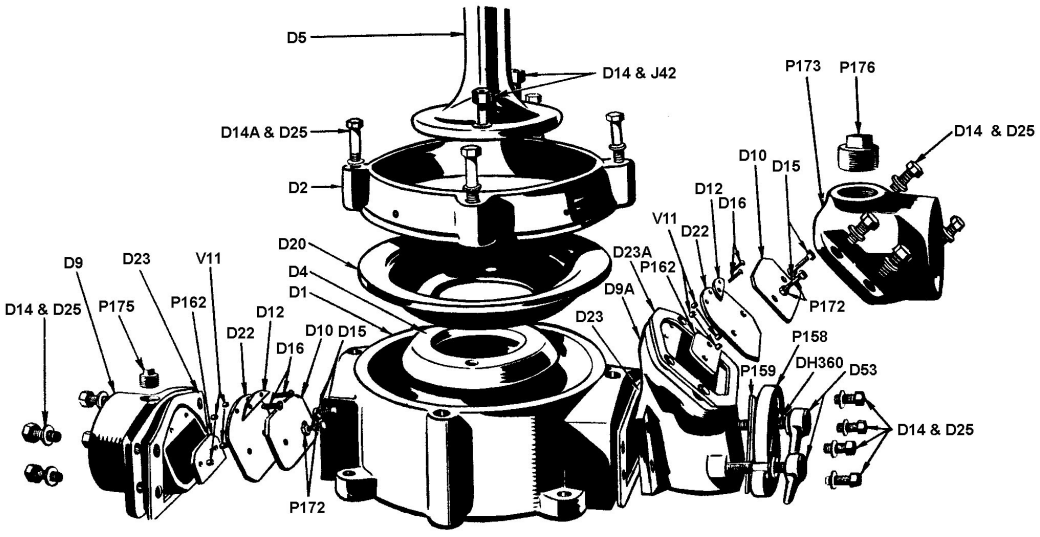
TM 5-4320-369-14&P

TECHNICAL MANUAL
OPERATOR, UNIT,
DIRECT SUPPORT, AND GENERAL
SUPPORT MAINTENANCE MANUAL
FOR
PUMP UNIT, DIAPHRAGM
DIESEL-DRIVEN
SELF-PRIMING

100 GPM WATER
SIZE B
(NSN 4320-01-506-9538)



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Technical Manual
TM 5-4320-369-14&P

HEADQUARTERS,
DEPARTMENT OF THE ARMY
Washington, DC, *2 September 2005*

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MODEL: NOVO 4 ADE

CURRENT AS OF: 27 May 2003

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TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

1. IDENTIFICATION

1.1 Manufacturer

American-Marsh Pumps, 185 Progress Road, Collierville, TN 38017, United States of America

1.2 Type of Pump

Horizontal self-priming positive displacement pump with diaphragm for handling liquids containing solids in suspension. These pumps can operate satisfactorily with liquids containing air or dissolved gases. This type of pump can also run dry, indefinitely.

1.3 Model

NOVO 4 ADE Series
This type of pump has a 4.00" suction and a 4.00" discharge NPT connection. The ADE models are flex coupled to Lombardini 15LD315 diesel engines.

1.4 Year of Manufacture

The year of manufacture is indicated on the pump data plate.

1.5 Instruction Book Identification

Prepared: May, 2003 **Edition:** 01 **Revision:** 00 **Date of Revision:**

1.6 Nameplate Information

1.6.1 Pump Data Plate (figure 1)

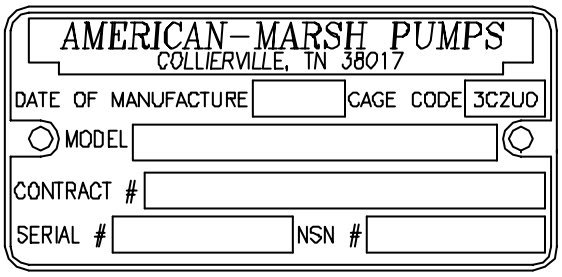


Figure 1

Date of Manufacture	:	Date the pump was manufactured (i.e. May 03 or 05/03)
Model	:	Model of Pump Unit (i.e. AM-XXXX 100 GPM WTR)
Contract Number	:	Army contract number (i.e. XXXXXX-XX-X-XXXX)
Serial Number	:	Denotes the serial number of the pump unit (i.e. XXXXXXX)
NSN	:	National Stock Number (i.e. XXXX-XX-XXX-XXXX)

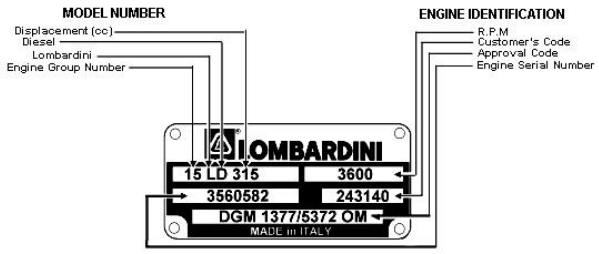


Figure 2

1.6.2 Engine Data Plate (figure 2)

When requesting parts for the pump/engine unit, be sure to use the serial number stamped on the PUMP data plate.

1.7 Field of Application

These pumps are suitable for handling liquids of viscosity up to 50 cSt containing solids in suspension. They are used in industry, civil engineering, shipbuilding, wastewater treatment, construction and agriculture.

1.8 In Case of Breakdown

Contact the American-Marsh Pumps' factory:
Phone: (901) 860-2300
Fax: (901) 860-2323

2 WARRANTY

American-Marsh Pumps guarantees that only high quality materials are used in the construction of our pumps and that machining and assembly are carried out to high standards.

The pumps are guaranteed against defective materials and/or faulty craftsmanship for a period of one year from the date of shipment unless specifically stated otherwise.

Replacement of parts or of the pump itself can only be carried out after careful examination of the pump by qualified personnel.

The warranty is not valid if third parties have tampered with the pump.

This warranty does not cover parts subject to deterioration or wear and tear (mechanical seals, diaphragms, pressure and vacuum gauges, rubber or plastic items, etc.) or damage caused by misuse or improper handling of the pump by the end user.

Parts replaced under warranty become the property of American-Marsh Pumps.

3 GENERAL INSTRUCTIONS

The pump and motor unit must be examined upon arrival to ascertain any damage caused during shipment. Loss or damage must be notified immediately to the carrier and to the sender. Check that the goods correspond exactly to the description on the shipping documents and report any differences as soon as possible to the sender. Always quote the pump type and serial number stamped on the data plate.

The pumps must be used only for applications for which the manufacturers have specified:

- **The construction materials**
- **The operating conditions (flow, pressure, temperature, etc.)**
- **The field of application**

In case of doubt, contact the manufacturer.

4 HANDLING AND TRANSPORT

4.1 Method of Transport

The pump must be transported in the horizontal position

4.2 Installation

During installation and maintenance, all components must be handled and transported securely by using suitable slings. Handling must be carried out by specialized personnel to avoid damage to the pump and persons. The lifting rings attached to various components should be used exclusively to lift the components for which they have been supplied.

⚠ CAUTION

Maximum lifting speed: 15 feet/second

5 STORAGE

5.1 Pump

- Store the pump under cover whenever possible. If the pump must be stored in the open, cover it with a tarpaulin.
- Avoid the accumulation of moisture around the pump.
- **Never leave liquid in the pump casing. Drain the casing immediately through the drain plug (figure 3, #P158). During winter months and cold weather, the liquid could freeze and damage the pump casing. If the liquid is hazardous, take all necessary precautions to avoid damage and injury before emptying the pump casing. From time to time, turn the shaft to avoid encrustation inside the pump.**

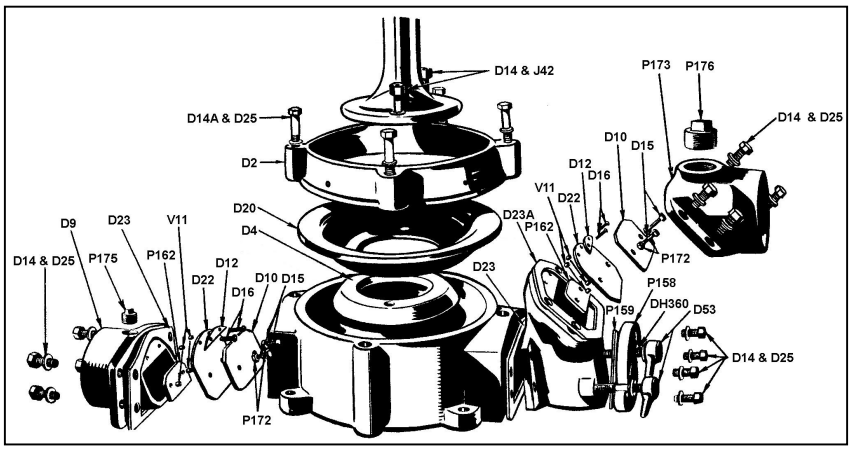


Figure 3

- For extended storage, longer than 6 months, flush the pump casing (figure 30, #D1) with a rust inhibitor that is compatible with the pumped fluid and use.
- Seal all openings with tape.
- Wrap the pump in a plastic film.

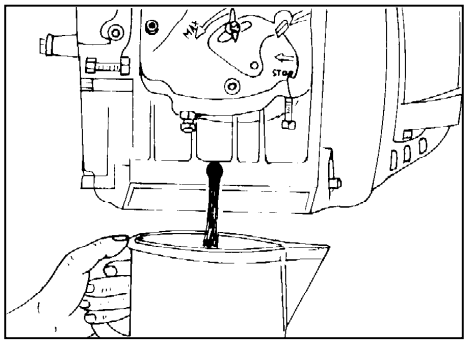


Figure 4

5.2 Engine & Pump

5.2.1 Temporary Protection (More than 1 month but less than 6 month storage)

- Let the engine run at idling speed in no-load conditions for 15 minutes.
- Fill the crankcase with protection oil MIL-1-644-P9 and let engine run at ¾ full speed for 5 to 10 minutes.
- When the engine is warm, empty oil pan and fill with standard new oil. See figure 4.
- Remove fuel tube (figure 25, #32) and empty the fuel tank (figure 25, #1). See figure 5.

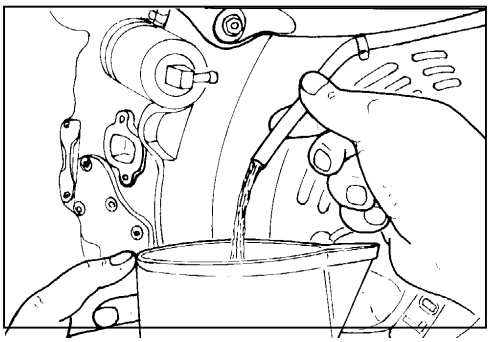


Figure 5

- Remove fuel filter (figure 25, #28), replace cartridge if dirty and refit.
- Carefully clean cylinder fins, heads and fan.
- Seal all openings with tape.

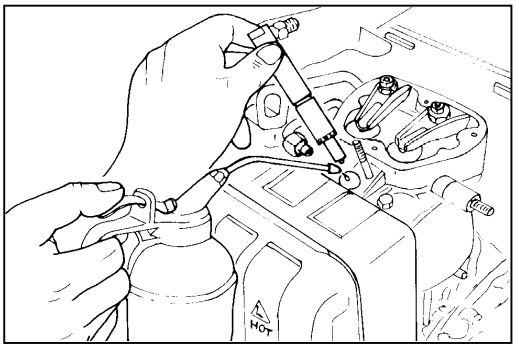


Figure 6

- Remove the two nuts (figure 25, #13) that hold the injector plate (figure 25, #12) above the injector (figure 25, #15).
- Loosen and remove the rigid fuel line (figure 25, #18) from the side of the injector (figure 25, #15).
- Loosen and remove the injector vent line (figure 25, #10).
- Remove injector (figure 25, #15), pour a spoonful of oil SAE 30 into the cylinder and rotate engine manually to distribute the oil. Refit the injectors (figure 25, #15). See figure 6.
- Spray oil type SAE 10W into exhaust and intake manifold, rocker arms, valves, tappet, etc. Grease all unpainted parts.
- Wrap the engine in a plastic film.
- Store engine in a dry place, if possible not directly on the soil and far from high voltage electric lines.

5.2.2 Permanent Protection (Greater than 6 months)

In addition to the above instructions:

- For the lubrication (engine & pump) and injection system as well as for moving parts use rustproof oil MIL-L-21260 P10 – grade 2, SAE 30. Let the engine and pump run with rustproof oil and drain any excess.
- Coat all external unpainted surfaces with antirust type MIL-C-116173D – grade 3.

6 INSTALLATION

Clean the suction and discharge lines thoroughly before connecting them to the pump.

The suction line must have a diameter equal to that of the pump suction connection. (For larger diameters, consult American-Marsh Pumps.) If possible, avoid curves, elbows and constrictions, which can limit the flow of liquid into the pump. Do not install a foot valve in the suction line; the pump casing has an integral non-return valve (figure 30, #D22) incorporated into the suction port.
Install the pump as close as possible to the liquid to be pumped. Try, where possible, to reduce the length of the suction line.
The pumps covered in this manual can pull a positive prime. Submergence, vapor pressure and suction pipe friction loss affect the suction pressure on the pump. Without sufficient suction pressure, the pump will not perform as required.
This suction line must be rigid to allow the pump to pull the water up and into the casing. The suction valve (figure 30, #D22) must be fully open at all times while the pump is operation.

The suction line connections must be completely airtight; check pipe threads, flange gaskets, quick couplings, etc.
The discharge line must let air escape from the system while the pump is priming.
The suction and discharge lines must be mounted in such a way as not to create a strain on the pump casing.
Engine driven pumps **must** have lengths of flexible hose to isolate the pipe work from the vibrations caused by the internal combustion engine.

7 STARTING

Before operating the pump, check that the electrical and mechanical parts of the system have been correctly installed.
Check that all safety devices are operative.

7.1 First Time Operation

- Clean the outside of the pump and motor unit.
- Remove protections and covers.
- Remove antirust with an appropriate solvent or degreaser.
- Ensure that the pump/motor unit rotates freely.
- Remove the two nuts (figure 25, #13) that hold the injector plate (figure 25, #12) above the injector (figure 25, #15).
- Loosen and remove the rigid fuel line (figure 25, #18) from the side of the injector (figure 25, #15).
- Loosen and remove the injector vent line (figure 25, #10).
- Remove injector (figure 25, #15), pour a spoonful of oil SAE 30 into the cylinder and rotate engine manually to distribute the oil. Refit the injectors (figure 25, #15). See figure 6.
- Remove the oil drain plug (figure 26, #45) and drain the protective oil. Fill crankcase with standard oil.
- Pour in one pint of 80/90 gear lube oil through filler hole in top of case (figure 32, #J157). A petcock (figure 32, #J174) is located near the bottom of the gear housing (figure 32, #J59) that allows for the proper oil level to be maintained. To ensure proper oil level:
  - Remove the fill plug (figure 32, #J157) on the top of the gear housing (figure 32, #J59).
  - Open the petcock (figure 32, #J174) near the bottom of the gear housing (figure 32, #J59).
  - Oil should be poured into the gear housing (figure 32, #J59) until just begins to leak out of this petcock (figure 32, #J174).
  - Tighten the petcock (figure 32, #J174) when finished.
- If the oil level is too low, the gears and bushings in the housing could overheat causing severe damage. If the oil level is too high, oil will leak out of the gear housing on the engine side. The petcock is placed so that the exact oil level is maintained.

⚠ CAUTION

In order to gain maximum life and smooth performance, the engine should be run at reduced speed and/or load (75%) for the first fifty (50) hours of operation.

7.2 After First Time Operation

- Ensure that the pump/motor unit rotates freely.
- Check fluid levels in the engine and pump (fuel, oil, etc.).
- Ensure that the pump/motor unit is lubricated properly.

7.2.1 PRIMING

If the pump does not prime, proceed to the Troubleshooting, Section 10.
Engine driven pumps should be brought up gradually to the running speed. Never change the accelerator limit stop: at higher speeds than that for which the engine is set, the pump would absorb more power that the engine can supply. **NEVER** exceed the maximum speed shown on the pump nameplate.

When the pump has primed:
- If the pump does not seem to be operating properly, it must be stopped and the cause found. See Troubleshooting, Section 10.

8 ENGINE MAINTENANCE

Before maintenance is carried out, the pump must be stopped.

⚠ WARNING ⚠

Residual liquid may be found in the pump casing, head and suction line.
Take the necessary precautions if the liquid is hazardous, flammable, corrosive, poisonous, infected, etc.

⚠ WARNING ⚠

During repair operations, when using compressed air, wear eye protection.

8.1 Engine Specifications

Engine Specifications:

Model:	Lombardini 15LD315
Displacement:	315 cm^3
Full Speed HP:	5.50 hp (4.1 kW)

Capacities:

Fuel Capacity:	1.135 gallons (4.30 liters)
Oil Sump:	1.25 quarts (1.2 liters)
Air Cleaner Tank:	0.317 quarts (0.3 liters)

8.1.1 Engine Cutaway

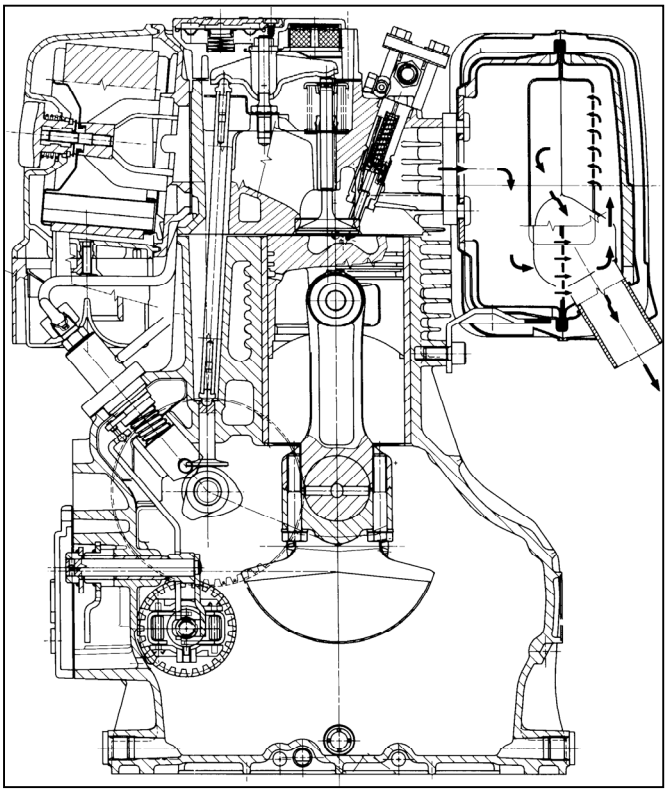


Figure 7

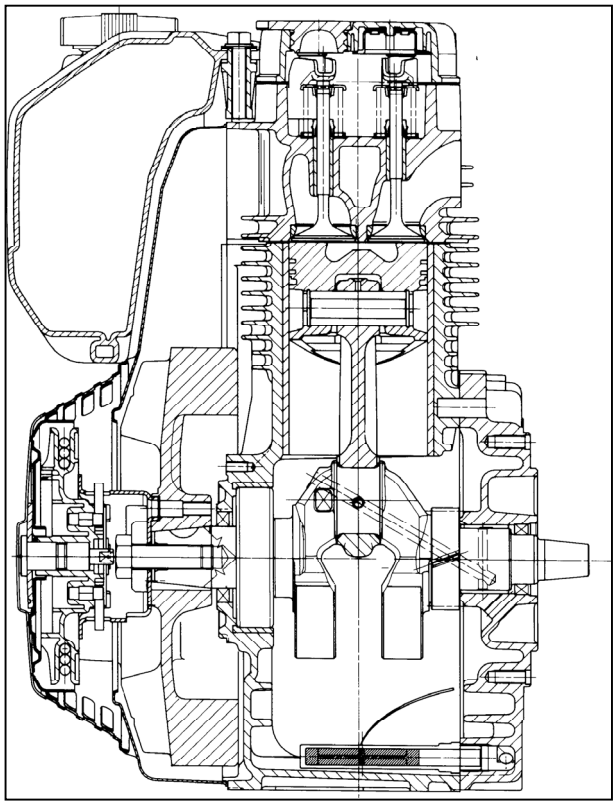


Figure 8

8.2 Engine Oil Recommendations

See temperature chart (figure 10) for appropriate oil recommendation.

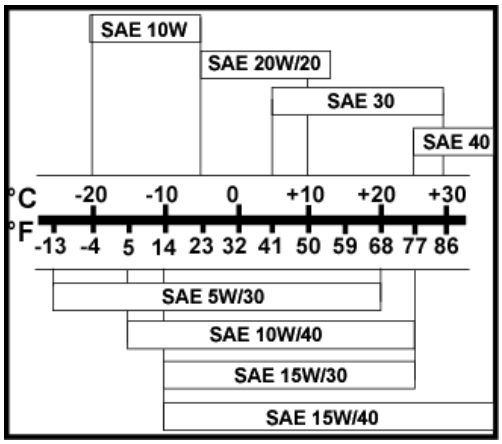


Figure 9

8.3 Engine Maintenance Chart

OPERATION	COMPONENT	Repair Section	INTERVAL (HOURS)						
			NOTES	10	50	125	250	500	1000
CLEANING	Head & Cylinder Fins	8.5.1	(*)		●		●		
	Fuel Tank	8.5.2							●
	Injector	8.5.3						●	
	Oil Filter Cartridge	8.5.4					●		
	Dry Air Filter Cartridge	8.5.5	(*)		●		●	●	●
CHECK	Oil Level	8.6.1		●		●		●	●
	Valve/Rocker Arm Clearance	8.6.2						●	
REPLACEMENT	Oil	8.7.1	(**)		□		●	●	●
	Oil Filter Cartridge	8.7.2							●
	Fuel Filter Cartridge	8.7.3					●		
	Dry Air Cleaner Cartridge	8.7.4	(°)						
	Injector	8.7.5	(***)						
	Fuel Pump	8.7.6	(***)						

□ First replacement
(*) Under severe working conditions, clean daily
(**) See recommended type
(***) Replace after 2500 hours or once per two years
(°) Examine and replace as necessary

8.4 Fuel System Diaphragm

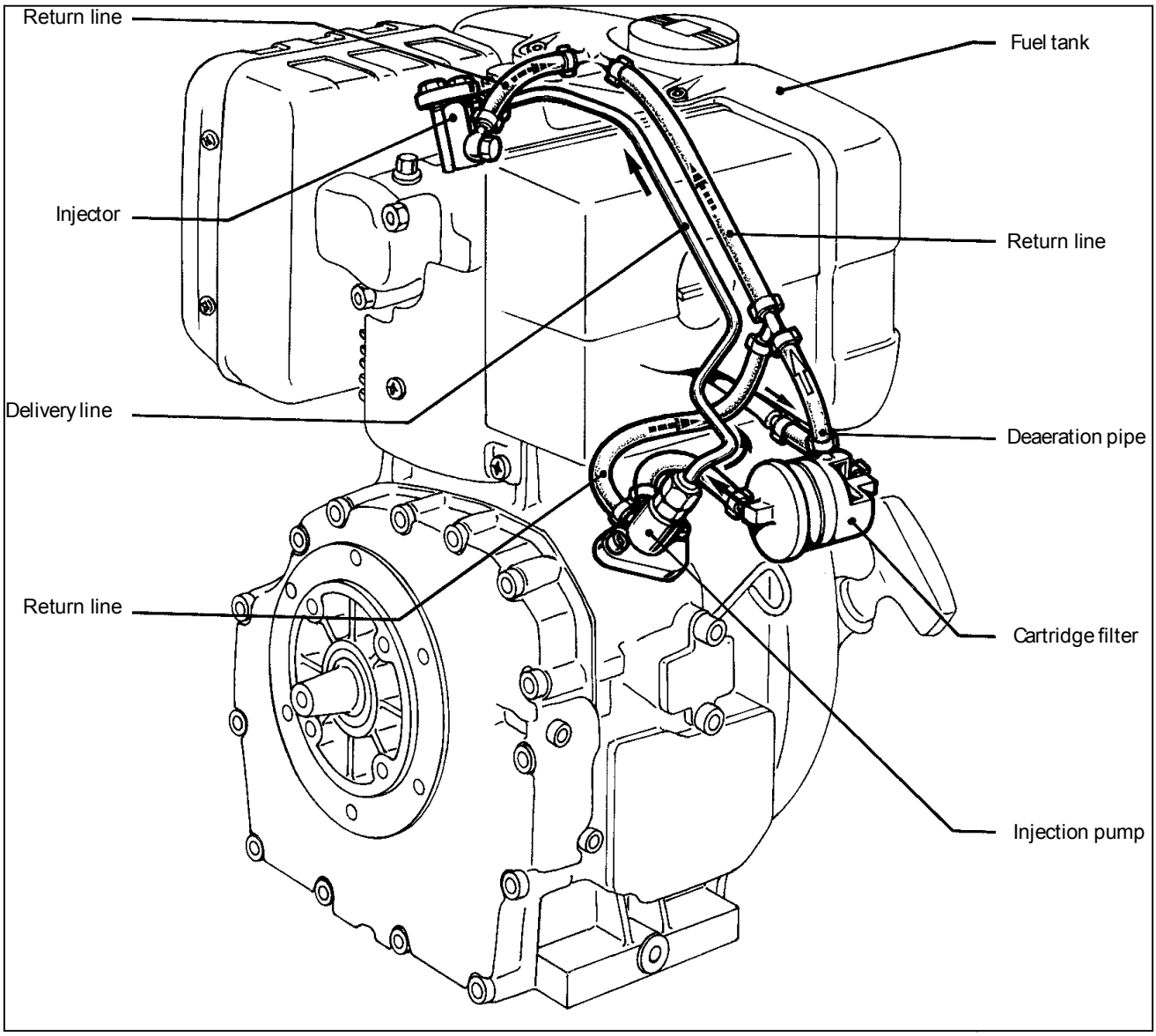


Figure 10

8.5 Oil Lubrication System Diagram

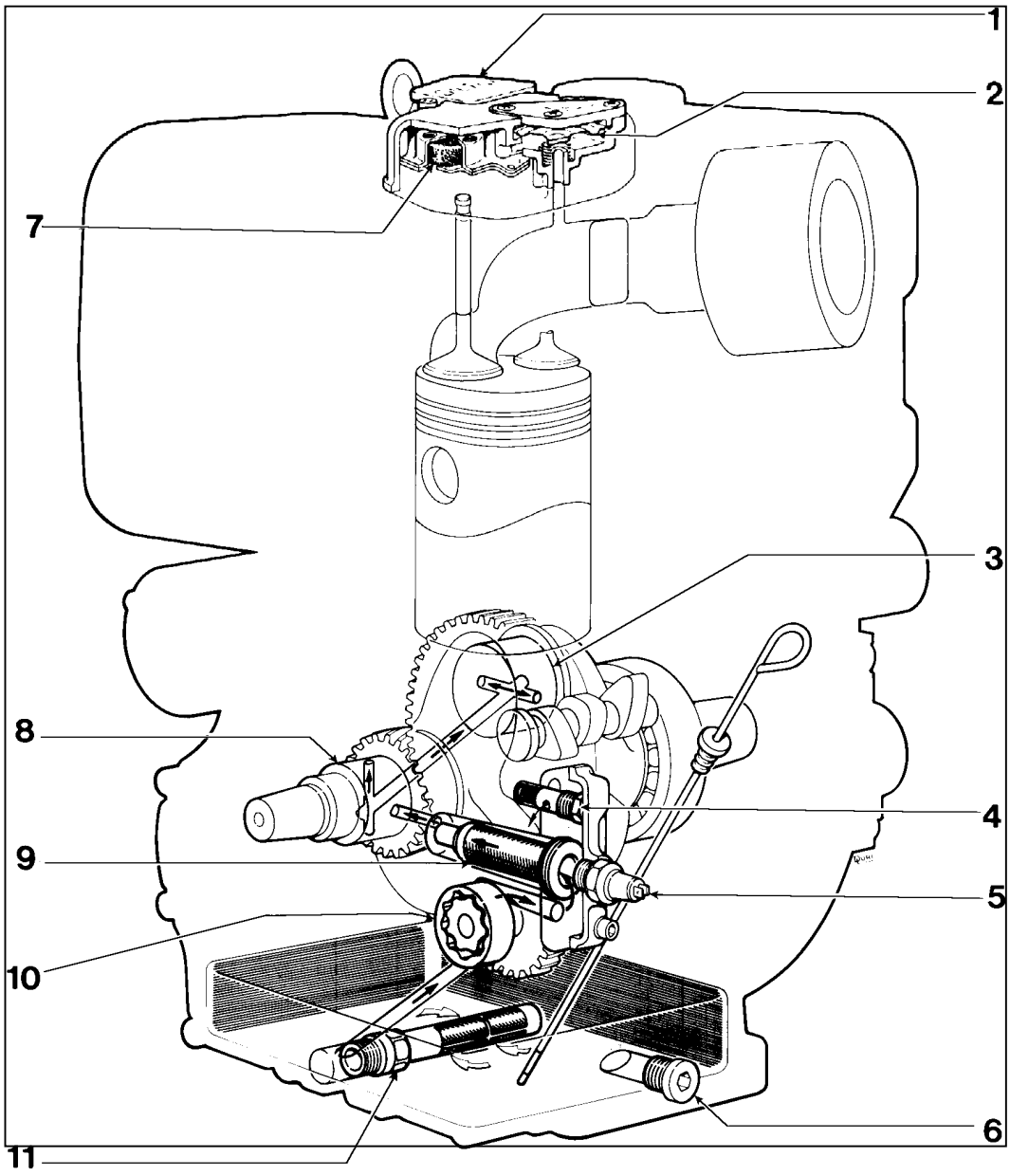


Figure 11

1 – Oil fill cap
2 – Safety valve
3 – Rod journal
4 – Pressure control valve
5 – Pressure switch (not supplied)
6 – Oil drain plug
7 – Metal filter element
8 – Main journal
9 – Oil filter
10 – Oil pump
11 – Strainer

8.5 Cleaning

8.5.1 Head & Cylinder Fins

Clear any debris and/or dirt that may accumulate around the engine head and cylinder. Because this type of engine is of the air-cooled type, these fins must be kept clean so that the engine will not overheat.

8.5.2 Fuel Tank (figure 25, #1)

- Unscrew the upper and lower stud nuts on the fuel tank and remove washers.
- Completely empty the fuel tank (figure 25, #1) to make sure that no impurities remain. See figure 5.
- When reassembling, tighten the upper nuts to 10 lb.-ft. and the lower nuts to 7 lb.-ft.

8.5.3 Injector (figure 25, #15)

The injector is located on top of the engine.

- Loosen the rigid steel fuel line (figure 25, #18) from the injector pump (figure 25, #24) to the injector (figure 25, #15) and move out of way.
- Loosen two nuts (figure 25, #13) and remove injector cover plate (figure 25, #12) and cover plate gasket (figure 25, #14).
- Make sure that the injector nozzle, the part of the injector that sits in the cylinder, is clear of debris and carbon residue.
- Prior to placing back onto engine, spray some oil on the injector seat ensuring that the injector slides back into place. See figure 6.
- Reassemble in reverse order.

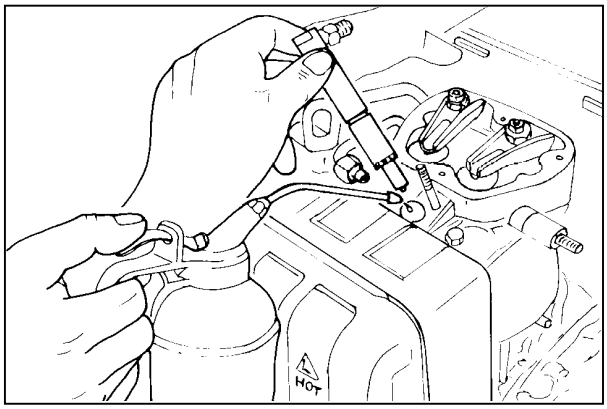


Figure 12

8.5.4 Oil Filter Cartridge (figure 27, #83)

- Loosen and remove the two cover screws (figure 27, #76) that hold the oil filter cartridge cover (figure 27, #77) to the engine.
- Remove the cover (figure 27, #77) and gasket (figure 27, #78).
- Pull the oil filter cartridge (figure 27, #83) out of the engine and clean.
- Reassemble in reverse order.

8.5.5 Dry Air Filter Cartridge (figure 24, #6)

The dry air filter (figure 24, #6) consists of a primary filter with a polyurethane pre-filter covering.
Loosen the filter cover knob (figure 24, #1) to loosen the filter housing cover (figure 24, #4). Remove the filter housing covering (figure 24, #4). Remove the dry air filter (figure 24, #6). Carefully remove the pre-filter and wash with soap and water and allow to dry. The pre-filter can be washed up to ten (10) times before needing to be replaced. Reassemble in reverse order.

8.6 Inspection

8.6.1 Oil Sump Level

Maintaining proper oil level in the engine will assure proper operation. Low levels, as well as high levels, can damage the engine and cause premature engine failure.

- Remove the oil dipstick (figure 27, #75) and check the oil level against the graduations etched on the dipstick.
- Adjust the oil level accordingly.

8.6.2 Valve/Rocker Arm Clearance

The two rocker arm assemblies are located under the rocker arm cover (figure 28, #28). The rocker arms ensure that the intake and discharge valves open and close properly. If the rocker arms are not adjusted properly, the valves may not open and close properly, affecting engine performance.

The engine must be cold to adjust the rocker arms properly.

- Loosen and remove the four rocker arm cover cap screws (figure 28, #25) and remove the rocker arm cover (figure 28, #28) and rocker arm cover gasket (figure 28, #41).
- Bring the piston to top dead center on the compression stroke and measure the rocker arm clearance. It should read 0.004 inches to 0.006 inches. If this is not the case, adjust the rocker arm clearance as follows. See figure 14.
- Bring the piston to top dead center on the compression stroke and loosen the locknut (figure 28, #29) to allow the adjusting nut (figure 28, #30) to move freely. Adjust the rocker arm adjustment nut until the rocker arm clearance measures 0.004 inches to 0.006 inches. One this measurement has been attained, tighten the locknut (figure 28, #29) to stop the rocker arm adjustment nut (figure 28, #30) from moving any further.
- Replace parts if they appear to be worn.

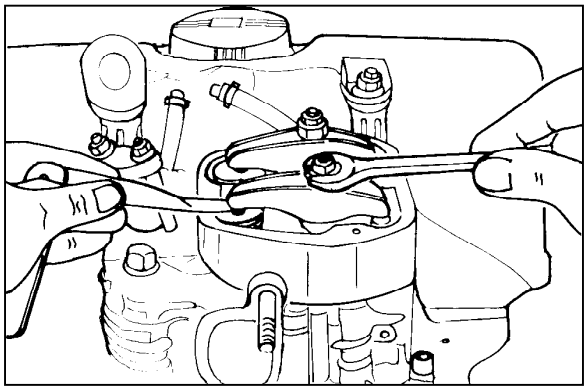


Figure 13

8.7 Replacement

Components that require replacement on the engine primarily deal with filtering parts for the air, fuel and oil systems. These filters are easily replaceable. See figures 11 & 12 for a graphical representation of the oil lubrication & fuel systems.

8.7.1 Oil

To ensure proper engine operation, the oil should be changed according to the schedule. In harsh or dirty environments, the oil should be checked and changed more often.

- Remove the oil drain plug (figure 26, #45) and discard of oil properly. See figure 15.
- Replace oil drain plug (figure 26, #45).
- Remove oil fill cap (figure 28, #62).
- Refill engine with appropriate grade of oil. Replace oil fill cap (figure 28, #62).
- Check level of oil with dipstick (figure 27, #75).

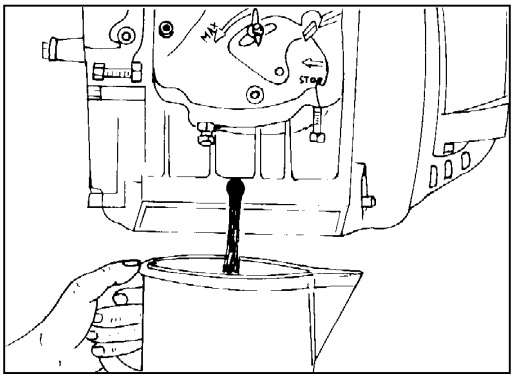


Figure 14

8.7.2 Oil Filter Cartridge (figure 27, #83)

The oil filter cartridge is designed to strain the oil prior to it being pumped to the journal bearings deeper in the engine.
Remove the two cartridge cover cap screws (figure 27, #76). Remove the cartridge cover (figure 27, #77) and gasket (figure 27, #78) from the side of the engine. Pull the oil filter cartridge (figure 28, #83) out of the engine and replace. Reassemble in reverse order.

8.7.3 Fuel Filter Cartridge (figure 25, #28)

The primary fuel filter cartridge (figure 25, #28) is mounted below the fuel tank (figure 25, #1).
Loosen the support bolt (figure 26, #25) and bracket (figure 25, #27) that hold the fuel filter (figure 25, #28) to the engine. Loosen fuel clamps (figure 25, #45, #46 & #47) and pull the three fuel hoses (figure 25, #32, #36 & #38) from the fuel filter (figure 25, #28). Remove the fuel filter (figure 25, #28) and replace. Reassemble in reverse order. See figure 16.

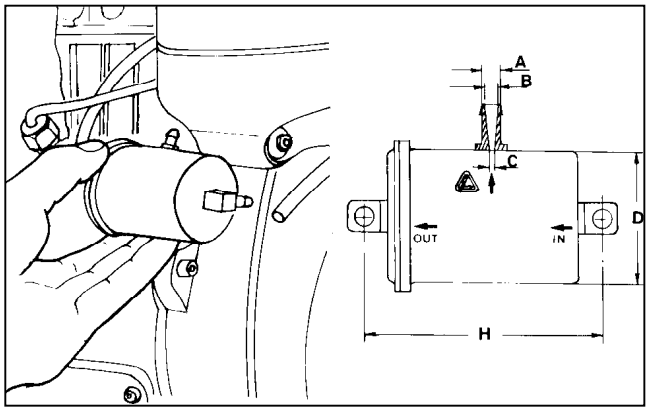


Figure 15

8.7.4 Dry Air Filter Cartridge (figure 24, #6)

The dry air filter (figure 24, #6) consists of a primary filter with a polyurethane pre-filter covering.
Loosen the filter cover knob (figure 24, #1) to loosen the filter housing cover (figure 24, #4). Remove the filter housing covering (figure 24, #4). Remove the dry air filter (figure 24, #6). Carefully remove the pre-filter and wash with soap and water and allow to dry. The pre-filter can be washed up to ten (10) times before needing to be replaced. Replace the dry air filter (figure 24, #6). Reassemble in reverse order.

8.7.5 Injector (figure 25, #15)

Over time, the injector will get plugged and will require replacement. During the Inspection portion of preventative maintenance, if the injector tip appears clogged or damaged, the injector should be replaced immediately.

- Remove the two nuts (figure 25, #13) that hold the injector plate (figure 25, #12) above the injector (figure 25, #15).
- Loosen and remove the rigid fuel line (figure 25, #18) from the side of the injector (figure 25, #15).
- Loosen and remove the injector vent line (figure 25, #10).
- Remove and replace the injector (figure 25, #15) and the injector gasket (figure 25, #22).
- Reassemble in reverse order. See figure 17.

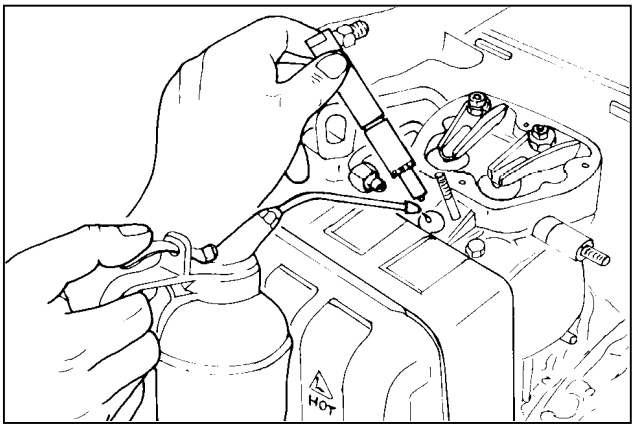


Figure 16

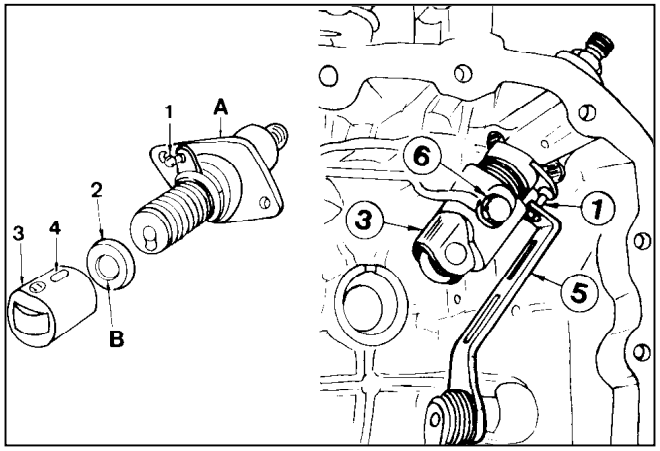
8.7.6 Fuel Pump (figure 25, #24)

The fuel pump (figure 25, #24) pressurizes the fuel from the fuel tank (figure 25, #1) and sends it to the injector (figure 25, #15) for injection into the engine cylinder. The fuel pump (figure 25, #24) is controlled by the camshaft via tappets.

- Remove the air cleaner cover (figure 24, #4).
- Loosen and remove the rigid fuel line (figure 25, #18) from the top of the fuel pump (figure 25, #24).
- Remove the inlet (figure 25, #38) and outlet (figure 25, #37) fuel hoses from the fuel pump (figure 25, #24).
- Loosen and remove the two fuel pump housing screws (figure 25, #23).
- Take care in removing the fuel pump (figure 25, #24) as the control delivery device will be engaged to the yoke lever (see figure 18).
- Be sure that if the fuel pump shim (figure 25, #25 & figure 22, C) is to be replaced that it is replaced by the equal thickness shim. Shims are available in sizes from 0.002 inches to 0.020 inches in thickness. If a different shim thickness is installed than what was originally in the engine, the fuel could be delayed entering the combustion chamber affecting engine operation.
- Take care that the fuel pump spacer (figure 18, #C) is not dropped into the oil sump during the removal of the fuel pump (figure 25, #24). If the oil spaces falls into the oil sump, injection pump (figure 25, #24) will be impaired.
- Reassemble in reverse order. Be sure that when reinserting the fuel pump (figure 25, #24) back into the engine housing that the control device is directed towards the yoke of the lever which should be in maximum delivery position.

CAUTION

If the control device is not engaged properly, the engine will not operate properly.



1 – Control device
2 – Spacer
3 – Tappets
4 – Guide
5 – Lever
6 – Set screw

Figure 17

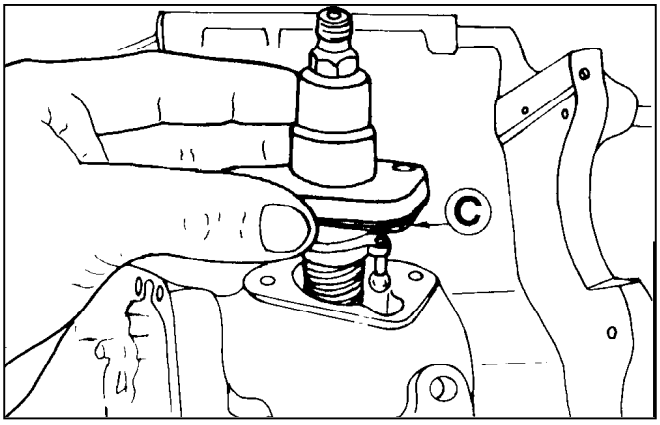


Figure 18

8.7.7 Engine Replacement

- Remove the four bolts (figure 33, #SPC104) that hold the engine down to the base.
- Remove the engine.
- Remove the coupling half and rubber insert from the engine shaft.
- Place the coupling and rubber insert onto the new motor shaft.
- Reassemble in reverse order.
- Once the engine is bolted to the base and before initial starting of the driver, proceed to Alignment Procedure below.

Alignment procedure

The faces of the coupling halves should be spaced far enough apart so that they cannot strike each other when the driver rotor is moved toward the pump. The necessary tools for checking the alignment of a flexible coupling are a straight edge and a taper gauge or a set of feeler gauges.

Angular alignment check is made by inserting the taper gauge or feelers between the coupling faces at 90-degree intervals around the coupling. The unit will be in angular alignment when the coupling faces are exactly the same distance apart at all points (see figure 22).

Parallel alignment check is made by placing a straight edge across both coupling rims at the top, bottom and at both sides. The unit will be in parallel alignment when the straight edge rests evenly on the coupling rim at all positions. Allowance may be necessary for temperature changes and for coupling halves that are not of the same outside diameter. Care must be taken to have the straight edge parallel to the axis of the shafts (see figure 22).

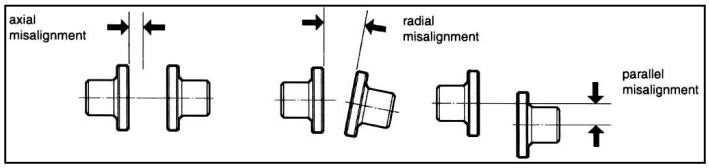


Figure 19

8.7.8 Rotational Speed of Motor

The rotational speed of the driver will determine overall pump performance. The faster the engine rotates, the more flow and pressure the pump will generate. Rotation of the motor past the maximum rated speed of the driver can result in damage to the driver. The throttle control on the side of the engine can be varied to gain proper pump performance.

To adjust the idling speed of the engine:

- After filling the engine with oil and fuel, follow the start up procedure (see Section 7), start the engine and let it warm up for ten (10) minutes.
- Adjust the idling speed to 1000 to 1250 revolutions per minute by turning the setscrew (figure 20, #1).
- Tighten the locknut.
- The washer (figure 20, #2) assures sealing and prevents possible oil leaks.

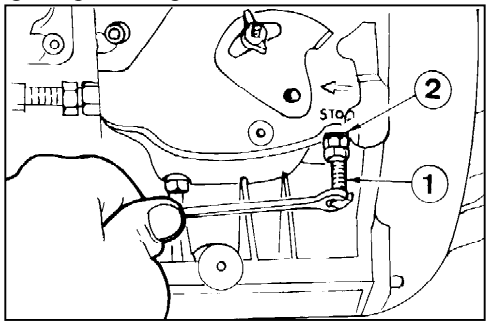


Figure 20

To adjust the full speed setting (no load conditions)

- After setting the idle speed (see above), turn the setscrew (figure 21, #2) and set full speed in no load conditions at 3800 revolutions per minute.
- Tighten the locknut.
- The washer (figure 21, #1) assures sealing and prevents possible oil leaks.

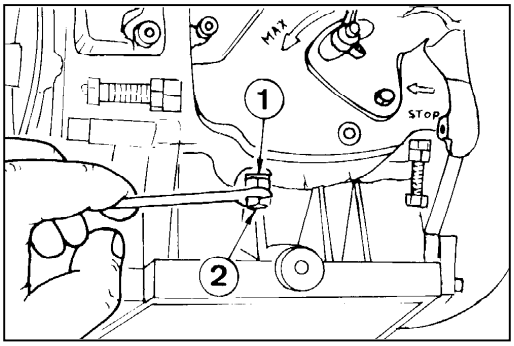


Figure 21

8.7.9 Pull Rope

- Remove the four cover screws and lock washers (figure 29, #23 & #24).
- Remove and discard remainder of worn pull rope (figure 29, #14).
- Replace pull rope (figure 29, #14).
- Reassemble in reverse order.

9 PUMP MAINTENANCE

Before maintenance is carried out, the pump must be stopped.

⚠ WARNING ⚠

Residual liquid may be found in the pump casing, head and suction line.
Take the necessary precautions if the liquid is hazardous, flammable, corrosive, poisonous, infected, etc.

⚠ WARNING ⚠

During repair operations, when using compressed air, wear eye protection.

9.1 Pump Maintenance Chart

OPERATION	COMPONENT	Repair Section	INTERVAL (HOURS)						
			NOTES	10	50	125	250	500	1000
CLEANING	Suction & Discharge Connections	9.2.1	(*)						
	Exterior of Pump	9.2.2			●		●	●	●
	Discharge Cleanout Port	9.2.3		●	●	●	●	●	●
INSPECTION	Lubrication Points	9.3.1	(*)						
	Suction Check Valve Assembly	9.3.2						●	●
	Discharge Check Valve Assembly	9.3.3						●	●
	Diaphragm	9.3.4						●	●
	Gear Case Oil Level	9.3.5	(**)						
REPLACEMENT	Suction Check Valve Assembly	9.4.1	(°)						
	Discharge Check Valve Assembly	9.4.2	(°)						
	Diaphragm	9.4.3	(°)					●	●
	Eccentric Bushings	9.4.4							●
	Gear Case Oil	9.4.5			●			●	●

(*) Check daily
(**) Check weekly
(°) Examine and replace as necessary

9.2 Cleaning

9.2.1 Suction & Discharge Connections

Keeping the suction and discharge connections clean will ensure that the hoses will connect to the pump unit with ease. A thread compound compatible with the pumped fluid can be used to aid in the connection or disconnection of the suction and discharge lines.

9.2.2 Exterior of Pump

Generally keep the exterior of the pumping assembly clean and clear of debris. This will extend the life of the pump casing and ensure smooth operation.

9.2.3 Discharge Cleanout Port (figure 30, #P158)

An ample clean out plate (figure 30, #P158) is located directly below the discharge flange (figure 30, #P173). This provides for cleaning out of any residue that may accumulate in the pump base and for inspection of the check valves (figure 30, #D22). The clean out plate is provided with easy-off handles (figure 30, #D53) requiring no wrench for removal of plate.

9.3 Inspection

9.3.1 Lubrication Points

There are four points of lubrication maintenance on the pump and gear case that require attention (refer to engine instructions for care of engine); the eccentric, the eccentric shaft, the intermediate shaft and the gear case. The eccentric, the eccentric shaft and the

intermediate shaft are lubricated by zerk fittings. These should have daily attention using a good grade of lithium-based grease. See figure 22.

- The eccentric: With pump running 5 to 8 pumps from grease gun.
- The eccentric shaft: With pump not running 1 pump from grease gun.
- The intermediate shaft: With pump not running 1 pump from grease gun.

The gear case (figure 32, #J59) is sealed oil tight for the gears to run in a bath of oil. Pour in one pint of 80/90 gear lube oil through filler hole in top of case (figure 32, #157). Check oil weekly and replenish when necessary. Ample lubrication with clean grease and oil prolongs the service to be had from any machine. See figure 22.

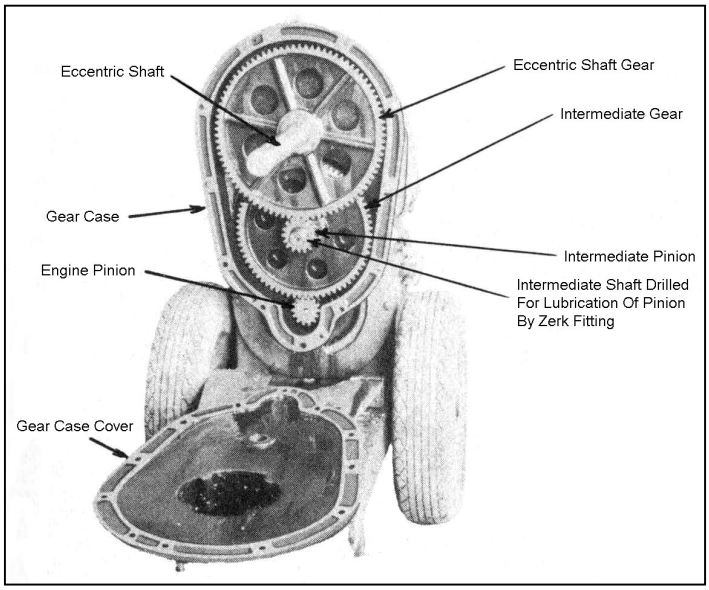


Figure 22

9.3.2 Suction Check Valve Assembly (figure 30, #D22)

The suction and discharge ports use the same check valve, small valve weight and large valve weight. Be sure that when inspection procedures require a specific suction or discharge inspection that the proper end of the pump is selected.

The suction valve is contained in an accessible cage making inspection and replacement an easy matter. Valves should be checked occasionally and replaced when worn to the extent they no longer seat properly. The length of service to be had from the valves depends largely on the solid content of the water being pumped and how abrasive or cutting it is.

The suction check valve assembly (figure 30, #D22) ensures that when the pump is in the off position liquid in the casing does not siphon out of the pump. It is essential that this valve seats completely against the suction port. There is an integral small valve weight (figure 30, #P162) and a large valve weight (figure 30, #D10) that also needs to be inspected to ensure that corrosion has not decreased its effectiveness.

- Remove the four bolts (figure 30, #D14) and remove the suction valve port (figure 30, #D9).
- Inspect the suction valve (figure 30, #D22), the small valve weight (figure 30, #P162) and the large valve weight (figure 30, #D10).

If the check valve (figure 30, #D22) is worn and not seating properly, the check valve assembly must be replaced (see section 9.3.2). If the valve weights appear to be damaged or are not functioning properly, the check valve needs to be replaced (see section 9.3.3).

9.3.3 Discharge Check Valve Assembly (figure 30, #D22)

The suction and discharge ports use the same check valve, small valve weight and large valve weight. Be sure that when inspection procedures require a specific suction or discharge inspection that the proper end of the pump is selected.

The discharge valve is contained in an accessible cage making inspection and replacement an easy matter. Valves should be checked occasionally and replaced when worn to the extent they no longer seat properly. The length of service to be had from the valves depends largely on the solid content of the water being pumped and how abrasive or cutting it is. The discharge check valve assembly (figure 30, #D22) ensures that when the pump diaphragm is drawn into the top dead center position, that the pump pulls water up and

out of the suction line. It is essential that this valve seats completely against the discharge port. There is an integral small valve weight (figure 30, #P162) and a large valve weight (figure 30, #D10) that also needs to be inspected to ensure that corrosion has not decreased its effectiveness.

- Remove the four bolts (figure 30, #D14) and remove the discharge valve port (figure 30, #P173).
- Inspect the discharge valve (figure 30, #D22), the small valve weight (figure 30, #P162) and the large valve weight (figure 30, #D10).

If the check valve (figure 30, #D22) is worn and not seating properly, the check valve assembly must be replaced (see section 9.4.2). If the valve weights appear to be damaged or are not functioning properly, the check valve needs to be replaced (see section 9.4.2).

9.3.4 Diaphragm (figure 30, #D20)

Rightfully called "The Heart of the Pump." For this reason your pump comes equipped with a Novo "Triple-Life" live rubber diaphragm, which under ordinary pumping conditions will stand up three to four times longer than the ordinary stock diaphragm. Inspect the diaphragm (figure 30, #D20) for elasticity and pliability. Ensure that there are no cracks or tears in the diaphragm (figure 30, #D20) itself. If the diaphragm (figure 30, #D20) is no longer pliable or is cracking, tearing or has holes in it, it must be replaced. (See section 9.4.3)

9.3.5 Gear Case Oil Level

The four gears that reduce the engine speed are enclosed in a gear housing (figure 32, #J59) that protects the gears and houses the oil bath. The gear case (figure 32, #J59) is sealed oil tight for the gears to run in a bath of oil. Pour in one pint of 80/90 gear lube oil through filler hole in top of case (figure 32, #J157). A petcock (figure 32, #J174) is located near the bottom of the gear housing (figure 32, #J59) that allows for the proper oil level to be maintained. To ensure proper oil level:

- Remove the fill plug (figure 32, #J157) on the top of the gear housing (figure 32, #J59).
- Open the petcock (figure 32, #J174) near the bottom of the gear housing (figure 32, #J59).
- Oil should be poured into the gear housing (figure 32, #J59) until just begins to leak out of this petcock (figure 32, #J174).
- Tighten the petcock (figure 32, #J174) when finished.

If the oil level is too low, the gears and bushings in the housing could overheat causing severe damage. If the oil level is too high, oil will leak out of the gear housing on the engine side. The petcock is placed so that the exact oil level is maintained.

Check oil weekly and replenish when necessary.

9.4 Replacement

9.4.1 Suction Check Valve Assembly (figure 30, #D22)

To change the suction check valve:

- Remove the four caps screws (figure 30, #D14 & #D25) on the suction side.
- The suction valve (figure 30, #D22) is fastened to the suction port (figure 30, #D9) by two ¼" machine screws (figure 30, #D16).
- Remove the two ¼" machine screws (figure 30, #D16).
- Remove the suction valve assembly (figure 30, #D22).

The new suction valve assembly consists of the following:
(1) Check valve (figure 30, #D22)
(1) Small valve weight (figure 30, #P162)
(1) Large valve weight (figure 30, #D10)
(4) Valve spacers (figure 30, #V11)
(2) Valve weight screws (figure 30, #D15)
(2) Valve weight nuts (figure 30, #P172)
(1) Valve retainer (figure 30, #D12)
(2) Valve retainer screws (figure 30, #D16)

The valve assembly will arrive assembled with the check valve (figure 30, #D22), small valve weight (figure 30, #P162), large valve weight (figure 30, #D10), valve spacers (figure 30, #V11), valve weight screws (figure 30, #D15) and valve weight nuts (figure 30, #P172) already pre-assembled together.

In assembling the new valve to the suction port (figure 30, #D9), first insert the two valve spacers (figure 30, #V11) into the screw holes in the suction valve (figure 30, #D22) to prevent pinching the valve out of shape. Insert the two valve retainer screws (figure 30,

#D16) through the valve retainer (figure 30, #D12) then through the valve (figure 30, #D22) and valve spacers (figure 30, #V11) and tighten into the suction port (figure 30, #D9). When replacing the suction port (figure 30, #D9), be sure the suction port gasket (figure 30, #D23) is in place. Reassemble in reverse order.

9.4.2 Discharge Check Valve Assembly (figure 30, #D22)

To change the discharge check valve:

- Remove the four caps screws (figure 30, #D14 & #D25) on the discharge side.
- The discharge valve (figure 30, #D22) is fastened to the discharge port (figure 30, #P173) by two ¼" machine screws (figure 30, #D16).
- Remove the two ¼" machine screws (figure 30, #D16).
- Remove the discharge valve assembly (figure 30, #D22).

The new discharge valve assembly consists of the following:
(1) Check valve (figure 30, #D22)
(1) Small valve weight (figure 30, #P162)
(1) Large valve weight (figure 30, #D10)
(4) Valve spacers (figure 30, #V11)
(2) Valve weight screws (figure 30, #D15)
(2) Valve weight nuts (figure 30, #P172)
(1) Valve retainer (figure 30, #D12)
(2) Valve retainer screws (figure 30, #D16)

The valve assembly will arrive assembled with the check valve (figure 30, #D22), small valve weight (figure 30, #P162), large valve weight (figure 30, #D10), valve spacers (figure 30, #V11), valve weight screws (figure 30, #D15) and valve weight nuts (figure 30, #P172) already pre-assembled together.

In assembling the new valve to the discharge port (figure 30, #P173), first insert the two valve spacers (figure 30, #V11) into the screw holes in the suction valve (figure 30, #D22) to prevent pinching the valve out of shape. Insert the two valve retainer screws (figure 30, #D16) through the valve retainer (figure 30, #D12) then through the valve (figure 30, #D22) and valve spacers (figure 30, #V11) and tighten into the suction port (figure 30, #D9). When replacing the suction port (figure 30, #P173), be sure the discharge port gasket (figure 30, #D23A) is in place. Reassemble in reverse order.

9.4.3 Diaphragm (figure 30, #D20)

The pump is so designed as to make replacement of the diaphragm an easy job.

- Remove the eccentric brace (figure 31, #J25) on the suction side of the pump.
- Remove the four cap screws (figure 30, #D14A & #D25) holding down the pump top (figure 30, #D2).
- With the eccentric (figure 31, #J19) at **UPPER DEAD CENTER**, swing the crosshead out.
- Remove the two nuts (figure 30, #D14 & #J42), which clamp the crosshead to the plunger bottom casing (figure 30, #D4).
- Swing the pump top (figure 30, #D2) over the crosshead. See figure 22.
- Remove the old diaphragm (figure 30, #D20) and plunger bottom (figure 30, #D4).
- Insert the new diaphragm to the plunger bottom and crosshead.
- Bring the pump top (figure 30, #D2) down to position on the diaphragm (figure 30, #D20), with the eccentric (figure 31, #J19) at **LOWER DEAD CENTER**, making certain the diaphragm (figure 30, #D20) is centered on the pump base (figure 30, #D1).
- Replace the eccentric brace (figure 31, #J25) and the four bolts (figure 30, #D14A & #D25) of the pump top (figure 30, #D2) drawing down evenly all around the pump. The pump is now ready for service.

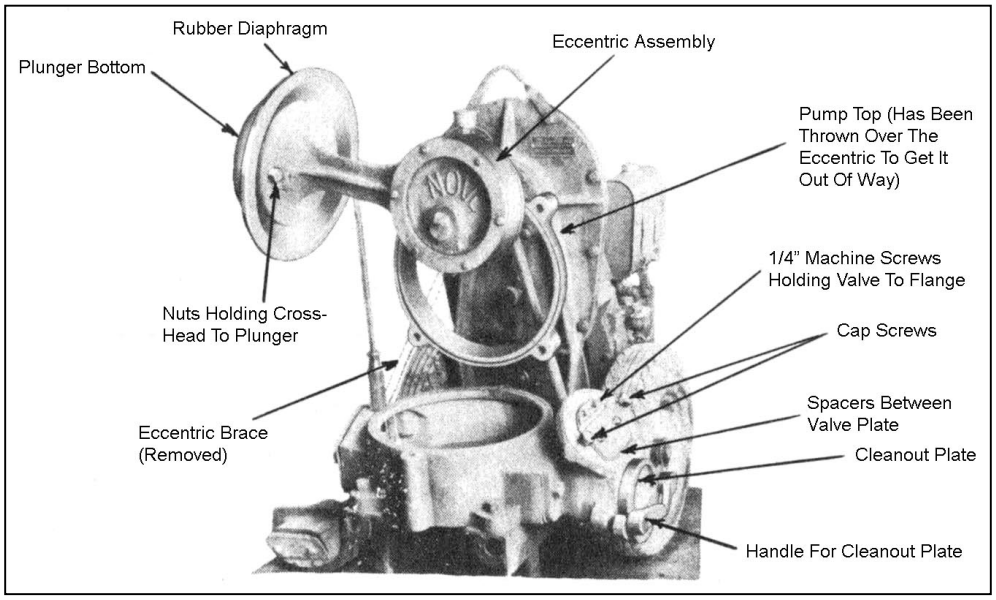


Figure 23

9.4.4 Eccentric Bushings (figure 31, #J74)

Remove the six eccentric plate screws, nuts and washers (figure 31, #D6)
Remove the front and rear eccentric plates (figure 31, #J205) taking care not to damage the eccentric plate gaskets (figure 31, #J222)
From the gear casing side and with a screw driver, force the eccentric bushings (figure 31, #J74) out of the crosshead taking care not to damage the eccentric (figure 31, #J19) outer diameter.
Replace the eccentric bushings (figure 31, #J74).
Reassemble in reverse order.
Once the eccentric assembly is back together, grease the eccentric bushings through the zerk fitting until grease is visible on the inner portion of the eccentric plates (figure 31, #J205).

9.4.5 Gear Case Oil

- Remove the gear case oil plug (figure 32, #J158).
- Drain all oil out of the gear housing (figure 32, #J59).
- Replace the gear case oil plug (figure 32, #J158).
- Loosen the oil level petcock (figure 32, #J174).
- Remove the gear case fill plug (figure 32, #J157) and pour in one pint of 80/90 gear lube oil through filler hole in top of case (figure 32, #J157). Fill the housing until oil just begins to drain out of petcock (figure 32, #J174).
- Tighten the oil level petcock (figure 32, #J174).
- Replace the gear case fill plug (figure 32, #J157).

9.4.6 Bearing Frame

- Remove the engine assembly (see Section 8.7.7)
- Drain the oil from the gear housing (see Section 9.4.5)
- Remove the two bolts (figure 33, #SPC107) that hold the bearing frame to the base.
- Remove three bolts (figure 32, #J170) and remove the entire power frame from the gear housing.
- Replace the power frame, taking care not to damage the o-ring (figure 31, #331C) when inserting the power frame into the gear housing.
- Tighten the three power frame bolts (figure 31, #J170).
- Re-mount and realign the motor (see Section 8.7.7).
- Replace the gear oil in the gear housing (see Section 9.4.5).

10 TROUBLESHOOTING

The following tables contain possible causes of some failures that may occur during operation. Always perform these simple checks before removing or replacing any part.

10.1 Engine Troubleshooting Chart

	POSSIBLE CAUSE	Repair Section	TROUBLE									
			Engine Does Not Start	Engine Starts But Stops	No Acceleration	Non-uniform Speed	Black Smoke	White Smoke	Too Low Oil Pressure	Increase Oil Level	Excessive Oil Consumption	Oil and Fuel Dripping From Exhaust
Fuel Circuit	Clogged Piping	8.5.2	●									
	Clogged Fuel Filter	8.7.3	●	●	●							
	Air Inside Fuel Circuit	8.5.2	●	●	●							
	Clogged Tank Breather	8.5.2	●	●	●							
	Faulty Feed Pump	8.7.6	●	●								
	Stuck Injector	8.7.5	●									
	Stuck Injection Pump Delivery Valve	8.7.6	●									
	Wrong Injector Setting	8.7.5					●					
	Excessive Plunger Blow-By	8.7.7								●		
	Stuck Injection Pump Delivery Control	8.7.6	●		●	●						
	Wrong Injection Pump Setting	8.7.6			●		●					
Lubrication	Too High Oil Level	8.6.1				●		●			●	
	Stuck Pressure Relief Valve	8.7.7							●			
	Worn Oil Pump	8.7.7							●			
	Air Inside Oil Suction Pipe	8.7.1							●			
	Faulty Pressure Gauge or Switch	8.7.7							●			
	Clogged Oil Suction Pipe	8.7.1							●			
Settings/Repairs	Advanced Injection	8.7.7	●									
	Retarded Injection	8.7.7					●					
	Incorrect Governor Linkage Adjustment	8.7.7	●			●						
	Broken or Loose Governor Spring	8.7.7			●							
	Worn Out or Stuck Piston Rings	8.7.7						●			●	●
	Worn Out Cylinders	8.7.7						●			●	●
	Worn Our Valve Guides	8.7.7						●			●	●
	Sticking Valves	8.7.7	●									
	Worn Our Bearings	8.7.7							●			
	Governor Linkage Not Freely Operating	8.7.7	●	●		●						
	Crankcase Vapor Re-circulation System	8.7.7				●	●				●	●
	Crankshaft Not Turning Freely	8.7.7					●					
	Pull Rope is Damaged	8.7.9	●									
	Damaged Cylinder Head Gasket	8.7.7	●									

10.2 Pump Troubleshooting Chart

POSSIBLE CAUSE	Repair Section	TROUBLE									
		Pump Does Not Prime	Loss of Suction Lift	Pump Doest Not Deliver Liquid	Not Enough Capacity	Not Enough Pressure	Pump Pulls Too Much Power	Pump Vibrates & Is Noisy	Pump Jams	Bearings Running Hot or Leaking Oil	Eccentric Very Hot
Pump Casing Is Empty	9.3.2	●	●	●		●		●			
Liquid In The Casing Is Overheated	--	●						●			
Air Leaks In The Joints or Cracks In The Suction Line	--	●	●		●						
Discharge Line Under Pressure	--	●									
Low Rotational Speed Of The Pump	8.7.8	●	●	●	●	●					
The Suction Lift Is Too High	--	●	●	●	●	●					
Head Required By The System Is Greater Than Rated Head Of Pump	--			●		●					
Excessive Friction Loss In The Suction Line	--			●							
Suction Or Discharge Lines Are Clogged	--		●	●	●						
Diameter of Suction Line Is Too Small	--				●						
Viscosity Of Pumped Liquid Too High	--			●		●	●		●		
Rotational Speed Too High	8.7.8						●	●			●
Gear Case Oil Level Incorrect	9.3.5									●	
Daily Lubrication Not Sufficient	9.3.1										●
Driver Misalignment	8.7.7								●	●	
Replace Bearing Frame	9.4.6										
Mechanical Breakdown	8.7.7							●	●		

11 MAINTENANCE ALLOCATION CHART

Operation Section	Task	Operation	Duration (Hours)
Engine Components			
8.5.5	Dry Air Cleaner	Inspection	0.10
8.5.5		Cleaning	0.25
8.7.4		Replacement	0.25
8.8.3	Fuel Filter Cartridge	Replacement	0.50
8.8.6	Fuel Pump	Replacement	0.50
8.6.2	Fuel Tank	Cleaning	0.50
8.6.1	Head & Cylinder fins	Cleaning	0.25
8.6.3	Injector	Cleaning/Inspection	0.50
8.8.5		Replacement	0.75
8.6.4	Oil Filter Cartridge	Cleaning	0.50
8.8.2		Replacement	0.50
8.7.1	Oil Level	Inspection	0.10
8.8.1		Replacement	0.25
8.7.2	Valve/Rocker Rocker Clearance	Inspection	1.00
8.7.2		Adjustment	0.50
Pump Components			
9.3.4	Diaphragm	Inspection	0.10
9.4.3		Replacement	0.50
9.2.3	Discharge Check Valve Assembly	Inspection	0.25
9.3.3		Replacement	0.50
9.2.3	Discharge Clean-out Port	Inspection	0.10
9.4.4	Eccentric Bushings	Replacement	1.00
9.2.2	Exterior of Pump	Cleaning	0.25
9.3.5	Gear Case oil	Inspection	0.10
9.4.5		Replacement	0.25
9.3.1	Lubrication Points	Inspection	0.10
9.2.1	Pump Suction & Discharge Connections	Cleaning	0.25
9.3.2	Suction Check Valve Assembly	Inspection	0.25
9.4.1		Replacement	0.50

12 TORQUE CHART

BOLT SIZE		TIGHTENING TORQUE	
		Lbf ft	Nm
4 mm	5/32”	2.7	3.6
5 mm	3/16”	5.2	7.0
6 mm	1/4”	8.9	12.0
7 mm	9/32”	14.6	19.8
8 mm	5/16”	21.8	29.6
9 mm	11/32”	28.0	38.0
10 mm	3/8”	38.7	52.5
12 mm	1/2”	65.6	89.0
14 mm	9/16”	99.6	135
16 mm	5/8”	151	205
18 mm	11/16”	190	257
20 mm	3/4”	264	358
22 mm	7/8”	321	435
24 mm	15/16”	411	557

13 Exploded Parts Diagrams

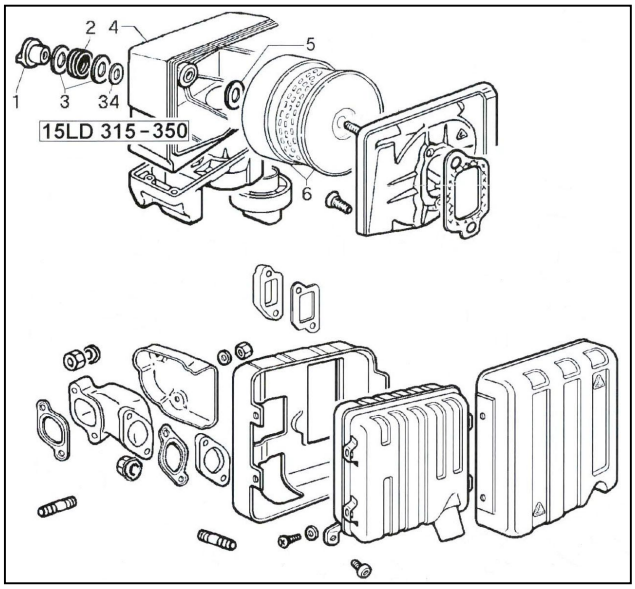


Figure 24, Intake/Exhaust

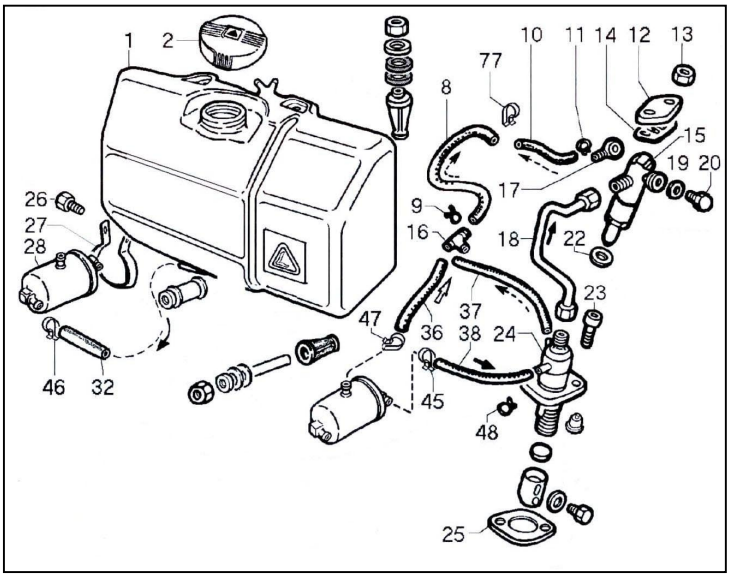


Figure 25, Fuel System

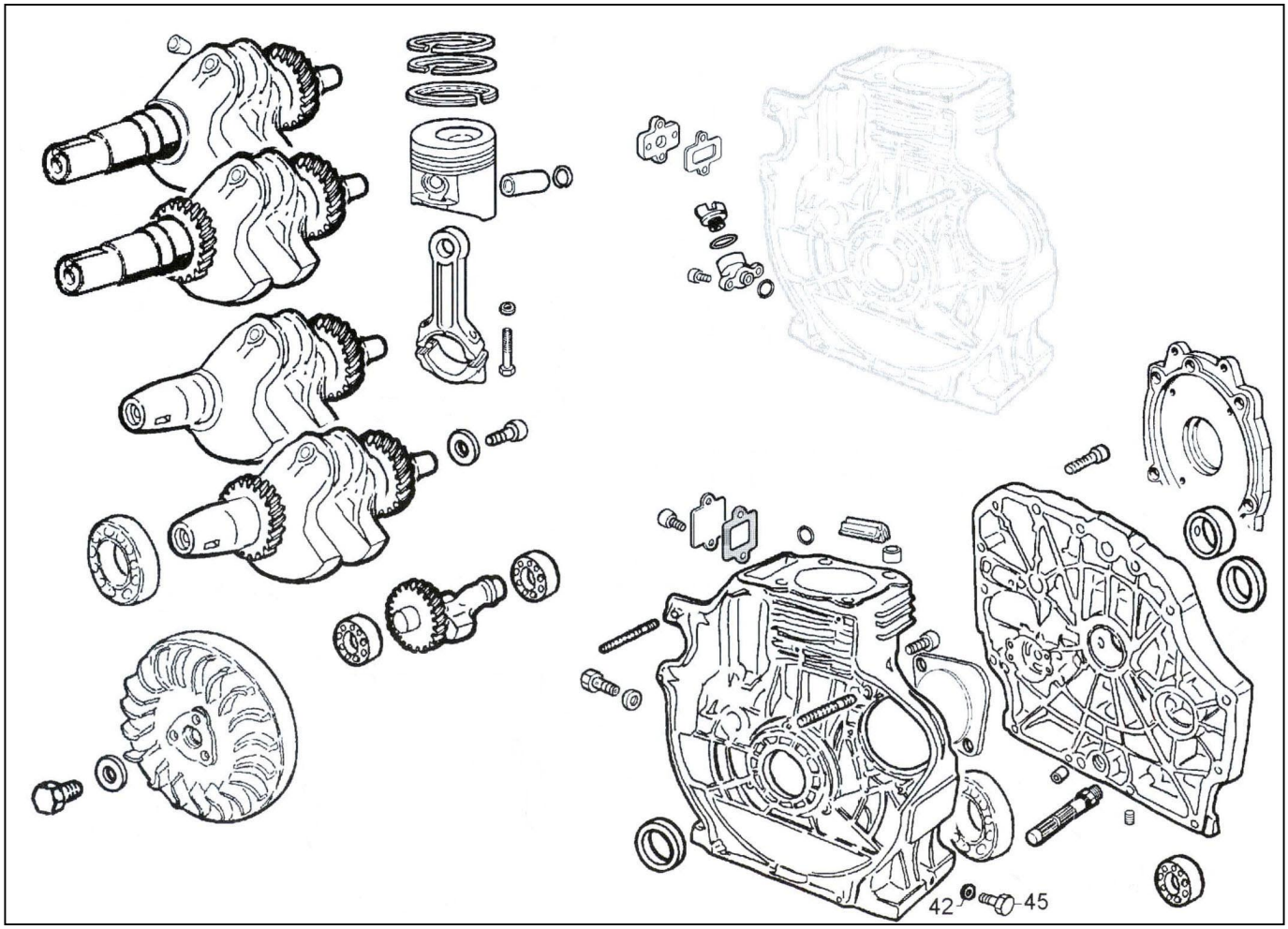


Figure 26, Crankcase

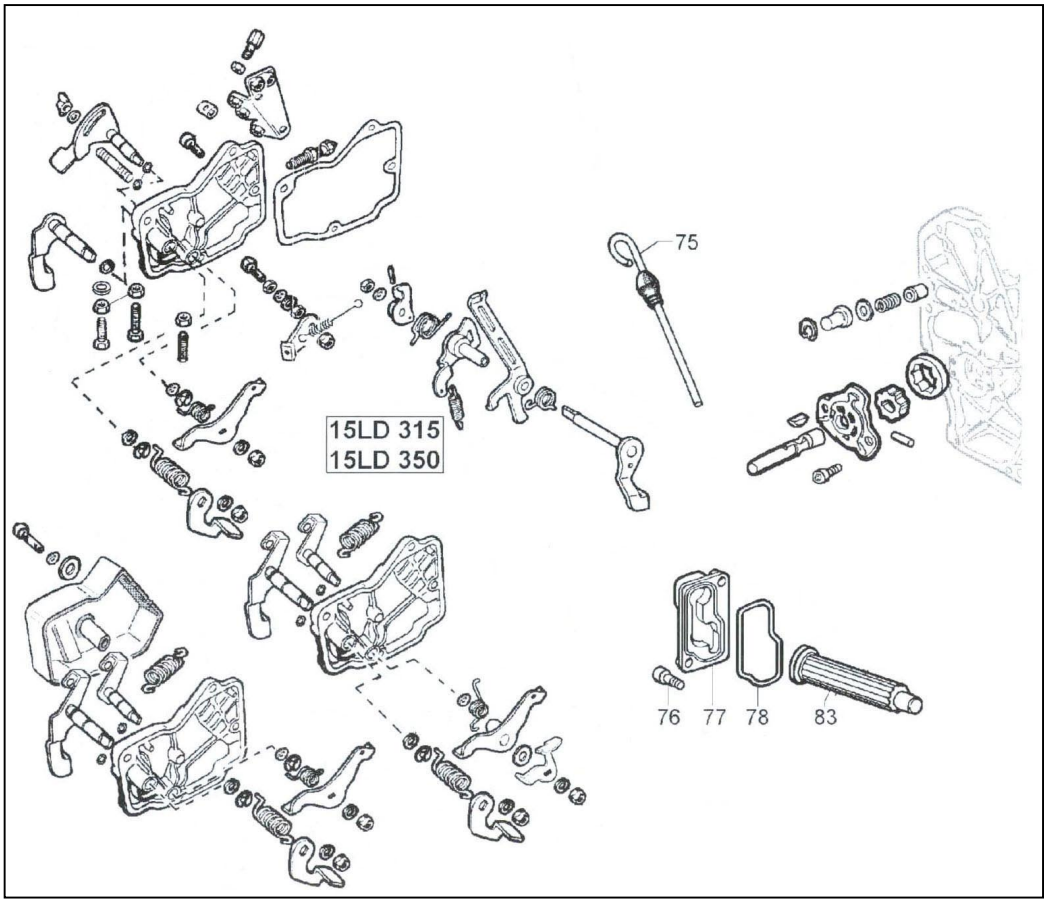


Figure 27, Lubricating System

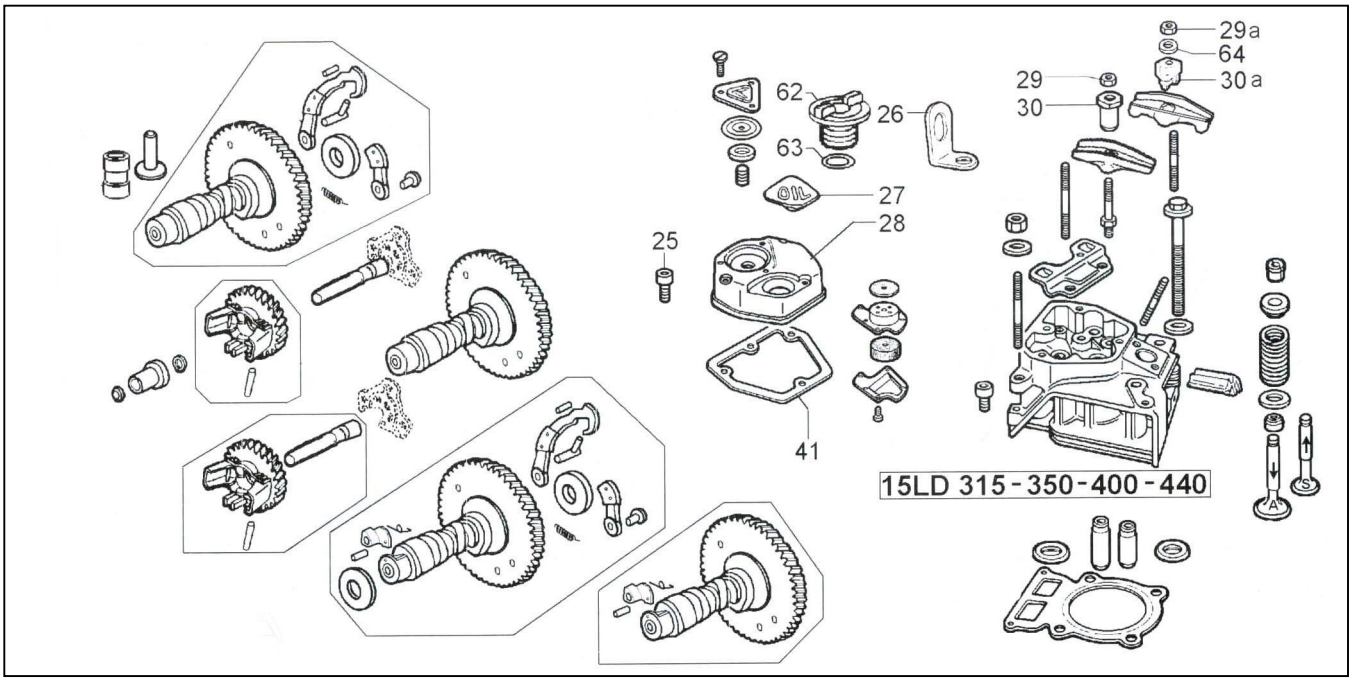


Figure 28, Cylinder Head

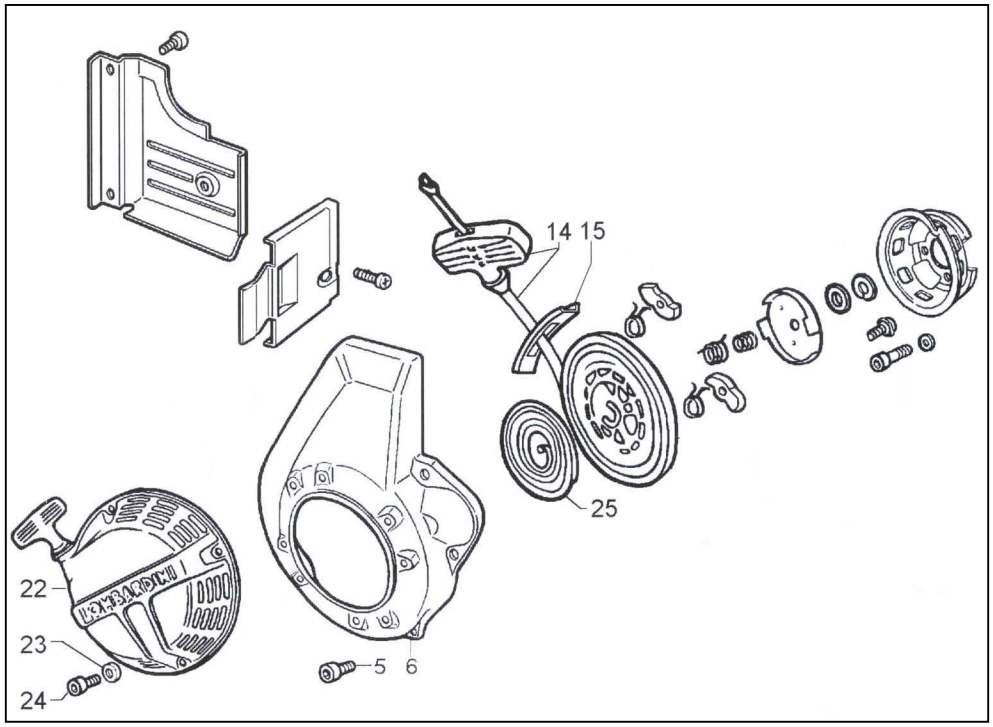


Figure 29, Starting

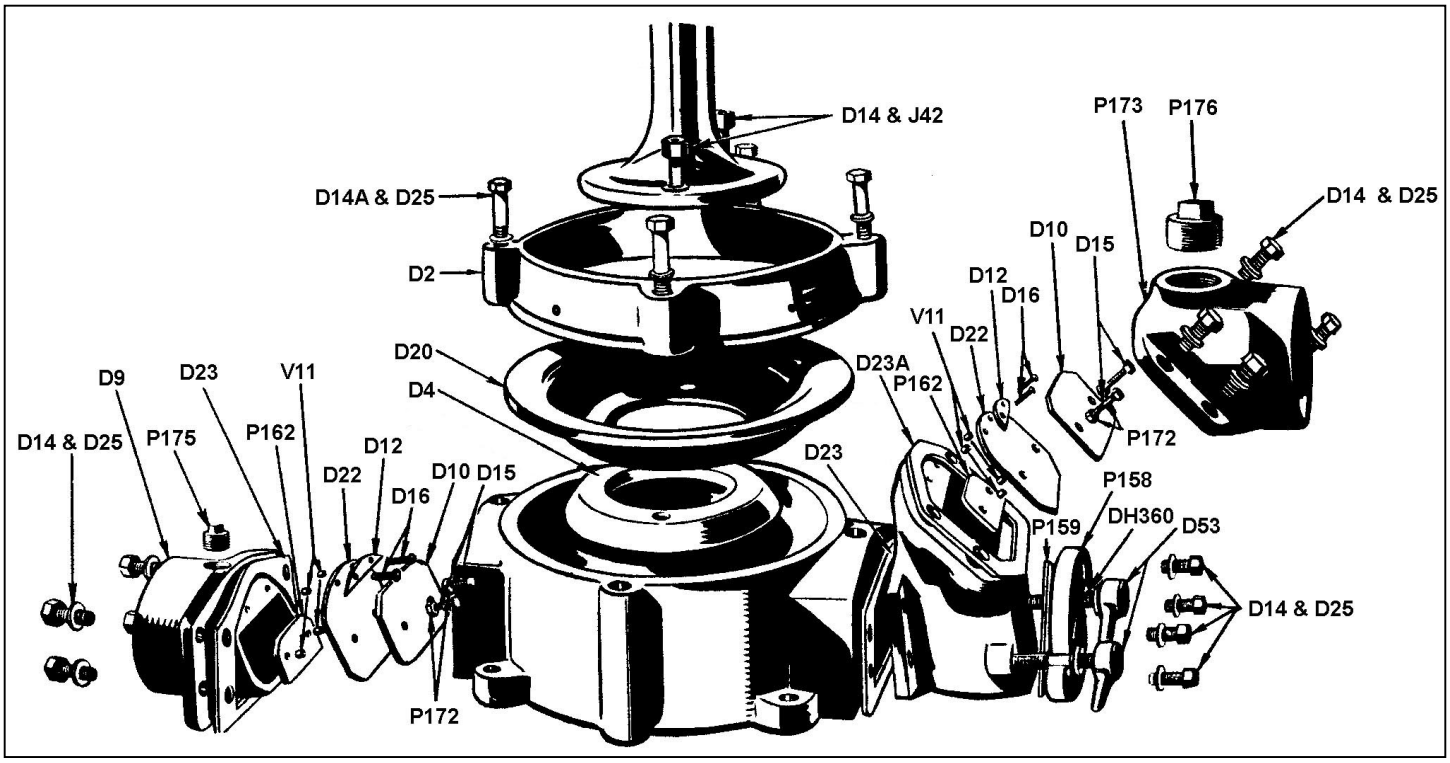


Figure 30, Pump Assembly

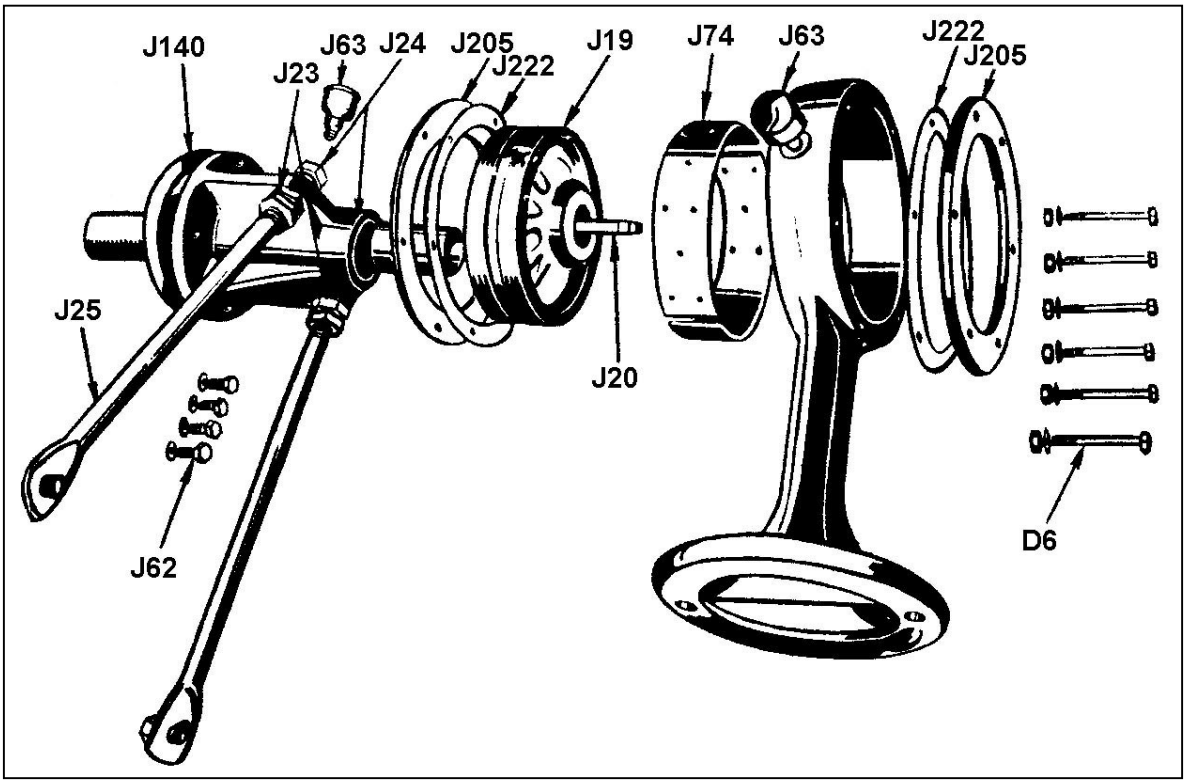


Figure 31, Eccentric Assembly

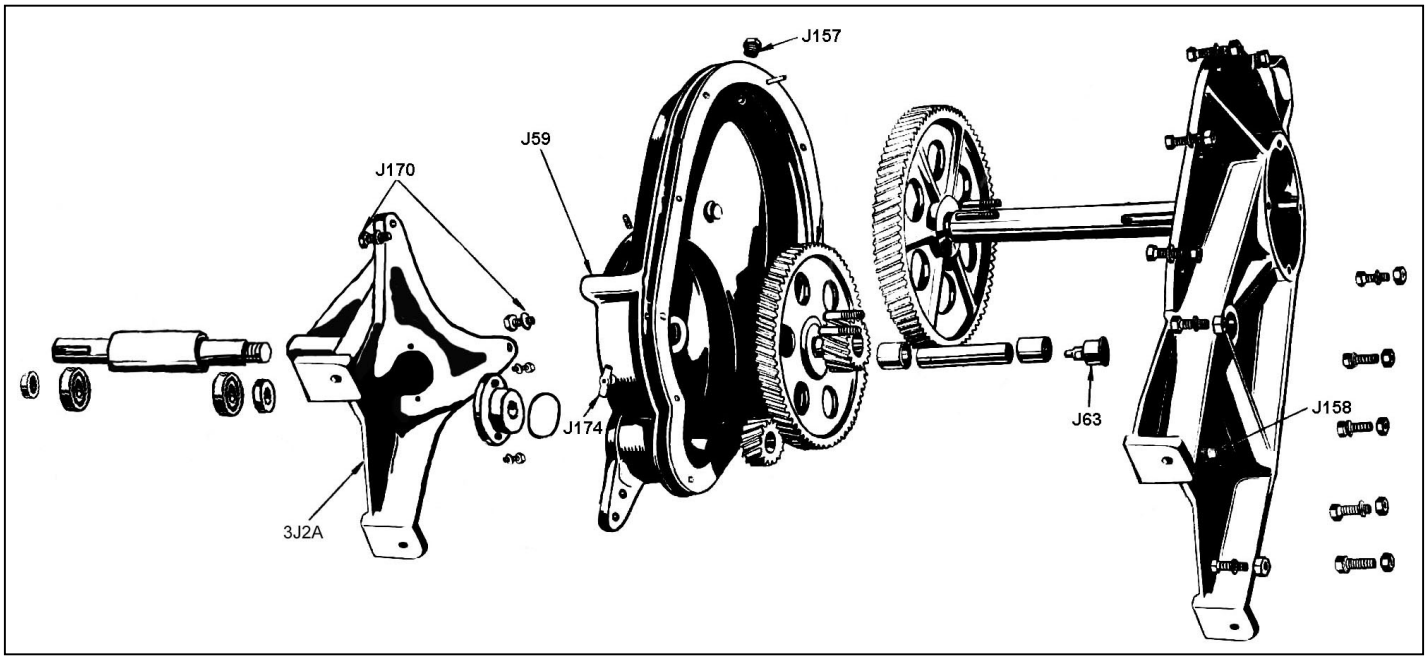


Figure 32, Gear Housing

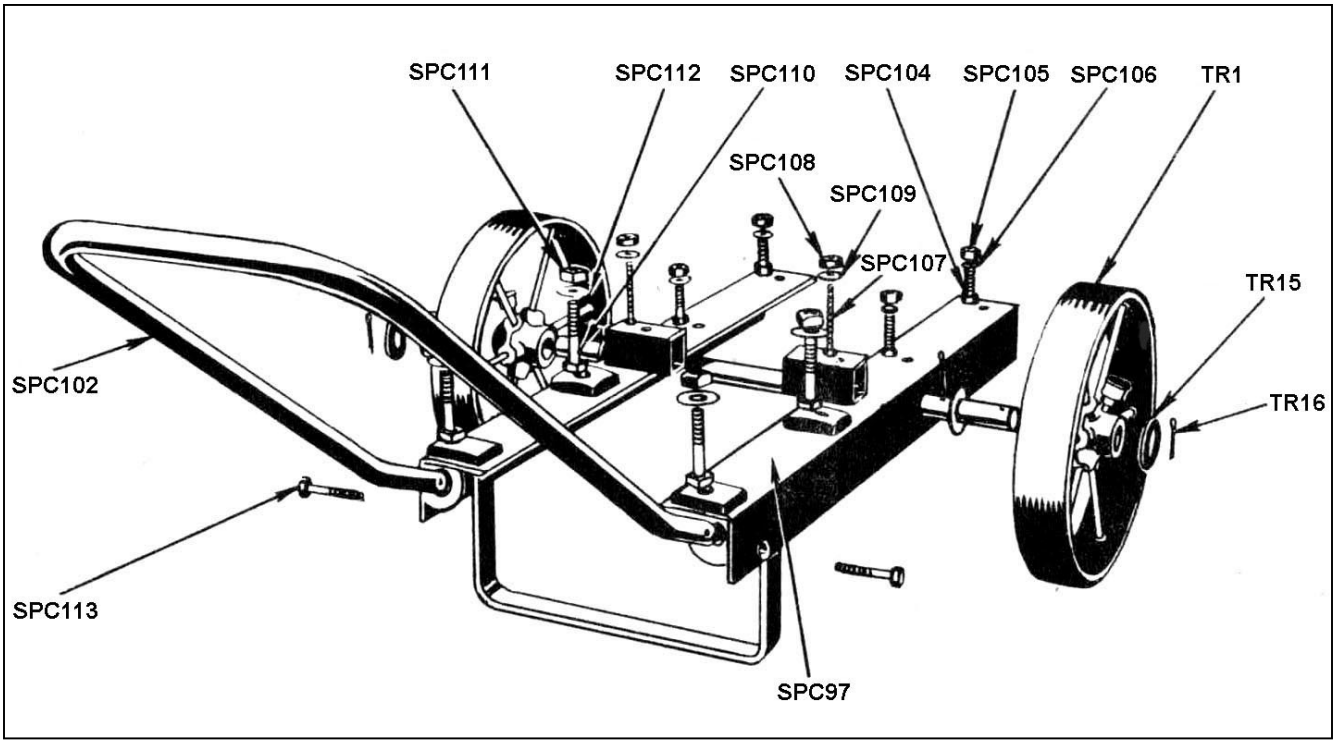


Figure 33, Base Assembly

14 Parts Breakdown

NOVO ADE Self-Primer Sectional Drawing

Item Number	Description	Quantity
Figure 24, Intake & Exhaust		
1	Knob	1
2	Spring	1
3	Washer	2
4	Air Cleaner Cover	1
5	Washer (D8)	1
6	Air Cleaner	1
34	Washer (D8)	1
Figure 25, Fuel System		
1	Fuel Tank	1
2	Fuel Tank Cap	1
8	Fuel Line	1
9	Clamp	2
10	Fuel Line	1
11	Clamp	1
12	Injection Flange	1
13	Nut (M6)	2
14	Injector Plate	1
15	Injector	1
16	Fitting	1
17	Union	1
18	High Pressure Fuel Line	1
19	Copper Washer	2
20	Union	1
22	Gasket	1
23	Screw (M6x20)	2
24	Injection Pump	1
25	Gasket	1
26	Screw (M6x12)	1
27	Fuel Filter Clamp	1
28	Fuel Filter	1
32	Fuel Line	1
36	Fuel Line	1
37	Fuel Line	1
38	Fuel Line	1
45	Clamp	1
46	Clamp	1
47	Clamp	1
48	Clamp	1
77	Clamp	1
Figure 26, Cylinder Head/Crank		
42	Gasket	2
45	Plug (M14)	2
Figure 27, Crankcase		
75	Oil Dipstick	1
76	Screw (M6x16)	2
77	Oil Filter Head	1
78	Gasket	1
83	Oil Filter Element	1
Figure 28, Lubrication System		
25	Screw (M6x40)	3
26	Lift Eye	1
27	Oil Filler Cap	1
28	Rocker Arm Cover Assembly	1
29	Safety Nut	2

Item Number	Description	Quantity
30	Special Nut	2
41	Gasket	1
62	Oil Plug	1
63	Oil Plug Gasket	1
64	Lockwasher	1
Figure 29, Starting		
5	Screw (M6x12)	5
6	Shroud	1
14	Handgrip	1
15	See Item 22	1
22	Rewind Starter	1
23	Washer (D6)	4
24	Screw (M6x8)	4
25	Spring	1
Figure 30, Pump Assembly		
D2	Pump Top	1
D4	Plunger Bottom	1
D9	Suction Flange	1
D10	Valve Weight (Large)	2
D12	Valve Rubber Retainer	2
D14	Stud	12
D14A	Cap Screw (5/8x3-½)	4
D15	Valve Retainer Set Screw (¼x1)	2
D16	Valve Weight Set Screw (¼x¾)	2
D20	Diaphragm	1
D22	Check Valve	2
D23	Suction Flange Gasket	2
D23A	Discharge Flange Gasket	1
D25	Washer – Plain	16
D53	Handle	2
DH360	Clean Out Plate Stud	2
J42	Plunger Bottom Stud	2
P158	Clean Out Plate	1
P159	Clean Out Plate Gasket	1
P162	Valve Weight (Small)	2
P172	Valve Nut	4
P173	Discharge Flange	1
P175	Suction Plug	1
P176	Discharge Plug	1
V11	Valve Spacer	8
Figure 31, Eccentric Assembly		
D6	Crosshead Plate Screws (¼x3)	6
J19	Eccentric	1
J20	Eccentric Key	1
J23	Brace Nuts (¾)	2
J24	Brace Nuts (¾)	2
J25	Pump & Jack Brace	2
J62	Eccentric Support Bolts (3/8x1)	4
J63	Zerk Fitting	3
J140	Eccentric Shaft Bearing Gasket	1
J205	Cross Head Side Plate	2
J222	Side Plate Gasket	2

NOVO ADE Self-Primer Sectional Drawing

Item Number	Description	Quantity
Figure 32, Gear Housing		
J59	Gear Case	1
J63	Zerk Fitting	1
J157	Oil Fill Plug	1
J158	Oil Drain Plug	1
J170	Adapter Cap Screws (7/16x1-¼)	3
J174	Fill Level Cock	1
3J2A	Bearing Pedestal	1
Figure 33, Base Assembly		
SPC97	Base Assembly	1
SPC102	Handle	1
SPC104	Motor Cap Screw	4
SPC105	Not Supplied	4
SPC106	Motor Washer	4
SPC107	Gear Housing Cap Screw	2
SPC108	Not Supplied	2
SPC109	Gear Housing Washer	2
SPC110	Pump Cap Screw	4
SPC111	Not Supplied	4
SPC112	Pump Washer	4
SPC113	Handle Pin	2
TR1	Pneumatic Wheel	2
TR15	Axle Washer	4
TR16	Cotter Pin	2

Item Number	Description	Quantity

By Order of the Secretary of the Army:

PETER J. SCHOOMAKER
General, United States Army
Chief of Staff

Official:

SANDRA R. RILEY
Administrative Assistant to the
Secretary of the Army
0521301

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PUBLICATION/FORM NUMBER	DATE	TITLE
TM 5-4320-369-14&P	2 September 2005	100 GPM Water Pump Unit

ITEM NO.	PAGE NO.	PARA-GRAPH	LINE NO.*	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES AND REASON *(Provide exact wording of recommended changes, if possible).*

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TM 5-4320-369-14&P	2 September 2005	100 GPM Water Pump Unit

PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

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