

Importance of Yarn Lubricants and Their Removal during Manufacturing Processes

Yarn lubricants, also called spin finish, are applied on the yarns to overcome fiber to metal friction and to control static charges during the yarn manufacturing process. The amount of spin finish applied on yarn is based on the type of post processing the yarn will experience after extrusion. For example, if the yarns go through a twisting process, the filaments will be subjected to fiber to fiber cohesion and thus require extra spin finish to overcome this. Post dyed yarns i.e. white yarns are dyed either in yarn form or in tufted greige rolls. Before the post dyeing process, the spin finish is scoured; i.e., washed off, prior to the post dyeing process. The carpets made from solution dyed nylon yarns; i.e., colors added during the extrusion, are all coated with topical solutions so they are stain and soil resistant. Also, some carpet styles, made from solution dyed polypropylene yarns, have topicals added to enhance these same characteristics. Other carpet styles, made of solution dyed polypropylene and without any topical, have only 1% or less spin finish remaining on finished carpet yarns.

All synthetic carpet fibers are produced from thermoplastic polymer chips, called resins. These resins are melted into a viscous liquid state, and then forced through a spinneret at a constant rate, referred to as the extrusion process. A spinneret is a metal device similar to a shower head that consists of tiny holes of a particular size and shape, to form the desired size and cross-sectional shape of the yarn filaments. After extrusion, the yarn is air cooled to solidify the molten filaments; this is referred to as the quenching process. The yarn at this point is undrawn with disoriented polymers and is very weak. Before any further processing of undrawn yarns, spin finish is applied on the filaments surface by an applicator to lubricate the yarns and to prevent any damage to the yarn during stretching, twisting, winding and tufting processes. Yarn lubricants can consist of either natural, organic, or synthetic oils. Oil soluble anionic and nonionic surfactants are added to help facilitate the removal of yarn lubricants by using a steam rinse, scouring, or by steam exhaustion during the heat setting operations. The amount of yarn lubricant applied is precisely controlled based on the type of post processing the yarns will encounter. Yarn manufacturers apply only the needed minimum amount of lubricants to help prevent soiling of the finished carpet products.

Scouring post-dyed i.e. fibers dyed after extrusion, is accomplished by bathing or rinsing in an alkaline solution, followed by a rinsing process after the continuous dyeing process to remove any residual dye and reduce yarn lubricant. Although solution dyed yarns i.e. fibers dyed during extrusion can be scoured to help remove residual yarn lubricant, the amount of water and energy required to scour solution dyed carpet yarns is not cost effective, and is not typical with current precise methods of lubricant application during the extrusion process.

Typically, the lubricants are reduced in yarns at each and every stage of carpet manufacturing. The extrusion process requires very small amounts of lubricant typically around 0.4% to get yarns on to the winder. Higher amounts of lubricants, typically around 1.2% - 1.4% is applied if the yarns are produced for twisting and heat setting processes. Heat setting the twisted yarns helps them retain their twist level and improves their resiliency characteristics. The yarns can be heat set either by Sussen, using dry heat, or by Superba, using steam heat. Beaulieu utilizes both the Superba and the Sussen heat setting machines. The heat setting process does diminish the amount of lubricants on yarns applied during the extrusion process.

Traces of yarn lubricant may be found on all finished carpets. Stringent quality control measures and test procedures are used to ensure that the level of residual yarn lubricant on the fibers of finished carpets does not exceed 2.0 % of the fiber weight, which is the maximum amount of extractible matter recognized by most fiber producers and carpet manufacturers in finished carpet, based on the ASTM D 2257 or AATCC 20 A, Extractible Matter in Yarns test method. All Beaulieu carpets will yield much less than 2.0 % of the fiber weight in yarn lubricants and other extractible matter.

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