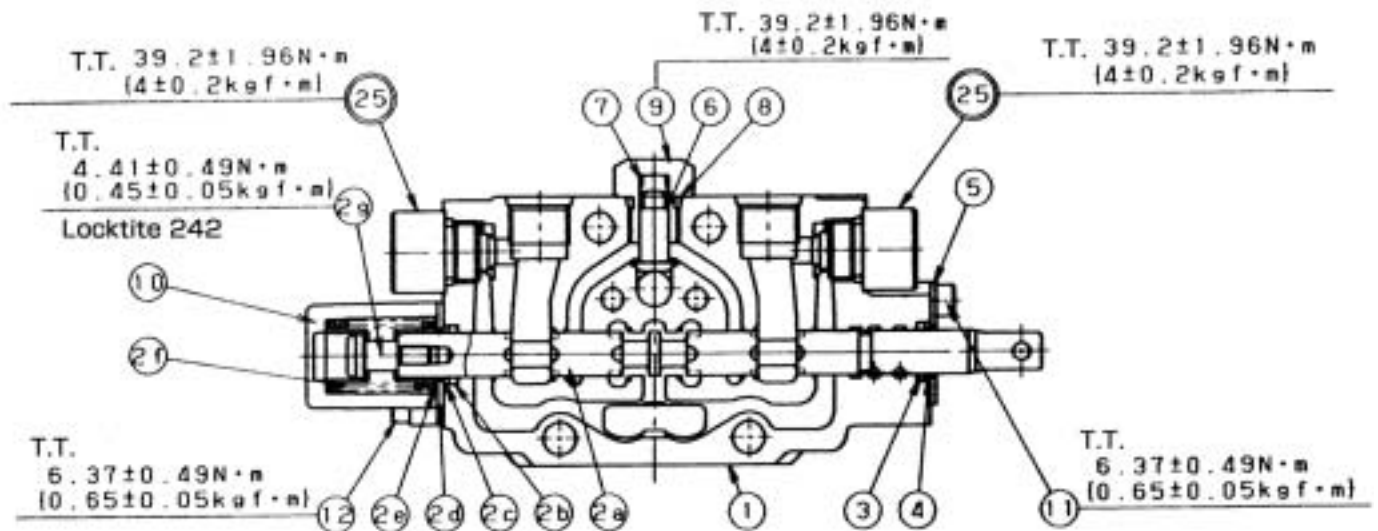
4-2 B-B : Dozer section



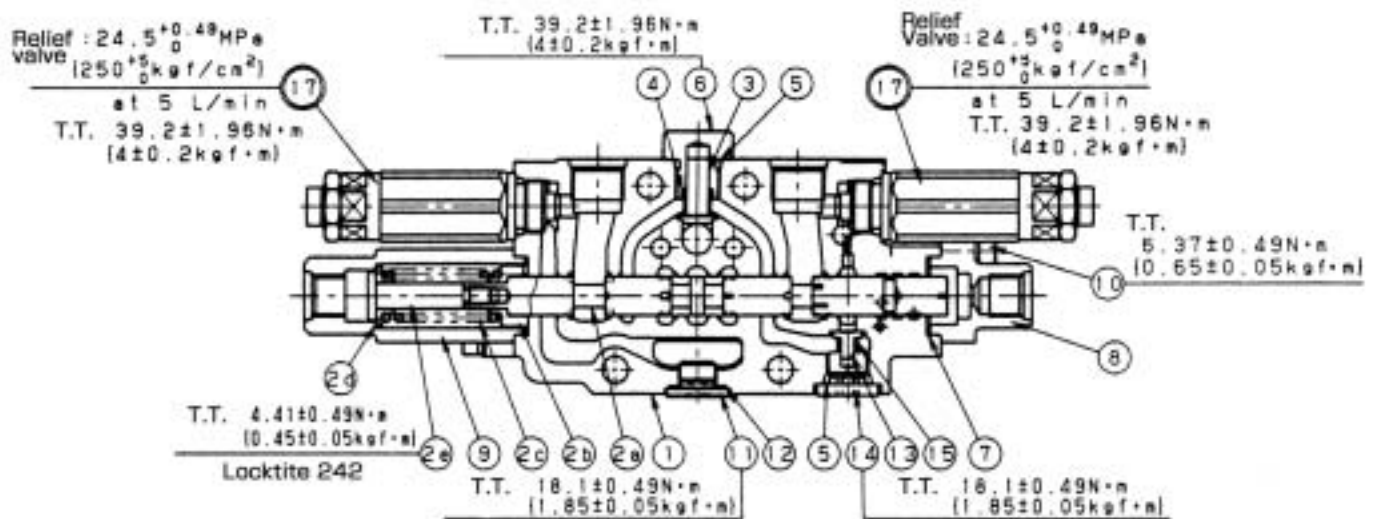
4-3 H-H : Confluence section



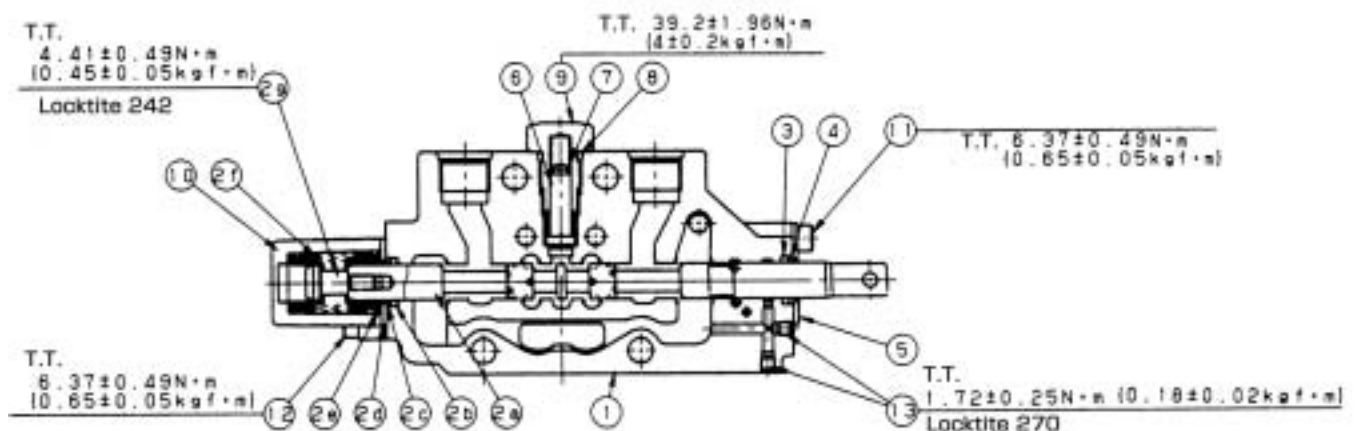
4-4 E-E : Service section



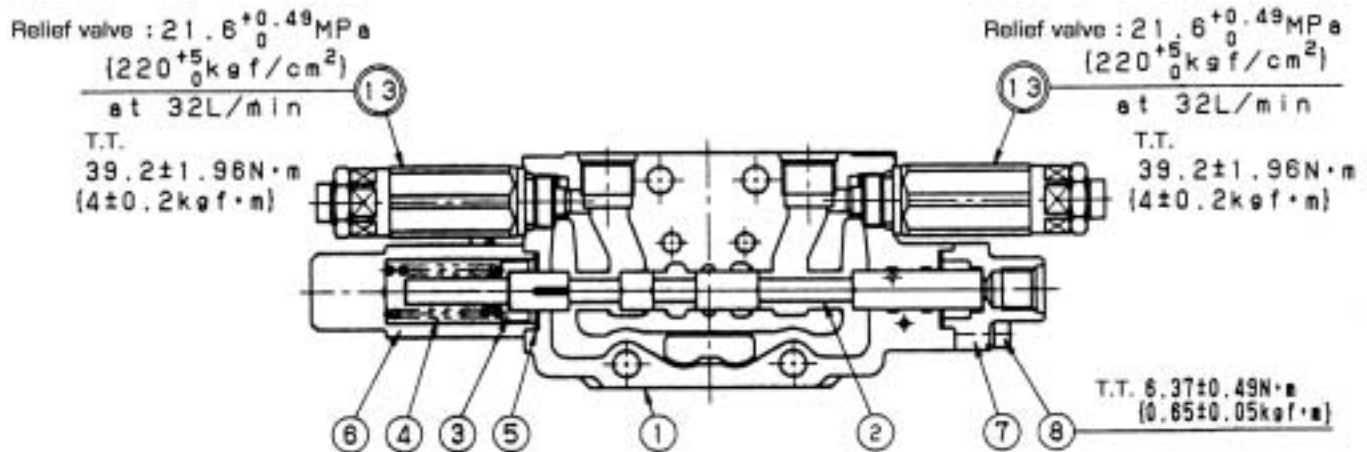
4-5 F-F : Arm section



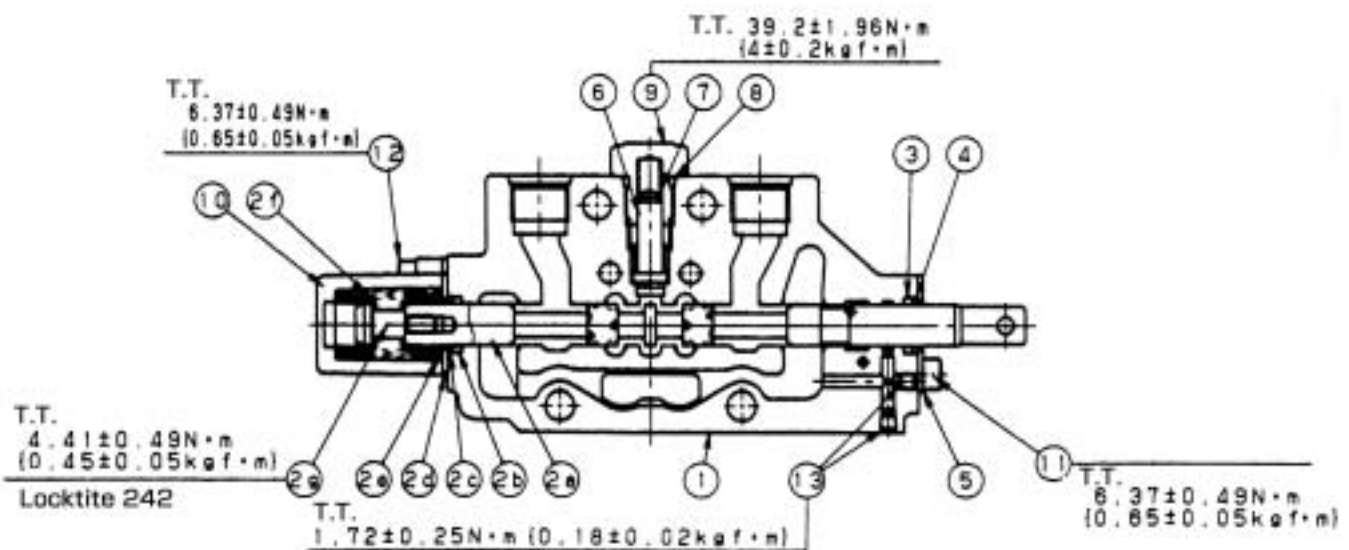
4-6 G-G : Travel R section



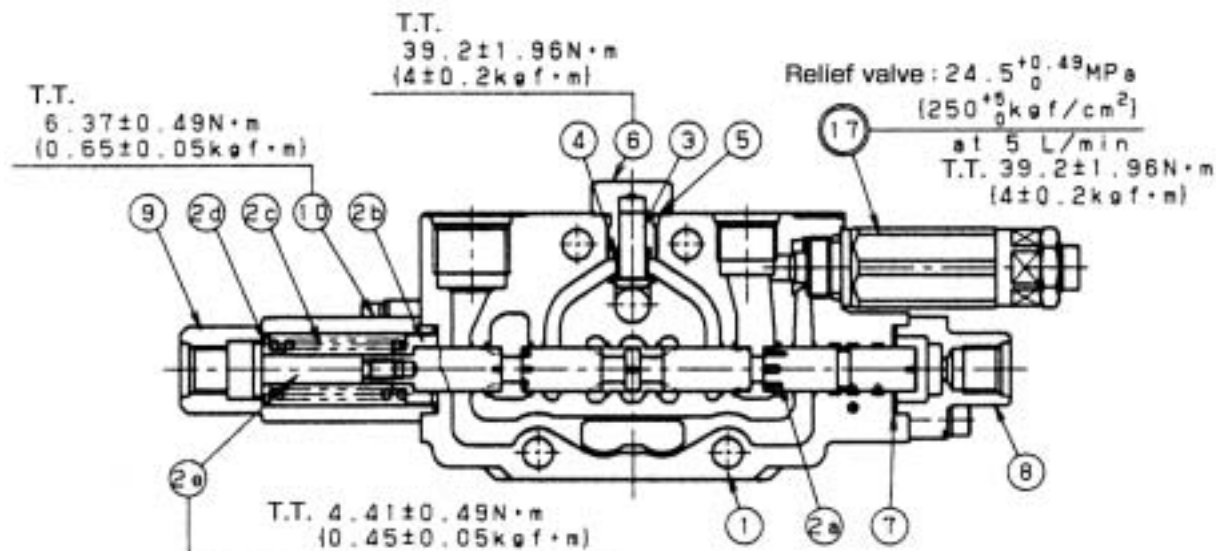
4-7 H-H : Inlet section



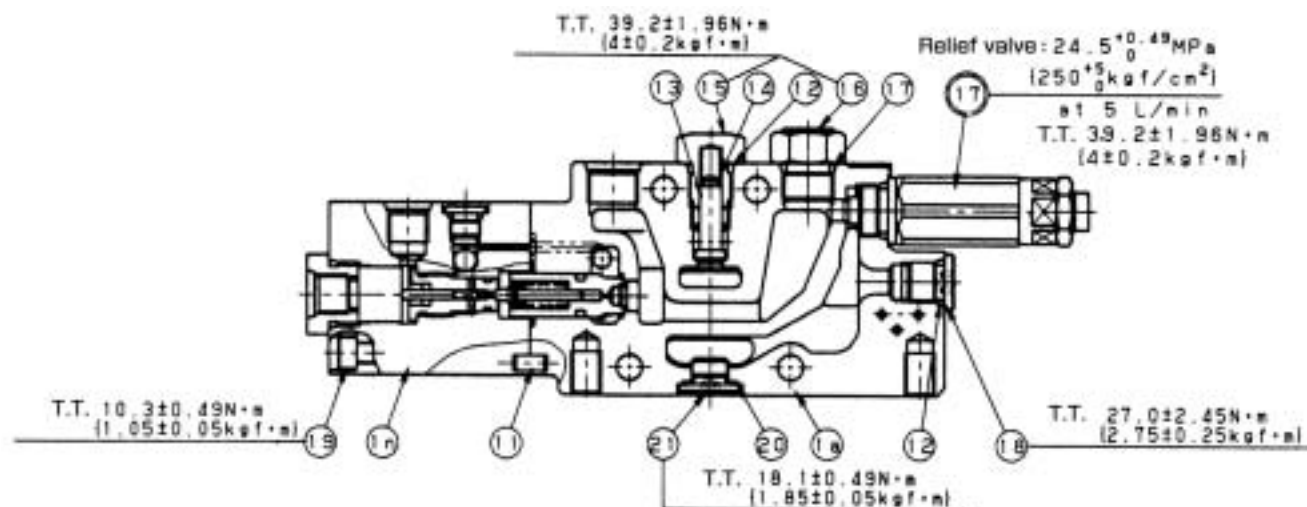
4-8 I-I : Travel R section



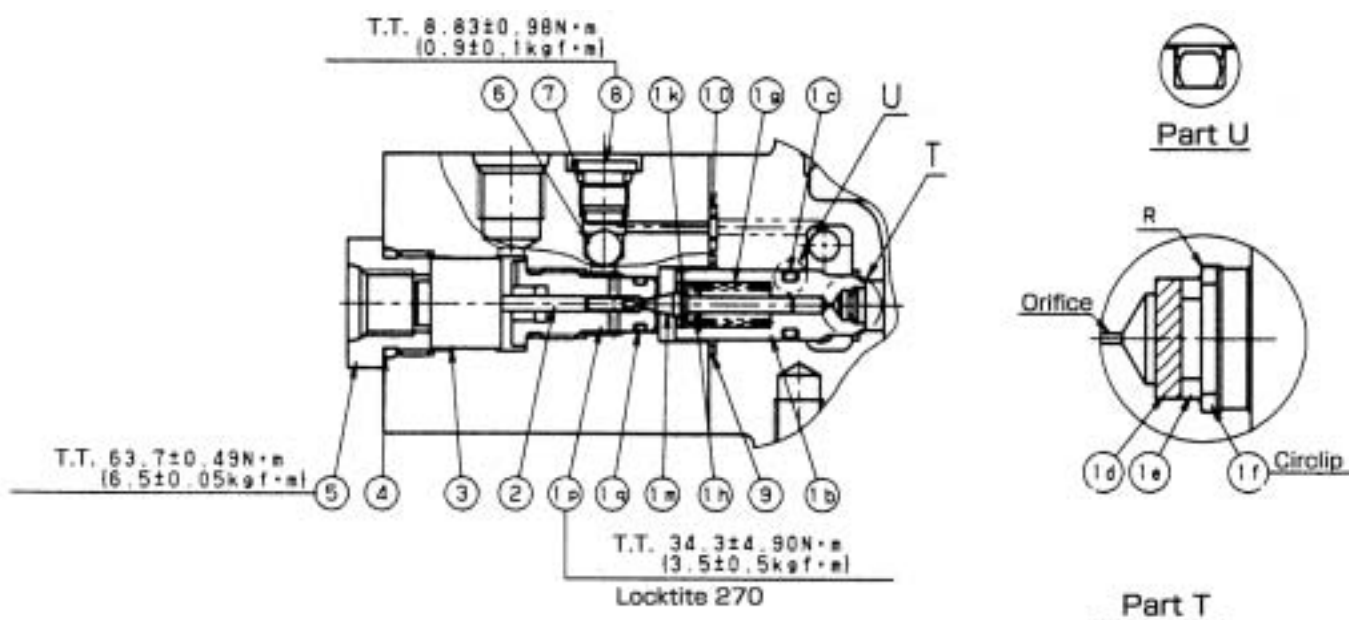
4-9 J-J : Boom section



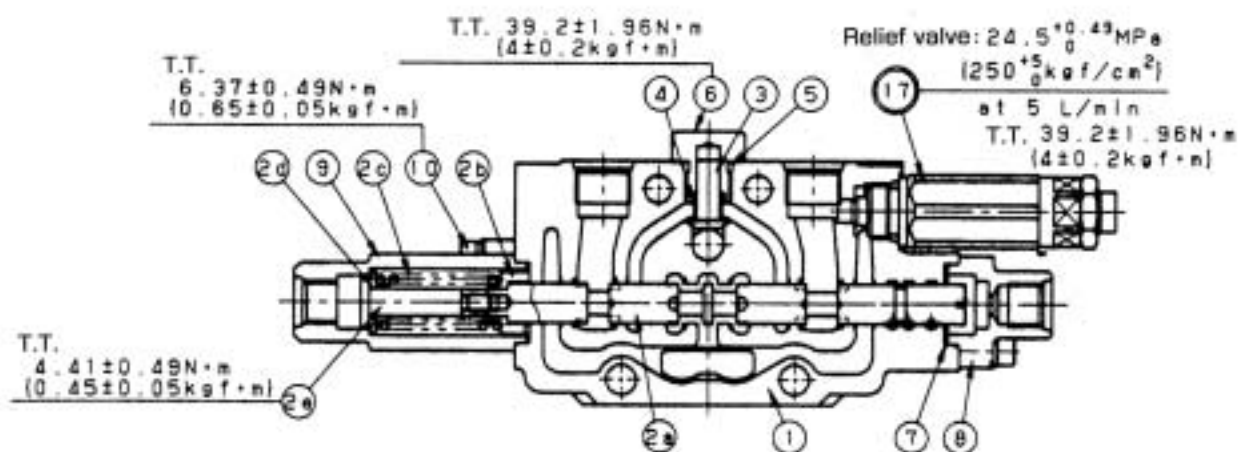
4-10 K-K : Boom lock valve



4-11 N-N : Book lock

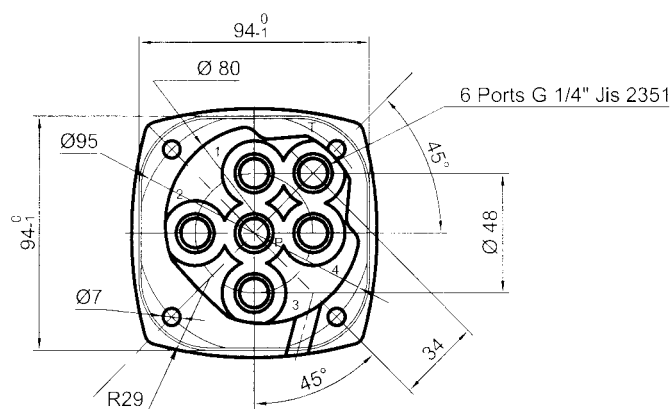
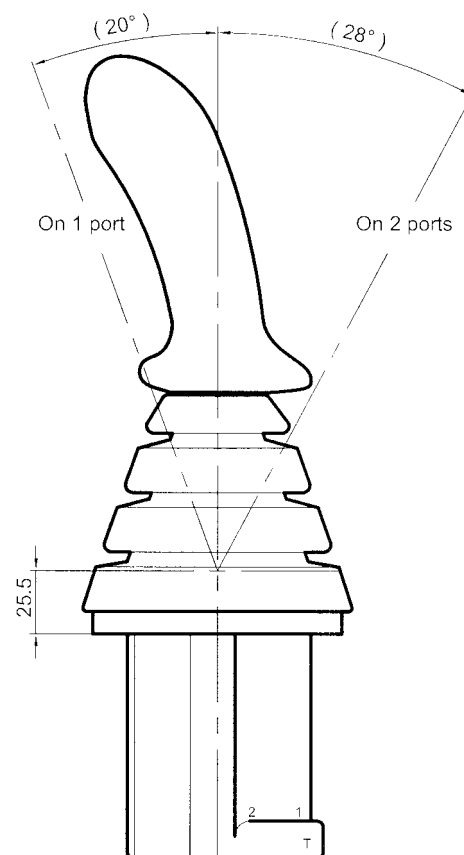
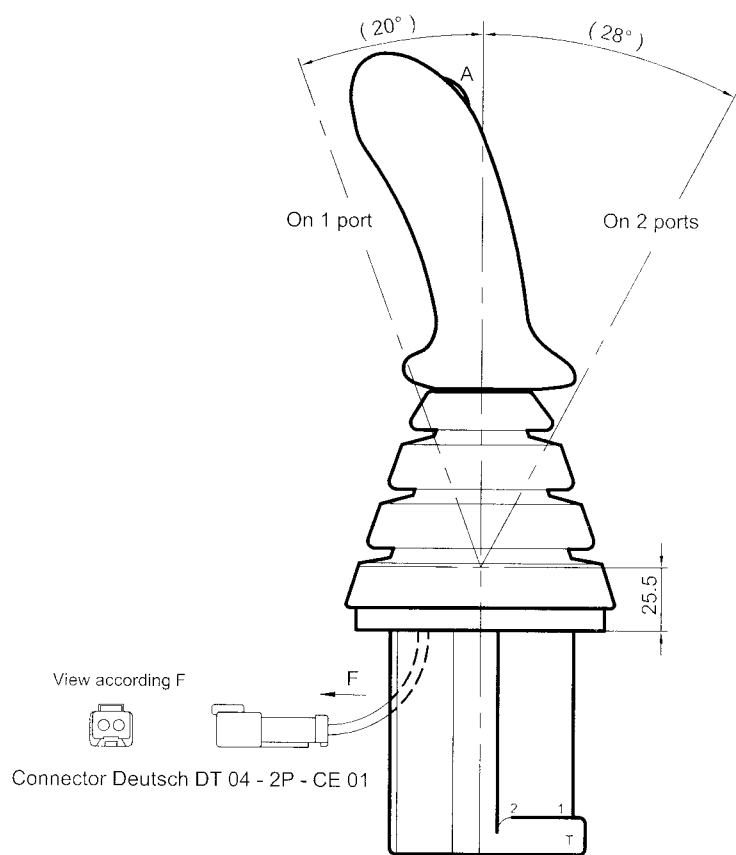


4-12 L-L : Bucket section

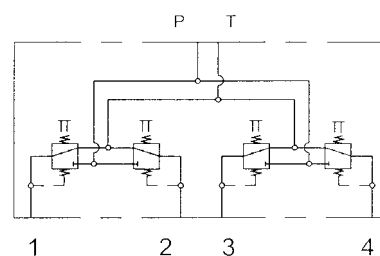


e. Pilot valve

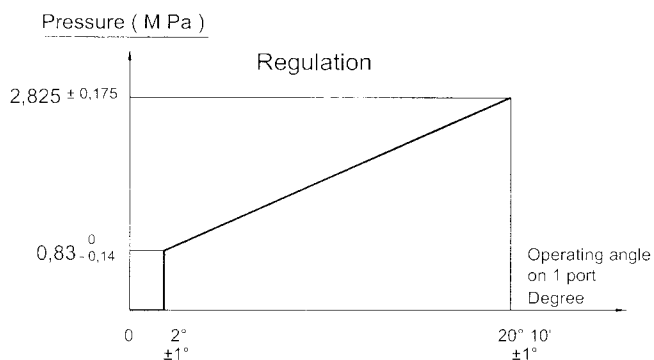
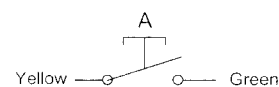
1. EU - version



Hydraulic symbol



Handle electric symbol



Switch power DC : 0,1 A / 250 V
Electrical characteristic : cf Doc 07 298 429

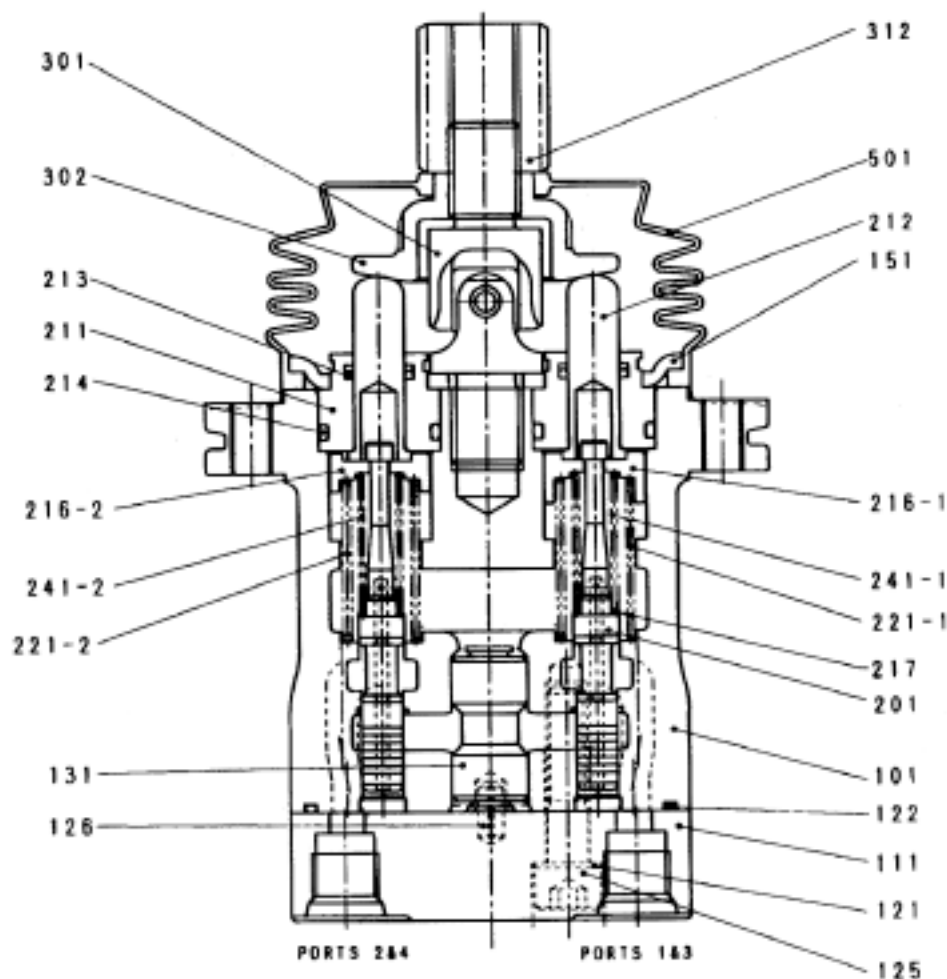
Maximum permissible operating torque at lever: 8 daN.m

Note : Pilot valve is identical among KX36-3, 41-3, 61-3 and KX71-3 for EU-version.

2. KTC, KCL, KTA-version

This pilot valve is identical among KX-91-3 and KX71-3.
assy No.=RC411-61721 (Kawasaki HI make)

2-1 Structure & specifications



121:
Not to be reused.

212:
Grease is applied on each top part.

217:
Shim for adjusting secondary pressure 1 sheet with designed thickness $t = 0.4$

301:
Grease is applied on each rotational part of the universal joint.

Tightening torque list

No.	SCREW SIZE	TIGHTNING TORQUE
125	M8	$20.6 \pm 1.5 \text{ N}\cdot\text{m}$ ($210 \pm 15 \text{ kgf}\cdot\text{cm}$)
301	M14	$47.1 \pm 2.9 \text{ N}\cdot\text{m}$ ($480 \pm 30 \text{ kgf}\cdot\text{cm}$)
312	M14	$68.6 \pm 4.9 \text{ N}\cdot\text{m}$ ($700 \pm 50 \text{ kgf}\cdot\text{cm}$)

No.	PART NAME	Q'ty
213	Seal	4
212	ROD, push	4
211	PLUG	4
201	SPOOL	4
151	PLATE	1
131	BUSH	1
126	PIN, spring	1
125	SCREW, hex, S.M.C	2
122	O-RING	1
121	WASHER, seal	2
111	PLATE, port	1
101	CASING	1

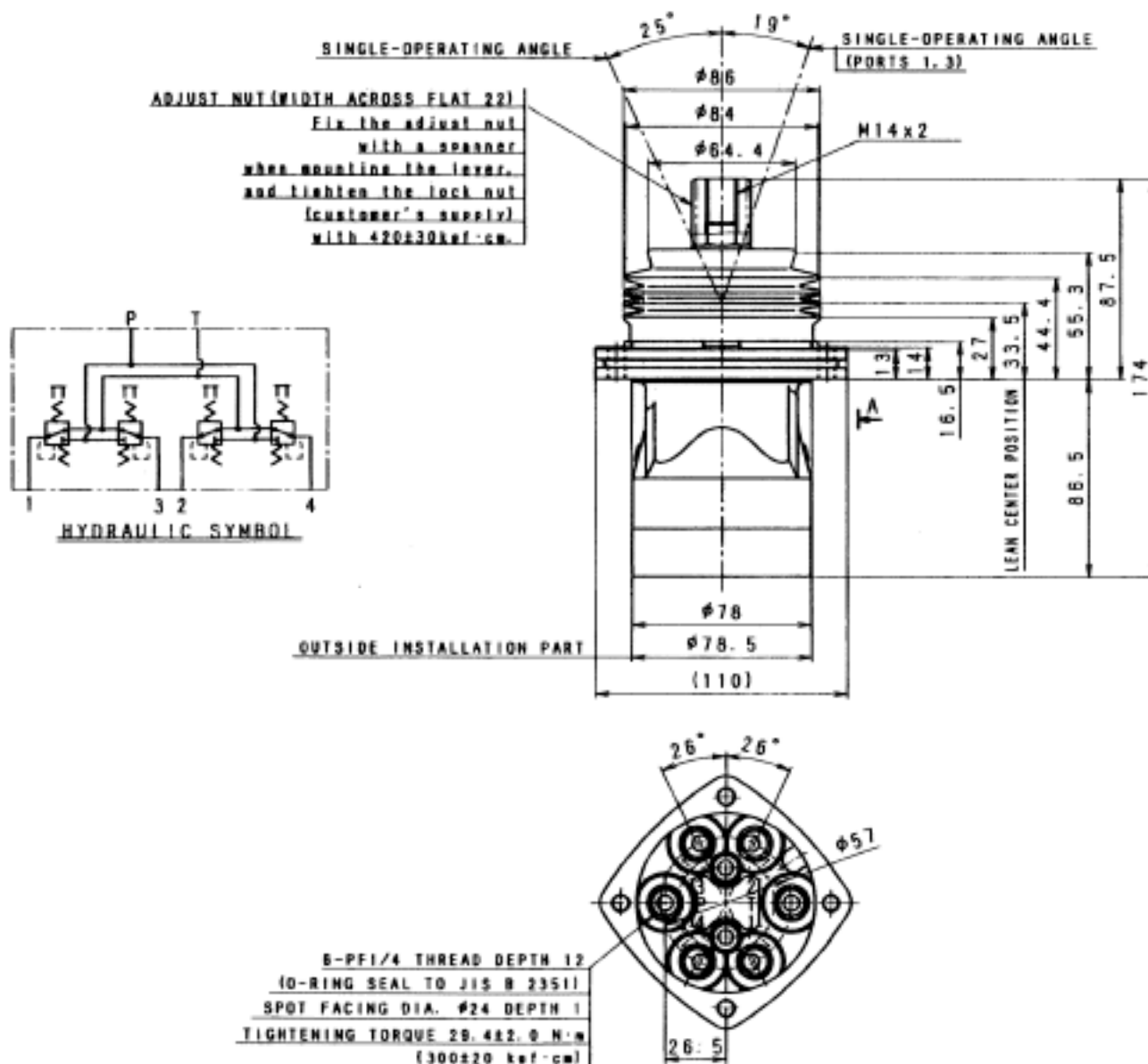
No.	PART NAME	Q'ty
501	BELLOWS	1
312	NUT, adjusting	1
302	PLATE, circular	1
301	JOINT	1
241-2	SPRING	2
241-1	SPRING	2
221-2	SPRING	2
221-1	SPRING	2
217	WASHER 2	4
216-2	SEAT 1, spring	2
216-1	SEAT 1, spring	2
214	O-RING	4

Specifications

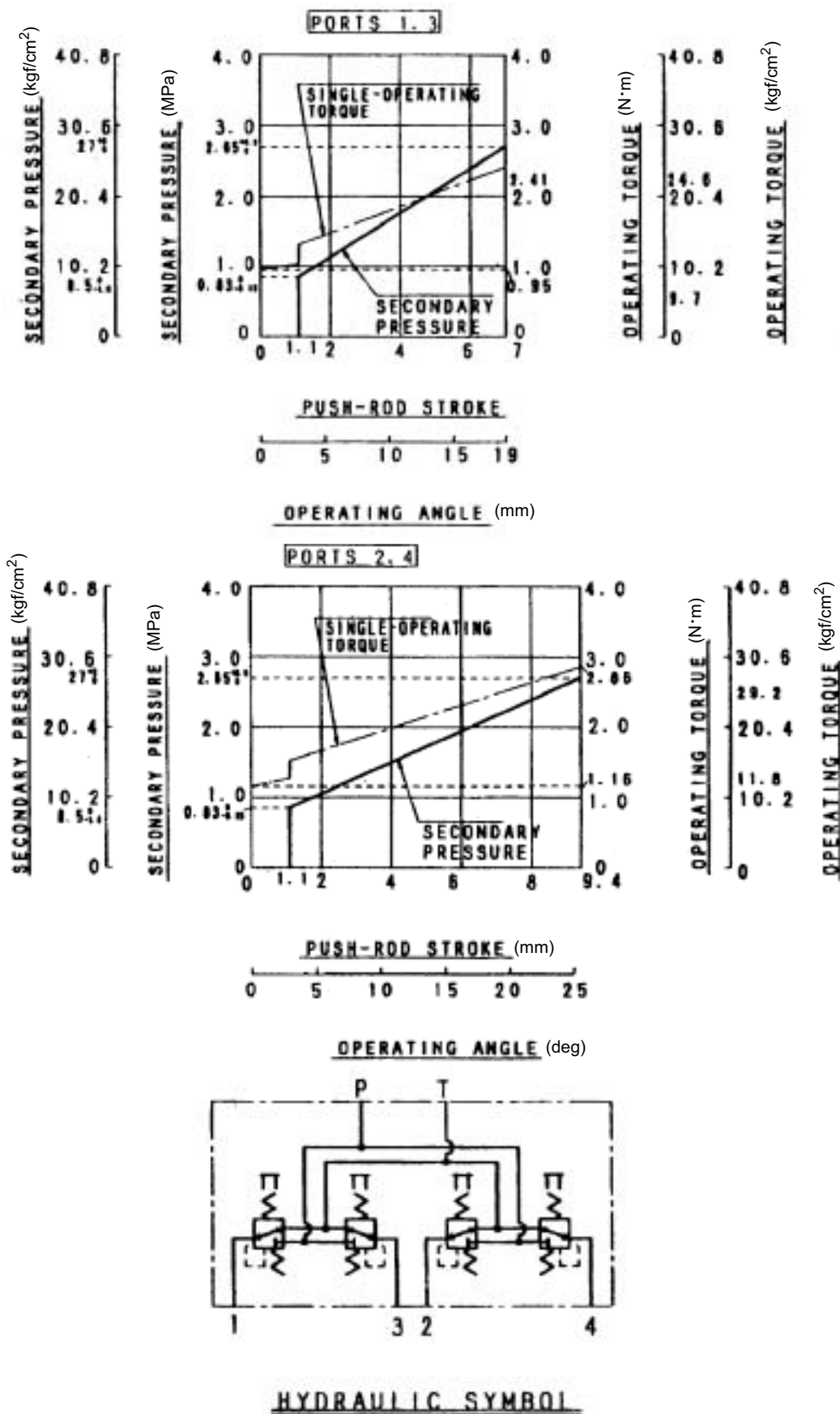
- | | | |
|--|---|---|
| (1) MAX PRIMARY PRESSURE | : | 6.9 NPa(70 kgf/cm ²) |
| (2) MAX BACK PRESSURE | : | 0.3 NPa(3 kgf/cm ²) |
| (3) RATED FLOW | : | 15 l/min |
| (4) SECONDARY PRESSURE CHARACTERISTICS | : | Refer to the "Control Diagram" shown below. |
| (5) OPERATING TORQUE | : | Refer to the "Control Diagram" shown below. |
| (6) MAX. ALLOWABLE EXTERNAL TORQUE | : | Refer to the "MAX. allowable external torque" shown below. |
| (7) HYDRAULIC OIL | : | MINERAL HYDRAULIC OIL |
| (8) OIL TEMP. RANGE | : | -20°C ~ 90°C |
| (9) FILTER | : | A filter of 40 ~ mesh and ever should be applied at the entrance of port P for preventins the spool stickine. |

Operating specifications

- | | | |
|----------------------|---|----------------------------------|
| (1) PRIMARY PRESSURE | : | 3.9 NPa(40 kgf/cm ²) |
|----------------------|---|----------------------------------|



2-2 Pilot valve control diagram



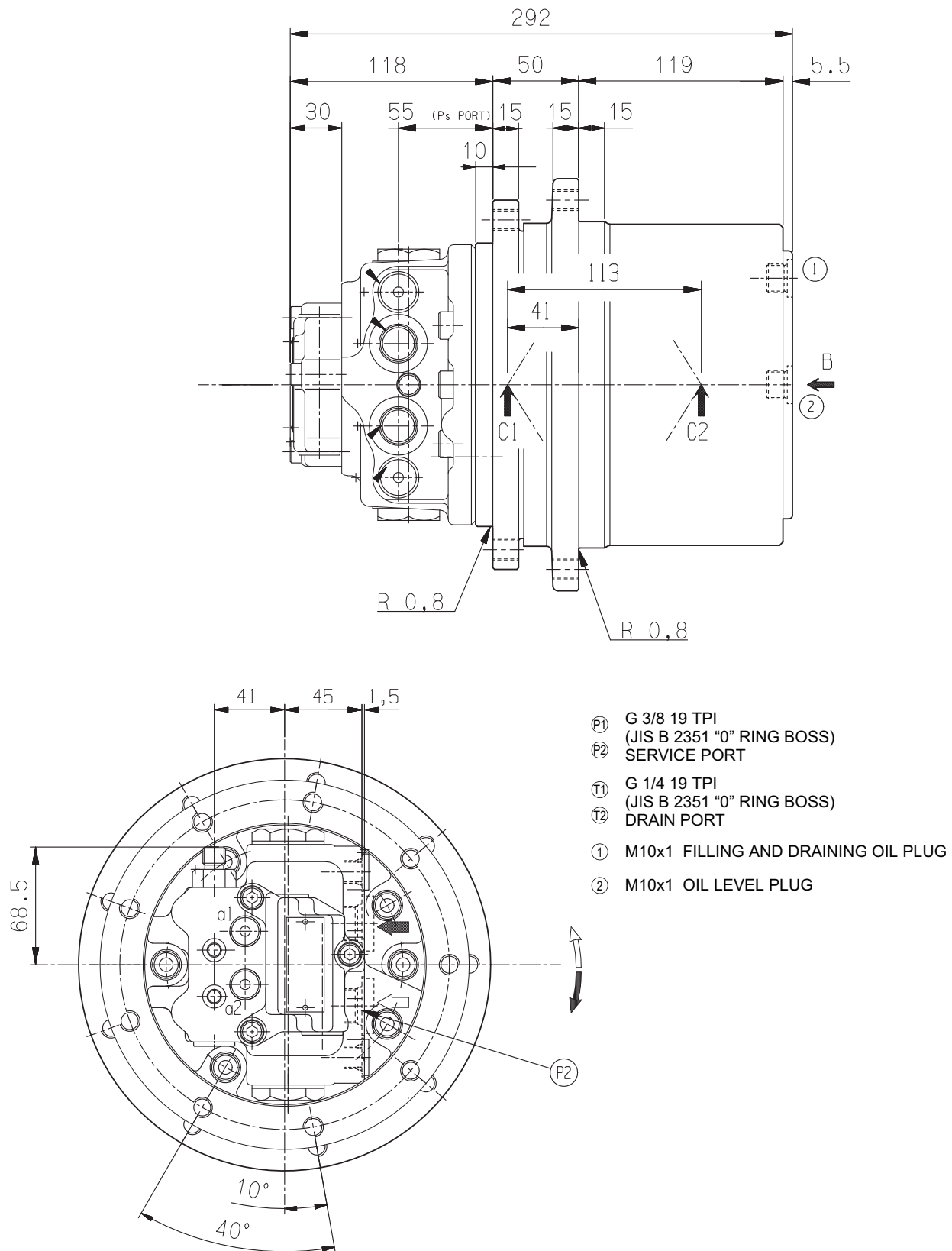
3. Technical data : Travel motor

No.	Machine model		KX61-3	KX71-3 EU	KX71-3 PP
1	Motor Displacement cc(cu-in) / rev	Low speed	16.8 (1.02)	18.4 (1.12)	18.082 (1.10)
		High speed	10.1 (0.62)	116 (0.71)	10.570 (0.64)
2	Gearbox ratio		1 : 42.4	1 : 41.9	1 : 45
3	Equivalent capacity for one turn of motor assy (cm ³ / rev)		712.32 / 428.24	770.96 / 486.04	813.7 / 475.6
4	Max, pressure		226 bar	235 bar	216 MPa (220 kgf/cm ²) 3129 psi
5	Max, flow	l(US gal) / min	29.4 (7.77)	32.2 (8.51)	←
6	Wheel motor rotating speed (RPM)		41.3/ 68.7	41.8 / 66.2	39.6 / 67.7
7	Max, drain pressure	Continuous	1 bar	←	←
		Peak	5 bar	←	←
8	Max, motor output torque (theoretical) (N·m)	High speed	36.3 N·m at 226 bar	43.3 N·m at 235 bar	←
		Low speed	60.4 N·m at 226 bar	68.8 Nm at 235 bar	←
9	Max, motor output speed (theoretical) (RPM)	High speed	2911	2776	3046
		Low speed	1750	1750	1781
10	Max, gearbox output torque (theoretical) (N·m)	High speed	1540	1814	1633
		Low speed	2562	2885	2794
11	Max, gearbox output speed (theoretical) (RPM)	High speed	67.3	66.4	67.7
		Low speed	40.4	41.7	39.6
12	Counter balance spool operating pressure		0.9 bar	0.9 bar	←
13	Check valve cracking pressure		less than 0.3 bar	←	←
14	High speed control spool pressure		6 bar	←	0.8 MPa (8.16 kgf/cm ²) 116 psi
15	Hydraulic motor oil		ISO VG 46	←	←
16	Gearbox oil type		Gear oil #90 GL4 or equivalent		
17	Gearbox oil: quantity	l (US gal)	0.6 ± 10 %	←	0.6 l (0.16 US gal)
18	Oil temperature		-20 °C / +90 °C	←	-20 °C / +90 °C (-4 °F / +194 °F)
19	Total weight		20 Kg	42 Kg	35Kg (77 lbs)
20	Manufacturere		Transmital Bonfiglioli		Kubota Seiki
21	Travel speed Km/h (Mile/h)	Rubber 1st/2nd	2.8 / 4.4 (1.74 / 2.73)	2.7 / 4.6 (1.68 / 2.86)	2.6 / 4.5 (1.61 / 2.80)
		Iron 1st/2nd	2.7 / 4.3 (1.68 / 2.67)	2.6 / 4.5 (1.61 / 2.80)	2.6 / 4.4 (1.61 / 2.73)
22	Travel block performance	mm (inch)	270 (10.6), 300 (11.8) >	280 (11.0), 300 (11.8) >	←
23	Travel straightness	mm (inch)	600 (23.6) >	←	←

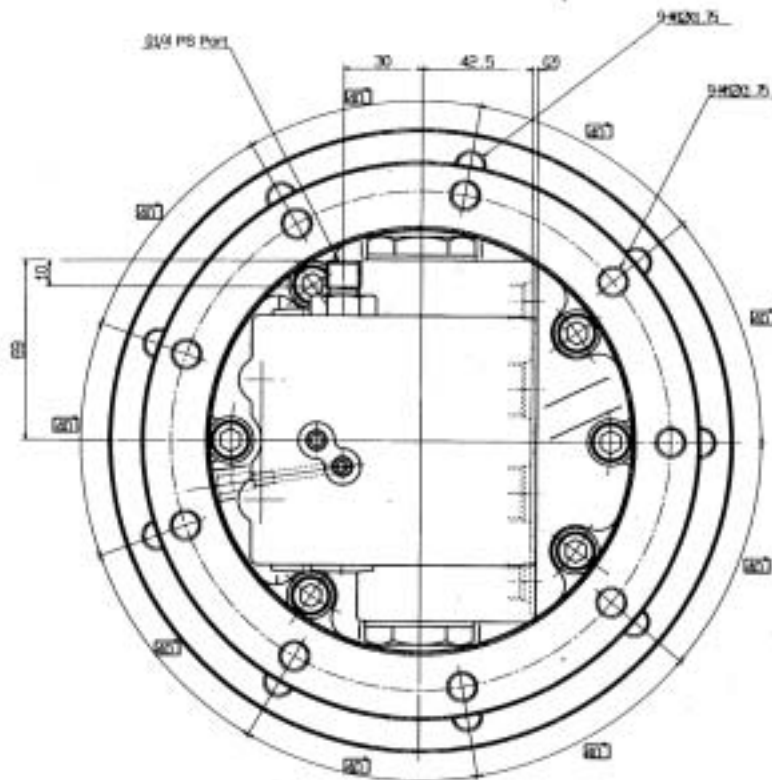
f. Travel motor

1. Structure

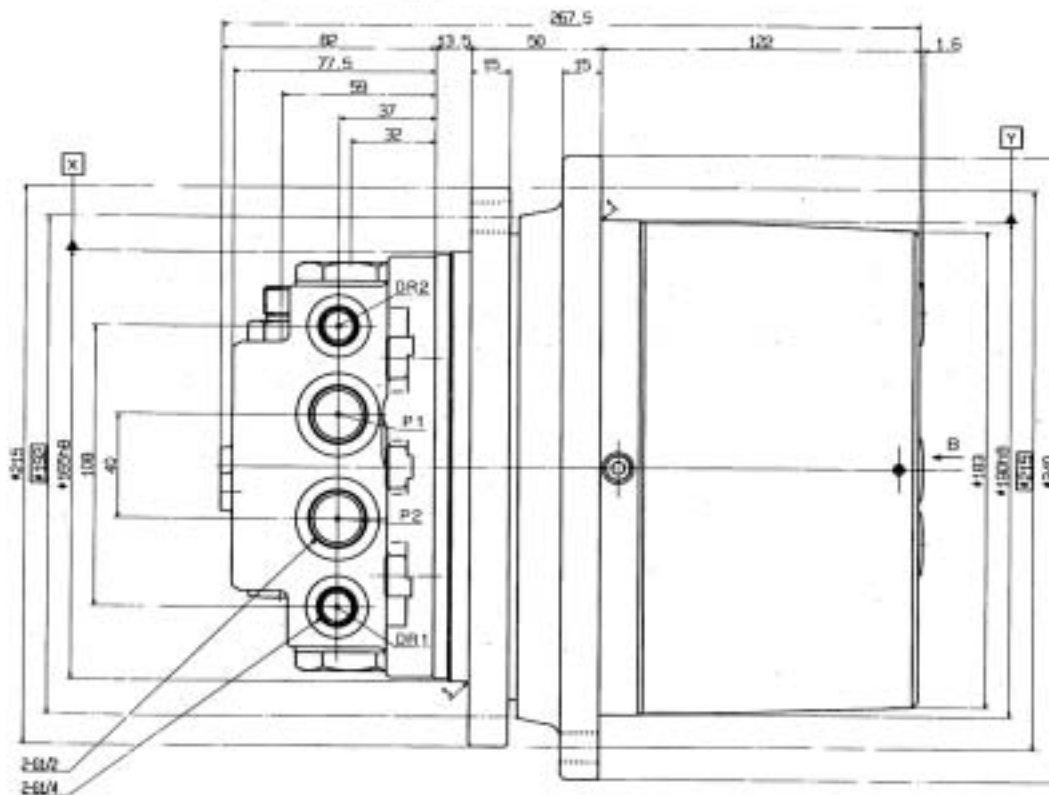
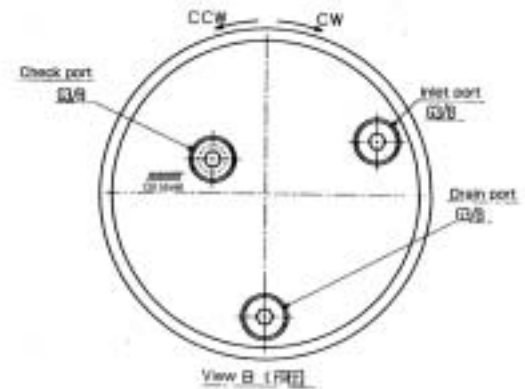
1-1 EU - version; Maker: Transmittal Bonfiglioli



1-2 KX71-3 PP-version

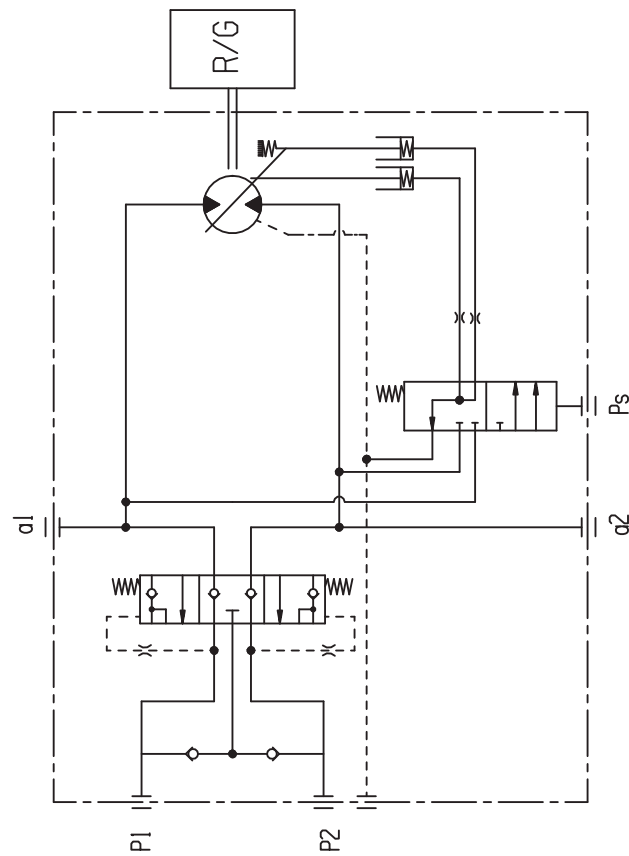
Motor rotating direction

Pressure port	Return port	Direction
P1	P2	CCW
P2	P1	CW

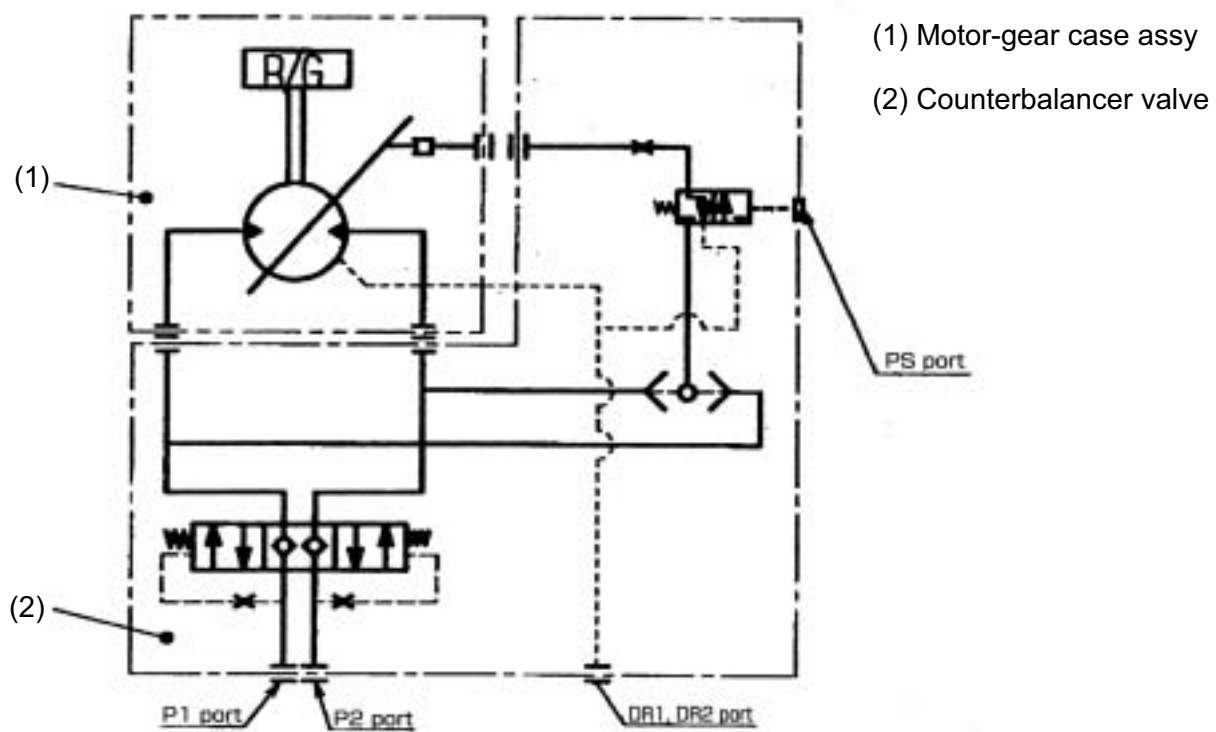


2. Circuit diagram

(KX61-3, 71-3 EU-version)



(KX71-3 PP-version)

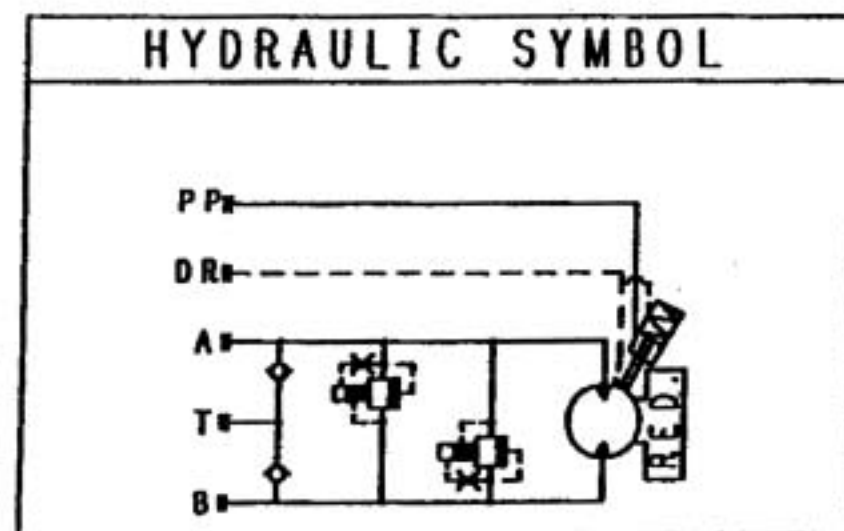
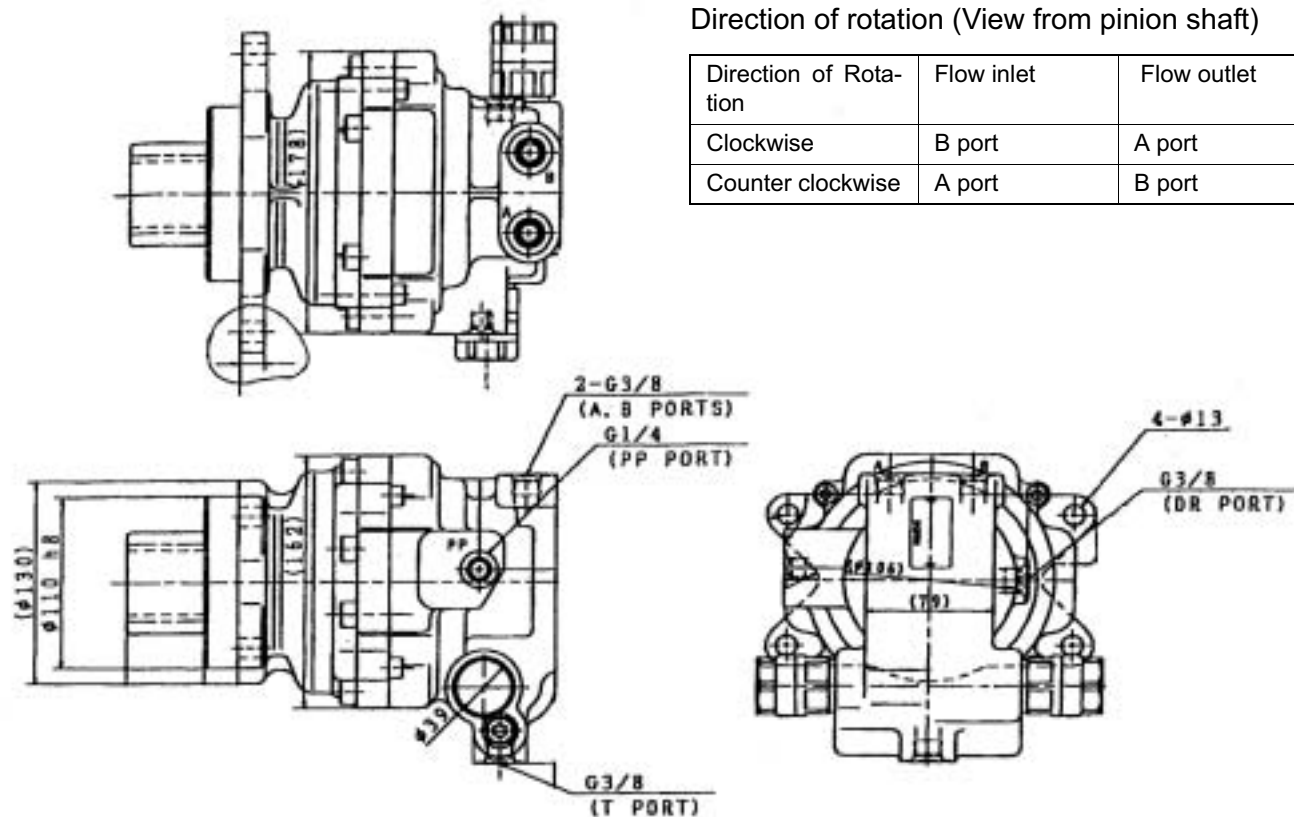


g. Swivel motor

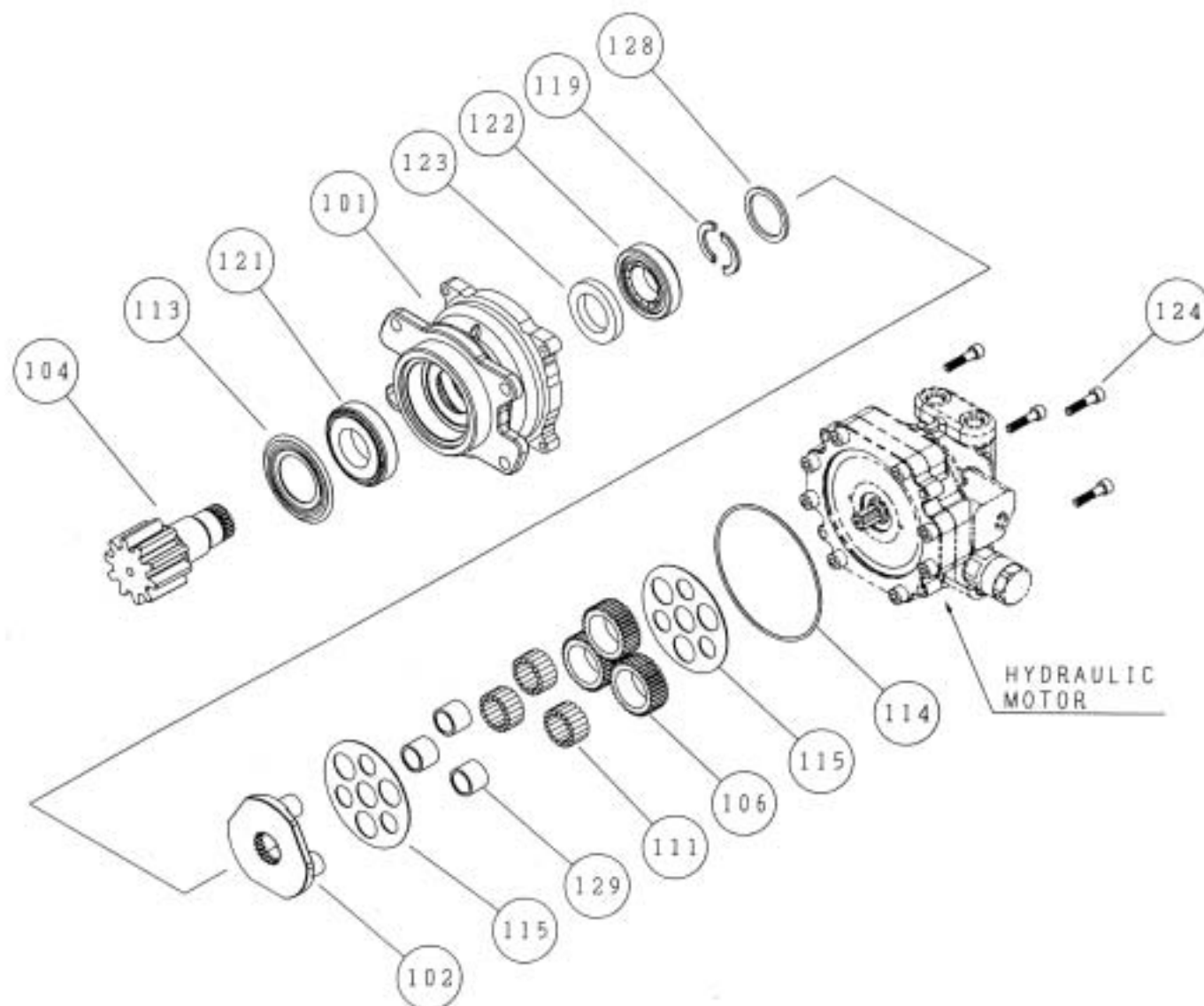
1. Technical data

Items		Unit	KX61-3 EU	KX71-3 EU	KX71-3 PP
Manufacturere			Nachi - Fujikoshi Corp.		
Type			PCR-1B-05A-P-8289A	PCR-1B-05A-P-8290A	
Motor capacity		cc/rev (in ³ /rev)	20.0 (1.22)	22.1 (1.35)	←
Gear reduction ratio			10	10	←
Total displacement		cc/rev (in ³ /rev)	20.0 (1.22)	22.1 (1.35)	←
Pump oil delivery		l/min (G/min)	16.8 (4.44)	18.4 (4.86)	←
Motor assy speed		RPM	84	83.3	←
Swivel bearing / pinion teeth			80 / 9	80 / 9	←
Swivel speed		RPM	9.5	9.4	←
Motor brake valve setting pressure		MPa (kgf/cm ²)	17.7 at 18 l/min (180)	17.7 at 16 l/min (180)	←
Motor brake valve cracking pressure		MPa (kgf/cm ²)	15.7 at 1 l/min (160)	←	←
Parking brake friction torque		N·m (kgf/cm ²)	68.4 (6.98)	←	←
Brake release pressure	Max.	MPa (kgf/cm ²)	4.9 (50.0)	←	←
	Min.	MPa (kgf/cm ²)	2.0 (20.4)	←	←
Check valve cracking pressure		MPa (kgf/cm ²)	0.02 (0.2)	←	←
Port T allowable pressure (Normal)		MPa (kgf/cm ²)	1.0 (10.2)	←	←
Drain port allowable pressure (Normal)		MPa (kgf/cm ²)	0.2 (2.04)	←	←
Swivel speed for 3 turns		sec.	18.9	19.1	←
Swivel block performance at engine stop		mm/min (inch/min)	0, < 5 (0.2) (Condition : Front horizontal, heaped bucket, 20° slope, oil tem. 50 ±50°C)		
Swivel block performance at engine running		mm/min (inch/min)	0, <30 (1.18) (Condition : Engine idling, lever unlock)		
Capable swivel rotation angle		deg.	21.3, >19	18.8, >17	16.0, >14
Sluggish at bucket tip		mm (inch)	60 (2.36), <73 (2.87) (Condition : Push with 5kgf and set zero point, and reversely push with 30 kgf.)		

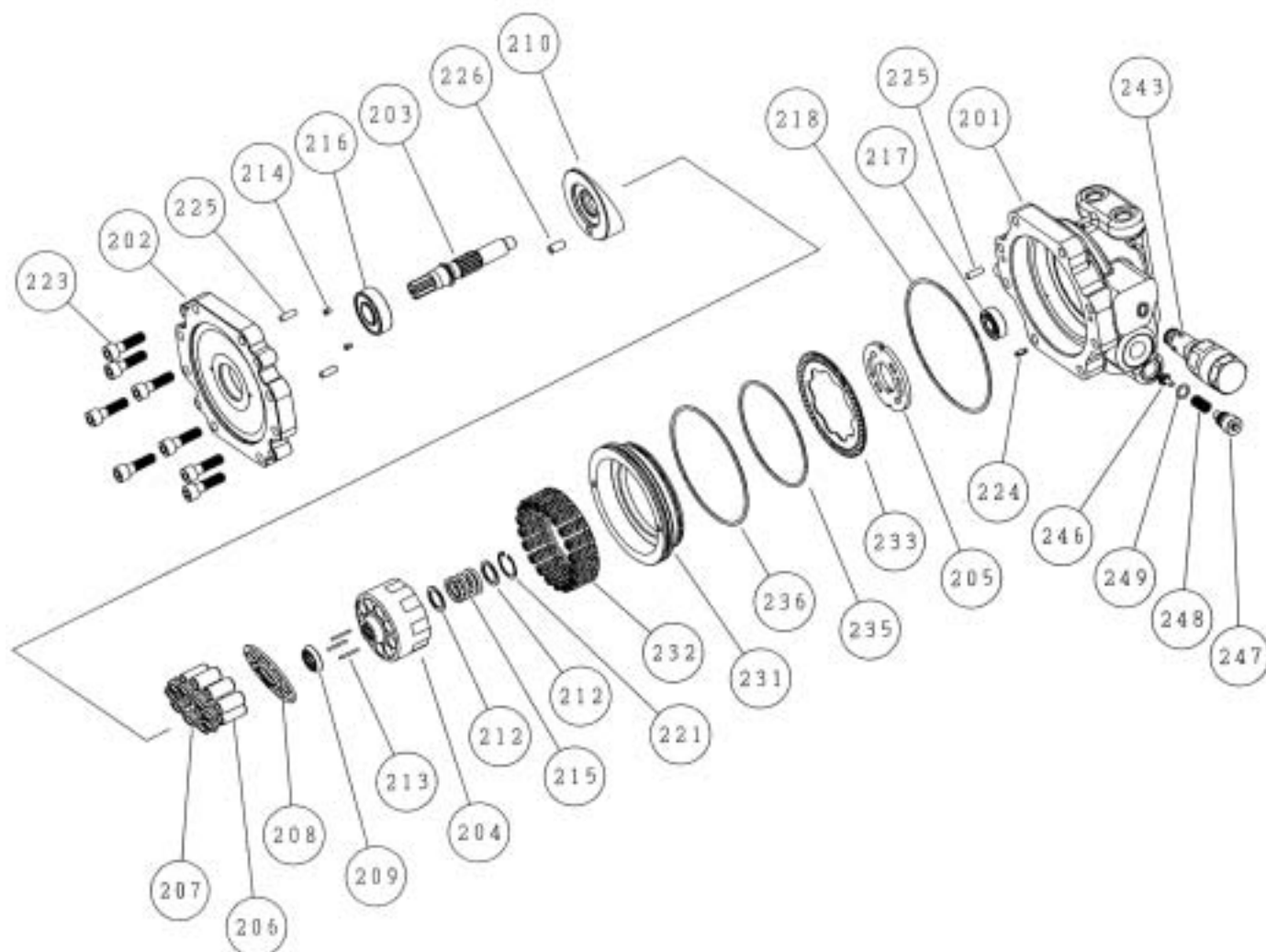
2. Outer view



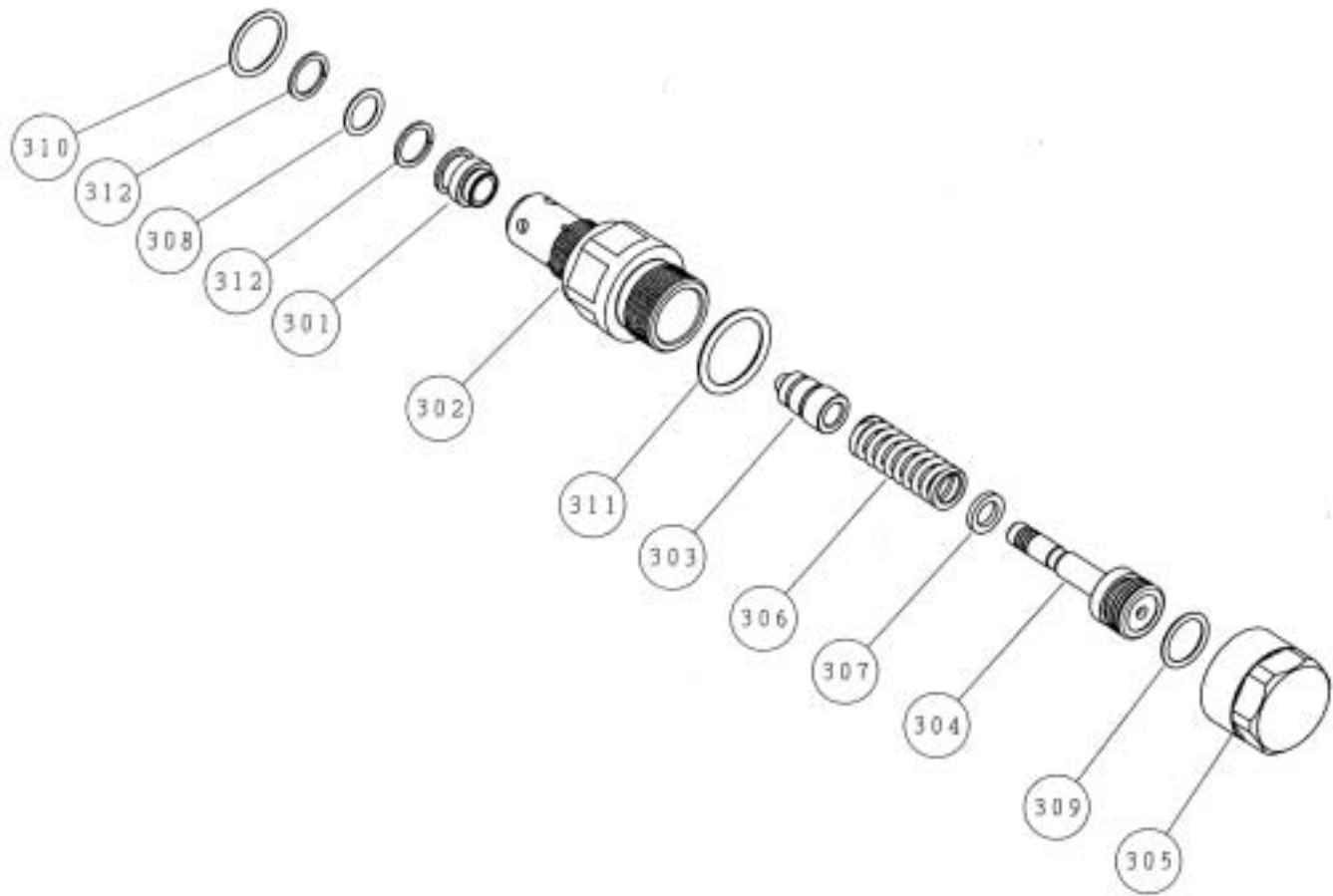
3. Inner parts



101	Body	119	Pre-load collar
102	Carrier 1	121	Bearing
104	Pinion shaft	122	Bearing
106	B1 gear	123	Oil seal
111	Needle	124	Screw
113	Ring seal	128	Ring
114	O ring	129	Ring
115	Thrust plate		

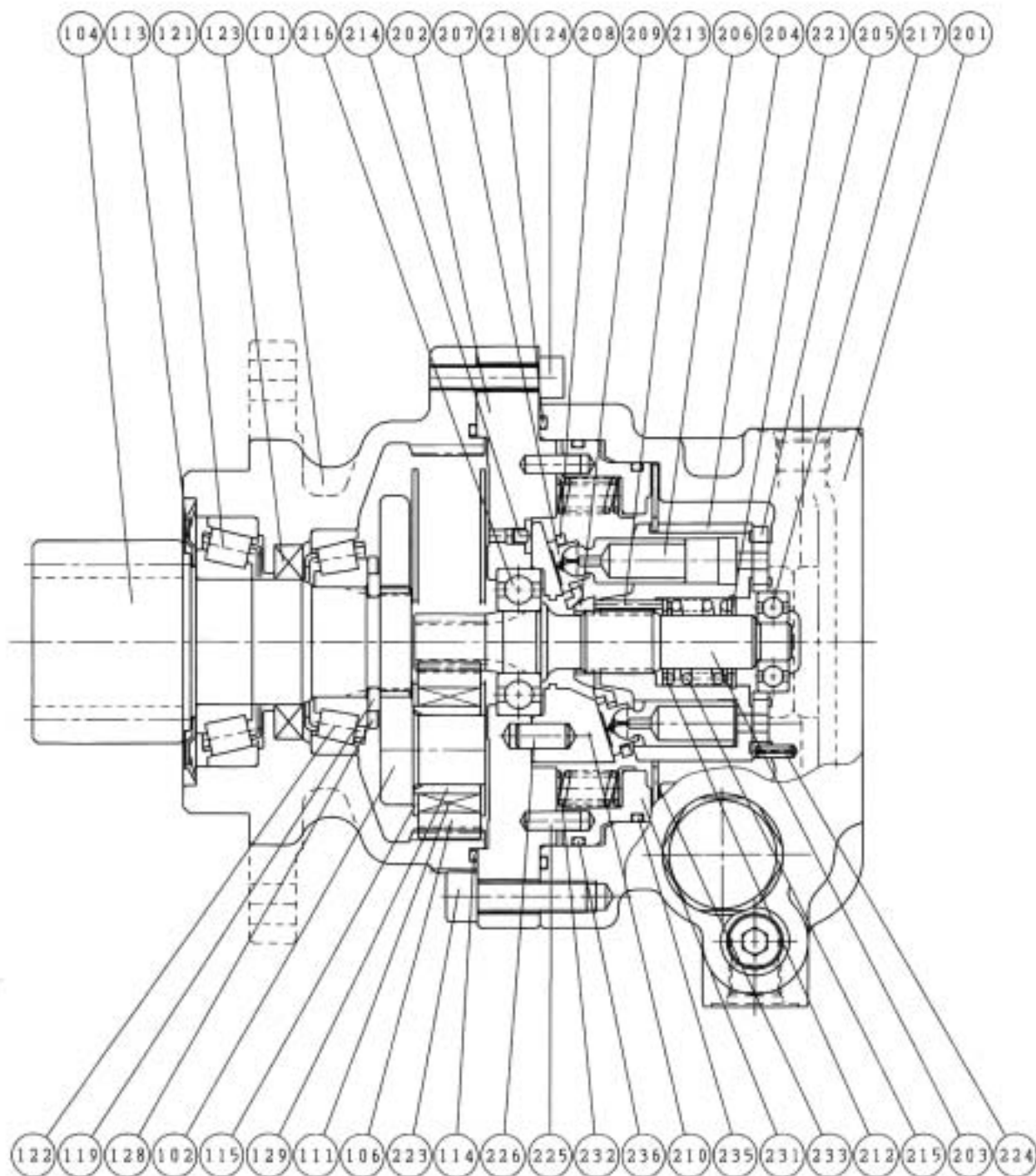


201	Body H	218	O ring
202	Plate S	221	Snap
203	Shaft	223	Spring pin
204	Cylinder Barrel	224	Oil seal
205	Valve plate	225	Pin
206	Piston	226	Pin
207	Shoe	231	Break piston
208	Shoe holder	232	Spring assy
209	Barrel holder	233	Disk plate
210	Swash plate	235	O ring
212	Retainer	236	O ring
213	Pin	243	Relief valve
214	Filter	246	Check valve
215	Spring C	247	Plug
216	Bearing	248	Spring
217	Bearing	249	O ring



301	Seat	307	Spacer
302	Retainer	308	O ring
303	Popeet	309	O ring
304	Piston	310	O ring
305	Cap	311	O ring
306	Spring	312	Back up ring

4. Sectional view (KX61-3, 71-3 Swivel motor assy)



a.Reduction gear GCG-05-1-8289

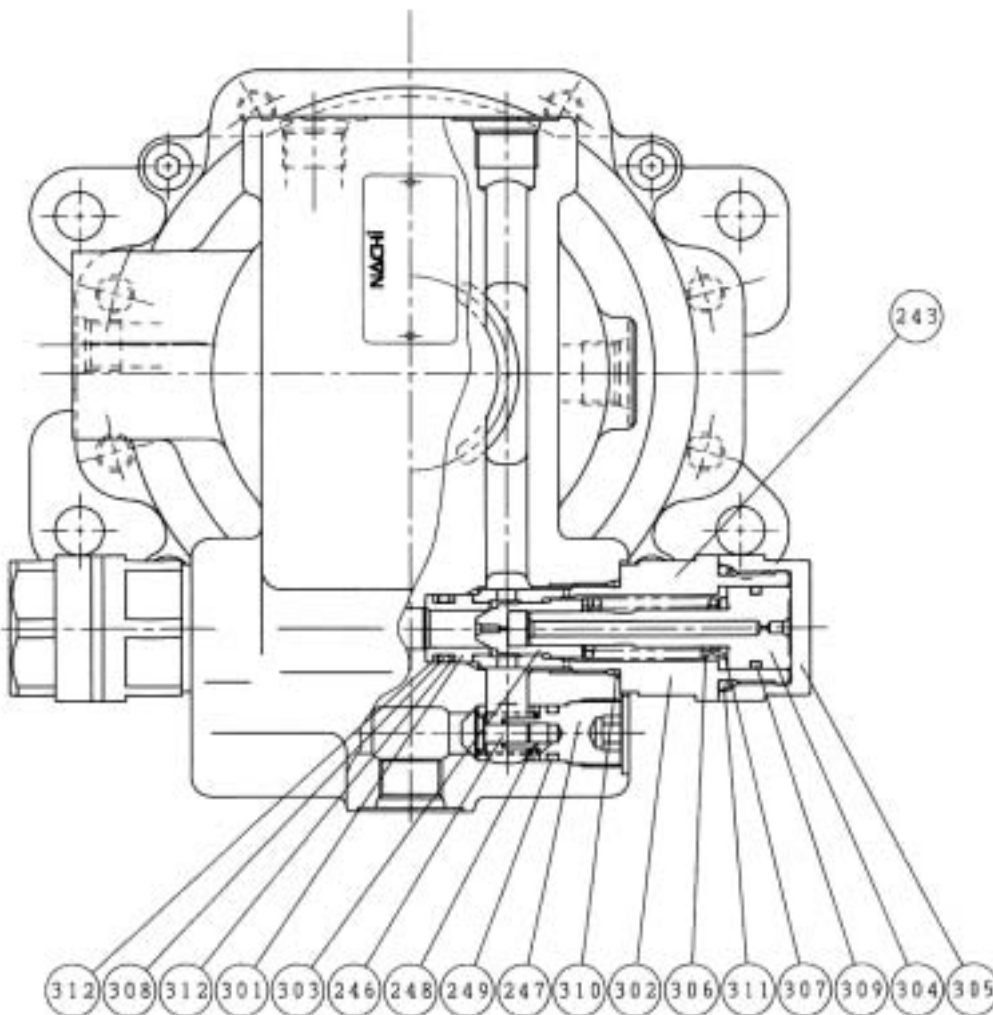
- 101 Body
- 102 Carrier 1
- 104 Pinion shaft
- 106 B1 gear
- 111 Needle
- 113 Ring seal
- 114 O ring
- 115 Thrust plate
- 119 Pre-load collar
- 121 Bearing
- 122 Bearing
- 123 Oil seal
- 124 Screw
- 128 Ring
- 129 Ring

b.Hydraulic motor PM-1B-S2-4585A

- 201 Body H
- 202 Plate S
- 203 Shaft
- 204 Cylinder barrel
- 205 Valve plate
- 206 Piston
- 207 Shoe
- 208 Shoe holder
- 209 Barrel holder
- 210 Swash plate
- 212 Retainer
- 213 Pin
- 214 Filter
- 215 Spring C
- 216 Bearing
- 217 Bearing
- 218 O ring
- 221 Snap ring
- 223 Screw
- 224 Snap pin
- 225 Pin
- 226 Pin
- 231 Break piston
- 232 Spring assy
- 233 Disk plate
- 235 O ring
- 236 O ring
- 243 Relief valve
- 246 Check valve
- 247 Plug
- 248 Spring
- 249 O ring

c.Relief valve assy ZR-03-TA18-8516A

- 301 Seat
- 302 Retainer
- 303 Popet
- 304 Piston
- 305 Cap
- 306 Spring
- 307 Spacer
- 308 O ring
- 309 O ring
- 310 O ring
- 311 O ring
- 312 Back up ring



h. Cylinder

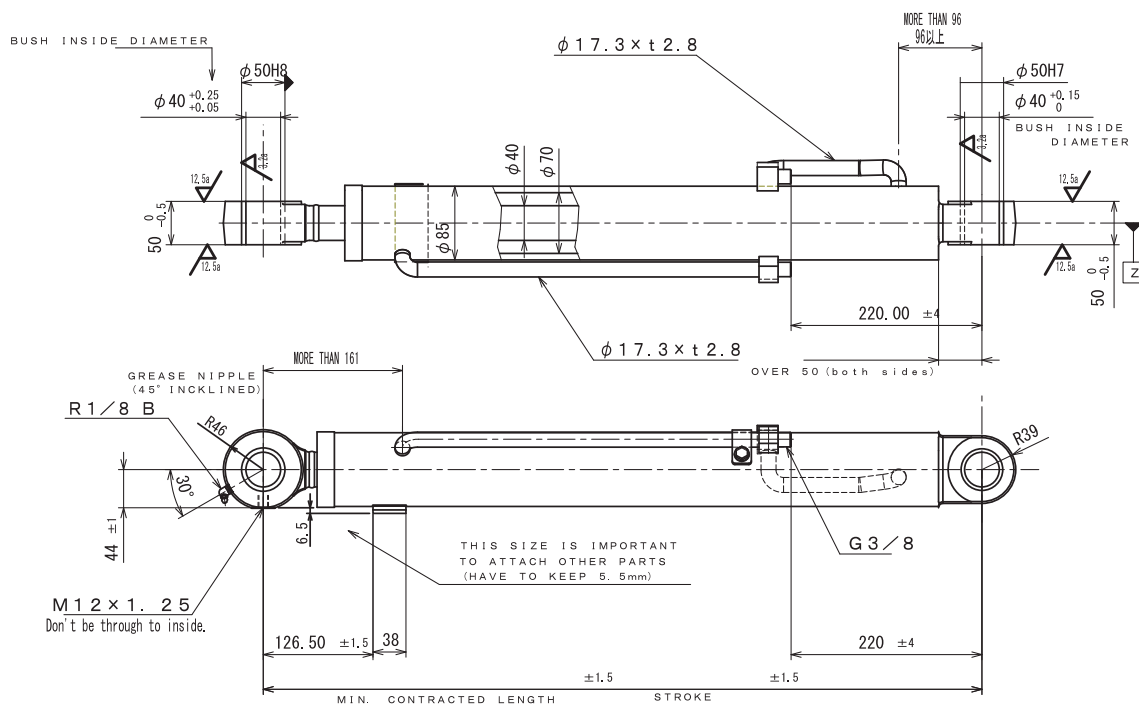
1. Major size

unit: mm (inch)

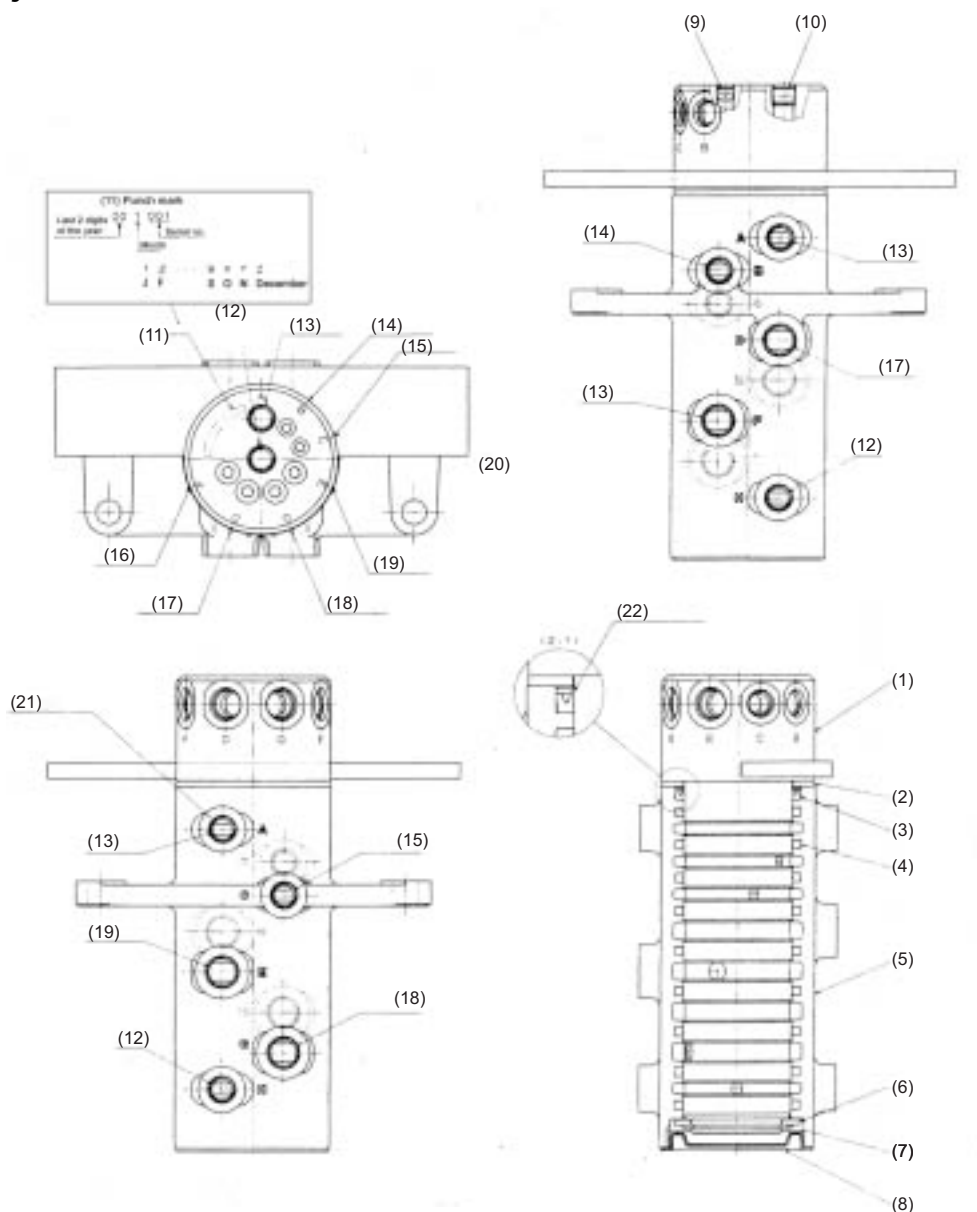
		Boom	Arm	Bucket	Swing	Blade
KX61-3 (EU)	Parts No.	RG248-67502	RG248-67601	RG248-67801	RG448-67401	RG248-75101
	bore	70 (2.76)	←	65 (2.56)	70 (2.76)	90 (3.54)
	rod	40 (1.57)	←	35 (1.38)	←	45 (1.77)
	stroke	542 (21.3)	482 (19.0)	381 (15.0)	432.5 (17.0)	126 (4.96)
	S length	850 (33.5)	800 (31.5)	762 (30.0)	686 (27.0)	505 (19.9)
	supplier	Leduc	Leduc	Leduc	Leduc	Leduc
KX71-3 (EU)	Parts No.	RG448-67502	RG448-67601	RG448-67801	RG448-67401	RG448-75101
	bore	70 (2.76)	←	←	←	90 (3.54)
	rod	40 (1.57)	←	←	35 (1.38)	45 (1.77)
	stroke	534.5 (21.0)	593 (23.2)	381 (15.0)	432.5 (17.0)	115 (4.53)
	S length	828.5 (32.6)	883.5 (34.8)	680 (26.8)	686 (27.0)	422 (16.6)
	supplier	Leduc	Leduc	Leduc	Leduc	Leduc
KX71-3 (KTC)	Parts No.	RC348-67502	RC348-67601	RC348-67801	RC348-67401	RC348-75101
	bore	70 (2.76)	←	65 (2.56)	70 (2.76)	90 (3.54)
	rod	40 (1.57)	←	←	35 (1.38)	45 (1.77)
	stroke	534.5 (21.0)	581.5 (22.9)	448 (17.6)	432.5 (17.0)	115 (4.53)
	S length	828.5 (32.6)	883.5 (34.8)	787 (31.0)	687.5 (27.1)	422 (16.6)
	supplier	Wipro	Wipro	Wipro	Wipro	Wipro
KX71-3 (KCL, KTA)	Parts No.	↑	↑	RC348-99901	↑	↑
	bore			70 (2.76)		
	rod			40 (1.57)		
	stroke			431 (17.0)		
	S length			791 (31.1)		
	supplier			Wipro		

S length : Mini, contracted length

Sample : KX71-3 US Boom cylinder



i. Rotary joint



- | | | |
|-------------|------------------------|---|
| (1) Shaft | (8) Plug | (15) C:Dozer up |
| (2) Collar | (9) Plug (PT 1/8) | (16) F:Travel L, R |
| (3) Packing | (10) Plug (PT 1/4) | (17) D:Travel L, F |
| (4) D-ring | (11) Punch mark | (18) G:Travel R, R |
| (5) Body | (12) Drain | (19) E:Travel R, F |
| (6) Collar | (13) A:2nd speed pilot | (20) Track frame (Dozer side) |
| (7) Circlip | (14) B:Dozer down | (21) Each port must be free from painting |
| | | (22) Packing should be installed completely inside. |

Note:

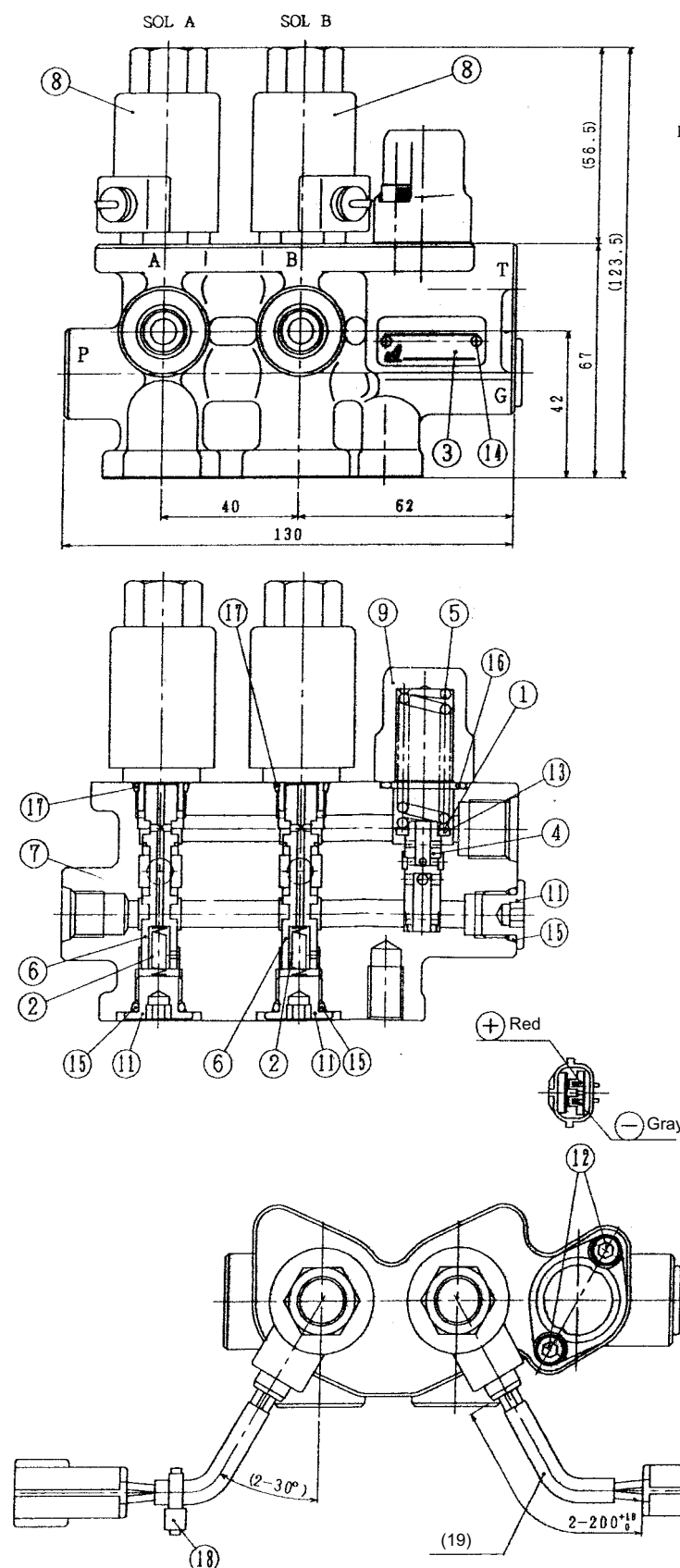
1. Proof pressure strength must be 34.3 MPa (350 kgf/cm²).
2. Turning torque, without load : 127 Nm (13 kgf·m) or less.
3. Oil sealing capacity : 10 cc or less for 2 min. applied pressure.

j. Accessories of hydraulic components

1. Unload valve (Change valve) : North America and Oceania - version

1-1 Structure

Maker : Nishina



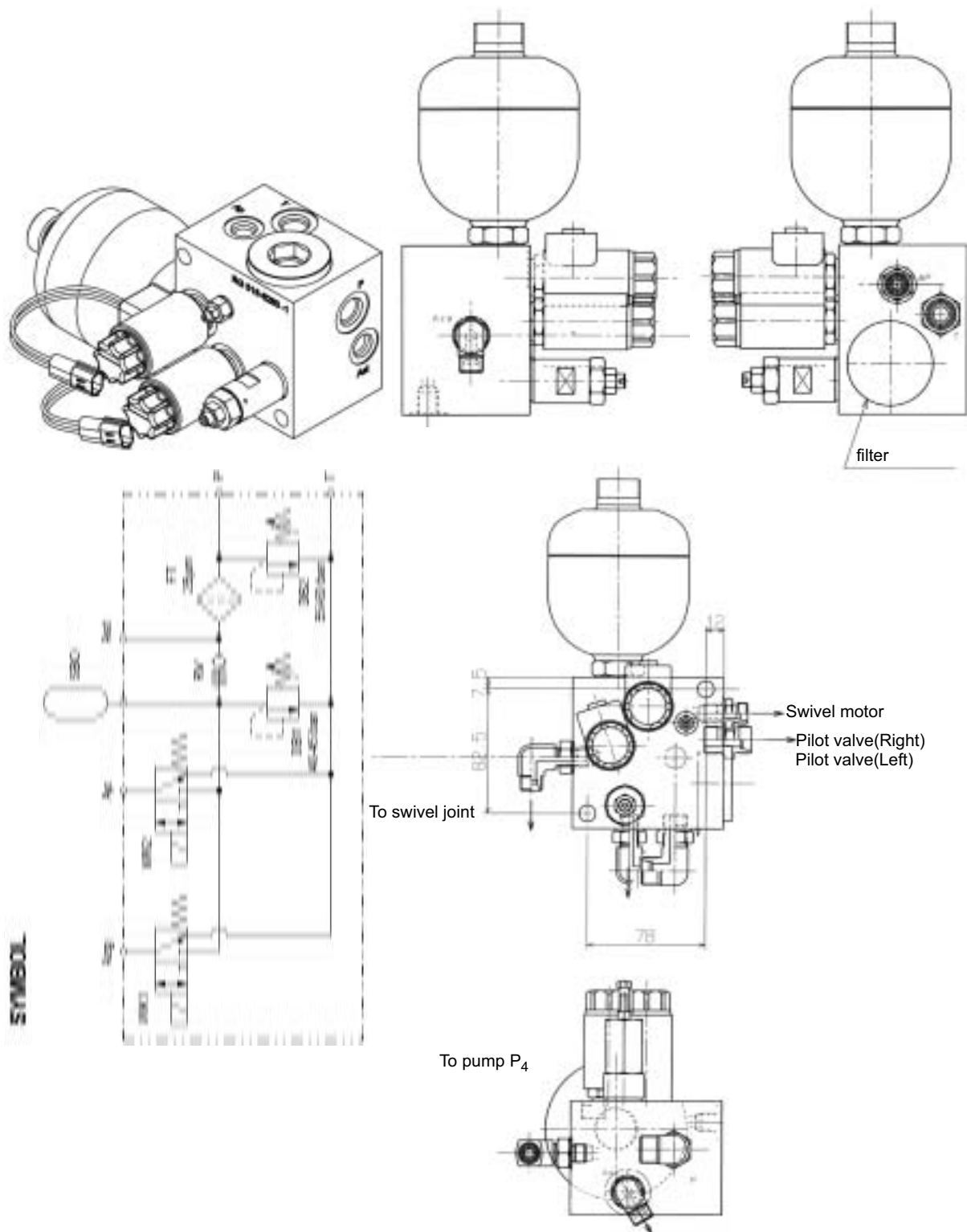
- | | |
|----------------|----------------------|
| (1) Shim | (11) Plug |
| (2) spring | (12) Hollow bolt |
| (3) Name plate | (13) Washer |
| (4) Plunger | (14) Screw |
| (5) Spring | (15) O-ring |
| (6) Spool | (16) O-ring |
| (7) Body | (17) O-ring |
| (8) Solenoid | (18) Cable clamp |
| (9) Cover | (19) Protection tube |

2) Specifications

- | | |
|--------------------------------|--|
| (1) Rated voltage: | DC 10.8 ~ 14.4V |
| (2) Current: | 1.2 A at 20 °C |
| (3) Insulation: | JIS C 4003 H |
| (4) Coil resistance: | Approx. 12 Ω |
| (5) Surge killer: | Diode |
| (6) Relief valve set pressure: | $3.9^{+0.2}_0$ MPa ($40^{+0.2}_0$ kgf/cm ²) at 6l/min |
| (7) Cracking pressure: | 3.4 MPa (35kgf/cm ²) at 2l/min
p → A, B |
| (8) Back pressure: | 0.2 MPa (2.0 kgf/cm ²) or less |
| (9) Port size: | A, B, G = pF 1/4
P, T = pF 3/8 |
| (10) Tightening torque : | PF 1/4:26.5 N·m (2.7kgf·m)
M5:3.92 N·m (0.4kgf·m)
M10:21.6N·m (2.2kgf·m) |

2. Change valve with accumulator : EU version

2-1 Structure Maker:Hydro control



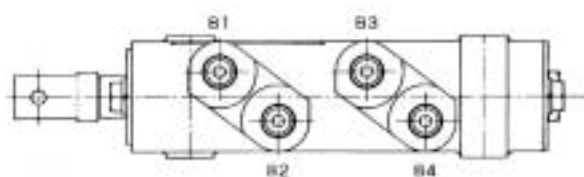
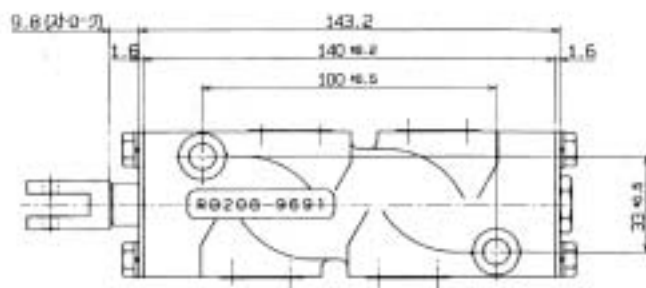
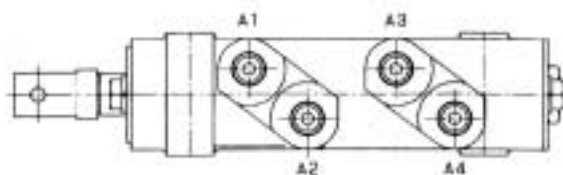
2-2 Specifications

- 1) Max. oil flow : 16 l/min (4.23 Us gal.)
- 2) Rated voltage and output : 12 V - 18W
- 3) Coil resistance : 8 Ω

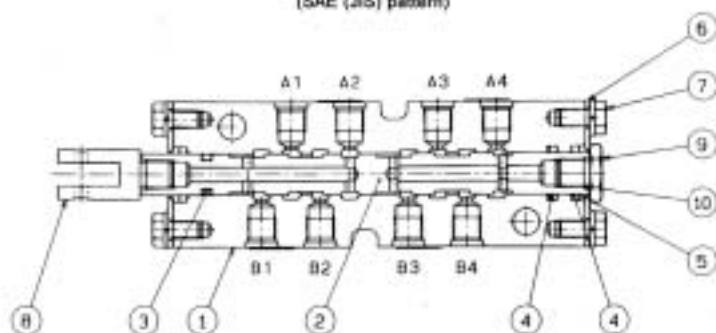
3. TPSS valve (Two pattern selection system)

3-1 Specifications

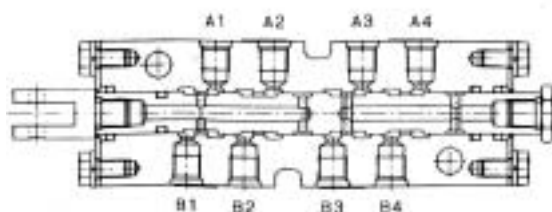
- Max. oil flow : 4 l/min (1.06 US gal.)
- Operating pressure : 3.9 MPa (40 kgf/cm²)
- Oil leakage : 30 cc/min or less (At 2.0 MPa, 50 ±5°C)
- Spool operating force : Push ; Pull ;



(SAE (JIS) pattern)



JD-pattern



Hydraulic circuit diagram

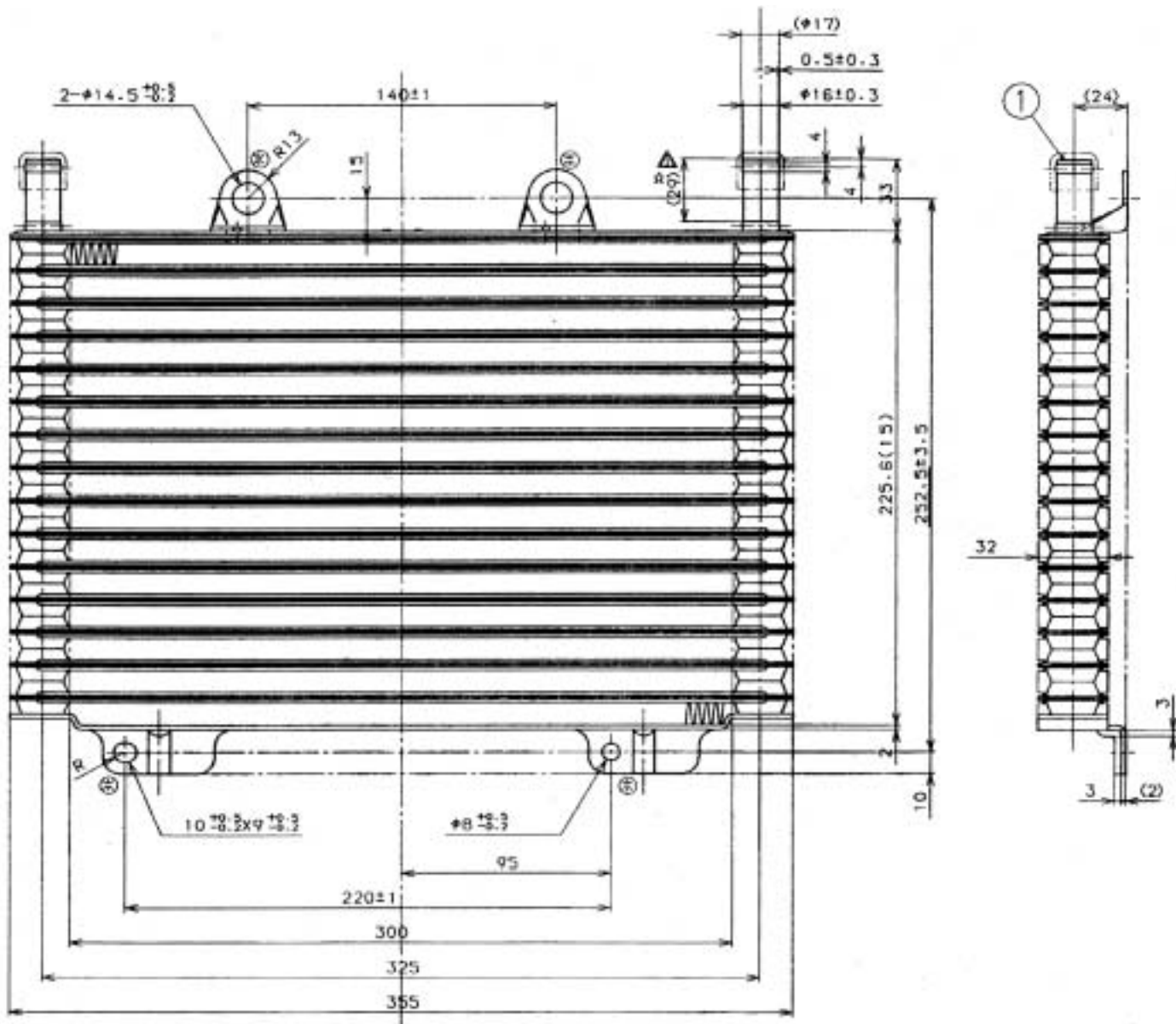


- (1) Body
- (2) Spool
- (3) O-ring
- (4) O-ring
- (5) Backup ring
- (6) Plate
- (7) Bolt, 4T
- (8) Rod (2)
- (9) Rod (1)
- (10) O-ring, Pq

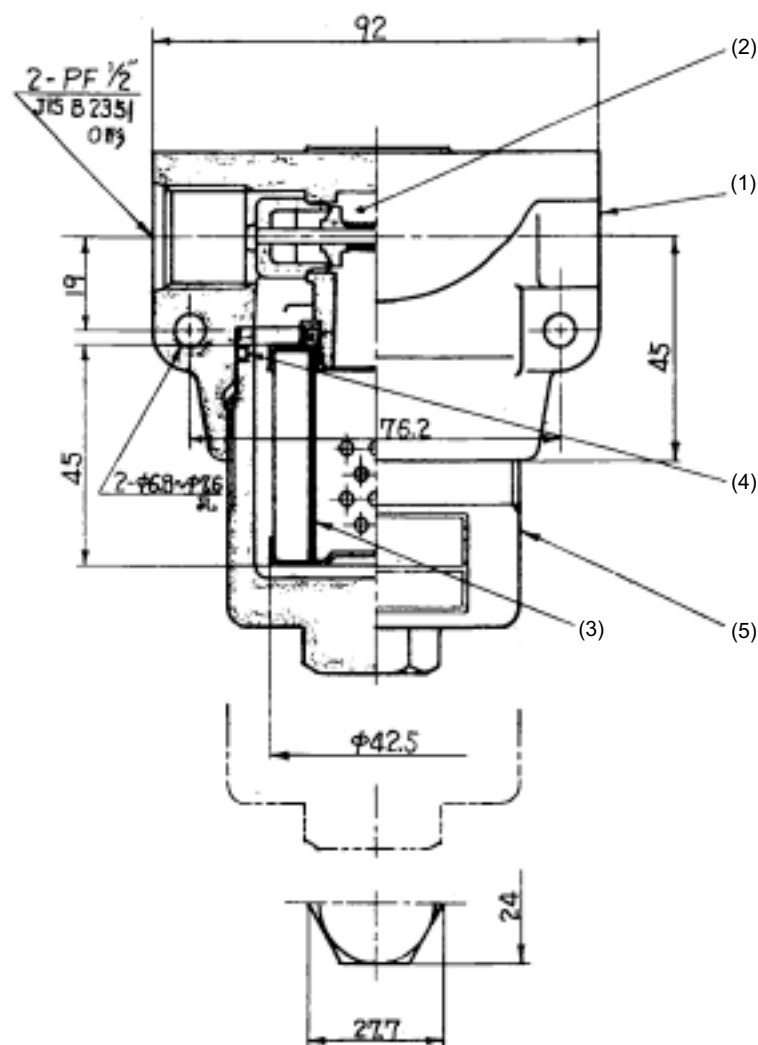
4. Oil cooler

4-1 Specifications

- Heat radiation capacity = 10.3 KW
- Core type : Corrugate fine with rouver
- Core size : 300 W × 255.6 H × 32 D (mm), 15 tier
- Heat radiation area (oil side) = 0.383 m² (4.12 sq.ft)
- Heat radiation area (air side) = 1.878 m² (20.2 sq.ft)
- Oil amount = 0.42 l (0.11 US gal.)
- Dry weight = 1.4 kgf (3.09 lbs)



5. Pilot filter



P/N RD401-61261

Durable pressure :70kgf/cm² (6.86 MPa) 996 psi

Filtering rate :10 μ

Valve setting pressure:1.5 kgf/cm² (0.15 MPa) 21 psi

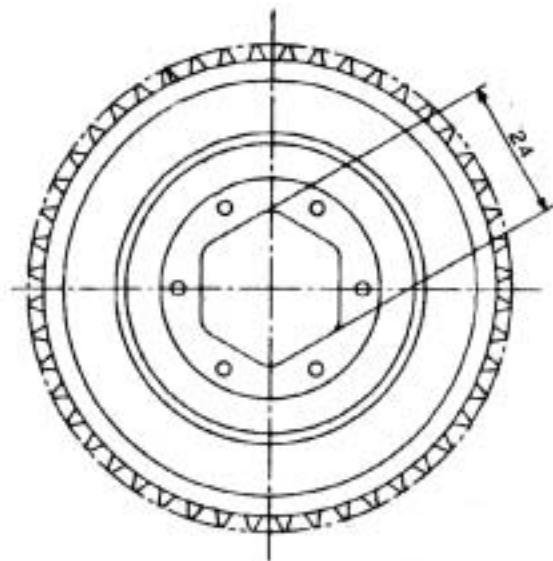
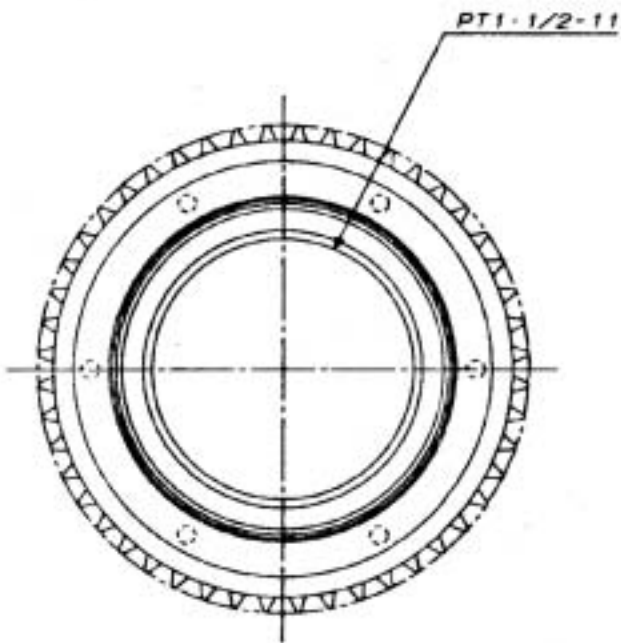
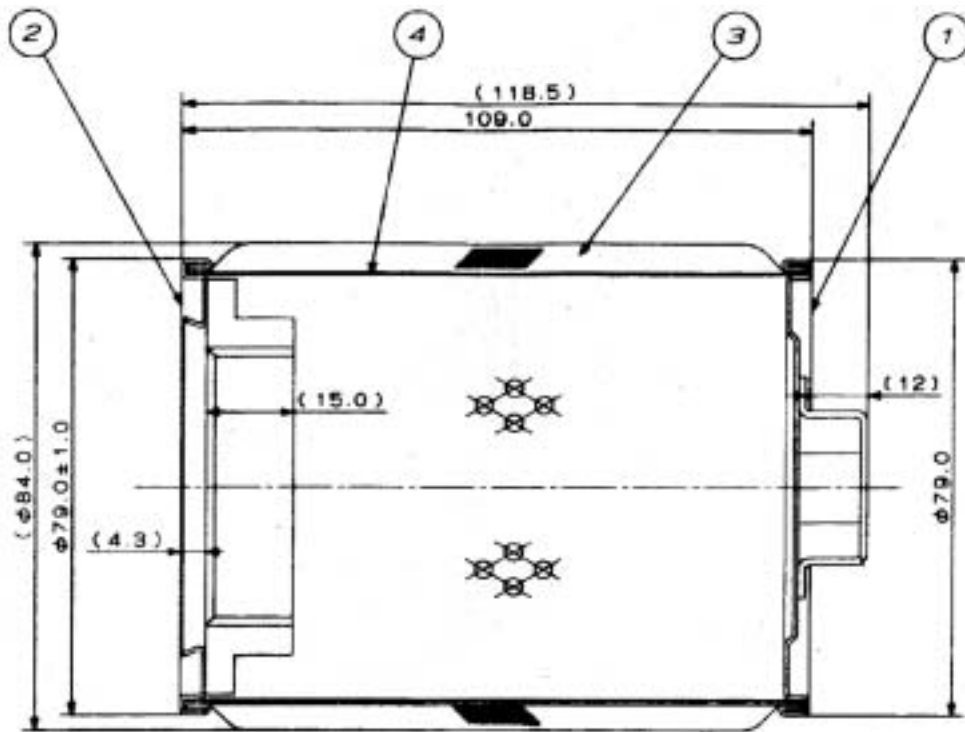
Max. flow amount :10 l/min (2.64 US gal)

Applied model= KX71-3, 91-3, 101-3

6. Suction filter

6-1 Specifications (RB411-62151)

- Percolation grade : 150 mesh (105 μ)
- Percolation area : 513 cm² (5522 sq.ft)
- Oil flow : Max. 100 l/min (26.4 US gal/min)

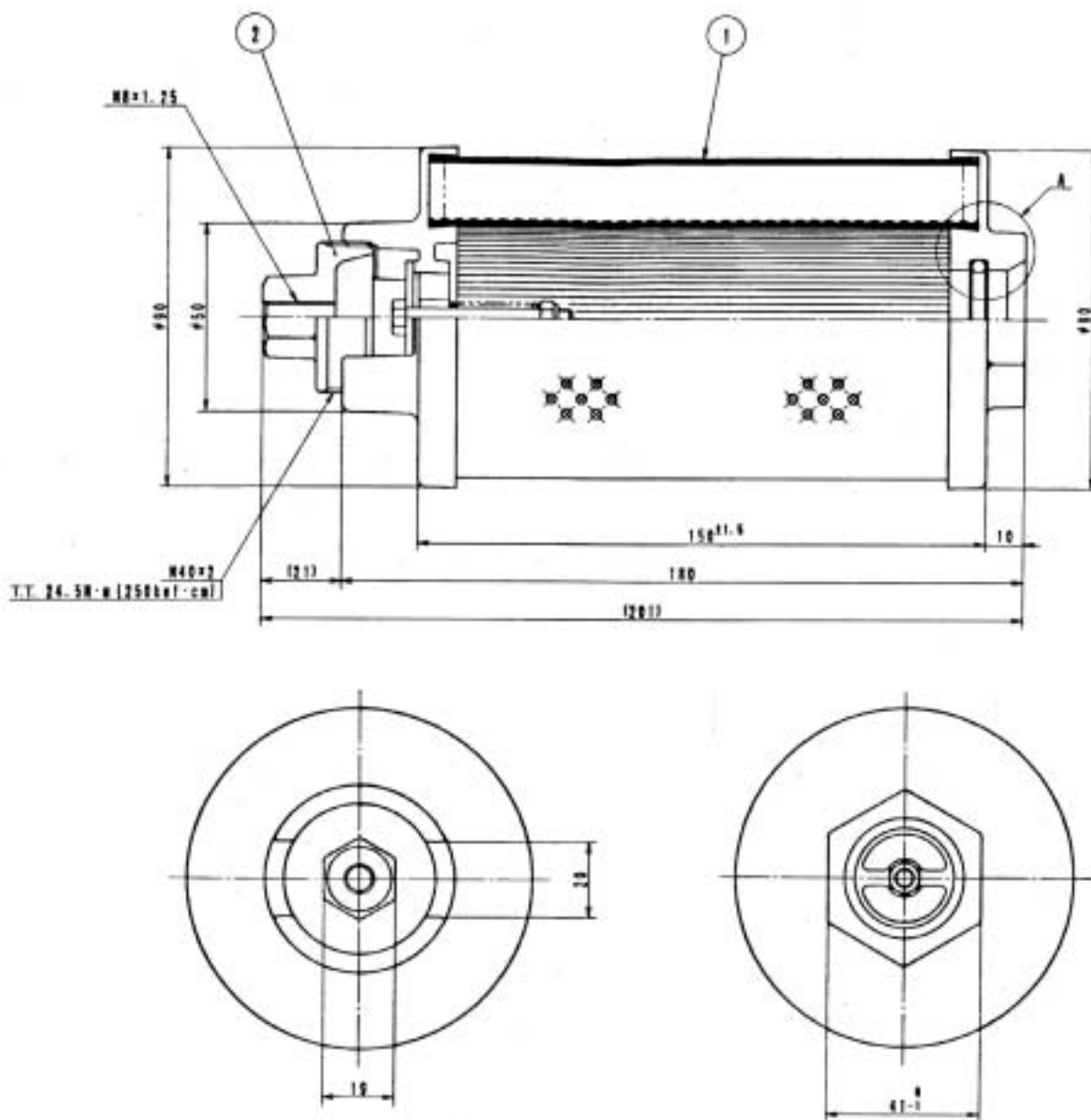


(1) : Cover, (2) : Bottom assy, (3) : Screen, (4) Tube

7. Return filter

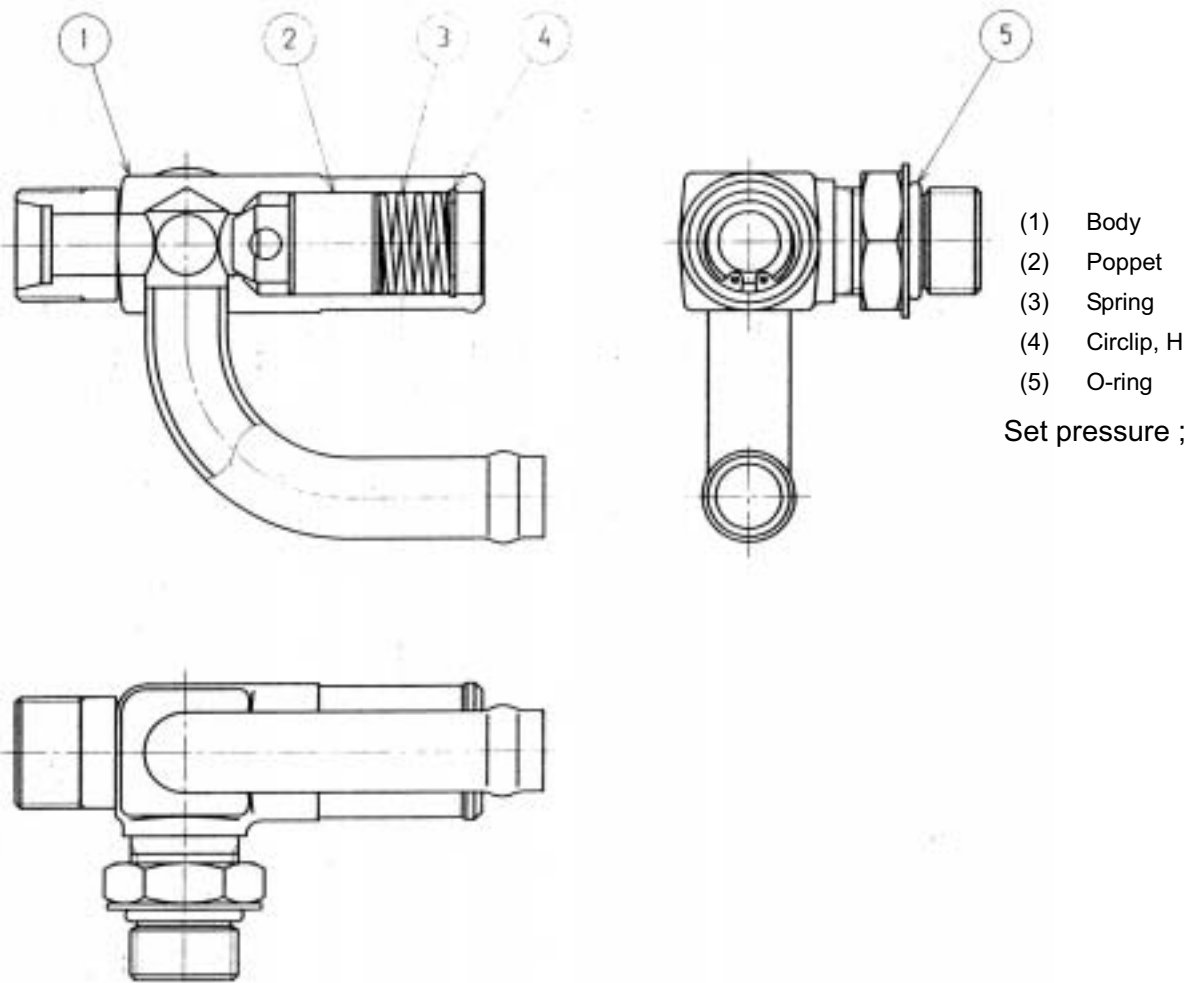
7-1 Specifications (RB411-62191)

- Percolation area : 3670 cm^2 (39504 sq.ft)
- Relief valve set pressure : $98.1 \pm 14.7 \text{ KPa}$ ($1 \pm 0.15 \text{ kgf/cm}^2$) $14.2 \pm 2.1 \text{ psi}$
- Durable pressure : 588 KPa (6 kgf/cm^2) 85.3 psi or more
- Oil flow direction : From filter inside to outside.



(1) Element assy, (2) Nut

8. Check valve



k. Maintenance specification

1. Main relief valve (at the measurement port on the machine)

No.	Location	Operating work	Unit	KX61-3 EU	KX71-3 EU	KX71-3 PP	Remarks
1	Pump 1, a1	Travel right, Boom, Bucket	Mpa kgf/cm ² psi	22.6 ±1.0 230 ±10 3271 ±140	23.5 ±1.0 240 ±10 3414 ±140	21.6 ±1.0 220 ±10 3129 ±140	Oil temp 50 ±5°C Engine RPM Rated ~Max
2	Pump 2, a2	Travel left, Arm, Auxiliary	Mpa kgf/cm ² psi	22.6 ±1.0 230 ±10 3271 ±140	23.5 ±1.0 240 ±10 3414 ±140	21.6 ±1.0 220 ±10 3129 ±140	
3	Pump 3, a3	Dozer, Swing, Swivel	Mpa kgf/cm ² psi	17.2 ±1.0 175 ±10 2489 ±140	20.6 ±1.0 210 ±10 2987 ±140	←	
4	Pilot pump, ap	Pilot valve, 2nd speed, negative brake	Mpa kgf/cm ² psi	3.9 ±0.5 40 ±5 569 ±70	←	←	

2. Overload relief valve (at the measurement port on the machine)

No.	Location	Operating work	Unit	KX61-3 EU	KX71-3 EU	KX71-3 PP	Remarks
5	b4, b5	Boom up Boom down	Mpa kgf/cm ² psi			26.5 ±1.0 270 ±10 3840 ±140	Oil temp 50 ±5°C Engine 1500RPM
6	b6	Bucket crowd	Mpa kgf/cm ² psi				
7	b2, b3	Arm dump Arm crowd	Mpa kgf/cm ² psi				
8	b1	Dozer down	Mpa kgf/cm ² psi				
9	c1	Swivel motor	Mpa kgf/cm ² psi			20.6 ±1.0 210 ±10 2987 ±140	Engine RPM Rated ~Max

3. Cylinder operating speed

Unit			KX61-3 EU		KX71-3 EU		KX71-3 PP		Remarks
			(A)	(B)	(A)	(B)	(A)	(B)	
Boom cylinder	Up	sec.	2.6 ±0.3	3.5	2.4 ±0.3	3.2	←	←	GL to Max. height (exclude cushion time)
Boom cylinder	Down	sec.	2.6 ±0.3	3.5	2.3 ±0.3	3.1	2.4 ±0.3	3.2	Max. height to GL
Boom cylinder	cushion	sec.	0.4 ~ 1.3	1.6	←	←	←	←	50 ±5°C
Arm cylinder	Crowd	sec.	2.6 ±0.3	3.5	3.0 ±0.3	4.0	2.9 ±0.3	3.8	Cylinder full stroke
Arm cylinder	Dump	sec.	2.6 ±0.3	3.5	3.0 ±0.3	4.0	2.9 ±0.3	3.8	
Bucket cylinder	Crowd	sec.	2.7 ±0.3	3.6	2.8 ±0.3	3.7	←	←	Cylinder full stroke
Bucket cylinder	Dump	sec.	1.9 ±0.3	2.6	1.9 ±0.3	2.6	←	←	
Swing cylinder	Left	sec.	6.5 ±0.5	8.4	6.1 ±0.5	7.9	←	←	Cylinder full stroke
Swing cylinder	Right	sec.	6.2 ±0.5	8.0	5.6 ±0.5	7.3	←	←	
Dozer cylinder	Up	sec.	2.3 ±0.3	3.1	2.2 ±0.3	3.0	←	←	Cylinder full stroke
Dozer cylinder	Down	sec.	3.0 ±0.3	4.0	2.8 ±0.3	3.7	←	←	

(A)New machine reference value

(B)Allowable limit

4. Cylinder natural fall amount

Unit		KX61-3 EU		KX71-3 EU/ KX71-3 PP		Remarks
		(A)	(B)	(A)	(B)	
Load weight	kg lbs	108 238	-	126/144 278/317	-	include bucket weight
Boom cylinder	mm in	20 0.79	100 3.94	20 0.79	100 3.94	
Arm cylinder	mm in	11 0.43	55 2.17	11 0.43	55 2.17	
Bucket cylinder	mm in	10 0.39	50 1.97	10 0.39	50 1.97	
Dozer cylinder	mm in	20 0.79	100 3.94	20 0.79	100 3.94	

(A)New machine reference value

(B)Allowable limit

Condition : Bucket heaped capacity load.

10 min = 50 ±5°C (122 ±41°F)

Load weight = bucket heaped capacity × 1800 [kgf]

V.Electrical System	M-V-2
a. Development concept	M-V-2
b. Outline of Kubota ICS (Intelligent Control System).	M-V-5
c. Operating Mode	M-V-8
d. Service mode menues	M-V-12
e. Failure Diagnosis	M-V-34
f. Circuit wiring diagram	M-V-47

V. Electrical System

a. Development concept

1. Background of Adoption of New Meter

- (1) The L1 (3-ton class) Series, which was released in Japan in 1999 for domestic users, adopted a new meter of LCD type (called YUYU NAVI). Since then, this meter has been one of the sales points of the Series.
- (2) Presently, the new meter is applied to only models for domestic users. No models for overseas users adopt this meter.
- (3) The new meter has a stable reputation for providing advanced performance, convenience, and user-friendliness. This sales point should be added to models for overseas users.

2. Features of New Meter

- (1) Advanced performance:
Digital display (multi-language support), alarm sound, and design performance (see fig. 2 on the right-hand side)
- (2) Parts integration:
Relays and controllers supporting a variety of functions for conventional models are integrated into the new meter for space saving and high cost performance. (Relays partly need to be installed externally.)
- (3) Functions in a Wide Variety
 1. Warning and self-diagnostic functions:
The following items are displayed on the LCD with graphics, failure (warning) numbers, and characters along with an alarm sound.
 - Remaining fuel (see fig. 3 on the right-hand side)
 - Oil pressure (see fig. 4 on the right-hand side)
 - Charge (see fig. 5 on the right-hand side)
 - Overvoltage
 - Overheating
 2. Inspection time instruction function:
"SERVICE HOURS" appears whenever the time has come for the inspection and replacement of the oil filter as explained in the manual, and prompts the user to make an inspection.
 3. Fuel replenishment assist function:
The meter beeps intermittently at the time of fuel replenishment, and the interval between beeps is shortened when the tank is almost filled to prevent the fuel from overflowing.
The beep functions with the key turned OFF, but one of the switch needs to be pressed.
 4. Service tester function:
This function allows the monitoring of the operation of electrical devices (e.g., an oil pressure switch) connected to the meter and provides the history of failures resulted in the past (see figs. 6 and 7 on the right-hand side).
While in harness manipulation mode, it is possible to diagnose and single out harness components that have internal failures (e.g., contact failures).
 5. Other functions
 - Low Travel speed reset at the time of restarting the engine (if the engine is turned OFF with high - low switch set to the high range).
 - Engine start check (preventing the engine from starting with the lever unlocked).
 - Starter motor automatic disconnection → Auto release
 - Auto glow
 - Built-in hour meter and display
 - Built-in tachometer and display
 6. Expansion function for the future (Presently not scheduled to adopt for KX61-3)
 - Monitoring with theft prevention set up
 - Service port (thumb) hand-held proportional control
 - Air-conditioner idling control
 - Auto idling

(Reference) LCD Display Examples of New Meter

Fig. 1
Normal screen



Key switch ON (Only the glowing moment)



Normal screen (with the tachometer selected)



Normal screen (with the hourmeter selected)

Fig. 2
Language selection screen



Fig. 3

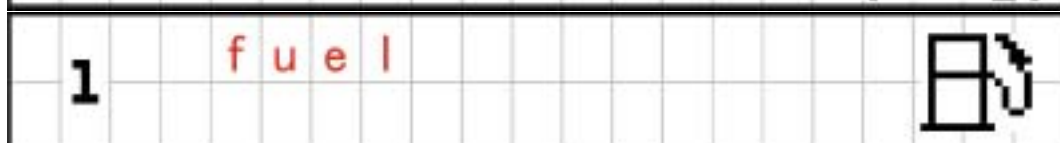


Fig. 4

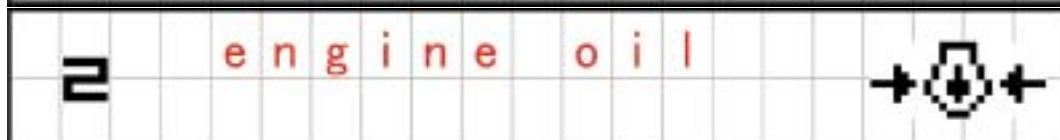


Fig. 5

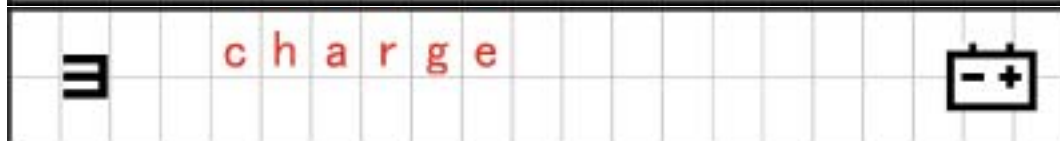


Fig. 6

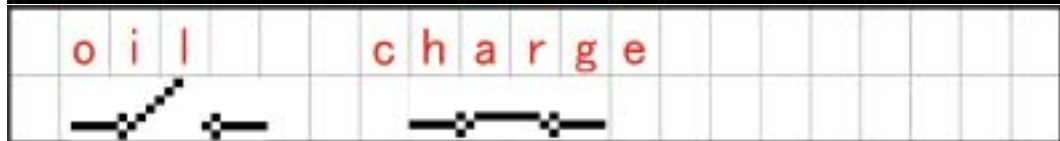
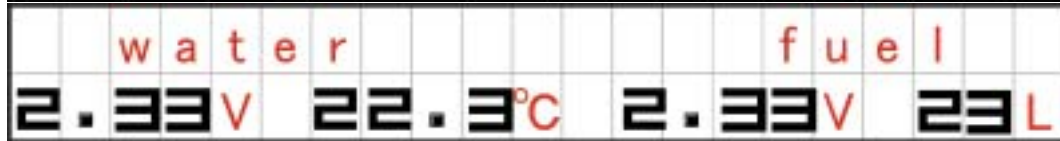


Fig. 7

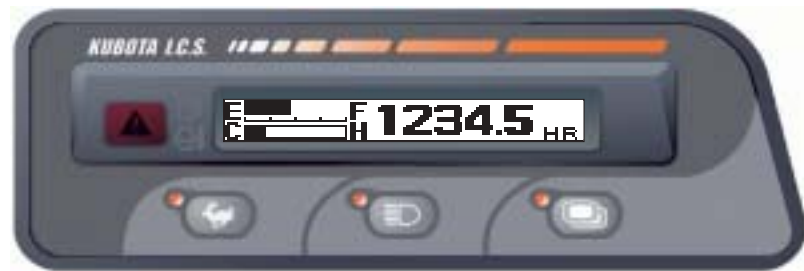


3. Electrical system : Functional comparison : KX61-3, KX71-3

No.	Function	EU-version	North America & Oceanea
1	KICS;Kubota Intelligent Control System, LCD(liquid crystal display) with character and illustration	Yes	Yes
2	Maintenance indication upon hour meter	Yes (delete method:manual)	Yes (delete method:auto)
3	Anti-theft system	Yes (sample, date not fixed)	No
4	AI(Auto idle) function	No	No
5	Engine overheat warning	Yes	No
6	Starter motor auto release function	Yes	Yes
7	Glowplug auto glow function	Yes	Yes
8	Travel high-low switch at lever grip	Yes	Yes
9	Fuel feed assist sound	Yes	Yes
10	Heater	Yes (cab version)	Yes (cab version)
11	Rotating lamp	Harness and switch are equipped as standard	Harness is incorporated
12			
13			
14			
15			

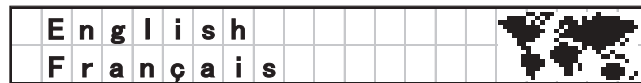
b. Outline of Kubota ICS (Intelligent Control System)

Feature of LCD Navigation System① (K.I.C.S. : Kubota Intelligent Control System)



① Advanced Feature

- Digital display (Multi language),
Design
- Alarm sound



② Integrated function

- Space saving, High Cost performance

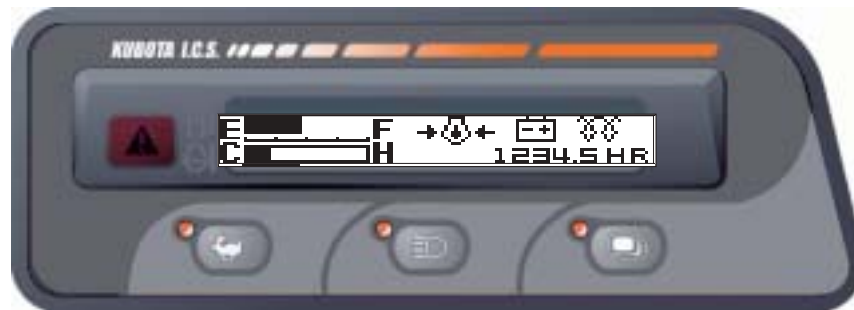
③ Additional function

- Convenient function by Easy operation.

Feature of LCD Navigation System②

Additional function

(1) Normal display



Key sw ON



Normal display

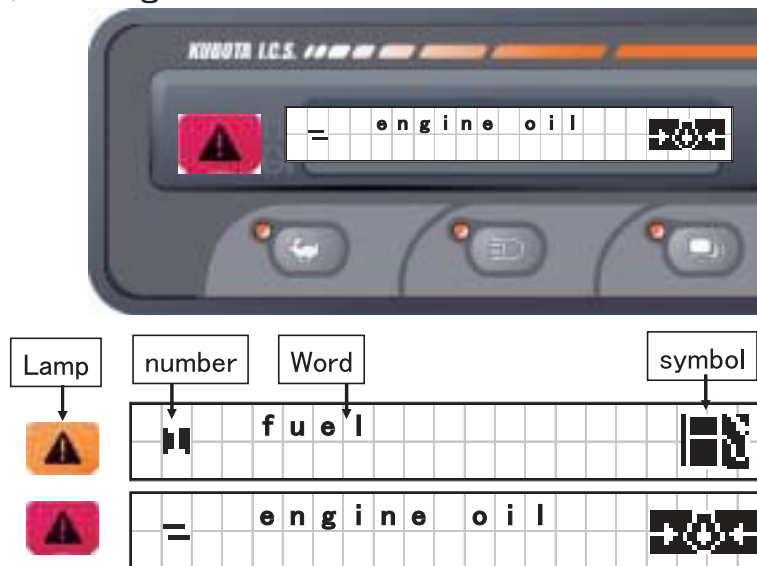
- Hour meter
- Tachometer



Feature of LCD Navigation System②

Additional function

(2)Warning & failure



The number is coordinated with the manual.

Feature of LCD Navigation System③

Additional function

(3)display of service maintenance time

[Remind check schedule of service]



10 seconds after key switch on then message disappear, and 10 times key switch off ,this message is terminated.

(North America & Oceania – version)

As for EU – version, this message should be deleted manually by pressing the work lamp switch for 3 seconds.

Feature of LCD Navigation System④



Additional function

(4)Refueling assistance

Prevents Fuel Overflow.

[Specification]

Buzzer sound changes
according to fuel level.

pi__pi__ → pi_pi_pi → pi-----

Push  with key off.
And this function starts.

Feature of LCD Navigation System⑤



Additional function

(6) The serviceman's support function.

Repairing time becomes shorter.

(for example)

▪ Tester Function

			o	i	l					c	h	a	r	g	e				
			—	—	—					—	—	—							
			w	a	t	e	r								f	u	e	l	
			2	.	3	3	V			2	2	.	3	°C		2	.	3	3
																			L

▪ Fail record

			f	a	i	l	r	e	c	o	r	d							
			d	e	l	e	t	e	r	e	c	o	r	d					

c. Operating Mode

1. Outline

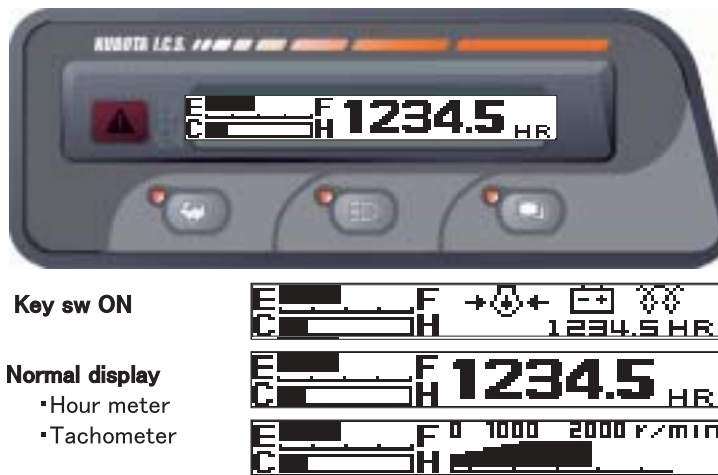
In operating mode, normally LCD shows three types of information.

- 1) Key switch ON,
- 2) Normal display, hour meter
- 3) Normal display, tachometer

Feature of LCD Navigation System①

Additional function

(1) Normal display

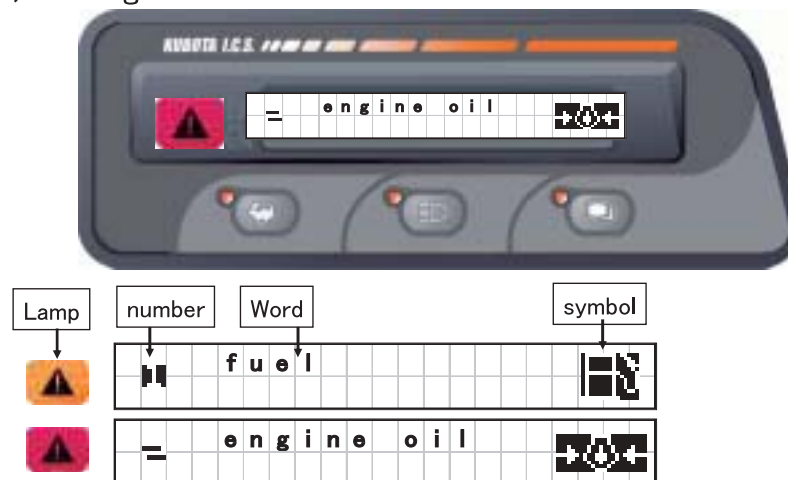


When in trouble, LCD shows warning and failure indications as shown below.

Feature of LCD Navigation System②

Additional function

(2) Warning & failure



The number is coordinated with the manual.

In the following list, item No.1, 2, 3, 4, 5, 11, 12, 13, 14, 21, 22, 23, 24, 25, 51, 52, 53, 54, 55, 61, will be indicated according to the machine conditions.

2. LCD display list

Below list shows all LCD letter indications for both operating mode and service mode.

In operating mode, data 003 ~ 022 will be on the display according to the machine condition.

In case of non AI, non S/P control machines, date 008 ~ 022 except 017, 019, 020, 021 won't come up to show.

name	English	meaning and explanation
data000		This LCD display shows the following conditions;fuel amount, water temp., engine oil pressure, battery, glow plug, and operating hour meter.
data001		This LCD display shows the following conditions;fuel amount, water temp., engine speed.
data002		This LCD display shows the following conditions;fuel amount, water temp., and operating hour meter.
data003	1 Fuel 	The letter on the LCD indicates the warning of each function;fuel amount shortage
data004	2 Engine oil 	The letter on the LCD indicates the warning of low engine oil pressure
data005	3 Charge 	The letter on the LCD indicates the warning of low charging voltage of alternator
data006	4 High voltage	The letter on the LCD indicates the warning of each function; higher voltage line connected for example, 24 V battery
data007	5 Overheat	The letter on the LCD indicates the warning thepossibility of engine overheating condition EU - version only : 124 ± °C
data008	11 Accel sensor	The letter on the LCD indicates the warning of accel sensor line break or shortage
data009	12 Governor sensor	The letter on the LCD indicates the warning of governor sensor line break or shortage
data010	13 AI motor short	The letter on the LCD indicates the warning of AI motor line shortage.
data011	14 AI motor break	The letter on the LCD indicates the warning of AI motor line break.
data012	21 S/P control	The letter on the LCD indicates the amount of auxiliary port flow.
data013	22 S/P Solenoid L short	The letter on the LCD indicates the warning of electrical shortage of aux. solenoid valve left side.
data014	23 S/P Solenoid L break	The letter on the LCD indicates the warning of electrical line break of aux. solenoid valve left side.
data015	24 S/P Solenoid R short	The letter on the LCD indicates the warning of electrical shortage of aux. solenoid valve right side.
data016	25 S/P Solenoid R break	The letter on the LCD indicates the warning of electrical line break of aux. solenoid valve right side.
data017	51 Coolant sensor	The letter on the LCD indicates the warning of coolant sensor or water temp. sensor fail.
data018	52 Fuel sensor	The letter on the LCD indicates the warning of fuel sensor fail.
data019	53 Sensor supply short 12V	The letter on the LCD indicates the warning of 12V sensor supply line shortage.
data020	54 Sensor supply short 5V	The letter on the LCD indicates the warning of 5V sensor supply line shortage.
data021	55 Meter controller error	The letter on the LCD indicates the warning of controller error in the meter panel.
data022	61 AI motor restricted	The letter on the LCD indicates the warning of AI motor being restricted by any means.

name	English	meaning and explanation	
data023	KX36-3	Indicates the model name.	
data024	KX41-3	Indicates the model name.	
data025	KX61-3	Indicates the model name.	
data026	KX71-3	Indicates the model name.	
data027	KX91-3	Indicates the model name.	
data028	KX101-3	Indicates the model name.	
data029	KX121-3	Indicates the model name.	
data030	KX161-3	Indicates the model name.	
data031	KX251-3	Indicates the model name.	
data032	U35-3	Indicates the model name.	
data033	U35	Indicates the model name.	
data034	U45-3	Indicates the model name.	
data035	English French		Owner is expected to select the language he prefers.
data036	German Spanish		
data037	Italian Portugese		
data038	Dutch Danish		
data039	Swedish Finnish		
data040	Diagnosis		
data041	Tester		This means tester mode which test the following circuit conditions electrically on real time.
data042	Engine 1234 r/min Battery 12.4 V		The letters and symbols indicate the real time conditions of the following items. engine speed , battery voltage
data043	E.oil  Charge 		Engine oil pressure switch condition; on or off, Alternator charging circuit condition; normal or abnormal
data044	Water 2.32V 51.6°C Fuel 0.33V 18L		Water V indicates water temp. sensor voltage Fuel V indicates fuel sensor voltage
data045	AI SW  Press  Motor 12.3A		AI SW indicates on or off condition of AI switch. Press indicates AI pressure switch condition. Motor A means current amount flowing to AI motor.
data046	Accel 1.33 Gover 1.33 2.33V 2.33 2.33V 2.33		Accel V indicates voltage amount at accel sensor. Gover V indicates voltage amount at governor sensor.
data047	Compressor 		Compressor indicates the condition of air conditioner's compressure switch.
data048	S/P  Breaker 		Aux. Is abbreviation of auxiliary port and indicates the switch condition, on or off. Breaker indicates the breaker switch condition ,on or off.
data049	S/P L R 2.33 V 0.3 A 0.3 A		Aux. means in this case auxiliary port solenoid valve. L; left side, R; right side, A; current amount to each solenoid valve.
data050	Fail record Delete record		Fail record means machines' failure record are stored in the memory and can be shown up on the display. Delete record means you can delete if you want.
data051	First 234h Last 2345h Count 23		First h indicates the operating hours when first failure occurred, last means last fail occurred. Count indicates the number of fail occurred.
data052	No fail record		This means no failure occurred in the past.
data053	Back tier		Back tier indicates that you can return back to one upper tier or same tier by pressing the buttom, for either a long or a short time.
data054			

name	English	meaning and explanation
data055	Other menu	Literary it means other menus.
data056	Circuit check Engine stop	This means micro computer is ready to check electrical harness conditions, break or breaking. In this case, for your safety engine should be off.
data057	Checking touch harness	This means micro computer is checking the harness conditions. Service personnel is required to put hands on the suspected harness, then controller detects the break of harness.
data058	AI motor drive	This display letter means that AI motor can be controlled by just pressing switches on the panel board. Aim of this function is to adjust AI motor link to fit the cable not by the accel knob but by switch.
data059	Max (C.W.) Idle (C.C.W.)	Max(CW) means AI motor link moves toward engine speed Max. direction. Idle(CCW) means AI motor link moves toward engine speed idle direction.
data060	All fail record	With this display on, all fail records will be shown up on LCD.
data061	EEPROM read	This display means that data in the EEPROM will be shown up on LCD.
data062	1234 FEDE FEDE FEDE FEDE FEBA FEDE FEDE FEDE FEDE	These figures and letters indicate the data of EEPROM. Data can be scrolled up by pressing the switch.
data063	LCD check	This indication shows that micro computer is checking the LCD function.
data064		This shows LCD condition.
data065		This shows LCD condition.
data066		This shows LCD condition.
data067	Service hour meter 1234.3 h	This indicates the service hours of the machine.
data068	Set up hour meter 1234.3 h	This indicates the hours of machine set up.
data069	Soft version 12345	This indicates the software version of main controller.
data070	Set up	This means initialization of the machine main controller.
data071	Engine start	This indicates that operator is required to start engine.
data072	Set up AI	This means initialization of the AI system.
data073	Accel max	This indicates that operator is suggested to turn the accel knob to Max engine speed.
data074	Accel idle	This indicates that operator is suggested to turn the accel knob to idle engine speed.
data075	Finish key off	This means all initialization process has completed and operator is suggested to turn off key.
data076	Set up machine	This means initialization of the machine.
data077	Set up solenoid	This means initialization of the solenoid valve.
data078	Set up idle 1200 r/min	This means initialization of the engine idle speed.
data079	Set up overheat warning	This means initialization of engine overheat warning system.
data080	Overheat temp. 114 °C -10 °C	This indicates the overheat temp. setting value.
data081	32  1500 HR service	This indicates service hour to conduct maintenance job.
data082	Made in Japan Made in Germany	These indicates where machine was manufactured.
data083	Lever Travel Start 	These letters and signs indicate the switch conditions; safety lock lever, travel high speed and main key position at start or not.
data084	31 Lift up unload lever	This indicates that operator is suggested to lift up unload lever(safety lock lever).
data085	Simple mode	Simple mode means that min. fail indications are shown up on LCD.

d. Service mode menus

1. Outline

Service mode is basically for dealer's service personnel.

This mode is so designed to initialize machine's condition, additional attachment and control system. and also diagnose machine trouble. Display indication items are listed in page 3-9 and 3-10, from data number 023 ~ 085.

Following pages include ;

- 1) Service mode flow chart
- 2) Main menus in detail

2. Service mode flow chart

How to enter the service mode;



1. While pushing the display select switch.



2. Turn the main key switch to ON position.



3. Then you are in the service mode.

3. Main menues and functions

3-1 Selection Method of 11 Languages

If the key is turned ON with the display selector pressed, the name of the model presently selected will appear. When the finger is off the display selector, the next language selection screen will appear. The information on the selected model is important. Therefore, this method enables the confirmation of the model first.

As explained above, the system is designed to support 11 languages, and the language selection screen will appear first. (See fig.)

The selection screen of the 11 languages is written in each of the languages as shown in figure. When a language is selected, a display corresponding to the language will appear.

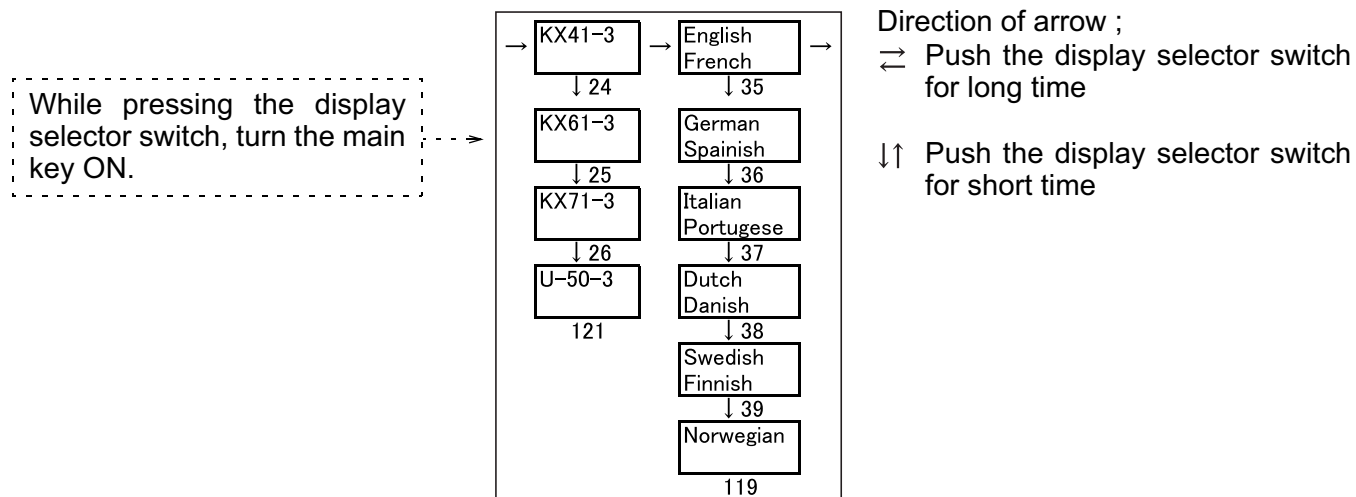


Fig.1. Service Mode Language Selection Screen

3-2 Tester mode

Items such as the present battery voltage can be displayed by selecting Diagnosis and Tester. (See fig. 2.)

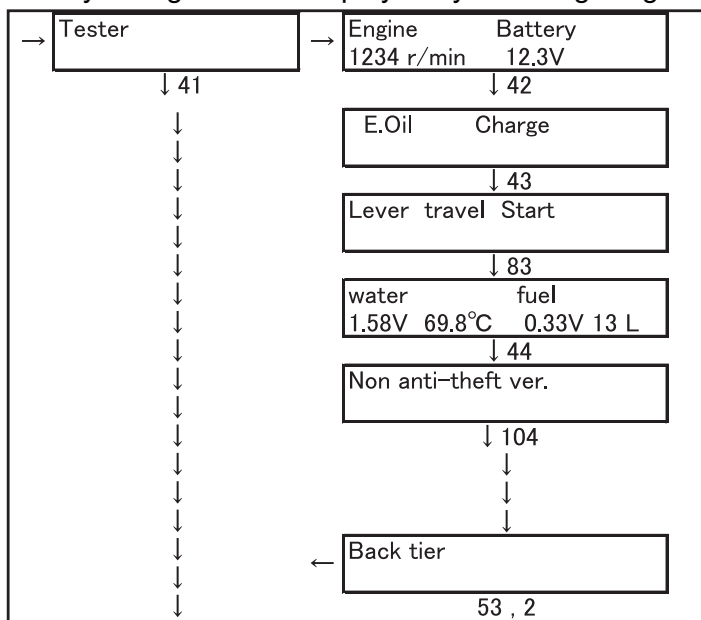


Fig.2. Tester menu

- Engine -> Engine revolution XXXX rpm
A revolution sensor is mounted to the injection pump gear.
The gear ratio varies with the model as described below.
KX41-3's gear ratio: 46
KX61-3 and KX71-3's gear ratio: 54
KX91-3, KX101-3, KX121-3, and KX161-3 gear ratio: 68

Calculation Method

A single rotation of the injection pump corresponds to two engine rotations.

The revolution of the engine is calculated by measuring the passing period of the number of gear tooth specified by the timer and obtaining the revolution under the same condition for 60 seconds.

- Battery: Battery Voltage
The battery voltage is input into the meter through two diodes. Therefore, the voltage displayed is added with 1.4 V in consideration of the potential drop caused by the diode.
- E. oil: Engine oil switch ON and OFF.
- Charge: Alternator L terminal ON and OFF.
These switches are turned ON with the engine stopped and turned OFF with the engine started while in normal operation.
- Lever: Lever lock.
- Trave: Running in second gear.
- Start: Start position of key switch.
- Water: Water temperature voltage and water temperature (C).
- Fuel: Fuel voltage and fuel quantity (in liters).
The quantity of fuel (in liters) displayed is a reference value.
The fuel (in liters) is displayed from data measured according to the model.
- Non anti-theft ver.: Not connected to theft prevention ECU (i.e., no communication is possible with the theft prevention ECU).

3-3 Fail record dump

The fail record can be displayed by selecting Diagnosis and Fail record. (See fig. 3.)

By selecting the Fail record, the system reads the contents of the EEPROM and checks the information on failures.

If failures are found, each failure item and the number of times on the hour meter can be scrolled at 1.5-second intervals.

By pressing the display selector just once, the next failure point can be viewed.

If there is no failure, "No fail record" will be displayed.

(See the Section of Fail Safe for failures in detail.)

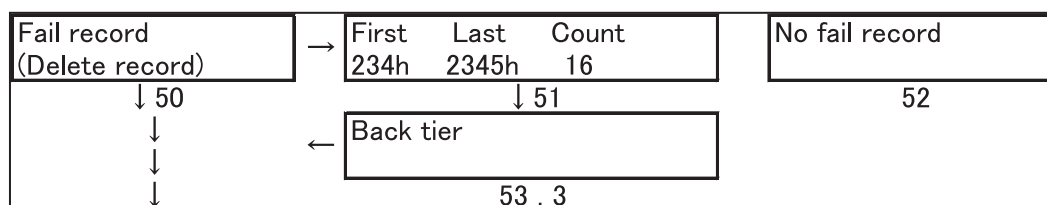


Fig. 3 Fail record dump

3-4 Deletion of Fail Record

The fail record can be deleted by selecting Diagnosis and Delete record. (See fig. 4.)

The message "Fail record deleted" will be displayed when the record is deleted.

By pressing the display selector while this message is displayed, the message to read the fail record will appear again. The message to read the fail record will, however, appear automatically in 3 seconds without pressing the display selector.

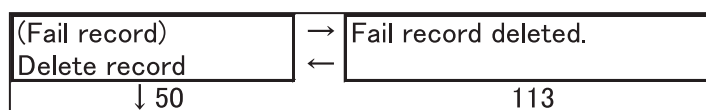


Fig. 4 Fail record delete

3-5 Machine model setup

Model settings can be made by selecting Set up and Set up machine. (See fig. 6.)

Here, information on the model and the country of manufacturer is selected.

By selecting the country of manufacturer, European specifications and North American specifications are distinguished.

(If AI optional specifications are provided, the selection of AI as an optional item will appear as well.)

Fig.5 Machine model setu-up

Note:

By selecting the country of manufacturer, optional functions attached to the country - version, such as the overheating and service auto manual items can be determined automatically.

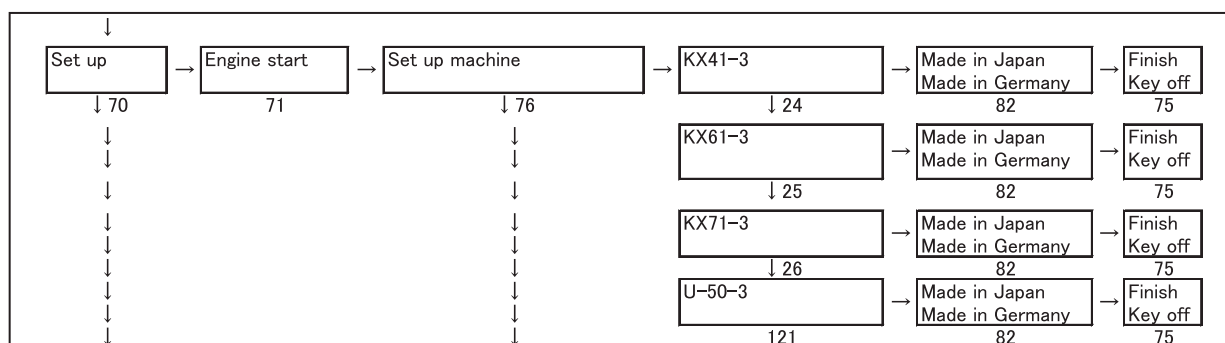


Fig.6 Machine model set-up

3-6 Overheat set-up

Note:

By selecting **Diagnosis**, **Set up**, **Engine start**, **Set up machine**, and **Set up overheat warning**, overheat warning settings can be made.

By turning the overheat warning ON, the overheating warning function will be enabled and the overheat warning will be output when the preset temperature is reached.

The preset temperature can be adjusted in 10 C increments or decrements.

The value will be negative with the working lamp switch turned ON and positive with the center switch turned ON. The entered value will be determined with the display selector continuously turned ON.

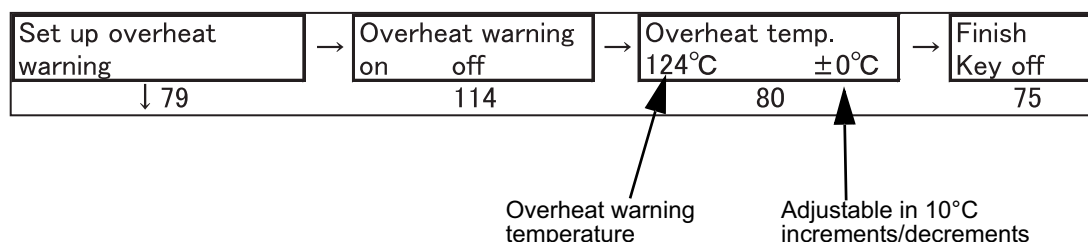


Fig. 7 Overheat Settings

In default condition, **Overheat warning** is OFF for North America and Oceania - version and ON for EU - version.

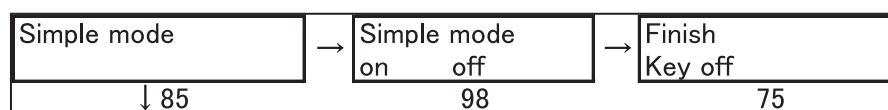
3-7 Simple mode set-up --- Chinese-version only

Simple-mode settings can be made by selecting Set up, Engine start, Set up machine, and Simple mode. (See fig. - .)

While in simple mode, the output will be turned OFF when the fail-safe function is activated, but no messages will be output. The fuel replenish mode will not be available.

No messages for failures including engine oil failures will be output while in simple mode. In this case, the hour meter cannot be switched over to the tachometer while in normal mode. Therefore, only the hour meter will be displayed. The reason is that the tachometer does not display the engine oil icon.

This meter is used for the U-50-3 meter for China, but the U-50-3 meter for China is shipped with a factory setting made to simple mode.



3-8 Harness check Mode

By selecting Other menu and Circuit check Engine stop, the present conditions of the harness connector can be checked (See fig. below.).

When the Circuit check Engine stop is selected, the message "Checking touch harness" will appear at the moment the engine revolution drops below 800 rpm. This mode is available on the condition that the engine is stopped. The mode cannot be selected when the engine revolution is 800 rpm or over.

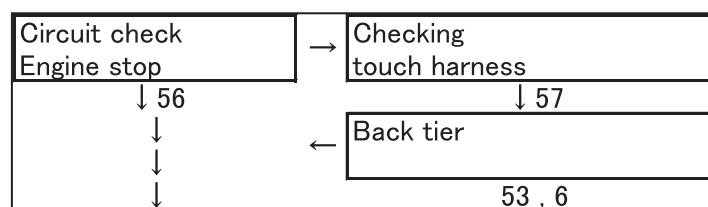
While in harness check mode, the following items can be checked. Items in parentheses are error criteria.

- Lever lock switch (OFF When lever is down).
- Fuel sensor (Reading of 2 V or more, or 0.2 V or less.).
- Water temperature (Water temperature of 140 C or more, or -30 C or lower.).
- Oil switch (OFF When engine stops and Key is ON).
- Charge circuit (OFF).

If there is any error, a message indicating the position of the error will flash automatically. Simultaneously, the buzzer will beep.

When the error is restored, the buzzer will be turned OFF, but the flashing memory will be kept on hold.

If there are a number of errors, the screen will scroll.



3-9 All Fail Record

All the accumulated failure records can be shown by selecting Other menu, Other menu, and All fail record (See Fig.6.).

By selecting All fail record, the first hour meter items generated after shipping through the last one will be shown.
There are 19 types of failure diagnostic items, and the details of each type of item can be checked. The hour meter will, however, remain even after the failure records are deleted.

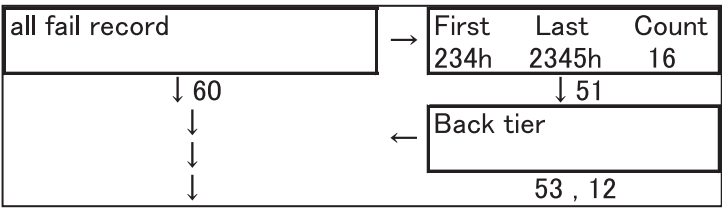


Fig.6 All Fail Record

3-10 EEPROM read

The data of the EEPROM can be checked by selecting Other menu, Other menu, and EEPROM read. (See Fig.7.)

Ten items are displayed on each page in hexadecimal, and 13 pages will be used in total.
The EEPROM consists of 128 x 16 bits.

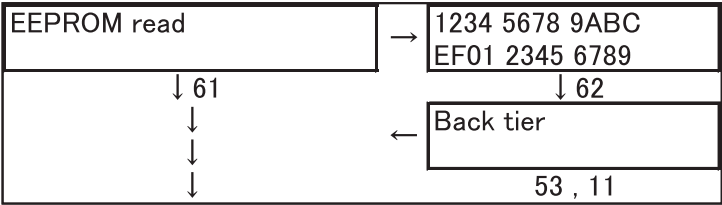


Fig.7 EEPROM read

3-11 LCD inspection

The dot type of the LCD can be checked by selecting Other menu, Other menu, and LCD check. (See Fig. 8.)

Checked pattern 1, checked pattern 2, and the outer frame will be displayed. Checked pattern 1 and checked pattern 2 are opposite to each other in dot ON-OFF pattern. Missing dots can be checked by using this function. (See Figs.9 and 10.)

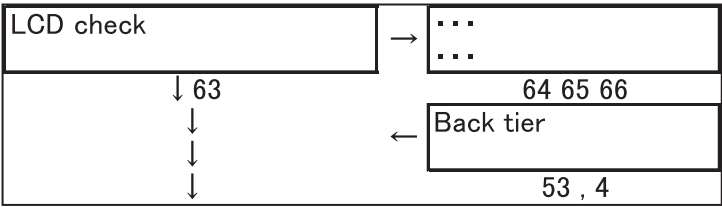


Fig.8 LCD check



Fig.9 Frame Display

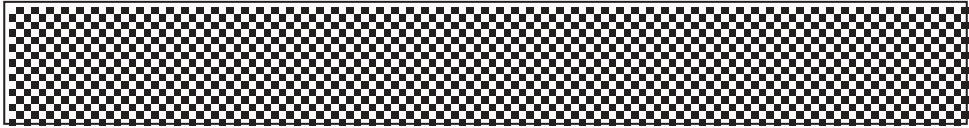
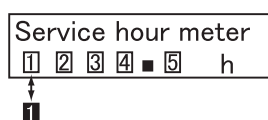
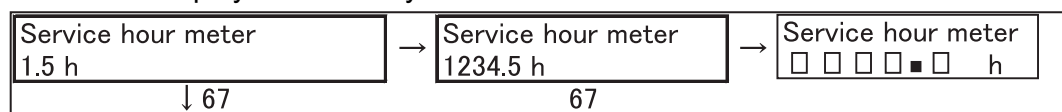


Fig.10 Checkered Pattern

3-12 Service hour meter check

The service hour meter can be checked and altered by selecting Other menu, Other menu, and Service hour meter.

Only the display selector switch is used to make value changes. The service hour meter will be changed when the meter is replaced, because the service hour meter will not be synchronized with the hour meter, and warnings will not be displayed in a timely manner.



As you reach to this menu, first box is blinking to ready to change the digit. Push the SW in short, the number will be incremented. Push the SW longer, the number will be fixed and shifted to next box. After fixing all boxes, the beep sounds three times and automatically returns to service hour meter with new service hours.

3-13 Service hour meter delete

A deletion method of the service hour meter can be set by selecting Other menu, Other menu, and Service warning selection.

Auto: North America & Oceania - version

The service hour meter will be turned off when the key is turned OFF and ON 10 times in total.

Manual: EU - version

The service hour meter will be turned off with the working lamp switch pressed continuously for 3 seconds.

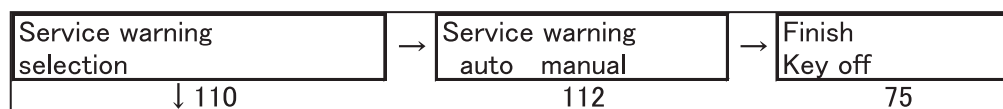
Note:

Change in Service Hour Meter

North American specifications: By default set to auto.

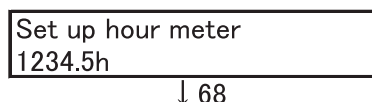
European specifications: By default set to manual.

Turn off the service hour meter with the working lamp switch pressed.



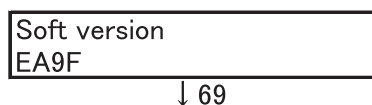
3-14 Set-up time

The hour meter used for model settings can be checked by selecting Other menu, Other menu, and Set up hour meter.



3-15 Software version

The software version can be checked by selecting Other menu, Other menu, and Soft version.



3-16 Auto glow control

The glow will be turned ON for an optimum time according to the temperature of engine cooling water.

3-16-1 Key-ON Processing

Water temperature: The glow-ON time is obtained from the glow time map (see Fig. 1, 2). The glow will not, however, turn ON while the engine is working or the temperature is 81 °C or over. The glow icon will appear with the glow turned ON.

When the user confirms that the glow icon turns OFF and tries starting the engine, a delay in response (usually 0.5 to 1.5 seconds) will result, during which the temperature of the glow plug will drop. Therefore, the actual glow will be kept turned ON for 2 seconds after the glow icon disappears. This will make a response time lag between the display and glow time, thus making it possible to start the engine smoothly. (See Fig. 3.)

Water temperature (°C)	Glow time (s)	Glow icon display time (s)
140	0.0	0.0
100	0.0	0.0
81	0.0	0.0
80	3.0	1.0
60	3.3	1.3
40	3.8	1.8
20	5.3	3.3
10	6.5	4.5
0	9.0	7.0
-10	11.0	9.0
-15	12.0	10.0
-40	12.0	10.0

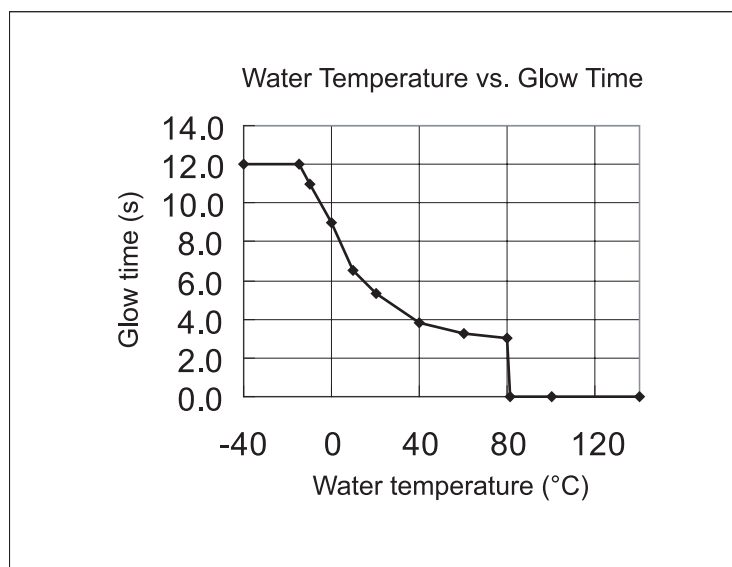


Fig.1.Cooling Water Temperature vs. Glow Time

Fig.2.Graph of Water Temperature vs. Glow Time

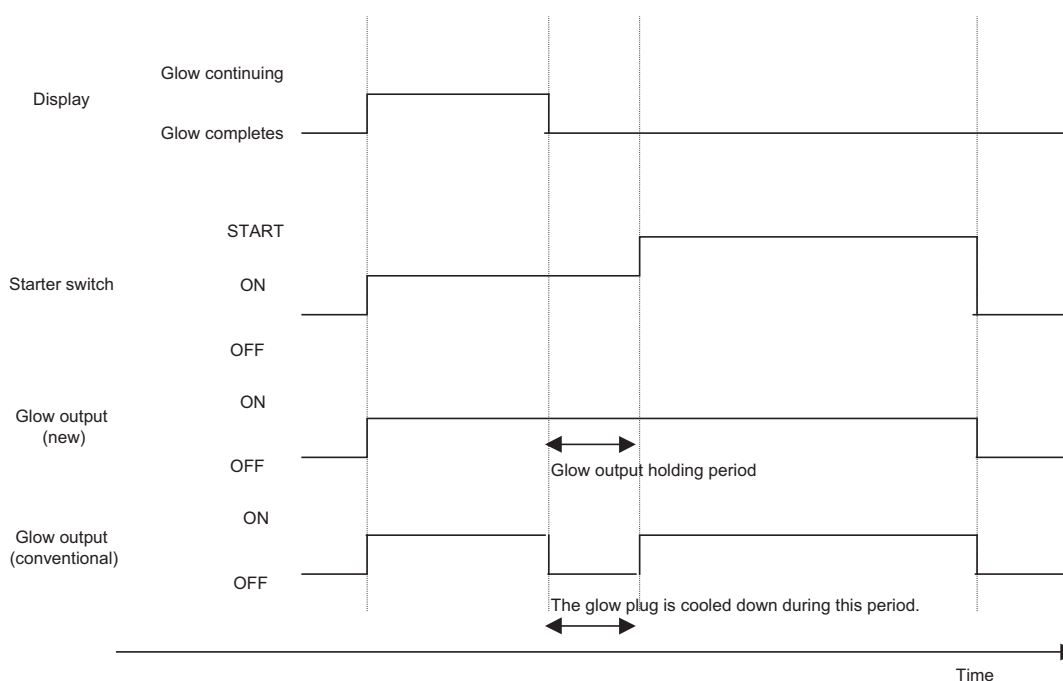


Fig.3.Transition Diagram of Glow and Starter Key

Glow ON/OFF Conditions

The glow will turn ON under any of the following conditions: The engine revolution is 1000 rpm or below; the engine oil pressure switch is OFF (the input terminal of the engine oil pressure switch is H); the charge is OFF (the L input terminal is H). If these conditions are not satisfied, the glow will be turned OFF because controller unit judges that the engine has started.

Relationship between Water Temperature and Dots

The gauge of the water temperature uses four dots vertically and 34 dots horizontally.

The relationship between the water temperature and dots is shown below.

Refreshment Cycle of Number of Dots

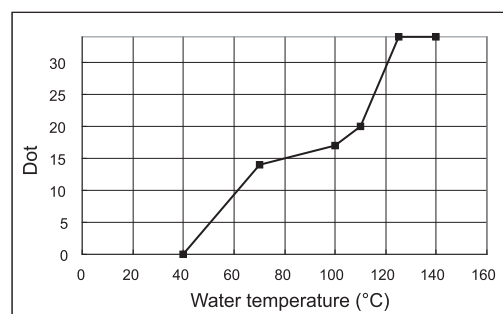
The average temperature of 721 samples obtained at 6.9344-ms intervals ($6.9344 \text{ ms} \times 721 = 5 \text{ s}$) is converted into the number of dots to refresh the display.



Water temperature	Dots
40	0
70	14
100	17
110	20
125	34
140	34

Relationship of Water Temperature and Number of Dots

Enlarged view of water temperature gauge



Relationship of Water Temperature and Number of Dots (Graph)

Glow Control (Others)

1. If the grounding of the motor to the engine is improper, the voltage may sneak to the glow relay, thus always turning the glow relay ON. Therefore, when the key is not at the start position, the glow relay will be turned OFF.
2. If the battery is discharged while the key turned ON (In case operator left the key ON) and when the battery voltage is close to the level of triggering the CPU, the following operation may be repeated.

The microcontroller starts and turns the glow relay ON to perform auto glowing.



The glow current flows and the battery voltage drops because the glow relay is turned ON.



The microcontroller is reset.



The battery voltage rises because the microcontroller is reset and the glow relay is turned OFF, when no current flows.



The microcontroller is triggered and the glow relay is turned ON because the battery voltage rises.

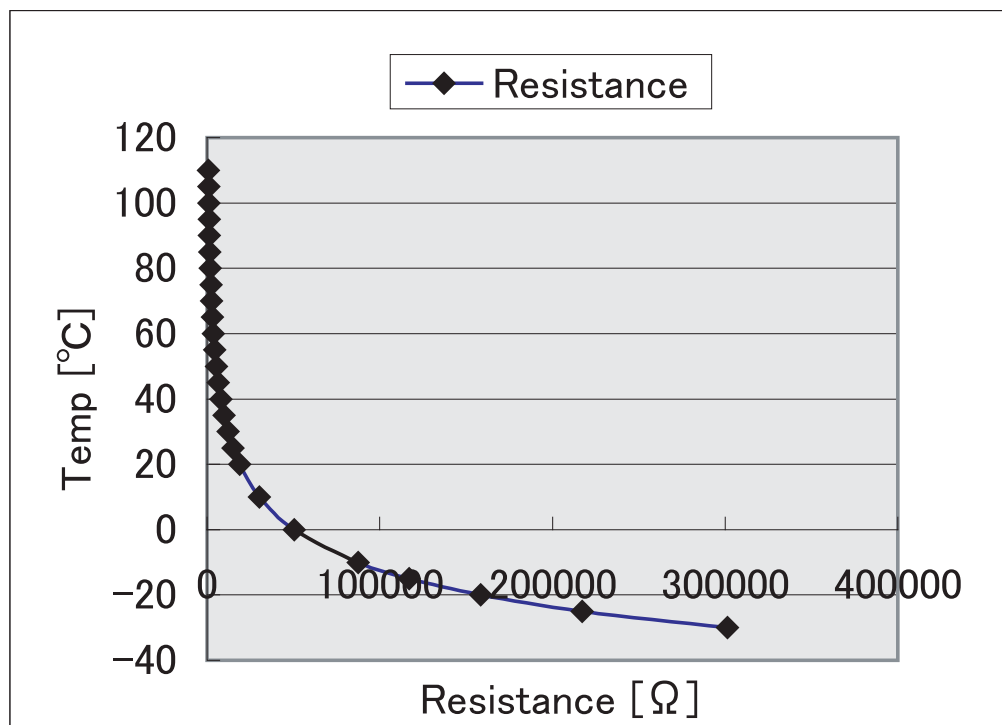


The above sequence is repeated. Then glow relay contact may have chattering and be damaged.

The glow relay will be always turned OFF in order to prevent the chattering of the above glow relay when the voltage is 7.5 V or below. The similar process will be performed for the relay for the working lamp. This know - how is to protect the relay itself.

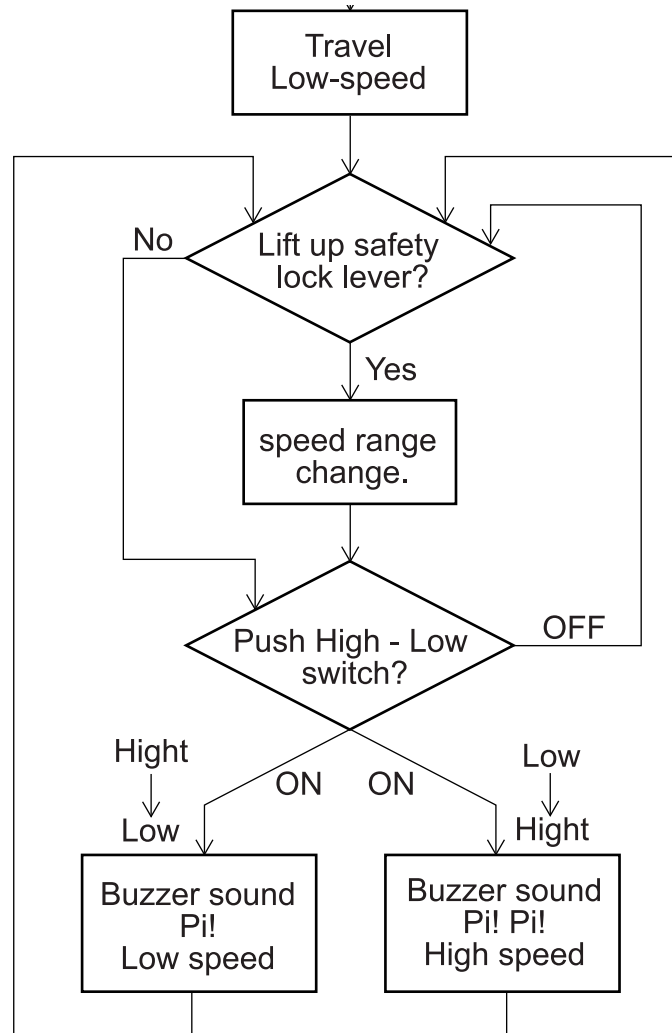
3. FYI (For your information)

water [V]	temp [°C]
0.33	140
0.409	130
0.504	120
0.634	110
0.795	100
1	90
1.26	80
1.58	70
1.96	60
2.4	50
2.86	40
3.36	30
3.77	20
4.15	10
4.44	0
4.66	-10
4.8	-20
4.89	-30
4.94	-40



3-17 Travel high - low switch control

1. Change travel speed by pressing the high - low switch on the dozer control lever. Refer to the control flow.
2. The travel mechanism will start in low gear to ensure safety when the key is turned ON.
3. With consideration of the change of the operator with the key kept turned ON, the frame mechanism will be set into low gear to ensure safety when the lever lock is lifted up.
4. Control flow chart.



Note:

System will always “Reset” to low speed when key is switched “OFF” or safety lock lever is lifted.

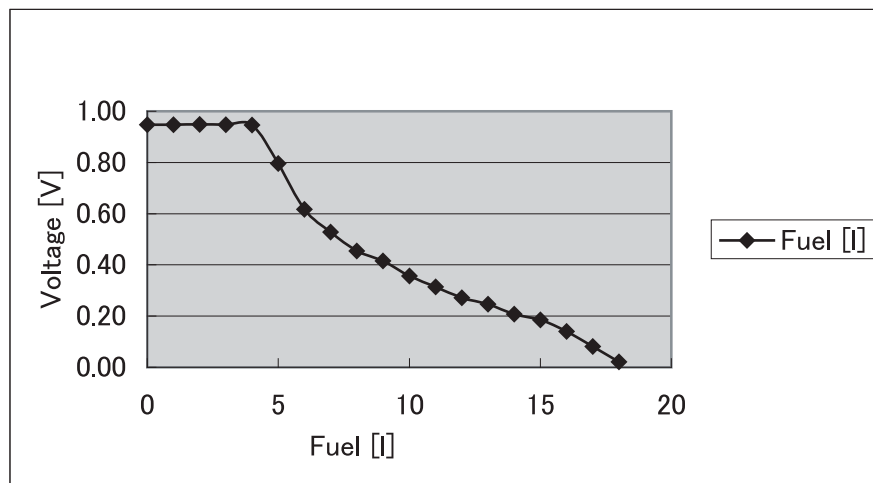
3-18 Fuel amount control

1. Outline

A map indicating the voltage and fuel relationship has been prepared by plotting each determined input voltage based on the float position of the fuel sensor and the remaining fuel.

The power supply voltage (5V) is input into the microcomputer according to the partial voltage varied with the float position. Therefore, when calculating the actual quantity of remaining fuel, make a map conversion with consideration of the power supply voltage.

The fuel shortage alarm will be displayed when the quantity of remaining fuel is between approximately 5 and 10 liters, the range of which, however, varies with the model. As a rule of thumb, the fuel will last for approximately one hour after the alarm turns ON.

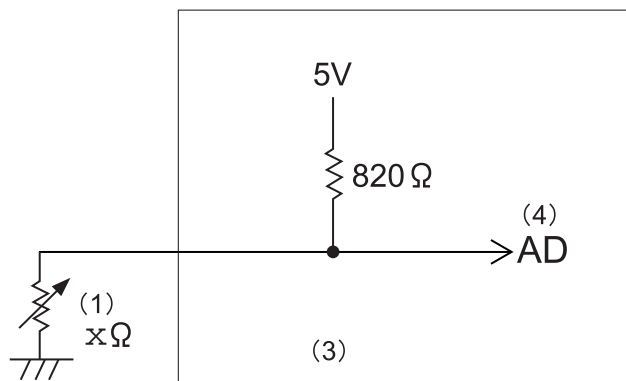


Voltage and fuel map

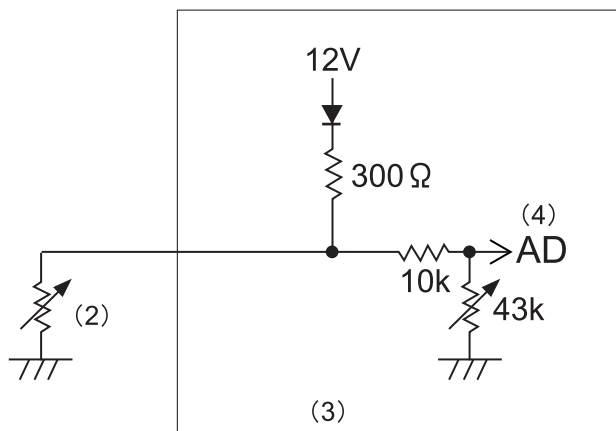
Fuel shortage alarm

Model	Fuel residual amount [L]
KX41-3	5 ± 3
KX61-3	7 ± 3
KX71-3	7 ± 3

Circuit diagram & function(Fuel sensor)



(Water temp sensor)



(1)Fuel sensor (2)Water temp sensor (3)Meter (4)AD voltage

(Calculation example) Voltage value is 0.899 for example.

$$\begin{aligned} \frac{5}{x + 820} \times x &= 0.899 \\ 5x &= 0.899x + 0.899 \times 820 \\ (5 - 0.899)x &= 0.899 \times 820 \\ x &= \frac{0.899 \times 820}{5 - 0.899} = \frac{737.18}{4.101} = 179.76 \, \Omega \end{aligned}$$

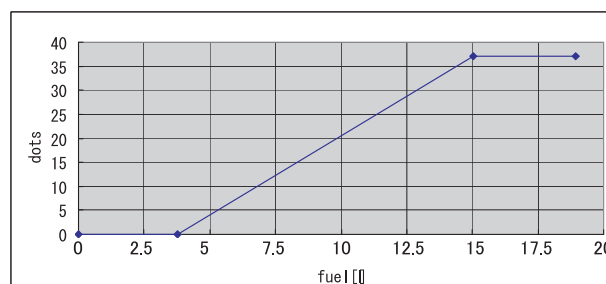
Theoretically, water sensor's resistance is 179.76 Ω

2. Meter display

- 1) The LCD with four vertical dots and 37 horizontal dots is used to display the fuel gauge.



Fuel level, Litter	KX41-3	KX61-3, 71-3
Full in tank	19 ± 3	42 ± 3
Sensor upper limit	17 ± 3	41 ± 3
Sensor lower limit	5 ± 3	9 ± 3

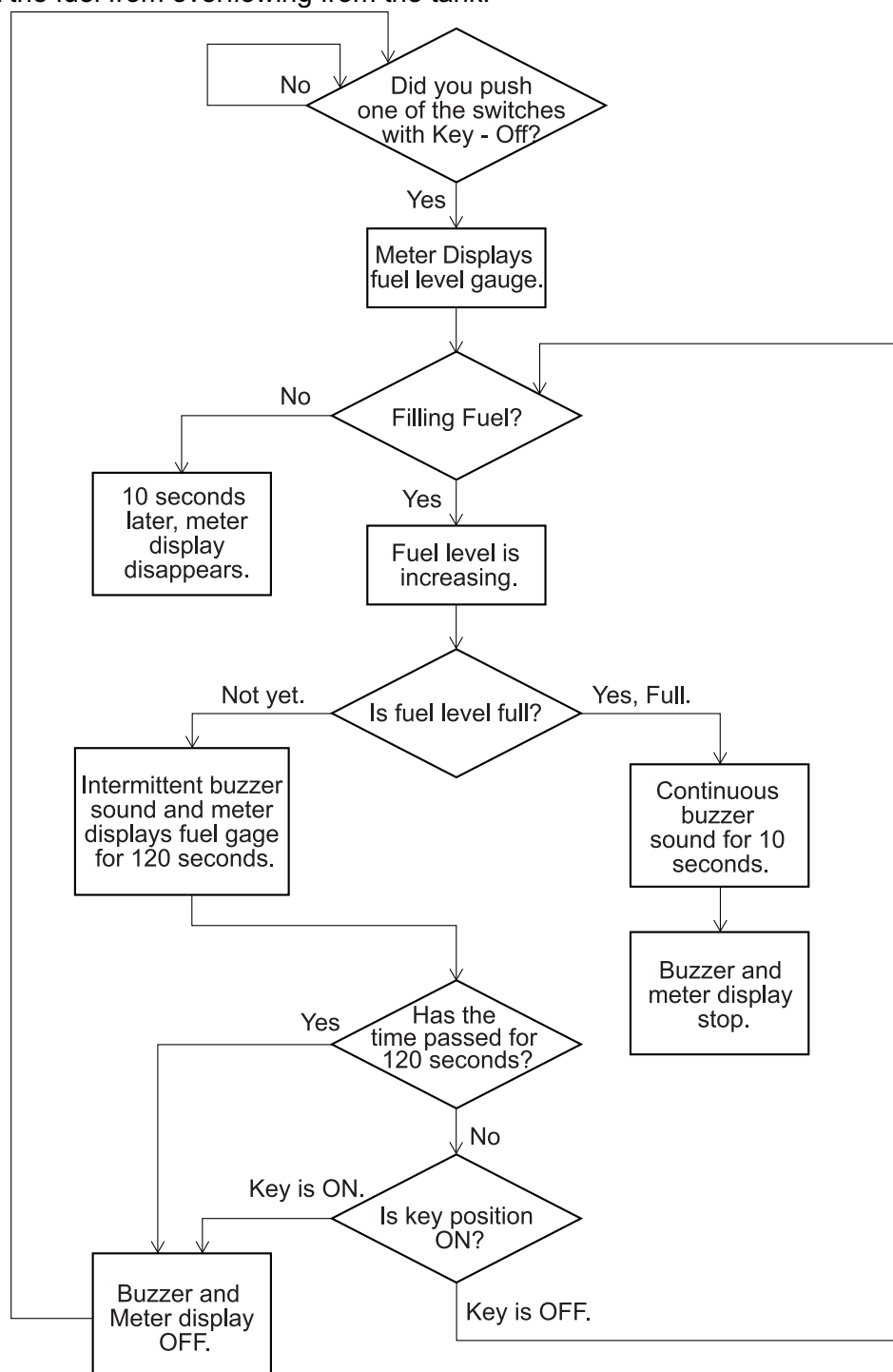


(Sample data : KX41-3)

- 2) A fuel shortage (0.899 V or over) is judged with 8,653 sampling times for 60 seconds. If a fuel shortage is detected 7,780 times or more (i.e., a minimum of 90% of the total), the fuel shortage alarm will be displayed.
- 3) If the fuel shortage alarm is displayed when the key is turned OFF, data on the alarm will be saved in the microcomputer. If the voltage on average for 0.2 second indicates a fuel shortage (0.899 V or over) when the key is turned ON again, the alarm will be displayed at once.
- 4) The alarm displayed will be canceled if the alarm cancel voltage (0.719 V or below) is detected 649 times or more (i.e., a minimum of 90% of the total) after the sensor signal is sampled 721 times for 5 seconds.
- 5) When the engine starts, the sensor float sways greatly, thus resulting in input voltage dispersion. Therefore, the sampling cycle of the sensor signal is set to 25 seconds.
- 6) If fuel sensor disconnection occurs, the existence of fuel is not detectable, and the fuel shortage alarm will not turn ON.

3. Fuel Replenishment Assist Function

While replenishing fuel by pressing any switch after the key is turned OFF, the buzzer interval will change according to the quantity of fuel replenished. When the fuel in the tank is not much, the buzzer will be heard at long intervals. When the quantity approaches the full tank level, the intermittent buzzer continues at shorter intervals. When the tank is full, the buzzer will be heard continuously with no intervals to prevent the fuel from overflowing from the tank.

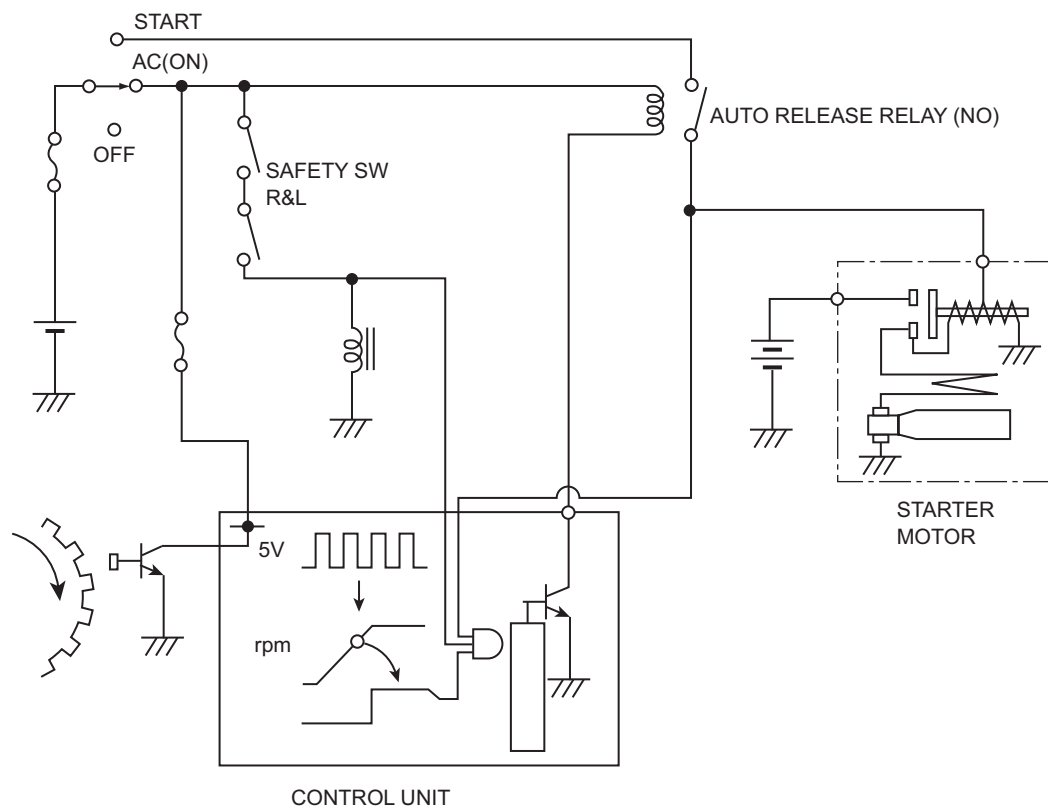


- Beep sound disappears approx 10 seconds after reaching to full of fuel.
- If fuel tank isn't full, keep sound continues to sound for two minutes in order to alarm.

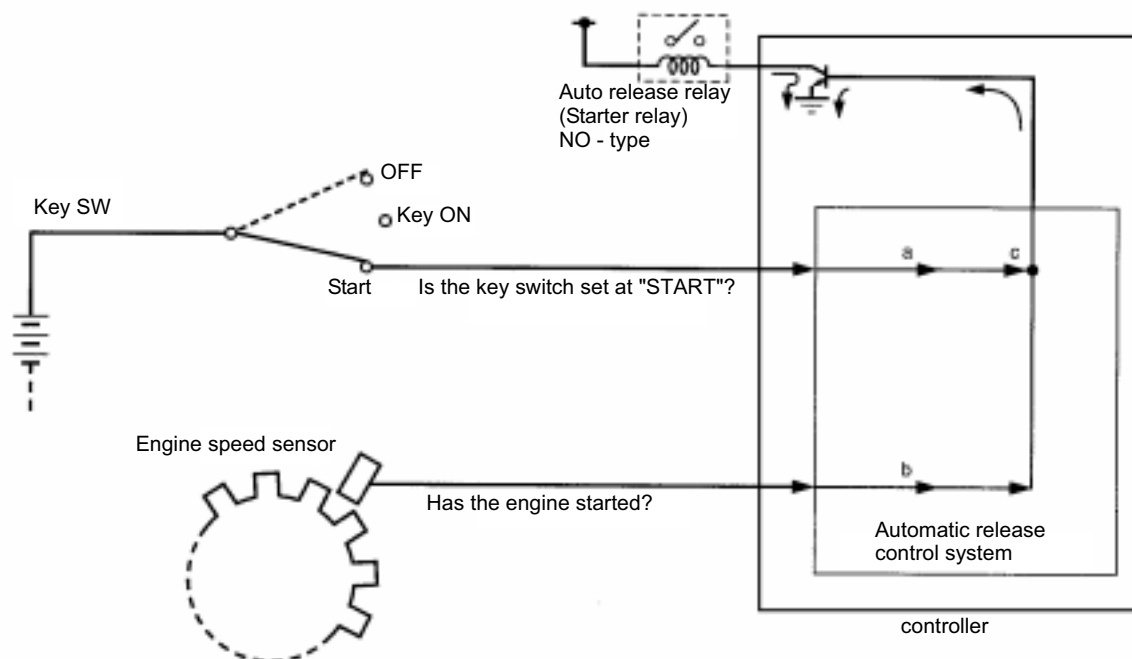
3-19 Starter auto release control

1. Outline

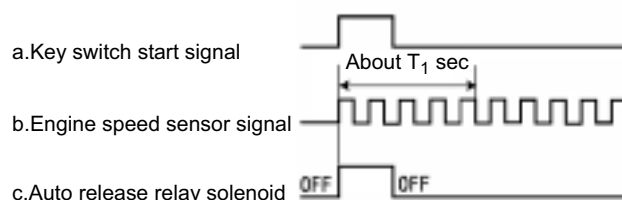
- 1) If the key is frozen in the start position, the auto release relay is turned OFF to prevent damage to the starter motor. At the same time, the glow relay will be turned OFF forcibly to prevent damage to the glow plug. (Prevention of starter motor from key freezing)
- 2) The start of the engine is judged from the engine revolution sensor signal to turn OFF the auto release relay. (Starter auto release)
- 3) If the key is turned OFF once and reset to the start position immediately while the engine is starting, the pinion gear will engage while the ring gear rotates, which deteriorates the durability of the gears. Therefore, the mechanism is designed to prevent of the engine from starting in two seconds after the key is turned OFF. (Reentry prevention control)
- 4) The engine on the KX41-3 does not start at low temperature unless the revolution rises approximately 800 rpm. Therefore, the start of the engine is judged at 1,000 rpm.
(The judgment of the release of the starter has been raised by 200 rpm in case of KX41-3)
In case of KX61-3, 71-3, the start of the engine is judged at 800 rpm.
- 5) If the key freezes while there is a failure in the engine revolution sensor, the auto release relay will be automatically turned OFF in 30 seconds and power supply to the starter will be stopped. (Prevention of starter burnout damage)
The reason the above period is set to 30 seconds is that it will be possible to start the engine by energizing the starter three times for 10 seconds after auto glowing even in winter at a temperature as low as -17 °C.



2. Auto release Circuit diagram & function



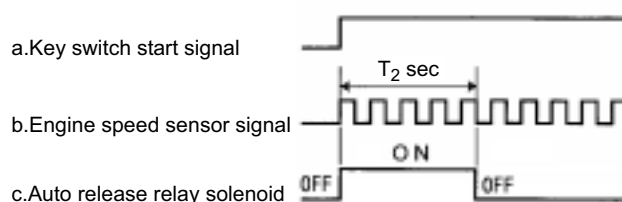
1) Function chart When in normal operation



When the key switch is returned after the engine got started, the auto release relay functions as shown below upon engine speed.

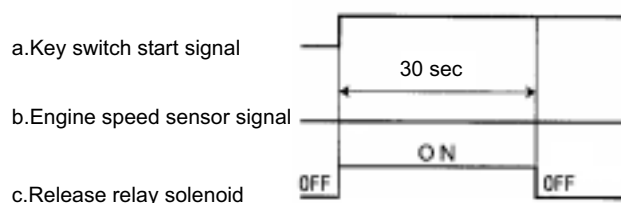
Engine speed	Auto release relay (T_1 , T_2)
$800 \geq N_x$	ON
801 ~ 950	ON (Within 6 seconds) OFF (After 6 seconds)
$951 \leq N_x$	ON (Within 0.5 seconds) OFF (After 0.5 seconds)

2) If the engine has started but the key switch fails to return (key switch failure)



Suppose that the key switch fails to return and the key switch start signal stays on. But if the engine speed sensor signal is fed, the automatic release control system regulates the transistor's base current flow, which turns off the release relay solenoid.

3) If the key switch fails to return and the engine speed sensor is also in trouble



If the key switch start signal is detected to have been on for 30 seconds, the automatic release control system (3) cuts the transistor's base current flow, which turns off the auto release relay solenoid (1) and turns off the starter motor's solenoid.

	a:Key switch status	b:Engine speed sensor status	c:Release relay solenoid action
(1)	Normal: No particular action	Normal	Normal: No particular action
(2)	Start position → Failure to return	Normal	Relay deactivated 0.5 or 6 seconds according the engine speed.
(3)	Start position → Failure to return	Engine failure to start, or no engine speed sensor signal	Relay deactivated 30 seconds after the key switch turn to "START"

3. Trouble shooting

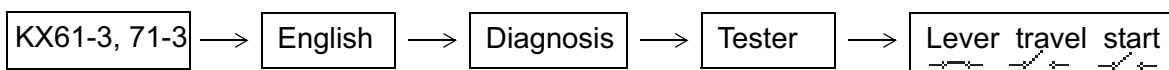
If Engine Does Not Start

1) Check if the safety lock lever is lifted.

Make sure that the safety switch is turned OFF.

Take the following steps, set the unit to tester mode, and check the condition of the safety switch.

(Service mode)



A manual check with a circuit tester is possible.

2) Check if the prevention of start mode reentry is working. (Wait two seconds or more.)

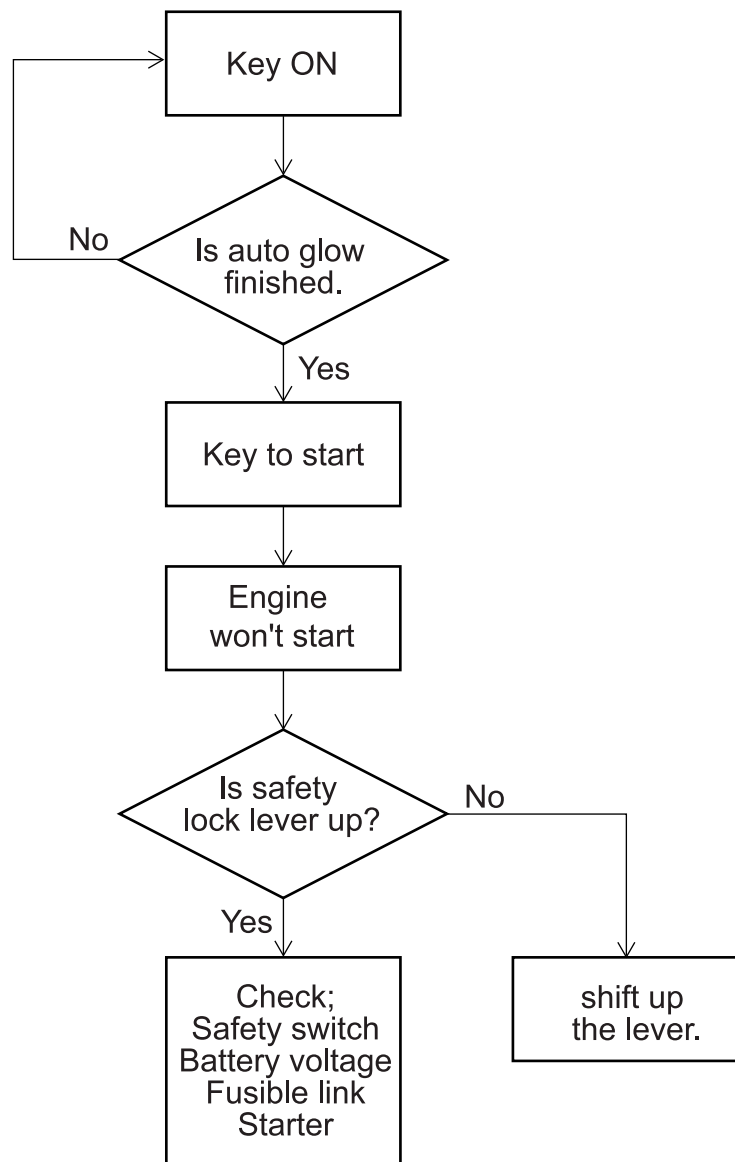
3) Check if the auto release relay is turned OFF.

Make a manual check with a circuit tester.

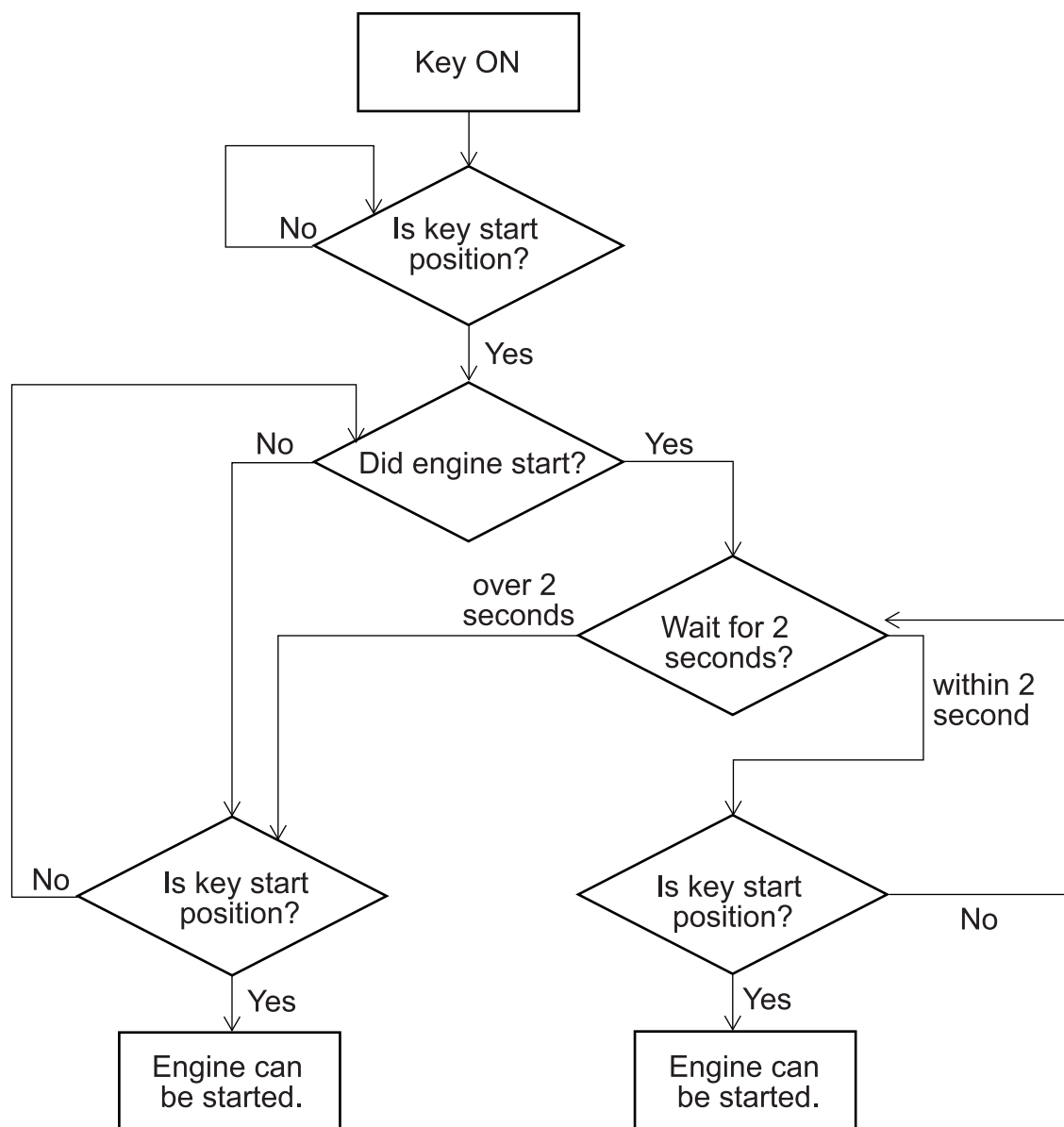
4) Check if the wrong model settings are made.

Depending on the model, the start of the engine is judged at 1,000 rpm or below. Therefore, the release of the starter motor is judged before the startup revolution of the engine is reached.

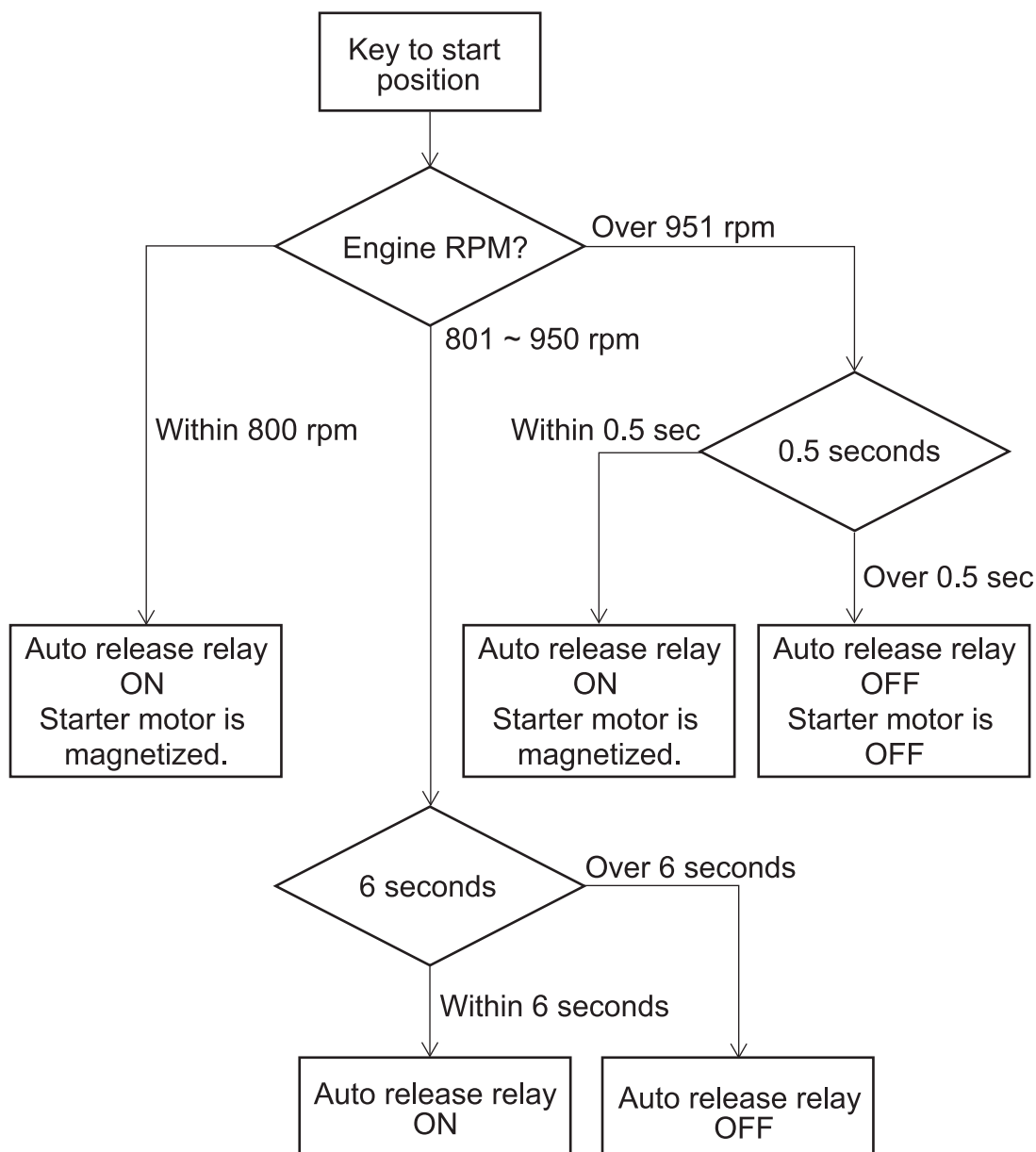
4. Operational flow chart 4-1



4-2



4-3



< Engine speed and condition of auto release relay >

Engine speed : N_x	Time : T_1, T_2	Auto release relay
$800 \geq N_x$		ON
801 ~ 950	Within 6 seconds	ON
	After 6 seconds	OFF
$951 \leq N_x$	Within 0.5 seconds	ON
	After 0.5 seconds	OFF

starter relay = Auto release relay

3-20 Service hour meter

A service maintenance message will appear when the preset hour meter item is activated.

The message will disappear in 10 seconds. Hereafter, whenever the key is turned OFF and ON, the message will appear for the first 10 seconds.

There are two modes (i.e., auto mode and manual mode) to turn OFF the inspection icon perfectly, either of which is selectable by the user's settings.

While the system is in auto mode, the icon will disappear when the key is turned OFF and ON 10 times in total. Then icon will not appear again with the key further pressed. This is convenient because the icon will disappear only with the key turned OFF and ON, in which case the actual maintenance of the equipment will be up to the user's choice.

While in manual mode, the icon will disappear with the working lamp pressed continuously for 3 seconds. In this case, the message will be eliminated after the user's maintenance work. Therefore, the problem of the careless omission of maintenance will be prevented. This method is, however, complicated. Therefore, it is necessary for each dealer to make maintenance management.

When all the described inspection items in the Operation Manual are considered, a message will be displayed at 50-hour intervals, which is not so meaningful. In view of the foregoing, important items (e.g., items related to the engine oil, operating oil, air filter, and engine oil filter) should be targeted so that a message will appear in the case of maintenance necessity for any of these items. The meter with North American specifications and that with European specifications share the same software, but the timing of maintenance varies with the specifications and the size of the system. Therefore, the displayed frequency of each item is changed according to the specifications. Fig. 2 shows an example of the display of the KX41-3 with North American specifications.

Usually, the service hour meter advances in synchronization with the hour meter, thus causing no problems. If the hour meter is replaced, however, the new hour meter will start with zero hour. In that case, the service hour meter will be asynchronous. Due to ethics reasons, the system cannot incorporate functions that allow the alternation of the hour meter. There are, however, no problems in altering the service hour meter. Therefore, items that can be input for the service hour meter have been prepared.

KX41-3 Service Hour Meter with North American Specifications

No.	Check points		Intervals	Hour meter indicator								Consequently	
				50	100	250	300	500	550	750	800		1000
1	Engine oil		change	○			○		○		○		every 250 hrs
2	Hydraulic oil										○		every 1000 hrs
3	Air filter element	Outer element	replace								○		every 1000 hrs
		Inner element								○		every 1000 hrs	
4	Drive unit oil		change		○			○			○		every 500 hrs
5	Engine oil filter		replace	○			○		○		○		every 250 hrs
6	Hydraulic return filter element					○			○				every 500 hrs
7	Hydraulic suction filter element										○		every 1000 hrs

The message appears. The message shows up as follows.

32

1500 HR
service

Fig. 2

EU - version machine

A message appears initial at 50-hour intervals and 250-hour intervals (i.e., every 250, 500, 750, and 1000 hours).

e. Failure Diagnosis

1. Failure display and diagnosis criteria

The following table 1 shows data on failure diagnosis, for operating mode and service mode.

Note:

- Display items of the system in service mode can be checked with the fail record.
- In the case of a warning for fuel scarcity, the buzzer will be turned ON for a moment at five-minute intervals.
- No.11 ~ 61 except 31, 32, 51, 52, 53, 54, 55 will be incorporated in future version machine, such as auto idle (AI) model, auxiliary port (AUX) model and anti - theft system model.

Table 1. Failure diagnosis

Display		Buzzer	Lamp	Reset method	Function stop point	EEPROM address	Method of diagnosis
Operating mode	service mode						
1 Fuel	-	5-minute intervals	Yellow	Replenish fuel	---	---	Fuel scarcity rate is 90% min. after 60-s sampling
2 Engine oil	2 Engine oil	Continuously	Red	Returns to normal	---	66, 86	At 5 V (normal). The following conditions continue 10 s: oil = L and 800 rpm min.
3 Charge	3 Charge	Momentarily	Red	Returns to normal	---	65, 85	At 5 V (normal). The following conditions continue 10 s: charge = L and 800 rpm min.
4 High voltage	4 High voltage	Continuously	Red	Turn key OFF	AI AUX	67, 87	At 5 V (normal). A power supply voltage of 18 V min. continues 3 s.
5 Overheat	5 Overheat	Continuously	Red	112°C±α max.	AI AUX	77, 97	At 5 V (normal). The following conditions continue: Engine revolution of 800 rpm min. with overheat warning When the water temperature sensor is normal, a water temperature of (124 ± α) C min. continues 5 s. (α : Adjustable between -10 C and +10 C.)
11 Accel sensor	11 Accel sensor	Momentarily	Red	Turn key OFF	AI	68, 88	At 5 V (normal). The accelerator sensor for AI specifications at 0.25 V max. or 4.75 V min. continues for 0.2 s.
12 Governor sensor	12 Governor sensor	Momentarily	Red	Turn key OFF	AI	71, 91	At 5 V (normal). The governor sensor for AI specifications at 0.25 V max. or 4.75 V min. continues for 0.2 s.
13 AI motor short	13 Almotor short	Momentarily	Red	Turn key OFF	AUX	69, 89	At 5 V (normal). AI specifications. The specifications are presently under consideration.
14 AI motor short	14 AI motor short	Momentarily	Red	Turn key OFF	AUX	70, 90	At 5 V (normal). AI specifications. The specifications are presently under consideration.

Display		Buzzer	Lamp	Reset method	Function stop point	EEPROM address	Method of diagnosis
Operating mode	service mode						
21 AUX.volum	21 AUX volum	Momentarily	Red	Cancel AUX	AUX	72, 92	At 5 V (normal). AUX specifications. AUX mode turns ON. The AUX sensor at 0.25 V max. or 4.75 min. continues for 0.2 s.
22 AUX.Solenoid L short	22 AUX. Solenoid L short	Momentarily	Red	Cancel AUX	AUX	73, 93	At 5 V (normal). AUX specifications. AUX mode turns ON. The specifications are presently under consideration.
23 AUX.Solenoid L break	23 AUX.Solenoid L break	Momentarily	Red	Cancel AUX	AUX	74, 94	At 5 V (normal). AUX specifications. AUX mode turns ON. The specifications are presently under consideration.
24 AUX.Solenoid R short	24 AUX.Solenoid R short	Momentarily	Red	Cancel AUX	AUX	75, 95	At 5 V (normal). AUX specifications. AUX mode turns ON. The specifications are presently under consideration.
25 AUX.Solenoid R short	24 AUX.Solenoid R short	Momentarily	Red	Cancel AUX	AUX	76, 96	At 5 V (normal). AUX specifications. AUX mode turns ON. The specifications are presently under consideration.
31 Lift up unload lever	-	Momentarily	Yellow	Wait for 5 s, then disappear	Engine does not start	---	The key is shifted to the start position with the lever lock moved down.
32 Service hour	-	Momentarily	Yellow	Wait for 10 s	---	---	The specified hour meter is set.
33 Key is wrong	-	Momentarily	Yellow	Wait for 3 s	Engine does not start	---	Theft prevention specifications The wrong key is used to start the engine. The specifications are presently under consideration.
34 Owner tag	-	Momentarily	Yellow	Wait for 3 s	Engine does not start	---	Theft prevention specifications The owner tag is used to start the engine. The specifications are presently under consideration.
-	51 Coolant sensor	Momentarily	Red	Turn key OFF	---	82, 102	At 5 V (normal). A water temperature of -30 C max. or 140 C min. continues for 1 s.
-	52 Fuel sensor	Momentarily	Red	Turn key OFF	---	81, 101	At 5 V (normal). The fuel sensor at 2 V min. continues for 10 s.
53 Sensor supply short 5V	53 Sensor supply short 5V	Momentarily	Red	Turn key OFF	LCD turns OFF AI AUX 5-V output turns OFF	79, 99	5-V short-circuiting detection terminal at H level continues for 0.1 s.
54 Sensor supply short 12V	54 Sensor supply short 12V	Momentarily	Red	Turn key OFF	AI AUX always 0 rpm	80, 100	At 5 V (normal). The 12-V short-circuiting detection terminal at H level continues for 0.1 s.
55 Meter controller error	-	Momentarily	Red	Turn key OFF	AI AUX	78, 98	The rightmost 16 bits of the added value of addresses 36 through 50 do not coincide with the value of address 64.
-	61 AI motor retricrd	Momentarily	Red	Press accelerator	---	83, 103	At 5 V (normal). AI specifications A motor current of 6 A min. continues for 3 s.

2. Fail record in EEPROM

If the sensor or actuator line has an error, the output of the actuator will stop and the LCD will display the contents of the error while the error point is written to the EEPROM. Fig. 2 and fig. 3 show the address allocation of the EEPROM.

2-1 Error Storage Method

If an error result, data in a corresponding EEPROM address will be overwritten. The data in the corresponding address has a capacity of 2×16 bits. The first address (1×16 bits) has an hour meter record for the latest error. The other address (1×16 bits) has an hour meter record of the first error along with the total number of errors in the past. The data will be written to the EEPROM after rounding off all hour meter values for less than one hour (see fig.1).

Hour meter data and the number of errors (1) will be written to both addresses if an error occurs for the first time. The last hour meter data will be converted into present hour meter data for errors on and after the second time. The count will remain 15 regardless of whether the actual number of errors exceeds 15, and only data on the last hour meter data will be overwritten.

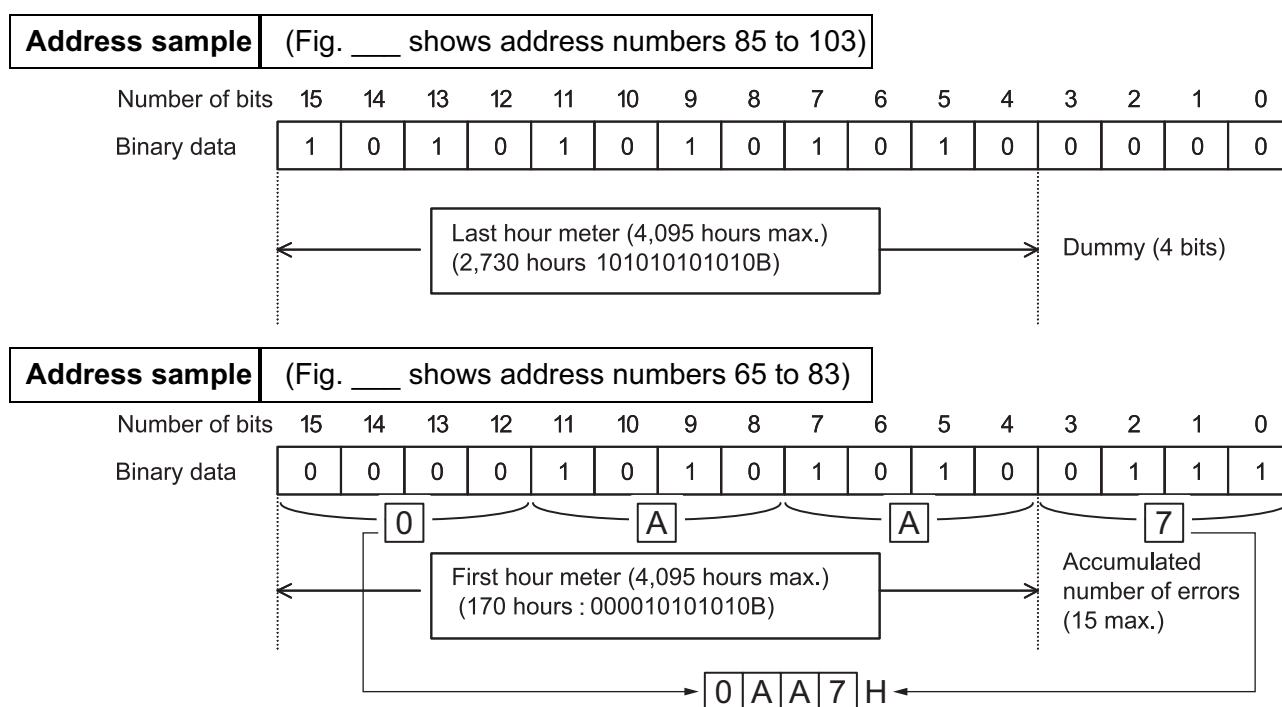
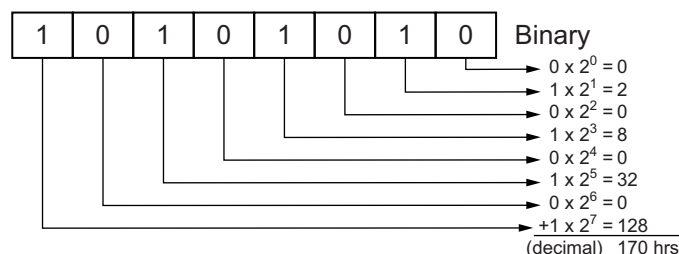


Fig. 1 Error Data Storage Method

2-2 Number of Errors

Data is stored in four bits. Therefore, the maximum number of errors is limited to 15. The count increases by one if an error occurs after the key is turned ON. Once the key is turned ON, however, the count increases only by one until the key is turned OFF.

(Example) Binary to decimal



2-3 Erasing Method of Error Log

The error log will be deleted by selecting Error Log Delete in Diagnosis Mode. In the software, only the 0th to third bits (the accumulated number of errors) in EEPROM addresses 85 through 103 will be zero cleared, but hour meter data will not be zero cleared. Error Log Delete in Diagnosis Mode judges that there is no error log if the number of errors is zero.

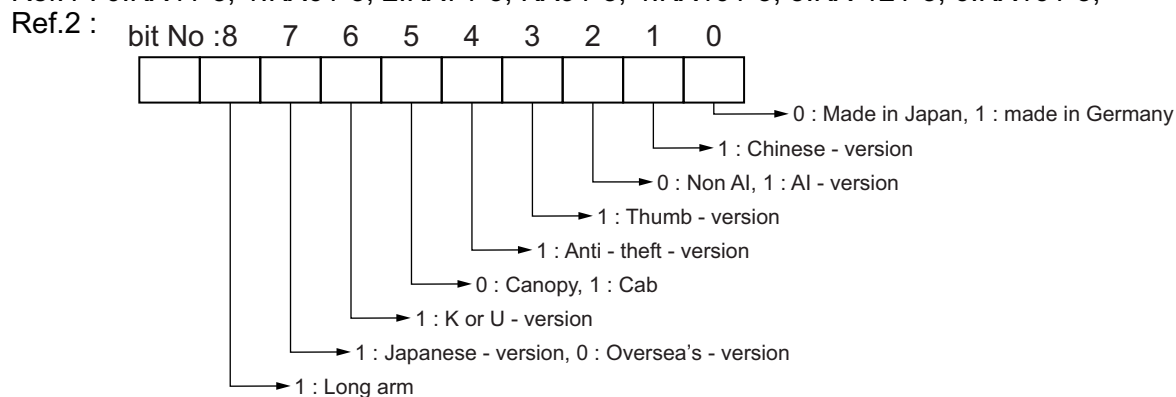
Hour meter data will not be deleted after executing Error Log Delete in Diagnosis Mode. Therefore, by dumping the EEPROM, hour meter data for errors will be known. This will make troubleshooting possible if the LCD meter is returned to the factory due to a failure after shipping.

The contents of addresses 65 through 103 are zero cleared with the PC before shipping.

Address No.	Contents & purpose to use
0 } 35	Hour meter
36	Machine model (Ref.1)
37	Optional item (Ref.2)
38 } 44	AI control data
45 } 50	Thumb control data
51 52	Overheat control data
53	Language (Ref.3)
54 } 63	Machine hours & times
64 } 104	Machine failure warning
105 } 127	Original manufacturer use Address No. 118 : Machine serial No.

Fig.2.Address and contents of EEPROM

Ref.1 : 0:KX41-3, 1:KX61-3, 2:KX71-3, KX91-3, 4:KX101-3, 5:KX-121-3, 6:KX161-3, ...



Address No.	Contents of failure	Data bit
65	3 Charge	The leftmost 12 bits display the hour meter value of the last error. The rightmost four bits display the accumulated number of errors.
66	2 Engine oil	
67	4 High voltage	
68	11 Accel sensor	
69	13 AI motor short	
70	14 AI motor break	
71	12 Governor sensor	
72	21 Aux.volume	
73	22 Aux.solenoid L short	
74	23 Aux.solenoid L break	
75	24 Aux.solenoid R short	
76	25 Aux.solenoid R break	
77	5 Overheat	
78	55 Meter controller error	
79	54 Sensor supply short 5V	
80	53 Sensor supply short 12V	
81	52 Fuel sensor	
82	51 Coolant sensor	
83	61 AI motor retracted	
84		reserve
85	3 Charge	The leftmost 12 bits display the hour meter value of the last error. The rightmost four bits are dummy bits.
86	2 Engine oil	
87	4 High voltage	
88	11 Accel sensor	
89	13 AI motor short	
90	14 AI motor break	
91	12 Governor sensor	
92	21 Aux.volume	
93	22 Aux.solenoid L short	
94	23 Aux.solenoid L break	
95	24 Aux.solenoid R short	
96	25 Aux.solenoid R break	
97	5 Overheat	
98	55 Meter controller error	
99	54 Sensor supply short 5V	
100	53 Sensor supply short 12V	
101	52 Fuel sensor	
102	51 Coolant sensor	
103	61 AI motor retracted	

Fig.3 EEPROM Addresses for Error Log

3. self-diagnosis of controller unit

3-1 Purpose

The error diagnosis of the meter is possible by using the self-diagnostic harness. The self-diagnostic function of a conventional model provided with a microcontroller can detect failures in the microcontroller only after all the failure diagnosis of the electrical devices other than the microcontroller is made. This kind of method requires time. Furthermore, there is a fear in the accuracy of the diagnosis.

By connecting the self-diagnostic harness to the meter and applying voltage from the battery, the self-diagnostic program built into the the meter will run, thus making the self-diagnosis of the incorporated hardware of the meter possible with the inputs and outputs of the meter automatically activated and checked.

Note:

It is not 100% possible to make the perfect self-diagnosis of the hardware of the meter, however, because not all hardware components built into the meter are checked.

3-2 Operation Procedure



1. Dismount the meter from the main harness of the equipment and connect the meter to the self-diagnostic harness.



2. Connect the 12-V terminal and negative terminal of the self-diagnostic harness to the battery.
3. Self-diagnosis starts automatically.



The red and yellow lamps flash alternately.



The LCD of the meter flashes black and white alternately.

The lamp as shown in the illustration on the right-hand side turns ON and OFF repeatedly.

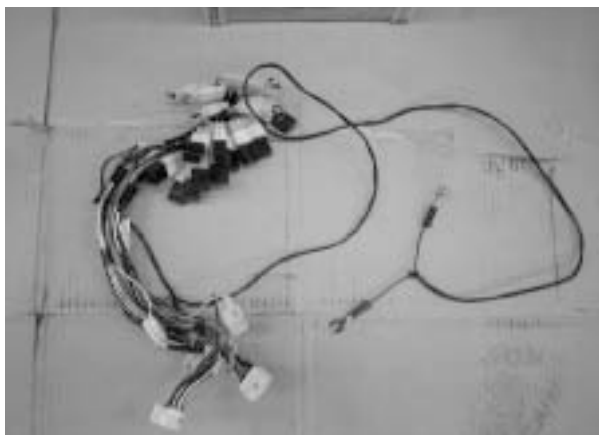
The buzzer beeps.

The backlight of the meter turns ON and OFF repeatedly.



4. If the following message appears in approximately one minute, the hardware in the meter is considered normal.

Finish key off



5. If any one out of numbers 2 through number 15 specified in table 2 is displayed, the meter has a failure.
6. If the lamp is kept turned ON while the three switches as shown in the illustration on the right-hand side are pressed, the switches and lamp are in normal condition.

3-3 Failure Display Number of Self-diagnostic Function

Table 2. Self - diagnosis of controller, items and methods

	Check item	Check parts	Check methods	Fail indication No.
2	Check sum	CPU ROM	Implement self-checksum.	1
3	Input & output	Glow relay output RS-485 (negative) (positive) flash TXD, RXD input	Turn OFF the glow relay and make sure that pin 29 (RXD2 power 7.1) is set to low level. Turn OFF the glow relay and make sure that flash RXD TXD input is set to high level.	2
	Input & output	Glow relay output RS-485 (negative) (positive) flash TXD, RXD input	Turn ON the glow relay and make sure that pin 29 (RXD2 port 7.1) is set to low level. Turn ON the glow relay and make sure that the flash RXD TXD input is set to low level.	
4	Input & output	Auto release relay output, lever lock switch input	Turn OFF the auto release relay and make sure that the lever lock switch is set to high level.	3
	Input & output	Auto release relay output, lever lock switch input	Turn ON the auto release relay and make sure that the lever lock switch is set to low level.	
5	Input & output	Working lamp relay output, start switch input	Turn OFF the working lamp relay and make sure that the start switch is set to high level.	
	Input & output	Working lamp relay output, start switch input	Turn ON the working lamp relay and make sure that the start switch is set to low level.	
6	Input & output	Compressor clutch relay output, engine rpm input	Turn OFF the compressor clutch relay and make sure that the engine rpm is set to low level.	4
	Input & output	Compressor clutch relay output, engine rpm input	Set the compressor clutch relay to high level and make sure that the engine rpm is set to high level.	
7	Input & output	AUX LED output, charge input	Turn OFF the AUX LED and make sure that the aircon switch is set to high level.	5
	Input & output	AUX LED output, charge input	Turn ON the AUX LED and make sure that the aircon switch is set to low level.	
8	Input & output	AI LED output, oil input	Turn OFF the AI LED and make sure that the oil is set to low level.	6
	Input & output	AI LED output, oil input	Turn ON the AI LED and make sure that the oil is set to low high level.	
9	Input & output	Travel sol output, aircon switch input	Turn OFF the travel sol and make sure that the charge is set to low level.	7
	Input & output	Travel sol output, aircon switch input	Turn ON the travel sol and make sure that the charge is set to high level.	

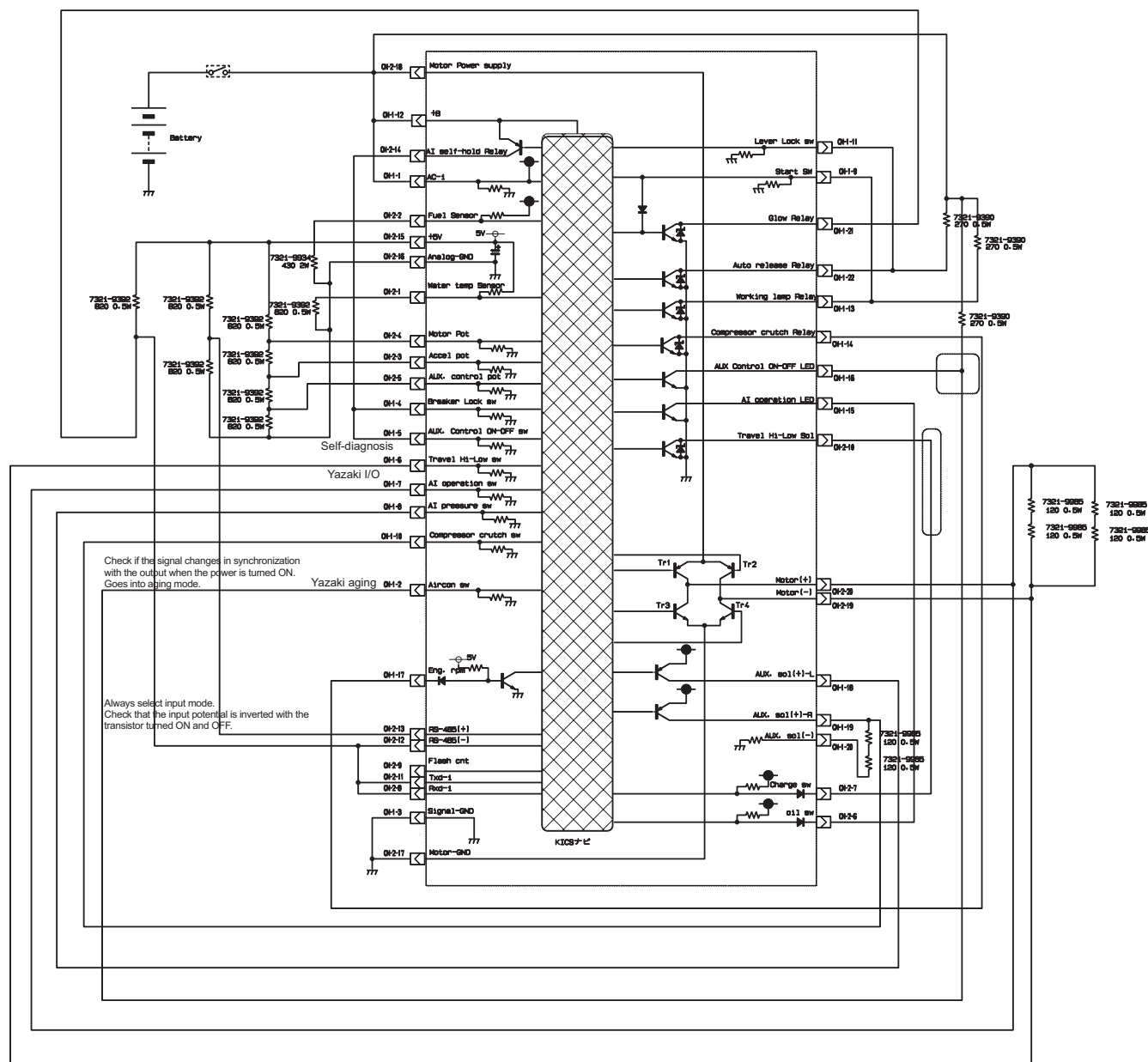
	Check item	Check parts	Check methods	Fail indication No.
10	Input & output	Motor Tr1, Tr2, Tr3, and Tr4 output AI operation switch input, travel switch input	Motor Tr1, Tr2, Tr3, and Tr4 are set to low output level. The AI operation switch is set to low level. The travel switch is set to low level.	8
	Input & output	Motor Tr1, Tr2, Tr3, and Tr4 output AI operation switch input, travel switch input	Motor Tr1 is set to high output level and Tr2, Tr3, and Tr4 are set to low output level. The AI operation switch is set to high level. The travel switch is set to high level.	
	Input & output	Motor Tr1, Tr2, Tr3, and Tr4 output AI operation switch input, travel switch input	Motor Tr1 and Tr4 are set to high output level and Tr2 and Tr3 are set to low output level. The AI operation switch is set to high level. The travel switch is set to low level.	
	Input & output	Motor Tr1, Tr2, Tr3, and Tr4 output AI operation switch input, travel switch input	Motor Tr2 is set to high output level and Tr1, Tr3, and Tr4 are set to low output level. The AI operation switch is set to high level. The travel switch is set to high level.	
	Input & output	Motor Tr1, Tr2, Tr3, and Tr4 output AI operation switch input, travel switch input	Motor Tr2 and Tr3 are set to high output level and Tr1 and Tr4 are set to low output level. The AI operation switch is set to low level. The travel switch is set to high level.	
11	Input & output	AUX sol (positive) (R) output, compressor clutch switch input	Turn OFF the AUX sol (positive) (R) and make sure that the compressor clutch switch is set to low level.	9
	Input & output	AUX sol (positive) (R) output, compressor clutch switch input AN2_7 input	Turn ON the AUX sol (positive) (R) and make sure that the compressor clutch switch is set to high level. The AN2_7 AD value varies more by 25 mV or more from the value with the input turned OFF. From theoretical values, 12 V and 240 Ω : 50 mA Voltage fluctuation corresponding to 50 mA: 50 mV	
12	Input & output	AUX sol (negative) (L) output, AI pressure switch input	Turn OFF the AUX sol (negative) (L) and make sure that the AI pressure switch is set to low level.	10
	Input & output	AUX sol (negative) (L) output, AI pressure switch input	Turn ON the AUX sol (negative) (L) and make sure that the AI pressure switch is set to high level.	
13	Input & output	AI self-hold relay output, breaker switch and AUX switch input	Turn OFF the AI self-hold relay and make sure that the breaker switch and AUX switch are set to low level.	11
	Input & output	AI self-hold relay output, breaker switch and AUX switch input	Turn ON the AI self-hold relay and make sure that the breaker switch and AUX switch are set to high level.	
14	AD (Analog and digital conversion)	fuel sensor	Check with the microcomputer that the AD value is 1.8 V $\pm$ 0.15.	12
15	AD (Analog and digital conversion)	water temp sensor	Check with the microcomputer that the AD value is 2.5 V $\pm$ 0.15.	
16	AD (Analog and digital conversion)	motor potention sensor	Check with the microcomputer that the AD value is 3.75 V $\pm$ 0.15.	
17	AD (Analog and digital conversion)	accel potention sensor	Check with the microcomputer that the AD value is 2.5 V $\pm$ 0.15.	
18	AD (Analog and digital conversion)	AUX potention sensor	Check with the microcomputer that the AD value is 1.25 V $\pm$ 0.15.	

FYI (For your information)**Check Sum Error**

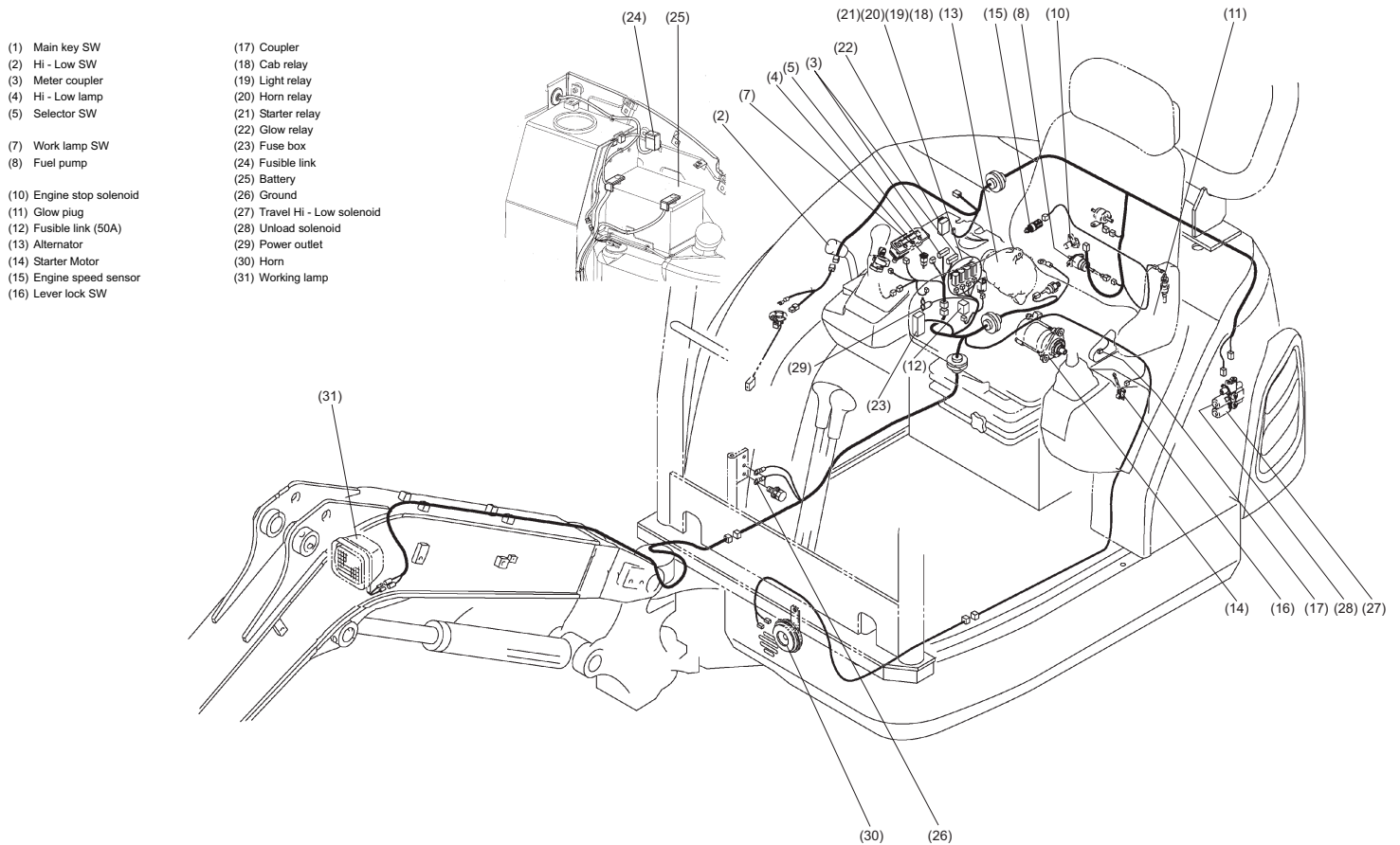
1. A check sum error is checked to see if the contents of the program for microcomputer control are corrupted.
2. The control program is saved in the ROM of the CPU. Once data is written to the ROM and shipped to the market, the data cannot be written in the market.
3. The total sum of the data in each address of the control program is obtained in advance and stored as check sum data prepared while in normal operation.
4. When the key is ON, the microcomputer calculates the total sum of the data in each address of the control program in self-control of the microcomputer. The microcomputer checks if the results coincide with the check sum data prepared while in normal operation (i.e., at the time of writing the program). The microcomputer will go to the next step after the microcomputer checks if the results are found normal.
5. If the data does not coincide, the microcontroller judges that the program is illegal. In that case, a check sum data error will result and an error alarm will be output. Error No. = 55
6. The program data can be reversed if the LSI in the controller partly fails to operate due to external environmental factors, such as abnormal temperatures or excessive shock. That is the reason the microcomputer makes this check when the key is turned ON, thus preventing the microcomputer resulting in out-of-control conditions due to program failures.

3-4 Functions of Self-diagnostic Harness

The harness short-circuits the input and output terminals of the meter in advance, switches the respective inputs of the meter ON and OFF in sequence, and checks if the data on the output side is normal.

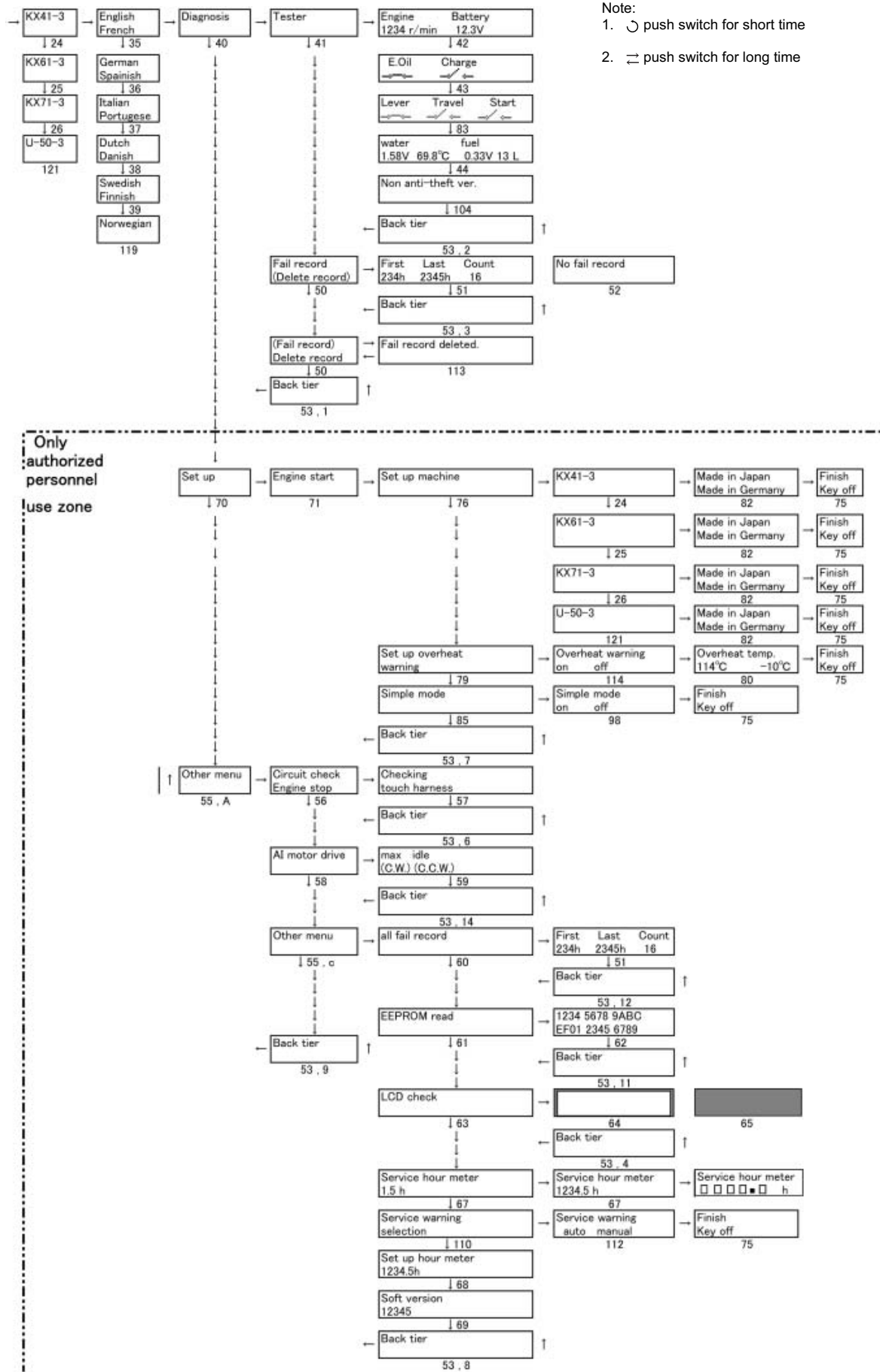


4. Electrical component layout



M-V-45

M-V-46

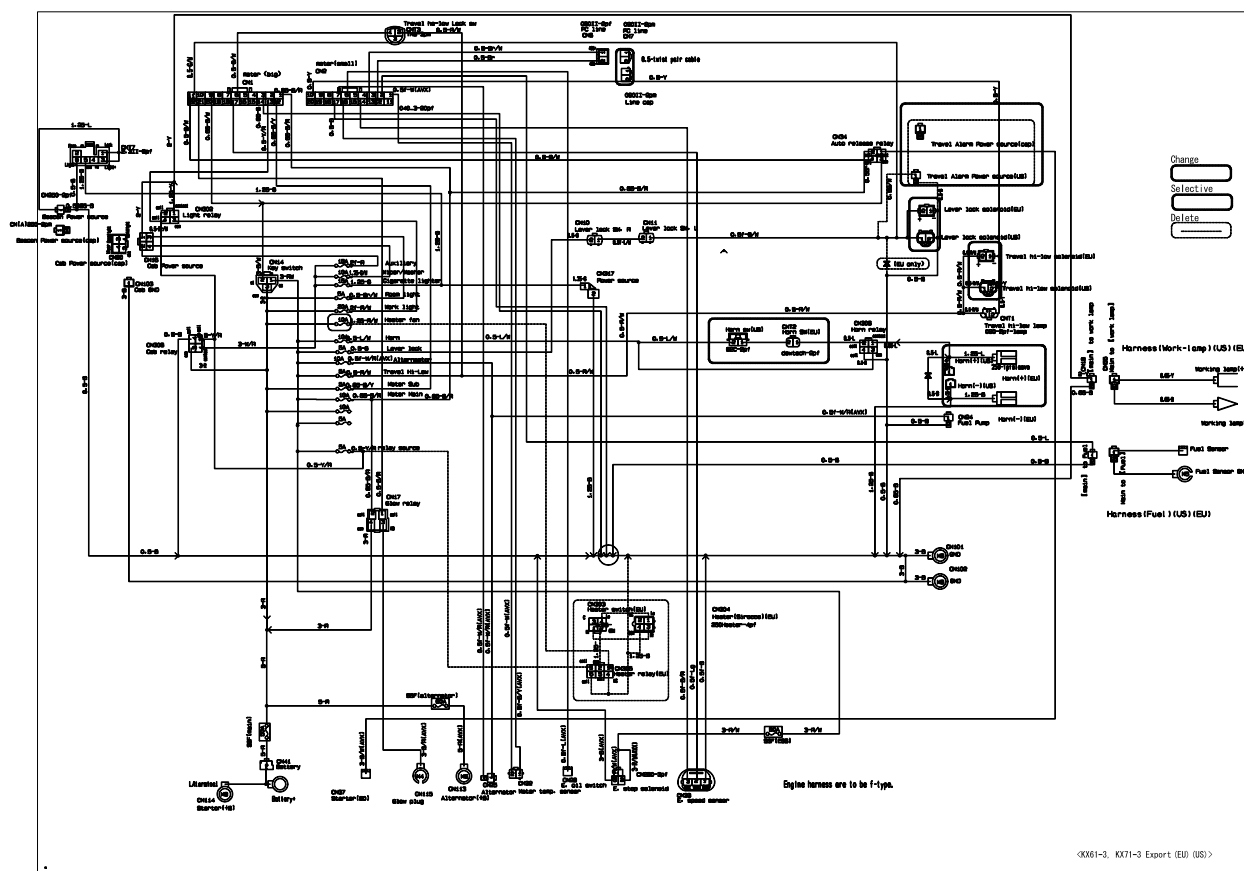


KX61-3, KX71-3 WSM-M

Electrical System

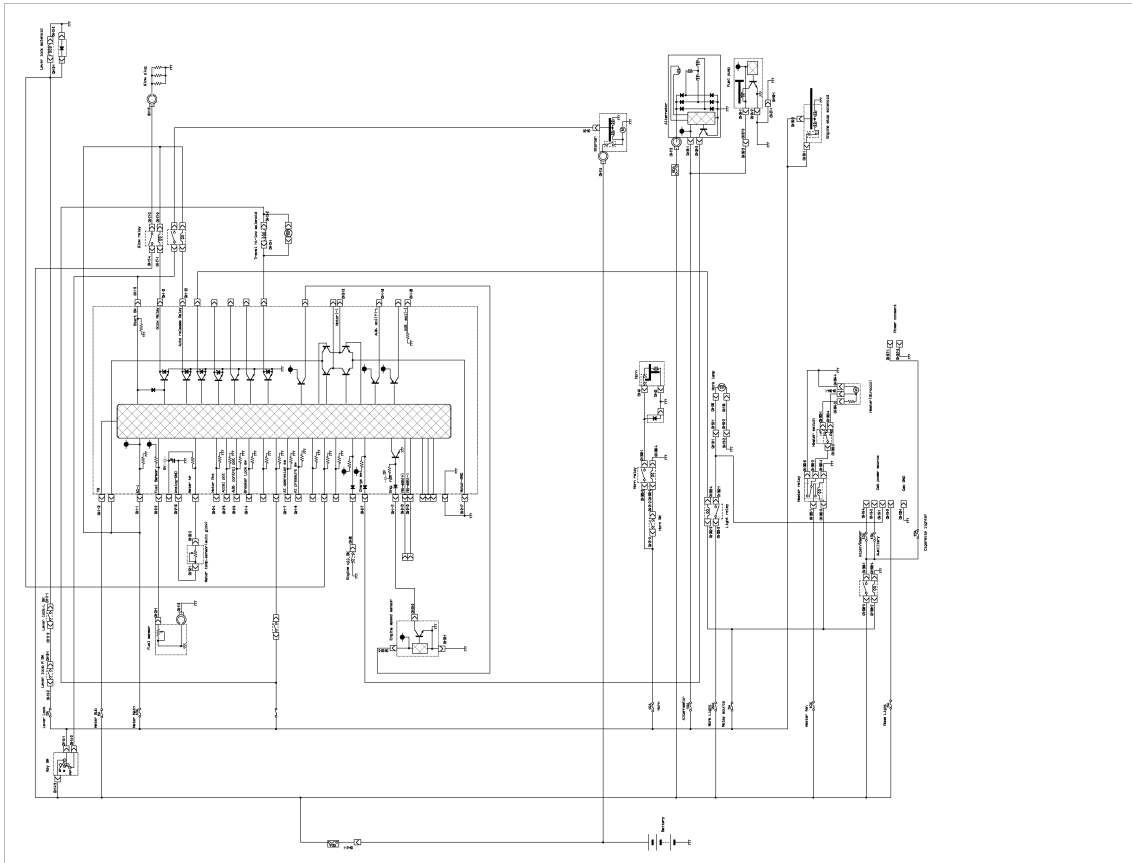
f. Circuit wiring diagram

1. KX61-3, KX71-3 Export (EU) (US)



M-V-47

2. KX61-3, KX71-3 Export standard type



M-V-48

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