

# DIN EN 280-1:2022-10 (E)

## Mobile elevating work platforms - Part 1: Design calculations - Stability criteria - Construction - Safety - Examinations and tests

---

<b>Contents</b>		<b>Page</b>
European foreword .....		5
Introduction .....		7
1	Scope .....	8
2	Normative references .....	9
3	Terms and definitions .....	11
4	Safety requirements and/or measures .....	17
4.1	General .....	17
4.2	Structural and stability calculations .....	18
4.2.1	General .....	18
4.2.2	Loads and forces .....	18
4.2.3	Determination of loads and forces .....	18
4.2.4	Stability calculations .....	21
4.2.5	Structural calculations .....	33
4.3	Chassis and stabilizers .....	35
4.3.1	Chassis .....	35
4.3.2	Stabilizers .....	39
4.4	Extending structure .....	41
4.4.1	Methods to avoid overturning and exceeding permissible stresses .....	41
4.5	Extending structure drive systems .....	44
4.5.1	General .....	44
4.5.2	Wire rope drive systems .....	45
4.5.3	Chain drive systems .....	47
4.5.4	Lead screw drive systems .....	48
4.5.5	Rack and pinion drive systems .....	48
4.6	Work platform .....	49
4.7	Controls .....	52
4.8	Electrical equipment .....	54
4.9	Hydraulic systems .....	55
4.10	Hydraulic cylinders .....	56
4.10.1	Structural design .....	56
4.11	Safety devices and safety functions .....	61
4.12	Noise .....	64
4.12.1	General .....	64
4.12.2	Noise determination and declaration .....	64
5	Verification of the safety requirements and/or measures .....	65
5.1	Examinations and tests .....	65
5.1.1	General .....	65
5.1.2	Design check .....	65
5.1.3	Manufacturing check .....	65
5.1.4	Tests .....	66
5.2	Type tests of MEWPs .....	71
5.3	Tests before placing on the market .....	71
6	Information for use .....	71
6.1	Instruction handbook .....	71

6.1.1	General .....	71
6.1.2	There shall be provisions in the instruction handbook to record .....	75
6.2	Marking .....	75
Annex A (informative) List of significant hazards .....		78
Annex B (informative) Use of MEWPs in wind speeds greater than 12,5 m/s (Beaufort-Scale) .....		82
Annex C (informative) Dynamic factors in stability and structural calculations .....		83
C.1	Stability calculations .....	83
C.2	Structural calculations .....	84
Annex D (normative) Calculation of wire rope drive systems .....		85
D.1	General .....	85
D.2	Calculation of wire rope drive systems .....	85
D.3	Calculation of rope diameters (coefficient c) .....	86
D.4	Calculation of the diameters of rope drums, rope pulleys and compensating pulleys [coefficient (h1 · h2)] .....	87
D.5	Efficiency of wire rope drive systems .....	91
Annex E (informative) Calculation example -- Wire rope drive systems .....		93
E.1	Method used to determine the coefficients and ratios used for 4.5.2 (wire rope drive systems) using the load cycle figures in 4.2.5.3 and operating speeds in 4.4.5 .....	93
E.1.1	General .....	93
E.1.2	Notes .....	93
E.1.3	Annex D (normative) method summarized .....	93
E.1.4	Calculation example .....	94
E.2	Calculation of the diameters of rope drums, pulleys and static pulleys .....	96
Annex F (informative) Calculation example - z factor, kerb obstacle collision .....		99
Annex G (normative) Additional requirements for wireless controls and control systems .....		102
G.1	General .....	102
G.2	Control limitation .....	102
G.3	Stop .....	102
G.4	Serial data communication .....	103
G.5	Use of more than one operator control station .....	103
G.6	Battery-powered operator control stations .....	103
G.7	Receiver .....	103
G.8	Warnings .....	103
G.9	Information for use .....	103
Annex H (normative) Dimensions of steps and ladders .....		104
Annex I (informative) Stress history parameters .....		106
I.1	Introduction .....	106
I.2	Guidance for selection of S class .....	106
I.3	Stress history parameters .....	107
I.3.1	General procedure .....	107
I.3.2	Direct calculation of stress history class .....	109
I.3.3	Simplified method to determine stress history class .....	110
Annex J (informative) Fatigue assessment: Relationship between S classes in EN 13001-3- 1:2012+A2:2018 and B groups in DIN 15018 .....		111
Annex K (normative) Requirements for Performance Level d safety functions .....		112

K.1	General .....	112
K.1.1	Introduction .....	112
K.1.2	Performance Level d safety functions utilizing category 2 architecture .....	112
K.1.3	Performance Level d safety functions implemented by SIL2 functions with a hardware fault tolerance of zero .....	113
K.2	Requirements for unmonitored non-electrical parts of category 3 architectures .....	113
Annex L (informative) Information on rescue procedure .....		114
Annex M (normative) Noise Test Code .....		115
M.0	General .....	115
M.1	Emission sound pressure level determination .....	115
M.1.1	General .....	115
M.1.2	Uncertainty .....	117
M.2	Sound power level determination .....	117
M.2.1	Measurement surface .....	117
M.2.2	Sound Power Level Calculation (L <sub>wA</sub> ) [dB] .....	117
M.2.3	Uncertainty .....	118
M.3	Installation and mounting conditions .....	118
M.4	Operating conditions .....	118
Annex ZA (informative) Relationship between this European Standard and the Essential Requirements of Directive 2006/42/EC aimed to be covered .....		119
Bibliography .....		125