

DIN EN 280:2016-04 (E)

Mobile elevating work platforms - Design calculations - Stability criteria - Construction - Safety - Examinations and tests (includes Amendment A1:2015)

Contents	Page
Foreword.....	5
Introduction	6
1 Scope	7
2 Normative references	8
3 Terms and definitions	9
4 List of hazards.....	14
5 Safety requirements and/or measures	18
5.1 General.....	18
5.2 Structural and stability calculations	18
5.2.1 General.....	18
5.2.2 Loads and forces	18
5.2.3 Determination of loads and forces.....	18
5.2.4 Stability calculations	21
5.2.5 Structural calculations	35
5.3 Chassis and stabilisers	36
5.3.1 Chassis	36
5.3.2 Stabilisers.....	40
5.4 Extending structure.....	42
5.4.1 Methods to avoid overturning and exceeding permissible stresses:	42
5.5 Extending structure drive systems.....	45
5.5.1 General.....	45
5.5.2 Wire rope drive systems	46
5.5.3 Chain drive systems.....	48
5.5.4 Lead-screw drive systems	49
5.5.5 Rack and pinion drive systems	50
5.6 Work platform.....	50
5.7 Controls	53
5.8 Electrical equipment.....	55
5.9 Hydraulic systems	56
5.10 Hydraulic cylinders.....	58
5.11 Safety devices	62
6 Verification of the safety requirements and/or measures	64
6.1 Examinations and tests.....	64
6.1.1 General.....	64
6.1.2 Design check.....	64
6.1.3 Manufacturing check.....	64
6.1.4 Tests.....	65
6.2 Type tests of MEWPs	70
6.3 Tests before placing on the market	70
7 Information for use	70
7.1 Instruction handbook	70
7.1.1 General.....	70
7.2 Marking	74

Annex A (informative) Use of MEWPs in wind speeds greater than 12,5 m/s (Beaufort-Scale)	77
Annex B (informative) Dynamic factors in stability and structural calculations	78
B.1 Stability calculations	78
B.2 Structural calculations	78
Annex C (normative) Calculation of wire rope drive systems	80
C.1 General	80
C.2 Calculation of wire rope drive systems	80
C.3 Calculation of rope diameters (coefficient c)	81
C.4 Calculation of the diameters of rope drums, rope pulleys and compensating pulleys [coefficient ($h_1 \cdot h_2$)]	81
C.5 Efficiency of wire rope drive systems	84
Annex D (informative) Calculation example - Wire rope drive systems	86
D.1 Method used to determine the coefficients and ratios used for 5.5.2 (wire rope drive systems) using the load cycle figures in 5.2.5.3 and operating speeds in 5.4.5	86
D.1.1 General	86
D.1.2 Notes	86
D.1.3 Annex C (normative) method summarised	86
D.1.4 Calculation example	87
D.1.4.1 General	87
D.1.4.2 Mode of operation (drive group) (see C.2 and Table C.1)	87
D.1.4.3 Calculation of minimum rope diameter (see C.3)	89
D.1.4.4 Working coefficients	89
D.2 Calculation of the diameters of rope drums, pulleys and static pulleys	89
Annex E (informative) Calculation examples - factor "z", kerb test	92
Annex F (normative) Additional requirements for wireless controls and control systems	94
F.1 General	94
F.2 Control limitation	94
F.3 Stop	94
F.4 Serial data communication	94
F.5 Use of more than one operator control station	95
F.6 Battery-powered operator control stations	95
F.7 Receiver	95
F.8 Warnings	95
F.9 Information for use	95
Annex G (normative) Dimensions of steps and ladders	96
A₁ Annex H A₁ (informative) Stress history parameters	98
H.1 Introduction	98
H.2 Guidance for selection of S class	98
H.3 Stress history parameters	99
H.3.1 General procedure	99
H.3.2 Direct calculation of stress history class	100
H.3.3 Simplified method to determine stress history class	101
A₁ Annex I A₁ (informative) Fatigue assessment: Relationship between S classes in EN 13001-3-1 and B groups in DIN 15018	103

Annex J ^{A1} (normative) Requirements for Performance Level d safety functions	104
J.1 General	104
J.1.1 Introduction.....	104
J.1.2 Performance Level d safety functions utilising category 2 architecture.....	104
J.1.3 Performance Level d safety functions implemented by SIL 2 functions with a hardware fault tolerance of zero	104
J.2 Requirements for unmonitored non-electrical parts of category 3 architectures	105
Annex ZA (informative) Relationship between this European Standard and the Essential Requirements of EU Directive 2006/42/EC	106
Bibliography	107