SLOVENSKI STANDARD
oSIST prEN 14584:2012

01-januar-2012

Neporušitveno preiskušanje - Akustična emisija - Pregled kovinskih tlačnih naprav med preskušanjem

Non-destructive testing - Acoustic emission - Examination of metallic pressure equipment during proof testing

Zerstörungsfreie Prüfung - Schallemissionsprüfung - Prüfung von metallischen Druckgeräten während der Abnahmeprüfung

Essais non destructifs - Emission acoustique - Vérification des équipements métalliques sous pression pendant l'épreuve - Localisation planaire des sources d'EA

Ta slovenski standard je istoveten z: prEN 14584

ICS:

17.140.20	Emisija hrupa naprav in opreme	Noise emitted by machines and equipment
19.100	Neporušitveno preskušanje	Non-destructive testing

oSIST prEN 14584:2012 en,fr,de

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

DRAFT
prEN 14584

August 2011

ICS 17.140.20; 77.040.20

Will supersede EN 14584:2005

English Version

Non-destructive testing - Acoustic emission - Examination of metallic pressure equipment during proof testing

Essais non destructifs - Emission acoustique - Vérification des équipements métalliques sous pression pendant l'épreuve - Localisation planaire des sources d'EA

Zerstörungsfreie Prüfung - Schallemissionsprüfung - Prüfung von metallischen Druckgeräten während der Abnahmeprüfung

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 138.

If this draft becomes a European Standard, 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.

This draft European Standard was established by CEN 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, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

Warning : This document is not a European Standard. It is distributed for review and comments. It is subject to change without notice and shall not be referred to as a European Standard.

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

Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. prEN 14584:2011: E

Contents

Page

Foreword

This document (prEN 14584:2011) has been prepared by Technical Committee CEN/TC 138 “Non-destructive testing”, the secretariat of which is held by AFNOR.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 14584:2005.

1 Scope

The purpose of this European Standard is to describe the method for conducting acoustic emission (AE) + testing of metallic pressure equipment during acceptance pressure testing using a planar location method. General principles of Acoustic Emissions are described in EN 13554.

The objectives of the AE testing are to provide 100 % volumetric testing to define regions of the structure, which are acoustically active with burst type AE e.g. as a result of sub-critical flaw evolution; thus increasing the reliability of the acceptance test. The test provides a reference map for comparison with results of future tests.

2 Normative references

The following referenced documents are indispensable for the application 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 1330-1, *Non-destructive testing – Terminology – Part 1: List of general terms*

EN 1330-2, *Non-destructive testing – Terminology – Part 2: Terms common to the non-destructive testing methods*

EN 1330-9, *Non-destructive testing – Terminology – Part 9: Terms used in acoustic emission testing*

EN 13477-2, *Non-destructive testing – Acoustic emission – Equipment characterisation – Part 2: Verification of operating characteristics*

EN 13554:2011, *Non-destructive testing – Acoustic emission testing – General principles*

EN 473:2008, *Non-destructive testing – Qualification and certification of NDT personnel – General principles*

EN ISO/IEC 17025:2005, *General requirements for the competence of testing and calibration laboratories*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 1330-1, EN 1330-2 and EN 1330-9 apply.

4 Personnel Qualification

It is assumed that acoustic emission testing is performed by qualified and capable personnel. In order to prove this qualification, it is recommended to certify the personnel in accordance with EN 473.

NOTE For pressure equipment see directive 97/23/EC, annex 3.1.3: "For pressure equipment in categories III and IV, the personnel must be approved by a third party organization recognized by a Member State"

5 General

5.1 General

The main target of the AE test is to detect, locate and monitor acoustic emission sources caused by phenomena generated by the applied load to the equipment e.g. crack growth and yielding.

The properties and structural state of the material, the type and magnitude of the applied stress and stress rate are significant factors affecting the emission.

All relevant located AE sources shall be evaluated by other NDT methods.

5.2 Application of load

The application of stress to the equipment shall be made using internal pressure following the procedure specified in the relevant Product Standard. The rate of the application of pressure shall be limited to avoid burst signal overlap. The pressurising system shall permit pressurisation at a steady controllable rate and shall allow the pressure to be held constant at the hold points. For pneumatic pressurisation the pressurisation rate would not normally exceed 1 % of test pressure per minute, and for hydraulic loading 5 % per minute. The intermediate hold periods, if necessary according to the AE activity or the pre-defined pressure schedule, will normally be 5 min to 10 min. The final hold period at the test pressure shall have a minimum duration of 15 min.

NOTE Intermediate hold periods are strongly recommended, especially if pressurisation rates exceed 0,5 % per minute for pneumatic or 2 % per minute for hydraulic tests.

Prior to starting the test, all the necessary actions shall be taken to identify and to reduce potential sources of extraneous noise.

Dependent upon the results of the initial loading, a reduction of the load to working pressure or lower, followed by re-pressurisation, may be required.

5.3 Sensors

The most commonly used frequency range is 100 kHz to 300 kHz. Lower frequency monitoring allows detection at greater distances and high frequency monitoring provides improved rejection of external noise. Selection of frequency range may optimise location accuracy by avoiding the detection of multiple wave modes.

The equipment surface below the sensors shall be cleaned to ensure the maximum coupling efficiency. The sensor couplant shall be as specified in the written test instruction. The sensors may be directly attached to the structure using magnetic devices or an adhesive.

The effectiveness and reliability of the acoustic couplant shall be verified. The characteristics of the type of the acoustic couplant used shall not affect the structure adversely.

5.4 Location

The location of AE sources is performed using delta t measurement.

The accuracy is normally within ± 5 % of the maximum used sensor spacing ($d_{max,u}$) (see 7.1.2) and shall be measured and verified using an artificial source. The artificial source shall have an amplitude equivalent to the Hsu-Nielsen source minus the value of K. Alternatively a Hsu-Nielsen source may be used and the detection threshold raised to the evaluation threshold during these location accuracy checks. If the accuracy is not within ± 5 %, appropriate action shall be taken.

For difficult geometry e.g. nozzles, manholes, reference measurements shall be made.

5.5 Preliminary information

Prior to the test, the AE Test Organisation shall collect the following information, as relevant:

a) relevant Product Standard;

b) type of equipment or structure and material characteristics and specifications;

c) assembly and/or layout drawings with sufficient details of the structure;

d) material specifications, including heat treatment; if applicable

e) proposed pressure/stress application sequence;

f) potential acoustic noise interference sources and the isolating mechanism applied;

g) where possible, locations of known discontinuities and the general results of prior NDT.

5.6 Written instruction requirements

The AE Test Organisation shall provide a written test instruction, which shall include but not necessarily be restricted to the following:

a) explicit indication of the purpose of the test and limitations if any;

b) sensor type, frequency and manufacturer;

c) method of sensor attachment;

d) type of acoustic couplant used;

e) type of surface preparation;

f) type of AE equipment used with the main characteristics;

g) energy measurement method to be used;

h) value of K from relevant Product standard, if available

i) sensor location maps representing the structure or part of it;

j) description of equipment verification procedure;

k) description of the in-situ verification (see 7.2.2);

l) sequence of pressurisation;

m) recorded data and recording method;

n) available on-line presentation of data;

o) real time evaluation criteria;

p) post analysis procedure with adopted filtering technique if used;

q) final report requirements;

r) qualification/certification of the personnel.

The test instruction shall be prepared in accordance with EN 473:2008, Table D.1.

6 Instrumentation

An AE system consists of sensors and equipment for signal conditioning and processing and for displaying and recording data according to EN 13477-1.

The AE instrument shall be capable of measuring at least the following parameters on all channels:

a) AE burst count;

b) Burst signal peak amplitude;

c) Burst signal duration;

d) Burst signal rise time;

e) Burst signal energy;

f) arrival time (leading edge and/or peak)

and on the external input: external parameters, such as pressure and/or other stress parameters.

In order to allow a real time control of the pressure equipment under test the test instrumentation shall:

— Store all the acquired AE data and the external parameter(s);

— Provide an on-line location display;

— Provide an on-line display of AE data and pressure.

To assist the on-line evaluation it is recommended that the instrumentation provides real time distance peak amplitude correction and applies grading.

The AE system performance check (including sensors) shall be performed according to EN 13477-2.

7 Testing

7.1 Pre-Tes Measurements

7.1.1 Wave propagation

Attenuation measurements shall be performed on the structure in order to determine the maximum sensor spacing. The measurements shall be performed with the test fluid in the equipment using the Hsu-Nielsen source. In the case that the Hsu-Nielsen source saturates the measurement chain, a lower energy artificial source shall be used up to the 20 e distance (see Annex). The obtained curve shall in this case be shifted-up to correspond with the original Hsu-Nielsen source.

The burst signal peak amplitude versus distance, and wave velocity to be used in the location algorithm, shall be measured using two sensors mounted in a region of the pressure equipment away from nozzles, manways, etc.

The shadowing effect of nozzles and ancillary attachments shall be quantified and transmission through the test fluid shall be taken into consideration.

7.1.2 Determination of maximum allowed sensor spacing

The sensors shall be positioned on the structure such that a source K dB less than a Hsu-Nielsen source can be detected and located to the specified accuracy, at any position on the equipment. This must also be achievable under test conditions where noise due to pressurisation may be present.

The value of K shall be obtained from the relevant Product Standard and given in the written test instruction.

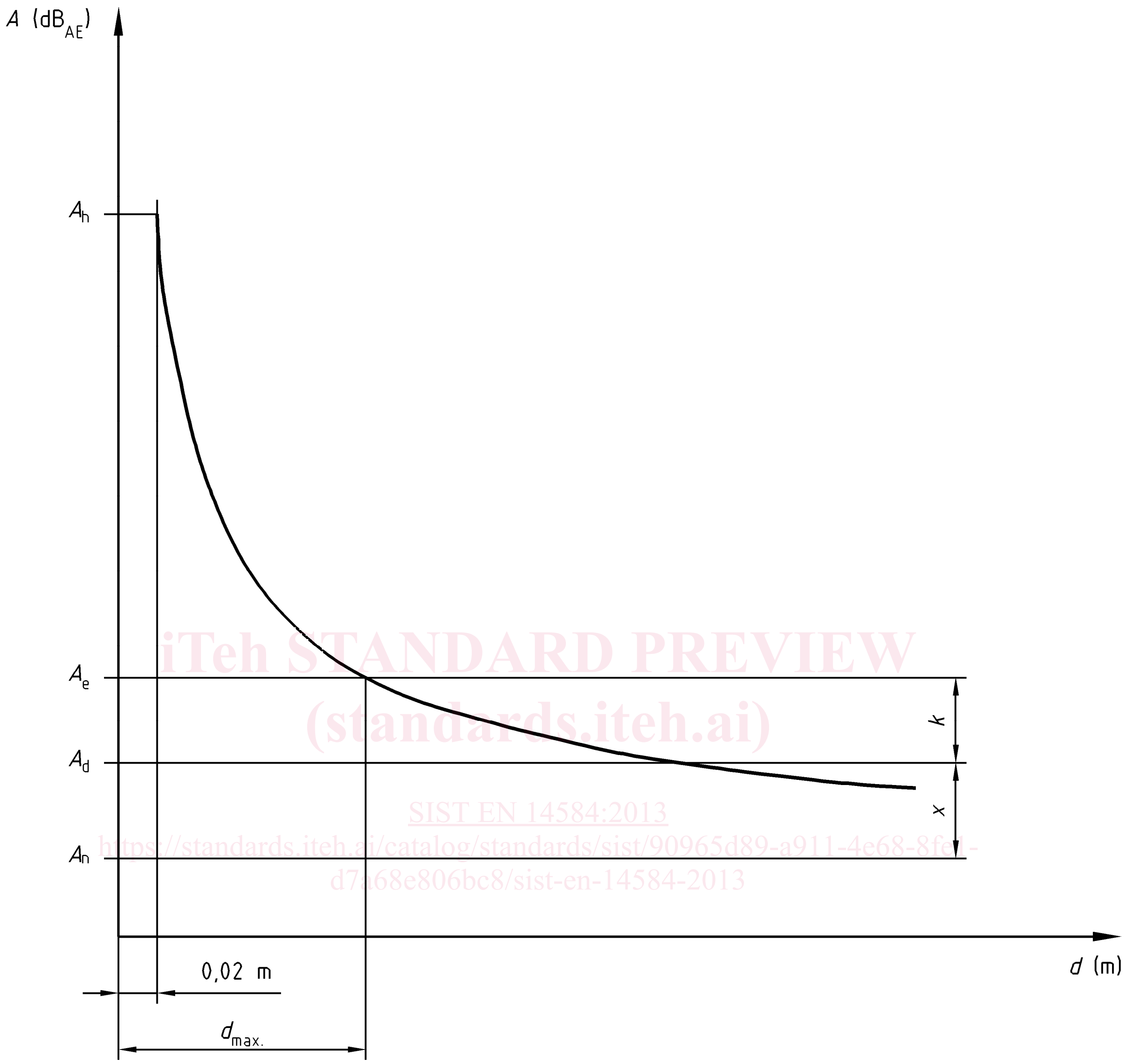
With reference to Figure 1

a) Set the detection threshold X dB above the peak background noise. The peak background noise is defined as the threshold at which there is less than one hit per second on any channel.

NOTE The value of X will typically be between 6 and 18 dB, dependent upon the noise level from pressurisation.

b) Set the evaluation threshold for determining the sensor spacing K dB above the detection threshold.

c) The maximum distance (d_{max}) is given by the intersection of the attenuation curve with the evaluation threshold (A_e),



Key

A peak amplitude

A_d detection threshold

A_e evaluation threshold

A_h peak amplitude of Hsu-Nielsen source at 0,02 m from the centre of sensor

A_n peak background noise

d distance

Figure 1 — Determination of the maximum sensor spacing from the attenuation curve.