

DIN EN 16452:2015-11 (E)

Railway applications - Braking - Brake blocks

| Contents | | Page |
|--------------------|--|-------------|
| Foreword | | 7 |
| Introduction | | 8 |
| 1 | Scope | 9 |
| 2 | Normative references | 9 |
| 3 | Terms and definitions | 10 |
| 4 | Abbreviations | 11 |
| 5 | Overall requirements | 12 |
| 5.1 | Deviations from requirements | 12 |
| 5.2 | Functions | 12 |
| 5.3 | Operational criteria | 13 |
| 5.3.1 | Friction material performance | 13 |
| 5.3.2 | Service performance | 13 |
| 5.3.3 | Brake block characteristics | 14 |
| 6 | Acceptance procedure | 14 |
| 6.1 | Brake block performance requirements | 14 |
| 6.1.1 | General | 14 |
| 6.1.2 | Category A | 14 |
| 6.1.3 | Category B | 15 |
| 6.1.4 | Category C | 15 |
| 6.2 | Approval test requirements | 15 |
| 6.3 | Dynamometer specification | 18 |
| 7 | Category A requirements | 18 |
| 7.1 | Brake block characteristics | 18 |
| 7.1.1 | Standard design | 18 |
| 7.1.2 | Brake block characterization test | 18 |
| 7.1.3 | Brake block mechanical characteristics for service operation | 18 |
| 7.2 | Dynamic friction performance | 19 |
| 7.2.1 | Generic requirements for assessment process | 19 |
| 7.2.2 | Bedded and non bedded performance | 19 |
| 7.2.3 | Variation in mean coefficient of friction in dry condition for a brake to rest | 19 |
| 7.2.4 | Mean friction coefficient variation under wet conditions | 19 |
| 7.2.5 | Mean friction coefficient variation at high initial temperature | 20 |
| 7.2.6 | Mean friction coefficient variation after simulation of a downhill brake application | 20 |
| 7.2.7 | Instantaneous friction coefficient variation during simulation of a downhill brake application | 20 |
| 7.2.8 | Variation in instantaneous friction for a brake to rest | 22 |
| 7.3 | Static friction coefficient | 22 |
| 7.4 | Extreme winter conditions (freight wagons) | 22 |
| 7.4.1 | General | 22 |
| 7.4.2 | Dynamometer test | 23 |
| 7.4.3 | Train brake test | 23 |
| 7.5 | Locked brake (fusibility) | 23 |
| 7.5.1 | Generic prescriptions | 23 |
| 7.5.2 | Specific prescriptions for freight wagons | 24 |

| | | |
|---|---|----|
| 8 | Category B requirements | 24 |
| 8.1 | Vehicle brake test | 24 |
| 8.2 | Dynamometer wear test (friction couple) | 25 |
| 8.3 | Dynamic friction performance | 25 |
| 8.4 | In service assessment | 25 |
| 9 | Category C requirements | 25 |
| 9.1 | Metal pick up | 25 |
| 9.2 | Influence on track circuit operation (shuntage) | 26 |
| 10 | Environmental issues | 26 |
| 10.1 | General | 26 |
| 10.2 | Noise | 26 |
| 10.3 | Odour | 26 |
| 10.4 | Smoke, fumes and sparking | 26 |
| 10.5 | Recycling and disposal | 26 |
| 11 | Marking | 27 |
| Annex A (normative) Summary of Dynamometer test programs and acceptance criteria | | 28 |
| Annex B (normative) General requirements for conducting dynamometer test programmes | | 30 |
| B.1 | General | 30 |
| B.2 | Rotation and ventilation conditions | 30 |
| B.3 | Brake application timing ts | 30 |
| B.4 | Bedding | 30 |
| B.5 | Wear | 30 |
| B.6 | Roughness index of the wheel tread | 31 |
| B.7 | Interruption of the tests | 31 |
| B.8 | Temperatures | 31 |
| B.9 | Wet conditions | 31 |
| B.10 | Test of simulation of downhill | 32 |
| B.11 | Test wheels | 32 |
| Annex C (normative) Composite brake blocks (K) (2Bg - 2Bgu)- Demonstration of friction properties for S and SS (S/SS) - braked freight wagons (vmax = 120 km/h) | | 33 |
| C.1 | Program for performance tests | 33 |
| C.2 | Program for simulation brake assessment | 38 |
| C.3 | Dispersion range of mean friction coefficients | 39 |
| C.4 | Dispersion range of instantaneous friction coefficients | 42 |
| Annex D (normative) Composite brake blocks (LL) - Demonstration of friction properties for S and SS (S/SS) - braked freight wagons (vmax = 120 km/h) | | 44 |
| D.1 | Program for performance tests | 44 |
| D.2 | Program for simulation brake assessment | 48 |
| D.3 | Dispersion range of mean friction coefficients | 50 |
| D.4 | Dispersion range of instantaneous friction coefficients | 52 |
| Annex E (normative) Composite brake blocks (K) (1Bg)- Demonstration of friction properties for S and SS (S/SS) - braked freight wagons (vmax = 120 km/h) | | 53 |
| E.1 | Program for performance tests | 53 |
| E.2 | Dispersion range of mean friction coefficients | 56 |
| E.3 | Dispersion range of instantaneous friction coefficients | 58 |
| Annex F (normative) Composite brake blocks (L) - Demonstration of friction properties for extra tread brake of coach | | 59 |

| | | |
|---|--|------------|
| F.1 | Program for performance tests | 59 |
| F.2 | Program for simulation brake assessment | 62 |
| F.3 | Dispersion range of mean friction coefficients in dry condition | 63 |
| F.4 | Dispersion range of mean friction coefficients in wet condition | 64 |
| F.5 | Dispersion range of instantaneous friction coefficients | 65 |
| Annex G (normative) Composite brake blocks (K) - Demonstration of friction properties for locomotives | | 67 |
| G.1 | Program for performance tests | 67 |
| G.2 | Program for simulation brake assessment | 70 |
| G.3 | Dispersion range of mean friction coefficients in dry condition | 71 |
| G.4 | Dispersion range of mean friction coefficients in wet condition | 72 |
| G.5 | Dispersion range of instantaneous friction coefficients | 73 |
| Annex H (normative) Composite brake blocks (K) - Demonstration of friction properties for EMU - DMU | | 75 |
| H.1 | Program for performance tests | 75 |
| H.2 | Program for simulation brake assessment | 80 |
| H.3 | Dispersion range of mean friction coefficients in dry condition | 81 |
| H.4 | Dispersion range of mean friction coefficients in wet condition | 82 |
| H.5 | Dispersion range of instantaneous friction coefficients | 83 |
| Annex I (normative) Composite brake blocks (K) - Demonstration of friction properties for High speed train (motor bogie) | | 85 |
| I.1 | Program for performance tests | 85 |
| I.2 | Program for simulation brake assessment | 88 |
| I.3 | Dispersion range of mean friction coefficients in dry condition | 89 |
| I.4 | Dispersion range of mean friction coefficients in wet condition | 91 |
| I.5 | Dispersion range of instantaneous friction coefficients | 92 |
| Annex J (informative) Dynamometer test program - Generic test program | | 94 |
| J.1 | General | 94 |
| J.2 | Generic test program | 94 |
| J.3 | Definitions | 97 |
| J.4 | Principle of assessment and pass/fail criteria | 98 |
| Annex K (normative) Dynamometer Test program to detect the formation of metal pick-up at the brake block | | 99 |
| K.1 | Test program for freight wagons with brake blocks type K and LL | 99 |
| K.2 | Test program for locomotives with brake blocks type K | 101 |
| K.3 | Test program for EMU - DMU with brake blocks type K | 103 |
| K.4 | Test program for High speed train with brake blocks type K | 106 |
| Annex L (normative) Dynamometer test program to demonstrate the extreme winter braking properties | | 109 |
| L.1 | Test program for freight wagons with brake blocks type K | 109 |
| L.2 | Test program for freight wagons with brake blocks type LL | 111 |
| L.3 | Specific requirements for conducting Test Programs L.1 and L.2 | 112 |
| L.4 | Process of assessment and pass fail criteria for test programs L.1 and L.2 | 113 |
| L.5 | Generic flow chart to perform test program | 114 |
| L.6 | Detailed flow chart to perform test program (example brake block K) | 115 |
| Annex M (normative) Test run to demonstrate the extreme winter braking properties brake blocks K - LL for freight wagons | | 118 |
| M.1 | General | 118 |

| | | |
|--|---|-----|
| M.2 | Test conditions | 118 |
| M.3 | Bases for assessment | 119 |
| M.4 | Assessment of measurement data and pass/fail criteria | 121 |
| Annex N (normative) Dynamometer Test program to simulate "Locked brake" | | 123 |
| N.1 | Test program for freight wagons with brake blocks type K and LL | 123 |
| N.2 | Test program for locomotives with brake blocks type K | 124 |
| N.3 | Test program for EMU - DMU with brake blocks type K | 125 |
| N.4 | Test program for High speed train with brake blocks type K | 126 |
| Annex O (normative) Dynamometer test program to demonstrate the compatibility with track circuits | | 127 |
| O.1 | General | 127 |
| O.2 | Short description of the measuring method used | 127 |
| O.3 | Schematic diagram of test set up | 127 |
| O.4 | Flow chart to perform test program | 129 |
| O.5 | Preparation of the disc and the rollers | 129 |
| O.6 | Preparation of the samples of brake block | 129 |
| O.7 | Contamination of disc | 130 |
| O.8 | Measurements | 131 |
| O.9 | Assessment of the results | 132 |
| Annex P (informative) Vehicle test to demonstrate the compatibility with track circuits | | 134 |
| P.1 | General | 134 |
| P.2 | Test conditions | 134 |
| P.3 | Assessment of results | 135 |
| P.4 | Pass/fail criteria | 136 |
| Annex Q (informative) Dynamometer test program - Determination of static friction coefficient | | 138 |
| Q.1 | Test program for freight wagons with brake blocks type K and LL | 138 |
| Q.2 | Test program for EMU - DMU and Locomotive with brake blocks type K | 139 |
| Q.3 | Test program for High speed train with brake blocks type K | 140 |
| Q.4 | Specific Requirements for conducting dynamometer test programmes Q.1 to Q.3 | 140 |
| Annex R (informative) Dynamometer test program - Simulation of service conditions for freight wagons | | 143 |
| R.1 | Simulation freight wagon with brake block type K 2Bgu | 143 |
| R.2 | Simulation freight wagon with brake block type LL 2Bgu | 145 |
| Annex S (normative) Interchangeability, rejection lugs and critical dimensions | | 148 |
| Annex T (normative) Brake block shear and flexural strength tests | | 151 |
| T.1 | General | 151 |
| T.2 | Shear strength test | 151 |
| T.3 | Flexural strength test | 152 |
| Annex U (normative) Limitation of permissible mechanical damage of brake block | | 154 |
| U.1 | General | 154 |
| U.2 | Cracked through to back-plate | 154 |
| U.3 | Crumbling of the friction material | 155 |
| U.4 | Metal pick-up | 155 |
| U.5 | Detachment from back-plate | 156 |
| U.6 | Cracks in the direction of wheel circumference | 156 |
| U.7 | Detachment of the friction material | 156 |
| U.8 | Interface with the brake block holder | 156 |

| | |
|---|------------|
| Annex V (normative) In service assessment of brake block | 158 |
| V.1 General | 158 |
| V.2 Freight wagon | 158 |
| V.3 Coach | 159 |
| V.4 Locomotive | 159 |
| V.5 EMU-DMU | 160 |
| V.6 High speed train | 160 |
| V.7 Description of areas to be monitored and additional measures | 161 |
| V.8 Pass/fail criteria | 162 |
| Annex W (informative) Complementary definitions and abbreviations | 163 |
| Annex X (informative) Brake block characterization test | 165 |
| Annex ZA (informative) Relationship between this European Standard and the Essential Requirements of EU Directive 2008/57/EC | 166 |
| Bibliography | 169 |