

# DIN EN 15610:2021-11 (E)

## Railway applications - Acoustics - Rail and wheel roughness measurement related to rolling noise generation

---

<b>Contents</b>		<b>Page</b>
European foreword .....		4
1	Scope .....	5
2	Normative references .....	6
3	Terms and definitions .....	6
4	Symbols .....	9
5	Rail roughness .....	9
5.1	Measuring system requirements .....	9
5.1.1	General .....	9
5.1.2	Accuracy of the output signal .....	9
5.1.3	Dimensions of the sensor .....	9
5.1.4	Tracking of the sensor .....	10
5.1.5	Sampling interval .....	10
5.1.6	Record length .....	10
5.1.7	Calibration and traceability to a national measurement standard .....	10
5.2	Data acquisition .....	10
5.2.1	General .....	10
5.2.2	Test section requirements .....	10
5.2.3	Reference surface choice .....	11
5.2.4	Data sampling .....	12
5.2.5	Preparation of the rail head surface .....	13
5.2.6	Acoustic roughness acquisition .....	13
5.3	Data processing .....	13
5.3.1	Principle .....	13
5.3.2	Spike removal technique .....	14
5.3.3	Curvature processing .....	15
5.3.4	Spectral analysis .....	16
5.3.5	Procedure for extending the wavelength range .....	17
5.3.6	Averaging process .....	17
6	Wheel roughness .....	17
6.1	Measuring system requirements .....	17
6.1.1	General .....	17
6.1.2	Accuracy of the output signal .....	17
6.1.3	Dimensions of the sensor .....	17
6.1.4	Tracking of the sensor .....	17
6.1.5	Sampling interval .....	17
6.1.6	Calibration and traceability to a national measurement standard .....	18
6.2	Data acquisition .....	18
6.2.1	General .....	18
6.2.2	Data sampling .....	18
6.2.3	Vehicle preparation .....	19
6.2.4	Acoustic roughness acquisition .....	19
6.2.5	Data quality checks .....	19
6.2.6	Localized geometric wheel features .....	20
6.3	Data processing .....	20
6.3.1	Principle .....	20

6.3.2	Spike removal technique .....	20
6.3.3	Curvature processing .....	21
6.3.4	Spectral analysis .....	21
6.3.5	Averaging the roughness spectra .....	22
7	Acceptance criteria .....	22
7.1	Rail roughness .....	22
7.2	Wheel roughness .....	22
8	Presentation of the rail and wheel roughness spectra .....	22
9	Report .....	23
9.1	Rail roughness .....	23
9.2	Wheel roughness .....	23
Annex A (informative) Examples of localized geometrical features on the rail .....		25
Annex B (normative) Algorithm used to synthesize a one-third octave band spectrum from a corresponding narrow band spectrum for rail roughness .....		27
Annex C (informative) Determination of the combined roughness (and contact filters) .....		28
Annex D (informative) Quantification of measurement uncertainties according to ISO/IEC Guide 98- 3 .....		29
D.1	General .....	29
D.2	Mathematical model .....	30
D.3	Determination of the standard uncertainties .....	30
D.4	Determination of the combined standard uncertainty .....	31
D.5	Determination of the expanded uncertainty .....	32
Annex E (informative) An example of a rail roughness report sheet .....		33
Annex ZA (informative) Relationship between this European Standard and the Essential Requirements of EU Directive 2008/57/EC aimed to be covered .....		34
Bibliography .....		35