

HOW TO ACHIEVE THE ACOUSTICAL PERFORMANCES WITH PLASTERBOARD SYSTEMS.

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ABSTRACT

To achieve the acoustical performance required in a building (normative and comfort), it's necessary an acoustical project with the maximum detail and according with the requirements and also a good execution that guarantee the quality in the installation of acoustical systems.

One of the most used construction system is with plasterboard that provides a high acoustical insulation with low weight and a minimum thickness. The plasterboard's installers have in their hands the constructive solution and they are from who depends the technical acoustical features or futures acoustic problems.

In this communication, we present the good practices in Plasterboard System installation with examples and the Professional Certification that provides installers capable of performing a good acoustic execution of the system.

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1. INTRODUCTION

The acoustic regulation that was implemented in the Technical Code in 2009 was a revolution in construction, it went from a little restrictive regulation of year 88 without any challenge at the acoustic level, practically all the traditional constructive solutions served, to have that to design the buildings with acoustic criteria with the necessity to detail in a more exhaustive way the encounters between the different elements in order to avoid the "acoustic bridges".

A first step was to update the projects and the constructive solutions, passing them through the general option or the simplified option for checking the Basic Document. With this first step, the DB HR is complying, since although the regulation specifies that acoustic tests can be carried out at the completion of the work, this need for tests was left to the request of one of the participants in the construction process (architect, promoter, end user ...) but without any obligation.

Step by step this has been changing and every time there are more Autonomous Communities and Town Halls that demand, to give the end of works in the building, an acoustic control to the finished work, this allows to guarantee that the acoustic quality is fulfilled and that the requirements indicated in the project have been consolidated in the execution phase.

The installation of the systems is, therefore, critical at the time of compliance "in situ" of the DB HR since in project a system can comply from a theoretical point of view and then on site its performance can be reduced by defects of execution.

In this communication we have studied the impact on the Plasterboard Systems in the system Type I: Masonry walls with wall lining and Type III: Plasterboard Systems in vertical separation elements, in which details must be taken into account when carrying out the project as well as that it's necessary review in the execution to ensure compliance with the regulations on acoustics.

2. PLASTERBOARD SYSTEMS

Plasterboard is a gypsum board linked to two sheets of cardboard. The boards, attached to the structure filled with a mineral wool, make up a plasterboard system with the following properties:

- Resistance
- Ease of maintenance and replacement
- Thermal insulation
- High acoustic comfort
- Fire resistance
- Versatility

The Plasterboard systems can be attached to a bearing element (usually brick, ceramic block or block "picón" in the Canary Islands) or as a constructive element by itself forming a self-supporting framework

The simplified option of the CTE DB HR calls them Type 1 when they are placed as wall lining and Type 2 when they are self-supporting framing (also used for internal partitions).

According to the required typology, there will be conditioning factors in floors, facades... depending on the acoustic "robustness" of the system and the lateral transmissions that occur.



3. ACOUSTIC CONTROLS DURING THE CONSTRUCTION

3.1 Reception the product.

The specific conditions of control for the reception of the products that form the constructive elements, including the necessary tests, must be indicated in the Project. In the worksite, therefore, the first check to be made is that the materials are adjusted to the requirements of the project, there being agreement between the project and the received.

In the Plasterboard system, the characterization of the products from an acoustic point of view is the following:

- Plasterboard: The surface mass of the installed board (kg/m^2) must be indicated
- Mineral wool: Resistance to airflow "r" ($\text{kPa}\cdot\text{s}/\text{m}^2$)
- Profiles of the system: Distances between the different profiles.

These characteristics should appear in the technical specifications of the products

3.2 System Installation.

The construction works must be executed according to the project, to the applicable legislation, norms of good constructive practice and the instructions in the project.

During the work, execution control must be carried out in accordance with the specifications of the project and the modifications authorized by the architect, carrying out the controls established in the project with the frequency indicated therein, if they exist.

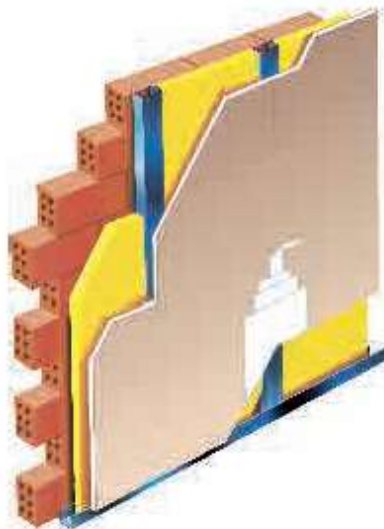
All the modifications made during the execution must be included in the documentation of the work so that a control can be made over them verifying that they have not produced any acoustic loss in the building.

3.3 Maintenance and Conservation.

The buildings must be maintained with the required acoustic conditions. This means that if any repair, modification or substitution of a constructive element is made, these must be made with materials or systems with similar acoustic properties.

It is important to bear in mind that the modification in the distribution within a unit of use can also substantially modify the acoustic conditions of the enclosures.

4. ELEMENTS TYPE 1. MASONRY WALL WITH PLASTERBOARD WALL LINING.



4.1. Design

The maximum height of these wall lining is given by the moment of inertia of the profile, its width, the modulation of the vertical profiles and the number of boards,

It is not advisable to install a single board of 12.5 mm, the minimum thickness when placing a single board is 15 mm. When double board is placed this can be 12.5 mm.

For a better acoustic behavior, it is advisable not to brace the structure to the masonry element.

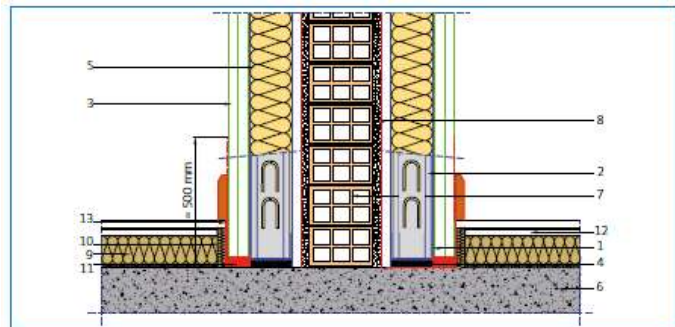
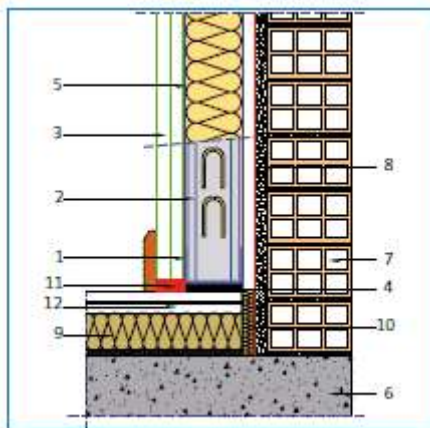
The installations will be passed through the profiles, ensuring that they are as straight as possible, for them the uprights of the system have an opening that guides the pipes of facilities.

Always place a waterproof band around the perimeter of the grid.

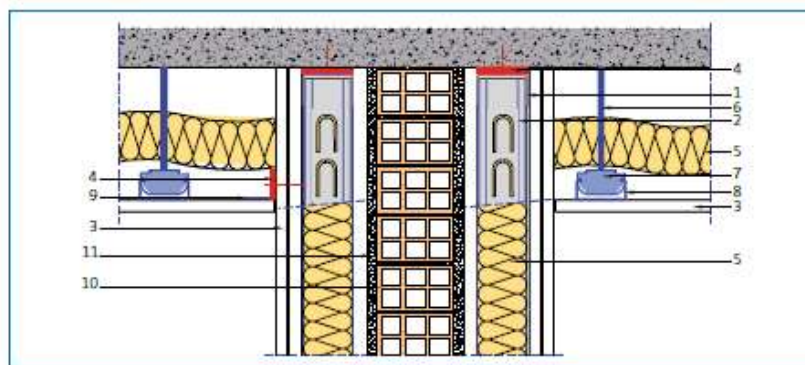
For the installations, special boxes adapted to the Plasterboard systems must be placed.

4.2. Connections

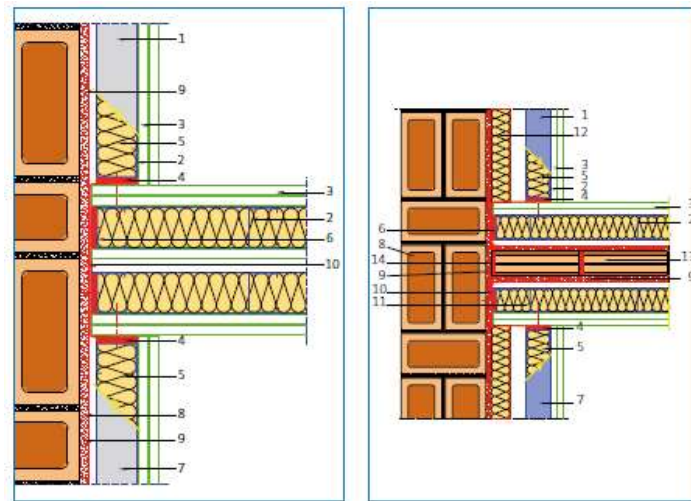
- Connection with the slab. The floating floor must not come into contact with the partition, interposing a layer of insulating material to impact noise. In case that the floating floor reaches the bricks, the insulating material will interpose between the floating floor and it, placing the wall lining over it.



- Connection with the suspended ceiling. The suspended ceiling is not continuous between two different use units interrupting the room between the floor and the ceiling.



- Connection with the facade. The inside sheet of the facade must not be continuous, interrupting and not connecting two different units of use.



- Connection with brick partition walls. The massive elements are connected interrupting the wall linings.
- Connection with plasterboard systems. The wall lining becomes continuous and on it tackles the partition of plasterboard system.
- Connection with pillars. The pillar must be completely covered with the wall lining in such a way that it does not put in contact two enclosures of different use.

4.3. Execution

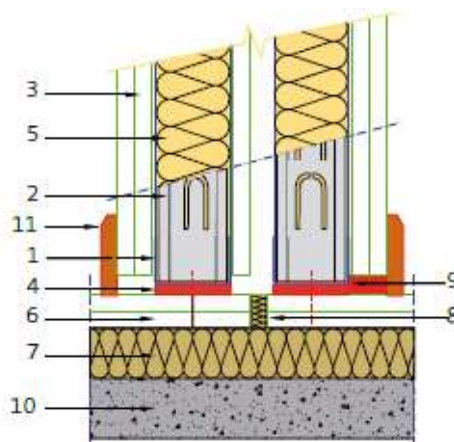
- The masonry wall should be covered to guarantee the continuity of the system, if is not the case, at least it has to be checked that there are no burrs or globs on the surface or holes without mortar between the bricks.
- The plasterboard wall linings are always placed over the sealing strip both on the roof and on the ground, as well as on the side meetings with masonry elements and pillars.
- The wall lining's profile must be separated from the masonry wall at least 10 mm to avoid stiffening the system with the consequent loss of acoustic insulation.
- The width of the mineral wool used as acoustic buffer must be equal to the profile upright to guarantee an optimal acoustic insulation covering the entire surface from floor to ceiling. Airflow resistance from mineral wool shall be $\geq 5 \text{ kPa}\cdot\text{s}/\text{m}^2$
- The installation pipes will pass through the studs, preventing them from connecting the masonry sheet and the plasterboards.
- The joint treatment should be carried out on the boards in such a way as to guarantee the tightness of the solution, with at least one Q2 being recommended.
- The installations are placed after the mineral wool to ensure that the acoustic absorbent covers the entire chamber. The installations must be in special boxes adapted to the Plasterboard systems for junction boxes and electrical mechanisms.
- The distribution of the pipes in the interior of the chamber is done by means of specific pieces for this purpose.

If the number of installations is very high and they do not fit in the thickness of the chosen structure, this thickness must be increased in order for the installations to pass and there is space for the mineral wool.



- In the case that there is more than one board on one side, the joints of both should not coincide. In both plates the treatment of joints must always be carried out to guarantee the continuity of the system.

5. ELEMENTS TYPE 3. PLASTERBOARD SYSTEM.



5.1. Design

This type of elements can go with or without intermediate board. The intermediate board is used to give greater security to the system by having a greater number of boards, so its use is very common in separations between different users. This intermediate board also ensures the tightness of the solution, preventing transmissions from occurring when placing installations that can reduce the acoustic insulation at some point.

As in the wall linings, the maximum height for type 3 elements will depend on the width of the profiles, their moment of inertia, the spacing between studs and the number of boards. In case of a double structure, the height increases if we brace both profiles, although in this case the acoustic insulation that is achieved is less when the building system is stiffened.

The installation's pipes are passed through the profiles, ensuring that there is no rigid contact between the boards.

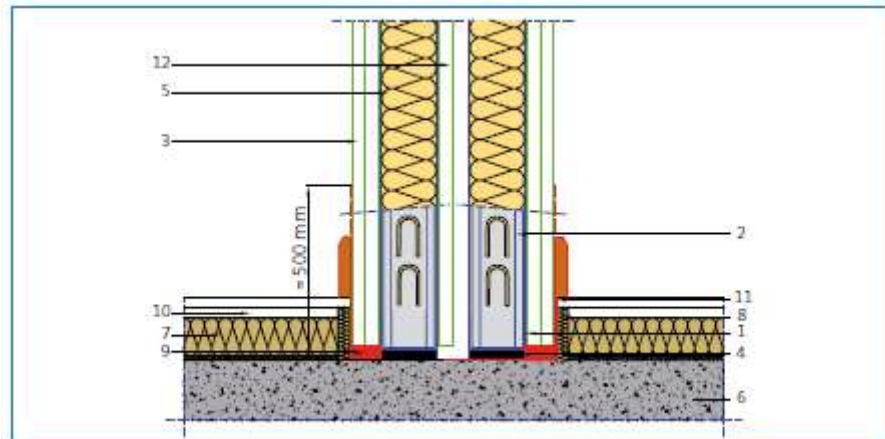
Special boxes adapted to plasterboard should be used for junction boxes and electrical mechanisms.

If a single board is placed, it must be at least 15 mm, if the system has a double board on the outside it could be 12.5 mm. The intermediate board can be 12.5 mm even if only one.

Always place a sealing band on the floor and roof prior to the placement of the channels, as well as in the connections with side walls and pillars. It must be checked that the surface where the partition is to be installed is not excessively discontinuous since the waterproof band could not absorb these imperfections and acoustic transmissions would occur on that part.

5.2. Connections

- Connection with the slab. The floating floor must not come into contact with the partition, interposing a layer of insulating material to impact noise. In case that the floating floor reaches the partition, the insulation material will interpose between the floating floor and the same, placing the partition on top of it.



- Connection with the suspended ceiling. The suspended ceiling is not continuous between two different use units interrupting the chamber between the floor and the ceiling.
- Connection with the facade. The inside sheet of the facade must not be continuous, interrupting and not connecting two different units of use.
- Connection with interior partitioning. Usually, the internal partitioning is also made of plasterboard system. The separating wall is continuous and the partition of plasterboard rushes on it.
- Connection with pillars. The pillar must be completely covered with the plasterboard system in such a way that it does not put in contact two enclosures of different use.

5.3. Execution

- The two profiles of the system must be at least 10 mm separate to avoid stiffening the system with the consequent loss of acoustic insulation. In the case that for structural reasons the two profiles are braced, it must be taken into account that the system will suffer a loss in acoustic insulation. If a minimum of acoustic insulation must be guaranteed, there are elastic braces that allow the union between the profiles without giving rigidity to the system.
- The width of the mineral wool used as acoustic buffer must be equal to that the profile upright to guarantee an optimal acoustic insulation covering the entire surface of the system from floor to ceiling. Airflow resistance from mineral wool shall be $\geq 5 \text{ kPa}\cdot\text{s}/\text{m}^2$
- The installation pipes will pass through the studs, preventing them from connecting the different profiles of the system.
- A joint treatment should be carried out on the boards in such a way as to guarantee the tightness of the solution, with at least one Q2 being recommended.

- The installations are placed after the mineral wool to ensure that the acoustic absorbent covers the entire chamber. The installations must be in special boxes adapted to the plasterboard systems for junction boxes and electrical mechanisms. The distribution of the pipes inside the chamber is made by specific pieces for it.
- If the number of installations is very high and they do not fit in the thickness of the chosen structure, this thickness must be increased in order for the installations to pass and there is space for the mineral wool.
- It should be avoided, as far as possible, that the mechanisms are faced (less critical if we have an intermediate board).
- In the case that there is more than one board on one side, the joints of both should not coincide. In both plates the treatment of joints must always be carried out to guarantee the continuity of the system.

6. THE IMPORTANCE OF A GOOD INSTALLER.

Everything indicated above must be accompanied by an installer who knows what the system is like and what things should be done (and not done) to guarantee a good installation with the acoustic performance requires in the project.

For this, it is important to professionalize the sector that is given by the "Certificate of Professionalism", this certificate guarantees that the person who owns it has gone through a process where it is accredited:

- The experience of the installer. In the event that the installer has not completed regulated studies but has extensive experience in the sector and the completion of training courses, he / she can access this Certificate of Professionalism.
- Experience + training. In this case, the installer accredits his experience and can carry out training courses for the parties in which he needs more knowledge.
- Training. There are courses that allow obtaining the Certificate of Professionalism with a theoretical part and another practice where the necessary knowledge is acquired.

With this accreditation we will ensure that the installer who carries out the work knows the system and will know how to solve the different details and small modifications that are presented in all the construction works. Obviously if the installer has the title of Professional Formation of Technician of Interior, Decoration and Rehabilitation Works they know perfectly the system, because there is an important teaching load on Plasterboard Systems.

Currently there are different open processes for accreditation in different Autonomous Communities:

