INTERNATIONAL STANDARD

ISO 16902-1

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Hydraulic fluid power — Test code for the determination of sound power levels using sound intensity techniques: Engineering method —

Part 1: Pumps

Transmissions hydrauliques — Code d'essai pour la détermination des niveaux de puissance acoustique à l'aide des techniques d'intensimétrie: Méthode d'expertise —

Partie 1: Pompes

Reference number
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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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

ISO 16902-1 was prepared by Technical Committee ISO/TC 131, *Fluid power systems*, Subcommittee SC 8, *Product testing*.

ISO 16902 consists of the following parts, under the general title *Hydraulic fluid power — Test code for the determination of sound power levels using sound intensity techniques: Engineering method*:

— *Part 1: Pumps*

— *Part 2: Motors*[1)]

1) In preparation.

Introduction

In hydraulic fluid power systems, power is transmitted and controlled through a liquid under pressure in a closed circuit. Pumps are components that convert rotary mechanical power into fluid power. During the process of converting mechanical power into fluid power, airborne noise, fluid-borne noise and structure-borne noise are radiated from the pump.

The airborne noise level of a hydraulic fluid power pump is an important consideration in component selection. ISO 4412-1 [1] describes a method of taking noise level measurements but requires a very specialized and costly test environment. The procedures described in this part of ISO 16902 do not require specialized and expensive test conditions but can be expected to achieve “engineering” or “survey” levels of accuracy. The results should be sufficiently accurate so that comparisons can be made between pumps. It should be noted that sound power is physically a function of the test environment, and may in some cases differ from the sound power of the same source determined under other conditions.

Hydraulic fluid power — Test code for the determination of sound power levels of pumps using sound intensity techniques: Engineering method —

Part 1: **Pumps**

1 Scope

This part of ISO 16902 establishes a test code based on ISO 9614-1 and ISO 9614-2 for determining the sound power levels of a hydraulic fluid power pump under controlled conditions of installation and operation. The sound power level will include sound power radiated by any piping within the measurement surface. This part of ISO 16902 is suitable for providing a basis for comparing the airborne noise levels of any type of pump that is normally used to convert rotary mechanical power to hydraulic fluid power, incorporating valves, solenoids, drive gears, couplings or any other auxiliary device normally fitted in service.

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.

ISO 3448, *Industrial liquid lubricants — ISO viscosity classification*

ISO 3744:1994, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Engineering method in an essentially free field over a reflecting plane*

ISO 5598, *Fluid power systems and components — Vocabulary*

ISO 6743-4, *Lubricants, industrial oils and related products (class L) — Classification — Part 4: Family H (Hydraulic systems)*

ISO 9614-1:1993, *Acoustics — Determination of sound power levels of noise sources using sound intensity — Part 1: Measurement at discrete points*

ISO 9614-2:1996, *Acoustics — Determination of sound power levels of noise sources using sound intensity — Part 2: Measurement by scanning*

ISO 9614-3, *Acoustics — Determination of sound power levels of noise sources using sound intensity — Part 3: Precision method for measurement by scanning*

IEC 61043, *Electroacoustics — Instruments for the measurement of sound intensity — Measurements with pairs of pressure sensing microphones*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 5598 and the following apply.

3.1
pumping frequency
frequency determined as follows:

$$\frac{n \times z}{60}$$

where

n is the pump shaft speed in revolutions per minute;

z is the number of pumping chambers per revolution.

4 Sound power level determination

The sound power level shall be determined in accordance with ISO 9614-1, ISO 9614-2 or ISO 9614-3.

In the above standards the quantity to be measured is sound intensity level in one octave and one-third octave frequency bands, while the quantity to be determined is sound power level in one octave and one-third octave frequency bands.

Because noise generated by pumps is dominated by the harmonics of pumping frequency, measurements of narrow band frequency are useful and are permitted in this part of ISO 16902.

5 Installation and mounting conditions

5.1 General

If two or more pumps are coupled together, they may be treated as a single pump. The operating conditions for each pump should be stated in the report.

5.2 Pump mounting

It is desirable that the pump mounting be constructed so that the noise radiated from the mounting is as low as possible. This shall be done by passive means (e.g. using a high damping material).

5.3 Drive coupling

The drive coupling shall conform to the pump manufacturer's recommendations.

5.4 Hydraulic circuit

5.4.1 The circuit shall include all oil filters, oil coolers, reservoirs and restrictor valves as required to conform to the pump hydraulic operating conditions.

5.4.2 The test fluid, temperature and contamination level shall conform to the pump manufacturer's recommendations.

5.4.3 Inlet and discharge lines shall be installed with diameters applicable to the pump manufacturer's recommendations. Care shall be exercised when assembling inlet lines in order to prevent air leaking into the circuit.

5.4.4 The inlet pressure sensor shall be mounted at the same height as the pump inlet or shall be calibrated for any height difference.

5.4.5 The load valve should be located so that it has negligible influence on the noise level of the pump.

5.4.6 A stable load valve shall be used.

NOTE Unstable load valves in the discharge line can generate and transmit noise through the fluid and piping, that can emerge as airborne noise at the pump.

5.4.7 All fluid lines shall operate as in a working installation (i.e. not wrapped in sound insulating material). See ISO 9614-1:1993, 0.3, and ISO 9614-2:1996, 0.4.

6 Measurement surfaces

6.1 General

Alternative mounting arrangements are depicted in Figures 1 to 5.

Measurement surfaces should conform to the recommendations given in ISO 9614-1, ISO 9614-2 or ISO 9614-3.

6.2 Piping

To simplify the geometry of measurement surfaces, if possible do not pass piping through them. If reflecting planes are used, pass the piping through these.

If there is no alternative to passing the piping through the measurement surface, split the surface into segments with the split lines on the pipe centre line (see Figure 5).

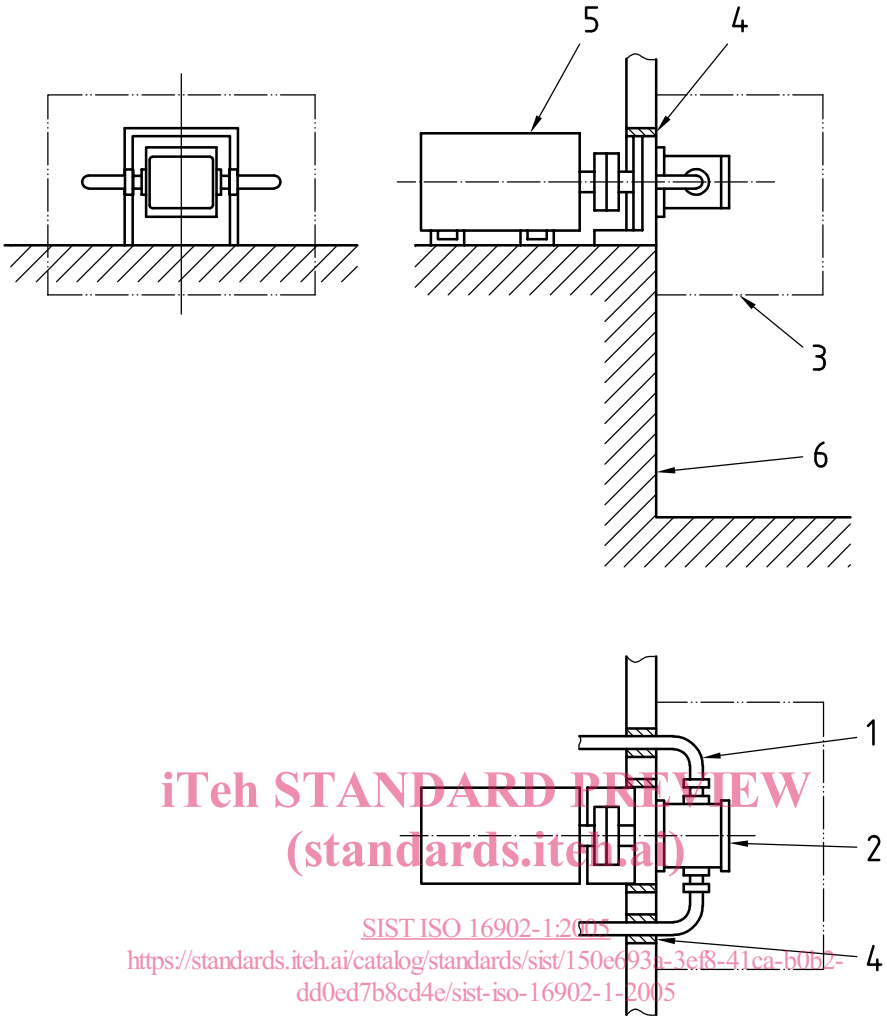
It is permissible to shield piping that is outside the measurement surface providing that this shielding does not account for more than 10 % of the area of the measurement surface.

6.3 Pump mounting

6.3.1 If a pump is flange-mounted, one of the measurement surfaces shall be aligned with the mounting face.

6.3.2 If the pump is flange-mounted to a bell housing or bracket where the noise radiated from the pump toward the drive motor cannot be measured at the mounting face, a reflecting plane coincident with the mounting face may be used.

6.3.3 If a pump is foot mounted, the floor may be used as a reflecting plane.



Key

1 piping
2 pump under test
3 measurement surface
4 soft rubber seal
5 prime mover
6 reflecting plane

Figure 1 — Reflecting plane at pump mounting face with rigid support for prime mover and with pipes passing through reflecting plane

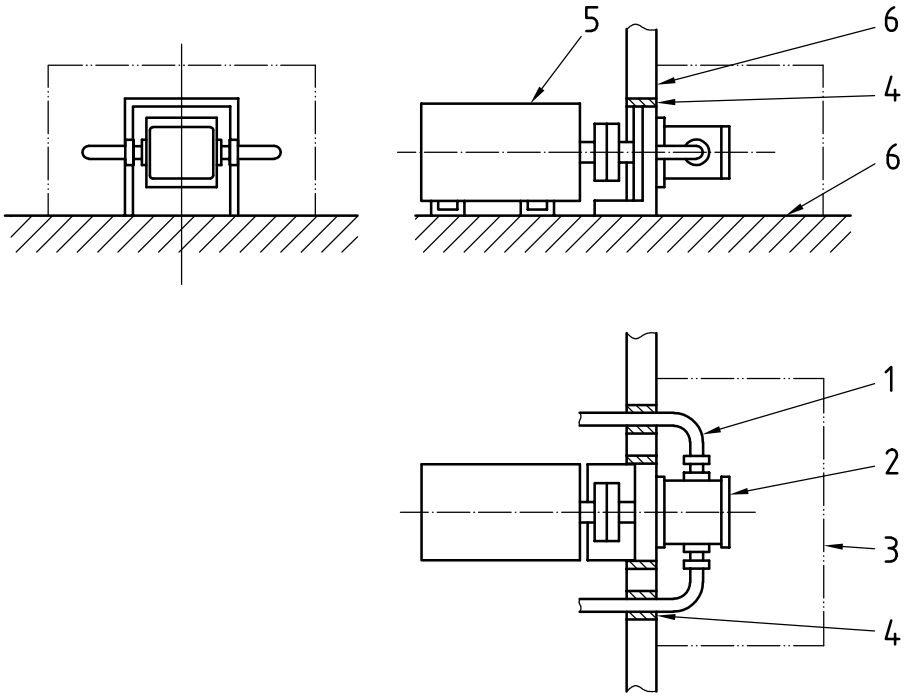


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Figure 2 — Reflecting plane at pump mounting face and underneath, having rigid support for prime mover and with pipes passing through reflecting plane