DIN EN ISO 13482:2014-11 (E)

Robots and robotic devices - Safety requirements for personal care robots (ISO 13482:2014)

Contents

Page

Foreword ... **4**

Introduction ... **5**

1 Scope ... **6**

2 Normative references ... **7**

3 Terms and definitions ... **8**

4 Risk assessment ... **14**
4.1 General ... 14
4.2 Hazard identification ... 14
4.3 Risk estimation ... 14

5 Safety requirements and protective measures ... **15**
5.1 General ... 15
5.2 Hazards related to charging battery ... 16
5.3 Hazards due to energy storage and supply ... 17
5.4 Robot start-up and restart of regular operation ... 19
5.5 Electrostatic potential ... 20
5.6 Hazards due to robot shape ... 21
5.7 Hazards due to emissions ... 22
5.8 Hazards due to electromagnetic interference ... 26
5.9 Hazards due to stress, posture and usage ... 27
5.10 Hazards due to robot motion ... 28
5.11 Hazards due to insufficient durability ... 36
5.12 Hazards due to incorrect autonomous decisions and actions ... 38
5.13 Hazards due to contact with moving components ... 39
5.14 Hazards due to lack of awareness of robots by humans ... 39
5.15 Hazardous environmental conditions ... 39
5.16 Hazards due to localization and navigation errors ... 42

6 Safety-related control system requirements ... **43**
6.1 Required safety performance ... 43
6.2 Robot stopping ... 45
6.3 Limits to operational spaces ... 48
6.4 Safety-related speed control ... 49
6.5 Safety-related environmental sensing ... 49
6.6 Stability control ... 51
6.7 Safety-related force control ... 52
6.8 Singularity protection ... 52
6.9 Design of user interface ... 53
6.10 Operational modes ... 54
6.11 Manual control devices ... 56

7 Verification and validation ... **57**

8 Information for use **57**
8.1 General 57
8.2 Markings or indications 58
8.3 User manual 59
8.4 Service manual 61
Annex A (informative) **List of significant hazards for personal care robots** **63**
Annex B (informative) **Examples of operational spaces for personal care robots** **71**
Annex C (informative) **Example of the implementation of a safeguarded space** **74**
Annex D (informative) **Examples of functional tasks of personal care robots** **77**
Annex E (informative) **Examples of markings for personal care robots** **80**
Annex ZA (informative) **Relationship between this European Standard and the Essential Requirements of EU Directive 2006/42/EC** **82**
Bibliography **83**