DIN EN 12663-1:2024-02 (E)

Railway applications - Structural requirements of railway vehicle bodies - Part 1: Locomotives and passenger rolling stock (and alternative method for freight wagons) (includes Amendment A2:2023)

Contents

Page

European foreword 4

Introduction 5

1 Scope 6

2 Normative references 6

3 Terms and definitions 6

4 Coordinate system 7

5 Structural requirements 7
5.1 General 7
5.2 Categories of railway vehicles 8
5.2.1 Structural categories 8
5.2.2 Locomotives 9
5.2.3 Passenger vehicles 9
5.2.4 Freight wagons 9
5.2.5 Other types of vehicles 9
5.3 Uncertainties in railway design parameters 9
5.3.1 Allowance for uncertainties 9
5.3.2 Loads 10
5.3.3 Material 10
5.3.4 Dimensional tolerances 10
5.3.5 Manufacturing process 10
5.3.6 Analytical accuracy 10
5.4 Demonstration of static strength and structural stability 11
5.4.1 Requirement 11
5.4.2 Yield or proof strength 11
5.4.3 Ultimate failure 12
5.4.4 Instability 13
5.5 Demonstration of stiffness 13
5.6 Demonstration of fatigue strength 14
5.6.1 General 14
5.6.2 Methods of assessment 14

6 Design load cases 15
6.1 General 15
6.2 Longitudinal static loads for the vehicle body 17
6.2.1 General 17
6.2.2 Longitudinal forces in buffers and/or coupling area 17
6.2.3 Compressive forces in end wall area 18
6.3 Vertical static loads for the vehicle body 19
6.3.1 Maximum operating load 19
6.3.2 Lifting and jacking 19
6.3.3 Lifting and jacking with displaced support 20
6.3.4 Re-railing and recovery 20
6.4 Superposition of static load cases for the vehicle body 21

6.5 Static proof loads at interfaces ... 22
6.5.1 Proof load cases for body to bogie connection ... 22
6.5.2 Proof load cases for equipment attachments ... 22
6.5.3 Proof load cases for joints of articulated units ... 23
6.5.4 Proof load cases for specific components on freight wagons ... 23
6.6 General fatigue load cases for the vehicle body ... 24
6.6.1 Sources of load input ... 24
6.6.2 Payload spectrum ... 24
6.6.3 Load/unload cycles ... 24
6.6.4 Track induced loading ... 24
6.6.5 Aerodynamic loading ... 25
6.6.6 Traction and braking ... 26
6.7 Fatigue loads at interfaces ... 26
6.7.1 General requirements ... 26
6.7.2 Body/bogie connection ... 26
6.7.3 Equipment attachments ... 26
6.7.4 Couplers ... 26
6.7.5 Fatigue load cases for joints of articulated units ... 27
6.8 Combination of fatigue load cases ... 27
6.9 Modes of vibration ... 27
6.9.1 Vehicle body ... 27
6.9.2 Equipment ... 27

7 Permissible stresses for materials ... 27
7.1 Interpretation of stresses ... 27
7.2 Static strength ... 28
7.3 Fatigue strength ... 28

8 Requirements of strength demonstration tests ... 28
8.1 Objectives ... 28
8.2 Proof load tests ... 29
8.2.1 Applied loads ... 29
8.2.2 Test procedure ... 29
8.3 Service or fatigue load tests ... 30
8.4 Impact tests ... 30

9 Validation programme ... 30
9.1 Objective ... 30
9.2 Validation programme for new design of vehicle body structures ... 31
9.2.1 General ... 31
9.2.2 Structural analyses ... 31
9.2.3 Testing ... 32
9.3 Validation programme for evolved design of vehicle body structures ... 32
9.3.1 General ... 32
9.3.2 Structural analyses ... 32
9.3.3 Testing ... 33

Annex A (informative) Treatment of local stress concentrations in analyses ... 34

Annex B (informative) Examples of proof load cases at articulation joints ... 36

Bibliography ... 39