



SLOVENSKI STANDARD

SIST EN 15495:2008

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Neporušitveno preskušanje - Akustična emisija - Preskušanje kovinske tlačne opreme pri prevzemu - Območje namestitve senzorjev akustične emisije

Non Destructive testing - Acoustic emission - Examination of metallic pressure equipment during proof testing - Zone location of AE sources

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

Essais non destructifs - Émission acoustique - Vérification des équipements métalliques sous pression pendant l'épreuve - Localisation par zone des sources d'EA

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Ta slovenski standard je istoveten z: **EN 15495:2007**

ICS:

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

EN 15495

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Non Destructive testing - Acoustic emission - Examination of metallic pressure equipment during proof testing - Zone location of AE sources

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

Zerstörungsfreie Prüfung - Schallemission - Prüfung von metallischen Druckgeräten während der Beanspruchung - Zonenortung von Schallemissionsquellen

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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 Management Centre has the same status as the official versions.

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Contents

Page

Foreword.....	3
1 Scope	4
2 Normative references	4
3 Terms and definitions	4
4 Personnel Qualifications.....	4
5 General.....	5
5.1 General.....	5
5.2 Application of load.....	5
5.3 Sensors.....	5
5.4 Zone location.....	5
5.5 Preliminary information	6
5.6 Written instruction requirements	6
6 Instrumentation.....	7
7 Testing	7
7.1 Pre-Test Measurements	7
7.1.1 General.....	7
7.1.2 Wave propagation.....	7
7.1.3 Determination of maximum allowed sensor spacing.....	8
7.2 Test steps	10
7.2.1 General Guidelines	10
7.2.2 In situ verification	10
7.2.3 Background Noise	10
7.2.4 Equipment Pressurisation	10
8 Interpretation of results	11
8.1 General.....	11
8.2 Test stop criteria.....	11
8.2.1 Test stop during the initial proof loading.....	11
8.2.2 Test stop during subsequent loadings	11
8.3 AE zone grading criteria	11
9 Documentation.....	12
Bibliography	13

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Foreword

This document (EN 15495:2007) 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 May 2008, and conflicting national standards shall be withdrawn at the latest by May 2008.

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.

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EN 15495:2007 (E)**1 Scope**

The purpose of this standard is to describe the methods for conducting an acoustic emission (AE) examination of metallic pressure equipment during acceptance pressure testing using a zone location procedure. General principles of Acoustic Emissions are described in EN 13554.

The objectives of the AE testing are to provide 100 % volumetric testing to define and grade zones of the structure which are acoustically active with burst type AE. The method should be regarded as supplementary to planar location. Planar location provides the source identification and characterisation. Zone location may also be applied in such cases where location of AE sources by planar location procedures according to EN 14584 is not possible.

The method identifies the need for further evaluation or follow-up by other NDT in localized zones.

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 1330-1:1998, *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 1330-9:2000, *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*

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

EN 14584, *Non-destructive testing - Acoustic emission - Examination of metallic pressure equipment during proof testing – Planar location of AE sources*

3 Terms and definitions

For the purpose of this European Standard, the terms and definitions given in EN 1330-1:1998, EN 1330-2:1998 and EN 1330-9:2000 apply.

4 Personnel Qualifications

It is assumed that acoustic emission testing is performed by qualified and capable personnel. 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 identify and monitor zones of high acoustic emission activity and intensity caused by phenomena, e.g. crack growth and yielding, generated by the applied load to the equipment.

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 zones showing significant activity shall be completely evaluated by other NDT methods. Evaluation according to EN 14584 may help to reduce the area to inspect.

5.2 Application of load

The application of the load 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 established so as 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. The pressurisation rate would not normally exceed 1 % of the test pressure per minute for pneumatic and 5 % of the test pressure per minute for the hydraulic test. The intermediate hold periods, if necessary according the AE activity or the pre-defined pressure schedule, are normally 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.

Depending on the results of the initial loading, it may be required to reduce the load to working pressure or lower, followed by re-pressurisation.

5.3 Sensors

The frequency range shall be chosen so that the expected AE has sufficient energy in the chosen frequency range and the test result is unaffected by external noise sources. 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.

The equipment surface below the sensors shall be prepared 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 suitable 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 Zone location

Zone location assigns each event producing at least one hit to the zone of the first-hit channel. Successive hits are assumed to belong to the same event as long as they arrive within the event definition time. The event definition time is a programmable time interval, which starts with the arrival of the first-hit of an event. The event definition time is determined during test set-up using a Hsu-Nielsen or another appropriate artificial source and is set so that the source is correctly assigned only to the closest sensor. It is essential for this type of location that all noise sources are well controlled.

EN 15495:2007 (E)**5.5 Preliminary information**

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

- a) relevant Product Standard;
- b) type of equipment or structure and material characteristics and specifications;
- c) design- and test pressure;
- d) working- and test temperature;
- e) assembly and/or layout drawings with sufficient details of the structure;
- f) material specifications, including heat treatment; if applicable
- g) proposed pressure/stress application sequence;
- h) potential acoustic noise interference sources and the isolating mechanism applied;
- i) 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) Test object (description and/or drawing; including area of interest and purpose of test);
- b) limitations if any; [SIST EN 15495:2008](https://standards.iteh.ai/catalog/standards/sist/cbd8eeeb-9078-4e5b-a0b6-777c7f8a3a/sist-en-15495-2008)
- c) sensor type, frequency and manufacturer; <https://standards.iteh.ai/catalog/standards/sist/cbd8eeeb-9078-4e5b-a0b6-777c7f8a3a/sist-en-15495-2008>
- d) method of sensor attachment;
- e) type of acoustic couplant used;
- f) type of surface preparation;
- g) type of AE equipment used with the main characteristics and settings;
- h) energy measurement method to be used;
- 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;
- s) value of K_z , (for definition see Figure 1) from the relevant Product Standard if available.

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;

and on external inputs pressure and/or other stress parameters.

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 activity vs channel display.
- Provide an on-line activity vs zone display.
- Provide an on-line display of AE data and pressure.

To assist the online evaluation it is recommended that the instrumentation provides data allowing real time AE noise identification. Online grading of zones is also recommended.

The AE system operating characteristics shall be verified according to EN 13477-2.

7 Testing

7.1 Pre-Test Measurements

7.1.1 General

The requirements listed in EN 14584 apply for a setup that uses both, planar and zone location. The following text is to be observed where planar location is not used.

7.1.2 Wave propagation

Attenuation measurements shall be performed on the structure to determine the maximum sensor spacing. The measurements shall be performed with the test fluid in the pressure equipment using the Hsu-Nielsen source. If the Hsu-Nielsen source saturates the measurement chain, a lower energy artificial source shall be