WOODWARD

Product Manual 04042
(Revision L, 2/2013)
Original Instructions

TG-13 and TG-17 Governors
TG611-13 and TG611-17 Governors

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.

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:

www.woodward.com/publications

The latest version of most publications is available on the *publications page*. If your publication is not there, please contact your customer service representative to get the latest copy.

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 Out-of-date translations are marked with ⚠.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

Manual 04042

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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.

Regulatory Compliance

European Compliance for CE Marking:
(Applicable only to units bearing the CE marking.)

ATEX Potentially Explosive Atmospheres Directive:	Declared to 94/9/EC COUNCIL DIRECTIVE of 23 March 1994 on the approximation of the laws of the Member States concerning equipment and protective systems intended for use in potentially explosive atmospheres as: II 2 G c IIC TX. The TX reflects special conditions for safe use.

Other European Compliance
Compliance with the following European Directive does not qualify this product for the application of the CE Marking:

Machinery Directive:	Compliant as partly completed machinery with Directive 2006/42/EC of the European Parliament and the Council of 17 May 2006 on machinery.
Pressure Equipment Directive:	Compliant as “SEP” per Article 3.3 to Pressure Equipment Directive 97/23/EC of 29 May 1997 on the approximation of the laws of the Member States concerning pressure equipment.

The TG-13/TG-17 and TG611-13/TG611-17 governors are suitable for use in European Zone 1, Group II environments per compliance with EN13463-5, Non-electrical equipment intended for use in potentially explosive atmospheres – Part 5; Protection by constructional safety ‘c’, with the following Special Conditions for Safe Use:

Special Conditions for Safe Use—Maximum Surface Temperature

The maximum surface temperature of the TG Governor is dependent upon three factors that are specific to the operating conditions of each individual application. These factors are as follows:

- Governor drive shaft speed
- Ambient temperature
- Hydraulic fluid selection (see Table 2-1)

The maximum surface temperature of the TG Governor must stay below the lowest ignition temperature of the surrounding explosive atmosphere and within allowable operating conditions for the hydraulic fluid selection. It is the user's responsibility to maintain a safe surface and fluid temperature. If normal operating conditions cause the surface temperature of the TG to rise close to ignition temperatures or near the maximum recommended hydraulic fluid temperature, a heat exchanger must be installed. Refer to the sections on “Heat Exchanger Installation” and “When is a Heat Exchanger Necessary?” for location and sizing of the ports for connection of a heat exchanger.

Compliance with the Machinery Directive 2006/42/EC noise measurement and mitigation requirements is the responsibility of the manufacturer of the machinery into which this product is incorporated.

This listing is limited only to those units bearing the CE Mark on the nameplate.

⚠WARNING

EXPLOSION HAZARD—Substitution of components may impair suitability for Zone 1 applications.

⚠AVERTISSEMENT

RISQUE D'EXPLOSION—La substitution de composants peut rendre ce matériel inacceptable pour les emplacements de Zone 1.

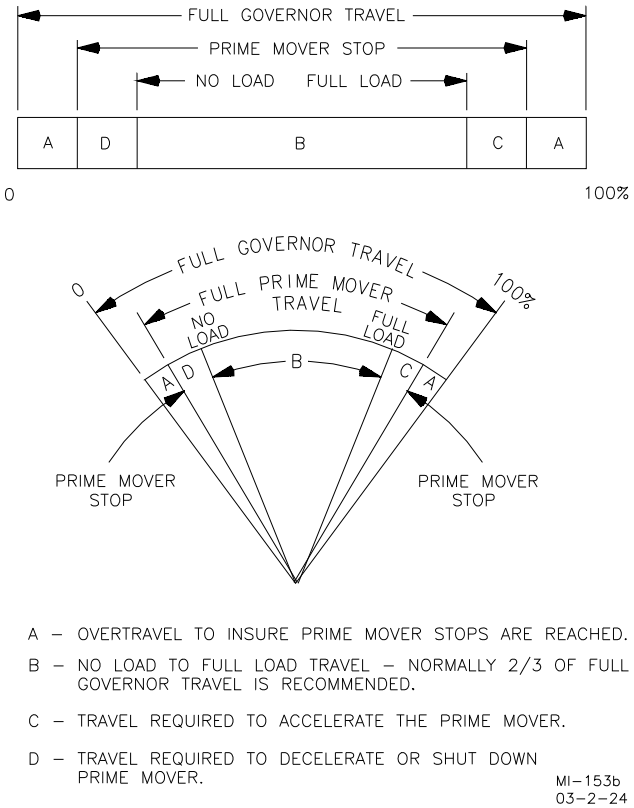
Chapter 1.
General Information

Description

The Woodward TG-13/TG-17 and TG611-13/TG611-17 are mechanical-hydraulic speed droop governors for controlling steam turbines—applications where isochronous (constant-speed) operation is not required.

The TG-13/TG-17 and TG611-13/TG611-17 governors have a full 40 degrees of maximum terminal-shaft travel. Recommended travel from the no load to the full load position is 2/3 of full governor travel.

See Figure 1-1 for a graphic representation of maximum work capacity for the governors and related governor terminal shaft travel information.



Maximum work capacity over full governor travel of 40° is 12.2 ft-lb (16.5 J) for the TG-13/TG611-13 and 17.5 ft-lb (23.7 J) for the TG-17/TG611-17. See above for recommended governor output travel. In special applications, min and max prime mover stops may be outside the governor stops.

Figure 1-1. Governor Work Output

Governor output is provided through a serrated terminal shaft extending from both sides of the case.

The internal pump for the governors is sized to operate over standard speed ranges:

- 1100 to 2400 rpm
- 2400 to 4000 rpm
- 4000 to 6000 rpm

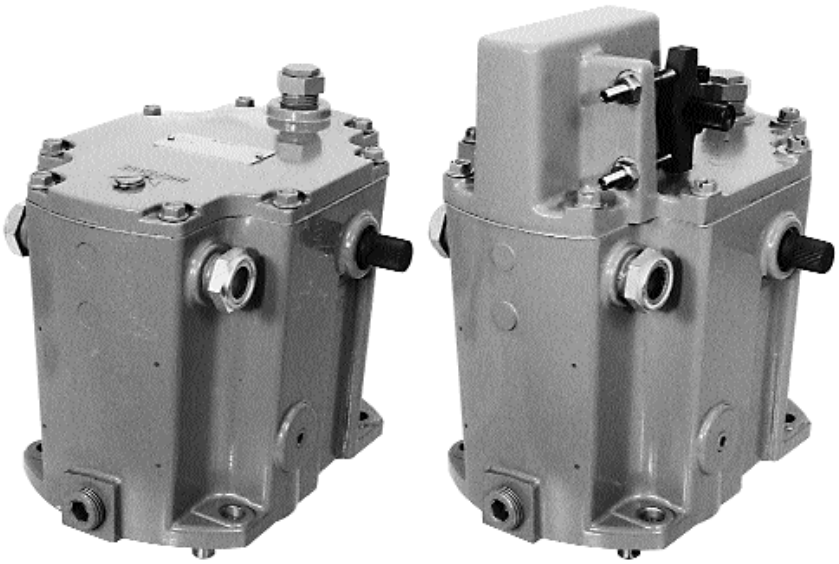


Figure 1-2a. TG-13 Governor
(screw speed setting, left; lever speed setting, right)

Figure 1-2b. TG611-13 Governor
(screw speed setting with overspeed test device)

The TG-13/TG611-13 governor operates with 1034 kPa (150 psi) internal oil pressure, and the TG-17/TG611-17 operates with 1379 kPa (200 psi) internal oil pressure.

Either governor is set to the speed range specified by the customer at time of order. The high-speed governor (4000 to 6000 rpm) may require a heat exchanger in some applications (see end of Chapter 2, “When is a Heat Exchanger Necessary?”). Both governors are capable of controlling at lower-than-specified speed range with some loss of output torque and performance. The governor should not be run at a speed greater than the range specified because of heat rise and component wear issues.

The governors are available with either a cast-iron case or a die-cast aluminum case.

Speed droop is required for stable governor operation. Droop is factory set, but internally adjustable.

Two means of speed setting are available. Screw speed setting is standard. Lever speed setting is optional and provided by a serrated shaft assembly extending from both sides of the cover.

IMPORTANT

The TG-13 and TG-17 governors are identified as either a screw speed-setting or as a lever speed-setting governor. The TG611 governors are screw speed-setting only (see Figure 1-2).

Governor drive shaft rotation for both governors is single direction only. In both the cast iron and the die-cast aluminum governors, rotation can be changed in the field. In the cast iron governor, it must be changed internally, and in the die-cast aluminum governor, it can be changed externally by removing four screws and rotating the pump housing 180 degrees (see Chapter 2).

Governor maintenance is minimal due to few moving parts, weatherproof design, and self-contained oil supply. The governor drive shaft operates a gerotor oil pump. Internal oil pump pressure is regulated by a relief valve/accumulator. The oil sight gauge installed on each side of the governor case makes oil condition and oil-level checking simple.

References

Additional helpful information can be found in these Woodward publications, available online (**www.woodward.com**):

Number	Title
03368	*TG611-13/-17 Governors* product specification
04038	*TG-13 and TG-17 Governors* product specification
25071	*Oils for Hydraulic Controls*
25075	*Commercial Preservation Packaging for Storage of Mechanical-Hydraulic Controls*
36641	*Governor Oil Heat Exchanger, Remote & Integral Types*
51348	*TG-13/-17 Overspeed Test Device Conversion Kit*

TG Part Numbers

Preferred Item Number	Description	Work Output (ft lbs)	Speed Setting	Rated Speed	High Speed @ 2°	Rated Speed @ 38°	Rated Speed @ 2°	Low Speed @ 2°	Drive Rotation	Replaced Item Number
8516-175	TG611-13 (2400 RPM) ATEX COMPLIANT, w/OTD	12	Screw	2400	2900	1800	2010	1200	CCW	8516-038
8516-176	TG611-13 (2400 RPM) ATEX COMPLIANT, w/OTD	12	Screw	2400	2900	1800	2010	1200	CW	A8516-038
8516-177	TG611-13 (2400 RPM) ATEX COMPLIANT, w/OTD	12	Screw	2400	2900	1800	1950	1200	CW	B8516-038
8516-178	TG611-13 (2400 RPM) ATEX COMPLIANT, w/OTD	12	Screw	2400	2900	1800	1950	1200	CCW	C8516-038
8516-179	TG611-13 (4000 RPM) ATEX COMPLIANT, w/OTD	12	Screw	4000	4400	3600	4035	2400	CCW	8516-039
8516-180	TG611-13 (4000 RPM) ATEX COMPLIANT, w/OTD	12	Screw	4000	4400	3600	4035	2400	CW	A8516-039
8516-181	TG611-13 (4000 RPM) ATEX COMPLIANT, w/OTD	12	Screw	4000	4400	3600	3910	2400	CW	F8516-039
8516-182	TG611-13 (4000 RPM) ATEX COMPLIANT, w/OTD	12	Screw	4000	4400	3600	3910	2400	CCW	G8516-039
8516-183	TG611-13 (6000 RPM) ATEX COMPLIANT, w/OTD	12	Screw	6000	6600	5400	6050	4000	CCW	8516-040
8516-184	TG611-13 (6000 RPM) ATEX COMPLIANT, w/OTD	12	Screw	6000	6600	5400	6050	4000	CW	A8516-040
9904-814	TG13 (2400 RPM) ATEX COMPLIANT	12	Screw	2400	2900	1800	2010	1200	CCW	8516-038
9904-815	TG13 (2400 RPM) ATEX COMPLIANT	12	Screw	2400	2900	1800	1950	1200	CW	B8516-038
9904-816	TG13 (2400 RPM) ATEX COMPLIANT	12	Screw	2400	2900	1800	1950	1200	CCW	C8516-038
9904-817	TG13L (2400 RPM) ATEX COMPLIANT	12	Lever	2400	2900	1800	1950	1200	CCW	8516-041
9904-818	TG13L (4000 RPM) ATEX COMPLIANT	12	Lever	4000	4400	3600	3910	2400	CW	C8516-042
9904-819	TG13L (4000 RPM) ATEX COMPLIANT	12	Lever	4000	4400	3600	3910	2400	CCW	D8516-042
9904-820	TG13 (4000 RPM) ATEX COMPLIANT	12	Screw	4000	4400	3600	3910	2400	CW	F8516-039
9904-821	TG13 (4000 RPM) ATEX COMPLIANT	12	Screw	4000	4400	3600	3910	2400	CCW	G8516-039
9904-822	TG13 (6000 RPM) ATEX COMPLIANT	12	Screw	6000	6600	5400	5860	4000	CCW	J8516-040
9904-823	TG13 (6000 RPM) ATEX COMPLIANT	12	Screw	6000	6600	5400	5860	4000	CW	H8516-040
9904-824	TG 13L (2400 RPM) ATEX COMPLIANT	12	Lever	2400	2900	1800	1950	1200	CW	B8516-041
9904-825	TG13L (6000 RPM) ATEX COMPLIANT	12	Lever	6000	6600	5400	5860	4000	CW	B8516-043
9904-826	TG13L (6000 RPM) ATEX COMPLIANT	12	Lever	6000	6600	5400	5860	4000	CCW	C8516-043
9904-827	TG13 (2400 RPM) ATEX COMPLIANT	12	Screw	2400	2900	1800	2010	1200	CW	A8516-038
9904-828	TG13 (4000 RPM) ATEX COMPLIANT	12	Screw	4000	4400	3600	4035	2400	CW	A8516-039

Table 1-1. TG-13 and TG611-13 Part Numbers

Item Number	Description	Work Output (ft lbs)	Speed Setting	Rated Speed	High Speed @ 2°	Rated Speed @ 38°	Rated Speed @ 2°	Low Speed @ 2°	Drive Rotation	Same As
8516-185	TG611-17 (2400 RPM) ATEX COMPLIANT, w/OTD	17.5	Screw	2400	2900	1800	1950	1200	CCW	8516-044
8516-186	TG611-17 (2400 RPM) ATEX COMPLIANT, w/OTD	17.5	Screw	2400	2900	1800	2010	1200	CW	A8516-044
8516-187	TG611-17 (4000 RPM) ATEX COMPLIANT, w/OTD	17.5	Screw	4000	4400	3600	4035	2400	CCW	8516-045
8516-188	TG611-17 (4000 RPM) ATEX COMPLIANT, w/OTD	17.5	Screw	4000	4400	3600	4035	2400	CW	A8516-045
8516-189	TG611-17 (4000 RPM) ATEX COMPLIANT, w/OTD	17.5	Screw	4000	4400	3600	3910	2400	CCW	C8516-045
8516-190	TG611-17 (6000 RPM) ATEX COMPLIANT, w/OTD	17.5	Screw	6000	6600	5400	6050	4000	CCW	8516-046
8516-191	TG611-17 (6000 RPM) ATEX COMPLIANT, w/OTD	17.5	Screw	6000	6600	5400	6050	4000	CW	A8516-046
9904-800	TG 17 (2400 RPM) ATEX COMPLIANT	17.5	Screw	2400	2900	1800	1950	1200	CCW	8516-044
9904-801	TG 17 (2400 RPM) ATEX COMPLIANT	17.5	Screw	2400	2900	1800	1950	1200	CW	B8516-044
9904-802	TG 17 (2400 RPM) ATEX COMPLIANT	17.5	Screw	2400	2900	1800	2010	1200	CCW	C8516-044
9904-803	TG 17 (4000 RPM) ATEX COMPLIANT	17.5	Screw	4000	4400	3600	4035	2400	CCW	8516-045
9904-804	TG 17 (4000 RPM) ATEX COMPLIANT	17.5	Screw	4000	4400	3600	3910	2400	CW	B8516-045
9904-805	TG 17 (4000 RPM) ATEX COMPLIANT	17.5	Screw	4000	4400	3600	3910	2400	CCW	C8516-045
9904-806	TG 17 (6000 RPM) ATEX COMPLIANT	17.5	Screw	6000	6600	5400	5860	4000	CW	C8516-046
9904-807	TG 17 (6000 RPM) ATEX COMPLIANT	17.5	Screw	6000	6600	5400	5860	4000	CCW	D8516-046
9904-808	TG 17L (2400 RPM) ATEX COMPLIANT	17.5	Lever	2400	2900	1800	2010	1200	CCW	8516-047
9904-809	TG 17L (2400 RPM) ATEX COMPLIANT	17.5	Lever	2400	2900	1800	2010	1200	CW	A8516-047
9904-810	TG 17L (4000 RPM) ATEX COMPLIANT	17.5	Lever	4000	4400	3600	4035	2400	CCW	8516-048
9904-811	TG 17L (4000 RPM) ATEX COMPLIANT	17.5	Lever	4000	4400	3600	4035	2400	CW	A8516-048
9904-812	TG 17L (6000 RPM) ATEX COMPLIANT	17.5	Lever	6000	6600	5400	6000	4000	CCW	8516-049
9904-813	TG 17L (6000 RPM) ATEX COMPLIANT	17.5	Lever	6000	6600	5400	6000	4000	CW	A8516-049
9903-528	TG 17 (4000 RPM) FOR NUCLEAR	17.5	Screw	4000	4400	3600	4035	2400	CCW	8516-045

Table 1-2. TG-17 and TG611-17 Part Numbers

Chapter 2.
Installation

Introduction

Use care while handling and installing the TG-13/TG-17 and TG611-13/ TG611-17 governors. Be particularly careful to avoid striking the drive shaft, terminal shafts, speed-setting shafts, or adjusting screw. Abuse can damage seals, internal parts, and factory adjustments.

Do not rest the governor on its drive shaft.

⚠WARNING

Explosion Hazard—The surface temperature of this governor depends on three operating conditions: drive shaft speed, ambient temperature, and hydraulic fluid selection. It is the user's responsibility to maintain a safe surface and fluid temperature. If normal operating conditions cause the surface temperature of the TG to rise close to ignition temperatures of hazardous gases in the external environment or near the maximum recommended hydraulic fluid temperature, a heat exchanger must be installed. Refer to the sections on "Heat Exchanger Installation" and "When is a Heat Exchanger Necessary?" for location and sizing of the ports for connection of a heat exchanger.

⚠WARNING

Explosion Hazard—External fire protection is not provided in the scope of this product. It is the responsibility of the user to satisfy any applicable requirements for their system.

⚠CAUTION

Due to typical noise levels in turbine environments, hearing protection should be worn when working on or around the TG governor.

⚠CAUTION

The surface of this product can become hot enough to be a hazard. Use protective gear for product handling in these circumstances.

Receiving

The governor is shipped from the factory bolted to a wooden platform in the vertical position and boxed. An oil sight gauge is factory installed on each side of the case, and a breather/filler cap is positioned for vertical governor mounting and operation.

After factory testing and adjusting, the governor is drained of oil, sealed, and painted. A light film of oil covers internal parts to prevent rust. External shafts are coated with a spray lubricant. No internal cleaning or flushing is necessary before installation and operation or customer retesting.

Storage

The governor may be stored for short periods of time as received from the factory. For long-term storage, storage in a hostile environment (large temperature changes, humid or corrosive atmosphere), or if the governor is installed on the turbine for storage, fill the governor with oil and follow preservation packaging instructions in Woodward Manual 25075, *Commercial Preservation Packaging for Storage of Mechanical-Hydraulic Controls*.

If the breather/filler cap has been moved for horizontal governor operation and the governor is to be stored vertically, replace the cap with a plug before filling the governor with oil to prevent oil from draining through the cap.

Drive-Shaft Rotation

Governor drive-shaft rotation is determined by looking at the governor from the top.

IMPORTANT

The correct direction of rotation of the TG, when viewed from the top of the governor, is stamped "cw" (clockwise) or "ccw" (counterclockwise) on the governor nameplate.

Governor drive-shaft rotation is single direction only. When looking at the governor from the top, the direction of rotation must be the same as the turbine-shaft rotation when looking at the mounting pad.

If the governor oil pump is rotated in the wrong direction, the governor will not have oil pressure. Without oil pressure, pump parts start heating up, which can result in possible seizure of rotating parts.

NOTICE

Be sure governor-drive and turbine-drive rotation is the same when looking at the governor and the mounting pad from the top. Incorrect drive rotation may cause governor damage.

Changing Drive-Shaft Rotation

TG with a Pump Eccentric not Machined into The Base

1. See Figures 2-1, 2-2, and 2-3.
2. Remove the governor from the turbine. Drain all oil from the governor.
3. Place the governor on its side with the cooler tap up.
4. Turn the key slot on the drive shaft to face up.
5. Remove the four pump-housing screws and remove the pump housing.
6. Notice the directional arrows stamped on the pump housing. Turn the eccentric ring so that the pin hole is next to the arrow for desired shaft rotation.

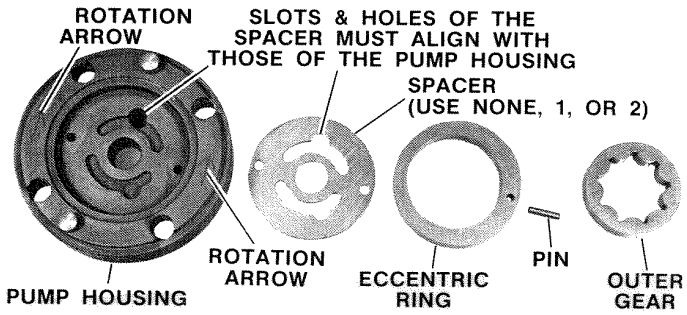


Figure 2-1. Pump-Housing Assembly

7. Insert the pin into the pin hole in the eccentric (pin must drop below flush).

8. Place the inner and outer gear in the pump housing.

9. Be sure that the key slot in the drive shaft is turned up and the square-headed pin on the pump drive is in place.

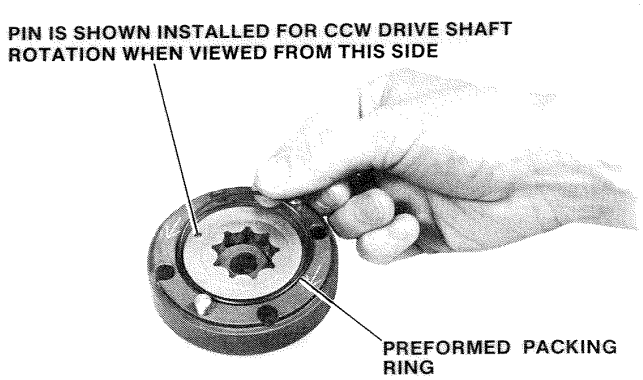


Figure 2-2. Pump -Housing Assembly

10. Install the pump-housing assembly on the drive shaft and align the slot in the inner gear with the pump-drive pin.

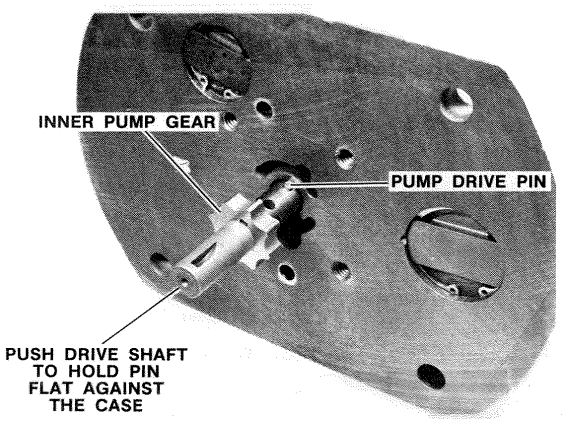


Figure 2-3. Location of Pump-Drive Pin

IMPORTANT **Do NOT turn the drive shaft in order to engage the outer and inner pump gears. It is possible for the pump drive pin to fall out if the drive shaft is turned. The square head on the pump drive pin must remain against the case bottom as shown in Figure 2-3.**

11. Fasten the pump housing to the case with four screws and torque to 33.9 N·m (300 lb-in).

12. Make sure that the drive shaft rotates freely.

13. Place the ballhead retaining collar on the drive shaft. Leave 0.25 mm (0.010 inch) clearance between the pump housing and collar. Torque to 5.6 N·m (50 lb-in).

IMPORTANT **If the drive shaft does not rotate freely, loosen the four screws on the pump housing, align the pump, and tighten the screws.**

TG with a Pump Eccentric Machined into the Base

1. See Figures 2-4, 2-5, and 2-6.

2. Remove the four pump-housing screws.

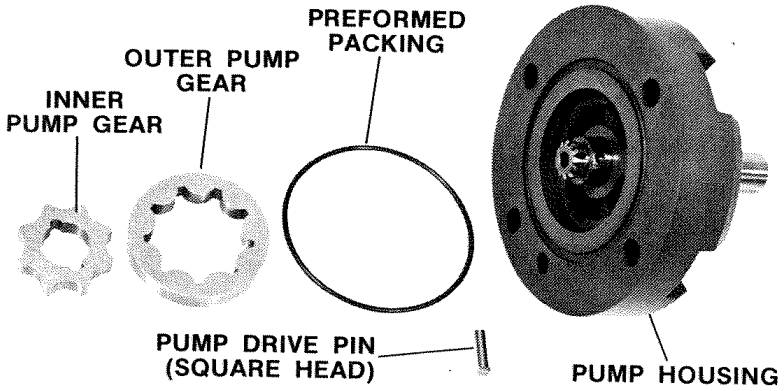


Figure 2-4. Pump-Housing Assembly

IMPORTANT **Hold the pump-housing assembly flat against the governor case when rotating the pump housing 180 degrees. (See WARNING below.)**

If the pump shaft (124) is allowed to become separated from the ballhead drive shaft (123) [see Figure 6-3], the governor will call for maximum fuel, possibly causing a dangerous overspeed.

⚠WARNING **Death, personal injury and/or extensive damage to equipment can result if the governor pump is reassembled with ballhead shaft and the pump drive shaft disconnected.**

3. Rotate the pump-housing assembly 180 degrees.

4. Align the arrow on the pump housing with the reference point on the governor case. Figure 2-5 shows the setup for clockwise (cw) rotation of the governor drive shaft, and Figure 2-6 shows the setup for counterclockwise (ccw) rotation of the governor drive shaft.

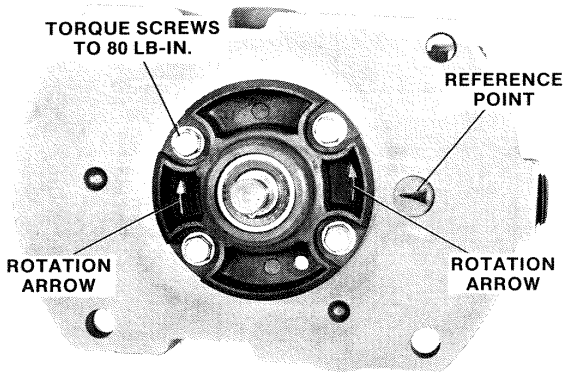


Figure 2-5. Setup for Clockwise Rotation of the Governor Drive Shaft

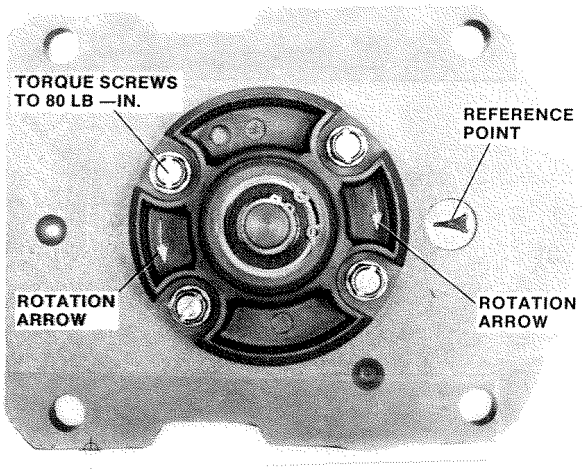


Figure 2-6. Setup for Counterclockwise Rotation of the Governor Drive Shaft

As seen in Figure 2-5, a TG described as having a “clockwise rotation” is set using the arrow that points *counterclockwise* next to the reference point on the governor case. And a TG described as having a “counterclockwise rotation,” as in Figure 2-6, is set using the arrow that points *clockwise* next to the reference point on the governor case. This is because normal rotation is stated viewing the governor from the top, whereas the governor is viewed from the bottom while changing rotation.

1. If the governor is fitted with a speed-setting screw, turn the speed-setting screw fully clockwise. If the governor is fitted with a lever speed setting, bring the speed-setting shaft to the maximum-fuel position using serration wrench 030943 and hold the speed-setting shaft in that position. This will compress the governor speeder spring and prevent a separation of the governor drive shaft (124) form the ballhead assembly (123) (see Figure 6-3).

   Be sure that the drive shaft line engages with the bushing.

Now keep maintaining pressure on the speeder spring while replacing the four screws, and torque to 9.0 N·m (80 lb-in). If the governor is equipped with an extended drive shaft (Figure 6-4), torque to 5.6 to 7.0 N·m (50 to 62 lb-in).

5. Make sure that the drive shaft rotates freely.

6. Remove the cover and make sure that the ballhead is rotating when the pump drive shaft is rotated. It is possible to reassemble the pump with the ballhead disengaged. If this happens, the governor will call for maximum fuel, possibly causing a dangerous overspeed.

⚠WARNING

Death, personal injury and/or extensive damage to equipment can result if the governor pump is reassembled with ballhead shaft and the pump drive shaft disconnected.

Governor Mounting

This governor can be mounted vertically or horizontally. Mounting is called vertical or horizontal if the drive shaft is in a vertical or horizontal position when viewing the governor installed on its mounting base.

The breather/filler cap and the drain plug are factory installed for vertical governor operation. For horizontal operation, the breather/filler cap and drain plug must be interchanged (each moved to the other's position). Retighten the breather/filler cap and drain plug to prevent them from leaking (25.4 ±1.7 N·m / 225 ±15 lb-in torque).

This places the servopiston on the bottom, keeping it completely immersed in oil and preventing air from being trapped in the servopiston. See the outline drawings (Figure 2-10) for alternate cap and plug positions as well as governor mounting-hole locations and hole sizes. This also places the oil sight gauge above the terminal shaft. The oil sight gauge may be moved to the right side, if desirable.

NOTICE

For horizontal operation, the TG governor must be installed with the oil sight gauge at the top of the governor, as shown in Figure 2-8.

Make sure that there is adequate clearance for attaching the fuel control or steam-valve linkage, manual speed adjustment or speed-setting lever linkage, and for oil maintenance.

Be sure that the device-shaft rotation (clockwise or counterclockwise), and the governor speed setting is correct for your installation.

IMPORTANT

Correct direction of the governor drive-shaft and the maximum governor speed setting is stamped on the data plate.

Governor drive-shaft rotation is single direction only. When looking at the governor from the top, the direction of rotation must be the same as the turbine-shaft rotation when looking at the mounting pad.

NOTICE

Be sure turbine drive and governor drive directions of rotation are the same. Incorrect drive rotation may cause governor damage.

If the governor oil pump rotates in the wrong direction, there will be no oil pressure. Without oil pressure, pump parts will heat up, and seizure of rotating parts will result.

Be sure that the governor drive shaft is accurately aligned and concentric with the turbine shaft. All fits must be close but free. The drive coupling used must allow for thermal expansion without end-loading the drive shaft. The coupling must also ensure that no side loads are applied to the governor drive shaft.

NOTICE

Do not pound the drive coupling on the governor drive shaft, or force the governor into position. The drive shaft diameter is 12.675 to 12.687 mm (0.4990 to 0.4995 inch). Force could damage the governor.

Use a gasket between the governor and the turbine mounting pad to allow for surface imperfections. Using a drive coupling of the correct length, and a No. 5 Woodruff key, install the governor on the mounting pad. Tighten the four governor mounting bolts equally.

IMPORTANT

Refer to the turbine manufacturer's specifications for torque limits when tightening the four governor mounting bolts.

Linkage Attachments

Terminal Shaft

The terminal shaft extends from both sides of the case and provides 40 degrees of full governor travel. Recommended travel between no load and full load is 2/3 of full governor travel. See Figure 1-1 for a graphic representation of maximum work capacity for the TG and related governor terminal shaft travel information. Installed linkages must operate smoothly, free of binding, and can be spring loaded in the shutdown direction only to remove looseness.

⚠WARNING

Be sure to allow sufficient overtravel at each end of the terminal shaft. Failure to provide sufficient overtravel at maximum fuel position can prevent the prime mover from giving maximum fuel when required. Failure to provide sufficient overtravel at minimum fuel position can prevent the governor from shutting down the prime mover and result in possible damage to equipment and personal injury.

Linkage should be free of any friction or binding. All lost motion should be eliminated. Terminal shaft connections should be a 0.625 to 0.636 serration clamped to the output shaft. Refer to Figure 2-7, for typical linkage arrangement.

Speed Setting Linkage

If the TG-13 or TG-17 is equipped with optional lever speed setting, linkage to the speed-setting shaft on either side must be installed. Lever speed setting requires 30 degrees travel for full governor speed-range. An internal return spring with a maximum force of 2.5 N·m (22 lb-in) is acting on the speed setting shaft. Speed-setting linkage also must operate smoothly, without binding or looseness.

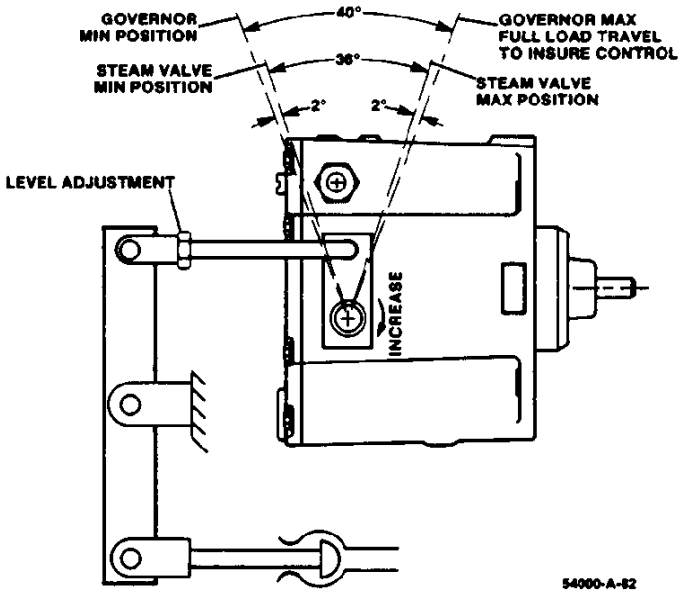


Figure 2-7. Typical Linkage Arrangement for the TG Governor

Heat Exchanger Installation (optional)

If it is necessary to install a heat exchanger, mount it below governor oil level in order to prevent overflow of oil through the governor breather/filler cap. Flush the heat exchanger before installation with the same grade and type of oil selected for the TG governor (see Oil Supply below) to remove possible oxidation.

Make the required piping connections to the cooler and the governor (see Figure 2-9, which illustrates tap locations and piping connections). Notice in Figure 2-8, Heat-Exchanger Tap Locations, that there are two tap locations for the oil from the cooler outlet. Which tap location is used depends on the governor mounting position.

Pipe must be sized to minimize pipe-pressure losses, which must not exceed 103 kPa (15 psi). Oil flow from the oil to cooler inlet tap (0.125”-27 NPTF) on a governor operating at 6000 rpm and using a 0.188 thick gerotor pump (0.188 is standard thickness on high-speed governors) is 3.8 L/min at 1034 kPa (1 US gal/min at 150 psi). Install a governor oil drain in the oil-from-cooler outlet pipe at the lowest point in the system (see Figure 2-9).

It is recommended that a throttling device be installed so that coolant flow to the heat exchanger can be regulated for optimum operating temperature of the oil. Excessive cooling of governor oil can cause marginal operation.

Oil Supply

Remove the breather/filler cap and fill the governor with 1.7 L (1.8 US quarts) of oil to a level visible on the oil sight gauge. Additional oil is required if the governor uses an oil heat-exchanger. Always make sure that the oil level is visible on the oil sight gauge before starting. After the turbine is started and the governor is at operating temperature, add oil if necessary.

Select an oil based on the operating temperature of the governor (see Table 2-1).

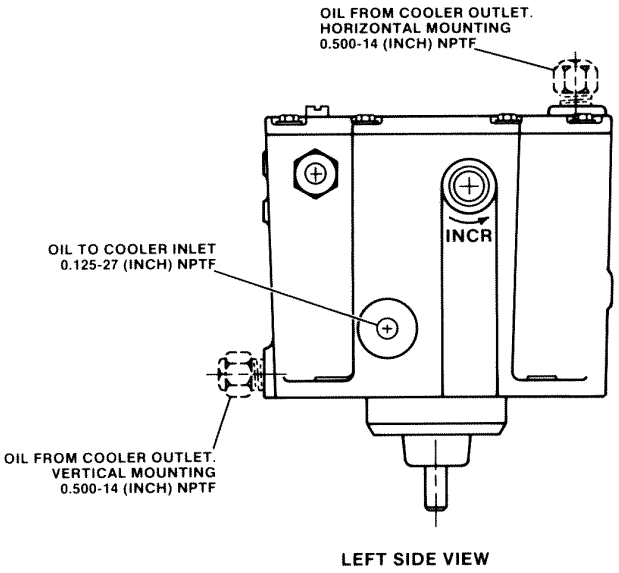


Figure 2-8. Heat-Exchanger Tap Locations

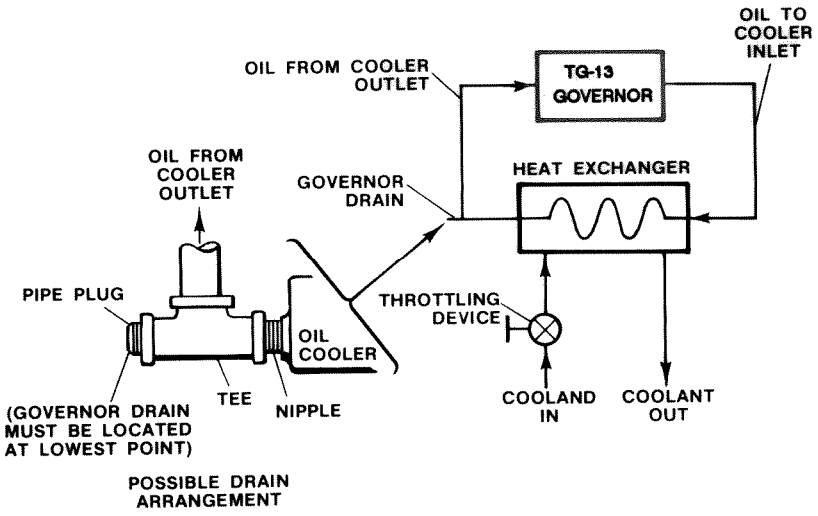


Figure 2-9. Heat-Exchanger Piping Schematic

Use Tables 2-1 and 2-2 as a guide in the selection of a suitable lubricating/ hydraulic oil. Oil grade selection is based on the operating-temperature range of the governor. Also, use this information to aid in recognizing and correcting common oil problems.

For applications where the governor shares the oil supply with the turbine, use the oil recommended by the turbine manufacturer.

Governor oil is both a lubrication oil and a hydraulic oil. It must have a viscosity index that allows it to perform over the operating-temperature range, and it must have the proper blending of additives that cause it to remain stable and predictable over this range.

Governor oil must be compatible with seal materials (nitrile, polyacrylic, and fluorocarbon). Many automotive and gas-engine oils, industrial lubrications oils, and other oils of mineral or synthetic origin, meet these requirements.

Woodward governors are designed to give stable operation with most oils with a viscosity, at operating temperature, of between 50 and 3000 SUS (Saybolt Universal Seconds). At normal operating temperature, the viscosity should be between 100 to 300 SUS. Poor actuator response or instability may be an indications that oil viscosity is outside this range.

Excessive component wear or seizure in a governor indicates the possibility of:

1. Insufficient lubrication caused by:
   - An oil that flows slowly when it is cold, especially during start-up.
   - No oil in the governor.

2. Contaminated oil caused by:
   - Dirty oil containers.
   - A governor exposed to heating-up and cooling-down cycles, which creates condensation of water in the oil.

3. Oil not suitable for the operating conditions caused by:
   - Changes in ambient temperature.
   - An improper oil level which creates foamy, aerated oil.

Operating a governor continuously beyond the high-limit temperature of the oil will result in oil oxidation. This is identified by varnish or sludge deposits on the governor parts. To reduce oil oxidation, lower the actuator operating-temperature with a heat exchanger or other means, or change to an oil more oxidation-resistant at the operating temperature.

⚠WARNING

A loss of stable governor control and possible turbine overspeed may result if the viscosity is not within the 50 to 3000 SUS range. An overspeeding and/or runaway prime mover can result in extensive damage to the equipment, personal injury and/or loss of life.

Specific oil-viscosity recommendations are given in the Oil Chart (Table 2-1). Select a readily available good brand of oil, either mineral or synthetic, and continue using that same brand. Do NOT mix different classes of oils. Oil that meets the API (American Petroleum Institute) engine-service classification in either the “S” group or the “C” group, starting with “SA” or “CA” through “SF” and “CD” is suitable for governor service. Oils meeting performance requirements of the following specifications are also suitable: US MIL-L-2104A, MIL-L-2104B, MIL-L-2104C, MIL-L-46152, MIL-L-46152A, MIL-L-46152B, MIL-L-45199B.

Replace the governor oil if it is either contaminated or suspected of contributing to governor instability, or every three years if the governor is in continuous operation. Drain the oil while it is still hot and agitated; flush the governor with a clean solvent having some lubrication quality (such as fuel oil or kerosene) before refilling with new oil. If drain time is insufficient for the solvent to completely drain or evaporate, flush the governor with the same oil it is being refilled with to avoid dilution and possible contamination of the new oil. To avoid recontamination, the replacement oil should be free of dirt, water, and other foreign material. Use clean containers to store and transfer oil.

⚠WARNING

Observe manufacturer's instructions or restrictions regarding the use of solvents. If no instructions are available, handle with care. Use the cleaning solvent in a well ventilated area away from fires or sparks.

Failure to follow the above safety instructions can result in dangerous fires, extensive damage to equipment, personal injury and/or loss of life.

Oil that has carefully selected to match the operating conditions and is compatible with governor components should give long service between oil changes. For governors operating under ideal conditions (minimum exposure to dust and water and within the temperature limits of the oil), oil changes can be extended. If available, a regularly scheduled oil analysis is helpful in determining the frequency of oil changes.

Any persistent or recurring oil problems should be referred to a qualified oil specialist for solution.

When is a Heat Exchanger Necessary?

The maximum surface temperature of the TG governor must stay below the lowest ignition temperature of the surrounding explosive atmosphere and within allowable operating conditions for the oil. The recommended continuous operating temperature of the oil is 60 to 93 °C (140 to 200 °F). The ambient temperature limits are –29 to +93 °C (–20 to +200 °F). Measure the temperature of the governor on the outside lower part of the case. The actual oil temperature will by slightly warmer by approximately 6 °C (10 °F).

Some applications of the TG governor may require that an oil heat exchanger be used to prevent oil breakdown, excessive surface temperatures, and problems due to excessive oil temperatures. TG governors operating at low and medium speed-ranges (1100 to 2400 rpm and 2400 to 4000 rpm) do not normally require use of a heat exchanger. The high-speed governor (4000 to 6000 rpm) may require a heat exchanger in some applications.

Factors such as oil viscosity, governor speed, heat radiation from surrounding sources, and mounting pad and ambient temperatures affect oil conditions, necessitating an oil cooler. See Woodward Manual 25071, *Oils for Hydraulic Controls*.

Depending on the individual installation, and external oil cooler may be required. If the oil viscosity at operating temperature is below 100 SUS, an oil cooler is required. The TG governor is equipped with a cooler tap.

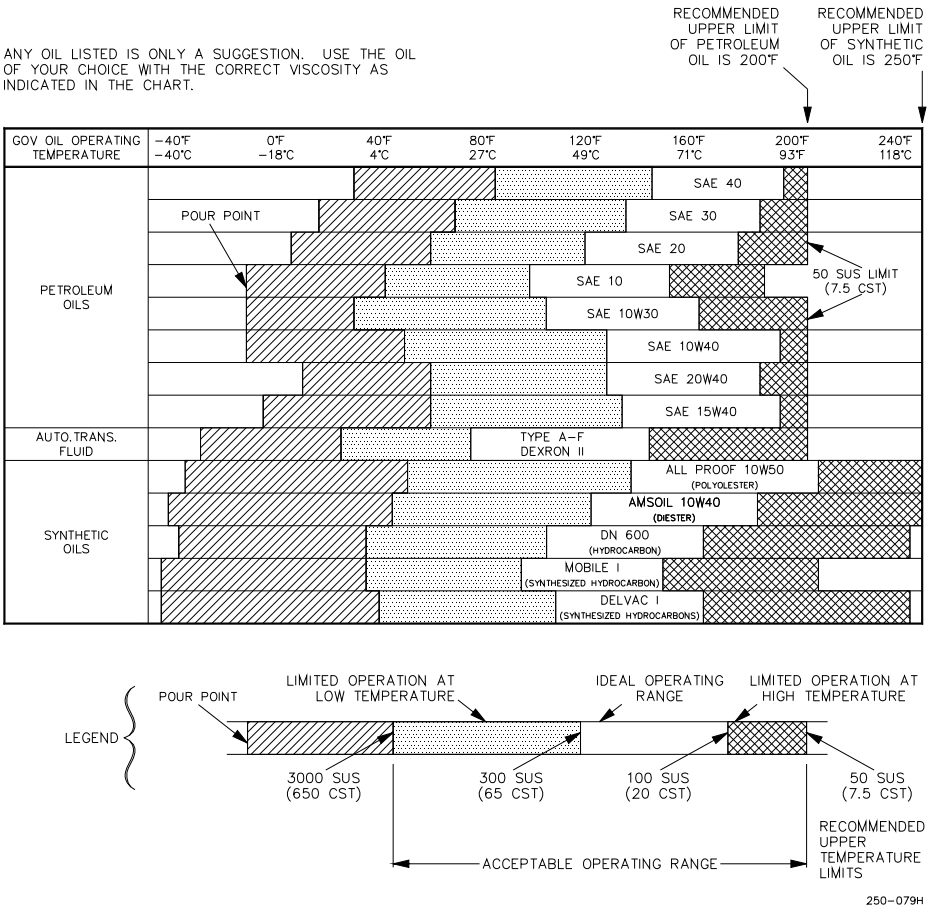


Table 2-1. Oil Chart

VISCOSITY COMPARISONS				
CENTISTOKES (CST, CS, OR CTS)	SAYBOLT UNIVERSAL SECONDS (SUS) NOMINAL AT 100 DEGREES F	SAE MOTOR (APPROXIMATE)	SAE GEAR (APPROXIMATE)	ISO
15	80	5W		15
22	106	5W		22
32	151	10W	75	32
46	214	10	75	46
68	310	20	80	68
100	463	30	80	100
150	696	40	85	150
220	1020	50	90	220
320	1483	60	115	320
460	2133	70	140	460

250−087
97−11−04 skw

Table 2-2. Viscosity Comparisons

Under laboratory test conditions, a single pass, counter-flow heat exchanger with 0.09 to 0.19 m^2 (1 to 2 ft^2) of effective heat-transfer area provides adequate cooling for most high-speed TG governor applications. If there is doubt concerning the need for, or size of a heat exchanger, contact Woodward or your local authorized distributor.

Overspeed Test Device

If you need to install an Overspeed Test Device on an older TG governor, please see Woodward application note 51348, *TG611-13/-17 Overspeed Test Device Conversion Kit*.

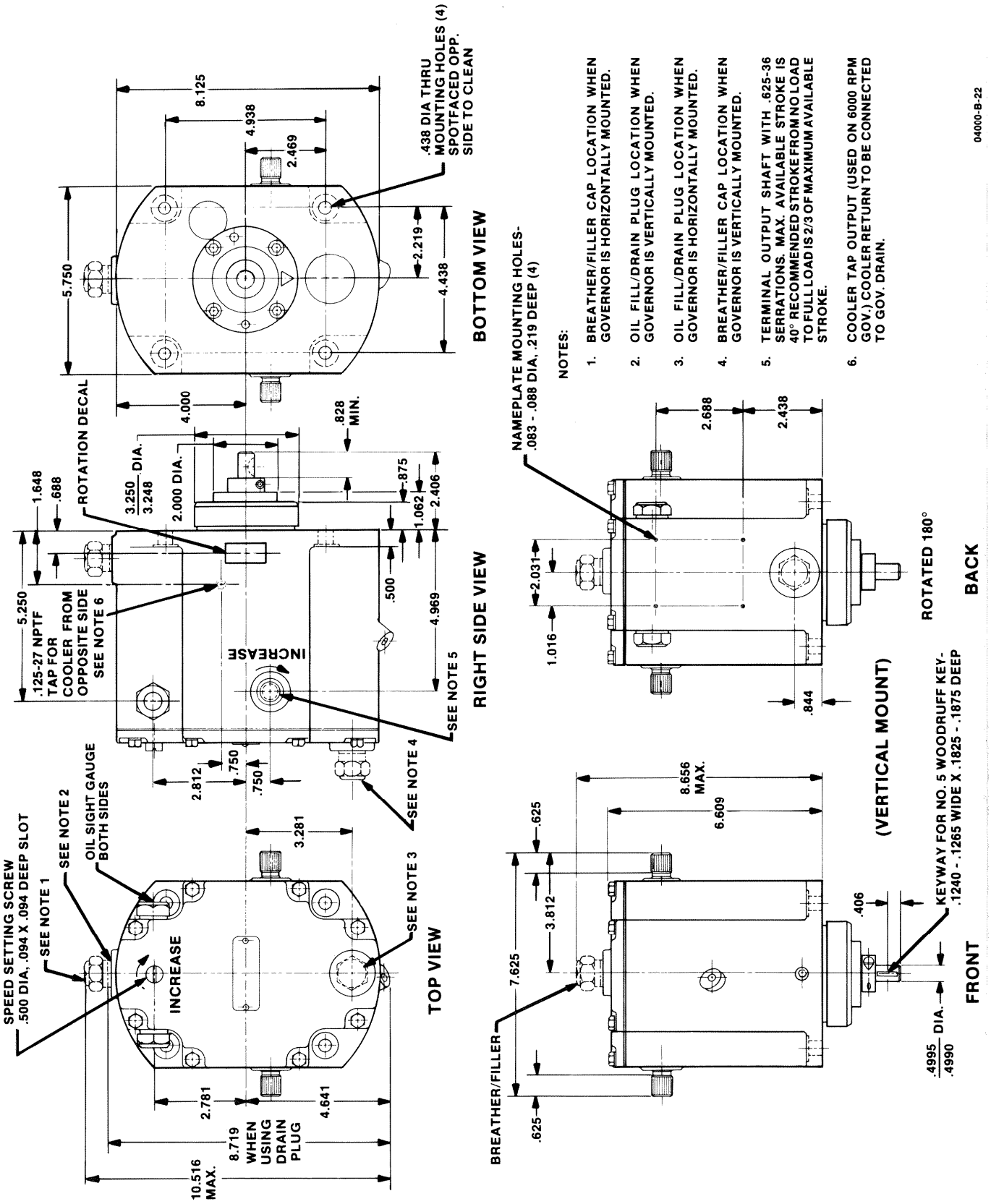


Figure 2-10a. TG-13/TG-17 Outline Drawing
Screw Speed Setting. Cast Iron Case. Do Not Use For Construction

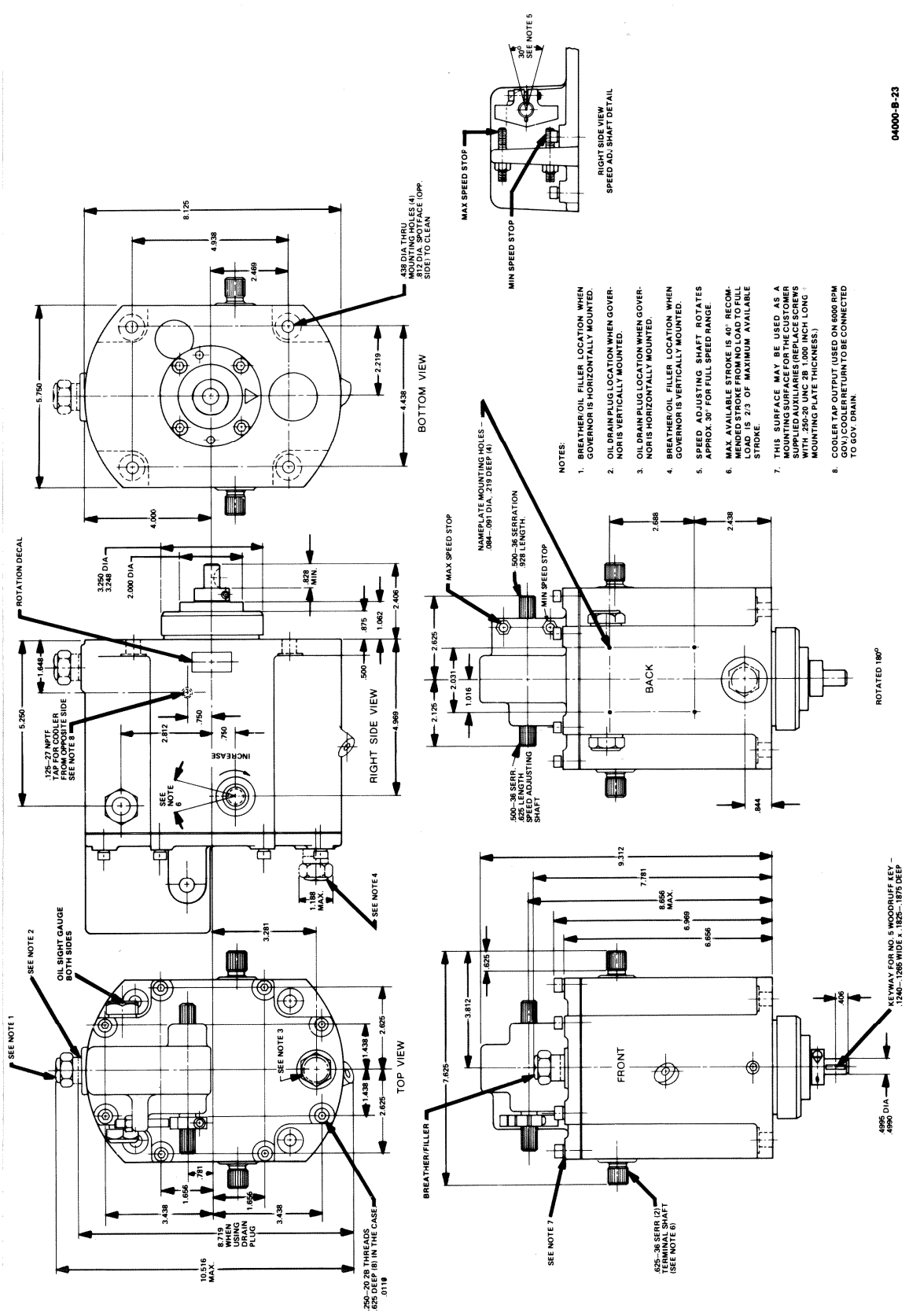


Figure 2-10b. TG-13/TG-17 Outline Drawing
Lever Speed Setting. Cast-Iron Case. Do Not Use For Construction

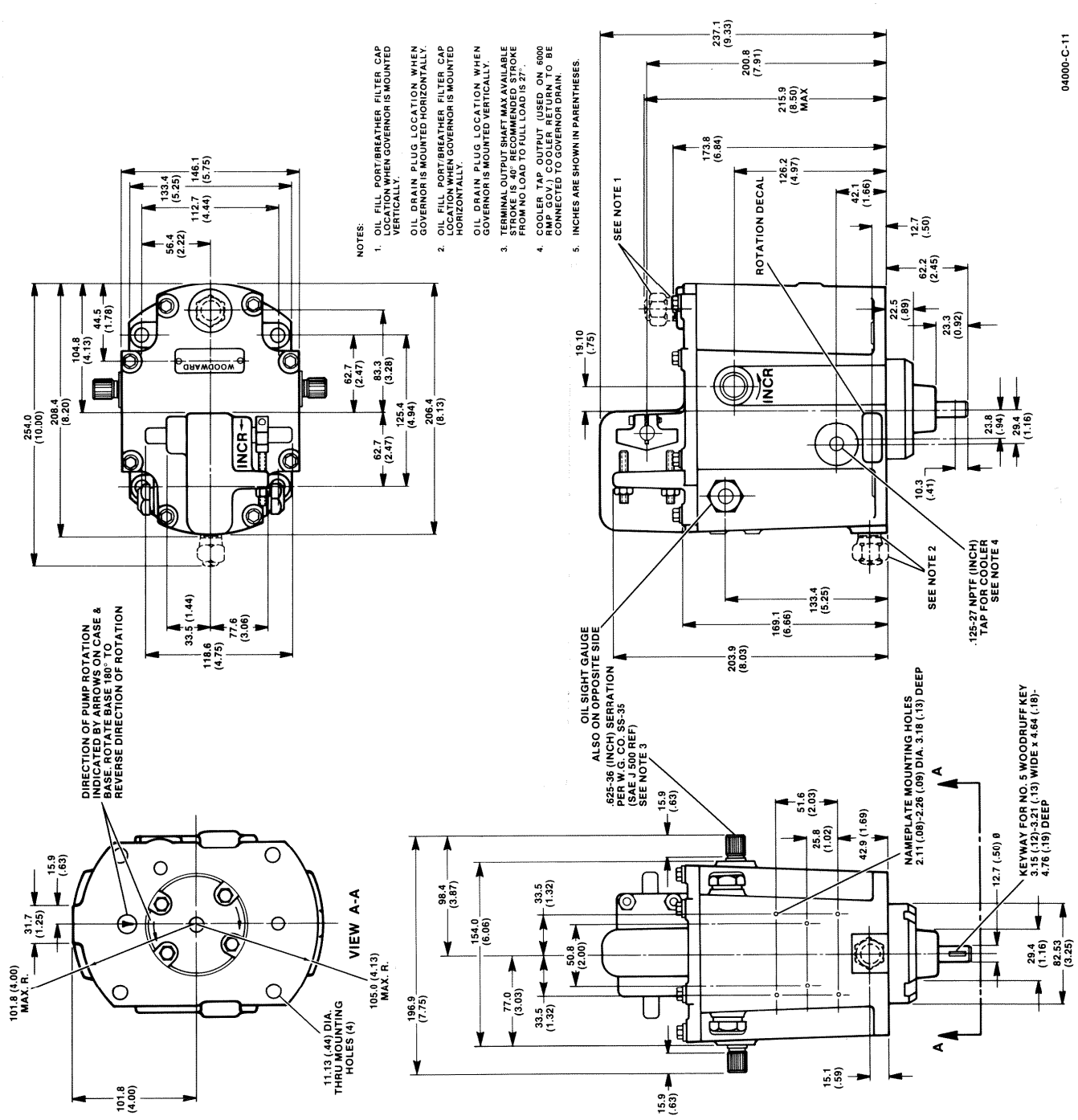


Figure 2-10c. TG-13/TG-17 Outline Drawing
Lever Speed Setting. Die-Cast Aluminum Case. Do Not Use For Construction

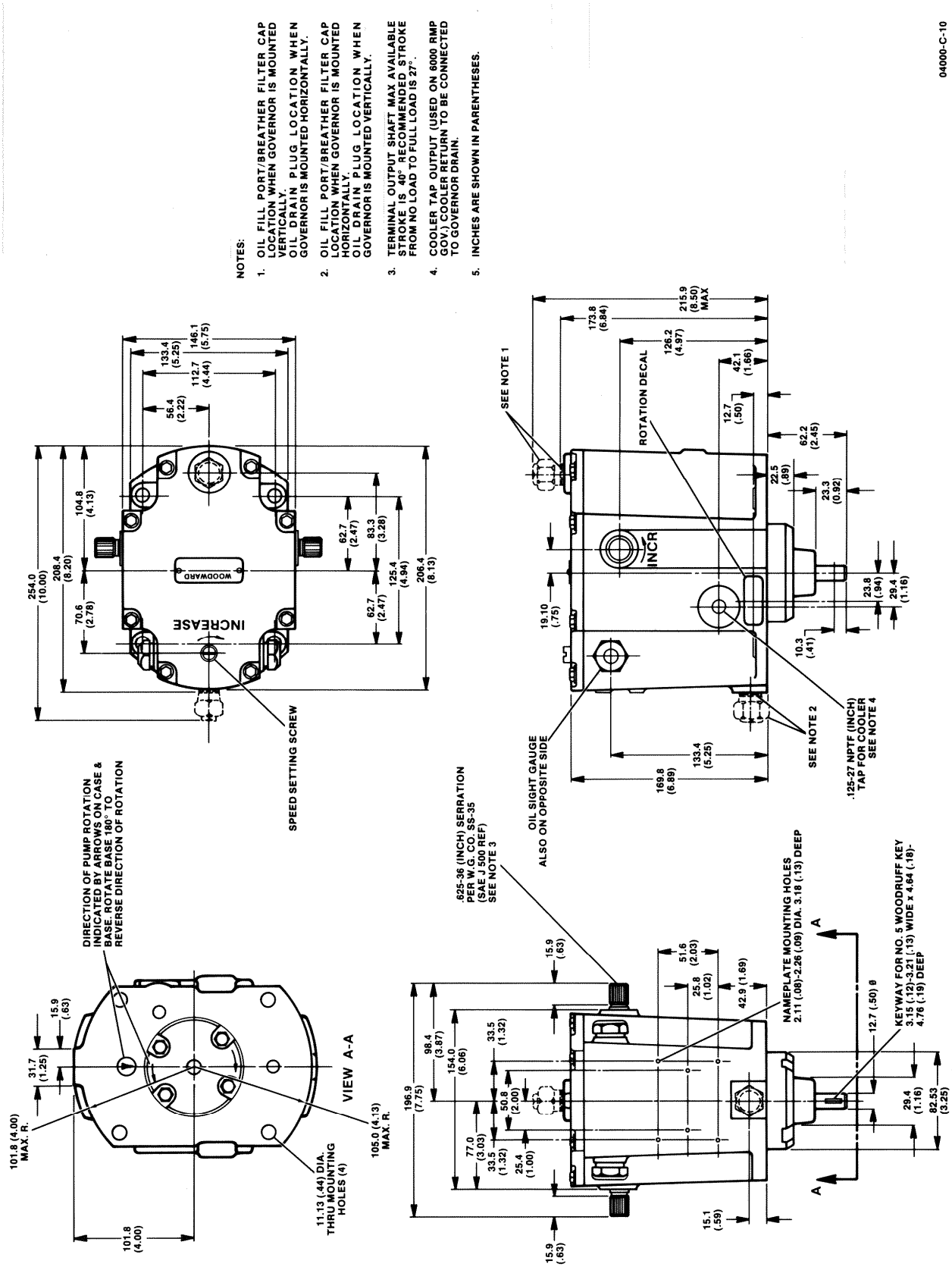


Figure 2-10d. TG-13/TG-17 Outline Drawing
Screw Speed Setting. Die-Cast Aluminum Case. Do Not Use For Construction

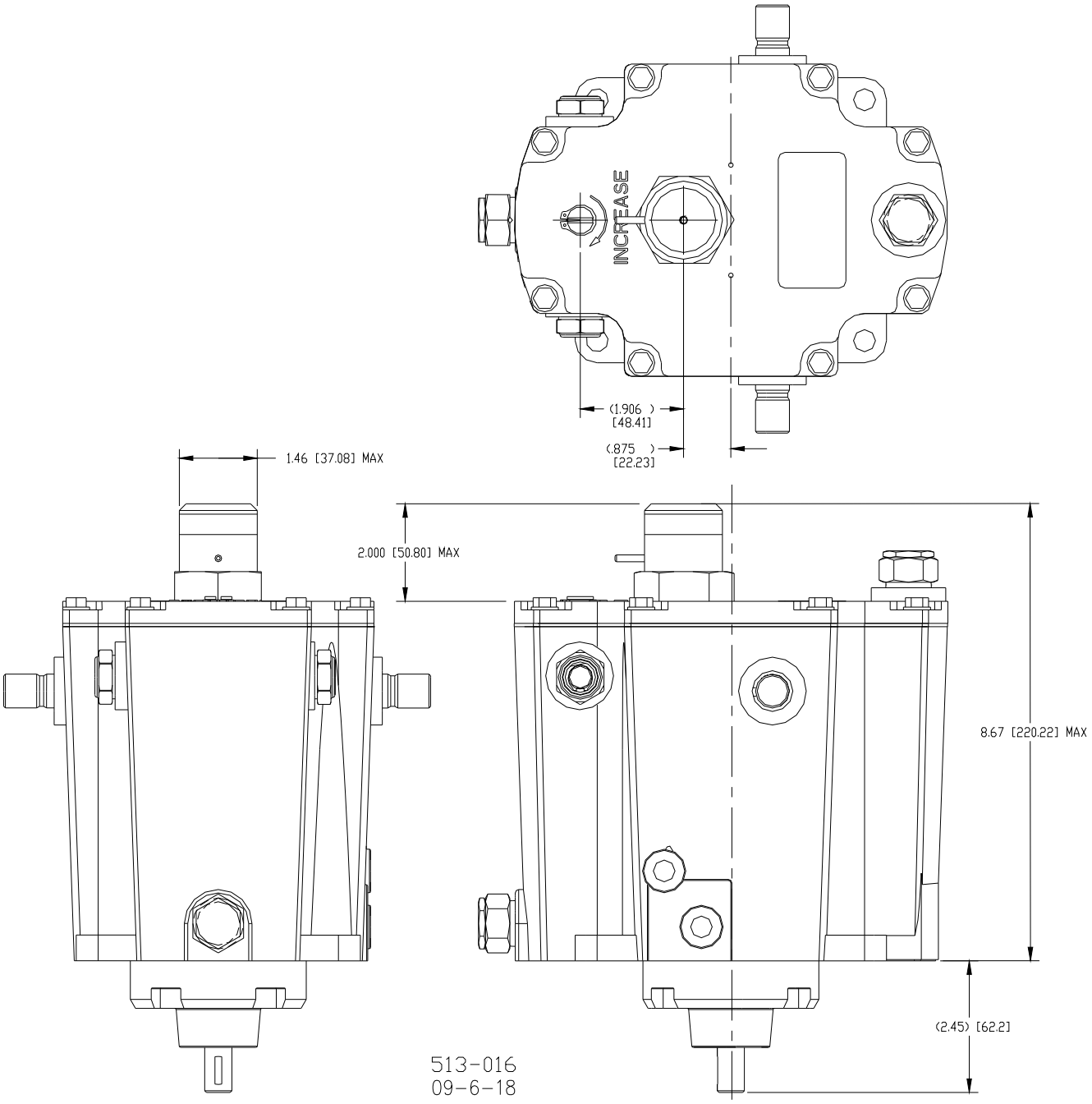


Figure 2-10e. TG611-13/TG611-17 Outline Drawing
Screw Speed Setting. Die-Cast Aluminum Case. Do Not Use For Construction
(Other than dimensions shown, TG611 dimensions are the same as other TG-13/TG-17)

Chapter 3.
Governor Operation and Adjustments

Introduction

This chapter provides initial operating instructions and adjustment features of the TG-13/TG-17 and TG611-13/TG611-17 governors.

⚠CAUTION

Due to typical noise levels in turbine environments, hearing protection should be worn when working on or around the TG governor.

⚠CAUTION

The surface of this product can become hot enough to be a hazard. Use protective gear for product handling in these circumstances.

Initial Operation

Before initial operation of the TG equipped turbine, be sure that all previous installation steps are successfully accomplished.

⚠WARNING

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.

Normally, the only requirements for putting a new or overhauled governor into service are to fill the governor with oil and adjust the rated speed setting. All other adjustments are accomplished during factory testing according to turbine-manufacturer specifications and should not require further adjustments.

Governor speed setting is factory set to give governor rated speed at initial start-up. This setting may be different than the rated turbine speed. It is recommended that the speed setting be decreased before start-up by turning the manual speed-setting screw, or by turning the high-speed stop screw clockwise on lever speed-setting models to give low speed at initial start-up.

Open the steam valve slowly. Check the turbine speed and adjust as necessary to bring the turbine to rated speed. Make sure the terminal-shaft linkage to the valve is correctly adjusted to allow maximum and minimum steam-flow requirement.

Check the governor for stable operation by manually disturbing the terminal shaft linkage or speed setting. Governor stability is satisfactory when the governor returns to speed with only a slight over or undershoot. Instability indicates the need for adjustment of droop.

Speed Droop

Speed droop, or simply droop, is a method of creating stability in a governor. It is the decrease in speed taking place when the governor terminal shaft moves from the minimum-fuel to the maximum-fuel position in response to a load increase, expressed as a percentage of rated speed.

If instead of a decrease in speed, an increase takes place, the governor is showing a negative droop. Negative droop will cause instability in a governor.

Not enough droop can cause instability in the form of hunting, or surging, in response to a load change. Too much droop can result in slow governor response in picking up or drooping off a load. Droop can be calculated with the following formula:

$$\% \text{ Droop} = \frac{\text{No Load Speed} - \text{Full Load Speed}}{\text{Full Load Speed}} \times 100$$

Droop Adjustment

The factory-made, 6% droop setting for 20 degrees terminal-shaft travel will provide sufficient stability for most applications and will not normally need to be adjusted before governor operation. Adjustment may be necessary if the governor has been disassembled.

IMPORTANT **If the governor terminal shaft does not use 2/3 of full governor travel from "NO LOAD" to "FULL LOAD", droop also will be reduced proportionately.**

Adjustment of droop may be required during governor operation if the governor shows instability or difficulty in responding to a load change. Instability, in the form of hunting or surging, indicates insufficient droop, and the droop-adjusting lever should be positioned to increase droop. If the TG shows difficulty in accepting load, or where the governor becomes unstable after a load change, excessive droop is indicated.

In cases where the governor droop setting must be changed on the turbine, use the following droop-adjusting procedure:

1. Shut down the turbine.

2. Remove the cover assembly to gain access to the droop-adjusting lever. Use care while removing the cover not to damage the cover gasket. If the governor is horizontally mounted, drain governor oil before removing the cover. The cover also fastens internal parts that can fall out, especially on horizontally mounted governors.

3. Loosen the socket-head screw which fastens the droop-adjusting lever just enough to slide the lever a very small amount, approximately 0.8 mm (1/32 inch) at a time, in the direction desired to adjust droop.

   Moving the droop-adjusting lever away or towards the terminal shaft center line, increases or decreases droop, respectively (see Figure 3-1).

⚠WARNING **Do not move the droop-adjusting lever in the decrease-droop direction too far toward zero droop (the center line of the terminal shaft), as this results in an unstable operation. TG governors are not stable at "0" droop.**

4. Tighten the screw and install the cover. Torque the cover screws to 11.3 N·m (100 lb-in) for cast iron governors.

5. Fill the governor with oil to a level visible on the oil sight gauge.

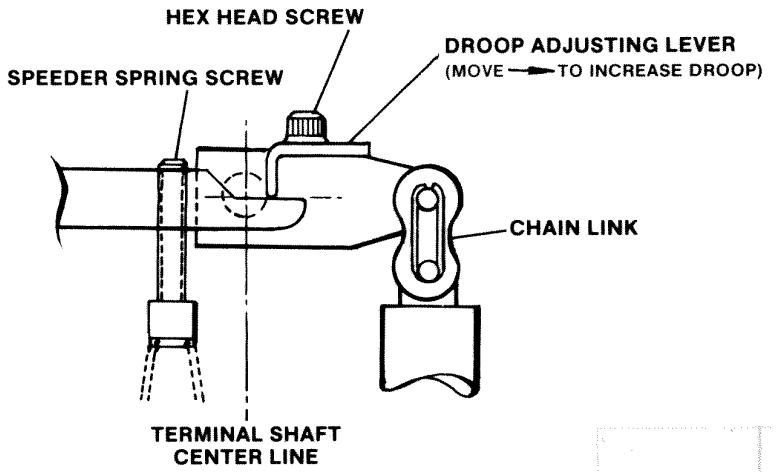


Figure 3-1. Droop-Adjusting Lever Movement

6. Observe governor operating behavior again and repeat adjustments to the droop-adjusting lever until governor operation is satisfactory. If repeated attempts at adjustment fail to provide governor stability, other problems are indicated. See Troubleshooting, Table 5-1.

⚠WARNING

The TG cover fastens internal parts into operating position. Do not operate the TG governor without the cover assembly in place. Failure to fasten the cover assembly securely in place can result in extensive damage to equipment and personal injury.

Operation of the Overspeed Test Device

Adjusting the Overspeed Test Device

The overspeed test device (OTD) must be adjusted for each application trip speed.

1. Begin the adjustment procedure with the turbine shut down.

2. Remove (unthread) the cap from the overspeed test device.

3. In the following steps, use the cap and adjusting dowel pin (Figure 6-6 item 1) to fully actuate the overspeed test device cam (Figure 6-6 item 12).

⚠WARNING

You must ensure that the overspeed device is fully activated before adjusting it. The OTD cap and adjusting pin must not be touching anything but the cam during the adjustment procedure.

4. With the turbine shut down, rotate the cam to full-stroke position and hold it in place while making sure that the trip push rod (Figure 6-6 item 14) is backed out as far as it can go, by turning it counterclockwise (CCW) with a 3/32” Allen wrench.

IMPORTANT **New units from the factory will already be set this way.**

5. Start and run the turbine at rated “no-load” speed.

6. Using the cap and adjusting pin, rotate the cam to full stroke position again and hold it in place (Figure 3-2).

7. While holding the cam in full-stroke position and monitoring the speed, use a 3/32” Allen wrench to adjust the push rod clockwise (CW), just until the trip speed is reached.

IMPORTANT **This may or may not cause the turbine trip mechanism to trip.**

8. While still holding the cam in full-stroke position, slowly turn the trip push rod clockwise (CW) an additional amount (about 1/2 turn in increments of no more than 1/8 turn) to obtain approximately 1% to 2% over the trip point. This should cause the turbine trip mechanism to trip.

IMPORTANT **This additional setting is the ultimate speed stop to ensure that the turbine will never be taken more than 2% above the normal trip speed setting if the turbine trip mechanism should fail.**

Using the Overspeed Test Function

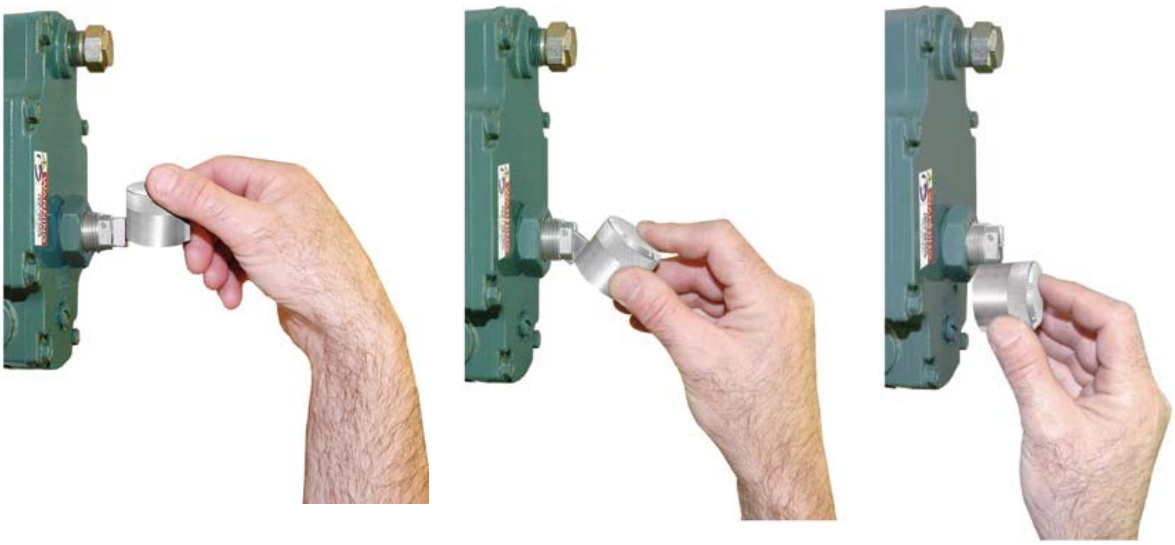


Figure 3-2. Operating the Overspeed Test Device

This is the procedure to follow in order to test the overspeed test function using the TG Governor overspeed test device (OTD).

1. Remove (unthread) the cap from the overspeed test device.
2. Run the turbine at rated “no load” speed.
3. With the system set up for the overspeed test, rotate the cam using the cap and adjusting pin until the speed begins to rise (**Note**: most of the travel is used to move the internal linkage to the beginning of the test start point).
4. When the speed begins to rise, continue to slowly rotate the cam, thereby raising the turbine speed, until the trip speed is reached.
5. The unit should trip at the trip speed. Return the cam to its original stowed position, and the unit will return to the rated speed.
6. Replace the cap, hand tight.
7. If the OTD reached the trip speed and the trip function did not work, repair the trip mechanism and then repeat this procedure.
8. If the OTD did not reach the trip speed, follow the OTD adjustment procedure above to set the OTD to the correct trip speed and then repeat this procedure.

To prevent malfunction of the overspeed test device (OTD) due to contamination from dirt or water, the OTD protective cap must be kept in place (hand-tight) when the OTD is not in use.

Chapter 4.
Principles of Operation

Introduction

Internally, the TG-13/TG-17 and TG611-13/TG611-17 governor consists of the following basic items:

- oil pump
- oil accumulator
- speeder-spring
- ballhead and pilot-valve bushing assembly
- pilot-valve plunger
- servopiston
- droop adjustment
- speed adjustment
- terminal lever and shafts

A schematic diagram (Figure 4-1) shows the relationship of these various items and provides a visual means of understanding the operation of the TG governor.

Description of Operation

Oil Pressure and Distribution

The governor is normally driven by the turbine through a flexible coupling. The inner gerotor of the oil pump is keyed to the governor drive shaft and pilot-valve bushing. The pump draws oil from the sump and distributes it through the oil passages within the case. Oil is also discharged to the spring-loaded accumulator. The relief valve/accumulator maintains 1034 kPa (150 psi) operating pressure at rated speed for the TG-13/TG611-13 and 1379 kPa (200 psi) operating pressure at rated speed for the TG-17/TG611-17. Excess pressure compresses the accumulator springs and oil is released to sump during steady-state operation.

A change in speed and centrifugal force moves the flyweights out or in. This moves the pilot-valve plunger either upward or downward depending on whether it is an increase or decrease in speed. Plunger movement opens the control port and releases oil either to sump or to the underside of the servopiston. During servopiston movement in the increase-fuel direction, the accumulator supplements the system oil supply with its stored volume of high-pressure oil and helps maintain the full work capacity of the governor.

Ballhead Operation

The ballhead assembly contains two flyweights, speeder spring, thrust bearing, pilot-valve plunger and pilot-valve bushing. As the flyweights are rotated, they produce a centrifugal force that is opposed by the downward force of the speeder-spring. The speeder-spring force can be varied by adjusting the speed-setting screw, or speed-setting lever.

A thrust bearing on top of the flyweight toes permits the pilot-valve bushing to rotate around the pilot-valve plunger. This reduces friction between the bushing and plunger.

Pilot-Valve Function

When the turbine is running at the governor set speed, the pilot-valve plunger is centered, covering the control ports of the pilot-valve bushing. In this position, no oil is discharged from or flows to the servopiston, and the governor terminal shaft cannot move. A change in either the flyweight centrifugal force (speed change) or the speeder-spring force (speed setting) moves the plunger from its centered position. Plunger movement opens the control port and releases oil either to sump or to the underside of the servopiston.

The pilot-valve plunger lowers if:

- An additional load slows the turbine and governor speed. This decreases the centrifugal force of the rotating flyweights which opposes the force for the speeder spring.
- The turbine speed is unchanged, but speeder-spring force is increased by raising the governor speed setting with the speed-setting screw or speed-setting lever.

Lowering the pilot-valve plunger opens the control ports. High-pressure oil is released to the area below the servopiston, forcing the servopiston upwards. This rotates the governor terminal shaft in the increase-steam direction.

As the servopiston rises, the speeder-spring force is decreased by movement of the terminal lever and allows the pilot-valve plunger to rise. The flow of high-pressure oil to the servopiston is closed off by the control land, stopping the upward motion of the servopiston.

The pilot-valve plunger raises if:

- The centrifugal force of the rotating flyweights is increased by a load decrease on the turbine. This causes an increase in turbine and governor speed.
- The governor speed is lowered by reducing the speeder-spring force with the speed-adjusting screw.

Raising the pilot-valve plunger again opens the ports, but this time control oil is released to sump from below the servopiston. High-pressure oil in the area above the servopiston cylinder forces the piston down. This rotates the terminal shaft in the decrease-steam or fuel direction. Speeder-spring pressure increases, forcing the pilot-valve plunger downward. Terminal-shaft movement stops as the control land covers the ports, stopping the release of control oil.

Droop-Adjusting Lever Function

Note that as the terminal lever rotates in the increase-fuel direction, the droop-adjusting lever is lifted and decreases the speeder-spring force on the flyweights. Thus, the ballhead is allowed to re-center the pilot-valve plunger at lower speeds as fuel is increased. This characteristic is referred to as “speed droop”. Closing the control port stops further movement of the servopiston simultaneously with the return of turbine speed to a speed determined by the new speed or spring force.

When moving in the decrease-fuel direction, the terminal lever lowers the droop-adjusting lever and increases the speeder-spring force. This increase in speeder-spring force re-centers the pilot-valve plunger and stops further servopiston movement.

The amount of speed change, or droop, for a given amount of terminal shaft rotation depends upon the positioning of the droop-adjusting lever on the terminal lever.

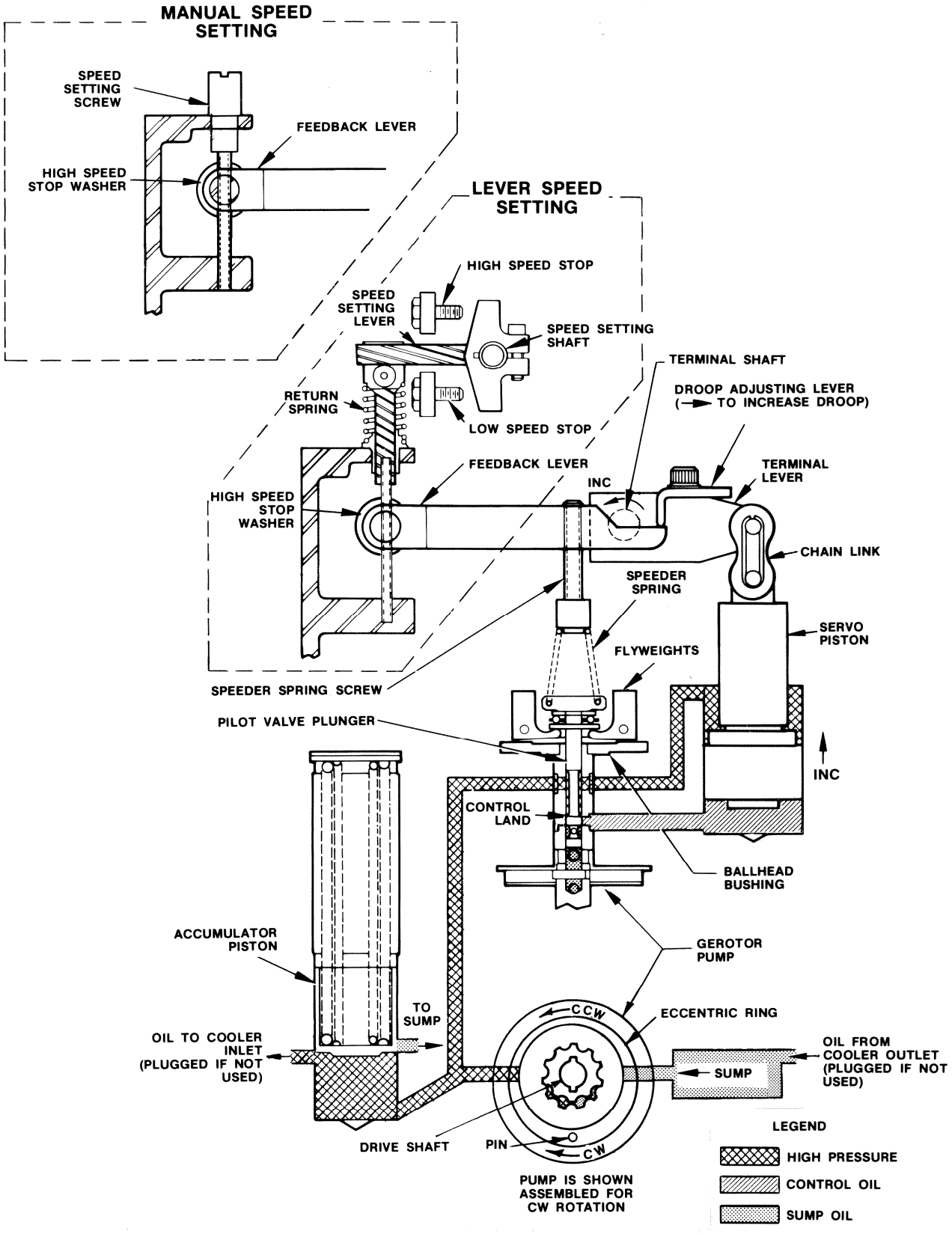


Figure 4-1. TG-13/TG-17 and TG611-13/TG611-17 Schematic Diagram

Overspeed Test Device Function

The overspeed test device (OTD), if so equipped, is used to safely test the independent trip function on the turbine by allowing a controlled method of increasing the speed of the TG Governor. The OTD must be set by the end user such that the speed can be increased to a maximum of 2% over the trip speed setting, thereby ensuring that the trip speed is reached, but the OTD will not allow the speed to be increased more than 2% over the trip speed. If the test device is released during operation, the governor will return to the current rated speed setting of the governor. The OTD is adjustable and can be set to a different trip speed setting if necessary.

Chapter 5. Troubleshooting

Introduction

Faults in governor operation are usually revealed as speed variations of the turbine. But not all such variations indicate a governor fault. Therefore, when improper operation is evident, check all components, adjustment settings, and the turbine for correct operation.

Use the following troubleshooting table to isolate and remedy faults in the governed system. When requesting additional information or service help from Woodward or an authorized service shop, it is important to include the following information:

- Governor serial number and part number shown on nameplate.
- A complete description of all problems and symptoms.

See Chapter 7 for Woodward locations.

Visual Inspection

Before attempting to troubleshoot the system, visually check the following items:

1. Check linkages installed between the governor output and a steam valve and any speed-setting linkage. Common sources of trouble are binding, lost motion, or inadequate travel.

2. Check the oil for proper level and good condition. Dirty oil causes many governor troubles. Oil contaminated by water or excessive heat breaks down rapidly, causing foaming and corrosion of internal parts.

3. Check for correct turbine operation. Be sure the drive to the governor drive is smooth and free of torsion vibration.

4. Be sure the speed variations are not the result of load changes beyond the capacity of the turbine.

Definitions

Terms used in the troubleshooting chart are defined as follows. See Table 5-1 for troubleshooting information.

HUNT—A rhythmic variation of speed which can originate in the governor or in the prime mover. A hunt usually has a frequency of less than 50 cycles per minute.

SURGE—A rhythmic variation of speed occurring at periodic intervals which can also originate in the governor or in the prime mover.

JIGGLE—A high frequency vibration of the governor terminal shaft and fuel linkage. Do not confuse this with normal controlling action of the governor. A jiggle has a frequency of more than 50 cycles per minute.

WARNING

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.

Symptom	Cause	Correction
1. The Turbine hunts or surges.	A. Low oil level.	Add oil to a level visible in the oil sight gauge.
	B. Dirt in governor.	Remove old oil, flush with lightweight oil, and refill to correct level with fresh oil.
	C. Binding terminal-shaft linkage.	Re-align linkage as necessary. If the governor was recently dissembled, make sure that the terminal-shaft bearings do not bind internally on the terminal lever.
	D. Insufficient droop adjustment.	Reposition the droop-adjusting lever to increase droop.
2. Governor terminal shaft jiggles.	A. Improper alignment of the governor drive coupling.	Check and repair as necessary.
	B. Worn flyweight pins.	Return governor to factory for repair.
3. The governor shows difficulty in accepting load, or is unstable as evidence by a slow and unsteady oscillation, especially after a load change.	A. Insufficient use of terminal-shaft travel.	Check linkage. Recommended travel is 2/3 of full governor travel for the TG governor from no load to full load. **IMPORTANT** **Droop and its stabilizing effect are a function of governor terminal-shaft travel. If the governor terminal-shaft linkage is arranged so that only a small percentage of terminal shaft travel is used from no load to full load, droop and its stabilizing effect is reduced proportionally.**
	B. Too much droop.	Reposition the droop-adjusting lever for decreased-droop compensation.
	C. High steam-valve gain.	Make sure that the steam valve is not too large or oversize for the particular application.
	D. Dirt in governor oil.	Drain, flush, and refill with fresh oil.

Symptom	Cause	Correction
4. The turbine does not pick up rated full load.	A. Speed-setting too low.	Increase governor speed setting.
	B. Incorrect terminal shaft linkage travel.	Check linkage. Recommended travel 2/3 of full governor travel for the TG governor from no load to full load.
	C. Governor speed range is incorrect for the particular application.	Check speed range of the governor.
	D. Droop setting too high.	Reposition droop-adjusting lever to decrease droop.
5. The governor does not start or control.	A. Wrong governor drive rotation.	Check the turbine drive to the governor. Reverse pump parts for different rotation if necessary.
	B. Key not properly installed or missing, drive shaft is not engaged.	Check drive installation.
	C. Pump drive pin in broken.	Return governor to factory for repair.
6. Governor starts, but remains at maximum.	A. Speed setting too high.	Reduce speed setting until governor controls, then adjust for desired speed.

Chapter 6.
Replacement Parts

Replacement Parts Information

When ordering replacement parts, include the following information:

- Governor serial number and part number shown on nameplate.
- Manual number (this is Manual 04042).
- Parts reference number in parts list and description of part or part name.

See Chapter 7 for Woodward locations.

⚠WARNING **Personal injury may result if accumulator springs are released suddenly. Use an arbor press to release or to install the accumulator springs.**

Replacement Parts List for Figure 6-1

Ref. No.	Part Name	Quantity
04042-1	Drive screw	2
04042-2	Governor nameplate	1
04042-3	Breather/Filler cap	1
04042-4	Cover (for screw speed setting	1
04042-5	Cover gasket	1
04042-6	Screw, soc hd .250-20 x 1.00”	3
04042-7	Flat washer, .265 x .500”	1
04042-8	Droop-adjusting lever	1
04042-9	Screw, soc hd sems, 250-20 x 2.00	2
04042-9A	Washer, .250 internal shockproof	2
04042-9B	Washer, .265 x .500 x .064 thick	2
04042-10	Connection link (chain link)	1
04042-11	Servopiston bushing	1
04042-12	Servopiston	1
04042-13	Straight pin	1
04042-14	Preformed packing ring, 2.114 ID x .070	1
04042-15	Gerotor oil pump	1
04042-16	Pump spacers	(use none, 1 or 2 AR)
04042-17	Pump housing	1
04042-18	Taper pin, #5	2
04042-19	Oil seal	1
04042-20	Ballhead retainer collar	1
04042-21	Screw, soc hd sems, .312-18 x 1.00”	4
04042-22	Terminal shaft	2
04042-23	Oil seal	2
04042-24	Roller bearing	2
04042-25	Pipe plug, .062-27 NPTF	1
04042-26	Pipe plug, .125-27 NPTF	2
04042-26A	Pipe plug .250-18 NPTF	1
04042-27	TG-13 and -17 case	1
04042-28	Oil baffle	1
04042-28A	Oil baffle (high speed TG-13 or TG-17 only)	1
04042-29		Not used
04042-30	Ballhead bushing assembly	1

04042-31	Terminal lever	1
04042-32	Flyweight pin	2
04042-33	Flyweight	2
04042-34	Ballhead cover	1
04042-35	Feedback lever	1
04042-36	Spring clip	1
04042-37	Pivot block	1
04042-38	Screw, hex hd	8
04042-39	Preformed packing ring	1
04042-40	Flat washer, .515 x .875	1
04042-41	Wave washer	1
04042-42	Speed-setting screw	1
04042-43	Pivot pin	1
04042-44	High-speed stop washer, s.s	2
04042-45	Speeder-spring screw	1
04042-45A	Speeder spring	1
04042-46	Pilot-valve plunger	1
04042-47	Thrust bearing	1
04042-48	Retaining ring	1
04042-49	Spring seat	1
04042-50	Accumulator spring, small	1
04042-51	Accumulator spring, large	1
04042-52	Accumulator piston	1
04042-53	Oil sight gauge	1
04042-54	Pipe plug, .500- 14 NPTF	2
04042-55	Pump drive pin, square head	1
04042-56	Preformed packing ring, 1.176 ID x .0706	1
04042-57	Bore plug	1
04042-58	Retaining ring	1
04042-59	Preformed packing-ring, 1.424 ID .x .0706	1
04042-60	Bore plug	1
04042-61	Retaining ring	1
04042-62	Rotation Decal	1
04042-63 to 79		Not used

Reference Numbers 1 through 62 are on this page.

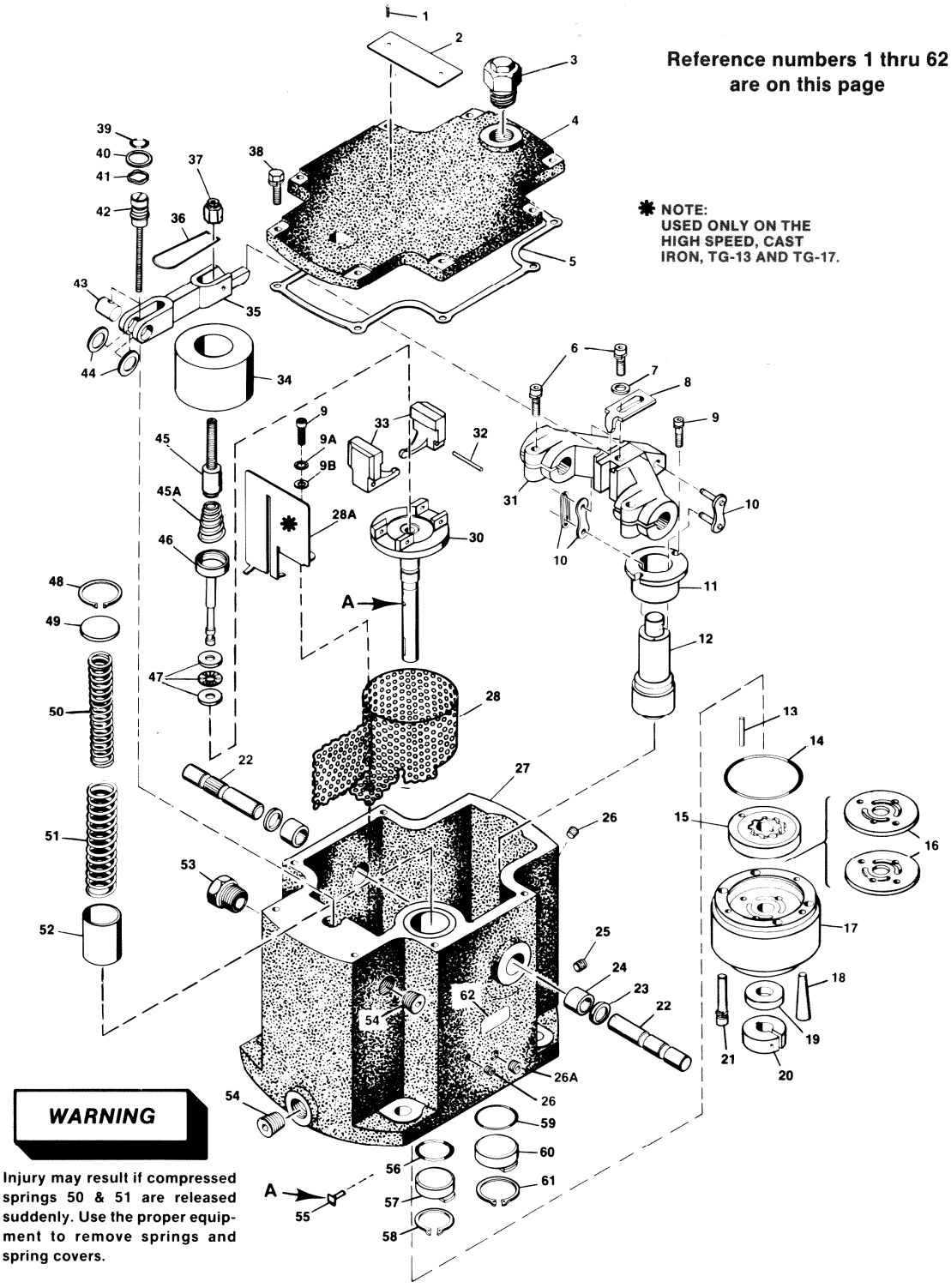


Figure 6-1. Parts for the TG-13 and -17 Governor, Cast-Iron Case, Screw Speed Setting

WARNING

Injury may result if compressed springs 50 and 51 are released suddenly. Use the proper equipment to remove springs and spring covers.

Replacement Parts List for Figure 6-2

Ref. No.	Part Name	Quantity
Reference numbers 63 through 79 are not used.		
04042-80	Cover (for lever speed setting)	1
04042-81	Bushing	2
04042-82	Oil seal	2
04042-83	Speed-setting shaft	1
04042-84	Screw, soc hd sems, .250-20 x 1.00”	8
04042-85	Speed-setting shaft lever	1
04042-86	Roll pin, s.s .188 x .750	1
04042-87	Spring seat	1
04042-88	Speed-setting return spring	1
04042-89	Speed-setting screw assembly	1
04042-90	Straight pin, .124 x .750”	1
04042-91	Roller	1
04042-92	Stop lever	1
04042-93	Hex nut, .250-28	2
04042-94	Set screw, oval point, .250–28 x .200”	2
Reference numbers 95 through 100 are not used.		

Reference numbers 80 through 94 are on this page

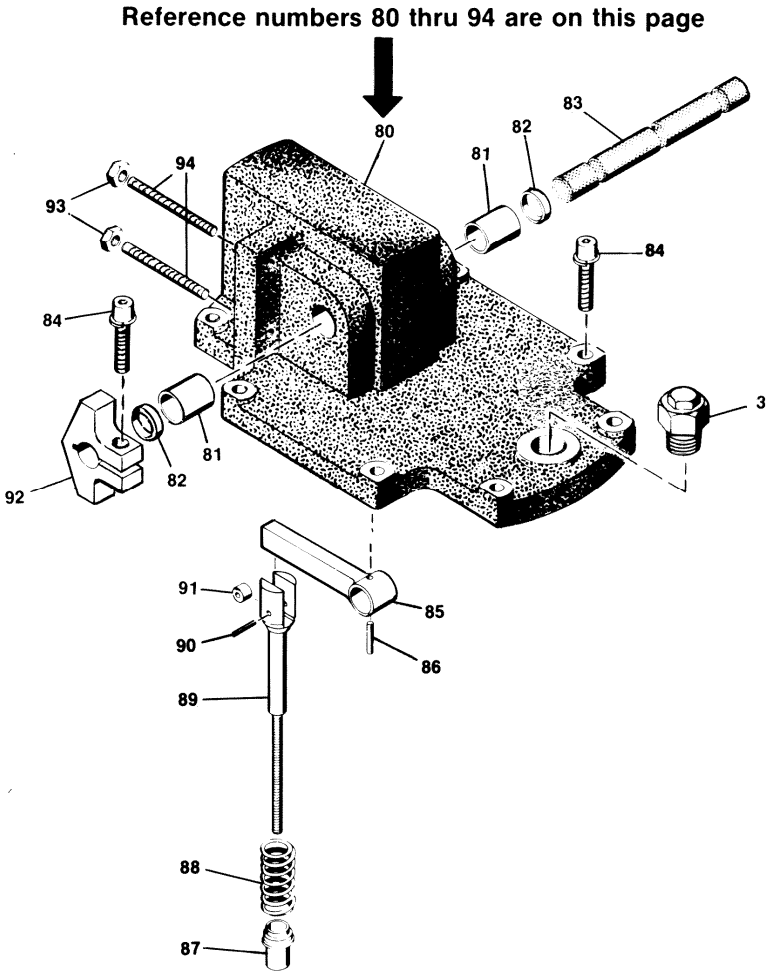


Figure 6-2. Parts for the TG-13 and -17 Cover Assembly (Lever Speed Setting) for Use with Cast-Iron Case TG-13 and -17

Replacement Parts List for Figure 6-3

Ref. No.	Part Name	Quantity
04042-101	Breather - Filler cap	1
04042-102	Screw - .250-20 x .750	14
04042-103	Stop washer	2
04042-104	Pivot	1
04042-105	Feedback lever	1
04042-106	Spring clip	1
04042-107	Screw - .250-20 x 1.000	7
04042-108	Droop-adjusting lever	1
04042-109	Terminal lever	1
04042-110	Servopiston bushing	1
04042-111	Connection-link assembly	1
04042-112	Piston	1
04042-113	Baffle	1
04042-114	Ballhead cover	1
04042-115	Speed-setting nut	1
04042-116	Speeder-screw assembly	1
04042-117	Speeder spring	1
04042-118	Pilot-valve plunger	1
04042-119		Not used
04042-120		Not used
04042-121	Flyweight	2
04042-122	Straight pin	2
04042-123	Ballhead-bushing assembly	1
04042-124	Pump drive pin	1
04042-125	Drive shaft	1
04042-126	Pipe plug - .500 socket head	2
04042-127	Case	1
04042-128	Pump housing	1
04042-129	Bowed retaining ring (internal)	1
04042-130	Bowed retaining ring .461 dia.	1
04042-131	Ball bearing	1
04042-132	Retaining ring - .461 diameter	2
04042-133	Oil seal	1
04042-134	Oilite bushing	1
04042-135	Preformed packing - .062 W x 2.000 ID	1
04042-136	Gerotor pump	1
04042-137	Accumulator piston	1
04042-138	Large accumulator spring	1
04042-139	Small accumulator spring	1
04042-140	Spring seat	1
04042-141	Retaining ring-1.526 diameter	1
04042-142	Speed-setting-screw assembly	1
04042-143	Loading spring	1
04042-144	Washer	1
04042-145	Speed-setting screw assembly	1
04042-146	Preformed packing - .364 ID x .070	1
04042-147	Oil sight gauge	2
04042-148	Needle bearing - .625 ID	2
04042-149	Oil seal	2
04042-150	Terminal shaft	2
04042-151	Cover gasket	1
04042-152	Cover	1
04042-153	Nameplate	1
04042-154	Drive screw - .2 x .188	2
04042-155	Needle thrust bearing and bearing race assembly	1
04042-156 through 160		Not used

Reference numbers 101 through 155 are on this page.

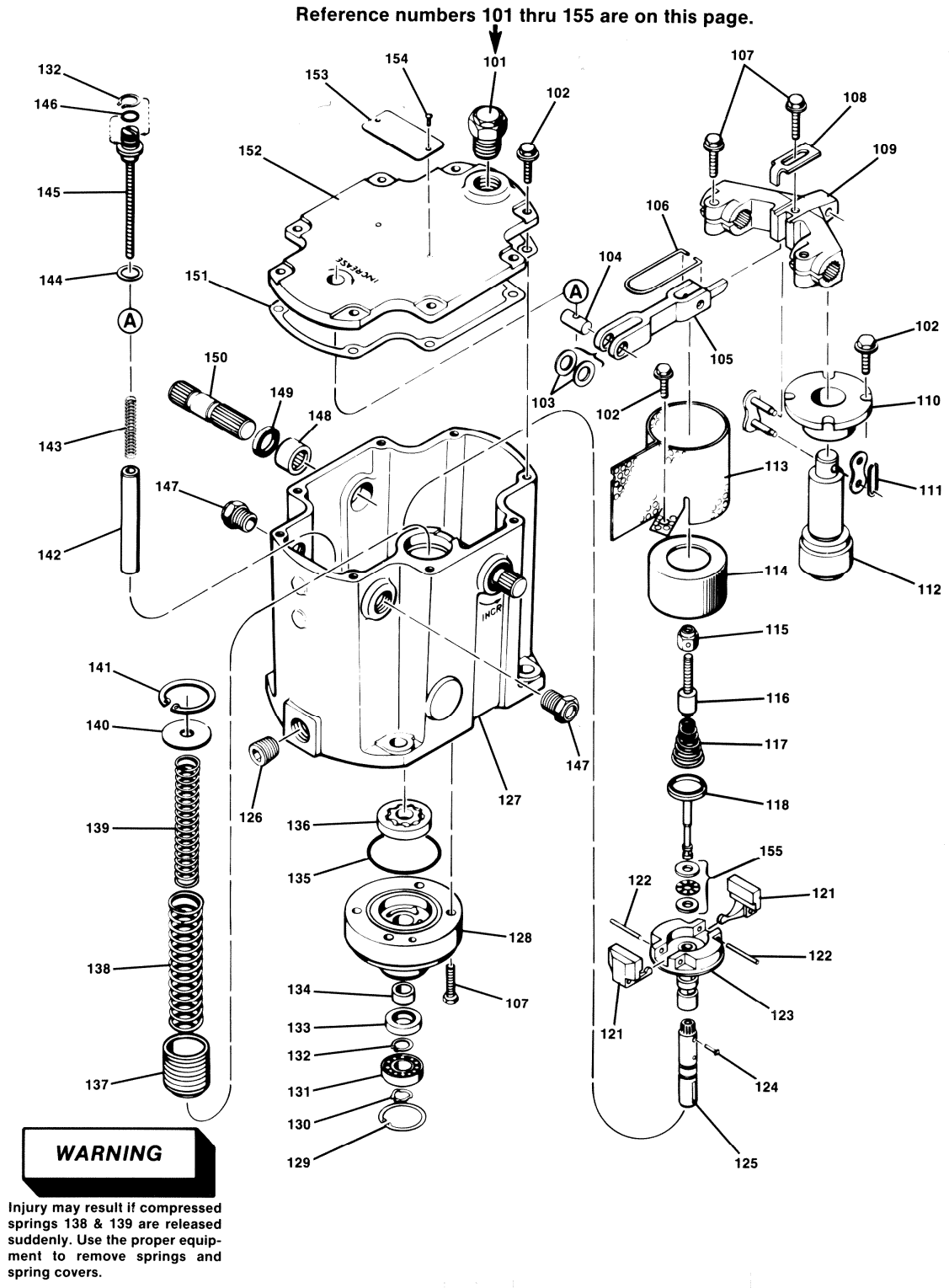


Figure 6-3. Parts for the TG-13 and -17 Governor. Die-cast Aluminum Case. Screw Speed Setting

⚠WARNING **Injury may result if compressed springs 138 and 139 are released suddenly. Use the proper equipment to remove springs and spring covers.**

Replacement Parts List for Figure 6-4

Ref. No.	Part Name	Quantity
Reference numbers 95 through 100 are not used.		
04042-101	Breather - Filler cap	1
04042-102	Screw - .250-20 x .750	14
04042-103	Stop Washer	2
04042-104	Pivot	1
04042-105	Feedback lever	1
04042-106	Spring clip	1
04042-107	Screw - .250-20 x 1.000	7
04042-108	Droop-adjusting lever	1
04042-109	Terminal lever	1
04042-110	Servopiston bushing	1
04042-111	Connection-link assembly	1
04042-112	Piston	1
04042-113	Baffle	1
04042-114	Ballhead cover	1
04042-115	Speed-setting nut	1
04042-116	Speeder-screw assembly	1
04042-117	Speeder spring	1
04042-118	Pilot-valve plunger	1
04042-119		Not used
04042-120		Not used
04042-121	Flyweight	2
04042-122	Straight pin	2
04042-123	Ballhead-bushing assembly	1
04042-124	Pump drive pin	1
04042-125	Drive shaft	1
04042-126	Pipe plug - .500 socket head	2
04042-127	Case	1
04042-128		Not used
04042-129	Bowed retaining ring (internal)	1
04042-130	Bowed retaining ring .461 diameter	1
04042-131	Ball bearing	1
04042-132	Retaining ring - .461 diameter	2
04042-133	Oil seal	1
04042-134	Oilite bushing	1
04042-135	Preformed packing .062 W x 2.000 ID	1
04042-136	Gerotor pump	1
04042-137	Accumulator piston	1
04042-138	Large accumulator spring	1
04042-139	Small accumulator spring	1
04042-140	Spring seat	1
04042-141	Retaining ring -1.526 diameter	1
04042-142	Speed-setting-screw assembly	1
04042-143	Loading spring	1
04042-144	Washer	1
04042-145	Speed-setting screw assembly	1
04042-146	Preformed packing - .364 ID x .070	1
04042-147	Oil sight gauge	2
04042-148	Needle bearing -.625 ID	2
04042-149	Oil seal	2
04042-150	Terminal shaft	2
04042-151	Cover gasket	1
04042-152	Cover	1
04042-153	Nameplate	1
04042-154	Drive screw - .2 x .188	2
04042-155	Needle thrust bearing and bearing race assembly	1

04042-156 Shaft Extended TG Drive 1
04042-157 Pump housing 1
04042-158 Pump housing extension.....1
04042-159 Screw .250-20 x 1.750 hex hd. cap 4
04042-160 Retaining ring (internal) 1.249 free diameter 1

Reference numbers 101 through 160 are on this page.

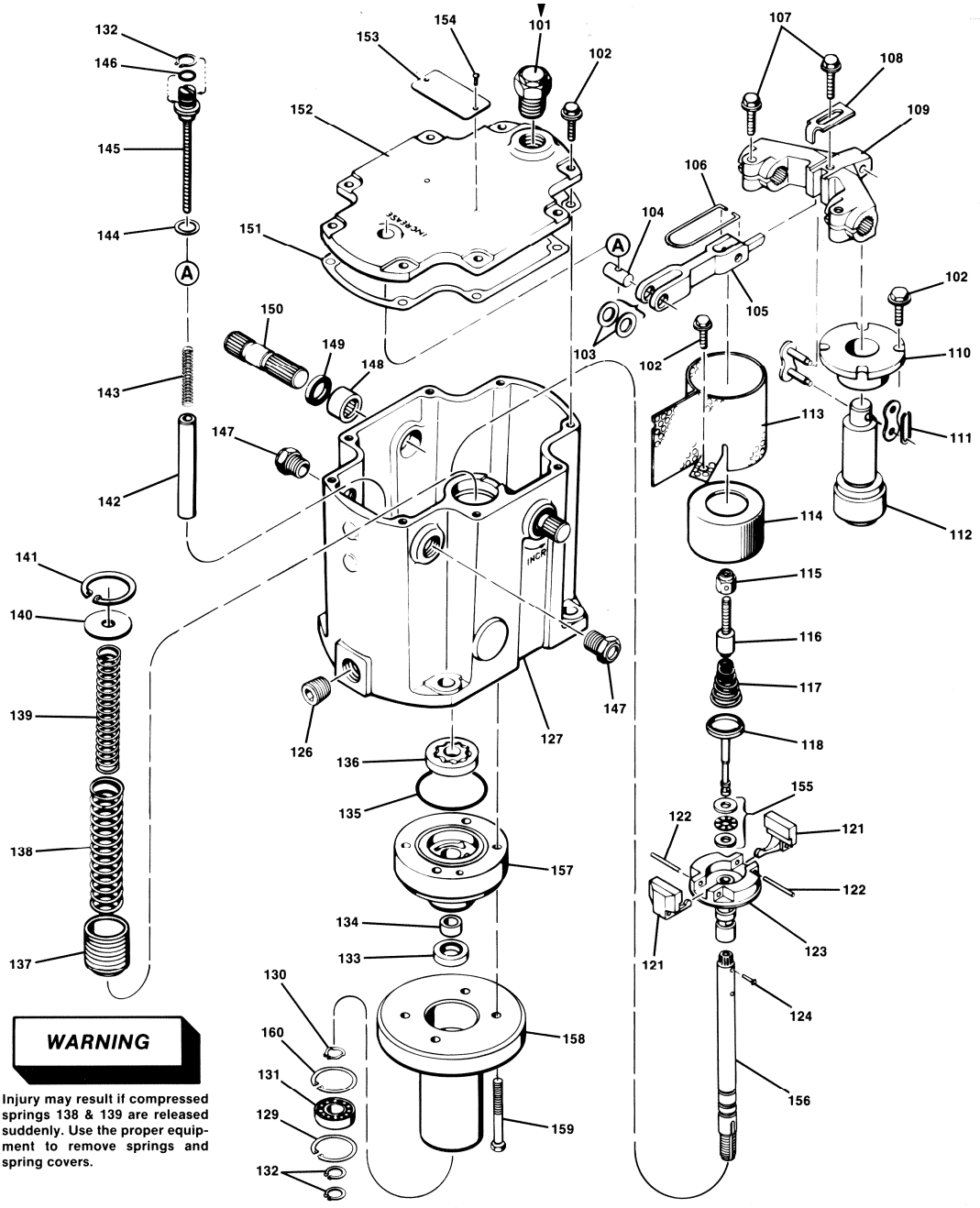


Figure 6-4. Parts for the TG-13 and -17 Governor with Extended Drive Shaft, Die-cast Aluminum Case, Screw Speed Setting

WARNING **Injury may result if compressed springs 138 and 139 are released suddenly. Use the proper equipment to remove springs and spring covers.**

Replacement Parts List for Figure 6-5

Ref. No.	Part Name	Quantity
04042-161	Breather/filler cap	1
04042-162	Screw - .250 -20 x 1.00	8
04042-163	Screw - .250 - 20 x 1.00 soc hd	1
04042-164	Washer - .250	1
04042-165	Stop - Max - Min	1
04042-166	Oil seal	2
04042-167	Bushing	2
04042-168	Cover	1
04042-169	Lever	1
04042-170	Roll pin .188 dia. x .750	1
04042-171	Straight pin .124 x .750	1
04042-172	Speed-setting plunger	1
04042-173	Screw	1
04042-174	Speed-setting spring	1
04042-175	Speed-setting-screw guide post	1
04042-176	Speed-setting-plunger guide	1
04042-177	Roller bushing	1
04042-178	Nut - .250-28	2
04042-179	Set screw - .250-28 x 2.00	2
04042-180	Speed-setting shaft	1

Reference numbers 161 through 180 are on this page.

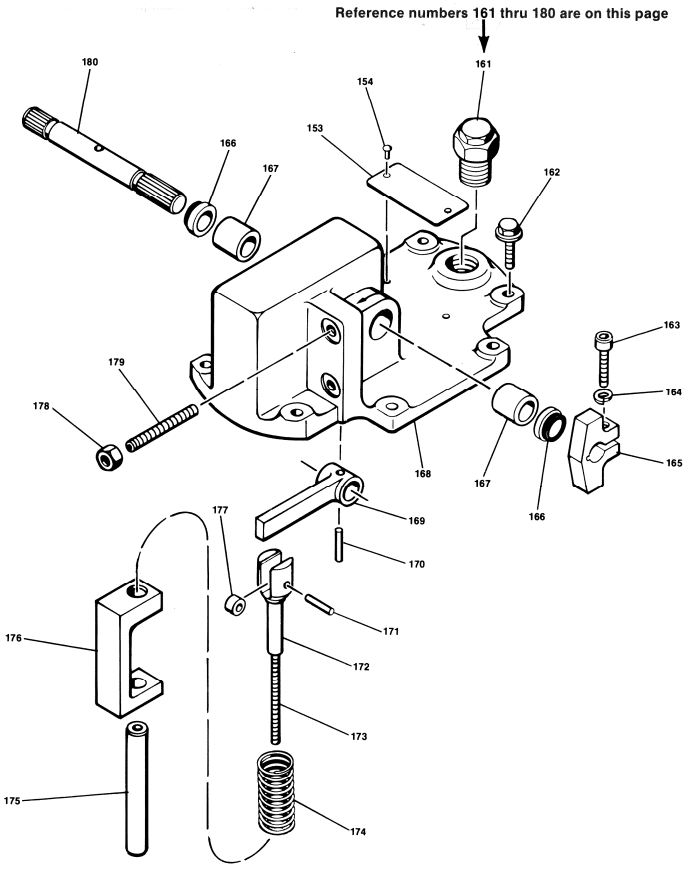


Figure 6-5. Parts for the TG-13 and -17 Cover Assembly (Lever Speed Setting), for Use with Aluminum Case TG-13 and –17

Replacement Parts List for Figure 6-6

Ref. No.	Part Name	Quantity
04042-6-1	Dowel Pin	1
04042-6-2	Cap	1
04042-6-3	O-ring	1
04042-6-4	Retention Nut	1
04042-6-5	Warning Label	1
04042-6-6	Cover Screw	8
04042-6-7	Retaining Ring	1
04042-6-8	Cover	1
04042-6-9	Cover Gasket	1
04042-6-10	O-ring	1
04042-6-11	Speed-Setting Screw (Assembly)	1
04042-6-12	Cam	1
04042-6-13	Cam Follower	1
04042-6-14	Push Rod	1
04042-6-15	Small Spring	2
04042-6-16	Small O-ring	1
04042-6-17	Large O-ring	1
04042-6-18	Pin	1
04042-6-19	Mounting Bushing	1
04042-6-20	Nameplate	1
04042-6-21	Drive Screw	2
04042-6-22	Mounting Guide	1
04042-6-23	Torsion Spring	1
04042-6-24	Spring Pin	1
04042-6-25	Alignment Guide	1
04042-6-26	Lever Bracket	1
04042-6-27	Spring Clip	1
04042-6-28	Snap Ring	2
04042-6-29	Large Washer	2
04042-6-30	Small Washer *	2
04042-6-31	Pivot Pin	1
04042-6-32	Spring Seat	1
04042-6-33	Loading Spring	1

* **NOTE**—The small washer (30) is used only with the bar-stock feedback level (0.625” wide) and not with the cast feedback lever (0.750” wide).

Reference numbers (6-)1 through (6-)33 are on this page.

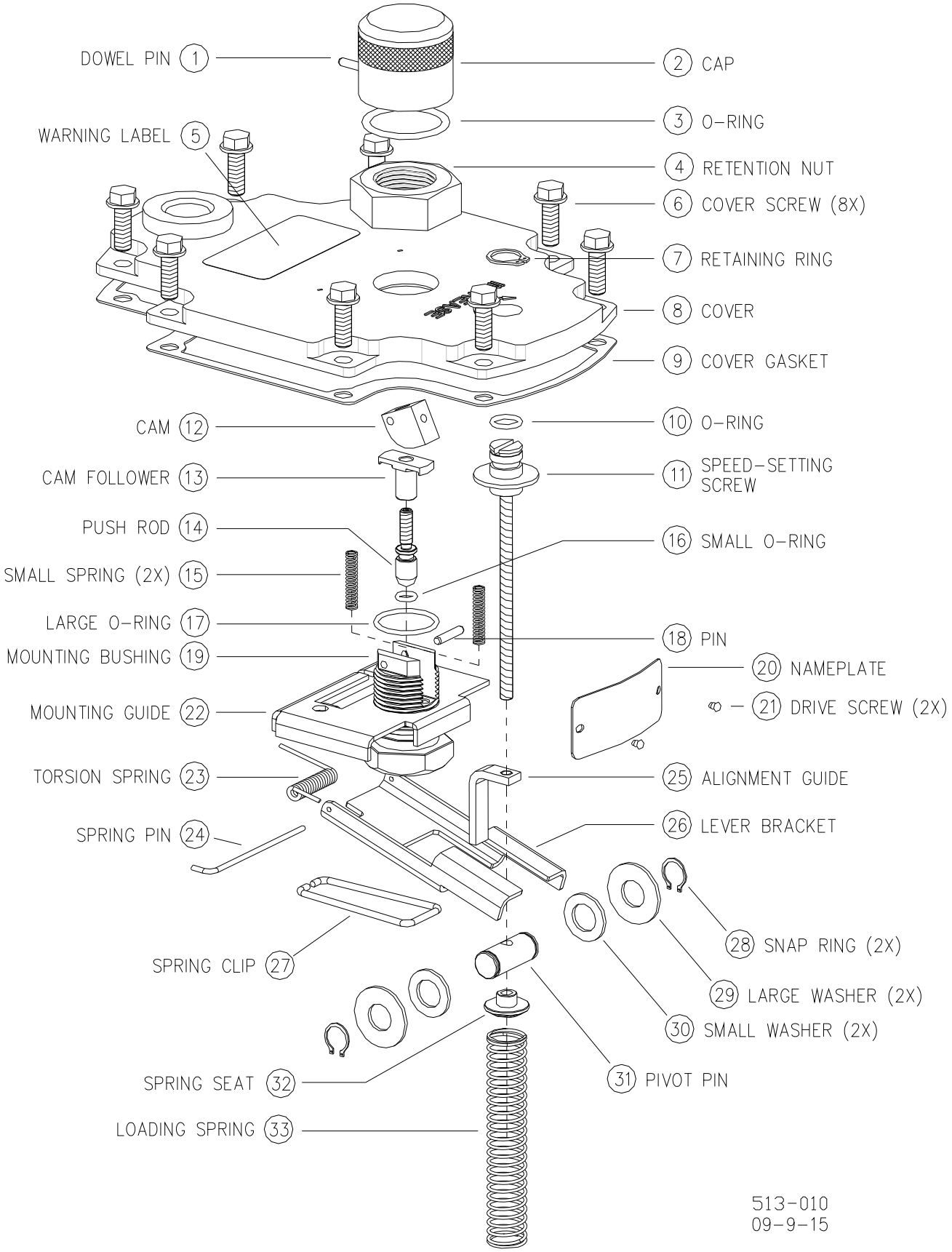


Figure 6-6. Parts for the TG611-13/-17 Overspeed Test Device

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

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.

Chapter 8.
Asset Management and Refurbishment Scheduling Period

This product is designed for continuous operation in a typical industrial environment and includes no components that require periodic service. However, to take advantage of related product software and hardware improvements, we recommend that your product be sent back to Woodward or to a Woodward authorized service facility after every five to ten years of continuous service for inspection and component upgrades. Please refer to the above service programs when returning products.

Revision History

Changes in Revision L—
- Updated Declarations

Changes in Revision K—
- Updated ATEX compliance listing

Declarations

DECLARATION OF CONFORMITY

Manufacturer's Name:	WOODWARD, INC
Manufacturer's Address:	Building A, Ditiantai Industrial Park, Huaihedao, Beichen High-Tech Industrial Park,
Model Names/Numbers:	TG-13, TG-17, and TG611-13/-17 Governors with CE Marking
Conformance to Directive:	94/9/EC Council Directive of 23 March 1994 on the approximation of the laws of the Member States concerning equipment and protective systems intended for use in potentially explosive atmospheres
Marking(s):	Ⓔx Category 2 Group II G, c IIC TX
Applicable Standard(s):	EN13463-1:2009 - Non-electrical equipment for potentially explosive atmospheres – Part 1: Basic method and requirements. EN13463-5:2011 - Non-electrical equipment for use in potentially explosive atmospheres - Protection by constructional safety "c"

We, the undersigned, hereby declare that the equipment specified above conforms to the above Directive(s).

MANUFACTURER

Signature

Jason Cheung

Full Name

Quality Manager

Position

Woodward, Tianjin, China

Place

Jan. 03. 2013

Date

Woodward Governor Company
Industrial Controls Group
Colorado, USA

ICG-1183
00334-04-EU-02-02

DECLARATION OF INCORPORATION
Of Partly Completed Machinery
2006/42/EC

Manufacturer's Name:	WOODWARD, INC
Manufacturer's Address:	Building A, Ditiantai Industrial Park, Huaihedao, Beichen High-Tech Industrial Park,
Model Names	TG-13, TG-17 and TG-611 Governors
Model Numbers:	8516-174 to 8516-191, 8516-193 to 8516-205, 9904-800 to 9904-828
Serial Numbers:	17000000 to 18000000
This product complies with the following Essential Requirements of Annex I:	1.1, 1.2, 1.3, 1.5, 1.6, 1.7

The relevant technical documentation is compiled in accordance with part B of Annex VII. Woodward shall transmit relevant information if required by a reasoned request by the national authorities. The method of transmittal shall be agreed upon by the applicable parties.

The person authorized to compile the technical documentation:

Name: Ralf Friedrich, Group Director, Quality, EPS
Address: Woodward GmbH, Handwerkstraße 29, 70565 Stuttgart, Germany

This product must not be put into service until the final machinery into which it is to be incorporated has been declared in conformity with the provisions of this Directive, where appropriate.

The undersigned hereby declares, on behalf of Woodward (Tianjin) Controls Co.,Ltd that the above referenced product is in conformity with Directive 2006/42/EC as partly completed machinery:

MANUFACTURER

Signature

Jason Cheung
Full Name

Quality Manager
Position

Woodward, Tianjin, China
Place

Jan. 08, 2013
Date

5-09-1182 (REV. 10) 00334-04-EU-02-01

We appreciate your comments about the content of our publications.

Send comments to: icinfo@woodward.com

Please reference publication 04042L.

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Email and Website—www.woodward.com

**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.