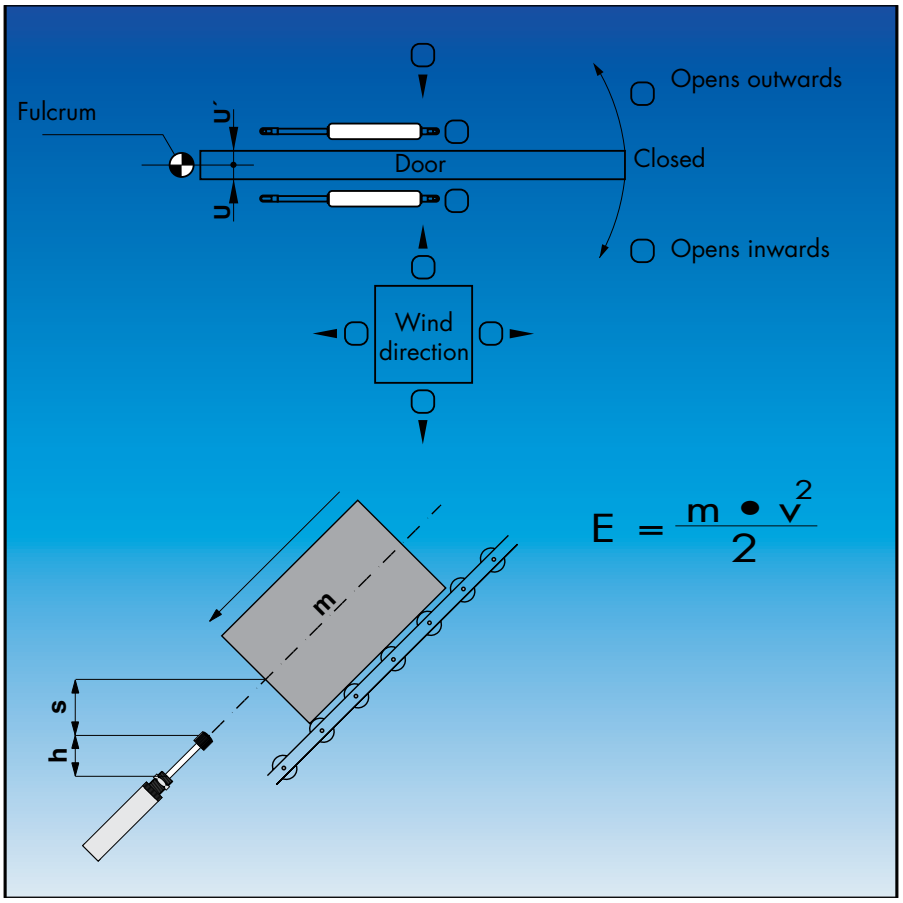
Advice for Calculation and Selection of the Appropriate Damper

DICTATOR assists you in selecting the appropriate damper for your application. You merely have to complete one of the following questionnaires. DICTATOR then will calculate and offer you the damper from our large range going best with your requirements.

On the next two pages you will find questionnaires for final dampers. They are followed by those for oil dampers with fixings on both ends. To facilitate your work there are several ones for different fields of application. You only have to fill in the one representing your use.

In case of questions or problems do not hesitate to contact our Technical Service.



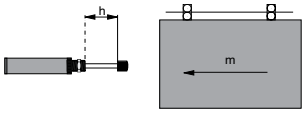
Outline of Questionnaires

Questionnaire for Final Dampers

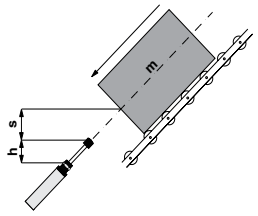
The questionnaire for final dampers consists of two pages. On the first page please mark which kind of impact you need to cushion. On the second page please fill in - as complete as possible - all information regarding mass and speed. Please send us these two pages. We gladly calculate the necessary damper.

In case you want to calculate the damper yourself, you will find the corresponding formula beginning with page 03.067.00.

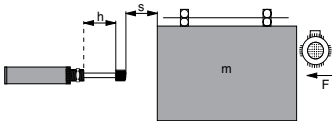
❑ **Horizontal impact**



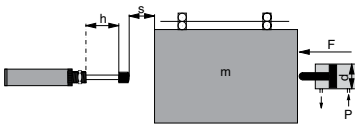
❑ **Inclined impact**



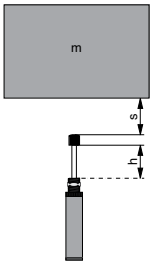
❑ **Electric operator**



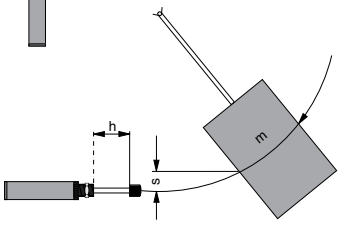
❑ **Pneumatic operator**



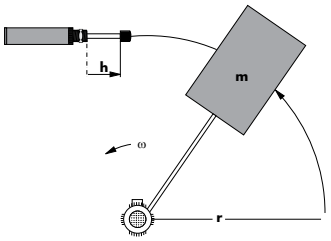
❑ **Vertical impact**



❑ **Falling pendulum**



❑ **Rotary operator**



Questionnaire for Final Dampers - cont.

Impact mass ..... **kg**

Impact speed

Direction of movement

❑ linear: → ..... **m / s**

❑ rotating: ↻ ..... **degree/s**

Angular velocity: ..... **rad / s**

Driving power

❑ linear: → ..... **N**

❑ rotating: ↻ ..... **Nm**

Driving power unknown

Kind of operator

❑ Pneumatic: Diameter of piston: ..... **mm**

Pressure: ..... **bar**

❑ Hydraulic system: Diameter of piston: ..... **mm**

Pressure: ..... **bar**

❑ Electric motor: Capacity: ..... **KW**

Gearing: .....

Movement direction of the mass

❑ **horizontally:**

❑ **vertically:** up: ❑ down: ❑

Drop height: ..... **mm**

❑ **incline:** Angle: .....

Distance of acceleration: ..... **mm**

❑ **rotating:** Distance between fulcrum and barycentre: .....**mm**

Distance between fulcrum and damper:... **mm**

Number of operations

❑ **continuously:** per minute: ..... per hour: .....

You don't have to fill in all questions, just what you know. Of course it would be most helpful to know the kind, mass and speed of the impact.
The developing of a damper includes a test under realistic conditions. Our experienced technicians gladly will advise you. Please contact us: +49-821-2467355

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Questionnaire for Oil Dampers with Fixings on Both Ends - Vertical

Address

Name :

Street :

Town, postcode :

Tel. :

Fax :

Person in charge :

Date :

Data of the flap

Weight [Kg] :

Barycentre [mm] T :

Barycentre [mm] B :

Hand lever [mm] A :

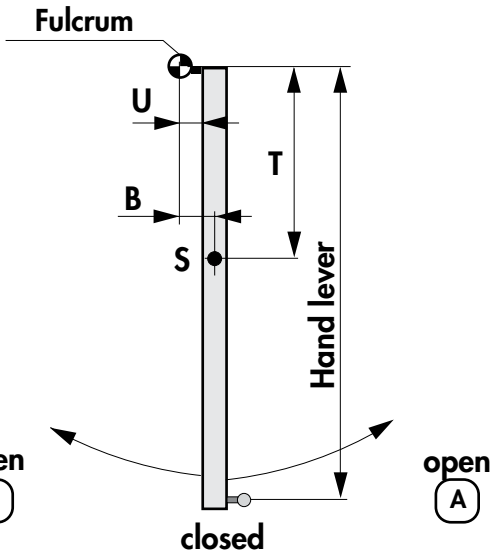
Opening angle [degree] q :

Distance lower edge U :

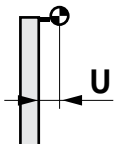
Number of dampers :

On which side shall the damper be positioned? Please draw in.

Please tick your application and indicate your dimensions.
The flap is shown in the closed position.



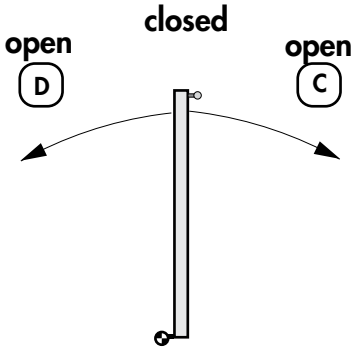
☐ Flap is left of fulcrum.



Fulcrum at the top

☐ A — Flap is vertical, opening to the exterior

☐ B — Flap is vertical, opening to the interior



Fulcrum below

☐ C — Flap is vertical, opening to the exterior

☐ D — Flap is vertical, opening to the interior

Questionnaire for Oil Dampers with Fixings on Both Ends - Horizontal

Address

Name :

Street :

Town, postcode :

Tel :

Fax :

Person in charge:

Date :

Data of the flap

Weight [Kg] :

Barycentre [mm] T :

Barycentre [mm] B :

Hand lever [mm] A :

Roof slope [degree] :

Opening angle [degree] q :

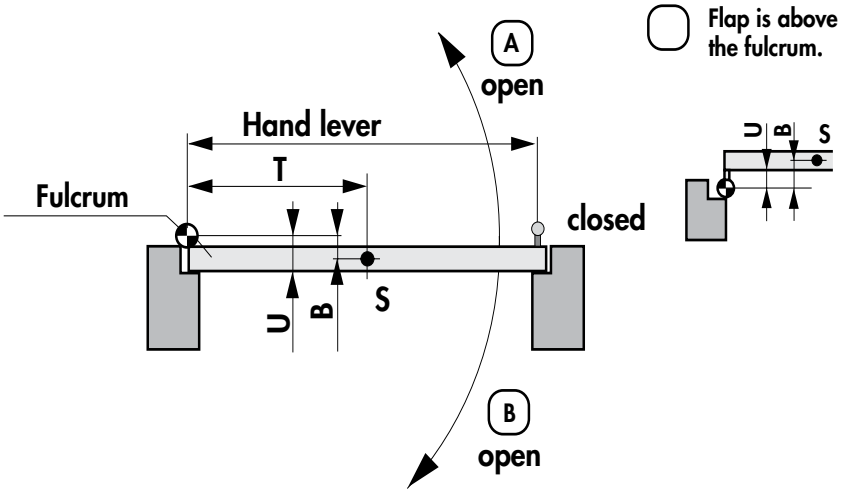
Distance lower edge U :

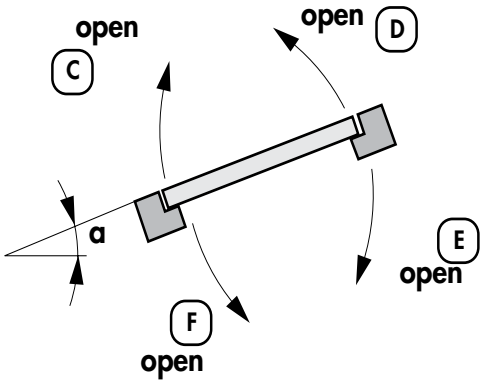
Number of dampers :

On which side shall the damper be positioned? Please draw in.

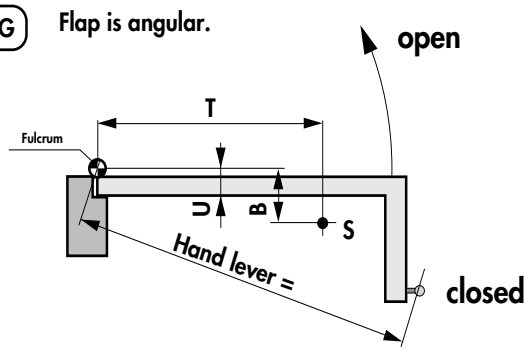
Please tick your application and indicate your dimensions.
The flap is shown in the closed position.

- (A) Flap is horizontal, opening angle to the top.
- (B) Flap is horizontal, opening angle to the bottom.
- (C) Flap is inclined, hinges are on top.
- (D) Flap is inclined, hinges are below.
- (E) Flap is inclined, hinges are below.
- (F) Flap is inclined, hinges are on top.





(G) Flap is angular.



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Questionnaire for Oil Dampers with Fixings on Both Ends - Hinged Doors

Address

Name :

Street :

Town, postal code :

Tel. :

Fax :

Person in charge :

Date :

Data of the door

Weight [kg] :

Width [mm] :

Height [mm] :

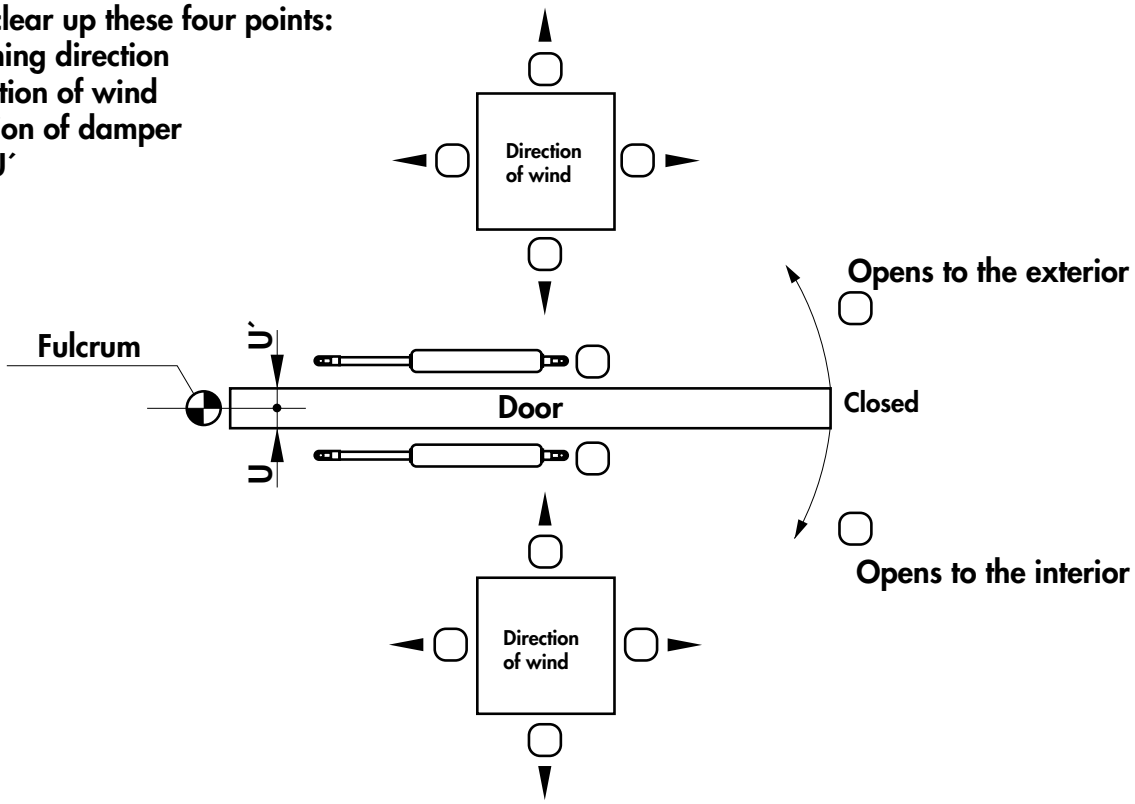
Opening angle [degree] :

Distance lower edge U / U´ :

Wind load [N/qm] :

Please tick your application.
Door shown in closed position.

Please clear up these four points:
1. Opening direction
2. Direction of wind
3. Position of damper
4. U / U´



Door is
- ☐ vertical
- ☐ inclined to the interior — angle of inclination :
- ☐ inclined to the exterior — angle of inclination :

Calculation and Determining of a Final Damper

Calculation Examples / Formula

Please follow the instructions given below to calculate yourself the required final damper.

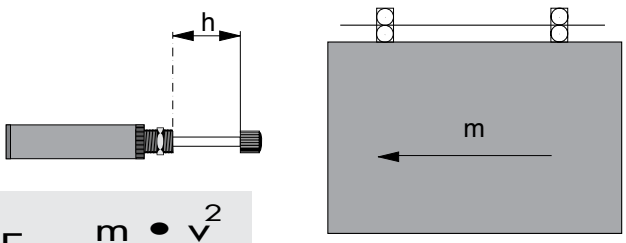
If the situation allows it, you should choose a stroke as long as possible, as this keeps the actual impact (damping force) lower.

To obtain the necessary damping force you first have to calculate the energy the damper has to absorb with every stroke. Therefore you need - depending on the application - the following data:

- impact mass **m** (e.g. weight of door) in kg — or
- mass moment of inertia **J** [kg · m²] = m · r² — and
- impact speed **v** in meters per second — or
- angular velocity ω [r/s] = Upm · 0.1047 — and
- damping distance (stroke) **h** — and
- correction factor $\mathbf{f_K}$ (see Technical Data of the damper) — and partly
- distance of acceleration **s** (e.g. height of fall) — and
- driving force **F** [N] — or
- turning moment **M** [Nm]

Which of these data you need depends on the purpose the damper is intended for.

Load moved horizontally without operator



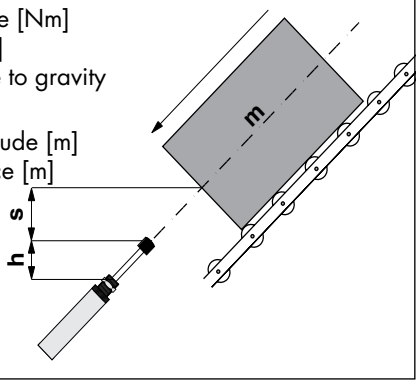
$$E = \frac{m \bullet v^2}{2}$$

E = energy per stroke [Nm]
m = impact mass [kg]
v = impact speed [m/s]
h = damping distance [m]

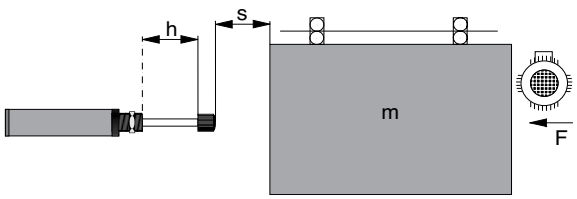
Load on an incline

$$E = (m \cdot g \cdot h) + (m \cdot g \cdot s)$$

E = energy per stroke [Nm]
m = impact mass [kg]
g = acceleration due to gravity [m/s²] = 9.81
s = acceleration altitude [m]
h = damping distance [m]



Load moved horizontally (electric operator)

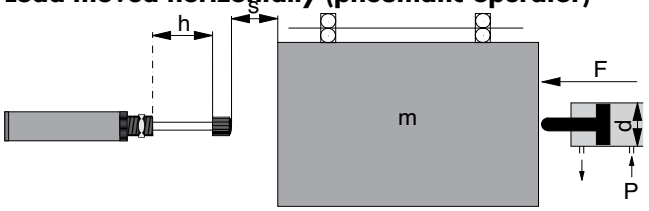


$$E = \frac{m \cdot v^2}{2} + F \cdot h$$

$$v = \sqrt{2 \frac{F \cdot s}{m}}$$

E = energy per stroke [Nm]
m = impact mass [kg]
v = impact speed [m/s]
s = acceleration distance [m]
F = driving force [N]
h = damping distance [m]

Load moved horizontally (pneumatic operator)



$$E = \frac{m \cdot v^2}{2} + F \cdot h$$

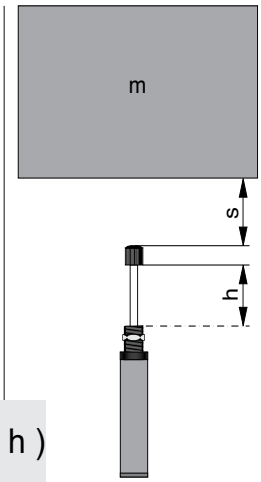
$$v = \sqrt{2 \frac{F \cdot s}{m}}$$

$$F = 0{,}07854 \cdot d^2 \cdot P$$

E = energy per stroke [Nm]
m = impact mass [kg]
v = impact speed [m/s]
F = driving force [N]
h = damping distance [m]
d = piston diameter of the pneumatic cylinder [mm]
P = pressure [bar]
s = acceleration distance [m]

Free fall

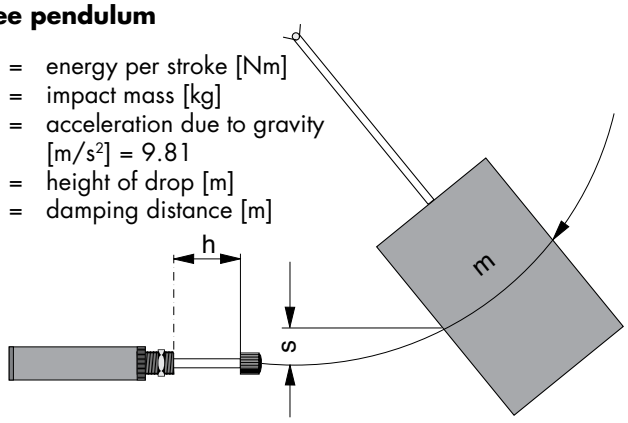
E = energy per stroke [Nm]
m = impact mass [kg]
g = acceleration due to gravity [m/s²] = 9.81
s = height of drop [m]
h = damping distance [m]



$$E = (m \cdot g \cdot s) + (m \cdot g \cdot h)$$

Free pendulum

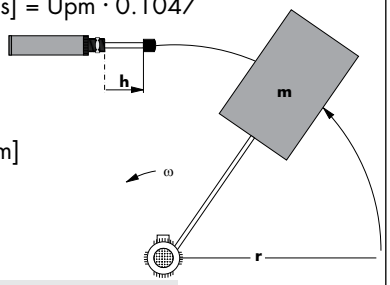
E = energy per stroke [Nm]
m = impact mass [kg]
g = acceleration due to gravity [m/s²] = 9.81
s = height of drop [m]
h = damping distance [m]



$$E = m \cdot g \cdot s$$

Turning load (electric operator)

E = energy per stroke [Nm]
J = mass moment of inertia [kg · m²] = m · r²
ω = angular velocity [r/s] = Upm · 0.1047
F = driving force [N]
h = damping stroke [m]
m = impact mass [kg]
r = radius [m]
M = turning moment [Nm]



$$E = \frac{J \cdot \omega^2}{2} + F \cdot h$$

$$= \frac{m \cdot r^2 \cdot (UpM \cdot 0{,}1047)^2}{2} + \frac{M \cdot h}{r}$$

Calculation of the damping force

Damping force [N] =

$$\frac{\text{energy per stroke [Nm] x correction factor x 1000}}{\text{stroke[mm]}}$$

Correction factor: it is indicated in the technical data of the respective damper type.
Now look in the table of the choosen damper type for the damper corresponding to the calculated damping force. The calculated damping force is valid only for the stroke used in the calculation.

In case you don't find in the choosen table a damper on which you could put the weight (damping force) calculated, there are three possibilities:

1. The choosen type of damper does not suit your application. Choose another type of damper and recalculate the damping force.
2. Your application is a special one needing a special damper. Please fill in the questionnaire on pages 03.062.00 and 03.063.00. We will calculate an appropriate damper.
3. There are no exact data at hand and you have to estimate the energy per stroke. In this case please also contact the DICTATOR Technical Service.

Calculation Example

"You are looking for a damper to cushion a pneumatically moved slider, e.g. with an EDH 20."

Impact mass (weight of slider and drive piston) m = 300 [kg]
Acceleration distance (not dampened) s = 0.15 [m]
Ø of piston of pneumatic cylinder d = 30 [mm]
Pressure P = 3.5 [bar]

Thus calculating:

Driving power F [N] = $0.07854 \times 30^2 \times 3.5 = 247.4$ N

Impact speed v [m/s] = $\sqrt{2 \times \frac{247{,}4 \times 0{,}15}{300}} = 0.5$ m/s

First calculation with a stroke of 25 mm, damper type EDH 20.

Resulting in:

Energy per stroke [Nm] = $\frac{300 \times 0{,}5^2}{2} + 247.4 \times 0.025 = 43.7$ Nm

As the correction factor for the type EDH 20 is 2,0:

Damping force [N] = $\frac{43{,}7 \times 2{,}0 \times 1000}{25} = 3\,496$ N

This result exceeds the maximum value in the table. But if you chose a longer stroke of e.g. 50 mm, the new calculation results in 2000 N. This value would be okay.