Vibration and Noise Information

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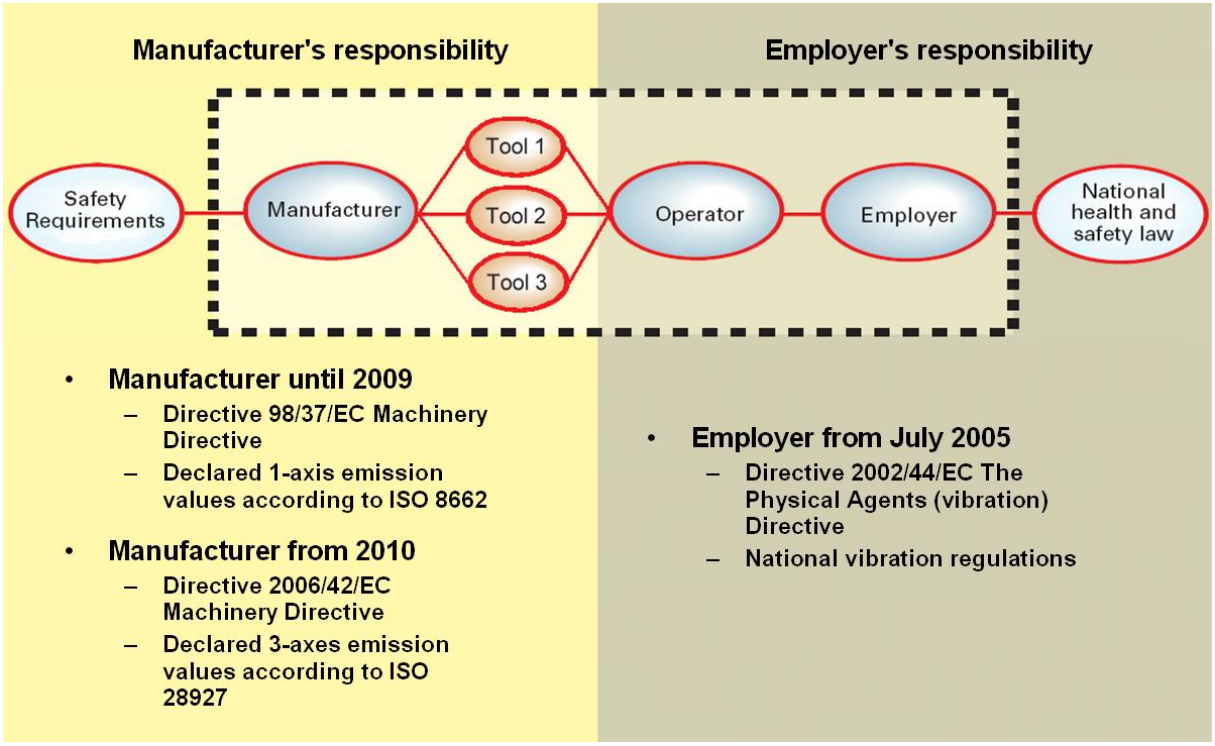
Introduction

Declared vibration and noise values are supplied with our tools.

In Europe the Machinery Directive from 1998 was active up to December 2009.
The declared values were single-axis values measured according to ISO 8662.
From 2010 a new directive 2006/42/EC became active. Declared vibration values changed to 3-axes values, measured according to ISO 28927 or EN 60745. These values are generally higher than the old declared values. The old and new values should not be mixed and cannot be compared. In case the machine tested is not covered in ISO 28927 the general standard ISO 20643 is used. The reference to ISO 20643 should preferably be followed by a note explaining how the test was performed. The noise values are declared using the same standard as before, ISO 15744. The only change is that the sound power should now be given when the sound pressure exceeds 80 dB(A). Also the uncertainty of both vibration and noise values shall be given.

The legal situation for employers is not affected by this change. For them the regulations based on the Physical Agents (Vibration) Directive 2002/44/EC that became active in 2005 gives action and limit values for the vibration exposure of operators**.** For noise the regulations are based on the Physical Agents (Noise) Directive 2003/10/EC.



Declared vibration emission values given by the manufacturer are often confused with the vibration exposure, A8.
A vibration exposure assessment comprises an estimated in-use vibration value and the exposure or trigger time expressed in hours per day. The in-use vibration is the vibration value at the specific workplace when the tool is triggered. The value used should be representative of the energy equivalent average, the rms value. This in-use value can in many cases be roughly estimated with the new 3-axes vibration value given by the manufacturer.

This document provides information on how vibration emission measurements have been performed for different types of machine. Important parameters that influence the in-use vibration are discussed and advice regarding control of vibration in the workplace is given.

General information valid for most tool types

Declared values and vibration exposure assessment

Quoted from the introduction to all parts of ISO 28927 standards: The values obtained are type-test values intended to be representative of the average of the upper quartile of typical vibration magnitudes in real-world use of the machines. However, the actual magnitudes will vary considerably from time to time and depend on many factors, including the operator, the task and the inserted tool or consumable. The state of maintenance of the machine itself might also be of importance. Under real working conditions the influences of the operator and process can be particularly important at low magnitudes. It is therefore not recommended that emission values below 2.5 m/s^2 be used for estimating the vibration magnitude under real working conditions. In such cases, it is recommended that a vibration magnitude of 2.5 m/s^2 is used to estimate the machine vibration.

The standards used for our declaration of vibration and noise emission are ISO 28927 for vibration and ISO 15744 for noise. Atlas Copco has also decided to use ISO standards for Electric tools. The ISO 28927 standards are in most cases similar to the standards in the EN 60745 series and the ISO standards can easily be found in most countries worldwide.

The vibration values and recommendations given are based on our experience. Atlas Copco cannot be held liable for the consequences of using this information, instead of values reflecting the actual exposure, in an individual risk assessment in a workplace situation over which we have no control.

The tools discussed may cause hand-arm vibration syndrome if the use is not adequately managed. An EU guide to managing hand-arm vibration can be found at http://www.humanvibration.com/EU/VIBGUIDE.htm
We recommend a program of health surveillance to detect early symptoms which may relate to vibration exposure, so that management procedures can be modified to help prevent future impairment.

We point out that application of any one tool to a sole specialist task may produce an average emission much higher or lower than the declared emission value and in such cases we strongly recommend a specific evaluation of the vibration emission. If workplace measurements are used in such evaluations, it is essential to use more than one operator, each performing at least 5 test runs, and to repeat the test on at least 3 tools of the same kind, if the result is intended to reflect a likely average in-use vibration in that workplace.

Scientific reports indicate that the risk of hand arm vibration syndrome from shock type vibration is higher than from the vibration from rotating machines. We therefore also recommend the use of vibration controlled percussive machines for applications where the risk assessment shows low risk of vibration disorders. Other reports indicate an increased risk when the vibration exposure is combined with cold.

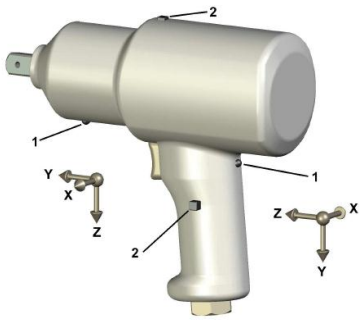
Information for specific tool types

Impulse nutrunners and Impact wrenches

Declared vibration emission values

Declared vibration emission values are based on measurements according to ISO 28927 part 2: Wrenches, nutrunners and screwdrivers.
The machines are run in a brake device with the spindle vertically downwards.
Machines weighing less than 2 kg are measured using one hand position only. Machines weighing more than 2 kg are measured using two hand positions, with one on the handle and one on the front part of the tool (Figure 1). Tools tested using two hand positions are also held with two hands during the test. Tools with support handles are held in the support handle. Tools without support handles are held with the supporting hand positioned in the rear of the machine even though the second transducer location is on the front housing. All test results are based on measurements where 3 operators each made 5 test runs on 3 different tools.

Key
1 prescribed location
2 secondary location



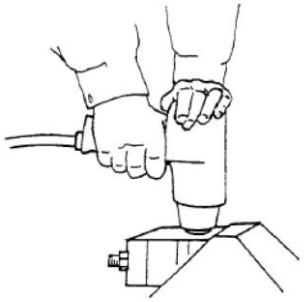


Figure 1 - Transducer locations and hand positions used.

In the tests the secondary position was used on the main handle.
For the models normally used with two hands the higher value was in most cases found on the front part of the tool, hence these values are used as the declared values.
The brake device used is constructed according to annex C of the test code. Brake blocks made of aluminum lined with a friction material were used (Figure 2).

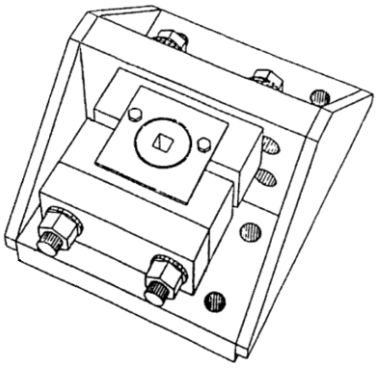


Figure 2 – Brake device

Information concerning vibration exposure

The vibration emission varies greatly with task and operator technique. The declared vibration value relates to the main hand position(s). Higher vibration levels may occur at other hand positions.
It is essential to avoid all contact with the socket. Measurements on the socket are difficult to perform but vibration values on the socket are usually much higher than on the machine itself. When one hand is on the socket that hand is exposed to vibrations that are in many cases in excess of 30 m/s^2. Worn sockets and the use of extensions normally increase the vibration emission.

Vibration exposure is also dependent on the exposure time. It is important to use a tool powerful enough to get the job done. Tightening times longer than 2 seconds should be avoided. Instead change to a more powerful tool.

Providing information for the operators regarding proper use of the machines can reduce the vibration exposure.

We believe that normal intended use of the machine will usually produce vibration emissions in the range of 50 to 150% of the given declared values (vibration total values, as defined in ISO 5349-1:2001), depending on the details of the task, but emissions outside this range may occur for some applications. The declared emission is probably a useful average emission value and can be used together with trigger time when, for example, roughly estimating the likely average exposures of users performing a wide range of tasks within the intended use of the tool. We point out that application of the tool to a sole specialist task may produce a different average emission and in such cases we strongly recommend a specific evaluation of the vibration emission.

Due to the shock type vibration in impact wrenches mechanical filters must be used for the measurements.

Pneumatic nutrunners and screwdrivers, shut-off and stall types, and all electric screwdrivers and nutrunners.

Declared vibration emission values

Declared vibration emission values are based on measurements according to ISO 28927 part 2: Wrenches, nutrunners and screwdrivers.
The machines are run in no load with the spindle pointing vertically down. Tools tested using two hand positions are also held with two hands during the test (Figure 3). Tools with support handles are held on the support handle. Tools without support handles are held with the supporting hand positioned in the normal grip area. All test results are based on measurements where 3 operators each made 5 test runs on 3 different tools.

Key
1 prescribed location
2 secondary location

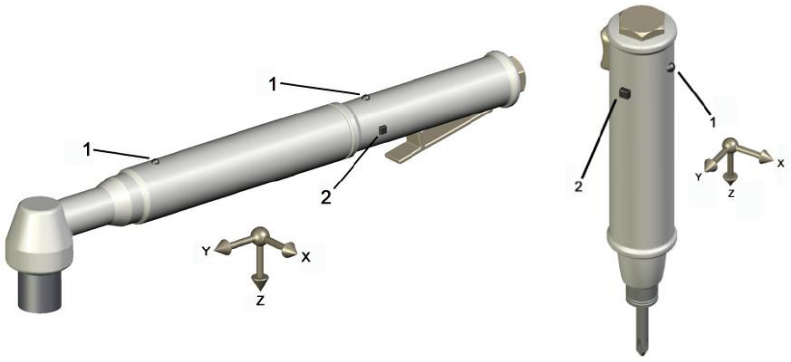


Figure 3 - Transducer locations and hand positions used.

Information concerning vibration exposure

The vibration emission varies greatly with task and operator technique. The declared vibration value relates to the main hand position(s). Higher vibration levels may occur at other hand positions.
Vibration emissions from these types of tool are normally low. In most cases no exposure assessment is needed. The use of long extensions might increase the vibration emission. Vibration exposure is also dependent on the exposure time. The total tightening time, including rundown, should be used as trigger time. In cases where long extensions are used it might be necessary to separate the vibration value and time for rundown, and the vibration value and time for the actual tightening, to get a valid exposure assessment.

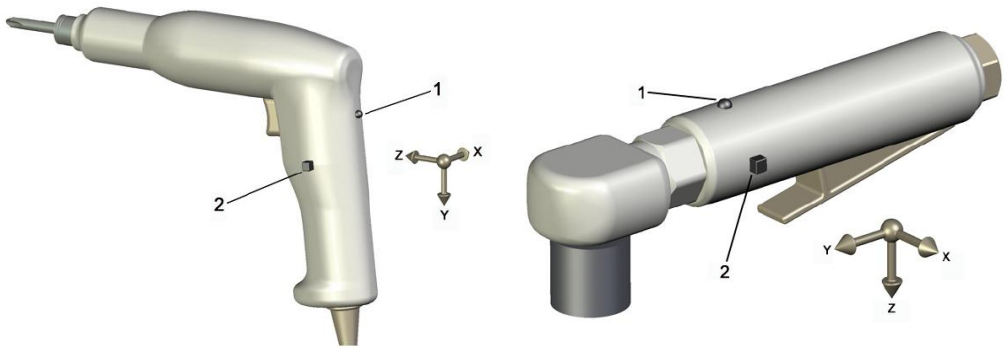
Providing information for the operators regarding proper use of the machines can reduce the vibration exposure.

We believe that normal intended use of the machine will usually produce vibration emissions below 2.5 m/s^2 (vibration total values, as defined in ISO 5349-1:2001), depending on the details of the task, but emissions outside this range may occur for some applications. The declared emission is probably a useful average emission value and can be used together with trigger time when, for example, roughly estimating the likely average exposures of users performing a wide range of tasks within the intended use of the tool. We point out that application of the tool to a sole specialist task may produce a different average emission and in such cases we strongly recommend a specific evaluation of the vibration emission.

Slip-clutch screwdrivers and ratchet wrenches

Declared vibration emission values

Declared vibration emission values are based on measurements according to ISO 28927 part 2: Wrenches, nutrunners and screwdrivers.
The machines are run in no load with the spindle pointing vertically down. This situation adequately represents the rundown. Tools tested using two hand positions are also held with two hands during the test. Tools with support handles are held with one hand on the support handle. Tools without support handles are held with the supporting hand positioned in the normal grip area (Figure 4). All test results are based on measurements where 3 operators each made 5 test runs on 3 different tools.



Key
1 prescribed location
2 secondary location

Figure 4 - Transducer locations and hand positions used.

Information concerning vibration exposure

The vibration emission varies greatly with task and operator technique. The declared vibration value relates to the main hand position(s). Higher vibration levels may occur at other hand positions.
Vibration emissions from slip-clutch type screwdrivers are normally low during rundown as indicated by the declared values. When the clutch is slipping the tools can have high vibration emission. It is therefore essential that the tool is stopped as soon as the clutch starts to slip. Slipping should not be used to increase torque or to overcome periods of high torque during rundown. For such applications an impulse nutrunner is probably a better choice. In normal use slipping is a small fraction of the total tightening time and therefore not the dominant part.

During slipping the vibration varies with tool type and torque range. Pistol grip tools have vibration emission values when slipping of around 6-15 m/s^2. Straight tools have vibration emissions when slipping of around 6 up to >30 m/s^2 for the high torque models. In situations where the tool is not stopped as soon as slipping starts that part must also be included in the vibration exposure assessment.

Ratcheting wrenches have relatively high vibrations during rundown as indicated by the declared vibration values. In cases where they are used on soft joints or prevailing bolts the wrenches will work under load for a considerable time. The vibration under load is normally higher than during rundown. When used under load ratcheting wrenches can be expected to have vibration values in the range 10 to 20 m/s^2 depending on the torque applied.

Providing information for the operators regarding proper use of the machines is essential to reduce the vibration exposure.

A realistic estimation of the in-use vibration for slip clutch screwdrivers, requires that both the vibration during rundown together with the rundown time, and the vibration when the clutch is slipping together with the slipping time, is included in the estimation. Also for ratcheting wrenches both rundown and tightening need to be included. The result of such a calculation is probably a useful average in-use value when, for example, roughly estimating the likely average exposures of users performing a wide range of tasks within the intended use of the tool. We point out that application of the tool to a sole specialist task may produce a different average emission and in such cases we strongly recommend a specific evaluation of the vibration emission.

Nutrunners and screwdrivers intended for fixtured applications

For this group of machines no vibration value is given. The size and weight of the fixture are important parts of the total system and a vibration value for only the machine can be misleading. Instead a value for the total system including the fixture should be used.

Grinders and straight grinders

Declared vibration emission values

Declared vibration emission values are based on measurements according to ISO 28927 part 1: Angle and vertical grinders, or to part 4: Straight grinders.
The machines are run in no load equipped with a test wheel geometrically equivalent to a grinding wheel but machined in aluminum and with a well-defined, calibrated, known imbalance.
Tools tested using two hand positions are also held with two hands during the test. Tools with support handles are held on the support handle (Figure 5). All test results are based on measurements where 3 operators each made 5 test runs on 3 different tools.

Key
1 prescribed location
2 secondary location

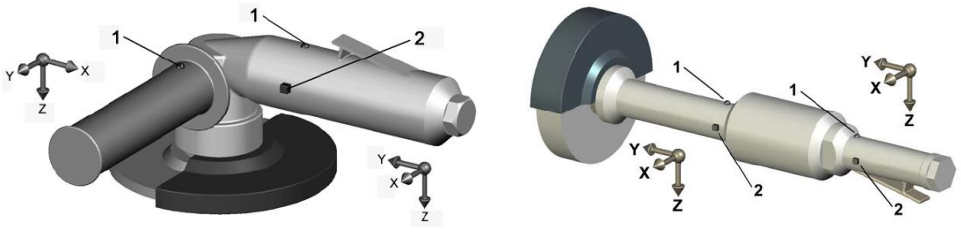


Figure 5 - Transducer locations and hand positions used.

In the tests the secondary transducer location was used on the main handle and the prescribed location was used on support and front handles.
For the models normally used with two hands the higher value was in most cases found on the support handle, hence these values are used as the declared values.

In part 1 and part 4 of ISO 28927 it is stated that the declared vibration for tools equipped with autobalancers is the measured vibration multiplied by a factor of 1.3. This correction is included, when applicable, in our declared vibration values.
It is also stated that the vibration emission for grinders used with wire brushes cannot be estimated using the declared vibration emission values.

Information concerning vibration exposure

The vibration emission varies greatly with task and operator technique. The declared vibration value relates to the main hand position(s). Higher vibration levels may occur at other hand positions.
In-use vibrations are related to the imbalance of the wheel. Therefore it is essential to use good quality wheels with low initial imbalance. Use flanges of good quality and change them when they get worn. The material removal rate depends on the type of grinding wheel used. A grinding wheel with good material removal rate for the intended task can reduce grinding time considerably. The wheel should also be chosen to match the machine and the material worked on. If not, the edge of the wheel might break off in pieces instead of being worn down. This can result in wheel imbalance. It is also important to check the air installation to ensure that the grinder can work at maximum performance.

Providing information for the operators regarding proper use of the machines can reduce the vibration exposure. Operators should be told to change the wheel when they feel unusually high vibrations.

We believe that normal intended use of the machine will usually produce vibration emissions in the range of 50 to 150% of the given declared values (vibration total values, as defined in ISO 5349-1:2001), depending on the details of the task, but emissions outside this range may occur for some applications. The declared emission is probably a useful average emission value and can be used together with trigger time when, for example, roughly estimating the likely average exposures of users performing a wide range of tasks within the intended use of the tool. We point out that application of the tool to a sole specialist task may produce a different average emission and in such cases we strongly recommend a specific evaluation of the vibration emission.

If workplace measurements are performed in such evaluations it is essential to use more than one operator, each performing at least 5 test runs, and to repeat the test on at least 3 tools of the same kind, if the result is intended to reflect a likely average in-use vibration in that workplace. The imbalance of the grinding wheel affects the in-use vibration. Therefore it is essential to do workplace measurements using a number of different wheels during the test.

Die grinders

Declared vibration emission values

Declared vibration emission values are based on measurements according to ISO 28927 part 12: Die grinders. This part of 28927 is a Draft International Standard (2010-04-15) and the values might be altered due to changes in the standard.
The machines are run in a grinding operation equipped with a hard metal burr or a cylindrical sleeve on a rubber holding fixture for the lower rotational speeds. Grinding is performed on a 4 or 1.5 mm wide steel surface, 250 or 200 mm long (Figure 6). The operation should be a typical deburring action with a limited feed force.

Tools tested using two hand positions are also held with two hands during the test (Figure 6). All test results are based on measurements where 3 operators made 5 test runs on 3 different tools.

Key
1 prescribed location
2 secondary location

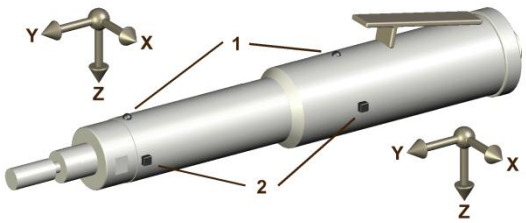


Figure 6 - Transducer locations and hand positions used. Right: Die Grinder vibration measurement.

In the tests the secondary position was used on the main handle and the prescribed location was used on the front part.
For the models normally used with two hands the higher value was in most cases found on the front part, hence these values are used as the declared values.

Information concerning vibration exposure

The vibration emission varies greatly with task and operator technique. The declared vibration value relates to the main hand position(s). Higher vibration levels may occur at other hand positions. It is essential to use good quality inserted tools with low initial imbalance. Use collets of good quality and change them when they become worn.

Applications where wire-brushes are used are at present not covered by this part of ISO 28927.

Providing information for the operators regarding proper use of the machines can reduce the vibration exposure. Operators should be told to change the machine when they feel unusually high vibrations. It might be the result of abuse resulting in a bent spindle.

We believe that normal intended use of the machine will usually produce vibration emissions in the range of 50 to 150% of the given declared values (vibration total values, as defined in ISO 5349-1:2001), depending on the details of the task, but emissions outside this range may occur for some applications. The declared emission is probably a useful average emission value and can be used together with trigger time when, for

example, roughly estimating the likely average exposures of users performing a wide range of tasks within the intended use of the tool. We point out that application of the tool to a sole specialist task may produce a different average emission and in such cases we strongly recommend a specific evaluation of the vibration emission.

If workplace measurements are performed in such evaluations it is essential to use more than one operator, each performing at least 5 test runs, and to repeat the test on at least 3 tools of the same kind, if the result is intended to reflect a likely average in-use vibration in that workplace. The imbalance of inserted tools other than hard metal burrs affects the in-use vibration. It is therefore essential to use more than one inserted tool on each machine when workplace measurements are performed.

Rotary sanders

Declared vibration emission values

Declared vibration emission values are based on measurements according to ISO 28927 part 3: Polishers and rotary, orbital and random orbital sanders.
Rotary sanders are run in a sanding operation on the flat surface of a steel block 300x300x40 mm. The machines are equipped with a pad and sanding disc normally used on steel. The abrasive material should be suitable for steel and have a grain size of 120. The machines are moved at a constant speed over the surface of the workpiece in a figure-of-eight pattern with an approximate radius of 50 mm. Each figure-of-eight pattern should take approximately 4 s. The total test time should allow for 16 s integration time when steady operation is achieved.
The vertical feed force, in addition to the weight of the machine, should ensure that the machine operates at its normal level of performance and in a stable manner.

Tools tested using two hand positions are also held with two hands during the test (Figure 7). All test results are based on measurements where 3 operators each made 5 test runs on 3 different tools.

Key
1 prescribed location
2 secondary location

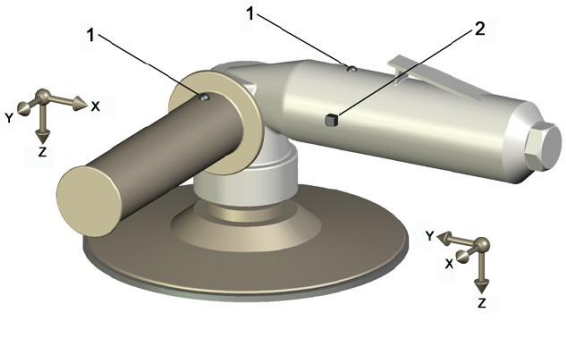


Figure 7 - Transducer locations and hand positions used.

In the tests the secondary position was used on the main handle and the prescribed location was used on the support handle.
For the models normally used with two hands the higher value was in most cases found on the support handle, hence these values are used as the declared values.

Information concerning vibration exposure

The vibration emission varies greatly with task and operator technique. The declared vibration value relates to the main hand position(s). Higher vibration levels may occur at other hand positions.

Use backing pads and sanding discs of good quality.

Providing information for the operators regarding proper use of the machines can reduce the vibration exposure. Worn backing pads and sanding discs should be changed. Operators should be told to change the machine when they feel unusually high vibrations. It might be the result of abuse resulting in a bent spindle.

We believe that normal intended use of the machine will usually produce vibration emissions in the range of 50 to 150% of the given declared values (vibration total values, as defined in ISO 5349-1:2001), depending on the details of the task, but emissions outside this range may occur for some applications. The declared emission is probably a useful average emission value and can be used together with trigger time when, for example, roughly estimating the likely average exposures of users performing a wide range of tasks within the intended use of the tool. We point out that application of the tool to a sole specialist task may produce a different average emission and in such cases we strongly recommend a specific evaluation of the vibration emission.

If workplace measurements are performed in such evaluations it is essential to use more than one operator, each performing at least 5 test runs, and to repeat the test on at least 3 tools of the same kind, if the result is intended to reflect a likely average in-use vibration in that workplace. The imbalance of inserted tools affects the in-use vibration. Therefore it is in such applications essential to do workplace measurements using a number of different inserted tools during the test.

Orbital sanders

Declared vibration emission values

Declared vibration emission values are based on measurements according to ISO 28927 part 3: Polishers and rotary, orbital and random orbital sanders.
Orbital and random orbital sanders are run in a sanding operation on the flat surface of a steel block 300x300x40 mm. The machines are equipped with a pad and a sanding disc normally used on steel. The abrasive material should be suitable for steel and have a grain size of 180. The machines are moved at a constant speed over the surface of the workpiece in a figure-of-eight pattern with an approximate radius of 50 mm. Each figure-of-eight pattern should take approximately 4 s. The total test time should allow for 16 s integration time when steady operation is achieved.
The vertical feed force, in addition to the weight of the machine, should ensure that the machine operates at its normal level of performance and in a stable manner. The magnitude of the vertical feed force, in addition to the mass of the machine, should be in the order of 30 N ± 5 N.

Tools tested using two hand positions are also held with two hands during the test (Figure 8). All test results are based on measurements where 3 operators each made 5 test runs on 3 different tools.

Key
1 prescribed location
2 secondary location

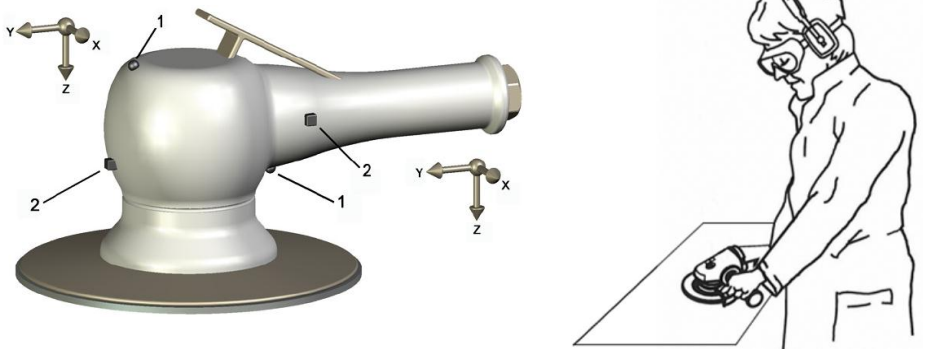


Figure 8 - Transducer locations and hand positions used

In the tests the prescribed position was used on the machine housing and the secondary position on the main handle.

Information concerning vibration exposure

The vibration emission varies greatly with task and operator technique. The declared vibration value relates to the main hand position(s). Higher vibration levels may occur at other hand positions.

Use backing pads and sanding discs of good quality.

Providing information for the operators regarding proper use of the machines can reduce the vibration exposure. It is important to change discs regularly to keep the material removal rate high.

The backing pads should be changed when they get worn to avoid unnecessary vibrations from imbalances. It is essential that the backing pad used is one recommended by the manufacturer. Also small deviations from the recommended weight or geometric shape can greatly influence the vibration magnitude. The whole machine should be changed when unusually high vibrations are experienced. It might be the result of abuse resulting in a bent spindle.

We believe that normal intended use of the machine will usually produce vibration emissions in the range of 50 to 150% of the given declared values (vibration total values, as defined in ISO 5349-1:2001), depending on the details of the task, but emissions outside this range may occur for some applications. The declared emission is probably a useful average emission value and can be used together with trigger time when, for example, roughly estimating the likely average exposures of users performing a wide range of tasks within the intended use of the tool. We point out that application of the tool to a sole specialist task may produce a different average emission and in such cases we recommend a specific evaluation of the vibration emission.

If workplace measurements are performed in such evaluations it is essential to use more than one operator, each performing at least 5 test runs, and to repeat the test on at least 3 tools of the same kind, if the result is intended to reflect a likely average in-use vibration in that workplace. If the machine is used with only a segment of the sanding disc or pad in contact with the workpiece, that work task also needs to be evaluated.

Circular cutters

Declared vibration emission values

Declared vibration emission values are based on measurements according to ISO 28927 part 8: Saws, polishing and filing machines with reciprocating action and small saws with oscillating or rotating action. These types of machine are normally intended for one hand operation and only one measurement point is used (Figure 9). All test results are based on measurements where 3 operators each made 5 test runs on 3 different tools.

Key
1 prescribed location
2 secondary location

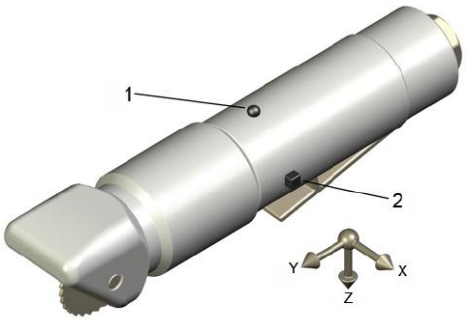


Figure 9 - Transducer locations and hand positions used.

In the tests the secondary position was used on the main handle.
As stated in the standard, in the test a strip is cut in a steel sheet 1 mm thick. For cutters with a rotating diamond cutter the test was run in 8 mm thick glass-fiber reinforced plastic.

Information concerning vibration exposure

The vibration emission varies greatly with task and operator technique. The declared vibration value relates to the main hand position and much higher vibration levels may occur at other hand positions.

Providing information for the operators regarding proper use of the machines can reduce the vibration exposure. Operators should be informed that it is necessary to change the cutter regularly. The feed force used should be adjusted to allow the machine to run at maximum power.

We believe that normal intended use of the machine will usually produce vibration emissions in the range of 50 to 150% of the given declared values (vibration total values, as defined in ISO 5349-1:2001), depending on the details of the task, but emissions outside this range may occur for some applications. The declared emission is probably a useful average emission value and can be used together with trigger time when, for example, roughly estimating the likely average exposures of users performing a wide range of tasks within the intended use of the tool. We point out that application of the tool

to a sole specialist task may produce a different average emission and in such cases we recommend a specific evaluation of the vibration emission.

If workplace measurements are performed in such evaluations it is essential to use more than one operator, each performing at least 5 test runs, and to repeat the test on at least 3 tools of the same kind, if the result is intended to reflect a likely average in-use vibration in that workplace.

Chipping hammers

Declared vibration emission values

Declared vibration emission values are based on measurements according to ISO 28927 part 10: Percussive drills, hammers and breakers.
Two hand positions are used, one on the handle and one on the front part of the machine housing (Figure 10). All our test results are based on measurements where 3 operators made 5 test runs on 3 different tools.

Key
1 prescribed location
2 secondary location

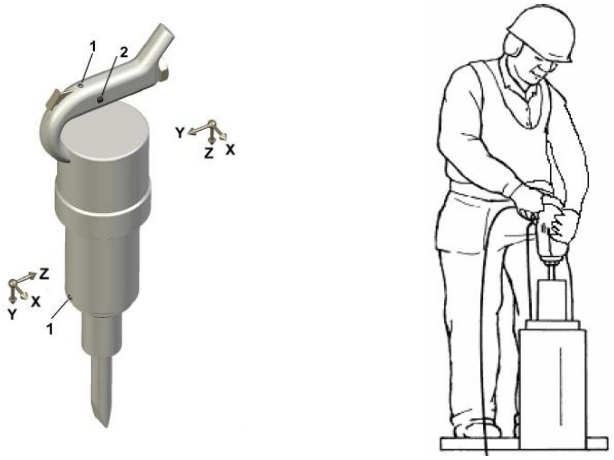


Figure 10 - Transducer locations and hand positions used. Right: Vibration measurement in the energy absorber.

In the tests the secondary position was used on the main handle and the prescribed position was used on the machine housing.

On most machines the higher value was found on the front part of the tool, hence these values are used as the declared values. As stated in the standard, the test is run in an energy absorber (Figure 10).

Information concerning vibration exposure

The vibration emission varies greatly with task and operator technique. The declared vibration value relates to the main hand positions and much higher vibration levels may occur at other hand positions.

It is essential to avoid all contact with the chisel set. The vibration value on the chisel is usually greater than 30 m/s^2, as pointed out in the ISO 28927-10 standard. For applications where it is necessary for the operator to guide the chisel with one hand we recommend the RRD machines where the chisel can be guided using the detachable hand

grip. The vibration in the hand grip is not included in the declared vibration value. That vibration depends on grip and feed forces, and a workplace measurement needs to be performed.

Providing information for the operators regarding proper use of the machines can reduce the vibration exposure. Worn chisels should be changed. Operators should be told to change the machine when they feel unusually high vibrations. Vibration controlled models are sensitive to feed force. Operators should be informed that it is necessary to use the correct feed force. Too high or too low feed force can result in increased vibration values.

We believe that normal intended use of the machine will usually produce vibration emissions in the range of 50 to 150% of the given declared values (vibration total values, as defined in ISO 5349-1:2001), depending on the details of the task, but emissions outside this range may occur for some applications. The declared emission is probably a useful average emission value and can be used together with trigger time when, for example, roughly estimating the likely average exposures of users performing a wide range of tasks within the intended use of the tool. We point out that application of the tool to a sole specialist task may produce a different average emission and in such cases we recommend a specific evaluation of the vibration emission.

If workplace measurements are performed in such evaluations it is essential to use more than one operator, each performing at least 5 test runs, and to repeat the test on at least 3 tools of the same kind, if the result is intended to reflect a likely average in-use vibration in that workplace.

Due to the shock type vibration in percussive machines mechanical filters must be used for the measurements.

Scalers

Declared vibration emission values

Declared vibration emission values are based on measurements according to ISO 28927 Part 9: Scaling hammers and needle scalers.
These types of machine are normally intended for one hand operation and only one measurement point is used (Figure 11). All our test results are based on measurements where 3 operators each made 5 test runs on 3 different tools.

Transducer locations

Key
1 prescribed location
2 secondary location

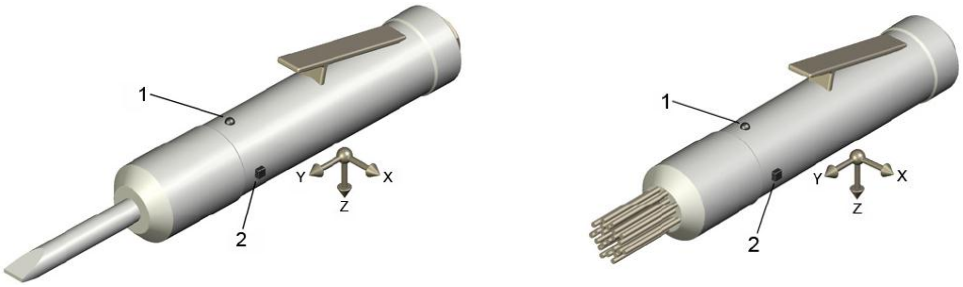


Figure 11 - Transducer locations and hand positions used.

In the tests the secondary position was used on the main handle.
As stated in the standard, the test is performed as a scaling operation on a steel plate.

Information concerning vibration exposure

The vibration emission varies greatly with task and operator technique. The declared vibration value relates to the main hand position and much higher vibration levels may occur at other hand positions.

It is essential to avoid all contact with the chisel. The vibration value on the chisel is usually greater than 30 m/s^2, as pointed out in the ISO 28927-9 standard.

Providing information for the operators regarding proper use of the machines can reduce the vibration exposure. Worn chisels should be changed.

We believe that normal intended use of the machine will usually produce vibration emissions in the range of 50 to 150% of the given declared values (vibration total values, as defined in ISO 5349-1:2001), depending on the details of the task, but emissions outside this range may occur for some applications. The declared emission is probably a useful average emission value and can be used together with trigger time when, for example, roughly estimating the likely average exposures of users performing a wide range of tasks within the intended use of the tool. We point out that application of the tool to a sole specialist task may produce a different average emission and in such cases we recommend a specific evaluation of the vibration emission.

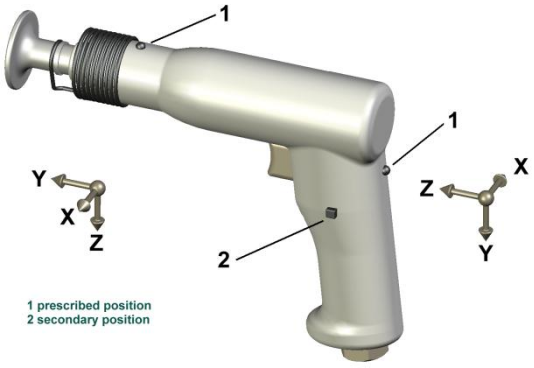
If workplace measurements are performed in such evaluations it is essential to use more than one operator, each performing at least 5 test runs, and to repeat the test on at least 3 tools of the same kind, if the result is intended to reflect a likely average in-use vibration in that workplace.

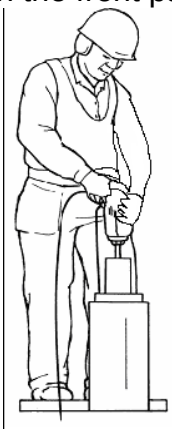
Due to the shock type vibration in percussive machines mechanical filters must be used for the measurements.

Riveting hammers

Declared vibration emission values

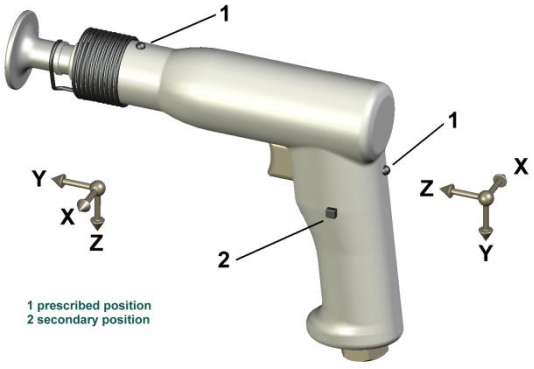
Declared vibration emission values are based on measurements according to ISO 28927 part 10: Percussive drills, hammers and breakers.
Two hand positions are used, one on the handle and one on the front part of the tool (

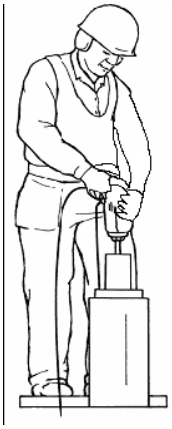




Key
1 prescribed location
2 secondary location

Figure 12). The smallest model in the range, RRH 04, is considered to be normally operated with only one hand and for that tool only one hand position has been used. All test results are based on measurements where 3 operators each made 5 test runs on 3 different tools.

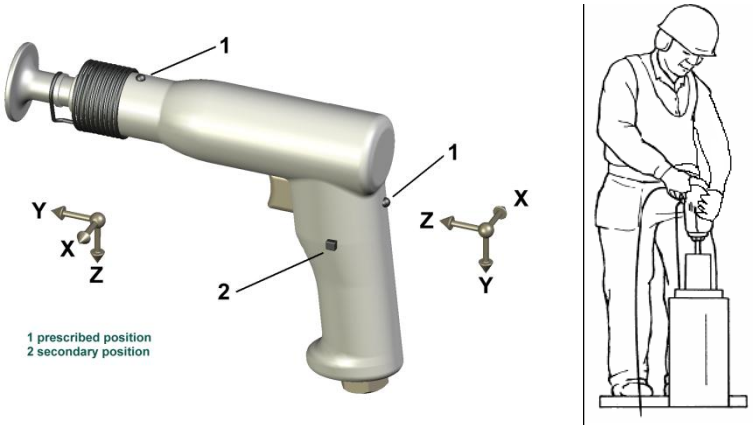




Key
1 prescribed location
2 secondary location

Figure 12 - Transducer locations and hand positions used. Right: Vibration measurement in the energy absorber.

In the tests the secondary position was used on the main handle.
For the models normally used with two hands the higher value was found on the front part of the tool, hence these values are used as the declared values.
As stated in the standard, the test is run in an energy absorber (



Key
1 prescribed location
2 secondary location

Figure 12).

Information concerning vibration exposure

The vibration emission varies greatly with task and operator technique. The declared vibration value relates to the main hand positions and much higher vibration levels may occur at other hand positions.

It is essential to avoid all contact with the rivet set. The vibration value on the set is usually greater than 30 m/s^2, as pointed out in the ISO 28927-10 standard. We therefore recommend that the adjustable hand guard be used.
Also the surface of the workpiece can often have vibration values much higher than those measured on the tool itself.
In a riveting process vibrations are often higher on the bucking bar side. We therefore recommend the use of vibration damped bucking bars in all situations where it is practically possible.

Providing information for the operators regarding proper use of the machines can reduce the vibration exposure. Operators should be told to change the machine when they feel unusually high vibrations.

We believe that normal intended use of the machine will usually produce vibration emissions in the range of 50 to 150% of the given declared values (vibration total values, as defined in ISO 5349-1:2001), depending on the details of the task, but emissions outside this range may occur for some applications. The declared emission is probably a useful average emission value and can be used together with trigger time when, for example, roughly estimating the likely average exposures of users performing a wide range of tasks within the intended use of the tool. We point out that application of the tool to a sole specialist task may produce a different average emission and in such cases we recommend a specific evaluation of the vibration emission.

If workplace measurements are performed in such evaluations it is essential to use more than one operator, each performing at least 5 test runs, and to repeat the test on at least 3 tools of the same kind, if the result is intended to reflect a likely average in-use vibration in that workplace.

Due to the shock type vibration in percussive machines mechanical filters must be used for the measurements.

Drills

Declared vibration emission values

Declared vibration emission values are based on measurements according to ISO 28927 part 5: Drills and impact drills.
One hand position is used for tools delivered without a support handle and two hand positions are used for tools delivered with a support handle (Figure 13). All test results are based on measurements where 3 operators each made 5 test runs on 3 different tools.

Key
1 prescribed location
2 secondary location

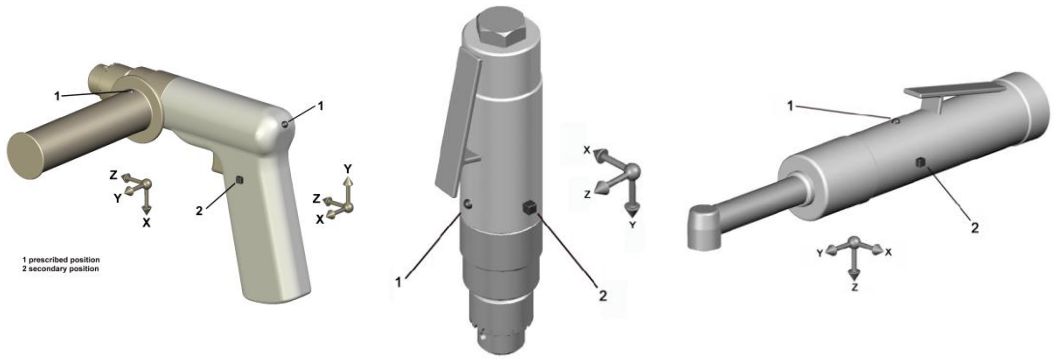


Figure 13 - Transducer locations and hand positions used.

For most tools the secondary position was used for the main handle. Models with rotational speed up to 10 000 rpm are tested performing a drilling operation into gray cast iron. Models with a rotating speed >10 000 rpm are tested running free with a 1.5 mm drill-bit inserted.

Information concerning vibration exposure

The vibration emission varies greatly with task and operator technique. The declared vibration value relates to the main hand positions and higher vibration levels may occur at other hand positions.

In-use vibration values are affected by the run out of the chuck and the drill-bit. The sharpness of the drill is another important factor. The material in the workpiece also influences the in-use vibration.

Providing information for the operators regarding proper use of the machines can reduce the vibration exposure.

We believe that normal intended use of the tool will usually produce vibration emissions in the range of 50 to 150% of the given declared values (vibration total values, as defined in ISO 5349-1:2001), depending on the details of the task, but emissions outside this range may occur for some applications. The declared emission is probably a useful average emission value when, for example, roughly estimating the likely average exposures of users performing a wide range of tasks within the intended use of the tool. We point out that application of the tool to a sole specialist task may produce a different average emission and in such cases we recommend a specific evaluation of the vibration emission.

If workplace measurements are performed in such evaluations it is essential to use more than one operator, each performing at least 5 test runs, and to repeat the test on at least 3 tools of the same kind, if the result is intended to reflect a likely average in-use vibration in that workplace.

Noise measurements

Quoted from the introduction of ISO 15744 standard: The noise test code presented by this International Standard gives methods for determining and declaring the noise emission values of handheld non-electric power tools: i.e., the total noise level from the power tool expressed as sound power level and as the emission sound pressure level at the workstation. These methods have been designed to give results that make it possible to compare the acoustic performance of various power tools.

The power tools are either run at no load, when this gives a representative value, or in an on-load condition but with the process noise muffled so that it is well below the noise level of the power tool. The standard is applicable to non-electric power tools such as rotary tools, orbital and random orbital sanders, rotary and non-rotary reciprocating and percussive tools and a variety of assembly tools. At Atlas Copco, the standard is also used for handheld electric power tools and fixtured electric power tools.

For many power tools in a real work situation the noise from the process dominates the total noise emission in actual use. The process noise varies within very wide limits and cannot be predicted. Users are cautioned that the emission sound pressure level as determined by this code may not be representative of actual operator exposure levels, which are unique characteristics of individual applications and environmental factors beyond the control of the manufacturers of the equipment covered by this International Standard, and are under the exclusive control (and therefore the responsibility) of the users of the equipment.

The noise value is measured in Atlas Copco Industrial Technique's semi-anechoic room. The microphone set-up, illustrated in Figure 14, consists of 5 microphones covering a hemisphere. The tool is positioned in the middle of the hemisphere. All test results are based on measurements where 1 operator performs 3 test runs on 3 different tools.

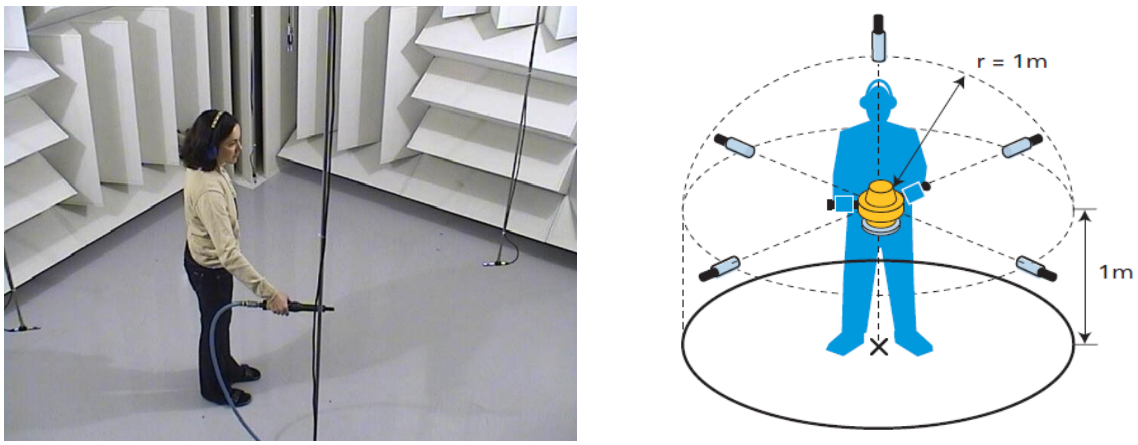


Figure 14 - The semi-anechoic room and the microphone set-up.

Pneumatic power tools

The noise generated from pneumatic tools is dominated by two sources; the noise from the motor and the aerodynamic noise generated from the exhaust air.
Vane and turbine motors generate a tone (single frequency) corresponding to the blade passing frequency (each time a single vane passes the outlet a pressure pulse is created). The vane motor generates a tone well within the hearing range of the human ear while the turbine motor, in general, generates a tone close to, or above, the upper hearing limit.
The aerodynamic noise from the exhaust air is dominated by broad band noise. The level of the noise is highly dependent on the flow velocity of the escaping air and a small reduction in velocity will decrease the noise significantly.

Grinders, sanders, drills, non-impact nutrunners, screwdrivers and circular cutters are run under no-load condition. Impact wrenches, impulse nutrunners, slip-clutch screwdrivers and ratchet wrenches are run at both no-load and on-load conditions. The condition generating the highest noise level will be declared. Percussive tools, such as chipping hammers, scalers and riveting hammers, together with random orbital sanders, are run under on-load conditions.

Electric handheld and fixtured power tools

The noise from electric tools is mainly generated from the gears. Radiation of noise from the housing may also generate some noise. The total noise value of this type of tool is rarely above 70 dB(A).

All electric tools, handheld and fixtured, are run under no-load conditions.