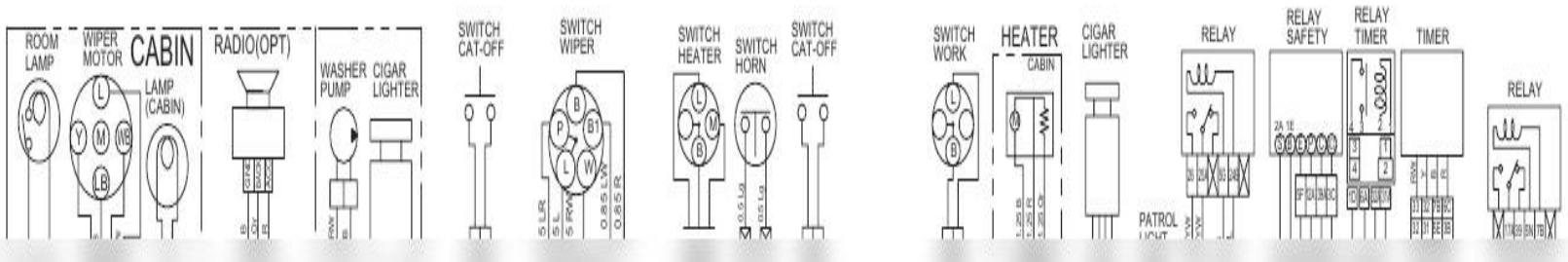
7. ADJUSTMENT AND REPAIR

7-1-3 Wiring Diagram

1) Standard Specifications



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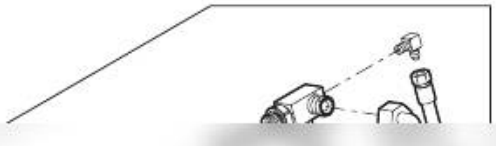
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7-5-8 Piping Layout

1) Upperstructure

(Hydraulic oil tank → Hydraulic pump → Control valve)



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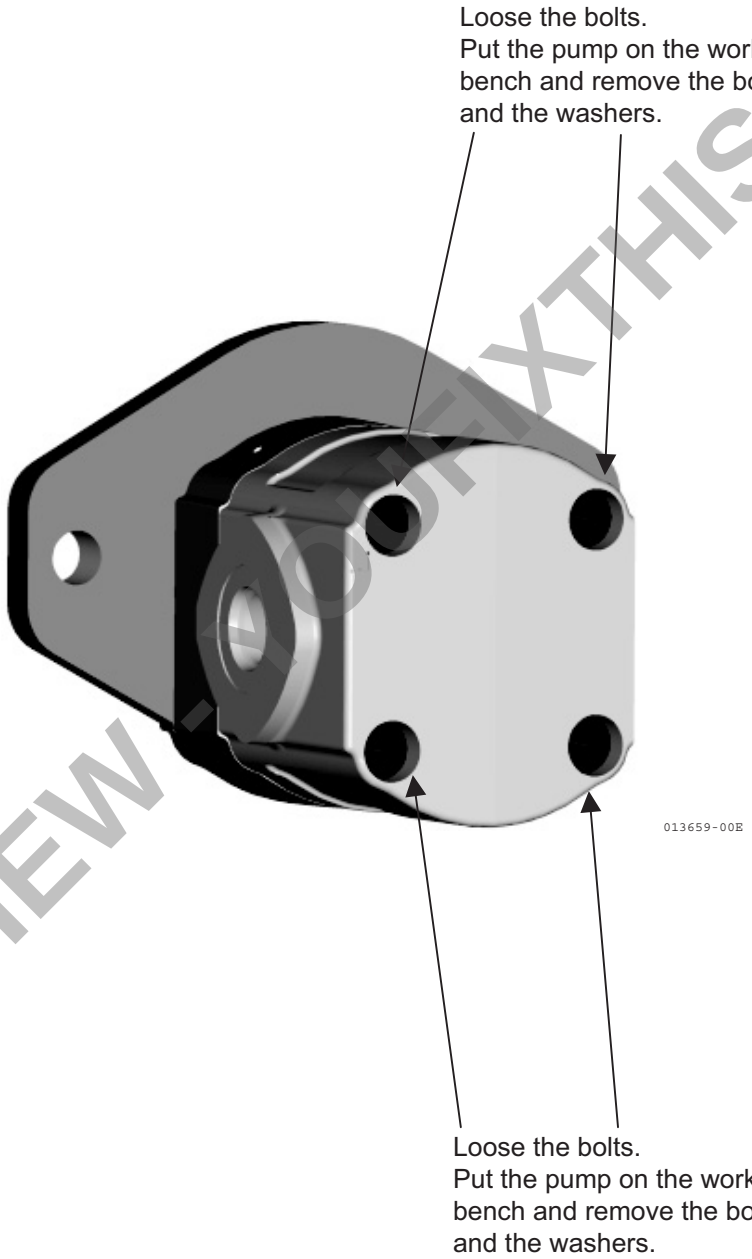
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6. Hydraulic Equipment

6-1 Hydraulic Pump

6-1-1 SV15

1. Disassembling



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3-7-2 Engine

Tightening torque for major bolts and nuts

No.	Item	Thread size × Pitch	Tightening torque Unit : N•m (kgf•m)	Lubricating oil
1	Cylinder head bolt	M9 × 1.25	53.9 to 57.9 (5.5 to 5.5)	Yes
2	Connecting rod bolt	M7 × 1.0	22.6 to 27.5 (2.3 to 2.8)	Yes

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1. GENERAL CAUTIONS FOR MAINTENANCE WORK

1. General Cautions for Maintenance Work

1-1 Correct Work

Correct work means the quickest possible completion of according to the correct procedures and the specified standards.

It is important when conducting certain operations always to bear in mind the equipment, tools, gauges, materials, oil and grease, etc. that you must have ready, as well as items to be checked, adjusted, or disassembled, and cautions to watch out for.

1-2 Safety Precautions

(1) Never attempt servicing while engine is running or immediately after stopping operation.
(2) Wear work cloths, safety shoes and helmet.
(3) Check the equipment and tools before use. Especially, be sure to check the crane, lifting equipment and tools.
(4) When working together with other persons, allocate everyone's share of job, arrange the signals and act in concert with the other persons.
(5) The operation of the crane and slinging work must be performed by qualified persons.
(6) Do not enter or pass under the raised load.
(7) Lift and support the massive parts by crane before removing the installation bolts.
(8) Disconnect cables from battery before repairing the electric system.
(9) Remove the battery when welding the machine.

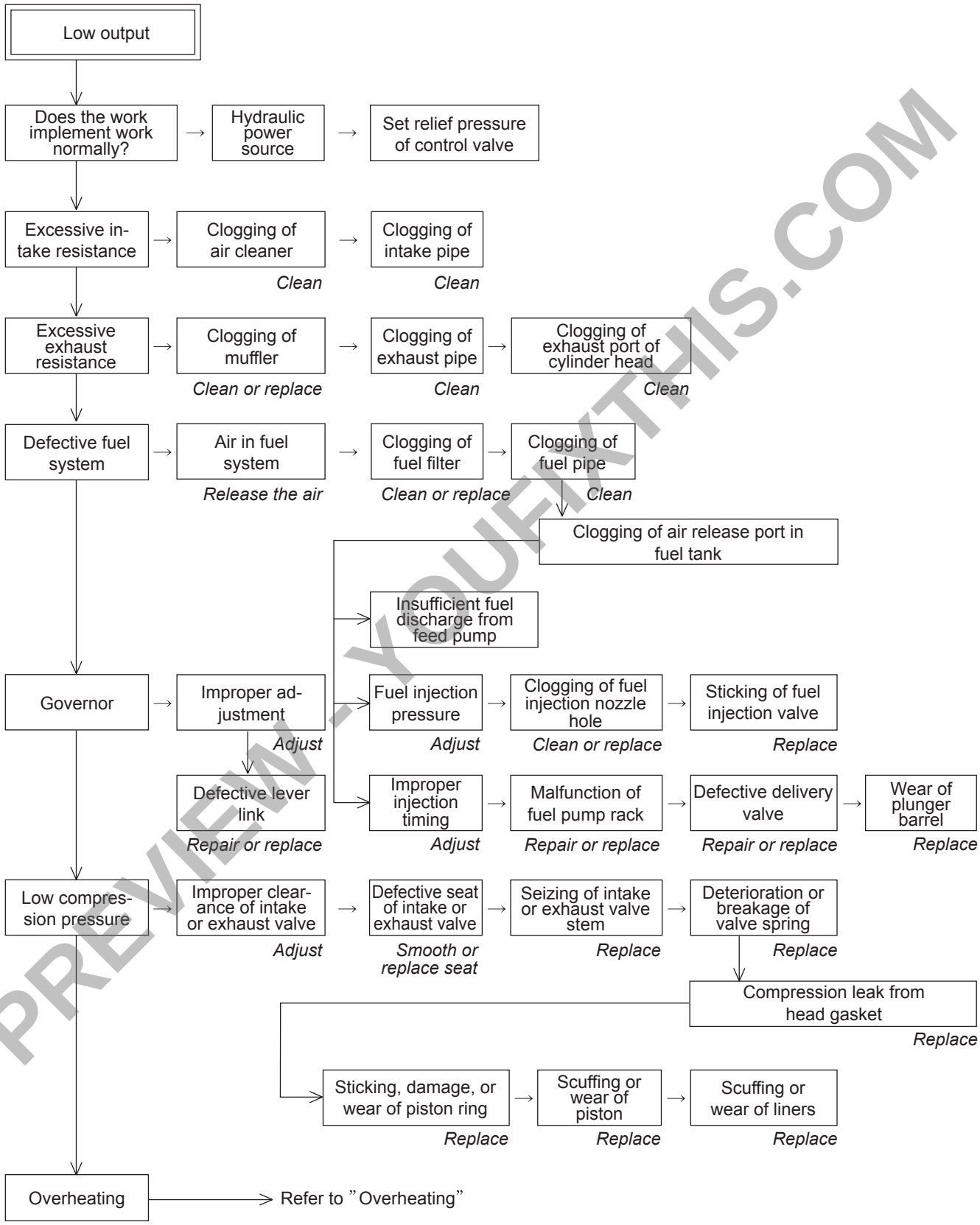
1-3 Preparations

(1) Check the service record of the machine. (That is, check how many months or hours the machine has been used since the preceding overhaul, what was the trouble then and what parts were replaced.)
(2) Have all servicing tools ready, i.e., tools, measuring devices (which have received periodic maintenance), containers, oil & grease, etc.
(3) Have the service literature (operation manual, parts catalog, etc.) ready.

1-4 Cautions for Disassembly and Reassembly

(1) Clean the machine before disassembly.
(2) Check and record the condition of the machine before disassembly :
  • Model, machine number, operation hours
  • Reasons for repair, history of repair
  • Contamination of filters
  • Fuel and oil condition
  • Damage to parts, etc.
(3) Place alignment marks on the necessary parts to facilitate reassembly.
(4) Clean all the removed parts and new replacement parts and put them in order.
(5) Use new seals, split pins, etc. for reassembly.

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2. TECHNICAL DATA

2. Technical Data

2-1 Specifications

Item	Unit	SV15	SV17	SV17EX
Main specifications of machine				
Dimensions				
Overall length (Transportation position)	mm	3450	3660	3660

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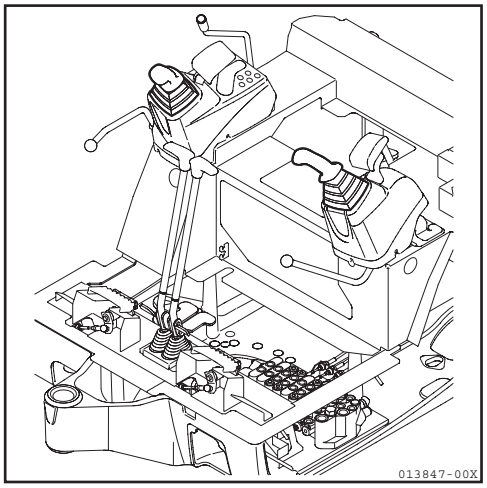
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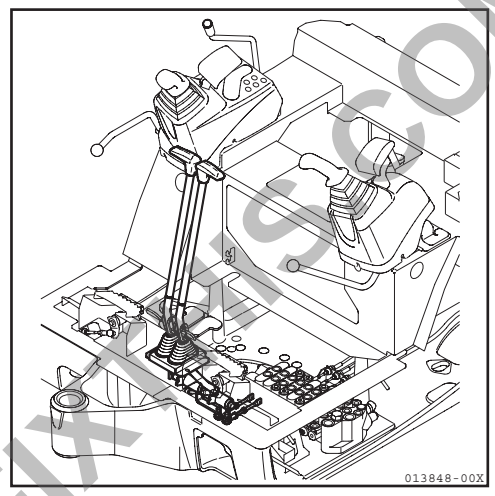
7-3 Controls

7-3-1 Control Train

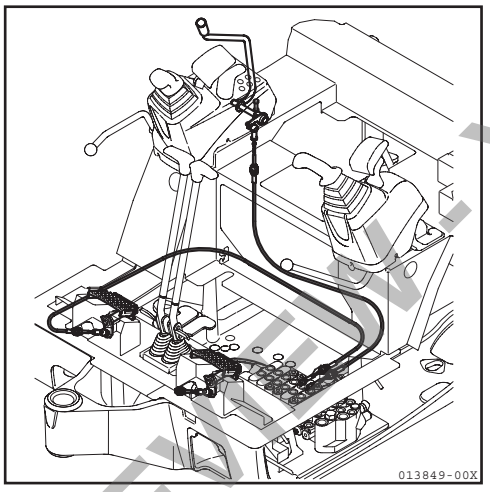
1) Control Lever (R)
Control Lever (L)



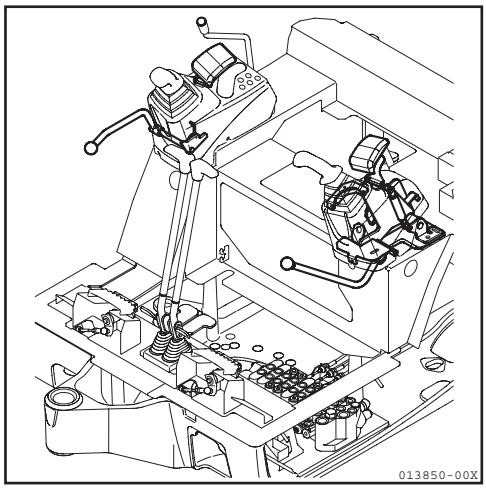
2) Travel Levers



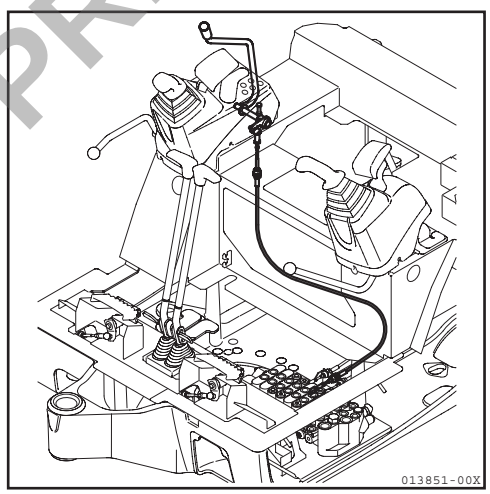
3) Boom Swing Pedal
4) P.T.O. Pedal



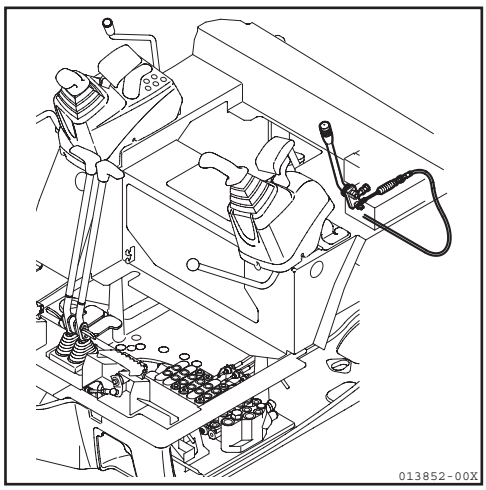
5) Lock Lever



6) Blade Lever
7) Track Gauge Change Lever



8) Accelerator Lever



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8. Periodic Inspection and Servicing

8-1 List of Periodic Inspection and Servicing

◇ : Check ○ : Supply ● : Replace □ : Adjust (clean) ■ : Oil & grease

Check & service items			Daily	Every 50	Every 100	Every 250	Every 500	Every 1000 hrs
General	Check falling off, breakage of parts		◇					
	Check loosened bolts & nuts, retighten		◇					
	Check engine condition		◇					
	Clean		□					
Lube oil	*Swing gear case oil	Check, resupply				◇/○		
		Replace			●1st time			●
	Travel reduction gear oil	Check, resupply				◇/○		
		Replace			●1st time			●
	*Transmission oil	Check, resupply	◇/○					
		Replace			●1st time			●
	*Differential gear oil	Check, resupply			◇/○			
		Replace			●1st time			●
Hydraulic system	Hydraulic oil	Check, resupply	◇/○					
		Replace						●
	Clean suction filter					□1st time		□
	Replace return filter					● 1st time	●	
	Check for abnormality of hydraulic pump		◇					
Grease	Check grease-up positions, grease		■					
	Greasing the swing gears and the swing bearings			■				
	Greasing the track gauge change cylinder and the link fulcrum			■				
Undercarriage	Check, adjust track tension		◇/□					
	*Check air pressure, wear, flaw in tyres		◇					
Steering equipment	*Check performance, play of steering lever		◇					
	Check performance, play of travel lever		◇					
	*Check performance of speed change lever		◇					
	*Check performance of forward/reverse pedal		◇					
	*Check performance, play of steering wheel		◇					
	*Brake pedal	Stroke	◇					
		Performance	◇					
	*Parking brake	Stroke	◇					
		Performance	◇					
	Check performance of accel. lever		◇					
Electric equipment	Check front & work lights, horn		◇					
	Check hourmeter function		◇					
	Check function of change, oil and pilot lamps		◇					
	Check wire breakage, short-circuits, loosened terminals retighten		◇					
	Check, resupply battery fluid		◇/○					
	Check specific gravity of electrolyte						□As required	
	Check function of OK monitor		◇					

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Applicable model				3TNV70-XBV1 / 3TNV70-XBVA	
Item			Unit	Standard	Wear limit
Crank shaft					
	Journal	Outside dia.	mm	Ø46.952 to 46.962	Ø46.902
		Main metal thickness		2.009 to 2.014	-
		Oil clearance		0.020 to 0.050	0.120
		Deviation from circular form (Drill diameter method)		0.01 or less	0.02
	Crank pin	Outside dia.		41.952 to 41.962	41.900
	Bend			-	0.01 or less
	Thrust metal width			1.930 to 1.980	1.850
Idle gear		Shaft outside dia.	mm	44.950 to 44.975	44.900
		Bush inside dia.		45.00 to 45.025	45.075
		Oil clearance		0.025 to 0.075	0.175
Trochoid pump		Outside clearance of outer rotor	mm	0.12 to 0.21	0.30
		Side clearance of outer rotor		0.02 to 0.07	0.12
		Inside clearance of inner rotor		0.13 to 0.20	0.25
Side gap		Crank shaft	mm	0.111 to 0.250	-
		Cam shaft		0.05 to 0.15	-
		Connecting rod		0.2 to 0.4	-
		Idle gear		0.05 to 0.25	-
Backlash		Crank gear	mm	0.06 to 0.12	-
		Cam gear		0.06 to 0.12	-
		Idle gear		0.06 to 0.12	-
		Fuel injection pump drive gear		0.06 to 0.12	-
		Lubricating oil pump gear		0.06 to 0.12	-
Others					
Lube oil pump discharge volume			L/min	15 or more (Oil temperature : 60°C)	-
Oil pressure regulating valve opening pressure			kPa (kgf/cm^2)	294.2 to 441.3 (3.0 to 4.5)	-
Oil pressure switch operating pressure			kPa (kgf/cm^2)	39.2 to 58.8 (0.4 to 0.6)	-
Cooling water pump discharge volume			L/min	50 [at 3350 min^{-1} (rpm)]	-
Thermostat valve opening temperature		Temperature	°C	69.5 to 72.5	-
		Lift at opening	mm	8.0 or more at 85°C or higher	-
Thermo-switch operating temperature		ON	°C	107 to 113	-
		OFF		100 or more	-

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4-3-8 Gears

1) Checking the Gears

Check the teeth surfaces of each gear and replace the gear if the teeth are damaged, worn, or flaked.

2) Measuring the Backlashes

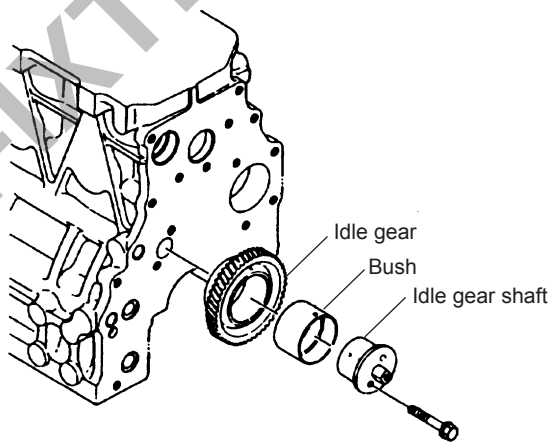
Apply a dial gauge onto the pitch circle of the gear, and measure the backlash.

		Standard	Wear limit
Backlash	Crank gear, cam gear, idle gear and fuel injection pump drive gear	Refer to Section "3-2 1) Nominal and Allowable Values".	
	Lubricating oil pump gear		

3) Checking and Measuring the Idle Gear Shaft and the Idle Gear

(1) Measure the idle gear bush inside diameter and the idle gear shaft outside diameter, and replace the bush or the idle gear shaft if the oil clearance exceeds the wear limit.

(2) Check that the oil holes in the idle gear shaft and the bush are aligned.

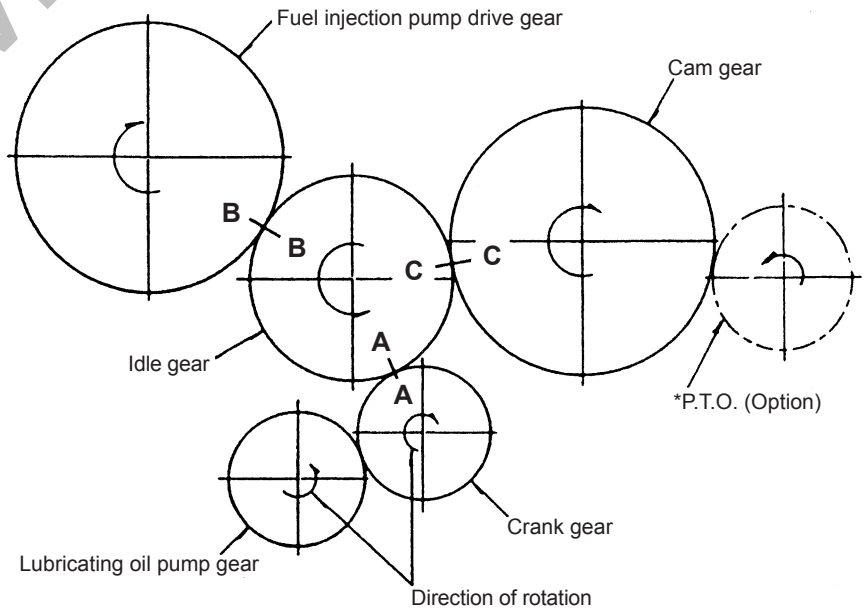


		Standard	Wear limit
Idle gear	Shaft outside dia.	Refer to Section "3-2 1) Nominal and Allowable Values".	
	Bush inside dia.		
	Oil clearance		

4) Gear Train

After installing all the gears, check that the matchmarkes A, B and C on the idle gear are aligned with those on the crank gear the fuel injection pump drive gear and the cam gear respectively.

(From the gear case side)



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2. Troubleshooting

CAUTION :

Before starting any procedures of trouble shooting or removing the control block, inspect the global machine's hydraulic system to eliminate all possible malfunctions not related to the SX 10 control block.

Abnormal operation of the actuators connected to the control block

Malfunction	Probable cause	Additional checks	Remedy
Lack of strength at all actuators	(1) LS pressure relief valve defective	Take a pressure measurement	Replace LS pressure relief valve
	(2) LS pressure relief valve out of adjustment		Make necessary adjustments
Lack of force on one actuator only	Secondary pressure relief valve defective or unsuitable		Replace secondary pressure relief valve
Lack of speed in the performance of a movement or all movements	(1) Spool stroke incorrect	Manual control: measure spool stroke	If stroke is incorrect: replace housing + spool assembly
	(2) Hydraulic operator adjustable stopnut out of adjustment		Make necessary adjustments
	(3) Individual compensator pressure blocked		Replace housing + pressure compensator assembly
Lack of load hold	(1) Load hold check valve failure		Replace check valve
	(2) Excessive clearance between the housing and the spool		Replace housing + spool assembly
Simultaneous movement malfunction	(1) Blockage of the individual compensator orifice		Remove and clean individual compensator
	(2) Individual pressure compensator blocked		Replace the housing + pressure compensator assembly
	(3) LS line leakage		Replace flow regulator

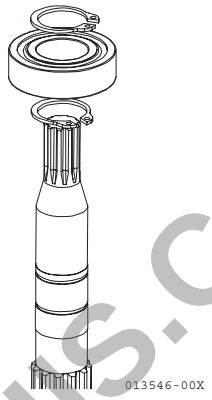
Abnormal machine operation

Malfunction	Probable Cause	Additional Checks	Remedy
Engine remains under load after spools are returned to neutral	(1) Flow regulator blocked		Replace flow regulator
	(2) Flow regulator filter clogged		Replace the filter

Abnormal machine operation

Malfunction	Probable Cause	Additional Checks	Remedy
Increase of force on controls or spool return defective	(1) Control block assembly tie rods too tight	Check tightening torque	Loosen and tighten to torque 15 ± 10% N.m. ***CAUTION :*** *Remove control block from its fixation points*
	(2) Spool seals obsolete		Replace spool seals

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Procedure	
Remove the first external retaining ring, the ball bearing can now be removed. The second external retaining ring can now be removed.	

The unit can now be re-assembled by reversing the above procedure. Please keep in mind the following requirements: 1) If one of the gears of the planetary units has been damaged it is advisable to replace the damaged planetary stage assembly complete with the sun gear. The reason is obvious, in that damage from one gear can cause microscopic fatigue cracks in mating gear teeth, leading to premature failure after servicing. 2) Use standard mechanical procedures, such lubricating O-rings, seals, etc..., upon reassembly.	

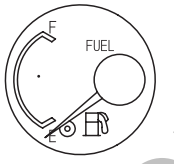
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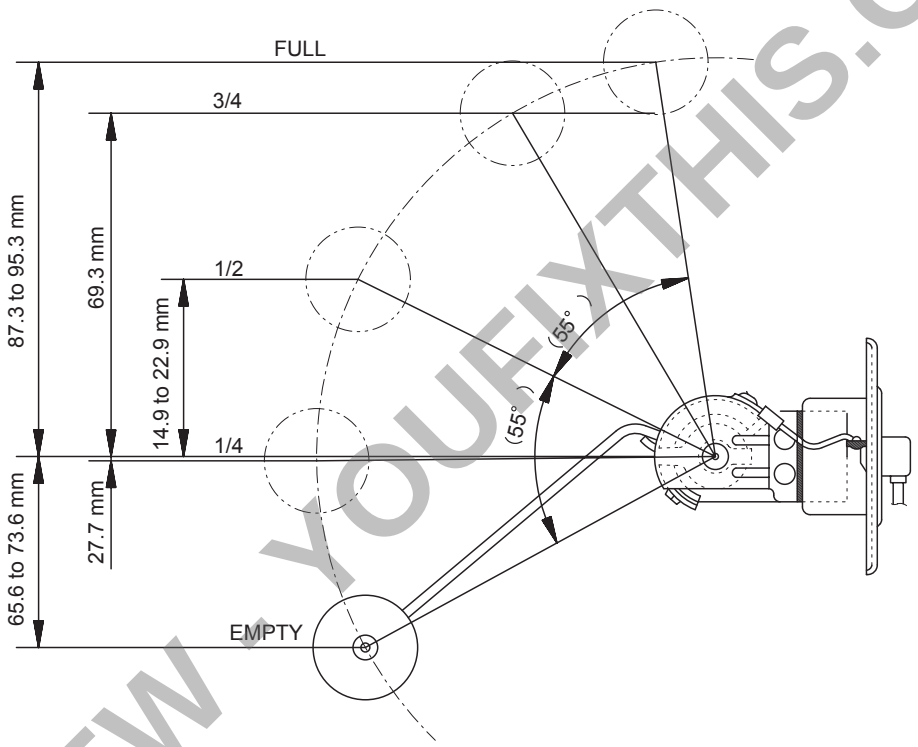
(4) Fuel gauge

When the starter switch is turned on, the fuel gauge starts to work to indicate the oil level in the fuel tank.

- It is normal for the fuel gauge to take some time to indicate the correct level after the starter switch is turned on.
- The remaining oil level indication can change depending on the inclination of the machine body.



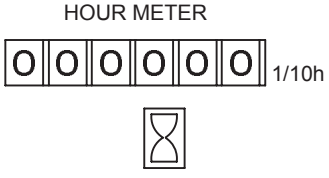
Fuel gauge unit



Float position	Resistance (Ω)
FULL	9.5 to 11.0
1/2	29 to 35
EMPTY	82 to 92

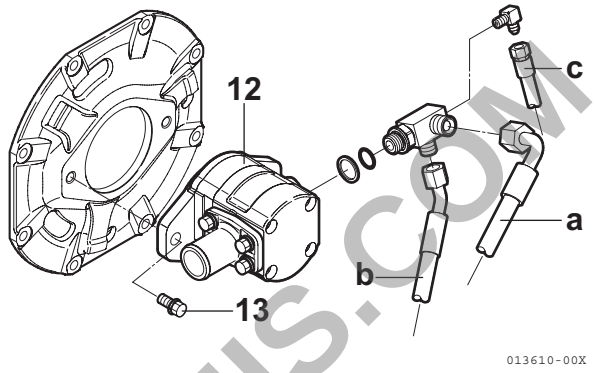
(5) Hour meter

When the starter switch is turned on, the hour meter starts to work.



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Procedure	
(5) Remove the hydraulic hoses from the hydraulic pump **12**. **a**. Hose (MAIN) **b**. Hose (PILOT) **c**. Hose (MESUR EMENT) (6) Remove the mounting bolts **13** and remove the hydraulic pump **12**.	

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9. REFERENCE DATA

9. Fuel, Lube Oil and Grease Recommended

Item	Type
Engine oil	Engine oil SAE10W30, CD class
Travel reduction gear oil	SAE 90 (GL-4)
Hydraulic oil	ISO VG46
Fuel	Diesel light oil
Engine cooling water	YANMAR genuine long-life coolant (LLC) 51% added water

Part be refilled	Oil type	Recommendations based on temperature ranges (°F) -4 14 32 50 68 86 (°C) (-20) (-10) (0) (10) (20) (30)	Prescribed amount of oil	Amount of oil to be changed
Engine oil pan	Engine oil	SAE 10WCD SAE 10W-30CD SAE 15W-40CD	3.0 Qts. (2.8 L)	3.0 Qts. (2.8 L)
Travel reduction gear	Gear oil	SAE 90 (GL-4)	0.53 Qts. (0.5 L) (For right and left each)	0.53 Qts. (0.5 L) (For right and left each)
Hydraulic oil system	Hydraulic oil	ISO VG46	In the tank 4.2 Gals. (16.0 L) Other parts 2.2 Gals. (8.5 L)	4.2 Gals. (16.0 L)
Fuel tank	Light oil	No.2-D No.3-D No.3-D (S)	6.5 Gals. (24.5 L)	–
Cooling system	Water	YANMAR genuine long-life coolant (LLC) added	Radiator 2.6 Qts. (2.5 L) Subtank 0.42 Qts. (0.4 L)	–

Lowest temperature	°F (°C)	23 (-5)	14 (-10)	5 (-15)	-4 (-20)	-13 (-25)	-22 (-30)	-31 (-35)	-40 (-40)
Amount of anti-freeze	Qts. (L)	0.42 (0.4)	0.85 (0.8)	0.95 (0.9)	1.06 (1.0)	1.16 (1.1)	1.37 (1.3)	1.59 (1.5)	1.69 (1.6)
Amount of water	Qts. (L)	2.64 (2.5)	2.22 (2.1)	2.11 (2.0)	2.01 (1.9)	1.90 (1.8)	1.69 (1.6)	1.48 (1.4)	1.37 (1.3)

Note :

At the delivery, water and antifreeze are mixed at the ratio for -31 °F (-35 °C) temperature above.

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