

ISO 13855:2024-11 (E)

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

Contents		Page
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