



2000 Series Pumps

Installation and Operation Manual



General Precautions

Read this entire manual and all other publications pertaining to the work to be performed before installing, operating, or servicing this equipment.

Practice all plant and safety instructions and precautions.

Failure to follow instructions can cause personal injury and/or property damage.



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Any unauthorized modifications to or use of this equipment outside its specified mechanical, electrical, or other operating limits may cause personal injury and/or property damage, including damage to the equipment. Any such unauthorized modifications: (i) constitute "misuse" and/or "negligence" within the meaning of the product warranty thereby excluding warranty coverage for any resulting damage, and (ii) invalidate product certifications or listings.



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The original source of this publication may have been updated since this translation was made. Be sure to check manual **26311**, *Revision Status & Distribution Restrictions of Woodward Technical Publications*, to verify whether this translation is up to date. Out-of-date translations are marked with . Always compare with the original for technical specifications and for proper and safe installation and operation procedures.

Revisions—Changes in this publication since the last revision are indicated by a black line alongside the text.

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Warnings and Notices

Important Definitions



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

- **DANGER**—Indicates a hazardous situation which, if not avoided, will result in death or serious injury.
- **WARNING**—Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
- **CAUTION**—Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
- **NOTICE**—Indicates a hazard that could result in property damage only (including damage to the control).
- **IMPORTANT**—Designates an operating tip or maintenance suggestion.

WARNING

Overspeed / Overtemperature / Overpressure

The engine, turbine, or other type of prime mover should be equipped with an overspeed shutdown device to protect against runaway or damage to the prime mover with possible personal injury, loss of life, or property damage.

The overspeed shutdown device must be totally independent of the prime mover control system. An overtemperature or overpressure shutdown device may also be needed for safety, as appropriate.

WARNING

Personal Protective Equipment

The products described in this publication may present risks that could lead to personal injury, loss of life, or property damage. Always wear the appropriate personal protective equipment (PPE) for the job at hand. Equipment that should be considered includes but is not limited to:

- Eye Protection
- Hearing Protection
- Hard Hat
- Gloves
- Safety Boots
- Respirator

Always read the proper Material Safety Data Sheet (MSDS) for any working fluid(s) and comply with recommended safety equipment.

WARNING

Start-up

Be prepared to make an emergency shutdown when starting the engine, turbine, or other type of prime mover, to protect against runaway or overspeed with possible personal injury, loss of life, or property damage.

WARNING

Automotive Applications

On- and off-highway Mobile Applications: Unless Woodward's control functions as the supervisory control, customer should install a system totally independent of the prime mover control system that monitors for supervisory control of engine (and takes appropriate action if supervisory control is lost) to protect against loss of engine control with possible personal injury, loss of life, or property damage.

NOTICE**Battery Charging
Device**

To prevent damage to a control system that uses an alternator or battery-charging device, make sure the charging device is turned off before disconnecting the battery from the system.

Electrostatic Discharge Awareness

NOTICE**Electrostatic
Precautions**

Electronic controls contain static-sensitive parts. Observe the following precautions to prevent damage to these parts:

- Discharge body static before handling the control (with power to the control turned off, contact a grounded surface and maintain contact while handling the control).
- Avoid all plastic, vinyl, and Styrofoam (except antistatic versions) around printed circuit boards.
- Do not touch the components or conductors on a printed circuit board with your hands or with conductive devices.

To prevent damage to electronic components caused by improper handling, read and observe the precautions in Woodward manual **82715**, *Guide for Handling and Protection of Electronic Controls, Printed Circuit Boards, and Modules*.

Follow these precautions when working with or near the control.

1. Avoid the build-up of static electricity on your body by not wearing clothing made of synthetic materials. Wear cotton or cotton-blend materials as much as possible because these do not store static electric charges as much as synthetics.
2. Do not remove the printed circuit board (PCB) from the control cabinet unless absolutely necessary. If you must remove the PCB from the control cabinet, follow these precautions:
 - Do not touch any part of the PCB except the edges.
 - Do not touch the electrical conductors, the connectors, or the components with conductive devices or with your hands.
 - When replacing a PCB, keep the new PCB in the plastic antistatic protective bag it comes in until you are ready to install it. Immediately after removing the old PCB from the control cabinet, place it in the antistatic protective bag.

Chapter 1.

General Information

General

Woodward 2000 Series pumping systems are complete, self contained units, designed to supply oil pressure from 1241 to 1379 kPa (180 to 200 psi) for hydraulic governors. For higher pressure options, consult Woodward representatives. This pump, when properly used, will pump air to initially charge, and to maintain its air head. Auxiliary features are available to automatically maintain this air head.

Specifications

Common specifications for both pump sizes:

1. Cleanliness control system:
To maintain system cleanliness from ISO 16/13 to ISO 18/15 (depending on level of dirt generation from systems external to this system)
2. ASME tank rating:
Tank is manufactured and tested to ASME Section 8, Division 1 of the code. The maximum pressure allowed is 2137 kPa (310 psi).
3. ASME air safety rating:
The ASME certified air safety will blow at or below 2137 kPa (310 psi)
4. Two oil sump float switches:
The contact rating of these two switches are 0.13 A at 125 Vdc.
5. One oil temperature switch:
The contact rating of this switch is 4 A at 125 Vdc.
6. Two pressure switches:
The contact rating of these two switches are 0.5 A at 125 Vdc
7. Pressure tank float valve:
Maximum flow rating is 1249 L/min (330 US gal/min)
Maximum pressure rating is 2758 kPa (400 psi)
Uses O-ring seal for dead tight shutoffs when closed
8. Sump air breathers:
Filters all incoming and outgoing air to sump through 3 μ m elements.
System includes water removal desiccants to keep airborne water out of sump.
9. Oil sump thermometer:
Dial thermometer reads from -18 to +104 °C (0 to 220 °F).
10. Air charging capability:
The air charging system (starting from no charge) takes approximately 1.5 hours to completely charge the tank.
11. Manual air blow-off valve
12. Viscosity control capability
13. Magnet trap in sump for return oil
14. Pressure tank drain valve
15. Motor starter
16. Electrical control box with ON/OFF switch

17. Automatic air admission system (to maintain oil level against air leakage):
This system can make up for the loss air up to 38 mm (1.5") of oil level change per day. (optional device)
18. Automatic air release system (to maintain oil level against air build-up):
This system can blow off air, up to 10 seconds per release on detection of lower than normal oil level. (optional device)
19. Dirty filter detection switch: trips at 186 kPa (27 psi)
The contact rating is 0.5 A for 125/250 Vdc (optional device).

Specific ratings for 2245 pump (replaces Woodward 20 series pump sizes 21, 22, 23, 24, and 24 1/2, with the largest normal governor capacity in this size range of 14 238 J [10 500 ft-lb]):

1. Overall dimensions:
 - Width 686 mm (27")
 - Length 1219 mm (48")
 - Height (sump) 533 mm (21")
 - Height (sump, and pressure tank) 1803 mm (71")
2. Weight (including normal oil levels) = 680 kg (1500 lb)
3. Motor: 3.7 kW (5 hp); 230/460 Vac; 60 Hz; 1750 rpm
4. Pump: 61 L/min (16 US gal/min), gear pump
5. Sump oil capacity: 227 L (60 US gal)
6. Pressure tank capacity:
With 14 238 N·m (10 500 ft-lb) Woodward governor (11.6 L or 0.41 ft³ servo) the pressure tank has 3 1/2 servos of usable oil from normal pressure 1379 kPa (200 psi) down to float valve closed pressure 862 kPa (125 psi).

Specific ratings of 2275 pump (replacing Woodward 20 series pumps 25, 26, 27, and 27 1/2, with the largest normal governor capacity in this size range of 56 952 J (42 000 ft-lb):

1. Overall dimensions:
 - Width 686 mm (27")
 - Length 1524 mm (60")
 - Height (sump) 622 mm (24.5")
 - Height (sump, and pressure tank) 2794 mm (110")
2. Weight (including normal oil levels) = 1134 kg (2500 lb)
3. Motor: 7.5 W (10 hp); 230/460 Vac; 60 Hz; 1750 rpm
4. Pump: 155 L/min (41 US gal/min), gear pump
5. Sump oil capacity = 378 L (100 gal)
6. Pressure tank capacity:
With 56 952 J (42 000 ft-lb) Woodward governor (45.6 liter or 1.61 ft³ servo) the pressure tank has 3 1/2 servos of usable oil from normal pressure 1379 kPa (200 psi) down to float valve closed pressure 862 kPa (125 psi).

Chapter 2. Description

General

The 2000 Series pumping systems are available in two sizes, the smaller, 2245, with 49 L/min (13 US gal/min) flow capacity being able to supply oil up to 14 238 J (10 500 ft-lb) governors. This system replaces 20 Series Woodward pumps (sizes 21, 22, 23.5, and 24.5). The larger system, 2275, with 155 L/min (41 US gal/min) flow capacity can supply oil up to 5695 J (42 000 ft-lb) governors. This system replaces Woodward 20 Series pumps (sizes 25, 26, 27, and 27.5). Adjustable blade turbines or penstock valves may be operated from the pump by using a pump of sufficient capacity.

Standard Features

Each of these 2000 Series Systems includes as standard:

1. 15 μ m (absolute) full flow filter (with mechanical dirt indicator)
2. Oil sump reservoir with following features:
 - Water trap sump filter/breathers
 - Permanent magnet in return oil path
 - High and low oil level float switches (plus high oil temperature switch, 66 °C [150 °F])
 - Sump sight glass with temperature indicator.
3. Pressure vessel with following features:
 - ASME certification to 2137 kPa (310 psi)
 - Sight gauge
 - Float valve
 - ASME air safety valve (set at or below tank rating)
 - Pressure tank to oil sump bypass valve (provides limited viscosity control)
 - Manual air blowoff valve
 - Pressure gauge
 - Pressure tank drain connection and valve
4. Electrical panel including:
 - Terminal blocks for all external wiring (terminals available for all auxiliary features for future plug and play if needed)
 - On-off pump control switch
 - 230/460 Vac motor starter
 - Pump control start-stop pressure switch
 - Low oil pressure shutdown pressure switch
5. Direct coupled 230/460 Vac (3 phase, 60 Hz) pump and motor set, along with interconnecting piping, oil pump relief valve, check valve, shutoff valve, and air charging capability

Optional Features

Optional features available for the 2000 Series include:

1. Automatic air maintenance:
 - System available if loss of air is problem (slow air adding)
 - System available if excessive air buildup is problem (auto air blowoff)
2. Pressure tank oil level switches (one needed for each above type auto level system)
3. Differential pressure switch to detect dirty oil filter

Functional Description

Sump Mounted Equipment

Pump / Motor—The pump/motor located on the sump delivers pressure oil from the oil sump, normally from 1241 to 1379 kPa (180 to 200 psi), to the pressure tank. It can also serve as an air compressor to both initially charge tank with air on start-up, and to manually make air level corrections as needed during normal operation.

This pump will generate a noise level of 82 to 85 dB at a distance of 91 cm (36") from the pump.

Full Flow Filter—The oil filter continuously clean the entire governor oil system during normal operation. It should be able to maintain a minimum ISO cleanliness level of 18/15, and eventually (over time) may bring the system to a more optimum ISO level of 16/13.

This filter can also be used as an initial system cleaner during start-up by running the pump more often (see First week of Operations under Unit Start-up). For more discussion on governor oil, see Woodward manual 25071, *Oils for Hydraulic Controls*.

Oil Safety—The oil safety protects motor from overload, and limits oil pressure buildup on pressure tank to 1862 kPa (270 psi).

Check Valve—The check valve is used to prevent reverse flow of oil from pressure tank back to the oil sump after the oil pump stops.

Air Inlet Valve—The air inlet valve is used to break the suction lift on the oil pump during air charging and to provide air breathing for the air compression process.

Pump Lube Valve—The pump lube valve is used to provide the “essential” oil pump lubrication during air charging.

Isolation Valve—The isolation valve is used to isolate the pressure tank from the pump for maintenance purposes.

LS1—The high sump oil level alarm; trips at approximately 305 mm (12") above floor.

LS2 & T1—The low sump oil level alarm trips at approximately 102 mm (4") above floor. The high oil temperature alarm trips at 66 °C (150 °F).

Auxiliary Air Chamber, SV1 Oil & SV1 Air (optional)—The air admission correction system is used to automatically make up for small air leakage losses. It works together with the pressure tank float switch, LS3 and will maintain the correct level within 51 mm (2").

Sump Magnet—The sump magnet is used to collect ferrous particles returning from the governor, preventing them from entering the suction line.

Sump Filler Breather with Watertrap—Used for filling sump with oil, and sump air filtration.

TD1 (optional)—Time delay relay is adjustable between 1 and 10 seconds for use with automatic air release system.

Pressure Tank Mounted Hardware

Drain Valve—The drain valve mounted on the pressure tank is used to drain the tank during maintenance.

Float Valve—The float valve is an oil-tight shutoff safety device to insure that air from the pressure tank can never enter the governor oil piping system. This float valve will close on final low oil level (approximately 862 kPa/125 psi).

Float Valve Equalizing Valve—There are some possible conditions (during initial air charging and after any float valve closure) when the float valve will remain sealed closed even after the normal oil level has been obtained. This condition is corrected by first closing the "customer isolation valve", and then opening the equalization valve.

PS1 & PS2, Pressure Tank Pressure Sensing Switches—The functions of the pressure tank pressure sensing switches are as follows:

- PS1: This pump control switch used to start motor at 1241 kPa (180 psi), and stop motor at 1379 kPa (200 psi).
- PS2: The low oil pressure shutdown switch normally operates at 1034 kPa (150 psi) (leaving 1 1/2 servo strokes minimum).

Air Safety—The air safety is used to protect pressure tank against high pressure due to fire and will release air at or below the tank rating of 2137 kPa (310 psi).

SV2, Auto Air Release Vent (optional)—This device provides an automatic release of air in the case of a pump that slowly builds up excessive air (can be caused by excessive air entrainment in oil sump). The air vent works with float switch LS4 and will give a brief air blow off (1–10 seconds), TD1 to automatically maintain the correct oil level, within 51 mm (2").

Manual Blow Off Valve—The manual blow off valve allows for manual release of air for level correction or for tank blowdown.

Bypass Valve—The tank to sump bypass valve is used to vary pump cycle time for oil warming, and/or increased oil filtering.

LS3 & LS4, Pressure Tank Float Switches (optional)—LS3 is set to trip with 9" (23 cm) of oil in sight glass. Used in conjunction with auto air admission system. LS4 is set to trip with 6" (15 cm) of oil in sight glass. Used in conjunction with auto air release system.

Chapter 3. Installation

Introduction

All equipment received has been thoroughly tested prior to packaging. All hydraulic, and mechanical, devices have been adjusted, and all electrical circuits completely checked out. Because field testing before start-up consists mainly of rechecking the above, the entire unit can be checked out completely in a few hours.

Woodward will assist with any installation details or questions. For those who do not wish to accept installation responsibility, Woodward suggests the use of a qualified Woodward field service engineer.

Care of Equipment When Received

The 2000 series pumping unit is a precision piece of equipment, and care must be taken during handling to prevent or minimize jolts and stresses. After unloading, extreme care must be taken to upright the pumping unit (See uncrating instructions attached to shipping crate).

After removing the shipping coverings, examine pumping unit carefully for any damage that might have occurred during shipment. Report any damage found immediately to the shipping company.

If the pumping unit is not to be installed immediately after it is received, it must be stored in a dry, weatherproof building. To minimize dust and dirt accumulation, keep unit covered during storage. The pumping unit should be inspected both inside and outside, for rust and general deterioration. If surface repair or an additional preservative is required, this should be done immediately to prevent further damage. After inspection or repair, the pressure and sump tanks must be re-sealed so that each item is airtight.

If indoor storage is not available, the pumping unit may be stored outside for short periods of time. If stored outdoors the unit must rest on dunnage so it does not contact the ground, and must be covered for protection from all weather conditions. The unit must be inspected every thirty days, as described above for indoor storage.

Pre-installation Procedures

The 2000 series pumping unit must be thoroughly cleaned using lint free cloths and a solvent to remove rust-preventative compounds applied before shipment, or during on-site storage.

Thoroughly clean the sump using lint free cloths and solvent. Wipe all corners, and the inside and outside of all pipes. When the sump has been cleaned thoroughly, check all pipe openings and the entire sump area to make certain that all rags and other foreign materials have been removed.

NOTICE

One rag carelessly left in a pipe or sump may necessitate the complete disassembly of the pipes, governor servomotor, pump, and a repeat of the entire cleaning process. Also, foreign material entering the control mechanisms may result in serious damage to equipment.

Installation

After pre-installation cleaning, lower the pumping unit into place over the anchor bolts. Expansion anchors or grouting may also be used. Once in place, level the unit carefully using a machinist's level placed on the top of the sump surface. Use flat steel shims and blocks to level it. DO NOT GROUT the pumping unit at this time.

NOTICE

Serious damage can occur to the 2000 series pumping unit if it is not mounted securely and falls over.

Piping

Once the pumping unit has been mounted, connect the piping between the pumping unit and the control. Care must be taken to keep pipes or tubing extremely clean during installation.

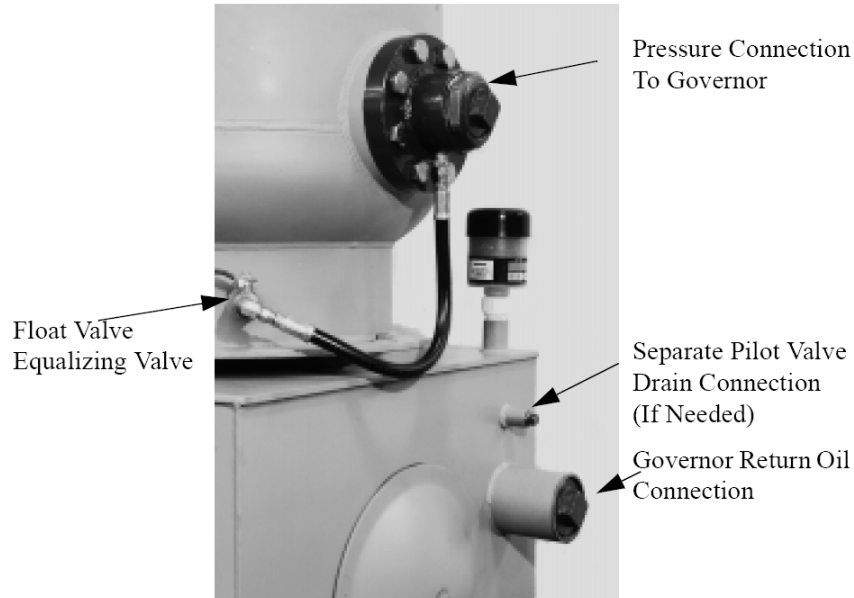


Figure 3-1. Customer Hydraulic Connections

If any field welding is required, the piping must be removed and thoroughly cleaned to remove any weld splatter that may have formed. After the pipes have been field welded and are thoroughly cleaned and oiled, the piping may be reassembled. The pumping unit may be slightly repositioned at this time to allow for minor adjustments required due to slight offsets of the piping.

Grouting (optional)

After the piping has been completed the pumping unit is ready to be grouted. A very dry sand-cement grout should be pounded under the pumping unit and around the shims and blocks until it gives complete support and the space under the bearing surface is filled in. The shims and blocks should be left in place permanently.

If the installation is such that a grout form is used, it is suggested that an expanding additive be added to the grout. This allows the grout to be wetter for easier filling of the form. Also, the expanding characteristics of the additive will assure a tighter grout seal around the pumping unit.

Wiring

All wiring must be done according to the wiring diagram. The internal wiring in the pumping unit is done in the factory and should not be changed without Woodward permission. However each connection, terminal block, screw, etc., should be checked for wires loosened during shipment.

Double check all external wiring connections since errors can cause serious damage to electrical equipment. See Figure 3-2 on the following page for the wiring diagram.

Unit Start-up

Oil Filling and Air Charging

Oil Filling—The oil currently in use may be used with the 2000 series pump. For more information on oils, see Woodward manual 25071, *Oils for Hydraulic Controls*. If the oil has not been changed in a long time (several years) it would be advisable to use new oil in this new pumping system. If there is any doubt about the quality/cleanliness of the oil, Woodward suggests an oil analysis be conducted at this time (see application note 55104, *Hydraulic Fluid Analysis Kit*). The most commonly used oil in most systems is ISO 68 oil (in colder climates ISO 46 oil may be used).

IMPORTANT

The 2000 Series pumping system requires more oil than the previous 20 Series pump.

When initially filling oil sump it is advisable to filter this oil through a 10 micron filter.

Amount Of Initial Filling—The initial oil quantities and filling levels for the 2000 series pumps are as follows:

- 2245 (small pump): Add 114 L (30 US gal) of oil, which will fill sump to a level of 178 mm (7").
- 2275 (large pump): Add 322 L (85 US gal) of oil, which will fill sump to a level of 330 mm (13").

IMPORTANT

The fill volumes do not include oil for the external system.

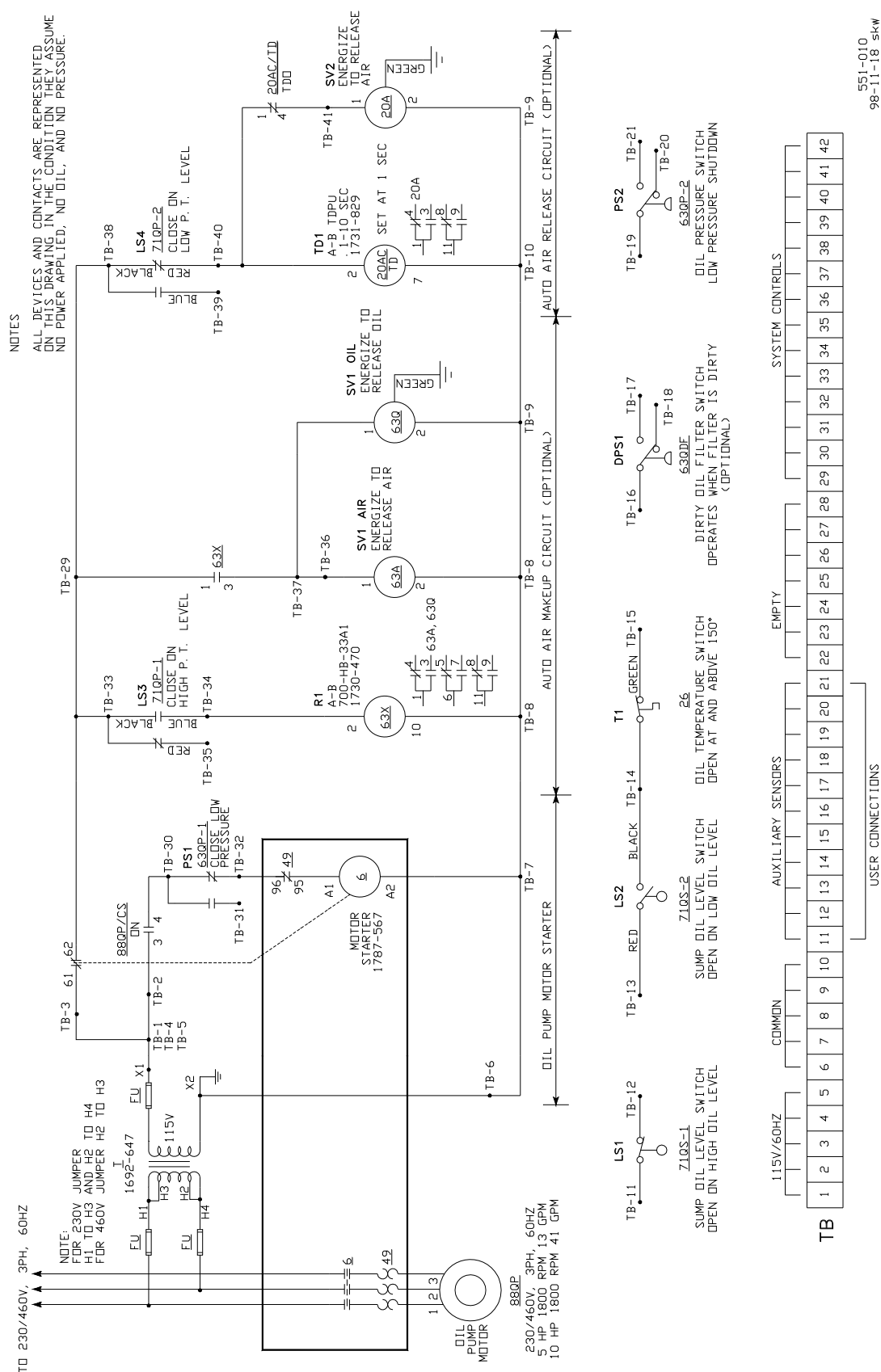


Figure 3-2. Wiring Diagram

Air Charging (After Initial Oil Filling)

Pump Rotation Check—To perform the pump rotation check, remove the coupling guard to view the coupling. Give motor a quick jog to view it's direction of rotation. If it is different from the arrow (counter clockwise from pump end of assembly), exchange and reconnect any two of the motor leads. Give final rotation check, and when correct, reinstall the coupling guard.

Before turning the pump control switch “on” all control valves should be in the following positions:

1. Isolation Valve—OPEN
2. Pressure Switch Isolation Valve—OPEN
3. Pressure Gauge Valve—OPEN
4. Tank to Sump Bypass Valve—CLOSED
5. Pump Lube Valve—CLOSED
6. Air Inlet Valve—CLOSED
7. Manual Blow-Off Valve—CLOSED
8. Pressure Tank Drain Valve—CLOSED
9. Isolation Valve To Auto Air Release Vent Solenoid (Optional)—OPEN
10. Float Valve Equalizing Valve—CLOSED
11. Customer Isolation Valve—CLOSED

The pump will start pumping oil into the pressure tank. Allow it to rise close to the top of the sight gauge (within 25 mm to 50 mm [1” to 2”] of top), and then turn motor “off”. This should bring the gauge pressure to 48 to 69 kPa (7 to 10 psi).

Start of Air Charging—Use the following steps to start air charging:

- Open pump air inlet valve
- Open pump lube valve to maximum opening (7 to 8 turns open)

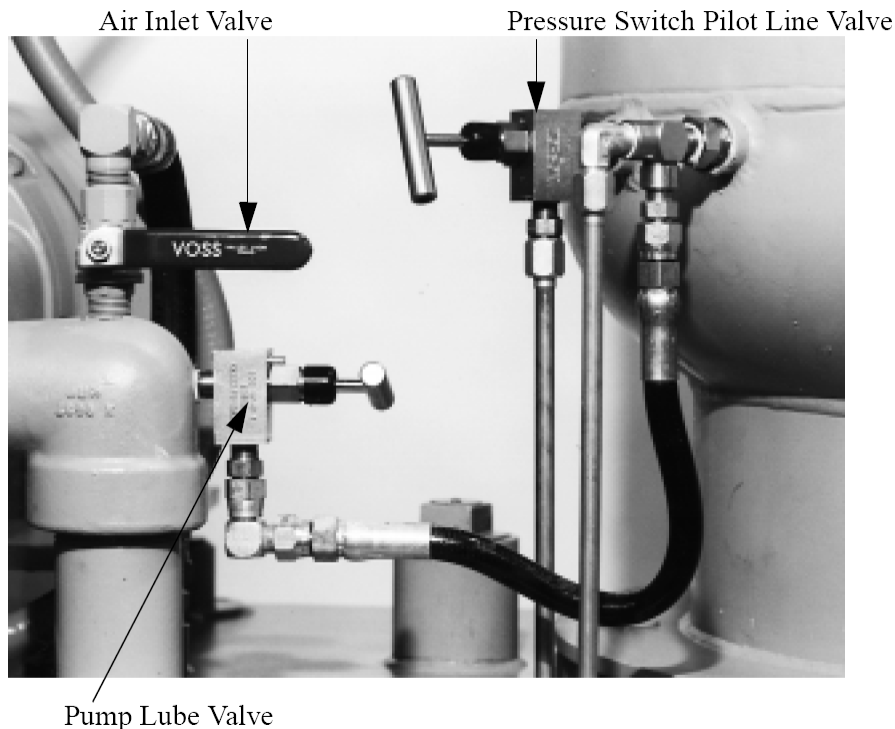


Figure 3-3. Air Charging Valves

**WARNING**

This lube valve **MUST** always be open (providing lubrication oil to the pump gears) whenever the pump is being used to pump air. Failure to lubricate these gears during air charging will be damaging to the pump.

- Turn on the pump motor to begin air charging

During the air charging process, which will take a little more than an hour, check for air leaks on the pressure tank. A “test solution” of soap and water applied to all fittings (located above normal oil level) will help to detect air leaks. Leaks should be repaired when found.

The air charge time can be reduced by 1/2 if shop air (690–862 kPa/100–125 psi, clean and dry) is used to initially charge tank to shop air pressure. Shop air, if used, should be admitted above normal oil level (manual air blow-off valve is an acceptable connection).

When charging air properly from 69 to 862 kPa (10 to 125 psi) (with lube valve full open), as the pressure slowly rises, the oil level in the sight gauge slowly drops, and by 862 kPa (125 psi) it will be low in the sight gauge.

At around 862 kPa (125 psi) (keeping the pump running), reclose the “air inlet valve” to enable the pump to restart pumping oil.

IMPORTANT

Closing the oil lube valve at this time will help to decrease pump noise. When the level approaches the top of the sight gauge, as before, begin opening the lube valve and then reopen the air inlet valve. This will start the air charging again.

IMPORTANT

At this higher pressure level the oil lube valve may be left anywhere between full open to 1/2 open, but never use the lube valve any less than 1/2 open.

Operation over the next 30 to 45 minutes should bring the proper oil level to 3/4 full in the sight gauge, with system pressure at 1379 kPa (200 psi).

Normal oil sump levels to be established at 1379 kPa (200 psi) (oil pump stop levels) are:

- 2245 oil sump: between 10 and 13 cm (4" and 5") (between 25 and 30 cm [10" and 12"] measured from floor of powerhouse to level in sight glass)
- 2275 oil sump: between 18 and 20 cm (7" and 8") (between 33 and 38 cm [13" and 15"] measured from floor of powerhouse to level in sight glass)

IMPORTANT

Charging the air will tend to cause the oil in both the oil sump and the pressure tank to foam up and the oil temperature to increase. It is advisable to let this system cool down for an hour, or two if possible, before putting into use. Also, if an oil pump relief valve test is required, this test should not be run until normal operating conditions have been reached.

Once normal operating temperatures are reached, final balancing of levels are to be as follows:

- If pumps stops at the normal operating pressure of 1379 kPa (200 psi) and the level is higher than desired, more air must be added with more air charging.
- If the level is too low at 1379 kPa (200 psi), then some air need to be blown off with the air blowoff valve.

The air charging parameters for the 2000 series pumps are as follows:

- 2245 Pump:
 - o Charges air (above 862 kPa/125 psi) at a rate of about 14 kPa/min (2 psi/min).
 - o Reference: 25 mm (1") of level change on this tank will cause about a 48 kPa (7 psi) change in tank pressure.
- 2275 Pump:
 - o Charges air (above 862 kPa/125 psi) at a rate of about 14 kPa/min (2 psi/min).
 - o Reference: 25 mm (1") of level change on this tank will cause about a 34 kPa (5 psi) change in tank pressure.

During the air charging process, the temperature of the oil pump will increase, but should not increase above 57 °C (135 °F) (Note: 54 to 60 °C [130 to 140 °F] is the maximum touch comfort level). If the temperature rises above this value, allow the pump to cool before proceeding. Pressure tank and oil sump temperatures should remain below 38 °C (100 °F) during air charging.

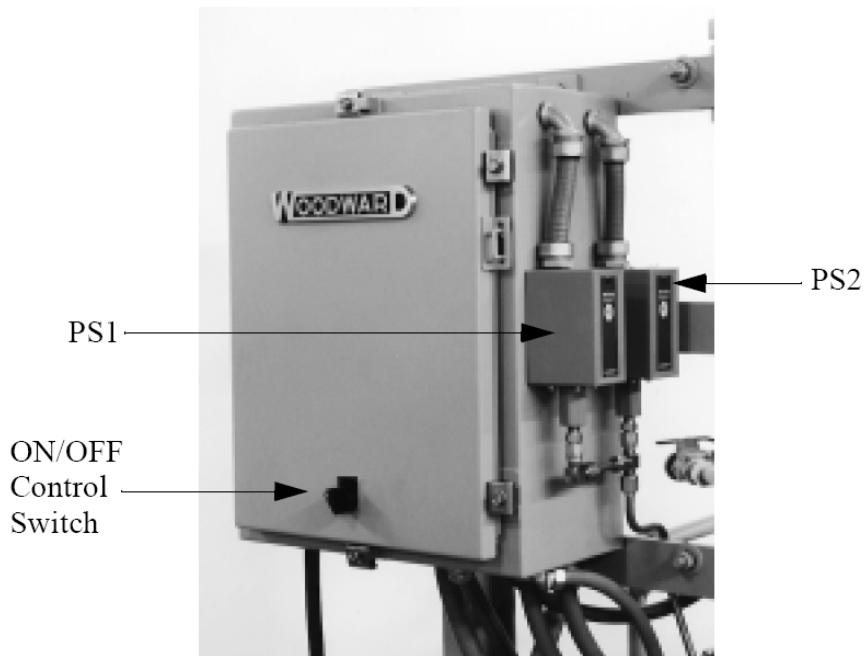


Figure 3-4. Control Box and Pressure Switches

First Week of Operation

During any installation where repiping is involved, the system will have some initial oil contamination. It is suggested to “temporarily” use a more frequent pump cycle time during the first week of operation. This will help to clean the system after installation. While normal pump cycles range from 5 minutes to 20 minutes, by using the “bypass valve” the pump frequency can be increased by slightly opening this valve. One to two turns open should bring the pump cycle time to a cycle rate of about one pump start every 2 minutes. This time period is frequent enough to clean the oil, and to raise the oil sump temperature around 6 °C (10 °F). This warmer oil temperature also helps in the cleaning process. This number of starts will also warm the motor, but it should not rise above 49 °C (120 °F).

Normal oil temperature of the oil in the sump (can be viewed at the thermometer at the sump level gauge) should run from 3 to 6 °C (5 to 10 °F) above ambient. See Woodward manual 25071, *Oils for Hydraulic Controls*, for recommendations on preferred oil viscosities for best performance. The bypass valve can be used for a small amount of oil warming (about 6 °C/10 °F above normal), but pump cycle rates should not be set faster (using the bypass valve) than one start every two minutes.

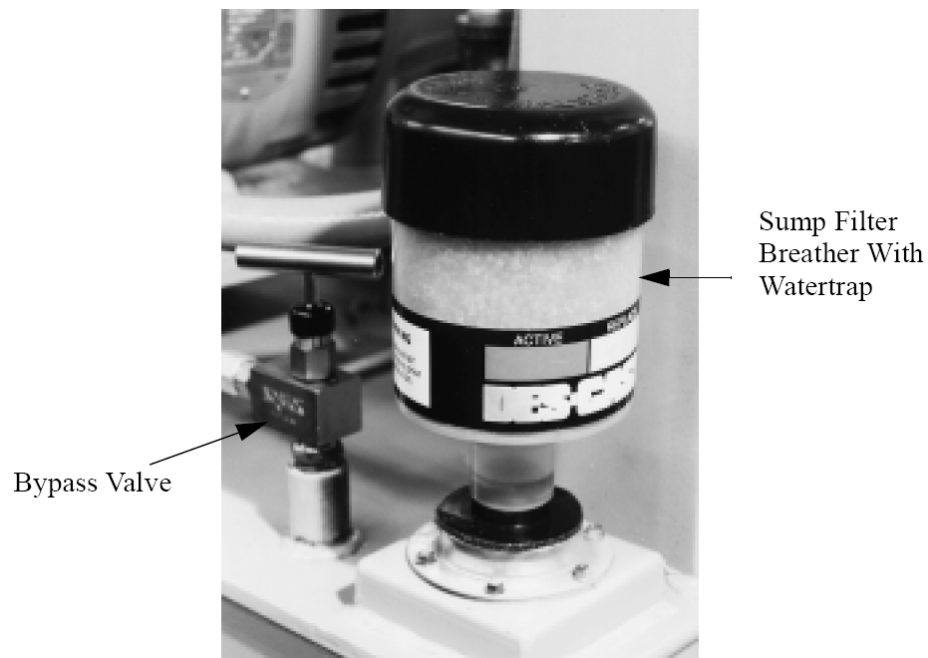


Figure 3-5. Bypass Valve and Sump Filter Arrangement

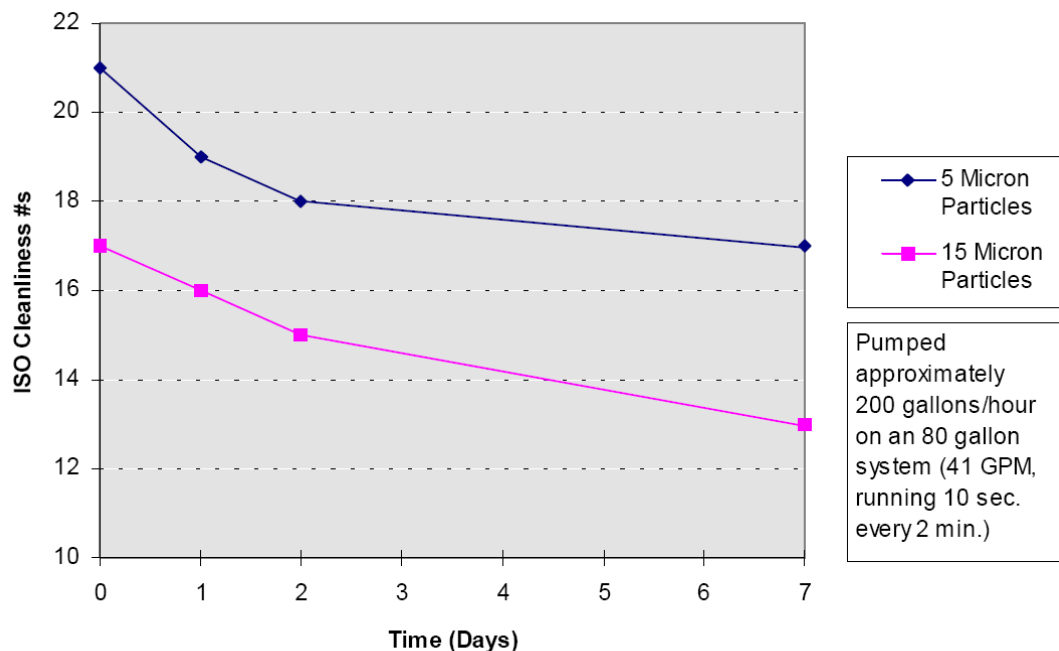
It is advisable to conduct an oil cleanliness check near the beginning of unit start-up. Wait one day after unit start-up so the contaminants can equalize in the system and then take a sample of oil. Woodward can provide oil sample kits if needed. To take this sample, lower a sample bottle (may use magnet coupling entrance) to approximately 8 to 15 cm (3" to 6") off sump bottom. As described in Chapter 2 of this manual, the minimum recommended cleanliness for the governor system is ISO 18/15. It is suggested that another cleanliness check be performed one week later, another check one month later, and finally checks every 6 months thereafter are advisable to insure proper cleanliness level is being maintained. Keeping the oil clean in the governor system will increase the life and reliability of all hydraulic components, not only on this new pumping system, but also on existing governor valving, and servo systems.

Clean oil (ISO 18/15 or better) will:

- Greatly increase pilot valve filter life.
- Nearly eliminate further pilot valve and main governor bushing and plunger wear.
- Greatly reduce all future governor seal wear (in governor pilot valve, distributing valve, and main governor servo).
- Improve oil life.

IMPORTANT

An actual shop test was conducted on a 2275 pump where intentionally dirty oil (303 L/80 US gal for dirty oil at an ISO cleanliness level of 21/17) was tested with a standard filter system. This system was not connected to a servo, but the bypass was adjusted to cycle the pump every two minutes. The final cleanliness level of ISO 17/13 is an excellent cleanliness level for this pressure (1379 kPa/200 psi). See Figure 3-6 for the cleaning capability of the standard system over a one- week period.



Test conducted on 2275 pumping system using beta/15 = 75 filter elements

Figure 3-6. 2000 Series Pump Oil Filtration Test

After one week of faster than normal pump cycling you may go back to the normal slower pump cycle rates by the reclosing of the bypass valve. The bypass may be used as required in the future for increased levels of filtration, or if a slight level of oil warming is desired.

It will be noted at any time the governor servo becomes more active (when the servo has more or faster movements) that the oil will tend to become agitated. The pump will become noisier under these conditions, moving its normal 82 to 85 dB levels to up to 92 dB. This will return to normal once servo activity goes back to normal and the air has a chance settle out again. Having an oil with good air release, warmer oil, and finally having a lower viscosity oil helps (using an ISO 46 oil instead of an ISO 68 oil).

Normal Operation

A normal operating pressure range of 1241 to 1379 kPa (180 to 200 psi) may, if needed, be adjusted to suit using the pump operating pressure switch (PS1).

Optional Devices

Electrical Dirty Oil Filter Indicator—The operation of this device is the same as the mechanical indicator, except that its output is an electrical contact.

Auto Air Admission Correction System—When this system is supplied (it can be added later as a kit if needed), it will automatically operate to correct for a small air leakage rate (of approximately 38 mm/1.5" of oil level change per day). With this device oil level will rise 25 to 50 mm (1" to 2") above normal level, and hold at this slightly higher than normal, as long as the leakage is not overly excessive.

Auto Air Release Correction System—When this system is supplied (it can also be added later as a kit), it will automatically operate to blow off excessive air buildup. The oil level will be maintained at 25 to 50 mm (1" to 2") below normal, but this device will hold this slightly lower level thereafter. A 1–10 second blast of air is used to control this process.

Chapter 4. Maintenance

Oil Filter Changing

During start-up the filter may require more frequent changing. The dirty filter indicator should be checked daily during the first week, weekly for the first month, and then monthly thereafter. In normal operation filter changing may be required every 2 to 6 months. Remember, if the system needs more frequent changes initially it means that a large amount of contaminants that need to be removed are being removed. A clean system will give better, trouble-free performance, and in time it will save money.

Water removing elements are available is water in the oil is a problem.

IMPORTANT

The dirty filter indicator can only be checked while the pump is running.

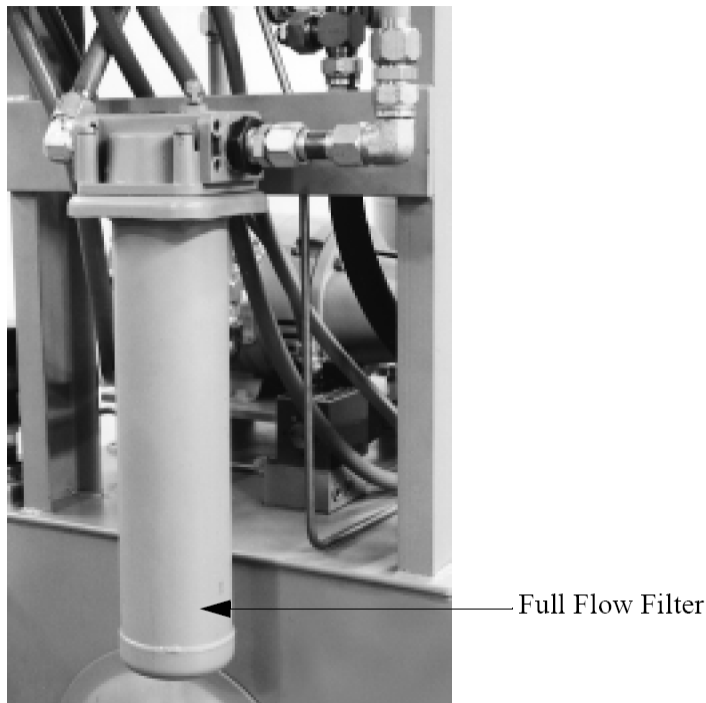


Figure 4-1. Oil Filter

IMPORTANT

The dirty filter indicator will indicate that it is time to change the filter. The filter system will start bypassing oil shortly after action of the dirty filter indicator. This bypassing action will not be a serious condition, but just a time the filter is not filtering. It should also be noted that cold and more viscous oil on start-up may cause the dirty filter indicator to trip due to viscosity rather than to dirty oil. Therefore, cleanliness should not be checked on cold unit conditions. If cold conditions are suspected as the cause for a dirty filter indication, wait until unit temperature is normal, reset the dirt indicator, and see if this clears the concern.

Sump Magnet

Along with a cleanliness test program, it is advisable to remove the permanent oil sump magnet on a semiannual basis. If particulates are found on this magnet this is another good reason to conduct your oil cleanliness test, and possibly to inspect systems further if particulates look excessive.

Sump Breather Changing

The sump air breather should be replaced when the desiccant material turns pink.

IMPORTANT

Remove the tabs from the new breather before placing it in service.

Chapter 5. Troubleshooting

Refer to Figure 5-1, Hydraulic Schematic.

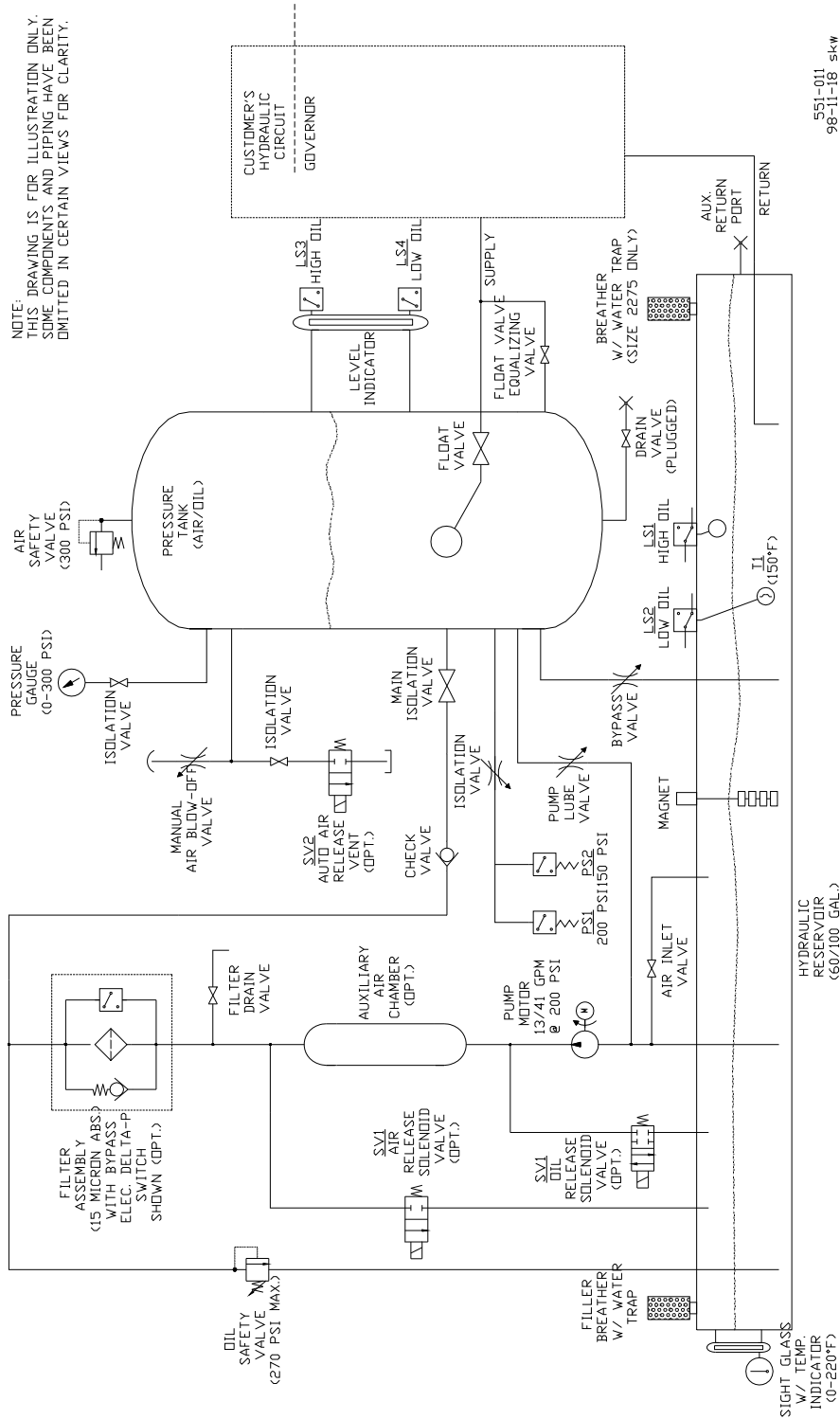
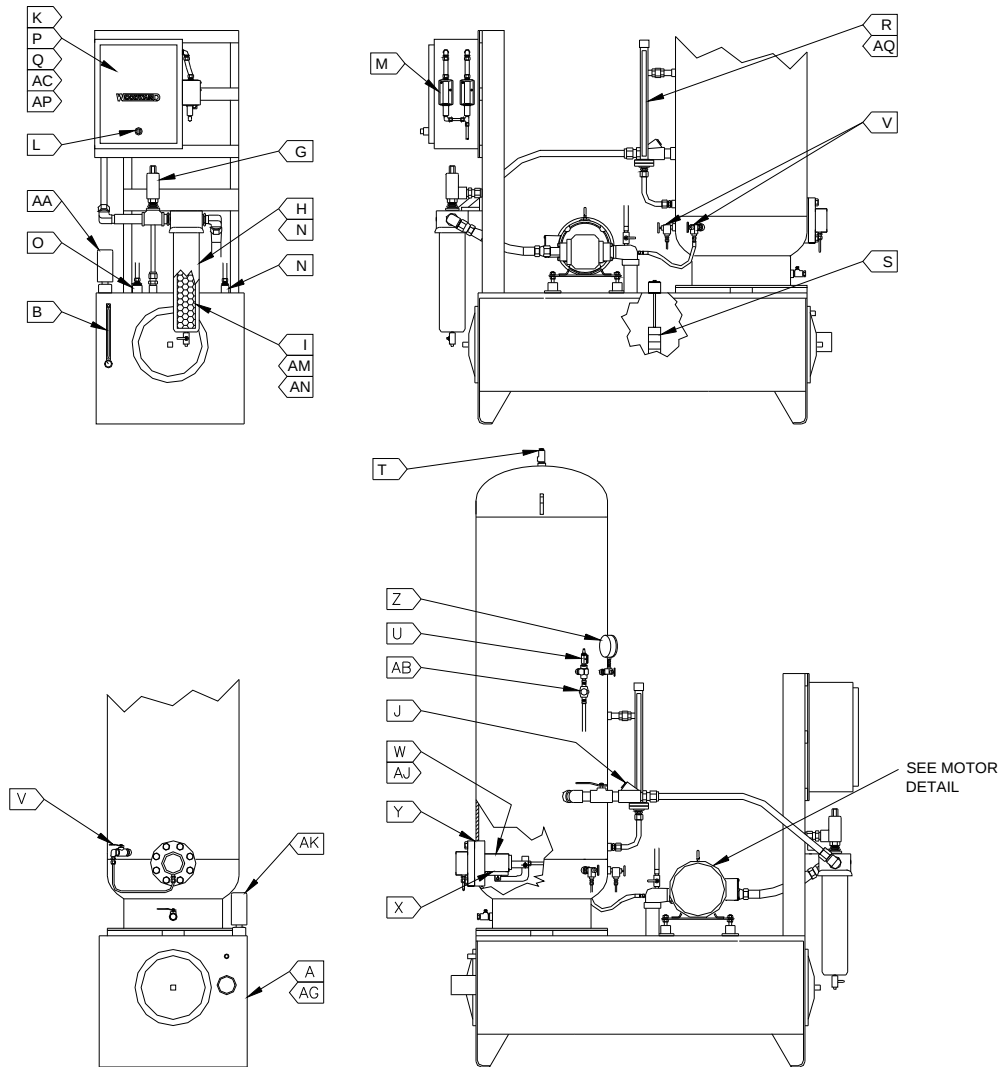


Figure 5-1. Hydraulic Schematic

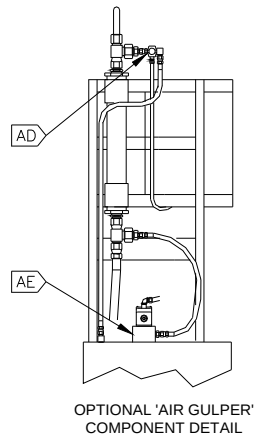
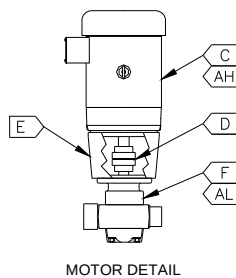
Chapter 6.

Replacement Parts Information

Refer to Figure 6-1 for parts replacement information.



MOTOR AND COMPONENT DETAIL



NOTE:
THIS DRAWING IS FOR ILLUSTRATION ONLY. SOME COMPONENTS AND PIPING
HAVE BEEN OMITTED IN CERTAIN VIEWS FOR CLARITY.

551-012a
98-11-18 skw

Figure 6-1a. Parts Arrangement

ITM	DESCRIPTION	MANUFACTURER	MFG PART NUMBER	WOODWARD PART NUMBER
A	Sump, 100 gallon (2275)	Hydrocraft	WC-100	N/A
AG	Sump, 60 gallon (2245)	Hydrocraft	WC-60-60	N/A
B	10" sump sight glass with thermometer	Hydrocraft	HSG-66-10	1723-117
AA	Air breather/filler, water trap type	Vescor	DC2-B	1325-269
C	10HP motor 1725RPM 3 phase 208-230/460 VAC (2275)	Baldor	CM3714T	1761-927
AH	5HP motor 1725RPM 3 phase 208-230/460 VAC (2245)	Baldor	CM3615T	1761-935
D	Pump/Motor coupling insert (2245/2275)	Magnaloy	M270H5	1431-589
E	Pump/Motor adapter	Reuland	N/A	N/A
AK	Air breather, threaded, water trap type (2275 only)	Vescor	DC2-1	1325-271
F	Fixed displacement gear pump, 41 GPM (2275)	Permco	P5000A086ADN22-32	1330-716
AL	Fixed displacement gear pump, 16 GPM (2245)	Permco	P3000A086ADTF10-32	1330-717
G	Oil relief valve	Kunkle	919BDEV01-JEo250	1306-319
H	Oil filter assembly w/ mech. dirt indicator & drain port	Schroeder	N/A	N/A
I	15.5 Micron Absolute Filter Element	Schroeder	K10	1327-196
AM	6.8 Micron Absolute Filter Element	Schroeder	K3	1327-194
AN	Water Removing Filter Element	Schroeder	KW	1327-157
J	Check Valve	Nibco	T-473-Y	1305-611
K	Nema 12 electrical panel	Hoffman	N/A	N/A
L	On/Off control switch	A-B	800E-2LX10	1705-359
M	Pressure switches (PS1,PS2)	A-B	836-C9A	1724-123
N	High sump level float switch (LS1)	Gems	01701	1723-189
O	Low sump level switch w/ high oil temp switch (LS2,T1)	Gems	57143	1723-191
P	230/460 to 110VAC transformer	A-B	1493-N16P	1692-647
Q	230/460 motor starter	A-B	100-A30ND3	1787-567
R	Pressure Tank Level Indicator	Gems	811868	1840-693
S	Removable magnet	Hydrocraft	HC-MT-12AS	3001-105
T	Air relief valve	Kingston	#114-2-300 set @ 300 psi	1306-177
U	Manual air blow off valve	Noshok	402FFC	1303-441
V	Oil shut off valves	Noshok	402FFAC and 402MFAC	1303-443
W	Float Valve (2275)	Woodward	5240-577	5240-577
AJ	Float Valve (2245)	Woodward	5240-583	5240-583
X	Float Valve Disc O-Ring	Woodward	1342-780	1342-780
Y	Float Valve Flange O-Ring	Woodward	1342-710	1342-710
Z	Pressure Gauge w/ shutoff valve	Noshok	40-300-600	1813-125

MOTOR AND COMPONENT DETAIL

ITM	OPTIONAL ITEMS	MANUFACTURER	MFG PART NUMBER	WOODWARD PART NUMBER
AB	Automatic air discharge valve (SV2)	ASCO	8262G1/120	1311-161
AC	Timer (0-10 sec.)	A-B	700HT12AA1	1731-829
AD	Auxiliary Air Chamber vent valve (SV1-AIR)	ASCO	8262G1/120	1311-161
AE	D05 Valve (SV1-OIL)	Bosch	9810-232-013	1312-163
AF	Oil filter with electrical dirt indicator	Schroeder	KF3-2K10-P-MS	1325-263
AP	D05 Auxiliary Relay	A-B	700-HB 33A	1730-551
AQ	LS3 (high) & LS4 (low) oil level switches	GEMS	811856	1723-517

OPTIONAL ITEMS

Automatic air discharge valve (SV2)
 Timer (0-10 sec.)
 Auxiliary Air Chamber vent valve (SV1-AIR)
 D05 Valve (SV1-OIL)
 Oil filter with electrical dirt indicator
 D05 Auxiliary Relay
 LS3 (high) & LS4 (low) oil level switches

551-012b
 98-11-18 skw

Figure 6-1b. Parts List

Chapter 7. Service Options

Product Service Options

If you are experiencing problems with the installation, or unsatisfactory performance of a Woodward product, the following options are available:

- Consult the troubleshooting guide in the manual.
- Contact the manufacturer or packager of your system.
- Contact the Woodward Full Service Distributor serving your area.
- Contact Woodward technical assistance (see “How to Contact Woodward” later in this chapter) and discuss your problem. In many cases, your problem can be resolved over the phone. If not, you can select which course of action to pursue based on the available services listed in this chapter.

OEM and Packager Support: Many Woodward controls and control devices are installed into the equipment system and programmed by an Original Equipment Manufacturer (OEM) or Equipment Packager at their factory. In some cases, the programming is password-protected by the OEM or packager, and they are the best source for product service and support. Warranty service for Woodward products shipped with an equipment system should also be handled through the OEM or Packager. Please review your equipment system documentation for details.

Woodward Business Partner Support: Woodward works with and supports a global network of independent business partners whose mission is to serve the users of Woodward controls, as described here:

- A **Full Service Distributor** has the primary responsibility for sales, service, system integration solutions, technical desk support, and aftermarket marketing of standard Woodward products within a specific geographic area and market segment.
- An **Authorized Independent Service Facility (AISF)** provides authorized service that includes repairs, repair parts, and warranty service on Woodward's behalf. Service (not new unit sales) is an AISF's primary mission.
- A **Recognized Engine Retrofitter (RER)** is an independent company that does retrofits and upgrades on reciprocating gas engines and dual-fuel conversions, and can provide the full line of Woodward systems and components for the retrofits and overhauls, emission compliance upgrades, long term service contracts, emergency repairs, etc.
- A **Recognized Turbine Retrofitter (RTR)** is an independent company that does both steam and gas turbine control retrofits and upgrades globally, and can provide the full line of Woodward systems and components for the retrofits and overhauls, long term service contracts, emergency repairs, etc.

You can locate your nearest Woodward distributor, AISF, RER, or RTR on our website at:

www.woodward.com/directory

Woodward Factory Servicing Options

The following factory options for servicing Woodward products are available through your local Full-Service Distributor or the OEM or Packager of the equipment system, based on the standard Woodward Product and Service Warranty (5-01-1205) that is in effect at the time the product is originally shipped from Woodward or a service is performed:

- Replacement/Exchange (24-hour service)
- Flat Rate Repair
- Flat Rate Remanufacture

Replacement/Exchange: Replacement/Exchange is a premium program designed for the user who is in need of immediate service. It allows you to request and receive a like-new replacement unit in minimum time (usually within 24 hours of the request), providing a suitable unit is available at the time of the request, thereby minimizing costly downtime. This is a flat-rate program and includes the full standard Woodward product warranty (Woodward Product and Service Warranty 5-01-1205).

This option allows you to call your Full-Service Distributor in the event of an unexpected outage, or in advance of a scheduled outage, to request a replacement control unit. If the unit is available at the time of the call, it can usually be shipped out within 24 hours. You replace your field control unit with the like-new replacement and return the field unit to the Full-Service Distributor.

Charges for the Replacement/Exchange service are based on a flat rate plus shipping expenses. You are invoiced the flat rate replacement/exchange charge plus a core charge at the time the replacement unit is shipped. If the core (field unit) is returned within 60 days, a credit for the core charge will be issued.

Flat Rate Repair: Flat Rate Repair is available for the majority of standard products in the field. This program offers you repair service for your products with the advantage of knowing in advance what the cost will be. All repair work carries the standard Woodward service warranty (Woodward Product and Service Warranty 5-01-1205) on replaced parts and labor.

Flat Rate Remanufacture: Flat Rate Remanufacture is very similar to the Flat Rate Repair option with the exception that the unit will be returned to you in “like-new” condition and carry with it the full standard Woodward product warranty (Woodward Product and Service Warranty 5-01-1205). This option is applicable to mechanical products only.

Returning Equipment for Repair

If a control (or any part of an electronic control) is to be returned for repair, please contact your Full-Service Distributor in advance to obtain Return Authorization and shipping instructions.

When shipping the item(s), attach a tag with the following information:

- return authorization number;
- name and location where the control is installed;
- name and phone number of contact person;
- complete Woodward part number(s) and serial number(s);
- description of the problem;
- instructions describing the desired type of repair.

Packing a Control

Use the following materials when returning a complete control:

- protective caps on any connectors;
- antistatic protective bags on all electronic modules;
- packing materials that will not damage the surface of the unit;
- at least 100 mm (4 inches) of tightly packed, industry-approved packing material;
- a packing carton with double walls;
- a strong tape around the outside of the carton for increased strength.

NOTICE

To prevent damage to electronic components caused by improper handling, read and observe the precautions in Woodward manual 82715, *Guide for Handling and Protection of Electronic Controls, Printed Circuit Boards, and Modules*.

Replacement Parts

When ordering replacement parts for controls, include the following information:

- the part number(s) (XXXX-XXXX) that is on the enclosure nameplate;
- the unit serial number, which is also on the nameplate.

Engineering Services

Woodward offers various Engineering Services for our products. For these services, you can contact us by telephone, by email, or through the Woodward website.

- Technical Support
- Product Training
- Field Service

Technical Support is available from your equipment system supplier, your local Full-Service Distributor, or from many of Woodward's worldwide locations, depending upon the product and application. This service can assist you with technical questions or problem solving during the normal business hours of the Woodward location you contact. Emergency assistance is also available during non-business hours by phoning Woodward and stating the urgency of your problem.

Product Training is available as standard classes at many of our worldwide locations. We also offer customized classes, which can be tailored to your needs and can be held at one of our locations or at your site. This training, conducted by experienced personnel, will assure that you will be able to maintain system reliability and availability.

Field Service engineering on-site support is available, depending on the product and location, from many of our worldwide locations or from one of our Full-Service Distributors. The field engineers are experienced both on Woodward products as well as on much of the non-Woodward equipment with which our products interface.

For information on these services, please contact us via telephone, email us, or use our website: www.woodward.com.

How to Contact Woodward

For assistance, call one of the following Woodward facilities to obtain the address and phone number of the facility nearest your location where you will be able to get information and service.

Electrical Power Systems

<u>Facility</u>	<u>Phone Number</u>
Brazil	+55 (19) 3708 4800
China	+86 (512) 6762 6727
Germany	+49 (0) 21 52 14 51
India	+91 (129) 4097100
Japan	+81 (43) 213-2191
Korea	+82 (51) 636-7080
Poland	+48 12 295 13 00
United States	+1 (970) 482-5811

Engine Systems

<u>Facility</u>	<u>Phone Number</u>
Brazil	+55 (19) 3708 4800
China	+86 (512) 6762 6727
Germany	+49 (711) 78954-510
India	+91 (129) 4097100
Japan	+81 (43) 213-2191
Korea	+82 (51) 636-7080
The Netherlands	+31 (23) 5661111
United States	+1 (970) 482-5811

Turbine Systems

<u>Facility</u>	<u>Phone Number</u>
Brazil	+55 (19) 3708 4800
China	+86 (512) 6762 6727
India	+91 (129) 4097100
Japan	+81 (43) 213-2191
Korea	+82 (51) 636-7080
The Netherlands	+31 (23) 5661111
Poland	+48 12 295 13 00
United States	+1 (970) 482-5811

You can also locate your nearest Woodward distributor or service facility on our website at:

www.woodward.com/directory

Technical Assistance

If you need to telephone for technical assistance, you will need to provide the following information. Please write it down here before phoning:

Your Name	_____
Site Location	_____
Phone Number	_____
Fax Number	_____
Engine/Turbine Model Number	_____
Manufacturer	_____
Number of Cylinders (if applicable)	_____
Type of Fuel (gas, gaseous, steam, etc)	_____
Rating	_____
Application	_____
Control/Governor #1	
Woodward Part Number & Rev. Letter	_____
Control Description or Governor Type	_____
Serial Number	_____
Control/Governor #2	
Woodward Part Number & Rev. Letter	_____
Control Description or Governor Type	_____
Serial Number	_____
Control/Governor #3	
Woodward Part Number & Rev. Letter	_____
Control Description or Governor Type	_____
Serial Number	_____

If you have an electronic or programmable control, please have the adjustment setting positions or the menu settings written down and with you at the time of the call.

We appreciate your comments about the content of our publications.

Send comments to: icinfo@woodward.com

Please reference publication 55110.



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as well as authorized distributors and other authorized service and sales facilities throughout the world.**

Complete address / phone / fax / email information for all locations is available on our website.