



Safety of machinery

Safety distances

against reaching with upper and lower limbs

For danger points which cannot be prevented by design measures and are safeguarded by safety devices, safety distances must be observed

for reaching through

Part of the body	Illustration	Opening e	Safety distance s	
			slot	square / circle
Tip of the toe / toe		$e \leq 5$	$s = 0$	$s = 0$
		$5 < e \leq 15$	$s \geq 10$	$s = 0$
		$15 < e \leq 35$	$s \geq 80^{1)}$	$s \geq 25$
Foot		$35 < e \leq 60$	$s \geq 180$	$s \geq 80$
		$60 < e \leq 80$	$s \geq 650^{2)}$	$s \geq 180$
Leg up to knee		$80 < e \leq 95$	$s \geq 1100^{3)}$	$s \geq 650^{2)}$
Leg up to crotch		$95 < e \leq 180$	$s \geq 1100^{3)}$	$s \geq 1100^{3)}$
		$180 < e \leq 240$	not admissible	$s \geq 1100^{3)}$

1) For slots with a length of ≤ 75 mm, the safety distance can be reduced to ≥ 50 mm.

2) This value relates to the leg (tip of the toe up to knee).

3) This value relates to the leg (tip of the toe up to crotch).

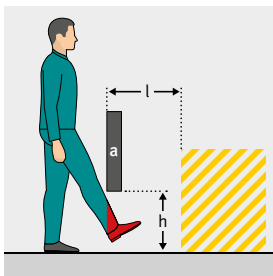
Distances preventing free access by the lower limbs

This table stipulates distances for special cases where access by the lower limbs of a person standing upright is prevented without additional measures. Where there is a risk of slipping or misuse, the values given in the table may be inadequate.

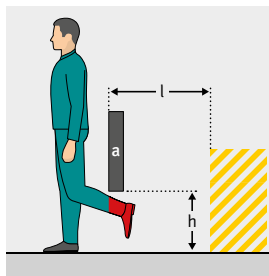
Where the value h is between two values of the table, the distance for the higher value of h should be selected.

l blocking distance
a protective structure
 h gap up to protective
structure

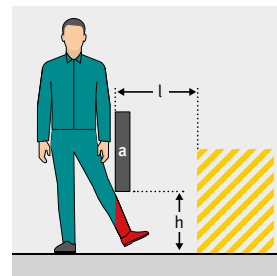
Case 1



Case 2



Case 3



$h \leq 200$	$l \geq 340$
$200 < h \leq 400$	$l \geq 550$
$400 < h \leq 600$	$l \geq 850$
$600 < h \leq 800$	$l \geq 950$
$800 < h \leq 1000$	$l \geq 1125$

$h \leq 200$	$l \geq 665$
$200 < h \leq 400$	$l \geq 765$
$400 < h \leq 600$	$l \geq 950$
$600 < h \leq 800$	$l \geq 950$
$800 < h \leq 1000$	$l \geq 1195$

$h \leq 200$	$l \geq 290$
$200 < h \leq 400$	$l \geq 615$
$400 < h \leq 600$	$l \geq 800$
$600 < h \leq 800$	$l \geq 900$
$800 < h \leq 1000$	$l \geq 1015$

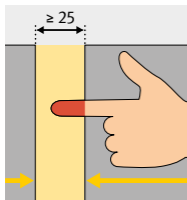
Measurements in mm

Picture credits:

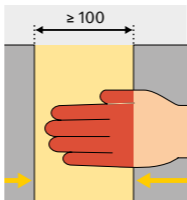
Cover picture: iStock-158692163/michaeljung

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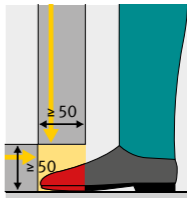
Minimum gaps (EN ISO 13854)



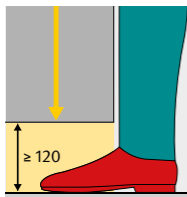
Finger



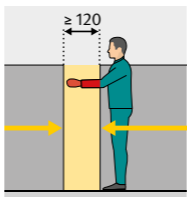
Fist / hand /
wrist



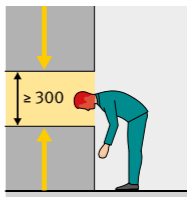
Toes



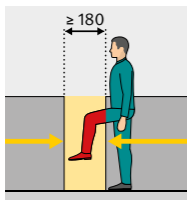
Foot



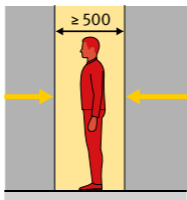
Arm



Head



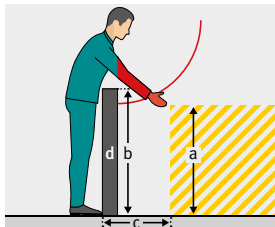
Leg



Body

Crushing is not considered dangerous for the parts of the body mentioned unless the distances are smaller than those specified.

for reaching over



- a height of the danger zone
- b height of the protective structure
- c horizontal distance to danger zone
- d protective structure

For determining the relevant safety distances, risk assessment must be carried out in accordance with EN ISO 12100. If the values determined for a, b or c are between two of the values given in the table, those values must be applied which ensure a higher level of integrity.

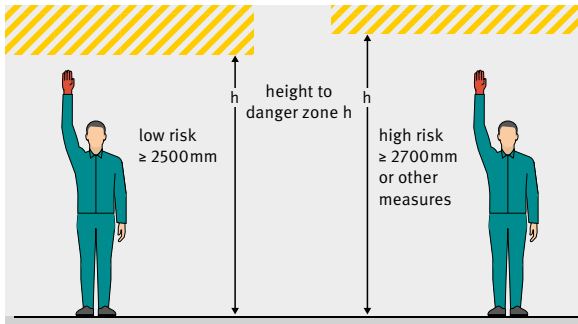
Height of the danger zone a ²	Height of the protective structure b ³								
	1000	1200	1400 ³	1600	1800	2000	2200	2400	2500
2600	–	–	–	–	–	–	–	–	–
	900	800	700	600	600	500	400	300	100
2400	100	100	100	100	100	100	100	100	–
	1100	1000	900	800	700	600	400	300	100
2200	600	600	500	500	400	350	250	–	–
	1300	1200	1000	900	800	600	400	300	–
2000	1100	900	700	600	500	350	–	–	–
	1400	1300	1100	900	800	600	400	–	–
1800	1100	1000	900	900	600	–	–	–	–
	1500	1400	1100	900	800	600	–	–	–
1600	1300	1000	900	900	500	–	–	–	–
	1500	1400	1100	900	800	500	–	–	–
1400	1300	1000	900	800	100	–	–	–	–
	1500	1400	1100	900	800	–	–	–	–
1200	1400	1000	900	500	–	–	–	–	–
	1500	1400	1100	900	700	–	–	–	–
1000	1400	1000	900	300	–	–	–	–	–
	1500	1400	1000	800	–	–	–	–	–
800	1300	900	600	–	–	–	–	–	–
	1500	1300	900	600	–	–	–	–	–
600	1200	500	–	–	–	–	–	–	–
	1400	1300	800	–	–	–	–	–	–
400	1200	300	–	–	–	–	–	–	–
	1400	1200	400	–	–	–	–	–	–
200	1100	200	–	–	–	–	–	–	–
	1200	900	–	–	–	–	–	–	–
0	1100	200	–	–	–	–	–	–	–
	1100	500	–	–	–	–	–	–	–

Horizontal distance to danger zone c⁴

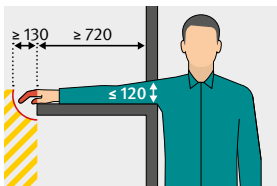
Measurements in mm

- 1) Protective structures with a height of less than 1000 mm are not mentioned as they do not ensure adequate restriction of movements.
- 2) For danger zones above 2500 or 2700 mm see safety distances for reaching up.
- 3) For high-risk danger points, protective structures lower than 1400 mm should not be used without additional technical safety measures.
- 4) The upper values apply to **low risk**. The lower values apply to **high risk** or other technical safety measures are applied.

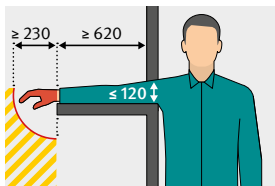
for reaching up



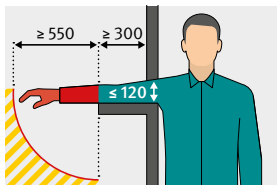
for reaching around



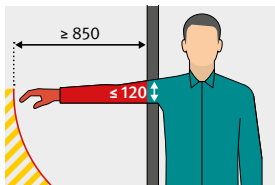
Arm and hand supported up to the knuckle joint



Arm supported up to the wrist

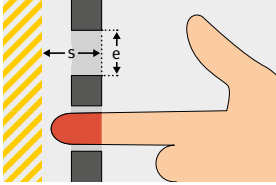
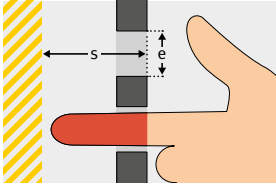
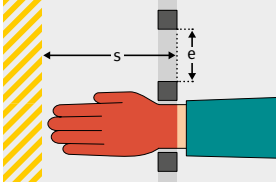
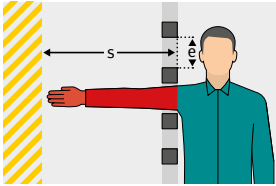


Arm supported up to the elbow



Limitation of movement only at shoulder and armpit

for reaching through

Part of body	Illustration	Opening ² e	Safety distance s		
			slot	square	circle
Finger tip		$e \leq 4$	$s \geq 2$	$s \geq 2$	$s \geq 2$
		$4 < e \leq 6$	$s \geq 10$	$s \geq 5$	$s \geq 5$
Finger up to knuckle joint		$6 < e \leq 8$	$s \geq 20$	$s \geq 15$	$s \geq 5$
		$8 < e \leq 10$	$s \geq 80$	$s \geq 25$	$s \geq 20$
		$10 < e \leq 12$	$s \geq 100$	$s \geq 80$	$s \geq 80$
		$12 < e \leq 20$	$s \geq 120$	$s \geq 120$	$s \geq 120$
	$20 < e \leq 30$	$s \geq 850^{1)}$	$s \geq 120$	$s \geq 120$	
	Arm up to shoulder joint		$30 < e \leq 40$	$s \geq 850$	$s \geq 200$
$40 < e \leq 120$			$s \geq 850$	$s \geq 850$	$s \geq 850$

- 1) Where the length of a slot opening is ≤ 65 mm, access is limited by the thumb and the safety distance can be reduced to 200 mm.
- 2) The opening width e corresponds to one side in case of square openings, to the diameter in case of circular openings and the smallest dimension in case of slot openings. For openings > 120 mm, the safety distances for reaching over protective structures must be applied.

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