DAEWOO HEAVY INDUSTRIES & MACHINERY LTD.

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Shop Manual

HYDRAULIC EXCAVATOR

SOLAR 010

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● DIESEL ENGINE

1. SAFETY

1.1 GENERAL SAFETY ESSENTIALS

1.1.1 Accessory Applications

1. The excavator has been primarily designed for moving earth with a bucket. For use as a grapple or for other object handling, contact Daewoo.
2. DO NOT use the machine for activities for which it was not intended.
3. Use of an accessory hydraulic hammer(breaker), work in rough terrain, demolition applications or other hazardous operation may require installation of additional protective structures to safeguard the operator.

1.2 USE AND MODIFICATION PRECAUTIONS

To operate safely the excavator should be on a firm, level and uniformly supporting surface. The operator is expected to make due allowance for all specific work site and lift-related conditions, and respond to changes in those conditions that could pose a hazard. The following could all cause hazardous conditions and accidents or injuries :

- Soft or uneven ground
- Off-level terrain
- Side loads
- Modifications or poor maintenance of the excavator
- Failure to lift squarely over the end or squarely over side of the machine

When a load in the air, the operator must remain alert.

- Avoid side loads that may be caused by uneven slings, traveling with the load, or swinging too quickly.
- The load can become unbalanced if a hookline is twisted and starts to rotate. If the surface area of the load is large enough, wind gusts can create side loads.
- Keep the bucket hook point directly over the load. Taglines on opposite sides of the load can help maintain greater stability against side loads and wind gusts.

Avoid traveling with a suspended load. Before swinging(or if required, traveling), bring the load in to an arm position(radius and height) that is safe. The operator and all work site personnel should be thoroughly familiar with safety instructions within this Manual.

Taglines on opposite sides of the load can be very helpful in keeping a suspended load secure, if they are anchored safely to control points on the ground.

⚠ **CAUTIONS :** *If you need more information or have any questions or concerns about safe operating procedures or working the excavator correctly in a particular application or in the specific conditions of your individual operating environment, please consult your local Daewoo representative or call Daewoo After Sales Service.*

1. Unauthorized Modifications

Any modification made without authorization or written approval from Daewoo can create a safety hazard, for which the machine owner must be held responsible.
For safety's sake, replace all OEM parts with the correct authorized or genuine Daewoo part. For example, not taking the time to replace fasteners, bolts or nuts with the correct replacement parts could lead to a condition in which the safety of critical assemblies is dangerously compromised.

2. Attachment Precautions

Options kits are available through yourdealer. Contact Daewoo for information on available one-way(single-acting) and two-way(double-acting) piping/valving/auxiliary control kits. Because Daewoo cannot anticipate, identify, or test all of the attachments that owners that owners may wish to install on their machines, please contact Daewoo for authorization and approval of attachments, and their compatibility with options kits.

1.3 WORK SITE PRECAUTIONS

1. Avoid High-voltage Cables

Serious injury or death can result from contact or proximity to high-voltage electric lines. The bucket does not have to make physical contact with power lines for current to be transmitted.

Use a spotter and hand signals to stay away from power lines not clearly visible to the operator.

Depending upon the voltage in the line and atmospheric conditions, strong current shocks can occur with the boom or bucket as far away as 4m-6m(13´0´´– 20´0´´) from the power line. Very high voltage and rainy weather could further decrease that safety margin.

⚠ **CAUTIONS :** *Before starting any type of operation near power lines(either above ground or buried cabletype), you should always contact the power utility directly and work out a safety plan with them.*

2. Before Starting to Dig, Contact Authorities

Below ground hazards also include natural gas lines, water mains, tunnels and buried foundations. know what's underneath the work site before starting to dig.

3. Be Aware of Height Obstacles

Any type of object in the vicinity of the boom could represent a potential hazard, or cause the operator to react suddenly and cause an accident. Use a spotter or signal person when working near bridges, phone lines, work site scaffolds, or other obstructions.

4. Use Care on Loose Support

Working heavy loads over loose, soft ground or uneven, broken terrain can cause dangerous side load conditions and possible tipover and injury. Travel without a load or a balanced load may also be hazardous under these conditions.
If temperatures are changing, be cautious of dark and wet patches when working or traveling over frozen ground. Stay away from ditches, overhangs and all other weak support surfaces. Halt work and install support mats or blocking if work is required in an area of poor track support.

5. Use Solid Support Blocking

Never rely on lift jacks or otehr inadequate supports when work is being done. Block tracks front and rear to prevent any movement.

6. Digging Beneath Overhangs

Digging beneath an overhang is dangerous. The overhang could collapse on top of the operator and cause serious injury or death. Go on to another digging area before steep overhangs are formed.
Know the height and reach limits of the excavator away from overhangs before work shutdown.

7. Digging Beneath the Excavator

Digging beneath the excavator is dangerous. The earth beneath the excavator could collapse. This could cause the excavator to tip, which could cause serious injury or death to the operator.
Working around deep pits, trenching, or along high walls may require support blocks, especially after heavy rainfalls or during spring thaws.

8. Sloping Terrain Requires Caution

Dig evenly around the work site whenever possible, trying to gradually level any existing slope. If it's not possible to level the area or avoid working on a slope, reducing the size and cycling rate of the workload is recommended.
On sloping surfaces, use caution when positioning the excavator prior to starting a work cycle. Stay alert for instability situations in order to avoid getting into them. For example, you should always avoid working the bucket over downhill crawler traks when parked perpendicular to the slope. Slow all downhill swing movements and avoid full extensions of the bucket in a downhill direction. Lifting the bucket too high, too close to the machine, while the excavator is turned uphill can also be hazardous.

9. Stay Alert for People Moving through the Work Area

- When loading a truck you should always know where the driver is.
- Avoid loading over the cab of a truck even if the driver is in a safe spot. Someone else could have gone inside. Avoid working where unseen passersby might be.
- Slow down the work cycle and use slower travel speeds in congested or populated areas. Use a commonly understood signal so that other members of the work crew can warn the operator to slow or halt work in an impending hazard situation.

1.4 Operation

⚠ *Be Prepared - Get to Know All Operating and Safety Instructions*

This is the Safety Alert Symbol. Wherever it appears - in this manual or on safety signs on the machine-you should be alert to the potential for personal injury or accidents. Always observe safety precautions and follow recommended procedures.

1. Operate While Seated at the Operator's Station ONLY

Never reach in through a window to work a control. Do not try to operate the excavator unless you're in the command position-seated at the controls. You should stay alert and focused on your work at all times but DO NOT twist out of the seat if job activity behind you (or to the side) requires your attention.

Use a spotter or signal person if you can't see clearly and something is happening behind you.

Replace damaged safety labels and lost or damaged owner's manuals.

Do not let anyone operate the machine unless they've been fully and completely trained, in safety and in operation of the machine.

2. Learn the Signal Words Used with the Safety Alert Symbol

The words "**CAUTION," "WARNING",** and **"DANGER"** used throughout this manual and on labels on the machine indicate degree of risk of hazards, or unsafe practice. All three degrees of risk indicate that safety is involved. Observe precautions indicated whenever you see the Safety Alert "Triangle", no matter which signal word.

⚠ **CAUTION** : *Indicates the presence of a hazardous situation that, if not avoided, could result in minor or moderate injury. It may also be used to alert against a generally unsafe practice.*

⚠ **WARNING** : *Indicates the presence of a hazardous situation that, if not avoided, could result in serious injury or death. It may also be used to alert against a highly unsafe practice.*

⚠ **DANGER** : *Indicates the imminent hazard of a situation that, if not avoided, is very likely to cause death or extremely serious injury. It may also be used to alert against equipment that may explode or detonate if handled or treated carelessly.*

3. Before Starting the Engine

Do a “Pre-start” safety check:

- Walk around your machine before getting in the operator’s cab. Look for evidence of leaking fluid, loose fasteners, mis-aligned assemblies or any other indications of possible equipment hazard.
- All equipment covers and machinery safety guards must be in place, to protect against injury while the machine is being operated.
- Look around the work site area for potential hazards, or people or property that could be at risk while operation is in progress.
- NEVER start the engine if there is any indication that maintenance or service work is in progress, or if a warning tag is attached to controls in the cab.
- A machine that has not been used recently, or is being operated in extremely cold temperatures, could require a warm-up or maintenance service prior to start-up.
- Check gauges and monitor displays for normal operation prior to starting the engine. Listen for unusual noises and remain alert for other potentially hazardous conditions at the start of the work cycle.

4. 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.

5. Mounting and dismounting

- NEVER get on or off a moving machine. Don’t jump on/off. The entry/egress path should 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.

6. 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 should be aware of assigned individual responsibilities and tasks.
Communication and hand signals used should be understood by everyone.
Terrain and soil conditions at the job site, approaching traffic, weather-related hazards and any above or below ground obstacles or hazards should be observed and monitored by all work crew members.

7. Engine Ventilation

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

8. Take Time to Provide Good Visibility

Halt work if visibility is poor. Strong rains, snow, fog and extremely dusty conditions can all obscure visibility so badly that it is best to wait for weather to change or dust to settle before continuing operation.

Night work in areas of limited visibility should be stopped and extra work lights on the machine or in the work area should be installed.

Keep dirt and dust off of windows and off the lens surfaces of work lights. Stop working if lights, windows or mirrors need cleaning or adjustment.

9. Fuel, Oil and Hydraulic Fluid Fire Hazards

Add fuel, oil, antifreeze and hydraulic fluid to the machine only in a well ventilated area. The machine must be parked with controls, lights and switches turned off. The engine must be off and any flames, glowing embers, auxiliary heating units or spark-causing equipment must be doused, turned off and/or kept well clear of the machine.

Static electricity can produce dangerous sparks at the fuel filling nozzle. In very cold, dry weather or other conditions that could produce static discharge, keep the tip of the fuel nozzle in constant contact with the neck of the fuel filling nozzle, to provide a ground.

Keep fuel and other fluid reservoir caps tight and do not start the engine until caps have been secured.

10. Boost Starting or Charging Engine Batteries

Turn off all electrical equipment before connecting leads to the battery. This includes electrical switches on the battery charger or boost starting equipment.

When boost-starting from another machine or vehicle do not allow the two machines to touch. Wear safety glasses or goggles while required parallel battery connections-positive to positive and negative to negative-are made.

Connect positive cable first when installing cables and disconnect the negative cable first when removing them. The final cable connection, at the metal frame of the machine being charged or boost-started, should be as far away from the batteries as possible.

11. Travel Controls May Produce Reversed Operations

Before starting the machine you should always check to see which end of the track frame is under the operator’s cab. In the normal travel configuration, track frame travel motors are at the rear of the machine, under the engine and counterweight. If the operator swings the cab 180 , travel motors will be underneath the operator’s cab, toward the front of the track frame and operating travel will be reversed.

When traveling the excavator always keep lights on; make sure that you are in compliance with all state and local regulations concerning warning flags and signs and keep the operator’s cab positioned over the idler end of the track frame. That will keep travel controls in their intended configuration and at the same time, maintain the proper orientation of lights on the machine and posted flags and signs.

12. Keep “Pinch Point” Areas Clear - Use Caution in Reverse & Swing

Use a signal person in high traffic areas and whenever the operator’s view is not clear, such as when traveling in reverse. Make sure that no one comes inside the swing radius of the machine.
Never allow anyone to ride on any part of the machine or attachment, including any part of the turntable or operator’s cab.

13. Travel Precautions

Attachment control levers should not be operated while traveling.
Never travel over obstacles or slopes that will cause the machine to tilt severely. Travel around any slope or obstacle that causes 10 degrees tilt, or more.

14. Operate Carefully on Snow and Ice and Very Cold Temperatures

In icy cold weather avoid sudden travel movements and stay away from even very slight slopes. The machine could skid off to one side very easily.

Snow accumulation could hide or obscure potential hazards. Use care while operating or while using the machine to clear snow.

Warming up the engine for a short period may be necessary, to avoid operating with sluggish or reduced working capacity. The jolting shocks and impact loads caused by bumping or bottoming the boom or attachment are more likely to cause severe stress in very cold temperatures. Reducing work cycle rate and work load may be necessary.

15. Parking the Machine

Avoid making sudden stops, or parking the machine wherever it happens to be at the end of the work day. Plan ahead so that the excavator will be on a firm, level surface away from traffic and away from high walls, cliff edges and any area of potential water accumulation or runoff. If parking on inclines is unavoidable, block the crawler tracks to prevent movement. Lower the bucket or other working attachment completely to the ground, or to an overnight support saddle. There should be no possibility of unintended or accidental movement.

16. Shutdown Control Functions

After the machine has been lowered to the overnight storage position and all switches and operating controls are in the OFF position, the control stand lock lever must be engaged. Release the left console to disable all pilot circuit control functions.

Insert the swing lock pin and engage all brakes and lock-down security equipment that may have been installed on the machine.

1.5 EQUIPMENT

1. Rough Operation May Require Use of Certified Safety Equipment

Work in mines, tunnels, deep pits or on loose or wet surfaces could produce danger from falling rock, roll over or hazardous flying objects.

Any reinforcement system that is installed on the machine must pass safety and certification standards and carry appropriate labeling and rating information.

Never attempt to alter or modify any type of protective structure reinforcement system, by drilling holes, welding or remounting or relocating fasteners. Any serious impact or damage to the system requires a complete integrity reevaluation. Reinstallation, recertification and/or replacement of the system may be necessary.

2. Install Additional Safety Equipment If Conditions Require

When working with a breaker or in some shear work applications, a front guard over the windshield may be required. The windshield guard may or may not be OPS/certified, depending upon the specific application and working situation.

Laminate glass protection for the front, side or rear windows may also be recommended depending upon particular site conditions.

Contact your Daewoo distributor for a available safety guards and/or recommendations if there is any danger of getting hit by objects that could strike the operator’s cab. Make sure that all other work site crew members are kept well away from the excavator and safe from potential hazards.

3. Movement Alarms

If the excavator is equipped with an audible travel movement alarm or visible swing movement alarm(strobe light), test the alarm on a daily basis. The audible alarm should sound as soon as the travel system is engaged. The strobe light should begin to flash as soon as the swing system is engaged.

4. Keep a Fire Extinguisher at Hand

It is recommended that an appropriately sized(2.27 kg [5 lb] or larger) multi-purpose “A/B/C” fire extinguisher be mounted in the cab. Check and service the fire extinguisher at regular intervals and make sure that all work site crew members are adequately trained in its use.

5. Maintain Standard Safety Equipment in Good Condition

Machinery guards and body panel covers must be in place at all times. Keep well clear of rotating parts. Pinch point hazards such as cooling fan and alternator drive belts could catch hair, jewelry or oversize or very loose clothing.

Safety labels must be replaced if they are damaged or become unreadable. The information on labels gives work crew members an important safety reminder exactly where it will do the most good.

6. Safety-Critical Parts Must Be Replaced Periodically

Replace the following fire-related components as soon as they begin to show any sign of wear, or at regular periodic intervals, whether or not deterioration is visible:

- Fuel system flexible hoses, the tank overflow drain hose and the fuel filler cap.
- Hydraulic system hoses, especially the pump outlet lines and front and rear pump branch hoses.
- Keep mounting brackets and hose and cable routing straps tight. Hose routing should have gradual bends.

7. Hydraulic Cylinder Seals Require Periodic Replacement

Check cylinder drift rate at regular intervals. Overhaul seal kits are available through Daewoo.

8. High Pressure Hydraulic Lines Can Store a Great Deal of Energy

Exposed hydraulic hoses on the arm or boom could react with explosive force if struck by a falling rock, overhead obstacle or other jobsite hazard. Extra safety guards may be required. NEVER allow hoses to be hit, bent or interfered with during operation.

9. The Operator's Cab and Turntable Deck Should Be Kept Clean

Cleaning off accumulations of grease and dirt helps extend equipment service life. Cleaning also provides an opportunity to inspect equipment. Minor damage can be repaired or corrected before major problems result.

Keep the cab floor and consoles free of tools and personal items.

10. Wear Eye Protection and Safety Clothing - Use Proper Tools

Full eye protection, a hard hat, safety shoes and gloves may be required at the job site.

While working on the machine, never use inadequate tools. They could break or slip, causing injury, or they may not adequately perform intended functions.

11. Breathing Masks, Ear Protection May Be Required

Don't forget that some risks to your health may not be immediately apparent. Exhaust gases and noise pollution may not be visible, but these hazards can cause disabling or permanent injuries.

12. Battery Electrolyte and Explosive Gases Can Be Lethal

Flush eyes with water for 10-15 minutes if acid is splashed in the face. Anyone who swallows acid must have immediate medical aid. Call the Poison Control listing in the front cover of the telephone directory. Water, a popsicle or ice cream are likely better than old remedies that try to induce vomiting(which would expose tissue to damage twice).

Explosive battery gas can be set off by sparks from incidental contact or static discharge. Turn off all switches and the engine when working on batteries. Keep battery terminals tight. Contact between a loose terminal and post can create an explosive spark.

13. Disconnect Batteries for Electrical Service Before Electrical Welding

Remove cable from negative terminal first, when disconnecting cable. Connect positive terminal cables first when installing a battery.

14. Use Low Heat Portable Lighting

Hot surfaces on trouble lights or portable work lights can set off fuel or battery explosive gases.

1.6 MAINTENANCE

1. Use Warning Tag Control Lockout Procedures During Service

Alert others that service or maintenance is being performed and tag operator's cab 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, non-active position.
Warning tags for controls are available from Daewoo distributors.

2. Do not Run the Engine If Repairs Are 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.

3. Always Use Adequate Equipment Supports and Blocking

Don't allow weight or equipment loads to remain suspended. Lower everything to the ground before leaving the operator's seat. don't use hollow, cracked or unsteady, wobbling weight supports. Don't work under any equipment supported solely by a lift jack.

4. Do Not Work on Hot Engines, Hot Cooling Systems or Hot Hydraulic Systems

Wait for the engine to cool off after normal operation. Park the excavator on a firm, level surface and lower all equipment before shutting down and switching off controls. When engine lube oil, gearbox lubricant or other fluids require change, wait for fluid temperatures to decrease to a moderate level before removing drain plugs.

NOTE : *Oil will drain more quickly and completely if it is warm. Do not drain fluids at 95°…(203°F) temperatures but don't allow full cool-down.*

5. Cool-down is Required Prior to Radiator

Stop the engine and allow heat to dissipate before performing service on the engine radiator. Both assemblies have air vent levers at or near the filler cap for venting built-up air pressure. Release the levers before trying to take off filler caps and LOOSEN CAPS SLOWLY, prior to removal.

6. Pressurized Hydraulic Oil Fluid Leaks Can Be Dangerous

Fluid leaks from hydraulic hoses or pressurized components can be difficult to see but pressurized oil has enough force to pierce the skin and cause serious injury.

Always use a piece of wood or cardboard to check for suspected hydraulic leaks. Never use your hands or expose your fingers.

Obtain immediate medical attention if pressurized oil pierces the skin.

⚠ **CAUTIONS :** *Failure to obtain prompt medical assistance could result in gangrene or other serious damage to tissue.*

7. Use Correct Replacement Fasteners Tightened to Proper Torque

Refer to the “General Maintenance” section of the Shop Manual for information on tightening torques and recommended assembly compounds and always use the correct part.

Poor or incorrect fastener connections can dangerously weaken assemblies.

8. Dispose of All Petroleum-based Oils and Fluids Properly

Physical contact with used motor oil may pose a health risk. Wipe oil from your hands promptly and wash off any remaining residue.

Used motor oil is an environmental contaminant and may only be disposed of at approved collection facilities. Never drain any petroleum-based product on the ground or dispose of old oil in municipal waste collection containers, or in metropolitan sewer systems or rural landfills.

Check state and local regulations for other requirements.

9. Track Tension Adjustments Require Caution

NEVER turn out the track tension grease fitting nut. To release pressure from the crawler frame track tension assembly, you should NEVER attempt to disassemble the track adjuster or attempt to remove the grease fitting or valve assembly.

Keep your face and body away from the valve. Refer to the track adjustment procedure in the Operation and Maintenance Manual or Shop Manual.

1.7 SHIPPING AND TRANSPORTATION

1. Obey State and Local Over-the-Road Regulations

Check state and local restrictions regarding weight, and length of a load prior to making any other preparation for transport.

The hauling vehicle, trailer and load must all be in compliance with local regulations governing the intended shipping route.

Partial disassembly or tear-down of the excavator may be necessary to meet travel restrictions or particular conditions at the job site. Refer to this shop Manual for information on partial disassembly.

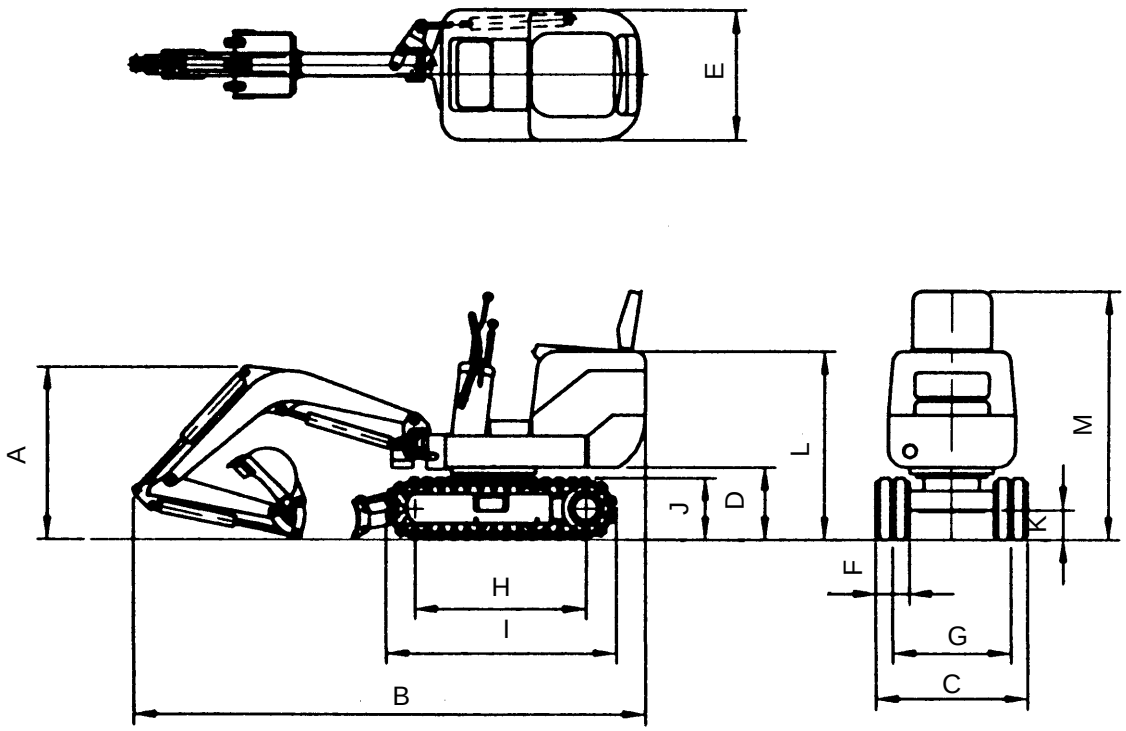
Refer to the Transportation and Shipping section of the Operation and Maintenance Manual for Information on loading and unloading, and towing.

2. SPECIFICATIONS

2.1 GENERAL SPECIFICATIONS

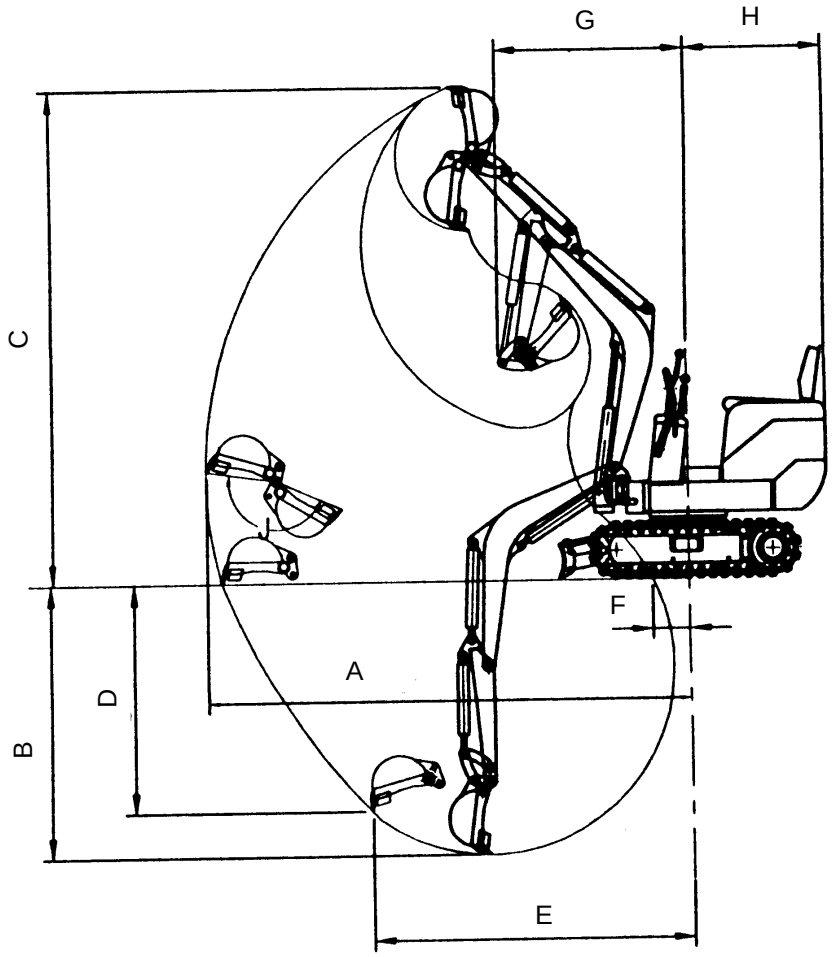
Operating Weight	770 kg (1,697 lb)
Major Component Weights Upper Structure, without Front Attachment, with Counterweight	317 kg (699 lb)
Lower Structure, below Swing Bearing	166 kg (366 lb)
Front Assembly	133 kg (293 lb)
Counter Weight	30 kg (66 lb)
Boom	36 kg (79 lb)
Arm	15 kg (33 lb)
Bucket	14 kg (28 lb)
Blade	42 kg (94 lb)
Boom Cylinder(each)	8 kg (18 lb)
Arm Cylinder	9 kg (20 lb)
Bucker Cylinder	8 kg (18 lb)
Dozer Cylinder	5 kg (11 lb)
Transport Dimensions	
Overall Shipping Length	2,800 mm(9´2˝)
Overall Shipping Width	810 mm(2´7˝)
Overall Shipping Height	1,520 mm(4´11˝)
Track Shipping Length	906 mm(3´0˝)
Major Component Dimensions	
Boom Length	1,345 mm(53˝)
Arm Length	660 mm(26˝)
Dozer Blade(W × H)	810 mm ×195 mm(2´7˝ × 7 1/2˝)
Shoe Width	180 mm(7.09 in)
Digging Force Bucket Cylinder Arm Cylinder	 820 metric tons 720 metric tons
Digging Capacity	0.82 Ton
Towing Capacity	0.57 Ton
Fuel Tank Capacity	7.5 ℓ(1.98 gal)
Hydraulic Tank Capacity	12 ℓ(3.14 gal)
Bucket Capacity(CECE Heaped)	0.02m^3(0.03 yd^3)
Excavator Ground Pressure	 0.20 kg/cm^2(2.84 psi)
Gradeability	30°
Boom Swing Angle (R/L)	90°/90°

2.2 GENERAL DIMENSIONS



		STANDARD
A	Shipping Height(Front)	915 mm(3´0˝)
B	Shipping Length	2,800 mm(9´2˝)
C	Overall & Blade	810 mm(2´7˝)
D	Frame Clearange	575 mm(1´11˝)
E	Width	680 mm(2´3˝)
F	Shoe Width	180 mm(7.09˝)
G	Track Gauge	630 mm(2´3˝)
H	Tumbler Cemter Distance	906 mm(3´0˝)
I	Track Length	1,220 mm(4´0˝)
J	Track Height	325 mm(1´1˝)
K	Ground Clearange	140 mm(5´5˝)
L	Cab Height	995 mm(3´3˝)
M	Shipping Height(Seat)	1,520 mm(3´0˝)

2.3 WORKING RANGE



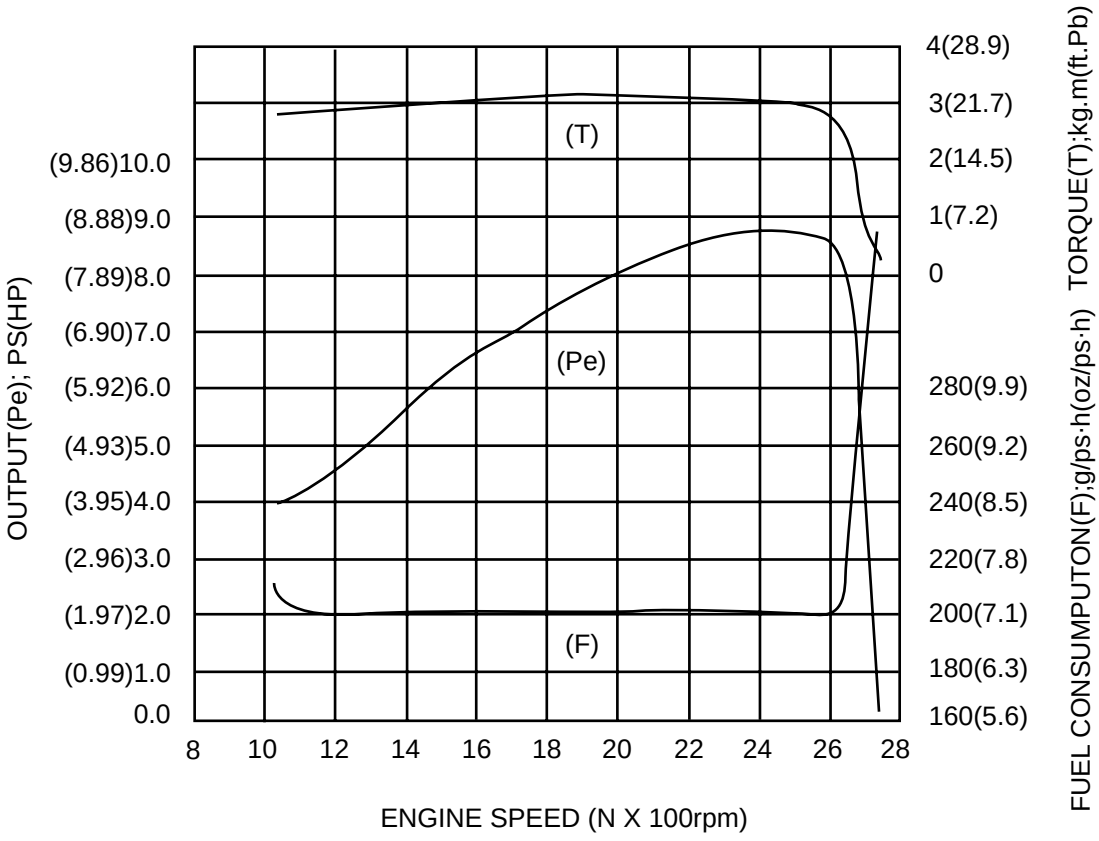
		STANDARD
A	MAX. Digging Reach	2,800 mm(9´2˝)
B	MAX. Digging Depth	1,550 mm(5´8˝)
C	MAX. Digging Height	2,825 mm(9´3˝)
D	MAX. Vertical	1,320 mm(4´3˝)
E	MAX. Radius Vertical	1,850 mm(6´1˝)
F	MIN. Digging Reach	214 mm(8´5˝)
G	MIN. Swing Radius	1,090 mm(3´7˝)
H	Tail Swing Radius	800 mm(2´8˝)
I	Bucket Angle	165°

2.4 ENGINE SPECIFICATIONS

Model	Yanmar 2TNE68
Type	4 Cycle, 2 Cylinder Diesel, Water-cooled, Forced Circulation.
Engine Block	
Combustion System	Swirl Pre-Combustion
Cylinder Bore and Stroke	68mm × 72mm(2.59 × 2.83)
Engine Displacement Direction of Rotation	523 cm^3 (31.91 in^3) Counterclockwise (viewed facing flywheel)
Compression Ratio	23:1
Compression Pressure	33 ± 1 kg/cm^2 at 250 rpm
Cylinder Firing Order	1-2
Engine Valve Cold Lash Adjustment	0.4 mm(0.016 in), intake ; 0.85 mm(0.034 in), exhaust.
Valve Timing	Intake Open @ 5-15° BTDC Intake Close @ 37-47° ABDC Exhaust Open @ 37-47° BBDC Exhaust Close @ 5-15° ATDC
Rated Flywheel Horsepower	8 Metric hp (7.9 hp) @ 2,550 (KS R1004) 5.9 kw @ 2,550 RPM (DIN 6271 & SAE J1349)
Torque Output	3.06 kg.m (22.13 ft lb) @ 1,900 RPM
No-load RPM	2,725 ± 50 RPM
Weight (DRY)	65 kg(143 lb)
Fuel System	
Fuel Injection Pump	Series Injection
Fuel Injection Pressure	120 kg/cm^2(1,706 psi)
Fuel Injection Timing	14° ± 1° BTDC
Fuel Filter	Cartridge Type
Governor	Mechanical Centrifugal
Fuel Consumption	20.5 g Per Ps.hr @ 2,550 minimum
Fuel Tank capacity	7.5 ℓ(28.33 gal)
Lubrication System	
Engine Oil Capacity (Engine only)	0.6 ℓ(0.63 qt)
Lubrication Pressure	3-4 kg/cm^2(42-57 psi)
Engine Oil	American Petroleum Institute/SAE Class CC/CD or better (Class CD-II, CE, CF-4, CG-4)
Cooling System	
Coolant Capacity (Engine only)	0.6 ℓ (0.63 qt)
(Radiator)	1.7 ℓ (1.8 qt)
Engine Coolant Thermostat	Wax - Pellet Type
Thermostat Temperature	Opening begins at 71°C (160°F), Fully open at 85°C (185°F)
Electrical System	
Batteries	12V, 35A
Charging System Regulator	IC Type(Integrated Circuit)
Generator	9A, 12V
Starter	12V, 0.8Kw

2.5 ENGINE PERFORMANCE CURVE

	TEST CONDITION
Barometric Pressure	KS R1004
Cooling Fan & Type	760 mmHg
Alternator	12V, 9A
Air Cleaner	0
Muppler	X



Performance Standard	KS R1004
Power(Rated)	9.5PS(9.37 HP) / 2,550 rpm
MAX. Torque	3.06 kg•m(22.13 ft lb) / 1,900 rpm
Fuel Consumption(Rated)	205 g/ps•h(7.23 oz/ps• h)

2.6 HYDRAULIC SYSTEM COMPONENT SPECIFICATIONS

Manin Pump	
Quantity	1
Displacement	4.1 cc/rev (0.25 cu in)
Max Flow Rate	10 ℓ/min X 2
Relief Pressure	150 kg/cm² (2,133 psi)
Bucket	180 kg/cm² (2,560 psi)
Arm	190 kg/cm² (2,702 psi)
Control Valve	
P1 Spools*	Dozer Travel, right Boom swing Boom Bucket
P2 Spools*	Auxiliary Travel, left Arm Swing
*Diameter 10 mm(0.39 in)	
Relief Valves (Main)	2 X 150 kg/cm²(2,133 psi)

Hydraulic Cylinders

	Boom	Arm	Bucket	Dozer	Boom swing
Quantity	1	1	1	1	1
Inner Diameter mm (in)	50 (1.97)	55 (2.16)	50 (1.97)	50 (1.97)	50 (1.97)
Stroke mm (in)	300 (11.82)	315 (11.22)	285 (2.75)	70 (14.57)	370 (11.82)
Rod, outer dia. mm (in)	25 (.98)	30 (1.18)	25 (.98)	25 (.98)	25 (.98)
Cylinder length, retracted mm (in)	555 (21.8)	540 (21.2)	505 (19.8)	330 (13.0)	588 (23.1)

SWING SYSTEM	
SWING MOTOR	
Type	Orbit Motor
Displacement	195 cc(11.9 in^2)/rev
Crossover Relief Valve Setting	65 kg/cm^2 @ 10 ℓ/min (924.5 psi @ 2.64 gpm)
MAX. Supply Flow Pate	15 ℓ/min (3.96 gpm)
Motor Shaft Speed	51.3 rpm
Motor Shaft Torque	46.6 kg• m (337.1 ft lb)
PINION GEAR	
Type	Profile Shifted Gear
Gear Pcd	51 mm(2.0˝)
Of Teeth	17 EA
Module	3
SWING BEARING	
Type	Ball Bearing Internal Gear
Gear Pcd	312 mm (12.3˝)
No. Of Teeth	104 EA
Ball Dia.	19.05 mm (0.75˝)
Race O. D.	445 mm (17.5˝)
Race Height	46 mm (1.8˝)
Static Thrust Load	61,500 kg (135,584 lb)
Weight	18 kg (39.68 lb)
SWING PERFORMANCE	
MAX. Swing Speed	9.1 rpm
MAX. Swing Torque	94 kg• m (ft lb)
SWING SAFETY LOCK	
Type	Manual Locking Pin

2. SPECIFICATIONS

TRAVEL SYSTEM	
TRAVEL MOTOR	
Type	Orbit Motor
Displacement	78.3 cc(4.78 in^3)/rev
Max. Supply Flow Pate	10 ℓ (2.6 gpm)/min
Motor Shaft Speed	16.4 kg• m (118.6 ft lb)
REDUCTION GEAR	
Type & Model	1 Stage Planetary
Reduction Gear Ratio	3.714 to 1
MAX. Out Speed	34.4 rpm
MAX. Output Torque	61 kg• m (441.2 ft lb)
SPROCKET	
Sprocket PCD	275.16 mm (10.8˝)
Track Link Pitch	72 mm (2.8˝)
No. Of Teeth	12 EA
TRAVEL PERFORMANCE	
Travel Speed	1.9 km/h (1.2 mph)
Traction Force	570 kg(1,256.6 lb)
Gradeability	58%
UNDER CARRIAGE	
Flange Type	Single
Qty Per Side	2 EA
DIA	60 mm (2.4˝)
FRONT IDLER	
Maker	Jin Sung
DIA	247 mm (9.7˝)
RUBBER TRACK	
Type	–
Link Pitch	72 mm (2.8˝)
Track Gauge	630 mm (24.8˝)
Tumbler Distance	906 mm (35.7˝)
Side Width	180 mm (7.09˝)
Ground Pressure	0.20 kg/cm^2 (2.84 psi)

3. HYDRAULIC SYSTEM OPERATION

Hydraulic oil from Pump 1 is directed to port P1 of the control valve and operates the travel(right), boom swing, boom and bucket. See Figure 3-1

Hydraulic oil Pump 2 is directed to port P2 of the control valve to operate swing, arm, travel(left) and the dozer blade.

An overload relief valve protects the boom, arm and bucket.

A return oil filter protects components by removing impurities from hydraulic oil as it returns to the hydraulic oil tank.

A hydraulic circuit diagram is shown in Figure 3-1.

3. HYDRAULIC SYSTEM OPERATION

- **HYDRAULIC CIRCUIT DIAGRAM**

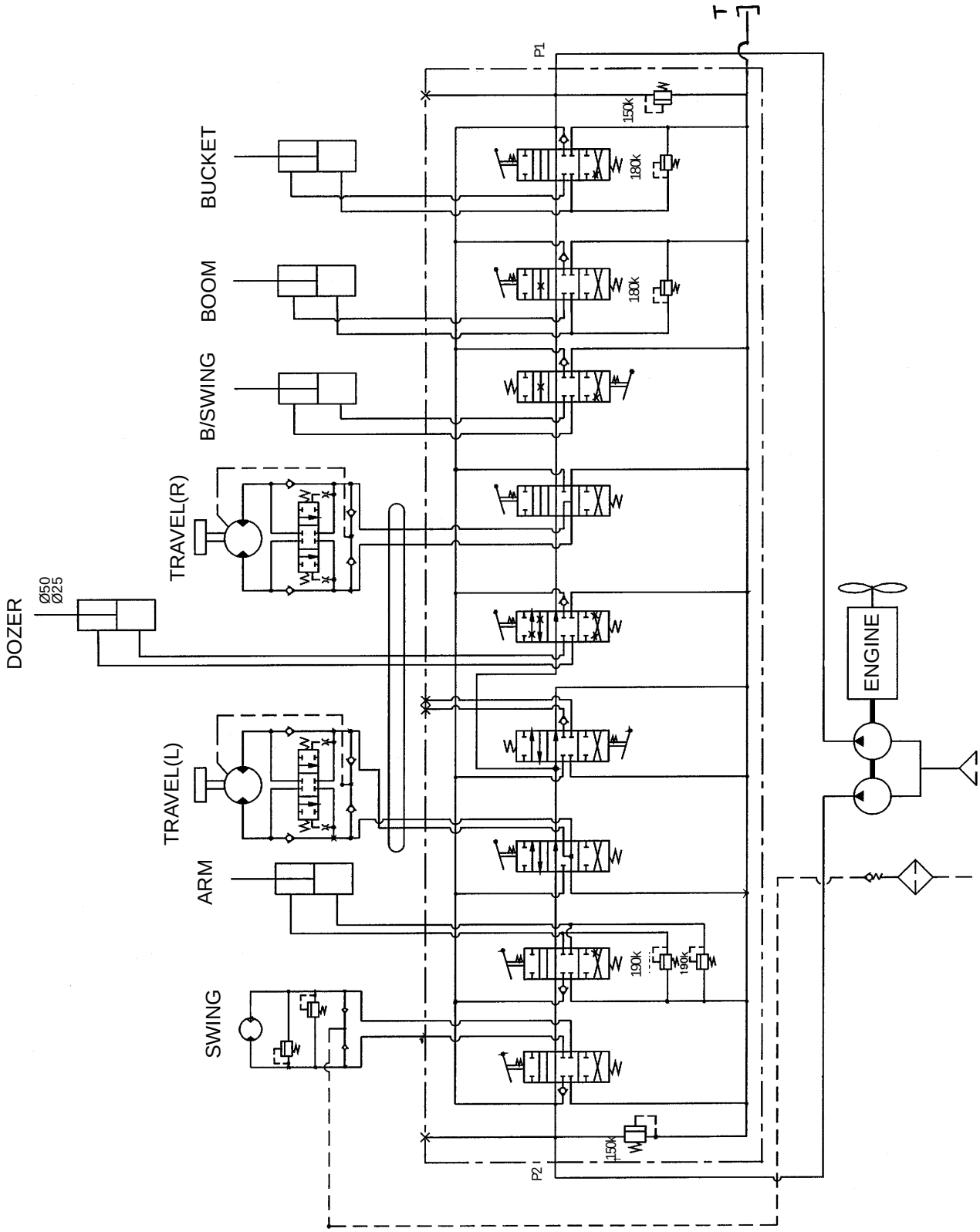


Figure 3-1

4. GEAR PUMP

4.1 ASSEMBLY DRAWING

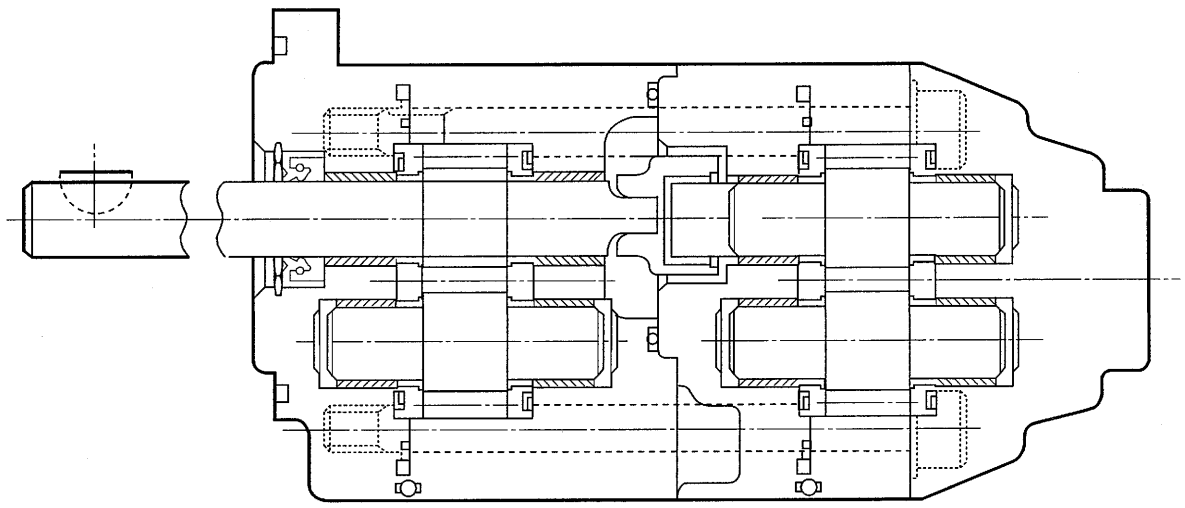


Figure 4-1

NOTE : *The pump rotates clockwise from a drive axle side.*

4.2 OVERHAULING DRAWING

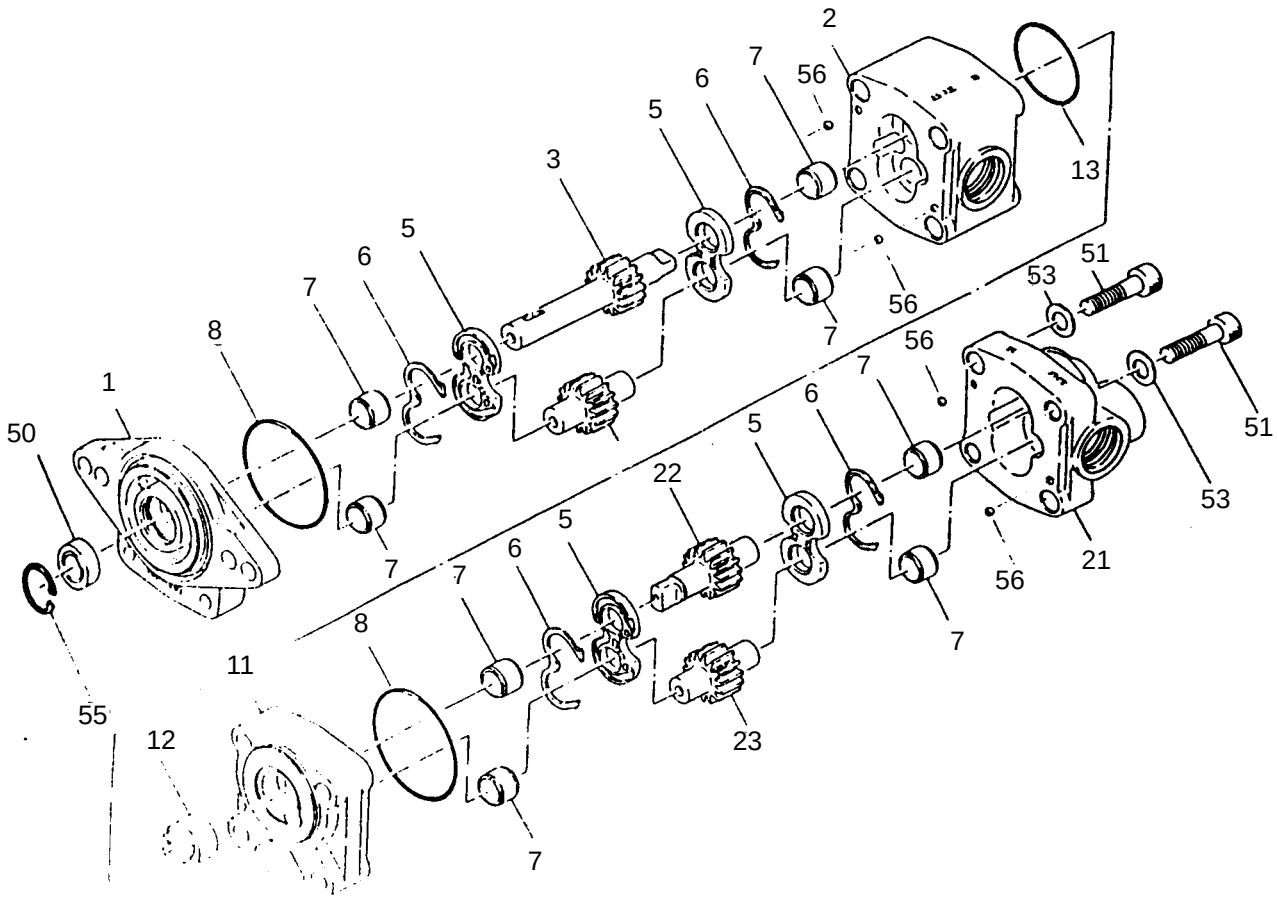


Figure 4-2

NOTE : *A cross section view is shown in Figure 4-1, and an exploded view is shown in Figure 4-2*

4.3 PUMP INSPECTION AND REPAIR

4.3.1 General Notes

- Check parts for discoloration and other signs of wear or damage.
- Clean parts, except for O-rings, gaskets, etc. in an approved nonflammable, non-toxic cleaning solution
- Whenever pump components are heat damaged or when the pump is excessively worn, the hydraulic oil and all filters in the system should be replaced.

4.3.2 Seals

NOTE : *The inner lips of oil seals prevent hydraulic oil leakage, while the outer lips prevent dust and air from entering the pump. Replace seals and packing rings whenever rebuilding the pump. See figure 4-3*

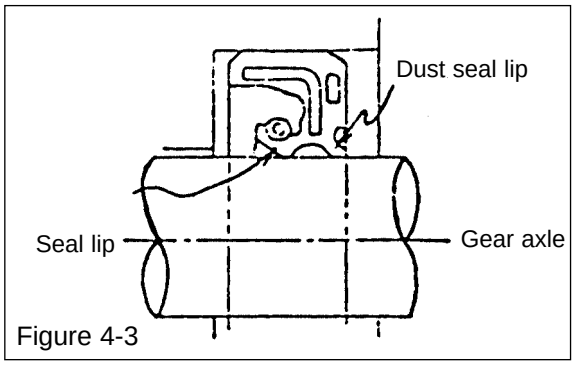


Figure 4-3

4.3.3 Gear Pump Body

NOTE : *The gear pump is designed so that the gear is in partial contact with the body, which creates a "normal" wear pattern.*

1. Check wear pattern : wear on about one third of the surface is normal ; wear on about one half the surface means the bearing and shaft are worn; while wear on more than one half of the surface means the body needs to be replaced. See Figure 4-4

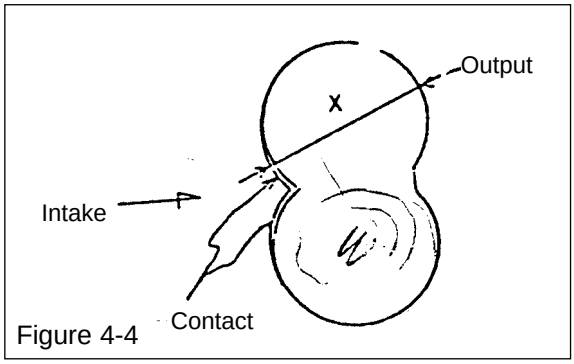


Figure 4-4

4.3.4 Bushing

1. Check wear pattern: the contact surface of the bore should be smooth and about half of the intake side should be “polished”. The high pressure side should be worn less than the contact face. See Figure 4-5

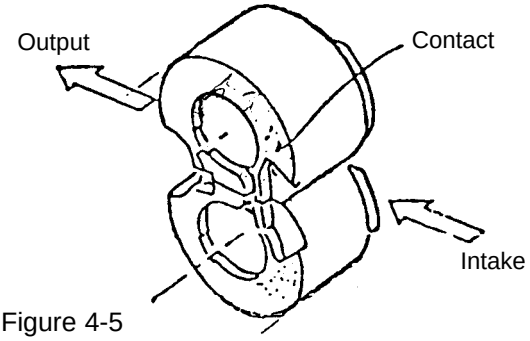


Figure 4-5

2. Replace bushing when the following conditions are observed :
   a. There is a contact pattern on the front surface of the bore and on the side of the gear.
   b. There are high number of scratches on the contact surface and on the side of the gear.
   c. There is foreign material on the bore and on the side face. This condition is often caused by contaminated hydraulic oil and may also be caused by a defective relief valve, by cavitation or by an abnormal increase in oil temperature which results in decreased viscosity. In this case, the gear should also be replaced, the hydraulic system should be flushed and the hydraulic oil should be replaced.

4.3.5 Gears

1. Replace gears when the following conditions are observed :
   a. There is a contact pattern on the shaft or side of the gear, or a tooth is excessively worn. See Figure 4-6
   b. When gear surfaces are damaged or discolored. In this case, the bushing and body should be examined further.

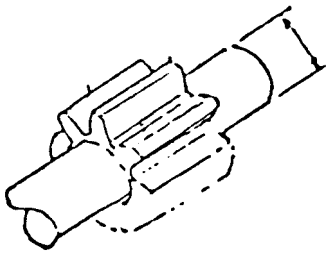


Figure 4-6

5. CONTROL VALVE

- **Control Valve Rebuild**

NOTE : *Repair control valve in a clean workplace to avoid damage to precision parts which can be damaged by extremely small amounts of dust or other foreign material. Always use new O-rings.*

5.1 TOOLS

ITEM	DIMENSION	Q'TY	NOTE
Wrench	3mm	1	M6
	4mm	1	M5
	5mm		PT 1/8
	6mm		PF 1/4
	8mm	1	PF 3/8
Box Wrench	8mm	1	
	10mm	1	M6 Three types of Hex. Nuts
	13mm		M8 Nuts
	21mm	1	Accessory Valve
Drive (+)		1	M5
Rod	4.5 X 100	1	Overhauling & Assembling of Spring Center
Torgue Wrench	2 ~ 10 kg• m	1	Assembling accessory Valve
	(14-73 ft lb)		Assembling M8 Nuts
	2 kg• m(14 ft lb) or less	1	Assembling Return Spring Holder