



SLOVENSKI STANDARD

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Nadomešča:
SIST EN 14584:2005

Neporušitveno preskušanje - 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 de sources d'EA

Ta slovenski standard je istoveten z: **EN 14584:2013**

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

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EUROPEAN STANDARD

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Supersedes EN 14584:2005

English Version

Non-destructive testing - Acoustic emission testing -
Examination of metallic pressure equipment during proof testing
- Planar location of AE sources

Essais non destructifs - Émission acoustique - Vérification
des équipements métalliques sous pression pendant
l'épreuve

Zerstörungsfreie Prüfung - Schallemissionsprüfung -
Prüfung von metallischen Druckgeräten während der
Abnahmeprüfung - Planare Ortung von
Schallemissionsquellen

This European Standard was approved by CEN on 7 March 2013.

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, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.



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Foreword

This document (EN 14584:2013) has been prepared by Technical Committee CEN/TC 138 “Non-destructive testing”, the secretariat of which is held by AFNOR.

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 November 2013, and conflicting national standards shall be withdrawn at the latest by November 2013.

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

This document supersedes EN 14584:2005.

Changes from the previous edition include:

- Clause 1: Applicability.
- Clause 4: Qualification of responsible test personnel AT2.
- Clause 8: Insertion of a further evaluation criteria about the occurrence of high energetic burst signals within a cluster.
- Annex A: Some clarifications for the recalculation according to the attenuation curve.

According to the CEN-CENELEC Internal Regulations, the national standards organisations 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, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

EN 14584:2013 (E)**1 Scope**

This European Standard describes the method for conducting acoustic emission testing (AT) of metallic pressure equipment during acceptance pressure testing using a planar location method. This standard is applicable also for subsequent tests for requalification. 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 evolution of sub-critical discontinuities, 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 documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 1330-1:1998, *Non destructive testing — Terminology — Part 1: List of general terms*

EN 1330-2:1998, *Non destructive testing — Terminology — Part 2: Terms common to the non-destructive testing methods*

EN 1330-9:2009, *Non-destructive testing — Terminology — Part 9: Terms used in acoustic emission testing*

EN 13477-1, *Non-destructive testing — Acoustic emission — Equipment characterisation — Part 1: Equipment description*

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

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

EN ISO 9712:2012, *Non-destructive testing — Qualification and certification of NDT personnel (ISO 9712:2012)*

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 1330-1:1998, EN 1330-2:1998 and EN 1330-9:2009 apply.

4 Qualification of personnel

Testing shall be carried out by proficient, suitably trained and qualified personnel at minimum level 2 according to EN ISO 9712. To demonstrate appropriate qualification, it is recommended that personnel be certified according to EN ISO 9712 or an equivalent formalised system. Operating authorisation for a qualified person shall be issued by the employer in accordance with a written procedure.

NDT operations, unless otherwise agreed, shall be authorised by a competent and qualified NDT supervisory individual (Level 3 according to EN ISO 9712 or equivalent) approved by the employer.

NOTE For pressure equipment, see Directive 97/23/EC, Annex I §3.1.3: "For pressure equipment in categories III and IV, the personnel must be approved by a third party organisation recognised by a Member State".

5 General

5.1 Initial considerations

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.

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 higher 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 coupling 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 coupling shall be verified. The characteristics of the type of the acoustic coupling used shall not affect the structure adversely.

5.4 Location

The location of AE sources is performed using Δt measurement.

The accuracy is normally within $\pm 5\%$ 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

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threshold raised to the evaluation threshold during these location accuracy checks. If the accuracy is not within $\pm 5\%$, 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 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 coupling used;
- e) type of surface preparation;
- f) type of AE equipment used with its 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) pre-defined pressure schedule;
- 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 ISO 9712:2012, Table D.1.

6 Instrumentation

An AT system shall consist of sensors and equipment for signal conditioning and processing, and for displaying and recording data according to EN 13477-1.

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

7 Testing

7.1 Pre-test 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 20e distance (see Annex A). The obtained curve shall in this case be shifted up to correspond with the original Hsu-Nielsen source.