

ELECTRIC GOVERNOR INSTALLATION MANUAL

Model SJ Actuator
With
Model E391 Controller

General

The following information is intended as an aid to properly applying a Precision Governor Electric Governor. Since these governors are used on a variety of engines in many different applications, much of the information is somewhat general in nature. If you need assistance concerning a specific application, please consult Precision Governors Application Engineering at 815/229-5300.

These instructions presume no electrical test equipment other than a multimeter for making the electrical measurements called for on the following pages. A suitable meter may be obtained at many outlets such as Radio Shack.

Many “governor problems” turn out to be installation problems, particularly in first-time installations. Careful attention to the directions provided will go far toward a successful installation made in the least amount of time.

Theory of operation

The SJ actuator is designed for use with a diesel engine to control the engine speed by directly operating the fuel rack in the injection pump. To do this, it is mounted on the rear of the injection pump where it is able to override the standard mechanical governor. The throttle on the engine must be set so that the mechanical governor is attempting to reach a speed a few hundred RPM over the maximum speed at which the electrical governor is desired to operate. Thus, the built-in mechanical unit is always trying to go faster than the electronically governed speed. The actuator then can push the fuel rack back to obtain the desired speed or speeds. The controller operates the actuator to maintain set speeds. Full extension of the actuator shaft causes fuel shutoff, stopping the engine. The advantages of using the electrical governor include ease of obtaining variable speeds, droopless operation and elimination of the shutdown solenoid.

Actuator installation

With the engine operable and without the electrical governor installed, run the engine and lock the manual throttle in a position where a speed of 300-400 RPM over the maximum desired speed is obtained. Use both adjustment screws to lock the throttle. The SJ actuator is then mounted to the rear of the fuel injection pump in place of a shutdown solenoid. An adapter is provided for each engine to facilitate mounting. The adapter is mounted to the engine with a gasket and 2 M6 socket head cap screws. The actuator is then mounted to the adapter, again, with 2 M6 socket head cap screws. (See illustrations) Use the 2 threaded holes that make access the easiest. Be sure the o-ring is in place on the actuator prior to installation. Slide the actuator straight into the pump to avoid damage to the pump or actuator.

Controller installation

The controller is water and weather resistant when the cover plate is sealed with RTV by the user. However, attention to the following points will enhance its performance and reliability.

- Select a reasonably cool , dry and vibration-free location.
- The cover plate will probably need to be removed during setup in order to make adjustments of speed setting and gain. You may wish to defer final mounting of the controller until the adjustments are complete.
- After completing the adjustments, replace cover and seal with a fillet of RTV. Mount so that water cannot pool on the cover. Also, mounting with this cover out of sight, discourages tampering.

Wiring

See the wiring diagram for connection details. The following information is important for a good installation.

- Use #18 wire minimum; #16 is preferred.
- If governor power is to be switched through the ignition switch, run power to the governor directly via a dedicated #16 wire. Check that the wiring from the battery to the switch is at least #14.
- Keep all wiring lengths as short as possible.
- Go directly from the controller ground terminal by dedicated wire to the battery minus terminal. If this cannot be done for some reason, go by dedicated wire to a very good engine ground.
- A properly functioning engine electrical system will supply 13.5 to 14.8 VDC when the engine is running. If wiring size is adequate, with good connections and proper grounds, this voltage will be obtained at terminals 1 & 2 or A & B when the governor is controlling engine speed. Be sure to verify this.
- **Improper hook-up can damage electronic circuits. Re-check wiring *before* applying power.**

Check-out & initial start-up procedures

Once the actuator and controller are installed and wired, proceed as follows:

- Turn ignition switch on. Do not start engine.
- Use a multimeter to check battery voltage at the battery. Now check battery voltage at the machine connection points for terminals 1 & 2 or A & B. The second voltage reading should be the same as at the battery. If not, shut down and correct wiring.
- Before proceeding, familiarize yourself with the locations of the **Speed Set** pot and the **Gain** pot. Also, read the section on **Adjustments**.
- Start the engine and set the machine controls to call for the highest governed speed required. Adjust the **Speed Set** pot slowly as needed to obtain the speed desired. If engine surges, reduce the **Gain** slightly.
- Re-check the voltage between the connections for terminals 1 & 2 or A & B. The reading should be between 13.5 and 14.6 VDC. If it is less, look for undersized

wiring somewhere in the system or for other components wired in parallel with the governor.

- Carefully adjust the **Gain** pot. You are looking for the best compromise between quick response and good stability. Make very small adjustments, then load and unload the engine. Usually, a good set-up is one that makes 1 to 3 small bounces and then settles down after a large load change. Too much **Gain** shows up as a rapid (once per second) instability, most commonly at light loads. Too little **Gain** shows up in large overshoots on startup or large load changes and generally sluggish operation.
- Set machine controls to obtain low engine speed. Make any adjustments required to the **Aux** speed at this time. The engine speed should now ramp between the low and high speeds, following the action of the up/down switch on the machine. The adjustment of the Speed Set and Aux Speed controls may need to be repeated a couple of times as there is some interaction between the 2 adjustments.
- Re-install the cover plate. Add a fillet of RTV around the edge of the cover to seal against dirt and moisture. Final mount the controller.

Governor adjustments

Multi-turn adjustments (Speed Set, Aux Speeds) – These adjustments are made by turning the 1/8” brass screw clockwise (CW) to increase and counterclockwise (CCW) to decrease the settings. The adjustment range of the pot is 25 full turns. This pot is protected by a slip clutch at each end of the range and is not damaged by moderate over-adjustment. However, the governor will not function while the pot is past full travel. If you suspect you may have over-adjusted one of these pots or have lost track of where you are, turn the pot 25 turns in one direction, then back 10-12 turns to get back into the normal range.

Single turn adjustments (Gain, Factory Adjust) – These pots are 3/8” square and have a 1/8” plastic screw slot in the center. **Be gentle!** These pots turn 270 degrees and over-turning will break the internal stops, making adjustments impossible. Turning these pots CW increase response while turning CCW decreases response.

Troubleshooting

If the governor system fails to operate or doesn't operate properly, check the following and apply corrections as appropriate.

- Power and wiring – check the wiring to the diagram furnished here or with the machine. Also, perform the voltage tests described above in the wiring section.

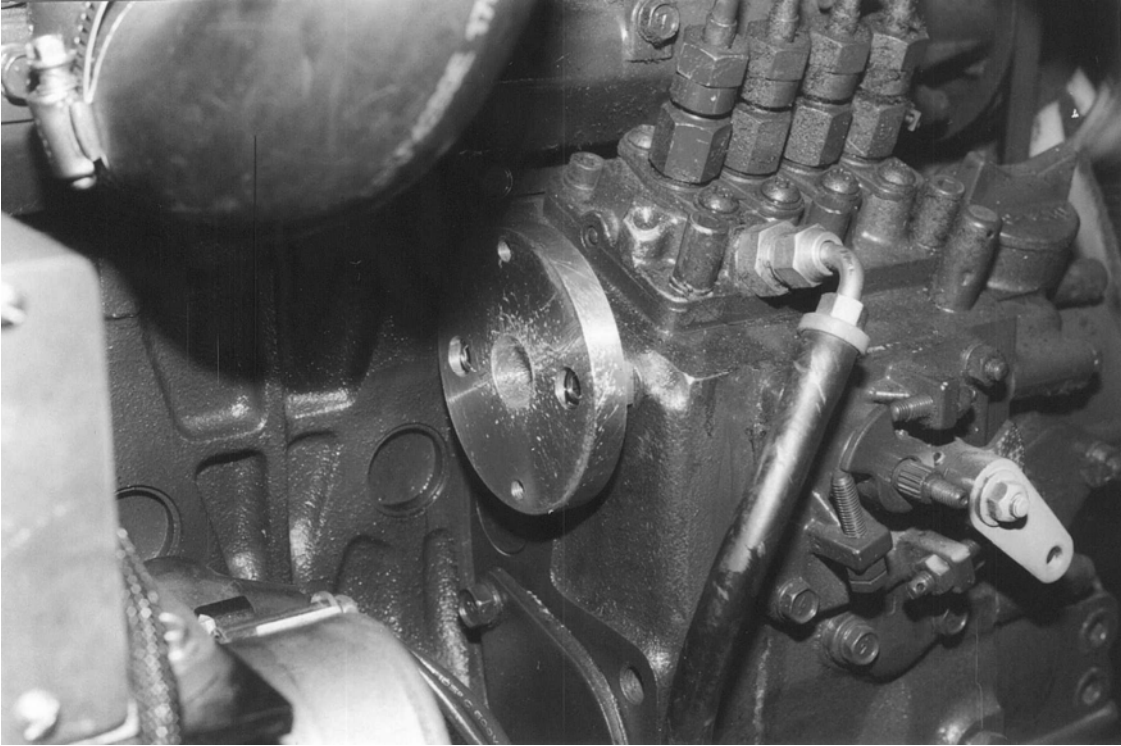
Wiring to the actuator should also be adequate and not be contacting the frame or engine.

- Speed reference signal – the magnetic pick-up mounted on the engine sensing the ring gear teeth must deliver a signal at a minimum of 5 VAC during cranking.
- Machine speed selection switches or relays – check that all machine wiring is functioning and providing the correct signals to the control box.

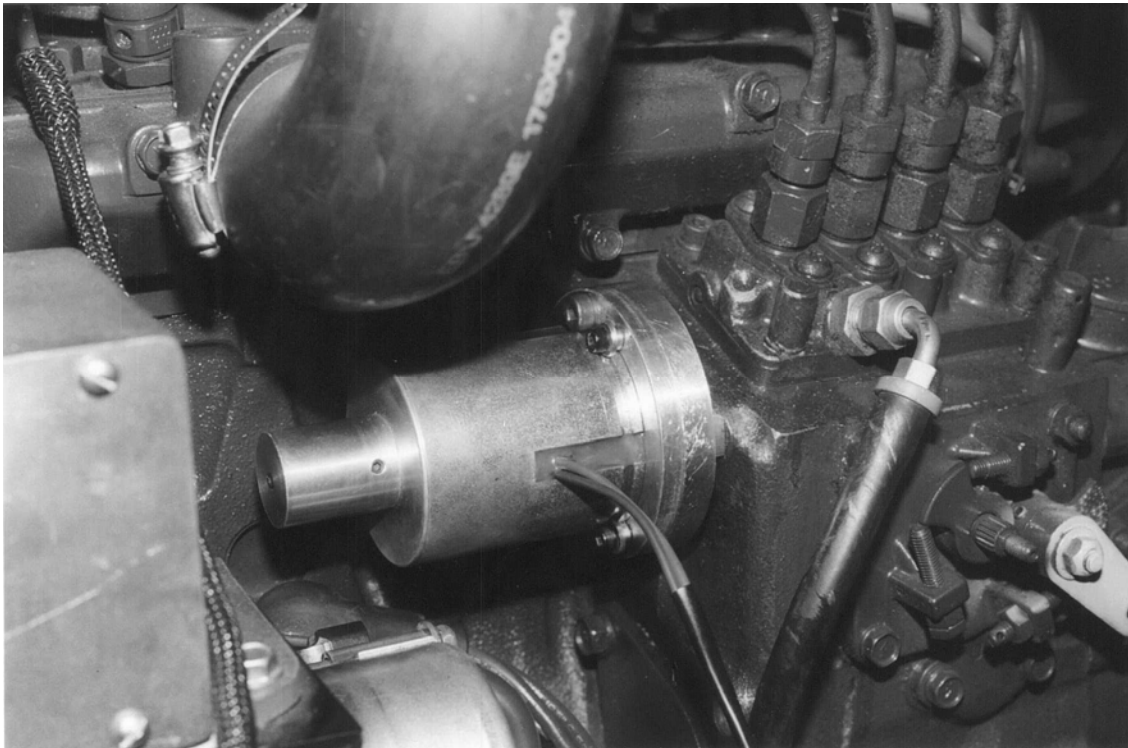
If the above test do not show a fault, the unit can be operationally checked as follows:

- With the engine stopped, remove the actuator from its adapter plate. Make the manual throttle hand operable.
- Start the engine and operate the throttle by hand running the engine above and below the speed the governor is set for. As the engine speed goes above and below this speed, the actuator rod should move in and out. This indicates the governor system is working and trying to control fuel to the engine. If suitable operation is noted with the actuator removed, check for any interference between the actuator rod and the fuel injection unit.
- Check during cranking that the actuator rod is fully pulled in. This is a function of an external relay furnished by the machine OEM.

Check adjustments of the controller. The controller is factory set during engine test to perform well. If the adjustments have been changed since this test, it may be wise to return the adjustments to a known starting point. Mid range on the speed pots is normally satisfactory. A good starting point on the gain and factory adjust pots is full CCW, then CW ¼ turn. The gain pot is the basic adjustment for stability or sensitivity. Make small adjustments and then re-check performance.



Adapter Installed



Actuator Installed in Adapter