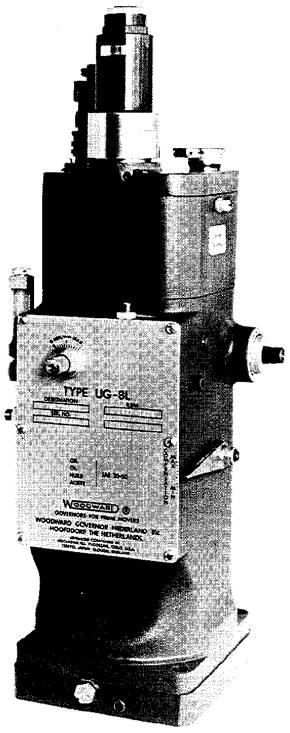
WOODWARD

Product Manual 03507
(Revision NEW)
Original Instructions



Manifold Pressure Fuel Limiter for UG-8L Governors

Operation Manual

General Precautions

Read this entire manual and all other publications pertaining to the work to be performed before installing, operating, or servicing this equipment.

Practice all plant and safety instructions and precautions.

Failure to follow instructions can cause personal injury and/or property damage.

Revisions

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

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Proper Use

Any unauthorized modifications to or use of this equipment outside its specified mechanical, electrical, or other operating limits may cause personal injury and/or property damage, including damage to the equipment. Any such unauthorized modifications: (i) constitute "misuse" and/or "negligence" within the meaning of the product warranty thereby excluding warranty coverage for any resulting damage, and (ii) invalidate product certifications or listings.

Translated Publications

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

The original source of this publication may have been updated since this translation was made. Be sure to check manual *26311* , *Revision Status & Distribution Restrictions of Woodward Technical Publications*, to verify whether this translation is up to date. Out-of-date translations are marked with ⚠. Always compare with the original for technical specifications and for proper and safe installation and operation procedures.

Revisions—Changes in this publication since the last revision are indicated by a black line alongside the text.

Warnings and Notices

Important Definitions

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

- **DANGER**—Indicates a hazardous situation which, if not avoided, will result in death or serious injury.
- **WARNING**—Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
- **CAUTION**—Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
- **NOTICE**—Indicates a hazard that could result in property damage only (including damage to the control).
- **IMPORTANT**—Designates an operating tip or maintenance suggestion.

⚠WARNING

Overspeed / Overtemperature / Overpressure

The engine, turbine, or other type of prime mover should be equipped with an overspeed shutdown device to protect against runaway or damage to the prime mover with possible personal injury, loss of life, or property damage.

The overspeed shutdown device must be totally independent of the prime mover control system. An overtemperature or overpressure shutdown device may also be needed for safety, as appropriate.

⚠WARNING

Personal Protective Equipment

The products described in this publication may present risks that could lead to personal injury, loss of life, or property damage. Always wear the appropriate personal protective equipment (PPE) for the job at hand. Equipment that should be considered includes but is not limited to:

- **Eye Protection**
- **Hearing Protection**
- **Hard Hat**
- **Gloves**
- **Safety Boots**
- **Respirator**

Always read the proper Material Safety Data Sheet (MSDS) for any working fluid(s) and comply with recommended safety equipment.

⚠WARNING

Start-up

Be prepared to make an emergency shutdown when starting the engine, turbine, or other type of prime mover, to protect against runaway or overspeed with possible personal injury, loss of life, or property damage.

⚠WARNING

Automotive Applications

On- and off-highway Mobile Applications: Unless Woodward's control functions as the supervisory control, customer should install a system totally independent of the prime mover control system that monitors for supervisory control of engine (and takes appropriate action if supervisory control is lost) to protect against loss of engine control with possible personal injury, loss of life, or property damage.

NOTICE

Battery Charging Device

To prevent damage to a control system that uses an alternator or battery-charging device, make sure the charging device is turned off before disconnecting the battery from the system.

Electrostatic Discharge Awareness

NOTICE

Electrostatic Precautions

Electronic controls contain static-sensitive parts. Observe the following precautions to prevent damage to these parts:

- **Discharge body static before handling the control (with power to the control turned off, contact a grounded surface and maintain contact while handling the control).**
- **Avoid all plastic, vinyl, and Styrofoam (except antistatic versions) around printed circuit boards.**
- **Do not touch the components or conductors on a printed circuit board with your hands or with conductive devices.**

To prevent damage to electronic components caused by improper handling, read and observe the precautions in Woodward manual *82715*, *Guide for Handling and Protection of Electronic Controls, Printed Circuit Boards, and Modules*.

Follow these precautions when working with or near the control.

1. Avoid the build-up of static electricity on your body by not wearing clothing made of synthetic materials. Wear cotton or cotton-blend materials as much as possible because these do not store static electric charges as much as synthetics.
2. Do not remove the printed circuit board (PCB) from the control cabinet unless absolutely necessary. If you must remove the PCB from the control cabinet, follow these precautions:
   - Do not touch any part of the PCB except the edges.
   - Do not touch the electrical conductors, the connectors, or the components with conductive devices or with your hands.
   - When replacing a PCB, keep the new PCB in the plastic antistatic protective bag it comes in until you are ready to install it. Immediately after removing the old PCB from the control cabinet, place it in the antistatic protective bag.

Chapter 1.
General Information

Introduction

As an optional feature, a manifold pressure fuel limiter is available for UG-8L governors used on turbo-supercharged engines.

When a conventional (unlimited) governor is used on a turbo-supercharged engine, the normal lag of supercharger speed and, consequently, manifold air pressure with respect to engine speed during accelerations, makes it possible for the governor to supply more fuel to the engine than can be burned with the available air. This results in an overly rich fuel/air mixture ratio, causing incomplete combustion with attendant smoke and poor acceleration.

The fuel limiter functions to restrict the movement of the governor power piston in the increase fuel direction and, thus, limits engine fuel during accelerations as a function of manifold air pressure (an approximation of the weight of air available at any instant). Limiting engine fuel to that which can be burned with the air available at any instant during the acceleration transient ensures more complete combustion of the fuel, reducing smoke to a minimum, and improving engine acceleration. The fuel limiter also serves as a protective device to limit engine fuel if the turbo-supercharger fails or other large reduction occur in the engine air supply. Figure 1 illustrates the unlimited, limited, and steady state fuel schedules for a typical engine, together with a typical acceleration transient from one steady state condition to another.

This manual describes the operation and adjustment of this device. The operation of the basic UG-8L governor is described in manual 03036. Other optional devices, like the electric solenoid shutdown (manual 03013) or the lubricating oil pressure shutdown (manual 03016), can be retained.

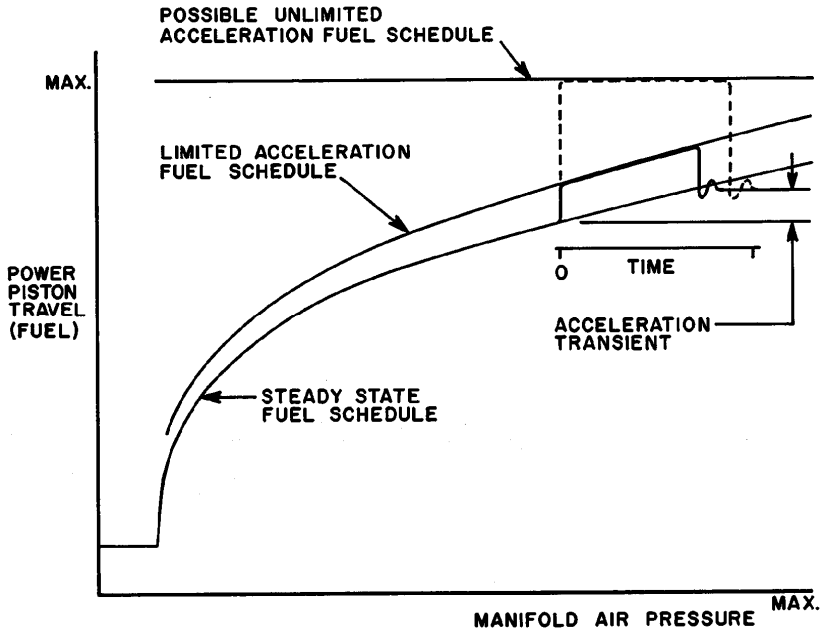


Figure 1. Typical Limited Acceleration Fuel Schedule Curve

Description

The fuel limiter consists essentially of a pressure sensor, a cam, and connecting linkage. The schematic arrangement of Figure 2 shows the device in limiting position. Pressure oil from the governor hydraulic system supplies the energy to operate the limiter.

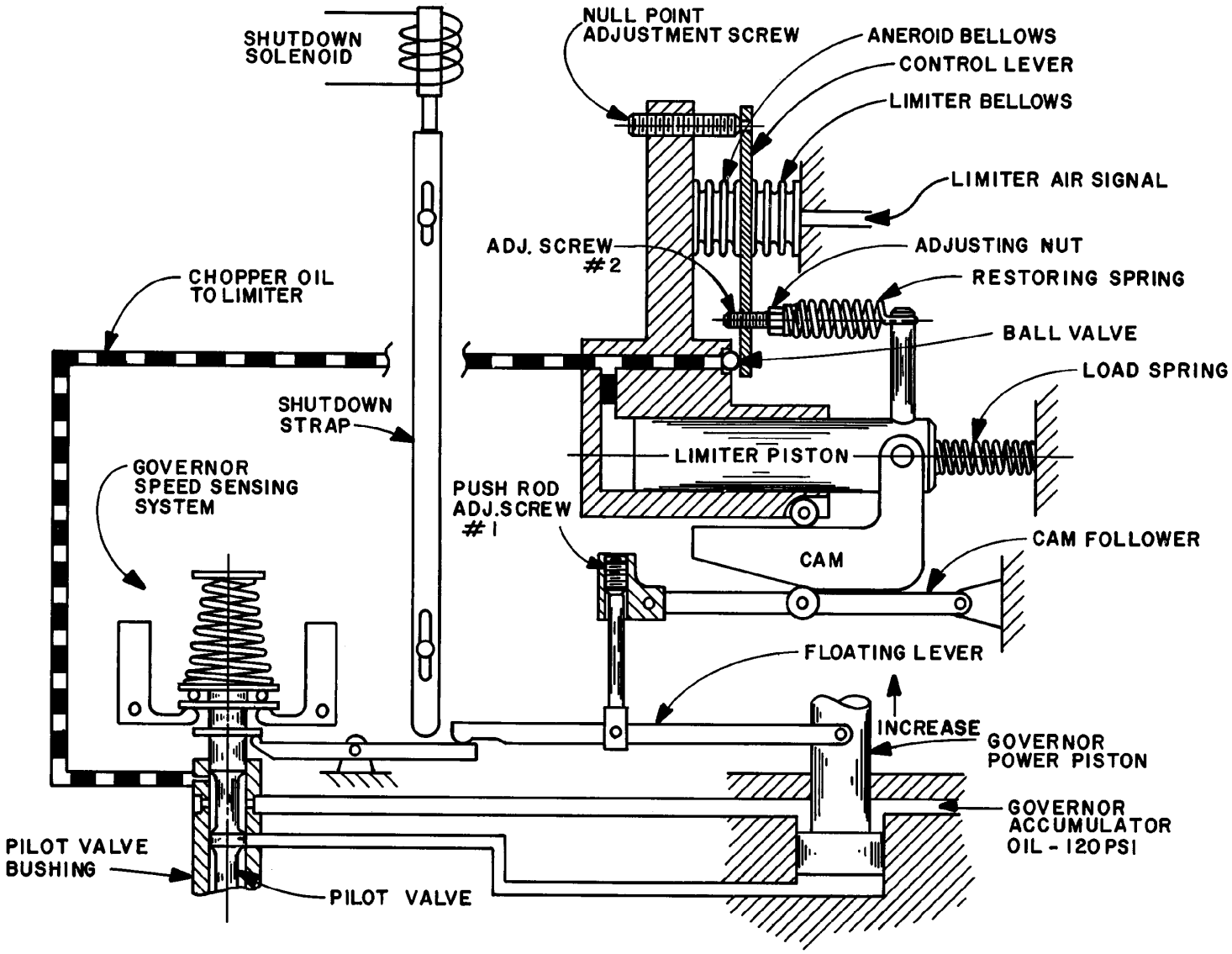


Figure 2. Limiter Schematic

A restricted pulsating flow is obtained by means of the chopper valve consisting of small ports in the rotating governor pilot valve bushing passing a hole in the controlet. In steady state operation, oil flows back to sump via the ball valve lifted off its seat. The ball valve is loaded by the sensing bellows, one bellows being connected to manifold pressure and opposed by the second one which is an aneroid. The force derived is proportional to the absolute value of the manifold pressure.

As manifold pressure increases, the ball valve seats and pressure develops, moving the limiter piston to the right against the load spring. This movement increases the tension on the restoring spring until the spring force just equals the bellows system force. The leak across the ball valve is re-established, and the piston stops. The piston position is proportional to the absolute value of the manifold pressure.

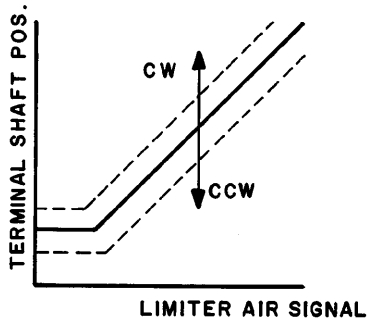
The cam attached to the limiter piston operates through linkage to limit the fuel by limiting the travel of the governor power piston. The power piston can travel upwards until the floating lever lifts the pilot valve above center, thus stopping piston movement.

When the engine is not running, the limiter piston is held to the left by the load spring. The fuel limit value at this position must be set high enough to give sufficient fuel foe starting.

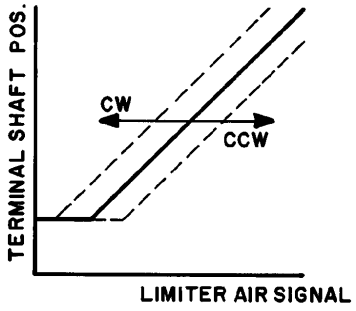
Adjustments

The manifold pressure versus fuel limit curve is established by the engine manufacturer; the cam in the limiter is made to fit this curve. However, if necessary to change the fuel limit curve, the following field adjustments can be made:

1. The curve can be shifted along the fuel limit line with adjusting screw 1: turning clockwise raises the curve, turning counterclockwise lowers it (right).

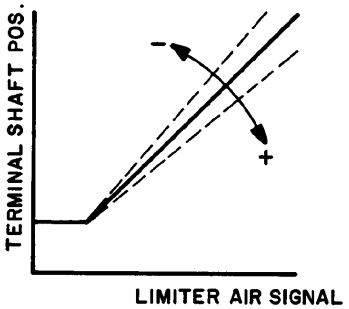


2. The curve can be shifted along the air pressure line with adjusting screw 2. While adjusting this screw, the restoring spring must be unhooked from the pin, and the set screw–nut–restoring spring assembly must be turned as a whole. Turning clockwise shifts the curve to the left, turning counterclockwise to the right (right).



3. The slope of the curve can be varied by changing the number of effective windings of the restoring spring. This can be done by unhooking the spring and screwing it up or down over the adjusting nut.

   Diminishing the number of windings results in a steeper slope; enlarging the number gives a flatter slope. It must be noted, however, that this adjustment also results in shifting the curve along the pressure line, so readjustment according to step 2 may be necessary (right).



The null point adjustment screw (Figure 2) is meant to give the control lever a precise mid-position between the two bellows, thus giving them the same working length and eliminating mechanical forces on the control lever. In general, no field readjustment is necessary; however, should this become necessary after disassembly or replacement of parts, be careful not to destroy or damage the bellows by excessive turning of the screw.

Information and Parts Replacement

When requesting additional information, or when ordering parts, it is essential that the following information accompany the request:

- Governor serial and/or designation number
- Manual number (this is manual 03507)
- Part reference number, name of part, or description of part.

The illustrated parts breakdown (Figure 3) illustrates and lists all the replaceable parts for the fuel limiter part of the governor. Foe identification of parts not shown here, please refer to manual 03036.

Ref. No.	Part Name	Quantity
03507-1	Solenoid adapter	1
03507-2	UG-8 cover	1
03507-3	#10-32 x.250 set screw	1
03507-4	Cover gasket	2
03507-5	#10-32 x 3.250 soc. hd screw	6
03507-6	#10-32 x .500 soc hd screw	2
03507-7	#10 splitlock washer	13
03507-8	Sub cap screw	2
03507-9	UG-8 sub cap	1
03507-10	Soc hd pipe plug	3
03507-11	Decal	1
03507-12	Snap ring	1
03507-13	Spring washer	1
03507-14	.250-28 set screw	1
03507-15	Aneroid bellows	1
03507-16	Bellows control lever (furnished assembled only)	1
03507-15–16	Bellows assy	1
03507-17	#10-32 x .875 set screw	1
03507-18	Rest. spring adjuster assy	1
03507-19	Restoring spring	1
03507-20	Bellows assy	1
03507-21	#10-32 x 1.250 soc. hd. screw	1
03507-22	Preformed packing	1
03507-23	Oil supply tube assy	1
03507-24	Preformed packing	2
03507-25	UG-8 controlet	1
03507-26	Pilot valve bushing	1
03507-27	.156 steel ball	1
03507-28	Preformed packing	2
03507-29	.187 steel ball	1
03507-30	Limiter body assy	1
03507-31	Preformed packing	1

Ref. No.	Part Name	Quantity
03507-32	Limiter body end cap	1
03507-33	#8-32 x .625 soc. hd. screw	3
03507-34	#8-32 x 500 soc. hd. screw	2
03507-35	Spring post	1
03507-36	Cotter pin	3
03507-37	Plain washer	2
03507-38	Straight pin	1
03507-39	Spring	1
03507-40	Ball bearing	2
03507-41	.250-28 set screw	1
03507-42	Pushrod pivot assy	1
03507-43	Cam follower lever	1
03507-44	Headed pin	1
03507-45	Straight drilled pin	2
03507-46	Piston guide plate	1
03507-47	#8 splitlock washer	5
03507-48	Oil supply tube adapter assy	1
03507-49	Piston guide pin	1
03507-50	Limiter piston	1
03507-51	#6-32 x .250 set screw	1
03507-52	Cam spacer assy	1
03507-53	Fuel limiter cam	1
03507-54	Shutdown strap assy	1
03507-55	Return spring	1
03507-56	Load limit push rod assy	1
03507-57	Servomotor link	1
03507-58	.375 OD washer	1
03507-59	Cotter pin	1
03507-60	.312 OD copper washer	1
03507-61	Floating lever assy	1
03507-62	Shutdown lever assy	1
03507-63	UG-8L panel	1
03507-64	#10-32 x .625 soc. hd. screw	2

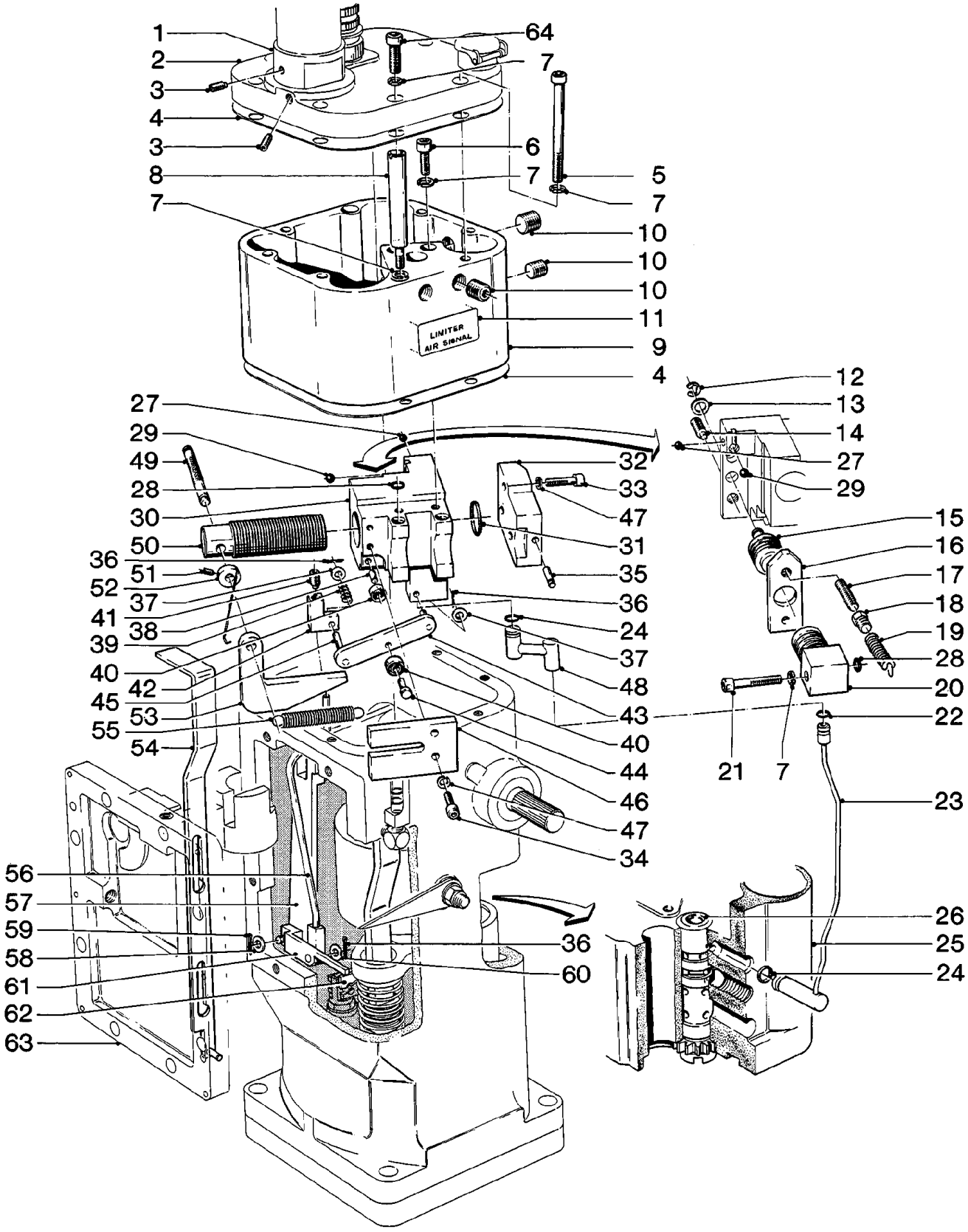


Figure 3. Illustrated Parts Breakdown

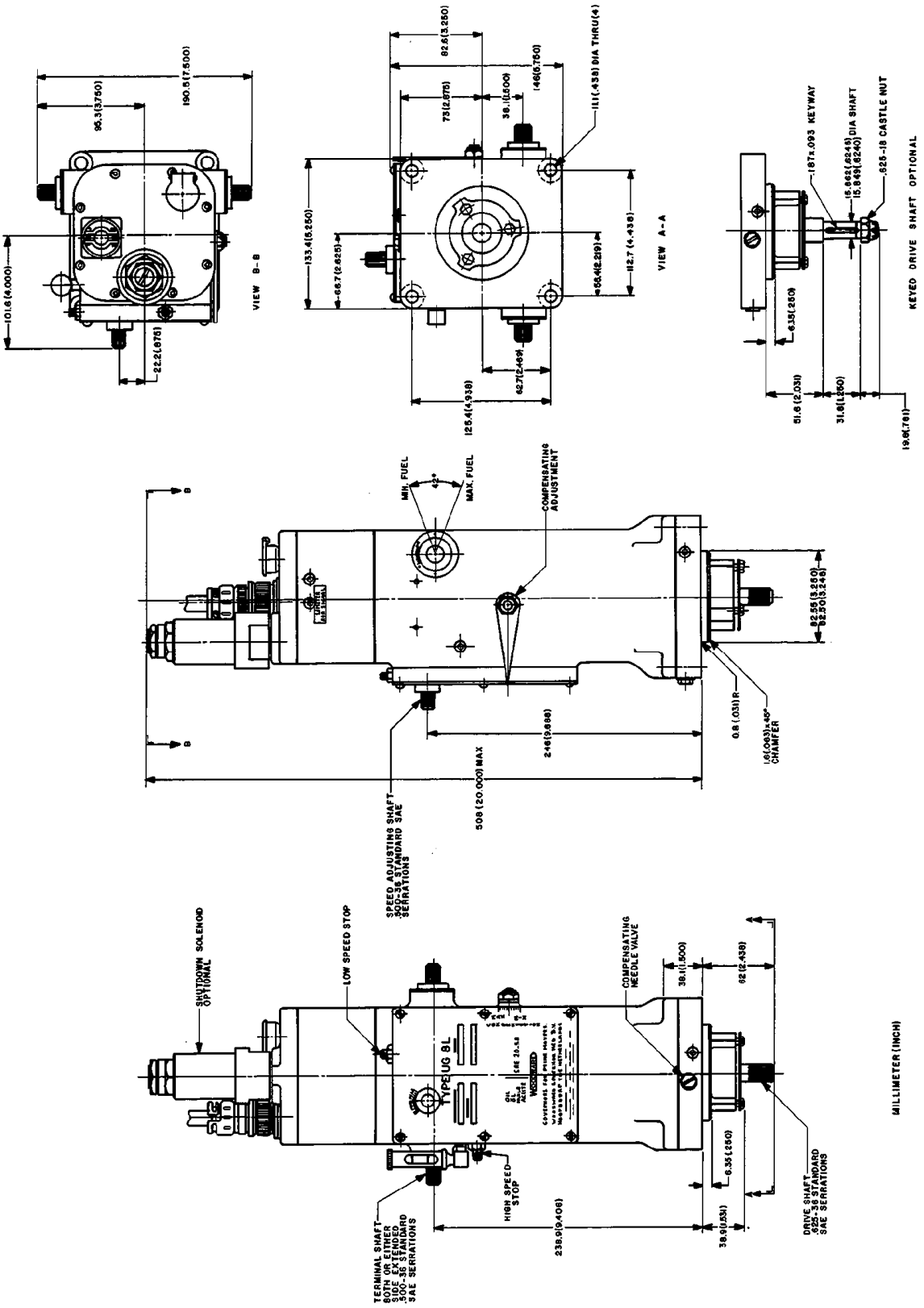


Figure 4. Outline Drawing

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Please reference publication 03507.

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