160X4

A3 Assembly Diagrams

SERVICE MANUAL

Mar. 2015

SUMITOMO

	Pressure line		Pilot tank line
	Tank line		Electric line
	Pilot pressure line		

1	Travel motor	11	Check with travel merge orifice	21	Backward left
2	Boom (up)	12	Boom (down)	22	Forward left
3	Boom (down)	13	Boom (up)	23	Forward right
4	Cushion valve	14	Travel mode select switch	24	Backward right
5	Remote control valve (boom, bucket)	15	Travel high speed	25	Oil cooler
6	Control valve	16	Lever lock	26	Check valve
7	Travel (right)	17	Console lever lock switch	27	Boom cylinder
8	Travel (left)	18	4 stack solenoid valve	28	Main computer
9	Straight travel valve	19	Hydraulic pump	29	Travel pilot pressure sensor
10	Proportional valve	20	Travel remote control valve	30	Boom-up pilot pressure sensor

As an example, this section explains the case in which forward travel and boom-up operations are carried out simultaneously.
By operating the travel remote control valve to the forward side, the pilot pressure oil is fed to the control valve 5a1 port and switches the left travel spool to the forward side.
In the same way, the oil is also fed to the 4a1 port and switches the right travel spool to the forward side.
The discharge oil from hydraulic pump A1 enters the control valve PR (P1) port and the discharge oil from hydraulic pump A2 enters the control valve PL (P2) port. Switching the left and right travel spools lets each oil flow to the respective travel motor, and causes forward travel.
If a boom-up operation is carried out during travel, the pilot pressure oil is fed via the cushion valve to the control valve 4b2 and 5a3 ports and switches the boom (1) (2) spools to the up side.
When a compound operation (it is a boom-up operation and travel left/right operation this time) are detected by the sensor, the pilot pressure oil is fed from the proportional valve to the straight travel valve and switches the straight travel spool.
The amount of switching of the straight travel spool varies with the upper pilot pressure. (The pilot pressure is low for slight upper operation, so the amount of switching of the straight travel spool is slight to prevent sharp reduction in the travel speed.)
Switching the straight travel makes it possible for the PR (P1) port pressure oil to drive travel and for the PL (P2) port pressure oil to drive the upper.
Since the left and right motors are driven by 1 pump for travel, the left and right motors have the same pressure and straight travel is possible.
Furthermore, the PL (P2) port excess oil is fed to the travel side via the check with travel merge orifice to minimize the drop in speed.
The same operations are carried out when travel and an upper actuator other than for the boom are operated simultaneously.

	Pressure line		Pilot tank line
	Tank line		Electric line
	Pilot pressure line		

1	Swing motor	7	Check valve	13	Main computer
2	Cushion valve	8	Oil cooler	14	Control valve
3	Right swing	9	Lever lock	15	Attachment pilot pressure sensors
4	Left swing	10	Swing brake	16	Hydraulic pump
5	Swing pilot pressure sensor	11	4 stack solenoid valve		
6	Remote control valve (arm, swing)	12	Console lever lock switch		

When the engine is started and the swing lever is in neutral, the swing brake solenoid valve comes ON (24 V input), the pressure to the swing motor P port is cut, and the swing parking brake works.
When the lever operation raises the reading to higher than the specified pressure value at the pressure sensor in the swing pilot line, the output from the main computer to the swing brake solenoid valve goes OFF, the swing motor P port pressure rises, the swing parking brake is released, and swing becomes possible.
As an example, this section explains the case in which the right swing operation is carried out.
By carrying out the right swing operation on the remote control valve, the pilot pressure oil is fed to the control valve 5b2 port via the cushion valve and switches the swing spool to the right swing side.
At the same time, the main computer detects the swing pilot pressure sensor signal, judges that there is a swing operation, the electrical signal output from the main computer goes OFF, and switches the swing brake solenoid valve.
The pilot pressure oil is fed to the swing motor P port from the swing brake solenoid valve C2 port to release the swing parking brake.
The discharge oil from hydraulic pump A1 enters the control valve PR (P1) port and is fed via the parallel oil path to the swing spool. Switching the spool lets the oil flow into the swing motor B port and the right swing operation is carried out.
The pressure oil from the swing motor A port returns to the hydraulic tank through the swing spool.
When this is followed by an attachment operation, the pilot pressure is detected by respective port pressure sensors and the swing parking brake continues to be released.
After the swing operation ends, if about 5 sec. pass with no upper operation, the swing brake solenoid valve output from the main computer comes ON and the swing parking brake works again.
After the swing ends, if this is followed by an upper operation, when about 1 sec. passes after the end of the upper operation, the swing parking brake works again.
The swing parking brake is also released for independent upper operations and when about 1 sec. passes after the end of the upper operation, the swing parking brake works again.

Key switch	Swing pilot pressure sensor	Attachment pilot pressure sensors	Swing brake solenoid valve	Swing motor mechanical brake
OFF	OFF	OFF	OFF	ON
ON	OFF	OFF	ON	ON
ON	Specified pressure	OFF	OFF	OFF
ON	OFF	Specified pressure	OFF	OFF
ON	Specified pressure	Specified pressure	OFF	OFF

	Pressure line		Pilot tank line
	Tank line		Electric line
	Pilot pressure line		

a	To tank line

1	Cushion valve	10	Lever lock	19	P1 pressure sensor
2	Boom (up)	11	Pressure boost relief	20	P2 pressure sensor
3	Boom (down)	12	4 stack solenoid valve	21	Hydraulic pump
4	Boom cylinder	13	Control valve	22	Check valve
5	Load holding valve check	14	Boom HBCV spool	23	Oil cooler
6	Bleed-off	15	Boom HBCV poppet	24	Boom-down pilot pressure sensor
7	Check A	16	Console lever lock switch	25	Load holding valve poppet
8	Back pressure check valve	17	Monitor display		
9	Remote control valve (boom, bucket)	18	Main computer		

By operating the remote control valve to the boom-down side, the pilot pressure oil is fed via the cushion valve to the control valve 4a2 port and switches the boom (1) spool to the down side.
The discharge oil from hydraulic pump A2 enters the control valve PL (P2) port and is fed via the center bypass oil path to the boom (1) spool.
Switching the spool lets the oil flow into the boom cylinder rod side, and the boom-down operation is carried out.
The pilot pressure oil from the Ps2 port is fed to the load holding valve check.
This opens the load holding valve poppet.
The pilot pressure oil flows into the HBCV PL port and switches the HBCV spool.
This opens the HBCV poppet.
The pressure oil at the boom cylinder bottom side passes through the HBCV poppet, load holding valve poppet, and boom (1) spool and pushes open check A through the back pressure check valve and is regenerated on the cylinder rod side.
The lower the cylinder rod side load pressure, the greater the volume of regeneration.
When the cylinder rod side load pressure becomes high, the check is closed and the cylinder bottom side return oil returns to the hydraulic tank through the boom (1) spool without regeneration.
Because the circuit is configured in such a way that, even if the boom (1) spool is at full stroke, negative control pressure is generated by the center bypass bleed-off oil path and the pump does not discharge full flow, the shortfall is made up for with regeneration, and engine output can be used effectively.

	Pressure line		Pilot tank line
	Tank line		Electric line
	Pilot pressure line		

a	To tank line

1	Arm (in)	8	Control valve	15	Arm cylinder
2	Arm (out)	9	Hydraulic pump	16	Oil cooler
3	Cushion valve	10	Console lever lock switch	17	Check valve
4	Remote control valve (arm, swing)	11	Monitor display	18	Arm HBCV spool
5	Lever lock	12	Main computer	19	Arm HBCV poppet
6	Pressure boost relief	13	Load holding valve poppet		
7	4 stack solenoid valve	14	Load holding valve check		

When the remote control valve arm operation lever is in neutral, the oil at the arm cylinder rod side is sealed by the load holding valve check, reducing internal leakage from the main spool and reducing the natural drop of the arm.
By operating the remote control valve to the arm-in side, the pilot pressure oil is fed via the cushion valve to the control valve 5b52 port and 4a4 port and switches the arm (1) (2) spools to the in side.
The discharge oil from hydraulic pump A1 enters the control valve PR (P1) port and is fed via the center bypass oil path to the arm (1) spool.
The discharge oil from hydraulic pump A2 enters the control valve PL (P2) port, flows via the center bypass oil path and arm (2) downstream arm merge oil path, and merges downstream of the arm (1) spool.
Switching the arm spool lets the oil flow into the arm cylinder bottom side, and the arm-in operation is carried out.
At the same time, the pilot pressure oil from the Ps2 port operates on the load holding valve poppet and the poppet opens.
In this way, the load holding valve check spring chamber oil is connected to the tank line through the load holding valve poppet, the spring chamber pressure drops, and the load holding valve check is opened.
The pilot pressure oil separated from the 5b52 port is fed to the holding control valve (HBCV) PL port and moves the HBCV spool.
In this way, the HBCV poppet spring chamber oil is connected to the tank line through the HBCV spool, the spring chamber pressure drops, and the HBCV poppet is opened.
The arm cylinder rod side pressure oil returns to the hydraulic tank through the HBCV poppet, load holding valve poppet and the arm (1) spool.

	Pressure line		Pilot tank line
	Tank line		Electric line
	Pilot pressure line		

1	Arm (in)	6	Cushion valve	11	Control valve
2	Arm (out)	7	Remote control valve (arm, swing)	12	Hydraulic pump
3	Cushion spool	8	Lever lock	13	Oil cooler
4	Orifice	9	4 stack solenoid valve	14	Check valve
5	Check valve	10	Console lever lock switch		

When a remote control valve arm-out operation is carried out, the pilot pressure oil enters from the remote control valve 4 port into the cushion valve, pushes up the internal check valve, and is fed to the control valve 5a5 and 4b4 ports.
At the same time, the oil switches the cushion valve cushion spool to the left.
The arm-in side oil pushed out from the control valve 4a4 and 5b52 ports passes from the cushion valve B port through the cushion spool switched to the left and returns to the hydraulic tank.
At this time, the warmed oil from the return line returns to the hydraulic tank through the cushion spool from the cushion valve R port, so heat performance is improved.

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Explanation of Hydraulic Circuit and Operations (option)

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	Pressure line		Pilot tank line
	Tank line		Electric line
	Pilot pressure line		

a	Fork close
b	Fork open

1	Control valve	7	Lever lock	13	Check valve
2	Hydraulic fork	8	4 stack solenoid valve	14	Oil cooler
3	Stop valve	9	Console lever lock switch	15	2 stack solenoid valve
4	Port relief valve	10	Hydraulic pump	16	ATT select switch
5	Monitor display	11	Lever switch	17	P1 pressure sensor
6	Main computer	12	P1 flow control proportional valve		

As an example, this section explains the case in which the hydraulic fork attachment is used.
By operating the lever switch to the fork-close side, the 2 stack solenoid valve is switched. The pilot pressure oil is fed to the control valve 5b4 port and switches the option spool to the close side.
The discharge oil from hydraulic pump A1 enters the control valve PR (P1) port, and is fed via the parallel oil path to the option spool. Switching the option spool lets the oil flow into the hydraulic fork, which operates to the close side.
At this time, the lever switch signal is detected, and the P1 flow control proportional valve is controlled by the output signal from the main computer to adjust the discharge flow.
The return oil from the hydraulic fork returns to the hydraulic tank through the option spool.
The option spool port relief valve pressure becomes the hydraulic fork set pressure.

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Electrical Connector Wiring Diagram

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Note

1.For connectors marked with *, install the suitable housing.

a	The terminals (CN. B24F, 25F, 26F) must be fastened with red tape.	c	CN. B21F must be fastened with red tape.	e	CN. B8F must be fastened with red tape.
b	CN. B6F must be fastened with red tape.	d	CN. B4F must be fastened with red tape.		

*1	White adhesive tape	*3	Blue adhesive tape
*2	Red adhesive tape	*4	Plate position

A42F	Cab main harness: A	B13F	Travel alarm switch
A43F	Cab main harness: B	B14F	Air conditioner panel: A
A44F	Cab main harness: C	B15F	Air conditioner panel: B
A45F	Cab main harness: D	B16F	Air conditioner unit: A
B1F	Starter switch	B17F	Air conditioner unit: B
B2M	Engine throttle switch	B18F	Radio
B3F	Gate limit switch	B19M	Option harness
B4F	Gate; Diode	B20F	Suspension seat
B5F	Knob right 1; Switch	B21F	Seat; Diode
B6F	Knob right 2; Switch	B22F	Air conditioner GND
B7F	Knob left 1; Switch	B23F	Computer GND
B8F	Knob left 2; Switch	B24F	+B 12 V
B9F	Engine stop switch	B25F	Ignition 12 V
B10F	Fan reverse switch	B26M	GND 12 V
B11F	Overload	B27F	Free swing switch
B12F	Beacon switch		

a	Plate

*1	Joint section details	*3	3-wire compound cable
*2	Heat shrink tubes (5 locations)	*4	White adhesive tape

CN.D1M	CCD camera
CN.D2F	CAB CCD harness