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Stamark™ Pavement Marking Tape and Liquid Pavement Markings

Application Guidelines for Pavement Markings in Grooved Pavement Surfaces

Information Folder 5.18 Grooving Applications **May, 2011**

Replaces IF 5.18 Dated August, 2009

Description

Grooving the pavement surface of a road or highway provides an alternative method for installation of 3M™ Stamark™ Pavement Marking Tape and 3M™ Liquid Pavement Markings (LPM, All Weather Paint and All Weather Thermoplastic). The benefits of grooving include enhanced protection of the pavement marking and retroreflective beads from snowplow damage in northern climates. Grooving extends the service life of the pavement markings.

This information folder lists the recommended procedures and application guidelines for completing a grooving application for products mentioned above.

The following sections can be found in this information folder:

I. Groove Specifications
II. Equipment Alternatives and Surface Texture Recommendations
III. Application Guidelines
IV. Measuring Groove Depths
V. Surface Wetting Test

Follow the detailed application instructions for "Overlay Applications" in 3M Information Folder 5.7 Pavement Surface Preparation and Application Techniques for Stamark tapes when applying pavement marking tapes in a groove.

All weather and climate conditions for the specific pavement marking product (liquid or tape) must be met before application into the groove.

For situations not specifically covered in this information folder, or questions regarding application of 3M products in a groove, it is the responsibility of the installer to contact the appropriate 3M Sales Representative or 3M pavement marking Technical Service Representative at 1-800-553-1380 for guidance.

I. Groove Specifications

Figure 1 shows a typical section of a pavement marking in a groove with the required groove width and depth indicated for both liquid and tape pavement markings.
(1000 mil = 1 inch)

Note: See Tables A and B for specific pavement marking type recommendations.

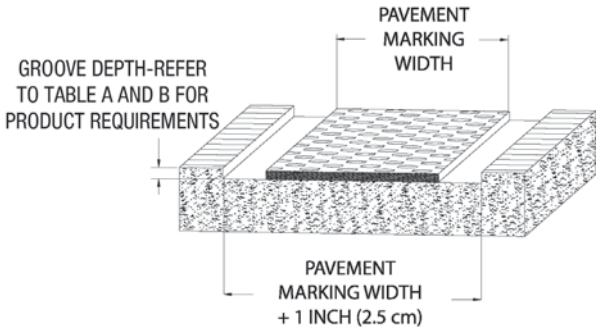


Figure 1 – Groove and Pavement Marking – Typical Section

Groove Depth
As shown on Figure 1, the groove depth should be cut according to the values recommended shown in Tables A and B below.

Table A UNIFORM GROOVE DEPTH

Pavement Marking Material	Required Groove Depth	
	Minimum	Maximum
3M™ Stamark™ Pavement Marking Tapes (Series 380 IES, 390, 270 ES, 310	100 mils (2.54 mm)	200 mils (5.08 mm)
3M™ Stamark™ Pavement Marking Tapes Series 380AW	110 mils (2.79 mm)	200 mils (5.08 mm)

Table B UNIFORM GROOVE DEPTH

Pavement Marking Material	Required Groove Depth
3M™ Stamark™ Liquid Pavement Markings Series 1000 w/AASHTO M247 beads	40mils (1.02 mm) Minimum
3M™ All Weather Paint with All Weather Elements	60 mils min. (1.52 mm) 80 mils (2.03 mm) for max retained reflectivity
3M™ Stamark™ Liquid Pavement Markings Series 1000 w/large beads AND Series 1400 Polyurea or Epoxy binder with All Weather Elements	60 mils min. (1.52 mm) 80 mils (2.03 mm) for max retained reflectivity
3M™ All Weather Thermoplastic or MMA with All Weather Elements	Minimum 30 mils in addition to binder thickness (0.76 mm + binder thickness) For maximum retained reflectivity - 40 mils in addition to the binder thickness specification. (1.02 mm + binder thickness)

Note: More aggressive traffic or climate environments may require deeper grooves.

Groove Width – Longitudinal Markings
As shown in Figure 1, the typical groove width shall be one inch (2.5 cm) plus the width of the pavement marking. A groove two inches (5 cm) wider than the pavement marking width is sometimes preferred to allow for ease of straight tape application within the groove. The extra width also allows for improved tamping of the edges of the tape. Narrower grooves may provide additional protection to the pavement marking, but extra care must be taken to cut straight grooves that will allow for a straight alignment of the pavement marking installed in the groove.

Groove Position
The recommended position of the groove edge is a minimum of 2 inches (5 cm) from the edge of concrete joints or asphalt seams along edge or centerlines.

Groove Cutting Speed
The speed of groove cutting equipment will vary with the width of the groove, the size of the application, the pavement surface (new or old asphalt or concrete) and the equipment and blades used for cutting. The speed must be set in accordance with other factors to ensure the required groove depth specifications are met.

Groove Cleaning
Cooling the cutting head with water may be necessary for some applications and equipment. In general, long continuous groove cuts for edge lines may require water to keep blades cool. Groove cutting for skip dash or other intermittent markings allows the blades to cool between cutting operations, so cooling water may not be necessary. If cooling water is necessary, flush the groove immediately with a high pressure power washer to remove any build-up of cement dust/water slurry. If this is not done, the slurry may harden in the groove.

Note: This process must also be used when dry grooving during a rainfall period.

Allow the groove to dry a minimum of 24 hours after groove cleaning, removal of excess water, and prior to pavement marking application if water is used in the grooving process. The groove must be clean and dry for proper application of the pavement marking.

Clean the groove completely prior to pavement marking application using an air compressor with at least 185 CFM air flow and 120 PSI air pressure. A street sweeper or pick-up broom may also be effective, but will require a pass with the air compressor to completely clean the bottom of the groove. **Note:** An open groove may be left open over night if it has been blown out or flushed out at the time of grooving. It is recommended to blow out the groove again before application of a pavement marking.

Grooved and Recessed Intersection Markings

Intersection markings such as crosswalks and stop bars can be grooved into the pavement and recessed by making multiple side-by-side passes with grooving equipment typically used for long line pavement markings. Multiple passes are made to allow for placement of the wider intersection markings in a groove.

Cutting grooves with multiple passes can result in a ridge between each pass due to the stops on each side of the cutting head resting on different levels of pavement surfaces. The first pass with the grooving equipment is completed with the stops resting on an even surface (Figure 2).

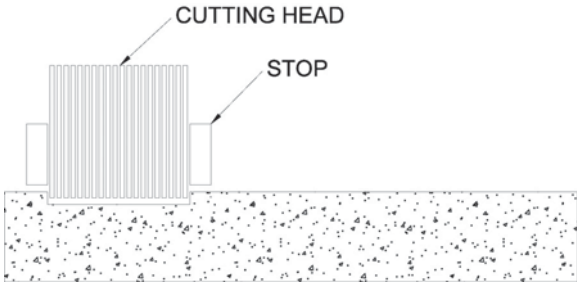


Figure 2 - Initial Pass, Intersection Groove Cut

After the first pass, one stop will sit on the old pavement surface and the other stop will sit in the newly cut groove (Figure 3). This produces ridges which are unacceptable.

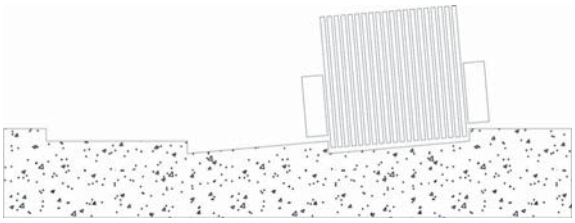


Figure 3 - Additional Passes with Ridge along Cutter Head Edge

Adjust the stops after the first pass to prevent this problem or grind off the ridges between the passes prior to placing the pavement marking in the recessed groove.

You can also use a metal plate the depth of the groove and move over for each cut across the groove face.

Legends and symbols can be grooved and recessed by grooving a large square or rectangular shaped area that will fit the pavement marking. Refer to IF 5.8 for more information.

Use wider cutting heads and more blades gang stacked on the saw auger to reduce the number of ridges formed by multiple passes with the cutting head.

Curb and median obstacles may not allow for cutting the groove using large truck-mounted equipment across the full width of the intersection marking. Use smaller equipment in areas near obstacles to achieve a groove at the recommended depth.

II. Equipment Alternatives and Surface Texture Recommendations

Several different cutting head configurations are available from different equipment manufacturers that specialize in saw cutting and grooving equipment. Different grooves will result from the use of different cutting heads and grooving equipment.

Groove equipment with a free-floating, independent head is recommended. This type of configuration allows the cutting head to follow irregularities in the pavement surface and provides a more consistent groove depth.

Important Note: The use of gang stacked cutting blades is required for asphalt pavement surfaces. The use of gang stacked cutting blades is strongly recommended for concrete pavement surfaces; especially for older surfaces or surfaces that show visible signs of deterioration.

Special note: Diamond cutting blades produce an optimal groove surface.

Saw Blade Cutting Heads

One alternative for grooving equipment consists of a single large diameter (12 -18 inch saw blades) cutting head, with gang-stacked, 1/8-inch (0.30 cm) to 1/4-inch (0.63 cm) wide carbide or diamond tipped cutting blades (Figure 4). Spacers are placed between the blades to provide a gap for the wider cutting head tips and to decrease the number of blades required for the cutting head.

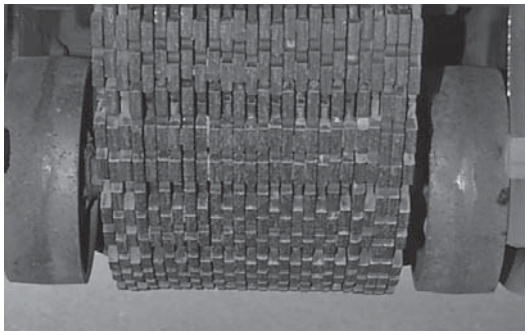


Figure 4 – Saw Blade Cutting Head

Wider spacing of the blades may result in a heavily "ribbed" or "ridged" pattern that is not recommended for pavement marking applications (Figure 5). The ribbed pattern or corduroy effect must not be irregular or large enough to prevent tape conformance into the lower areas of the pattern. If the tape bridges these lower areas and does not make contact with the pavement surface, poor adhesion will occur due to moisture penetration.

Use of gang-stacked diamond tipped cutting blades creates a corduroy or ribbed pattern as shown in Figure 5.

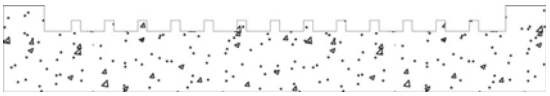


Figure 5 – Cross Section Coarse Tooth Pattern Widely Spaced or Worn Blades

Replace blades and/or change spacing to correct this appearance.

Thinner spacers may be used between the blades to prevent an irregular raised pattern in the groove. This will result in a groove with a smoother surface (Figure 6, 7 and 8). The height of the ridges should be no greater than 15 mil. above the base of the groove.

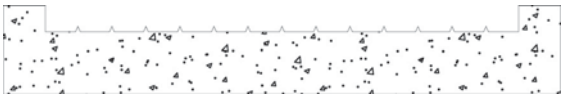


Figure 6 – Cross Section Smooth Groove Thin Spacers and New Blades.

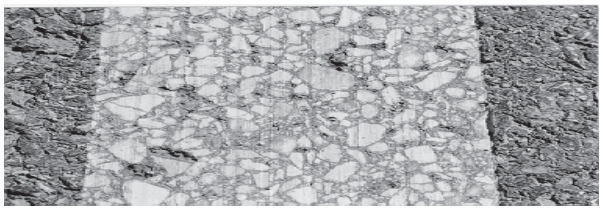


Figure 7 – ACC Light Corduroy or ribbed pattern made with properly spaced, gang stacked cutting blades.

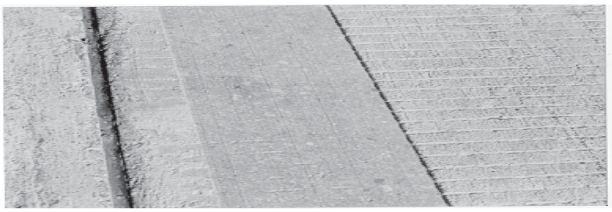


Figure 8 – PCC Light Corduroy or ribbed pattern made with properly spaced, gang stacked cutting blades.

Grinder Cutting Heads

Another alternative for grooving ONLY newer PCC pavement surfaces in good repair is the use of a grinder-type cutting head (Figure 9).

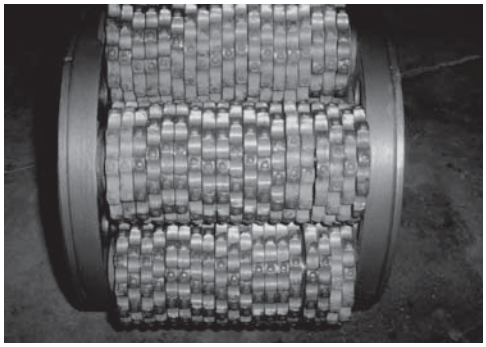


Figure 9 – Grinder Cutting Head

Use of the grinder head shown in Figure 9 results in a groove with an irregular surface texture shown in Figure 10 and 11. This surface texture is often the superior surface for application of liquid pavement markings.

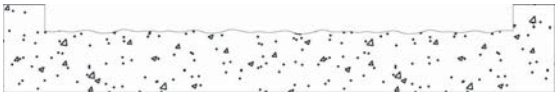


Figure 10- Cross Section Textured Groove Cut with Grinder Head

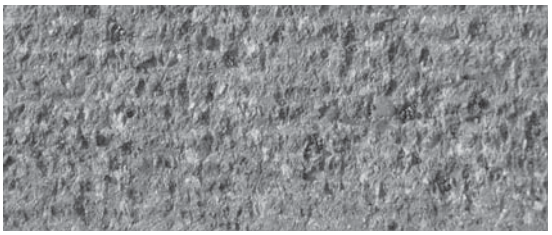


Figure 11 – Textured Groove Surface

Achieving a Textured Surface with Saw Blades

A textured groove surface is a groove bottom surface that has an irregular pattern and does not show the typical ribbed or corduroy pattern common to new grooves cut with saw blades.

Besides using a grinder cutting head as shown in Figure 9, a textured groove surface can also be achieved with the saw blade configuration shown in Figure 4 using the following procedure. The textured surface is achieved by using a slow moving shot blaster, grinder, or sand blaster to knock down the ridges and create the textured surface after cutting the initial groove with the saw blade cutting head. Hydroblasting can also be used, but the groove must be allowed to dry (24-hour minimum) prior to application of the pavement markings.

New concrete surfaces may contain more fine cement dust after cutting. This dust and any cement residue must be removed and blown clean from the groove prior to application of the pavement marking.

Asphalt Cement Concrete (ACC) Surfaces

As with concrete, grooving asphalt surfaces provides some of the same benefits for pavement markings such as reducing the profile to help prevent snow plow damage and providing a "new" exposed surface for adhesion.

Important Note: The use of gang stacked cutting blades is required for asphalt pavement surfaces.

Special Note: Diamond cutting blades produce an optimum groove surface

Existing asphalt surfaces should possess the strength necessary to support the cutting of a groove. Inspect the surface for obvious signs of distress before cutting a groove. Refer to the 3M Road Surface Guide for guidance. Always inspect the groove at start-up for signs of weakness in the channel or at the groove wall. Light scratching in the channel or at the groove wall, light scratching with a pointed object can help to determine the integrity of the cut.

Groove cutting some older asphalt surfaces may result in weak aggregate/asphalt bonds near the surface. The structural integrity of the groove bottom should be checked after grooving and prior to application of pavement markings.

In general, new asphalt shall not be grooved within a minimum 10 days of the placement of the final course of pavement. The asphalt surface must be open to traffic during this period. Asphalt may be too soft within 10 days of placement to support grooving operations, especially during periods of hot weather.

Some asphalt mixes may require as long as 30 days to achieve enough strength to support grooving operations. Perform a field test at a small localized area on new asphalt mixes to verify that proper surface strength has been achieved.

Inlay techniques (rolling tape into fresh hot asphalt) for Stamark tape should be utilized for new asphalt surfaces whenever possible. See 3M Information Folder 5.7 for additional information on inlay techniques.

III. Application Guidelines

The following are specific application guidelines for Stamark tapes in a groove. Review the detailed application instructions in 3M Information Folder 5.7, Pavement Surface Preparation and Application Techniques for 3M™ Stamark™ Tapes, as well as climate and weather recommendations for proper installation and application.

Clean the Groove

Clean the groove completely prior to pavement marking application using an air compressor with at least 185 CFM air flow and 120 PSI air pressure. There should be no more than 50 feet of 3/4-inch ID hose from the compressor to the air nozzle and the air nozzle should be no less than1/2-inch ID. The compressor should also be equipped with a moisture and oil trap. When cleaning the groove it is recommended that the air nozzle be more than two feet from the ground. A street sweeper or pick-up broom may also be effective, but will require a pass with air compressor to completely clean the bottom of the groove.

Apply the Tape

Apply Stamark tape in the groove following the detailed instructions for "Overlay Applications" in 3M Information Folder 5.7, Pavement Surface Preparation and Application Techniques for 3M™ Stamark™ Tapes.

Tamp the Tape

Tamp the tape thoroughly with a minimum of six (6) passes minimum (three passes back and forth) over the surface of the new tape in the groove. Use a RTC-2 Tamper Cart (contact Century Tool at 763-428-2168) with a 200-pound (90 kg) load.

Tape application in a groove will require tamping with a tamper cart roller cut to fit in the groove. Tamping the edges of the tape is very important. A vehicle tire may tamp the center of the tape but not the tape edges near the edge of the groove. Use a modified tamper cart roller if necessary. (See Figure 11) Modified rollers can be purchased from Century Tool, 763-428-2168. A typical modified roller will have a 4-inch width and a 1/4-inch depth. **Important Note:** Use of a vehicle tire to tamp a long line application of pavement marking tape in a groove is acceptable for waffle pattern tapes (380IES, 270ES, 310, 390, and 380AW). Refer to IF 5.7 for further information.

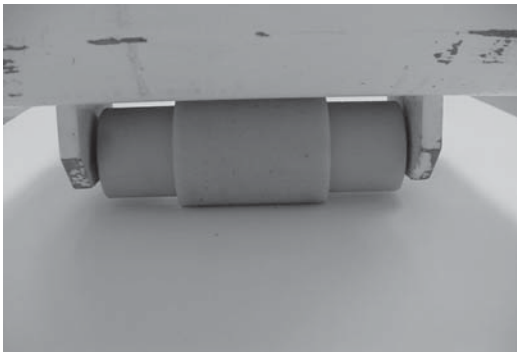


Figure 11 – Tamper cart roller cut for groove tamping

3M Liquid Pavement Markings

Applying Liquid Pavement Markings products properly in a groove provides increased durability and improved long-term retroreflective performance. This method is especially effective to extend the service life of the pavement marking in northern climates where snow removal equipment is used.

Refer to Information Folder 5.20 (Liquid Pavement Markings), 5.22 (All Weather Paint), and 5.24 (All Weather Thermoplastic) for proper surface preparation and application requirements.

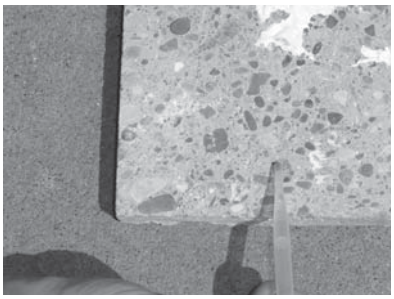
The liquid pavement marking must be placed fully within the groove for successful application and to achieve the full benefit of the groove. A wider groove (up to two inches greater than the marketing width) may be needed to allow for the proper placement of the liquid pavement marking into the groove.

IV. Measuring Uniform Groove Depths

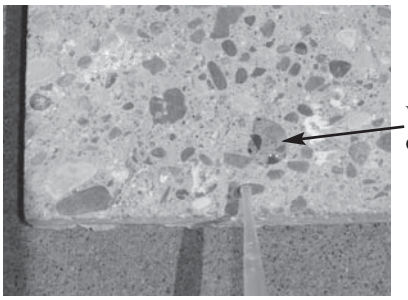
A micrometer or depth gage can be used to verify the uniform depth of new grooves. Another method is the use of depth plate (see Appendix A). Grooves should be checked frequently as a new alignment is cut to make adjustments early in the process. As an example, on a new groove cutting application, check the groove depths at 10-foot intervals for the first 50 feet. Each measurement should be within the tolerance shown in Table A. Calculate an average of the five depths measured – the average should equal the appropriate depth shown in Table A. If the average does not equal the values in the table, make adjustments to the cutting equipment and check the next 50 feet using a similar method. Continue to adjust the equipment until the depth shown in Table A is the average calculated groove depth.

V. Surface Wetting Test

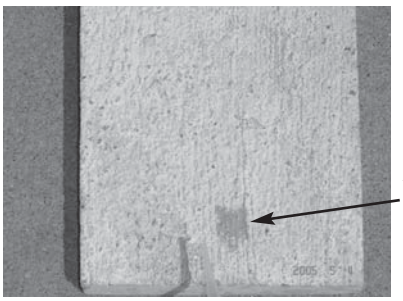
Measure wetability of the grooved surface. Use an eye dropper to apply drop of water to the surface. The water drop should wet out in the groove surface. If not, the groove needs to be cleaned out, ground, or shot blasted.



Place a drop of clean drinking or distilled water on the pavement surface.



If the drop of water does not spread (but instead forms a bead on surface), the surface may be contaminated, need additional surface preparation or need to be recleaned with high pressure air.



If the water drop spreads (wets), the surface is ready to accept application of pavement marking.

Appendix A

Depth plate 100 mil or the agency's specifications

Drop plate into groove

Check to see if plate fits into groove

Put straight edge across groove over the top of depth plate

Slide plate back and forth to see if groove is at the right depth

Health and Safety Information

Read all health hazard, precautionary, and first aid statements found in the Material Safety Data Sheet (MSDS), and/or product label of chemicals prior to handling or use. Also refer to the MSDS for information about the volatile organic compound (VOC) content of chemical products. Consult local regulations and authorities for possible restrictions on product VOC content and/or VOC emissions. Electronically, visit us at www.3M.com/us and select MSDS search.

Literature References

PB 270 ES	3M™ Stamark™ Pavement Marking Tape Series 270 ES
PB 380I ES	3M™ Stamark™ High Performance Tape Series 380I ES
PB 1000	3M™ Stamark™ Liquid Pavement Marking Series 1000
PB 1400	All Weather Liquid Pavement Marking Series 1400
PB 380AW	3M™ Stamark™ High Performance All Weather Tape Series 380AW
PB 310	3M™ Stamark™ Pavement Marking Tape Series 310
PB 390	3M™ Stamark™ High Performance Pavement Marking Tape Series 390
IF 5.7	Pavement Surface Preparation and Application Techniques for 3M™ Stamark™ Tapes
IF 5.8	Instructions for Precut Symbols and Legends
IF 5.20	Application Guidelines for Liquid Pavement Markings
IF 5.22	3M™ All Weather Paint Application Guidelines
IF 5.24	3M All Weather Thermoplastic application guidelines
PB AWT	All Weather Thermoplastic
PB AW Dry	All Weather Dry Elements
PB AWE	All Weather Elements

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