Solar 220LC-V

Shop Manual

2023-7115BE

Serial Number 0001 and Up

June 2004

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.

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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 130LC-V	0001 and Up
Solar 140LC-V	1001 and Up
Solar 170LC-V	1001 and Up
Solar 175LC-V	1001 and Up
Solar 220LC-V	0001 and Up
Solar 220N-V	1001 and Up
Solar 225LC-V	1001 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
Solar 300LC-V	1001 and Up
Solar 300LL	1001 and Up
Solar 330LC-V	1001 and Up
Solar 340LC-V	1001 and Up
Solar 400LC-V	1001 and Up
Solar 420LC-V	1001 and Up
Solar 450LC-V	1001 and Up
Solar 470LC-V	1001 and Up

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January 2004

MOUNTING AND DISMOUNTING

Before getting on or off the machine, if there is any oil, grease, or mud on the handrails, steps, or track shoes, wipe it off immediately. Always keep these parts clean. Repair any damage and tighten any loose bolts.

Never jump on or off the machine. In particular, never get on or off a moving machine. These actions may lead to serious injury.

When getting on or off the machine, always face the machine, and maintain three-point contact (both feet and one hand or one foot and both hands) with the handrails, steps, and track shoes to ensure that you support yourself securely.

Never hold any control levers when getting on or off the machine.

Apply the door lock securely. If you grip the handrail inside the door when moving on top of the track shoes, and the door lock is not applied securely, the door may move and cause you to fall.

Use the points marked by arrows in the diagram when getting on or off the machine.

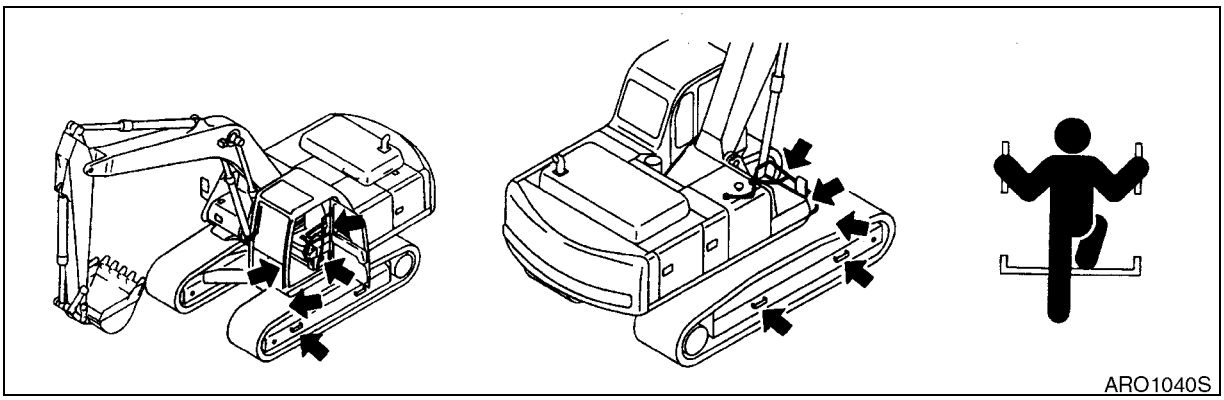

Figure 2

TRAVEL PRECAUTIONS

Never turn the starting switch to the "O" (OFF) position when traveling. It is dangerous if the engine stops when the machine is traveling. It will be impossible to operate the steering.

Attachment control levers should not be operated while traveling.

Do not change selected travel mode (FAST/SLOW) while traveling.

Fold in work equipment so that the outer end of the boom is as close to the machine as possible, and is 40 - 50 cm (16 - 20 in) above ground.

Never travel over obstacles or slopes that will cause the machine to tilt severely. Travel around any slope or obstacle that causes the machine to tilt 10° or more to the right or left, or 30° or more from front to rear.

Do not operate the steering suddenly. The work equipment may hit the ground and cause the machine to lose its balance, and this may damage the machine or structures in the area.

When traveling on rough ground, travel at low speed, and avoid sudden changes in direction.

Always keep to the permissible water depth. Permissible water depth is to the center line of the upper track rollers.

When traveling over bridges or structures on private land, check first that the bridge or structure can withstand the weight of the machine. When traveling on public roads, check with the local authorities and follow their instructions.

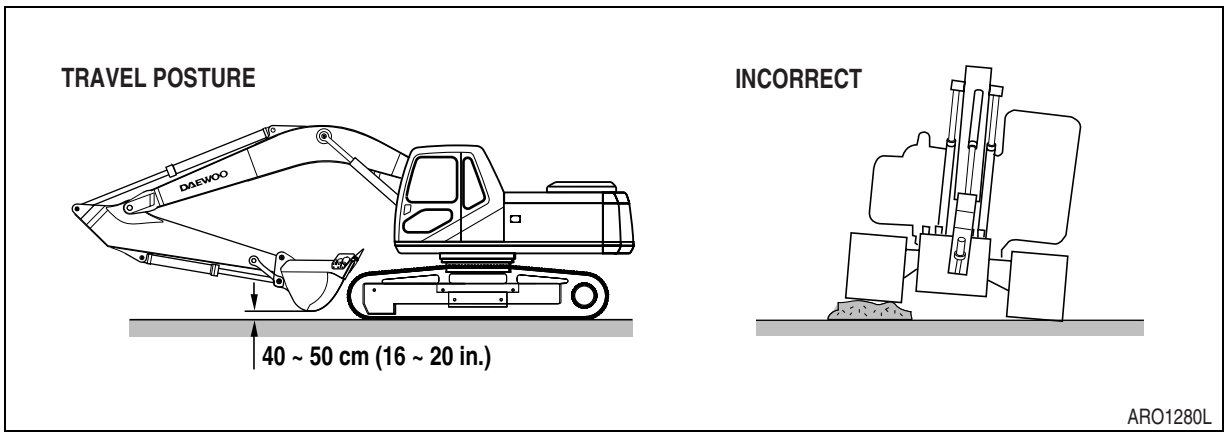

Figure 17

PRECAUTIONS FOR REMOVAL, INSTALLATION, AND STORAGE OF ATTACHMENTS

Before starting removal and installation of attachments, decide the team leader.

Do not allow anyone except the authorized workers close to the machine or attachment.

Place attachments that have been removed from the machine in a safe place so that they do not fall. Put up a fence around the attachments and take other measures to prevent unauthorized persons from entering.

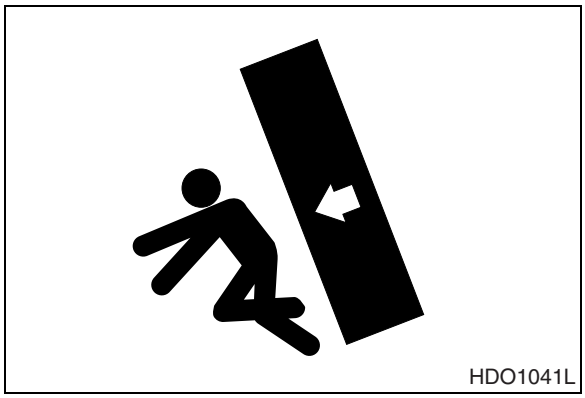

Figure 33

PRECAUTIONS WHEN WORKING ON MACHINE

When carrying out maintenance operations on the machine, keep the area around your feet clean and tidy to prevent you from falling. Always do the following:

- Do not spill oil or grease.
- Do not leave tools laying about.
- Watch your step when walking.

Never jump down from the machine. When getting on or off the machine, use the steps and handrails, and maintain a three-point contact (both feet and one hand or both hands and one foot) to support yourself securely.

If the job requires it, wear protective clothing.

To prevent injury from slipping or falling, when working on the hood or covers, never use any part except the inspection passage fitted with nonslip pads.

Figure 34

LOCK INSPECTION COVERS

When carrying out maintenance with the inspection cover open, lock the cover securely in position with the lock bar.

If maintenance work is carried out with the inspection cover open but not locked, there is danger that it may suddenly close and cause injury if there is a gust of wind.

SPECIFICATIONS FOR SOLAR 220LC-V

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MODEL	SERIAL NUMBER RANGE
Solar 220LC-V	0001 and UP

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March 1999

APPROXIMATE WEIGHT OF WORKLOAD MATERIALS

IMPORTANT

Weights are approximations of estimated average volume and mass. Exposure to rain, snow or ground water; settling or compaction due to overhead weight, chemical or industrial processing or changes due to thermal or chemical transformations could all increase the value of weights listed in the table.

MATERIAL	LOW WEIGHT OR DENSITY 1,100 KG/M^3 (1,850 LB/YD^3), OR LESS	MEDIUM WEIGHT OR DENSITY 1,600 KG/M^3 (2,700 LB/YD^3), OR LESS	HIGH WEIGHT OR DENSITY 2,000 KG/M^3 (3,370 LB/YD^3), OR LESS
Charcoal	401 kg/m^3 (695 lb/yd^3)	----------	----------
Coke, blast furnace size	433 kg/m^3 (729 lb/yd^3)	----------	----------
Coke, foundry size	449 kg/m^3 (756 lb/yd^3)	----------	----------
Coal, bituminous slack, piled	801 kg/m^3 (1,350 lb/yd^3)	----------	----------
Coal, bituminous r. of m., piled	881 kg/m^3 (1,485 lb/yd^3)	----------	----------
Coal, anthracite	897 kg/m^3 (1,512 lb/yd^3)	----------	----------
Clay, DRY, in broken lumps	1,009 kg/m^3 (1,701 lb/yd^3)	----------	----------
Clay, DAMP, natural bed	----------	1,746 kg/m^3 (2,943 lb/yd^3)	----------
Cement, Portland, DRY granular	----------	1,506 kg/m^3 (2,583 lb/yd^3)	----------
Cement, Portland, DRY clinkers	----------	1,362 kg/m^3 (2,295 lb/yd^3)	----------
Dolomite, crushed	----------	1,522 kg/m^3 (2,565 lb/yd^3)	----------
Earth, loamy, DRY, loose	----------	1,202 kg/m^3 (2,025 lb/yd^3)	----------

GENERAL MAINTENANCE

Normal Bearing

Smooth even surfaces with no discoloration or marks.

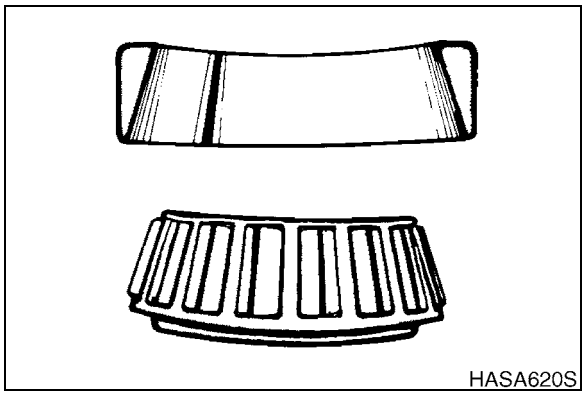

Figure 2

Bent Cage

Cage damage due to improper handling or tool usage.

Replace bearing.

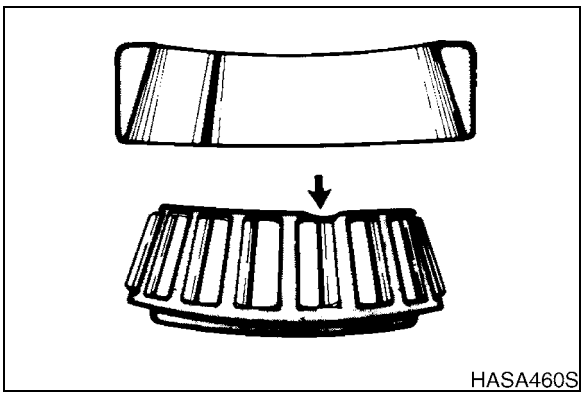

Figure 3

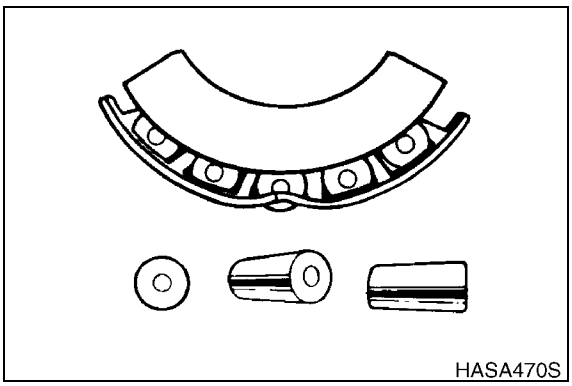

Figure 4

Galling

Metal smears on roller ends due to overheat, lubricant failure or overload.

Replace bearing - check seals and check for proper lubrication.

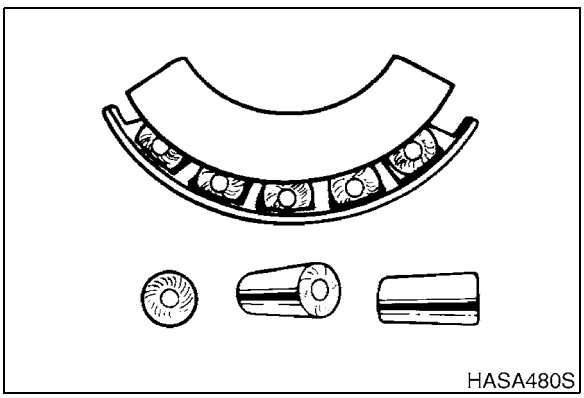

Figure 5

The following General Torque Values must be used in all cases where **SPECIAL TORQUE VALUES** are not given.

NOTE: *TORQUE VALUES LISTED THROUGHOUT THIS MANUAL ARE LUBRICATED (WET) THREADS; VALUES MUST BE INCREASED 1/3 FOR NONLUBRICATED (DRY) THREADS.*

THREAD SIZE	HEAT TREATED MATERIAL GRADE 5 AND GRADE 8			
	GRADE 5 (3 RADIAL DASHES ON HEAD)		GRADE 8 (6 RADIAL DASHES ON HEAD)	
	FOOT POUNDS (ft lb)	NEWTON METER (Nm)	FOOT POUNDS (ft lb)	NEWTON METER (Nm)
1/4" - 20	6	8	9	12
1/4" - 28	7	9	11	15
5/16" - 18	13	18	18	24
5/16" - 24	15	20	21	28
3/8" - 16	24	33	34	46
3/8" - 24	27	37	38	52
7/16" - 14	38	52	54	73
7/16" - 20	42	57	60	81
1/2" - 13	58	79	82	111
1/2" - 20	65	88	90	122
9/16" - 12	84	114	120	163
9/16" - 18	93	126	132	179
5/8" - 11	115	156	165	224
5/8" - 18	130	176	185	251
3/4" - 10	205	278	290	393
3/4" - 16	240	312	320	434
7/8" - 9	305	414	455	617
7/8" - 14	334	454	515	698
1" - 8	455	617	695	942
1" - 14	510	691	785	1064
1 1/8" - 7	610	827	990	1342
1 1/8" - 12	685	929	1110	1505
1 1/4" - 7	860	1166	1400	1898
1 1/4" - 12	955	1295	1550	2102
1 3/8" - 6	1130	1532	1830	2481
1 3/8" - 12	1290	1749	2085	2827
1 1/2" - 6	1400	2034	2430	3295
1 1/2" - 12	1690	2291	2730	3701
1 3/4" - 5	2370	3213	3810	5166
2" - 4 1/2	3550	4813	5760	7810

NOTE: *If any bolts and nuts are found loose or at values less than what the chart states, it is recommended that the loose bolt and/or nut be replaced with a new one.*

CABIN

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MODEL	SERIAL NUMBER RANGE
Solar 130LC-V	0001 and Up
Solar 170LC-V	1001 and Up
Solar 220LC-V	0001 and Up
Solar 220LL	1001 and Up
Solar 220N-V	1001 and Up
Solar 250LC-V	1001 and Up
Solar 290LC-V	0001 and Up
Solar 290LL	1001 and Up
Solar 330LC-V	1001 and Up
Solar 400LC-V	1001 and Up
Solar 450LC-V	1001 and Up

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COUNTERWEIGHT

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Solar 130LC-V	0001 and Up
Solar 140LC-V	1001 and Up
Solar 170LC-V	1001 and Up
Solar 200W-V	0001 and Up
Solar 220LC-V	0001 and Up
Solar 220LL	1001 and Up
Solar 250LC-V	1001 and Up
Solar 290LC-V	0001 and Up
Solar 290LL	1001 and Up
Solar 330LC-V	1001 and Up
Solar 400LC-V	1001 and Up
Solar 450LC-V	1001 and Up
Solar 225LL	1001 and Up
Solar 300LL	1001 and Up

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GENERAL DESCRIPTION

WARNING!

Engine fuel is highly flammable and potentially explosive. To prevent possible injury and/or damage to equipment, extinguish or move to a safe distance all potential fire hazards.

FUEL TRANSFER PUMP

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MODEL	SERIAL NUMBER RANGE
Mega 130	0001 and Up
Mega 160	0001 and Up
Mega 200-III	1001 and Up
Mega 200-V (Tier I and II)	1001 and Up
Mega 250-III	1001 and Up
Mega 250-V (Tier I)	1001 thru 2000
Mega 250-V (Tier II)	2001 and Up
Mega 300-V (Tier I)	1001 thru 2000
Mega 300-V (Tier II)	2001 thru 3000
Mega 300-V	3001 and Up
Mega 400-III PLUS	1001 and Up
Mega 400-V	1001 and Up
Mega 500-V	1001 thru 2000
Mega 500-V (Tier II)	2001 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

Models continued on back of cover.

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3. Lift outer ring and check that inner ring can move freely. See Figure 5, if not, replace seal (3, Figure 4) and/or seal (4, Figure 4).

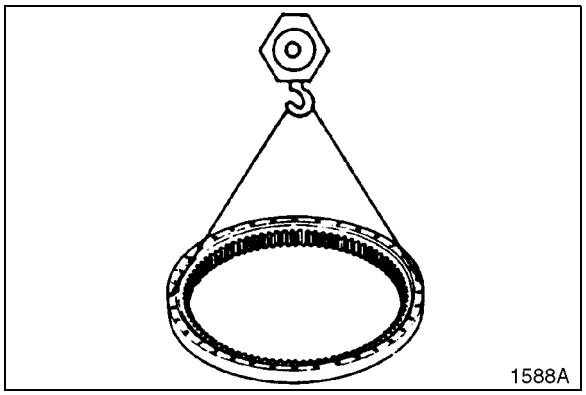


Figure 5

4. Turn inner ring and use magnet bar (1, Figure 6) to remove steel balls (2).

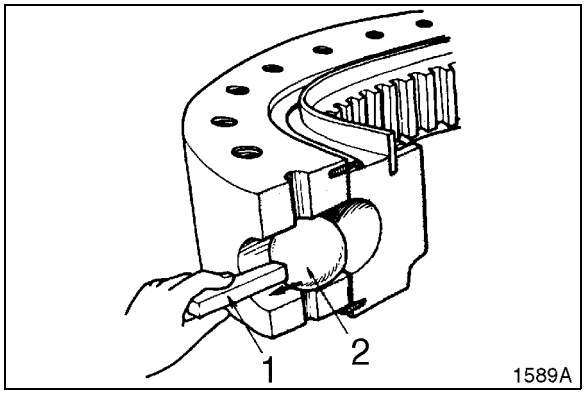


Figure 6

5. Turn inner ring and use wire (1, Figure 7) to remove retainers (2).

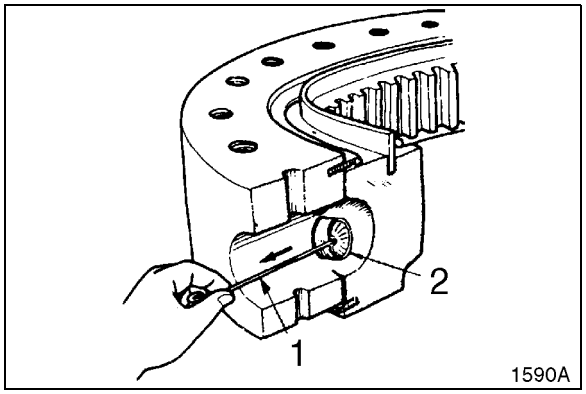


Figure 7

6. Assemble in reverse order of disassembly and then adjust the gap between the steel balls and retainers using the following guidelines:
   - Assemble the steel balls, retainer (A) and retainer (B) to the bearing.
   - If the gap is too wide, adjust by moving the steel balls or by replacing one of the retainers.

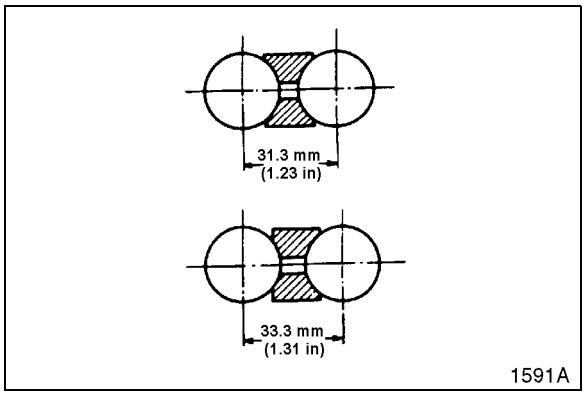


Figure 8

DISASSEMBLY

NOTE: *Reassembly of the gearbox is easier and more likely to be trouble free — or cause damage to surfaces or components — if special tools shown on the preceding page are used. These can be ordered through DOOSAN After Sales Service, or individual jigs can be fabricated at a local machine shop to the specifications shown.*

1. Drain gear oil from the swing motor final drive before removal of the gearbox.

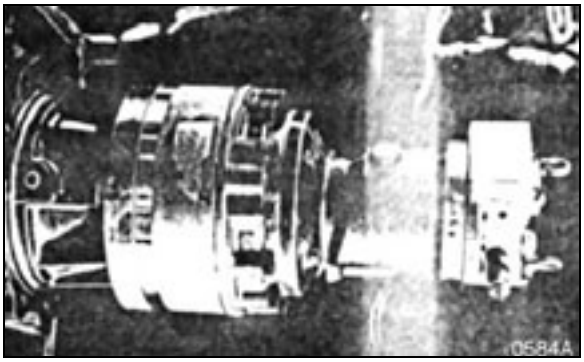


Figure 7

IMPORTANT

Use a clean, dry container (with at least 8 liters, or 2 gallons capacity) to catch gear oil. A clean container allows an evaluation to be made of the used oil. The presence or relative lack of metal wear shavings in the used oil or obvious deterioration or contamination of the oil can provide a useful indicator of the motor's general condition.

NOTE: *Dispose of drained fluids according to local regulations.*

2. Loosen and remove the retaining bolts from around the rim of the gearbox. Separate the gearbox and swing motor from the excavator.

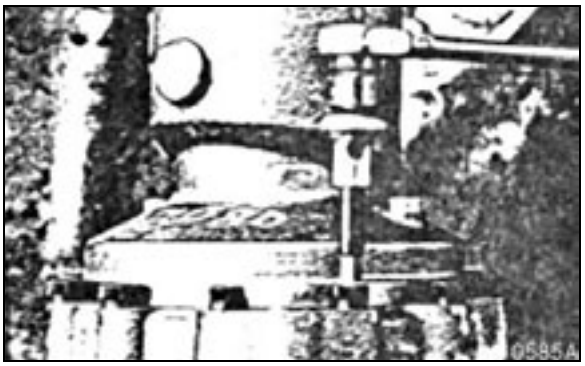


Figure 8

3. Remove the No. 1 sun gear as shown.

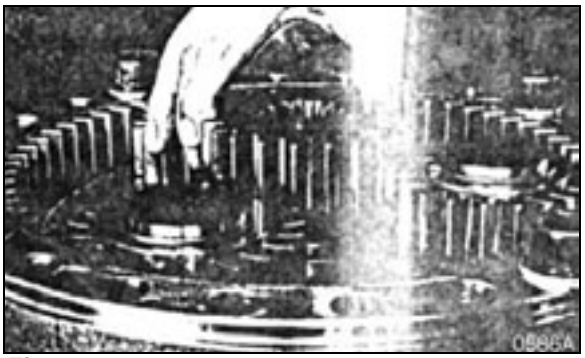


Figure 9

18. Use a punch to make two strikes on the spring pin.

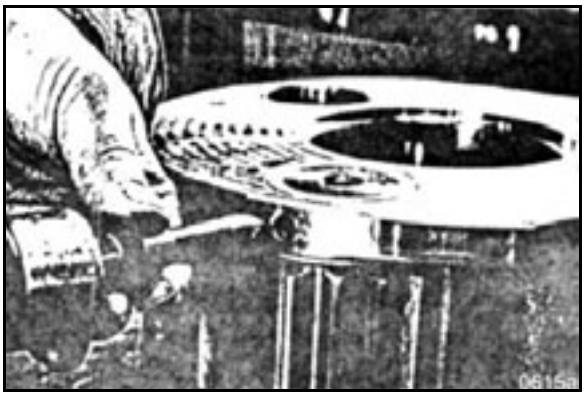


Figure 39

19. Install the thrust ring.

Figure 40

20. Reposition the assembly on top of the workbench. The drive shaft must be facing down.

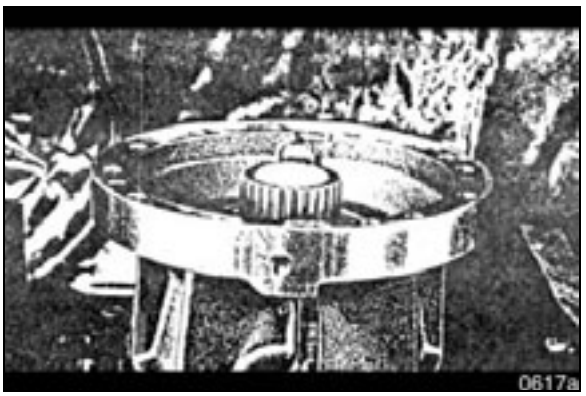


Figure 41

21. Push lock pins into the four holes in the gearbox housing. Apply an even, thin, continuous bead of Silicone flexible sealant to the contact surfaces of the housing and the ring gear. A noncorrosive, increased oil resistance silicone formula is recommended.

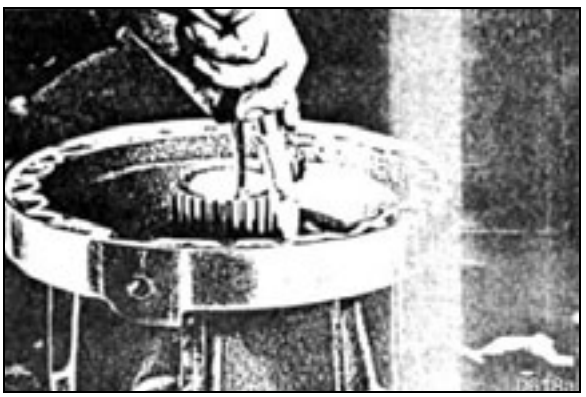


Figure 42

GENERAL DESCRIPTION

The track assembly is composed of the following major components:

1. Track
2. Front Idler Roller
3. Upper Roller
4. Lower Roller
5. Track Spring and Track Adjustment Cylinder

TRACK TENSION

⚠ WARNING!

Safely measuring track tension requires two people. One person must be in the operator's seat, running the controls to keep one side frame in the air, while the other person makes dimensional checks. Take all necessary precautions to make sure the machine won't move or shift position during service. Warm up the engine to prevent stalls, travel the excavator to an area that provides level, uniform ground support and/or use support blocks when necessary.

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.

Track shoe link pins and bushings wear with normal usage, reducing track tension. Periodic adjustment is necessary to compensate for wear and it may also be required by working conditions.

1. Track tension is checked by jacking up one side of the excavator. See Figure 1. Place blocking under frame while taking measurement.

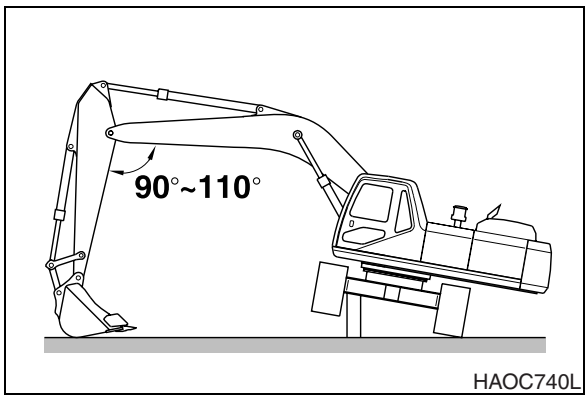


Figure 1

FRONT IDLER ROLLER DISASSEMBLY

1. Remove plug (2, Figure 20) and drain oil from roller assembly (1).

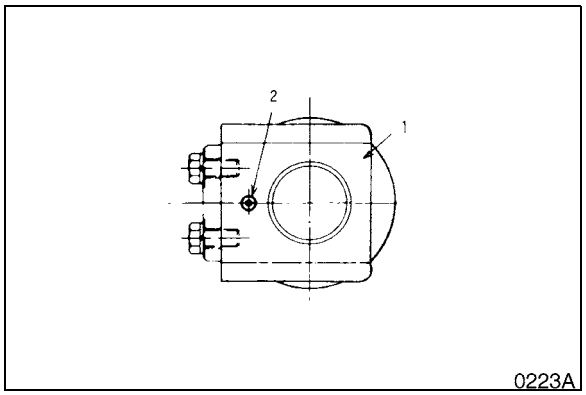


Figure 20

2. Separate the pin (3, Figure 21) from the bearing (1).

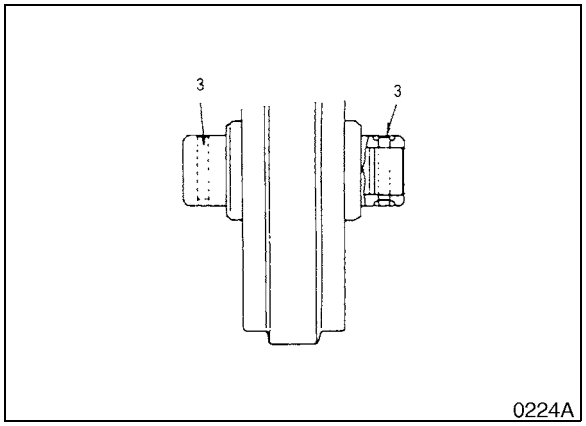


Figure 21

3. Use a press to remove the bearing from the axle. Separate the O-ring (4, Figure 22) from the axle and insert it into the bearing.

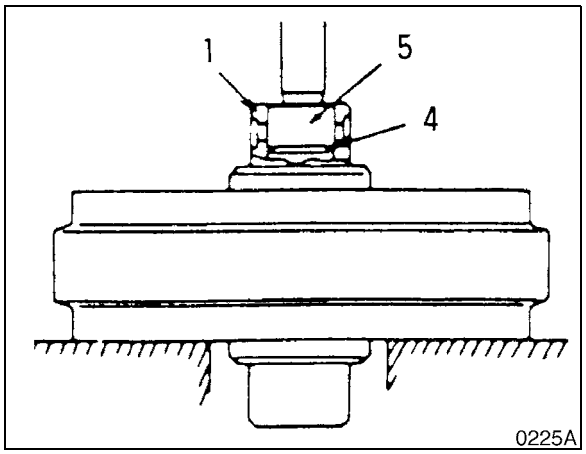


Figure 22

2. Insert group seal (8, Figure 47) into the roller (6) and bushing.

   NOTE: *Apply clean engine oil to the joint side of the group seal. Apply grease to the group seal O-ring.*

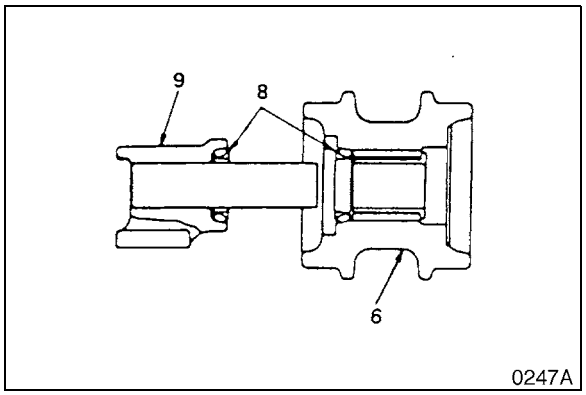


Figure 47

3. Install the axle, washer (5, Figure 48) and bolt (4).
4. Attach group seal (8, Figure 39) to the roller (6, Figure 48) and cover (3).
5. Insert the O-ring (11, Figure 48) to the cover. Attach cover (3) and bolt (2) to the roller.
6. Fill with 200 cc (6.8 fluid ounces) of engine oil.

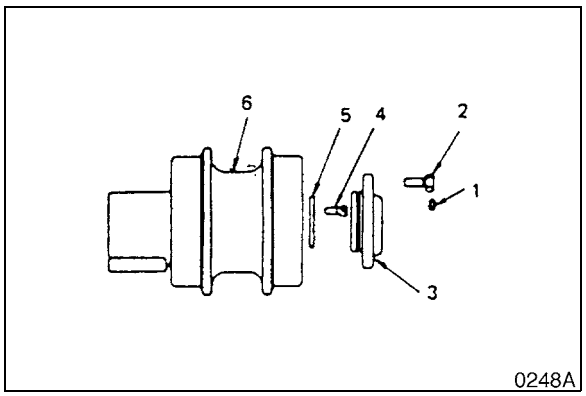


Figure 48

7. Tighten plug (1, Figure 49).

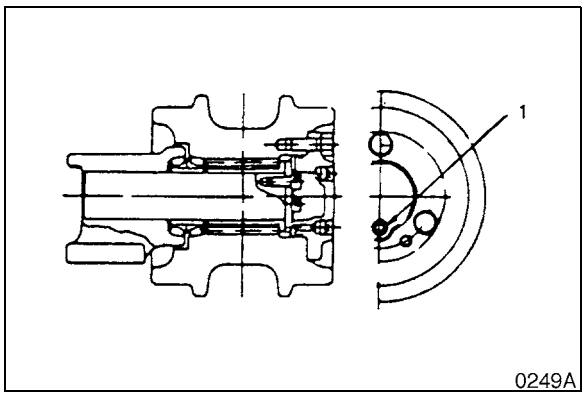
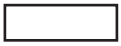


Figure 49

Shading	Temperature	Refrigerant State
	High	High-pressure Gas
	High	High-pressure Liquid
	Low	Low-pressure Liquid
	High	High-pressure Gas/Liquid
	Low	Low-pressure Gas

- Refrigerant (R134a) is compressed to approximately 15 kg/cm^2 (210 psi) within the compressor.
- The compressed refrigerant flows into the condenser at high temperature (approximately 80°C (176°F)).
- The refrigerant in the condenser is cooled to approximately 60° by the condenser fan. At this time the refrigerant changes from the gas to the liquid state, even though the temperature has only been reduced 20°C (68°F). (From 80° - 60°C (176° - 140°F)).
- The refrigerant in its liquid form is injected into the evaporator through the expansion valve. At this time the pressure is reduced by approximately 2 kg/cm^2 (28 psi) and the temperature is also reduced. As a result, the refrigerant absorbs the heat from the air surrounding the evaporator creating a cooling effect and changes from the gas to the liquid state.
- The refrigerant again flows into the compressor in the gaseous state and the process is repeated.

⚠ WARNING!

Refrigerant gas is pressurized and sealed in the air-conditioning system. Special precautions are required for the proper recharging or release of refrigerant. Release of refrigerant into the atmosphere is strictly regulated by law. Make sure that you are in compliance with all mandated federal, state and municipality requirements, before starting any service or repair of the air conditioner. Refrigerant gas used in the system must meet or exceed specifications for R134a refrigerant, or any subsequently issued environmentally-mandated standard.

3	**High-pressure: Approximately 20 - 25 kg/cm^2 (285 - 355 psi)** **Low-pressure: Approximately 2.5 - 3.5 kg/cm^2 (35 - 50 psi)**

Possible Cause: Air in system.

1. Recover any remaining refrigerant.
2. Vacuum out system.
3. Recharge system.

NOTE: *If the system has been exposed to the air for a long period of time, replace the receiver dryer.*

4	**High-pressure: Over 6 kg/cm^2 (85 psi)** **Low-pressure: Approximately 760 mmHg (Negative Pressure)**

Possible Cause: Refrigerant does not circulate

Step	Inspection Item		Remedy
1	1. Connect manifold gauge and start engine. 2. Turn on air conditioner. 3. Set blower switch to "HIGH" position. 4. Turn air conditioner "OFF" and wait 10 minutes. 5. Recheck high / low-pressure readings. High-pressure: 13 - 19 kg/cm^2 (185 - 270 psi). Low-pressure: 1.5 - 3.3 kg/cm^2 (21.3 - 46.9 psi).	Yes	Moisture in system, replace receiver dryer.
		No	Contaminated system, replace expansion valve. (Replace evaporator core assembly.)

5	**High-pressure: Over 6 - 18 kg/cm^2 (85 - 256 psi)** **Low-pressure: 500 mmHg (Negative Pressure) - Dial indicator needle unstable.**

Possible Cause: Moisture in system has iced up the expansion valve.

NOTE: *When the absorbed moisture freezes the pressure readings may look normal. Careful readings must be made to determine whether pressure is in normal range.*

1. Recover any remaining refrigerant.
2. Vacuum out system.
3. Recharge system.

NOTE: *If the system has been exposed to the air for a long period of time, replace the receiver dryer.*

6	**High-pressure: Over 22 - 23 kg/cm^2 (313 - 327 psi)** **Low-pressure: 2.5 kg/cm^2 (36 psi)**

Possible Cause: Refrigerant pressure problem due to defective expansion valve or temperature sensor.

Step	Inspection Item	Remedy

REFRIGERANT CHARGING

1. Perform the vacuuming procedure, vacuum holding and leaking tests as described in the proceeding headings.

   NOTE: *First charge the refrigerant system with 100 g (3.5 ounces) of refrigerant with the engine off. Then using the manifold gauges as a guide fully charge the system with the engine running.*

   When exchanging refrigerant containers, press the manifold gauge low side valve to eliminate air from the charging hose.

Reference Number	Description
1	To Compressor
2	Low-pressure Side
3	High-pressure Side
4	From Receiver
5	Refrigerant Supply Container

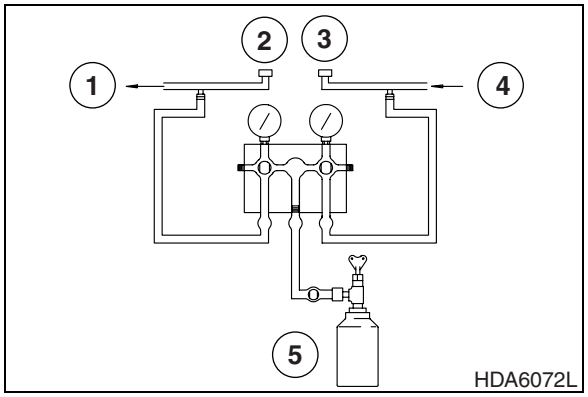


Figure 19

2. Charge the system by opening the manifold gauge low side valve.

   Initial charge amount: 100 g (3.5 ounces).

3. If refrigerant does not flow freely into system, try starting engine first before operating air conditioner.

   - Temperature control switch setting: Maximum Cooling.
   - Blower Speed Setting: Hi (3 step).
   - Engine Speed: 1,300 - 1,500 rpm.

⚠ WARNING!

When charging refrigerant system with the engine running:

- **Always keep refrigerant supply container in the upright position.**
- **Never open the high side pressure valve.**

4. Open the manifold gauge low side valve and charge system to standard capacity.

Gauge Dial	Standard Reading
High Side Gauge	13 - 20 kg/cm^2 (185 - 285 psi)
Low Side Gauge	1.5 - 3.5 kg/cm^2 (21 - 49 psi)

NOTE: *These standards are for outside temperatures between 30° - 35°C (86° - 95°F). The gauge readings may vary for extreme temperature conditions.*

UCHIDA PUMP TOOL

This tool is used to control the distance between the shoulder on the pump drive shaft and the rear face of the drive coupling hub (Figure 7 and Figure 10). This distance will be referred to as "Measurement H" in the installation instructions that follow.

NOTE: *In manufacturing drawing (Figure 8), dimension "A" equals "Measurement H."*

Figure 7

HYDRAULIC SYSTEM TROUBLESHOOTING, TESTING AND ADJUSTMENT

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 220LC-V	0001 and Up
Solar 220LL	1001 and Up

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PILOT PRESSURE

ADJUSTMENT AND TESTING

⚠ WARNING!

This procedure must be done with two people. To reduce the chance of accident or unintended start-up, one person should remain at the operator's control stand while checks and adjustments are made.

Vent hydraulic pressure from the reservoir before breaking the seal on fittings to install two in-line "T-style" adapters and test gauges (60 bar/1,000 psi) at the gear pump outlet port, and at the joystick control valve pilot line.

Start the engine and turn the engine speed control dial to the maximum setting. After the excavator has been operated long enough to reach normal operating temperature, back off the engine control dial to minimum rated rpm speed. With all controls in neutral, make sure the left console control stand is locked in the down (operating) position and check pressure at the gear pump outlet port and at the joystick.

If gear pump pressure is outside the tolerance specified in the table, adjust gear pump relief pressure by loosening the lock nut and turning the set screw in (clockwise) to increase pressure, or turning it out to decrease it.

NOTE: *Be aware that serial number changes and variation in the joystick assemblies used on different excavators could produce slight change in actual performance characteristics. Comparison of part numbers to serial numbers stamped on your assembly may be required, if questions or doubt exists.*

IMPORTANT

Top off the hydraulic fluid reservoir if there is any measurable loss of hydraulic oil during test gauge and adapter fitting installation.

Engine RPM	Pilot Pressure @ Pump	Pilot Pressure - Joystick
Minimum Speed Setting (full left) on Speed Control Dial	40 ±5 bar (580 ±73 psi)	28 ±1.5 bar (406 ±22 psi)

Engine RPM	Pressure	Flow
	100 kg/cm^2 (1,422 psi)	
	135 kg/cm^2 (1,930 psi)	
	180 kg/cm^2 (2,560 psi)	
	240 kg/cm^2 (3,413 psi)	
	320 kg/cm^2 (4,550 psi)*	
	*See Note, below	

Compare recorded values with output shown in the P-Q curve in the specifications section of this book.

If test results do not measure up to specified values, pump output tests can be repeated using different control levers. Recheck front pump operation while stroking the bucket cylinder out lever, and the rear pump by actuating the swing control lever.

NOTE: *When testing bucket and swing functions, read maximum flow tests at 330 kg/cm^2 (4,785 psi), not 350 kg/cm^2 (5075 psi).*

ACCUMULATOR

⚠ 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
Mega 130	0001 and Up
Mega 160	0001 and Up
Mega 200-III	1001 and Up
Mega 200-V	1001 and Up
Mega 250-III	1001 and Up
Mega 250-V	1001 and Up
Mega 300-V (Tier I)	1001 thru 2000
Mega 300-V (Tier II)	2001 thru 3000
Mega 300-V	3001 and Up
Mega 400-III PLUS	1001 and Up
Mega 400-V	1001 and Up
Mega 500-V	1001 thru 2000
Mega 500-V (Tier II)	2001 and Up
Solar 130LC-V	0001 and Up
Solar 130W-V	0001 and Up
Solar 170LC-V	1001 and Up
Solar 170W-V	1001 and Up
Solar 200W-V	0001 and Up
Solar 220LC-V	0001 and Up

Models continued on back of cover.

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June 2002

GENERAL DESCRIPTION

The center joint (swivel) is designed to allow hydraulic oil from the upper structure to flow to components in the lower structure.

It is capable of allowing continuous 360° rotation of the upper structure in relationship to the lower structure.

GENERAL DESCRIPTION

Two essentially similar types of hydraulic cylinders are used on the excavator. The cylinder that is used to operate the excavator boom or bucket is equipped with a rod stopper, which acts as a cushion only when the cylinder rod is fully retracted (and the bucket is pulled close to the arm). This type of cylinder is shown in the lower drawing.

Arm cylinders have a cushion or stopper for operation in both directions. This type of cylinder is shown in the upper drawing.

THEORY OF OPERATION

Reference Number	Description
1	Piston
2	Oil Path A
3	Oil Path B

Cylinder piston rods are extended or retracted by oil flow to the back side of the cylinder (shown as ("oil path A") or to the front of the cylinder ("oil path B").

The cylinder rod is extended as oil flow is pumped through the circuit to the back side of the piston. The force (F1) of the piston stroke can be expressed by the formula below, where P = circuit oil pressure and the inside diameter of the cylinder is expressed by B (Figure 1).

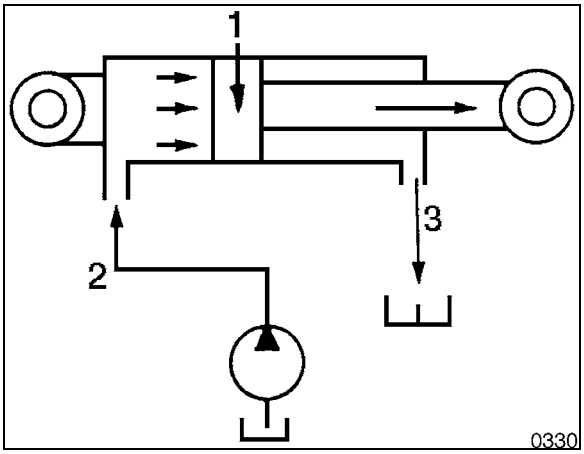

Figure 1

$$F_1 = P \times \frac{\pi B^2}{4}$$

(P: Pressure, p = 3.14, B: Cylinder Inside Diameter)

Reference Number	Description
1	Cylinder Inside Diameter - B
2	Oil Path A
3	Oil Path B
4	Rod Diameter

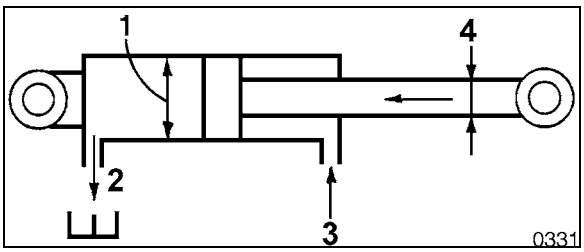

Figure 2

When the cylinder rod is retracted, oil flow through the circuit from the pump to the front side of the cylinder generates a force (F2) that can be expressed by the formula in which the diameter of the piston rod is expressed by R, and the other two terms are the same as in the preceding expression.

$$F_2 = P \times \frac{\pi(B^2-R^2)}{4}$$

7. Immobilize piston rod by inserting a wooden or other nonscoring, nonmetallic support through end of rod.

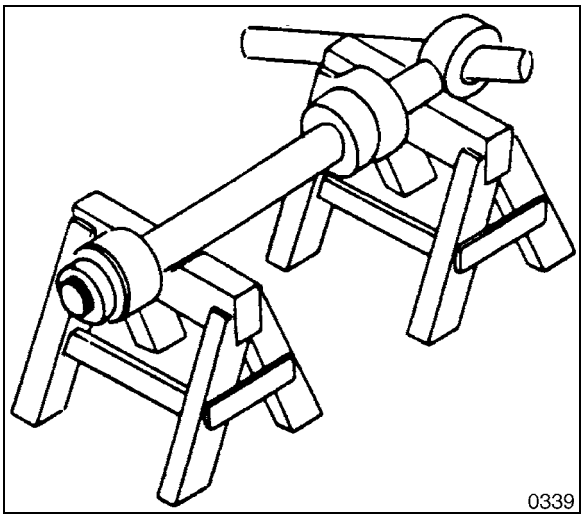

Figure 18

8. Remove set screw by using a socket wrench.

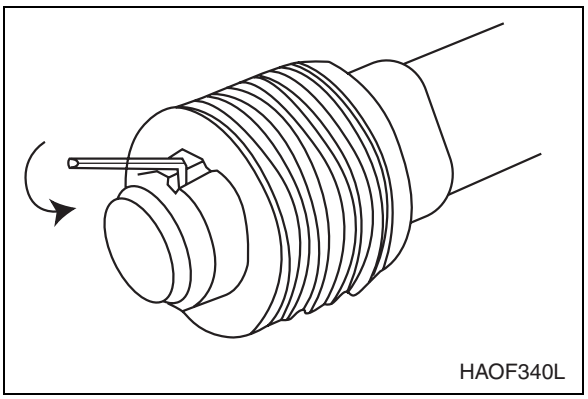

Figure 19

9. Fabricate or purchase a piston nut removal wrench. (Dimensions are called off at beginning of this procedure. This tool may also be ordered through your local *DOOSAN* Parts distributor). Remove nut from end of piston.

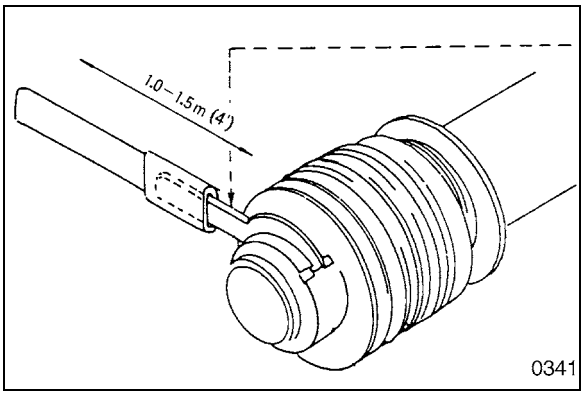

Figure 20

GENERAL DESCRIPTION

THEORY OF OPERATION

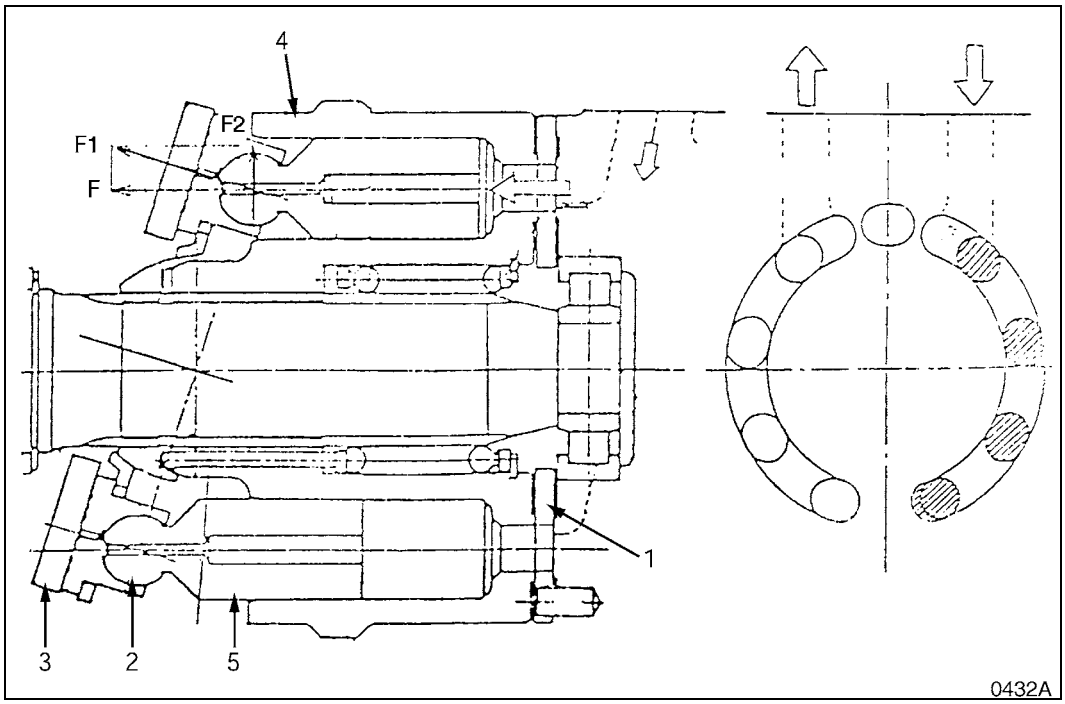

Figure 1

Reference Number	Description
1	Valve Plate
2.	Shoe
3.	Swash Plate

Reference Number	Description
4.	Cylinder Block
5.	Piston

The cross sectional views of the swing motor, show most of the main components of an axial-piston type hydraulic motor. Arrows indicating direction of flow and other graphic symbols provide a general guide for understanding basic operation (Figure 1).

When high-pressure oil enters the cylinder through the inlet port of the valve plate (1, Figure 1), the sliding piston inside the cylinder is driven back, generating force "F" against the shoe behind the piston (2).

Force "F" acts in two different directions, as indicated by the arrows (Figure 1). Force F1 exerts pressure directly on the swash plate (Item 3) to generate oil flow through the motor, while force F2 pushes laterally - at a right angle - against the drive shaft, providing the rotational energy to turn the cylinder block around the drive shaft.

All nine pistons in the cylinder block have equal width bore, length and volume. They are configured in a concentric layout around the drive shaft, as shown in the cross section end view. As oil is forced through the inlet port, pistons rotating past the pressurized (supply) side of the motor (indicated as the shaded cylinders) transmit drive torque - one after the next, each in turn - to the swash plate (through F1, direct output force) and to the cylinder block (F2, lateral force to keep the block rotating).

8. Loosen and remove all four socket head bolts (401) and separate upper valve casing (303) from lower casing (301).

   NOTE: *Valve plate (131) inside upper valve casing (303) must be separated from assembly but take extra care to make sure that it is not scratched or damaged by an accidental fall, after cover is removed.*

9. Remove all twenty brake springs.

   NOTE: *If brake springs are to be reused and not replaced, check and record spring free height. If a test stand is available, check height of all twenty springs under consistent loading. Replace all springs that show excessive variation or weakness.*

10. Disassemble brake piston assembly using special tool and corresponding piston bolt hole.

    NOTE: *See "Special Tools" portion of this section for manufacturing details of special tool.*

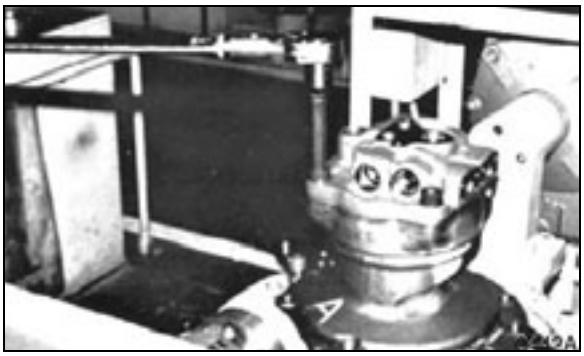

Figure 12

Figure 13

Figure 14

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11. Put cylinder block (111) and retainer plate (123) back in motor. Spherical bushing and grooves of cylinder block splines should fit together without undue difficulty. (Do not try to force or pound parts together.)

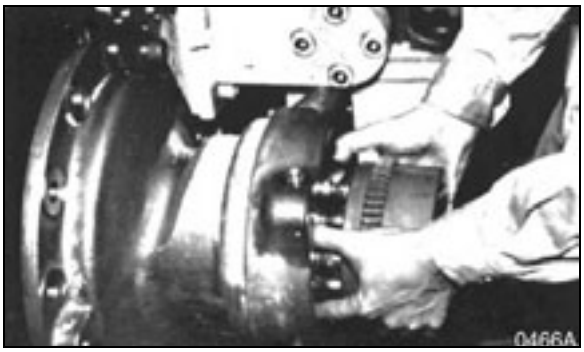


Figure 37

12. Turn motor so that front cover side (304) is down. Put separator plates (743) and friction plates (742) back in same order in which they were removed. There are three separator plates (743) and two friction plates (742), which must be positioned as shown in drawing below, with clearance towards side of casing with brake valve (1, Figure 38).

Reference Number	Description
1	Brake Valve

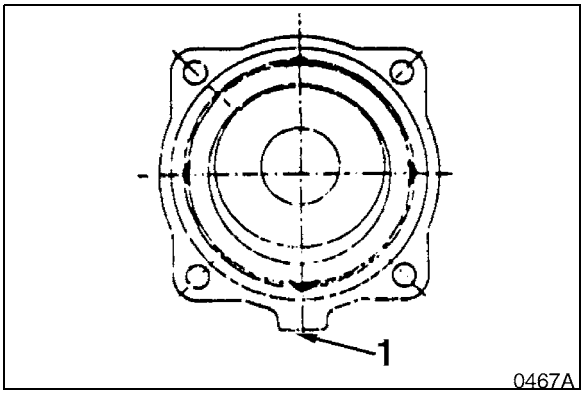


Figure 38 \

13. Very lightly grease larger O-rings (706 and 707, Figure 4) before replacing them in casing (301).

Figure 39

14. Position brake piston (1, Figure 40) in casing. The diagram shows position of four piston grooves (2) in relation to valve connected side (3), and two 8 mm bolts which must be tightened in an even, progressive rotation.

Reference Number	Description
1	Brake Piston
2	Groove
3	Valve Connected Side

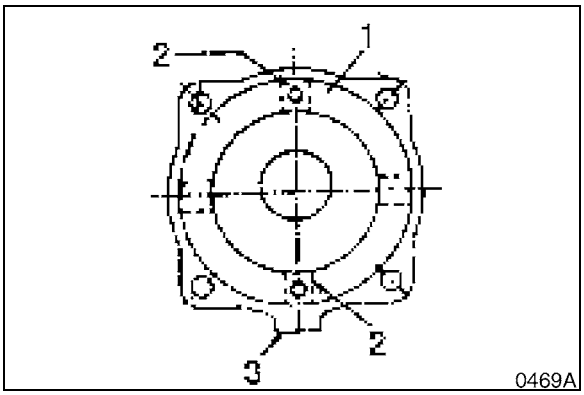


Figure 40

3. Parking Brake

A. During Travel.

If the pressure oil is supplied by the brake valve, the brake valve spool of the hydraulic motor part is operated, and the passage into the parking brake is opened. So the pressure oil flows into the cylinder a which consists of a spindle and a piston.

If the pressure rises above 11 kg/cm^2 (156 psi), it overcomes the spring force, and the piston (112) moves.

By the movement of the piston, the force exerted by the piston (112) on the separator plate (116) and the friction plate (115) is released, and the friction plate (115) can move freely. So the brake force acting on the hydraulic motor's cylinders is released.

If the pressure rises above 45 kg/cm^2 (640 psi), the pressure is reduced by the reduction valve and the pressure at the chamber a is fixed at 45 kg/cm^2 (640 psi). A safety valve which is set up at 100 kg/cm^2 (1,422 psi) as a limit is installed to the reduction valve.

B. During Braking.

If the pressure of the cylinder drops below 11 kg/cm^2 (156 psi) because the pressure oil of the brake valve is blocked, the piston (112) returns by the spring (113) force.

If the piston (112) is pushed by the spring force, the separator plate (116) and the friction plate (115) are pushed to the spindle of the reduction device.

The friction force generated by this push generates braking torque of 49.3 kg•m (357 ft lb) to hydraulic motor shaft by removing turning force of the cylinder. It operates smoothly because of proper oil paths.

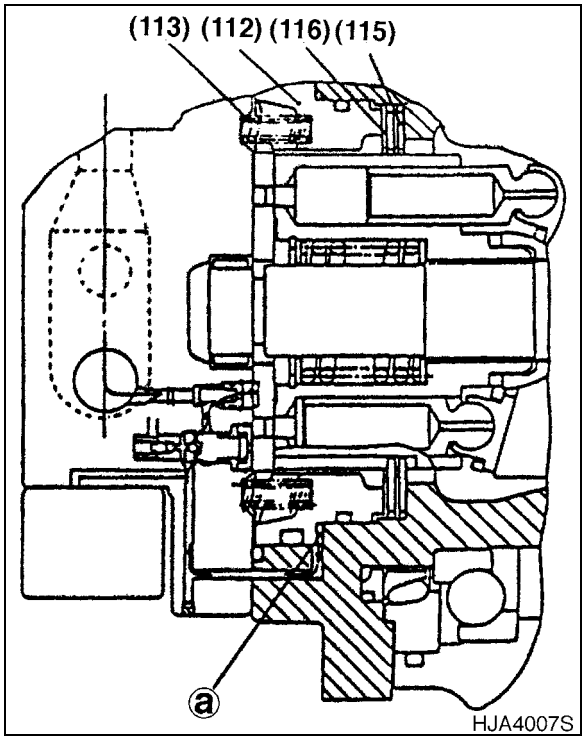


Figure 5

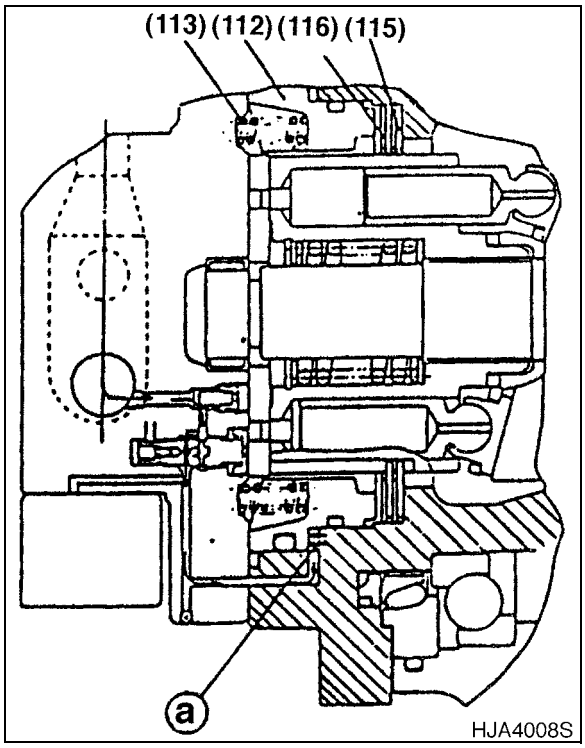
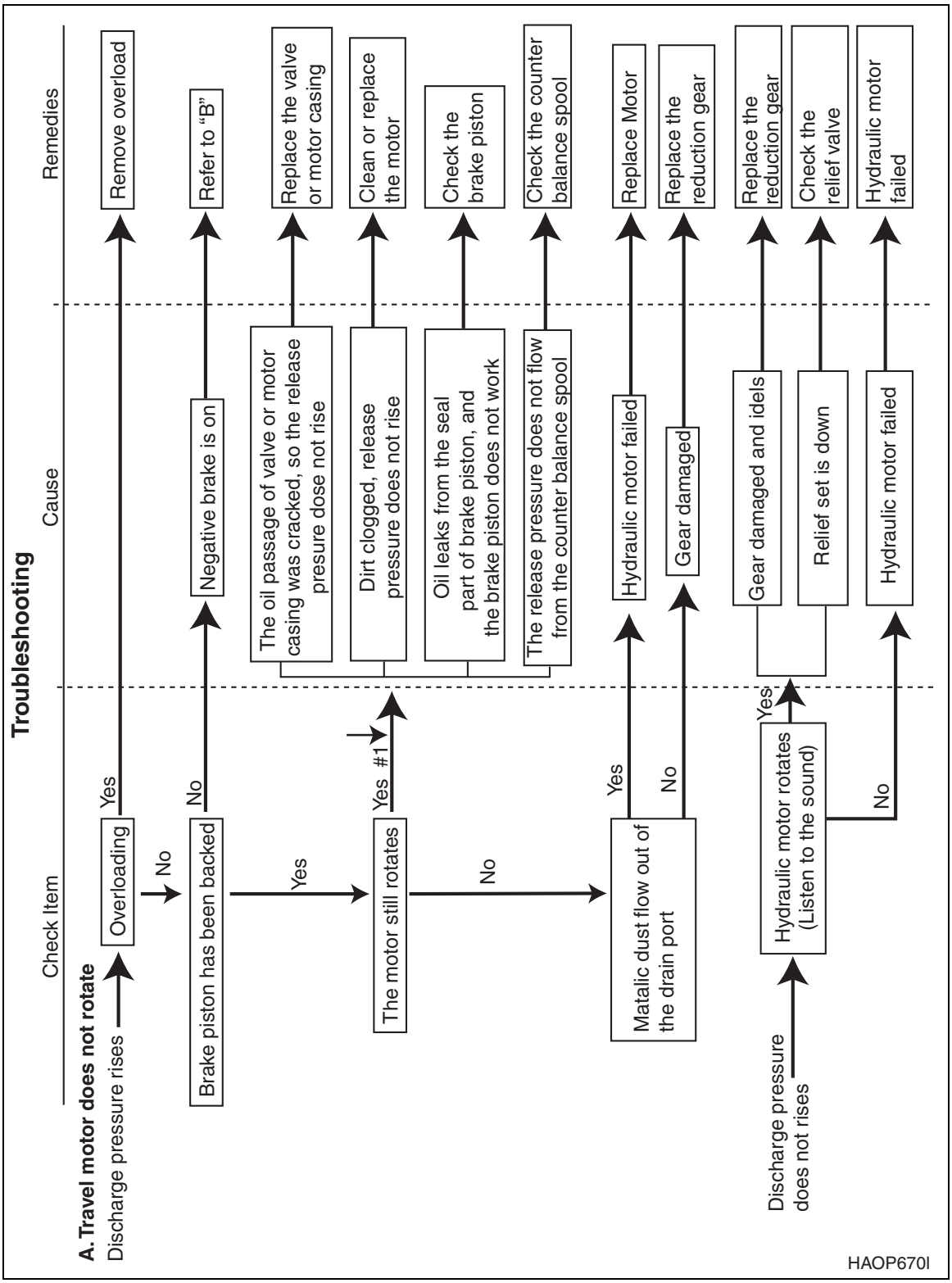


Figure 6


Troubleshooting
Check Item
Cause
Remedies
A. Travel motor does not rotate
Discharge pressure rises
Overloading
Yes
Remove overload
No
Brake piston has been backed
No
Negative brake is on
Refer to "B"
Yes
The motor still rotates
Yes #1
The oil passage of valve or motor casing was cracked, so the release presure dose not rise
Replace the valve or motor casing
Dirt clogged, release pressure does not rise
Clean or replace the motor
Oil leaks from the seal part of brake piston, and the brake piston does not work
Check the brake piston
No
Matalic dust flow out of the drain port
Yes
Hydraulic motor failed
Replace Motor
No
Gear damaged
Replace the reduction gear
The release pressure does not flow from the counter balance spool
Check the counter balance spool
Discharge pressure does not rises
Hydraulic motor rotates (Listen to the sound)
Yes
Gear damaged and idels
Replace the reduction gear
Relief set is down
Check the relief valve
No
Hydraulic motor failed
Hydraulic motor failed
HAOP670I

Motor Internal Parts Disassembly

1. Position motor laterally.

   (Incline motor 90°.)

2. Drain oil in motor.

3. By holding cylinder block (104) with both hand, take out from spindle (2).

4. Remove companion plate (116) and friction plate (115) by two respectively that are attached around circumference of removed cylinder block (104).

Figure 39

5. Separate piston assembly. (piston (105), shoe (106)), collar (111), five needle type rollers (151) that are attached on removed cylinder block (104).

Figure 40

6. Take out swash plate (103) from the inside of spindle (2)

Figure 41

7. Take out shaft (102)

8. Take out two pivot (167) and two parallel pin (171).

Figure 42

REASSEMBLY

GENERAL INSTRUCTIONS FOR REASSEMBLY

1. General Notes

A. Clean parts with cleaning solution and dry with compressed air. Do not use cloth that may leave cloth fibers on parts.

B. Use the torque values provided to securely tighten all bolts, plugs and screws using a torque wrench.

C. When it is necessary to use a hammer, be certain to use a plastic hammer to prevent any damage to the parts.

D. The number in parentheses (#) after part name corresponds to the part number in the parts list.

First Reassemble the hydraulic motor section then the reduction gearbox section.

TRAVEL MOTOR REAR FLANGE REASSEMBLY

Check Valve Reassembly

1. Assemble O-ring (337) to plug (326).
2. Assemble spring (330) and valve (327) into plug and lightly coat with grease.
3. Insert plug into rear flange (301) assembly and tighten to specified torque.
   - Tightening Torque: 26 ±4 kg•m (188 ±29 ft lb).

Figure 59

Spool Reassembly

1. Insert spool (323) into rear flange (301).
2. Install O-ring (326) to plug (324).

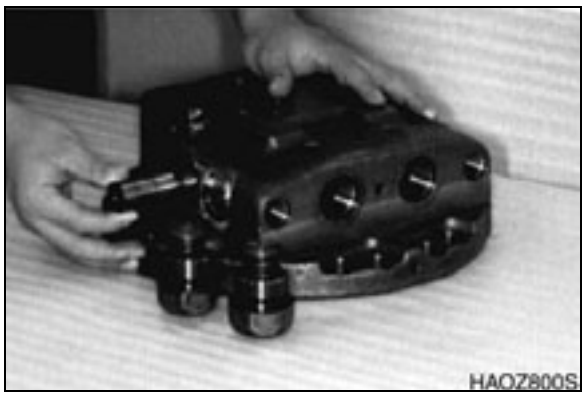


Figure 60

Piston Assembly (161 and 162) Reassembly

1. Coat grease on spring (193) and install into piston assembly.
2. Coat piston assembly with hydraulic oil and install into piston hole of spindle (2).
3. Inserting two pins (171) and two pivot (167) into spindle.
4. Lightly coat grease onto spherical surface.

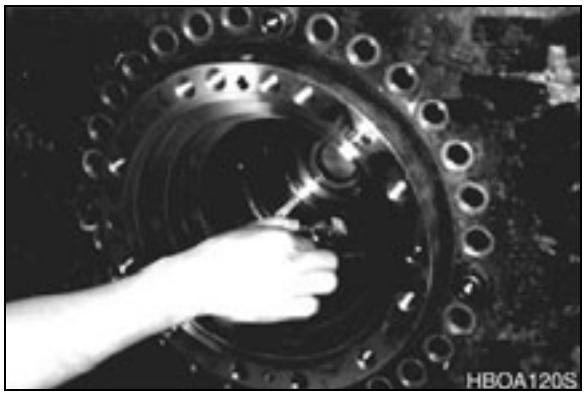


Figure 90

Cylinder Block Internal Parts Reassembly

1. Place cylinder block (104) on the press work bench.

Figure 91

2. Put washer (110), spring (114), washer (110) into cylinder block (104).

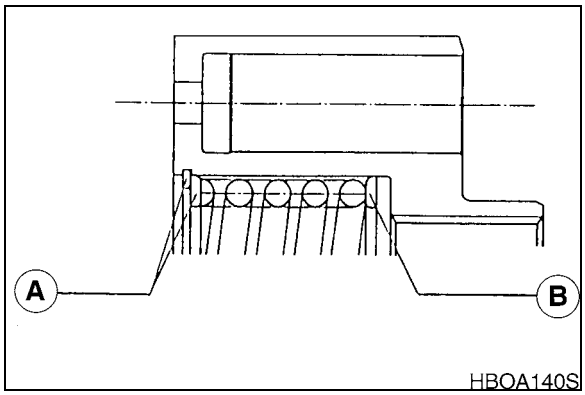


Figure 92

3. Place cylinder block assembly on work bench and press metal fitting on washer (114) and install C type retaining ring (145).

Figure 93

GENERAL DESCRIPTION

THEORY OF OPERATION

Refer to the assembly cross-section at the end. Travel motor consists of the hydraulic motor and reduction gearbox.

Hydraulic motor consists of the rotary part, cross relief valve, negative brake, counterbalance valve and tilting parts. The reduction gearbox consists of a 3-speed planetary gearbox. Figure 1, shows the motor as a symbol.

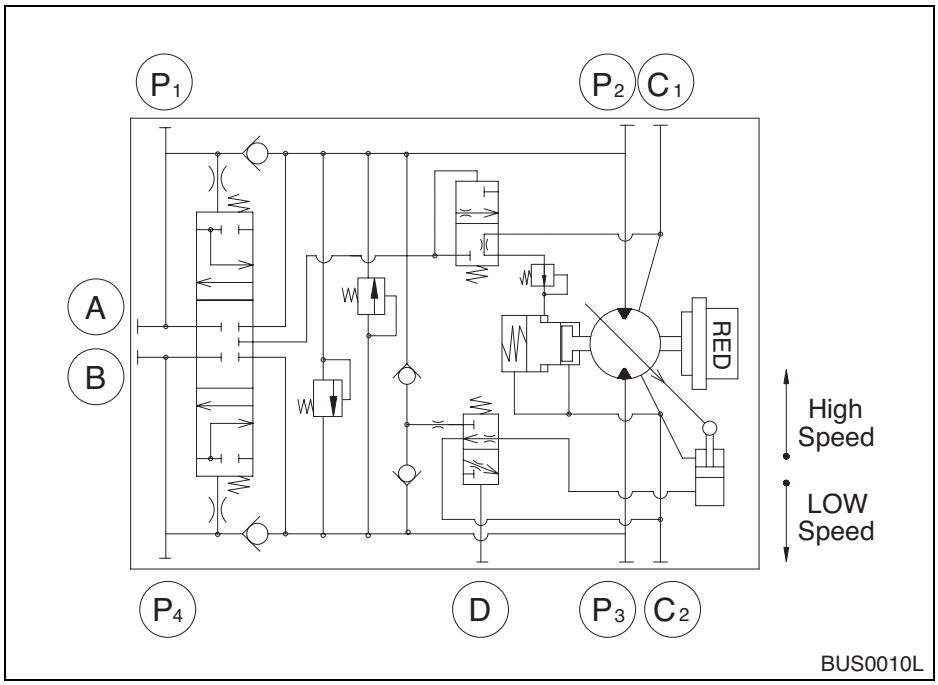


Figure 1

Reference Number	Description
	Travel Reduction Gear
	Hub
2	Spindle
3	Flange; Holder
	RV Gear Kit
4	RV Gear A
5	RV Gear B
6	Gear; Input
7	Gear; Spur
8	Cover
9	Crank; Shaft
12	Spacer
13	Distance Piece
15	Coupling
17	Pin
19	Bolt; Socket M24x70

Reference Number	Description
20	Ring; Snap
21	Bearing; A/Ball
22	Bearing; T/R
23	Bearing; Needle
25	Ring; Snap
27	O-ring 1BP8
29	O-ring 1AG230
30	O-ring 1AP335
31	Seal; Floating
33	Plug
34	Pin; Parallel
35	Bolt; Socket M12x32
36	Ball; Steel
37	Washer; Plain
42	Pin; Parallel
43	O-ring 1 Bp18

2. Remove springs (330) and valves (327) from two flanges (301).
3. Remove O-ring (337) from plug (326).

Figure 24

Two Speed Switching Valve Disassembly

1. Remove plug (357) from rear flange (301).

Figure 25

2. Remove spool (363) and spring (366) from rear flange (301)
3. Remove O-ring (355) from plug (357).

Figure 26

Disassembly of Internal Parts (SRV)

1. Remove two plugs (380).
2. Remove O-ring (359) from plug (380).

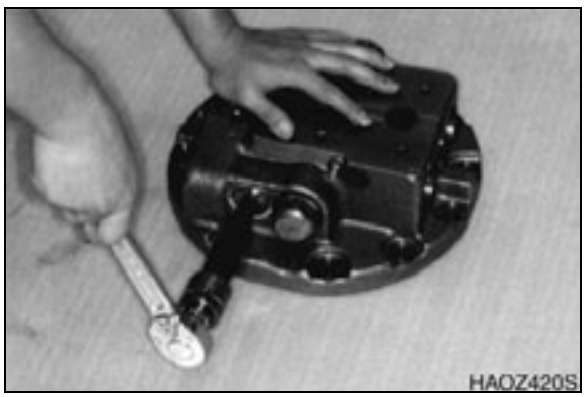


Figure 27

4. Putting screwdriver on the outer edge of oil seal (A) in spindle (2), by tapping with hammer, remove oil seal. (132).

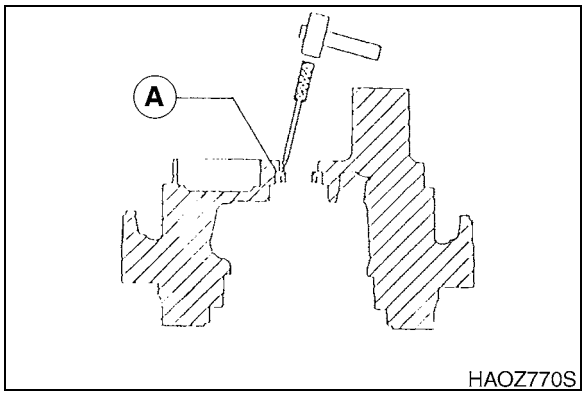


Figure 57

Bearing (149) Disassembly

1. Putting clamping metal fitting {II} (D) on the press work bench, and put shaft into it.
2. Remove deep ditch ball bearing (C, Figure 58) (149) with holding down the shaft tip (B) parts by a press (A).

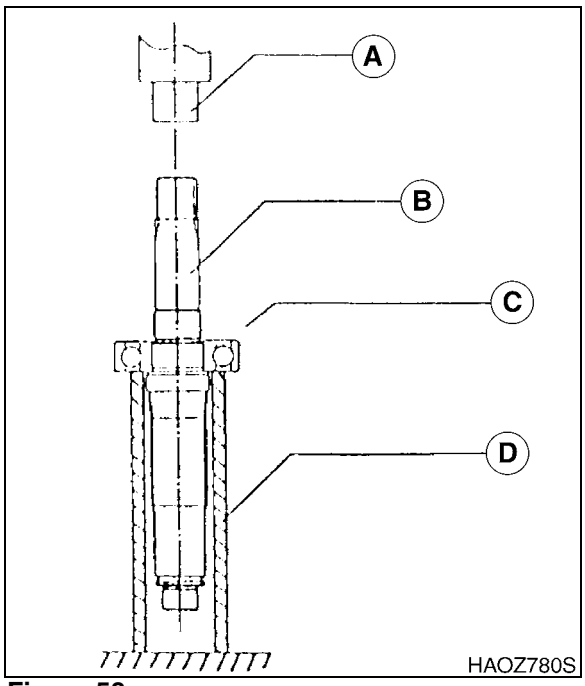


Figure 58

Hub and Spindle Reassembly

1. Install two eyebolts (M16) to spindle (2) at opposite ends to distribute the weight evenly.
2. Use a lifting device slowly lower spindle (2) into hub (1).
3. Insert two stationary metal fittings to hub (1) and spindle (2) and tighten.
4. Turn motor in opposite direction and position the cover side upward.
5. Place three bearing races (22) to their respective locations within the spindle (2).

Figure 76


Figure 77

RV Gear Reassembly

1. Install lifting tool (A, Figure 78) to RV gear assembly.
2. Using a lifting device lower RV gear assembly it into spindle (2).
3. Insert twenty-four pins (17) between the gear teeth and pin.

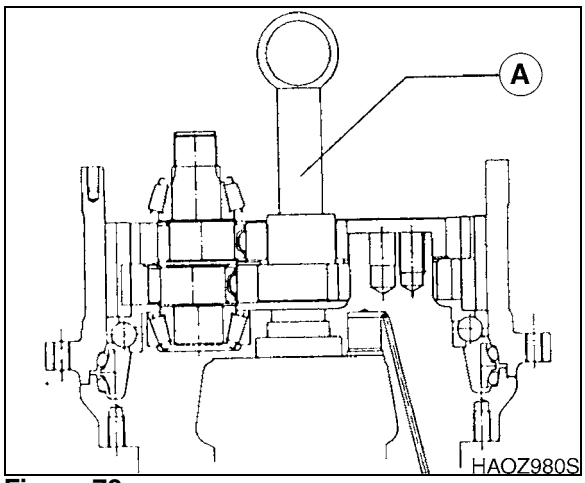


Figure 78

REDUCTION GEAR COVER REASSEMBLY

1. Insert coupling gear (15).
2. Coat a generous amount of grease onto steel ball (36) and place ball on concave part of input gear (6).
3. Attach O-ring (30) on cover (8).
4. Install two eyebolts into threaded holes on cover (8).

Figure 107

5. Lift cover (8) and install to hub (1).

Figure 108

6. Tighten twelve allen head bolts (35) to specified torque.
7. Fill with lubricating oil:
   5.40 liters (1.4 U.S. gal.)
8. Tightening Torque:
   10.4 ±1.6 kg•m (75 ±12 ft lb).

Figure 109

PUMP OUTPUT DECREASE

When pilot pressure (Pi) increases, the pilot piston (643) shifts toward the right, stopping at that point at which pilot pressure and the force of the return spring (646) cancel each other out. Movement of the pilot piston pushes the pin (875) attached to the feedback lever assembly (613, 611, 897) around the "B-point plug" (614) and the pin (875) on the opposite side of the feedback lever assembly. The pin at the lower end of the feedback lever is attached to the tilting pin of the swash plate (531/538 in Figure 1).

NOTE: *In Figure 6, the circled capital letter "D" at the lower end of the feedback lever shows the approximate location where the assemblies shown in Figure 1, Figure 6 and Figure 8 react as the pin (897) at the top of the feedback lever moves and the piston shifts, maintaining dynamic balance through the valve between pilot pressure (Pi) and discharge output flow (Q) as shown in Figure 7.*

PUMP DISCHARGE DECREASE

The regulator feedback lever assembly is also pin-connected to the outermost spool (652) in the discharge port (CI) of the regulator (Figure 8). As that spool moves toward the right, in response to differences in servo pressure, the servo piston moves to the right, resulting in a decreased swash plate tilt angle and reduced pump output flow. The system is balanced and control movement of the spool (and servo piston) stops when the outermost spool (652) and spool sleeve (651) close into each other, shutting off oil movement.

PUMP DISCHARGE INCREASE

When pilot pressure (Pi) decreases, the pilot piston shifts toward the left and the feedback lever assembly pivots around point "D" (Figure 6), pushing the spool and servo piston left. Swash plate tilt angle is heightened and pump output flow begins to increase as a result. Control movement of the spool and servo piston stops when the feedback lever assembly rotates around point "C" (Figure 6), moving the spool to the right until it slides into the sleeve (651) and oil movement is blocked.

HORSEPOWER CONTROL

Horsepower control function occurs as each regulator responds to changes in the output of the opposite pump. As increases or decreases in pump output occur (as outlined in the preceding paragraphs) at one pump, it is necessary for the output of the remaining pump to compensate to allow equalizing of the total discharge rate.

The relationship between changes in pressure and changes in output flow when the operation of both pumps (P1 and P2) is measured (Figure 9).

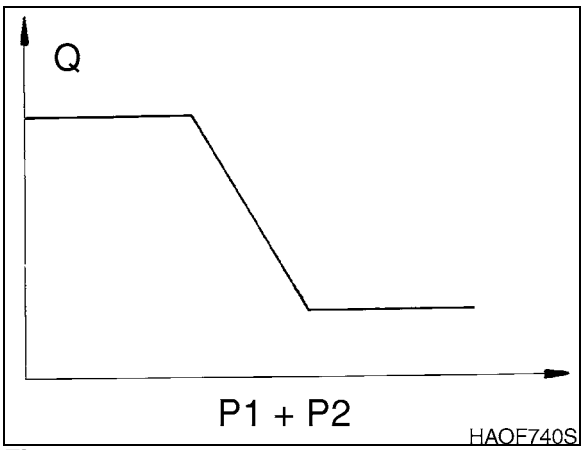


Figure 9

Main Pump Pressure/Flow Output (Model: SOLAR 255LC-V)

Engine Speed	2000 rpm (High Mode)	1900 rpm (Standard Mode)
Pump Input Horsepower	162 ps (160 hp)	132 ps (130 hp)
Main Pump Total Displacement	112 cc (7.44 in^3) x 2 pumps	
Main Pump Pressure	350 kg/cm^2 (4,550 psi) (for pressure up)	
Pilot Pump Displacement	15 cc/rev (0.9 in^3/rev)	
Pilot Pump Pressure	40 kg/cm^2 (569 psi)	

NOTE: *Values in the graph marked "K" are pressure, in kg/cm^2.*

NOTE: *Values in the graph marked "L" are flow, in Liters/minute.*

NOTE: *If a complete tear down and reassembly is being performed, the only parts which should NOT be loosened or removed are the hex nut (808) spring pin servo piston stoppers in the swash plate supports. (The preset discharge value would require calibration if they were removed.) All other remaining parts may be withdrawn from valve block - needle bearing (124), spline coupling (114) and pump casing - along with stoppers (534, 535), servo piston (532) and tilting pin (531) from the top of the pump casing.*

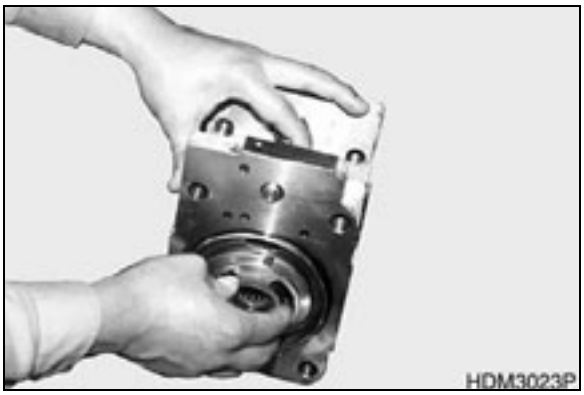


Figure 26

IMPORTANT

Separation of servo pistons (532) and tilting pins (531) must be done with a special fixture. Loctite #609 is required for reassembly - on servo piston/tilting pin/feedback pin (538).

NOTE: *Do not disassemble needle bearings (124). They can only be replaced with new parts if they are excessively worn or have been damaged.*

PUMP REGULATOR DISASSEMBLY

1. Remove four allen head bolts (412, 413) and pump regulator assembly from pump body. Remove and inspect
   O-ring gaskets (708, 724) found between regulator casing and pump body.

   NOTE: *The regulator mounting bolts are uneven in length and must be noted and replaced to the same location.*

   Once the regulator has been removed from pump, go to a clean, well lighted, protected area for further disassembly. Use a rubber mat or other protective covering on the workbench area to prevent damage or scratching of any precision machined components.

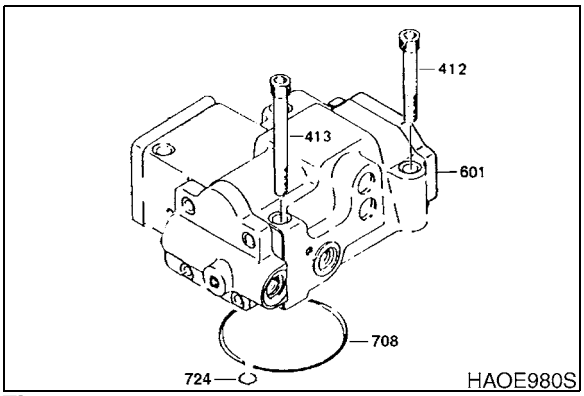


Figure 27

14. Insert adjusting screw bushing (647) into pilot piston bore. Install O-rings (725, 730, 732, 734) into their proper locations. Mount pilot cover (641) onto regulator casing by using four allen head bolts (436, 438).

    NOTE: *Cover mounting bolts (436, 438) are uneven in length and must be replaced to their proper location.*

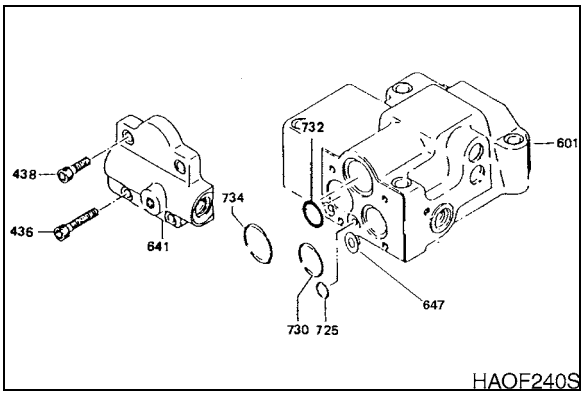


Figure 51

15. Install O-rings (708, 724) to regulator casing base and mount regulator to pump body using four allen head bolts (412, 413)

    NOTE: *The regulator mounting bolts (412, 413) are uneven in length and must be replaced to their proper location.*

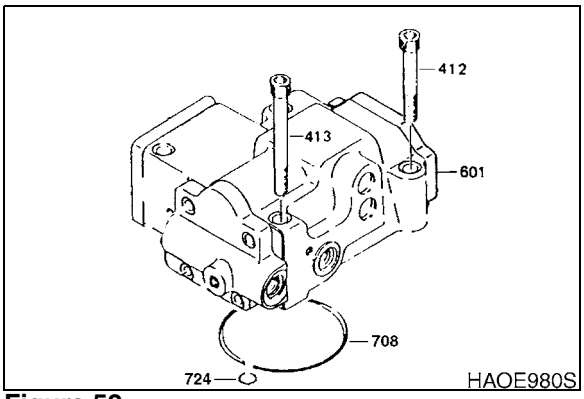


Figure 52

MAIN PUMP REASSEMBLY

NOTE: *Reassembly must be done by reversing disassembly steps.*

1. Begin reassembly with servo piston (532), tilting pin (531) and feedback pin (538) at top of pump case. Use Loctite #609 to hold tilting pin and servo piston if those parts have been disassembled.
2. Bolt swash plate support (251) to pump casing (271). Tighten four allen head mounting bolts.
3. Turn pump case upside down, with regulator mounting surface on work surface. Insert tilting bushing (214) of swash plate into tilting pin (531) and assemble swash plate assembly (212/211) to support (251).

    NOTE: *Apply lubricant to all parts of swash plate assembly to make assembly work easier. Use both hands to check and verify complete free movement of assembly after parts have been reinstalled.*

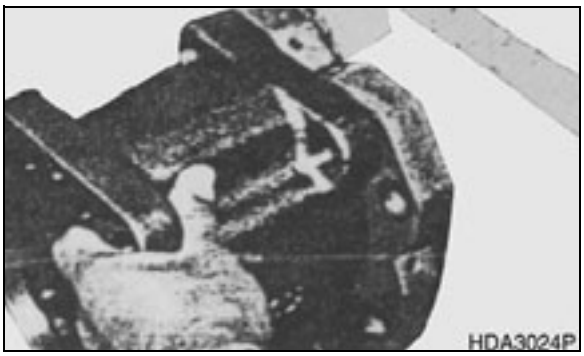


Figure 53

STRAIGHT TRAVELING CIRCUIT

Straight traveling circuit maintains straight travel of the excavator even if other actuators (SW, AM, BKT, BM) are operated in combination.

1. Straight Travel Circuit (Travel Only)

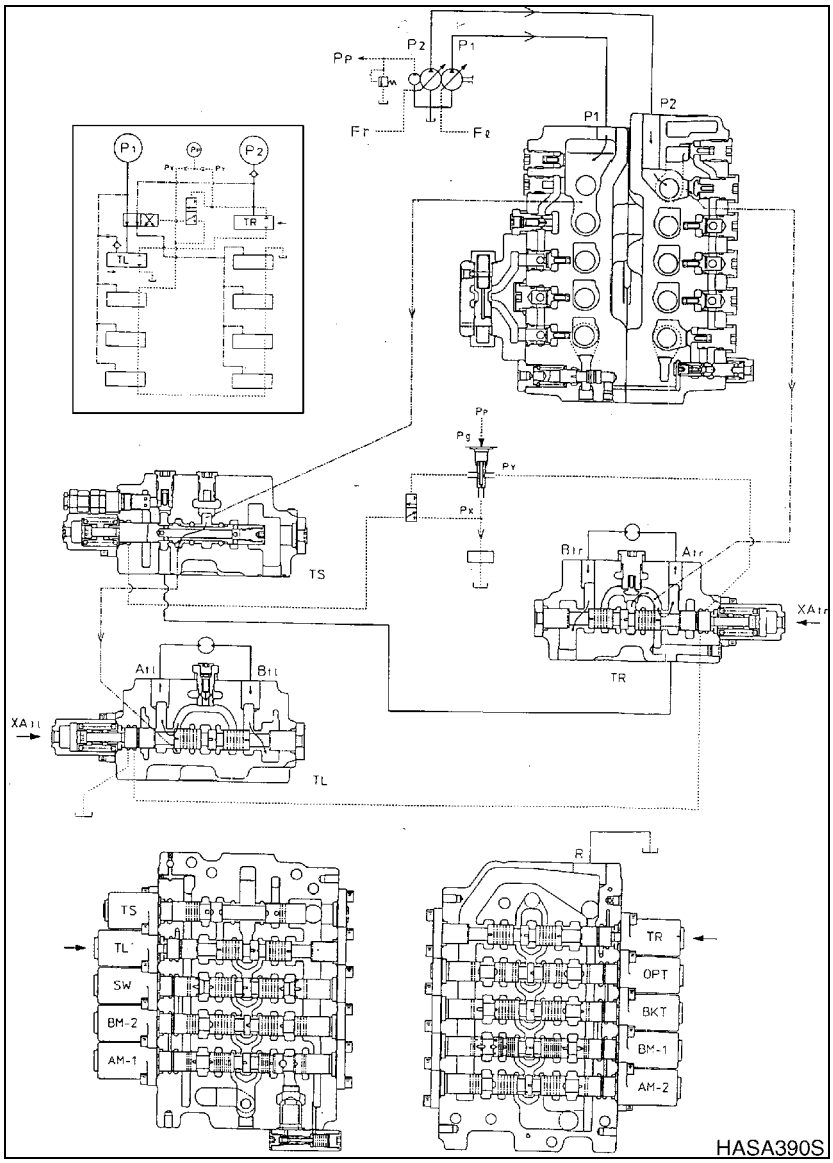


Figure 4

A. As the plunger is switched on the pilot signal line (Py) is blocked off, but since the signal line (Px) is connected to the tank by the orifice, the hydraulic fluid flow from P1 pump is supplied to the left travel motor without activating the travel straight (TS) switching valve.

B. The hydraulic fluid flow from P2 pump is supplied to the right travel motor in the same manner. As a result P1 pump powers the left travel motor and P2 pump powers the right travel motor and straight travel is achieved.

B. Boom-down (Pc > Pv) (Pi pilot signal: "ON").

Pilot signal pressure enters signal port, spool A moves to the right and chamber (1) and drain (1) are connected allowing chamber (1) to drain. Since pressure Pc is greater than Pv, oil flows through the opened poppet B and flows back to the tank.

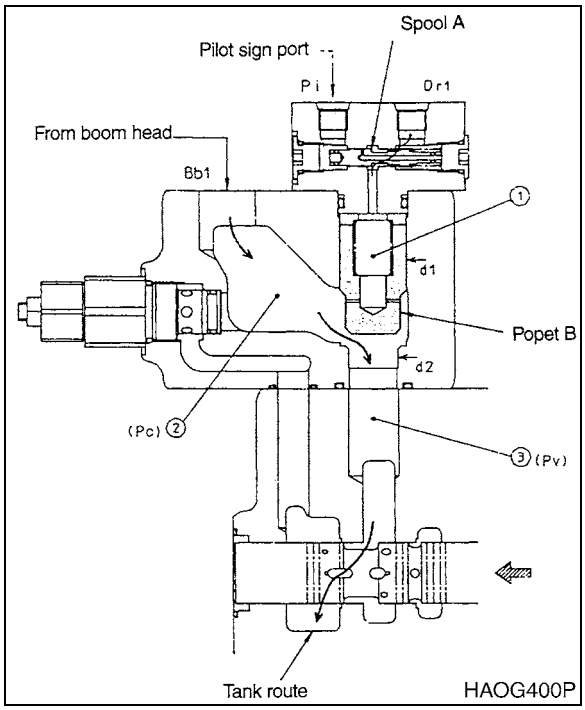


Figure 21

Arm Regeneration Valve

Reference Number	Description
1	Cap
2	Piston
3	O-ring
4	Spool
5	Spring
6	Sleeve

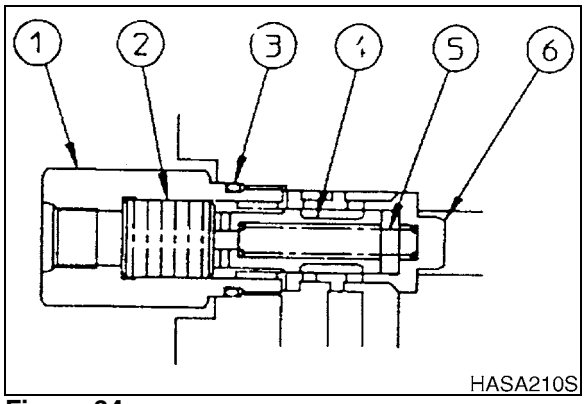


Figure 34

Foot Relief Valve

Reference Number	Description
1	Cap
2	Seam
3	Seam
4	Cap
5	Spring
6	Poppet
7	O-ring

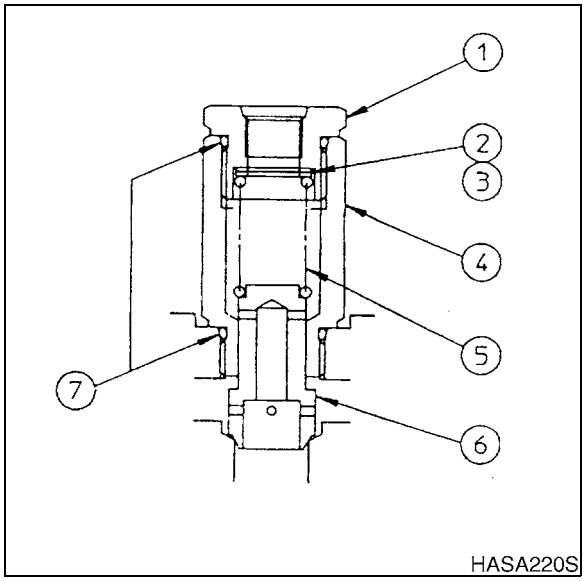


Figure 35

Arm Priority Valve [Ap Valve]

Reference Number	Description
1	Cap
2	O-ring
3	Spring
4	Check
5	Spool BP
6	Spring
7	Cover
8	Bolt With Hole
9	O-ring

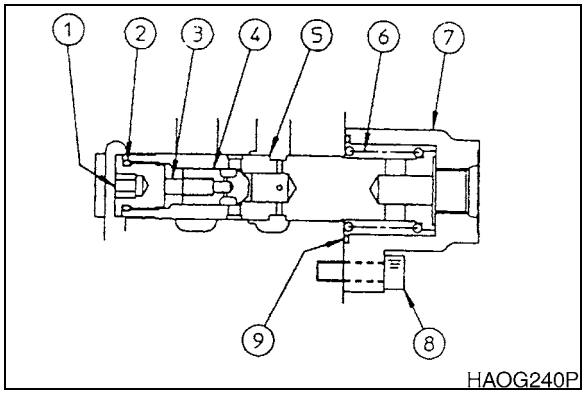


Figure 36

Reference Number	Description	Quantity
1	Main Plunger	9
2	Main Relief Valve	1
3	Overload Relief Valve	8
4	Bucket 2-Speed Check	1
5	Boom Holding Valve	1
6	Boom 2-Speed Check	1
7	Arm Regeneration Valve	1
8	Foot Relief Valve	2
9	Arm Priority Valve (AP Valve)	1
10	Check Valve (TR, AM-2)	2
11	Check Valve (OPT, BKT, BM-1, BM-2)	4
12	Check Valve	1
13	Check Valve	1
14	Cap	1
15	Check Valve (TL)	1
16	Check Valve (SW)	1
17	Check Valve (AM-1)	1
18	Straight Travel Pilot Valve	1
19	Swing Priority Valve (SP Valve)	1
20	Center Bypass Valve (CB Valve)	1
21	Arm Holding Valve	1
22	Orifice (Px, Py)	1

IMPORTANT

When disassembling Arm Load Holding Valve, tag and label each component so that all parts can be reassembled in the proper order.

Check Valve Main Body

1. Remove allen head bolts (1) and cover (2).

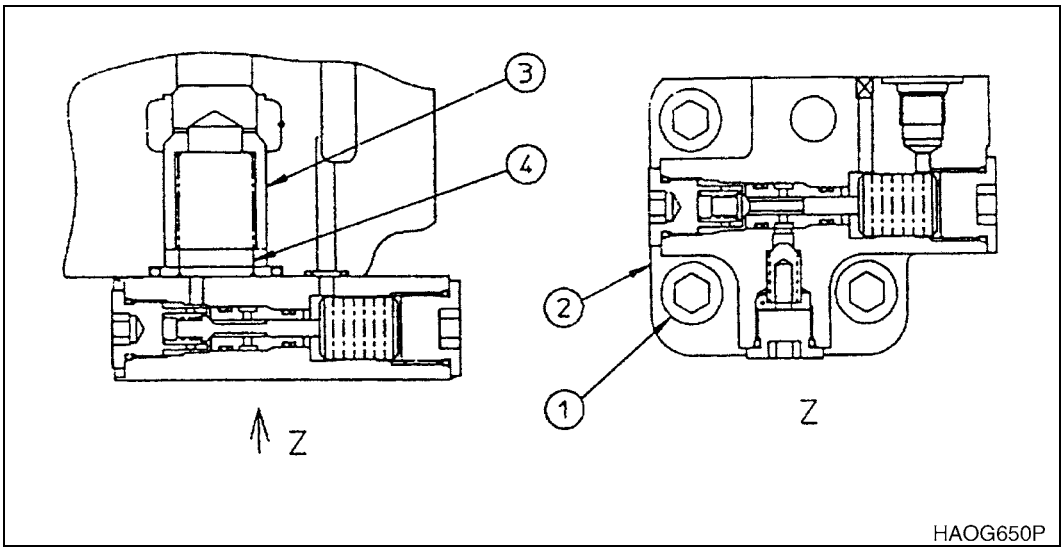


Figure 80

Mounting Bolt Allen Socket	10 mm
Tightening Torque	10 kg•m (72 ft lb)

IMPORTANT

When assembling cover, inspect O-rings for any damage and replace as necessary.

2. Remove spring (3) and poppet (4).

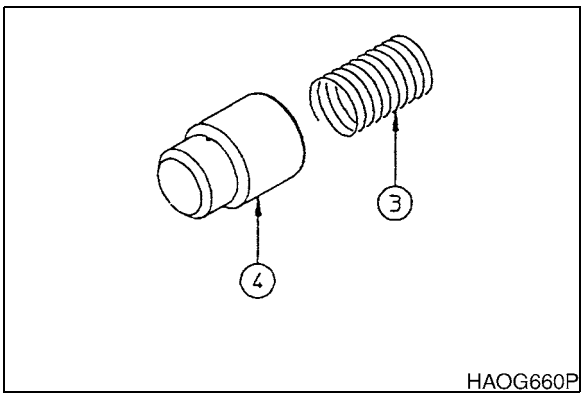


Figure 81

2. Slide out spool assembly and remove spring (3).

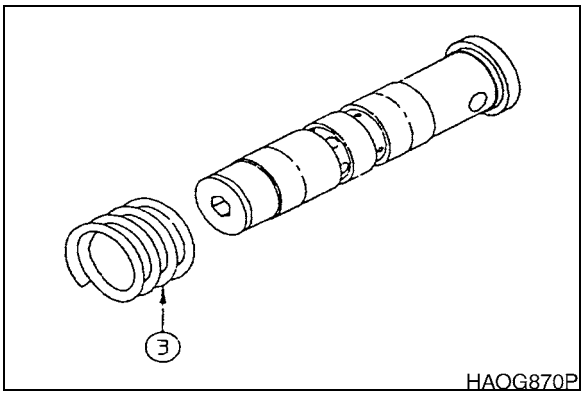


Figure 101

3. Using the tool described above, clamp and hold the spool in place. Remove cap (4), Spring (5) and check (6).

Allen Hole Size	6 mm
Tightening Torque	3.5 kg•m (25 ft lb)

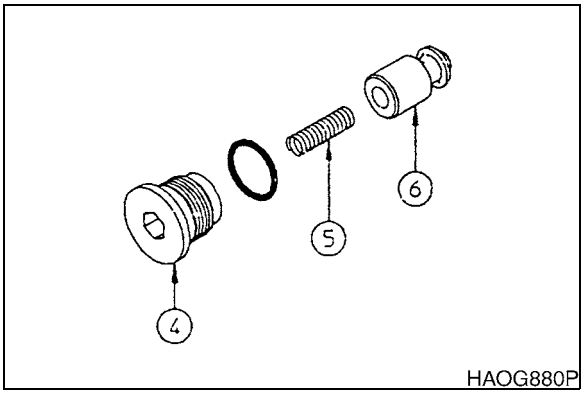


Figure 102

G: Check Valve [AM-1]

IMPORTANT
SP valve must be removed first, before removing SW valve.

IMPORTANT
The SW and AM-1 sleeves may look similar but are different and cannot be interchanged.

Reference Number	Description
1	Sleeve
2	Check
3	Spring

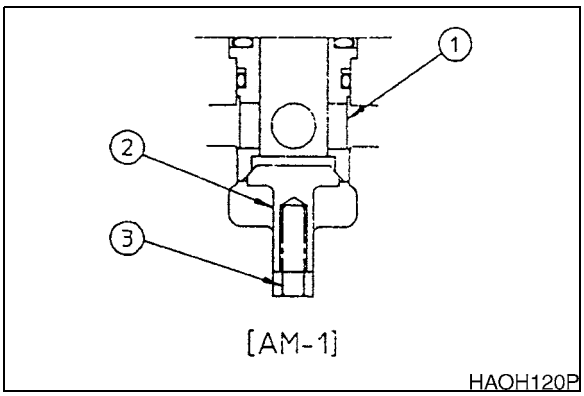


Figure 122

1. Pull out sleeve (1) by using traverse holes.

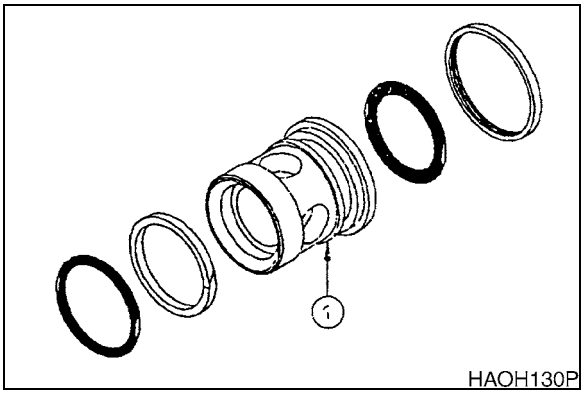


Figure 123

2. Remove check (2) and spring (3).

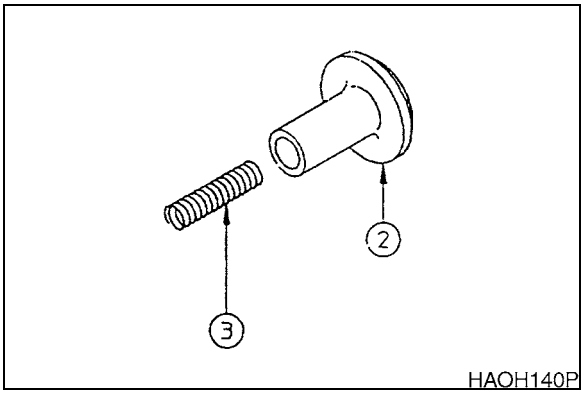


Figure 124

3. Remove hex nut (5) and plate (23).

Figure 6

4. Detach joint (24) using special tool.

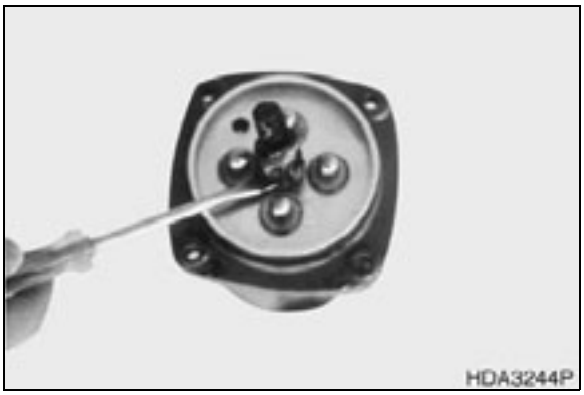


Figure 7

Figure 8

5. Remove plate (23).

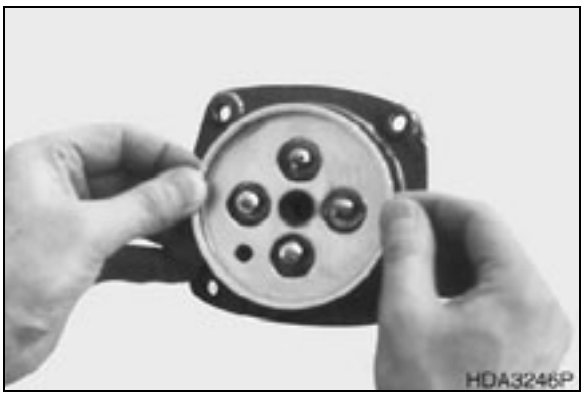


Figure 9

TRAVEL 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 130LC-V	0001 and Up
Solar 170LC-V	1001 and Up
Solar 220LC-V	0001 and Up
Solar 220LL	1001 and Up
Solar 220n-V	1001 and Up
Solar 250LC-V	1001 and Up
Solar 290LC-V	0001 and 0760
Solar 290LL	1001 and 1020
Solar 330LC-V	1001 and 1023
Solar 400LC-V	1001 and 1010

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DISASSEMBLY

IMPORTANT

1. **Prepare a clean, well lit, stable work bench where disassembly can be performed.**
2. **Prepare the necessary tools, materials and a container in which disassembled parts can be stored.**
3. **All precision parts must be handled with great care and all parts must be reassembled to their original position.**
4. **All parts must be carefully reassembled and not be forced. Damaged parts will cause oil leaks and poor performance of the equipment.**
5. **Do not leave parts exposed to air during or after disassembly. Exposed parts will come in contact with contaminants and will cause rust and damage.**

NOTE: *Dispose of drained fluids according to local regulations.*

1. Clean the remote control valve with solvent. Close up each port with a plug.
2. Using a soft mounting device clamp the remote control valve in a vice. Remove bellows (501) and cover (201).

Figure 10

3. Loosen the set screw (423) using a allen wrench.

IMPORTANT

Loctite #241 compound has been applied on the threads and it may be difficult to loosen these screws.

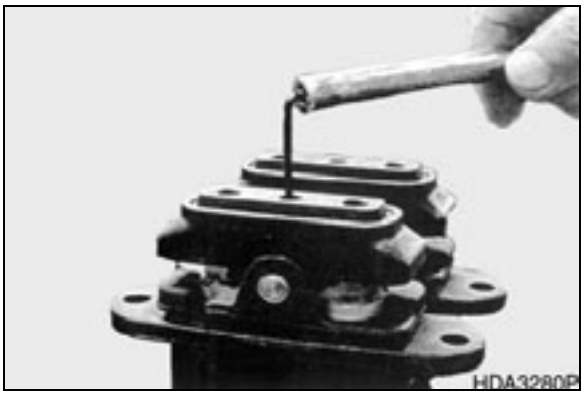

Figure 11

4. Insert the spool assembly, previously assembled in steps 1 and 2, into the housing.

IMPORTANT
Replace spool assembly to its original location in housing.

Figure 37

IMPORTANT
When inserting pressure reducing valve assembly into the housing, be careful not to damage the spool by hitting the edge of the housing.

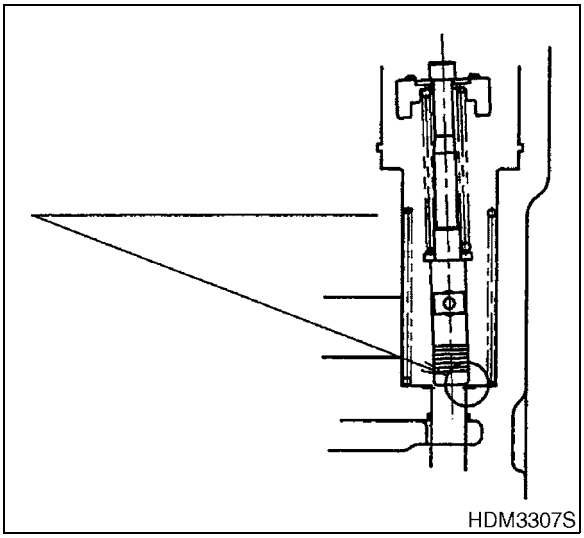

Figure 38

5. Assemble the bushing (223) into the housing above the spring seat (311).

IMPORTANT
Replace bushing to its original location in housing.

Figure 39

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.

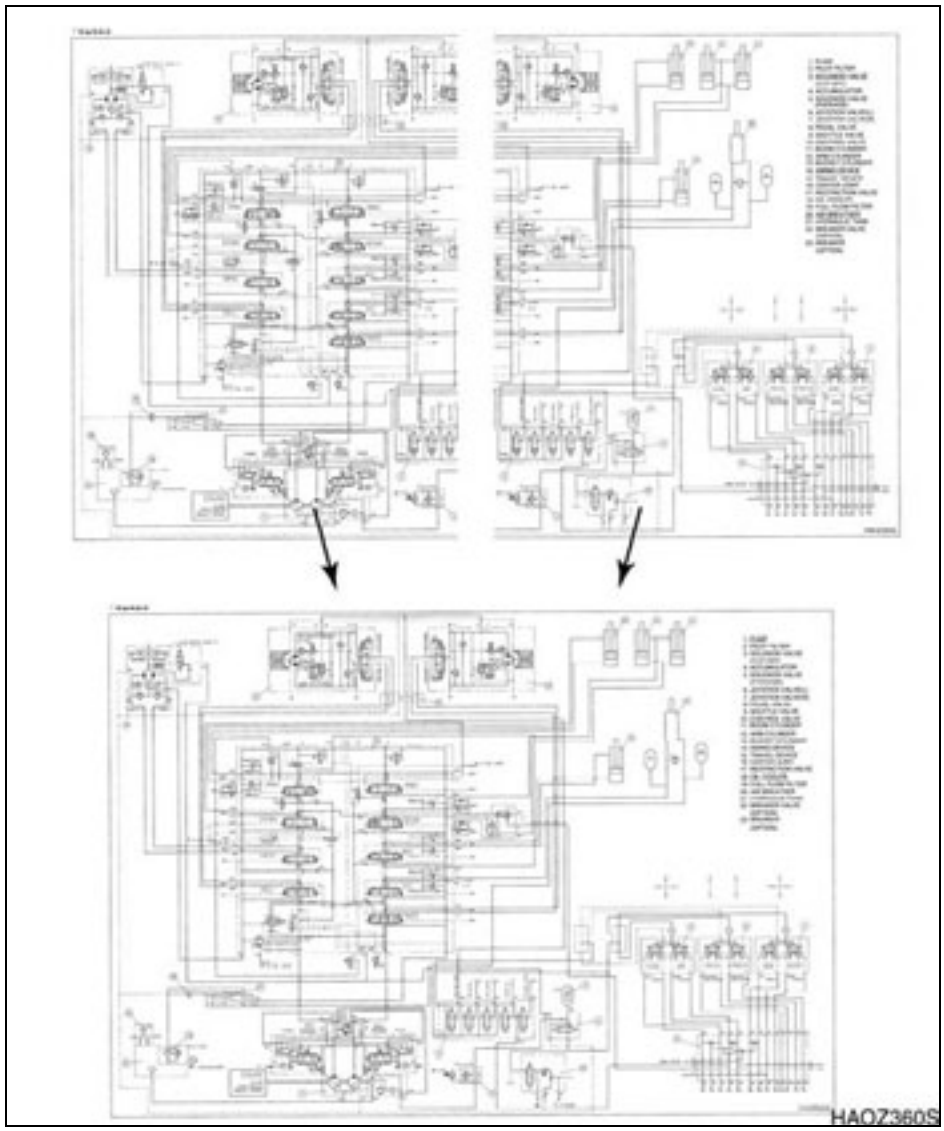

Figure 1

WIRING HARNESS ILLUSTRATIONS

The electrical system diagram(s) is available in the "Hydraulic and Electrical Schematic Shop Manual." This manual is a collection of diagrams and schematics for a number of models.

OVERVIEW

The electrical system for this equipment is DC 24 volts. The rated voltage for all electric components is 24 volts with the exception of the stereo and the air-conditioning control actuator. The system contains two 12 volt batteries connected in series and 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: *0.85G: Nominal sectional area of wire core less insulator = 0.85 mm^2*

MONITORING SYSTEM

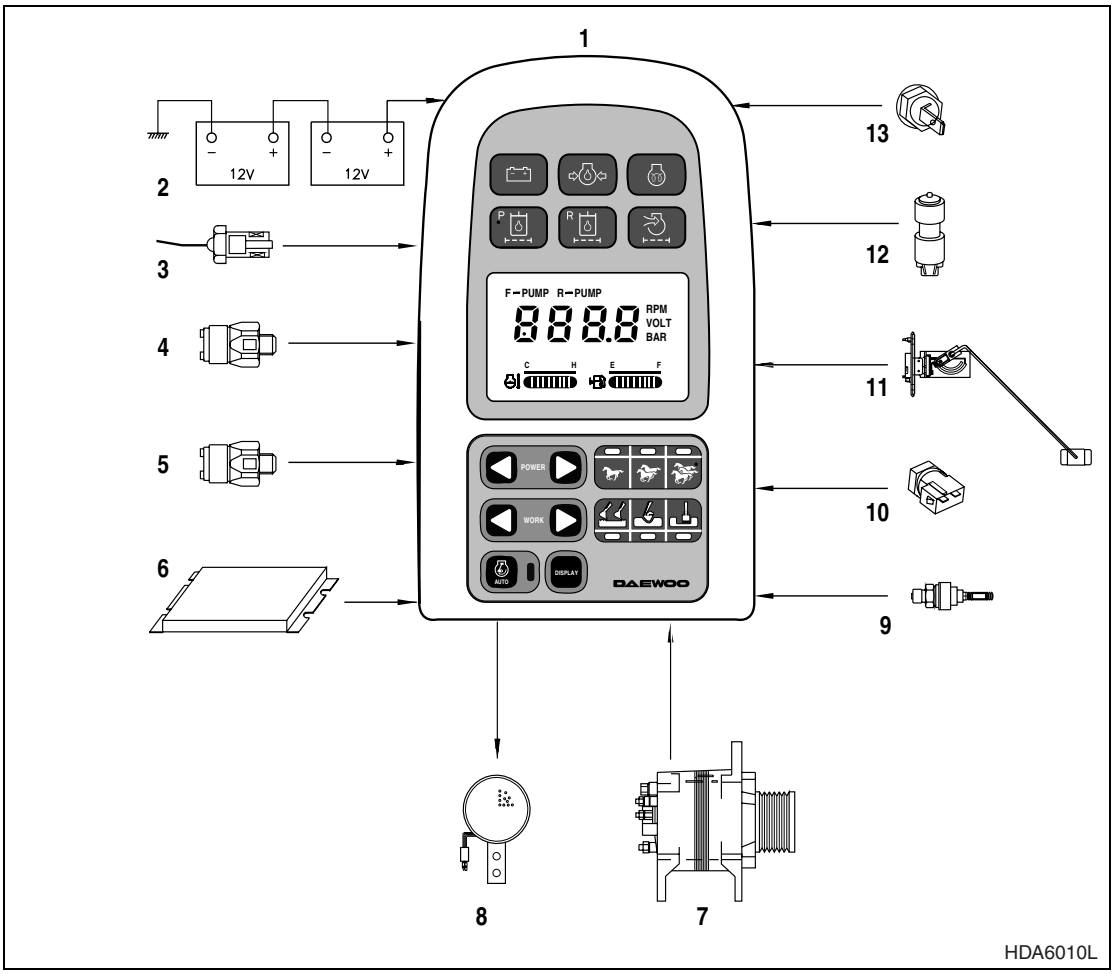

Figure 10

Reference Number	Description
1	Instrument Panel
2	Battery
3	Engine Speed Sensor
4	Return Filter Switch
5	Pilot Filter Switch
6	EPOS-V Controller
7	Alternator

Reference Number	Description
8	Warning Buzzer
9	Pump Discharge Pressure Sensor
10	Engine Coolant Temperature Sensor
11	Fuel Sensor
12	Air Cleaner Indicator
13	Engine Oil Pressure Switch

The monitoring system displays the various data and warning signals onto the instrument panel by processing the information gathered from the various sensors throughout the equipment.

The operator can select the information to be displayed on the instrument panel.

1. Leveling Mode

This mode is used for precise ground leveling work. Among the three control valve solenoids, the current is switched to the arm regeneration valve. As a result the oil pressure which operates the arm regeneration valve and the arm two-speed spool of the control valve is shut off, reducing the arm speed and giving increased arm control.

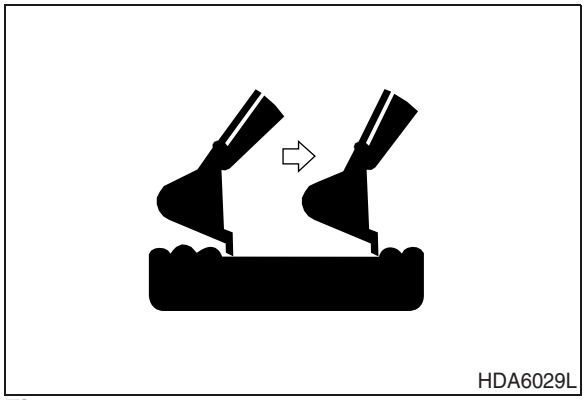

Figure 24

2. Digging Mode

This mode is used for general digging work, loading work and ground leveling work requiring quick stops. Among the three control valve solenoids, the voltage is assigned to the arm priority control valve and becomes operational. When the arm priority control valve is selected the oil pressure activates the arm priority valve and a path is made to the two-speed spool.

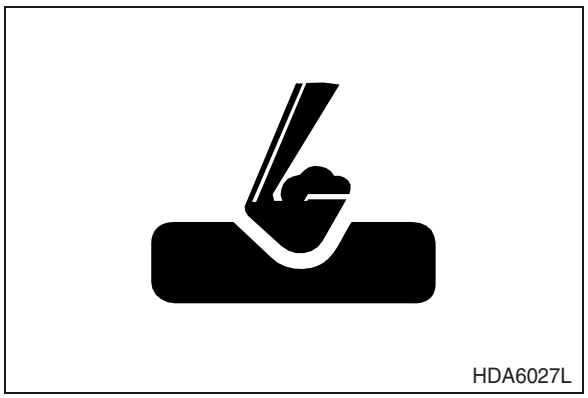

Figure 25

3. Trenching Mode

This mode is used for heavy duty ditch digging work or for loading work requiring big swing angles. Among the three control valve solenoids, the voltage is assigned to the swing priority control valve activating the swing control valve restricting the flow of oil to the boom and the arm.

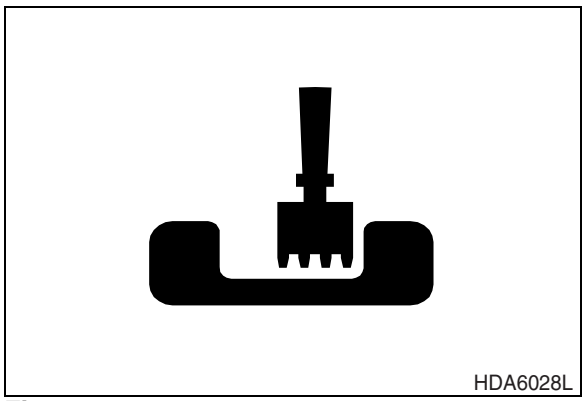

Figure 26

AUTOMATIC TRAVEL SPEED CONTROL

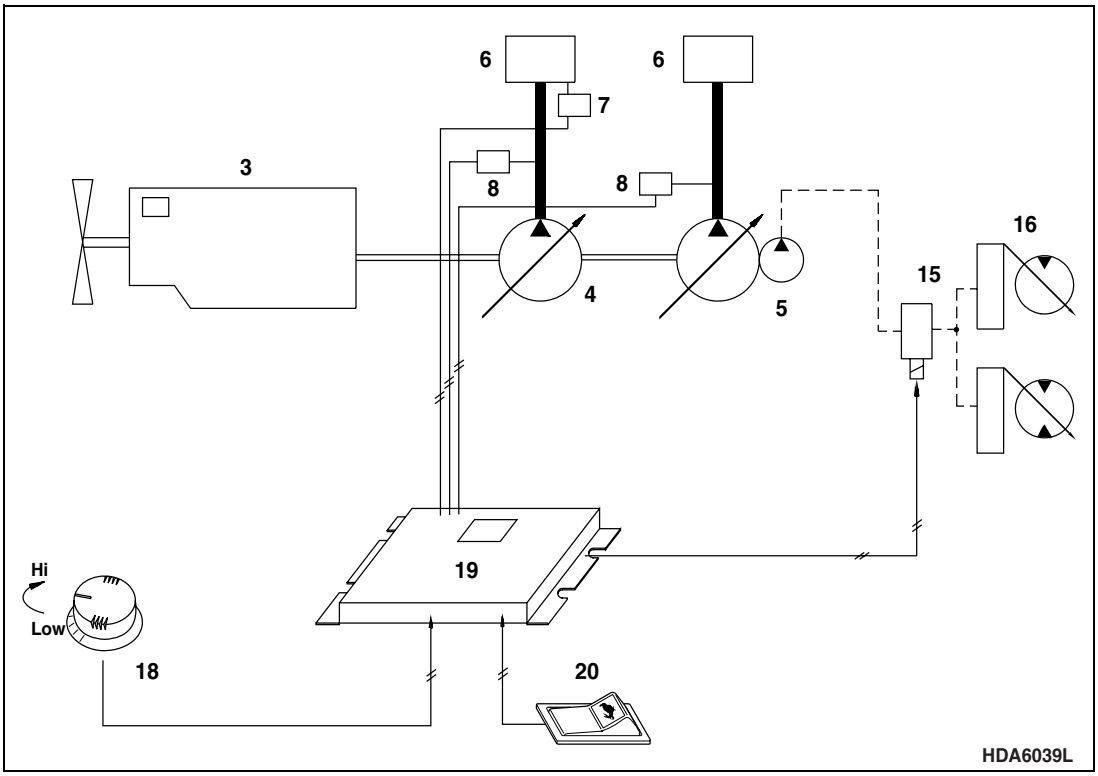

Figure 36

Reference Number	Description
3	Engine
4	Main Pump
6	Control Valve
7	Pressure Switch
8	Pump Pressure Sensor
15	Solenoid Valve (Travel II - Speed)

Reference Number	Description
16	Travel Motor
18	Engine Control Dial
19	EPOS-V Controller
20	Selector Switch for Automatic Travel

If the automatic travel speed control switch is set to the "OFF" position, the travel motor will run in the I-speed (low speed) range. If the selector switch is set to the "ON" position, the EPOS-V controller will monitor the main pump discharge pressure and automatically select the "ON - OFF" state of the II - speed travel solenoid valve based on the travel load. The travel speed is changed between the I-speed and the II-speed mode.

The travel load is monitored by the two pressure sensors in the discharge lines of the front and rear pumps. When the travel load is high (pressure over 270 kg/cm^2 (3,840 psi)) the solenoid valve is turned "OFF" and I-speed (low) is selected. In the case when the travel load is low (pressure under 130 kg/cm^2 (1,849 psi)), the solenoid valve will is turned "ON" and the II-speed will be selected. But, if the engine speed control switch dial is set below approximately 1400 rpm, the travel speed will be set to I-speed mode.

ELECTRICAL SCHEMATIC (SOLAR 220LC-V)

⚠ 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 220LC-V	0001 and Up

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March 1999

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 (Inches)	Length, mm (Inches)
A	90 mm (3.54 in)	792 mm (31.18 in)
B	80 mm (3.15 in)	792 mm (31.18 in)
C	80 mm (3.15 in)	225 mm (8.86 in)
D	90 mm (3.54 in)	529 mm (20.83 in)
E	80 mm (3.15 in)	225 mm (8.86 in)
F	80 mm (3.15 in)	211 mm (8.31 in)
G	71 mm (2.80 in)	448 mm (17.64 in)
H	80 mm (3.15 in)	448 mm (17.64 in)
I	80 mm (3.15 in)	509 mm (20.04 in)
J	80 mm (3.15 in)	509 mm (20.04 in)
K	80 mm (3.15 in)	211 mm (8.31 in)

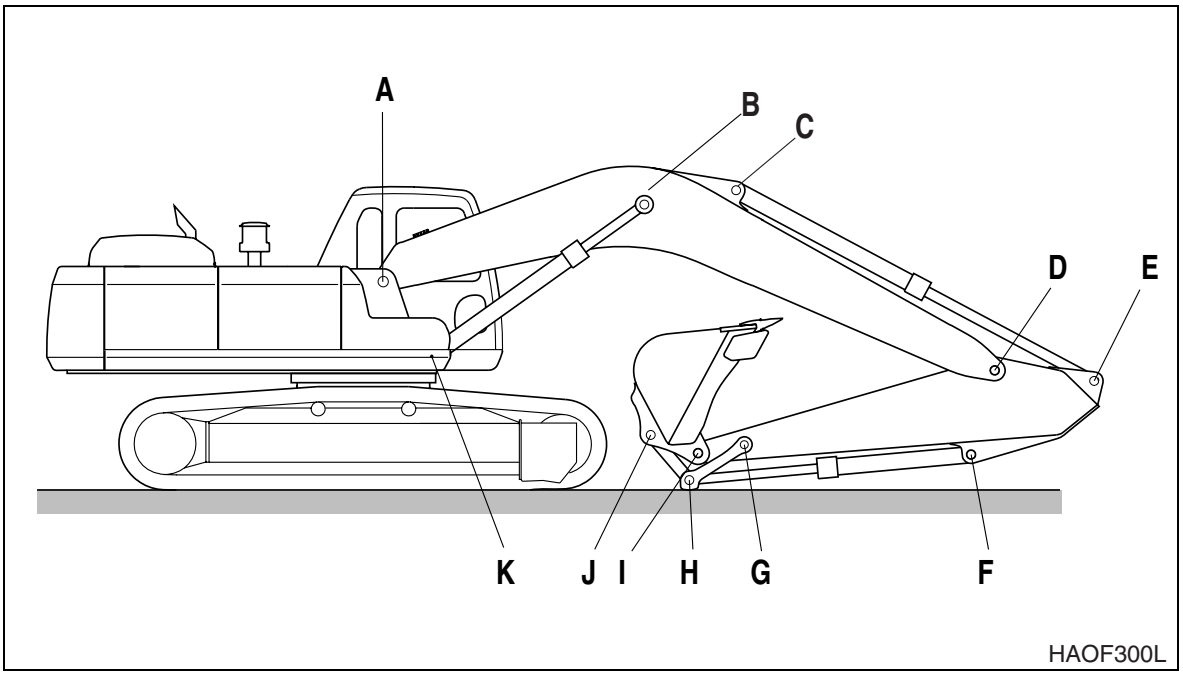

Figure 1

4. Slide the new tooth into position and insert shims. Shim tooth until gap is less than "X" [0.5 mm (0.020 in)]. See Figure 5.
5. Secure tooth and shim into position with seat, plain washers, lock washers and bolts.

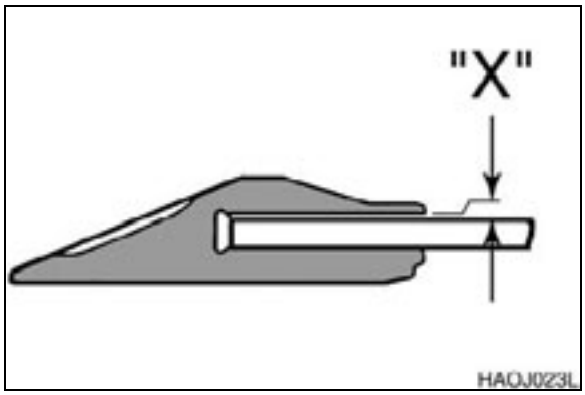

Figure 5

TYPE 3

⚠ WARNING!

Due to the possibility of flying metal objects, always wear safety helmet, protective gloves and eye protection when changing bucket teeth.

Curl the bucket upwards and place the round rear surface of the bucket firmly on the ground. Place wooden blocks under front of bucket. Shut the engine off and lock out the hydraulic controls before working on the bucket.

Inspect locking pin assembly and replace it if the following conditions exist:

1. The locking pin is too short when both surfaces are aligned.
2. The rubber has been torn and bosses of the steel balls are liable to slip off.
3. Pressing steel ball causes the boss to go inside.

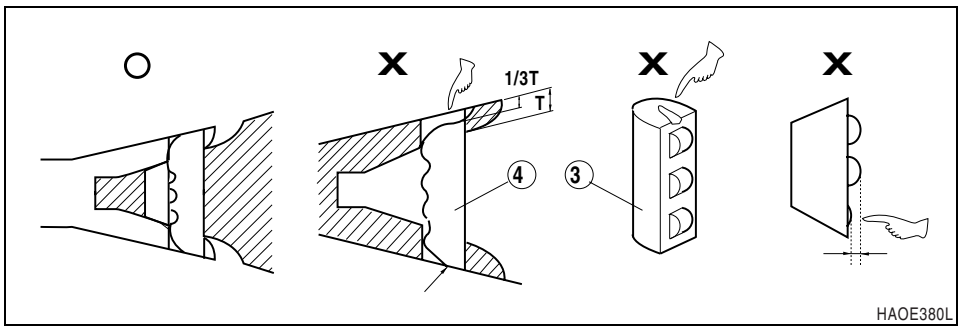

Figure 6

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