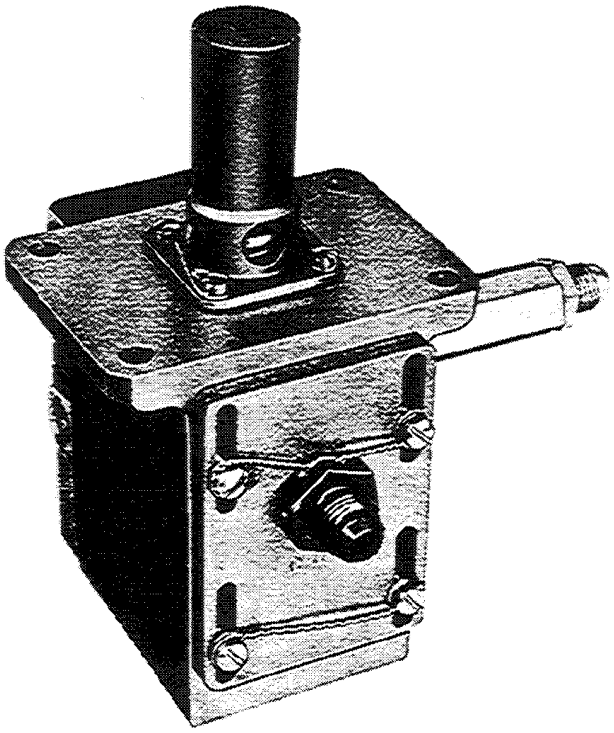
WOODWARD

Product Manual 45005
(Revision C)
Original Instructions



CDP Sensor Assembly (Temperature Biased)

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 Out-of-date translations are marked with ⚠.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

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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

Introduction

This manual provides description, operation, overhaul and replacement parts information for the Compressor Discharge Pressure (CDP) Sensor Assembly. In non-airborne turbines of the split-shaft type, the CDP sensor assembly, used in conjunction with a fuel limiter, schedules acceleration fuel flow as a function of compressor discharge pressure and compressor inlet temperature (CIT). Through a bleed valve, downstream of an orifice, the sensor assembly regulates signal pressure to the acceleration limiter.

Specifications

The description, requirements, and capabilities of a CDP sensor assembly vary with application. Obtain specifications for the particular assembly from Woodward. Give the exact type of assembly, the serial number, and the part number shown on the nameplate. Typical specifications are shown below.

Air Signal

Compressor Discharge Air Pressure	0 to 230 psig (0 to 1586 kPa)
Discharge Air Temperature	0 to 300 °F (–18 to +149 °C)
Compressor Inlet Air Temperature	–65 to +130 °F (–54 to +54 °C)
Temperature Bellows Response	63% in 1 minute
CDP Bellows Response	63% in 100 milliseconds
Fluid Inlet Pressure	240 to 500 psig (1655 to 3448 kPa)

Environmental Specifications

Ambient Temperature	–20 to +300 °F (–29 to +149 °C)
Fluid Temperature	0 to 200 °F (–18 to +93 °C)

Porting

Compressor Discharge Pressure (CDP)	MS33656-6 or MS33656-4
Sump Drain (DRAIN)	MS33656-4
P_3C	MS33649-4
Overboard Drain (2)	1/8-27NPTF
Orifice Pack-in	MS33656-4 or MS33656-6

Chapter 2.
Principles of Operation

The CDP sensor assembly is a force-balance device for use with non-airborne gas turbines. The sensor converts a constant hydraulic pressure (PC) from the governor section of the turbine into a pressure signal to the fuel valve as a function of compressor discharge pressure (CDP) and compressor inlet temperature (CIT).

During operation, CDP is applied to the CDP bellows (see Figure 2-1 or 2-2). PC is supplied to the sensor through an orifice pack. P_3C is the gauge pressure of the sensor and is a function of CDP and temperature.

An increase in CDP increases the force on the CDP lever. This force is transmitted through fulcrum F_1 and the pressure regulating lever, increasing the closing force on the bleed valve. P_3C must increase, exerting more force on the pressure regulating bellows and opening the bleed valve to maintain a constant bleed-off.

Conversely, a decrease in CDP decreases the forces and reduces P_3C.

The ratio of change of P3C with respect to change of CDP depends on the position of fulcrum F_1. The CDP sensor is mounted with the temperature bellows in the compressor inlet air stream. As the air temperature changes, the temperature bellows expands or contracts, moving fulcrum F_1. The movement of fulcrum F_1 biases the ratio of P_3C to CDP.

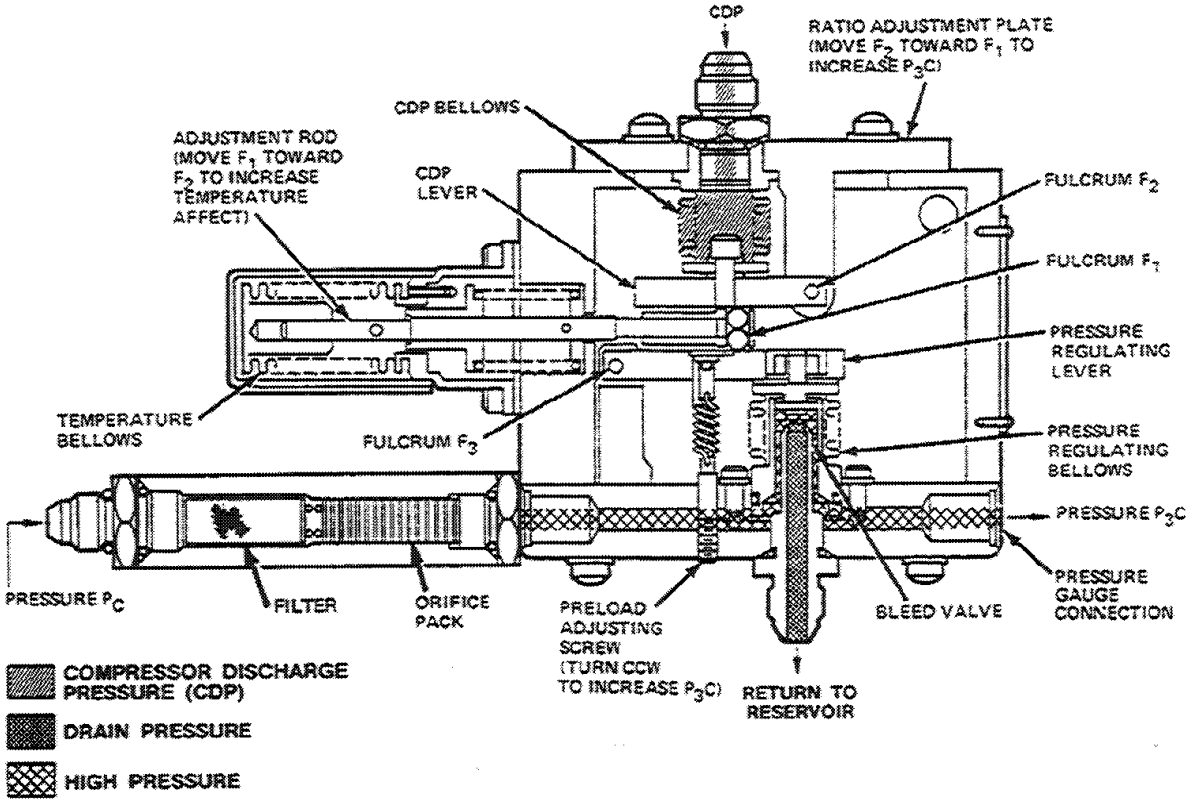

Figure 2-1. CDP Sensor Schematic Diagram with Pressure P_3C Proportional to Temperature

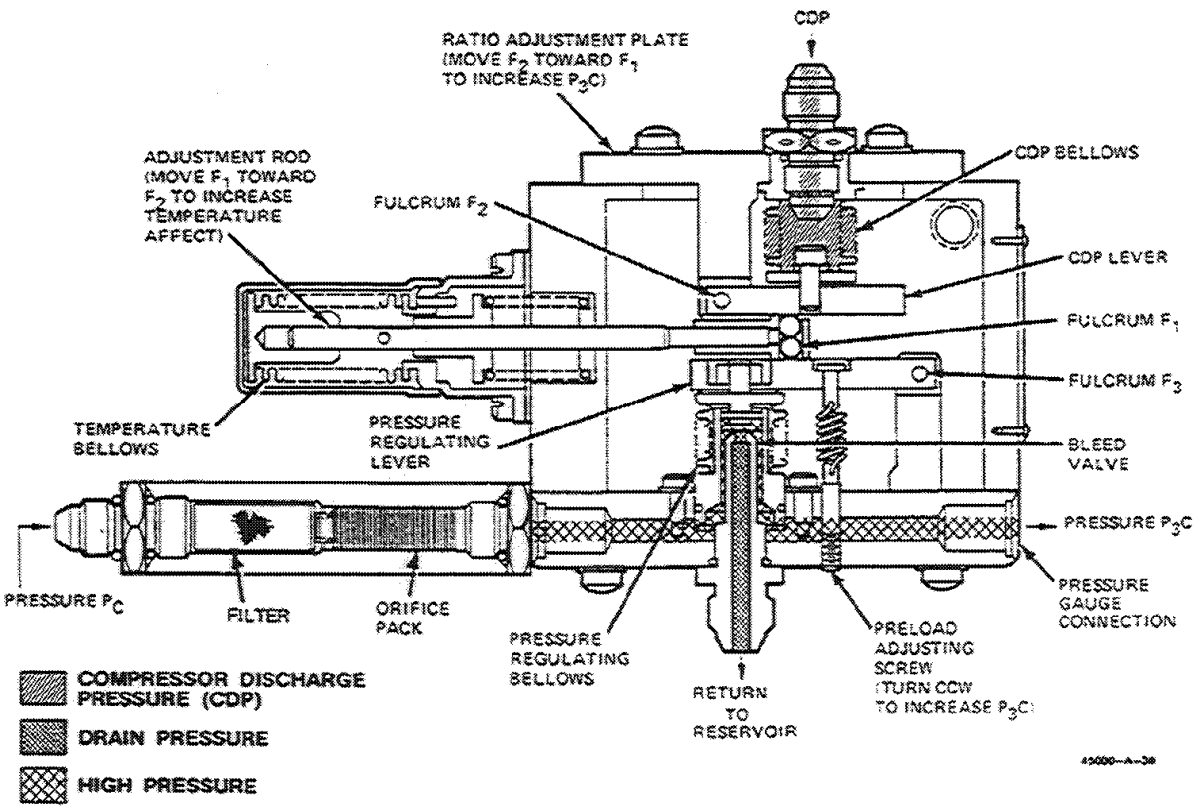

Figure 2-2. CDP Sensor Schematic Diagram with Pressure P_3C Inversely Proportional to Temperature

Chapter 3.
Troubleshooting and Maintenance

Troubleshooting

This troubleshooting table is for use in determining probable cause and recommended corrections for troubles which may be encountered in the field. Every possible trouble that might occur cannot be anticipated, and in some instances may be due to faulty operation of equipment associated with the CDP.

Problem	Cause	Recommended Correction
Insufficient P_3C Pressure Signal (output)	Low oil supply pressure.	Check supply.
	Damaged bellows.	Replace bellows.
	Clogged screen or orifice.	Disassemble and clean orifice pack.
	Low CDP signal.	Check CDP signal lines for leaks or obstructions and clean as required..
	Out of adjustment.	Readjust (see Figures 2-1 and 2-2).
Time Lag in P_3C Pressure Signal	Trapped air in P3C line.	Bleed P_3C line and reroute to eliminate air trap.
	Insufficient oil supply pressure.	Check oil supply and lines.
	Orifice size too small.	Replace or rework orifice.
Excessive P_3C Pressure Signal	Parts sticking because of bad storage area or insufficient oil.	Clean and repair parts as required.
	Out of adjustment.	Readjust (see Figures 2-1 and 2-2).
Improper Temperature Correction	Adjustment rod out of adjustment	Readjust (see Figures 2-1 and 2-2).
No Temperature Correction	Bellows damaged or inoperative.	Replace bellows.

Maintenance

If the unit has been stored, check it over for rust, and clean and repair as required.

Special Tools

A Temperature Simulator, Woodward part number T-79122, is available to simulate temperature changes for the temperature bellows assembly during adjustment and test.

Disassembly

Disassemble the sensor assembly in the sequence of index numbers assigned in Figure 3-1, giving special attention to the following. Circled index numbers do not require further disassembly unless repair or replacement of parts is required.

1. Use care when removing bellows assemblies (7 and 28, Figure 3-1) to prevent distortion or other damage to the convolutions of the bellows.

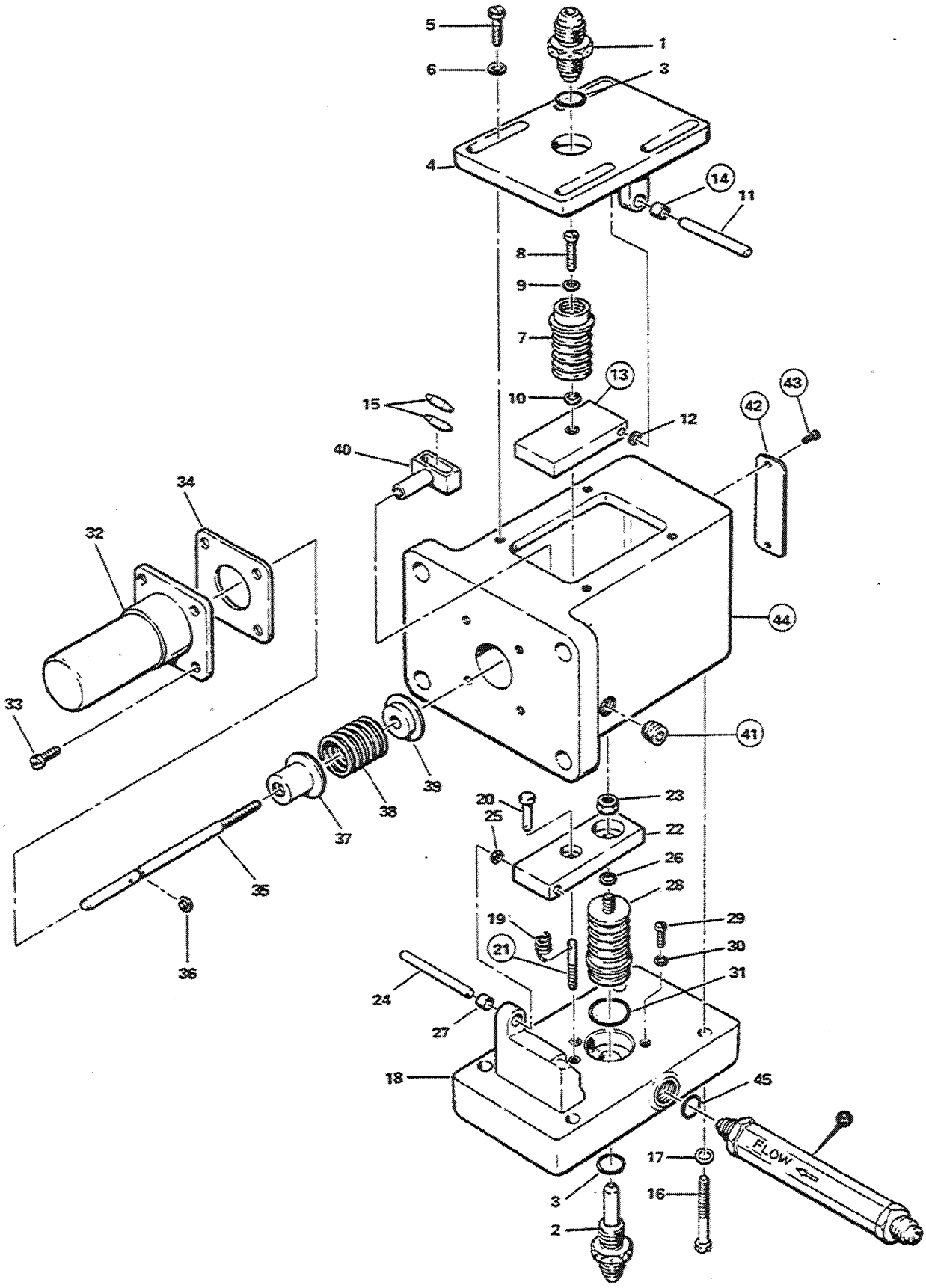

Figure 3-1. Exploded View of CDP Sensor Assembly

2. Clean the exterior surfaces of the sensor with a clean cloth moistened with cleaning solvent (Federal Specification P-D-680).

3. Discard all gaskets, O-rings, seals, retaining rings, etc., removed in the process of disassembly.

Cleaning

1. Immerse all parts in cleaning solvent (Federal Specification P-D-680) and clean ultrasonically or by agitation. Do not permit bellows (7 and 28), bearing rollers (15), bearing surfaces of CDP lever (13), or bearing surfaces of pressure regulator lever (22) to contact any other object. Use a non-metallic brush or jet of compressed air to clean slots and holes.

2. Dry all parts after cleaning with a jet of clean, dry air.

Inspection

1. Visually inspect all parts for evidence of wear, corrosion, pitting, deep scoring, nicks, cracks, or other damage.

2. Inspect all needle bearings in accordance with standard practice. Replace bearings where there is any detectable roughness or stickiness or any pitting, scoring, galling, or brinelling of needles or races.

3. Mating surfaces must be free of nicks, burrs, cracks, or other damage.

4. Screws, threaded plugs, and thread inserts must be free of corrosion, cracks, burred slots, rounded flats, or damaged threads.

5. All moving and actuating parts must be free of corrosion and must move freely without excessive play.

6. All surfaces and fluid passages must be free of foreign matter.

7. Check the preload spring (19, Figure 3-1) for free length (including hook ends). Replace the spring if the free length is not 0.594 ±0.020 inch (15.09 ±0.51 mm).

8. Check the bellows spring (38) for free length, squareness, and compressed height under load.

    a. Replace the spring if the free length is not 1.224 ±0.030 inches (31.09 ±0.76 mm).

    b. Replace the spring if the ends are out-of-square with the spring axis or are not parallel with each other within 4 degrees.

    c. Place the spring in a suitable tester and load to 11.5 lb (51.2 N). The height of the compressed spring must be 0.875 ±0.020 inch (22.22 ±0.51 mm). Do not exceed 19.5 lb (86.7 N) of load, as this will overstress the spring and necessitate replacement. Replace the spring if the height under load is not as specified.

9. Inspect the CDP bellows assembly (7) and pressure regulator bellows assembly (28) as follows:

    a. Replace either bellows assembly if the bellows convolutions are nicked, dented. cracked, or distorted, or if there is evidence of crystallization, separation, or other damage at soldered joints between the end pieces and bellows.

    b. Replace the pressure regulator bellows assembly if the internal poppet is perceptibly scored or otherwise damaged.

10. Replace the temperature bellows assembly (32) if any of following defects are found:

    a. If any dent or other depression in the circumference or the end of the external shell around the bellows is greater than 0.010 inch (0.25 mm) in depth.

    b. If there is any evidence of alcohol leakage, insert a rod measuring 0.187 ±0.001 inch (4.75 ±0.03 mm) in diameter by 2 inches (51 mm) long into the seat of the bellows. Place the bellows in a suitable spring tester with the rod uppermost. Set the tester indicator to zero with no load. Apply a 12 lb (53 N) load on the end of the rod. If the deflection is more than 0.006 inch (0.15 mm) with a 12 lb (53 N) load, leakage is indicated and the assembly must be replaced. Remove the rod.

    c. Insert an adjustment rod (35) into the seat of the bellows. Hold the bellows upright, with the rod uppermost. The adjustment rod must be square with the mounting flange within 0.5 degree.

11. Replace the bleed valve fitting (2) if the sharp edge of the seat is rounded, nicked, or otherwise damaged.

Repair or Replacement

1. Repairing small parts of this unit is impractical and should generally be limited to the removal of nicks and burrs from mating flanges, replacement of bearings, and light burnishing of mating parts.

NOTICE **Handle all critical parts with extreme care so the mating edges and surfaces are not damaged and sharp edges are maintained.**

2. Replace damaged thread inserts in accordance with standard practices.

3. Polish slightly corroded areas with a fine grit abrasive cloth or paper and oil.

4. Minor nicks, gouges, scratches, etc., in the surfaces of aluminum parts which expose base metal must be burnished and the corrosion resistant surface finish restored. The following instructions are for chemical treatment to produce corrosion-resistant surface finish on small areas in lieu of complete stripping and re-anodizing.

    a. Degrease the part or parts as instructed in cleaning procedure.

    b. Deoxidize the exposed area with alkaline cleaning compound (Military Specification MIL-C-2579) for 5 to 15 minutes depending on the degree of oxidation.

c. Prepare a solution of 2.2 to 4.0 ounces of Iridite 14.2 (Military Specification MIL-C-5541) to one US gallon of water (pH 09 to 1.3) [17 to 31 mL of Iridite per liter of water]. Smaller quantities may be prepared in proportion.

d. Apply the solution to the area with a brush or swab, scrubbing the surface to ensure thorough wetting. Maintain a continuous film of wet solution by repeated applications until an iridescent yellow film forms on the surface of metal.

e. Rinse the area with cold water or remove the excess solution by wiping it with a clean, soft cloth, or swab dampened with water. Exercise care to avoid removing or damaging the film, which is soft when newly formed.

f. Dry the parts with a jet of clean, dry compressed air.

Lubrication

1. Lubrication of the moving parts of this assembly is not required.

2. Lubricate all O-rings with petrolatum (Federal Specification V V-P-236) before installation.

Reassembly

Reassemble the CDP sensor assembly parts in reverse order of the index numbers in Figure 3-1, following the special instructions given below.

IMPORTANT

A dust-free work area is recommended for reassembly if acceptable overhaul results are to be obtained.

1. When installing O-rings over threaded surfaces, use the appropriate size thimble, or tape the threaded area to prevent damage to the O-rings.

2. Reassemble with new gaskets, O-rings, retaining rings, and etc.

NOTICE

Count out only the required number of small parts such as screws, washers, retaining rings or clips, etc., before proceeding. When a sufficient number of parts is not available, the missing part(s) must be located before performing the next step. If some part(s) cannot be located, it is essential to disassemble the unit as necessary to ensure that the missing part(s) has not fallen into an internal cavity. Any parts in the assembly which are not properly secured or in place can readily cause jamming and render the unit inoperative.

3. Reassemble the orifice pack assembly (46 through 53, Figure 3-2). Install the inlet fitting (51) in the housing (53) and then alternately install the gaskets (50) and orifice plates (49). Make certain a gasket is initially installed immediately adjacent to the inlet fitting. Do not install the completed assembly in the bottom plate assembly (18, Figure 3-1) as this time.

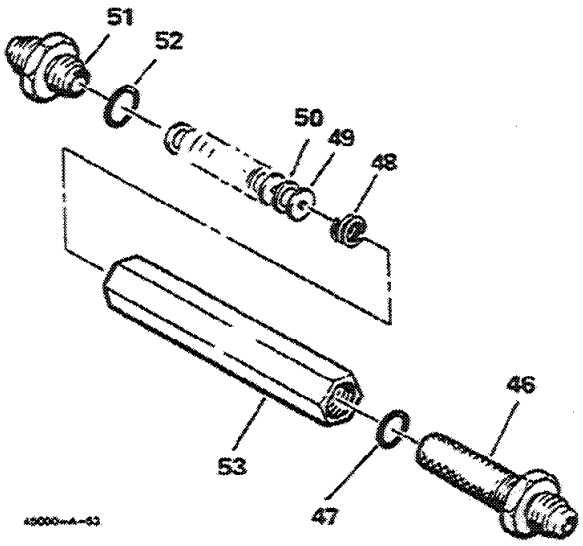

Figure 3-2. Exploded View of Orifice Pack Assembly

4. Reassemble the CDP bellows lever (13) and the CDP bellows assembly (7) onto the top plate (4). Refer to Figure 3-3 and measure dimensions A and B. Adjust the thickness of the laminated shim (10) as required until dimension B is equal to A (±0.002 inch/±0.05 mm). Record the final measurement of dimension B.

5. Reassemble the pressure regulator lever (22, Figure 3-1) and the pressure regulator bellows assembly (28) onto the bottom plate (18). Take up the slack in the preload spring and then back out the adjusting screw an additional turn.

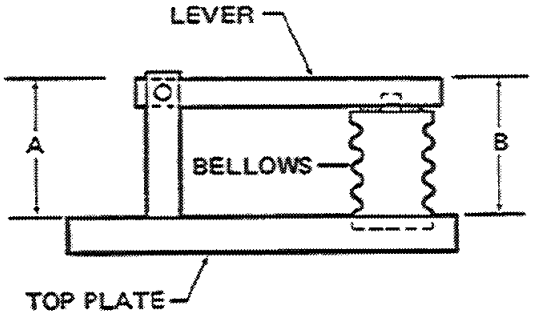

Figure 3-3. Leveling CDP Bellows Lever

6. Refer to Figure 3-3. Level regulator lever (22) and measure dimensions A and B. Adjust the thickness of the laminated shim (26) as required until dimension B is equal to A (±0.1002 inch/±0.05 mm). Record the final measurement of dimension B.

7. Assemble the bottom plate onto the sensor case (44).

8. Reassemble the roller retainer (40) and the adjustment rod (35) onto the case. Center the retainer midway between the regulator bellows and the preload spring by turning the adjusting rod as required. Insert the bearing rollers (15) in the retainer.

9. Immerse the sensing element of the temperature bellows assembly (32) into calibrating fluid (Military Specification MIL-F-7024, Type II) at the mid-range temperature specified on the specification data sheet. Use an insulated container to maintain a stable temperature. Do not allow the fluid to enter the interior of the assembly. Allow a 5 minute stabilization period and then determine the seating depth of the adjusting rod (35) (including bellows gasket), using a depth micrometer. See Figure 3-4. Transfer this dimension to the temperature simulator (T-79122, Figure 3-5), setting the simulator micrometer anvil so that it just contacts the anvil of the depth micrometer. Record the simulator micrometer reading for future reference.

10. Install the temperature simulator onto the sensor case as shown in Figure 3-5, using screws (33, Figure 3-1). If necessary, turn the adjusting rod in and then back it out until the rod just contacts the anvil of the simulator micrometer.

11. Using a depth micrometer, determine the distance from the top of the case to the top of the uppermost bearing roller. This distance should be the same as dimension B plus 0.002 to 0.004 inch (0.05 to 0.10 mm). Refer to reassembly step 4. If necessary, adjust the thickness of the laminated shim (10) to obtain the specified distance.

IMPORTANT **Do not remove the temperature simulator at this time, as it will be required for the test procedures.**

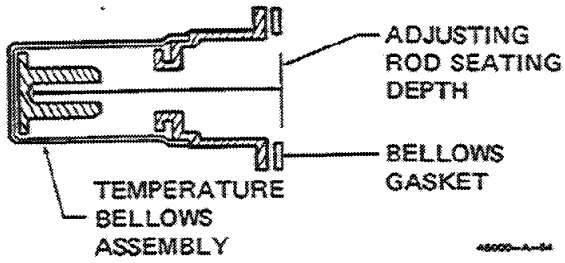

Figure 3.4. Measurement of Adjusting Rod Seating Depth

Test Procedures

The test procedures outlined below are to be followed for all CDP sensor assemblies. To obtain the desired test results, all values of temperature and pressure which vary with application must be inserted from the test data sheet for the particular assembly. Obtain the data sheets from Woodward. Give the serial number and the part number shown on the nameplate.

Figure 3.6 illustrates a typical test hookup.

1. Determine the low and high temperature settings for the temperature simulator micrometer from the applicable data sheet for the temperatures required.

2. Conduct all the adjustments and tests using lubricating oil (use test fluid per MIL-L-23699 or equivalent).

3. Connect the sensor to a suitable test stand or to individual oil and air supplies as shown in Figure 3-6.

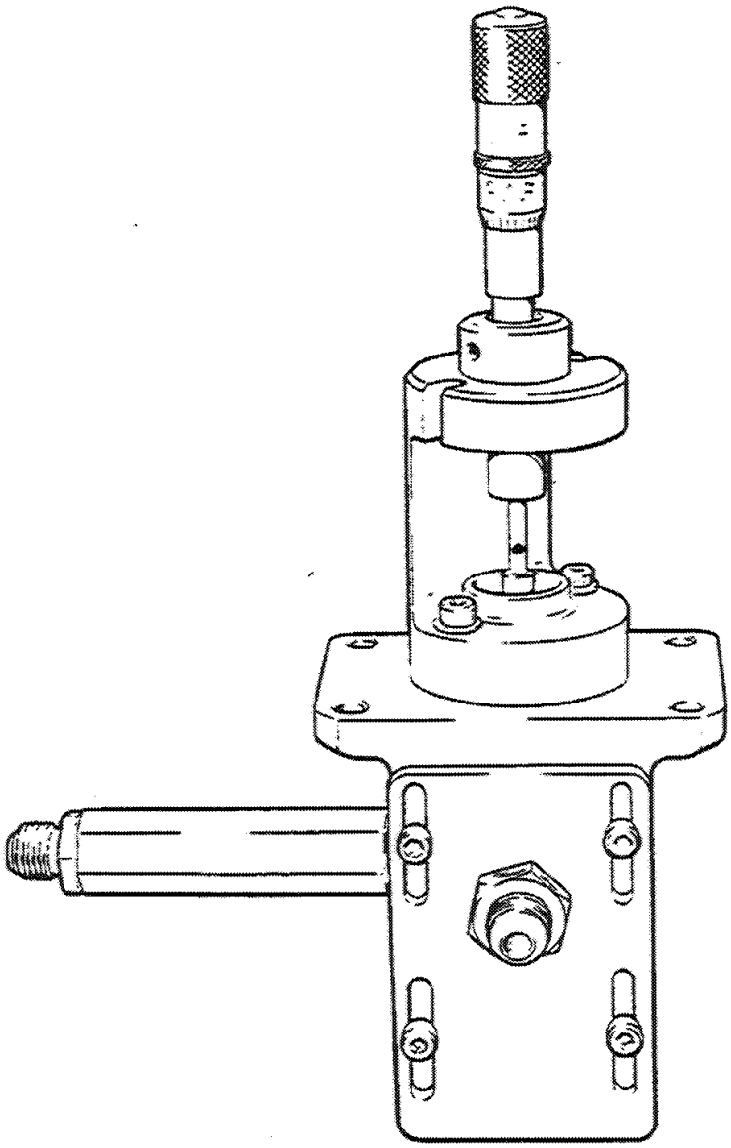

Figure 3-5. Temperature Simulator (T-79122)

4. The oil temperature must be maintained within a specified range (approximately 125 to 190 °F/52 to 88 °C) during all adjustments and tests. (Refer to the data sheet.)

5. Regulate pressure PC (inlet) as specified on the data sheet.

6. Allow 10 to 15 minutes for warm-up.

7. Check the leakage from the sensor drain at the end of the warm-up period with the CDP at zero. Leakage must be within the range specified. If leakage is less or more than specified, remove the sensor from the test stand and repeat step 3 of the reassembly instructions. If no apparent cause for trouble can be found, replace the orifice pack.

8. With the CDP at 0 psig (0 kPa) and the simulator micrometer at mid-position, adjust the pre-load adjusting screw (21) to obtain the specified P_3C. Adjust is counterclockwise to increase P_3C.

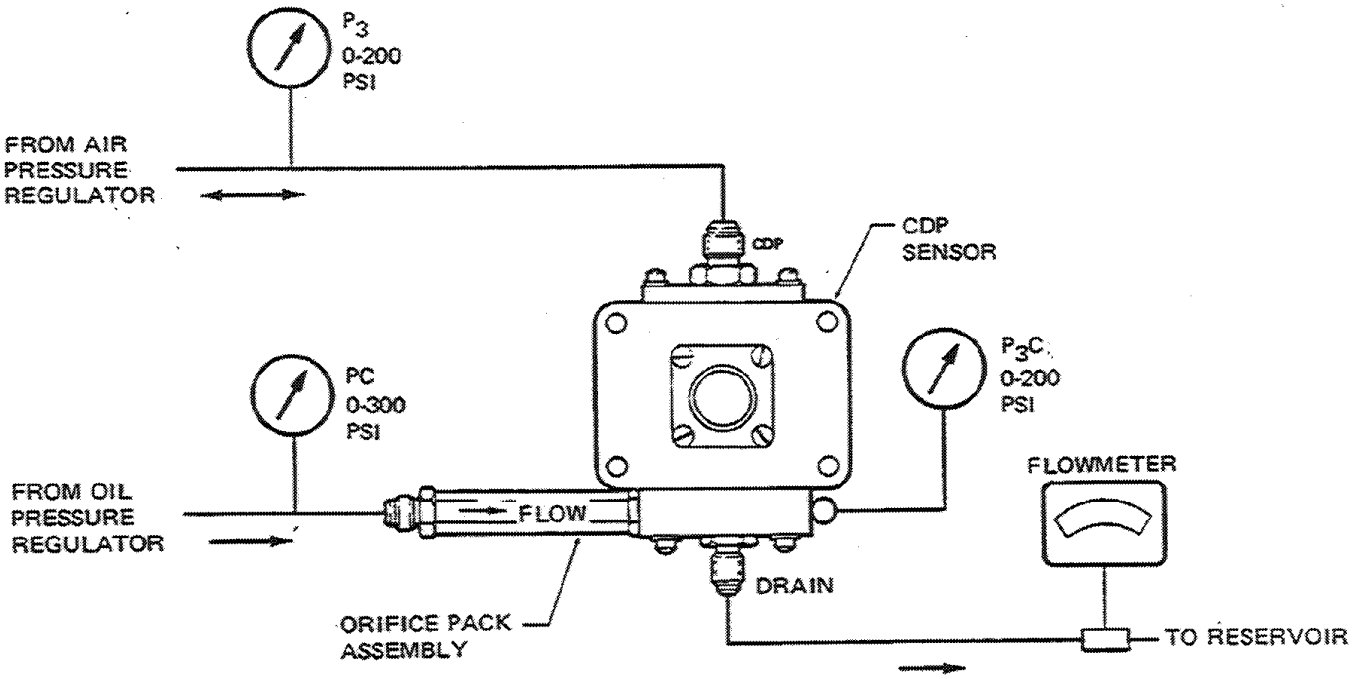

Figure 3-6. Typical Test Hookup for CDP Sensor Assembly

9. Increase the CDP to the maximum value listed on the data sheet, then loosen the mounting screws and adjust the top plate (4) position to obtain the specified P_3C.

10. Repeat steps 8 and 9 above until no further adjustment is required.

11. Check the sensor range as follows:
    Increase the CDP to the highest value shown on the date sheet. Refer to the data sheet test schedule and set the temperature simulator micrometer for the low temperature setting (refer to step 1 above). Turn the adjusting rod (35) to obtain the specified P_3C as shown in Figure 2-1 or 2-2. Use a 3/32 inch diameter pin in the hole provided.

12. Repeat step 11, setting the temperature simulator micrometer for the high temperature setting. Pressure P_3C should be within the range indicated on the data sheet test schedule.

13. Repeat steps 3 through 12 until no further adjustment is required.

14. Check the complete pressure schedules given on the data sheets, setting the temperature simulator micrometer for each schedule. Vary the CDP and record the pressure P_3C for each of the CDP settings as the simulated temperatures.

    The range adjustment (step 11) also affects the P_3C pressure schedules, causing a greater change in pressure at the high end of the schedules than at the low end. It may be necessary to shift the range adjustment toward a minimum or maximum limit at one end of a schedule in order to bring the other end within the limits. This must be accomplished without causing either of the other two schedules to go out of the limits. Minor adjustment of the adjusting rod and/or preload adjusting screw may also be found necessary to bring all three schedules within limits.

15. When step 14 has been satisfactorily completed, remove the temperature simulator and install the temperature bellows assembly.

16. Perform a closed loop test as follows:

    a. Immerse the temperature sensing element in fluid at the low temperature specified on the data sheet. After a 10 to 15 minute stabilization period, successively regulate the CDP pressure to minimum and maximum values. Record the pressure P_3C at each of these point. Closed loop pressure P_3C at each point must be within ±0.5 psig (3.4 kPa) of the values in step 14.

    b. Repeat step “a” using fluid at the mid-range temperature specified on the data sheet.

    c. Repeat step “a” using fluid at the high temperature specified on the data sheet.

17. Shut down the test stand and remove the sensor assembly. Drain as much fluid as possible from the unit.

18. Using MS9226-3 safety wire, secure the attaching screws of the temperature bellows, top plate, and bottom plate.

19. If the unit is to be shipped or stored after testing, flush the pressure regulating section, including the orifice pack assembly, with corrosion-preventive oil (Military Specification MIL-C-6529, Type 3).

20. Install the shipping caps and/or plug all open ports.

Adjustments

It is recommended that no adjustments be made on the sensor unless adequate facilities are available for testing and calibrating. The adjustments required on the sensor are accomplished during the test of the unit in steps 8 through 11 under test procedures.

Chapter 4.
Replacement Parts

When ordering replacement parts, it is essential that the following information be given:

- The CDP sensor part number and serial number (from the nameplate)
- Manual number (this is manual 45005)
- Part reference number, as given in parts list and on Figure 4-1, and part name or description

Figure 4-1 illustrates and lists all parts for the CDP sensor assembly. Index numbers are assigned in disassembly sequence. Circled index numbers indicates items which do not require further disassembly unless repair or replacement of the part is required.

Ref. No.	Part Name	Quantity
45005-1	Reducing union	1
45005-2	Bleed valve fitting	1
45005-3	O-ring, 0.495 OD (NAS1595-004)	2
45005-4	Top plate	1
45005-5	Screw, fil. hd, 10-32 x 5/8 (MS35266-64)	4
45005-6	Washer, flat (AN960-10L)	4
45005-7	CDP bellows assembly	1
45005-8	Screw, soc hd cap, 8-2 x 3/8 (MS24677-14)	1
45005-9	Washer, copper	1
45005-10	Aluminum laminated shim	1
45005-11	Straight pin	1
45005-12	Bearing spacer	2
45005-13	CDP bellows lever assembly	1
45005-14	Needle bearing	2
45005-15	Roller bearing	2
45005-16	Screw, fil hd (MS35268-67)	4
45005-17	Washer, flat (AN960-10L)	4
45005-18	Bottom plate assembly	1
45005-19	Preload spring	1
45005-20	Drilled headed pin	1
45005-21	Adjusting screw	1
45005-22	Pressure regulator lever	1
45005-23	Locknut, 8-32	1
45005-24	Straight pin	1
45005-25	Bearing spacer	2
45005-26	Aluminum laminated shim	1
45005-27	Needle bearing	2
45005-28	Pressure regulator bellows assembly	1
45005-29	Screw, soc hd cap, 6-32 X 5/16 (MS24674-2)	2
45005-30	Washer, flat (AN960C6)	2
45005-31	O-ring, 0.754 OD (NAS1593-016)	1
45005-32	Temperature bellows assembly	1
45005-33	Screw, fil hd, 8-32 X 1/2 (MS35275-46}	4
45005-34	Bellows gasket	1
45005-35	Adjustment rod	1
45005-36	Retaining ring	1
45005-37	Spring seat (outer)	1
45005-38	Bellows spring	1
45005-39	Spring seat (inner)	1
45005-40	Roller retainer assembly	1
45005-41	Pipe plug. soc hd	2
45005-42	Nameplate	1
45005-43	Screw, drive, 0.073 dia x 3/16 (AN636-0-3)	1
45005-44	CDP sensor case	1
45005-45	O-ring, 0.495 OD (NAS1595-004)	1
45005-46	Screen and fitting assembly	1
45005-47	O-ring, 0.658 OD (NAS1595-005)	1
45005-48	Spring	1
45005-49	Orifice plate	27
45005-50	Gasket	27
45005-51	inlet fitting	1
45005-52	O-ring, 0.495 OD (NAS1595-004)	1
45005-53	Orifice housing	1

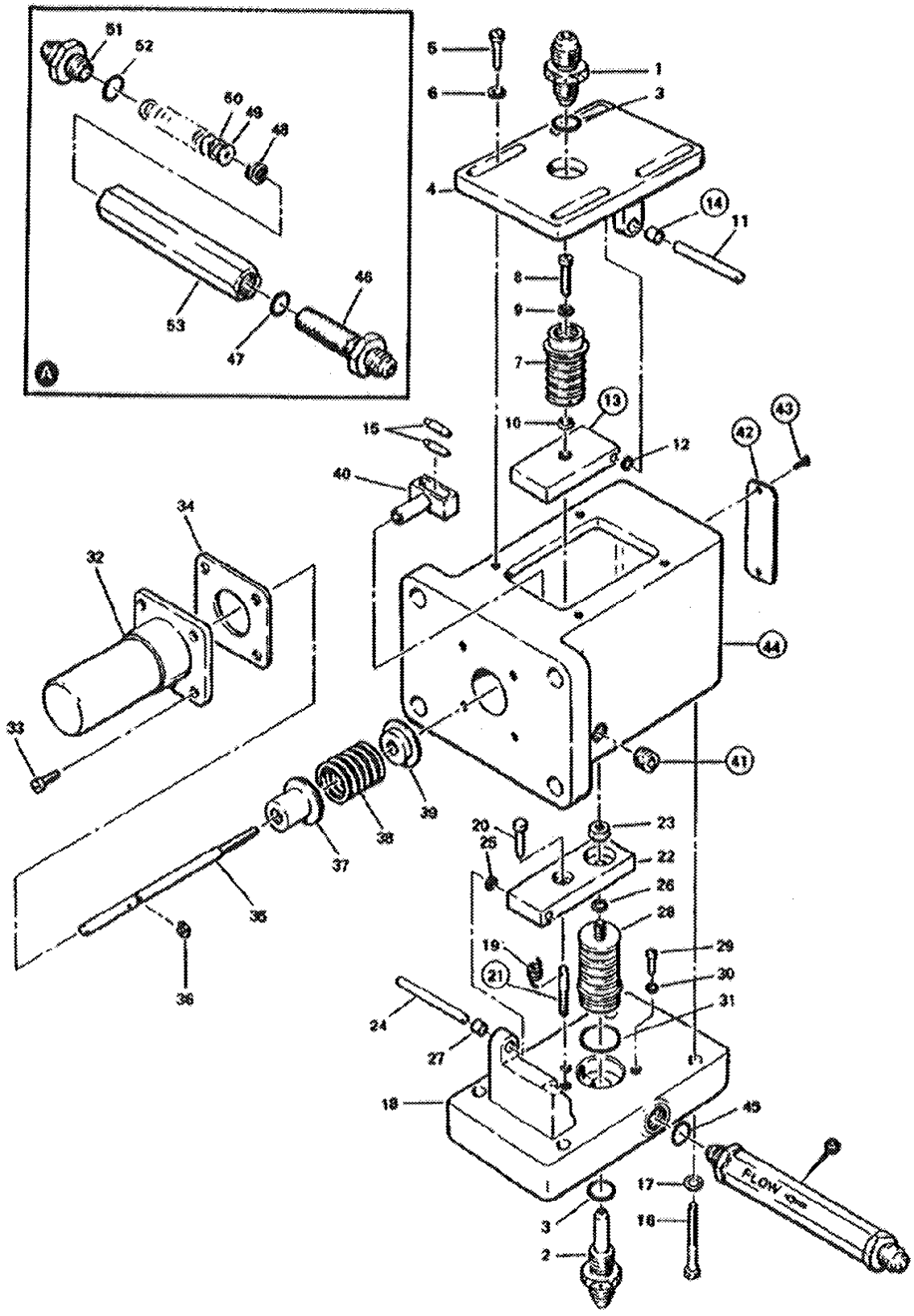

Figure 4-1. Exploded View of CDP Sensor Assembly

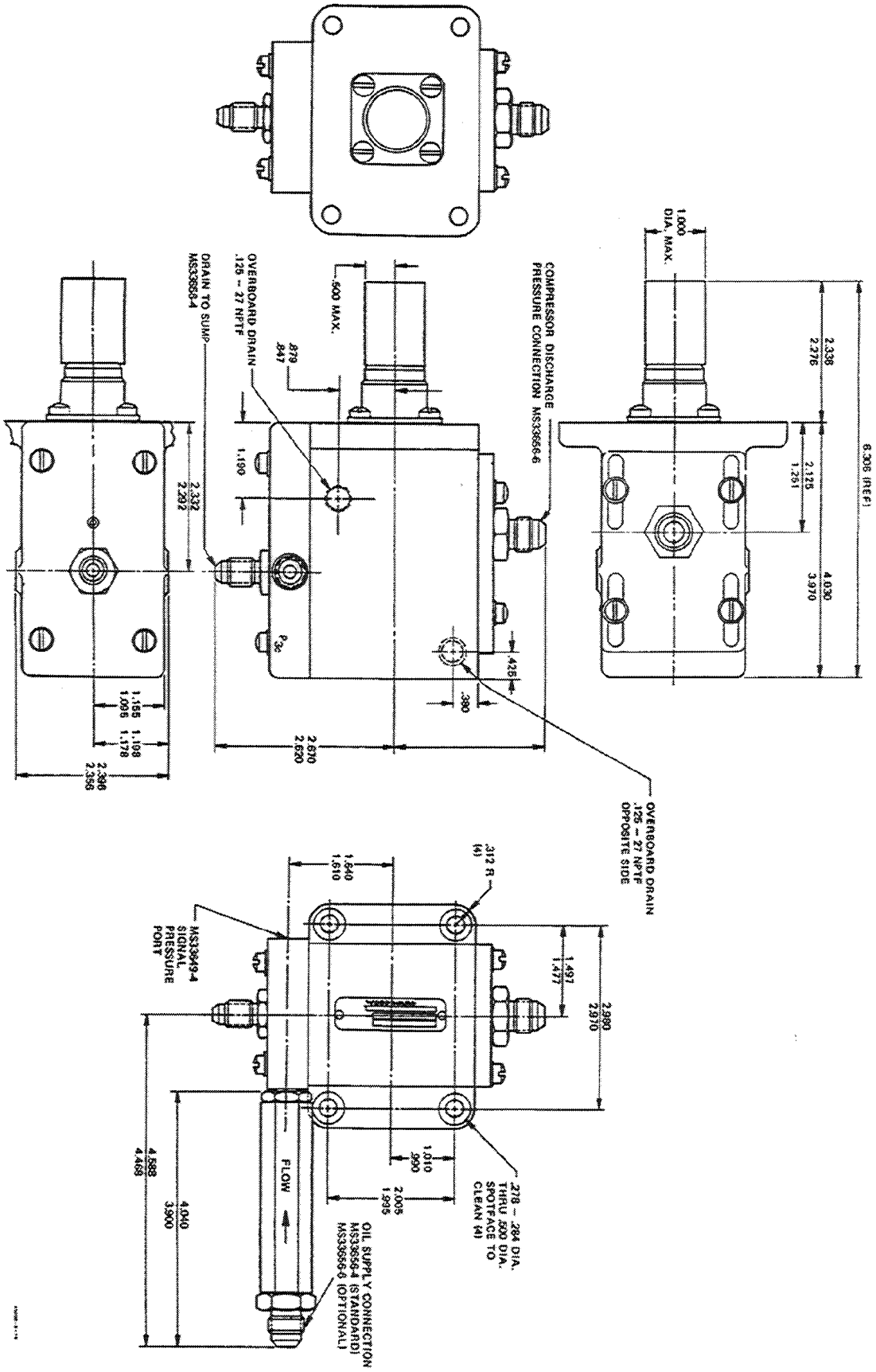

Figure 4-2. Outline Drawing of CDP Sensor Assembly

Chapter 5.
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

Facility	Phone Number
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

Facility	Phone Number
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

Facility	Phone Number
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 45005C.

B45005:C

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**Woodward has company-owned plants, subsidiaries, and branches,
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.

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