Solar 015 PLUS & Solar 018-VT

Shop Manual

K1000237E

Serial Number 30001 and Up

DOOSAN reserves the right to improve our products in a continuing process to provide the best possible product to the market place. These improvements can be implemented at any time with no obligation to change materials on previously sold products. It is recommended that consumers periodically contact their distributors for recent documentation on purchased equipment.

This documentation may include attachments and optional equipment that is not available in your machine's package. Please call your distributor for additional items that you may require.

Illustrations used throughout this manual are used only as a representation of the actual piece of equipment, and may vary from the actual item.

TRACK EXCAVATOR SAFETY

⚠ CAUTION!

Follow all safety recommendations and safe shop practices outlined in the front of this manual or those contained within this section.

Always use tools and equipment that are in good working order.

Use lifting and hoisting equipment capable of safely handling load.

Remember, that ultimately safety is your own personal responsibility.

MODEL	SERIAL NUMBER RANGE
Solar 015	0001 and Up
Solar 015 PLUS	1001 thru 1157, 20001 thru 20065, 20066 thru 30000, 30001 and Up
Solar 018-VT	30001 and Up

May 2004

NEVER USE ETHER STARTING AIDS

An electric grid type manifold heater is used for cold starting. The glowing heater element can cause ether or other starting fluid to detonate, causing injury.

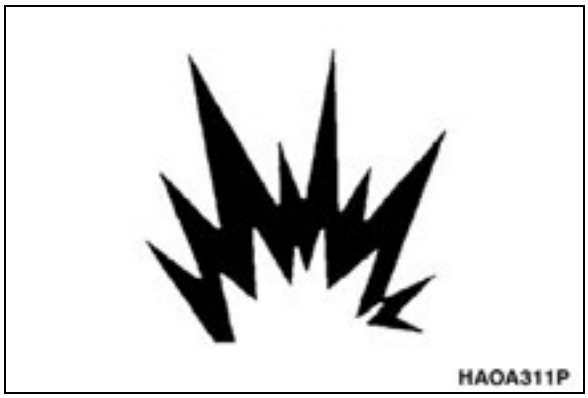


Figure 9

MOUNTING AND DISMOUNTING

NEVER get on or off a moving machine. Do not jump on/off. The entry/egress path must be clear of mud, oil and spills and mounting hardware must be kept tight and secure.

Always use handholds, steps or track shoes and maintain at least 3-point contact of hands and feet. Never use controls as handholds.

NEVER get up from the operator's seat or leave the operator's station and dismount the machine if the engine is running.

Figure 10

OBSERVE GENERAL SAFETY RULES

Only trained and authorized personnel, with a good knowledge and awareness of safe procedures, may be allowed to operate or perform maintenance or service on the excavator.

All personnel at the work site must be aware of assigned individual responsibilities and tasks. Communication and hand signals used must be understood by everyone.

Terrain and soil conditions at the work site, approaching traffic, weather related hazards and any above or below ground obstacles or hazards must be observed and monitored by all work crew members.

ENGINE VENTILATION

Engine exhaust gases can cause fatal accidents, and unconsciousness, loss of alertness, judgement and motor control and serious injury.

Make sure of adequate ventilation before starting the engine in any enclosed area.

You should also be aware of open windows, doors or ductwork into which exhaust may be carried, or blown by the wind, exposing others to danger.

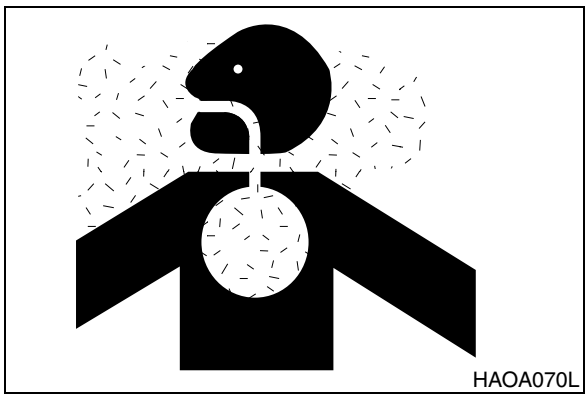


Figure 11

MAINTENANCE

KEEP MACHINE CLEAN AT ALL TIMES

Keep machine free of oil and grease at all times.

Water will damage the electrical system. Never use water or steam on the inside of the cabin, in the engine compartment or in any location where it may reach sensors, connectors or other electrical components.

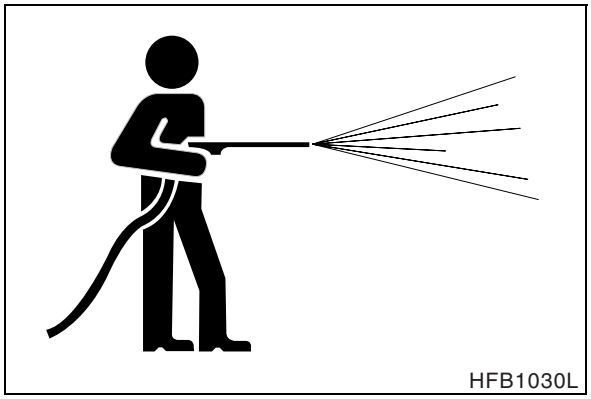


Figure 25

USE WARNING TAG CONTROL LOCKOUT PROCEDURES DURING SERVICE

Alert others that service or maintenance is being performed and tag operator's cabin controls - and other machine areas if required - with a warning notice. OSHA mandated control lever lockout can be made with any OSHA certified lockout device and a length of chain or cable to keep the left-hand control console in the fully raised, nonactive position.

Warning tags for controls are available from *DOOSAN* distributors.

Figure 26

DO NOT RUN THE ENGINE IF REPAIRS OR WORK IS BEING PERFORMED ALONE

You should always have at least two people working together if the engine must be run during service. One person needs to remain in the operator's seat, ready to work the controls or stop the machine and shut off the engine.

ALWAYS USE ADEQUATE EQUIPMENT SUPPORTS AND BLOCKING

Do not allow weight or equipment loads to remain suspended. Lower everything to the ground before leaving the operator's seat. Do not use hollow, cracked or unsteady, wobbling weight supports. Do not work under any equipment supported solely by a lift jack. When inspecting or performing service under a machine that is jacked up, keep boom at a 90°-100°angle to the arm and chock tracks securely.

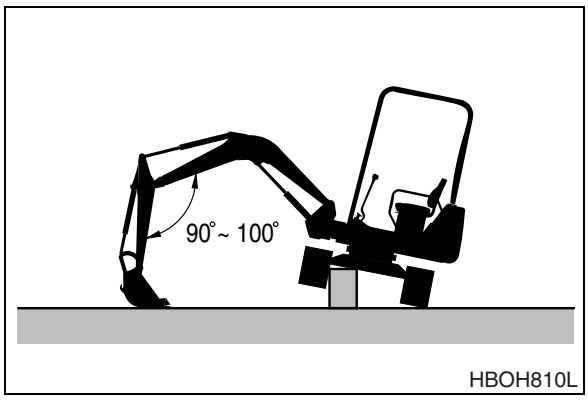


Figure 27

GENERAL DESCRIPTION

The excavator has three main component sections:

- The Upper Turntable
- The Lower Undercarriage and Track Frames
- The Excavator Front End Attachment

The following illustration identifies main components and their locations. (See Figure 1 on page -4.)

Reference	Description	Machine Type			
		Solar 015 PLUS		Solar 018-VT	
	Boom Type (One Piece)	1,690 mm (66.53 in)			
	Arm Type	850 mm (33.46 in)	1,100 mm (43.30 in)	850 mm (33.46 in)	1,100 mm (43.30 in)
	Bucket Type (SAE)	0.04 m^3			
A	Max. Digging Reach	3,700 mm (145.67 in)	3,920 mm (153.62 in)	3,700 mm (145.67 in)	3,920 mm (153.62 in)
B	Max. Digging Reach (Ground)	3,605 mm (141.93 in)	3,850 mm (151.57 in)	3,565 mm (140.35 in)	3,595 mm (141.54 in)
C	Max. Digging Depth	2,140 mm (84.25 in)	2,385 mm (93.90 in)	2,075 mm (81.69 in)	2,325 mm (91.53 in)
D	Max. Loading Height	2,245 mm (88.39 in)	2,420 mm (95.28 in)	2,310 mm (90.95 in)	2,485 mm (97.83 in)
E	Min. Loading Height	1,225 mm (48.23 in)	1,085 mm (42.72 in)	1,285 mm (50.59 in)	1,500 mm (59.06 in)
F	Max. Digging Height	3,400 mm (133.86 in)	3,560 mm (140.16 in)	3,465 mm (136.42 in)	3,625 mm (142.72 in)
G	Max. Bucket Pin Height	2,830 mm (111.42 in)	3,005 mm (118.31 in)	2,870 mm (113.00 in)	3,045 mm (119.89 in)
H	Max. Vertical Wall Depth	1,630 mm (64.17 in)	1,845 mm (72.64 in)	1,565 mm (61.61 in)	1,780 mm (70.08 in)
I	Min. Swing Radius	1,500 mm (59.06 in)	1,670 mm (65.75 in)	1,500 mm (59.06 in)	1,670 mm (65.75 in)
d	Bucket Angle	159 °	159 °	159 °	159 °

BOOM SWING TEST

With the boom, arm and bucket in the same position as for the swing speed test with the boom evenly centered between the side frames, pointing straight ahead. Use the controls to swing the boom to one side then back to the center. Measure the time it takes for the boom to swing to the maximum position (75° from the center). Repeat the process for the other side.

	S/N 30001 and Up
Left	5.3 sec.
Right	3.8 sec.

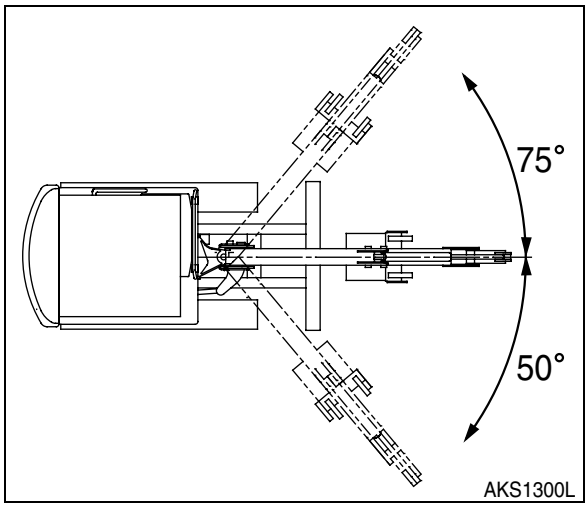


Figure 7

CYLINDER PERFORMANCE TESTS

NOTE: *All tests are performed with standard boom, arm and bucket configuration. The bucket must be empty.*

Boom Cylinders Test

The starting points for the test are with the boom and arm extended away from the excavator, and the bucket curled inward. The arm cylinder must be fully retracted; boom and bucket cylinders must be extended. Test movement in both directions, several times, and average results.

Arm Cylinder Test

Start with the boom up and the arm cylinder fully retracted. Test movement in both directions several times, between the "crowd" and "dump" positions, and average the results of both tests.

Bucket Cylinder Test

Start with the boom up and the teeth of the bucket hanging vertically, 500 mm (1.5' - 2') above the ground. Dump and crowd the bucket several times, and average results.

Dozer Blade Cylinder

Start with the blade in the rest position on level ground. Test the movement of the blade cylinder several times. Measure the times it takes for the blade to move from the level ground rest position to the up position and back down to the rest position on level ground.

Move the excavator to a spot where the blade can be moved up and down through the full stroke. Start with the blade in the lowest position. Test the movement of the blade cylinder several times. Measure the times it takes for the blade to move through the full stroke from the lowest position to the highest position and back down to the lowest position.

IMPORTANT

Hydraulic system operating conditions (repetitive cycling, heavy work loads, fluid circulating under high-pressure) make it extremely critical that dust, grit or any other type of contamination be kept out of the system. Observe fluid and filter change maintenance interval recommendations and always preclean any exterior surface of the system before it is exposed to air. For example, the reservoir fill cap and neck area, hoses that have to be disassembled, and the covers and external surfaces of filter canisters should all be cleaned before disassembly.

MAINTENANCE SERVICE AND REPAIR PROCEDURE

GENERAL PRECAUTIONS

Fluid level and condition should always be checked whenever any other type of maintenance service or repair is being performed.

NOTE: *If the unit is being used in an extreme temperature environment (in subfreezing climates or in high temperature, high humidity tropical conditions), frequent purging of moisture condensation from the hydraulic reservoir drain tap must be a regular and frequent part of the operating routine. In more moderate, temperate climates, draining reservoir sediment and moisture may not be required more than once or twice every few months.*

Inspect drained oil and used filters for signs of abnormal coloring or visible fluid contamination at every oil change. Abrasive grit or dust particles will cause discoloration and darkening of the fluid. Visible accumulations of dirt or grit could be an indication that filters are overloaded (and will require more frequent replacement) or that disintegrating bearings or other component failures in the hydraulic circuit may be imminent or have already occurred. Open the drain plugs on the main pump casings and check and compare drain oil in the pumps. Look for evidence of grit or metallic particles.

Vibration or unusual noise during operation could be an indication of air leaking into the circuit (Refer to the appropriate Troubleshooting section for component or unit for procedures.), or it may be evidence of a defective pump. The gear type pilot pump could be defective, causing low pilot pressure, or a main pump broken shoe or piston could be responsible.

NOTE: *If equipped, indicated operating pressure, as shown on the multidisplay digital gauge on the Instrument Panel ("F-Pump" and "R-Pump") will be reduced as a result of a mechanical problem inside the pump. However, pressure loss could also be due to cavitation or air leakage, or other faults in the hydraulic system.*

Check the exterior case drain oil in the main pumps. If no metallic particles are found, make sure there is no air in the system. Unbolt and remove the tank return drain line from the top part of the swing motor, both travel motors and each main pump. If there is air in any one of the drain lines, carefully prefill the assembly before bolting together the drain line piping connections. Run the system at low rpm.

STANDARD TORQUES

CAUTION!

Follow all safety recommendations and safe shop practices outlined in the front of this manual or those contained within this section.

Always use tools and equipment that are in good working order.

Use lifting and hoisting equipment capable of safely handling load.

Remember, that ultimately safety is your own personal responsibility.

MODEL	SERIAL NUMBER RANGE
ALL MODELS	ALL RANGES

May 2002

I. "Loctite" Fastener Adhesives

Product	Application	Color	Removal	Breakaway Cure Strength (in lb) of Sealer Alone
222	Low strength for 6 mm (1/4") or smaller fasteners.	Purple	Hand tools	45
242 or 243	Medium strength for 6 mm (1/4") and larger fasteners.	Blue	Hand tools	80
262	High strength for high grade fasteners subject to shock, stress and vibration.	Red	Heat/260°C (500°F) Remove HOT (NO solvent)	160
271	Extra high strength for fine thread fasteners up to 25 mm (1") diameter.	Red	Heat/260°C (500°F) Remove HOT	160
272	High temperature/high strength for hostile environments to 232°C (450°F).	Red	Heat/316°C (600°F) Remove HOT	180
277	Extra high strength for coarse thread fasteners 25 mm (1") diameter and larger.	Red	Heat/260°C (500°F) Remove HOT	210

II. "Loctite" Pipe Thread Sealant

Product	Application	Color	Removal	Required Setup
545	"No-filler/nonclog" formula for high-pressure hydraulic systems. Over application will not restrict or foul system components.	Purple	Hand tools	4 Hours (or 1/2 hour with Locquic "T" Primer)
656	Solvent resistant, higher viscosity tapered thread sealer.	White	Hand tools	4 Hours (or 1/2 hour with Locquic "T" Primer)

III. "Loctite" gasket/flange sealer

Product	Application	Color	Notes
518	Gasket eliminator specifically made for aluminum flanges/surfaces. For hydraulic systems to 34,475 kPa (5,000 psi).	Red	Use Locquic "N" primer for fast (1/2 - 4 hours) setup. Unprimed setup 4 - 24 hours.
504	Low-pressure/wide-gap gasket eliminator compound. Fills gaps to 0.0012 mm (0.030"), cures to rigid seal.	Orange	Use Locquic "N" primer for faster (1/2 - 4 hours) setup. Unprimed setup 4 - 24 hours.
515	General purpose, fast setup, flexible-cure gasket eliminator. For nonrigid assemblies subject to shock, vibration or deflection.	Purple	Use Locquic "N" primer for faster (1/4 - 2 hours) setup. Unprimed setup 1 - 12 hours.

2. Measure the distance (A, Figure 2) between the rolling surface of the track roller and the contact surface of the crawler.

   NOTE: *This measurement can be thrown off if there is too much mud or dirt or other material in the track assembly. Clean off the tracks before checking clearance.*

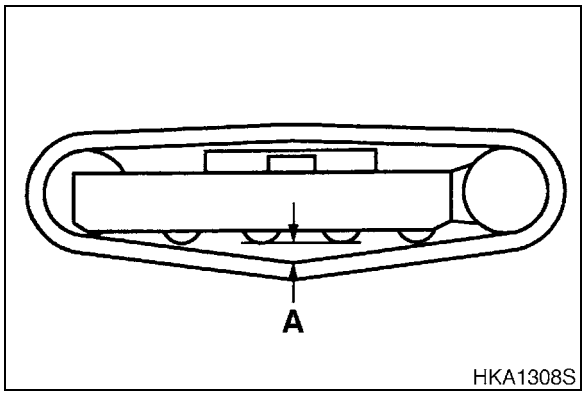


Figure 2

   A. For rubber crawlers

      It is accepted if the distance between the rolling surface of the track roller and the contact surface of the crawler is 10 - 15 mm (0.39 - 0.59 in).

3. Too little sag in the crawler track can cause excessive component wear. The recommended adjustment can also be too tight causing accelerated stress and wear if ground conditions are wet, marshy or muddy, or if the ground is hard and full of rocks or gravel.

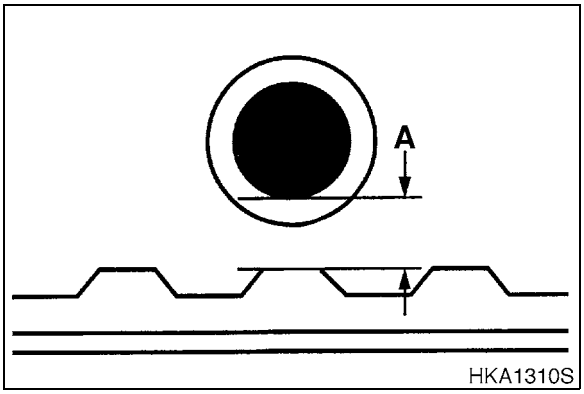


Figure 3

⚠ WARNING!

The track adjusting mechanism is under very high-pressure. NEVER release pressure too suddenly. The grease cylinder valve should never be backed off more than 1 complete turn from the fully tightened down position. Bleed off pressure slowly and keep your body away from the valve at all times.

3. Use a steel bar for leverage and slide the rubber track assembly over the idler assembly.
4. Apply track tension. Refer to "Track Tension" in this section for procedure.

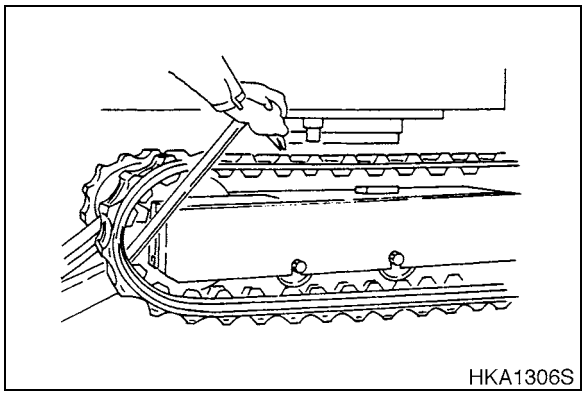


Figure 16

ENGINE AND DRIVE TRAIN

ENGINE SPECIFICATIONS

Model		Item					
		L2A	L2C	L2E	L3A	L3C	L3E
General	Engine Type	4-cycle, Water Cooled, Vertical, Diesel					
	Firing Order	1-2			1-3-2		
	Compression Ratio	23:1					
	Combustion Chamber	Swirl Chamber					
	Dry Weight	61 kg (134 lb)			75 kg (165 lb)		
Cylinders	Number of Cylinders	2			3		
	Bore x Stroke	65 x 70 mm (2.56 x 2.76 in)	70 x 70 mm (2.76 - 2.76 in)	76 x 70 mm (2.99 - 2.76 in)	65 x 70 mm (2.56 x 2.76 in)	70 x 70 mm (2.76 - 2.76 in)	76 x 70 mm (2.99 - 2.76 in)
	Total Displacement	464 cc (28.32 in^3)	538 cc (32.83 in^3)	635 cc (38.75 in^3)	696 cc (42.47 in^3)	808 cc (49.31 in^3)	952 cc (58.09 in^3)
Performance	Maximum Power Maximum Torque Specific Fuel Consumption	See the engine performance curves.					
List Ability	In every direction (to lower limit of oil level)	25° continuous			30° in a short time (within 30 min.)		
Fuel System	Injection Pump	Bosch NC type					
	Nozzle	Throttle type					
	Fuel	JIS No. 2 or No. 3 Diesel Fuel					
Lubrication System	Lubricating Method	Forced Lubrication					
	Oil Filtration	Paper Element Filter (Full-flow Type)					
	Oil Capacity Upper Limit/Lower Limit (Excluding 0.5 liters (0.13 U.S. gal.) for oil filter)	2.4/1.4 liters (0.63/0.37 U.S. gal.)			3.0/1.5 liters (0.79 - 0.40 U.S. gal.) 3.6/1.8 liters (0.95 - 0.48 U.S. gal.) or 4.8/3.0 liters (1.3 - 0.79 U.S. gal.)		
Cooling System	Cooling Method	Forced water circulation with pressurized radiator.					
	Coolant Capacity (Except Radiator and Hose)	1.20 liters (0.32 U.S. gal.)			1.80 liters (0.48 U.S. gal.)		
Accessories	Alternator	12 V @ 15 A or 12 V @ 40 A					
	Starting Motor	12 V @ 1.2 kW or 12 V @ 0.6 kW					
	Battery	45 Ah or more			60 Ah or more		

2. Lower limit of engine speed can be adjusted with LOW-SPEED stopper bolt.
3. Never remove sealing cap unnecessarily to adjust torque spring setting. For proper disassembly procedure see “Torque Spring” on page 90.

> **CAUTION!**
>
> **Warm up engine (until coolant temperature rises up to 50°C (122°F) or above) before adjusting engine speeds.**

4. While running engine for speed adjustment, check engine for exhaust gas leak, water leak, oil leak, and fuel leak.
5. After adjustment, perform engine acceleration and deceleration test to confirm that engine is free from hunting and smoking.

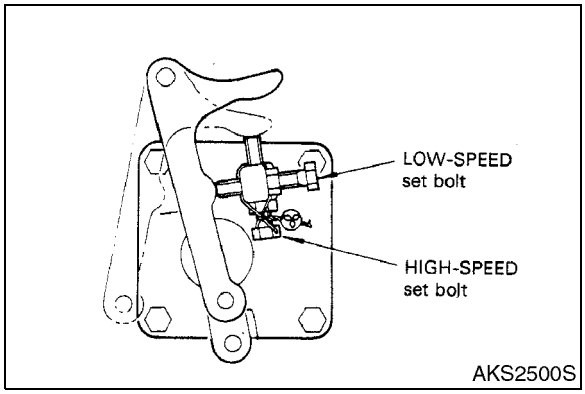


Figure 31 HIGH SPEED AND LOW SPEED SET BOLTS

Checking and Adjustment of Nozzles

To check and adjust injection nozzles, use following procedure:

1. Injection start pressure.
   A. Remove nozzle assembly to be tested from cylinder head and set nozzle on nozzle tester.

      Perform air bleeding by moving tester hart file up and down.

   B. Operate handle at a speed of 60 rpm or more and read gauge pressure of fuel injected from nozzle.

      NOTE: *Injection start pressure: 140^{+10}_{-0} kg/cm^2 (1,990 $^{+140}_{-0}$ psi).*

   C. If reading of gauge pressure is not within specified range, disassemble nozzle and vary thickness of adjusting shim.

      Increasing or decreasing shim thickness by 0.1 mm (0.0039 in) will cause injection pressure to vary about 10 kg/cm^2 (142 psi).

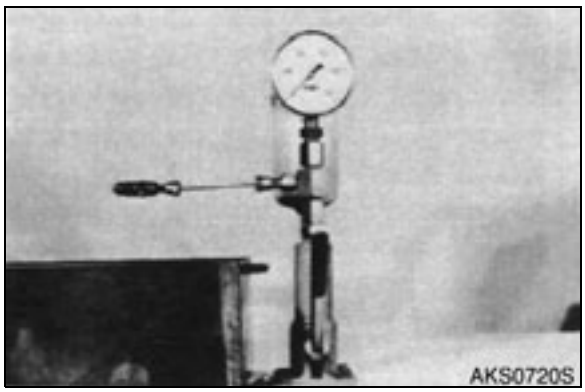
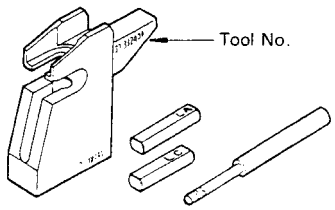
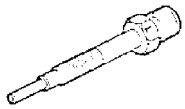
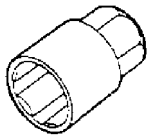


Figure 32 TESTING INJECTION START PRESSURE

ENGINE

SPECIAL TOOLS

Use	Tool Name	Sketch	Referential Page
Removal and installation of piston pin	Piston pin setting tool ST332400		
Measurement of cylinder compression	Compression gauge adapter ST332270		
Removal and installation of oil pressure switch	Oil pressure switch socket wrench (26) MD998054		
Repair of valve seat	Valve seat cutter pilot Valve seat cutter, 45° Valve seat cutter, 60° Valve seat cutter, 30°	 	

1. Repair of valve face.

   If valve face is found worn down, resurface with a valve refacer. If margin of resurfaced valve exceeds service limit, replace valve.

2. Repair of valve stem end.

   If valve stem end has been indented by wear, flatten with an oil stone.

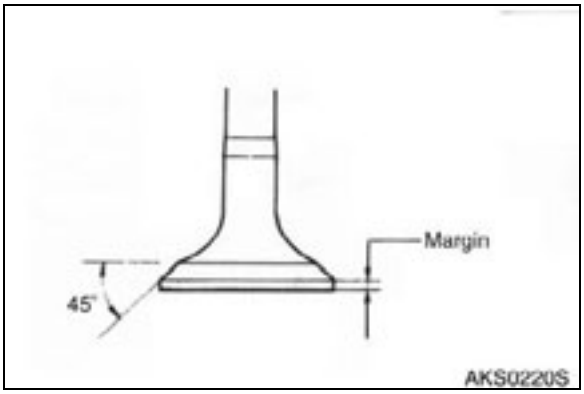


Figure 56 INSPECTING VALVE

Installation

1. Install valves and valves spring, referring to notes shown in Figure 57.
2. Mount cylinder head assembly.
3. Adjust valve clearances.

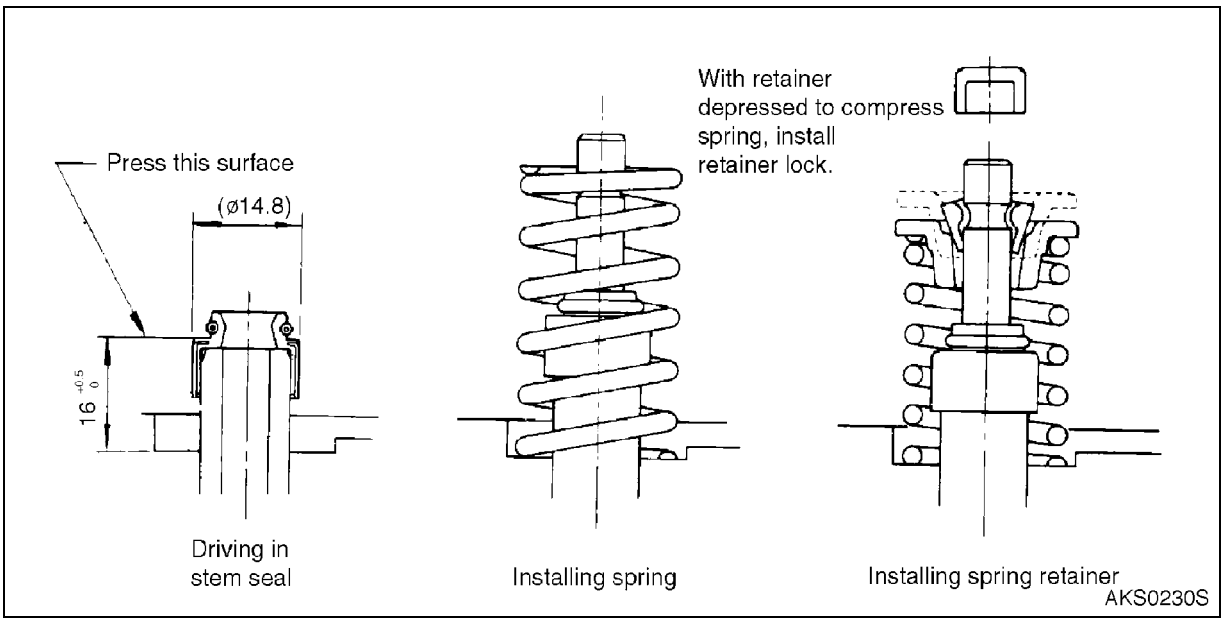


Figure 57 INSTALLATION OF VALVE SPRING

CAUTION!

Be careful not to damage spring and stem seal by excessively compressing spring when installing valve spring.

CAMSHAFTS (VALVE AND PUMP)

Construction

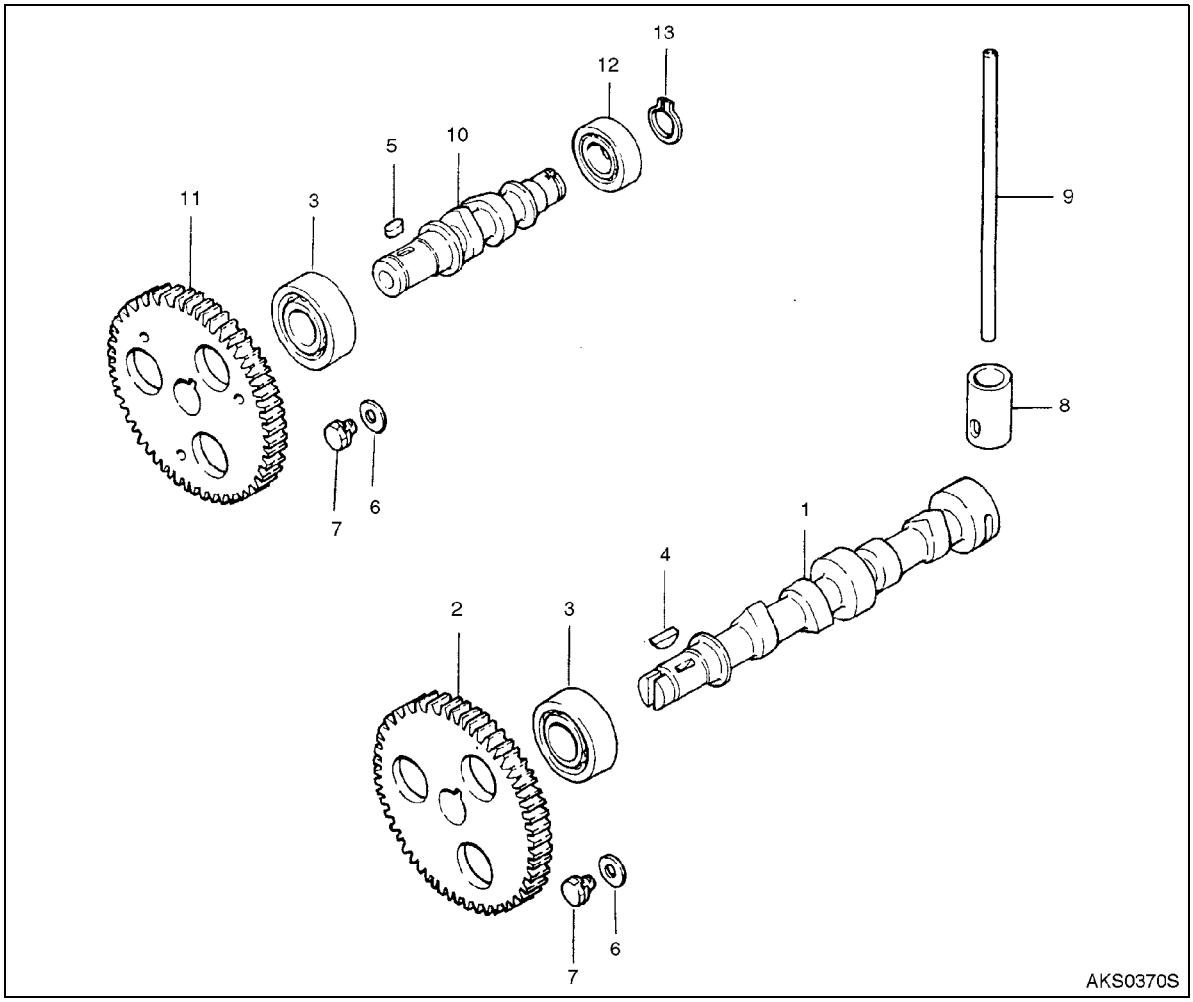


Figure 71 CAMSHAFT COMPONENT PARTS

Reference Number	Description
1	Camshaft (Valve)
2	Camshaft Gear
3	Ball Bearing
4	Woodruff Key
5	Sunk Key
6	Camshaft Stopper
7	Bolt

Reference Number	Description
8	Tappet
9	Push Rod
10	Camshaft (Injection Pump)
11	Camshaft Gear
12	Ball Bearing (Rear)
13	Retaining Ring

CRANKSHAFT

Construction

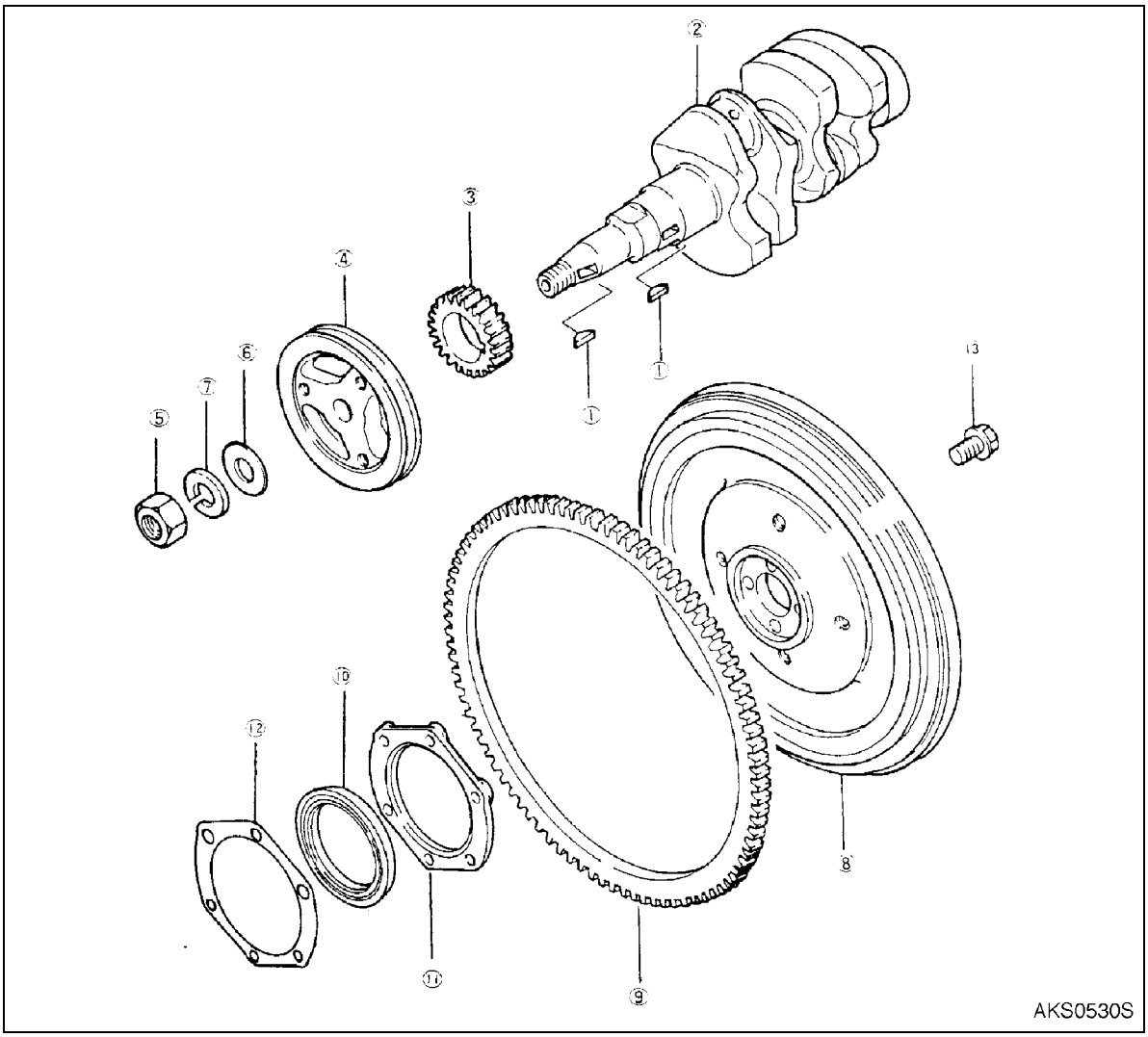


Figure 86 CRANKSHAFT COMPONENT PARTS

Reference Number	Description
1	Key
2	Crankshaft
3	Crankshaft Gear
4	Crankshaft Pulley
5	Nut
6	Washer
7	Spring Washer

Reference Number	Description
8	Flywheel
9	Ring Gear
10	Rear Oil Seal
11	Rear Oil Seal Case
12	Gasket
13	Flywheel Bolt

FUEL SYSTEM

GENERAL

Inspection

Description			Specification	
			L2	L3
Injection Pump	Type		In-line type (Bosch NC)	
	Direction of rotation		Clockwise (as viewed from driving side)	
	Injection order		1-1	1-3-2
	Plunger diameter		6 ∅	
	Number of plungers		2	3
	MS retard		4° (for crank)	
	Delivery valve		Silt or Bosch	
Injection Nozzle	Type		Thread Type	
	Nozzle	Type	Throttle Type	
		Number of jet	See “Alternator and Dynamo” on page 113.	
	Injection Pressure		$140\ ^{+10}_{0}$ kg/cm^2 ($1{,}990\ ^{+142}_{-0}$ psi)	
Fuel Pump (Optional)	Type		Electromagnetic diaphragm type	
	Delivery		0.37 l/min (0.10 gpm) (12 V, at 20°C (68°F))	
	Type		Electromagnetic plunger type	
	Delivery: Common type		0.9 l/min (0.24 U.S. gal.) (12 V, at 20°C (68°F))	
	Compact type		0.4 l/min (0.11 U.S. gal.) (12 V, at 20°C (68°F))	
	Type		Mechanical drive type	
	Delivery		0.225 l/min (0.059 U.S. gal.)	
Fuel Cutoff Valve	Type		Solenoid pull hold type	
	Rated current pull		55 A	
	hold		1.0 A	
	Working voltage		12 V, DC	
	Stroke		13.50 mm (0.5315 in)	
	Type		Solenoid push out type	
	Coil Resistance		1.6 Ω ±10% (at 20°C (68°F))	
	Stroke		10.0 mm (0.3937 in)	
Fuel Filter			Paper Element Type	

Reference Number	Description
1	Sealing Metal
2	Sealing Wire
3	Low and High Speed
4	Governor Spring
5	Sliding Shaft
6	Stopper
7	Governor Spring
8	Governor Shaft
9	Governor Lever
10	Tie Rod
11	Tie Rod Clip
12	Tie Rod Cover
13	Tie Rod Cover Gasket
14	Tension Lever

Reference Number	Description
15	Start Spring
16	Governor Spring Lever
17	Speed Control Lever
18	Cover Assembly
19	Governor Cover Gasket
20	Return Spring
21	Stop Lever Assembly
22	O-ring
23	Retaining Ring
24	Stop Lever
25	Grooved Pin (3 x 20)
26	Grooved Pin (3 x 14)
27	Torque Spring Set
28	Sealing Cap

Inspection of Engine Coolant Temperature Gauge Unit

If gauge does not function properly, replace it.

CAUTION!

Handle hot oil with special care not to cause a scald or a fire.

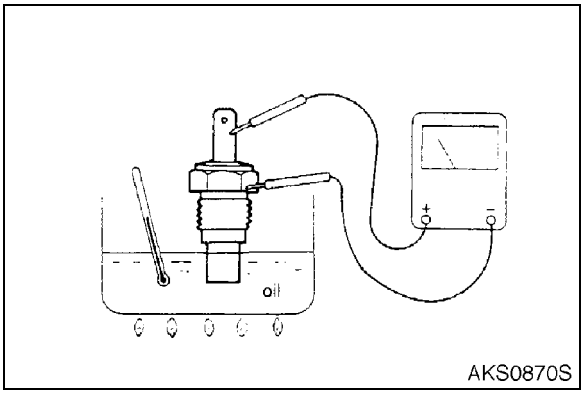


Figure 125 INSPECTING TEMPERATURE GAUGE UNIT

Gauge Unit Part No.	Specification
MD001380	70°C (158°F) / 104 ±13.5 Ω, 115°C (239°F) / 23.8 ±2.5 Ω
MM435133	80°C (176°F) / 118 ±6 Ω, 115°C (239°F) / 42 ±2.5 Ω
451510100	80°C (176°F) / 29.5 ±2.5 Ω, 106°C (223°F) / 14.3 ±0.5 Ω

Inspection of Thermo Switch

NOTE: *Switch "ON" temperature 108 - 114°C (226 - 237°F).*

CAUTION!

Handle hot oil with special care not to cause a scald or a fire.

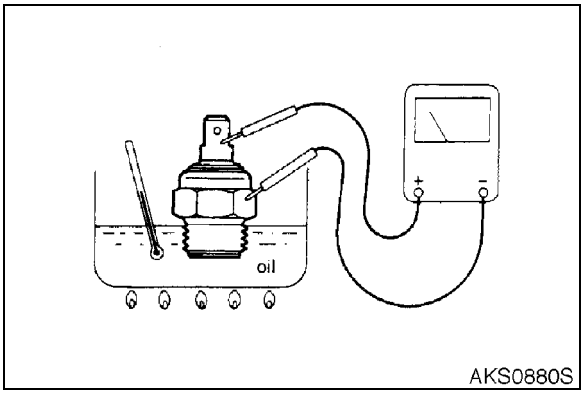


Figure 126 INSPECTING THERMO SWITCH

Disassembly

1. Disconnect wire from magnetic switch terminal "M."
2. Loosen two screws fastening magnetic switch. Remove magnetic switch assembly.
3. Remove two through bolts and two screws fastening brush holder. Remove rear bracket.

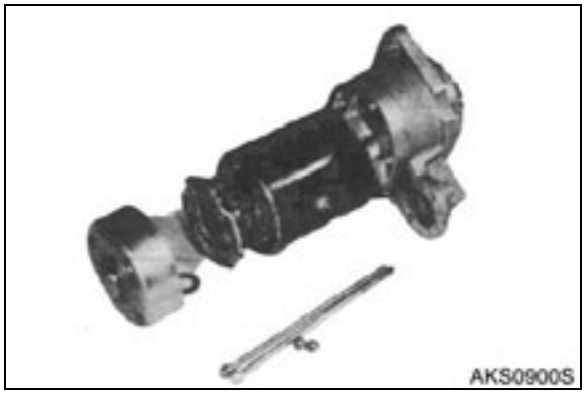


Figure 138 REMOVING BRUSH HOLDER ASSEMBLY

4. With two brushes brought in floating state, remove yoke and brush holder assembly. Then, pull armature out.
5. Remove cover and pry retaining ring out.
6. Unscrew bolts and remove center bracket. At same time, washers for pinion shaft end play adjustment will come off.
7. Pull out reduction gear lever and lever spring from front bracket.
8. On pinion side, pry retaining ring out, and pull out pinion and pinion shaft.
9. At each end of armature, remove ball bearing with a bearing puller.

   It is impossible to replace ball bearing press fitted in front bracket. If that bearing has worn off, replace front bracket assembly.

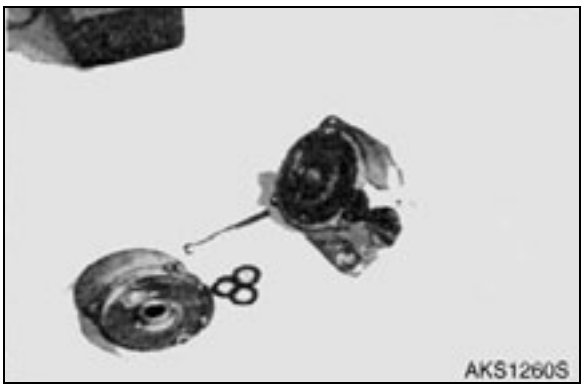


Figure 139 REMOVING REDUCTION GEAR

B. Check for continuity between each lead wire and stator core;. If any continuity is found, stator coil is suspected to be poor in insulation. Replace stator coil.

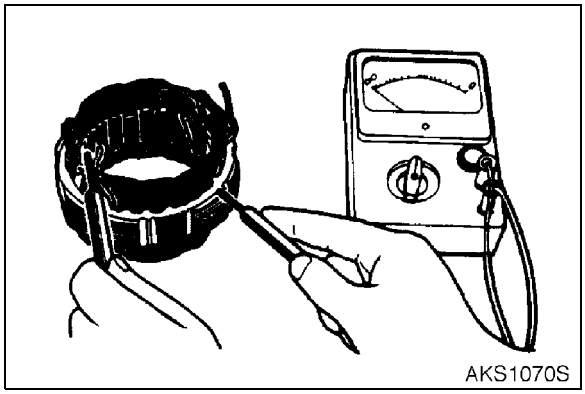


Figure 156 CHECK STATOR COIL FOR INSULATION

Assembly of Alternator

Reassemble alternator assembly in reverse order of disassembly, paying attention to the following:

1. The rear bearing has an eccentric groove.

   Install retaining ring so that its projection fits in deepest part of groove.

2. When installing a new rear bearing, press fit bearing with its groove facing slip ring side.

3. When press fitting rear bearing into rear bracket, heat bracket.

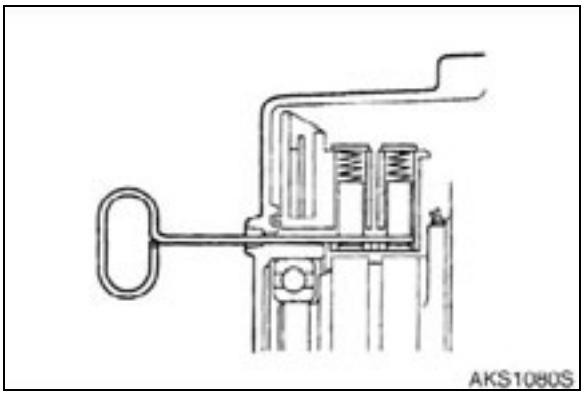


Figure 157 LIFTING BRUSHES

⚠ CAUTION!

Press a wire through small hole in rear bracket to lift brushes before installing rotor to rear bracket. Remove wire after rotor is installed.

Unit: mm

Description	Specification or Standard	Repair Limit	Service Limit
Piston			
Type	Solid type	----------	----------
Material	Aluminum alloy	----------	----------
O.D. (Skirt End)			
L2A, L3A	65.0 mm (2.5591 in)	----------	----------
L2C, L3C	70.0 mm (2.7559 in)	----------	----------
L2E, L3E	76.0 mm (2.9921 in)	----------	----------
Clearance To Cylinder	----------	----------	0.2
Oversize	0.25, 0.50, 0.75 mm (0.0098, 0.0197, 0.0295 in)	----------	----------
Protrusion From Cylinder Block Top Surface	0.90 mm (0.0354 in)	----------	----------
Piston Pin			
Type	Semifloating type	----------	----------
O.D.	18.0 mm (0.7087 in)	----------	----------
Piston Pin To Piston Clearance	----------	----------	0.080 mm (0.0031 in)
Piston Pin To Connecting Rod Clearance	Press fit load: 1000 ±500 kg (2,200 ±1,100 lb)	----------	(Within standard range)
Piston Rings			
Number of Rings			
Compression	2 (No. 1: Chrome plated, semikeystone type. No. 2: Tapered.)	----------	----------
Oil	1 (Chrome plated ring with coil expander)	----------	----------
Ring Width			
Compression (No. 2)	2.0 mm (0.0787 in)	----------	----------
Oil	3.0 mm (0.1181 in)	----------	----------
Ring Side Clearance			
Compression No. 1	0.05 - 0.09 mm (0.0020 - 0.0035 in)	----------	----------
No. 2	0.03 - 0.07 mm (0.0012 - 0.0028 in)	----------	0.20 mm (0.0079 in)
Oil Ring	0.15 - 0.40 mm (0.0059 - 0.0157 in)	----------	0.20 mm (0.0079 in)
Ring Gap	----------	----------	1.50 mm (0.0591 in)

Parts To Be Tightened	SIze (Width Across Flat of Hex Head)	Tightening Torque (kg•m)
Rocker Stay Bolt	M8 (12)	1.5 - 2.2 kg•m (11 - 16 ft lb)
Rocker Cover Nut	M6 (10)	0.5 - 0.7 kg•m (3.62 - 5.06 ft lb)
Nozzle Holder (Fitting To Engine)	M20 (21)	5.0 - 6.0 kg•m (36 - 43 ft lb)
Nozzle Union Color Fixing Nut	M12 (17)	2.0 - 3.0 kg•m (14 - 22 ft lb)
Nozzle Retaining Nut	M16 (21)	3.5 - 4.0 kg•m (25 - 29 ft lb)
Fuel Injection Pipe Nut	M12 (17)	2.5 - 3.5 kg•m (18 - 25 ft lb)
Delivery Valve Holder	M16 (17)	3.5 - 3.9 kg•m (25 - 28 ft lb)
Injection Pump Hollow Screw	M10 (14)	1.0 - 1.5 kg•m (7 - 11 ft lb)
Injection Pump Air Vent Screw	M6 (10)	0.5 - 0.7 kg•m (3.62 - 5.06 ft lb)
Solenoid Locknut	M30 (36)	4.0 - 5.0 kg•m (29 - 36 ft lb)
Coolant Temperature Gauge Joint	M16 (23)	2.0 - 3.0 kg•m (14 - 22 ft lb)
Thermo Switch	M16 (19)	1.9 - 2.7 kg•m (14 - 19 ft lb)
Thermo Gauge Unit	M16 (17)	1.9 - 2.7 kg•m (14 - 19 ft lb)
Oil Filter	M20	1.1 - 1.3 kg•m (8.0 - 9 ft lb)
Oil Relief Plug	M18 (22)	4.0 - 5.0 kg•m (29 - 36 ft lb)
Oil Drain Plug	M18 (19)	5.0 - 6.0 kg•m (36 - 43 ft lb)
Glow Plug	M10 (12)	1.5 - 2.0 kg•m (11 - 14 ft lb)
Glow Plug Lead Wire Fitting Nut	M4 (7)	0.1 - 0.15 kg•m (0.72 - 1.08 ft lb)

TIGHTENING TORQUE FOR COMMON BOLTS AND NUTS

Designation of Screw Thread	Head Mark	
	4	7
M6	0.3 - 0.5 kg•m (2.17 - 3.62 ft lb)	0.8 - 1.0 kg•m (5.79 - 7.23 ft lb)
M8	1.0 - 1.3 kg•m (7.23 - 9.4 ft lb)	1.5 - 2.2 kg•m (11 - 16 ft lb)
M10	1.8 - 2.5 kg•m (13 - 18 ft lb)	3.0 - 4.2 kg•m (22 - 30 ft lb)

Reference Number	Description	Dimension	
		Body Side	Spindle Side
a		166 mm (6.53 in)	
b		36 mm (1.42 in)	
c		83 mm (3.27 in)	
d		95 mm (3.74 in)	
e		248.4 mm (9.78 in)	
A	Track Extension	PF1/4	PF1/4
B	Track Decrease	PF1/4	PF1/4
C	Right Travel Reverse	PF3/8	PF3/8
D	Left Travel Reverse	PF3/8	PF3/8
E	Right Travel Forward	PF3/8	PF3/8
F	Left Travel Forward	PF3/8	PF3/8
G	2 Speed Travel	PF1/4	PF1/4
H	Drain	PF1/4	PF1/4
I	Dozer Up	PF1/4	PF1/4
J	Dozer Down	PF1/4	PF1/4

4. Install wood blocks (1, Figure 16) on the inside of the vise as shown so that the piston rod will not be damaged and clamp the rod for reassembly.

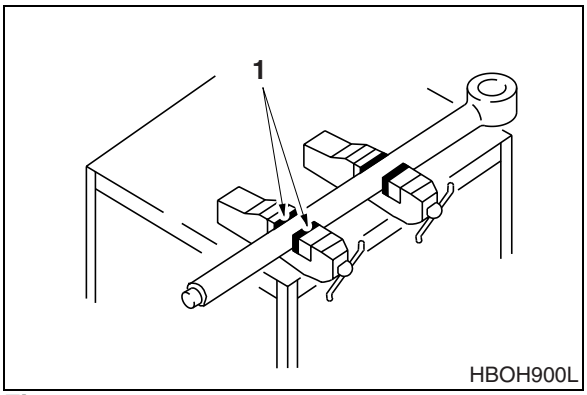


Figure 16

5. Verify the direction of the retaining ring (1, Figure 17) and seal ring (2).
6. Use a new set pin and use a punch to set the new pin (3 and 4, Figure 17) into place so that it does not slip out.

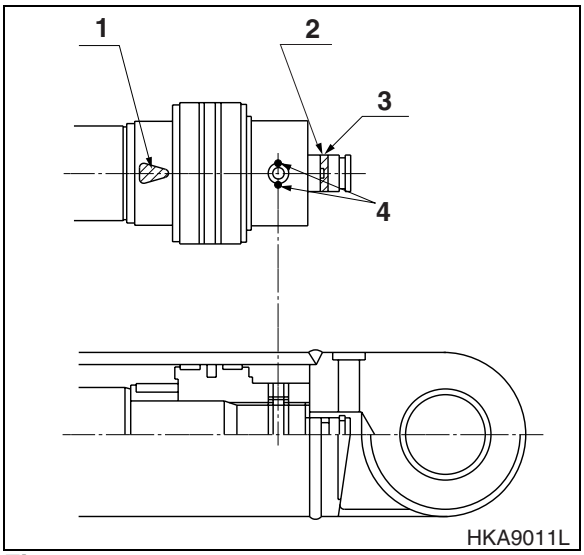


Figure 17

7. Install the nut to the piston rod assembly by turning the nut slowly clockwise.

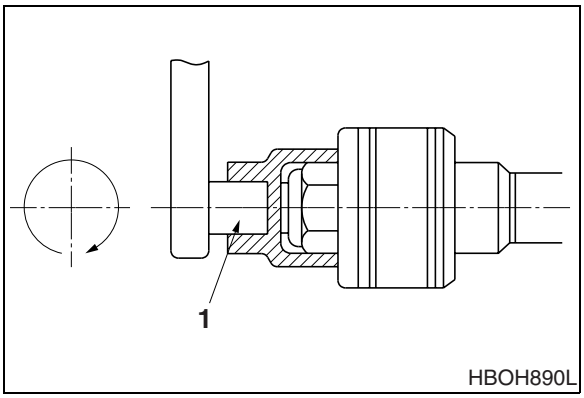


Figure 18

SWIVEL TURN MEASUREMENT

1. Fill the bucket with approximately 60 kg (130 lb) of material.
2. Park the machine on an incline with an angle of 12° with the hydraulic oil temperature at 50° ±5°C 50°C (122° ±41°F)
3. Fully extend the arm cylinder, position the boom cylinder parallel to the surface of the incline and shut down engine.
4. Measure the amount of swing bearing outer race movement after 3 minutes.

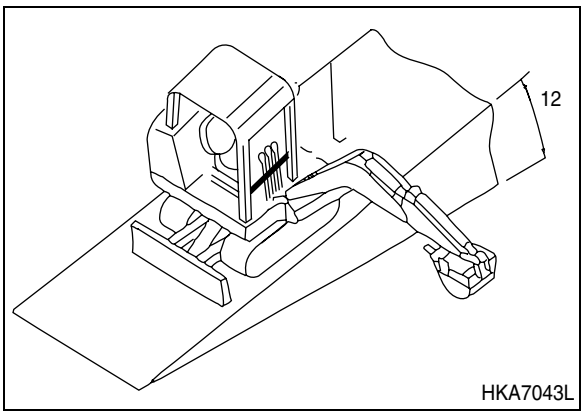


Figure 6

Model	Standard	Limit	Weight
SOLAR 015	100 mm (4 in) or less	200 mm (8 in) or less	60 kg (130 lb)

AMOUNT OF DRAG WHEN SWINGING IS STOPPED

1. Position the machine on a level ground with high engine rpm, oil temperature at 50°C ±5°C, and at maximum operating radius as shown, and align the boom joint 1 parallel to the arm bucket coupling pin.
2. Apply a weight to the bucket tip, and measure the moving length with the bucket tip as a basis after making a turn.

   NOTE: *Bucket load: 60 kg (132 lb)*

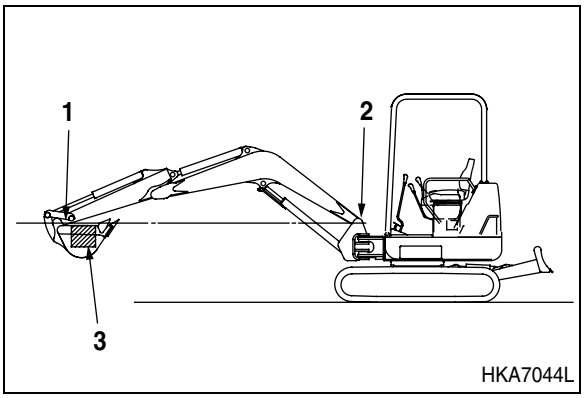


Figure 7

13. Attach inner face seal (2, Figure 35) and outer face seal (1) to balance plate (3).

Figure 34

Reference Number	Description
1	Outer Seal
2	Inner Seal
3	Balance Plate

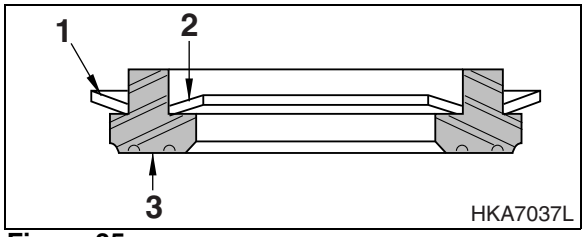


Figure 35

14. After matching up the cutting face of balance plate (3, Figure 36) to pin, assemble it to valve housing (1).

Reference Number	Description
1	Valve Housing
2	Outer Seal
3	Balance Plate
4	Inner Seal

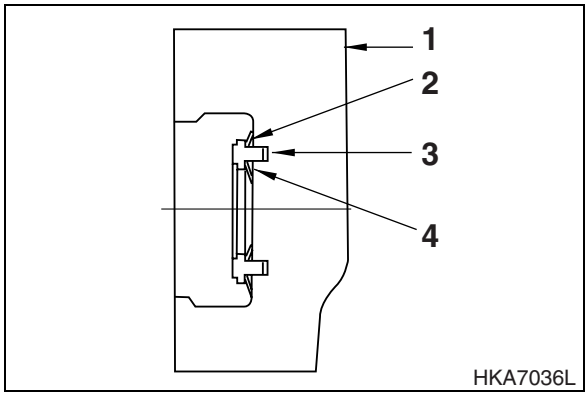


Figure 36

15. Attach O-ring to valve housing. After inserting a drive or long thin rod into hole of port, assemble valve housing to valve pressing not to be loosen the balance plate.

    Assemble valve housing to valve matching up the drain hole of valve housing and valve plate.

Figure 37

3. Two Speed Motor Operation

The swash plate, which has two surfaces (I and II) on the opposite side of sliding shoe surface. The swash is supported by two pivot balls that are mounted in the motor body 2. These two pivot balls allow the swash plate to tilt.

Since the two pivot balls are in an offset position from the center line of the drive shaft and cylinder block, in the low speed range, surface I is forced into contact with body 2, by the supply oil pressure in the piston and the spring in the cylinder barrel. The swash plate angle is α (Max. capacity). This action causes the motor displacement capacity is increased. This increase in displacement allows the same volume of supply oil to rotate the motor at a slower speed, but produces more torque.

When a speed change is made, the pressurized supply oil is routed to the control chamber. The control chamber contains a control piston. The control piston then presses against surface I of the swash plate. The swash plate moves/tilts until surface II contacts body 2, and the swash plate angle becomes β. This action causes the motor displacement capacity is decreased. This decrease in displacement allows the same volume of supply oil to rotate the motor at a higher speed, but produces less torque.

When a engine is stopped, the control chamber is connected to the tank port and the swash plate returns to the low speed position by the spring force. Starting position is always the low speed.

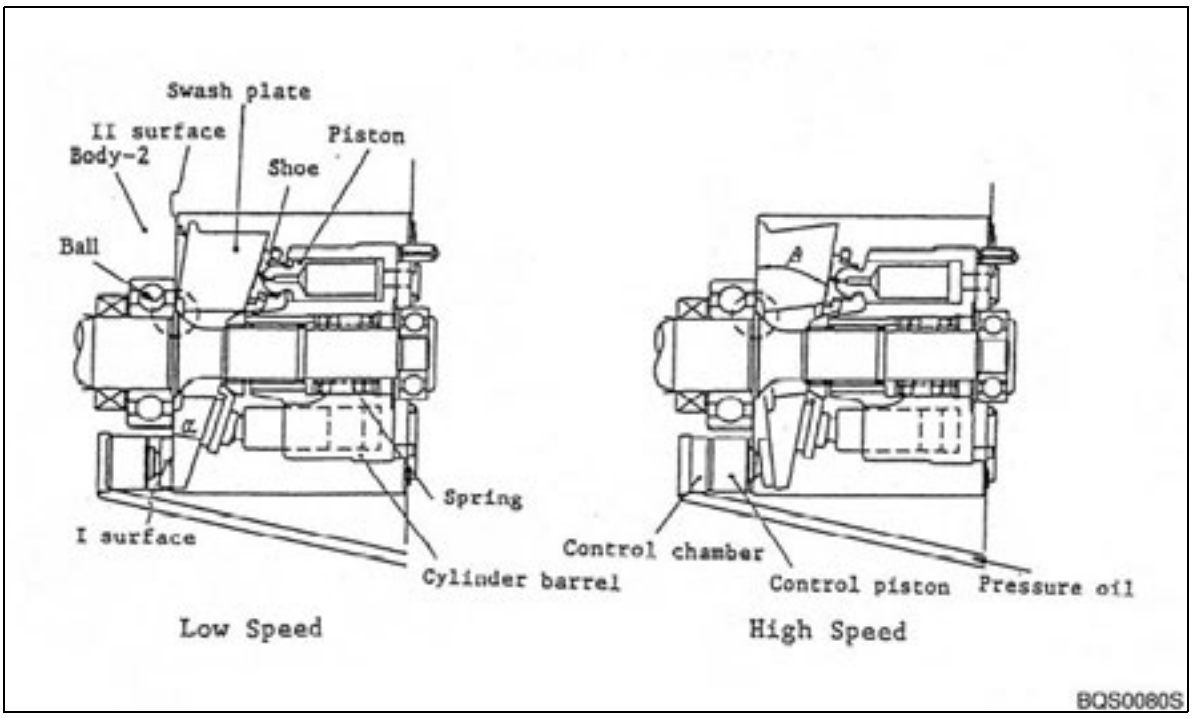


Figure 5

Preference Number	Description
301	Body 1
302	Spool
303	Check Valve
304	Spring Guide
305	Spool
306	Shuttle Spool
307	Spring V1
308	Spring V2
309	Spring V3
310	Plug
311	Plug
312	Plug

Preference Number	Description
313	Choke
314	Ring
315	Plug
316	Plug
317	O-ring
318	O-ring
319	O-ring
320	Choke
321	Needle
322	Plug
323	Choke

REDUCTION GEAR SECTION

1. Position floating seal with O-ring on motor.

   NOTE: *Apply grease to O-ring to aid installation, and then wipe excess grease from seal surface.*

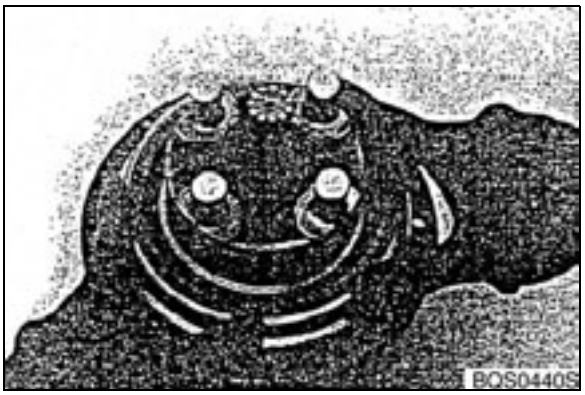


Figure 42

2. Install inner race and bearing retainer with balls into hydraulic motor (1 set)

   NOTE: *a. Pay attention to direction of inner race and retainer. (See cross section drawing for direction.)*

   b. Do not disassemble balls from retainer.

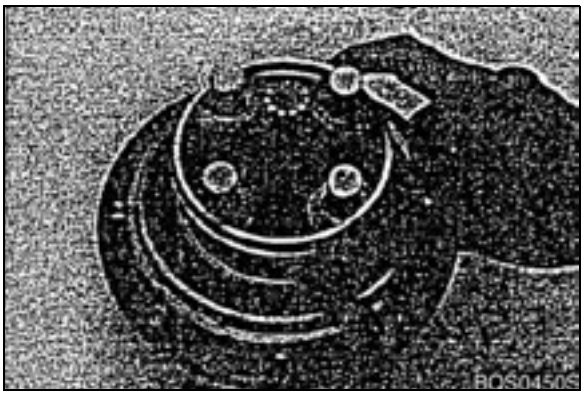


Figure 43

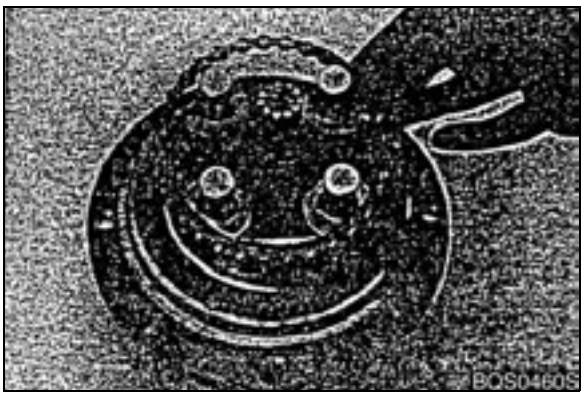


Figure 44

3. Position floating seal with O-ring on body.

   NOTE: *Apply grease to O-ring to aid installation, and then wipe excess grease from seal surface.*

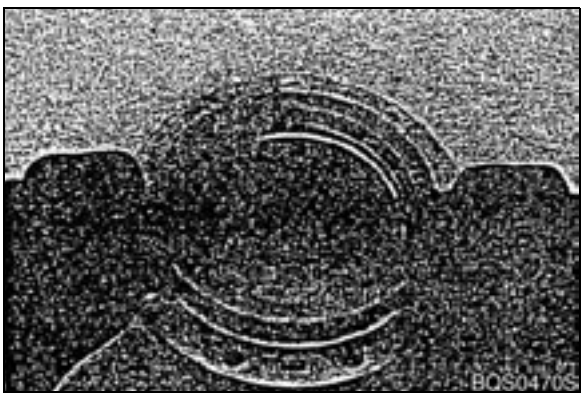


Figure 45

GENERAL DESCRIPTION

THEORY OF OPERATION

The pilot control valve contains four push rods, a spring holder and return spring, which are in the valve casing. The valve works as a pressure reduction valve. The housing has six ports, which include input port "P," tank port "T" and four secondary pressure ports.

The electric horn button is installed in the valve handle. Gear pump pressure is used for operating control spools.

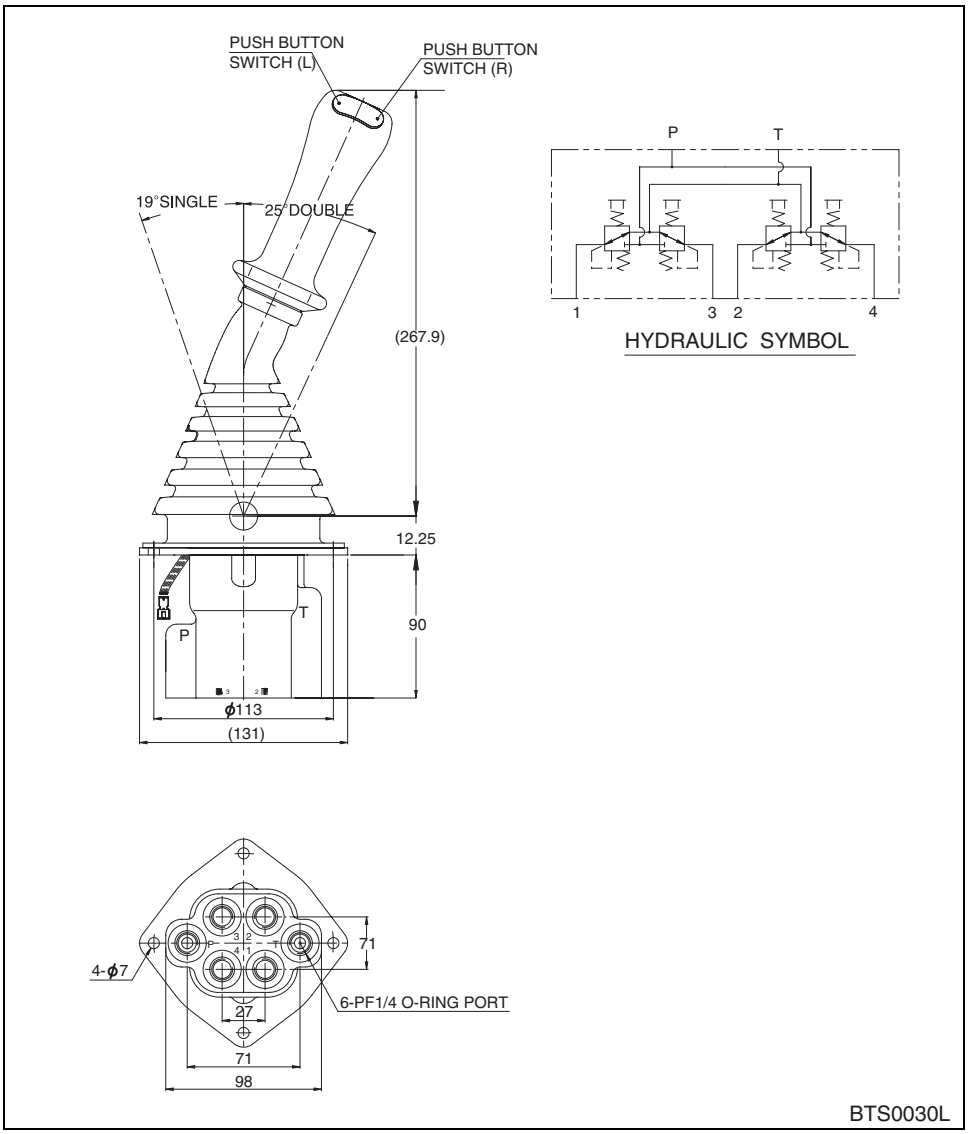


Figure 1

Maximum Primary Pressure	40 kg/cm^2 (569 psi)
Permissible Exhaust Pressure	3 kg/cm^2 (43 psi)
Rated Flow	20 liters (5.5 U.S. gal.)

Port	Name	Size / Standard
S1	Suction Port	SAE 1 1/2 (Standard)
A1•A2	Delivery Port	G1/2-17 (JIS B2351 O type)
A3	Delivery Port	G1/2-17 (JIS B2351 O type)
A4	Pilot Port	G38-13 (JIS B2351 O type)
R1	Air Bleeding Port	M10x1.0 generic plug
R2	Air Bleeding Port	M10x1.0 (Attached to bleeder pump)

ADJUSTMENT (WARRANTY)

This hydraulic pump has been set up by using a specified input horse power and flow control pressure.

If the pump is readjusted, not only will each control function not operate properly, the pump will not be in warranty. Never touch the adjust screw.

PROCEDURES FOR TEST OPERATION

When starting the engine, check the following items and use care:

1. Is the tank washed and clean?
2. Is the piping clean and mounted so that stress is not applied to it?
3. Is the piping properly connected according to the piping diagram (circuit diagram)?
4. Are joints or properly flanges tightened?
5. Are the motor and pump joints properly mounted?
6. Is the rotating direction of the motor in the same direction as that of the pump?
7. Is the specified working oil fed through the filter? Is the tank filled with oil up to the indicated mark on the oil level gauge?
8. Does the filter have the specified filtering precision? (10 μm or less)
9. Is the filter properly mounted in relation to the flow direction?
10. Is the pump housing filled with fluid?
11. Is the control pump set to the bypass position?
12. Start the starting motor. If necessary, run it at low speed.
13. Do not apply any load to the system and check the actuator for movement.
14. If the motor reaches traveling speed, apply load to the actuator for checking.
15. If a monitoring device or measuring device is installed, check it.
16. Keep an eye on the noise level.
17. Check the oil level in the tank, and add oil if necessary.
18. Apply load to the actuator and check the pressure control valve for setting.
19. Check to see that there are no oil leaks at each part. Correct leaks if necessary.
20. Stop the motor.
21. Tighten all the bolts and plugs again, if oil leaks are found. (When retightening them, be sure to set the circuit pressure to no-load.)
22. Check the tank for oil level.
23. Check functions of the pump and actuator.
24. Irregular movement of the actuator indicates that air is still present in the circuits. If proper air bleeding of circuits is properly carried out, all the parts should function normally, without any irregular movements, and there is no generation of air bubbles on the oil surface of the tank.
25. Check oil temperature.
26. Stop the motor.
27. Check the filter, and check the element for dirt.
28. If the element has been severely contaminated, flush the entire hydraulic circuit.

RELIEF VALVE DISASSEMBLY

1. Remove hex nut.

   NOTE: *To set pressure, perform removal operation only if disassembly is needed.*

   Spanner 24 mm

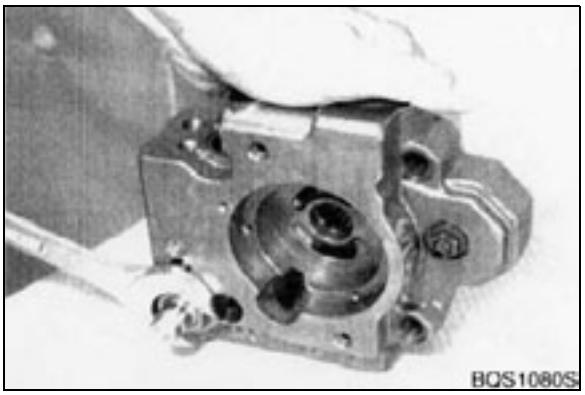


Figure 37

2. Remove adjust screw.

   NOTE: *Be careful of shim.*

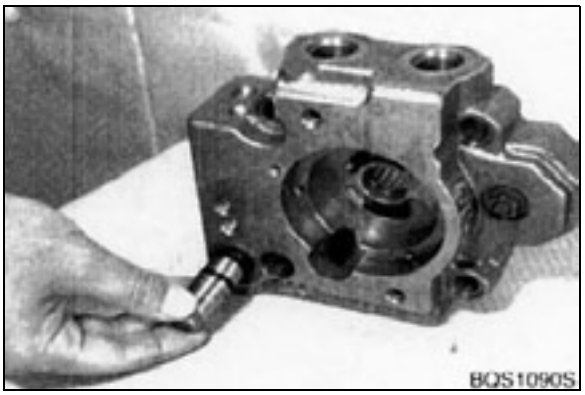


Figure 38

3. Remove spring.

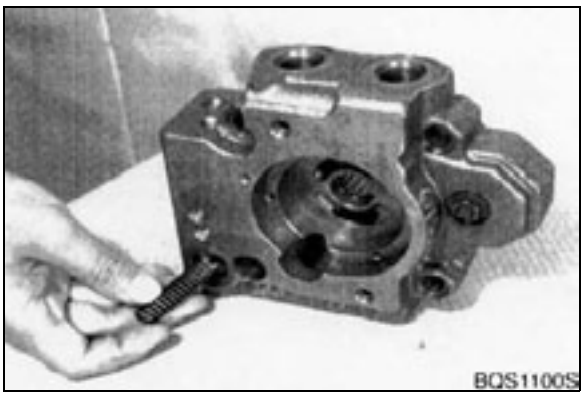


Figure 39

4. Remove spool.

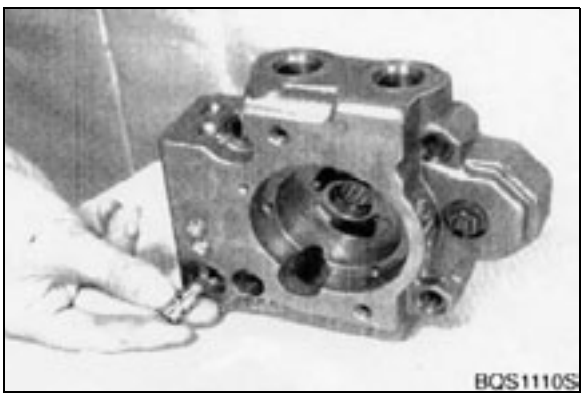


Figure 40

CONTROL SPRING AND SPRING WASHER REASSEMBLY

1. Grease round part of spring washer before assembly.

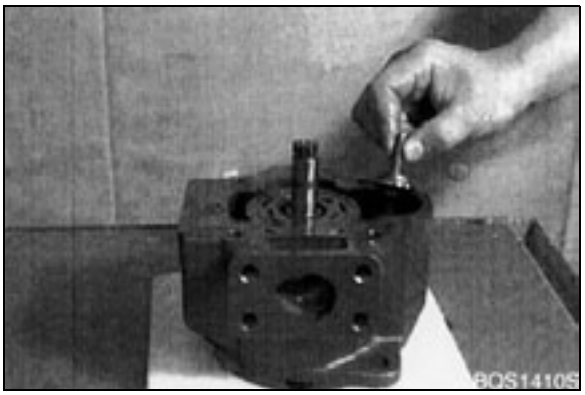


Figure 70

2. Assemble two control springs (inner and outer) and guide.

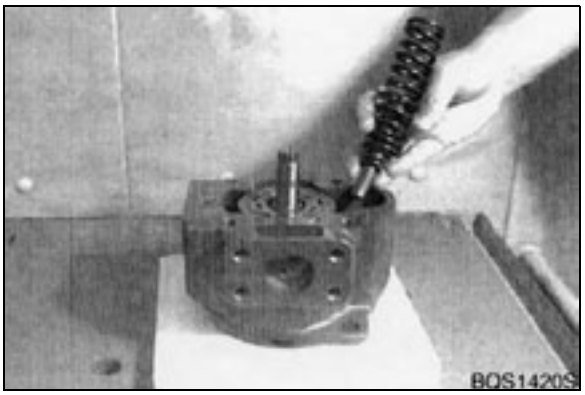


Figure 71

COVER REASSEMBLY

1. Grease inner side of spring washer (to prevent it from falling out) and assemble it to cover.

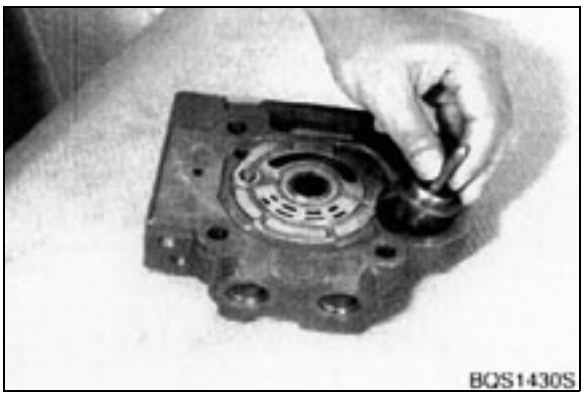


Figure 72

2. Grease inner side of control plate (to prevent it from falling out), align it with knock hole to assemble it to cover.

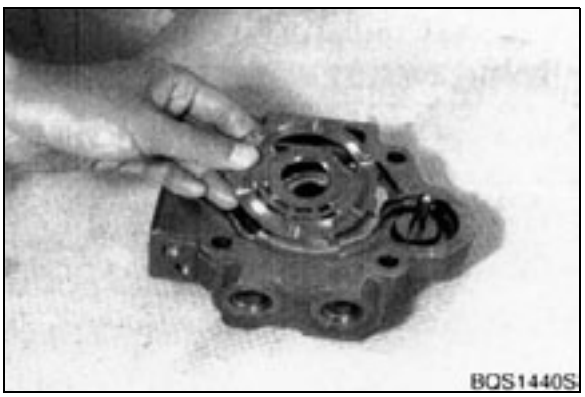


Figure 73

MAIN CONTROL VALVE

⚠ CAUTION!

Follow all safety recommendations and safe shop practices outlined in the front of this manual or those contained within this section.

Always use tools and equipment that are in good working order.

Use lifting and hoisting equipment capable of safely handling load.

Remember, that ultimately safety is your own personal responsibility.

MODEL	SERIAL NUMBER RANGE
Solar 015 PLUS	1001 thru 1157, 20001 thru 20065, 20066 thru 30000, 30001 and Up
Solar 018-VT	30001 and Up

May 2004

Reference Number	Description
1	Control Valve Assembly
2	Pump Block (P1)
3	Travel Block (LH)
4	Spare Block
5	Arm Block
6	PTO Block
7	Travel Block (RH)
8	Bucket Block
9	Boom Block
10	Pump Block (P2)
11	Swing Block
12	Dozer Block
13	Swing Block
14	Pump Block (P3)
15	O-ring
16	O-ring
17	O-ring

Reference Number	Description
18	Main Relief Valve
19	O-ring
20	O-ring
21	Conflex Valve Block
22	O-ring
23	O-ring
24	Port Relief Valve
25	O-ring
26	O-ring
27	Suction Check Valve
28	O-ring
29	O-ring
30	Plug
31	Plug
32	Tie Rod
33	Nut

SOLENOID VALVE

CAUTION!

Follow all safety recommendations and safe shop practices outlined in the front of this manual or those contained within this section.

Always use tools and equipment that are in good working order.

Use lifting and hoisting equipment capable of safely handling load.

Remember, that ultimately safety is your own personal responsibility.

MODEL	SERIAL NUMBER RANGE
Solar 015 PLUS	20066 thru 30000, 30001 and Up
Solar 018-VT	30001 and Up

May 2004

GENERAL DESCRIPTION

Schematic(s) presented in this section are laid out on facing pages.

An overlapping edge has been taken into consideration so that a photocopy can be made and pasted together to make a complete schematic.

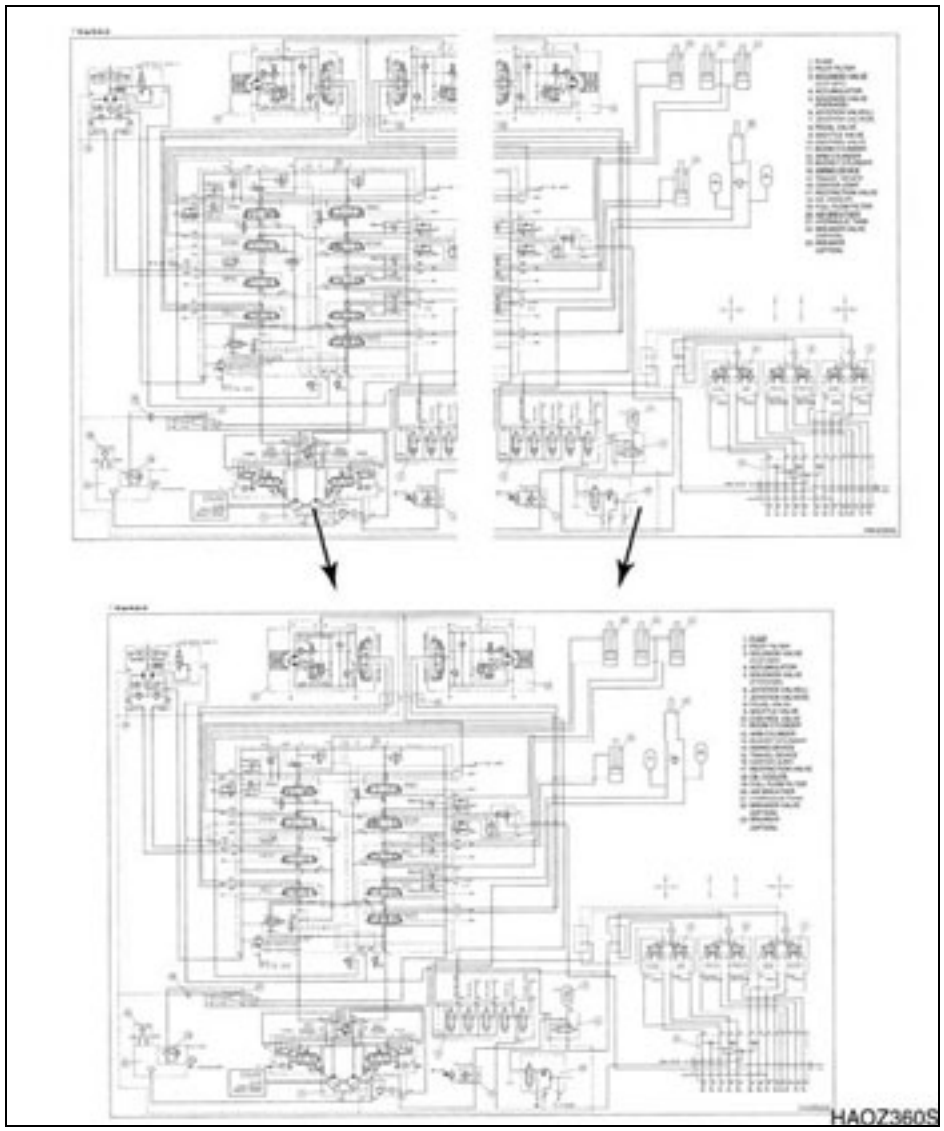


Figure 1

TROUBLESHOOTING - ELECTRICAL SYSTEM

Problem	Possible Cause	Remedy
Battery will not stay charge.	Internal battery short.	Replace battery.
	Short in order part of circuit.	Repair wiring or replace component.
Battery does not charge.	Battery worn out or defective.	Replace battery.
	Defective alternator or belt.	Repair or replace.
	Cable connection loose or severely corrected. Circuit ground corroded or weak.	Repair or replace.

OVERVIEW

The electrical system for this equipment is DC 12 volts.

This rated voltage for all electric components is 12 volts. The system contains a three phase AC generator with a rectifier. The electric wiring used in the system is easily identifiable by the insulator color. The color symbols used in the electrical system are listed in the following chart.

Electric Wire Color

Symbol	Color
W	White
G	Green
Or	Orange
B	Black
L	Blue
Lg	Light green

Symbol	Color
R	Red
Gr	Gray
P	Pink
Y	Yellow
Br	Brown
V	Violet

NOTE: *RW: Red wire with white stripe.*
R - Base color, W - Stripe color.

NOTE: *0.85 G: Nominal sectional area of wire core less insulator = 0.85 mm^2.*

ELECTRICAL SCHEMATIC (SOLAR 015 PLUS / SOLAR 018-VT)

⚠ CAUTION!

Follow all safety recommendations and safe shop practices outlined in the front of this manual or those contained within this section.

Always use tools and equipment that are in good working order.

Use lifting and hoisting equipment capable of safely handling load.

Remember, that ultimately safety is your own personal responsibility.

MODEL	SERIAL NUMBER RANGE
Solar 015 PLUS	30001 and Up
Solar 018-VT	30001 and Up

May 2004

FRONT ATTACHMENT PIN SPECIFICATIONS

The table below has a complete listing of dimensional specifications for all mounting pins used on the front attachment.

NOTE: *Some mounting pins must be drilled and tapped for lubrication fittings and piping, or may have other required specifications. Consult DOOSAN After Sales Service for information on wear tolerances and replacement limits for mounting pins*

Mounting Pin	Diameter, mm (In)	Length, mm (In)
A	30 mm (1.18 in)	172 mm (6.77 in)
B	30 mm (1.18 in)	172 mm (6.77 in)
C	30 mm (1.18 in)	165 mm (6.50 in)
D	30 mm (1.18 in)	172 mm (6.77 in)
E	30 mm (1.18 in)	104 mm (4.09 in)
F	30 mm (1.18 in)	104 mm (4.09 in)
G	30 mm (1.18 in)	167 mm (6.57 in)
H	35 mm (1.38 in)	225 mm (8.86 in)
I	40 mm (1.57 in)	94 mm (3.70 in)
J	40 mm (1.57 in)	94 mm (3.70 in)
K	30 mm (1.18 in)	220 mm (8.66 in)
L	30 mm (1.18 in)	104 mm (4.09 in)
M	30 mm (1.18 in)	195 mm (7.68 in)

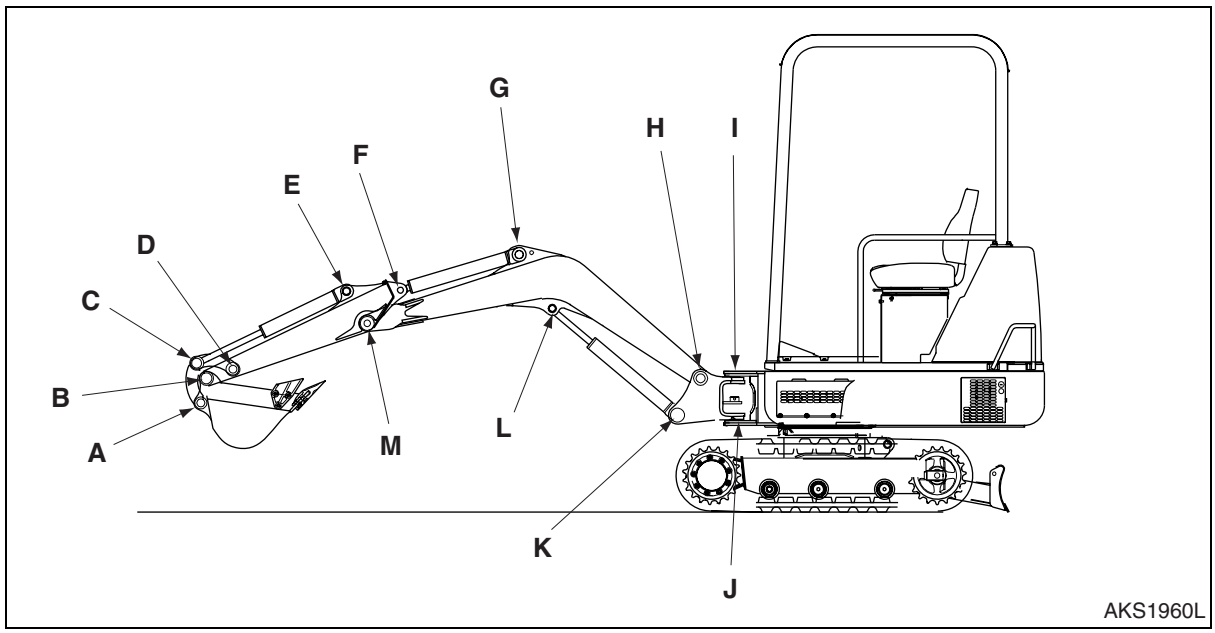


Figure 1

BUCKET

⚠ CAUTION!

Follow all safety recommendations and safe shop practices outlined in the front of this manual or those contained within this section.

Always use tools and equipment that are in good working order.

Use lifting and hoisting equipment capable of safely handling load.

Remember, that ultimately safety is your own personal responsibility.

MODEL	SERIAL NUMBER RANGE
Solar 015	0001 and Up
Solar 015 PLUS	1001 thru 1157, 20001 thru 20065, 20066 thru 30000, 30001 and Up
Solar 018-VT	30001 and Up
Solar 130LC-V	0001 and Up
Solar 130W-V	0001 and Up
Solar 140LC-V	1001 and Up
Solar 140W-V	1001 and Up
Solar 160W-V	1001 and Up
Solar 170LC-V	1001 and Up
Solar 170W-V	1001 and Up
Solar 180W-V	1001 and Up
Solar 200W-V	0001 and Up
Solar 210W-V	1001 and Up
Solar 220LC-V	0001 and Up
Solar 225NLC-V	1001 and Up
Solar 250LC-V	1001 and Up
Solar 255LC-V	1001 and Up
Solar 290LC-V	0001 and Up

Models continued on back of cover.

May 2004