WOODWARD

Product Manual 03019
(Revision G)
Original Instructions

Auxiliary Devices for UG-40 Governors used in Marine Service

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 Out-of-date translations are marked with ⚠.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

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.

Auxiliary Devices for UG-40 Governors in Marine Service

Introduction

This manual describes optional features particularly suited for the UG-40 governor used on propulsion engines. The governor itself is described in manual 03039.

One such feature is a torque limit arrangement which limits fuel as a function of governor speed setting. As load increases with submergence of the propeller in rough weather, the governor increases fuel to maintain speed until the fuel limit is reached. Upon limiting, engine speed drops until engine and propeller torque are equal.

Another optional device is a solenoid shutdown. As is usual with electric shutdown devices, it is available in all standard voltages and can be arranged to shut the engine down when energized or when de-energized.

An important accessory is the manifold pressure fuel limiter. It limits fuel as a function of supercharger discharge pressure to ensure that there is sufficient air available to burn the fuel.

Each of these three auxiliary devices operates independently of the others. A governor may be equipped with any or all of them.

The last feature added to the torque limit governor is a micro-switch which closes or opens a contact when the governor has just reached its fuel limit. The micro-switch, therefore, gives an indication whether the engine is running at set speed or whether it is running with limited fuel at a lower speed.

⚠WARNING

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.

Before attempting any adjustments while the engine is running, make sure that the overspeed protection is operating properly.

Operation

Torque Limit Control—The schematic diagram (Figure 1), shows the essential parts of the UG-40 governor and optional features.

NOTICE

When installing and/or adjusting linkage to the governor, observe these precautions:

1. **The speed adjusting control shaft must be at the MAXIMUM speed setting position when checking the stroke of the terminal shaft.**
2. **The terminal shaft must be at the MINIMUM fuel position when checking the stroke of the speed adjusting control shaft.**

Failure to follow these procedures may damage the governor internally.

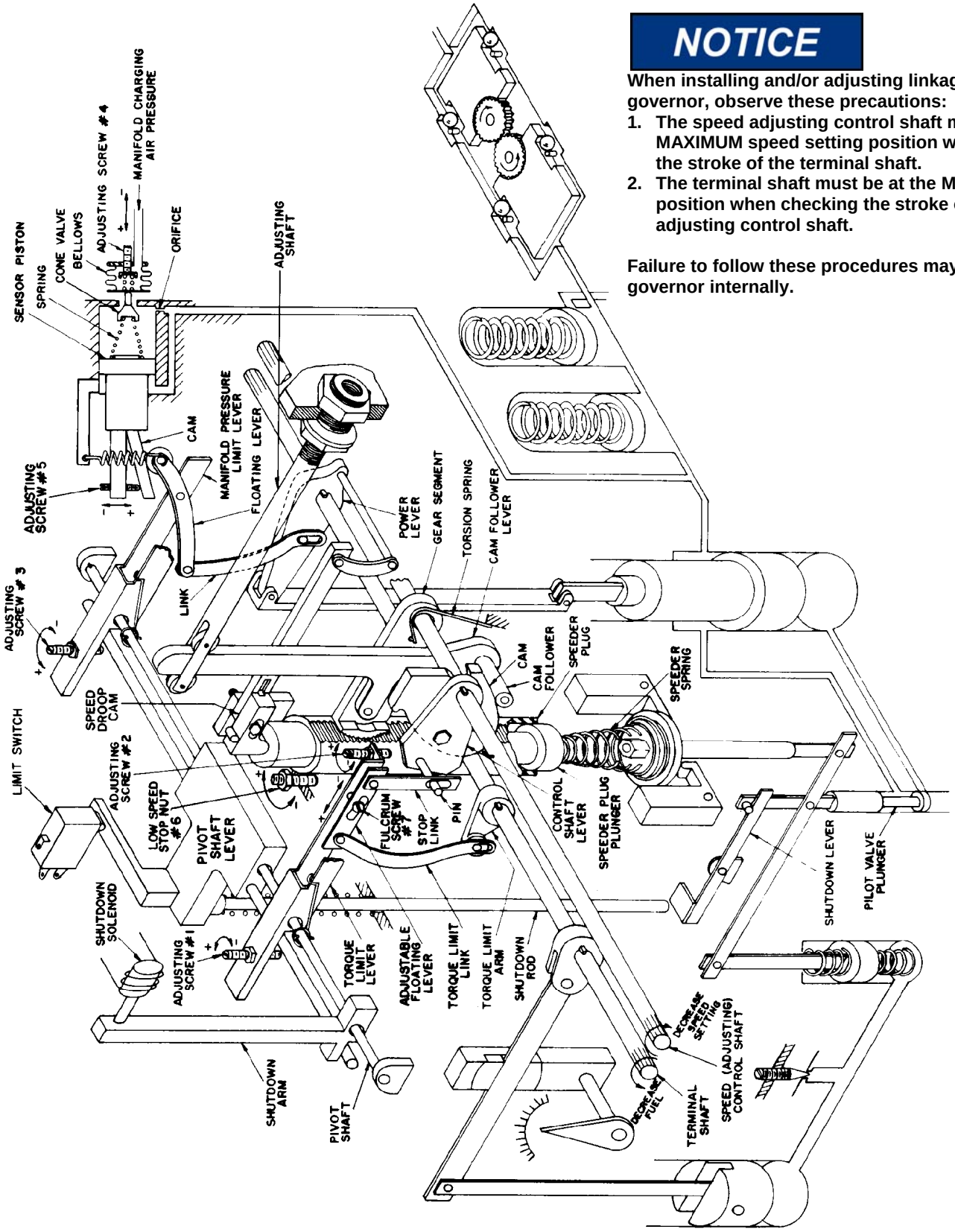


Figure 1. UG-40 Governor Schematic Diagram

The control lever is rigidly fixed to the speed (adjusting) control shaft and rotates with the control shaft. The pin in the control shaft lever thus has a position for each setting of the speed control shaft. The torque limit arm is rigidly fixed to the terminal shaft and rotates with the terminal shaft. The pin in the torque limit arm raises the torque limit link and the left end of the adjustable floating lever as the terminal shaft rotates to increase fuel. The adjustable floating lever pivots about the fulcrum screw. The right end of the lever moves down as the left end is raised only until the upper end of the slot in the stop link stops against the pin in the control shaft. Further rotation of the terminal shaft in the increase fuel direction raises the left end of the floating lever still higher. However, since the stop link and tight end of the lever cannot move down further, the fulcrum screw is raised and with it the right end of the torque limit lever. The torque limit lever pivots about the pivot shaft. Adjusting screw #1 in the left end of the torque limit lever is thus brought into contact with she rod extending from each side of the pivot shaft lever. The end of the pivot shaft lever is lowered and pushes down on the shutdown rod, causing the pilot valve to be lifted back to its centered position by the shutdown lever. Movement of the terminal shaft is thereby stopped, limiting fuel at that point.

Note that each position of the speed adjusting shaft thus establishes a unique fuel limit.

Speed Setting—The gear segment which moves the speeder plug up and down does not turn with the speed control shaft as it does in standard lever-type governors. Instead, it is free to pivot about the control shaft; it is moved by the cam follower lever. The speeder spring and torsion spring continually urge the speeder plug plunger, speeder plug, and gear segment up. This has the effect of keeping the upper end of the cam follower lever in contact with the roller, and the cam follower (as the lower end of the lever) in contact with the cam. The cam is bolted to the control shaft lever. Thus, as the speed control shaft turns, the cam turns, and the upper end of the cam follower lever pivots about the roller as the cam, acting against the cam follower, displaces the lower end of the lever. In this manner, the gear segment lowers the speeder plug when the control shaft is turned in the direction to increase the speed setting. If the control shaft is turned in the direction to decrease the speed setting, the speeder spring and torsion spring push the speeder plug up as the cam follower follows the receding cam surface.

Manual Shutdown—Adjusting screw #2 provides a means through which the speed control shaft can be used to shut the unit down. When the control shaft lever contacts and lifts adjusting screw #2, the left end of the torque limit lever is lowered. The pivot shaft lever pushes down on the shutdown rod, and the governor pilot valve plunger is lifted and held above center, causing the terminal shaft to be rotated to the “no fuel” position.

Solenoid Shutdown—When the solenoid acts to shut the unit down, it pushes the shutdown arm against the rod protruding from the pivot shaft lever. The lever thus forces the shutdown rod down, causing the pilot valve plunger to be lifted above center. As oil drains from under the power piston, the terminal shaft moves to the “no fuel” position.

Manifold Pressure Fuel Limiter—The position of the right end of the manifold pressure fuel limit lever is normally determined by the cam attached to the sensor piston. The roller on one end of the floating lever is held in contact with the cam by a spring. The floating lever connects to the limit lever. The other end of the floating lever connects to a link, the slotted end of which is fastened to the power lever.

Thus, for any position of the sensor piston and cam, the power lever can move up—increasing fuel—without affecting the limit lever position until the pin in the power lever reaches the upper end of the slot in the link. Further upward movement of the power lever (further increase in fuel) lifts the right end of the limit lever. The lever turns about the pivot shaft, and the adjusting screw in the left end of the lever pushes down on the rod protruding from the pivot shaft lever. The shutdown rod re-centers the pilot valve plunger and halts further increase of fuel.

The sensor piston to which the cam is attached is part of a force-balance system in which the piston takes a position proportional to manifold pressure. Pressure oil flows unrestricted to the left side of the limit piston and to the right side through a series of orifices. The manifold (charging air) pressure in the bellows produces a force which is transmitted so the cone valve. This force is opposed by the force of the spring between the cone valve and sensor piston.

Except while changes are occurring in the manifold pressure, the bellows force tending so push the cone valve to the left is balanced or equaled by the spring force from the opposite direction. Thus, the cone valve normally “floats” just off its seat and continually bleeds to sump the oil admitted through the orifice into the area on the right side of the piston.

Adjustments

A typical speed setting–torque limit curve is shown in Figure 2. Adjustments to this curve can be made by means of some adjustment screws (see Figure 1).

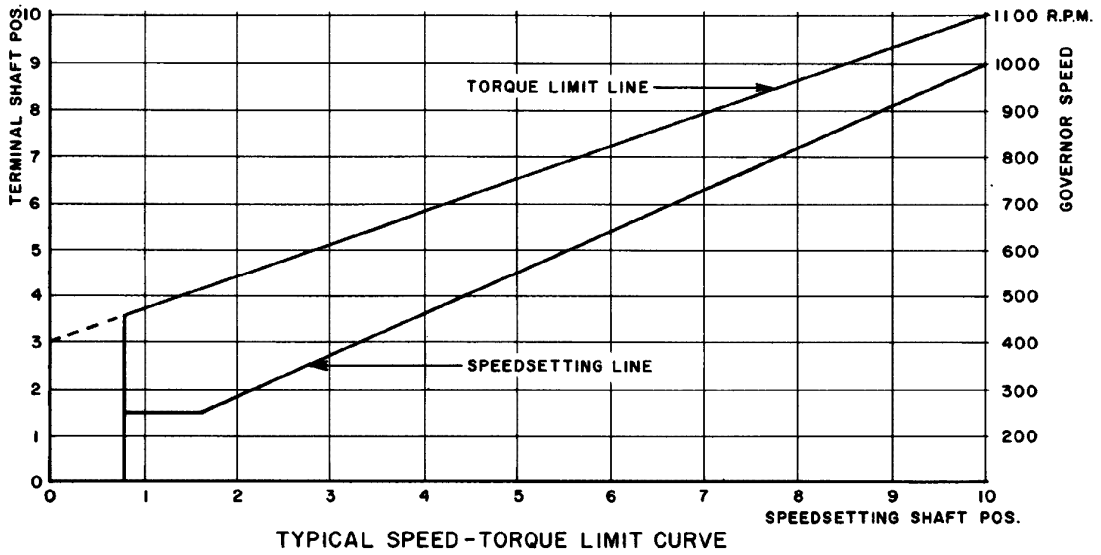
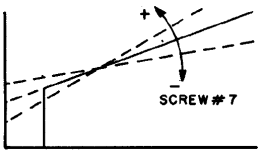
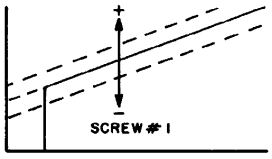


Figure 2. Typical Speed Setting–Torque Limit Curve

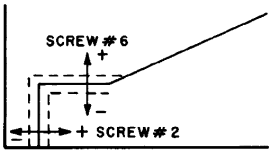
The torque limit and the manifold pressure fuel limit curves are established by the engine manufacturer. Because of straight links and levers connecting input shaft to terminal shaft, the torque limit curve is a straight line. The position of the fulcrum screw #7 in the adjustable floating lever determines the slope of the curve. It is customary to raise the curve at low speed settings so that enough fuel for starting will be obtained at idle speed setting.



If a higher or lower limit curve is necessary, screw #1 may he readjusted using a 3/32 inch or 2.5 mm hex allen wrench.

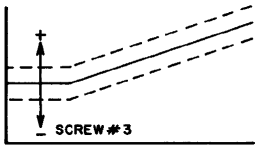


From the torque limit curve, the engine manufacturer calculates the engine speed and draws the curve defining the speed setting cam. Minimum speed will be adjusted with the low speed stop nut #6. By adjusting screw #2, the engine can be shut down through the speed control shaft. It is usually not necessary to change the speed setting curve, However, it can be shifted up and down by adjusting shaft 03019-127.

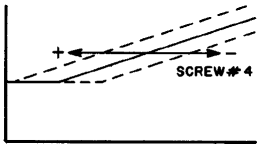


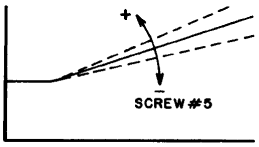
The manifold pressure fuel limiter has three adjustments:

- Adjusting screw #3 raises or lowers the curve.
- Adjusting screw #4 determines the point where the flat curve starts to rise.
- The slope may be changed with adjusting screw #5.



As it is difficult to make adjustments when the governor controls the engine fuel pumps, the engine manufacturer should make arrangements so that the pumps can be disconnected from the governor and the engine be run at low speed with a fixed fuel setting. If the speed adjusting shaft is set as position 10 or maximum speed, the governor is not satisfied and the terminal shaft will move to position 10. If the speed control shaft is now moved to a lower speed setting, the terminal shaft should move down along the torque limit curve. When the speed setting of the governor passes engine speed, the shaft drops to zero. The governor should, therefore, be run with the lowest speed possible.





To check the manifold pressure fuel limiter, the governor should be disconnected from the fuel pumps as described earlier and also be run at low speed with fixed fuel. The fuel limiter curve can be checked with an air signal from a pneumatic transmitter. Use a very accurate pressure gauge to check pressure at the fuel limiter. By increasing or decreasing this pressure, the governor output should move along the manifold pressure fuel limit curve.

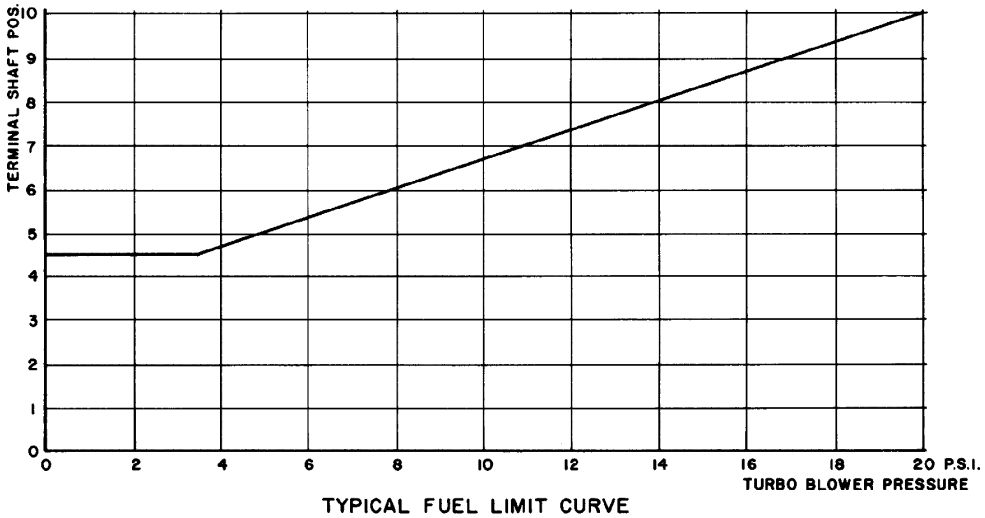


Figure 3. Typical Fuel Limit Curve

Replaceable Parts

This section provides replacement parts information for specific torque limit governor parts and optional features. See manual 03039 for identification of parts not shown or identified in Figure 4.

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

- Governor serial number and part number shown on nameplate
- Manual number (this is manual 03019)
- Parts reference number and part name

Ref. No.	Part Name
03019-1	Socket hd. screw (.250-28)
03019-2	Oil cup
03019-3	Cover
03019-4	Gasket
03019-5	Elastic stop nut (#10-32)
03019-6	Lay shaft stud.
03019-7	Bearing
03019-11	Cotter pin
03019-12	Pin
03019-19	Body
03019-20	Fillister hd. screw
03019-21	Wire strap
03019-35	Lock washer (#6)
03019-36	Screw (#6-32)
03019-37	Connector plug
03019-38	Connector socket
03019-39	Screw
03019-40	Bearing
03019-41	Cam follower lever assembly
03019-42	Spring
03019-43	Nut
03019-44	Spacer
03019-45	Cotter pin
03019-46	Pin
03019-48	Snap ring
03019-50	Torsion spring
03019-51	Lay shaft lever
03019-52	Pin
03019-53	Lay shaft rod
03019-55	Flexloc lock nut (.250-28)
03019-56	Set screw
03019-57	Ratio changing bushing
03019-58	Spacer
03019-59	Cotter pin
03019-60	Control shaft link
03019-61	Speed-to-fuel link
03019-62	Ratio changing screw
03019-63	Headed pin
03019-64	Lay shaft
03019-68	Snap ring
03019-69	Control shaft link assembly
03019-70	Cotter pin
03019-71	Hex hd. screw (.250-28)
03019-72	Washer
03019-73	Cam
03019-74	Needle bearing
03019-75	Cotter pin
03019-76	Cam follower lever assembly
03019-77	Gear segment assembly
03019-78	Torsion spring
03019-79	Speed droop cam
03019-80	Screw
03019-81	Headed pin
03019-82	Cotter pin
03019-83	Speed droop lever
03019-84	Pin
03019-85	Cotter pin
03019-86	Speeder plug
03019-87	Speed droop plunger
03019-88	Speed droop link
03019-89	Cotter pin
03019-92	Terminal lever link
03019-93	Taper pin
03019-94	Lever assembly
03019-96	Flexloc hex nut (#10-32)
03019-97	Stud
03019-99	Indicator plate
03019-100	Round hd. screw (#6-32)
03019-101	Speed adjusting shaft
03019-102	Snap ring
03019-103	Bushing
03019-104	Oil seal
03019-105	Socket hd. set screw (#10-32)
03019-106	Speed adjusting indicator disc
03019-107	Terminal lever indicator disc
03019-108	Shutdown rod assembly
03019-109	Spring
03019-110	Case
03019-125	Socket hd. set screw (.250-28)
03019-126	Manifold pressure sensor assembly
03019-127	Adjusting screw
03019-128	Speed selector bushing
03019-129	Washer
03019-130	Lock nut (.750-32)
03019-131	O-ring
03019-132	Set screw
03019-133	Shutdown solenoid assembly
03019-134	Adjustable cam assembly
03019-135	Tubing assembly
03019-136	Tubing assembly
03019-137	Washer
03019-138	Connector elbow
03019-139	Gasket
03019-140	Adapter plate
03019-141	Socket head screw (#10-32)
03019-142	Washer
03019-143	Filter assembly
03019-144	Socket head screw (.250-28)
03019-145	Washer
03019-146	Tubing assembly

Ref. No.	Part Name
03019-147	O-ring
03019-148	Washer
03019-149	Lever
03019-150	Nylock socket head screw (# 6-32)
03019-151	Washer
03019-152	Bracket
03019-153	Socket head screw (#10-32)
03019-154	Washer
03019-155	Mounting block assembly
03019-156	Adjusting screw
03019-157	Washer
03019-158	Nut
03019-159	Switch
03019-160	Screw (#4-40)
03019-161	Fuel limit link assembly
03019-162	Adjusting screw
03019-163	Torque limit link assembly with heli-coil
03019-164	Solenoid-to-shutdown link
03019-165	Socket hd. screw (.375-24)
03019-166	Lock washer
03019-167	Power lever assembly
03019-168	Cotter pin
03019-169	Socket hd. screw (.250-28)
03019-170	Lock washer
03019-171	Plug

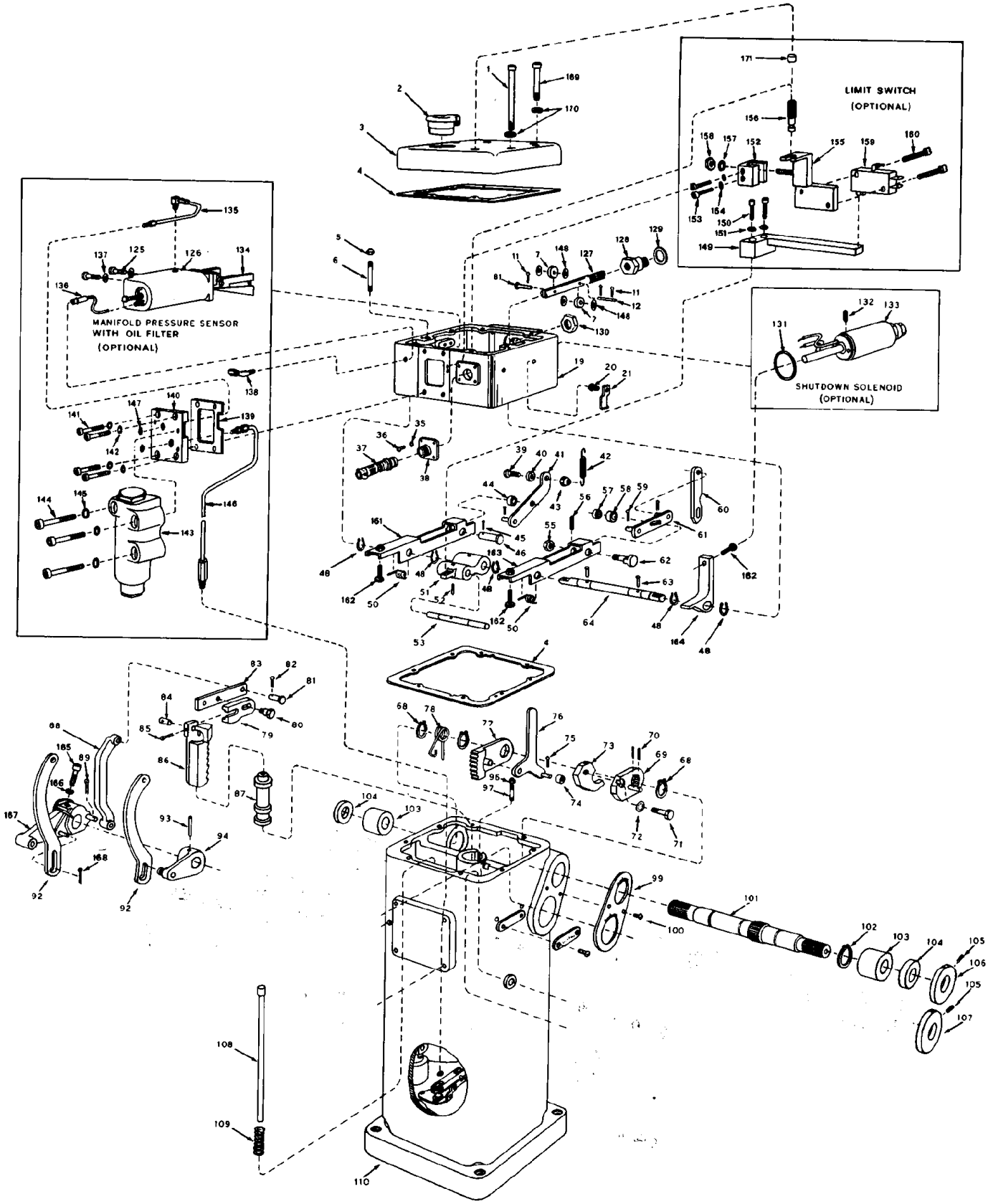


Figure 4. Exploded View of UG-40 Governor

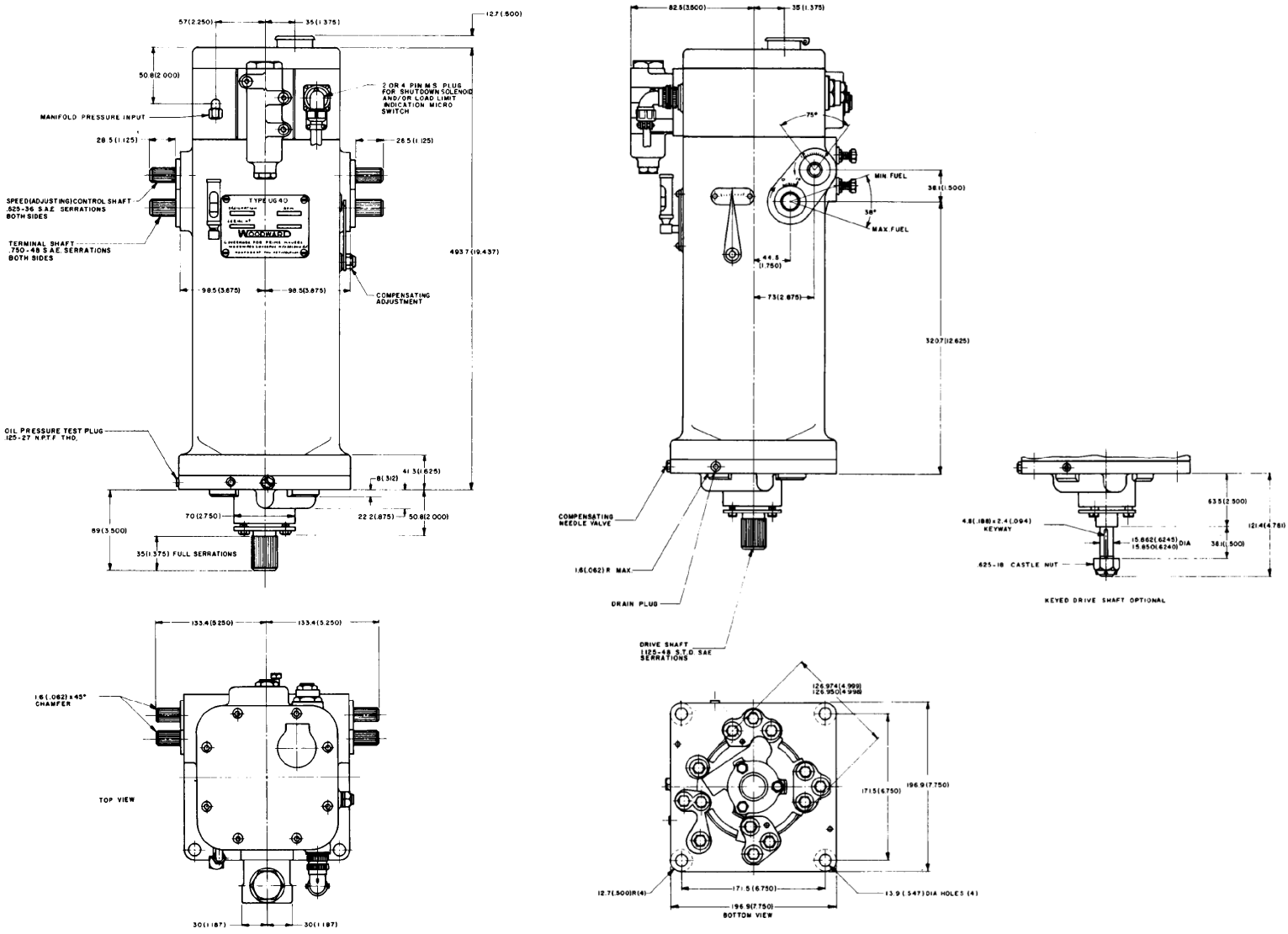


Figure 5. Typical UG-40 Governor Outline with Torque Control and/or Fuel Limiter Assembly
(Do not use for construction.)

We appreciate your comments about the content of our publications.

Send comments to: icinfo@woodward.com

Please reference publication 03019G.

WOODWARD

PO Box 1519, Fort Collins CO 80522-1519, USA
1000 East Drake Road, Fort Collins CO 80525, USA
Phone +1 (970) 482-5811 • Fax +1 (970) 498-3058

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.

2012/11/Colorado