markSolid
european marking quality

MANUAL

Marking on Glass and Ceramic

User Manual

This manual describes the necessary measures and operations for marking on glass and ceramics, including the terms used in the specific product data sheets.

For detailed information and instructions you will need:

- this manual
- the product-specific manual and data sheet
- the product-specific safety data sheet

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Proceed as follows:

Preparation	of the surface to be marked and the product, as well as the personal protection measures
Coating	the surface with the product
Laser marking	the dried coating
Removing	the excess coating

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1 Preparation

1.1 Safe handling of the product - data safety sheet

We take your health and that of your employees very serious. Before using the product, please read the data safety sheet, which is based on the relevant statutory requirements and is constantly updated.

The safety data sheet provides structured information regarding all aspects of handling the product, such as potential hazards, first aid measures, handling and storage, personal protective equipment, toxicological and environmental information, and more.

Sections 7 and 8, which include information on handling, storage and **personal protection measures,** are particularly important for you as the user of the product. In general, avoid skin and eye contact with the product (gloves, safety glasses) and do not breathe vapors or spray mist. Only spray under suction and/or provide sufficient ventilation at your workplace and wear a respirator.

➔ For all important details, please refer directly to the safety data sheet. Should it not be available to you, **ask your supervisor for the safety data sheet**.

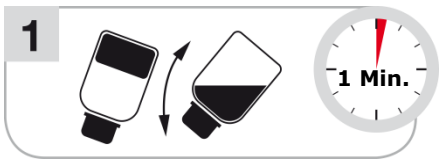
1.2 Prepare substrate or component surface

The product must be directly applied to the surface to be marked. Painted or other organic coatings or dirty surfaces cannot be marked.

- The surface to be marked must be free of dust, dry and free of grease. Cleaning with alcohol or acetone has proved to be effective, or use a detergent that is specifically made for this contamination. When choosing the cleaner, check its compatibility with the material to be marked.
- Sometimes parts have traces of silicone in some areas, which were left behind from the manufacturing process and are not visible. Such residues may adversely impact the marking result and might require special cleaners.
- An already existing transparent lacquer layer can be detected by a scratching test with a metallic scraper on a particular area. Because of the protective function of the coating, it should not be removed with solvents over a large area. To still achieve markings in "emergencies", you can try to remove the coating by engraving the exact same areas with the later marking in an upstream laser run. Pay attention to unwanted consequences (blistering, discoloration...)

1.3 Preparing markSolid Product - Storage - Dilution

1.3.1 Shake product

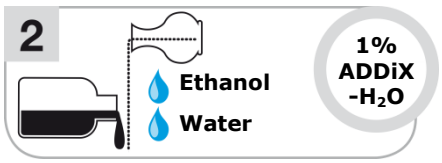


The product consists of a mixture of liquid and solids that can settle on the bottom of the container and over time thicken to a certain degree.

Shake the container until the solids are completely removed from the bottom and the container walls, and then keep shaking to break up possible thickened clumps which may still be present in the liquid. The time indicated on the label is only a guideline for the time required in normal case.

In most cases, this procedure is sufficient. After an extremely long shelf life - without occasional shaking in between - previous stirring makes the shaking of the product easier.

1.3.2 Dilute product



There are several reasons why a dilution of the product can be useful. Diluting can make the application onto the surface easier; some diluents also improve the wetting of the substrate surface.

The dilution does not generally have an impact on the finished marking, because the applied layer must be dry and therefore all liquid fractions must evaporate before the laser marking. Only the remaining solid component of the product is effective for the marking. Select a degree of dilution which enables *you* to work comfortably and with repeated accuracy with *your* application tool (e.g. airbrush).

Always mix the diluent and the product in a separate container, so the original container will not be contaminated.

For curved or slanted surfaces, it is advantageous to dilute less and rather to spray “dry” with excess air. This prevents a liquid coating from running down before it dries off.

On horizontal and flat surfaces, a higher dilution helps to ensure that, after drying, a thinner coating remains. This can be an advantage for "untrained sprayers", as the final layer thickness is built up over several applications and thus corrections are easy to do.

For the best results and the easiest handling, it is preferable that you use the recommended diluent. If the dilution is mixed with alcohol it often helps to improve the wetting of the substrate surface. Some water-based products, which may not be mixed with alcohol, ADDiX-H_2O fulfils the same purpose. ADDiX-H_2O is suitable for spray applications, but not for brush applications.

1.3.3 Store product

After the product is removed, make sure the container is sealed as quickly as possible. Do not dilute the product in the original container. Keep diluted products in a separate container.

Store the product free of frost, cool and in a dry place between 5 °C and 40 °C. The container must be always tightly sealed. Make sure that the product does not dry out. A dried-product can no longer be used.

For longer storage durations, occasionally check the liquid in the container, add more liquid if necessary (depending on the product, only with distilled water or alcohol, see liquid-base) and also shake the product from time to time.

When these measures are observed, the product can be stored with the same high quality for many months.

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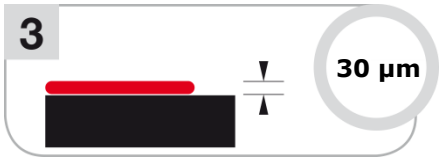
2 Apply markSolid Product

The application of the product is an important part of the marking process. The more evenly and the more accurately you apply the product onto the surface to be marked, the better results that you see. The principle "less is better" applies often in regard to the layer thickness.

2.1 Recommended layer thickness



In general, the marking process works better with thinner layers than with a thicker coating. Here, it is worth experimenting a little, since the optimal layer thickness depends also to a certain extent on the material to be marked and the laser used.

We recommend you start with the recommended dry layer thickness. This strength can be checked with the naked eye without any additional tools and adjusted accurately enough by coating the substrate until it is just opaque. A level, evenly covered layer corresponds to a dry layer thickness of about 30µm.

During the spraying with the airbrush, the surface is not visible from that point on. If at a later point, microscopic small uncoated points are visible in the dry layer, they will disappear during the laser marking and are a sign of the thinnest possible layer thickness.

In the end, the absolute layer thickness is not so crucial for a good marking result. It is much more important that the layer thickness is, as far as possible, the same across the entire area. For this reason, spraying is always preferable to brushing.

Thicker layers require more laser energy (higher performance or reduced speed) to achieve the same stability of the marking. Depending on the substrate, higher laser energy can also be detrimental because either the substrate or the laser marking material could be subject to thermal overload. In individual cases, higher thicker layers have the advantage that saturated colors or better covering markings can occur. However, a higher layer thickness can also be detrimental, as the raised markings pose larger/higher weak points to mechanically abrasive loads.

2.2 Application with a brush

Brushing is not suitable for glass, porcelain, or other glazed surfaces.

With a suitable substrate (e.g. unglazed ceramic), brushing can still be a viable application method for small markings. The surface to be coated should not be greater than the area that can be coated with a single brush stroke. A slightly higher selected dilution of the product makes the brushing easier in respect to a more even and thinner layer.

Very small areas (e.g., 5mm * 10mm) can still be easily coated with a soft hair brush. For larger areas, a wider and fine-pored foam brush is easier to use and also gets better results.

If the coat applied with a brush becomes uneven, brush strokes might be visible in the final marking, or chipping in some parts or other serious faults in the finished marking occur.

2.3 Application by spraying

Spraying is the recommended application method. Depending on the sprayer, it requires only a little practice to create even and reproducible coatings by hand. As the product is abrasive to the spray nozzle, use stainless steel nozzles instead of brass (d = approx. 0.3 to 0.8 mm) for your spray gun.

You can use *two different methods* to spray:

- Use a rather ***high degree of dilution***:
  Initially you will get a more liquid layer, which leaves a very thin coating of the solids after drying. This thin coating does not generally cover completely and the procedure may have to be repeated several times until you get a covering layer.
  Advantage: the step by step application of the coating can be controlled well and, in some areas, existing variations of the layer thickness can be easily corrected in the next step. The approach and optimization of the layer thickness is very easy with this procedure. This method helps beginners familiarise themselves with this spray application
  Disadvantage: This procedure requires more time because, in between applications, one has to wait for it to dry. Due to the excessive amount of liquid, this method works only for flat and even surfaces, which must be horizontal when spraying, so that the liquid layer does not run down on one side.

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- Use a rather ***low degree of dilution***:
  In a single step, you can apply a much larger amount of product solids at once. Uneven or inclined surfaces can be coated a lot easier because the sprayed product tends to run significantly less. This method requires more precise work, in particular one must move the spray gun at a constant speed over the surface, which requires some practice. Usually just one spray application of the required thickness is sufficient.

- Our recommendation: adjust the degree of dilution so that you can work with your gun comfortably and with repeated accuracy.

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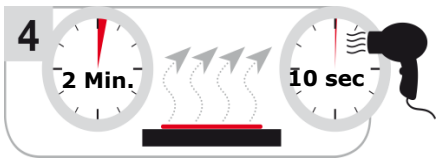
3 Drying the coated layer and properties

The coating must be completely dry before starting the laser marking. Coatings that are still wet cause erroneous markings e.g. limited durability of the marking.

3.1 Air drying

The simplest solution is to wait until the applied layer dries by itself. It usually takes 1-2 minutes when dried by air and no additional tools must be used.



Depending on the room temperature, the existing humidity and thickness of the applied layer, the drying time may be slightly shorter or longer.

3.2 Accelerated drying

A hot air blower (e.g. a simple hair dryer) can reduce the drying time by few seconds and is the easiest way to reduce drying time.

Heat radiators or simple ventilation (with room air) can also be used.

But beware: too much heat can cause the formation of tension cracks in the coating. These are visible to the naked eye and must be avoided at all costs as, during the marking, it will cause failure where the cracks are.

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3.3 Properties of the coating (prior to laser marking)

Depending on the product, the applied layer has different characteristics that must be considered for future handling.

Powdered	After drying, the solid components of the product responsible for the laser marking lie loose, without any special inner bond, in the form of a powder coating on the substrate surface. Powdered layers cannot be touched before the laser marking.
Light adhesion	After drying, the layer with the substrate surface and in itself have a low bonding, which will withstand a light touch with the fingertips but cannot be exposed to any strains.
Good adhesion	After drying, the coating is so durable that touching does not pose a problem and several parts can be stacked on top of the coated surface. A scraping, scratching load can lead to damage to the layer and must be avoided.

3.3.1 Remove excess coating (after marking)

The removal can be done manually or mechanically when dry, moist or wet. Some components are not allowed to become wet and other surfaces are susceptible to scratches. Therefore, select the method according to the requirements of the marked object.

Powdered coatings	Powder coatings can be removed dry (e.g. compressed air, brushes etc.), moist (e.g. wet cloth etc.), or wet (e.g. ultrasound etc.). Watch for dust formation when using the dry method and take appropriate protective measures.
Light adhering / well-adhering coatings	Adherent coatings can be cleaned with a damp or wet cloth. Unless otherwise stated, water is sufficient for this purpose.

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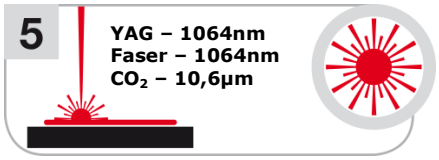
4 Laser marking

The physical and chemical processes during the laser marking are highly complex. In order to ensure easy comprehension, the terms and physical correlations used in the following chapters have been greatly simplified.

4.1 Substrates and laser that are suitable for marking



If you have an option to choose an marking laser and pick between the CO_2 laser and for example the YAG laser, you should pick the wavelength of 1064 nm (Nd:YAG lasers, fiber lasers, etc.). With these wavelengths, the optimal laser settings offer a larger working window and are therefore easier to determine.

Each material responds differently to the laser wavelength of 1064 nm of the Nd:YAG laser and 10.6 µm of the CO_2laser. In general, substrates like glass and ceramic absorb only a small portion of the laser energy at the wavelength of 1064 nm and are not heated directly by the laser.

This is different when using a CO_2 laser. The wavelength of 10.6 µm is usually very well absorbed by all substrates and therefore the laser energy directly heats the material of the surface to be marked. When using a CO_2 laser, the thermal load of the substrate is higher.

When using a CO_2 laser with sensitive materials, e.g. glass, the tendency toward the formation of thermal stress cracks is significantly higher. The working window becomes smaller because on one hand a minimum heat is required to "fuse" the laser marking material but, then again, too much heat can damage the substrate to be marked. Micro cracks can form in the glass surface, just like with laser direct writing. Even though they are covered by the colored markings, depending on the application, it can result in reduced operational strength.

However, this is not a reason not to mark glass with the CO_2 laser. But it does require more detailed work in terms of an even layer thickness during the application of the product and slightly more effort in searching for and optimizing the laser parameters.

In this sense, the most sensitive substrates include most types of glass, all glazed ceramic surfaces, such as tile or porcelain, enameled surfaces etc.

Less sensitive materials are quartz glass, unglazed surfaces, such as stone or technical ceramics, such as aluminum oxide or zirconia-based ceramics etc.

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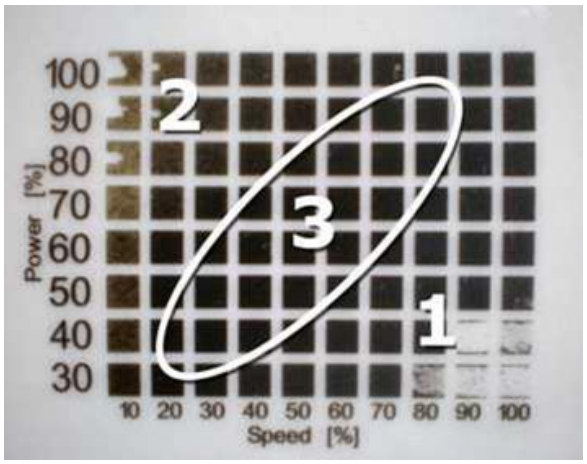
4.2 Laser settings and durability of marking



Laser markings create physical bonds between the laser marking material and the substrate through "fusing", and, stimulated by the introduced heat, they also create chemical bonds. Both bonding mechanisms require a certain "minimum energy" that must be provided by the laser.

- If the heat amount introduced by the laser is too small, these two bonds can only be partially formed or not at all and the best possible durability will not be achieved. **[1]**
- With increasing energy input, the bonds are strengthened until they are completely formed **[3]**. Thus, the best resistance is achieved while ensuring the lowest possible thermal load on the substrate itself.
- A further increase only leads to still greater heating of the substrate and does not provide additional benefits to the durability. [3→**2**]
- If the heat amount introduced by the laser heat is too great, it can lead to the destruction of laser marking material and/or damage the substrate. **[2]**

Knowing whether the best possible resistance for a marking has been achieved is therefore mainly influenced by the selection of the optimal laser settings.

The amount of heat introduced by the laser is set primarily by the parameter performance and speed; it is also influenced by the resolution (DPI, LPI) or spacing of hatches, which can reach an overlap of "laser tracks" depending on the device.

Focusing lenses with a shorter focal length usually produce a smaller diameter of the focal point and thus an increase of the energy density in the spot. Therefore, a smaller surface will be little hotter. From the viewpoint of the marking, this represents an increase of the applied laser energy with an otherwise unchanged laser power.

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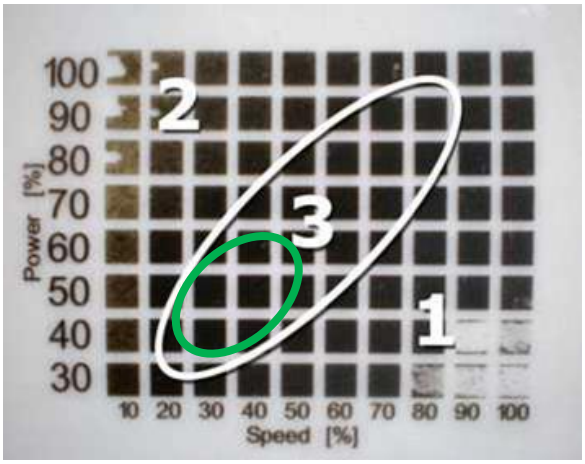
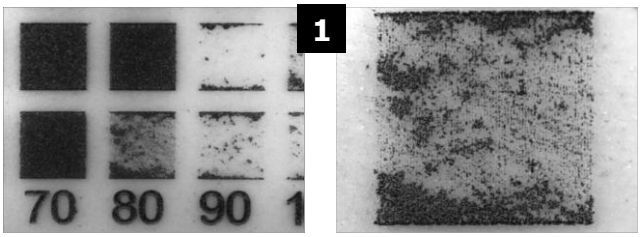
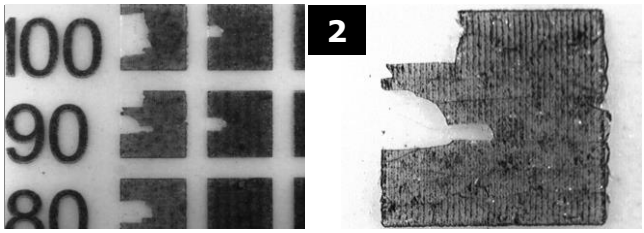
4.3 Evaluation and optimization of marking results

The picture shows a glazed tile, which is marked with small squared boxes in a test grid. The arrangement of boxes in the coordinate system with the marking speed on the horizontal axis and the laser power on the vertical axis, assigns a different combination of power and marking speed to each box. The entire possible range is shown from "**[1]** too little energy" to "**[2]** too much energy."

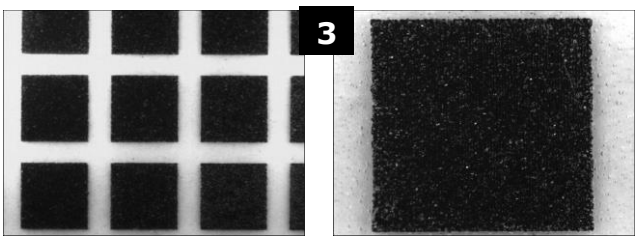




It is clearly visible that the energy introduced in range **[1]** with low powers and high marking speeds is not sufficient. The marking is only partially connected with the surface and is partially removed during the subsequent cleaning.



The selectively introduced amount of heat is highest with the highest performance and lowest speeds **[2].** The picture shows the already partially removed coating and the damage to the component surface by chipping of the glaze clearly.



The working window for good marking **[3]** is in between that, with smooth transitions to areas [1] and [2].

On brittle surfaces e.g. glass or glazed surfaces lower values for laser power and speed tend to result in better marks.

4.4 Special case - pulsed laser

For optimum marking it is necessary that the laser can provide the required thermal energy and introduce it mainly to the applied layer. From a physical point of view, the pulsed laser is not the best option for this task, as they generate heat mainly onto the area which they are focused on.

Expressed greatly simplified however, the pulsed laser is better suited to the prevention of heat input into the substrate by generating a (very) short-term and extreme overheating of the focused spot.

4.4.1 CO_2 laser

Pulsed CO_2 lasers produce with their pulses relatively small power increases that may even be useful for marking. To set the optimal laser parameters, start with deactivated pulse overshoot. Once you are satisfied with the results, you can check if other improvements (e.g. increasing the marking speeds etc.) can be achieved with the help of the pulse function. Major changes are not expected.

For marking in the vector mode a higher frequency setting is more favourable.

4.4.2 Nd:YAG and fiber laser

The ideal mode for this laser is the mode "continuous wave" or CW mode. This also corresponds to the Q-switch frequency = 0 Hz. In this mode, the laser beam generates uninterrupted heat that is required for the focused spot.

For better results during laser direct marking, these lasers are mostly used in pulsed operation. The lasers are therefore capable of generating short laser pulses of few nanoseconds in duration at a frequency that is typically between 20 kHz and 500 kHz. The energy can be significantly increased (e.g. 10,000 times or more) in a single laser pulse for a short time. On impact with the substrate or the coating, the material is instantly vaporized and thus the introduced heat dissipates at the same time.

The laser pulses immediately remove the coating that is applied with laser marking material, even before they can bond with the surface to be marked. If you cannot switch your laser from the pulsed mode into CW mode, you can try to "defuse" the pulses through appropriate settings (Quasi-CW) in order to to achieve a more uniform heat generation.

4.4.3 Quasi-CW for :YAG- and fiber laser

If your unit does not operate in CW mode or with frequency = 0 Hz, you should try the following:

- Select the highest possible frequency
- Set the pulse to the longest possible duration and the pulse pause to the shortest possible value.
- As a trial mark with different values for speed and performance.
- If the marking is not successful, see if the results can be improved by slightly defocussing it.
- Ask your laser manufacturer about the best way to set a quasi-CW operation.

Please note:
These instructions change the properties of your laser so that they are similar to those of a CW laser. It ultimately depends on the capabilities and features of your laser device whether these settings can lead to a perfect marking result.

5 Laser settings - examples

The optimal laser settings result from the interaction of the substrate with the product laser marking material and the laser marking device used. Unfortunately, for this reason, laser settings cannot be uniformly provided for product-based or substrate-based lasers available on the market. The settings listed in the following table refer to certain specified lasers below. Using these values, you can firstly convert the values to your own device and then proceed with further optimization of the settings as described in [4.3. Evaluation and optimization of marking results]

The examples of the laser settings were determined for the recommended layer thicknesses for the following devices.

CO_2 – 10.6 µm:

[C_1] Versalaser VL300, P-max=35 Watt, v-max=1500mm/s, f=1.5"

Nd:YAG – 1064 nm:

[F_1] fiber laser, beam source: SPI-G3, P-max=20W, f=163mm, BeamExp.=2.8

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CO2	CERAMIC				GLASS			
	P [Watt]	**v** [mm/s]	**dpi/ppi**	**Laser**	**P** [Watt]	**v** [mm/s]	**dpi/ppi**	**Laser**
CerMark								
LMM 6001p	8	1200	500 / 500	[C_1]	6	1200	500 / 500	[C_1]
LMM 6013p	16	900	500 / 500	[C_1]	6	750	500 / 500	[C_1]
LMM 6044p	8	450	500 / 500	[C_1]	6	450	500 / 500	[C_1]
LMM 6062p	12	1100	500 / 500	[C_1]	6	1100	500 / 500	[C_1]
markSolid								
markSolid 501	8	450	500 / 500	[C_1]	8	450	500 / 500	[C_1]
markSolid 551	10	400	500 / 500	[C_1]	7	300	500 / 500	[C_1]
markSolid 560	7	450	500 / 500	[C_1]	7	600	500 / 500	[C_1]
markSolid 590	10	600	500 / 500	[C_1]	10	600	500 / 500	[C_1]
markSolid-Industry								
KMM 70.7021	10	600	500 / 500	[C_1]	10	600	500 / 500	[C_1]

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Nd:YAG or Fiber laser in Continuous Wave Mode or Frequency = 0 Hz	CERAMIC				GLASS			
	P [Watt]	**v** [mm/s]	**Spacing of hatches**	**Laser**	**P** [Watt]	**v** [mm/s]	**Spacing of hatches**	**Laser**
CerMark								
LMM 6001p	7	300	50 µm	[F1]	6	350	60 µm	[F1]
LMM 6013p	7	300	50 µm	[F1]	6	350	60 µm	[F1]
LMM 6044p	7	300	50 µm	[F1]	6	350	60 µm	[F1]
LMM 6062p	7	300	50 µm	[F1]	6	350	60 µm	[F1]
markSolid								
markSolid 501	8	250	40 µm	[F1]	8	250	40 µm	[F1]
markSolid 551	7	350	50 µm	[F1]	7	350	50 µm	[F1]
markSolid 560	8	350	60 µm	[F1]	8	350	60 µm	[F1]
markSolid 590	8	350	60 µm	[F1]	8	400	60 µm	[F1]
markSolid - Industry								
KMM 10.9801	10	400	40 µm	[F1]	45	400	50 µm	[F1]
KMM 10.9802	8	500	40 µm	[F1]	45	500	50 µm	[F1]
KMM 70.5007	10	300	40 µm	[F1]	10	300	50 µm	[F1]
KMM 70.7021	8	350	60 µm	[F1]	8	350	60 µm	[F1]
KMM 70.7038	10	350	40 µm	[F1]	40	350	50 µm	[F1]
KMM 80.7047	*See data sheet*							

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Product Overview / Selection Guide

Marking on Metals

Aerosol Spray Cans

Liquid/Paste Products

Transfer Tape

Screen Printing

Information on aerosol cans

Marking on Glass / Ceramics /...

Liquid/Paste Products for Spraying

Aerosol Spray Cans

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Marking on Metals

markSolid products for metal marking produce permanent markings, highly resistant against mechanical and chemical strain as well as high temperatures (> 1000°C, depending on the metal). The products are suitable for use with CO_2 lasers and Nd:YAG and fibre lasers.

One of the most common uses is the marking of stainless steel. Furthermore, the products may be used for marking non-ferrous metals, precious metals, or metal coatings. Unless otherwise indicated, the products may be used universally and for various metals.

Determine the required laser settings depending on the metal to be marked. Stainless steel has the lowest requirements for the marking laser. Based on this, some metals or metal coatings require higher energy for marking. Equally, the rule of thumb applies: the better the heat conduction of the metal, the more energy required for marking.

Anodised aluminium holds a special position amongst the metals. The all-round metal marking products are not as suited for this or will not work with most types of anodised aluminium. Please use products specially developed for the marking of anodised aluminium.

Several options are available for the application of the marking material to the metal surface.

The most common and also most convenient method is aerosol coating.

Brushing is only a good alternative when the entire surface can be coated with only one brush stroke.

Spraying of the liquid/paste products, e.g. using airbrush, makes sense when coating larger surfaces in one work step.

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Aerosol Cans

Efficient Use and Comfortable Handling

The aerosol spray can allows for efficient, time-saving and very convenient application of the laser marking material.

This often makes the can the most economical solution. Set-up times due to thinning adjustments, preparation of the airbrush equipment and its subsequent cleaning are completely omitted.

A thinly applied layer - just enough for covering - is beneficial compared to a thicker layer. A thicker layer requires higher laser energy. A very thin coating will create lighter markings.

After completion of the laser marking process, make sure to remove the excess laser marking material.

The soft spraying system of the markSolid aerosol creates a smaller spraying mark and effectively reduces overspray.

Aerosol cans according to the *markSolid standard* automatically clean the valve and spray head and can be placed back on the shelf after use without requiring any care.

➔ See also "*Information on Aerosol Cans*"

Product	Colour	Intended Use	Characteristics
markSolid **114**	Black	**All-round** metal marking material, perfectly suited for stainless steel and other metals, including polished surfaces. The sprayed layer is powdery and easy to remove after the laser marking process. The benefit of a powdery layer is that the heat expansion of the metal underneath the layer never causes separation of the coating during the laser process and thus prevents subsequent marking errors. *markSolid 114 complies with the markSolid standard for aerosol cans.*	Developed for **highest durability at the same time highest marking speed** Very good blackening Highly reliably working aerosol spray can with excellent spraying characteristics
LMM **6000** *CerMark*	Black	**All-round** Metal marking material, preferably for stainless steel. For non-ferrous metals, lasers with higher performance are beneficial. The sprayed layer is dry to the touch after drying and allows the stacking of signs, etc. *LMM 6000 complies with the US standard for aerosol cans.*	**Dry to the touch coating** before laser markings Very good blackening and durability

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Liquid/Paste Products
Application with Airbrush or Brush

When applying the product, it is important to apply a thin layer as evenly as possible. For this reason, as an alternative to brushing, spraying (e.g. using airbrush) is always the better option. We only recommend brushing for small surfaces and only when it is possible to coat the entire surface with only one brush stroke.

A thinly applied layer - just enough for covering - is beneficial compared to a thicker layer. A thicker layer requires higher laser energy. A very thin coating will create lighter markings.

After completion of the laser marking process, make sure to remove the excess laser marking material. Use water for moistening. Solvents, etc. are not required.

Product	Colour	Intended use	Characteristics
markSolid **015**	Black	All-round metal marking material, perfectly suited for stainless steel and non-ferrous metals, except brass and glossy surfaces that are liable to a matting effect (in this case use the markSolid 026 or an markSolid aerosol can). The sprayed layer is powdery after drying and easy to remove after the laser marking process. The benefit of a powdery layer is that the heat expansion of the metal underneath the layer never causes separation of the coating during the laser process and thus prevents subsequent marking errors. After applying the product, the drying can be accelerated by means of hot air.	Developed for **highest durability at the same time highest marking speed** Good blackening Water-based product → can be diluted with water or Alcohol
LMM **6000** *CerMark*	Black	**All-round** Metal marking material for black markings, preferably for use on stainless steel. Higher laser performances are beneficial for non-ferrous metals. A coat applied with the Airbrush or brush is dry to touch after drying and allows a cautious stacking of pre-coated plates.	**Coating is dry to touch** before laser markings Good blackening Good resistance
markSolid **904**	Black	The solution to inexpensively mark **anodised aluminium** in large quantities or on large surfaces. Marks every type of anodised aluminium Airbrush is the recommended application method. Depending on the laser, slight defocusing may significantly improve the results. May require some training time and more precise application compared to the other metal marking products.	Good blackening Very good resistance Requires more precise work when applying the product (→ thin coating)

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Transfer tape

For manual application from the roll

Laser transfer tape is a self-adhesive roll of various widths which is simply stuck to the marking surfaces in the required lengths.

When marking, the laser transfers the colour from the transfer tape on to the surface to be marked. In the process, the marking from the transfer tape is "cut off".

After marking, the remaining parts of the transfer tapes are removed again.

Product	Colour	Intended Use	Characteristics
LMM **6018** *CerMark*	Black	We recommend the product for marking on **anodised aluminium**. In addition, it's also suitable for marking other surfaces. Usually liquid/paste or aerosol spray can products produce better results at higher marking speeds. The transfer tape can be an alternative in cases where spraying or brushing must not be used. Higher laser performance is beneficial. Otherwise, the marking speed could be very slow.	**Very easy handling**

Screen Printing

In screen printing, the laser marking material is only applied to those positions which need to be marked afterwards. For example, application is carried out as a rectangular area within which the marking takes place. After successful laser marking, the excess material is washed off.

Product	Colour	Intended Use	Characteristics
LMM **6012** *CerMark*	Black	All-round metal marking material, preferably for stainless steel. For non-ferrous metals, lasers with higher performance are beneficial. The printed-on layer is dry to touch after drying and allows cautious stacking of pre-coated signs in stock. The properties of the markings are like those of LMM 6000.	**Dry to the touch coating** before the laser markings Very good blackening Good resistance Kiln drying required

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Information on Aerosol Cans

For aerosol cans to create a clean spraying pattern and perfect coating, it is most important to provide a perfect interplay of the spray head, the liquid content, and the pressure ratio inside the can. The manufacturer coordinated these elements in the development of the aerosol can.

By considering a few basics regarding the handling of the aerosol can, you as the user will be able to maintain the aerosol's optimal characteristics over its entire life.

- Aerosol cans work best at normal room temperature. Allow enough time for the aerosol spray can to heat or cool to room temperature (e.g. after several hours of transport in the freight truck).
- An aerosol can cools itself during spraying due to the propellant gas expansion inside the can. For this reason, when spraying for a long time without noteworthy interruption, the pressure inside the can reduces and causes the spraying pattern to worsen after some time. When spraying very large surfaces, we recommend that you alternate between several spray cans to allow the cans to heat back to room temperature in between sprayings.
- When spraying, always push the spray head as far as it will go.
- Extended non-use of an aerosol spray can will cause the solid ingredients to deposit at the bottom of the can, in some products more than in others. Therefore, it is crucial to always shake the can prior to use for a while to allow the contents to properly mix again. After shaking for a few seconds, you will hear the mixing ball inside the can. Only then will the ball start to work. Do not stop shaking at that point but keep shaking the spray can for some time when the mixing ball is audible.
- Always shake aerosol cans with your hand, never with an automatic shaker. These machines are much too powerful and can cause damage to the inside of the can and consequently its premature failure.

markSolid Standard for Aerosol Cans

markSolid aerosol cans feature increased spraying efficiency and reliable functionality to the last drop. markSolid aerosol cans are manufactured in Germany and provide characteristics that help the user save valuable time and money:

- Two spray heads with different spraying properties (round and flat steel) allow for better adaptation to the surface to be sprayed.
- Spraying is possible even at short spraying distance. The smaller spray cone allows for economic use even with small surfaces requiring coating.
- After use, simply place the aerosol can back on the shelf. Spray head and valve do not require complex cleaning. Even the commonly required "upside-down clearing" of the spray head is no longer necessary. This saves time and does not waste any of the laser marking material.

CerMark Aerosol Cans - USA Standard

The reliable functionality of the aerosol can requires the user to consistently perform maintenance after using the can:

- Clearing the spray head and the valve, including the inlet tube inside the can, by holding it upside-down and spraying until only propellant gas without laser marking material leaves the spray head. Make sure not to waste unnecessary amounts of propellant gas.
- If needed, soak the spray head (nozzle) in warm water and then blow it through using compressed air.

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Marking on Glass / Ceramics / ...

The products produce permanent markings, highly resistant against mechanical and chemical strain as well as high temperatures.

markSolid products are generally suited for CO_2-lasers, Nd:YAG and fibre lasers. Due to the preexisting physical interaction of the laser at certain wave lengths with the material to be marked, a certain wavelength may be of advantage depending on the substrate.

Particularly with glass it is beneficial to use Nd:YAG or fibre lasers, as glass is almost fully transparent for their wave length of 1064 nm and the laser energy is only absorbed by the laser marking material.

Glass and ceramic surfaces often absorb the laser energy better at a wavelength of 10.6 µm of the CO_2-laser, which causes significantly stronger heating of the rough substrates. Therefore, when working with the CO_2-laser, the application window is slightly smaller and requires (repeated) accurate application of the layer and laser parameters coordinated with the layer thickness.

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Liquid/Paste Products for Spraying

For glass and ceramic marking we recommend product application using airbrush. Brush application would cause uneven layer thicknesses, which would significantly compromise the quality of the marking result.

It is most important to apply the product in an even layer. The laser parameters will then be optimised for the thickness of the applied layer. We recommend that you start with very thin layers. It is easier to find optimal laser settings for thin layers. Thicker layers create better coverage, but they also require more energy for marking. A layer thickness that is just thick enough to evenly cover the surface is ideal to begin with.

Unless otherwise stated, all products are suited for the marking of surfaces of glass/ceramics/enamel/porcelain/cast stone/etc. Natural stone is problematic due to the often very inhomogeneous properties of the natural product - at least from the perspective of laser marking.

Product	Colour	Product Characteristics	Special Notes
markSolid **501** *(old product name: markSolid 098)*	White	Strong white markings, good coverage even on dark surfaces. Chemically and mechanically highly resistant. Dishwasher proof, also suitable for commercial applications	Nd:YAG or fibre laser recommended
markSolid **551**	Deep Blue	Beautiful cobalt-blue markings, high mechanical resistance, however limited chemical resistance. May darken in alkaline environment May bleach in acid environment	Nd:YAG or fibre laser recommended
markSolid **560**	Green	Chemically and mechanically highly resistant markings Dishwasher proof, also suitable for commercial applications	Good for CO_2- and fibre laser
markSolid **590**	Black	Chemically and mechanically highly resistant markings Dishwasher proof, also suitable for commercial applications	Good for CO_2- and fibre laser
LMM **6044p** *CerMark*	Black	Dishwasher proof, suitable for household applications	Good for CO_2- and fibre laser

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Aerosol spray cans for labels on glass/ceramics/...

Spray cans enable timesaving and work to be carried out in comfort and are often also a very economical solution.

Set-up times, due to thinning adjustments, preparation of the airbrush equipment and subsequent cleaning, are completely avoided.

Also, please note the above "Information on Aerosol Cans".

Product	Colour	Product Characteristics	Special Notes
LMC **6044p** *CerMark*	Black	However, like LMM 6044p the aerosol can requires a slightly thicker coating, which creates a good opaque marking on glass and ceramics. Due to the thickness of the coat needed, the product is less suitable for thin and delicate structures. For these reasons we recommend the use of a liquid/ paste product. *LMM 6044p is a CerMark aerosol can and complies with US standards.*	Good opaque black markings

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markSolid Products for Industry

By this we mean products developed for specific, limited applications and used in industrial manufacturing processes. However, the products are not limited to these applications. Most products can also be used to mark other substrates.

A wealth of colour gradations is now available, each developed based on a customer template.

An existing logo, e.g., on an original ceramic, can serve as a colour template. Likewise, a color shade according to RAL can be defined as a target.

Colour measurements, e.g., in the CIELab colour space, help with an objective assessment even at spatially separated locations.

Contact us and let us advise you.

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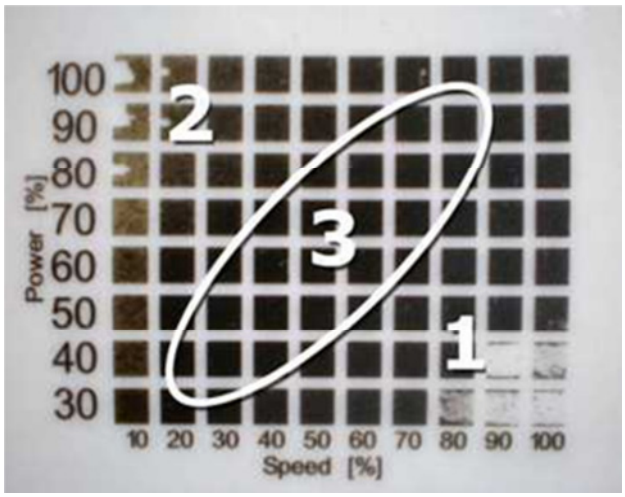
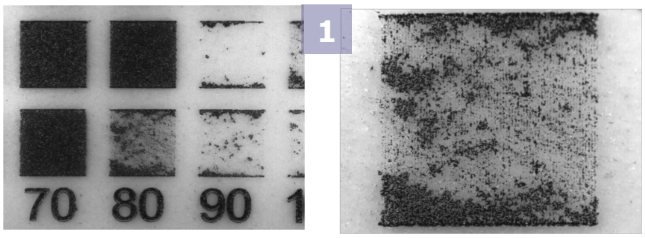
Optimization of laser parameters

The markSolid process is a thermally activated process. The result is a permanent bond of the Laser Marking Material with the surface to be marked.
The process of marking only takes place when a certain amount of temperature is transported by the laser. The result will be a physical and chemical fusion. Too little power leads to the LMM not bonding at all with the surface or only in part **(1)**. Likewise a "too much" of power causes the LMM to be removed and may lead to damage to the substrate surface **(2)**. The working window of good marks **(3)** lies in between.

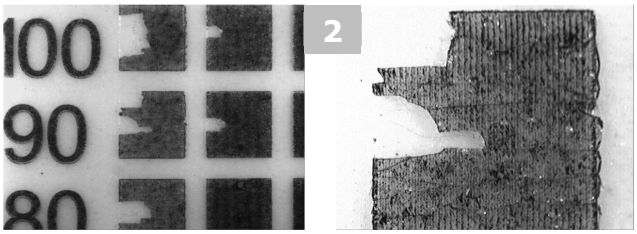


Evaluation of the results

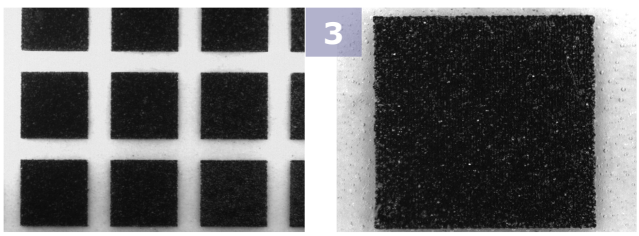
The laser parameters vary from square to square. The depicted test screens show the varying speed processes in the X-axis and the CO_2 laser marker power in the Y-axis.



It is easily recognizable that in the area (**1**) with the lower power and higher speed in process the energy supplied was insufficient. The LMM is not sufficiently fixed to the surface and could partly be removed upon cleaning.



The energy amount is at its best **(2)** when the highest power and lowest speed is applied. The failure of the LMM and damage to the surface of the component is well recognizable in the picture.



The working window for good and permanent marks (**3)** lies in between, with the lines flowing.

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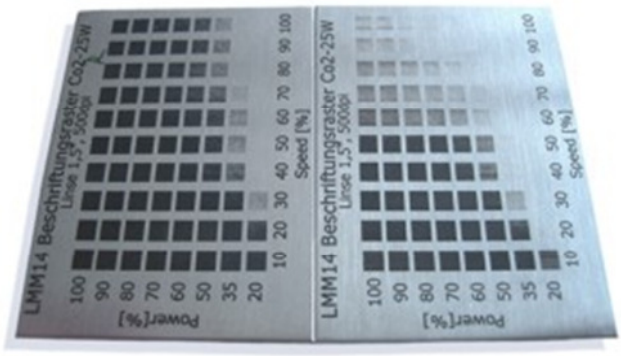
Best durability

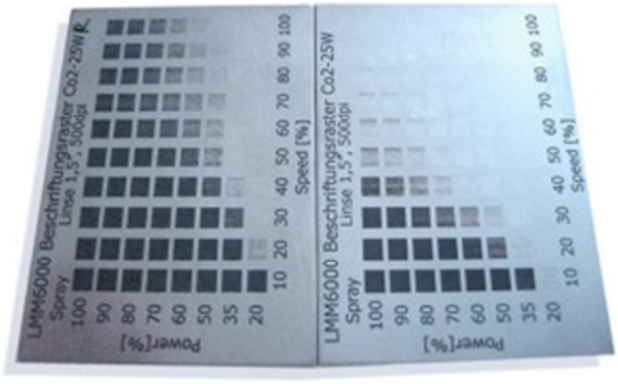
The Laser Marking Materials generally offer a great working window. The width of the usable working area is, however, depending on several factors.

- If the substrate to be marked is a good heat conductor, e.g. aluminium, higher laser energy (less processing speed and/or higher power) is required.

- The more intensive the substrate reacts on the laser wavelength (e.g. glass reacts very sensible to the CO2 laser radiation) the lower the laser energy should be applied. For a good result a carefully and evenly applied thickness of the LMM coating is especially important

- Strong wear and tear of markings remain in proper condition when made with the highest possible energy within the recommended working window. Compared to those, markings are less stress able when produced with lower energy.





Both pictures show 2 stainless steel tags marked with different laser settings:

Left tag is before and right tag is after 1 week exposition to aggressive chemical environment.

Both pictures show a test screen before and after setting out to a chemical reaction. It can well be recognized that the most consistent markings were produced with parameter combinations in the area of lower speed and higher power.

As a rule markings are tried to be made as quickly as possible and normally a parameter combination will be chosen of higher speed in process (and thereby lower energy). However, in order to receive a most resistant marking a parameter combination with a higher energy input should be chosen.

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