

1. How to use this manual (857S-0005-1E)

- (1) Carry out preoperational checks before starting operation.
(2) Check each test item according to the testing schedule of monthly and yearly tests.

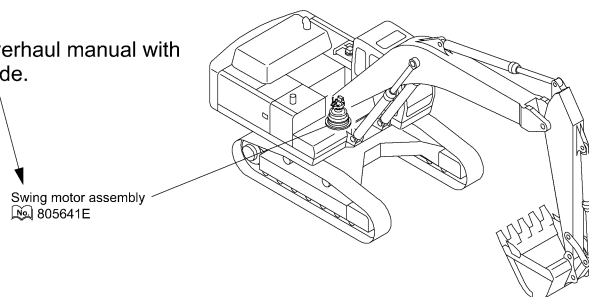
If a problem occurs

Refer to each equipment chapter and investigate the location of the problem.

C: Layout and circuit diagram of equipment	H: Superstructure
D: Engine unit	I: Lower structure
E: Hydraulic pump equipment	J: Electrical equipment
F: Control equipment	APC100: Refer to the separate manual.
G: Front attachment	

- If disassembly of hydraulic units and other devices is required, refer to the "disassembly and assembly of equipment" section of each equipment chapter.
- The manual code of the "overhaul manual" of hydraulic units and other devices required for disassembly and assembly is printed, so refer to that procedure manual.

Refer to the overhaul manual with this manual code.



857S-00671E

When you have repaired any malfunctioning parts, carry out the specified inspections and check that there is enough oil.

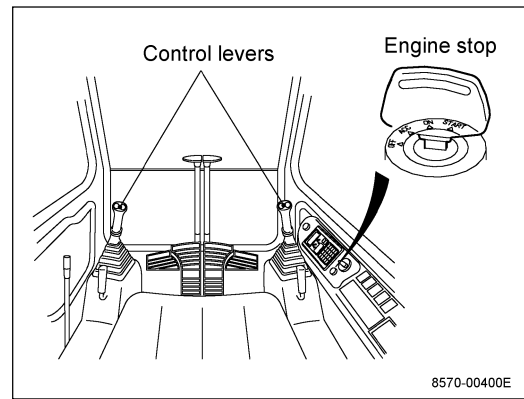
When replacing parts, always check them with reference to the relevant parts list.

Carry out preoperational checks and test-run the equipment unloaded to confirm its safety.

Start work.

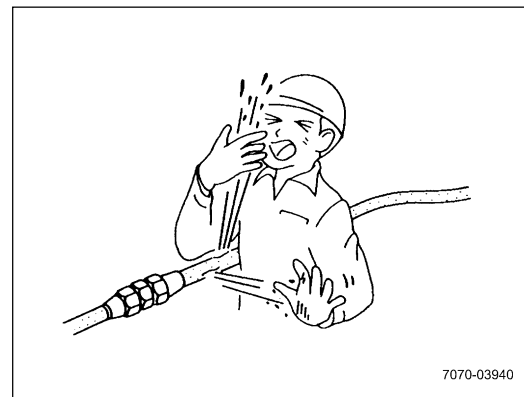
(9) Relieve hydraulic pressure

- Stop the engine and move the control levers for one or two minutes to relieve pressure.
- It is dangerous to replace or repair hydraulic hoses, joints and equipment without relieving pressure first.



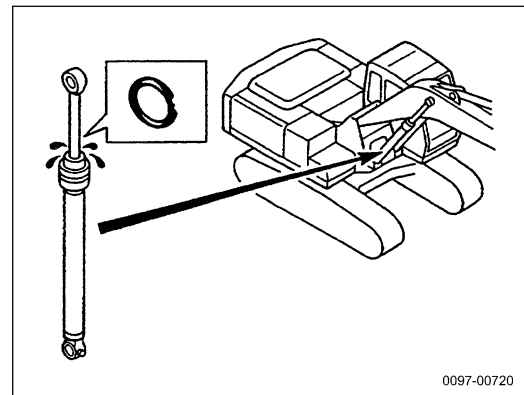
(10) Beware of highly pressurized oil

- Hydraulic oil or reduction gear oil at high pressure can cause serious skin and eye injuries.
Before cutting or opening a hydraulic pipe, always relieve the pressure inside it.
- Oil leakage may not be visible to the eye, so check with thick paper or wood-shavings. Do not detect oil leakage by naked hand or finger.
- Wear protective goggles to protect your eyes.
- If oil penetrates your skin, consult a doctor well experienced immediately.



(11) Precautions on replacing seals etc.

- After you remove an O-ring or other seal, wash the surfaces on which it was fitted before you fit the replacement.
- Before you fit an O-ring or other seal, check that it is undamaged and cover it with a film of oil. If you find a defective seal of any kind, do not use it because it could cause oil leakage.



(12) Be careful when you open the radiator cap

- When the radiator coolant is hot, it could spray out dangerously when you take the radiator cap off, possibly causing burns.
- If you have to take the radiator cap off, wait until the coolant has had time to cool and slowly loosen the cap to allow pressure to dissipate before you remove it. Check the coolant level and top up with the coolant from the reserve tank.



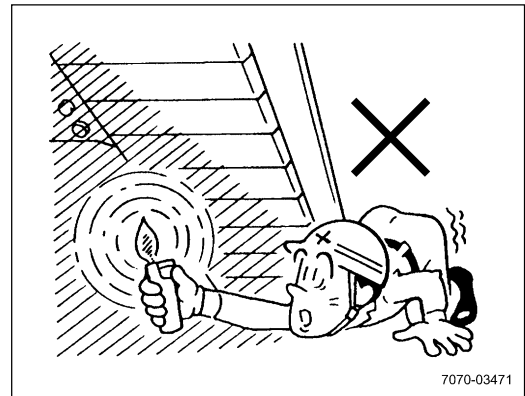
(24) The equipments are hot immediately after the engine stops

- The equipments are hot immediately after the engine stops, so you could be burned if you touch them. In particular the engine, silencer, oil reservoir, coolant, radiator, sliding parts, hydraulic equipment, pipes etc. will be very hot.
- Wait for all parts to cool before you begin inspection and servicing.



(25) Illumination

- If you are working in poor light, you cannot see well enough what you are doing, so you could injure yourself. Before operation, prepare illumination enough to light the working place.
- Do not use a lighter or other flame in place of a lamp to light dark places. You could start a fire or cause an explosion by igniting gas generated by the battery.
- Use an explosion-preventive type of lamp when looking at the battery or fuel.



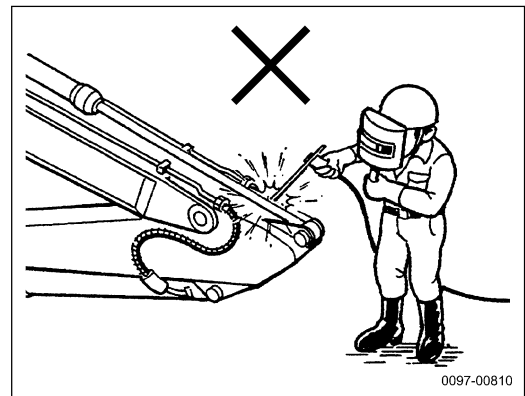
CAUTION

(8270-0160-1E)

The power socket for the lighter on the dashboard in the cab can be used as the 24V power source for up to 5A.

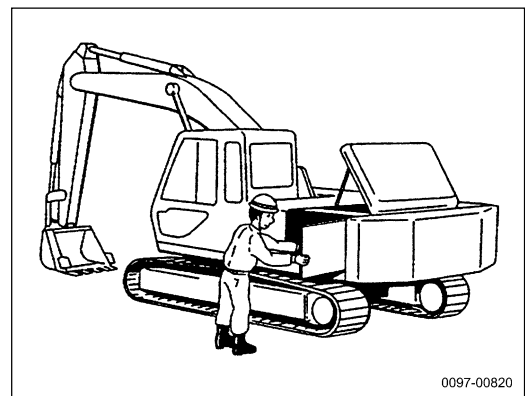
(26) Do not heat hydraulic equipment or pipes

- If you heat hydraulic equipment or pipes or areas near them, it could generate and ignite flammable vapour or smoke. Avoid welding, soldering or heating with a torch near hydraulic equipment or pipes.
- If you directly heat pressurized pipes or rubber hoses, they may rupture suddenly.



(27) Lock all inspection covers

- If you leave the inspection covers open, they can swing shut suddenly when the wind blows and trap fingers etc.
- When you open an inspection cover or cab door, always use the stopper to lock it securely in the fully open position. When there is a strong wind, do not open the door or covers.



	Part	Inspection location and service task	Task	When defective	Daily		Weekly or 60h	Monthly or 100h	Every 250h	Every 6 months or 500h	Yearly or 1000h	Oil Part to change	Reference section		
					Pre-operational	Post-operational							Instruction manual	Service manual	
Swing-related	Swing motor reduction gear		Check oil level						○			—	4-4-1	H, 2-5	
			Replace						☆		○	GO	4-4-1	H, 2-5	
	Swing gear	Bearing	Abnormal noise on swinging	Inspect		○							—	5	H, 3-1
			Ball contact surface	Grease				○					EG	3-3	A, 6-3
	Swing gear	Gear tooth surface	Wear, damage	Inspect								○	—	3-3-1	H, 3-1
			Pinion	Grease							○		EG	3-3-1	A, 6-3
	Swing brake action		Inspect		○								—	—	
Front attachment-related	Bucket	Bucket pin	Grease		○							EG	5 3-3	A, 6-3	
		Cylinder pin (rod and bottom ends)	Grease				○					EG	3-3	A, 6-3	
		Deformation, cracks	Inspect		○								—	5	G, 2-1-2
		Worn points	Inspect or replace				○						Point	4-5-1	G, 2-1-7
		Wear and looseness of the side cutters	Inspect or replace		○								Side cutter	5 4-5-2	G, 2-1-8
	Boom	Bending, cracks	Inspect				○						—	5	G, 2-3
		Foot pin	Grease		○								EG	5 3-3	A, 6-3
		Cylinder pin (bottom end)	Grease		○								EG	5 3-3	A, 6-3
		Cylinder pin (rod end)	Grease				○						EG	3-3	A, 6-3
	Arm	Bending, cracks	Inspect				○						—	5	G, 2-2
		Boom and arm connection pin	Grease		○								EG	5 3-3	A, 6-3
		Cylinder pin (rod and bottom ends)	Grease				○						EG	3-3	A, 6-3
	Side link pin		Grease				○						EG	3-3	A, 6-3
	Damage or loss of the bolts and nuts which stop the pins		Inspect				○						—	—	G, 2-1 G, 2-2 G, 2-3

(947S-0048-3E)

7. Tightening torque table (0097-0022-0E)

7-1 Tightening torque for meter screw standard bolt (0097-0023-0E)

[Standard]

Units: N·m (kgf·m)

Nominal	Pitch	4.6	7T (reference)	8.8	10.9	12.9
M6	1.00	4 (0.4)	8 (0.8)	10 (1.0)	15 (1.5)	17 (1.7)
M8	1.25	9 (0.9)	18 (1.9)	24 (2.5)	35 (3.6)	41 (4.2)
M10	1.50	18 (1.8)	37 (3.7)	48 (4.9)	73 (7.5)	85 (8.7)
M12	1.75	31 (3.2)	67 (6.8)	87 (8.9)	127 (13.0)	149 (15.2)
M14	2.00	52 (5.3)	106 (10.9)	139 (14.2)	204 (20.8)	238 (24.3)
M16	2.00	81 (8.3)	166 (16.9)	217 (22.1)	318 (32.5)	371 (37.9)
—	—	—	—	—	—	—
M20	2.50	159 (16.2)	324 (33.0)	423 (43.2)	621 (63.4)	725 (74.0)
M24	3.00	274 (28.0)	560 (57.1)	731 (74.6)	1073 (109.5)	1254 (127.9)
—	—	—	—	—	—	—
M30	3.50	546 (55.8)	1116 (113.8)	1456 (148.6)	2139 (218.2)	2498 (254.9)

(541D-0152-0E)

[Fine]

Units: N·m (kgf·m)

Nominal	Pitch	7T (reference)	8.8
—	—	—	—
M8	1.00	20 (2.0)	26 (2.7)
M10	1.25	42 (4.2)	54 (5.5)
M12	1.25	74 (7.5)	96 (9.8)
M14	1.50	116 (11.8)	151 (15.4)
M16	1.50	179 (18.2)	233 (23.8)
M18	1.50	260 (26.5)	339 (34.6)
M20	1.50	363 (37.1)	474 (48.4)
M24	2.00	617 (62.9)	805 (82.1)
M27	2.00	896 (91.3)	1169 (119.3)
M30	2.00	1248 (127.3)	1629 (166.3)

(541D-0176-0E)

7-2 Tightening torque for designated bolt (8570-0096-0E)

Regarding tightening torques for the bolts related to the track shoe, swing gear, engine mounting and counterweight, abide by the values shown below.

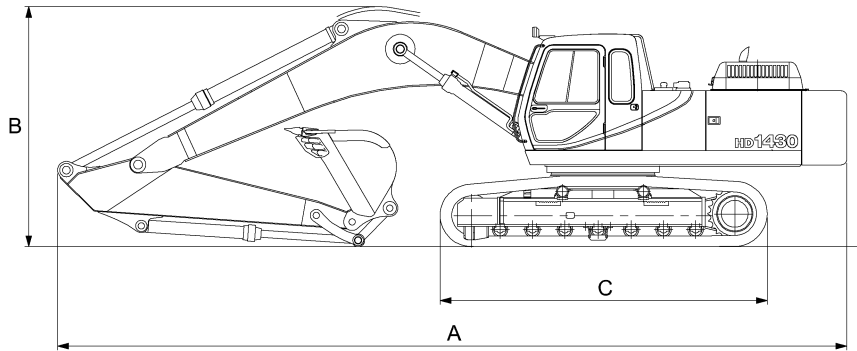
Track shoe	N·m (kgf·m)	843 (86)	
Swing gear	N·m (kgf·m)	1073 (109.5)	
Engine mounting	N·m (kgf·m)	Front	373 (38)
		Rear	549 (56)
Counterweight	N·m (kgf·m)	2908 (296)	

(8570-0051-1E)

4. Dimensions and weight (8570-0052-2E)

(1) Total weight

1) Without disassembly

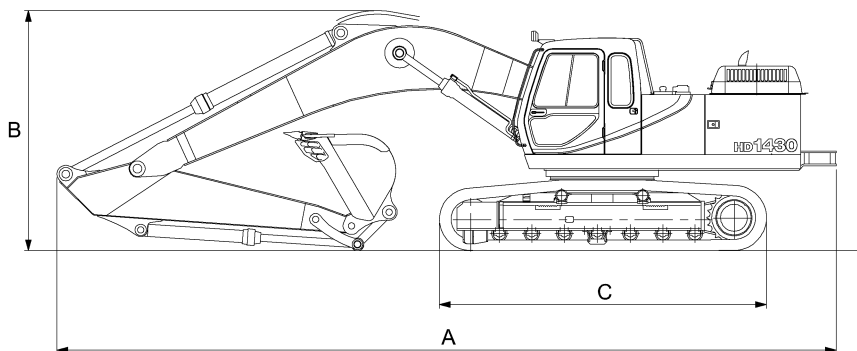


8570-00490

	A mm	B mm	C mm	Shoe type	Shoe width mm	Maximum width mm	Weight kg
STD	11200	3380	4640	Grouser	600	3200	30200
LC	11200	3380	4970	Grouser	600	3200	31100
BMH	11010	3470	4640	Grouser	600	3200	31300

(857E-0018-0E)

2) Without counterweight



8570-00500

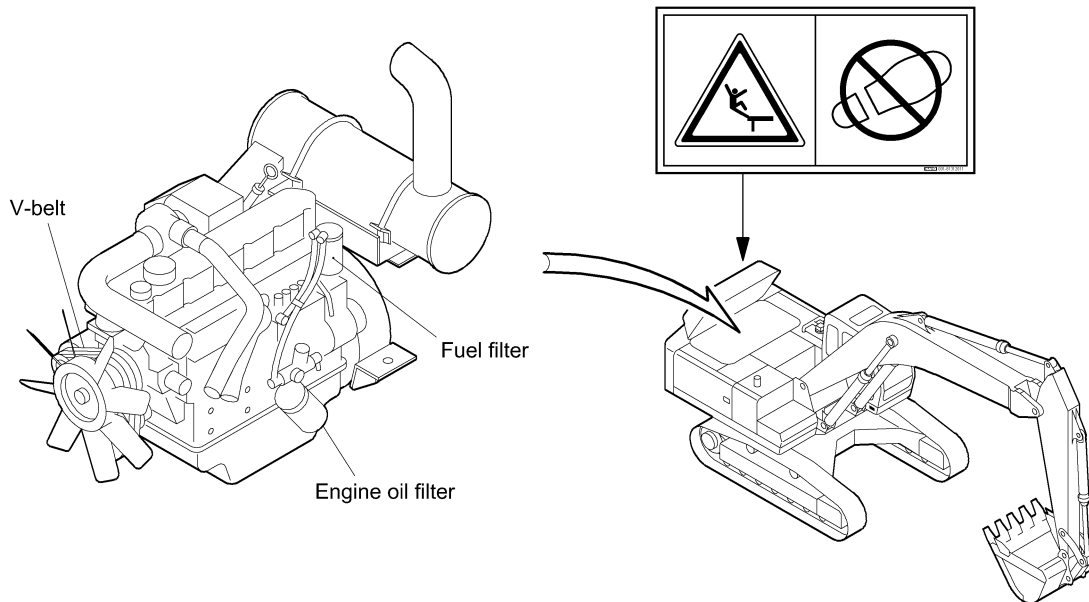
	A mm	B mm	C mm	Shoe type	Shoe width mm	Maximum width mm	Weight kg
STD	11060	3380	4640	Grouser	600	3200	23800
LC	11060	3380	4970	Grouser	600	3200	24700
BMH	10870	3470	4640	Grouser	600	3200	24900

(857E-0019-0E)

1. Engine-related equipment (937S-0110-0E)

1-1 Engine inspection and servicing (857S-0107-1E)

- Take the engine inspection points from the "Inspection and servicing table".
- Take the engine inspection methods from the separate engine manual.
- Refer to the separate service manual (electronic governor-equipped machine) for APC.



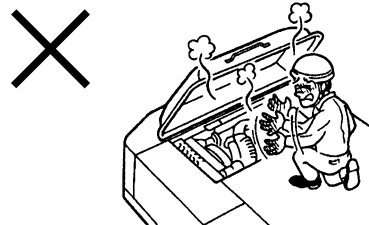
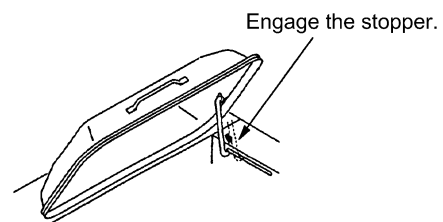
857E-00810E



WARNING

(8270-0172-2E)


- Always stop the engine before inspecting it.
If you inspect and service the engine while it is running, you risk severe injury by trapping your hands etc. in the cooling fan or fan belt.
- When you open the engine hood, always engage the stopper.
- Immediately after the engine stops each part will be very hot and you risk burns if you touch it. If you are going to open the engine hood to inspect the engine, check that it has cooled sufficiently.
- The sound absorbing material in the engine compartment is designated as a safety part for periodic replacement.
Inspect it at regular intervals and if any damaged is discovered, then replace it even if it is before the scheduled replacement time. If it falls off, it could cause a fire.



(4) Adding the coolant

Always check the coolant volume before starting the engine and check that the volume exceeds the "LOW" level of the reserve tank. Add the coolant if the level is low.

KATO Diesel Long Life Coolant is used in this machine. When adding the coolant, use KATO Diesel Long Life Coolant and avoid using plain water.



WARNING

(8570-0099-0E)

When you add the coolant, check that it has cooled sufficiently.

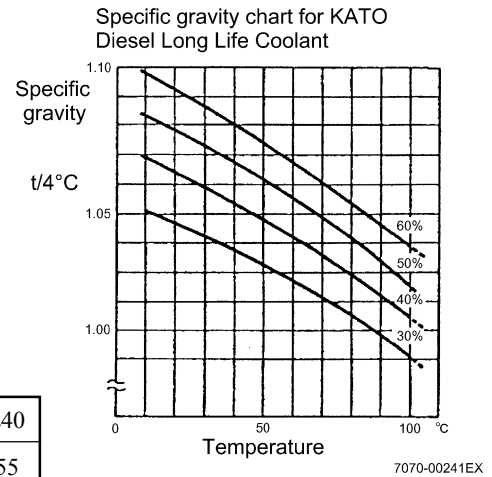
(5) Addition of Long Life Coolant and calculation of its concentration

1) The freezing temperature of the coolant varies greatly with the concentration of the Long Life Coolant it contains. Set the coolant freezing temperature 5°C below the lowest recorded temperature in the operating region and use that temperature to determine the required concentration of the Long Life Coolant and therefore the Long Life Coolant volume to add.

Coolant freezing temperature against addition volume of the Long Life Coolant


Freezing temperature	(°C)	-15	-20	-25	-30	-40
Long Life Coolant concentration	(%)	30	35	40	45	55
Long Life Coolant addition volume (L)		10.8	12.6	14.4	16.2	19.8
Water volume	(L)	25.2	23.4	21.6	19.8	16.2
Total coolant volume	(L)	36				

(Using KATO Diesel Long Life Coolant)
(857E-0034-0E)



2) If it is possible that the temperature may be about to drop below the freezing temperature of the coolant currently in use, add the Long Life Coolant.

Once you have finished adjusting the Long Life Coolant concentration, start the engine and allow it to mix the coolant fully, then use a hydrometer or concentration gauge to check the actual concentration.



CAUTION

(8570-0083-0E)

- Use only genuine KATO Diesel Long Life Coolant. Other brands could cause corrosion of copper and aluminum components and reduce their lifespan. The freezing temperature might be different, leaving the risk of freezing and engine damage.
- Use the Long Life Coolant within the concentration range between 30—60%. If the concentration is below 30%, anti-corrosion effect is reduced. If it is 60% or more, the freezing temperature becomes higher.
- If you top up the coolant level with water or repair coolant leakage, always recheck the Long Life Coolant concentration. If you do not check and adjust the concentration as necessary, the reduced Long Life Coolant concentration could allow freezing of the coolant which would damage the engine.

(1) Removal

- 1) Disconnect all hoses etc. from the pump. (Fig. ①)

Note Drain all hydraulic oil from the oil reservoir before you disconnect the suction hose.

- 2) Detach the stop cable for engine control from the engine. (Fig. ②)
- 3) Disconnect the heater hoses (for the machine with the heater provided) and fuel hoses from the engine. (Fig. ③)

Note Drain all fuel before you detach the fuel hose.

- 4) Disconnect the air conditioner hoses from the engine (for the machine with the air conditioner provided). (Fig. ④)

- 5) Remove the bolts which fasten the engine to the slewing table, attach the sling wire rope to the engine and lift it with a crane clear of the slewing table. (Fig. ⑤)

Note 1. Electrical wiring to the engine must be disconnected.

2. Mass

- ① Engine mass: 600kg (dry mass)
- ② Hydraulic pump mass: 149kg
- ③ Pump cover mass: 39kg

(2) Inspection and mounting

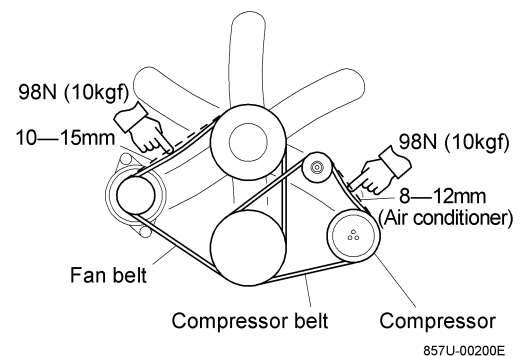
1) Inspection

Refer to the engine service manual for inspection and repair procedures for the engine.

2) Mounting

Reverse the removal procedure to remount the engine and then check the following points.

- ① Tightening torque for engine mounting bolts: 373N·m (38kgf·m) (front side)
549N·m (56kgf·m) (rear side)
- ② Thoroughly wipe away all traces of oil and grease from the threaded parts of the bolts and always apply screw-lock compound to them before tightening them.
- 3) After mounting it, check the following points.
 - ① Confirm that the engine stop cable is correctly attached to the engine.
 - ② Confirm that the oil pan drain plug on the underside of the engine is not loose and that the washer is in the place.
 - ③ Confirm for the tension of the fan belt. Confirm that fan belt pulley is not bent and that the belt is not chafed.



(3) Input and output specifications

1) Switch input

Terminal No.	Connect destination	Circuit	Input threshold voltage	Contact current (at DC28V)	Remarks
60	Starter switch (M)-1			5.0mA	
61	Starter switch (M)-2	↑	↑	↑	
65	Starter switch (ST)			5.0mA	
82	Memory clear connector			5.0mA	Normal close
71	Diagnosis display switch			5.0mA	Normal close
39	Accelerator switch-1			5.0mA	
67	Accelerator switch-2	↑	↑	↑	
49	Accelerator switch-3	↑	↑	↑	
86	APC controller Pin No. 7/CC2	↑	↑	↑	
70	APC controller Pin No. 12/CC1	↑	↑	↑	
81	APC controller Pin No. 5/CC1	↑	↑	↑	
97	APC controller Pin No. 4/CC1 Pin No. 13/CC1			5.0mA	
57	APC controller Pin No. 6/CC1 Pin No. 15/CC1	↑	↑	↑	

857S-00770E



CAUTION

(857S-0136-0E)

Input threshold voltage and contact current are ECU's real values, not guaranteed values.

2) Sensor input

Terminal No.	Connect destination	Circuit (inside of ECU)	Input characteristic	Remarks
73 (SIG) 83 (GND)	Accelerator dial			

857S-00780E

(2) Failure diagnosis item and backup

Diag- nosis code	Failure	Judgment condition	Diag- nosis lamp	Backup mode at the time of failure	Go/no-go for operation (*1)	Judgment criteria for resumption
01	Normal	—	—	—	○	—
07	Engine overrun	Engine speed \geq engine speed judged to be overrun	Red	Engine to be stopped by pull-down function (*2)	x	Engine speed \leq engine speed judged to be resumption of overrun
45	Engine reverse rotation	When starter switch turns OFF, engine speed is ultra-low.	Red	Engine to be stopped by pull-down function	x	Starter switch: ON or engine rotation=0 min ⁻¹
11	Governor servo system	Discrepancy between ECU command value and feedback value	Red	Engine to be stopped by pull-down function (possible to restart an engine)	Δ (*3)	ECU power source OFF
22	Rack sensor	0.5V \geq rack sensor \geq 4.4V	Red	Engine to be stopped by pull-down function (possible to restart an engine)	Δ (*3)	ECU power source OFF
14	Backup NE sensor	Cross check with NE sensor	—	Normal control (controlled by NE sensor)	○	Resumption of backup NE sensor pulse
15	NE sensor	Cross check with backup NE sensor	—	Normal control (controlled by backup NE sensor)	○	Resumption of NE sensor pulse
14+15	Both speed sensors	When starter switch turns ON, no pulse for neither of the rotation sensors	Red	Engine to be stopped by pull-down function	x	Starter switch: OFF or resumption of either of rotation sensor pulses
24	Accelerator dial (*5)	0.2V > accelerator dial > 4.8V (*6)	Orange	To be controlled by accelerator SW (1 : 0%, 2 : 69.5%, 3 : 100%)	Δ	0.2V \leq accelerator dial \leq 4.8V
32	Boost sensor	0.5V \geq boost sensor \geq 4.8V	Orange	Boost pressure to be fixed at 0 kPa (relative pressure)	Δ	0.5V < boost sensor < 4.8V
21	Coolant temperature sensor	Coolant temperature sensor \geq 4.9V	—	Coolant temperature to be fixed at 80°C (to be fixed at -20°C at engine start)	○	Coolant temperature sensor < 4.9V
19	Atmospheric pressure sensor	1.89V \geq atmospheric pressure sensor > 5.0V	—	Atmospheric pressure to be fixed at 101 kPa	○	1.89V < atmospheric pressure sensor < 5.0V
34	Q-Adjustment resistance	0.1V \geq Q resistor \geq 4.6V	—	Corrective value of injected quantity to be fixed at the lowest limit	○	0.1V < Q-Adjustment resistance < 4.6V
78	Heater relay	Detection of a break Detection of a short circuit	Orange	Startup preheat control to be discontinued	○(*4)	No detection of a break ECU power source OFF
33	System error	• Micro computer check error • CPU interactive monitoring error • Interrupt process overflow	Red	Engine to be stopped by pull-down function	x	ECU power source OFF

*1 ○ : Operation possible Δ : Operation with backup mode possible (traveling for repair only, no operation possible) x : No operation possible

*2 Pull-down function: Pullback action of rack, function to protect an engine by pulling the rack toward non-injection direction in case of engine overrun or severe failures

*3 Backup operation is possible by the limp home mode when the engine is restarted.

Limp home mode: Backup mode when the real rack position cannot be fed back due to governor servo system or rack sensor failures [when in limp home mode, diagnosis lamp-2 (orange) illuminates]

*4 Normal operation is possible, but an engine may not start in cold climates.

*5 APC100 may detect E31, E36, E37 etc. at the same time when diagnosis code No. 24 occurs.

*6 When the accelerator backup switch is switched to the "MANUAL" position, operations will be possible.

No.	Subject	Working details	Adjustment	Data name	Rated value
5	Check accelerator dial attachment status	① Turn the accelerator dial fully clockwise until it reaches the stopper. ② Read the SVAD data on the display and confirm that it is the rated value. ③ Turn the accelerator dial fully counterclockwise until it reaches the stopper. ④ Read the SVAD data on the display and confirm that it is the rated value.		SVAD	$4.22 \leq$ $SVAD \leq$ 4.75
				SVAD	$0.24 \leq$ $SVAD \leq$ 0.70
		[IF NOT] Adjust the accelerator dial attachment status so that each rated value is displayed in the items ② and ④ above.			
6	Check high idling speed	① Turn the accelerator dial fully clockwise until it reaches the stopper. ② Read the AES data on the display. ③ Set the accelerator switch to the "3" position and the accelerator backup switch to the "MANUAL" position. At this time, check that the displayed AES value is the same as item ② above.		AES	
		[IF NOT] Check the accelerator dial attachment status.			
		④ Return the accelerator backup switch to the "AUTO" position.			
7	Check low idling speed	① Turn the accelerator dial fully counterclockwise until it reaches the stopper. ② Read the AES data on the display. ③ Set the accelerator switch to the "1" position and the accelerator backup switch to the "MANUAL" position. At this time, check that the displayed AES value is the same as item ② above.		AES	
		[IF NOT] Check the accelerator dial attachment status.			
		④ Return the accelerator backup switch to the "AUTO" position.			
8	Complete adjustment	① Press switch "E" to return to the ADJUST MODE menu. ② Press switch "E" again to return to the normal mode.	<input type="checkbox"/> E <input type="checkbox"/> E		

(857A-0055-2E)

The main components of this machine are the crawler-type lower structure, superstructure which carries the engine, pumps, operator's seat etc., and front attachment comprising the boom, arm and bucket.

Each part is operated by pressurised oil sent from two engine-driven pumps P1 and P2. Pressurised oil from pump P1 passes to the control valve in block A and pressurised oil from pump P2 passes to the control valve in block B. The right control lever controls the boom and bucket cylinders while the left control lever controls the arm cylinder and the swing motor. The central traveling control levers operate the right and left traveling motors respectively.

The hydraulic circuit of this machine is equipped with the following safety devices to ensure smooth work and safeguard the hydraulic circuit.

- Travel brake valve and parking brake

When the machine is stopped, this automatic braking device operates to prevent the machine moving off down slopes or slipping on inclined roads, and the mechanical brake works securely when the machine is stopped and parked.

- Swing brake valve

Maintains an appropriate amount of speed reduction of the superstructure to prevent motor damage caused by the shocks when swinging stops.

- Swing parking brake

When swinging stops, this brake operates automatically to prevent the superstructure from swinging spontaneously on slopes.

- Anti-drift valve

Built into the boom cylinder bottom and arm cylinder rod sides of the control valve to reduce spontaneous fall of the attachments.

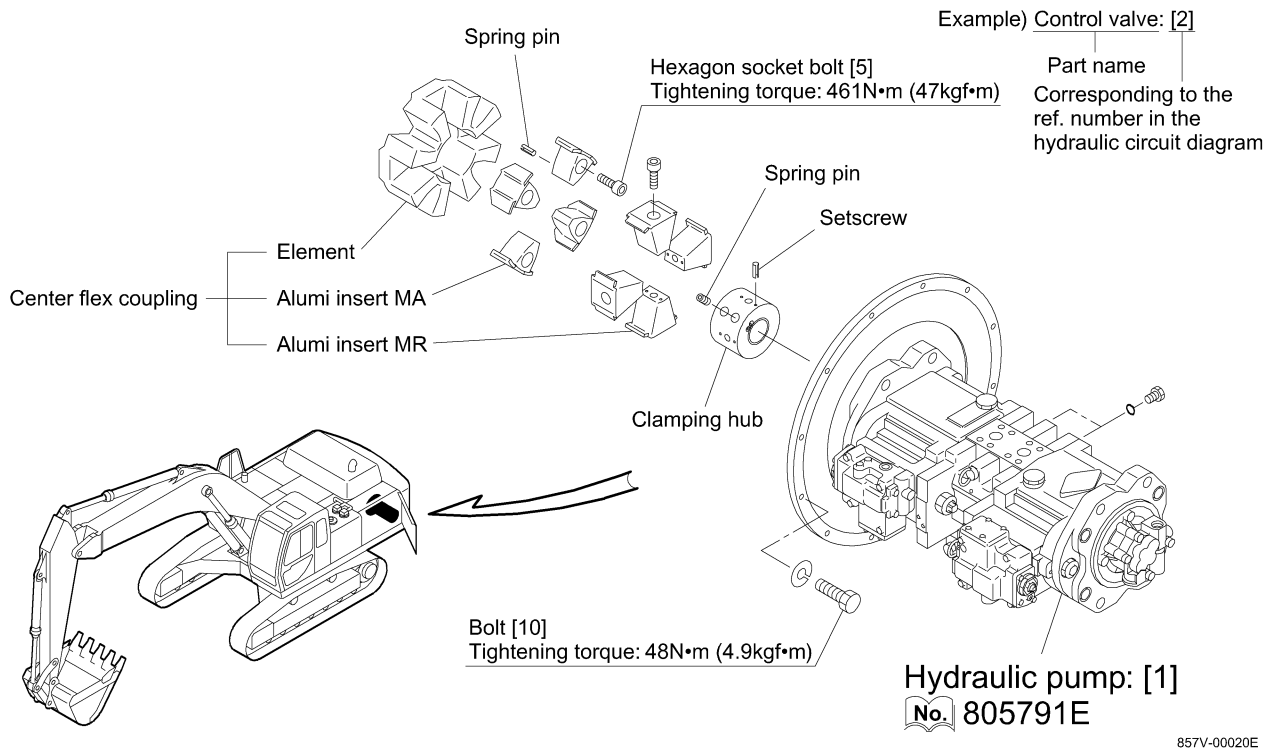
- Main relief valve

Built into the control valve to prevent damage to hydraulic equipment under overloads and to limit the working pressure of the hydraulic circuit.

- Overload relief valve

Built into the cylinder ports of the control valve to restrict abnormally high pressures inside the cylinders generated by overloading and protect the cylinders, boom, arm and bucket.

4-1-2 Pump and pump drive (857S-0026-1E)



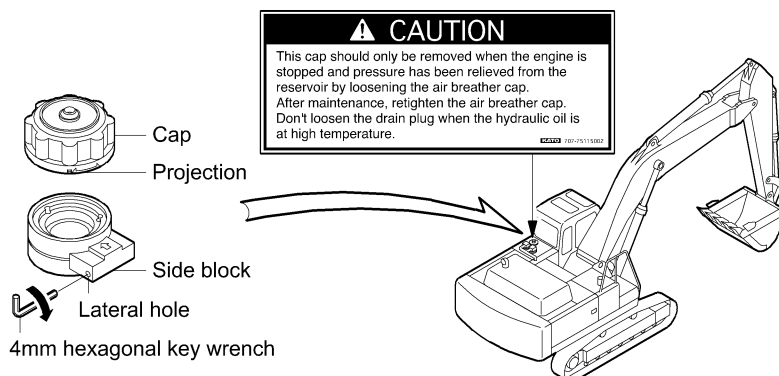
857V-00020E

(1) Reduction of pressure in the oil reservoir

When taking apart hydraulic piping or changing hydraulic oil, stop the engine and remove the air breather cap. Start work after pressure has been completely relieved. When you refill with hydraulic oil, remove the cover from the return filter.

1) How to remove and fit the air breather cap

- ① Insert a hexagonal key wrench (4mm) into the lateral hole in the side block.
- ② Turn the wrench to the outside and slowly turn the cap counterclockwise.
Pressure will be relieved and then you can remove the cap.
- ③ To refit the cap, align the projection on the cap with the arrow mark on the case, fit the cap in and turn it clockwise until it locks.



857E-00340E



CAUTION

(7770-0051-0E)

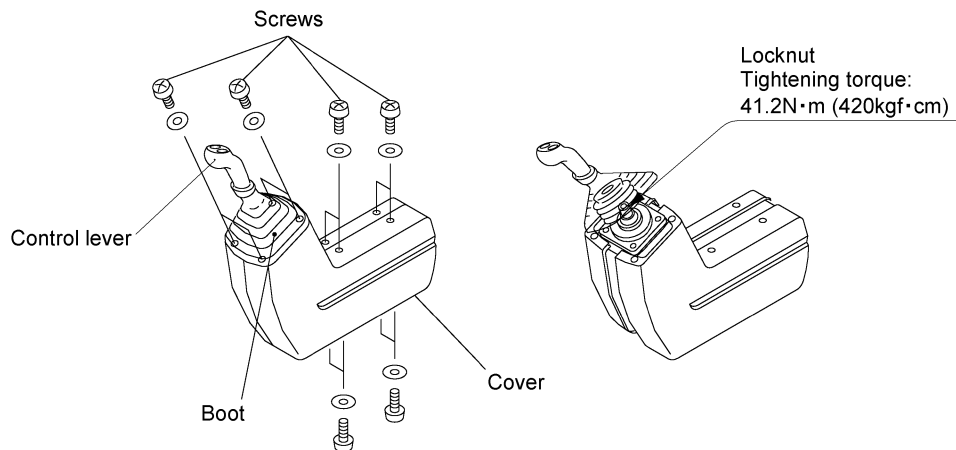
Always use the hexagonal key wrench to release the lock before you try to remove the cap.

2-1 Pilot valves (boom, arm, bucket, swing) (777S-0080-1E)

(1) Removal

- 1) Remove 12 screws (left and right) from the cover and lift the boot to unscrew the locknut of the control lever.
- 2) Disconnect the wiring cord from the control lever and detach the control lever from the pilot valve while turning it.
- 3) Remove the pilot valve attachment bolts and disconnect the hoses connected to the pilot valve with the pilot valve slightly raised.

Note Mark each hose with the name of the corresponding port to prevent mistakes in reassembly.



8370-00971EA

(2) Attachment

Reverse the removal procedure to attach the pilot valve with particular attention to the following points.

- 1) Tightening torque for the locknut of the control lever: 41.2N·m (420kgf·cm)
- 2) Secure the boot by using the cover to clamp it from the side.
- 3) Tighten the screws to the tightening torque about 0.39N·m (4kgf·cm). Do not over tighten the screws as this may crack the cover.
- 4) Put a bundle of wires into the "U" groove of the valve to press it down using the boot.