



Noise Excitation for Building Acoustics

Loudspeaker Systems Nor250 and Nor270

Power Amplifier Nor280

NEW! Tapping Machine Nor277

Excitation requirements

Building Acoustic measurement requires noise excitation in the source room in order to measure the sound insulation between two rooms. This is the case both for airborne sound insulation where a loudspeaker system is used, and for impact sound insulation where a tapping machine is used. Noise excitation is additionally required for making the corresponding reverberation time measurements in the receiving room.

The requirements for the loudspeaker systems used for laboratory measurements are found in Annex C of ISO 140/3. For field measurements the requirements are found in Annex A of ISO 140/4. For Reverberation Time measurements the requirements are found in Annex A of ISO 3382. These Standards specifies the directivity as well as the internal differences for the individual frequency bands in the noise spectrum. The Norsonic Dodecahedron Loudspeakers Nor270 and Nor270H fulfil these requirements both for laboratory and field measurements. The Norsonic Hemi-Dodecahedron Loudspeaker Nor250 fulfils the requirements for the field measurements.

For impact sound insulation measurements, the requirements to the tapping machine are found in Annex A of ISO 140/6, ISO 140/7 and ISO 140/8. These Standards specify the rotational speed, the weight and curvature of the hammers, the falling height of the hammers, as well as the physical distance between the hammers and the legs. The Norsonic Nor277 Tapping Machine fulfils these requirements both for laboratory and field measurements.



Features:

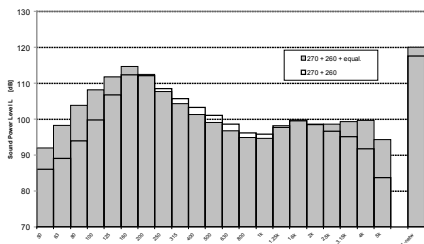
- Designed for optimal airborne and impact noise excitation of Building Acoustic measurement
- Up to 123 dB LW noise level
- Portable and rugged design for field use
- Nor250 and Nor270 fulfill ISO-140/4 Annex A field standard for airborne insulation
- Nor270 fulfils ISO-140/3 Annex C laboratory standard for airborne insulation, and ISO-3382 Annex A 3.1 standard for reverberation time
- Nor277 fulfils ISO-140/6 Annex A laboratory standard and ISO-140/7 Annex A field standard for impact insulation .

Dodecahedron Loudspeakers Nor270 & Nor270H

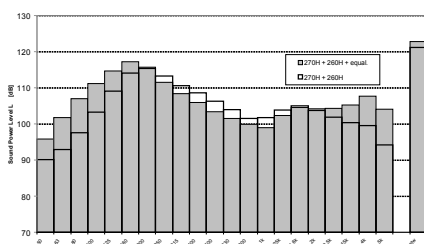


A multitude of applications within the field of building acoustics requires the use of isotropic sound fields. The loudspeakers Nor-270/270H have been designed to comply with these requirements and satisfies the ISO-140/3 Annex C (Laboratory measurements), ISO-140/4 Annex A (Field measurements) and the ISO-3382 Annex A (Reverberation Time measurements). The difference between the two products lies in the sound power output levels which are 120dB for Nor270 and 123dB for Nor270H.

The speakers come with a tripod ensuring correct placement so that



The sound power level vs. frequency of the loudspeakers Nor270 (upper graph) and Nor270H (lower graph) when used with power amplifier Nor280.



unwanted reflections and structural transmissions are kept at a minimum. The rugged cabinets are made of fibre glass and the speaker elements themselves are protected by grids to further enhance the concept.

Both the Nor270 and 270H have been designed for continuous operation for more than one hour at full power. They are matched to the Norsonic Power Amplifier Nor280, but may be used with other power amplifiers as long as impedances and max power ratings are kept within the specifications.

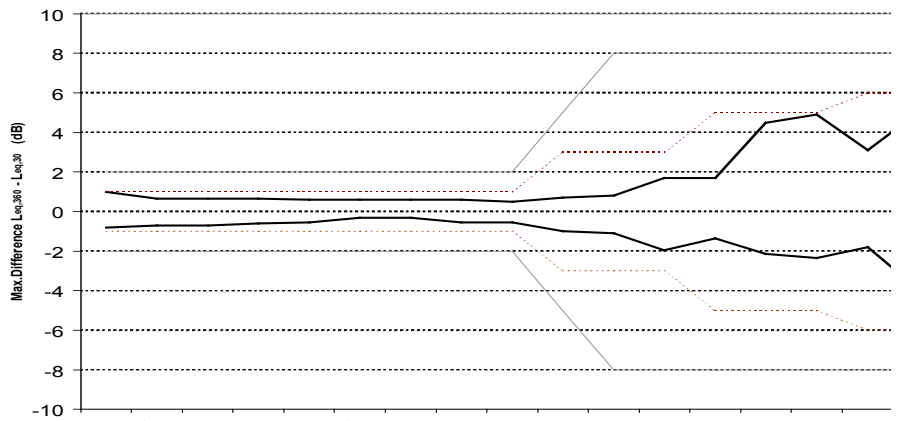
The speaker input socket accepts Speakon NL4FC connectors. A mounting rod ($\varnothing=1''$) makes tripod mounting easy and safe.

The Nor280 Power Amplifier has an equalisation circuitry designed to boost the high and low frequencies to improve the system performance when used for building acoustics. Both sound power graphs below include the sound power spectrum with and without the effects of the equalisation circuitry.

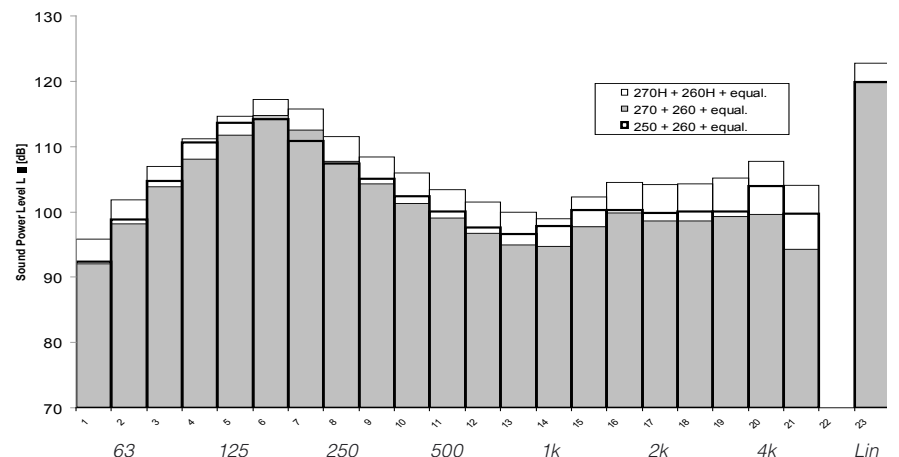
Hemi-dodecahedron Loudspeaker Nor250



A powerful sound source designed for building acoustics measurements per ISO-140/4 Annex A (Field measurements). The source provides uniform sound radiation. When used with the power amplifier Nor280 the high sound power level ensures accurate descriptors in measurement conditions that include high background levels, high sound insulation properties and large room volumes.

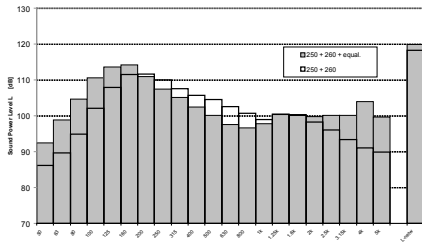


Directivity of the Nor270 with maximum deviation from mean value for gliding 30° arc. Upper and lower curves are the ISO 140 tolerances, while the inner tolerance curves are from the ISO 3382.

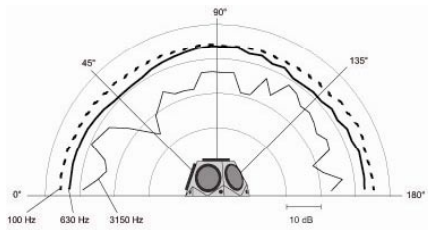


Sound Power of Nor250, Nor270 and Nor270H connected to a Nor280 amplifier with equalisation

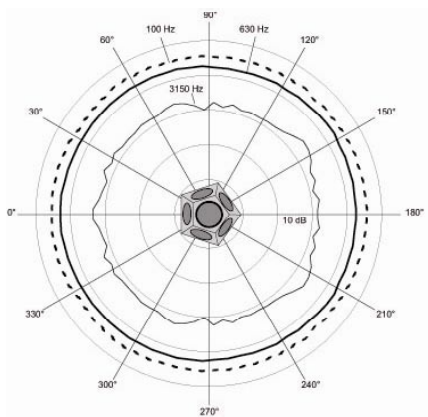
The loudspeaker is designed to operate at full power for more than one hour continuously.



Typical Nor250 third octave band frequency response when fed with pink noise from the Nor280 power amplifier, with and without the equalisation circuitry activated. Equalisation is used to boost the high and low spectrum extremes for better system performance when used for building acoustics



Typical Nor250 third octave band noise directivity pattern for 100 Hz, 630 Hz and 3 150 Hz centre frequencies in the vertical plane



Typical Nor250 third octave band noise directivity pattern for 100 Hz, 630 Hz and 3 150 Hz centre frequencies in the horizontal plane,

Power Amplifier Nor280



The Building Acoustics Standards place heavy demands on loudspeakers and as such many may be destroyed if traditional PA power amplifiers are used to drive them. These amplifiers are normally very powerful and designed to give a flat frequency response covering a much wider range that the speaker system can handle. Feeding these systems with broadband pink or red/white noise may destroy the speaker; the low frequency content of the noise causes the speaker cone to move with much higher amplitude than its design limits. Hence, the speaker coil or the cone itself may be destroyed. In addition a lot of energy is wasted in the low frequency area below 15Hz.

To overcome this problem, and to optimise the power where it is needed, a unique built in equalization network compensates for the falling frequency response of the speaker system in both the low and high frequency areas. This also ensures that the 5 dB requirement between neighbour frequency bands are met when used in combination with the Nor250 or Nor270 loudspeakers. A part of the equalization network is a high pass filter that removes low frequency signals that lie below the required frequency range for building acoustic measurements and a low pass filter that removes all frequencies above 12kHz. This feature protects the speakers from distortion and concentrates power into the frequency bands where it is needed.

The class D amplifier construction ensures low weight, high power output and low heat dissipation. The amplifier delivers up to 500Wrms into a 4 ohm load and an output current of up to 35 Amp!

Both the input and output of the amplifier are short circuit protected and an automatic system will guard against overheating and too high signal voltage on the input. The built in cooling fan is normally not running. Only at high room temperatures or prolonged use of the amplifier at full power will the fan switch on. It will however, immediately switch off when the input signal goes off; this feature makes the unit well suited to reverberation measurements in areas of low background noise.

Specifications	Nor250	Nor270	Nor270H
Physical design	Hemi-dodecahedron	Dodecahedron	Dodecahedron
Sound power output:	120 dB Lin	120 dB Lin	123 dB Lin
Speakers:	6x6.5"	12x6.5"	12x6.5"
Power (broadband):	250 WRMS	250 WRMS	400 WRMS
Impedance:	5,4ohm as standard 12ohm and 48ohm on request	6ohm as standard Other impedances on request	2,7ohm as standard Other impedances on request
Diameter:	415mm	450mm	450mm
Height	235mm	-	-
Weight:	11.7kg	12.5kg	20kg
Tripod mounting-rod		1" diameter	1" diameter
Accessories included:	Speakon NL4FC plug Nor1494/5 assembled cable if ordered with Nor280	Rugged tripod Speakon NL4FC plug Nor1494/5 assembled cable if ordered with Nor280	Rugged tripod Speakon NL4FC plug Nor1494/5 assembled cable if ordered with Nor280
Accessories available:	Nor1327A carrying case for Nor250 Speaker & Nor280 Amplifier		

The noise generator features both Pink, White and Red/White noise excitation signals. The noise or line signal can be attenuated in 5 dB steps to -35dB. By adding option 1, wireless on/off you may switch on/off the signal remotely from another room. The balanced line input ensures minimum cross talk and induced noise when using long signal cables.

Specifications	Nor280 Amplifier
Output:	Short-circuit and over-temperature protected
Output connector:	Speakon NL4MP
Output power:	500 WRMS into 4ohm 250 WRMS into 8ohm THD+N < 0.1% The built-in LP and HP filters ensure that the output power matches the Norsonic Nor250 and Nor270 series of dodecahedron loudspeakers
Peak power:	>1 kWPEAK into 4ohm
Output current:	Maximum 35 A
Input:	Balanced input to avoid ground loops and cross talk to signal cables
Input connector:	XLR
Input sensitivity:	1.0 VRMS
Input impedance:	10 kΩ//220 pF
Dimensions: (D x W x H)	275 x 110 x 246 [mm] 11 x 4,3 x 9,7 [inch]
Weight:	3,5 kg
Temperature:	-20 to +35 °C
Rel. Humidity:	0-90%
Enclosure class:	IP20
Mains:	220 VAC (±10%) or 110 VAC (±10%)
Fuse:	T 3,15A (220 V) T 6A (110 V)
EMC and Safety Standards:	EN55103-1, EN55103-2, IEC61340-5 part 1&2, IEC61010, FCC part 15b part 1&2
Accessories included:	Mains cable Output connector ²
Ordering information:	Option 2: Wireless on/off remote control (must be specified when ordering)
Accessories available:	Nor1327A Rugged carrying case for Nor250 and Nor280.

Tapping Machine Nor277

The tapping machine Nor277 has been designed to fulfil Annex A of ISO-140/6, /7 and /8. These parts of the standards require a tapping machine as sound source for impact noise measurements.

In brief the requirements are as follows: The tapping machine shall have five hammers placed in a line spanning 400mm. The mean time between successive impacts shall be 100ms±5ms and the effective mass of each hammer shall be 0.5kg (within 2.4%). The dropping of a hammer on a flat floor shall be the equivalent – with respect to the momentum – to a free, frictionless drop of 40mm (within 5%). Finally, the part of the hammer striking the floor shall be a cylinder made of hardened steel, 3cm in diameter with a spherical end having a radius of 50cm. The Nor277 has been designed to comply with these requirements.

An electronic system monitors the speed of the falling hammers as well as the frequency of impacts. Errors are indicated on the front by a LED for each hammer. A gauge is included to facilitate verification of the fall height. Fall height adjustments are carried out by adjustments of the tapping machine's three feet.

In its standard version the Nor277 is operated off mains, but battery operation off an internal battery is available as



an optional extension (Option 1). This optional extension must be specified on ordering. The rechargeable battery provides a maximum operating time of no less than 1,5 hour before a recharge is needed. Charging time is 2 hours.

Nor277 is equipped with RS232 serial interface for controlling the operation. As an option the unit may be equipped with a wireless hand-switch for remote start and stop (Option 2). In this way, the hammer operation can be switched on and off from the receiving room where the measuring instrumentation normally is located.

The tapping machine No277 is a rugged and light-weight construction –the weight is not more than 10 kg – designed with field applications in mind.

(Separate Product Data sheet is available)

Specifications	Nor277 Tapping Machine
Hammers:	5 hammers @ 500 g. Effective falling height 40 mm (adjustable)
Tapping sequence:	10 impacts per second, rpm controlled via servo feedback loop.
Power:	84 – 264 V, 47 – 63 Hz
Battery operation:	Optional built-in Li-Ion rechargeable battery with typically 1,5 hour operating time. Battery charging time is 2 hours.
Power consumption:	Less than 30 W
Dimensions:	HxLxW: 230x495x165 (265 feet extended) mm. Add 50 mm to the height for Handle.
Weight:	10 kg (22 lb) including battery and wireless remote option
Ordering information:	Option 1: Battery operation, must be specified when ordering Option 2: Wireless remote control, must be specified when ordering
Accessories included:	Instruction manual, mains cable, small rod used for the verification of the fall height.
Optional accessories:	Carrying case/Shipping case Nor1336
CE conformity	EMC compliance according to EN50081-1 and EN50082-1 Safety according to EN61010-1-1993 and Machine directive 89/392

Distributor: