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Interested committees:

Title: Draft BS ISO 29821 Condition monitoring and diagnostics of machines — Ultrasound — General guidelines, procedures and validation

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Introduction

This draft standard is based on international discussions in which the UK has taken an active part. Your comments on this draft are invited and will assist in the preparation of the consequent standard. Comments submitted will be reviewed by the relevant BSI committee before sending the consensus UK vote and comments to the international secretariat, which will then decide appropriate action on the draft and the comments received.

If the international standard is approved, it is possible the text will be published as an identical British Standard.

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Please indicate whether you consider the UK should submit a negative (with reasons) or positive vote on this draft.

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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	(7)
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/ Figure/ Table/Note	Type of comment	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	

DRAFT INTERNATIONAL STANDARD

ISO/DIS 29821

ISO/TC 108/SC 5

Secretariat: SA

Voting begins on:
2017-03-23

Voting terminates on:
2017-06-14

Condition monitoring and diagnostics of machines — Ultrasound — General guidelines, procedures and validation

Surveillance des conditions et diagnostic d'état des machines — Ultrasons

ICS: 17.160

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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The committee responsible for this document is ISO/TC 108, *Mechanical vibration, shock and condition monitoring*, Subcommittee SC 5, *Condition monitoring and diagnostics of machine systems*.

Introduction

ISO 29821 provides specific guidance on the interpretation of ultrasonic readings and wave files or frequency and time domain printouts (sometimes called “sound images”) as part of a programme for condition monitoring and diagnostics of machines. Airborne (AB) and structure-borne (SB) ultrasound can be used to detect abnormal performance or machine anomalies. The anomalies are detected as high frequency acoustic events caused by turbulent flow, ionization events and friction, which are caused, in turn, by incorrect machinery operation, leaks, improper lubrication, worn components, and/or electrical discharges.

Airborne and structure-borne ultrasound is based on measuring the high frequency sound that is generated by either turbulent flow, friction or by the ionization created from the anomalies. The inspector therefore requires an understanding of ultrasound and how it propagates through the atmosphere and through structures as a prerequisite to the creation of an airborne and structure-borne ultrasound programme. Ultrasonic energy is present with the operation of all machines. It can be in the form of friction, turbulent flow and/or ionization as a property of the process, or produced by the process itself. As a result, ultrasonic emissions are created and these are an ideal parameter for monitoring the performance of machines, the condition of machines, and for diagnosing machine anomalies. Ultrasound is an ideal technology to do this monitoring because it provides an efficient way to quickly and non-invasively determine the location of an anomaly with little setup and in a very short period of time.

Condition monitoring and diagnostics of machines — Ultrasound — General guidelines, procedures and validation

1 Scope

This international Standard

- provides guidance on establishing severity assessment criteria for anomalies identified by airborne (AB) and structure borne (SB) ultrasound,
- outlines methods and requirements for carrying out ultrasonic examination of machines, including safety recommendations and sources of error, and
- provides information relative to data interpretation, assessment criteria and reporting.

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.

ISO 13372, *Condition monitoring and diagnostics of machines — Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 13372 and the following apply.

3.1

airborne and structure-borne ultrasound

A&SB ultrasound

non-destructive test method used to inspect for airborne and structure-borne ultrasound above 20 kHz created from or through a medium

3.2

background noise

unwanted noise present in a signal which cannot be attributed to a specific cause

[ISO 13372:—, [\[1\]](#) 5.2]

Note 1 to entry: This ultrasonic noise can emanate from the area surrounding the inspection which can cause false indications.

3.3

scanning

moving a receiving transducer or an array of transducers around a suspected source of ultrasound to verify the location

3.4

sonic reflection

airborne ultrasound reflected off a solid surface possibly indicating a false reading

3.5

stethoscope module

waveguide in the form of a rod that is coupled to a receiving transducer that receives ultrasounds by making physical contact with the subject and test equipment, for structure-borne ultrasounds

4 Principle of the airborne and structure-borne method

Airborne and structure-borne ultrasound is a physical wave that occurs within, or on the surface of, the test subject (material or machinery component) and is detected externally either close to or at a distance from the test subject. This technology is based on the detection of high-frequency sounds. Most ultrasonic instruments employed to monitor equipment detect frequencies above 20 kHz, which is above the range of human hearing (20 Hz to 20 kHz). The differences in the way low-frequency and high-frequency sounds travel helps to explain why this technology can be effective for condition monitoring. Low-frequency sounds maintain a high intensity of sound volume and travel further than high-frequency sounds. High-frequency sounds are more directional. As high-frequency sound waves propagate from the point of generation, their intensity level decreases rapidly with distance depending on the elasticity and density of the medium traversed, which helps to identify the origin of a sound source.

Airborne ultrasound is propagated through an atmosphere (air or gas) and detected with an ultrasonic microphone while structure-borne ultrasound is generated within and propagated through the structure, and is usually detected with a stethoscope (contact) module, although other sensors may be used. These stethoscope modules do not require any coupling agent, as the detection frequencies are low enough that, unlike traditional pulse-echo ultrasound, small air gaps between the contact probe and the structure under test do not significantly attenuate the received signal. If permanently mounted sensors are used, careful mounting techniques should be utilized to avoid signal attenuation or resonances, or both. The structure may be a machine or any component of a machine or a system.

4.1 Application of airborne and structure-borne ultrasound within condition monitoring programmes

Ultrasound is not normally used as a primary monitoring technique in typical condition monitoring programmes. The exceptions to this are when ultrasound is preferred as a non-invasive indicator of impending failure or performance deterioration or when rapid pressure or vacuum leak localization is necessary to lessen machine performance degradation. [Table 1](#) shows typical examples of ultrasound applications to machine condition monitoring

4.2 Correlation with other technologies

Traditionally, airborne and structure-borne ultrasonic inspection is used in a condition-monitoring programme to detect characteristics of failure modes that have been previously identified by another technology. There are instances where airborne or structure-borne ultrasound is the first indicator of a failure mode, such as in the detection of faulty slow-speed bearings and/or insufficient lubrication in rolling element bearings. Airborne or structure-borne ultrasound can also be used to identify a potential safety hazard to an inspector using an alternate technology, for example in the inspection of enclosed electrical systems. Airborne and structure-borne ultrasound are used to determine if an arc flash hazard is present before opening the cabinet for an infrared thermographic inspection.

Table 1 — Ultrasonic application examples

Machine description	Pressure or vacuum leak detection ^a	Mechanical ^a	Electrical ^a
Heat exchangers	AB	—	—
Boilers	AB	—	—
Condensers	AB	—	—
Control air systems	AB	—	—

^a AB: airborne; SB: structure borne.