



# Grinnell Electric Actuator

## Electrical Operation

When electrical power is supplied, as shown on individual wiring diagrams provided inside each unit, the actuator will operate automatically. Individually adjustable end of travel SPDT auxiliary open and close limit switches will provide for remote position indication or interlock.

Should the torque of the actuator exceed the factory preset torque limit, then SPDT open and close torque switches will shut-off power to the motor until the over-torque situation is corrected. All sizes except the GSE-3 are equipped with torque switches.

All motors are equipped with a thermal overload protector imbedded in the stator windings. The thermal protector will disconnect power to the motor if 250° F (120° C) is exceeded. Power will be automatically restored when the motor cools below 250° F (120° C).

## Manual Operation

The manual override handwheel is completely independent of the motor drive and can be safely operated at any time, whether or not the motor is in operation.

- The GSE manual override mechanism is designed to produce rated torque outputs at low handwheel rim pulls. (See Performance Data charts on page 6 of Publication #280-Grinnell GSE 1.0 8/98).
- Use of "Chainwheel Operators" is not recommended. If required, please contact the factory for application limitations.
- Clockwise rotation of the handwheel will rotate the output drive clockwise.
- Counterclockwise rotation of the handwheel will rotate the output drive counterclockwise.

Manual operation provides rotation in the following manner:

- Rotation of the handwheel drives the manual input shaft.
- The manual input shaft drives the splined worm gear.
- The compound gear simultaneously engages both the fixed annulus gear and the output drive gear, causing them to rotate together.
- The wormgear is free to drive the fixed annulus, but the fixed annulus will not backdrive the worm gear. Therefore, no de-clutch mechanism is required for manual operation.

## Torque Limiting

Except for the GSE-3, all GSE actuators have over-torque protection switches which operate in the following manner:

- Output torque puts a reaction onto the fixed annulus gear via the compound gear.
- The reaction force on the fixed annulus tries to move the splined worm gear against the Belleville washers stacked at either end of the worm gear (See Figures 10 and 11). This movement is proportional to out-put torque.
- The axial movement of the worm gear is converted to a rotation of the torque switch cam shaft. This movement will trip the torque overload switch corresponding to the direction of travel if the preset torque limit is exceeded.

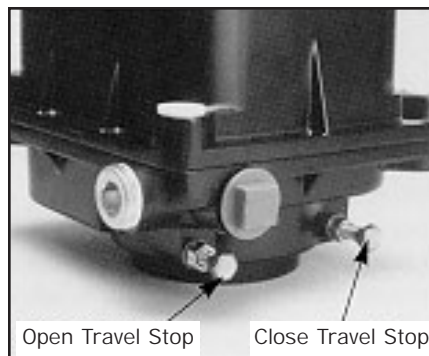


Figure 1

## CAUTION!

Torque switches are factory set and sealed. Do not attempt to adjust.

## Travel Limiting - Electrical

The SPDT end of travel limit switches are operated by precisely adjustable switch cams mounted on the indicator shaft which is rigidly connected to the output drive. Each switch is individually adjustable.

## Travel Limiting - Mechanical

Externally adjustable travel stops are provided for manual operation limits only. They should not be used to limit travel during electrical operation (See Figure 1).

## Pre-installation Storage

All units are shipped with one solid conduit plug and one red plastic shipping plug installed in the conduit openings.

It is preferable that units can be stored inside a dry, temperature controlled area prior to installation to prevent formation of condensation inside the unit.

If units must be stored outside, they should be covered and protected against rising water. The red plastic shipping plug must be replaced with a solid conduit plug to prevent entrance of water into the unit.

## Installation Procedures

When installing the actuator on a valve, ensure the following:

1. Both valve and actuator are in the same position. The actuator can be handwheel operated to any position to accommodate the valve.
2. The valve can travel freely in both directions.
3. If the valve is equipped with mechanical travel stops, that the stops do not block actuator travel.

## Step 1 - Mounting

- Install proper adapter, if required, onto valve stem to accommodate actuator bore.
- Install furnished mounting studs into actuator base mounting holes (short threaded length into actuator).
- Position actuator bore over valve stem with mounting studs aligned with valve bonnet or mounting bracket holes.

*NOTE: Standard mounting orientation is with the manual override shaft perpendicular to the run of the valve. A second keyway is provided for mounting 90° to standard.*

- Lower actuator onto valve stem and secure in place with hex nuts and lock washers furnished.

## Step 2 - Close Limit Switch and Travel Stop Adjustment

- Manually operate the actuator handwheel clockwise, until the valve is fully closed.
- Check that, at this closed position, the lower two limit switches (wired with blue wires) are actuated by the cam lobes. For adjustment, rotate the cam's brass worm screw until the cam lobe just trips the switch from a clockwise direction. Each cam is individually adjustable.
- With the close limit switches adjusted, loosen the closed travel stop locknut (closed stop located on right when viewed from travel stop side of actuator, see Figure 1).
- Rotate open travel stop clockwise until it just touches the internal stop lug of the output drive.
- Rotate open travel stop 1/2 turn counterclockwise and lock in position with locknut.

*NOTE: Travel stops are located on the base of the GSE-3 thru GSE-51 and on the gear case housing of the GSE-91 and GSE-151.*

## Step 3 - Open Limit Switch and Travel Stop Adjustment

- Manually operate the actuator handwheel counterclockwise, until the valve is fully open.
- Check that, at this open position, the upper two limit switches (wired with red wires) are actuated by the cam lobes.
- For adjustment, rotate the cam's brass worm screw until the cam lobe just trips the switch from a counter-clockwise direction. Each cam is individually adjustable.
- With the open limit switches adjusted, loosen the open travel stop locknut (open stop located on left when viewed from travel stop side of actuator (See Figure 1).
- Rotate open travel stop clockwise until it just touches the internal stop lug of the output drive.
- Rotate open travel stop 1/2 turn counterclockwise and lock in position with locknut.

## Step 4 - Wiring

- A wiring diagram is enclosed with each actuator and external wiring should be terminated at the terminal strip in accordance with this diagram.
- Each actuator is provided with two conduit entries threaded for 1" NPT. Due to variable cable gland requirements, glands are not supplied with the actuator.
- Proper sealing of the conduit connections must be done by the user to maintain the weatherproof integrity of the actuator enclosure.

## Troubleshooting Checklist

If the actuator does not function properly, examine the items on the following checklist:

1. All customer wiring should be securely in place and in accordance with the proper diagram.
2. The power supply input should be in accordance with that specified on the actuator nameplate.
3. The internal wiring should be securely in place.

4. The travel limit switches should be properly adjusted and should operate before the mechanical travel stops are reached.
5. The gear train should move freely when the handwheel is rotated.
6. All gears should be properly meshed, secured and free from excessive wear.
7. The motor shaft should turn by hand with only a small amount of resistance.
8. Tripping the torque or travel limit switches should stop the motor. Switches connected with red wire prevent the actuator from further counterclockwise rotation. Switches connected with blue wire prevent the actuator from further clockwise rotation.
9. The valve on which the actuator is mounted should not be jammed or require more than the rated torque of the actuator.
10. The capacitor and its associated wiring should be securely connected. A loose or defective capacitor will cause the motor to hum, but not rotate.
11. The torque switches should be factory calibrated and the torque shaft drive pin should fit in the annular groove on the worm gear. Rotation of the handwheel, after contact has been made with the travel stop, should simulate an overtorque situation and cause a rotary motion of the torque shaft to operate the torque switch associated with that direction of travel.

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12. The application should not require the actuator to be operated in excess of its duty rating.
13. The ambient temperature should be between -20° F and 140° F.
14. The thermal overload protector should only operate and disconnect motor circuit on fault conditions. If the thermal overload protector does operate, it will not automatically reset until the motor temperature cools down to a safe level.
15. The control circuitry feeding the actuator must not allow power to be supplied to both "open" and "close" motor windings at the same time. For example, when power is applied to the "open" terminal, the "close" terminal must be isolated from the power supply and vice versa. Failure to do so will result in motor overheating.
16. If two or more actuators are to be controlled in parallel with one 3-position switch, that switch must have isolated contacts for each actuator being controlled.

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## CAUTION:

Do not attempt to connect either the open or close terminal of a GSE actuator directly to the open or close terminal of another GSE actuator. Contact the factory for proper wiring procedures.

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## Preventative Maintenance

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### WARNING:

Ensure that electrical supply is shut-off prior to performing maintenance.

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- Remove cover as per instructions for Figure 3.
- Check visually that:
  1. All fixing screws are secure.
  2. All wiring terminal block screws are secure.
  3. All wiring quick disconnect terminations on capacitor, torque switches and travel limit switches are secure.
  4. Torque and travel limit switch operating cams are secure. Check that cam fixing set screws are tight.
  5. Electrical compartment shows no signs within of excessive dampness, overheating, dirt or foreign bodies.
  6. Cover O-ring is in place and not damaged or distorted.
  7. Indicator shaft O-ring is in place and not worn or damaged.
  8. Ground terminal is intact and secure.

## Disassembly/Assembly Procedures

The photographs are of the Model GSE-13 for illustrations, but the same basic procedure is applicable to all models.

### Figure 2 - Handwheel Removal

- Unit is shown with handwheel removed. This would be done with loosening the set screws located in the handwheel hub and pulling off the handwheel.



Figure 2

### Figure 3 - Cover Removal

- Remove the yellow position indicator by prying off with a screwdriver.
- Remove the socket head capscrew and black indicator cap.
- Remove the yellow dust covers, exposing the cover/base socket head capscrews.
- Disengage the captive capscrews from the base. Screws will remain captive in the cover.
  - GSE-3 has 4 x 5/16"-18 UNC screws (not retained).
  - GSE-6/13 have 4 x 1/2"-13 UNC retained screws.
  - GSE-36/51/91/151 have 6 x 1/2"-13 UNC retained screws.
- Remove cover by pulling up in a vertical direction as shown.

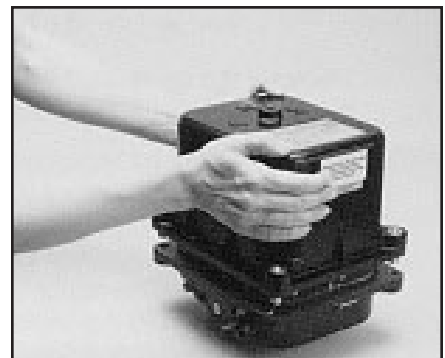


Figure 3

Figure 4 - Customer Wiring Removal

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**WARNING:**

Check that supply voltage is shut-off before attempting to remove any wiring.

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- Customer wiring should be tagged for later reinstallation. All units are shipped with wiring diagram enclosed inside the housing.
- Remove customer incoming wiring at terminal block.

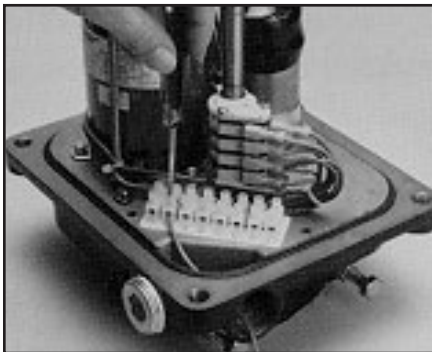


Figure 4

## Main Unit Disassembly

- Remove actuator from valve before commencing disassembly.

### Figure 5 - Indicator Shaft O-Ring and Snap Ring Removal

- Remove the O-ring from the top of the indicator shaft by squeezing the O-ring and rolling it up out of the O-ring groove.
- Remove the snap ring from the indicator shaft.

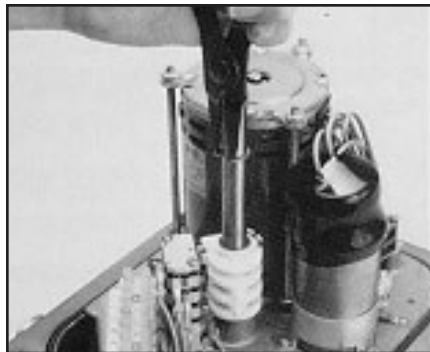


Figure 5

### Figure 7 & 8 - Switchplate Removal

- Remove the socket head capscrews situated on the switchplate.
- Capscrew Sizes:
  - GSE-3 has 3 x #10-32 UNF screws
  - GSE-6/13 have 4 x #10-32 UNF screws
  - GSE-36/51/91/151 have 6 x 5/16" - 18 UNC screws
- Remove the complete switchplate sub-assembly by carefully lifting the switchplate up the indicator shaft. Do not force.



Figure 7/8

### Figure 6 - Cam Removal

- Loosen the two set screws in each cam ring and remove the cams from the indicator shaft.
- For easier access to cam set screws, the capacitor can be removed by loosening the cup bracket clamping screws.

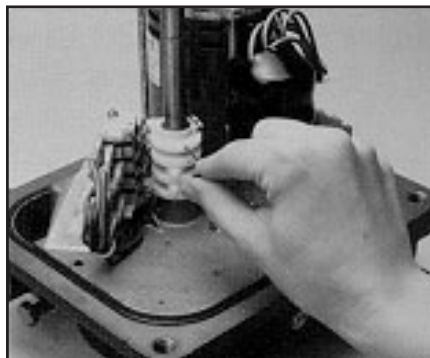


Figure 6

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**Figure 9 - Gear Train Removal - EPI-6/13**

*NOTE: The motor may be removed from the switchplate by removing the motor-mounting bolts and hex nuts after disconnecting the motor wiring from the capacitor and terminal block. The motor may be lifted from the switchplate with the motor pinion gear attached.*

- Grasp the indicator shaft and pull up to release the assembly.
- Take note of top and bottom sides of the fixed annulus so that it may be reassembled properly.
- The two M6 screws securing the input gear may be removed and the input gear separated from the gear set.



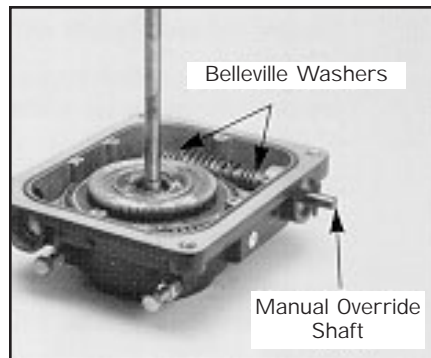
**Figure 9**

*NOTE: Removal and reinstallation of the manual override shaft and worm gear will require tools suitable for compressing the Belleville washers. The override shaft bushing must be pressed against the Belleville washers to allow clearance for the removal or installation of the bushing retaining snap ring. Take note of the number and placement of the Belleville washers so that they can be reassembled correctly (See Figure 11).*

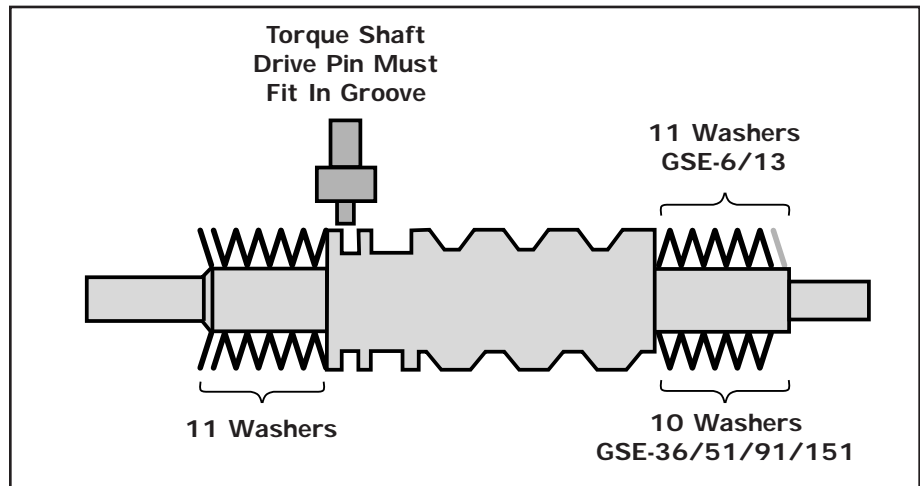
**Figure 10 - Gear Train Removal - GSE-36/51/91/151**

- Removal of the gear train from the GSE-36 through GSE-151 models first requires removal of the manual override shaft and worm gear (See note above) to release the fixed annulus.
- Follow procedures for Figure 9.

*Do not attempt further disassembly of gear set.*



**Figure 10**



**Figure 11**

## Reassembly Procedures

- Although the gear train is permanently lubricated at the factory, disassembly and reassembly of the actuator may require additional lubrication. A liberal coat of "Grinnell Actuator Lubricant" is recommended for this purpose.
- Worn or damaged O-rings should be replaced prior to reassembly.
- Reinstall the gear train assembly by pressing the output drive firmly into the lower housing bore.
- Reinstall the fixed annulus and if removed, manual override worm gear and shaft.
- Reinstall the input gear.
- Slide the switchplate down over the indicator shaft. Take care that the torque shaft drive pin fits into the annular groove of the manual override worm gear. (See Figure 11).
- The switchplate should fit flush on the lower housing without forcing. Rotation of the motor shaft by hand may be required for proper meshing of the pinion gear and input gear.
- Secure the switchplate with the socket head capscrews removed earlier.
- Slide the limit switch cams onto the indicator shaft with the brass worm gears up. (See Figure 12). Do not lock in place at this time.
- Manually close the actuator by rotating the handwheel clockwise.
- Rotate the two lower cams in a clock-wise direction toward the switch trip levers. Ensure that the cam lobes are level with their respective switch levers and tighten the locking set screws in the cam rings. (See Figure 12).
- Manually open the actuator by rotating the handwheel counterclockwise.
- Rotate the top two cams in a counter-clockwise direction toward the switch trip levers. Ensure that the cam lobes are level with their respective switch levers and tighten the locking set screws.
- Reinstall the snap ring and O-ring on the indicator shaft.
- Follow the installation procedures for mounting, limit switch adjustment and travel stop adjustment.

*NOTE: Refer to separate publications for installation and/or calibration of specific accessories.*

- Reinstall the cover and position indicator.
- Unit should now be ready for power operation.

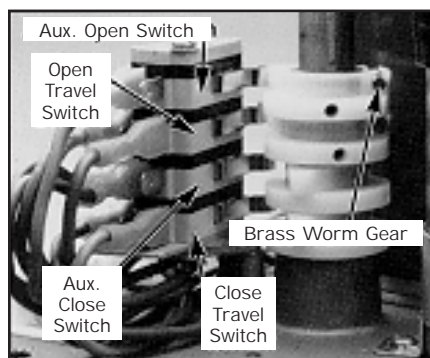


Figure 12



# Grinnell Electric Actuator



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