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Noise insulation of refrigeration pipe rings

Korff FIX 76/19

Report No. M126957/01

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1 Situation and task

For a pipe fixing system of Korff Isolmatic SP. z. o. o the structure-borne sound insulation is to be determined for common preloads.

The measurements are to be carried out according to the “tonpilz”-method (acoustic mushroom) following the EN ISO 10846-4 [1]. In form of velocity level differences, the vibration transfer factors measured with this method can be used as product information for manufacturers, suppliers and users.

2 Documents used

[1] DIN EN ISO 10846-4: Acoustics and vibration – Laboratory measurement of the vibro-acoustic transfer properties of resilient elements –
Part 4: Dynamic stiffness of elements other than elastic supports for translatory motion. 2004-02.

[2] DIN ISO 5348: Mechanical vibration and shock –
Mechanical mounting of accelerometers. 1999-07.

[3] DIN EN ISO 3822-1: Acoustics – Laboratory tests on noise emission from appliances and equipment used in water supply installations –
Part 1: Method of measurement. 2009-07

3 Measurement method

The structure-borne sound insulating properties of the pipe ring is determined based on the “tonpilz”-method in combination with the indirect method of standard DIN EN ISO 10846-4:

> *Laboratory measurement of the vibro-acoustic transfer properties of resilient elements – Part 4: Dynamic stiffness of elements other than elastic supports for translatory motion of February 2004 [1].*

Other than in the set-ups described in section 5.1 of the DIN EN ISO 10846, part 4, here, the measurement set-up is modified following the “tonpilz”-method – based on section 5.3.1. Thus, the preload is not generated by a weight working in vertical downward direction, but rather by a defined tightening torque at the pipe ring.

In compliance with standard DIN EN ISO 10846, part 4, the vibration transfer factor is measured in the test laboratory of Müller-BBM in Planegg as velocity level difference.

The components to be measured are mounted between two masses of 30 kg each. An adapter is used to couple the pipe ring between the two masses.

The exciter mass (sender) is excited longitudinally with continuous sinusoidal oscillation. The vibrations are transmitted to the encumbrance mass (receiver) via the sample. On both masses velocity levels are measured in axial exciter direction. These are integrated to velocity levels and the velocity level differences between sender and receiver are calculated.

In order to eliminate potential interference as far as possible, the vibratory system is suspended by ropes.

In the measurement procedure the evaluable measuring range is limited to 2 kHz. Above this threshold the distance between wanted signal and interfering signal on the receiving side is so short that a clear evaluation of the signal is no longer possible. With respect to the fact that the relevant main exciting frequencies of HVACR-systems are well below 2 kHz, this limitation in the upper frequency range is without any practical significance.

The measurements were performed in the frequency range of 10 Hz to 2 kHz.

The measurement set-up with reference clamp without sound insulation lining is exemplarily shown in Figure 1, while Figure 2 shows the set-up with test object.

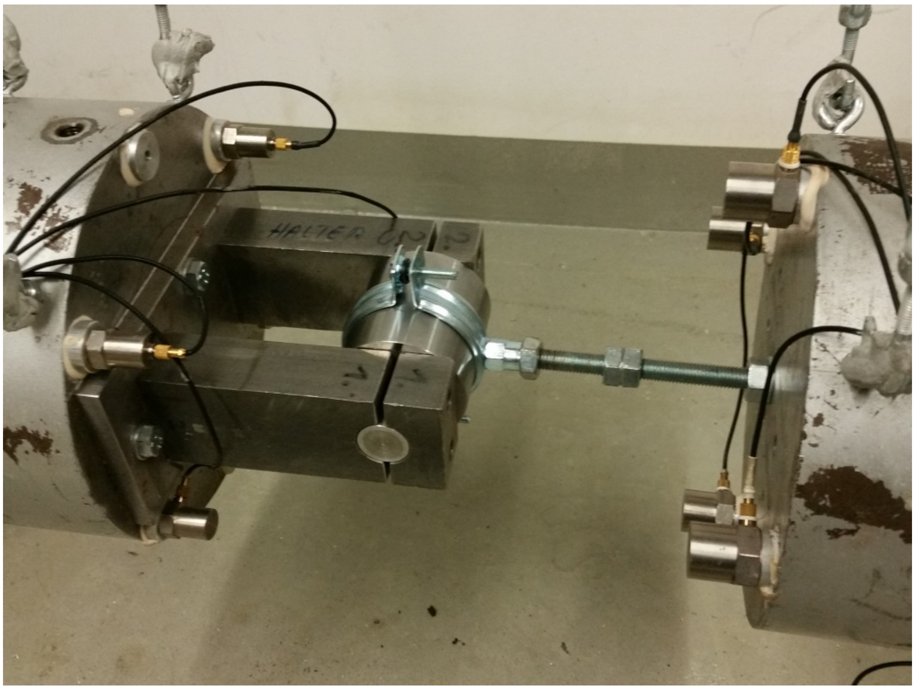

Figure 1. Measurement set-up with reference clamp without sound insulation lining.

Figure 2. Measurement set-up with test object (example).

To give evidence of the structure-borne sound insulating effect the vibration transfer factor was determined for always three samples of a test object as velocity level difference; these three results were then averaged.

4 Measurement performance

4.1 Time and place

The vibration measurements were performed within the period of 22 February to 29 February 2016 at Müller-BBM's test laboratory in Planegg.

4.2 Test object

The objects to be tested were fixture systems for a pipe diameter of 76 mm consisting of a two-screw pipe ring and insulation layers made of a polymer foam (Figure 3).

Figure 3. Test object Korff FIX 76/19.

4.3 Environmental conditions

The environmental conditions at the time of the measurements were as follows:

temperature:	approx. 23 °C
relative humidity:	approx. 44 %
air pressure:	approx. 1028 hPa

4.4 Measuring instruments

The calibration of the instruments used (as listed hereafter) was checked on-site; their proper function was confirmed. Within Müller-BBM's quality assurance system the instruments are additionally checked in regular intervals and calibrated with retraceability to national standards (in Müller-BBM's calibration laboratory).

Table 1. Compilation of the measuring equipment used.

Measuring device	Type	Serial no.	Manufacturer
Four-channel analyser	35670A	3928A04219	Hewlett&Packard
Electro-dynamic vibration exciter	52216-LS	043/04	Tira
Power amplifier	BAA 1000	B1000E01A0 3K0050	Tira
Charge amplifier sender	2635	1422945	Brüel & Kjaer
Charge amplifier receiver	2635	1422946	Brüel & Kjaer
Accelerometer sender	4371	976119	Brüel & Kjaer
	4371	976122	Brüel & Kjaer
	4371	2296687	Brüel & Kjaer
	4371	958265	Brüel & Kjaer
Accelerometer receiver	4381	984902	Brüel & Kjaer
	4381	985057	Brüel & Kjaer
	4370	1425970	Brüel & Kjaer
	4370	1513465	Brüel & Kjaer
Accelerometer calibrator	4294	1332343	Brüel & Kjaer

The accelerometers for measuring the acceleration on the sender side and the receiver side of the measurement set-up were mounted on the exciter mass (input side) and the encumbrance mass (output side), respectively. Coupling was done in accordance with DIN ISO 5348 *Mechanical mounting of accelerometers* of July 1999 [2].

5 Results

5.1 Analysis and presentation of the measurement results

The increased impact ΔL of the pipe ring with respect to structure-borne sound insulation becomes clear in the difference between the graphs of testing object and reference clamp (see figures in Appendix A). They give an idea of potential structure-borne sound insulation effects.

In the following Table 2 the structure-borne sound insulating effect of the testing object is shown.

Table 2. Structure-borne sound insulation effect $\Delta L_{500\ \mathrm{Hz}}$ of the testing object.

Description	Manufacturer	Tightening torque in Nm	$\Delta L_{500\ \mathrm{Hz}}$ *) in dB
FIX 76/19	Korff Isolmatic	1.0	24.1

*) The comparison of results from previous investigations according to DIN EN ISO 3822-1 „Laboratory tests on noise emission from appliances and equipment used in water supply installations" of July 2009 *[3]* shows that the noise reduction ΔL_A as in DIN EN ISO 3822-1 of July 2009 is approximately equivalent to the structure-borne sound reduction $\Delta L_{500\ \mathrm{Hz}}$ at the third-octave band centre frequency of 500 Hz.

Nils Gollub, B.Sc.

Appendix A

Diagram

Evaluation of noise insulation
with the "tonpilz" method following EN ISO 10846-4
Diameter(Pipe): 76 mm
Manufacturer: Korff Isolmatic