KOBELCO

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SERVICE MANUAL

Hydraulic Excavator

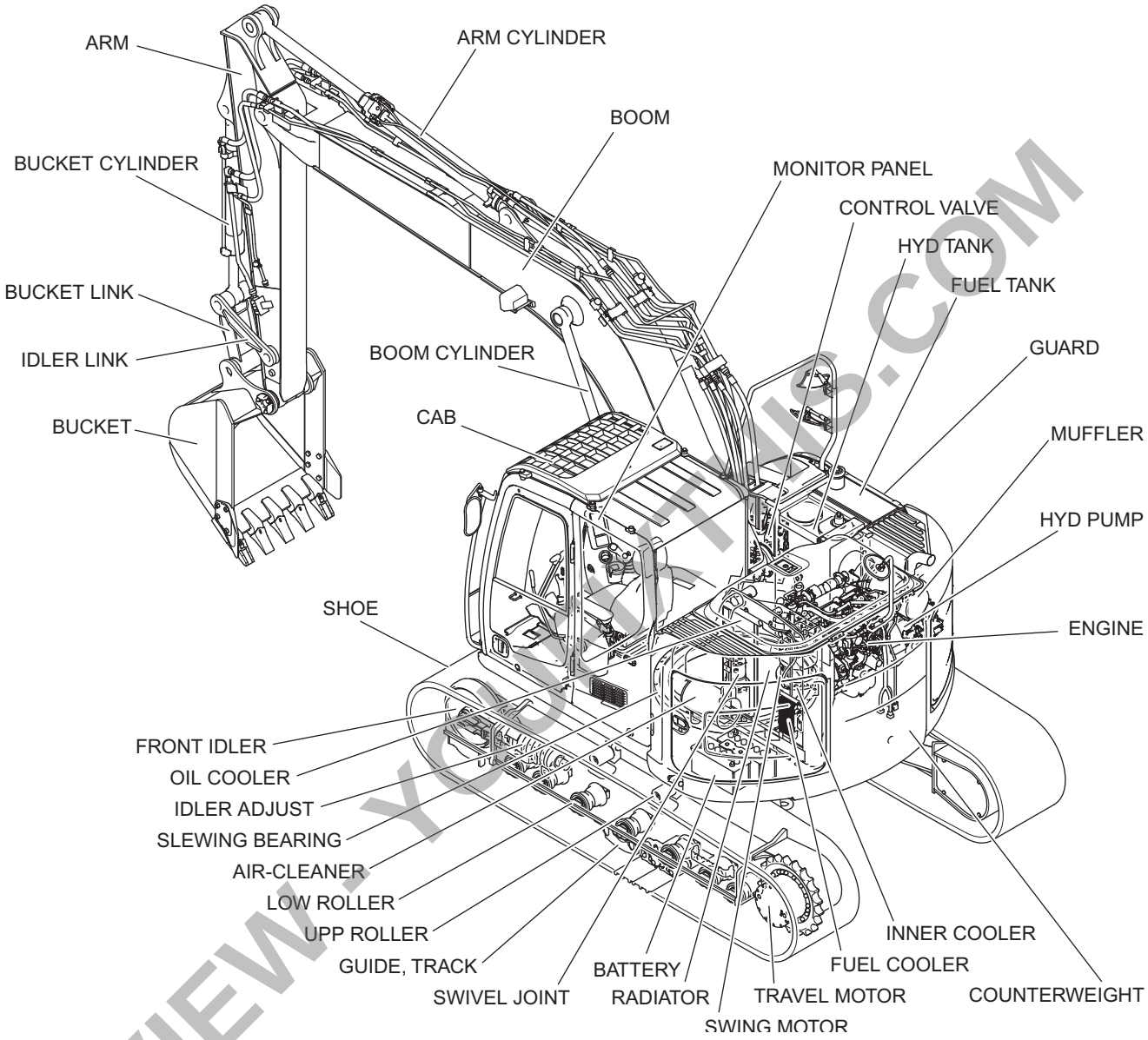
140SRLC-3
Tier 4

S5YY0024E02

Issued September 2012
1st Edition

APPLICABLE:
140SRLC-3 . . . . . YH07-09001~

2.1 NAME OF COMPONENTS



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11.1 TIGHTENING TORQUES FOR CAPSCREWS AND NUTS

Tables Table "Metric coarse thread (Not plated)" and Table "Metric fine thread (Not plated)" indicate tightening torques applicable to cases where no special note is given.
Overtightening of bolts may result in a twist-off and a fracture under load.
Insufficient tightening may lead to a loosening or loss of bolts. Always tighten bolts to proper torques.

Unit : N•m (lbf•ft)

Classification		4.8T		7T		10.9T	
Nominal size		No lubrication	Oil lubrication	No lubrication	Oil lubrication	No lubrication	Oil lubrication
M6	P=1	4.4±0.5 (3.2±0.4)	3.7±0.4 (2.7±0.3)	9.6±1.0 (7.1±0.7)	8.1±0.8 (6.0±0.6)	17.4±1.8 (12.8±1.3)	14.7±1.5 (10.8±1.1)
M8	P=1.25	10.7±1.1 (7.9±0.8)	9.0±0.9 (6.6±0.7)	23.5±2.0 (17.3±1.5)	19.6±2.0 (14.5±1.5)	42.2±3.9 (31.1±2.9)	35.3±3.9 (26.0±2.9)
M10	P=1.5	21.6±2.0 (15.9±1.4)	17.9±1.8 (13.2±1.3)	46.1±4.9 (34.0±3.6)	39.2±3.9 (28.9±2.9)	83.4±8.8 (61.5±6.5)	70.6±6.9 (52.1±5.1)
M12	P=1.75	36.3±3.9 (26.8±2.9)	31.4±2.9 (23.2±2.1)	79.4±7.8 (58.6±5.8)	66.7±6.9 (49.2±5.1)	143±15 (105±11)	121±12 (89.2±8.9)
M14	P=2	57.9±5.9 (42.7±4.4)	49.0±4.9 (36.1±3.6)	126±13 (92.9±9.6)	106±10 (78.2±7.4)	226±20 (167±15)	191±19 (141±14)
M16	P=2	88.3±8.8 (65.1±6.5)	74.5±6.9 (55.0±5.1)	191±20 (141±15)	161±16 (119±12)	343±39 (253±29)	284±29 (209±21)
M18	P=2.5	122±12 (90.0±8.9)	103±10 (75.8±7.2)	265±29 (195±21)	226±20 (167±15)	481±49 (355±36)	402±39 (297±29)
M20	P=2.5	172±17 (127±13)	144±14 (106±10)	373±39 (275±29)	314±29 (232±21)	667±69 (492±51)	559±59 (412±44)
M22	P=2.5	226±20 (167±15)	192±20 (142±15)	500±49 (369±36)	422±39 (311±29)	902±88 (665±65)	755±78 (557±58)
M24	P=3	294±29 (217±21)	235±29 (173±21)	637±69 (470±51)	520±49 (383±36)	1160±118 (856±87)	941±98 (694±72)
M27	P=3	431±39 (318±29)	353±39 (260±29)	941±98 (694±72)	765±78 (564±58)	1700±167 (1250±123)	1370±137 (1010±101)
M30	P=3.5	588±59 (434±44)	490±49 (361±36)	1285±127 (948±94)	1079±108 (796±80)	2300±235 (1700±173)	1940±196 (1430±145)
M33	P=3.5	794±78 (586±58)	667±69 (492±51)	1726±177 (1270±131)	1451±147 (1070±108)	3110±314 (2290±232)	2610±265 (1930±195)
M36	P=4	1030±98 (760±72)	863±88 (637±65)	2226±226 (1640±167)	1863±186 (1370±137)	4010±402 (2960±297)	3360±333 (2480±246)

Tightening torque for metric coarse threads (not plated)

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01 Attachment

Group	Location	Work to be done	Unit	Remarks	Unit: Hour
00	Bucket relation			See 32.1.2	
01	Bucket ASSY	Detach/attach	1 pc.	Include adjustment	0.5
02	-Bucket attaching and detaching position	Preparation	1 pc.		0.1
03	-Bucket attaching pin	Detach/attach	1	Include omission of pin	0.1
04	-Bucket drive pin	Detach/attach	1		0.1
05	-Bucket sling and movement	Preparation	1 pc.		0.1
06	Bucket (single)	O/H	1 pc.	Not include attaching and detaching	2.0
07	-Tooth	Replace	1 pc.		0.5
08	-Side cutter	Replace	1 pc.		1.0
09	-Bushing	Replace	1 pc.		0.5
10	Arm relation			See 32.1.3	
11	Arm ASSY	Detach/attach	1 pc.		1.0
12	-Bucket cylinder attaching and detaching position and piping	Preparation	1 pc.		0.3
13	-Bucket cylinder rod pin	Detach/attach	1 pc.	Include stopper pin.	0.1
14	-Bucket cylinder head pin	Detach/attach	1 pc.	Include stopper pin.	0.1
15	-Bucket cylinder assy	Detach/attach	1 pc.		0.1
16	-Arm cylinder rod pin	Detach/attach	1 pc.	Include stopper pin.	0.1
17	-Boom top pin	Detach/attach	1 pc.	Include wire stop pin	0.1
18	-Arm sling and movement	Detach/attach	1 pc.		0.1
30	Boom portion			See 32.1.4	
31	Boom ASSY	Detach/attach	1 pc.		1.0
32	-Boom attaching and detaching position	Preparation	1 pc.		0.1
33	-Boom cylinder temporary slinging	Preparation	2 pcs.		0.2
34	-Boom cylinder rod pin	Detach/attach	2	Include two stopper pins.	0.2
35	-Boom cylinder piping	Detach/attach	2 pc.		0.2
36	-Arm & bucket piping	Detach/attach	1 pc.		0.2
37	-Boom assy temporary slinging	Detach/attach	1 pc.		0.1
38	-Boom foot pin	Detach/attach	1	Include stopper pin.	0.2
39	-Boom assy slinging	Detach/attach	1 pc.		0.1
40	Arm cylinder attaching and detaching	Detach/attach	1 pc.		0.3
41	-Arm cylinder piping	Detach/attach	1 pc.		0.1
42	-Arm cylinder head pin	Detach/attach	1 pc.	Include stopper pin.	0.1
43	-Arm cylinder slinging	Detach/attach	1 pc.		0.1
50	Boom cylinder attaching and detaching	Detach/attach	2 pcs.		0.6
51	-Boom cylinder piping	Detach/attach	2		0.2
52	-Boom cylinder head pin	Detach/attach	2 pcs.		0.2
53	-Boom cylinder slinging	Detach/attach	2		0.2
60	Bucket cylinder	O/H	1		3.0
61	-Pin bushing	Replace	1	Include seal.	1.0
70	Arm cylinder	O/H	1		3.0
71	-Pin bushing	Replace	1 set	Include seal.	1.0
80	Boom cylinder	O/H	2		6.0
81	-Pin bushing	Replace	1 set	Include seal.	1.0

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13.2 PERFORMANCE INSPECTION STANDARD TABLE

Note

Unless otherwise specified, measure it on "H" mode.

13.2.1 STANDARD VALUE TABLE

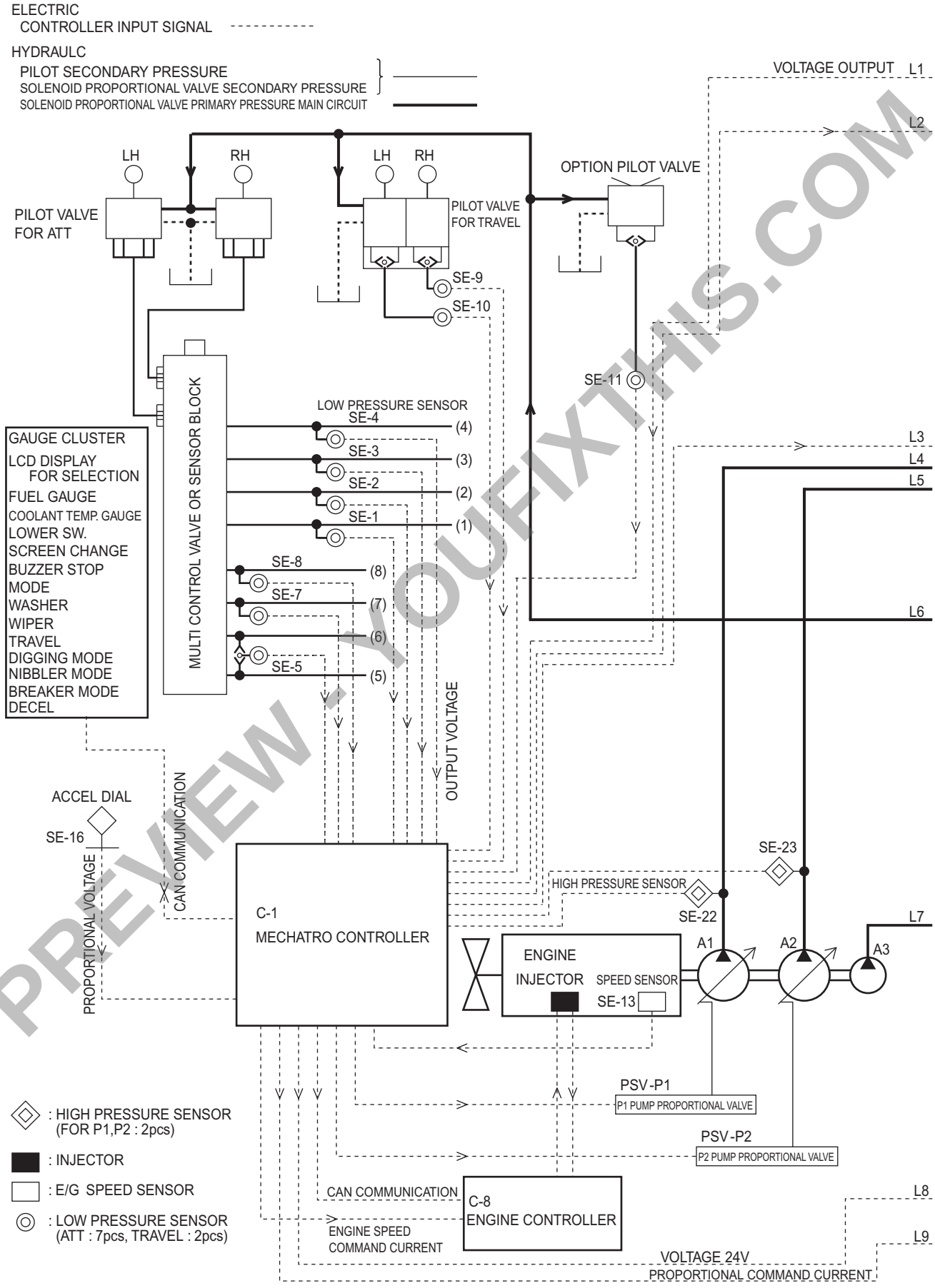
Inspection Item				Measuring Position: Position	Size	Port	Standard value	Tolerance: Hi	Lo	Unit	Adjusting Point	Measuring condition
Standard Measuring condition	Cleanliness of hydraulic oil			Hydraulic oil in tank			NAS 9 or less	—	—	Class	—	Sampling
	Hydraulic oil temperature			Tank surface			50 (122)	+ 5 (41)	- 5 (23)	°C	—	Atmospheric temp 50°C~-10°C (122°F~14°F)
	Water temperature			Radiator surface			75 (167)	+ 15 (59)	- 15 (5)	(°F)	—	
	Engine speed	H mode Lo idle		Measure the engine speed at multi display on the gauge cluster, or measure with diesel speed meter.			1100	+ 30	- 30	min^{-1}	Adjustment not required	LOW throttle
		H mode Hi idle					2000	+ 30	- 30			Full throttle (HI idle)
		H mode Decel					1150	+ 30	- 30			Perform all measurement with the air-conditioner "OFF".
		S mode Hi idle					1900	+ 30	- 30			
		ECO mode Hi idle					1800	+ 30	- 30			
Pilot primary pressure circuit				G pump	PF1/4	a4	5.0 (725)	+ 0.5 (+73)	0	MPa (psi)	PR1	HI idle
High pressure circuit	Main relief valve pressure	ATT	P1	Main pump		a1	34.3 (4970)	+ 0.7 (+100)	- 0.5 (-73)		MR1	Boom up
			P2			a2						
		Boost	P1			a1	—	—	—		MR1	—
			P2			a2						
	Over load relief valve pressure	Boom	R			a1	37.8 (5480)	0	- 4.0 (-580)		OR4	Boom down
			H				37.8 (5480)	0	- 4.0 (-580)		OR3	Boom up
		Arm	R			a2	37.8 (5480)	0	- 4.0 (-580)		OR8	Arm out
			H				37.8 (5480)	0	- 4.0 (-580)		OR7	Arm in
		Bucket	R			a1	37.8 (5480)	0	- 4.0 (-580)		OR2	Bucket dump
			H				37.8 (5480)	0	- 4.0 (-580)		OR1	Bucket digging
		Swing	RH			a2	28.0 (4060)	+ 3.4 (+493)	+ 0.5 (+73)		OR6	Swing RH
			LH				28.0 (4060)	+ 3.4 (+493)	+ 0.5 (+73)		OR5	Swing LH
		Travel RH	FW			a1	34.3 (4970)	+ 1.7 (+240)	- 0.5 (-73)		—	Simultaneous operation of travel RH and LH
			RV								—	
		Travel LH	FW			a2	34.3 (4970)	+ 1.7 (+240)	- 0.5 (-73)		—	
			RV								—	

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21.1 SUMMARY OF MECHATRO CONTROL SYSTEM

21.1.1 MECHATRO CONTROL SYSTEM IN GENERAL



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22.1 SUMMARY

22.1.1 FUNCTION AND FEATURES OF HYDRAULIC CIRCUIT

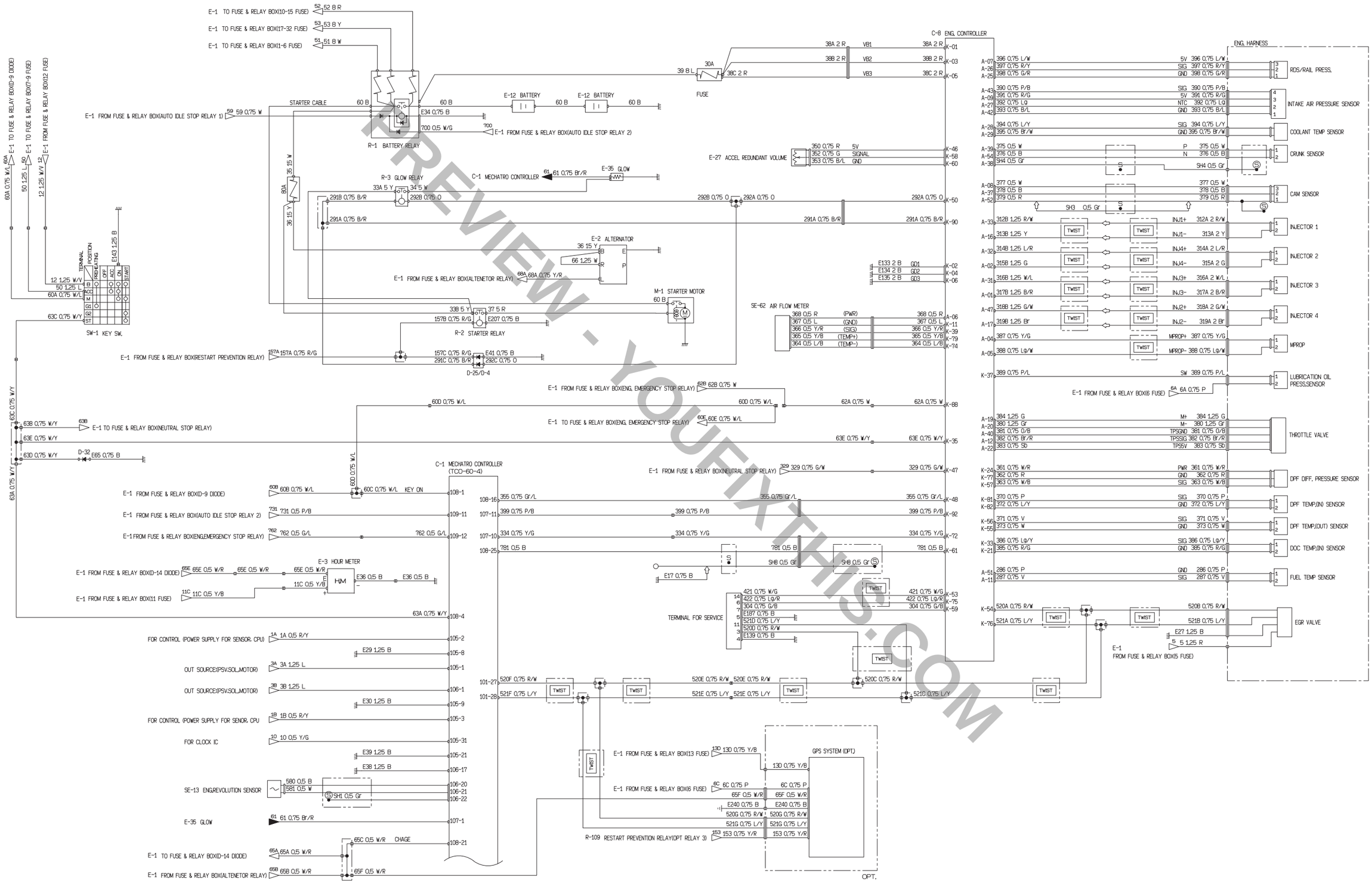
The hydraulic circuits are built up with the following functions and features in order to achieve easy operability, safety, mass volume handling and low fuel consumption.

Perfor-mance	Device	Function	Features
Easy operability and safety	Travel	● Travel straight	● Travel straight at combined operation
		● Travel 2-speed change & Auto 1st (low) speed return	● 1-2 travel speed change and low speed / high torque at heavy duty
		● Auto parking brake	● Automatic braking when parking
		● Motor overrun protection	● Prevents overrunning of travel motor on the down hill slope.
		● Travel pilot operation	● Prevents hunting by the built in travel shockless mechanism
	Swing	● Reverse rotation protective function	● Easy positioning to protect it from swinging back when stops swinging.
		● Swing priority circuit (simultaneous operation of arm in and swing motions)	● Easy operation of stable swing speed, arm slanted leveling, swing press digging
		● Automatic swing parking brake	● Swing parking brake when operating at on a slope
		● AB bypass valve function	● Improvement of swing stop feeling
	Attachment	● Hydraulic pilot control system	● Light action with operating lever
		● Pilot safety lock system	● Cut out of pilot circuit by safety lock lever.
		● Lock valve (boom / arm)	● Protect boom and arm from unexpected drop (Natural fall).
		● Boom/Arm safety valve (Option)	● Prevention of boom and arm falling when boom head side and arm rod side pipings break
		● Lowering boom to the ground in case of emergency	● When engine is stalled, the boom is lowered to the ground safely.
	Others	● Pressurized hydraulic oil tank	● To prevent hydraulic oil from entering dust and to promote self suction ability of pump
		● Suction strainer	● Remove dust on suction side.
		● Line filter ; pilot circuit	● To prevent pilot operating circuit from malfunctioning
		● Return circuit	● To prevent hydraulic oil from contamination
		● Cooling hydraulic oil by oil cooler	● To prevent hydraulic oil from being deteriorated.
		● Pressure draining circuit	● To release the main circuit pressure for piping repair work.
		● Main control valve with optional valve	● Optional piping and additional work are easy
		● Switching of return line for N&B machine in the cab (Option)	● Switching of return line for N&B machine is able to change with a switch in the cab
		● Extra circuit (Option)	● Installation of optional piping is easy after shipping
Mass handling capability	Pump	● Electric flow controlled variable displacement pump	● Pump delivery rate control by a current command to the solenoid proportional valve of the variable displacement pump
		● Positive flow rate control	● Flow control by positive pilot control pressure
	Attachment	● Boom up conflux circuit	● Speed up of boom up operation
		● Arm conflux circuit	● Speed up of arm operation
		● Optimum operation by work mode select (H,S,E)	● Efficient operation in all work modes
Low fuel consumption	Micro computer	● Auto accel	● Reduce fuel consumption and noise by lowering engine speed when control lever is in neutral position.

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23.1 ELECTRIC CIRCUIT DIAGRAM



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(1/10)

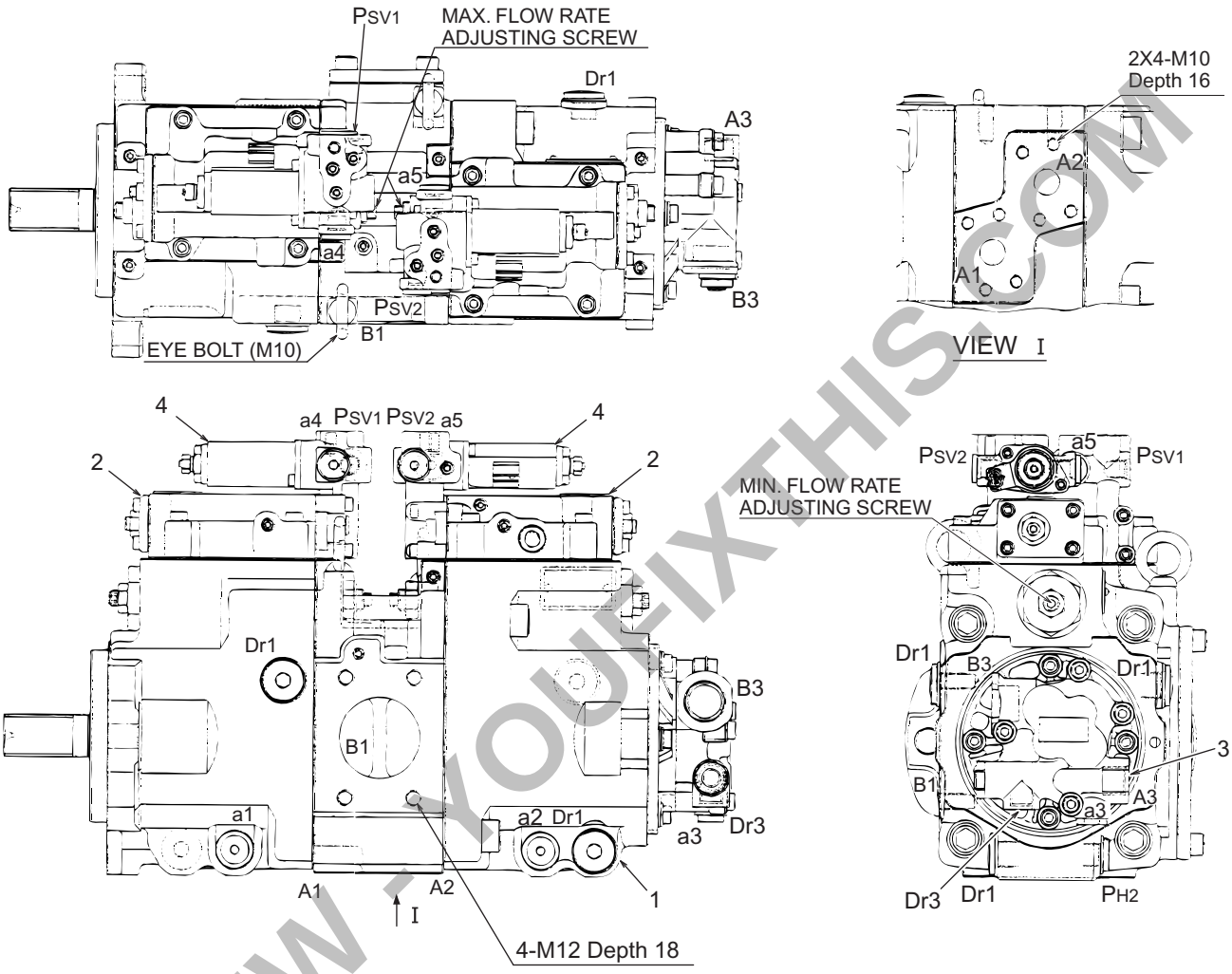
YY03Z00033P1 (01)

24.1 HYDRAULIC COMPONENTS

24.1.1 HYDRAULIC PUMP - REGULATOR

24.1.1.1 SUMMARY

(1) Outside view and Hydraulic port



No.	Parts	Q'TY
1	Main pump assy	1
2	Regulator assy	2
3	Gear pump assy(for pilot)	1
4	Solenoid proportional reducing valve	2

Hydraulic ports

Code	Ports name	Size
A1,2	Delivery port	SAE 6000psi 3/4"
B1	Suction port	SAE 2500psi 2 1/2"
Dr1	Drain port	PF1/2-19
PSV1,2	Servo assist port	PF1/4-13
PH1,2	Pressure sensor port	PF3/8-17
a1,a2	Gauge port	PF1/4-15
a3	Gauge port	PF1/4-14
a4,a5	Gauge port	PF1/4-13
A3	Delivery port of gear pump	PF1/2-19
B3	Suction port of gear pump	PF3/4-20.5
Dr3	Drain port of gear pump	PF3/8-15

Hydraulic pump - regulator

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24.2 ELECTRICAL EQUIPMENT

24.2.1 ELECTRICAL EQUIPMENT LIST

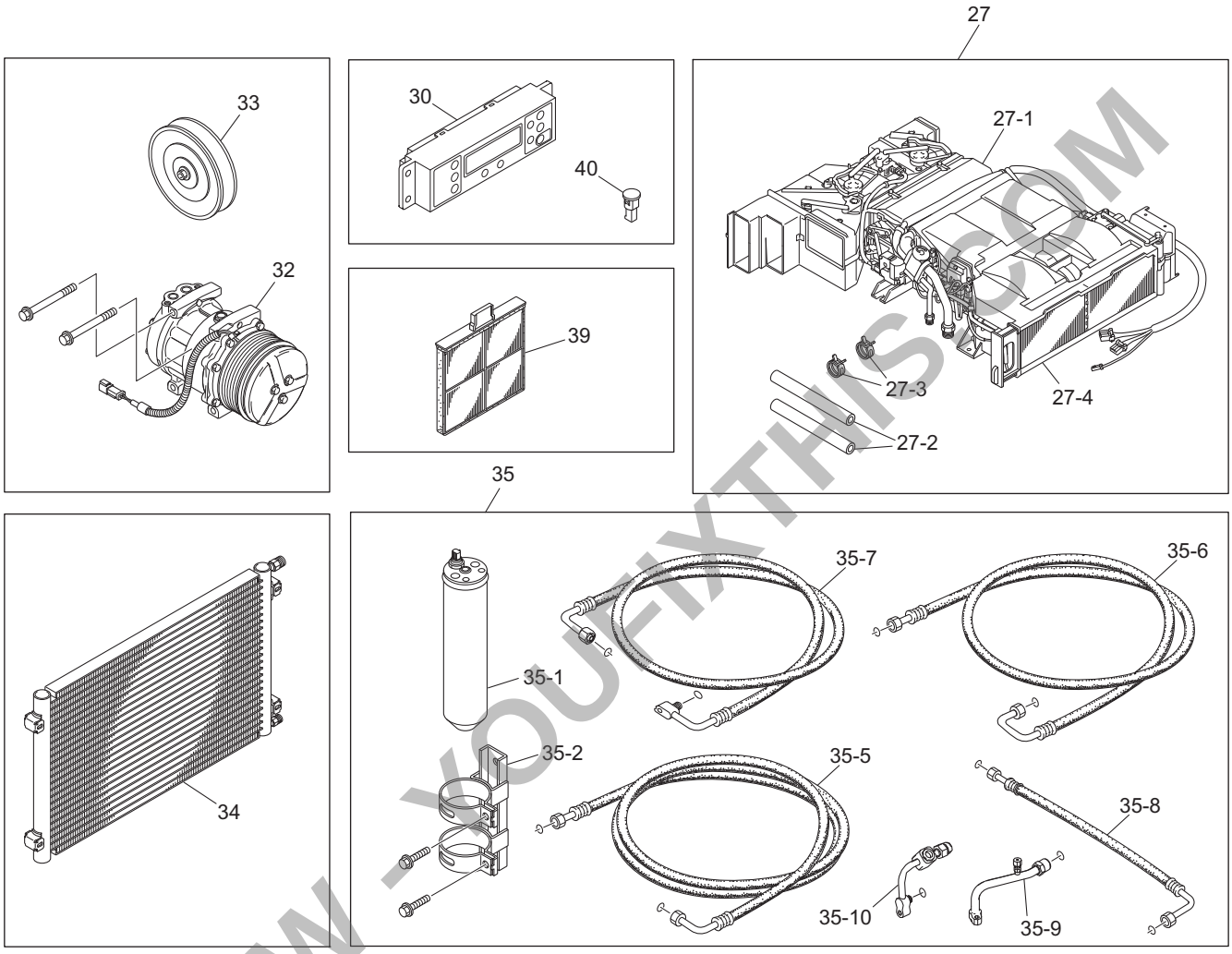
Group	Code	Part Name	Part No.
(C) Controller	C - 1	Mechatro controller	YN22E00425F1
	C - 2	Gauge cluster	YN59S00028F1
	C - 4	Air-con controler (including panel)	YY20M01228P1
	C - 8	Engine controller	16E10-00060
(D) Diode	D - 4	Diode	YN02D01001P1(4P)
	D - 5	Diode	Accessory of relay box
	D - 6	Diode	↑
	D - 9	Diode	↑
	D - 10	Diode	↑
	D - 12	Diode	↑
	D - 13	Diode	↑
	D - 14	Diode	↑
	D - 15	Diode	↑
	D - 16	Diode	↑
	D - 17	Diode	↑
	D - 20	Diode	↑
	D - 21	Diode	↑
	D - 22	Diode	↑
	D - 23	Diode	↑
	D - 25	Diode	YN02D01001P1(4P)
	D - 32	Diode	YN02D01001P1(2P)
(E) Electric fittings	E - 1	Fuse and Relay box	YY24E00021F1
	E - 2	Alternator	32G68-02300
	E - 3	Hour meter	LQ58S00002P1
	E - 5	Horn high	LC53S00001D1
	E - 6	Horn low	LC53S00001D2
	E - 7	Tuner AM & FM	YN54S00045P2
	E - 8	Speaker left	YN54S00006P1
	E - 9	Speaker right	↑
	E - 10	Receiver dryer	YN54S00041P1
	E - 11	Air-con compressor	YX91V00001F1
	E - 12	Battery	2484U171
	E - 13	Travel alarm	YN53S00004F1
	E - 22	DC-DC converter	YN77S00005F1
	E - 23	12V socket	YN81S01002P1
	E - 35	Glow	32A66-07021
	E - 49	DC-DC converter (proportional)	YN77S00017P1
	E - 63	DC-DC converter (for camera)	YN77S00040P1

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25.2 COMPONENT AND CONSTRUCTION

25.2.1 COMPONENT



Air-conditioner group

A/C ASSY: YY20M00031F1 (01)

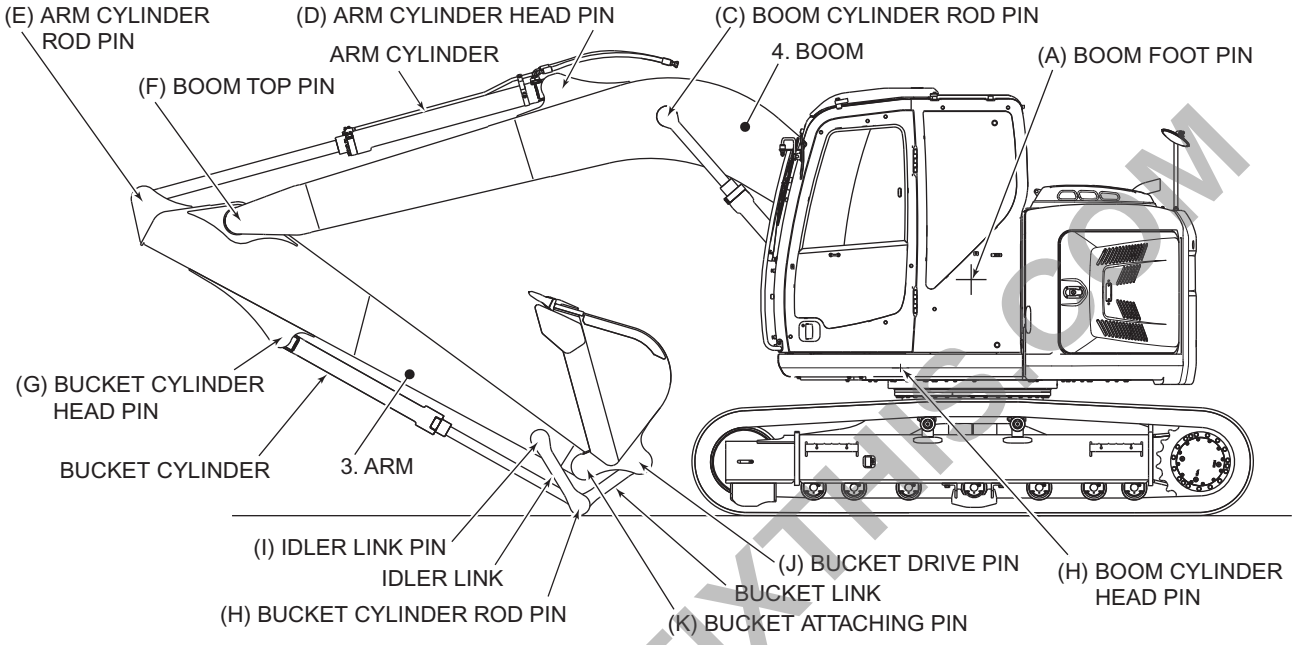
No.	Parts	Q'ty	No.	Parts	Q'ty	No.	Parts	Q'ty
27	Air-conditioner assy	1	33	Pulley	1	35-7	L hose	1
27-1	Air-conditioner unit	1	34	Condenser	1	35-8	L hose: 15 dia.	1
27-2	Hose	2	35	Air dryer assy	1	35-9	S tube: 16 dia.	1
27-3	Clamp	2	35-1	Receiver dryer	1	35-10	L tube: 8.5 dia.	1
27-4	Filter	1	35-2	Bracket	1	39	Filter	1
30	Panel assy	1	35-5	S hose: 24 dia.	1	40	Solar radiation sensor	1
32	Compressor	1	35-6	D hose	1			

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32.1 REMOVING AND INSTALLING

32.1.1 ATTACHMENT ASSY

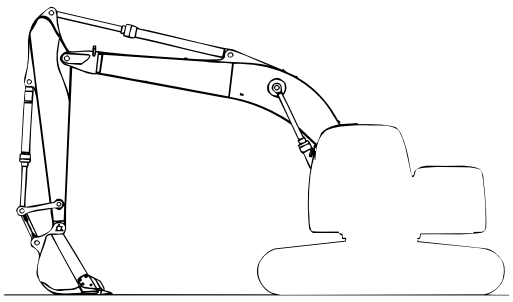


Front attachment and position

32.1.2 BUCKET

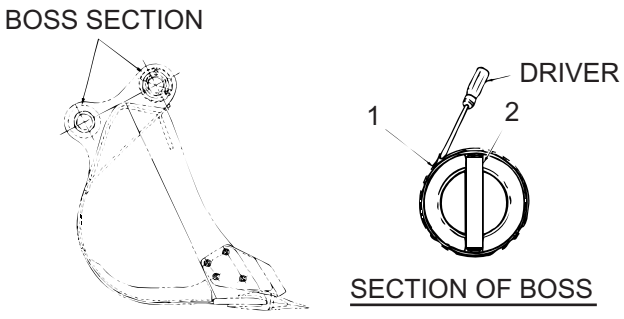
32.1.2.1 REMOVING BUCKET

(1) Put the machine in position to remove bucket.



Position to remove bucket

(2) Removing pin (2)
Expand slit of ring (1) with screwdriver, and remove it. Push out the pin (2) with flat-blade screwdriver .



Removing pin (2)

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33.1 REMOVING AND INSTALLING

33.1.1 OPERATOR SEAT

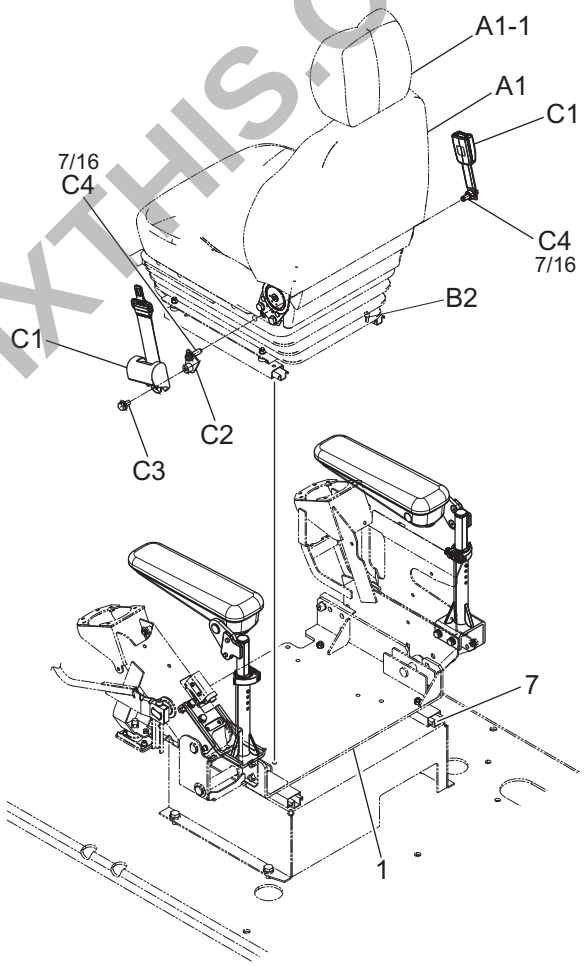
33.1.1.1 REMOVAL

(1) Preparation for removal

1. Remove the head rest (A1-1) of the operator's seat (A1) to ease handling.
2. Move the whole control stand to its foremost position.
3. Move the operator's seat to its forward end.
4. Incline the reclining seat as forward as possible.

(2) Remove operator's seat. (Include upper rail.)

1. With the above-mentioned condition, remove two cap screws (B2) M8X20 from the upper rail. Then move the control stand to its rearmost end and remove two capscrews (B2) M8X20.
   Tools: Allen wrench: 6mm
2. Remove the operator's seat. [about 28 kg (62 lbs).]
   Carry out the following operations as required.
3. Remove seat belt (C1), bracket (C2).
4. Remove armrest (A3)(A4).
5. Remove bracket assy (1), rail (7).



Disassembling and Assembling seat

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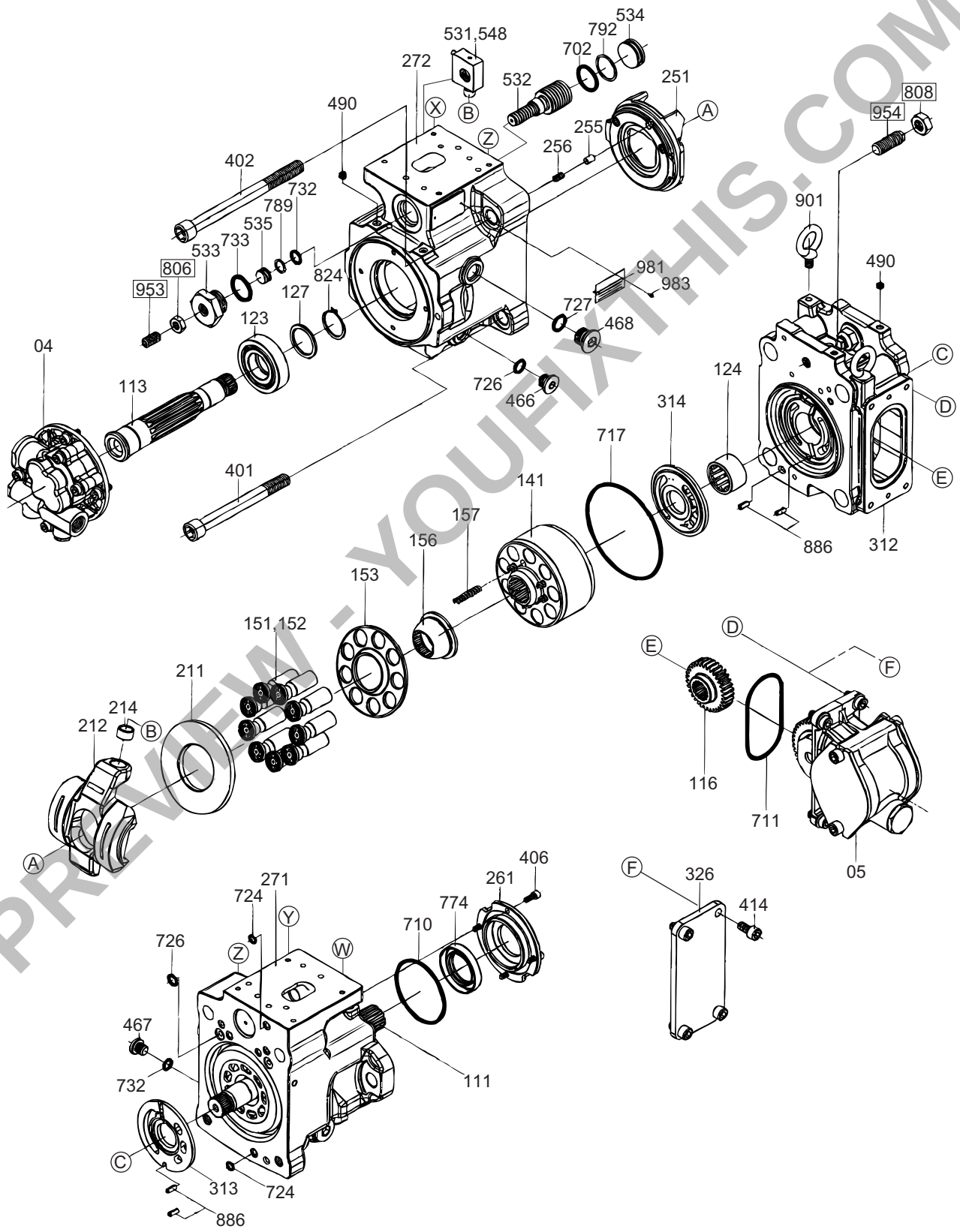
33.2 DISASSEMBLING AND ASSEMBLING

33.2.1 HYDRAULIC PUMP - REGULATOR

33.2.1.1 HYDRAULIC PUMP

33.2.1.1.1 Structural exploded view

(1) Main pump



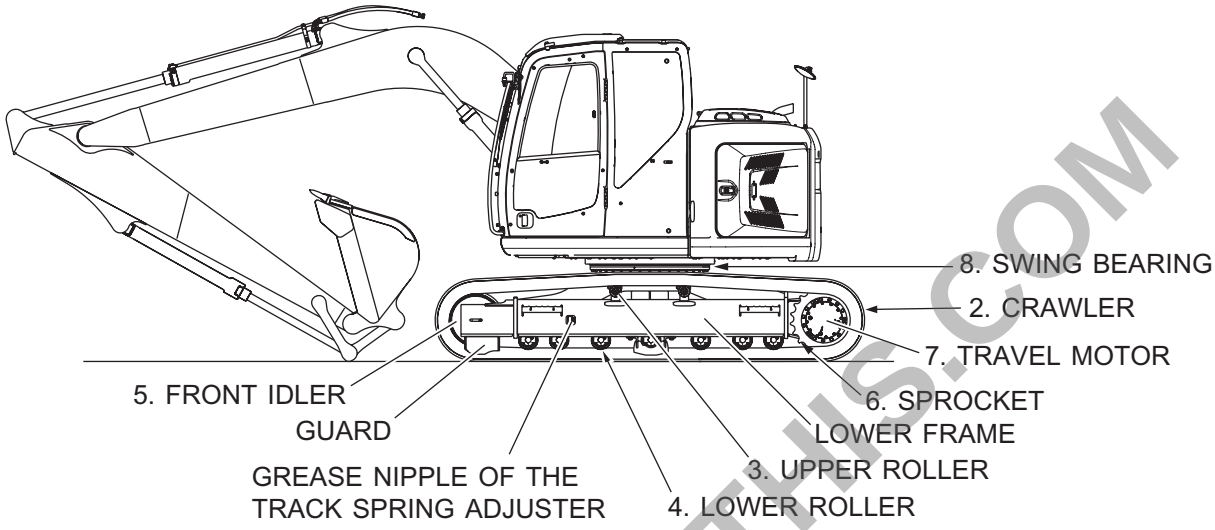
Structural exploded view of main pump

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34.1 REMOVING AND INSTALLING

34.1.1 TRAVEL SYSTEM



Designation and location of undercarriage

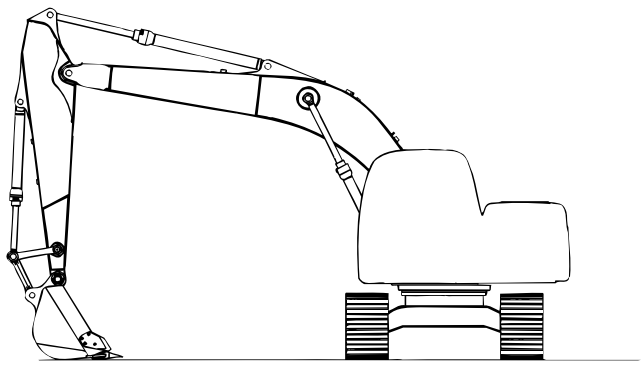
34.1.2 CRAWLER

34.1.2.1 REMOVING CRAWLER

(1) Position the machine to remove crawler.

(2) Pushing out master pin.

1. Find the master pin and place it in its removing/ fixing position in below Fig.
2. Loosen the grease nipple and slacken crawler.
   Tools: Socket: 19 mm



Crawler removing position

CAUTION

-When loosening the grease nipple of the adjuster, do not loosen it more than one turn.
-Where grease does not come out well, move the machine back and forth. The over loosening of grease nipple may cause it to jump out incurring danger of injury. So be careful not to over loosen the grease nipple.

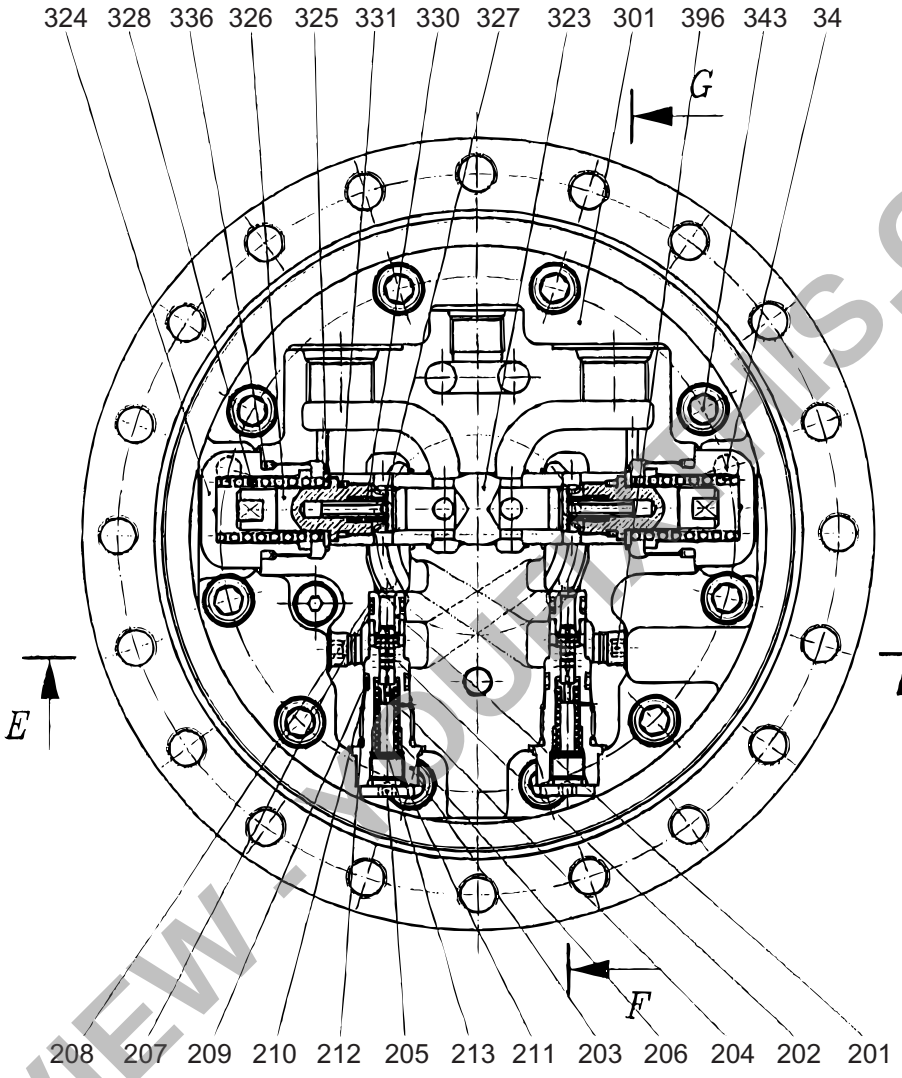
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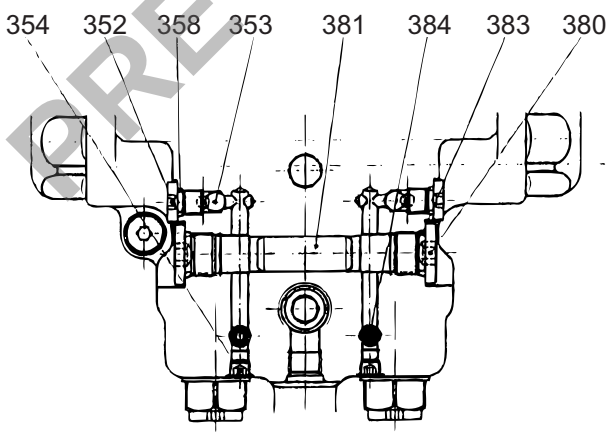
34.2 REMOVAL AND INSTALLATION OF TRAVEL MOTOR UNIT

34.2.1 CONSTRUCTION OF TRAVEL MOTOR

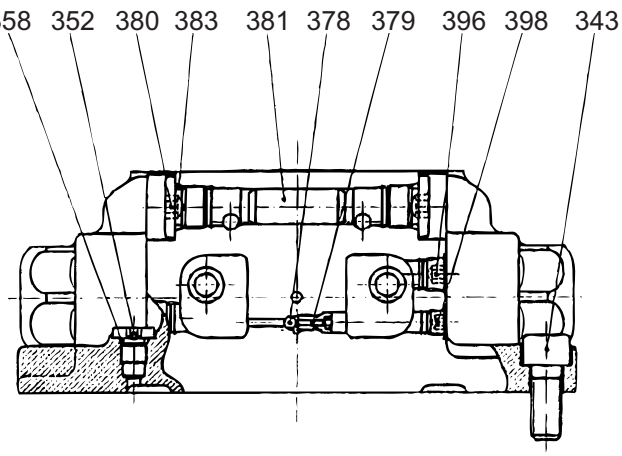
34.2.1.1 CROSS-SECTIONAL VIEW OF TRAVEL MOTOR ASSEMBLY



SECTION A-A



SECTION D-D



SECTION E-E

Cross-sectional view of travel motor unit assembly (1/2)

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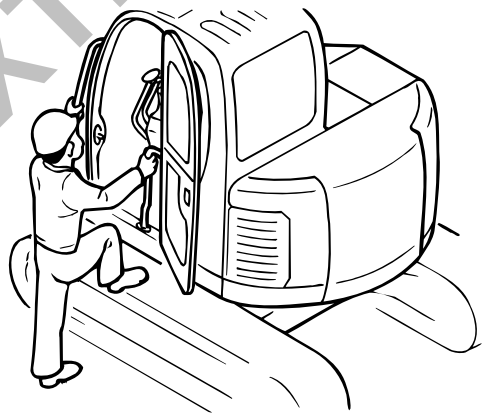
46.1 JUDGMENT OF ACTUAL THING AT SITE

(1) Get to the site as quickly as possible.
Verify model, serial number, situation of trouble and field, and notify person of arrival time.
(2) Verify background of trouble occurred
1. Model name and serial number
2.
Kind of attachment
Check that the combination of attachment is proper or that the operating method is not unreasonable.
3. Operating time by hour-meter
4.
History of trouble occurred and additional works.
5.
Recurrence of past trouble, or problems on the additional works.



Verifying background of trouble occurred.

(3) How to diagnose trouble
1. Verify defective part
2. Make the condition of trouble again
3.
Where defective parts can not be verified, surmise causes systematically.
4. Verify reasons for surmise
5.
Report methods, procedure, and period for repairing to user.



Confirm the symptoms of the trouble.

(4) Explanation of the cause of trouble
1.
Explain the cause of trouble to clients. For example, oil leak through piston is caused by flaws on the piston rod. And the method of using the machines should be explained so that the same kind of trouble does not reoccur.
2.
Treatment of damaged parts
The damaged parts to be claimed and returned are evidence so they should be handled with care. Protect them from entry of water, soils, etc. into port of hydraulic unit, etc. and return them. And also use care not to flaw and damage those surfaces.



Diagnosing fail by means troubleshooting.

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47. TROUBLESHOOTING (BY TROUBLE)

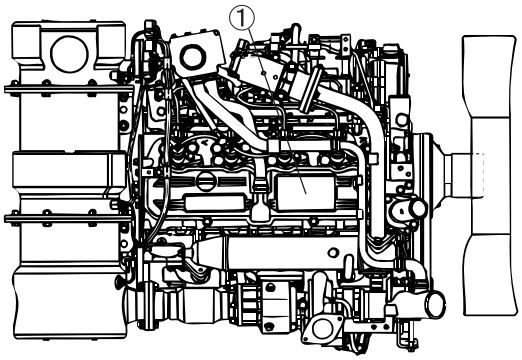
(1) All controls do not function/slow

No.	Sections	Contents/normal value		Corrective action, others
1	Fuse	Check fuse No.4 (10A)	If the fuse is blown out, check on the short-circuited section.	
2	Safety lever lock switch	Carry out service diagnosis	No.4 K-4 switch: Push down the lever and it turns on, push up and it turns off.	Check action of switch by tester, or check that the power voltage is lowered by pushing the lever down.
3	Safety lever lock switching	Check that the solenoid is switched correctly	Measure both terminals of solenoid connector. 24V by pushing the lever down, 0V by pushing it up	Check solenoid unit for possible failure. Check harness for possible failure.
4	Safety lever lock relay	Carry out service diagnosis	No.4 K-4 lock lever: Push down the lever and it turns off, push up and it turns on.	Check action of relay by tester
5	Pilot pressure sensor	-Stop engine stop and key is on position. All pilot low pressure sensors are 0MPa to 0.1MPa.	Check 5V power for controller	
6	Solenoid valve for safety lock lever	Measure pressure of solenoid A1 port	About 0MPa by pushing the lever up, and 4MPa or more by push it down.	Replace solenoid valve
7	Pilot line filter	Disassemble and check it visually	Check filter for clogging	Clean filter
8	Pilot gear pump	Measure pilot primary pressure at gear pump	Check that it is 4MPa or more in high idling	Check gear pump and the relief valve for possible failure
9	Multi control valve (in case that travel is operable)	Change position	Since all are blocked due to poor switching performance, check that the lever select pattern is set to the proper position.	
10	Actual measuring current value of P1/P2 unload proportional valve	Carry out service diagnosis	-No.7 D-1 P1 unload valve (cut valve) D-1 P2 unload valve (cut valve) -See Service Diagnosis Data List Operation No.3 Boom up full lever & relief	In case where the reading is largely differed from the actually measured value, check proportional valve and controller for possible failure.
11	Secondary pressure of P1, P2 unload proportional valve	Measure the proportional valve secondary pressure directly at the ports A7 and A5 of 7 sections solenoid block	Check that P1/P2 unload secondary pressures are within the range of 0.5 to 1.2MPa in boom up full lever and high idling operation	Replace proportional valve

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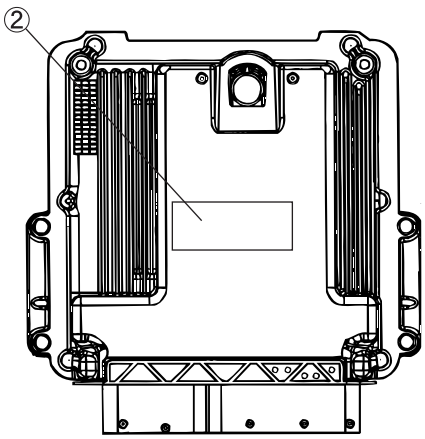
a) Serial No. plate on the top of engine



① Serial No. plate on the top of engine



b) Serial No. plate on the top of engine ECU.



ECU, CONTROLLER

② Serial No. plate on the top of engine ECU



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1. Maintenance Service Data

1.1 Maintenance Service Data of Engine General

Unit: mm [in.]

Item			Nominal value	Standard value	Limit value	Remarks
Compression pressure			2.9 MPa {30 kgf/cm²} [420.6 psi] (300min^{-1})		2.6 MPa {27 kgf/cm²} [377.1 psi]	At the oil temperature and water temperature at 20 to 30 °C [68 to 86 °F].
Engine oil pressure	at rated		0.2 to 0.4 MPa {2 to 4 kgf/cm²} [29.0 to 58.0 psi]		0.15 MPa {1.5 kgf/cm²} [21.76 psi]	At the oil temperature is 70 to 110 °C [158 to 230 °F].
	When idling:		0.1 MPa {1 kgf/cm²} [14.5 psi]		0.05 MPa {0.5 kgf/cm²} [7.25 psi]	
Valve Timing	Inlet	Open	BTDC 18°			±2° (Crank angle)
		Close	ABDC 54°			
	Exhaust	Open	BBDC 66°			
		Close	ATDC 22°			
Valve clearance (when cold)	Inlet			0.25 [0.0098]		
	Exhaust			0.25 [0.0098]		
Fan belt deflection				11 to 13 [0.43 to 0.51]		Deflection when pushed firmly with thumb New part standard 9 to 11 [0.35 to 0.43]

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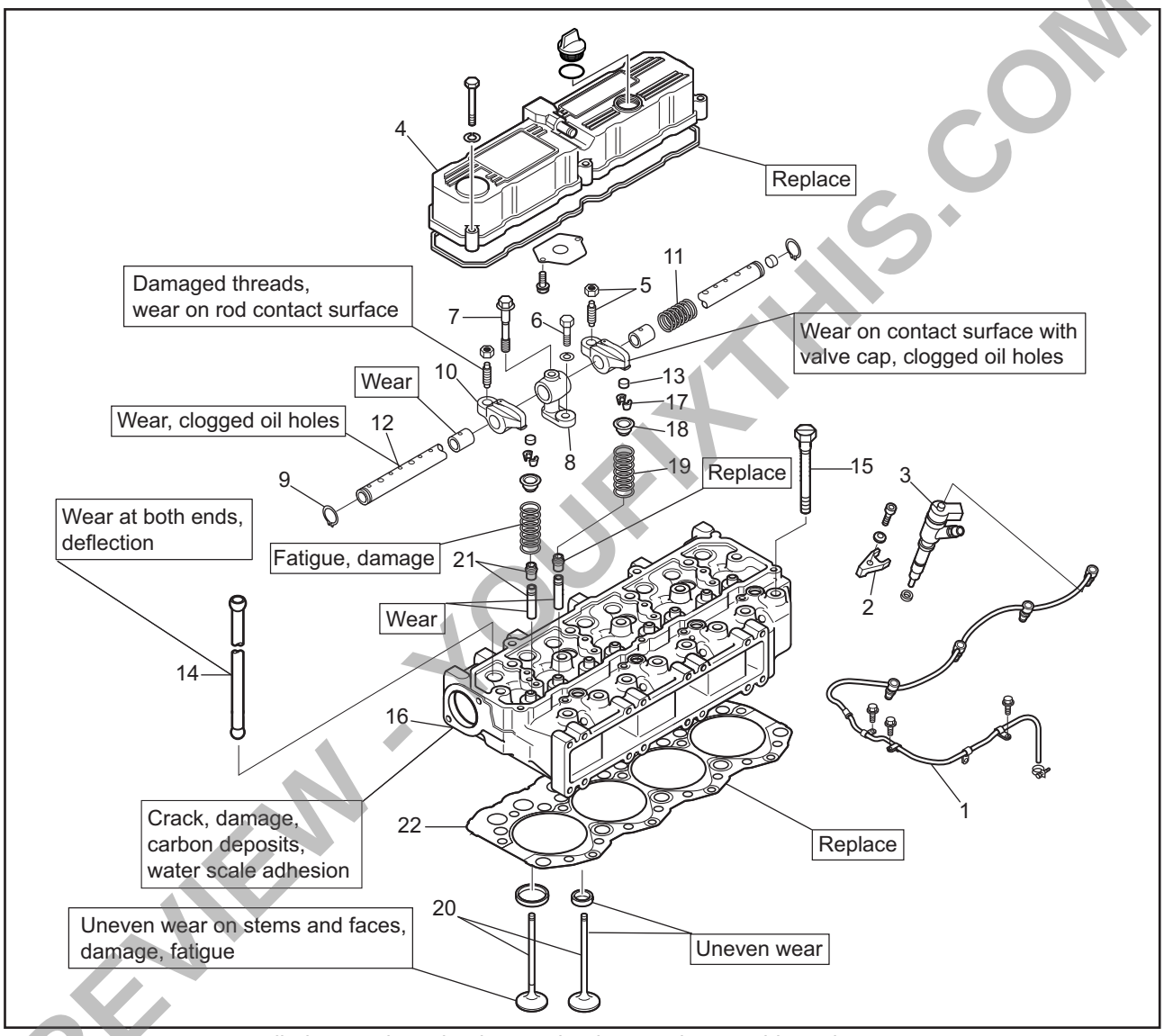
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1. Cylinder Heads and Valve Mechanisms - Disassemble and Inspect

Understanding of the current engine condition before disassembling is very important to know the cause of trouble and do the efficient work.

Depending on the maintenance work or purpose, it is desirable to inspect some of the following items before proceeding with any job.

- Inspection of valve clearance
- Measurement of valve sinkage



Cylinder Heads and Valve Mechanisms - Disassemble and Inspect

Disassembling sequence

1 leak-off hose
2 Nozzle gland
3 Injector
4 Rocker cover
5 Adjusting screw
6 Rocker bracket bolt (short)
7 Rocker bracket bolt (long)
8 Rocker shaft bracket
9 Snap ring
10 Rocker arm
11 Rocker shaft spring
12 Rocker shaft
13 Valve cap
14 Push rod
15 Cylinder head bolt
16 Cylinder head
17 Valve cotter
18 Valve retainer
19 Valve spring
20 Valve
21 Valve, valve stem seal
22 Cylinder head gasket

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1. Environmental Condition to Disassemble and Assemble the Fuel System

To keep the cleanliness in installing, removing, inspection and repair works of the fuel system of this engine, obey the instructions below:

- **Clean the engine before the work.**
- **Cover the electronic components and connectors to protect the electric system and avoid the electrical leak and short circuit.**
- **Drying and cleaning with compressed air must be applied before removing the fuel system to prevent the injection pipe from dust entering.**
- **Seal the openings of fuel system parts with plugs or others immediately after the removal to avoid entering of foreign substances.**
- **The assembling job must be done on a clean stainless-steel-top work table.**
- **Use clean tools, and clean the tools after the job.**
- **Install a filter to the air inlet fan if installed on the working room. Do not use fan in the working room.**
- **The worker must not wear fuzzy clothes, must wear clean dothes and must not use hand cream or others. Wear rubber gloves for presice-part work if needed.**

2. Fuel System - Remove

⚠ WARNING

(a) Do not place flame or heat near the fuel system when removing. It may cause a fire.

(b) Wipe off any spilled fuel. The spilt fuel may cause a fire.

(c) Do not start the disassembling job immediately after the engine stop. Highly pressurized fuel may remain in the fuel system parts such as high-pressure pump, common rail and injection pipe.

(d) Stop the fuel supply from the fuel tank then start the work.

CAUTION

(a) Plug or cover the inlet and outlet of each part to prevent the fuel system from dust entering.

(b) Ask the specialized service shop for the maintenance job of high-pressure pump, common rail and injector if the procedure is not written in this manual.

(c) Clean the fuel system inside with the clean fuel oil if foreign substances enter the fuel system.

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SAFETY PRECAUTIONS

WARNING

The proper and safe lubrication and maintenance for this machine, recommended by Manufacturer, are outlined in the OPERATOR'S MANUAL for the machine.
Improper performance of lubrication or maintenance procedures are dangerous and could result in injury or death. Read and understand the MANUAL before performing any lubrication or maintenance.

The serviceman or mechanic may be unfamiliar with many of the systems on this machine. This makes it important to use caution when performing service work. A knowledge of the system and or components is important before the removal or disassembly of any component.

Because of the size of some of the machine components, the serviceman or mechanic should check the weights noted in this manual. Use proper lifting procedures when removing any components. Weight of components table is shown in the section ; SPECIFICATIONS.

The following is a list of basic precautions that must always be observed.

(1) Read and understand all Warning plates and decal on the machine before Operating, Maintaining or Repairing this machine.

(2) Always wear protective glasses and protective shoes when working around machines. In particular, wear protective glasses when using hammers, punches or drifts on any part of the machine or attachments. Use welders gloves, hood/goggles, apron and the protective clothing appropriate to the welding job being performed. Do not wear loose fitting or torn clothing. Remove all rings from fingers, loose jewelry, confine long hair and loose clothing before working on this machinery.

(3) Disconnect the battery and hang a "Do Not Operate" tag in the Operators Compartment. Remove ignition keys.

(4) If possible, make all repairs with the machine parked on a firm level surface. Block the machine so it does not roll while working on or under the machine. Hang a "Do Not Operate" tag in the Operators Compartment.

(5) Do not work on any machine that is supported only by lift, jacks or a hoist. Always use blocks or jack stands, capable of supporting the machine, before performing any disassembly.

WARNING

Do not operate this machine unless you have read and understand the instructions in the OPERATOR'S MANUAL. Improper machine operation is dangerous and could result in injury or death.

(6) Relieve all pressure in air, oil or water systems before any lines, fittings or related items are disconnected or removed. Always make sure all raised components are blocked correctly and be alert for possible pressure when disconnecting any device from a system that utilizes pressure.

(7) Lower the bucket, dozer, or other attachments to the ground before performing any work on the machine. If this cannot be done, make sure the bucket, dozer, ripper or other attachment is blocked correctly to prevent it from dropping unexpectedly.

(8) Use steps and grab handles when mounting or dismounting a machine. Clean any mud or debris from steps, walkways or work platforms before using. Always face to the machine when using steps, ladders and walkways. When it is not possible to use the designed access system, provide ladders, scaffolds, or work platforms to perform safe repair operations.

(9) To avoid back injury, use a hoist when lifting components which weigh 20kg (45lbs) or more. Make sure all chains, hooks, slings, etc., are in good condition and are the correct capacity. Be sure hooks are positioned correctly. Lifting eyes are not to be side loaded during a lifting operation.

(10) To avoid burns, be alert for hot parts on machines which have just been stopped and hot fluids in lines, tubes and compartments.

(11) Be careful when removing cover plates. Gradually back off the last two capscrews or nuts located at opposite ends of the cover or device and carefully pry cover loose to relieve any spring or other pressure, before removing the last two capscrews or nuts completely.

(12) Be careful when removing filler caps, breathers and plugs on the machine. Hold a rag over the cap or plug to prevent being sprayed or splashed by liquids under pressure. The danger is even greater if the machine has just been stopped because fluids can be hot.

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2. Brake Valve

a. Operation (Brake released)

The pressure oil is led to through port (A), opens valve (327), and led to port (C) on the section side of hydraulic motor to rotate hydraulic motor.

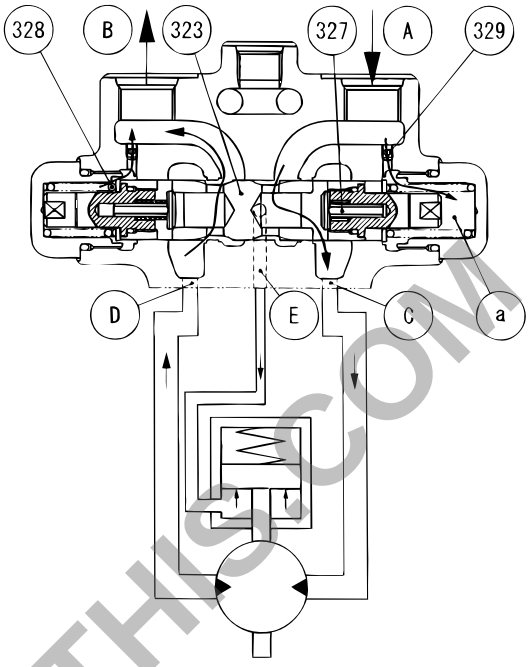
At the same time, the pressure oil enters chamber (a) through orifice (329), and exerts on the end of spool (323) to generate the force. Then the force of spring (328) slides the spool (323) placed on the neutral position leftward.

The sliding of spool (323) forms the space (passage) between spool (323) and rear flange (301) with spool groove.

This passage is connected to port (D) and port (B) of the return circuit of the hydraulic motor, and the returns oil returns to tank side, enabling hydraulic motor to rotate.

Then, the sliding of spool (323) leads pressure oil to port (E). The pressure oil led to port (E) moves piston (112) of parking brake, and releases parking braking force. (For details, refer to item "Parking brake".)

If pressurized oil is supplied from port (B), the movements of spool (323) and valve (327) are reversed so that the hydraulic motor is rotated reversely.

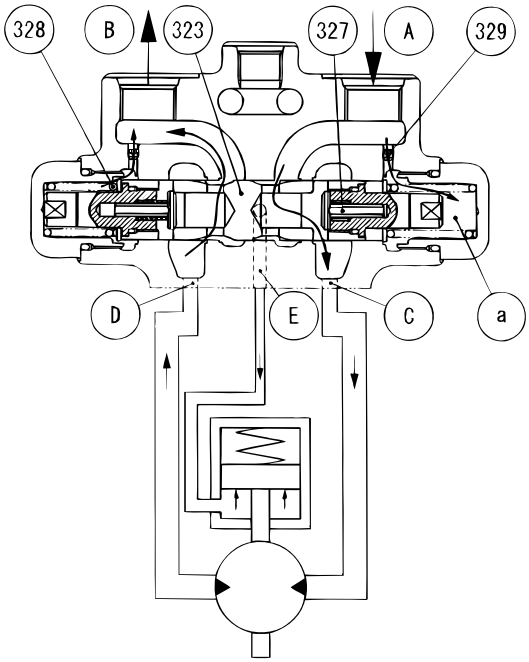


b. Self-traveling

While machine is being operated, as the travel speed is increased due to steep slope, the oil flow rate of the hydraulic motor is higher than the supply flow rate of the hydraulic oil pump.

The rotation of the hydraulic motor in this case is called a self-traveling. (Overrun) While self-traveling, the pressure is lowered similar to the stopping condition. Then brake valve is moved similar to the stopping condition, throttles passage in the return side of hydraulic motor, and generate backing pressure.

In addition, the force of inertia decreases the revolution of hydraulic motor to revolution having a balance with the supply flow rate of pump.



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(13) Removing rear flange

1. Turn over GM motor. (Rear flange (301) is on top.)

Note

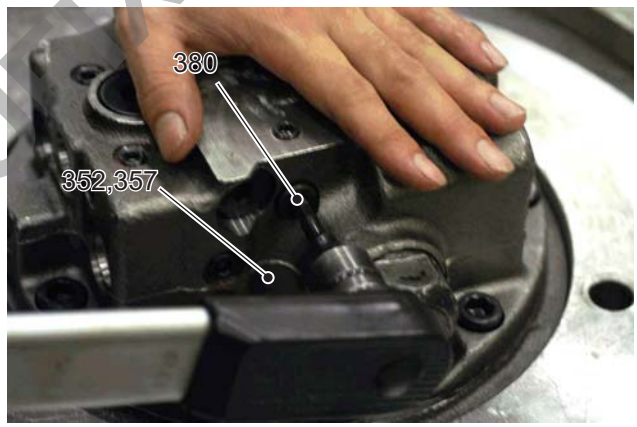
This work is carrying out to remove easily the pugs (324) at the following work.
Do not loosen the plugs (324) if the inside of rear flange assembly is not disassembled.

2. Temporarily loosen plugs (324) (2 plugs).



Removing plugs (324)

3. Temporarily loosen plugs (380) (2 plugs).



Removing plugs (380), (352), (357)

Note

This work is carrying out to remove easily the pugs (380) at the following work.
Do not loosen the plugs (380) if the inside of rear flange assembly is not disassembled.

4. Temporarily loosen plugs (352) (2 plugs).

Note

This work is carrying out to remove easily the pugs (352) at the following work.
Do not loosen the plugs (352) if the inside of rear flange assembly is not disassembled.

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