DIN 50100:2016-12 (E)

Load controlled fatigue testing - Execution and evaluation of cyclic tests at constant load amplitudes on metallic sp ecimens and components

Contents

Page

Foreword 4

Introduction 5

1 Scope 6

2 Normative references 6

3 Symbols and abbreviations 6

4 S-N curve (Wöhler curve) 12

5 Load types 17

6 Shape of the specimens and specimen manufacturing 19

7 Test setup 21

8 Test procedure 22
8.1 General 22
8.2 High cycle fatigue 22
8.2.1 General 22
8.2.2 Pearl string method 26
8.2.3 Load level method 33
8.3 Long life fatigue strength 41
8.3.1 General 41
8.3.2 Staircase method 44

9 Test evaluation 50
9.1 General 50
9.2 High cycle fatigue 51
9.2.1 General 51
9.2.2 Pearl string method 51
9.2.3 Load level method 54
9.3 Evaluating long life fatigue strength 56
9.3.1 General 56
9.3.2 Staircase method 56
9.4 Number of cycles at knee point and course of the S-N curve in the long life fatigue regime 58
9.5 S-N curve for failure probabilities other than 50 % 59

10 Documentation 60
10.1 General 60
10.2 Material 61
10.3 Specimen (material sample or component) 61
10.4 Test setup 62
10.5 Test procedure 62
10.6 Test evaluation 62
10.7 S-N curve (Wöhler curve) 63

Annex A (normative) Pearl string method: Determination of the required random sample size 64

A.1 Pearl string method: Number of specimens required for estimation of the mean number of cycles ... 64
A.2 Pearl string method: Number of specimens required for estimation of the slope kGG of the S-N curve ... 70

Annex B (normative) Load level method: Determination of the required random sample size ... 76

B.1 Load level method: Required number of specimens from the entire test series for estimation of the mean number of cycles ... 76
B.2 Load level method: Number of specimens from the entire test series required for estimation of the slope of the S-N curve in the high cycle fatigue regime ... 82

Annex C (informative) Typical standard deviations in the high cycle fatigue regime ... 88

Annex D (informative) Examples of test protocols ... 89

D.1 Record sheet for a high cycle fatigue test series ... 90
D.2 Record sheet for a long life fatigue strength test series ... 91

Annex E (normative) Examples of test evaluations ... 92

E.1 Example: Evaluation of the S-N curve in the high cycle fatigue regime obtained using the pearl string method ... 92
E.1.1 Test results ... 92
E.1.2 Position and slope of the S-N curve in the high cycle fatigue regime ... 93
E.1.3 S-N curve in the high cycle fatigue regime for a failure probability of 50 % ... 94
E.1.4 Standard deviation of the test results ... 94
E.1.5 S-N curve in the high cycle fatigue regime for a failure probability of 10 % ... 96
E.1.6 S-N curve in the high cycle fatigue regime for a failure probability of 90 % ... 96
E.1.7 Graphical representation of the S-N curve in the high cycle fatigue regime ... 97
E.2 Example: Evaluation of the S-N curve in the high cycle fatigue regime obtained using the load level method ... 97
E.2.1 Test results ... 97
E.2.2 Mean and standard deviation for load level 1 ... 98
E.2.3 Mean and standard deviation for load level 2 ... 99
E.2.4 S-N curve in the high cycle fatigue regime for a failure probability of 50 % ... 100
E.2.5 S-N curve for a failure probability of 10 % ... 100
E.2.6 S-N curve in the high cycle fatigue regime for a failure probability of 90 % ... 101
E.2.7 Graphical representation the S-N curve in the high cycle fatigue regime ... 101
E.3 Example: Evaluation of the long life fatigue strength obtained using the staircase method ... 102
E.4 Example: Determination of the number of cycles at knee point and of the course of the S-N curves up to the ultimate number of cycles ... 104
E.4.1 Pearl string method ... 104
E.4.2 Load level method ... 105
E.5 Example: Graphical representation of the S-N curve ... 107
E.5.1 Pearl string method ... 107
E.5.2 Load level method ... 109

Bibliography ... 112