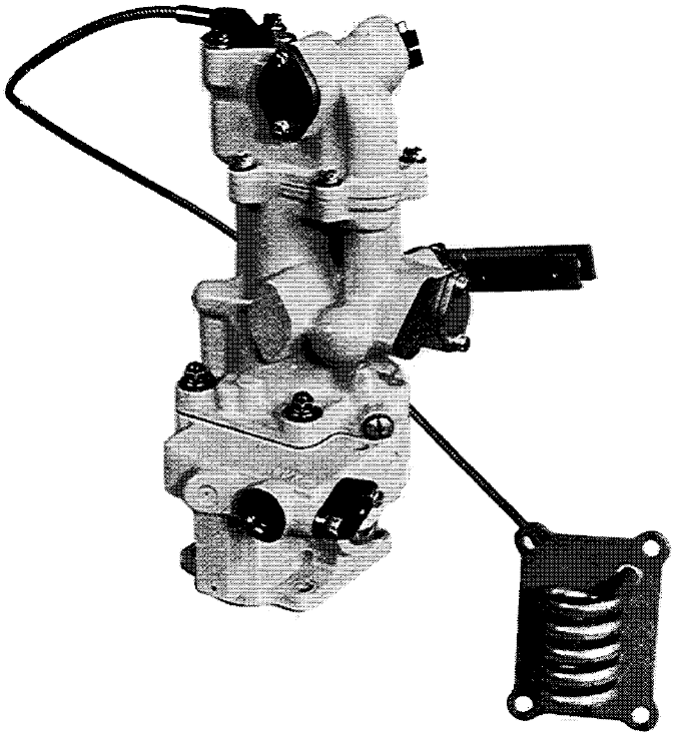
WOODWARD

Product Manual 54106
(Revision A)
Original Instructions



Tachometer Assembly

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 Out-of-date translations are marked with ⚠.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

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.

Tachometer Assembly

General Information

The tachometer assembly is a hydromechanical control for use with non-airborne gas turbines. The unit delivers a rotary output signal which is a function of turbine speed and compressor inlet temperature. Through a servo-actuator, the output signal is amplified to position inlet guide vanes or bleed valves of the turbine. A pump assembly connected in parallel with the tachometer assembly provides the oil pressure required to operate the control valve and servo-actuator.

Tachometer Installation

Use care while handling and installing the tachometer assembly. Be particularly careful to avoid striking the drive shaft.

Do not set the tachometer assembly on its drive shaft. Abuse can damage seals, internal parts, and factory adjustments.

Make sure the tachometer assembly drive shaft turns freely before installing the assembly on the turbine. The drive shaft and/or coupling must slip freely into the turbine drive. Do not apply external force.

The drive must be free of binding, side load, or excess end play. Improper alignment or fit between the parts can result in excessive wear or seizure. The drive spline is connected in the tachometer through a quill shaft to filter high frequency torsional vibrations from the tachometer. Because of this, the drive spline is not rigid and will self-align to a drive pad with 0.003 inch (0.08 mm) maximum eccentricity between pilot and drive spline.

Mount the tachometer assembly squarely on the mounting pad. Use a gasket between the assembly and the mounting pad. Torque the mounting bolts evenly. There must be no movement, or rocking of the tachometer assembly on the turbine mounting pad.

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.

Temperatures, pressures, dimensions, etc., vary among models of tachometer assemblies. Data used in this installation manual is typical of a tachometer assembly. For data specification sheets which apply to your specific unit, contact Woodward (**www.woodward.com**) or your authorized dealer or distributor. Include the serial number and part number shown on the nameplate. Refer to prime mover manufacturer instructions for setting up the linkages.

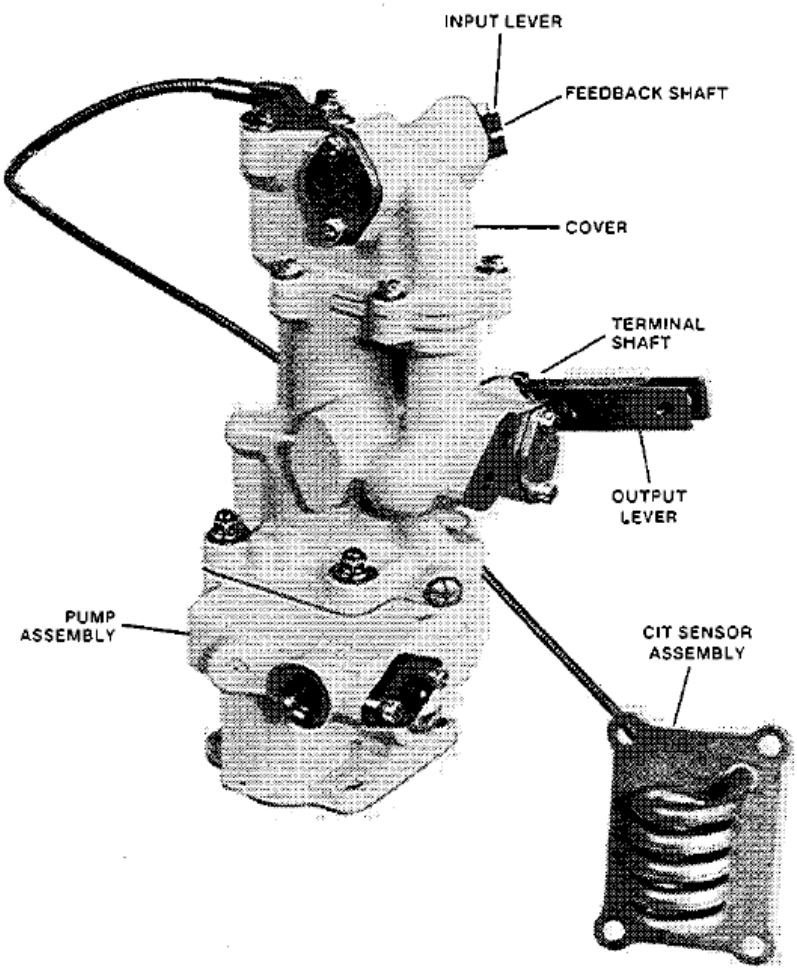

Figure 1. External Features of Tachometer Assembly

Specifications

Hydraulic Fluid	US MIL-L-7808, Grade 1010 or equivalent
Filtration	10 µm
Inlet Pressure	15 to 50 psig ()
Outlet Pressure	375 to 425 psig ()
	Variable among units
Drive Speed	0 to 5500 rpm
Rotation	Counterclockwise (facing tachometer base)
Speed Sensing Range	See specification sheet
Torque Output	100 lb-in () minimum at 900 rpm
Temperature Limits:	
Ambient Temperature	–20 to +200 °F (–29 to +93 °C)
Fluid Temperature	–20 to +250 °F (–29 to +121 °C)
Porting:	
Servo (OUT)	AND10050-6
Inlet (IN)	3/8-NPT or MS16142-8
Spline	AND10262XII-K
	Variable among units

Troubleshooting

Since the tachometer assembly must have proper test fixtures installed to make external adjustments, it must be tested on a test stand. The complete assembly is calibrated together, therefore parts cannot be changed within the assembly without bench re-calibration. **Do not make any adjustments to the tachometer assembly on the turbine.**

A pressure check can be made on the pump with the oil temperature at 120 °F (49 °C). A minimum of 5 psi (34 kPa) is required at the oil inlet while the outlet pressure must be 350 to 400 psi (2413 to 2758 kPa). If the oil supply pressure is not 5 psi (34 kPa), check and replace the oil filter. If the outlet oil pressure is not 350 to 400 psi (2413 to 2758 kPa), replace or have the tachometer assembly rebuilt.

If the terminal shaft is not in the position specified for the speed and temperature inputs as per the specification sheet, remove the tachometer assembly from the turbine and replace it with a new unit.

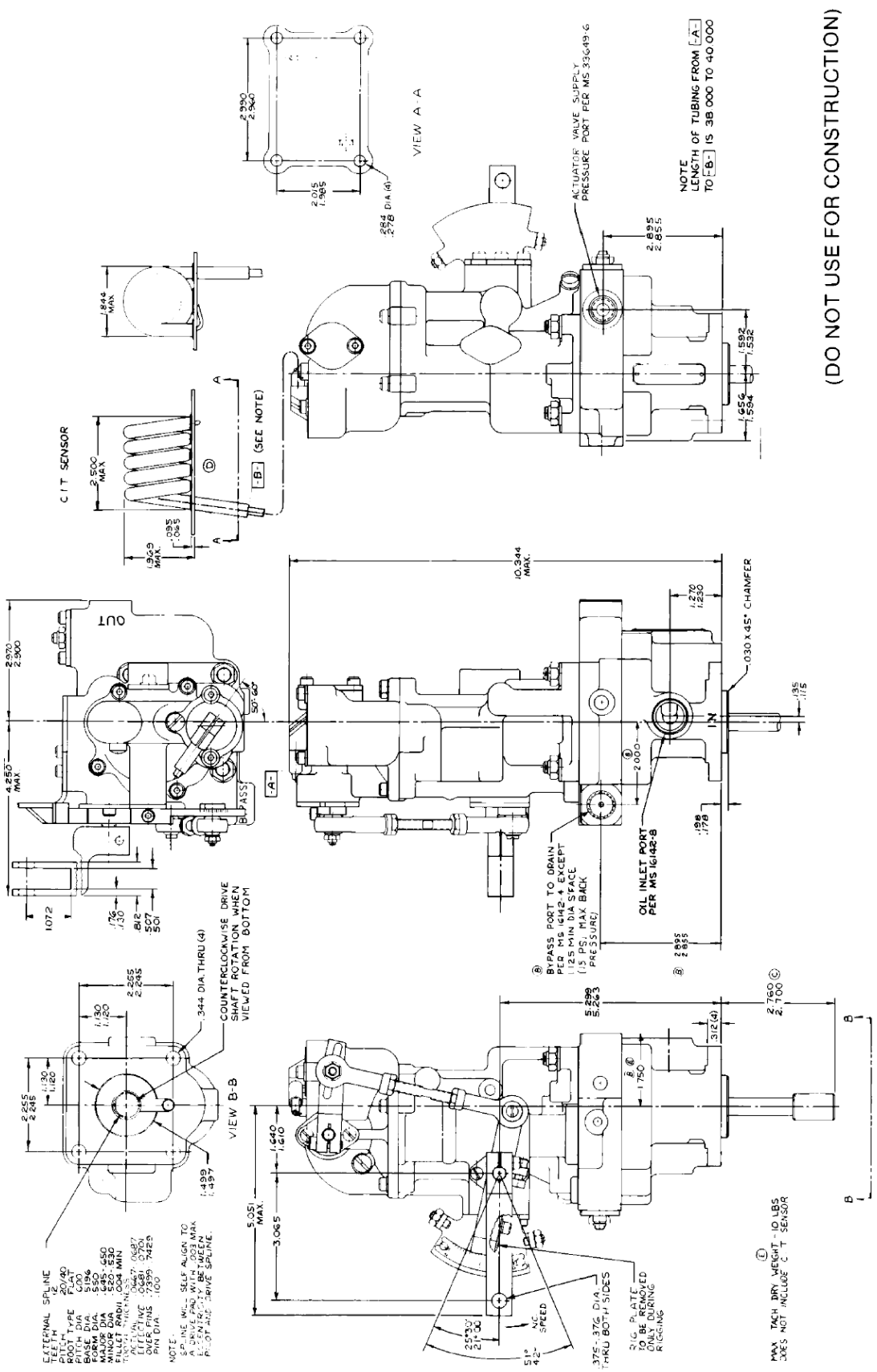

Figure 2. Outline Drawing of Tachometer Assembly

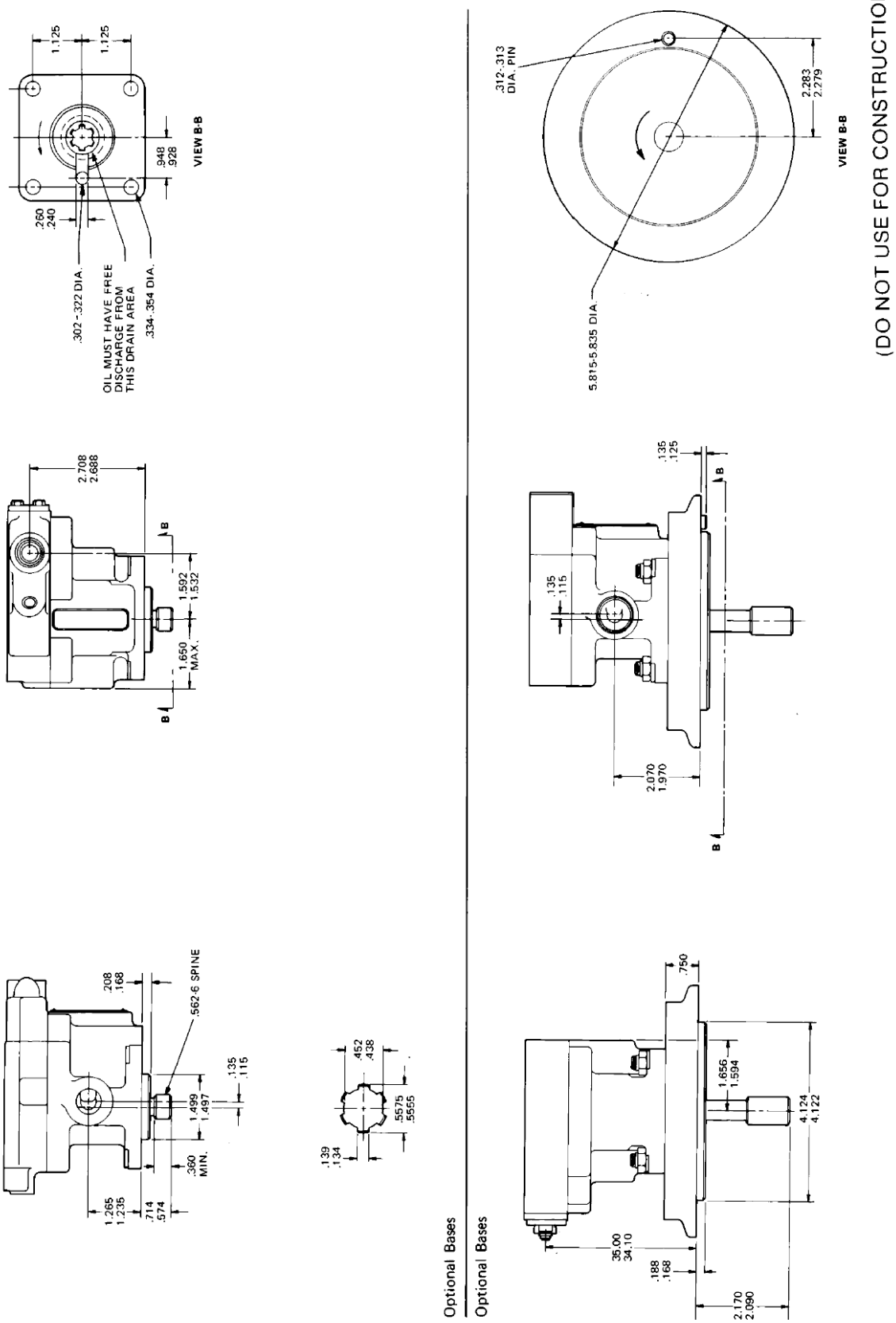

Figure 3. Optional Bases for Tachometer Assembly

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Send comments to: icinfo@woodward.com

Please reference publication 54106A.

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