markSolid

User Manual

markSolid 114

Black Marks on all Metals

Important to know:

➔ **Shake can well before every use**
Don't stop shaking, once you can hear the pea inside the can, because this is the moment when it starts working and takes care of producing a homogeneous suspension. Subsequently, shake for at least twice this time. **The spraying can must not be shaken in an automatic shaker!**

➔ **Keep the spray can as upright as possible whilst spraying**
Within the can, a dip tube can be found which leads from the valve to the bottom of the can. It is very important that the dip tube's lower end is always dipped in the liquid within the can. When the can is partially empty and is kept horizontally, there is the risk of the dip tube aspirating only the propellant gas instead of the liquid content. This leads to breaks in the sprayed coat and it may be possible that the spray can cannot be emptied completely due to the early exhaust of the propellant gas.

➔ As soon as you have finished spraying **do not operate the can upside down** trying to clean the valve and nozzle. The spray can is equipped with a self-cleaning valve. Upside down operation could cause stained nozzles and subsequently an impairment of serviceability or the loss of propellant gas.

➔ Make sure, the **spray can has room temperature** while using. The gas pressure in the can is adjusted for best spraying results with room temperature. During the storage in a cold storeroom, the gas pressure in the spray can decreases and accordingly the characteristics of spraying can change. Similarly, continued spraying for a long time (e.g. for large areas) can lead to the can's refrigeration and according to this, the gas pressure will decrease. When receiving the spray can in winter by the postman, please let it warm up to room temperature before you start working with it. As well, coating by continued spraying for a long time (e.g. coating of large areas) can lead to cooling the can and in succession to decreasing pressure of the propellant gas within the can. Therefore cover very large areas in several sections or work with two spray cans in turn.

➔ markSolid 114 works with all **marking lasers** which are industry standard and work with a wavelength of 10,6µm (CO_2) or 1064nm (Fiber-, Nd:YAG-Laser). When working with YAG- or fibre lasers choose the „CW" (= **Continuous Wave** resp. frequency = 0 Hz) setting. If CW is not available then start with highest possible frequency and also try slightly defocussed laser beam. In case of doubt please contact your laser device manufacturer.

How to proceed:

1. The **metal surface** must be clean, dry and free from grease. When indicated, clean with alcohol or acetone.

2. **Shake the aerosol can for an adequate period of time**.
   During a longer period of non-usage, it is possible that the aerosol can's light and heavy contents divide from each other. Sufficient long and intense shaking causes the regeneration of a homogenous suspension. After some seconds of shaking, you will hear the pea in the can for the first time. After this point of time the pea supports the mixing of the contents. **Don't stop the shaking** as soon as you hear the pea in the can for the first time! Shake at least twice as long from this point of time.

3. **Choose the most suitable nozzle**.
   The markSolid 114 aerosol can comes with two spraying nozzles, creating a circular or alternatively an elliptical spray spot. The angle of the elliptical spraying nozzle is infinitely adjustable at 360° for an optimal adjustment to the coating job.

4. **Coat the metal surface**. Take care to hold the can as upright as possible, especially with regard to emptying cans, to make sure that the dip tube at the can's bottom will not stick out of the liquid. When indicated, put the area, which is to be coated in an upright position, to be able to use the can as upright as possible again.

5. **Lead the spray jet over the surface as smooth as possible**. Keep the nozzle pushed while changing direction and pay attention to do this only outside the area which is to be coated.

6. **The coat should be very thin, barely enough to cover the surface**. This is equivalent to approx. 30 µm thickness of the dried layer. Layers which are too thick cause a higher laser energy, thin layers in turn possibly lead to brighter marks. Thicker layers, which have been marked with adjusted laser power can show a higher chemical resistance under several circumstances, yet there is danger that mechanical resistance may be slightly reduced.

7. **Dry the marking material before you begin marking**. Exposed to the air one or two minutes are enough. A warm air blower reduces the drying time to a few seconds.

8. **After marking remove the excess product** with a damp cloth or in water (also ultrasonic cleaning is possible).

Optimising laser parameters:

For determination of the correct laser parameters the knowledge about some basic contexts is helpful:

- Well thermo conducting metals lead the absorbed laser energy very fast to the inside (e.g. aluminium alloys, brass, copper, …) and therefore afford a higher laser power and/or a reduced marking speed.
- Due to their structures, „refined" surfaces (e.g. chromed, nickel-plated) and even high-alloyed steel grades need a higher energy to achieve a good and permanent result.
- Lacquered surfaces cannot be marked, as the marking material has to be in direct contact with the metal surface. Every "non metallic" coating impedes the marking.
- In general, subsequent context is valid: if the mark is removable, the laser energy has to be increased. Normally the mark will occur darker and more permanent the more the energy increases, until an optimal result is existent. A further increase of application of energy beyond this point may cause a pejoration of the result.

Example stainless steel: With too low laser energy, the mark is removable. More laser energy leads to an enduring mark which will have a greyish look. Only an increase in power leads to a permanent black mark with optimal durability. A further increase of application of energy would cause first bright annealing colours in the marking area, which brighten the mark and let it look brownish. It is possible that annealing colours can change the characteristics of stainless steel, e.g. a higher danger of corrosion.

Examples for laser parameters with CO_2-plotter systems and YAG/Fibre lasers

CO_2-Laser: P= 35 Watt =100%, V= 1.500 mm/sec =100%, f= 1,5"

substrate	*power*	*speed*	*dpi / ppi*
stainless steel 1.4301	90 %	30 %	500
aluminium	100 %	10 %	500
brass	100 %	15 %	500
chrome-plated metal	100 %	10 %	500

YAG/Fibre laser: P= 20W =100%, f= 160 mm, operation mode =CW (Continuous Wave or f= 0Hz)

substrate		*power*	*speed*	*hatch spacing*
stainless steel 1.4301	*)	40 %	300 mm/s	40 µm
stainless steel 1.4301	**)	100 %	600 mm/s	40 µm
aluminium		80 %	125 mm/s	40 µm
brass		90 %	100 mm/s	40 µm
chrome-plated metal		60 %	150 mm/s	40 µm
high-alloyed steel		50 %	200 mm/s	40 µm

*) parameter for blackest marking **) parameter for fastest marking speed

Systematic approach for adjusting and optimising the laser parameter

For example: for a CO_2-lasers (plotter systems) with approx. 50 Watt and fibre- resp. YAG-lasers in power range approx. 20 Watt to 50 Watt:

STEP 1: Start with approx. 2/3 of laser power and approx. 1/3 of maximum marking speed. If the mark is durable, continue with step 2.
In case of removable marks, increase the laser power to 100 % and repeat the test. If the mark is still removable, you should reduce the marking speed for the next tries significantly, until you receive a durable result.

STEP 2: Determine the values for maximum and minimum marking speed for the adjusted laser power. Use the following approach:
Increase the marking speed initially in bigger, and later in smaller steps as long as either the marking colour is brighter or the mark is removable again. When indicated, reduce the laser power in time to work just below maximum speed.
Now reduce with given laser power the marking speed initially in bigger and later in smaller steps as long as you recognize a pejoration of the result.
This depends on the material, normally the colour changes from black to the brownish or the mark starts to change it's look strongly when examining at different angles of light exposure.
The optimum marking speed (in respect of darkest black and durability) is reached shortly before change happens.

Optimising: Based on this adjustment you can now increase power and speed in small steps as long as your laser marking device's maximum capacity is not exceeded. Possibly you will notice even before that the marking process will not allow any further increase in power or speed.

This manual is a recommendation how a systematic search for the right laser parameters can look like. In fact, some laser marking devices support and simplify with each own functions the determination of optimal parameters. Use the functions which your device supports and receive the optimal result even faster.

Further documents and basic useful information:

- MSDS_markSolid-114.pdf — material safety data sheet
- Laser_Adjustment.pdf — laser adjustment by test grid
- QuickStart_Spray.pdf — three steps to the complete mark