

Motor Technology

How it works series

TECHTORQUE ARTICLE

Electric motors for valve actuators vary widely in their design and application. They can be broadly classified into two groups:

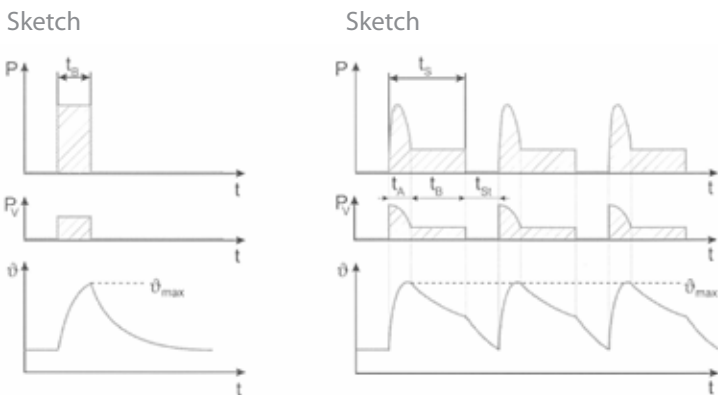
- 1) Motors for on / off control (Fully open or fully closed Valve)
- 2) Motors for Valve positioning and modulating control.

Electric motors for valve actuation are required to work in conjunction with the following basic components (see figure 2) to provide the required torques to open, close or position the valve in accordance with the process requirement:

- 1) Gear train assembly,
- 2) Hand-wheel & declutch mechanism,
- 3) Torque & limit /position switches or sensors.

The motor is usually a high speed, low inertia reversible type, connected through a gear train to reduce the speed & thereby increase the torque at the valve stem. Its rotation is reversed to open or close or change direction of the valve. This is achieved by changing the direction of the current in the winding or interchanging a phase in the case of a 3 phase supply. The de-clutch mechanism disconnects the motor from the gear assembly and allows the valve to be operated by the hand-wheel.

Limit switches de-energise the motor when the valve has reached a specified position. Torque switches de-energise the motor when the amount of turning force reaches a specified value. This turning force or torque is the largest when the valve is seated or unseated. This feature can prevent damage to the valve & motor if the valve jams in any position. The motor is also provided with Thermal cut-outs embedded in the windings to prevent over-heating due to a locked rotor situation.



P Power
Pv Loss
V temperature
Vmax max temperature

T time
T_A starting-up time
T_B loading time
T_S cycle time
T_{St} pause time

Motor Operation & Duty Cycle.

The duty cycle is related to the allowed load to the electric motor in use. It defines the limiting values for which the actuator may be used.

IEC 34-1, 8 ratings are defined as S1 to S9. S1 (continuous service) is automatically valid when no rating is specified.

For electrical valve actuators the selection of an electrical motor for continuous service would result in huge over-dimensioning for usually realistic on / off & modulating service. Therefore S2 & S4 ratings are assigned for such services as follows:

- S2 Control or on / off service
- S4 Regulating or modulating service.

Duty cycle S2. Short time service.

This duty cycle considers application of a constant load which is not long enough so that the thermal limits of the motor are not exceeded. Then a break is required of such duration to allow the motor to cool.

The duty cycle S2 is designated by the code S2 and the duration of the operating time.

Example S2 10 min

Duty Cycle S4, intermittent service influenced by start-up operation.

This duty cycle has sequences of similar cycles, each of which consists of a noticeable start-up period, a period of constant load and a pause.

The duty cycle S4 is designated by the code S4 followed by the ratio of motor on time to total cycle time as a%, plus the number of cycles per hour.

Example S4 25% ED 1200C/hr (where ED denotes extended duty)

As the heat dissipation from the motor is influenced by the temperature of the surrounding, the duty rating must be specified along with the ambient temperature.

Duty Cycle S2 & S4 according to IEC 34-1,8

Figure 2 - Electric Actuator Components

