

BASIC PRINCIPLE OF FAIL SAFE ELECTRIC ACTATORS

An electric actuator in the valve automation field is a device that converts electrically generated high speed low rotary motor torque into low speed high rotary torque which, when coupled to a part-turn or multi-turn valve, drives the valve.

In basic mechanical electric valve actuator types, the motor is stopped at the desired position when cams mounted to the actuator's output drive shaft make mechanical switches. Without electrical power the electric actuator cannot move and stays put.

A fail safe electric actuator has a way of driving the actuator to the desired fail safe position when external power is unavailable. There are 2 basic ways of achieving fail safe functionality:

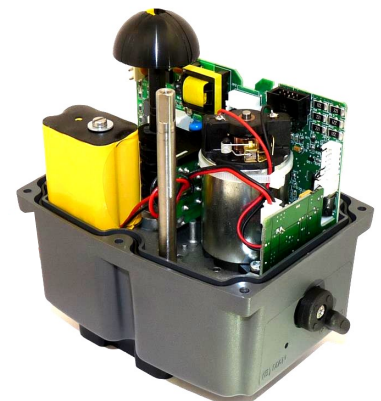
- 1) Stored electrical energy that can be used in place of the external power to power the motor
- 2) Stored mechanical energy to physically drive the gear box independently from the motor

ACTUATOR FAIL SAFE FUNCTION - STORED ELECTRICAL ENERGY

Two methods of storing electrical charge that can be used to drive the electric actuator's motor when external power is unavailable are in common use, a fully re-chargeable battery back-up system, or capacitors.

Battery back-up systems use industrial strength rechargeable batteries that are kept at full charge by a trickle-charger when external power is available. An internal switch draws charge from the batteries when external power is lost, and the trickle charger replaces the charge used when external power is restored. The security of the battery needs to be considered as it's capacity can be affected by insufficient recharge and battery degradation, and these factors can limit its use in some applications.

A capacitor is an electronic component that fully charges within a few seconds as soon as external power is applied to it and it typically holds its charge indefinitely. This makes the capacitor the safer of the two stored electrical energy fail safe methods, however they can only store relatively low amounts of charge or they become excessively large and impractical.



Battery back-up installed

ACTUATOR FAIL SAFE FUNCTION - STORED MECHANICAL ENERGY

Electro-mechanical spring actuators store kinetic energy in an internal spring system and external power holds the springs in their compressed state whilst available. When external power is lost, the hold is released and the springs discharge their energy to physically drive the gears in the actuator's gearbox, completely independently of the actuator's electrical system eg: circuitry and motor.

The clear advantage of a mechanical fail safe system in electric actuators is this elimination of the actuator's electrical system and the fail safe system is 100% mechanical, and specifiers feel more secure with this than trusting batteries or electronic components, which can fail.

The disadvantage of a mechanical spring system is its physical size and weight, and cost. Typically the weight is 10-15 times heavier than a failsafe electric actuator with battery or capacitor, and the cost can be similar.

The final choice will be dictated by the application and if the valve simply must fail safe, the mechanical spring system will generally be selected.



Mechanical spring installed