

Review of Carpet Dyeing Methods

Carpet color is one of the most considered aspects of a carpet by consumers. Carpet colors are obtained by various types of carpet yarn and fiber dye methods. Although various type dye methods are typically included in product specifications, most consumers do not understand how carpet is dyed. Essentially, there are two types of dye methods, which are pre-dye and post dye. Listed below are brief explanations of these dye methods and their processes.

Post Dyeing

Post dyeing involves various processes of dyeing yarn after it has been tufted, and does not include the addition of a secondary backing at this stage of manufacturing. These yarns are extruded as a white fiber that does not contain dye pigment, and are then tufted into a greige roll. In most cases, post dyeing is done by continuous dyeing, beck dyeing, or printing.

Continuous dyeing utilizes spray jets that continuously and evenly apply the dye across the full width of 12 ft. wide carpet sewn end to end. The fibers are dyed as the dye applicator moves across the carpet's width by jet applicators, as it moves it moves forward on the dye range. Only one applicator is used to produce solid colors, and a series of applicators are used to produce multi-color effects. Steam is then applied to produce the energy necessary to set these dyes, followed by drying. Using this dye method, the cost of dyeing is reduced, and the amount of carpet that can be dyed can be several hundred lineal feet per hour, and in unlimited greige roll quantities.

Beck dyeing is a process where the tufted, 12 foot wide greige rolls are immersed individually into a stainless steel tank containing dye (i.e., "dye bath"). The temperature of the negatively charged dyes is elevated at this point in order to open the positively charged dye sites on the fiber to better accept dyes. Rinsing and drying follow. Although used primarily to dye solid colors, carpet fibers dye affinity can be modified to produce stripe and moresque colors. Beck dyeing is the most expensive means to dye fiber, beck dyeing is still considered necessary in order to obtain the dye penetration needed on heavier carpet fiber constructions.

Print Dyeing is very similar to continuous dyeing. The addition of colors to obtain the desired pattern can be applied by various methods. The use of flat bed and rotary printers are used to produce a wide variety of patterns. Dye is applied by either roll-on or jet applicators. In this dye method, tufted greige rolls are sewn end to end.

Pre-Dyeing

Pre-dyeing involves various dyeing processes where the yarn is dyed prior to tufting. The most common of these methods is referred to as solution dyeing. Included in this dyeing method are solution dyeing, space dyeing, stock dyeing, and skein dyeing.

Solution dyeing is obtained by pre-heating to the polymer melt point, where it obtains a liquid state. At this point, dye pigments are dispersed into the polymer melt to obtain the desired color. This now colored polymer melt is extruded through a device known as a spinneret, which is similar to a showerhead. As the polymer melt is extruded, the fiber cross-section is determined by the shape of the holes in the spinneret and the extruded fiber is air-cooled and solidified. Because solution dyeing dyes the fiber throughout, rather than impregnating dye into the fiber, this method of dyeing produces the most effective stain cleanability of all fibers.

Space dyeing, referred to also as yarn dyeing, is a process used primarily in various types of commercial carpet loop constructions made from or including the use of continuous filament nylon. In this process of dyeing, two or more different colors are essentially printed along the length of the fiber to create a multi-color affect in short lengths of the fiber that typically appear as horizontal or diagonal stripes. This is done by printing other colors on the base color by knitting the yarn into narrow tubes. The tubes are steamed and dried. The yarn is then de-knitted and wound onto cones for tufting or warping. Space dyed nylon is commonly used in carpet made primarily from solution dyed yarn to provide accent color.

Skein dyeing also referred to as another form of yarn dyeing is similar to stock dyeing. Skein dyeing involves a process where yarn is wound into large skeins that are hung in dye vats and then dyed to produce smaller dye lots. After dyeing the yarn is then wound onto cones. Skein dyeing is often used to dye custom colors.

Stock dyeing is considered to be the oldest method of dyeing carpet yarns. In this process, large quantities of staple yarns are placed in a large vat (“kettle”), and are dyed under pressure using non-water soluble disperse dyes. Once dyed, the kettle is drained and the yarns are then centrifuged to remove excess water. Stock dyed yarns must go through the spinning and heat-setting process. The vast majority of polyester fiber is dyed by this method.

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