

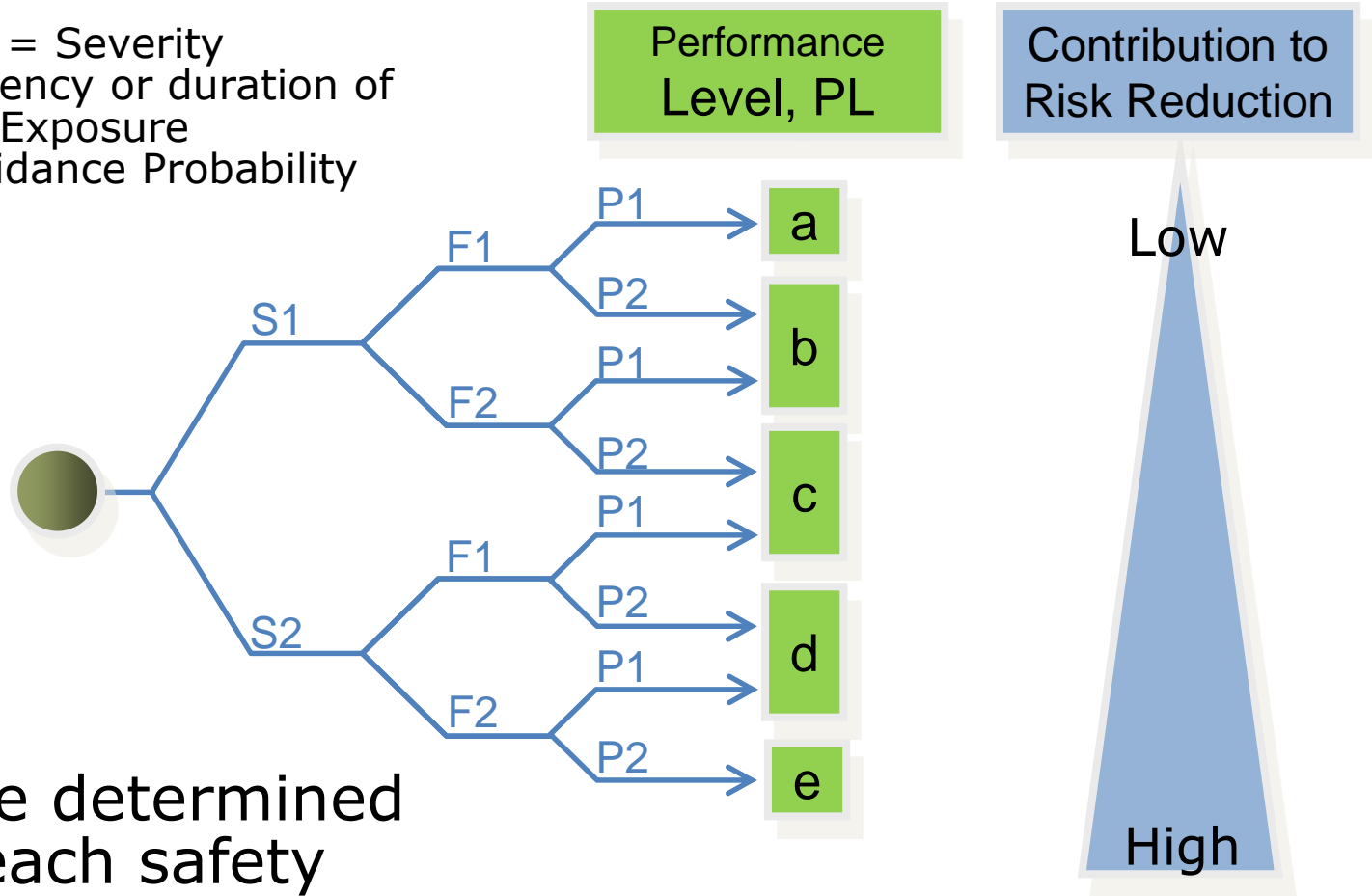
Pneumatic Safety Example (Winder Unloader with Control Reliable Valves)

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Risk Assessment - ISO 13849

S = Severity
F = Frequency or duration of Exposure
P = Avoidance Probability

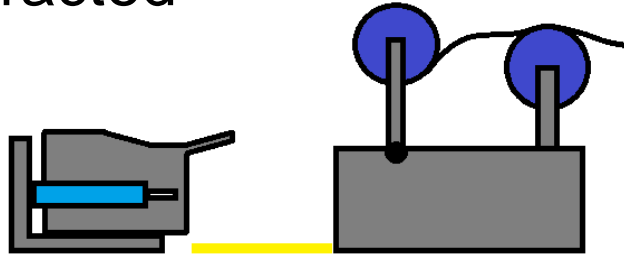


Must be determined for each safety function!

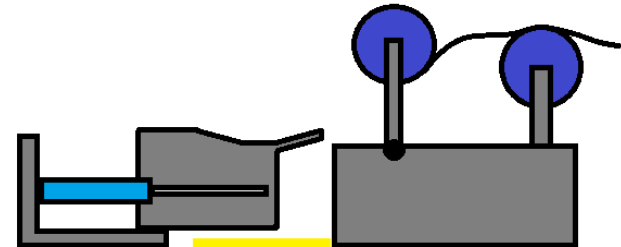
Example – Winder unloading table

- Moveable winder table

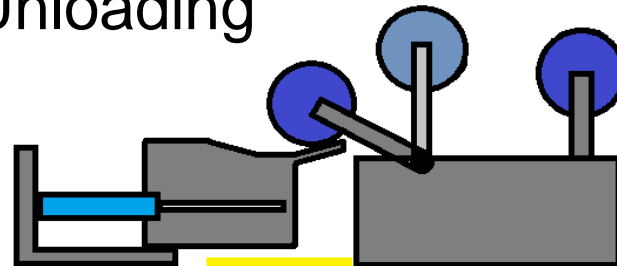
Retracted



Extended

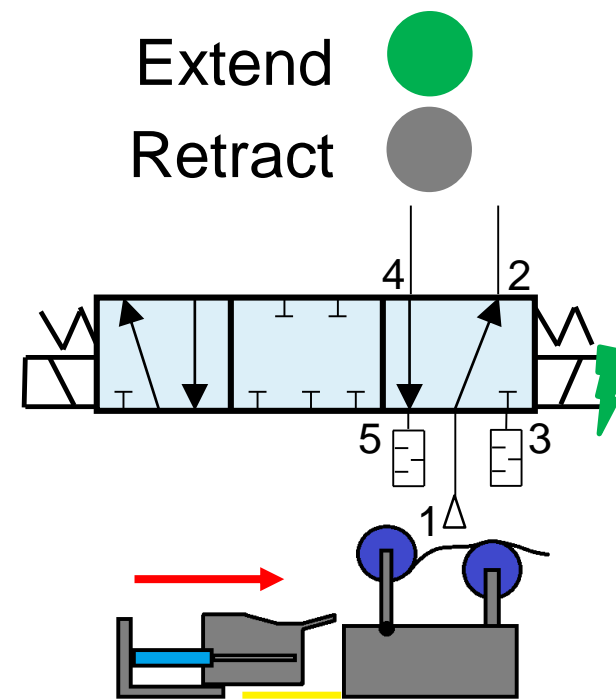
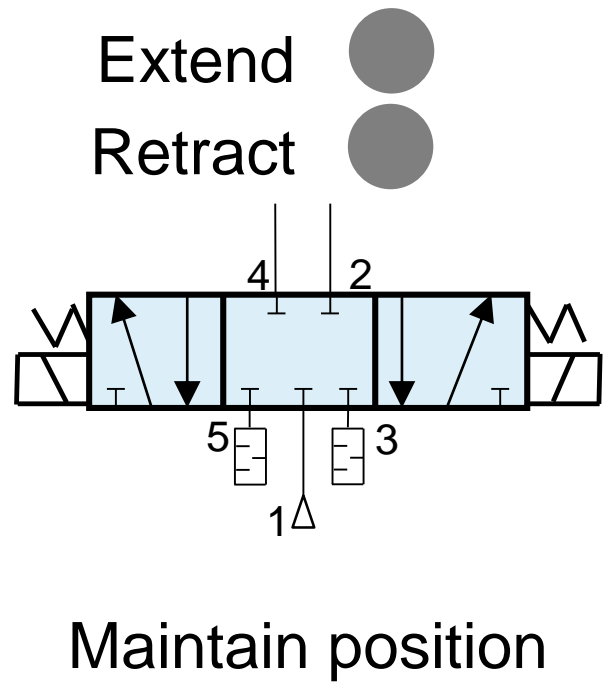
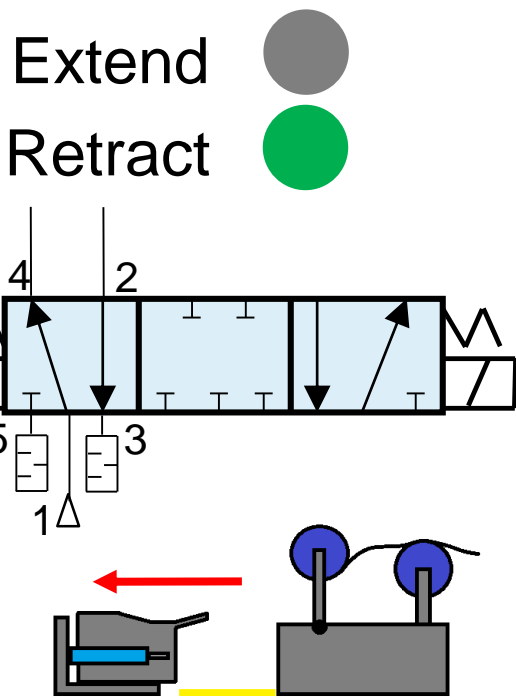


Unloading



Example – Winder unloading table

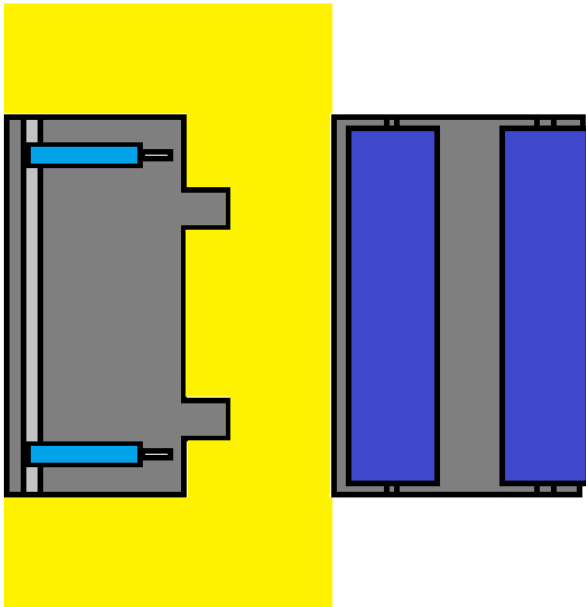
- Pneumatic moving table
 - Three potential positions
 - No consideration of failure modes



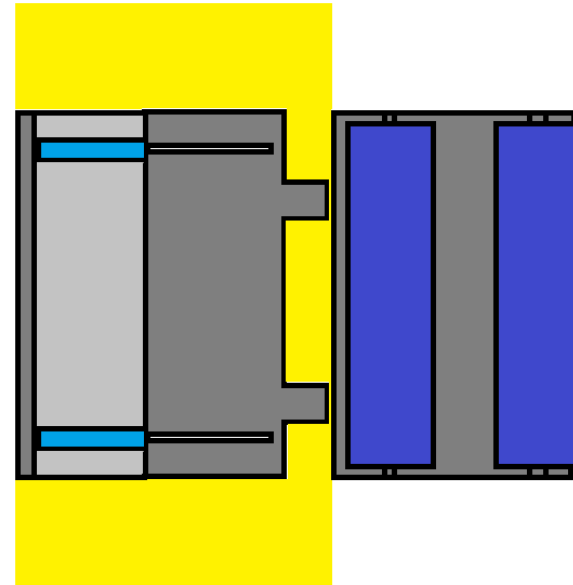
Example – Winder unloading table

- Safety control
 - Safety mat - Safety relay - Valve

Retracted



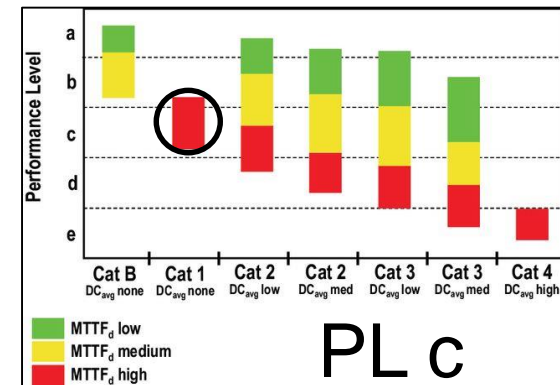
Extended



Example – Winder unloading table

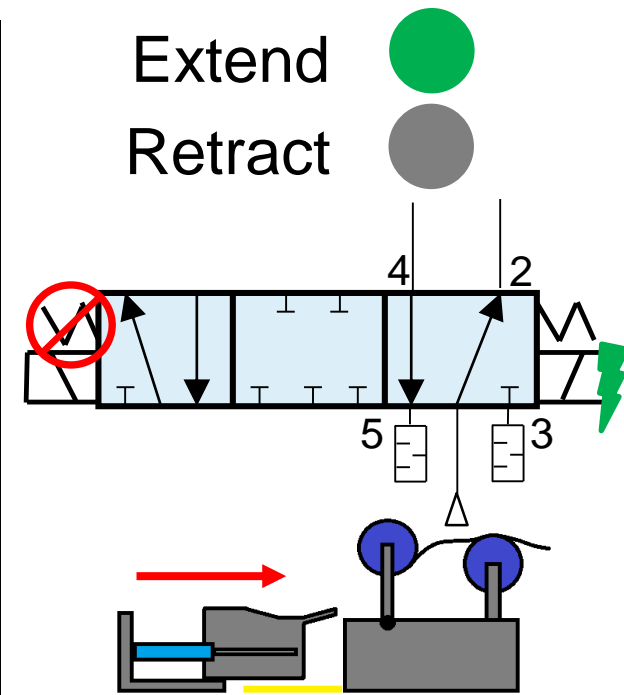
- Safety mat cycle rate = every five minutes
- Valve cycle rate = every 10 minutes

Cycles	Safety Mat	Valve	
	300	600	cycle time (sec)
	8	8	hours per day
	5	5	days per week
	52	52	weeks per year
	24960	12480	cycles per year
	Input	Logic	Output
Description	Safety Mat	Safety Relay	Valve
B10_d			20000000
n_{op}	24960		12480
MTTF_d	100	100	16026
DC	99%	99%	0%
Category	4	4	1
System MTTF_d	50	High	
System DC	99%	None	
System Category	1		
PL	c		



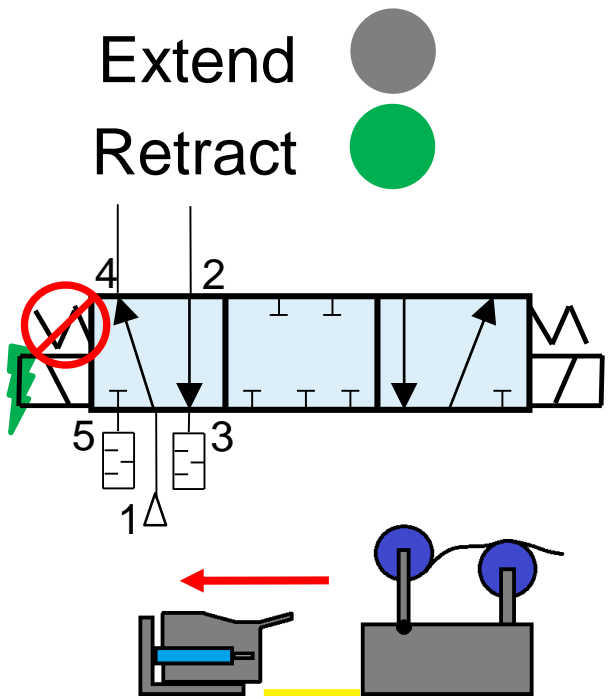
Example – Winder unloading table

- Valve failure mode - Broken spring
 - Retract position still works



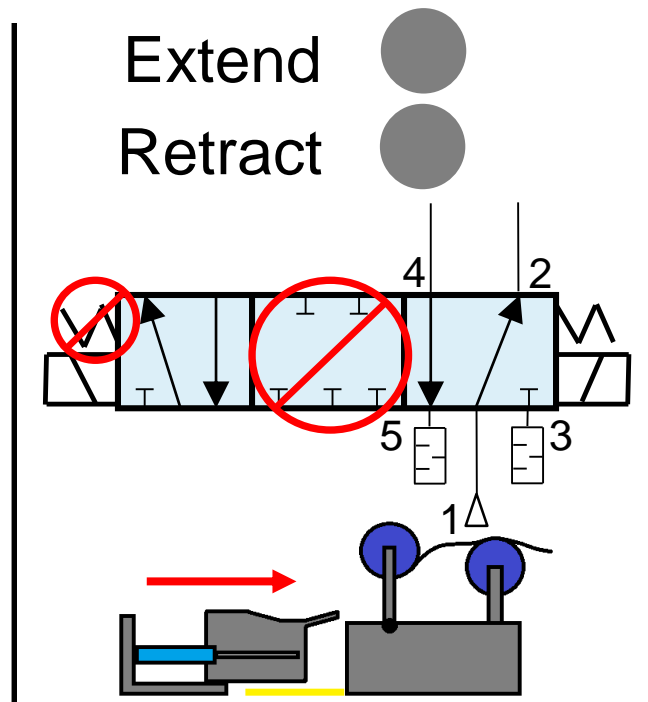
Example – Winder unloading table

- Valve failure mode - Broken spring
 - Extend function still works



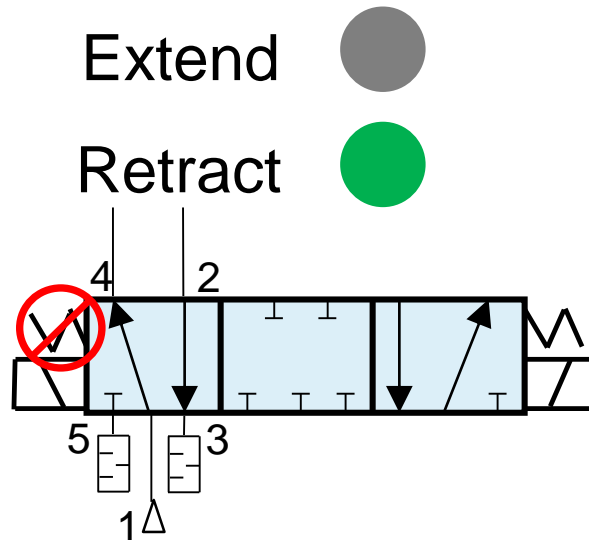
Example – Winder unloading table

- Valve failure mode - Broken spring
 - No center position
 - Always extend unless retracting



Example – Winder unloading table

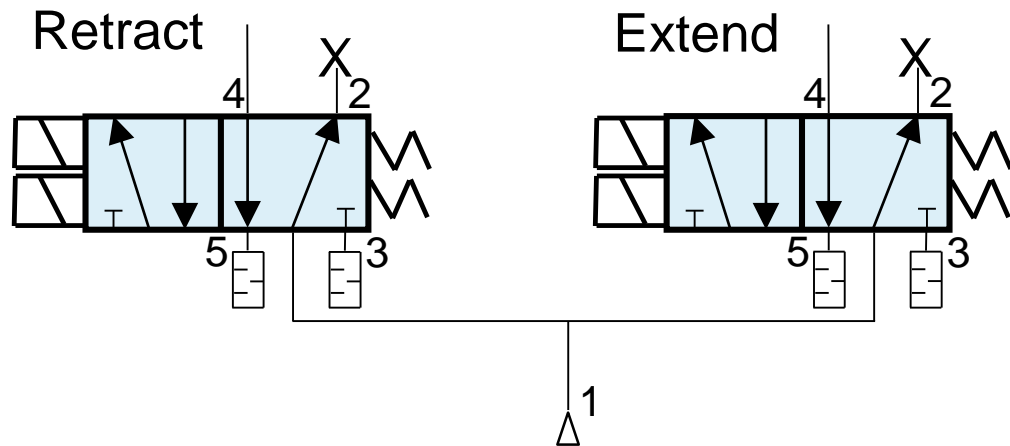
- Only safe mode
 - Must hold button to move table back



What happens if someone steps on the safety mat?

Example – Winder unloading table

- Pneumatic solution
 - Two dual valves to simulate 5/3 open center
 - Exhausts cylinder when de-energized
 - Allows manual movement if necessary



Example – Winder unloading table

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n_{op}	24960		12480
MTTF_d	100	100	16026
DC	99%	99%	99%
Category	4	4	4
System MTTF_d	50	High	
System DC	99%	High	
System Category	4		
PL	e		

