

DIN EN 15595:2019-03 (E)

Railway applications - Braking - Wheel slide protection

Contents		Page
European foreword		6
Introduction		7
1	Scope	8
2	Normative references	8
3	Terms and definitions	9
4	Symbols and abbreviations	12
5	Requirements	12
5.1	Functional requirements	12
5.1.1	Objectives of wheel slide protection	12
5.1.2	General functional requirements	13
5.1.3	Control of the brake force	13
5.1.4	Wheel slide protection watchdog (safety timer)	14
5.1.5	Air supply	14
5.1.6	Wheel diameter differences	14
5.1.7	Wheel rotation monitoring (WRM)	14
5.1.8	Diagnostics	15
5.2	Design requirements	16
5.2.1	Environmental specification	16
5.2.2	Fire behaviour	16
5.2.3	RAMS	17
5.2.4	Mechanical construction	17
5.2.5	Power management	17
5.2.6	Software	18
5.2.7	Electronic control unit Input/Output (I/O)	18
5.2.8	Sensor - axle speed acquisition	18
5.2.9	Actuator - modification of brake force	18
5.3	Installation recommendations	19
5.3.1	General installation requirements	19
5.3.2	Air system	19
5.3.3	Power supply and electrical system	19
5.4	Performance requirements for WSP	20
5.4.1	Performance	20
5.4.2	Stopping distance and adhesion improvement	21
5.4.3	Wheelset slide limits	21
5.4.4	Track damage	22
5.4.5	Maximum deceleration	22
5.4.6	Air consumption	23
5.4.7	Output based on speed information provided by WSP	23
6	Range of tests	24
6.1	General	24
6.1.1	Test classifications	24
6.1.2	Assessor	24
6.2	Type Test	24
6.2.1	General	24
6.2.2	Test requirements	24

6.2.3	Individual component Type Test	24
6.3	Vehicle Implementation Test	25
6.3.1	General	25
6.3.2	Test requirements	26
6.3.3	Conformity of previous vehicle tests	26
6.4	List of tests	26
6.4.1	Standard tests	26
6.4.2	Drag tests	26
6.4.3	Test methods for speeds from 160 up to 200 km/h	27
6.4.4	Test methods for speeds > 200 km/h	27
6.4.5	Supplementary higher deceleration tests	27
6.4.6	Supplementary approval tests for WSP acting in vehicles with brakes that are independent of adhesion	27
6.4.7	Supplementary approval tests involving tractive units and trainsets having dynamic brakes	27
6.4.8	Testing of wheel rotation monitoring (WRM)	28
6.5	Re-testing	34
6.5.1	General	34
6.5.2	Hardware	34
6.5.3	Software	35
7	Test methods	35
7.1	General	35
7.2	Measurement	36
7.3	Tests on vehicle	37
7.3.1	General	37
7.3.2	Generation of degraded adhesion	38
7.3.3	Environmental conditions	38
7.4	Test in simulation environment	39
7.4.1	General	39
7.4.2	Tests on simulation rig	39
7.4.3	Additional specific simulator tests	40
7.4.4	Optional tests	40
8	Evaluation of test	40
8.1	Correcting the stopping distances	40
8.2	Number and validity of dry tests	40
8.3	Evaluation of slide test	40
8.3.1	General	40
8.3.2	Evaluation of stopping performance	41
8.3.3	Evaluation of test validity	42
8.3.4	Evaluation of relative air consumption	51
9	Documentation of tests	52
9.1	Test Specification	52
9.2	Test report	53
10	Routine test and inspection	54
11	Designation, identification and marking	54
Annex A (normative) Tables linking the WSP / WRM Requirements to Tests and Test Criteria		55
Annex B (normative) Minimum requirements for a WSP simulator		75
B.1	General	75
B.1.1	General	75
B.1.2	Use of the simulator model	75
B.2	Adhesion model	81
B.2.1	General	81
B.2.2	Constant adhesion condition	81
B.2.3	Variable adhesion condition	81

B.2.4	Adhesion conditioning factors	82
B.3	Test and performance model	82
B.3.1	General	82
B.3.2	Simulator performance	82
B.3.3	Test requirements	82
B.3.4	Stopping performance	82
B.3.5	Wheel damage	83
B.3.6	Air system	83
B.3.7	Pass/fail limits	83
B.3.8	Fault conditions	83
B.3.9	WSP outputs	84
B.4	Vehicle performance model	84
B.4.1	General	84
B.4.2	Friction material	84
B.4.3	Pneumatic actuator/brake demand	84
B.4.4	Body/Bogie/wheel dynamics	84
B.5	Vehicle functional model	85
B.5.1	General	85
B.5.2	Functional inputs	85
B.6	Simulator validation	85
B.6.1	General	85
B.6.2	Validation of test benches	85
B.6.3	Management	88
Annex C (informative) Example of customer specific simulator tests		89
C.1	Naturally occurring variable adhesion tests	89
C.1.1	General	89
C.1.2	Sequence	89
C.1.3	Measurement and pass/fail criteria	91
C.2	Sustained low adhesion track condition (SLAC) Tests	92
C.2.1	Sequence	92
C.2.2	Measurement/pass fail criteria	93
C.2.3	WSP speed reference (vref)	93
C.3	Operating speeds above 160 km/h	93
C.3.1	Criteria	93
C.3.2	Sequence	94
C.3.3	Measurement and pass/fail criteria	94
Annex D (informative) Optional tests		95
D.1	Sander system tests -- Criteria	95
D.2	Dynamic braking system tests -- Criteria	96
D.3	Peripheral output tests -- Criteria	96
Annex E (informative) Typical diagram of a real WSP test		98
Annex F (informative) In-service monitoring		100
Annex G (informative) Braking configurations		101
G.1	Per bogie control	101
G.2	Per wagon control	101
Annex ZA (informative) Relationship between this European Standard and the Essential Requirements of EU Directive 2008/57/EC aimed to be covered		103
Bibliography		105