WOODWARD

Product Manual 36054
(Revision NEW)
Original Instructions

Dual Buffer System for PG-200/300/500 Governors

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.

Revisions

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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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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.

Dual Buffer System for PG-200/300/500 Governors

Introduction

A dual buffer system, used with PGA 200/300 and PGA 500 governors in applications controlling long-stroke marine-propulsion engines, provides standard dynamics at low fuel (low speed) operation and preloaded buffer springs and stiffer dynamics at high fuel operation.

Long-stroke marine propulsion engines present severe engine torsional oscillations in speed at high load levels. This condition requires the use of preloaded buffer springs to provide stable governor control. These engines are designed to operate over a wide range of speeds and at all but the high load levels control well with standard dynamics achieved with normal buffer springs.

The dual-buffer system improves the performance of the governor system on these engines by switching dynamics according to the fuel levels. At the high fuel level, the preloaded buffer springs reduce jiggle due to torsional oscillations. At the low fuel level, the standard buffer springs provide the responsive governor operation that assures maximum performance of the engine. (The governor responds quicker to observed speed changes with standard dynamics than it does with preloaded buffer springs.)

Selection of the operating dynamics is determined by the position of a fuel-position-sensing pilot-valve plunger. This plunger follows the position of the main power cylinder and directs power-cylinder oil to the bottom of a shuttle pilot valve when the governor is in a high-fuel position. The shuttle valve determines which dynamics are operational at any given time.

References

Installation of the dual buffer governor is identical to the installation of governors with simple dynamics. Refer to manual 36618 for PG-200/300 governor installation, and to manual 36633 for PG-500 installation. PGA manual 36604 should be used for all installation and setup of the control portion of the governor except for the adjustment of dynamics, which is provided in this manual.

Additional information on the preloaded buffer springs is included in manual 36680. The buffer springs are adjusted at the factory and should not need to be changed. The only field adjustments which should be made are to the two needle valves and to the dynamics switch-point adjustment.

Construction

Figures 1a and 1b show the location of the dual buffer devices on the PGA governors.

Notice the location of the high-fuel needle valve at the bottom of the dual buffer system and the low-fuel needle valve at the top of the system. The original compensation needle valve, located near the terminal shaft indicator, must be completely closed when the dual buffer system is present.

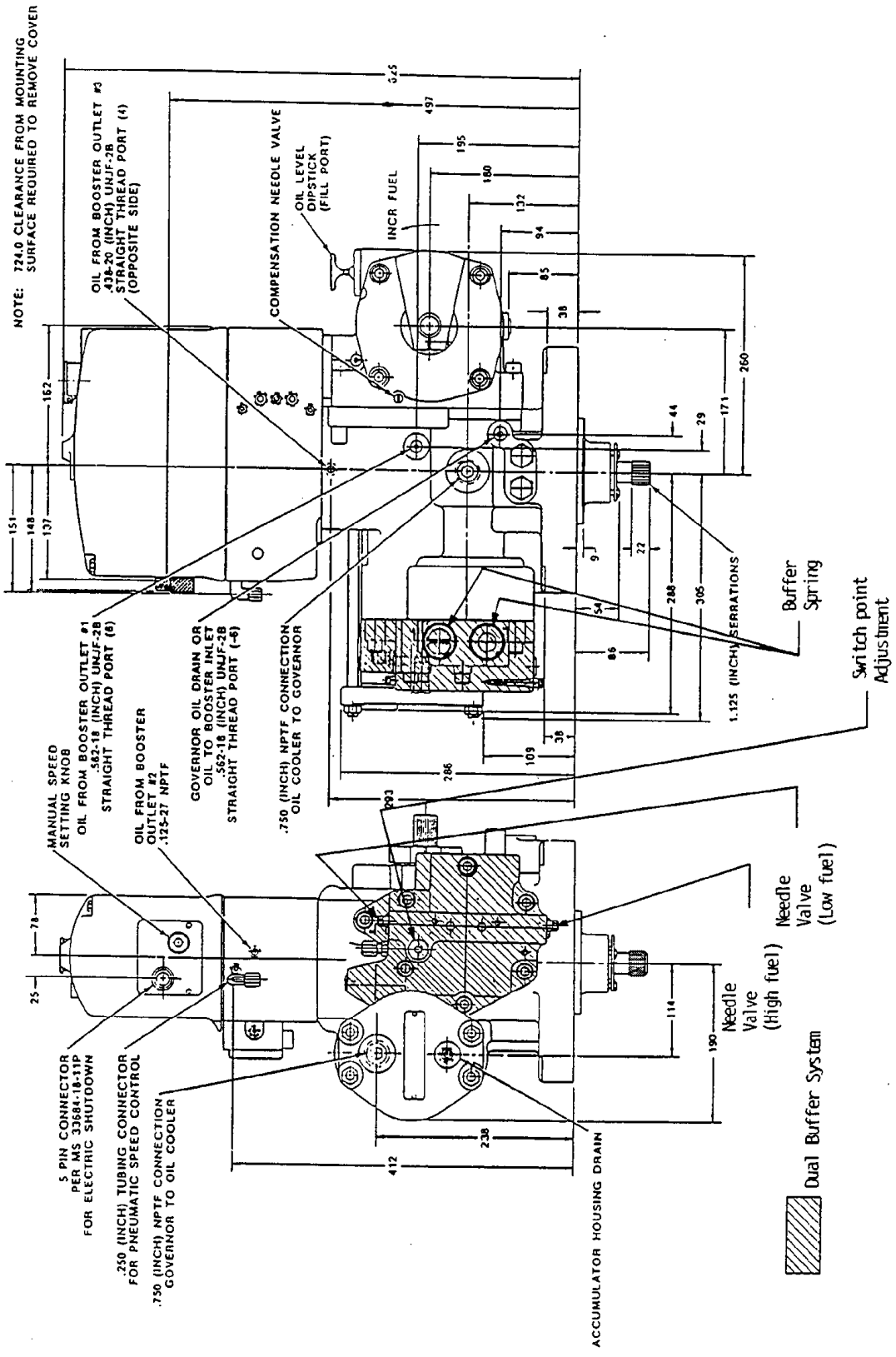

Figure 1a. PGA 200/300 with Dual Buffer System

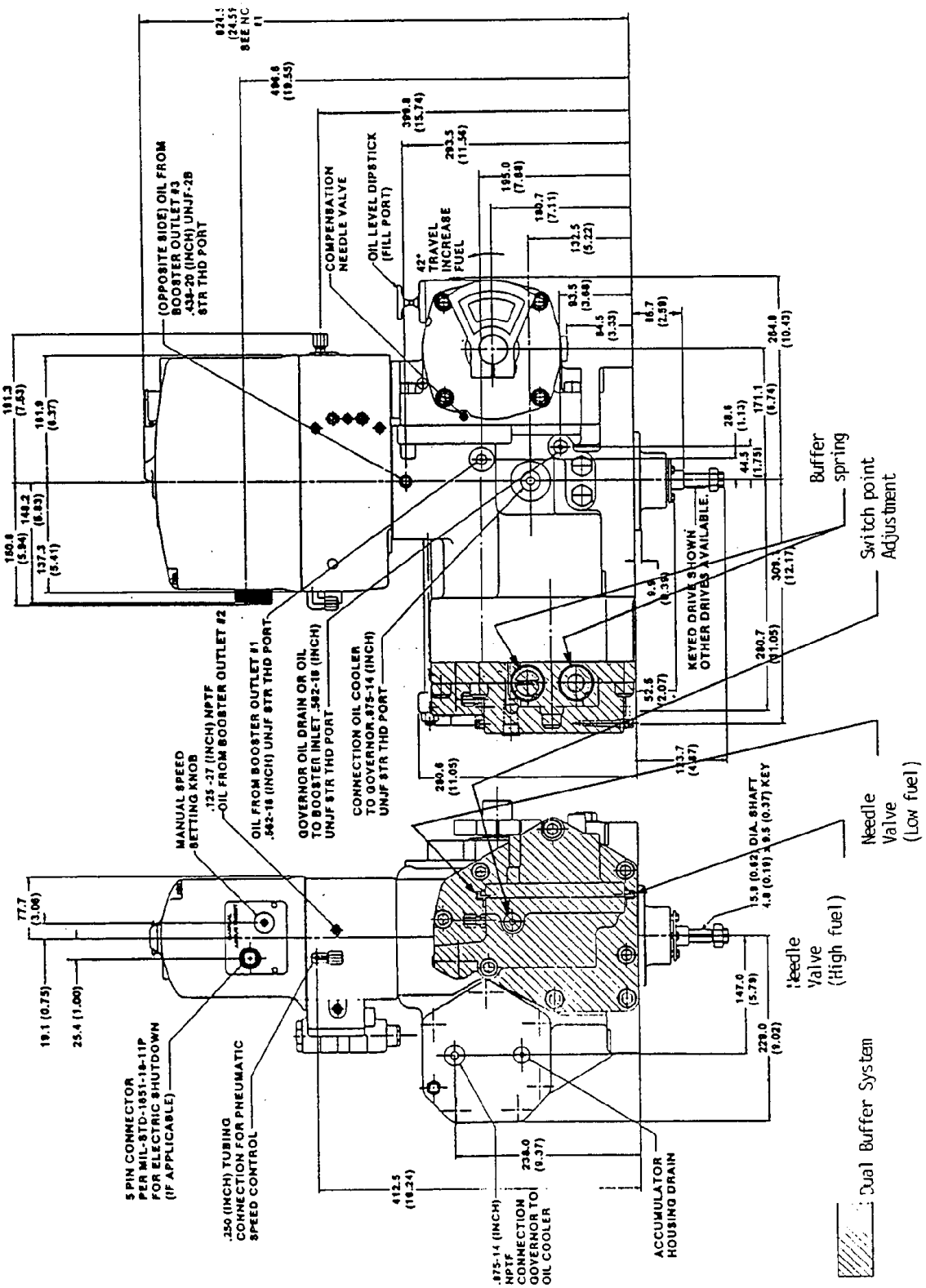

Figure 1b. PGA 500 with Dual Buffer System

Figure 2 shows the construction of a PG 200/300 dual buffer system. The PG-500 system is similar to the system shown, although a few of the parts are not interchangeable. The reference numbers will provide correct parts for the system specified.

The upper buffer system is for the low-fuel area. The lower buffer system is for the high-fuel area. Each buffer system has a needle-valve adjustment. The shuttle-valve plunger switches the buffer-system operation. When the plunger is positioned at the top of its stroke, the lower buffer system (for the high-fuel area) operates. The upper buffer system (for low-fuel area) operates when the plunger is in the lower position. The fuel-piston sensing piston switches the shuttle-valve plunger position.

Parts List for Figure 2

Ref. No.	Part Name	Quantity
36054-1	Fitting, St. Thread	1
36054-2	O-ring, 0.351 ID	3
36054-3	Screw, 0.500-13 x 2”	4
	Screw, 0.625-11 x 2.250 (for PG-500)	6
36054-4	Lockwasher	AR
36054-5	Screw, 0.500-13	2
	Screw, 0.625-11 x 0.500 for PG-500)	2
36054-6	Lockwasher	AR
36054-7	Housing. Dual Buffer	5
36054-8	Plug, 0.438-20	2
36054-9	O-ring, 0.644 ID x 0.087	3
36054-10	Plug, 0.750-16	3
36054-11	Screw. Passage	1
36054-12	Plunger Assembly	1
36054-13	Gasket. Servo Cover	1
	PG-500 uses 7.987 O-ring	1
36054-14	Needle Valve Screw	2
36054-15	O-ring, 0.301 ID	2
36054-16	Spring. Dual Buffer PV	1
36054-17	Buffer Spring	2
36054-18	O-ring, 1.296 ID	2
36054-19	Plug. Butter Bore	1
36054-20	Ring, Int. Retaining	2
36054-21	Piston, Buffer	1
36054-22	Seat. Buffer Spring	1
36054-23	Ring, Wire Retaining	1
36054-24	Plug. Buffer	1
36054-25	Washer, Flat Ns. 10	1
36054-26	Nut 10-32	1
36054-27	Cover, PG Dual Buffer	1
36054-28	Spacer	1
36054-29	O-ring, 0.208 ID	1
36054-30	Screw, Buffer Preload	2
36054-31	Piston, Buffer	1
36054-32	Cup-Buffer Spring	2
36054-33	Buffer Spring	2
36054-34	Screw. Buffer Preload	2
36054-35	Seat	2
36054-36	Nut 0.312-24 Jam	1
36054-37	Cup. Buffer	2
36054-38	O-ring, 1.239 ID	2
36054-39	Connector, Buffer Oil	1
36054-40	O-ring, 1.296 ID	2
36054-41	Connector, Buffer Oil	1

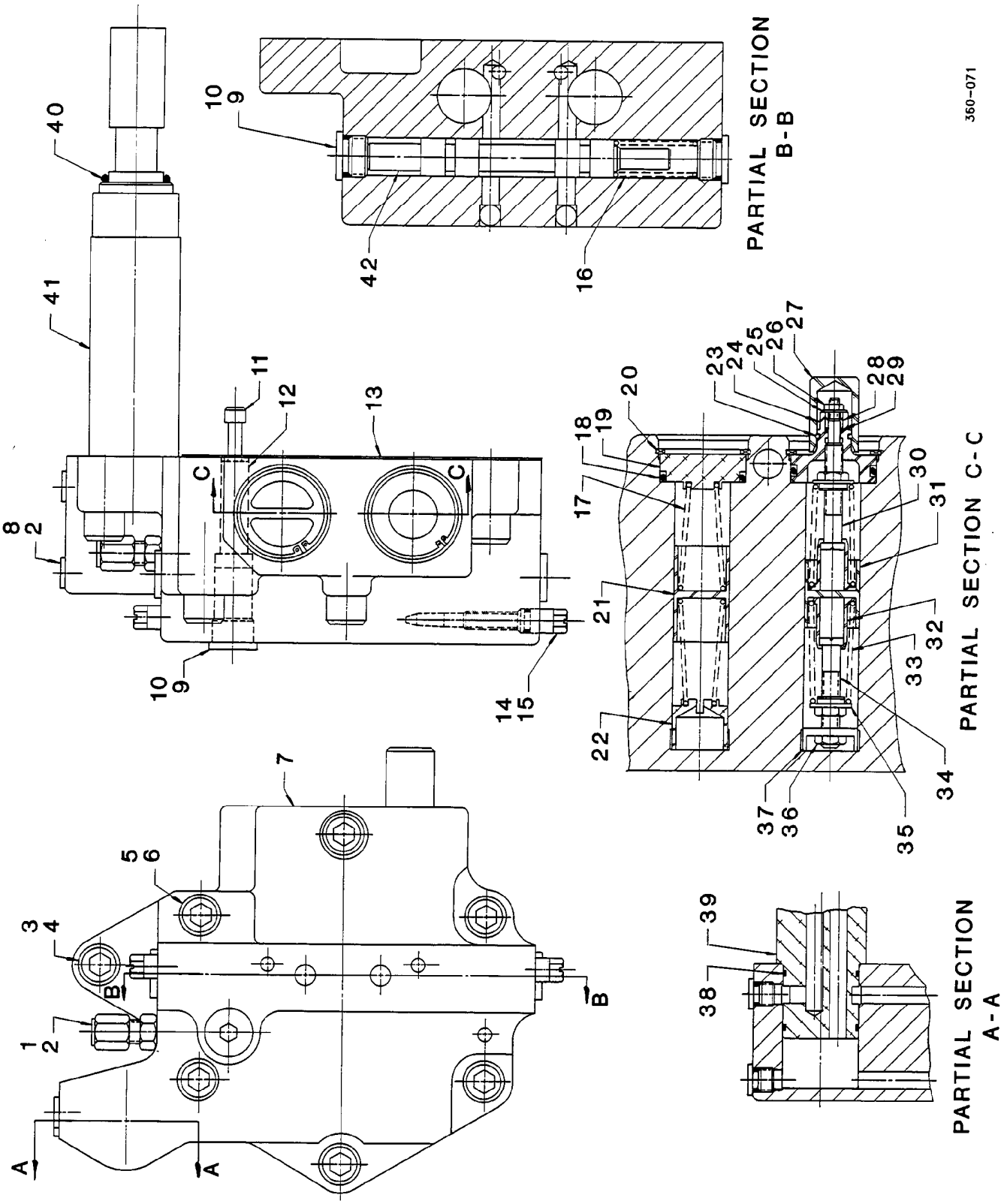

Figure 2. Layout of PG-200/300 Dual Buffer

Operation

Figures 3a and 3b are schematic diagrams of the dual-buffer system in a PGA-200/300 or PGA-500 governor.

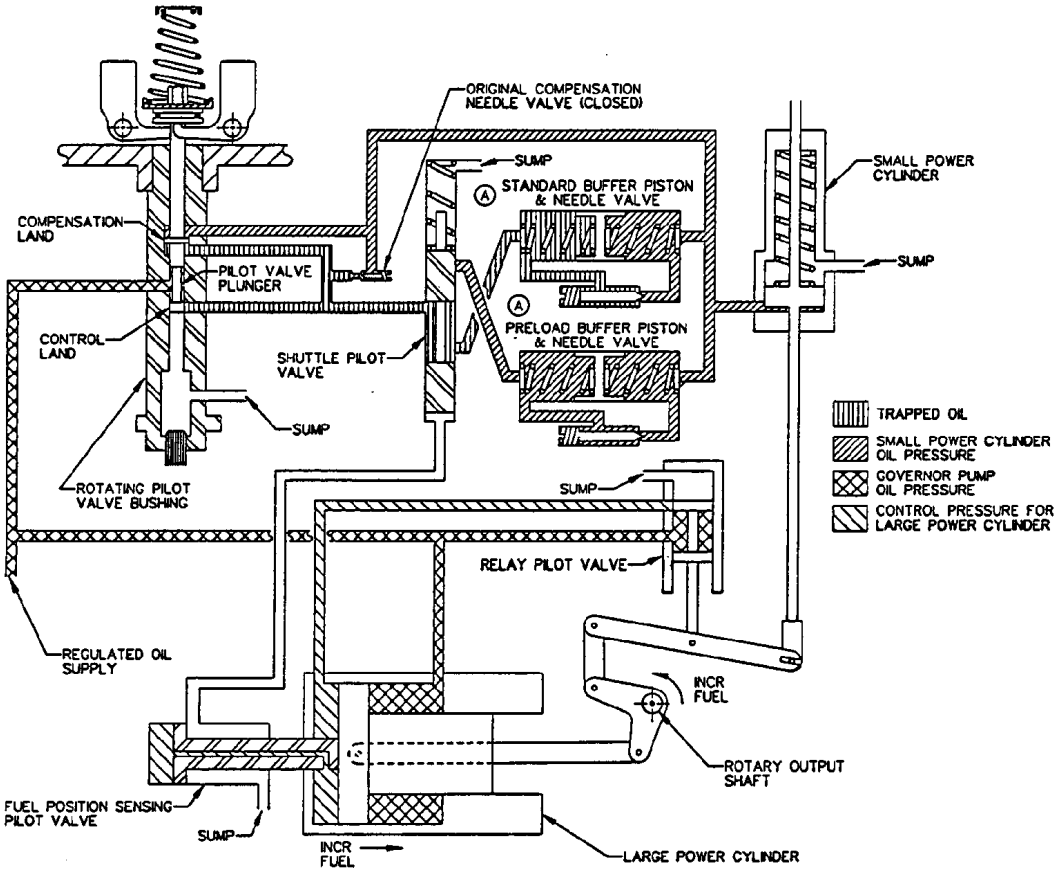

Figure 3a. Low Fuel Position Mode Using Standard Buffer

In Figure 3a, the large power piston is in the low-fuel position, and the shuttle pilot valve directs oil between the pilot-valve plunger and the standard buffer-spring system. Oil for the preloaded buffer-spring system is blocked. The shuttle pilot valve plunger is held in its lower position by a spring. Oil at the bottom of the plunger is released to sump through the fuel-position-sensing pilot valve.

When the large power piston moves toward high fuel (Figure 3b), the fuel-position-sensing pilot-valve piston moves in the same direction. When the head of the sensing piston passes beyond the port which leads to the bottom of the shuttle pilot-valve plunger, high-pressure oil from the large power cylinder forces the shuttle plunger upwards. The lower (preloaded) buffer system operates, and the upper (standard) buffer system is rendered inoperative.

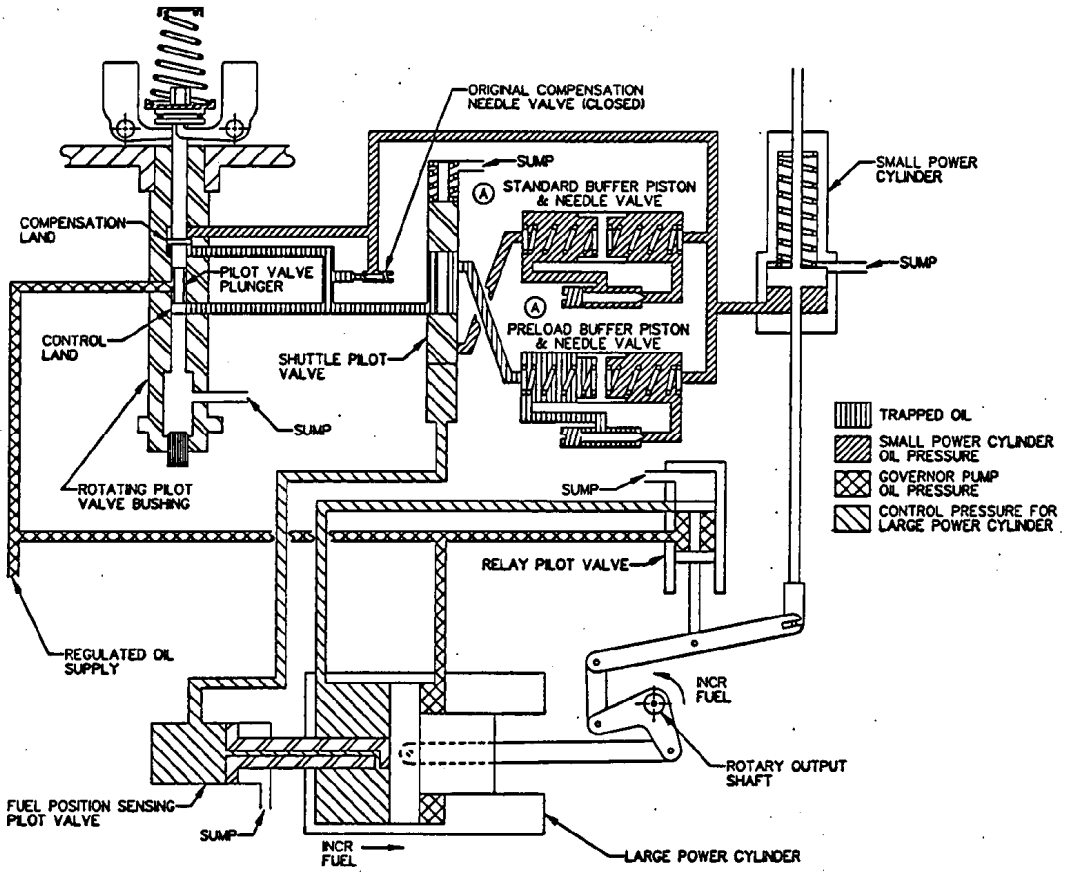

Figure 3b. High Fuel Position Mode Using Preloaded Buffer

Adjustments

Needle Valve Adjustment

NOTICE **The original compensation needle valve must be closed at all times.**

The two-buffer system has low-sensitivity needle valves for both the standard dynamics and the preloaded dynamics. One turn open of this valve nearly equals 1/8 turn open of the standard needle valve.

Each needle valve must be adjusted separately for optimum performance of the engine-governor. Adjust the upper needle for stable engine operation and maximum engine response. Adjust the lower needle valve for stable operation under full load.

Switch Point Adjustment

The switch point can be changed by changing the total length of the fuel-position sensing pilot valve. The relation between the switch point and the length is shown in Figure 4.

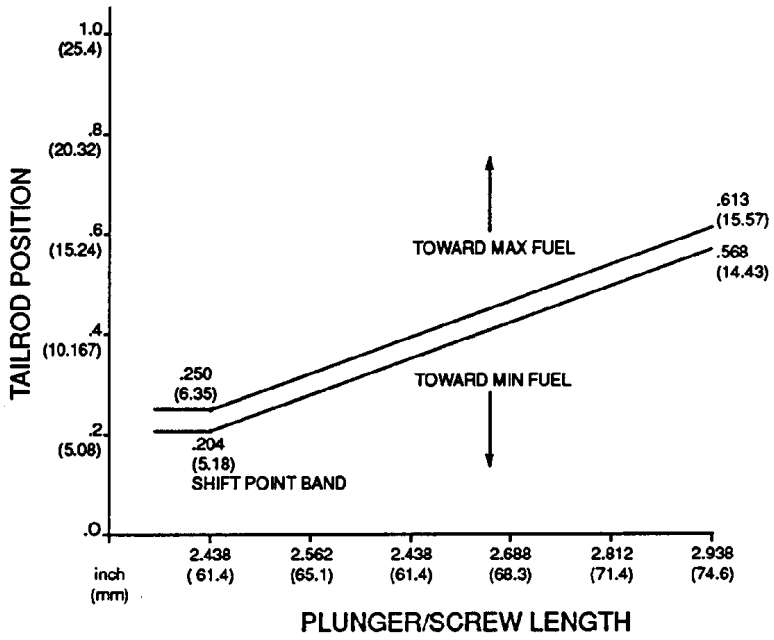

Figure 4. Dual Buffer Switch Point Adjustment PG-200/300/500

IMPORTANT **The engine must be stopped to change the switch point.**

To take out the piston, remove the plug for the plunger/passage screw assembly. After taking out the piston, adjust the passage screw to get a proper length. Making the plunger/screw longer will move the switch point away from minimum fuel.

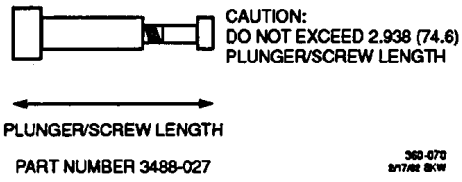

Figure 5. Plunger/Passage Screw

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