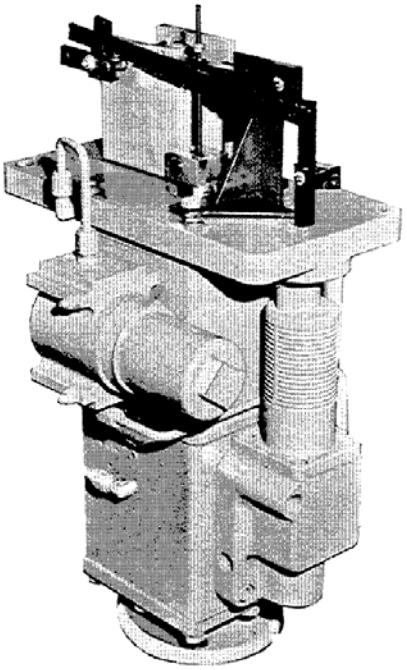
WOODWARD

Product Manual 36623
(Revision A)
Original Instructions



PG Dial Governor
Back Pressure Controller

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

This publication may have been revised or updated since this copy was produced. To verify that you have the latest revision, check manual *26311* , *Revision Status & Distribution Restrictions of Woodward Technical Publications*, on the *publications page* of the Woodward website:

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Proper Use

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.

Translated Publications

If the cover of this publication states "Translation of the Original Instructions" please note:

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 Out-of-date translations are marked with ⚠.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.

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.

PG Dial Governor
Back Pressure Controller

General Information

References

Manual 36600, PG Governor Basic Elements
Manual 36614, PG Governor Dial Type Speed Setting
Manual 89013, Hydraulic Amplifier (Pressure Input)

Controller Description

The back pressure control is a position setting device proportional to air pressure. It can be used with an outside pneumatic controller (which is not supplied by Woodward) that senses exhaust back pressure or similar parameters.

It is a force balance system that includes:
- bellows assembly
- pilot valve plunger assembly (for hydraulic positioning)
- positioning servo
- terminal lever assembly
- restoring linkage

The PG Dial governor with back pressure control is designed and set to:
- position the steam valve at maximum with a minimum pneumatic control signal pressure
- position the steam valve at minimum with a maximum pneumatic control signal pressure

Turbine speed at these conditions will be determined by linkage configurations and inlet steam conditions.

This means the governor will only “speed limit” at the set point of the PG Dial Governor speed setting. It only acts as a control positioner (no speed sensing) when controlling with pneumatic signal pressure.

Controller Operation

The input signal to the pneumatic control is directed to a bellows assembly (1) which senses changes in the signal air pressure. Pilot valve plunger (2) is connected to the bellows. A change in signal pressure to the bellows moves pilot valve plunger (2). This movement causes a change in the controller terminal shaft (17) position.

The pilot valve plunger (2) controls the flow of oil to and from the area below positioning servo piston (4). If pilot valve plunger (2) is raised to open the control port in pilot valve bushing (10), oil is drained to the governor sump from the bottom of servo piston (4). Oil then flows to the top of positioning servo piston (4) and pushes the servo piston down. This causes a clockwise rotation of lever assembly (5) and output lever (6). One end of the restoring lever (7) rides on the output lever ball bearing (8). The other end of the restoring lever is connected to tailrod link (11).

Restoring lever (7) is connected to the pivot link (16). Shutdown rod (9) runs through the pivot link and is connected to pilot valve plunger (12). The clockwise motion of lever arm (5) raises the pilot valve plunger allowing power piston control oil to return to sump, a reduction in flyweight centrifugal force, and a decrease in speeder spring (14) compression.

With constant air signal to the bellows assembly (1) the force put on the pilot valve plunger (2) by the air signal is offset by the force of bellows spring (3) on the bellows housing.

Consider the result of increasing the signal pressure. The pressure expands the bellows assembly (1) raising pilot valve plunger (2). Positioning servo piston assembly (4) moves down as oil from the positioning servo flows to the governor sump. Positioning servo piston assembly (4) is connected to one end of lever assembly (5) which pivots on the upper spring seat. Lowering the positioning servo piston assembly (4) results in a clockwise motion of output lever (6) which is attached to lever assembly (5). The motion of the output lever (6) is transferred to restoring lever (7) at the point of contact with output lever ball bearing (8). The result is the restoring lever (7) is moved up. This movement is transferred to the pivot link (16) by a pin connection. Raising the pivot link results in the raising of the pilot valve plunger through the pivot link and plunger connection with shut down rod (9). The raising of pilot valve plunger (2) causes the power piston (13) to go to minimum. The tailrod link (11) connected to power piston (13) moves down permitting the restoring lever (7) to drop shutdown rod (9). This permits the governor pilot valve plunger (12) to re-center.

Decreasing the signal pressure produces the same sequence of movements as explained above, but in the opposite direction.

Test Procedure

Introduction

1. Place the governor on the test stand and drive it in the normal manner. Use 10W-30 oil at 160 to 180 °F (71 to 82 °C).

2. With top cover removed make a connection between the link connected to the governor servo tailrod and the test stand speed control system. For governor with output rod, connect to test stand in normal manner.

3. From a source capable of supplying 0 to 50 psi (0 to 345 kPa) control air pressure, make a connection to the bellows in the pressure controller. Do not exceed 50 psi (345 kPa).

4. Put dial indicators on both governor power piston and controller power piston.

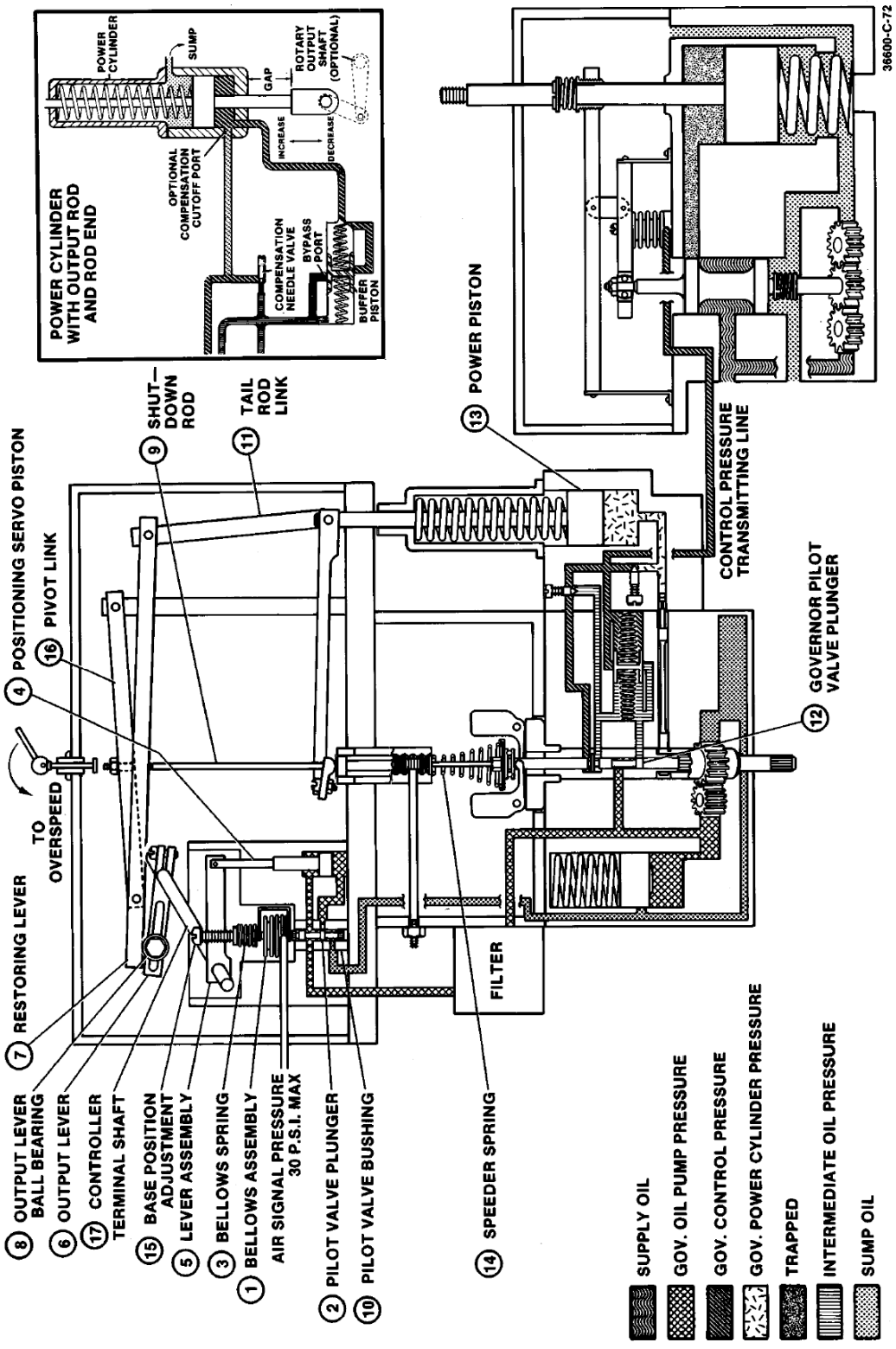

Figure 1. Schematic of Back Pressure Controller for the PG Dial Governor

Test Procedure

For Pressure Output Power Cylinder or Output Rod with Rod End:

1. With control air pressure at zero and the shutdown nuts clear of the pivot link, run the governor at about 1000 rpm. Check the governor power cylinder output pressure. If pressure is not per TSP specifications, disassemble power cylinder and change amount of shim (0.020" = 1 psi approximately []).

2. With same conditions as above, set the speed droop for the amount required or for 50 rpm (±5) rise above 1000 rpm for 10–60 psi (69–414 kPa) power cylinder pressure change.

3. Set the dial stops for LOW and HIGH rpm with the power cylinder pressure at 55 psi (379 kPa).

4. Adjust the base position adjustment screw in the controller to set the positioning servo piston down 0.008 to 0.012 inch (0.20 to 0.30 mm) from the top at zero psi. Apply air to the pressure controller.

   Check for full stroke of the positioning servo piston. Do not exceed 50 psi (345 kPa). Approximately 45 psi (310 kPa) should be required.

5. Adjust output lever of controller so that the restoring lever clears the terminal shaft of the controller when its piston is at the top of its stroke.

6. Disconnect governor from test stand feedback linkage. Run stand manually, increase speed, and hold between 800 and 900 rpm.

7. Bring control pressure to 4.5 psi (31 kPa). Adjust the shutdown nuts down until the governor power cylinder pressure moves to 60 psi (414 kPa) travel or needed maximum stroke.

8. Bring control pressure to 30 psi (207 kPa).

   (Governor power cylinder pressure should be 37–39 psi/255–269 kPa) or given position.

   a. If the power cylinder pressure is above 39 psi (269 kPa), or servo position is high, move the roller left.

   b. If the power cylinder pressure is below 37 psi (255 kPa), or servo position is low, move the roller right.

9. Replace cover. Adjust stand speed to 1200 rpm. Adjust the overspeed test device to give 40 psi (276 kPa) power cylinder pressure. With the overspeed test device in overspeed test condition, lower stand speed until power cylinder pressure goes to 60 psi (414 kPa). Slowly raise speed until power cylinder pressure is again 40 psi (276 kPa). Record speed (for pressure output governor only). Power cylinder pressure must return to zero psi when overspeed test device is placed back into the normal run position.

10. Set the compensation needle valve 1/2 turn open.

11. Set the anticipation needle valve 1 turn open (for pressure output governor only).

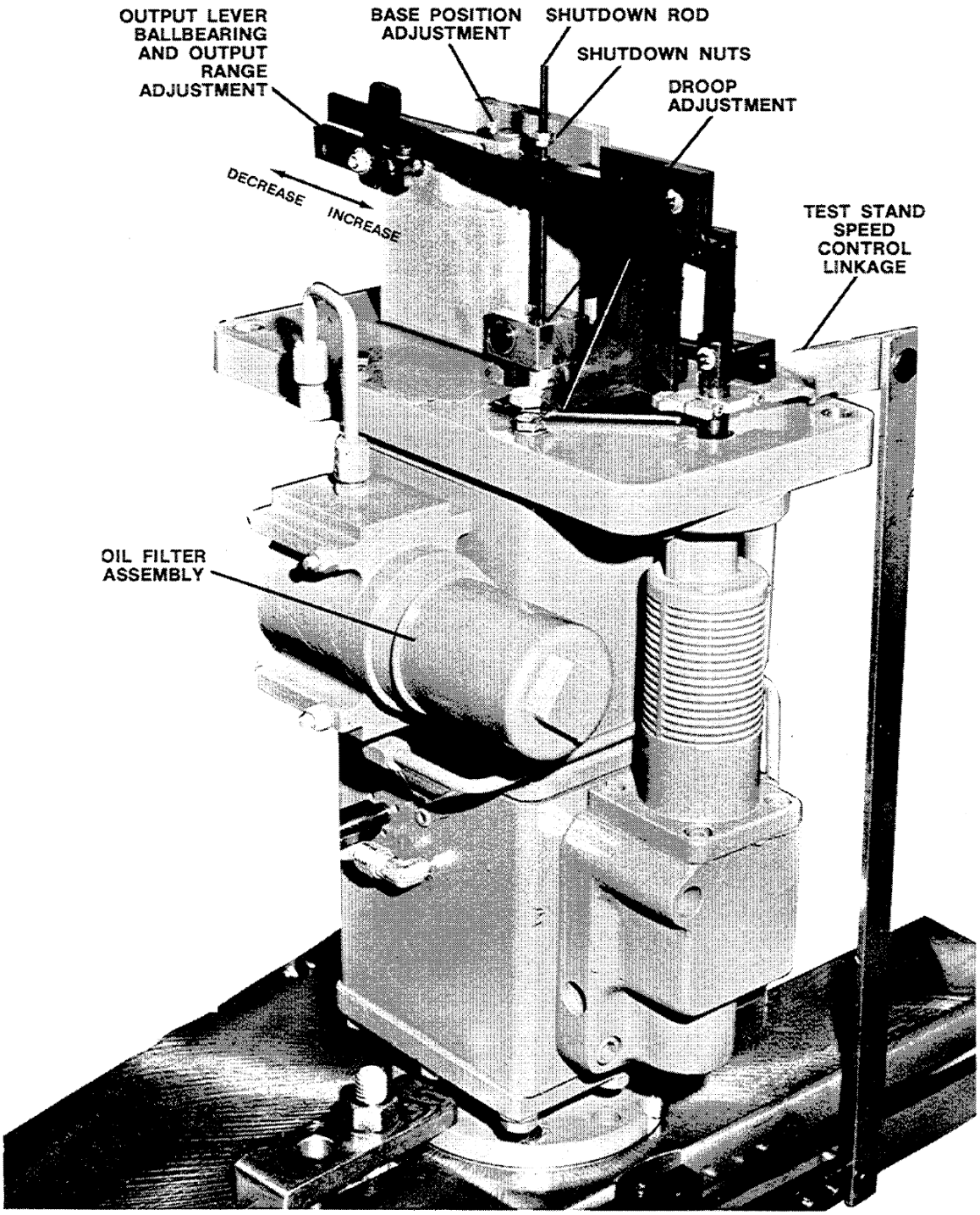

Figure 2. PG Dial Governor with Back Pressure Controller

Replacement Parts

When ordering parts, it is necessary to include the following information:

- Serial number and part number shown on nameplate

10 µm filter element conforms to AN 6235-4A (not supplied by Woodward).

Parts Lists For Figures 3 and 4

Ref. No.	Part Name	Quantity
36623-1	Connecting Link	1
36623-2	Servo Piston	1
36623-3	Spring	1
36623-4	Bellows Assembly	1
36623-5	Bellows Clamp	1
36623-6	Gasket	1
36623-7	Packing 0.551 ID Preformed	1
36623-8	PV Bushing	1
36623-9	PV Plunger Assembly	1
36623-10	Packing 0.239 ID Preformed	1
36623-11	Connector 125 Straight Thread	1
36623-12	Spring Seat	1
36623-13	Compression Spring	1
36623-14	Shoulder Bushing	1
36623-15	Retaining Clip	1
36623-16	Washer	2
36623-17	Screw 10-24 x 0.825	1
36623-18	Case – Assembly	1
36623-19	P.V. Link	1
36623-20	Link Assembly - Back Pressure Adj.	1
36623-21	Needle Bearing	1
36623-22	Upper Spring Seat	1
36623-23	Terminal Lever Assembly	1
36623-24	Screw 10-24 x .375 Rd. Head	1
36623-25	Washer	2
36623-26	Plug - 0.250 Soc. Hd. Pipe	2
36623-27	Terminal Lever Assembly	1
36623-28	Screw 6-32 x 0.375	1
36623-29	Shim – Compensation	4
36623-30	Spirol Pin	1
36623-31	L.H. Terminal Shaft	1
36623-32	Connector Plate Assembly	1
36623-33	Nut 8-32 Hex	2
36623-34	Washer	1
36623-35	Pin	1
36623-36	Pivot Link	1
36623-37	Tailrod Link	1
36623-38	Tailrod Block Assembly	1
36623-39	Seal	1
36623-40	Ball Bearing	1
36623-41	Washer	2
36623-42	Nut 10-32 Elastic	1
36623-43	Screw 10-32 x 0.812	1
36623-44	Lever Guide	1
36623-45	Washer	1
36623-46	Output Lever	1
36623-47	Washer	1
36623-48	High Shock Bracket Assembly	1
36623-49	Restoring Lever Assembly	1
36623-50	Spacer	7
36623-51	Washer	1

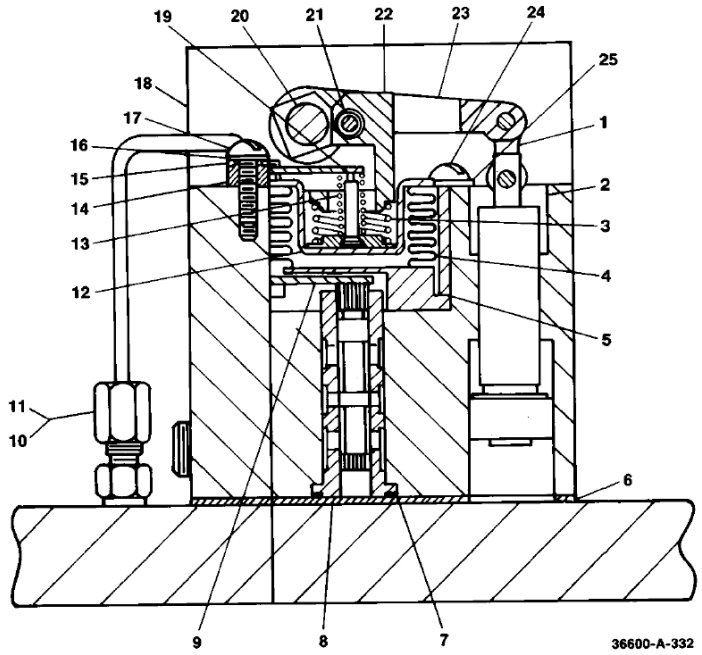

Figure 3. Parts for the Back Pressure Controller

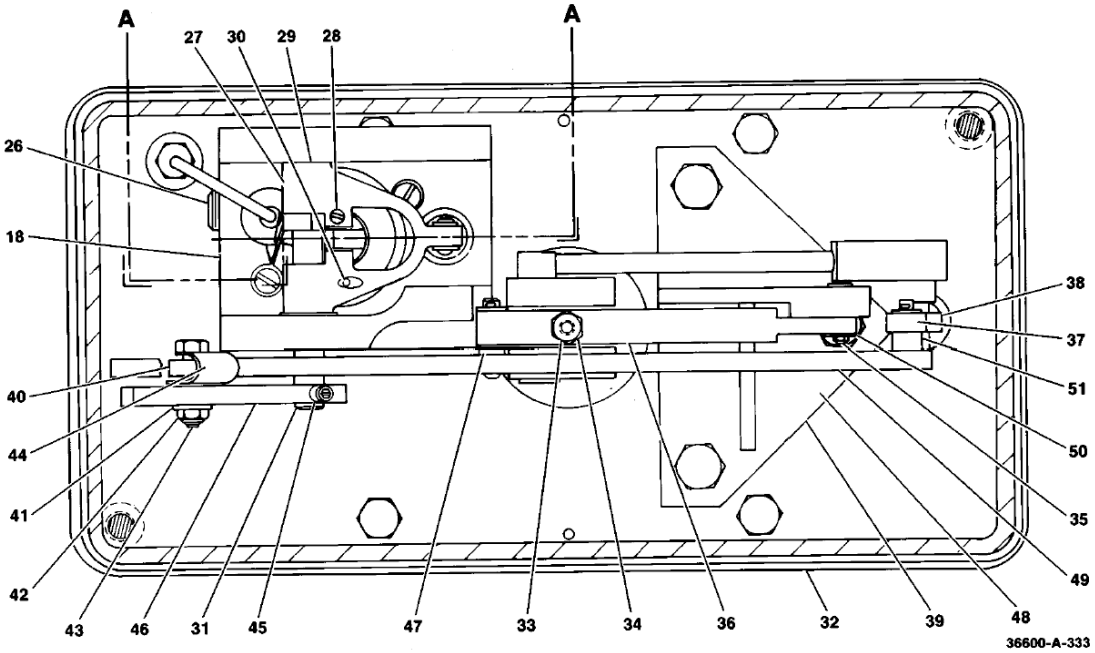

Figure 4. Parts for the Back Pressure Controller

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Send comments to: icinfo@woodward.com

Please reference publication 36623A.

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