



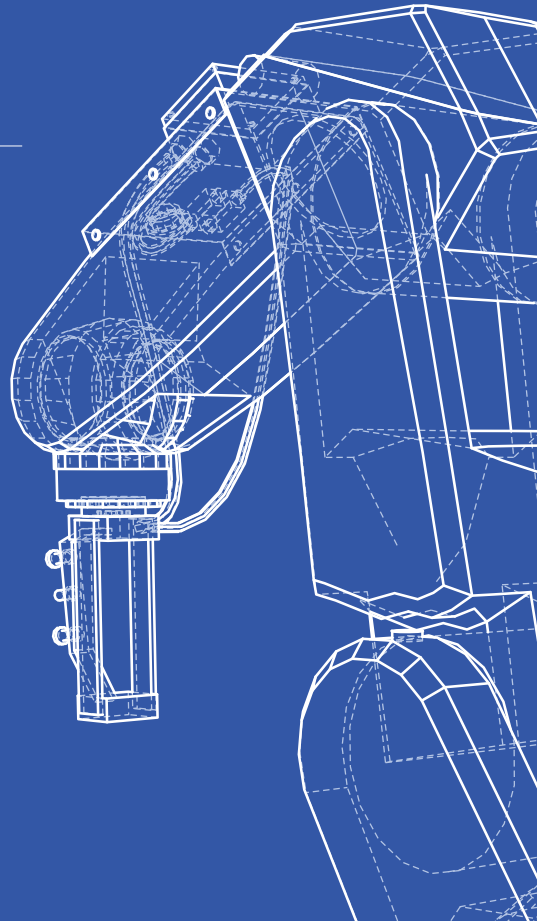
# Machinery Safety - Reach Distances

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In accordance with type-B1 standard  
- BS EN ISO 13857

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The following references do not apply if there is a type C standard for the chosen application; the specifications of C-type standards take precedence over A or B type standards.



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# Definitions

**Protective structure** - safeguard or other physical obstruction which restricts the movement of the body and/or part of it in order to prevent reaching hazard zones.

**Reference plane** - level at which persons would normally stand during the use of the machine or access to the hazard zone.

**Safety distance** - minimum distance a protective structure is required to be placed from a hazard zone.

## Reaching over protective structures - Only minor injuries along with a low probability of occurrence

Height of hazard zone nearest to the upper limb reach (mm)	Height of protective structure (mm) <sup>X</sup>								
	1000	1200	1400	1600	1800	2000	2200	2400	2500
	Horizontal safety distance to hazard zone nearest to the upper limb reach (mm)								
2500	0	0	0	0	0	0	0	0	0
2400	100	100	100	100	100	100	100	100	0
2200	600	600	500	500	400	350	250	0	0
2000	1100	900	700	600	500	350	0	0	0
1800	1100	1000	900	900	600	0	0	0	0
1600	1300	1000	900	900	500	0	0	0	0
1400	1300	1000	900	800	100	0	0	0	0
1200	1400	1000	900	500	0	0	0	0	0
1000	1400	1000	900	300	0	0	0	0	0
800	1300	900	600	0	0	0	0	0	0
600	1200	500	0	0	0	0	0	0	0
400	1200	300	0	0	0	0	0	0	0
200	1100	200	0	0	0	0	0	0	0
0	1100	200	0	0	0	0	0	0	0

X - Protective structures less than 1000 mm in height are not included because they do not sufficiently restrict movement of the body.

## Reaching over protective structures

Height of hazard zone nearest to the upper limb reach (mm) <sup>x</sup>	Height of protective structure (mm) <sup>y, z</sup>									
	1000	1200	1400	1600	1800	2000	2200	2400	2500	2700
	Horizontal safety distance to hazard zone nearest to the upper limb reach (mm)									
2700	0	0	0	0	0	0	0	0	0	0
2600	900	800	700	600	600	500	400	300	100	0
2400	1100	1000	900	800	700	600	400	300	100	0
2200	1300	1200	1000	900	800	600	400	300	0	0
2000	1400	1300	1100	900	800	600	400	0	0	0
1800	1500	1400	1100	900	800	600	0	0	0	0
1600	1500	1400	1100	900	800	500	0	0	0	0
1400	1500	1400	1100	900	800	0	0	0	0	0
1200	1500	1400	1100	900	700	0	0	0	0	0
1000	1500	1400	1000	800	0	0	0	0	0	0
800	1500	1300	900	600	0	0	0	0	0	0
600	1400	1300	800	0	0	0	0	0	0	0
400	1400	1200	400	0	0	0	0	0	0	0
200	1200	900	0	0	0	0	0	0	0	0
0	1100	500	0	0	0	0	0	0	0	0

X - For hazard zone above 2700mm, refer to 4.2.1 in BS 13857:2019

Y - Protective structures less than 1000 mm in height are not included because they do not sufficiently restrict movement of the body.

Z - Protective structures lower than 1400 mm should not be used without additional protective measures.

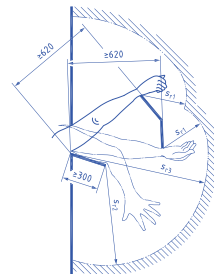
## Reaching around with additional protective structures

Limitation of movement at shoulder and armpit:  
two separate protective structures — one permits movement from the wrist, the other movement from the elbow.

$$s_{r1} \geq 230$$

$$s_{r2} \geq 550$$

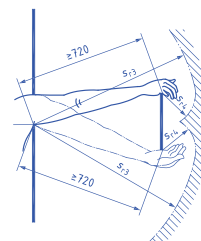
$$s_{r3} \geq 850$$



Limitation of movement at shoulder and armpit:  
one separate protective structure, which permits movement from the fingers up to the knuckle joint.

$$s_{r3} \geq 850$$

$$s_{r4} \geq 130$$



# Reaching through regular openings — Persons of 14 years of age and above

Part of body	Illustration	Opening	Safety distance to hazard zone (mm), $s_r$		
			Slot	Square	Round
Fingertip		$e \leq 4$	$\geq 2$	$\geq 2$	$\geq 2$
		$4 < e \leq 6$	$\geq 10$	$\geq 5$	$\geq 5$
Finger up to knuckle joint		$6 < e \leq 8$	$\geq 20$	$\geq 15$	$\geq 5$
		$8 < e \leq 10$	$\geq 80$	$\geq 25$	$\geq 20$
Hand		$10 < e \leq 12$	$\geq 100$	$\geq 80$	$\geq 80$
		$12 < e \leq 20$	$\geq 120$	$\geq 120$	$\geq 120$
		$20 < e \leq 30$	$\geq 850^x$	$\geq 120$	$\geq 120$
Arm up to junction with shoulder		$30 < e \leq 40$	$\geq 850$	$\geq 200$	$\geq 120$
		$40 < e \leq 120$	$\geq 850$	$\geq 850$	$\geq 850$

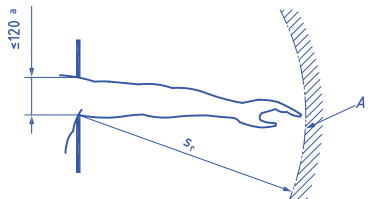
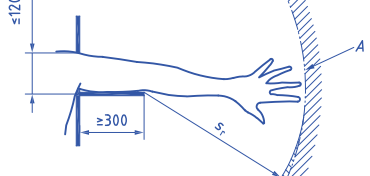
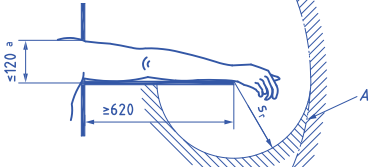
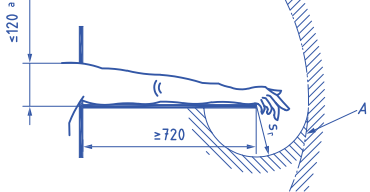
The bold lines within the table delineate that part of the body restricted by the opening size.

x - If the length of the slot opening is  $\leq 65$  mm, the thumb will act as a stop and the safety distance may be reduced to  $\geq 200$ mm.

## Whole body access

Protective structures with a slot opening greater than 180mm and square or round opening greater than 240mm shall not be used without additional protective measures as they can allow whole body access.

# Reaching around with limitation of movement

Limitation of movement	Safety distance to hazard zone, $s_r$	Illustration
Only at shoulder and armpit	$\geq 850$	
Arm supported up to elbow	$\geq 550$	
Arm supported up to wrist	$\geq 230$	
Arm and hand supported up to knuckle joint	$\geq 130$	

A - Range of movement of upper limb

$s_r$  - Radial safety distance

a - This is either the diameter of a round opening, or the side of a square opening, or the narrowest dimension of the slot opening.

## Reaching through openings of regular shape by lower limbs

Part of body	Illustration	Opening	Safety distance to hazard zone (mm), $s_r$	
			Slot	Square or Round
Toe tip		$e \leq 5$	0	0
		$5 < e \leq 15$	$\geq 10$	0
Toe		$15 < e \leq 35$	$\geq 80^X$	$\geq 25$
Foot		$35 < e \leq 60$	$\geq 180$	$\geq 80$
		$60 < e \leq 80$	$\geq 650^Y$	$\geq 180$
Leg (toe tip to knee)		$80 < e \leq 95$	$\geq 1100^Z$	$\geq 650^Y$
Leg (toe tip to crotch)		$95 < e \leq 180$	$\geq 1100^Z$	$\geq 1100^Z$
		$180 < e \leq 240$	Not admissible	$\geq 1100^Z$

X - If the length of the slot opening is  $\leq 75$  mm, the distance may be reduced to  $\geq 50$  mm.

Y - The value corresponds to leg (toe tip to knee).

Z - The value corresponds to leg (toe tip to crotch).

Note - Slot openings with  $e > 180$  mm and square or round openings with  $e > 240$  mm will allow access for the whole body.

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