

MAIN DIESEL GENERATOR PRIME MOVER CATERPILLAR D-398

GENERAL DESCRIPTION

The T-AGOS has four Main Diesel Generators, each generator is driven by a constant speed Caterpillar D-398 diesel engine. Each engine is installed on its own skid base and then mounted on a special sound isolation base. The D-398 is a V-12 and each engine develops 970 horsepower at 1200 rpm.

Each D-3988 is complete with the following:

- Air Cleaners with Maintenance Indicator.
 - Crankcase Vent Emission Filer.
 - Crankcase Relief Valves.
 - Manual Shut Off Control Lever.
 - Local Electric Pushbutton Shutoff.
 - Seawater-To-Jacket Water Cooler.
 - Fuel and Lube Oil Filter.
 - Speed Actuator.
 - Water-Cooled Exhaust Manifold.
 - Marine Oil Pan (110 Gallons).
 - Jacket Water Cooled After Cooler.
 - Air Starting System.
 - Turbo Charger.
 - Turbocharger Air Outlet Dampers.
 - Muffler.
 - Gauge Board (modified).
 - Electronic Overspeed Control.
 - Jacket Water Heater.
 - Manual and Electric Pre-Lube Pump.
 - Service Meter and Tachometer Drive.
- Each gauge board (modified) contains the following gauges/meters:
- RPM.
 - Engine Oil Pressure.
 - Fuel Pressure.
 - Exhaust, Left & Right.
 - Engine Oil Temperature.
 - Jacket Water Temperature.
 - Left & Right Manifold Air Temperature.
 - SW Cooling Pump Discharge Pressure.
 - JW Recirculating Pump Discharge Pressure.
 - Local Shutdown Pushbutton.

Woodward EG-3P actuator

To maintain a constant engine speed a Woodward EG-3P actuator is mounted in the vee of each engine. The actuator controls the fuel racks in accordance with the signals received from the Generator Engine Module mounted in the Generator Control Panel (Part of the 600 volt switchboard). The GEM maintains the engine speed at 1200 rpm.

The essential element of the EG-3P actuator is an electro-hydraulic transducer which controls oil flow to and from the power piston through the action of a polarized solenoid. The position of the terminal shaft on the EG-3P actuator is proportional to the input current to the solenoid coil controlling the hydraulic pilot plunger.

The EG-3P actuator normally goes to minimum fuel if the electric signal is interrupted. Oil for the EG-3P actuator is taken from the engine lubricating system.

An EG-3P actuator drive shaft is driven by the prime mover to provide relative rotation between the pilot valve plunger and bushing and to rotate the oil pump gears. The drive shaft should rotate between 1200 and 3600 RPM. it can rotate in one direction only. The direction of rotation is determined by the placement of plugs in the oil passage in the actuator base and case. A relieve valve is incorporated within the actuator to maintain the operating oil pressure at approximately 350 PSI above supply pressure.

Oil from the external source enters the suction side of the oil pump. The pump gears carry the oil to the pressure side of the pump, first filling the oil passages and then increasing the hydraulic pressure. When the pressure becomes great enough to overcome the relief valve spring force and push the relief valve plunger down to uncover the bypass hole, the oil recirculates through the pump.

The movement of two opposing pistons rotates the actuator terminal shaft. The prime mover fuel linkage is attached to the terminal shaft. Pressure oil from the pump is supplied directly to the underside of the loading piston. Pressure in this hydraulic circuit always tends to turn the terminal shaft in the "decrease fuel" direction.

Since the linkage that connects the loading piston to the terminal shaft is shorter than the linkage that connects power piston to the terminal shaft, the loading piston cannot move up unless the power piston moves down. The power piston moves down only when the oil trapped beneath it escapes to sump.

The flow of oil to and from the power piston is controlled by the pilot valve plunger. With the pilot valve plunger centered, no oil flows to or from the power piston. The pilot valve plunger is centered when its control land exactly covers the control port in the pilot valve bushing.

The greater of two forces moves the pilot valve plunger up or down. When the forces are equal, the plunger does not move.

The pilot valve plunger is connected to a permanent magnet that is spring-suspended in the field of a two-coil solenoid. The output signal from the electric control box is applied to the solenoid coils and produces a force, proportional to current in the coils, which tends always to move the magnet -and pilot valve plunger down.

A spring force tends always to move the pilot valve plunger and magnet up. The centering spring sits atop the case in which the solenoid coils are located. It exerts a constant upward force on the pilot valve plunger. The restoring spring exerts a downward force on the pilot valve plunger. The downward force from the restoring spring depends upon the position of the restoring lever. The restoring lever moves up to decrease the restoring spring force as the terminal shaft rotates in the "increase" fuel direction. The resultant force from the combined output of the centering spring and restoring spring is a force that is always urging the pilot valve plunger in the "up" direction; this resultant force increases as the terminal shaft moves in the "increase" fuel direction.

With the unit running on-speed under steady-state conditions, the resultant spring force and force from the current in the solenoid coils are equal but opposite.

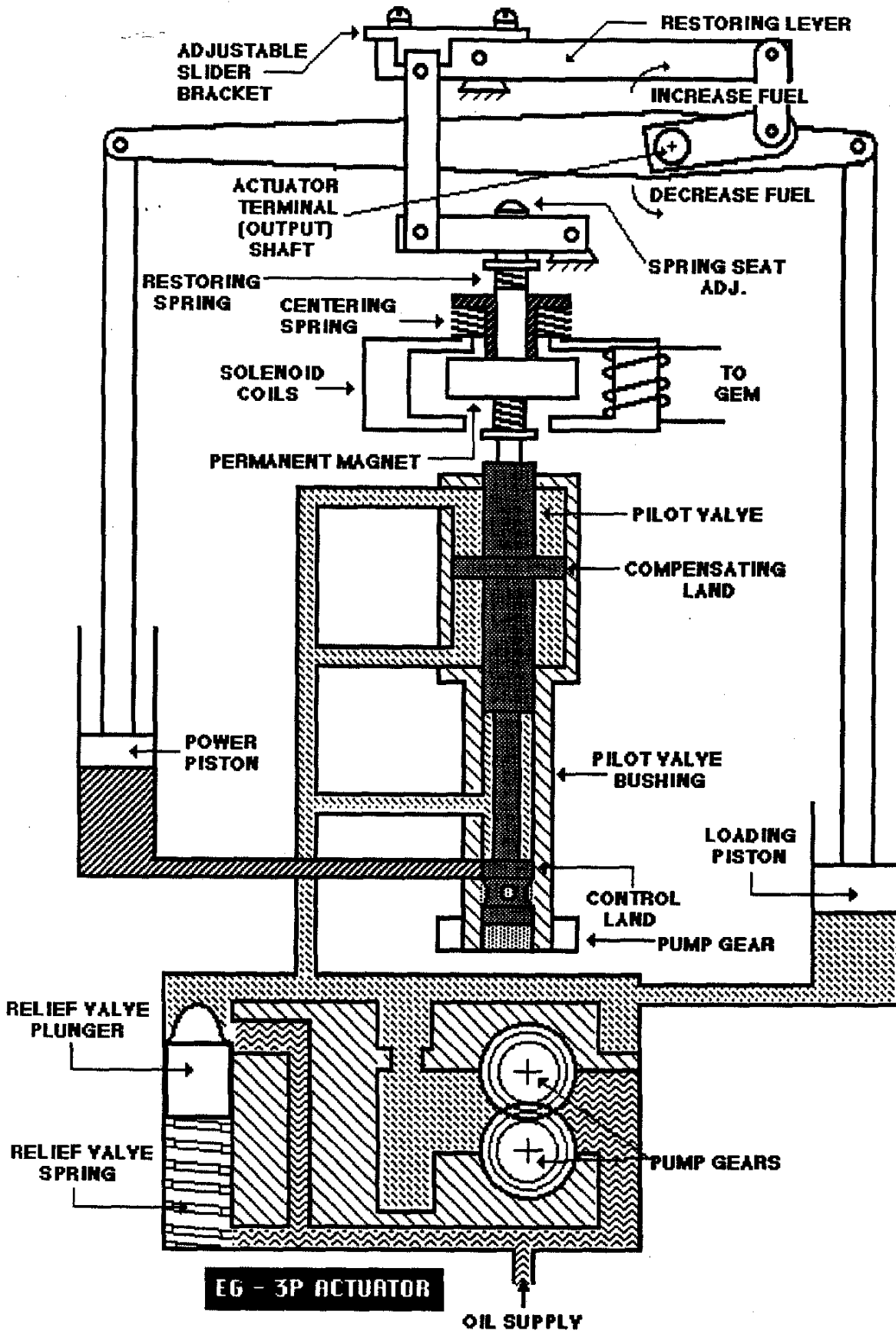
Assume the unit is running on-speed under steady-state conditions. The pilot valve plunger is centered. A decrease in voltage input to the solenoid coils - due to a decrease in setting or a decrease in load - decrease the force tending to lower the pilot valve plunger. Consequently, the unchanged spring force is now greater and lifts the plunger above center. As oil escapes from under the power piston, the terminal shaft rotates in the "decrease" fuel direction. When the terminal shaft has rotated far enough to satisfy the new fuel requirement, the increase in restoring spring force will "equal", the decrease in downward force from the current in the solenoid coils, and the pilot valve plunger will be recentered by the again equal but opposite forces acting upon it.

Where the voltage signal input to the solenoid coils increased - due to an increase in load or an increase in speed setting - similar but opposite reactions would occur. The now greater downward force from the solenoid coils should move the pilot valve plunger down. The power piston and restoring lever would be moved up, decreasing the downward force of the restoring spring.

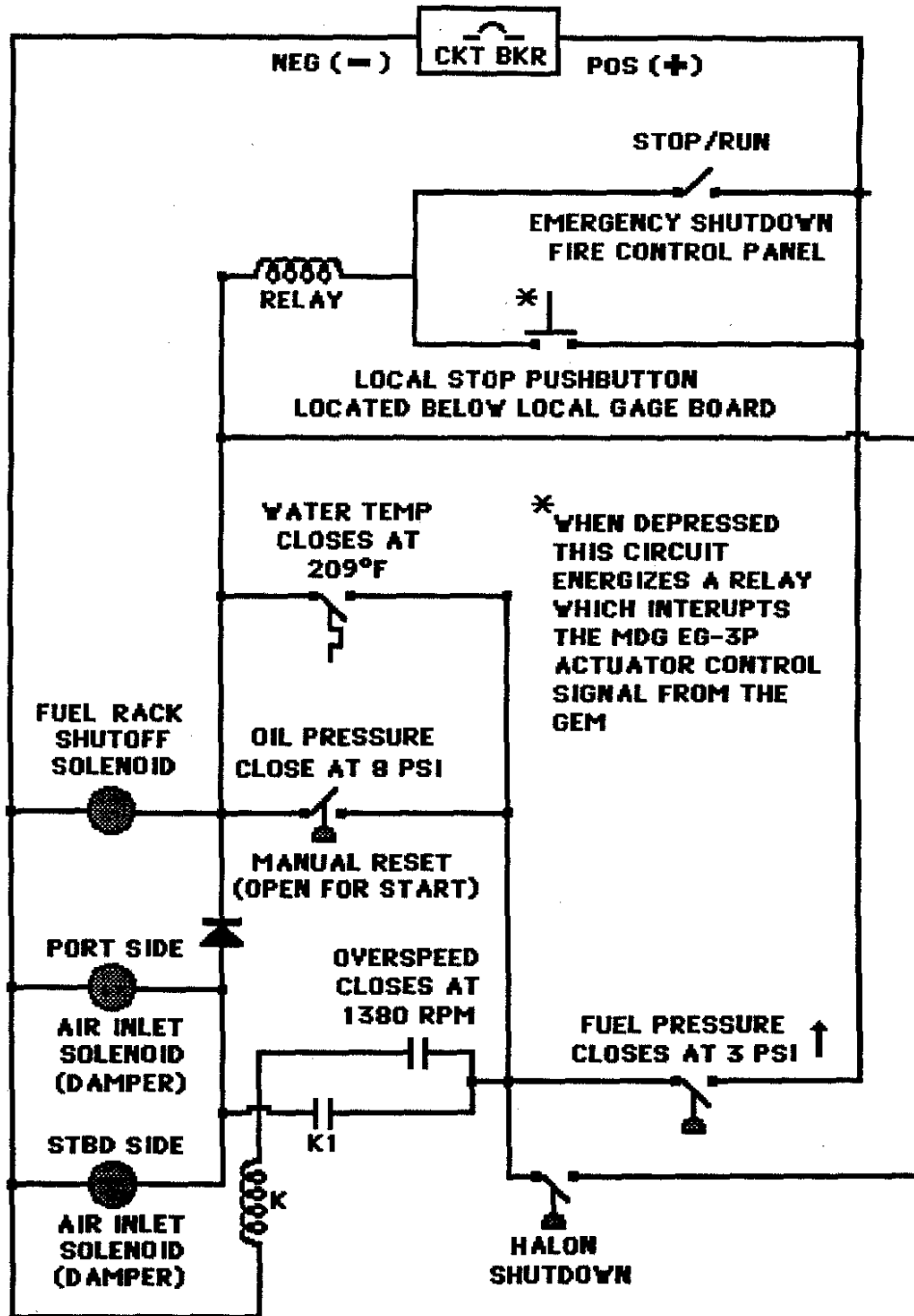
When the terminal shaft would have rotated far enough to satisfy the new fuel requirement, the decrease in restoring spring force would "equal" the increase in downward force from the current in the solenoid coils and the pilot valve plunger would be recentered by the again equal but opposite forces acting upon it.

The AC Generator Engine Module (GEM) is responsible for regulating the solenoid coil current.

The actuator is also the source of oil pressure use to automatically shut down the electric pre-lube pump at approximately 6-7 psi.



**24 VDC SECTION
EMERGENCY SWITCHBOARD**



MAIN GENERATOR MANUAL-AUTO SHUTDOWN SCHEMATIC