

SVENSK STANDARD

SS-EN 16727-2-1:2018

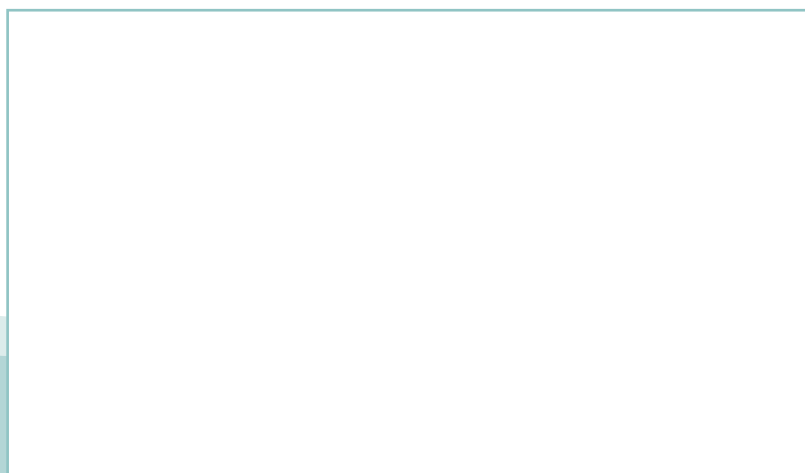
Fastställt/Approved: 2018-07-04
Utgåva/Edition: 1
Språk/Language: engelska/English
ICS: 45.060.01;93.100

Järnvägar – Spår – Bullerbarriärer och andra arrangemang som motverkar utbredningen av luftburet buller – Icke-akustiska egenskaper –

Del 2-1: Mekaniska egenskaper vid dynamiska belastningar orsakade av passerande tåg – Beständighet mot utmattning

Railway applications – Track – Noise barriers and related devices acting on airborne sound propagation – Non-acoustic performance –

Part 2-1: Mechanical performance under dynamic loadings due to passing trains – Resistance to fatigue



Standarder får världen att fungera

SIS (Swedish Standards Institute) är en fristående ideell förening med medlemmar från både privat och offentlig sektor. Vi är en del av det europeiska och globala nätverk som utarbetar internationella standarder. Standarder är dokumenterad kunskap utvecklad av framstående aktörer inom industri, näringsliv och samhälle och befrämjar handel över gränser, bidrar till att processer och produkter blir säkrare samt effektiviserar din verksamhet.

Delta och påverka

Som medlem i SIS har du möjlighet att påverka framtida standarder inom ditt område på nationell, europeisk och global nivå. Du får samtidigt tillgång till tidig information om utvecklingen inom din bransch.

Ta del av det färdiga arbetet

Vi erbjuder våra kunder allt som rör standarder och deras tillämpning. Hos oss kan du köpa alla publikationer du behöver – allt från enskilda standarder, tekniska rapporter och standardpaket till handböcker och onlinetjänster. Genom vår webbtjänst e-nav får du tillgång till ett lättnavigerat bibliotek där alla standarder som är aktuella för ditt företag finns tillgängliga. Standarder och handböcker är källor till kunskap. Vi säljer dem.

Utveckla din kompetens och lyckas bättre i ditt arbete

Hos SIS kan du gå öppna eller företagsinterna utbildningar kring innehåll och tillämpning av standarder. Genom vår närhet till den internationella utvecklingen och ISO får du rätt kunskap i rätt tid, direkt från källan. Med vår kunskap om standarders möjligheter hjälper vi våra kunder att skapa verklig nytta och lönsamhet i sina verksamheter.

Vill du veta mer om SIS eller hur standarder kan effektivisera din verksamhet är du välkommen in på www.sis.se eller ta kontakt med oss på tel 08-555 523 00.



Standards make the world go round

SIS (Swedish Standards Institute) is an independent non-profit organisation with members from both the private and public sectors. We are part of the European and global network that draws up international standards. Standards consist of documented knowledge developed by prominent actors within the industry, business world and society. They promote cross-border trade, they help to make processes and products safer and they streamline your organisation.

Take part and have influence

As a member of SIS you will have the possibility to participate in standardization activities on national, European and global level. The membership in SIS will give you the opportunity to influence future standards and gain access to early stage information about developments within your field.

Get to know the finished work

We offer our customers everything in connection with standards and their application. You can purchase all the publications you need from us - everything from individual standards, technical reports and standard packages through to manuals and online services. Our web service e-nav gives you access to an easy-to-navigate library where all standards that are relevant to your company are available. Standards and manuals are sources of knowledge. We sell them.

Increase understanding and improve perception

With SIS you can undergo either shared or in-house training in the content and application of standards. Thanks to our proximity to international development and ISO you receive the right knowledge at the right time, direct from the source. With our knowledge about the potential of standards, we assist our customers in creating tangible benefit and profitability in their organisations.

If you want to know more about SIS, or how standards can streamline your organisation, please visit www.sis.se or contact us on phone +46 (0)8-555 523 00



Europastandarden EN 16727-2-1:2018 gäller som svensk standard. Detta dokument innehåller den officiella engelska versionen av EN 16727-2-1:2018.

The European Standard EN 16727-2-1:2018 has the status of a Swedish Standard. This document contains the official version of EN 16727-2-1:2018.

© Copyright/Upphovsrätten till denna produkt tillhör SIS, Swedish Standards Institute, Stockholm, Sverige. Användningen av denna produkt regleras av slutanvändarlicensen som återfinns i denna produkt, se standardens sista sidor.

© Copyright SIS, Swedish Standards Institute, Stockholm, Sweden. All rights reserved. The use of this product is governed by the end-user licence for this product. You will find the licence in the end of this document.

Upplysningar om sakinnehållet i standarden lämnas av SIS, Swedish Standards Institute, telefon 08-555 520 00. Standarder kan beställas hos SIS som även lämnar allmänna upplysningar om svensk och utländsk standard.

Information about the content of the standard is available from the Swedish Standards Institute (SIS), telephone +46 8 555 520 00. Standards may be ordered from SIS, who can also provide general information about Swedish and foreign standards.

Denna standard är framtagen av kommittén för Järnvägar, SIS/TK 254.

Har du synpunkter på innehållet i den här standarden, vill du delta i ett kommande revideringsarbete eller vara med och ta fram andra standarder inom området? Gå in på www.sis.se - där hittar du mer information.

EUROPEAN STANDARD

EN 16727-2-1

NORME EUROPÉENNE

EUROPÄISCHE NORM

June 2018

ICS 93.100

English Version

Railway applications - Track - Noise barriers and related devices acting on airborne sound propagation - Non-acoustic performance - Part 2-1: Mechanical performance under dynamic loadings due to passing trains - Resistance to fatigue

Applications ferroviaires - Voie - Écrans antibruit et dispositifs connexes influant sur la propagation aérienne du son - Performances non acoustiques -
Partie 2-1 : Tenue mécanique sous charges dynamiques dues à la circulation ferroviaire -
Résistance à la fatigue

Bahnanwendungen - Oberbau - Lärmschutzwände und verwandte Vorrichtungen zur Beeinflussung der Luftschallausbreitung - Nicht akustische Eigenschaften -
Teil 2-1: Mechanische Eigenschaftsanforderungen unter dynamischen Belastungen aufgrund vorbeifahrender Züge - Prüfverfahren zum Ermüdungsverhalten

This European Standard was approved by CEN on 8 February 2018.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

SS-EN 16727-2-1:2018 (E)

Contents	Page
European foreword	3
Introduction	4
1 Scope	5
2 Normative references	5
3 Terms and definitions	5
4 Symbols and abbreviations	6
5 Analytical verification	7
6 General requirements for testing	8
7 Test arrangement and evaluation of results	9
7.1 General	9
7.2 Verification procedure A	10
7.3 Verification procedure B	10
7.4 Verification procedure C	11
8 Test report	12
Annex A (informative) Determination of the fatigue-strength curve	14
Annex B (informative) Verification procedure C – Additional information	17
Bibliography	20

European foreword

This document (EN 16727-2-1:2018) has been prepared by Technical Committee CEN/TC 256 “Railway applications”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by December 2018, and conflicting national standards shall be withdrawn at the latest by December 2018.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document is one of the series EN 16727, *Railway applications — Track — Noise barriers and related devices acting on airborne sound propagation — Non-acoustic performance*, as listed below:

- *Part 1: Mechanical performance under static loadings — Calculation and test method;*
- *Part 2-1: Mechanical performance under dynamic loadings due to passing trains — Resistance to fatigue [this document];*
- *Part 2-2: Mechanical performance under dynamic loadings caused by passing trains — Calculation method;*
- *Part 3: General safety and environmental requirements.*

It is intended to be read in conjunction with:

- EN 16727-1, *Railway applications — Track — Noise barriers and related devices acting on airborne sound propagation — Non-acoustic performance — Part 1: Mechanical performance under static loadings — Calculation and test method;*
- EN 16727-2-2, *Railway applications — Track — Noise barriers and related devices acting on airborne sound propagation — Non-acoustic performance — Part 2-2: Mechanical performance under dynamic loadings caused by passing trains — Calculation method.*

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

SS-EN 16727-2-1:2018 (E)**Introduction**

Passing trains generate an air pressure wave, which impacts on noise barriers installed alongside the track. It is important that noise barriers withstand this impact without any part of them becoming detached or displaced in an unsafe manner; they should be designed for the specified requirements in ultimate, serviceability and fatigue limit states. Where no design rules or sufficient experience with components are available, the design should be based on calculation and/or tests carried out in a way that provides information on the properties of the component for design in ultimate and serviceability limit states and the resistance to fatigue. This document applies for noise barrier components or for noise barriers considered as a whole.

1 Scope

This document describes the basic requirements for the verification of ultimate and serviceability limit states and the resistance to fatigue either of the noise barrier or its components by means of analytical methods and/or tests.

Analytical methods can be used for the determination of the characteristic values and design values.

Where sufficient information is not available, the analytical procedure can be combined with results from tests.

This document provides the following types of test procedures:

- test on small samples for defining detail categories, which may not be covered by Eurocodes (verification procedure A);
- test on a global element for defining the limit state against fatigue (verification procedure B);
- full scale tests under a given representative loading (verification procedure C) to determine fatigue resistance of the noise barrier components for defined loading conditions; verification procedure C is given as alternative to verification procedures A and B.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 1990:2002¹, *Eurocode — Basis of structural design*

EN 1992 (all parts), *Eurocode 2: Design of concrete structures*

EN 1993 (all parts), *Eurocode 3 — Design of steel structures*

EN 1999 (all parts), *Eurocode 9: Design of aluminium structures*

EN 16727-1, *Railway applications — Track — Noise barriers and related devices acting on airborne sound propagation — Non-acoustic performance — Part 1: Mechanical performance under static loadings — Calculation and test method*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

¹ This document is currently impacted by the amendment EN 1990:2002/A1:2005 and corrigendum EN 1990:2002/A1:2005/AC:2010.

SS-EN 16727-2-1:2018 (E)

3.1

noise barrier

noise reducing device, which obstructs the direct transmission of airborne sound emanating from railways, and which will typically span between posts and also may overhang the railway

Note 1 to entry: Noise barriers are generally made of acoustic and structural elements (3.3 and 3.4).

3.2

cladding

noise reducing device, which is attached to a wall or other structure and reduces the amount of sound reflected

Note 1 to entry: Claddings are generally made of acoustic and structural elements (3.3 and 3.4).

3.3

acoustic element

element whose primary function is to provide the acoustic performance of the device

3.4

structural element

element whose primary function is to support or hold in place acoustic elements

Note 1 to entry: In some noise barriers, the acoustic function and the structural function cannot be clearly separated and attributed to different components.

3.5

added device

added component that influences the acoustic performance of the original noise-reducing device (acting primarily on the diffracted energy)

Note 1 to entry: In some noise barriers, the acoustic function and the structural function cannot be clearly separated and attributed to different components.

3.6

representative loading

loading which takes into account the load effects caused by the air pressure wave of the train, the site-dependent parameters, the dynamic amplification factor and the fatigue stress behaviour of the component, including the fatigue damage accumulation

Note 1 to entry: Examples of site-dependent parameters are: the design life, the number of trains per day, the maximum train speed, the spacing between the noise barrier and the rail track.

4 Symbols and abbreviations

For the purposes of this document, the following symbols and abbreviations apply.

Table 1 — Symbols and abbreviations

Symbol or abbreviation	Designation	Unit
a	term for the representation of the mean value (50 % exceedance probability) of the S-N curve on a logarithmic scale	-
a_k	auxiliary parameter	-
m	factor for the representation of the mean value (50 % exceedance probability) of the S-N curve on a logarithmic scale	-
$\Delta\sigma_i$	single value of the stress range	Pa
$\Delta\sigma_{G,m}$	stress range at 2 million load cycles, mean value	Pa
$\Delta\sigma_{G,k}$	characteristic value of the fatigue strength at 2 million load cycles	Pa
$\Delta\sigma_R$	stress range of the S-N-curve	Pa
N_i	single value of the number of load cycles	-
N_c	number of 2 million load cycles	-
$N_{c,k}$	spread around the mean value under the assumption of a Student-t distribution	-
N_R	number of load cycles of the S-N-curve	-
x_i	$\log \Delta\sigma_i$	-
y_i	$\log N_i$	-
\bar{x}	mean value of x_i	-
\bar{y}	mean value of y_i	-
n	number of specimens	-
S_{xx}	variance of the random variable x_i	-
S_{yy}	variance of the random variable y_i	-
S_{xy}	covariance of the random variables x_i and y_i	-
S_N	standard deviation	-
f	auxiliary parameter for the representation of the 95 % confidence interval derived from the S-N curve on a logarithmic scale	-
x_c	auxiliary parameter	-
$t(\alpha)$	parameter describing the Student-t Distribution with $(n-2)$ degrees of freedom and a 95 % confidence interval	-

5 Analytical verification

Where the design can be performed by analytical models, the verification for the foundations, posts and panels shall be in accordance with relevant Eurocodes or European Assessment Documents (EAD)².

² European Assessment Documents (EAD), established by the European Organisation for Technical Assessment (EOTA), under the Construction Products Regulation (CPR) 305/2011. Freely available at <https://www.eota.eu/>.