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JAPANESE INDUSTRIAL STANDARDS FOR THE DETERMINATION, DECLARATION AND VERIFICATION OF NOISE EMITTED FROM MACHINERY AND EQUIPMENT - STATE OF THE ARTS

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ABSTRACT

In Japan, establishments of national standards for the determination of noise emitted from machinery and equipment are in progress, especially during past five years. These standards are divided into two groups: basic standards and individual standards. Basic standards for the determination of sound power levels and emission sound pressure levels are essentially in conformity with corresponding international standards. On the other hand, individual standards for specific machinery and equipment are not necessarily conformed with corresponding international and national standards. In this paper, background of these situations is described in details.

1 - INTRODUCTION

In Japan, methods for measurement and evaluation of noise have been standardized in Japanese Industrial Standards (JIS). These standards are divided into three parts: (1) standards on the methods for measurement of noise emitted by machinery, equipment and other sound sources; (2) standards on the method for measurement of environmental noise; (3) standards on measurement instruments. The first group standards are further divided into two groups – basic standards and specific standards, which specify test codes to be adopted for specific sound sources.

The Agency of Industrial Science and Technology, MITI, usually leaves the preparation of new draft standards and/or the revision of existing standards to appropriate organizations. As to the basic standards on noise, Acoustical Society of Japan or INCE/Japan draft the basic standards on noise. *Ad hoc* technical committees are established in the respective societies, and experts prepare draft standards in these committees.

Until recently, these national standards have not necessarily been in harmony with corresponding international standards. Due to strong requirements from the World Trade Organization (WTO), the Japanese government made a basic policy decision in 1995; that all Japanese Industrial Standards shall have complete conformity to the international standards, such as those published by ISO, IEC etc. The target date was the end of 1998 March. Thus, the revision of existing standards and the preparation of new standards were almost finalized.

In this paper, state of the arts on the Japanese Industrial Standards in the field of the methods for measurements of noise emitted from machinery and equipment and of the relevant standards will be described.

2 - BASIC CONSTRUCTION OF STANDARDS

The Japanese Industrial Standards on the methods for measurements of noise emitted from machinery and equipment are classified into the following two groups:

- standards which specify the methods for measurements of noise. In these standards, the title includes the term such as measurement or determination.

- standards which specify the specifications for products on machinery and equipment. Among various specifications, a clause concerning noise is included.

The first group of standards is divided further into two sub-groups: One is the so-called basic standards. They prescribe the general rules for the measurement of emitted noise without any description on specific type of machinery and equipment. Another group of standards describes the method for measurement of specific type of machinery and equipment.

The second group of standards is product standard. The titles of standards show only the names of products. As one of the performance specifications, noise limit is prescribed. Most of these standards have specifications on the method for measurement.

In the following sections, details of standards are described for respective groups.

3 - BASIC STANDARDS FOR THE DETERMINATION OF SOUND POWER LEVELS AND THE MEASUREMENT OF EMISSION SOUND PRESSURE LEVELS

3.1 - Determination of sound power levels

Basic JIS standards for the determination of sound power levels of noise sources are summarized in Table 1.

Three standards for sound pressure method, JIS Z 8732, Z 8733 and Z 8734, were already published during 1986 and 1988, respectively. Revised draft standards are prepared as the translation of corresponding ISO standards. They will be published before the end of 2000.

Two standards for the determination of sound power levels by sound intensity method, JIS Z 8736-1 and Z 8736-2 were newly published. They are basically translation standards with corresponding ISO standards. Only the conformity on the terminology and definitions between two standards was revised carefully.

JIS number	measured quantity	measurement environment	accuracy grade	corresponding ISO standard
Z 8732:xxxx	sound pressure	free-field & hemi free-field	precision	ISO/DIS 3745
Z 8733:xxxx	sound pressure	approximately hemi free-field	engineering	ISO 3744:94
Z 8734:xxxx	sound pressure	reverberant	precision	ISO 3741:99
Z 8736-1:99	sound intensity	any	precision, engineering, survey	ISO 9614-1:93
Z 8736-2	sound intensity	any	engineering, survey	ISO 9614-2:96

Table 1: Determination of sound power levels.

In connection with above standards, draft JIS Z XXXX was prepared for the reference sound source. This is also the complete translation standard with ISO 6926:99.

3.2 - Measurement of emission sound pressure levels

The older standard JIS Z 8731, which was originally published in 1957, specified the method for measurement of A-weighted sound pressure level of noise emitted from machinery and equipment. However, in the overall revision of JIS Z 8731 in 1983, the scope of this standard was restricted to the measurement of environmental noise and the provision concerning the measurement of machinery noise was completely deleted. Until recently, there has not been basic standard in Japan on the method for measurement of emission sound pressure level of machinery and equipment.

New draft standards were prepared which correspond to the ISO 11200 series. Table 2 shows the construction of these standards which are complete translation standards, respectively. These standards will be published before the end of 2000.

JIS number	measurement environment	accuracy grade	Corresponding ISO standard
Z 8737-1:xxxx	essentially hemi free-field	engineering	ISO 11201:95
Z 8737-2:xxxx	<i>In situ</i>	survey	ISO 11202:95

Table 2: Measurement of emission sound pressure levels.

4 - STANDARDS FOR SPECIFIC MACHINERY AND EQUIPMENT

4.1 - Measurement standards

There are a number of standard which prescribe the method for measurement of noise emitted from specific family of machinery and equipment. The titles of these standards include the term "method for measurement of noise" or similar expressions. Japanese Industrial Standards for specific machinery and equipment are classified according to the machinery group.

The titles of these standards are listed below:

[Civil Engineering and Building Engineering]

- A 1424-1-98: Method for laboratory tests on noise emission from appliances and equipment used in water supply installations – Part 1: Measurement method
- A 1424-2-98: Method for laboratory tests on noise emission from appliances and equipment used in water supply installations – Part 2: Mounting and operating conditions for draw-off taps and mixing valves
- A 1708-94: Method of test for noise of equipment units for dwellings
- A 8305-88: Method for the measurement of airborne noise emitted by construction equipment intended for outdoor use

[Machinery]

- B 1548-95: Rolling bearing – Measuring methods of A-weighted sound pressure level
- B 1753-99: Acceptance code for gears – Determination of airborne sound power levels emitted by gear units
- B 6004-80: Method of sound level measurement for machine tools
- B 6406-91: Mechanical press – Methods of measurement of A-weighted sound pressure level
- B 6521-78: Method of measurement for noise emitted by wood working machinery
- B 8005-98: Reciprocating internal combustion engines – Measurement of emitted airborne noise – Engineering method and survey method
- B 8310-85: Methods of A-weighted sound pressure level measurement for pumps
- B 8346-91: Fans, blowers and compressors – Determination of A-weighted sound pressure level
- B 8350-89: Methods of noise level measurement for oil hydraulic pumps and motors
- B 9064-98: Method of sound level measurement for industrial sewing machine

[Automobile]

- D 1024-99: Acoustics – Measurement of noise emitted by accelerating road vehicles – Engineering method
- D 1026-87: Measurement of noise emitted by stationary road vehicles
- D 1041-87: Method of acoustic test of horns for motor cycles
- D 1616-95: Road vehicles – Measurement methods of noise emitted by exhaust systems
- D 8301-93: Acoustics – Specification of test tracks for the purpose of measuring noise emitted by road vehicles

[Railway]

- E 4041-94: Railway rolling stock – Test methods inside noise

[Ship]

- F 0904-81: Measurement of noise level on board vessels (Machinery part)

- F 0905-98: Measurement of noise level on board vessels (Hull part)

[Aircraft]

- W 0851-93: Acoustics – Measurement of noise inside aircraft

[Information Technology]

- X 7779-xx: Acoustics – Measurement of airborne noise emitted by information technology and telecommunications equipment

In these standards, quantities to be derived are sound power levels and/or sound pressure levels. In Japan, for the evaluation of noise emitted from machinery and equipment, A-weighted sound pressure levels at specified positions, usually 1 meter from the surface of the source have been used extensively. So, most of the above standards prescribe the method for measurements of sound pressure levels. In relatively recent years, some industries have had special interests on the determination of sound power levels of sound sources.

Table 3 shows Japanese Industrial Standards which specify the method for determination of sound power levels on the specific type of machinery and equipment.

JIS number	test environment	corresponding ISO	Remarks
A 1708	laboratory, field		
A 8305	field	ISO 4872	
B 1753	laboratory	ISO 8579-1	
B 6406	laboratory		Annex (informative)
B 8005	laboratory	ISO 6798	
B 8310	laboratory		Annex (informative)
B 8346	laboratory		Annex (informative)
B 8350	laboratory	ISO 4412-1 ISO 4412-2	Annex (informative)
B 9064	laboratory		Annex (informative)
X 7779	laboratory	ISO 7779, 9295	

Table 3: JISs which include the sound power level determination.

4.2 - Product standards

Product standards which include the performance specifications on noise emitted from machinery and equipment are listed below.

[Civil Engineering and Building Engineering]

- A 4003-95: Warm air furnaces

[Machinery]

- B 8609-81: Performance tests of mechanical draft cooling tower

[Electronic Equipment & Electric Machinery]

- C 8106-99: Fluorescent lamp luminaries for commercial industrial and public lighting
- C 8108-91: Ballasts for fluorescent lamps
- C 8112-99: Table study lamps for fluorescent lamps
- C 8115-99: Fluorescent lamp luminaries for residential lighting
- C 9108-92: Electric vacuum cleaners
- C 9603-88: Ventilating fans

- C 9606-93: Electric washing machine
- C 9609-90: Electric blenders and electric juicers for household use
- C 9610-76: Portable electric grinders
- C 9611-90: Electric disc grinders
- C 9612-99: Room air conditioners
- C 9614-95: Electric shavers
- C 9615-95: Air cleaners
- C 9625-76: Portable electric planers
- C 9626-92: Portable electric circular saws

All of these standards specify the measurement of sound pressure levels, especially A-weighted sound pressure levels for respective products. The microphone positions depend on the kind of products. Recently in Japan, there are tendencies to standardize the method for determination of sound power levels of noise emitted from household appliances in parallel with the measurement of emission sound pressure level. They will be referred to the following IEC standard:

- IEC 60704-1: Household and similar electrical appliances – Test code for the determination of airborne acoustical noise – Part 1: General requirements

5 - FUTURE TRENDS

An international conformity of Japanese Industrial Standards on the method for measurement of noise emitted from machinery and equipment is now in progress as shown above. In case of product standard, conformity with basic standards shown in Table 1 and 2 has scarcely been considered.

This is due to the long experiences in respective industries. It will be expected that the existing standards will be revised in order to take a due conformity with international standards.

Another important problem on Japanese Industrial Standards in the field of machinery noise must be the preparation of standards on declaration and verification of noise emission. Recently, draft standard JIS X 9296: Acoustics - Declared noise emission values of computer and business equipment, was prepared. This is the complete translation of ISO 9296:1988.

In several industries, it has been required to standardize the method for noise labeling of machinery and equipment. In near future, it is expected to prepare the Japanese Industrial Standard corresponding to ISO 4871: Acoustics – Declaration and verification of noise emission values of machinery and equipment. Through the publication of this standard, the international harmonization of Japanese Industrial Standards on machinery noise will be finalized.