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Principle double acting actuator

The principle of the double acting actuator

If the port '2' is under pressure and port '4' evacuated, the both pistons are moving into the endpositions and a turning of the drive shaft is the result (a turning of the drive shaft in its opposite is possible through a turned mounting of the pistons -> type DL).

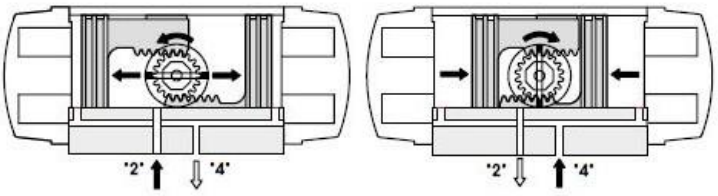

Fig. DR02 Top view and principle of a double acting actuator under pressure

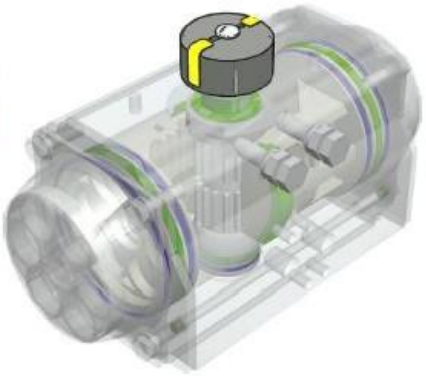

Fig. DR01:
Principle of a double acting actuator

If the port '4' is under pressure and the port '2' de-aerated, the pistons are moving into the middle position. This also has as result a turning of the drive shaft (a turning of the drive shaft in its opposite is possible through a turned mounting of the pistons).

With rack and pinion construction the output torque of an actuator is obtained by multiplying the piston force (given by air supply pressure) by the pitch shaft radius (lever arm) as shown in fig. DR03 less the force lost for friction (efficiency). Because of this concept the output torque is linear as shown in the diagram DR04 in both clockwise and counterclockwise rotation.
The suggested safety factor for double acting actuators in normal working conditions is 15-20%.

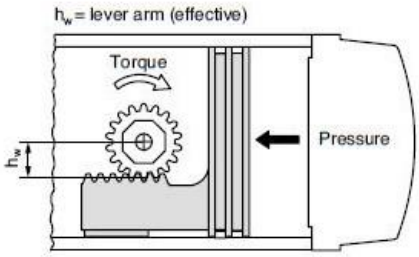

Fig. DR03: Top view of a double acting actuator under pressure

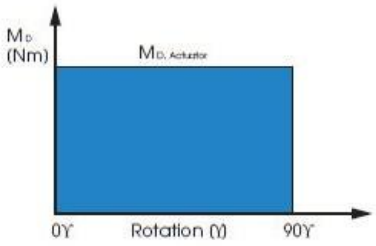

Fig. DR04: Principle of the torque (double acting)

Sizing example for double acting actuator (data see datasheet):

Published butterfly valve torque	= 40 Nm
Safety factor	= 40 Nm + 20 % = 48 Nm
Air supply pressure available	= 5 bar

The double acting AT actuator that produces a minimum of 48 Nm at 5 bar is the DR60.

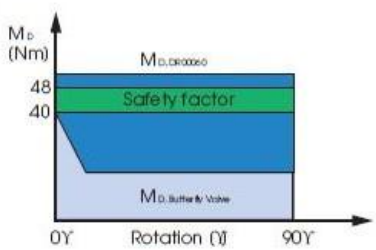

Fig. DR05:
Principle of the sizing a double-acting actuator

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Principle single acting actuator

Principle of Single Acting Actuators (Spring Return)

If the port '2' is under pressure and port '4' evacuated, the both pistons are moving into the endpositions and compress the springs - result is a turning of the drive shaft (a turning of the drive shaft in its opposite is possible through a turned mounting of the pistons -> type SO).

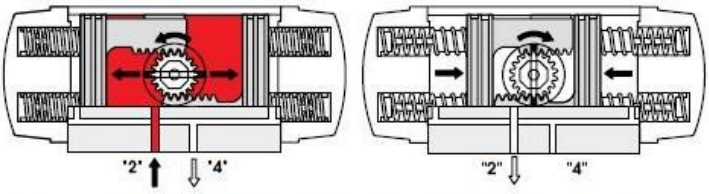

Fig. SC02: Top view and principle of a single acting actuator under spring pressure

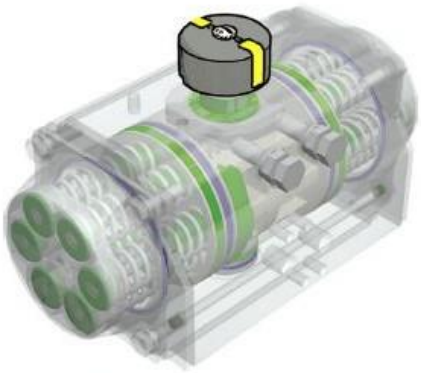

Fig. SC01:
Principle of a single acting actuator

By of the spring force a fail-save position by air or electricity loss is guaranteed.
In spring return applications the output torque is obtained in two different operations. Each operation produces two different values in relation to the stroke position (0° or 90°). For spring return actuators the output torque is produced by multiplying the force (air or springs acting on the pistons) by the lever arm.

First case:
The output torque is generated by air supply pressure at port '2' after compressing the springs called 'output torque air stroke'. In this case air forces the pistons from the 0° to the 90° position and consequently the torque starts from a high value and during the stroke it constantly decreases until 90° due to the natural force that springs generate (oppose) when they are compressed (see diagram SC04).

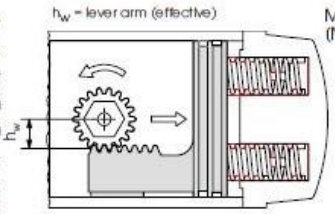

Fig. SC03:
Top view of a single-acting actuator

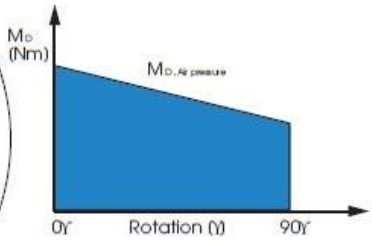

Diagram SC04:
Principle of the air torque

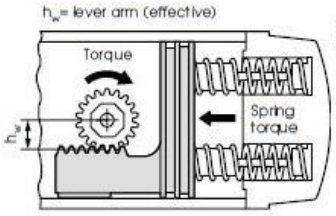

Fig. SC05:
Top view of a single acting actuator

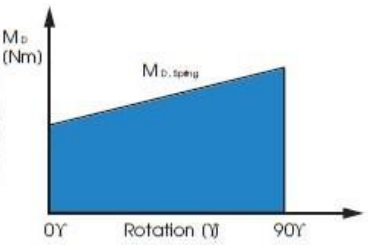

Diagram SC06:
Principle of the spring torque

Second case:
The output torque is generated by the force that springs release onto the pistons when air fails, called 'output torque spring stroke'. In this case the torque, starting from the 90° position, constantly decreases until 0° because of springs extending (see diagram SC06).

AT spring return actuators are designed to produce a balanced torque in the two conditions explained above when the number of springs per side is equal to the air pressure supply (4 bar - 4 springs each side) as shown in the diagram SC07. For certain applications it is possible to achieve (where desired), the unbalanced torque, as shown in diagram SC08, by changing the relation between the number of springs per side and air pressure supply in bar (for example 6 springs and 5,5 bar or vice versa).

In spring return applications two conditions can be archieved: air failure to close or failure to open.
The suggested safety factor for spring return actuators in normal working conditions is 20-25%.