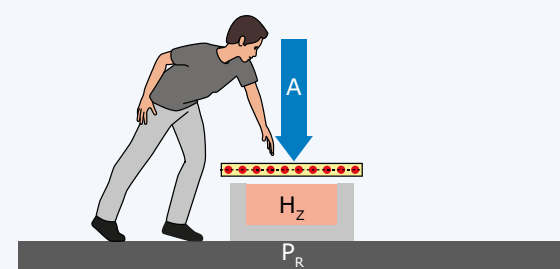
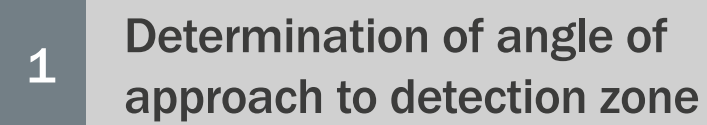
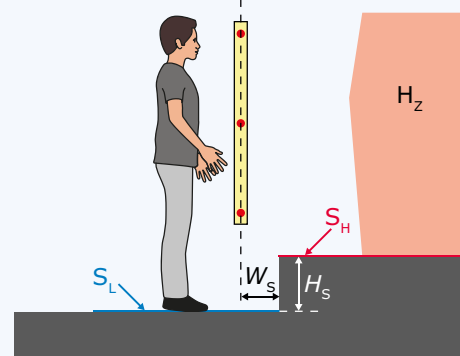


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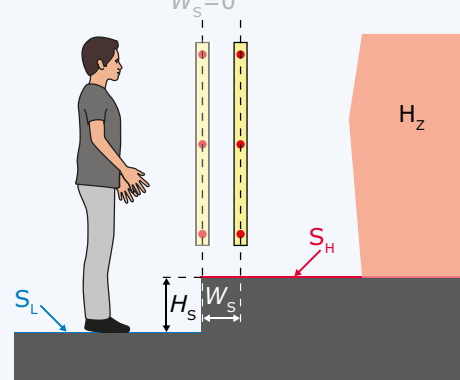


ORTHOGONAL APPROACH

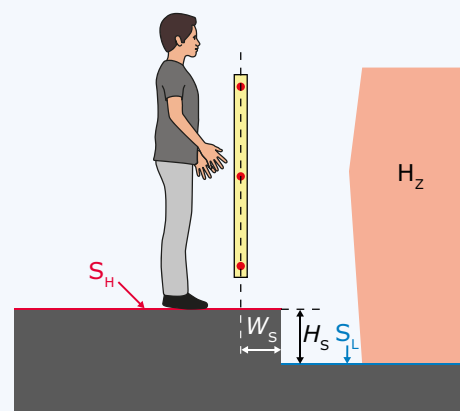
Use the blue boxes for subsequent steps



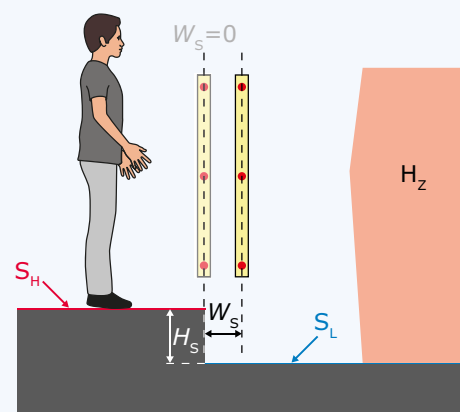
2a) Stepping up (SPE in front of the step)



2b) Stepping up (SPE behind or at the step)



2c) Stepping down (SPE in front of the step)



2d) Stepping down (SPE behind or at the step)

The reference plane P_R that shall be applied for the determination of the separation distance S results from the possibility of an undetected access to the hazard zone H_z

Scenario	SPE location to step	Resulting reference plane
A	Undetected access to higher surface not possible	Lower surface S_i
B	Access to higher surface not possible	Lower surface S_i
C	Undetected access to higher surface possible	Higher surface S_h
D	Undetected access to lower surface not possible	Higher surface S_h
E	Undetected access to higher surface not possible	Higher surface S_h
F	Undetected access to higher surface possible	Lower surface S_i
G	Undetected access to higher surface possible	Lower surface S_i

Explanation of limit values	
50 mm	Average smallest heel width
1000 mm	Height difference not easily reached by stepping up
500 mm	Height difference that presents a risk of falling

Source
DIN 33402-2:2020-12 Table 60
ISO 13857:2019 Tables 1, 2
ISO 14122-2:2016, 4.23

$T \geq t_{SRP/CS} + t_{me} + t_f$

Where:

- T is the overall system response time used in the calculation to determine the separation distance S
- $t_{SRP/CS}$ is the response time of the SRP/CS (safety-related parts of the control system)
- t_{me} is the response time of the machinery
- t_f is the time related to tolerance factors of the machinery (wearing lubrication, creep, or thermal expansion, etc.)

$t_{\text{SRP/CS}}$

is the sum of:

- t_i is the response time of the input (e.g., sensor, protective device...)
- t_l is the response time of the SRP/CS logic (e.g., PLC, microcontroller...)
- t_o is the response time of the SRP/CS output (e.g., contactor, valve...)

is the sum of:

- t_{re} is the time related to dissipation of source energy (e.g., pneumatic pressure, voltage, heat...)
- t_{tr} is the time related to mechanical response (e.g., time to travel to a safe position...)
- t_{in} is the time related to mechanical inertia (e.g., moving masses, rotating parts...)

Key for image elements and abbreviations from ISO 13855:2024

d_e	effective detection capability
D_{100}	reaching distance over a vertical detection zone
D_{25}	reaching distance associated with a protective device
D_{20T}	reaching distance through a vertical detection zone
D_{20U}	reaching distance under a vertical detection zone
F_D	depth of the horizontal detection zone
G_D	distance from the detection zone to the nearest obstruction
H	height from the reference plane

H_D	height of the horizontal detection zone from the reference plane
H_{D0}	height of the lower edge of the detection zone from the reference plane
H_{D1}	height of the upper edge of the detection zone from the reference plane
H_h	height of the hazard zone from the reference plane
H_s	height of step
K	approach speed

	Key for additional image elements
separation distance	A direction of approach
sensitive protective equipment	B_1 spacing between individual beams
safety-related manual control device	B_2 detection zone
overall system response time	H_2 hazard zone
width of step from edge to detection zone	P_R reference plane
supplemental distance factor	S_H higher surface
angle of approach to detection zone	S_L lower surface

Key for additional image elements

A	direction of approach
B _S	spacing between individual beams
D _Z	detection zone
H _Z	hazard zone
P _R	reference plane
S _H	higher surface
S _L	lower surface

WARNING

This information is intended as an overview to the application of ISO 13855:2024. This information does not replace the referenced standards and cannot be used to claim conformity with those and other applicable machinery safety standards, laws and regulations. It is not possible to derive any claims whatsoever from the following information, irrespective of the legal basis, as every machine requires a specific solution against the background of national and international regulations and standards.

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T is the overall system response time for the machine to achieve the intended risk reduction

Where:

- T is the overall time required to determine the lubrication condition
- $t_{SRP/CS}$ is the response time of the control system
- t_{ME} is the response time of the measurement
- t_F is the time for lubrication

 t_{service} τ_{MC}

Key for image elements and abbreviations from ISO 13855:2024

Key for additional image elements

