

# ISO 13855:2024-11 (E)

## Safety of machinery - Positioning of safeguards with respect to the approach of the human body

---

<b>Contents</b>		<b>Page</b>
Foreword .....		v
Introduction .....		vii
1	Scope .....	1
2	Normative references .....	2
3	Terms, definitions, symbols and abbreviated terms .....	2
3.1	Terms and definitions .....	2
3.2	Symbols and abbreviated terms .....	5
3.2.1	Symbols .....	5
3.2.2	Abbreviated terms .....	5
4	Methodology .....	6
4.1	General .....	6
4.2	Static and dynamic separation distances .....	8
4.3	Reference planes .....	8
4.4	Assumptions .....	10
4.5	Specific requirements for ESPE regarding whole body access .....	11
4.5.1	General .....	11
4.5.2	Additional requirements for detection zones mounted vertical to the reference plane .....	11
4.5.3	Additional requirements for single beam devices .....	12
4.6	Reaching distance to SRMCD .....	12
4.7	Direction of approach toward detection zone of SPE .....	12
4.8	Speed and separation control (SSC) .....	13
5	Separation distance .....	13
5.1	General .....	13
5.2	Separation distance S .....	14
5.3	Approach speed K .....	14
5.3.1	Approach speed of the human body .....	14
5.3.2	Approach speed of mobile machinery .....	14
5.4	Overall system response time T .....	15
5.5	Reaching distance factors associated with a protective device DDS .....	17
5.5.1	General .....	17
5.5.2	Reaching distance in applications initiating a safety function .....	17
5.5.3	Reaching distance in applications where hazard zones can be reached by circumventing the safeguard .....	17
5.6	Supplemental distance factors .....	18
6	Dynamic separation distance .....	18
6.1	General .....	18
6.2	Dynamic separation distance for unknown human direction of approach .....	19
6.3	Dynamic separation distance for known human direction of approach .....	20
7	Consideration of the direction of approach to a detection zone .....	22
8	Orthogonal approach to a detection zone .....	23
8.1	Determination of the reaching distance for an orthogonal approach to a detection zone ..	23
8.2	Reaching over a vertical detection zone .....	25
8.2.1	General .....	25

8.2.2	Vertical detection zones without additional protective structures .....	25
8.2.3	Vertical detection zones with additional protective structures .....	27
8.3	Reaching through a vertical detection zone .....	27
8.3.1	General .....	27
8.3.2	Reaching through a vertical detection zone with effective detection capability $d_e \geq 40$ mm	28
8.3.3	Reaching through a vertical detection zone with effective detection capability $40$ mm < $d_e \leq 55$ mm .....	29
8.3.4	Reaching through a vertical detection zone with effective detection capability $55$ mm < $d_e \leq 120$ mm .....	29
8.3.5	Reaching through a vertical detection zone with effective detection capability $d_e > 120$ mm or undefined .....	30
8.3.6	Indirect approach -- Path restricted by obstacles .....	31
8.4	Reaching under a vertical detection zone .....	33
8.4.1	General .....	33
8.4.2	Reaching under a vertical detection zone with $(d_e + HDB) \geq 40$ mm .....	34
8.4.3	Reaching under a vertical detection zone with height of the lower edge from the reference plane $40$ mm < $d_e + HDB$ and $HDB \leq 300$ mm .....	34
8.4.4	Reaching under a vertical detection zone with additional protective structures .....	35
8.5	Single beam applications .....	36
8.6	Cycle re-initiation of machine operation employing active opto-electronic protective devices (AOPDs) with control function .....	36
9	Parallel approach to a detection zone .....	37
9.1	General .....	37
9.2	Height of a detection zone for a parallel approach .....	37
9.3	Separation distance of a detection zone for a parallel approach .....	39
9.4	Depth of a detection zone for a parallel approach .....	39
10	Two-hand control devices .....	40
10.1	Two-hand control devices not preventing encroachment .....	40
10.2	Two-hand control devices preventing encroachment .....	41
11	Single control devices .....	41
11.1	Hand-operated single control devices .....	41
11.2	Foot-operated single control devices .....	42
12	Interlocking guards .....	43
12.1	General .....	43
12.2	Interlocking devices without guard locking .....	43
12.2.1	General .....	43
12.2.2	Calculation of the opening $e$ for an interlocking guard with an interlocking device with rotary cam actuated position switch .....	45
12.3	Interlocking devices with guard locking .....	46
Annex A (informative)	Achieving intended risk reduction .....	48
Annex B (informative)	Measurement and calculation of system performance to achieve the intended risk reduction .....	49
Annex C (normative)	Devices with multiple beams or arrangements of single beams with effective detection capability $d_e > 120$ mm or undefined -- Number of beams and their height above the reference plane without change in elevation .....	52
Annex D (normative)	Supplier information for time and distance to achieve the intended risk reduction ....	54
Annex E (informative)	Variable key for determining separation distance for safeguards .....	55
Annex F (normative)	Time factors in the overall system response time to achieve the intended risk reduction .....	64
Annex G (informative)	Explanation of the formulae and values used within this document .....	67
Bibliography	.....	71