

ISO 17757:2019-07 (E)

Earth-moving machinery and mining - Autonomous and semi-autonomous machine system safety

Contents		Page
Foreword		v
Introduction		vi
1	Scope	1
2	Normative references	1
3	Terms, definitions and abbreviated terms	2
3.1	Terms and definitions	2
3.2	Abbreviated terms	5
4	Safety requirements and/or protective/risk reduction measures	5
4.1	General	5
4.2	Stop systems	6
4.2.1	General	6
4.2.2	All-stop system	6
4.2.3	Remote stop system	6
4.3	Warning devices and safety signs	6
4.3.1	Visual indicators	6
4.3.2	Audible alarms	7
4.3.3	Safety signs	7
4.4	Fire protection	7
4.5	Machine access systems	7
4.6	Braking and steering	7
4.6.1	General	7
4.6.2	Braking	8
4.6.3	Steering	8
4.7	Adaptation to environmental conditions	9
4.8	On-board electrical power	9
4.8.1	General	9
4.8.2	Requirements	9
5	Positioning and orientation (POSE)	10
5.1	General	10
5.2	Risk and failure modes	10
5.3	Requirements	10
6	Digital terrain map (DTM)	11
6.1	General	11
6.2	Requirements	11
7	Perception	11
7.1	General	11
7.2	Risk and failure modes	11
7.2.1	Failure to detect or late detection of an object	11
7.2.2	False detection of non-existent object	12
7.2.3	Erroneous location of a detected object	12
7.2.4	Misclassification of an object	12
7.3	Requirements	12

8	Navigation system	13
8.1	General	13
8.2	Risks	13
8.3	Requirements	13
9	Task planner	13
9.1	General	13
9.2	Risks	13
9.3	Requirements	14
10	Communications and networks	14
10.1	General	14
10.2	Risk and failure modes	14
10.2.1	Risks	14
10.2.2	Failure modes	15
10.2.3	Potential causes	15
10.3	Communication system requirements	15
10.3.1	Communication integrity	15
10.3.2	Cyber security	16
10.4	Safety messages	16
11	ASAM supervisor system	16
11.1	General	16
11.2	Requirements	17
12	AOZ access, permissions and security	17
12.1	Permissions and security	17
12.2	AOZ access and warnings	17
12.3	Operational risks	18
12.4	Mode changes	18
13	ASAMS site operating procedures	18
13.1	General	18
13.2	Incident recording	18
13.3	Commissioning	18
13.4	Documentation and training	19
13.4.1	Documentation	19
13.4.2	Training	19
14	Operational hazard controls	20
15	Verification of safety requirements and/or protective/risk reduction measures	20
16	Conformity assessment	20
17	Information for use	20
17.1	Safety labels and machine markings	20
17.2	User manual	20
Annex A	(informative) List of significant hazards	21
Annex B	(informative) Safety and the risk management process	23
Annex C	(informative) Integration of ASAMS into the site planning process	26
Annex D	(informative) Access control systems	28
Annex E	(informative) Change management -- Example for mining	30
Annex F	(informative) Supervision	32

Annex G (informative) Commissioning	33
Annex H (informative) Operational hazard controls	35
Annex I (informative) Form to verify the conformity to the requirements	36
Bibliography	47