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

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

Contents

Page

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 (LwA) [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