# Technical basics

On an assembly line workpiece pallets (WT) have to be transported from one station to another.
These stations are, for example, manual workstations, robotic or automatic stations.
Workpiece pallets hold the workpieces.
All operations on the workpiece will be done on the workpiece pallet
The workpiece pallet is conveyed by a transfer system.
On the conveyor media of the transfer system workpiece pallets are carried along by friction.
Several workpiece carriers can be accumulated in front of a workstation.
If one or more workpiece pallets are stopped by a separator or angle damper, the conveyor continues to run under the workpiece pallet. This gives the workpiece pallet a propulsion force $F_R$.

## Propulsion force $F_R$

For choosing the right separator the propulsion force must be determined.
At best, the propulsion force can be determined (measured) because the assumed coefficient of friction may could differ from reality.

The propulsion force is calculated using the formula:
$F_R = m \times g \times \mu$

In this case mean:

m ... Sum of the masses of all workpiece pallet, which currently simultaneously push at the separator or angle damper.

g ... 9,81 m/s²

μ ... Coefficient of friction between wear pads of the workpiece pallet and the conveyor medium.
Typical coefficients of friction at different conveyor media:
μ = 0,2 (for the conveyor media: belt, toothed belt)
μ = 0,3 (for the conveyor media: flat top chain or plastic link chain)
μ = 0,035 (for the conveyor media: accumulation roller chain)

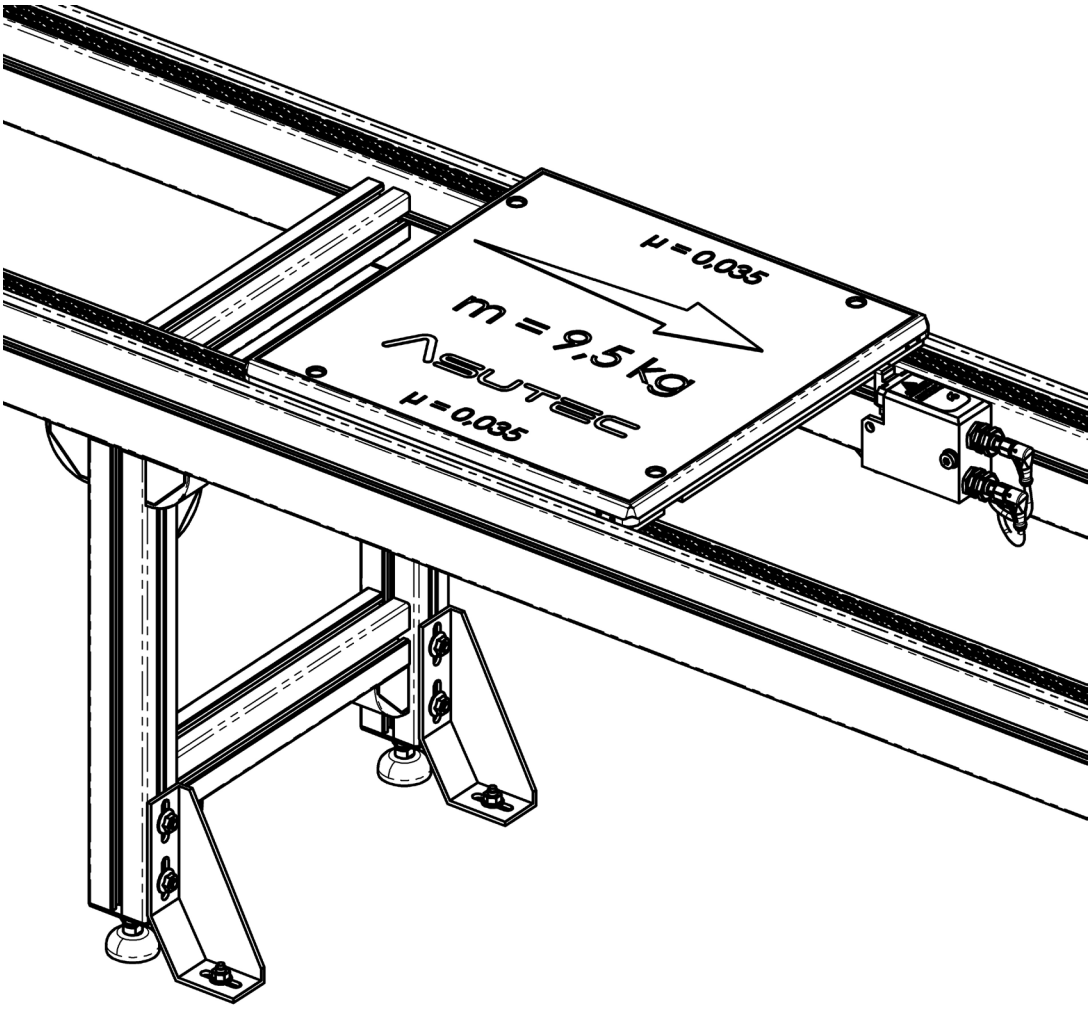
## Minimum propulsive force $F_{R\,min}$

If the propulsive force is too low, the stop plate from the damped separator or angle damper will not be pushed in completely.
In this case, the workpiece pallet will stop at an undefined position.
The minimum propulive force may be calculated with the minimum load specification of the respective separator or angle damper and the basic friction factor $\mu_{norm} = 0,07$.
$F_{Rmin} = m_{min} \times g \times \mu_{norm}$

With the result of the minimum driving force FR min and the real coefficients of friction now it has to be checked that the "comparative minimum load" ($m_{min, Ersatz}$) is lower than the minimum weight ($m_{WT}$) of one workpiece pallet.

$$m_{min,Ersatz} = \frac{F_{R\,min}}{g \cdot \mu} \quad ; \quad m_{min,Ersatz} \leq m_{WT}$$

An example: The separator ASM-100-EW-08 with $m_{min}$ = 3 kg, should be used to damp and stop at least one workpiece pallet with a minimum weight of $m_{WT}$ = 9,5 kg.




Calculation:

$$F_{R\,min} = m_{min} \cdot g \cdot \mu_{norm} = 3kg \cdot 9{,}81\,m/s^2 \cdot 0{,}07 \qquad F_{R\,min} = 2{,}06\,N$$

$$m_{min,Ersatz} = \frac{F_{R\,min}}{g \cdot \mu} = \frac{2{,}06\,N}{9{,}81\,m/s^2 \cdot 0{,}035} = 6\,kg \quad ; \quad 6\,kg \leq 9{,}5\,kg$$

Thus, the separating stop is well suited to dampen the workpiece pallet.

**Maximum propulsive force $F_{R\,max}$ and „Utilization of the lowering force“**

If the propulsive force is to big, the separator or slide stop will not be able to lower because the friction between stop plate and workpiece pallet will prevent this movement.
The maximum propulsive force, for which a separator or slide stop is designed, is dependent on:
- the construction of the device (Arrangement of the guides for lowering)
- friction factors of the guides and the friction between workpiece and stop plate
- the lowering force (piston diameter, spring force, magnet force, strength of the motor)

In the calculation of the Asutec product finder the friction between the workpiece carrier and the stop is expected to be under 0,2.
The maximum propulsive force $F_{R\,max}$ are not specified on data sheets or in the technical data information.
The calculation of the maximum propulsive force $F_{R\,max}$
and „Utilization of the lowering force „is performed with the Asutec product finder.
The calculation results of the „utilization of the lowering force“ are given as a percentage.
For small workpiece pallet loads, many devices with a utilization of lowering force of <1% are displayed in the search results.
A small degree of capacity utilization of lowering force has no negative impact on the function. For large workpiece pallet loads and high friction characteristics this utilization of lowering force may be in the critical region.
Basically all Asutec devices with lowering function are dimensioned so that a lowering is possible when a workpiece pallet with the maximum specified load (mmax), on a transfer system with a friction of $\mu_{norm} = 0{,}07$ pushes against the stop plate.
Thus, the following equation is valid: $F_{Rmax} > m_{max} \times g \times \mu_{norm}$

**Utilization of the separator**

The utilization of the separator is calculated by the Asutec Product Finder and is the most important result of calculation for the selection of a suitable separator.
The following factors affect the utilization of the separator:
- the coefficient of friction between the workpiece pallet and conveyor media
- the weight of the workpiece pallets which need to be stopped
- the conveying speed of the workpiece pallets
- the damping stroke of the separator

In the search results of the Asutec product finder damped separators with a utilization rate of more than 15% will be displayed.
In the search results of the Asutec product finder undamped separators with a utilization rate of more than 0,1% will be displayed.