

COTTO MANETTI



LAYING AND SEALING OF TERRACOTTA TILES



MANETTI
GUSMANO
& FIGLI

INDOOR TERRACOTTA FLOORING

GENERAL PROBLEMS AND LAYING TECHNIQUES

The general techniques that must be taken into consideration for indoor flooring projects are less demanding than the ones for outdoor flooring and they only involve the problems related to technical joints in special cases in which – depending on the considerable size of the surface to be floored and/or the particular working conditions of the floor itself – it is advisable to use expansion joints that can absorb variations in the flooring caused by temperature swings.

The joints that are left open between the terracotta elements (in correspondence with the technical expansion joints made in the sub-floor) should not be grouted with mortar or synthetic grout, but closed using specially-designed rubber strips or, better yet, with special sealing materials that can handle any deformation. For average-sized indoor flooring, it will be sufficient to prepare an open joint around the edge of the floor field near the vertical walls, which can be absorbed visually by the thickness of the skirting that is used. When particularly large floors are being laid, it is advisable to have technical joints every 6 to 8 meters, both lengthwise and crosswise. In general, it is important to note that the overall process involved in completing an indoor terracotta floor that can be utilised and enjoyed fully is based on a series of work phases that can be summarised as follows:

- laying the terracotta elements
- sealing the joints
- washing the floor field
- floor treatment

LAYING THE TERRACOTTA ELEMENTS

The phase involved in laying the terracotta elements generally begins once the masonry work and painting have been completed (with the exception of completing the Finish coat if necessary). With all types of laying, the elements must be laid in the direction of the groove. It is also highly recommended to mix tiles from different boxes and different pallets. In modern execution procedures, there are basically three alternative criteria related to the laying techniques used for terracotta elements:

1. Contemporary
1. Modern
2. Classic

1. Contemporary – Using synthetic adhesives

The first laying system is the one involving a gluing technique (using industrial products that have recently been introduced in building practices). This technique can be used on existent floors as well as on screeds that have been prepared especially for this purpose and have dried completely.

This system, which is particularly suited for restructuring and restoration work, offers the advantage of working with adhesives that have a low moisture content, thus making it possible to carry out final floor treatment after a much shorter amount of time than the other laying techniques described above. There are various types of adhesives available, but it is essential to follow all the detailed instructions given by the manufacturer. The main execution phases involve:

- Preparing a sub-floor (screed) that is perfectly flat to make it easy to keep the terracotta elements level with each other, since only a thin (3-5 mm) layer of adhesive is used (thus offering very little laying adaptability and tolerance).
- Cleaning the laying surface (thoroughly removing debris, dust, oil or other types of residue) once the screed is completely dry, before starting the actual gluing of the terracotta elements.
- Preparing a uniform layer of adhesive, using a special notched trowel to spread it in a layer that is 3-5 mm thick.
- Laying the terracotta elements so the timing corresponds to the quick setting of the adhesives being used, without letting the glue create a “film” due to prolonged exposure to air. The terracotta elements must be “thwacked” evenly on the adhesive – either individually with a rubber hammer or using a roller-vibrator machine over larger flooring areas – so that the gasket surfaces of all the terracotta elements are in contact and set with the glue.
- Preparing the “open” joints between the various terracotta elements according to design specifications (generally 4-5 mm), using special spacers if necessary.

2. Modern – Semi-wet mortar laid as a screed

The second laying system involves spreading bedding mortar over the entire surface to be floored (or, to facilitate optimum building-site management, over larger areas) in the form of a well-compacted and levelled semi-wet screed. More specifically, the main execution phases are as follows:

- Making the bedding screed for large areas of the flooring surface (thwacked and levelled with a “straightedge” so it is perfectly flat) that will have a tacky consistency and a thickness of at least 3-4 cm for the subsequent laying phases of the terracotta elements.
- Dusting an adequate amount of dry cement (cement powder) over the screed.
- Laying the terracotta elements after wetting them with water to facilitate consolidation with the screed, taking advantage of the setting action of the cement powder.
- Preparing the “open” joints between the various elements in terracotta according to design specifications (generally 3-5 mm), using special spacers if necessary.
- Compacting using a roller vibrator (in order to ensure complete setting and consolidation of the terracotta elements with respect to the bedding support) and wetting the laid floor.

3. Classic – With wet mortar laid immediately when the individual terracotta elements are put in place

The third system involves forming the screed and setting surface for the terracotta elements. This is done in a single operation. In essence, the leveling screed and the support surface used for setting the elements are completed at the same time. This is done immediately rather than working over a large area, so that the bedding operation of the rather wet mortar coincides with the process of laying the individual terracotta elements. In effect, the process is similar to the masonry technique used for fair-faced brickwork: the mortar is “loaded”, the terracotta element is laid and then the excess mortar is scraped away with a trowel. This criterion is suitable when laying large terracotta elements (over 30×30 cm) and above all when using handmade terracotta where, due to the greater and more evident shape/size tolerance of the different pieces produced using hand workmanship methods, it is advisable to use more flexible laying criteria that can adapt to the specific geometric aspects of each individual element.

The fact that the screed has not been spread completely flat over an extended surface area allows the layer to prepare a bedding thickness (together with alignments and joint spacing) that can adapt to the needs of each terracotta element. The use of cement lime mortar (instead of cement mortar) makes it possible to copy the laying methods and thus the appearance of the terracotta flooring that has been part of the glorious historical Italian tradition. This type of laying involves preparing “open” joints, according to design specifications, that must generally be at least 5-6 mm in width, using spacers if necessary.

SEALING THE JOINTS

Regardless of the type of laying technique being used, before proceeding you must wait at least 24 hours after the last phases involved in bedding the terracotta elements have been completed. The “grouting” operation completes the “rough” laying of the flooring that will remain visible. As we mentioned above, this is carried out by filling and compacting the joints that were left open when the terracotta tiles were laid. The joints can be sealed using two different kinds of specific preparations:

- cement-based mixtures
- industrially-prepared synthetic grout

Cement-based grouting

The use of cement-based mixes makes it possible to grout joints with a repetitive thickness (3-6 mm) that can also be larger based on design indications. In general, we can subdivide these joints into three size ranges: up to 5 mm, from 6 to 10 mm, and over 10 mm.

Joints up to 5 mm – For this type of joint, you must prepare a rather fluid cement grouting (composed solely of “325” grey cement and water) that is then poured over the flooring surface and spread particularly along the grouting lines using rubber-ended trowels until all the joints have been filled. During subsequent phases, the excess cement is cleared from the floor using a damp sponge and before the grouting has a chance to harden, river sand (fine, dry, clean sand) is rubbed carefully over the floor field using a medium-hard broom (broomcorn types are ideal).

This operation using sand serves two purposes: the first one is to clean off any cement residue through abrasive action, while the second one is to create a sort of “frame” for the joints (once the sand has adhered to the surface layer of the joints), thus mitigating any shrinkage in the initial mixture composed solely of water and cement.

Joints from 6 to 10 mm – With this type of joint (which we can consider average in size), you can proceed directly to mixing clean silica sand (100 lt), “325” grey cement (80 kg) and water. The mixture is then spread over the floor and at this point, again using a rubber ended trowel, it is carefully allowed to flow into the joints and is tamped down. Before the grouting material has hardened, a dry mixture of cement and sand is spread over the top and is rubbed vigorously over the floor field to consolidate the surface structure of the mortar joints and carry out an initial basic cleaning of the field.

This operation is completed by removing the excess mortar, cleaning the surface with a damp sponge and completing each individual joint. Joints of over 10 mm. The same procedure described above is used for this type of joint (not generally used in laying indoor floors). The only change is in the percentage of “325” cement (which is decreased to 50-60 kg for every 100 kg of sand) in order to minimize shrinkage of the cement inside thicker grouting.

Synthetic grouting

To complete the joints with pre-packaged mixtures, first of all it is essential to check the type of use that applies to the products available on the market. More specifically:

- the use of sealants free of synthetic resins or polymers that, once the work is completed, could create unsightly rings around the visible edge of the terracotta elements, ruining the evenness and beauty of the terracotta material used for the floor field;
- the use of sealants that are not characterized by an excessive contrast in the final colour arrangement with respect to the terracotta, both in terms of the maintaining a consistent shade of colour between the joints and the tiling as well as to make cleaning the residue from the surface of the terracotta simpler and more effective.

WASHING THE FLOOR FIELD

Before proceeding with final cleaning of the terracotta floor, you must wait for the entire floor “package” to dry completely and to release all the relative humidity created by the laying phase. We recommend:

- waiting about 10-15 days if the floor was laid with synthetic adhesives;
- waiting about 20-30 days if the floor was laid with cement mortar (in general, one week for every centimetre of thickness of the screed).

During this waiting period, any surface protection on the floor (used to proceed with other building-yard activities) must allow the material to breathe in order to get rid of any moisture it has taken in. Therefore, we recommend using paper, cardboard or other types of material that allow transpiration.

Once the material is properly cured, proceed with the initial washing. The goal of the cleaning phase is to intervene effectively (and permanently) on the floor in order to remove all foreign matter that could compromise full enjoyment of the flooring as far as appearance is concerned. This includes:

- traces of cement and residue left on the terracotta elements after the joints have been grouted
- calcium and saltpetre deposits caused by efflorescence of calcium salts contained in the bedding mortar or the grouting used for the joints
- enamel and synthetic paint stains.

Simultaneous removal of cement residue, calcium and saltpetre residues is generally done using buffered acid prepared for more or less concentrated washing at the building site; Enamel and synthetic paint stains can be removed using specific solvents.

The cleaning operation is the most important one in order to ensure optimum results during the subsequent (and final) phase involved in treating the terracotta. Cleaning can be done either with ordinary scrub brushes or with professional cleaning machines, such as single scrubbers or wet-vacs that can exert more penetrating action on the laid floor and above all, can quickly remove waste liquids, thereby making the entire operation faster and more efficient.

The operating sequence can be summarized as follows:

- Washing the floor with the above-mentioned acid solution, leaving it to act for 3-4 minutes; if the results obtained with an initial washing are not satisfactory, the operation can be repeated by slightly increasing the acid percentage of the solution and/or the contact time
- After these first few minutes, proceed by scrubbing the floor with scrub brushes or with a professional single scrubber in order to enhance the cleaning action of the acid solution
- collecting (vacuuming) and removing the acid solution that has been used
- Repeated rinsing with plenty of clean water
- Wait until the floor is completely dry

FLOOR TREATMENT

Once the floor has been cleaned thoroughly and it is completely dry (we recommend letting air circulate in the room even during the winter in order to allow the moisture to evaporate), you can carry out the final treatment phase (i.e. surface finish); this procedure is carried out in two phases:

1. Actual waterproofing of the floor using a water and oil protector (using liquid solutions);
2. Surface waxing (done likewise using liquid wax).

The anti-staining action of waterproofing protector is achieved by applying the product with a fleece pad or other appropriate applicator. Apply the product to saturation evenly in order to avoid – in the subsequent Finish phase – a differentiated absorption of the waxing products and,

consequently, an uneven appearance over the floor field; it is also recommended to start waterproofing from the point farthest away from the exit in order to avoid walking on the floor field before it is perfectly dry.

When these solutions dry, this generates an effective and long-lasting protection, invisible to the eye, which limits the absorption of water and staining agents into the floor. At the same time, this waterproofing acts (of course, if the installation was carried out correctly) as a barrier against the efflorescence of salts that can cause unsightly surface phenomena.

Instructions on exact application are usually furnished by the manufacturer, who will generally specify the correct way to use the product. Once the floor is dry, then proceed with the application of the liquid wax using a fleece pad or other appropriate applicator; wait one hour, then, if necessary, apply a second coat of product. The wax, to be chosen according to the aesthetic effect you want to give the material, allows you to achieve a matt or a glossy effect.

Forty-eight hours after the polishing emulsion has been spread, the floor is finally ready to be used. The floor field does not need to be polished since these water based emulsions polymerize as they dry, thus giving the floor a shine that is also water and oil resistant. Note that the wax can be used only in case of internal floor. Do not use it outside. In ending this brief illustration on the laying and treatment procedures required for all terracotta products without any kind of finish process, it is important to point out to those of you who prefer to speed up the total completion time that finished protected cotto is now available on the market.

This category includes Cotto Flash System produced by Manetti Gusmano & Figli, which represents the highest and most complete level of preventive treatment. In fact, together with in-depth protection, Cotto Flash System also features surface protection and a matt finish so that no expensive or special treatment is needed to finish the floor after it has been laid.

FLASH SYSTEM

Flash System is the exclusive treatment (sealing) method for interior developed by Sannini, and now used by Manetti Gusmano & Figli. It entails a complete cycle of working, using avantgarde techniques and products studied to preserve the terracotta's natural qualities as a sign of respect to the environment and its ecosystem. All materials used for the treatment of Flash are nontoxic, and being water-based, do not contain solvents. Essential feature of Flash System is its in-depth protection which guarantees resistance to stains, damp rings and efflorescence, although the original transpiring nature of the material is maintained.

As a consequence, this ready-to use Cotto presents itself with the colour and aspect of terracotta treated traditionally on site with acids and waxing. Such operations become superfluous since Flash products do not alter when laid if the mounting instructions are followed correctly. With Cotto Flash System, the floors take on a traditional aspect and tonality, attaining warm and transparent hues which only an expert hand would manage to achieve. The pre treated Cotto Flash System is available in all types of Finishes, both Machinery drawn and Handmade, and in different formats, for indoor use only. Instructions for use of Flash System floors are provided to customers.

OUTDOOR TERRACOTTA FLOORING

GENERAL PROBLEMS AND LAYING TECHNIQUES

Before we begin analysing the different laying techniques used for terracotta flooring, we feel it would be helpful to take a brief look at the design criteria used, or more specifically, at the problems and general aspects that should be taken into consideration and resolved effectively in outdoor flooring plans.

Completing the laying support

The laying support – as a set of layers that are specialized and differentiated both materially as well as in terms of the functional layers such as the foundation surface, any drainage or waterproofing layer, the actual laying surface (i.e. the screed) and the bedding layer – is undoubtedly the first element to influence the end quality of the flooring.

This is because it carries out a number of functions ranging from static functions to protecting the surface layer of the terracotta by preventing occurrences such as rising humidity, which would inevitably bring the salts contained in the soil or in the flooring layers to the surface.

The technological definition of this latter aspect must therefore be extremely precise and entails close examination with regard to the specific types that are being used (private or public flooring, areas designed for pedestrians only or for vehicular traffic) in order to take the particular operating conditions (loads) into consideration on an individual basis.

Particularly when defining the terracotta floor laying support, in outdoor applications it is essential to plan for efficient drainage in order to avoid trapping moisture that would otherwise inevitably provoke surface efflorescence and/or rings.

If these phenomena persist over a long period of time, they can even cause scaling/chipping of the tiling material when freezing occurs. A further condition that must be observed – and this involves geometric and technical aspects that are nevertheless connected with the need to prevent water and moisture from getting trapped on the laying surface of the floor field (even though they come from the outside environment in this case) – is to ensure levelness and suitable slope of the back surface of the laying support.

Slope

Apart from the type of laying technique that is utilized, when dealing with outdoor terracotta flooring special attention must be paid during planning in order to respond adequately to rainwater runoff. This is done by dividing the floor field into different drainage surfaces if necessary and giving them an effective slope and perfect levelness (without any settling).

This will avoid trapping water and moisture on the floor surface since they cause undesirable and unsightly effects due to rings, saltpeter efflorescence and dirt buildup. Moreover, trapped water is particularly dangerous in cold climates (especially in central and northern Europe), where frequent frost can cause harmful tension in the porous structure of terracotta products.

The following slopes are recommended for safety:

- small flooring surfaces: gradient > 1%
- large flooring surfaces: gradient > 2%

Expansion joints

Particularly when working with extensive surface areas (or when particular work environments are involved, such as extreme temperature swings), when steps are being taken for effective removal of rainwater, it is also essential to divide the overall floor field into compartments by preparing technical expansion joints in a crosswise and/or longitudinal direction (minimum 5-mm joints every five meters). This is done using top quality rubber strips or special grouting materials that can adapt to deformations in the floor field.

Treatment

For outdoor applications, we advise against doing any type of surface treatment on the terracotta. This is true above all for areas designed for intensive public use (such as squares, public pathways, landscaping, etc.) in which the considerable thickness of the terracotta elements will also ensure a high technological quality level.

When the floor is initially finished, air pollution and/or the inevitable transmission to the tile flooring field of substances contained in the materials used to complete the subfloor can generally cause a “ring” effect or surface staining that will gradually fade until they disappear, thanks to the characteristic transpiring nature of terracotta. Every year, it is a good idea to wash the flooring with water in order to remove any build-up of dirt and deposits caused by environmental pollution. At the same time, this will also restore the terracotta floor’s “breathability” and beautiful appearance.

For flooring intended to be used as an outdoor extension of living areas or public buildings (such as porticoes, covered terraces, surfaces protected by projections or roof overhangs, etc.), it is a good idea to protect the terracotta flooring as effectively as possible from moisture rising up from the ground by using adequate drainage and, if necessary, by waterproofing the screed with a damp-proof membrane or other materials. These floors (which are limited in extension and are protected to some extent) can also be washed every so often with acid or alkaline products, which will be sufficient to maintain the beautiful look of the terracotta.

Types of laying technique Laying techniques used for outdoor terracotta flooring are the outcome of well-established experience (whose historic roots go back to the Roman floors done in opus spicatum) and it has not been until just recently, with the introduction of new laying products to the market, that they have shown any significant updating and improvement as far as execution is concerned.

As mentioned for indoor terracotta flooring it is highly recommended to mix tiles from different boxes and pallets. In general, there are three laying techniques involved in the process of executing the floor as a whole, ranging from completing the sub-floor to preparing the bedding layer of the terracotta elements to how the joints are implemented.

These laying techniques envision:

- laying the terracotta elements on a cement-based screed (with completion of the joints using mortar)
 - laying the terracotta elements on a sand bedding layer (with subsequent sealing of the joints, again using sand)
 - laying the terracotta elements, again with a sand laying technique, but using joints that are large enough to be sealed during the final phase with liquid mortar rather than sand in order to protect the joints to some extent from water flowing through them.
- It is clear that of the three techniques listed above, the third one is simply a cross between the first two. As a result, below we will analyse only the first two techniques.

LAYING ON A CEMENT – BASED SCREED

The most widely-practiced solution is the one utilizing a screed made of cement mortar to form the setting support in contact with the terracotta elements. This is done in order to achieve a compact and resistant finished floor that can prevent any settling or buckling processes, particularly in demanding work conditions. The main phases are: Making the laying screed In order to lay the terracotta elements over mortar, a screed is prepared starting with a loose stone foundation (or more rarely, it is laid directly on the ground, depending on soil characteristics).

The screed, which must be thick enough for the working loads, must be well compacted and level, and it is made of cement mortar (325 cement and silica sand with a particle size of 0.3, in a proportion of 150 kg of cement for every cubic meter of sand). When making this screed (which can also be reinforced with electro welded metal netting if necessary), as we indicated above, it is a good idea to prepare adequately-sized technical expansion joints that can absorb any dimensional variations to which the overall flooring may be subjected, particularly as a result of broad fluctuations in temperature (especially when large floors are involved). These technical joints must be respected and reproduced in the Finish layer comprising the terracotta elements.

Laying the terracotta elements

Once the laying screed has been completed, the terracotta elements are laid down using synthetic adhesive or a semi-wet mortar:

- In the first case, the terracotta elements are glued to the screed using synthetic adhesive (see what has been said in reference to the criteria for contemporary laying for interiors, page 227, paragraph “Contemporary”). There are various types of synthetic adhesives available on the market which can be used, however, taking care to always follow the specific instructions given by the manufacturers.
- In the second case in order to ensure effective execution of the bedding phase, when the mixture is semimoist, the “dusting” phase is carried out (sprinkling cement powder over the surface of the screed). This is followed by the actual laying of the terracotta elements, which must be wetted adequately and positioned according to the design pattern along the open-joint bedding layer. (see what has been said with reference to the criteria for indoor laying, page 227, paragraph “Modern”)

Completion of the joints

The phase in which the joints are sealed – or in other words, the completion of the enclosing network structure along the perpendicular surfaces of the laying faces of the terracotta elements – is generally carried out using cement mortar (composed of three parts cement to one part silica sand with a particle size of 0.3) or cement lime mortar that must be quite fluid. The fluidity of the mortar being used is essential in order to tamp it down easily and effectively inside the network of joints, completely filling in the empty spaces without any breaks. The operation can be carried out through various procedures:

- Application with a trowel
- Casting using a jug and funnel
- Application using a “pastry bag” fitted with a metal tip

The last two methods make it easier to control the work sequence as far as clean workmanship is concerned, but the compacting action on the grouting material is less effective and therefore, a final operation is subsequently required to finish the joints.

Cleaning and finishing the joints

Even when the joint-sealing operation has been done in an expert fashion, the mortar inevitably overflow from the grouting “channels”, dirtying the floor field to some extent. A dry mixture composed of thoroughly clean fine sand mixed with a small amount (4-5%) of “325” cement is used to remove the excess cement. As soon as the grouting is done, this mixture is spread over the laid floor and is then rubbed vigorously with a medium-hard broom (broomcorn is ideal). This vigorous abrasive action removes the excess grouting on the terracotta flooring surface, while cleaning it at the same time.

LAYING ON SAND BEDDING

An alternative solution to mortar bedding involves laying the terracotta elements on a suitably prepared sand bed laid directly over the ground or on a more stabilized laying surface.

Making the sand bed

In this laying technique, the sand is “compacted”, smoothed and leveled to form an even layer that is about 5 cm thick (after final compacting, the thickness will decrease to about 4 cm). The tiles are then laid directly onto the sandy layer. Particularly when this type of laying technique is involved, it is obvious that the overall quality of the flooring will not depend solely on the characteristics of the terracotta elements, but to a great extent also on the sand and on the procedure used to make the bed that is going to act as a filter element between the tiling and the soil or between the tiling and the concrete screed beneath it. The composition of the sand is fundamental. It is important to point out that if the sand is too fine, it will take on a pasty consistency when it is damp. If it is too coarse, there will not be enough cohesion among the grains of sand. For optimum particle size, Fuller’s curve should be respected as closely as possible. In addition, the type of compacting done on the sandy layer is also important since the

degree of cohesion of the roadbed is dependent on this operation. It is essential to do this operation progressively in layers in order to achieve stable and dense compacting.

Laying the terracotta elements

As a rule, the tiling elements should be laid and then thwacked with a rubber hammer, being careful to leave open joints of about 2-4 millimeters between the various elements.

Completing the joints

The joints are then sealed using clean fine sand (with a maximum particle size of 2 mm) until they have been fully compacted. This operation is performed by spreading the sand over the terracotta elements, making it penetrate into the joints with a broom in order to seal them. After the flooring has been completed, this operation must be repeated several times, a few weeks apart. These joints prevent any movement between the terracotta elements while also ensuring adequate waterproofing against surface water. When working with flooring that has a considerable slope (more than 15%), you can use dry cement (5% by volume) mixed with the sand in order to improve consolidation and evenness in the grouting material.

At the end of the joint-sealing phase, the flooring must be compacted. This operation is done using a machine fitted with a steel vibrating plate (with a rubber bumper underneath), going over the flooring surface at least two times. The last phase involves wetting down the flooring by sprinkling water over it (sprinkling the water acts as a precaution against “washing” the sand out of the joints) in order to consolidate the floor as a whole. For flooring that entails more demanding conditions of use as far as working load is concerned, it is essential to make a screed that is thick enough for the planned working load. The screed is placed between the ground and the sand so the sand will abut with an already consolidated bed.

For terracotta flooring that is to be placed directly on natural ground, suitable “finished flooring” arrangements must obviously be prepared with effective drainage devices. The sub-floor in contact with the ground must be made with large stones, completing the upper layers with finer aggregates that will also help achieve the design slope of the floor field. In order to prevent the sand being used for the laying bed from gradually being washed away by rainwater and thus creating cavities (potentially causing buckling of the laid floor), a geo-fabric underlay can be placed between the sub-floor and the sand bed.

Herringbone textures (and in general, all patterns with crisscrossed grouting) are particularly effective for dry laying, since separating the joints into compartments affords better protection of the sand compacted into the joints. With this laying technique, it is extremely effective to plan adequate lateral edging, which helps resist against the pressure produced by the flooring when it is loaded. To achieve this function, concrete rolls can be set up in the subfloor, changing the laying orientation of the terracotta elements on the surface by means of a different floor texture pattern.