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### 1. STRUCTURE

This service manual has been prepared as an aid to improve the quality of repairs by giving the serviceman an accurate understanding of the product and by showing him the correct way to perform repairs and make judgements. Make sure you understand the contents of this manual and use it to full effect at every opportunity.

This service manual mainly contains the necessary technical information for operations performed in a service workshop.

For ease of understanding, the manual is divided into the following sections.

#### SECTION 1 GENERAL

This section explains the safety hints and gives the specification of the machine and major components.

#### SECTION 2 STRUCTURE AND FUNCTION

This section explains the structure and function of each component. It serves not only to give an understanding of the structure, but also serves as reference material for troubleshooting.

#### SECTION 3 HYDRAULIC SYSTEM

This section explains the hydraulic circuit, single and combined operation.

### **SECTION 4 ELECTRICAL SYSTEM**

This section explains the electrical circuit, monitoring system and each component. It serves not only to give an understanding electrical system, but also serves as reference material for trouble shooting.

#### SECTION 5 MECHATRONICS SYSTEM

This section explains the computer aided power optimization system and each component.

#### SECTION 6 TROUBLESHOOTING

This section explains the troubleshooting charts correlating **problems** to **causes**.

#### SECTION 7 MAINTENANCE STANDARD

This section gives the judgement standards when inspecting disassembled parts.

#### SECTION 8 DISASSEMBLY AND ASSEMBLY

This section explains the order to be followed when removing, installing, disassembling or assembling each component, as well as precautions to be taken for these operations.

The specifications contained in this shop manual are subject to change at any time and without any advance notice. Contact your HD Hyundai Construction Equipment distributor for the latest information.

### 2. HOW TO READ THE SERVICE MANUAL

### Distribution and updating

Any additions, amendments or other changes will be sent to HD Hyundai Construction Equipment distributors.

Get the most up-to-date information before you start any work.

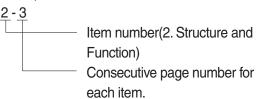
### Filing method

1. See the page number on the bottom of the page.

File the pages in correct order.

2. Following examples shows how to read the page number.

### Example 1



3. Additional pages: Additional pages are indicated by a hyphen(-) and number after the page number. File as in the example.

### Revised edition mark(123...)

When a manual is revised, an edition mark is recorded on the bottom outside corner of the pages.

#### Revisions

Revised pages are shown at the list of revised pages on the between the contents page and section 1 page.

### **Symbols**

So that the shop manual can be of ample practical use, important places for safety and quality are marked with the following symbols.

Symbol	Item	Remarks
A	Cofoty	Special safety precautions are necessary when performing the work.
	Safety	Extra special safety precautions are necessary when performing the work because it is under internal pressure.
*	Caution	Special technical precautions or other precautions for preserving standards are necessary when performing the work.

#### 3. CONVERSION TABLE

Method of using the Conversion Table

The Conversion Table in this section is provided to enable simple conversion of figures. For details of the method of using the Conversion Table, see the example given below.

#### Example

# 1. Method of using the Conversion Table to convert from millimeters to inches Convert 55mm into inches.

- (1) Locate the number 50in the vertical column at the left side, take this as ⓐ, then draw a horizontal line from ⓐ.
- (2) Locate the number 5in the row across the top, take this as ⓑ, then draw a perpendicular line down from ⓑ.
- (3) Take the point where the two lines cross as ©. This point © gives the value when converting from millimeters to inches. Therefore, 55mm = 2.165 inches.

#### 2. Convert 550mm into inches.

- (1) The number 550 does not appear in the table, so divide by 10(Move the decimal point one place to the left) to convert it to 55mm.
- (2) Carry out the same procedure as above to convert 55mm to 2.165 inches.
- (3) The original value(550mm) was divided by 10, so multiply 2.165 inches by 10(Move the decimal point one place to the right) to return to the original value.

  This gives 550mm = 21.65 inches.

	Millimete	rs to inch	es				(b)		1mm = 0.03937 in		
		0	1	2	3	4	5	6	7	8	9
	0		0.039	0.079	0.118	0.157	0.197	0.236	0.276	0.315	0.354
	10	0.394	0.433	0.472	0.512	0.551	0.591	0.630	0.669	0.709	0.748
	20	0.787	0.827	0.866	0.906	0.945	0.984	1.024	1.063	1.102	1.142
	30	1.181	1.220	1.260	1.299	1.339	1.378	1.417	1.457	1.496	1.536
	40	1.575	1.614	1.654	1.693	1.732	1.772	1.811	1.850	1.890	1.929
							c				
(a)	50	1.969	2.008	2.047	2.087	2.126	2.165	2.205	2.244	2.283	2.323
	60	2.362	2.402	2.441	2.480	2.520	2.559	2.598	2.638	2.677	2.717
	70	2.756	2.795	2.835	2.874	2.913	2.953	2.992	3.032	3.071	3.110
	80	3.150	3.189	3.228	3.268	3.307	3.346	3.386	3.425	3.465	3.504
	90	3.543	3.583	3.622	3.661	3.701	3.740	3.780	3.819	3.858	3.898

Millimeters to inches 1mm = 0.03937in

	111111 = 0.00007111									
	0	1	2	3	4	5	6	7	8	9
0		0.039	0.079	0.118	0.157	0.197	0.236	0.276	0.315	0.354
10	0.394	0.433	0.472	0.512	0.551	0.591	0.630	0.669	0.709	0.748
20	0.787	0.827	0.866	0.906	0.945	0.984	1.024	1.063	1.102	1.142
30	1.181	1.220	1.260	1.299	1.339	1.378	1.417	1.457	1.496	1.536
40	1.575	1.614	1.654	1.693	1.732	1.772	1.811	1.850	1.890	1.929
50	1.969	2.008	2.047	2.087	2.126	2.165	2.205	2.244	2.283	2.323
60	2.362	2.402	2.441	2.480	2.520	2.559	2.598	2.638	2.677	2.717
70	2.756	2.795	2.835	2.874	2.913	2.953	2.992	3.032	3.071	3.110
80	3.150	3.189	3.228	3.268	3.307	3.346	3.386	3.425	3.465	3.504
90	3.543	3.583	3.622	3.661	3.701	3.740	3.780	3.819	3.858	3.898

Kilogram to Pound 1kg = 2.2046lb

	0	1	2	3	4	5	6	7	8	9
0		2.20	4.41	6.61	8.82	11.02	13.23	15.43	17.64	19.84
10	22.05	24.25	26.46	28.66	30.86	33.07	35.27	37.48	39.68	41.89
20	44.09	46.30	48.50	50.71	51.91	55.12	57.32	59.5.	61.73	63.93
30	66.14	68.34	70.55	72.75	74.96	77.16	79.37	81.57	83.78	85.98
40	88.18	90.39	92.59	94.80	97.00	99.21	101.41	103.62	105.82	108.03
50	110.23	112.44	114.64	116.85	119.05	121.25	123.46	125.66	127.87	130.07
60	132.28	134.48	136.69	138.89	141.10	143.30	145.51	147.71	149.91	152.12
70	154.32	156.53	158.73	160.94	163.14	165.35	167.55	169.76	171.96	174.17
80	176.37	178.57	180.78	182.98	185.19	187.39	189.60	191.80	194.01	196.21
90	198.42	200.62	202.83	205.03	207.24	209.44	211.64	213.85	216.05	218.26

Liter to U.S. Gallon 1  $\ell$  = 0.2642 U.S.Gal

	0	1	2	3	4	5	6	7	8	9
0		0.264	0.528	0.793	1.057	1.321	1.585	1.849	2.113	2.378
10	2.642	2.906	3.170	3.434	3.698	3.963	4.227	4.491	4.755	5.019
20	5.283	5.548	5.812	6.6076	6.340	6.604	6.869	7.133	7.397	7.661
30	7.925	8.189	8.454	8.718	8.982	9.246	9.510	9.774	10.039	10.303
40	10.567	10.831	11.095	11.359	11.624	11.888	12.152	12.416	12.680	12.944
50	13.209	13.473	13.737	14.001	14.265	14.529	14.795	15.058	15.322	15.586
60	15.850	16.115	16.379	16.643	16.907	17.171	17.435	17.700	17.964	18.228
70	18.492	18.756	19.020	19.285	19.549	19.813	20.077	20.341	20.605	20.870
80	21.134	21.398	21.662	21.926	22.190	22.455	22.719	22.983	23.247	23.511
90	23.775	24.040	24.304	24.568	24.832	25.096	25.631	25.625	25.889	26.153

Liter to U.K. Gallon 1  $\ell$  = 0.21997 U.K.Gal

	0	1	2	3	4	5	6	7	8	9	
0		0.220	0.440	0.660	0.880	1.100	1.320	1.540	1.760	1.980	ĺ
10	2.200	2.420	2.640	2.860	3.080	3.300	3.520	3.740	3.950	4.179	Ì
20	4.399	4.619	4.839	5.059	5.279	5.499	5.719	5.939	6.159	6.379	Ì
30	6.599	6.819	7.039	7.259	7.479	7.969	7.919	8.139	8.359	8.579	ı
40	8.799	9.019	9.239	9.459	9.679	9.899	10.119	10.339	10.559	10.778	Ì
											ı
50	10.998	11.281	11.438	11.658	11.878	12.098	12.318	12.528	12.758	12.978	ı
60	13.198	13.418	13.638	13.858	14.078	14.298	14.518	14.738	14.958	15.178	ı
70	15.398	15.618	15.838	16.058	16.278	16.498	16.718	16.938	17.158	17.378	ı
80	17.598	17.818	18.037	18.257	18.477	18.697	18.917	19.137	19.357	19.577	ı
90	19.797	20.017	20.237	20.457	20.677	20.897	21.117	21.337	21.557	21.777	ı

 $\textbf{kgf} \cdot \textbf{m to lbf} \cdot \textbf{ft}$   $1 \text{kgf} \cdot \textbf{m} = 7.233 \text{lbf} \cdot \textbf{ft}$ 

	0	1	2	3	4	5	6	7	8	9
		7.2	14.5	21.7	28.9	36.2	43.4	50.6	57.9	65.1
10	72.3	79.6	86.8	94.0	101.3	108.5	115.7	123.0	130.2	137.4
20	144.7	151.9	159.1	166.4	173.6	180.8	188.1	195.3	202.5	209.8
30	217.0	224.2	231.5	238.7	245.9	253.2	260.4	267.6	274.9	282.1
40	289.3	396.6	303.8	311.0	318.3	325.5	332.7	340.0	347.2	354.4
50	361.7	368.9	376.1	383.4	390.6	397.8	405.1	412.3	419.5	426.8
60	434.0	441.2	448.5	455.7	462.9	470.2	477.4	484.6	491.8	499.1
70	506.3	513.5	520.8	528.0	535.2	542.5	549.7	556.9	564.2	571.4
80	578.6	585.9	593.1	600.3	607.6	614.8	622.0	629.3	636.5	643.7
90	651.0	658.2	665.4	672.7	679.9	687.1	694.4	701.6	708.8	716.1
100	723.3	730.5	737.8	745.0	752.2	759.5	766.7	773.9	781.2	788.4
110	795.6	802.9	810.1	817.3	824.6	831.8	839.0	846.3	853.5	860.7
120	868.0	875.2	882.4	889.7	896.9	904.1	911.4	918.6	925.8	933.1
130	940.3	947.5	954.8	962.0	969.2	976.5	983.7	990.9	998.2	10005.4
140	1012.6	1019.9	1027.1	1034.3	1041.5	1048.8	1056.0	1063.2	1070.5	1077.7
150	1084.9	1092.2	1099.4	1106.6	1113.9	1121.1	1128.3	1135.6	1142.8	1150.0
160	1157.3	1164.5	1171.7	1179.0	1186.2	1193.4	1200.7	1207.9	1215.1	1222.4
170	1129.6	1236.8	1244.1	1251.3	1258.5	1265.8	1273.0	1280.1	1287.5	1294.7
180	1301.9	1309.2	1316.4	1323.6	1330.9	1338.1	1345.3	1352.6	1359.8	1367.0
190	1374.3	1381.5	1388.7	1396.0	1403.2	1410.4	1417.7	1424.9	1432.1	1439.4

**kgf/cm²** to **lbf/in²** 1 kgf / cm² = 14.2233 lbf / in²

•								ingi	/ OIII — 1-1.	ZZ33101 / 1112
	0	1	2	3	4	5	6	7	8	9
		14.2	28.4	42.7	56.9	71.1	85.3	99.6	113.8	128.0
10	142.2	156.5	170.7	184.9	199.1	213.4	227.6	241.8	256.0	270.2
20	284.5	298.7	312.9	327.1	341.4	355.6	369.8	384.0	398.3	412.5
30	426.7	440.9	455.1	469.4	483.6	497.8	512.0	526.3	540.5	554.7
40	568.9	583.2	597.4	611.6	625.8	640.1	654.3	668.5	682.7	696.9
50	711.2	725.4	739.6	753.8	768.1	782.3	796.5	810.7	825.0	839.2
60	853.4	867.6	881.8	896.1	910.3	924.5	938.7	953.0	967.2	981.4
70	995.6	1010	1024	1038	1053	1067	1081	1095	1109	1124
80	1138	1152	1166	1181	1195	1209	1223	1237	1252	1266
90	1280	1294	1309	1323	1337	1351	1365	1380	1394	1408
100	1422	1437	1451	1465	1479	1493	1508	1522	1536	1550
110	1565	1579	1593	1607	1621	1636	1650	1664	1678	1693
120	1707	1721	1735	1749	1764	1778	1792	1806	1821	1835
130	1849	2863	1877	1892	1906	1920	1934	1949	1963	1977
140	1991	2005	2020	2034	2048	2062	2077	2091	2105	2119
150	2134	2148	2162	2176	2190	2205	2219	2233	2247	2262
160	2276	2290	2304	2318	2333	2347	2361	2375	2389	2404
170	2418	2432	2446	2460	2475	2489	2503	2518	2532	2546
180	2560	2574	2589	5603	2617	2631	2646	2660	2674	2688
200	2845	2859	2873	2887	2901	2916	2930	2944	2958	2973
210	2987	3001	3015	3030	3044	3058	3072	3086	3101	3115
220	3129	3143	3158	3172	3186	3200	3214	3229	3243	3257
230	3271	3286	3300	3314	3328	3343	3357	3371	3385	3399
240	3414	3428	3442	3456	3470	3485	3499	3513	3527	3542

### **TEMPERATURE**

Fahrenheit-Centigrade Conversion.

A simple way to convert a fahrenheit temperature reading into a centigrade temperature reading or vice verse is to enter the accompanying table in the center or boldface column of figures.

These figures refer to the temperature in either Fahrenheit or Centigrade degrees.

If it is desired to convert from Fahrenheit to Centigrade degrees, consider the center column as a table of Fahrenheit temperatures and read the corresponding Centigrade temperature in the column at the left.

If it is desired to convert from Centigrade to Fahrenheit degrees, consider the center column as a table of Centigrade values, and read the corresponding Fahrenheit temperature on the right.

°C		°F	°C		°F	°C		°F	°C		°F
-40.4	-40	-40.0	-11.7	11	51.8	7.8	46	114.8	27.2	81	117.8
-37.2	-35	-31.0	-11.1	12	53.6	8.3	47	116.6	27.8	82	179.6
-34.4	-30	-22.0	-10.6	13	55.4	8.9	48	118.4	28.3	83	181.4
-31.7	-25	-13.0	-10.0	14	57.2	9.4	49	120.2	28.9	84	183.2
-28.9	-20	-4.0	-9.4	15	59.0	10.0	50	122.0	29.4	85	185.0
-28.3	-19	-2.2	-8.9	16	60.8	10.6	51	123.8	30.0	86	186.8
-27.8	-18	-0.4	-8.3	17	62.6	11.1	52	125.6	30.6	87	188.6
-27.2	-17	1.4	-7.8	18	64.4	11.7	53	127.4	31.1	88	190.4
-26.7	-16	3.2	-6.7	20	68.0	12.8	55	131.0	32.2	90	194.0
-26.1	-15	5.0	-6.7	20	68.0	12.8	55	131.0	32.2	90	194.0
-25.6	-14	6.8	-6.1	21	69.8	13.3	56	132.8	32.8	91	195.8
-25.0	-13	8.6	-5.6	22	71.6	13.9	57	134.6	33.3	92	197.6
-24.4	-12	10.4	-5.0	23	73.4	14.4	58	136.4	33.9	93	199.4
-23.9	-11	12.2	-4.4	24	75.2	15.0	59	138.2	34.4	94	201.2
-23.3	-10	14.0	-3.9	25	77.0	15.6	60	140.0	35.0	95	203.0
-22.8	-9	15.8	-3.3	26	78.8	16.1	61	141.8	35.6	96	204.8
-22.2	-8	17.6	-2.8	27	80.6	16.7	62	143.6	36.1	97	206.6
-21.7	-7	19.4	-2.2	28	82.4	17.2	63	145.4	36.7	98	208.4
-21.1	-6	21.2	-1.7	29	84.2	17.8	64	147.2	37.2	99	210.2
-20.6	-5	23.0	-1.1	35	95.0	21.1	70	158.0	51.7	125	257.0
-20.0	-4	24.8	-0.6	31	87.8	18.9	66	150.8	40.6	105	221.0
-19.4	-3	26.6	0	32	89.6	19.4	67	152.6	43.3	110	230.0
-18.9	-2	28.4	0.6	33	91.4	20.0	68	154.4	46.1	115	239.0
-18.3	-1	30.2	1.1	34	93.2	20.6	69	156.2	48.9	120	248.0
-17.8	0	32.0	1.7	35	95.0	21.1	70	158.0	51.7	125	257.0
-17.2	1	33.8	2.2	36	96.8	21.7	71	159.8	54.4	130	266.0
-16.7	2	35.6	2.8	37	98.6	22.2	72	161.6	57.2	135	275.0
-16.1	3	37.4	3.3	38	100.4	22.8	73	163.4	60.0	140	284.0
-15.6	4	39.2	3.9	39	102.2	23.3	74	165.2	62.7	145	293.0
-15.0	5	41.0	4.4	40	104.0	23.9	75	167.0	65.6	150	302.0
-14.4	6	42.8	5.0	41	105.8	24.4	76	168.8	68.3	155	311.0
-13.9	7	44.6	5.6	42	107.6	25.0	77	170.6	71.1	160	320.0
-13.3	8	46.4	6.1	43	109.4	25.6	78	172.4	73.9	165	329.0
-12.8	9	48.2	6.7	44	111.2	26.1	79	174.2	76.7	170	338.0
-12.2	10	50.0	7.2	45	113.0	26.7	80	176.0	79.4	172	347.0

# SECTION 1 GENERAL

Group	1	Safety Hints	1-1
Group	2	Specifications	1-10

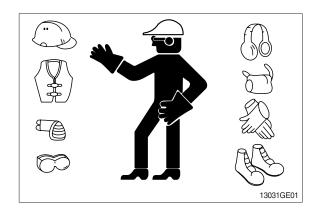
## **GROUP 1 SAFETY**

### **FOLLOW SAFE PROCEDURE**

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

#### WEAR PROTECTIVE CLOTHING

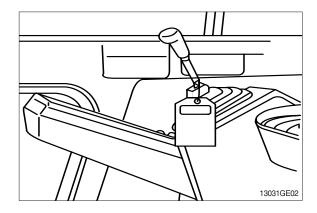
Wear close fitting clothing and safety equipment appropriate to the job.



#### WARN OTHERS OF SERVICE WORK

Unexpected machine movement can cause serious injury.

Before performing any work on the excavator, attach a 「Do Not Operate」 tag on the right side control lever.



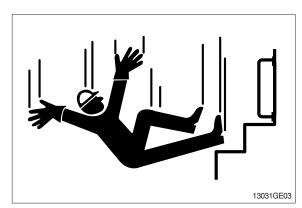
### **USE HANDHOLDS AND STEPS**

Falling is one of the major causes of personal injury.

When you get on and off the machine, always maintain a three point contact with the steps and handrails and face the machine. Do not use any controls as handholds.

Never jump on or off the machine. Never mount or dismount a moving machine.

Be careful of slippery conditions on platforms, steps, and handrails when leaving the machine.

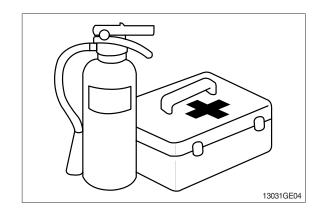


#### PREPARE FOR EMERGENCIES

Be prepared if a fire starts.

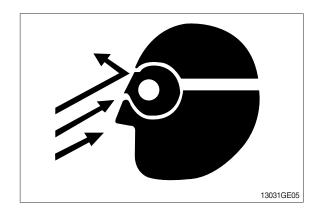
Keep a first aid kit and fire extinguisher handy.

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



#### PROTECT AGAINST FLYING DEBRIS

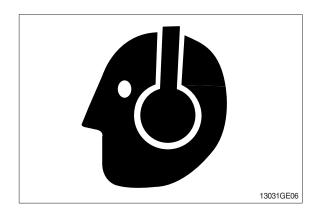
Guard against injury from flying pieces of metal or debris; Wear goggles or safety glasses.



### PROTECT AGAINST NOISE

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

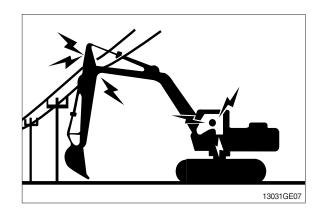
Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortable loud noises.



#### **AVOID POWER LINES**

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

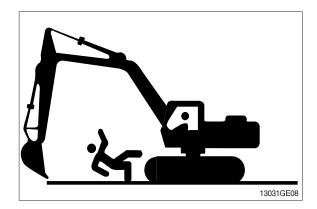
Never move any part of the machine or load closer to electric line than 3m(10ft) plus twice the line insulator length.



#### KEEP RIDERS OFF EXCAVATOR

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

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

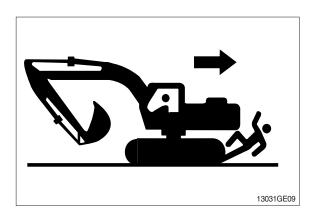


#### MOVE AND OPERATE MACHINE SAFELY

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

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

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



#### OPERATE ONLY FORM OPERATOR'S SEAT

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

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



### PARK MACHINE SAFELY

Before working on the machine:

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

#### SUPPORT MACHINE PROPERLY

Always lower the attachment or implement to the ground before you work on the machine. If you must work on a lifted machine or attachment, securely support the machine or attachment.

Do not support the machine on cinder blocks, hollow tiles, or props that may crumble under continuous load.

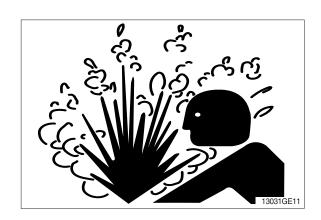
Do not work under a machine that is supported solely by a jack. Follow recommended procedures in this manual.



### SERVICE COOLING SYSTEM SAFELY

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

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



#### HANDLE FLUIDS SAFELY-AVOID FIRES

Handle fuel with care; It is highly flammable. Do not refuel the machine while smoking or when near open flame or sparks. Always stop engine before refueling machine.

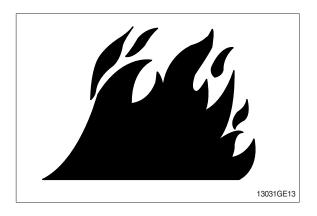
Fill fuel tank outdoors.



Store flammable fluids away from fire hazards. Do not incinerate or puncture pressurized containers.

Make sure machine is clean of trash, grease, and debris.

Do not store oily rags; They can ignite and burn spontaneously.



#### **BEWARE OF EXHAUST FUMES**

Prevent asphyxiation. Engine exhaust fumes can cause sickness or death.

If you must operate in a building, be positive there is adequate ventilation. Either use an exhaust pipe extension to remove the exhaust fumes or open doors and windows to bring enough outside air into the area.

# REMOVE PAINT BEFORE WELDING OR HEATING

Avoid potentially toxic fumes and dust.

Hazardous fumes can be generated when paint is heated by welding, soldering, or using a torch.

Do all work outside or in a well ventilated area. Dispose of paint and solvent properly.

Remove paint before welding or heating:

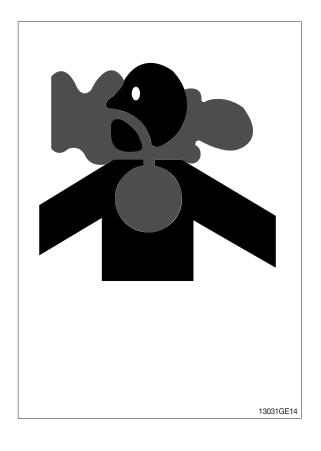
 If you sand or grind paint, avoid breathing the dust.

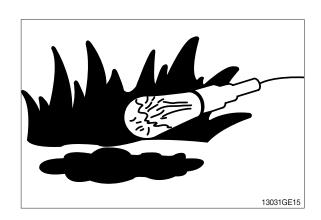
Wear an approved respirator.

· If you use solvent or paint stripper, remove stripper with soap and water before welding. Remove solvent or paint stripper containers and other flammable material from area. Allow fumes to disperse at least 15 minutes before welding or heating.

#### ILLUMINATE WORK AREA SAFELY

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

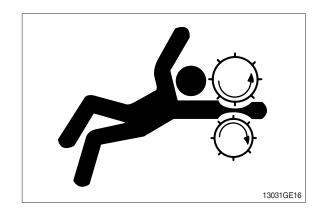




#### SERVICE MACHINE SAFELY

Tie long hair behind your head. Do not wear a necktie, scarf, loose clothing or necklace when you work near machine tools or moving parts. If these items were to get caught, severe injury could result.

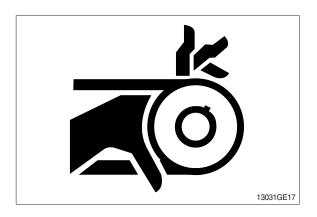
Remove rings and other jewelry to prevent electrical shorts and entanglement in moving parts.



#### STAY CLEAR OF MOVING PARTS

Entanglements in moving parts can cause serious injury.

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



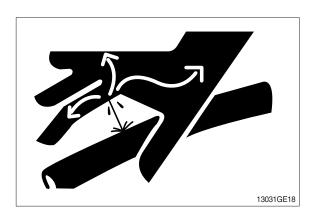
### **AVOID HIGH PRESSURE FLUIDS**

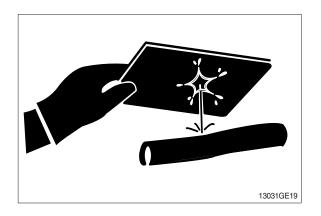
Escaping fluid under pressure can penetrate the skin causing serious injury.

Avoid the hazard by relieving pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure.

Search for leaks with a piece of cardboard. Protect hands and body from high pressure fluids.

If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result.





# AVOID HEATING NEAR PRESSURIZED FLUID LINES

Flammable spray can be generated by heating near pressurized fluid lines, resulting in severe burns to yourself and bystanders. Do not heat by welding, soldering, or using a torch near pressurized fluid lines or other flammable materials.

Pressurized lines can be accidentally cut when heat goes beyond the immediate flame area. Install fire resisting guards to protect hoses or other materials.



#### PREVENT BATTERY EXPLOSIONS

Keep sparks, lighted matches, and flame away from the top of battery. Battery gas can explode.

Never check battery charge by placing a metal object across the posts. Use a volt-meter or hydrometer.

Do not charge a frozen battery; It may explode. Warm battery to 16  $\,^{\circ}$ C (60  $\,^{\circ}$ F).



#### PREVENT ACID BURNS

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

Avoid the hazard by:

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

If you spill acid on yourself:

- 1. Flush your skin with water.
- 2. Apply baking soda or lime to help neutralize the acid.
- 3. Flush your eyes with water for 10-15 minutes. Get medical attention immediately.

If acid is swallowed:

- 1. Drink large amounts of water or milk.
- 2. Then drink milk of magnesia, beaten eggs, or vegetable oil.
- 3. Get medical attention immediately.

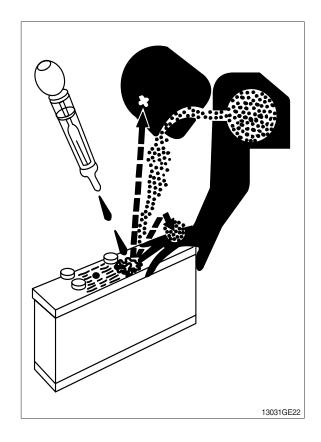
#### **USE TOOLS PROPERLY**

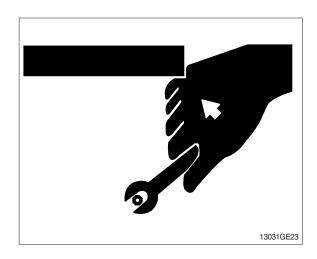
Use tools appropriate to the work. Makeshift tools, parts, and procedures can create safety hazards.

Use power tools only to loosen threaded tools and fasteners.

For loosening and tightening hardware, use the correct size tools. DO NOT use U.S. measurement tools on metric fasteners. Avoid bodily injury caused by slipping wrenches.

Use only recommended replacement parts. (See Parts catalogue.)



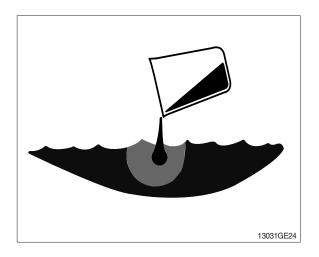


### **DISPOSE OF FLUIDS PROPERLY**

Improperly disposing of fluids can harm the environment and ecology. Before draining any fluids, find out the proper way to dispose of waste from your local environmental agency.

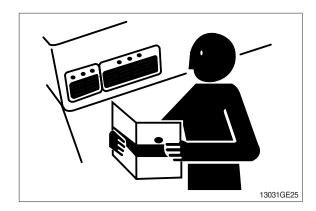
Use proper containers when draining fluids. Do not use food or beverage containers that may mislead someone into drinking from them.

DO NOT pour oil into the ground, down a drain, or into a stream, pond, or lake. Observe relevant environmental protection regulations when disposing of oil, fuel, coolant, brake fluid, filters, batteries, and other harmful waste.



### **REPLACE SAFETY SIGNS**

Replace missing or damaged safety signs. See the machine operator's manual for correct safety sign placement.

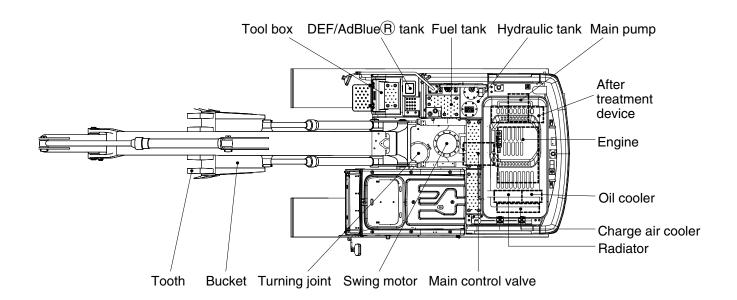


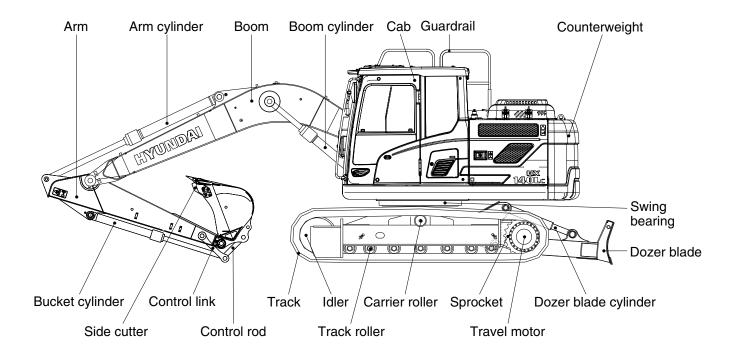
#### LIVE WITH SAFETY

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

# **GROUP 2 SPECIFICATIONS**

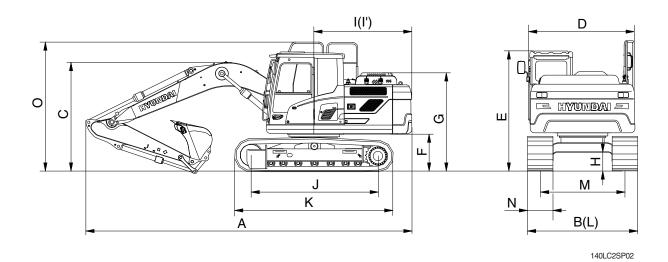
### 1. MAJOR COMPONENT





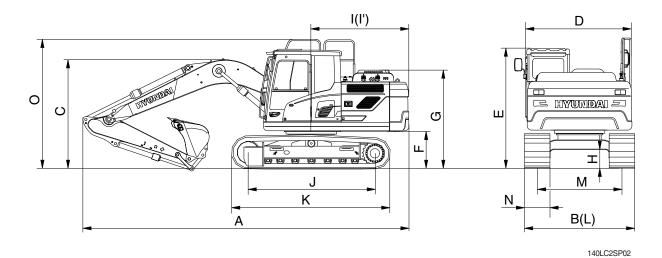
# 2. SPECIFICATIONS

# 1) HX140 LC, 4.60 m (15' 1") MONO BOOM



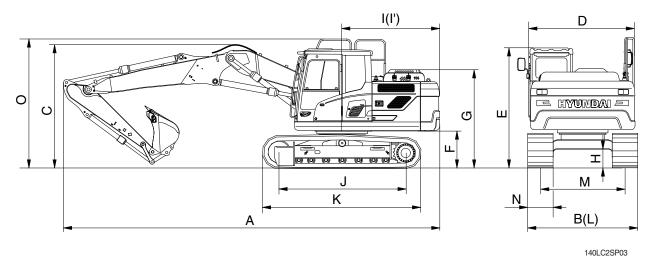
		Uı	nit	Specification					
Description			Boom		4	.6			
2 3 3 3 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5		m	Arm	1.9	2.1	2.5	3.0		
		mm	Shoe		60	00			
Operating weight		kg	(lb)	13955 (30765)	13990 (30843)	14050 (30975)	14090 (31063)		
Bucket capacity (SAE heaped), stan	dard	m³ (	yd³)	0.58 (0.76)	0.58 (0.76)	0.58 (0.76)	0.58 (0.76)		
Overall length	Α			7830 (25' 7")	7855 (25' 8")	7830 (25' 7")	7795 (25' 6")		
Overall width, with 600 mm shoe	В			2600 (8' 6")	2600 (8' 6")	2600 (8' 6")	2600 (8' 6")		
Overall height of boom	С			2580 (8' 5")	2710 (8' 9")	2680 (8' 8")	3010 (9' 9")		
Superstructure width	D			2475 (8' 1")	2475 (8' 1")	2475 (8' 1")	2475 (8' 1")		
Overall height of cab	Е			2860 (8' 7")	2860 (8' 7")	2860 (8' 7")	2860 (8' 7")		
Ground clearance of counterweight	F			940 (3' 1")	940 (3' 1")	940 (3' 1")	940 (3' 1")		
Engine cover height	G			2390 (7' 10")	2390 (7' 10")	2390 (7' 10")	2390 (7' 10")		
Minimum ground clearance	Н	mana i	(# in)	440 (1' 5")	440 (1' 5")	440 (1' 5")	440 (1' 5")		
Rear-end distance	I	111111	(ft-in)	2330 (7' 8")	2330 (7' 8")	2330 (7' 8")	2330 (7' 8")		
Rear-end swing radius	ľ			2330 (7' 8")	2330 (7' 8")	2330 (7' 8")	2330 (7' 8")		
Distance between tumblers	J			3000 (9' 10")	3000 (9' 10")	3000 (9' 10")	3000 (9' 10")		
Undercarriage length	K			3708 (12' 1")	3708 (12' 1")	3708 (12' 1")	3706 (12' 1")		
Undercarriage width	L			2600 (8' 6")	2600 (8' 6")	2600 (8' 6")	2600 (8' 6")		
Track gauge	М			2000 (6' 7")	2000 (6' 7")	2000 (6' 7")	2000 (6' 7")		
Track shoe width, standard	N			600 (24")	600 (24")	600 (24")	600 (24")		
Overall height of guardrail	0			3100 (10' 2")	3100 (10' 2")	3100 (10' 2")	3100 (10' 2")		
Travel speed (low/high)		km/hr	(mph)	3.3/5.6 (2.1/3.5)	3.3/5.6 (2.1/3.5)	3.3/5.6 (2.1/3.5)	3.3/5.6 (2.1/3.5)		
Swing speed		rp	m	11.4	11.4	11.4	11.4		
Gradeability		Degre	e (%)	35 (70)	35 (70)	35 (70)	35 (70)		
Ground pressure (600 mm shoe)		kgf/cr	m²(psi)	0.36 (5.13)	0.36 (5.13)	0.36 (5.13)	0.36 (5.13)		
Max traction force		kgf	(lbf)	12660 (27910)	12660 (27910)	12660 (27910)	12660 (27910)		

# 2) HX140 LC, 4.10 m (13' 5") MONO BOOM



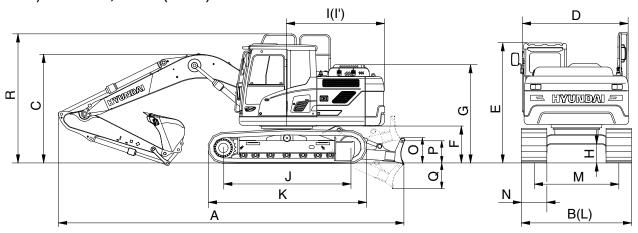
		ı	Jnit		
			Boom	<b>A</b>	 .1
Description	m	Arm	1.9	2.1	
	mm	Shoe		00	
Operating weight			g (lb)	13900 (30644)	13935 (30721)
Bucket capacity (SAE heaped), standard			(yd³)	0.58 (0.76)	0.58 (0.76)
Overall length	Α		,	7325 (24' 1")	7350 (24' 2")
Overall width, with 600 mm shoe	В	-		2600 (8' 6")	2600 (8' 6")
Overall height of boom	С			2660 (8' 7")	2830 (9' 3")
Superstructure width	D	-		2475 (8' 1")	2475 (8' 1")
Overall height of cab	Е			2860 (9' 4")	2860 (9' 4")
Ground clearance of counterweight	F	-		940 (3' 1")	940 (3' 1")
Engine cover height	G			2390 (7' 10")	2390 (7' 10")
Minimum ground clearance	Н		/ft :\	440 (1' 5")	440 (1' 5")
Rear-end distance	I	mr	r (ft-in)	2330 (7' 8")	2330 (7' 8")
Rear-end swing radius	ľ			2330 (7' 8")	2330 (7' 8")
Distance between tumblers	J			3000 (9' 10")	3000 (9' 10")
Undercarriage length	K			3708 (12' 1")	3708 (12' 1")
Undercarriage width	L			2600 (8' 6")	2600 (8' 6")
Track gauge	М			2000 (6' 7")	2000 (6' 7")
Track shoe width, standard	N			600 (24")	600 (24")
Overall height of guardrail	0			3100 (10' 2")	3100 (10' 2")
Travel speed (low/high)		km/h	nr (mph)	3.3/5.6 (2.1/3.5)	3.3/5.6 (2.1/3.5)
Swing speed		r	pm	11.4	11.4
Gradeability			Degree (%)	35 (70)	35 (70)
Ground pressure (600 mm shoe)			kgf/cm²(psi)	0.36 (5.13)	0.36 (5.13)
Max traction force			kgf (lbf)	12660 (27910)	12660 (27910)

# 3) HX140 LC, 4.90 m (16' 1") 2-PIECE BOOM



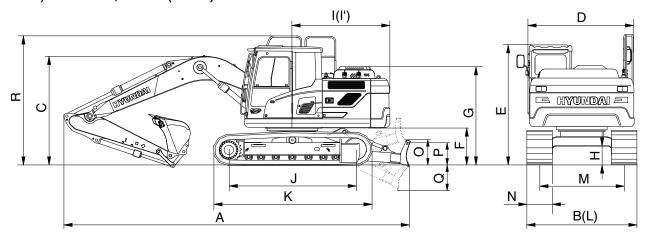
		U	nit	Specification			
Description			Boom		4.9		
Description		m	Arm	1.9	2.1	2.5	
		mm Shoe			600		
Operating weight		kg (lb)		14660 (32320)	14700 (32408)	14760 (32540)	
Bucket capacity (SAE heaped), stand	ard	m³ (	(yd³)	0.58 (0.76)	0.58 (0.76)	0.58 (0.76)	
Overall length	Α			8170 (26' 8")	8175 (26' 8")	8155 (26' 8")	
Overall width, with 600 mm shoe	В			2600 (8' 6")	2600 (8' 6")	2600 (8' 6")	
Overall height of boom	С			2670 (8' 8")	2670 (8' 8")	2700 (8' 9")	
Superstructure width	D			2475 (8' 1")	2475 (8' 1")	2475 (8' 1")	
Overall height of cab	Е			2860 (9' 4")	2860 (9' 4")	2860 (9' 4")	
Ground clearance of counterweight	F			940 (3' 1")	940 (3' 1")	940 (3' 1")	
Engine cover height	G			2390 (7' 10")	2390 (7' 10")	2390 (7' 10")	
Minimum ground clearance	Н		/# in\	440 (1' 5")	440 (1' 5")	440 (1' 5")	
Rear-end distance	I		mm (ft-in)	2330 (7' 8")	2330 (7' 8")	2330 (7' 8")	
Rear-end swing radius	ľ			2330 (7' 8")	2330 (7' 8")	2330 (7' 8")	
Distance between tumblers	J			3000 (9' 10")	3000 (9' 10")	3000 (9' 10")	
Undercarriage length	K			3750 (12' 3")	3750 (12' 3")	3750 (12' 3")	
Undercarriage width	L			2600 (8' 6")	2600 (8' 6")	2600 (8' 6")	
Track gauge	М			2000 (6' 7")	2000 (6' 7")	2000 (6' 7")	
Track shoe width, standard	N			600 (24")	600 (24")	600 (24")	
Overall height of guardrail	0			3100 (10' 2")	3100 (10' 2")	3100 (10' 2")	
Travel speed (low/high)		km/hr	(mph)	3.3/5.6 (2.1/3.5)	3.3/5.6 (2.1/3.5)	3.3/5.6 (2.1/3.5)	
Swing speed		rp	m	11.4	11.4	11.4	
Gradeability		Degre	e (%)	35 (70)	35 (70)	35 (70)	
Ground pressure (600 mm shoe)		kgf/cr	n² (psi)	0.38 (5.37)	0.38 (5.37)	0.38 (5.37)	
Max traction force		kgf	(lbf)	12660 (27910)	12660 (27910)	12660 (27910)	

# 4) HX140 LC, 4.60 m (15' 1") MONO BOOM AND DOZER BLADE



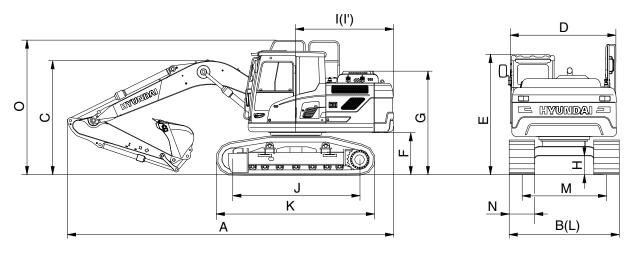
		U	nit	Specification					
Description			Boom	4.6					
Description		m	Arm	1.9	2.1	2.5	3.0		
		mm Shoe			60	00	I		
Operating weight		kg	(lb)	14770 (32562)	14810(32650)	14870(32783)	14910(32871)		
Bucket capacity (SAE heaped), stan	dard	m³ (	(yd³)	0.58 (0.76)	0.58 (0.76)	0.58 (0.76)	0.58 (0.76)		
Overall length	Α			8360 (27' 5")	8390 (25' 8")	8360 (25' 8")	8330 (25' 8")		
Overall width, with 600 mm shoe	В			2600 (8' 6")	2600 (8' 6")	2600 (8' 6")	2600 (8' 6")		
Overall height of boom	С			2590 (8' 5")	2710 (9' 1")	2690 (9' 1")	3010 (9' 1")		
Superstructure width	D			2475 (8' 1")	2475 (8' 1")	2475 (8' 1")	2475 (8' 1")		
Overall height of cab	Е			2860 (9' 4")	2860 (9' 4")	2860 (9' 4")	2860 (9' 4")		
Ground clearance of counterweight	F			940 (3' 1")	940 (3' 1")	940 (3' 1")	940 (3' 1")		
Engine cover height	G			2390 (7' 10")	2390 (7' 10")	2390 (7' 10")	2390 (7' 10")		
Minimum ground clearance	Н			440 (1' 5")	440 (1' 5")	440 (1' 5")	440 (1' 5")		
Rear-end distance	I			2330 (7' 8")	2330 (7' 8")	2330 (7' 8")	2330 (7' 8")		
Rear-end swing radius	ľ	mm	(ft-in)	2330 (7' 8")	2330 (7' 8")	2330 (7' 8")	2330 (7' 8")		
Distance between tumblers	J			3000 (9' 10")	3000 (9' 10")	3000 (9' 10")	3000 (9' 10")		
Undercarriage length	K			3708 (12' 1")	3708 (12' 1")	3708 (12' 1")	3708 (12' 1")		
Undercarriage width	L			2600 (8' 6")	2600 (8' 6")	2600 (8' 6")	2600 (8' 6")		
Track gauge	М			2000 (6' 7")	2000 (6' 7")	2000 (6' 7")	2000 (6' 7")		
Track shoe width, standard	N			600 (24")	600 (24")	600 (24")	600 (24")		
Height of blade	0			575 (1' 9")	575 (1' 9")	575 (1' 9")	575 (1' 9")		
Ground clearance of blade up	Р			560 (1' 8")	560 (1' 8")	560 (1' 8")	560 (1' 8")		
Depth of blade down	Q			500 (1' 7")	500 (1' 7")	500 (1' 7")	500 (1' 7")		
Overall height of guardrail	R			3100 (10' 2")	3100 (10' 2")	3100 (10' 2")	3100 (10' 2")		
Travel speed (low/high)		km/hr	(mph)	3.3/5.6 (2.1/3.5)	3.3/5.6 (2.1/3.5)	3.3/5.6 (2.1/3.5)	3.3/5.6 (2.1/3.5)		
Swing speed		rp	m	11.4	11.4	11.4	11.4		
Gradeability		Degre	ee (%)	35 (70)	35 (70)	35 (70)	35 (70)		
Ground pressure (600 mm shoe)		kgf/cr	n²(psi)	0.38 (5.43)	0.38 (5.43)	0.38 (5.43)	0.38 (5.43)		
Max traction force		kgf	(lbf)	12660 (27910)	12660 (27910)	12660 (27910)	12660 (27910)		

## 5) HX140 LC, 4.10 m (13' 5") MONO BOOM AND DOZER BLADE



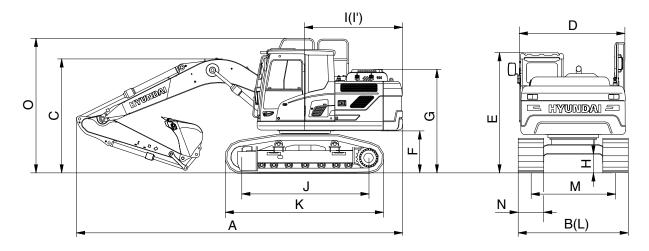
	U	nit			
Description		m	Boom	4	.1
Description	Description			1.9	2.1
	mm	Shoe	60	00	
Operating weight			kg (lb) 14720(32452)		14760(32540)
Bucket capacity (SAE heaped), standard	d	m³ (	(yd³)	0.58 (0.76)	0.58 (0.76)
Overall length	Α			7860 (25' 8")	7920 (25' 8")
Overall width, with 600 mm shoe	В			2600 (8' 6")	2600 (8' 6")
Overall height of boom	С			2660 (8' 7")	2830 (9' 3")
Superstructure width	D			2475 (8' 1")	2475 (8' 1")
Overall height of cab	Е			2860 (9' 4")	2860 (9' 4")
Ground clearance of counterweight	F			940 (3' 1")	940 (3' 1")
Engine cover height	G			2390 (7' 10")	2390 (7' 10")
Minimum ground clearance	Н			440 (1' 5")	440 (1' 5")
Rear-end distance	I			2330 (7' 8")	2330 (7' 8")
Rear-end swing radius	ľ	mm	(ft-in)	2330 (7' 8")	2330 (7' 8")
Distance between tumblers	J			3000 (9' 10")	3000 (9' 10")
Undercarriage length	K			3708 (12' 1")	3708 (12' 1")
Undercarriage width	L			2600 (8' 6")	2600 (8' 6")
Track gauge	М			2000 (6' 7")	2000 (6' 7")
Track shoe width, standard	N			600 (24")	600 (24")
Height of blade	0			575 (1' 9")	575 (1' 9")
Ground clearance of blade up	Р			560 (1' 8")	560 (1' 8")
Depth of blade down	Q			500 (1' 7")	500 (1' 7")
Overall height of guardrail	R	]		3100 (10' 2")	3100 (10' 2")
Travel speed (low/high)		km/hı	r (mph)	3.3/5.6 (2.1/3.5)	3.3/5.6 (2.1/3.5)
Swing speed		rp	om	11.4	11.4
Gradeability		Degre	ee (%)	35 (70)	35 (70)
Ground pressure (600 mm shoe)		kgf/cr	n²(psi)	0.38 (5.43)	0.38 (5.43)
Max traction force		kgf	(lbf)	12660(27910)	12660(27910)

# 6) HX140 LC, 4.60 m (15' 1") HIGH WALKER



		U	nit		Specification				
December			Boom	4.6					
Description  Operating weight		m	Arm	1.9	2.1	2.5	3.0		
		mm Shoe			8	00			
		kg	(lb)	16850 (37148)	16890 (37236)	16950 (37369)	16990 (37457)		
Bucket capacity (SAE heaped), stan	dard	m³	(yd³)	0.58 (0.76)	0.58 (0.76)	0.58 (0.76)	0.58 (0.76)		
Overall length	Α			7775 (25' 6")	7830 (25' 7")	7775 (25' 6")	7840 (25' 7")		
Overall width, with 800 mm shoe	В			2840 (9' 4")	2840 (9' 4")	2840 (9' 4")	2840 (9' 4")		
Overall height of boom	С			2680 (8' 8")	2800 (9' 2")	2740 (9' 0")	3005 (9' 9")		
Superstructure width	D			2475 (8' 1")	2475 (8' 1")	2475 (8' 1")	2475 (8' 1")		
Overall height of cab	Е			3220 (10' 6")	3220 (10' 2")	3220 (10' 2")	3220 (10' 2")		
Ground clearance of counterweight	F			1200 (3' 10")	1200 (3' 11")	1200 (3' 11")	1200 (3' 11")		
Engine cover height	G			2630 (8' 7")	2390 (8' 8")	2390 (8' 8")	2390 (8' 8")		
Minimum ground clearance	Н		/ft :\	600 (2' 0")	600 (2' 0")	600 (2' 0")	600 (2' 0")		
Rear-end distance	I	mm	(ft-in)	2330 (7' 8")	2330 (7' 8")	2330 (7' 8")	2330 (7' 8")		
Rear-end swing radius	ľ			2330 (7' 8")	2330 (7' 8")	2330 (7' 8")	2330 (7' 8")		
Distance between tumblers	J			3030 (9' 9")	3030 (9' 9")	3030 (9' 9")	3030 (9' 9")		
Undercarriage length	K			3740 (12' 3")	3740 (12' 8")	3740 (12' 8")	3740 (12' 8")		
Undercarriage width	L			2800 (9' 2")	2800 (9' 4")	2800 (9' 4")	2800 (9' 4")		
Track gauge	М			2040 (6' 8")	2040 (6' 8")	2040 (6' 8")	2040 (6' 8")		
Track shoe width, standard	N			800 (32")	800 (32")	800 (32")	800 (32")		
Overall height of guardrail	0			3100 (10' 2")	3100 (10' 2")	3100 (10' 2")	3100 (10' 2")		
Travel speed (low/high)		km/hı	r (mph)	3.3/5.6 (2.1/3.5)	3.3/5.6 (2.1/3.5)	3.3/5.6 (2.1/3.5)	3.3/5.6 (2.1/3.5)		
Swing speed		rp	om	11.4	11.4	11.4	11.4		
Gradeability		Degre	ee (%)	35 (70)	35 (70)	35 (70)	35 (70)		
Ground pressure (800 mm shoe)		kgf/cr	n²(psi)	0.32 (4.58)	0.32 (4.58)	0.32 (4.58)	0.32 (4.58)		
Max traction force		kgf	(lbf)	12660 (27910)	12660 (27910)	12660 (27910)	12660 (27910)		

# 7) HX140 LC, 4.10 m (13' 5") HIGH WALKER

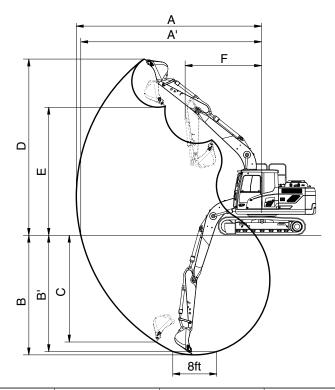


					140LC2SP0
	U	nit			
<b>_</b>			Boom	4	.1
Description	m	Arm	1.9	2.1	
	mm	Shoe	80	00	
Operating weight		kg	(lb)	16800 (37038)	16840 (37126)
Bucket capacity (SAE heaped), standard		m³ (	yd³)	0.58 (0.76)	0.58 (0.76)
Overall length	Α			7245 (24' 8")	7320 (24' 0")
Overall width, with 800 mm shoe	В			2840 (9' 4")	2840 (9' 4")
Overall height of boom	С			2640(8' 7")	2825 (9' 3")
Superstructure width	D			2475 (8' 1")	2475 (8' 1")
Overall height of cab	Е			3220 (10' 6")	3220 (10' 6")
Ground clearance of counterweight	ht F			1200 (3' 1")	1200 (3' 1")
Engine cover height	G			2390 (8' 8")	2390 (8' 8")
Minimum ground clearance	Н	H		600 (2' 0")	600 (2' 0")
Rear-end distance	I	mm	(IT-IN)	2330 (7' 8")	2330 (7' 8")
Rear-end swing radius	ľ			2330 (7' 8")	2330 (7' 8")
Distance between tumblers	J			3030 (9' 9")	3030 (9' 9")
Undercarriage length	K			3740 (12' 3")	3740 (12' 3")
Undercarriage width	L			2800 (9' 2")	2800 (9' 2")
Track gauge	М			2040 (6' 8")	2040 (6' 8")
Track shoe width, standard	N			800 (32")	800 (32")
Overall height of guardrail	0			3100 (10' 2")	3100 (10' 2")
Travel speed (low/high)		km/hr	(mph)	3.3/5.6 (2.1/3.5)	3.3/5.6 (2.1/3.5)
Swing speed		rp	m	11.4	11.4
Gradeability		Degre	e (%)	35 (70)	35 (70)
Ground pressure (800 mm shoe)		kgf/cn	n²(psi)	0.32 (4.58)	0.32 (4.58)
Max traction force		kgf	(lbf)	12660 (27910)	12660 (27910)

# 3. WORKING RANGE

# 1) HX140 LC

# (1) 4.60 m (15<sup>1</sup> 1") MONO BOOM

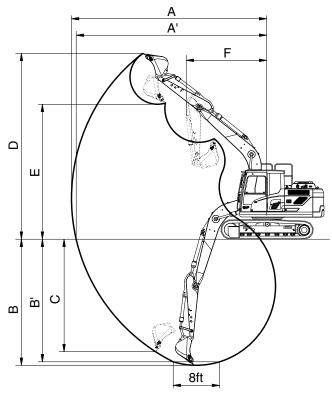


140LC2SP06

Description		1.90 m (6' 3") Arm	2.10 m (6' 11") Arm	%2.50 m (8' 2") Am	3.00 m ( 9' 10") Arm
Max digging reach	Α	7750 mm (25' 5")	7920 mm (25'11")	8320 mm (27' 4")	8780 mm (28'10")
Max digging reach on ground	A'	7590 mm (24'11")	7760 mm (25' 6")	8175 mm (26'10")	8640 mm (28' 4")
Max digging depth	В	4920 mm (16' 2")	5120 mm (16' 10")	5520 mm (18' 3")	6020 mm (19' 10")
Max digging depth (8ft level)	B'	4655 mm (15' 4")	4870 mm (16' 1")	5310 mm (17' 6")	5840 mm (19' 3")
Max vertical wall digging depth	С	4470 mm (15' 3")	4665mm (16' 1")	5065 mm (17' 6")	5570 mm (19' 2")
Max digging height	D	8130 mm (26' 7")	8195 mm (26' 10")	8525 mm (27'11")	8800 mm (28' 10")
Max dumping height	Е	5690 mm (18' 7")	5770 mm (18' 10")	6075 mm (19'11")	6340 mm (20' 9")
Min swing radius	F	2630 mm ( 8' 8")	2675 mm ( 8' 9")	2650 mm ( 8' 8")	2680 mm ( 8' 10")
	SAE	87.9 [95.4]] kN	87.9 [95.4] kN	87.9 [95.4] kN	87.9 [95.4] kN
		SAE	8960 [9730] kN	8960 [9730] kN	8960 [9730] kN
Pucket diaging force		19750 [21450] kN	19750 [21450] kN	19750 [21450] kN	19750 [21450] kN
Bucket digging force		103 [111.8] kN	103 [111.8] kN	103 [111.8] kN	103 [111.8] kN
	ISO	10490 [11390]] kN	10490 [11390] kN	10490 [11390] kN	10490 [11390] kN
		23130 [25120] kN	23130 [25120] kN	23130 [25120] kN	23130 [25120] kN
		76.7 [83.2] kN	73.6 [79.9] kN	62.7 [68.1] kN	56.1 [60.9] kN
	SAE	7820 [8490] kgf	7510 [8150] kgf	6400 [6940] kgf	5710 [6200] kgf
Arms around force		17230 [18710] lbf	16550 [17970] lbf	14100 [15310] lbf	12600 [13680] lbf
Arm crowd force		80.6 [87.5] kN	77.1 [83.8] kN	64.4 [71.0] kN	58.2 [63.1] kN
	ISO	8210 [8920] kgf	7860 [8540] kgf	6700 [7240] kgf	5930 [6440] kgf
		18110 [19660] lbf	17430 [18820] lbf	14700 [15960] lbf	13070 [14190] lbf

\* : STD [ ]: Power boost

# (2) 4.10 m (13' 5") MONO BOOM

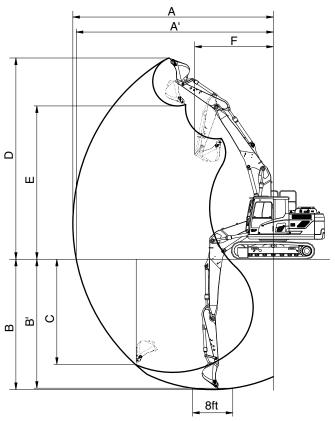


140LC2SP06

Description		1.90 m (6' 3") Arm	2.10 m (6' 11") Arm
Max digging reach	А	7250 mm (23' 10")	7420 mm (24' 4")
Max digging reach on ground	A'	7080 mm (23' 3")	7250 mm (23'10")
Max digging depth	В	4505 mm (14' 11")	4705 mm (15' 7")
Max digging depth (8ft level)	B'	4240 mm (14' 1")	4460 mm (14' 9")
Max vertical wall digging depth	С	4055 mm (13' 11")	4250 mm (14' 3")
Max digging height	D	7730 mm (25' 3")	7790 mm (25' 6")
Max dumping height	Е	5280 mm (17' 3")	5360 mm (17' 6")
Min swing radius	F	2350 mm ( 7' 9")	2460 mm ( 8' 1")
		87.9 [95.4]] kN	87.9 [95.4] kN
	SAE	8960 [9730] kN	8960 [9730] kN
Dualest diaging force		19750 [21450] kN	19750 [21450] kN
Bucket digging force		103 [111.8] kN	103 [111.8] kN
	ISO	10490 [11390]] kN	10490 [11390] kN
		23130 [25120] kN	23130 [25120] kN
		76.7 [83.2] kN	73.6 [79.9] kN
	SAE	7820 [8490] kgf	7510 [8150] kgf
Arm crowd force		17230 [18710] lbf	16550 [17970] lbf
Ann crowd force		80.6 [87.5] kN	77.1 [83.8] kN
	ISO	8210 [8920] kgf	7860 [8540] kgf
		18110 [19660] lbf	17430 [18820] lbf

[ ]: Power boost

# (3) 4.90 m (16' 1") ADJUST BOOM



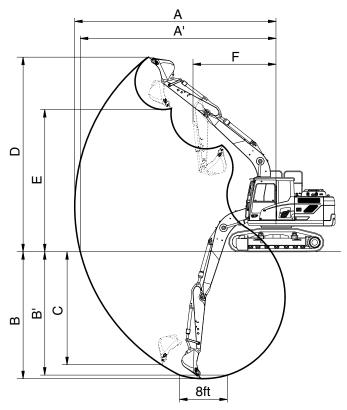
140LC2SP08

Description		1.90 m (6' 3") Arm	2.10 m (6' 11") Arm	2.50 m ( 8' 2") Arm
Max digging reach	Α	8140 mm (26' 8")	8320 mm (27' 4")	8730 mm (28' 7")
Max digging reach on ground	A'	7990 mm (26' 3")	8170 mm (26'10")	8585 mm (28' 2")
Max digging depth	В	5080 mm (16' 9")	5380 mm (17' 5")	5680 mm (18' 9")
Max digging depth (8ft level)	B'	4960 mm (16' 5")	5165 mm (17' 0")	5575 mm (18' 5")
Max vertical wall digging depth	О	4450 mm (14' 9")	4610 mm (15' 3")	5070 mm (16' 10")
Max digging height	D	8850 mm (28' 11")	8860 mm (29' 2")	9310 mm (30' 5")
Max dumping height	Е	6370 mm (20' 9")	6490 mm (21' 0")	6820 mm (22' 3")
Min swing radius	F	2660 mm ( 8' 9")	2820 mm ( 9' 3")	2690 mm ( 8' 10")
	SAE	87.3 [94.8] kN	87.3 [94.8] kN	87.3 [94.8] kN
		8960 [9660] kgf	8960 [9660] kgf	8960 [9660] kgf
Bucket digging force		19620 [21300] lbf	19620 [21300] lbf	19620 [21300] lbf
Bucket diggling force		102 [110.8] kN	102 [110.8] kN	102 [110.8] kN
	ISO	10490 [11290] kgf	10490 [11290] kgf	10490 [11290] kgf
		22930 [24890] lbf	22930 [24890] lbf	22930[24890] lbf
		76.5 [83.1] kN	73.6 [79.9] kN	62.8 [68.2] kN
	SAE	7820 [8470] kgf	7510 [8140] kgf	6400 [6950] kgf
Arm around force		17200 [18670] lbf	16530 [17950] lbf	14110 [15320] lbf
Arm crowd force		80.4 [87.3] kN	77.5 [84.1] kN	65.7 [71.4] kN
	ISO	8210 [8900] kgf	7860 [8580] kgf	6700 [7270] kgf
		18080 [19630] lbf	17420 [18910] lbf	14770 [16040] lbf

[ ]: Power boost

# 2) HX140 LC HIGH WALKER

# (1) 4.6 m (15' 1") MONO BOOM



140LC2SP09

Description		1.90 m (6' 3") Arm	2.10 m (6' 11") Arm	%2.50 m (8' 2") Am	3.00 m ( 9' 10") Arm
Max digging reach	Α	7750 mm (25' 5")	7920 mm (26' 0")	8320 mm (27' 4")	8780 mm (28'10")
Max digging reach on ground	A'	7590 mm (24' 9")	7760 mm (25' 4")	8175 mm (26' 7")	8640 mm (28' 2")
Max digging depth	В	4920 mm (15' 5")	5120 mm (16' 1")	5520 mm (17' 4")	6020 mm (19' 0")
Max digging depth (8ft level)	B'	4655 mm (14' 6")	4687 mm (15' 3")	5310 mm (16' 8")	5840 mm (18' 5")
Max vertical wall digging depth	С	4470 mm (14' 9")	4665 mm (15' 3")	5065 mm (16' 8")	5570 mm (18' 4")
Max digging height	D	8130 mm (27' 5")	8195 mm (27' 8")	8525 mm (28' 9")	8800 mm (29' 7")
Max dumping height	Е	5690 mm (19' 5")	5770 mm (19' 8")	6075 mm (20' 9")	6340 mm (21' 7")
Min swing radius	F	2630 mm ( 8' 8")	2675 mm ( 8' 9")	2650 mm ( 8' 8")	2680 mm ( 8' 10")
	SAE	87.9 [95.4]] kN	87.9 [95.4] kN	87.9 [95.4] kN	87.9 [95.4] kN
		SAE	8960 [9730] kN	8960 [9730] kN	8960 [9730] kN
Punket diaging force		19750 [21450] kN	19750 [21450] kN	19750 [21450] kN	19750 [21450] kN
Bucket digging force		103 [111.8] kN	103 [111.8] kN	103 [111.8] kN	103 [111.8] kN
	ISO	10490 [11390]] kN	10490 [11390] kN	10490 [11390] kN	10490 [11390] kN
		23130 [25120] kN	23130 [25120] kN	23130 [25120] kN	23130 [25120] kN
		76.7 [83.2] kN	73.6 [79.9] kN	62.7 [68.1] kN	56.1 [60.9] kN
	SAE	7820 [8490] kgf	7510 [8150] kgf	6400 [6940] kgf	5710 [6200] kgf
Arm around force		17230 [18710] lbf	16550 [17970] lbf	14100 [15310] lbf	12600 [13680] lbf
Arm crowd force		80.6 [87.5] kN	77.1 [83.8] kN	64.4 [71.0] kN	58.2 [63.1] kN
	ISO	8210 [8920] kgf	7860 [8540] kgf	6700 [7240] kgf	5930 [6440] kgf
		18110 [19660] lbf	17430 [18820] lbf	14700 [15960] lbf	13070 [14190] lbf

\* : STD [ ]: Power boost

## 4. WEIGHT

# 1) HX140 LC

Item	HX14	40 LC	HX140 LC DOZER BLADE		
	kg	lb	kg	lb	
Upper structure assembly	5760	12500	<b>←</b>	_	
Main frame weld assembly	1095	2414	+	_	
Engine assembly	348	767	+	_	
Aftertreatment	38	84	+	_	
Main pump assembly	100	220	+	_	
Main control valve assembly	140	310	+	_	
Swing motor assembly	120	260	+	_	
Hydraulic oil tank assembly	150	330	+	_	
Fuel tank assembly	150	330	+	_	
Counterweight	2000	4410	+	_	
Cab assembly	500	1100	+	_	
Lower chassis assembly	5840	12875	6660	14680	
Track frame weld assembly	1555	3428	1725	3803	
Swing bearing	214	472	+	_	
Travel motor assembly	480	1060	+	_	
Turning joint	50	110	+	_	
Track recoil spring	89.5	197	+	_	
Idler	108	238	+	_	
Carrier roller	19	42	<b>*</b>	_	
Track roller	33	73	+	_	
Track-chain assembly (600 mm standard triple grouser shoe)	1027	2265	+	_	
Dozer blade assembly		-	505	1113	
Front attachment assembly (4.6 m boom, 2.5 m arm, 0.58 m³ SAE heaped bucket)	2600	5730	+	_	
4.6 m boom assembly	830	1830	+	_	
2.5 m arm assembly	435	960	+	_	
0.58 m³ SAE heaped bucket	480	1060	+	_	
Boom cylinder assembly	121	267	+	_	
Arm cylinder assembly	171	377	·	_	
Bucket cylinder assembly	123	271	·	_	
Bucket control rod assembly	90	200	+	_	
Dozer blade cylinder assembly		-	52	115	

# 2) HX140 LC HIGH WALKER

lkene	HX140 LC HI	GH WALKER
ltem	kg	lb
Upper structure assembly	5760	12500
Main frame weld assembly	1095	2414
Engine assembly	348	767
Aftertreatment	38	84
Main pump assembly	100	220
Main control valve assembly	140	310
Swing motor assembly	120	260
Hydraulic oil tank assembly	150	330
Fuel tank assembly	150	330
Counterweight	2000	4410
Cab assembly	480	1060
Lower chassis assembly	8740	19270
Track frame weld assembly	2200	4850
Swing bearing	214	472
Travel motor assembly	305	670
Turning joint	50	110
Tension cylinder assembly	132	291
Idler assembly	151	333
Carrier roller assembly	40	88
Track roller assembly	40	88
Track-chain assembly (800 mm standard triple grouser shoe)	1370	3020
Front attachment assembly (4.6 m boom, 2.5 m arm, 0.58 m³ SAE heaped bucket)	2600	5730
4.6 m boom assembly	830	1830
2.5 m arm assembly	435	960
0.58 m³ SAE heaped bucket	480	1060
Boom cylinder assembly	121	267
Arm cylinder assembly	171	377
Bucket cylinder assembly	123	271
Bucket control rod assembly	90	200

### 5. LIFTING CAPACITIES

## 1) 4.6 m (15' 1") MONO BOOM

Model	Boom	Boom	Arm	Counterweight	Shoe	Doze	er	Outrig	ger
	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX140 LC	40 LC Mono 4600		2500	2000	600	-	-	-	-

: Rating over-front

· Rating over-side or 360 degree



Unit: mm

				I	_ift-point	radius (B)				At	max. re	each
Lift-point height (A)		1.5 m (4.9 ft)		.9 ft) 3.0 m (9.8 ft)		4.5 m (	4.5 m (14.8 ft) 6.0 m		6.0 m (19.7 ft)		acity	Reach
				ŀ	#	·	#	·	#	<b>U</b>	#	m (ft)
6.0m	kg					*3400	*3400			*2390	*2390	5.50
19.7ft	lb					*7500	*7500			*5270	*5270	(18.0)
4.5m	kg					*3700	*3700	*3500	2610	*2210	*2210	6.44
14.8ft	lb					*8160	*8160	*7720	5750	*4870	*4870	(21.1)
3.0m	kg			*6380	*6380	*4630	3920	3770	2540	*2200	2010	6.93
9.8ft	lb			*14070	*14070	*10210	8640	8310	5600	*4850	4430	(22.7)
1.5m	kg			*7050	6670	5690	3680	3660	2430	*2320	1900	7.07
4.9ft	lb			*15540	14700	12540	8110	8070	5360	*5110	4190	(23.2)
0.0m	kg			*6550	6390	5500	3510	3570	2350	*2590	1950	6.88
0.0ft	lb			*14440	14090	12130	7740	7870	5180	*5710	4300	(22.6)
-1.5m	kg	*4890	*4890	*10080	6370	5430	3450	3550	2330	*3160	2170	6.34
-4.9ft	lb	*10780	*10780	*22220	14040	11970	7610	7830	5140	*6970	4780	(20.8)
-3.0m	kg	*9020	*9020	*8820	6480	5490	3500			4300	2810	5.31
-9.8ft	lb	*19890	*19890	*19440	14290	12100	7720			9480	6190	(17.4)

### \* Note

- 1. Lifting capacity are based on SAE J1097 and ISO 10567.
- 2. Lifting capacity of the ROBEX series does not exceed 75% of tipping load with the machine on firm, level ground or 87% of full hydraulic capacity.
- 3. The lift-point is bucket pivot mounting pin on the arm (without bucket mass).
- 4. \*indicates load limited by hydraulic capacity.
- \* Lifting capacities are based upon a standard machine conditions.

Lifting capacities will vary with different work tools, ground conditions and attachments.

The difference between the weight of a work tool attachment must be subtracted.

Consult your HD Hyundai Construction Equipment dealer regarding the lifting capacities for specific work tools and attachments.

▲ Failure to comply to the rated load can cause possible personal injury or property damage.

Make adjustments to the rated load as necessary for non-standard configurations.

Unit: mm

Model	Boom	Boom	Arm	Counterweight	Shoe	Doze	er	Outrigo	ger
Model	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX140 LC	Mono	4600	1900	2000	600	Down	-	-	-

: Rating over-front  $\cdot$  : Rating over-side or 360 degree



				l	_ift-point	radius (B)				At max. reach		
Lift-point height (A)		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (	4.5 m (14.8 ft)		6.0 m (19.7 ft)		acity	Reach
		Ů	#	ŀ	#	<b>U</b>	#	·		ŀ	#	m (ft)
6.0m	kg					*4200	*4200			*3650	*3650	4.73
19.7ft	lb					*9260	*9260			*8050	*8050	(15.5)
4.5m	kg					*4330	*4330			*3340	3090	5.80
14.8ft	lb					*9550	*9550			*7360	6810	(19.0)
3.0m	kg					*5220	4420	*4420	2890	*3330	2650	6.35
9.8ft	lb					*11510	9740	*9740	6370	*7340	5840	(20.8)
1.5m	kg					*6220	4210	*4790	2810	*3540	2510	6.50
4.9ft	lb					*13710	9280	*10560	6190	*7800	5530	(21.3)
0.0m	kg			*5750	*5750	*6760	4090	*4990	2750	*4050	2590	6.29
0.0ft	lb			*12680	*12680	*14900	9020	*11000	6060	*8930	5710	(20.6)
-1.5m	kg	*5700	*5700	*9710	7610	*6600	4070			*4960	2970	5.68
-4.9ft	lb	*12570	*12570	*21410	16780	*14550	8970			*10930	6550	(18.6)
-3.0m	kg			*7880	7770	*5100	4190			*5080	4180	4.51
-9.8ft	lb			*17370	17130	*11240	9240			*11200	9220	(14.8)

Unit: mm

Ī	Model	Boom	Boom	Arm	Counterweight	Shoe	Doze	er	Outrigo	ger
		Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
Ī	HX140 LC	Mono	4600	1900	2000	600	Up	-	-	-

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



		Lift-point radius (B)									At max. reach			
Lift-poi		1.5 m	(4.9 ft)	.9 ft) 3.0 m (9.8 ft)		4.5 m (	4.5 m (14.8 ft) 6.0 m		6.0 m (19.7 ft)		Capacity			
height (A)		<b>P</b>	#	ŀ	#	Ů	#	·		ŀ	#	m (ft)		
6.0m	kg					*4200	*4200			*3650	*3650	4.73		
19.7ft	lb					*9260	*9260			*8050	*8050	(15.5)		
4.5m	kg					*4330	4280			*3340	2870	5.80		
14.8ft	lb					*9550	9440			*7360	6330	(19.0)		
3.0m	kg					*5220	4090	3760	2680	*3330	2450	6.35		
9.8ft	lb					*11510	9020	8290	5910	*7340	5400	(20.8)		
1.5m	kg					5670	3880	3670	2600	3260	2320	6.50		
4.9ft	lb					12500	8550	8090	5730	7190	5110	(21.3)		
0.0m	kg			*5750	*5750	5530	3760	3620	2540	3380	2390	6.29		
0.0ft	lb			*12680	*12680	12190	8290	7980	5600	7450	5270	(20.6)		
-1.5m	kg	*5700	*5700	*9710	6880	5510	3740			3910	2740	5.68		
-4.9ft	lb	*12570	*12570	*21410	15170	12150	8250			8620	6040	(18.6)		
-3.0m	kg			*7880	7040	*5100	3860			*5080	3850	4.51		
-9.8ft	lb			*17370	15520	*11240	8510			*11200	8490	(14.8)		

Model	Boom	Boom	Arm	Counterweight	Shoe	Doze	er	Outrig	ger
Iviouei	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX140 LC	Mono	4600	1900	2000	600	-	-	-	-

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



				l	_ift-point	radius (B)				At	max. re	each
Lift-po		1.5 m	(4.9 ft)	3.0 m	(9.8 ft)	4.5 m (	14.8 ft)	6.0 m (	19.7 ft)	Cap	acity	Reach
height	(A)	Ů	#	ŀ	#	·	#	·		Ů	#	m (ft)
6.0m	kg					*4200	4120			*3650	*3650	4.73
19.7ft	lb					*9260	9080			*8050	*8050	(15.5)
4.5m	kg					*4330	4070			*3340	2720	5.80
14.8ft	lb					*9550	8970			*7360	6000	(19.0)
3.0m	kg					*5220	3880	3760	2530	*3330	2320	6.35
9.8ft	lb					*11510	8550	8290	5580	*7340	5110	(20.8)
1.5m	kg					5670	3680	3680	2460	3270	2190	6.50
4.9ft	lb					12500	8110	8110	5420	7210	4830	(21.3)
0.0m	kg			*5750	*5750	5540	3550	3620	2400	3380	2260	6.29
0.0ft	lb			*12680	*12680	12210	7830	7980	5290	7450	4980	(20.6)
-1.5m	kg	*5700	*5700	*9710	6520	5520	3540			3920	2590	5.68
-4.9ft	lb	*12570	*12570	*21410	14370	12170	7800			8640	5710	(18.6)
-3.0m	kg			*7880	6670	*5100	3650			*5080	3640	4.51
-9.8ft	lb			*17370	14700	*11240	8050			*11200	8020	(14.8)

Unit: mm

Mode	Boom	Boom	Arm	Counterweight	Shoe	Doze	er	Outrigg	ger
ivioue	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX140 LC	Mono	4600	1900	2300	600	Down	-	-	-



				I	_ift-point	radius (B)				At	max. re	each
Lift-po		1.5 m	(4.9 ft)	3.0 m	(9.8 ft)	4.5 m (	14.8 ft)	6.0 m (	19.7 ft)	Cap	acity	Reach
height	(A)	Ů	#	ŀ	#	ŀ	#	Ů		ŀ	#	m (ft)
6.0m	kg					*4200	*4200			*3650	*3650	4.73
19.7ft	lb					*9260	*9260			*8050	*8050	(15.5)
4.5m	kg					*4330	*4330			*3340	3250	5.80
14.8ft	lb					*9550	*9550			*7360	7170	(19.0)
3.0m	kg					*5220	4650	*4420	3040	*3330	2790	6.35
9.8ft	lb					*11510	10250	*9740	6700	*7340	6150	(20.8)
1.5m	kg					*6220	4430	*4790	2960	*3540	2640	6.50
4.9ft	lb					*13710	9770	*10560	6530	*7800	5820	(21.3)
0.0m	kg			*5750	*5750	*6760	4310	*4990	2910	*4050	2730	6.29
0.0ft	lb			*12680	*12680	*14900	9500	*11000	6420	*8930	6020	(20.6)
-1.5m	kg	*5700	*5700	*9710	8010	*6600	4290			*4960	3130	5.68
-4.9ft	lb	*12570	*12570	*21410	17660	*14550	9460			*10930	6900	(18.6)
-3.0m	kg			*7880	*7880	*5100	4410			*5080	4400	4.51
-9.8ft	lb			*17370	*17370	*11240	9720			*11200	9700	(14.8)

Model	Boom	Boom	Arm	Counterweight	Shoe	Dozer		Outrigger	
Iviouei	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX140 L	C Mono	4600	1900	2300	600	Up	-	-	-

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



				I	_ift-point	radius (B)				At	max. re	each
Lift-po		1.5 m	(4.9 ft)	3.0 m	(9.8 ft)	4.5 m (	(14.8 ft)	6.0 m (	19.7 ft)	Сар	acity	Reach
height	(A)	Ů		·	#	Ů	#	ŀ		ŀ		m (ft)
6.0m	kg					*4200	*4200			*3650	*3650	4.73
19.7ft	lb					*9260	*9260			*8050	*8050	(15.5)
4.5m	kg					*4330	*4330			*3340	3020	5.80
14.8ft	lb					*9550	*9550			*7360	6660	(19.0)
3.0m	kg					*5220	4300	3940	2820	*3330	2590	6.35
9.8ft	lb					*11510	9480	8690	6220	*7340	5710	(20.8)
1.5m	kg					5940	4090	3850	2740	3430	2450	6.50
4.9ft	lb					13100	9020	8490	6040	7560	5400	(21.3)
0.0m	kg			*5750	*5750	5800	3970	3800	2690	3550	2530	6.29
0.0ft	lb			*12680	*12680	12790	8750	8380	5930	7830	5580	(20.6)
-1.5m	kg	*5700	*5700	*9710	7260	5780	3950			4110	2900	5.68
-4.9ft	lb	*12570	*12570	*21410	16010	12740	8710			9060	6390	(18.6)
-3.0m	kg			*7880	7410	*5100	4070			*5080	4050	4.51
-9.8ft	lb			*17370	16340	*11240	8970			*11200	8930	(14.8)

Unit: mm

Model	Boom	Boom	Arm	Counterweight	Shoe	Doze	er	Outrigger	
iviodei	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX140 LC	Mono	4600	1900	2300	600	-	-	-	-



				I	_ift-point	radius (B)				At	max. re	each
Lift-po		1.5 m	(4.9 ft)	3.0 m	(9.8 ft)	4.5 m (	14.8 ft)	6.0 m (	19.7 ft)	Cap	acity	Reach
height	(A)	Ů	#	ŀ	#	ŀ	#	<b>U</b>		ŀ	#	m (ft)
6.0m	kg					*4200	*4200			*3650	*3650	4.73
19.7ft	lb					*9260	*9260			*8050	*8050	(15.5)
4.5m	kg					*4330	4280			*3340	2870	5.80
14.8ft	lb					*9550	9440			*7360	6330	(19.0)
3.0m	kg					*5220	4090	3940	2680	*3330	2460	6.35
9.8ft	lb					*11510	9020	8690	5910	*7340	5420	(20.8)
1.5m	kg					5950	3890	3860	2600	3430	2320	6.50
4.9ft	lb					13120	8580	8510	5730	7560	5110	(21.3)
0.0m	kg			*5750	*5750	5810	3770	3800	2550	3550	2390	6.29
0.0ft	lb			*12680	*12680	12810	8310	8380	5620	7830	5270	(20.6)
-1.5m	kg	*5700	*5700	*9710	6890	5790	3750			4110	2750	5.68
-4.9ft	lb	*12570	*12570	*21410	15190	12760	8270			9060	6060	(18.6)
-3.0m	kg			*7880	7050	*5100	3860			*5080	3850	4.51
-9.8ft	lb			*17370	15540	*11240	8510			*11200	8490	(14.8)

Model	Boom	Boom	Arm	Counterweight	Shoe	Dozer		Outrigger	
Model	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX140 LC	Mono	4600	2100	2000	600	Down	-	-	-

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



				I	Lift-point	radius (B)				At	max. re	each
Lift-po		1.5 m	(4.9 ft)	3.0 m	(9.8 ft)	4.5 m (	14.8 ft)	6.0 m (	19.7 ft)	Cap	acity	Reach
height	(A)	r de	#	ŀ	#	ŀ	#	·		ŀ	#	m (ft)
6.0m	kg					*3910	*3910			*3470	*3470	4.97
19.7ft	lb					*8620	*8620			*7650	*7650	(16.3)
4.5m	kg					*4120	*4120			*3210	2940	5.99
14.8ft	lb					*9080	*9080			*7080	6480	(19.7)
3.0m	kg			*7310	*7310	*5030	4430	*4280	2880	*3220	2530	6.52
9.8ft	lb			*16120	*16120	*11090	9770	*9440	6350	*7100	5580	(21.4)
1.5m	kg					*6070	4210	*4680	2800	*3430	2400	6.67
4.9ft	lb					*13380	9280	*10320	6170	*7560	5290	(21.9)
0.0m	kg			*6160	*6160	*6690	4070	*4950	2730	*3910	2470	6.47
0.0ft	lb			*13580	*13580	*14750	8970	*10910	6020	*8620	5450	(21.2)
-1.5m	kg	*5500	*5500	*9870	7550	*6630	4040			*4820	2810	5.88
-4.9ft	lb	*12130	*12130	*21760	16640	*14620	8910			*10630	6190	(19.3)
-3.0m	kg			*8230	7700	*5470	4130			*5000	3830	4.75
-9.8ft	lb			*18140	16980	*12060	9110			*11020	8440	(15.6)

Unit: mm

	Mode	Boom	Boom	Arm	Counterweight	Shoe	Doze	er	Outrigg	ger
	ivioue	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
ĺ	HX140 LC	Mono	4600	2100	2000	600	Up	-	-	-



				l	_ift-point	radius (B)				At	max. re	each
Lift-po		1.5 m	(4.9 ft)	3.0 m	(9.8 ft)	4.5 m (	(14.8 ft)	6.0 m (	19.7 ft)	Cap	acity	Reach
height	(A)	<b>U</b>	#	ŀ	#	ŀ	#	·		ŀ	#	m (ft)
6.0m	kg					*3910	*3910			*3470	*3470	4.97
19.7ft	lb					*8620	*8620			*7650	*7650	(16.3)
4.5m	kg					*4120	*4120			*3210	2730	5.99
14.8ft	lb					*9080	*9080			*7080	6020	(19.7)
3.0m	kg			*7310	*7310	*5030	4090	3760	2670	*3220	2350	6.52
9.8ft	lb			*16120	*16120	*11090	9020	8290	5890	*7100	5180	(21.4)
1.5m	kg					5670	3870	3660	2590	3130	2220	6.67
4.9ft	lb					12500	8530	8070	5710	6900	4890	(21.9)
0.0m	kg			*6160	*6160	5510	3740	3590	2520	3230	2280	6.47
0.0ft	lb			*13580	*13580	12150	8250	7910	5560	7120	5030	(21.2)
-1.5m	kg	*5500	*5500	*9870	6820	5480	3710			3700	2590	5.88
-4.9ft	lb	*12130	*12130	*21760	15040	12080	8180			8160	5710	(19.3)
-3.0m	kg			*8230	6960	*5470	3790			*5000	3530	4.75
-9.8ft	lb			*18140	15340	*12060	8360			*11020	7780	(15.6)

Model	Boom	Boom	Arm	Counterweight	Shoe	Doze	er	Outrigger	
Iviodei	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX140 LC	Mono	4600	2100	2000	600	-	-	-	-

: Rating over-front  $\cdot$  : Rating over-side or 360 degree



				I	_ift-point	radius (B)				At	max. re	each
Lift-po		1.5 m	(4.9 ft)	3.0 m	(9.8 ft)	4.5 m (	14.8 ft)	6.0 m (	19.7 ft)	Cap	acity	Reach
height	(A)	Ů	#	·	#	ŀ	#	·		ŀ	#	m (ft)
6.0m	kg					*3910	*3910			*3470	*3470	4.97
19.7ft	lb					*8620	*8620			*7650	*7650	(16.3)
4.5m	kg					*4120	4090			*3210	2580	5.99
14.8ft	lb					*9080	9020			*7080	5690	(19.7)
3.0m	kg			*7310	7220	*5030	3890	3760	2530	*3220	2220	6.52
9.8ft	lb			*16120	15920	*11090	8580	8290	5580	*7100	4890	(21.4)
1.5m	kg					5670	3670	3660	2440	3130	2100	6.67
4.9ft	lb					12500	8090	8070	5380	6900	4630	(21.9)
0.0m	kg			*6160	*6160	5520	3530	3600	2380	3230	2150	6.47
0.0ft	lb			*13580	*13580	12170	7780	7940	5250	7120	4740	(21.2)
-1.5m	kg	*5500	*5500	*9870	6460	5480	3500			3700	2450	5.88
-4.9ft	lb	*12130	*12130	*21760	14240	12080	7720			8160	5400	(19.3)
-3.0m	kg			*8230	6600	*5470	3590			*5000	3340	4.75
-9.8ft	lb			*18140	14550	*12060	7910			*11020	7360	(15.6)

Unit: mm

Ī	Model	Boom	Boom	Arm	Counterweight	Shoe	Doze	er	Outrigo	ger
	Model	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
Ī	HX140 LC	Mono	4600	2100	2300	600	Down	-	-	-



				I	_ift-point	radius (B)				At	max. re	each
Lift-po		1.5 m	(4.9 ft)	3.0 m	(9.8 ft)	4.5 m (	14.8 ft)	6.0 m (	19.7 ft)	Сар	acity	Reach
height	(A)	Ů	#	ŀ	#	ŀ	#	Ů		ŀ	#	m (ft)
6.0m	kg					*3910	*3910			*3470	*3470	4.97
19.7ft	lb					*8620	*8620			*7650	*7650	(16.3)
4.5m	kg					*4120	*4120			*3210	3090	5.99
14.8ft	lb					*9080	*9080			*7080	6810	(19.7)
3.0m	kg			*7310	*7310	*5030	4650	*4280	3040	*3220	2670	6.52
9.8ft	lb			*16120	*16120	*11090	10250	*9440	6700	*7100	5890	(21.4)
1.5m	kg					*6070	4430	*4680	2950	*3430	2530	6.67
4.9ft	lb					*13380	9770	*10320	6500	*7560	5580	(21.9)
0.0m	kg			*6160	*6160	*6690	4290	*4950	2890	*3910	2610	6.47
0.0ft	lb			*13580	*13580	*14750	9460	*10910	6370	*8620	5750	(21.2)
-1.5m	kg	*5500	*5500	*9870	7950	*6630	4260			*4820	2970	5.88
-4.9ft	lb	*12130	*12130	*21760	17530	*14620	9390			*10630	6550	(19.3)
-3.0m	kg			*8230	8100	*5470	4350			*5000	4040	4.75
-9.8ft	lb			*18140	17860	*12060	9590			*11020	8910	(15.6)

Model	Boom	Boom	Arm	Counterweight	Shoe	Dozer		Outrigger	
Model	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX140 LC	Mono	4600	2100	2300	600	Up	-	-	-

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



				I	Lift-point	radius (B)				At	max. re	each
Lift-po		1.5 m	(4.9 ft)	3.0 m	(9.8 ft)	4.5 m (	14.8 ft)	6.0 m (	19.7 ft)	Cap	acity	Reach
height	(A)	<b>U</b>	#	·	#	Ů	#	·		ŀ	#	m (ft)
6.0m	kg					*3910	*3910			*3470	*3470	4.97
19.7ft	lb					*8620	*8620			*7650	*7650	(16.3)
4.5m	kg					*4120	*4120			*3210	2870	5.99
14.8ft	lb					*9080	*9080			*7080	6330	(19.7)
3.0m	kg			*7310	*7310	*5030	4300	3940	2820	*3220	2480	6.52
9.8ft	lb			*16120	*16120	*11090	9480	8690	6220	*7100	5470	(21.4)
1.5m	kg					5940	4080	3840	2730	3290	2350	6.67
4.9ft	lb					13100	8990	8470	6020	7250	5180	(21.9)
0.0m	kg			*6160	*6160	5780	3950	3780	2670	3400	2410	6.47
0.0ft	lb			*13580	*13580	12740	8710	8330	5890	7500	5310	(21.2)
-1.5m	kg	*5500	*5500	*9870	7200	5750	3920			3890	2740	5.88
-4.9ft	lb	*12130	*12130	*21760	15870	12680	8640			8580	6040	(19.3)
-3.0m	kg			*8230	7340	*5470	4000			*5000	3730	4.75
-9.8ft	lb			*18140	16180	*12060	8820			*11020	8220	(15.6)

Unit: mm

Mode	Boom	Boom	Arm	Counterweight	Shoe	Doze	er	Outrigo	ger
Mode	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX140 LC	Mono	4600	2100	2300	600	-	-	-	-



				I	_ift-point	radius (B)				At	max. re	each
Lift-po		1.5 m	(4.9 ft)	3.0 m	(9.8 ft)	4.5 m (	(14.8 ft)	6.0 m (	19.7 ft)	Сар	acity	Reach
height	(A)	<b>U</b>	#	ŀ	#	·	#	·		ŀ		m (ft)
6.0m	kg					*3910	*3910			*3470	*3470	4.97
19.7ft	lb					*8620	*8620			*7650	*7650	(16.3)
4.5m	kg					*4120	*4120			*3210	2730	5.99
14.8ft	lb					*9080	*9080			*7080	6020	(19.7)
3.0m	kg			*7310	*7310	*5030	4100	3940	2680	*3220	2350	6.52
9.8ft	lb			*16120	*16120	*11090	9040	8690	5910	*7100	5180	(21.4)
1.5m	kg					5940	3880	3850	2590	3290	2220	6.67
4.9ft	lb					13100	8550	8490	5710	7250	4890	(21.9)
0.0m	kg			*6160	*6160	5790	3740	3780	2530	3400	2290	6.47
0.0ft	lb			*13580	*13580	12760	8250	8330	5580	7500	5050	(21.2)
-1.5m	kg	*5500	*5500	*9870	6840	5750	3710			3890	2600	5.88
-4.9ft	lb	*12130	*12130	*21760	15080	12680	8180			8580	5730	(19.3)
-3.0m	kg			*8230	6980	*5470	3800			*5000	3540	4.75
-9.8ft	lb			*18140	15390	*12060	8380			*11020	7800	(15.6)

Model	Boom	Boom	Arm	Counterweight	Counterweight Shoe		er	Outrigger	
Model	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX140 LC	Mono	4600	2500	2000	600	Down	-	-	-

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



				I	Lift-point	radius (B)				At	max. re	each
Lift-po		1.5 m	(4.9 ft)	3.0 m	(9.8 ft)	4.5 m (	14.8 ft)	6.0 m (	19.7 ft)	Cap	acity	Reach
height	(A)	r de	#	ŀ	#	ŀ	#	·		ŀ	#	m (ft)
6.0m	kg					*3400	*3400			*2390	*2390	5.50
19.7ft	lb					*7500	*7500			*5270	*5270	(18.0)
4.5m	kg					*3700	*3700	*3500	2960	*2210	*2210	6.44
14.8ft	lb					*8160	*8160	*7720	6530	*4870	*4870	(21.1)
3.0m	kg			*6380	*6380	*4630	4470	*4000	2890	*2200	*2200	6.93
9.8ft	lb			*14070	*14070	*10210	9850	*8820	6370	*4850	*4850	(22.7)
1.5m	kg			*7050	*7050	*5760	4220	*4480	2790	*2320	2190	7.07
4.9ft	lb			*15540	*15540	*12700	9300	*9880	6150	*5110	4830	(23.2)
0.0m	kg			*6550	*6550	*6530	4050	*4850	2710	*2590	2240	6.88
0.0ft	lb			*14440	*14440	*14400	8930	*10690	5970	*5710	4940	(22.6)
-1.5m	kg	*4890	*4890	*10080	7460	*6670	3990	*4820	2680	*3160	2500	6.34
-4.9ft	lb	*10780	*10780	*22220	16450	*14700	8800	*10630	5910	*6970	5510	(20.8)
-3.0m	kg	*9020	*9020	*8820	7580	*5920	4040			*4580	3230	5.31
-9.8ft	lb	*19890	*19890	*19440	16710	*13050	8910			*10100	7120	(17.4)

Unit: mm

	Model	Boom	Boom	Arm	Counterweight	Shoe	Doze	er	Outrigo	ger
	Model	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
Ī	HX140 LC	Mono	4600	2500	2000	600	Up	-	-	-



				I	_ift-point	radius (B)	)			At	max. re	each
Lift-po		1.5 m	(4.9 ft)	3.0 m	(9.8 ft)	4.5 m (	(14.8 ft)	6.0 m (	19.7 ft)	Сар	acity	Reach
height	(A)	Ů	#	ŀ	#	Ů	#	·		ŀ		m (ft)
6.0m	kg					*3400	*3400			*2390	*2390	5.50
19.7ft	lb					*7500	*7500			*5270	*5270	(18.0)
4.5m	kg					*3700	*3700	*3500	2750	*2210	*2210	6.44
14.8ft	lb					*8160	*8160	*7720	6060	*4870	*4870	(21.1)
3.0m	kg			*6380	*6380	*4630	4130	3770	2680	*2200	2130	6.93
9.8ft	lb			*14070	*14070	*10210	9110	8310	5910	*4850	4700	(22.7)
1.5m	kg			*7050	7030	5690	3880	3660	2580	*2320	2020	7.07
4.9ft	lb			*15540	15500	12540	8550	8070	5690	*5110	4450	(23.2)
0.0m	kg			*6550	*6550	5500	3710	3570	2500	*2590	2070	6.88
0.0ft	lb			*14440	*14440	12130	8180	7870	5510	*5710	4560	(22.6)
-1.5m	kg	*4890	*4890	*10080	6730	5430	3660	3540	2470	*3160	2310	6.34
-4.9ft	lb	*10780	*10780	*22220	14840	11970	8070	7800	5450	*6970	5090	(20.8)
-3.0m	kg	*9020	*9020	*8820	6840	5490	3710			4300	2980	5.31
-9.8ft	lb	*19890	*19890	*19440	15080	12100	8180			9480	6570	(17.4)

Model	Boom	Boom	Arm	Counterweight	Shoe	Doze	er	Outrigo	ger
Model	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX140 LC	Mono	4600	2500	2300	600	Down	-	-	-

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



				ı	Lift-point	radius (B)				At	max. re	each
Lift-po		1.5 m	(4.9 ft)	3.0 m	(9.8 ft)	4.5 m (	(14.8 ft)	6.0 m (	19.7 ft)	Cap	acity	Reach
height	(A)	r de	#	·	#	Ů	#	·		ŀ	#	m (ft)
6.0m	kg					*3400	*3400			*2390	*2390	5.50
19.7ft	lb					*7500	*7500			*5270	*5270	(18.0)
4.5m	kg					*3700	*3700	*3500	3110	*2210	*2210	6.44
14.8ft	lb					*8160	*8160	*7720	6860	*4870	*4870	(21.1)
3.0m	kg			*6380	*6380	*4630	*4630	*4000	3040	*2200	*2200	6.93
9.8ft	lb			*14070	*14070	*10210	*10210	*8820	6700	*4850	*4850	(22.7)
1.5m	kg			*7050	*7050	*5760	4440	*4480	2940	*2320	2310	7.07
4.9ft	lb			*15540	*15540	*12700	9790	*9880	6480	*5110	5090	(23.2)
0.0m	kg			*6550	*6550	*6530	4270	*4850	2860	*2590	2370	6.88
0.0ft	lb			*14440	*14440	*14400	9410	*10690	6310	*5710	5220	(22.6)
-1.5m	kg	*4890	*4890	*10080	7860	*6670	4210	*4820	2830	*3160	2640	6.34
-4.9ft	lb	*10780	*10780	*22220	17330	*14700	9280	*10630	6240	*6970	5820	(20.8)
-3.0m	kg	*9020	*9020	*8820	7980	*5920	4260			*4580	3410	5.31
-9.8ft	lb	*19890	*19890	*19440	17590	*13050	9390			*10100	7520	(17.4)

Unit: mm

Mode	Boom	Boom	Arm	Counterweight	Shoe	Doze	er	Outrigo	ger
ivioue	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX140 LC	Mono	4600	2500	2300	600	Up	-	-	-



				I	_ift-point	radius (B)				At	max. re	each
Lift-po		1.5 m	(4.9 ft)	3.0 m	(9.8 ft)	4.5 m (	(14.8 ft)	6.0 m (	19.7 ft)	Cap	acity	Reach
height	(A)	Ů	#	ŀ	#	ŀ	#	<b>U</b>		ŀ		m (ft)
6.0m	kg					*3400	*3400			*2390	*2390	5.50
19.7ft	lb					*7500	*7500			*5270	*5270	(18.0)
4.5m	kg					*3700	*3700	*3500	2890	*2210	*2210	6.44
14.8ft	lb					*8160	*8160	*7720	6370	*4870	*4870	(21.1)
3.0m	kg			*6380	*6380	*4630	4340	3950	2820	*2200	*2200	6.93
9.8ft	lb			*14070	*14070	*10210	9570	8710	6220	*4850	*4850	(22.7)
1.5m	kg			*7050	*7050	*5760	4090	3840	2720	*2320	2140	7.07
4.9ft	lb			*15540	*15540	*12700	9020	8470	6000	*5110	4720	(23.2)
0.0m	kg			*6550	*6550	5770	3930	3750	2640	*2590	2190	6.88
0.0ft	lb			*14440	*14440	12720	8660	8270	5820	*5710	4830	(22.6)
-1.5m	kg	*4890	*4890	*10080	7110	5700	3870	3720	2620	*3160	2440	6.34
-4.9ft	lb	*10780	*10780	*22220	15670	12570	8530	8200	5780	*6970	5380	(20.8)
-3.0m	kg	*9020	*9020	*8820	7220	5760	3920			4510	3150	5.31
-9.8ft	lb	*19890	*19890	*19440	15920	12700	8640			9940	6940	(17.4)

Model	Boom	Boom	Arm	Counterweight	Shoe	Doze	er	Outrigo	ger
Model	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX140 LC	Mono	4600	2500	2300	600	-	-	-	-

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



				I	_ift-point	radius (B)				At	max. re	each
Lift-po		1.5 m	(4.9 ft)	3.0 m	(9.8 ft)	4.5 m (	(14.8 ft)	6.0 m (	19.7 ft)	Сар	acity	Reach
height	(A)	<b>U</b>	#	·	#	ŀ	#	·		ŀ	#	m (ft)
6.0m	kg					*3400	*3400			*2390	*2390	5.50
19.7ft	lb					*7500	*7500			*5270	*5270	(18.0)
4.5m	kg					*3700	*3700	*3500	2750	*2210	*2210	6.44
14.8ft	lb					*8160	*8160	*7720	6060	*4870	*4870	(21.1)
3.0m	kg			*6380	*6380	*4630	4130	3950	2680	*2200	2130	6.93
9.8ft	lb			*14070	*14070	*10210	9110	8710	5910	*4850	4700	(22.7)
1.5m	kg			*7050	7050	*5760	3890	3840	2580	*2320	2020	7.07
4.9ft	lb			*15540	15540	*12700	8580	8470	5690	*5110	4450	(23.2)
0.0m	kg			*6550	*6550	5770	3720	3750	2500	*2590	2070	6.88
0.0ft	lb			*14440	*14440	12720	8200	8270	5510	*5710	4560	(22.6)
-1.5m	kg	*4890	*4890	*10080	6750	5700	3660	3730	2480	*3160	2310	6.34
-4.9ft	lb	*10780	*10780	*22220	14880	12570	8070	8220	5470	*6970	5090	(20.8)
-3.0m	kg	*9020	*9020	*8820	6860	5760	3710			4510	2980	5.31
-9.8ft	lb	*19890	*19890	*19440	15120	12700	8180			9940	6570	(17.4)

Unit: mm

Model	Boom	Boom	Arm	Counterweight	Shoe	Doze	er	Outrigo	ger
Iviouei	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX140 LC	Mono	4600	3000	2000	600	Down	-	-	-



				I	_ift-point	radius (B)				At	max. re	each
Lift-po		1.5 m	(4.9 ft)	3.0 m	(9.8 ft)	4.5 m (	(14.8 ft)	6.0 m (	19.7 ft)	Сар	acity	Reach
height	(A)	Ů		ŀ	#	ŀ	#	Ů		ŀ		m (ft)
6.0m	kg							*2230	*2230	*2000	*2000	6.08
19.7ft	lb							*4920	*4920	*4410	*4410	(20.0)
4.5m	kg							*3280	3000	*1880	*1880	6.94
14.8ft	lb							*7230	6610	*4140	*4140	(22.8)
3.0m	kg			*5250	*5250	*4130	*4130	*3670	2910	*1870	*1870	7.40
9.8ft	lb			*11570	*11570	*9110	*9110	*8090	6420	*4120	*4120	(24.3)
1.5m	kg			*8390	7960	*5340	4270	*4220	2800	*1970	*1970	7.53
4.9ft	lb			*18500	17550	*11770	9410	*9300	6170	*4340	*4340	(24.7)
0.0m	kg			*7180	*7180	*6290	4060	*4700	2700	*2180	2020	7.36
0.0ft	lb			*15830	*15830	*13870	8950	*10360	5950	*4810	4450	(24.1)
-1.5m	kg	*4370	*4370	*9280	7410	*6660	3960	*4860	2650	*2610	2220	6.85
-4.9ft	lb	*9630	*9630	*20460	16340	*14680	8730	*10710	5840	*5750	4890	(22.5)
-3.0m	kg	*7550	*7550	*9420	7480	*6270	3970			*3560	2740	5.91
-9.8ft	lb	*16640	*16640	*20770	16490	*13820	8750			*7850	6040	(19.4)

Model	Boom	Boom	Arm	Counterweight	Shoe	Shoe Dozer		Outrigo	ger
iviouei	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX140 LC	Mono	4600	3000	2000	600	Up	-	-	-

· Pating over-front · Rating over-side or 360 degree



				I	_ift-point	radius (B)	)			At	max. re	each
Lift-po		1.5 m	(4.9 ft)	3.0 m	(9.8 ft)	4.5 m (	(14.8 ft)	6.0 m (	19.7 ft)	Сар	acity	Reach
height	(A)	<b>U</b>	#	ŀ	#	Ů	#	·		ŀ		m (ft)
6.0m	kg							*2230	*2230	*2000	*2000	6.08
19.7ft	lb							*4920	*4920	*4410	*4410	(20.0)
4.5m	kg							*3280	2780	*1880	*1880	6.94
14.8ft	lb							*7230	6130	*4140	*4140	(22.8)
3.0m	kg			*5250	*5250	*4130	*4130	*3670	2700	*1870	*1870	7.40
9.8ft	lb			*11570	*11570	*9110	*9110	*8090	5950	*4120	*4120	(24.3)
1.5m	kg			*8390	7210	*5340	3930	3670	2580	*1970	1830	7.53
4.9ft	lb			*18500	15900	*11770	8660	8090	5690	*4340	4030	(24.7)
0.0m	kg			*7180	6780	5510	3720	3560	2490	*2180	1860	7.36
0.0ft	lb			*15830	14950	12150	8200	7850	5490	*4810	4100	(24.1)
-1.5m	kg	*4370	*4370	*9280	6680	5400	3630	3510	2440	*2610	2040	6.85
-4.9ft	lb	*9630	*9630	*20460	14730	11900	8000	7740	5380	*5750	4500	(22.5)
-3.0m	kg	*7550	*7550	*9420	6750	5420	3640			*3560	2520	5.91
-9.8ft	lb	*16640	*16640	*20770	14880	11950	8020			*7850	5560	(19.4)

Unit: mm

	Mode	Boom	Boom	Arm	Counterweight	Shoe	Doze	er	Outrigg	ger
	ivioue	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
ĺ	HX140 LC	Mono	4600	3000	2000	600	-	-	-	-



				I	Lift-point	radius (B)				At	max. re	each
Lift-po		1.5 m	(4.9 ft)	3.0 m	(9.8 ft)	4.5 m (	(14.8 ft)	6.0 m (	19.7 ft)	Сар	acity	Reach
height	(A)	<b>U</b>	#	ŀ	#	ŀ	#	·		ŀ	#	m (ft)
6.0m	kg							*2230	*2230	*2000	*2000	6.08
19.7ft	lb							*4920	*4920	*4410	*4410	(20.0)
4.5m	kg							*3280	2640	*1880	*1880	6.94
14.8ft	lb							*7230	5820	*4140	*4140	(22.8)
3.0m	kg			*5250	*5250	*4130	3990	*3670	2560	*1870	1810	7.40
9.8ft	lb			*11570	*11570	*9110	8800	*8090	5640	*4120	3990	(24.3)
1.5m	kg			*8390	6840	*5340	3720	3670	2440	*1970	1720	7.53
4.9ft	lb			*18500	15080	*11770	8200	8090	5380	*4340	3790	(24.7)
0.0m	kg			*7180	6420	5510	3520	3560	2340	*2180	1750	7.36
0.0ft	lb			*15830	14150	12150	7760	7850	5160	*4810	3860	(24.1)
-1.5m	kg	*4370	*4370	*9280	6320	5400	3430	3510	2290	*2610	1920	6.85
-4.9ft	lb	*9630	*9630	*20460	13930	11900	7560	7740	5050	*5750	4230	(22.5)
-3.0m	kg	*7550	*7550	*9420	6380	5420	3440			*3560	2380	5.91
-9.8ft	lb	*16640	*16640	*20770	14070	11950	7580			*7850	5250	(19.4)

Model	Boom	Boom	Arm	Counterweight	Shoe	Doze	er	Outrigo	ger
Model	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX140 LC	Mono	4600	3000	2300	600	Down	-	-	-

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



				I	_ift-point ı	radius (B)				At	max. re	each
Lift-po		1.5 m	(4.9 ft)	3.0 m	(9.8 ft)	4.5 m (	(14.8 ft)	6.0 m (	19.7 ft)	Сар	acity	Reach
height	(A)	Ů	#	ŀ	#	·	#	ŀ		U	#	m (ft)
6.0m	kg							*2230	*2230	*2000	*2000	6.08
19.7ft	lb							*4920	*4920	*4410	*4410	(20.0)
4.5m	kg							*3280	3150	*1880	*1880	6.94
14.8ft	lb							*7230	6940	*4140	*4140	(22.8)
3.0m	kg			*5250	*5250	*4130	*4130	*3670	3060	*1870	*1870	7.40
9.8ft	lb			*11570	*11570	*9110	*9110	*8090	6750	*4120	*4120	(24.3)
1.5m	kg			*8390	8360	*5340	4490	*4220	2950	*1970	*1970	7.53
4.9ft	lb			*18500	18430	*11770	9900	*9300	6500	*4340	*4340	(24.7)
0.0m	kg			*7180	*7180	*6290	4280	*4700	2850	*2180	2140	7.36
0.0ft	lb			*15830	*15830	*13870	9440	*10360	6280	*4810	4720	(24.1)
-1.5m	kg	*4370	*4370	*9280	7810	*6660	4180	*4860	2800	*2610	2350	6.85
-4.9ft	lb	*9630	*9630	*20460	17220	*14680	9220	*10710	6170	*5750	5180	(22.5)
-3.0m	kg	*7550	*7550	*9420	7880	*6270	4190			*3560	2890	5.91
-9.8ft	lb	*16640	*16640	*20770	17370	*13820	9240			*7850	6370	(19.4)

Unit: mm

	Model	Boom	Boom	Arm	Counterweight	Shoe	Doze	er	Outrigo	ger
	Model	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
ĺ	HX140 LC	Mono	4600	3000	2300	600	Up	-	-	-



				I	_ift-point	radius (B)				At	max. re	each
Lift-po		1.5 m	(4.9 ft)	3.0 m	(9.8 ft)	4.5 m (	(14.8 ft)	6.0 m (	19.7 ft)	Сар	acity	Reach
height	(A)	Ů	#	ŀ	#	ŀ	#	·		ŀ		m (ft)
6.0m	kg							*2230	*2230	*2000	*2000	6.08
19.7ft	lb							*4920	*4920	*4410	*4410	(20.0)
4.5m	kg							*3280	2930	*1880	*1880	6.94
14.8ft	lb							*7230	6460	*4140	*4140	(22.8)
3.0m	kg			*5250	*5250	*4130	*4130	*3670	2840	*1870	*1870	7.40
9.8ft	lb			*11570	*11570	*9110	*9110	*8090	6260	*4120	*4120	(24.3)
1.5m	kg			*8390	7580	*5340	4140	3850	2730	*1970	1940	7.53
4.9ft	lb			*18500	16710	*11770	9130	8490	6020	*4340	4280	(24.7)
0.0m	kg			*7180	7160	5780	3930	3740	2630	*2180	1970	7.36
0.0ft	lb			*15830	15790	12740	8660	8250	5800	*4810	4340	(24.1)
-1.5m	kg	*4370	*4370	*9280	7060	5670	3840	3690	2580	*2610	2170	6.85
-4.9ft	lb	*9630	*9630	*20460	15560	12500	8470	8140	5690	*5750	4780	(22.5)
-3.0m	kg	*7550	*7550	*9420	7120	5690	3850			*3560	2670	5.91
-9.8ft	lb	*16640	*16640	*20770	15700	12540	8490			*7850	5890	(19.4)

	Model	Boom	Boom	Arm	Counterweight	Shoe	Doze	er	Outrigg	ger
	Model	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
ĺ	HX140 LC	Mono	4600	3000	2300	600	-	-	-	-



				I	_ift-point	radius (B)				At	max. re	each
Lift-po		1.5 m	(4.9 ft)	3.0 m	(9.8 ft)	4.5 m (	(14.8 ft)	6.0 m (	19.7 ft)	Cap	acity	Reach
height	(A)	·	#	·	#	Ů	#	·		Ů		m (ft)
6.0m	kg							*2230	*2230	*2000	*2000	6.08
19.7ft	lb							*4920	*4920	*4410	*4410	(20.0)
4.5m	kg							*3280	2790	*1880	*1880	6.94
14.8ft	lb							*7230	6150	*4140	*4140	(22.8)
3.0m	kg			*5250	*5250	*4130	*4130	*3670	2700	*1870	*1870	7.40
9.8ft	lb			*11570	*11570	*9110	*9110	*8090	5950	*4120	*4120	(24.3)
1.5m	kg			*8390	7220	*5340	3930	3850	2590	*1970	1830	7.53
4.9ft	lb			*18500	15920	*11770	8660	8490	5710	*4340	4030	(24.7)
0.0m	kg			*7180	6800	5780	3730	3740	2490	*2180	1860	7.36
0.0ft	lb			*15830	14990	12740	8220	8250	5490	*4810	4100	(24.1)
-1.5m	kg	*4370	*4370	*9280	6690	5680	3640	3690	2440	*2610	2050	6.85
-4.9ft	lb	*9630	*9630	*20460	14750	12520	8020	8140	5380	*5750	4520	(22.5)
-3.0m	kg	*7550	*7550	*9420	6760	5690	3650			*3560	2530	5.91
-9.8ft	lb	*16640	*16640	*20770	14900	12540	8050			*7850	5580	(19.4)

Model	Boom	Boom	Arm	Counterweight	Shoe	Doze	er	Outrigo	ger
iviouei	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX140 LC	Mono	4600	3000	2000	700	-	-	-	-



					L	ift-point	radius (E	3)				At r	nax. re	ach
Lift-po		1.5 m	(4.9 ft)	3.0 m	(9.8 ft)	4.5 m (	14.8 ft)	6.0 m (	(19.7 ft)	7.5 m (	24.6 ft)	Сар	acity	Reach
height	(A)	·	#	·	#	·	#	·	#	ŀ		ŀ	#	m (ft)
7.5m	kg					*2430	*2430					*2410	*2410	4.51
24.6ft	lb					*5360	*5360					*5310	*5310	(14.8)
6.0m	kg							*2110	*2110			*2010	*2010	6.04
19.7ft	lb							*4650	*4650			*4430	*4430	(19.8)
4.5m	kg							*3260	2720			*1880	*1880	6.92
14.8ft	lb							*7190	6000			*4140	*4140	(22.7)
3.0m	kg					*4070	*4070	*3640	2630			*1870	1870	7.39
9.8ft	lb					*8970	*8970	*8020	5800			*4120	4120	(24.2)
1.5m	kg			*8250	7050	*5280	3830	3850	2510	*2120	1780	*1960	1770	7.53
4.9ft	lb			*18190	15540	*11640	8440	8490	5530	*4670	3920	*4320	3900	(24.7)
0.0m	kg			*7160	6590	5770	3620	3730	2410			*2170	1790	7.37
0.0ft	lb			*15790	14530	12720	7980	8220	5310			*4780	3950	(24.2)
-1.5m	kg	*4260	*4260	*9140	6470	5660	3510	3680	2350			*2580	1960	6.87
-4.9ft	lb	*9390	*9390	*20150	14260	12480	7740	8110	5180			*5690	4320	(22.6)
-3.0m	kg	*7390	*7390	*9440	6530	5660	3520					*3500	2410	5.96
-9.8ft	lb	*16290	*16290	*20810	14400	12480	7760					*7720	5310	(19.6)
-4.5m	kg			*7080	6760							*4500	3830	4.38
-14.8ft	lb			*15610	14900							*9920	8440	(14.4)

Model	Boom	Boom	Arm	Counterweight	Shoe	Doze	er	Outrigo	ger
Model	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX140 LC	Mono	4600	3000	2000	700	down	-	-	-



					L	ift-point	radius (I	3)				At r	nax. re	each
Lift-po		1.5 m	(4.9 ft)	3.0 m	(9.8 ft)	4.5 m (	(14.8 ft)	6.0 m (	(19.7 ft)	7.5 m (	24.6 ft)	Cap	acity	Reach
height	(A)	·	#	ŀ	#	·	#	·	#	·	#	·	#	m (ft)
7.5m	kg					*2430	*2430					*2410	*2410	4.51
24.6ft	lb					*5360	*5360					*5310	*5310	(14.8)
6.0m	kg							*2110	*2110			*2010	*2010	6.04
19.7ft	lb							*4650	*4650			*4430	*4430	(19.8)
4.5m	kg							*3260	3020			*1880	*1880	6.92
14.8ft	lb							*7190	6660			*4140	*4140	(22.7)
3.0m	kg					*4070	*4070	*3640	2940			*1870	*1870	7.39
9.8ft	lb					*8970	*8970	*8020	6480			*4120	*4120	(24.2)
1.5m	kg			*8250	8030	*5280	4300	*4180	2820	*2120	2010	*1960	*1960	7.53
4.9ft	lb			*18190	17700	*11640	9480	*9220	6220	*4670	4430	*4320	*4320	(24.7)
0.0m	kg			*7160	*7160	*6240	4080	*4660	2710			*2170	2020	7.37
0.0ft	lb			*15790	*15790	*13760	8990	*10270	5970			*4780	4450	(24.2)
-1.5m	kg	*4260	*4260	*9140	7430	*6630	3980	*4850	2660			*2580	2210	6.87
-4.9ft	lb	*9390	*9390	*20150	16380	*14620	8770	*10690	5860			*5690	4870	(22.6)
-3.0m	kg	*7390	*7390	*9440	7490	*6280	3980					*3500	2710	5.96
-9.8ft	lb	*16290	*16290	*20810	16510	*13850	8770					*7720	5970	(19.6)
-4.5m	kg			*7080	*7080							*4500	4320	4.38
-14.8ft	lb			*15610	*15610							*9920	9520	(14.4)

	Model	Boom	Boom	Arm	Counterweight	Shoe	Doze	er	Outrigo	ger
	Model	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
ĺ	HX140 LC	Mono	4600	3000	2000	700	Up	-	-	-



					L	ift-point	radius (I	3)				At r	nax. re	each
Lift-po		1.5 m	(4.9 ft)	3.0 m	(9.8 ft)	4.5 m (	(14.8 ft)	6.0 m	(19.7 ft)	7.5 m (	24.6 ft)	Сар	acity	Reach
height	(A)		#	ŀ	#		#		#	l l			#	m (ft)
7.5m	kg					*2430	*2430					*2410	*2410	4.51
24.6ft	lb					*5360	*5360					*5310	*5310	(14.8)
6.0m	kg							*2110	*2110			*2010	*2010	6.04
19.7ft	lb							*4650	*4650			*4430	*4430	(19.8)
4.5m	kg							*3260	2810			*1880	*1880	6.92
14.8ft	lb							*7190	6190			*4140	*4140	(22.7)
3.0m	kg					*4070	*4070	*3640	2720			*1870	*1870	7.39
9.8ft	lb					*8970	*8970	*8020	6000			*4120	*4120	(24.2)
1.5m	kg			*8250	7280	*5280	3960	3800	2600	*2120	1850	*1960	1840	7.53
4.9ft	lb			*18190	16050	*11640	8730	8380	5730	*4670	4080	*4320	4060	(24.7)
0.0m	kg			*7160	6820	5700	3740	3690	2500			*2170	1860	7.37
0.0ft	lb			*15790	15040	12570	8250	8140	5510			*4780	4100	(24.2)
-1.5m	kg	*4260	*4260	*9140	6700	5590	3640	3630	2440			*2580	2040	6.87
-4.9ft	lb	*9390	*9390	*20150	14770	12320	8020	8000	5380			*5690	4500	(22.6)
-3.0m	kg	*7390	*7390	*9440	6760	5590	3650					*3500	2500	5.96
-9.8ft	lb	*16290	*16290	*20810	14900	12320	8050					*7720	5510	(19.6)
-4.5m	kg			*7080	6990							*4500	3970	4.38
-14.8ft	lb			*15610	15410							*9920	8750	(14.4)

### 2) 4.1 m (13' 5") MONO BOOM

Model	Boom	Boom	Arm	Counterweight	Shoe	Doze	er	Outrigo	ger
iviodei	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX140 LC	Mono	4100	1900	2000	600	Down	-	-	-

: Rating over-front

· 🖶 : Rating over-side or 360 degree



Unit: mm

				I	_ift-point	radius (B)				At	max. re	each
Lift-po		1.5 m	(4.9 ft)	3.0 m	(9.8 ft)	4.5 m (	(14.8 ft)	6.0 m (	19.7 ft)	Сар	acity	Reach
height	(A)	<b>U</b>	#	·	#	·	#	·		ŀ	#	m (ft)
6.0m	kg									*3500	*3500	4.01
19.7ft	lb									*7720	*7720	(13.2)
4.5m	kg					*4620	*4620			*3070	*3070	5.24
14.8ft	lb					*10190	*10190			*6770	*6770	(17.2)
3.0m	kg			*7190	*7190	*5320	4510			*3020	*3020	5.83
9.8ft	lb			*15850	*15850	*11730	9940			*6660	*6660	(19.1)
1.5m	kg			*9910	7970	*6300	4320	*3230	2860	*3220	2860	6.00
4.9ft	lb			*21850	17570	*13890	9520	*7120	6310	*7100	6310	(19.7)
0.0m	kg			*10670	7760	*6870	4200			*3720	2970	5.78
0.0ft	lb			*23520	17110	*15150	9260			*8200	6550	(19.0)
-1.5m	kg	*8110	*8110	*9920	7780	*6560	4180			*4950	3530	5.11
-4.9ft	lb	*17880	*17880	*21870	17150	*14460	9220			*10910	7780	(16.7)
-3.0m	kg			*7310	*7310					*5520	*5520	3.75
-9.8ft	lb			*16120	*16120					*12170	*12170	(12.3)

#### Note

- 1. Lifting capacity are based on SAE J1097 and ISO 10567.
- 2. Lifting capacity of the ROBEX series does not exceed 75% of tipping load with the machine on firm, level ground or 87% of full hydraulic capacity.
- 3. The lift-point is bucket pivot mounting pin on the arm (without bucket mass).
- 4. \*indicates load limited by hydraulic capacity.
- \* Lifting capacities are based upon a standard machine conditions.

Lifting capacities will vary with different work tools, ground conditions and attachments.

The difference between the weight of a work tool attachment must be subtracted.

Consult your HD Hyundai Construction Equipment dealer regarding the lifting capacities for specific work tools and attachments.

 $\pmb{\triangle}$  Failure to comply to the rated load can cause possible personal injury or property damage.

Make adjustments to the rated load as necessary for non-standard configurations.

Model	Boom	Boom	Arm	Counterweight	Shoe	Doze	er	Outrigo	ger
Model	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX140 LC	Mono	4100	1900	2000	600	Up	-	-	-

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



				I	Lift-point	radius (B)				At	max. re	each
Lift-po		1.5 m	(4.9 ft)	3.0 m	(9.8 ft)	4.5 m (	14.8 ft)	6.0 m (	19.7 ft)	Cap	acity	Reach
height	(A)	Ů	#	ŀ	#	·	#	·		ŀ	#	m (ft)
6.0m	kg									*3500	*3500	4.01
19.7ft	lb									*7720	*7720	(13.2)
4.5m	kg					*4620	4310			*3070	*3070	5.24
14.8ft	lb					*10190	9500			*6770	*6770	(17.2)
3.0m	kg			*7190	*7190	*5320	4170			*3020	2810	5.83
9.8ft	lb			*15850	*15850	*11730	9190			*6660	6190	(19.1)
1.5m	kg			*9910	7230	5790	3980	*3230	2650	*3220	2650	6.00
4.9ft	lb			*21850	15940	12760	8770	*7120	5840	*7100	5840	(19.7)
0.0m	kg			*10670	7030	5650	3860			*3720	2750	5.78
0.0ft	lb			*23520	15500	12460	8510			*8200	6060	(19.0)
-1.5m	kg	*8110	*8110	*9920	7040	5630	3850			4670	3260	5.11
-4.9ft	lb	*17880	*17880	*21870	15520	12410	8490			10300	7190	(16.7)
-3.0m	kg			*7310	7230					*5520	5160	3.75
-9.8ft	lb			*16120	15940					*12170	11380	(12.3)

Unit: mm

	Model	Boom	Boom	Arm	Counterweight	Shoe	Doze	er	Outrigg	ger
	Model	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
ĺ	HX140 LC	Mono	4100	1900	2000	600	-	-	-	-



				I	_ift-point	radius (B)				At	max. re	each
Lift-po		1.5 m	(4.9 ft)	3.0 m	(9.8 ft)	4.5 m (	14.8 ft)	6.0 m (	19.7 ft)	Сар	acity	Reach
height	(A)	Ů	#	ŀ	#	·	#*	·		ŀ	#	m (ft)
6.0m	kg									*3500	*3500	4.01
19.7ft	lb									*7720	*7720	(13.2)
4.5m	kg					*4620	4100			*3070	*3070	5.24
14.8ft	lb					*10190	9040			*6770	*6770	(17.2)
3.0m	kg			*7190	*7190	*5320	3960			*3020	2670	5.83
9.8ft	lb			*15850	*15850	*11730	8730			*6660	5890	(19.1)
1.5m	kg			*9910	6870	5790	3780	*3230	2510	*3220	2500	6.00
4.9ft	lb			*21850	15150	12760	8330	*7120	5530	*7100	5510	(19.7)
0.0m	kg			*10670	6660	5650	3660			*3720	2600	5.78
0.0ft	lb			*23520	14680	12460	8070			*8200	5730	(19.0)
-1.5m	kg	*8110	*8110	*9920	6680	5640	3640			4670	3080	5.11
-4.9ft	lb	*17880	*17880	*21870	14730	12430	8020			10300	6790	(16.7)
-3.0m	kg			*7310	6860					*5520	4900	3.75
-9.8ft	lb			*16120	15120					*12170	10800	(12.3)

Model	Boom	Boom	Arm	Counterweight	Shoe	Doze	er	Outrigo	ger
Model	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX140 LC	Mono	4100	2100	2000	600	Down	-	-	-

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



				I	_ift-point	radius (B)				At	max. re	each
Lift-po		1.5 m	(4.9 ft)	3.0 m	(9.8 ft)	4.5 m (	(14.8 ft)	6.0 m (	19.7 ft)	Cap	acity	Reach
height	(A)	Ů	#	·	#	·	#	·		<b>U</b>	#	m (ft)
6.0m	kg									*3360	*3360	4.26
19.7ft	lb									*7410	*7410	(14.0)
4.5m	kg					*4370	*4370			*2990	*2990	5.43
14.8ft	lb					*9630	*9630			*6590	*6590	(17.8)
3.0m	kg			*6740	*6740	*5110	4520	*3030	2910	*2960	2900	6.01
9.8ft	lb			*14860	*14860	*11270	9960	*6680	6420	*6530	6390	(19.7)
1.5m	kg			*9580	8000	*6140	4320	*4480	2850	*3160	2730	6.17
4.9ft	lb			*21120	17640	*13540	9520	*9880	6280	*6970	6020	(20.2)
0.0m	kg			*10620	7730	*6800	4180			*3650	2830	5.95
0.0ft	lb			*23410	17040	*14990	9220			*8050	6240	(19.5)
-1.5m	kg	*7660	*7660	*10090	7720	*6650	4150			*4800	3320	5.30
-4.9ft	lb	*16890	*16890	*22240	17020	*14660	9150			*10580	7320	(17.4)
-3.0m	kg			*7830	*7830					*5510	5020	4.02
-9.8ft	lb			*17260	*17260					*12150	11070	(13.2)

Unit: mm

	Mode	Boom	Boom	Arm	Counterweight	Shoe	Doze	er	Outrigo	ger
	ivioue	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
Ī	HX140 LC	Mono	4100	2100	2000	600	Up	-	-	-

· Pating over-front · Pating over-side or 360 degree · Rating over-side or 360 degree



				I	Lift-point	radius (B)				At	max. re	each
Lift-po		1.5 m	(4.9 ft)	3.0 m	(9.8 ft)	4.5 m (	(14.8 ft)	6.0 m (	19.7 ft)	Сар	acity	Reach
height	(A)	<b>U</b>	#	ŀ	#	Ů	#	<b>U</b>		ŀ		m (ft)
6.0m	kg									*3360	*3360	4.26
19.7ft	lb									*7410	*7410	(14.0)
4.5m	kg					*4370	4320			*2990	*2990	5.43
14.8ft	lb					*9630	9520			*6590	*6590	(17.8)
3.0m	kg			*6740	*6740	*5110	4170	*3030	2700	*2960	2690	6.01
9.8ft	lb			*14860	*14860	*11270	9190	*6680	5950	*6530	5930	(19.7)
1.5m	kg			*9580	7250	5790	3980	3720	2640	*3160	2530	6.17
4.9ft	lb			*21120	15980	12760	8770	8200	5820	*6970	5580	(20.2)
0.0m	kg			*10620	7000	5630	3840			*3650	2620	5.95
0.0ft	lb			*23410	15430	12410	8470			*8050	5780	(19.5)
-1.5m	kg	*7660	*7660	*10090	6990	5600	3810			4390	3060	5.30
-4.9ft	lb	*16890	*16890	*22240	15410	12350	8400			9680	6750	(17.4)
-3.0m	kg			*7830	7150					*5510	4610	4.02
-9.8ft	lb			*17260	15760					*12150	10160	(13.2)

Model	Boom	Boom	Arm	Counterweight	Shoe	Doze	er	Outrigo	ger
Model	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX140 LC	Mono	4100	2100	2000	600	-	-	-	-



				I	Lift-point	radius (B)				At	max. re	each
Lift-po		1.5 m	(4.9 ft)	3.0 m	(9.8 ft)	4.5 m (	(14.8 ft)	6.0 m (	19.7 ft)	Cap	acity	Reach
height	(A)	r de	#	Ů	#	Ů	#	Ů		ŀ		m (ft)
6.0m	kg									*3360	*3360	4.26
19.7ft	lb									*7410	*7410	(14.0)
4.5m	kg					*4370	4120			*2990	*2990	5.43
14.8ft	lb					*9630	9080			*6590	*6590	(17.8)
3.0m	kg			*6740	*6740	*5110	3970	*3030	2550	*2960	2550	6.01
9.8ft	lb			*14860	*14860	*11270	8750	*6680	5620	*6530	5620	(19.7)
1.5m	kg			*9580	6890	5790	3780	3720	2500	*3160	2390	6.17
4.9ft	lb			*21120	15190	12760	8330	8200	5510	*6970	5270	(20.2)
0.0m	kg			*10620	6640	5640	3640			*3650	2480	5.95
0.0ft	lb			*23410	14640	12430	8020			*8050	5470	(19.5)
-1.5m	kg	*7660	*7660	*10090	6630	5600	3610			4390	2900	5.30
-4.9ft	lb	*16890	*16890	*22240	14620	12350	7960			9680	6390	(17.4)
-3.0m	kg			*7830	6790					*5510	4370	4.02
-9.8ft	lb			*17260	14970					*12150	9630	(13.2)

### 3) 4.9 m (16' 1") ADJUST BOOM

Model	Boom	Boom	Arm	Counterweight	Shoe	Doze	er	Outrigo	ger
Model	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX140 LC	2pcs	4939	2500	2300	600	Down	-	-	-

: Rating over-front

· 🖶 : Rating over-side or 360 degree



Unit: mm

				I	_ift-point	radius (B)				At	max. re	each
Lift-po		3.0 m	(9.8 ft)	4.5 m (	14.8 ft)	6.0 m (	19.7 ft)	7.5 m (	24.6 ft)	Cap	acity	Reach
height	(A)	ŀ	#	·	#	Ů	#	·		·	#	m (ft)
7.5m	kg			*3500	*3500					*3500	*3500	4.50
24.6ft	lb			*7720	*7720					*7720	*7720	(14.8)
6.0m	kg			*3340	*3340	*2970	*2970			*2890	*2890	6.01
19.7ft	lb			*7360	*7360	*6550	*6550			*6370	*6370	(19.7)
4.5m	kg			*3840	*3840	*3710	3130			*2680	2480	6.88
14.8ft	lb			*8470	*8470	*8180	6900			*5910	5470	(22.6)
3.0m	kg			*4930	4650	*4140	3030			*2640	2200	7.35
9.8ft	lb			*10870	10250	*9130	6680			*5820	4850	(24.1)
1.5m	kg			*6170	4370	*4710	2910			*2740	2110	7.48
4.9ft	lb			*13600	9630	*10380	6420			*6040	4650	(24.5)
0.0m	kg	*4510	*4510	*7010	4190	*5170	2810			*2990	2150	7.30
0.0ft	lb	*9940	*9940	*15450	9240	*11400	6190			*6590	4740	(23.9)
-1.5m	kg	*8370	7750	*7230	4140	*5290	2780			*3490	2370	6.78
-4.9ft	lb	*18450	17090	*15940	9130	*11660	6130			*7690	5220	(22.3)
-3.0m	kg	*9850	7880	*6710	4190					*4610	2950	5.84
-9.8ft	lb	*21720	17370	*14790	9240					*10160	6500	(19.2)

#### Note

- 1. Lifting capacity are based on SAE J1097 and ISO 10567.
- 2. Lifting capacity of the ROBEX series does not exceed 75% of tipping load with the machine on firm, level ground or 87% of full hydraulic capacity.
- 3. The lift-point is bucket pivot mounting pin on the arm (without bucket mass).
- 4. \*indicates load limited by hydraulic capacity.
- \* Lifting capacities are based upon a standard machine conditions.

Lifting capacities will vary with different work tools, ground conditions and attachments.

The difference between the weight of a work tool attachment must be subtracted.

Consult your HD Hyundai Construction Equipment dealer regarding the lifting capacities for specific work tools and attachments.

▲ Failure to comply to the rated load can cause possible personal injury or property damage. Make adjustments to the rated load as necessary for non-standard configurations.

Model	Boom	Boom	Arm	Counterweight	Shoe	Doze	er	Outrigo	ger
Model	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX140 LC	2pcs	4939	2500	2300	600	Up	-	-	-

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



				l	_ift-point ı	radius (B)	)			At	max. re	each
Lift-po		3.0 m	(9.8 ft)	4.5 m (	14.8 ft)	6.0 m (	(19.7 ft)	7.5 m (	24.6 ft)	Cap	acity	Reach
height	(A)	<b>U</b>	#	ŀ	#	·	#	·		Ů	#	m (ft)
7.5m	kg			*3500	*3500					*3500	*3500	4.50
24.6ft	lb			*7720	*7720					*7720	*7720	(14.8)
6.0m	kg			*3340	*3340	*2970	2900			*2890	*2890	6.01
19.7ft	lb			*7360	*7360	*6550	6390			*6370	*6370	(19.7)
4.5m	kg			*3840	*3840	*3710	2900			*2680	2300	6.88
14.8ft	lb			*8470	*8470	*8180	6390			*5910	5070	(22.6)
3.0m	kg			*4930	4290	3950	2800			*2640	2040	7.35
9.8ft	lb			*10870	9460	8710	6170			*5820	4500	(24.1)
1.5m	kg			5910	4020	3820	2680			*2740	1940	7.48
4.9ft	lb			13030	8860	8420	5910			*6040	4280	(24.5)
0.0m	kg	*4510	*4510	5710	3850	3720	2590			2820	1980	7.30
0.0ft	lb	*9940	*9940	12590	8490	8200	5710			6220	4370	(23.9)
-1.5m	kg	*8370	6990	5650	3790	3690	2560			3120	2190	6.78
-4.9ft	lb	*18450	15410	12460	8360	8140	5640			6880	4830	(22.3)
-3.0m	kg	*9850	7110	5710	3840					3910	2720	5.84
-9.8ft	lb	*21720	15670	12590	8470					8620	6000	(19.2)

Unit: mm

Model	Boom	Boom	Arm	Counterweight	Shoe	Doze	er	Outrigo	ger
iviodei	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX140 LC	2pcs	4939	2500	2300	600	-	-	-	-



				l	_ift-point	radius (B)				At	max. re	each
Lift-po		3.0 m	(9.8 ft)	4.5 m (	14.8 ft)	6.0 m (	(19.7 ft)	7.5 m (	24.6 ft)	Сар	acity	Reach
height	(A)	<b>b</b>	#	·	#	Ů	#	ŀ	#	ŀ	#	m (ft)
7.5m	kg			*3500	*3500					*3500	*3500	4.50
24.6ft	lb			*7720	*7720					*7720	*7720	(14.8)
6.0m	kg			*3340	*3340	*2970	2760			*2890	2750	6.01
19.7ft	lb			*7360	*7360	*6550	6080			*6370	6060	(19.7)
4.5m	kg			*3840	*3840	*3710	2760			*2680	2180	6.88
14.8ft	lb			*8470	*8470	*8180	6080			*5910	4810	(22.6)
3.0m	kg			*4930	4090	3950	2660			*2640	1930	7.35
9.8ft	lb			*10870	9020	8710	5860			*5820	4250	(24.1)
1.5m	kg			5920	3820	3820	2540			*2740	1840	7.48
4.9ft	lb			13050	8420	8420	5600			*6040	4060	(24.5)
0.0m	kg	*4510	*4510	5720	3640	3720	2450			2820	1870	7.30
0.0ft	lb	*9940	*9940	12610	8020	8200	5400			6220	4120	(23.9)
-1.5m	kg	*8370	6630	5650	3590	3690	2420			3120	2070	6.78
-4.9ft	lb	*18450	14620	12460	7910	8140	5340			6880	4560	(22.3)
-3.0m	kg	*9850	6750	5710	3640					3910	2580	5.84
-9.8ft	lb	*21720	14880	12590	8020					8620	5690	(19.2)

Model	Boom	Boom	Arm	Counterweight	Shoe	Doze	er	Outrigo	ger
Model	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX140 LC	2pcs	4939	2100	2300	600	Down	-	-	-

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



				l	_ift-point	radius (B)				At	max. re	each
Lift-po		3.0 m	(9.8 ft)	4.5 m (	14.8 ft)	6.0 m (	19.7 ft)	7.5 m (	24.6 ft)	Cap	acity	Reach
height	(A)	Ů	#	·	#	ŀ	#	·		Ů	#	m (ft)
7.5m	kg									*4380	*4380	3.77
24.6ft	lb									*9660	*9660	(12.4)
6.0m	kg			*3810	*3810					*4110	3570	5.50
19.7ft	lb			*8400	*8400					*9060	7870	(18.0)
4.5m	kg	*5010	*5010	*4260	*4260	*4050	3100			*3830	2760	6.44
14.8ft	lb	*11050	*11050	*9390	*9390	*8930	6830			*8440	6080	(21.1)
3.0m	kg			*5340	4610	*4410	3020			*3800	2420	6.93
9.8ft	lb			*11770	10160	*9720	6660			*8380	5340	(22.7)
1.5m	kg			*6500	4360	*4920	2910			*3980	2300	7.07
4.9ft	lb			*14330	9610	*10850	6420			*8770	5070	(23.2)
0.0m	kg			*7190	4220	*5300	2840			*4410	2360	6.88
0.0ft	lb			*15850	9300	*11680	6260			*9720	5200	(22.6)
-1.5m	kg	*9240	7860	*7230	4190	*5260	2830			*4880	2650	6.33
-4.9ft	lb	*20370	17330	*15940	9240	*11600	6240			*10760	5840	(20.8)
-3.0m	kg			*6420	4270							, ,
-9.8ft	lb			*14150	9410							

Unit: mm

Mode	Boom	Boom	Arm	Counterweight	Shoe	Doze	er	Outrigo	ger
iviode	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX140 LC	2pcs	4939	2100	2300	600	Up	-	-	-



				l	_ift-point ı	radius (B)				At	max. re	each
Lift-po		3.0 m	(9.8 ft)	4.5 m (	14.8 ft)	6.0 m (	19.7 ft)	7.5 m (	24.6 ft)	Cap	acity	Reach
height	(A)	ŀ	#	ŀ	#	ŀ	#	<b>H</b>	#	ŀ	#	m (ft)
7.5m	kg									*4380	*4380	3.77
24.6ft	lb									*9660	*9660	(12.4)
6.0m	kg			*3810	*3810					*4110	3320	5.50
19.7ft	lb			*8400	*8400					*9060	7320	(18.0)
4.5m	kg	*5010	*5010	*4260	*4260	4030	2880			3580	2560	6.44
14.8ft	lb	*11050	*11050	*9390	*9390	8880	6350			7890	5640	(21.1)
3.0m	kg			*5340	4260	3940	2800			3140	2240	6.93
9.8ft	lb			*11770	9390	8690	6170			6920	4940	(22.7)
1.5m	kg			5890	4010	3830	2690			3000	2130	7.07
4.9ft	lb			12990	8840	8440	5930			6610	4700	(23.2)
0.0m	kg			5730	3870	3750	2620			3090	2180	6.88
0.0ft	lb			12630	8530	8270	5780			6810	4810	(22.6)
-1.5m	kg	*9240	7100	5700	3840	3740	2610			3480	2440	6.33
-4.9ft	lb	*20370	15650	12570	8470	8250	5750			7670	5380	(20.8)
-3.0m	kg			5790	3920							` ′
-9.8ft	lb			12760	8640							

Model	Boom	Boom	Arm	Counterweight	Shoe	Doze	er	Outrigo	ger
Model	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX140 LC	2pcs	4939	2100	2300	600	-	-	-	-

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



				l	_ift-point r	radius (B)				At	max. re	each
Lift-po		3.0 m	(9.8 ft)	4.5 m (	14.8 ft)	6.0 m (	(19.7 ft)	7.5 m (	24.6 ft)	Сар	acity	Reach
height	(A)	<b>U</b>	#	·	#	·	#	<b>U</b>		ŀ		m (ft)
7.5m	kg									*4380	*4380	3.77
24.6ft	lb									*9660	*9660	(12.4)
6.0m	kg			*3810	*3810					*4110	3160	5.50
19.7ft	lb			*8400	*8400					*9060	6970	(18.0)
4.5m	kg	*5010	*5010	*4260	*4260	4030	2740			3580	2430	6.44
14.8ft	lb	*11050	*11050	*9390	*9390	8880	6040			7890	5360	(21.1)
3.0m	kg			*5340	4050	3940	2660			3150	2120	6.93
9.8ft	lb			*11770	8930	8690	5860			6940	4670	(22.7)
1.5m	kg			5900	3810	3830	2550			3000	2010	7.07
4.9ft	lb			13010	8400	8440	5620			6610	4430	(23.2)
0.0m	kg			5740	3670	3750	2480			3090	2060	6.88
0.0ft	lb			12650	8090	8270	5470			6810	4540	(22.6)
-1.5m	kg	*9240	6730	5710	3640	3740	2470			3480	2310	6.33
-4.9ft	lb	*20370	14840	12590	8020	8250	5450			7670	5090	(20.8)
-3.0m	kg			5800	3720							, ,
-9.8ft	lb			12790	8200							

Unit: mm

Model	Boom	Boom	Arm	Counterweight	Shoe	Doze	er	Outrig	ger
iviodei	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX140 LC	2pcs	4939	1900	2300	600	Down	-	-	-



				l	_ift-point	radius (B)				At	max. re	each
Lift-po		3.0 m	(9.8 ft)	4.5 m (	14.8 ft)	6.0 m (	19.7 ft)	7.5 m (	24.6 ft)	Сар	acity	Reach
height	(A)	Ů	#	·	#	ŀ	#	<b>H</b>		ŀ		m (ft)
7.5m 24.6ft	kg lb									*4720 *10410	*4720 *10410	3.42 (11.2)
6.0m 19.7ft	kg lb			*4060 *8950	*4060 *8950					*4310 *9500	3820 8420	5.27 (17.3)
4.5m 14.8ft	kg lb	*5420 *11950	*5420 *11950	*4480	*4480	*4240 *9350	3100 6830			*3980 *8770	2900 6390	6.24
3.0m	kg	11950	11950	*9880 *5550	*9880 4600	*4550	3020			*3940	2530	(20.5) 6.75
9.8ft 1.5m	lb kg			*12240 *6670	10140 4360	*10030 *5030	6660 2930			*8690 *4110	5580 2400	(22.1) 6.89
4.9ft	lb			*14700	9610	*11090	6460			*9060	5290	(22.6)
0.0m 0.0ft	kg lb			*7270 *16030	4240 9350	*5360 *11820	2860 6310			*4560 *10050	2470 5450	6.70 (22.0)
-1.5m -4.9ft	kg lb	*9520 *20990	7930 17480	*7220 *15920	4220 9300	*5210 *11490	2870 6330			*5030 *11090	2790 6150	6.13 (20.1)
-3.0m -9.8ft	kg	20330	17400	10320	3000	11430	0000			11090	0130	(20.1)

Model	Boom	Boom	Arm	Counterweight	Shoe	Doze	er	Outrigo	ger
Iviodei	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX140 LC	2pcs	4939	1900	2300	600	Up	-	-	-

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



				l	_ift-point r	radius (B)				At	max. re	each
Lift-po		3.0 m	(9.8 ft)	4.5 m (	14.8 ft)	6.0 m (	19.7 ft)	7.5 m (	24.6 ft)	Сар	acity	Reach
height	(A)	<b>U</b>	#	·	#	ŀ	#	ŀ		ŀ		m (ft)
7.5m 24.6ft	kg lb									*4720 *10410	*4720 *10410	3.42 (11.2)
6.0m	kg			*4060	*4060					*4310	3540	5.27
19.7ft 4.5m	lb kg	*5420	*5420	*8950 *4480	*8950 *4480	4020	2870			*9500 3760	7800 2690	(17.3) 6.24
14.8ft	lb	*11950	*11950	*9880	*9880	8860	6330			8290	5930	(20.5)
3.0m	kg			*5550	4250	3940	2800			3280	2340	6.75
9.8ft	lb			*12240	9370	8690	6170			7230	5160	(22.1)
1.5m	kg			5890	4010	3840	2710			3130	2220	6.89
4.9ft	lb			12990	8840	8470	5970			6900	4890	(22.6)
0.0m	kg			5760	3890	3770	2640			3230	2290	6.70
0.0ft	lb			12700	8580	8310	5820			7120	5050	(22.0)
-1.5m	kg	*9520	7170	5740	3880	3770	2650			3670	2580	6.13
-4.9ft	lb	*20990	15810	12650	8550	8310	5840			8090	5690	(20.1)
-3.0m	kg											
-9.8ft	lb											

Unit: mm

Mode	Boom	Boom	Arm	Counterweight	Shoe	Doze	er	Outrigg	ger
ivioue	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX140 LC	2pcs	4939	1900	2300	600	-	-	-	-



				l	_ift-point r	radius (B)				At	max. re	each
Lift-po		3.0 m	(9.8 ft)	4.5 m (	14.8 ft)	6.0 m (	19.7 ft)	7.5 m (	24.6 ft)	Сар	acity	Reach
height	(A)	Ů	#	ŀ	#	·	#	<b>H</b>		ŀ		m (ft)
7.5m 24.6ft	kg lb									*4720 *10410	*4720 *10410	3.42 (11.2)
6.0m 19.7ft	kg lb			*4060 *8950	*4060 *8950					*4310 *9500	3380 7450	5.27 (17.3)
4.5m 14.8ft	kg lb	*5420 *11950	*5420 *11950	*4480 *9880	4280 9440	4020 8860	2730 6020			3760 8290	2550 5620	6.24
3.0m	kg	11930	11930	*5550	4040	3950	2660			3280	2220	(20.5) 6.75
9.8ft 1.5m	lb kg			*12240 5900	8910 3810	8710 3840	5860 2570			7230 3130	4890 2100	(22.1) 6.89
4.9ft	lb			13010	8400	8470	5670			6900	4630	(22.6)
0.0m 0.0ft	kg lb			5760 12700	3690 8140	3770 8310	2500 5510			3230 7120	2160 4760	6.70 (22.0)
-1.5m -4.9ft	kg lb	*9520 *20990	6800 14990	5740 12650	3670 8090	3770 8310	2500 5510			3670 8090	2440 5380	6.13 (20.1)
-3.0m -9.8ft	kg	20330	14330	12000	0030	0010	3310			0090	3300	(20.1)

## 4) 4.6 m (15' 1") HIGH WALKER

Counterweight Outrigger Boom Boom Arm Shoe Dozer Model Type Length Length Weight (kg) Width Front Rear Front Rear HX140 LC Mono 4600 1900 2000 800

· 🖟 : Rating over-front

· 🖶 : Rating over-side or 360 degree



Unit: mm

					Lift-point	radius (B)	)			At	max. re	ach
Lift-po		1.5 m	(4.9 ft)	3.0 m	(9.8 ft)	4.5 m (	14.8 ft)	6.0 m (	19.7 ft)	Сар	acity	Reach
height	(A)	·	#	<b>U</b>	#	U	#	·	#	ŀ	#	m (ft)
6.0 m	kg					*4200	*4200			*3650	*3650	4.73
(19.7 ft)	lb					*9260	*9260			*8050	*8050	(15.5)
4.5 m	kg					*4330	*4330			*3340	3,080	5.8
(14.8 ft)	lb					*9550	*9550			*7360	6,790	(19.0)
3.0 m	kg					*5220	4,380	4,310	2,880	*3330	2,640	6.35
(9.8 ft)	lb					*11510	9,660	9,500	6,350	*7340	5,820	(20.8)
1.5 m	kg					*6220	4,170	4,220	2,800	*3540	2,500	6.5
(4.9 ft)	lb					*13710	9,190	9,300	6,170	*7800	5,510	(21.3)
0.0 m	kg			*5750	*5750	6,350	4,050	4,160	2,750	3,900	2,580	6.29
(0.0 ft)	lb			*12680	*12680	14,000	8,930	9,170	6,060	8,600	5,690	(20.6)
-1.5 m	kg	*5700	*5700	*9710	7,400	6,330	4030			4,500	2,960	5.68
(-4.9 ft)	lb	*12570	*12570	*21410	16,310	13,960	8880			9,920	6,530	(18.6)
-3.0 m	kg			*7880	7,560	*5100	4,150			*5080	4,140	4.51
(-9.8 ft)	lb			*17370	16,670	*11240	9,150			*11200	9,130	(14.8)

Unit: mm

Model	Boom	Boom	Arm	Counterweight	Shoe	Doze	er	Outrigo	ger
iviodei	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX140 LC	Mono	4600	2100	2000	800	-	-	-	-

: Rating over-front

· 🖶 : Rating over-side or 360 degree



					Lift-point	radius (B)	)			At	max. re	ach
Lift-po		1.5 m	(4.9 ft)	3.0 m	(9.8 ft)	4.5 m (	(14.8 ft)	6.0 m (	19.7 ft)	Сар	acity	Reach
height	(A)	Ů	#	Ů	#	Ů	#	Ů	#	Ů	#	m (ft)
6.0 m	kg					*3910	*3910			*3470	*3470	4.97
(19.7 ft)	lb					*8620	*8620			*7650	*7650	(16.3)
4.5 m	kg					*4120	*4120			*3210	2930	5.99
(14.8 ft)	lb					*9080	*9080			*7080	6460	(19.7)
3.0 m	kg			*7310	*7310	*5030	4390	*4280	2870	*3220	2530	6.52
(9.8 ft)	lb			*16120	*16120	*11090	9680	*9440	6330	*7100	5580	(21.4)
1.5 m	kg					*6070	4170	4210	2790	*3430	2400	6.67
(4.9 ft)	lb					*13380	9190	9280	6150	*7560	5290	(21.9)
0.0 m	kg			*6160	*6160	6330	4030	4140	2730	3730	2470	6.47
(0.0 ft)	lb			*13580	*13580	13960	8880	9130	6020	8220	5450	(21.2)
-1.5 m	kg	*5500	*5500	*9870	7340	6300	4000			4260	2800	5.88
(-4.9 ft)	lb	*12130	*12130	*21760	16180	13890	8820			9390	6170	(19.3)
-3.0 m	kg			*8230	7490	*5470	4090			*5000	3800	4.75
(-9.8 ft)	lb			*18140	16510	*12060	9020			*11020	8380	(15.6)

Model	Boom	Boom	Arm	Counterweight	Shoe	Doze	er	Outrigo	ger
Model HX140 LC	Type Length		Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX140 LC	Mono	4600	2500	2000	800	-	-	-	-

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



					Lift-point	radius (B)				At	max. re	ach
Lift-poi		1.5 m	(4.9 ft)	3.0 m	(9.8 ft)	4.5 m (	(14.8 ft)	6.0 m (	19.7 ft)	Сар	acity	Reach
height (	(A)	·	#	Ů	#	Ů	#*	Ů	#	Ů	#	m (ft)
6.0 m	kg					*3400	*3400			*2390	*2390	5.50
(19.7 ft)	lb					*7500	*7500			*5270	*5270	(18.0)
4.5 m	kg					*3700	*3700	*3500	2950	*2210	*2210	6.44
(14.8 ft)	lb					*8160	*8160	*7720	6500	*4870	*4870	(21.1)
3.0 m	kg			*6380	*6380	*4630	4420	*4000	2880	*2200	*2200	6.93
(9.8 ft)	lb			*14070	*14070	*10210	9740	*8820	6350	*4850	*4850	(22.7)
1.5 m	kg			*7050	*7050	*5760	4170	4200	2780	*2320	2190	7.07
(4.9 ft)	lb			*15540	*15540	*12700	9190	9260	6130	*5110	4830	(23.2)
0.0 m	kg			*6550	*6550	6320	4010	4120	2700	*2590	2240	6.88
(0.0 ft)	lb			*14440	*14440	13930	8840	9080	5950	*5710	4940	(22.6)
-1.5 m	kg	*4890	*4890	*10080	7250	6250	3950	4090	2680	*3160	2500	6.34
(-4.9 ft)	lb	*10780	*10780	*22220	15980	13780	8710	9020	5910	*6970	5510	(20.8)
-3.0 m	kg	*9020	*9020	*8820	7370	*5920	4000			*4580	3210	5.31
(-9.8 ft)	lb	*19890	*19890	*19440	16250	*13050	8820			*10100	7080	(17.4)

Unit: mm

Model	Boom	Boom	Arm	Counterweight	Shoe	Doze	er	Outrigo	ger
IVIOGEI	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX140 LC	Mono	4600	3000	2000	800	-	-	-	-

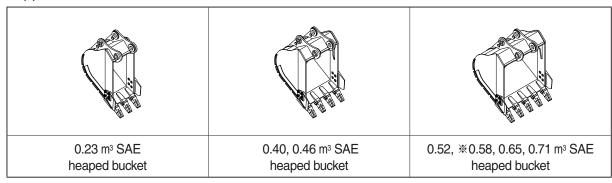


			Lift-point radius (B)								At max. reach		
Lift-po		1.5 m	(4.9 ft)	3.0 m	(9.8 ft)	4.5 m (	(14.8 ft)	6.0 m	(19.7 ft)	Сар	acity	Reach	
height	(A)	U	#	ŀ	#	<b>U</b>	#	ŀ	#	ŀ	#	m (ft)	
6.0 m	kg							*2230	*2230	*2000	*2000	6.08	
(19.7 ft)	lb							*4920	*4920	*4410	*4410	(20.0)	
4.5 m	kg							*3280	2,990	*1880	*1880	6.94	
(14.8 ft)	lb							*7230	6,590	*4140	*4140	(22.8)	
3.0 m	kg			*5250	*5250	*4130	*4130	*3670	2,900	*1870	*1870	7.40	
(9.8 ft)	lb			*11570	*11570	*9110	*9110	*8090	6,390	*4120	*4120	(24.3)	
1.5 m	kg			*8390	7,730	*5340	4,220	4,220	2,790	*1970	*1970	7.53	
(4.9 ft)	lb			*18500	17,040	*11770	9,300	9,300	6,150	*4340	*4340	(24.7)	
0.0 m	kg			*7180	*7180	*6290	4,020	4,110	2,690	*2180	2,020	7.36	
(0.0 ft)	lb			*15830	*15830	*13870	8,860	9,060	5,930	*4810	4,450	(24.1)	
-1.5 m	kg	*4370	*4370	*9280	7,200	6,220	3,920	4,050	2,640	*2610	2,220	6.85	
(-4.9 ft)	lb	*9630	*9630	*20460	15,870	13,710	8,640	8,930	5,820	*5750	4,890	(22.5)	
-3.0 m	kg	*7550	*7550	*9420	7,270	6,240	3,930			*3560	2,730	5.91	
(-9.8 ft)	lb	*16640	*16640	*20770	16,030	13,760	8,660			*7850	6,020	(19.4)	

#### **6. BUCKET SELECTION GUIDE**

#### 1) HX140 LC

### (1) General bucket



0	Capacity		\				Recomm	nendation		
Capa	acity	VVI	Width			4.6 m (15	1") boom		4.1 m (13' 5") boom	
SAE heaped	CECE heaped	Without side cutter	With side cutter	Weight	1.9 m arm (6' 3")	2.1 m arm (6' 11")	2.5 m arm (8' 2")	3.0 m arm (9' 10")	1.9 m arm (6' 3")	2.1 m arm (6' 11")
0.23 m <sup>3</sup> (0.30 yd <sup>3</sup> )	0.20 m <sup>3</sup> (0.26 yd <sup>3</sup> )	520 mm (20.5")	620 mm (24.4")	335 kg (740 lb)	•	•	•	•	•	•
0.40 m <sup>3</sup> (0.52 yd <sup>3</sup> )	0.35 m <sup>3</sup> (0.46 yd <sup>3</sup> )	760 mm (29.9")	860 mm (33.9")	410 kg (900 lb)	•	•	•	•	•	•
0.46 m <sup>3</sup> (0.60 yd <sup>3</sup> )	0.40 m <sup>3</sup> (0.52 yd <sup>3</sup> )	850 mm (33.5")	950 mm (37.4")	435 kg (960 lb)	•	•	•	0	•	•
0.52 m <sup>3</sup> (0.68 yd <sup>3</sup> )	0.45 m <sup>3</sup> (0.59 yd <sup>3</sup> )	935 mm (36.8")	1035 mm (40.8")	460 kg (1010 lb)	•	•	•		•	•
*0.58 m³ (0.76 yd³)	0.50 m <sup>3</sup> (0.65 yd <sup>3</sup> )	1030 mm (40.6")	1130 mm (44.5")	480 kg (1060 lb)	•	•	•		•	•
0.65 m <sup>3</sup> (0.85 yd <sup>3</sup> )	0.55 m <sup>3</sup> (0.72 yd <sup>3</sup> )	1110 mm (43.7")	1210 mm (47.6")	500 kg (1100 lb)	•	•	0		•	•
0.71 m <sup>3</sup> (0.93 yd <sup>3</sup> )	0.60 m <sup>3</sup> (0.78 yd <sup>3</sup> )	1205 mm (47.4")	1305 mm (51.4")	540 kg (1190 lb)	0	0			•	0

#### \* : Standard bucket

Applicable for materials with density of 2000 kg/m³ (3370 lb/yd³) or less

Applicable for materials with density of 1600 kg/m³ (2700 lb/yd³) or less

Applicable for materials with density of 1100 kg/m³ (1850 lb/yd³) or less

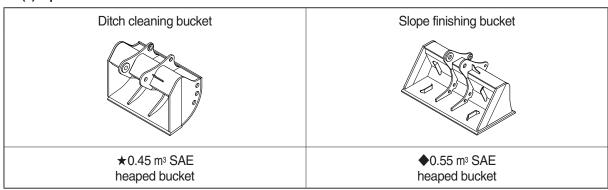
\* These recommendations are for general conditions and average use.

Work tools and ground conditions have effects on machine performance.

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

Consult your HD Hyundai Construction Equipment dealer for information on selecting the correct boom-arm-bucket combination.

## (2) Special bucket



Capacity		\\/idth			Recommendation						
Сара	acity	Width		Weight		4.6 m (15	1") boom		4.1 m (13' 5") boom		
SAE heaped	CECE heaped	Without side cutter	With side cutter	Weignt	1.9 m arm (6' 3")	2.1 m arm (6' 11")	2.5 m arm (8' 2")	3.0 m arm (9' 10")	1.9 m arm (6' 3")	2.1 m arm (6' 11")	
★0.45 m³ (0.59 yd³)		1520 mm (59.8")	-	410 kg (900 lb)	•	•	•		•	•	
◆0.55 m³ (0.72 yd³)		1800 mm (70.9")	-	585 kg (1290 lb)	•	•	0		•	•	

★ : Ditch cleaning bucket ◆ : Slope finishing bucket

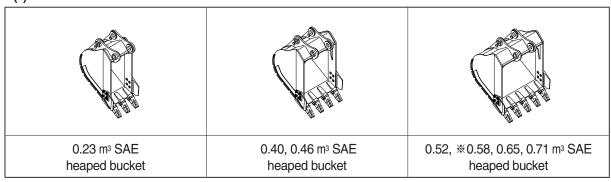
Applicable for materials with density of 2000 kgf/m³ (3370 lbf/yd³) or less

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

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

## 2) HX140 LC, ADJUST BOOM

### (1) General bucket



Can	Capacity		Width		Recommendation				
Сар	acity	Widaii		Weight	4.9	m (16' 1") adjust bo	oom		
SAE heaped	CECE heaped	Without side cutter	With side cutter	vvoignt	1.9 m arm (6' 3")	2.1 m arm (6' 11")	2.5 m arm (8' 2")		
0.23 m <sup>3</sup> (0.30 yd <sup>3</sup> )	0.20 m <sup>3</sup> (0.26 yd <sup>3</sup> )	520 mm (20.5")	620 mm (24.4")	335 kg (740 lb)	•	•	•		
0.40 m <sup>3</sup> (0.52 yd <sup>3</sup> )	0.35 m <sup>3</sup> (0.46 yd <sup>3</sup> )	760 mm (29.9")	860 mm (33.9")	410 kg (900 lb)	•	•	•		
0.46 m <sup>3</sup> (0.60 yd <sup>3</sup> )	0.40 m <sup>3</sup> (0.52 yd <sup>3</sup> )	850 mm (33.5")	950 mm (37.4")	435 kg (960 lb)	•	•	•		
0.52 m <sup>3</sup> (0.68 yd <sup>3</sup> )	0.45 m <sup>3</sup> (0.59 yd <sup>3</sup> )	935 mm (36.8")	1035 mm (40.8")	460 kg (1010 lb)	•	•	•		
% 0.58 m³ (0.76 yd³)	0.50 m <sup>3</sup> (0.65 yd <sup>3</sup> )	1030 mm (40.6")	1130 mm (44.5")	480 kg (1060 lb)	•	0	0		
0.65 m <sup>3</sup> (0.85 yd <sup>3</sup> )	0.55 m <sup>3</sup> (0.72 yd <sup>3</sup> )	1110 mm (43.7")	1210 mm (47.6")	500 kg (1100 lb)	0	0			
0.71 m <sup>3</sup> (0.93 yd <sup>3</sup> )	0.60 m <sup>3</sup> (0.78 yd <sup>3</sup> )	1205 mm (47.4")	1305 mm (51.4")	540 kg (1190 lb)	0				

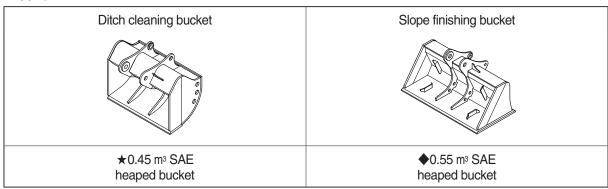
### \* : Standard bucket

Applicable for materials with density of 2000 kg/m³ (3370 lb/yd³) or less

Applicable for materials with density of 1600 kg/m³ (2700 lb/yd³) or less

Applicable for materials with density of 1100 kg/m³ (1850 lb/yd³) or less

### (2) Special bucket



Capacity		Width			Recommendation			
Сара	acity	VVICITI		Weight	4.9 m (16' 1") boom			
SAE heaped	CECE heaped	Without side cutter	With side cutter	VVCigrit	1.9 m arm (6' 3")	2.1 m arm (6' 11")	2.5 m arm (8' 2")	
★0.45 m³ (0.59 yd³)	0.40 m <sup>3</sup> (0.52 yd <sup>3</sup> )	1520 mm (59.8")	-	410 kg (900 lb)	•	•	0	
◆0.55 m³ (0.72 yd³)	0.45 m <sup>3</sup> (0.59 yd <sup>3</sup> )	1800 mm (70.9")	-	585 kg (1290 lb)	•	0	0	

★ : Ditch cleaning bucket◆ : Slope finishing bucket

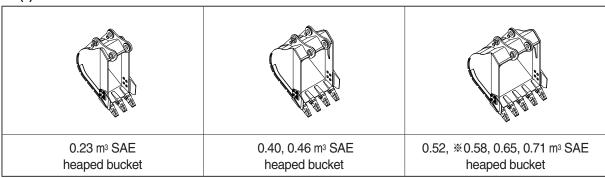
Applicable for materials with density of 2000 kgf/m³ (3370 lbf/yd³) or less

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

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

## 3) HX140 LC HIGH WALKER

### (1) General bucket



Can	Capacity		Width		Recommendation					
Сар	acity	VVI	ulli	Weight		4.6 m (15	1") boom			
SAE heaped	CECE heaped	Without side cutter	With side cutter	VVCIGITE	1.9 m arm (6' 3")	2.1 m arm (6' 11")	2.5 m arm (8' 2")	3.0 m arm (9' 10")		
0.23 m <sup>3</sup> (0.30 yd <sup>3</sup> )	0.20 m <sup>3</sup> (0.26 yd <sup>3</sup> )	520 mm (20.5")	620 mm (24.4")	335 kg (740 lb)	•	•	•	•		
0.40 m <sup>3</sup> (0.52 yd <sup>3</sup> )	0.35 m <sup>3</sup> (0.46 yd <sup>3</sup> )	760 mm (29.9")	860 mm (33.9")	410 kg (900 lb)	•	•	•	•		
0.46 m <sup>3</sup> (0.60 yd <sup>3</sup> )	0.40 m <sup>3</sup> (0.52 yd <sup>3</sup> )	850 mm (33.5")	950 mm (37.4")	435 kg (960 lb)	•	•	•	•		
0.52 m <sup>3</sup> (0.68 yd <sup>3</sup> )	0.45 m <sup>3</sup> (0.59 yd <sup>3</sup> )	935 mm (36.8")	1035 mm (40.7")	460 kg (1010 lb)	•	•	•	0		
*0.58 m³ (0.76 yd³)	0.50 m <sup>3</sup> (0.65 yd <sup>3</sup> )	1030 mm (40.6")	1130 mm (44.5")	480 kg (1060 lb)	•	•	•			
0.65 m <sup>3</sup> (0.85 yd <sup>3</sup> )	0.55 m <sup>3</sup> (0.72 yd <sup>3</sup> )	1110 mm (43.7")	1210 mm (47.6")	500 kg (1100 lb)	•	•	•			
0.71 m <sup>3</sup> (0.93 yd <sup>3</sup> )	0.60 m <sup>3</sup> (0.78 yd <sup>3</sup> )	1205 mm (47.4")	1305 mm (51.4")	540 kg (1190 lb)	•	•	0			

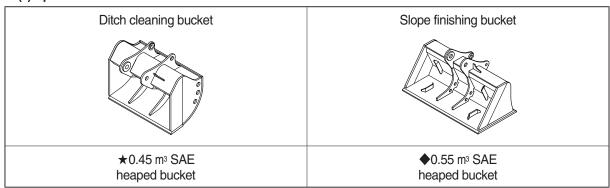
\* : Standard bucket

Applicable for materials with density of 2000 kg/m³ (3370 lb/yd³) or less

Applicable for materials with density of 1600 kg/m³ (2700 lb/yd³) or less

Applicable for materials with density of 1100 kg/m³ (1850 lb/yd³) or less

### (2) Special bucket



Capacity		Width			Recommendation			
Сар	acity	VVICILI		Weight	4.9 m (16' 1") boom			
SAE heaped	CECE heaped	Without side cutter	With side cutter	vveign	1.9 m arm (6' 3")	2.1 m arm (6' 11")	2.5 m arm (8' 2")	
★0.45 m³ (0.59 yd³)	0.40 m <sup>3</sup> (0.52 yd <sup>3</sup> )	1520 mm (59.8")	-	410 kg (900 lb)	•	•	0	
◆0.55 m³ (0.72 yd³)	0.45 m <sup>3</sup> (0.59 yd <sup>3</sup> )	1800 mm (70.9")	-	585 kg (1290 lb)	•	0	0	

 $\bigstar$ : Ditch cleaning bucket  $\spadesuit$ : Slope finishing bucket

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

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

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

### 7. UNDERCARRIAGE

### 1) TRACKS

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

### 2) TYPES OF SHOES

				Grouser	
Model	Shape	S	Triple		Double
	Shoe width	mm (in)	500 (20)	<b>%</b> 600 (24)	700 (28)
HX140 LC	Operating weight	kg (lb)	13840 (30510)	14050 (30975)	14260 (31440)
HX140 LC	Ground pressure	kgf/cm² (psi)	0.43 (6.07)	0.36 (5.13)	0.31 (4.47)
	Overall width	mm (ft-in)	2500 (8' 2")	2600 (8' 6")	2700 (8' 10")
	Shoe width	mm (in)	500 (20)	<b>%600 (24)</b>	700 (28)
HX140 LC	Operating weight	kg (lb)	14660 (32320)	14870 (32780)	15080 (33245)
DOZER BLADE	Ground pressure	kgf/cm² (psi)	0.45 (6.43)	0.38 (5.43)	0.33 (4.72)
	Overall width	mm (ft-in)	2500 (8' 2")	2600 (8' 6")	2700 (8' 10")
	Shoe width	mm (in)	<b>★</b> 700 (28)	<b>%</b> 800 (32)	☆960 (38)
HX140 LC HIGH	Operating weight	kg (lb)	16715 (36850)	16950 (37370)	17220 (37960)
WALKER	Ground pressure	kgf/cm² (psi)	0.36 (5.16)	0.32 (4.58)	0.27 (3.88)
	Overall width	mm (ft-in)	2750 (9' 0")	2840 (9' 4")	3000 (9' 10")

<sup>\* :</sup> Standard

### 3) NUMBER OF ROLLERS AND SHOES ON EACH SIDE

Item	Quantity			
item	HX140 LC	HX140 LC HIGH WALKER		
Carrier rollers	1 EA	2 EA		
Track rollers	7 EA	7 EA		
Track shoes	46 EA	47 EA		

<sup>☆ :</sup> Single grouser

<sup>★ :</sup> Double grouser

### 4) SELECTION OF TRACK SHOE

Suitable track shoes should be selected according to operating conditions.

#### Method of selecting shoes

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

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

#### \* Table 1

Track shoe	Specification	Category
600 mm triple grouser	Standard	A
500 mm triple grouser	Option	A
700 mm triple grouser	Option	В
700 mm triple grouser	HX140 LC HW only	В
800 mm triple grouser	HX140 LC HW only	В
960 mm single grouser	HX140 LC HW only	В

#### X Table 2

Category	Applications	Applications
А	Rocky ground, river beds, normal soil	Travel at low speed on rough ground with large obstacles such as boulders or fallen trees
В	Normal soil, soft ground	<ul> <li>These shoes cannot be used on rough ground with large obstacles such as boulders or fallen trees</li> <li>Travel at high speed only on flat ground</li> <li>Travel slowly at low speed if it is impossible to avoid going over obstacles</li> </ul>

## 8. SPECIFICATIONS FOR MAJOR COMPONENTS

# 1) ENGINE

Item	Specification
Model	Cummins QSF3.8
Туре	4-cycle turbocharged charge air cooled diesel engine
Cooling method	Water cooling
Number of cylinders and arrangement	4 cylinders, in-line
Firing order	1-3-4-2
Combustion chamber type	Direct injection type
Cylinder bore × stroke	102 x 115 mm (4.02" x 4.53")
Piston displacement	3800 cc (229 cu in)
Compression ratio	17.2:1
Rated net horse power (SAE J1349)	127 Hp (95 kW) at 2200 rpm
Rated gross horse power (SAE J1995)	130 Hp (97 kW) at 2200 rpm
Maximum torque	50 kgf · m (360 lbf · ft) at 1600 rpm
Engine oil quantity	12 liter (3.2 U.S. gal)
Weight (wet)	348 kg (767 lb)
High idling speed	$2230\pm50~\mathrm{rpm}$
Low idling speed	900 ± 50 rpm
Rated fuel consumption	168 g/Hp · hr at 2000 rpm
Starting motor	24 V-4.8 kW
Alternator	28 V-70 A
Battery	2×12 V×100 Ah

# 2) MAIN PUMP

Item	Specification		
Туре	Variable displacement axial piston pumps		
Capacity	$2 \times 65$ cc/rev		
Maximum pressure	350 kgf/cm² (4980 psi) [380 kgf/cm² (5400 psi)]		
Rated oil flow	2 × 126.8 ℓ /min (33.4 U.S. gpm / 27.8 U.K. gpm)		
Rated speed	1950 rpm		

[ ]: Power boost

# 3) GEAR PUMP

Item	Specification		
Туре	Fixed displacement gear pump single stage		
Capacity	15cc/rev		
Maximum pressure	40 kgf/cm² (570 psi)		
Rated oil flow	29.2 $\ell$ /min (7.7 U.S. gpm / 6.4 U.K. gpm)		

# 4) MAIN CONTROL VALVE

Item	Specification		
Туре	11 spools		
Operating method	Hydraulic pilot system		
Main relief valve pressure	350 kgf/cm² (4980 psi)[380 kgf/cm² (5400 psi)]		
Overload relief valve pressure	400 kgf/cm² (5690 psi)		

## [ ]: Power boost

# 5) SWING MOTOR

Item	Specification		
Туре	Fixed displacement axial piston motor		
Capacity	72 cc/rev		
Relief pressure	285 kgf/cm² (4054 psi)		
Braking system	Automatic, spring applied hydraulic released		
Braking torque	Minimum 30 kgf · m (217 lbf · ft)		
Brake release pressure	15~50 kgf/cm² (213~711 psi)		
Reduction gear type	2 - stage planetary		

# 6) TRAVEL MOTOR

ltem	Specification
Туре	Variable displacement axial piston motor
Relief pressure	350 kgf/cm² (4980 psi)
Capacity (max / min)	77/44.5 cc/rev
Reduction gear type	2-stage planetary
Braking system	Automatic, spring applied hydraulic released
Brake release pressure	12.5 kgf/cm² (178 psi)
Braking torque	33.12 kgf · m (240 lbf · ft)

## 7) CYLINDER

Item		Specification		
Boom cylinder	Bore dia $\times$ Rod dia $\times$ Stroke	Ø105× Ø75× 1075 mm		
	Cushion	Extend only		
Arm ordindor	Bore dia $\times$ Rod dia $\times$ Stroke	Ø115× Ø80×1138 mm		
Arm cylinder	Cushion	Extend and retract		
Bucket cylinder	Bore dia $\times$ Rod dia $\times$ Stroke	Ø100 × Ø70 × 850 mm		
	Cushion	Extend only		
Dozer cylinder (opt)	Bore dia $\times$ Rod dia $\times$ Stroke	$\varnothing$ 100 $\times$ $\varnothing$ 70 $\times$ 250 mm		
	Cushion	-		
Adjust cylinder (opt)	Bore dia $\times$ Rod dia $\times$ Stroke	Ø145× Ø90× 613 mm		
	Cushion	-		
Adjust been evilades (ant)	Bore dia $\times$ Rod dia $\times$ Stroke	$\varnothing$ 105 $\times$ $\varnothing$ 75 $\times$ 975 mm		
Adjust boom cylinder (opt)	Cushion	Extend only		

<sup>\*</sup> Discoloration of cylinder rod can occur when the friction reduction additive of lubrication oil spreads on the rod surface.

## 8) SHOE

Item		Width	Ground pressure	Link quantity	Overall width	
Standard		600 mm (24")	0.36 kgf/cm² (5.13 psi)	46	2600 mm ( 8' 6")	
HX140 LC	Option	500 mm (20")	0.43 kgf/cm² (6.07 psi)	46	2500 mm ( 8' 2")	
		700 mm (28")	0.31 kgf/cm² (4.47 psi)	46	2700 mm ( 8' 10")	
HX140 LC DOZER BLADE Option	Standard	600 mm (24")	0.38 kgf/cm² (5.43 psi)	46	2600 mm ( 8' 6")	
	Onting	500 mm (20")	0.45 kgf/cm² (6.43 psi)	46	2500 mm ( 8' 2")	
	Ориоп	700 mm (28")	0.33 kgf/cm² (4.72 psi)	46	2700 mm ( 8' 10")	
HX140 LC	Standard	800 mm (32")	0.32 kgf/cm² (4.58 psi)	47	2840 mm ( 9' 4")	
HIGH WALKER	Option	700 mm (28")	0.36 kgf/cm² (5.16 psi)	47	2850 mm ( 9' 0")	
		960 mm (38")	0.27 kgf/cm² (3.88 psi)	47	3000 mm ( 9' 10")	

# 9) BUCKET

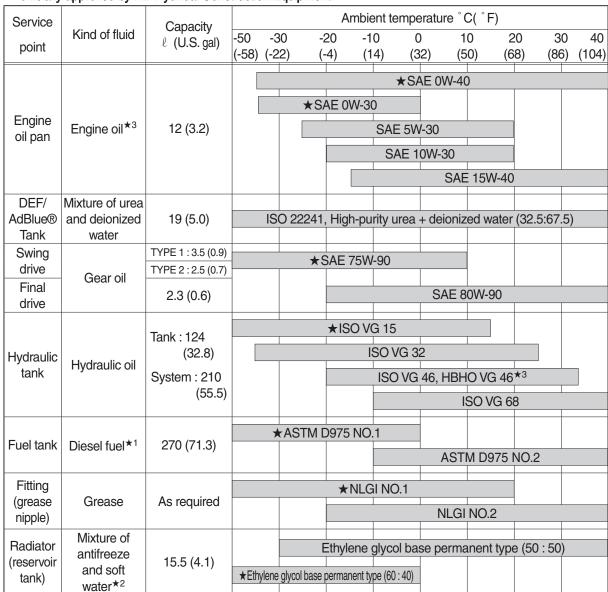
Item		Capacity		Tooth	Width	
		SAE heaped	CECE heaped	quantity	Without side cutter	With side cutter
	Standard	<b>※</b> 0.58 m³ (0.76 yd³)	0.50 m³ (0.65 yd³)	5	1030 mm (40.6")	1130 mm (44.5")
HX140 LC Option	0.23 m³ (0.30 yd³)	0.20 m³ (0.26 yd³)	3	520 mm (20.5")	620 mm (24.4")	
		0.40 m³ (0.52 yd³)	0.35 m³ (0.46 yd³)	4	760 mm (29.9")	860 mm (33.9")
		0.46 m³ (0.60 yd³)	0.40 m³ (0.52 yd³)	4	850 mm (33.5")	950 mm (37.4")
	Option	0.52 m³ (0.68 yd³)	0.45 m³ (0.59 yd³)	5	935 mm (36.8")	1035 mm (40.8")
	Option	0.65 m³ (0.85 yd³)	0.55 m³ (0.72 yd³)	5	1110 mm (43.7")	1210 mm (47.6")
		0.71 m³ (0.93 yd³)	0.60 m <sup>3</sup> (0.78 yd <sup>3</sup> )	5	1205 mm (47.4")	1305 mm (51.4")
		★0.45 m³ (0.59 yd³)	0.40 m <sup>3</sup> (0.52 yd <sup>3</sup> )	-	1520 mm (59.8")	-
		◆0.55 m³ (0.72 yd³)	0.45 m <sup>3</sup> (0.59 yd <sup>3</sup> )	-	1800 mm (70.9")	-

★ : Standard ★ : Ditch cleaning bucket ♦ : Slope finishing bucket

<sup>\*</sup> Discoloration does not cause any harmful effect on the cylinder performance.

#### 9. RECOMMENDED OILS

HD Hyundai Construction Equipment genuine lubricating oils have been developed to offer the best performance and service life for your equipment. These oils have been tested according to the specifications of HD Hyundai Construction Equipment and, therefore, will meet the highest safety and quality requirements. We recommend that you use only HD Hyundai Construction Equipment genuine lubricating oils and grease officially approved by HD Hyundai Construction Equipment.



**SAE**: Society of Automotive Engineers

API : American Petroleum Institute

ISO : International Organization for Standardization

**NLGI**: National Lubricating Grease Institute

**ASTM**: American Society of Testing and Material

**DEF**: Diesel Exhaust Fluid, DEF compatible with AdBlue®

\* : Cold region (Russia, CIS, Mongolia)

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

★2: Soft water

City water or distilled water

\*3 : HD Hyundai Construction Equipment Bio Hydraulic Oil

- \* Using any lubricating oils other than HD Hyundai Construction Equipment genuine products may lead to a deterioration of performance and cause damage to major components.
- \* Do not mix HD Hyundai Construction Equipment genuine oil with any other lubricating oil as it may result in damage to the systems of major components.
- \* Do not use any engine oil other than that specified above, as it may clog the diesel particulate filter(DPF).
- \* For HD Hyundai Construction Equipment genuine lubricating oils and grease for use in regions with extremely low temperatures, please contact HD Hyundai Construction Equipment dealers.

# SECTION 2 STRUCTURE AND FUNCTION

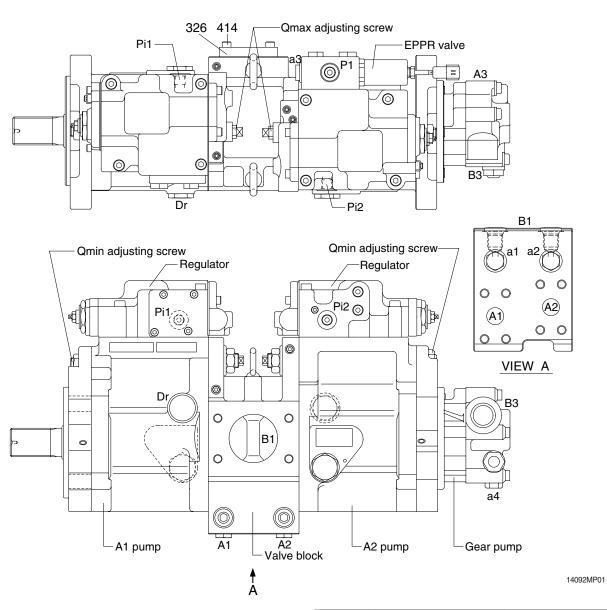
Group	1 Pump Device ·····	2-1
Group	2 Main Control Valve	2-19
Group	3 Swing Device	2-46
Group	4 Travel Device ·····	2-58
Group	5 RCV Lever ·····	2-79
Group	6 RCV Pedal ·····	2-86

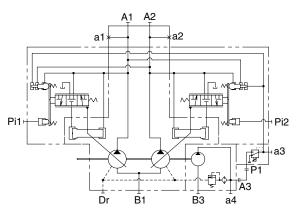
# **SECTION 2 STRUCTURE AND FUNCTION**

# **GROUP 1 PUMP DEVICE**

# 1. STRUCTURE

The pump device consists of main pump, regulator and gear pump.

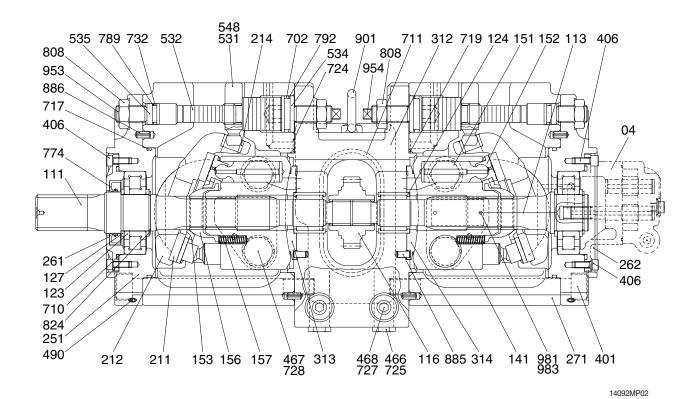




Port	Port name	Port size
A1, A2	Delivery port	SAE6000 psi 3/4"
B1	Suction port	SAE2500 psi 2 1/2"
Dr	Drain port	PF 1/2 - 19
Pi1, Pi2	Pilot port	PF 1/4 - 15
P1	EPPR port	PF 1/4 - 15
a1, a2, a3	Gauge port	PF 1/4 - 15
a4	Gauge port	PF 1/4-14
A3	Gear pump delivery port	PF 1/2 - 19
В3	Gear pump suction port	PF 3/4 - 20.5

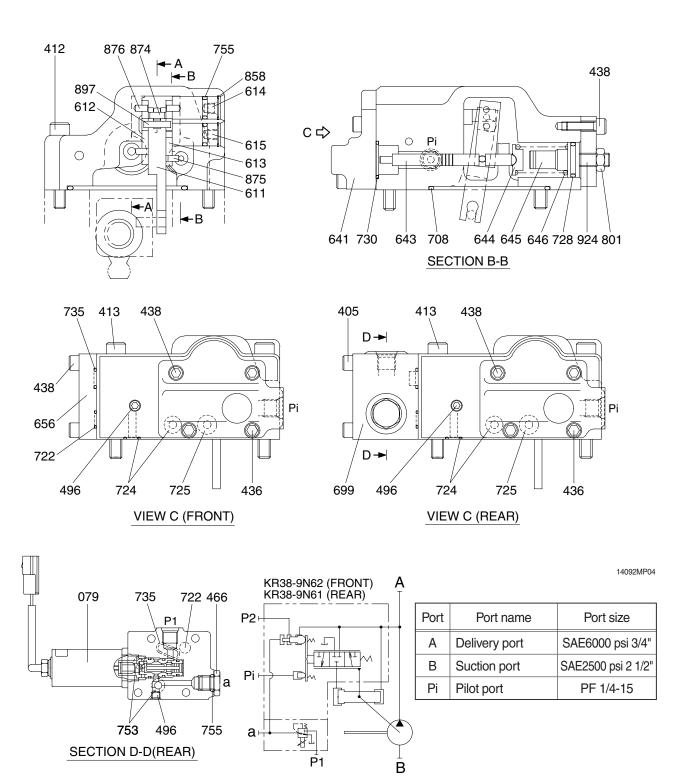
# 1) MAIN PUMP

The main pump consists of two piston pumps (front & rear) and valve block.

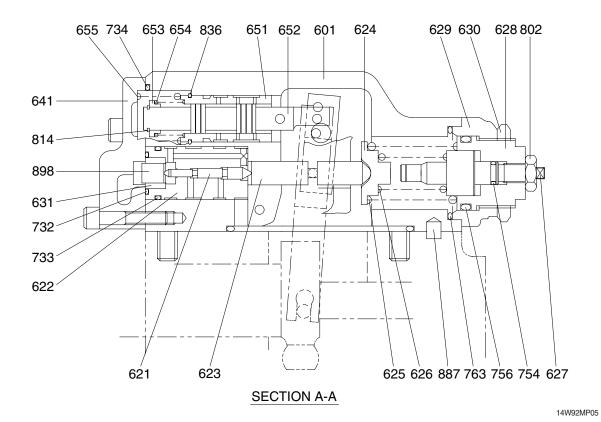


04	Gear pump	312	Valve block	717	O-ring
111	Drive shaft (F)	313	Valve plate (R)	719	O-ring
113	Drive shaft (R)	314	Valve plate (L)	724	O-ring
116	1st Gear	326	Cover	725	O-ring
123	Roller bearing	401	Hexagon socket bolt	727	O-ring
124	Needle bearing	406	Hexagon socket bolt	728	O-ring
127	Bearing spacer	414	Hexagon socket bolt	732	O-ring
141	Cylinder block	466	Plug	774	Oil seal
151	Piston	467	plug	789	Back up ring
152	Shoe	468	Plug	792	Back up ring
153	Set plate	490	Plug	808	Hexagon head nut
156	Bushing	531	Tilting pin	824	Snap ring
157	Cylinder spring	532	Servo piston	885	Pin
211	Shoe plate	534	Stopper (L)	886	Spring pin
212	Swash plate	535	Stopper (S)	901	Eye bolt
214	Bushing	548	Pin	953	Set screw
251	Support	702	O-ring	954	Set screw
261	Seal cover (F)	710	O-ring	981	Plate
271	Pump casing	711	O-ring	983	Pin
	· 1 · · · · · · ·		- 3		

# 2) **REGULATOR** (1/2)

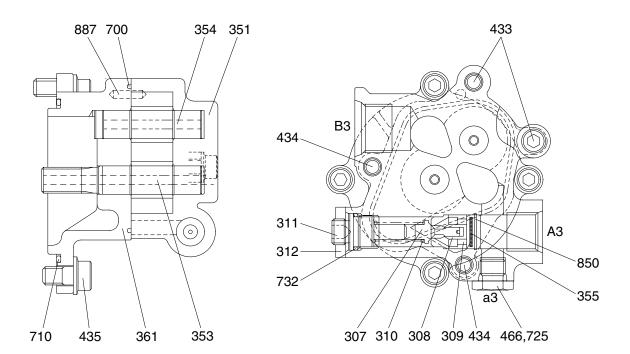


# REGULATOR (2/2)



079	EPPR valve assembly	629	Cover (C)	733	O-ring
405	Hexagon socket screw	630	Lock nut	734	O-ring
412	Hexagon socket screw	631	Sleeve, Pf	735	O-ring
413	Hexagon socket screw	641	Pilot cover	753	O-ring
436	Hexagon socket screw	643	Pilot piston	754	O-ring
438	Hexagon socket screw	644	Spring seat (Q)	755	O-ring
466	Plug	645	Adjust stem (Q)	756	O-ring
496	Plug	646	Pilot spring	763	O-ring
601	Casing	651	Sleeve	801	Nut
611	Feed back lever	652	Spool	802	Nut
612	Lever (1)	653	Spring seat	814	Snap ring
613	Lever (2)	654	Return spring	836	Snap ring
614	Center plug	655	Set spring	858	Snap ring
615	Adjust plug	656	Block cover	874	Pin
621	Compensator piston	699	Valve casing	875	Pin
622	Piston case	708	O-ring	876	Pin
623	Compensator rod	722	O-ring	887	Pin
624	Spring seat (C)	724	O-ring	897	Pin
625	Outer spring	725	O-ring	898	Pin
626	Inner spring	728	O-ring	924	Set screw
627	Adjust stem (C)	730	O-ring		
628	Adjust screw (C)	732	O-ring		

# 3) GEAR PUMP



14092MP06

307	Poppet	353	Drive gear	466	Plug
308	Seat	354	Driven gear	700	Ring
309	Ring	355	Filter	710	O-ring
310	Spring	361	Front case	725	O-ring
311	Screw	433	Flange socket	732	O-ring
312	Nut	434	Flange socket	850	Snap ring
351	Gear case	435	Flange socket	887	Pin

#### 2. FUNCTION

#### 1) MAIN PUMP

The pumps may classified roughly into the rotary group performing a rotary motion and working as the major part of the whole pump function: the swash plate group that varies the delivery rates: and the valve cover group that changes over oil suction and discharge.

#### (1) Rotary group

The rotary group consists of drive shaft (F) (111), cylinder block (141), piston shoes (151,152), set plate (153), spherical bushing (156) and cylinder spring (157). The drive shaft is supported by bearing (123,124) at its both ends.

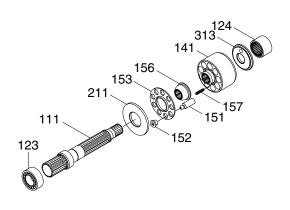
The shoe is caulked to the piston to from a spherical coupling. It has a pocket to relieve thrust force generated by loading pressure and the take hydraulic balance so that it slides lightly over the shoe plate (211). The sub group composed by a piston and a shoe is pressed against the shoe plate by the action of the cylinder spring via a retainer and a spherical bush. Similarly, the cylinder block is pressed against valve plate (313) by the action of the cylinder spring.

### (2) Swash plate group

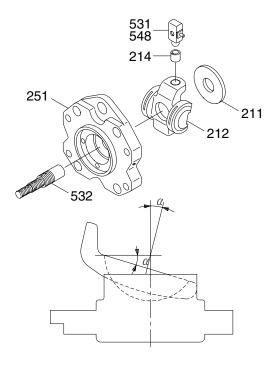
The swash plate group consists of swash plate (212), shoe plate (211), swash plate support (251), tilting bush (214), tilting pin (531) and servo piston (532).

The swash plate is a cylindrical part formed on the opposite side of the sliding surface of the shoe and is supported by the swash support.

If the servo piston moves to the right and left as hydraulic force controlled by the regulator is admitted to hydraulic chamber located on both sides of the servo piston, the swash plate slides over the swash plate support via the spherical part of the tilting pin to change the tilting angle (  $\alpha$  )



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### (3) Valve block group

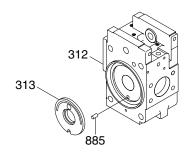
The valve block group consists of valve block (312), valve plate (313) and valve plate pin(885).

The valve plate having two melon-shaped ports is fixed to the valve block and feeds and collects oil to and from the cylinder block.

The oil changed over by the valve plate is connected to an external pipeline by way of the valve block.

Now, if the drive shaft is driven by a prime mover (electric motor, engine, etc), it rotates the cylinder block via a spline linkage at the same time. If the swash plate is tilted as in Fig (previous page) the pistons arranged in the cylinder block make a reciprocating motion with respect to the cylinder block, while they revolve with the cylinder block.

If you pay attention to a single piston, it performs a motion away from the valve plate (oil sucking process) within 180 degrees, and makes a motion towards the valve plate (or oil discharging process) in the rest of 180 degrees. When the swash plate has a tilting angle of zero, the piston makes no stroke and discharges no oil.



21092MP07

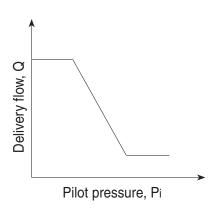
# 2) REGULATOR

Regulator consists of the negative flow control, total horse power control and power shift control function.

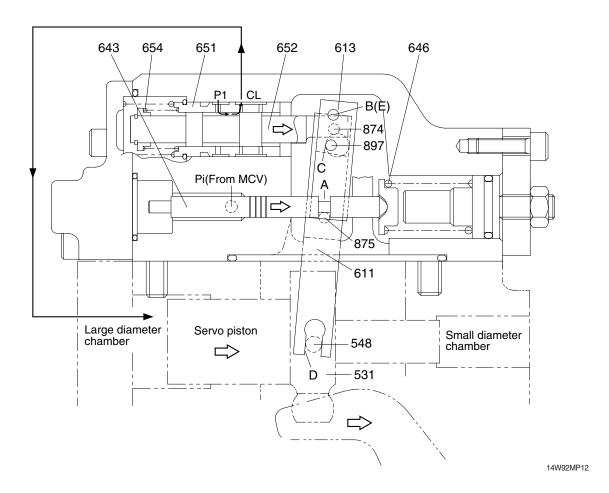
# (1) Negative flow control

By changing the pilot pressure Pi, the pump tilting angle (delivery flow) is regulated arbitrarily, as shown in the figure.

This regulator is of the negative flow control in which the delivery flow Q decreases as the pilot pressure Pi rises. With this mechanism, when the pilot pressure corresponding to the flow required for the work is commanded, the pump discharges the required flow only, and so it does not consume the power uselessly.



### ① Flow reducing function



As the pilot pressure Pi rises, the pilot piston (643) moves to the right to a position where the force of the pilot spring (646) balances with the hydraulic force.

The groove (A) in the pilot piston is fitted with the pin (875) that is fixed to lever 2 (613). Therefore, when the pilot piston moves, lever 2 rotates around the fulcrum of point B [fixed by the fulcrum plug (614) and pin (875)]. Since the large hole section (C) of lever 2 contains a protruding pin (897) fixed to the feedback lever (611), the pin (897) moves to the right as lever 2 rotates. Since the opposing-flat section (D) of the feedback lever is fitted with the pin (548) fixed by the tilting pin (531) that swings the swash plate, the feedback lever rotates around the fulcrum of point D, as the pin (897) moves.

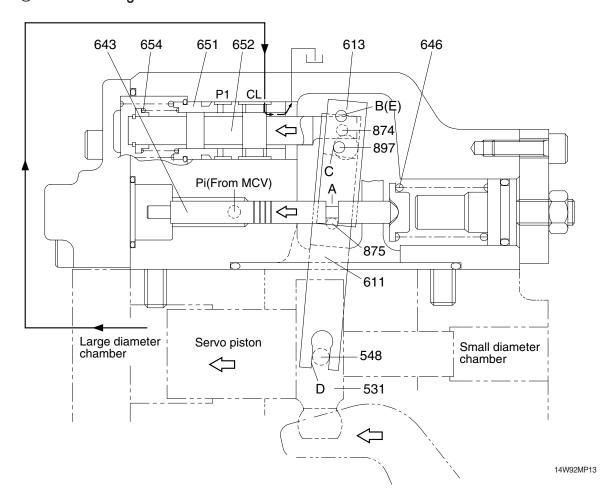
Since the feedback lever is connected with the spool (652) via the pin (874), the spool moves to the right.

The movement of the spool causes the delivery pressure P1 to connect to port CL through the spool and to be admitted to the large diameter section of the servo piston. The delivery pressure P1 that is constantly admitted to the small diameter section of the servo piston moves the servo piston to the right due to the area difference, resulting in decrease of the tilting angle.

When the servo piston moves to the right, point D also moves to the right. The spool is fitted with the return spring (654) and is tensioned to the left at all times, and so the pin (897) is pressed against the large hole section (C) of lever 2.

Therefore, as point D moves, the feedback lever rotates around the fulcrum of point C, and the spool is shifted to the left. This causes the opening between the sleeve (651) and spool (652) to close slowly, and the servo piston comes to a complete stop when it closes completely.

#### ② Flow increasing function



As the pilot pressure Pi decreases, the pilot piston (643) moves to the left by the action of the pilot spring (646) and causes lever 2 (613) to rotate around the fulcrum of point B. Since the pin (897) is pressed against the large hole section (C) of lever 2 by the action of the return spring (654) via the spool (652), pin (874), and feedback lever (611), the feedback lever rotates around the fulcrum of point D as lever 2 rotates, and shifts the spool to the left. Port CL opens a way to the tank port as the spool moves. This deprives the large diameter section of the servo piston of pressure, and shifts the servo piston to the left by the discharge pressure P1 in the small diameter section, resulting in an increase in the flow rate.

As the servo piston moves, point D also moves to the left, the feedback lever rotates around the fulcrum of point C, and the spool moves to the right till the opening between the spool and sleeve is closed.

# 3 Adjustment of flow control characteristic

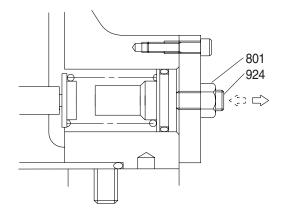
The flow control characteristic can be adjusted with the adjusting screw.

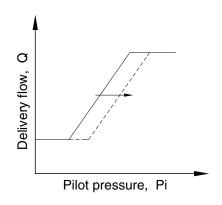
Adjust it by loosening the hexagon nut (801) and by tightening (or loosening) the hexagonal socket head screw (924).

Tightening the screw shifts the control chart to the right as shown in the figure.

# \* Adjusting value

Speed	Adjustment of flow control characteristic				
			_		
	Tightening amount of adjusting screw (924)	Flow control starting pressure change amount	Flow change amount		
(min <sup>-1</sup> )	(Turn)	(kgf/cm²)	( \ell /min)		
1900	+1/4	+1.6	+9		





21092MP11

#### (2) Total horsepower control

The regulator decreases the pump tilting angle (delivery flow) automatically to limit the input torque within a certain value with a rise in the delivery pressure P1 of the self pump and the delivery pressure P2 of the companion pump.

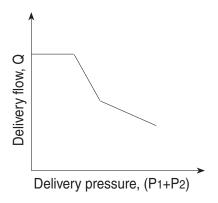
(The input horsepower is constant when the speed is constant.)

Since the regulator is of the simultaneous total horsepower type that operates by the sum of load pressures of the two pumps in the tandem double-pump system, the prime mover is automatically prevented from being overloaded, irrespective of the load condition of the two pumps, when horsepower control is under way.

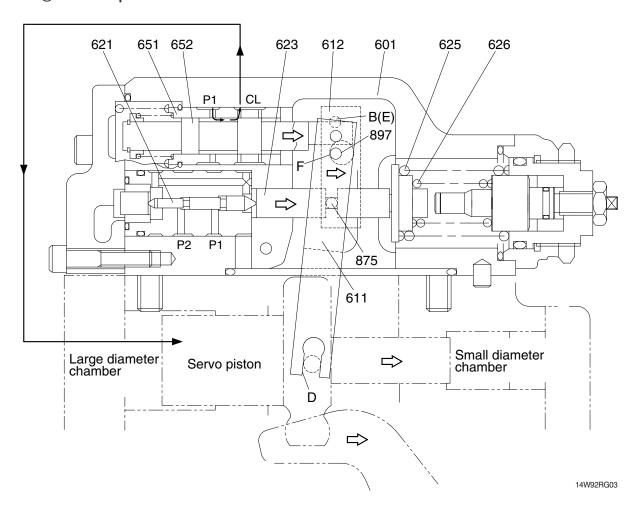
Since this regulator is of the simultaneous total horsepower type, it controls the tilting angles (displacement volumes) of the two pumps to the same value as represented by the following equation:

Tin = P1×q/2
$$\Pi$$
 + P2×q/2 $\Pi$   
= (P1+P2)×q/2 $\Pi$ 

The horsepower control function is the same as the flow control function and is summarized in the following. (For detailed behaviors of respective parts, refer to the section of flow control).



#### ① Overload preventive function



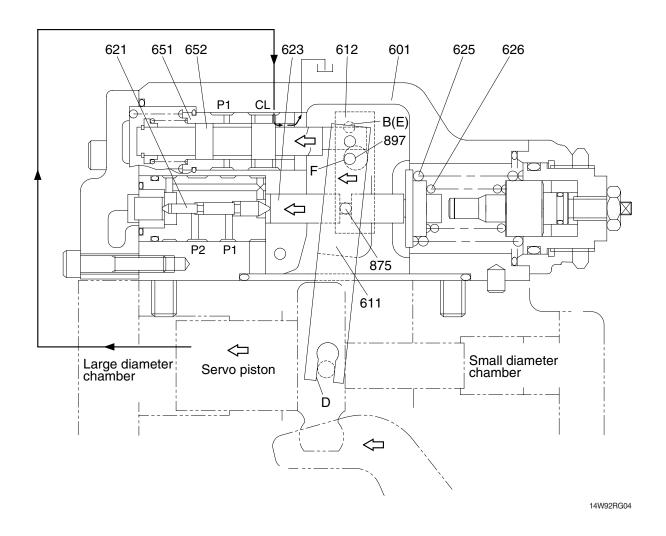
When the self pump delivery pressure P1 or the companion pump delivery pressure P2 rises, it acts on the stepped part of the compensating piston (621). It presses the compensating rod (623) to the right till the force of the outer spring (625) and inner spring (626) balances with the hydraulic force. The movement of the compensating rod is transmitted to lever 1 (612) via pin (875).

Lever 1 rotates around the pin (875) (E) fixed to the casing (601).

Since the large hole section (F) of lever 1 contains a protruding pin (897) fixed to the feedback lever (611), the feedback lever rotates around the fulcrum of point D as lever 1 rotates, and then the spool (652) is shifted to the right. As the spool moves, the delivery pressure P1 is admitted to the large diameter section of the servo piston via port CL, causes the servo piston move to the right, reduces the pump delivery, flow rate, and prevents the prime mover from being overloaded.

The movement of the servo piston is transmitted to the feedback lever via point D. Then the feedback lever rotates around the fulcrum of point F and the spool is shifted to the left. The spool moves till the opening between the spool (652) and sleeve (651) is closed.

#### ② Flow reset function



As the self pump delivery pressure P1 or the companion pump delivery pressure P2 decreases, the compensating rod (623) is pushed back by the action of the springs (625 & 626) to rotate lever 1 (612) around point E. Rotating of lever 1 causes the feedback lever (611) to rotate around the fulcrum of point D and then the spool (652) to move to the left. As a result, port CL opens a way to the tank port.

This causes the servo piston to move to the left and the pump's delivery rate to increase.

The movement of the servo piston is transmitted to the spool by the action of the feedback mechanism to move it till the opening between the spool and sleeve is closed.

#### 3 Low tilting angle (low flow) command preferential function

As mentioned above, flow control and horsepower control tilting angle commands are transmitted to the feedback lever and spool via the large-hole sections (C & F) of levers 1 and 2. However, since sections C and F have the pins ( $\varnothing$ 4) protruding from the large hole ( $\varnothing$ 8), only the lever lessening the tilting angle contacts the pin (897); the hole ( $\varnothing$ 8) in the lever of a larger tilting angle command is freed without contacting the pin (897). Such a mechanical selection method permits preference of the lower tilting angle command of the flow control and horsepower control.

# 4 Adjustment of input horsepower

Since the regulator is of total cumulative horsepower type, adjust the adjusting screws of both the front and rear pumps, when changing the horsepower set values. The pressure change values by adjustment are based on two pumps pressurized at the same time, and the values will be doubled when only one pump is loaded.

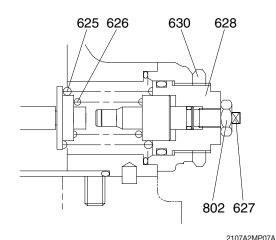
### a. Adjustment of outer spring

Adjust it by loosening the hexagon nut (630) and by tightening (or loosening) the adjusting screw C (628).

Tightening the screw shifts the control chart to the right and increases the input horsepower as shown in the figure. Since turning the adjusting screw C (628) by N turns changes the setting of the inner spring (626), return the adjusting stem C (627) by  $N \times A$  turns at first. (A=1.73)

#### \* Adjusting value

Speed	Adjustment of input horsepower					
	Tightening amount of adjusting screw (C) change amount (628) Compensating control change amount starting pressure (628) change amount					
(min <sup>-1</sup> )	(Turn)	(kgf/cm <sup>2</sup> )	(kgf · m)			
1900	+1/4	+19.2	+3.4			



Delivery pressure, (P1+P2)

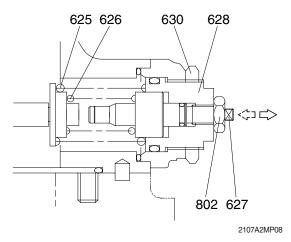
# b. Adjustment of inner spring

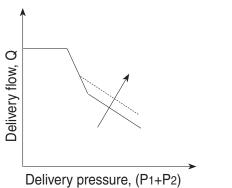
Adjust it by loosening the hexagon nut (802) and by tightening (or loosening) the adjusting stem C (627).

Tightening the screw increases the flow and then the input horsepower as shown in the figure.

# \* Adjusting value

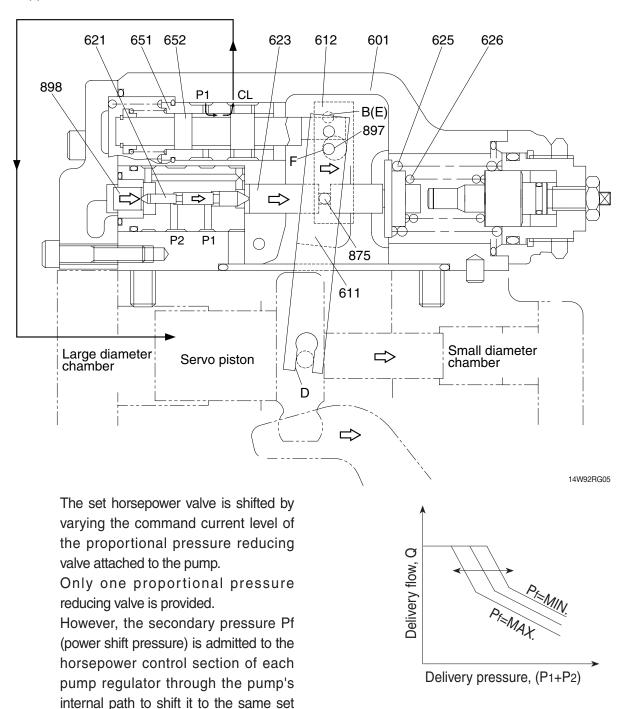
Speed	Adjustment of input horsepower				
	Tightening amount of adjusting stem (C) (627)	Flow change amount	Input torque change amount		
(min <sup>-1</sup> )	(Turn)	( \ell /min)	(kgf · m)		
1900	+1/4 +8.6 +4.5				





#### (3) Power shift control

horsepower level.



This function permits arbitrary setting of the pump output power, thereby providing the optimum power level according to the operating condition.

The power shift pressure Pf controls the set horsepower of the pump to a desired level, as shown in the figure.

As the power shift pressure Pf rises, the compensating rod (623) moves to the right via the pin (898) and compensating piston (621).

This decreases the pump tilting angle and then the set horsepower in the same way as explained in the overload preventive function of the horsepower control. On the contrary, the set horsepower rises as the power shift pressure Pf falls.

# (4) Adjustment of maximum and minimum flows

# ① Adjustment of maximum flow

Adjust it by loosening the hexagon nut (808) and by tightening (or loosening) the set screw (954).

The maximum flow only is adjusted without changing other control characteristics.

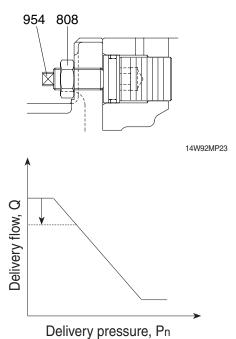
Speed	Adjustment of max flow				
	Tightening amount of adjusting screw (954)	Flow change amount			
(min <sup>-1</sup> )	(Turn)	( ℓ /min)			
1900	+1/4	-3.0			

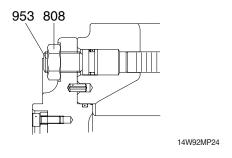


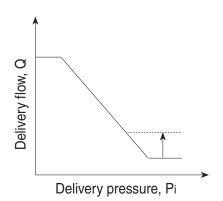
Adjust it by loosening the hexagon nut (808) and by tightening (or loosening) the hexagonal socket head set screw (953). Similarly to the adjustment of the maximum flow, other characteristics are not changed.

However, remember that, if tightened too much, the required horsepower during the maximum delivery pressure (or during relieving) may increase.

Speed	Adjustment of min flow				
	Tightening amount of adjusting screw (953)	Flow change amount			
(min -1)	(Turn)	( ℓ /min)			
1900	+1/4	+3.0			

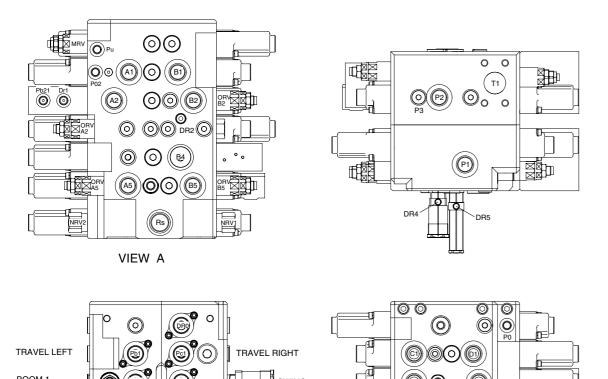


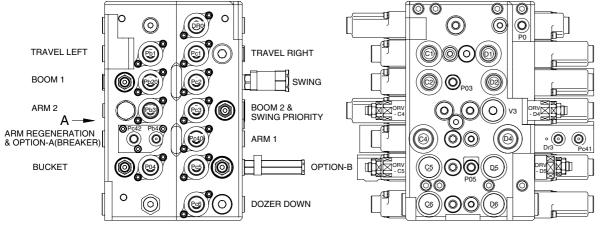


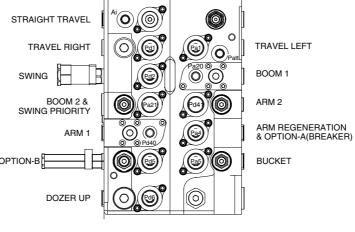


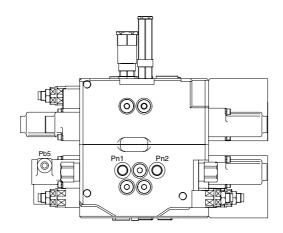
# **GROUP 2 MAIN CONTROL VALVE**

# 1. STRUCTURE



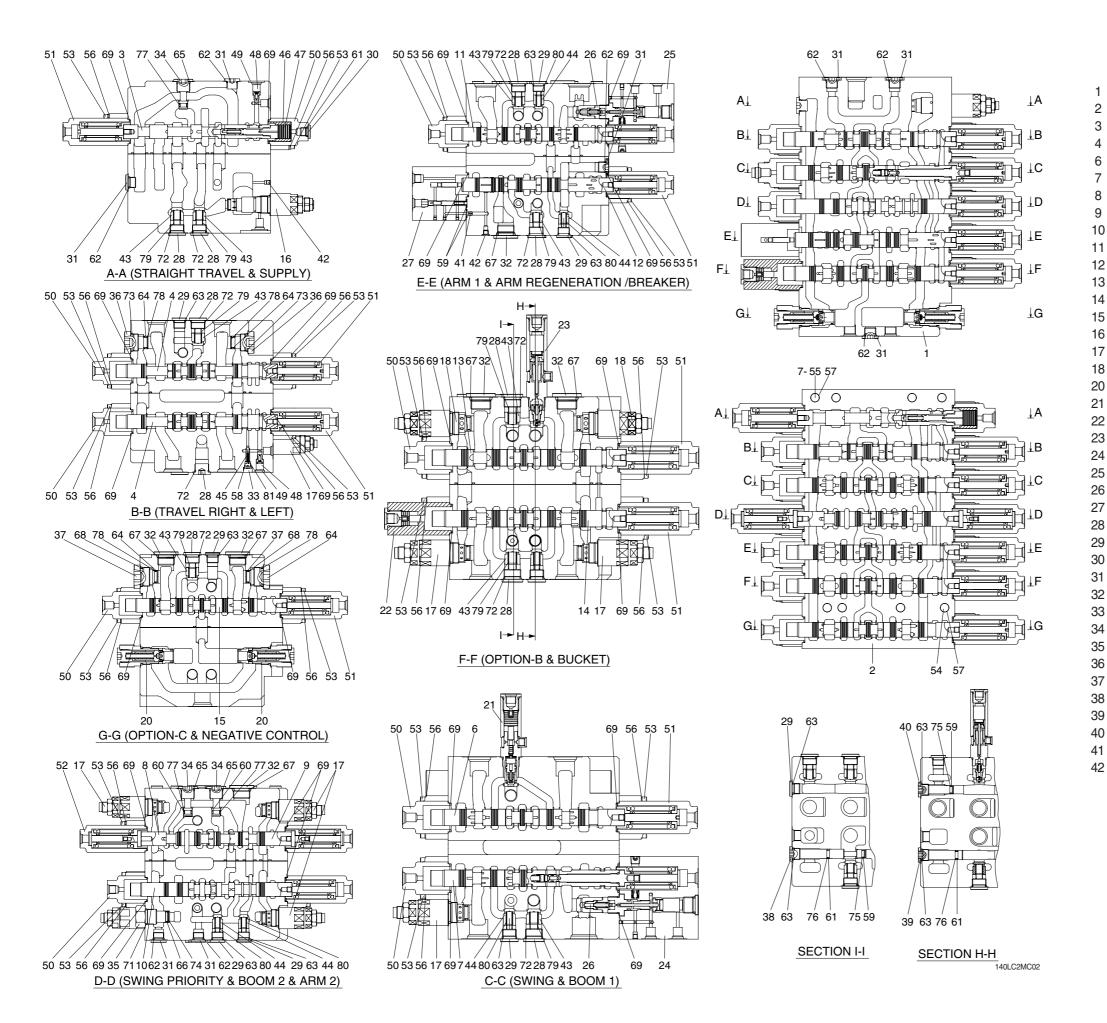






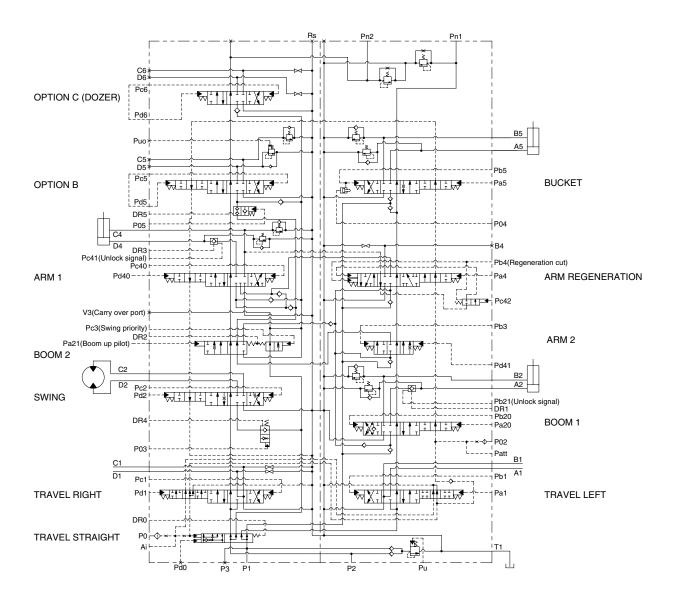
Mark	Port name	Port size	Tightening torque
Rs	Make up for swing motor	UNF 1 3/16	18 kgf · m (130 lbf · ft)
Pa1 Pb1 Pc1 Pa20 Pa21 Pb20 Pb21 Pc2 Pb3 Pc3 Pc44 Pc440 Pc441 Pa5 Pc5 Pc6 Pd6 Pd6 Pc9 Pc9 Pc9 Pc9 Pc9 Pc9 Pc9 Pc9 Pc9 Pc9	Travel left pilot port (BW) Travel left pilot port (FW) Travel right pilot port (FW) Travel right pilot port (BW) Boom up pilot port Boom up confluence pilot port Boom down pilot port (boom) Swing pilot port (LH) Swing pilot port (LH) Arm in confluence pilot port Option A pilot port (breaker) Arm in regeneration cut port Arm in pilot port Lock valve pilot port (arm) Arm in regen-cut signal selector port Arm out confluence pilot port Bucket in pilot port Option B pilot port Option B pilot port Option C pilot port (dozer blade down) Option C pilot port (dozer blade up) Pilot pressure up pilot port Auto idle signal port Auto idle signal-attachment Pilot signal port Boom parallel orifice pilot port Breaker summation pilot port Drain port (boom 2 & swing priority) Drain port (arm holding valve) Quick clamp port	PF 1/4	3.5~3.9 kgf · m (25.3~28.2 lbf · ft)
Pn1 Pn2	Negative control signal port (P1 port side) Negative control signal port (P2 port side)	PF 3/8	7~8 kgf · m (50.6~57.8 lbf · ft)
A1 B1 C1 D1 B2 C2 D2 B4 A5 B5 C5 D6 P1 P2	Travel motor left side port (BW) Travel motor left side port (FW) Travel motor right side port (FW) Travel motor right side port (BW) Boom rod side port Swing motor port (RH) Swing motor port (LH) Option A port (breaker) Bucket head side port Bucket rod side port Option B port Option B port Option C pilot port (dozer down port) Option C pilot port (dozer up port) Pump port (P1 side) Pump port (P2 side)	PF 3/4	15~18 kgf · m (109~130 lbf · ft)
A2 C4 D4	Boom head side port Arm head side port Arm rod side port	PF 1	20~25 kgf · m (115~180 lbf · ft)
DR4 DR5	Drain port (swing logic valve) Drain port (flow summation)	PF 1/8	1.5~1.9 kgf · m (10.8~13.7 lbf · ft)
T1	Return port	SAE3000, 1 1/2 (M12×1.75)	8.5~11.5 kgf · m (61.5~83.1 lbf · ft)

140LC2MC01



	Housing-P1	43	Load check-poppet 1
-	Housing-P2	44	Load check-poppet 2
3	Spool-straight travel	45	Signal-poppet
	Spool-travel (LH, RH)	46	Travel straight-sleeve
	Spool-swing	47	Travel straight-piston
7	Spool-boom 1	48	Orifice signal
3	Spool-swing priority	49	Coin type filter
)	Spool-boom 2	50	Pilot A cap
0	Spool-arm 2	51	Pilot B1 cap
1	Spool-arm 1	52	Pilot B2 cap
2	Spool-arm regeneration	53	Socket bolt
3	Spool-option B	54	Socket bolt
4	Spool-bucket	55	Socket bolt
5	Spool-option C (dozer)	56	Plain washer
6	Main relief valve	57	Spring washer
7	Overload relief valve	58	O-ring
8	Overload relief valve	59	O-ring
0	Negacon relief valve	60	O-ring
1	Swing logic valve	61	O-ring
2	Bucket stroke limit	62	O-ring
3	Option on-off valve	63	O-ring
4	Holding valve kit A1	64	O-ring
5	Holding valve kit A2	65	O-ring
6	Holding valve kit B	66	O-ring
7	Regeneration block	67	O-ring
8	Plug	68	O-ring
9	Plug	69	O-ring
0	Plug	71	O-ring
1	Plug	72	O-ring
2	Plug	73	O-ring
3	Plug	74	Backup-ring
4	Plug-parallel	75	Backup-ring
5	Plug-relief cartridge	76	Backup-ring
6	Plug-relief cartridge	77	Backup-ring
7	Plug-relief cartridge	78	Backup-ring
8	Plug-bucket	79	Load check spring
9	Plug-bucket parallel	80	Load check spring
0	Plug-option	81	Check spring
1	Plug-orifice	82	Regen pin
2	Plug		

# 2. HYDRAULIC CIRCUIT



140LC2MC05

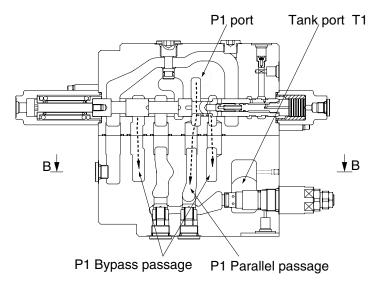
#### 3. FUNCTION

# 1) CONTROL IN NEUTRAL

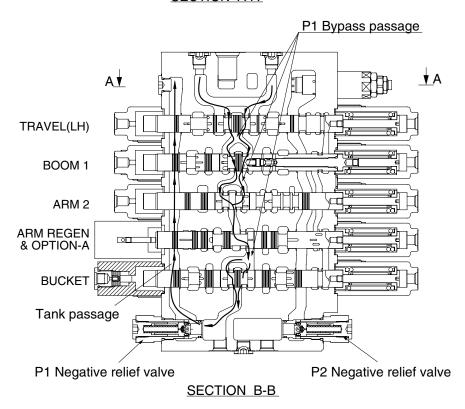
# (1) P1 side

The hydraulic fluid from pump A2 flows into the main control valve through the inlet port "P1", pass the straight travel spool into the P1 bypass passage and P1parallel passage.

The hydraulic fluid from the pump A2 is directed to the tank through the bypass passage of spools: travel left, boom 1, arm 2, arm regeneration & option A and bucket, the negative relief valve of P1, tank passage, and the tank port "T1"



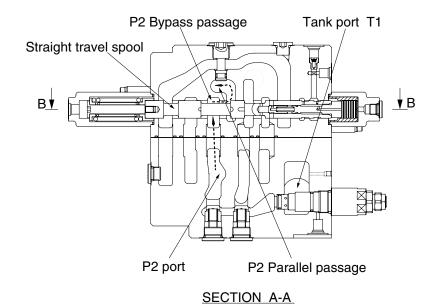
SECTION A-A

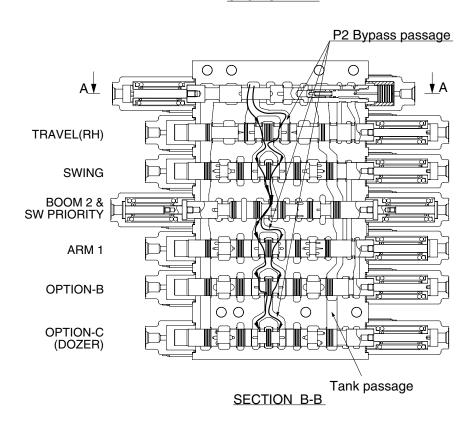


# (2) P2 side

The hydraulic fluid from pump A1 flows into the main control valve through the inlet port "P2", into the P2 bypass passage and P2 parallel passage.

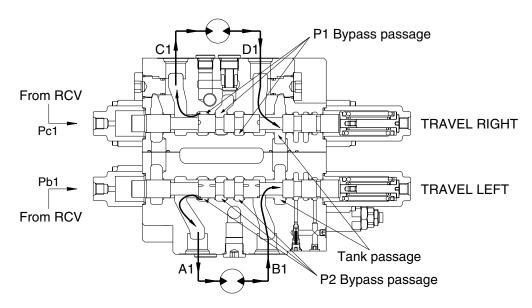
The hydraulic fluid from the pump A1 is directed to the tank through the bypass passage of spools: travel right, swing, boom 2 & swing priority, arm 1, option "B" and option "C" (dozer), the negative relief valve of P2, tank passage and the tank port "T1".





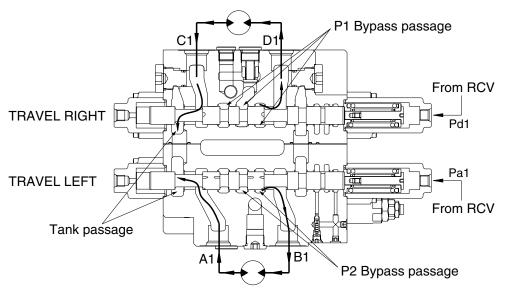
# 2) TRAVEL OPERATION

#### (1) Travel forward operation



14092MC18

#### (2) Travel backward operation



14092MC17

During the travel forward operation, the hydraulic fluid of the pump A2 is supplied to the travel left motor and the hydraulic fluid of the pump A1 is supplied to the other travel right motor.

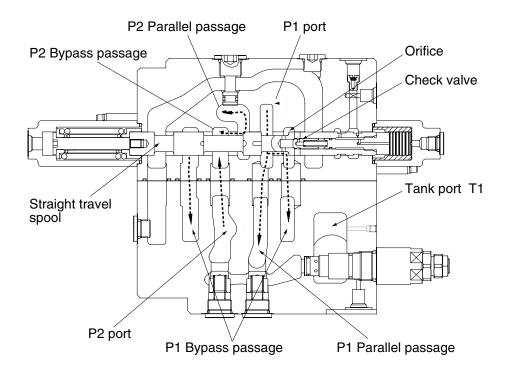
The pilot pressure from the pilot control valve is supplied to the spring side of pilot port (pb1, pc1).

And it shifts travel right and left spools in the left direction against springs. Hydraulic fluid from the pump A1 flow into the travel right spool through the bypass passage and hydraulic fluid from the pump A2 flow into the travel left spool through the bypass passage.

Then they are directed to the each travel motor through port A1 and C1. As a result, the travel motors turn and hydraulic fluid returns to the tank passage through the travel spools.

In case of the reverse operation, the operation is similar.

#### (3) Travel straight function



14092MC19

This function keeps straight travel in case of simultaneous operation of other actuators (boom, arm, bucket, swing) during a straight travel.

#### ① During travel only:

The hydraulic fluid of the pump A1 is supplied to the travel right motor and the pump A2 is supplied to the travel left motor.

Thus, the machine keep travel straight.

#### ② The other actuator operation during straight travel operation:

When the other actuator spool (s) is selected under straight travel operation, the straight travel spool is moved.

The hydraulic fluid from pump A2 is supplied actuator through P2 and P1 parallel pass and travel motors through orifice at side of straight travel spool.

The hydraulic oil fluid from pump A1 is supplied to travel motors (left/right).

Therefore, the other actuator operation with straight travel operation, hydraulic oil fluid from pump A2 is mainly supplied to actuator, and the hydraulic oil fluid form pump A1 is mainly supplied to travel motors (left/right).

Then the machine keeps straight travel.

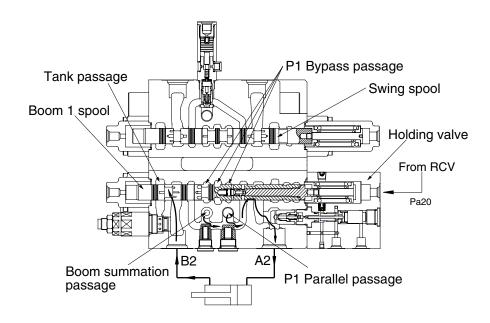
#### 3) BOOM OPERATION

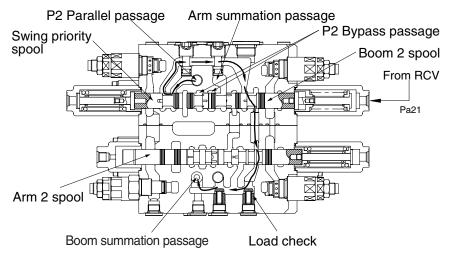
#### (1) Boom up operation

During boom up operation, the pilot secondary pressure from RCV is supplied to the port Pa20 of the spring side and shifts the boom 1 spool in the left direction. The bypass passage is shut off by the movement of the boom 1 spool and the hydraulic oil fluid from pump A2 is entered P1 parallel passage and then passes through the load check, bridge passage and boom holding valve then flows into the port A2. Following this it flows into the head side of the boom cylinder. (In this case, the boom holding valve is free flow condition)

At the same time, the pilot pressure from RCV is supplied to the port Pa21 of the spring side of boom 2 and shifts the boom 2 spool. The bypass passage is shut off by the movement of the boom 2 spool and the hydraulic oil fluid from pump A1 entered boom summation passage via the P2 parallel passage, the land of the swing priority spool, notch of the boom 2 spool, arm 2 spool and the check. The flows combine in passage and are directed to port A2 and head side of boom cylinder.

At the same time, the flow from rod side of the boom cylinder return to the boom 1 spool through the port B2. Thereafter it is directed to the hydraulic oil tank through the tank passage.





#### (2) Boom down operation

During the boom lowing operation, the pilot pressure from RCV is supplied to the port Pb20 of the spring opposite side and shifts the boom 1 spool in the right direction.

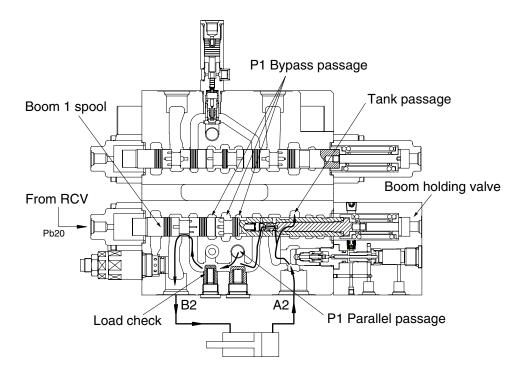
The bypass passage is shut off by the movement of the boom 1 spool and the hydraulic fluid from the pump A2 enters the parallel passage and is directed to the port B2 through the load check. Following this, it flows into the rod side of the boom cylinder.

At the same time, the return flow from the head side of the boom cylinder returns to the port A2 and boom holding valve. And it is directed to the hydraulic oil tank through opened tank passage by movement of the boom 1 spool.

Meanwhile some of return flow is directed to P1 parallel passage through the internal passage of the boom 1 spool. (boom regeneration)

In this case, the holding valve is open condition, for details of the boom holding valve, see page following page.

During the boom lowering operation, the fluid from A1 pump is not summation.

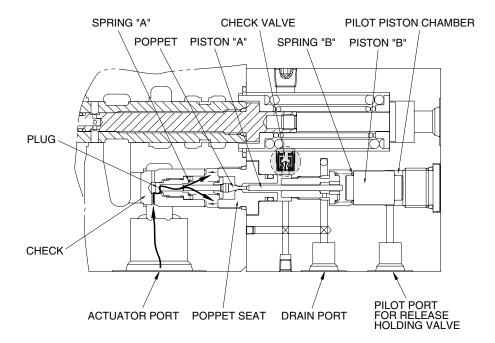


# 4) HOLDING VALVE OPERATION

# (1) Holding operation

At neutral condition, the pilot piston chamber is connected to drain port through the pilot port. And the piston "B" is supported with spring "B".

Also, the pressured fluid from actuator entered to inside of the holding valve through the periphery hole of check, crevice of the check and the plug and the periphery hole of plug. Then, this pressured oil pushed the poppet to the poppet seat and the check to the seat of body. So the hydraulic fluid from actuator is not escaped and the actuator is not moved.

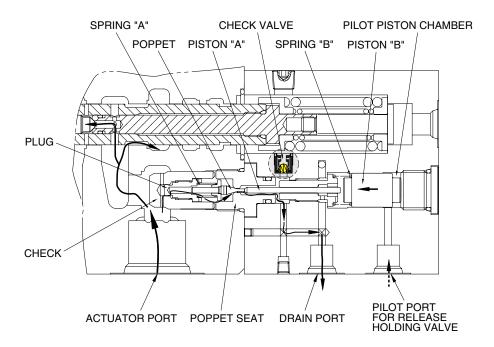


#### (2) Release holding operation

The pilot pressure is supplied to the pilot port for release holding valve and shifts the piston "B" in the left direction against the spring "B", and shifts the poppet in the left direction through piston "B" and piston "A" against spring "B" and shifts the spool in the left side.

At same time, the return fluid from actuator returns to the drain port through the periphery hole of check, crevice of the check and the plug, the periphery hole of the plug, in side of holding valve, crevice of the poppet and the poppet seat, the periphery hole of the poppet seat, crevice of socket and spool and internal passage of spool.

When the poppet is opened, pressure of inside of holding valve is decreased and the return fluid from actuator returns to the tank passage through the notch of spool.



# 5) BUCKET OPERATION

# (1) Bucket in operation

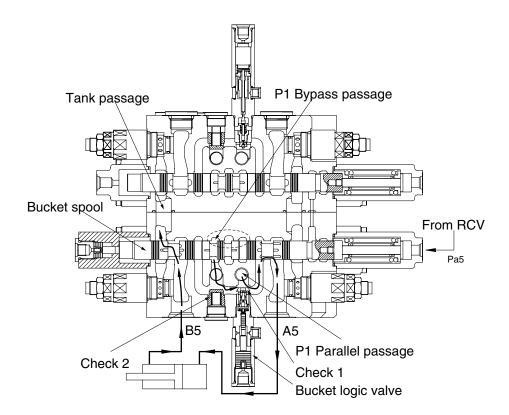
During the bucket in operation, the pilot secondary pressure from RCV is supplied to port Pa5 of the spring side and shifts the bucket spool in the left direction.

The bypass passage is shut off by the movement of the bucket spool and the hydraulic fluid from pump A2 entered P1 parallel passage and is directed to the port A5 through the check 1 of bucket logic valve.

At the same time, the hydraulic fluid from P1 bypass passage is directed to the port A5 through the check 2.

Following this it flows into the head side of the bucket cylinder.

The return flow from the rod side of the bucket cylinder returns to the bucket spool through the port B5. Thereafter it is directed to the hydraulic oil tank through the tank passage.



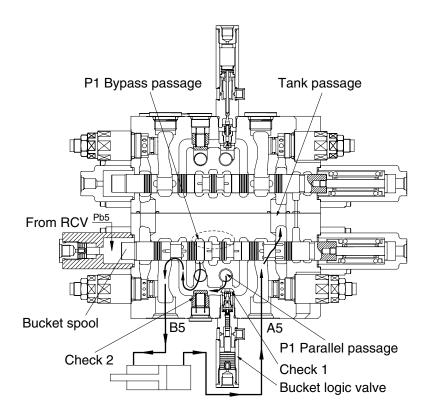
# (2) Bucket out operation

During the bucket out operation, the pilot secondary pressure from RCV is supplied to port Pb5 of the spring opposite side and shifts the bucket spool in the right direction.

The bypass passage is shut off by the movement of the bucket spool and the hydraulic fluid from pump A2 entered P1 parallel passage and is directed to the port B5 through the check 1 of bucket logic valve.

At the same time, the hydraulic fluid from P1 bypass passage is directed to the port B5 through the check 2.

The return flow from the head side of the bucket cylinder returns to the hydraulic oil tank through the port A5 and the tank passage.



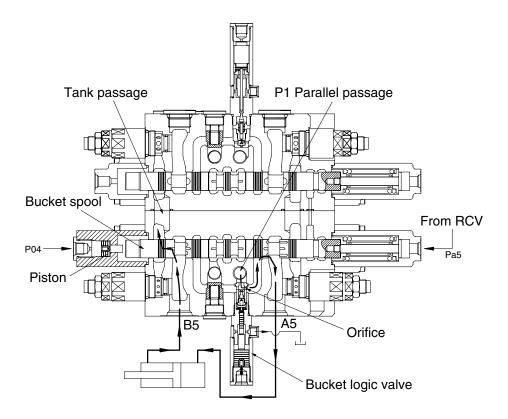
#### (3) Bucket in operation with boom operation

When combined operation, mostly same as previous page but the fluid from P1 bypass passage is empty.

So only the fluid from P1 parallel passage is supplied to the bucket cylinder. Also, parallel passage is installed the orifice of bucket logic valve for supplying the fluid from pump A2 to the boom operation prior to the bucket operation. In case of the bucket out operation with boom operation, operation is similar.

Also the boom up operation, the boom up pilot pressure is supplied the pilot port (P04) of bucket spool stroke limit and the piston is shifted to the right and then the bucket in spool stroke is limited and the open of the bucket in spool is reduced.

Accordingly, the oil of the bucket in spool is reduced and the boom speed up.



# 6) SWING OPERATION

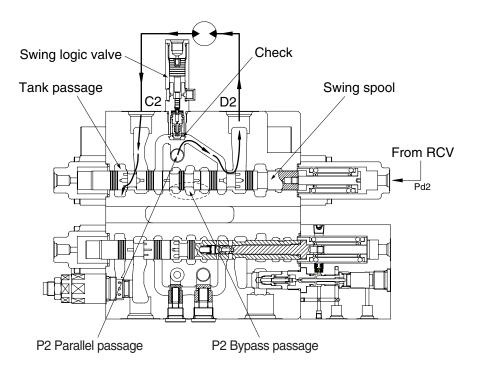
#### (1) Swing left & right operation

During the swing left operation, the pilot secondary pressure from the RCV is supplied to the port Pd2 of the spring side and shift the swing spool in left direction. The bypass passage is shut off by the movement of the swing spool and the hydraulic fluid from pump A1 flows into swing spool through the P2 parallel passage. Then it is directed to swing motor through the port D2.

As the result, swing motor turns and flow from the swing motor returns to the hydraulic oil tank through the port C2, swing spool and the tank passage.

In case of swing right operation, the operation is similar to swing left operation but the pilot secondary pressure from the RCV is supplied to the port Pc2 of the spring opposite side.

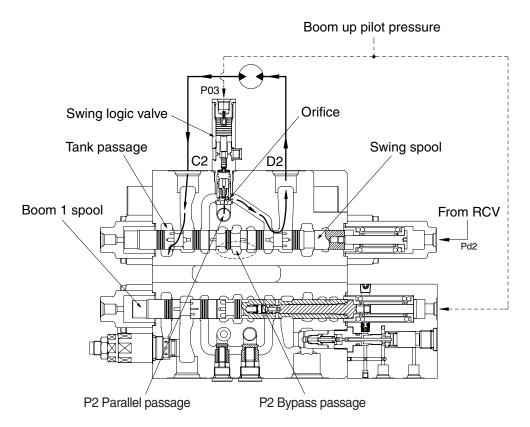
Accordingly, the hydraulic fluid from pump A1 flows into swing motor through the port C2 and returns to the hydraulic oil tank through the port D2 and the tank passage.



# (2) Swing left operation with arm or boom operation

When combined operation, mostly same as previous page but the fluid from P2 bypass passage is empty.

So only the fluid from parallel passage is supplied to the swing motor. Also, parallel passage is installed the orifice of swing logic valve for supplying the fluid from pump A1 to the boom or the arm operation prior to the swing operation. In case of the swing right operation with arm or boom operation, operation is similar.



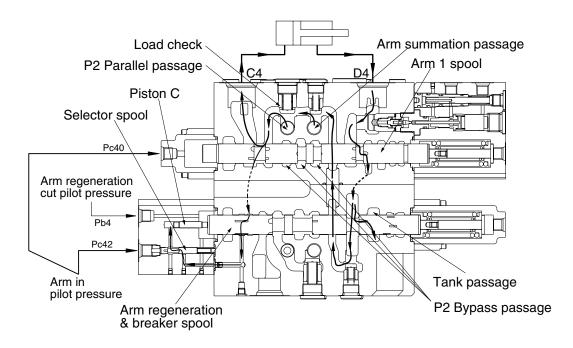
# 7) ARM OPERATION

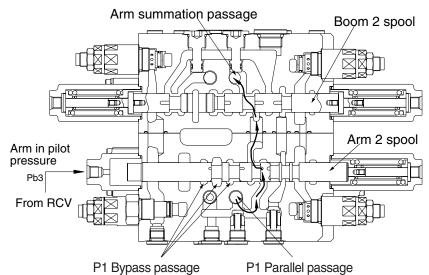
### (1) Arm in operation

During arm in operation, the pilot secondary pressure from the RCV is supplied to the port Pc40 of spring opposite side and shifts arm 1 spool in the right direction.

The bypass passage is shut off by the movement of the arm 1 spool and the hydraulic oil from the pump A1 flows into the arm cylinder head side through P2 parallel passage, the load check valve, bridge passage and the port C4.

At same time, the pilot secondary pressure from the RCV is supplied to the port Pb3 of spring opposite side and shifts arm 2 spool in the right direction. The bypass passage is shut off by the movement of the arm 2 spool and the hydraulic fluid from the pump A2 flows into the arm summation passage through P1 parallel passage, the check valve, the arm 2 spool and the boom 2 spool. Then it entered the arm cylinder head side with hydraulic fluid from arm 1 spool.





140L2MC21

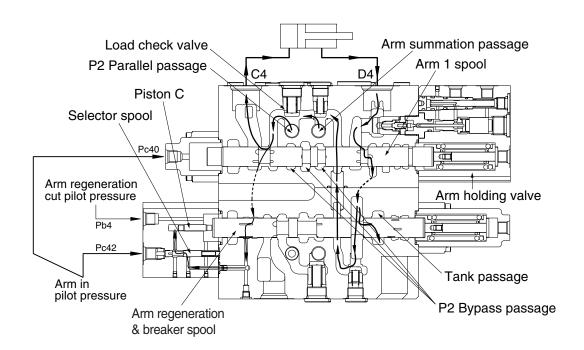
#### Arm regeneration

The return flow from the arm cylinder rod side is pressurized by self weight of arm and so, returns to port D4. The pressurized oil returning to port D4 enters the arm regeneration & breaker spool through the arm holding valve and the arm 1 spool. It is supplied the arm cylinder head through internal passage. This is called the arm regeneration function.

The amount of regeneration fluid is changed by movement of the arm regeneration spool. A few fluids after P2 parallel passage is push piston "C" through the notch of arm regeneration spool and selector spool. At this time, the selector spool is opened by pilot pressure from RCV.

Then, the arm regeneration spool shifts to right side and flow to tank pass increases and regeneration flow decreases. Therefore, pressure of arm cylinder head increases, then, arm regeneration flow decreases.

Furthermore, the arm regeneration cut pressure is supplied to the port Pb4 of spring opposite side and arm regeneration spool is move into the right direction fully. The flow from the arm cylinder rod is returned to the hydraulic oil tank and regeneration function is not activated. (The return fluid is maximum condition)



# (2) Arm out operation

During arm out operation, the pilot secondary pressure from RCV is supplied to the port Pd40 of spring side and shifts arm 1 spool in the left direction.

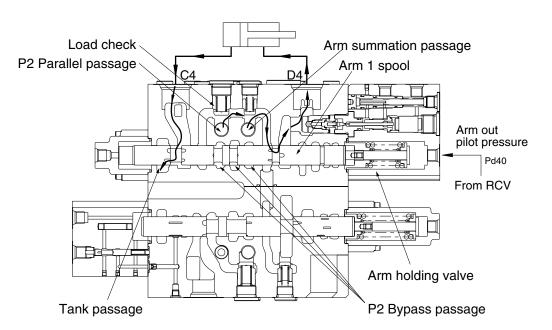
The bypass passage is shut off by the movement of the arm 1 spool and the hydraulic fluid from pump A1 flows into arm 1 spool through the P2 parallel passage. Then it enters into the arm cylinder rod side through the load check, bridge passage, arm holding valve and the port D4.

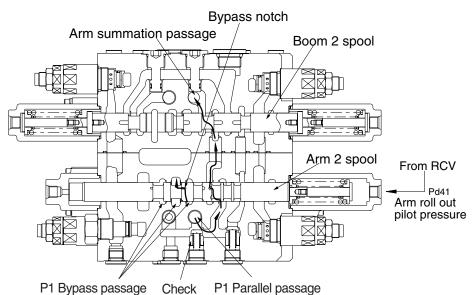
Also, the pilot secondary pressure from RCV is supplied to the port Pd41 of spring side and shifts arm 2 spool in the left direction.

The bypass passage is shut off by the movement of the arm 2 spool and some of the hydraulic fluid from pump A2 bypassed through bypass notch. The rest of hydraulic fluid from pump A2 flows into the arm summation passage through P1 parallel passage, the check valve, arm 2 spool and boom 2 spool.

Then it enters into the arm cylinder rod side with the fluid from the arm 1 spool.

The return flow from the arm cylinder head side returns to the hydraulic tank through the port C4, the arm 1 spool and tank passage.





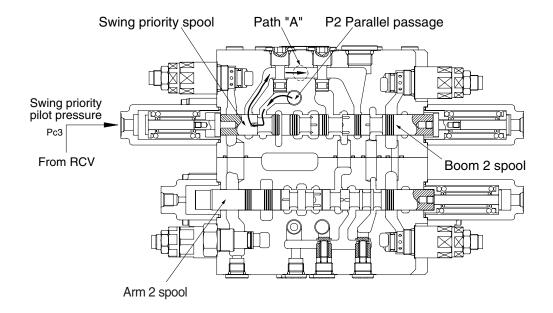
140L9MC23

### 8) SWING PRIORITY FUNCTION

During swing priority operation, the pilot secondary pressure is supplied to the port Pc3 of the spring side of the swing priority spool and shift swing priority spool in the right direction.

The hydraulic fluid from P2 parallel passage flows into the parallel passage of arm 1 side through swing priority spool and the path "A" and also flows into the boom 2 spool.

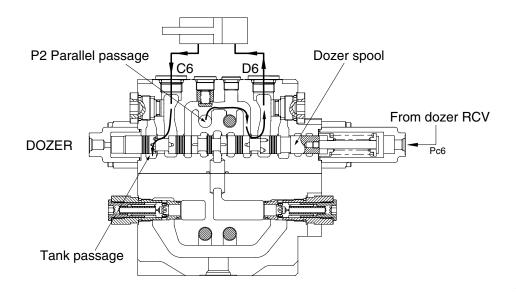
When the swing priority spool is neutral condition, the passage is same as normal condition. But due to shifting of the swing priority spool, the fluid from pump A1 flows to swing side more then the boom 2, arm 1, option B and dozer spools to make the swing operation most preferential.



140L2MC27

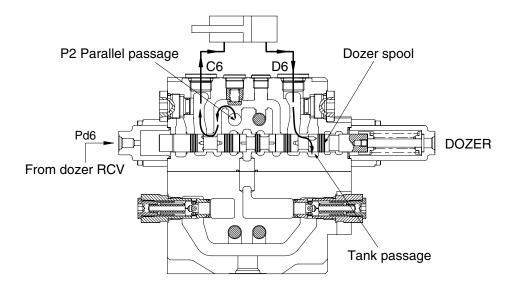
# 9) DOZER OPERATION

# (1) Dozer down operation



14W92MC30

# (2) Dozer up operation



14W92MC31

During the dozer down operation, the pilot pressure from the dozer control valve is supplied into the port Pc6 of the spring side and it shifts the dozer spool in the left direction.

The hydraulic fluid from the pump A1 enters the parallel passage and is direction to the head side of the dozer cylinder through port D6.

The return flow from the rod side of the dozer cylinder returns to the dozer spool through C6 port. Thereafter it is directed to the hydraulic tank through tank passage.

In case of the dozer up operation, operation is similar.

# 10) NEGATIVE RELIEF VALVE OPERATION)

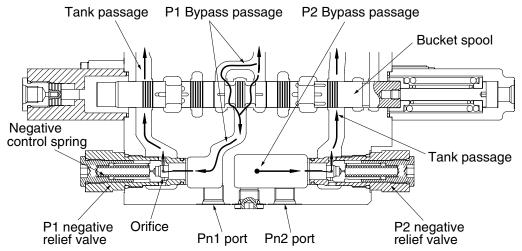
When no function is being actuated on P1 side, the hydraulic fluid from the pump A2, flows into the tank passage through the P1 bypass passage and orifice. The restriction caused by this orifice thereby pressurizes. This pressure is transferred as the negative control signal pressure Pn1 to the pump A2 regulator.

It controls the pump regulator so as to minimize the discharge of the pump A2.

The bypass passage is shut off when the shifting of one or more spools and the flow through bypass passage became zero. The pressure of negative control signal becomes zero and the discharge of the pump A2 becomes maximum.

The negative control pressure reaches to the set level, the hydraulic fluid in the passage pushes open negative control valve and escapes into the return passage.

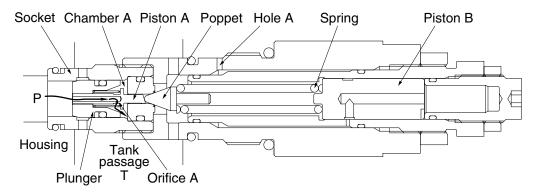
For the pump A1 the same negative control principle.



140L2MC28

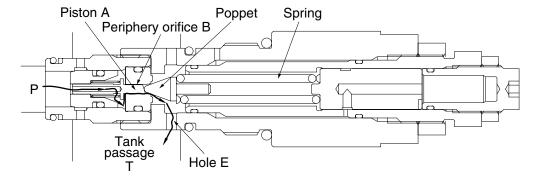
# 11) OPERATION OF MAIN RELIEF VALVE

(1) The pressurized oil passes through the orifice (A) of the plunger is filled up in chamber A of the inside space, and seats the plunger against the housing securely.



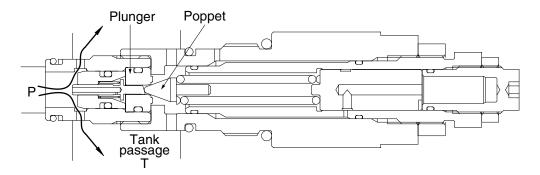
14W92MC36

(2) When the pressure at (P) becomes equal to the set pressure of the spring the hydraulic oil passes through the piston (A) pushes open the poppet and flows to tank passage (T) through the plunger internal passage, periphery orifice A, chamber A, periphery orifice B and the hole (E).

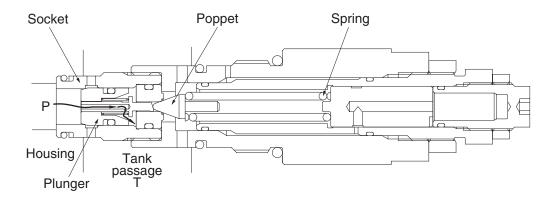


14W92MC37

(3) Opening the poppet causes the pressure in chamber A to fall and the plunger to open. As the result the pressurized oil at port P runs into tank passage (T).

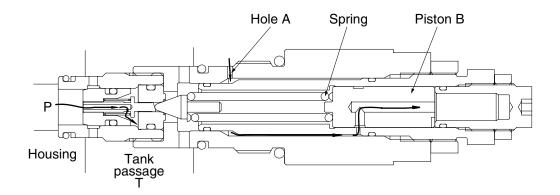


(4) The pressure at port P becomes lower than set pressure of the spring, the poppet is seated by spring force. Then the pressure at port P becomes equal to set pressure of the spring and the plunger is seated to the socket.



14W92MC39

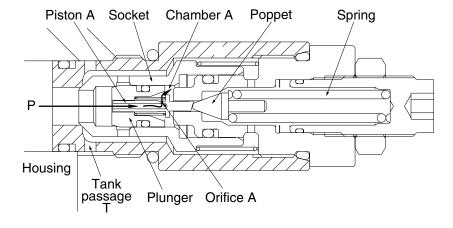
(5) When the power boost switch is ON, the pilot pressure enters through hole A.
It pushes the piston (B) in the left direction to increase the force of the spring and change the relief set pressure to the high pressure.



# 12) OPERATION OF OVERLOAD RELIEF VALVE

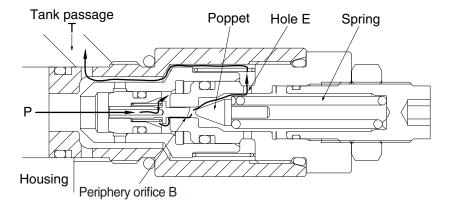
### **FUNCTION AS RELIEF VALVE**

(1) The pressurized oil passes through the piston A and orifice A is filled up in chamber A of the inside space and seat the plunger against the socket and the socket against the housing securely.

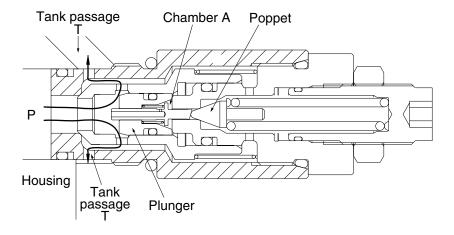


14W92MC41

(2) When the pressure at port P becomes equal to the set pressure of the spring, the pressurized oil pushes open the poppet and flows to tank passage (T) through the plunger internal passage, orifice A, chamber A, periphery orifice B and hole E.

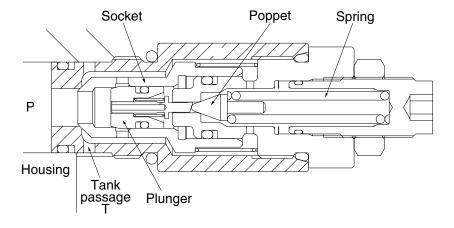


(3) Opening of the poppet causes the pressure in chamber A to fall and the plunger to open. As the result the pressurized oil at port P runs into tank passage (T).



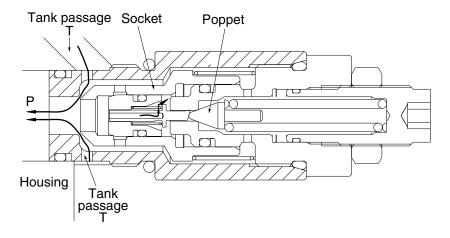
14W92MC43

(4) The pressure at port P becomes lower than set pressure of the spring, the poppet is seated by spring force. Then the pressure at port P becomes equal to set pressure of the spring and the plunger is seated to the socket.



### MAKE-UP FUNCTION

(5) When negative pressure exists at port P, the oil is supplied through tank passage (T). When the pressure at tank passage (T) becomes higher than that of at port P, the socket moves in the right direction. Then, sufficient oil passes around the socket from tank passage (T) to port P and fills up the space.

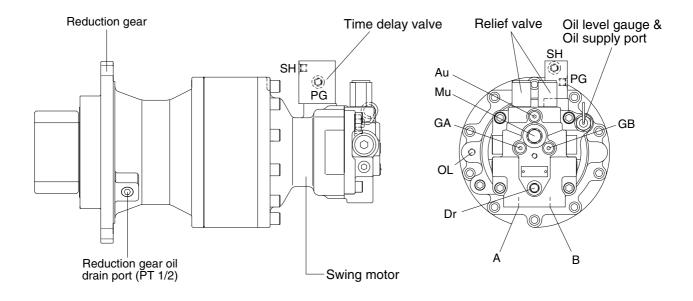


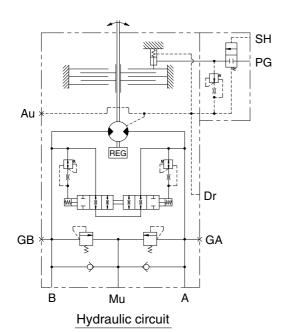
# **GROUP 3 SWING DEVICE**

# 1. STRUCTURE

Swing device consists swing motor, swing reduction gear.

Swing motor include mechanical parking valve, relief valve, make up valve and time delay valve.

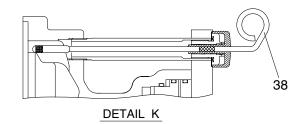


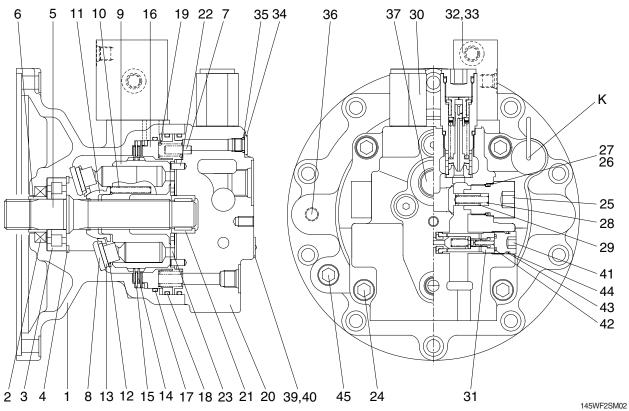


Port	Port name	Port size
А	Main port	Ø13
В	Main port Ø13	
Dr	Drain port	PF 3/8
Mu	Make up port	PF 3/4
SH	Brake release stand by port	PF 1/4
PG	Brake release pilot port	PF 1/4
GA, GB	Gauge port	PF 1/4
Au	Air vent port	PF 1/8

140LC2SM01

# 1) SWING MOTOR





1	Body
2	Oil seal
3	Roller bearing
4	Snap ring
5	Drive shaft
6	Bushing
7	Pin
8	Shoe plate
9	Cylinder block
10	Spring
11	Ball guide
12	Set plate
13	Piston assembly
14	Friction plate

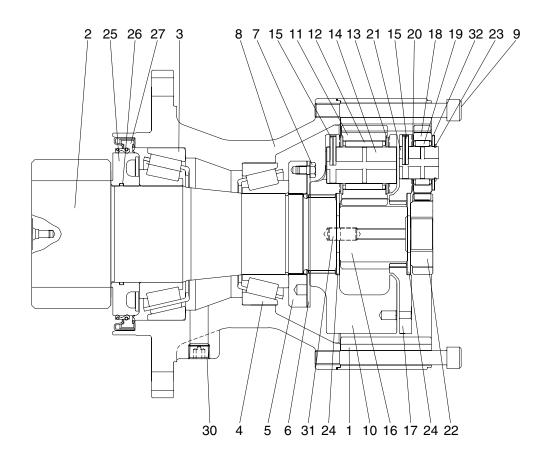
Separate plate

18	О-	ring
19	Bra	ake spring
20	Re	ar cover
21	Ne	edle bearing
22	Pir	1
23	Va	lve plate
24	Wr	ench bolt
25	PΙι	ıg
26	Ba	ck up ring
27	0-	ring
28	Sp	ring
29	Ch	eck
30	Re	lief valve

16 Brake piston17 O-ring

	31
31	Relief valve assy
32	Time delay valve
33	Wrench bolt
34	Plug
35	O-ring
36	Plug
37	Plug
38	Level gauge
39	Name plate
41	Plug
42	O-ring
43	O-ring
44	Back up ring
45	Plug
	-

# 2) REDUCTION GEAR



125LCR2SM23

1	Ring gear	11	Planetary gear No. 2	21	Carrier pin No. 1
2	Drive shaft	12	Needle bearing No. 2	22	Sun gear No. 1
3	Taper roller bearing	13	Thrust washer No. 2	23	Snap ring
4	Taper roller bearing	14	Carrier pin No. 2	24	Thrust plate
5	Ring nut	15	Spring pin	25	Sleeve
6	Lock plate	16	Sun gear No. 2	26	O-ring
7	Hexagon bolt	17	Carrier No. 1	27	Oil seal
8	Casing	18	Planetary gear No. 1	30	Plug
9	Socket bolt	19	Needle bearing No. 1	31	Parallel pin
10	Carrier No. 2	20	Thrust washer No. 1	32	Thrust washer No. 1

### 2. PRINCIPLE OF DRIVING

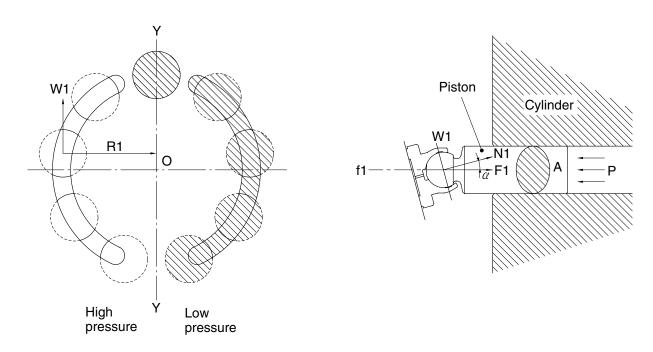
# 1) GENERATING THE TURNING FORCE

The high hydraulic supplied from a hydraulic pump flows into a cylinder block (9) through rear cover (20) of motor and valve plate (23).

The high hydraulic oil is built as flowing on one side of Y-Y line connected by the upper and lower sides of piston (13). The high hydraulic oil can generate the force, F1=P×A (P : supplied pressure, A : fluid pressure area), like following pictures, working on a piston.

This force, F1, is divided as N1 thrust partial pressure and W1 radial partial pressure, in case of the plate of a tilt angle,  $\alpha$ . W1 generates torque, T=W1+R1, for Y-Y line connected by the upper and lower sides of the piston as following pictures. The sum of torque ( $\Sigma$ W1×R1), generated from each piston (4~5 pieces) on the side of a high hydraulic oil, generates the turning force.

This torque transfers the turning force to a cylinder (9) through a piston; because a cylinder is combined with a turning axis and spline, a turning axis rotates and a turning force is sent.



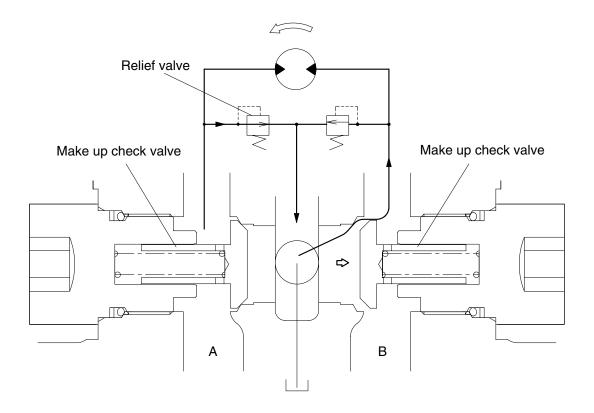
140LC2SM05

### 2) MAKE UP VALVE

In the system using this type of motor, there is no counter balance functioning valve and there happens the case of revolution exceeding hydraulic supply of motor. To prevent the cavitation caused by insufficient oil flow there is a make up valve to fill up the oil insufficiency.

A make up valve is provided immediately before the port leading to the hydraulic oil tank to secure feed pressure required when the hydraulic motor makes a pumping action. The boost pressure acts on the hydraulic motor's feed port via the make up valve. Pressurized oil into the port B, the motor rotate counterclockwise.

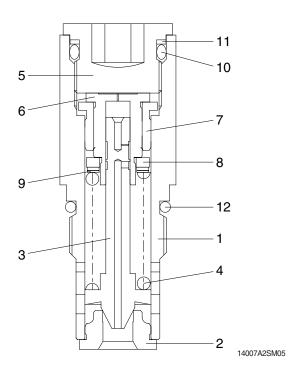
If the plunger of MCV moves neutral position, the oil in the motor is drain via left relief valve, the drain oil run into motor via right make up valve, which prevent the cavitation of motor.



140LC2SM04

# 3) RELIEF VALVE

Figure illustrates how the pressure acting on the relief valve is related to its rising process. Here is given the function, referring to the figure following page.



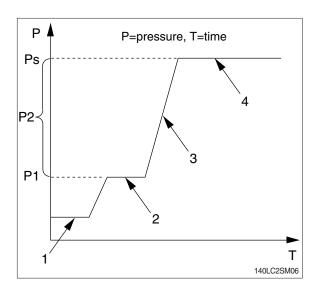
- 1 Body
- 2 O-ring
- 3 Plunger
- 4 Spring
- 5 Adjust screw
- 6 Piston
- 7 Bushing
- 8 Spring seat
- 9 Shim
- 10 O-ring
- 11 Back up ring
- 12 O-ring

# (1) Construction of relief valve

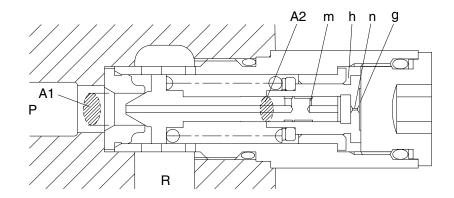
The valve casing contains two cartridge type relief valves that stop the regular and reverse rotations of the hydraulic motor. The relief valves relieve high pressure at start or at stop of swing motion and can control the relief pressure in two steps (high and low) in order to insure smooth operation.

# (2) Function of relief valve

Right figure illustrates how the pressure acting on the relief valve is related to its rising process. Here is given the function, referring to the figure following page.



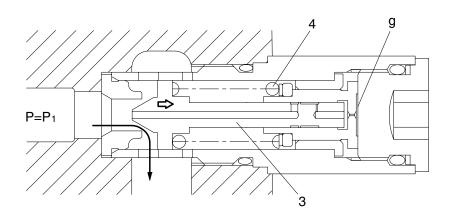
① Ports (P,R) at tank pressure.



14007A2SM06

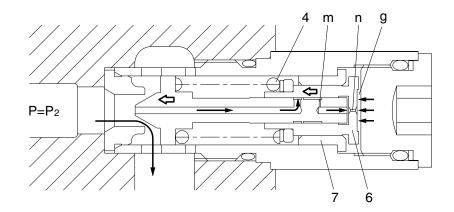
$$P1 \times A1=Fsp+Pg \times A2$$

$$P1 = \frac{Fsp + Pg \times A_2}{A_1}$$



14007A2SM07

③ The oil flows into chamber (g) via orifice (m) and (n). When the pressure of chamber (g) reaches the preset force (Fsp) of spring (4), the piston (6) moves left and stop the piston (6) hits the bottom of bushing (7).

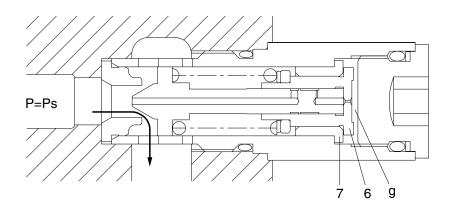


14007A2SM08

④ When piston (6) hits the bottom of bushing (7), it stops moving to the left any further. As the result, the pressure in chamber (g) equals (Ps).

$$Ps \times A1=Fsp+Ps \times A2$$

$$Ps = \frac{Fsp}{A_1-A_2}$$



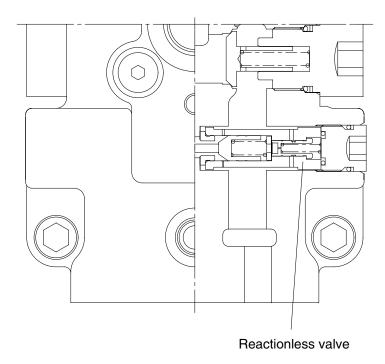
14007A2SM09

# 4) REACTIONLESS VALVE

In the event of swing motor operates switch part to drive and stop the swing part. By the action of pump on motor, there is brake on both-side of port because of the block on both sides.

Swing part is stopped by pressure of brake (in order words, 4-5 times of inversion).

Under the operating condition, the side of anti-inversion blocks off both ports but bypassing compressed oil which is blocked in processing of anti-inversion fixed time and amount to inverse port, prevent increasing pressure of motor and decrease inversing action.

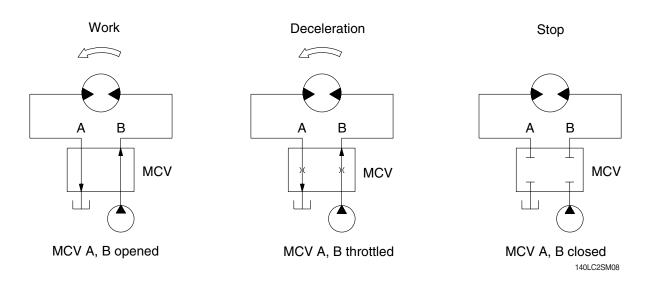


140LC2SM10

# 5) BRAKE SYSTEM

### (1) Control valve swing brake system

This is the brake system to stop the swing motion of the excavator during operation. In this system, the hydraulic circuit is throttled by the swing control valve, and the resistance created by this throttling works as a brake force to slow down the swing motion.



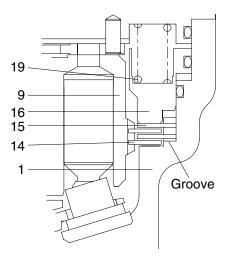
# (2) Mechanical swing parking brake system

This is function as a parking brake only when the swing control lever and arm in control lever are not operated.

# ① Brake operation

Circumferential rotation of separate plate (15) is constrained by the groove located at body (1). When housing is pressed down by brake spring (19) through friction plate (14), separate plate (15) and parking piston (16), friction force occurs between friction plate and separate plate.

Friction force constrains motion of cylinder block (9). When hydraulic force exceeds spring force, brake is released.



140LC2SM15

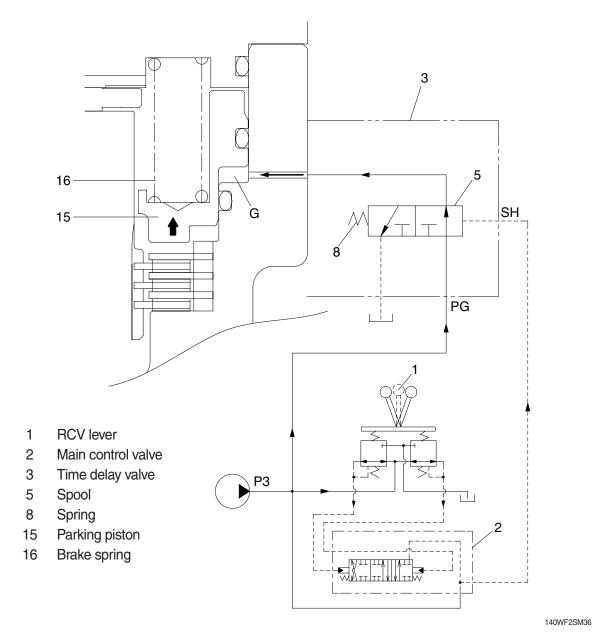
1	Body	15	Separate plate
9	Cylinder block	16	Parking piston
14	Friction plate	19	Brake spring

# 2 Operating principle

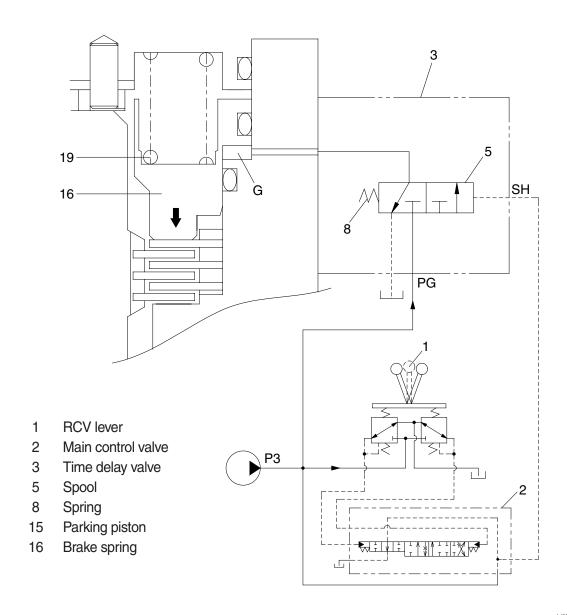
a. When swing or arm in operation of the RCV lever (1) is tilted, the each spool is shifted to left or right and the pilot oil flow is blocked. Then the pilot oil go to SH of the time delay valve (3).

This pressure moves spool (5) to the leftward against the force of the spring(8), so pilot pump charged oil (P3) goes to the chamber G through port PG.

This pressure is applied to move the parking piston (16) to the upward against the force of the brake spring (19). Thus, it releases the brake force.



b. When all of the RCV lever (1) are set the neutral position, the spool (5) returns to right.Then, the parking piston (16) is moved lower by spring (19) force and the return oil from the chamber G flows back to tank port.At this time, the brake works.



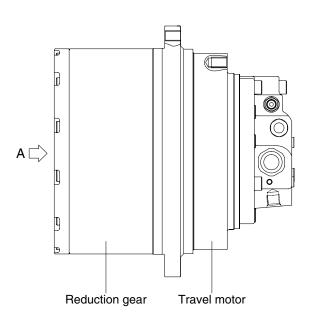
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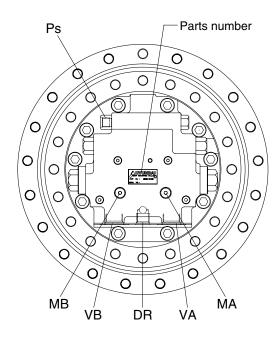
# **GROUP 4 TRAVEL DEVICE (STD)**

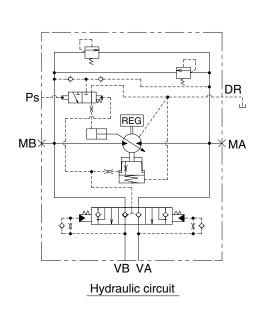
# 1. CONSTRUCTION

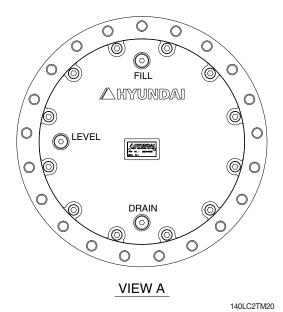
Travel device consists travel motor and gear box.

Travel motor includes brake valve, parking brake and high/low speed changeover mechanism.



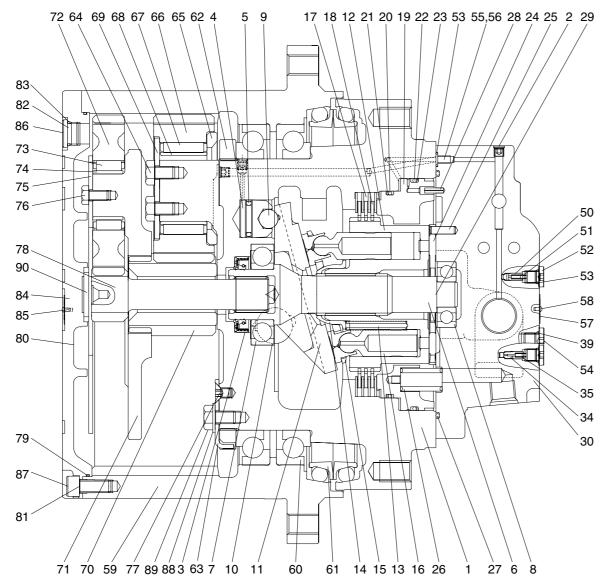


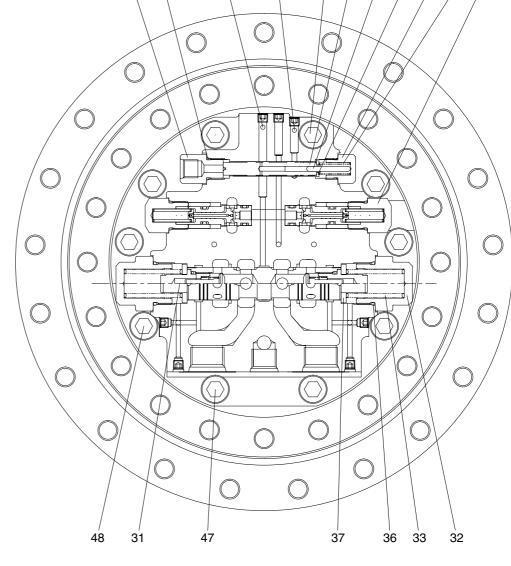




Port	Port name	Port size
VA, VB	Valve port	PF 3/4
Ps	Pilot port	PF 1/4
DR	Drain port	PF 1/2
MA MR	Gauge port	PF 1/4

# 2. STRUCTURE





45

46

-	
2	Plug
3	Oil seal
4	Piston
5	Piston seal
6	Shaft
7	Front ball bearing
8	Rear ball bearing
9	Steel ball
10	Pivot
11	Swash plate
12	Cylinder block
13	Spring
14	Ball guide
15	Retainer plate
16	Piston assy
17	Friction plate
18	Separated plate

1 Casing

Parking piston 19 20 O-ring 21 Back up ring O-ring 22 Back up ring 24 Valve plate 25 Spring pin 26 Spring O-ring 27 Spring pin 28 Parallel pin Rear cover 30 Main spool assy 32 Cover 33 Spring Restrictor 35 Spring

36 O-ring

Spring seat Relief valve assy 39 O-ring Spool 40 41 Plug 42 Spring seat 43 Parallel pin Spring 45 Connector 46 O-ring 47 Hexagon socket head bolt 48 Hexagon socket head bolt Hexagon socket head bolt Check valve 50 Spring Plug 52 53 O-ring

54 Plug

Restrictor 55 56 Restrictor 57 Name plate Rivet 58 59 Ring gear 60 Bearing 61 Floating seal assy 62 Nut ring 63 Lock plate 64 Hexagon head bolt 65 Thrust plate No. 2 66 Planetary gear No.2 67 Needle bearing No.2 68 Inner race No. 2 69 Thrust washer No. 2 70 Sun gear No.2 71 Carrier No.1

72 Planetary gear No.1

73 Needle bearing No.1 74 Inner race No. 1 75 Thrust plate No. 1 76 Hexagon head bolt 77 Countersunk head screw 78 Sun gear No.1 O-ring 79 80 Cover Hex socket head bolt 82 Plug 83 O-ring Name plate 85 Rivet 86 Rubber cap 87 Rubber cap Plain washer Hexagon bolt

90 Thrust plate

130ZF2TM21

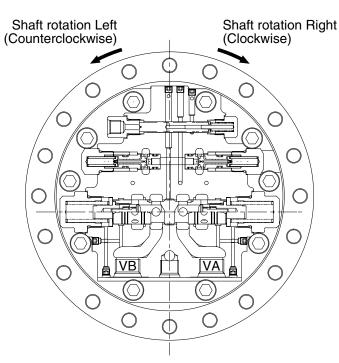
49 40 43 42 41 44 38

### 3. OPERATION

### 1) MOTOR

High pressure oil delivered form hydraulic pump is led to inlet port that is provided in the brake valve portion and, through the rear cover (30) and valve plate (24), led to cylinder block (12).

The oil flow and direction of shaft rotation are indicated in table.



Inlet port	Outlet port	Direction of shaft rotation (viewing from rear cover)
VB	VA	Right (clockwise)
VA	VB	Left (counterclock wise)

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As shown in below figure, high pressure oil is supplied to the pistons which are on one side of the line Y-Y that connects upper and lower dead points and produces force F1.

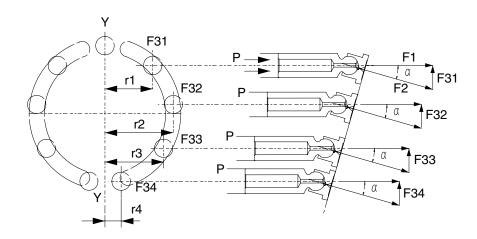
 $F1 = P \times A$  (P : pressure, A : area of piston section)

The swash plate (11) with inclined angle of  $^{\alpha}$  divides this force F1 into thrust force F2 and radial force F31-34.

This radial force is applied to axis Y-Y as turning force and generate drive torque of T.

$$T = r_1 \cdot F31 + r_2 \cdot F32 + r_3 \cdot F33 + r_4 \cdot F34$$

This drive torque is transmitted via cylinder block (12) to driving shaft (6).



29092TM07

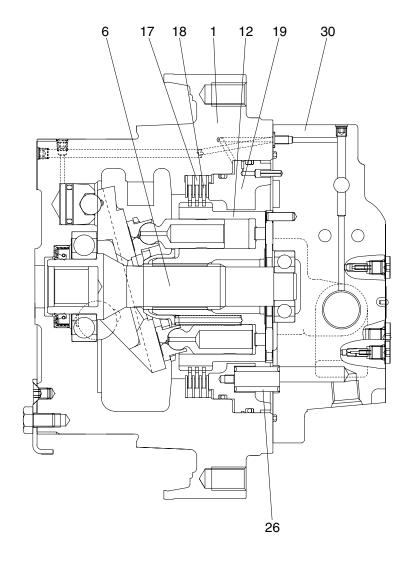
# 2) PARKING BRAKE

Parking brake is released when high pressure oil selected by the brake valve portion that is connected directly to the rear cover (30), is applied to the parking piston (19).

Otherwise the braking torque is always applied.

This braking torque is generated by the friction between the separated plates (18), inserted into the casing (1), and friction plates (17), coupled to cylinder block (12) by the outer splines.

When no pressure is activated on the parking piston (19), it is pushed by the brake springs (26) and it pushes friction plates (17) and separated plates (18) towards casing (1) and generates the friction force which brakes the rotation of cylinder block (12) and hence the shaft (6).



#### 3) CAPACITY CONTROL MECHANISM

Figure typically shows the capacity control mechanism.

When high speed pilot line is charged with the pressure  $P_A$  that overcome the spring (44), the spring (44) is compressed and spool (40) shifts to the right to connect the port P and port C.

Then, the highest pressure is selected by the check valve (50) from inlet and outlet pressure of the motor and high speed pilot line pressure and pushes shifter piston (4). As a result, swash plate (11) turns around the line L which connect the two pivot (10) as shown by dotted lines. The turn stops at the stopper (1-1) of casing and swash plate (11) keeps the position.

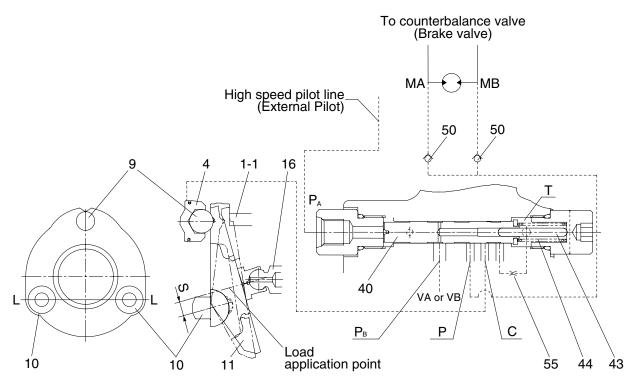
In this case, the piston stroke become shorter and motor capacity become smaller and motor rotates faster, around 1.60 times, by the same volume of oil.

When no pressure is in the high speed pilot line  $P_A$ , spool (40) is pushed back by the spring (44) and pressure that pressed the shifter piston (4) is released to the hydraulic tank through restrictor (55).

Here, nine pistons are there and they equally spaced on the swash plate (11). The force that summed up those of pistons comes to almost the center of the swash plate (11) as shown. Since the steel balls (10) are off-set by S from the center, the rotating force of product S and the force moves swash plate (11) to the former position and the speed returns to low.

When the power demand exceeds the engine power, such as in steep slope climbing or turning at high speed mode, the system step down to the low speed automatically. The mechanism is that: pump pressure is led to the port  $P_B$  and this pressure activate on pin (43). When the pressure at  $P_B$  exceeds predetermined value, spool (40) returns to the left by the counter-pressure against pin (43) and the pressure on the shifter piston (4) through port C is released to the tank and the motor comes to low speed.

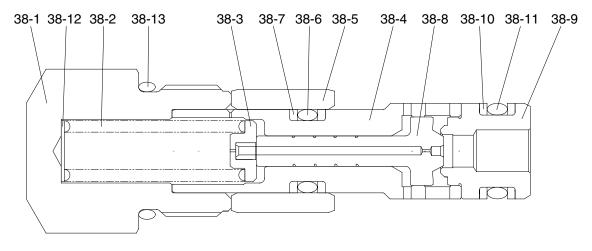
When P<sub>B</sub> goes down, the spool (40) moves to the right and the speed become high.



# 4) OVERLOAD RELIEF VALVE

# (1) Structure

This valve is screwed in the motor rear cover (30) and consists of : plug (38-1) that is screwed and fixed in the rear cover (30), poppet (38-8) and supports the poppet seat (38-9), spring (38-2) that is operating relief valve setting pressure and supports the spring seat (38-3), that is inserted in the sleeve (38-4), piston (38-5) that reduce the shock.



38-1	Plug	38-6	O-ring	38-11 O-ring
38-2	Spring	38-7	Back-up ring	38-12 Ring
38-3	Spring seat	38-8	Poppet	38-13 O-ring
38-4	Sleeve	38-9	Poppet seat	
38-5	Piston	38-10	Back-up ring	

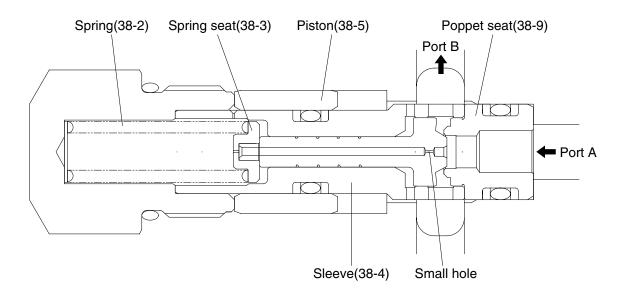
#### (2) Operation

Two pieces of overload valves are located at cross-over position in the counterbalance circuit of brake valve and have the following functions:

- ① When hydraulic motor starts, keep the driving pressure below predetermined value and while accelerating, bypasses surplus oil to return line.
- ② When stopping the motor, keep the brake pressure, that develops on the outlet side of motor, under the predetermined value to stop the inertial force.
- ③ To accelerate sharply while starting, and to mitigate the braking shock while stopping. For these purposes, the developed pressure is kept comparatively low for a short period, then keep the line pressure as normal value. While the pressure is low, meshing of reduction gears, crawler and sprocket etc. can be smoothly done and the shock are absorbed.

When starting, "A" port pressure of overload valve increases, this pressure is applied to the effective diameter of poppet (38-8) which seats on the poppet seat (38-9) and, at the same time, is delivered, via small hole, to the spring seat (38-3) located inside the sleeve (38-4) and the seat bore pressure increases up to "A" port pressure. The poppet (38-8) opposes to spring (38-2) by the force of the pressure exerted on the area difference between poppet seat's effective diameter and spring seat bore and keep the predetermined pressure.

When hydraulically braking, the piston (38-5) is at the left position by the driving pressure, and when "A" port pressure increases, the pressure is applied also to the piston (38-5) through the small hole in the poppet (38-8), sleeve (38-4) and piston (38-5) moves rightward until it touches the stopper in rear cover. In this while, the poppet (38-8) maintains "A" port pressure at comparatively low against the spring (38-2) force and exhaust oil to "B" port side. After the piston reached to the plug, the valve acts the same as at starting.



# 5) BRAKE VALVE

### (1) Structure

The brake valve portion mainly consists of the following parts:

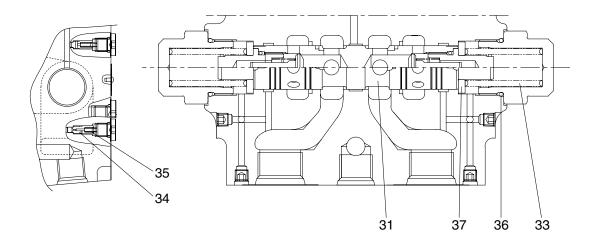
# ① Spool

By shifting the spool (31), the discharged oil from hydraulic motor is automatically shut off or restricted according to the condition and give the effect of holding, accelerating, stopping and counterbalance operations.

(See page 2-66, (2) Operation)

# ② Check valve (built in the spool)

This valve is located in the oil supplying passage to hydraulic motor, and at the same time functions to lock oil displacement. Therefore, this valve serves as not only a suction valve but also a holding valve for hydraulic motor.



31	Main spool	34	Restrictor	36	O-ring
33	Spring	35	Restrictor spring	37	Spring seat

# (2) Operation

### ① Holding operation

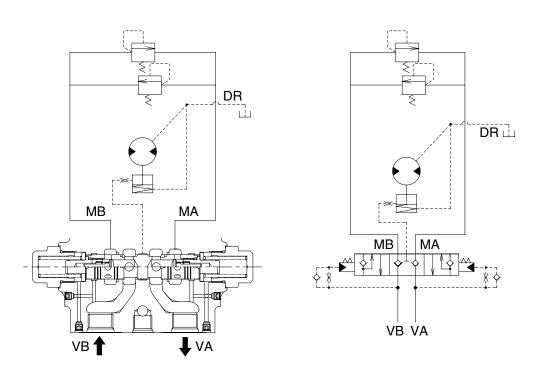
When the control valve is at neutral position, VA and VB ports are connected to the tank, and the spring (33) located on both spool ends holds the spool (31) at central position.

Therefore, the passages from VA to MA and VB to MB are closed, which result in closing MA and MB ports connected to hydraulic motor.

Since the passage to parking brake is connected to the tank line, the brake cylinder pressure is equal to the tank pressure and the brake is applied by the springs. Thus, the rotation of the motor is mechanically prevented.

If external torque is exerted on the motor shaft, the motor would not rotate as usual by this negative parking brake.

In case the brake should be released for some reason, pressure is built on MA or MB port. But, due to oil leakage inside hydraulic motor or so, high-pressure oil escapes from the closed circuit and motor rotates a bit. So, the cavitation tends to occur in the lower pressure side of the closed circuit. Then, the check valve, built in the spool (31), operates to avoid the cavitation and opens the passage from VA to MA or from VB to MB. Then the oil equivalent to the leakage is sucked from the tank line to the closed circuit.

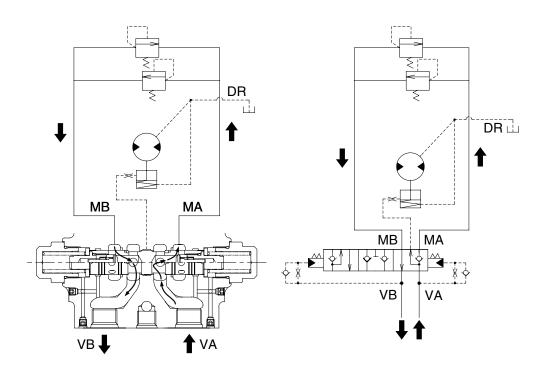


# 2 Accelerating operation

When VA and VB ports are connected respectively to pump and tank by operating the control valve, hydraulic oil from pump is forwarded through VA port to push open the check valve provided inside spool (31), and oil flows to motor via MA port to rotate the motor.

Therefore, the pressure increases and negative brake is released by the pressure supplied from pump. At the same time, the pressure of pilot chamber increases to push and move the spool (31) leftwards, overcoming the spring (33) force. Thus, the return line from MB to VB opens to rotate the motor.

In case inertia load is too big to start rotation, accelerating pressure reaches the set pressure of relief valve and high pressure oil is being relieved while the motor gains the rotational speed. As the rotational speed goes up, the relieved volume decreases, and finally the motor rotates at a fixed speed.

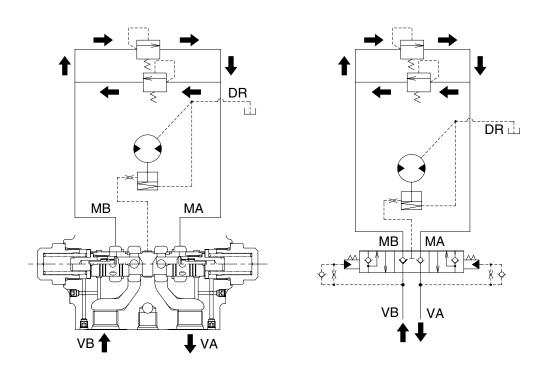


### 3 Stopping operation

Returning the control valve to neutral position while running the motor, the oil supply is cut off and VA and VB ports are connected to the tank line. Then the pressure of the pilot chamber located on both spool ends become equal, and the spool (31) returns to the neutral position by spring (33) force. Thus, the passage from MA to VA is closed.

Owing to the inertia force of the load, the hydraulic motor tends to continue the rotation. Here, the motor functions as a pump and forwards the oil to MB port but the passage is blocked and MB port pressure increases. Then the relief valve opens to relieve the pressure and rotational speed decelerates and at last the motor stops.

Negative brake release pressure is gradually lowered due to the restrictor and finally the brake works and the motor is mechanically stopped.



# 4 Counterbalance operation

Counterbalance operation is required to decelerate slowly the hydraulic motor while absorbing inertia force.

In case the hydraulic oil is gradually decreased from pump to VB port, the drive shaft of hydraulic motor tends to rotate faster than that matched to the volume of oil supply.

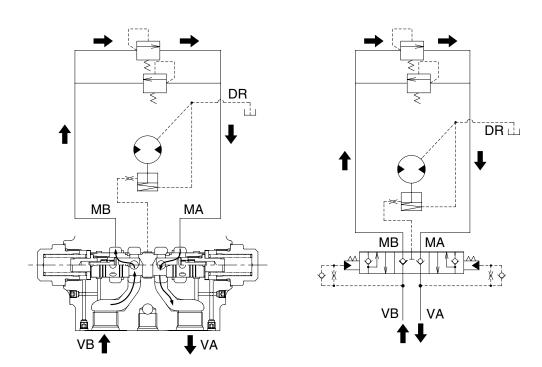
Consequently, the pilot chamber pressure on MB to VB side decreases and the spring (33) force moves the spool (31) leftwards towards neutral position.

Therefore, the area of passage from MA to VA becomes smaller and the pressure on MA side rises due to increased resistance in the passage and the motor receives hydraulic braking effect.

If the motor rotates slower than that matched to the volume of supplied oil, the pilot chamber pressure on VB port increases, and spool (31) moves rightwards to enlarge the area of passage from MA to VA. Therefore the braking effect becomes smaller and the rotational speed of motor is controlled to correspond to the volume of supplied oil.

In order to give stable counterbalance operation, the restrictors (34) are set in the pilot chamber to damp the spool (31) movement.

The parking brake is released during pressure adjusting action of the spool (31).



### 6) REDUCTION GEAR

Reduction unit slows down the rotating speed of motor and converts motor torque to strong rotating force

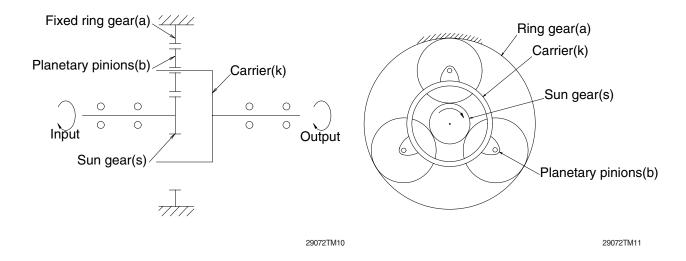
This reduction unit utilizes two stages, planetary reduction system.

Planetary reduction system consists of sun gear, planetary gears, (planetary) carriers, and ring gear.

When the sun gear (s) is driven through input shaft, planetary pinions (b), rotating on their center, also move, meshing with fixed ring gear (a), around sun gear (s).

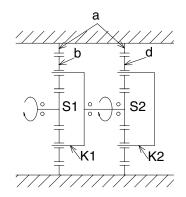
This movement is transferred to carrier (k) and deliver the torque.

This mechanism is called planetary gear mechanism.



When the sun gear S1 is driven by input shaft, planetary action occurs among gears S1, a and b and revolution of gear b transfers the rotation of carrier K1 to second sun gear S2, and also evokes planetary action between gear S2, a and d.

This time, because carrier **K2** is fixed to frame, gear **d** drives ring gear **a** and then ring gear **a** rotates to drive sprocket.



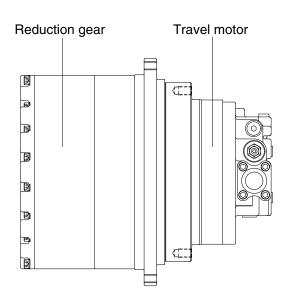
29072TM12

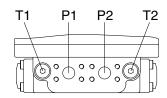
# TRAVEL DEVICE (HIGH WALKER, TYPE 1)

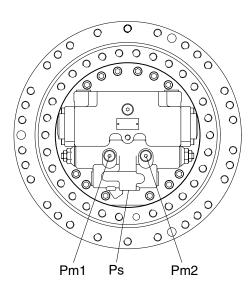
## 1. CONSTRUCTION

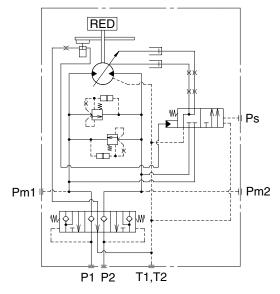
A Hydraulic motor includes followings.

- · Part of rotary generating turning force
- · Part of a valve of relief
- · Part of Brake
- · Part of a valve of counterbalance
- · Part of flowing changeover
- · Part of auto changeover





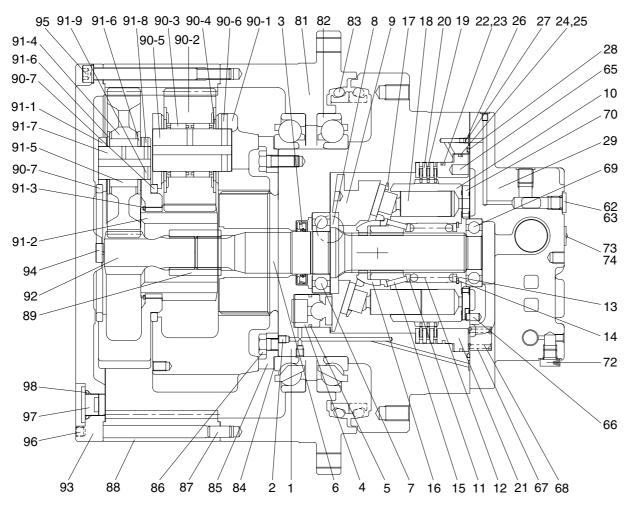


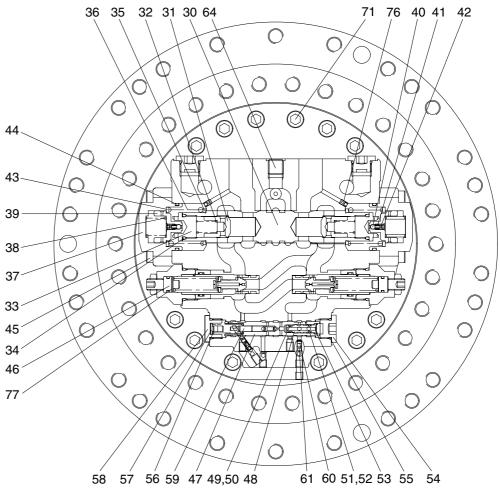


Hydraulic circuit

Port	Port name	Port size
P1, P2	Main port	SAE 4694psi 1"
Pm1, Pm2	Gauge port	PF 1/4
T1, T2	Drain port	PF 1/2
Ps	2 speed control port	PF 1/4

# 2. STRUCTURE





1	Shaft casing
2	Plug
3	Oil seal
4	Swash piston
5	Piston ring
6	Shaft
7	Bearing
8	Steel ball
9	Swash plate
10	Cylinder block
11	Spring seat
12	Spring
13	End plate
14	Snap ring
15	Pin
16	Ball guide
17	Set plate
18	Piston assy

19 Friction plate

20	Separate plate
21	Parking piston
22	O-ring
23	Back up ring
24	O-ring
25	Back up ring
26	Orifice
27	O-ring
28	O-ring
29	Rear cover
30	Spool
31	Check
32	Spring
33	Plug
34	O-ring
35	Spring seat
36	Spring
37	Cover
38	Spring

39	Spool
40	Steel ball
41	Spring
42	Plug
43	Spring seat
44	O-ring
45	Wrench bolt
46	Relief valve assy
47	Spool
48	Guide
49	O-ring
50	Back up ring
51	O-ring
52	Back up ring
53	Snap ring
54	plug
55	O-ring
56	Spring
57	Spring seat

58 Plug Spool 59 Orifice 61 Orifice Plug O-ring 64 Plug 65 Pin Pin 66 Spring 67 Spring Bearing 70 Valve plate 71 Wrench bolt 72 Plug 73 Name plate 74 Rivet 75 Seal kit 76 Orifice

77 Shim 81 Housing Main bearing 83 Floating seal 84 Shim Retainer 85 Hex head bolt 87 Parallel pin 88 Ring gear Coupling 90 Carrier assy No.2 90-1 Carrier No.2 90-2 Planetary gear No.2 90-3 Needle bearing No.2 90-4 Thrust washer 90-5 Pin No.2 90-6 Spring pin 90-7 Thrust ring 91 Carrier assy No.1

16092TM02 91-1 Carrier No.1 91-2 Sun-gear No.2 91-3 Retaining ring 91-4 Planetary gear No.1 91-5 Needle bearing No.1 91-6 Thrust washer 91-7 Pin No.1 91-8 Spring pin 91-9 Spring pin 92 Sun gear No.1 93 Cover 94 Pad 95 Hex socket head bolt 96 Hex socket Screw 97 Hydraulic plug 98 O-ring 99 Name plate

#### 3. OPERATION

#### 1) GENERATING THE TURNING FORCE

The high hydraulic supplied from a hydraulic pump flows into a cylinder block (10) through rear cover (29) of motor, and valve plate (70).

The high hydraulic is built as flowing on one side of Y-Y line connected by the upper and lower sides of piston assy (18).

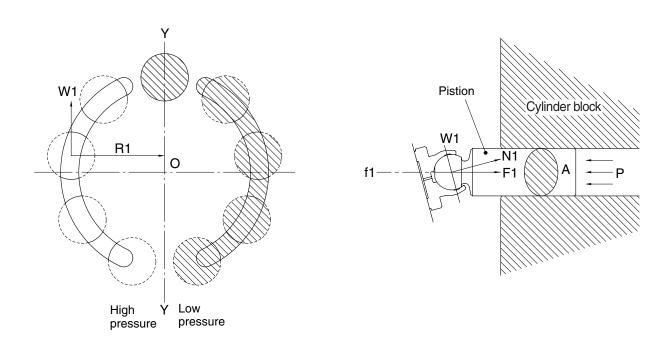
The high hydraulic can generate the force,  $F1 = P \times A$  (P : supplied pressure, A : water pressure area), like following pictures, working on a piston.

This force, F1, is divided as N1 thrust partial pressure and W1 radial partial pressure, in case of the plate (09) of a tilt angle,  $\alpha$ .

W1 generates torque, T = W1+R1, for Y-Y line connected by the upper and lower sides of piston as following pictures.

The sum of torque ( $\Sigma$ W1×R1), generated from each piston (4~5 pieces) on the side of a high hydraulic, generates the turning force.

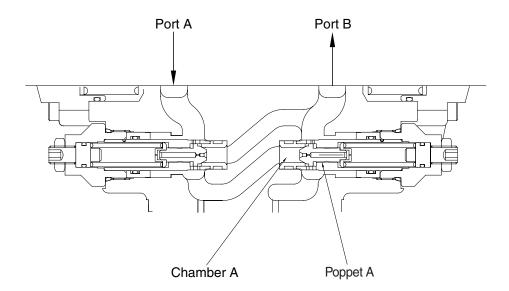
This torque transfers the turning force to a cylinder block (10) through a piston; because a cylinder block is combined with a turning axis and spline, a turning axis rotates and a turning force is sent.



# 2) WORKING OF RELIEF VALVE

Relief valve carries on two functions of followings.

- (1) It standardizes a pressure in case of driving a hydraulic motor; bypasses and extra oil in a motor inlet related to acceleration of an inertia to an outlet.
- (2) In case of an inertia stopped, it forces an equipment stopped, according to generating the pressure of a brake on the projected side.
  - Room A is always connected with port A of a motor. If the pressure of port is increased, press poppet A. And if it is higher than the setting pressure of a spring, the oil of an hydraulic flows from room A to port B, because poppet A is detached from the contact surface of seat A.



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#### 3) WORKING OF NEGATIVE BRAKE

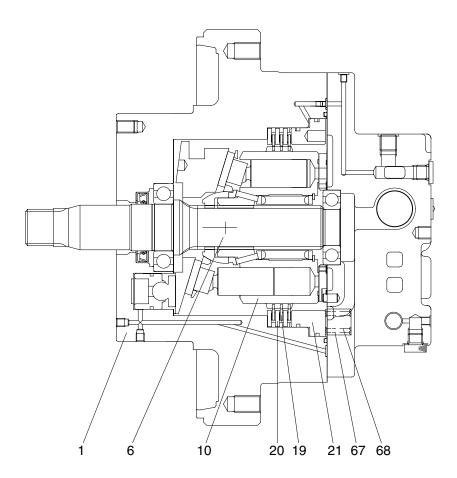
When the operating pressure is supplied to the brake piston (21) through the spool (simultaneous peripheral operation online) built in the shaft casing (1), the negative brake is released.

When the pressure does not work, the brake always runs.

The force of a brake is generated by the frictional force among a separate plate (20) fixed by shaft casing, parking piston (21) and a frictional plate (19) connected through spline outside a cylinder block (10).

When a pressure does not work on the part of piston, brake spring presses brake piston; oil in a brake room flows into the drain of a motor through an orifice; in that time, brake piston compresses a frictional plate and a detached plate in the middle of shaft casing (1) and brake piston (21) according to the force that presses 10 pieces of brake springs (67, 68); finally, it makes a frictional force.

This frictional force helps the brake fixing a turning shaft (6) connected by a cylinder and spline operated.



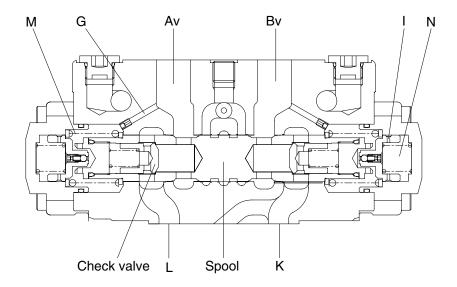
## 4) COUNTERBALANCE VALVE

Av port is connected to a hydraulic pump; Bv port is connected to a tank.

An oil supplied from a hydraulic pump presses check valve and flows into L port. It makes a hydraulic motor circulated. The oil pressure out of a pump is increased and transferred to spring room M through the path G because negative brake is working on. When the pressure of room M exceeds the force of spring that keeps spool at its neutral position, the spool begins to move the right side.

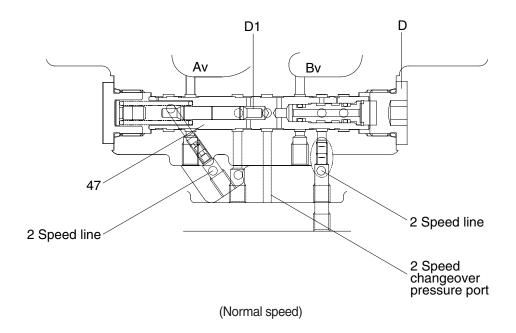
An oil in room N is sent to room M by orifice I and discharged from G line to a tank.

Then the spool moves to the right and the oil flows from K to Bv.



# 5) WORKING DESCRIPTION OF AUTOMATIC SWITCH (AT NORMAL SPEED)

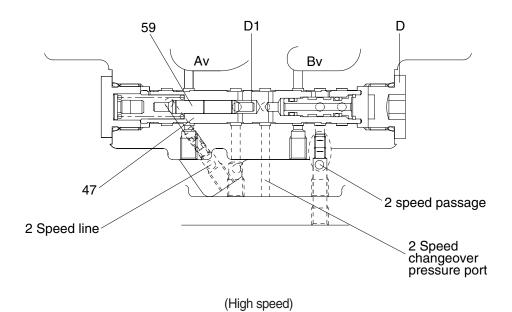
Due to no pressure on pilot now, spool (47) is not working.



# 6) WORKING DESCRIPTION OF AUTOMATIC SWITCH (AT HIGH SPEED)

At normal speed, once the hydraulic oil which is through the inner path of spool (47) flows into high speed switching pressure port (the pressure of external pilot :  $Pi = 35 \text{ kgf/cm}^2$ ) spool (47) moves from right to left.

At high speed, turning pressure of motor (D1) is over 250 kgf/cm², when the power forcing to spool (59) (pressure, P1) is stronger than spool (47) and spool (59) is pushed out, after then spool (47) moves from left to right. So it is switched.



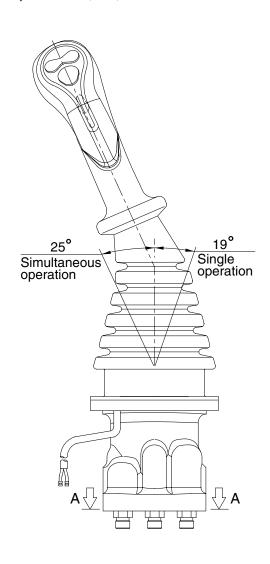
# **GROUP 5 RCV LEVER**

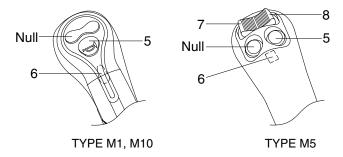
## 1. STRUCTURE

The casing has the oil inlet port P (primary pressure) and the oil outlet port T (tank). In addition the secondary pressure is taken out through ports 1, 2, 3 and 4 provided at the bottom face.

\* Refer to the parts manual for the types of the RCV lever.

## 1) TYPE M1, M5, M10

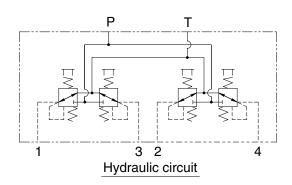




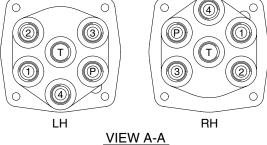
#### **Switches**

Туре	No.	LH	RH
M1,	5	One touch decel	Horn
M10	6	Power boost	Breaker
	5	One touch decel	Horn
M5	6	Power boost	Null
CIVI	7	CCW rotation	Close
	8	CW rotation	Open

\* Number 7 and 8 : Option attachment



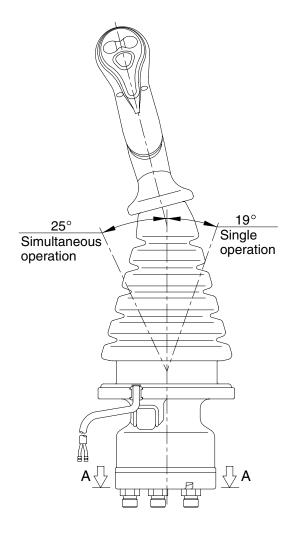


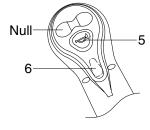


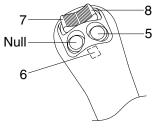
Port	LH	RH	Port size
Р	Pilot oil inlet port	Pilot oil inlet port	
Т	Pilot oil return port	Pilot oil return port	
1	Left swing port	Bucket out port	PF 3/8
2	Arm out port	Boom up port	FF 3/0
3	Right swing port	Bucket in port	
4	Arm in port	Boom down port	

140LC2RL01

# 2) TYPE M2, M6, M9







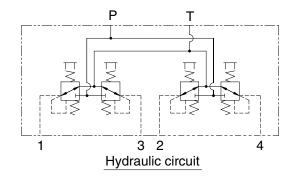
TYPE M2, M9

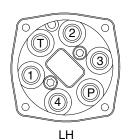
TYPE M6

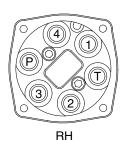
#### **Switches**

Туре	No.	LH	RH
NAO NAO	5	One touch decel	Horn
M2, M9	6	Power boost	Breaker
	5	One touch decel	Horn
M6	6	Power boost	Null
IVIO	7	CCW rotation	Close
	8	CW rotation	Open

\* Number 7 and 8 : Option attachment







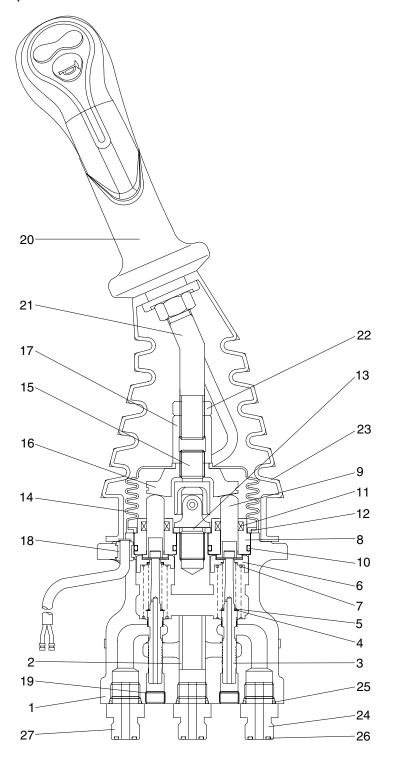
VIEW A-A

# Pilot ports

_				
	Port	LH	RH	Port size
	Р	Pilot oil inlet port	Pilot oil inlet port	
	Т	Pilot oil return port	Pilot oil return port	
	1	Left swing port	Bucket out port	PF 3/8
	2	Arm out port	Boom up port	FF 3/0
	3	Right swing port	Bucket in port	
	4	Arm in port	Boom down port	

140LC2RL05

## 3) CROSS SECTION



- 1 Case
- 2 Bushing
- 3 Spool
- 4 Shim
- 5 Spring
- 6 Spring seat
- 7 Spring
- 8 Plug
- 9 Push rod
- 10 O-ring
- 11 Rod seal
- 12 Plate
- 13 Spacer
- 14 Boot
- 15 Joint assembly
- 16 Swash plate
- 17 Adjusting nut
- 18 Bushing
- 19 Plug
- 20 Handle assembly
- 21 Handle bar
- 22 Nut
- 23 Boot
- 24 Last guard filter
- 25 O-ring
- 26 O-ring
- 27 Connector

300L2RL06

#### Item numbers are based on the type M1.

The construction of the pilot valve is shown in the attached cross section drawing. The casing has vertical holes in which reducing valves are assembled.

The pressure reducing section is composed of the spool (3), spring (5) for setting secondary pressure, return spring (7), spring seat (6) and shim (4). The spring for setting the secondary pressure has been generally so preset that the secondary pressure is 5 to 20.5 kgf/cm² (depending on the type). The spool is pushed against the push rod (9) by the return spring.

When the push rod is pushed down by tilting the handle, the spring seat comes down simultaneously and changes setting of the secondary pressure spring.

#### 2. FUNCTIONS

## 1) FUNDAMENTAL FUNCTIONS

The pilot valve is a valve that controls the spool stroke, direction, etc of a main control valve. This function is carried out by providing the spring at one end of the main control valve spool and applying the output pressure (secondary pressure) of the pilot valve to the other end.

For this function to be carried out satisfactorily, the pilot valve is composed of the following elements.

- (1) Inlet port (P) where oil is supplied from hydraulic pump.
- (2) Output ports (1, 2, 3 & 4) to apply pressure supplied from inlet port to ends of control valve spools.
- (3) Tank port (T) necessary to control the above output pressure.
- (4) Spool to connect output port to inlet port or tank port.
- (5) Mechanical means to control output pressure, including springs that work on the above spools.

#### 2) FUNCTIONS OF MAJOR SECTIONS

#### Item numbers are based on the type M1.

The functions of the spool (3) are to receive the supply oil pressure from the hydraulic pump at its port P, and to change over oil paths to determine whether the pressure oil of port P is led to output ports 1, 2, 3 & 4 or the output port pressure oil to tank port T.

The spring (5) works on this spool to determine the output pressure.

The change the deflection of this spring, the push rod (9) is inserted and can slide in the plug (8).

For the purpose of changing the displacement of the push rod through the swash plate (16) and adjusting nut (17) are provided the handle assy (20) that can be tilted in any direction around the fulcrum of the universal joint (15) center.

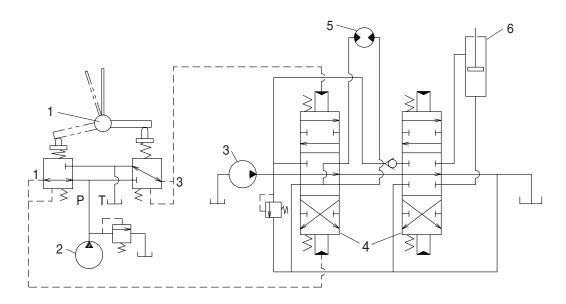
The spring (7) works on the case (1) and spring seat (6) and tries to return the push rod (9) to the zero-displacement position irrespective of the output pressure, securing its resetting to the center position.

This also has the effect of a reaction spring to give appropriate control feeling to the operator.

# 3) OPERATION

The operation of the pilot valve will be described on the basis of the hydraulic circuit diagram shown below and the attached operation explanation drawing.

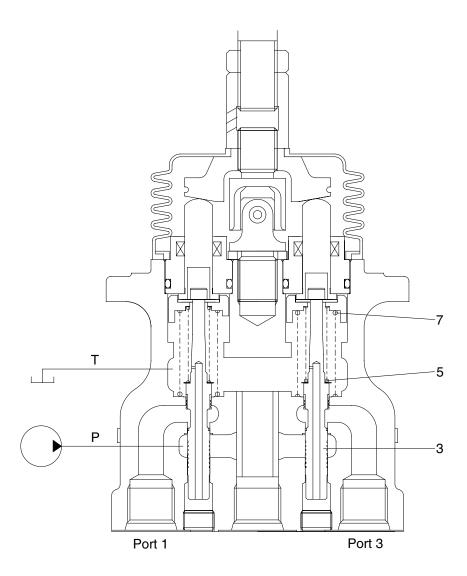
The diagram shown below is the typical application example of the pilot valve.



2-70

- 1 Pilot valve
- 2 Pilot pump
- 3 Main pump
- 4 Main control valve
- 5 Hydraulic motor
- 6 Hydraulic cylinder

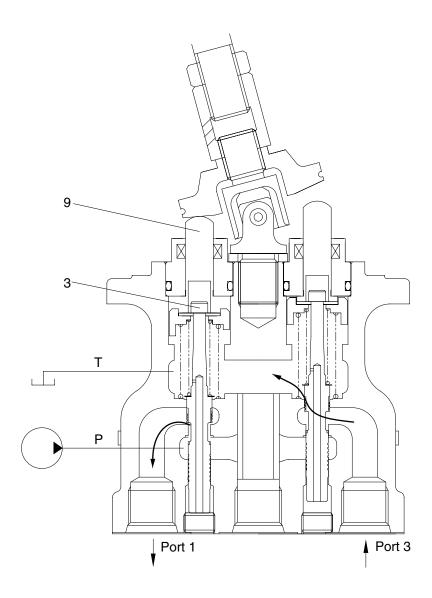
# (1) Case where handle is in neutral position



300L2RL03

The force of the spring (5) that determines the output pressure of the pilot valve is not applied to the spool (3). Therefore, the spool is pushed up by the spring (7) to the position of port (1, 3) in the operation explanation drawing. Then, since the output port is connected to tank port T only, the output port pressure becomes equal to tank pressure.

#### (2) Case where handle is tilted



300L2RL04

When the push rod (9) is stroked, the spool (3) moves downwards.

Then port P is connected with port (1) and the oil supplied from the pilot pump flows through port (1) to generate the pressure.

When the pressure at port (1) increases to the value corresponding to the spring force set by tilting the handle, the hydraulic pressure force balances with the spring force. If the pressure at port (1) increases higher than the set pressure, port P is disconnected from port (1) and port T is connected with port (1). If it decreases lower than the set pressure, port P is connected with port (1) and port T is disconnected from port 1.

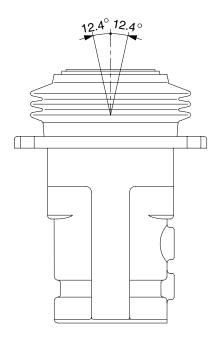
In this manner the secondary pressure is kept at the constant value.

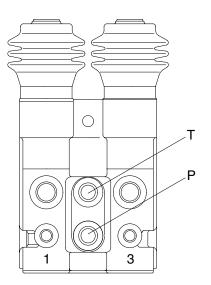
Besides, in some type, when the handle is tilted more than a certain angle, the upper end of the spool contacts with the inside bottom of the push rod and the output pressure is left to be connected with port P.

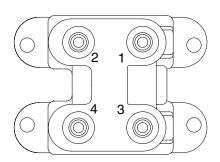
# GROUP 6 RCV PEDAL

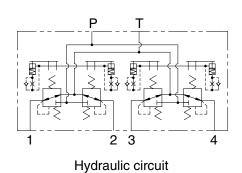
# 1. STRUCTURE

The casing (spacer) has the oil inlet port P (primary pressure), and the oil outlet port T (tank). In addition the secondary pressure is taken out through ports 1,2,3 and 4 provided at the bottom face.









Port	Port	Port size
Р	Pilot oil inlet port	
Т	Pilot oil return port	
1	1 Travel (LH, Forward)	
2	Travel (LH, Backward)	PF 1/4
3 Travel (RH, Forward)		
4	Travel (RH, Backward)	

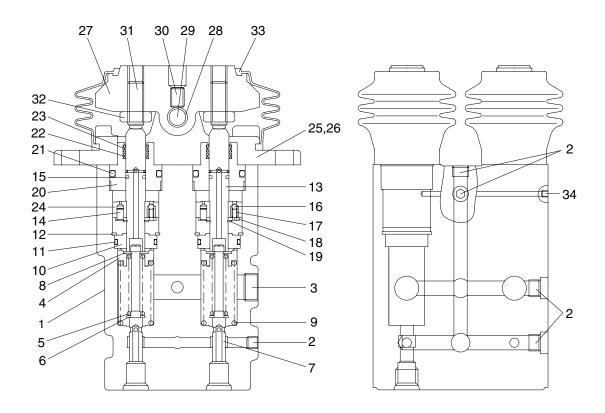
130ZF2RP01

#### **CROSS SECTION**

The construction of the RCV pedal is shown in the below drawing. The casing has vertical holes in which reducing valves are assembled.

The pressure reducing section is composed of the spool (7), spring (5) for setting secondary pressure, return spring (9), stopper (8), and spring seat (6). The spring for setting the secondary pressure has been generally so preset that the secondary pressure is  $6.3\pm1$  to  $24.9\pm1.5$  kgf/cm² (depending on the type). The spool is pushed against the push rod (13) by the return spring.

When the push rod is pushed down by tilting pedal, the spring seat comes down simultaneously and changes setting of the secondary pressure spring.



130ZF2RP02

1	Body	13	Push rod	25	Cover
2	Plug	14	Spring pin	26	Wrench bolt
3	Plug	15	Seal	27	Cam
4	Spring seat	16	Steel ball	28	Bushing
5	Spring	17	Spring	29	Cam shaft
6	Spring seat	18	Plate	30	Set screw
7	Spool	19	Snap ring	31	Set screw
8	Stopper	20	Plug	32	Hex nut
9	Spring	21	O-ring	33	Bellows
10	Rod guide	22	Rod seal	34	Expand
11	O-ring	23	Dust seal	35	Name plate
12	Snap ring	24	Piston		

#### 2. FUNCTION

#### 1) FUNDAMENTAL FUNCTIONS

The pilot valve is a valve controls the spool stroke, direction, etc of a main control valve. This function is carried out by providing the spring at one end of the main control valve spool and applying the output pressure (secondary pressure) of the pilot valve to the other end.

For this function to be carried out satisfactorily, the pilot valve is composed of the following elements.

- (1) Inlet port (P) where oil is supplied from hydraulic pump.
- (2) Output port (1, 2, 3 & 4) to apply pressure supplied from inlet port to ends of control valve spools.
- (3) Tank port (T) necessary to control the above output pressure.
- (4) Spool to connect output port to inlet port tank port.
- (5) Mechanical means to control output pressure, including springs that work on the above spools.

#### 2) FUNCTIONS OF MAJOR SECTIONS

The functions of the spool (8) are to receive the supply oil pressure from the hydraulic pump at its port P, and to change over oil paths to determine whether the pressure oil of port P is led to output ports 1, 2, 3 & 4 or the output spool to determine the output pressure.

The spring (6) works on this spool to determine the output pressure.

The change the deflection of this spring, the push rod (13) is inserted and can slide in the plug (20). For the purpose of changing th displacement of the push rod through the cam (27) and adjusting nut (32) are provided the pedal that can be tilted in any direction around the fulcrum of the cam (27) center.

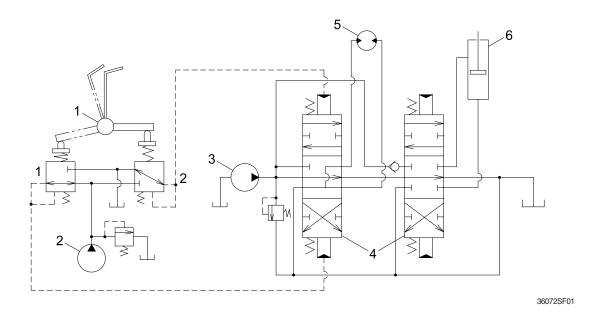
The spring (9) works on the body (1) and spring seat (6) and tries to return the push rod (13) to the zero-displacement position irrespective of the output pressure, securing its resetting to the center position.

This also has the effect of a reaction spring to give appropriate control feeling to the operator.

# 3) OPERATION

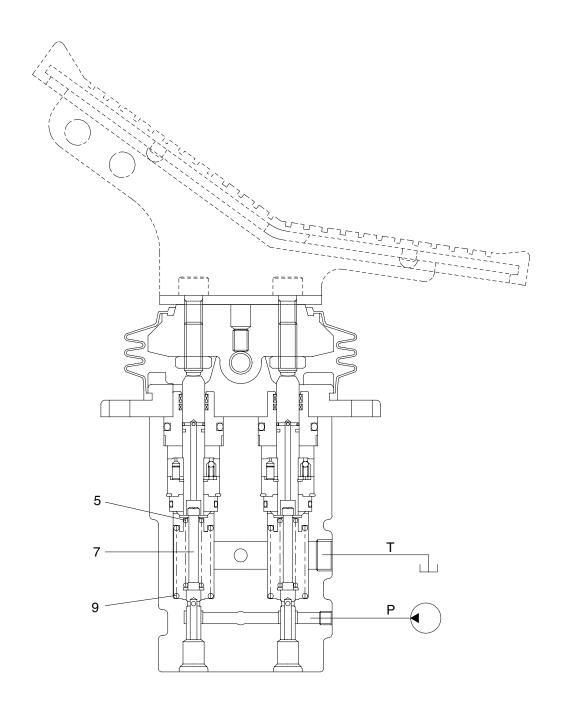
The operation of the pilot valve will be described on the basis of the hydraulic circuit diagram shown below and the attached operation explanation drawing.

The diagram shown below is the typical application example of the pilot valve.



- 1 Pilot valve
- 2 Pilot pump
- 3 Main pump
- 4 Main control valve
- 5 Hydraulic motor
- 6 Hydraulic cylinder

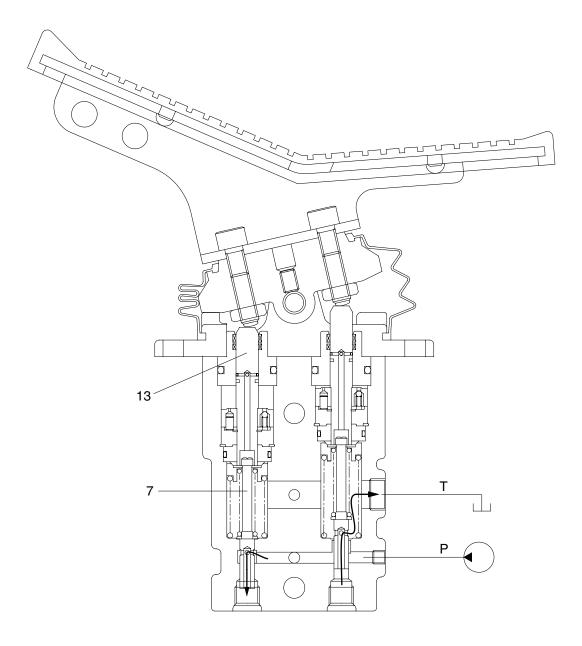
# (1) Case where pedal is in neutral position



130ZF2RP03

The force of the spring (5) that determines the output pressure of the pilot valve is not applied to the spool (7). Therefore, the spool is pushed up by the spring (9) to the position of 1 and port 2. Then, since the output port is connected to tank port T only, the output port pressure becomes equal to tank pressure.

## (2) Case where pedal is tilted



130ZF2RP04

When the push rod (13) is stroked, the spool (7) moves downwards.

Then port P is connected with port 1, and the oil supplied from the pilot pump flows through port 1 to generate the pressure.

When the pressure at port 1 increases to the value corresponding to the spring force set by tilting the handle, the hydraulic pressure force balances with the spring force. If the pressure at port 1 increases higher than the set pressure, port P is disconnected from port 1 and port T is connected with port 1. If it decreases lower than the set pressure, port P is connected with port 1 and port T is disconnected from port 1.

In this manner the secondary pressure is kept at the constant value.

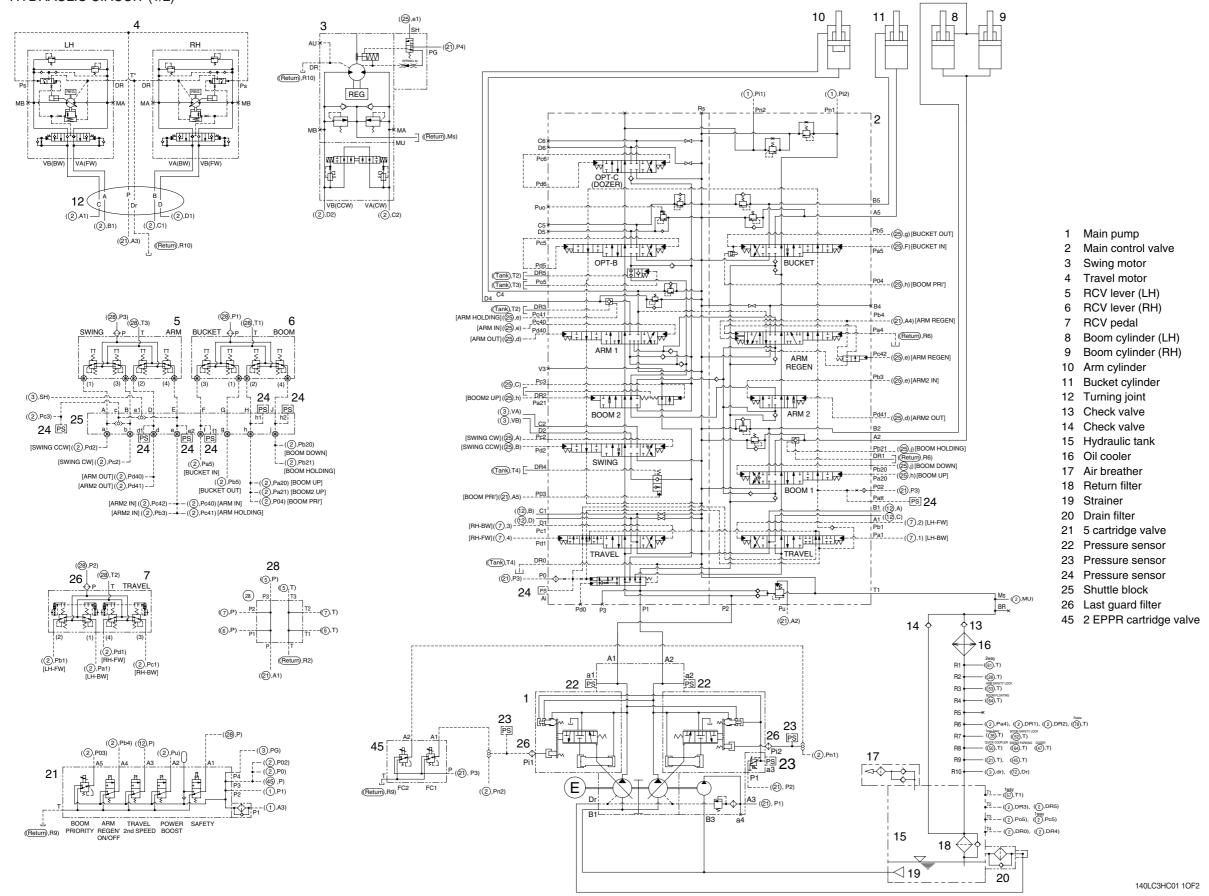
Besides, in some type, when the handle is tilted more than a certain angle, the upper end of the spool contacts with inside bottom of the push rod and the output pressure is left to be connected with port P.

# SECTION 3 HYDRAULIC SYSTEM

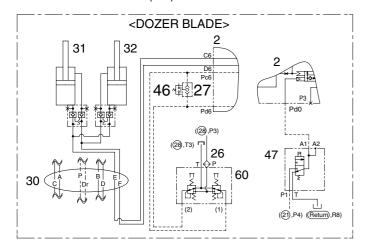
Group	1	Hydraulic Circuit	3-1
Group	2	Main Circuit ·····	3-3
Group	3	Pilot Circuit	3-6
Group	4	Single Operation	3-15
Group	5	Combined Operation	3-27

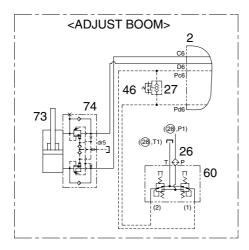
# **GROUP 1 HYDRAULIC CIRCUIT**

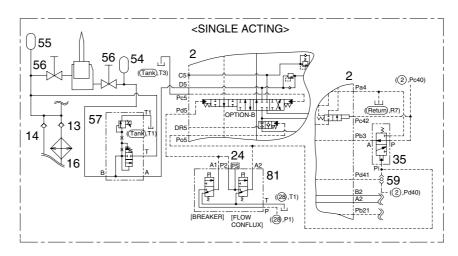
· HYDRAULIC CIRCUIT (1/2)

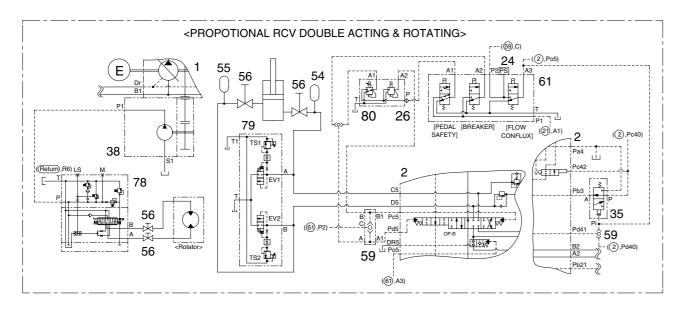


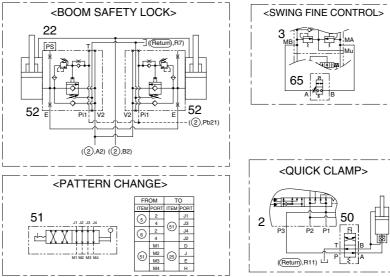
#### · HYDRAULIC CIRCUIT (2/2)

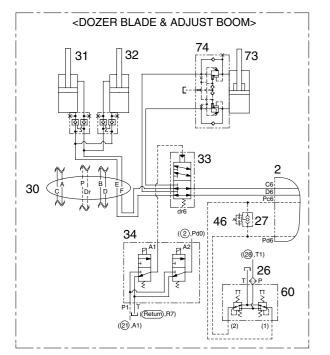


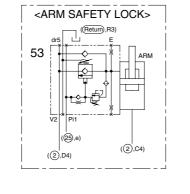


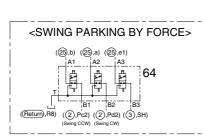


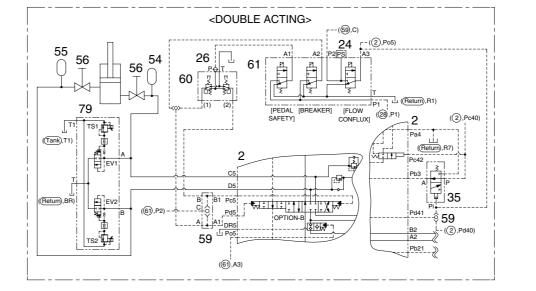












- Main pump
- Main control valve
- Swing motor
- Pressure sensor
- 22 24 26
- Pressure sensor Last guard filter Turning joint(option)
- Dozer cylinder(LH, option) 31
- Dozer cylinder(RH, option)
- 33 Selector valve(option)
- 34 Solenoid valve (option)
- Pilot selector valve(option) 35
- Fan drive pump(option)
  Solenoid valve(option) 38
- 46
- Pressure switch(option)
  Solenoid valve(option) 47
- Solenoid valve(option)
- Pattern change valve(option)
- Boom safety valve(option)
- Arm safety valve(option)
- Accumulator(option)
  Accumulator(option)
- Stop valve(option)
  Proportional relief valve(option)
- 59 Shuttle valve(option)
- 2 way pedal(option)
  Solenoid valve(option) 61
- Float cartridge valve(option)
  Solenoid valve(option)
- 63
- 64 Solenoid valve(option)
- Solenoid valve(option)
- Adjust boom cylinder(option)
  Adjust boom safety valve(option) 73
- 78
- Proportional valve(option)
- Proportional relief valve(option) 79
- 2 EPPR valve(option) 80
- Solenoid valve(option)

140LC3HC01 2OF2

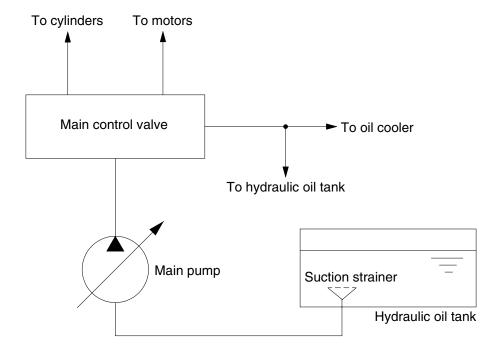
# **GROUP 2 MAIN CIRCUIT**

The main hydraulic circuit consists of suction circuit, delivery circuit, return circuit and drain circuit.

The hydraulic system consists of one main pump, one control valve, one swing motor, four cylinders and two travel motors.

The swash plate type variable displacement axial piston pump is used as the main pump and is driven by the engine at ratio 1.0 of engine speed.

#### 1. SUCTION AND DELIVERY CIRCUIT



140L3CI01

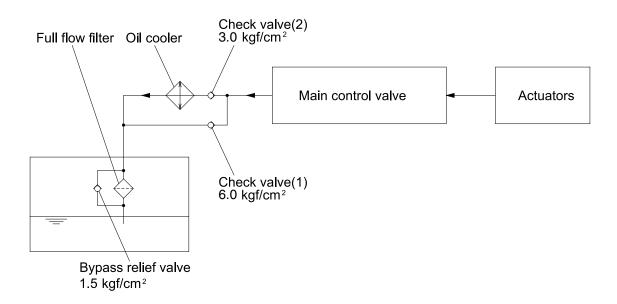
The pumps receive oil from the hydraulic tank through a suction strainer. The discharged oil from the pump flows into the control valve and goes out the tank ports.

The oil discharged from the main pump flows to the actuators through the main control valve.

The main control valve controls the hydraulic functions.

The return oil from the actuators flows to the hydraulic tank through the main control valve and the oil cooler.

#### 2. RETURN CIRCUIT



140L3Cl02

All oil returned from each actuator returns to the hydraulic tank through the main control valve.

The bypass check valves are provided in the return circuit.

The setting pressure of bypass check valves are 3.0 kgf/cm² (43 psi) and 6.0 kgf/cm² (85 psi). Usually, oil returns to the hydraulic tank from the left side of control valve through oil cooler.

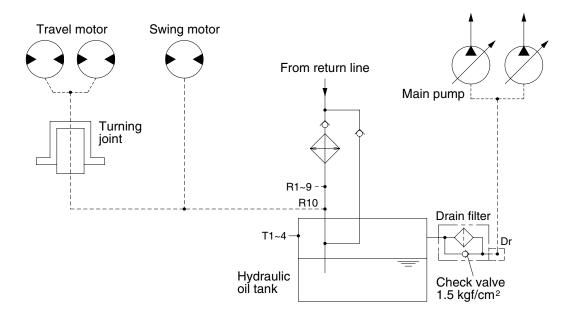
When oil temperature is low, viscosity becomes higher and flow resistance increases when passing through the oil cooler. When the oil pressure exceeds 6.0 kgf/cm² (85 psi), the oil returns directly to the hydraulic tank, resulting in the oil temperature being raised quickly at an appropriate level.

When the oil cooler is clogged, the oil returns directly to the hydraulic tank through bypass check valve (1). The full-flow filter and bypass relief valve are provided in the hydraulic tank.

The oil returned from right and left side of control valve is combined and filtered by the full-flow filter. A bypass relief valve is provided in the full-flow filter.

When the filter element is clogged, the bypass relief valve opens at 1.5 kgf/cm² (21 psi) differential pressure.

#### 3. DRAIN CIRCUIT



140LC3CI03

Besides internal leaks from the motors and main pump, the oil for lubrication circulates. These oil have to be fed to the hydraulic tank passing through drain filter.

When the drain oil pressure exceed 1.5 kgf/cm² (21 psi), the oil returns to the hydraulic tank directly.

#### 1) TRAVEL MOTOR DRAIN CIRCUIT

Oil leaked from the right and left travel motors comes out of the drain ports provided in the respective motor casing and join with each other. These oils pass through the turning joint and return to the hydraulic tank after being filtered by drain filter.

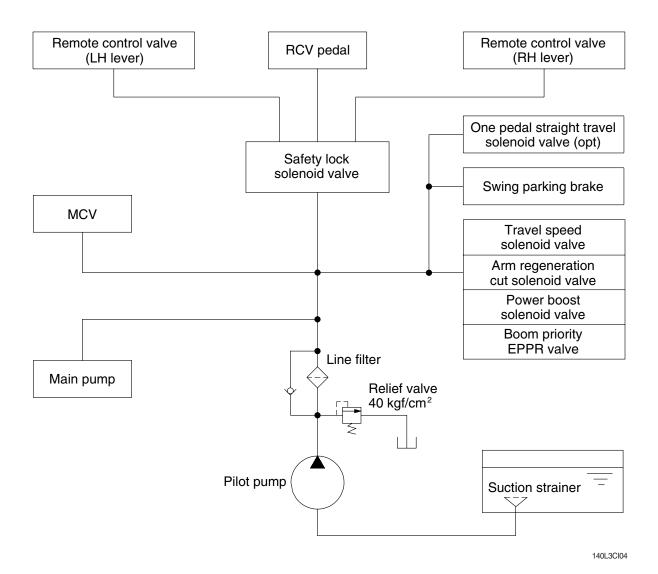
## 2) SWING MOTOR DRAIN CIRCUIT

Oil leaked from the swing motor returns to the hydraulic tank passing through drain filter.

### 3) MAIN PUMP DRAIN CIRCUIT

Oil leaked from main pump returns to the hydraulic tank passing through drain filter.

# **GROUP 3 PILOT CIRCUIT**

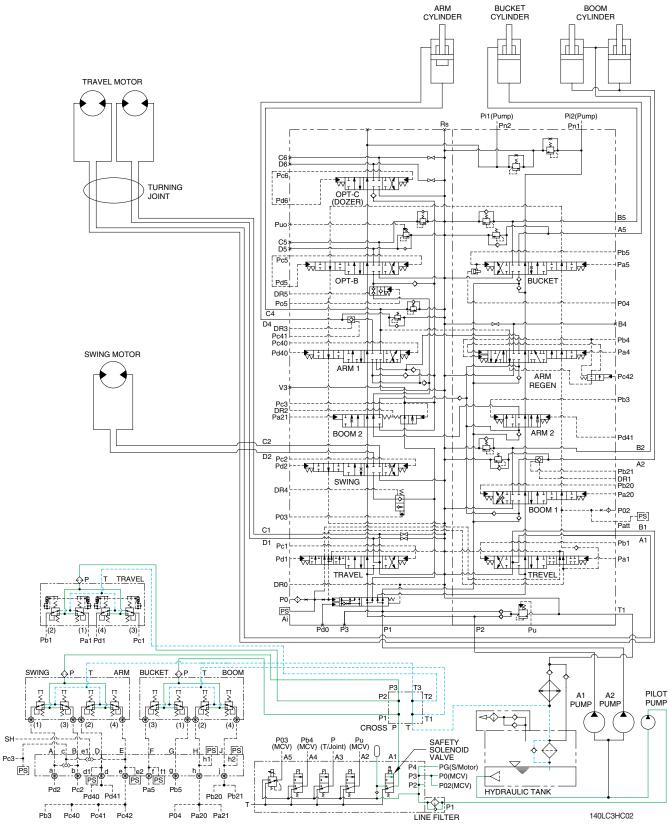


The pilot circuit consists of suction circuit, delivery circuit and return circuit.

The pilot pump is provided with relief valve, receives the oil from the hydraulic tank through the suction strainer.

The discharged oil from the pilot pump flows to the remote control valve through line filter, EPPR valve, solenoid valve assemblies, swing parking brake, main control valve and safety lock solenoid valve.

#### 1. SUCTION, DELIVERY AND RETURN CIRCUIT

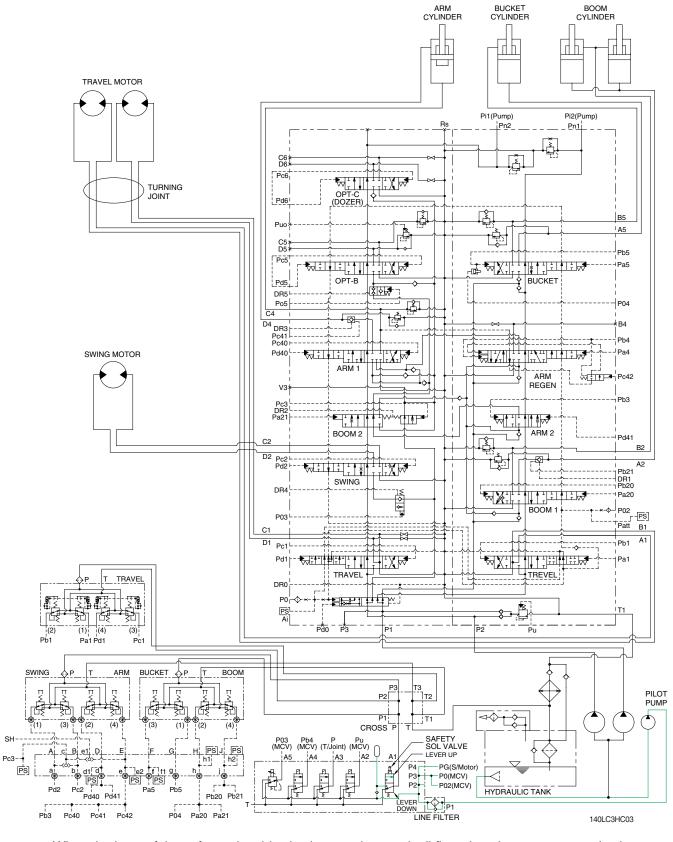


The pilot pump receive oil from the hydraulic tank. The discharged oil from the pilot pump flows to the safety solenoid valve through the line filter. The oil is filtered by the line filter. The pilot relief valve is provided in the pilot pump for limiting the pilot circuit pressure.

The oil filtered by line filter flows remote control valve through safety solenoid valve.

The return oil flow into the hydraulic tank.

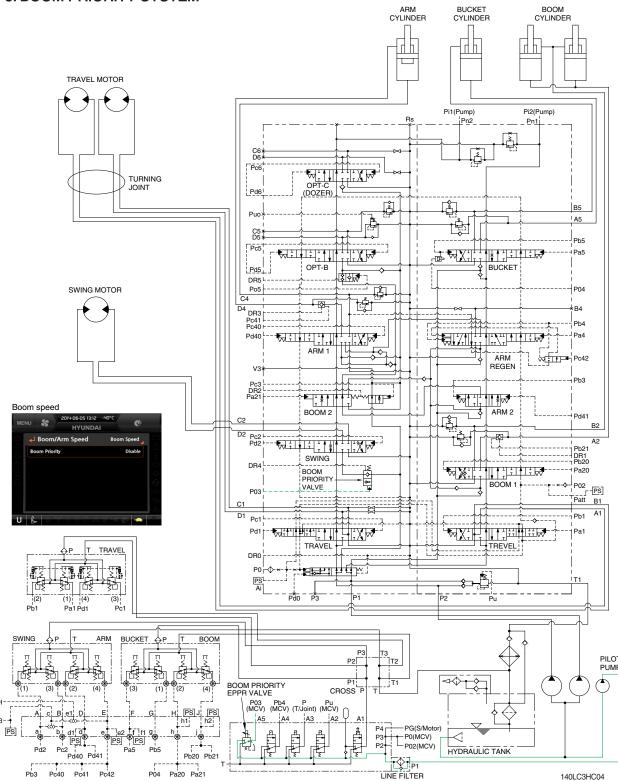
# 2. SAFETY VALVE (SAFETY LEVER)



When the lever of the safety solenoid valve is moved upward, oil flows into the remote control valve through solenoid valve and line filter.

When the lever of the safety solenoid valve is moved downward, oil does not flow into the remote control valve, because of the blocked port.

#### 3. BOOM PRIORITY SYSTEM



When carrying out the combined operation of swing and boom up, the boom up operating speed is lowered then normal operation.

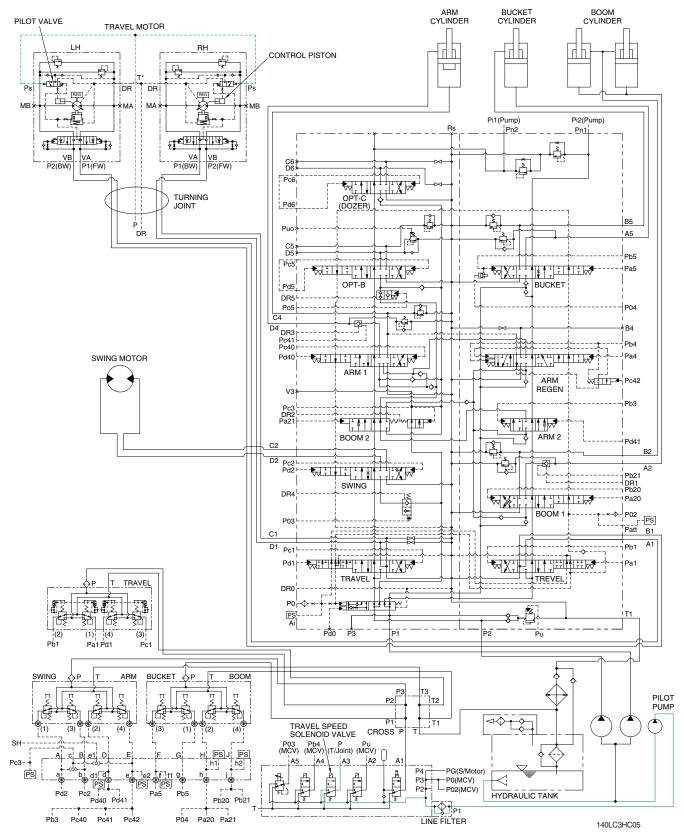
To increase working efficiency, swing speed reducing system is used.

The pilot oil from pilot pump flow into **P03** port in main control valve through boom priority EPPR valve. **P03** oil pressure moves swing reducing spool to lower position and oil flow rate to the swing motor decreased.

Then, the boom up speed is increased. This is called the boom priority system.

The boom up speed can be adjusted by the cluster. Refer to page 3-20 of the operator's manual.

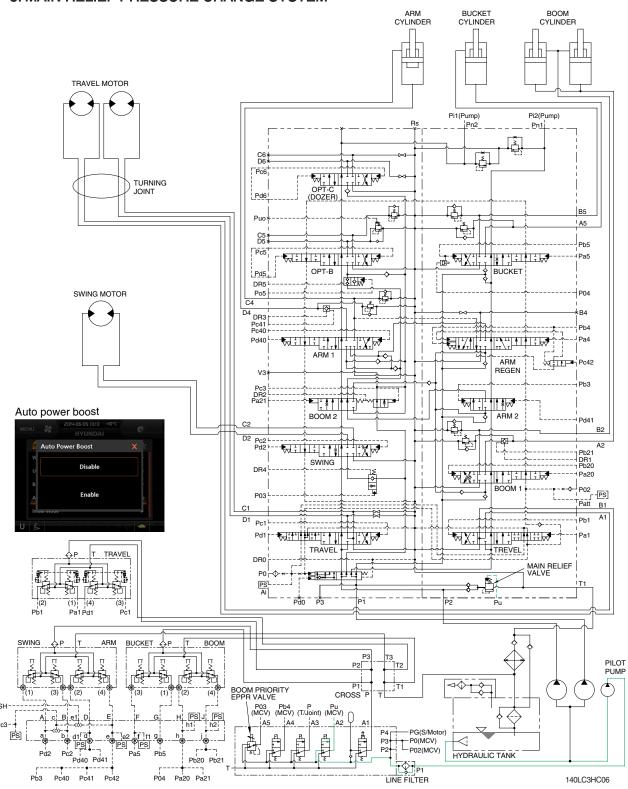
#### 4. TRAVEL SPEED CONTROL SYSTEM



When the travel speed solenoid valve was placed in the Hi position, the pressure oil from pilot pump through line filter flows to port **Ps** of travel speed change over valve, and the control piston is pushed left and right, thus minimizing the displacement.

When the travel speed solenoid valve was placed in the Lo position, the oil of **Ps** port return to the tank and the control piston is returned, thus maximizing the displacement.

#### 5. MAIN RELIEF PRESSURE CHANGE SYSTEM

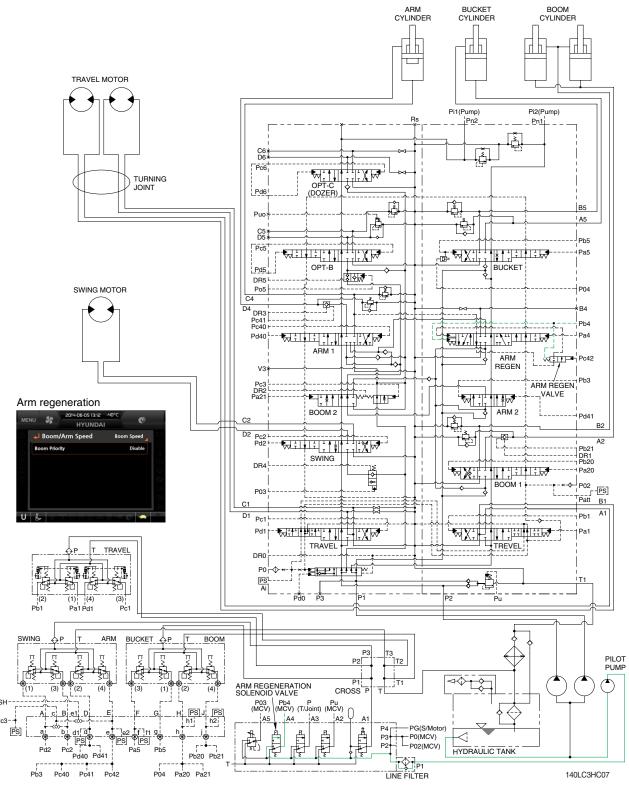


When the power boost switch on the left control lever is pushed ON, the power boost solenoid valve is actuated, the discharged oil from the pilot pump flows into **Pu** port of the main relief valve of main control valve; then the setting pressure of the main relief valve is raised from 350 kgf/cm² (4980 psi) to 380 kgf/cm² (5400 psi) for increasing the digging power.

And even when pressed continuously, it is canceled after 8 seconds.

When the auto power boost function is selected to enable on the cluster, the pressure of the main relief pressure is automatically increased to 380 kgf/cm² (5400 psi) as working condition by the MCU. It is operated max 8 seconds.

#### 6. ARM REGENERATION CUT SYSTEM



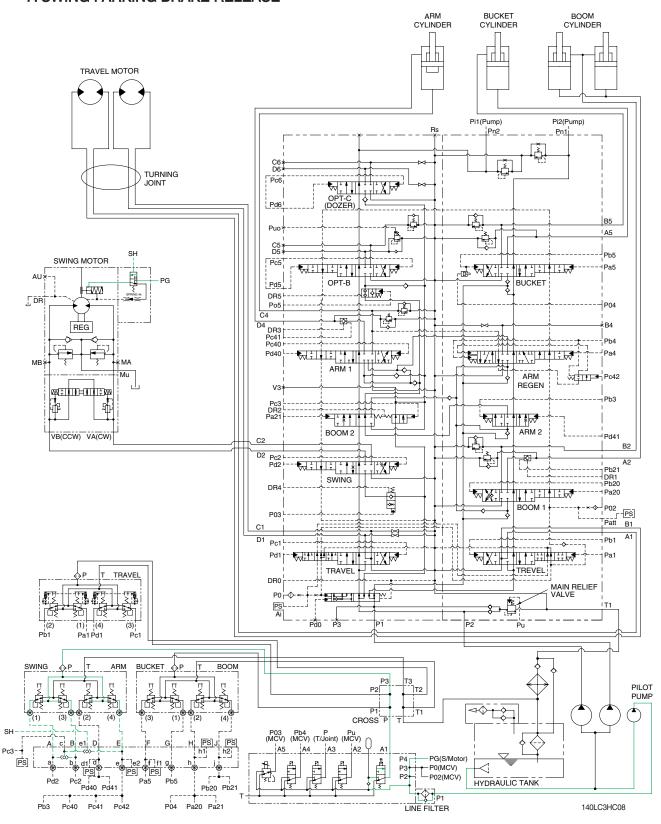
When the arm regeneration is selected to disable on the cluster, the arm regeneration solenoid valve is activated. The pilot oil from pilot pump flow into **Pb4** port in main control valve through solenoid valve and the arm regeneration spool is shifted to left.

Then, the oil from arm regeneration passage returns to tank and the arm regeneration function is deactivated.

When the arm regeneration is selected to enable on the cluster, the arm regeneration function is activated and arm in operation speed is increased.

Refer to page 2-36 for the arm regeneration function.

#### 7. SWING PARKING BRAKE RELEASE

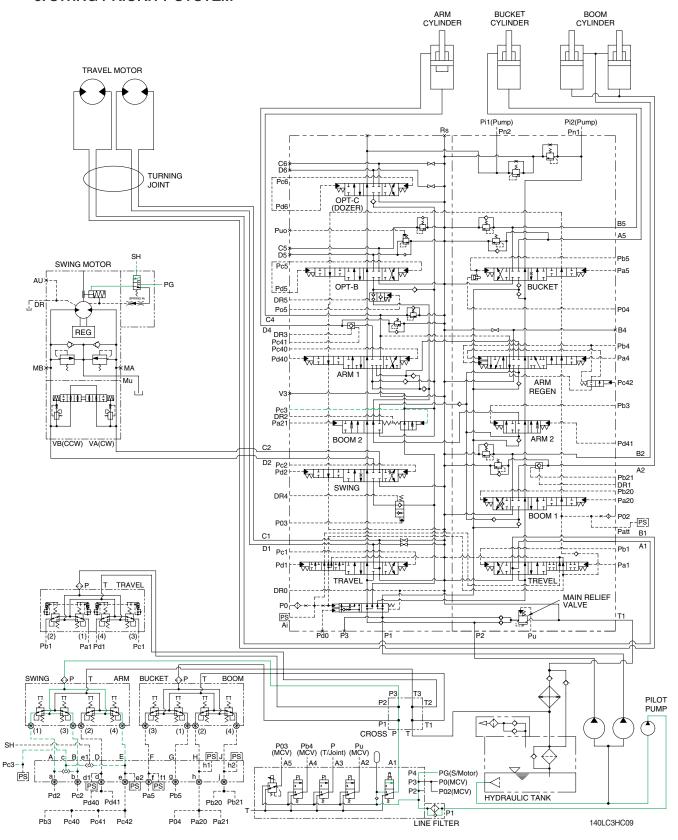


When the swing control lever or arm in control lever is tilted, the pilot oil flows into **SH** port through shuttle valve.

This pressure moves spool of the swing brake valve so, discharged oil from pilot pump flows to swing motor **PG** port. This pressure is applied to swing motor disc, thus the brake is released.

When the swing control lever and arm in control lever are set in the neutral position, oil in the swing motor disc cylinder is drained, thus the brake is applied.

#### 8. SWING PRIORITY SYSTEM



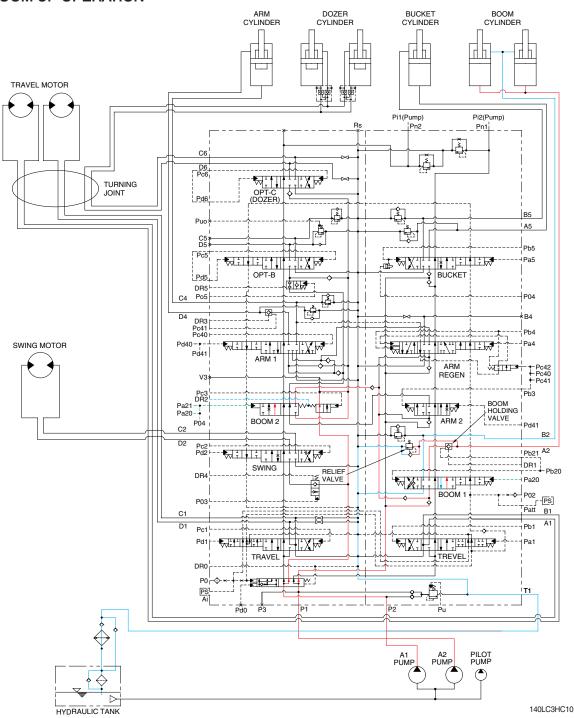
When carrying out the combined operation of swing and arm of the left control valve, the swing speed can be lowered than operating speed of arm.

**Pc3** pressure from the swing shuttle block change the swing priority spool and decreases the oil flow rate to the next section to make the swing operation most preferential.

This is called the swing priority system. For details, refer to page 2-38.

## **GROUP 4 SINGLE OPERATION**

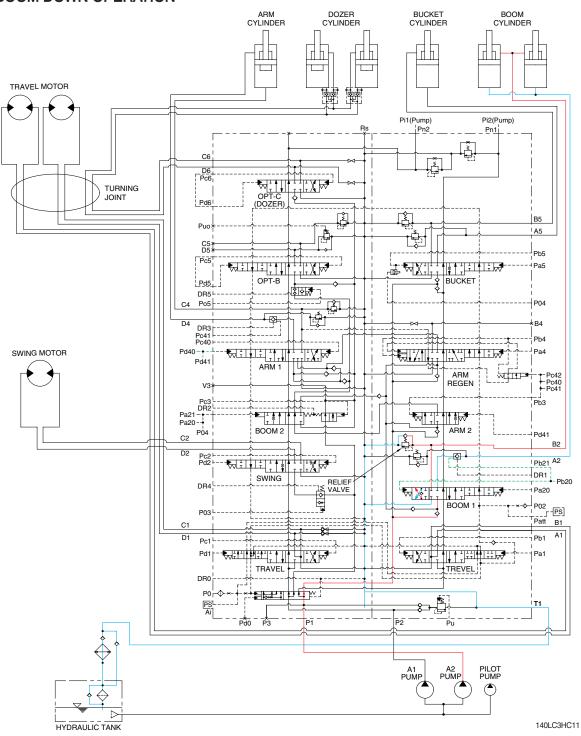
#### 1. BOOM UP OPERATION



When the right control lever is pulled back, the boom spools in the main control valve are moved to the up position by the pilot oil pressure from the remote control valve.

The oil from the A1 and A2 pump flows into the main control valve and then goes to the large chamber of boom cylinders. At the same time, the oil from the small chamber of boom cylinders returns to the hydraulic oil tank through the boom 1 spool in the main control valve. When this happens, the boom goes up. The excessive pressure in the boom cylinder head side is prevented by relief valve. When the boom is up and the control lever is returned to neutral position, the circuit for the holding pressure at the head side of the boom cylinder is closed by the boom holding valve. This prevents the hydraulic drift of boom cylinder.

#### 2. BOOM DOWN OPERATION



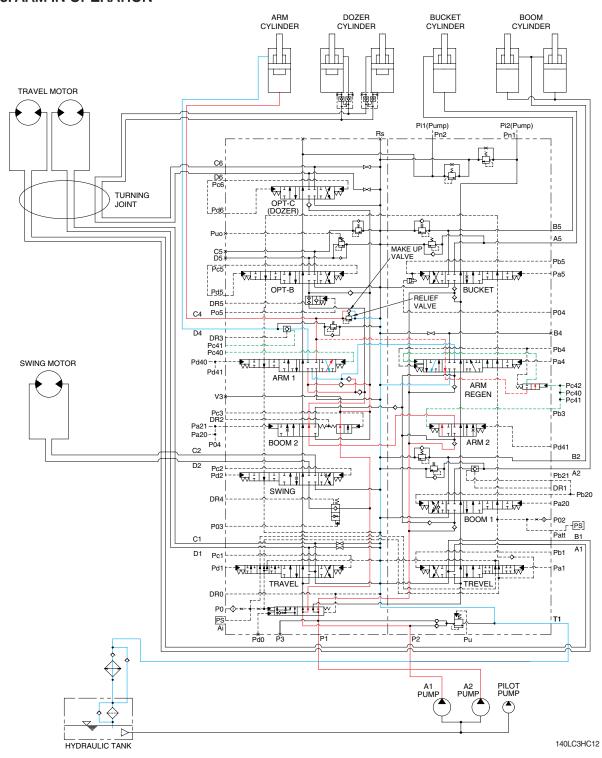
When the right control lever is pushed forward, the boom 1 spool in the main control valve is moved to the down position by the pilot oil pressure from the remote control valve.

The oil from the A2 pump flows into the main control valve and then goes to the small chamber of boom cylinders. At the same time, the oil from the large chamber of boom cylinders returns to the hydraulic tank through the boom 1 spool in the main control valve.

When the down speed of boom is faster, the oil returned from the large chamber of boom cylinder combines with the oil from the A2 pump, and flows into the small chamber of the cylinder.

This prevents cylinder cavitation by the negative pressure when the A2 pump flow can not match the boom down speed. And the excessive pressure in the boom cylinder rod side is prevented by the relief valve.

#### 3. ARM IN OPERATION



When the left control lever is pulled back, the arm spools in the main control valve are moved to the arm in position by the pilot oil pressure from the remote control valve.

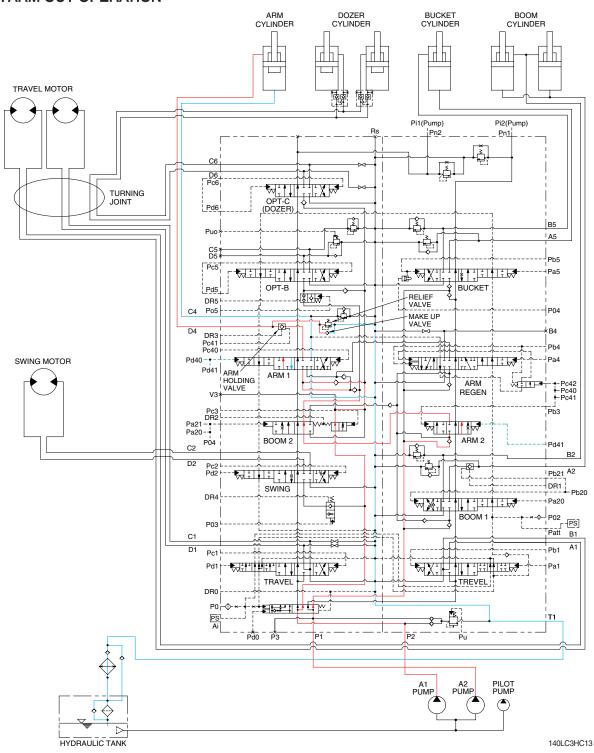
The oil from the A1 and A2 pump flows into the main control valve and then goes to the large chamber of arm cylinder.

At the same time, the oil from small chamber of arm cylinder returns to the hydraulic oil tank through the arm 1 spool in the main control valve. When this happens, the arm rolls in.

The excessive pressure in the arm cylinder head side is prevented by relief valve.

The cavitation which will happen to the head side of the arm cylinder is also prevented by the makeup valve in the main control valve.

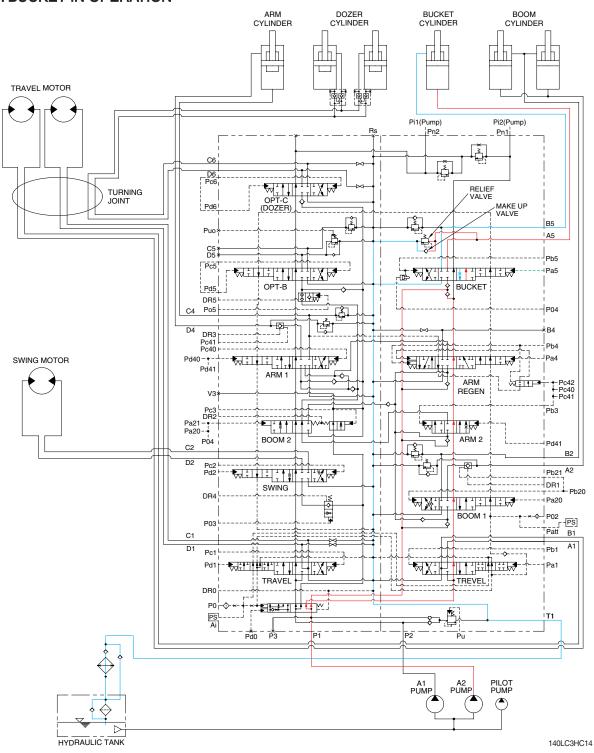
#### 4. ARM OUT OPERATION



When the left control lever is pushed forward, the arm spools in the main control valve are moved to the arm out position by the pilot oil pressure from the remote control valve.

The oil from the A1 and A2 pump flows into the main control valve and then goes to the small chamber of arm cylinder. At the same time, the oil from the large chamber of arm cylinder returns to the hydraulic oil tank through the arm 1 spool in the main control valve. When this happens, the arm rolls out. The cavitation which will happen to the rod side of the arm cylinder is also prevented by the make-up valve in the main control valve. When the arm is roll out and the control lever is returned to neutral position, the circuit for the holding pressure at the rod side of the arm cylinder is closed by the arm holding valve. This prevent the hydraulic drift of arm cylinder.

#### 5. BUCKET IN OPERATION



When the right control lever is pulled left, the bucket spool in the main control valve is moved to the roll in position by the pilot oil pressure from the remote control valve.

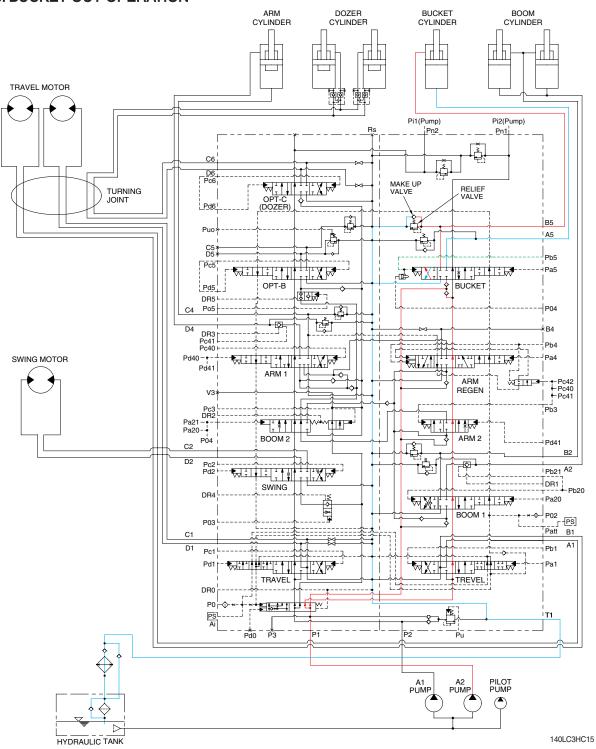
The oil from the A2 pump flows into the main control valve and then goes to the large chamber of bucket cylinder.

At the same time, the oil from the small chamber of bucket cylinder returns to the hydraulic oil tank through the bucket spool in the main control valve. When this happens, the bucket rolls in.

The excessive pressure in the bucket cylinder head side is prevented by relief valve.

The cavitation which will happen to the head side of the bucket cylinder is also prevented by the make-up valve in the main control valve.

#### 6. BUCKET OUT OPERATION



When the right control lever is pushed right, the bucket spool in the main control valve is moved to the bucket out position by the pilot oil pressure from the remote control valve.

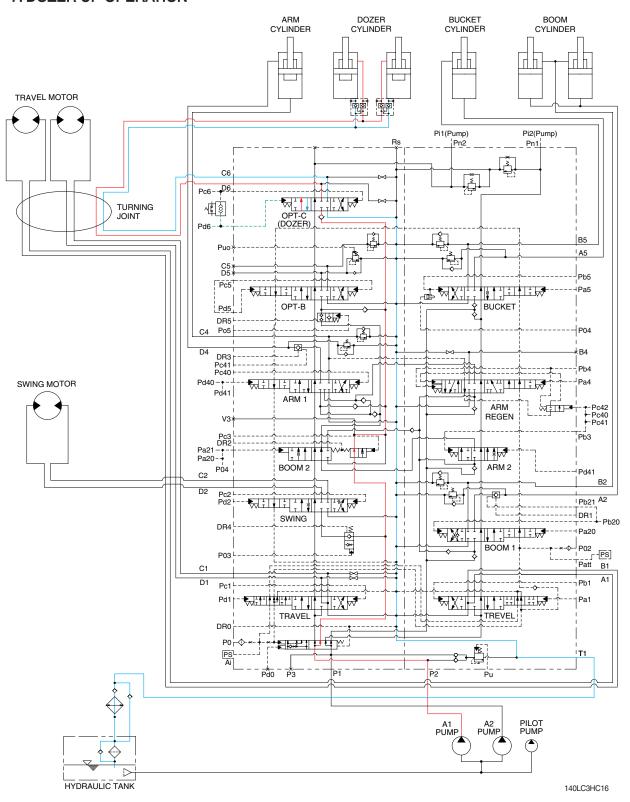
The oil from the A2 pump flows into the main control valve and then goes to the small chamber of bucket cylinder.

At the same time, the oil from the large chamber of bucket cylinder returns to the hydraulic oil tank through the bucket spool in the main control valve. When this happens, the bucket rolls out.

The excessive pressure in the bucket cylinder rod side is prevented by relief valve.

The cavitation which will happen to the rod side of the bucket cylinder is also prevented by the make-up valve in the main control valve.

## 7. DOZER UP OPERATION

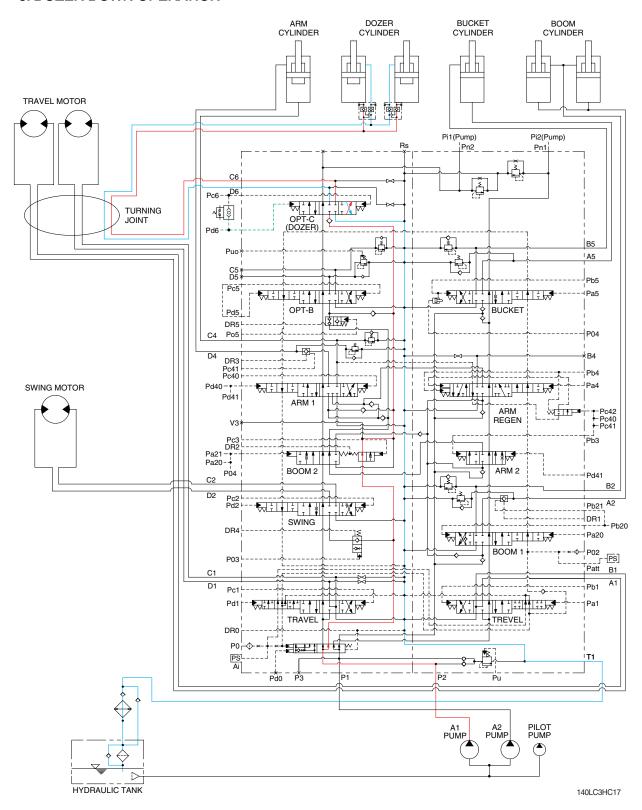


When the dozer control lever is pulled back, the dozer spool in the main control valve is moved to the dozer up position by the pilot oil pressure from the remote control valve.

The oil from the A1 pump flows into the main control valve and then goes to the small chamber of dozer cylinder.

At the same time, the oil from the large chamber of dozer cylinders returns to the hydraulic oil tank through the dozer spool in the main control valve. When this happens, the dozer goes up.

## 8. DOZER DOWN OPERATION

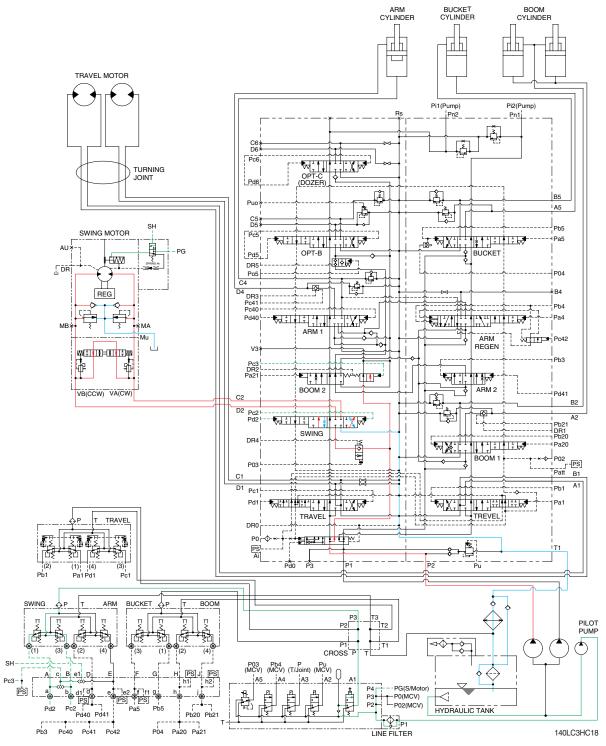


When the dozer control lever is pushed forward, the dozer spool in the main control valve is moved to the dozer down position by the pilot oil pressure from the remote control valve.

The oil from the A1 pump flows into the main control valve and then goes to the large chamber of dozer cylinder.

At the same time, the oil from the small chamber of dozer cylinders returns to the hydraulic oil tank through the dozer spool in the main control valve. When this happens, the dozer goes down.

#### 9. SWING OPERATION



When the left control lever is pushed left or right, the swing spool in the main control valve is moved to the left or right swing position by the pilot oil pressure from the remote control valve.

Also the swing operation preference function is operated by the pilot pressure **Pc3** (refer to page 3-13).

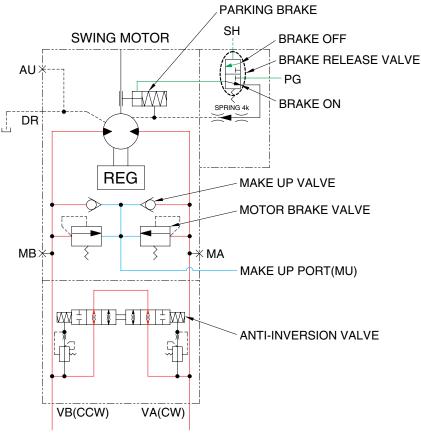
The oil from the A1 pump flows into the main control valve and then goes to the swing motor.

At the same time, the return oil from the swing motor returns to the hydraulic oil tank through the swing spool in the main control valve.

When this happens, the upper structure swings to the left or right.

The swing parking brake, make up valve and the motor brake valve are provided in the swing motor. The cavitation which will happen to the swing motor is also prevented by the make up valve in the swing motor itself.

#### SWING CIRCUIT OPERATION



TO / FROM MAIN CONTROL VALVE

140L3HC18A

#### 1) MOTOR BRAKE VALVE

Motor brake valve for the swing motor limits to cushion the starting and stopping pressure of swing operation and controls the swing motor operating pressure.

## 2) MAKE UP VALVE

The make up valves prevent cavitation by supplying return oil to the vacuum side of the motor.

## 3) PARKING BRAKE

This is function as a parking brake only when the swing control lever and arm in control lever are not operated.

#### PARKING BRAKE "OFF" OPERATION

The parking brake is released by the pilot pressure oil from the pilot pump.

When the swing control lever or arm in control lever placed in the operating position, the pilot oil flows into SH port through the MCV. This pressure transferred to the brake release valve and the brake release valve is change over. Then the pilot oil pressure PG lift the brake piston and release the parking brake.

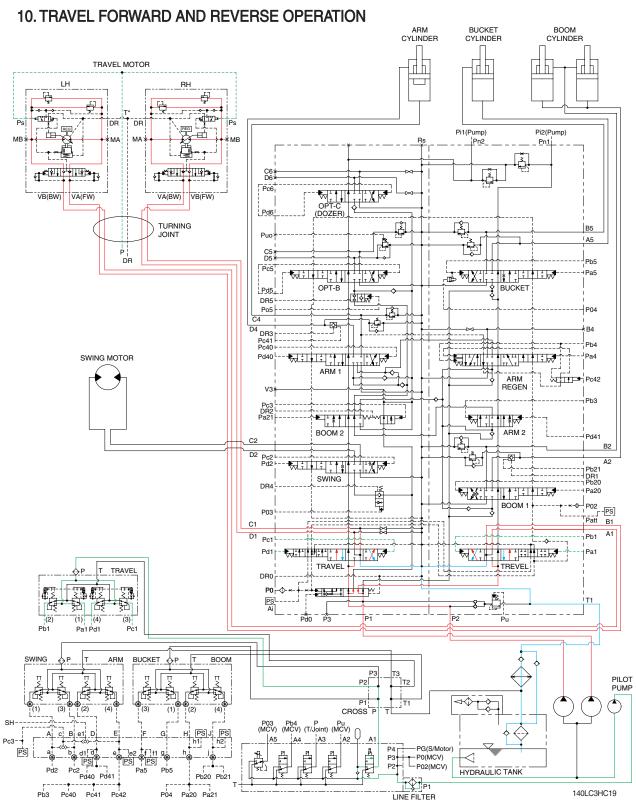
#### PARKING BRAKE "ON" OPERATION

When the swing control lever and arm in control lever placed in the neutral position, the pressure of the pilot oil passage down.

Then the brake release valve returned to the neutral position and the oil is returned from the brake piston to the hydraulic oil tank. And the brake is set to 'ON'.

#### 4) ANTI-INVERSION VALVE

This anti-inversion valve absorbs shocks produced as swing motion stops and reduced oscillation cause by swing motion.



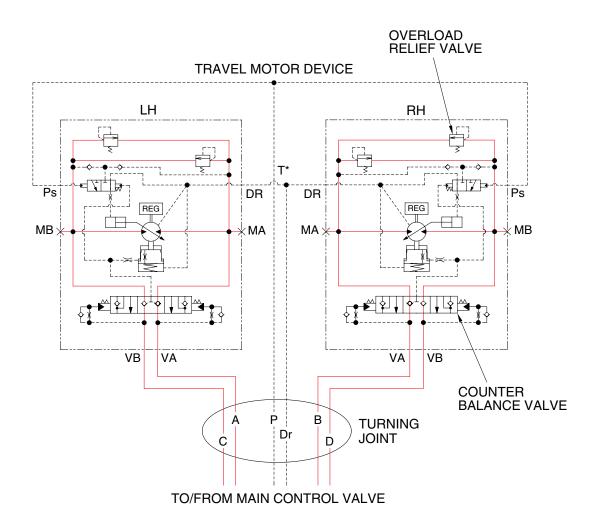
When the travel levers are pushed forward or reverse position, the travel spools in the main control valve are moved to the forward or reverse travel position by the pilot oil pressure from the remote control valve.

The oil from the each pump flows into the main control valve and then goes to the each travel motor through the turning joint.

The return oil from both travel motors returns to the hydraulic oil tank through the turning joint and the travel spools in the main control valve.

When this happens, the machine moves to the forward or reverse.

## TRAVEL CIRCUIT OPERATION



140L3HC19A

Valves are provided on travel motors to offer the following functions.

## 1) COUNTER BALANCE VALVE

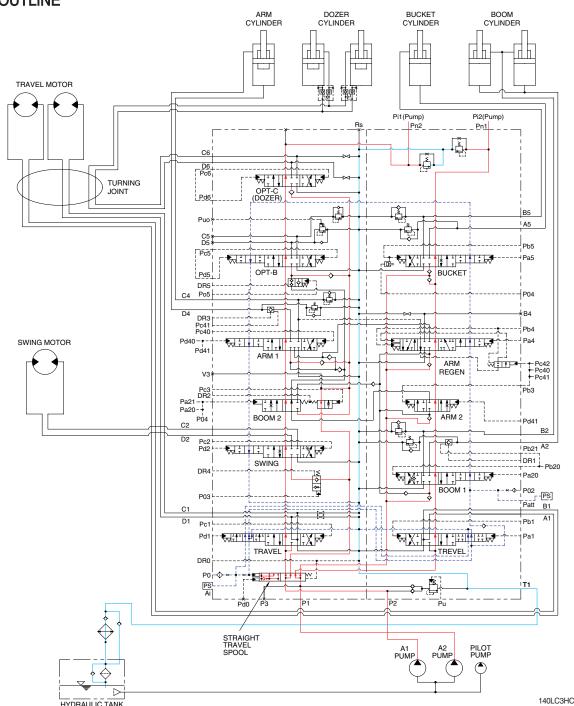
When stopping the motor of slope descending, this valve to prevent the motor over run.

## 2) OVERLOAD RELIEF VALVE

Relief valve limit the circuit pressure below 350 kgf/cm² (4980 psi) to prevent high pressure generated at a time of stopping the machine. Stopping the motor, this valve sucks the oil from lower pressure passage for preventing the negative pressure and the cavitation of the motor.

## **GROUP 5 COMBINED OPERATION**

#### 1. OUTLINE



The oil from the A1 and A2 pump flows through the neutral oil passage, bypass oil passage and confluence oil passage in the main control valve. Then the oil goes to each actuator and operates them. Check valves and orifices are located on these oil passage in the main control valve. These control the oil from the main pumps so as to correspond to the operation of each actuator and smooth the combined operation.

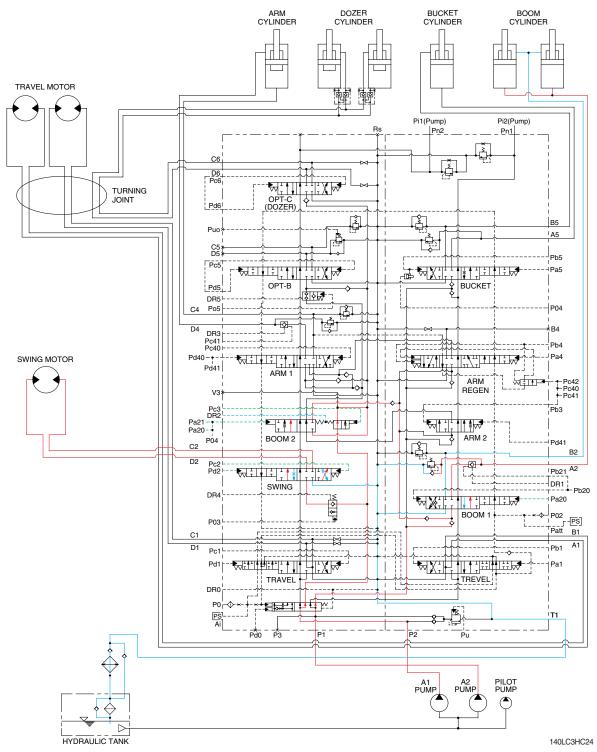
#### STRAIGHT TRAVEL SPOOL

This straight travel spool for straight travel is provided in the main control valve.

If any actuator is operated when traveling, the straight travel spool is pushed to the right by the pilot oil pressure.

Consequently, the left and right travel oil supply passage are connected, and equivalent amount of oil flows into the left and right travel motors. This keeps the straight travel.

## 2. COMBINED SWING AND BOOM UP OPERATION



When the swing and boom up functions are operated simultaneously, the swing spool and boom spools in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve.

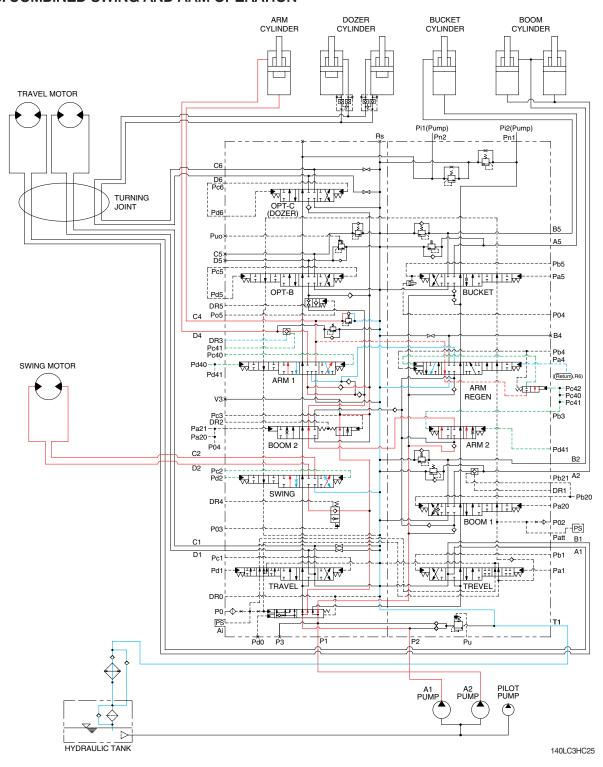
The oil from the A1 pump flows into the swing motor through swing spool and the boom cylinder through boom 2 spool.

The oil from the A2 pump flows into the boom cylinders through the boom 1 spool in the right control valve.

The super structure swings and the boom is operated.

Refer to page 3-9 for the boom priority system.

## 3. COMBINED SWING AND ARM OPERATION



When the swing and arm functions are operated simultaneously, the swing spool and arm spools in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve.

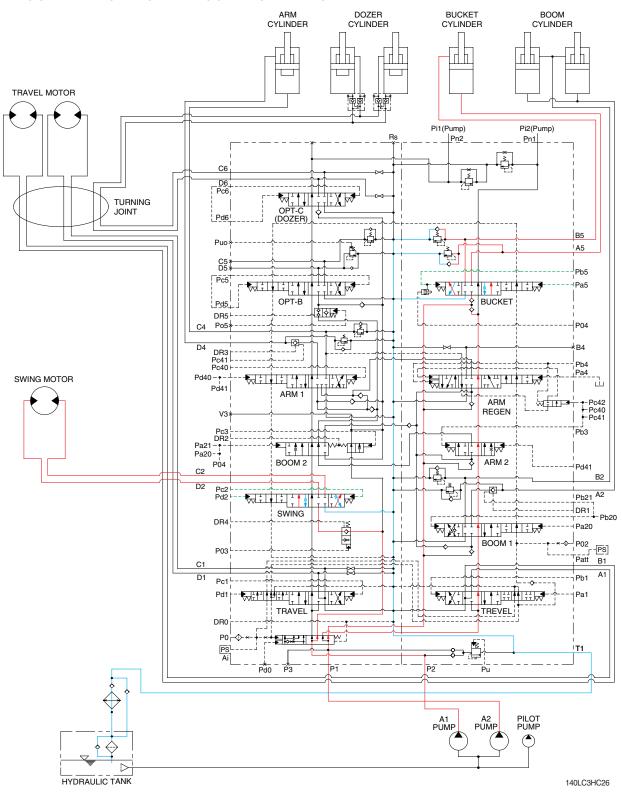
The oil from the A1 pump flows into the swing motor through swing spool and the arm cylinder through arm 1 spool.

The oil from the A2 pump flows into the arm cylinder through the arm 2 spool of the right control valve.

The super structure swings and the arm is operated.

Refer to page 3-14 for the swing operation preference function.

## 4. COMBINED SWING AND BUCKET OPERATION

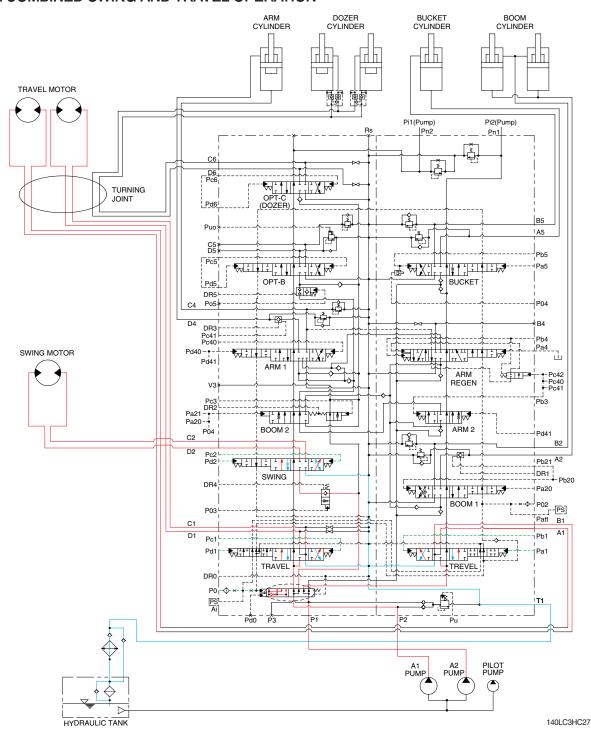


When the swing and bucket functions are operated simultaneously, the swing spool and bucket spool in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve.

The oil from the A1 pump flows into the swing motor through the swing spool in the left control valve. The oil from the A2 pump flows into the bucket cylinder through the bucket spool in the right control valve.

The super structure swings and the bucket is operated.

#### 5. COMBINED SWING AND TRAVEL OPERATION



When the swing and travel functions are operated simultaneously, the swing spool and travel spools in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve and straight travel spool is pushed to the right by the pilot oil pressure from the pilot pump.

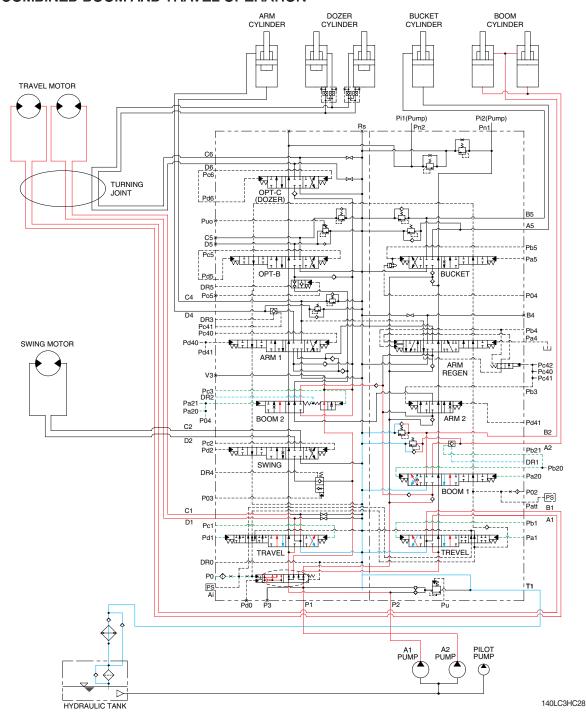
The oil from the A1 pump flows into the travel motors through the RH travel spool of the left control valve and the LH travel spool of the right control valve via the straight travel spool.

The oil from the A2 pump flows into the swing motor through in the straight travel spool.

When the pressure of the travel motors is lower than the pressure of the swing motor, some oil from the A2 pump flows into the travel motors through the check valve and orifice in the straight travel spool. This prevents the rapid slowdown of the travel.

The upper structure swings and the machine travels straight.

#### 6. COMBINED BOOM AND TRAVEL OPERATION



When the boom and travel functions are operated simultaneously, the boom spools and travel spools in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve and the straight travel spool is pushed to the right by the oil pressure from pilot pump.

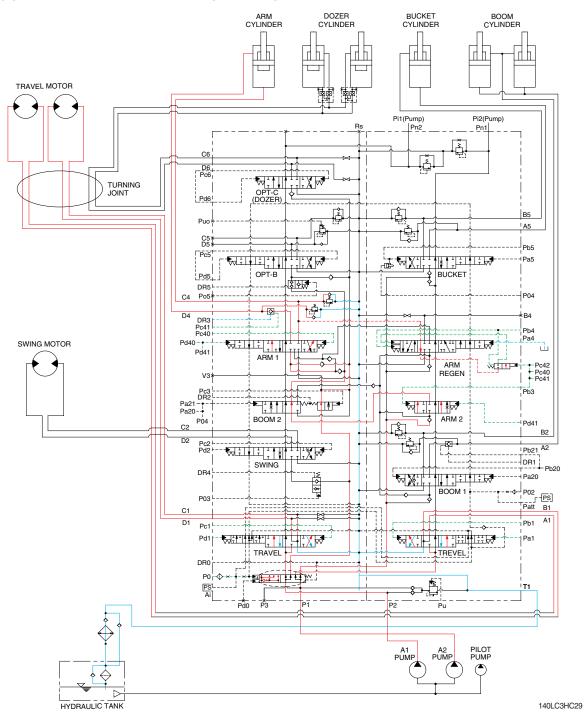
The oil from the A1 pump flows into the travel motors through the RH travel spool of the left control valve and the LH travel spool of the right control valve via the straight travel spool.

The oil from the A2 pump flows into the boom cylinders through the boom 2 spool and boom 1 spool via the parallel and confluence oil passage in case boom up operation.

When the pressure of the travel motors is lower than the pressure of the boom cylinders, some oil from the A2 pump flows into the travel motors through the check valve and orifice in the straight travel spool. This prevents the rapid slowdown of the travel.

The boom is operated and the machine travels straight.

## 7. COMBINED ARM AND TRAVEL OPERATION



When the arm and travel functions are operated simultaneously, the arm spools and travel spools in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve and the straight travel spool is pushed to the right by the oil pressure from pilot pump.

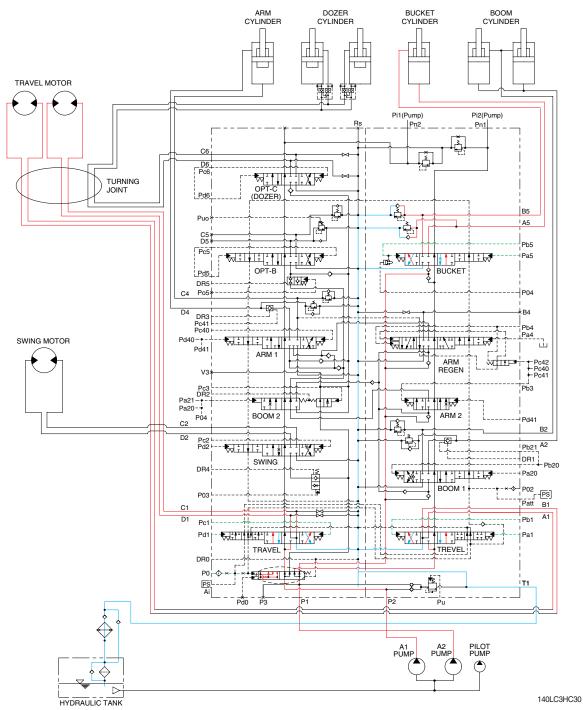
The oil from the A1 pump flows into the travel motors through the RH travel spool of the left control valve and the LH travel spool of the right control valve via the straight travel spool.

The oil from the A2 pump flows into the arm cylinders through the arm 1 spool and arm 2 spool via the parallel and confluence oil passage.

When the pressure of the travel motors is lower than the pressure of the arm cylinder, some oil from the A2 pump flows into the travel motors through the check valve and orifice in the straight travel spool. This prevents the rapid slowdown of the travel.

The arm is operated and the machine travels straight.

#### 8. COMBINED BUCKET AND TRAVEL OPERATION



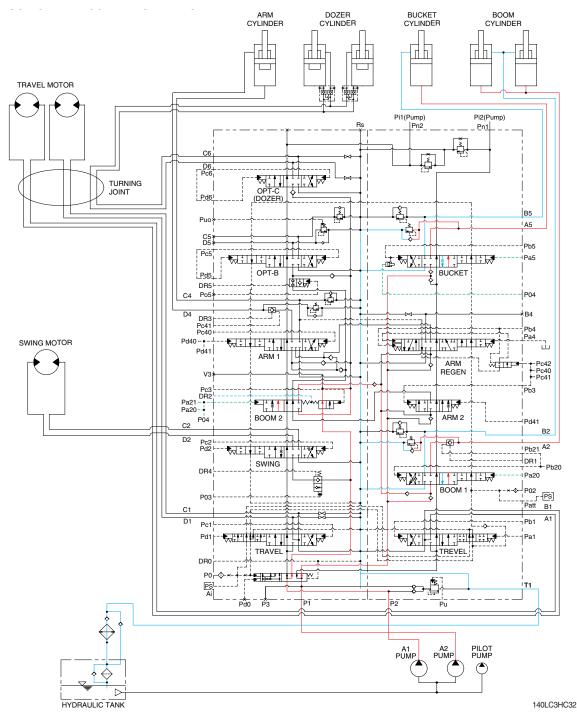
When the bucket and travel functions are operated simultaneously, the bucket spool and travel spools in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve, and the straight travel spool is pushed to the right by the oil pressure from pilot pump. The oil from the A1 pump flows into the travel motors through the RH travel spool of the left control valve and the LH travel spool of the right control valve via the straight travel spool of the control valve.

The oil from the A2 pump flows into the bucket cylinder through the bucket spool via the confluence oil passage.

When the pressure of the travel motors is lower than the pressure of the bucket cylinder, some oil from the A2 pump flows into the travel motors through the check valve and orifice in the straight travel spool. This prevents the rapid slowdown of the travel.

The bucket is operated and the machine travels straight.

#### 9. COMBINED BOOM UP AND BUCKET OPERATION



When the boom up and bucket functions are operated simultaneously, each spool in the main control valve is moved to the functional position by the pilot oil pressure from the remote control valve.

The oil from the A1 pump flows into the boom cylinders through the boom 2 spool in the left control valve. The oil from the A2 pump flows into the boom cylinders and bucket cylinder through the boom 1 spool, bucket spool and the parallel and confluence oil passage in the right control valve.

Also, when the boom up and bucket in functions are operated simultaneously, the boom up operation preference function is operated by the pilot pressure **P04** and then the bucket spool transfers in the half stroke not full stroke (refer to page 2-32). Therefore, the most of pressurized oil flows into boom 1 spool than the bucket spool to make the boom up operation more preferential. The boom and bucket are operated.

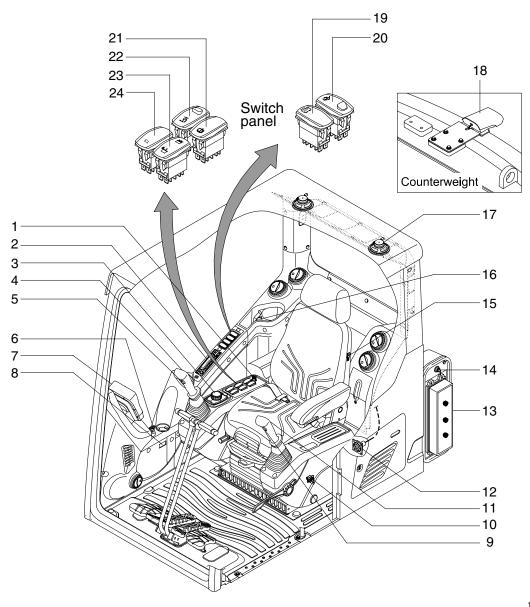
# SECTION 4 ELECTRICAL SYSTEM

Group	1	Component Location ·····	4-1
Group	2	Electrical Circuit	4-3
Group	3	Electrical Component Specification	4-23
Group	4	Connectors ·····	4-34

# **SECTION 4 ELECTRICAL SYSTEM**

# **GROUP 1 COMPONENT LOCATION**

## 1. LOCATION 1



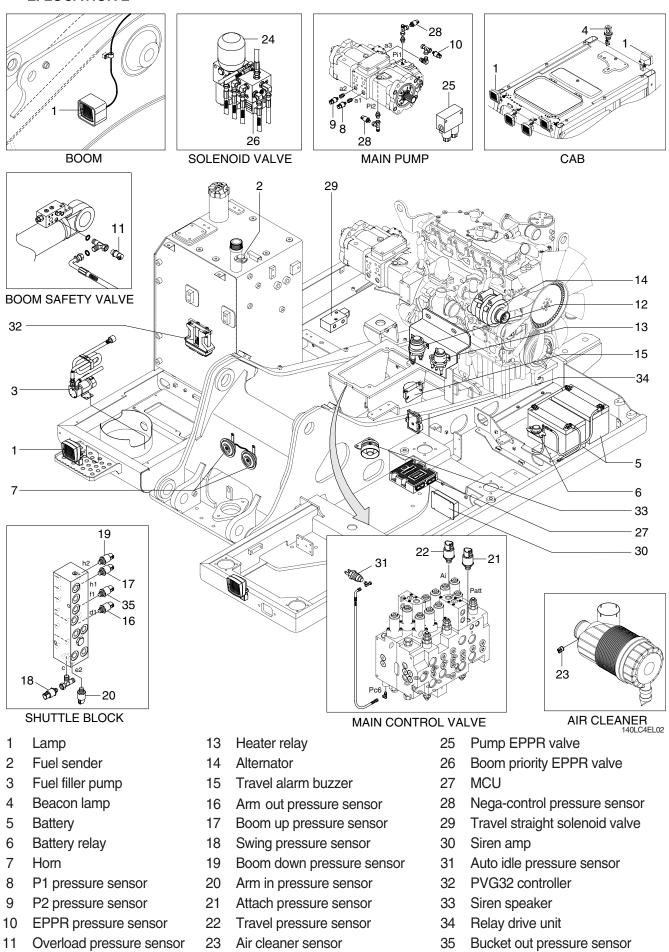
140LC4EL01

1	Cigar lighter	9	Power max switch	17	Speaker
2	Radio & USB player	10	Emergency engine stop switch	18	Camera kit
3	Haptic controller	11	One touch decel switch	19	Air compressor switch
4	Horn switch	12	RS232 & J1939 service socket	20	Quick clamp switch
5	Breaker operation switch	13	Fuse & relay box	21	Lower wiper & washer switch
6	Starting switch	14	Master switch	22	Boom floating switch
7	Cluster	15	Seat heater switch	23	Swing lock/fine switch
8	Service meter	16	Power socket	24	Travel straight switch

## 2. LOCATION 2

12

Start relay

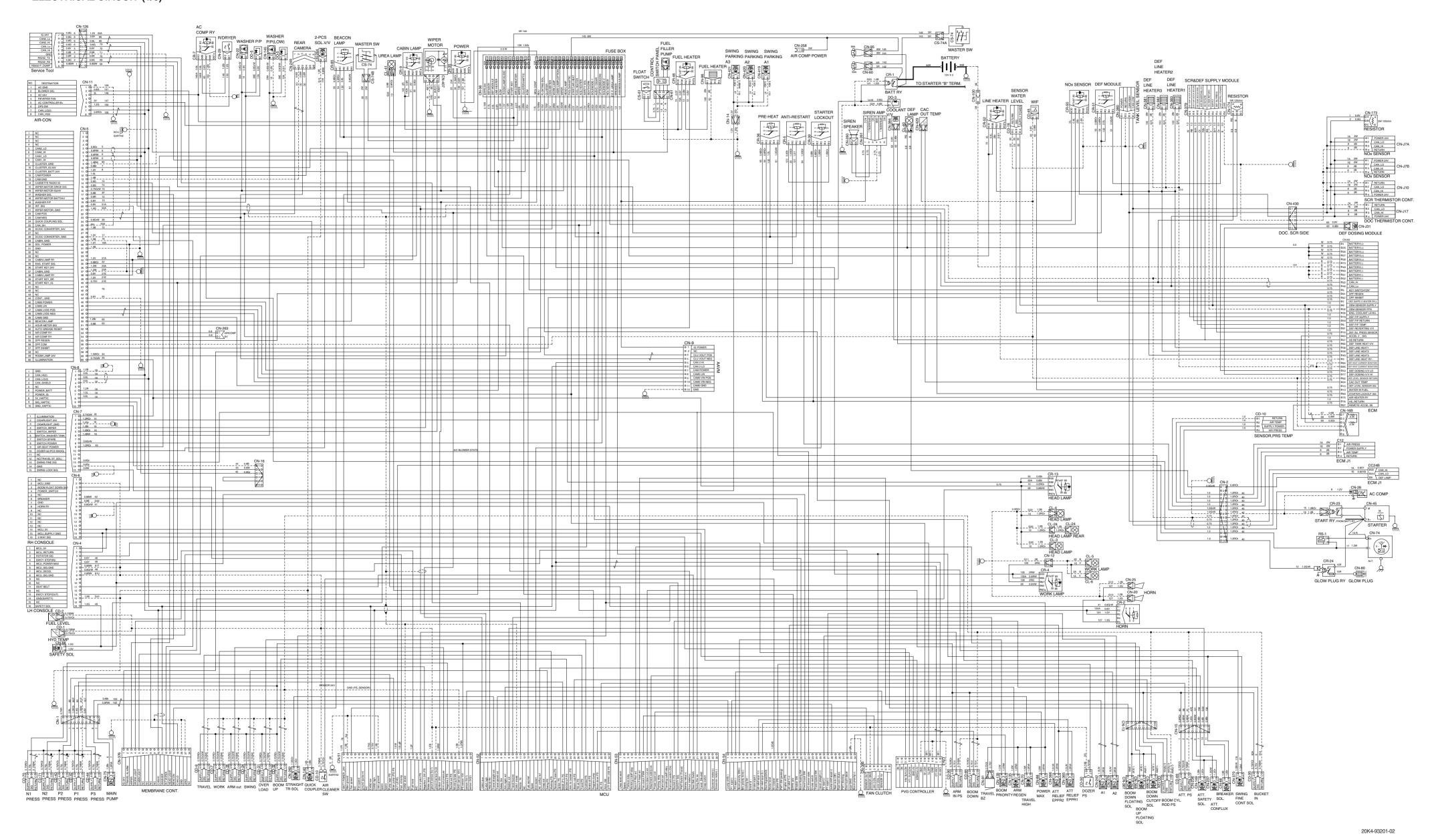


Solenoid valve

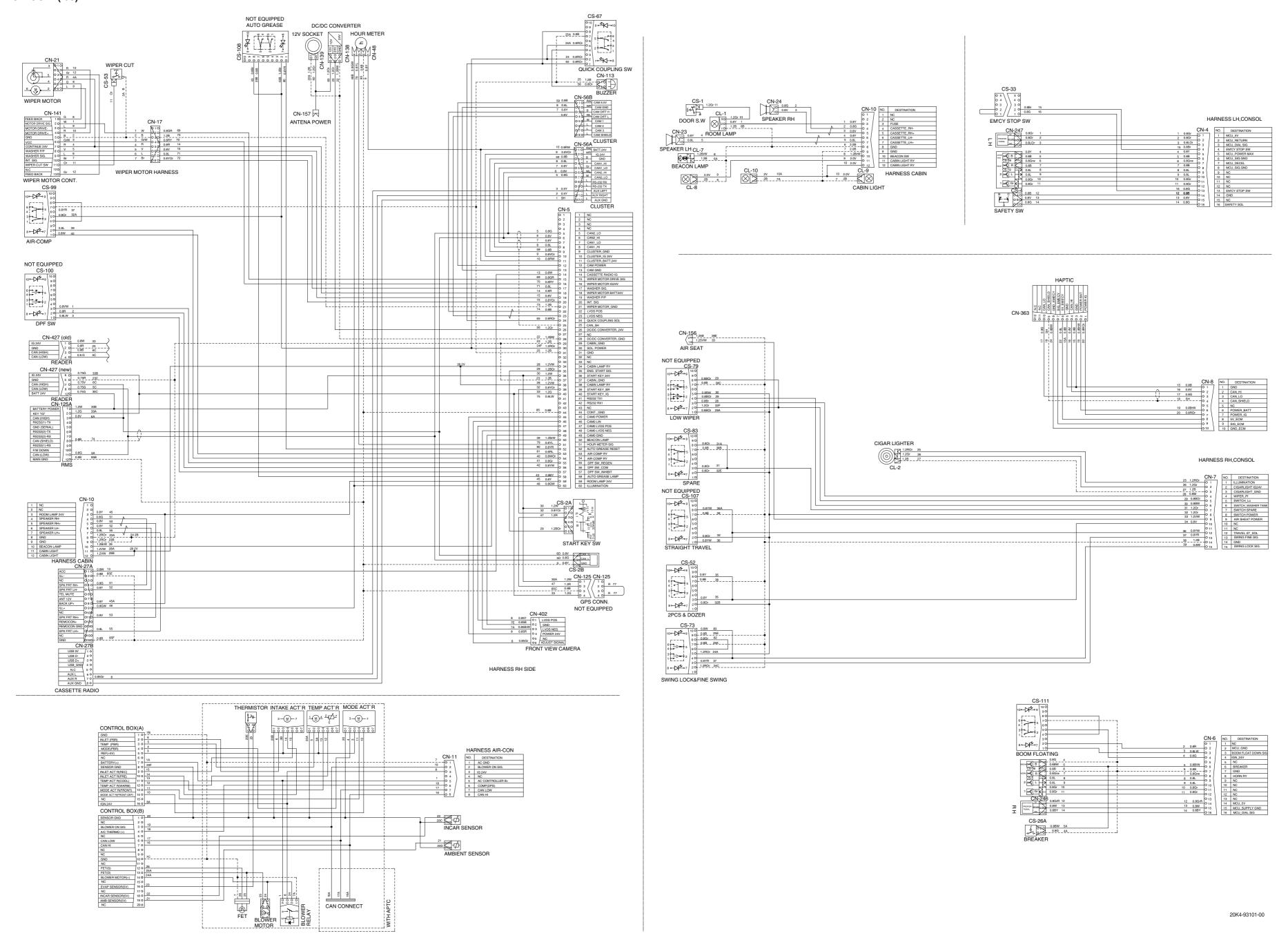
24

## **GROUP 2 ELECTRICAL CIRCUIT**

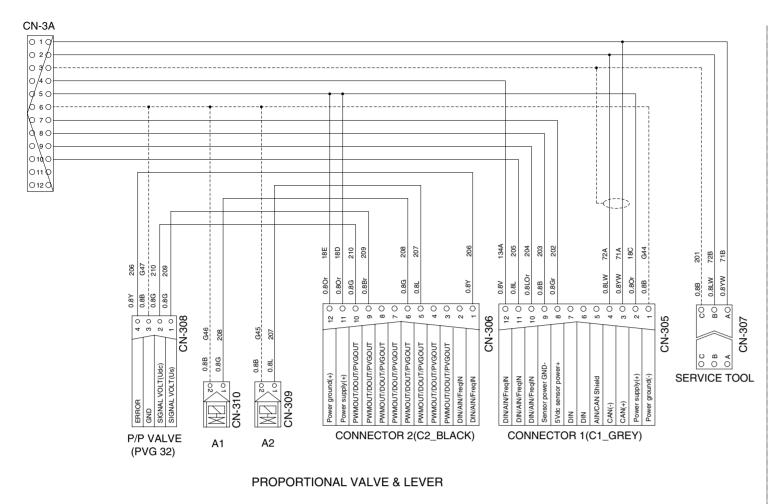
# · ELECTRICAL CIRCUIT (1/3)

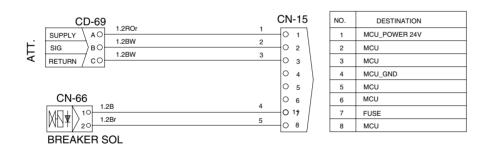


## · ELECTRICAL CIRCUIT (2/3)

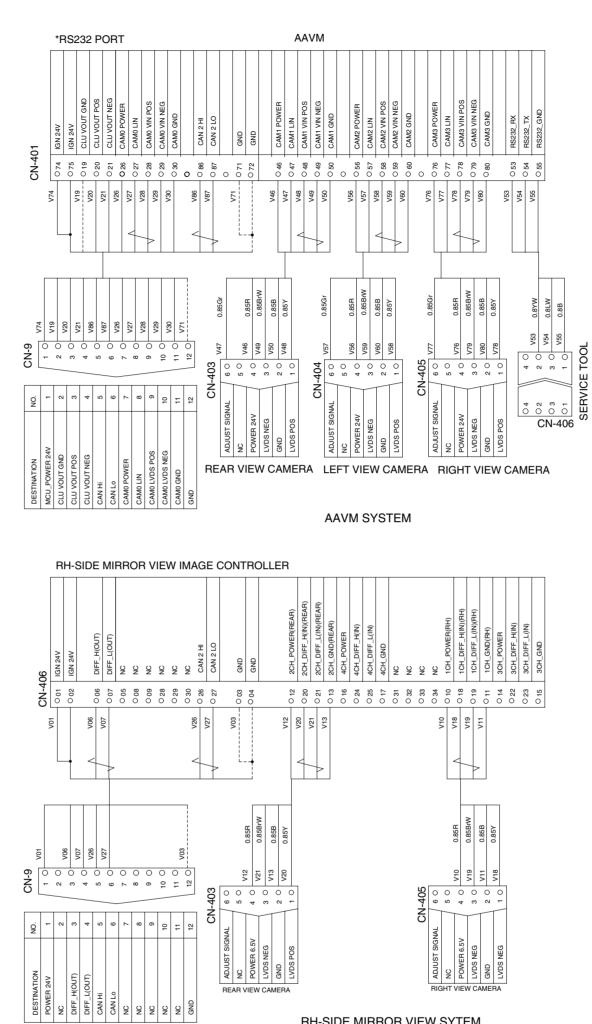


# · ELECTRICAL CIRCUIT (3/3)





HARNESS BREAKER



20K4-93300-01

RH-SIDE MIRROR VIEW SYTEM

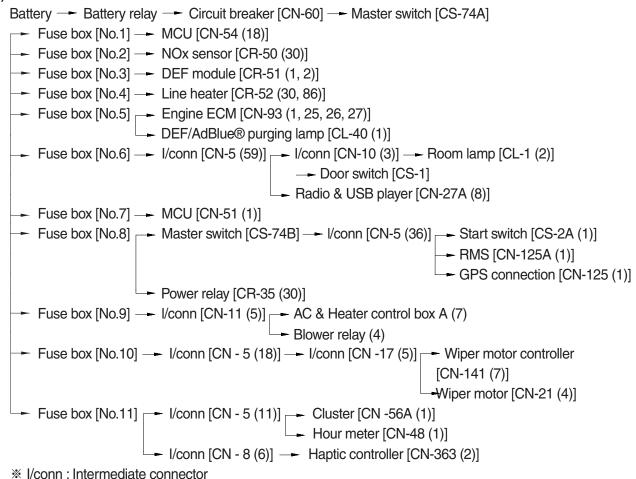
# **MEMORANDUM**

## 1. POWER CIRCUIT

The negative terminal of battery is grounded to the machine chassis.

When the start switch is in the OFF position, the current flows from the positive battery terminal as shown below.

## 1) OPERATING FLOW

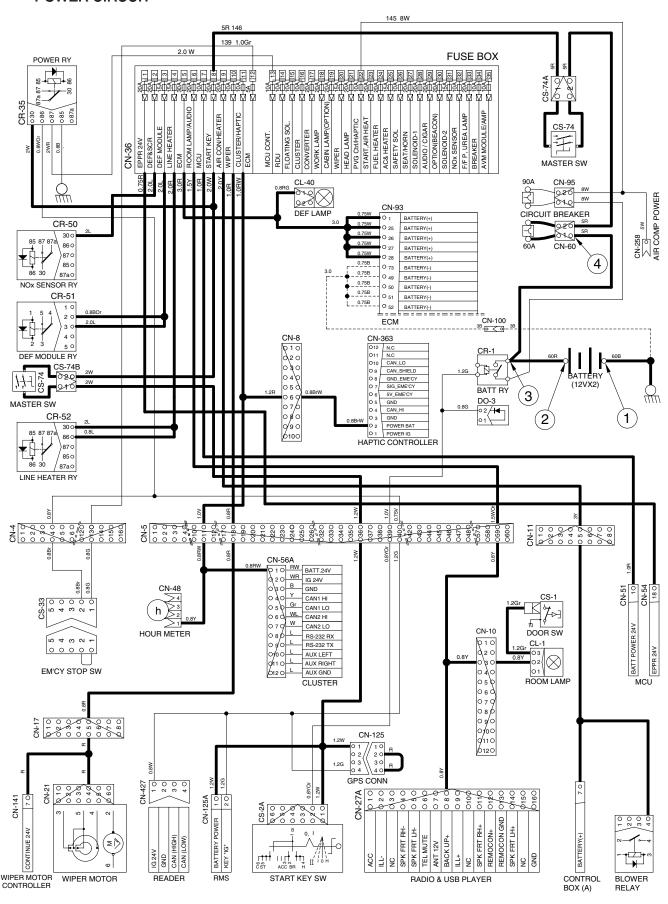


## 2) CHECK POINT

Engine	Start switch	Check point	Voltage
	OFF	① - GND (battery 1EA)	10~12.5V
CTOD		② - GND (battery 2EA)	20~25V
STOP		③ - GND (battery relay)	20~25V
		④ - GND (circuit breaker)	20~25V

**\* GND: Ground** 

## **POWER CIRCUIT**



140LC4EL05

## 2. STARTING CIRCUIT

## 1) OPERATING FLOW

```
Battery (+) terminal — Battery relay [CR-1] — Circuit breaker [CN-60] — Master switch [CS-74A] — Fuse box [No.8] — Master switch [CS-74B] — I/conn [CN-5(36)] — Start switch [CS-2A (1)]
```

## (1) When start key switch is in ON position

```
Start switch ON [CS-2A (2)] → I/conn [CN-5 (39)]

— Battery relay [CR-1] — Battery relay operating (all power is supplied with the electric component)

Start switch ON [CS-2A (3)] — GPS conn [CN-125 (2)→(4)]

— I/conn [CN-5 (40)] — Power relay [CR-35 (86) → (87)] — Fuse box [No.13]

— MCU [CN-51 (26)]

— I/conn [CN-4 (4)] — Emergency engine stop sw [CS-33 (2)→(1)]

— I/conn [CN-4 (13)] — Fuse box [No. 12]

— Engine ECM [CN-93 (5)]

— Reader [CN-427 (1)]

— RMS [CN-125A (2)]
```

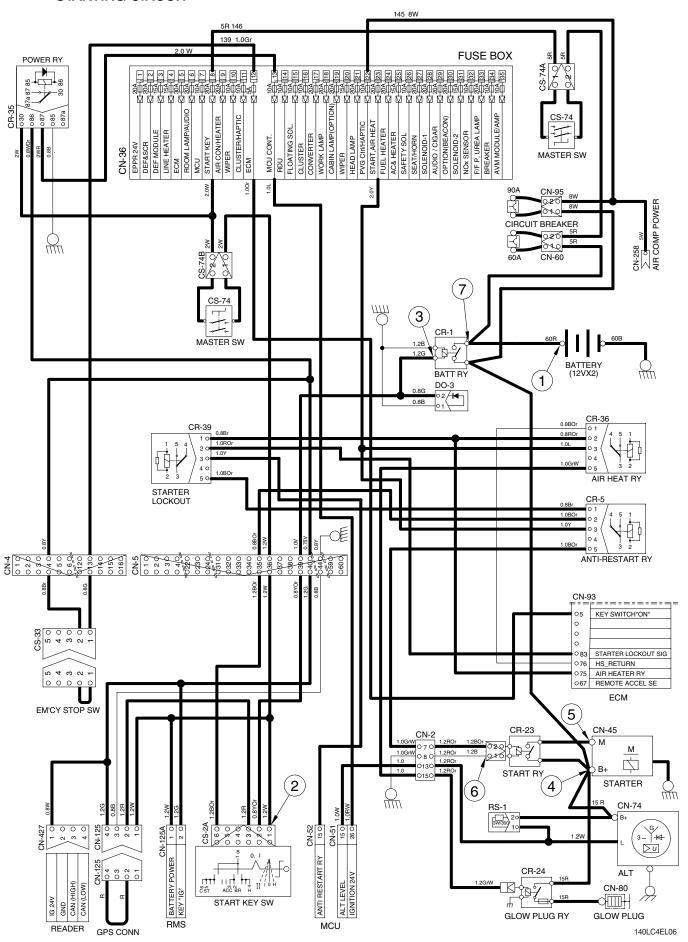
## (2) When start key switch is in START position

```
Start switch START [CS-2A (6)] → I/conn [CN-5 (35)] → Anti-restart relay [CR-5 (2) → (5)] → I/conn [CN-2 (7)] → Start relay [CR-23 (2)] → Starter motor operating
```

## 2) CHECK POINT

Engine	Start switch	Check point	Voltage
		① - GND (battery)	
		② - GND (start key)	
		③ - GND (battery relay M4)	
OPERATING	START	④ - GND (starter B+)	20~25V
		⑤ - GND (starter M)	
		⑥ - GND (start relay)	
		⑦ - GND (battery relay M8)	

## STARTING CIRCUIT



## 3. CHARGING CIRCUIT

When the starter is activated and the engine is started, the operator releases the key switch to the ON position.

Charging current generated by operating alternator flows into the battery through the battery relay [CR-1].

The current also flows from alternator to each electrical component and controller through the fuse box.

## 1) OPERATING FLOW

## (1) Warning flow

Alternator "L" terminal — I/conn [CN-2 (13)] — MCU alternator level [CN-51 (15)] — Cluster charging warning lamp (Via CAN interface)

## (2) Charging flow

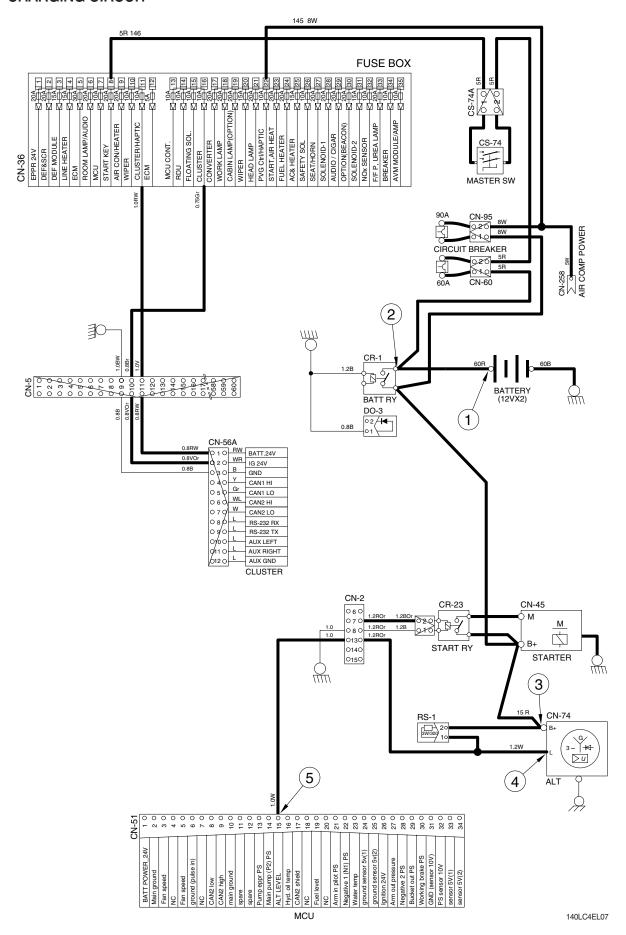
```
Alternator "B+" terminal — Starter motor [CN-45 (B+)]
— Battery relay (M8) — Battery (+) terminal
— Circuit breaker [CN-60] — Master switch [CS-74A]
— Fuse box [No.1~11]
— Circuit breaker [CN-95] — Fuse box [No.17~35]
```

## 2) CHECK POINT

Engine	Start switch	Check point	Voltage
		① - GND (battery voltage)	
		② - GND (battery relay)	
RUN	ON	③ - GND (alternator B <sup>+</sup> terminal)	20~25V
		④ - GND (alternator L terminal)	
		⑤ - GND (MCU)	

**\*** GND : Ground

## **CHARGING CIRCUIT**



## 4. HEAD AND WORK LIGHT CIRCUIT

## 1) OPERATING FLOW

```
Fuse box (No.21) — Head light relay [CR-13 (30, 86)] Fuse box (No.18) — Work light relay [CR-4 (30, 86)]
```

## (1) Head light switch ON

```
Head light switch ON [CN-376 (13)] — Head light relay [CR-13 (85) \rightarrow (87)] — Head light ON [CL-3 (2), CL-4 (2), CL-24 (2)] — I/conn [CN-7 (1)] — Cigar lighter [CL-2] — I/conn [CN-5 (60)] — Radio & USB player illumination ON [CN-27A (9)]
```

## (2) Work light switch ON

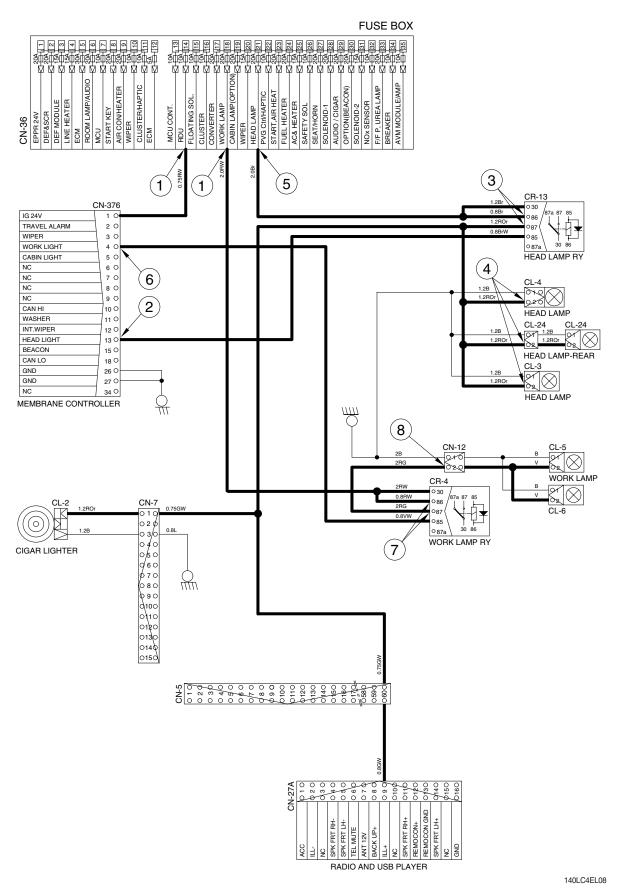
Work light switch ON [CN-376 (4)]  $\longrightarrow$  Work light relay [CR-4 (85)  $\rightarrow$  (87)]  $\longrightarrow$  l/conn [CN-12 (2)]  $\longrightarrow$  Work light ON [CL-5 (2), CL-6 (2)]

## 2) CHECK POINT

Engine	Start switch	Check point	Voltage
	ON	① - GND (fuse box)	
		② - GND (head light switch power output)	
		③ - GND (head light relay)	00.0514
CTOD		④ - GND (head light)	
STOP		⑤ - GND (fuse box)	20~25V
		⑥ - GND (work light switch power output)	
		⑦ - GND (work light relay)	
		8 - GND (work light)	

**\*** GND : Ground

## **HEAD AND WORK LIGHT CIRCUIT**



### 5. BEACON LAMP AND CAB LIGHT CIRCUIT

### 1) OPERATING FLOW

```
Fuse box (No.30) — Beacon lamp relay [CR-85 (2, 3)] Fuse box (No.19) — Cab light relay [CR-9 (30, 86)]
```

### (1) Beacon lamp switch ON

### (2) Cab light switch ON

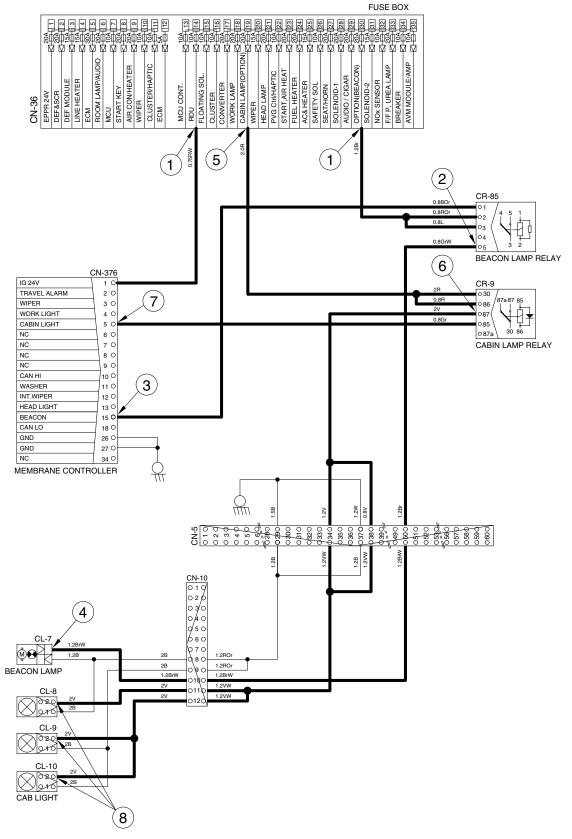
Cab light switch ON [CN-376 (5)] — Cab lamp relay [CR-9 (85) 
$$\rightarrow$$
 (87)] — I/conn [CN-5 (34, 38)] — I/conn [CN-10 (11)] — Cab light ON [CL-8 (2)] — I/conn [CN-10 (12)] — Cab light ON [CL-9 (2), CL-10 (2)]

### 2) CHECK POINT

Engine	Start switch	Check point	Voltage
		① - GND (fuse box)	
		② - GND (beacon lamp relay)	
	③ - GND (beacon lamp switch power output)		
STOP	ON	④ - GND (beacon lamp)	20. 2EV
510P		⑤ - GND (fuse box)	20~25V
		⑥ - GND (cabin light relay)	
		⑦ - GND (cab light switch power output)	
		8 - GND (cab light)	

\* GND: Ground

### BEACON LAMP AND CAB LIGHT CIRCUIT



140LC4EL09

#### 6. WIPER AND WASHER CIRCUIT

### 1) OPERATING FLOW

### (1) Key switch ON

Fuse box (No.14) — Membrane controller [CN-376 (1)]

Fuse box (No.10) — I/conn [CN-5 (18)] — I/conn [CN-17 (5)] — Wiper motor controller [CN-141 (7)] — Wiper motor [CN-21 (4)]

Fuse box (No.20) - I/conn [CN-5 (16)] - I/conn [CN-17 (4)] - Wiper motor controller [CN-141 (6)] - Low wiper motor [CN-407 (3)]

(2) Wiper switch ON (Intermittent)

Wiper switch ON [CN-376 (12)] → I/conn [CN-5 (20)] → I/conn [CN-17 (8)]

── Washer pump [CN-22 (2)]

→ Wiper motor controller [CN-141 (10)→(3)] → Wiper motor [CN-21 (6)] → Intermittently operating

(3) Wiper switch ON (continual)

Wiper switch ON [CN-376 (3)] → I/conn[CN-5 (15)] → I/conn[CN-17 (2)]

— Wiper motor controller [CN-141 (2) → (4)] — Wiper motor [CN-21 (2)] — Continual operating

(4) Washer switch ON

Washer switch ON [CN-376 (11)] → I/conn [CN-5 (17)] → I/conn [CN-17 (7)]

- → Wiper motor controller [CN-141 (9) → (8)] → I/conn [CN-17 (6)] → I/conn [CN-5 (19)]
- → Washer pump [CN-22 (1)] → Washer operating

Wiper switch ON [CN-376 (3)] → I/conn[CN-5 (15)] → I/conn[CN-17 (2)]

→ Wiper motor controller [CN-141 (2) → (4)] → Wiper motor [CN-21 (2)] → Continual operating

(5) Auto parking (when switch OFF)

Switch OFF [CN-376 (3, 12)] → Wiper motor parking position by wiper motor controller

### 2) OPERATING FLOW (LOW WIPER)

#### (1) Key switch ON

Fuse box (No. 30) → I/conn [CN-7 (8)] → Low wiper switch [CS-79 (1, 5)]

(2) Wiper switch ON (1st)

Wiper switch ON [CS-79 (1  $\rightarrow$  2)]  $\longrightarrow$  I/conn [CN-7 (5)]  $\longrightarrow$  Low wiper motor [CN-407 (4)]  $\longrightarrow$  Wiper operating

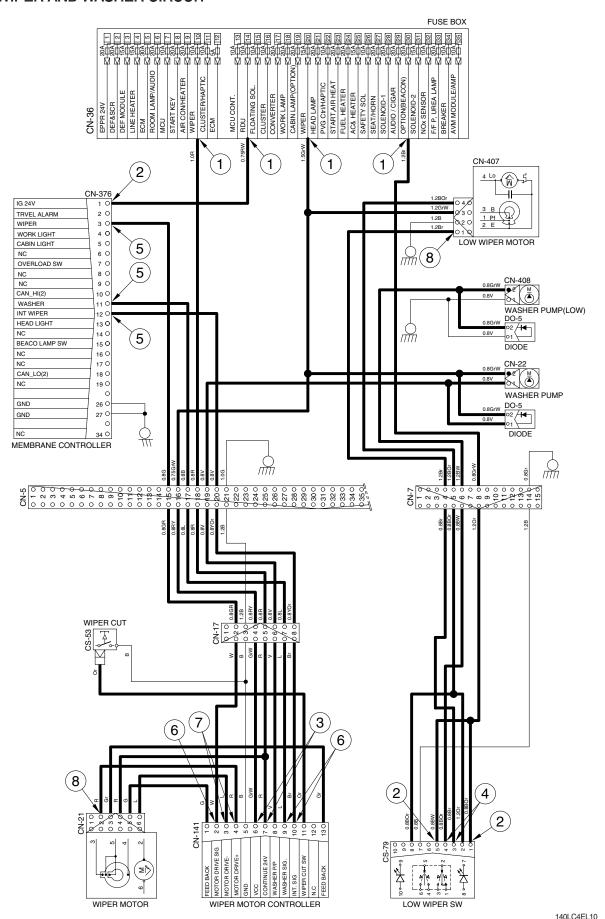
(3) Wiper switch ON (2nd)

Wiper switch ON [CS-79 (5  $\rightarrow$  4)]  $\longrightarrow$  I/conn [CN-7 (6)]  $\longrightarrow$  Low washer pump [CN-408 (2)]  $\longrightarrow$  Washer operating Wiper switch ON [CS-79 (1  $\rightarrow$  2)]  $\longrightarrow$  I/conn [CN-7 (5)]  $\longrightarrow$  Low wiper motor [CN-407 (4)]  $\longrightarrow$  Wiper operating

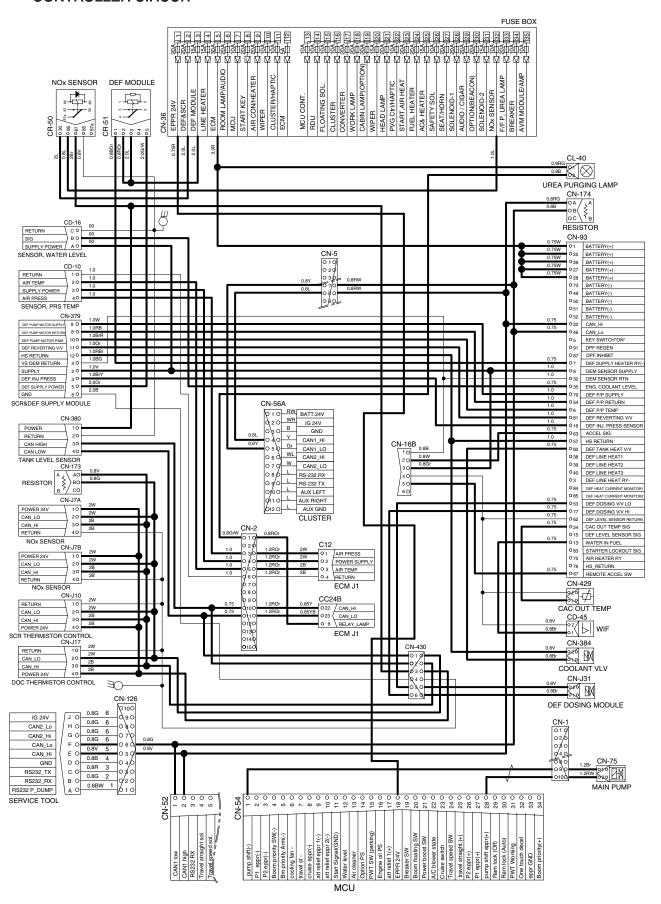
### 3) CHECK POINT

Engine	Start switch	Check point	Voltage	
		① - GND (fuse box)		
		② - GND (switch power input)	00 057	
	ON	③ - GND (wiper power input)	20~25V	
CTOD		④ - GND (switch power output)		
STOP		⑤ - GND (switch power output)	0 51	
		6 - GND (wiper power input)	0 ~ 5V	
		7 - GND (wiper power output)	24V	
		8 - GND (wiper motor)	0 or 24V	

### WIPER AND WASHER CIRCUIT

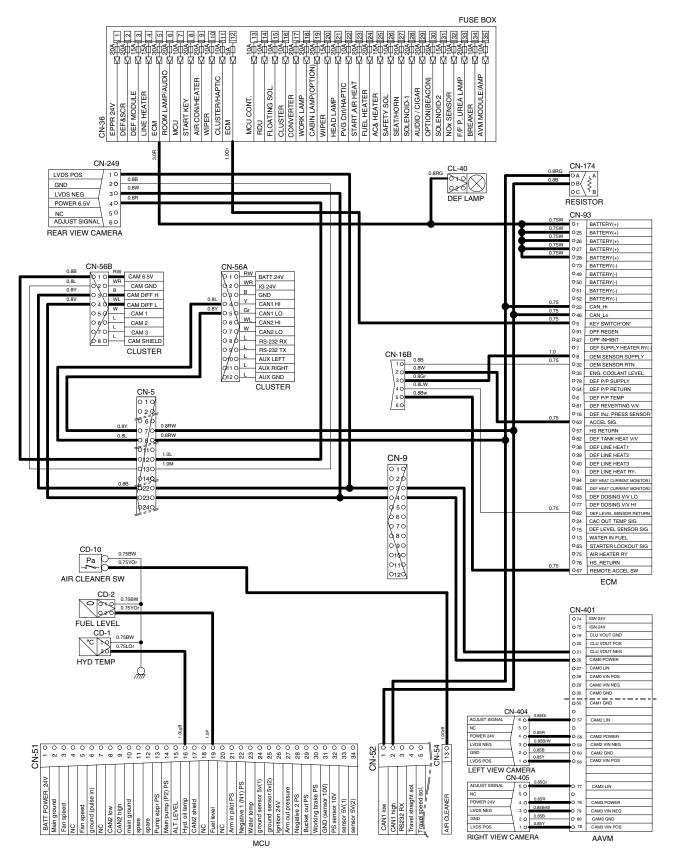


### **CONTROLLER CIRCUIT**

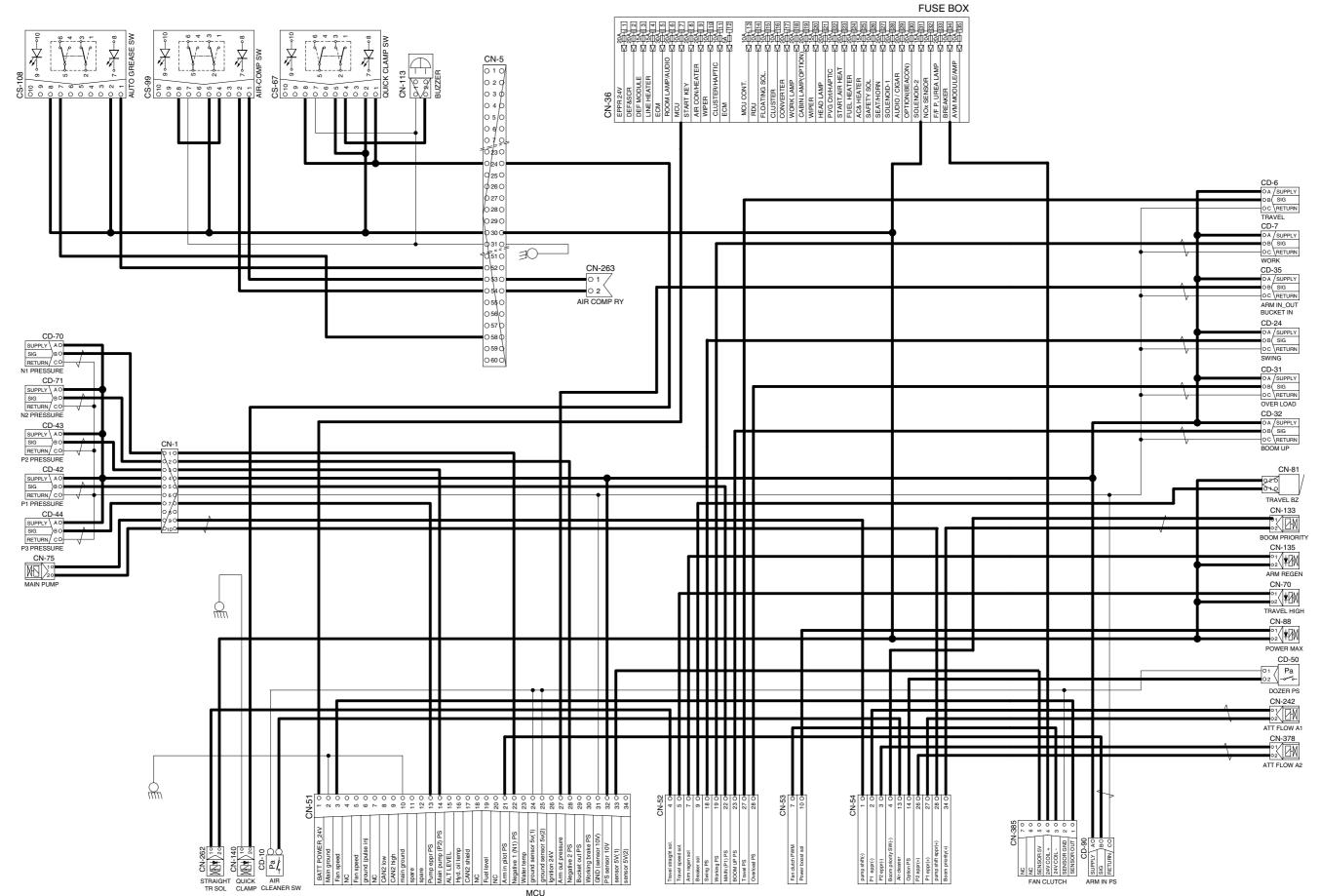


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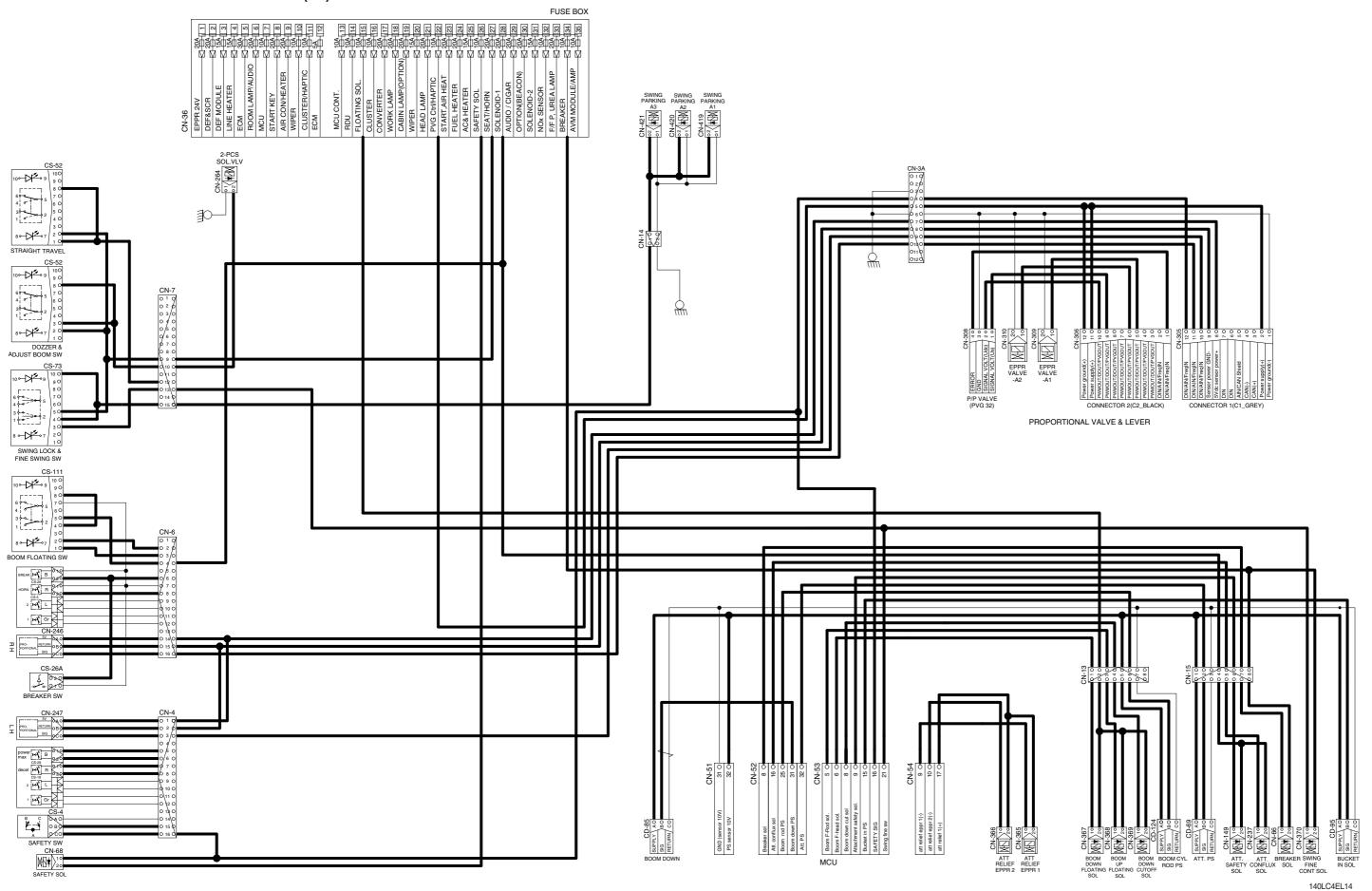
#### MONITORING CIRCUIT



### **ELECTRIC CIRCUIT FOR HYDRAULIC (1/2)**



## **ELECTRIC CIRCUIT FOR HYDRAULIC (2/2)**



# GROUP 3 ELECTRICAL COMPONENT SPECIFICATION

Part name	Symbol	Specifications	Check
Battery		12V × 100Ah (2EA)	<ul> <li>Check specific gravity</li> <li>1.280 over : Over charged</li> <li>1.280 ~ 1.250 : Normal</li> <li>1.250 below : Recharging</li> </ul>
Battery relay	CR-1	Rated load: 24V 100A (continuity) 1000A (30 seconds)	<ul> <li>Check coil resistance(M4 to M4)         Normal : About 50 Ω     </li> <li>Check contact         Normal : ∞ Ω     </li> </ul>
Glow plug relay	CR-24	24V 200A	** Check contact     Normal : 0.942 Ω     (For terminal -GND)
Start key	CS-2A	B-BR : 24V 1A B-ACC : 24V 10A B-ST : 24V 40A	% Check contact OFF: $\infty \Omega$ (for each terminal) ON: $0\Omega$ (for terminal 1-3 and 1-2) START: $0\Omega$ (for terminal 1-6)
Pressure sensor	CD-6 CD-7 CD-24 CD-31 CD-32 CD-35 CD-42 CD-71 CD-85 CD-90 CD-95 CD-124	8~30V	* Check contact Normal : 0.1 Ω
Resistor	○ A	<b>3W 120</b> Ω	* Check resistance A-B: 120 Ω

Part name	Symbol	Specifications	Check
Glow plug	CN-80	24V 200A	% Check resistance     0.25~0.12 Ω
Temperature sensor (hydraulic)	°C 10 20 CD-1	-	% Check resistance $50^{\circ}\text{C}$ : $804\Omega$ $80^{\circ}\text{C}$ : $310\Omega$ $100^{\circ}\text{C}$ : $180\Omega$
Floating switch	O 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	-	-
Air cleaner pressure switch	Pa	N.O TYPE	% Check contact High level : $\infty \Omega$ Low level : $0 \Omega$
Fuel level sender	CD-2	-	% Check resistance Full: $50\Omega$ 6/12: $350\Omega$ 11/12: $100\Omega$ 5/12: $400\Omega$ 10/12: $150\Omega$ 4/12: $450\Omega$ 9/12: $200\Omega$ 3/12: $500\Omega$ 8/12: $250\Omega$ 2/12: $550\Omega$ 7/12: $300\Omega$ 1/12: $600\Omega$ Empty warning: $700\Omega$
Relay (air con blower)	3 4 40 30 20 1 2 10	24V 16A	% Check resistance Normal : About 200 $\Omega$ (for terminal 1-3) $\infty \Omega$ (for terminal 2-4)

Part name	Symbol	Specifications	Check
Relay	CR-2 CR-5 CR-36 CR-39 CR-51 CR-85	24V 16A	% Check resistance Normal : About 160 $\Omega$ (for terminal 1-2) $0\Omega$ (for terminal 3-4) $\infty\Omega$ (for terminal 3-5)
Relay	CR-4 CR-7 CR-9 CR-13 CR-35 CR-46 CR-50 CR-52	24V 16A	% Check resistance Normal : About 160 $\Omega$ (for terminal 85-86) $0\Omega$ (for terminal 30-87a) $\infty\Omega$ (for terminal 30-87)
Solenoid valve	CN-66 CN-68 CN-70 CN-88 CN-135 CN-140 CN-149 CN-237 CN-262 CN-264 CN-367 CN-368 CN-369 CN-370 CN-419 CN-420 CN-421	24V 1A	** Check resistance     Normal: 15~25 Ω     (for terminal 1-2)
EPPR valve	CN-75 CN-133 CN-242 CN-309 CN-310 CN-365 CN-366 CN-378	700mA	** Check resistance     Normal : 15~25 Ω     (for terminal 1-2)
Speaker	CN-23 (LH) CN-24 (RH) CN-260	20W	% Check resistance     Normal : A few Ω
Switch (locking type)	CS-52 CS-67 CS-83 CS-99 CS-107 CS-108 CS-111	24V 1.5A	% Check contact Normal ON : 0 $\Omega$ (for terminal 2-3, 5-6) $\infty$ $\Omega$ (for terminal 1-2, 4-5) OFF: $\infty$ $\Omega$ (for terminal 2-3, 5-6) 0 $\Omega$ (for terminal 1-2, 4-5)

Part name	Symbol	Specifications	Check
Room lamp	3 O 2 O 1 O	24V 10W	% Check disconnection Normal : $1.0\Omega$ ON : $0\Omega$ (For terminal 1-2) $\Omega$ (For terminal 1-3) OFF : $\Omega$ (For terminal 1-2) $\Omega$ (For terminal 1-3)
Head lamp, Work lamp, Cab lamp	CL-3 CL-4 CL-5 CL-6 CL-8 CL-9 CL-10 CL-24	24V 65W (H3 Type)	※ Check disconnection Normal: 1.2 Ω
Beacon lamp	CL-7	21V 70W (H1 Type)	※ Check disconnection  Normal: A few  Ω
Fuel filler pump	0 4 8 9 3 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	24V 10A 35 ℓ /min	** Check resistance     Normal: 1.0 Ω
Hour meter	4 3 2 h	16~32V	Check operation     Supply power(24V) to terminal     No.2 and connect terminal No.1     and ground
Horn	CN-20 CN-25	DC22~28V 2A	** Check operation     Supply power(24V) to each     terminal and connect ground.

Part name	Symbol	Specifications	Check
Safety switch	B C O A O O B O C O C S-4	24V 15A (N.C TYPE)	% Check contact Normal : $1.0\Omega$ ON : $0\Omega$ (for terminal A-B) $\propto \Omega$ (for terminal A-C) OFF : $\propto \Omega$ (for terminal A-B) $0\Omega$ (for terminal A-C)
Wiper cut switch	CS-53	24V (N.O TYPE)	* Check contact     Normal : ∞Ω (one pin to ground)
Receiver dryer	O 2 Pa Pa CN-29	24V 2.5A	% Check contact Normal : $ ∞$ Ω
Radio & USB player	CN-27A   C	24V 2A	** Check voltage     20~25V     (for terminal 1-3, 3-8)
Washer pump	©2 <u>M</u> O1 CN-22	24V 3.8A	% Check contact Normal : $10.7 \Omega$ (for terminal 1-2)
Wiper motor	3 0 10 0 20 0 30 0 40 0 60 CN-21	24V 2A	$st$ Check disconnection Normal : $7\Omega$ (for terminal 2-6)

Part name	Symbol	Specifications	Check
DC/DC Converter	0 3 0 12V 12V 24V CN-138	12V 3A	<ul><li> Check voltage</li><li>24V (for terminal 1-2)</li><li>12V (for terminal 1-3)</li></ul>
Low wiper motor	B 3 0 3 0 0 2 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0	-	-
Cigar lighter	CL-2	24V 5A 1.4W	<ul> <li>Check coil resistance         Normal : About 1MΩ</li> <li>Check contact         Normal : ∞Ω         Operating time : 5~15sec</li> </ul>
Alternator	CN-74	28V 70A	% Check contact     Normal : 0 Ω (for terminal B <sup>+</sup> -L)     Normal : 24~27.5V
Starter	M M B+ CN-45	24V 4.8kW	** Check contact     Normal : 0.1 Ω
Travel alarm	CN-81	24V 0.5A	** Check contact     Normal: 5.2 Ω

Part name	Symbol	Specifications	Check
Air conditioner compressor	CN-28 =	24V 79W	$lpha$ Check contact Normal : 13.4 $\Omega$
Start relay	CR-23	24V 300A	% Check contact Normal : $0.94\Omega$ (for terminal 1-2)
Blower motor	2 M	24V 9.5A	% Check resistance     Normal : 2.5 Ω (for terminal 1-2)
Thermistor	020	1°C OFF 4°C ON	** Check resistance     Normal : 0 Ω (for terminal 1-2),     the atmosphere temp :     Over 4°C
Door switch	CS-1	24V 2W	** Check resistance     Normal : About 5M Ω
Switch (power max, one touch decel, horn, breaker)	CS-5 CS-19 CS-26 CS-29	24V 6A	$\Re$ Check resistance Normal : $\infty$ Ω

Part name	Symbol	Specifications	Check
Circuit breaker	CN-60 CN-95	CN-60 : 60A CN-95 : 90A	<ul> <li>※ Check disconnection         Normal : 0 Ω         (connect ring terminal and check resist between terminal 1 and 2)     </li> </ul>
Master switch	CS-74A CS-74B	6-36V	* Check disconnection     Normal: 0.1 Ω
Breaker switch	CS-26A	-	-
Quick clamp buzzer	CN-113	24V 200mA 107±4dB	-
Socket	O1 O2 CN-139	12V 10A	-
Switch	CS-24 001 001 003 004 008 008 009 009 009 009 009 009	24V 8A	% Check contact Normal OFF : $0\Omega$ (for terminal 2-3, 5-6) $\infty\Omega$ (for terminal 1-2, 4-5) ON : $1\text{st}:0\Omega$ (for terminal 1-2) $2\text{nd}:0\Omega$ (for terminal 4-5)

Part name	Symbol	Specifications	Check
Switch	CS-100	24V 8A	% Check contact Normal OFF : $\infty \Omega$ (for terminal 2-1, 2-3, 5-4, 5-6)
Switch	CS-73	24V 8A	% Check contact Normal OFF: $\infty \Omega$ (for terminal 2-1, 2-3, 5-4, 5-6)
DEF/AdBlue® line heater	0 1 0 2	-	-
WIF sensor	0 2	-	※ Check disconnection  Normal: 68.8~4.94   Ω
DEF/AdBlue® fill up warning lamp (LED)	CL-40	-	-
Proportional valve sensor	Proportional SIG CO  CN-246 CN-247	-	-

Part name	Symbol	Specifications	Check
DEF/AdBlue® full lamp	020 010 CL-41	-	-
Temperature sensor (A/C incar, A/C ambient)	020	-	-
Coolant diverter valve	CN-J31	-	-
Proportional valve sensor	○ 1	-	-
Dozer act pressure switch	Pa 2 0 1 0 CD-50	N.O type	% Check resistance Normal : $∞$ $Ω$ (open)
Water level sensor	O C RETURN O B SIG O A SUPPLY POWER CD-16	-	-

Part name	Symbol	Specifications	Check
Camera	01 LVDS POS 02 GND 03 LVDS NEG 04 POWER 24V 05 NC 06 ADJUST SIGNAL  CN-402 CN-403 CN-404 CN-405	-	-
NOx sensor (tail out, turbo out)	O1 POWER 24V O2 CAN_LO O3 CAN_HI RETURN  CN-J7A CN-N7B	-	-
Thermistor control sensor (SCR, DOC)	O1	-	-
Fuel heater	01 02 03 04 CN-96	-	-

# **GROUP 4 CONNECTORS**

## 1. CONNECTOR DESTINATION

Connector	Time	No. of	Destination	Connecto	or part No.
number	Type	pin	Destination	Female	Male
CN-1	AMP	10	I/conn (Frame harness-Pump PS harness)	S816-010002	S816-110002
CN-2	AMP	15	I/conn (Frame harness-Engine harness)	285262-1	368301-1
CN-3	AMP	12	PVG harness	174661-2	368537-1
CN-3A	TYCO	12	I/conn (Frame harness-PVG harness)	174661-2	368537-1
CN-4	AMP	16	I/conn (Console harness LH-Frame harness)	368047-1	368050-1
CN-5	DEUTSCH	60	I/conn (Side harness RH-Frame harness)	DRB16-60SAE-L018	DRB14-60PAE-L018
CN-6	AMP	16	I/conn (Console harness RH-Frame harness)	368047-1	368050-1
CN-7	AMP	15	I/conn (Console harness RH-Frame harness)	2-85262-1	368301-1
CN-8	AMP	10	I/conn (Console harness RH-Frame harness)	S816-010002	174655-2
CN-9	DEUTSCH	12	I/conn (Frame harness-AAVM harness)	DT06-12SA-EP06	DT04-12PA-P021
CN-10	DEUTSCH	12	I/conn (Cab harness-Side harness RH)	DT06-12S-EP06	DT04-12PA-P021
CN-11	DEUTSCH	8	I/conn (Frame harness-Aircon harness)	DT06-8S-EP06	-
CN-12	DEUTSCH	2	I/conn (Frame harness-Boom wire harness)	DT06-2S-EP06	DT04-2P-E005
CN-13	AMP	8	I/conn (Frame harness-Boom floating harness)	174982-2	174984-2
CN-14	DEUTSCH	2	I/conn (Frame harness-Swing parking harness)	DT06-2S-EP06	DT04-2P-EP06
CN-15	AMP	8	I/conn (Frame harness-Breaker sol harness)	S816-008002	S816-108002
CN-16	AMP	6	Emergency engine start & speed control	S816-006002	S816-106002
CN-16B	AMP	6	Emergency engine start & speed control	S816-006002	21NB-10710
CN-17	AMP	8	I/conn (Side harness RH-Wiper harness)	S816-008002	S816-108002
CN-20	MOLEX	2	Horn	36825-0211	-
CN-21	AMP	6	Wiper motor	S810-006202	-
CN-22	KET	2	Washer tank	MG640605	-
CN-23	KET	2	Speaker-LH	MG610070	-
CN-24	KET	2	Speaker-RH	MG610070	-
CN-25	MOLEX	2	Horn	36825-0211	-
CN-27A	KUM	16	Radio & USB player	PK145-16017	-
CN-27B	AMP	8	Radio & USB player	-	174984-2
CN-28	KUM	1	Aircon compressor	NMWP01F-B	-
CN-29	KET	2	Receiver dryer	MG640795	-
CN-36	-	-	Fuse & relay box	21Q7-10910	-
CN-45	RING-TERM	-	Starter motor B+	S820-108000	-
CN-48	KET	1	Hour meter	2-520193-2	-
CN-51	TE	34	MCU	2-1437285-3	-
CN-52	TE	34	MCU	4-1437290-1	-
CN-53	TE	26	MCU	1473416-1	-
CN-54	TE	34	MCU	4-1437290-0	-

Connector	Time	No. of	Destination	Connecto	or part No.
number	Type	pin	Destination	Female	Male
CN-56A	AMP	12	Cluster	-	174663-2
CN-56B	AMP	8	Cluster	-	174984-2
CN-60	-	2	Circuit breaker	-	S813-130201
CN-61	DEUTSCH	4	Fuel filler pump	DT06-4S	DT04-4P
CN-66	DEUTSCH	2	Breaker solenoid	DT06-2S-EP06	-
CN-68	DEUTSCH	2	Safety solenoid	DT06-2S-EP06	-
CN-70	DEUTSCH	2	Travel high solenoid	DT06-2S-EP06	-
CN-74	RING-TERM	1	Alternator "L" terminal	-	S820-105000
CIN-74	TIIING-TETIIVI	1	Alternator "B" terminal	-	S820-108000
CN-75	AMP	2	Pump EPPR valve	S816-002002	-
CN-80	RING-TERM	-	Glow plug	S820-306000	-
CN-81	DEUTSCH	2	Travel buzzer solenoid	DT06-2S-EP06	DT04-2P-E005
CN-88	DEUTSCH	2	Power max solenoid	DT06-2S-EP06	-
CN-93	DELPHI	-	ECM	13964577	-
CN-95	-	2	Circuit breaker	-	S813-130201
CN-96	-	4	Fuel heater	2-967325-3	-
CN-100	KET	1	ECM ground	MG640944-5	-
CN-113	KET	2	Buzzer	MG651205-5	-
CN-125	Econoseal J	4	GPS connector	S816-004002	S816-104002
CN-125A	DEUTSCH	12	GPS	DT06-12S-P021	DT04-12PA- P021
CN-126	AMP	10	I/conn (Frame harness-Service tool)	2-1418390-1	S816-110002
CN-133	DEUTSCH	2	Boom priority solenoid	DT06-2S-EP06	-
CN-135	DEUTSCH	2	Arm regeneration solenoid	DT06-2S-EP06	-
CN-138	FASTEN	3	DC/DC Converter	S810-003202	-
CN-139	FASTEN	2	12V socket	172434-2	-
CN-140	DEUTSCH	2	Quick clamp solenoid	DT06-2S-EP06	DT04-2P-E005
CN-141	AMP	13	Wiper motor controller	172498-1	-
CN-145	DEUTSCH	2	Fuel filler pump	DT06-2S-EP06	-
CN-149	DEUTSCH	2	Attach safety solenoid	DT06-2S-EP06	-
CN-156	DEUTSCH	2	Air seat heat	DT06-2S	DT04-2P
CN-157	AMP	1	Antena power	S822-014002	-
CN-173	DEUTSCH	3	Resistor	DT06-3S-EP06	DT04-3P-EP06
CN-237	DEUTSCH	2	Attach conflux solenoid	DT06-2S-EP06	-
CN-242	DEUTSCH	2	Attach EPPR A1	DT06-2S-EP06	-
CN-246	DEUTSCH	3	Proportional valve-RH	DT06-3S	DT04-3P
CN-247	DEUTSCH	3	Proportional valve-LH	DT06-3S	DT04-3P
CN-249	DEUTSCH	6	Rear view camera	DT06-6S-EP06	DT04-6P-E005
CN-258	KET	1	Air compressor power	MG640944-5	21Q4-13100
CN-260	AMP	2	Siren AMP	174352-2	S816-102002

Connector	T	No. of	Destination	Connecto	or part No.
number	Type	pin	Destination	Female	Male
CN-261	KET	6	Siren AMP	MG610049	-
CN-262	DEUTSCH	2	Straight travel solenoid	DT06-2S-EP06	DT04-2P-E005
CN-263	DEUTSCH	2	Air compressure relay	DT06-2S-EP06	-
CN-264	DEUTSCH	2	2 Piece solenoid	DT06-2S-EP06	DT04-2P-E005
CN-305	DEUTSCH	12	To PVG controller	DTM06-12SA	-
CN-306	DEUTSCH	12	To PVG controller	DTM06-12SB	-
CN-307	DEUTSCH	3	Proportional-Service tool	DT06-3S-EP06	DT04-3P-E005
CN-308	AMP	4	Proportional-PVG32	2-967059-1	-
CN-309	DEUTSCH	2	Proportional-EPPR valve A1	DT06-2S-EP06	-
CN-310	DEUTSCH	2	Proportional-EPPR valve A2	DT06-2S-EP06	-
CN-363	AMP	12	Haptic controller	174045-2	-
CN-365	DEUTSCH	2	Attach EPPR valve 1	DT06-2S-EP06	-
CN-366	DEUTSCH	2	Attach EPPR valve 2	DT06-2S-EP06	DT04-2P-E005
CN-367	DEUTSCH	2	Boom down floating solenoid	DT06-2S-E005	-
CN-368	DEUTSCH	2	Boom up floating solenoid	DT06-2S-E005	-
CN-369	DEUTSCH	2	Boom down cut off solenoid	DT06-2S-E005	-
CN-370	DEUTSCH	2	Swing fine control solenoid	DT06-2S-EP06	DT04-2P-E005
CN-376	AMP	34	Membrane controller	4-1437290-1	-
CN-378	DEUTSCH	2	Attach EPPR A2	DT06-2S-EP06	-
CN-379	-	12	DEF supply module	2-1703639-1	-
CN-380	-	4	DEF tank level sensor	-	1-967325-1
CN-381	DEUTSCH	2	DEF/AdBlue® line heater 1	1 928 403 894	-
CN-382	DEUTSCH	2	DEF/AdBlue® line heater 2	1 928 403 894	-
CN-383	DEUTSCH	2	DEF/AdBlue® line heater 3	1 928 403 894	-
CN-384	DEUTSCH	2	Coolant diverter valve	DT06-2S-EP06	-
CN-385	-	7	Fan clutch	965570	-
CN-401	FCI	-	AAVM controller	A2C00021583	-
CN-401	AMP	34	AAVM controller	4-1437290-0	-
CN-402	DEUTSCH	6	Front view camera	DT06-6S-P021	DT04-6P-P021
CN-403	DEUTSCH	6	Rear view camera	DT06-6S-EP06	DT04-6P-EP14
CN-404	DEUTSCH	6	LH view camera	DT06-6S-EP06	DT04-6P-EP14
CN-405	DEUTSCH	6	RH view camera	DT06-6S-EP06	DT04-6P-EP14
CN-406	DEUTSCH	3	Service tool	DT06-3S-EP06	DT04-3P-E005
CN-407	FCI	4	Low wiper motor	180900-0	-
CN-419	DEUTSCH	2	Swing parking solenoid-A1	DT06-2S-EP06	-
CN-420	DEUTSCH	2	Swing parking solenoid-A2	DT06-2S-EP06	-
CN-421	DEUTSCH	2	Swing parking solenoid-A3	DT06-2S-EP06	-
CN-427	MOLEX	4	Reader-RMS	039012040	026013096
OIN-42/	IVIULEA	12	I IGAUGI-I IIVIO	5557-12R	5559-12P

Connector	<b>T</b>	No. of	Destruction	Connecto	or part No.
number	Type	pin	Destination	Female	Male
CN-429	DELPHI	2	CAC out sensor	12162197	-
CN-430	DEUTSCH	6	Vconn (Frame harness-Afterfrement harness)	DT06-6S-EP06	DT04-6P-E005
CN-J7A	TYCO	4	DOC NOx sensor	2-1418390-1	-
CN-J7B	TYCO	4	SCR NOx sensor	1-1418390-1	-
CN-J10	TYCO	4	SCR temperature sensor	3-1418390-1	-
CN-J17	TYCO	4	DOC temperature sensor	4-1418390-1	1 928 403 874
CN-J31	BOSCH	2	DEF/AdBlue® dosing module	1-928-403-874	-
C12	FCI	4	ECM J1	54200415	-
CC24B	-	24	ECM J1	F934000	-
· Relay					
CR-1	RING-TERM	-	Battery relay	ST710289-2	-
CR-2	-	5	Horn relay	-	-
CR-4	-	5	Working lamp relay	-	-
CR-5	-	5	Anti restart relay	-	-
CR-7	-	5	Aircon compressor relay	-	-
CR-9	-	5	Cabin lamp relay	-	-
CR-13	-	5	Head lamp relay	-	-
CR-23	KET	2	Start relay	-	S814-102001
CR-24	RING TERM	1	Preheat relay	S822-014000	-
CR-35	-	5	Power relay	-	-
CR-36	-	5	Preheat relay	-	-
CR-39	-	5	Start lockout relay	-	-
CR-46	-	5	Fuel heater relay	-	-
CR-50	-	5	NOx sensor relay	-	-
CR-51	-	5	DEF module relay	-	-
CR-52	-	5	Line heater relay	-	-
CR-85	-	5	Beacon lamp relay	-	-
· Switch					
CS-1	SHUR	1	Door switch	S822-014002	-
CS-2A	WP	6	Start key switch	S814-006100	-
CS-2B	DEUTSCH	3	Reader	DT06-3S-EP06	DT04-3P-E005
CS-4	DEUTSCH	3	Safety switch	DT06-3S	-
CS-5	DEUTSCH	2	Horn switch	-	DT04-2P
CS-19	DEUTSCH	2	One touch decel switch	-	DT04-2P
CS-26	DEUTSCH	2	Breaker switch	DT06-2S	-
CS-26A	AMP	2	Breaker pedal switch	S816-002002	S816-102002
CS-29	DEUTSCH	2	Power max switch	DT06-2S	-
CS-33	AMP	6	Emergency engine stop switch	S816-006002	S816-106002
CS-52	CARLING	10	Adjust & dozer switch	VC2-01	-

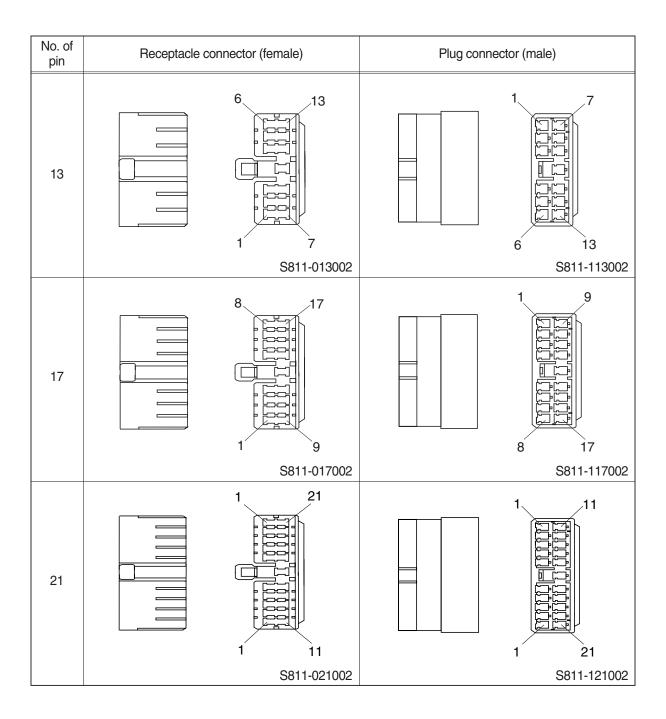
Connector	<b>T</b>	No. of	Destantes	Connecto	or part No.
number	Type	pin	Destination	Female	Male
CS-53	AMP	1	Wiper cut switch	S822-014002	-
CS-61	AMP	2	Floating switch	174352-2	-
CS-67	CARLING	10	Quick clamp switch	VC2-01	-
CS-73	CARLING	10	Swing lock & fine switch	VC2-01	-
CS-74A	AMP	2	Master switch	S813-030201	S813-130201
CS-74B	DEUTSCH	2	Master switch	DT06-2S-EP06	DT04-2P-E005
CS-79	CARLING	10	Lower wiper switch	VC2-01	-
CS-83	CARLING	10	Spare switch	VC2-01	-
CS-99	CARLING	10	Air compressor switch	VC2-01	-
CS-100	CARLING	10	SCR system cleaning switch	VC2-01	-
CS-107	CARLING	10	Travel straight switch	VC2-01	-
CS-108	CARLING	10	Auto grease switch	VC2-01	-
CS-111	CARLING	10	Boom floating switch	VC2-01	-
CS-250	DEUTSCH	2	Seat switch	DT06-2S	-
· Light					
CL-1	KET	3	Room lamp	MG651032	-
CL-2	AMP	1	Cigar lighter	S822-014002 S810-001202	S822-114002
CL-3	DEUTSCH	2	Head lamp-LH	DT06-2S-EP06	-
CL-4	DEUTSCH	2	Head lamp-RH	DT06-2S-EP06	-
CL-5	DEUTSCH	2	Work lamp-LH	DT06-2S-EP06	-
CL-6	DEUTSCH	2	Work lamp-RH	DT06-2S-EP06	-
CL-7	SHUR	1	Beacon lamp	S822-014002	S822-114002
CL-8	DEUTSCH	2	Cab light-LH	DT06-2S-EP06	DT04-2P
CL-9	DEUTSCH	2	Cab light-RH	DT06-2S-EP06	DT04-2P
CL-10	DEUTSCH	2	Cab light	DT06-2S-EP06	DT04-2P
CL-24	DEUTSCH	2	Head lamp	DT06-2S-EP06	DT04-2P-E005
CL-40	DEUTSCH	2	DEF/AdBlue® purging lamp	DT06-2S-EP06	-
CL-41	AMP	1	DEF/AdBlue® full warning lamp	S822-01400	S822-11400
· Sensor, se	endor				
CD-1	AMP	2	Hydraulic oil temp sender	85202-1	-
CD-2	DEUTSCH	2	Fuel sender	DT06-2S-EP06	-
CD-6	DEUTSCH	3	Travel pressure switch	DT06-3S-EP06	-
CD-7	DEUTSCH	3	Working pressure switch	DT06-3S-EP06	-
CD-10	AMP	2	Air cleaner switch	85202-1	-
CD-16	DELPHI	3	Water level sensor	12110293	-
CD-24	DEUTSCH	3	Swing pressure sensor	DT06-3S-EP06	-
CD-31	DEUTSCH	3	Overload pressure sensor	DT06-3S-EP06	DT04-3S-E003
CD-32	DEUTSCH	3	Boom up pressure sensor	DT06-3S-EP06	-

Connector	Time	No. of	Destination	Connecto	r part No.
number	Type	pin	Destination	Female	Male
CD-35	DEUTSCH	3	Arm out pressure sensor	DT06-3S-EP06	-
CD-42	DEUTSCH	3	Pump pressure sensor 1	DT06-3S-EP06	-
CD-43	DEUTSCH	3	Pump pressure sensor 2	DT06-3S-EP06	
CD-44	DEUTSCH	3	Pump pressure sensor 3	DT06-3S-EP06	-
CD-45	DEUTSCH	2	WIF sensor	DT06-2S-EP06	-
CD-50	KET	2	Dozer pressure sensor	MG640795	-
CD-69	DEUTSCH	3	Attach pressure sensor	DT06-3S-EP06	-
CD-70	DEUTSCH	3	N1 pressure sensor	DT06-3S-EP06	-
CD-71	DEUTSCH	3	N2 pressure sensor	DT06-3S-EP06	-
CD-85	DEUTSCH	3	Boom down sensor	DT06-3S-EP06	-
CD-90	DEUTSCH	3	Arm in pressure sensor	DT06-3S-EP06	-
CD-95	DEUTSCH	3	Bucket in pressure sensor	DT06-3S-EP06	-
CD-124	DEUTSCH	3	Boom cylinder rod pressure	DT06-3S-E005	-

## 2. CONNECTION TABLE FOR CONNECTORS

# 1) PA TYPE CONNECTOR

No. of pin	Receptacle connector (female)	Plug connector (male)	
5	2 5 1 3	1 3 2 5	
7	\$811-005002 3 7 1 4 \$811-007002	\$811-105002 1 4 3 7 \$811-107002	
9	4 9 1 5 S811-009002	1 5 4 9 3S811-109002	
11	5 11 1 6 S811-011002	1 6 5 11 S811-111002	

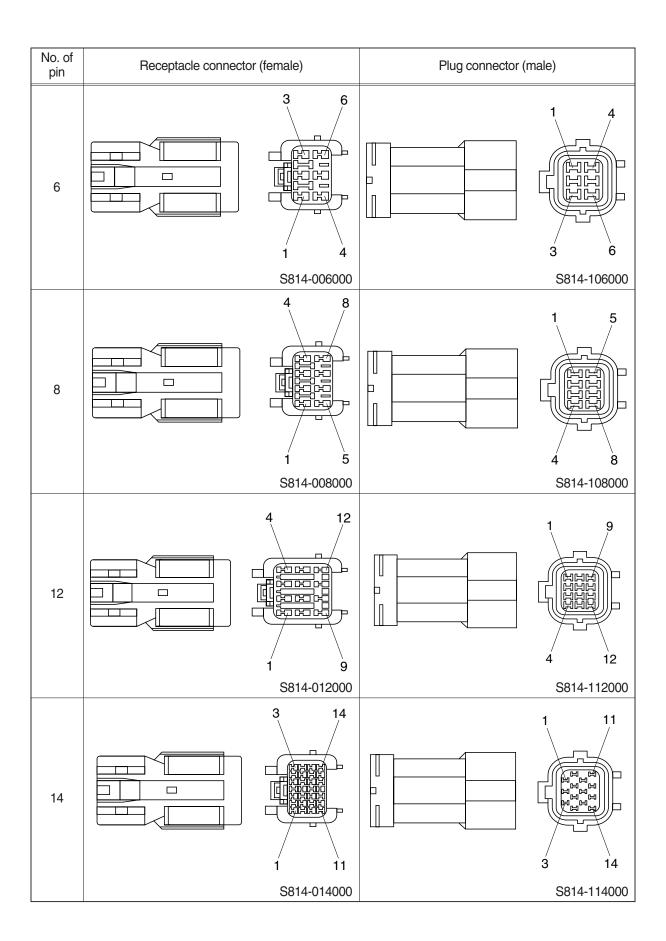


## 2) J TYPE CONNECTOR

No. of pin	Receptacle conne	ector (female)	Plug connector	r (male)
2		2 S816-002001		2 1 S816-102001
3		3 1 S816-003001		3 1 2 S816-103001
4		3 1 4 2 S816-004001		3 1 S816-104001
8		6 3 1 8 5 2 S816-008001		8 5 2 1000 6 3 1 S816-108001

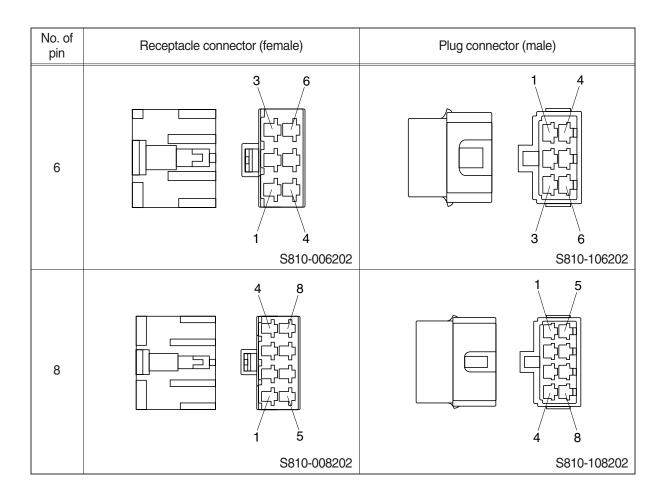
## 3) SWP TYPE CONNECTOR

No. of pin	Receptacle connector (	female)	Plug connector (m	nale)
1		S814-001000		S814-101000
2		2 1 S814-002000		2 S814-102000
3		3 2 1 S814-003000		2 3 S814-103000
4		2 4 1 3 5814-004000		1 3 2 4 S814-104000

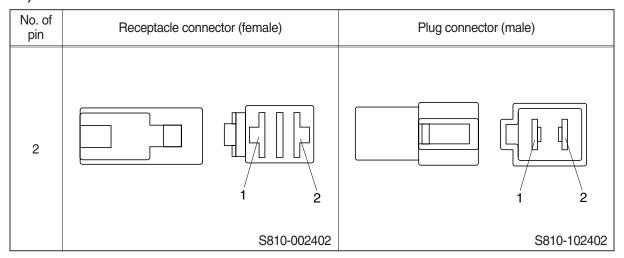


## 4) CN TYPE CONNECTOR

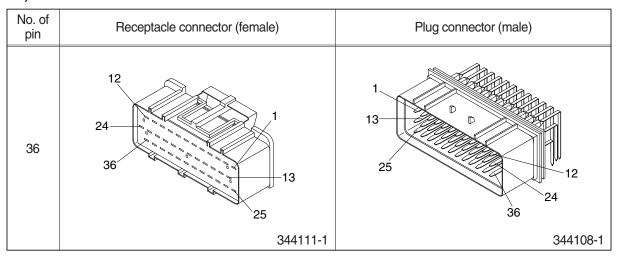
No. of pin	Receptacle connecto	or (female)	Plug connector (	male)
1		1		1
		S810-001202		S810-101202
2		1		1
		S810-002202		S810-102202
3		1 2		1 3
		S810-003202		S810-103202
4		2 4		1 3
		S810-004202		S810-104202



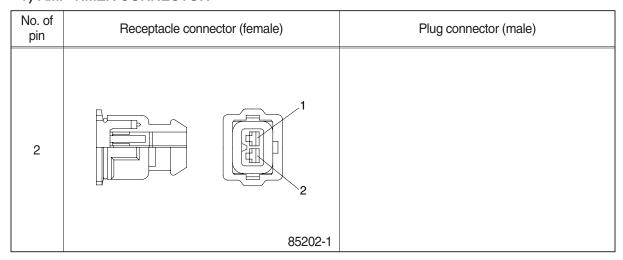
### 5) 375 FASTEN TYPE CONNECTOR



## 6) AMP ECONOSEAL CONNECTOR



## 7) AMP TIMER CONNECTOR



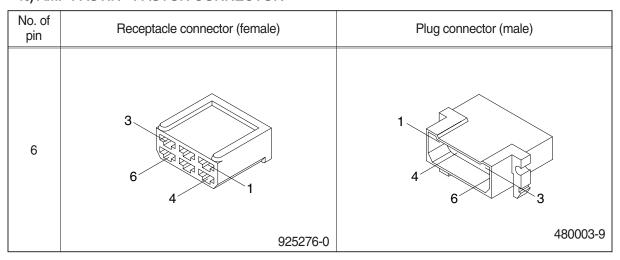
## 8) AMP 040 MULTILOCK CONNECTOR

No. of pin	Receptacle connector (female)	Plug connector (male)
12	7 12	
	174045-2	

## 9) AMP 070 MULTILOCK CONNECTOR

No. of pin	Receptacle connector (female)	Plug connector (male)
14	1 7 14 173852	
	1/3852	

## 10) AMP FASTIN - FASTON CONNECTOR



## 11) KET 090 CONNECTOR

No. of pin	Receptacle connector (female)	Plug connector (male)
2	1 2	
	MG610070	

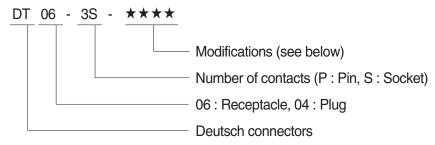
## 12) KET 090 WP CONNECTORS

No. of pin	Receptacle connector (female)	Plug connector (male)
2	1 2 MG640605	
2	1 2 MG640795	

## 13) KET SDL CONNECTOR

No. of pin	Receptacle connector (female)	Plug connector (male)
14	7	
	MG610406	

### 14) DEUTSCH DT CONNECTORS



### Modification

E003: Standard end cap - gray

E004 : Color of connector to be black E005 : Combination - E004 & E003

EP04: End cap

EP06: Combination P012 & EP04

P012: Front seal enhancement - connectors color to black for 2, 3, 4 & 6pin

No. of pin	Receptacle connector (female)	Plug connector (male)
2		1 2
	DT06-2S	DT04-2P
3	1 2 3	2 1 1 3
	DT06-3S	DT04-3P
4	2 3	3 2
	DT06-4S	DT04-4P

No. of pin	Receptacle connector (female)	Plug connector (male)
6		6 1 4 3
	DT06-6S	DT04-6P
8	5 4 8 1	1 8 PT04 0B
	DT06-8S	DT04-8P
12	7 6	1 12
	DT06-12S	DT04-12P

## 15) MOLEX 2CKTS CONNECTOR

No. of pin	Receptacle connector (female)	Plug connector (male)
2	1 2	
	35215-0200	

## 16) ITT SWF CONNECTOR

No. of pin	Receptacle connector (female)	Plug connector (male)
10	1 9	
	SWF593757	

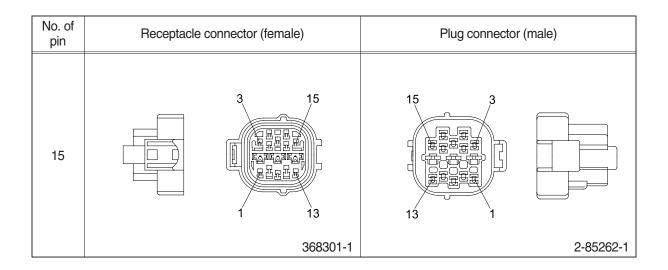
## 17) MWP NMWP CONNECTOR

No. of pin	Receptacle connector (female)	Plug connector (male)
1	1	
	NMWP01F-B	

## 18) ECONOSEAL J TYPE CONNECTORS

No. of pin	Receptacle connector (female)	Plug connector (male)
1	S816-001002	S816-101002
2	1 2 S816-002002	2 1 S816-102002
3	1 2 3 S816-003002	3 2 1 S816-103002
4	3 4 S816-004002	2 1 4 3 S816-104002

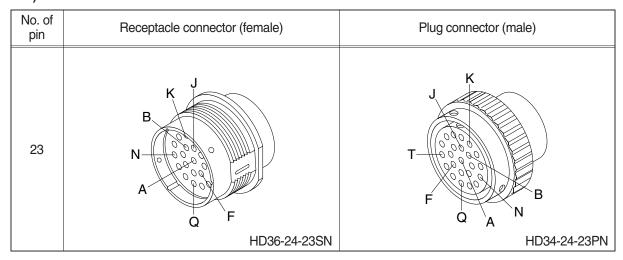
No. of pin	Receptacle connector (female)	Plug connector (male)
6	3 4 6 S816-006002	3 1 6 4 S816-106002
8	5010 000002 1 4 5 8 8 8816-008002	4 1 8 5 S816-108002
10	5 6 10 S816-010002	5 10 6 S816-110002
12	7 12 S816-012002	6 1 12 7 S816-112002



### 19) METRI-PACK TYPE CONNECTOR

No. of pin	Receptacle connector (female)	Plug connector (male)
2	2 ————————————————————————————————————	
	12040753	

### 20) DEUTSCH HD30 CONNECTOR



## 21) DEUTSCH SERVICE TOOL CONNECTOR

pin		Plug connector (Male)
9	C E A B HD10-9-96P	

## 22) AMP FUEL WARMER CONNECTOR

No. of pin	Receptacle connector (Female)	Plug connector (Male)
4	3 2 4	
	2-967325-3	

## 23) DEUTSCH ENGINE ECM CONNECTOR

No. of pin	Receptacle connector (Female)	Plug connector (Male)
50	11 5 6 10 21 20 20 41 45 46 50 40 DRC26-50S-04	

## 24) DEUTSCH INTERMEDIATE CONNECTOR

No. of pin	Receptacle connector (Female)	Plug connector (Male)
60	1 13 25 31 37 30 36 49 48 60 DRB16-60SAE-L018	

### 25) TE MCU CONNECTOR

25) TE MCU CONNECTOR			
No. of pin	Receptacle connector (Female)	Plug connector (Male)	
26	1 8 14 20 20 20 20 20 20 20 20 1473416-1		
34	1 10 18 26 26 34 4-1437290-0		
34	1 10 18 26 26 34 4-1437290-1		

# SECTION 5 MECHATRONICS SYSTEM

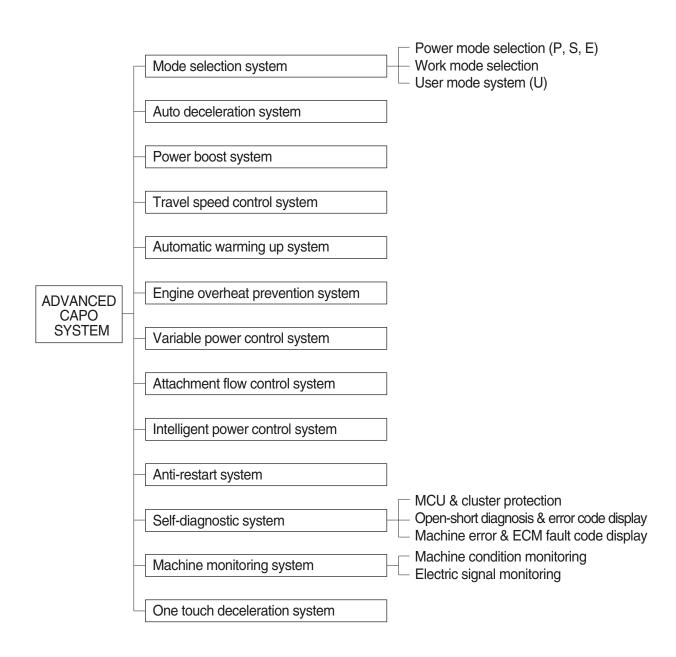
Group	1	Outline	5-1
Group	2	Mode Selection System ·····	5-3
Group	3	Automatic Deceleration System ·····	5-6
Group	4	Power Boost System	5-7
Group	5	Travel Speed Control System	5-8
Group	6	Automatic Warming Up System ·····	5-9
Group	7	Engine Overheat Prevention System ·····	5-10
Group	8	Variable Power Control System	5-11
Group	9	Attachment Flow Control System	5-12
Group	10	Intelligent Power Control System	5-13
Group	11	Anti-Restart System ·····	5-15
Group	12	Self-Diagnostic System ····	5-16
Group	13	Engine Control System ·····	5-59
Group	14	EPPR Valve	5-60
Group	15	Monitoring System	5-65
Group	16	Fuel Warmer System ·····	5-103

## **SECTION 5 MECHATRONICS SYSTEM**

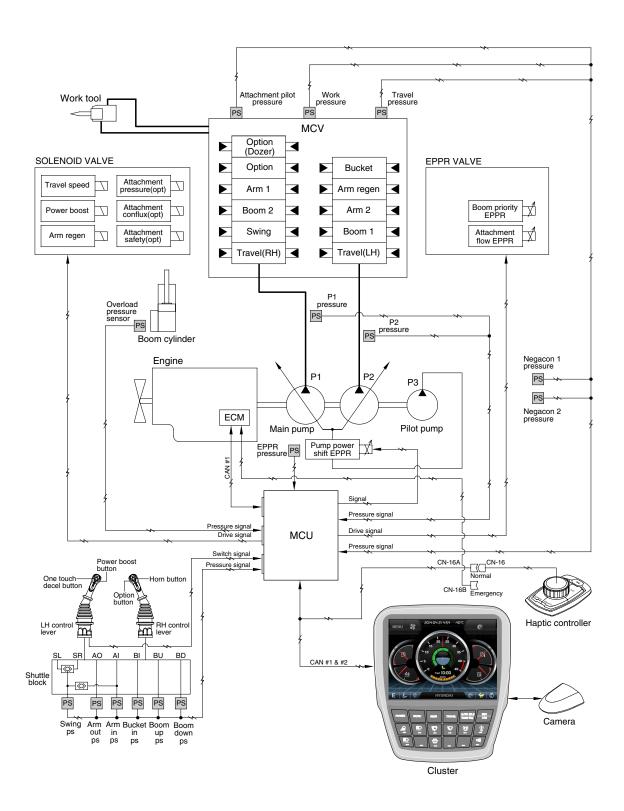
### **GROUP 1 OUTLINE**

The ADVANCED CAPO (Computer Aided Power Optimization) system controls engine and pump mutual power at an optimum and less fuel consuming state for the selected work by mode selection, auto-deceleration, power boost function, etc. It monitors machine conditions, for instance, engine speed, coolant temperature, hydraulic oil temperature, and hydraulic oil pressure, etc.

It consists of a MCU, a cluster, an ECM, EPPR valves, and other components. The MCU and the cluster protect themselves from over-current and high voltage input, and diagnose malfunctions caused by short or open circuit in electric system, and display error codes on the cluster.



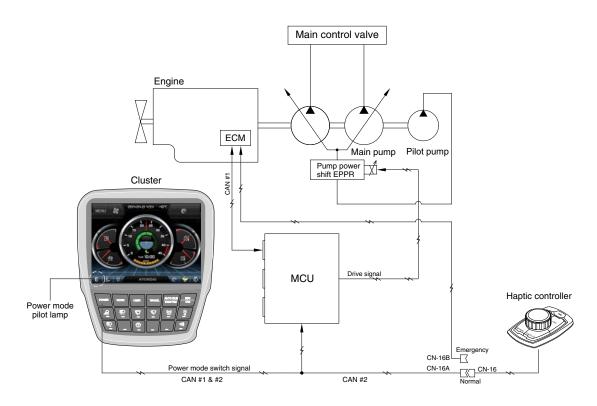
### SYSTEM DIAGRAM



140LC5MS04

### **GROUP 2 MODE SELECTION SYSTEM**

### 1. POWER MODE SELECTION SYSTEM



140L5MS02

Mode selection system (micro computer based electro-hydraulic pump and engine mutual control system) optimizes the engine and pump performance.

The combination of 3 power modes (P, S, E) and acceleration mode (10 set) of haptic controller makes it possible to use the engine and pump power more effectively corresponding to the work conditions from a heavy and great power requesting work to a light and precise work.

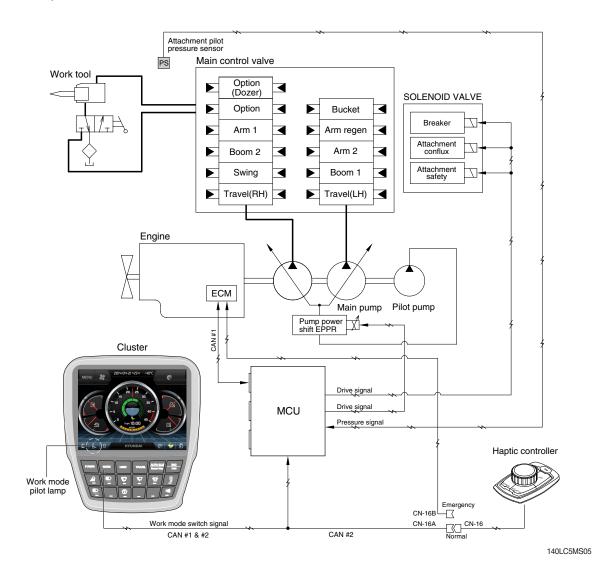
		Engine rpm			Power shift by EPPR valve				
Power	Application	Standard		Option		Standard		Option	
mode		Unload	Load	Unload	Load	Current (mA)	Pressure (kgf/cm²)	Current (mA)	Pressure (kgf/cm²)
Р	Heavy duty power	1850±50	1950±50	1850±50	2000±50	400±30	15 (10)	330±30	10 (5)
S	Standard power	1750±50	1850±50	1750±50	1900±50	460±30	18 (13)±3	365±30	13 (8)±3
Е	Economy operation	1650±50	1750±50	1650±50	1800±50	500±30	20 (15)±3	400±30	15 (10)±3
AUTO DECEL	Engine deceleration	1100±100	-	1100±100	-	700±30	38±3	700±30	38±3
One touch decel	Engine quick deceleration	1000±100	-	1000±100	-	700±30	38±3	700±30	38±3
KEY START	Key switch start position	1000±100	-	1000±100	-	700±30	38±3	700±30	38±3

\* Power shift (Standard/Option) can be changed by "Service menu" in "Management" on the cluster.

※ (~\*): Load

### 2. WORK MODE SELECTION SYSTEM

Work mode consists of the general operation (bucket) and the optional attachment (breaker, crusher).



### 1) GENERAL WORK MODE (bucket)

This mode is used to general digging work.

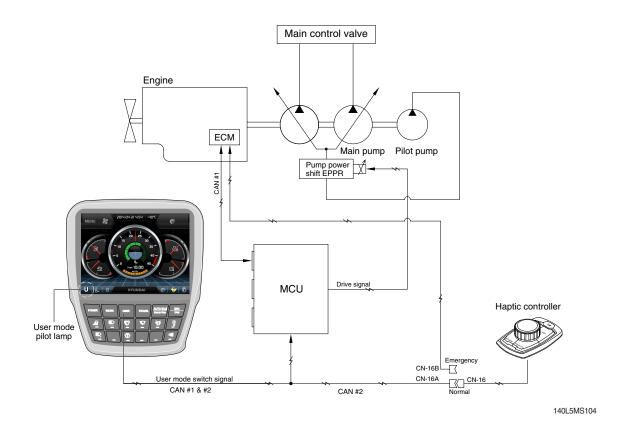
### 2) ATT WORK MODE (breaker, crusher)

It controls the pump flow and system pressure according to the operation of breaker or crusher.

Description	General mode	Work tool	
Description	Bucket	Breaker	Crusher
Attachment safety solenoid	OFF	-	ON
Attachment conflux solenoid	OFF	ON/OFF	ON/OFF
Attachment flow EPPR current	100 mA	100~700 mA	100~700 mA
Breaker solenoid★	OFF	ON	-

<sup>★</sup> When breaker operating button is pushed.

### 3. USER MODE SELECTION SYSTEM

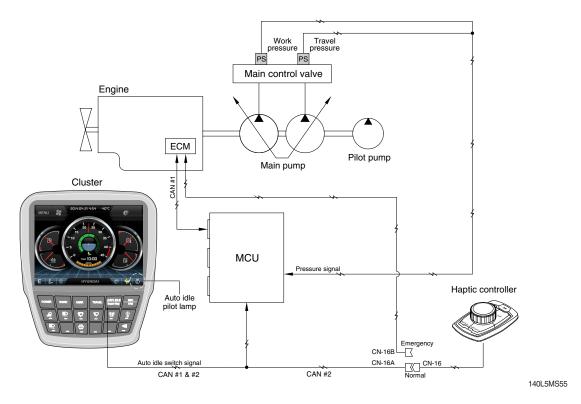


1) High idle rpm, auto idle rpm and EPPR pressure can be adjusted and memorized in the U-mode.

### 2) LCD segment vs parameter setting

Step ( ■ )	Engine speed (rpm)	Idle speed (rpm)	Power shift (bar)
1	1300	750	0
2	1400	800	3
3	1500	850	6
4	1600	900	9
5	1700	950	12
6	1800	1000	16
7	1850	1050	20
8	1900	1100 (auto decel)	26
9	1950	1150	32
10	2000	1200	38

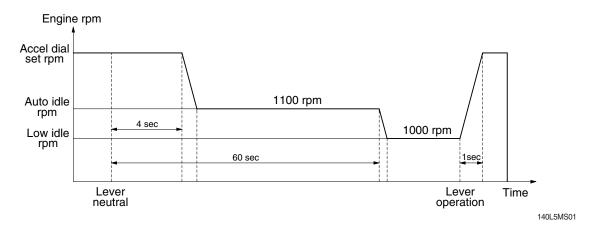
### **GROUP 3 AUTOMATIC DECELERATION SYSTEM**



#### 1. WHEN AUTO IDLE PILOT LAMP ON

When all of the work equipment control levers including swing and travel levers are at neutral for 4 seconds, MCU sends throttle command to ECM to reduce the engine speed to 1100 rpm. If the control levers are at neutral for 1 minute, MCU reduces the engine speed to 1000 rpm. As the result of reducing the engine speed, fuel consumption and noise are effectively cut down during non-operation of the control levers.

When the Auto idle pilot lamp is turned off by pressing the switch or any control lever is operated, the reduced engine speed rises upto the speed before deceleration in a second.

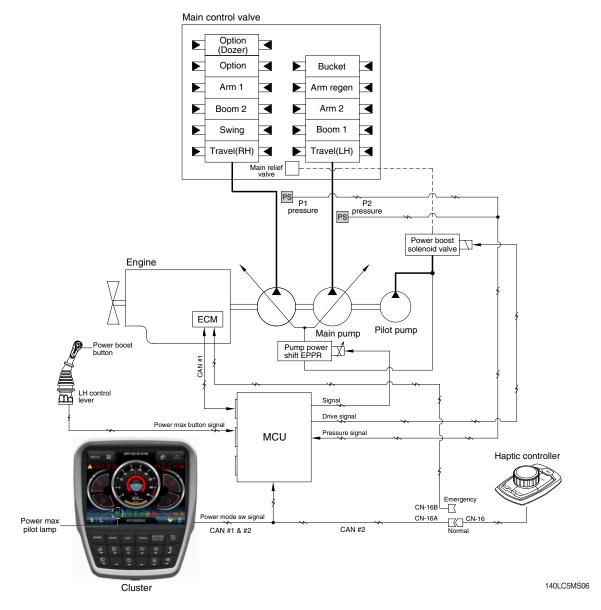


#### 2. WHEN AUTO IDLE PILOT LAMP OFF

The engine speed can be set as desired using the multimodal dial switch, and even if the control levers are neutral, the engine speed is not reduced.

\* Auto idle function can be activated when multimodal dial position is over 4.

### **GROUP 4 POWER BOOST SYSTEM**

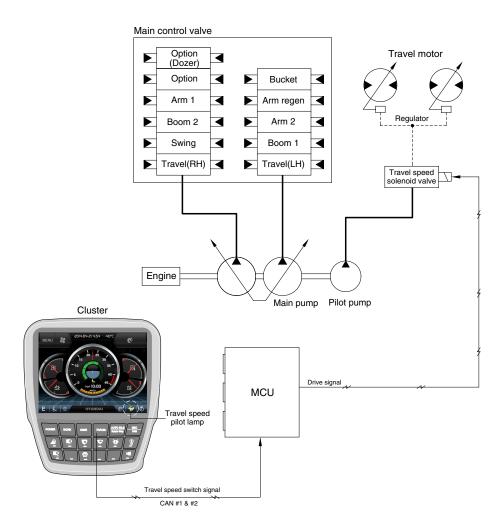


- When the power boost switch on the left control lever knob is pushed ON, the power mode is set P mode and maximum digging power is increased by 10 %.
- When the power boost function is activated, the power boost solenoid valve pilot pressure raises the set pressure of the main relief valve to increase the digging power.

Description	Condition	Function
Activated	Power boost switch : ON Accel dial : over 8	- Power mode : P - Accel dial power : 9 - Power boost solenoid : ON - Power boost pilot Imap : ON - Operating time : max 8 seconds
Canceled	Power boost switch : OFF	<ul><li>- Pre-set power mode</li><li>- Power boost solenoid : OFF</li><li>- Power boost pilot lamp : OFF</li></ul>

When the auto power boost is set to Enable and power mode is set to P mode on the cluster, the digging power is automatically increased as working conditions by the MCU. It is operated max 8 seconds.

## **GROUP 5 TRAVEL SPEED CONTROL SYSTEM**



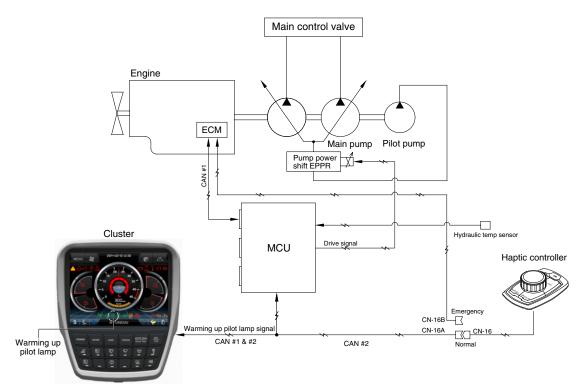
140LC5MS07

Travel speed can be switched manually by pressing the travel speed switch on the cluster.

Speed	Travel speed solenoid valve	Lamp on cluster	Operation
Low	OFF	Turtle	Low speed, high driving torque in the travel motor
High	ON	Rabbit	High speed, low driving torque in the travel motor

※ Default : Turtle (Low)

## **GROUP 6 AUTOMATIC WARMING UP SYSTEM**

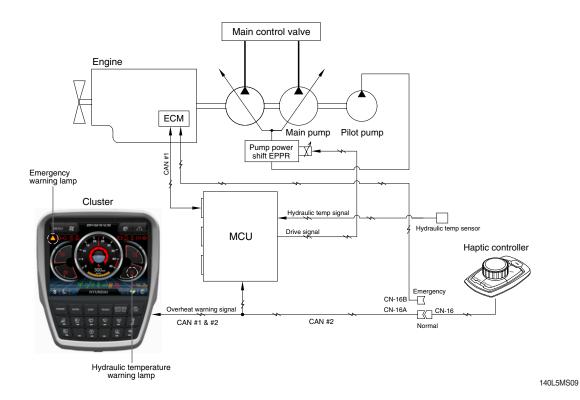


- 140L5MS08
- The MCU receives the engine coolant temperature from the ECM, and if the coolant temperature is below 30°C, it increases the engine speed from key start rpm to 1100 rpm. At this time the mode does not change. If the coolant temperature sensor has fault, the hydraulic oil temperature signal is substituted.
- 2. In case of the coolant temperature increases up to 30°C, the engine speed is decreased to key start speed. And if an operator changes power mode set during the warming up function, the MCU cancels the automatic warming up function.

### 3. LOGIC TABLE

Description	Condition	Function
Actuated	- Coolant temperature : below 30°C (after engine run)	- Power mode : Default (E mode) - Warming up time : 10 minutes (max) - Warming up pilot lamp : ON
Canceled	<ul> <li>Coolant temperature: Above 30°C</li> <li>Warming up time: Above 10 minutes</li> <li>Changed power mode set by operator</li> <li>RCV lever or pedal operating</li> <li>Auto idle cancel</li> <li>If any of the above conditions is applicable, the automatic warming up function is canceled</li> </ul>	- Power mode : set mode - Warming up pilot lamp : OFF

## **GROUP 7 ENGINE OVERHEAT PREVENTION SYSTEM**

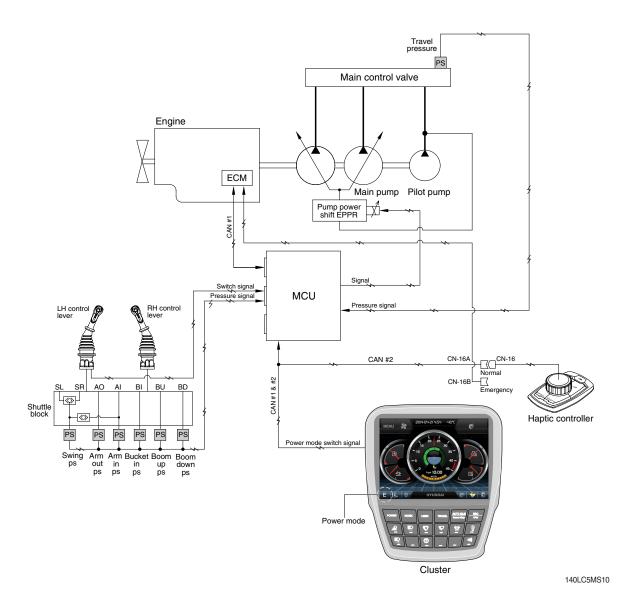


1. If the engine coolant temperature or the hydraulic oil temperature is overheated over 100°C, the warning lamp is ON and the pump input torque or the engine speed is reduced as below logic table.

### 2. LOGIC TABLE

Descrip	otion	Condition	Function
	Activoted	- Coolant temperature : Above 103°C	- Warning lamp : ON , buzzer : OFF - Pump input torque is reduced.
First step	Activated	- Hydraulic oil temperature : Above 100°C	<ul><li>Warning lamp &amp; buzzer : ON</li><li>Pump input torque is reduced.</li></ul>
warning	Canceled	- Coolant temperature : Less than 100°C - Hydraulic oil temperature : Less than 95°C	- Return to pre-set the pump absorption torque.
Second stop	Activated	- Coolant temperature : Above 107°C - Hydraulic oil temperature : Above 105°C	<ul><li>Emergency warning lamp pops up on the center of LCD and the buzzer sounds.</li><li>Engine speed is reduced after 10 seconds.</li></ul>
Second step warning	Canceled	- Coolant temperature : Less than 103°C - Hydraulic oil temperature : Less than 100°C	<ul> <li>Return to pre-set the engine speed.</li> <li>Hold pump absorption torque on the first step warning.</li> </ul>

## **GROUP 8 VARIABLE POWER CONTROL SYSTEM**



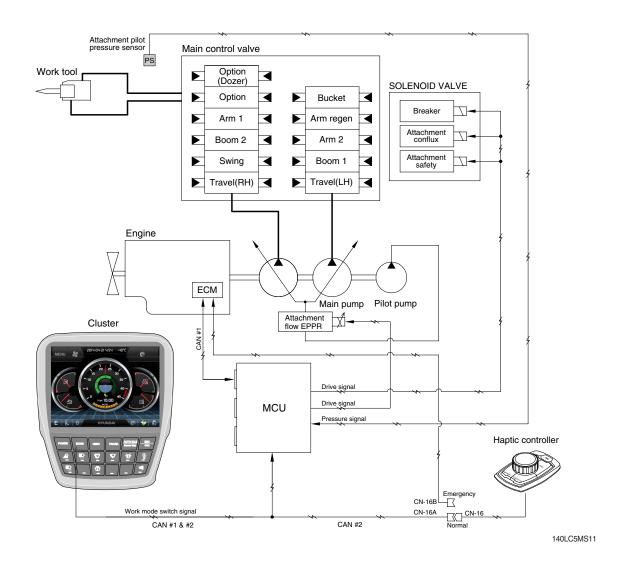
The variable power control system controls the engine and pump mutual power according to RCV lever stroke and pump load.

It makes fuel saving and smooth control at precise work.

Description	Working condition
Power mode	P, S, E
Work mode	General (bucket)
Pressure sensor	Normal

\* The variable power control function can be activated when the power mode is set to all power mode.

## **GROUP 9 ATTACHMENT FLOW CONTROL SYSTEM**

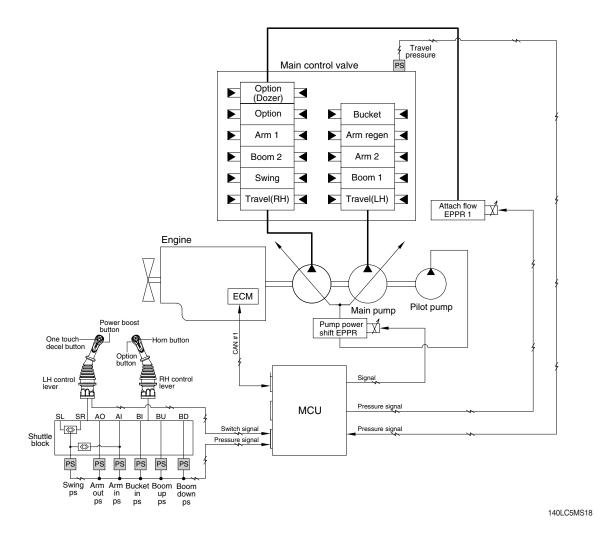


• The system is used to control the pump delivery flow according to set of the work tool on the cluster by the attachment flow EPPR valve.

Description	Work tool		
Description	Breaker	Crusher	
Flow level	100 ~ 180 lpm	100 ~ 440 lpm	
Attach safety solenoid	-	ON	
Attach conflux solenoid	ON/OFF	ON/OFF	
Breaker solenoid*	ON	-	

- \* Refer to the page 5-79 for the attachment kinds and max flow.
- ★ When breaker operating button is pushed.

## **GROUP 10 INTELLIGENT POWER CONTROL SYSTEM**



1. When the requirement of pump flow rate is low, IPC mode controls pump flow rate to improve fuel efficiency.

Condition <sup>★1</sup>	Function
IPC mode : ON*2	
Boom up Arm in	Limitation of pump flow rate : Activated
Not travel motion	
Not swing motion	
None of upper condition	Limitation of pump flow rate : Canceled

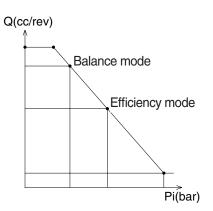
<sup>\*1</sup> AND condition

<sup>\*2</sup> IPC mode ON/OFF is selected at "Mode setup > IPC mode". See next page.

### 2. IPC MODE SELECTION

IPC mode ON/OFF and the levels of flow rate limit can be selected at "Mode setup > IPC mode"

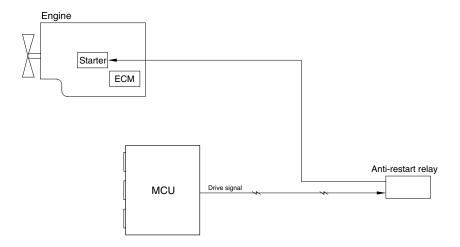




290F3CD311

IPC mode	Description
Balance mode (default)	IPC mode ON, limit level 1
Efficiency mode	IPC mode ON, limit level 2
Speed mode	IPC mode OFF

## **GROUP 11 ANTI-RESTART SYSTEM**



140L5MS12

### 1. ANTI-RESTART FUNCTION

After a few seconds from the engine starts to run, MCU turns off the start safety relay to protect the starter from inadvertent restarting.

### **GROUP 12 SELF-DIAGNOSTIC SYSTEM**

#### 1. OUTLINE

When any abnormality occurs in the ADVANCED CAPO system caused by electric parts malfunction and by open or short circuit, the MCU diagnoses the problem and sends the error codes to the cluster and also stores them in the memory.

### 2. MONITORING

#### 1) ACTIVE FAULT



· The active faults of the MCU, engine ECM or air conditioner can be checked by this menu.

### 2) LOGGED FAULT



• The logged faults of the MCU, engine ECM or air conditioner can be checked by this menu.

#### 3) DELETE LOGGED FAULT



• The logged faults of the MCU, engine ECM or air conditioner can be deleted by this menu.

## MACHINE ERROR CODES TABLE

Diagnostic Criteria   G   C   W	DTC		Diagnostic Critorio	Ар	plicati	on
4 10 seconds continuous, Hydraulic Oil Temp. Measurement Voltage < 0.3V    (Results / Symptoms)  1. Monitor – Hydraulic oil temperature display failure  2. Control Function – Fan revolutions control failure (Checking list)  1. CD-1 (#1)- CN-51 (#16) Checking Open/Short  2. CD-1 (#1)- CN-51 (#24, #25) Checking Open/Short  2. CD-1 (#1)- CN-51 (#24, #25) Checking Open/Short  0	HCESPN	FMI	Diagnostic Criteria	G	С	W
(Results / Symptoms)  1. Monitor – Hydraulic oil temperature display failure  2. Control Function – Fan revolutions control failure (Checking list)  1. CD-1 (#2)- CN-51 (#24, #25) Checking Open/Short  2. CD-1 (#1)- CN-51 (#24, #25) Checking Open/Short  0		3	10 seconds continuous, Hydraulic Oil Temp. Measurement Voltage > 3.8V	•		
1. Monitor – Hydraulic oil temperature display failure 2. Control Function – Fan revolutions control failure (Checking list) 1. CD-1 (#2)- CN-51 (#24, #25) Checking Open/Short 2. CD-1 (#1)- CN-51 (#24, #25) Checking Open/Short  0		4	10 seconds continuous, Hydraulic Oil Temp. Measurement Voltage < 0.3V	•		
1. Monitor – Hydraulic oil temperature display failure 2. Control Function – Fan revolutions control failure (Checking list) 1. CD-1 (#2)- CN-51 (#24, #25) Checking Open/Short 2. CD-1 (#1)- CN-51 (#24, #25) Checking Open/Short  0		(Resu	Its / Symptoms)			
2. Control Function – Fan revolutions control failure (Checking list) 1. CD-1 (#2)- CN-51 (#16) Checking Open/Short 2. CD-1 (#1)- CN-51 (#24, #25) Checking Open/Short  0 10 seconds continuous, Working Press. Sensor Measurement Voltage > 5.2V 1 10 seconds continuous, 0.3V≤ Working Press. Sensor Measurement Voltage < 0.8V 4 10 seconds continuous, Working Press. Sensor Measurement Voltage < 0.3V (Results / Symptoms) 1. Monitor – Working Press. display failure 2. Control Function – Auto Idle operation failure, Engine variable horse power control operation failure (Checking list) 1. CD-7 (#B) – CN-52 (#19) Checking Open/Short 2. CD-7 (#A) – CN-51 (#32) Checking Open/Short 3. CD-7 (#C) – CN-51 (#31) Checking Open/Short 10 seconds continuous, Travel Oil Press. Sensor Measurement Voltage > 5.2V 1 10 seconds continuous, Travel Oil Press. Sensor Measurement Voltage < 0.8V 4 10 seconds continuous, Travel Oil Press. Sensor Measurement Voltage < 0.3V (Results / Symptoms) 1. Monitor – Travel Oil Press. display failure 2. Control Function – Auto Idle operation failure, Engine variable horse power control operation failure, IPC operation failure, Driving alarm operation failure (Checking list) 1. CD-6 (#B) – CN-52 (#27) Checking Open/Short 2. CD-6 (#A) – CN-51 (#32) Checking Open/Short	101	,				
1. CD-1 (#2)- CN-51 (#16) Checking Open/Short 2. CD-1 (#1)- CN-51 (#24, #25) Checking Open/Short  0 10 seconds continuous, Working Press. Sensor Measurement Voltage > 5.2V  1 10 seconds continuous, Unit of Voltage < 0.3V  4 10 seconds continuous, Working Press. Sensor Measurement Voltage < 0.3V  (Results / Symptoms) 1. Monitor – Working Press. display failure 2. Control Function – Auto Idle operation failure, Engine variable horse power control operation failure (Checking list) 1. CD-7 (#B) – CN-52 (#19) Checking Open/Short 2. CD-7 (#A) – CN-51 (#32) Checking Open/Short 3. CD-7 (#C) – CN-51 (#31) Checking Open/Short  1 10 seconds continuous, Travel Oil Press. Sensor Measurement Voltage < 0.8V  1 10 seconds continuous, Travel Oil Press. Sensor Measurement Voltage < 0.8V  4 10 seconds continuous, Travel Oil Press. Sensor Measurement Voltage < 0.3V  (Results / Symptoms) 1. Monitor – Travel Oil Press. display failure 2. Control Function – Auto Idle operation failure, Engine variable horse power control operation failure, IPC operation failure, Driving alarm operation failure (Checking list) 1. CD-6 (#B) – CN-52 (#27) Checking Open/Short 2. CD-6 (#A) – CN-51 (#32) Checking Open/Short	101	2. Cor	ntrol Function – Fan revolutions control failure			
2. CD-1 (#1)- CN-51 (#24, #25) Checking Open/Short  0 10 seconds continuous, Working Press. Sensor Measurement Voltage > 5.2V  1 10 seconds continuous, 0.3V≤ Working Press. Sensor Measurement Voltage < 0.8V  4 10 seconds continuous, Working Press. Sensor Measurement Voltage < 0.3V  (Results / Symptoms)  1. Monitor – Working Press. display failure 2. Control Function – Auto Idle operation failure, Engine variable horse power control operation failure (Checking list)  1. CD-7 (#B) – CN-52 (#19) Checking Open/Short 2. CD-7 (#A) – CN-51 (#32) Checking Open/Short 3. CD-7 (#C) – CN-51 (#31) Checking Open/Short  10 seconds continuous, Travel Oil Press. Sensor Measurement Voltage > 5.2V  1 10 seconds continuous, 0.3V ≤ Travel Oil Press. Sensor Measurement Voltage < 0.8V  1 10 seconds continuous, Travel Oil Press. Sensor Measurement Voltage < 0.3V  (Results / Symptoms)  1. Monitor – Travel Oil Press. display failure 2. Control Function – Auto Idle operation failure, Engine variable horse power control operation failure, IPC operation failure, Driving alarm operation failure (Checking list) 1. CD-6 (#B) – CN-52 (#27) Checking Open/Short 2. CD-6 (#A) – CN-51 (#32) Checking Open/Short		(Chec	king list)			
10 seconds continuous, Working Press. Sensor Measurement Voltage > 5.2V  1 10 seconds continuous, 0.3V≤ Working Press. Sensor Measurement Voltage < 0.8V  4 10 seconds continuous, Working Press. Sensor Measurement Voltage < 0.3V  (Results / Symptoms) 1. Monitor – Working Press. display failure 2. Control Function – Auto Idle operation failure, Engine variable horse power control operation failure (Checking list) 1. CD-7 (#B) – CN-52 (#19) Checking Open/Short 2. CD-7 (#A) – CN-51 (#32) Checking Open/Short 3. CD-7 (#C) – CN-51 (#31) Checking Open/Short  10 seconds continuous, Travel Oil Press. Sensor Measurement Voltage > 5.2V  1 10 seconds continuous, 0.3V ≤ Travel Oil Press. Sensor Measurement Voltage < 0.8V  1 10 seconds continuous, Travel Oil Press. Sensor Measurement Voltage < 0.3V  (Results / Symptoms) 1. Monitor – Travel Oil Press. display failure 2. Control Function – Auto Idle operation failure, Engine variable horse power control operation failure, IPC operation failure, Driving alarm operation failure (Checking list) 1. CD-6 (#B) – CN-52 (#27) Checking Open/Short 2. CD-6 (#A) – CN-51 (#32) Checking Open/Short		1. CD	-1 (#2)- CN-51 (#16) Checking Open/Short			
1 Neasurement Voltage > 5.2V 1 10 seconds continuous, 0.3V≤ Working Press. Sensor Measurement Voltage < 0.8V 4 10 seconds continuous, Working Press. Sensor Measurement Voltage < 0.3V  (Results / Symptoms) 1. Monitor – Working Press. display failure 2. Control Function – Auto Idle operation failure, Engine variable horse power control operation failure (Checking list) 1. CD-7 (#B) – CN-52 (#19) Checking Open/Short 2. CD-7 (#A) – CN-51 (#32) Checking Open/Short 3. CD-7 (#C) – CN-51 (#31) Checking Open/Short 10 seconds continuous, Travel Oil Press. Sensor Measurement Voltage > 5.2V 1 10 seconds continuous, Travel Oil Press. Sensor Measurement Voltage < 0.8V 4 10 seconds continuous, Travel Oil Press. Sensor Measurement Voltage < 0.3V  (Results / Symptoms) 1. Monitor – Travel Oil Press. display failure 2. Control Function – Auto Idle operation failure, Engine variable horse power control operation failure, IPC operation failure, Driving alarm operation failure (Checking list) 1. CD-6 (#B) – CN-52 (#27) Checking Open/Short 2. CD-6 (#A) – CN-51 (#32) Checking Open/Short		2. CD	-1 (#1)- CN-51 (#24, #25) Checking Open/Short			
Measurement Voltage > 5.2V  1		0	10 seconds continuous, Working Press. Sensor			
1 Voltage < 0.8V  4 10 seconds continuous, Working Press. Sensor Measurement Voltage < 0.3V  (Results / Symptoms)  1. Monitor – Working Press. display failure  2. Control Function – Auto Idle operation failure, Engine variable horse power control operation failure  (Checking list)  1. CD-7 (#B) – CN-52 (#19) Checking Open/Short  2. CD-7 (#A) – CN-51 (#32) Checking Open/Short  3. CD-7 (#C) – CN-51 (#31) Checking Open/Short  0 10 seconds continuous, Travel Oil Press. Sensor Measurement Voltage > 5.2V  1 10 seconds continuous, 0.3V ≤ Travel Oil Press. Sensor Measurement Voltage < 0.8V  4 10 seconds continuous, Travel Oil Press. Sensor Measurement Voltage < 0.3V  (Results / Symptoms)  1. Monitor – Travel Oil Press. display failure  2. Control Function – Auto Idle operation failure, Engine variable horse power control operation failure, IPC operation failure, Driving alarm operation failure (Checking list)  1. CD-6 (#B) – CN-52 (#27) Checking Open/Short  2. CD-6 (#A) – CN-51 (#32) Checking Open/Short		U	Measurement Voltage > 5.2V			
Voltage < 0.8V		1	10 seconds continuous, $0.3V \le Working \ Press. \ Sensor \ Measurement$			
4 Measurement Voltage < 0.3V  (Results / Symptoms)  1. Monitor – Working Press. display failure  2. Control Function – Auto Idle operation failure, Engine variable horse power control operation failure  (Checking list)  1. CD-7 (#B) – CN-52 (#19) Checking Open/Short  2. CD-7 (#A) – CN-51 (#32) Checking Open/Short  3. CD-7 (#C) – CN-51 (#31) Checking Open/Short  0 10 seconds continuous, Travel Oil Press. Sensor  Measurement Voltage > 5.2V  1 10 seconds continuous, Travel Oil Press. Sensor Measurement  Voltage < 0.8V  4 10 seconds continuous, Travel Oil Press. Sensor  Measurement Voltage < 0.3V  (Results / Symptoms)  1. Monitor – Travel Oil Press. display failure  2. Control Function – Auto Idle operation failure, Engine variable horse power control operation failure, IPC operation failure, Driving alarm operation failure  (Checking list)  1. CD-6 (#B) – CN-52 (#27) Checking Open/Short  2. CD-6 (#A) – CN-51 (#32) Checking Open/Short			, and the second			
(Results / Symptoms)  1. Monitor – Working Press. display failure  2. Control Function – Auto Idle operation failure, Engine variable horse power control operation failure  (Checking list)  1. CD-7 (#B) – CN-52 (#19) Checking Open/Short  2. CD-7 (#A) – CN-51 (#32) Checking Open/Short  3. CD-7 (#C) – CN-51 (#31) Checking Open/Short  0 10 seconds continuous, Travel Oil Press. Sensor Measurement Voltage > 5.2V  1 10 seconds continuous, 0.3V ≤ Travel Oil Press. Sensor Measurement Voltage < 0.8V  4 10 seconds continuous, Travel Oil Press. Sensor Measurement Voltage < 0.3V  (Results / Symptoms)  1. Monitor – Travel Oil Press. display failure  2. Control Function – Auto Idle operation failure, Engine variable horse power control operation failure, IPC operation failure, Driving alarm operation failure (Checking list)  1. CD-6 (#B) – CN-52 (#27) Checking Open/Short  2. CD-6 (#A) – CN-51 (#32) Checking Open/Short			_			
1. Monitor – Working Press. display failure  2. Control Function – Auto Idle operation failure, Engine variable horse power control operation failure  (Checking list)  1. CD-7 (#B) – CN-52 (#19) Checking Open/Short  2. CD-7 (#A) – CN-51 (#32) Checking Open/Short  3. CD-7 (#C) – CN-51 (#31) Checking Open/Short  0						
1. Monitor – Working Press. display failure  2. Control Function – Auto Idle operation failure, Engine variable horse power control operation failure  (Checking list)  1. CD-7 (#B) – CN-52 (#19) Checking Open/Short  2. CD-7 (#A) – CN-51 (#32) Checking Open/Short  3. CD-7 (#C) – CN-51 (#31) Checking Open/Short  0	105	,				
failure  (Checking list)  1. CD-7 (#B) – CN-52 (#19) Checking Open/Short  2. CD-7 (#A) – CN-51 (#32) Checking Open/Short  3. CD-7 (#C) – CN-51 (#31) Checking Open/Short  0 10 seconds continuous, Travel Oil Press. Sensor  Measurement Voltage > 5.2V  1 10 seconds continuous, 0.3V ≤ Travel Oil Press. Sensor Measurement  Voltage < 0.8V  4 10 seconds continuous, Travel Oil Press. Sensor  Measurement Voltage < 0.3V  (Results / Symptoms)  1. Monitor – Travel Oil Press. display failure  2. Control Function – Auto Idle operation failure, Engine variable horse power control operation failure, IPC operation failure, Driving alarm operation failure  (Checking list)  1. CD-6 (#B) – CN-52 (#27) Checking Open/Short  2. CD-6 (#A) – CN-51 (#32) Checking Open/Short	100					
(Checking list)  1. CD-7 (#B) – CN-52 (#19) Checking Open/Short  2. CD-7 (#A) – CN-51 (#32) Checking Open/Short  3. CD-7 (#C) – CN-51 (#31) Checking Open/Short  0 10 seconds continuous, Travel Oil Press. Sensor Measurement Voltage > 5.2V  1 10 seconds continuous, 0.3V ≤ Travel Oil Press. Sensor Measurement Voltage < 0.8V  4 10 seconds continuous, Travel Oil Press. Sensor Measurement Voltage < 0.3V  (Results / Symptoms)  1. Monitor – Travel Oil Press. display failure  2. Control Function – Auto Idle operation failure, Engine variable horse power control operation failure, IPC operation failure, Driving alarm operation failure (Checking list)  1. CD-6 (#B) – CN-52 (#27) Checking Open/Short  2. CD-6 (#A) – CN-51 (#32) Checking Open/Short		2. Cor		opera	ation	
1. CD-7 (#B) – CN-52 (#19) Checking Open/Short 2. CD-7 (#A) – CN-51 (#32) Checking Open/Short 3. CD-7 (#C) – CN-51 (#31) Checking Open/Short  0 10 seconds continuous, Travel Oil Press. Sensor Measurement Voltage > 5.2V  1 10 seconds continuous, 0.3V ≤ Travel Oil Press. Sensor Measurement Voltage < 0.8V  4 10 seconds continuous, Travel Oil Press. Sensor Measurement Voltage < 0.3V  (Results / Symptoms) 1. Monitor – Travel Oil Press. display failure 2. Control Function – Auto Idle operation failure, Engine variable horse power control operation failure, IPC operation failure, Driving alarm operation failure (Checking list) 1. CD-6 (#B) – CN-52 (#27) Checking Open/Short 2. CD-6 (#A) – CN-51 (#32) Checking Open/Short						
2. CD-7 (#A) – CN-51 (#32) Checking Open/Short  3. CD-7 (#C) – CN-51 (#31) Checking Open/Short  0 10 seconds continuous, Travel Oil Press. Sensor Measurement Voltage > 5.2V  1 10 seconds continuous, 0.3V ≤ Travel Oil Press. Sensor Measurement Voltage < 0.8V  4 10 seconds continuous, Travel Oil Press. Sensor Measurement Voltage < 0.3V  (Results / Symptoms) 1. Monitor – Travel Oil Press. display failure 2. Control Function – Auto Idle operation failure, Engine variable horse power control operation failure, IPC operation failure, Driving alarm operation failure (Checking list) 1. CD-6 (#B) – CN-52 (#27) Checking Open/Short 2. CD-6 (#A) – CN-51 (#32) Checking Open/Short		· '				
3. CD-7 (#C) – CN-51 (#31) Checking Open/Short  0 10 seconds continuous, Travel Oil Press. Sensor Measurement Voltage > 5.2V  1 10 seconds continuous, 0.3V ≤ Travel Oil Press. Sensor Measurement Voltage < 0.8V  4 10 seconds continuous, Travel Oil Press. Sensor Measurement Voltage < 0.3V  (Results / Symptoms) 1. Monitor – Travel Oil Press. display failure 2. Control Function – Auto Idle operation failure, Engine variable horse power control operation failure, IPC operation failure, Driving alarm operation failure (Checking list) 1. CD-6 (#B) – CN-52 (#27) Checking Open/Short 2. CD-6 (#A) – CN-51 (#32) Checking Open/Short			. , , , , , , , , , , , , , , , , , , ,			
10 seconds continuous, Travel Oil Press. Sensor Measurement Voltage > 5.2V  1 10 seconds continuous, 0.3V ≤ Travel Oil Press. Sensor Measurement Voltage < 0.8V  4 10 seconds continuous, Travel Oil Press. Sensor Measurement Voltage < 0.3V  (Results / Symptoms) 1. Monitor – Travel Oil Press. display failure 2. Control Function – Auto Idle operation failure, Engine variable horse power control operation failure, IPC operation failure, Driving alarm operation failure (Checking list) 1. CD-6 (#B) – CN-52 (#27) Checking Open/Short 2. CD-6 (#A) – CN-51 (#32) Checking Open/Short			. , , , , , , , , , , , , , , , , , , ,			
1		3. CD				
1 10 seconds continuous, 0.3V ≤ Travel Oil Press. Sensor Measurement Voltage < 0.8V  4 10 seconds continuous, Travel Oil Press. Sensor Measurement Voltage < 0.3V  (Results / Symptoms) 1. Monitor – Travel Oil Press. display failure 2. Control Function – Auto Idle operation failure, Engine variable horse power control operation failure, IPC operation failure, Driving alarm operation failure (Checking list) 1. CD-6 (#B) – CN-52 (#27) Checking Open/Short 2. CD-6 (#A) – CN-51 (#32) Checking Open/Short		0	· · · · · · · · · · · · · · · · · · ·			
108 Voltage < 0.8V  4 10 seconds continuous, Travel Oil Press. Sensor Measurement Voltage < 0.3V  (Results / Symptoms) 1. Monitor – Travel Oil Press. display failure 2. Control Function – Auto Idle operation failure, Engine variable horse power control operation failure, IPC operation failure, Driving alarm operation failure (Checking list) 1. CD-6 (#B) – CN-52 (#27) Checking Open/Short 2. CD-6 (#A) – CN-51 (#32) Checking Open/Short			•			
108 10 seconds continuous, Travel Oil Press. Sensor Measurement Voltage < 0.3V  (Results / Symptoms) 1. Monitor – Travel Oil Press. display failure 2. Control Function – Auto Idle operation failure, Engine variable horse power control operation failure, IPC operation failure, Driving alarm operation failure (Checking list) 1. CD-6 (#B) – CN-52 (#27) Checking Open/Short 2. CD-6 (#A) – CN-51 (#32) Checking Open/Short		1				
108    Measurement Voltage < 0.3V			9			
(Results / Symptoms)  1. Monitor – Travel Oil Press. display failure  2. Control Function – Auto Idle operation failure, Engine variable horse power control operation failure, IPC operation failure, Driving alarm operation failure  (Checking list)  1. CD-6 (#B) – CN-52 (#27) Checking Open/Short  2. CD-6 (#A) – CN-51 (#32) Checking Open/Short		4				
1. Monitor – Travel Oil Press. display failure 2. Control Function – Auto Idle operation failure, Engine variable horse power control operation failure, IPC operation failure, Driving alarm operation failure  (Checking list) 1. CD-6 (#B) – CN-52 (#27) Checking Open/Short 2. CD-6 (#A) – CN-51 (#32) Checking Open/Short		(Resu				
<ul> <li>2. Control Function – Auto Idle operation failure, Engine variable horse power control operation failure, IPC operation failure, Driving alarm operation failure</li> <li>(Checking list)</li> <li>1. CD-6 (#B) – CN-52 (#27) Checking Open/Short</li> <li>2. CD-6 (#A) – CN-51 (#32) Checking Open/Short</li> </ul>	108	`				
failure, IPC operation failure, Driving alarm operation failure  (Checking list)  1. CD-6 (#B) – CN-52 (#27) Checking Open/Short  2. CD-6 (#A) – CN-51 (#32) Checking Open/Short				onera	ation	
(Checking list) 1. CD-6 (#B) – CN-52 (#27) Checking Open/Short 2. CD-6 (#A) – CN-51 (#32) Checking Open/Short		2. 001	·	орого		
1. CD-6 (#B) – CN-52 (#27) Checking Open/Short 2. CD-6 (#A) – CN-51 (#32) Checking Open/Short		(Chec				
2. CD-6 (#A) – CN-51 (#32) Checking Open/Short		· '				
			. , , , , , , , , , , , , , , , , , , ,			
ן אווסרווע שווער ( איז די בייט ( איז בייט ( איז בייט אווער בייער) אווער בייט אווער בייט אווער בייט אווער בייט א			-6 (#C) – CN-51 (#31) Checking Open/Short			

 $\ensuremath{\,\%\,}$  Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC			Ap	plicat	ion
HCESPN	FMI	Diagnostic Criteria	G	С	W
	_	10 seconds continuous, Main Pump 1 (P1) Press. Sensor Measurement			
	0	Voltage > 5.2V			
	1	10 seconds continuous, 0.3V ≤ Main Pump 1 (P1) Press. Sensor			
		Measurement Voltage < 0.8V			
	4	10 seconds continuous, Main Pump 1 (P1) Press. Sensor Measurement			
	/Deau	Voltage < 0.3V			
120	'	lts / Symptoms) nitor – Main Pump 1 (P1) Press. display failure			
		ntrol Function – Automatic voltage increase operation failure, Overload at compe	ancat	ion co	ntrol
	2. 001	failure	51 ISAL	1011 66	111101
	(Chec	king list)			
	`	-42 (#B) – CN-52 (#22) Checking Open/Short			
		-42 (#A) – CN-51 (#32) Checking Open/Short			
	3. CD	-42 (#C) – CN-51 (#31) Checking Open/Short			
	_	10 seconds continuous, Main Pump 2 (P2) Press. Sensor Measurement			
	0	Voltage > 5.2V			
	1	10 seconds continuous, 0.3V≤ Main Pump 2 (P2) Press. Sensor			
	•	Measurement Voltage < 0.8V			
	4	10 seconds continuous, Main Pump 2 (P2) Press. Sensor Measurement			
	/Pocu	Voltage < 0.3V  Its / Symptoms)			
121		nitor – Main Pump 2 (P2) Press. display failure			
		ntrol Function – Automatic voltage increase operation failure, Overload at compe	ensat	ion co	ntrol
	failure				
		king list)			
		-43 (#B) – CN-51 (#14) Checking Open/Short			
	2. CD	-43 (#A) – CN-51 (#32) Checking Open/Short			
	3. CD	-43 (#C) – CN-51 (#31) Checking Open/Short			
		(when you had conditions mounting pressure sensor)			
	1	10 seconds continuous, 0.3V ≤ Overload Press. Sensor Measurement			
		Voltage < 0.8V			
		(when you had conditions mounting pressure sensor)	_		
	4	10 seconds continuous, Overload Press. Sensor			
		Measurement Voltage < 0.3V			
122	`	Its / Symptoms)			
		nitor – Overload Press. display failure			
		ntrol Function – Overload warning alarm failure			
		king list) -31 (#B) – CN-52 (#28) Checking Open/Short			
		-31 (#B) – CN-52 (#26) Checking Open/Short			
		-31 (#A) – CN-51 (#32) Checking Open/Short			
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 $\ensuremath{\,\%\,}$  Some error codes are not applied to this machine.

 ${\sf G:General} \qquad \qquad {\sf C:Crawler\,Type} \qquad \qquad {\sf W:Wheel\,Type}$ 

DTC			Ар	plicat	ion			
HCESPN	FMI	Diagnostic Criteria	G	С	W			
		10 seconds continuous, Negative 1 Press. Sensor						
	0	Measurement Voltage > 5.2V						
	1	10 seconds continuous, $0.3V \le$ Negative 1 Press. Sensor Measurement Voltage $< 0.8V$	•					
	4	10 seconds continuous, Negative 1 Press. Sensor Measurement Voltage < 0.3V	•					
123	(Resu	Its / Symptoms)						
	1. Mor	nitor – Negative 1 Press. display failure						
	2. Cor	ntrol Function – IPC operation failure, Option attachment flow control operation f	ailure					
	(Chec	king list)						
	1. CD	-70 (#B) – CN-51 (#22) Checking Open/Short						
	2. CD-	-70 (#A) – CN-51 (#32) Checking Open/Short						
	3. CD-	-70 (#C) – CN-51 (#31) Checking Open/Short						
	•	10 seconds continuous, Negative 2 Press. Sensor						
	0	Measurement Voltage > 5.2V						
	1	10 seconds continuous, 0.3V≤ Negative 2 Press. Sensor Measurement						
		Voltage < 0.8V						
	4	10 seconds continuous, Negative 2 Press. Sensor						
		Measurement Voltage < 0.3V						
124	(Results / Symptoms)							
	Monitor – Negative 2 Press. display failure							
	2. Cor	ntrol Function – Option attachment flow control operation failure						
	(Chec	king list)						
	1. CD	-71 (#B) – CN-51 (#28) Checking Open/Short						
	2. CD	-71 (#A) – CN-51 (#32) Checking Open/Short						
	3. CD	-71 (#C) – CN-51 (#31) Checking Open/Short						
	0	10 seconds continuous, Boom Up Pilot Press. Sensor						
	0	Measurement Voltage > 5.2V						
	1	10 seconds continuous, 0.3V≤ Boom Up Pilot Press. Sensor Measurement						
		Voltage < 0.8V						
	4	10 seconds continuous, Boom Up Pilot Press. Sensor Measurement < 0.3V						
	(Resu	Its / Symptoms)						
127	Monitor – Boom Up Pilot Press. display failure							
	2. Cor	ntrol Function – Engine/Pump variable horse power control operation failure, IPC	Соре	ration	I			
		failure, Boom first operation failure						
	(Chec	king list)						
	1. CD	-32 (#B) – CN-52 (#23) Checking Open/Short						
	2. CD	-32 (#A) – CN-51 (#32) Checking Open/Short						
	3. CD	-32 (#C) – CN-5 1(#31) Checking Open/Short						

 $\ensuremath{\,\%\,}$  Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Critoria		plicat	ion
HCESPN	FMI	Diagnostic Criteria	G	С	W
	0	(when you had conditions mounting pressure sensor)  10 seconds continuous, Boom Down Pilot Press. Sensor Measurement Voltage > 5.2V	•		
	1	(when you had conditions mounting pressure sensor)  10 seconds continuous, 0.3V≤ Boom Down Pilot Press. Sensor  Measurement Voltage < 0.8V	•		
128	4	(when you had conditions mounting pressure sensor)  10 seconds continuous, Boom Down Pilot Press. Sensor Measurement Voltage < 0.3V	•		
	1. Mor 2. Cor (Chec 1. CD- 2. CD-	Its / Symptoms) nitor – Boom Down Pilot Press. display failure ntrol Function – Boom floating operation failure king list) -85 (#B) – CN-52 (#31) Checking Open/Short -85 (#A) – CN-51 (#32) Checking Open/Short -85 (#C) – CN-51 (#31) Checking Open/Short			
	0	10 seconds continuous, Arm In Pilot Press. Sensor  Measurement Voltage > 4.8V  10 seconds continuous, 0.3V≤ Arm In Pilot Press. Sensor Measurement	•		
	4	Voltage < 0.8V  10 seconds continuous, Arm In Pilot Press. Sensor  Measurement Voltage < 0.3V	•		
129	1. Mor 2. Cor (Chec 1. CD- 2. CD-	Its / Symptoms)  nitor – Arm In Pilot Press. display failure  ntrol Function – IPC operation failure  king list)  -90 (#B) – CN-51 (#21) Checking Open/Short  -90 (#A) – CN-51 (#32) Checking Open/Short  -90 (#C) – CN-51 (#31) Checking Open/Short			
	0	10 seconds continuous, Arm Out Pilot Press. Sensor Measurement Voltage > 5.2V 10 seconds continuous, 0.3V≤ Arm Out Pilot Press. Sensor Measurement Voltage < 0.8V	•		
133	4 (Rosu	10 seconds continuous, Arm Out Pilot Press. Sensor Measurement Voltage < 0.3V	•		
	1. Mor 2. Cor (Chec 1. CD- 2. CD-	Its / Symptoms)  nitor – Arm Out Pilot Press. display failure  ntrol Function – Engine variable horse power control operation failure  king list)  -35 (#B) – CN-52 (#27) Checking Open/Short  -35 (#A) – CN-51 (#32) Checking Open/Short  -35 (#C) – CN-51 (#31) Checking Open/Short			

\* Some error codes are not applied to this machine.

 $\mbox{G : General} \qquad \qquad \mbox{C : Crawler Type} \qquad \qquad \mbox{W : Wheel Type}$ 

DTC			Ар	plicat	ion
HCESPN	FMI	Diagnostic Criteria	G	С	W
	0	10 seconds continuous, Swing Pilot Press. Sensor			
	0	Measurement Voltage > 5.2V			
	1	10 seconds continuous, 0.3V≤ Swing Pilot Press. Sensor Measurement			
		Voltage < 0.8V			
	4	10 seconds continuous, Swing Pilot Press. Sensor			
		Measurement Voltage < 0.3V			
135	l ,	Its / Symptoms)			
		nitor – Swing Pilot Press. display failure			
		ntrol Function – IPC operation, Boom first operation failure			
	l ,	king list)			
		-24 (#B) – CN-52 (#18) Checking Open/Short			
		-24 (#A) – CN-51 (#32) Checking Open/Short			
	3. CD	-24 (#C) – CN-51 (#31) Checking Open/Short			ı
	_	Monitor – Select Attachment(breaker / crusher)			
	0	10 seconds continuous, Attachment Pilot Press. Sensor Measurement			
		Voltage > 5.2V			
	1	Monitor – Select Attachment(breaker / crusher)			
		10 seconds continuous, 0.3V≤ Attachment Pilot Press. Sensor			
		Measurement Voltage < 0.8V			
	4	Monitor – Select Attachment(breaker / crusher)			
138		10 seconds continuous, Attachment Pilot Press. Sensor Measurement Voltage < 0.3V			
	/Deau				
	l '	Its / Symptoms)			
		nitor – Attachment Pilot Press. display failure			
		ntrol Function – Option attachment flow control operation failure king list)			
	,	-69 (#B) – CN-52 (#32) Checking Open/Short			
		-69 (#A) – CN-51 (#32) Checking Open/Short			
		-69 (#C) – CN-51 (#31) Checking Open/Short			
	0.00	10 seconds continuous, 0.3V≤ Option Pilot Press. Sensor Measurement			
	1	Voltage < 0.8V			
		10 seconds continuous, Option Pilot Press. Sensor			
	4	Measurement Voltage < 0.3V			
	(Resu	Its / Symptoms)			
139	l ,	nitor – Option Pilot Press. display failure			
100		ntrol Function – Auto Idle operation failure			
		king list)			
	l ,	-100 (#B) – CN-52 (#21) Checking Open/Short			
		-100 (#A) – CN-51 (#3) Checking Open/Short			
		-100 (#C) – CN-1 (#6) Checking Open/Short			
	0.00				

 $\ensuremath{\,\mathbb{X}\,}$  Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Ap	plicat	ion
HCESPN	FMI	Diagnostic Criteria	G	С	W
	5	(Detection)  (When Main Pump EPPR Current is more than 10 mA)  10 seconds continuous, Main Pump EPPR drive current < 0 mA  (Cancellation)  (When Main Pump EPPR Current is more than 10 mA)  3 seconds continuous, Main Pump EPPR drive current ≥10 mA	•		
140	6	(Detection)  10 seconds continuous, Main Pump EPPR drive current > 1.0A  (Cancellation)  3 seconds continuous, Main Pump EPPR drive current ≤ 1.0 A	•		
	1. Cor	Ilts / Symptoms)  ntrol Function – Main Pump horse power setting specification difference  (Fuel efficiency/speed specification failure)			
		-75 (#2) – CN-54 (#28) Checking Open/Short -75 (#1) – CN-54 (#1) Checking Open/Short			
	5	<ul> <li>(Model Parameter) mounting Boom Priority EPPR</li> <li>(Detection)</li> <li>(When Boom Priority EPPR Current is more than 10 mA)</li> <li>10 seconds continuous, Boom Priority EPPR drive current &lt; 0 mA</li> <li>(Cancellation)</li> <li>(When Boom Priority EPPR Current is more than 10 mA)</li> <li>3 seconds continuous, Boom Priority EPPR drive current ≥ 10 mA</li> </ul>	•		
141	6	(Detection)  10 seconds continuous, Boom Priority EPPR drive current > 1.0 A  (Cancellation)  3 seconds continuous, Boom Priority EPPR drive current ≤ 1.0 A	•		
	1. Cor (Chec 1. CN	olts / Symptoms) Introl Function – Boom first control operation failure Eking list) -133 (#2) – CN-54 (#34) Checking Open/Short -133 (#1) – CN-54 (#4) Checking Open/Short			

 $\ensuremath{\,\%\,}$  Some error codes are not applied to this machine.

 ${\sf G:General} \qquad \qquad {\sf C:Crawler\,Type} \qquad \qquad {\sf W:Wheel\,Type}$ 

DTC	;	Dia suppostia Cuitavia	Ap	plicat	ion
HCESPN	FMI	Diagnostic Criteria	G	С	W
	5	(Detection)  (When Travel EPPR Current is more than 10 mA)  10 seconds continuous, Travel EPPR drive current = 0 mA  (Cancellation)  (When Travel EPPR Current is more than 100 mA)  3 seconds continuous, Travel EPPR drive current ≥ 10 mA			•
143	6	(Detection) 10 seconds continuous, Travel EPPR drive current > 1.0 A (Cancellation) 3 seconds continuous, Travel EPPR drive current ≤ 1.0 A			•
	1. Cor (Chec 1. CN	lts / Symptoms)  ntrol Function – cruise control operation failure  king list)  -246 (#2) – CN-54 (#39) Checking Open/Short  -246 (#1) – CN-51 (#40) Checking Open/Short			
145	5	(Model Parameter) mounting Remote Cooling Fan EPPR (Detection) (When Remote Cooling Fan EPPR Current is more than 10 mA) 10 seconds continuous, Remote Cooling Fan EPPR drive current = 0 mA (Cancellation) (When Remote Cooling Fan EPPR Current is more than 10 mA) 3 seconds continuous, Remote Cooling Fan EPPR drive current ≥ 10 mA	•		
	6	(Detection)  10 seconds continuous, Remote Cooling Fan EPPR drive current > 1.0 A  (Cancellation)  3 seconds continuous, Remote Cooling Fan EPPR drive current ≤ 1.0 A	•		
	1. Cor (Chec 1. CN	lts / Symptoms) htrol Function – Remote fan control operation failure king list) -385 (#3) – CN-53 (#7) Checking Open/Short -385 (#1) – CN-51 (#3) Checking Open/Short			

 $\ensuremath{\,\mathbb{X}\,}$  Some error codes are not applied to this machine.

 ${\sf G:General} \qquad \qquad {\sf C:Crawler\,Type} \qquad \qquad {\sf W:Wheel\,Type}$ 

DTC	<u> </u>	Dia was akin Oshasia	Ap	plicat	on			
HCESPN	FMI	Diagnostic Criteria	G	С	W			
HCESPN 164	4 6	(Detection)  (When Working Cutoff Relay is Off)  10 seconds continuous, Working Cutoff Relay drive unit Measurement Voltage ≤ 3.0V  (Cancellation)  (When Working Cutoff Relay is Off)  3 seconds continuous, Working Cutoff Relay drive unit Measurement Voltage > 3.0V  (Detection)  (When Working Cutoff Relay is On)  10 seconds continuous, Working Cutoff Relay drive current > 6.5 A  (Cancellation)	G	С	•			
		(When Working Cutoff Relay is On) 3 seconds continuous, Working Cutoff Relay drive current ≤ 6.5 A						
	(Resu	Its / Symptoms)						
	Control Function – (Wheel Excavator) In driving mode, attachment hydraulic pilot pressure cut off failure							
	,	king list)						
		-47 (#85) – CN-54 (#9) Checking Open/Short -47 (#30, #86) – Fuse box (#28) Checking Open/Short						
	2. 011	(Detection)						
	4	(When Power Max Solenoid is Off)  10 seconds continuous, Power Max Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Power Max Solenoid is Off)  3 seconds continuous, Power Max Solenoid drive unit Measurement Voltage > 3.0V	•					
166	6	(Detection)  (When Power Max Solenoid is On)  5 seconds continuous, Power Max Solenoid drive current > 4.5 A  (Cancellation)  (When Power Max Solenoid is On)  3 seconds continuous, Power Max Solenoid drive current ≤ 4.5 A	•					
	(Resu	Its / Symptoms)						
	,	ntrol Function – Voltage increase operation failure						
	(Chec	king list)						
		-88 (#1) – CN-53 (#10) Checking Open/Short						
	2. CN	-88 (#2) – Fuse box (#31) Checking Open/Short						

※ Some error codes are not applied to this machine.

 $\mbox{G : General} \qquad \qquad \mbox{C : Crawler Type} \qquad \qquad \mbox{W : Wheel Type}$ 

DTC	;	Diamental Criteria	Ap	plicati	on
HCESPN	FMI	Diagnostic Criteria	G	С	W
167		(Detection)  (When Travel Speed Solenoid is Off)  10 seconds continuous, Travel Speed Solenoid drive unit Measurement Voltage ≤ 3.0V  (Cancellation)  (When Travel Speed Solenoid is Off)  3 seconds continuous, Travel Speed Solenoid drive unit Measurement Voltage > 3.0V		•	
	4	(When Parking mode is not) (Detection) (When Travel Speed Solenoid is Off) 10 seconds continuous, Travel Speed Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Travel Speed Solenoid is Off) 3 seconds continuous, Travel Speed Solenoid drive unit Measurement Voltage > 3.0V			•
	6	(Detection)  (When Travel Speed Solenoid is On)  10 seconds continuous, Travel Speed Solenoid drive current > 4.5 A  (Cancellation)  (When Travel Speed Solenoid is On)  3 seconds continuous, Travel Speed Solenoid drive current ≤ 4.5 A	•		
	1. Coi	lts / Symptoms)  ntrol Function – driving in 1/2 transmission operation failure sking list)			
	1. CN	-70 (#1) – CN-52 (#5) Checking Open/Short -70 (#2) – Fuse box (#31) Checking Open/Short			

\* Some error codes are not applied to this machine.

 ${\sf G:General} \qquad \qquad {\sf C:Crawler\:Type} \qquad \qquad {\sf W:Wheel\:Type}$ 

DTC HCESPN FMI		Diagnostic Critoria		plicati	ion
HCESPN	FMI	Diagnostic Criteria	G	С	W
	4	Monitor – Selecting attachment(breaker / crusher) (Detection) (When Attachment Conflux Solenoid is Off) 10 seconds continuous, Attachment Conflux Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Attachment Conflux Solenoid is Off) 3 seconds continuous, Attachment Conflux Solenoid drive unit Measurement Voltage > 3.0V	•		
169	6	(Detection)  (When Attachment Conflux Solenoid is On)  10 seconds continuous, Attachment Conflux Solenoid drive Current > 6.5 A  (Cancellation)  (When Attachment Conflux Solenoid is On)  3 seconds continuous, Attachment Conflux Solenoid drive Current ≤ 6.5 A	•		
	(Resu	Its / symptoms)			
	1. Cor	ntrol Function – Option attachment flow control – Joining operation failure			
	(Eco	breaker mode, crusher mode)			
	(Chec	king list)			
	1. CN	-237 (#1) – CN-52 (#16) Checking Open/Short			
	2. CN	-237 (#2) – Fuse box (#28) Checking Open/Short			
170	4	(Model Parameter) mounting Arm Regenerating Solenoid (Detection) (When Arm Regeneration Solenoid is Off) 10 seconds continuous, Arm Regeneration Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Arm Regeneration Solenoid is Off) 3 seconds continuous, Arm Regeneration Solenoid drive unit Measurement Voltage > 3.0V	•		
	6	(Detection)  (When Arm Regeneration Solenoid is On)  10 seconds continuous, Arm Regeneration Solenoid drive current > 4.5 A  (Cancellation)  (When Arm Regeneration Solenoid is On)  3 seconds continuous, Arm Regeneration Solenoid drive current ≤ 4.5 A	•		
	(Resu	Its / symptoms)			
	· '	ntrol Function – Arm regeneration operation failure			
		king list)			
	l ,	-135 (#1) – CN-52 (#7) Checking Open/Short			
		-135 (#2) – Fuse box (#31) Checking Open/Short			

 $\ensuremath{\,\%\,}$  Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC HCESPN FMI		Diagnostic Criteria		plicat	ion		
HCESPN	FMI	Diagnostic Criteria	G	С	W		
	4	Monitor – Selecting attachment(crusher) (Detection) (When Attachment Safety Solenoid is Off) 10 seconds continuous, Attachment Safety Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Attachment Safety Solenoid is Off) 3 seconds continuous, Attachment Safety Solenoid drive unit Measurement Voltage > 3.0V	•				
171	6	(Detection)  (When Attachment Safety Solenoid is On)  10 seconds continuous, Attachment Safety Solenoid drive current > 6.5 A  (Cancellation)  (When Attachment Safety Solenoid is On)  3 seconds continuous, Attachment Safety Solenoid drive current ≤ 6.5 A	•				
	(Resu	lts / Symptoms)					
	1. Co	ntrol Function - Option attachment flow control - Option spool pilot pressur	e cut	off fa	ailure		
	(crusher mode)						
	(Chec	king list)					
	1. CN	-149 (#1) – CN-53 (#9) Checking Open/Short					
	2. CN	-149 (#2) – Fuse box (#28) Checking Open/Short					
	4	Monitor – Selecting attachment(breaker / crusher) (Detection) (When Breaker Operating Solenoid is Off) 10 seconds continuous, Attachment Safety Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Breaker Operating Solenoid is Off) 3 seconds continuous, Attachment Safety Solenoid drive unit Measurement Voltage > 3.0V	•				
179	6	(Detection)  (When Breaker Operating Solenoid is On)  10 seconds continuous, Attachment Safety Solenoid drive current > 6.5 A  (Cancellation)  (When Breaker Operating Solenoid is On)  3 seconds continuous, Attachment Safety Solenoid drive current ≤ 6.5 A  Its / Symptoms)	•				
	1. Cor (Chec 1. CN	ntrol Function – Option attachment flow control – Breaker operation failure (breaking list) -66 (#1) – CN-52 (#8) Checking Open/Short -66 (#2) – Fuse box (#34) Checking Open/Short	ıker m	node)			

\* Some error codes are not applied to this machine.

 ${\sf G:General} \qquad \qquad {\sf C:Crawler\,Type} \qquad \qquad {\sf W:Wheel\,Type}$ 

DTC		Diamonatic Criteria	Ар	plicat	ion
HCESPN	FMI	Diagnostic Criteria	G	С	W
181	4	(Model Parameter) mounting Reverse Cooling Fan Solenoid (Detection) (When Reverse Cooling Fan Solenoid is Off) 10 seconds continuous, Reverse Cooling Fan Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Reverse Cooling Fan Solenoid is Off) 3 seconds continuous, Reverse Cooling Fan Solenoid drive unit Measurement Voltage > 3.0V	•		
	6	<ul> <li>(Detection)</li> <li>(When Reverse Cooling Fan Solenoid is On)</li> <li>10 seconds continuous, Reverse Cooling Fan Solenoid drive current &gt; 4.5 A</li> <li>(Cancellation)</li> <li>(When Reverse Cooling Fan Solenoid is On)</li> <li>3 seconds continuous, Reverse Cooling Fan Solenoid drive current ≤ 4.5 A</li> </ul>	•		
	•	lts / Symptoms)			
	1. Cor	ntrol Function – Cooling Fan reverse control operation failure (not applicable)			
	5	(Detection)  (When Attach Flow EPPR A1 current is equal or more than 300 mA)  10 seconds continuous, Attach Flow EPPR A1 drive current < 100 mA  (Cancellation)  (When Attach Flow EPPR A1 current is equal or more than 300 mA)  3 seconds continuous, Attach Flow EPPR A1 drive current ≥ 100 mA	•		
188	6	(Detection) 10 seconds continuous, Attach Flow EPPR A1 drive current > 1.0 A (Cancellation) 3 seconds continuous, Attach Flow EPPR A1 drive current ≤ 1.0 A	•		
	1. Cor (Chec 1. CN	lts / Symptoms) htrol Function – IPC operation failure, Option attachment flow control operation fishing list) -242 (#2) – CN-54 (#27) Checking Open/Short -242 (#1) – CN-54 (#2) Checking Open/Short	failure	<b>)</b>	

 $<sup>\</sup>ensuremath{\,\%\,}$  Some error codes are not applied to this machine.

DTC	;	Diagnostic Criteria	Ap	plicat	ion
HCESPN	FMI	Diagnostic Criteria	G	С	W
	5	(Detection)  (When Attatch Flow EPPR A2 current is equal or more than 300 mA)  10 seconds continuous, Attatch Flow EPPR A2 drive current < 100 mA  (Cancellation)  (When Attatch Flow EPPR A2 current is equal or more than 300 mA)  3 seconds continuous, Attatch Flow EPPR A2 drive current ≥ 100 mA	•		
189	6	(Detection)  10 seconds continuous, Attatch Flow EPPR A2 drive current > 1.0 A  (Cancellation)  3 seconds continuous, Attatch Flow EPPR A2 drive current ≤ 1.0 A	•		
	1. Cor (Chec 1. CN	Its / Symptoms)  htrol Function – Option attachment flow control operation failure king list)  -378 (#2) – CN-54 (#26) Checking Open/Short  -378 (#1) – CN-54 (#3) Checking Open/Short			
	0	HW145 10 seconds continuous, Attachment flow control EPPR 1 press. Sensor Measurement Voltage > 5.2V			
	1	HW145 10 seconds continuous, 0.3V≤ Attachment flow control EPPR 1 press. Sensor Measurement Voltage < 0.8V			
196	4	HW145 10 seconds continuous, Attachment flow control EPPR 1 press. Sensor Measurement Voltage < 0.3V			
	1. Cor (Chec 1. CD- 2. CD-	Its / Symptoms) htrol Function – Driving second pump joining function operation failure king list) -93 (#B) – CN-52 (#34) Checking Open/Short -93 (#A) – CN-51 (#32) Checking Open/Short -93 (#C) – CN-51 (#31) Checking Open/Short			
	0	10 seconds continuous, Pump EPPR Press. Sensor Measurement Voltage $>$ 5.2V 10 seconds continuous, $0.3V \le$ Pump EPPR Press. Sensor Measurement Voltage $<$ 0.8V	•		
	4	10 seconds continuous, Pump EPPR Press. Sensor Measurement Voltage $<$ 0.3V			
200	1. Moi 2. Cor (Chec 1. CD- 2. CD-	Its / Symptoms)  nitor – Pump EPPR Press. display failure  ntrol Function – Pump input horse power control failure, Overload at compensation operation failure (Fuel efficiency/speed performance failure)  king list)  -44 (#B) – CN-51 (#13) Checking Open/Short  -44 (#A) – CN-51 (#32) Checking Open/Short  -44 (#C) – CN-51 (#31) Checking Open/Short	tion co	ontrol	

DTC		Diagnostic Criteria	Application		
HCESPN	FMI	Diagnostic Chiena	G	С	W
	0	(Mounting pressure sensor)  10 seconds continuous, Boom Cylinder Rod Press. Sensor Measurement Voltage > 5.2V	•		
	1	(Mounting pressure sensor)  10 seconds continuous, 0.3V≤ Boom Cylinder Rod Press. Sensor Measurement Voltage < 0.8V	•		
205	4	(Mounting pressure sensor)  10 seconds continuous, Boom Cylinder Rod Press. Sensor Measurement Voltage < 0.3V	•		
	1. Moi 2. Cor (Chec 1. CD- 2. CD-	Its / Symptoms)  nitor – Boom Cylinder Rod Press. display failure  ntrol Function – Boom floating control operation failure  king list)  -124 (#B) – CN-52 (#25) Checking Open/Short  -124 (#A) – CN-51 (#32) Checking Open/Short  -124 (#C) – CN-51 (#31) Checking Open/Short			
	4	Mounting pressure sensor (HCESPN128 or HCESPN 205) (Detection) (When Boom Up Floating Solenoid is Off) 10 seconds continuous, Boom Up Floating Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Boom Up Floating Solenoid is Off) 3 seconds continuous, Boom Up Floating Solenoid drive unit Measurement Voltage > 3.0V	•		
218	6	(Detection)  (When Boom Up Floating Solenoid is On)  10 seconds continuous, Boom Up Floating Solenoid drive current > 6.5 A  (Cancellation)  (When Boom Up Floating Solenoid is On)  3 seconds continuous, Boom Up Floating Solenoid drive current ≤ 6.5 A	•		
	1. Cor (Chec 1. CN	Its / Symptoms)  htrol Function – Boom floating control operation failure  king list)  -368 (#1) – CN-53 (#5) Checking Open/Short  -368 (#2) – Fuse box (#15) Checking Open/Short			1

DTC	<u> </u>	Discountie Office	Ap	plicati	on
HCESPN	FMI	Diagnostic Criteria	G	С	W
	4	Mounting pressure sensor (HCESPN 128 or 205) (Detection) (When Boom Down Pilot Pressure Cutoff Solenoid is Off) 10 seconds continuous, Boom Down Pilot Pressure Cutoff Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Boom Down Pilot Pressure Cutoff Solenoid is Off) 3 seconds continuous, Boom Down Pilot Pressure Cutoff Solenoid drive unit Measurement Voltage > 3.0V	•		
220	6	(Detection)  (When Boom Down Pilot Pressure Cutoff Solenoid is On)  10 seconds continuous, Boom Down Pilot Pressure Cutoff Solenoid drive current > 6.5 A  (Cancellation)  (When Boom Down Pilot Pressure Cutoff Solenoid is On)  3 seconds continuous, Boom Down Pilot Pressure Cutoff Solenoid drive current ≤ 6.5 A	•		
	(Resu	Its / Symptoms)			
	1. Cor	ntrol Function – Boom floating control operation failure			
	(Chec	king list)			
	1. CN	-369 (#1) – CN-53 (#8) Checking Open/Short			
	2. CN	-369 (#2) – Fuse box (#15) Checking Open/Short			
	5	Monitor – Selecting attachment(breaker / crusher) (Detection) (When ATT Relief Setting EPPR 1 Current is equal or more than 10 mA) 10 seconds continuous, ATT Relief Setting EPPR 1 drive current = 0 mA (Cancellation) ATT Relief Setting EPPR 1 Current is equal or more than 10 mA) 3 seconds continuous, ATT Relief Setting EPPR 1 drive current ≥ 10 mA	•		
221	6	(Detection)  10 seconds continuous, ATT Relief Setting EPPR 1 drive current > 1.0 A  (Cancellation)  3 seconds continuous, ATT Relief Setting EPPR 1 drive current ≤ 1.0 A	•		
	(Resu	Its / Symptoms)			
	l ,	ntrol Function – Option attachment flow control – P1 relief pressure setting failur	е		
	(Chec	king list)			
	1. CN	-365 (#2) – CN-54 (#17) Checking Open/Short			
	2. CN	-365 (#1) – CN-54 (#9) Checking Open/Short			

DTC	;	D: 1: 0 1: 1	Ap	plicat	ion
HCESPN	FMI	Diagnostic Criteria	G	С	W
	5	Monitor – Selecting attachment(crusher) (Detection) (When ATT Relief Setting EPPR 2 Current is equal or more than 10 mA) 10 seconds continuous, ATT Relief Setting EPPR 2 drive current = 0 mA (Cancellation) (When ATT Relief Setting EPPR 2 Current is equal or more than 10 mA) 3 seconds continuous, ATT Relief Setting EPPR 2 drive current ≥ 10mA	•		
222	6	(Detection) 10 seconds continuous, ATT Relief Setting EPPR 2 drive current > 1.0 A (Cancellation) 3 seconds continuous, ATT Relief Setting EPPR 2 drive current ≤ 1.0 A	•		
	'	Its / Symptoms)			
	(Chec	ntrol Function – Option attachment flow control – P2 relief pressure setting fail king list) -366 (#2) – CN-54 (#17) Checking Open/Short -366 (#1) – CN-54 (#10) Checking Open/Short	ure		
	3	10 seconds continuous, Fuel Level Measurement Voltage > 3.8V			
	4	10 seconds continuous, Fuel Level Measurement Voltage < 0.3V			
301	1. Mod (Chec 1. CD	lts / Symptoms) nitor – Fuel remaining display failure king list) -2 (#2) – CN-51 (#19) Checking Open/Short -2 (#1) – CN-51 (#24, 25) Checking Open/Short			
	4	(Model Parameter) mounting Fuel Warmer Relay (Detection) (When Fuel Warmer Relay is Off) 10 seconds continuous, Fuel Warmer Relay drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Fuel Warmer Relay is Off) 3 seconds continuous, Fuel Warmer Relay drive unit Measurement Voltage > 3.0V	•		
325	1. Cor	(Detection) (When Fuel Warmer Relay is On) 10 seconds continuous, Fuel Warmer Relay drive current > 4.5 A (Cancellation) (When Fuel Warmer Relay is On) 3 seconds continuous, Fuel Warmer Relay drive current ≤ 4.5 A  lts / Symptoms) ntrol Function – Fuel warmer operation failure king list)	•		
		-46 (#85) – CN-52 (#13) Checking Open/Short -46 (#86) – Fuse box (#22) Checking Open/Short			

DTC		Discounting Office in	Ap	plicat	ion
HCESPN	FMI	Diagnostic Criteria	G	С	W
	0	10 seconds continuous, Transmission Oil Press. Sensor Measurement Voltage > 5.2V			•
	1	10 seconds continuous, $0.3V \le Transmission Oil Press. Sensor Measurement Voltage < 0.8V$			•
504	4	10 seconds continuous, Transmission Oil Press. Sensor Measurement Voltage < 0.3V			•
501	1. Mor (Chec 1. CD- 2. CD-	Its / Symptoms) nitor – Transmission Oil Press. display failure, Transmission Oil low pressure waking list) -5 (#B) – CN-52 (#26) Checking Open/Short -5 (#A) – CN-51 (#32) Checking Open/Short -5 (#C) – CN-51 (#31) Checking Open/Short	arnin	g failu	re
	0	10 seconds continuous, Brake Oil Press. Sensor  Measurement Voltage > 5.2V  10 seconds continuous, 0.3V≤ Brake Oil Press. Sensor Measurement  Voltage < 0.8V			•
	4	10 seconds continuous, Brake Oil Press. Sensor Measurement Voltage < 0.3V			•
503	1. Mor (Chec 1. CD- 2. CD-	Its / Symptoms) nitor – Brake Oil Press. display failure, Brake Oil low pressure warning failure king list) -3 (#B) – CN-52 (#29) Checking Open/Short -3 (#A) – CN-51 (#32) Checking Open/Short -3 (#C) – CN-51 (#31) Checking Open/Short			
	0	10 seconds continuous, Working Brake Press. Sensor Measurement Voltage > 5.2V  10 seconds continuous, 0.3V≤ Working Brake Press. Sensor Measurement			•
	4	Voltage < 0.8V  10 seconds continuous, Working Brake Press. Sensor Measurement Voltage < 0.3V			•
505	1. Mor (Chec 1. CD 2. CD	lts / Symptoms) hitor – Working Brake Oil Press. display failure, Working Brake Oil low pressure king list) -38 (#B) – CN-51 (#30) Checking Open/Short -38 (#A) – CN-51 (#32) Checking Open/Short -38 (#C) – CN-51 (#31) Checking Open/Short	e warr	ning fa	illure

DTC	;	Diamantia Critaria	Ap	plicat	ion
HCESPN	FMI	Diagnostic Criteria	G	С	W
		(Detection)			
		(When Parking Relay is Off)			
		10 seconds continuous, Parking Relay drive unit			
	4	Measurement Voltage ≤ 3.0V			
	4	(Cancellation)			
		(When Parking Relay is Off)			
		3 seconds continuous, Parking Relay drive unit			
		Measurement Voltage > 3.0V			
		(Detection)			
514		(When Parking Relay is On)			
	6	10 seconds continuous, Parking Relay drive current > 6.5 A			
	O	(Cancellation)			
		(When Parking Relay is On)			
		3 seconds continuous, Parking Relay drive current ≤ 6.5 A			
	(Resu	Its / Symptoms)			
	1. Cor	ntrol Function – Parking Relay operation failure			
	(Chec	king list)			
	1. CR	-66 (#1) - CN-53 (#11) Checking Open/Short			
	2. CR	-66 (#2) - Fuse box (#30) Checking Open/Short			
		(Detection)			
		(When Traveling Cutoff Relay is Off)			
		10 seconds continuous, Traveling Cutoff Relay drive unit Measurement			
	4	Voltage ≤ 3.0V			
	7	(Cancellation)			
		(When Traveling Cutoff Relay is Off)			
		3 seconds continuous, Traveling Cutoff Relay drive unit Measurement			
		Voltage > 3.0V			
		(Detection)			
517		(When Traveling Cutoff Relay is On)			
	6	10 seconds continuous, Traveling Cutoff Relay drive current > 6.5 A			
		(Cancellation)			
		(When Traveling Cutoff Relay is On)			
		3 seconds continuous, Traveling Cutoff Relay drive current ≤ 6.5 A			
	,	Its / Symptoms)			
		ntrol Function – Traveling Cutoff Relay operation failure			
	,	king list)			
		-47 (#85) – CN-53 (#04) Checking Open/Short			
	2. CR	-47 (#86) – Fuse box (#28) Checking Open/Short			

※ Some error codes are not applied to this machine.

DTC	;	Diamantia Critaria	Ap	plicat	ion
HCESPN	FMI	Diagnostic Criteria	G	С	W
		(Detection)			
		(When Ram Lock Solenoid is Off)			
		10 seconds continuous, Ram Lock Solenoid drive unit Measurement			
	4	Voltage ≤ 3.0V			
	4	(Cancellation)			
		(When Ram Lock Solenoid is Off)			
		3 seconds continuous, Ram Lock Solenoid drive unit			
		Measurement Voltage > 3.0V			
		(Detection)			
525		(When Ram Lock Solenoid is On)			
	6	10 seconds continuous, Ram Lock Solenoid drive current > 6.5 A			
	0	(Cancellation)			
		(When Ram Lock Solenoid is On)			
		3 seconds continuous, Ram Lock Solenoid drive current ≤ 6.5 A			
	(Resu	Its / Symptoms)			
	1. Cor	ntrol Function – Ram lock control operation failure			
	(Chec	king list)			
	1. CN	-69 (#1) – CN-53 (#12) Checking Open/Short			
	2. CN	-69 (#2) – Fuse box (#33) Checking Open/Short			
		(Detection)			
		(When Creep Solenoid is Off)			
		10 seconds continuous, Creep Solenoid drive unit			
	4	$Measurement\ Voltage \leq 3.0V$			
	4	(Cancellation)			
		(When Creep Solenoid is Off)			
		3 seconds continuous, Creep Solenoid drive unit			
		Measurement Voltage > 3.0V			
		(Detection)			
527		(When Creep Solenoid is On)			
	6	10 seconds continuous, Creep Solenoid drive current > 6.5 A			
		(Cancellation)			
		(When Creep Solenoid is On)			
		3 seconds continuous, Creep Solenoid drive current ≤ 6.5 A			
	(Resu	Its / Symptoms)			
	1. Cor	ntrol Function – Creep mode operation failure			
	(Chec	king list)			
	1. CN	-206 (#1) – CN-52 (#17) Checking Open/Short			
	2. CN	-206 (#2) - Fuse box (#30) Checking Open/Short			

DTC		Dia was atta Oritaria	Ap	plicat	ion			
HCESPN	FMI	Diagnostic Criteria  10 seconds continuous, Travel Forward Press, Sensor Measurement		С	W			
	0	10 seconds continuous, Travel Forward Press. Sensor Measurement						
		Voltage > 5.2V						
	1	10 seconds continuous, 0.3V≤ Travel Forward Press. Sensor Measurement Voltage < 0.8V			•			
	4	10 seconds continuous, Travel Forward Press. Sensor Measurement Voltage < 0.3V			•			
530	(Resu	Its / Symptoms)						
	1. Mor	nitor – Travel Forward Press. display failure						
	2. Cor	ntrol Function – Driving interoperability power control operation failure						
	(Chec	king list)						
	1. CD-	-73 (#B) - CN-51 (#20) Checking Open/Short						
	2. CD-	-73 (#A) – CN-51 (#32) Checking Open/Short						
	3. CD-	-73 (#C) – CN-51 (#31) Checking Open/Short						
	1	10 seconds continuous, 0.3V≤ Travel Reverse Press. Sensor Measurement Voltage < 0.8V			•			
	4	10 seconds continuous, Travel Reverse Press. Sensor Measurement Voltage < 0.3V			•			
	(Resu	Its / Symptoms)						
531	,	nitor – Travel Reverse Press. display failure						
		ntrol Function – Driving interoperability power control operation failure						
	(Chec	king list)						
	1. CD-	-74 (#B) – CN-52 (#20) Checking Open/Short						
	2. CD-	-74 (#A) – CN-51 (#32) Checking Open/Short						
	3. CD-	-74 (#C) – CN-51 (#31) Checking Open/Short						
	0	10 seconds continuous, Battery input Voltage > 35V	•					
	1	10 seconds continuous, Battery input Voltage < 18V						
705	(Resu	Its / Symptoms)						
	1. Control Function – Startup impossibility							
	(Chec	king list)						
	1. CS-	74A (#1) – CN-51 (#1) Checking Open/Short						
		(When Engine is equal or more than 400 rpm) 10 seconds continuous,						
	1	Alternator Node L Measurement Voltage < 18V						
		(In case 12v goods, Alternator Node L Measurement Voltage < 9V)						
707	(Resu	Its / Symptoms)						
	1. Cor	ntrol Function – Battery charging circuit failure						
	,	king list)						
	1. CS-	74A (#1) – CN-51 (#26) Checking Open/Short						

DTC		Diagnostia Critoria	Ар	plicat	ion
HCESPN	FMI	Diagnostic Criteria	G	С	W
	3	(Model Parameter) Mounting Acc. Dial			
	3	10 seconds continuous, Acc. Dial Measurement Voltage > 5.2V			
	4	(Model Parameter) Mounting Acc. Dial			
		10 seconds continuous, Acc. Dial Measurement Voltage < 0.3V			
714	(Resu	Its / Symptoms)			
	1. Mo	nitor – Acc. Dial Voltage display failure			
	2. Cor	ntrol Function – Engine rpm control failure			
	`	king list)			
	1. CN	-7 (#15) – CN-52 (#33) Checking Open/Short			
		(Detection)			
		(When Travel Alarm (Buzzer) Sound is Off)			
		10 seconds continuous, Travel Alarm (Buzzer) Sound Relay drive unit			
	4	Measurement Voltage $\leq 3.0V$			
	4	(Cancellation)			
		(When Travel Alarm (Buzzer) Sound Relay is Off)			
		3 seconds continuous, Travel Alarm (Buzzer) Sound Relay drive unit			
		Measurement Voltage > 3.0V			
		(Detection)			
		(When Travel Alarm (Buzzer) Sound is On)			
722		10 seconds continuous, Travel Alarm (Buzzer) Sound Relay drive			
	6	current > 4.5 A			
	O	(Cancellation)			
		(When Travel Alarm (Buzzer) Sound is On)			
		3 seconds continuous, Travel Alarm (Buzzer) Sound Relay drive			
		current ≤ 4.5 A			
	(Resu	Its / Symptoms)			
	1. Cor	ntrol Function – Driving alarm operation failure			
	(Chec	king list)			
	1. CN	-81 (#1) – CN-52 (#9) Checking Open/Short			
	2. CN	-81 (#2) – Fuse box (#31) Checking Open/Short			
		(When mounting the A/C Controller)			
	2	60 seconds continuous, A/C Controller Communication Data Error			
	(Resu	Its / Symptoms)			
831	1. Cor	ntrol Function – A/C Controller operation failure			
		king list)			
	1. CN	-11 (#8) – CN-51 (#9) Checking Open/Short			
		-11 (#7) – CN-51 (#8) Checking Open/Short			
	2	60 seconds continuous, Cluster Communication Data Error			
	(Resu	lts / Symptoms)			
	'	ntrol Function – Cluster operation failure			
840		king list)			
	'	-56A (#5) – CN-52 (#1) Checking Open/Short			
		-56A (#4) – CN-52 (#2) Checking Open/Short			
	2. ON				

<sup>\*</sup> Some error codes are not applied to this machine.

C : Crawler Type G: General

W : Wheel Type 5-37

DTC	;	Diagnostic Criteria	Ар	ion	
HCESPN	FMI	Diagnostic Criteria	G	С	W
	2	10 seconds continuous, ECM Communication Data Error	•		
	(Resu	Its / Symptoms)			
841	1. Cor	ntrol Function – ECM operation failure			
041	(Chec	king list)			
	1. CN	-93 (#22) – CN-52 (#2) Checking Open/Short			
	2. CN	-93 (#46) – CN-52 (#1) Checking Open/Short			
	2	(When mounting the Haptic Controller)			
		60 seconds continuous, Haptic Controller Communication Data Error			
	(Resu	Its / Symptoms)			
848	1. Cor	ntrol Function – Haptic Controller operation failure			
	(Chec	king list)			
	1. CN				
	2. CN	-8 (#3) – CN-51 (#8) Checking Open/Short			
	2	(When mounting the RMCU)			
		60 seconds continuous, RMCU communication Data Error			
	,	luts / Symptoms)			
850		ntrol Function – RMCU operation failure			
	l ,	king list)			
		-125A (#3) – CN-51 (#9) Checking Open/Short			
	2. CN	-125A (#11) – CN-51 (#8) Checking Open/Short	1		
	2	(When mounting the AAVM)			
		60 seconds continuous, AAVM communication Data Error			
	,	Its / Symptoms)			
866		ntrol Function – AAVM operation failure			
	l ,	king list)			
		-9 (#5) – CN-51 (#9) Checking Open/Short -9 (#6) – CN-51 (#8) Checking Open/Short			
	2	60 seconds continuous, Membrane controller communication Data Error			
	l ,	lts / Symptoms)			
867		ntrol Function – Membrane controller operation failure			
	`	king list)			
		-376 (#10) – CN-51 (#9) Checking Open/Short			
	2. CN	-376 (#18) – CN-51 (#8) Checking Open/Short			

DTC		Diagnostia Critoria	Appli		ion					
HCESPN	FMI	Diagnostic Criteria	G	С	W					
	2	60 seconds continuous, Switch Controller communication Data Error								
	(Resu	Its / Symptoms)								
868	1. Cor	ntrol Function – Switch Controller operation failure								
000	(Chec	Checking list)								
	1. CN	l-56A (#7) – CN-51 (#8) Checking Open/Short								
	2. CN-56A (#6) – CN-51 (#9) Checking Open/Short									
	2	(When mounting the BKCU)								
		60 seconds continuous, BKCU communication Data Error								
	(Resu	Its / Symptoms)								
869	1. Cor	ntrol Function – BKCU operation failure								
	(Chec	(Checking list)								
	1. CS-	-2B (#B) – CN-51 (#8) Checking Open/Short								
	2. CS-	-2B (#A) - CN-51 (#9) Checking Open/Short								

\* Some error codes are not applied to this machine.

# 4. ENGINE FAULT CODE

J1939 SPN J1939 FMI	Name	Description
27 4	EGR valve position circuit	Voltage below normal, or shorted to low source
51 3	Engine intake throttle actuator position sensor circuit	Voltage above normal, or shorted to high source
51 4	Engine intake throttle actuator position sensor circuit	Voltage above normal, or shorted to low source
84 2	Wheel-based vehicle speed	Data erratic, intermittent or incorrect
84 10	Wheel-based vehicle speed sensor circuit tampering has been detected	Abnormal rate of change
84 19	Wheel-based vehicle speed	Received network data in error
91 3	Accelerator pedal or lever position sensor 1 circuit	Voltage above normal, or shorted to high source
91 4	Accelerator pedal or lever position sensor 1 circuit	Voltage below normal, or shorted to low source
91 1	Accelerator pedal or lever position 1 sensor circuit frequency	Data valid but below normal operating range
91 0	Accelerator pedal or lever position sensor 1	Data valid but above normal operational range - most severe level
91 2	Accelerator pedal or lever position sensor 1	Data erratic, intermittent or incorrect
91 3	Accelerator pedal or lever position sensor 1 circuit	Voltage above normal, or shorted to high source
91 4	Accelerator pedal or lever position sensor 1 circuit	Voltage below normal, or shorted to low source
91 19	SAE J1939 multiplexed accelerator pedal or lever sensor system	Received network data in error
91 9	SAE J1939 multiplexed accelerator pedal or lever sensor system	Abnormal update rate
94 3	Fuel delivery pressure sensor circuit	Voltage above normal, or shorted to high source
94 4	Fuel delivery pressure sensor circuit	Voltage below normal, or shorted to low source
95 16	Fuel filter differential pressure	Data valid but above normal operating range - moderately severe level
97 15	Water in fuel indicator	Data valid but above normal operating range - least severe level
97 3	Water in fuel indicator sensor circuit	Voltage above normal, or shorted to high source

<sup>\*</sup> Some fault codes are not applied to this machine.

J1939 SPN J1939 FMI	Name	Description
97 4	Water in fuel indicator sensor circuit	Voltage below normal, or shorted to low source
97 16	Water in fuel indicator	Data valid but above normal operating range - moderately severe level
100 3	Engine oil rifle pressure 1 sensor circuit	Voltage above normal, or shorted to high source
100 4	Engine oil rifle pressure 1 sensor circuit	Voltage below normal, or shorted to low source
100 18	Engine oil rifle pressure	Data valid but below normal operating range - moderately severe level
100 1	Engine oil rifle pressure	Data valid but below normal operational range - most severe level
100 2	Engine oil rifle pressure	Data erratic, intermittent or incorrect
102 3	Intake manifold 1 pressure sensor circuit	Voltage above normal, or shorted to high source
102 4	Intake manifold 1 pressure sensor circuit	Voltage below normal, or shorted to low source
102 16	Intake manifold 1 pressure	Data valid but above normal operating range - moderately severe level
102 2	Intake manifold 1 pressure	Data erratic, intermittent or incorrect
105 3	Intake manifold 1 temperature sensor circuit	Voltage above normal, or shorted to high source
105 4	Intake manifold 1 temperature sensor circuit	Voltage below normal, or shorted to low source
105 0	Intake manifold 1 temperature	Data valid but above normal operational range - most severe level
105 16	Intake manifold 1 temperature	Data valid but above normal operating range - moderately severe level
105 15	Intake manifold 1 temperature	Data valid but above normal operating range - least severe level
107 16	Engine air filter differential pressure	Data valid but above normal operating range - moderately severe level
107 15	Engine air filter differential pressure	Data valid but above normal operating range - least severe level
108 3	Barometric pressure sensor circuit	Voltage above normal, or shorted to high source
108 4	Barometric pressure sensor circuit	Voltage above normal, or shorted to low source
110 3	Engine coolant temperature 1 sensor circuit	Voltage above normal, or shorted to high source

<sup>※</sup> Some fault codes are not applied to this machine.

J1939 SPN J1939 FMI	Name	Description
110 4	Engine coolant temperature 1 sensor circuit	Voltage below normal, or shorted to low source
110 16	Engine coolant temperature	Data valid but above normal operating range - moderately severe level
110 0	Engine coolant temperature	Data valid but above normal operational range - most severe level
110 31	Engine coolant temperature	Condition exists
111 3	Coolant level sensor 1 circuit	Voltage above normal, or shorted to high source
111 4	Coolant level sensor 1 circuit	Voltage below normal, or shorted to low source
111 18	Coolant level	Data valid but below normal operating range - moderately severe level
111 1	Coolant level	Data valid but below normal operational range - most severe level
111 17	Coolant level	Data valid but below normal operating range - least severe level
111 9	Coolant level sensor	Abnormal update rate
111 3	Coolant level sensor 1 circuit	Voltage above normal, or shorted to high source
111 4	Coolant level sensor 1 circuit	Voltage below normal, or shorted to low source
157 0	Injector metering rail 1 pressure	Data valid but above normal operational range - most severe level
157 3	Injector metering rail 1 pressure sensor circuit	Voltage above normal, or shorted to high source
157 4	Injector metering rail 1 pressure sensor circuit	Voltage below normal, or shorted to low source
157 16	Injector metering rail 1 pressure	Data valid but above normal operating range - moderately severe level
157 18	Injector metering rail 1 pressure	Data valid but below normal operating range - moderately severe level
168 18	Battery 1 voltage	Data valid but below normal operating range - moderately severe level
168 16	Battery 1 voltage	Data valid but above normal operating range - moderately severe level
168 17	Battery 1 voltage	Data valid but below normal operating range - least severe level
168 15	Battery 1 voltage	Data valid but above normal operating range - least severe level

 $<sup>\</sup>ensuremath{\,\mathbb{X}\,}$  Some fault codes are not applied to this machine.

J1939 SPN J1939 FMI	Name	Description
168 17	Battery 1 voltage	Data valid but below normal operating range - moderately severe level
171 3	Ambient air temperature sensor 1 circuit	Voltage above normal, or shorted to high source
171 4	Ambient air temperature sensor 1 circuit	Voltage below normal, or shorted to low source
171 9	Ambient air temperature	Abnormal update rate
175 3	Engine oil temperature sensor 1 circuit	Voltage above normal, or shorted to high source
175 4	Engine oil temperature sensor 1 circuit	Voltage below normal, or shorted to low source
190 0	Engine crankshaft speed/position	Data valid but above normal operational range - most severe level
190 2	Engine crankshaft speed/position	Data erratic, intermittent or incorrect
190 2	Engine crankshaft speed/position	Data erratic, intermittent or incorrect
191 16	Transmission output shaft speed	Data valid but above normal operating range - moderately severe level
191 18	Transmission output shaft speed	Data valid but below normal operating range - moderately severe level
191 9	Transmission output shaft speed	Abnormal update rate
191 19	Transmission output shaft speed	Received network data in error
237 13	Vehicle identification number	Out of calibration
411 2	Exhaust gas recirculation differential pressure	Data erratic, intermittent or incorrect
411 3	Exhaust gas recirculation differential pressure sensor circuit	Voltage above normal, or shorted to high source
411 4	Exhaust gas recirculation differential pressure sensor circuit	Voltage below normal, or shorted to low source
412 3	Exhaust gas recirculation temperature sensor circuit	Voltage above normal, or shorted to high source
412 4	Exhaust gas recirculation temperature sensor circuit	Voltage below normal, or shorted to low source
412 15	Exhaust gas recirculation temperature	Data valid but above normal operating range - least severe level
412 16	Exhaust gas recirculation temperature	Data valid but above normal operating range - moderately severe level

<sup>※</sup> Some fault codes are not applied to this machine.

J1939 SPN J1939 FMI	Name	Description
441 14	Auxiliary temperature sensor input 1	Special instructions
441 3	Auxiliary temperature sensor input 1 circuit	Voltage above normal, or shorted to high source
441 4	Auxiliary temperature sensor input 1 circuit	Voltage below normal, or shorted to low source
441 14	Auxiliary temperature sensor input 1	Special instructions
442 3	Auxiliary temperature sensor input 2 circuit	Voltage above normal, or shorted to high source
442 4	Auxiliary temperature sensor input 2 circuit	Voltage below normal, or shorted to low source
558 2	Accelerator pedal or lever idle validation switch	Data erratic, intermittent or incorrect
558 13	Accelerator pedal or lever idle validation switch circuit	Out of calibration
558 19	Accelerator pedal or lever idle validation switch	Received network data in error
563 9	Anti-lock braking (ABS) controller	Abnormal update rate
563 31	Anti-lock braking (ABS) active	Condition exists
611 2	Auxiliary intermediate (PTO) speed switch validation	Data erratic, intermittent or incorrect
612 2	Engine magnetic speed/position lost both of two signals	Data erratic, intermittent or incorrect
625 9	Proprietary datalink error (OEM/vehicle datalink)	Abnormal update rate
629 12	Engine control module critical internal failure	Bad intelligent device or component
629 12	Engine control module warning internal hardware failure	Bad intelligent device or component
630 12	Engine control module calibration memory	Bad intelligent device or component
633 31	Electronic fuel injection control valve circuit	Condition exists
639 9	SAE J1939 multiplexing PGN timeout error	Abnormal update rate
639 13	SAE J1939 multiplexing configuration error	Out of calibration
640 14	Auxiliary commanded dual output shutdown	Special instructions

<sup>\*</sup> Some fault codes are not applied to this machine.

J1939 SPN J1939 FMI	Name	Description
641 15	VGT actuator driver over temperature (calculated)	Data valid but above normal operating range - least severe level
647 4	Fan control circuit	Voltage below normal, or shorted to low source
647 3	Fan control circuit	Voltage above normal, or shorted to high source
647 3	Fan control circuit	Voltage above normal, or shorted to high source
647 4	Fan control circuit	Voltage below normal, or shorted to low source
649 3	Engine exhaust back pressure regulator control circuit	Voltage above normal, or shorted to high source
649 4	Engine exhaust back pressure regulator control circuit	Voltage below normal, or shorted to low source
649 5	Engine exhaust back pressure regulator control circuit	Current below normal or open circuit
651 5	Injector solenoid driver cylinder 1 circuit	Current below normal or open circuit
652 5	Injector solenoid driver cylinder 2 circuit	Current below normal or open circuit
652 7	Injector solenoid driver cylinder 2	Mechanical system not responding or out of adjustment
653 5	Injector solenoid driver cylinder 3 circuit	Current below normal or open circuit
653 7	Injector solenoid driver cylinder 3	Mechanical system not responding or out of adjustment
654 5	Injector solenoid driver cylinder 4 circuit	Current below normal or open circuit
654 7	Injector solenoid driver cylinder 4	Mechanical system not responding or out of adjustment
677 3	Starter relay driver circuit	Voltage above normal, or shorted to high source
677 4	Starter relay driver circuit	Voltage below normal, or shorted to low source
697 3	Auxiliary PWM driver 1 circuit	Voltage above normal, or shorted to high source
697 4	Auxiliary PWM driver 1 circuit	Voltage below normal, or shorted to low source
701 14	Auxiliary input/output 1	Special instructions
702 3	Auxiliary input/output 2 circuit	Voltage above normal, or shorted to high source

<sup>※</sup> Some fault codes are not applied to this machine.

J1939 SPN J1939 FMI	Name	Description
703 3	Auxiliary input/output 3 circuit	Voltage above normal, or shorted to high source
723 7	Engine speed / position camshaft and crankshaft misalignment	Mechanical system not responding or out of adjustment
723 2	Engine camshaft speed / position sensor	Data erratic, intermittent or incorrect
729 3	Engine intake air heater 1 circuit	Voltage above normal, or shorted to high source
729 4	Engine intake air heater 1 circuit	Voltage below normal, or shorted to low source
748 9	Transmission output retarder	Abnormal update rate
862 3	Crankcase breather filter heater circuit	Voltage above normal, or shorted to high source
862 4	Crankcase breather filter heater circuit	Voltage below normal, or shorted to low source
974 3	Remote accelerator pedal or lever position sensor 1 circuit	Voltage above normal, or shorted to high source
974 4	Remote accelerator pedal or lever position sensor 1 circuit	Voltage below normal, or shorted to low source
974 19	SAE J1939 multiplexing remote accelerator pedal or lever position sensor system	Received network data in error
976 2	Auxiliary intermediate (PTO) speed switch validation	Data erratic, intermittent or incorrect
1072 3	Engine brake actuator driver 1 circuit	Voltage above normal, or shorted to high source
1072 4	Engine brake actuator driver 1 circuit	Voltage below normal, or shorted to low source
1073 4	Engine brake actuator driver output 2 circuit	Voltage below normal, or shorted to low source
1073 3	Engine brake actuator driver output 2 circuit	Voltage above normal, or shorted to high source
1075 3	Electric lift pump for engine fuel supply circuit	Voltage above normal, or shorted to high source
1075 4	Electric lift pump for engine fuel supply circuit	Voltage below normal, or shorted to low source
1081 9	Engine wait to start lamp	Abnormal update rate
1172 3	Turbocharger 1 compressor intake temperature circuit	Voltage above normal, or shorted to high source
1172 4	Turbocharger 1 compressor intake temperature circuit	Voltage below normal, or shorted to low source

<sup>\*</sup> Some fault codes are not applied to this machine.

J1939 SPN J1939 FMI	Name	Description
1176 3	Turbocharger 1 compressor intake pressure circuit	Voltage above normal, or shorted to high source
1176 4	Turbocharger 1 compressor intake pressure circuit	Voltage below normal, or shorted to low source
1176 2	Turbocharger 1 compressor intake pressure	Data erratic, intermittent or incorrect
1194 13	Anti-theft encryption seed	Out of calibration
1209 3	Exhaust gas pressure sensor 1 circuit	Voltage above normal, or shorted to high source
1209 4	Exhaust gas pressure sensor 1 circuit	Voltage below normal, or shorted to low source
1209 2	Exhaust gas pressure 1	Data erratic, intermittent or incorrect
1231 2	J1939 network #2	Data erratic, intermittent or incorrect
1235 2	J1939 network #3	Data erratic, intermittent or incorrect
1267 3	Idle shutdown vehicle accessories relay driver circuit	Voltage above normal, or shorted to high source
1267 4	Idle shutdown vehicle accessories relay driver circuit	Voltage below normal, or shorted to low source
1323 31	Engine misfire cylinder 1	Condition exists
1324 31	Engine misfire cylinder 2	Condition exists
1325 31	Engine misfire cylinder 3	Condition exists
1326 31	Engine misfire cylinder 4	Condition exists
1347 4	Engine fuel pump pressurizing assembly 1 circuit	Voltage below normal, or shorted to low source
1347 3	Engine fuel pump pressurizing assembly 1 circuit	Voltage above normal, or shorted to high source
1347 7	Engine fuel pump pressurizing assembly	Mechanical system not responding or out of adjustment
1349 3	Injector metering rail 2 pressure sensor circuit	Voltage above normal, or shorted to high source
1377 2	Multiple unit synchronization switch	Data erratic, intermittent or incorrect
1378 31	Engine oil change interval	Condition exists

 $<sup>\</sup>ensuremath{\,\%\,}$  Some fault codes are not applied to this machine.

J1939 SPN J1939 FMI	Name	Description
1387 3	Auxiliary pressure sensor input 1 circuit	Voltage above normal, or shorted to high source
1387 4	Auxiliary pressure sensor input 1 circuit	Voltage below normal, or shorted to low source
1388 14	Auxiliary pressure sensor input 2	Special instructions
1388 3	Auxiliary pressure sensor input 2 circuit	Voltage above normal, or shorted to high source
1388 4	Auxiliary pressure sensor input 2 circuit	Voltage below normal, or shorted to low source
1569 31	Engine protection torque derate	Condition exists
1623 9	Tachograph output shaft speed	Abnormal update rate
1623 19	Tachograph output shaft speed	Received network data in error
1623 13	Tachograph output shaft speed	Out of calibration
1632 14	Engine torque limit feature	Special instructions
1639 0	Fan speed	Data valid but above normal operational range - most severe level
1639 1	Fan speed	Data valid but below normal operational range - most severe level
1639 15	Fan speed	Data valid but above normal operational range - least severe level
1639 17	Fan speed	Data valid but below normal operational range - most severe level
1639 2	Fan speed	Data erratic, intermittent, or incorrect
1668 2	SAE J1939 network #4	Data erratic, intermittent or incorrect
1675 31	Engine starter mode overcrank protection	Condition exists
1761 4	Aftertreatment 1 diesel exhaust fluid tank level sensor circuit	Voltage below normal, or shorted to low source
1761 3	Aftertreatment 1 diesel exhaust fluid tank level sensor circuit	Voltage above normal, or shorted to high source
1761 1	Aftertreatment 1 diesel exhaust fluid tank level	Data valid but below normal operational range - most severe level
1761 17	Aftertreatment 1 diesel exhaust fluid tank level	Data valid but below normal operating range - least severe level

 $<sup>\</sup>ensuremath{\,\mathbb{X}\,}$  Some fault codes are not applied to this machine.

J1939 SPN J1939 FMI	Name	Description
1761 18	Aftertreatment 1 diesel exhaust fluid tank level	Data valid but below normal operating range - moderately severe level
1761 9	SAE J1939 multiplexing PGN timeout error	Abnormal update rate
1761 13	Aftertreatment 1 diesel exhaust fluid tank level sensor	Out of calibration
1761 11	Aftertreatment 1 diesel exhaust fluid tank level sensor	Root cause not known
1761 10	Aftertreatment 1 diesel exhaust fluid tank level sensor	Abnormal rate of change
2623 3	Accelerator pedal or lever position sensor 2 circuit	Voltage above normal, or shorted to high source
2623 4	Accelerator pedal or lever position sensor 2 circuit	Voltage below normal, or shorted to low source
2630 3	Engine charge air cooler outlet temperature	Voltage above normal, or shorted to high source
2630 4	Engine charge air cooler outlet temperature	Voltage below normal, or shorted to low source
2789 15	Turbocharger turbine intake temperature	Data valid but above normal operating range - least severe
2791 13	EGR valve controller	Out of calibration
2791 15	EGR valve control circuit over temperature	Data valid but above normal operating range - least severe level
2791 5	EGR valve control circuit	Current below normal or open circuit
2791 6	EGR valve control circuit	Current above normal or grounded circuit
2791 7	EGR valve control circuit	Mechanical system not responding or out of adjustment
2797 13	Engine injector bank 1 barcodes	Out of calibration
3031 4	Aftertreatment 1 diesel exhaust fluid tank temperature sensor	Voltage below normal, or shorted to low source
3031 3	Aftertreatment 1 diesel exhaust fluid tank temperature sensor	Voltage above normal, or shorted to high source
3031 2	Aftertreatment 1 diesel exhaust fluid tank temperature	Data erratic, intermittent or incorrect
3031 9	Aftertreatment 1 diesel exhaust fluid tank temperature	Abnormal update rate
3031 13	Aftertreatment 1 diesel exhaust fluid tank temperature sensor	Out of calibration

 $<sup>\</sup>ensuremath{\,\%\,}$  Some fault codes are not applied to this machine.

J1939 SPN J1939 FMI	Name	Description
3031 11	Aftertreatment 1 diesel exhaust fluid tank temperature	Root cause not known
3216 4	Aftertreatment 1 intake NOx sensor circuit	Voltage below normal, or shorted to low source
3216 2	Aftertreatment 1 intake NOx sensor	Data erratic, intermittent or incorrect
3216 9	Aftertreatment 1 intake NOx sensor	Abnormal update rate
3216 13	Aftertreatment 1 intake NOx	Out of calibration
3216 10	Aftertreatment 1 intake NOx sensor	Abnormal rate of change
3216 20	Aftertreatment 1 intake NOx sensor	Data not rational - drifted high
3216 21	Aftertreatment 1 intake NOx sensor	Data not rational - drifted low
3218 2	Aftertreatment 1 intake NOx sensor power supply	Data erratic, intermittent or incorrect
3226 2	Aftertreatment 1 outlet NOx sensor	Data erratic, intermittent or incorrect
3226 4	Aftertreatment 1 outlet NOx sensor circuit	Voltage below normal, or shorted to low source
3226 9	Aftertreatment 1 outlet NOx sensor	Abnormal update rate
3226 10	Aftertreatment 1 outlet NOx sensor	Abnormal rate of change
3226 13	Aftertreatment 1 outlet NOx sensor	Out of calibration
3226 20	Aftertreatment 1 outlet NOx sensor	Data not rational - drifted high
3226 21	Aftertreatment 1 outlet NOx sensor	Data not rational - drifted high
3228 2	Aftertreatment 1 outlet NOx sensor power supply	Data erratic, intermittent or incorrect
3249 17	Aftertreatment exhaust gas temperature 2	Data valid but below normal operating range - least severe level
3249 18	Aftertreatment exhaust gas temperature 2	Data valid but below normal operating range - moderately severe level
3361 2	Aftertreatment 1 diesel exhaust fluid dosing unit temperature	Data erratic, intermittent or incorrect
3361 3	Aftertreatment 1 diesel exhaust fluid dosing unit	Voltage above normal, or shorted to high source

 $<sup>\</sup>ensuremath{\,\%\,}$  Some fault codes are not applied to this machine.

J1939 SPN J1939 FMI	Name	Description
3361 4	Aftertreatment 1 diesel exhaust fluid dosing unit	Voltage below normal, or shorted to low source
3362 31	Aftertreatment 1 diesel exhaust fluid dosing unit input lines	Condition exists
3363 3	Aftertreatment 1 diesel exhaust fluid tank heater	Voltage above normal, or shorted to high source
3363 4	Aftertreatment 1 diesel exhaust fluid tank heater	Voltage below normal, or shorted to low source
3363 18	Aftertreatment 1 diesel exhaust fluid tank heater	Data valid but below normal operating range - moderately severe level
3363 16	Aftertreatment 1 diesel exhaust fluid tank heater	Data valid but above normal operating range - moderately severe level
3363 7	Aftertreatment 1 diesel exhaust fluid tank heater	Mechanical system not responding or out of adjustment
3363 18	Aftertreatment 1 diesel exhaust fluid tank heater	Data valid but below normal operating range - moderately severe level
3363 3	Aftertreatment 1 diesel exhaust fluid tank heater	Voltage above normal, or shorted to high source
3363 4	Aftertreatment 1 diesel exhaust fluid tank heater	Voltage below normal, or shorted to low source
3364 4	Aftertreatment diesel exhaust fluid quality sensor circuit	Voltage below normal, or shorted to low source
3364 3	Aftertreatment diesel exhaust fluid quality sensor circuit	Voltage above normal, or shorted to high source
3364 13	Aftertreatment diesel exhaust fluid quality	Out of calibration
3364 11	Aftertreatment diesel exhaust fluid quality	Root cause not known
3364 1	Aftertreatment diesel exhaust fluid quality	Data valid but below normal operational range - most severe level
3364 18	Aftertreatment diesel exhaust fluid quality	Data valid but below normal operating range - moderate severe level
3364 9	Aftertreatment diesel exhaust fluid quality	Abnormal update rate
3364 7	Aftertreatment diesel exhaust fluid quality sensor	Mechanical system not responding or out of adjustment
3364 12	Aftertreatment diesel exhaust fluid quality sensor	Bad intelligent device or component
3364 2	Aftertreatment diesel exhaust fluid quality	Data erratic, intermittent or incorrect
3364 10	Aftertreatment diesel exhaust fluid quality	Abnormal rate of change

<sup>\*</sup> Some fault codes are not applied to this machine.

J1939 SPN J1939 FMI	Name	Description		
3364 18	Aftertreatment diesel exhaust fluid quality	Data valid but below normal operating range - moderately severe level		
3464 3	Electronic throttle control actuator driver circuit	Voltage above normal, or shorted to high source		
3464 4	Electronic throttle control actuator driver circuit	Voltage above normal, or shorted to low source		
3464 5	Electronic throttle control actuator driver circuit	Current below normal or open circuit		
3509 4	Sensor supply 1 circuit	Voltage below normal, or shorted to low source		
3509 3	Sensor supply 1 circuit	Voltage above normal, or shorted to high source		
3510 4	Sensor supply 2 circuit	Voltage below normal, or shorted to low source		
3510 3	Sensor supply 2 circuit	Voltage above normal, or shorted to high source		
3511 4	Sensor supply 3 circuit	Voltage below normal, or shorted to low source		
3511 3	Sensor supply 3 circuit	Voltage above normal, or shorted to high source		
3512 3	Sensor supply 4 circuit	Voltage above normal, or shorted to high source		
3512 4	Sensor supply 4 circuit	Voltage below normal, or shorted to low source		
3513 3	Sensor supply 5	Voltage above normal, or shorted to high source		
3513 4	Sensor supply 5	Voltage below normal, or shorted to low source		
3514 3	Sensor supply 6 circuit	Voltage above normal, or shorted to high source		
3514 4	Sensor supply 6 circuit	Voltage below normal, or shorted to low source		
3515 10	Aftertreatment 1 diesel exhaust fluid temperature 2	Abnormal rate of change		
3515 5	Aftertreatment 1 diesel exhaust fluid temperature 2 sensor circuit	Current below normal or open circuit		
3515 6	Aftertreatment 1 diesel exhaust fluid temperature 2 sensor circuit	Current above normal or grounded		
3515 11	Aftertreatment 1 diesel exhaust fluid temperature 2	Root cause not known		
3515 10	Aftertreatment 1 diesel exhaust fluid temperature 2	Abnormal rate of change		

 $<sup>\</sup>ensuremath{\,\%\,}$  Some fault codes are not applied to this machine.

J1939 SPN J1939 FMI	Name	Description		
3521 11	Aftertreatment 1 diesel exhaust fluid property	Root cause not known		
3597 12	Injector power supply	Bad intelligent device or component		
3597 2	Power supply lost with ignition on	Data erratic, intermittent or incorrect		
3597 17	ECU power output supply voltage 1	Data valid but below normal operating range - moderately severe level		
3667 3	Engine air shutoff circuit	Voltage above normal, or shorted to high source		
3667 4	Engine air shutoff circuit	Voltage below normal, or shorted to low source		
3695 2	Aftertreatment regeneration inhibit switch	Data erratic, intermittent or incorrect		
3695 2	Aftertreatment regeneration inhibit switch	Data erratic, intermittent or incorrect		
3750 14	Diesel particulate filter 1 conditions not met for active regeneration	Condition exists		
4094 31	NOx limits exceeded due to insufficient reagent quality	Condition exists		
4096 31	Aftertreatment diesel exhaust fluid tank empty	Condition exists		
4185 31	Overspeed shutdown relay driver diagnostic has detected an error	Condition exists		
4186 31	Low oil pressure (LOP) shutdown relay driver diagnostic has detected an error	Condition exists		
4187 31	High engine temperature (HET) shutdown relay driver diagnostic has detected an error	Condition exists		
4188 31	Pre-low oil pressure warning relay driver diagnostic has detected an error	Condition exists		
4223 31	Pre-high engine temperature warning relay driver diagnostic has detected an error	Condition exists		
4334 3	Aftertreatment 1 diesel exhaust fluid pressure sensor	Voltage above normal, or shorted to high source		
4334 4	Aftertreatment 1 diesel exhaust fluid pressure sensor	Voltage below normal, or shorted to low source		
4334 18	Aftertreatment 1 diesel exhaust fluid pressure sensor	Data valid but below normal operating range		
4334 16	Aftertreatment 1 diesel exhaust fluid pressure sensor	Data valid but above normal operating range		

 $<sup>\</sup>ensuremath{\,\%\,}$  Some fault codes are not applied to this machine.

J1939 SPN J1939 FMI	Name	Description		
4334 2	Aftertreatment 1 diesel exhaust fluid pressure sensor	Data erratic, intermittent or incorrect		
4337 10	Aftertreatment 1 diesel exhaust fluid dosing temperature	Abnormal rate of change		
4340 3	Aftertreatment 1 diesel exhaust fluid line heater 1 circuit	Voltage above normal, or shorted to high source		
4340 4	Aftertreatment 1 diesel exhaust fluid line heater 1 circuit	Voltage below normal, or shorted to low source		
4340 5	Aftertreatment 1 diesel exhaust fluid line heater 1 circuit	Current below normal or open circuit		
4342 3	Aftertreatment 1 diesel exhaust fluid line heater 2 circuit	Voltage above normal, or shorted to high source		
4342 4	Aftertreatment 1 diesel exhaust fluid line heater 2 circuit	Voltage below normal, or shorted to low source		
4342 5	Aftertreatment 1 diesel exhaust fluid line heater 2 circuit	Current below normal or open circuit		
4344 3	Aftertreatment diesel exhaust fluid line heater 3 circuit	Voltage above normal, or shorted to high source		
4344 4	Aftertreatment diesel exhaust fluid line heater 3 circuit	Voltage below normal, or shorted to low source		
4344 5	Aftertreatment diesel exhaust fluid line heater 3 circuit	Current below normal or open circuit		
4360 3	Aftertreatment 1 SCR intake temperature sensor circuit	Voltage above normal, or shorted to high source		
4360 4	Aftertreatment 1 SCR intake temperature sensor circuit	Voltage below normal, or shorted to low source		
4360 2	Aftertreatment 1 SCR intake temperature sensor	Data erratic, intermittent or incorrect		
4360 15	Aftertreatment 1 SCR intake temperature	Data valid but above normal operating range - least severe		
4360 0	Aftertreatment 1 SCR intake temperature	Data valid but above normal operational range - most severe level		
4360 16	Aftertreatment 1 SCR intake temperature	Data valid but above normal operating range - moderately severe level		
4363 3	Aftertreatment 1 SCR outlet temperature sensor circuit	Voltage above normal, or shorted to high source		
4363 4	Aftertreatment 1 SCR outlet temperature sensor circuit	Voltage below normal, or shorted to low source		
4363 2	Aftertreatment 1 SCR outlet temperature sensor	Data erratic, intermittent or incorrect		
4363 0	Aftertreatment 1 SCR outlet temperature	Data valid but above normal operational range - most severe		

 $<sup>\</sup>ensuremath{\,\%\,}$  Some fault codes are not applied to this machine.

J1939 SPN J1939 FMI	Name	Description		
4363 16	Aftertreatment 1 SCR outlet temperature	Data valid but above normal operating range - moderately severe level		
4364 18	Aftertreatment SCR catalyst conversion efficiency	Data valid but below normal operating range - moderately severe level		
4364 17	Aftertreatment SCR catalyst conversion efficiency	Data valid but below normal operating range - moderately severe level		
4376 3	Aftertreatment diesel exhaust fluid return valve	Voltage above normal, or shorted to high source		
4376 4	Aftertreatment diesel exhaust fluid return valve	Voltage below normal, or shorted to low source		
4376 7	Aftertreatment diesel exhaust fluid return valve	Mechanical system not responding or out of adjust		
4765 16	Aftertreatment 1 diesel oxidation catalyst intake temperature	Data valid but above normal operating range		
4765 4	Aftertreatment 1 diesel oxidation catalyst intake temperature sensor circuit	Voltage below normal, or shorted to low source		
4765 3	Aftertreatment 1 diesel oxidation catalyst intake temperature sensor circuit	Voltage above normal, or shorted to high source		
4765 2	Aftertreatment 1 diesel oxidation catalyst intake temperature	Data erratic, intermittent or incorrect		
4792 7	Aftertreatment SCR catalyst system	Mechanical system not responding or out of adjustment		
4792 14	Aftertreatment 1 SCR catalyst system	Special instructions		
4794 31	Aftertreatment 1 SCR catalyst system missing	Condition exists		
4796 31	Aftertreatment 1 diesel oxidation catalyst missing	Condition exists		
5018 11	Aftertreatment 1 diesel oxidation catalyst face plugged	Root cause not known		
5024 10	Aftertreatment 1 intake NOx sensor heater	Abnormal rate of change		
5031 10	Aftertreatment 1 outlet NOx sensor heater	Abnormal rate of change		
5125 3	Sensor supply 7 circuit	Voltage above normal, or shorted to high source		
5125 4	Sensor supply 7 circuit	Voltage below normal, or shorted to low source		
5245 31	Aftertreatment diesel exhaust fluid tank low level indicator	-		
5246 0	Aftertreatment SCR operator inducement	Data valid but above normal operational range - most severe level		

<sup>※</sup> Some fault codes are not applied to this machine.

J1939 SPN J1939 FMI	Name	Description		
5298 18	Aftertreatment 1 diesel oxidation catalyst conversion efficiency	Data valid but below normal operating range - moderately severe level		
5298 17	Aftertreatment 1 diesel oxidation catalyst conversion efficiency	Data valid but below normal operating range - moderately severe level		
5394 5	Aftertreatment diesel exhaust fluid dosing valve	Current below normal or open circuit		
5394 7	Aftertreatment diesel exhaust fluid dosing valve	Mechanical system not responding or out of adjustment		
5394 2	Aftertreatment diesel exhaust fluid dosing valve	Data erratic, intermittent or incorrect		
5484 3	Engine fan clutch 2 control circuit	Voltage above normal, or shorted to high source		
5484 4	Engine fan clutch 2 control circuit	Voltage below normal, or shorted to low source		
5491 3	Aftertreatment diesel exhaust fluid line heater relay	Voltage above normal, or shorted to high source		
5491 4	Aftertreatment diesel exhaust fluid line heater relay	Voltage below normal, or shorted to low source		
5491 7	Aftertreatment 1 diesel exhaust fluid line heater relay	Mechanical system not responding or out of adjustment		
5571 7	High pressure common rail fuel pressure relief valve	Mechanical system not responding or out of adjustment		
5571 0	High pressure common rail fuel pressure relief valve	Data valid but above normal operational range		
5571 15	High pressure common rail fuel pressure relief valve	Data valid but above normal operating range - least severe level		
5603 9	Cruise control disable command	Abnormal update rate		
5603 31	Cruise control disable command	Condition exists		
5605 31	Cruise control pause command	Condition exists		
5625 3	Engine exhaust back pressure regulator position sensor circuit	Voltage above normal, or shorted to high source		
5625 4	Engine exhaust back pressure regulator position sensor circuit	Voltage below normal, or shorted to low source		
5626 13	Engine exhaust back pressure regulator	Out of calibration		
5742 12	Aftertreatment diesel particulate filter temperature sensor module	Bad intelligent device or component		
5743 9	Aftertreatment selective catalytic reduction temperature sensor module	Abnormal update rate		

<sup>\*</sup> Some fault codes are not applied to this machine.

J1939 SPN J1939 FMI	Name	Description		
5743 12	Aftertreatment selective catalytic reduction temperature sensor module	Bad intelligent device or component		
5743 3	Aftertreatment selective catalytic reduction temperature sensor module	Voltage above normal, or shorted to high source		
5743 4	Aftertreatment selective catalytic reduction temperature sensor module	Voltage below normal, or shorted to low source		
5743 16	Aftertreatment selective catalytic reduction temperature sensor module	Data valid but above normal		
5743 11	Aftertreatment selective catalytic reduction temperature sensor module	Root cause not known		
5745 3	Aftertreatment 1 diesel exhaust fluid dosing unit heater	Voltage above normal, or shorted to high source		
5745 4	Aftertreatment 1 diesel exhaust fluid dosing unit heater	Voltage below normal, or shorted to low source		
5745 18	Aftertreatment 1 diesel exhaust fluid dosing unit heater	Data valid but below normal operating range		
5745 17	Aftertreatment 1 diesel exhaust fluid dosing unit heater	Data valid but below normal operating range		
5746 3	Aftertreatment 1 diesel exhaust fluid dosing unit heater relay	Voltage above normal, or shorted to high source		
5746 4	Aftertreatment 1 diesel exhaust fluid dosing unit heater relay	Voltage below normal, or shorted to low source		
5798 10	Aftertreatment 1 diesel exhaust fluid dosing unit heater temperature	Abnormal rate of change		
6655 3	Maintain ECU power lamp	Voltage above normal, or shorted to high source		
6655 4	Maintain ECU power lamp	Voltage below normal, or shorted to low source		
6799 3	Fan blade pitch position sensor circuit	Voltage above normal, or shorted to high source		
6799 4	Fan blade pitch position sensor circuit	Voltage below normal, or shorted to low source		
6799 7	Fan blade pitch	Mechanical system not responding or out of adjustment		
6799 2	Fan blade pitch	Data erratic, intermittent, or incorrect		
6802 31	Aftertreatment 1 diesel exhaust fluid dosing system frozen	Condition exists		
6881 9	Scr operator inducement override switch	Abnormal update rate		
6881 13	Scr operator inducement override switch	Out of calibration		

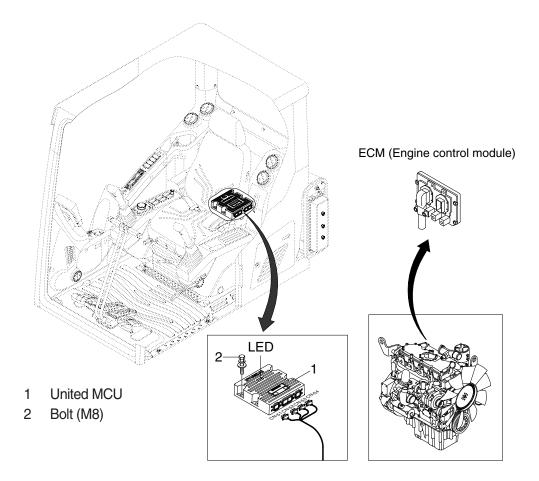
 $<sup>\</sup>ensuremath{\,\%\,}$  Some fault codes are not applied to this machine.

J1939 SPN J1939 FMI	Name	Description		
6918 31	Scr system cleaning inhibited due to inhibit switch	Condition exists		
6928 31	Scr system cleaning inhibited due to system timeout	Condition exists		
7848 14	Aftertreatment 1 scr system conditions not met for active cleaning	Special instructions		
520968 9	Machine constrained operation	Abnormal update rate. No communication or an invalid data transfer rate has been detected on the J1939 data link between the ECM and the machine electronic control unit.		
520968 19	Machine constrained operation	Received network data in error. The received J1939 datalink message was not valid.		
524286 31	Aftertreatment 1 diesel oxidation catalyst system	Special instruction		

<sup>\*</sup> Some fault codes are not applied to this machine.

# **GROUP 13 ENGINE CONTROL SYSTEM**

## 1. UNITED MCU and ENGINE ECM



140LC5MS52

## 2. UNITED MCU ASSEMBLY

- 1) To match the pump absorption torque with the engine torque, united MCU varies EPPR valve output pressure, which control pump discharge amount whenever feedbacked engine speed drops under the reference rpm of each mode set.
- 2) Three LED lamps on the united MCU display as below.

LED lamp	Trouble	Service	
G is turned ON	Normal	-	
G and R are turned ON	Trouble on united MCU	· Change the united MCU	
G and Y are turned ON	Trouble on serial communication line	Check if serial communication     lines between united MCU and cluster are disconnected	
Three LED are turned OFF	Trouble on united MCU power	<ul> <li>Check if the input power wire (24 V, GND) of united MCU is disconnected</li> <li>Check the fuse</li> </ul>	

G: green, R: red, Y: yellow

# **GROUP 14 EPPR VALVE**

### 1. PUMP EPPR VALVE

#### 1) COMPOSITION

EPPR (Electro Proportional Pressure Reducing) valve consists of electro magnet and spool valve installed at main pump.

### (1) Electro magnet valve

Receive electric current from MCU and move the spool proportionally according to the specific amount of electric current value.

### (2) Spool valve

Is the two way direction control valve for pilot pressure to reduce main pump flow. When the electro magnet valve is activated, pilot pressure enters into flow regulator of main pump.

## (3) Pressure and electric current value for each mode

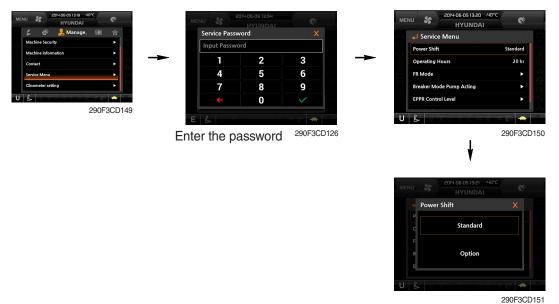
Mode		Pressure		Electric current	Engine rpm
		kgf/cm <sup>2</sup>	psi	(mA)	(at accel dial 10)
	Р	10	142	330 ± 30	1850 ± 50
Standard	S	13 $\pm$ 3	189 ± 40	365 ± 30	1750 ± 50
	E	15 ± 3	218 ± 40	400 ± 30	1650 ± 50
	Р	0	0	160 ± 30	2100 ± 50
Option	S	5 ± 3	73 ± 40	250 ± 30	2000 ± 50
	Е	10 ± 3	142 ± 40	330 ± 30	1750 ± 50

### 2) HOW TO SWITCH THE POWER SHIFT (STANDARD ↔ OPTION) ON THE CLUSTER

You can switch the EPPR valve pressure set by selecting the power shift (standard ↔ option).

### - Management

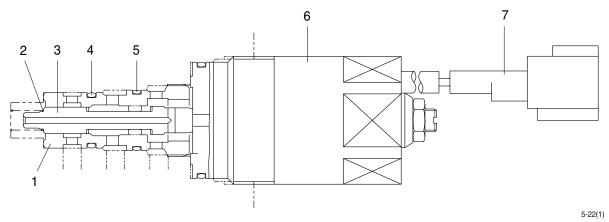
· Service menu



· Power shift (standard/option): Power shift pressure can be set by option menu.

# 3) OPERATING PRINCIPLE (PUMP EPPR VALVE)

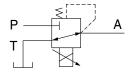
# (1) Structure



- 1 Sleeve
- 2 Spring
- 3 Spool

- 4 O-ring
- 5 O-ring

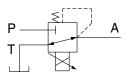
- 6 Solenoid valve
- 7 Connector

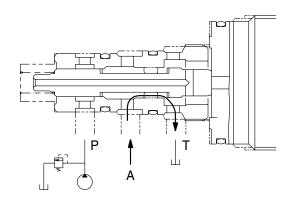


- P Pilot oil supply line (pilot pressure)
- T Return to tank
- A Secondary pressure to flow regulator at main pump

# (2) Neutral

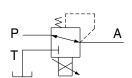
Pressure line is blocked and A oil returns to tank.

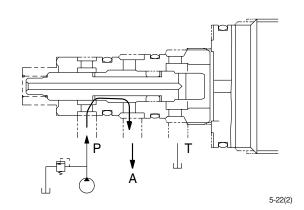




# (3) Operating

Secondary pressure enters into A.





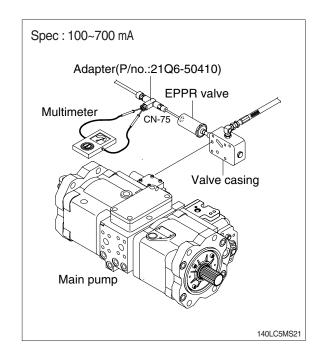
# 4) EPPR VALVE CHECK PROCEDURE

## (1) Check electric current value at EPPR valve

- ① Disconnect connector CN-75 from EPPR valve.
- ② Insert the adapter to CN-75 and install multimeter as figure.
- ③ Start engine.
- ④ Set S-mode and cancel auto decel mode.
  Position the multimodal dial at 10.
- $^{\scriptsize{\textcircled{5}}}$  If rpm display show approx 1750  $\pm$  50 rpm
- ⑥ check electric current at bucket circuit relief position.

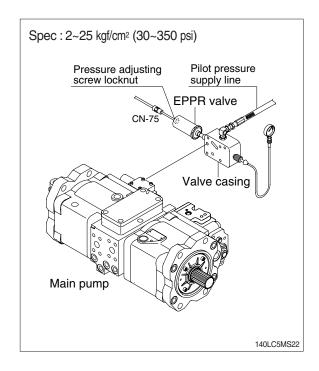
Check electric current at bucket circuit

7 relief position.



# (2) Check pressure at EPPR valve

- ① Remove plug and connect pressure gauge as figure.
  - · Gauge capacity: 0 to 50 kgf/cm² (0 to 725 psi)
- ② Start engine.
- 3 Set S-mode and cancel auto decel mode.
- 4 Position the multimodal dial at 10.
- $\bigcirc$  If tachometer show approx 1750 $\pm$ 50 rpm check pressure at relief position of bucket circuit by operating bucket control lever.
- 6 If pressure is not correct, adjust it.
- 7 After adjust, test the machine.



### 2. BOOM PRIORITY EPPR VALVE

## 1) COMPOSITION

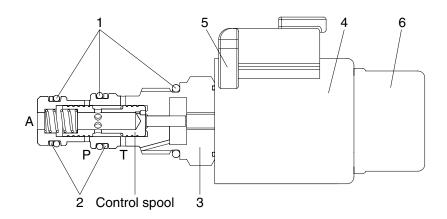
The boom priority EPPR valve is built in a manifold and mainly consisting of valve body and coil. This EPPR valve installed under the solenoid valve.

### 2) CONTROL

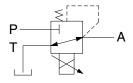
The boom priority EPPR valve has to be controlled by a specific electronic amplifier card, which is supplying the coil with a current 580 mA at  $30\Omega$  and 24 V.

### 3) OPERATING PRINCIPLE

## (1) Structure



21095MS14



P : Pilot supply line T : Return to tank

A : Secondary pressure to flow MCV

O-ring
 Support ring

3 Valve body

5 Connector

4 Coil

6 Cover cap

#### (2) Operation

In de-energized mode the inlet port (P) is closed and the outlet port (A) is connected to tank port (T).

In energized mode the solenoid armature presses onto the control spool with a force corresponding to the amount of current. This will set a reduced pressure at port A. The setting is proportional to the amount of current applied.

## (3) Maximum pressure relief

If a pressure from outside is applied on port A the valve may directly switch to tank port (T) and protect the system before overload.

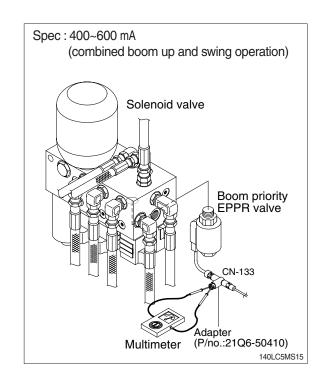
# 2) EPPR VALVE CHECK PROCEDURE

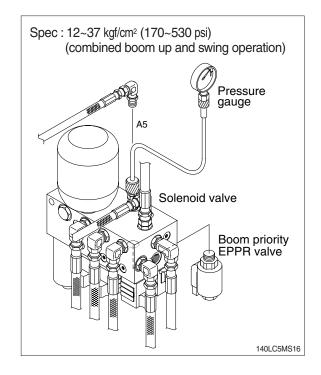
# (1) Check electric current value at EPPR valve

- ① Disconnect connector CN-133 from EPPR valve.
- ② Insert the adapter to CN-133 and install multimeter as figure.
- ③ Start engine.
- Set S-mode and cancel auto decel mode.
- ⑥ Check electric current in case of combined boom up and swing operation.

# (2) Check pressure at EPPR valve

- ① Remove hose from A5 port and connect pressure gauge as figure.
  - · Gauge capacity: 0 to 50 kgf/cm² (0 to 725 psi)
- ② Start engine.
- 3 Set S-mode and cancel auto decel mode.
- 4 If rpm display approx 1750 $\pm$ 50 rpm check pressure (In case of combined boom up and swing operation).
- (5) If pressure is not correct, adjust it.
- (6) After adjust, test the machine.





# **GROUP 15 MONITORING SYSTEM**

# 1. OUTLINE

Monitoring system consists of the monitor part and switch part.

The monitor part gives warnings when any abnormality occurs in the machine and informs the condition of the machine.

Various select switches are built into the monitor panel, which act as the control portion of the machine control system.

#### 2. CLUSTER

# 1) MONITOR PANEL



140LC3CD01

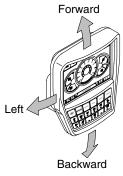
\* The warning lamp pops up and/or blinks and the buzzer sounds when the machine has a problem.

The warning lamp blinks until the problem is cleared. Refer to page 5-71 for details.

\* This cluster is adjustable.

· Vertical (forward/backward) : each 15°

· Horizontal (left only): 8°



290F3CD47

#### 2) CLUSTER CHECK PROCEDURE

# (1) Start key: ON

#### ① Check monitor

- a. Buzzer sounding for 4 seconds with HYUNDAI logo on cluster.
- \* If the ESL mode is set to the enable, enter the password to start engine.
- ② After initialization of cluster, the operating screen is displayed on the LCD.

Also, self diagnostic function is carried out.

- a. Engine rpm display: 0 rpm
- b. Engine coolant temperature gauge: White range
- c. Hydraulic oil temperature gauge: White range
- d. Fuel level gauge: White range

#### ③ Indicating lamp state

- a. Power mode pilot lamp: E mode or U mode
- b. Work mode pilot lamp : General operation mode (bucket)
- c. Travel speed pilot lamp: Low (turtle)

# (2) Start of engine

#### ① Check machine condition

- a. RPM display indicates at present rpm
- b. Gauge and warning lamp: Indicate at present condition.
- When normal condition : All warning lamp OFF
- c. Work mode selection: General work
- d. Power mode selection: E mode or U mode
- e. Travel speed pilot lamp: Low (turtle)

#### When warming up operation

- a. Warming up pilot lamp: ON
- b. After engine started, engine speed increases to 1100 rpm.
- \* Others same as above.

#### ③ When abnormal condition

- a. The warning lamp lights up and the buzzer sounds.
- b. If BUZZER STOP switch is pressed, buzzer sound is canceled but the lamp warning lights up until normal condition.
- \* The pop-up warning lamp moves to the original position and blink when the buzzer stop switch is pushed. Also the buzzer stops.

# 3) CLUSTER CONNECTOR

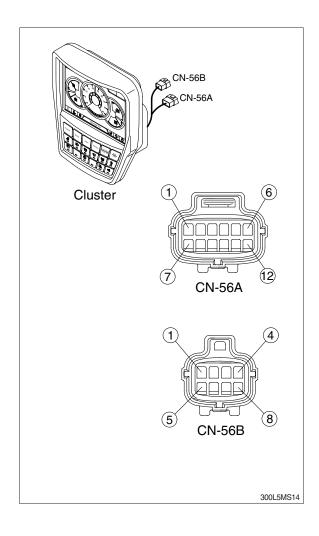
# (1) CN-56A

No.	Name	Signal
1	Battery 24V	20~32V
2	Power IG (24V)	20~32V
3	GND	-
4	CAN 1 (H)	0~5V
5	CAN 1 (L)	0~5V
6	CAN 2 (H)	0~5V
7	CAN 2 (L)	20~32V
8	NC	-
9	NC	-
10	Aux left	0~5V
11	Aux right	0~5V
12	Aux GND	-

# (2) CN-56B

No.	Name	Signal
1	CAM 6.5V	6.3~6.7V
2	CAM GND	-
3	CAM DIFF (H)	0~5V
4	CAM DIFF (L)	0~5V
5	CAM 1	NTSC signal
6	CAM 2	NTSC signal
7	CAM 3	NTSC signal
8	CAM shield	0~5V

NTSC: National Television System Committee



## 4) GAUGE

#### (1) Operation screen

When you first turn starting switch ON, the operation screen will appear.





290F3CD51

- 1 RPM / Speed gauge
- 2 Engine coolant temperature gauge
- 3 Hydraulic oil temperature gauge
- 4 Fuel level gauge

- 5 DEF/AdBlue® level gauge
- 6 Tripmeter display
- 7 Eco guage
- 8 Accel dial gauge
- Operation screen type can be set by the screen type menu of the display.
   Refer to page 5-94 for details.

# (2) RPM / Speed gauge



① This display the engine speed.

#### (3) Engine coolant temperature gauge



290F3CD53

- ① This gauge indicates the temperature of coolant.
  - · White range: 40-107°C (104-225°F)
  - · Red range : Above 107°C (225°F)
- ② If the indicator is in the red range or lamp pops up and the buzzer sounds turn OFF the engine and check the engine cooling system.
- \* If the gauge indicates the red range or lamp blinks in red even though the machine is on the normal condition, check the electric device as that can be caused by the poor connection of electricity or sensor.

# (4) Hydraulic oil temperature gauge



290F3CD54

- ① This gauge indicates the temperature of hydraulic oil.
  - · White range: 40-105°C(104-221°F)
  - · Red range : Above 105°C(221°F)
- ② If the indicator is in the red range or limit lamp pops up and the buzzer sounds reduce the load on the system. If the gauge stays in the red range, stop the machine and check the cause of the problem.
- \* If the gauge indicates the red range or lamp blinks in red even though the machine is on the normal condition, check the electric device as that can be caused by the poor connection of electricity or sensor.

#### (5) Fuel level gauge



- ① This gauge indicates the amount of fuel in the fuel tank.
- \* If the gauge indicates the red range or lamp blinks in red even though the machine is on the normal condition, check the electric device as that can be caused by the poor connection of electricity or sensor.

#### (6) DEF/AdBlue® Level gauge



- ① This gauge indicates the amount of liquid in the DEF/AdBlue®
- ② Fill the DEF/AdBlue® when the red range, or 😂 lamp pops up and the buzzer sounds.
- ③ Do not pour DEF/AdBlue® any more when the DEF/AdBlue® fill up warning lamp lights ON.
- \* Refer to page 5-76.
- \* If the gauge indicates the red range or implicates in red even though the machine is on the normal condition, check the electric device as that can be caused by the poor connection of electricity or sensor.

#### (7) Tripmeter display



- ① This displays the engine the tripmeter.
- Refer to page 5-96 for details.

# (8) Eco gauge



290F3CD58

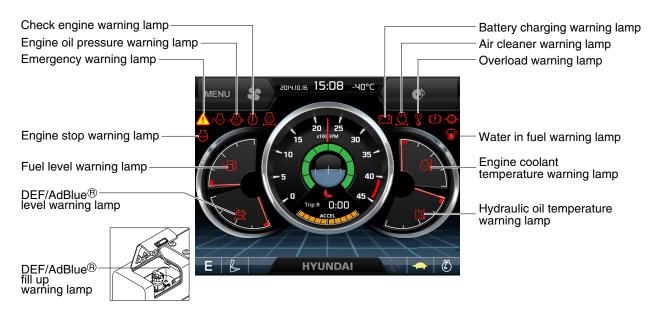
- ① This gauge indicates the fuel consumption rate and machine load status. So that operators can be careful with fuel economy.
- ② The fuel consumption rate or machine load is higher, the number of segment is increased.
- ③ The color of Eco gauge indicates operation status.
  - · White: Idle operation
  - · Green : Economy operation
  - · Yellow : Non-economy operation at a medium level.
  - · Red : Non-economy operation at a high level.

# (9) Accel dial gauge



① This gauge indicates the level of accel dial.

# 5) WARNING LAMPS



140L3CD60

# Warning lamps and buzzer

Warnings	When error happened	Lamps and buzzer	
All warning lamps	Warning lamp pops up on	The pop-up warning lamp moves to the original position and	
except below	the center of the LCD and	blinks, and the buzzer stops when ;	
oxeopt solon	the buzzer sounds	- the buzzer stop switch	
		- the knob of the haptic controller is pushed	
		- the lamp of the LCD is touched	
-4-2.	Warning lamp pops up on	The pop-up warning lamp moves to the original position and	
\tag{\tau}'	the center of the LCD and	light ON, and the buzzer stops when ;	
	the buzzer sounds	- the buzzer stop switch	
		- the knob of the haptic controller is pushed	
		- the lamp of the LCD is touched	
		※ Refer to operator's manual page 3-11 for details.	
	Warning lamp pops up on	* Refer to operator's manual page 3-7 for details.	
	the center of the LCD and		
	the buzzer sounds		

<sup>\*</sup> Refer to page 5-81 for the buzzer stop switch haptic controller.

# (1) Engine coolant temperature warning lamp



- ① Engine coolant temperature warning is indicated two steps.
  - 103°C over : The □ lamp pops up and the buzzer sounds.
  - 107°C over: The (1) lamp pops up and the buzzer sounds.
- when the buzzer stop switch with is pushed. And the buzzer stops and  $\bigcirc$ ,  $\triangle$  lamps keep  $\overline{\text{blink}}$ .
- 3 Check the cooling system when the lamps keep blink.

#### (2) Hydraulic oil temperature warning lamp

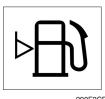


290F3CD62

- ① Hydraulic oil temperature warning is indicated two steps.

  - 105°C over: The /i\lamp pops up and the buzzer sounds.
- ② The pop-up  $|\dot{a}|$ ,  $\hat{N}$  lamps move to the original position and blinks when the buzzer stop switch is pushed. And the buzzer stops and  $|\dot{b}|$ ,  $\hat{l}$  lamps keep blink.
- 3 Check the hydraulic oil level and hydraulic oil cooling system.

#### (3) Fuel level warning lamp



290F3CD63

- ① This warning lamp pops up and the buzzer sounds when the level of fuel is below 31  $\ell$  (8.2 U.S. gal).
- ② Fill the fuel immediately when the lamp blinks.

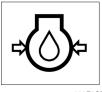
#### (4) Emergency warning lamp



290F3CD64

- ① This warning lamp pops up and the buzzer sounds when each of the below warnings is happened.
  - Engine coolant overheating (over 107°C)
  - Hydraulic oil overheating (over 105°C)
  - MCU input voltage abnormal
  - Cluster communication data error
  - Engine ECM communication data error
- The pop-up warning lamp moves to the original position and blinks when the buzzer stop switch witch is pushed. And the buzzer stops.
- ② When this warning lamp blinks, machine must be checked and serviced immediately.

# (5) Engine oil pressure warning lamp



290F3CD65

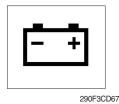
- ① This warning lamp pops up and the buzzer sounds when the engine oil pressure is low.
- ② If the lamp blinks, shut OFF the engine immediately. Check oil level.

# (6) Check engine warning lamp



- ① This warning lamp pops up and the buzzer sounds when the communication between MCU and engine ECM on the engine is abnormal, or if the cluster received specific fault code from engine ECM.
- ② Check the communication line between them. If the communication line is OK, then check the fault codes on the cluster.

# (7) Battery charging warning lamp



① This warning lamp pops up and the buzzer sounds when the battery charging voltage is low.

① This warning lamp pops up and the buzzer sounds when the

① When the machine is overload, the overload warning lamp pops up and the buzzer sounds during the overload switch is

② Check the battery charging circuit when this lamp blinks.

# (8) Air cleaner warning lamp



② Check the filter and clean or replace it.

filter of air cleaner is clogged.

(9) Overload warning lamp (opt)



ON. (if equipped) ② Reduce the machine load.

# (10) Engine stop warning lamp



290F3CD252

- ① This warning lamp pops up and the buzzer sounds when 30 minutes elapsed with empty condition of the DEF/AdBlue® tank, stop the engine immediately and check the DEF/AdBlue® tank.
- ② Fill the DEF/AdBlue® immediately in the DEF/AdBlue® tank.
- \* Refer to the 5-76 page.

# (11) Water in fuel warning lamp



210WF3CD02

- ① This warning lamp pops up and the buzzer sounds when the water separator is full of water or malfunctioning.
- When this lamp blinks, stop the machine and spill water out of the separator.

# (12) DEF/AdBlue® level warning lamp

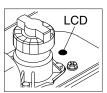


290F3CD257

- ① This warning lamp indicates when ON or blinking, that the DEF/AdBlue® level is low as table below.
- It is recommended that the DEF/AdBlue® tank be filled completely full of the DEF/AdBlue® in order to correct any fault conditions.

Warning lamp				
DEF/AdBlue® level	Check engine	Stop engine	Description	
<u></u>	<u>(i)</u>	STOP		
On	Off	Off	The DEF/AdBlue® level has fallen below the initial warning level (20%).	
On	Off	Off	The DEF/AdBlue® level has fallen below the critical warning level (14%).	
On	On	Off	<ul> <li>The DEF/AdBlue® level has fallen below the initial derate warning level (8%).</li> <li>75% torque derate.</li> </ul>	
On	On	On	<ul> <li>The DEF/AdBlue® level has fallen below the initial warning level (3.5%).</li> <li>5 minute control engine speed and then hold idle only.</li> </ul>	

# (13) DEF/AdBlue® fill up warning lamp



290F3CD272

- ① This lamp lights ON when the DEF/AdBlue® tank is completely filled with DEF/AdBlue®.
- \*\* Fill the tank with the DEF/AdBlue® after start switch ON and then turn OFF the start switch.
- Do not pour DEF/AdBlue® any more when this lamp lights
   ON. Otherwise DEF/AdBlue® tank may freeze and burst in
   winter season.

# 6) PILOT LAMPS



# (1) Mode pilot lamps

No	Mode	Pilot lamp	Selected mode
		P	Heavy duty power work mode
1	Power mode	S	Standard power mode
		Е	Economy power mode
2	User mode	U	User preferable power mode
			General operation - IPC speed mode
			General operation - IPC balance mode
3	Work tool mode		General operation - IPC efficiency mode
			Breaker operation mode
		Á	Crusher operation mode
4	Travel mode		Low speed traveling
7	mavormode	<b>*</b>	High speed traveling
5	Auto idle mode		Auto idle

# (2) Power max pilot lamp



- ① The lamp will be ON when pushing power max switch on the LH RCV lever.
- ② The power max function is operated maximum 8 seconds.
- \* Refer to the operator's manual page 3-38 for power max function.

#### (3) Preheat pilot lamp



290F3CD79

- ① Turning the start key switch ON position starts preheating in cold weather.
- ② Start the engine after this lamp is OFF.

## (4) Warming up pilot lamp



290F3CD80

- ① This lamp is turned ON when the coolant temperature is below 30°C(86°F).
- ② The automatic warming up is cancelled when the engine coolant temperature is above 30°C, or when 10 minutes have passed since starting the engine.

# (5) Decel pilot lamp



290F3CD81

- ① Operating one touch decel switch on the RCV lever makes the lamp ON.
- ② Also, the lamp will be ON and engine speed will be lowered automatically to save fuel consumption when all levers and pedals are at neutral position, and the auto idle function is selected.
- One touch decel is not available when the auto idle pilot lamp is turned ON.
- Refer to the operator's manual page 3-38.

#### (6) Fuel warmer pilot lamp



290F3CD82

- ① This lamp is turned ON when the coolant temperature is below 10°C (50°F) or the hydraulic oil temperature 20°C (68°F).
- ② The automatic fuel warming is cancelled when the engine coolant temperature is above 60°C, and the hydraulic oil temperature is above 45°C since the start switch was ON position.

#### (7) Maintenance pilot lamp



290F3CD83

- ① This lamp will be ON when the consuming parts are needed to change or replace. It means that the change or replacement interval of the consuming parts remains below 30 hours.
- ② Check the message in maintenance information of main menu
  - Also, this lamp lights ON for 3 minutes when the start switch is ON position.
- Refer to the 5-90 page.

# (8) Entertainment pilot lamp



290F3CD84

- ① This lamp is on when audio or video files are playing.
- $\divideontimes$  Refer to the 5-96 page.

# (9) Smart key pilot lamp (opt)



290F3CD214

- ① This lamp is ON when the engine is started by the start button.
- ② This lamp is red when the a authentication fails, green when succeeds.
- \* Refer to the 5-91 page.

# 7) SWITCHES



When some of the switches are selected, the pilot lamps are displayed on the LCD. Refer to the page 5-77 for details.

#### (1) Power mode switch



- ① This switch is to select the machine power mode and selected power mode pilot lamp is displayed on the pilot lamp position.
  - · P : Heavy duty power work.
  - · S : Standard power work.
  - · E : Economy power work.
- ② The pilot lamp changes  $E \rightarrow S \rightarrow P \rightarrow E$  in order.

# (2) Work mode switch



- ① This switch is to select the machine work mode, which shifts from general operation mode to optional attachment operation mode.
  - · 💪 : General operation mode
  - · S : Breaker operation mode (if equipped)
  - : Crusher operation mode (if equipped)
  - · Not installed: Breaker or crusher is not installed.
- Refer to the operator's manual page 4-7 for details.

# (3) User mode switch



- ① This switch is used to memorize the current machine operating status in the MCU and activate the memorized user mode.
  - · Memory : Automatically saved after key OFF.
  - · Action : Push this switch.
  - · Cancel : Push this switch once more.
- ② Refer to the page 5-85 for another set of user mode.

#### (4) Travel speed switch



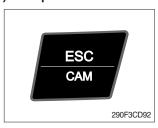
- ① This switch is used to select the travel speed alternatively.
  - · Low speed : High speed
- Do not change the setting of the travel speed switch. Machine stability may be adversely affected.
- ♠ Personal injury can result from sudden changes in machine stability.

# (5) Auto idle/ buzzer stop switch



- ① This switch is used to activate or cancel the auto idle function.
  - · Pilot lamp ON : Auto idle function is activated.
  - · Pilot lamp OFF: Auto idle function is cancelled.
- ② The buzzer sounds when the machine has a problem. In this case, push this switch and buzzer stops, but the warning lamp blinks until the problem is cleared.

#### (6) Escape/Camera switch



- ① This switch is used to return to the previous menu or parent menu.
- ② In the operation screen, pushing this switch will display the view of the camera on the machine (if equipped).

  Please refer to page 5-97 for the camera.
- ③ If the camera is not installed, this switch is used only ESC function.

#### (7) Work light switch



- ① This switch is used to operate the work light.
- ② The pilot lamp is turned ON when operating the switch.

# (8) Head light switch



- ① This switch is used to operate the head light.
- ② The pilot lamp is turned ON when operating the switch.

#### (9) Intermittent wiper switch



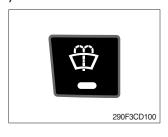
- ① This switch is used to wipe operates intermittently.
- ② The pilot lamp is turned ON when operating the switch.

#### (10) Wiper switch



- ① This switch is used to operate the window wiper.
- 2 Note that the wiper will self-park when switched off.
- ③ The pilot lamp is turned ON when operating the switch.
- If the wiper does not operate with the switch in ON position, turn the switch OFF immediately. Check the cause.
  If the switch remains ON, motor failure can result.

#### (11) Washer switch



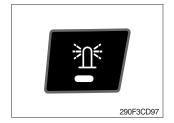
- ① The washer liquid is sprayed and the wiper is operated only while pressing this switch.
- ② The pilot lamp is turned ON when operating the switch.

# (12) Cab light switch



- ① This switch turns ON the cab light on the cab.
- ② The pilot lamp is turned ON when operating the switch.

#### (13) Beacon switch



- ① This switch turns ON the rotary light on the cab.
- ② The pilot lamp is turned ON when operating the switch.

#### (14) Overload switch



- ① When this switch turned ON, buzzer makes sound and overload warning lamp comes ON in case that the machine is overload.
- 2 When it turned OFF, buzzer stops and warning lamp goes out.
- ♠ Overloading the machine could impact the machines stability which could result in tipover hazard. A tipover hazard could result in serious injury or death. Always activate the overload warning device before you handle or lift objects.

# (15) Travel alarm switch



- ① This switch is to activate travel alarm function surrounding when the machine travels.
  - · ON : The travel alarm function is activated.
  - · OFF : The travel alarm function is not activated.

#### (16) Air conditioner quick touch switch



- ① This switch used to select air conditioner control mode.
- \* Refer to the page 5-100.

# (17) Main menu quick touch switch



- ① This switch is to activate the main menu in the cluster.
- ※ Refer to the page 5-84.

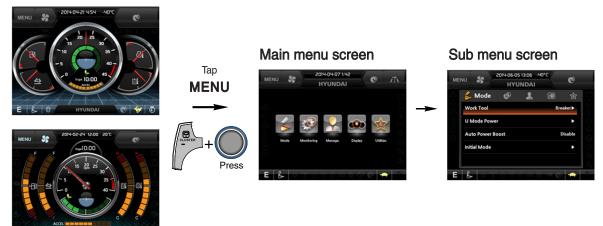
#### (18) Entertainment quick touch switch



- ① This switch is to activate the entertainment control menu in the cluster.
- ※ Refer to the page 5-96.

# 8) MAIN MENU

- You can select or set the menu by the haptic controller or touch screen.
   On the operation screen, tap MENU to access the main menu screen.
   On the sub menu screen, you can tap the menu bar to access functions or applications.
- · Operation screen



290F3CD102

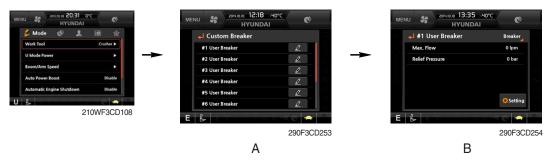
\* Please refer to the haptic controller, operator's manual page 3-58 for selection and change of menu and input value.

# (1) Structure

0110	Ottucture				
No	Main menu	Sub menu	Description		
1	Mode 290F3CD103	Work tool U mode power Boom/Arm speed Auto power boost IPC mode Auto engine shutdown (option) Initial mode Emergency mode	Breaker, Crusher, Not installed User mode only Boom speed, Arm speed Enable, Disable Speed mode, Balance mode, Efficiency mode One time, Always, Disable Key on initial mode, Accel initial mode / step Switch function		
2	Monitoring 290F3CD104	Active fault Logged fault Delete logged fault Monitoring	MCU, Engine ECM MCU, Engine ECM All logged fault delete, Initialization canceled Machine information, Switch status, Output status,		
3	Management 290F3CD105	Fuel rate information Maintenance information Machine security Machine information  Contact Service menu  Clinometer Update	General record, Hourly, Daily, Mode record Replacement, Change interval oils and filters ESL mode setting, Password change Model, MCU, Monitor, Haptic / switch controller, RMCU, Relay drive unit, FATC, AAVM (opt) A/S phone number, A/S phone number change Power shift, Operating hour, Breaker mode pump acting, EPPR current level, Overload pressure Clinometer setting Cluster, ETC device		
4	Display 290F3CD106	Display item Clock Brightness Unit setup Language selection Screen type	Engine speed, Tripmeter A, Tripmeter B, Tripmeter C Clock Manual, Auto Temperature, Pressure, Flow, Distance, Date format Korean, English, Chinese, ETC A type, B type		
5	Utilities 290F3CD107	Entertainment Tripmeter Camera	Play Video, Audio, Smart terminal. 3 kinds (A, B, C) Number of active, Display order, AAVM (opt)		

# (2) Mode setup

# ① Work tool



- · Select on installed optional attachment
  - A: It can set the user's attachment.
     It is available in setting #1~#10.
  - B : Max flow Set the maximum flow for the attachment. Relief pressure Set the relief pressure.

# 2 U mode power



290F3CD112

- Engine high idle rpm, auto idle rpm and pump torque (power shift) can be modulated and memorized separately in U-mode.
- · U-mode can be activated by user mode switch.

Step ( ■ )	Engine speed (rpm)	Idle speed (rpm)	Power shift (bar)
1	1300	750	0
2	1400	800	3
3	1500	850	6
4	1600	900	9
5	1700	950	12
6	1800	1000	16
7	1850	1050	20
8	1900	1100 (auto decel)	26
9	1950	1150	32
10	2000	1200	38

※ One touch decel & low idle: 1000 rpm

# 3 Boom/Arm speed



#### · Boom speed

Boom priority function can be activated or cancelled
 Enable - Boom up speed is automatically adjusted as working conditions by the MCU.
 Disable - Normal operation

#### · Arm speed

- Arm regeneration function can be activated or cancelled.
  - Enable Arm in speed is up.
  - Disable Normal operation.

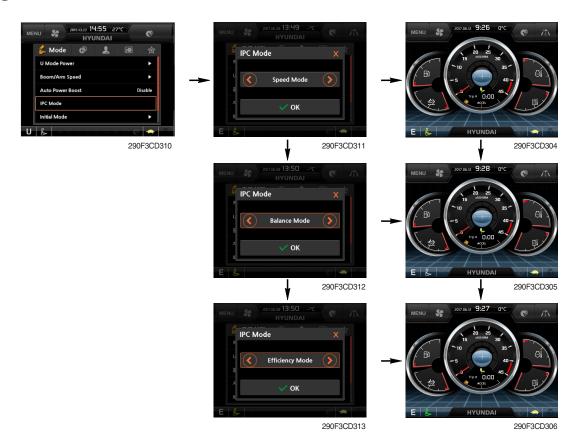
# 4 Auto power boost



290F3CD117

- · The power boost function can be activated or cancelled.
  - Enable The digging power is automatically increased as working conditions by the MCU. It is operated max 8 seconds.
  - Disable Not operated.

# ⑤ IPC mode



- · The IPC mode can be selected by this menu.
  - Speed mode
  - Balance mode (default)
  - Efficiency mode
- · This mode is applied only general operation mode of the work tool mode.
- \*\* Please update the cluster programs if this mode is not displayed in the mode setup menu. Refer to the operator's manual page 3-25-1.

# 6 Automatic engine shutdown (option)



- The automatic engine shutdown function can be set by this menu.
  - One time
  - Always
  - Disable
  - Wait time setting: Max 40 minutes, min 2 minutes

#### 7 Initial mode



290F3CD119

- · Key on initial mode
  - Selected the power mode is activated when the engine is started.
- · Accel initial mode
  - Last setting value
  - User setting value
- · Accel initial step
  - 0~9 step

# **® Emergency mode**



- · This mode can be use when the switches are abnormal on the cluster.
- · The cluster switches will be selected by touched each icon.

# (3) Monitoring

## ① Active fault



· The active faults of the MCU, engine ECM or air conditioner can be checked by this menu.

# ② Logged fault



· The logged faults of the MCU, engine ECM or air conditioner can be checked by this menu.

#### 3 Delete logged fault



· The logged faults of the MCU, engine ECM or air conditioner can be deleted by this menu.

# 4 Monitoring



- The machine status such as the engine rpm, oil temperature, voltage and pressure etc. can be checked by this menu (Analog input).
- The switch status or output status can be confirmed by this menu (Digital input & Digital output).
- The activated switch or output pilot lamps are light ON.

# (4) Management

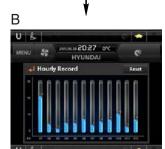
#### ① Fuel rate information

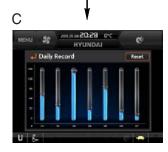














210WF3CD16

# · General record (A)

- Average fuel rate (left) (from "Reset" to now)
   Fuel consumption devided by engine run time (service meter time).
- A days fuel used (right)
   Fuel consumption from 24:00 (or "Reset" time) to now (MCU real time).

#### · Hourly record (B)

- Hourly fuel rates for past 12 hours (service meter time).
- No record during key-off time.
- One step shift to the right for every one hour.
- Automatic deletion for 12 hours earlier data.
- All hourly records deletion by "Reset".

#### · Daily record (C)

- Daily fuel consumption for past seven days (MCU real time).
- No record during key-off time.
- One step shift to the right at 24:00 for every day.
- Automatic deletion for 7 days earlier data.
- All daily records deletion by "Reset".

## · Mode record (D)

- Average fuel rate for each power mode/accel dial (at least 7) from "Reset" to now.
- No record during idle.
- All mode records deletion by "Reset".

# 2 Maintenance information



- · Alarm lamp ( ) is ON when oil or filter needs to be changed or replaced.
- · Replacement : The elapsed time will be reset to zero (0).
- · Change interval: The change or replace interval can be changed in the unit of 50 hours.

# · Change or relpace interval

No	Item	Interval
1	Engine oil	500
2	Final gear oil	1000
3	Swing gear oil	1000
4	Hydraulic oil	5000
5	Pilot line filter	1000
6	Drain filter	1000
7	Hydraulic oil return filter	1000
8	Engine oil filter	500
9	Fuel filter	500
10	Pre-filter	500
11	Hydraulic tank breather	1000
12	Air cleaner (inner & outer)	2000
13	Radiator coolant	2000
14	Swing gear pinion grease	1000
15	DEF/AdBlue® supply module filter	1500
16	Crankcase Breather Filter	1500

# 3 Machine security



#### · ESL mode setting

- ESL : Engine Starting Limit
- ESL mode is desingned to be a theft deterrent or will prevent the unauthorized operation of the machine.
- When you Enable the ESL mode, the password will be required when the starting switch is turned to the on position.
- Machine security

Disable: ESL function is disabled and password is not required to start engine.

Enable (always): The password is required whenever the operator starts engine.

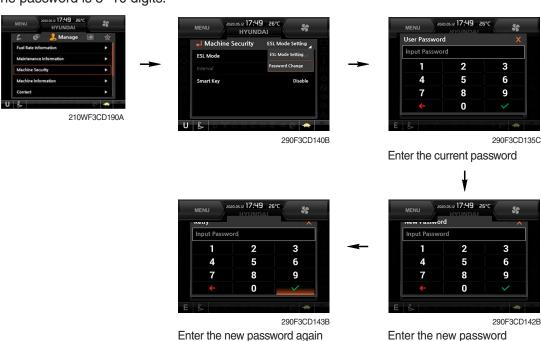
 Interval: The password is required when the operator starts engine first. But the operator can restart the engine within the interval time without inputting the password. The interval time can be set to a maximum 4 hours.

※ Default password : 00000 + 
✓

- Smart key (option) : Refer to next page.

# Password change

- The password is 5~10 digits.



\* Before first use, please set user password and owner password in advance for machine security.

290F3CD138A

# - Smart key



- Smart key is registered when equipped with optional smart key. If smart key is not inside of the cabin, authentication process fails and the password is needed.
- · Tag management menu is activated when the Smart key menu is Enabled.

You can register and delete the tags.

# - Tag management

- · When registering a tag : Only the tag you want to register must be in the cabin.
- $\cdot$  When deleting a tag : All registered tags are deleted.



← Machine Security

ESL Mode





290F3CD005

#### 4 Machine Information



· This can confirm the identification of the model information (ECU), MCU, monitor, haptic controller, switch controller, RMCU, relay driver unit, FATC (air conditioner controller), AAVM (opt).

# (5) Contact (A/S phone number)



Enter the new A/S phone number

#### 6 Service menu



- · Power shift (standard/option): Power shift pressure can be set by option menu.
- · Operating hours : Operating hours since the machine line out can be checked by this menu.
- · Breaker mode pump acting (1 pump/2 pump)
- EPPR current level (attach flow EPPR 1 & 2, boom priority EPPR, attach relief pressure EPPR 1& 2)
- · Overload pressure: 100 ~ 350 bar

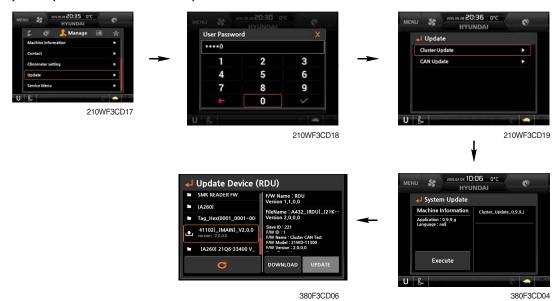
#### Clinometer



· When the machine is on the flatland, if tap the "initialization", the values of X, Y reset "0".

· You can confirm tilt of machine in cluster's operating screen.

# **® Update (cluster & ETC devices)**



- · ETC devices and cluster can be updated through CAN 2 network.
- · Insert USB memory stick which includes program files, start download.

# (5) Display

# ① Display item



- · The center display type of the LCD can be selected by this menu.
- · The engine speed or each of the tripmeter (A,B,C) is displayed on the center display.

#### 2 Clock



- The first line's three spots "\*\*/\*\*\*" represent Month/Day/Year each.
- The second line shows the current time. (0:00~23:59)

# ③ Brightness



· If "Auto" is chosen, brightness for day and night can be differently set up. Also by using the bar in lower side, users can define which time interval belongs to day and night. (in bar figure, white area represents night time while orange shows day time)

# 4 Unit



 $\cdot \ \, \text{Temperature} \, : \, {}^{\circ}\text{C} \longleftrightarrow {}^{\circ}\text{F}$ 

· Pressure : bar  $\leftrightarrow$  MPa  $\leftrightarrow$  kgf/cm<sup>2</sup>

 $\begin{array}{ll} \cdot \ \, \text{Volume} & : \ell \longleftrightarrow \text{gal} \\ \cdot \ \, \text{Flow} & : \text{lpm} \longleftrightarrow \text{gpm} \\ \cdot \ \, \text{Distance} & : \text{km} \longleftrightarrow \text{mile} \end{array}$ 

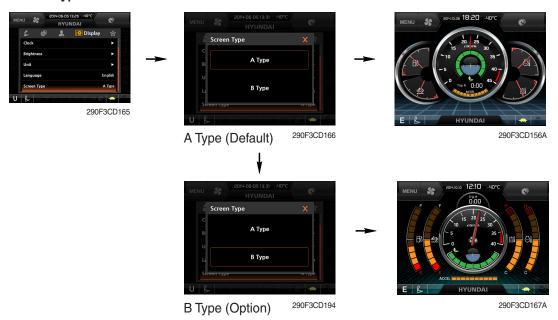
· Date format :  $yy/mm/dd \leftrightarrow mm/dd/yy \leftrightarrow dd-mm-yy$ 

# **⑤** Language



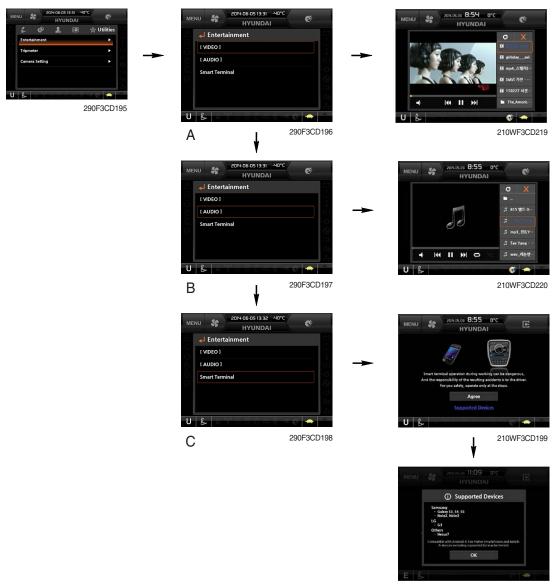
· User can select preferable language and all displays are changed the selected language.

# 6 Screen type



# (6) Utilities

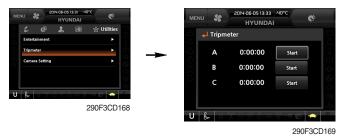
# ① Entertainment



210WF3CD22

- Video (A): This menu operates the video play function. mp4, mkv, avi files and so on.
- Audio (B): This menu operates the play music. mp3, mp4 files and so on.
- Smart terminal (C): The menu features a smartphone and operates the miracast.

# 2 Tripmeter



- · Maximum 3 kinds of tripmeters can be used at the same time.
- Each tripmeter can be turned on by choosing "Start" while it also can be turned off by choosing "Stop".
- · If the tripmeter icon is activated in the operation screen, it can be controlled directly there.

# ③ Camera setting

- · If the rear camera is not installed on the machine, set disable.
- · If the rear camera installed on the machine, set enable.



· In the operation screen, rear camera screen show up when ESC/CAM button is pushed.



# **(4) AAVM** (All Around View Monitoring, option)

· The AAVM buttons of the cluster consist of ESC/CAM and AUTO IDLE/Buzzer stop.



#### - Escape button

- · It will enter into the AAVM mode from the beginning screen if the AAVM is installed.
- · While in the AAVM mode, select the ESC button to return to the beginning screen.



## - Buzzer stop button

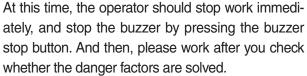
- In AAVM mode, it detects surrounding pedestrians or objects and the warning buzzer sounds.
- · User can turn OFF the warning sound by pressing buzzer stop button.



290F3CD246

- · When the worker or pedestrian go to the blue line (radius 5 m), an external danger area of equipping on the cluster screen, the warning buzzer sounds and it displays the blue rectangular box for the recognition of the worker and pedestrian. At this time, the operator should stop work immediately, and stop the buzzer by pressing the buzzer stop button. And then, please work after you check
  - When the worker or pedestrian go inside of red line (radius 3 m), an internal danger area of equipping on the cluster screen, the warning buzzer sounds and it displays the red rectangular box for the recognition of the worker and pedestrian.

whether the danger factors are solved.





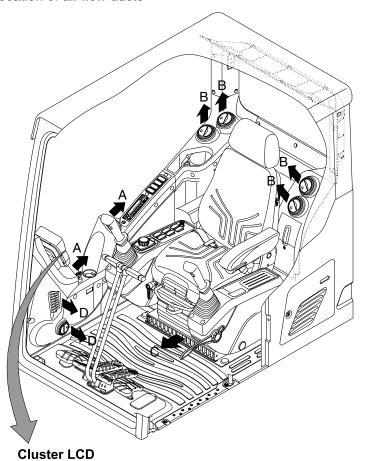
290F3CD247

In AAVM mode, a touch screen of the LCD is available only. The multimodal dial of the haptic controller is not available.

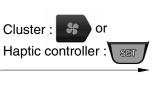
#### 9) AIR CONDITIONER AND HEATER

Full auto air conditioner and heater system automatically keeps the optimum condition in accordance with operator's temperature configuration sensing ambient and cabin inside temperature.

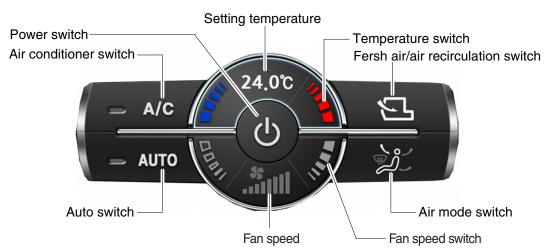
#### · Location of air flow ducts











\* Haptic controller: Refer to the operator's manual page 3-58.

290F3CD201

#### (1) Power switch



- ① This switch makes the system ON/OFF.

  Just before the power OFF, set values are stored.
- ② Default setting values

Function	Air conditioner	In/outlet	LCD	Temperature	Mode
Value	OFF	Inlet	OFF	Previous sw OFF	Previous sw OFF

#### (2) Air conditioner switch



- ① This switch turns the compressor ON/OFF.
- \*\* Air conditioner operates to remove vapor and drains water through a drain hose. Water can be sprayed into the cab in case that the drain cock at the ending point of drain hose has a problem.

In this case, exchange the drain cock.

#### (3) Auto switch



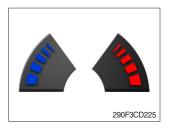
① Auto air conditiner and heater system automatically keeps the optimum condition in accordance with operator's temperature configuration sensing ambient and cabin inside temperature.

#### (4) Setting temperature



① Display the temperature setting out.

#### (5) Temperature switch



- ① Setting temperature indication
  - · Lo (17°C), 17.5~31.5°C, Hi (32°C)
- ② Max cool and max warm beeps 5 times.
- The max cool or the max warm position operates as following table.

Temperature	Compressor	Fan speed	In/outlet	Mode
Max cool	ON	Hi (8 step)	Recirculation	Face
Max warm	OFF	Hi (7 step)	Fresh	Def/Foot

- ④ Temperature unit can be changed between celsius (°C) and fahrenheit (°F)
  - a. Default status (°C)
  - b. Push Up/Down temperature switch simultaneously more than
     5 second displayed temperature unit change (°C → °F)

#### (6) Fan speed switch



- ① Fan speed is controlled automatically by setted temperature.
- ② This switch controls fan speed manually.
  - · There are 8 up/down steps to control fan speed.
  - · The maximum step or the minimum step beeps 5 times.

#### (7) Fan speed



① Steps 1 through 8 to display the amount of wind.

#### (8) Fresh air/air recirculation switch



- ① It is possible to change the air-inlet method.
- a. Fresh air (ᠫ)
  Inhaling air from the outside.
- b. Air recirculation (邑)
  It recycles the heated or cooled air to increase the energy efficiency.
- \* Change air occasionally when using recirculation for a long time.
- \* Check out the fresh air filter and the recirculation filter periodically to keep a good efficiency.

#### (9) Air mode switch



① Operating this switch, it beeps and displays symbol of each mode in order. (Face → Face/Rear → Face/Rear/Foot → Foot → Def/Foot)

Mod	do	Face	Face/Rear	Face/Rear/Foot	Foot	Def/Foot
swit		رڅ	ريم	کی ۔	مُدُكُ	Š
	Α	•	•	•		
Outlet	В		•	•		
Outlet	С			•	•	•
	D					•

② When defroster mode operating, FRESH AIR/AIR RECIRCULATION switch turns to FRESH AIR mode and air conditioner switch turns ON.

### (10) Self diagnosis function

- ① Diagnostic methods : Diagnostic information window, select
- ② Diagnostic indication (Displays fault)

Fault code	Description	Fail safe function
F01	Ambient temperature sensor open	00°C alternate value control
F02	Ambient temperature sensor short	20°C alternate value control
F03	Cab inside temperature sensor open	25°C alternate value control
F04	Cab inside temperature sensor short	25 C alternate value control
F05	Evaporate temperature sensor open	0°C alternate value control
F06	Evaporate temperature sensor short	U C alternate value control
F07	Null	-
F08	Null	-
F09	Mode 1 actuator open/short	The alternate value is face
F10	Mode 1 actuator drive circuit malfunction	If not, the alternate value is Def/Foot
F11	Intake actuator open/short	The alternate value is air recirculation
F12	Intake actuator drive circuit malfunction	The alternate fresh air
F13	Temperature actuator open/short	If opening amount is 0 %, the alternate value is 0 %
F14	Temperature actuator drive circuit malfunc-	If not, the alternate value is 100 %
114	tion	in not, the alternate value is 100 %
F15	Null	-
F16	Null	-

#### **GROUP 16 FUEL WARMER SYSTEM**

#### 1. SPECIFICATION

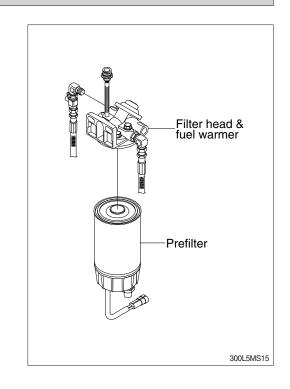
1) Operating voltage :  $24\pm4~V$ 

2) Power : 350  $\pm$  50 W

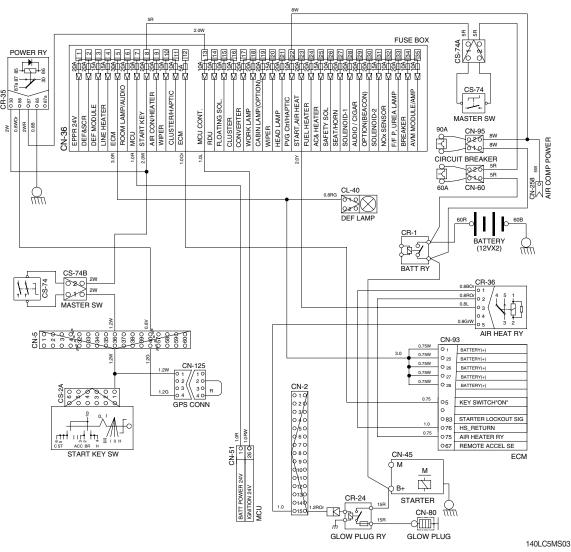
3) Current: 15 A

#### 2. OPERATION

- 1) The current of fuel warmer system is automatically controlled without thermostat according to fuel temperature.
- 2) At the first state, the 15 A current flows to the fuel warmer and engine may be started in 1~2 minutes.
- 3) If the fuel starts to flow, ceramic-disk in the fuel warmer heater senses the fuel temperature to reduce the current as low as 1.5 A.
  - So, fuel is protected from overheating by this mechanism.



#### 3. ELECTRIC CIRCUIT



## SECTION 6 TROUBLESHOOTING

Group	1	Before Troubleshooting ·····	6-1
Group	2	Hydraulic and Mechanical System	6-4
Group	3	Electrical System	6-24
Group	4	Mechatronics System ·····	6-40

### SECTION 6 TROUBLESHOOTING

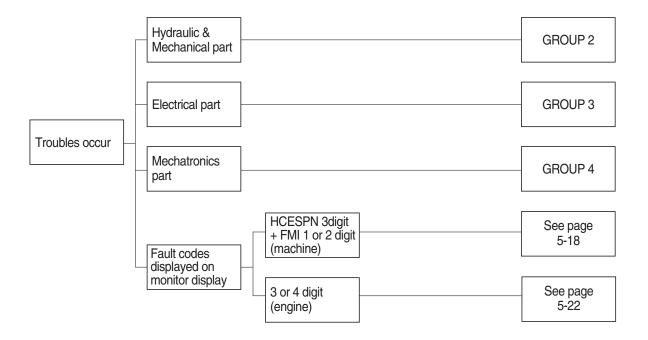
### **GROUP 1 BEFORE TROUBLESHOOTING**

#### 1. INTRODUCTION

When a trouble is occurred in the machine, this section will help an operator to maintain the machine with easy.

The trouble of machine is parted Hydraulic & Mechanical system, Electrical system and Mechatronics system. At each system part, an operator can check the machine according to the troubleshooting process diagram.

\* Before carring out troubleshooting procedure, check monitoring menu in the cluster.



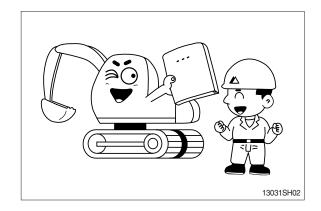
#### 2. DIAGNOSING PROCEDURE

To carry out troubleshooting efficiently, the following steps must be observed.

#### STEP 1. Study the machine system

Study and know how the machine is operating, how the system is composing, what kinds of function are installed in the machine and what are specifications of the system components by the machine service manual.

Especially, deepen the knowledge for the related parts of the trouble.



#### STEP 2. Ask the operator

Before inspecting, get the full story of malfunctions from a witness --- the operator.

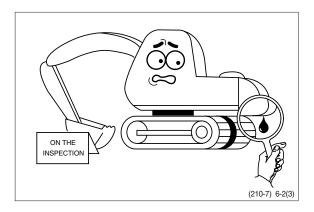
- 1) How the machine is used and when it is serviced?
- 2) When the trouble was noticed and what work the machine was doing at that time?
- 3) What is the phenomenon of the trouble? Was the trouble getting worse, or did it come out suddenly for the first time?
- 4) Did the machine have any troubles previously? If so, which parts were repaired before.



#### STEP 3. Inspect the machine

Before starting troubleshooting, check the machine for the daily maintenance points as shown in the operator's manual.

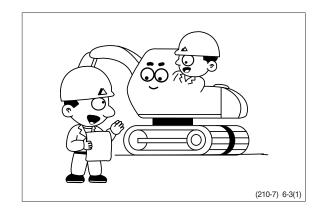
And also check the electrical system including batteries, as the troubles in the electrical system such as low battery voltage, loose connections and blown out fuses will result in malfunction of the controllers causing total operational failures of the machine.



## STEP 4. Inspect the trouble actually on the machine

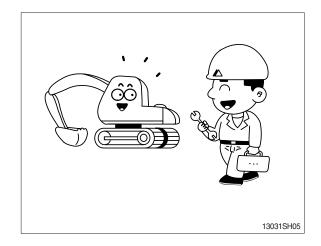
In case that some trouble cannot be confirmed, obtain the details of the malfunction from the operator.

Also, check if there are any in complete connections of the wire harnesses are or not.



#### STEP 5. Perform troubleshooting

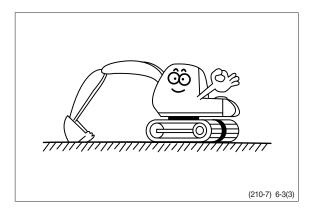
According to where the trouble parts are located, hydraulic & mechanical system part or electrical system part or mechatronics system part, perform troubleshooting the machine refer to the each system part's troubleshooting process diagram.



#### STEP 6. Trace a cause

Before reaching a conclusion, check the most suspectible causes again. Try to trace what the real cause of the trouble is.

Make a plan of the appropriate repairing procedure to avoid consequential malfunctions.



#### **GROUP 2 HYDRAULIC AND MECHANICAL SYSTEM**

#### 1. INTRODUCTION

#### 1) MACHINE IN GENERAL

- (1) If even a minor fault is left intact and operation is continued, a fatal failure may be caused, entailing a large sum of expenses and long hours of restoration.
  - Therefore when even a small trouble occurs, do not rely on your intuition and experience, but look for the cause based on the troubleshooting principle and perform maintenance and adjustment to prevent major failure from occurring. Keep in mind that a fault results from a combination of different causes.
- (2) The following lists up commonly occurring faults and possible causes with this machine. For the troubleshooting of the engine, refer to the coming troubleshooting and repair.
- (3) When carrying out troubleshooting, do not hurry to disassemble the components. It will become impossible to find the cause of the problem.
- (4) Ask user or operator the following.
- ① Was there any strange thing about machine before failure occurred?
- 2 Under what conditions did the failure occur?
- 3 Have any repairs been carried out before the failure?
- (5) Check before troubleshooting.
- ① Check oil and fuel level.
- ② Check for any external leakage of oil from components.
- 3 Check for loose or damage of wiring and connections.

#### 2) MACHINE STATUS MONITORING ON THE CLUSTER

(1) The machine status such as the engine rpm, oil temperature, voltage and pressure etc. can be checked by this menu.



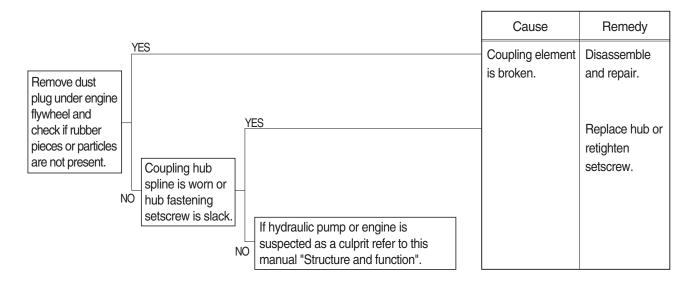


(2) Specification

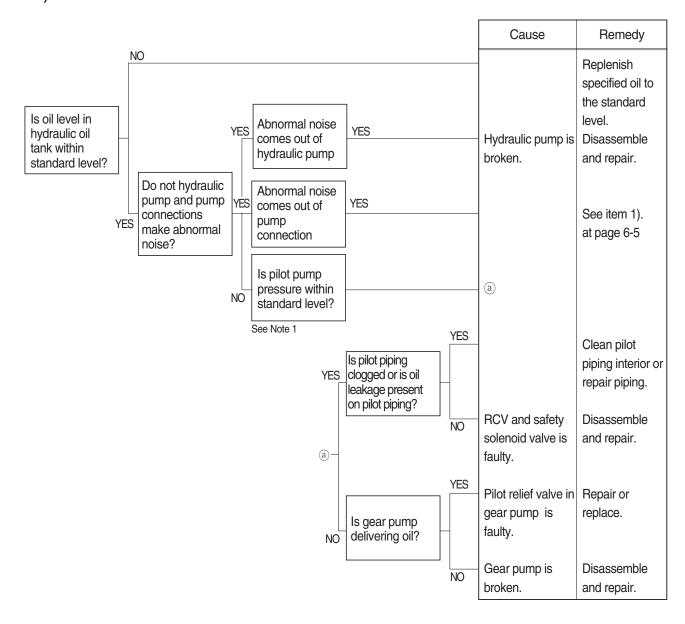
No.	Description	Specification
Note 1	Work pilot pressure	40 <sup>+2</sup> bar
Note 2	Swing pilot pressure	0~40 bar
Note 3	Boom up pilot pressure	0~40 bar
Note 4	Arm/bucket pilot pressure	0~40 bar
Note 5	Pump 1 regulator pressure	0~50 bar
Note 6 Pump 2 regulator pressure		0~50 bar
Note 7	Pump 1 pressure	350 bar

#### 2. DRIVE SYSTEM

### 1) UNUSUAL NOISE COMES OUT OF PUMP CONNECTION

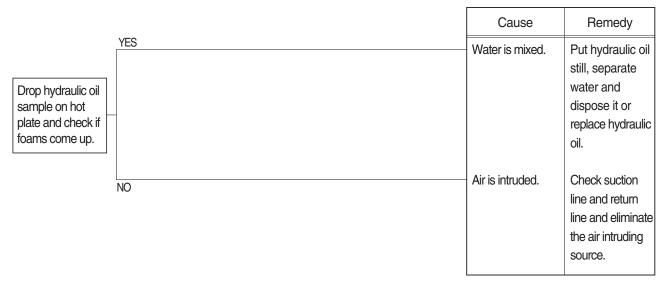


#### 2) ENGINE STARTS BUT MACHINE DOES NOT OPERATE AT ALL

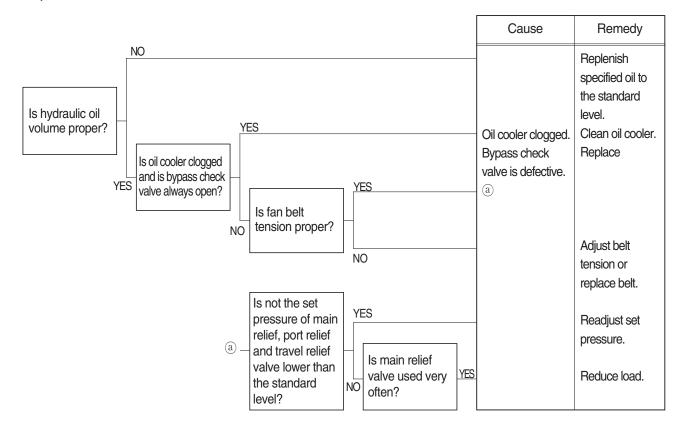


#### 3. HYDRAULIC SYSTEM

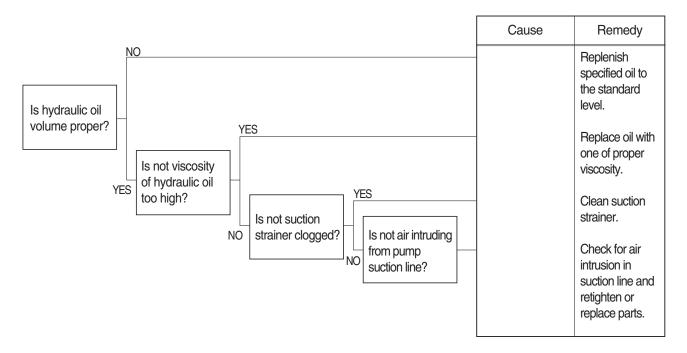
#### 1) HYDRAULIC OIL IS CLOUDY



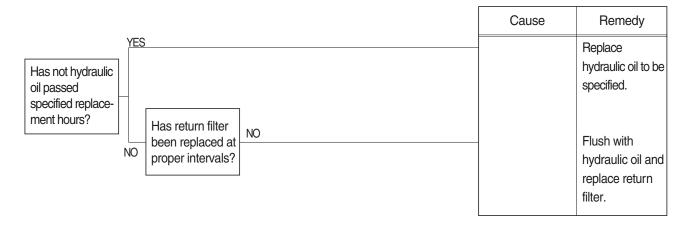
#### 2) HYDRAULIC OIL TEMPERATURE HAS RISEN ABNORMALLY



#### 3) CAVITATION OCCURS WITH PUMP

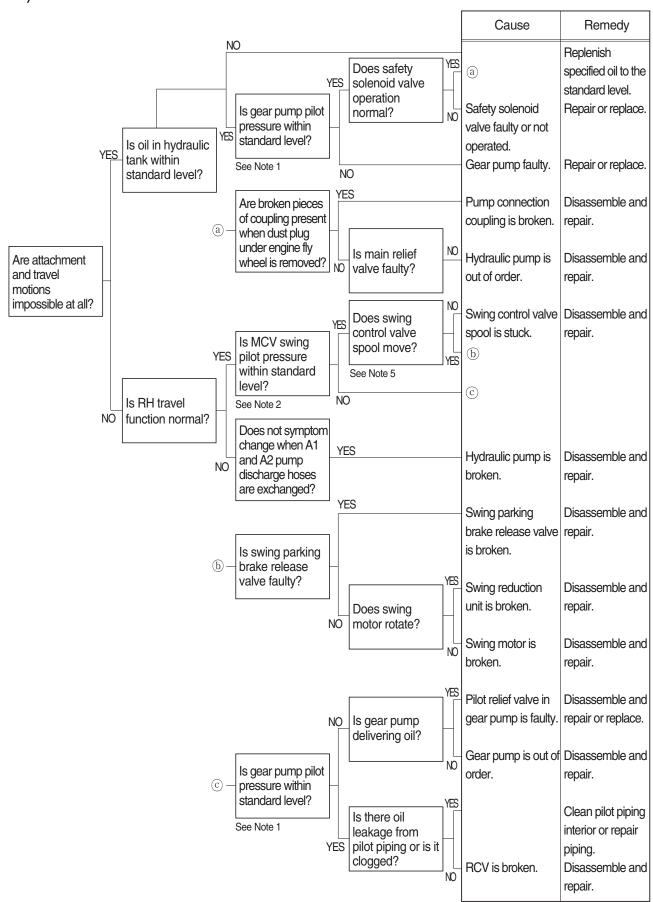


#### 4) HYDRAULIC OIL IS CONTAMINATED

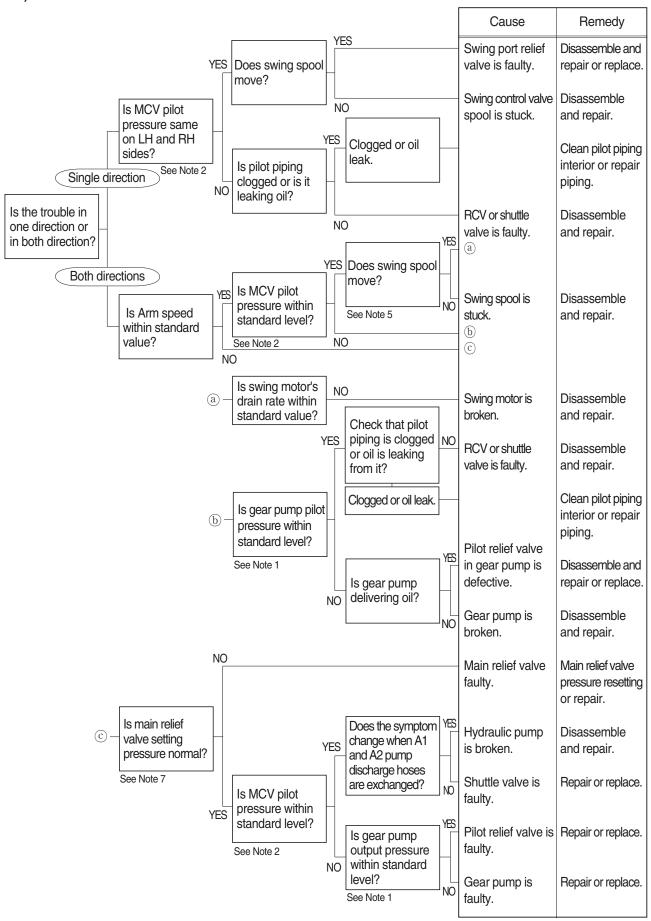


#### 4. SWING SYSTEM

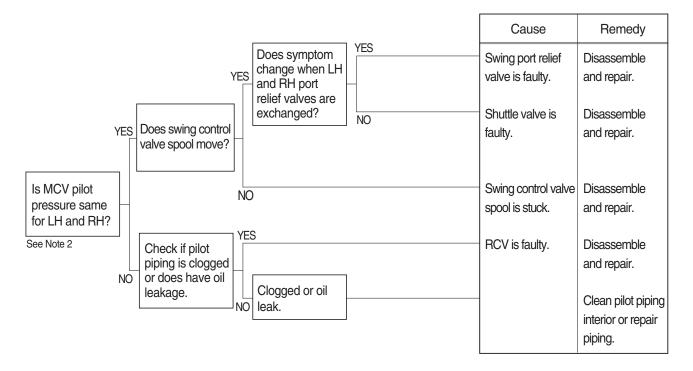
#### 1) BOTH LH AND RH SWING ACTIONS ARE IMPOSSIBLE



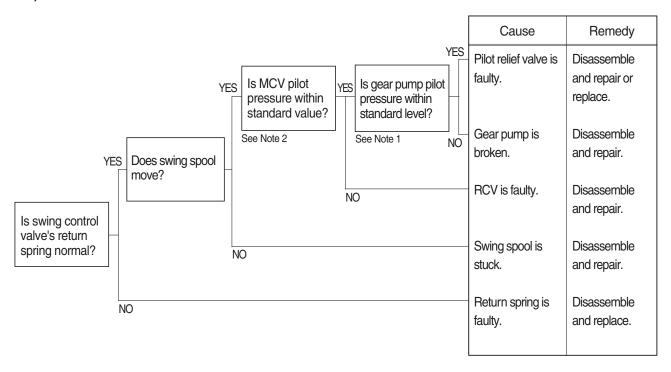
#### 2) SWING SPEED IS LOW



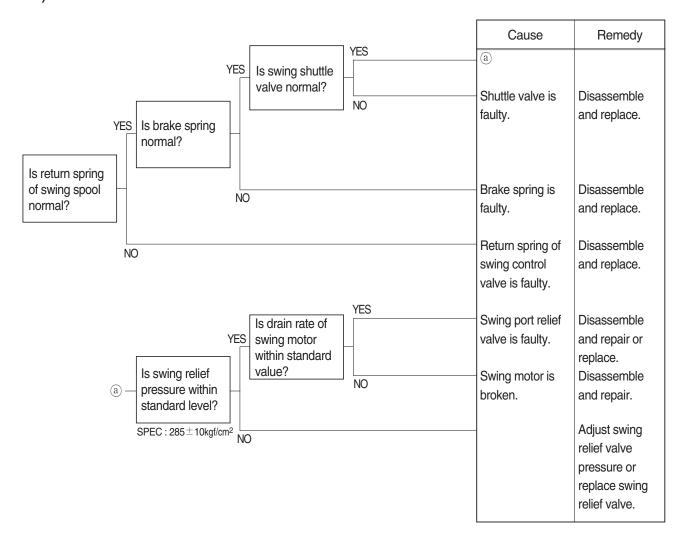
#### 3) SWING MOTION IS IMPOSSIBLE IN ONE DIRECTION



#### 4) MACHINE SWINGS BUT DOES NOT STOP

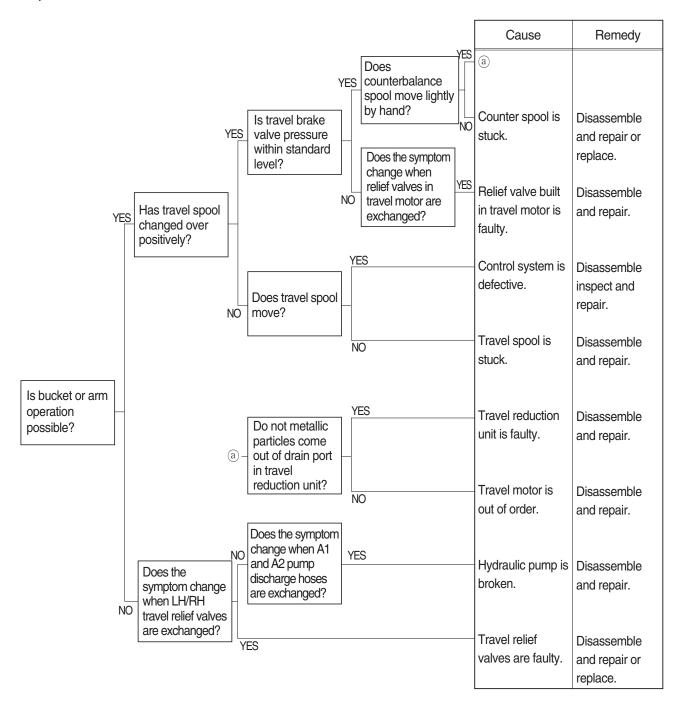


#### 5) THE SWING UNIT DRIFTS WHEN THE MACHINE IS AT REST ON A SLOPE

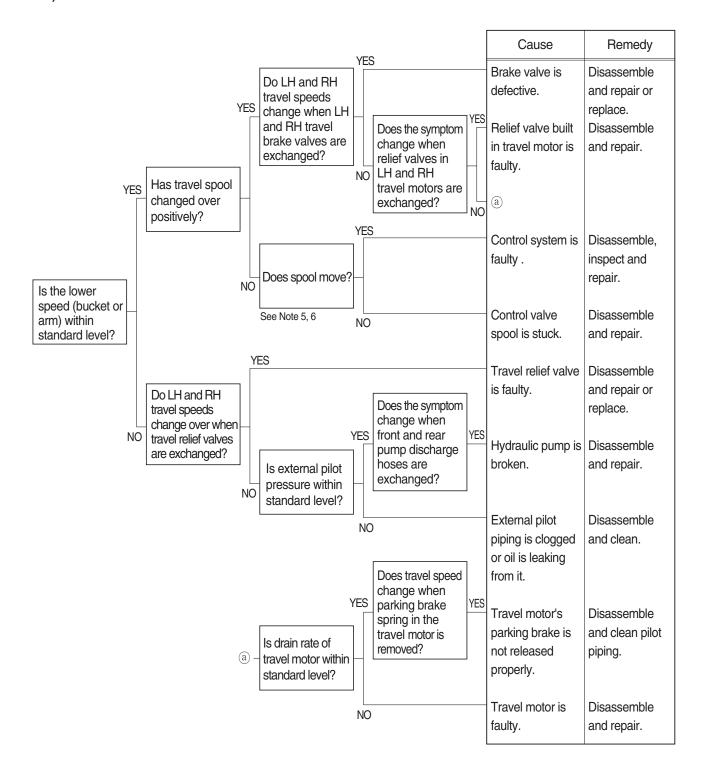


#### 5. TRAVEL SYSTEM

#### 1) TRAVEL DOES NOT FUNCTION AT ALL ON ONE SIDE

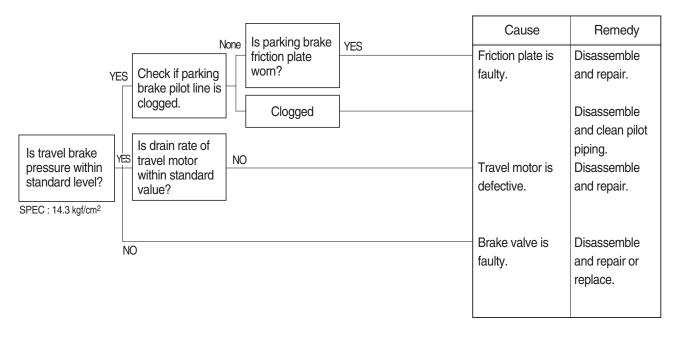


#### 2) SPEED ON ONE SIDE FALLS AND THE MACHINE CURVES

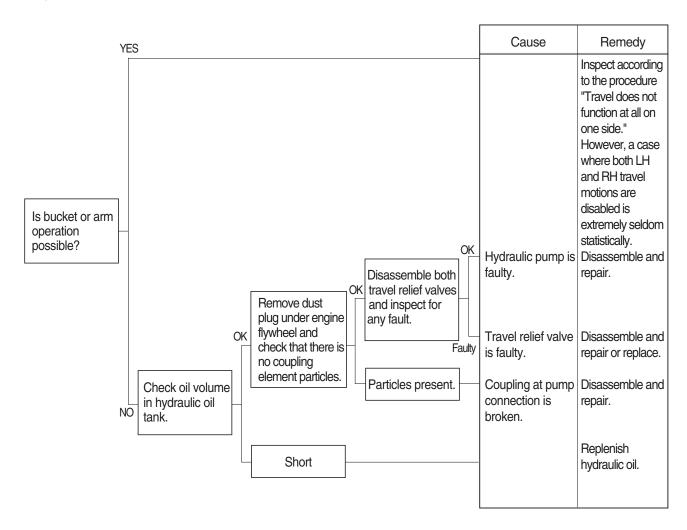


#### 3) MACHINE DOES NOT STOP ON A SLOPE

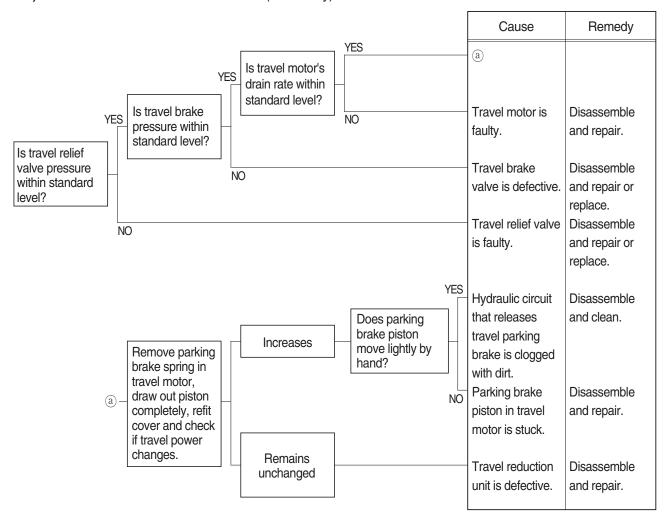
Machine is pulled forward as sprocket rotates during digging operation.



#### 4) LH AND RH TRAVEL MOTIONS ARE IMPOSSIBLE



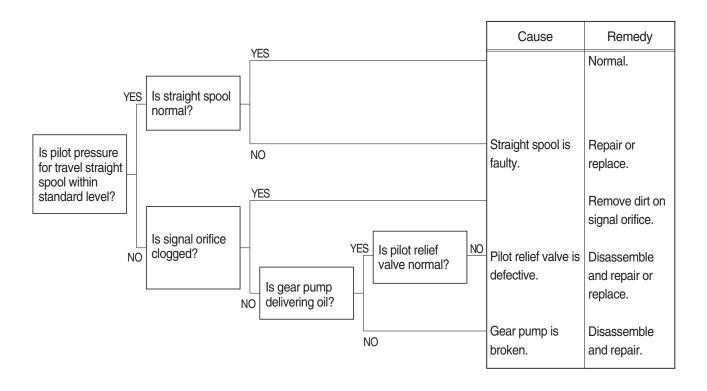
#### 5) TRAVEL ACTION IS POWERLESS (travel only)



#### 6) MACHINE RUNS RECKLESSLY ON A SLOPE

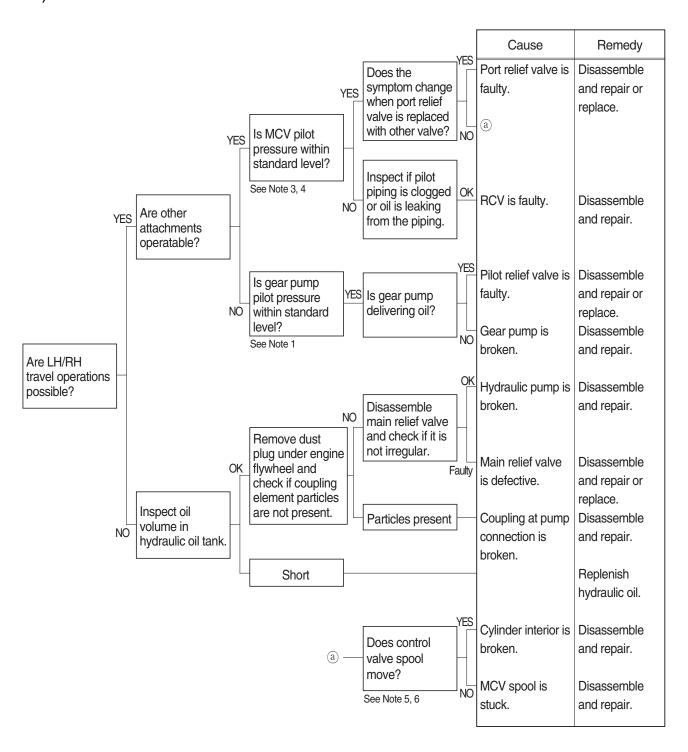
Travel brake valve	brake valve	Cause	Remedy
(counterbalance valve) is faulty.			Disassemble and repair or replace.

# 7) MACHINE MAKES A CURVED TRAVEL OR DOES NOT TRAVEL AT ALL WHEN TRAVEL AND ATTACHMENT OPERATIONS ARE EXECUTED AT THE SAME TIME

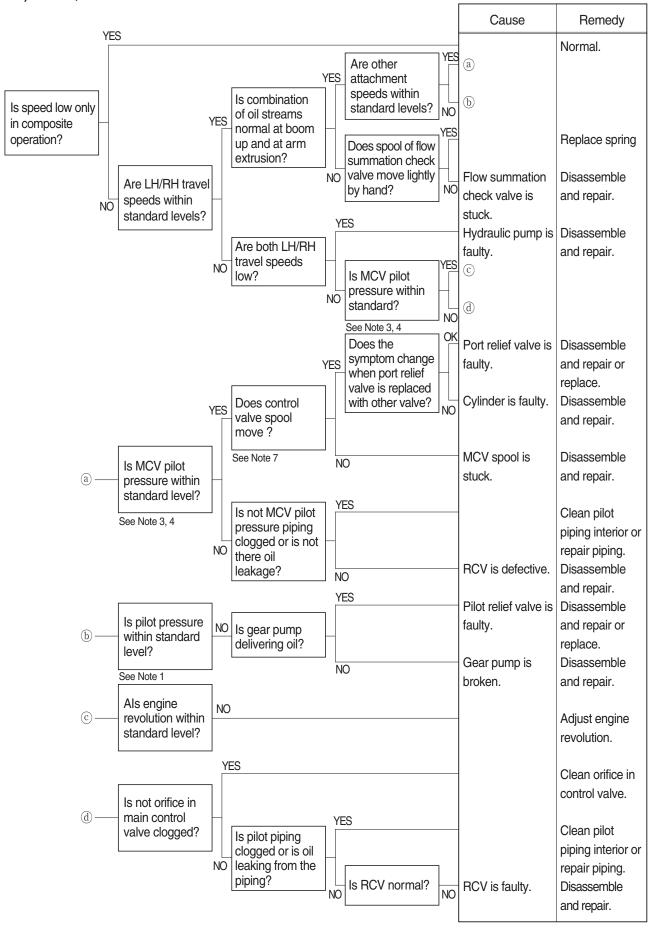


#### 6. ATTACHMENT SYSTEM

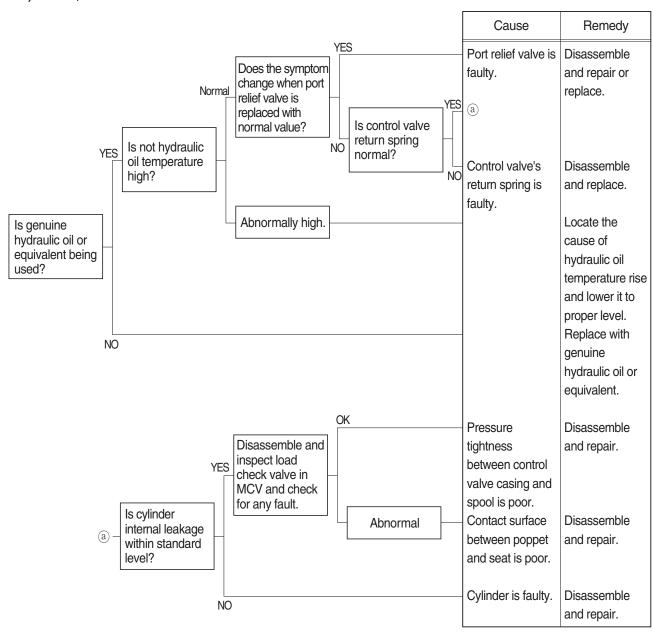
#### 1) BOOM OR ARM ACTION IS IMPOSSIBLE AT ALL



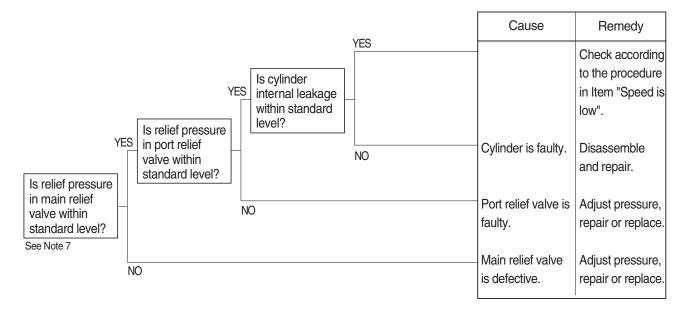
#### 2) BOOM, ARM OR BUCKET SPEED IS LOW



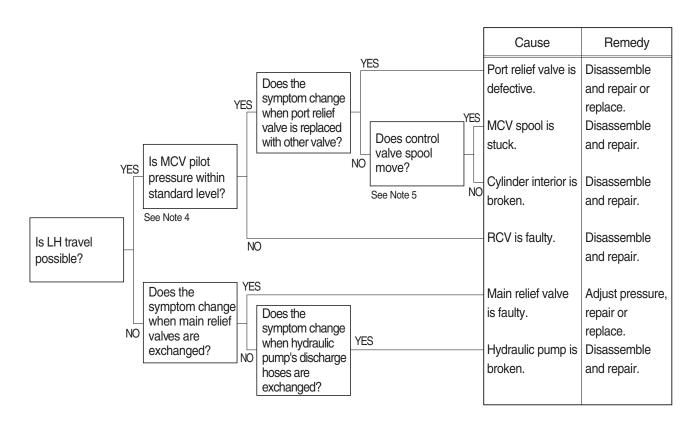
#### 3) BOOM, ARM OR BUCKET CYLINDER EXTENDS OR CONTRACTS ITSELF AND ATTACHMENT FALLS



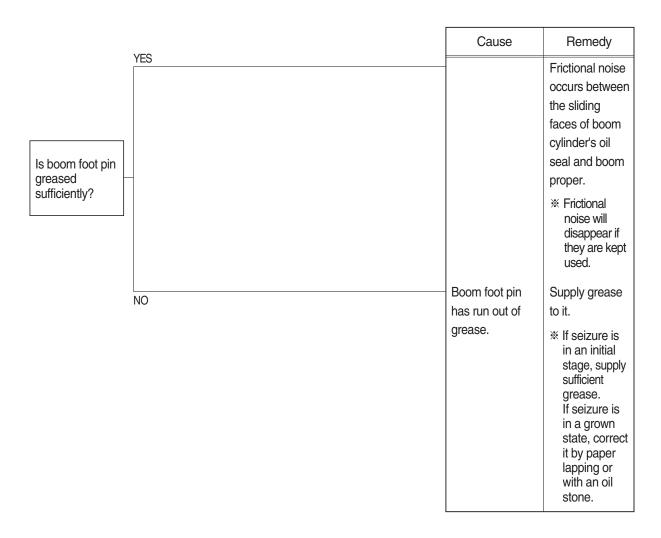
#### 4) BOOM, ARM OR BUCKET POWER IS WEAK



#### 5) ONLY BUCKET OPERATION IS TOTALLY IMPOSSIBLE

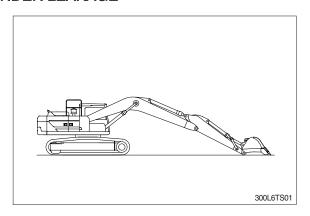


### 6) BOOM MAKES A SQUEAKING NOISE WHEN BOOM IS OPERATED

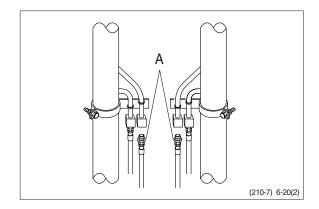


#### **\*\* HOW TO CHECK INTERNAL BOOM CYLINDER LEAKAGE**

1. Lower the bucket teeth to the ground with bucket cylinder fully retracted and arm cylinder rod retracted almost in full.



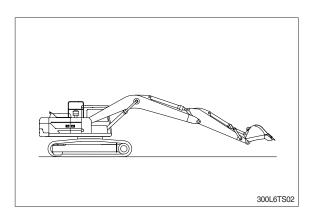
2. Disconnect hose (A) from rod side of boom cylinder and drain oil from cylinders and hose. (put cups on piping and hose ends)



3. Raise bucket OFF the ground by retracting the arm cylinder rod.

If oil leaks from piping side and boom cylinder rod is retracted there is an internal leak in the cylinder.

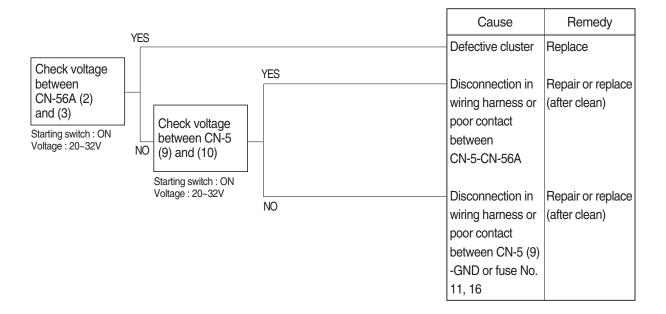
If no oil leaks from piping side and boom cylinder rod is retracted, there is an internal leak in the control valve.



### **GROUP 3 ELECTRICAL SYSTEM**

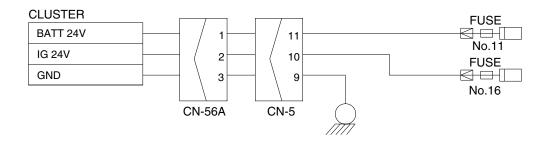
#### 1. WHEN STARTING SWITCH IS TURNED ON, CLUSTER DISPLAY DOES NOT APPEAR

- · Before disconnecting the connector, always turn the starting switch OFF.
- · Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No. 11, 16.
- · After checking, insert the disconnected connectors again immediately unless otherwise specified.



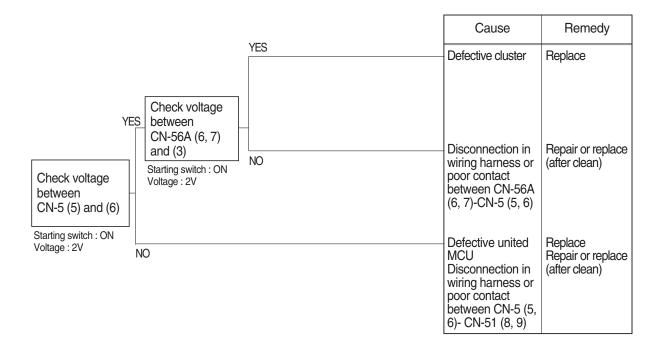
#### Check voltage

YES	20~32V
NO	0V



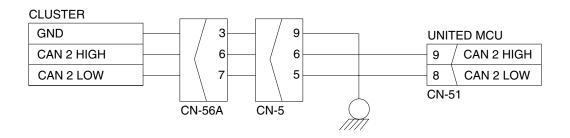
## 2. COMMUNICATION ERROR FLASHES ON THE CLUSTER (HCESPN 840, FMI 2)

- · Before disconnecting the connector, always turn the starting switch OFF.
- · Before carrying out below procedure, check all the related connectors are properly inserted.
- · After checking, insert the disconnected connectors again immediately unless otherwise specified.



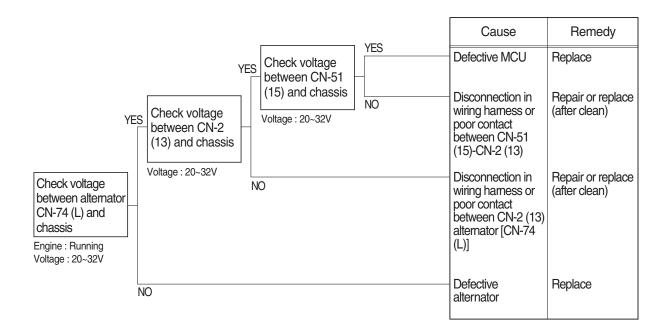
#### Check voltage

YES	2V	
NO	0V	



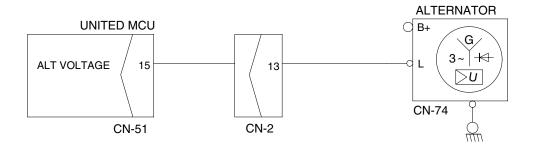
### 3. F BATTERY CHARGING WARNING LAMP LIGHTS UP (Starting switch : ON)

- · Before disconnecting the connector, always turn the starting switch OFF.
- · Before carrying out below procedure, check all the related connectors are properly inserted.
- · After checking, insert the disconnected connectors again immediately unless otherwise specified.



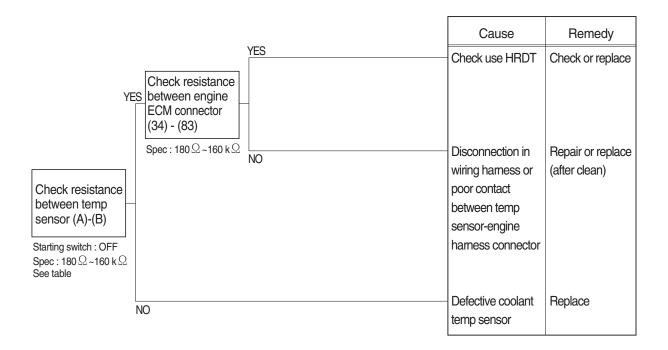
#### Check voltage

YES	20~32V	
NO	0V	



### 4. WHEN COOLANT OVERHEAT WARNING LAMP LIGHTS UP (engine is started)

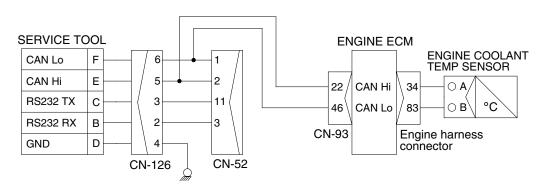
- · Before disconnecting the connector, always turn the starting switch OFF.
- · Before carrying out below procedure, check all the related connectors are properly inserted.
- · After checking, insert the disconnected connectors again immediately unless otherwise specified.





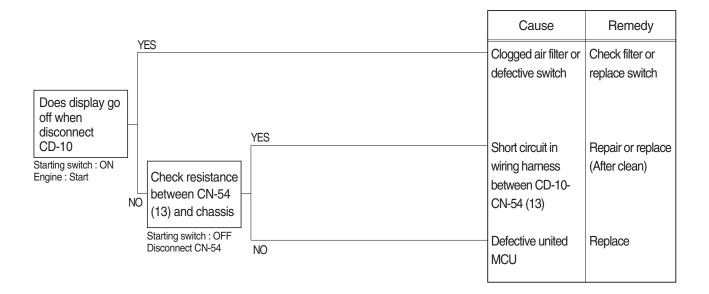
#### Check Table

Temperature (°C)	0	25	50	80	95
Resistance ( $k\Omega$ )	30~37	9.3~10.7	3.2~3.8	1.0~1.3	0.7~0.8



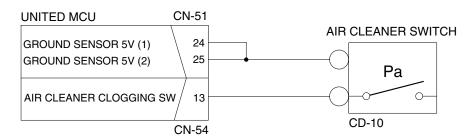
### 5. WHEN AIR CLEANER WARNING LAMP LIGHTS UP (engine is started)

- · Before disconnecting the connector, always turn the starting switch OFF.
- · Before carrying out below procedure, check all the related connectors are properly inserted.
- · After checking, insert the disconnected connectors again immediately unless otherwise specified.



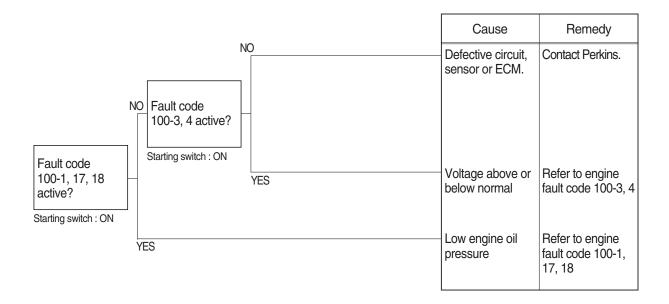
#### Check resistance

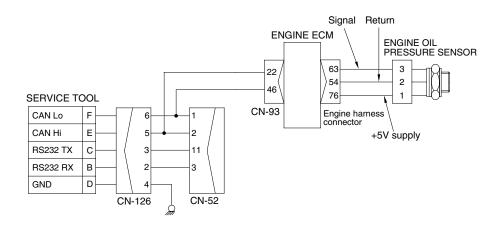
YES	<b>MAX 1</b> Ω
NO	MIN 1MΩ



### 6. WHEN ENGINE OIL PRESSURE WARNING LAMP LIGHTS UP (engine is started)

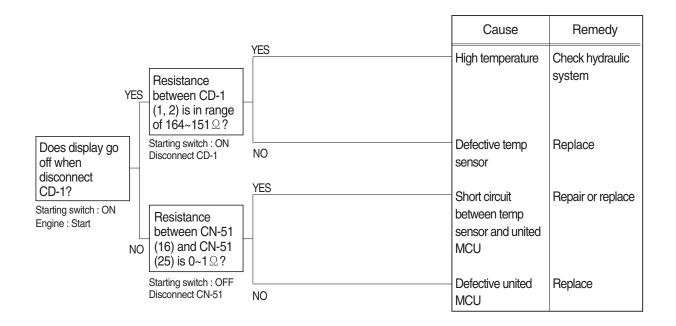
- · Before disconnecting the connector, always turn the starting switch OFF.
- · Before carrying out below procedure, check all the related connectors are properly inserted.
- · After checking, insert the disconnected connectors again immediately unless otherwise specified.





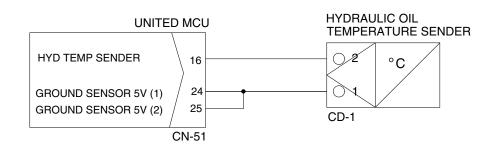
### 7. WHEN HYDRAULIC OIL TEMPERATURE WARNING LAMP LIGHTS UP (engine is started)

- · Before disconnecting the connector, always turn the starting switch OFF.
- · Before carrying out below procedure, check all the related connectors are properly inserted.
- · After checking, insert the disconnected connectors again immediately unless otherwise specified.



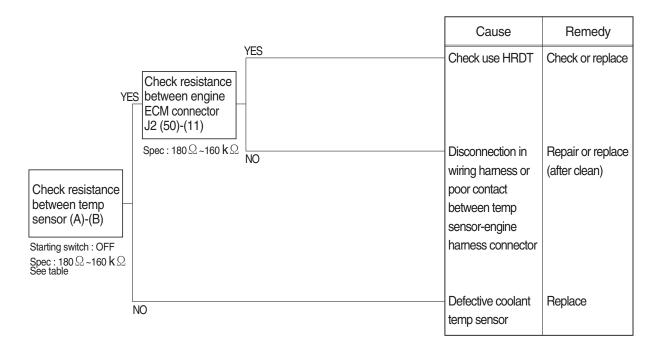
#### **Check Table**

Temperature (°C)	~ -30	~ -10	~ 0	~ 40	~ 70	~ 80	~ 90	~ 100	105~
Resistance ( $k\Omega$ )	22.22 ~31.78	8.16 ~10.74	5.18 ~ 6.6	1.06 ~1.28					



#### 8. WHEN COOLANT TEMPERATURE GAUGE DOES NOT OPERATE

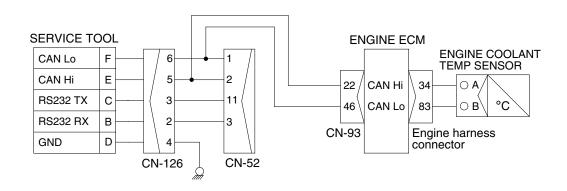
- · Before disconnecting the connector, always turn the starting switch OFF.
- · Before carrying out below procedure, check all the related connectors are properly inserted.
- · After checking, insert the disconnected connectors again immediately unless otherwise specified.





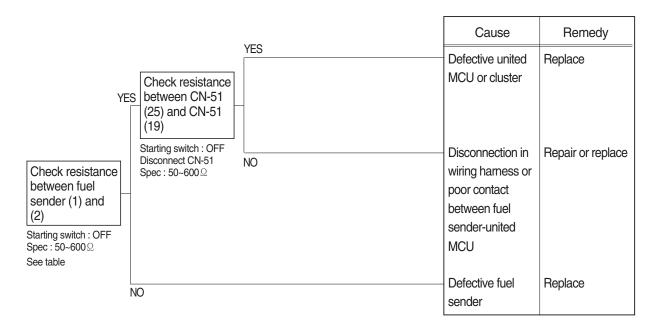
#### **Check Table**

Temperature (°C)	0	25	50	80	95
Resistance ( $k\Omega$ )	30~37	9.3~10.7	3.2~3.8	1.0~1.3	0.7~0.8



# 9. WHEN FUEL GAUGE DOES NOT OPERATE (HCESPN 301, FMI 3 or 4)

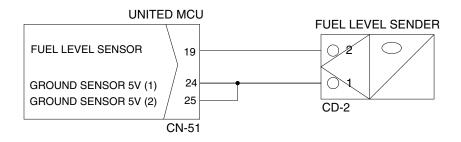
- · Before disconnecting the connector, always turn the starting switch OFF.
- · Before carrying out below procedure, check all the related connectors are properly inserted.
- · After checking, insert the disconnected connectors again immediately unless otherwise specified.





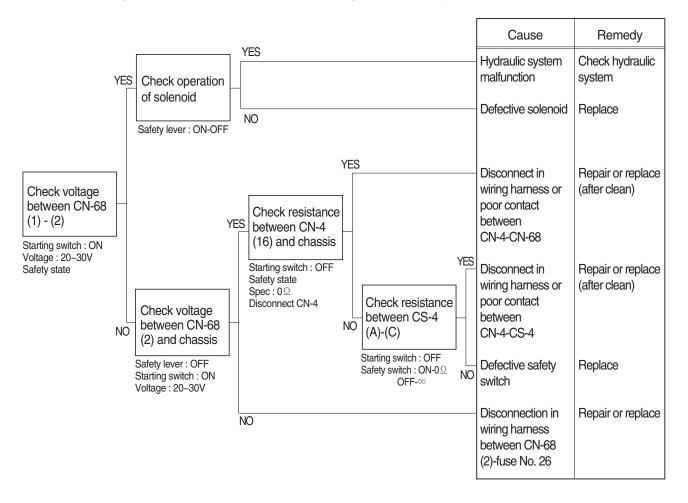
#### **Check Table**

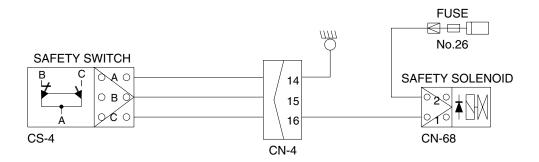
Range	Resistance ( $\Omega$ )	Range	Resistance ( $\Omega$ )
Full	50	5/12	400
11/12	100	4/12	450
10/12	150	3/12	500
9/12	200	2/12	550
8/12	250	1/12	600
7/12	300	Empty warning	700
6/12	350	-	-



### 10. WHEN SAFETY SOLENOID DOES NOT OPERATE

- · Before disconnecting the connector, always turn the starting switch OFF.
- · Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No. 26.
- · After checking, insert the disconnected connectors again immediately unless otherwise specified.

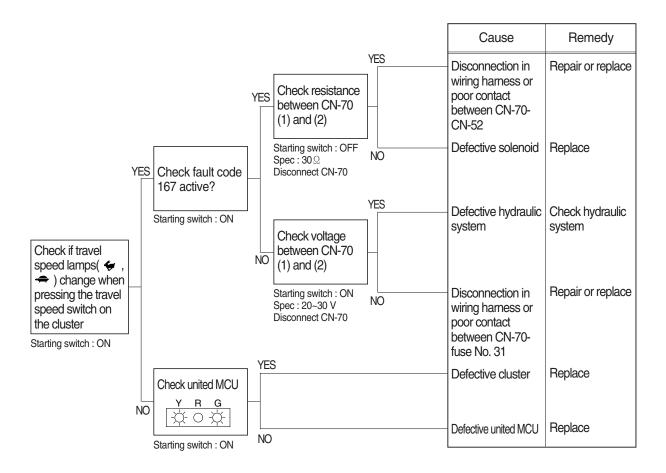


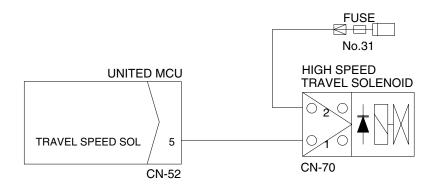


140L6ES109

### 11. WHEN TRAVEL SPEED 1, 2 DOES NOT OPERATE (HCESPN 167, FMI 4 or 6)

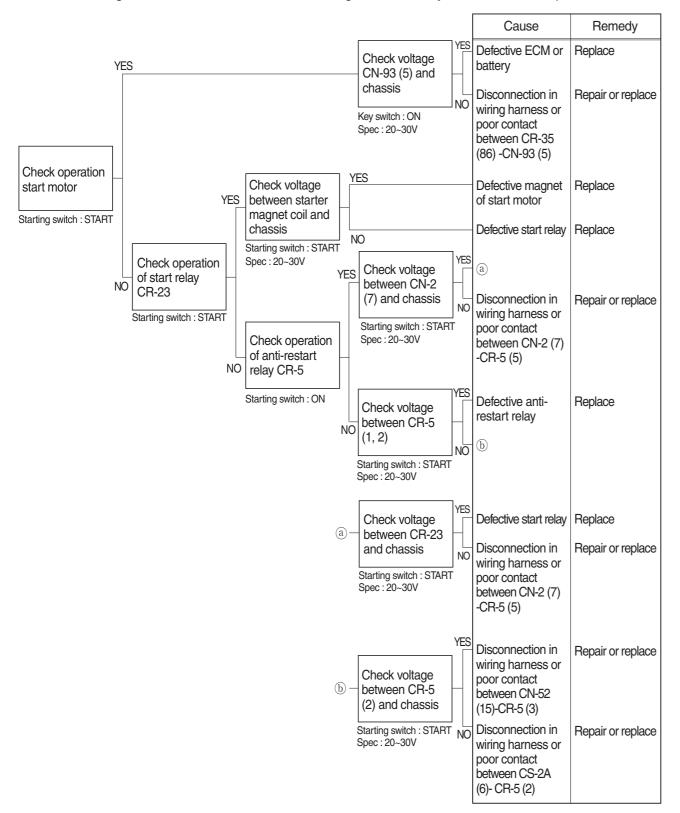
- · Before disconnecting the connector, always turn the starting switch OFF.
- · Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No. 31.
- · After checking, insert the disconnected connectors again immediately unless otherwise specified.

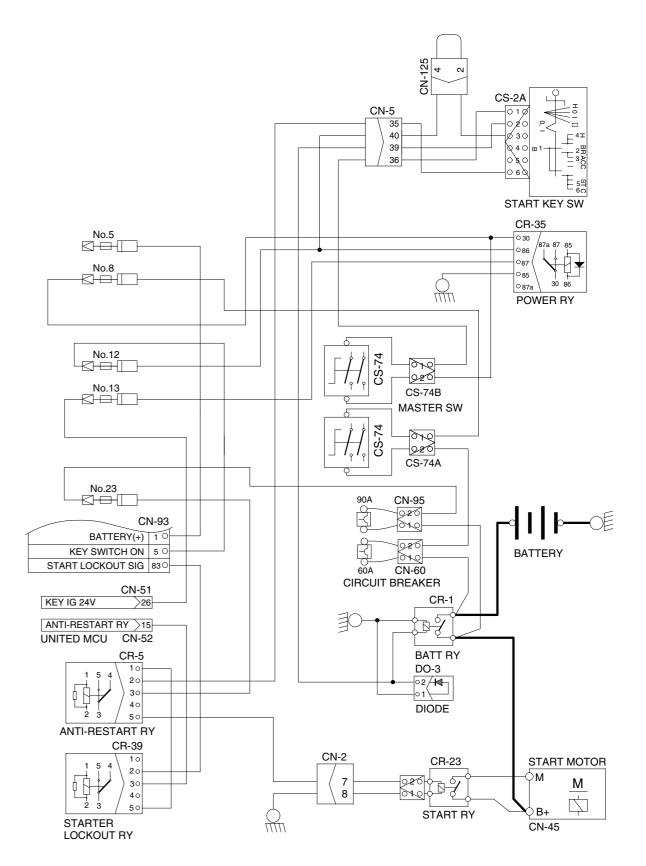




# 12. WHEN ENGINE DOES NOT START ( | lights up condition)

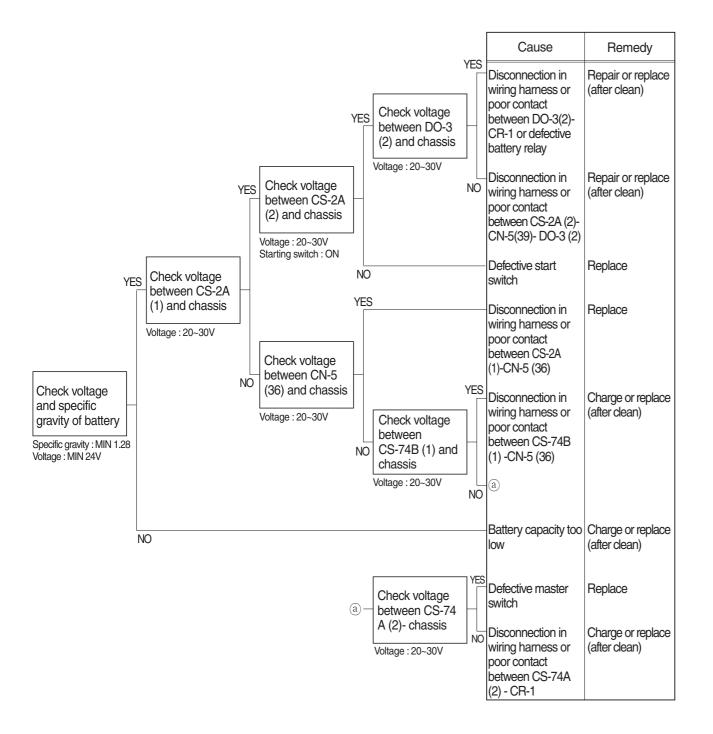
- · Before disconnecting the connector, always turn the starting switch OFF.
- · Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No. 5, 8, 12, 13, 23.
- · After checking, insert the disconnected connectors again immediately unless otherwise specified.

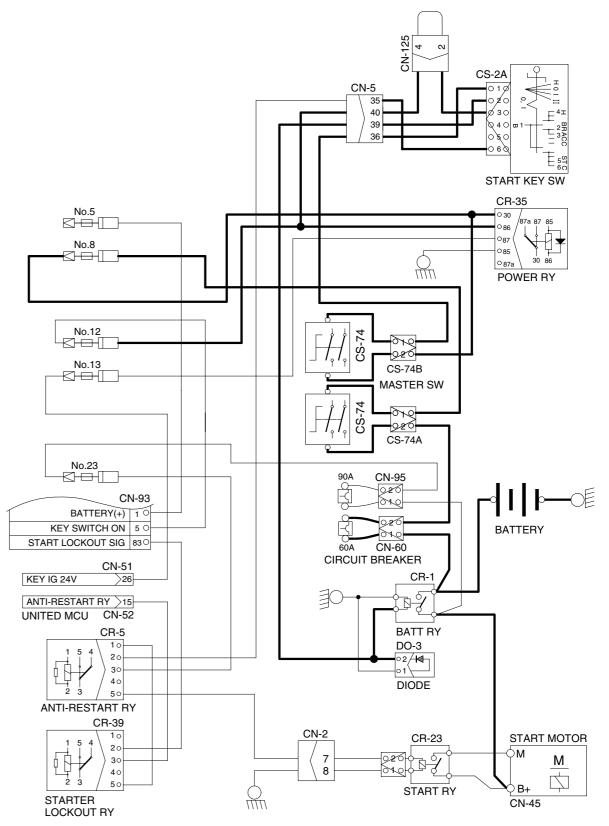




### 13. WHEN STARTING SWITCH ON DOES NOT OPERATE

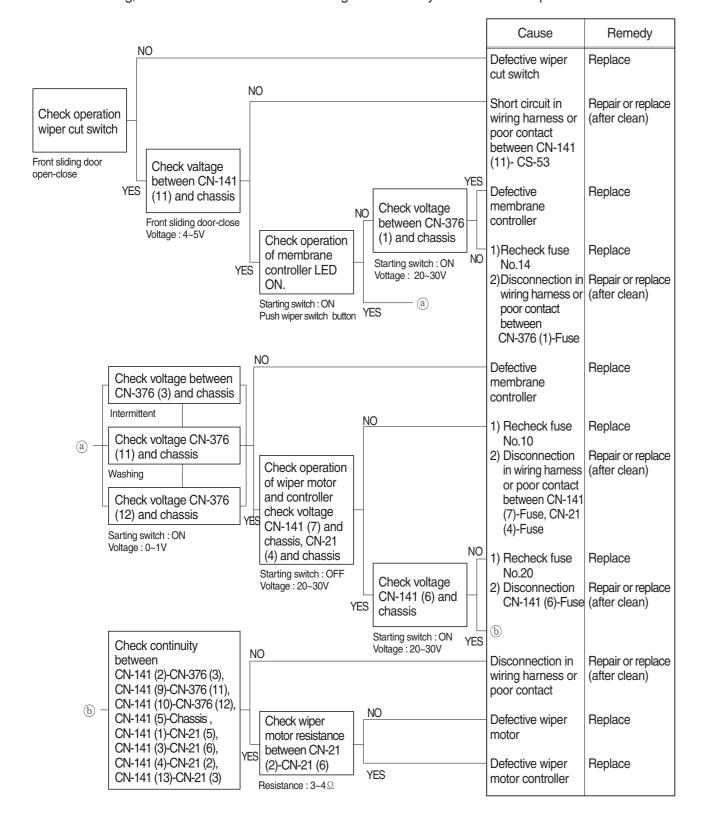
- · Before disconnecting the connector, always turn the starting switch OFF.
- Before carrying out below procedure, check all the related connectors are properly inserted, master switch ON and check open circuit of circuit breaker (CN-60, CN-95).
- · After checking, insert the disconnected connectors again immediately unless otherwise specified.

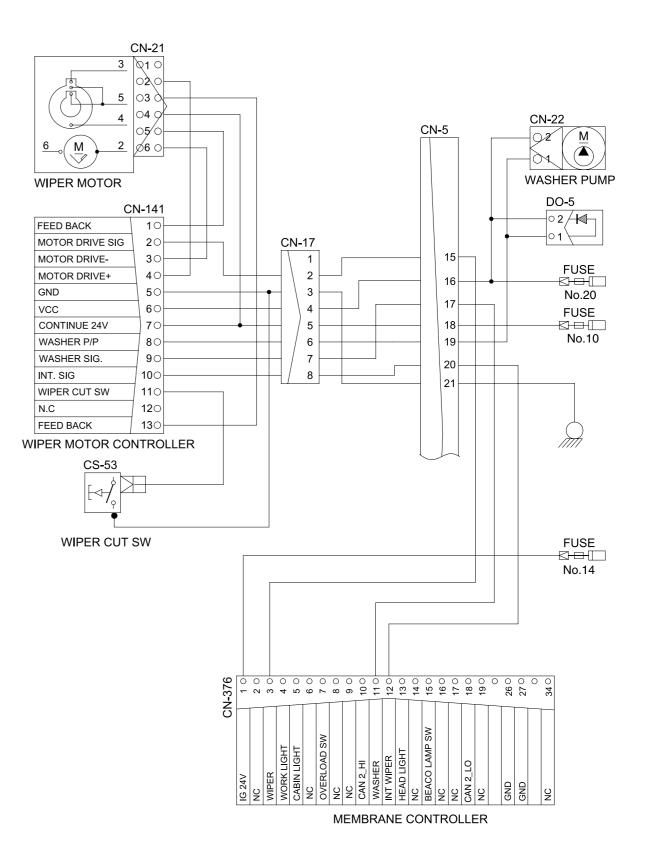




#### 14. WHEN STARTING SWITCH IS TURNED ON, WIPER MOTOR DOES NOT OPERATE

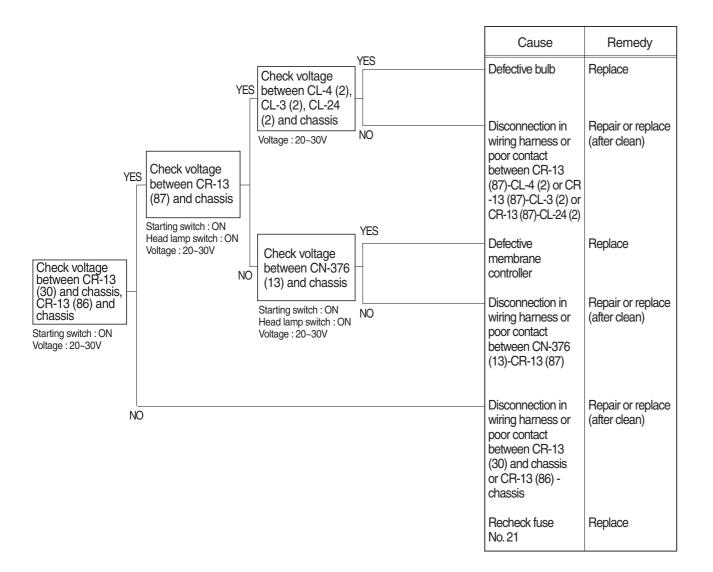
- · Before disconnecting the connector, always turn the starting switch OFF.
- · Before carrying out below procedure, check all the related connectors are properly inserted and the fuse No. 10, 14 and 20 is not blown out.
- · After checking, insert the disconnected connectors again immediately unless otherwise specified.

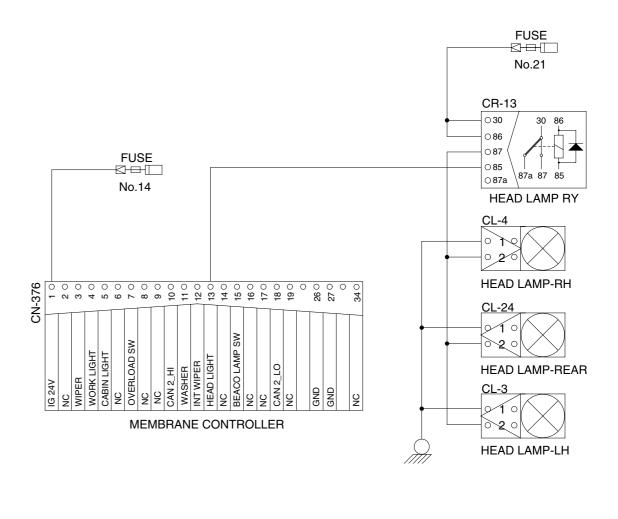




# 15. WHEN STARTING SWITCH IS TURNED ON, HEAD LAMP DOES NOT LIGHTS UP

- · Before disconnecting the connector, always turn the starting switch OFF.
- · Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No.14 & 21.
- · After checking, insert the disconnected connectors again immediately unless otherwise specified.



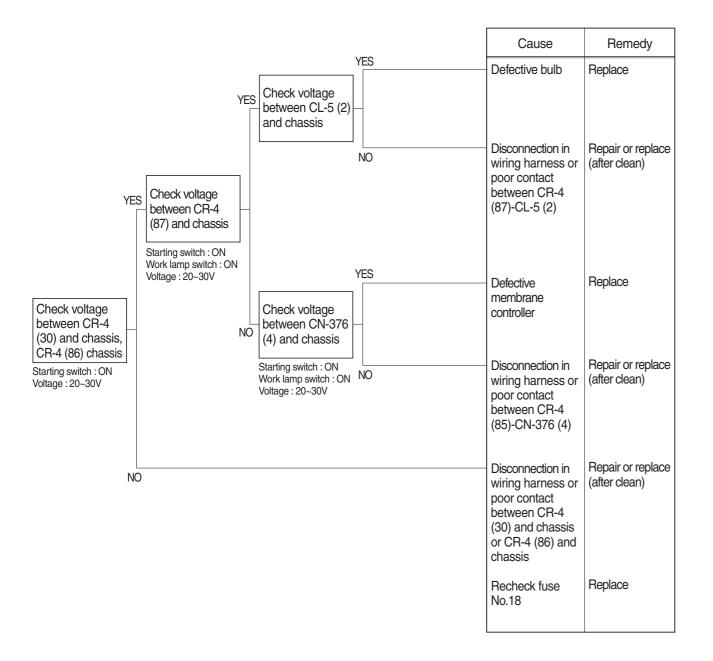


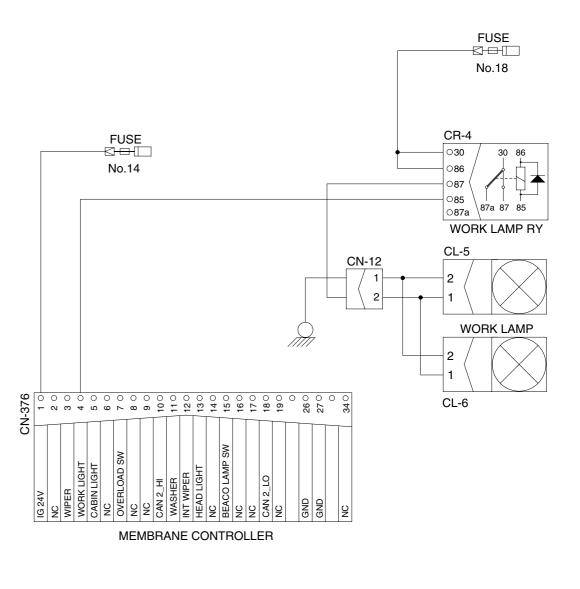
140LC6ES22

6-38

# 16. WHEN STARTING SWITCH IS TURNED ON, WORK LAMP DOES NOT LIGHTS UP

- · Before disconnecting the connector, always turn the starting switch OFF.
- Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No.14 & 18.
- · After checking, insert the disconnected connectors again immediately unless otherwise specified.





140LC6ES12

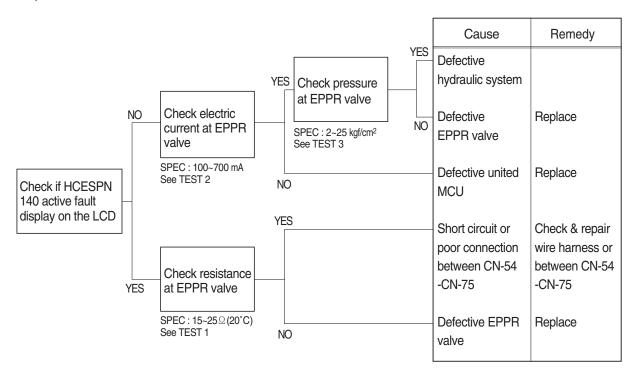
6-39

### **GROUP 4 MECHATRONICS SYSTEM**

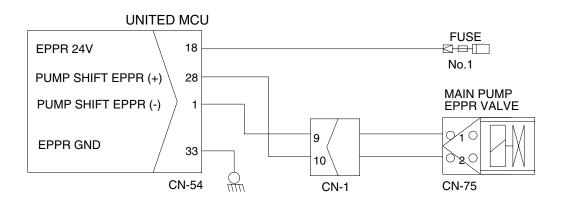
#### 1. ALL ACTUATORS SPEED ARE SLOW

- \* Boom, Arm, Bucket, Swing and travel speed are slow, but engine speed is good.
- $\divideontimes$  Spec : P-mode 1850  $\pm$  50 rpm S -mode 1750  $\pm$  50 rpm E-mode 1650  $\pm$  50 rpm
- \* Before carrying out below procedure, check all the related connectors are properly inserted and fault code on the cluster.

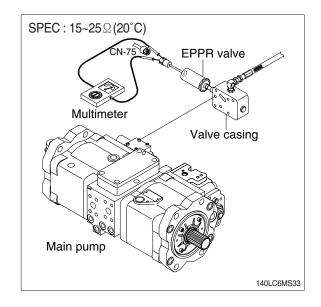
# 1) INSPECTION PROCEDURE



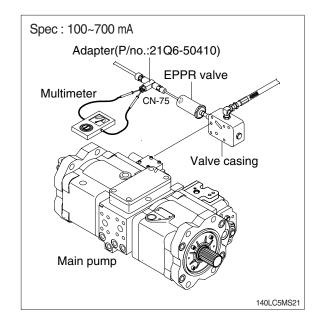
### Wiring diagram



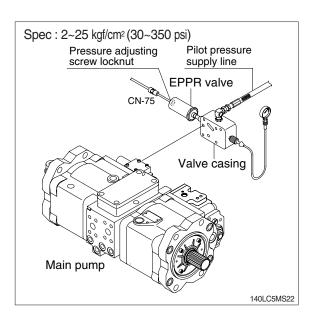
- (1) **Test 1**: Check resistance at connector CN-75.
- ① Starting switch OFF.
- ② Disconnect connector CN-75 from EPPR valve at main hydraulic pump.
- ③ Check resistance between 2 lines as figure.



- (2) **Test 2**: Check electric current at EPPR valve.
- ① Disconnect connector CN-75 from EPPR valve.
- ② Insert the adapter to CN-75 and install multimeter as figure.
- ③ Start engine.
- 4 Set S-mode and cancel auto decel mode.
- (5) Position the multimodal dial at 10.
- ⑥ If tachometer show approx 1750±50 rpm disconnect one wire harness from EPPR valve.
- ⑦ Check electric current at bucket circuit relief position.



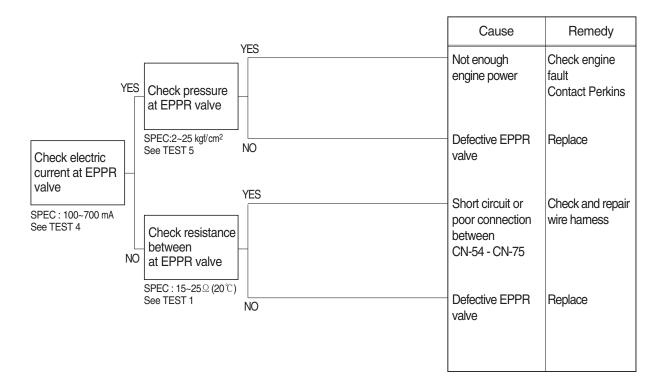
- (3) Test 3: Check pressure at EPPR valve.
  - ① Remove plug and connect pressure gauge as figure.
    - · Gauge capacity: 0 to 50 kgf/cm² (0 to 725 psi)
  - ② Start engine.
  - 3 Set S-mode and cancel auto decel mode.
  - 4 Position the multimodal dial at 10.
  - ⑤ If tachometer show approx 1750±50 rpm check pressure at relief position of bucket circuit by operating bucket control lever.
- 6 If pressure is not correct, adjust it.
- 7 After adjust, test the machine.



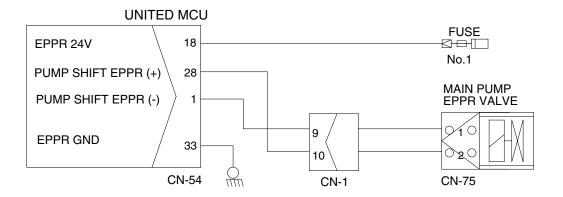
#### 2. ENGINE STALL

\* Before carrying out below procedure, check all the related connectors are properly inserted.

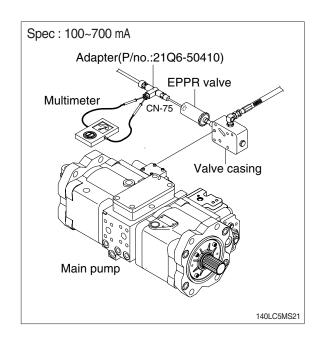
# 1) INSPECTION PROCEDURE

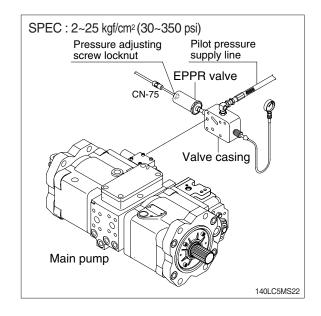


# Wiring diagram



- (1) Test 4 : Check electric current at EPPR valve.
  - ① Disconnect connector CN-75 from EPPR valve.
  - ② Insert the adapter to CN-75 and install multimeter as figure.
  - ③ Start engine.
  - Set S-mode and cancel auto decel mode.
  - 5 Position the multimodal dial at 10.
  - ⑥ If rpm show approx 1750±50 rpm disconnect one wire harness from EPPR valve.
  - Check electric current at bucket circuit relief position.
- (2) Test 5: Check pressure at EPPR valve.
  - ① Remove plug and connect pressure gauge as figure.
    - · Gauge capacity: 0 to 50 kgf/cm² (0 to 725 psi)
  - 2 Start engine.
  - 3 Set S-mode and cancel auto decel mode.
- 4 Position the multimodal dial at 10.
- ⑤ If rpm show approx 1750±50 rpm check pressure at relief position of bucket circuit by operating bucket control lever.
- 6 If pressure is not correct, adjust it.
- 7 After adjust, test the machine.

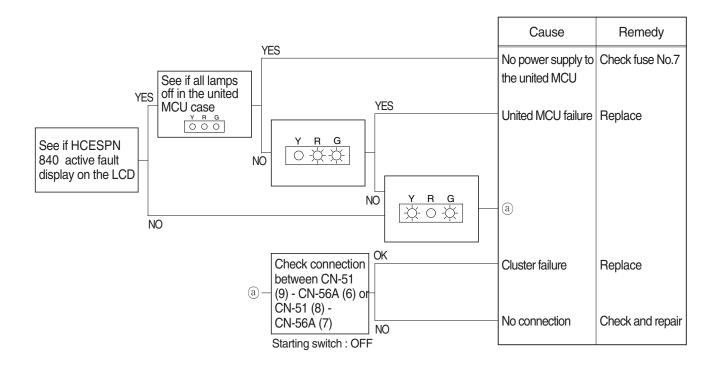




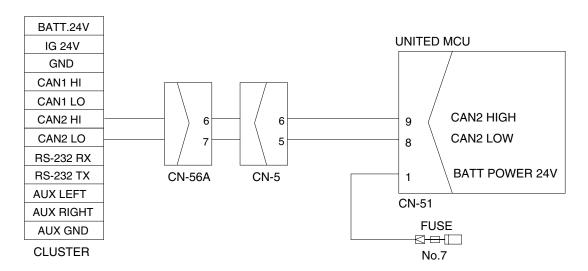
#### 3. MALFUNCTION OF CLUSTER OR MODE SELECTION SYSTEM

\* Before carrying out below procedure, check all the related connectors are properly inserted.

# 1) INSPECTION PROCEDURE



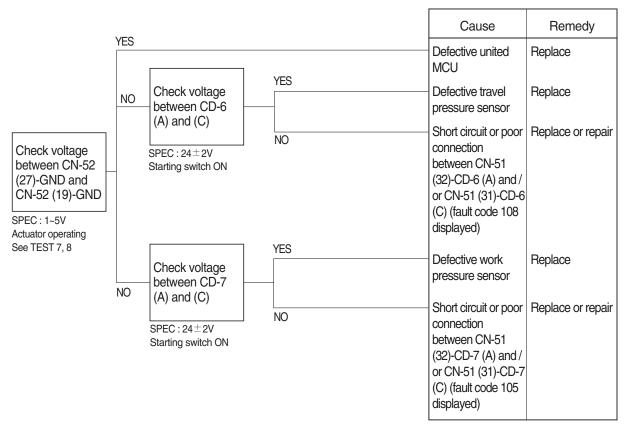
### Wiring diagram



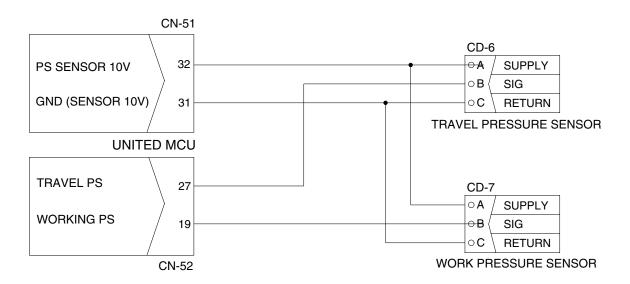
#### 4. AUTO DECEL SYSTEM DOES NOT WORK

- Fault code: HCESPN 105, FMI 0~4 (work pressure sensor)
   HCESPN 108, FMI 0~4 (travel oil pressure sensor)
- \* Before carrying out below procedure, check all the related connectors are properly inserted.

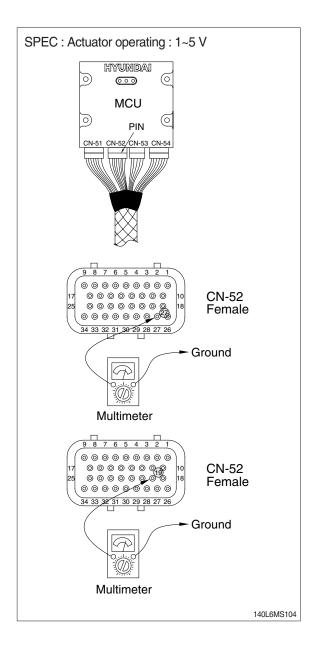
### 1) INSPECTION PROCEDURE



#### Wiring diagram



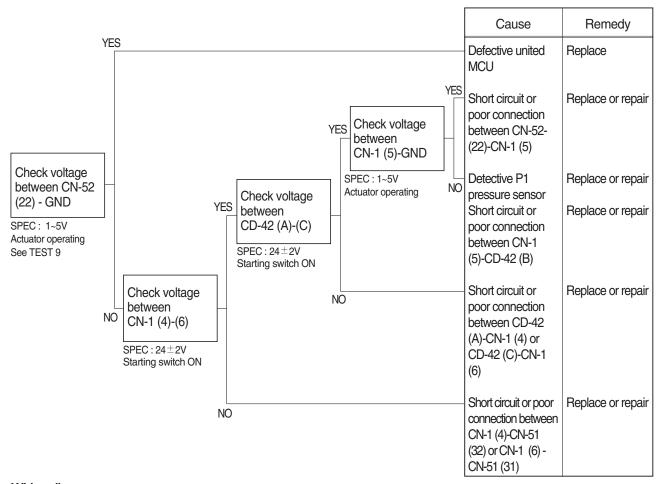
- (1) Test 7: Check voltage at CN-52 (27) and ground.
- ① Prepare 1 piece of thin sharp pin, steel or copper.
- ② Insert prepared pin to rear side of connectors: One pin to (27) of CN-52.
- 3 Starting switch ON.
- ④ Check voltage as figure.
- (2) Test 8: Check voltage at CN-52 (19) and ground.
- Prepare 1 piece of thin sharp pin, steel or copper
- ② Insert prepared pin to rear side of connectors: One pin to (19) of CN-52.
- ③ Starting switch ON.
- ④ Check voltage as figure.



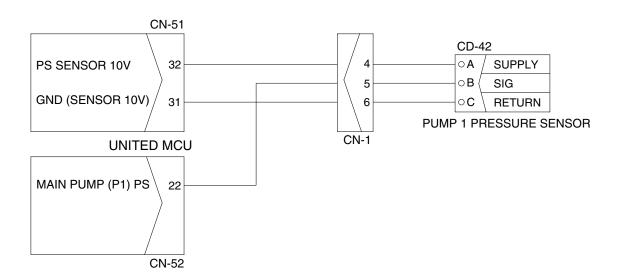
# 5. MALFUNCTION OF PUMP 1 PRESSURE SENSOR (SERIAL NO.: #0611-)

- · Fault code: HCESPN 120, FMI 0~4
- \* Before carrying out below procedure, check all the related connectors are properly inserted.

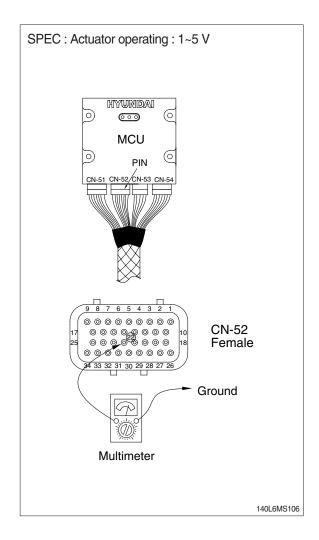
# 1) INSPECTION PROCEDURE



# Wiring diagram



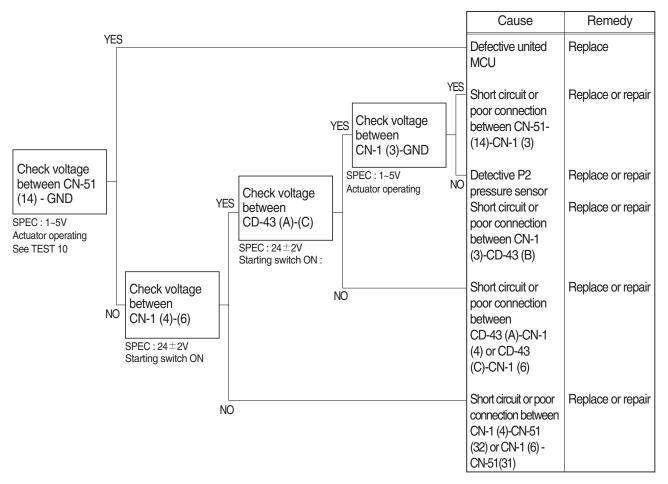
- (1) Test 9: Check voltage at CN-52 (22) and ground.
- ① Prepare 1 piece of thin sharp pin, steel or copper.
- ② Insert prepared pin to rear side of connectors: One pin to (22) of CN-52.
- ③ Starting switch ON.
- ④ Check voltage as figure.



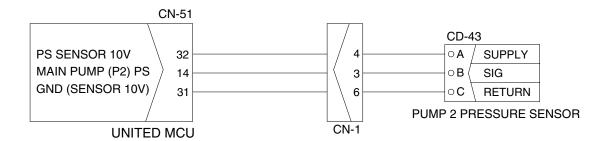
#### 6. MALFUNCTION OF PUMP 2 PRESSURE SENSOR

- · Fault code: HCESPN 121, FMI 0~4
- \* Before carrying out below procedure, check all the related connectors are properly inserted.

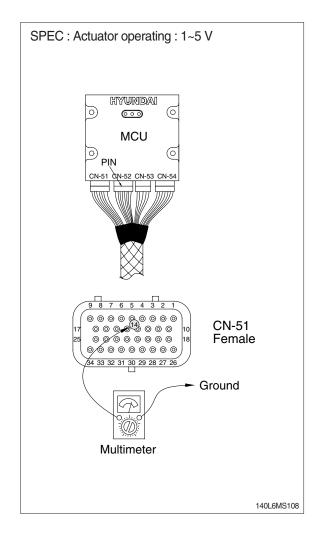
# 1) INSPECTION PROCEDURE



#### Wiring diagram



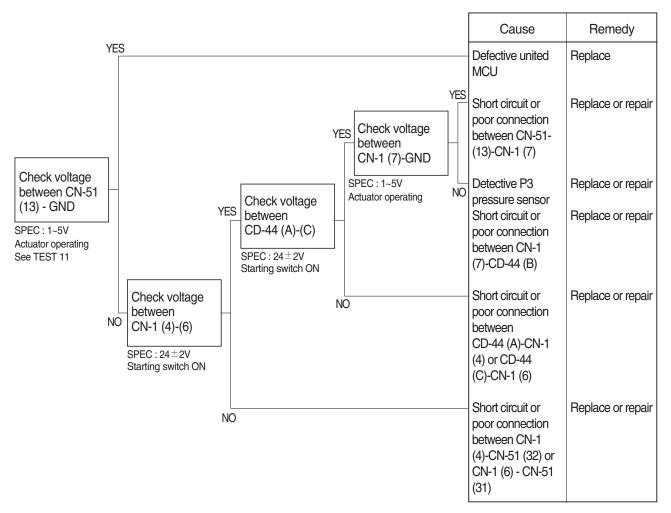
- (1) Test 10: Check voltage at CN-51 (14) and ground.
- ① Prepare 1 piece of thin sharp pin, steel or copper.
- ② Insert prepared pin to rear side of connectors: One pin to (14) of CN-51.
- ③ Starting switch ON.
- ④ Check voltage as figure.



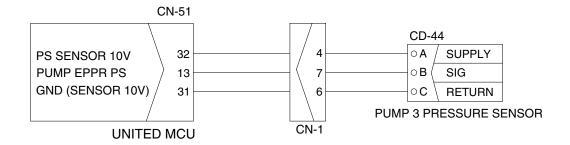
#### 7. MALFUNCTION OF PUMP 3 PRESSURE SENSOR

\* Before carrying out below procedure, check all the related connectors are properly inserted.

### 1) INSPECTION PROCEDURE

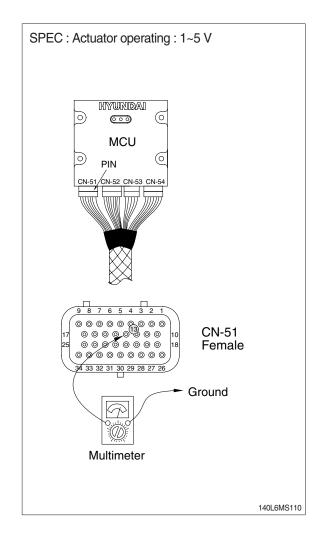


#### Wiring diagram



140L6MS109

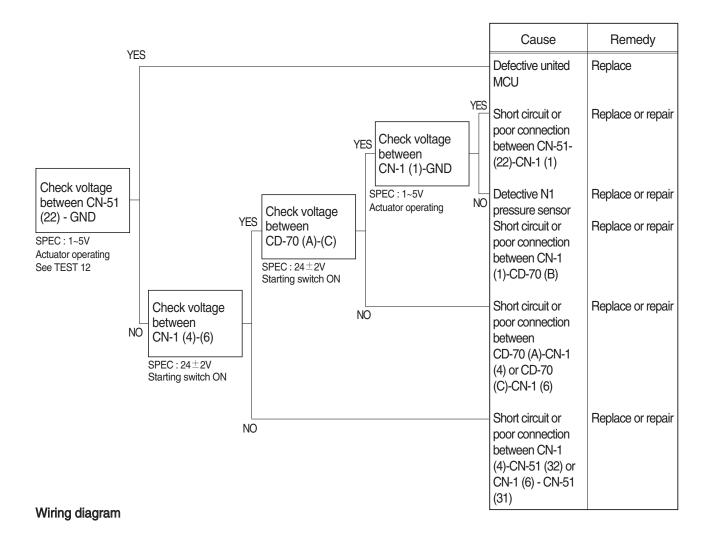
- (1) Test 11: Check voltage at CN-51 (13) and ground.
- ① Prepare 1 piece of thin sharp pin, steel or copper.
- ② Insert prepared pin to rear side of connectors: One pin to (13) of CN-51.
- ③ Starting switch ON.
- ④ Check voltage as figure.

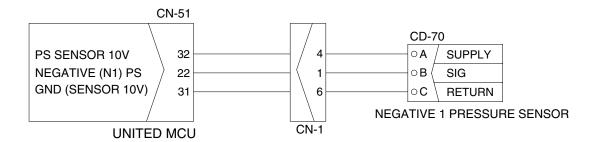


#### 8. MALFUNCTION OF NEGATIVE 1 PRESSURE SENSOR

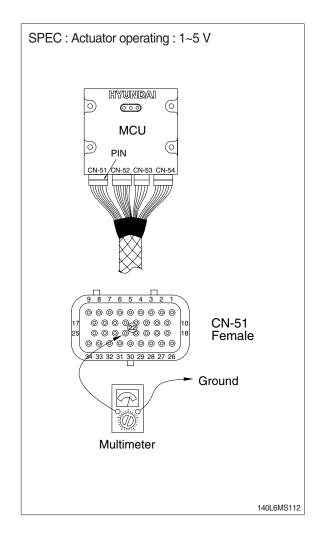
- · Fault code: HCESPN 123, FMI 0~4
- \* Before carrying out below procedure, check all the related connectors are properly inserted.

# 1) INSPECTION PROCEDURE





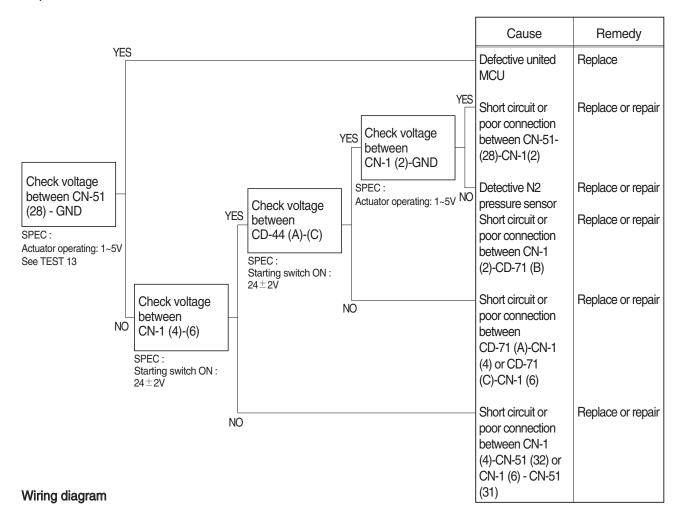
- (1) Test 12: Check voltage at CN-51 (22) and ground.
- ① Prepare 1 piece of thin sharp pin, steel or copper.
- ② Insert prepared pin to rear side of connectors: One pin to (22) of CN-51.
- ③ Starting switch ON.
- ④ Check voltage as figure.

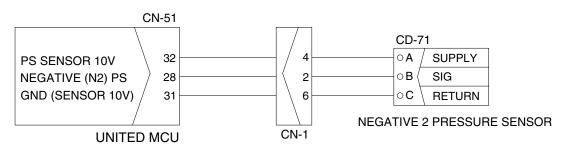


#### 9. MALFUNCTION OF NEGATIVE 2 PRESSURE SENSOR

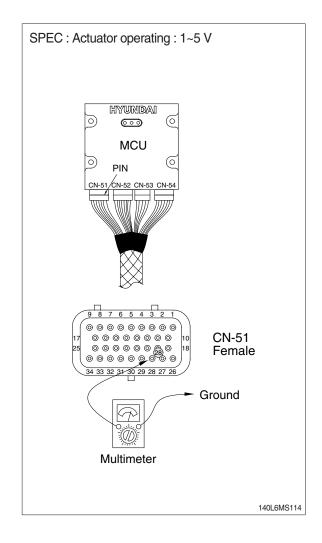
- · Fault code: HCESPN 124, FMI 0~4
- \* Before carrying out below procedure, check all the related connectors are properly inserted.

# 1) INSPECTION PROCEDURE





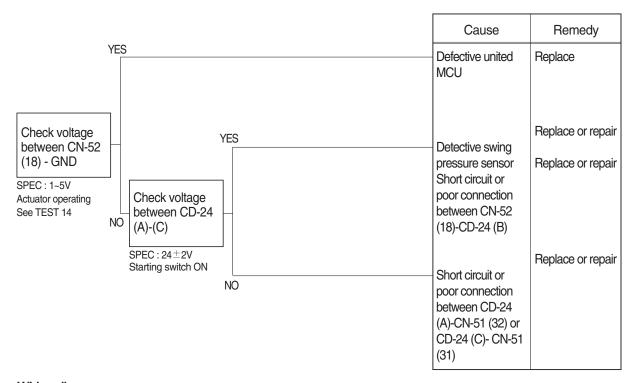
- (1) Test 13: Check voltage at CN-51 (28) and ground.
- ① Prepare 1 piece of thin sharp pin, steel or copper.
- ② Insert prepared pin to rear side of connectors: One pin to (28) of CN-51.
- ③ Starting switch ON.
- ④ Check voltage as figure.



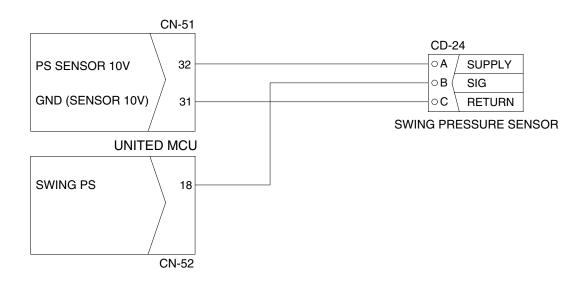
#### 10. MALFUNCTION OF SWING PRESSURE SENSOR

- · Fault code: HCESPN 135, FMI 0~4
- \* Before carrying out below procedure, check all the related connectors are properly inserted.

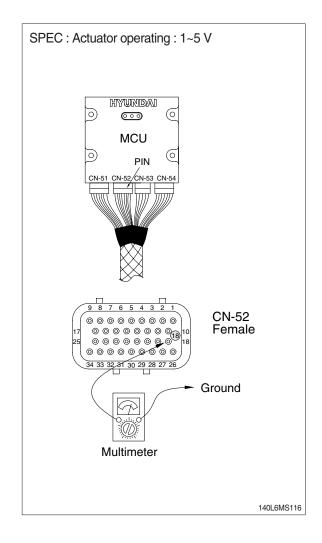
### 1) INSPECTION PROCEDURE



# Wiring diagram



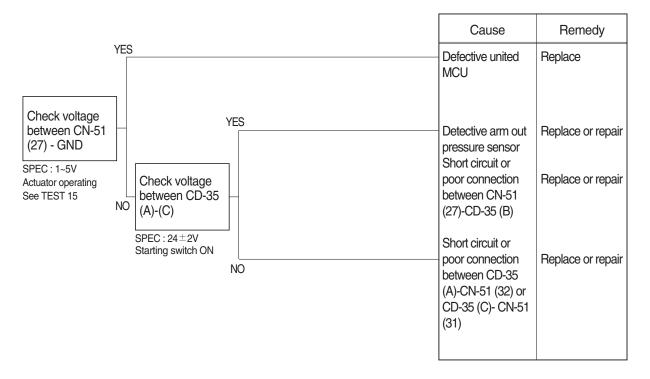
- (1) Test 14: Check voltage at CN-52 (18) and ground.
- ① Prepare 1 piece of thin sharp pin, steel or copper.
- ② Insert prepared pin to rear side of connectors: One pin to (18) of CN-52.
- ③ Starting switch ON.
- ④ Check voltage as figure.



### 11. MALFUNCTION OF ARM OUT PRESSURE SENSOR

- · Fault code: HCESPN 133, FMI 0~4
- \* Before carrying out below procedure, check all the related connectors are properly inserted.

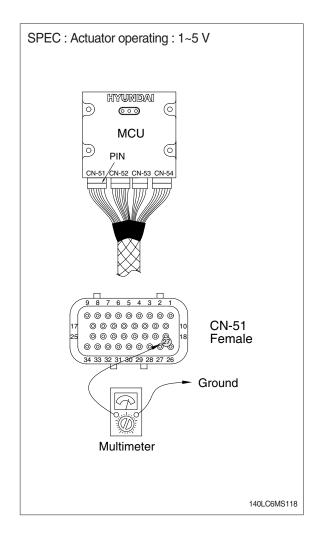
# 1) INSPECTION PROCEDURE



# Wiring diagram



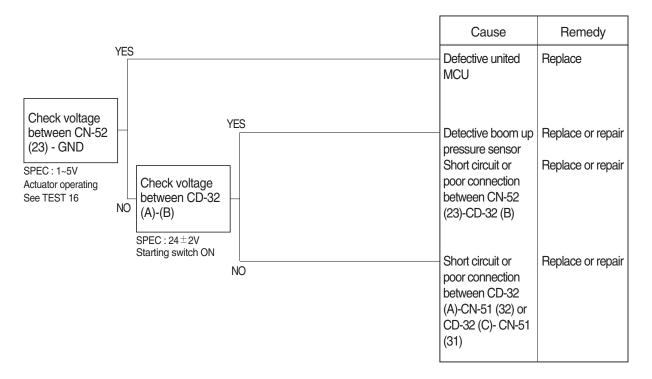
- (1) Test 15: Check voltage at CN-51 (27) and ground.
- ① Prepare 1 piece of thin sharp pin, steel or copper.
- ② Insert prepared pin to rear side of connectors: One pin to (27) of CN-51.
- ③ Starting switch ON.
- ④ Check voltage as figure.



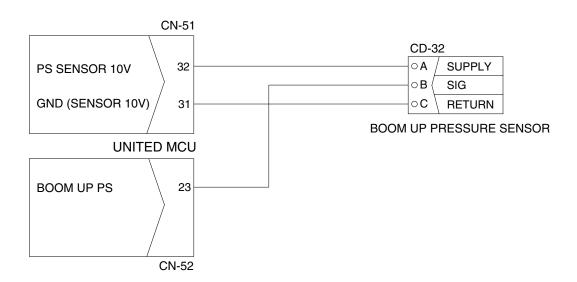
### 12. MALFUNCTION OF BOOM UP PRESSURE SENSOR

- · Fault code: HCESPN 127, FMI 0~4
- \* Before carrying out below procedure, check all the related connectors are properly inserted.

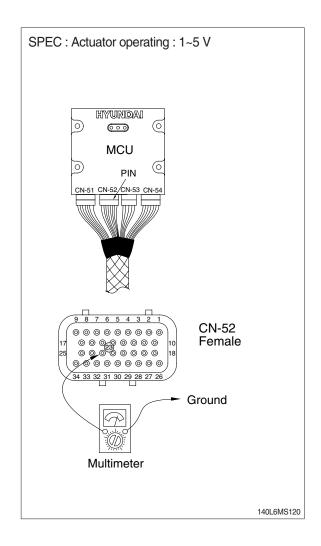
### 1) INSPECTION PROCEDURE



# Wiring diagram



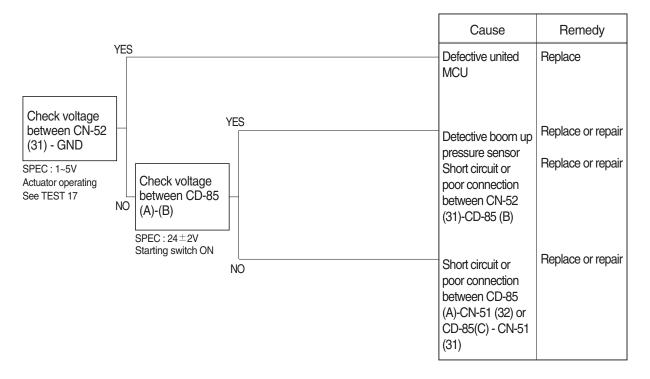
- (1) Test 16: Check voltage at CN-52 (23) and ground.
- ① Prepare 1 piece of thin sharp pin, steel or copper.
- ② Insert prepared pin to rear side of connectors: One pin to (23) of CN-52.
- ③ Starting switch ON.
- ④ Check voltage as figure.



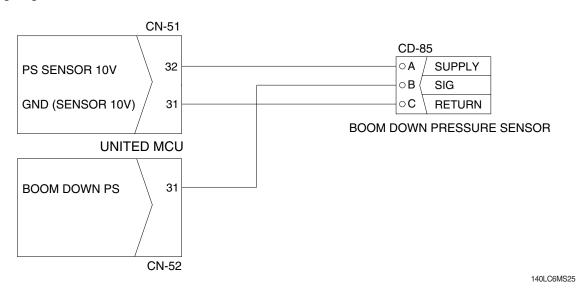
### 13. MALFUNCTION OF BOOM DOWN PRESSURE SENSOR

- · Fault code: HCESPN 128, FMI 0~4
- \* Before carrying out below procedure, check all the related connectors are properly inserted.

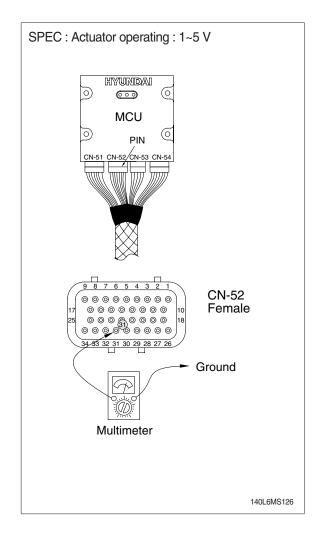
### 1) INSPECTION PROCEDURE



### Wiring diagram



- (1) Test 17: Check voltage at CN-52 (31) and ground.
- ① Prepare 1 piece of thin sharp pin, steel or copper.
- ② Insert prepared pin to rear side of connectors: One pin to (31) of CN-52.
- ③ Starting switch ON.
- 4 Check voltage as figure.

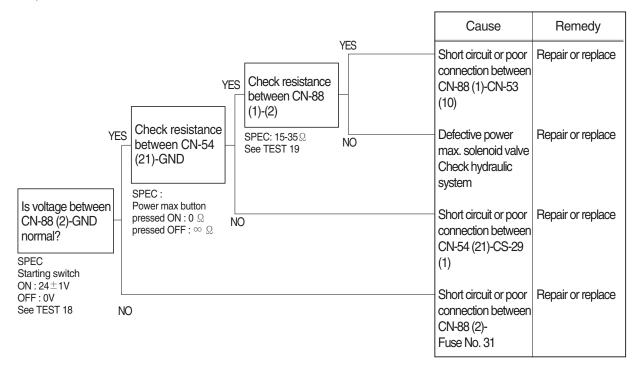


#### 14. MALFUNCTION OF POWER MAX

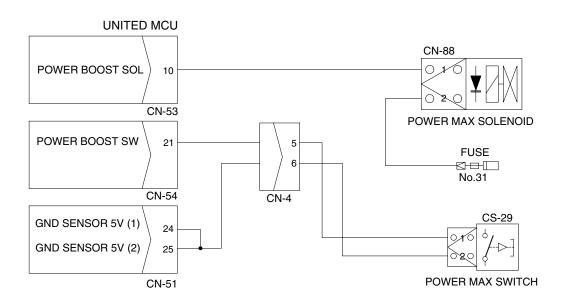
· Fault code: HCESPN 166, FMI 4 or 6

\* Before carrying out below procedure, check all the related connectors are properly inserted.

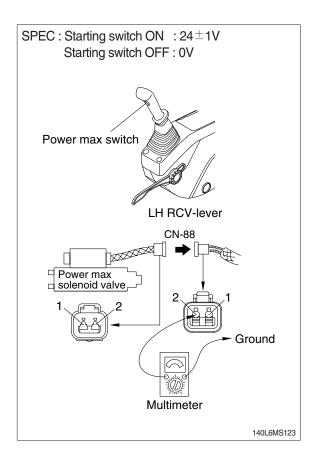
# 1) INSPECTION PROCEDURE



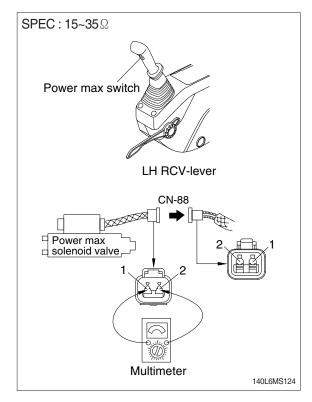
#### Wiring diagram



- (1) Test 18: Check voltage between connector CN-88 (2) GND.
- ① Disconnect connector CN-88 from power max solenoid valve.
- ② Start switch ON.
- 3 Check voltage as figure.



- (2) Test 19: Check resistance of the solenoid valve between CN-88 (1)-(2).
- ① Starting switch OFF.
- ② Disconnect connector CN-88 from power max solenoid valve.
- ③ Check resistance as figure.

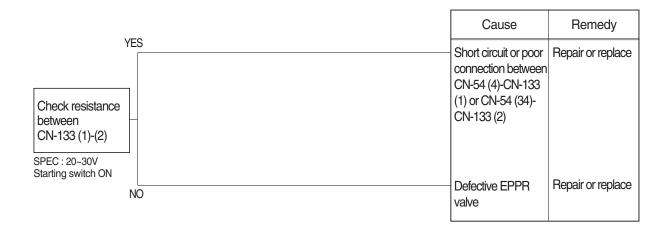


#### 15. MALFUNCTION OF BOOM PRIORITY EPPR VALVE

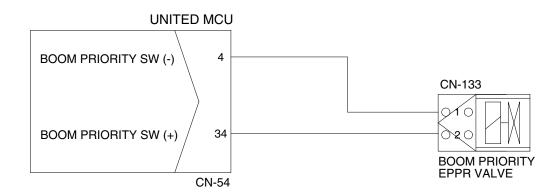
· Fault code: HCESPN 141, FMI 5 or 6

\* Before carrying out below procedure, check all the related connectors are properly inserted.

#### 1) INSPECTION PROCEDURE



#### Wiring diagram



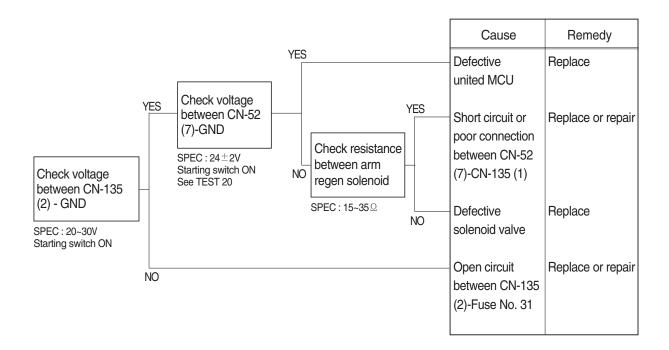
140LC6MS22

#### 16. MALFUNCTION OF ARM REGENERATION SOLENOID

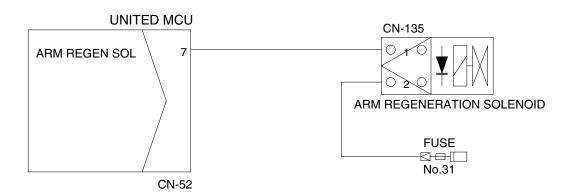
· Fault code: HCESPN 170, FMI 4 or 6

\* Before carrying out below procedure, check all the related connectors are properly inserted.

### 1) INSPECTION PROCEDURE



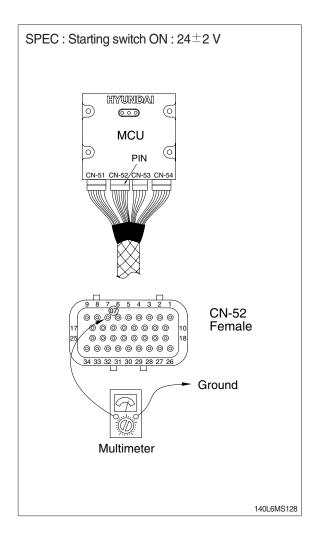
#### Wiring diagram



140LC6MS27

#### 2) TEST PROCEDURE

- (1) Test 20: Check voltage at CN-52 (7) and ground.
- ① Prepare 1 piece of thin sharp pin, steel or copper.
- ② Insert prepared pin to rear side of connectors: One pin to (7) of CN-52.
- ③ Starting switch ON.
- ④ Check voltage as figure.



# SECTION 7 MAINTENANCE STANDARD

Group	1	Operational Performance Test ·····	7-1
Group	2	Major Components	7-21
Group	3	Track and Work Equipment	7-30

### SECTION 7 MAINTENANCE STANDARD

### **GROUP 1 OPERATIONAL PERFORMANCE TEST**

#### 1. PURPOSE

Performance tests are used to check:

# 1) OPERATIONAL PERFORMANCE OF A NEW MACHINE

Whenever a new machine is delivered in parts and reassembled at a customer's site, it must be tested to confirm that the operational performance of the machine meets HD Hyundai Construction Equipment spec.

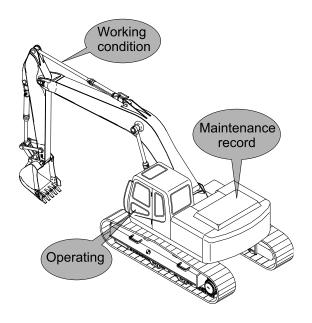
# 2) OPERATIONAL PERFORMANCE OF A WORKING MACHINE

With the passage of time, the machine's operational performance deteriorates, so that the machine needs to be serviced periodically to restore it to its original performance level.

Before servicing the machine, conduct performance tests to check the extent of deterioration, and to decide what kind of service needs to be done(by referring to the "Service Limits" in this manual).

# 3) OPERATIONAL PERFORMANCE OF A REPAIRED MACHINE

After the machine is repaired or serviced, it must be tested to confirm that its operational performance was restored by the repair and/or service work done.

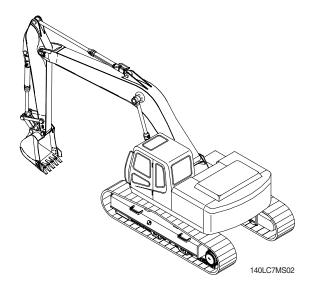


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#### 2. TERMINOLOGY

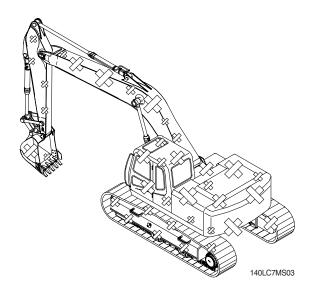
#### 1) STANDARD

Specifications applied to the brand-new machine, components and parts.



### 2) SERVICE LIMIT

The lowest acceptable performance level. When the performance level of the machine falls below this level, the machine must be removed from work and repaired. Necessary parts and components must be replaced.



#### 3. OPERATION FOR PERFORMANCE TESTS

1) Observe the following rules in order to carry out performance tests accurately and safely.

#### (1) The machine

Repair any defects and damage found, such as oil or water leaks, loose bolts, cracks and so on, before starting to test.

#### (2) Test area

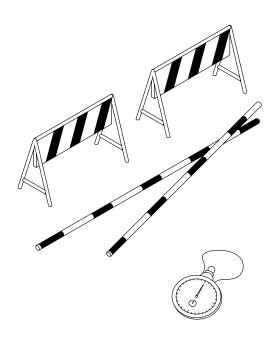
- ① Select a hard, flat surface.
- ② Secure enough space to allow the machine to run straight more than 20m, and to make a full swing with the front attachment extended.
- ③ If required, rope off the test area and provide signboards to keep unauthorized personnel away.

#### (3) Precautions

- ① Before starting to test, agree upon the signals to be employed for communication among coworkers. Once the test is started, be sure to communicate with each other using these signals, and to follow them without fail.
- ② Operate the machine carefully and always give first priority to safety.
- ③ While testing, always take care to avoid accidents due to landslides or contact with high voltage power lines. Always confirm that there is sufficient space for full swings.
- Avoid polluting the machine and the ground with leaking oil. Use oil pans to catch escaping oil. Pay special attention to this when removing hydraulic pipings.

#### (4) Make precise measurements

- Accurately calibrate test instruments in advance to obtain correct data.
- ② Carry out tests under the exact test conditions prescribed for each test item.
- ③ Repeat the same test and confirm that the test data obtained can be procured repeatedly. Use mean values of measurements if necessary.



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#### 2) ENGINE SPEED

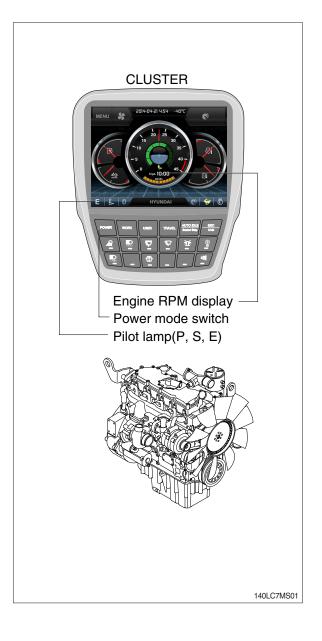
- (1) Measure the engine speed at each power mode
- \*\* The engine speed at each power mode must meet standard RPM; if not, all other operational performance data will be unreliable. It is essential to perform this test first.

#### (2) Preparation

- ① Warm up the machine, until the engine coolant temperature reaches 50°C or more, and the hydraulic oil is 50±5°C.
- ② Set the multimodal dial at 10 (Max) position.
- ③ Measure the engine RPM.

#### (3) Measurement

- ① Start the engine. The engine will run at start idle speed. Measure engine speed with a engine rpm display.
- ② Measure and record the engine speed at each mode (P, S, E).
- ③ Select the P-mode.
- ① Lightly operate the bucket control lever a few times, then return the control lever to neutral; The engine will automatically enter the auto-idle speed after 4 seconds.
- Measure and record the auto deceleration speed.



#### (4) Evaluation

The measured speeds should meet the following specifications.

Unit: rpm

Model	Engine speed	Standard	Remarks
	Start idle	1000±100	
	P mode	1850±50	
111/4 40 1 0	S mode	1750±50	
HX140 LC	E mode	1650±50	
	Auto decel	1100±100	
	One touch decel	1000±100	

Condition: Set the multimodal dial at 10 (Max) position.

#### 3) TRAVEL SPEED

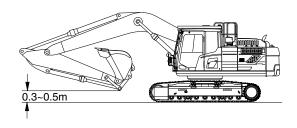
(1) Measure the time required for the excavator to travel a 20 m test track.

#### (2) Preparation

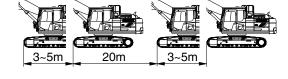
- ① Adjust the tension of both tracks to be equal.
- ② Prepare a flat and solid test track 20m in length, with extra length of 3 to 5 m on both ends for machine acceleration and deceleration.
- ③ Hold the bucket 0.3 to 0.5 m above the ground with the arm and bucket rolled in.
- 4 Keep the hydraulic oil temperature at  $50\pm5^{\circ}$ C.



- ① Measure both the low and high speeds of the machine.
- ② Before starting either the low or high speed tests, adjust the travel mode switch to the speed to be tested, then select the following switch positions.
- · Power mode switch : P mode
- 3 Start traveling the machine in the acceleration zone with the travel levers at full stroke.
- 4 Measure the time required to travel 20 m.
- S After measuring the forward travel speed, turn the upperstructure 180° and measure the reverse travel speed.
- ⑥ Repeat steps ④ and ⑤ three times in each direction and calculate the average values.



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#### (4) Evaluation

The average measured time should meet the following specifications.

Unit: Seconds / 20 m

Model	Travel speed	Standard	Maximum allowable	Remarks
11744010	1 Speed	21.8±2.0	27.3	
HX140 LC	2 Speed	12.9±1.0	16.1	

#### 4) TRACK REVOLUTION SPEED

(1) Measure the track revolution cycle time with the track raised off ground.

#### (2) Preparation

- ① Adjust the tension of both side tracks to be equal.
- ② On the track to be measured, mark one shoe with chalk.
- ③ Swing the upperstructure 90 °and lower the bucket to raise the track off ground. Keep the boom-arm angle between 90 to 110 °as shown. Place blocks under machine frame.
- 4 Keep the hydraulic oil temperature at  $50\pm5^{\circ}$ C.



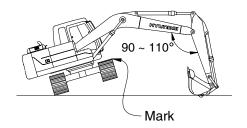
- ① Select the following switch positions.
- · Travel mode switch : 1 or 2 speed
- · Power mode switch : P mode
- · Auto idle switch : OFF
- ② Operate the travel control lever of the raised track in full forward and reverse.
- 3 Rotate 1 turn, then measure time taken for next 3 revolutions.
- ④ Raise the other side of machine and repeat the procedure.
- ⑤ Repeat steps ③ and ④ three times and calculate the average values.

#### (4) Evaluation

The revolution cycle time of each track should meet the following specifications.

Unit: Seconds / 3 revolutions

Model	Travel speed	Standard	Maximum allowable
HX140 LC	1 Speed	25.1±2.0	31.4
	2 Speed	14.7±2.0	18.4



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#### 5) TRAVEL DEVIATION

(1) Measure the deviation by the tracks from a 20m straight line.

#### (2) Preparation

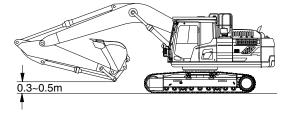
- ① Adjust the tension of both tracks to be equal.
- 2 Provide a flat, solid test yard 20 m in length, with extra length of 3 to 5 m on both ends for machine acceleration and deceleration.
- ③ Hold the bucket 0.3 to 0.5 m above the ground with the arm and bucket rolled in.
- 4 Keep the hydraulic oil temperature at 50±5°C.



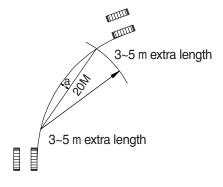
- ① Measure the amount of mistracking at high and low travel speeds.
- 2 Before beginning each test, select the following switch positions.
- · Power mode switch : P mode
- 3 Start traveling the machine in the acceleration zone with the travel levers at full stroke.
- ④ Measure the distance between a straight 20 m line and the track made by the machine. (Dimension a)
- (5) After measuring the tracking in forward travel, turn the upperstructure 180° and measure that in reverse travel.
- 6 Repeat steps 4 and 5 three times and calculate the average values.

#### (4) Evaluation

Mistrack should be within the following specifications.



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Unit: mm/20 m

Model	Standard	Maximum allowable	Remarks
HX140 LC	200 below	240	

#### 6) SWING SPEED

(1) Measure the time required to swing three complete turns.

#### (2) Preparation

- ① Check the lubrication of the swing gear and swing bearing.
- ② Place the machine on flat, solid ground with ample space for swinging. Do not conduct this test on slopes.
- With the arm rolled out and bucket rolled in, hold the bucket so that the height of the bucket pin is the same as the boom foot pin. The bucket must be empty.
- 4 Keep the hydraulic oil temperature at  $50\pm5^{\circ}$ C.



- ① Select the following switch positions.
- · Power mode switch : P mode
- ② Operate swing control lever fully.
- ③ Swing 1 turn and measure time taken to swing next 3 revolutions.
- ④ Repeat steps ② and ③ three time and calculate the average values.



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#### (4) Evaluation

The time required for 3 swings should meet the following specifications.

Unit: Seconds / 3 revolutions

Model	Power mode switch	Standard	Maximum allowable
HX140 LC	P mode	15.6±1.5	19.5

#### 7) SWING FUNCTION DRIFT CHECK

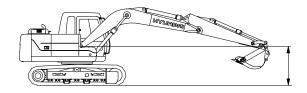
 Measure the swing drift on the bearing outer circumference when stopping after a 360 °full speed swing.

#### (2) Preparation

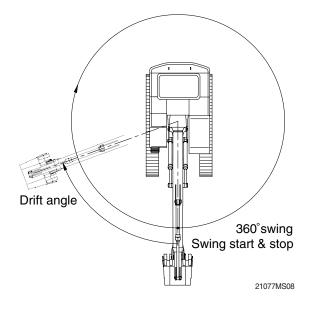
- ① Check the lubrication of the swing gear and swing bearing.
- ② Place the machine on flat, solid ground with ample space for swinging. Do not conduct this test on slopes.
- With the arm rolled out and bucket rolled in, hold the bucket so that the height of the bucket pin is the same as the boom foot pin. The bucket must be empty.
- Make two chalk marks: one on the swing bearing and one directly below it on the track frame.
- 5 Swing the upperstructure 360°.
- 6 Keep the hydraulic oil temperature at  $50\pm5^{\circ}$ C.

#### (3) Measurement

- ① Conduct this test in the M mode.
- ② Select the following switch positions.
- · Power mode switch : P mode
- ③ Operate the swing control lever fully and return it to the neutral position when the mark on the upperstructure aligns with that on track frame after swinging 360 °
- Measure the distance between the two marks.
- S Align the marks again, swing 360 °, then test the opposite direction.
- ⑥ Repeat steps ④ and ⑤ three times each and calculate the average values.



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#### (4) Evaluation

The measured drift angle should be within the following specifications.

Unit : Degree

Model	Power mode switch	Standard	Maximum allowable	Remarks
HX140 LC	P mode	90 below	157.5	

### 8) SWING BEARING PLAY

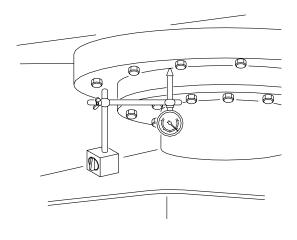
(1) Measure the swing bearing play using a dial gauge to check the wear of bearing races and balls.

#### (2) Preparation

- ① Check swing bearing mounting cap screws for loosening.
- ② Check the lubrication of the swing bearing. Confirm that bearing rotation is smooth and without noise.
- ③ Install a dial gauge on the track frame as shown, using a magnetic base.
- ④ Position the upperstructure so that the boom aligns with the tracks facing towards the front idlers.
- ⑤ Position the dial gauge so that its needle point comes into contact with the bottom face of the bearing outer race.
- 6 Bucket should be empty.

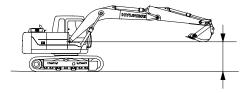
#### (3) Measurement

- With the arm rolled out and bucket rolled in, hold the bottom face of the bucket to the same height of the boom foot pin.
   Record the dial gauge reading (h1).
- ② Lower the bucket to the ground and use it to raise the front idler 50cm. Record the dial gauge reading (h2).
- 3 Calculate bearing play (H) from this data (h1 and h2) as follows.H=h2-h1

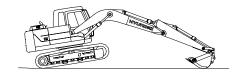


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#### Measurement: (h1)



Measurement: (h2)



(4) Evaluation

The measured drift should be within the following specifications.

Unit: mm

Model	Standard	Maximum allowable	Remarks
HX140 LC	0.5 ~ 1.5	3.0	

#### 9) HYDRAULIC CYLINDER CYCLE TIME

 Measure the cycle time of the boom, standard arm, and standard bucket cylinders.

#### (2) Preparation

- ① To measure the cycle time of the boom cylinders:
  - With the arm rolled out and the empty bucket rolled out, lower the bucket to the ground, as shown.
- ② To measure the cycle time of the arm cylinder.
  - With the empty bucket rolled in, position the arm so that it is vertical to the ground. Lower the boom until the bucket is 0.5 m above the ground.
- ③ To measure the cycle time of the bucket cylinder.
  - The empty bucket should be positioned at midstroke between roll-in and roll-out, so that the sideplate edges are vertical to the ground.
- ① Keep the hydraulic oil temperature at  $50\pm5^{\circ}$ C.

#### (3) Measurement

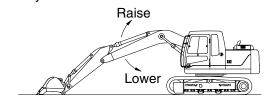
- ① Select the following switch positions.
  - · Power mode switch : P mode
- ② To measure cylinder cycle times.
  - Boom cylinders.

Measure the time it takes to raise the boom, and the time it takes to lower the boom. To do so, position the boom at one stroke end then move the control lever to the other stroke end as quickly as possible.

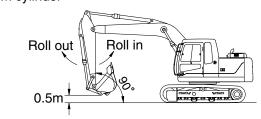
- Arm cylinder.

Measure the time it takes to roll in the arm, and the time it takes to roll out the arm. To do so, position the bucket at one stroke end, then move the control lever to the other stroke end as quickly as possible.

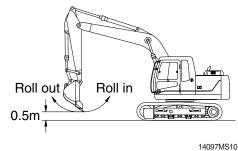
#### Boom cylinder



#### Arm cylinder



#### Bucket cylinder



#### - Bucket cylinders

Measure the time it takes to roll in the bucket, and the time it takes to roll out the bucket. To do so, position the bucket at one stroke end, then move the control lever to the other stroke end as quickly as possible.

- Repeat each measurement 3 times and calculate the average values.

#### (4) Evaluation

The average measured time should meet the following specifications.

Unit: Seconds

Model	Function		Standard	Maximum allowable	Remarks
	Boom raise		3.4±0.4	4.4	
	Boom lower		2.6±0.4	3.6	
	Arm in	Regen ON	2.6±0.4	3.6	
HX140 LC		Regen OFF	3.1±0.4	4.0	
	Arm out		2.8±0.3	3.6	
	Bucket in		3.5±0.4	4.6	
	Bucket out		2.2±0.3	2.9	

#### 10) DIG FUNCTION DRIFT CHECK

(1) Measure dig function drift, which can be caused by oil leakage in the control valve and boom, standard arm, and standard bucket cylinders, with the loaded bucket. When testing the dig function drift just after cylinder replacement, slowly operate each cylinder to its stroke end to purge air.

#### (2) Preparation

- Load bucket fully. Instead of loading the bucket, weight(W) of the following specification can be used.
  - · W= $M^3 \times 1.5$

Where:

M<sup>3</sup> = Bucket heaped capacity (m<sup>3</sup>)

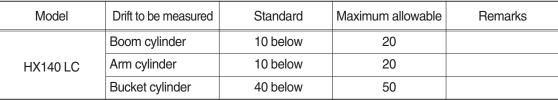
1.5 = Soil specific gravity

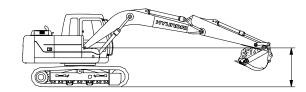
- ② Position the arm cylinder with the rod 20 to 30mm extended from the fully retracted position.
- ③ Position the bucket cylinder with the rod 20 to 30mm retracted from the fully extended position.
- With the arm rolled out and bucket rolled in, hold the bucket so that the height of the bucket pin is the same as the boom foot pin.
- ⑤ Keep the hydraulic oil temperature at  $50\pm5^{\circ}$ C.

#### (3) Measurement

- ① Stop the engine.
- ② Five minutes after the engine has been stopped, measure the changes in the positions of the boom, arm and bucket cylinders.
- ③ Repeat step ② three times and calculate the average values.
- (4) The measured drift should be within the following specifications.

Unit: mm/5min





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#### 11) CONTROL LEVER OPERATING FORCE

(1) Use a spring scale to measure the maximum resistance of each control lever at the middle of the grip.

#### (2) Preparation

① Keep the hydraulic oil temperature at  $50\pm5^{\circ}$ C.

#### (3) Measurement

- ① Start the engine.
- ② Select the following switch positions.
  - · Power mode switch: P mode
- ③ Operate each boom, arm, bucket and swing lever at full stroke and measure the maximum operating force for each.
- ④ Lower the bucket to the ground to raise one track off the ground. Operate the travel lever at full stroke and measure the maximum operating force required. When finished, lower the track and then jack-up the other track.
- ⑤ Repeat steps ③ and ④ three times and calculate the average values.

#### (4) Evaluation

The measured operating force should be within the following specifications.

Unit: kgf

Model	Kind of lever	Standard	Maximum allowable	Remarks
	Boom lever	1.3 or below	1.7	
	Arm lever	1.3 or below	1.7	
HX140 LC	Bucket lever	1.3 or below	1.7	
	Swing lever	1.3 or below	1.7	
	Travel lever	2.1 or below	3.15	

#### 12) CONTROL LEVER STROKE

- (1) Measure each lever stroke at the lever top using a ruler.
- When the lever has play, take a half of this value and add it to the measured stroke.

#### (2) Preparation

Keep the hydraulic oil temperature at  $50\pm5^{\circ}$ C.

#### (3) Measurement

- ① Stop the engine.
- ② Measure each lever stroke at the lever top from neutral to the stroke end using a ruler.
- ③ Repeat step ② three times and calculate the average values.

#### (4) Evaluation

The measured drift should be within the following specifications.

Unit: mm

Model	Kind of lever	Standard	Maximum allowable	Remarks
	Boom lever	90±10	115	
	Arm lever	90±10	115	
HX140 LC	Bucket lever	90±10	115	
	Swing lever	90±10	115	
	Travel lever	142±10	178	

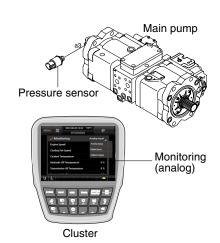
#### 13) PILOT PRIMARY PRESSURE

### (1) Preparation

① Keep the hydraulic oil temperature at  $50\pm5^{\circ}$ C.

#### (2) Measurement

- ① Select the following switch positions.
  - · Power mode switch : P mode
  - · Auto decel switch : OFF
- ② Measure the primary pilot pressure by the monitoring menu of the cluster.



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#### (3) Evaluation

The average measured pressure should meet the following specifications:

Unit: kgf/cm<sup>2</sup>

Model	Engine speed	Standard	Allowable limits	Remarks
HX140 LC	P mode	40 +2	-	

#### 14) FOR TRAVEL SPEED SELECTING PRESSURE:

#### (1) Preparation

- ① Stop the engine.
- ② Loosen the cap and relieve the pressure in the tank by pushing the top of the air breather.
- ③ To measure the speed selecting pressure: Install a connector and pressure gauge assembly to turning joint P port as shown.
- ④ Start the engine and check for on leakage from the adapter.
- $\bigcirc$  Keep the hydraulic oil temperature at  $50\pm5^{\circ}$ C.

#### (2) Measurement

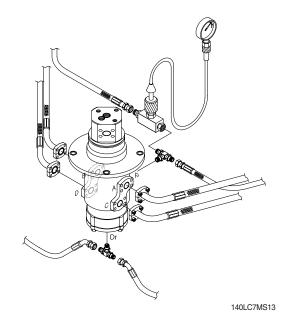
① Select the following switch positions.

Travel mode switch: 1 speed

2 speed

· Mode selector : P mode

- ② Measure the travel speed selecting pressure in the Hi or Lo mode.
- ③ Repeat step ② three times and calculate the average values.



#### (3) Evaluation

The average measured pressure should be within the following specifications.

Unit: kgf/cm2

Model	Travel speed mode	Standard	Maximum allowable	Remarks
HX140 LC	1 Speed	0	-	
HX140 LC	2 Speed	40±5	-	

#### 15) SWING PARKING BRAKE RELEASING PILOT PRESSURE

#### (1) Preparation

- ① Stop the engine.
- ② Loosen the cap and relieve the pressure in the tank by pushing the top of the air breather.
- The pressure release L wrench to bleed air.
- ④ Install a connector and pressure gauge assembly to swing motor SH port, as shown.
- ⑤ Start the engine and check for oil leakage from the adapter.
- ⑥ Keep the hydraulic oil temperature at  $50\pm5^{\circ}$ C.



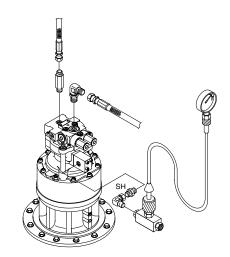
- ① Select the following switch positions.
  - · Power mode switch : P mode
- ② Operate the swing function or arm roll in function and measure the swing brake control pressure with the brake disengaged. Release the control lever to return to neutral and measure the control pressure when the brake is applied.
- ③ Repeat step ② three times and calculate the average values.

#### (3) Evaluation

The average measured pressure should be within the following specifications.

Unit: kgf/cm2

Model	Description	Standard	Allowable limits	Remarks
HX140 LC	Brake disengaged	40	Over 9	
TIXT40 LO	Brake applied	0	-	



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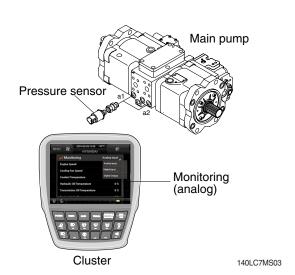
#### 16) MAIN PUMP DELIVERY PRESSURE

### (1) Preparation

① Keep the hydraulic oil temperature at  $50\pm5^{\circ}$ C.

#### (2) Measurement

- ① Select the following switch positions.
- · Power mode switch : P mode
- ② Measure the main pump delivery pressure in the P mode (high idle).



#### (3) Evaluation

The average measured pressure should meet the following specifications.

Unit: kgf/cm2

Model	Engine speed	Standard	Allowable limits	Remarks
HX140 LC	High idle	40 +2	-	

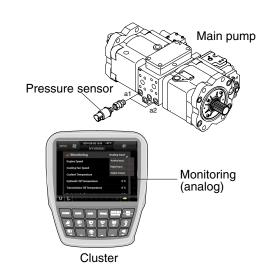
#### 17) SYSTEM PRESSURE REGULATOR RELIEF SETTING

#### (1) Preparation

① Keep the hydraulic oil temperature at  $50\pm5^{\circ}$ C.

#### (2) Measurement

- ① Select the following switch positions.
  - · Power mode switch : P mode
- ② Slowly operate each control lever of boom, arm and bucket functions at full stroke over relief and measure the pressure.
- ③ In the swing function, place bucket against an immovable object and measure the relief pressure.
- ④ In the travel function, lock undercarriage with an immovable object and measure the relief pressure.



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#### (3) Evaluation

The average measured pressure should be within the following specifications.

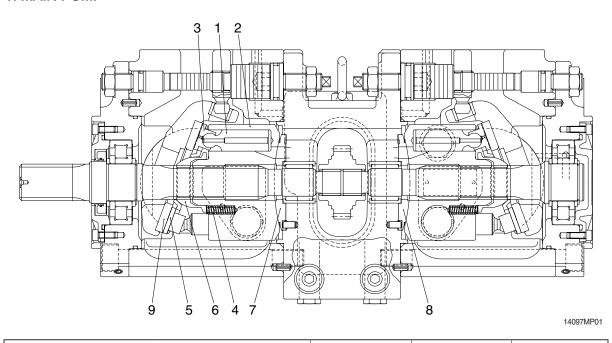
Unit: kgf/cm2

Model	Function to be tested	Standard	Port relief setting at 20 lpm
	Boom, Arm, Bucket	350 (380)±10	400±10
HX140 LC	Travel	350±10	-
	Swing	285±10	-

): Power boost

## **GROUP 2 MAJOR COMPONENT**

### 1. MAIN PUMP



Part name & inspection item		Standard dimension	Recommended replacement value	Counter measures
Clearance between piston (1) & cylinder bore (2) (D-d)	d D	0.028	0.056	Replace piston or cylinder.
Play between piston (1) & shoe caulking section (3)	•	0-0.1	0.3	Replace
Thickness of shoe (t)	8	3.9	3.7	assembly of piston & shoe.
Free height of cylinder spring(4) (L)		31.3	30.5	Replace cylinder spring.
Combined height of set plate(5)(H) & spherical bushing(6)(h) (H-h)	h H	19.0	18.3	Replace retainer or set plate.
Surface roughness for valve plate (Sliding face)(7,8), swash plate (shoe plate	Surface roughness necessary to be corrected	3	Z	Lanning
area) (9), & cylinder (2) (Sliding face)	Standard surface roughness (Corrected value)	0.4z o	r lower	Lapping

### 2. MAIN CONTROL VALVE

Part name	Inspection item	Criteria & measure
Casing	· Existence of scratch, rusting or corrosion.	· In case of damage in following section, replace part.
		<ul> <li>Sliding sections of casing fore and spool, especially land sections applied with holded pressure.</li> <li>Seal pocket section where spool is inserted.</li> <li>Seal section of port where O-ring contacts.</li> <li>Seal section of each relief valve for main, travel, and port.</li> <li>Other damages that may damage normal functions.</li> </ul>
Spool	· Existence of scratch, gnawing, rusting or corrosion.	Replacement when its outside sliding section has scratch (especially on seals-contacting section).
	· O-ring seal sections at both ends.	· Replacement when its sliding section has scratch.
	· Insert spool in casing hole, rotate and reciprocate it.	<ul> <li>Correction or replacement when O-ring is damaged or when spool does not move smoothly.</li> </ul>
Poppet	· Damage of poppet or spring	· Correction or replacement when sealing is incomplete.
	· Insert poppet into casing and function it.	<ul> <li>Normal when it can function lightly without being caught.</li> </ul>
Around spring	Rusting, corrosion, deformation or breaking of spring, spring seat, plug or cover.	· Replacement for significant damage.
Around seal	· External oil leakage.	· Correction or replacement.
for spool	Rusting, corrosion or deformation of seal plate.	· Correction or replacement.
Main relief valve,	· External rusting or damage.	· Replacement.
port relief valve & negative control	· Contacting face of valve seat.	· Replacement when damaged.
relief valve	· Contacting face of poppet.	· Replacement when damaged.
	· Abnormal spring.	· Replacement.
	· O-rings, back up rings and seals.	$\cdot$ 100% replacement in general.

### 3. SWING DEVICE

## 1) WEARING PARTS

Inspection item	Standard dimension	Standard dimension	Counter measures
Clearance between piston and cylinder block bore	0.028	0.058	Replace piston or cylinder block
Play between piston and shoe caulking section ( $\delta$ )	0	0.3	Replace assembly of piston and shoe
Thickness of shoe (t)	5.5	5.3	Replace assembly of piston and shoe
Combined height of retainer plate and spherical bushing (H-h)	6.5	6.0	Replace set of retainer plate and spherical bushing
Thickness of friction plate	4.0	3.6	Replace
tδ			2507A7MS05

### 2) SLIDING PARTS

Part name	Standard roughness	Allowable roughness	Remark
Shoe	0.8-Z (Ra=0.2) (LAPPING)	3-Z (Ra=0.8)	
Shoe plate	0.4-Z (Ra=0.1) (LAPPING)	3-Z (Ra=0.8)	
Cylinder	1.6-Z (Ra=0.4) (LAPPING)	12.5-Z (Ra=3.2)	
Valve plate	0.8-Z (Ra=0.2) (LAPPING)	6.3-Z (Ra=1.6)	

### 4. TRAVEL MOTOR

### 1) STANDARD

Problem		Cause	Remedy
Does not start	Pressure is not developed	Pump failure     Control valve malfunction	<ul> <li>Check if action other than traveling is available. If faulty, repair.</li> <li>Check if spool moves correctly. Repair if necessary.</li> </ul>
	Pressure is developed	<ul> <li>Brake valve failure</li> <li>-Sleeve stick</li> <li>-Check valve stick</li> <li>Motor failure</li> <li>-Valve seat seizure</li> <li>Gear broken and fragment locked</li> <li>Overloaded</li> </ul>	<ul> <li>Replace brake valve</li> <li>Replace</li> <li>Check hydraulic oil for contamination</li> <li>Replace reduction gear</li> <li>Reduce load</li> </ul>
Oil leakage	Leakage from engaging surfaces	<ul><li>Scratch on engaging surfaces</li><li>Loosening by poor bolt tightening</li></ul>	Correct surfaces by oilstone or sandpa- per or replace     Check after retightening
	Leakage from casing	<ul><li>Plug loosened</li><li>Crack formed by stone</li></ul>	Retighten     Replace reduction gear
	Leakage from floating seal	· Sliding surfaces worn · Creep on O-ring	Replace reduction gear     Replace floating seal
	Leakage from hydraulic motor	Bolt loosened     O-ring damaged     Sealing surface scratched	Tighten properly     Replace O-ring     Correct by oilstone or sandpaper
Coasts on sl	ope excessively	<ul> <li>Poor volumetric efficiency of hydraulic motor</li> <li>Increase of internal leakage of brake valve</li> <li>Parking brake not actuated</li> <li>Spring breakage</li> <li>Wear of friction plate</li> </ul>	<ul> <li>Replace hydraulic motor</li> <li>Replace brake valve</li> <li>Replace spring</li> <li>Replace parking brake</li> </ul>
Excessive te reduction ge	emperature on ar case	<ul><li>Pitting on bearing</li><li>Lack of gear oil</li><li>Hydraulic oil introduced to gear case</li></ul>	<ul><li>Replace reduction gear</li><li>Supply gear oil properly</li><li>Check motor and replace oil seal</li></ul>
Meanders	Meanders at low pressure	<ul> <li>Delivery rate is different between right and left</li> <li>Motor drain rate is different between right and left</li> </ul>	Repair pump     Replace motor
	Meanders at high pressure	<ul><li>Delivery rate is different between right and left</li><li>Motor drain rate is different between right and left</li></ul>	Repair regulator or pump     Replace motor
	Meanders at high pressure	<ul> <li>Relief pressure dropped at right and left brake valve</li> <li>Main relief pressure dropped at right or left of control valve</li> </ul>	Replace brake valve     Replace main relief valve
Pump delivery is poor		<ul><li>Regulator operation poor</li><li>External leakage of pump is excessive</li></ul>	· Repair regulator · Repair pump
External leaf	kage of motor is	-	· Replace motor

### 2) HIGH WALKER (TYPE 1 & 2)

	2, 11311 17/12/12/1					
Inspection item	Standard dimension	Recommended replacement value	Counter measures			
Clearance between piston and cylinder block bore	0.025	0.050	Replace piston or cylinder block			
Play between piston and shoe caulking section (T)	0	0.3	Replace assembly of piston and shoe			
Thickness of shoe (t)	4.5	4.3	Replace assembly of piston and shoe			
Combined height of set plate and ball guide (H)	7.3	7.0	Replace set of set plate and ball guide			
Thickness of friction plate	3.0	2.6	Replace			
t T			H H			

## 2) SLIDING PARTS

Part name	Standard roughness	Remark
Shoe	0.8S	-
Shoe plate	0.8S	-
Cylinder	0.8S	-
Valve plate	0.8S	-

### 5. RCV LEVER

Maintenance check item	Criteria	Remark
Leakage	The valve is to be replaced when the leakage becomes more than 1000 cc/m at neutral handle position, or more than 2000 cc/m during operation.	
Spool	This is to be replaced when the sliding surface has worn more than 10 $\mu$ m, compared with the non-sliding surface.	
Push rod	This is to be replaced when the top end has worn more than 1mm.	
Play at operating section	The pin, shaft, and joint of the operating section are to be replaced when their plays become more than 2 mm due to wears or so on.	· ·
Operation stability	When abnormal noises, hunting, primary pressure drop, etc. are generated during operation, and these cannot be remedied, referring to section 6 troubleshooting, replace the related parts.	

Notes 1. It is desirable to replace seal materials, such as O-rings, every disassembling. However, they may be reused, after being confirmed to be free of damage.

#### 6. RCV PEDAL

Maintenance check item	Criteria	Remark
Leakage	The valve is to be replaced when the leakage effect to the system. For example, the primary pressure drop.	Conditions : Primary pressure : 40 kgf/cm² Oil viscosity : 23 cSt
Spool	This is to be replaced when the sliding surface has worn more than 10 $\mu$ m, compared with the non-sliding surface.	The leakage at the left condition is estimated to be nearly equal to the above leakage.
Push rod	This is to be replaced when the top end has worn more than 1 mm.	
Play at operating section	The pin, shaft, and joint of the operating section are to be replaced when their plays become more than 2 mm due to wears or so on.	When a play is due to looseness of a tightened section, adjust it.
Operation stability	When abnormal noises, hunting, primary pressure drop, etc. are generated during operation, and these cannot be remedied, referring to section 6.  Troubleshooting, replace the related parts.	

Notes 1. It is desirable to replace seal materials, such as O-rings, every disassembling. However, they may be reused, after being confirmed to be free of damage.

#### 7. TURNING JOINT

Part name		Maintenance standards	Remedy	
	Sliding surface with sealing sections.	Plating worn or peeled due to seizure or contamination.	Replace	
	Sliding surface between body and	Worn abnormality or damaged more than 0.1 mm (0.0039 in) in depth due to seizure contamination.	Replace	
Body, Stem	stem other than sealing section.	· Damaged more than 0.1 mm (0.0039 in) in depth.	Smooth with oilstone.	
	Sliding surface	· Worn more than 0.5 mm (0.02 in) or abnormality.	Replace	
	with thrust plate.	· Worn less than 0.5 mm (0.02 in).	Smooth	
		Damage due to seizure or contamination remediable within wear limit (0.5 mm) (0.02 in).	Smooth	
	Sliding surface	· Worn more than 0.5 mm (0.02 in) or abnormality.	Replace	
Cover	with thrust plate.	· Worn less than 0.5 mm (0.02 in).	Smooth	
		Damage due to seizure or contamination remediable within wear limit (0.5 mm) (0.02 in).	Replace	
		· Extruded excessively from seal groove square ring.	Replace	
	-	Square ring Extrusion		
		· Slipper ring 1.5 mm (0.059 in) narrower than seal groove, or narrower than back ring.	Replace	
Seal set	-	1.5mm (max.) (0.059 in)		
		· Worn more than 0.5 mm (0.02 in) ~ 1.5 mm (MAX.) (0.059 in)	Replace	
	-			

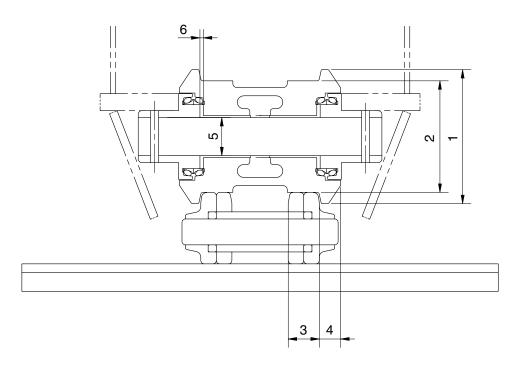
### 8. CYLINDER

Part name	Inspecting section	Inspection item	Remedy	
Piston rod · Neck of rod pin		· Presence of crack	· Replace	
· Weld on rod hub		· Presence of crack	· Replace	
Stepped part to which piston is attached.		· Presence of crack	· Replace	
· Threads		· Presence of crack	· Recondition or replace	
	· Plated surface	· Plating is not worn off to base metal.	· Replace or replate	
		· Rust is not present on plating.	· Replace or replate	
		· Scratches are not present.	· Recondition, replate or replace	
	· Rod	· Wear of O.D.	· Recondition, replate or replace	
	· Bushing at mounting part	· Wear of I.D.	· Replace	
Cylinder tube	· Weld on bottom	· Presence of crack	· Replace	
	· Weld on head	· Presence of crack	· Replace	
	· Weld on hub	· Presence of crack	· Replace	
	· Tube interior	· Presence of faults	· Replace if oil leak is seen	
	· Bushing at mounting part	· Wear on inner surface	· Replace	
Gland	· Bushing	· Flaw on inner surface	· Replace if flaw is deeper than coating	

# GROUP 3 TRACK AND WORK EQUIPMENT

### 1. TRACK

### 1) TRACK ROLLER

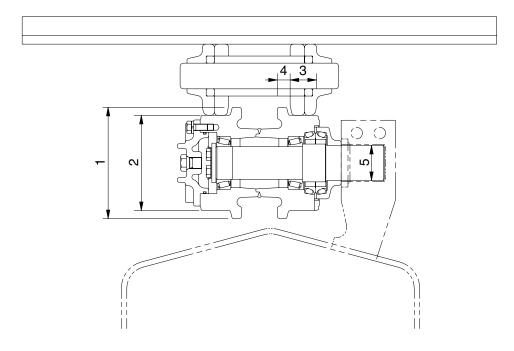


21037MS01

Unit: mm

No.	Check item	Criteria				Remedy	
4 Outside dispersion of flarence		Standard size		Repair limit			
1	Outside diameter of flange	Ø190		_		Rebuild or replace	
2	Outside diameter of tread	Ø150		Ø138			
3	Width of tread	36.5		42.5			
4	Width of flange	26.5		-			
		Standard	tole	ance	Standard	Clearance	
5	Clearance between shaft and bushing	size	Shaft	Hole	clearance	limit	Replace bushing
		Ø <b>6</b> 5	-0.25 -0.35	+0.12 +0.075	0.325 to 0.47	2.0	
6	Side clearance of roller	Standard clearance		Clearance limit		Replace	
0	(both side)	0.1 to 1.3		2.0			

### 2) CARRIER ROLLER

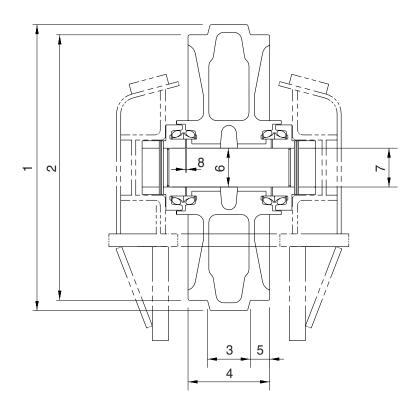


21037MS02

Unit: mm

No.	Check item		Remedy			
4	Outside dispersion of flames	Standard size		Repair limit		
'	1 Outside diameter of flange		Ø 175		_	
2	Outside diameter of tread	Ø151		Ø141		Rebuild or replace
3	Width of tread	37.25		42.25		
4	Width of flange	18.25		-		
	Clearance between shaft and hole	Standard size	e & Tolerance	Standard	Clearance	
5		Shaft	Hole	clearance	limit	Replace bushing
		Ø41.27 <sup>0</sup> <sub>+0.05</sub>	Ø41.5 +0.2 - 0.1	0.13 to 0.48	1.2	busiling

# 3) IDLER

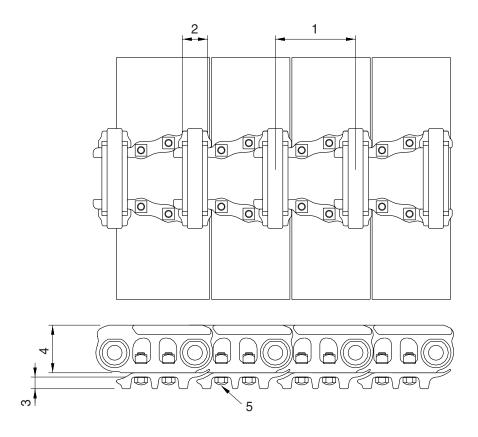


21037MS03

Unit: mm

No.	Check item		Remedy			
	Outside dispostant of floores	Stand	ard size	Repair limit		
1	Outside diameter of flange	Q	552	-		
2	Outside diameter of tread	Ø507		Ø <b>49</b> 7		Rebuild or replace
3	Width of protrusion	67		-		
4	Total width	135		-		
5	Width of tread	34		39		
		Standard siz	e & Tolerance	Standard	Clearance	
6	Clearance between shaft and bushing	Shaft	Hole	clearance	limit	Replace
aı		Ø70 <sub>-0.03</sub>	Ø70 +0.35 +0.30	0.3 to 0.38	2.0	bushing
7	Clearance between shaft and support	Ø70 <sub>-0.03</sub>	Ø70 +0.106 +0.060		1.2	Replace
8	Side clearance of idler	Standard clearance		Clearance limit		Replace
-	(both side)	0.31	to 1.29	2.0		bushing

# 4) TRACK

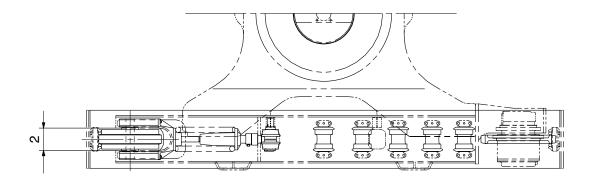


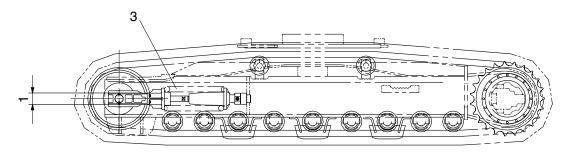
21037MS04

Unit : mm

No.	Check item	Crit	Remedy		
1	Linkaritah	Standard size	Repair limit	Turn or	
	Link pitch	171.45	175.65	replace	
2	Outside diameter of bushing	Ø 53.75	Ø43.95		
3	Height of grouser	25	16	Rebuild or replace	
4	Height of link	94.5	86.5	Topiaoo	
5	Tightening torque (Tightening angle method)	Initial tightening torque: 42 description Additional tightening angle:	Retighten		

## 5) TRACK FRAME AND RECOIL SPRING



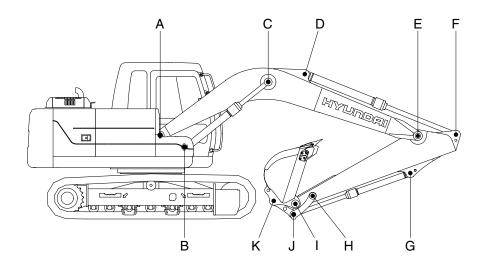


21037MS05

Unit: mm

No.	Check item		Criteria					Remedy	
			Standar	d size	Tole	erance	Repair limit		
1	Vertical width of idler guide	Track frame	e 100	3	+2 0		107		
			rt 100	0		+0.3 - 0.3	98	Rebuild or replace	
	2 Horizontal width of idler guide		e 192	2		+2 0	196		
			rt 190	)		-	188		
		(		Standard size		Repair limit			
3	Recoil spring	Free length	Installation length	Installa load		Free length	Installation load	Replace	
		Ø192×470	405	8,497	7kg	_	6,978kg		

# 2. WORK EQUIPMENT



14097MS01

Unit: mm

	Measuring point (Pin and Bushing)		Pin		Bushing		Damadu
Mark		Normal value	Recomm. service limit	Limit of use	Recomm. service limit	Limit of use	Remedy & Remark
Α	Boom Rear	70	69	68.5	70.5	71	Replace
В	Boom Cylinder Head	70	69	68.5	70.5	71	"
С	Boom Cylinder Rod	70	69	68.5	70.5	71	"
D	Arm Cylinder Head	70	69	68.5	70.5	71	"
Е	Boom Front	70	69	68.5	70.5	71	"
F	Arm Cylinder Rod	70	69	68.5	70.5	71	"
G	Bucket Cylinder Head	70	69	68.5	70.5	71	"
Н	Arm Link	65	64	63.5	65.5	66	"
I	Bucket and Arm Link	65	64	63.5	65.5	66	"
J	Bucket Cylinder Rod	70	69	68.5	70.5	71	"
K	Bucket Link	65	64	63.5	65.5	66	"

# SECTION 8 DISASSEMBLY AND ASSEMBLY

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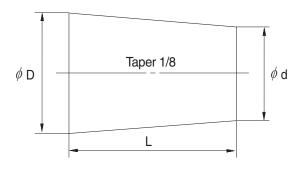
## SECTION 8 DISASSEMBLY AND ASSEMBLY

### **GROUP 1 PRECAUTIONS**

#### 1. REMOVAL WORK

- Lower the work equipment completely to the ground.
   If the coolant contains antifreeze, dispose of it correctly.
- 2) After disconnecting hoses or tubes, cover them or fit blind plugs to prevent dirt or dust from entering.
- 3) When draining oil, prepare a container of adequate size to catch the oil.
- 4) Confirm the match marks showing the installation position, and make match marks in the necessary places before removal to prevent any mistake when assembling.
- 5) To prevent any excessive force from being applied to the wiring, always hold the connectors when disconnecting the connectors.
- 6) Fit wires and hoses with tags to show their installation position to prevent any mistake when installing.
- 7) Check the number and thickness of the shims, and keep in a safe place.
- 8) When raising components, be sure to use lifting equipment of ample strength.
- 9) When using forcing screws to remove any components, tighten the forcing screws alternately.
- 10) Before removing any unit, clean the surrounding area and fit a cover to prevent any dust or dirt from entering after removal.
- 11) When removing hydraulic equipment, first release the remaining pressure inside the hydraulic tank and the hydraulic piping.
- 12) If the part is not under hydraulic pressure, the following corks can be used.

Nominal		Dimensions		
number	D	d	L	
06	6	5	8	
08	8	6.5	11	
10	10	8.5	12	
12	12	10	15	
14	14	11.5	18	
16	16	13.5	20	
18	18	15	22	
20	20	17	25	
22	22	18.5	28	
24	24	20	30	
27	27	22.5	34	



#### 2. INSTALL WORK

- 1) Tighten all bolts and nuts (sleeve nuts) to the specified torque.
- 2) Install the hoses without twisting or interference.
- 3) Replace all gaskets, O-rings, cotter pins, and lock plates with new parts.
- 4) Bend the cotter pin or lock plate securely.
- 5) When coating with adhesive, clean the part and remove all oil and grease, then coat the threaded portion with 2-3 drops of adhesive.
- 6) When coating with gasket sealant, clean the surface and remove all oil and grease, check that there is no dirt or damage, then coat uniformly with gasket sealant.
- 7) Clean all parts, and correct any damage, dents, burrs, or rust.
- 8) Coat rotating parts and sliding parts with engine oil.
- 9) When press fitting parts, coat the surface with antifriction compound (LM-P).
- 10) After installing snap rings, check that the snap ring is fitted securely in the ring groove (Check that the snap ring moves in the direction of rotation).
- 11) When connecting wiring connectors, clean the connector to remove all oil, dirt, or water, then connect securely.
- 12) When using eyebolts, check that there is no deformation or deterioration, and screw them in fully.
- 13) When tightening split flanges, tighten uniformly in turn to prevent excessive tightening on one side.
- 14) When operating the hydraulic cylinders for the first time after repairing and reassembling the hydraulic cylinders, pumps, or other hydraulic equipment or piping, always bleed the air from the hydraulic cylinders as follows:
- (1) Start the engine and run at low idling.
- (2) Operate the control lever and actuate the hydraulic cylinder 4-5 times, stopping 100mm before the end of the stroke.
- (3) Next, operate the piston rod to the end of its stroke to relieve the circuit. (The air bleed valve is actuated to bleed the air.)
- (4) After completing this operation, raise the engine speed to the normal operating condition.
- If the hydraulic cylinder has been replaced, carry out this procedure before assembling the rod to the work equipment.
- « Carry out the same operation on machines that have been in storage for a long time after completion of repairs.

#### 3. COMPLETING WORK

- 1) If the coolant has been drained, tighten the drain valve, and add water to the specified level. Run the engine to circulate the water through the system. Then check the water level again.
- 2) If the hydraulic equipment has been removed and installed again, add engine oil to the specified level. Run the engine to circulate the oil through the system. Then check the oil level again.
- 3) If the piping or hydraulic equipment, such as hydraulic cylinders, pumps, or motors, have been removed for repair, always bleed the air from the system after reassembling the parts.
- 4) Add the specified amount of grease (molybdenum disulphied grease) to the work equipment related parts.

# **GROUP 2 TIGHTENING TORQUE**

## 1. MAJOR COMPONENTS

No		Descriptions		Torque		
No.	Descriptions		Bolt size	kgf · m	lbf ⋅ ft	
1		Engine mounting bolt (engine-bracket, FR)	M12 × 1.75	11.5 ± 1.0	81.2 ± 7.2	
2		Engine mounting bolt (engine-bracket, RR)	M12 × 1.75	11.5 ± 1.0	81.2 ± 7.2	
3		Engine mounting bolt (bracket-frame, FR)	M16 × 2.0	29.7 ± 4.5	215 ± 32.5	
4	Engine	Engine mounting bolt (bracket-frame, RR)	M16 × 2.0	29.7 ± 4.5	215 ± 32.5	
5		Radiator mounting bolt	M16 × 2.0	29.7 ± 4.5	215 ± 32.5	
6		Coupling mounting socket bolt	M16 × 2.0	32.0 ± 1.6	231 ± 11.6	
7		Main pump housing mounting bolt	M10 × 1.5	6.0 ± 1.5	43.4 ± 10.9	
8		Main pump mounting socket bolt	M16 × 2.0	35.6 ± 7.1	257 ± 51.4	
9		Main control valve mounting bolt	M12 × 1.75	12.2 ± 1.3	88.2 ± 9.4	
10	Hydraulic system	Fuel tank mounting bolt	M20 × 2.5	57.9 ± 8.7	419 ± 62.9	
11	- Cycloiii	Hydraulic oil tank mounting bolt	M20 × 2.5	57.9 ± 8.7	419 ± 62.9	
12	Turning joint mounting bolt, nut		M12 × 1.75	$12.8 \pm 3.0$	92.6 ± 21.7	
13		Swing motor mounting bolt	M16 × 2.0	29.6 ± 3.2	214 ± 23.1	
14	Power	Swing bearing upper part mounting bolt	M18 × 2.5	41.3 ± 4.5	299 ± 32.5	
15	train	Swing bearing lower part mounting bolt	M16 × 1.5	31.3 ± 3.2	226 ± 23.1	
16	system	Travel motor mounting bolt	M16 × 2.0	25.7 ± 4.0	186 ± 28.9	
17		Sprocket mounting bolt	M16 × 2.0	29.7 ± 3.0	215 ± 21.7	
18		Carrier roller mounting bolt, nut	M16 × 2.0	29.7 ± 3.0	215 ± 21.7	
19		Track roller mounting bolt	M16 × 2.0	29.7 ± 3.0	215 ± 21.7	
20	Under	Track roller mounting bolt (HIGH WALKER)	M 20× 2.5	57.9 ± 6.0	419 ± 43.4	
21	carriage	Track tension cylinder mounting bolt	M16 × 2.0	29.7 ± 4.5	215 ± 32.5	
22		Track shoe mounting bolt, nut	5/8 - 18UNF	42 ± 4.0	304± 28.9	
23	Track guard mounting bolt		M16 × 2.0	29.6 ± 3.2	214± 23.1	
24		Counterweight mounting bolt	$M27 \times 3.0$	135 ± 15	976 ± 108	
25	Others	Cab mounting bolt	M12 × 1.75	12.8 $\pm$ 3.0	92.6 ± 21.7	
26		Operator's seat mounting bolt	M 8 × 1.25	4.05 ± 0.8	29.3 ± 5.8	

<sup>\*</sup> For tightening torque of engine and hydraulic components, see engine maintenance guide and service manual.

## 2. TORQUE CHART

Use following table for unspecified torque.

# 1) BOLT AND NUT

## (1) Coarse thread

Dolt size	8.8T		10	.9T	12.9T		
Bolt size	kgf⋅m	lbf∙ft	kgf⋅m	lbf⋅ft	kgf⋅m	lbf∙ft	
M 6×1.0	0.8 ~ 1.2	5.8 ~ 8.6	1.2 ~ 1.8	8.7 ~ 13.0	1.5 ~ 2.1	10.9 ~ 15.1	
M 8 × 1.25	2.0 ~ 3.0	14.5 ~ 21.6	2.8 ~ 4.2	20.3 ~ 30.4	3.4 ~ 5.0	24.6 ~ 36.1	
M10 × 1.5	4.0 ~ 6.0	29.0 ~ 43.3	5.6 ~ 8.4	40.5 ~ 60.8	6.8 ~ 10.0	49.2 ~ 72.3	
M12 × 1.75	6.8 ~ 10.2	50.0 ~ 73.7	9.6 ~ 14.4	69.5 ~ 104	12.3 ~ 16.5	89.0 ~ 119	
M14 × 2.0	10.9 ~ 16.3	78.9 ~ 117	16.3 ~ 21.9	118 ~ 158	19.5 ~ 26.3	141 ~ 190	
M16 × 2.0	17.9 ~ 24.1	130 ~ 174	25.1 ~ 33.9	182 ~ 245	30.2 ~ 40.8	141 ~ 295	
M18 × 2.5	24.8 ~ 33.4	180 ~ 241	34.8 ~ 47.0	252 ~ 340	41.8 ~ 56.4	302 ~ 407	
M20 × 2.5	34.9 ~ 47.1	253 ~ 340	49.1 ~ 66.3	355 ~ 479	58.9 ~ 79.5	426 ~ 575	
M22 × 2.5	46.8 ~ 63.2	339 ~ 457	65.8 ~ 88.8	476 ~ 642	78.9 ~ 106	570 ~ 766	
M24 × 3.0	60.2 ~ 81.4	436 ~ 588	84.6 ~ 114	612 ~ 824	102 ~ 137	738 ~ 991	
M30 × 3.5	120 ~ 161	868 ~ 1164	168 ~ 227	1216 ~ 1641	202 ~ 272	1461 ~ 1967	

## (2) Fine thread

Bolt size	8.8T		10	.9T	12.9T		
DOIL SIZE	kgf · m	lbf ⋅ ft	kgf · m	lbf ⋅ ft	kgf · m	lbf ⋅ ft	
M 8 × 1.0	2.1 ~ 3.1	15.2 ~ 22.4	3.0 ~ 4.4	21.7 ~ 31.8	3.6 ~ 5.4	26.1 ~ 39.0	
M10 × 1.25	4.2 ~ 6.2	30.4 ~ 44.9	5.9 ~ 8.7	42.7 ~ 62.9	7.0 ~ 10.4	50.1 ~ 75.2	
M12 × 1.25	7.3 ~ 10.9	52.8 ~ 78.8	10.3 ~ 15.3	74.5 ~ 110	13.1 ~ 17.7	94.8 ~ 128	
M14 × 1.5	12.4 ~ 16.6	89.7 ~ 120	17.4 ~ 23.4	126 ~ 169	20.8 ~ 28.0	151 ~ 202	
M16 × 1.5	18.7 ~ 25.3	136 ~ 182	26.3 ~ 35.5	191 ~ 256	31.6 ~ 42.6	229 ~ 308	
M18 × 1.5	27.1 ~ 36.5	196 ~ 264	38.0 ~ 51.4	275 ~ 371	45.7 ~ 61.7	331 ~ 446	
M20 × 1.5	37.7 ~ 50.9	273 ~ 368	53.1 ~ 71.7	384 ~ 518	63.6 ~ 86.0	460 ~ 622	
M22 × 1.5	51.2 ~ 69.2	370 ~ 500	72.0 ~ 97.2	521 ~ 703	86.4 ~ 116	625 ~ 839	
M24 × 2.0	64.1 ~ 86.5	464 ~ 625	90.1 ~ 121	652 ~ 875	108 ~ 146	782 ~ 1056	
M30 × 2.0	129 ~ 174	933 ~ 1258	181 ~ 245	1310 ~ 1772	217 ~ 294	1570 ~ 2126	

# 2) PIPE AND HOSE (FLARE TYPE)

Thread size (PF)	Width across flat (mm)	kgf · m	lbf ⋅ ft
1/4"	19	4	28.9
3/8"	22	5	36.2
1/2"	27	9.5	68.7
3/4"	36	18	130.2
1"	41	21	151.9
1-1/4"	50	35	253.2

## 3) PIPE AND HOSE (ORFS TYPE)

Thread size (UNF)	Width across flat (mm)	kgf · m	lbf ⋅ ft
9/16-18	19	4	28.9
11/16-16	22	5	36.2
13/16-16	27	9.5	68.7
1-3/16-12	36	18	130.2
1-7/16-12	41	21	151.9
1-11/16-12	50	35	253.2

# 4) FITTING

Thread size	Width across flat (mm)	kgf · m	lbf ⋅ ft	
1/4"	19	4	28.9	
3/8"	22	5	36.2	
1/2"	27	9.5	68.7	
3/4"	36	18	130.2	
1"	41	21	151.9	
1-1/4"	50	35	253.2	

## **GROUP 3 PUMP DEVICE**

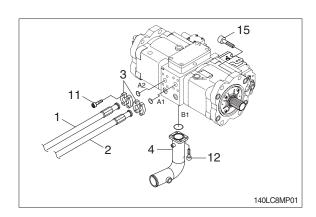
#### 1. REMOVAL AND INSTALL

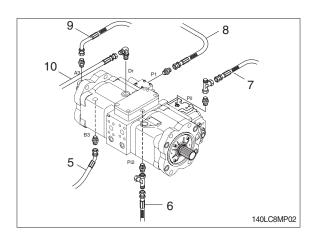
#### 1) REMOVAL

- (1) Lower the work equipment to the ground and stop the engine.
- (2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping
- (3) Loosen the breather slowly to release the pressure inside the hydraulic tank.
- A Escaping fluid under pressure can penetrate the skin causing serious injury.
- (4) Loosen the drain plug under the hydraulic tank and drain the oil from the hydraulic tank.
  - · Hydraulic tank quantity : 124  $\ell$  (32.8 U.S. gal)
- (5) Remove socket bolts (11) and disconnect hoses (1,2).
- (6) Disconnect pilot line hoses (5, 6, 7, 8, 9, 10).
- (7) Remove socket bolts (12) and disconnect pump suction pipe (4).
- When pump suction tube is disconnected, the oil inside the piping will flow out, so catch it in oil pan.
- (8) Sling the pump assembly and remove the pump mounting bolts.
  - · Weight: 100 kg (220 lb)
  - · Tightening torque :  $29.7 \pm 4.5 \text{ kgf} \cdot \text{m}$  (215 ± 32.5 lbf · ft)
- Pull out the pump assembly from housing.

When removing the pump assembly, check that all the hoses have been disconnected.





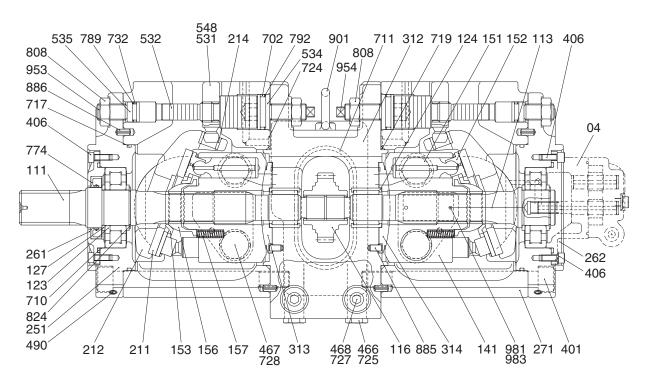


#### 2) INSTALL

- (1) Carry out installation in the reverse order to removal.
- (2) Remove the suction strainer and clean it.
- (3) Replace return filter with new one.
- (4) Remove breather and clean it.
- (5) After adding oil to the hydraulic tank to the specified level.
- (6) Bleed the air from the hydraulic pump.
- ① Remove the air vent plug (2EA).
- ② Tighten plug lightly.
- 3 Start the engine, run at low idling, and check oil come out from plug.
- 4 Tighten plug.
- (7) Start the engine, run at low idling (3~5 minutes) to circulate the oil through the system.
- (8) Confirm the hydraulic oil level and check the hydraulic oil leak or not.

## 2. MAIN PUMP (1/2)

## 1) STRUCTURE



14092MP02

04	Gear pump	312	Valve block	717	O-ring
111	Drive shaft (F)	313	Valve plate (R)	719	O-ring
113	Drive shaft (R)	314	Valve plate (L)	724	O-ring
116	1st Gear	326	Cover	725	O-ring
123	Roller bearing	401	Hexagon socket bolt	727	O-ring
124	Needle bearing	406	Hexagon socket bolt	728	O-ring
127	Bearing spacer	414	Hexagon socket bolt	732	O-ring
141	Cylinder block	466	Plug	774	Oil seal
151	Piston	467	plug	789	Back up ring
152	Shoe	468	Plug	792	Back up ring
153	Set plate	490	Plug	808	Hexagon head nut
156	Bushing	531	Tilting pin	824	Snap ring
157	Cylinder spring	532	Servo piston	885	Pin
211	Shoe plate	534	Stopper (L)	886	Spring pin
212	Swash plate	535	Stopper (S)	901	Eye bolt
214	Bushing	548	Pin	953	Set screw
251	Support	702	O-ring	954	Set screw
261	Seal cover (F)	710	O-ring	981	Plate
271	Pump casing	711	O-ring	983	Pin

## 2) TOOLS AND TIGHTENING TORQUE

## (1) Tools

The tools necessary to disassemble/reassemble the pump are shown in the follow list.

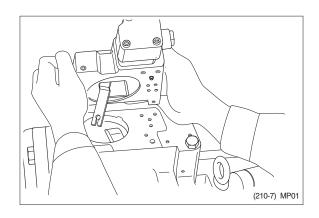
Tool name & size	Part name							
Name	В	· ·		T plug PO plug Tthread) (PF threa		_	Hexagon socket head setscrew	
Allen wrench	4	M 5	M 5 BP-1/16		-		M 8	
	5	M 6	BP-1/8		-		M10	
	6	M 8	I	3P-1/4	PO-1/4		M12, M14	
	8	M10	I	3P-3/8	PO-3/8	3	M16, M18	
	17	M20, M22		BP-1	PO-1, 1 1/4,	1 1/2	-	
Double ring spanner,	-	Hexagon bolt		Hexagon nut		VP plug (PF thread)		
socket wrench, double (single)	19	M12		M12		VP-1/4		
open end spanner	24	M16		M16		-		
В	27	M18		M18		VP-1/2		
	30	M20		M20		-		
	36	-			-	VP-3/4		
Adjustable angle wrench		Medium size, 1 se	et					
Screw driver		Minus type screw	Minus type screw driver, Medium size, 2 sets					
Hammer		Plastic hammer, 1 set						
Pliers		For snap ring, TSR-160						
Steel bar		Steel bar of key material approx. 10×8×200						
Torque wrench		Capable of tightening with the specified torques						

# (2) Tightening torque

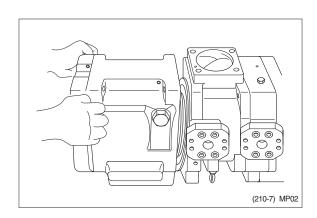
Dort name	Bolt size	Tor	que	Wrench size		
Part name	DOIL SIZE	kgf · m	lbf ⋅ ft	in	mm	
Hexagon socket head bolt	M 5	0.7	5.1	0.16	4	
(material : SCM435)	M 6	1.2	8.7	0.20	5	
	M 8	3.0	21.7	0.24	6	
	M10	5.8	42.0	0.31	8	
	M12	10.0	72.3	0.39	10	
	M14	16.0	116	0.47	12	
	M16	24.0	174	0.55	14	
	M18	34.0	246	0.55	14	
	M20	44.0	318	0.67	17	
PT Plug (material : S45C)	PT1/16	0.7	5.1	0.16	4	
	PT 1/8	1.05	7.59	0.20	5	
turns round the plug	PT 1/4	1.75	12.7	0.24	6	
	PT 3/8	3.5	25.3	0.31	8	
	PT 1/2	5.0	36.2	0.39	10	
PF Plug (material : S45C)	PF 1/4	3.0	21.7	0.24	6	
	PF 1/2	10.0	72.3	0.39	10	
	PF 3/4	15.0	109	0.55	14	
	PF 1	19.0	137	0.67	17	
	PF 1 1/4	27.0	195	0.67	17	
	PF 1 1/2	28.0	203	0.67	17	

#### 3) DISASSEMBLY

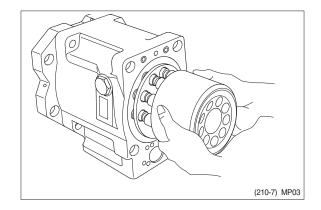
- (1) Select place suitable to disassembling.
- Select clean place.
- Spread rubber sheet, cloth or so on on overhaul workbench top to prevent parts from being damaged.
- (2) Remove dust, rust, etc, from pump surfaces with cleaning oil or so on.
- (3) Remove drain port plug (468) and let oil out of pump casing (front and rear pump).
- (4) Remove hexagon socket head bolts (412, 413) and remove regulator.



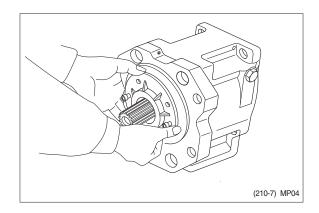
- (5) Loosen hexagon socket head bolts (401) which tighten swash plate support (251), pump casing (271) and valve block (312).
- If gear pump and so on are fitted to rear face of pump, remove them before starting this work.
- (6) Place pump horizontally on workbench with its regulator-fitting surface down and separate pump casing (271) from valve block (312).
- Before bringing this surface down, spread rubber sheet on workbench without fail to prevent this surface from being damaged.

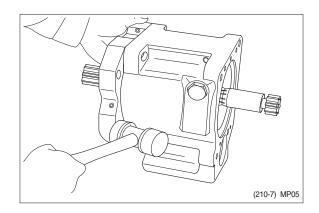


- (7) Pull cylinder block (141) out of pump casing (271) straightly over drive shaft (111). Pull out also pistons (151), set plate (153), spherical bush (156) and cylinder springs (157) simultaneously.
- \* Take care not to damage sliding surfaces of cylinder, spherical bushing, shoes, swash plate, etc.

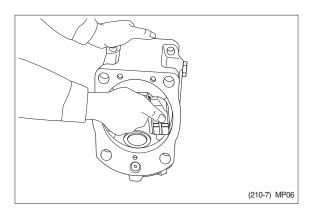


- (8) Remove hexagon socket head bolts (406) and then seal cover (F, 261).
- Fit bolt into pulling out tapped hole of seal cover (F), and cover can be removed easily.
- Since oil seal is fitted on seal cover (F), take care not to damage it in removing cover.
- (9) Remove hexagon socket head bolts (408) and then seal cover (R, 262).In case fitting a gear pump, first, remove gear pump.
- (10) Tapping lightly fitting flange section of swash plate support (251) on its pump casing side, separate swash plate support from pump casing.

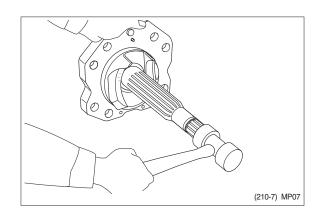




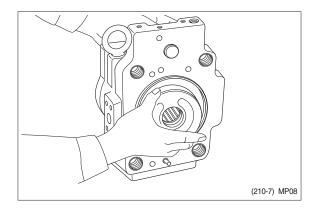
(11) Remove shoe plate (211) and swash plate (212) from pump casing (271).



(12) Tapping lightly shaft ends of drive shafts (111, 113) with plastic hammer, take out drive shafts from swash plate supports.



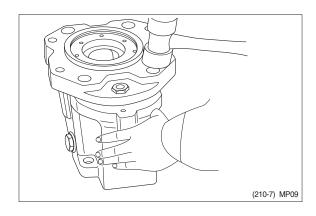
- (13) Remove valve plates (313, 314) from valve block (312).
- These may be removed in work (6).



- (14) If necessary, remove stopper (L, 534), stopper (S, 535), servo piston (532) and tilting pin (531) from pump casing (271), and needle bearing (124) and splined coupling (114) from valve block (312).
- In removing tilting pin, use a protector to prevent pin head from being damaged.
- Since loctite is applied to fitting areas of tilting pin and servo piston, take care not to damage servo piston.
- Do not remove needle bearing as far as possible, except when it is considered to be out of its life span.
- Do not loosen hexagon nuts of valve block and swash plate support.
  If loosened, flow setting will be changed.

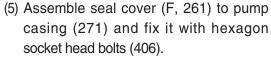
#### 4) ASSEMBLY

- (1) For reassembling reverse the disassembling procedures, paying attention to the following items.
- ① Do not fail to repair the parts damaged during disassembling, and prepare replacement parts in advance.
- ② Clean each part fully with cleaning oil and dry it with compressed air.
- 3 Do not fail to apply clean working oil to sliding sections, bearings, etc. before assembling them.
- ④ In principle, replace seal parts, such as O-rings, oil seals, etc.
- 5 For fitting bolts, plug, etc., prepare a torque wrench or so on, and tighten them with torques shown in page 8-11, 12.
- ⑥ For the double-pump, take care not to mix up parts of the front pump with those of the rear pump.
- (2) Fit swash plate support (251) to pump casing (271), tapping the former lightly with a hammer.
- After servo piston, tilting pin, stopper (L) and stopper (S) are removed, fit them soon to pump casing in advance for reassembling.
- In tightening servo piston and tilting pin, use a protector to prevent tilting pin head and feedback pin from being damaged. In addition, apply loctite (Medium strength) to their threaded sections.



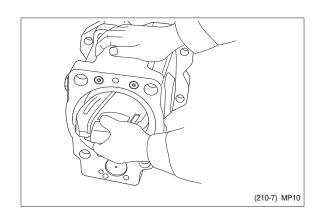
- (3) Place pump casing with its regulator fitting surface down, fit tilting bush of swash plate to tilting pin (531) and fit swash plate (212) to swash plate support (251) correctly.
- Confirm with fingers of both hands that swash plate can be removed smoothly.
- Apply grease to sliding sections of swash plate and swash plate support, and drive shaft can be fitted easily.
- (4) To swash plate support (251), fit drive shaft (111) set with bearing (123), bearing spacer (127) and snap ring (824).
- Do not tap drive shaft with hammer or so on.
- Assemble them into support, tapping outer race of bearing lightly with plastic hammer.

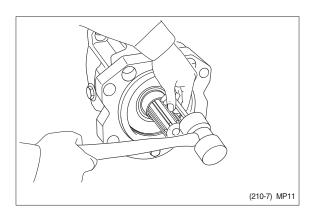
Fit them fully, using steel bar or so on.

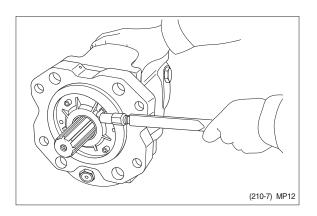


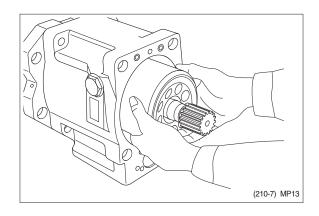
- Apply grease lightly to oil seal in seal cover (F).
- Assemble oil seal, taking full care not to damage it.
- For tandem type pump, fit rear cover (263) and seal cover (262) similarly.
- (6) Assemble piston cylinder subassembly [cylinder block (141), piston subassembly (151, 152), set plate (153), spherical bush (156), spacer (158) and cylinder spring (157)].

Fit spline phases of retainer and cylinder. Then, insert piston cylinder subassembly into pump casing.

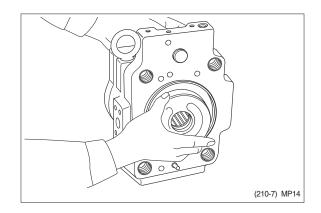




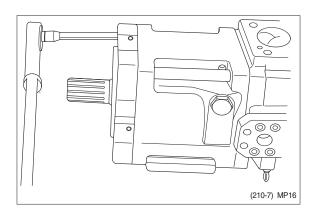


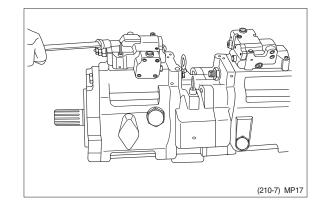


- (7) Fit valve plate (313) to valve block (312), entering pin into pin hole.
- \* Take care not to mistake suction / delivery directions of valve plate.



- (8) Fit valve block (312) to pump casing (271) and tighten hexagon socket head bolts (401).
- At first assemble this at rear pump side, and this work will be easy.
- \* Take care not to mistake direction of valve block.
- Clockwise rotation (Viewed from input shaft side) - Fit block with regulator up and with delivery flange left, viewed from front side.
- Counter clockwise rotation (Viewed from input shaft side) Fit block with delivery flange right, viewed from front side.
- (9) Putting feedback pin of tilting pin into feedback lever of regulator, fit regulator and tighten hexagon socket head bolts (412, 413).
- \* Take care not to mistake regulator of front pump for that of rear pump.



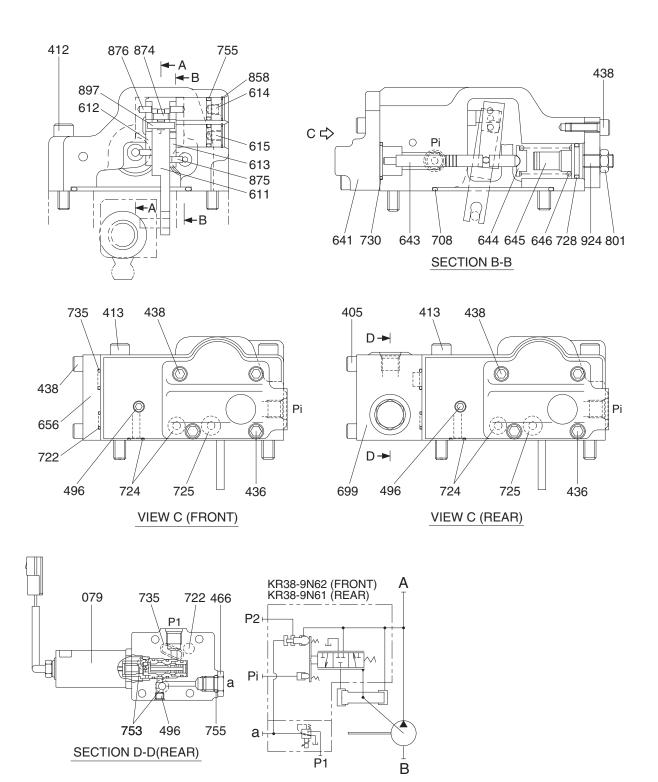


(10) Fit drain port plug (468).

This is the end of reassembling procedures.

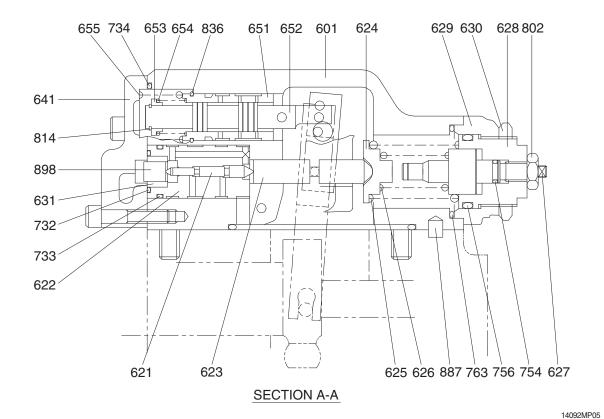
#### 3. REGULATOR

## 1) STRUCTURE (1/2)



14092MP04

#### **REGULATOR** (2/2)



079 EPPR valve assembly 629 Cover (C) 733 O-ring 405 Hexagon socket screw 630 Lock nut 734 O-ring 412 Hexagon socket screw 631 Sleeve, Pf 735 O-ring 413 Hexagon socket screw 641 Pilot cover 753 O-ring 436 Hexagon socket screw 643 Pilot piston 754 O-ring 438 Hexagon socket screw 755 O-ring 644 Spring seat (Q) 466 Plug 645 Adjust stem (Q) 756 O-ring 496 Plug 646 Pilot spring 763 O-ring 601 Casing 651 Sleeve 801 Nut 611 Feed back lever 802 Nut 652 Spool 653 Spring seat 612 Lever (1) 814 Snap ring 613 Lever (2) 654 Return spring 836 Snap ring 614 Fulcrum plug 655 Set spring 858 Snap ring 615 Adjust plug 656 Block cover 874 Pin 621 Compensator piston 875 Pin 699 Valve casing 622 Piston case 708 O-ring 876 Pin 623 Compensator rod Pin 722 O-ring 887 624 Spring seat (C) 897 Pin 724 O-ring 625 Outer spring 725 O-ring 898 Pin 626 Inner spring 728 O-ring 924 Set screw 627 Adjust stem (C) 730 O-ring 628 Adjust screw (C) 732 O-ring

## 2) TOOLS AND TIGHTENING TORQUE

## (1) Tools

The tools necessary to disassemble/reassemble the pump are shown in the follow list.

Tool name & size	Part name							
Name	В	Hexagon socket head bolt	PT plug PO plug (PT thread) (PF thread)			Hexagon socket head setscrew		
Allen wrench	4	M5 BF		3P-1/16	P-1/16 -		M 8	
B	5	M6	ı	BP-1/8	-		M10	
	6	M8	ı	BP-1/4	PO-1/4		M12, M14	
Double ring spanner, socket wrench, double (single) open end spanner	-	Hexagon hea bolt	nead Hexagon nut  M 8		gon nut		VP plug (PF thread)	
	6	M 8				-		
Adjustable angle wrench		Small size, Max 3	Small size, Max 36 mm					
Screw driver		Minus type screw	driver	, Medium siz	e, 2 sets			
Hammer		Plastic hammer, 1	l set					
Pliers	For snap ring, TSR-160							
Steel bar	4×100 mm							
Torque wrench	Capable of tightening with the specified torques							
Pincers		-						
Bolt M4, Length : 50 mm								

# (2) Tightening torque

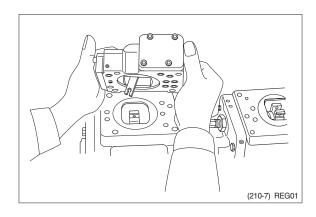
Part name	Bolt size	To	Torque		ch size
Fait name	DOIL SIZE	kgf · m	lbf ⋅ ft	in	mm
Hexagon socket head bolt	M 5	0.7	5.1	0.16	4
(material : SCM435)	M 6	1.2	8.7	0.20	5
	M 8	3.0	21.7	0.24	6
	M10	5.8	42.0	0.31	8
	M12	10.0	72.3	0.39	10
	M14	16.0	116	0.47	12
	M16	24.0	174	0.55	14
	M18	34.0	246	0.55	14
	M20	44.0	318	0.67	17
PT Plug (material : S45C)	PT1/16	0.7	5.1	0.16	4
	PT 1/8	1.05	7.59	0.20	5
turns round the plug	PT 1/4	1.75	12.7	0.24	6
	PT 3/8	3.5	25.3	0.31	8
	PT 1/2	5.0	36.2	0.39	10
PF Plug (material : S35C)	PF 1/4	3.0	21.7	0.24	6
	PF 1/2	10.0	72.3	0.39	10
	PF 3/4	15.0	109	0.55	14
	PF 1	19.0	137	0.67	17
	PF 1 1/4	27.0	195	0.67	17
	PF 1 1/2	28.0	203	0.67	17

#### 3) DISASSEMBLY

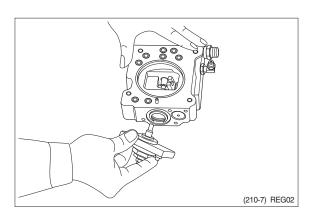
Since the regulator consists of small precision finished parts, disassembly and assembly are rather complicated.

For this reason, replacement of a regulator assembly is recommended, unless there is a special reason, but in case disassembly is necessary for an unavoidable reason, read through this manual to the end before starting disassembly.

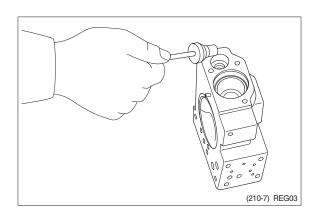
- (1) Choose a place for disassembly.
- Choose a clean place.
- Spread rubber sheet, cloth, or so on on top of work-bench to prevent parts from being damaged.
- (2) Remove dust, rust, etc. from surfaces of regulator with clean oil.
- (3) Remove hexagon socket head screw (412, 413) and remove regulator main body from pump main body.
- \* Take care not to lose O-ring.

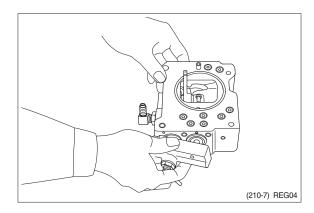


- (4) Remove hexagon socket head screw (438) and remove cover (C,629)
- \*\* Cover (C) is fitted with adjusting screw (C, 628), adjusting ring (C, 627), lock nut (630), hexagon nut (801) and adjusting screw (924).
- Do not loosen these screws and nuts. If they are loosened, adjusted pressureflow setting will vary.

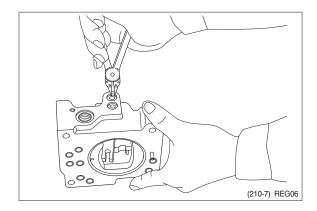


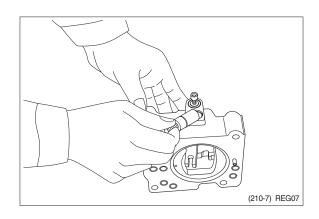
- (5) After removing cover (C, 629) subassembly, take out outer spring (625), inner spring (626) and spring seat (C, 624) from compensating section.
  Then draw out adjusting ring (Q, 645), pilot spring (646) and spring seat (644) from pilot section.
- Adjusting ring (Q,645) can easily be drawn out with M4 bolt.
- (6) Remove hexagon socket head screws (436, 438) and remove pilot cover (641). After removing pilot cover, take out set spring (655) from pilot section.



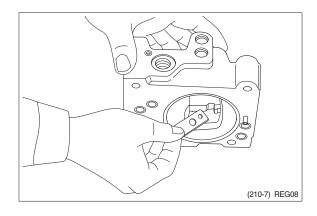


- (7) Remove snap ring (814) and take out spring seat (653), return spring (654) and sleeve (651).
- Sleeve (651) is fitted with snap ring (836).
- When removing snap ring (814), return spring (654) may pop out. Take care not to lose it.
- (210-7) REG05
- (8) Remove locking ring (858) and take out fulcrum plug (614) and adjusting plug (615).
- Fulcrum plug (614) and adjusting plug (615) can easily be taken out with M6 bolt.



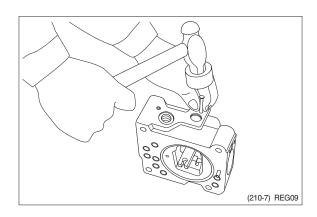


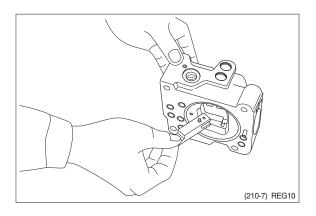
- (9) Remove lever (2, 613). Do not draw out pin (875).
- Work will be promoted by using pincers or so on.



(10) Draw out pin (874) and remove feedback lever (611).

Push out pin (874, 4 mm in dia.) from above with slender steel bar so that it may not interfere with lever (1, 612).



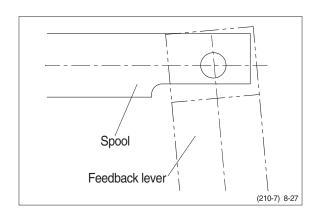


- (11) Remove lever 1 (612). Do not draw out pin (875).
- (12) Draw out pilot piston (643) and spool (652).
- (13) Draw out piston case (622), compensating piston (621) and compensating rod (623).
- Piston case (622) can be taken out by pushing compensating rod (623) at opposite side of piston case.

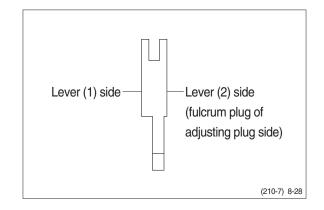
This completes disassembly.

#### 4) ASSEMBLY

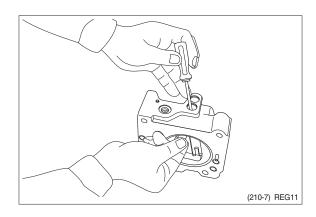
- For assembly, reverse disassembly procedures, but pay attention to the following items.
- ① Always repair parts that were scored at disassembly.
- ② Get replacement parts ready beforehand. Mixing of foreign matter will cause malfunction.
  - Therefore, wash parts well with cleaning oil, let them dry with jet air and handle them in clean place.
- 3 Always tighten bolts, plugs, etc. to their specified torques.
- ④ Do not fail to coat sliding surfaces with clean hydraulic oil before assembly.
- ⑤ Replace seals such as O-ring with new ones as a rule.
- (2) Put compensating rod (623) into compensating hole of casing (601).
- (3) Put pin force-fitted in lever 1 (612) into groove of compensating rod and fit lever 1 to pin force-fitted in casing.
- (4) Fit spool (652) and sleeve (651) into hole in spool of casing.
- Confirm that spool and sleeve slide smoothly in casing without binding.
- Pay attention to orientation of spool.



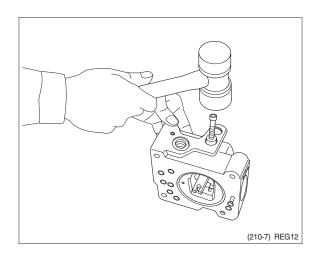
- (5) Fit feedback lever (611), matching its pin hole with pin hole in spool. Then insert pin (874).
- Insert pin in feedback lever a little to ease operation.
- \* Take care not to mistake direction of feedback lever.

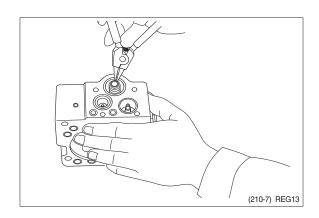


- (6) Put pilot piston (643) into pilot hole of casing.
- Confirm that pilot piston slides smoothly without binding.
- (7) Put pin force-fitted in lever 2 (613) into groove of pilot piston. Then fix lever 2.



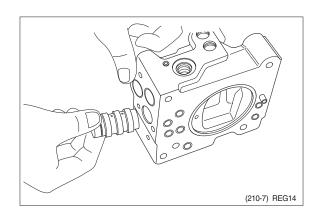
- (8) Fit fulcrum plug (614) so that pin forcefitted in fulcrum plug (614) can be put into pin hole of lever 2.
  - Then fix locking ring (858).
- (9) Insert adjusting plug (615) and fit locking ring.
- \* Take care not to mistake inserting holes for fulcrum plug and adjusting plug. At this point in time move feedback lever to confirm that it has no large play and is free from binding.
- (10) Fit return spring (654) and spring seat (653) into spool hole and attach snap ring (814).



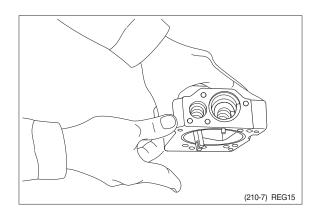


compensating piston (621) and piston case (622) into compensating hole. Fit pilot cover (641) and tighten it with hexagonal socket head screws (436, 438).

(11) Fit set spring (655) to spool hole and put



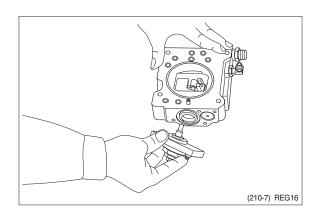
- (12) Put spring seat (644), pilot spring (646) and adjusting ring (Q, 645) into pilot hole. Then fix spring seat (624), inner spring (626) and outer spring (625) into compensating hole.
- When fitting spring seat, take care not to mistake direction of spring seat.



(13) Install cover (C, 629) fitted with adjusting screws (628), adjusting ring (C, 627), lock nut (630), hexagon nut (801) and adjusting screw (924).

Then tighten them with hexagonal socket head screws (438).

This completes assembly.



## **GROUP 4 MAIN CONTROL VALVE**

#### 1. REMOVAL AND INSTALL OF MOTOR

#### 1) REMOVAL

- (1) Lower the work equipment to the ground and stop the engine.
- (2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.
- (3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

# A Escaping fluid under pressure can penetrate the skin causing serious injury.

- When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.
- (4) Remove the wirings for the pressure sensor and so on.
- (5) Remove bolts and disconnect pipe.
- (6) Disconnect pilot line hoses.
- (7) Disconnect pilot piping.
- (8) Sling the control valve assembly and remove the control valve mounting bolt and bracket.
  - · Weight: 140kg (310lb)
  - · Tightening torque : 12.8 ± 3.0 kgf · m

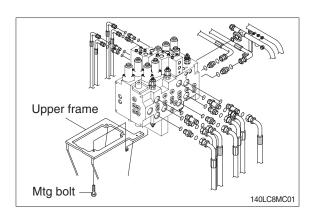
 $(92.6 \pm 21.7 lbf \cdot ft)$ 

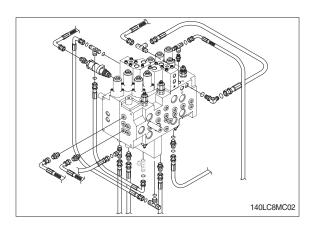
(9) Remove the control valve assembly. When removing the control valve assembly, check that all the piping have been disconnected.

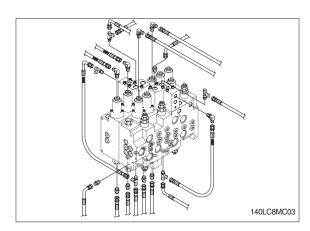
## 2) INSTALL

- Carry out installation in the reverse order to removal.
- (2) Bleed the air from below items.
- ① Cylinder (Boom, arm, bucket)
- ② Swing motor
- ③ Travel motor
- \* See each item removal and install.
- (3) Confirm the hydraulic oil level and recheck the hydraulic oil leak or not.

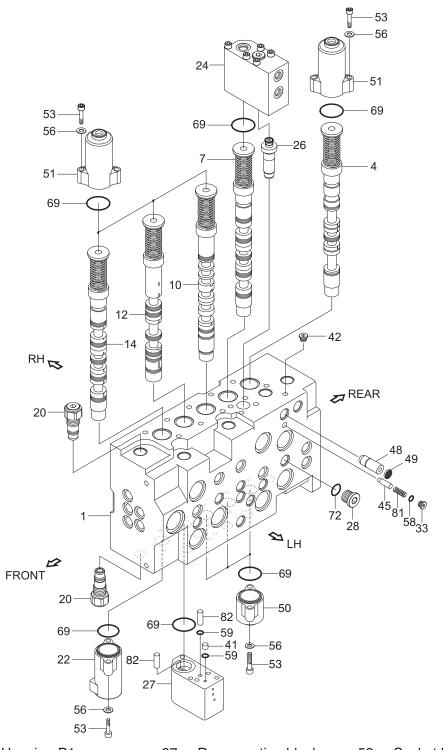








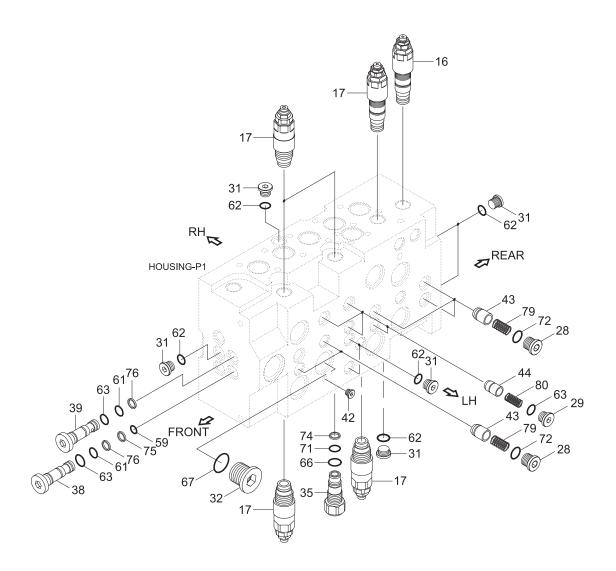
# 2. STRUCTURE (1/4)



1	Housing-P1	27	Regeneration block	53	Socket head bolt
4	Spool assy-travel(LH)	28	Plug	56	Plain washer
7	Spool assy-boom 1	33	Plug	58	O-ring
10	Spool assy-arm 2	41	Orifice plug	59	O-ring
12	Spool assy-arm regen	42	Plug	69	O-ring
14	Spool assy-bucket	45	Signal poppet	72	O-ring
20	Nega con relief valve	48	Signal orifice	81	Check spring
22	Bucket stroke limiter	49	Coin type filter	82	Regeneration pin
24	Holding valve kit A1	50	Pilot A cap		
26	Lock valve kit B	51	Pilot B1 cap		

140L8MC04

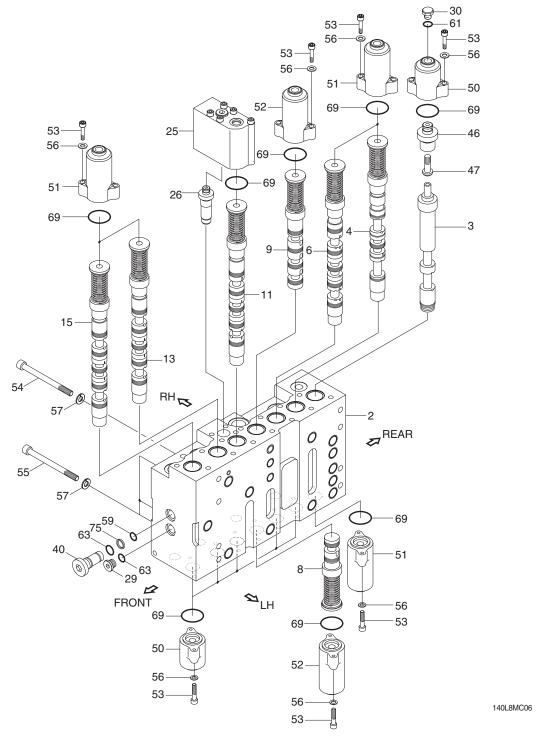
# STRUCTURE (2/4)



140L8MC05

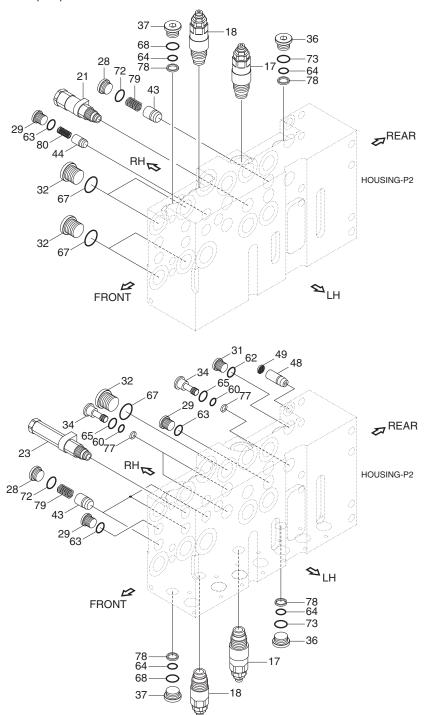
16	Main relief valve	42	Plug	71	O-ring
17	Overload relief valve	43	Poppet 1	72	O-ring
28	Plug	44	Poppet 2	74	Back up ring
29	Plug	59	O-ring	75	Back up ring
31	Plug	61	O-ring	76	Back up ring
32	Plug	62	O-ring	79	Spring
35	Plug	63	O-ring	80	Spring
38	Plug	66	O-ring		
39	Plug	67	O-ring		

# STRUCTURE (3/4)



2	Housing-P2	26	Lock valve kit B	54	Socket head bolt
3	Spool assy-straight travel	29	Plug	55	Socket head bolt
4	Spool assy-travel(RH)	30	Plug	56	Plain washer
6	Spool assy-swing	40	Plug	57	Spring washer
8	Spool assy-swing priority	46	T/straight sleeve	59	O-ring
9	Spool assy-boom 2	47	T/straight piston	61	O-ring
11	Spool assy-arm 1	50	Pilot A cap	63	O-ring
13	Spool assy-option B	51	Pilot B1 cap	69	O-ring
15	Spool assy-option C	52	Pilot B2 cap	75	Back up ring
25	Arm 1 holding valve kit A2	53	Socket head bolt		_

# STRUCTURE (4/4)



140L8MC07

17	Overload relief valve	37	Plug	67	O-ring
18	Overload relief valve	43	Poppet 1	68	O-ring
21	Swing logic valve	44	Poppet 2	72	O-ring
23	ON/OFF valve-option	48	Signal orifice	73	O-ring
28	Plug	49	Coin type filter	77	Back up ring
29	Plug	60	O-ring	78	Back up ring
31	Plug	62	O-ring	79	Spring
32	Plug	63	O-ring	80	Spring
34	Plug	64	O-ring		
36	Plug	65	O-ring		

#### 3. DISASSEMBLY AND ASSEMBLY

### 1) GENERAL PRECAUTIONS

- (1) All hydraulic components are manufactured to a high precision. Consequently, before disassembling and assembling them, it is essential to select an especially clean place.
- (2) In handling a control valve, pay full attention to prevent dust, sand, etc. from entering into it.
- (3) When a control valve is to be remove from the machine, apply caps and masking seals to all ports. Before disassembling the valve, recheck that these caps and masking seals are fitted completely, and then clean the outside of the assembly. Use a proper bench for working. Spread paper or a rubber mat on the bench, and disassemble the valve on it.
- (4) Support the body section carefully when carrying or transferring the control valve. Do not lift by the exposed spool, end cover section etc.
- (5) After disassembling and assembling of the component it is desired to carry out various tests (for the relief characteristics, leakage, flow resistance, etc.), but hydraulic test equipment is necessary for these tests. Therefore, even when its disassembling can be carried out technically, do not disassemble such components that cannot be tested, adjusted, and so on. Additionally one should always prepare clean cleaning oil, hydraulic oil, grease, etc. beforehand.

### 2) TOOLS

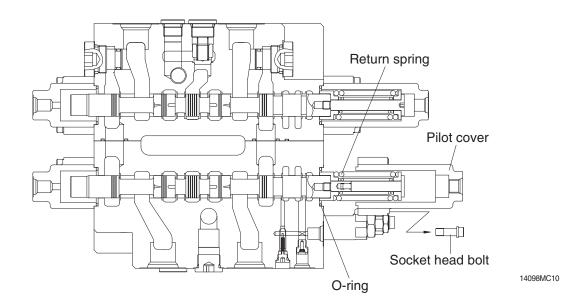
Before disassembling the control valve, prepare the following tools beforehand.

Name of tool	Quantity	Size (mm)		
Vice mounted on bench (soft jaws) 1 unit				
Hexagon wrench	Each 1 piece	5, 6, 10, 12 and 14		
Socket wrench	Each 1 piece	27 and 32		
Spanner	Each 1 piece	32 (main relief valve, overload relief valve, negative relief valve) 26 (holding valve)		

## 3) DISASSEMBLY

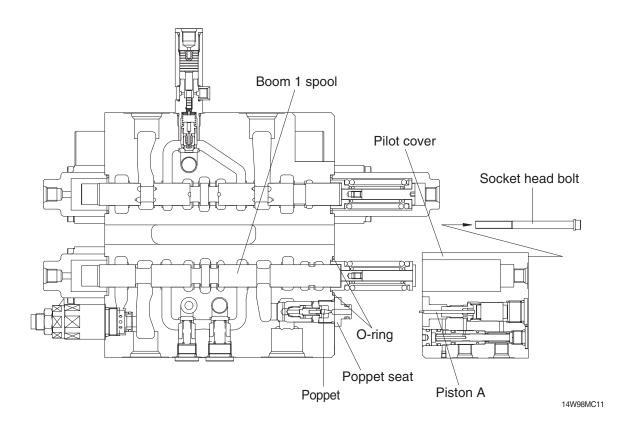
## (1) Disassembly of spools without holding valve (travel right, travel left)

- ① Loosen hexagon socket head bolts with washer. (hexagon wrench: 5 mm)
- ② Remove the pilot cover.
- \* Pay attention not to lose the O-ring under the pilot cover.
- ③ Remove the spool assembly from the body by hand slightly.
- \* When extracting each spool from its body, pay attention not to damage the body.
- When extracting each spool assembly, it must be extracted from spring side only.
- When any abnormal parts are found, replace it with completely new spool assembly.
- When disassembled, tag the components for identification so that they can be reassembled correctly.



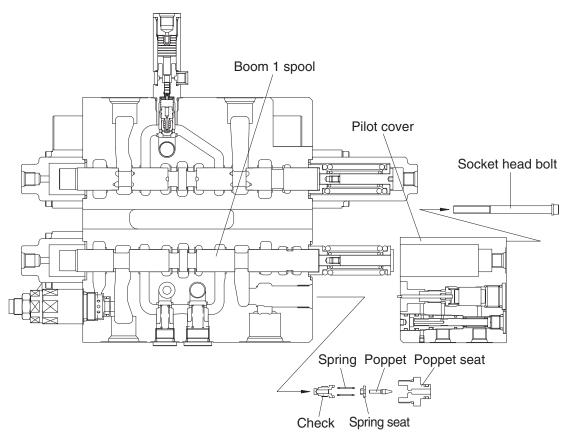
## (2) Disassembly of spools with holding valve (boom 1, Arm 1 spool)

- ① Loosen hexagon socket head bolts with washer. (hexagon wrench: 5 mm)
- ② Remove the pilot cover with internal parts.
- \* Pay attention not to lose the O-ring and the poppet under the pilot cover.
- Pay attention not to damage the "piston A" under pilot cover.
- ③ Remove the spool assembly from the body by hand slightly.
- When extracting each spool from its body, pay attention not to damage the body.
- When extracting each spool assembly, it must be extracted from spring side only.
- When any abnormal parts are found, replace it with completely new spool assembly.
- When disassembled, tag the components for identification so that they can be reassembled correctly.



## (3) Disassembly of the holding valve

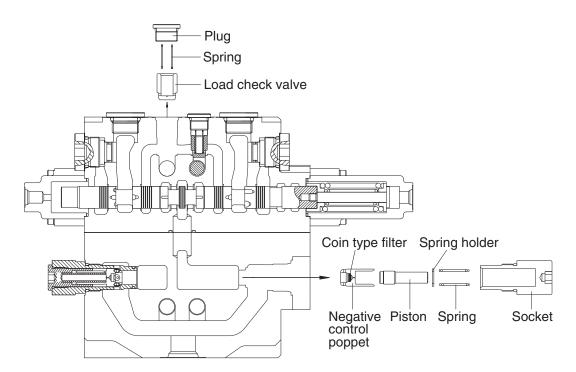
- ① Remove the pilot cover with the holding valve as described on previous page.
- \* Do not disassembled internal parts of the pilot cover.
- ② Loosen the poppet seat and remove the poppet, spring seat, spring and check. (spanner : 26 mm)
- Pay attention not to lose the poppet.
- \* Do not disassembled internal parts of the check.



14W98MC12

## (4) Disassembly of the load check valve and the negative relief valve

- ① The load check valve
  - a. Fix the body to suitable work bench.
  - ※ Pay attention not to damage the body.
  - b. Loosen the plug (hexagon wrench: 10 mm).
  - c. Remove the spring and the load check valve with pincers or magnet.
- ② The negative relief valve
  - a. Loosen the socket (spanner: 32 mm).
  - b. Remove the spring, spring holder, piston and negative control poppet.



14W98MC13

## (5) Disassembly of the main and overload relief valve

① Fix the body to suitable work bench.

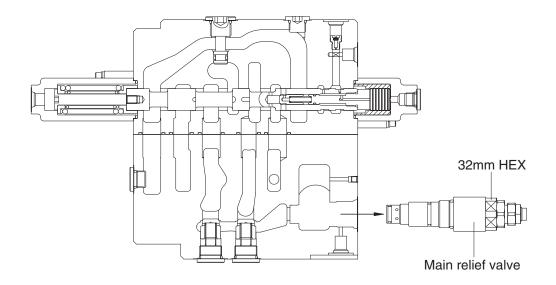
② Remove the main relief valve.

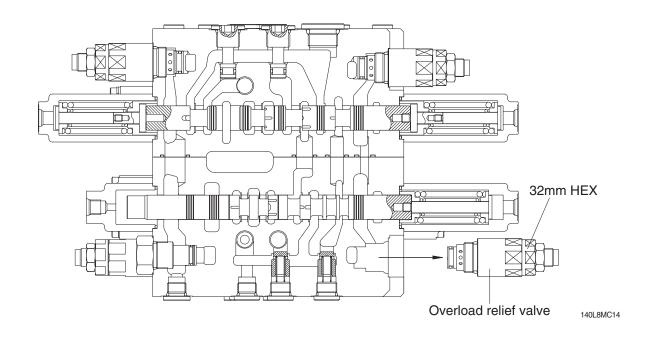
(spanner: 32 mm)

③ Remove the overload relief valve.

(spanner: 32 mm)

- \* When disassembled, tag the relief valve for identification so that they can be reassembled correctly.
- » Pay attention not to damage seat face.
- \* When any abnormal parts are found, replace it with completely new relief valve assembly.





#### (6) Inspection after disassembly

Clean all disassembled parts with clean mineral oil fully, and dry them with compressed air. Then, place them on clean papers or cloths for inspection.

#### Control valve

- a. Check whole surfaces of all parts for burrs, scratches, notches and other defects.
- b. Confirm that seal groove faces of body and block are smooth and free of dust, dent, rust etc.
- c. Correct dents and damages and check seat faces within the body, if any, by lapping.
- Pay careful attention not to leave any lapping agent within the body.
- d. Confirm that all sliding and fitting parts can be moved manually and that all grooves and path's are free foreign matter.
- e. If any spring is broken or deformed, replace it with new one.
- f. When a relief valve does not function properly, repair it, following it's the prescribed disassembly and assembly procedures.
- g. Replace all seals and O-rings with new ones.

#### 2 Relief valve

- a. Confirm that all seat faces at ends of all poppets and seats are free of defects and show uniform and consistent contact faces.
- b. Confirm manually that main poppet and seat can slide lightly and smoothly.
- c. Confirm that outside face of main poppet and inside face of seat are free from scratches and so on.
- d. Confirm that springs are free from breakage, deformation, and wear.
- e. Confirm that orifices of main poppet and seat section are not clogged with foreign matter.
- f. Replace all O-rings with new ones.
- g. When any light damage is found in above inspections, correct it by lapping.
- h. When any abnormal part is found, replace it with a completely new relief valve assembly.

### 4) ASSEMBLY

#### (1) General precaution

- ① In this assembly section, explanation only is shown.
  - For further understanding, please refer to the figures shown in the previous structure & disassembly section.
- ② Pay close attention to keeping all seals free from handling damage and inspect carefully for damage before using them.
- ③ Apply clean grease or hydraulic oil to the seal so as to ensure it is fully lubricated before assembly.
- ④ Do not stretch seals so much as to deform them permanently.
- ⑤ In fitting O-rings, pay close attention not to roll them into their final position in addition, a twisted O-ring cannot easily untwist itself naturally and could thereby cause inadequate sealing and
- 6 thereby both internal and external oil leakage.
  Tighten fitting bolts for all sections with a torque wrench adjusted to the respective tightening torque.
- 7 Do not reuse removed O-rings and seals.

#### (2) Load check valve

- ① Assemble the load check valve and spring.
- 2 Put O-rings on to plug.
- ③ Tighten plug to the specified torque.
  - · Hexagon wrench: 10 mm
  - · Tightening torque : 6~7 kgf · m (43.4~50.6 lbf · ft)

#### (3) Negative control relief valve

- ① Assemble the nega-con poppet, piston, spring holder and spring together into body.
- ② Put O-ring on to plug and tighten the latter to its specified torque.
  - · Hexagon wrench: 12 mm
  - · Tightening torque: 8~9 kgf · m (57.8~65.1 lbf · ft)

## (4) Main relief, overload relief valves

Install main relief valve, overload relief valve into the body and tighten to the specified torque.

Component	Tools	Tightening torque			
Component	TOOIS	kgf · m	lbf · ft		
Main relief valve	Spanner 32 mm	8~9	57.8~65.1		
Overload relief valve	Spanner 32 mm	8~9	57.8~65.1		

#### (5) Main spools

- ① Carefully insert the previously assembled spool assemblies into their respective bores within of body.
- Fit spool assemblies into body carefully and slowly. Do not under any circumstances push them forcibly in.

## (6) Pilot covers

- ① Fit spool covers to the non-spring assembly end of the spool, and tighten the hexagonal socket head bolts to the specified torque.
  - · Hexagon wrench: 5 mm
  - · Tightening torque: 1.0~1.1 kgf · m (7.2~7.9 lbf · ft)
- Confirm that O-rings have been fitted.
- ② Fit spring covers to the spring end for the spools, and tighten hexagon socket head bolts to the specified torque.
  - · Hexagon wrench: 5mm
  - · Tightening torque: 1.0~1.1 kgf·m (7.2~7.9 lbf·ft)
- Confirm that O-rings have been fitted.

### (7) Holding valves

- ① Assemble the check, spring seat and poppet together into body.
- ② Tighten the poppet seat to the specified torque.
  - · Spanner: 26 mm
  - · Tightening torque : 6~7 kgf · m (43.4~50.6 lbf · ft)
- ③ Fit the "piston A" under pilot cover with internal parts into hole on the poppet seat.
- ④ Tighten hexagon socket head bolt to specified torque.
  - · Hexagon wrench: 5mm
  - · Tightening torque: 1.0~1.1 kgf · m (7.2~7.9 lbf · ft)

## **GROUP 5 SWING DEVICE**

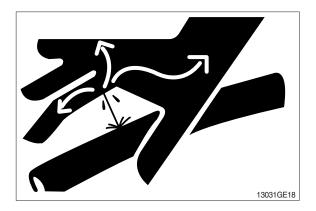
#### 1. REMOVAL AND INSTALL OF MOTOR

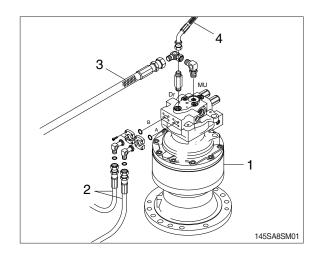
### 1) REMOVAL

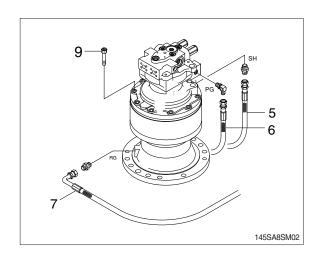
- (1) Lower the work equipment to the ground and stop the engine.
- (2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.
- (3) Loosen the breather slowly to release the pressure inside the hydraulic tank.
- ▲ Escaping fluid under pressure can penetrate the skin causing serious injury.
- When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.
- (4) Disconnect hose assembly (2).
- (5) Disconnect pilot line hoses (3, 4, 5, 6, 7, 8).
- (6) Sling the swing motor assembly (1) and remove the swing motor mounting socket bolts (9).
  - · Motor device weight: 43 kg (94.8 lb)
  - $\cdot$  Tightening torque : 17.5 $\pm$ 1.8 kgf  $\cdot$  m (127 $\pm$ 13.0 lbf  $\cdot$  ft)
- (7) Remove the swing motor assembly.
- When removing the swing motor assembly, check that all the piping have been disconnected.

## 2) INSTALL

- (1) Carry out installation in the reverse order to removal.
- (2) Bleed the air from the swing motor.
- Remove the air vent plug.
- ② Pour in hydraulic oil until it overflows from the port.
- ③ Tighten plug lightly.
- 4 Start the engine, run at low idling and check oil come out from plug.
- ⑤ Tighten plug fully.
- (3) Confirm the hydraulic oil level and check the hydraulic oil leak or not.

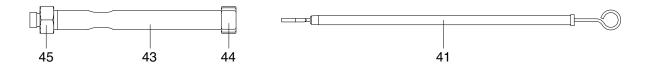


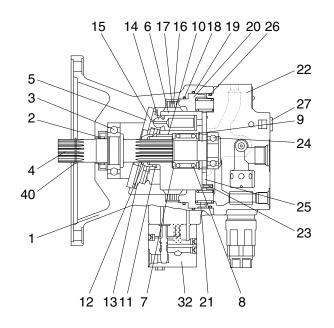


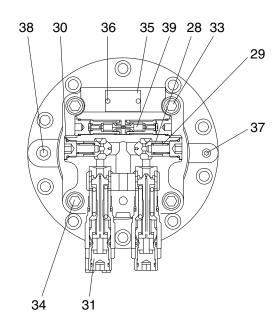


# 2. DISASSEMBLY AND ASSEMBLY OF SWING MOTOR

# 1) STRUCTURE







145WF2SM81

1	Casing
2	Oil seal
3	Ball bearing
4	Drive shaft
5	Shoe plate
6	Cylinder block
7	Washer
8	Spring
9	Snap ring
10	Roller
11	Collar washer
12	Thrust ball
13	Retainer plate
14	Piston
15	Shoe

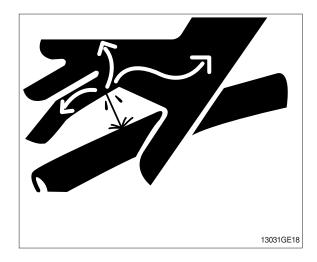
16	Separate plate
17	Friction plate
18	O-ring
19	O-ring
20	Brake piston
21	Spring
22	Valve casing
23	Spring pin
24	Ball bearing
25	Valve plate
26	O-ring
27	Plug
28	Plunger
29	Spring
30	Plug

		145WF
31	l Re	elief valve assy
32	2 Br	ake valve assy
33	3 Sc	ocket bolt
34	4 Sc	ocket bolt
35	5 Na	ame plate
36	S Sc	crew
37	7 Pli	ug
38	B Pl	ug
39	) Re	eactionless valve assy
40	) Sr	nap ring
41	l Le	vel gauge
42	2 pip	oe
43	Ba	ır
44	1 Ca	ар
45	5 Re	educer

### 3. REMOVAL AND INSTALL OF REDUCTION GEAR

## 1) REMOVAL

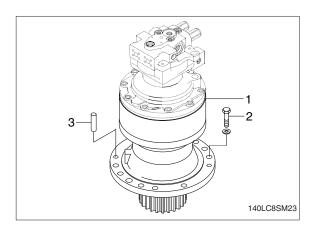
- Remove the swing motor assembly.
   For details, see removal of swing motor assembly.
- (2) Sling reduction gear assembly (1) and remove dowel pin (3) and mounting bolts (2).
- (3) Remove the reduction gear assembly.
  - · Reduction gear weight : 75 kg (165 lb)



# 2) INSTALL

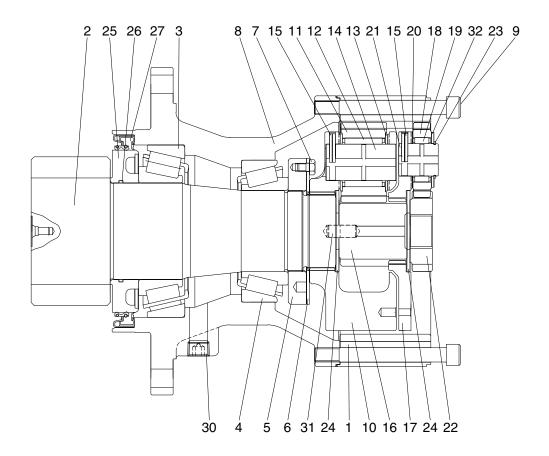
(1) Carry out installation in the reverse order to removal.

 $\cdot$  Tightening torque : 29.6  $\pm$  3.2 kgf  $\cdot$  m (214  $\pm$  23.1 lbf  $\cdot$  ft)



# 4. DISASSEMBLY AND ASSEMBLY OF REDUCTION GEAR

# 1) STRUCTURE



125LCR2SM23

1 2 3 4 5 6 7 8 9	Ring gear Drive shaft Taper roller bearing Taper roller bearing Ring nut Lock plate Hexagon bolt Casing Socket bolt	13 14 15	Planetary gear No. 2 Needle bearing No. 2 Thrust washer No. 2 Carrier pin No. 2 Spring pin Sun gear No. 2 Carrier No. 1 Planetary gear No. 1 Needle bearing No. 1	22 23 24 25	Carrier pin No. 1 Sun gear No. 1 Snap ring Thrust plate Sleeve O-ring Oil seal Plug Parallel pin	
9 10	Socket bolt Carrier No. 2	19 20	Needle bearing No. 1 Thrust washer No. 1	_	Parallel pin Thrust washer No. 1	
7 8 9	Hexagon bolt Casing Socket bolt	17 18 19	Carrier No. 1 Planetary gear No. 1 Needle bearing No. 1	27 30 31	Oil seal Plug Parallel pin	No. 1

# 2) DISASSEMBLY

(1) Remove the swing motor, and then place swing reduction gear on the bench.



125I CB8SM60

(2) Disassemble sun gear No.1 (22).



125I CB8SM61

(3) Disassemble carrier No.1 sub assembly.



125LCR8SM62

## Carrier No.1 sub assy disassembly

(4) Put carrier No.1 sub assembly on the bench, then remove the snap ring (23).



125LCR8SM63

(5) Disassemble thrust washer No.1 (upper) (32).(3 pcs)



125LCR8SM64

(6) Disassemble planetary gear No.1 (18).(3 pcs)



125LCR8SM65

(7) Disassemble thrust plate (24).



125LCR8SM66

(8) Disassemble needle bearing No.1 (19). (3 pcs)



125LCR8SM67

(9) Disassemble thrust washer No.1 (lower) (20). (3 pcs)



125LCR8SM68

- (10) After placing spring pin (15) to center of carrier pin No.1 (21) with a jig, disassemble it. (3 pcs)
- Do not reuse spring pin, carrier and carrier pin.



125LCR8SM69

(11) Disassemble sun gear No.2 (16).



125LCR8SM70

(12) Disassemble carrier No.2 sub assembly.



125LCR8SM71

# Carrier No.2 sub assy disassembly

- (13) After placing spring pin (15) to center of carrier pin No.2 (14) with a press machine, disassemble it.(3 pcs)
- \* Do not reuse spring pin.



125LCR8SM72

(14) Disassemble planetary gear No.2.(3 pcs)



125LCR8SM73

(15) Disassemble thrust plate (24).



125LCR8SM74

(16) Disassemble thrust washer No.2 (13).(6 pcs)



125LCR8SM75

(17) Disassemble needle bearing No.2 (12). (3 pcs)



125LCR8SM76

(18) Separate ring gear (1) from casing (8).



125LCR8SM77

(19) Loosen bolt (7) (4 pcs), and disassemble lock plate (6).



125LCR8SM78

(20) Disassemble ring nut (5) by using the jig.



125LCR8SM79

# Drive shaft sub assy disassembly

(21) Separate drive shaft sub assembly from casing (8).



125LCR8SM80

(22) Disassemble taper roller bearing (3) and oil seal (27) by using a press machine.



25LCR8SM81

(23) Disassemble sleeve (25) and O-ring (26).



125LCR8SM82

(24) Disassemble the outer ring of taper roller bearing (3) in casing (8) by using the jig.



125LCR8SM83

### 3) ASSEMBLY

- Even though assembly is accomplished by reversing disassembly steps, be careful of the following.
- ① Repair the damaged part when disassemblying and prepare parts for exchange in advance.
- 2 All parts should be cleaned with cleaner, dried with compressed air.
- 3 Sliding surface, O-ring, bearing and oil seal should be lubricated with clean hydraulic oil, prior to final assembly.
- 4 Replacement of O-ring and oil seal with new parts is generally recommended.
- (5) Use a torque wrench to make sure that assembly fasteners are tightened to specified values.
- 6 When assembling bolt, spread loctite.

## Carrier No.1 sub assembly

(1) After heating the carrier No.1 (17), assemble carrier pin No.1 (21) to the side without thehole.

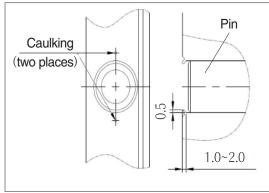


125I CR8SM84

(2) After drilling  $\emptyset$  6 hole, assemble spring pin (15).(3 pcs)



- (3) Caulking is performed on the assembled spring pin unit.
- To cover pins, implement the caulking in two places that are located direction of 180 degrees around assembled spring pin.



125LCR8SM86

(4) Assemble thrust washer No.1 (lower) (20). (3 pcs)



125LCR8SM87

(5) Assemble needle bearing No.1 (19).(3 pcs)



125LCR8SM88

(6) Assemble thrust plate (24).



125LCR8SM89

(7) Assemble planetary gear No.1 (18) of which groove is faced downward.(3 pcs)



125LCR8SM90

(8) Assemble thrust washer No.1 (upper) (32). (3 pcs)



125LCR8SM91

- (9) Assemble snap ring (23) (3 pcs), complete carrier No.1 sub assembly.
- Gear rotation state should be smooth.



125LCR8SM92

## Carrier No.2 sub assy assembly

(10) Assemble needle bearing No.2 (12) in the planetary gear No.2 (11).



125LCR8SM93

(11) After spreading grease on thrust washer No.2 (13), assemble it on both upper side and lower side of planetary gear No.2.



125LCR8SM94

(12) Assemble thrust plate (24).



125LCR8SM95

- (13) Assemble planetary gear No.2 in the carrier No.2 (10).(3 pcs)
- \* Thrust washer No.2 should notseparated.



125LCR8SM96

(14) Assemble carrier pin No.2 (14) to match the pin hole of the carrier No.2.(3 pcs)



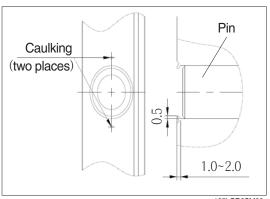
125LCR8SM97

(15) Assemble spring pin (15).(3 pcs)



125LCR8SM98

- (16) Caulking is performed on the assembled spring pin unit.
- \* To cover pins, implement the caulking in two places that are located direction of 180 degrees around assembled spring pin.



125LCR8SM99

# Drive shaft sub assy assembly

(17) After heating sleeve (25), assemble O-ring (26) to groove of inside diameter in it.



125LCR8SM100

- (18) Shrink fit the sleeve on drive shaft (2).
- Be careful of fully seat at the bottom.



125LCR8SM101

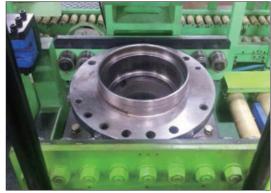
(19) Shrink fit taper roller bearing (3) on drive shaft, complete drive shaft sub assembly.



125LCR8SM102

## Casing assembly

(20) Press outer ring of the taper roller bearing in the casing (8) by using the jig.



125LCR8SM103

- (21) Press in oil seal (27) by using the jig.
- \* Be careful of the direction of the assembly.



125LCR8SM104

- (22) Assemble drive shaft sub assembly.
- \* Be careful of damage of oil seal.



125LCR8SM105

(23) After fixing drive shaft so that it does not fall, and then turn it over, press taper bearing (4).



125LCR8SM106

(24) Assemble nut ring (5) by using the jig.  $\divideontimes$  Tightening torque : 3.5  $\pm$  0.4 kgf  $\cdot$  m (25.3  $\pm$  2.9 lbf  $\cdot$  ft)



125LCR8SM107

(25) Place lock plate (6) on the nut ring.



125LCR8SM108

(26) After spreading loctite #242, assemble the bolt (7) (4 pcs).

\*\* Tightening torque : 2.5  $\pm$  0.25 kgf  $\cdot$  m (18.1  $\pm$  1.8 lbf  $\cdot$  ft)

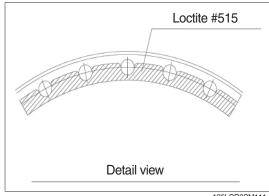


125LCR8SM109

(27) Press parallel pin (31) by using press machine.



- (28) Spread the loctite #515 on the casing with reference to the right detail view.
- Loctite should not flow into casing.



125LCR8SM111

- (29) Assemble ring gear (1) in accordance with a pin hole on casing.
- \* Be careful of damage of the ring gear.



(30) Assemble carrier No.2 sub assembly.



125LCR8SM113

(31) Assemble sun gear No.2 (16).



25I CB8SM114

(32) Assemble carrier No.1 sub assembly.



125LCR8SM115

(33) Assemble sun gear No.1 (22) of which grinding surface is faced downward.



125LCR8SM116

(34) Fill with gear oil 3.5 liter.



125LCR8SM117

# **GROUP 6 TRAVEL DEVICE (STD)**

#### 1. REMOVAL AND INSTALL

### 1) REMOVAL

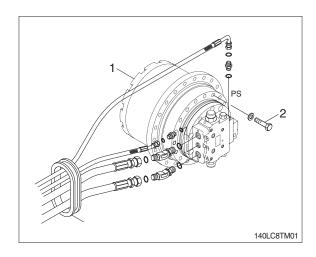
- (1) Swing the work equipment 90° and lower it completely to the ground.
- (2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.
- (3) Loosen the breather slowly to release the pressure inside the hydraulic tank.
- A Escaping fluid under pressure can penetrate the skin causing serious injury.
- When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.
- (4) Remove the track shoe assembly.
  For details, see removal of track shoe assembly.
- (5) Remove the cover.
- (6) Remove the hose.
- \* Fit blind plugs to the disconnected hoses.
- (7) Remove the bolts and the sprocket.
  - · Tightening torque : 29.7±3.0 kgf · m (215±21.7 lbf · ft)
- (8) Sling travel device assembly (1).
- (9) Remove the mounting bolts (2), then remove the travel device assembly.
  - · Weight: 140 kg (310 lb)
  - $\cdot$  Tightening torque : 25.7±4.0 kgf  $\cdot$  m (186±28.9 lbf  $\cdot$  ft)

### 2) INSTALL

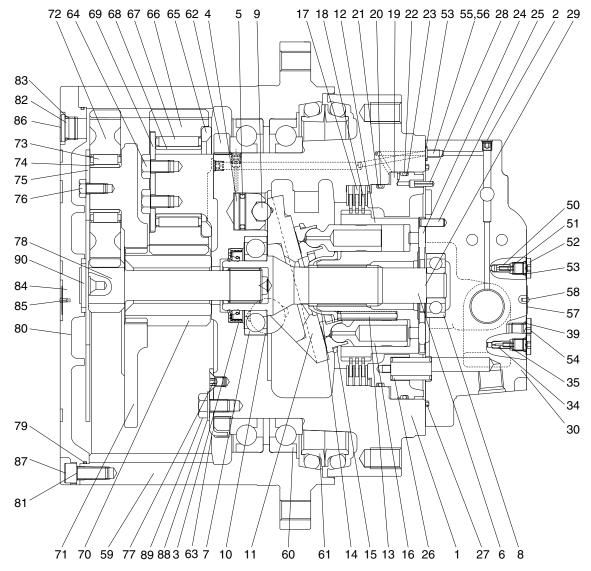
- (1) Carry out installation in the reverse order to removal.
- (2) Bleed the air from the travel motor.
- ① Remove the air vent plug.
- 2 Pour in hydraulic oil until it overflows from the port.
- ③ Tighten plug lightly.
- ④ Start the engine, run at low idling, and check oil come out from plug.
- 5 Tighten plug fully.
- (3) Confirm the hydraulic oil level and check the hydraulic oil leak or not.

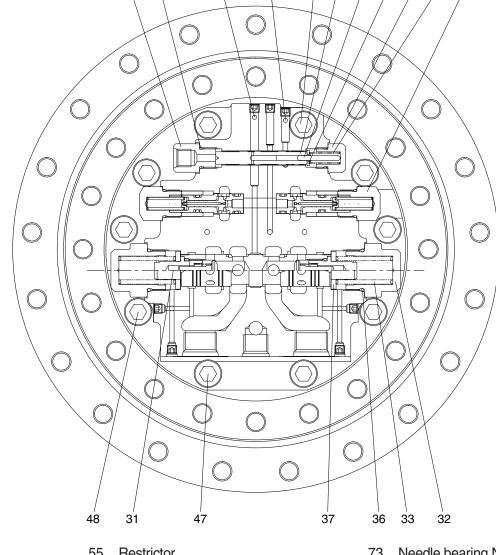
8-Î 2





## 2. TRAVEL MOTOR





49 40 43 42 41 44 38

45 46

1	Casing
2	Plug
3	Oil seal
4	Piston
5	Piston seal
6	Shaft
7	Front ball bearing
8	Rear ball bearing
9	Steel ball
10	Pivot
11	Swash plate
12	Cylinder block
13	Spring
14	Ball guide
15	Retainer plate
16	Piston assy
17	Friction plate
18	Separated plate

19	Parking piston
20	O-ring
21	Back up ring
22	O-ring
23	Back up ring
24	Valve plate
25	Spring pin
26	Spring
27	O-ring
28	Spring pin
29	Parallel pin
30	Rear cover
31	Main spool assy
32	Cover
33	Spring
34	Restrictor
35	Spring

36 O-ring

37	Spring seat
38	Relief valve assy
39	O-ring
40	Spool
41	Plug
42	Spring seat
43	Parallel pin
44	Spring
45	Connector
46	O-ring
47	Hexagon socket head bolt
48	Hexagon socket head bolt
49	Hexagon socket head bolt
50	Check valve
51	Spring
52	Plug
53	O-ring

54 Plug

55	Restrictor
56	Restrictor
57	Name plate
58	Rivet
59	Ring gear
60	Bearing
61	Floating seal assy
62	Nut ring
63	Lock plate
64	Hexagon head bolt
65	Thrust plate No. 2
66	Planetary gear No.2
67	Needle bearing No.2
68	Inner race No. 2
69	Thrust washer No. 2
70	Sun gear No.2
71	Carrier No.1
72	Planetary gear No.1

31	47	31	30	33	32
Restrictor			73	Needl	le bearing No.1
Restrictor			74	Inner	race No. 1
Name pla	te		75	Thrus	t plate No. 1
Rivet			76	Hexa	gon head bolt
Ring gear			77	Count	tersunk head screw
Bearing			78	Sun g	ear No.1
Floating s	eal assy		79	O-ring	)
Nut ring			80	Cover	•
Lock plate	9		81	Hex s	ocket head bolt
Hexagon	head bolt		82	Plug	
Thrust pla	ate No. 2		83	O-ring	)
Planetary	gear No.2		84	Name	e plate
Needle be	earing No.2		85	Rivet	
Inner race	e No. 2		86	Rubb	er cap
Thrust wa	sher No. 2		87	Rubb	er cap
Sun gear	No.2		88	Plain	washer
Carrier No	p.1		89	Hexa	gon bolt
Planetary	gear No.1		90	Thrus	t plate

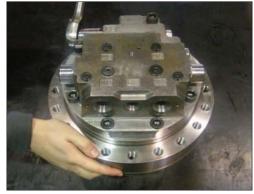
# 2) DISASSEMBLY

- (1) Choose a clean place, remove contaminants (dust, etc) and cleans motor before placing it on worktable.
- \* Lay the rubber plate on worktable and take care not to damage the component.



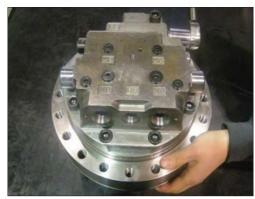
125LCR8TM02

(2) Remove the connector (45) using 21 mm socket wrench.



125LCR8TM03

(3) Remove plug (41) using 21 mm socket wrench.



125LCR8TM04

- (4) Disassemble parallel pin (43) and spring (44).
- Do not lose spring.
- \* Do not mix spring with other springs.



125LCR8TM05

(5) Remove spring seat (42) and spool (40).



125LCR8TM06

(6) Disassemble relief valve assembly (38) using 26 mm socket wrench. (2 sets)



125LCR8TM07

(7) Disassemble cover (32) using 41 mm socket wrench.



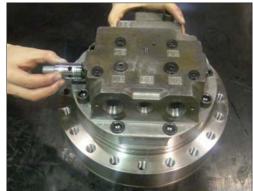
125LCR8TM08

(8) Disassemble spring seat (37) and spring (33). (2 sets)



125LCR8TM09

(9) Separate main spool assembly (31) from rear cover.



125LCR8TM10

(10) Unscrew socket bolt (47) (1EA), (48) (3EA), (49) (6EA) from rear cover.



125LCR8TM11

(11) Remove parallel pin (29).



125LCR8TM12

- (12) From rear cover, disassemble valve plate (24) and O-ring (27).
- \* Take care not to damage assembly surface of rear cover.



125LCR8TM13

- (13) Disassemble restrictor (55, 56) (2EA).
- Mark the number on restrictor and its hole to avoid confusing (55) and (56).



1251 CDQTM14

(14) Remove plug (52).



125LCR8TM15

- (15) Remove restrictor (34) and spring (35). (2 sets)
- Do not confuse restrictor (34) and check valve (50).
- \* Do not confuse spring (35) and spring (51).
- \* Do not lose spring.
- Do not mix spring with other springs.



125LCR8TM16

(16) Remove plug (52) using 5 mm hexagon wrench.



125LCR8TM17

- (17) Remove check valve (50) and spring (51). (2 sets)
- Do not confuse restrictor (34) and check valve (50).
- \* Do not confuse spring (35) and spring (51).
- Do not lose spring.
- \* Do not mix spring with other springs.



125LCR8TM18

- (18) From parking piston, remove spring (26) (12ea).
- Do not lose spring.
- \* Do not mix spring with other springs.



125LCR8TM19

(19) Disassemble parking piston (19) using air gun or jig.



125LCR8TM20

(20) From parking piston, separate O-ring (22) and back-up ring (23).



125LCR8TM21

(21) From parking piston separate O-ring (20) and back-up ring (21).



125LCR8TM22

(22) Lay casing down horizontally and remove cylinder block assembly, friction plate (17) (3EA) and separator plate (18) (4EA).



125LCR8TM23

- (23) Separate retainer plate (15) and piston assembly (16).
- \* Take care not to damage sliding surface of each component.



125LCR8TM24

- (24) Disassemble ball guide (14) and spring (13) (9EA).
- Do not lose spring.
- \* Do not mix spring with other springs.



125LCR8TM25

- (25) Disassemble swash plate (11) and pivot (10).
- \* Take care not to damage sliding surface.



125LCR8TM26

- (26) Disassemble shaft (6) and ball bearing (7).
- Do not remove ball bearing unless malfunction is detected, since it is mounted by shrink fit.



125LCR8TM27

(27) Disassemble 1, 2 speed piston (4) and steel ball (9) using air gun.



125LCR8TM28

(28) Disassemble piston seal (5).



125LCR8TM29

(29) Turn casing (1) upside down and remove oil seal (3) using jig.



125LCR8TM30

### 3) ASSEMBLY

- Even though assembly is accomplished by reversing disassembly steps, be careful of the following.
- ① Repair the damaged part when disassemblying and prepare parts for exchange in advance.
- ② All parts should be cleaned with cleaner, dried with compressed air.
- Sliding surface, O-ring, bearing and oil seal should be lubricated with clean hydraulic oil, prior to final assembly.
- ④ Replacement of O-ring and oil sealwith new parts is generally recommended.
- ⑤ Use a torque wrench to make sure that assembly fasteners are tightened to specified values shown table1.
- 6 When assembling bolt, spread Loctite.
- (1) Put casing (1) on the worktable.



125LCR8TM31

(2) After applying grease on the external diameter of oil seal (3), insert oil seal in casing.



125LCR8TM32

(3) After applying grease on pivot (10), insert steel ball in casing.



125LCR8TM33

- (4) After assembling piston seal (5) and steel ball(9) in 1, 2 speed piston (4), insert piston in hole of casing.
- Check whether piston sticks in hole.
- \* Use piston seal jig.



125LCR8TM34

- (5) Mount ball bearing (7) on shaft (6) by shrink fit. Insert shaft in casing.
- \* Take care not to damage oil seal.



125LCR8TM35

- (6) Assemble swash plate (11) by matching its hole and steel ball.
- \* Take care not to damage sliding surface.



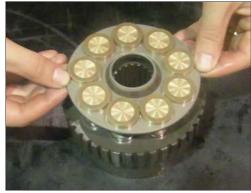
125LCR8TM36

(7) Assemble spring (13) (9ea) and ball guide (14) in cylinder block (12) in that order.



125LCR8TM37

- (8) Insert piston assembly (16) in retainer plate (15) and assemble them in cylinder block.
- Spread hydraulic oil on piston assembly.
- \* Take care not to damage each component.
- Check cylinder block and piston assembly runs properly.



125LCR8TM38

- (9) Lay casing down horizontally and assemble cylinder block assembly by matching its spline with shaft.
- Make sure swash plate stays in place.
- Check the assembling status of cylinder block by pressing it.



125LCR8TM39

(10) Assemble separator plate (18) (4EA) and friction plate (17) (3EA) alternately.



(11) Insert back-up ring & O-ring in parking piston.



125LCR8TM41

- (12) Align the pin hole of parking piston (19) with oil hole of casing, assemble them using jig.
- Spread grease on O-ring and back-up ring.
- \* Take care not to damage components.



125LCR8TM42

(13) Insert spring (26) (12EA) in parking piston.



125LCR8TM43

(14) Insert parallel pin (29) (2EA) in casing.



125LCR8TM44

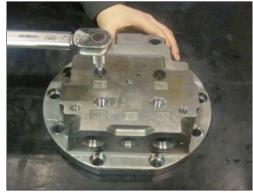
- (15) Assemble check valve (50) and spring (51) in order.
- Do not confuse check valve (50) and restrictor (34).
- Do not confuse spring (51) and spring (35)



125I CB8TM45

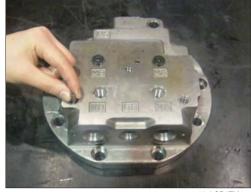
(16) Clamp plug (52) using 5 mm hexagon wrench.

\*\* Tightening torque :  $3.0\pm0.3 \text{ kgf} \cdot \text{m}$  (21.7±2.2 lbf · ft)



125LCR8TM46

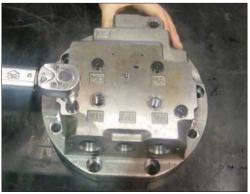
- (17) Assemble restrictor (34) and spring (35) in order.
- Do not confuse check valve (50) and restrictor (34).
- \* Do not confuse spring (51) and spring (35).



125LCR8TM47

(18) Clamp plug (52).

\*\* Tightening torque :  $3.0\pm0.3 \text{ kgf} \cdot \text{m}$  (21.7 $\pm2.2 \text{ lbf} \cdot \text{ft}$ )



125LCR8TM48

(19) Clamp plug (54).

※ Tightening torque: 4.5±0.5 kgf ⋅ m

(20.5 - 0.0 lbf ⋅ ft)

(20.7 - 0.0 lbf ⋅ ft)

(

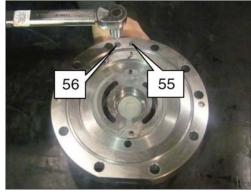
(32.5±3.6 lbf · ft)



125LCR8TM49

(20) Assemble restrictor (55) and (56) in rear cover.

- \* Check whether the restrictor is placed in exact hole.
- \* Do not confuse (55) and (56).



125LCR8TM50

(21) Assemble ball bearing (8) in rear cover using jig.



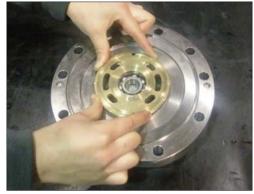
125LCR8TM51

(22) Insert spring pin (25) (2ea) and (28) in rear cover using jig.



125LCR8TM52

- (23) After spreading grease sufficiently to the bottom side of valve plate (24), assemble valve plate in rear cover by matching its holes with pins.
- \* Take care not to damage sliding surface.
- Pay attention to the assembly direction.



125I CB8TM53

- (24) Assemble O-ring (27) in rear cover.
- Spread grease on O-ring.



125LCR8TM54

- (25) Put rear cover upon casing, paying attention to the location of pin and hole. And tighten bolt (47), (48) and (49).
- Tightening torque: 17.5±1.8 kgf⋅m
   (127±13.0 lbf⋅ft)
- Make sure valve plate stays in place.
- Check bolt position.



125LCR8TM55

(26) Assemble main spool assembly (31), spring seat (37) and spring (33) in rear cover.



125LCR8TM56

(27) Settle cover (32).

\*\* Tightening torque :  $15\pm1.5 \text{ kgf} \cdot \text{m}$  ( $108\pm10.8 \text{ lbf} \cdot \text{ft}$ )



125LCR8TM57

(28) Insert relief valve (38) in rear cover.

 $\divideontimes$  Tightening torque : 15±1.8 kgf · m (108±13.0 lbf · ft)



125LCR8TM58

(29) After clamping connector (45) to rear cover, assemble spool (40).



125LCR8TM59

(30) After inserting parallel pin (43), assemble seat-spring (42).



125LCR8TM60

(31) After assembling spring (44) in order, clamp plug (41).

\*\* Tightening torque : 5.5±0.5 kgf  $\cdot$  m (39.8±3.6 lbf  $\cdot$  ft)



125I CR8TM61

# 3. TRAVEL REDUCTION GEAR DISASSEMBLY

1) While travel reduction gear is tilted to one side disassemble PF3/8 plug (82), remove gear oil and place motor sideto the bench.



125I CB8TM70

2) Disassemble cover (80) by unscrewing the M10 bolts (81) (12 pcs).



125LCR8TM71

3) Disassemble sun gear No.1 (78).



125LCR8TM72

4) Disassemble carrier No.1 assembly.



125LCR8TM73

# Carrier No. 1 sub assy disassembly

5) Disassemble M8 bolt (76) from the carrier assembly. (3 pcs)



125LCR8TM74

6) Disassemble thrust plate No.1 (75) from the carrier assembly.



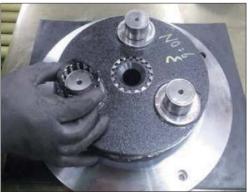
125LCR8TM75

7) Disassemble planetary gear No.1 (72).(3 pcs)



125LCR8TM76

- 8) Disassemble needle bearing (73).(3 pcs)
- Do not disassemble inner race in the absence of abnormalities.



125LCR8TM77

9) Disassemble Sun gear No.2 (70).



125LCR8TM78

10) Disassemble M10 bolt (64).(4 pcs)



125LCR8TM79

11) Disassemble thrust washer No.2 (65).(4 pcs)



125LCR8TM80

12) Disassemble planetary gear No.2 (66).(4 pcs)



125LCR8TM81

13) Disassemble needle bearing No.2 (67).(4 pcs)



125LCR8TM82

- 14) Disassemble thrust plate No.2 (69).(4 pcs)
- Do not disassemble inner race in the absence of abnormalities.



125LCR8TM83

15) Disassemble M10 bolt (89), plain washer (88) and M8 screw (77).



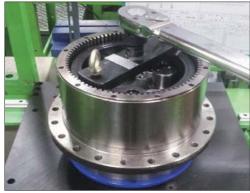
125LCR8TM84

16) Disassemble lock plate (63).



125LCR8TM85

17) Disassemble nut ring (62) by using the jig.



125LCR8TM86

18) Disassemble ring gear assembly (59) from motor assembly.



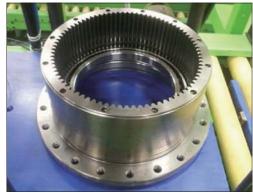
25I CB8TM87

19) Disassemble folating seal assembly (61) from ring gear assembly and motor assembly.



125LCR8TM88

- 20) Disassemble bearing (60) (2ea) from ring gear assembly.
- \* Do not disassemble bearing in the absence of abnormalities.



125LCR8TM89

### 4. TRAVEL REDUCTION GEAR ASSEMBLY

- Even though assembly is accomplished by reversing disassembly steps, be careful of the following.
- ① Repair the damaged part when disassemblying and prepare parts for exchange in advance.
- ② All parts should be cleaned with cleaner, dried with compressed air.
- Sliding surface, O-ring, bearing and oil seal should be lubricated with clean hydraulic oil, prior to final assembly.
- ④ Replacement of O-ring and oil seal with new parts is generally recommended.
- ⑤ Use a torque wrench to make sure that assembly fasteners are tightened to specified values.
- 6 When assembling bolt, spread loctite.
- 1) Put carrier No.1 (71) on the jig, and shrink-fit inner race No.1 (74) to carrier pin.(3 places)
- \* Do not tilt inner race to one side.
- \* Match inner race and end of carrier pin.



125LCR8TM90

2) Assemble needle bearing No.1 (73).(3 pcs)



125LCR8TM91

3) Assemble planetary gear No.1 (72) of which groove is faced downward. (3 places)



125LCR8TM92

4) Assemble thrust plate No.1 (75).



125LCR8TM93

- 5) After spreading loctite #242, assemble the M8 bolt (76).(3 pcs)
- $\ensuremath{\,\times\,}$  Tightening torque : 2.7  $\pm$  0.3 kgf  $\cdot$  m
- \* After the assembly, instantly check the noise and interference by rotatong the gear.



125LCR8TM94

6) First, place bearing (60) on the ring gear (59), then put jig on it, then press it with press machine.



- 7) After turning ring gear over, assemble bearing the same way.
- Be care of nick and safety when turn ring gear over.



125LCR8TM96

- 8) Assemble folating seal assembly (61) by using the iia.
- After assembling, wipe steel-lined section with alcohol.
- \* Flatness deviation has to be less than 1 mm.



125LCR8TM97

- 9) Place folating seal assembly on the motor assembly then assemble it.
- After assembling, wipe steel-lined section with alcohol.
- \* Flatness deviation has to be less than 1 mm.



125LCR8TM98

- 10) After arriving safely ring gear assembly in the motor assembly, press it with press machine.
- \* After press-fitting, clamp ring gear to fixit.
- When using the press pay attention to bearing damage.



125LCR8TM99

- 11) After assembling nut ring (62) by using the jig, disassemble the clamping.
- X Tightening torque: 60 kgf ⋅ m (434 lbf ⋅ ft)



125I CB8TM100

- 12) Place lock plate (63) on the nut ring groove.
- Select best position from one of 4 casing hole to assemble lock plate.

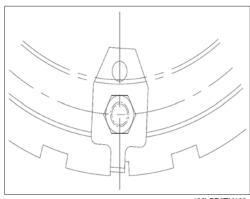


125LCR8TM101

- 13) Place lock plate th the direction which nut ring is loosed and then assemble M10 bolt (89) with M8 screw (77) after spreading loctite #242. (Refer to assembly detail drawing)
- st Tightening torque (M10) : 5.5  $\pm$  0.6 kgf  $\cdot$  m (39.8  $\pm$  4.3 lbf  $\cdot$  ft)
- % Tightening torque (M8)  $\div$  2.7  $\pm$  0.3 kgf  $\cdot$  m
- \*\* Figure (iii)  $\pm$  0.3 kg/·ff) (19.5  $\pm$  2.2 lbf·ff)
- Make sure that M8 screw doesn't stick out of lock plate.
- \* Assembly detail drawing lock plate.



125LCR8TM102



125LCR8TM103

14) Shrink fit the inner race No.2 (68).(4 pcs)



125LCR8TM104

15) Assemble thrust plate No.2 (69).(4 pcs)



125LCR8TM105

16) Assemble needle bearing No.2 (67).(4 pcs)



125LCR8TM106

17) Assemble planetary gear No.2 (66).(4 pcs)※ Grooves of planetary gear will be facingup.



125LCR8TM107

18) Assemble thrust washer No.2 (65).(4 pcs)



125I CR8TM108

19) After spreading loctite #242, assemble the M10 bolt (64).(4 pcs)

\*\* Tightening torque : 5.5  $\pm$  0.6 kgf  $\cdot$  m (39.8  $\pm$  4.3 lbf  $\cdot$  ft)



125LCR8TM109

20) Assemble sun gear No.2 (70).



125LCR8TM110

21) Assemble carrier No.1 assembly.



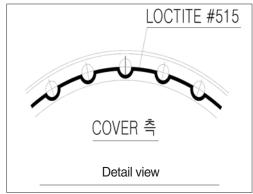
125LCR8TM111

22) Assemble sun gear No.1 (72).



125LCR8TM112

23) Spread the loctite #515 on the cover (80) with reference to the right detail view.



125LCR8TM114

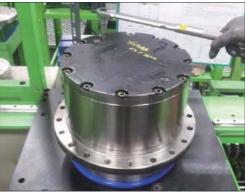
24) Place cover (80) to fit the bolt holes.



125LCR8TM115

25) After spreading loctite #242, assemble the M10 bolt (81).(12 pcs)

\*\* Tightening torque : 6.3  $\pm$  0.7 kgf  $\cdot$  m (45.6  $\pm$  5.1 lbf  $\cdot$  ft)



125LCR8TM116

26) Inject the 2.3  $\,\pm\,$  0.3 liter gear oil to PF3/8 tap section.



125I CB8TM117

27) After assembling the O-ring (83) to the plug (82), assemble it to the cover. (3 pcs)

% Tightening torque : 5.5  $\pm$  0.5 kgf  $\cdot$  m (39.8  $\pm$  3.6 lbf  $\cdot$  ft)



125LCR8TM118

# TRAVEL DEVICE (HIGH WALKER, TYPE1)

#### 1. REMOVAL AND INSTALL

#### 1) REMOVAL

- (1) Swing the work equipment 90 ° and lower it completely to the ground.
- (2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.
- (3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

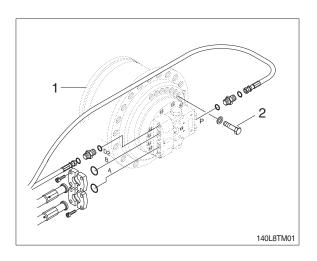
# ▲ Escaping fluid under pressure can penetrate the skin causing serious injury.

- When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.
- (4) Remove the track shoe assembly.
  For details, see removal of track shoe assembly.
- (5) Remove the cover.
- (6) Remove the hose.
- \* Fit blind plugs to the disconnected hoses.
- (7) Remove the bolts and the sprocket.
  - · Tightening torque : 29.7±3.0 kgf · m (215±21.7 lbf · ft)
- (8) Sling travel device assembly (1).
- (9) Remove the mounting bolts (2), then remove the travel device assembly.
  - · Weight: 300 kg (660 lb)
  - · Tightening torque : 25.7±4.0 kgf · m (166±28.9 lbf · ft)

#### 2) INSTALL

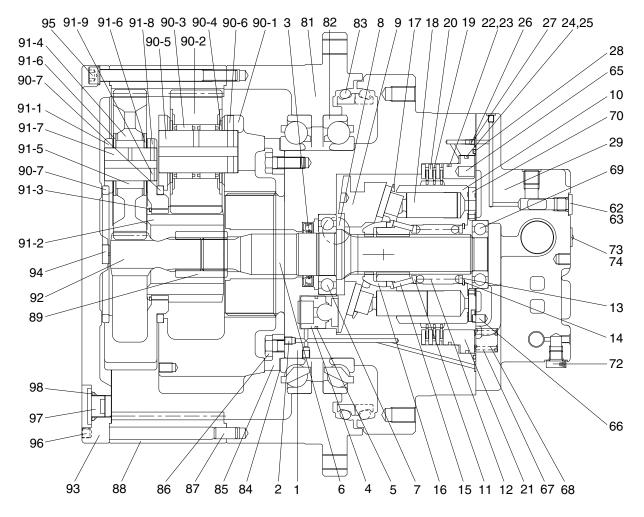
- (1) Carry out installation in the reverse order to removal.
- (2) Bleed the air from the travel motor.
- ① Remove the air vent plug.
- ② Pour in hydraulic oil until it overflows from the port.
- 3 Tighten plug lightly.
- ④ Start the engine, run at low idling, and check oil come out from plug.
- 5 Tighten plug fully.
- (3) Confirm the hydraulic oil level and check the hydraulic oil leak or not.

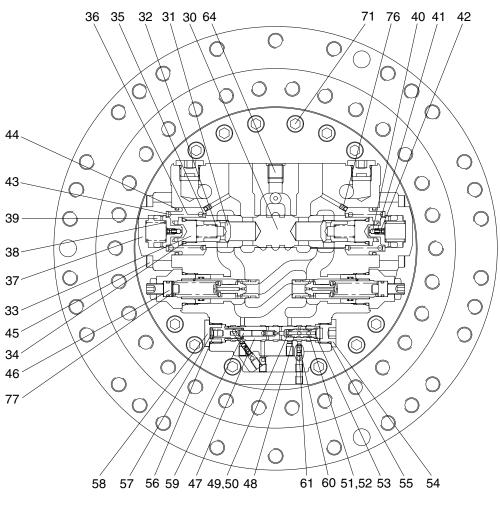




# 2. TRAVEL MOTOR

# 1) STRUCTURE





1	Shaft casing
2	Plug
3	Oil seal
4	Swash piston
5	Piston ring
6	Shaft
7	Bearing
8	Steel ball
9	Swash plate
10	Cylinder block
11	Spring seat
12	Spring
13	End plate
14	Snap ring
15	Pin
16	Ball guide
17	Set plate
18	Piston assy
19	Friction plate

20	Separate plate
21	Parking piston
22	O-ring
23	Back up ring
24	O-ring
25	Back up ring
26	Orifice
27	O-ring
28	O-ring
29	Rear cover
30	Spool
31	Check
32	Spring
33	Plug
34	O-ring
35	Spring seat
36	Spring
37	Cover
38	Spring

39	Spool
40	Steel ball
41	Spring
42	Plug
43	Spring seat
44	O-ring
45	Wrench bolt
46	Relief valve assy
47	Spool
48	Guide
49	O-ring
50	Back up ring
51	O-ring
52	Back up ring
53	Snap ring
54	plug
55	O-ring
56	Spring
57	Spring seat

58 59	Plug Spool
60	Orifice
61	Orifice
62	Plug
63	O-ring
64	Plug
65	Pin
66	Pin
67	Spring
68	Spring
69	Bearing
70	Valve plate
71	Wrench bolt
72	Plug
73	Name plate
74	Rivet
75	Seal kit
76	Orifice

77	Shim
81	Housing
82	Main bearing
83	Floating seal
84	Shim
85	Retainer
86	Hex head bolt
87	Parallel pin
88	Ring gear
89	Coupling
90	Carrier assy No.2
90-1	Carrier No.2
90-2	Planetary gear No.2
90-3	Needle bearing No.2
90-4	Thrust washer
90-5	Pin No.2
90-6	Spring pin
90-7	Thrust ring
91	Carrier assy No.1

16092TM02 91-1 Carrier No.1 91-2 Sun-gear No.2 91-3 Retaining ring 91-4 Planetary gear No.1 91-5 Needle bearing No.1 91-6 Thrust washer 91-7 Pin No.1 91-8 Spring pin 91-9 Spring pin 92 Sun gear No.1 93 Cover 94 Pad 95 Hex socket head bolt 96 Hex socket Screw 97 Hydraulic plug 98 O-ring 99 Name plate

# 2) TOOLS AND TIGHTENING TORQUE

# (1) Tools

Tool name		Remark		
Allen wrench		2, 5, 4, 6, 10	В	
Socket for socket wrench, spanner	Socket	8, 14, 24, 27		
Torque wrench		Capable of tightening with the specified torques		
Pliers		-		
Plastic and iron hammer		Wooden hammer allowed. Normal 1 or so		
Monkey wrench		-		
Oil seal inserting jig		-		
Bearing pliers		-		
Seal tape		-		
Eye bolt		M10, M12, M14		
Press (0.5 ton)		-		
Oil stone		-		
Bearing assembling jig		-		

# (2) Tightening torque

Part name	Item	Size	Torque	
Fait name			kgf · m	lbf ⋅ ft
Plug	2	NPT 1/16	1±0.1	7.2±0.7
Orifice	26	M5	0.7±0.1	5±0.7
Wrench bolt	45	M12×40	10 $\pm$ 1.0	72±7.0
Relief valve	46	HEX 27	18±1.0	130±7.0
Plug	54	PF 1/2	$8.5 \pm 1.0$	61 ± 7.0
Plug	58	HEX 24	5±1.0	36±7.0
Plug	62	PF 1/4	5±1.0	36±7.0
Wrench bolt	71	M12×35	10±1.0	72±7.0
Hex head bolt	-	M12×25	11 $\pm$ 1.5	79±10
Hex socket head bolt	-	M12×155	11±1.5	79±10
Hex socket head plug	-	PF 3/4	19±1	137±7.0

### 3. OUTLINE OF DISASSEMBLING

### 1) GENERAL SUGGESTIONS

- Select a clean place for dismantling.
   Spread a rubber plate on a working table in order to prohibit the damage of parts.
- (2) Clean a deceleration equipment and a motor part, washing out dirt and unnecessary substances.
- (3) Without any damage of O-ring, oil seal, the adhered surface of other seals, a gear, a pin, the adhered surface of other bearings, and the surface of moisturized copper, treat each parts.
- (4) Numbers written in the parenthesis, (), next to the name of a part represent the part numbers of a cross-sectional view annexed with a drawing.
- (5) The side of a pipe in a motor can be written as a rear side; the side of out-put as a front side.
- (6) Using and combining a liquid gasket, both sides must be dried completely before spraying a liquid gasket.
- (7) In case of bonding volts, combine a standard torque by torque wrench after spraying loctite 262 on the tab parts. (It can be dealt as assembling NPTF screws and an acceleration equipment.)

### 2) DISASSEMBLING

- (1) Unloosing wrench bolt and disassemble cover (37).
- Wrench bolt = M12×40L-8 EA (purchasing goods)



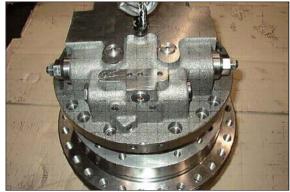
21078TM21

(2) Disassemble parts related to counterbalance valve.



21078TM22

(3) Unloosing wrench bolt (M12×35L, 16 EA) and disassemble rear cover assembly from motor assembly.



21078TM23



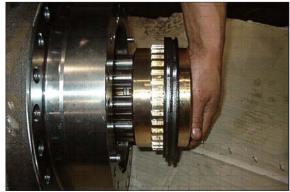
21078TM24

(4) Dismantle packing piston (21) using compressed air.



21078TM25

(5) Disassembly rotary kit from motor assembly (cylinder block assembly, piston assembly, ball guide, set plate, friction plate, steel plate...)



21078TM26

(6) Using a jig, disassemble swash plate (9) from shaft casing.



21078TM27

(7) Using compressed air, disassemble piston swash (4) piston ring (5), respectively.



21078TM28



21078TM29

(8) Using a hammer, disassemble shaft (6) from shaft casing (1).



21078TM30

# ■ Disassemble cylinder sub.

(9) Disassemble cylinder block assembly, piston assembly (9) and seat plate (M).



21078TM31



21078TM32

(10) Disassemble ball guide (16), ring and pin (15) from cylinder block, respectively.



21078TM33



21078TM34



21078TM35

(11) Pushing spring (12) by an assembling jig, disassemble snap ring (14), spring seat (13), spring (12) and spring seat (11), respectively.



21078TM36

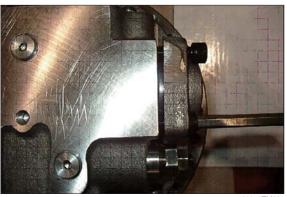


21078TM37

### ■ Disassemble valve casing sub.

(12) Using an hexagon wrench, unloosing wrench bolt (45) and disassemble cover (37), spring (38), spool (39), spring seat (43), spring (36) and spring seat (35), respectively.

(same balance on both sides)



21078TM38



21078TM39

(13) Disassemble spool (59), spool (47), O-ring (51), guide (48) and snap ring (53) on rear cover, respectively.



21078TM40



21078TM41

(14) Using a torque wrench, disassemble relief valve assembly (46) on rear cover.



21078TM42

### 4. OUTLINE FOR ASSEMBLING

# 1) GENERAL SUGGESTIONS

- (1) After washing each parts cleanly, dry it with compressed air. Provided that you do not wash friction plate with treated oil.
- (2) In bonding each part, fasten bond torque.
- (3) When using a hammer, do not forget to use a plastic hammer.

# 2) ASSEMBLING

# ■ Assemble the sub of turning axis

(1) Using a jig, assemble oil seal (3) into shaft casing (1)



21078TM43

(2) Have a bearing (8) thermal reacted into shaft (6).



21078TM44



21078TM45



21078TM46

(3) Using a jig, assemble shaft assembly into shaft casing (1).



21078TM47

(4) After spreading grease on steel ball (8) assemble into shaft casing (1).



21078TM48

(5) Assemble swash piston assembly (4, 5) into shaft casing (1).



21078TM49

(6) Assemble swash plate (9) into shaft casing (1).



21078TM50

## ■ Assemble cylinder block sub.

(7) Assemble spring seat (13), spring (12), spring seat (11) into cylinder block (10) respectively, pushing spring (12) using by a jig, assemble snap ring (14) with a snap ring (14).



21078TM51



21078TM52

(8) Assemble ring, pin (15) on cylinder block (10) ball guide (16) respectively.



21078TM53



21078TM54



21078TM55

(9) Assemble cylinder block assembly, piston assembly (9), seat plate (17).



21078TM56



21078TM57

(10) Assemble cylinder block assembly (9) into shaft casing (1).



21078TM5

(11) Assemble friction plate (19) and plate (20) into shaft casing (1) respectively, prepare 6 set.



21078TM59

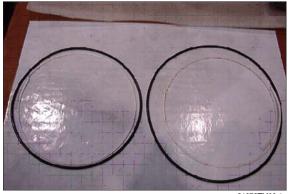


21078TM59-1

(12) Assemble O-ring (22, 23) into packing piston (21).



21078TM60



21078TM60-1

(13) After spreading grease on packing piston (21) bond wrench bolt and assemble shaft casing (1).



21078TM61

### ■ Assemble rear cover sub.

(14) Using a jig, assemble bearing (69) into rear cover (29).



21078TM62

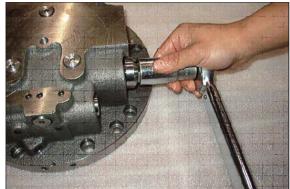
(15) After assembling spool (59), spool (47), O-ring (51), guide (48) and snap ring (53) respectively into rear cover (29).
Using torque wrench, assemble it.



21078TM63



21078TM64



21078TM65

(16) Assemble spring seat (35), spring (36), spring seat (43), spool (39), spring (38), cover (37) respectively and assemble wrench bolt (45).

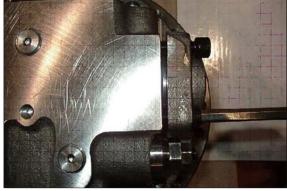
(same balance on both sides)



21078TM66



21078TM67



21078TM67-1

(17) Assemble plug (2).

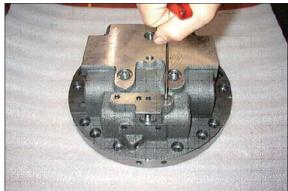
\*\* Plug (NPT1/16) - 11 EA



21078TM68



21078TM69



21078TM70



21078TM71

(18) Assemble plug (64). ※ Plug (PT3/8) - 11 EA



(19) Assemble plug (62, 63) into rear cover (29) and assemble relief valve assembly.



21078TM73



21078TM74

(20) Put spring (67, 68) together into rear cover (29), prepare 6 set.





21078TM76

(21) Assemble valve plate (70) into rear cover (29).



21078TM77

(22) After assembling shaft casing (1) and rear cover (29).

Assemble spool assembly (30), spring (38), spool (39), cover (37) after then complete assembly with wrench bolt (45).



21078TM78

(23) Finish assembly.



21078TM79

#### 5. DISASSEMBLING REDUCTION UNIT

### 1) PREPARATION FOR DISASSEMBLING

- (1) The reduction units removed from excavator are usually covered with mud. Wash outside of propelling unit and dry it.
- (2) Locate reducer in order for drain port to be at the lowest level loosen taper screw plug of drain port, and drain oil from reduction gear.
- While oil is still hot, inside of the unit may be pressurized.
- ▲ Take care of the hot oil gushing out of the unit when loosening the plug.

### (3) Mark for mating

Put marks on each mating parts when disassembling so as to reassemble correctly as before.



21078TM80

# 2) SETTING REDUCTION UNIT (OR WHO-LE PROPELLING UNIT) ON WORK STAND FOR DISASSEMBLING

- (1) Remove M12 hexagon socket head bolts (95) at 3 places from cover (93) almost equally apart each other, and then install M12×155L eye bolts.
  - Lift up the unit using them and place it on work stand with cover upward.
- ▲ Take great care not to pinch your hand between parts while disassembling nor let fall parts on your foot while lifting them.



21078TM81

### 3) REMOVING COVER

- (1) Remove the rest of M12 hexagon socket head bolts (95) that securing gear and housing. Loosen all the socket bolts and then, disassemble cover.
- (2) As the cover (93) is adhered to ring gear (88), disassemble ring gear (88) and cover (93) vy lightly hammering slantwise upward using sharpen punch inserted between the cover and ring gear.



21078TM8

### 4) REMOVING NO.1 CARRIER SUB ASS-EMBLY

(1) Screw three M10 eye-bolt in No.1 carrier and lift up and remove No.1 carrier assy.



21078TM83

- (2) Remove No.1 sun gear
- Be sure to maintain it vertical with the ground when disassembling No.1 sun gear.



21078TM84

# 5) REMOVING NO.2 CARRIER SUB ASSEMBLY

(1) Screw three M10 eye-bolt in No.2 carrier and lift up and remove No.2 carrier assy.



21078TM85

- (2) Remove No.2 sun gear
- Be sure to maintain it vertical with the ground when disassembling No.2 sun gear.



21078TM86

### 6) REMOVING RING GEAR

- (1) As the ring gear (88) is adhered to housing (81), disassemble ring gear (88) and housing (81) by lightly hammering slantwise upward using sharpen punch inserted between the ring gear and housing.
- Carefully disassembling ring gear not to make scratch on it.
- (2) Screw M14 eye-bolt in ring gear and lift up and remove it.



### 7) REMOVING COUPLING

(1) Remove coupling.



### 8) REMOVING RETAINER & SHIM

- (1) Remove M12 hexagon socket head bolts that secure retainer and motor.
- (2) Remove retainer & shim.



### 9) REMOVING HOUSING SUB ASSEMBLY

(1) Screw M12 eye bolt in housing and lift up housing assembly including angular bearing and floating seal.



21078TM90

### 10) REMOVING FLOATING SEAL

(1) Lift up a piece of floating seal of motor side.



## 11) DISASSEMBLING HOUSING ASSEMB-LY

- (1) After turning housing, lift up a piece of floating seal from housing and then remove it.
- Don't disassemble angular bearing.



21078TM92

### 12) DISASSEMBLING NO.1 CARRIER

- (1) Remove thrust ring (90-7) from carrier.
- (2) Knock spring pin (91-8) fully into No.1 pin (91-7).
- (3) Remove planetary, thrust washer, No.1 pin, bearing from carrier.



21078TM93





21078TM95

# 13) DISASSEMBLING NO.2 CARRIER

(1) Disassemble No.2 carriers, using the same method for No.1 carrier assembly.



21078TM96



21078TM97

### 6. ASSEMBLY REDUCTION GEAR

### 1) GENERAL NOTES

Clean every part by kerosene and dry them by air blow.

Surfaces to be applied by locktite must be decreased by solvent.

Check every part for any abnormals.

Each hexagon socket head bolt should be used with locktite No.

262 applied on its threads.

Apply gear oil slightly on each part before assembling.

Take great care not to pinch your hand between parts or tools while assembling nor let fall parts on your foot while lifting them.

### Inspection before reassembling

### Thrust washer

- Check if there are seizure, abnormal wear or uneven wear.
- Check if wear is over the allowable limit.

#### Gears

- · Check if there are pitting or seizure on the tooth surface.
- Check if there are cracks on the root of tooth by die check.

### **Bearings**

 Rotate by hand to see if there are something unusual such as noise or uneven rotation.

### Floating seal

 Check flaw or score on sliding surfaces or O-ring.

21078TM98

### 2) ASSEMBLING NO.1 CARRIER

- (1) Put No.1 carrier (91-1) on a flat place.
- (2) Install No.1 needle bearing (91-5) into No.1 planetary gear (91-4), put 2 EA of No.1 thrust washer (91-6) on both sides of bearing, and then, install it into carrier.



21078TM99

(3) Install No.1 pin (91-5) into No.1 carrier where the holes for No.1 pin (91-5) are to be in line with those of No.1 carrier, and then, install spring pins into the holes.



21078TM100

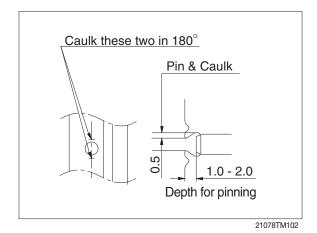
- (4) Caulk carrier holes as shown on the picture.
- (5) Assembly thrust ring (90-7) into carrier.



21078TM101

### 3) ASSEMBLING NO.2 CARRIER

- (1) Put No.2 carrier (90-1) on a flat place.
- (2) Install No.2 needle bearing (90-3) into No.2 planetary gear (90-2), put 2 EA of No.2 thrust washer (90-4) on both sides of bearing, and then, install it into carrier.



(3) Install No.2 pin (90-5) into No.2 carrier where the holes for No.2 pin (90-5) are to be in line with those of No.2 carrier, and then, install spring pins into the holes.



21078TM103

- (4) Caulk carrier holes as shown on the picture.
- (5) Assembly thrust ring (90-7) into carrier.



21078TM104

# 4) ASSEMBLING FLOATING SEAL (83) AND MAIN BEARING (82)

- (1) Assemble floating seal into motor by use of pressing jig. Grease the contact parts for floating seal which is assembled into motor.
- (2) Heat bearing at 60~70°C and then, put into the motor side.
- Be sure to maintain it vertical with the ground when assembling bearing and floating seal.



21078TM105



21078TM106

### 5) ASSEMBLING HOUSING

- (1) Heat housing at 60~70°C while clearing it out and then, assemble floating seal into housing by use of pressing jig.
- Be sure to maintain it vertical with the ground when assembling floating seal.



21078TM705

### 6) INSTALLING HOUSING ASSEMBLY

- Install 2 EA of M12 eye-bolt into housing assembly.
- (2) Assemble housing into motor by use of hoist and eye-bolt.
- Be sure to tighten eye-bolt deep enough.



21078TM108

### 7) INSTALLING MAIN BEARING (82)

- Heat main bearing at 60~70 °C and then, install.
- \*\* Be sure to maintain it vertical with the ground when assembling bearing.



21078TM109

# 8) INSTALLING RETAINER (85) AND SHIM (84)

- (1) Measure clearance between main bearing and retainer by use of jig to decide the thickness of shim and select an appropriate shim, and then, assemble retainer.
- (2) Apply locktite (#262) on M12 hexagon head bolt, and then, bolt.



21078TM110

### 9) INSTALLING COUPLING

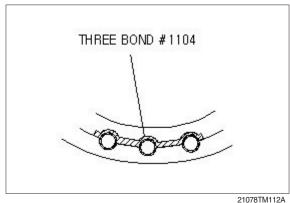
(1) Install coupling on spline of the motor.

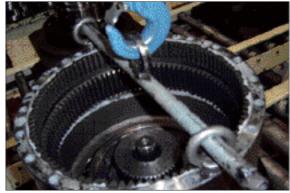


21078TM111

### 10) INSTALLING RING GEAR

- (1) Apply three bone #1104 (loctite #515) on housing for ring gear without gap.
- (2) Insert lock pin into housing hole.
- (3) Install M14 eye-bolt on the tap of ring gear.
- (4) Lift ring gear and then, assemble into housing in order for hole of ring gear and parallel pin of housing to be in line.
- (5) Temporarily secure 4EA of M12 hexagon socket bolt and shim with cover thickness having appropriate torque.





# 11) INSTALLING NO.2 CARRIER SUB ASS-**EMBLY**

- (1) Install M10 eye-bolt on No.2 carrier assembly.
- (2) Lift No.2 carrier assembly and then, slowly put it down on ring gear.
- (3) Rotate planetary gear by hands and install on ring gear.



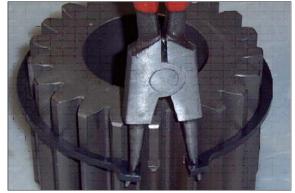
### 12) INSTALLING NO.2 SUN GEAR (91-2)

 Install No.2 sun gear on the spline of No.2 carrier and No.2 planetary gear, matching teeth of them.



21078TM115

(2) Install No.2 sun gear on the spline of No.2 carrier and No.2 planetary gear, matching teeth of them.



21078TM116

# 13) INSTALLING NO.1 CARRIER SUB ASSEMBLY

- (1) Install M10 eye-bolt on No.2 carrier assembly.
- (2) Lift No.1 carrier assembly and then, slowly put it down on ring gear.
- (3) Rotate planetary gear by hands and install on ring gear.



21078TM117

### 14) INSTALLING NO.1 SUN GEAR (92)

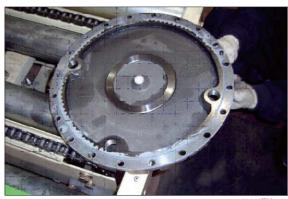
- (1) Put down No.1 sun gear on No.1 carrier, maintaining it vertical with spline of coupling.
- (2) Install No.1 sun gear on No.1 planetary gear, matching their teeth.



21078TM118

# 15) INSTALLING COVER (93)

- (1) Beat pad (94) with plastic hammer, and press it into the center of cover.
- (2) Apply three bond #1104, loctite (#515) on the ring gear for cover without gap.
- (3) Put cover on ring gear, apply loctite (#262) on M12 hexagon socket head bolt, and then, bolt.
- (4) Fill gear oil (5.8 liter) into drain port.
- (5) Apply gear oil on PF3/4 hydraulic plug (97) and then, bolt.



21078TM119



21078TM120

# **GROUP 7 RCV LEVER**

### 1. REMOVAL AND INSTALL

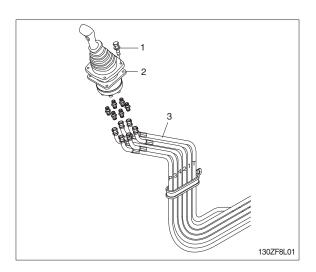
### 1) REMOVAL

- (1) Lower the work equipment to the ground and stop the engine.
- (2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.
- (3) Loosen the breather slowly to release the pressure inside the hydraulic tank.
- ▲ Escaping fluid under pressure can penetrate the skin causing serious injury.
- (4) Loosen the socket bolt (1).
  - · Tightening torque : 2.5±0.5 kgf · m (18.1±3.6 lbf · ft)
- (5) Remove the cover of the console box.
- (6) Disconnect pilot line hoses (3).
- (7) Remove the pilot valve assembly (2).
- When removing the pilot valve assembly, check that all the hoses have been disconnected.

### 2) INSTALL

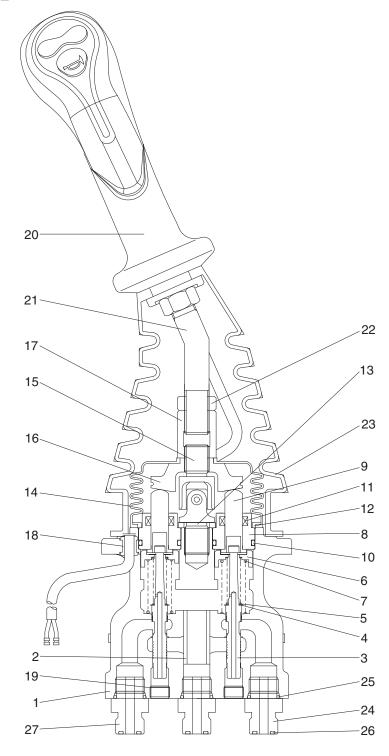
- Carry out installation in the reverse order to removal.
- (2) Confirm the hydraulic oil level and check the hydraulic oil leak or not.





# 2. DISASSEMBLY AND ASSEMBLY

# 1) STRUCTURE



300L2RL06

1	Case	8	Plug	15	Joint assembly	22	Nut
2	Bushing	9	Push rod	16	Swash plate	23	Boot
3	Spool	10	O-ring	17	Adjusting nut	24	Last guard filter
4	Shim	11	Rod seal	18	Bushing	25	O-ring
5	Spring	12	Plate	19	Plug	26	O-ring
6	Spring seat	13	Spacer	20	Handle assembly	27	Connector
7	Spring	14	Boot	21	Handle bar		

# 2) TOOLS AND TIGHTENING TORQUE

# (1) Tools

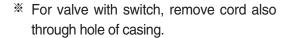
Tool name	Remark		
Allen wrench	6 <u>B</u>		
Cronno	22		
Spanne	27		
(+) Driver	Length 150		
(-) Driver	Width 4~5		
Torque wrench	Capable of tightening with the specified torques		

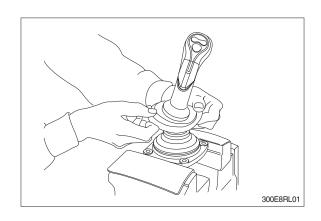
# (2) Tightening torque

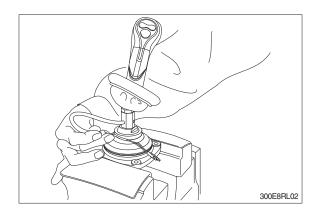
Part name	Item	Size	Torque		
Fait name	item	Size	kgf · m	lbf ⋅ ft	
Joint	15	M14	3.5	25.3	
Swash plate	16	M14	5.0±0.35	36.2±2.5	
Adjusting nut	17	M14	5.0±0.35	36.2±2.5	
Lock nut	22	M14	5.0±0.35	36.2±2.5	

### 3) DISASSEMBLY

- \* Procedures are based on the type M1.
- (1) Clean pilot valve with kerosene.
- Put blind plugs into all ports
- (2) Fix pilot valve in a vise with copper (or lead) sheets.
- (3) Remove end of boot (23) from case (1) and take it out upwards.



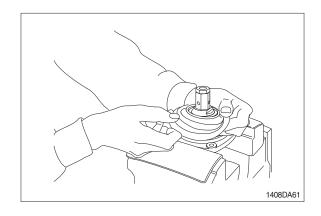




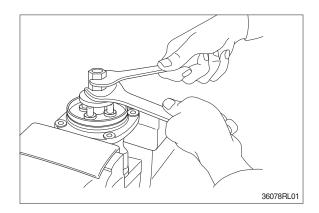
(4) Loosen lock nut (22) and adjusting nut (17) with spanners on them respectively, and take out handle section as one body.

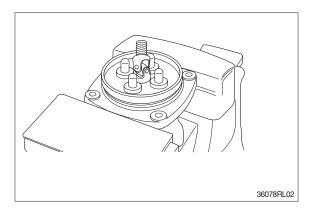


(5) Remove the boot (14).

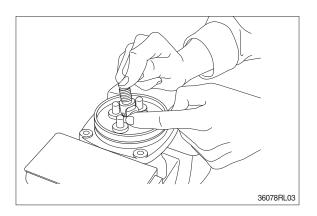


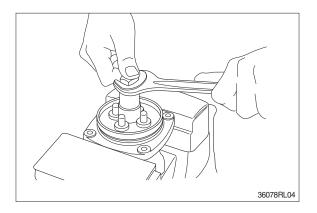
(6) Loosen adjusting nut (17) and swash plate (16) with spanners on them respectively, and remove them.



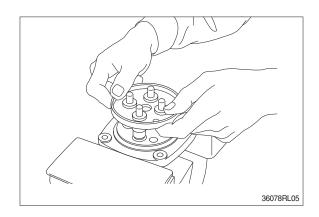


- (7) Turn joint anticlockwise to loosen it, utilizing jig (Special tool).
- When return spring (7) is strong in force, plate (12), plug (8) and push rod (9) will come up on loosening joint. Pay attention to this.

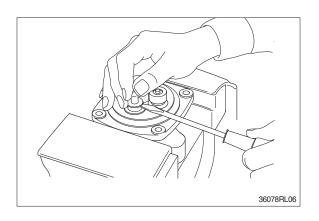


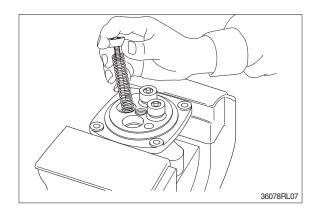


### (8) Remove plate (12).

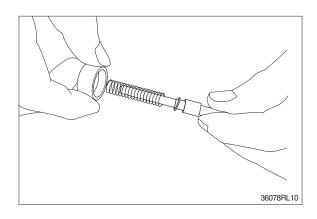


- (9) When return spring (7) is weak in force, plug (8) stays in casing because of sliding resistance of O-ring.
- \* Take it out with minus screwdriver. Take it out, utilizing external periphery groove of plug and paying attention not to damage it by partial loading.
- During taking out, plug may jump up due to return spring (7) force.
  Pay attention to this.
- (10) Remove reducing valve subassembly and return spring (7) out of casing.
- \*\* Record relative position of reducing valve subassembly and return springs.

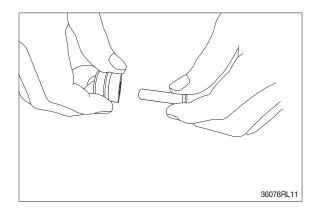




- (11) Separate spool (3), spring seat (6), spring (5) and shim (4) individually.
- Pay attention not to damage spool surface.
- Record original position of spring seat (6).
- W Until being assembled, they should be handled as one subassembly group.

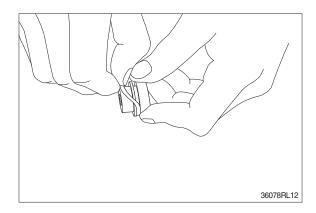


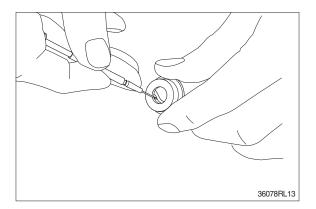
(12) Take push rod (9) out of plug (8).



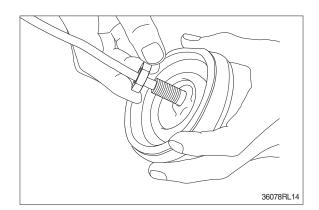
(13) Remove O-ring (10) and seal (11) from plug (8).

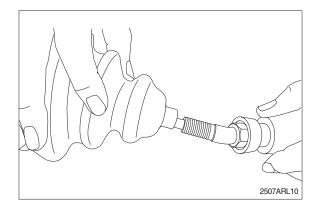
Use small minus screwdriver or so on to remove this seal.





(14) Remove lock nut (22) and then boot (23).





### (15) Cleaning of parts

- ① Put all parts in rough cleaning vessel filled with kerosene and clean them (rough cleaning).
- If dirty part is cleaned with kerosene just after putting it in vessel, it may be damaged. Leave it in kerosene for a while to loosen dust and dirty oil.
- If this kerosene is polluted, parts will be damaged and functions of reassembled valve will be degraded.
  - Therefore, control cleanliness of kerosene fully.
- 2 Put parts in final cleaning vessel filled with kerosene, turning it slowly to clean them even to their insides (finish cleaning).
- \*\* Do not dry parts with compressed air, since they will be damaged and/or rusted by dust and moisture in air.

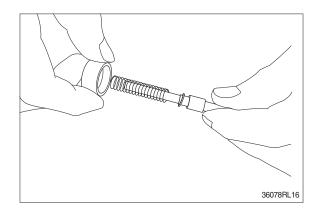
### (16) Rust prevention of parts

Apply rust-preventives to all parts.

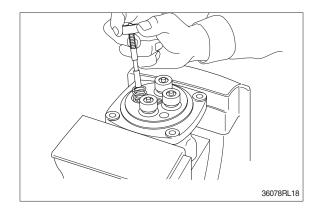
If left as they after being cleaned, they will be rusted and will not display their functions fully after being reassembled.

# 4) ASSEMBLY

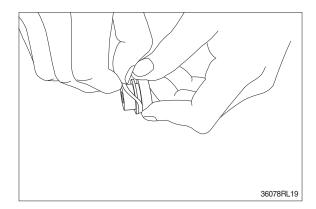
(1) Put shim (4), springs (5) and spring seat (6) onto spool (3) in this order.



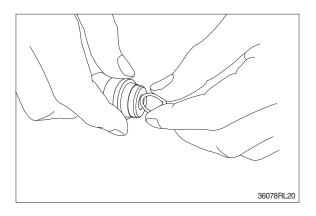
- (2) Assemble spring (7) into casing (1).
  Assemble reducing valve subassembly into casing.
- Assemble them to their original positions.



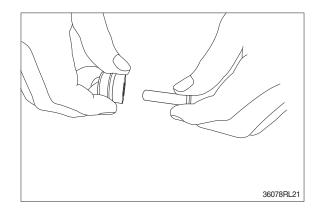
(3) Assemble O-ring (10) onto plug (8).



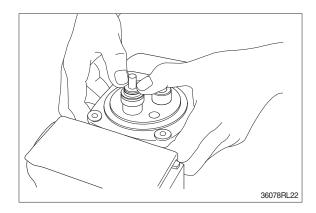
- (4) Assemble seal (11) to plug (8).
- Assemble seal in such lip direction as shown below.



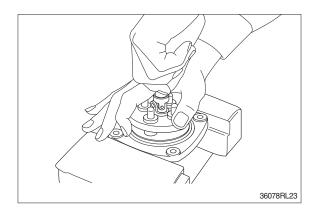
- (5) Assemble push rod (9) to plug (8).
- \* Apply working oil on push-rod surface.



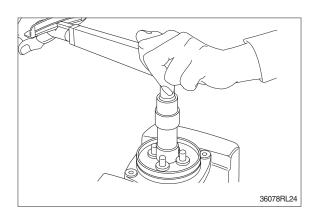
- (6) Assemble plug subassembly to casing.
- When return spring is weak in force, subassembly stops due to resistance of O-ring.



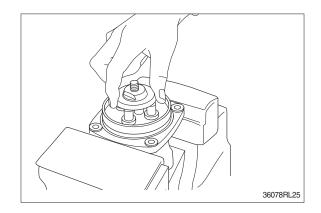
(7) When return spring is strong in force, assemble 4 sets at the same time, utilizing plate (12), and tighten joint (15) temporarily.



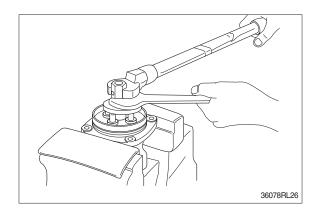
- (8) Fit plate (12).
- (9) Tighten joint (15) with the specified torque to casing, utilizing jig.



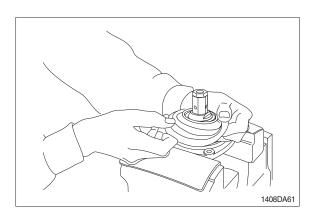
- (10) Assemble swash plate (16) to joint (15).
- Screw it to position that it contacts with 4 push rods evenly.
- \* Do not screw it over.



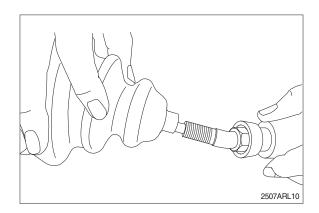
- (11) Assemble adjusting nut (17), apply spanner to width across flat of plate (16) to fix it, and tighten adjusting nut to the specified torque.
- During tightening, do not change position of disk.

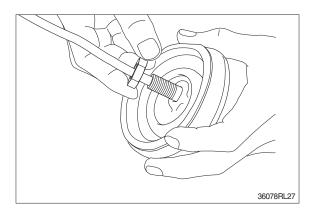


(12) Fit boot (14) to plate.

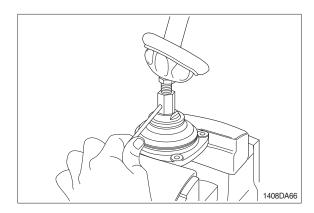


(13) Fit boot (23) and lock nut (22), and handle subassembly is assembled completely.

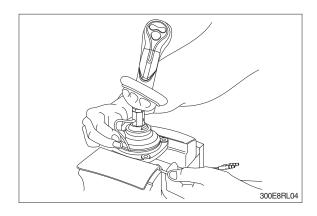




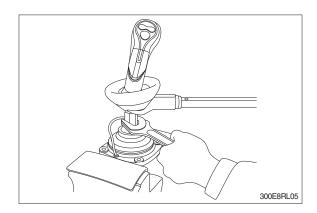
(14) Pull out cord and tube through adjusting nut hole provided in direction 60 °to 120 °from casing hole.



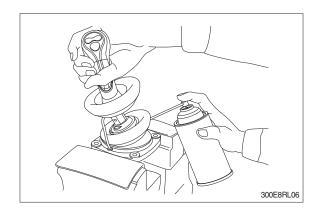
- (15) Assemble bushing (18) to plate and pass cord and tube through it.
- Provide margin necessary to operation.



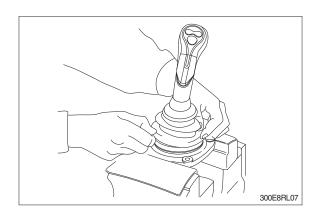
(16) Determine handle direction, tighten lock nut (22) to specified torque to fix handle.



(17) Apply grease to rotating section of joint and contacting faces of disk and push rod.



- (18) Assemble lower end of bellows to casing.
- (19) Inject volatile rust-preventives through all ports and then put blind plugs in ports.



### **GROUP 8 TURNING JOINT**

### 1. REMOVAL AND INSTALL

### 1) REMOVAL

- (1) Lower the work equipment to the ground and stop the engine.
- (2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.
- (3) Loosen the breather slowly to release the pressure inside the hydraulic tank.
- ▲ Escaping fluid under pressure can penetrate the skin causing serious injury.
- When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.
- (4) Disconnect all hoses.
- (5) Sling the turning joint assembly (1) and remove the mounting bolt (2).

· Weight: 50 kg (110 lb)

 $\cdot$  Tightening torque : 12.3  $\pm$  1.3 kgf  $\cdot$  m (88.9  $\pm$  9.4 lbf  $\cdot$  ft)

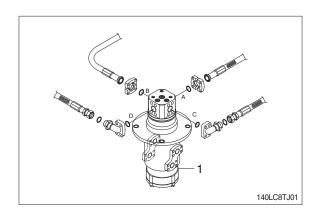
- (6) Remove the turning joint assembly.
- When removing the turning joint, check that all the hoses have been disconnected.

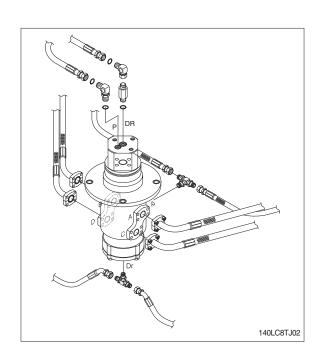
### 2) INSTALL

- Carry out installation in the reverse order to removal.
- \* Take care of turning joint direction.
- Assemble hoses to their original
- \* positions.

Confirm the hydraulic oil level and check the hydraulic oil leak or not.

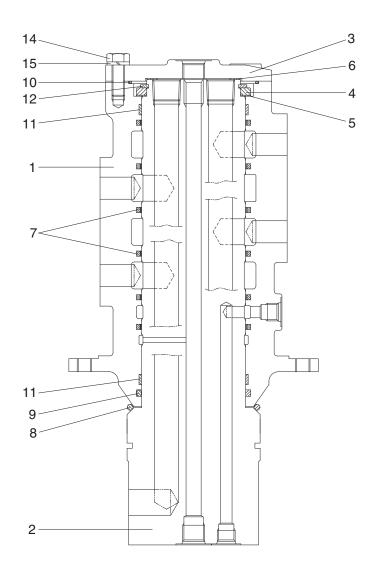






# 2. DISASSEMBLY AND ASSEMBLY

# 1) STRUCTURE

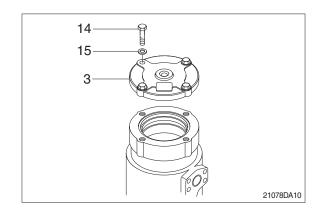


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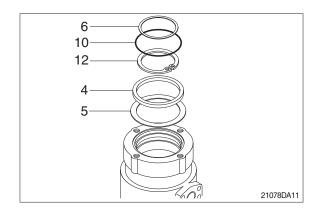
1	Hub	6	Shim	11	Wear ring
2	Shaft	7	Slipper seal	12	Retainer ring
3	Cover	8	O-ring	13	Plug
4	Spacer	9	O-ring	14	Hexagon bolt
5	Shim	10	O-ring	15	Spring washer

### 2) DISASSEMBLY

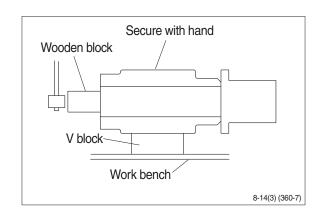
- Before the disassembly, clean the turning joint.
- (1) Remove bolts (14), washer (15) and cover (3).



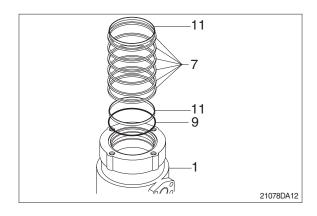
- (2) Remove shim (6) and O-ring (10).
- (3) Remove retainer ring (12), spacer (4) and shim (5).



- (4) Place hub (1) on a V-block and by using a wood buffer at the shaft end, hit out shaft(2) to about 1/2 from the body with a hammer.
- Take care not to damage the shaft (2) when remove hub (1) or rest it sideway.
- Put a fitting mark on hub (1) and shaft (2).

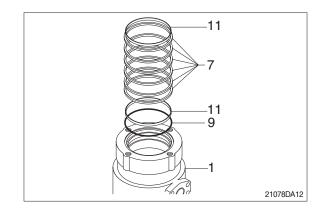


(5) Remove six slipper seals (7) and O-ring (9), two wear ring (11) from hub (1).

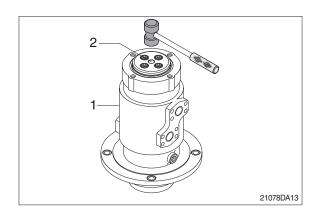


# 3) ASSEMBLY

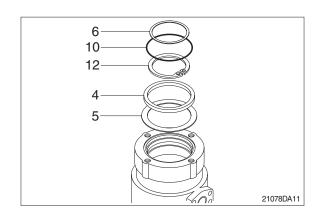
- ※ Clean all parts.
- As a general rule, replace oil seals and O-ring.
- Coat the sliding surfaces of all parts with engine oil or grease before installing.
- (1) Fix seven slipper seal (7) and O-ring (9), two wear ring (11) to hub (1).
- (2) Fit O-ring (8) to shaft (2).



(3) Set shaft (2) on block, tap hub (1) with a plastic hammer to install.

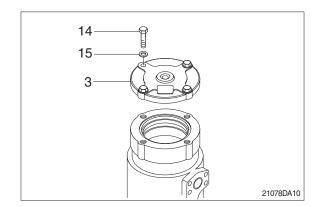


- (4) Fit shim (5), spacer (4) and retainer ring (12) to shaft (2).
- (5) Fit O-ring (10) to hub (1).
- (6) Fit shim (6) to shaft (2).



(7) Install cover (3) to body (1) and tighten bolts (14).

 $\cdot$  Torque : 10~12.5 kgf  $\cdot$  m  $$(72.3{\sim}90.4\ \text{lbf}\cdot\text{ft})$$ 



# GROUP 9 BOOM, ARM, BUCKET AND DOZER CYLINDERS

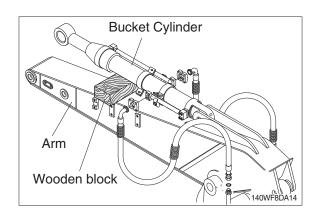
#### 1. REMOVAL AND INSTALL

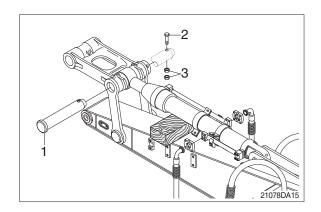
#### 1) BUCKET CYLINDER

#### (1) Removal

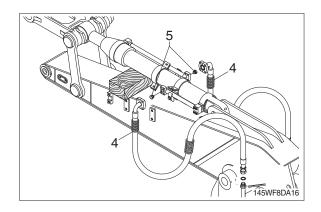
- Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.
- \* Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.
- Loosen the breather slowly to release the pressure inside the hydraulic tank.
- ♠ Escaping fluid under pressure can penetrate the skin causing serious injury.
- Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.
- ① Set block between bucket cylinder and arm.
- ② Remove bolt (2), nut (3) and pull out pin (1).
  - · Tightening torque : 29.7  $\pm$  4.5 kgf·m (215  $\pm$  32.5 lbf·ft)
- \* Tie the rod with wire to prevent it from coming out.





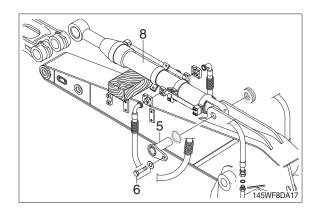


③ Disconnect bucket cylinder hoses (4) and put plugs (5) on cylinder pipe.



- ④ Sling bucket cylinder assembly (8) and remove bolt (6) then pull out pin (5).
- ⑤ Remove bucket cylinder assembly (8).
  - · Weight: 100 kg (220 lb)
  - · Tightening torque : 29.7 ± 4.5 kgf⋅m

 $(215 \pm 32.5 lbf \cdot ft)$ 



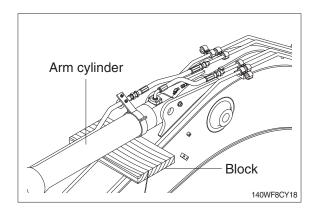
- ① Carry out installation in the reverse order to removal.
- A When aligning the mounting position of the pin, do not insert your fingers in the pin hole.
- \* Bleed the air from the bucket cylinder.
- Confirm the hydraulic oil level and check
   the hydraulic oil leak or not.

### 2) ARM CYLINDER

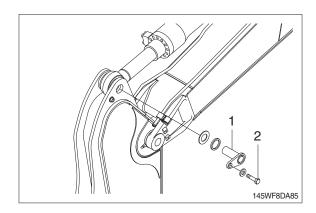
#### (1) Removal

- Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.
- \* Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.
- Loosen the breather slowly to release the pressure inside the hydraulic tank.
- ▲ Escaping fluid under pressure can penetrate the skin causing serious injury. Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.
- ① Set block between arm cylinder and boom.

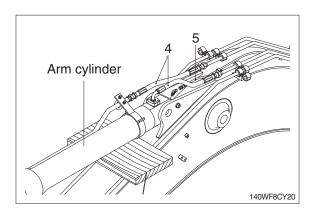




- ② Remove bolt (2) and pull out pin (1).
- Tie the rod with wire to prevent it from coming out.
  - $\cdot$  Tightening torque : 29.7 ± 4.5 kgf·m (215 ± 32.5 lbf·ft)



- ③ Disconnect arm cylinder hoses (4) and put plugs on cylinder pipe.
- 4 Disconnect greasing pipings (5).

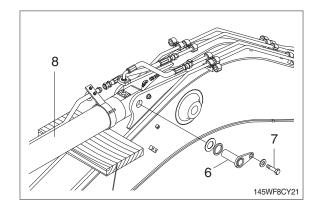


- ⑤ Sling arm cylinder assembly(8) and remove bolt (7) then pull out pin (6).
- 6 Remove arm cylinder assembly (8).

· Weight: 160 kg (350 lb)

· Tightening torque : 29.7 ± 4.5 kgf·m

 $(215 \pm 32.5 lbf \cdot ft)$ 



- ① Carry out installation in the reverse order to removal.
- ♠ When aligning the mounting position of the pin, do not insert your fingers in the pin hole.
- \* Bleed the air from the arm cylinder.
- Confirm the hydraulic oil level and check
   the hydraulic oil leak or not.

### 3) BOOM CYLINDER

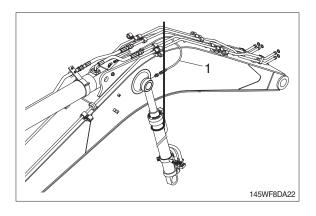
#### (1) Removal

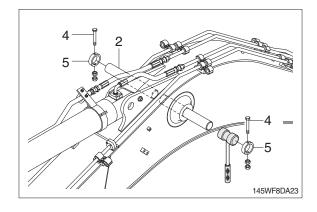
- Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.
- \* Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.
- Loosen the breather slowly to release the pressure inside the hydraulic tank.

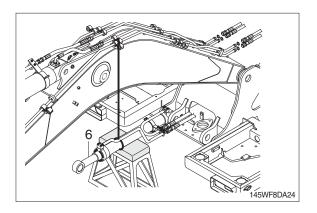
# ♠ Escaping fluid under pressure can penetrate the skin causing serious injury.

- Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.
- ① Disconnect greasing hoses (1).
- ② Sling boom cylinder assembly.
- ③ Remove bolt (4), stopper (5) and pull out pin (2).
  - · Tightening torque : 29.7  $\pm$  4.5 kgf·m (215  $\pm$  32.5 lbf·ft)
- \*\* Tie the rod with wire to prevent it from coming out.
- ④ Lower the boom cylinder assembly (6) on a stand.

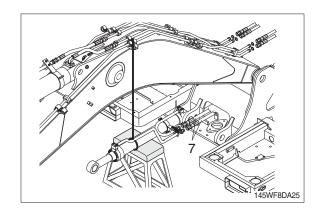








⑤ Disconnect boom cylinder hoses (7) and put plugs on cylinder pipe.

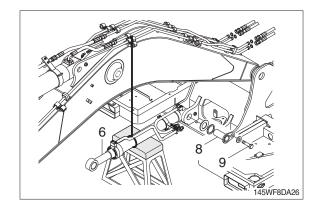


6 Remove bolt (9) and pull out pin (8).

 $\cdot$  Tightening torque : 29.7  $\pm$  4.5 kgf·m (215  $\pm$  32.5 lbf·ft)

7 Remove boom cylinder assembly (6).

· Weight: 130 kg (285 lb)

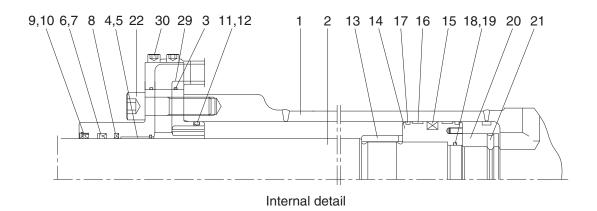


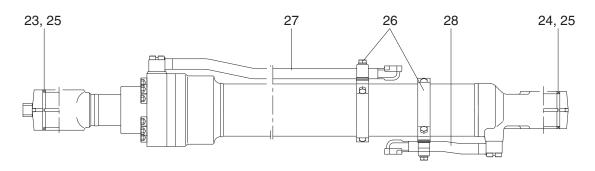
- ① Carry out installation in the reverse order to removal.
- A When aligning the mounting position of the pin, do not insert your fingers in the pin hole.
- Bleed the air from the boom cylinder.
- \* Conformed the hydraulic oil level and check the hydraulic oil leak or not.

# 2. DISASSEMBLY AND ASSEMBLY

# 1) STRUCTURE

# (1) Bucket cylinder

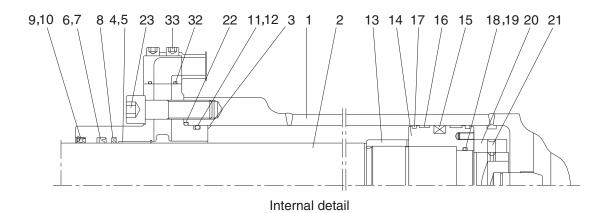


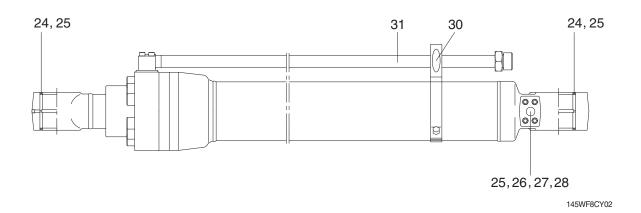


145WF8CY01

1	Tube assembly	11	O-ring	21	Hexagon socket set screw
2	Rod assembly	12	Back up ring	22	Hexagon socket head bolt
3	Gland	13	Cushion ring	23	Pin bushing
4	DD2 bushing	14	Piston	24	Pin bushing
5	Snap ring	15	Piston seal	25	Dust seal
6	Rod seal	16	Wear ring	26	Band assembly
7	Back up ring	17	Dust ring	27	Pipe assembly-R
8	Buffer ring	18	O-ring	28	Pipe assembly-B
9	Dust wiper	19	Back up ring	29	O-ring
10	Snap ring	20	Lock nut	30	Hexagon socket head bolt

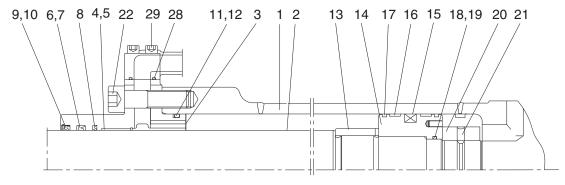
# (2) Arm cylinder



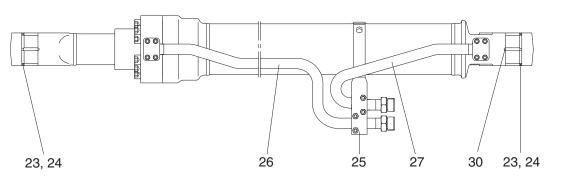


1	Tube assembly	12	Back up ring	23	Hexagon socket head bolt
2	Rod assembly	13	Cushion ring	24	Pin bushing
3	Gland	14	Piston	25	Dust seal
4	DD2 bushing	15	Piston seal	26	Check valve
5	Snap ring	16	Wear ring	27	Coil spring
6	Rod seal	17	Dust ring	28	O-ring
7	Back up ring	18	O-ring	29	Plug
8	Buffer ring	19	Back up ring	30	Band assembly
9	Dust wiper	20	Lock nut	31	Pipe assembly-R
10	Snap ring	21	Hexagon socket set screw	32	O-ring
11	O-ring	22	O-ring	33	Hexagon socket head bolt

# (3) Boom cylinder



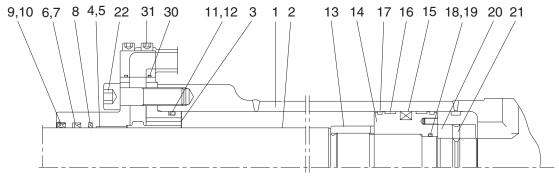
Internal detail



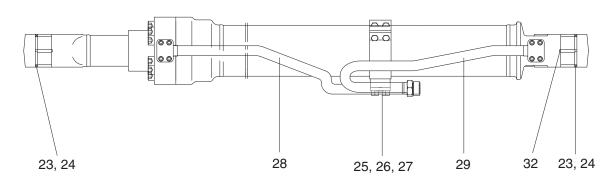
140LC8CY03

1	Tube assembly	11	O-ring	21	Hexagon socket set screw
2	Rod assembly	12	Back up ring	22	Hexagon socket head bolt
3	Gland	13	Cushion ring	23	Pin bushing
4	DD2 bushing	14	Piston	24	Dust seal
5	Snap ring	15	Piston seal	25	Band assembly
6	Rod seal	16	Wear ring	26	Pipe assembly-R
7	Back up ring	17	Dust ring	27	Pipe assembly-B
8	Buffer ring	18	O-ring	28	O-ring
9	Dust wiper	19	Back up ring	29	Hexagon socket head bolt
10	Snap ring	20	Lock nut	30	Socket plug

# (4) Adjust boom cylinder



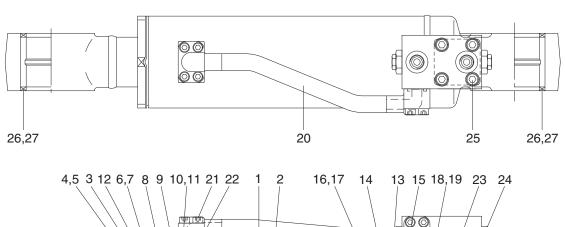
Internal detail

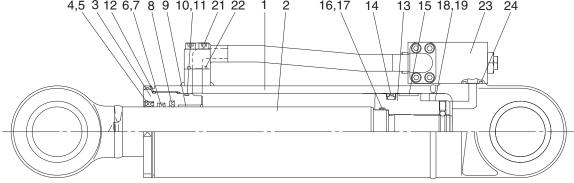


140LC8CY04

1	Tube assembly	12	Back up ring	23	Pin bushing
2	Rod assembly	13	Cushion ring	24	Dust seal
3	Gland	14	Piston	25	Band assembly
4	DD2 bushing	15	Piston seal	26	Hexagon head bolt
5	Snap ring	16	Wear ring	27	Spring washer
6	Rod seal	17	Dust ring	28	Pipe assembly-R
7	Back up ring	18	O-ring	29	Pipe assembly-B
8	Buffer ring	19	Back up ring	30	O-ring
9	Dust wiper	20	Lock nut	31	Hexagon socket head bolt
10	Snap ring	21	Hexagon socket set screw	32	Socket plug
11	O-ring	22	Hexagon socket head bolt		

# (5) Dozer cylinder





14098CY05

1	Tube assembly	10	O-ring	19	Set screw
2	Rod assembly	11	Back up ring	20	Pipe assembly
3	Gland	12	O-ring	21	Hexagon socket head bolt
4	Dust wiper	13	Piston	22	O-ring
5	Retainer ring	14	Piston seal	23	Check valve assembly
6	Rod seal	15	Wear ring	24	O-ring
7	Back up ring	16	O-ring	25	Hexagon socket head bolt
8	Buffer ring	17	Back up ring	26	Pin bushing
9	DU bushing	18	Steel ball	27	Dust seal

# 2) TOOLS AND TIGHTENING TORQUE

# (1) Tools

Tool name	Remark
	6
Allen wrongh	8 B
Allen wrench	14
	17
Channer	7
Spanner	8
(-) Driver	Small and large sizes
Torque wrench	Capable of tightening with the specified torques

# (2) Tightening torque

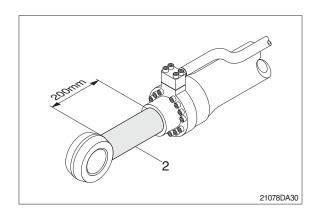
Part name		Item	Size	Torque		
F	Faithaine			kgf · m	lbf ⋅ ft	
	Bucket cylinder (★1)	22	M14	15±2.0	108±14.5	
Socket head bolt	Boom cylinder (★1)	22	M14	15±2.0	108±14.5	
Socket nead boil	Arm cylinder (★1)	23	M16	23±2.0	166±14.5	
	Adjust boom cylinder (★1)	22	M14	15±2.0	108±14.5	
Check valve mounting socket head bolt	Dozer cylinder	25	M10	5.4±0.5	39.1±3.6	
	Bucket cylinder	30	M10	5.4±0.5	39.1 ± 3.6	
	Boom cylinder	29	M8	2.7±0.3	19.5±2.2	
Pipe mounting socket head bolt	Arm cylinder	33	M10	5.4±0.5	39.1 ± 3.6	
300Ret rieda boit	Adjust boom cylinder	29	M8	2.7±0.3	19.5±2.2	
	Dozer cylinder	21	M8	2.7±0.3	19.5±2.2	
	Bucket cylinder	20	M45		723±72.3	
Lock nut	Boom cylinder	20	M50	100±10.0		
LOCK Hut	Arm cylinder	20	M55	100 ± 10.0		
	Adjust boom cylinder	20	M50			
	Bucket cylinder	14				
	Boom cylinder	14				
Piston	Arm cylinder	14	-	150±15.0	1085 $\pm$ 109	
	Adjust boom cylinder	14				
	Dozer cylinder	13				
Gland	Dozer cylinder	3	M105	85±8.5	615±61.5	
	Bucket cylinder	21	M8	2.7±0.3	19.5±2.2	
	Boom cylinder	21	M8	2.7±0.3	19.5±2.2	
Set screw	Arm cylinder	21	M8	2.7±0.3	19.5±2.2	
	Adjust boom cylinder	21	M8	2.7±0.3	19.5±2.2	
	Dozer cylinder	19	M8	2.7±0.3	19.5±2.2	

 $<sup>\ \ \, \</sup>mbox{$\%$}$  Apply loctite #243 (  $\mbox{$\bigstar$}$  1) on the thread before tightening.

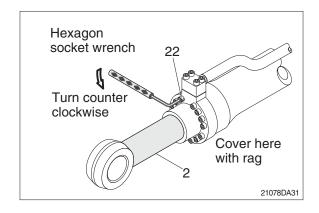
#### 3) DISASSEMBLY

#### (1) Remove cylinder head and piston rod

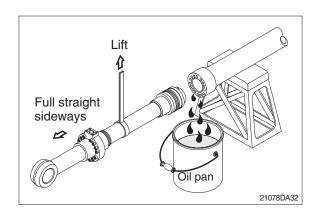
- \* Procedures are based on the bucket cylinder.
- ① Hold the clevis section of the tube in a vise.
- We Use mouth pieces so as not to damage the machined surface of the cylinder tube. Do not make use of the outside piping as a locking means.
- ② Pull out rod assembly (2) about 200mm (7.1in). Because the rod assembly is rather heavy, finish extending it with air pressure after the oil draining operation.



- 3 Loosen and remove socket bolts (22) of the gland in sequence.
- Cover the extracted rod assembly (2)
   with rag to prevent it from being accidentally damaged during operation.

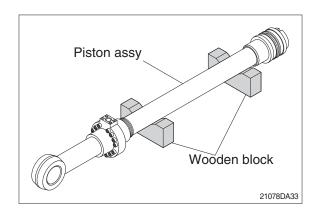


- ① Draw out cylinder head and rod assembly together from tube assembly (1).
- Since the rod assembly is heavy in this case, lift the tip of the rod assembly (2) with a crane or some means and draw it out. However, when rod assembly (2) has been drawn out to approximately two thirds of its length, lift it in its center to draw it completely.



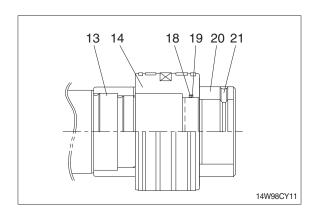
Note that the plated surface of rod assembly (2) is to be lifted. For this reason, do not use a wire sling and others that may damage it, but use a strong cloth belt or a rope.

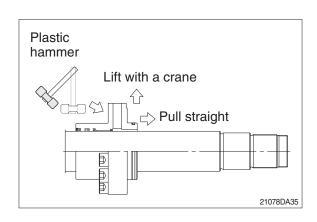
- ⑤ Place the removed rod assembly on a wooden V-block that is set level.
- Cover a V-block with soft rag.



## (2) Remove piston and cylinder head

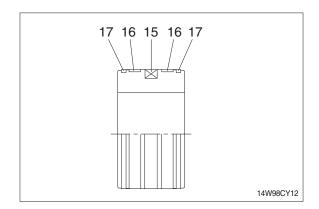
- ① Remove set screw (21).
- Since set screw (21) and lock nut (20) is tightened to a high torque, use a hydraulic and power wrench that utilizers a hydraulic cylinder, to remove the lock set screw (21) and lock nut (20).
- ② Remove piston assembly (14), back up ring (19), and O-ring (18).
- ③ Remove the cylinder head assembly from rod assembly (2).
- If it is too heavy to move, move it by striking the flanged part of cylinder head with a plastic hammer.
- Pull it straight with cylinder head assembly lifted with a crane.
  Exercise care so as not to damage the lip of rod bushing (4) and packing (5,6,7,8,9,10) by the threads of rod assembly (2).





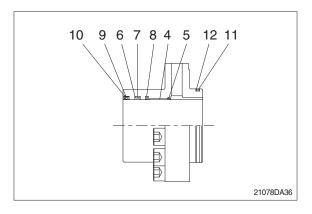
## (3) Disassemble the piston assembly

- ① Remove wear ring (16).
- ② Remove dust ring (17) and piston seal (15).
- Exercise care in this operation not to damage the grooves.



## (4) Disassemble cylinder head assembly

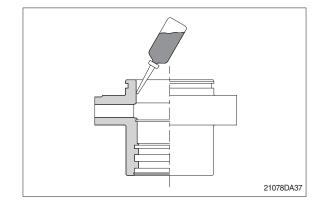
- ① Remove back up ring (12) and O-ring (11).
- ② Remove snap ring (10), dust wiper (9).
- ③ Remove back up ring (7), rod seal (6) and buffer ring (8).
- Exercise care in this operation not to damage the grooves.
- Do not remove seal and ring, if does not damaged.
- \* Do not remove bushing (4).



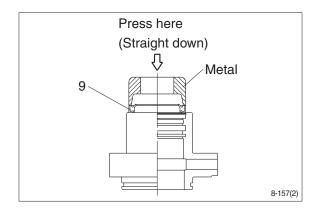
## 3) ASSEMBLY

### (1) Assemble cylinder head assembly

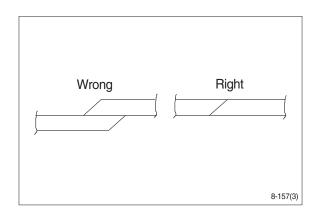
- \* Check for scratches or rough surfaces if found smooth with an oil stone.
- ① Coat the inner face of gland (3) with hydraulic oil.



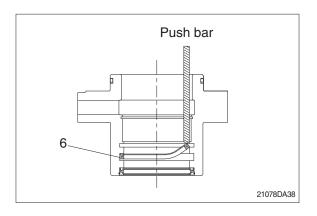
- ② Coat dust wiper (9) with grease and fit dust wiper (9) to the bottom of the hole of dust seal.
  - At this time, press a pad metal to the metal ring of dust seal.
- ③ Fit snap ring (10) to the stop face.



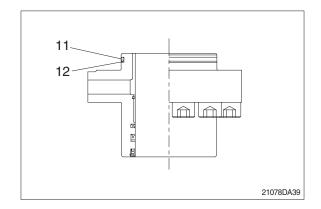
- ④ Fit back up ring (7), rod seal (6) and buffer ring (8) to corresponding grooves, in that order.
- \* Coat each packing with hydraulic oil before fitting it.
- Insert the backup ring until one side of it is inserted into groove.



- \*\* Rod seal (6) has its own fitting direction. Therefore, confirm it before fitting them.
- Fitting rod seal (6) upside down may damage its lip. Therefore check the correct direction that is shown in fig.

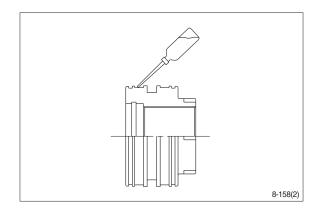


- 5 Fit back up ring (12) to gland (3).
- № Put the backup ring in the warm water of 30~50°C.
- 6 Fit O-ring (11) to gland (3).

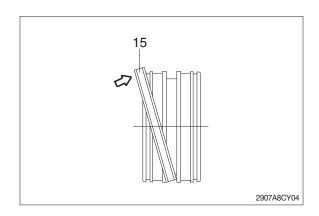


# (2) Assemble piston assembly

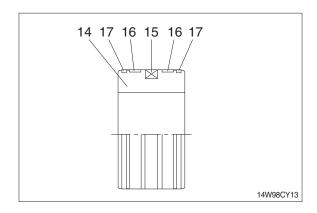
- \* Check for scratches or rough surfaces.
  If found smooth with an oil stone.
- ① Coat the outer face of piston (14) with hydraulic oil.



- ② Fit piston seal (15) to piston.
- Put the piston seal in the warm water of 60~100°C for more than 5 minutes.
- \* After assembling the piston seal, press its outer diameter to fit in.

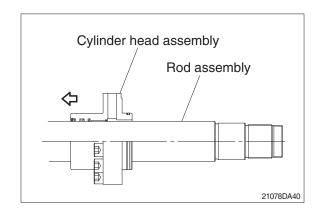


3 Fit wear ring (16) and dust ring (17) to piston (14).

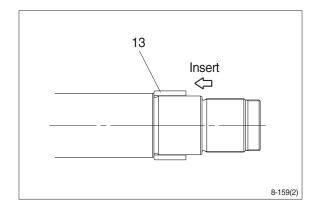


### (3) Install piston and cylinder head

- ① Fix the rod assembly to the work bench.
- ② Apply hydraulic oil to the outer surface of rod assembly (2), the inner surface of piston and cylinder head.
- ③ Insert cylinder head assembly to rod assembly.

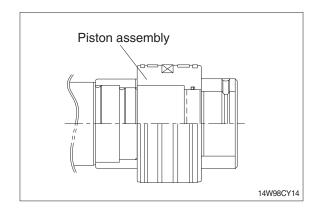


- ④ Insert cushion ring (13) to rod assembly.
- Note that cushion ring (13) has a direction in which it should be fitted.



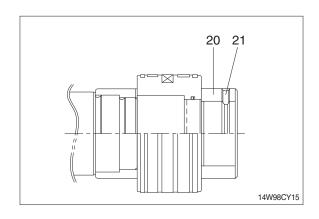
- 5 Fit piston assembly to rod assembly.
  - $\cdot$  Tightening torque : 150  $\pm$  15 kgf  $\cdot$  m

(1085 $\pm$ 108 lbf  $\cdot$  ft)



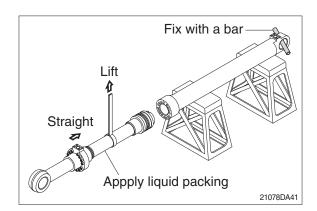
- ⑤ Fit lock nut (20) and tighten the set screw (21).
  - · Tightening torque:

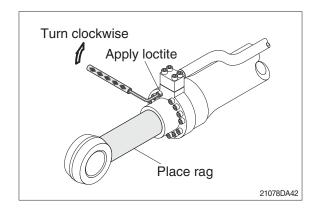
Item		kgf · m	lbf ⋅ ft
	Bucket		
20	Boom	100±10	$723 \pm 72.3$
	Arm		
21		2.7±0.3	19.5±2.2



### (3) Overall assemble

- ① Place a V-block on a rigid work bench. Mount the tube assembly (1) on it and fix the assembly by passing a bar through the clevis pin hole to lock the assembly.
- ② Insert the rod assembly in to the tube assembly, while lifting and moving the rod assembly with a crane.
- Be careful not to damage piston seal by thread of tube assembly.
- ③ Match the bolt holes in the cylinder head flange to the tapped holes in the tube assembly and tighten socket bolts to a specified torque.
- \* Refer to the table of tightening torque.





# **GROUP 10 UNDERCARRIAGE**

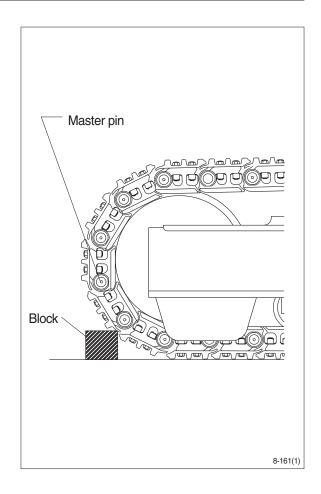
#### 1. TRACK LINK

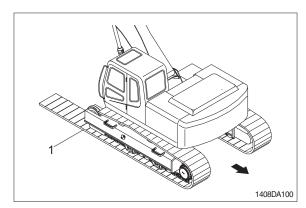
#### 1) REMOVAL

- (1) Move track link until master pin is over front idler in the position put wooden block as shown.
- (2) Loosen tension of the track link.
- If track tension is not relieved when the grease valve is loosened, move the machine backwards and forwards.
- We Unscrew the grease nipple after release the tension by pushing the poppet only when necessarily required. Grease leaking hole is not existing. So, while unscrew the grease nipple, grease is not leaking until the grease nipple is completely coming out. If the tension is not released in advance, the grease nipple can be suddenly popped out by
- (3) Push out master pin by using a suitable tool.

pressurized grease.

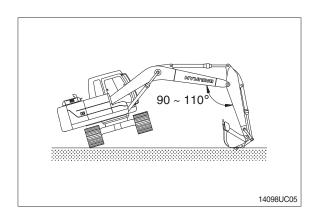
- (4) Move the machine slowly in reverse, and lay out track link assembly (1).
- ¾ Jack up the machine and put wooden block under the machine.
- \* Don't get close to the sprocket side as the track shoe plate may fall down on your feet.





#### 2) INSTALL

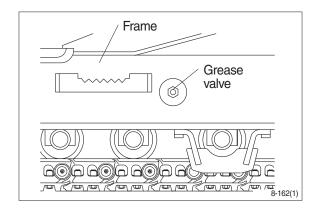
- (1) Carry out installation in the reverse order to removal.
- \* Adjust the tension of the track link.



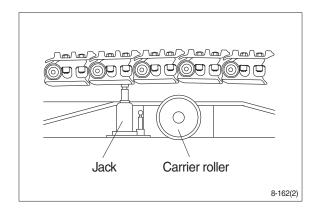
### 2. CARRIER ROLLER

# 1) REMOVAL

(1) Loosen tension of the track link.



(2) Jack up the track link height enough to permit carrier roller removal.

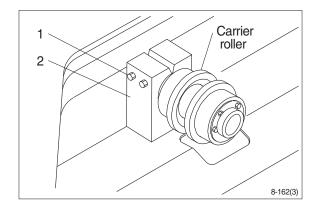


- (3) Loosen the lock nut (1).
- (4) Open bracket(2) with a screwdriver, push out from inside, and remove carrier roller assembly.

· Weight: 19 kg (42 lb)

· Tightening torque : 29.7  $\pm$  4.5 kgf·m

 $(215 \pm 32.5 lbf \cdot ft)$ 



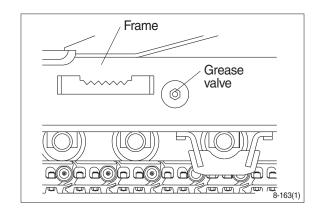
### 2) INSTALL

(1) Carry out installation in the reverse order to removal.

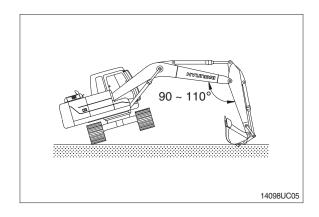
### 3. TRACK ROLLER

# 1) REMOVAL

(1) Loosen tension of the track link.

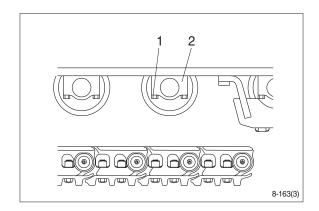


- (2) Using the work equipment, push up track frame on side which is to be removed.
- \* After jack up the machine, set a block under the unit.



- (3) Remove the mounting bolt (1) and draw out the track roller (2).
  - · Weight: 33 kg (73 lb)
  - · Tightening torque: 29.7 ± 4.5 kgf·m

 $(215 \pm 32.5 lbf \cdot ft)$ 



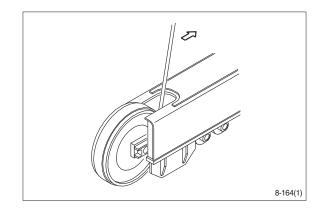
# 2) INSTALL

(1) Carry out installation in the reverse order to removal.

### 4. IDLER AND RECOIL SPRING

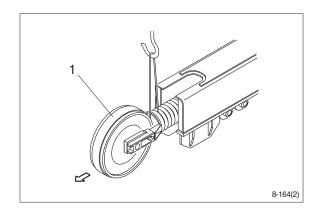
# 1) REMOVAL

Remove the track link.
 For detail, see removal of track link.



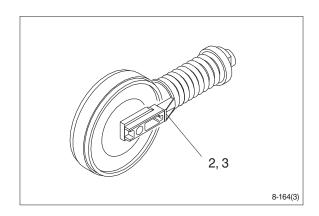
(2) Sling the recoil spring (1) and pull out idler and recoil spring assembly from track frame, using a pry.

· Weight: 192 kg (423 lb)



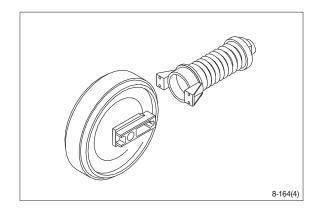
(3) Remove the bolts (2), washers (3) and separate ilder from recoil spring.

Tightening torque:  $29.7 \pm 4.5 \text{ kgf} \cdot \text{m}$  (215 ± 32.5 lbf·ft)



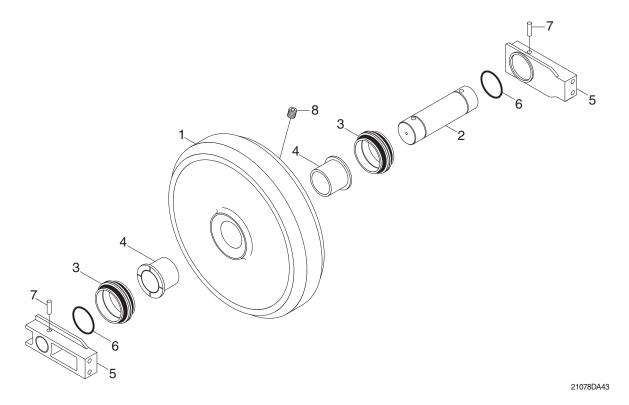
### 2) INSTALL

- (1) Carry out installation in the reverse order to removal.
- Make sure that the boss on the end face of the recoil cylinder rod is in the hole of the track frame.



# 3) DISASSEMBLY AND ASSEMBLY OF IDLER

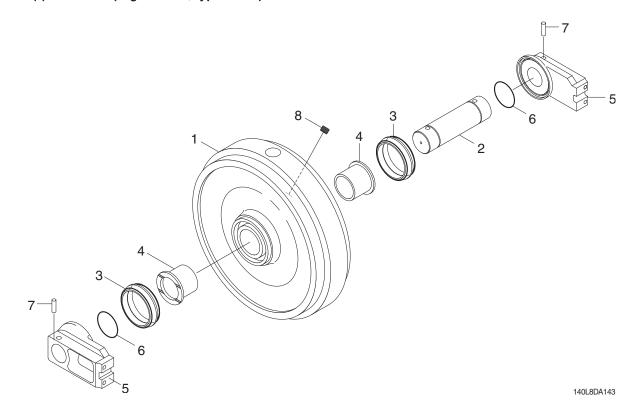
# (1) Structure (standard)



- 1 Shell
- 2 Shaft
- 3 Seal assembly
- 4 Bushing
- 5 Bracket
- 6 O-ring

- 7 Spring pin
- 8 Plug

# (1) Structure (High walker, type 1 & 2)



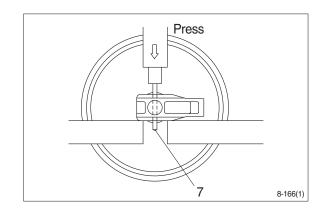
- 1 Shell
- 2 Shaft
- 3 Seal assy

- 4 Bushing
- 5 Bracket
- 6 O-ring

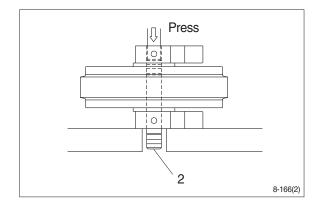
- 7 Spring pin
- 8 Hex Plug

# (2) Disassembly

- \* The illustrations are base on the type 1.
- ② Draw out the spring pin (7), using a press.

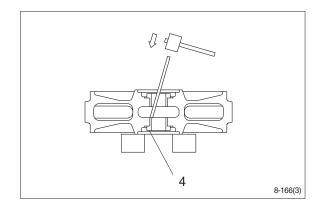


- ③ Pull out the shaft (2) with a press.
- ④ Remove seal (3) from idler (1) and bracket (5).
- 5 Remove O-ring (6) from shaft.



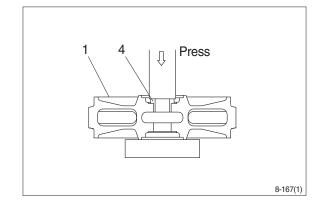
 Remove the bushing (4) from idler, using a special tool. Only remove bushing if replacement is

Only remove bushing if replacement is necessity.

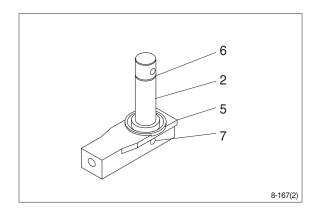


### (3) Assembly

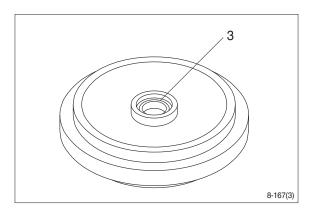
- \* Before assembly, clean the parts.
- Coat the sliding surfaces of all parts with oil.
- Cool up bushing (4) fully by some dry ice and press it into shell (1).
   Do not press it at the normal temperature, or not knock in with a hammer even after the cooling.



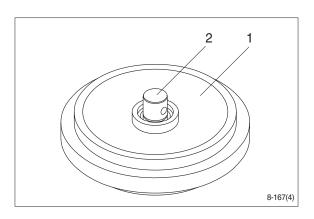
- ② Coat O-ring (6) with grease thinly, and install it to shaft (2).
- ③ Insert shaft (2) into bracket (5) and drive in the spring pin (7).



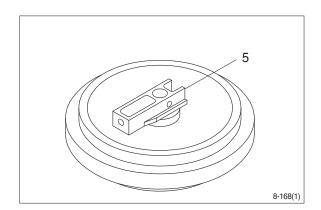
④ Install seal (3) to shell (1) and bracket (5).



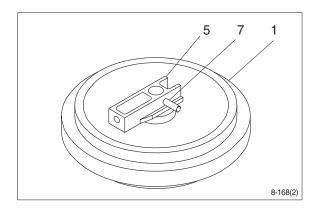
5 Install shaft (2) to shell (1).

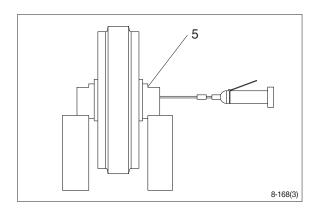


⑥ Install bracket (5) attached with seal (3).



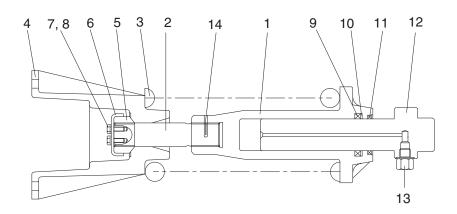
Through the Spring pin (7) with a hammer.





# 4) DISASSEMBLY AND ASSEMBLY OF RECOIL SPRING

# (1) Structure (standard)



140LC8UC30

Body
Body

2 Tie bar

3 Spring

4 Bracket

5 Lock nut

6 Lock plate

7 Bolt

8 Spring washer

9 Rod packing

10 Back up ring

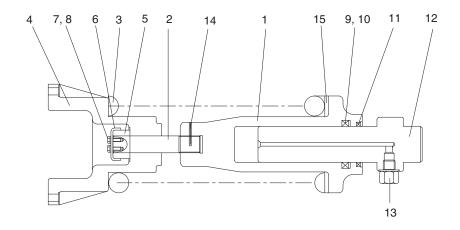
11 Dust seal

12 Rod

13 Grease valve

14 Spring pin

# Structure (High walker, type 1 & 2)



140L8UC130

1	Body
2	Tie bar
_	o .

3 Spring4 Bracket

5 Lock nut

6 Lock plate

7 Bolt

8 Spring washer

9 Rod seal

10 Back up ring

11 Dust seal

12 Rod assembly

13 Grease valve

14 Spring pin

15 Spacer

### (2) Disassembly

- \* The illustrations are base on the type
- 1 1

Apply pressure on spring (3) with a press.

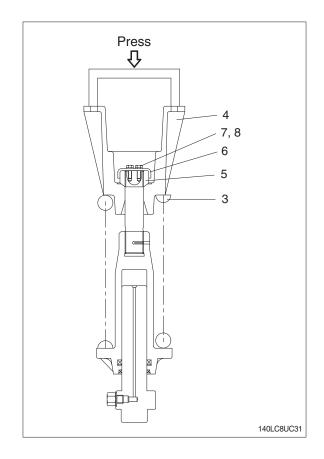
- \* The spring is under a large installed load. This is dangerous, so be sure to set
- ② properly.

  Remove bolt (7), spring washer (8) and
- ③ lock plate (6).

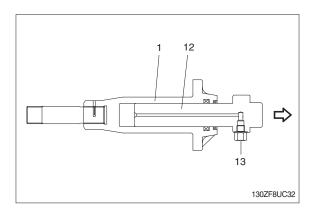
Remove lock nut (5).

Take enough notice so that the press which pushes down the spring, should

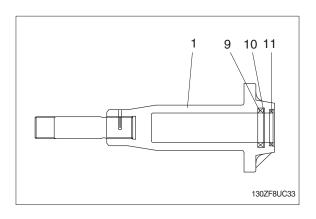
not be slipped out in its operation.
 Lighten the press load slowly and remove bracket (4) and spring (3).



- 5 Remove rod (12) from body (1).
- 6 Remove grease valve (13) from rod (12).



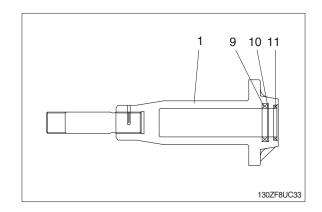
7 Remove rod seal (9), back up ring (10) and dust seal (11).



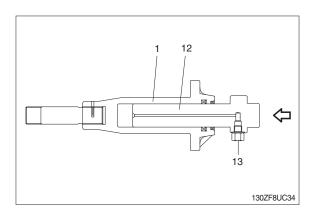
#### (3) Assembly

Install dust seal (11), back up ring (10) and rod seal (9) to body (1).

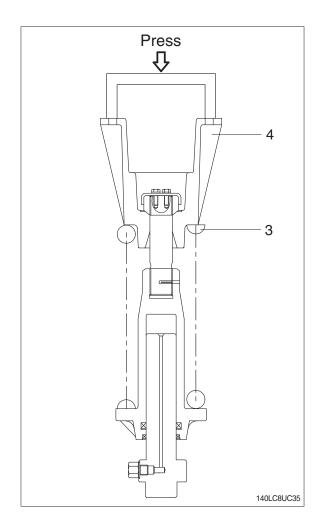
When installing dust seal (11) and rod seal (9), take full care so as not to damage the lip.



- ② Pour grease into body (1), then push in rod (12) by hand.
  After take grease out of grease valve mounting hole, let air out.
- If air letting is not sufficient, it may be difficult to adjust the tension of crawler.
- ③ Fit grease valve (13) to rod (12).
  - $\cdot$  Tightening torque : 13.0  $\pm$  0.5 kgf  $\cdot$  m (94.0  $\pm$  3.6 lbf  $\cdot$  ft)



- (4) Install spring (3) and bracket (4) to body (1).
- ⑤ Apply pressure to spring (3) with a press and tighten lock nut (5).
  - Spring set load
    - Standard: 8497 kg (18733 lb)
    - High walker: 11908 kg (26253 lb)
- \* Apply sealant before assembling.
- Meson During the operation, pay attention specially to prevent the press from slipping out.

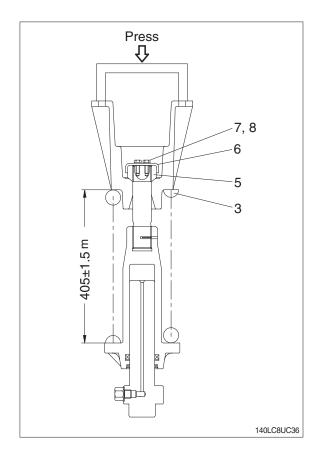


⑥ Lighten the press load and confirm the set length of spring (3).

- Standard :  $405 \pm 1.5$  mm - High walker :  $420 \pm 1.5$  mm

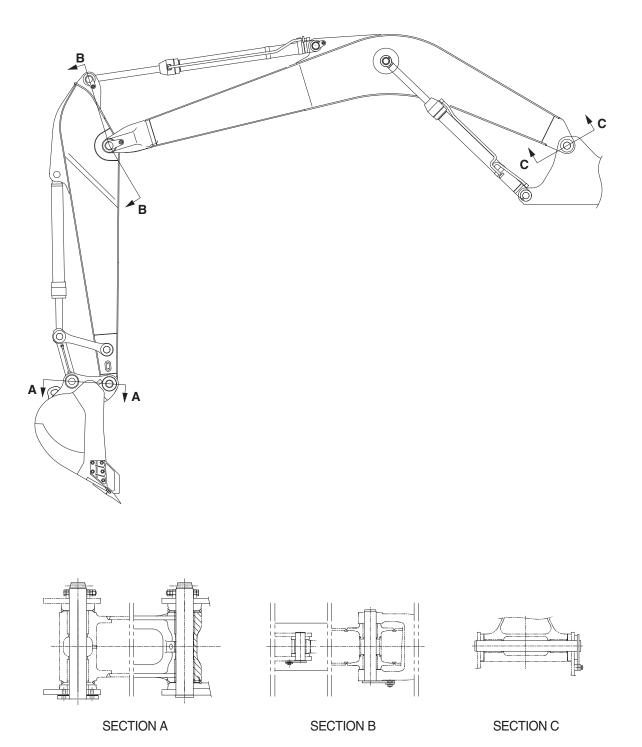
The setting of spring (3), install lock plate (6), spring washer (8) and bolt (7).

· Tightening torque : 15±0.5 kgf·m (108±3.6 lbf·ft)



# **GROUP 11 WORK EQUIPMENT**

# 1. STRUCTURE



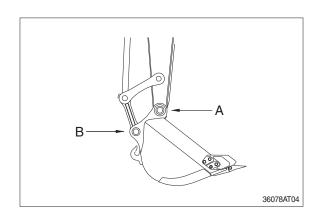
21078DA44

### 2. REMOVAL AND INSTALL

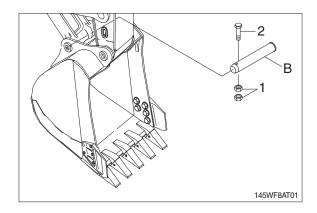
# 1) BUCKET ASSEMBLY

# (1) Removal

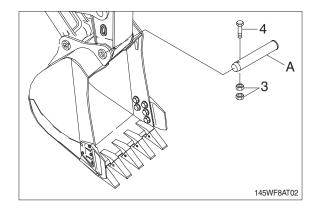
① Lower the work equipment completely to ground with back of bucket facing down.



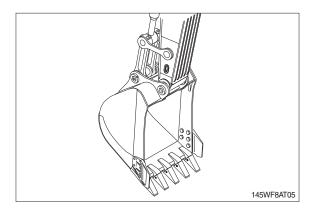
② Remove nut (1), bolt (2) and draw out the pin (B).



- ③ Remove nut (3), bolt (4) and draw out the pin (A) then remove the bucket assembly.
  - · Weight: 480 kg (1060 lb)
  - $\cdot$  Tightening torque : 29.7 ± 4.5 kgf·m (215 ± 32.5 lbf·ft)



- ① Carry out installation in the reverse order to removal.
- ♠ When aligning the mounting position of the pin, do not insert your fingers in the pin hole.
- Adjust the bucket clearance.
  For detail, see operation manual.



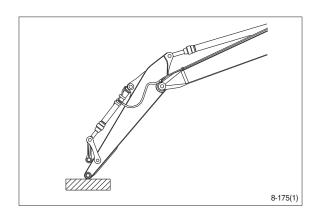
### 2) ARM ASSEMBLY

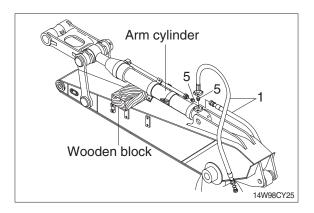
#### (1) Removal

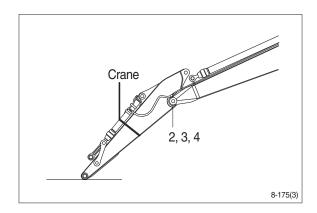
- Loosen the breather slowly to release
   the pressure inside the hydraulic tank.
- ♠ Escaping fluid under pressure can penetrated the skin causing serious injury.
- Remove bucket assembly.
   For details, see removal of bucket assembly.
- ② Disconnect bucket cylinder hose (1).
- ♠ Fit blind plugs (5) in the piping at the chassis end securely to prevent oil from spurting out when the engine is started.
- 3 Sling arm cylinder assembly, remove spring, pin stopper and pull out pin.
- \* Tie the rod with wire to prevent it from coming out.
- ④ For details, see removal of arm cylinder assembly.
  - Place a wooden block under the cylinder and bring the cylinder down to it.
- ⑤ Remove bolt (2), plate (3) and pull out the pin (4) then remove the arm assembly.
  - · Weight: 570 kg (1260 lb)
  - · Tightening torque : 12.8 ± 3.0 kgf·m

 $(92.6 \pm 21.7 \text{ lbf} \cdot \text{ft})$ 

When lifting the arm assembly, always lift the center of gravity.







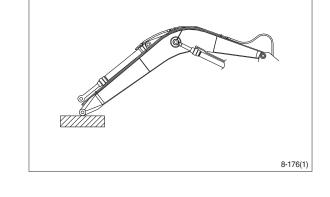
- ① Carry out installation in the reverse order to removal.
- ♠ When lifting the arm assembly, always lift the center of gravity.
- Bleed the air from the cylinder.

### 3) BOOM CYLINDER

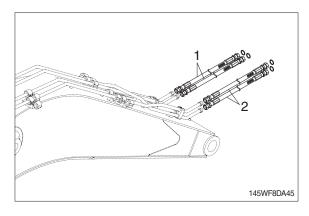
### (1) Removal

- Remove arm and bucket assembly.
   For details, see removal of arm and bucket assembly.
- ② Remove boom cylinder assembly from boom.

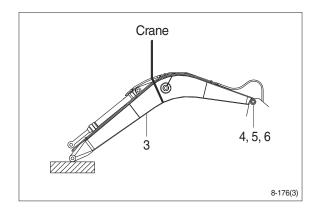
For details, see removal of arm cylinder assembly.



- 3 Disconnect head lamp wiring.
- ④ Disconnect bucket cylinder hose (2) and arm cylinder hose (1).
- When the hose are disconnected, oil may spurt out.
- ⑤ Sling boom assembly (3).



- ⑥ Remove bolt (4), plate (5) and pull out the pin (6) then remove boom assembly.
  - · Weight: 1020 kg (2250 lb)
  - · Tightening torque :  $12.8 \pm 3.0 \text{ kgf} \cdot \text{m}$ (92.6 ± 21.7 lbf·ft)
- When lifting the boom assembly always lift the center of gravity.



- ① Carry out installation in the reverse order to removal.
- ♠ When lifting the arm assembly, always lift the center of gravity.
- Bleed the air from the cylinder.

