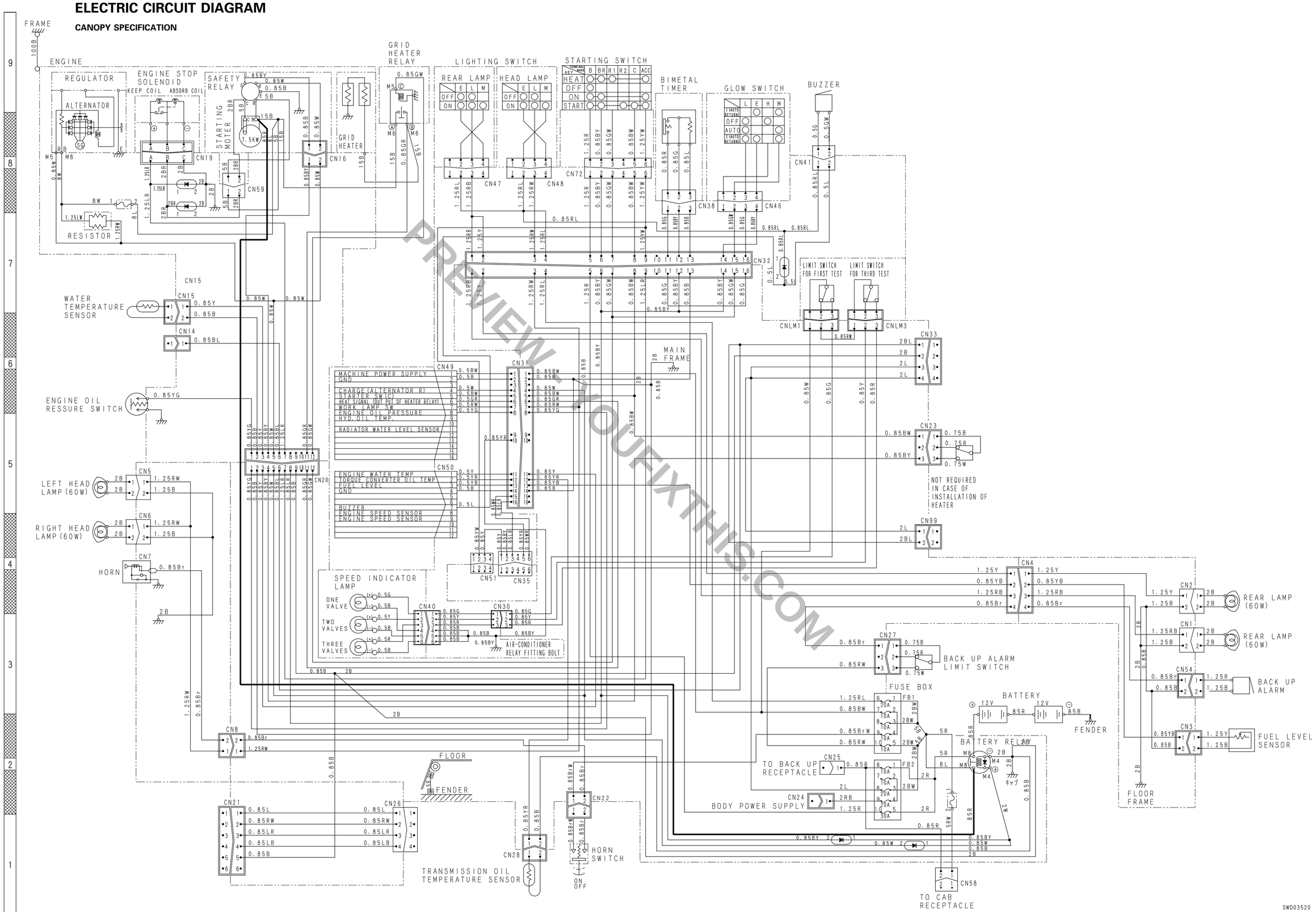
ELECTRIC CIRCUIT DIAGRAM

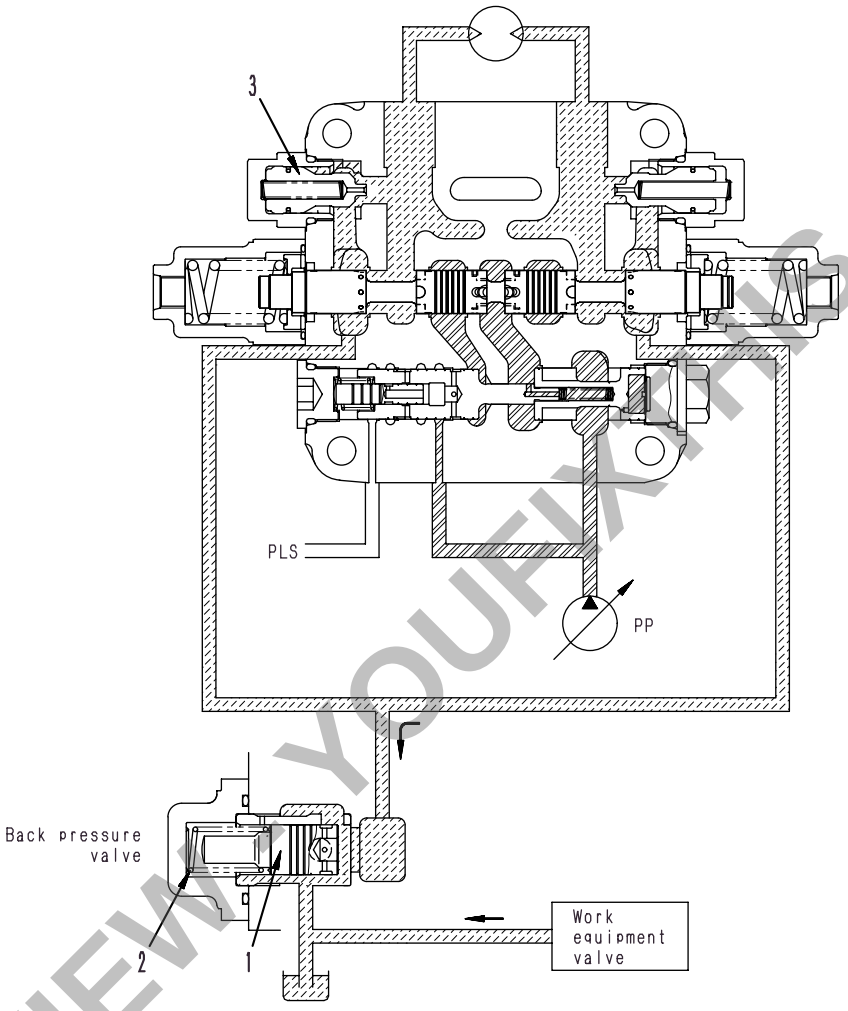
CANOPY SPECIFICATION



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BACK PRESSURE VALVE



SVD03440

Function

- When the machine is steered or stopped, the back pressure valve heightens the effect of suction valve (3) by heightening the pressure in the steering drain circuit to prevent cavitation in the HSS motor.

Operation

- The back pressure valve (1) and spring (2) heighten the draining pressure of the steering circuit.

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STANDARD TIGHTENING TORQUE

STANDARD TIGHTENING TORQUE TABLE (WHEN USING TORQUE WRENCH)

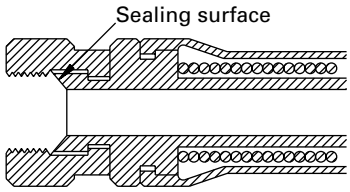
★ In the case of metric nuts and bolts for which there is no special instruction, tighten to the torque given in the table below.

Thread diameter of bolt	Width across flats	Tightening torque	
		 CDL00372	
mm	mm	Nm	kgm
6	10	11.8 – 14.7	1.2 – 1.5
8	13	27 – 34	2.8 – 3.5
10	17	59 – 74	6 – 7.5
12	19	98 – 123	10 – 12.5
14	22	153 – 190	15.5 – 19.5
16	24	235 – 285	23.5 – 29.5
18	27	320 – 400	33 – 41
20	30	455 – 565	46.5 – 58
22	32	610 – 765	62.5 – 78
24	36	785 – 980	80 – 100
27	41	1150 – 1440	118 – 147
30	46	1520 – 1910	155 – 195
33	50	1960 – 2450	200 – 250
36	55	2450 – 3040	250 – 310
39	60	2890 – 3630	295 – 370

Thread diameter of bolt	Width across flats	Tightening torque	
		 CDL00373	
mm	mm	Nm	kgm
6	10	5.9 – 9.8	0.6 – 1.0
8	13	13.7 – 23.5	1.4 – 2.4
10	14	34.3 – 46.1	3.5 – 4.7
12	27	74.5 – 90.2	7.6 – 9.2

TABLE OF TIGHTENING TORQUES FOR FLARED NUTS

★ In the case of flared nuts for which there is no special instruction, tighten to the torque given in the table below.



SAD00483

Thread diameter	Width across flat	Tightening torque	
mm	mm	Nm	kgm
14	19	24.5 ± 4.9	2.5 ± 0.5
18	24	49 ± 19.6	5 ± 2
22	27	78.5 ± 19.6	8 ± 2
24	32	137.3 ± 29.4	14 ± 3
30	36	176.5 ± 29.4	18 ± 3
33	41	196.1 ± 49	20 ± 5
36	46	245.2 ± 49	25 ± 5
42	55	294.2 ± 49	30 ± 5

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Millimeters to Inches

1 mm = 0.03937 in

	0	1	2	3	4	5	6	7	8	9
0	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

1 kg = 2.2046 lb

	0	1	2	3	4	5	6	7	8	9
0	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	59.53	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

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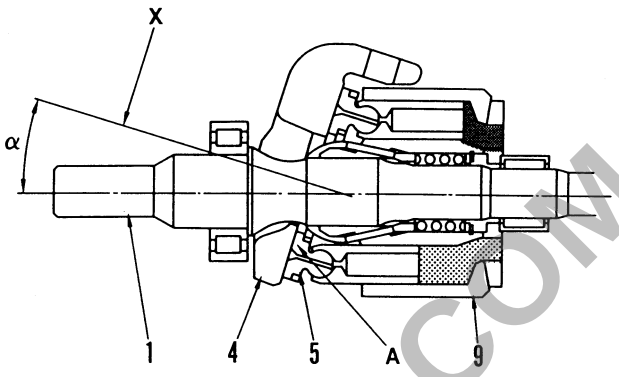
OPERATION

1. Operation of pump

Cylinder block (9) rotates together with shaft (1), and shoe (5) slides on plane **A**.

When this happens, rocker cam (4) moves along cylindrical surface **B**, so angle α of center line **X** of rocker cam (4) to the axial direction of cylinder block (9) changes.

This angle α is called the swash plate angle.

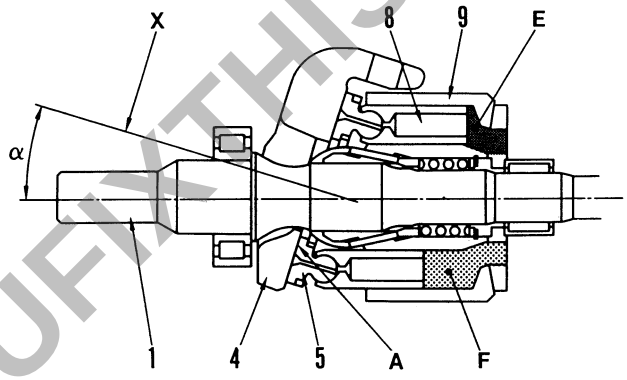


140F12118

(i) With swash plate angle α formed by the angle between center line **X** of rocker cam (4) to the axial direction of cylinder block (9), plane **A** acts as a cam for shoe (5).

In this way, piston (8) slides inside cylinder block (9), and as a result, a difference is generated between volumes **E** and **F** inside the cylinder block. The amount of suction and discharge is equal to difference **F** – **E**.

In other words, cylinder block (9) rotates, and the volume of chamber **E** becomes smaller, so oil is discharged during this process. At the same time, the volume of chamber **F** becomes larger and oil is sucked in this process.

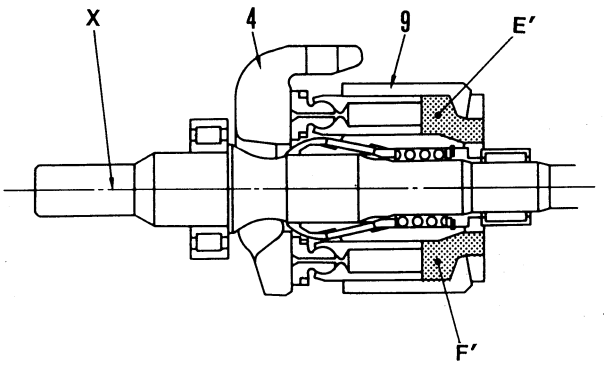


140F12119

(ii) When center line **X** of rocker cam (4) is the same as the axial direction of cylinder block (9) (swash plate angle = 0), the difference between volumes **E'** and **F'** inside cylinder block (9) is 0, so pump does not suction and discharge, and no pumping's carried out.

Actually swash plate angle does not become 0.)

The swash plate angle α is proportional to pump discharge volume.



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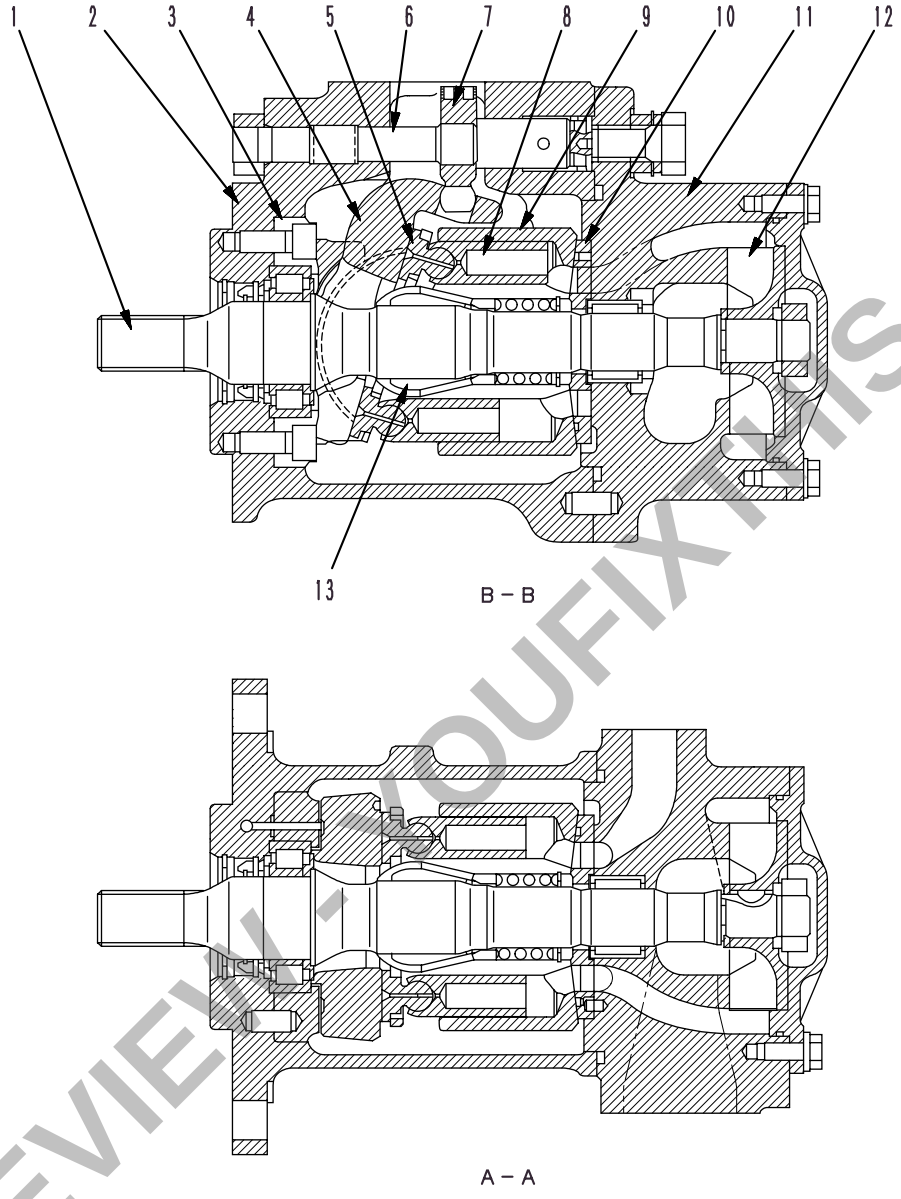
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SPECIFICATIONS

Machine model				D61EX-12	D61PX-12
Serial Numbers				1001 and up	1001 and up
Weight	Operating weight				
	• bare tracktor		kg	13,130	14,150
	• with angle tiltdozer			15,470	16,780
	• with angle tiltdozer + cab + ROPS			16,090	17,790
Performance	Min. truning radius		m	3.6	3.6
	Gradeability		deg	30	30
	Stability (front, rear, left, right)		deg	35	35
	Speed ranges	Forward 1st	km/h	3.5	3.5
		Forward 2nd		6.0	6.0
		Forward 3rd		10.3	10.3
		Reverse 1st	km/h	4.6	4.6
		Reverse 2nd		7.9	7.9
		Reverse 3rd		12.8	12.8
	Ground pressure	Bare tractor	kPa {kg/cm²}	41 {0.42}	25 {0.26}
		Angle tiltdozer		49 {0.50}	30 {0.31}
		Angle tiltdozer + cab + ROPS		50 {0.51}	31 {0.32}
Dimensions	Overall length	Bare tractor	mm	3,935	4,210
		With angle tiltdozer		5,030	5,465
	Overall width	Bare tractor	mm	2,500	3,000
		With angle tiltdozer		3,275	3,860
	Overall heights	To tip of exhaust pipe	mm	2,945	2,970
		To top of operator's compartment		2,195	2,225

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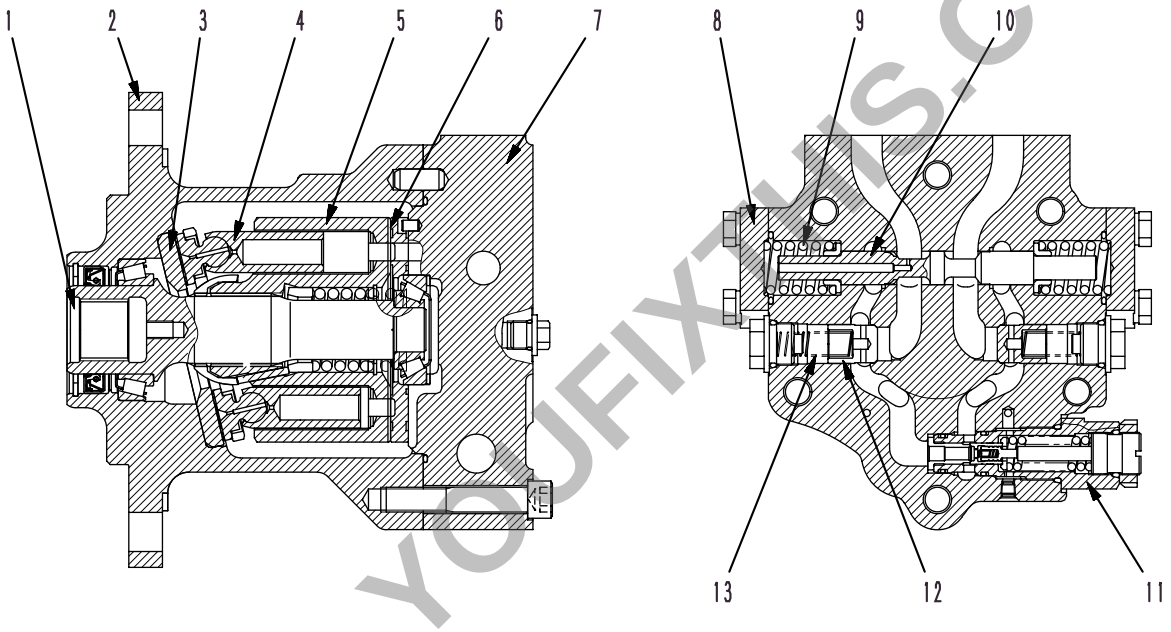
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1. Shaft
2. Case
3. Cradle
4. Rocker cam
5. Shoe
6. Servo piston
7. Rod
8. Piston
9. Cylinder block
10. Valve plate
11. End cap
12. Impeller
13. Spline

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SVD03442

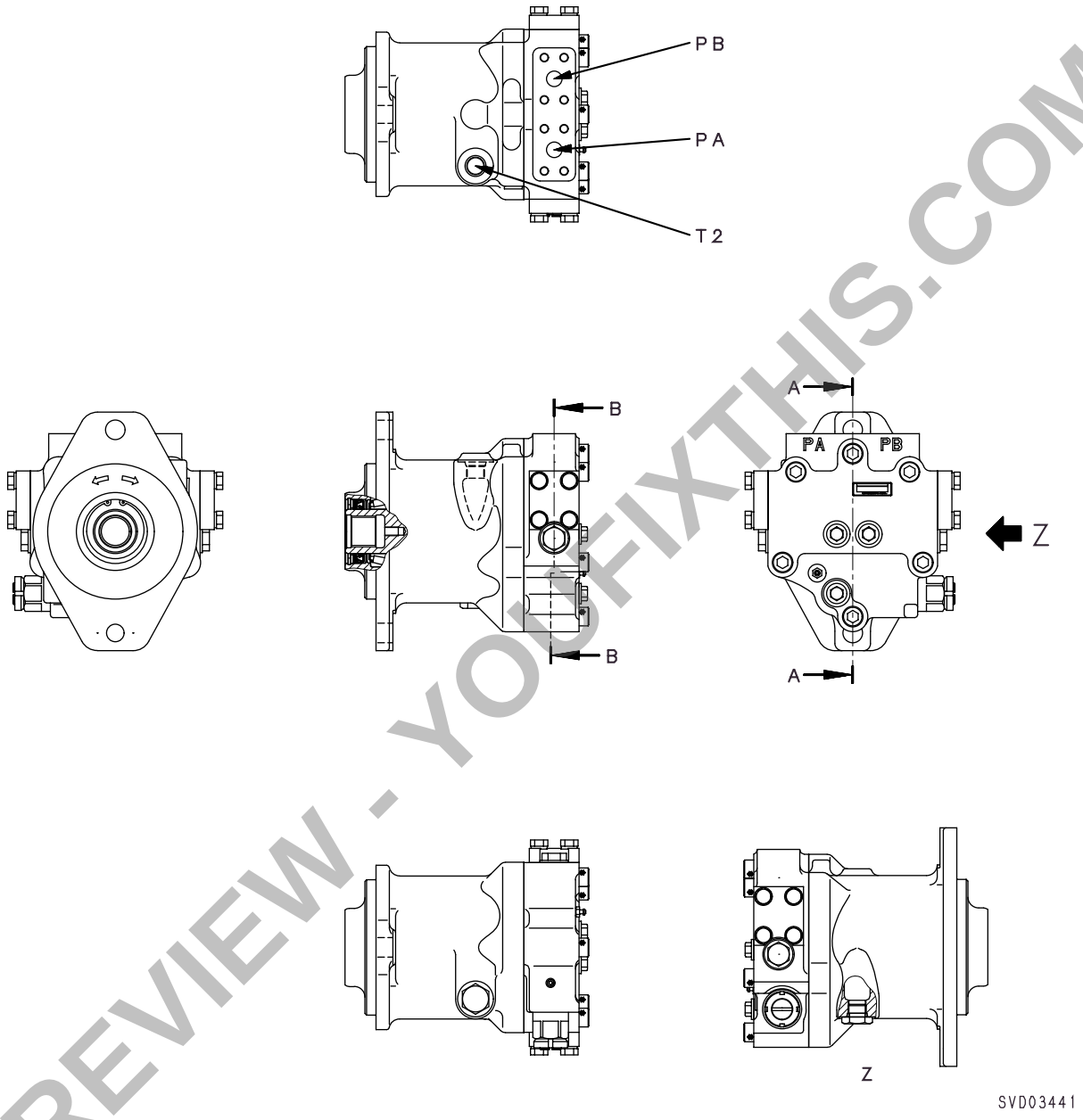
1. Output shaft
2. Motor case
3. Thrust plate
4. Piston
5. Cylinder
6. Valve plate
7. End cover
8. Brake valve assembly
9. Spool return spring
10. Counterbalance valve
11. Safety valve
12. Check valve
13. Check valve spring

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HSS MOTOR

Model: HMF95



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PA: Motor inlet port
PB: Motor outlet port
T2: Drain port

Specification

Model	HMF95
Theoretical displacement capacity	80 cm^3/rev
Rated pressure	41.2MPa {420kg/cm^2}
Rated speed	1,836 rpm

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TABLE OF TIGHTENING TORQUES FOR SPLIT FLANGE BOLTS

★ In the case of split flange bolts for which there is no special instruction, tighten to the torque given in the table below.

Thread diameter	Width across flat	Tightening torque	
mm	mm	Nm	kgm
10	14	59 – 74	6 – 7.5
12	17	98 – 123	10 – 12.5
16	22	235 – 285	23.5 – 29.5

TABLE OF TIGHTENING TORQUES FOR O-RING BOSS PIPING JOINTS

★ Unless there are special instructions, tighten the O-ring boss piping joints to the torque below.

Norminal No.	Thread diameter	Width across flat	Tightening torque (Nm {kgm})	
	mm	mm	Range	Target
02	14	Varies depending on type of connector.	35 – 63 {3.5 – 6.5}	44 {4.5}
03, 04	20		84 – 132 {8.5 – 13.5}	103 {10.5}
05, 06	24		128 – 186 {13.0 – 19.0}	157 {16.0}
10, 12	33		363 – 480 {37.0 – 49.0}	422 {43.0}
14	42		746 – 1010 {76.0 – 103}	883 {90.0}

TABLE OF TIGHTENING TORQUES FOR O-RING BOSS PLUGS

★ Unless there are special instructions, tighten the O-ring boss plugs to the torque below.

Norminal No.	Thread diameter	Width across flat	Tightening torque (Nm {kgm})	
	mm	mm	Range	Target
08	08	14	5.88 – 8.82 {0.6 – 0.9}	7.35 {0.75}
10	10	17	9.8 – 12.74 {1.0 – 1.3}	11.27 {1.15}
12	12	19	14.7 – 19.6 {1.5 – 2.0}	17.64 {1.8}
14	14	22	19.6 – 24.5 {2.0 – 2.5}	22.54 {2.3}
16	16	24	24.5 – 34.3 {2.5 – 3.5}	29.4 {3.0}
18	18	27	34.3 – 44.1 {3.5 – 4.5}	39.2 {4.0}
20	20	30	44.1 – 53.9 {4.5 – 5.5}	49.0 {5.0}
24	24	32	58.8 – 78.4 {6.0 – 8.0}	68.6 {7.0}
30	30	32	93.1 – 122.5 {9.5 – 12.5}	107.8 {11.0}
33	33	—	107.8 – 147.0 {11.0 – 15.0}	124.4 {13.0}
36	36	36	127.4 – 176.4 {13.0 – 18.0}	151.9 {15.5}
42	42	—	181.3 – 240.1 {18.5 – 24.5}	210.7 {21.5}
52	52	—	274.4 – 367.5 {28.0 – 37.5}	323.4 {33.0}

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Liter to U.S. Gallon

1ℓ = 0.2642 U.S. Gal

	0	1	2	3	4	5	6	7	8	9
0	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	6.076	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	25.361	25.625	25.889	26.153

Liter to U.K. Gallon

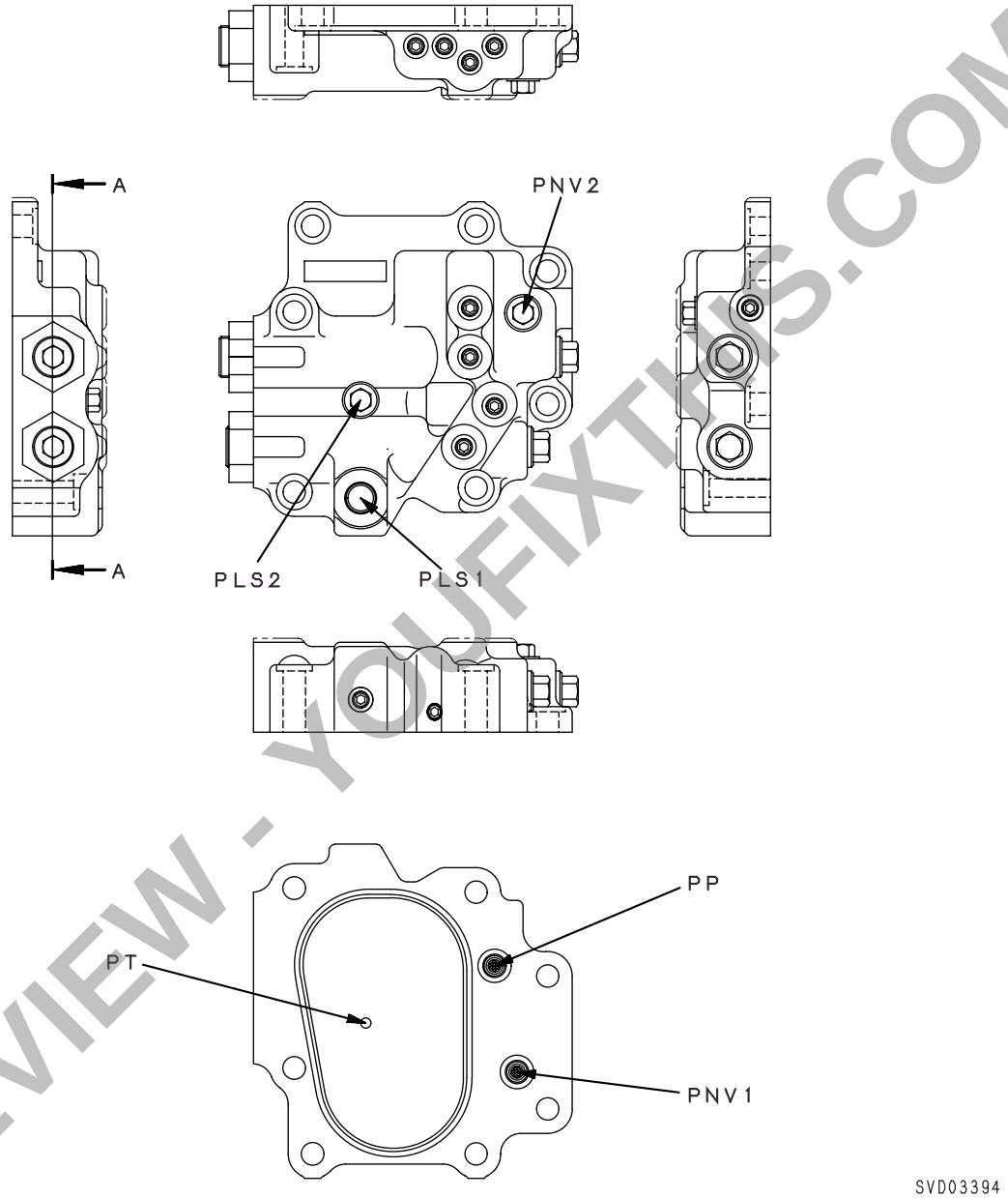
1ℓ = 0.21997 U.K. Gal

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

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LS VALVE



PLS1: Load pressure signal port
PLS2: Load pressure detect port
PNV1: Control pressure port
PNV2: Control pressure detect port
PP: Pump pressure signal port
PT: Drain port

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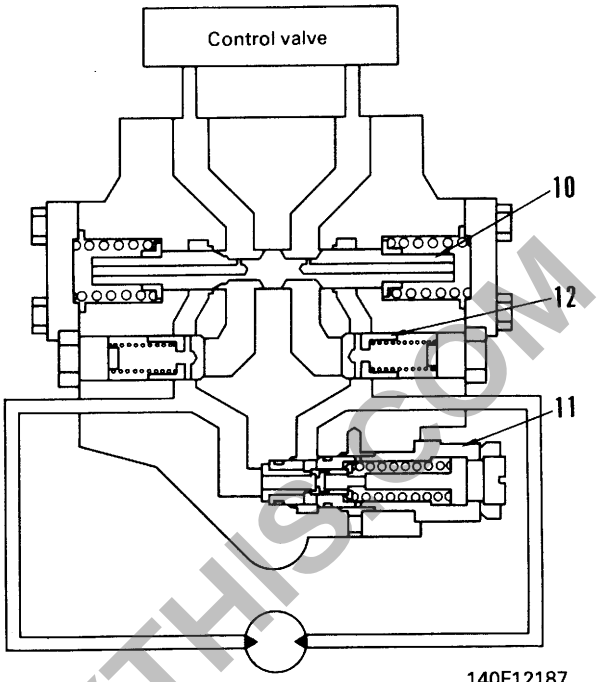
Machine model				D61EX-12	D61PX-12
Serial Numbers				1001 and up	1001 and up
Dimensions	Overall height	When ROPS cab is installed	mm	3,115	3,140
		When ROPS canopy is installed		3,115	3,140
		When canopy is installed		2,940	2,965
	Track gauge		mm	1,900	2,140
	Length of track on ground			2,600	3,170
	Width of track shoe (standard)			600	860
	Min. ground clearance (To bottom of undercover)			390	470
Engine	Model			S6D114E-1A	
	Type			4-cycle, water cooled, inline vertical type direct injection With turbocharger	
	No. of cylinder – bore x stroke		mm	6 – 114 x 135	
	Piston displacement		ℓ {cc}	8.27 {8,270}	
	Performance	Rated horsepower	kw/rpm {HP/rpm}	112/1,850 {150/1,850}	
		Max. torque	Nm/rpm {kgm/rpm}	784/1,300 {80/1,300}	
		High idling	rpm	2,000	
		Low idling	rpm	850	
		Min. fuel consumption ratio	g/kwh {g/HPh}	222 {165}	
	Starting motor			24V, 7.5kW	
	Alternator			24V, 40A	
	Battery			12V, 140Ah x 2	
	Radiator core type			D-6	
Power train system	Torque converter			3-element, 1-stage, 1 phase	
	Transmission			Planetary gear type, multiple disc clutch, hydraulically actuated, lubrication gear pump, force feed, forward 3 speed, reverse 3 speed, manual mechanical type	

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OPERATION OF BRAKE VALVE

- The brake valve consists of check valve (12), counterbalance valve (10), and safety valve (11), and forms a circuit such as that shown on the right.



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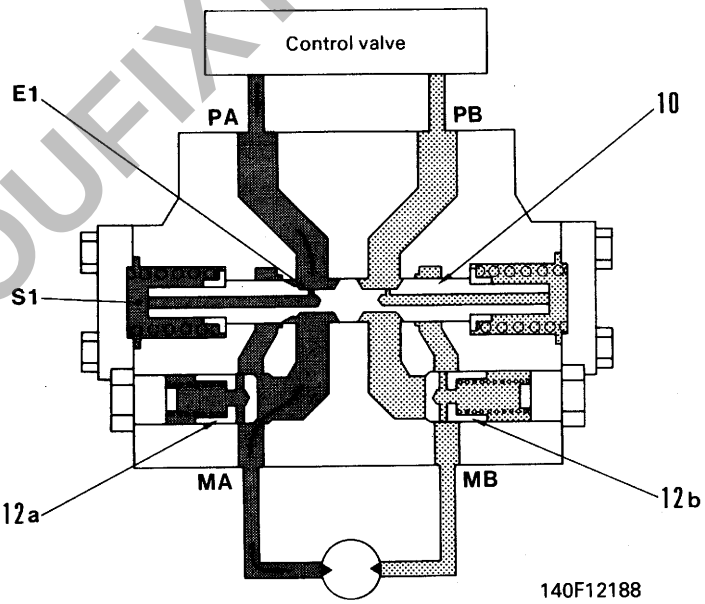
1. COUNTERBALANCE VALVE, CHECK VALVE

FUNCTION

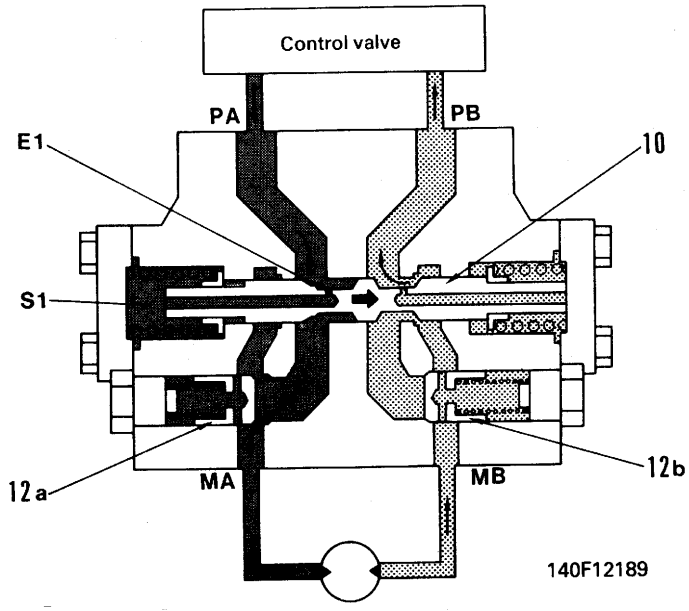
- When operating the steering on slopes, the weight of the machine produces a force in the downward direction which makes the machine try to turn faster than the speed of the motor. Because of this, if the engine is run at low speed and the steering is operated, the motor will overrun, and this will create an extremely dangerous condition.
- To prevent this, this valve is installed to carry out the steering in accordance with the engine speed (pump discharge volume).

Operation when oil is supplied

- When the steering lever is operated, the pressurized oil from the control valve is supplied to port **PA**. It pushes open check valve (12a), and flows from motor inlet port **MA** to motor outlet port **MB**.
- However, the outlet port side of the motor is closed by check valve (12b) and spool (10), so the pressure at the side where the oil is being supplied rises.
- The pressurized oil at the side where the oil is being supplied flows from orifice **E1** of spool (10) into chamber **S1**. And when the pressure in chamber **S1** becomes greater than the spool switching pressure, spool (10) is pushed to the right.
  In this way, port **MB** and port **PB** are connected, so the outlet port side of the motor is opened and the motor starts to turn.



140F12188



140F12189

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TIGHTENING TORQUE FOR 102 ENGINE SERIES

1) BOLT AND NUTS

Use these torques for bolts and nuts (unit: mm) of Cummins Engine.

Thread diameter	Tightening torque	
mm	Nm	kgm
6	10 ± 2	1.02 ± 0.20
8	24 ± 4	2.45 ± 0.41
10	43 ± 6	4.38 ± 0.61
12	77 ± 12	7.85 ± 1.22

2) EYE JOINTS

Use these torques for eye joints (unit: mm) of Cummins Engine.

Thread diameter	Tightening torque	
mm	Nm	kgm
6	8 ± 2	0.81 ± 0.20
8	10 ± 2	1.02 ± 0.20
10	12 ± 2	1.22 ± 0.20
12	24 ± 4	2.45 ± 0.41
14	36 ± 5	3.67 ± 0.51

3) TAPERED SCREWS

Use these torques for tapered screws (unit: inch) of Cummins Engine.

Thread diameter	Tightening torque	
inch	Nm	kgm
1 / 16	3 ± 1	0.31 ± 0.10
1 / 8	8 ± 2	0.81 ± 0.20
1 / 4	12 ± 2	1.22 ± 0.20
3 / 8	15 ± 2	1.53 ± 0.41
1 / 2	24 ± 4	2.45 ± 0.41
3 / 4	36 ± 5	3.67 ± 0.51
1	60 ± 9	6.12 ± 0.92

TIGHTENING TORQUE TABLE FOR HOSES (TAPER SEAL TYPE AND FACE SEAL TYPE)

★ Tighten the hoses (taper seal type and face seal type) to the following torque, unless otherwise specified.

★ Apply the following torque when the threads are coated (wet) with engine oil.

Nominal size of hose	Width across flats	Tightening torque (Nm {kgm})		Taper seal type	Face seal type	
		Range	Target	Thread size (mm)	Nominal thread size - Threads per inch, Thread series	Root diameter (mm) (Reference)
02	19	34 - 63 {3.5 - 6.5}	44 {4.5}	14	$\frac{9}{16}$ - 18UNF	14.3
03	22	54 - 93 {5.5 - 9.5}	74 {4.5}	–	$\frac{11}{16}$ - 16UN	17.5
	24	59 - 98 {6.0 - 10.0}	78 {8.0}	18	–	–
04	27	84 - 132 {8.5 - 13.5}	103 {10.5}	22	$\frac{13}{16}$ - 16UN	20.7
05	32	128 - 186 {13.0 - 19.0}	157 {16.0}	24	1 - 14UNS	25.4
06	36	177 - 245 {18.0 - 25.0}	216 {22.0}	30	$1\frac{3}{16}$ - 12UNF	30.3
(10)	41	177 - 245 {18.0 - 25.0}	216 {22.0}	33	–	–
(12)	46	197 - 294 {20.0 - 30.0}	245 {25.0}	36	–	–
(14)	55	246 - 343 {25.0 - 35.0}	294 {30.0}	42	–	–

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kgm to ft. lb

1 kgm = 7.233 ft. lb

	0	1	2	3	4	5	6	7	8	9
0	0	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	296.6	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	1005.4
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

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FOREWORD
GENERAL

This shop 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 shop 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 chapters; these chapters are further divided into the each main group of components.

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.
In addition, this section may contain hydraulic circuit diagrams, electric circuit diagrams, and maintenance standards.

TESTING AND ADJUSTING

This section explains checks to be made before and after performing repairs, as well as adjustments to be made at completion of the checks and repairs.
Troubleshooting charts correlating "Problems" with "Causes" are also included in this section.

DISASSEMBLY AND ASSEMBLY

This section explains the procedures for removing, installing, disassembling and assembling each component, as well as precautions for them.

MAINTENANCE STANDARD

This section gives the judgment standards for inspection of disassembled parts.
The contents of this section may be described in STRUCTURE AND FUNCTION.

OTHERS

This section mainly gives hydraulic circuit diagrams and electric circuit diagrams.
In addition, this section may give the specifications of attachments and options together.

NOTICE

The specifications contained in this shop manual are subject to change at any time and without any advance notice. Use the specifications given in the book with the latest date.

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SAFETY
SAFETY NOTICE

IMPORTANT SAFETY NOTICE

Proper service and repair is extremely important for safe machine operation. The service and repair techniques recommended by Komatsu and described in this manual are both effective and safe. Some of these techniques require the use of tools specially designed by Komatsu for the specific purpose.

To prevent injury to workers, the symbol ⚠ is used to mark safety precautions in this manual. The cautions accompanying these symbols should always be followed carefully. If any dangerous situation arises or may possibly arise, first consider safety, and take the necessary actions to deal with the situation.

GENERAL PRECAUTIONS

Mistakes in operation are extremely dangerous. Read the Operation and Maintenance Manual carefully BEFORE operating the machine.

1. Before carrying out any greasing or repairs, read all the precautions given on the decals which are fixed to the machine.
2. When carrying out any operation, always wear safety shoes and helmet. Do not wear loose work clothes, or clothes with buttons missing.
   - Always wear safety glasses when hitting parts with a hammer.
   - Always wear safety glasses when grinding parts with a grinder, etc.
3. If welding repairs are needed, always have a trained, experienced welder carry out the work. When carrying out welding work, always wear welding gloves, apron, hand shield, cap and other clothes suited for welding work.
4. When carrying out any operation with two or more workers, always agree on the operating procedure before starting. Always inform your fellow workers before starting any step of the operation. Before starting work, hang UNDER REPAIR signs on the controls in the operator's compartment.
5. Keep all tools in good condition and learn the correct way to use them.
6. Decide a place in the repair workshop to keep tools and removed parts. Always keep the tools and parts in their correct places. Always keep the work area clean and make sure that there is no dirt or oil on the floor. Smoke only in the areas provided for smoking. Never smoke while working.

PREPARATIONS FOR WORK

7. Before adding oil or making any repairs, park the machine on hard, level ground, and block the wheels or tracks to prevent the machine from moving.
8. Before starting work, lower blade, ripper, bucket or any other work equipment to the ground. If this is not possible, insert the safety pin or use blocks to prevent the work equipment from falling. In addition, be sure to lock all the control levers and hang warning signs on them.
9. When disassembling or assembling, support the machine with blocks, jacks or stands before starting work.
10. Remove all mud and oil from the steps or other places used to get on and off the machine. Always use the handrails, ladders or steps when getting on or off the machine. Never jump on or off the machine. If it is impossible to use the handrails, ladders or steps, use a stand to provide safe footing.

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PRECAUTIONS DURING WORK

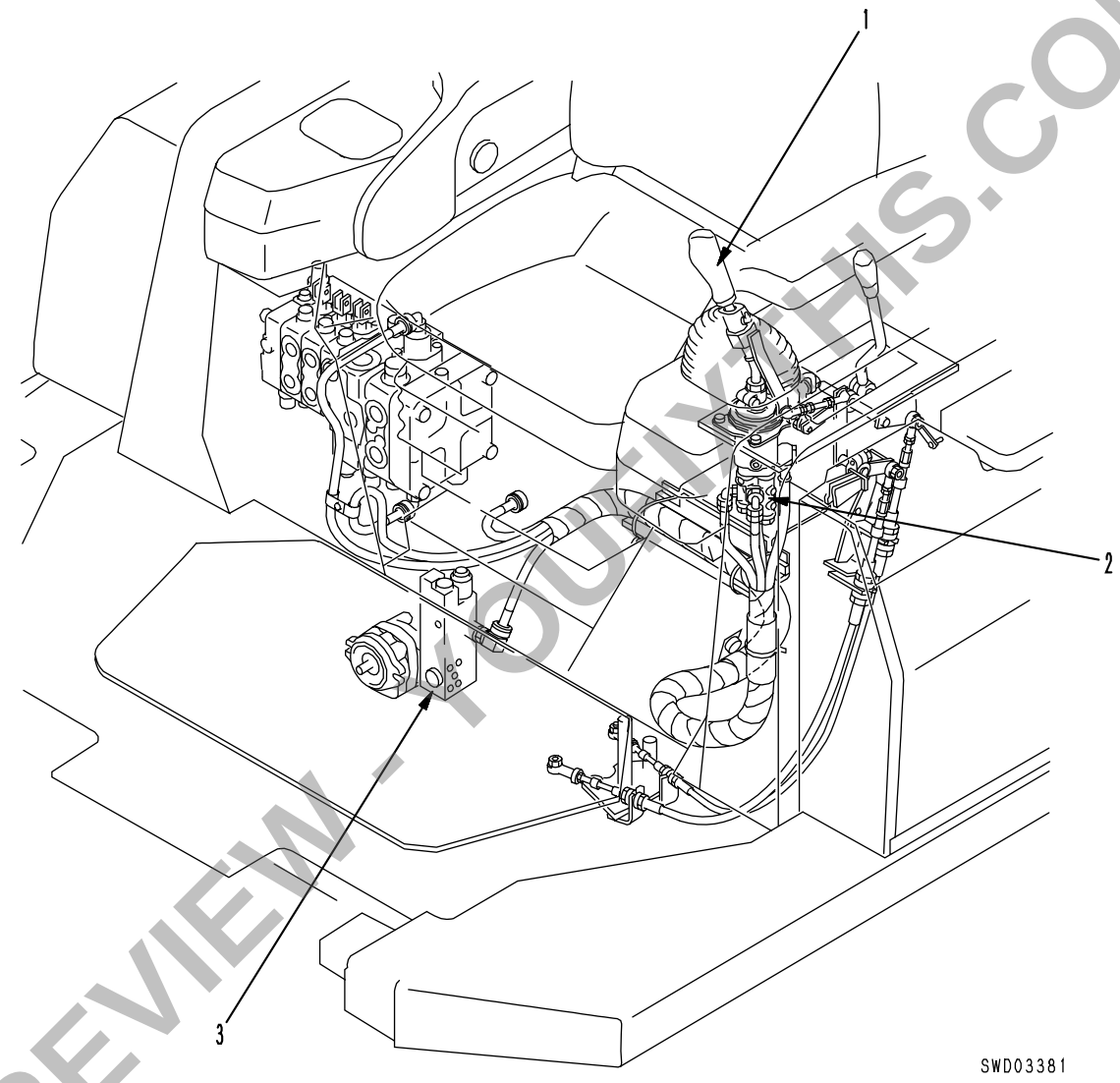
11. When removing the oil filler cap, drain plug or hydraulic pressure measuring plugs, loosen them slowly to prevent the oil from spurting out.
    Before disconnecting or removing components of the oil, water or air circuits, first remove the pressure completely from the circuit.
12. The water and oil in the circuits are hot when the engine is stopped, so be careful not to get burned.
    Wait for the oil and water to cool before carrying out any work on the oil or water circuits.
13. Before starting work, remove the leads from the battery. Always remove the lead from the negative (–) terminal first.
14. When raising heavy components, use a hoist or crane.
    Check that the wire rope, chains and hooks are free from damage.
    Always use lifting equipment which has ample capacity.
    Install the lifting equipment at the correct places.
    Use a hoist or crane and operate slowly to prevent the component from hitting any other part.
    Do not work with any part still raised by the hoist or crane.
15. When removing covers which are under internal pressure or under pressure from a spring, always leave two bolts in position on opposite sides. Slowly release the pressure, then slowly loosen the bolts to remove.
16. When removing components, be careful not to break or damage the wiring. Damaged wiring may cause electrical fires.
17. When removing piping, stop the fuel or oil from spilling out. If any fuel or oil drips onto the floor, wipe it up immediately. Fuel or oil on the floor can cause you to slip, or can even start fires.
18. As a general rule, do not use gasoline to wash parts. In particular, use only the minimum of gasoline when washing electrical parts.
19. Be sure to assemble all parts again in their original places.
    Replace any damaged parts with new parts.
    - When installing hoses and wires, be sure that they will not be damaged by contact with other parts when the machine is being operated.
20. When installing high pressure hoses, make sure that they are not twisted. Damaged tubes are dangerous, so be extremely careful when installing tubes for high pressure circuits. Also, check that connecting parts are correctly installed.
21. When assembling or installing parts, always use the specified tightening torques. When installing protective parts such as guards, or parts which vibrate violently or rotate at high speed, be particularly careful to check that they are installed correctly.
22. When aligning two holes, never insert your fingers or hand. Be careful not to get your fingers caught in a hole.
23. When measuring hydraulic pressure, check that the measuring tool is correctly assembled before taking any measurements.
24. Take care when removing or installing the tracks of track-type machines.
    When removing the track, the track separates suddenly, so never let anyone stand at either end of the track.

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PPC CONTROL PIPING DIAGRAM

(Steering control)



1. Steering and directional lever
2. Steering and directional PPC valve
3. PPC charge valve

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STANDARD VALUE TABLE FOR ELECTRICAL SYSTEM

<table>
<tr><th>Classification</th><th colspan="2">Check Item</th><th>Connector No.</th><th>Inspection method</th><th>Judgement table</th><th>Measurement conditions</th></tr>
<tr><td rowspan="2">Monitor system</td><td rowspan="2">Monitor panel</td><td>CHECK, CAUTION group
Buzzer signal

The voltage for H and L in the table are as follows.

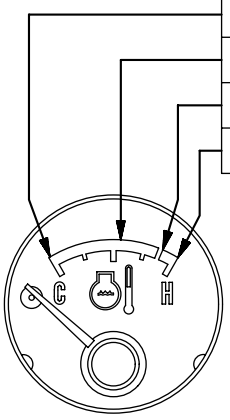
*1. Engine oil pressure signal
H: 3.5 – 30V
L: Approx. 0V
*2. Starting signal
H: 3 – 30V
L: Approx. 0V

The starting signal is H once, but after that it becomes L. However, until the starting switch is turned OFF, the starting signal is held in the memory inside the monitor panel as H.

*3. Alternator signal
H: 27.5 – 30V
L: Max. 5V
*4. Sensor signal
H: 3.5–30V
L: Approx. 0V</td><td></td><td></td><td>If the condition is as shown in Table 1 and Table 2, the monitor panel is normal.

Table 1 (CHECK, CAUTION group)
<table><tr><th>Signal / Monitor item</th><th>Monitor auxiliary signal input
Engine oil pressure signal *1
CN49 ⑧</th><th>Starting signal *2
CN49 ⑤</th><th>Alternator signal *3
CN49 ④</th><th>Monitor item sensor signal *4</th><th>Monitor display</th></tr><tr><td>Preheat CN49 ⑥</td><td colspan="2">—</td><td>—</td><td>L</td><td>ON</td></tr><tr><td></td><td colspan="2"></td><td></td><td>H</td><td>OFF</td></tr><tr><td>Engine oil pressure CN49 ⑧</td><td>L</td><td>H</td><td>H</td><td>—</td><td>Flashing</td></tr><tr><td></td><td>H</td><td></td><td></td><td></td><td>OFF</td></tr><tr><td>Charge CN49 ④</td><td>H</td><td>H</td><td>L</td><td>—</td><td>Flashing</td></tr><tr><td></td><td></td><td></td><td>H</td><td></td><td>OFF</td></tr></table>
Table 2 (Buzzer signal)
<table><tr><td>A</td><td>CN49 ① – ②
(+24V input)</td><td>Starting switch ON
20 – 30</td></tr><tr><td></td><td></td><td>Starting switch OFF
0V</td></tr><tr><td>B</td><td>CN50 ⑦ (Alarm buzzer output) – ④

Disconnect CN15 (coolant temp. sensor) ↔ Connect short connector to CN15</td><td>Remove connector CN15, and buzzer sounds, or the following cycle is repeated.

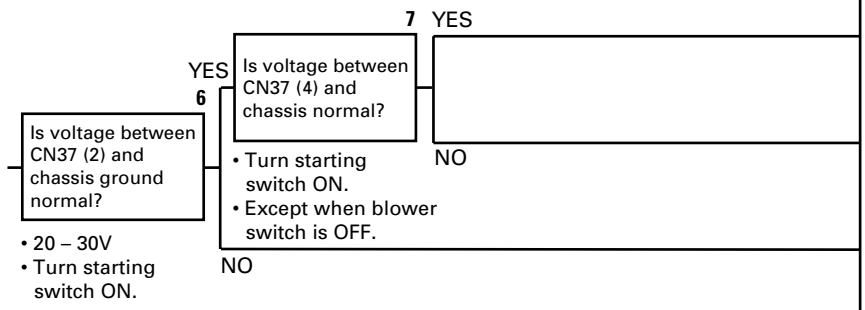
Over 20V: 0.8 sec.
3V: 0.8 sec.</td></tr><tr><td></td><td></td><td>When short connector is connected, buzzer stops or voltage is 20 – 30V.</td></tr></table></td><td>1) Start engine
2) Insert T-adapter</td></tr>
<tr><td>GAUGE group</td><td>Coolant temperature</td><td>CN15
① – ②</td><td>Measure resistance</td><td><table><tr><th>Coolant temperature</th><th>Resistance of senser</th></tr><tr><td>50° C</td><td>Approx. 17KΩ</td></tr><tr><td>90° C</td><td>Approx. 5KΩ</td></tr><tr><td>104° C</td><td>Approx.3.7KΩ</td></tr><tr><td>122° C</td><td>Approx.2.3KΩ</td></tr></table>
TXD01201</td><td>1) Turn starting switch OFF and insert dummy resistance or measure resistance of sensor.

2) Turn starting switch ON, and check display.

3) Connect socket.</td></tr>
</table>

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Cause	Remedy
Go to A	—
Defective air conditioner relay	Replace
Defective contact, or disconnection in wiring harness between fuse No.3 and CN37 (female) (2)	Repair or replace
Defective contact, or disconnection in wiring harness between CN44 (female) (4) and CN33 (male) (2)	Repair or replace
Defective blower switch	Replace
Defective contact, or disconnection in wiring harness between CN37 (female) (3) and CN44 (female) (3)	Repair or replace
Defective air conditioner relay	Replace
Defective contact, or disconnection in wiring harness between fuse No.3 and CN37 (female) (1)	Repair or replace

Table 1

Position \ Terminal	B	LW	LY	L
OFF	○			
ON	○	○		
ME	○	○	○	
HI	○	○		○

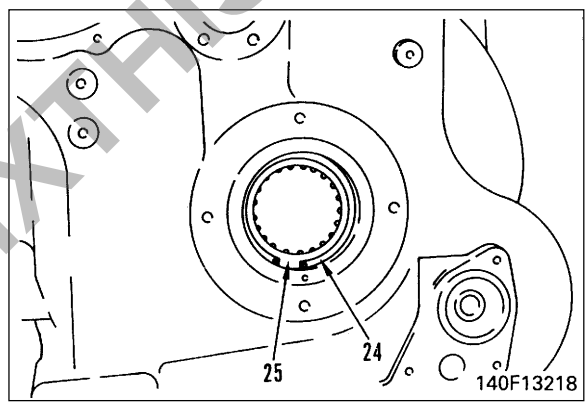
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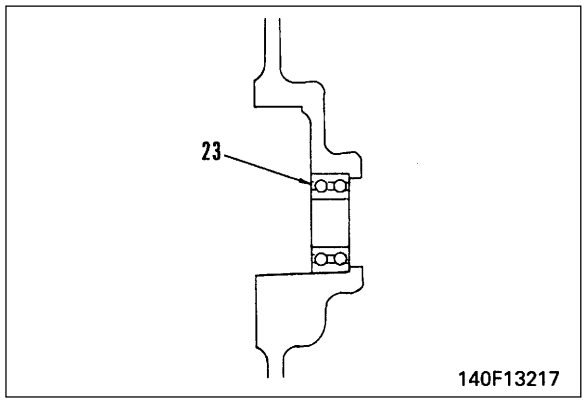
ASSEMBLY OF PTO ASSEMBLY

★ Clean all parts, and check for dirt or damage before installing.
★ Drop 6 cc of engine oil on the rotating portion of the bearing, then rotate it 10 turns.
★ Check that the snap ring is fitted securely in the groove.

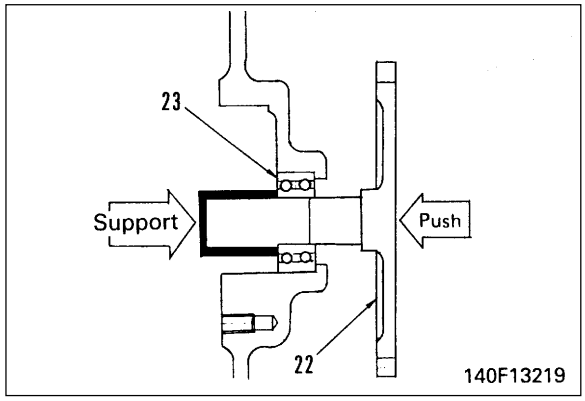
1. Input shaft bearing
Press fit bearing (25), and install snap ring (24).



2. Scavenging pump drive gear
1) Install bearing (23).



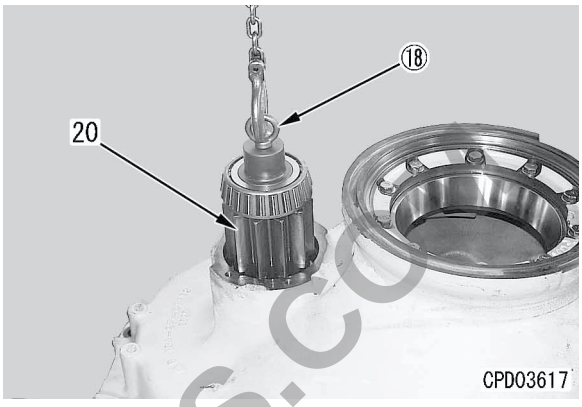
2) Support inner race end of bearing (23), and install gear (22) to bearing.



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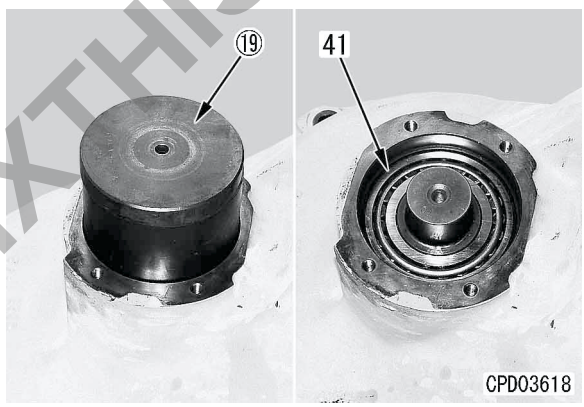
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v) Using hanging bolt ⑱, sling and install No. 2 pinion and bearing assembly (20) to No. 1 gear.



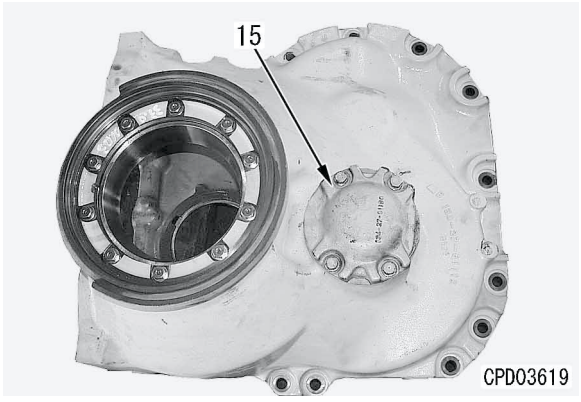
vi) Using push tool ⑲, press fit outer race (41) to case (36).

★ Do not press fit outer race (41) completely, but press fit only about 19 mm from ecn of case. (Leave about 5 mm.)



vii) Fit O-ring, then install No. 2 pinion cover (15).

★ Press fit outer race (41) completely by installing No. 2 pinion cage (19) (to eliminate the clearance between the outer race and No. 2 pinion cover).

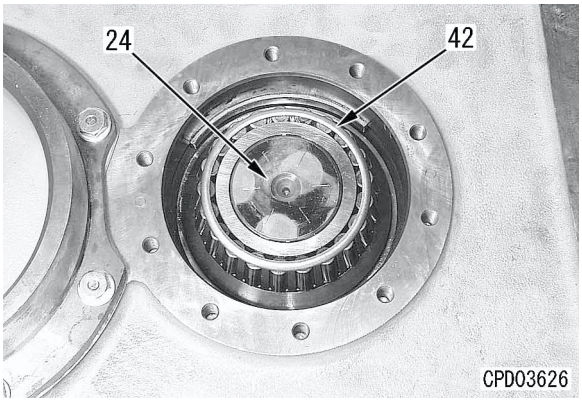


viii) Turn over case assembly to set No. 1 pinion up.

ix) Remove tool **J2**.

x) Heat bearing (42) with bearing heater, etc. and fit it to No. 2 pinion (24) by shrink fit.

★ If the bearing is heated too much, its heat treatment hardness is lowered. Accordingly, do not raise the bearing temperature above 120°C.



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13. Tilt spool
1) Remove case (61).
2) Remove plug (62), then remove retainer (63), spring (64), and retainer (65).
   ★ Loosen plug (62) while spool (66) is installed.
3) Remove yoke (67) from tilt spool (66).
   ★ Loosen yoke (67) while spool (66) is installed.
4) Pull tilt spool (66) out of body.
5) Remove plates (68) and (69) and seals (118) and (119) from body.

14. Lift spool
1) Remove ring (72), then remove plug (73).
2) Remove plug (74), then push in guide (75) to remove ball (76).
   ★ Loosen plug (74) while spool (85) is installed.
3) Remove guide (75) and spring (77).
4) Remove case (78), then remove detent (79).
5) Remove valve (80), then remove retainer (81), spring (82), retainer (83), and plate (84).
6) Remove yoke (86) from lift spool (85).
   ★ Loosen yoke (86) while spool (85) is installed.
7) Pull lift spool (85) out of body.
8) Remove plates (87) and (88) from body, then remove seal (89) from plate (88).
9) Remove seal (90) and plate (91) from body.

15. Steering spool
1) Remove case (92), then remove spring (93) and retainer (94).
2) Remove case (95), then remove spring (96).
3) Remove steering spool (97).

16. Disconnection of each body
1) Remove 4 mounting bolts (106), then remove cover (107), angle valve body (108), tilt valve body (109), and lift valve body (110).
2) Remove 4 mounting bolts (111), then remove cover (112) and steering valve body (113) from block (114).

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