

OPERATING MANUAL

HD2040

Tapping machine



EN
V1.6

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1 Introduction

The tapping machine **HD2040** is a normalized impact noise generator for the measurement of sound insulation of floors.

It has 5 hammers in line driven by a motor controlled by an electronic system, by means of camshaft. The rate of fall of the hammer and the frequency of the impacts are constantly monitored to ensure compliance with the legislation. LED indicators on the front panel indicate the proper functioning of each hammer, detected by an optical sensor.

The hammers are made of stainless steel, hardened and dimensionally stable over time.

The unit is equipped with support feet with height-adjustable rubber base. The **reference spacer** for drop height verification is fitted on the back cover. The spacer enters the holder with light pressure; it is pulled to pull it out. The feet can be rotated under the base to reduce the size of the package and make it easier to transport the machine.

The machine is started and stopped by a button on the front panel or remotely using the supplied remote control. The antenna is screwed to the connector on the top of the unit and it has to be unscrewed it to store the unit in its case. Mains power supply 100 ... 240 VAC or rechargeable lithium-ion battery housed inside the unit. The charger is built; the battery recharges automatically when the machine is connected to the network.

The aluminium frame reduces the weight of the machine and makes it easily transportable.

A spirit level on the lid of the machine allows it to be placed perfectly in a horizontal plane.

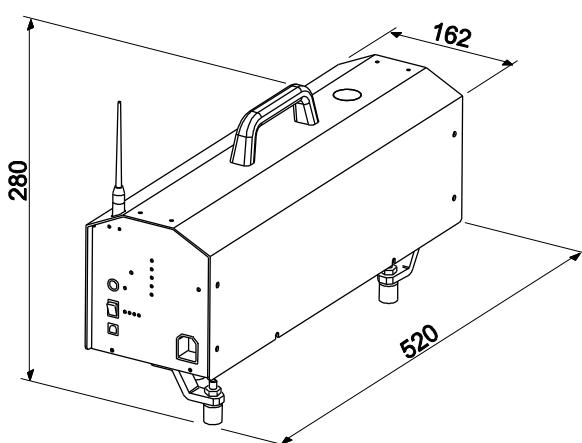
The inside of the machine lid is treated with sound absorbing material.

The machine meets the requirements of the following standards:

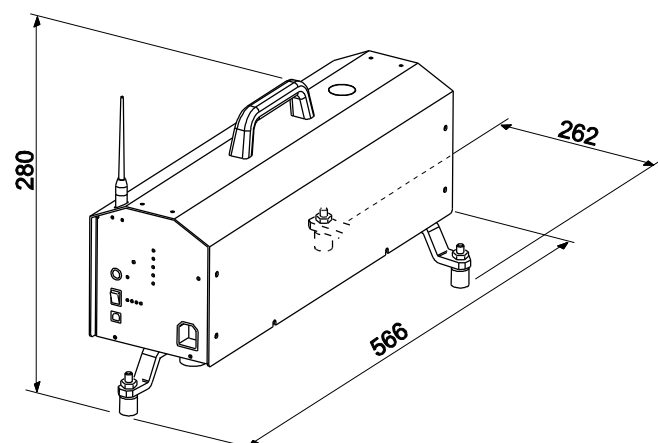
- **Product standards**
 - ISO 10140-5:2021
 - EN ISO 16283-2:2020
- **Test methods**
 - EN ISO 717-2:2020
 - ISO 10140-3:2021
 - ISO 10140-4:2021
 - ASTM E492 e E1007

2 Technical specifications

Number of hammers	5 in line
Weight of the hammers	500 ± 12g each
Fall height	40 mm
Tapping interval	100 ± 20 ms
Average tapping interval	100 ± 5 ms
Interval between the impact and the lifting of the hammer	< 80 ms
Distance among the hammers	100 ± 3 mm
Head of the hammers	Diameter 30 ± 0.2 mm, spherical impact surface with radius of curvature 500 ± 100 mm
Tapping direction	Perpendicular to impact surface within ± 0.5°
Support feet	3 height-adjustable feet with rubber pads.
Service serial output	USB with type B connector
Remote control	Yes
Power supply	100...240Vac, 50÷60Hz Lithium-Ion rechargeable battery, rated voltage 7.2V, rated capacity 2900 mAh
Power consumption	< 30 W
Fuse	3A / 250V Time-delay fuse
Battery autonomy	About 80 min of continuous operation
Working Temperature and Humidity	-10...+50 °C, 0 ... 90 %RH no condensation
Weight	11 kg the machine complete with battery pack and remote control 5.4 kg the carrying case
Structure of the machine	Anodized and painted aluminum
Dimensions (L x W x H)	520 x 162 x 280 mm with cover with handle and retracted feet 566 x 262 x 280 mm with cover with handle and extended feet (excluding the antenna for the remote control)

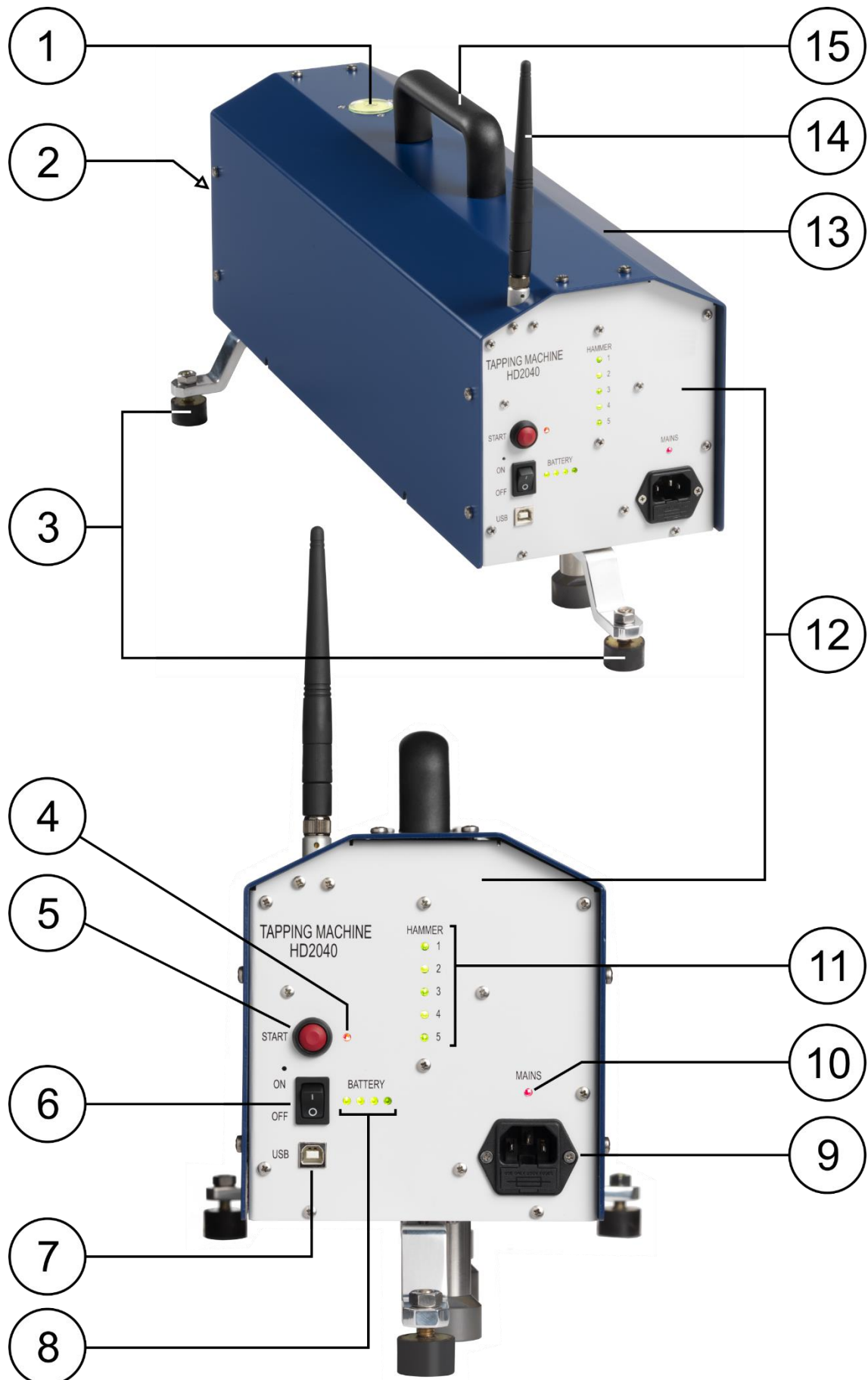


With retracted feet



With extended feet

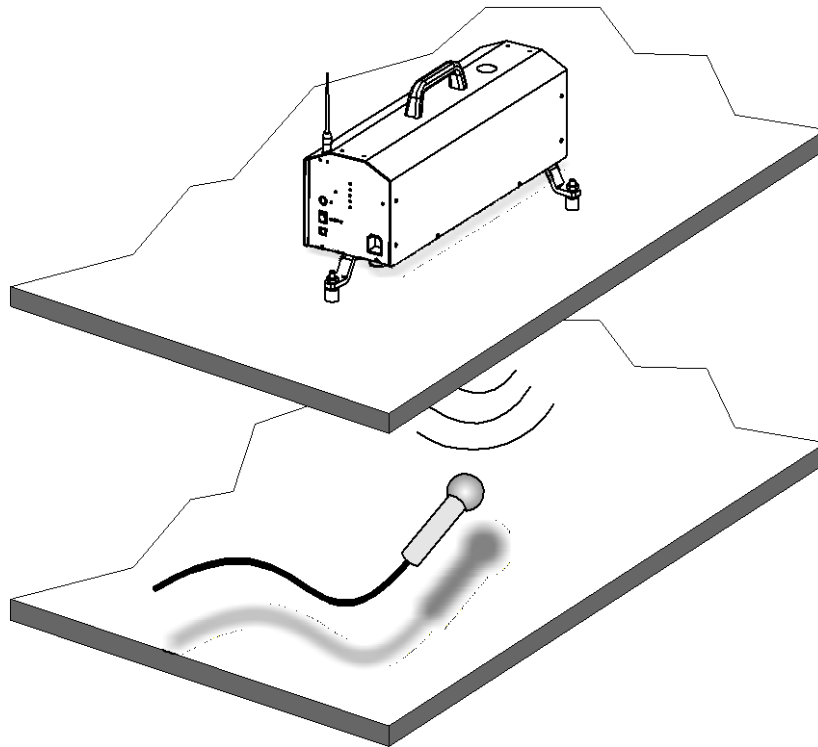
3 Description



- 1.** Bubble level for horizontal levelling.
- 2.** Level gauge placed on the rear panel of reference for checking the height of fall of the hammer.
The level gauge enters its site with a little pressure; pull to remove.
- 3.** Support feet with height-adjustable rubber base.
The legs can be rotated under the base to reduce the footprint of the machine.
- 4.** LED indicator of the correctness of the motor shaft rotation speed.
The LED is green if the speed is correct. Otherwise the LED is red.
- 5.** Button to start and stop the unit motor.
- 6.** On/Off switch.
Turn the power switch to ON to power the unit. Turn the power switch to OFF to switch off unit power.
- 7.** USB type B port for PC connection.
The use of the port is intended for technical service personnel for maintenance.
- 8.** LED indicators of the status of internal battery charge.
The indication is multi-level type. All LEDs on indicate that the battery is charged. The rightmost LED flashing indicates that the battery charge is complete. The leftmost LED flashing indicates that the battery is low and needs recharging.
The LEDs are off when the power switch is OFF. To check the battery charge level is necessary to place the power switch to ON.
- 9.** 100 ... 240 V AC mains inlet, with fuse holder for fuses 5x20 mm.
Equipped with fuse 3A/250V.
- 10.** LED indicator of the presence of the external power supply.
The lit LED indicates that the power cord is plugged. The status LED is independent of the position of power switch.
- 11.** LED indicators of the regular falling of the hammers.
A LED is green when the falling of the corresponding hammer is regular. Otherwise the LED is red.
- 12.** Front panel.
- 13.** Anodized and painted aluminium cover.
The cover is removable for battery installation and maintenance of the unit.
- 14.** Remote control antenna.
- 15.** Carrying handle.

4 Measurement general information

The sound insulation of floors is measured by operating the machine on the test floor and measuring the level of noise in the underlying.



The test methods are defined by EN ISO 717-2:2020, ISO 10140-3:2021, ISO 10140-4:2021, ASTM E492 and ASTM E1007 standards. Here are some basics called for proper implementation of the measure of sound insulation.

During the measurement, position the machine by observing the following rules:

- The machine must be positioned at least in 4 different points on the test surface. If the surface is anisotropic (for example, ribbed slabs), it may take more positions.
- The hammer should be at a distance of at least 0.5 m from the edges of the test surface.
- The line of hammers should be oriented at 45° to the axis of the beams.
- If the test surface is smooth and elastic, stabilize the machine to ensure a hammer drop height of 40 mm.

In the receiver environment must be provided at least 4 microphone stations evenly distributed in the environment, two of which must correspond to the position of the tapping machine in the emitting environment. You can use multiple fixed microphones or one microphone moved from one location to another. Place the microphones so that:

- The distance between each station and the upper floor excited by the tapping machine is at least 1 m.
- The distance between each station and the walls of the environment is at least 0.5 m.
- The distance between different microphone positions is at least 0.7 m.
- The distance between each station and the operator is at least 3 m.

In the receiving environment, take a measure of the level of background noise when the unit is not in the tapping action. The sound pressure level in the receiving room when the machine is in action should be greater than 10 dB compared to the level of background noise. Otherwise, to the measurement of sound pressure level with the machine in action must be applied the appropriate corrections defined by regulations.

The isolation of a structure is assessed by the *level of impact noise normalized with respect to the sound absorption*:

$$L'_n = L_i + 10 \times \log \frac{A}{A_0} \text{ [dB]}$$

or by the *level of impact noise normalized with respect to the reverberation time*:

$$L'_{nT} = L_i + 10 \times \log \frac{T_{60}}{T_0} \text{ [dB]}$$

where:

L_i = average level of sound pressure measured at several points of the receiving environment when on the surface under test the impact noise generator is in action.

A = equivalent area of sound absorption of the receiving environment, in m^2 .

A_0 = reference acoustic absorption equivalent area, equal to $10 m^2$.

T_{60} = reverberation time in the receiving environment, in seconds.

T_0 = reference reverberation time, equal to $0.5 s$.

The equivalent area of sound absorption of the receiving environment is calculated using by the Sabine formula:

$$A = 0.16 \times \frac{V}{T_{60}} \text{ [m}^2\text{]}$$

where:

V = receiving environment volume, in m^3 .

The measurement of sound pressure levels L_i is conducted by third octave bands in the frequency range from 100 Hz to 3.15 kHz. The measurement result is a curve that shows the trend of the level L'_n as a function of noise frequency.

Briefly, the isolation is represented by the *evaluation index of the tapping level* $L'_{n,w}$, obtained by comparing the reference curve defined in EN ISO 717-2:2020 with the curve of the L'_n values calculated at the various measurement frequencies.

Unlike the values L'_n , which allow more detailed spectral analysis of sound insulation provided by the test surface, the $L'_{n,w}$ index provides an overall indication which does not contain information on the frequency behavior of the surface.

MEASURES IN PLACE AND IN LABORATORY

The superscript in the symbols L'_n and $L'_{n,w}$ characterizes measurements in place, in which the noise is also transmitted from the side walls or other elements bordering the floor. Symbols without superscript L_n and $L_{n,w}$ are used to indicate measurements in the laboratory, in which the noise is transmitted only from the test surface. The noise level in place is generally higher than that measured in the laboratory, due to the side transmission:

$$L'_{n,w} = L_{n,w} + K.$$

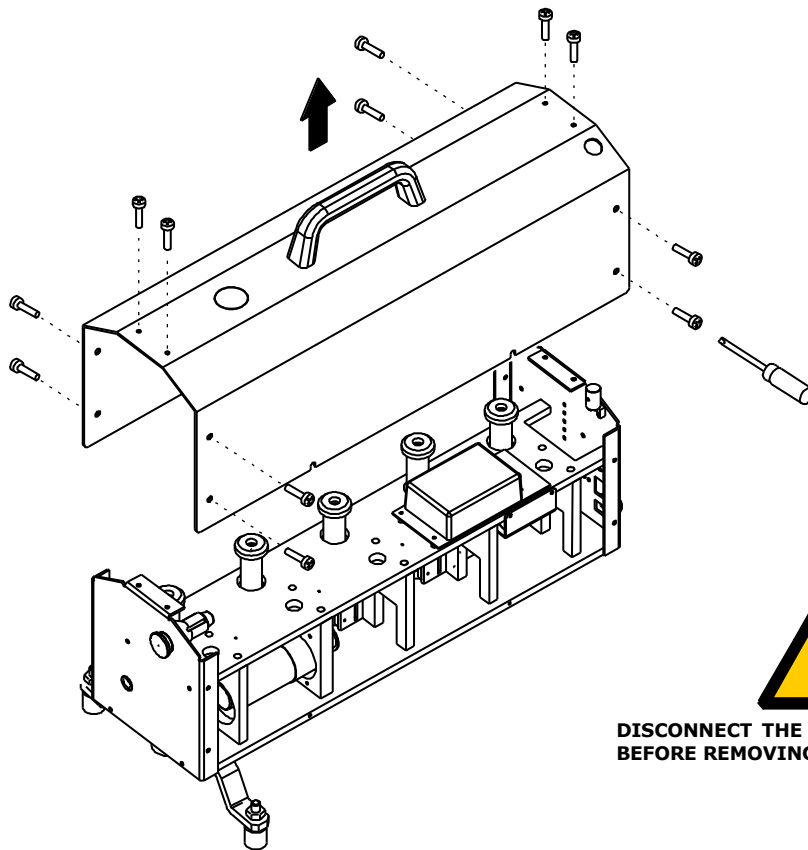
There are tables that show the value of the correction factor K as a function of surface mass (mass per unit area) of the floor and walls.

5 Installing the battery

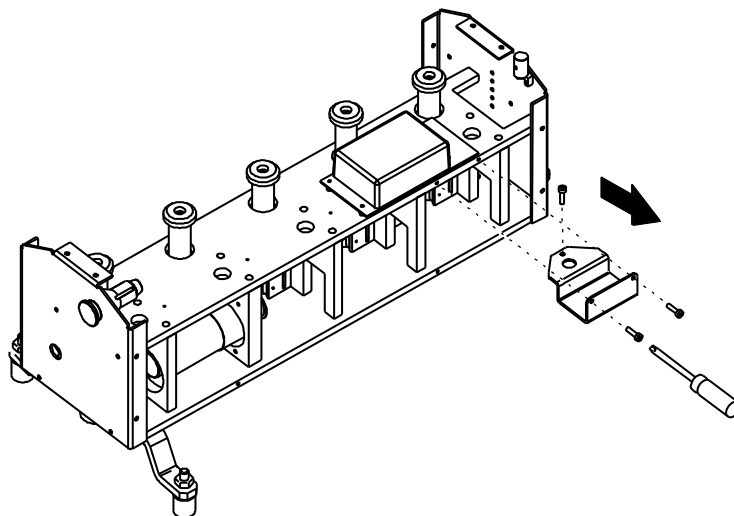
For security reasons, the machine is delivered without the rechargeable lithium-ion battery installed.

Before you start using the unit you have to install the battery supplied. Install as shown below:

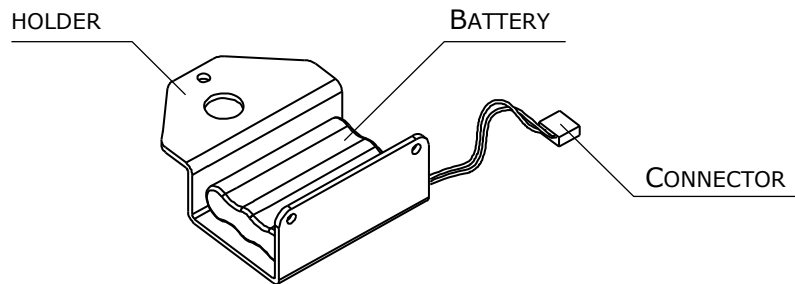
1. Make sure the power switch is OFF and **the power cable is disconnected**.
2. Unscrew the 12 screws that secure the cover to the base of the unit and remove the cover.



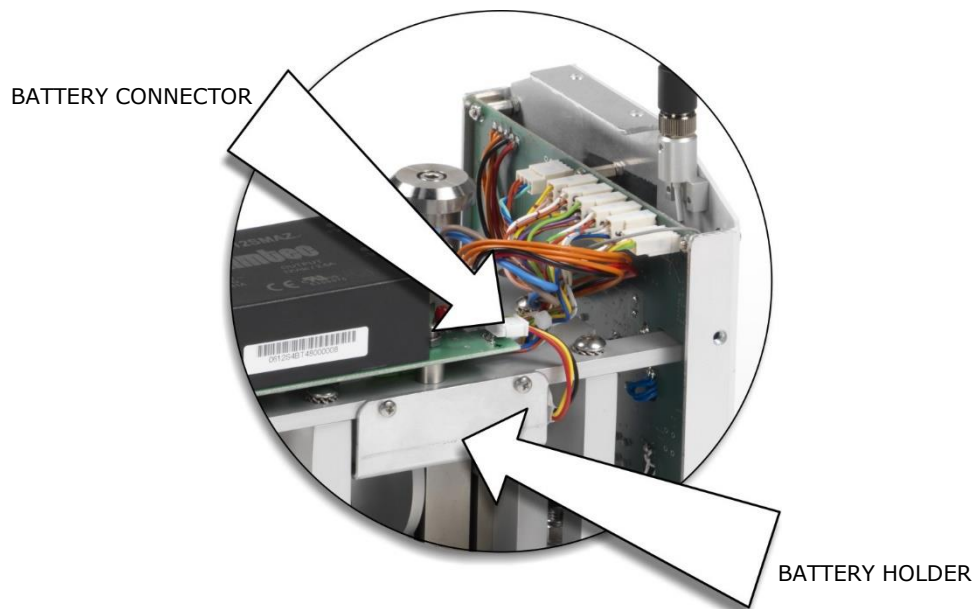
3. Unscrew the 3 screws that secure the battery holder to the structure of the unit and remove the holder.



4. Insert the battery into the holder, making sure that the cable connecting the battery comes out towards the front panel of the machine.



5. Attach the battery holder to the unit structure.
6. Connect the battery to the circuit board, observing the correct polarity. The connector has a polarizing key that prevents the possibility to insert the plug incorrectly.



7. Replace the cover of the machine and secure the base with the 12 screws. The cover must be oriented so that the hole for the antenna is towards the front panel of the unit and the spirit level towards the rear panel.
8. Connect the power cable to the unit and to the mains to start charging the battery. Leave the battery charging for at least 8 hours before using it for the first time. The battery charges automatically when you plug the power cable to the mains (MAINS LED on), regardless of the position of the power switch.

Note

When you install a new battery, the indicator of the charge level on the front panel may be inaccurate until the first full charge is finished. After the first full charge, the level will start to be shown correctly.

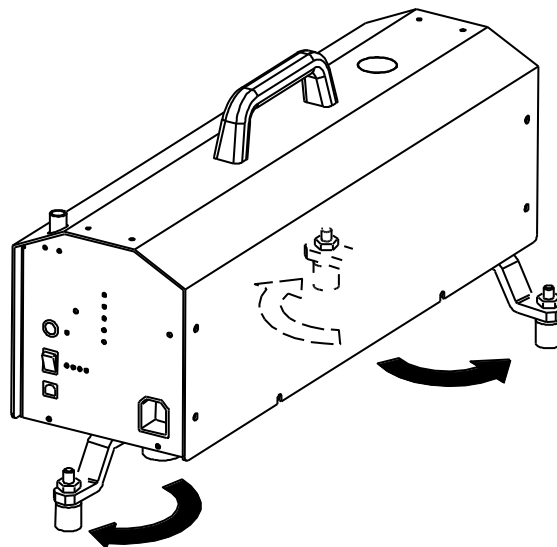
6 Preparing the machine

**ATTENTION:**

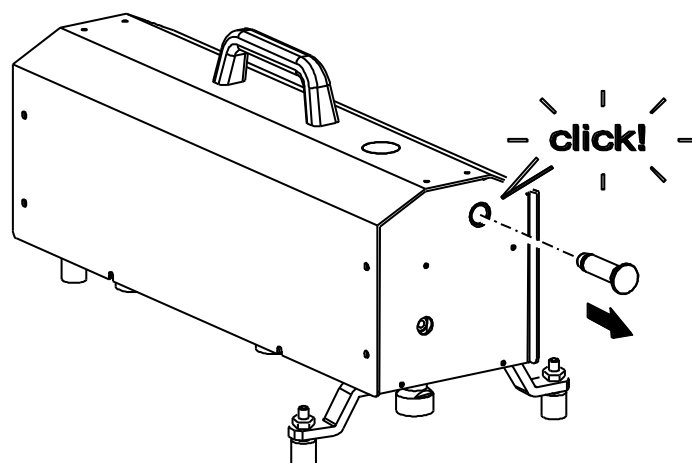
THE UNIT HAS MOVING MECHANICAL PARTS, SO MAKE SURE THAT THE POWER SWITCH IS SET TO **OFF** AND THAT THE POWER CABLE IS UNPLUGGED BEFORE PERFORMING THE OPERATIONS DESCRIBED IN THIS CHAPTER.

The tapping machine is supplied with the hammers locked in up position. Remove the cover of the machine and unlock the hammers by removing the plastic tie-wraps around the hammers.

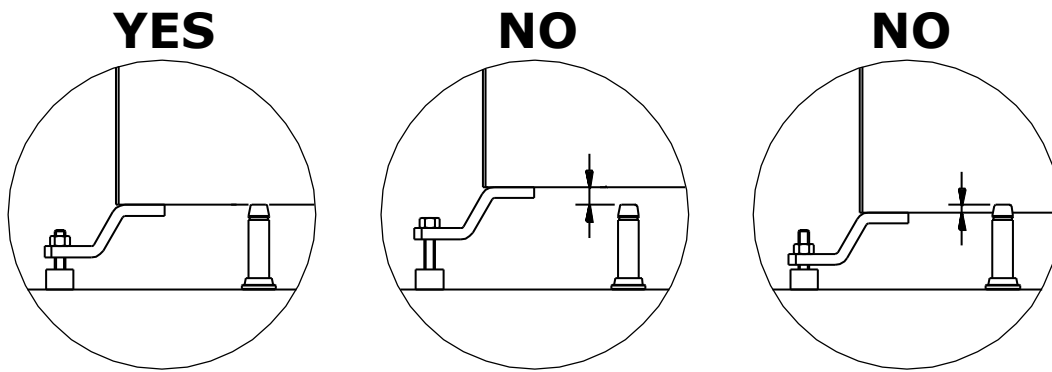
The tapping machine is supplied with the feet retracted in the transport position. To prepare the machine for normal operation it is necessary to rotate the three feet in the working position.



The tapping machine is delivered with the feet already adjusted to grant the correct fall height of the hammers. If necessary, it is possible to verify and adjust the fall height of the hammers by using the rod mounted on the backside of the machine. Pull the gauge out to release it from its site.

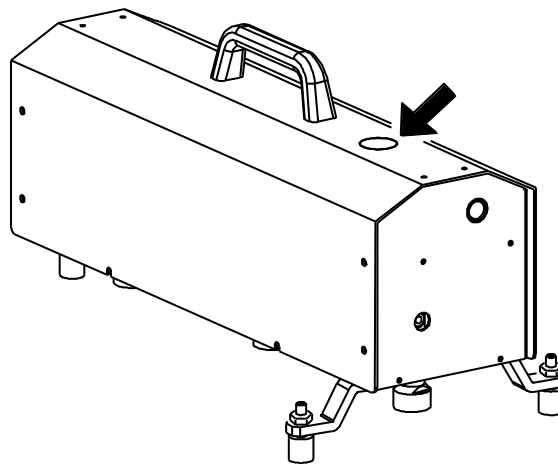


Put the machine on a flat, horizontal surface. Place the gauge between the surface and the bottom of the machine, so that the gauge is along the line of the hammers. The fall height is correct if the distance between the surface and the bottom of the machine corresponds to the height of the gauge.



If adjustments are needed, proceed as follows:

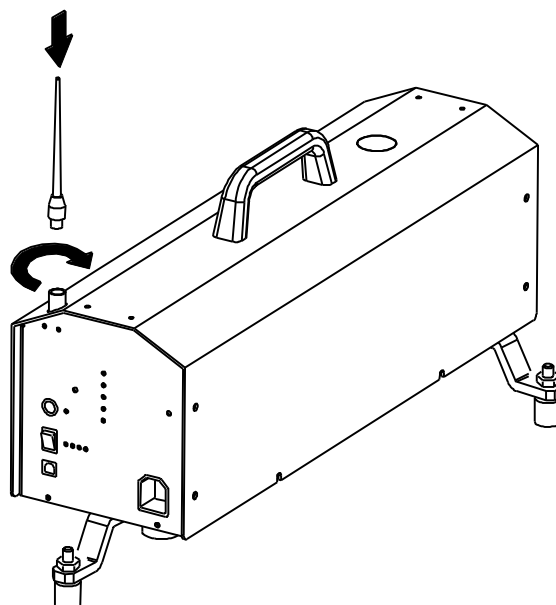
1. Unlock the feet by using the supplied 13 mm wrench.
2. Place the gauge along the line of the hammers, as close as possible to the foot to be checked.
3. Screw or unscrew the feet to adjust the height, checking with the spirit level that the machine is on an horizontal plane.



4. Lock the position of the feet by fixing the nuts.

After use, place the gauge back in its place with a slight pressure.

If you want to use the supplied remote control, mount the antenna on the connector on the top of the machine near the front panel.



7 Operation of the machine

7.1 Power supply

The machine operates with 100...240 Vac by mains or powered by lithium-ion battery 7.2 V / 2900 mAh housed inside the machine.

CAUTION: The machine is shipped without the battery installed and with the hammers locked. Before starting the machine, install the battery and unlock the hammers.

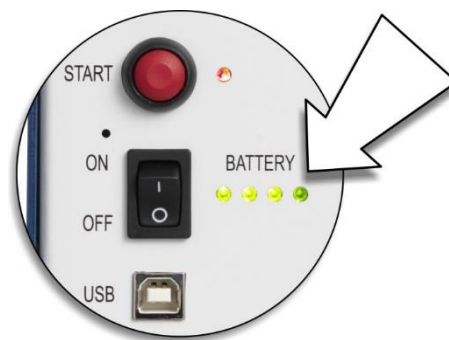
The machine always works with mains power supply if the power cable is connected. MAINS LED is lit when the mains supply is present, regardless of the position of power switch.

To turn on the machine, set the power switch to ON.

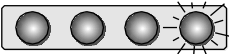
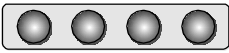




Note: The motor **does not** start automatically when you turn on the machine, the motor control is manual via the START button or the remote control.

If you plan to use the machine in places where there is no mains, be sure to fully charge the battery before use. The first time you charge the battery, let it charge for at least 8 hours. After the first charge, the battery completely discharged requires a charging time of about 4 hours (if the motor is not running).

The battery charges automatically if the power cable is connected to the mains (MAINS LED on), regardless of the position of power switch. The LEDs indicating battery charge level however are turned off if the power switch is set to OFF. To check the charge level of the battery, turn the machine on by setting the power switch to ON. The level is indicated by four LEDs to the right of the switch.



The following table shows the level of battery charge indicated by LEDs.

Indication	Level of battery charge
 Rightmost LED flashing	Fully charged
 4 LEDs	Greater than 75%
 3 LEDs on	Between 50 and e 75%
 2 LEDs on	Between 25 and 50%
 1 LED on	Lower than 25%
 Leftmost LED flashing	It is necessary to recharge the battery

It is possible to keep the power cable connected to the mains even if the battery is fully charged, without danger of damage.

The autonomy of the fully charged battery is about 80 minutes.

7.2 Starting and stopping the motor



WARNING:

THE MACHINE HAS MOVING MECHANICAL PARTS, MAKE SURE NOT TO CAUSE DAMAGES TO PEOPLE OR THINGS DURING THE OPERATION OF THE MOTOR. DO NOT MOVE THE MACHINE WHEN THE HAMMERS ARE WORKING.

After turning on the machine, in order to start/stop the movement of the hammers press the START button on the front panel or the remote control ON/OFF button shown in the figure (hold the remote control button pressed for more than one second).

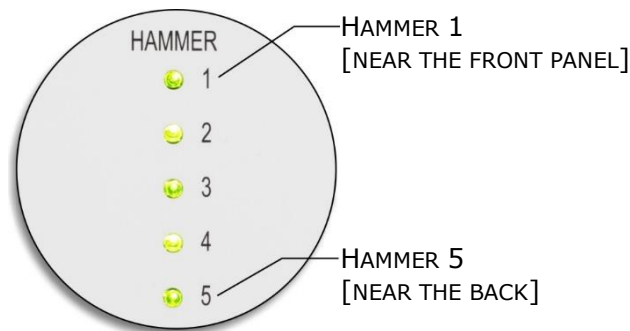


By pressing the radio control ON/OFF button for about one second, the LED of the radio control indicates the status of the machine: green LED = hammers stopped, red LED = hammers in motion.

To change the status of the machine with the remote control (start the hammers if they are stationary or stop them if they are in motion), hold the remote control ON/OFF button pressed for more than one second, until the LED changes color.

The impact sequence of hammers is 1-3-5-2-4. The hammer number 1 is located next to the front, the hammer number 5 is located near the rear panel.

The regularity of the falling of the hammers is reported by the HAMMER LEDs on top of the front panel. There is one LED for each hammer.



The HAMMER LED for one hammer is green if the falling of the hammer is regular. If the falling of a hammer is not regular, the LED turns red.

The LED to the right of the START button and the HAMMER LEDs are off when the hammers are at standstill.

NOTES FOR THE USE OF REMOTE CONTROL:

- If you use the remote control, make sure that the antenna is properly inserted into the connector located on top of the machine.
- Any obstructions between the transmitter and the machine may limit the range of the remote control.

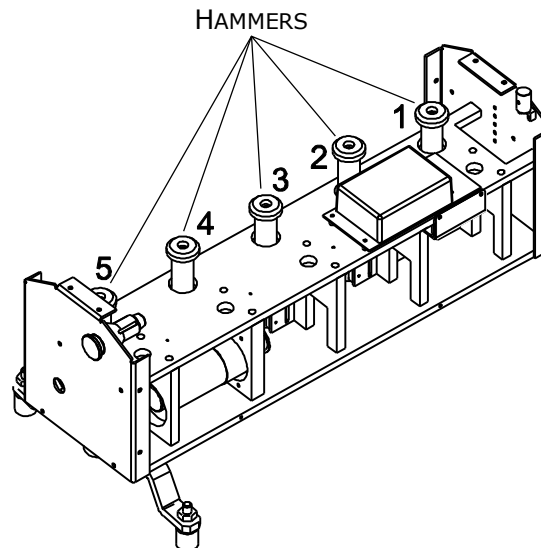
8 Maintenance



WARNING:

MAKE SURE THAT THE POWER SWITCH IS SET TO OFF AND THE POWER CABLE IS UNPLUGGED BEFORE ANY MAINTENANCE OF THE MACHINE.

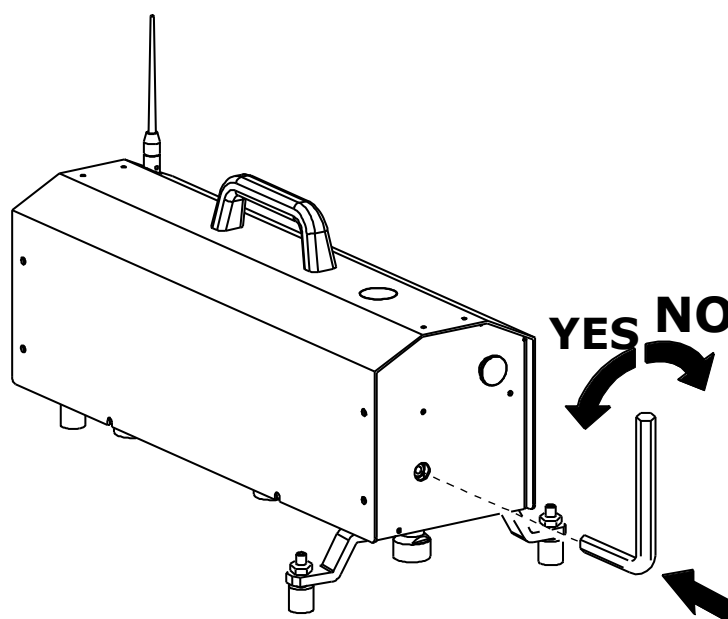
If the LED indicators of the proper functioning of the hammers signal anomalies in the fall speed or impact interval, clean and lubricate the hammers. To access the hammers, remove the cover by unscrewing the 12 screws that secure the base of the machine.



If the problem persists, contact an authorized service center for maintenance and calibration of the machine.

It is advisable to check the proper functioning of the machine at an accredited calibration laboratory at least every two years.

You can manually check the correct movement of the hammers. Insert a 5 mm hex wrench at the end of the motor shaft on the rear panel, then rotate the shaft **COUNTER-CLOCKWISE**.



WARNING: To avoid any damage, turn off the machine before manually turning the shaft.

9 Safety instructions

The machine proper operation and operating safety can be ensured only in the climatic conditions specified in this manual and if all standard safety measures as well as the specific measures described in this manual are followed.

Do not use the machine in places where there are:

- Corrosive or flammable gases.
- Direct vibrations or shocks to the instrument.
- High-intensity electromagnetic fields, static electricity.

Do not carry the machine when the hammers are in motion.

Do not remove the cover of the machine before you set the power switch to OFF and unplug the power cable.

In case of mains power supply, ensure that there is the system ground and the cable is in good condition.

During transport or when the machine is not used, remove the antenna so to avoid any damage.

User obligations

The transmitter operator shall follow the directives and regulations below that refer to the treatment of dangerous materials:

- EU directives on workplace safety.
- National law regulations on workplace safety.
- Accident prevention regulations.

10 Accessories ordering codes

The machine is supplied with lithium-ion rechargeable battery, built-in battery charger, remote control and carrying case.

HD2040-R Additional remote control.

HD2040-A Spare antenna for the remote control.

HD2040-V Additional carrying case.

HD2040-B Spare rechargeable lithium-ion battery pack. Nominal voltage 7.2 V. Rated capacity 2900 mAh.

Notes

WARRANTY

The manufacturer is required to respond to the "factory warranty" only in those cases provided by Legislative Decree 6 September 2005 - n. 206. Each instrument is sold after rigorous inspections; if any manufacturing defect is found, it is necessary to contact the distributor where the instrument was purchased from. During the warranty period (24 months from the date of invoice) any manufacturing defects found will be repaired free of charge. Misuse, wear, neglect, lack or inefficient maintenance as well as theft and damage during transport are excluded. Warranty does not apply if changes, tampering or unauthorized repairs are made on the product. Solutions, probes, electrodes and microphones are not guaranteed as the improper use, even for a few minutes, may cause irreparable damages.

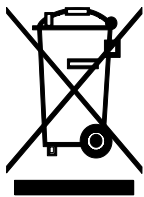
The manufacturer repairs the products that show defects of construction in accordance with the terms and conditions of warranty included in the manual of the product. For any dispute, the competent court is the Court of Padua. The Italian law and the "Convention on Contracts for the International Sales of Goods" apply.

TECHNICAL INFORMATION

The quality level of our instruments is the result of the continuous product development. This may lead to differences between the information reported in the manual and the instrument you have purchased.

We reserve the right to change technical specifications and dimensions to fit the product requirements without prior notice.

DISPOSAL INFORMATION



Electrical and electronic equipment marked with specific symbol in compliance with 2012/19/EU Directive must be disposed of separately from household waste. European users can hand them over to the dealer or to the manufacturer when purchasing a new electrical and electronic equipment, or to a WEEE collection point designated by local authorities. Illegal disposal is punished by law.

Disposing of electrical and electronic equipment separately from normal waste helps to preserve natural resources and allows materials to be recycled in an environmentally friendly way without risks to human health.



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