MANUAL
FOR DRYWALL FITTER

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1. Introduction

1.1. Information about the IPCIC project

The main objective of the project was to improve education in the field of construction, in line with new legal regulations and construction sector trends. To achieve that goal, training system was prepared. It contains knowledge necessary for the finishing works specialists and tutors (mentors), with particular emphasis on efficiency of work and quality of education, H&S regulations, and soft skills. The main subjects are: drywall fitter, plumber and tiler. Project also helps to improve mobility of construction personnel, due to its international content (presentation of practices from participating countries) and multi-language form (materials prepared in EN, PL, LT and IT and help users to learn vocabulary specific for finishing works). The project complies with EQAVET requirements and it is foreseen that it should increase quality of didactic process for construction workers education including CPD. The objectives of the project include promotion and improvement of cooperation between construction industry and VET providers, including WBL scheme (that is why one of the partners in the project is a construction company). The partnership was established to ensure the best quality of results. It consists of VET organizations from Italy, Lithuania, and Poland (Centro Edile A. Palladio; Viesoji Istaiga Vilniaus Statybininku Rengimo Centras; Centrum Kształcenia Zawodowego i Ustawicznego Nr 1 in Warsaw), construction company (ERBUDS.A.), professional association (Polish Association of Building Managers - the Project Promoter) and university (Civil Engineering Faculty of Warsaw University of Technology). Target groups of the project are: young people, participants of CPD courses, young technicians, construction workers (also those who would like to retrain), stakeholders and associations in the construction sector, SMEs and companies (construction sector); providers of future courses: vocational schools, technical schools (primary and secondary - depending on the national systems terminology); VET providers, teachers, mentors; construction companies (training departments). 5 intellectual outputs were prepared: courses programmes, courses methodology, didactic materials, movie materials, materials for teachers training. All the results were presented and tested during multiplier events.

1.2. General information about the profession

The contemporary architectural scene presents an increasing use of innovative building systems, such as the technology of dry systems that characterize the formal aspect of architecture and enable the achievement of high performance building.

To evaluate, in an integral perspective, the advantages of dry system technology, it is necessary to know all the aspects that contribute to the design, technology, energy, structural and economic-management definition.

The execution must be performed by personnel who know all aspects of this construction technology well. The drywall fitter is a highly professional operator specialized on the realization of masonry using drywall systems. The drywall fitter indeed uses the creation of drywall systems to unite the specific characteristics of the materials to solve various problems as moisture, acoustic, thermal insulation problems and adding the possibility to create real design effects.

The drywall fitter using his skills as a craftsman, combined with the knowledge of the material, is able to create partitions between different environments, lower the ceilings, allowing you to also

create decorative effects that not only give a new look to the environment but also allow you to solve humidity problems, thermal or cold insulation problems, acoustic problems, etc.

Plasterboard is a simple material as a composition as it is composed of plaster, generally fiberglass or wood and pressed into two cardboard panels, however there are specific types on the market which, by coupling it with other materials or using specific creations, can acquire particular characteristics so that they can be used according to specific needs. In fact, there are flexible panels on the market, panels for the resolution of acoustic problems, panels for the resolution of humidity problems, different levels of fire resistance, outdoor panels and much more.

The qualification in the application and use of basic methodologies, tools and specific information allow him to carry out, depending on the specialization, activities related to the realization of plasterboard sheets, managing independently and with responsibility the entire laying process, even in the presence of organized laying teams operating under its coordination.

1.3. Learning Outcomes

The installer of plasterboard sheets can have two levels of specialization:

BASIC: it is aimed to the settling of simple drywall systems, as dividing walls, counter walls and false ceilings with:

- Distributive
- Finishing functions.

ADVANCED: aimed at the installation of complex dry systems, such as partitions, against walls and false ceilings characterized by specific laying levels, responding to performance requirements such as:

- sound insulation,
- fire protection,
- resistance to burglary,
- resistance to seismic stress,
- thermal protection,
- height greater than 3 meters,

and technical-aesthetic requirements such as:

- geometries of curved surfaces,
- inclined, corrugated surfaces,
- details,
- predisposition for the correct passage of the technical installations.

The qualification in the application and use of basic methodologies, tools and specific information allow him to carry out, depending on the specialization, activities related to the realization of plasterboard sheets, managing independently and with responsibility the entire laying process, even in the presence of organized laying teams operating under its coordination.

COMMON SKILLS

They are identified as common skills at the two levels:

A. Planning and organization of their work.

B. Installation of plasterboard sheets.

SKILLS FOR THE BASIC LEVEL

The installation of simple dry systems is identified as a specific process for the basic level.

SKILLS FOR ADVANCED LEVEL

The installation of complex dry systems is identified as a specific process for the advanced level.

KNOWLEDGE, ABILITY AND SKILLS ASSOCIATED WITH PROFESSIONAL ACTIVITY

The basic course corresponds to the sum of the knowledge, skills and competences of levels 1, 2 and 3, while the advanced course corresponds to the sum of the knowledge, skills and competences of level 4 in Table 1.1.

Table 1.1. Knowledge, skills and competences.

Level	Knowledge	Skills	Competences
1	Basic general knowledge of: - language, aimed at reading and understanding documentation, systems, materials and products which will used; - materials and tools..	Identify the materials, products and tools according to the deliveries received.	Assist in laying and learn basic information on the use of materials, products and tools used.
2	Preparation of tools, equipments and machinery. Knowledge of basic and recurring operations,	Understand the function of the individual tools and the individual equipments and their methods of use. Operate alongside top-level operators, solving recurring problems and employing simple tools and rules.	Prepare tools, equipment and machinery necessary for the various phases of activity, based on the instructions received and the expected final result. Cooperate in the execution of basic and recurrent laying operations.
3	Knowledge of dry systems and complementary materials and their application methods depending on the intended use.	Evaluate the laying site and identifying solutions, tools and materials for the correct installation of dry systems.	Check the installation context and the surrounding conditions. Check that the products / materials / systems are equipped with the prescribed technical documentation (CE marking, declaration of performance, technical data sheet, etc.). Set up any masonry support independently.

			Verify and lay the dry systems on their own. Adopt behaviors and solutions aimed at correcting any anomalies in relation to the finished work. Clear and clean the workplace. To deliver the work and release the required documentation. Manage activities independently in case of restoration work in existing buildings.
4	Knowledge of the different types of dry systems, of complementary materials / products, their characteristics and their application methods according to their use and their intended use. Knowledge of: criteria for managing the economic offer and preparing the installation estimate in relation to the project specifications; safety, hygiene and environmental standards;, acoustics and energy saving; sectoral technical standards; processes and work cycles related to the different types of installation of dry systems; planning of the laying process; principles, mechanisms and parameters of operation and maintenance of the tools used; types of masonry supports, their performance characteristics, applicable standards and parameters of suitability for the types of installation of dry systems; restoration techniques of pre-work supports (for example, wet walls).	To evaluate the installation context and the related surrounding conditions, identifying specific solutions, tools and materials for the correct installation of the various types of dry systems. To identify: - materials, products, tools, and equipment suitable for the various phases of activity; - criteria for organizing their work in relation to the activities to be performed and the context; - methods of planning and organization of activities in respect of the construction site and of safety, hygiene and environment, acoustics and energy saving standards, and of sectoral technical standards. To evaluate: - procedures and techniques for the preparation of products, tools and equipment in relation to the different types of dry systems and the required result. In the presence of activities with laying teams, to identify skills, to assign tasks and roles of individual operators, in relation to the laying phases, materials, products, tools and equipment used, and the final result required and to	To manage independently the own activity in the context of job, from the management of the economic offer to the delivery of the finished work, also with reference to: - checking of the installation context and related conditions of the context; - checking that the products / materials / systems used are accompanied by the prescribed accompanying documentation (CE marking, declaration of performance, technical data sheet, etc.); preparation in autonomy of any masonry support; - checking and autonomous installation of dry systems and complementary materials; verification during the course of the conditions for the application and/or execution of the finishing operations required and, where required, solution of any problems; - checking the correct execution of the work carried out and the suitability for the use of the finished work, in relation to the project or specifications; clearing and cleaning the workplace; delivery of the work and release of the prescribed accompanying documentation. To adopt procedures, techniques, behaviors and solutions aimed at overcoming and eventually correcting anomalies and / or

		coordinate the activities.	observations in relation to the finished work. To manage independently in the case of interventions on existing buildings, identifying specific solutions and ensuring the effectiveness of the intervention. Coordinating and overseeing the work of others, assuming the relative responsibility for the assessment of the installation activities.

2. Legal aspects of the profession

2.1. Construction workers right and obligations

The legislation identifies in the worker the person who carries out a work activity employed by a public or private employer, even if only to learn a trade, an art or a profession.

In order for the dependency relationship to exist, the worker must perform a subordinate service which is not only substantiated in having to comply with the organizational and functional decisions, but is obliged to scrupulously observe the rules set to protect the physical safety of all employees of the company, and to use the tools and preventive measures made available by the company.

Vocational training is the privileged objective that companies must pursue in order to guarantee effective growth in the construction sector both in terms of implementation of the quality of work and development of the technical-productive capacities of companies and aimed at pursuing the following objectives:

- respond to the real needs of businesses and workers, governing the sector's growth and development processes, through flexible, articulated and efficient tools;
- provide services and implement effective and measurable interventions to respond promptly to the needs and requirements of the construction sector;
- governing the labor market and in particular its evolution
- have a structural and measurable impact on the production fabric.

Professional training is mandatory in the following cases:

- establishment of a new employment relationship or, in the case of a supply contract, start of use;
- hiring workers with an apprenticeship contract;
- transfer or change of duties;
- introduction of new work equipment, technologies or use of new dangerous substances and preparations.

The vocational training system and the protection of health and safety in the workplace in the construction sector are a priority.

The employer is required to ensure that each worker receives sufficient and adequate training in health and safety at work, also with respect to his / her language skills, with particular reference to:

- concepts of risk, damage, prevention, protection, organization of corporate prevention, rights and duties of the various corporate subjects, Supervisory bodies, control, assistance;
- risks related to the duties and possible damages and the consequent prevention and protection measures and procedures characteristic of the sector or sector to which the company belongs.

2.2. Safety of works

Safety is an essential value and therefore in addition to always respecting the quality requirements of products and systems, the constant commitment to the protection of health and safety is fundamental.

On the construction site, small or large, it is good practice to respect some simple rules in order to protect yourself and those close to us. Precise rules of behavior, handling of loads and storage of materials must be followed in order to work in compliance with one's own safety and those around us.

Always pay attention to:

- *people working nearby;*
- *possible suspended loads and / or material lifting means with risk of falling; do not stand under them at all;*
- *disconnections of the floor, altitude jumps, unstable steps and in any case materials that could obstruct the passage (also electric cables) or false parapets; always be cautious and alert on where you walk and never get distracted;*
- *eliminate any risk situations;*
- *do not act hastily placing yourself in dangerous situations.*

2.2.1. Safety in the construction of dry systems

WORK PHASE: REALIZATION OF PLASTERBOARD WALLS

This is the construction of plasterboard partitions, by assembling the gypsum slabs on load-bearing metal framework, consisting of uprights and guides in galvanized steel or aluminum, anchored to the load-bearing structures of the building. The plasterboard panels are bonded with gypsum-based adhesives, are grouted to eliminate the depressions and are then sanded with sandpaper, in order to be painted.

<u>Machinery / Equipment</u>

The following equipment / machines are used in the work phase being evaluated:

- Saw for metal profiles
- Electric shears
- Cutter for plasterboards
- Cutter
- Cordless screwdriver
- Screws and plugs
- Nail gun
- Trowel, spatula, sandpaper
- Bubble level, plumb line and pinstripe wire
- Commonly used hand tools

Dangerous substances

The following Dangerous Substances are used in the work phase being evaluated:

- Smoothing mortar for plasterboard
- Plaster for plasterboard

Provisional works

The following Provisional Works are used in the work phase of the evaluation:

- Trestle Scaffolding
- Rolling Scaffold Tower

Table 2.1. Risk Assessment. Source: https://www.testo-unico-sicurezza.com

Description	Chance	Damage	Grade
Inhalation of dusts and fibers	possible	significant	**considerable**
Stings, cuts and abrasions	possible	significant	**considerable**
Manual handling of loads	possible	significant	**considerable**
Jets and sketches	probable	minor	**acceptable**
Noise	possible	moderate	**acceptable**
Slips, falls on level	possible	moderate	**acceptable**
Bumps, knocks, impacts and compressions	possible	moderate	**acceptable**
Allergens	not likely	significant	**acceptable**

Interventions / Provisions / Procedures to reduce risks

Following the risk assessment, the interventions / provisions / procedures aimed at safeguarding the safety and health of workers are reported in a non-exhaustive way:

- Follow the general preventive measures for the individual risks identified above
- All workers must be adequately informed and trained on the correct methods of carrying out the activities and using the equipment
- For work carried out inside normally closed environments, ventilation must be provided
- In works carried out with materials or products that give rise to jets and splashes that are harmful to health, measures must be taken to prevent their propagation in the work environment, by limiting the area of intervention
- The construction of bridges on trestles must always be appropriate even when, for the execution of finishing works, their use is limited in time (short-term work). The big planks 4 in length must always rest on three trestles and must be at least 4 in

number, well next to each other, fixed to the trestles and with the cantilevered part not exceeding 20 cm

- Use the bridge on trestles respecting the maximum allowed height (without adding superstructures), maximum capacity, and number of people allowed at the same time for use
- If you use bridges on wheels (scaffolding) it is necessary to remember that, even if the duration of the works is limited to a few minutes, the safety rules must be respected and in particular: the height of the scaffolding must be that foreseen by the manufacturer, without the use of superstructures; the wheels must be locked; the deck must be complete and fixed to the supports; the parapets must be of regular height (at least 1 m), present on the four sides and complete with toeboards
- To access bridges on trestles and / or scaffolding, regular hand ladders must be used and not those made on site. Hand ladders must be at a height of at least 1,00 meters above the arrival level, be equipped with non-slip devices, be tied or fixed so as not to overturn and, when arranged towards the outside of the scaffolding, must be provided with protection (parapet)
- It is necessary to carry out the cleaning of the work and passage places, accumulating the resulting material in order to be able to lower it to the ground conveniently collected or slung
- Promptly impart to the staff the necessary information for the correct handling of heavy or bulky loads
- Respect the instructions received for an exact and correct position to be taken when handling loads. For heavy or bulky loads, the mass must be handled with the intervention of several people in order to distribute and reduce the effort
- Avoid the lifting of materials heavier than that established by current legislation by an individual worker. For heavy and / or bulky loads, the mass must be handled with the intervention of several people in order to distribute and reduce the effort
- Adopt support systems (lifting and lowering platforms serving the means of transport, manually operated trans-pallets, etc.) to reduce the loads transported.
- Implement the technical, organizational and procedural interventions that can be practically implemented in order to minimize the risks deriving from exposure to noise
- Always use the personal protective equipment provided
- Check the constant use of PPE by all operating personnel

Personal protective equipment (PPE)

Depending on the risks highlighted, the following PPE will be used, of which the description and regulatory references are given, as shown in table 2.2.

Table 2.2. Personal protective equipment (PPE). Source: https://www.testo-unico-sicurezza.com

RISKS	PPE	DESCRIPTION
Stings, cuts and abrasions due to contact with the equipment during processing	Protective gloves 	Mechanical protection gloves to be used in workplaces characterized by the presence of materials and / or tools that can cause abrasion / cutting / perforation of the hands
Injury from contact with equipment	Safety shoes 	Reinforced steel toe against crushing / abrasion / perforation / wounds of the lower limbs and non-slip sole and to protect the ankle from sprains
Bumps, knocks, impacts and compressions	Protective helmet 	Useful device to protect the worker from the risk of offense to the garment due to falling material or for contact with dangerous elements
Inhalation of dusts and fibers	Filtering facepiece for powders 	Mask for the protection of medium toxicity powders, fibers and aqueous aerosols of particulate matter> = 0.02 microns.
Exposure to dust during processing	Protective suit 	Work overalls to wear to prevent dust from coming into contact with the skin

Noise that exceeds the allowed limits	Ear muffs 	The models currently on the market allow you to adjust the pressure of the ear cups, while the dirty and worn bearings can easily be replaced
Jets and sketches	Protective goggles 	With single panoramic polycarbonate lens treated anti-scratch, with side protection

The simple picture guidance in this section suggests appropriate methods for handling Gypsum products including plasterboards, plasters, frame metal, boards and ceiling products.

Fig. 2.1. Loading and unloading pallets

Fig. 2.2. Mixing - emptying bags into a mixer

Fig. 2.3. Handling lengths of metal - one person

Fig. 2.4. Handling boards: one person

Fig. 2.5. Handling boards: two person

Fig. 2.6. Fixing walls

Fig. 2.7. Lifting plasterboards into place (including ceilings) - two person operation

Fig. 2.8. Fixing ceilings

2.3. Environment protection

Gypsum based products and systems are counted among the construction solutions that allow the complete recycling circuit (the waste can be used to still manufacture the same product) and the reuse of most of the components, even on the same site, reducing costs of transport and times related to the start-up of those demolished and those relating to new production material.

If the components of the systems cannot be reused after demolition, they can be recycled: sheets, profiles and screws.

Gypsum as such is 100% recyclable and indefinitely, as the chemical composition of the raw material remains unchanged. Gypsum stone (bi-hydrate calcium sulphate - CaSO * 2H O) is the only mineral that can, after cooking and the subsequent addition of the lost water, return to its natural state thanks to the physical-chemical phenomenon of the setting. The emission of greenhouse gases, for example in the production phase of the slabs, is minimal since the cooking, rehydration and setting of the plaster core always take place at low temperatures.

To promote waste reduction and improve the product recycling process, it is important to consider the following aspects: waste prevention, through an efficient and interactive dialogue with designers and works managers for the adequate storage, handling, fixing and finishing of gypsum-based products and systems, the use of removable and reusable partitions in the case of commercial destinations and solutions, where possible, designed "to measure"; adoption of waste reduction measures through adequate demolition design which translates into research and development of solutions and systems that ensure maximum recycling, differentiated demolition and distribution among stakeholders and in particular the demolition industries, optimization of production capacity to use internal recycled material by adopting measures to reduce waste when laying dry systems by means of adequate technical-professional training of the installers.

Currently, manufacturers have implemented the concepts of environmental sustainability and reuse of recycled material in their processes by activating systems for recovering the scraps of plasterboard from production and installation (distribution and construction sites), to return to the factories. The plasterboard sheets that are part of the production plants are "cleaned" of the coating cardboard, deriving 100% from recycled paper, which can be given to the paper producers while the gypsum core is properly treated and, combined with the gypsum coming from the quarries in adequate percentages, reused for the production of new slabs.

Recycled gypsum can also be used in the production of cement where it is mixed with clinker to ensure the setting phase.

Fig. 2.9. Idea of recycling. Source: - "The White Book" - www.british-gypsum.com

To promote waste reduction and improve the product recycling process, it is important to consider the following aspects:

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- adoption of waste reduction measures through adequate demolition design which translates into research and development of solutions and systems that ensure maximum recycling, differentiated demolition and distribution among stakeholders and in particular the demolition industries, optimization of production capacity to use internal recycled material by adopting measures to reduce waste when laying dry systems by means of adequate technical-professional training of the installers.

Minimising waste by good design: most drywall projects generate waste – there's a 10% waste factor on many building sites, and in some cases it's up to 25%. Few offcuts are suitable for use elsewhere on a particular building site, so most go to waste

European legislation is in place to prevent high sulphate wastes, such as gypsum, from being landfilled with other biodegradable material unless placed in a dedicated sulphate cell. In practice, this means that the majority of gypsum waste, such as plasterboard, is instead recycled. Plasterboard can nearly always be recycled and both the paper and gypsum re-used to manufacture new plasterboard.

Most specialist recycling contractors offer a range of bags, bins, skips and containers to ensure that an adequate waste holding capacity is provided as close as possible to the point of need.

It is important to separate waste plasterboard from other site wastes to prevent contamination that could prevent the material being recycled and re-used.

The positioning of plasterboard waste receptacles and the types used are dependant on the size of the building project and the space available on site. These should be planned to minimise the physical handling of plasterboard waste.

Minimising waste by good design: most drywall projects generate waste – there's a 10% waste factor on many building sites, and in some cases it's up to 25%. Few offcuts are suitable for use elsewhere on a particular building site, so most go to waste.

2.4. Construction workers right and obligations

The person who has passed the exam for certification purposes has the necessary technical and theoretical notions relating to a particular requirement or a particular technique in the laying of dry construction systems.

In particular, it can be qualified in the following specializations:

- Realization of walls, counter walls and false ceilings.
- Systems for insulation and sound absorption.
- Systems for passive fire protection.
- Systems for curved surfaces.
- Containment systems for brick and cement floors subject to a "knocking" phenomenon.
- Management and coordination of installation teams.

3. Technology

3.1. The raw material: gypsum

The properties of plaster have been known since ancient times, when it was used both as a building material and for the artistic production of alabaster objects.

Gypsum is a mineral that occurs naturally in the form of gypsum stone. It is an evaporitic sedimentary rock that has different degrees of purity: it can appear gray and opaque with fine grain, white or transparent like a crystal (selenite), up to the purest form of alabaster.

Gypsum was formed as a result of the evaporation of marine waters from the sedimentation of salts such as rock salt, calcite and aragonite. It is found as a natural CaSO4 anhydrite or as a rock with a crystalline structure consisting of calcium sulphate bi-hydrate CaSO4 - 2H2O.

Fig. 3.1. Example of a mineral - gypsum. Source: training manual - I sistemi a secco a base gesso – Assogesso

To make it workable, the plaster must be dried in ovens. In fact, due to its characteristic, subjected to certain temperatures, the plaster loses a part of its component of crystallization water and turns into a hydrate.

THE PROPERTIES

HYGROMETRIC ADJUSTMENT

Gypsum has characteristics that make it a natural humidity regulator. During drying, the plaster loses all the mixing water, maintaining a porous structure that makes it receptive in the case of high environmental humidity. In the same way, once this is scarcely supplied, it releases the collected humidity to the environment to a state of equilibrium. In construction, this feature guarantees healthy environments, free from condensation mold.

THERMAL INSULATION

Gypsum stone proves to be a good thermal insulator for two specific characteristics:

- during the drying or setting phase, the gypsum structure becomes porous and retains small air bubbles inside that reduce its thermal conductivity. The low ability to transmit heat makes it a highly insulating material even in simple form.

- the ability to grow in a homogeneous form, determines final products with smooth and continuous surfaces that do not present different densities, possible weak points in the ability to isolate.

SOUNDPROOFING

The same porous structure and the homogeneous surface of the gypsum-based construction elements allow this material to have good sound-attenuating and sound-absorbing characteristics. Sound-attenuating is defined as a material capable of reducing the transmission of noise from one environment to another; the sound-absorbing instead is a quality that allows you to limit and control the sound reverberation, leaving the sounds pure and without echo or rumble. Both characteristics prove to be important in the building industry, for the construction of walls or panels that guarantee soundproofing in accordance with the law.

RESISTANCE AND REACTION TO FIRE

Other characteristics that gypsum naturally possesses are resistance and reaction to fire, due to its molecular composition containing water. Gypsum appears as non-combustible and is able to delay the spread of flames for a long period of time. The construction materials in plaster are therefore particularly effective in fire protection for homes or commercial buildings: this quality is strengthened thanks to special laying methods that increase its resistance.

MECHANICAL RESISTANCE

The mechanical strength of pure gypsum varies according to the process that has been followed in its processing, in particular the cooking phase proves to be important. The porosity and the quantity of water contained in certain conditions can prove to be a weak point of the mechanical resistance capacity. For use in construction, therefore, a production process is first followed to create resistant mixtures, which are mixed with different materials such as sand, fibers, synthetic, vegetable or glass resins. Today's products are particularly suitable for buildings with anti-seismic characteristics.

LIGHT REFLECTION

Gypsum has a high coefficient of light radiation and therefore contributes to increasing the brightness of the rooms. Furthermore, the plaster-treated surfaces have the gift of not altering the chromatic quality of the light source.

HYGIENE AND HEALTH

Of entirely natural origin, gypsum is a material that does not give off harmful substances even after processing. It reveals an important protective action against other materials, such as wood, protecting it from attacks by insects and pests that often cause their degradation.

THE PRODUCTION PROCESS

EXTRACTION

The extraction of the gypsum takes place underground or by excavation in open-air quarries by mechanical or explosive means. The extracted material is transported to the processing plant. To facilitate operations, factories are usually placed in quarry premises. This allows to minimize the movements for the transport of the extracted material and to bring the processing residues back to the quarry for the reconstitution of the soil. When necessary, the extracted material is deposited in an intermediate area where it is selected according to quality and characteristics to be then destined for different final processes.

PROCESSING

The gypsum blocks from the quarry have different sizes: the largest are reduced in size still in the quarry to facilitate transport. The next step is storage in oil mills, where the rocks are crushed and ground to make the passage to the ovens easier and the "cooking" phase more effective.

COOKING

- by "dry way" β-hydride and anhydrites are obtained, used for the production of gypsum for plasters, stuccos, artistic processes, aggregates and substrates for floors.
- by "wet method" α hemihydrate is obtained for the production of special plasters.

BUILDING APPLICATIONS

USE IN TRADITION

Easy to find and work with, plaster has always been a material used in construction to build and decorate. As a construction element it is found in pieces of different sizes or as plaster. Given the habit of using the stony materials available in the area for construction, the use of blocks and stones was more frequent in areas where the material was easily available.

Instead, the use of gypsum powder as a decorative element is wider given the greater ease of transport. The rough stone is found in the construction of dry stone walls, for homes, defense or border walls. The stone cut into square blocks was used for the cantonal structures of the buildings or to define portals, doorways and windows, also becoming a decorative element of the facade. As a binder it is found in cement conglomerates used as coarse plaster, in finer plasters, but also in original structures that use small stone or plant elements for the construction of floors and ceilings.

Some have found solutions for filling structures with wooden uprights. The most frequent mode of use, however, remains the decorative one, in artisan forms or in real artistic productions.

MODERN USE

Today plaster is rarely used as a pure stone in construction. Its workability qualities make it a material that can be transformed into forms more suited to modern construction methods that enhance its performance. It is used in the form of coated slabs or blocks, mixed with other substances, for the construction of partition walls and infill walls. Healthiness, mechanical strength and workability of the finished product are the most important construction qualities. In powder or granules it is used for the realization of mortars and plasters.

The three Sectors where Gypsum is most used are:

Fig. 3.2. Sectors, where Gypsum is using, from left: The Block Sector, The Plaster Sector, The Dry Systems Sector. Source: training manual - I sistemi a secco a base gesso - Assogesso

3.2. Materials

THE CE MARKING

Regulation 305/11 / EU for Construction Products, CPR, Construction Products Regulations, which has been in force since July 2013

The CE marking certifies the conformity of a product to a technical specification, and is the result of an iter that has the purpose of evaluating / ascertaining / guaranteeing and declaring the performance of a product, by means of Test or Calculation and Control procedures of the Production

The DoP (Declaration of Performance) is the fundamental document without which the CE marking cannot be affixed. It replaces the Declaration of Conformity (DoC). DoP is mandatory.

The DoP guarantees that the INFORMATION concerning the Products is provided according to a pre-established model. Together with the DoPs, the Safety Data Sheets and the Technical Data Sheets must also be delivered.

The CE marking must report some data present in the DoP, in accordance with the provisions of the CPR.

The obligation to apply the CPR concerns:

- The Manufacturers (those who manufacture or have a Product manufactured and market it with their name or brand)
- The Distributors
- Importers

The manufacturers, in addition to the DoP and the CE marking, must ensure that their products are accompanied by instructions and information on their safety (especially for those products that are considered dangerous according to RE 1907/2006).

COATED PLASTER SLABS (PLASTERBOARD)

They consist of a rehydrated gypsum core covered on both sides with a special high-strength cardboard.

The production process

The mixture consisting of water, plaster and other elements is distributed on the lower cardboard tape; a second upper cardboard tape is deposited on the dough, creating a paper-plaster-paper sandwich.

A continuous belt of defined dimensions is created (1200 mm wide, for a thickness between 6 and 25 mm) which along the molding line, giving the plaster dough time to harden in order to move on to the next phases. The continuous web is cut into individual plates which pass through a dryer.

The slabs are the basic product for the construction of walls, false walls, false ceilings and dry screeds.

The width of the slabs is usually 1200 mm and they can have various thicknesses, lengths and technical characteristics depending on the performance required.

Fig. 3.3 Example of coated plaster slabs (plasterboard). Source: - "Manuale Tecnico: Soluzioni per interni" – GYPSOTECH – www.fassabortolo.it

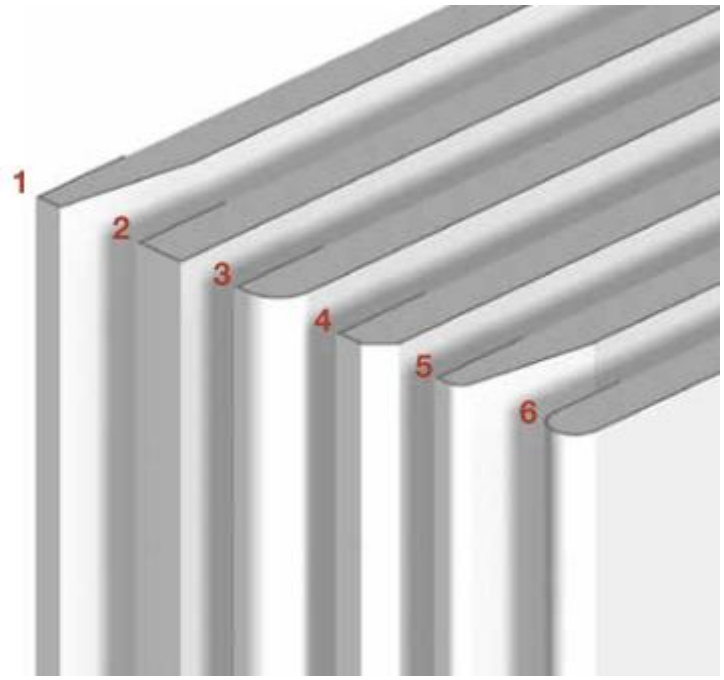
The EN 520 standard provides for eight types of slabs, of which we describe the main characteristics:

type A slab: standard slab, suitable for receiving the application of plaster or decoration.

- H type sheet: sheet with reduced water absorption, with additives that reduce its absorption, suitable for special applications where this property is required; it can be of type H1, H2 or H3 according to the different degree of total water absorption (less than 5, 10, 25%), while the surface water absorption must in any case not be greater than 180 g / m^2.
- type E sheet: sheet for external cladding, but not permanently exposed to atmospheric agents; it has a reduced water absorption and a vapor resistance factor of no more than 25.
- type F slab: slab with gypsum core with improved adhesion at high temperature, also called fire type; has mineral fibers and / or other additives in the gypsum core, which allows the slab to have better behavior in case of fire

- P type slab: base slab, suitable for receiving the application of gypsum plaster; can be perforated during production.
- type D slab: controlled density slab, not less than 800 kg / m 3, which allows superior performance in certain applications, with a face suitable for receiving the application of plaster or decoration.
- type R sheet: sheet with improved mechanical strength, it has a greater flexural strength (about 50% higher than the other sheets), both longitudinally and transversely, compared to the other types of sheets, with a face suitable for receive the application of plaster plaster or decoration.
- type I sheet: sheet with improved surface hardness, suitable for applications where this characteristic is required, assessed on the basis of the impression left by the impact of a steel ball, which must not be greater than 15mm, with a face suitable for receive the application of plaster plaster or decoration.

The standard also provides for six different types of edge:



1) Thinned edge
2) Straight edge
3) Half rounded edge
4) Beveled edge
5) Half rounded edge thinned
6) Rounded edge

Fig. 3.4. Types of edges in a standard plasterboard. Source: - "Manuale Tecnico: Soluzioni per interni" – GYPSOTECH – www.fassabortolo.it

Plasterboard sheets can have various thicknesses ...

- the most common thicknesses are 12.5 mm and 15 mm
- the thicknesses are between 6 mm and 25 mm
- the 6 mm thick slab can be used for the creation of curved surfaces in partitions, false walls and false ceilings and / or for aesthetic purposes
- the 9.5 mm thick slab can be used in non-single slab partitions and counter walls.

Plasterboard sheets can also be coupled with thermo-acoustic insulators:

they consist of plasterboard sheets which, after production, undergo a further manufacturing process which consists in gluing, on the back of the sheet, a layer of plastic insulating material (expanded or extruded polystyrene) or mineral insulating material (rock wool or glass) in order to improve its thermal and / or acoustic insulation performance.

In addition to the coated plaster systems, other types of slabs for dry systems with a particular composition are available on the market such as:

- Special type plaster fiber board, based on gypsum, cellulosic fibers and mineral additives. Ideal for the construction of partition walls with high impact resistance, dry plaster, counter walls on the structure and false ceilings of pitched roofs.
- Cement-based slab lightened with expanded polystyrene, reinforced on both sides with a fiberglass mesh and with the exposed face treated with a porosity limiter. Product suitable for the construction of walls and counter walls that require high mechanical resistance, water and humidity, both for indoor and outdoor environments.

METAL PROFILES

Galvanized steel frames: they are the structural soul of the system.

The metal profiles are made with 0.6 mm thick galvanized steel sheet, shaped in various shapes according to their function

The suspensions of heavy loads, sanitary fixtures and lighting fixtures are fixed on them.

U-GUIDES: which must be positioned on the floor and ceiling by means of metal anchors or nails and which are used to contain the metal uprights inside.

C-PILLARS : housed inside the guides by simple interlocking: the pitch between the uprights depends on the width of the slabs, and since they are usually 1200 mm wide, it follows that an upright is laid every 600 mm, or 400 mm, or 300 mm, depending on the height and performance required of the system.

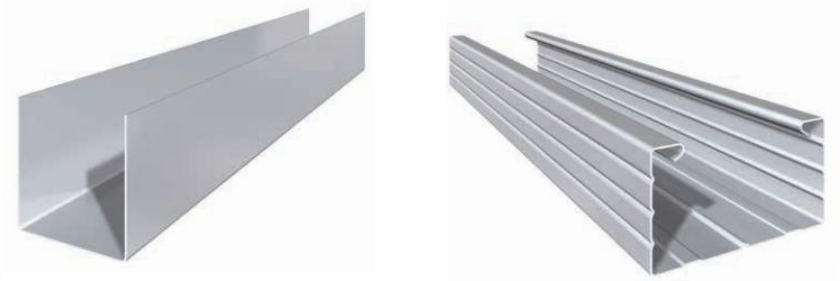


Fig. 3.5. Examples of metal profiles used in the construction of support structures.
Source: “Manuale Tecnico: Soluzioni per interni” – GYPSOTECH - www.fassabortolo.it

GUIDES AND UPRIGHTS FOR FALSE CEILINGS: similar to the previous ones, but with smaller overall dimensions.

Table 3.1. They differ in size, shape and thickness. Source: training manual - I sistemi a secco a base gesso – Assogesso

TYPES OF PROFILES	measure mm
C profiles for false ceilings	50x15
	50x27
U-shaped guides for false ceilings	15x30
	27x30
C-pillars for walls	50x50
	55x50
	75x50
	100x50
U-shaped guides for walls	50x40
	55x40
	75x40
	100x40
L-shaped corner profiles	50x50
	60x60

The plaster slabs can also be applied directly on wooden frames both as dry plaster and, in appropriate configurations, as bracing panels, on internal and external partitions.

PLASTERS

The techniques of treatment of the joints of the slabs and the screw heads can be very varied, but in any case all of them provide for the use of plaster putties, which have the function of filling the thinned edges of the slabs and of making the surface uniform aesthetic point of view, both mechanical.

Those mainly used can be divided into two categories:

1. Powder putties: these are products basically made up of gypsum powder and various additives, and yes they prepare on site by mixing them with water; they can have different workability times according to the additives present which delay the workability time more or less. To underline the fact that the workability time and the setting time of the grout are strongly conditioned by climatic conditions (temperature, humidity, ventilation), and also by correctness of preparation

2. Ready putty: stucco pre-mixed with water and special additives, and therefore ready for use; they usually have longer drying times than powder ones

Gypsum based adhesives for coated plasterboards: these are products used to glue slabs without using metal warping. They consist of gypsum powder and additives, and are prepared on site with methods similar to those of putty.

THE INSULATORS

The insulators, with varying thicknesses and densities, are used to optimize the thermo-acoustic performance and can be simply integrated between the profiles.

The most used materials are:

- Rock wool
- fiberglass
- XPS - extruded polystyrene foam
- EPS - sintered expanded polystyrene

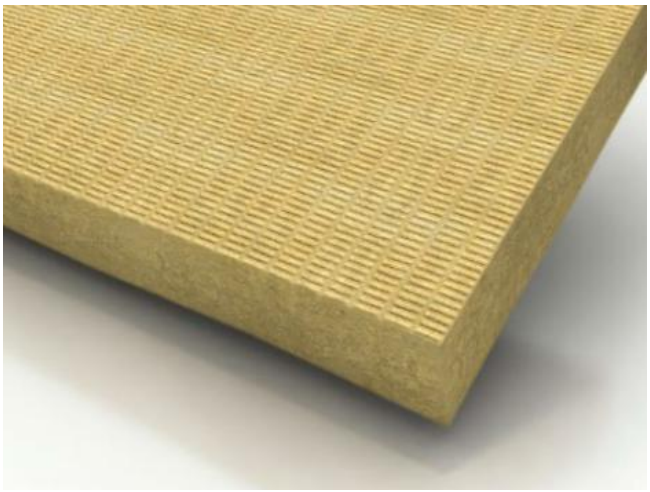
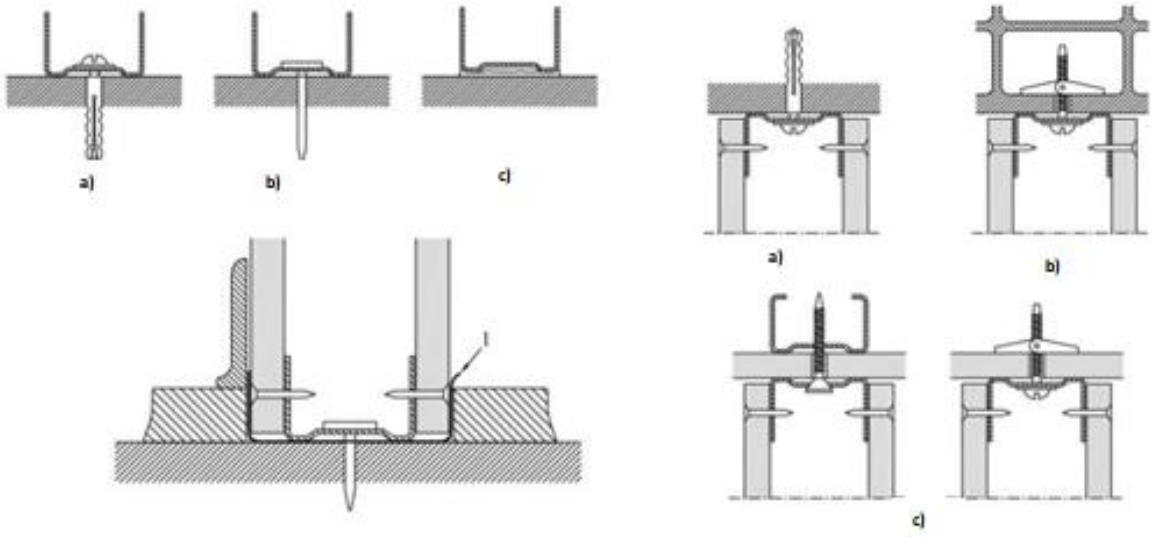


Fig. 3.6. Example of insulators used between the profiles. Source: web.

THE ACCESSORIES

The anchoring elements of the metal profiles



Rys. 3.7. Examples of anchoring elements of drywall steel profiles. Source: - "Manuale dei sistemi a secco" – www.gyproc.it

The fixing elements of the slabs:

The phosphated metal screws are used to fasten the plates to the profiles: their pitch can vary from 200 to 300 mm maximum: must be screwed taking care that the head is slightly below the edge of the surface of the slab.

They are of various lengths, and can be tipped nail or drill, depending on the thickness of the sheet to be drilled: the screw with nail tip yes uses for sheets up to 0.8 mm thick, while the screw with drill bit is suitable for sheet thicknesses more.

Other types of screws with washer head are used for fasten different metal components together.

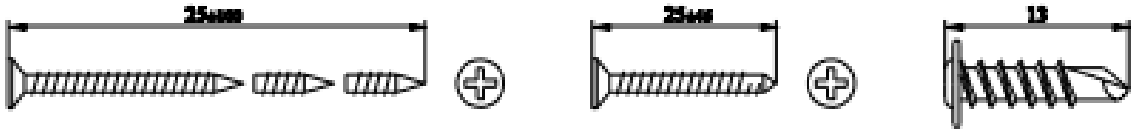


Fig. 3.8. Examples of screws used in drywall assembly.
Source: - "Manuale dei sistemi a secco" – www.gyproc.it

The suspension elements for suspended ceilings:

The various metal components for false ceilings are made with galvanized steel sheet in thicknesses from 0.6 to 1.0 mm, depending on their function:

- Hooks with spring
- Orthogonal union hooks
- Snap hooks
- Spacer hooks
- Rods, adjustment springs

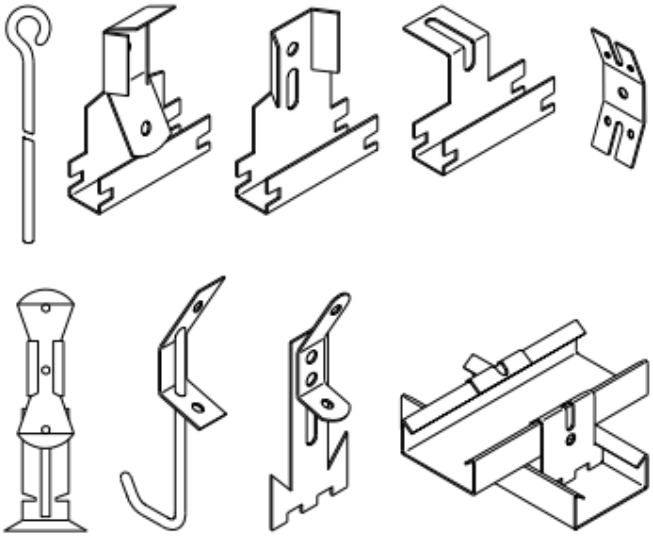


Fig. 3.9. Examples of elements used in the installation of suspended ceilings. Source: training manual - I sistemi a secco a base gesso – Assogesso

The grouting materials (reinforcement tapes and corner protectors)

Reinforcement tape

The joint reinforcement tape gives adequate mechanical resistance to the grouting, absorbing the tensions that occur on the joint due to micro-movements of the substrate, impacts and induced mechanical stresses, or for hygrothermal stresses.

MATERIALS USED FOR DRYWALL ASSEMBLY

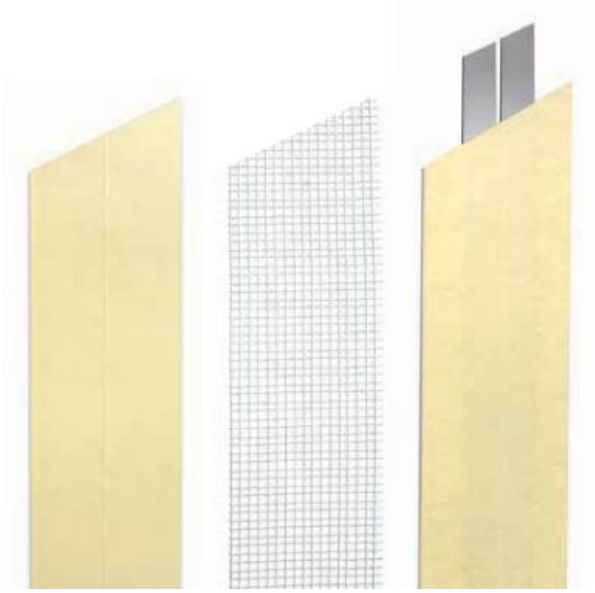


Fig. 3.10. Examples of grouting materials. Source: "Manuale Tecnico: Soluzioni per interni" GYPSOTECH - www.fassabortolo.it

To reinforce the joint between the slabs we use:

- The micro-perforated paper tape: made up of a special cellulose fiber strip 50mm wide with a rough face (to be placed on the slab) and a smoother one. It represents the traditional method for grouting and offers total reliability over time, giving the joint a mechanical resistance superior to any other grouting technique.
- The self-adhesive mesh tape: it is certainly the fastest and easiest way to reinforce the joints. Consisting of a narrow orthogonal mineral fiber mesh with an adhesive face that allows it to adhere directly to the cardboard surface of the sheets, it avoids the base coat required for fixing the paper tape. This tape slightly reduces the execution time of the joint, but offers a lower mechanical resistance than the joint with paper grouting.
- The fiberglass tape: used on the joints of special plaster slabs coated with non-woven fiberglass fabric (with high fire resistance), it can also sometimes be used on the plaster slabs coated with cardboard.

To acoustically isolate and avoid bridges audible:single-sided and double-sided tape: closed cell polyethylene foam tapes, of density 30 kg / m 3, with slightly less width to that of the profiles, to be interposed between the elements in steel and supporting structures.

Metal corner guards and reinforcement tapes

Corner reinforcements are normally of three types:

- rigid edge protector in galvanized steel, for 90 ° angles
- aluminum tape / galvanized steel sheets on a micro-perforated tape background, for all edges
- silicone tape on micro-perforated bottom, for all edges

Fig. 3.11. Example of an aluminum profile used for making corners. Source: “Manuale Tecnico: Soluzioni per interni” GYPSOTECH - www.fassabortolo.it

Dowel for plasterboard

There is a wide variety of fixing devices suitable for securing fixtures and fittings to Gypsum systems.

Generally, the choice of individual fixing devices will depend on the type of system and the loading requirements.

It should be noted that, with drylined walls, there is normally a cavity to be bridged between the boards and the background. The fixing device should be long enough to allow for this and to penetrate well into the solid wall or background.

Fig. 3.12. Example of an electrical box.

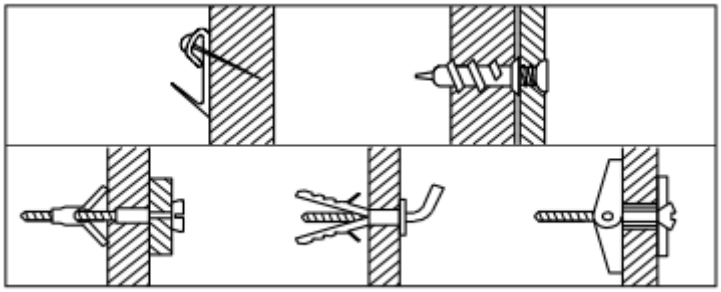


Fig. 3.13. Example of plasterboard dowels. Source: training manual - I sistemi a secco a base gesso - Assogesso

Figure 3.14. Example of drywall installation. Source: training manual - I sistemi a secco a base gesso - Assogesso

3.3. Tools

A good tool is the essential prerequisite for obtaining a perfect result.

To get started, focus on quality products for which you can rely on long experience in developing excellent levels of use and safety.

The following about tools and accessories give you a first orientation on the minimum equipment.

Table 3.2. Tracking and measuring equipment. Source: elaboration by architect Ferronato for SCVAP (images from the web)

 **Double meter**	 **Flexometer**
 **Projection laser level**	 **Tracer Wire**
 **Magnetic level**	 **Millimeter rod**

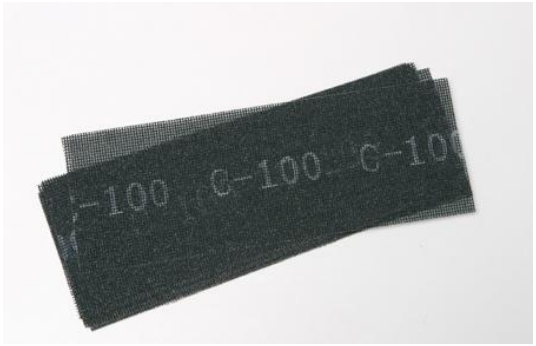
Table. 3.3.Handling And Processing Equipment. Source: elaboration by architect Ferronato for SCVAP (images from the web)

 **Slabs trolley**	 **Raise slabs**
 **Slabs lifter**	 **Professional cordless screwdriver**
 **Shears for metal profiles**	 **Punch press**

 **Cutter**	 **Pointed hacksaw**
 **Rasp for slabs**	 **Cup cutter**

Table 3.4. Grouting and finishing. Source: elaboration by architect Ferronato for SCVAP (images from the web)

 **Mixer**	 **Bucket**

 **Putty tray**	 **Trowel**
 **Spatulas**	 **Stainless steel trowel**
 **Buffer for sanding**	 **Emery cloth**

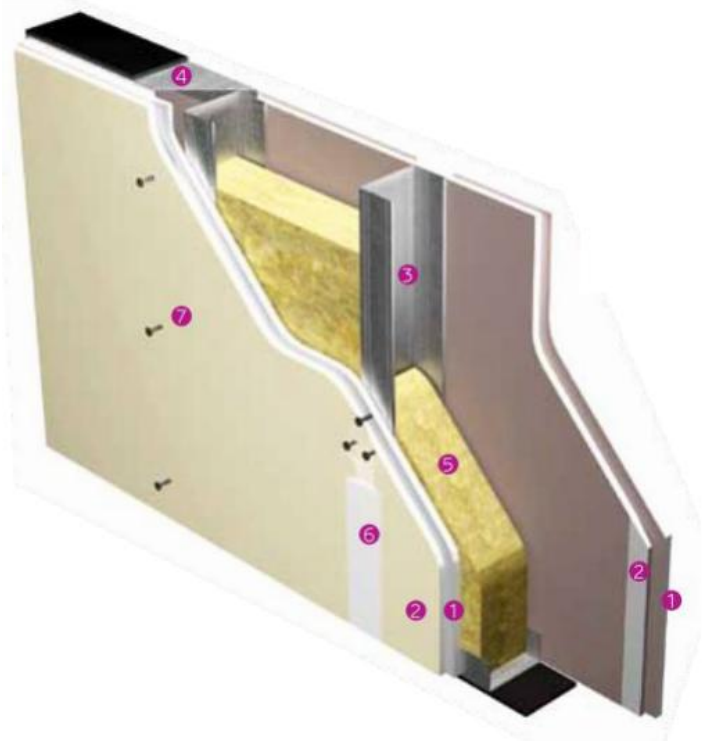
3.4. Construction typologies

We are talking about non-load-bearing systems that respond effectively to all needs for safety and home comfort, such as:

- partition walls and external walls
- internal and external counter walls
- false ceilings for indoors and outdoors

Figure 3.15. Examples of used construction typologies. Source: training manual - I sistemi a secco a base gesso - Assogesso

INTERIOR PARTITION WALLS



SINGLE FRAME WALLS

1. Slab
2. Slab
3. C-pillar
4. U-shaped guide
5. Insulating panel
6. Grouting the joint with reinforcement tape
7. Screws

Figure 3.16. Internal partition wall - cross section. Source: “Manuale del Posatore” – Siniat – www.siniat.it

DOUBLE FRAME WALLS

1. Slab
2. Slab
3. C-pillar
4. U-shaped guide
5. Insulating panel
6. Screws
7. Screws
8. Grouting the joint
9. Joint reinforcement tape

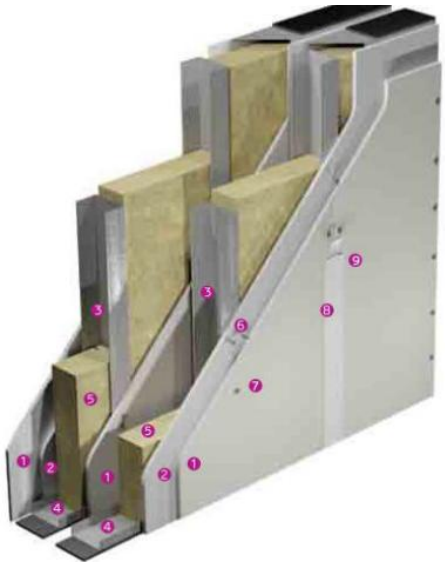


Fig. 3.17. Double-walled walls - cross section. Source: “Manuale del Posatore” – Siniat –www.siniat.it

INTERNAL COUNTERWALLS

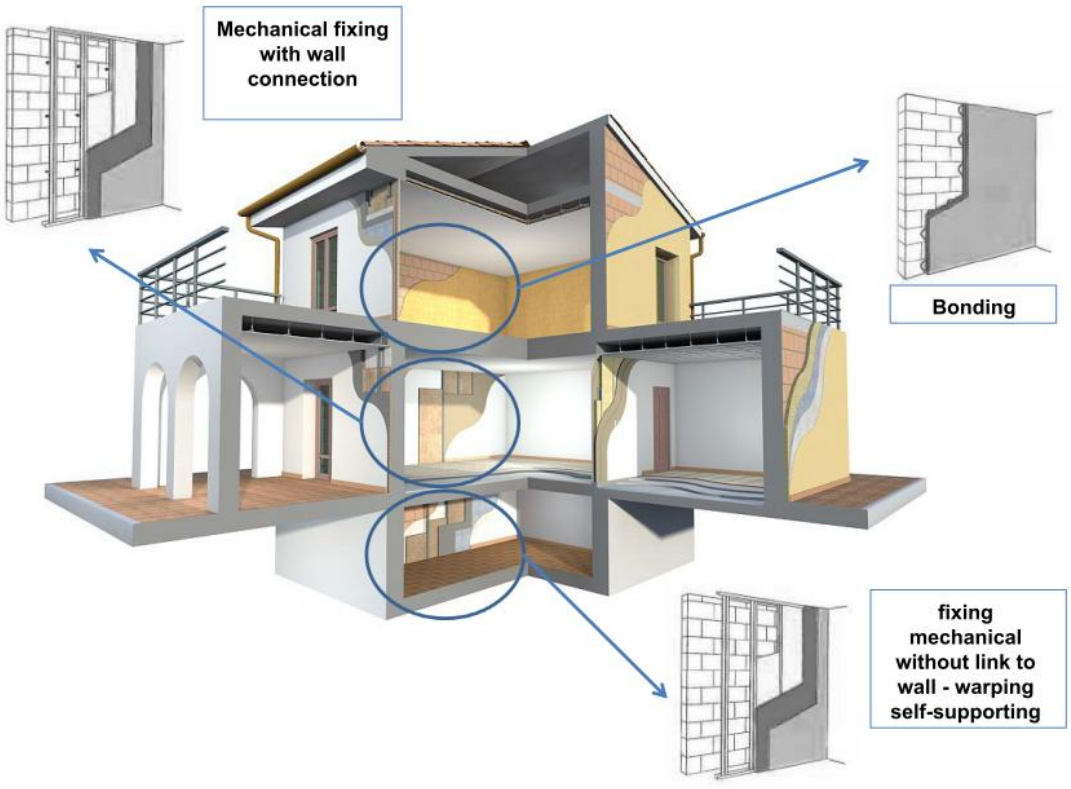


Figure 3.18. Internal counterwalls - example of use. Source: training manual - I sistemi a secco a base gesso - Assogesso

1. Slab
2. Slab
3. C-pillar
4. U-shaped guide
5. Screws
6. Screws
7. Grouting the joint
8. Joint reinforcement tape
9. Insulating panel

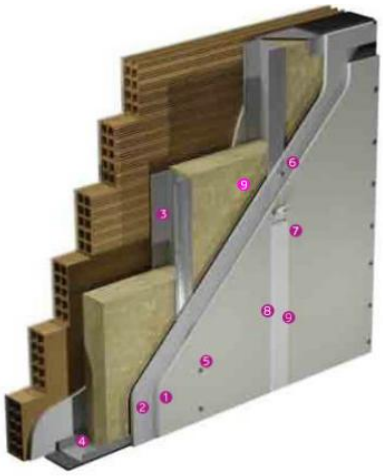
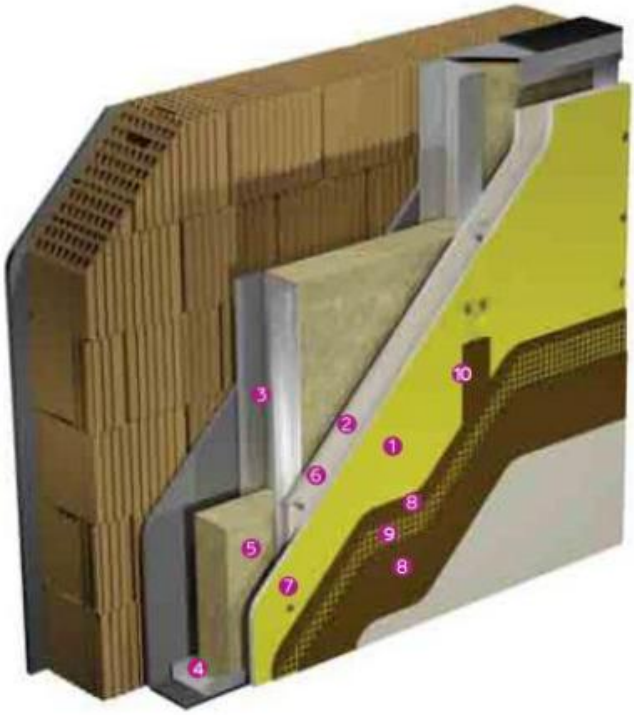


Fig. 3.19. Internal counterwalls - cross section. Source: “Manuale del Posatore” – Siniat – www.siniat.it

EXTERNAL COUNTERWALLS



1. Outdoor slab
2. Slab
3. Anti-corrosion C-post
4. Anti-corrosion U-guide
5. Thermo-acoustic insulation
6. Screws
7. Anti-corrosion screws
8. Armor net
9. Smoothing / adhesive
10. Mesh tape and grouting

Fig. 3.20. External counterwalls - cross section. Source: “Manuale del Posatore” www.siniat.it

OUTDOOR BUILDING WALLS

1. Slab
2. Outdoor slab
3. Slab with vapor barrier
4. C-pillar
5. U-shaped guide
6. Anti-corrosion C-post
7. Anti-corrosion U-guide
8. Thermo-acoustic insulation
9. Screws
10. Screws
11. Anti-corrosion screws
12. Smoothing/adhesive for exteriors
13. Armor net
14. Mesh tape and grouting
15. Thermal-acoustic insulation

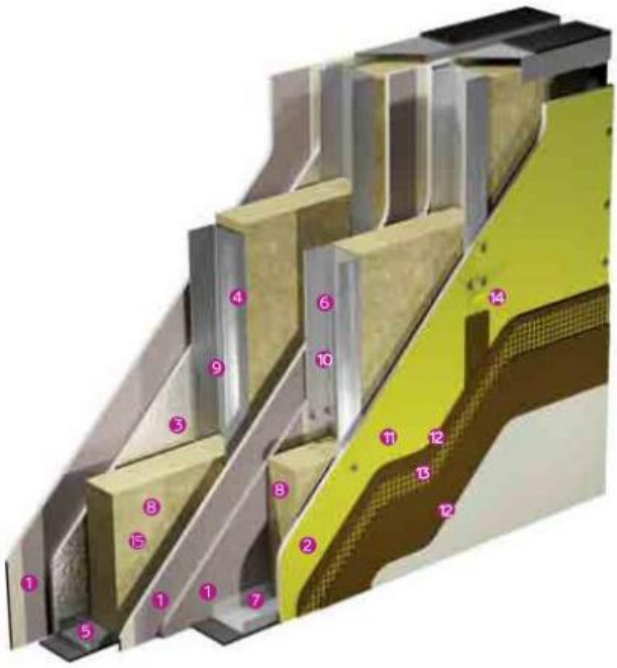


Fig. 21. Exterior walls of the building - cross section. Source: "Manuale del Posatore" www.siniat.it

FALSE CEILING

ADHERENT FALSE CEILING

1. Slab
2. Profile for suspended ceilings
3. Guide for suspended ceilings
4. Hooking
5. Screws
6. Grouting the joint
7. Joint reinforcement tape

Figure 3.22. Example of a false ceiling. ***Source:*** "Manuale del Posatore" – Siniat –www.siniat.it

SUSPENDED CEILING

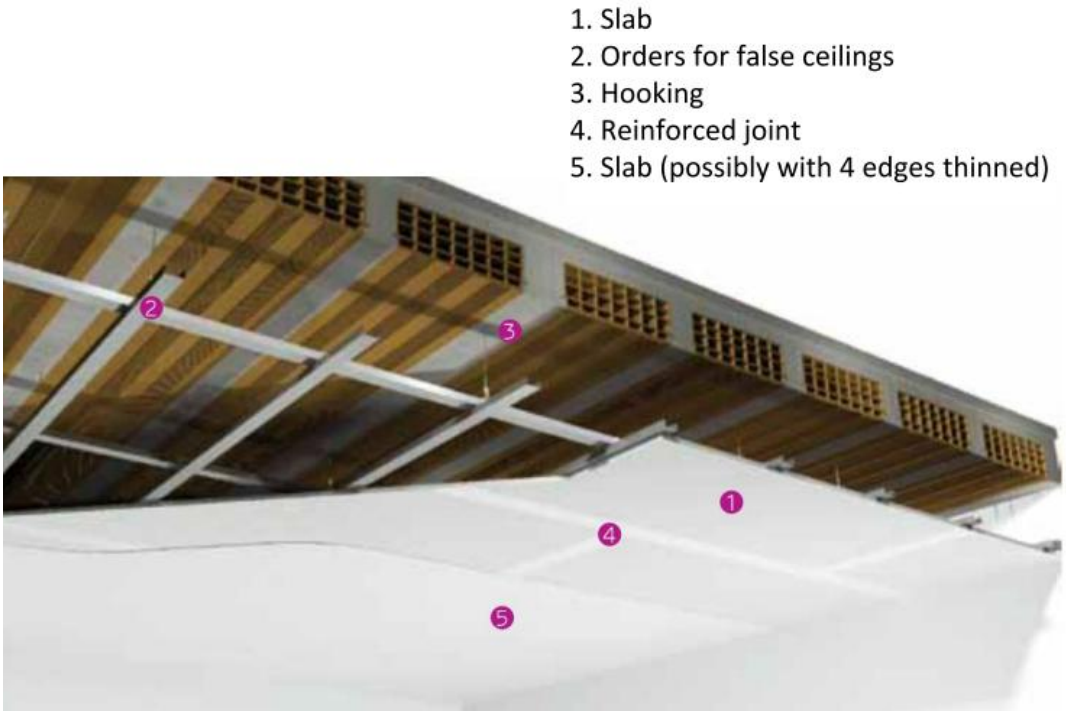


Fig. 3.23. Example of a suspended ceiling. “Manuale del Posatore” – Siniat –www.siniat.it

3.5. Techniques

3.5.1 The partition walls

THE PARTITION WALLS

The dry construction system refers to highly standardized materials that allow great variability in the design / assembly phase, such that the performance of the walls can be modulated according to the materials chosen. Self-supporting and non-load-bearing walls are made, with a high technological content and simple construction, provided that the details are taken care of both in the design and construction phase.

The walls are essentially composed of:

- Metal warping
- Coating in coated plasterboards

The walls thus created are also identified as "light walls", as the specific weight of a "dry" partition is 8 - 10 times lower than that of a masonry partition.

The wall cladding, as an alternative to the coated gypsum slabs, can be made with:

- Gypsum-fiber plates for a particular impact resistance;
- Fiber-reinforced concrete slabs for walls with extremely high impact and humidity resistance performance and also suitable for outdoor use.

The coated plaster slabs, in turn, differ as indicated in the previous pages for the different characteristics of resistance to moisture, fire, etc.

The metal frame is connected to the adjacent load-bearing elements and can be simple or double (the profiles in this case can be placed side by back or boxed, to increase the mechanical resistance of the wall and therefore the maximum height). The frames can also be arranged in double parallel series, adjacent or spaced apart, separated or connected with strips of adequately arranged and fixed slabs.

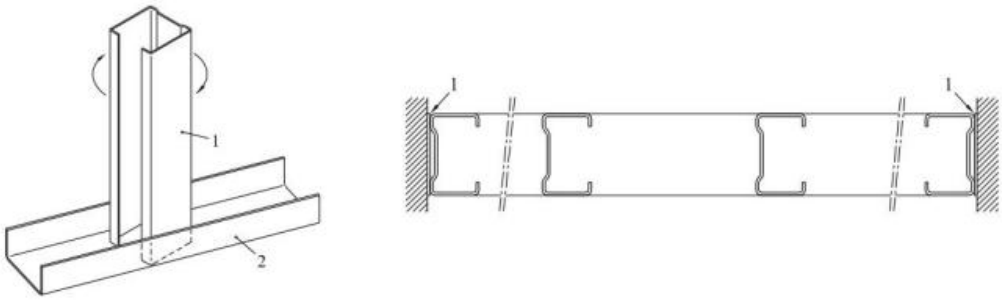


Fig. 24. Example of joining steel profiles at partition walls. Source: 'Manuale dei sistemi a secco ”- Gyproc - www.gyproc.it

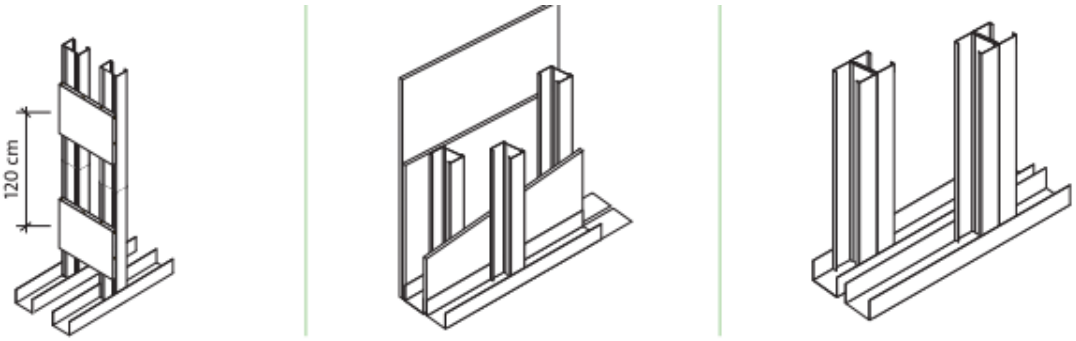


Fig. 3.25. Example of joining steel profiles at partition walls. Source: “Manuale dei sistemi a secco” – Gyproc - www.gyproc.it

The sheet coating can be made up of one, two or three layers per side. The type and number of the cladding slabs are chosen according to the performance of the wall in relation to the static, fire protection, acoustics and thermal insulation.

TRACKING AND INSTALLATION OF THE ORDER

The load-bearing structure of the wall consists of the metal frame: profiles in thin steel sheet (≥ 0.6mm) cold-formed and protected from corrosion by hot galvanizing, with zinc coating.

Profiles are of two types:

- U-shaped guides, to be placed on the floor and ceiling
- "C" uprights, to be inserted in the guides.

The construction of a coated plaster wall begins by tracing the position of the U-shaped guides on the floor. Once the final thickness of the wall has been determined, trace the position of the guide on the floor and then bring it back, with plumb line or laser, to the ceiling to position the upper guide.

Fig. 3.26. Example of running profiles and installations. Source: “Manuale Tecnico: Soluzioni per interni” – GYPSOTECH - www.fassabortolo.it

Also immediately report the position of openings, doors and sanitary fixtures in order to correctly position the uprights in the guides. Apply the single / double-sided tape of polyethylene foam insulating gasket to the guide core, to contain the lateral acoustic transmissions. Fasten the lower guide with fixings at a center distance of 50 cm.

Apply the upper guide to the ceiling, with fixings suitable for the support, placed at a maximum distance of 50 cm.

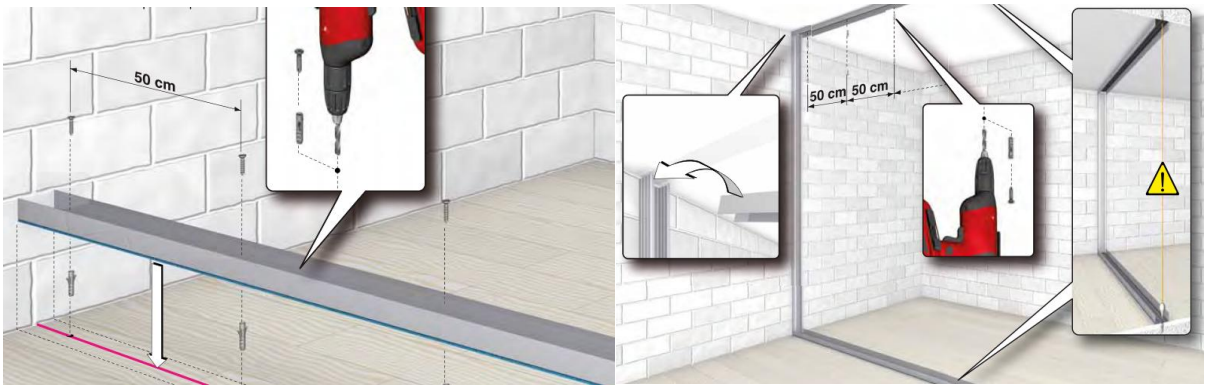


Fig. 3.27. Example of mounting steel profiles. Source: “Manuale Tecnico: Soluzioni per interni” – GYPSOTECH - www.fassabortolo.it

Once the U-shaped guides have been fixed, the positioning of the uprights is carried out. Cut the "C" upright profiles of the length equal to the distance between the guides, decreased by 15 mm to facilitate insertion into the guides. Slots for the passage of plant pipes are present on the core of the uprights. They always match with the lower part of the wall to facilitate cable passage.

If the wall is high and it is necessary to join the profiles, make an overlap. The jointed profiles must be joined with screws every 50/100 cm. The joints must be staggered. The wings of the "C" uprights have different height, to allow the insertion of one upright into the other to form a box profile, with high mechanical rigidity.

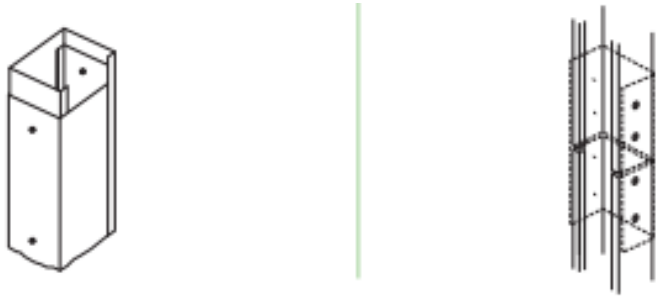


Fig. 3.28. Example of a solution used when connecting vertical profiles. Source: “Manuale dei sistemi a secco” – Gyproc - www.gyproc.it

Insert the "C" profiles with a 600/400/300 mm center distance according to the static and / or fire, acoustic or impact resistance standards. If ceramic tiles are to be glued, the center distance of the uprights must not exceed 400 mm.

Consider that the laying direction of the slabs must follow the direction of the "open" side of the profile, so that the upright is not subject to twisting when screwing the slabs. Check the verticality of the uprights. Punch the uprights to the guides.

Fig. 3.29. Example of mounting vertical supports - "C" profiles. Sorce: “Manuale Tecnico: Soluzioni per interni” – GYPSOTECH - www.fassabortolo.it

To create T-corners and intersections of walls, the "U" guides must be interrupted, leaving space also for the coating with the slabs, which must be continuous.

INSULATION MATERIAL IN THE SPACE BETWEEN BOARDS

After laying the metal frames, it is necessary to insert the plant nets and then also any insulating wool mattress between the uprights.

The gaps in the walls in coated plaster can be used to interpose different types of insulating material. Fibrous materials (such as glass wool and rock wool) of various thickness and density are normally used to increase the thermal and / or acoustic insulation performance of the partition.

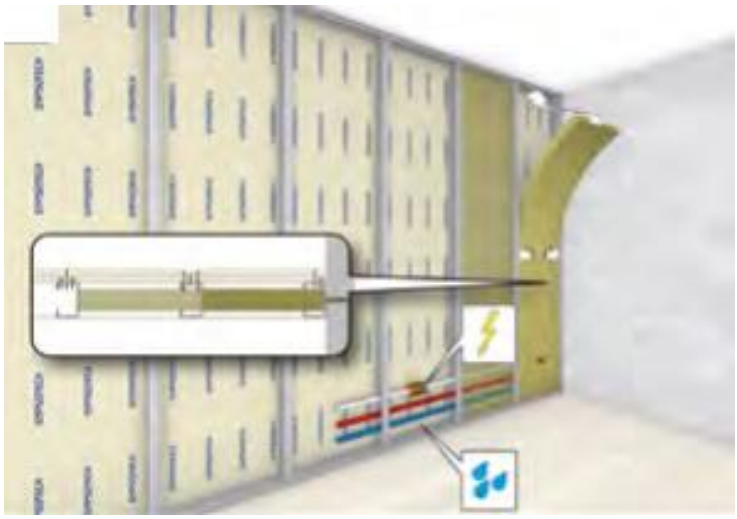


Fig. 3.30. Example of laying insulation inside a partition wall. Source: “Manuale Tecnico: Soluzioni per interni” GYPSOTECH - www.fassabortolo.it

Reference must always be made to the laboratory certifications and the Manufacturer's indications to correctly choose and size the insulating material to be affixed in the cavity if necessary.

COATING

Metal frames can be coated with one or more layers of slabs.

The simplest wall, with a single slab on each side, is suitable for rooms not susceptible to crowding and as a simple partition, with the function of separating rooms. It guarantees basic requirements for thermal and acoustic insulation and is universally equipped with plant networks and suspended loads (up to 40 kg / m). Any insertion of plant networks, insulation, supports, etc. must be completed before laying the closing plates of the wall.

The metal frames are coated with slabs measuring the height of the room, where possible, arranged vertically. The slabs are usually laid vertically: the most developed side is along the vertical.

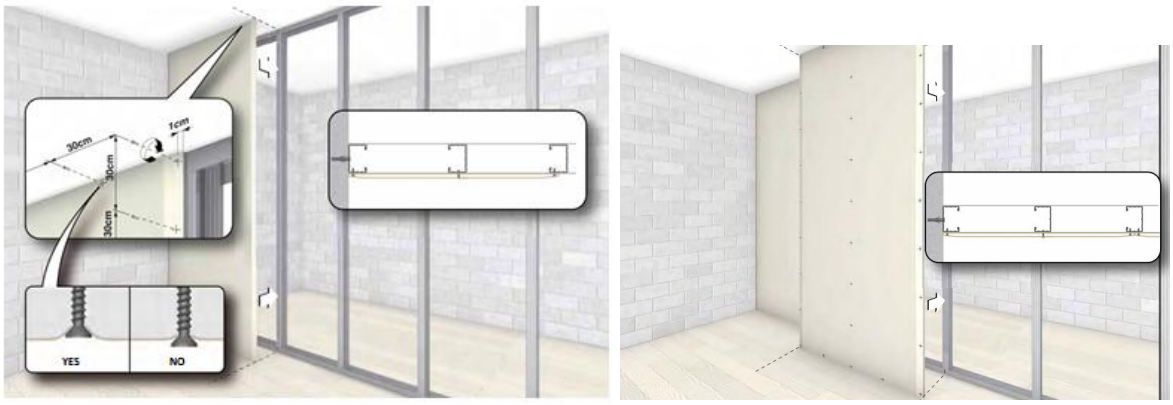


Fig. 3.31. Example of enclosing drywall steel profiles. Source: “Manuale Tecnico: Soluzioni per interni” – GYPSOTECH - www.fassabortolo.it

Keep the plates raised approx. 1 cm from the floor and place them on the ceiling. Use a mechanical window lifter or pedal plate lifter.

The joints between the slabs on the two sides of the walls must never coincide on the same uprights, that is, they must be staggered.

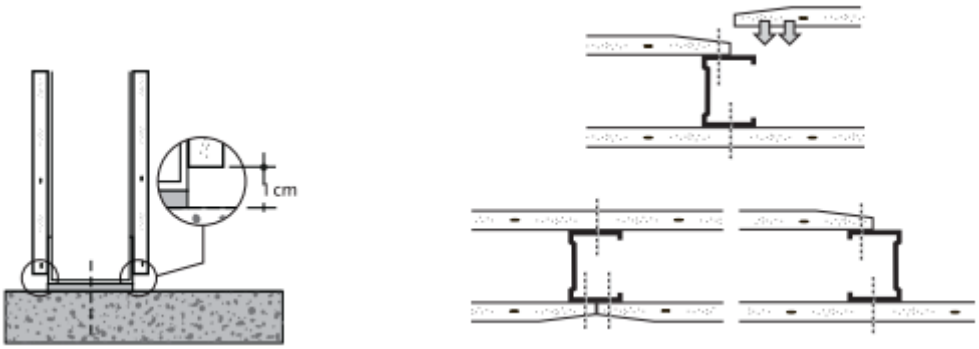


Fig. 3.32. Example of using joints between plates. Source: “Manuale dei sistemi a secco” – Gyproc - www.gyproc.it

Start screwing the slabs to the warping from top to bottom, taking care that the coating remains perfectly adherent to the load-bearing warping. The longitudinal edges of the slabs must be in the center of the wings of the uprights.

The length of the screws must be at least 1 cm greater than the thickness of the slabs.

Adjust the tip of the screwdriver so that the screws are at the right depth, with the head perfectly flush with the sheet coating. The screws should be placed approx. 1 cm from the longitudinal edge of the slab and approx. 1.5 cm from the leading edge

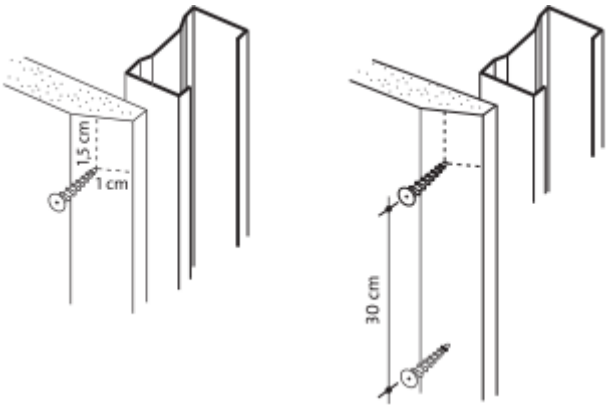


Fig. 3.33. Example of screwing plates to the construction grate. Source: “Manuale dei sistemi a secco” – Gyproc - www.gyproc.it

Crooked screws, or not flush with the plate, must be removed and replaced because they will lack the seal. The self-tapping screws phosphated from plasterboard have a countersunk head to allow correct penetration into the sheet where the screw does not break the cardboard, but keeps it as a continuous support base for the head. This allows for proper operation of the anchor.

Proceed with the covering of the warping always in the opening direction of the profile and first place the screws near the rib of the uprights, checking that the wings do not bend, to obtain the perfect flatness of the finished surface. In any case, respect the maximum screwing distances on the "U" guides and on the uprights.

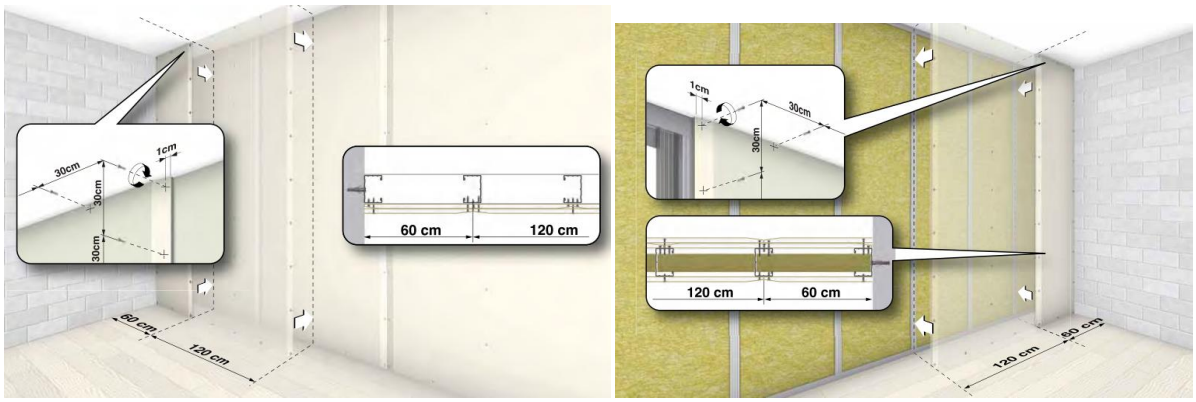


Fig. 3.34. Example of laying insulation inside a partition wall. Source: "Manuale Tecnico: Soluzioni per interni" – GYPSOTECH - www.fassabortolo.it

To obtain high performance of acoustic insulation, mechanical and impact resistance, fire resistance and thermal insulation, the metal frames are coated with two or more layers of slabs per side.

In the case of walls with a double coating layer, the slabs of the first layer can be screwed up to 60 cm between the screws. The second layer of slabs will have the joints offset from the first.

In the case of triple-layer walls (three slabs on each side), each layer must have the joints offset from the previous one.

Fig. 3.35. Example of the correct use of three-layer boards. Source: training manual - I sistemi a secco a base gesso - Assogesso

THE DOOR SPACE

To create openings on which doors can be installed, the profiles and slabs must be arranged as shown below:

To create the square joint at the foot of the opening, leave the guide 20 cm longer, then cut it, fold it at an angle and punch it to the upright. The floor guide must be fixed no more than 15 cm from the door post.

The cladding slabs must be mounted, with a "flag" joint, ie by staggering the slabs by not making the joints coincide with the line of the door compartment upright.

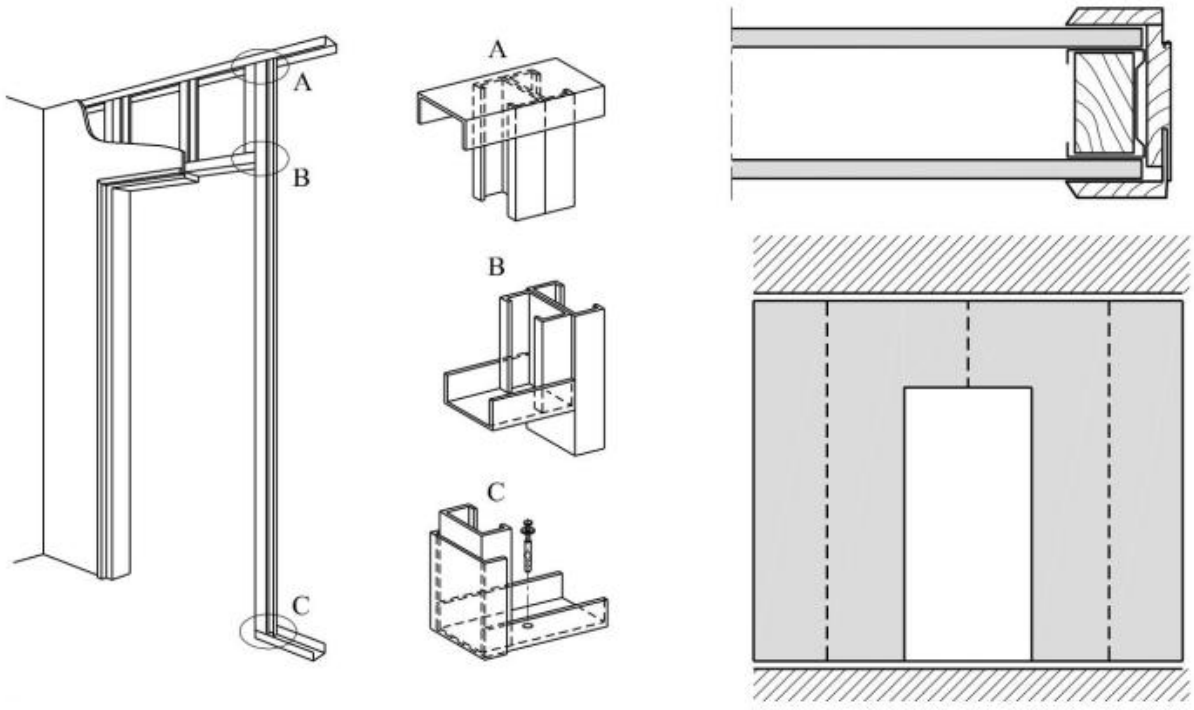


Fig. 3.36. Example of how to install the door correctly. Source: “Manuale dei sistemi a secco” – Gyproc - www.gyproc.it

3.5.2 The counterwalls

COUNTERWALLS

The Dry Construction System refers to highly standardized materials that allow great variability in the design and assembly phase, so as to be able to modulate the performance of the counter-walls according to the materials chosen.

It is possible to create a counter wall on any type of support as long as the correct laying technique and the appropriate slab have been identified.

The counter walls can be made simply by gluing a slab to the wall, or by first creating a suitable metal structure (self-supporting or constrained to the existing wall) and then fixing the slabs to the warping, perhaps interposing before the insulating material. Specific interventions can also be designed and implemented even with a high technological content and always simple to carry out, provided that the details are taken care of both in the design and construction phase.

Counter walls are divided into:

1. Glued counter-walls, which provide for the wall application of the slabs, also coupled with insulating materials, through the use of specific adhesives
2. Counter walls on a metal structure, which in turn are divided into:
   - metal frame counter walls connected to the partition behind
   - counter-walls with self-supporting metal framework.

3.5.2.1 Dry bonding / plaster counterwalls

DRY BONDING / PLASTER COUNTERWALLS

This application technology is recommended for small surfaces. The maximum height that can be reached is equal to one slab; slightly higher heights can be achieved by tessellating a wooden strip, using it as a screwing base for the upper slab. The gluing technique is foreseen and possible only for single plate coatings.

SUPPORT PREPARATION

The bonding of the slabs or of the pre-coupled panels with insulation can only be carried out on walls that are free of traces of dust, grease and free of humidity.

Therefore for very porous walls, e.g. exposed masonry and rough uncoated concrete, it will be advisable to wet the masonry surface or apply a coat of special insulating treatment with water dispersion resins, to prevent water from being removed from the adhesive plaster mortar before setting has started.

Smooth concrete walls, prefabricated products obtained with a metal formwork, must be treated with a special gripping base.

Plastered walls with hydraulic mortar without surface finishing treatment must be probed for the entire surface in order to identify cavities and any detached areas of the plaster; this will then have to be removed and restored. The surface will therefore be treated with an insulating primer.

Generally coated walls (deteriorated paint, wallpaper, tiles, etc ..) must be stripped of the coating at the gluing points, which must be guaranteed directly on the masonry, or of the entire coating.

APPLICATION OF ADHESIVE MORTAR

The gypsum-based adhesive mortar is applied differently depending on whether it is:

Flat substrate (e.g. concrete): apply the fine bed adhesive mortar to the edges of the slab with a notched trowel. Then apply an additional longitudinal adhesive strip in the center (in some cases even two).

Uneven substrate with deviations of up to 20 mm (e.g. masonry): run the bead of continuous adhesive along the edges of the slab and apply piles of adhesive mortar with a diameter of approximately 10/12 cm on the back of the slab or directly on the masonry . Check that the piles are placed at a distance of 40 cm in the transverse direction and 45 cm in the longitudinal direction.

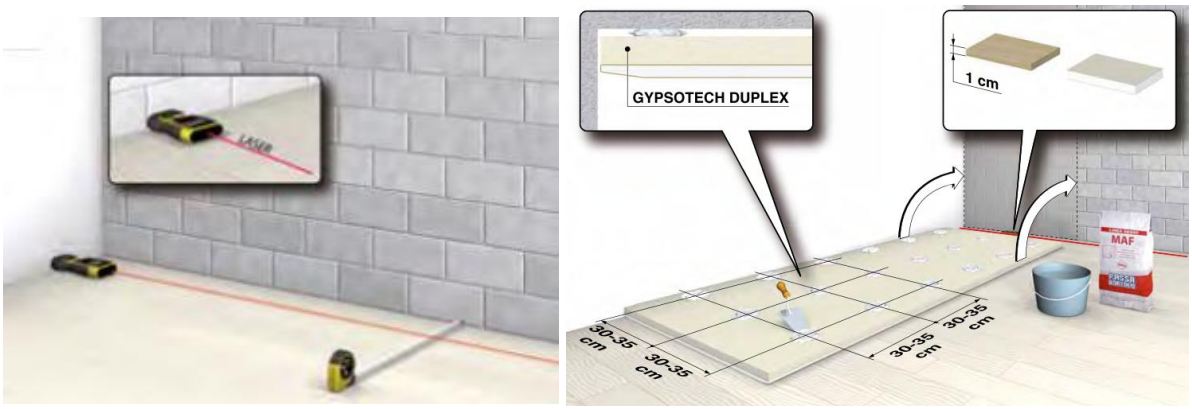


Fig. 3.37. Example of using glue mortar. Source: "Manuale Tecnico: Soluzioni per interni" – GYPSOTECH - www.fassabortolo.it

Substrate with strong roughness, with deviations greater than 20 mm (e.g. old walls): apply strips of 10 cm wide slabs to the substrate with the adhesive at the edge and center of the slab and glue the slab on these strips with mortar fine bed adhesive (as for the flat bottom).

LAYING THE COATING

Trace the finished wire of the external surface on the ground and ceiling and place 1 cm thick spacers against the wall.

Place the slabs against the wall, which must be struck with light strokes of the hand or with a metallic ruler so as to obtain perfect alignment with the tracks on the floor and ceiling.

Fig. 3.38. Example of laying a wall casing. Source: "Manuale Tecnico: Soluzioni per interni" – GYPSOTECH - www.fassabortolo.it

Carefully put the adjacent panels together to avoid the adhesive mortar from spilling out. Wait for the glue to set, then remove the thicknesses and procedures for grouting the joints.

In the case of pre-coupled panels with insulation, be careful to maintain the continuity of the insulation to cover the entire surface of the masonry (especially in the corners or intersections).

3.5.2.2 Metallic structure counterwalls

METALLIC STRUCTURE COUNTERWALLS

METALLIC STRUCTURE COUNTERWALLS WITH WALL CONNECTION.

The construction of a coated plaster counter wall begins by tracing the position of the U-shaped guides on the floor. Once the final thickness of the wall has been determined, trace the position of the guide on the floor and then bring it back, with plumb line or laser, to the ceiling to position the upper guide.

Apply the single / double-sided tape of polyethylene foam insulation gasket on the guide core, to contain the lateral acoustic transmissions. Fasten the lower guide with fixings at a center distance of 50 cm.

Fig. 3.39. Example of using caps with a metal substructure. Source: "Manuale Tecnico: Soluzioni per interni" – GYPSOTECH - www.fassabortolo.it

Apply the upper guide to the ceiling, with fixings suitable for the support, placed at a maximum distance of 50 cm.

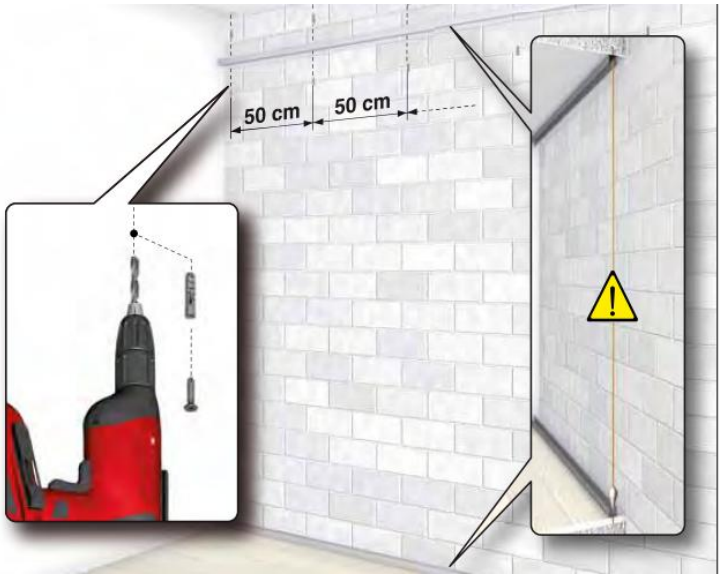


Fig. 3.40. The next stage of mounting the main guide profile.

Once the "U" guides are fixed, the adjustable hooks positioned vertically at a center distance of approximately 700-900 mm are positioned according to the profiles used.

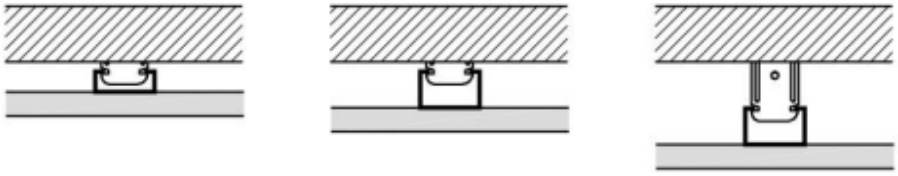


Fig. 3.41. Example of mounting the upper ceiling guide. Source: “Manuale dei sistemi a secco” – Gyproc - www.gyproc.it

We then proceed to insert the uprights at a 600 mm center distance unless the ceramic coating is provided where the center distance is reduced to 400 mm.

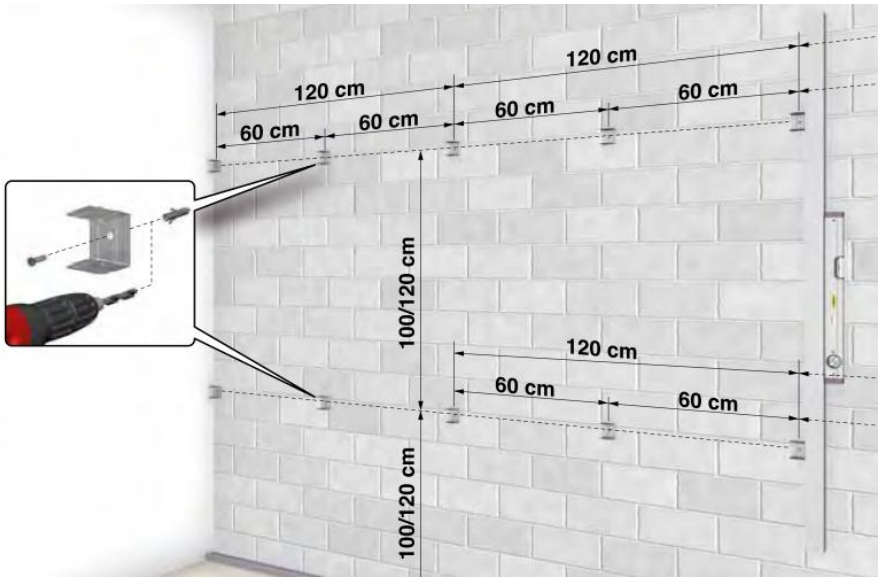


Fig. 3.42. Example of the arrangement of individual fasteners. Source: “Manuale Tecnico: Soluzioni per interni” – GYPSOTECH - www.fassabortolo.it

Cut the uprights of the length equal to the distance between the guides decreased by 15 mm to facilitate insertion into the guides. Insert the uprights inside the guides and fix them to the hooks.

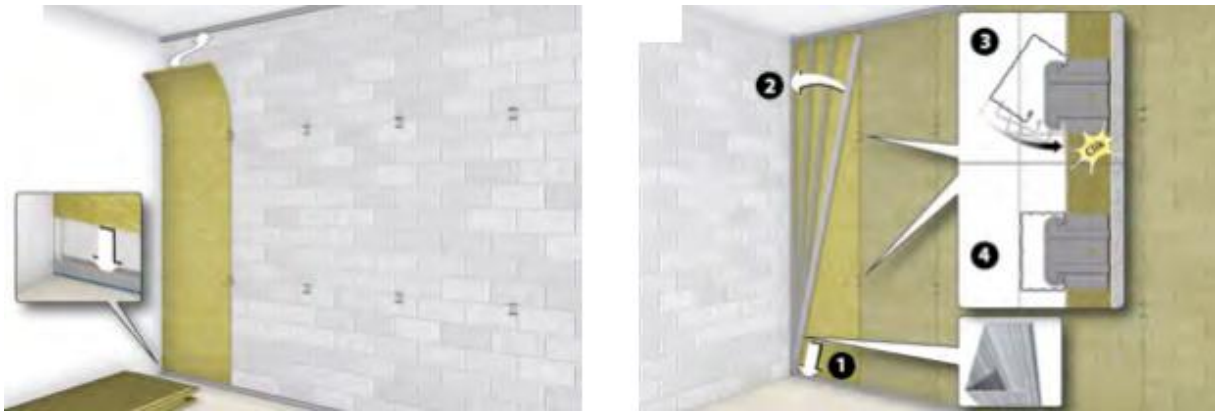


Fig. 3.43. Example of mounting vertical supports. Source: “Manuale Tecnico: Soluzioni per interni” – GYPSOTECH - www.fassabortolo.it

Adjust the distance of the uprights from the rear wall so as to allow the insertion of the insulating material in the interspace and facilitate the passage of the systems. Check the verticality of the uprights and screw them to the guides.

SELF-SUPPORTING METALLIC STRUCTURE WALLS

The construction of a plaster-lined counter-wall begins by tracing the position of the U-shaped guides on the floor.

Once the final thickness of the wall has been determined, trace the position of the guide on the floor and then bring it back, with plumb line or laser, to the ceiling to position the upper guide.

Immediately report the position of any sanitary ware in order to correctly position the uprights in the guides. Apply the single / double-sided tape of polyethylene foam insulating gasket to the guide core, to contain the lateral acoustic transmissions. Fasten the lower guide with fixings at a center distance of 50 cm.

Fig. 3.44. Example of using self-supporting shells with a steel substructure. Source: “Manuale Tecnico: Soluzioni per interni” – GYPSOTECH - www.fassabortolo.it

Apply the upper guide to the ceiling, with fixings suitable for the support, placed at a maximum distance of 50 cm.

Once the U-shaped guides have been fixed, the positioning of the uprights is carried out. Cut the "C" upright profiles of the length equal to the distance between the guides, decreased by 15 mm to facilitate insertion into the guides.

Insert the "C" profiles with a 600/400/300 mm center distance according to the static and / or parameters

of fire, acoustic or impact resistance certification. If ceramic tiles are to be glued, the center distance of the uprights must not exceed 400 mm.

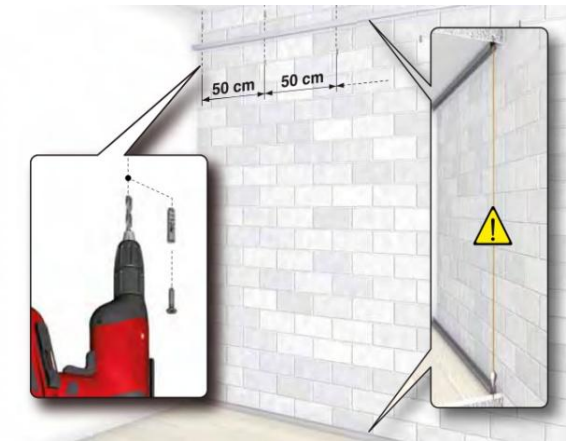


Fig. 3.45. Example of mounting the upper ceiling guide. Source: “Manuale Tecnico: Soluzioni per interni” – GYPSOTECH - www.fassabortolo.it

Consider that the laying direction of the slabs must follow the direction of the "open" side of the profile, so that the upright is not subject to twisting when screwing the slabs. Check the verticality of the uprights. Punch the uprights to the guides.

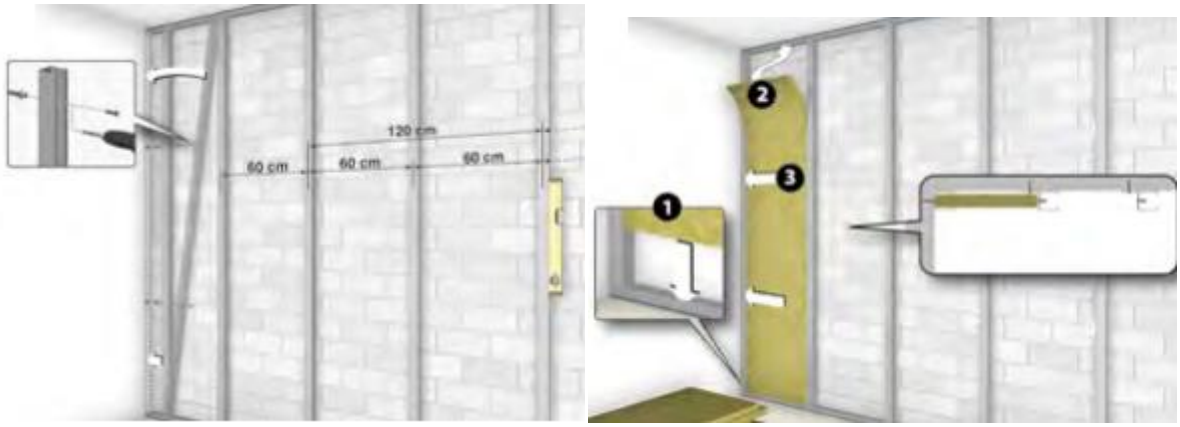


Fig. 3.46. Example of how to place the panels correctly - installation direction. Source: “Manuale Tecnico: Soluzioni per interni” – GYPSOTECH - www.fassabortolo.it

INSULATION MATERIAL IN THE SPACES BETWEEN BOARDS

After laying the metal frames, it is necessary to insert the plant nets and then also any insulating wool mattress between the uprights.

The gaps in the walls in coated plaster can be used to interpose different types of insulating material. Fibrous materials (such as glass wool and rock wool) of various thickness and density are normally used to increase the thermal and / or acoustic insulation performance of the partition.

COATING

Metal frames can be coated with one or more layers of slabs.

The metal frames are covered with plates measuring the height of the room minus 1 cm, arranged vertically: the most developed side is along the vertical.

Keep the plates raised approx. 1 cm from the floor and place them on the ceiling. Use a mechanical window lifter or pedal plate lifter.

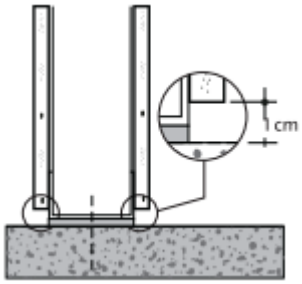


Fig. 3.47. Example of mounting the board between the floor and ceiling. Source: “Manuale dei sistemi a secco” – Gyproc - www.gyproc.it

Start screwing the slabs to the warping from top to bottom, taking care that the coating remains perfectly adherent to the load-bearing warping. The longitudinal edges of the slabs must be in the center of the wings of the uprights.

The length of the screws must be at least 1 cm greater than the thickness of the slabs. Adjust the tip of the screwdriver so that the screws are at the right depth, with the head perfectly flush with the coating of the slab. The screws should be placed approx. 1 cm from the longitudinal edge of the slab and approx. 1.5 cm from the leading edge

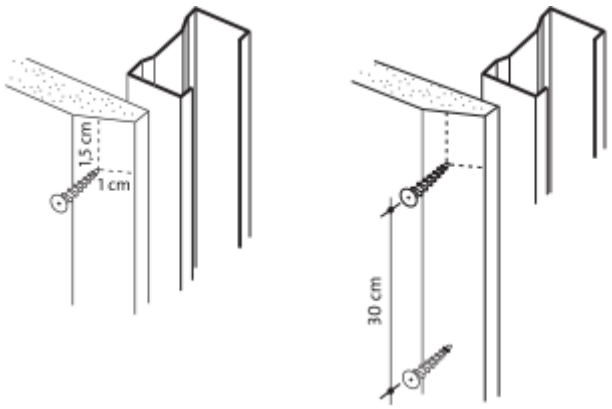


Fig. 3.48. Example of mounting panels to a steel grate. Source: “Manuale dei sistemi a secco” – Gyproc - www.gyproc.it

Crooked screws, or not flush with the plate, must be removed and replaced because they will lack the seal. The self-tapping screws phosphated from plasterboard have a countersunk head to allow correct penetration into the sheet where the screw does not break the cardboard, but keeps it as a continuous support base for the head. This allows for proper operation of the anchor.

Proceed with the covering of the warping always in the opening direction of the profile and first place the screws near the rib of the uprights, checking that the wings do not bend, to obtain the perfect flatness of the finished surface. In any case, respect the maximum screwing distances on the "U" guides and on the uprights.

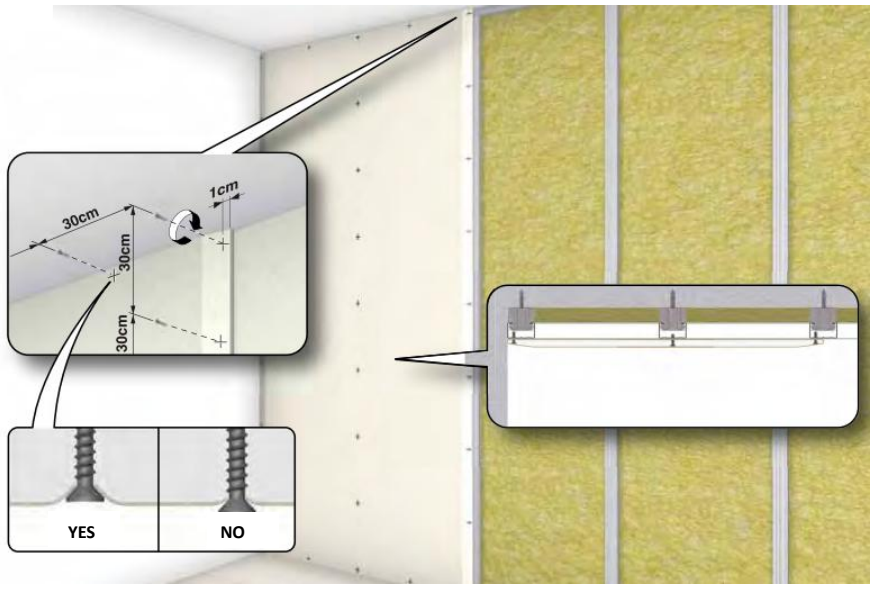


Fig. 3.49. Example of enclosing a steel grate. Source: “Manuale Tecnico: Soluzioni per interni” - GYPSOTECH - www.fassabortolo.it

To obtain high performance of acoustic insulation, mechanical and impact resistance, fire resistance and thermal insulation, the metal frames are coated with two or more layers of slabs per side.

In the case of walls with a double coating layer, the slabs of the first layer can be screwed up to 60 cm between the screws. The second layer of slabs will have the joints offset from the first.

Fig. 3.50. Example of the correct use of three-layer boards. Source: training manual - I sistemi a secco a base gesso - Assogesso

TIPS

Counter walls on external walls

Counter walls are often used to improve the thermal insulation of a building and sometimes the choice is made to create the counter wall by applying pre-coupled slabs with insulation to the existing masonry. It is always good to remember that this application is to be done by gluing the slabs with the systems described in the manual. The use of mechanical fasteners does not give a guarantee against the oxidation of the head of the fixing screws over time, as these metallic elements create small thermal bridges on which condensation can form and, consequently, over time, oxidation.

Which system for which use?

For every problem (acoustic insulation, thermal insulation or other) there is a suitable answer. Before choosing the counter wall system, it is necessary to dwell on the requirements to which the work will have to respond, then consult technical experts, to choose together the system that will give the best performance and therefore the greatest satisfaction of the result.

3.5.3 The false ceilings

The Dry Construction System refers to highly standardized materials that allow great variability in the design and assembly phase, so as to be able to modulate the performance of the false ceilings according to the materials chosen. It is possible to create a false ceiling on any type of support as long as the correct laying technique and the appropriate slab have been identified.

False ceilings can be made simply by first creating an adequate metal structure (sloping to the existing or self-supporting slab) and then fixing the slabs to the warping, perhaps by first inserting the insulating material into the interspace.

Therefore, specific interventions can also be designed and implemented with a high technological content and always of simple realization, provided that the details are taken care of both in the design and construction phase.

Suspended ceilings are divided into:

1. Suspended suspended ceilings on the slab above

   This system first of all determines the weight of the ceiling (structure, covering, insulating materials and any hanging elements), the choice of the suspension system, the definition of the suspension distances and the interaxis of the support frame, both according to the weight. Normally, 12.5 mm and 15 mm coated plaster slabs are used, fixed with screws on the pendulous metal frame.

2. Suspended ceiling with self-supporting metal frame
   Depending on the specific needs, horizontal compartments can be created, without the need to make a slab: the typical case occurs in rooms to be closed or compartmented, for example offices in an industrial warehouse, where it is not possible to reach the walls up to the coverage (room in room). This system creates a self-supporting and non-load-bearing structure.

METAL STRUCTURE TRACKING

Metal profiles are of two types:

- "U" guides to be positioned on the wall.
- “C” uprights to be inserted in the guides and suspended from the above slab with hooks, spacers, hangers and slotted bars whose pitch depends on the calculated load class.

It is necessary to verify that the slab, to which the false ceiling will be applied, is able to bear the new applied load, fixed by means of point suspensions.

In case of adherent false ceilings use a simple hook. To distance the false ceiling from the slab, instead use a spaced hook compatible with the "C" profiles or a universal spacer that allow to create cavities. For important lowering of the false ceiling, a hanger with spring hook can be used as a suspension element.

Fig. 3.51. Examples of mounting hooks used when installing steel profiles. Source: “Manuale Tecnico: Soluzioni per interni” – GYPSOTECH - www.fassabortolo.it

The construction of a coated plaster ceiling begins by tracing the position of the U-shaped guides on the wall. Once the false ceiling has been lowered, trace the position of the guide on the first wall and then return it with the laser to the remaining walls. The laser bubble allows to minimize the errors that are reported by going from wall to wall while using the bubble to ensure the planarity of the tracing.

For the correct positioning of the hooks for the suspension of the warping, consider that the distance of the first suspension point from the wall must be approximately 1/3 of the distance between the suspensions.

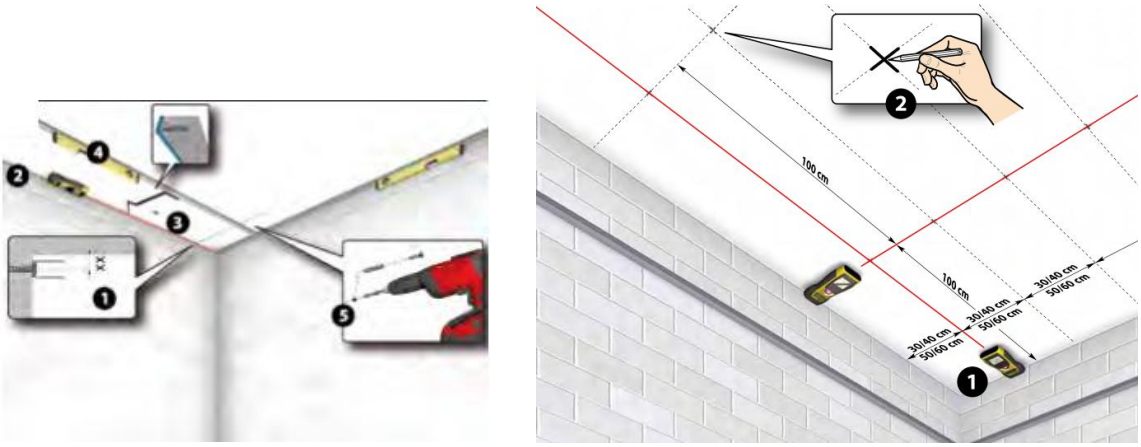


Fig. 3.52. Example of the correct hook configuration. Source: “Manuale Tecnico: Soluzioni per interni” – GYPSOTECH - www.fassabortolo.it

Apply the single-sided tape of insulating polyethylene foam gasket to the guide core, to contain the lateral acoustic transmissions. If a universal spacer is used, it is advisable to insert the single-sided tape between the masonry and the hook as an acoustic cut. Lock the perimeter guides with fixings with a maximum center to center distance of 50 cm.

INSTALLATION OF THE METALLIC ORDER

Once the "U" rails are fixed, the positioning of the adjustable hooks located at the center distance dictated by the load class of the false ceiling and the insertion of the "C" profiles inside the "U" rails are carried out.

Laying the single metal framework

The simple metal frame is recommended for small lowerings of false ceilings.

Cut the "C" uprights of the length equal to the distance between the guides reduced by 15 mm to facilitate insertion into the guides. When the length dimension of the profiles does not allow to continuously exceed the distance between the opposite walls, it is necessary to proceed with a connection joint. The latter must be carried out using the appropriate linear joint and respecting the following rules: the joint must be positioned so as to be staggered between one profile and the other and the joint must have a mechanical strength at least equivalent to that of the profile. Insert the uprights inside the guides and tie them to the suspension system adopted.

False ceilings in adherence:

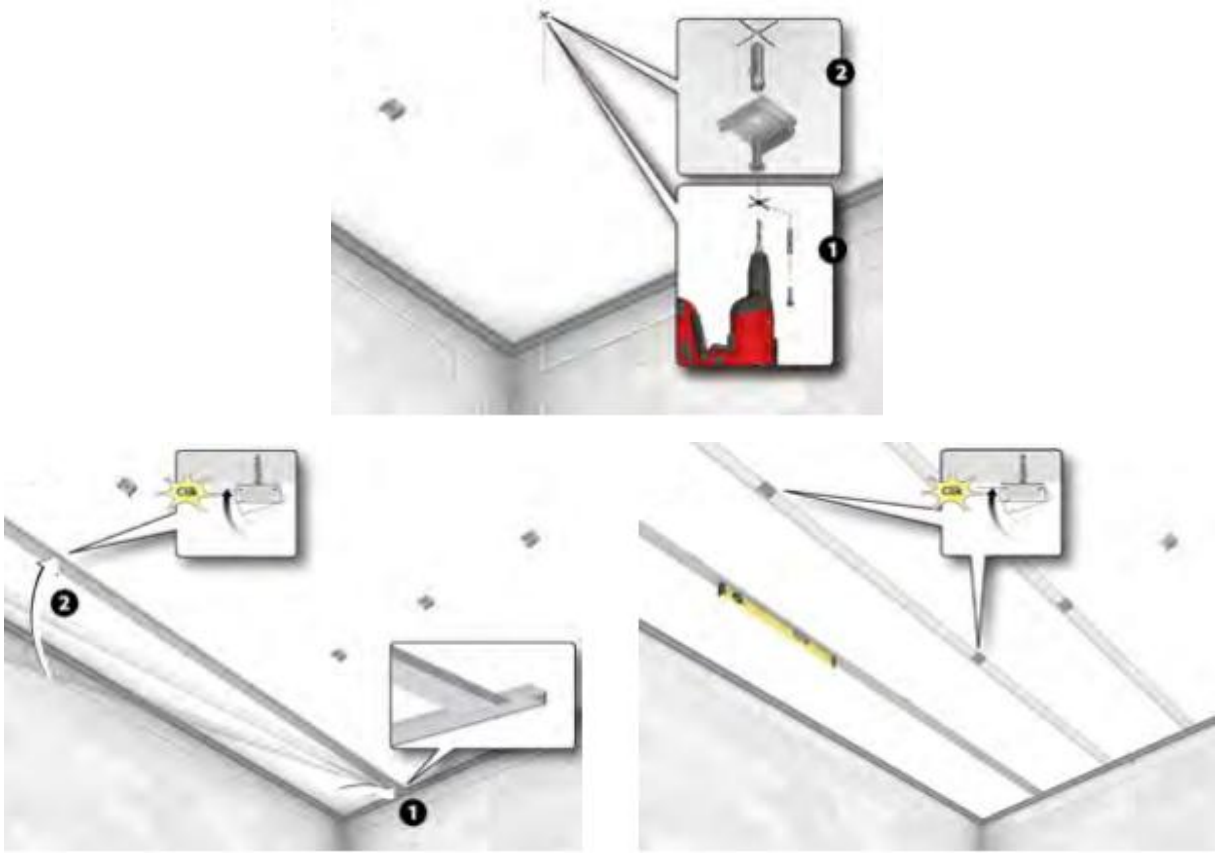


Fig. 3.53. Example of adjacent suspended ceilings. Source: “Manuale Tecnico: Soluzioni per interni” – GYPSOTECH - www.fassabortolo.it

The warping must be performed slightly concave upwards in the center of the room. Check the flatness using a 2.00 m rule (the irregularities must be less than 5 mm) and the horizontality of the metal frame (the level difference with respect to the reference plane must be less than 3 mm / m).

Low ceilings:

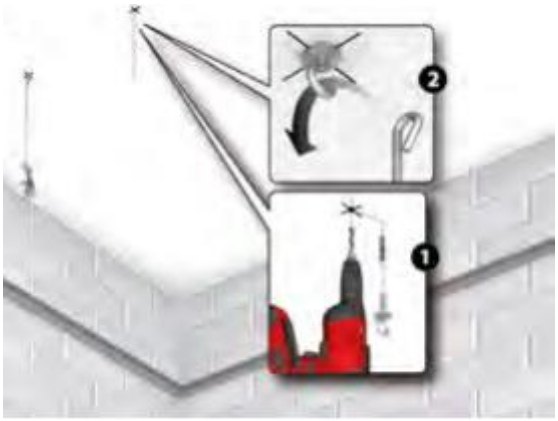


Fig. 3.54. Example of low suspended ceilings. Part A.

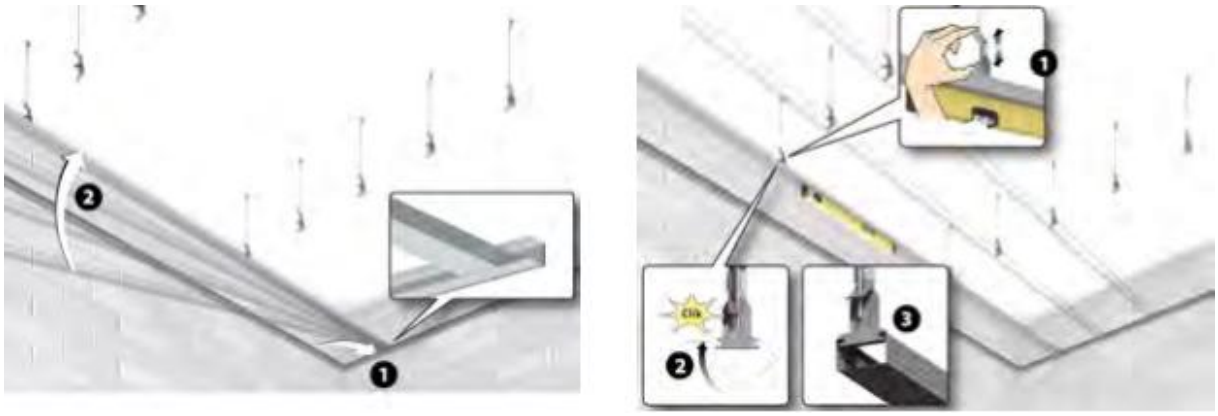


Fig. 3.54. Example of low suspended ceilings. Part B. Source: “Manuale Tecnico: Soluzioni per interni” – GYPSOTECH - www.fassabortolo.it

Laying the double overlapping metal frame

The double warping consists of a primary and a secondary warping, joined to the first with suitable orthogonal union hooks.

The pitch of the suspensions and the center distances of the primary and secondary warping are determined according to the expected load.

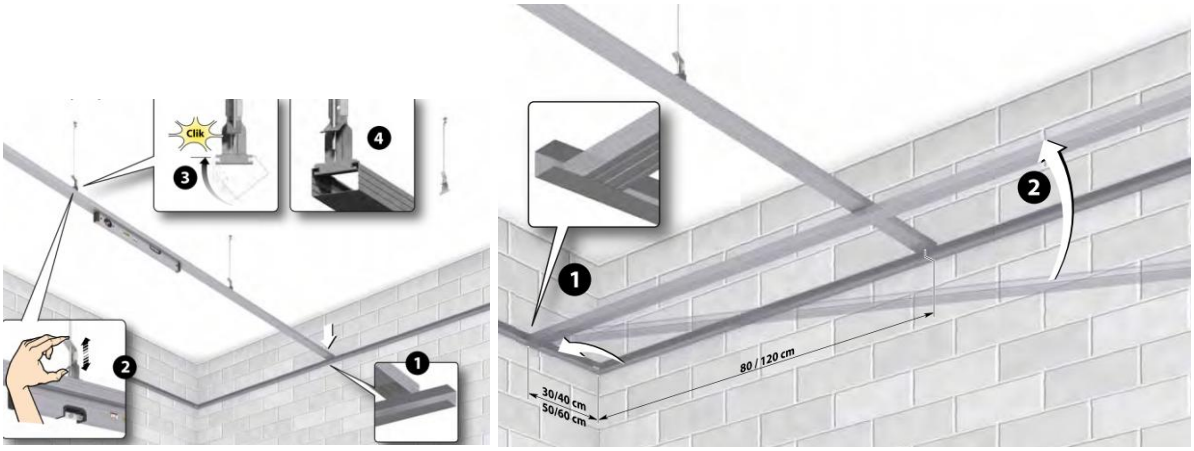


Fig. 3.55. Installation example for low suspended ceilings.

Cut the "C" uprights of the primary and secondary structure of the length equal to the distance between the guides decreased by 15 mm to facilitate insertion into the guides. When the length dimension of the profiles does not allow to continuously exceed the distance between the opposite walls, it is necessary to proceed with a connection joint.

Place the primary "C" profiles on the perimeter and tie them to the suspension system adopted. Adjust the distance of the hangers / slotted bars from the overlying slab so as to allow the insertion of the insulating material in the interspace and facilitate the passage of the systems.

Fig. 3.56. Installation example for low suspended ceilings. Source: “Manuale Tecnico: Soluzioni per interni” – GYPSOTECH - www.fassabortolo.it

Insert the secondary profiles in the perimeter guides and secure them to the primary using the orthogonal union hooks.

The warping must be performed slightly concave upwards in the center of the room. Check the flatness using a 2.00 m straight edge and the horizontality of the metal frame.

INSULATION MATERIAL IN THE SPACE BETWEEN BOARDS

After the laying of the metal frames, it is necessary to insert the plant nets and subsequently also the possible insulating wool panel above the uprights.

The gaps in the coated plaster ceilings can be used to interpose different types of insulating material. Fibrous materials (such as glass wool and rock wool) of various thickness and density are normally used to increase the thermal and / or acoustic insulation performance of the partition.

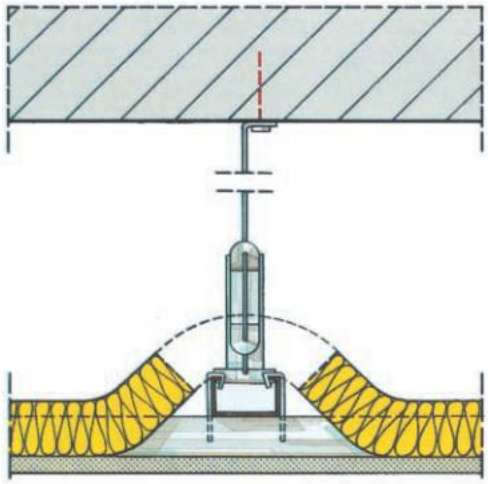


Fig . 3.57. Example of an insulating material for a ceiling space. Source: “Manuale dei sistemi a secco” – Gyproc - www.gyproc.it

THE COVERING

The laying of the slabs must preferably be carried out perpendicularly (B) with respect to the warping to which they are fixed, but parallel laying (A) to the warping itself is also allowed.

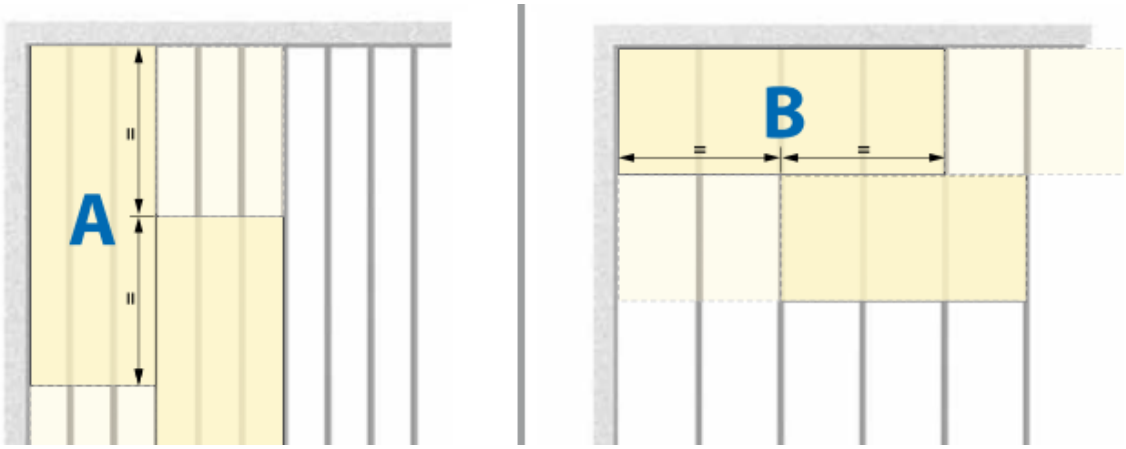


Fig. 3.58. Example of laying housing plates. Source: “Manuale Tecnico: Soluzioni per interni” – GYPSOTECH - www.fassabortolo.it

The butt joints of the slabs must be staggered by at least 400 mm and must correspond to a frame profile. The slabs must be fixed starting from the center or from one edge of the slab, to avoid compression deformations. It is necessary to forcefully force the slabs onto the structure during screwing.

The screws must be placed every 200 mm.

In the case of a coating consisting of several layers, it is necessary to offset the joints in the two directions. For the first layer, the center distance of the fixing points can be increased up to two times: the subsequent layers must be applied within a short time (approximately one day).

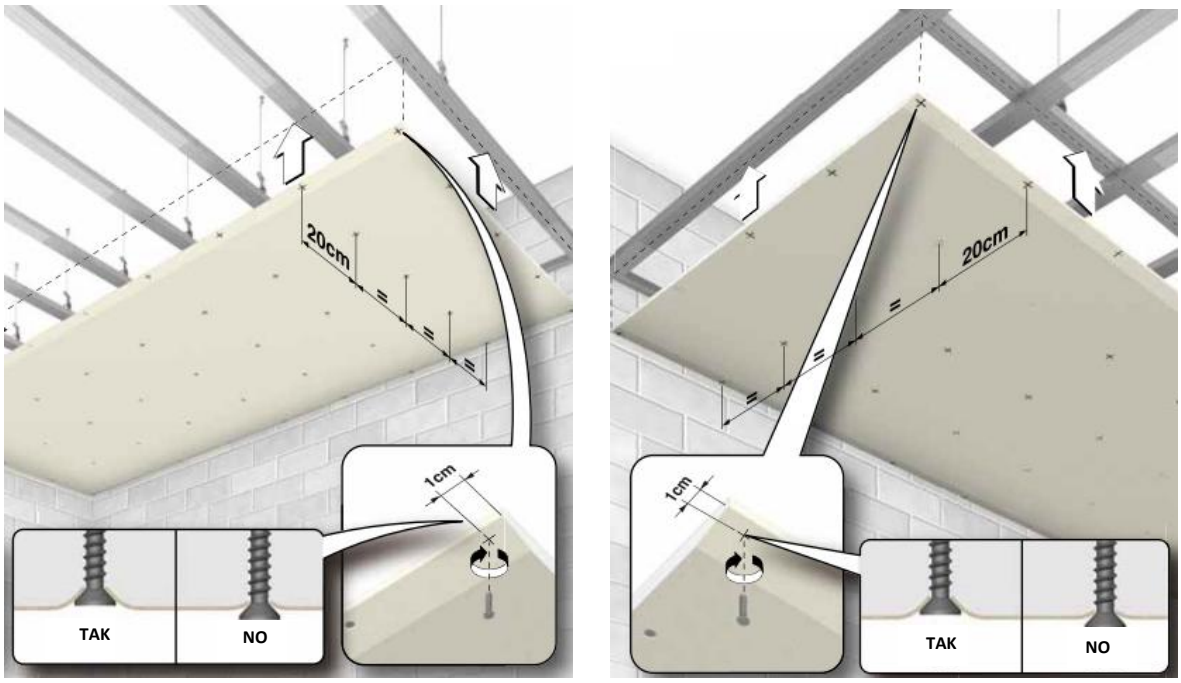


Fig. 3.59. Example of mounting the ceiling casing. Source: "Manuale Tecnico: Soluzioni per interni" – GYPSOTECH - www.fassabortolo.it

The slabs will be worked on site and positioned at height. The use of the mechanical window lift allows you to lift the plate, position it, crush it to the metal frame and screw it comfortably.

Adjust the tip of the screwdriver so that the screws are at the right depth, with the head perfectly flush with the sheet coating. The screws must be placed approximately 10 mm from the longitudinal edge of the slab and approximately 15 mm from the leading edge.

Crooked screws, or not flush with the plate, must be removed and replaced because they will lack the seal. The self-tapping screws phosphated from plasterboard have a countersunk head to allow correct penetration into the sheet where the screw does not break the cardboard, but contains it as a base for supporting the head. This allows for proper operation of the anchor.

EXPANSION JOINTS

The expansion joint, capable of allowing differential movements, must be made in correspondence with the expansion joints of the bearing structure of the building and in the case of large dimensions, the work must be interrupted every 12 m of ceiling development.

Fig. 3.60. Examples of drywall expansion joints. Source: "Manuale dei sistemi a secco" – Gyproc - www.gyproc.it

3.5.4 Grouting the joints

GROUTING THE JOINTS

In the realization of systems in coated gypsum slabs (walls, counter walls, false ceilings), the grouting of the joints and the treatment of the surfaces represent one of the processing phases that most characterize the quality of the final product.

The finish is always preceded by the correction of surface imperfections and by the grouting of the joints between the slabs and the heads of the screws.

With a good grouting, surfaces with a high degree of finish are obtained, suitable for receiving valuable paintings and decorations. In grouting there are certainly basic rules to follow, but it is above all in the sensitivity and manual skill of the operator that you can condense safe quality in a final gesture.

The treatment of the joints gives mechanical and aesthetic continuity to the sheet product.
Each grouting operation must always ensure:

- Sealing of the joint, designed to ensure continuity of acoustic insulation and fire resistance performance.
- Mechanical resistance of the joint (tensile and shear)
- Aesthetic quality
- Durability

Basic processes:

- preparation of the surfaces to be grouted
- filling and finishing of the joints between the slabs
- corner treatment
- treatment of the perimeter joints

Complementary processes:

- treatment of sliding joints
- edge protection
- preparation of the surface for painting
- complete smoothing for perfectly smooth surfaces.

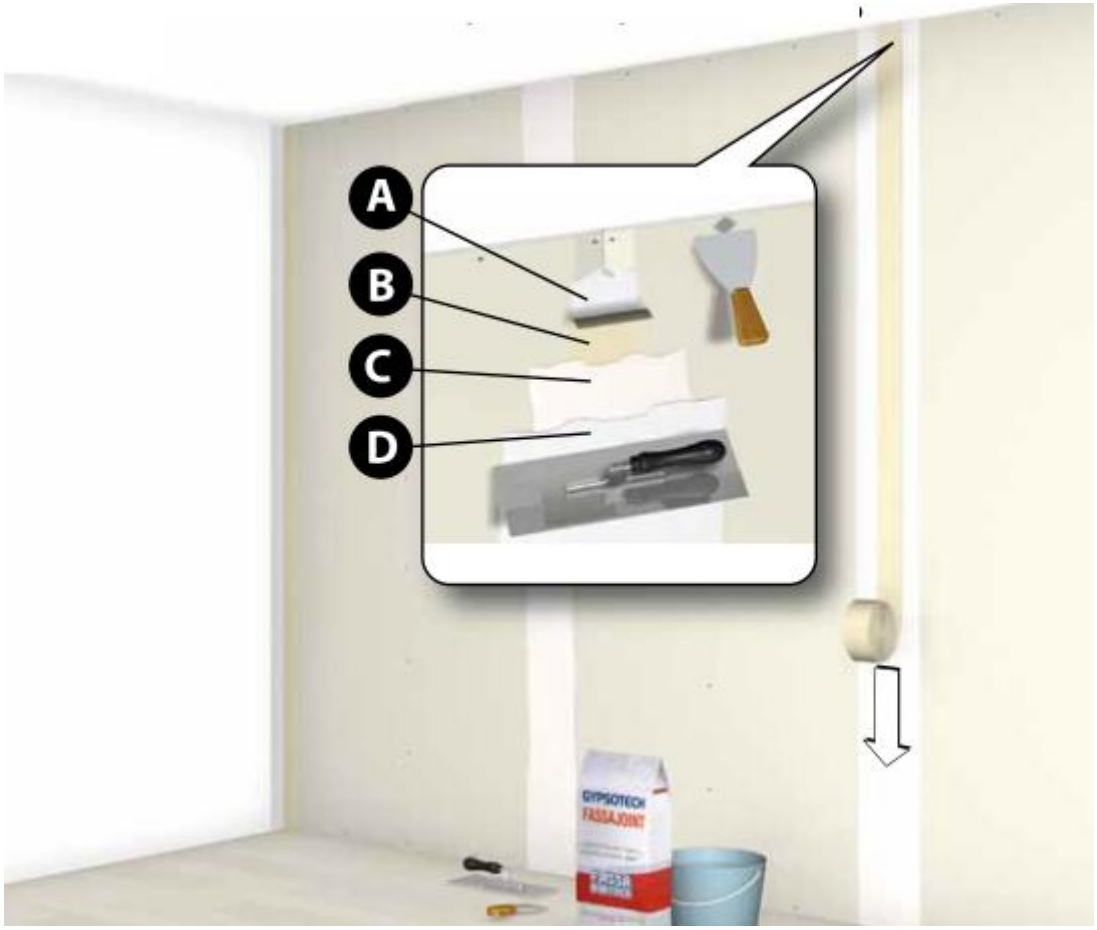


Fig. 3.61. Example of making grouting plate joints. Source: “Manuale Tecnico: Soluzioni per interni” – GYPSOTECH - www.fassabortolo.it

THE CHOICE OF STUCCO

- Grouting coat / Type of processing

Drying fillers are used for the complete grouting and finishing of the joint, or as a finishing coat on joints grouted with setting grouts.

Setting grouts must not be used as a finishing coat on joints grouted with drying grouts. Repair operations on coated plaster slabs, such as grouting cracks, dowel holes, leveling roughness, can be carried out with special "setting" grouts, with a high degree of adhesion and stability over time.

- Type and edge of the slab

Coated plaster slabs can be grouted with both "setting" and "drying" grouts. Special slabs, require the use of appropriate putties. Reference is made to the specific technical data sheets of the manufacturer.

- Humid environments

In environments with high humidity limited in time (bathrooms, kitchens, toilets), it is necessary to foresee not only the laying of special H-coated plaster plates resistant to humidity, but also a grouting of the joints carried out with grouts fast "and highly resistant to environmental humidity, for H sheets

- Quality of the finish

Appropriate use of putties and expert hand create an excellent level of quality with all types of putty. However, for special aesthetic finishing needs (e.g. smoothing of curved walls or ceilings), paste-drying putties, ready for use, generally very fine, are recommended.

THE PREPARATION OF THE FILLERS

Before starting the preparation it is essential to know the manufacturer's prescriptions and the methods of use that are reported in the product sheets, in order to obtain the best results and the most convenient yield.

"Drying" fillers are prepared with the mixer (mechanical mixing).

"Setting" fillers are prepared with a plaster spatula or trowel (manual mixing).

REINFORCEMENT TAPE

The joint reinforcement tape gives adequate mechanical resistance to the grouting, absorbing the tensions that occur on the joint due to micro-movements of the substrate, impacts and induced mechanical stresses, or for hygrothermal stresses.

To reinforce the joint between the slabs we use:

- The micro-perforated paper tape: made up of a special cellulose fiber strip 50mm wide with a rough face (to be placed on the slab) and a smoother one. It represents the traditional method for grouting and offers total reliability over time, giving the joint a mechanical resistance superior to any other grouting technique.
- The self-adhesive mesh tape: it is certainly the fastest and easiest way to reinforce the joints. Consisting of a narrow orthogonal mineral fiber mesh with an adhesive face that allows it to adhere directly to the cardboard surface of the sheets, it avoids the base coat required for fixing the paper tape. This tape slightly reduces the execution time of the joint, but offers a lower mechanical resistance than the joint with paper grouting.
- The fiberglass tape: used on the joints of special plaster slabs coated with non-woven fiberglass fabric (with high fire resistance), it can also sometimes be used on the plaster slabs coated with cardboard.

GROUTING METHOD

Check the absence of holes and surface alterations along the edges of the slabs and repair if necessary with the same grout used for grouting; wait until the grout has set (about 1h) before proceeding with the grouting.

The grouting takes place in three coats: a first filling coat (which in the grouting with the paper is preceded by a light coat to attach the tape) and two successive coats of finishing and smoothing of the joint.

- Laying the micro-perforated tape: distribute an abundant and homogeneous layer of stucco along the edge of the slabs until reaching the level of the slab surface. The grout must be prepared in order to have adequate fluidity and smoothness to lay the paper tape. Then spread the micro-perforated reinforcement tape with the rough side facing the slab, centered in the middle of the joint; exert adequate pressure with the spatula to remove excess grout under and on the sides of the tape, taking care to avoid the formation of air bubbles.
- Installation of the self-adhesive net: make the adhesive net centered on the joint between the slabs adhere perfectly. Distribute the stucco of the first coat along the edge until it reaches the level of the surface of the slab, so as to make the stucco penetrate well between the meshes of the adhesive net and in the joint.

Before proceeding to the second and third coat it is advisable to make sure that the previous layer has set and is completely dry, so that any shrinkage phenomenon has ended.

After drying, check that there are no imperfections or micro-irregularities along the grouted joint; for this purpose drag the spatula across the joint, placed transversely to the axis, and remove any rough edges with the same spatula or with a special pad with fine-grained sandpaper.

Then apply the second coat of stucco which will extend for a width of about 30 cm, necessary to bring the stuccoed surface to the same level as the cardboard surface.

Wait again for the complete drying before proceeding with the sanding if necessary and then with the third finishing coat which will be wide and very thin.

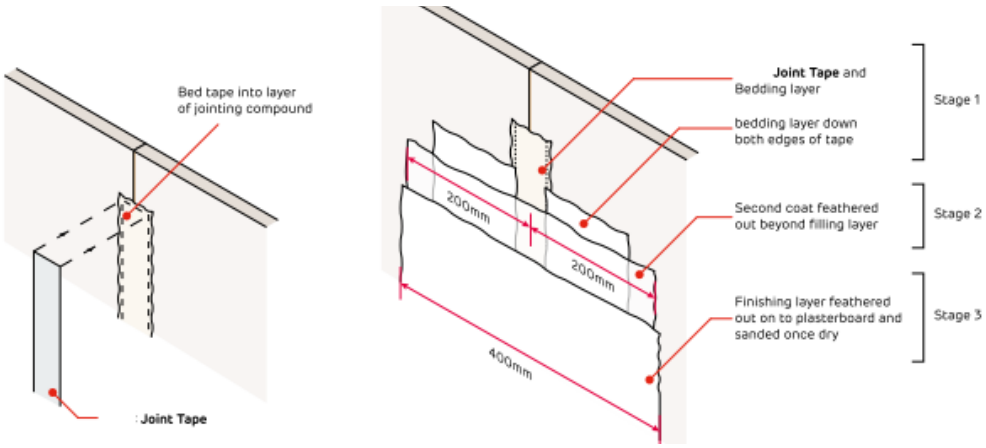


Fig. 3.63. Example of using connecting tapes - flat surfaces. Source: “Manuale del Posatore” – Siniat – www.siniat.it

The grouting of the screw heads is carried out simultaneously with the grouting of the joints between the slabs, after replacing the incorrectly positioned screws, by applying at least two coats of grout on each screw, pressing with the spatula to level the grout to the surface of the slab. Wait for the grout to dry between one coat and the other.

Metal corner guards and reinforcement tapes

Corner reinforcements are normally of three types:

- rigid edge protector in galvanized steel, for 90 ° angles
- aluminum tape / galvanized steel sheets on a micro-perforated tape background, for all edges

- silicone tape on micro-perforated bottom, for all edges

The greater resistance of the rigid corner protector and the excellent final quality mean, on the other hand, a wider compensation grouting band to keep the opening at 90 °.

Check the correct installation of the slabs at 90 ° and eventually restore the corner by filling the grout. Apply the rigid galvanized steel corner protector on the stucco bed, suitably drilled for drowning in the stucco. Cover with putty and then finish.

To apply the armed band, distribute a layer of stucco; spread the tape, centered on the two sides of the edge and folded along its entire length, with the reinforcement flaps facing inwards, exerting light pressure with your fingers to remove the excess grout. Then carry out the covering and finishing coats.

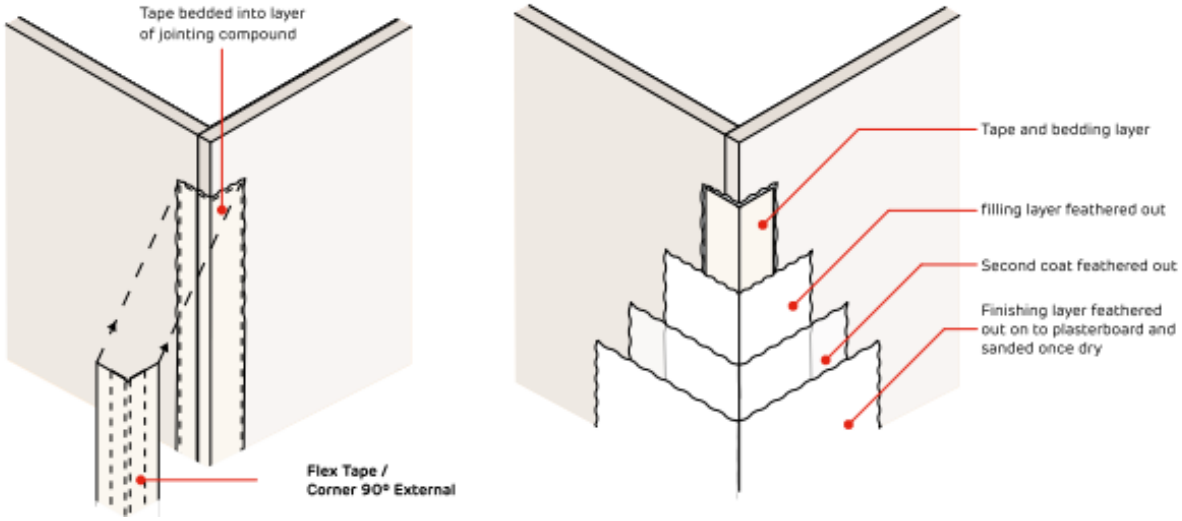


Fig. 3.64. Example of using connecting tapes - external corners. Source: “Manuale del Posatore” – Siniat –www.siniat.it

GROUTING THE CORNERS

In the event that the coating material is all in coated plaster slabs, the corner must be grouted following the procedures already seen and armed with micro-perforated tape.

The micro-perforated tape will be turned over at 90 ° on the corner, so that it is arranged half on one wall and half on the other, creating a continuity between the two sheet surfaces. The edges will then be treated as for flat joints using a smaller spatula or the appropriate corner spatula.

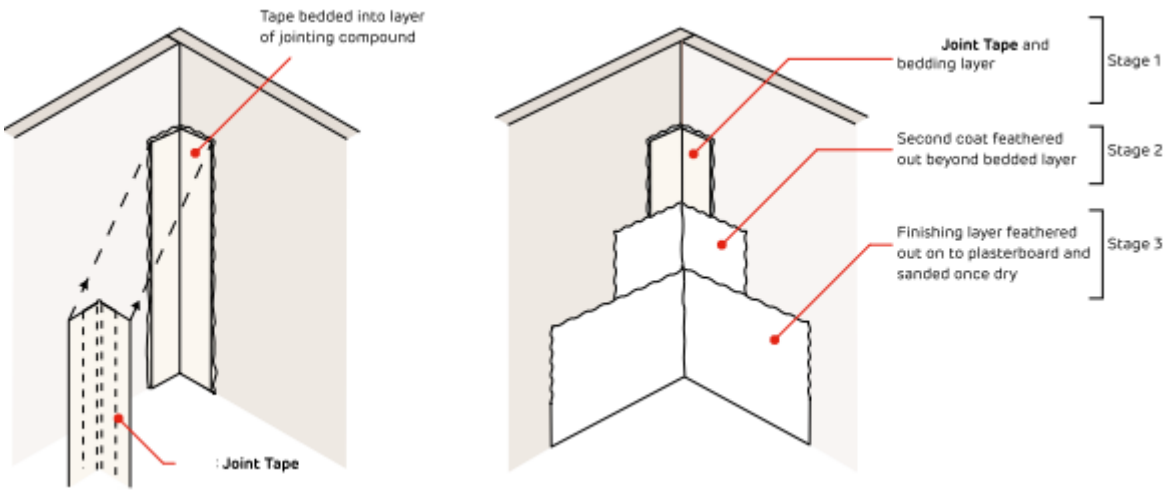


Fig. 3.65. Example of using connecting tapes - internal corners. Source: “Manuale del Posatore” – Siniat –www.siniat.it

FINISHING AND SMOOTHING COAT OF JOINTS AND SLABS

The third coat of grouting is also called "finishing grouting" and is carried out with the same "setting" grouts used in previous coats or with "drying" groats with finer grain.

In some cases, due to particular finishing needs and in the case of grazing light, surface treatments with glossy varnishes, etc., it is necessary to completely shave the surface of the slabs to cover any imperfections of the joints, align the cardboard surface of the slabs to that grouting the joints and smoothing the lining board before final decoration.

SANDING

Particular attention must be paid to the final sanding with sandpaper or emery cloth so that the coating of the slabs is not damaged, which must remain smooth, without producing leaks of cellulose fiber that would be even more evident after painting.

3.6. Work quality

Like in the case of majority of construction works, the final effect of using drywall systems depends on each and every stage of their installation. When we talk about the final effect we mean completion of all works connected with drywall system installation, from the moment of the wall positioning until final mudding preceding painting, wallpapering or any other method of finishing the surface.

A number of activities undertaken by the drywall system assembler belong to the socalled "disappearing works". Therefore, at the moment of the works acceptance some difficulties can occur when it comes to assessing their quality. For this reason the drywall system assembler should realize that whereas careless positioning of a wall or a ceiling will be clearly visible and easy to prove at the moment of the works acceptance, a careless execution of a steel profile structure or fitting the mineral wool insulation will become visible later after the building has been used for some time.

The following "disappearing works" are usually specified when we speak about the installation of drywall system elements:

- making a steel profile structure,
- mineral wool fitting,
- installation of plasterboards and the use of a joint tape,
- joint filling and mudding.

The final effect of the works performed is equally important. A drywall assembler – while performing works - should be aware that during the acceptance procedure of the works he did among the aspects assessed there will be dimensional tolerances for the positioning of planes and edges.

Particular attention will be given to:

- deviations of surfaces from the plane, in other words is the wall surface "corrugated",
- deviation of the plane edges from the straight line, in other words are there any deviations vertically and horizontally in the places where two planes intersect, e.g. in internal angles, and external wall angles,
- deviations of surfaces and edges from the vertical direction,
- deviations of surfaces and edges from the horizontal direction,
- deviations of intersecting planes from the angle specified in the documentation.

Table 3.5. Work Quality Checks. Source: UNI 11242 standard (elaboration by architect Ferronato for SCVAP)

FINAL CHECKS	LAYING TOLERANCES
Visual inspection	Smooth surfaces free from dust, holes or other
Verticality	To be carried out on a height of 2.50 m - Permissible tolerance must not be> 5 mm
Horizontality	2 m long ruler positioned in all development directions of the system - The level difference with respect to the reference plane must be less than 3 mm / m and not greater than 2 cm
Flatness of the joints	20 cm long ruler positioned at the joints - The height difference allowed must not be> 1 mm

Table 3.6. Surface Quality Levels. Source: UNI 11242 standard (elaboration by architect Ferronato for SCVAP)

QUALITY LEVELS	FEATURES
Q1	surfaces that do not have to satisfy requests for decorative finishes
Q2	medium smooth or rough finishes, opaque, opaque paints, with medium and rough finish, applied by hand and finishing coatings with particle size> 1 mm
Q3	fine grain finishes, matt and fine coatings / paints, finish coatings with particle size <1 mm
Q4	smooth or glossy finishes, sponged, varnishes or layers of medium gloss finish and special coatings, such as marmorino, stucco or special decorative finishes

4. Work organization

4.1. Elements of pricing

The price analysis can be defined as the analytical study (qualitative and quantitative) that leads to the definition of the unit price of a process, through the identification of its elementary components.

The elementary components are generally the following:

- workforce
- materials
- rentals
- overheads
- business profit

MANPOWER
The cost of manpower is defined by the type of workers and the necessary hours of work. Hourly costs can be deduced from the published official parametric tables.

MATERIALS
To define the cost of the materials necessary for the realization it is necessary to identify the following items:

- the purchase price
- transport to the construction site
- the discharge
- stacking
- waste (an excess percentage considering the waste material produced by the processing).

RENTALS
Rentals (of vehicles and / or equipment) can be of 2 types:

- the "hot freight": the freight of the work vehicle and / or equipment is also inclusive of the operator (example: crane and crane operator). The hot freight includes the labor costs necessary for its use, for consumables (fuel, lubricants etc.), normal maintenance and insurance.
- "cold hire": in this case the work vehicle and / or equipment are rented without the operator. Cold freight does not include the labor costs necessary for its use, fuel, lubricant and maintenance

OVERHEADS
Overheads are the costs incurred indirectly, not attributable to the processing and the construction site. They are quantifiable on average with a fixed percentage.
General expenses include the following items:

- administrative and organizational management
- plant
- surveys, tracks and checks
- temporary jobs and custody
- corporate profit

The company profit represents the expected earnings of the enterprise.

Price analysis: typical model
To determine the prices of complex items, it is necessary to decompose the processing into its elementary parts, identifying the necessary quantities of each element.

Below we present a model facsimile to understand how the calculation of the single process is carried out, specifically for work related to plasterboard works:

Table. 4.1. Tabular example of calculation of one process - works performed with boards. Source: own property SCVAP (elaboration by architect Ferronato)

OBJECT OF THE ANALYSIS NECESSARY WORKS AND PROVISIONS	UNIT OF MEASURE	QUANTITY	UNIT PRICE	AMOUNT
Partition wall consisting of two plasterboard sheets, fixed by screws to a structure made up of 6/10 mm thick galvanized steel sections with a center distance of 600 mm, including the same structure and the grouting of the joints: slab thickness 12, 5 mm	m2	1,00		
1) Skilled worker or 3rd level -	hours	0,25	A	0,25 X A
2) Common worker or 1st level -	hours	0,25	B	0,25 X B
3) Plasterboard slab thickness 12.5 mm	m2	2,10	C	2,1 X C
4) U-shaped guide 55 mm	m	0,75	D	0,75 X D
5) C-pillar in galvanized steel 54 mm	m	2,00	E	2 X E
6) Medium price expansion anchor on site	n	2,00	F	2 X F
7) Self-drilling screws 35 mm	n	15,00	G	15 X G
8) Gypsum-based grout	kg	0,70	H	0,7 X H
9) Special paper tape for slab joints	m	3,00	L	3 X L
				M
10) OVERHEADS - 15,00%				M X 15% = N
11) BUSINESS PROFIT - 10,00%				(M+N) X 10% = P
APPLICATION PRICE	€/m2			M + N + P

To define the materials for the construction of the work and therefore to define the price, it is essential to know the incidence of the materials. The following tables show the indicative quantities of each component necessary for the construction of a square meter of system.

Table. 4.2. An example for a single wall. Source: "Manuale Tecnico: Soluzioni per interni" - GYPSOTECH - www.fassabortolo.it

Single facing wall (one slab per side)			
PRODUCT	**UNIT OF MEASURE**	**QUANTITY**	
		wheelbase uprights 60 cm	wheelbase uprights 40 cm
Slab	m^2	2	2
U-shaped guide	m	0,7	0,7
C-pillar	m	1,8	2,6
Screw 25 mm	n	15	21
Joint tape	m	2,7	2,7
Grout	kg	0,7	0,7
NOTE 1: any scrap is to be calculated according to the construction site			

Double facing wall (one slab per side)			
PRODUCT	**UNIT OF MEASURE**	**QUANTITY**	
		wheelbase uprights 60 cm	wheelbase uprights 40 cm
Slab	m^2	4	4
U-shaped guide	m	0,7	0,7
C-pillar	m	1,8	2,6
Screw 25 mm	n	5	8
Screw 35 mm	n	15	21
Joint tape	m	2,7	2,7
Grout	kg	0,7	0,07
NOTE 1: any scrap is to be calculated according to the construction site			
NOTE 2: in the case of walls with specific performances, some incidences may vary			

Double facing wall (one slab per side) with double frame			
PRODUCT	**UNIT OF MEASURE**	**QUANTITY**	
		wheelbase uprights 60 cm	wheelbase uprights 40 cm
Slab	m^2	4	4
U-shaped guide	m	1,4	1,4
C-pillar	m	3,6	5,2
Screw 25 mm	n	5	8
Screw 35 mm	n	15	21
Joint tape	m	2,7	2,7
Grout	kg	0,7	0,7
NOTE 1: any scrap is to be calculated according to the construction site			
NOTANOTE 2: in the case of walls with specific performances, some incidences may vary			

Table 4.3. Example of counterwall. Source: "Manuale Tecnico: Soluzioni per interni" – GYPSOTECH - www.fassabortolo.it

Glued counter wall		
PRODUCT	**UNIT OF MEASURE**	**QUANTITY**
Slab	m^2	1
Adhesive mortar	kg	2-3
Joint tape	m	1,4
Grout	kg	0,35
NOTE 1: any scrap is to be calculated according to the construction site		

Counterwall on warping (single slab)			
PRODUCT	**UNIT OF MEASURE**	**QUANTITY**	
		wheelbase uprights 60 cm	wheelbase uprights 40 cm
Slab	m^2	1	1
U-shaped guide	m	0,7	0,7
C-pillar	m	1,8	2,6
Spacer hook	n	1,8	2,6
Screw 25 mm	n	8	11
Joint tape	m	1,4	1,4
Grout	kg	0,35	0,35
NOTE 1: any scrap is to be calculated according to the construction site			

Counterwall on warping (double slab)			
PRODUCT	**UNIT OF MEASURE**	**QUANTITY**	
		wheelbase uprights 60 cm	wheelbase uprights 40 cm
Slab	m^2	2	2
U-shaped guide	m	0,7	0,7
C-pillar	m	1,8	1,8
Spacer hook	n	1,8	2,6
Screw 25 mm	n	3	4
Screw 35 mm	n	8	11
Joint tape	m	1,4	1,4
Grout	kg	0,35	0,35
NOTE 1: any scrap is to be calculated according to the construction site			
NOTE 2: in the case of walls with specific performances, some incidences may vary			

Table. 4.4. – Example of suspended cailling list. Source: “Manuale Tecnico: Soluzioni per interni” – GYPSOTECH - www.fassabortolo.it

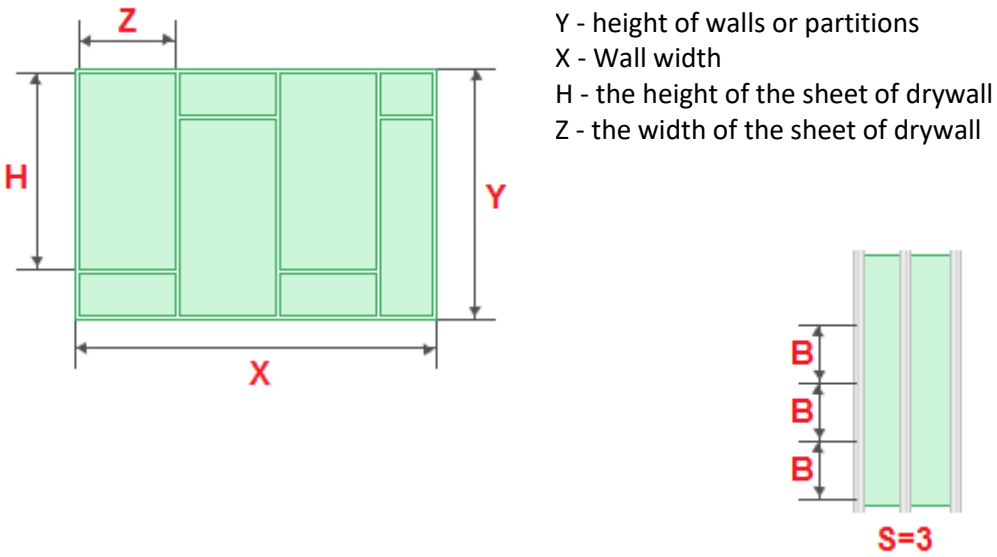
Suspended ceiling with simple warping (parallel or perpendicular laying - 1 slab of 12.5 or 15)			
PRODUCT	**UNIT OF MEASURE**	**QUANTITY**	
		warp center distance 40 cm parallel installation	warp center distance 60 cm perpendicular installation
Slab	m^2	1	1
Hook with spring	n	2	1,3
Eyelet rod	n	2	1,3
Warping structure	m	2,5	1,7
Connection joint	n	0,75	0,5
Perimeter structure L or U	m	0,5-1	0,5-1
Screw 25 mm	n	12	9
Special paper tape	m	1,6	1,6
Grout	kg	0,4	0,4
NOTE 1: any scrap is to be calculated according to the construction site			

Suspended ceiling with double warping (parallel or perpendicular laying - 1 slab of 12.5 or 15)			
PRODUCT	**UNIT OF MEASURE**	**QUANTITY**	
		Primary wheelbase 120 cm Secondary wheelbase 40 cm Parallel pose	Primary wheelbase 120 cm Secondary wheelbase 60 cm Parallel pose
Slab	m^2	1	1
Hook with spring	n	0,7	0,7
Eyelet rod	n	0,7	0,7
Warping structure	m	0,85	0,85
Union hook	n	2	1,4
Secondary structure	m	2,5	1,7
Connection joint	n	0,75	0,5
Perimeter structure L or U	m	0,5-1	0,5-1
Screw 25 mm	n	12	9
Special paper tape	m	1,6	1,6
Grout	kg	0,4	0,4
NOTE 1: any scrap is to be calculated according to the construction site			

There are also specific software available on the market which, based on the requirements and dimensions of the work to be carried out, can help in defining the necessary materials.
Below is an example:

CALCULATION OF WALLS, CEILINGS OR PARTITIONS OF GYPSUM CARDBOARD
http://www.zhitov.ru/en/drywall/

Select the required dimensions in millimetres



Y - height of walls or partitions
X - Wall width
H - the height of the sheet of drywall
Z - the width of the sheet of drywall

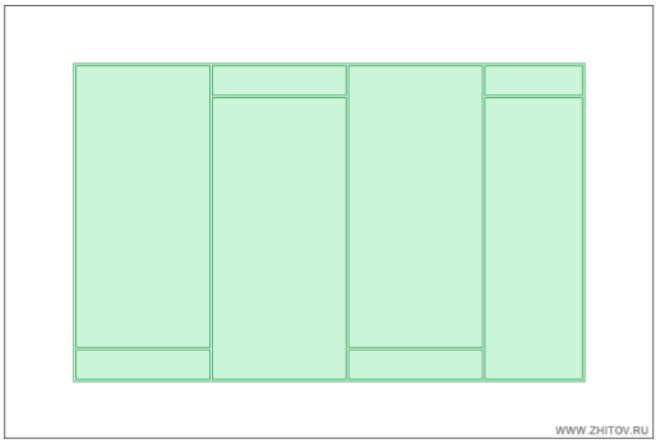
Fig. 4.1. Drawing showing the calculation of walls, ceilings or partitions with plasterboard. Source: http://www.zhitov.ru/en/drywall/

S - the number of profile rack on one sheet of drywall
V - the number of layers of drywall
V=1 - in one layer, for wall or ceiling
V=2 - in two layers for walls or for partitions
V=3-4 - for partitions
B - The distance between the screws

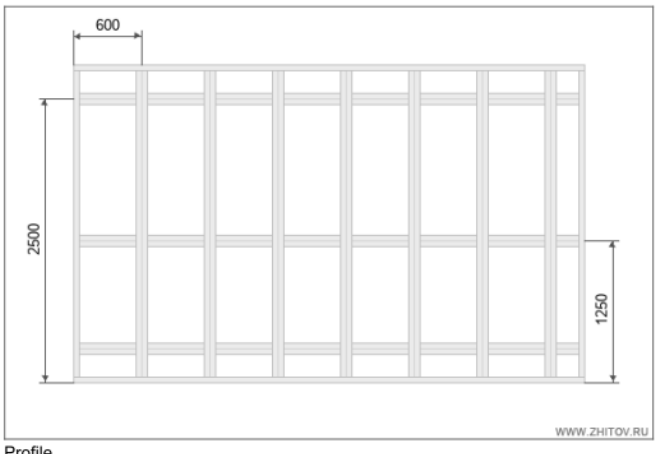
The program can calculate the required number of finishing materials-primer, filler, paint.
To do this, specify the rate of consumption per square metre N1, N2, N3, N4.

As a result, the program will calculate:
- the area of the wall, the ceiling or the walls of plasterboard
- the required number of sheets of drywall
- the required number of frame profile
- approximate number of screws, reinforcing and sealing tape
- insulation or soundproofing and finishing materials.

The program does not take into account openings for doors and Windows, as well as material consumption varies slightly.



Drywall



Profile

Fig. 4.2. An example illustrating the limitations of the calculation program. Source: http://www.zhitov.ru/en/drywall/

Square partitions: 12.6 m^2 or 25.2 m^2 with the two parties
The number of sheets of drywall: 10 pieces (2 layer)
Guide profile: 14.6 m or 5 pieces of 3 m
Rack profile: 33.1 m or 12 pieces of 3 m

Self-tapping screw for gypsum plasterboard: 191 pieces or 382 pieces with the two parties
Screws for frame: 158 pieces
Self-tapping screw only: 349 pieces or 540 pieces with the two parties

Tape sealing: 14.6 m
Reinforcing tape: 37 m or 74 m with the two parties
Heat Insulation Material: 12.6 m^2 или 0.63 m^3 at a thickness of 50 mm

Primer: 2.52 litres or 5.04 litres with the two parties
Putty: 11.34 kg or 22.68 kg with the two parties
Finishing PuTTY: 15.12 kg or 30.24 kg with the two parties
Paint: 2.52 litres or 5.04 litres with the two parties

4.2. Elements of scheduling

The term "construction process" means the organizational sequence of phases that lead from the detection of the needs of the client-user of a building asset to their satisfaction through the design, production, construction and management of the asset itself.

The main operators of this process are: clients, designers and builders.
A good planning, built upstream, of the various bureaucratic, planning, executive, control and verification procedures with the Customer, allows to identify the most critical points and therefore to consider any corrective measures to resolve the anomalous situations, without compromising the final .
The preventive and systematic control of the planning and realization times, costs, construction phases, up to the moment of the tests are a great guarantee for the achievement of the objectives established by the project.

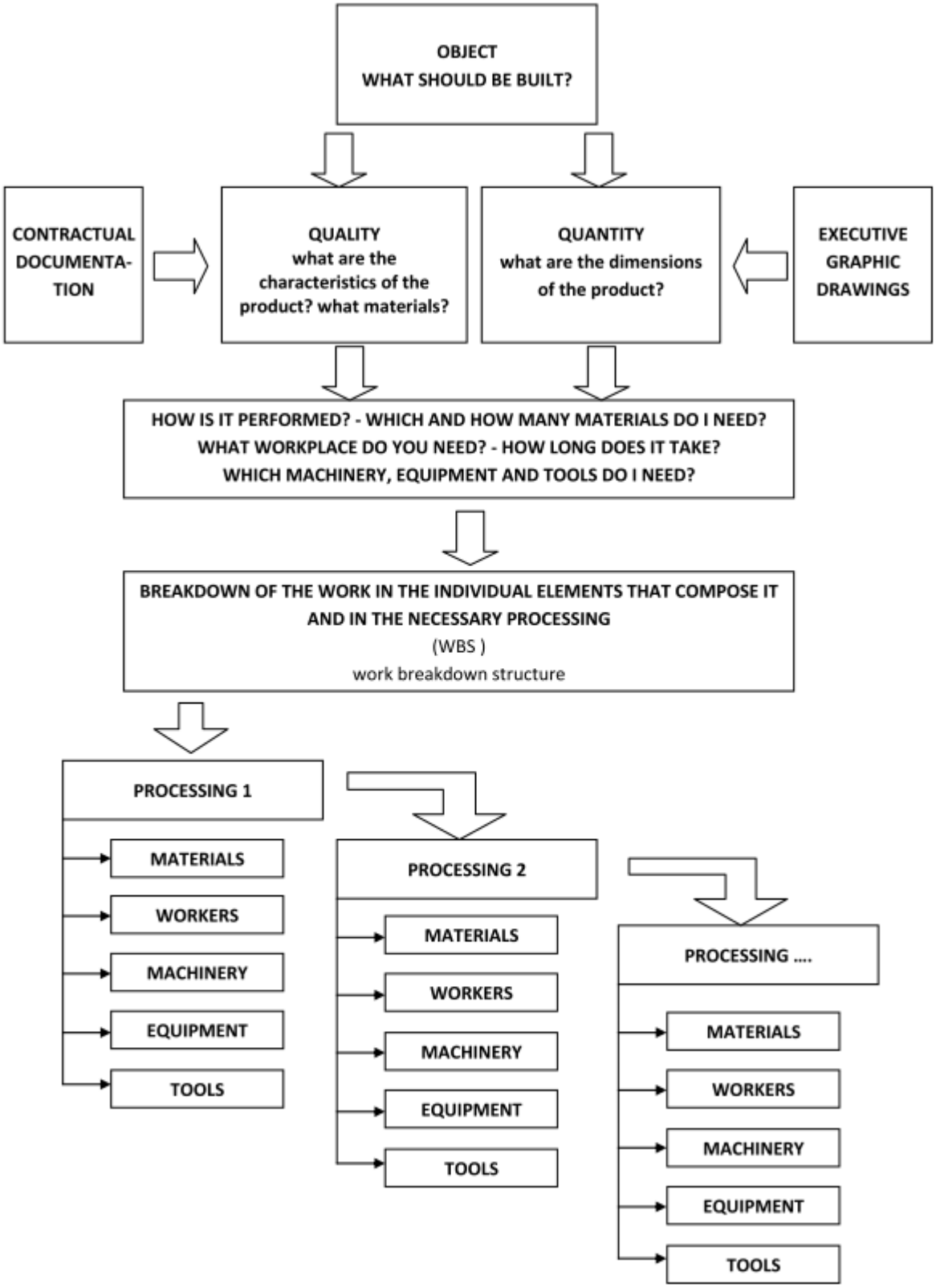
The construction phase can be split into two phases: - planning - execution of the works.
The characteristic operations of the organism's construction level are, therefore, the following:

1. operational planning
2. organization of the operational phases
3. programming of the operating phases
4. technical-functional check of the system parts
5. execution of the operational phases
6. control during construction
7. final check

The manufacturer must be able to carry out the work entrusted to him by organizing and managing capital, machines and workers. The contractor is required to carry out the work in a workmanlike manner and in accordance with the related projects and contracts. When the works are carried out differently from the technical prescriptions or with materials other than those established, the contractor will have to demolish them and redo them at his own expense.

In the executive management of a work, therefore, knowledge of all the technical and operational aspects is essential in order to be aware of what the needs are and plan the necessary resources in time.

The scheme below clearly summarizes the concept.


OBJECT
WHAT SHOULD BE BUILT?
CONTRACTUAL DOCUMENTA-TION
QUALITY
what are the characteristics of the product? what materials?
QUANTITY
what are the dimensions of the product?
EXECUTIVE GRAPHIC DRAWINGS
HOW IS IT PERFORMED? - WHICH AND HOW MANY MATERIALS DO I NEED?
WHAT WORKPLACE DO YOU NEED? - HOW LONG DOES IT TAKE?
WHICH MACHINERY, EQUIPMENT AND TOOLS DO I NEED?
BREAKDOWN OF THE WORK IN THE INDIVIDUAL ELEMENTS THAT COMPOSE IT AND IN THE NECESSARY PROCESSING
(WBS)
work breakdown structure
PROCESSING 1
MATERIALS
WORKERS
MACHINERY
EQUIPMENT
TOOLS
PROCESSING 2
MATERIALS
WORKERS
MACHINERY
EQUIPMENT
TOOLS
PROCESSING ....
MATERIALS
WORKERS
MACHINERY
EQUIPMENT
TOOLS

5. Ethics of work

Codes of professional ethics for some professions, those with special social meaning and a deep impact on human situations, have been compiled for a very long time.

At present, however, much attention is paid to values virtually in any profession. The industrial era ended – not only physically, but also spiritually. The binder related to that era, industrial relations, is fading away as well. At the time of virtual network-based organisations spread across many locations, a new binder is needed – values.

The management manner, organisational culture and organisational ethics cannot be enacted overnight and one cannot count that the actual state will adapt to one's needs. This is an lengthy process the performance of which requires a good concept, proper communication, consistency, patience, trainings and monitoring. Sometimes personal changes must be reverted to. It is highly significant who is employed, who is allowed to work in an organisation – whether or not there will be good cooperation with such a person, also in terms of building or maintaining the desired organisational culture and ethics. However, such diagnosis is not easy to make. It requires knowledge, experience and intuition. It is easy to make mistakes here, for instance employ only people similar to each other in terms of age, education and culture. Such homogeneous teams may fail where new solutions and are sought and extraordinary situations have to be dealt with. Heterogeneous teams do a much better job, which are teams composed of people of different sexes, at different age, with different experience and education, representing diverse disciplines of knowledge and speciality, more creative in general. In a lot of companies, this is what **diversity policy** is: it is said how valuable "diversity" in teams is.

Helpful in shaping the principles of ethics in organisations are codes of good practices, more often than not referred to as **codes of ethics** – they promote selected values and fair and ethical practices (of conduct and behaviour), both inside the organisation and in its relations with the external environment, notably with all stakeholders.

Therefore, the function of such codes is twofold: internal and external. The internal function is expressed in striving to promote ethical practices and eradicate unethical practices in one organisation. The external function is expressed in striving to find the relations with external partners on the followed ethical standards and values. This activity may lead to benefit for the given organisation as well as a result of feedback. The external function also entails the shaping of good image of the organisation.

For several dozen years, the number of corporations and larger companies employing codes of good practices has been growing in highly developed countries. It is assumed that most global companies already belong to this group. According to various estimates, such codes occur in 18-23% of medium and large organisation operating in Poland.

5.1. Status of the construction worker

Construction enterprises have a specific nature. In most companies, there is a division into two closely cooperating employee groups – supervision employees (engineers with a university diploma, foremen, construction work managers, construction site managers, contract/design managers), who

direct the execution of a building structure in a specific place or to a specific extent, and manual labour workers – persons having the skills and qualifications to carry out physical technical activities at the construction site.

The construction industry is witnessing many problems related to the deficit of manual labour workers in particular. No labour is one of the more burdensome barriers in the operation and development of construction companies. There is no supply of new workers in the country, there is no education that would be effective for the labour market and that would supply young and qualified craftsmen and specialists in such professions as the following: Steel fixer, concrete placer, shuttering carpenter, bricklayer, tile layer or hydraulic. The experienced part of the workers have retired and they did not even have the opportunity to teach their hands-on knowledge. This results in more and more companies starting to employ workers from abroad. This resulted in multiculturalism among construction works crews and a stronger need for acceptance and respect for the norms and customs of others.

In each organisation, the personal freedom is to some extent limited due to the requirement to follow the working strategy and discipline, achieve collective aims, perform tasks and follow instructions of superiors etc. From the vantage point of ethics, there should be no more limitations than what is absolutely necessary. Furthermore, people should understand the reasons for which some limitations are necessary so that they accept them. In the case of construction industry organisations, this mostly applies to OHS regulations and observance of the requirements of technology and the ordering party, other important work-related procedures, specified limitations and self-limitations related to teamwork etc. There should be no limitations where they are not absolutely necessary.

5.1.1. Ethical standards in the recruitment phase

An organisation builds its image through quality of communication with prospective workers. Ethics provides that the information given to candidates both in the recruitment phase and after it, when communicating a refusal to hire, should be true. A high standard in this area includes reliable and specific job descriptions and specification of offered worker benefits, including the spread of possible earnings. Benefits for the worker should be described specifically, e.g. “We allow you to obtain a crane operator’s licence in 2 years.”

A high recruitment standard also involves a situation where all job applicants have an opportunity to demonstrate their skills regardless of sex, ethnic origin, disabilities, age and other factors unrelated to the job. All forms of recruitment should be related to the tasks that will be performed on the job. It is recommended to use the so-called job samples as a stage in the recruitment process for construction industry jobs involving manual work. For supervision-related jobs, one can test their knowledge or skills in using given software.

Questions which go beyond the code of labour and penetrate the personal life of future employees are not a good choice. Such issues as the worldview or addictions should not be used as actual criteria to assess a candidate.

5.1.2. Quality of life at work - friendly work environment

Upon signing the employment contract, a person starts to systematically train in the duties imposed on them by the organisation. They get to know their subordinates and colleagues: they already met their superiors at the very start. They are in the phase that cannot be critically assessed from the ethical vantage point. The fresh worker is showered with new information. As a result, they have difficulty assessing things in ethical terms and gain some distance.

There is a lot of liberty and sense of personal freedom in an ethical organisation. One can voice their thoughts and views (and criticise others while maintaining good manners and being respectful) without fear of sanctions or harassment. Actions that are surprising and contrary to the workers' will are avoided, people are not held in uncertainty. In addition, workers in such an organisation should avoid actions surprising the employer and causing them trouble. The freedom and the sense of security are facilitated by transparency, a principle applying to everyone.

Ethics organisations ensure that their members enjoy:

- protection against violation of their personal dignity and the need for respect, freedom from rudeness and lack of good manners – in particular, this applies to relations between the employee and their superior. This is so as the superior's evaluation of their subordinate is often expressed in a manner violating the employee's dignity. All employees, even those with poor evaluation results, have the right to experience civil behaviour that complies with the principles of community life;
- freedom from persecution, mobbing and sexual harassment in any form;
- freedom from any discriminatory practices – each employee has the right to equal treatment and access to the same resources and benefits regardless of their religion, sex, age, origin etc.;
- freedom from violation of law and good morals – the organisation cannot use prohibited contractual provisions towards any entities and persons, force its employees to perform unfair competition acts or unfair market practices; the organisation is obliged to create safe and hygienic working conditions and exercise effective supervision over the observance of OHS regulations and the labour law, law of commercial companies etc. being in vigour;
- freedom from burdensome, dehumanised leadership styles – fighting all pathologies (corruption, discrimination, nepotism, glass ceiling, manipulation and other);
- freedom from interference with privacy – each employee has the right to preserving their private life as unavailable to others from their professional environment.

Ethical organisations operate so as to support innovativeness and creativity of the people involved. They do it by accepting the assertiveness of others (clients, workers, subcontractors) and supporting the professional development of workers – expansion and modification of work content in directions which the workers and the organisation are interested in.

Such organisations create for all their workers conditions for equal opportunity for promotion according to the same far and proper criteria – they do not allow the formation of the so-called glass ceiling.

5.2. Social relations with company / client / environment

5.2.1. Social relations with company

The harmony among the basic human life spheres, professional and non-professional, is the foundation of ethical relations in the company-worker dyad. The time and manner of work cannot be detrimental to the family and reduce it to a secondary social phenomenon. It is best for the work and the family when mutual harmony is sustained and positive signals from both spheres complement each other. Such a phenomenon is referred to as the **Work Life Balance**.

This principle is difficult to maintain in the construction industry. It is often the case that the investments being implemented are located outside the place of residence of workers. This creates the need for working far from home. However, an ethical employee guarantees its workers a regular opportunity to contact their family and home and establishes such terms of rest that ensure comfort and suggests additional benefits such as sports, cultural or social events.

Here attention needs to be drawn to the growing frequency of integration meetings for workers, organised by employers. This is related to creating the involvement atmosphere and the so-called team spirit – the ideal for many organisational cultures. However, participation in integration meetings or charity events of the company should always be voluntary – a worker unwilling to spend their free time in such a way should be able to say no to such events.

5.2.2. Social relations with client and contractors

The quality, innovation and client's satisfaction have taken the first three places in terms of the values that are the most cherished – both in the world and in Poland. The only difference is that in the world the order was quality, innovation and client's satisfaction and in Poland – client's satisfaction, quality and innovation.

Clients cherish the quality of goods and services the most – this also endows quality with an ethical dimension. It is unethical to sell or use products that are defective, dangerous to use, burdensome and costly in upkeep. A service poor in quality and provided negligently is particularly unethical. In terms to service provision, widely understood competences of persons responsible for order execution might be assumed as having a high ethical rank.

<u>As regards client relations, several topics of ethical nature can be listed:</u>

1. Quality of products (goods or services) – the organisation should make an effort for the provided services to be at the highest level or to meet the expectations of the ordering party;

2. Sale contracts – making sure that contractual provisions are fair and reliable, parties' obligations lawful and terms of contracts fulfilled;

3. After sales service, warranty repairs, implied warranties – fulfilment of obligations under the effective law, satisfaction of clients' legitimate interests, care for the good name of clients and the company;

4. Promotion, including advertisement – communication of true information, activities compliant with the principles of fair competition, observance of good manners and good taste, possibility to tell the difference between the facts and the fiction.

As regards contractors and subcontractors:

1. Taking into account reasonable interests of both parties – care for the cooperation terms and conditions to be equally beneficial for the organisation's contractors; avoiding situations where the company's brand and size (including the available resources, e.g. legal services) to force contractual provisions unfavourable for the other party;

2. Settlement of amounts due on time – the problem of payment gridlock impacts nearly a half of businesses in Poland (48%). It most often occurs in the construction and production industries. Therefore, delays in payment settlement are a common phenomenon that hinders operation because only slightly more than a half of receivables are paid on time in the group of companies having problems with obtaining their receivables;

3. Mutual provision of the necessary and true information – avoidance of holding information back or manipulating it;

4. Avoidance of actions surprising the contractors and unfavourable for them.

5.2.3. The essence of corporate social responsibility

Enterprises' attitude to corporate social responsibility (CSR) varies. Most have the sense of duty, but to a limited extent. The problem boils down to the conflict between the enterprise's striving for profit increase and the social interest. Life shows that the enterprises often ignore social interests when striving for higher profitability of the business.

Corporate social responsibility applies to the following relations:

1. Organisation-clients (discussed above)

In this relation, what is the most important is the quality and safety of use of products, warranties and warranty repairs, servicing and satisfaction of other obligations under the contract (see above);

2. Organisation-state

This relation mostly includes payment of taxes, insurance contributions and other effective tax-like charges, which are required for normal functioning of the state and the society, but also the prestige and image of the state. It is unethical to offer workers payment of remuneration "under the table" – such incidents are at least violation of law, or even circumvention of law, to exclude an element or part of remuneration from the tax base and the system of insurance contributions.

3. Organisation-natural environment

This relation ensues in cooperation with the local authorities and other institutions responsible for the environment condition and ecological supervision. Neglects in this area, let alone ecological disasters, are always shocking and have far-reaching consequences. Ecological sensitivity and awareness of the society is growing and organisations' impact on the environment is becoming to be seen as more and more important.

4. Organisation-competition

In the market economy, competition should be protected as it plays an important role in it. Everything degenerates without competition. Even though it is difficult to grasp and understand to many entrepreneurs, they should not strive to destroy their competition. All the more so as competitors are more and more often creating networks of cooperating entities, are participating in joint technical, logistic, marketing and other ventures and – in turn – make profit on it.

In practice, the shaping and harmonisation of all those relations is a complicated process. On the one hand, in such a process an organisation must protect itself against excess in demands and expectations which may sometimes be threatening its future and existence. On the other, it cannot be egocentric as bad image and enmity of clients, the state or the society towards the organisation are not conducive to its far-reaching interests either.

Time is of essence when discussing ethics. In the short run, people in charge of an organisation may have an impression that unethical behaviour may "be profitable.' This looks different in the long run, though.

Assumptions of CSR in the Erbud Group

The Erbud Group treats CSR as one of the tools for implementation of its long-term development strategy. The CSR activity of the Group aims to build the image of Group Companies obtaining good economic results and being socially responsible and friendly at the same time.

The main areas of sponsoring and social activity:

- the sponsoring and social activity related to the business areas where the Erbud Group Companies operate

Activities taken in this area allow promotion of the business activity of the Group Companies. They are taken for local communities, support for personnel education in areas related to the business activity of the Companies, support for sports activity.

- the sponsoring and social activity performed in agreement with business partners of the Erbud Group Companies.

This area of activity aims to create a positive image of the Group's brands and build their prestige. Our activities in this focus mostly on support for sports and charity activity of our business partners.

- support for the activities of Erbud's foundation WSPÓLNE WYZWANIA im. Eryka Grzeszczaka *(Eryk Grzeszczak COMMON CHALLENGES Foundation).*

The essence of the Foundation is to help young people in difficult life situation who, at the threshold of maturity, face a range of problems related to becoming self-sufficient. The Foundation takes care of the young people leaving Children's Homes in the first place. The assistance is provided in individual form and involves care of the Foundation's mentor for the ward under fostering. The mentors are Erbud Group's workers – the assistance is provided mostly in the form of worker's voluntary service.

FUNDACJA ERBUD wspólne wyzwania

Purposes of the actions taken:

- Building a positive image of the Group and individual Group Companies as brands characterised not only by high professionalism in business activities, but also friendly and sensitive towards social and local needs;
- Promoting the Group and the Erbud Group's brands by increasing the degree to which the cycle of business partners are aware of them;
- Reaching environments significant for the Group and the Group Companies and emphasising the magnitude of high standards of undertakings and initiatives organised by the Group;
- Building the Group's and the Group Companies' reputation and acquiring rapport and sympathy of the public eye.
- Supporting promotional and commercial activities of the Group and the Group Companies.

Our activities are focused in the area of activity of companies being members of the Erbud Group.

We support local initiatives as well as nationwide activities.

The Erbud Group does not become involved that could prejudice facilities of historical or artistic merit or in events that could negatively impact the natural environment. Furthermore, it does not become involved in projects related to political activities, serving any discrimination, violating the law or generally accepted social norms or referred to alcohol, addictions and pathology in their theme.

6. References / further reading

6.1. Glossary

Acoustic plasterboard: a gypsum plasterboard with a higher density core than standard wallboard. Used for wall lining, ceiling and partition systems where improved sound insulation is required.

Angle bead: a metal or plastic angle used to reinforce external corners .

Backing coat: undercoat plaster used as part of a two-coat plaster system .

Bonding agent: liquid preparation applied to the wall or ceiling surface prior to plastering to provide adhesion to challenging backgrounds.

Caulk: a joint sealing material, applied in a plastic state.

Closing-in: the operation of consolidating the surface of a final coat plaster with a finishing trowel.

Control joint: a joint which accepts movement in the form of lateral expansion or contraction. Allows relatively small movements to occur without damage to the internal surface.

Core board: a version of fire resistant and moisture resistant plasterboard with square edges and green coloured paper liners supplied in 19mm thickness. Used as an inside stud (core) board in shaft wall systems.

Cove: a decorative moulding used at the wall to ceiling angle.

Cut end: end of a gypsum board showing the exposed core.

Dry construction: a general term describing wall linings, ceiling linings, lightweight partitions and separating walls in board or sheet materials, either self-finished, plastered or jointed as distinct from construction with solid plaster finishes.

Drying shrinkage: shrinkage caused by the evaporation of water.

Drylining: creating a wall or ceiling lining using plasterboard as an internal finish instead of solid plaster treatment.

Drywall partition: lightweight partition either self-finished, plastered or jointed as distinct from masonry construction with solid plaster finishes.

Drywall: a partition, separating wall or wall lining which uses plasterboard as a lining instead of solid plastering (can be skim plastered however).

Edge profile of plasterboard: the bound edge of a plasterboard which is traditionally square or tapered.

Edge bead: a metal or plastic bead to protect the edges of plasterboard or to form a feature.

Expansion joint: a permanent joint between different parts of the structure to allow relatively small movements to occur without damage to the surface.

Face: the side of the plasterboard from which the covering paper is carried round the edges e.g. the exposed side for direct decoration or plastering.

Finishing compound: jointing material applied over the bedding compound in one or more applications and which forms the final finished surface.

Fire resistant plasterboard: a gypsum plasterboard with greater fire protection properties than standard plasterboard.

Glass mineral wool: mineral wool manufactured from glass, used for improved thermal or acoustic insulation.

Gypsum: calcium sulphate dihydrate (CaSO4.2H2O). A natural mineral deposit and the main raw material from which gypsum plaster is made.

Gypsum adhesive: a gypsum-based compound which, when mixed with water, provides an adhesive for use in drylining systems

Gypsum plasterboard: a building board, complying with EN 520, composed of a core of aerated gypsum plaster bonded between two sheets of strong paper.

Hair Line crack: crack just visible to the naked eye.

Impact resistant plasterboard: a gypsum plasterboard with a heavy duty face paper, a higher density core than standard plasterboard and additives in the core to improve impact performance .

Insulating drylining: drylining using laminates composed of plasterboard and polystyrene, phenolic foam or mineral wool.

Joint tape: Tape which is embedded in the bedding compound to reinforce the joint.

Jointing: the process of using hand or mechanical systems for achieving a flush seamless surface on dry construction, based on tapered edge plasterboard, and applicable to walls and ceilings.

Metal stud partition: a partition consisting of a metal stud / channel framework, lined both sides with sheet materials such as plasterboard. This is a form of stud and sheet partition .

Metal stud separating wall: a metal stud / plasterboard partition, which meets the separating wall requirements of national Building Regulations for multi-occupancy dwellings.

Moisture resistant plasterboard: a gypsum plasterboard with moisture-repellent additives in the core, which is enclosed in water-repellent green coloured paper liners.

Nogging: cross member between main members of a framed construction. Also known as ‘dwang’.

Panel: decorative or functional portion of the cladding of a floor, ceiling, roof or wall, supported by a concealed or exposed frame.

Partition: a non-loadbearing vertical construction dividing space .

Perforated ceiling: a ceiling incorporating tile or board products available in various edge profiles and with circular, square or rectangular perforations in random or regular pattern designs, typically used in suspended ceilings to provide sound absorption .

Plenum: an enclosed chamber, e.g. space between a suspended ceiling and the floor above.

Sealant: joint sealing material, applied in a plastic state.

Self-drilling, self-tapping: shank and point design of a metal screw which facilitates penetration and grip into a light gauge metal section.

Shaft wall: a partition or lining used to form fire protective enclosures to all forms of shafts including, service cores and lift shafts. It consists of multi-layers of gypsum plasterboard fixed to single or twin metal frames to give fire resistance.

Sound absorption: is the loss of sound energy when striking or transmitting into a boundary surface material or obstacle, or when causing a volume of air to resonate.

Square edge boards: plasterboard with a square edge profile used for textured finishes or undecorated applications, as well as being suitable to receive gypsum plaster.

Stone wool: mineral wool manufactured from stone, used to improve fire resistance performance.

Stud: vertical member in framed wall or partition.

Suspended ceiling: a ceiling formed with boards or tiles fixed into (or onto) a grid with a cavity between the suspension system and the structural soffit, joists or trusses.

Suspension system: grid of metal sections, consisting of main and cross members, to support ceiling panels.

Tapered edge: a design of a board or sheet material applicable to plasterboard particularly and to its long bound edges to enable flush seamless jointing or plastering to be carried out in dry construction.

Thermal laminate: a laminate consisting of gypsum plasterboard with a backing of factory bonded insulation material providing enhanced thermal insulation. Used to provide insulated wall and soffit linings or ceilings.

Three-coat work: plasterwork with rendering, floating and finishing coats. Generally used when a very high quality finish is required.

Timber stud partition: a partition consisting of a timber frame lined on each side with materials such as plasterboard.

Vapour control plasterboard: a gypsum plasterboard backed with metallised polyester for wall and ceiling linings, which enables the lining and the vapour check membrane to be fixed in one operation.

Vapour control layer: a material (usually a membrane) that substantially reduces the transfer of water vapour through a building element in which it is incorporated.

Working time: the period during which a plaster mix is workable, i.e. does not significantly stiffen.

X-ray plaster: plaster containing barytes (barium sulphate $BaSO_4$) as the aggregate, which gives protection or shielding from electro-magnetic radiation.

6.2. References

- “Site Book” - Installation guide for British Gypsum systems - Saint-Gobain Company March 2018- www.british-gypsum.com
- “The White Book” - British Gypsum - Saint-Gobain Company - Last updated 12/2019 - www.british-gypsum.com
- “The Complete Drywall Manual” - A guide to our drylining products and services - Knauf – 2013 – www.Knauf.com
- “Manuale base dell'Applicatore” - Le pareti, Le contropareti, I controsoffitti - Knauf – 04/2011 – www.Knauf.it
- “Manuale dei sistemi a secco” – Gyproc - Saint-Gobain Company -2018 - www.gyproc.it
- “Manuale Tecnico: Soluzioni per interni” – GYPSOTECH – Fassa Bortolo – 11/2017 - www.fassabortolo.it
- “Manuale del Posatore” – Siniat – Etex Building Performance spa – 02/2017 - www.siniat.it
- “Installation of partition wall systems“ - Krzysztof Wojewoda, Piotr Rogalsk - Instytut Technologii Eksploatacji – Państwowy Instytut Badawczy - Radom 2010

7. Questions for self assessment

7.1 Questions

N°	Question	Answer options	Correct Answer
1.	Gypsum is a product ...	A. A mineral found naturally in the form of a stone B. Artificial, chemically synthesized in the laboratory C. Natural found as dust in sand	
2.	Which of the following characteristics is not typical of plaster?	A. Fire resistance B. Soundproofing capacity C. Waterproofing	
3.	The EN 520 standard provides for multiple types of slabs with different characteristics. How many types are there?	A. 6 B. 8 C. 10	
4.	The slabs can have various thicknesses (depending on use) and lengths; but selected what is the width?	A. 800 mm B. 1200 mm C. 1500 mm	
5.	What material are the structures of the plasterboard partitions made of?	A. bricks or other small materials B. concrete C. steel profiles D. wood	
6.	Which of the following sheets are suitable for outdoor use?	A. Standard plasterboard sheet B. Gypsum-fiber board C. Fiber-reinforced concrete slab	
7.	The scraps of plasterboard from production and installation can be recycled	A. Only for the plaster part B. Only for the paper part C. Both the plaster part and the backing paper	
8.	Identify the basic tools used to cut plasterboard sheets	A. electric saw B. Pointed hacksaw C. Angle grinder D. cutter	
9.	The metal profiles are characterized by their particular section and from which they take their name. Which of the following does not exist?	A. - C - B. - L - C. - S - D. - U -	

10.	What is the initial stage for laying a plasterboard wall?	A. tracking the position of the floor guide B. the identification of the position of the vertical profiles C. tracking of the position of the ceiling guide D. the placement of sanitary equipment	
11.	In a wall, where should the guides be placed?	A. floor and ceiling B. only on the floor C. only on the ceiling	
12.	At what maximum center distance should we position the C-pillars of a wall?	A. 30 cm B. 40 cm C. 60 cm D. 120 cm	
13.	Where should the resilient band for acoustic insulation of the plaster walls be applied?	A. under the floor and ceiling guides B. on the wings of the uprights C. on the core of the end posts	
14.	How are the gypsum coated sheets fixed to the metal frame?	A. With phosphated self-tapping screws B. With nails C. With special polyurethane adhesives D. With rivets	
15.	What is the optimal distance that the screws must have from the longitudinal edge of the slabs when screwing the slabs themselves?	A. 5 mm B. 10 mm C. 15 mm D. 20 mm	
16.	At what maximum center distance should the anchors for the "U" guides be fixed to the floor and ceiling?	A. 30 cm B. 50 cm C. 100 cm D. 200 cm	
17.	How far should the fixing screws of the plates penetrate the metal frame?	A. 8 mm B. 10 mm C. 15 mm D. 20 mm	
18.	We must make walls with 1 slab per side: at which maximum center distance should we place the screws for fixing the slabs?	A. 15 cm B. 30 cm C. 40 cm D. 60 cm	
19.	When laying a counter wall, what is meant by pre-coupled panels?	A. From the set of plasterboard and panel of a fibrous or plastic nature B. From the set of 2 plasterboards C. From the set of plaster and brick slabs of various thickness	

20.	When laying double-sided walls on each side, how should the slabs be laid?	A. Staggered 60 cm between them B. Staggered 20 cm between them C. Do not stagger	
21.	In order to create an adherent wall by means of gluing on an uneven wall, in addition to laying the glue on the edges, must intermediate points be provided?	A. Yes, at a distance of 60 cm only in the longitudinal direction B. Yes, at a distance of 30-35 cm in the transverse and longitudinal directions. C. No, the glue should only be applied in bands on the edges plus a band in the center	
22.	In the walls and counter walls, what size must the slabs have compared to the height of the room?	A. the slab must be placed on the ceiling and raised 1 cm above the ground B. the slab must be 1 cm away from the ceiling and from the ground C. the slab must be placed on the ground and spaced 1cm from the ceiling	
23.	In suspended ceilings, plasterboard panels are fixed in the following ways:	A. bonding B. gluing and mechanical fixing C. mechanical fixing only D. it depends on the type of structure	
24.	What is the direction determined for the installation of the plasterboard sheets on the false ceiling?	A. the longest side of the room B. depends on the type of suspended ceiling structure C. in the direction of sunlight, D. there are no determinants	
25.	The intervals between the steel metal screws along the profiles in a suspended ceiling are:	A. 30 cm B. 15 cm C. 20 cm D. 40 cm.	
26.	To distance the false ceiling from the slab, which type of anchorage must be provided?	A. simple hook B. plastic cable ties C. hanger with spring hook D. iron wire	
27.	What are the fillers that cannot be used for grouting the screw heads?	A. Setting grouts B. Both setting grouts and drying grouts C. Drying grouts	
28.	Which of the following tapes is not needed to reinforce the joints between the slabs:	A. The micro-perforated paper tape B. The self-adhesive net tape C. The fiberglass tape D. The armed gang	
29.	In the construction of the joint, which of the following reinforcement tapes offers the best sealing performance?	A. The micro-perforated paper tape B. The self-adhesive net tape C. The fiberglass tape D. The armed gang	

30.	When making the joint, how should I correctly position the micro-perforated tape?	A. With the rough side facing the plate B. With the smooth side facing the slab C. Depending on the type of grout used D. The direction of installation does not matter	
31.	What is the characteristic of setting putties compared to drying putties?	A. are gypsum based B. have a longer setting time than drying C. do not contain chalk D. non-drinking water is also fine	
32.	If I made the first coat of grouting using a plaster-based grout, which grout should I use for subsequent coats?	A. Only gypsum-based grout B. Only drying putty C. With a mixture of the two D. It is indifferent	
33.	How should I mix gypsum-based grouts?	A. by hand B. with the mechanical mixer C. with both	
34.	Indicates the correct way of grouting the 90 ° edges between plasterboard partitions	A. Gypsum-based putty and net tape spread on both sides B. Drying putty and micro-perforated tape turned up at an angle on the 2 materials C. Edge protection profile in galvanized steel on a plaster or drying stucco bed	
35.	Does the Q3 finishing level provide?	A. Surfaces that do not have to satisfy requests for decorative finishes B. Fine-grained finishes, matt and fine coatings / paints…. C. Smooth or glossy finishes,…., stucco or special decorative finishes	

7.2 Answers

No	Question	Correct answer
1.	Gypsum is a product ...	A. A mineral found naturally in the form of a stone
2.	Which of the following characteristics is not typical of plaster?	C. Waterproofing
3.	The EN 520 standard provides for multiple types of slabs with different characteristics. How many types are there?	B. 8
4.	The slabs can have various thicknesses (depending on use) and lengths; but selected what is the width?	B. 1200 mm
5.	What material are the structures of the plasterboard partitions made of?	C. steel profile
6.	Which of the following sheets are suitable for outdoor use?	C. Fiber-reinforced concrete slab
7.	The scraps of plasterboard from production and installation can be recycled	C. Both the plaster part and the backing paper
8.	Identify the basic tools used to cut plasterboard sheets	B. Pointed hacksaw D. cutter
9.	The metal profiles are characterized by their particular section and from which they take their name. Which of the following does not exist?	A. - S -
10.	What is the initial stage for laying a plasterboard wall?	A. tracking the position of the floor guide
11.	In a wall, where should the guides be placed?	A. floor and ceiling
12.	At what maximum center distance should we position the C-pillars of a wall?	C. 60 cm
13.	Where should the resilient band for acoustic insulation of the plaster walls be applied?	A. under the floor and ceiling guides
14.	How are the gypsum coated sheets fixed to the metal frame?	A. With phosphated self-tapping screws
15.	What is the optimal distance that the screws must have from the longitudinal edge of the slabs when screwing the slabs themselves?	B. 10 mm
16.	At what maximum center distance should the anchors for the "U" guides be fixed to the floor and ceiling?	B. 50 cm
17.	How far should the fixing screws of the plates penetrate the metal frame?	B. 10 mm
18.	We must make walls with 1 slab per side: at which maximum center distance should we place the screws for fixing the slabs?	B. 30 cm
19.	When laying a counter wall, what is meant by pre-coupled panels?	A. From the set of plasterboard and panel of a fibrous or plastic nature

20.	When laying double-sided walls on each side, how should the slabs be laid?	A. Staggered 60 cm between them
21.	In order to create an adherent wall by means of gluing on an uneven wall, in addition to laying the glue on the edges, must intermediate points be provided?	A. Yes, at a distance of 30-35 cm in the transverse and longitudinal directions.
22.	In the walls and counter walls, what size must the slabs have compared to the height of the room?	A. the slab must be placed on the ceiling and raised 1 cm above the ground
23.	In suspended ceilings, plasterboard panels are fixed in the following ways:	C. mechanical fixing only
24.	What is the direction determined for the installation of the plasterboard sheets on the false ceiling?	D. there are no determinants
25.	The intervals between the steel metal screws along the profiles in a suspended ceiling are:	C. 20 cm
26.	To distance the false ceiling from the slab, which type of anchorage must be provided?	C. hanger with spring hook
27.	What are the fillers that cannot be used for grouting the screw heads?	B. Both setting grouts and drying grouts
28.	Which of the following tapes is not needed to reinforce the joints between the slabs:	D. The armed gang
29.	In the construction of the joint, which of the following reinforcement tapes offers the best sealing performance?	A. The micro-perforated paper tape
30.	When making the joint, how should I correctly position the micro-perforated tape?	A. With the rough side facing the plate
31.	What is the characteristic of setting putties compared to drying putties?	A. are gypsum based
32.	If I made the first coat of grouting using a plaster-based grout, which grout should I use for subsequent coats?	D. It is indifferent
33.	How should I mix gypsum-based grouts?	A. by hand
34.	Indicates the correct way of grouting the 90 ° edges between plasterboard partitions	C. Edge protection profile in galvanized steel on a plaster or drying stucco bed
35.	Does the Q3 finishing level provide?	B. Fine-grained finishes, matt and fine coatings / paints….