TOOLS FOR INSTALLING CERAMIC TILE

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INTRODUCTION

The striving of ceramic tile manufacturers is to reach customers through a product that competes in the marketplace, in terms of performance, design and price, with products made by the best manufacturers.

In order to obtain better products, manufacturers invest in laboratories to study clays, glazes, etc., in designs for new colours, compositions, shapes, etc., in marketing and studies on improving production processes.

However, between a manufacturer and his final customer stands a person, a professional, quite independent of ceramic tile manufacturers, who is responsible for installing this material: this is the TILE FIXER.

Customer satisfaction as far as ceramic tiles are concerned, wholly depends on the technical means and training of this professional, which is reflected in the quality of the work performed.

It is therefore obvious that the best ceramic products will not satisfy the customer unless they are correctly installed.

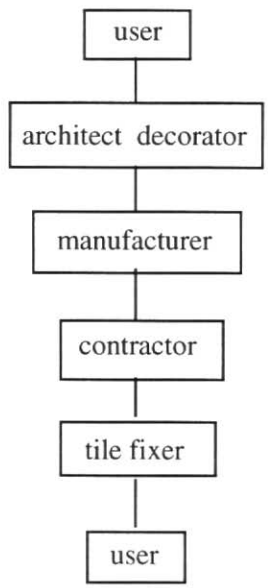
Some points follow, regarding issues to which insufficient attention is usually paid, but which are of importance for ceramic tile manufacturers.

1.- ANALYSIS OF CERAMIC MATERIALS FROM THE TILE FIXER'S POINT OF VIEW.

- Kinds of ceramic materials:
  * wall tile (twice fired)
  * floor tile (single fired)
- Physical characteristics:
  * weight
  * size
  * thickness
  * glaze thickness
  * uniformity

- Kind of customer:
  * private
  * industrial

2.- CERAMIC TILE INSTALLATION PROCESS, WITH RESPONSIBILITIES AND OBLIGATIONS



3.- TILER TRAINING

To date, in Spain, tile fixers have learnt their trade as masons, entering the building profession as unskilled workers and becoming tile fixers after years of continuous contact with the work. These workers lack a good theoretical/practical basis that will allow them to solve the problems that arise, which their experienced has not provided for.

Besides the initial training of these professionals, the existence of a Tile Fixers Association would also be very useful, in which ceramic tile manufacturers could participate for greater, direct communication between tiler fixers and manufacturers.

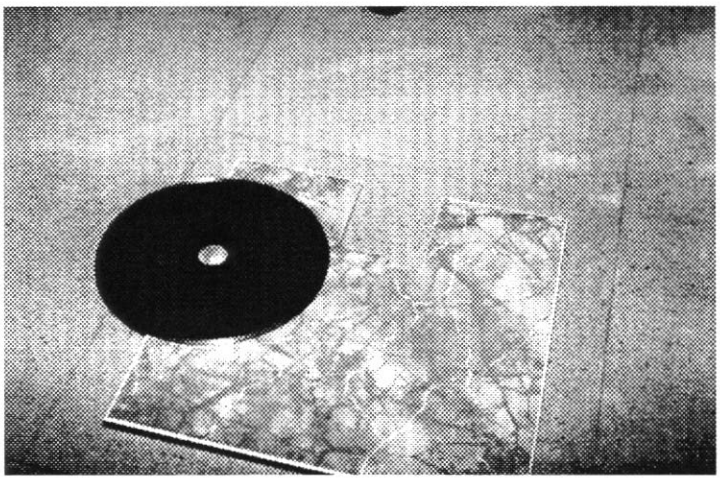
There is, in fact, no point improving ceramic quality day by day, whether in performance or design, if the quality of the installation carried out by the tile fixer does not resemble that of the materials used. The best ceramic materials will not show their excellence unless they are suitably installed.

4.- ADVANTAGES OF KNOWING AND USING SUITABLE TOOLS.

- The ARCHITECT/DECORATOR should know all the available means and tools for performing the work involved. Thus he will know the tile fixer's way of working and his means better, and will also be able to carry out more complex projects, knowing they can be fully executed. Designs can thus be obtained in which combinations of ceramic materials, shapes and colours, will improve classic or less complicated projects that have been executed, which suffered from constraints as a result of technical limitations in existing tools and materials.

- The TILE FIXER must be acquainted with the rapid evolution that has taken place in tools

and methods in his trade in recent years. The professional tiler needs on-going retraining in order to offer his customers new services, which were until recently quite impossible. This has now become possible through tools providing modern technologies using diamonds, or high precision conventional tools, whose performance involves errors of less than one millimetre. Examples are electric machines that can make very special cuts, diamond bits for drilling through stoneware, terrazzo, porcelain tile, etc.



- Fitted piece cut with a diamond disk.

There are, thus, a great many new tools and products, whose cost does not justify not using them, tools that help the tile fixer improve his performance as far as finishes and yield are concerned.

5.- MINIMUM TOOLS NEEDED BY THE TILE FIXER

The professional ceramic tile fixer needs to invest very little in order to carry out his work. This professional cannot justify lack of quality as being a consequence of the cost of his tools and utensils.

The tiler does not need to have any special premises of his own to do the work.

The tools used by these professionals are highly wear resistant.

The only major expenses are the initial outlay. A list of the minimum, essential tools a tile fixer needs for his work with a maximum assortment of utensils, has been drawn up below. These tools, and the tiler's professional skill allow assuring a correct installation.

- Electric cutter for special cuts	69.000
- Hand cutter for large sizes	39.900
- Electric percussion drill	7.000
- Diamond bit kit	29.080
- Widia bit kit	4.700
- Steel float	840
- Rubber float	1.250
- Notched trowel	840

- Trowel and pointing trowel	5.400
- Bucket and mortar box	2.000
- Mallet and chisel	4.500
- Rulers	1.500
- Level and plumb line	2.800
- Abrasive block	990
- Pliers for mosaic	1.850
- Knee guards	1.850
- Rubber pounder	670
- Mixer for ready-mix cement	2.000
- Spatula for wall tiling	620
- Tile spacers	225
- Adjustable bench	9.900
- Cleaning utensils and products	5.000
TOTAL Ptas.	191.915

Prices have been taken from different catalogues.

The maintenance required for these tools only involves replacing worn out pieces like scoring wheels, floats, chisels, etc. and the cleaning materials on ending the work.

Maintenance costs will depend on the amount of work performed. However, it is assessed at less than 5% of the profit obtained from the work.

As may be observed, the outlay involved in carrying out work in perfect conditions, offering maximum quality in performance, is quite reasonable.

6.- DEFICIENCIES:

- When the tile is being fixed
- After tile has been installed
- In maintenance

The level of performance expected by the buyer, and those offered by the manufacturer are the decisive factors at the purchase. However, it must be taken into account that ceramic materials require a link between manufacturer and consumer.

In the case of ceramic materials, the consumer does not immediately perceive the quality offered by the manufacturer, who only supplies the material, but it is through a professional of the building trade who installs it, that the user starts becoming aware of this quality.

This is directly affected by the quality of the installation. A defective installation will entail

rejection of that ceramic material by the user, be it of the highest quality, and he may even come to distrust the trademark, although it is possibly far from being responsible for the deficiencies observed.

The most important factors to be taken into account in installing tile are:

- the adhesives and ceramic materials used,
- the tools used to assure suitable installation, above all in special finishes,
- planning and design of the installation, which must be conceived in function of the use to which it will be put, and
- preparation of the background, respecting the optimum conditions for professional installation.

When it comes to choosing the tile to be installed, it is necessary to select suitable material, as a mistaken choice could lead to subsequent problems.

It is currently possible to choose suitable material for each of the multiple, different installations being executed, whether in wall or floor tiling, residential interiors or exteriors, public buildings or urban decorations.

It is also necessary to choose sizes and materials correctly, when putting together combinations that must match the function of the installation.

Ceramic tiling possesses qualities that allow us, besides benefiting from their aesthetic beauty, to also enjoy functional characteristics such as resistance to physically and chemically aggressive products and substances, thermal and acoustic insulation, and easy maintenance.

It may in summary be stated that selecting materials requires taking into account:

- function of the installation
- location of the installation
- special service conditions
- nature of the background material
- climate of the area

The defects arising from unsuitable installation of the material are usually detected after the tiling has been in service for some time. It is difficult to detect these defects on installing the tile, unless surface flaws are involved as a result of not using suitable tools in cutting or preparing special adaptations.

The most frequent, serious defects appearing after some time stem from defective bonding or rupture owing to lacking expansion joints. It is also common for pieces to become darker as a result of unsuitable jointing material or because of defective maintenance.

This kind of deficiencies in ceramic installation could be avoided by suitable tiler training, while at the same time avoiding harming the reputation of ceramic materials.

On suitably installing the material, it is important that it be used correctly, without any other performance being required than was foreseen, as there is otherwise a risk of spoiling it.

It is also necessary to mention possible restorations, modifications or amplifications of the work, which may affect the material, modifying bonding conditions, expansion joints, initial stress or

elasticity. The initial conditions must be respected so as to lengthen the service life of this material.

The deficiencies owing to inappropriate maintenance are mostly due to the consumer or person in charge of maintenance not being aware of the material's specific characteristics - information that should be provided by the manufacturer. He should supply directions for the maintenance of his material, as he will be aware of the class of products that are most suited better than anyone else.

As this is not always the case, the customer must worry about looking for and purchasing suitable products for maintenance or cleaning, which do not alter the characteristics of the material.

In the case of cleaning, it is necessary to know the origin of the stain, and use a product containing inhibitors to neutralize the effect of its application on the material. Choosing the wrong product can give rise to deteriorations or reactions that change the material's surface quality, whether in its appearance or its physical properties. This can cause it to become dirtier more easily, or give rise to changes in colours or shades. Thus, secondary, unwanted effects can arise by applying unsuitable products.

7.- MANUFACTURING DEFECTS AFFECTING THE TILE FIXER.

Most ceramic tile manufacturers prevent defective ceramic materials from reaching the consumer, by destroying these materials. However, it is always possible that some batch may get through the controls.

There may therefore be certain defects in the material, which make the tile fixer perform certain actions in an attempt to disguise them, or they may simply not allow him to do the job properly.

The defects leading to these courses of action can stem from shape, with tiles exhibiting wedging, differences in dimensions, warpage, lack of straightness in sides, curvature, etc. Some of these defects can be disguised by using a wider joint, giving rise to incongruence between tile size and joint.

The lack of calibration between the pieces is also a defect that is found in the market - differences of 2 or 3 mm, which means performing more measurements than should be necessary, losing more pieces during cutting, and especially, requiring more complex cutting equipment to be purchased in order to mitigate these circumstances.

Other defects that are harder to disguise are differences in colours and shades among the pieces. This irregularity means the tile fixer must make a great effort to combine the pieces in such a way as to attenuate this defect as best he can.

Excessively porous materials require applying protection before proceeding to fix the tile, in order to be able to clean the stains arising during tile installation, as well as subsequent protective applications for ease of maintenance of the ceramic material.

If the hardness of the material is not uniform, or if the ratio between body and glaze is not correct, or if there is any kind of component that favours a bad cut in the ceramic piece, the tile fixer must devote more time, tools, and ceramic materials to the work than he would with suitable ceramic material.

8.- MAINTENANCE OF CERAMIC MATERIALS.

The subject of maintenance of ceramic materials is usually a matter for the customer to look after. On the one hand, he faces a floor or wall stained by pollution, time, occasional accidents, or vandalism, painting or graffiti, etc., and on the other hand, an abundance of cleaning agents in the

marketplace to solve these problems.

At times a product is chosen to clean or protect a surface, which on being applied reacts with it, forming pastes or stains that are hard to neutralize.

On other occasions, products are applied that do not solve the problems, leaving everything just as it was.

The issue of the matter is not really knowing which product to use, owing to a lack of awareness of the characteristics of the material and the nature of the stain.

A simple classification would be as follows:

Source of the stain	**Cleaning product**
inorganic (dust from building activities, plaster, etc.)	acid
organic (dust from pollution,oil, etc.)	basic

There are other kinds of specific stains like tar, paint, etc. that require special cleaning agents.

When the basic material is delicate, as in the case of polished marble, it is necessary to use products containing inhibitors to protect the material from reacting with the product.

There are protective products available on the market for installations, which protect porous materials like rustic tiles when jointing these, so that the material will not become stained, making thorough cleaning of the material easy.

Surface protection has a double function:

- it serves to make it water-repellent, sealing pores and at the same time, as a result of the sealant,
- makes cleaning the material easy if it should become stained.

There are also cleaners for efflorescence in rustic tile, and some products also help keep it from reappearing.

It should be highlighted that it is polished ceramic materials which give the fewest problems as far as maintenance is concerned, especially if they are resistant to chemical attack.

It would be advisable for ceramic tile manufacturers to provide their customers with a list of products and advice on maintenance for their materials, as they can really best advise as to the most suitable products to be used for each kind of stain, protection, or effect, without leaving this task to the customer.

9.- OFFICIAL PRESENTATION OF THE STRESS MACHINE

As a result of the evolution in recent years in the development of ceramic materials, we have at its disposal a test laboratory, at which all the possible innovative needs or improvements in its products are studied, in order to assure their correct response to market demands.

With this striving, one of the main topics for study has been the behaviour of ceramic materials that appear on the market. In general, all the characteristics that can influence a correct separation of the piece, such as hardness, brittleness, homogeneity, etc., are studied.

For this purpose, we have built a testing machine designated the «Stress Machine», to enable the different kinds and classes of ceramic materials to be monitored, allowing it to continue modifying, improving and adapting the machines to the needs of the professionals in the trade.

- STRESS MACHINE

The Stress Machine has two important functions:

- studying the our cutters, using a standard ceramic tile as a constant, and
- studying the ceramic materials by the most representative hand separators, such as the TS, TM and TX range.

For this reason, the Stress Machine can perform two basic kinds of measurement:

1) Determining the multiplication factor

$$Fm = \frac{\text{Force exerted by the dolly}}{\text{Force applied to the driving lever}}$$

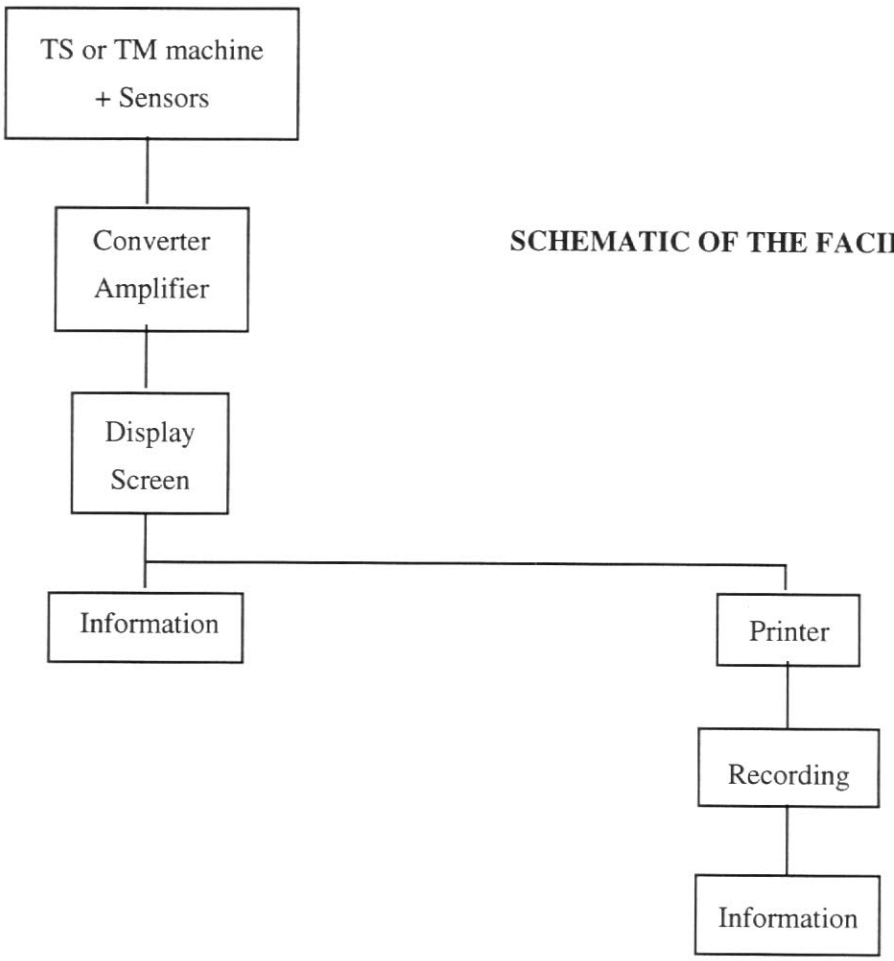
The variables being:

- thickness of the piece,
- angle of the driving lever and
- position of the separating lever.

2) obtaining plots of the breaking of different kinds of ceramic materials, determining the maximum forces exerted by the driving lever and the dolly.

- Instrumentation inserted in the hand cutters.

The whole system which will be described in detail below, has been applied to a TS-40 and TM-50 in a commuted form. Thus, verifications can be performed using two kinds of machines, which on carrying out the same functions, yield varying performances.



SCHEMATIC OF THE FACILITY

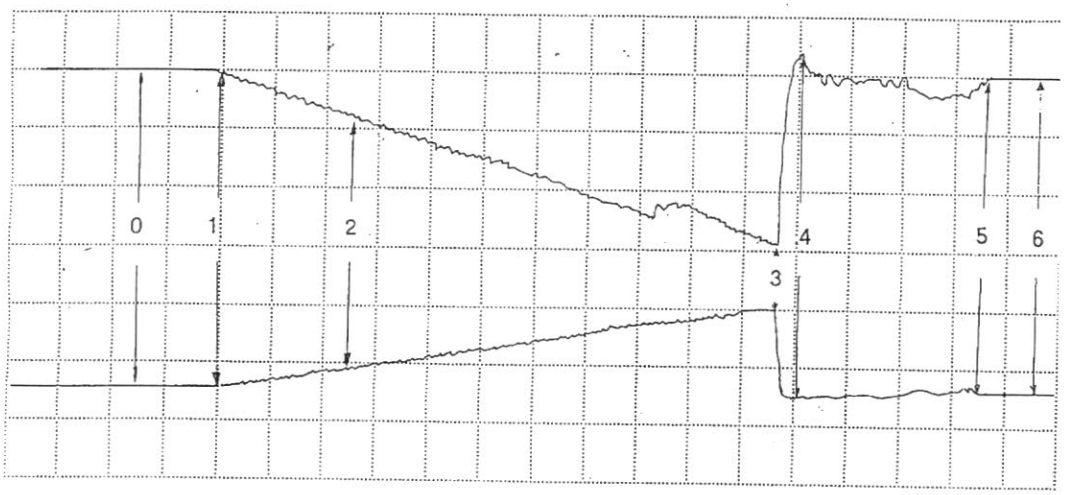
GRAPH No 1

SIGNALPARAMETER

CH1 - VOLTS/DIV: 2 V
CH2 - VOLTS/DIV: 2 V
TIMEBASE - SEC/DIV: 10 ms

SIGNALPARAMETER

ZOOMRANGE - CH1: 0-5
ZOOMRANGE - CH2: 0-5
HARDCOPY SOURCE: HM 20



Two strain gauges were located on the bottom lever, which quantify the stress transmitted in μE (micro-deformations), by the driving lever, through a signal amplifier.

The same kind of gauge was also located on the driving lever, however using a different calibration at the amplifier entrance, so that the μE exerted on the lever by the worker can be quantified.

The places chosen to locate the gauges are the points where the maximum stress is applied, by the worker (on the lever), as well as by the separator (on the dolly), so that information is provided from the first minimum stress found.

Two gauges were fitted to the assembly, in an intent to add up the effects of each, and obtain greater sensitivity and reliability when the information is provided in the display.

The signal produced by the cutter at the moment of separation, goes through two amplifiers that transform it from μE to mV. This signal is picked up by an oscilloscope with a storage capability, which, after transforming the mV to kgf, shows graphically how the stresses are transmitted, allowing the stress applied by the worker on the lever to be compared with that exerted by the dolly on the ceramic tile. The kgf required to cause the piece to break are also determined, as well as the evolution of the energy dissipation transmitted to the tile by the dolly.

The Tigger of the oscilloscope allows the evolution to be observed from the moment the operation is started, to the complete dissipation of the energy produced by the lever, that is, the return to a state of rest. The cycle is as follows:

Period

0-1 : rest situation, no force is applied.

1-2 : commencement of force application.

2-3 : maximum force withstood before breaking.

3-4 : breaking of the piece, the force decreases instantly with such inertia that deformation arises in the opposite direction.

4-5 : oscillation period. Total dissipation of energy in the form of vibrations.

5-6 : rest, energy is totally dissipated.

The time that elapses in the interval between period 0 to 6 is 150 ms. Only sufficiently sophisticated equipment, with a very finely tuned calibration will enable all the information detailed below to be obtained, as this kind of graph remains in storage, to be extracted via the printer that is also part of the assembly.

The following data can be obtained by means of these graphs and repeated tests:

* maximum force required by the worker to cause separation
* critical force beyond which separation of the ceramic piece takes place,
* study of the evolution of the fissure throughout the ceramic piece,
* homogeneity of the material throughout the piece,
* homogeneity of the material among different pieces,
* percentage assurance of correct separation,

* number of travels needed with the scoring wheel for correct separation,
* efficiency of the machine,
* etc.

Summing up, this procedure yields all the data required to decide if the material will be well or badly received by professional tile fixers, who are directly affected by the difficulty involved in cutting tile for correct installation.

With our experience in matters involving fixing and tools, we invite all ceramic manufacturers that wish to do so, to use our laboratory for this free service, only the cost of the material used to perform the test will be charged. It has been functioning regularly and has the confidence of the ceramic tile manufacturers that have used it, in Italy and Spain.

The report that is drawn up is wholly confidential, nor is any copy kept. It is submitted to the manufacturer requesting it, together with the pieces forwarded for testing, so that this service remains strictly confidential.