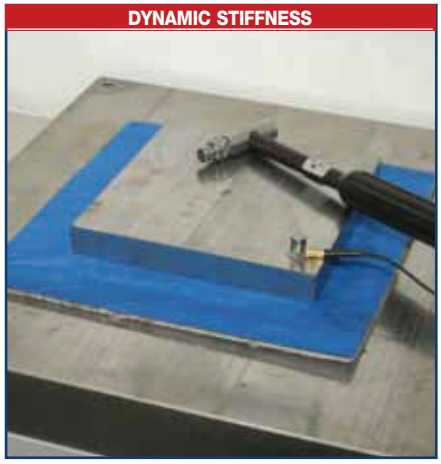
■ MAIN CHARACTERISTICS OF THE ACOUSTIC INSULATION OF FLOATING FLOORS

DYNAMIC STIFFNESS AN ACOUSTIC INSULATION AGAINST MODULAR FOOT-TRAFFIC

Dynamic stiffness is the characteristic that determines the insulating properties of floating floor materials, and defines the capacity of the material to deform elastically and dampen dynamic stresses - foot-traffic - it is subjected to when it is pre-loaded with the weight of the screed.
Dynamic stiffness is reduced as the thickness of the material increases.
As concerns insulation against foot-traffic, it is considered in the construction industry, that the dynamic stiffness of a good quality insulation material must be in the range from 35 to 7 MN/m^3 and acoustic attenuation is higher the lower the dynamic stiffness (see graph C1).
A higher rigidity means that the material is too rigid under the stress specified for floors and does not deform elastically. It may be suitable for dampening the vibrations of a heavy machine or those of a railway track when a train passes through, but it is unsuitable for dampening 'light' stress such as foot-traffic.
For example, the rigidity of an elastic material, as rubber is commonly believed to be, is too high for it to be used for insulating floors. To ensure that it works, it must be lightened or steps must be taken to increase the unit preload, perhaps by reducing the support surface by suitable measures.
However, dynamic stiffness must not be too low either, otherwise this means that the material is too compressible and is crushed. INDEX has designed and patented three insulation systems with dynamic stiffness in the range from 21 to 9 MN/m^3.
The first one, i.e. 21 MN/m^3, is based on laying of a layer of FONOSTOPDuo, as we have already described.
If we increase the thickness of the phono-resilient material, the dynamic stiffness of the insulating layer is reduced, dropping to 11 MN/m^3 and, therefore, the degree of acoustic insulation increases. Consequently, if we lay two layers of FONOSTOPDuo instead of just one, we can obtain a higher degree of insulation.
In this case, the first layer is laid with the blue face toward the laying surface, whereas the second layer is laid across the joining lines of the first, with the blue face directed upward in order to oppose the two white non-woven fabrics which are the springs of the insulating system.
To further increase insulation, we created a new insulation material called FONOSTOP-Trio.

DYNAMIC STIFFNESS



RESISTIVITY TO AIR FLOW

FONOSTOPTrio is a foot-traffic acoustic insulation product, which, when combined with FONOSTOPDuo, makes it possible to create insulation systems. Dynamic stiffness is 9 MN/m^3 which guarantees even higher acoustic comfort levels.
With the introduction of this latter product, modular insulation solutions which satisfy any requirements are now possible, starting from the FONOSTOPDuo single-layer system.
The following table indicates the foot-traffic noise levels L'_{nw} and the increase of phono-insulating power ΔR_w for a floor of 20+4 in clay/cement weighing 237 Kg/m^2 with a 7 cm foundation lightened to a density of 800 Kg/cu.m. It starts from a level of foot-traffic noise $L_{nw,eq}$=77.66 dB and phono-insulating power R_w=48.74 dB (screed included) insulated with 5 cm (d:2000Kg/m^3) of floating screed on the three systems described above, which can be calculated with the simplified forecasting method specified in standard EN 12354-2.

Index constantly checks the characteristics of dynamic stiffness and of resistance to air flow in its own acoustics laboratory, both on raw materials and on finished products. It is consequently able to guarantee high standards of constant quality, compliant with the requirements imposed by standard UNI EN ISO 9001.

SYSTEM A
FONOSTOPDuo

SYSTEM B
FONOSTOPDuo+FONOSTOPDuo

SYSTEM C
FONOSTOPTrio+FONOSTOPDuo

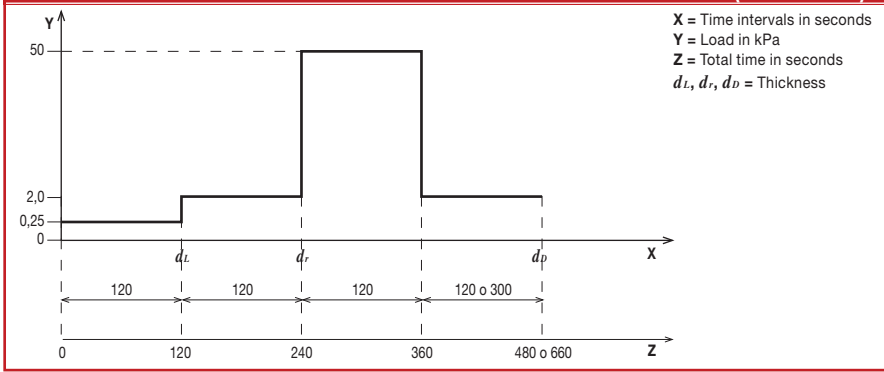
	System	Characteristics measured in the laboratory: Certificate I.T.C. n.	Dynamic stiffness	Performance calculated pursuant to EN 12354-2: ΔL_w	$L_{n,w}$ insulated floor (K=3 dB)	ΔR_w
A	FONOSTOPDuo	3402/RP/01	21 MN/m^3	28 dB	53 dB	7,63 dB
B	FONOSTOPDuo+FONOSTOPDuo	3403/RP/01	11 MN/m^3	32 dB	48 dB	10,63 dB
C	FONOSTOPTrio+FONOSTOPDuo	3404/RP/01	9 MN/m^3	33,5 dB	47 dB	10,63 dB

COMPRESSION CAPABILITY AND MAINTENANCE OF PERFORMANCE

Another important characteristic of insulating material for floating floors is resistance to crushing under the loads it is subjected to.
Clearly, if the material is crushed by the weight of the screed and of the expected overloads, it is no longer able to perform the insulation functions.
There are specific test methods to evaluate this characteristic:

- UNI EN 12431. Determination of the thickness of insulating materials for floating floors, where the thickness is determined after a series of compression cycles under a load of 2 kPa and 50 kPa
- UNI EN 1606. Determination of creep under compression, where thickness is measured after the material was kept under a constant load of 2 kPa for 122 days.

MEASUREMENT OF THE THICKNESS VALUES ACCORDING TO TIME AND LOAD (UNI-EN 12431)



Compression capability was measured according to UNI EN 12431 on both single and double layer FONOSTOPDuo.

COMPRESSION CAPABILITY OF FONOSTOPDuo

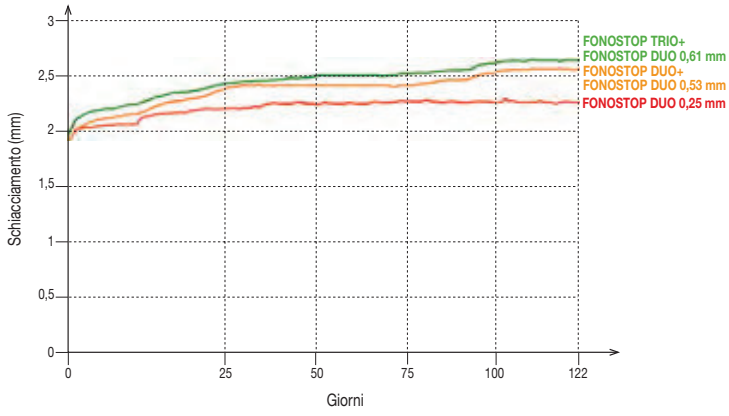
	Comprimibilità	Livello
FONOSTOPDuo	2 mm	CP2
FONOSTOPDuo+FONOSTOPDuo	3 mm	CP3

COMPRESSION CAPABILITY

Crushing under a constant load of 200 Kg/m² conforming to UNI EN 1606 was measured on all the systems described above.

CRUSHING UNDER CONSTANT LOAD

	Schiacciamento
FONOSTOPDuo	0,25 mm
FONOSTOPDuo+FONOSTOPDuo	0,53 mm
FONOSTOPDuo+FONOSTOPTrio	0,61 mm



The maintenance of the acoustic performance of FONOSTOPDuo when subjected to foot-traffic on a reference floor (INDEX's internal method) was also measured. The ΔL_w was measured of a sample placed under a concrete slab of 50x70 cm at a load of 200 Kg/m².

The results show the excellent long-term stability of the FONOSTOPDuo systems both in terms of resistance to crushing and maintenance of the insulating capacities.

MANTEINING THE ACOUSTIC PERFORMANCE

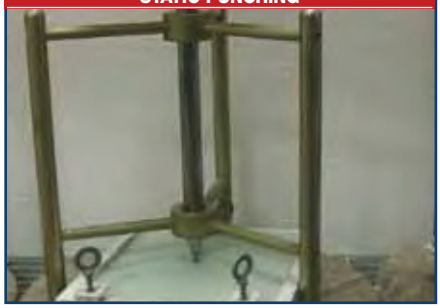
FONOSTOPDuo	Time	ΔLw
	• New	27 dB
	• 30 days	29 dB
	• 90 days	29 dB
	• 270 days	30 dB

RESISTANCE TO PUNCHING

The insulation's resistance to punching caused by accidental impact or strain is no less important than its compressibility rating.
Experience tells us that materials with excellent characteristics of elasticity and compressibility, once laid on site, do not give the foreseen results because they are damaged before they are actually used.
The situation of the site is merciless towards light and delicate materials that are too sensitive to site traffic; only materials that are resistant to punching (static punching, to withstand the roughness of the irregular foundations under the load of the screed and dynamic punching to withstand impact caused by dropped objects and the traffic of site equipment) are able to ensure the planned levels of acoustic insulation.
To assess resistance to static and dynamic punching of FONOSTOPDuo we used the test methods EN 12730 and EN 12691 respectively; these standards are used to assess the resistance of waterproofing membranes that are subjected to similar strain when laid under the flooring and when walked over during laying and subsequently when in use; the results are written in the table that follows:

- STATIC PUNCHING EN 12730: resistant under a load of 35 kg applied for 24 hours on a spherical punch of 10 mm in diameter placed on the material.

STATIC PUNCHING



- DYNAMIC PUNCHING EN 12691: resistant to the impact of a 1 kg weight dropped from a height of 200 mm complete with a spherical punch of 12.7 mm in diameter.

DYNAMIC PUNCHING

The resistance values obtained exceed the minimum levels foreseen by the standards for waterproofing membranes, which confirms the tendency to use FONOSTOPDuo in aggressive environments, as are building sites.