



The Carpet Primer



THE CARPET AND RUG INSTITUTE

The Carpet and Rug Institute, Inc.
PO Box 2048
Dalton, GA 30722-2048 USA

www.carpet-rug.org
706.278.3176
info@carpet-rug.org

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INTRODUCTION

As a successful designer, specifier, facility manager, or end-user, it is important to make the most informed carpet decisions to create a visually pleasing and long-lasting environment. The Carpet and Rug Institute's *Carpet Primer* details the fundamentals of carpet—how it is made, specified, installed, and maintained—the basic technical knowledge you need to make sound carpet decisions. Also included is carpet's role in environmental issues, specifically indoor air quality and recycling.

The Carpet and Rug Institute (CRI) is the national trade association, representing the carpet and rug industry. Headquartered in Dalton, Georgia, the Institute's membership consists of manufacturers representing majority of all carpet produced in the United States, and suppliers of raw materials and services to the industry. There is continued coordination with other segments of the industry, such as distributors, retailers, and installers.

The Carpet Primer may be used as a comprehensive resource for carpet specifiers and users, or as a training manual for those just entering the industry. It will be revised periodically to provide the most up-to-date information available. If you have any questions or comments regarding this resource, or to obtain a listing of other CRI publications available, please contact the CRI at or refer to the website www.carpet-rug.org.

CARPET CONSTRUCTION

It is important to understand carpet construction to apply the variables that affect performance of a specific installation. Tufted carpet consists of the following components: the face yarn, which can be cut pile, loop pile, or a combination of cut and loop pile; primary backing fabric; a bonding compound, usually latex compounds, but may be polyurethane, polyolefin, PVC, bitumen, or fabric; and (often) a secondary backing fabric.

The development of the broadloom tufting machine and the introduction of synthetic carpet yarns in the early 1950s transformed the American carpet industry from low-volume production of woven luxury products to mass production of high-quality and comfortable, yet popularly priced, goods. The explosive growth of carpet sales in the United States in the ensuing years paralleled the continual development of tufting technology, the proliferation of high-speed tufting machines, and the development of synthetic carpet fibers and alternative backing systems. As a result, today's carpet is both better and less expensive.

PILE FIBERS AND YARNS

Almost all carpet produced in the United States is manufactured from one of four pile fibers: nylon, olefin (polypropylene), polyester, and some natural fibers. The major fibers for commercial carpet are nylon, olefin, polyester, and wool. Synthetic fibers comprise the vast majority of the face fiber market for carpets. Historically, wool was the most prevalent fiber in the carpet industry, but as the market exploded in the 1960s, synthetic fibers were developed that provided a high quality, durable product in a more affordable price range.

Pile yarn or fibers represent a majority percentage of the total material cost of the carpet, making this the primary cost factor. Fiber selection and yarn construction will affect end-use performance. Manufacturers are a valuable resource in determining the fiber most appropriate to the application and the budget.

1. FIBER/YARN TYPES AND CHARACTERISTICS

Fiber	Definition and Characteristics	Characteristics in Carpet
NYLON (Polyamide)	<ul style="list-style-type: none"> • Fiber-forming substance of any long-chain, synthetic polyamide having recurring amide groups as an integral part of the polymer chain. Available as Nylon 6 or Nylon 6,6 • Offered as Bulk Continuous Filament (BCF) or staple, both used for residential and commercial applications • Can be colored with dyestuffs or pigmented (solution dyed) • Extensively used for commercial carpet and accounts for a high percentage of all carpet face fibers 	<ul style="list-style-type: none"> • Durable, resilient • Abrasion-resistant • Versatile in coloration possibilities • Wet-cleaning friendly • Excellent colorfastness • Excellent color clarity
OLEFIN (Polypropylene)	<ul style="list-style-type: none"> • Fiber-forming substance of any long-chain, synthetic polymer composed of at least 85%, by weight, of ethylene, propylene, or other olefin units • Offered as BCF (or staple for needle-punch carpet) • Can be colored with dyestuffs or pigmented (solution dyed) • Can be engineered for outdoor applications 	<ul style="list-style-type: none"> • Resists fading • Generates low levels of static electricity • Chemical, moisture and stain-resistant • Favorably priced
POLYESTER (Polyethylene Terephthalate)	<ul style="list-style-type: none"> • Made from terephthalic acid and ethylene glycol • Offered in BCF and staple form • Used in residential and some low traffic Commercial applications 	<ul style="list-style-type: none"> • Excellent color clarity • Excellent colorfastness • Resistant to water-soluble stains
WOOL	<ul style="list-style-type: none"> • Natural fiber from sheep • Inherent resilient property 	<ul style="list-style-type: none"> • Durable • Scaly character of fiber scatters light and reduces visible soil • Largely self-extinguishing when burned; will char rather than melt or drip

2. NATURAL FIBERS

Wool is the predominant natural fiber used in carpet production today. Although wool represents less than one percent of the fiber used to make carpet today, some still perceive it to be the premier fiber. It is often more expensive by the low production of wool worldwide. New Zealand, Argentina, China, and Britain are the major wool-producing centers.

3. SYNTHETIC FIBERS

Synthetic fibers are formed by a process in which molten polymer is extruded or forced through tiny holes in a spinneret, or metal plate. After the filaments emerge from the spinneret, they are cooled, drawn, and texturized to add bulk and cover.

Synthetic fibers can be extruded in different shapes or cross sections, such as round, trilobal, pentalobal, octalobal or square, depending on the design and shape of the spinneret holes. These cross-sectional shapes can affect many properties of carpet, including luster, bulkiness, texture retention, and soil-hiding abilities. Manufacturers may mix additives with the melted polymer prior to or during extrusion to produce various properties. Such additives may be a color pigment to produce solution-dyed color, or delustering, additives to produce whiter and less transparent fibers with a more natural look, and protection from solar radiation.

After fiber extrusion, post-treatments, including drawing and annealing (heating/cooling), increase tensile strength and generally enhance the fiber's physical properties. The filament bundle then goes through a crimping or texturing process that converts straight filaments to ones with a repeating kinked, curled, or saw-tooth configuration.

YARN PRODUCTION

A single strand of yarn looks like a simple thing, but a series of complicated processes must occur to produce it. Bulk continuous filament, or BCF, is produced in yarn form, but staple fiber (short lengths of fiber) goes through several processes to convert it into yarn ready for tufting.

4. BCF PROCESSING

Bulk continuous filament, or BCF, yarns are synthetic fiber formed into yarn bundles of a given number of filaments. These are subsequently texturized to give bulk and resilience in the finished carpet. The extruded BCF product, containing the proper number of filaments for the desired yarn denier, is wound directly onto take-up packages. Additional processing may include air entangling or twisting and heat-setting.

Air-entangled yarns are yarn ends that are passed through an air jet to mingle the filaments, creating a cohesive yarn bundle. Air entangling of colored yarns yields a heather-effect yarn often used in loop construction commercial carpets.

If the intended end use for the yarn is cut pile carpet, twisting of individual yarns and combining of yarn ends is normally required. Following twisting, the yarn is heat set to ensure twist stability.

5. STAPLE YARN PROCESSING

Staple fibers may be converted into spun yarns by textile yarn spinning processes. When staple fiber is produced, large bundles of fiber called "tow" are extruded. After a crimping process, the tow is cut into fiber lengths of four to eight inches.

Staple fiber is spun into yarn and requires three critical preparation steps – blending, carding, and drafting – prior to the spinning process. Blending carefully mixes staple fiber from different bales to ensure that the fibers intermingle in a way that yarn streaking will not occur during subsequent dyeing operations. Carding aligns the fibers and puts them in a continuous sliver (rope-like) configuration.

Drafting has three main functions – it blends fibers, assures uniformity of weight per unit length, places them in a parallel form, and continues to decrease the weight per unit length of the total fiber bundle, making it easier to spin into the final yarn.

Spinning twists the fibers into yarn and creates the desired yarn size.

6. THE HEAT-SETTING PROCESS

Yarn twist in either BCF or staple yarns can be an important factor in the look and performance of carpet. In a cut pile carpet, a high twist will result in a friezé, a medium twist will produce a saxony, and a low twist with little or no heat setting will produce a velour or saxony plush fabric.

After twisting, the yarn to be used in cut pile and some loop construction carpet is wound onto yarn cones to prepare it for the heat-setting process to stabilize the yarn twist.

Heat-setting creates a “memory” in the yarn by application of extreme heat. This stabilization of the yarn configuration is a major benefit in cut pile carpet. Modern yarn production uses one of two commonly used systems of continuous heat-setting: Suessen and Superba. The Suessen uses dry heat, reaching temperatures over 425°F for nylon yarns. The Superba uses steam and lower temperatures to heat the yarn.

7. YARN SIZE

Yarn size, in addition to fiber type, is often explicitly specified in contract carpet. The carpet industry in the United States has two yarn numbering systems primarily used to define yarn size or linear density. They are 1) cotton count and 2) denier. The former is used for spun yarns, and the latter for BCF yarns. Internationally, the Tex system is commonly used for designation of linear density.

COLORATION TECHNIQUES

Color is one of the most important aesthetic properties of carpet. It plays a major part in the visual appeal that makes carpet a highly desirable decorating element. Because the dye methods can provide enhancements for performance, such as colorfastness, specifiers should be familiar with the major methods of color application to select the appropriate carpet for a given application.

Fibers of the same generic type can be treated or modified so that their affinity for certain dyes is changed, producing a multicolored or two-toned effect.

Coloration for tufted carpet is attained at two possible times in the manufacturing process—either by dyeing the fiber or yarn before the fabric is tufted (pre-dyeing), or by dyeing the tufted fabric (or greige goods) before the application of the secondary backing and the finishing process (post-dyeing). Most woven carpet is made with pre-dyed yarns, although some are post-dyed via printing.

8. PRE-DYEING METHODS

Pre-dyeing is done before the actual formation of the carpet. There are two methods of pre-dyeing: solution dyeing and yarn dyeing. In most pre-dyeing methods (other than solution-dyeing, in which the color pigment is actually extruded with the fiber), the process of getting the color into the fiber is an “exhaustion” process. This means that when the yarn is placed in the dye bath, the dye is exhausted, or transferred, into the fiber.

8.1. SOLUTION-DYED FIBERS

Solution-dyed yarns and fibers are pre-colored by the fiber manufacturer by introducing pigments into the molten polymer before extrusion into fiber. Solution-dyed fibers have outstanding fade- resistance and colorfastness. Some solution-dyed fibers for outdoor use are stabilized with ultraviolet inhibitors. Some are solution-dyed for interior use. Solution-dyed nylon continues to increase in use. Olefin yarns are almost always solution-dyed.

8.2. YARN DYEING

Several different techniques are used to apply color to undyed yarn:

8.2.1. SKEIN DYEING

Yarn is wound into large skeins resembling oversized hand-knitting skeins and is dyed in this form. Almost any yarn or fiber type, except olefin, may be dyed this way if the yarn has sufficient strength to withstand skein winding and back-winding onto cones. The method is applicable to spun yarns, bulked continuous filament yarns, heat-set yarns, and nonheat-set yarns of many fiber types.

Skein dyeing is especially suited to small volume production of custom colorations, although a high labor cost is involved. Solid-color, skein-dyed yarns are primarily used in woven carpet and for accent colors in tufted graphic styles.

8.2.2. SPACE DYEING

Space dyeing, primarily for nylon BCF, produces segments of different colors along the length of the yarn. The three most frequently used techniques are knit-de-knit, warp-sheet printing, and multicolor skein dyeing. Various continuous space-dye methods are used (Superba and Belmont are examples).

Knit-de-knit – With this technique, a circular knitting machine forms the yarn into a tube or sock that is printed on both sides, usually in diagonal and horizontal stripes.

The printed tube (or sock) is steamed, dried, de-knitted or raveled, and wound onto cones. Most knit-de-knit yarns are printed with multiple colors, and print overlaps yield additional colors, producing a random multicolor look with relatively short segments of color.

Knit-de-knit yarns often are found in loop style and contract carpet. Manufacturers can easily incorporate custom or accent colors into the knit-de-knit dyeing technique.

Warp-sheet Printing – With this method, a sheet of yarn is supplied from a standard tufting-type creel. A computer controlled printer applies a color in various lengths along the yarn axis. The fully relaxed yarn sheet is then steamed, rinsed, dried, and wound back onto cones. This method allows complete randomization of color spacing and length, provides excellent color clarity, and is well-suited for both loop and cut/loop carpet. In general, spacings are longer than in knit-de-knit.

Multicolor Skein Dyeing – A modified skein dyeing process dyes various portions of the skein different colors, resulting in a yarn with varied colored segments along its length. The rather long color bands are less random than those achieved by other space-dyeing methods, but are used to advantage in multicolor cut and loop styles.

9. POST-DYEING METHODS

There are several post-dyeing methods used after the carpet is constructed. Piece dyeing is the application of color from an aqueous dye bath onto unfinished carpet, or greige goods (pronounced “gray” goods), consisting only of primary backing tufted with undyed yarns. Beck dyeing, a form of piece dyeing, handles batches of 12-foot-wide grieger goods of approximately 150 running yards in a dye beck or large vat.

9.1. CONTINUOUS DYEING

Continuous dyeing is an economical process of dyeing almost unlimited quantities of various widths of carpet, sewn end to end. This process may be used for solid and multicolor carpet with variations in the yarns or equipment used.

Continuous dyeing typically utilizes a dye applicator that distributes the dye evenly across the full width of the carpet as it moves in open width form under the applicator, injecting color into the carpet. For solid dyeing, only one applicator is used; for a multicolored effect, a series of applicators are used.

There are numerous techniques and variations in the continuous dyeing process, but most continuous dye ranges include the dye process and the finishing process.

The general process for continuous dyeing:

1. *Staging, or Preparation:* Rolls of undyed goods are sewn end-to-end to give ample linear footage to ensure a continuous carpet production line through the very large dye range.
2. *Pre-Conditioning:* Wets the carpet with water or wetting chemicals.
3. *Dye Application:* Dye liquors are applied by single applicators for solid color effect or by multiple applicators for multicoloration.
4. *Steaming:* Provides the energy necessary to exhaust the dye liquor into the fiber.
5. *Washing:* Removes all residual dyestuffs and chemicals.
6. *Drying:* Dries the carpet prior to applying the back coating and secondary backing.

9.2. BECK DYEING

When dyeing in becks, or large, specialized stainless steel tanks, the carpet is moved in and out of the dye bath by a motorized reel, usually in rope form. The movement process provides maximum color uniformity, or “level dyeing” in dyer’s jargon. Rinsing and drying follow.

Beck dyeing generally is used for solid colors. However, two or more colors can be produced in tweed, Moresque, or stripe patterns in a carpet from a single dyebath by using fibers of modified and/or altered dye affinity. Selection of fiber dye variants and appropriate dye-stuffs can produce both tone-on-tone and contrasting (cross-dye) colors.

9.3. PRINTING

Carpet printing uses machinery that essentially is enlarged, modified textile printing equipment. Jet printing machinery has color jets arranged in rows across the width of the carpet. The closely spaced jets may be opened or closed by computer-controlled valves as the carpet moves below them.

Controlled patterns are produced without direct machine contact as the jets squirt color onto the carpet surface, but do not crush the pile. Computer-controlled jet printing allows for rapid pattern changes and can achieve almost any type of patterning effects. Jet printing frequently is used for area rug styling.

Flatbed and rotary screen printers are an additional technique. Printed carpet is available in a wide variety of patterns or textures that can simulate woven patterns at a much lower cost.

CARPET FABRIC CONSTRUCTION

The primary carpet fabric construction methods include tufting, weaving, needle punching, and bonding.

10. TUFTING

Most carpet produced is tufted. Tufting machines are similar to giant sewing machines, using hundreds of threaded needles in a row across the width of the machine. Today's machines are increasingly complex and sophisticated, providing a wide variety of styles and constructions.

The creel, located in front of the tufter, may be racks of many yarn cones or multiple large spools, referred to as beams, and containing many individual strands of yarn. From the creel, the yarns are passed overhead through guide tubes to puller rolls. The speed of the puller rolls controls the amount of yarn supplied to the tufter and, along with other factors, determines the carpet's pile height.

The eyed needles, which number up to 2,000 for very fine gauge machines, insert the yarn into a primary backing fabric supplied from a roll of material located in front of the machine. Spiked rolls on the front and back of the tufting machines feed the backing through the machine.

Below the needle plate are loopers or hooks, devices shaped like inverted hockey sticks, timed with the needles to catch the yarn and hold it to form loops. If a cut pile is called for, a looper and knife combination is used to cut the loops. For cut-loop combinations, a special looper and conventional cutting knife are used.

Tufting has reached a high degree of specialization, utilizing a variety of patterning devices, many of which are computer-controlled. Stepping, or zigzag moving needle bars, individually controlled needles and yarn feeding systems greatly expand patterning possibilities.

After completion of tufting, the unbacked tufted carpet is dyed (if precolored yarns were not used) then followed by a finishing step to add an adhesive compound backing and, usually, a secondary backing material.

Tufted carpet styles range from loop, cut pile, and combinations of both in solids, tweeds, stripes, and patterns from the most simple to the exotic and complex. The designer has an endless variety of carpet choices due to advances in tufting-technology, coloration options, and finishing techniques.

COMMON TUFTING TERMS

TERM	DEFINITION
GAUGE	The distance between two needle points expressed in fraction of an inch. Applies to both knitting and tufting.
STITCHES PER INCH	Number of yarn tufts per running inch of a single tuft row in tufted carpet.
PILE THICKNESS OR TUFT HEIGHT	Generally measured from surface of the primary backing to the top of tufted yarn. Adjustments in this property can affect the pile yarn weight. There are standard laboratory methods for determining pile thickness (for loop pile carpets) and tuft height (for cut pile carpets).

TUFTING CONSTRUCTION

Tufted carpet is typically 600-2,000 rows of pile yarn simultaneously stitched through carrier fabric (primary backing). Most prevalent method for carpet production (over 90% Tufting vs Weaving/Knitting). Textural flexibility achieved with varying colors, surface textures, using various types of yarns, etc.

TYPE	DESCRIPTION	SPECIAL CHARACTERISTICS
Cut Pile	A fabric in which the face is composed of cut ends of pile yarn	<ul style="list-style-type: none"> • Custom tufting available for specially designed orders • Patterned effects created in the cut pile constructions by using different colors of yarns
Loop Pile	Level loop Multilevel loop	<ul style="list-style-type: none"> • All loops same height from row to row • A patterning attachment is used to achieve different pile heights in a pattern repeat
Cut-and-Loop Pile	A fabric in which the face is composed of a combination of cut ends of pile yarns and loops.	<ul style="list-style-type: none"> • Varying levels of pile height pile textures create surface interest

11. WEAVING

While there are several methods of weaving and several types of looms, there are basic similarities to all. In general, woven carpet is formed by the interweaving of warp and weft yarns. The warp yarns are wound from parallel or heavy beams that unwind slowly as weaving progresses. Two main types of warp yarns form the carpet back: chain and stuffer. Chain yarns provide structure and stability while stuffer warp yarns increase bulk and stiffness of the fabric. The face yarns of woven carpet are also pre-dyed warp yarns that are normally fed into the loom from a yarn creel.

The warp yarns run through a heddle, a series of vertical wires, each having an eye in the center through which the yarn is threaded. The heddle controls the action of the warp yarns. The wires are mounted on two frames that rise alternately to form a space or shed.

The face of the carpet is formed with warp yarns moving into the loom from yarn creels. These pile yarns are looped over wires that lie at right angles to the warp yarns that are then bound with a yarn known as the weft, which is shot through the shed with a shuttle or other means. When a cut pile carpet is desired, wires with a knife blade at one end are used.

COMMON WEAVING TERMS

TERM	DEFINITION
ROWS OR WIRES PER INCH	The number of tufts per inch in the length of the woven carpet. Expressed in whole numbers. Number varies among different weaves.
PITCH	Same as gage, or gauge, in tufted carpet. In woven carpet it is the number of ends of yarn in 27 inches of carpet width.
WARP	A weaving term for yarns that run lengthwise in woven fabrics and carpets. Warp yarns are usually delivered to the loom from a beam, a large spool with hundreds of ends of yarn wound on it, mounted behind the loom. Woven carpets usually have three sets of warp yarns, which may be wound on three loom beams. These include stuffer warp for lengthwise strength and stiffness, pile warp, which forms the carpet surface tufts, and chain warp, which interlaces with fill yarn to lock the structure together.
WEFT	Yarn that runs widthwise in woven cloth or carpet, interlacing with the warp yarns.
SHOT	A weaving term for fill yarn, the yarn inserted at right angles to the warp across the fabric width. In woven carpet, it is the number of picks of fill yarn per row of pile tufts.
FRAMES	Racks at back of the Wilton loom holding spools from which yarns are fed into the loom. Each frame holds a separate color; thus, a 3-frame Wilton has three colors in the design.

WEAVING CONSTRUCTION

Pile yarns and backing yarns woven simultaneously into finished product

- Primarily used in commercial installations
- Heavy, firm hand; high strength
- Often used in hospitality settings

TYPE	DESCRIPTION	SPECIAL CHARACTERISTICS
Velvet Carpet	Carpet made on velvet loom; cut or loop, level or multi-level pile	<ul style="list-style-type: none"> • Simplest loom of the three • Dominated by solid colors, but multicolor and multi-texture effects are becoming more widespread • Service quality is achieved with pile density (high-pile density is achieved by specifying high pitch or a heavy yarn weight)
Wilton Carpet	Carpet made on Wilton loom; can have various pile heights (level or multilevel) and can have loop or cut pile	<ul style="list-style-type: none"> • Capable of intricate patterning, styling, and coloration versatility • Withstands heavy traffic; used mostly in commercial applications and area rugs • Weaving process contributes to durability, strength, firmness, and flexibility
Axminster Carpet	Carpet made on Axminster looms are cut pile only	<ul style="list-style-type: none"> • Offers wide range of patterns and colors • Withstands heavy traffic; used mostly in commercial applications and area rugs • Weaving process contributes to durability, strength, firmness, and flexibility (bends only horizontally)

12. KNITTING

A carpet knitting machine, known as a double needle bar knitter, has a row arrangement of hundreds of latch needles that move in an up-and-down motion in conjunction with yarn guide bars. Yarn guide tubes are attached to a guide bar that passes the yarns between and about the needles, thus laying down the pile face yarns and weft backing yarns. Separate sets of guide bars control each of the yarns—knitting, backing and face yarns. Additional bars may be used for color and design variety.

Knitted carpet is used mainly for commercial loop construction and is sometimes referred to as woven interlock. It often is used in school applications.

KNITTING CONSTRUCTION

DESCRIPTION	SPECIAL CHARACTERISTICS
Warp-knitted yarn fabricated on face and back simultaneously. Pile, backing and stitching yarns are looped together by three sets of needles	<ul style="list-style-type: none"> • Similar to woven carpet, but less stiff; bends horizontally only • Most is solid colored or tweed • Quality depends on the amount of pile yarn and strength of attachment of the face, chain, and backing yarns; quantity of yarn depends on the gauge and stitches per inch warpwise, which are related to the yarn size

13. NEEDLEPUNCHING

In the needlepunching process, several webs of fibers are superimposed to create a thick, loose batting. The batting is then tacked, or lightly needled, to reduce its thickness before it is fed into the machine. As the batting is fed into the machine, it passes between two plates. The stationary lower plate contains many holes, while the upper plate, or headboard, contains several rows of barbed needles. The batting passes between the plates and the headboard moves up and down, passing the barbed needles through the fibers. As the needles pass through the fibers, they carry fiber ends from the top of the batting to the bottom, and when they are withdrawn, vice versa. The needles are passed repeatedly through the batting as it moves through the machine to form the carpet.

Needlepunch carpet is used mainly for outdoor applications and may include uses like entrance mats, marine uses, wall coverings, and automotive applications. Surface patterning creates a large number of design possibilities.

NEEDLEPUNCHING CONSTRUCTION

DESCRIPTION	SPECIAL CHARACTERISTICS
Web of fibers moves through machine. Barbed felting needles penetrate and entangle fibers into durable felt-like fabrics	<ul style="list-style-type: none"> • Usually made with a solution-dyed polypropylene • Diverse range of designs-ribs, sculptured designs, and patterns • Only used in glue-down installations

14. BONDING

Fusion-bonded carpet is produced by implanting the pile yarn directly into a liquid polymer, usually PVC, which fastens it directly to the backing. This results in very little buried yarn compared to other processes. The yarns can be closely packed, producing very high densities suitable for high-use areas. This process is used most frequently to produce carpet to be cut into carpet tiles or modules. Fusion-bonded carpet may be loop construction, but most often is a cut pile product, made by a two-back process, slicing apart two simultaneously made carpets that are mirror images.

BONDING CONSTRUCTION

DESCRIPTION

Yarns are implanted into vinyl or thermoplastic coated backing

SPECIAL CHARACTERISTICS

- Often die-cut for carpet (tiles)
- Cut pile produced by slitting two parallel sheets of face-to-face carpet

SIX-FOOT CARPET AND CARPET TILES

Six-foot-wide carpet is increasing in use and is available in many designs, with a variety of backcoat systems created to accommodate performance needs. This narrow carpet roll is often a benefit in high-rise buildings, where transporting a 12-foot roll is difficult, heavy, or expensive. The narrow width can also be a cost saver for hallways and other narrow spaces. However, careful planning is needed to avoid too many seams.

Continually changing configurations of open-plan office systems have advanced the use of carpet tile, or modules, for increased functional benefits, distinctive designs for pleasing aesthetics, the facilitation of removal and installation, and/or flexibility in design and replacement to change work and high-traffic areas. Carpet tiles come in a variety of styling and construction options, offering anti-soiling, and/or anti-static options. The possibility of rotating the tiles where heavy traffic or soiling occurs is an alternative to complete broadloom replacement.

Raised access flooring with attached cushion carpet or carpet tiles is often utilized with the growing use of electronic cabling in facilities.

Carpet tiles are installed with standard adhesives, releasable adhesives, mill-applied peel-and-stick adhesives, and floating systems. In many facilities, carpet tile installation is easier and offers less downtime and productivity loss than traditional carpet installation. The system divider panels and office furniture do not have to be removed from the area, but simply lifted with a “jack” system while the tiles are installed underneath. An entire office area can often be recarpeted in one overnight shift rather than disrupting an office for days. This minimal disruption of business may circumvent the extra cost of the product and installation.

ENTRANCE MATS

Manufacturers now provide a variety of constructions of entry mats and systems to avoid tracking in exterior soils onto interior floor coverings.

The pile of most mats is olefin or solution-dyed nylon, while backs may be PVC or rubber.

Some manufacturers are creating a system with multiple mats. The first is usually a rubber or molded plastic mat with shoe scrapers molded into the mat. A second mat may be inside the doorway and is typically a tufted, deep, or needle bonded carpet that continues to brush the shoes. A third mat may extend into the building for 10 to 15 feet to pick up the maximum amount of tracked-in soil and moisture.

AREA RUGS

The design freedom that comes with area rugs is a medley of wonderful patterns, textures, colors, constructions, and sizes to enhance and blend with any décor. Accent or area rugs are most often used to create a visual, decorating focal point, to soften hard surfaces, to provide walking/standing comfort, or to diminish noise.

Custom-designed rugs are another alternative available for personalized design treatment. Options are infinite for selecting colors and patterns for any interior design. Rugs can depict a company logo or a corporate look, or they can mirror architectural details or duplicate other design elements from wall coverings, fabric, or art.

These rugs are seldom permanently installed (they are loose-laid), but still offer many of the functional benefits of wall-to-wall carpet—comfort, insulation, safety, and noise reduction. In a commercial atmosphere, rugs can be removed or turned back with relative ease to permit ready access to the sub-floor in installations where access is important.

Construction can be woven, tufted, hand-gun tufted, or pieced from tufted broadloom carpet. The most common fibers used are nylon, olefin, and wool.

NEW MANUFACTURING TECHNOLOGY FOR CARPET CONSTRUCTION

Computers have revolutionized the way carpet is made today. Developments in the design studio and in new tufting and weaving equipment have made great advances, expanding color and patterning capabilities, and increasing the speed of manufacturing. Computer-aided design (CAD) product simulation programs have made carpet design possibilities virtually limitless. Designers can visualize carpet down to the fiber type on-screen and can print realistic color outputs to save time and money in making strike-offs.

The most recent CAD innovation demonstrates how products will look in a specific setting by digitally displaying the carpet on the floor of a scanned, photographed room. This can save the carpet manufacturer a significant amount of time running expensive machinery to perfect an end product. Additionally, designers or sales representatives in the field can work with mills on color or pattern changes. Salespeople can also use these graphic programs to show customers specific designs in different colors.

Current computerized tufting machines produce such precise patterns that today's tufted carpet and rugs rival woven products in complexity of pattern, number of colors, and construction. Computerized servo motors, systems that control mechanical functions via computer signals, create greater efficiencies, decrease human error, and allow for more design flexibility.

Technology also is revitalizing the weaving looms. Traditional looms that used to have Jacquard pattern devices, an apparatus that uses perforated cards as a mechanism to activate the color selection to be raised to the pile surface, are now computerized with electronic Jacquard systems. Like servo motors on tufters, electronic Jacquard systems control many primary functions and make weaving faster and more economical.

FINISHING TECHNIQUES

Once the carpet face has been constructed and dyed, it must go through a series of steps to make sure the finished product looks and performs to specifications.

One of the following finishing techniques completes the manufacturing process:

1. lamination of fabric secondary backing,
2. application of synthetic foam, attached cushion,
3. coating with a synthetic latex, vinyl or other polymer. For a complete list of backing systems used with various constructions methods, see Carpet Construction > Backing Systems.

PROTECTIVE TREATMENT

Safeguarding and preserving carpet appearance is achieved with protective treatments. Topically applied stain and soil resistance treatments are used to protect carpet fibers. Soil treatments retard soiling by coating the carpet fibers with a low-surface energy polymer. This coating resists wetting from oil, a common component of most soils and many staining agents. This coating also resists water and waterborne soils and functions by not allowing soils to stick to the fiber surface; therefore, when the fibers are cleaned, the soil is released.

Stain-resist treatments act like colorless dyes that block or provide a barrier mechanism against many common food stains.

It should be noted, however, that these treatments are enhancements; they do not make the carpet stain proof. For example, carpet treated with a stain-resistant finish is still subject to stains if the spot is not removed promptly and properly. Chemical treatments also are not a substitute for the preventive measures of vacuuming and extraction cleaning.

To avoid using cleaning agents that might react with the finish or may void the manufacturer's warranties, follow the manufacturer's recommendations for spotting and deep-cleaning methods.

BACKING SYSTEMS

Commercial carpet backing systems are more numerous and varied than those for residential use. Each fulfills a specific function.

Backing systems consist of three possible elements:

- 1) the primary backing,
- 2) the applied bonding adhesive and
- 3) the secondary backing or cushion/hard back.

In the most common system, the yarn is secured into the primary backing by the synthetic latex or vinyl, and a secondary backing (or cushion) is attached to provide further pile-yarn stability and to add dimensional stability to the carpet structure.

In tufted carpet, the primary backing is usually woven, slit film polypropylene or polyester fabric, although some polypropylene and polyester nonwovens also are used for special applications. A secondary fabric backing, a woven scrim polypropylene, may be applied. Synthetic backings are resistant to moisture shrinkage.

Tufted carpet backings, consisting only of a chemical backing without an added secondary backing, are called unitary backings. They are appropriate only for glue-down installations. Styrene butadiene latex is the most frequently used backing and laminating compound, although other compounds, such as polyvinyl chloride, amorphous resin, vinyl acetate ethylene, polyethylene, and polyurethane, are used. Natural latex is used only on small, washable rugs.

The choice of laminating material influences many of the physical properties of the carpet, including dimensional stability, tuft-bind, pilling and fuzzing, adhesion of secondary backing, durability, and resistance to edge ravel.

In woven and knitted carpet, backing fabric and pile yarns are combined during the fabric formation process. A variety of backing or construction yarns have been used in weaving: jute, linen, cotton, kraftcord, rayon, polyester and polypropylene. Today, polypropylene yarns are primarily used. They are moisture-resistant for warp, filling, and stuffer yarns.

Some needlepunched carpet may contain a supporting scrim fabric into which the base fibers are needled during needlepunching. However, most have neither a primary nor secondary backing.

Backing systems with moisture barriers from the base of the pile yarn to the floor prevent spills from penetrating the backing and seeping into the sub-floor. This type of backing can be on either broadloom or carpet tile. Moisture barriers may be valuable in healthcare environments, where spills are inevitable and cleaning is frequent. The moisture barrier of the carpet itself and the sealing techniques for the seams may provide lower long-term maintenance costs. When using moisture barriers, attention to floor preparation is important before installation to assure that moisture vapor emissions in the sub-floor are not excessive. See CRI 104/105 Installation Standards at www.carpet-rug.org/install for more information.

New backing systems that are designed to provide enhanced performance are now available. Some alleviate the previous problems of distortion of patterns—bowing and skewing—with stability in the tufting process. These backings sometimes contain a combination of woven and nonwoven backings.

Other options are newly developed latex-backed products that offer a softer hand to the backing, creating a new ease in installation, with less damage to walls and baseboards, along with increased strength and other physical properties. Some of these backings also provide water impervious qualities that enhance the softness and strength.

The manufacture of carpet-backing is a quickly developing industry. Specifiers should stay in contact with carpet manufacturers for the latest in backing technology innovations.

CARPET BACKING SYSTEMS		
Construction Method	Typical Backing Fabrics and/or Backing Components	Typical Backcoating Chemical Compounds
Tufted	<u>Primary:</u> <ul style="list-style-type: none"> woven polypropylene or polyester slit film non-woven, polypropylene or polyester <u>Secondary:</u> <ul style="list-style-type: none"> woven leno weave polypropylene, non-woven polypropylene, or polyester woven jute, seldom used now fiberglass reinforcement attached cushion 	<ul style="list-style-type: none"> synthetic styrene butadiene rubber latex polyurethane polyvinyl acetate vinyl acetate ethylene polyvinyl chloride amorphous resins or thermoplastic polyolefin Styrene acrylic polyvinyl butyral
Woven	<u>Construction yarns may include:</u> <ul style="list-style-type: none"> cotton jute polypropylene polyester viscose rayon blends or combinations 	<ul style="list-style-type: none"> Similar materials as tufted, but usually thinner coatings
Bonded	Fiberglass matting	<ul style="list-style-type: none"> polyvinyl chloride
Needlepunched	(None typically used)	<ul style="list-style-type: none"> styrene butadiene rubber latex Acrylics Vinyl acetate ethylene Styrene butadiene rubber latex foam ethylene vinyl acetate

SHEARING

After processing a cut pile carpet surface may be uneven. In order to clean up the surface of the carpet, it will pass through a shearing unit, resulting in a clean, groomed surface.

The shearing heads brush the carpet pile to make it both erect and uniform, and then pass it through a series of rotary knives or blades that shear, or cut off, the fiber tips at a precise height. Multiple-head shears have a double set of hard bristle or nylon brushes and two, three or more shear blades per unit. The shear head action is like a rotary blade lawnmower.

The shear also is used for tip, or random shearing, an effect that creates a textured look. When a tip-sheared carpet is specified, the carpet is tufted as a multi-level loop carpet. Loops significantly longer

than the others are formed for subsequent cutting by the shear. The cut fiber tips showing on the surface against the loop pile background give darker, or shaded, cut areas and surface interest to the carpet. Tip shearing can be an integral part of the carpet design or pattern.

Pattern effects also can be achieved with a pattern shear. In pattern shearing, carpet rides along a rotating, hard rubber composition belt that carries a raised design. As the carpet rides along the raised portions of the design, the shear cuts a level surface, creating a high-low, three-dimensional appearance to the carpet.

CARPET SPECIFICATION

Certain issues must be addressed to specify carpet, regardless of the installation site. Most of the critical decisions made during specification, including those for installation and maintenance, will determine the life cycle of the carpet. The specifier should determine the expectation for the carpet and the most important selection criteria. A proper specification covers the key technical aspects—from sub-floor preparation to choosing the proper cushion and method of installation to post-installation cleanup—none of which can be overlooked in a successful installation.

Consider the following basic issues to create a carpet specification:

- **Aesthetics considerations:** color, texture, design/pattern, luster, appearance or the “look”
 - Market considerations: hospitality, retail, office, etc.
 - Desired ambiance
 - Color selection parameters
 - Flexible and functional
 - Restricted: must match or blend with other furnishings
 - Dark or bright ambient lighting
 - Nature of lighting: fluorescent, incandescent, etc.
 - Psychological/motivational factors
- **Functional considerations:**
 - value
 - acoustics
 - ergonomics
 - safety
 - thermal insulation
 - low maintenance costs
 - flammability
 - static propensity
 - indoor air quality
 - life-cycle value

- **Appearance considerations:**

- durability
- wearability
- cleanability
- installability
- color retention and fastness
- texture retention
- appearance retention

- **Primary end-use considerations:**

- Traffic levels and patterns
- Wheeled traffic and ADA requirements
- Nature of regional soil
- Projected life span
- Projected quality of maintenance
- Government or building code requirements

AESTHETIC CONSIDERATIONS

Carpet is widely recognized for its excellent “first impression” of beauty, prestige, and dignity in any business or facility. Well-chosen carpet dramatically enhances the feeling of quality and distinction in interior design, a major consideration for hotels, restaurants, and corporate buildings. Carpet also has the ability to “de-institutionalize” a building, creating a “home-like” factor in improved patient and staff morale in healthcare facilities and in student and teacher attitudes in schools. Carpet can give inhabitants a positive, warm feeling.

Carpet is available in a wide array of colors, patterns, textures, and constructions to complete every décor. Running lines from manufacturers are more extensive than ever. Advanced computer and machine technology makes custom-designed carpet available in quick turnaround time and at moderate prices to pull together custom logos or corporate looks. Sophistication or playfulness—either extreme is possible with today’s carpet.

Color plays a key role in the performance of carpet, even though technological advances, such as soil-retardant improvements, may increase the flexibility of using more shades in applications. For more heavily trafficked areas, mid-tone colors, heavy patterns, tweeds, and heathers perform better. Also, consider the color of the local soil or the unique soil produced within a facility.

Texture includes a wide variety of choices: level loop, cut pile saxonomies, and velvets for a plush look; combination cut and loops, multilevel loops, tip-sheared patterns for a more casual look. The ideal specification provides a balance between the desired aesthetic and the functional needs of a particular installation.

FUNCTIONAL CONSIDERATIONS

15. CARPET'S VALUE IN NEW CONSTRUCTION AND RENOVATIONS

The overall cost of a quality commercial carpet installation - total life cycle cost - (capital and maintenance costs) makes carpet an attractive alternative to other types of floor covering. Major mortgage companies accept the total installed cost of carpet in long-term financing of all kinds, just as they do hardwood, tile, or other hard surfaces. The U.S. Department of Housing and Urban Development (HUD) and the Federal Housing Authority (FHA) include carpet that meets or exceeds minimum federal specifications.

Savings in actual construction costs are significant when initial building plans call for carpet because it is unnecessary to install finished sub-flooring materials prior to carpet installation.

Remodeling floors in older buildings can cost less with carpet too. For example, if badly worn wood floors were ceramic tiled, they would have to be resurfaced entirely. Normally, they would be resurfaced with plywood or other underlay material before the hard surface tile could be installed. By specifying a carpet installation with cushion, bad areas can simply be patched for leveling. This prevents premature, localized wear on the carpet, avoiding the need for total resurfacing. In general, as long as sub-floors are sound, there's no need for total resurfacing.

Carpet can also be installed over some resilient tile floors, a solution that can alleviate the challenge of removing asbestos-containing flooring. Loose tiles are simply replaced, and chipped areas leveled with a compatible patching compound. The carpet is installed over a separate cushion or a carpet with attached cushion, or appropriate backing system can be adhered directly to the hard surface floor.

16. THERMAL INSULATION OR TEMPERATURE CONTROL

The pile construction of carpet is an efficient thermal insulator, reducing energy consumption and cost for heat and air conditioning. The surface temperature of carpet is usually higher than cold, hard surfaces, reducing coldness at foot and ankle levels. Additionally, carpet helps to sustain empty building temperatures over weekends and other nonuse periods, reducing the absorption of heat by cold floor surfaces. Because carpet insulates, it extends the usable workspace in elementary school classrooms to the floor, allowing children to work or play on the carpet in comfort as they do at home.

Thermal tests to determine the thermal resistance or R-value of carpet alone and carpet with cushion combinations have shown R-values range from 0.5 to 4.0. The R-value represents a resistance to heat flow; thus, the higher the R-value of a material, the better the insulation value of that material. The table below gives the typical R-values for some common materials based upon equivalent one-inch-thick specimens.

Thermal Resistance of Common Materials	
R-value (Hr - ft. ² - °F/BTU) per inch	
Copper	0.00037
Concrete	0.10
Plywood	1.25
Carpet	2.4
Fiberglass insulation	3.2

Carpet is a good insulator relative to concrete and plywood, common flooring materials.

A study conducted by the Georgia Institute of Technology and Dynatech, Inc., has found a direct proportionality between total thickness of the test sample and the corresponding R-value for that sample. Test results show the contribution of any component of the carpet–pile or cushion to the total R-value is more dependent on the thickness of the component rather than the fiber and/or yarn type.

The study concluded, “in all cases, carpet was found to provide insulation value for any installation on a floor surface exposed to outside temperatures. In extreme climates, the dollar value of this insulation effect can be significant.”

17. ACOUSTICS

Carpet controls noise by reducing ambient sound and surface noise up to 70 percent, and by reducing impact sound transmission from floor to floor. Carpet absorbs ten times more airborne noise than any other floor covering and as much as most other types of standard acoustical materials. It virtually eliminates floor impact noises at the source. Carpet, the only material that serves the dual role as an acoustical material and as a floor covering, provides even more substantial savings and greater planning flexibility for acoustical treatment. In actuality, the cost of carpet should be compared to the costs of other floor materials plus an equivalent acoustical treatment. For more acoustical information, see the [Acoustical Characteristics of Carpet Technical Bulletin](#) for more information.

18. SCHOOLS

In a school setting, carpet is not only a floor covering, it is also an exceptional absorber of sound by reducing airborne noise and impact sounds more than any other floor covering. A quieter school environment is definitely more conducive to listening and learning.

19. ERGONOMICS

Carpet reduces “floor fatigue.” It feels better underfoot than a hard, unyielding surface, a characteristic important to salespersons, teachers, nurses, food servers, and other personnel who spend many hours on their feet during a workday. Carpet heightens morale and increases productivity by helping reduce fatigue.

20. SAFETY

The National Safety Council reports that falls cause most indoor injuries. By contrast, carpet reduces incidents of slips and falls in what might otherwise be high accident areas. Carpet also cushions when falls do occur, translating into enhanced comfort along with savings in medical costs, workman's compensation, and insurance claims. Carpet reduces reflected glare that might be annoying or distracting, especially to the elderly or those with vision problems.

21. MAINTENANCE—LESS COSTLY

Specifiers know maintenance and cleaning factors of a building will often equal the capital cost of the building. Carpet offers an advantage when compared to hard surface flooring because maintenance is easier and less costly. Carpet generally requires only regular vacuuming and periodic deep cleaning, while hard surfaces require a schedule of mopping, buffing, stripping, and re-waxing, all of which are more costly.

22. SPECIFICATIONS CASE STUDY

Situation: A new football/sporting and concert event stadium

What carpet should be specified to address the following performance needs?

- Designed as an interior space, rather than a stadium, it is essential that carpet retain an “executive” look.
- Carpet must sustain concert goers, football fans, conventioners, and the abuse of extreme high traffic.
- Carpet must resist stains and spills easily, which would be a daily and frequent occurrence.

What could be specified to ensure a high-performance carpet for this situation?

- Tufted loop-pile carpet with custom-designed pattern to help hide spots or spills
- 100 percent solution-dyed nylon
- Pile height finished: .156 inches
- Pile yarn weight finished: 24 oz./sq. yd.
- Average pile yarn density (APYD) = 6,000 or greater
- Unitary backing or high performance secondary backing to help meet high-traffic demand
- CRI Green Label Plus Indoor Air Quality Testing Program Label for both carpet and adhesives
- Installation adhering to *Standard for Installation of Commercial Carpet, CRI-104*
- Regular maintenance as defined by manufacturer

CONSTRUCTION SPECIFICATIONS

There are two types of carpet specifications:

1. Construction
2. Performance

These specifications tell the manufacturer in very precise terms how the carpet is to be made (look, size, weight, and manufacturing of raw materials and processes) without directly stipulating performance needs or end-use requirements. A construction specification should include the following:

- Construction type: tufted, woven, knitted, needlepunched, bonded
- Construction materials: fiber (fiber type and size), backing (type and weight), and adhesives
- Construction methods: yarn manufacturing, fabric formation (gauge, pile height, texture, density, and total weight), coloration techniques, finishing and treatments
- Product characteristics: texture, color/design, size/type, and functional enhancements

Common errors in construction specifications are either to under- or overspecify. When too many minor details are included, the tendency is to specify beyond the capabilities of the manufacturer or to limit the flexibility of new technology. The specification for yarn size might be too large for a particular gauge, or the yarn size, gauge, stitch, pile height and weight might be impossible to create in the specified combination. There also is a tendency to perceive that more is better - more pile weight, more plies, more rows, etc. - mean better durability. Each of these does play a role, but more specification may not relate to better performance or product.

With modern manufacturing and computer controls, many standard terms may not apply today.

Construction specifications should describe the overall formation of a product, but not be so detailed they limit the manufacturer from making a quality product.

23. IMPORTANT FACTORS

An important factor in construction specification is density. Density is the amount of yarn in a given volume or area of carpet. The higher the density value, the more compact the pile.

23.1. DENSITY

The density of the pile yarn is an important determinant of carpet performance, especially for high-traffic environments. With synthetic fibers, it is almost impossible to wear out the face fiber, regardless of weight. However, crushing can occur if the density is too low. Specify a minimum average pile density consistent with expected traffic conditions. In cut pile carpets, yarn twist must also be adjusted to provide improved appearance retention.

Density is influenced by many factors, such as stitches per inch, yarn thickness, gauge, and tuft height. Gauge is more a function of yarn size: a “fat,” or larger size, can be tufted at a wider gauge, or smaller yarns at a tighter gauge, and receive the same density rating. Understanding the various factors affecting density creates a better chance of specifying the best carpet performance for a given budget.

Stating relative density specification for pile carpet can be done several ways. Average Pile Yarn Density (APYD) is the most common and useful decision tool used in conjunction with other carpet specifications. APYD is determined by pile weight (specified in finished ounces per square yard), pile thickness, or tuft height. Pile thickness and tuft height are laboratory means of determining what is commonly known as “pile height.” Pile height is sometimes measured with a small ruler or “dipstick.” However, these make only rough determinations and should not be considered accurate.

Generally, the higher the APYD value, the better the expected carpet performance once other important factors are considered. The average pile yarn density method is most often used.

The figure below also shows a useful empirical formula to determine APYD and other density measurements.

23.2. PILE DENSITY FORMULAS

PILE DENSITY FORMULAS

**Average Pile
Yarn Density =**

$$\frac{36 \times w}{t \text{ (or } T)}$$

Where: w = pile yarn weight in ounces/sq. yard
t = pile thickness in inches as determined by ASTM D 6859 for loop styles
T = tuft height in inches as determined by ASTM D 5823 for cut pile styles.

Note: This formula is the most commonly used. Values are usually between 1000 and 7000.

Example: A 32-ounce-per-square-yard carpet with a 1/4-inch pile thickness has a calculated APYD = 4608.

**Kilotex Rating
(Canadian Method) =**

$$\frac{\text{Yarn tex number} \times \text{tufts}/100 \text{ cm}^2}{100,000}$$

or

$$\frac{\text{Yarn denier} \times \text{pile ends}/\text{sq. inch}}{58,070}$$

Note: This approach converts all units to metric values, and is used primarily in the Canadian market.

Example: A 1/8-gauge product with 9.5 stitches per inch made from a 2300 denier pile yarn has a calculated pile density = 6.02 Ktex/cm².
(To obtain pile ends per square inch, double the tufts per square inch.)

23.3. GAUGE

In tufted carpet, gauge, or the reciprocal of the number of tuft rows per inch of width, is often detailed. For example, a 1/8-gauge carpet has eight tuft rows per inch of width and a 5/32-gauge carpet has 6.4 rows per inch of width.

TUFTED CONSTRUCTION GAUGES	
Gauge	Tuft Rows Per Inch
5/32	6.4
1/8	8
1/10	10
5/64	12.8
1/16	16

For woven carpet, the equivalent of gauge can be obtained by dividing the pitch (number of ends of yarn in 27 inches of width) by 27 inches.

The number of stitches (tufts) per inch in the length of carpet is usually specified directly for tufted carpet, but is called “rows per inch” for woven carpet. The numerical product of tuft rows per inch (gauge) of width multiplied by stitches per inch is the number of tufts per square inch, or tuft density.

24. ADDITIONAL FACTORS

Other factors that may affect carpet performance include yarn size and characteristics. Yarn twist and proper heat setting are important for most cut pile styles. A low twist, or poorly heat-set yarn in a cut pile carpet, may tend to mat, tangle, and appear worn.

Other determinants often written into construction specifications are the backing systems used, the type of fiber, and the dye method used.

Although not considered descriptive of quality or performance, total finished carpet weight is sometimes included in specifications. It should not be confused with pile yarn weight. Total finished weight encompasses all components of the product including pile yarn and backing materials. Like pile yarn weight, total finished carpet weight is expressed in ounces per square yard or per square foot. It is primarily used as an indication of roll weights for determining trucking costs.

Construction specifications can be proprietary, identifying a specific carpet by grade, name, and manufacturer. An “or equal” specification also could identify a specific grade, listing its construction factors so that other manufacturers can bid for the order competitively. In this case, the usual procedure is to approve “or equals” in advance of the actual bidding.

25. SUMMARY

Avoid over-specification. As new technologies emerge, construction specifications will become less important, especially as an estimate of performance. Appearance is simply an aesthetic choice, while appearance retention is a performance issue. Therefore, specifications containing performance factors are becoming more common.

PERFORMANCE SPECIFICATIONS

Necessary performance attributes are listed in the performance specifications, telling the manufacturer how the carpet must perform without detailing how it must be made. Specifying performance, rather than construction, takes the difficult pressures off the specifier to provide accurate details and is safer for the specifier not familiar with the latest carpet technology and materials.

A typical performance specification for carpet might include the following:

- Functionality factors, such as:
 - Tuftbind
 - Delamination resistance
 - Colorfastness (light)
 - Crocking (rubbing off)
 - Electrostatic properties
 - Moisture penetration
- Performance Appearance Retention Rating
- Indoor Air Quality Emissions Requirements—complying with CRI Indoor Air Quality Program criteria (green label)
- Safety/Regulatory Requirements, such as flammability

The creative factors—pattern, color, and texture—that are properly and exclusively the province of the carpet designer or decorator on the job, are also *major* contributing factors in the specification.

26. PERFORMANCE SPECIFICATIONS FOR CUSTOM ORDERS

Keep in mind that specifying performance for special order or custom-made carpet rather than for in-stock grades can create unanticipated delays. Not only must the manufacturer have time to develop the basic construction of custom orders, trial samples must be performance tested. The time involved may run considerably longer than typical specifying and bidding periods allow.

SPECIFICATION REQUIREMENTS OR INCLUSIONS

Whether written for construction or performance, carpet specifications should incorporate requirements governing the following items:

- Installation procedures and materials. (Follow manufacturer's recommendations and/or *Standard for Installation of Commercial Carpet, CRI-104* or *Standard for Installation of Residential Carpet, CRI-105*.)
- Qualifications of the installation contractor (Floor Covering Installation Board certified or certified by the manufacturer) and CRI Seal of Approval status
- Type of installation (stretch-in, glue-down, or alternative methods)
- Cushion type and weight
- Certification that materials meet federal, state, and local government ordinances for flammability and ADA requirements
- Delivery and installation schedules
- Carpet maintenance (request manufacturer maintenance instructions or maintenance contract)
- Government specifications and regulations
- Special installation instructions for patterns, unusual shapes, borders, etc.
- Warranties
- Guidelines for indoor air quality during installation

27. INSTALLATIONS

Two of the most important factors in completing the specification are stipulating installation procedures and cushion requirements. The two main types of commercial carpet installation methods are glue-down and stretch-in. In some cases, other types of installations may be used, such as double glue-down and alternative methods. Several factors go into determining installation type, including:

- The load and nature of the traffic (direct glue-down generally is specified where rolling equipment and heavy traffic is expected).
- Necessity to do a partial installation (such as when the workplace is occupied).
- Type and condition of the sub-floor. Especially important for glue-down installation on concrete slabs.

See CRI 104/105 Carpet Installation Standards at www.carpet-rug.org/install for more information on proper carpet installation.

28. SPECIFYING TESTING PROCEDURES AND CRITERIA

Typical resources for testing procedures and criteria are American Society for Testing and Materials (ASTM), American Association of Textile Chemists and Colorists (AATCC), National Fire Protection Association (NFPA), Building/Fire Codes, Federal Test Methods (FTM) and the Carpet and Rug Institute (CRI).

Resources for government test requirements include (Federal) GSA, FHA, DOD, and DOE. Other requirements may include state and local, as well as in-house, client-based requirements.

29. GOVERNMENT SPECIFICATIONS AND REGULATIONS

When specifying carpet for use by a government entity, specific requirements need to be included. As a major user of carpet, the federal government publishes standards regarding carpet performance and use through three federal agencies: the General Services Administration (GSA), Consumer Product Safety Commission (CPSC) and the Department of Housing and Urban Development (HUD).

When specifying carpet for government facilities, various government agencies may have specific requirements. These may be:

- General Services Administration (GSA) Carpet Technical Requirements
- Department of Housing and Urban Development (HUD) Carpet Certification Program, for the FHA market described in HUD Bulletin UM-44d
- Textile Fabric Products Identification Act (Federal Trade Commission)
- Consumer Product Safety Commission (CPSC): FF1-70, 16 CFR 1630 – Flammability requirement for all carpet (Federal Fabric Flammability Act)
- Regional or local regulations for flammability for regulated areas – flooring and radiant panel test method for carpet installed in corridors ASTM E-648 or NFPA-253
- Americans with Disabilities Act (ADA) section 4.5 Ground and Floor Surfaces

GSA is the agency responsible for many government purchases, including interior furnishings. Other agencies, such as the Army Corps of Engineers and the U.S. Navy, may act as design/construction managers for Department of Defense agencies. The current GSA Technical Requirements for Carpet, Carpet Tile, and Carpet Cushion should be referenced. HUD oversees the Federal Housing Administration (FHA).

29.1. RESIDENTIAL CARPET IN FHA MARKET

Since the mid-1960s, the FHA has permitted the inclusion of carpet in federally-insured mortgages. A manufacturer wanting to offer carpet in the “FHA market” must participate in a carpet certification program adopted by HUD in 1975. The program, outlined in HUD bulletin UM-44d, requires all carpet to be certified by a HUD-approved administrator.

FHA standards provide for *minimum* carpet qualities for residences. Whenever possible, consideration should be given to selecting carpet appropriate for the expected traffic, often a better grade than an FHA minimum.

30. FLAMMABILITY REQUIREMENTS

All carpet and rugs 4 ft. x 6 ft. (122 cm x 183 cm) or larger must meet the requirements of FF1-70 (flammable fabrics) as found in 16 CFR 1630 (Code of Federal Regulations). This requirement, under the jurisdiction of the Consumer Product Safety Commission (CPSC), helps protect consumers and users against a small-ignition-source fire occurrence.

30.1. PILL TEST

The test method, known as the “pill test,” involves subjecting eight 9 in. x 9 in. (23 cm x 23 cm) specimens, which have been dried in an oven, to the flame from a standard igniting source in the form of a methenamine tablet. The tablet, or “pill,” is placed on top of the pile in the center of each specimen and ignited with a match, providing a standardized flame source for a period of about two minutes. If the flame spreads more than three inches from the point of ignition, the specimen fails; and if more than one specimen of the eight fails, the style of carpet cannot be legally manufactured for sale. The burden of compliance with FF1-70 rests with the carpet manufacturer.

30.2. FLOORING RADIANT PANEL TEST

The flooring radiant panel test method evaluates the tendency of a floor system to spread fire when exposed to the radiant heating of a gas-fired radiant panel. The method determines a material's critical radiant flux, or the minimum radiant energy necessary to sustain flame propagation of the flooring system (measured in watts per square centimeter). The flooring radiant panel apparatus involves a 39 in. x 8 in. (100 cm x 20 cm) sample mounted horizontally on the floor of the test chamber.

The test is continued until the specimen ceases to burn. The distance the flooring system burned is noted. The level of radiant heat-energy exposure is noted at the point the flooring system "self-extinguished." This measurement is reported as the sample's critical radiant flux, or the minimum energy necessary to sustain flame propagation.

The recommended critical radiant flux class limits for specific installations where automatic sprinkler protection is not provided:

Class I ≥ 0.45 watts per square centimeter within exits and access to exits (corridors) of health care facilities (hospitals, nursing homes, etc.) and new construction of detention and correctional facilities.

Class II ≥ 0.22 watts per square centimeter within exits and access to exits (corridors) of day care centers, existing detention and correctional facilities, hotels, dormitories, and apartment buildings.

The higher level of critical radiant flux recommended within health care occupancies is established based on the assumption that non-ambulatory occupants (patients) require a higher level of protection than where occupants are mobile and rapid escape is possible.

The flooring radiant panel concept is used in the Basic Building Code of Building Officials and Code Administrators International, Inc. (BOCA); the Standard Building Code of Southern Building Code Congress International, Inc. (SBCC); the Life Safety Code of the National Fire Protection Association (NFPA); and the Uniform Fire Code of the International Conference of Building Officials (ICBO). The test method also has been accepted by the American Society for Testing and Materials (ASTM) and the National Fire Protection Association (NFPA) and is identified as ASTM E-648 and NFPA.253, respectively. It is used by virtually all federal agencies.

The flooring radiant panel test method is applicable to carpet installed in commercial building corridors and has no application to room installations.

31. THE AMERICANS WITH DISABILITIES ACT

See the [American Disabilities Act Technical Bulletin](#) for more information.

32. COMMON TEST METHODS USED FOR FINISHED COMMERCIAL CARPET

COMMON TEST METHODS USED FOR FINISHED COMMERCIAL CARPET		
Characteristic	Test Method/Explanation	Suggested Requirement
Average Pile Yarn Weight (ounces/square yard)	ASTM* D-5848 METHOD OF TESTING MASS PER UNIT AREA: Chemically dissolves parts of the finished carpet sample to determine the pile mass or weight. Pile mass or weight includes the pile yarn, both above the primary backing and the amount hidden or buried below the backing.	As specified
Tufts Per Square Inch	Determine the gauge and multiply by the stitches per inch (SPI). ASTM D-5793 offers instructions on counting the binding sites per unit length or width.	As specified
Pile Thickness/Tuft Height	ASTM D-418 METHOD OF TESTING PILE YARN FLOOR COVERING CONSTRUCTION: Determine pile thickness for level-loop carpet. Tuft height for cut pile carpet should be determined by ASTM D-5823, Tuft Height for Pile Floor Coverings. Accurate laboratory determination of height is important for the average pile yarn density determinations.	As specified
Average Pile Yarn Density (See Table 2.1)	CALCULATION: Measures the amount of pile fiber by weight in a given area of carpet space. Typically calculated in ounces per cubic yard. Important element in equating quality of carpet to wearability, resilience, and appearance retention.	As specified
Tuft Bind	ASTM D-1335 TEST METHOD FOR TUFT BIND OF PILE FLOOR COVERINGS: The amount of force required to pull a single carpet from its primary backing. Determines the ability of the tufted carpet to withstand zippering and snags.	10.0 lbs. of force for loop pile only [minimum average value]
Delamination Strength of Secondary Backing	ASTM D-3936 TEST METHOD FOR DELAMINATION STRENGTH OF SECONDARY BACKING OF PILE FLOOR COVERINGS: Measures the amount of force required to strip the secondary backing from the primary carpet structure. Measured in pounds of force per inch width. Its importance is to predict the secondary delaminating due to flexing caused by traffic or heavy rolling objects.	2.5 pounds of force per inch is the minimum average value

COMMON TEST METHODS USED FOR FINISHED COMMERCIAL CARPET

Characteristic	Test Method/Explanation	Suggested Requirement
Colorfastness to Crocking	COLORFASTNESS TO CROCKING: CARPET - AATCC-165 CROCKMETER METHOD: Transfer of colorant from the surface of a carpet to another surface by rubbing. The transference of color is graded against a standardized scale ranging from 5 (no color transference) to 1 (severe transference).	Rating of 4 minimum, wet and dry, using AATCC color transference scale
Colorfastness to Light	COLORFASTNESS TO LIGHT: WATER - COOLED XENON - ARC LAMP, CONTINUOUS LIGHT AATCC-16, OPTION E: Accelerated fading test using a xenon light source. After specified exposure, the specimen is graded for color loss using a 5 (no color change) to 1 (severe change) scale.	Rating of 4 minimum after 40 AATCC fading units using AATCC gray scale for color change
Electrostatic Propensity	AATCC-134 ELECTROSTATIC PROPENSITY OF CARPETS: Assesses the static-generating propensity of carpets developed when a person walks across them by laboratory simulation of conditions that may be met in practice. Static generation is dependent upon humidity condition; therefore, testing is performed at 20 percent relative humidity. Results are expressed as kilovolts (kV). The threshold of human sensitivity is 3.5 kV, but sensitive areas may require that a lower kV product be specified.	Less than 3.5 kV for general commercial areas
Flammability		
Surface Flammability	FF 1-70 AS FOUND IN 16 CFR 1630 AND ALSO ASTM D-2859: This small-scale ignition test is required of all carpet for sale in the U.S. Methenamine tablet is used as an ignition source.	All carpet must meet this standard, per federal regulation
Critical Radiant Flux***	ASTM E-648, CRITICAL RADIANT FLUX OF FLOOR COVERING SYSTEMS USING A RADIANT HEAT ENERGY SOURCE: Depending upon occupancy use and local, state or other building or fire codes, carpets for commercial use may require flooring radiant panel test classification (class I or II). Class I is considered to be a minimum rating of 0.45 watts per sq. cm or greater. Most codes require flooring radiant panel testing only for carpet to be installed in corridors and exit-way areas.	Applicable local, state and federal requirements

COMMON TEST METHODS USED FOR FINISHED COMMERCIAL CARPET

Characteristic	Test Method/Explanation	Suggested Requirement
Additional Requirements For Carpet Tile		
Tile Size And Thickness	Physical Measurement	Typical tolerances are in the range of five thousandths of an inch (5 mils, 0.0005 inch) within 1/32 inch of stated dimensional specifications
Dimensional Stability	Machine-made Textile Floor Coverings - Determination of Dimensional Changes in Varying Moisture Conditions ISO 2551 (Aachen Test)	+/- 0.2% maximum
Requirement For Indoor Air Quality		
CRI Green Label Plus Testing Program Label	The Green Label Plus (GLP) program assesses emission rates of carpet product types to meet program criteria. When using carpet cushion or adhesive, include the CRI GLP label.	Total volatile organic compounds criteria

*ASTM standard test methods are available from the American Society for Testing and Materials, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959 USA, Telephone: 1-877-909-2786 (USA & Canada) or 610-832-9585 (International)

33. SPECIFYING FOR ACOUSTICS

See the [Acoustical Characteristics of Carpet Technical Bulletin](#) for more information.

34. SPECIFYING FOR STATIC CONTROL

Electrostatic Propensity and Electrostatic Discharge Commercial carpets are often installed where electrostatic properties may be of concern. There are usually two aspects of this concern. The first involves the threshold of human static discharge sensitivity. The second involves electronic sensitivity.

When static shock and human comfort is predicted to be a concern, it is advisable to specify a permanent built-in static control system. It has been found that carpet that has been tested by the American Association of Textile Chemists and Colorists (AATCC) Test Method 134 and does not exceed a 3.5 kilovolt level is usually acceptable for general commercial areas. For more critical commercial areas, a 2.0 kV is an accepted upper limit.

The AATCC Test Method 134, Electrostatic Propensity of Carpets, is a laboratory simulation that assesses the static-generating tendency developed when a person walks across a carpeted area. Static

generation is dependent upon humidity conditions; therefore, all testing is performed in highly controlled test chambers at 20% (2% relative humidity). A specification for a selected maximum kV level of performance will satisfy the majority of commercial carpet applications. As carpet is considered for use in evolving and increasingly high technology applications or electronic offices, a new specification characteristic has become a key consideration. The miniaturization of electronic devices has made them even more susceptible to electrostatic discharge damage. The Electrostatic Discharge Association suggests that appropriate floorings, of any type, must also be static dissipative in addition to being low in their kV performance levels. They have developed a commonly used test method, ESD-S7.1, to measure dissipation and characterize floor coverings.

An additional characteristic that may also be incorporated into an ESD performance specification is the static decay rate. It is suggested that Federal Test Method 4046 (101C) be used for product evaluations.

AATCC Section 12.6 which deals with Electrical Resistance states “If required use National Fire Protection Association Test Method 99 or ESD/EOS STM 7.1 to measure resistance. For products intended to be installed in electrostatic-discharge-sensitive areas (i.e. electronics component manufacturing) or assembly areas, several test methods developed by the ESD Association may be appropriate.”

Carpet performance may be engineered, through the introduction of conductive filaments and other techniques, to meet specified static propensity requirements as well as specified resistive and charge decay rates.

35. SPECIFYING FOR GOOD INDOOR AIR QUALITY

Currently, no federal laws or regulations govern IAQ in commercial or institutional buildings; but the federal government encourages builders, designers, and manufacturers to adopt standards to ensure good indoor air quality (IAQ).

Although many factors affect IAQ, one proactive way to ensure good air quality is to specify low-emitting indoor furnishings, building supplies, and surfaces.

The Carpet and Rug Institute has developed three indoor air quality testing programs that will minimize the potential of emissions from new carpet installations. The programs cover carpet, carpet cushion, and floor covering adhesive products, identifying products that have been tested and meet stringent indoor air quality requirements. A fourth program is for vacuum cleaners, tested for dust containment, soil removal, and carpet appearance retention.

In the testing programs for carpet, separate carpet cushion, and floor covering adhesives for carpet installations, samples are collected from the manufacturer’s production process. Each sample is tested individually for chemical emissions by an independent laboratory, using highly sophisticated, dynamic, environmental chamber technology. Products are retested on an on-going basis to ensure the required emission levels are not exceeded.

When specifying carpet, cushion or adhesives, choose a product that bears CRI’s Green Label Plus Testing Program label for assurance that they are low-emitting products, and the low emissions will have minimal impact on the indoor environment.

When considering installation measures that will protect the indoor environment, specify that installation contractors follow the *STANDARD For INSTALLATION of COMMERCIAL CARPET - CRI 104* and the *STANDARD For INSTALLATION of RESIDENTIAL CARPET - CRI 105*.

For protection of the investment and for good IAQ measures, specify a well-planned and executed maintenance program (following the recommendations of the carpet manufacturer), including the regular use of vacuum cleaners bearing the CRI Seal of Approval program label. This will ensure that regular vacuuming will contain the dust minimizing dust going back into the air, removing adequate soil, and protecting the carpet's appearance.

It is advisable to require common sense guidelines for installation and a maintenance regimen to ensure good IAQ. Refer to the [Carpet Maintenance Guidelines for Commercial Applications](#) for cleaning guidelines and [CRI 104/105 Carpet Installation Standards](#) for proper installation procedures.

36. UNDERSTANDING "USE-LIFE" COSTS

The common perception is that carpet costs more than vinyl composition tile flooring. The reverse is true: over time, carpet is less expensive. For an accurate assessment of use costs, the analysis should be based on the total use-life or use costs. The life-cycle of the floor covering system, also referred to as the "use-life," should be the actual years the product is used rather than indicating when the product is worn out. (Floor coverings may be removed because of aesthetic renovation or during scheduled refurbishment of the facility.)

36.1. FLOOR COVERING INSTALLATION COST COMPARISON IN SCHOOL FACILITIES

Total use-life costs should include:

- The initial installed cost of the product
- The length of the use-life (in terms of durability and appearance retention)
- Maintenance expenses (including labor, equipment, and equipment maintenance costs)
- The removal costs

It is recognized that equipment and repair costs on hard surface cleaning equipment are higher than on carpet maintenance equipment because of the higher-speed moving parts.

WARRANTIES

Warranties are commonly offered by manufacturers as an assurance to end users of long-term satisfaction and product performance. They are often listed as part of the specification.

Common items typically covered by warranties are wear (loss from fiber abrasion), static propensity, tuft bind, edge ravel, dimensional stability, staining, and other unspecified latent defects. In most cases, warranties are limited to a specific number of years, but with some items, such as static, the warranty is in effect for the life of the product.

Review warranties carefully to determine the obligations of the end-user and the manufacturer.

TIMELINE FOR A QUALITY SPECIFICATION

The following timeline will be an effective guide whether the installation is for a new facility or a replacement of carpet in an existing facility.

120 days before occupancy:

- ☐ Write specifications for carpet and installation
- ☐ Request proposals

90 days before occupancy:

- ☐ Review proposals
- ☐ Check references of carpet companies and installation contractors under consideration
- ☐ Select company; place order
- ☐ Prepare maintenance plan under the guidance of the carpet manufacturer

60 days before occupancy:

- ☐ Confirm that order was placed with mill; confirm shipment date from mill
- ☐ Schedule delivery, arranging for holding site
- ☐ Confirm installation date

30 days before occupancy:

- ☐ Check correctness of shipment: carpet style, color, pattern and dye lot
- ☐ Check for material handline damage manufacturing defects (Note: manufacturers will not replace carpet that has been installed)
- ☐ Complete all other construction prior to installation to protect new carpet and check the sub-floor for moisture content
- ☐ Have carpet installed observing CRI 104/105 guidelines for installation
- ☐ Ventilate during installation to protect indoor air quality
- ☐ Have representative come to review punch list

CARPET INSTALLATION

See *STANDARD For INSTALLATION of COMMERCIAL CARPET - CRI 104* or *STANDARD For INSTALLATION of RESIDENTIAL CARPET - CRI 105* at www.carpet-rug.org/install.

CARPET MAINTENANCE

See CRI's [Carpet Maintenance Guidelines for Commercial Applications](#) for more information on proper cleaning techniques.

CARPET AND THE ENVIRONMENT

INDOOR AIR QUALITY

Many factors affect indoor air quality (IAQ), including outdoor air quality. Commercial buildings are self-contained environments, usually connected to the much larger environment by a mechanical heating, ventilation, and air conditioning (HVAC) system. If the outdoor air is polluted, as is the case in many areas, indoor air will also be polluted.

Good IAQ depends on solid building design, effective building operations and maintenance programs, and the appropriate selection of low-emitting interior products. The United States Environmental Protection Agency (EPA) emphasizes the importance of source reduction measures, such as specifying low-emitting products and performing effective and frequent cleaning for the maintenance of acceptable indoor air quality.

37. CARPET'S ROLE IN THE INDOOR ENVIRONMENT

Scientific research studies, including those done by the EPA and independent laboratories, have concluded that carpet is one of the lowest emitters of volatile organic compounds (VOCs) in the indoor environment.

All man-made products impact indoor air. Other products, such as paint, wall coverings, and other floor coverings, may emit VOC levels up to ten times higher.

In many cases, poor indoor air quality is the result of inadequate ventilation and chemical emissions from multiple indoor sources. Emissions sometimes linger in the environment for many weeks or months. With proper ventilation, the minimal VOC emissions and the nonhazardous odor from new carpet dissipates within the first 48 to 72 hours after installation.

The carpet industry takes all issues regarding the safety of carpet seriously and has worked closely with the EPA, the Consumer Products Safety Commission (CPSC), and academic and independent laboratories to evaluate carpet's role in the indoor environment.

There are misconceptions about the effects new carpet emissions may have on the indoor environment. A study completed in 1994 by ENVIRON, an independent research company, assessing the risk of any emissions, states that "no cancer or health risks were identified that would be considered of public health concern." The study also stated, "there are no human safety concerns with contaminants of, or emissions from, carpet." Researchers have found no scientific link between new carpet and any health hazard.

Dr. Alan Hedge, professor of Environmental Analysis at Cornell University, reported, "concentrations of VOCs in carpet emissions are substantially below any known thresholds for toxicity effects—orders of magnitude lower than those known to produce effects—a hundred, a thousand, ten thousand times lower than any known effects. New carpet emissions should not create health problems for people—any people."

38. TESTING FOR GOOD IAQ

Today, indoor air quality is an important environmental consideration for many Americans. It is important to know how to identify low-emitting products and installation supplies to preserve the environment. We spend 90 percent of our time indoors—at home and at work—often in energy-efficient buildings that lack sufficient fresh air ventilation. The quality of the outside air, activities in the building, and the presence of people impact these self-contained environments. Many new construction products, surface finishes, interior furnishings, floor coverings, and renovating and cleaning agents play roles in the quality of indoor air.

Even though researchers have told us new carpet is one of the lowest emitters, responsible carpet manufacturers have been proactive in their efforts to scrutinize their products and develop ways to further reduce product emissions. CRI developed three indoor IAQ testing programs to ensure minimal emissions from new installations. The programs cover carpet, carpet cushion, and floor covering adhesive products.

38.1. THE GOAL

The goal of these programs is to help consumers make better buying decisions by identifying products that are tested and meet stringent indoor IAQ requirements.

38.2. HOW THE PROGRAMS WORK

Samples of carpet, carpet cushion, and floor covering adhesives are collected from the manufacturer's production process for testing. Each sample is individually tested for chemical emissions by an independent laboratory, using highly-sophisticated environmental chamber technology.

The test procedure follows a methodology approved by the Environmental Protection Agency (EPA) and the American Society for Testing and Materials (ASTM D-5116). The volatile organic compound (VOC) emissions are identified and quantified as though the products were in an authentic building situation. Products are retested on an ongoing basis to ensure that required emission levels are not exceeded.

38.3. CARPET

Carpet products are tested for total volatile compounds, formaldehyde (to show it is not used in manufacturing), 4-PCH (4-phenylcyclohexene), and styrene.

38.4. CUSHION

Separate cushion products are tested for total volatile organic compounds, BHT (butylated hydroxy-toluene), formaldehyde, and 4-PCH.

38.5. ADHESIVES

The carpet/floor covering adhesive program is a test similar to the carpet and cushion tests. The criteria take into account that adhesives are a wet substrate when applied during installation. Adhesives are tested for total volatile organic compounds, formaldehyde, and 2-ethyl-1-hexanol. This program also covers accessory adhesive products like seam sealers.

38.6. THE CRITERIA

Products that meet the emission criteria are allowed to display the Green Label Plus logo. If these products exceed the emission criteria, the manufacturer is advised and requested to make process or formulation changes to reduce emissions. After the product modification, the manufacturer may re-submit the product for additional testing. Products that do not meet the test criteria will not be allowed to bear the label.

In each of these programs, the authorized label displayed on the product contains an identification number assigned specifically to the individual manufacturer for each product that meets the criteria.

It is also important to remember that with most products, adequate ventilation will lower concentrations and minimize the impact on IAQ. Regular and effective cleaning also enhances good air quality.

To determine whether a product has met program criteria, go to the Carpet and Rug Institute's website: www.carpet-rug.org/GLP.

39. CARPET INSTALLATION GUIDELINES

When installing carpet or any other renovation material, it is wise to follow "common-sense," fresh-air ventilation guidelines.

- Ventilate with fresh air (open doors or windows and use fans) during removal, installation, and for approximately 48 hours following.
- Vacuum the old carpet before removal to minimize the amount of airborne dust particles.
- Vacuum the floor after the old carpet and cushion have been removed.
- The installer should follow the installation guidelines (CRI 104/105) published by the Carpet and Rug Institute.
- Persons who are sensitive to low levels of odors and emissions may want to avoid the area during the removal and installation process.

40. MAINTENANCE GUIDELINES

To provide a healthy indoor environment, two elements are most important: humidity control and proper maintenance of all surfaces and operating systems. It is common knowledge that indoor air problems exist primarily when there is excess moisture and an inadequately maintained facility. Mold and mildew cannot grow without excess moisture and dirt. Therefore, it is critical that buildings have properly-controlled relative humidity at 60 percent or below, and a good, scheduled maintenance program to clean all surfaces.

Proper maintenance of carpet will extend its lifespan, keep its fresh appearance, and keep the indoor environment cleaner. Because dust and allergens tend to remain on carpet, cleaning will protect the carpet investment and will help keep the environment cleaner.

- Vacuum regularly with a well functioning vacuum cleaner that features a powerful airflow, a high-efficiency filtration and internally-housed vacuum bag, and correct brush height adjustment.
- Remove spills quickly to minimize staining.
- Have carpet extraction-cleaned before it shows any signs of soiling, preferably by a professional cleaning service.

41. MINIMIZING AIRBORNE ALLERGENS

An extra benefit is that carpet acts as a filter that keeps dust and allergens on carpet until it is vacuumed and cleaned away. Studies have shown that dust is not easily re-suspended in a carpeted room by foot traffic and air circulation. This is a definite benefit for persons with allergies.

42. USING AN EFFECTIVE VACUUM CLEANER

Vacuuming substantially reduces the quantity of dust and dust mite allergens. CRI suggests that the vacuum cleaner, whether a home or commercial model, have powerful air flow, adjustable brushes, an enclosed vacuum bag - and that a high-filtration, disposable bag (less than 1 micron filtration) be used. The high-efficiency bag is essential to hold vacuumed dirt in the bag instead of blowing it back

into the room. Frequent changing of the filtration bag is important to increase efficiency. In addition, high traffic areas should be vacuumed more often than others.

Any vacuum cleaner chosen should bear the CRI Seal of Approval label. This label identifies vacuum cleaners that have been tested and meet the criteria for three tasks: dust containment, soil removal, and carpet appearance retention. This choice will assure that when used regularly, good cleaning is taking place without damaging the quality of indoor air. These guidelines for a vacuum cleaner apply whether the surface is hard surface or carpet. The program includes vacuum cleaners for residential and commercial environments. It also includes vacuums of all types: upright, canister, backpack, walk-behind, and built-in systems.

43. SUMMARY

Carpet is made of the same compounds found in popular clothing—polyester, nylon, and olefin fibers, latex (synthetic rubber), and polypropylene backing. Carpet is an environmentally responsible product that has been used confidently for many years by millions of people for comfort and beauty. Not only does carpet have low emissions that dissipate quickly, it actually holds contaminants so they can easily be extracted and not recirculated into the breathing zone.

It should be pointed out, however, indoor air quality involves more than just carpet. It involves all interior products, such as paint, cleaning materials, ventilation and air conditioning ducts, furnishings, draperies, adequate cleaning, and humidity control. To accurately assess indoor air quality, a specifier must take the holistic approach and consider all of these impacting factors.

REDUCE, REUSE, RECYCLE

Carpet mills are very conscious of protecting the environment and the footprints their companies leave for future generations. To reduce the footprint, water, energy fuels, and raw materials are constantly monitored to determine areas where efficiencies can be found and usage can be reduced. The companies are also researching and developing new products that utilize less virgin material and more recycled material, and perform well over a longer period of time. Each of these efforts adds value to the environment and value for the purchaser and user of the carpet product.

The carpet and rug industry recognizes the need to continue to minimize the effect of industrial waste and post-consumer carpet products on existing landfills.

Although more efficient manufacturing is reducing excess carpet waste, the industry has found creative uses for carpet by-products like carpet trim and yarn scraps to avoid the use of local landfills.

Individual companies are engaged in a variety of recycling and reuse efforts, including:

- Fiber and yarn that cannot be reused in manufacturing is often sent to yarn vendors to be sold for crafts and other end uses.
- Excess carpet is cut into mats and sold.
- Waste carpet trimmings, backing, and yarn often are sold to recycling plants to be processed into carpet cushion, furniture battings and cushions, concrete filler, fence posts, road underlayment, parking stops, plastic lumber and furniture, and automotive parts.
- Waste polypropylene carpet backing is sold for use as geo-textiles for soil retention and sod reinforcement, reused to wrap carpet rolls, and recovered for re-extrusion into other molded or extruded items.
- Polyethylene packaging, used to wrap carpet rolls, is converted into plastic wrap or plastic trash bags, or is used in molded automotive parts.

- Other material used in the manufacturing process, such as cardboard, paper, aluminum, wooden pallets, fuel drums, batteries, yarn cones, roll cores, liquid containers, raw material packaging, and scrap metal are either reused or recycled.

44. MANUFACTURING'S ENVIRONMENTAL ROLE

Carpet manufacturers are striving to minimize the quantities of natural and energy resources used in day-to-day operations.

Mills are reducing waste, reusing and recycling raw materials, packaging materials, and by-products. Individual companies are pursuing environmental efforts at different points in the manufacturing process. Many of the following efforts are industry wide, but some are small pilot programs.

Advanced monitoring systems and processes in the mills help conserve water, electricity, and other natural resources. As an example, new developments in dyeing techniques require less water. In some mills, dye materials are removed from waste water; the waste water is monitored, reprocessed, and reintroduced into the manufacturing system. To reduce electrical energy use, mills are purchasing more efficient lighting, heat and air systems, and monitoring equipment.

45. POST-CONSUMER CARPET

Because the collection, sorting, and transporting of used carpet is such a challenge, the tasks are being addressed by carpet companies and fiber companies and individual entrepreneurs. Collection sites are developing, and efficient means are increasing to separate carpet components and recover valuable polymers. The industry is working toward recycling these materials into new carpet fiber and carpet components, such as carpet cushions and backings. There are currently components being used in other end-use products as well as new carpet. Such products are marine lumber, outdoor furniture, molded plastics for underhood automotive casings, and many other extruded plastics. The industry is working toward recycling these materials into new carpet fiber. Some companies are refurbishing used carpet modules, and others recycling returned carpet when a new installation goes in. Currently, the only fiber that is derived from other recycled materials is polyester made from plastic beverage bottles. (Polyester is used primarily in residential carpet.) Many companies use a small percentage of recycled nylon in new nylon carpet.

A committee of industry experts developed a carpet component identification system that can be stamped or coded onto the back of carpet. In the future, this identification system will make the sorting of fiber and backing compounds much easier and more efficient. The committee is in place for sharing technology that is hoped to accelerate the recycling of used carpet back into raw materials – a “closed loop” recycling system.

46. ENCOURAGING RECYCLING WITH SPECIFICATION

As a specifier, you may wish to encourage the reuse or recycling of old commercial carpet when you specify a new installation. It is important that this be coordinated with the building owner, the construction contractor, the installation contractor, and the reclamation company. Many carpet manufacturers can assist in the planning with their individual recycling/reuse programs.

It is important to have the carpet and cushion removed in large pieces, rolled tightly, and packed neatly in a container or truck trailer, often supplied by the reclamation agency. (The container/trailer should be kept locked or supervised.) Deposit only clean and dry used carpet in containers. (Clean is defined as carpet free from demolition debris, asbestos contamination, garbage, and tack strips.)

GLOSSARY

A

ACRYLIC	A manufactured fiber in which the fiber-forming substance is any long-chain synthetic polymer composed of at least 85 percent by weight of acrylonitrile units, only available as a staple. Spun yarns from acrylic exhibit aesthetics similar to wool.
ADHESIVE	A substance that dries to a film capable of holding materials together by surface attachment. Applying adhesive to the floor normally is accomplished with a trowel, airless spray, or roller.
ANTIMICROBIAL CARPET	Carpet chemically treated to reduce the growth of common bacteria, fungi, yeast, mold, and mildew.
ANTISTATIC	The ability of a carpet system to dissipate an electrostatic charge before it reaches the threshold of human sensitivity.
ATTACHED CUSHION	Cushion material permanently bonded to the back of carpet by the manufacturer.
AVERAGE PILE YARN WEIGHT	Mass per unit area of the pile yarn, including buried portions of the pile yarn. In the U.S., it is usually expressed as ounces per square yard.
AXMINSTER - ELECTRONIC JACQUARD (EJ) GRIPPER TYPE	Utilizing a maximum of 12-16 colors, the EJ Axminster loom can produce multiple design and pattern repeats within the same run. "Full EJ" projects drastically reduce seams, carpet waste and installation labor. Most modern day Axminster looms are EJ.
AXMINSTER – SPOOL TYPE	Patented in the US in 1856, the Spool Axminster loom offers unlimited colors and large design repeats.
AXMINSTER CARPET	Carpet woven on an Axminster loom. Pile tufts are individually inserted from varied colored yarns and weaving up to nine backing yarns around each tuft. It is possible to produce complex designs with many colors and patterns in cut pile only. The most noticeable characteristic is the stiff bend in the width due to the weft filling used during the weaving process. An Axminster will stretch in length only. There is no secondary backing on Axminster carpet.

B

BACKING	<p>Materials (fabrics, yarns, or chemical compounds) in a carpet other than the pile yarns.</p> <p><u>Primary back</u> - In tufting, usually a woven or nonwoven fabric in which the pile yarn is inserted by the tufting needles.</p> <p><u>Secondary back</u> - Fabric laminated to the back of carpet to reinforce and increase dimensional stability.</p> <p>Backings of woven carpet are the “construction yarns,” comprising chain warp, stuffer warp-and-shot or fill, which are interwoven with the face yarn during carpet fabric formation.</p>
BCF	<p><i>See Bulked Continuous Filament.</i></p>
BEAM	<p>Large, horizontal cylinders or spools. Warp yarns are wound on beams and located on line in back of the weaving or tufting operation.</p>
BECK DYEING	<p>A batch or piece-dyeing method whereby griego carpet is dyed in a large vessel or tank containing a cylindrical reel to advance or rotate the carpet in the dye solution.</p>
BERBER	<p>A carpet constructed with thick yarns having randomly-spaced flecks of color against a background of a base color.</p>
BINDING	<p>A band or strip sewn over a carpet edge to protect, strengthen, or decorate the edge.</p>
BLEEDING	<p>Undesirable transfer of fiber dyes from carpet or other fabrics by a liquid, usually water, with subsequent re-depositing on other fibers.</p>
BLEND	<p>A mixture of two or more fibers or yarns.</p>
BOBBIN	<p>A spool-like device made of various materials, shapes, and constructions, with a head at one or both ends and a hole through its length, or barrel, for placement on a spindle or skewer. It is used to hold yarn for spinning, weaving, or sewing.</p>
BODY	<p>The compact, solid, firm, or full feel of a fabric.</p>
BONDED CARPET	<p><i>See Fusion Bonded.</i></p>
BONDED POLYURETHANE CUSHION	<p>A carpet cushion made from polyurethane trim, generated from polyurethane foam product manufacture, which has been granulated and bonded to form a porous foam material and fabricated into foam sheets. Frequently used as a residential cushion. Also called rebond cushion.</p>
BONNET CLEANING	<p>Floor-cleaning method, using absorbent pad and a rotary floor machine.</p>

BRAIDED	Reversible oval or round rugs produced from braided strips of new or used material.
BREAKING STRENGTH	The ability or capacity of a material to withstand the ultimate tensile load or force required before it breaks.
BROADLOOM	A term used to denote carpet produced in widths wider than six feet or two meters.
BUCKLING	A condition of wrinkling, bubbling, or ridging of carpet following installation. In a stretch-in installation, it may be due to improper stretching. In a glue-down installation, it may be caused by insufficient or improper adhesive. Changes in humidity and temperature sometimes affect the severity. Buckling also results from a manufacturing defect, such as delamination.
BULKED CONTINUOUS FILAMENT (BCF)	Continuous strands of synthetic fiber formed into yarn bundles of a given number of filaments and texturized to increase bulk and cover. Texturizing changes the straight filaments into kinked or curled configurations.
BULLNOSE	The colloquial name for Step Return. <i>See Step Return.</i>
BURIED YARN	The pile yarn in a carpet that remains hidden in the backing structure.
BURLING	A hand-tailoring operation to remove any knots and loose ends, insert missing tufts of surface yarns. A repair operation on worn or damaged carpet is called “reburling.”

C

CARPET	All textile fabrics used as floor coverings and not designated as rugs.
CARPET CUSHION	A term used to describe any kind of material placed under carpet to provide softness and adequate support when it is walked upon. Carpet cushion provides a softer feel underfoot. It usually provides added acoustical benefits and longer wear life for the carpet. In some cases, the carpet cushion is attached to the carpet when it is manufactured. Also referred to as “padding” or “underlay,” although “carpet cushion” is the preferred term.
CARPET TILES	Carpet packaged as different shapes and sizes; example – square, rectangle, octagonal, etc.
CHAIN	In weaving: 1. The binder warp yarn that works over and under the filling yarns of the carpet;

2. Axminster loom refers to the endless chain that carries the tube frames;
3. Dobby loom refers to the endless chain of pattern selector bars.

CHAIN BINDERS	Yarns running warpwise (lengthwise) in the back of a woven or woven interlock carpet, binding construction yarns.
CHENILLE	A pile fabric woven by the insertion of a prepared weft row of surface yarn tufts in a “fur” or “caterpillar” form through very fine but strong cotton “catcher” warp yarns and over a heavy woolen backing yarn. The forerunner of rugs and carpet, chenille bedspreads were made with this method, using thick cotton yarns in a cotton fabric.
COLORFASTNESS	The ability of a fabric to retain its color. Resistance of a material to change in any of its color characteristics, to transfer its color to adjacent materials, or both, as a result of its exposure to atmospheric conditions or elements that might be encountered in use, storage, or processing. Dye stuff, fiber type, and dyeing method influence the ability of colored carpet and fabrics to withstand the effects of color-destroying agents.
COMMERCIAL MATCHING	Matching of colors within acceptable tolerances generally mutually agreed upon in the marketplace.
CONSTRUCTION	The method by which a carpet is made (combining the face yarn and both primary and secondary backing).
CONTINUOUS DYEING	Process of dyeing carpet in a continuous production line, as opposed to piece dyeing in separate or “batch” lots. Continuous dyeing equipment flows on dyestuff, as distinguished from submerging carpet, as in separate dye becks.
CONTINUOUS FILAMENT	Continuous strands of synthetic fibers extruded in yarn form without need for the spinning.
CONTRACT WALKER TEST	People are contracted to walk a certain number of footsteps on carpet to determine the carpet’s performance with a specific amount of traffic.
COTTON FIBER	A unicellular, natural fiber composed of cellulose. In carpet, its use is primarily for warp yarns in woven carpet. Today, it is seldom used as a face fiber, other than in rugs.
COUNT	<ol style="list-style-type: none">1. A number which identifies the yarn size or weight per unit length or vice versa, depending on the particular system being used.2. Cotton count references spun yarns and denier references BCF yarn.3. Count of fabric is indicated by the number of warp ends and filling ends per inch.
COVER	Degree to which the underlying structure is concealed by the face yarn.

CREEL	A rack or framework designed to hold yarns so that ends can be unwound smoothly and evenly without tangling, feeds a tufting machine, a warper, or a dye range.
CREELING	The process of mounting yarn packages on the yarn package holder of the creel.
CRIMP	In fiber, a nonlinear configuration, such as a sawtooth, zigzag, or random curl, relative to the fiber axis. In woven fabrics, nonlinear yarn configurations caused by three-dimensional displacements, such as the zigzagging of warp yarn over fill yarn. Most synthetic fibers, both staple and filament, used in carpet are crimped. Fiber crimp increases bulk and cover and facilitates interlocking of staple fibers in spun yarns.
CROCKING	Term used to describe excess color rubbing off as the result of improper dye penetration, fixation or selection, and can be both wet or dry.
CROSS SEAMS	Seams used to join the ends of carpet together.
CROSS SECTION	The shape of an individual filament or fiber when cut at right angles to its axis. Synthetic fibers used for carpet may have various shapes, including round, trilobal, and pentalobal, as well as hollow varieties.
CROSS-DYED	Multicolored effects produced in a fabric with fibers of different dye affinities.
CRUSH MARKS	Widthwise bands in a roll of carpet due to flattening of the pile from compression. Usually a temporary condition, also called roll crush.
CRUSHING	Loss of tuft definition due to compression of the pile yarns or fibers.
CUSHION	Carpet cushion of either foam rubber or urethane material.
CUSHION-BACK CARPET	A carpet having a cushioning lining, padding, or underlay material as an integral part of its backing. Same as attached-cushion carpet.
CUT	A length of carpet cut from a full roll to fill an order.
CUT AND LOOP PILE	A fabric in which the face is composed of a combination of cut ends of pile yarns and loops.
CUT PILE	A fabric in which the face is composed of cut ends of pile yarn.

D

DEEP DYE FIBERS	Modified synthetic fibers with increased dye affinity relative to regular dye fibers. By combining deep dye fibers with regular dye fibers, a two- color or two-toned effect can be achieved within one dye bath.
DELAMINATION	Separation of the secondary backing from the primary backing.
DELAMINATION STRENGTH	Force required to separate the secondary backing from the primary backing.
DELUSTERED FIBERS	Synthetic fibers that have the brightness or reflectivity reduced, usually by the incorporation of a fraction of a percent of white pigment, such as titanium dioxide. Fiber producers' designations include dull, semi-dull and semi-bright, whereas bright fibers are nondelustered.
DENIER	A yarn-count unit system for expressing linear density, equal to the weight in grams per 9,000 meters of yarn, filament, fiber, or other textile strand. Denier is a direct numbering system—the higher the denier, the larger the yarn or fiber.
DENSITY/AVERAGE PILE YARN	<p>The weight of pile yarn in a unit volume of carpet expressed in ounces per cubic yard is given by the formula:</p> $D = \frac{W \times 36}{t}$ <p>In which "D" is density, "W" is pile yarn weight in ounces per square yard, and <i>t</i> is pile thickness in inches.</p>
DIFFERENTIAL DYEING FIBERS	Fibers of the same generic type, either natural or man-made, treated or modified so that their affinity for certain dyes becomes changed, thus creating a multicolored effect when dyed.
DIMENSIONAL STABILITY	Ability of a fabric to retain its original size and shape; may be brought about by chemical treatment or mechanical means; e.g., a secondary backing adds dimensional stability to carpet.
DIRECT GLUE-DOWN	An installation method whereby carpet is adhered to the floor.
DOBBY	A carpet loom device that selects the rotation in which one or more of a group of harnesses are raised over a filling shot. Can float an end over as many filling shots as desired. Produces geometric patterns in woven carpet.
DOUBLE STICK/DOUBLE GLUE-DOWN	An installation method whereby carpet cushion is first adhered to the floor, with an adhesive, and then carpet is adhered to the cushion with an adhesive.

DROP MATCH	A patterned carpet that repeats diagonally. Each corresponding pattern element drops down a certain distance, usually a half pattern repeat in length, instead of simply repeating horizontally across the width as in set match.
DRY EXTRACTION (ABSORBENT) CLEANING	A carpet cleaning method consisting of absorbent compound impregnated with dry cleaning fluids, detergents, and other cleaners. The dry compound is sprinkled on the carpet, worked into the pile with a brush, left to adsorb soil for a short time, and then removed with the absorbed soil by vacuuming.
DRY FOAM SHAM- POO	A carpet-cleaning method, using a detergent solution containing only a small amount of water. Generated foam is mechanically worked into the surface of the carpet, and loose soil is removed by vacuuming.
DRY ROT	A condition caused by the attack of micro-organisms on fibers, textiles, carpets or other materials, characterized by loss of strength and integrity. Attack on carpet backings permits carpet to break and tear easily. Natural materials, such as jute, are susceptible, whereas nylon, polypropylene, and other synthetics are resistant.
DYE	A highly-colored substance capable of permanent physical or chemical attachment to textile fibers; coloration of fibers occurs upon attachment of small quantities. Most dyes are applied from water solutions or dispersions. Referred to as dyestuffs.
DYE BECK	A large vat for piece dyeing carpet by immersions in aqueous solutions of dyes and chemicals. Fitted with a reel for circulating carpet in and out of the dye liquor, inlets for steam and water, drains and temperature controls.
DYE LOTS	Lots of carpet dyed in one batch of solution, or in a single continuous operation.
DYEING	Coloring fibers, yarns, fabrics, carpet, or other materials by addition or incorporation of small amounts (usually one percent or less) of highly-colored materials known as dyes and pigments.
DYESTUFF	A highly-colored substance capable of permanent or chemical attachment to textile fibers. Coloration of fibers occurs upon attachment of small amounts. Most dyes are applied from water solutions or dispersions.

E

ELECTROSTATIC FLOCKING	A method used for producing flocked fabrics, including flocked carpet. Flocking consists of attaching short lengths of fibers to fabric substrates
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with adhesives. In electrostatic flocking, precision-cut fibers are aligned in an electrostatic field perpendicular to the substrate, thus creating a plush-like surface.

ELECTROSTATIC PROPENSITY

The ability to produce and accumulate an electrical charge. Carpets are normally tested for this property with AATCC Test Method 134, with the results expressed as kilovolt (kV) rating.

END

1. An individual strand of yarn in tufted carpet.
2. An individual warp yarn in woven carpet.

F

FACE WEIGHT

See Average Pile Yarn Weight.

FADE-OMETER

A laboratory device, developed by Atlas Electric Devices, Chicago, Illinois, for determining the effects of light on the properties of yarns, fibers, fabrics, carpet, plastic and other materials. It uses a standard light source, either carbon-arc or xenon, to simulate approximately the spectrum of sunlight. Generally used for measuring fade resistance of carpet colors, which are rated according to the number of units exposure required to produce visible loss of color.

FADING

Loss of color. Caused by exposure to sunlight or artificial light; atmospheric gases, including ozone, nitrous oxide and hydrogen sulfide; cleaning and bleaching chemicals, such as sodium hypochlorite and other household and industrial products; chlorine chemicals for swimming pools; and other factors.

FELTING

A nonwoven fabric formation process comprising entanglement of fibers by mechanical or other means. The end product is called felt. Felts made by needle entanglement of solution dyed fibers, such as polypropylene, are used as outdoor carpet. Unlike weaving and tufting, felting does not employ yarns, but converts fiber directly to fabric.

FIBER

Substance, either natural or man-made, that forms the basic element of fabrics and other textile structures. Further characterized as having a high ratio of its length to its thickness. Useful textile fibers have high tensile strengths, flexibility, and resistance to heat, light, chemicals, and abrasives.

FIBER CUSHION

Carpet cushion made of needle-felted animal hair, jute, other fibers or fiber blends. Some are rubberized and may have one or two rubber faces.

FILAMENT

A single continuous strand of natural or synthetic fiber.

FILLER	A low-cost material used for extending rubber, plastic or other polymers. Fillers are generally powders of very small particle size. Carpet latex laminating compounds and foams may contain large amounts of fillers. The most common filler in carpet latex is finely powdered calcium carbonate, often called “whiting,” produced by grinding limestone.
FILLING YARN	A weaving term meaning any yarn running across the width of the fabric perpendicular to the warp yarns. In woven carpet, filling yarns are part of the group of construction yarns that also include chain and stuffer warp and form the backing. Woven carpet filling and chain warp yarns interlace to secure the pile yarns. Filling and other construction yarns usually are cotton, polypropylene, jute, polyester, fiberglass, or similar materials.
FILM YARN	Yarn produced by slitting extruded films into narrow strips. Slit-film, polypropylene yarns are woven into fabrics used as primary backings in tufted carpets.
FILTRATION SOILING	A localized stain that results from airborne dust and pollutant accumulation where airflow is restricted or channeled over or through carpet pile. It is usually most evident along baseboards, stairs, doors, ventilation ducts, and draperies.
FINISHING	A collective term denoting final processing of carpet and textiles subsequent to tufting, weaving, and dyeing. Carpet finishing processes include shearing, brushing, application of secondary backing, application of attached foam cushion, application of soil retardant and antistatic chemicals, back beating, steaming, and others.
FLOCKED CARPET	Carpet composed of short, chopped fiber or flock that is adhered, usually by electrostatic processes, to a base fabric, resulting in a short pile material with a velvety texture. <i>See Electrostatic Flocking.</i>
FLOORING RADIANT PANEL	Laboratory testing device for measuring the critical radiant flux of horizontal mounted floor covering systems exposed to a flaming ignition source in a graded radiant heat energy environment.
FLUFFING	Appearance on carpet surface of loose fiber fragments left during manufacture; not a defect, but a characteristic that disappears after carpet use and vacuuming. Sometimes called “fuzzing” or “shedding.”
FLUOROCARBON FINISH	A polymeric finish applied to the pile fiber of carpet to impart soil/stain resistance and oil/water repellency. Commonly used on nylon face fiber carpets, but seldom on other fibers.
FRAMES	Racks at back of the Wilton loom holding spools from which yarns are fed into the loom. Each frame holds a separate color; thus, a 3-frame Wilton has three colors in the design.

FRIEZE	A cut pile carpet made of highly twisted yarns normally plied and heat-set. A kinked or curled yarn effect is achieved. The hard-twisted pile yarn results in excellent durability.
FULL ROLL	A length of carpet; roll goods are usually approximately 100-feet long; also called a shipping roll by carpet manufacturers. Shipping roll standards vary and may be as short as 30 feet, depending upon carpet thickness and manufacturers' quality criteria. In the United States, almost all roll goods are 12 feet, 13 feet 6 inches, or 15 feet wide, with 12 feet being predominant.
FUSION BONDED	A method of creating a carpet pile construction by attaching loops or lengths of yarn to a supporting adhesive material, usually PVC, to form either cut- or loop-pile structures.
FUZZING	An undesirable hairy effect on fabric surface caused by fibers slipping out of yarn. It is sometimes correctable by shearing.

G

GAUGE	The distance between two needle points expressed in fraction of an inch. Applies to both knitting and tufting.
GAUGE WIRE	A standing wire used with an extra filling yarn to control the height of the pile on a carpet-weaving loom.
GLUE-DOWN	An installation method whereby the carpet is adhered to the floor with an adhesive. This method is used extensively in commercial installations.
GREIGE GOODS	(Usually pronounced "gray goods") Undyed carpet or other textile materials.
GRINNING	Visibility of carpet backing through the face, often between two adjoining tuft rows. May be caused by low pile yarn weight, off-gauge tufting machine parts, tuft row deflection, inadequate blooming of pile yarn or installation over sharp curves, such as stair nosings.
GULLY	The distance between the tack strip and the wall. It should always be slightly less than the thickness of the carpet.

H

HAND	The tactile aesthetic qualities of carpet and textiles. Factors determining how carpet feels to the hand include pile weight, stiffness, topical finish, fiber type, denier, density, backing, and latex. For example, a stiff or hard feel is poor hand. A good hand is described as springy or soft feel.
HARNESS	Part of a weaving loom, comprising the frames holding the heddles, through which the warp yarns pass. It is used to raise and lower them to form the shed in which the shuttle moves to insert fill yarn.
HEAT SETTING	Process for stabilization of carpet yarns by exposure to either moist or dry heat. Conventional autoclave heat setting treats yarns in relaxed skein configuration with pressurized steam, usually at temperatures in the 240° - 300° F range. Suessen is a continuous heat-setting system in which yarn is wound around conveyor ropes that pass through the setting chamber filled with superheated steam. Superba is a continuous heat-setting system in which yarns are in a relaxed coil configuration on a moving conveyor belt that passes through a setting chamber where heat and steam are applied under pressure. The principal benefits are twist retention in plied yarns in cut pile carpet and general stabilization of yarn configuration.
HEATHER	A multicolor effect provided by blending fibers of different colors.
HEAT-SET YARN	Carpet yarns thermally stabilized to a final crimp or twist configuration so as to reduce loss of twist and bulk in service.
HEDDLE	Part of a weaving loom comprising one of the sets of parallel wires, blades, or cords (often with eyelets in their centers through which warp yarns pass) that with their mounting compose the harness used to guide warp threads and raise and lower them in weaving.
HEDDLE FRAME	The part of the weaving loom in which the heddles are mounted.
HEXAPOD DRUM TESTER	A rotatable drum (12-inch diameter) designed to subject carpet samples to simulated trafficking with the incorporation of a metal tumbler with six attached polyurethane studs or cleats. Carpet sample(s) lining the inside circumference of the rotating drum are subjected to the tumblers rolling randomly on the pile surface for a specified number of revolutions.
HIGH DENSITY FOAM	Carpet cushion made from compounded natural and/or synthetic latex or polyurethane foam, having a minimum density of 15 pounds per cubic foot.
HIGH LOW PILE	Multi-level carpet style combining high and low loop pile areas or high cut pile and low loop areas.

HOT MELT ADHESIVE	Thermo plastic adhesive material sometimes used for laminating secondary backing to tufted carpet. Hot melt adhesives are compounded from thermoplastic polymers. They may be melted and solidified repeatedly by application of heat.
HOT WATER EXTRACTION	A cleaning process that has hot water and detergent sprayed onto the carpet and immediately removed, along with suspended soils, by a vacuum system.
HOT MELT SEAMING TAPE	Tape precoated with a thermoplastic adhesive used for joining or seaming two sections of carpet.

I

INDENTATION	A small impression in carpet, usually under heavy furniture or objects.
INDOOR AIR QUALITY	Term used to describe the purity and quality of the air breathed by the occupants of a building.
INDOOR/OUTDOOR CARPET	A type of carpet which is made entirely of components which have been especially designed or treated to withstand moisture, extreme temperatures, ultraviolet rays, and other type of outdoor exposure.

J

JACQUARD	An apparatus for a carpet-weaving loom that produces patterns from colored yarns. The pattern information is contained on perforated cards. The holes in the cards activate the mechanism that selects the color to be raised to the pile surface. Wilton looms have jacquard pattern devices.
JERKER BAR	Part of a tufting machine comprising a movable guide or eyeboard through which the pile yarns are threaded. It controls tension on the pile yarns on their path to the tufting needles, removing slack on the upstroke of the needle bar and contributing to yarn feed control.
JUTE	A natural cellulosic fiber made from certain plants of the linden family, which grow in warm climates, such as those found in India and Bangladesh. Jute yarns are used for woven carpet construction (backing) yarns. Woven jute fabrics may be used in tufted carpet as secondary backing.

K

KNEE KICKER

A carpet installation tool consisting of a pinned plate connected to a short section of metal tubing. The end opposite the plate has a padded cushion that the installer strikes with his/her knee to position carpet, which is gripped by the pinned plate. In general, adequate stretching of carpet installations cannot be achieved with knee kickers. A power stretcher should always be used for stretching carpet during installation.

KNITTED CARPET

Carpet produced in a fabric formation or process by interlacing yarns in a series of connected loops. As in weaving, pile and backing are produced simultaneously. Multiple sets of needles interlace pile, backing and stitching yarns in one operation. Only a small portion of all carpet is knitted.

L

LATEX

A compound, consisting of synthetic rubber, used to coat the back of carpet or rugs to adhere carpet components and secondary backing to one another. Most carpet latex consists of styrene-butadiene synthetic latex (SB Latex) compounded with powdered fillers, such as calcium carbonate.

LENO WEAVE

A woven fabric construction in which paired warp yarns twist around one another between fill yarn picks. It is similar to woven gauze bandage construction. Leno construction renders the yarns relatively immobile within the fabric, making possible very open weaves that are relatively stable. Woven polypropylene secondary backings for tufted carpets are generally of Leno weave construction.

LEVEL LOOP

A carpet construction in which the yarn on the face of the carpet forms a loop anchored into the carpet back. The pile loops are of substantially the same height and uncut, making a smooth and level surface.

LOOM

A machine that produces woven fabrics. In weaving, lengthwise yarns (warp) are interlaced with weft yarns (fill) by the shuttle or other devices, such as gripper or rapier.

LOOP PILE

Carpet style having a pile surface consisting of uncut loops. May be woven or tufted. Also called “round wire” in woven carpet terminology.

LOW ROWS

A quality defect sometimes found in carpet made up of rows of tufts having pile heights below specification.

LUSTER

Brightness or reflectivity of fibers, yarns, carpet, or fabrics. Synthetic fibers are produced in various luster classifications, including bright, semi-bright, semi-dull, and dull. Bright fibers usually are clear (have no white pigment), whereas the “delustered” fibers have small amounts of white pigments, such as titanium dioxide. In addition to delustering agents, fiber luster is dependent upon the fiber’s cross-sectional shapes. Luster of finished carpet also depends upon yarn heat-setting methods, dyeing and finishing. In high-traffic, commercial areas, duller carpet is often preferred for soil-hiding ability.

M

MARKERS

Colored yarns woven into the backs of woven carpets to aid installers in achieving correct pattern match and pile direction.

MATCH, SET, OR DROP

Pattern match designates the arrangement and dimensions of the repeating units making up the design of patterned carpet, including woven patterns, prints, tufted high-lows and others. A typical pattern repeat might be 36 inches wide by 24 inches long. In set match, this rectangular pattern unit is arranged in parallel rows across the carpet width. In a half-drop pattern, the start of each pattern repeat unit is transposed to the midpoint of the side of the adjacent unit. In an example, each adjacent unit starts 12 inches down the side of the neighboring one. In quarter drop match, each unit in the example would start 6 inches past the neighboring pattern unit’s starting point. Thus, pattern repeat units in drop match repeat diagonally across the width, and in set match, they repeat straight across the width perpendicularly to the length. Pattern repeat dimensions and match are significant to specifiers and purchasing agents because they influence the amount of excess carpet (over measured area) needed in multiple width installations.

MATTING

Severe pile crush combined with loss of yarn twist resulting in entanglement of fibers and tufts. In addition, the entanglement can be caused by poor maintenance.

MENDING

Hand repair of carpet after tufting and weaving to replace missing tufts, remove knots and loose ends, and other defects.

METALLIC FIBER

Synthetic fiber made of metal, metal-coated plastic, or plastic-coated metal is sometimes used in small amounts in carpet to dissipate static electricity, thus preventing shock. Sometimes used as a decorative accent.

MILL END

A short piece of carpet roll goods having a length less than that of a full shipping roll or short roll but more than a remnant. Quality standards differ among mills, but a mill end length specification of 9 to 20 feet is typical.

MITER JOINT	A junction of two pieces of carpet (or other material) at an angle. Most miter joints involve pieces at right angles to one another with their ends cut at 45 degrees to form the joint.
MOLDING	A wooden or plastic strip attached to the bottom of a baseboard or wall to cover the joint between wall and floor. It is also metal- or vinyl-formed strips used to cover raw edges of carpet at doorways or where carpet abuts another type of floor covering.
MONOFILAMENT	A single, continuous strand of synthetic polymer.
MORESQUE	A distinctive textural appearance given to carpet by the use of yarns that have been twisted with other yarns of different colors or shades. Moresque yarns thus have a “barber pole” appearance. Moresque carpet in suitable colors have good soil hiding capabilities in high-traffic areas.
MULTIFILAMENT	Synthetic yarns composed of a multiplicity of continuous fiber strands extruded together, usually from the multiple holes of a single spinneret. Multifilament carpet yarns are texturized to increase bulk and coverage, and are called “bulked continuous filament” yarns or BCF yarns.

N

NAP	Carpet or rug pile surface and direction of the pile.
NEEDLE	<ol style="list-style-type: none">1. Tufting - An eyed needle that inserts yarns into primary backing to form tufts.2. Needlepunching - Barbed felting needles that entangle and compress fibrous fleeces into needled felts, such as those used for outdoor carpet and some carpet backings3. Axminster Weave - An eyed needle that delivers filling yarn across the loom through the warp yarn shed.
NEEDLE LOOM	A machine for producing needled felt fabrics, also called needle-punched fabrics, which are sometimes used as outdoor carpet. The needle loom converts fiber directly to fabric by entangling and compressing fiber batts or webs with barbed felting needles. Additional explanation is found under Needle punch Carpet. (NOTE: “Needle Loom” also denotes a certain narrow weaving loom used in tape production having a needle instead of a shuttle as the fill insertion device.)
NEEDLEPUNCH CARPET	Carpet produced by mechanically binding with barbed needles a fiber web or fleece. Needle punched carpet is normally made with solution-dyed polypropylene and is often used as an outdoor carpet, although its usage in other applications is quite broad.

NONWOVEN	A fabric manufactured directly from fibers or filaments, or from a web of fibers, without the yarn preparation needed for weaving, knitting or tufting.
NOSING	The front dividing line of a step, where the top of a riser joins the front of a tread.
NYLON	Synthetic thermoplastic of the polyamide family widely used as a carpet face yarn in either BCF or staple yarn form. Two chemical types, nylon-6,6 and nylon-6, are used in carpet.

O

OLEFIN FIBER	A manufactured fiber consisting of a long chain, synthetic polymer composed of at least 85 percent by weight of ethylene, propylene, or other olefin units. Polypropylene is used in carpet as both backing and pile fiber. <i>See Polypropylene.</i>
OPEN-TIME	The interval between spreading adhesive on a substrate and the placement of a floor covering material into the adhesive for bonding.
ORIENTAL RUGS	Hand-woven rugs made in the Middle East and Asia. Also may refer to the typical designs, but made elsewhere.
OUTDOOR CARPET	Carpet that may be used outdoors without rapid fading or deterioration. The principal requirements are resistance to sunlight and water. Most outdoor carpet pile yarns are solution-dyed polypropylene containing ultraviolet stabilization additives. Coating and backing materials are synthetics that are water and rot resistant. <i>See Indoor/Outdoor Carpet.</i>
OZONE FADING	The fading of a dyed carpet, especially those containing blue dyestuffs, caused by atmospheric ozone (O ³). High humidity and temperatures accelerate the fading effects.

P

PACKAGE DYED	Yarn dyed while wound on perforated tubes or wire forms. The package dye machine forces dye liquor through the yarn on the dye package.
PADDING	<i>See Carpet Cushion.</i>

PATCHING	Process of repairing holes, cracks, breaches, etc., in a floor surface prior to installation of carpet.
PATTERN	Artistic, decorative design on the surface of carpet. It may be printed, tufted or woven with colored yarns or sculptured in multiple pile heights.
PATTERN STREAKS	Visually apparent streaking in patterned carpet, resulting from linear juxtaposition of pattern elements in one direction. It is usually most visible in the length direction. It is not a carpet defect, but is inherent in certain designs. Contract specifiers should view rolls of carpet laid out on a floor to evaluate geometric or other busy patterns for this characteristic that may be objectionable in long corridors and other large areas, but not visible in small rooms.
PICKS PER INCH	In woven fabric, the number of insertions per inch of length.
PIECE DYED	Carpet dyed by immersion into an aqueous dye bath. Usually associated with beck dyeing.
PIGMENT	Highly colored, insoluble, powdered substance used to impart color to other materials. White pigments, e.g., titanium dioxide, are dispersed in fiber-forming polymers to produce delustered (semi-dull and dull) fibers.
PIGMENTED YARNS	<i>See Solution-Dyed Fiber.</i>
PILE	The visible wear surface of carpet consisting of yarn tufts in loop and/or cut configuration. Sometimes called “face” or “nap.”
PILE HEIGHT	The length of the extended tufts measured from the primary backing top surface to their tips. Pile tufts should be gently extended, but not stretched, during this measurement.
PILE CRUSH	Loss of pile thickness by compression and blending of tufts caused by traffic and heavy furniture. The tufts collapse into the air space between them. It may be irreversible if the yarn has inadequate resilience and/or the pile has insufficient density for the traffic load.
PILE DENSITY	<i>See Density.</i>
PILE REVERSAL	An irreversible, localized change in the orientation of the pile of a carpet. The phenomenon has different names in different countries. In the U.S. it is often referred to as “watermarking,” “pooling,” “highlighting,” and “shading.”
PILE SETTING	Carpet cleaning term for the process of erecting the damp and disheveled pile after shampooing by means of a pile brush or pile-lifting machine.

PILE WIRE	A metal strip on a Wilton-weaving loom on which the pile tufts are formed.
PILE YARN	The yarn that forms the tufts of the carpet. Also called “face yarn.”
PILE YARN WEIGHT	<i>See Average Pile Yarn Weight.</i>
PILL TEST	Flammability test for carpet to determine its ease of ignition by a small incendiary source, e.g., methenamine timed burning tablet. Federal regulations require all carpet sold to pass this small-scale ignition test (FF1-70).
PILLING	A condition of the carpet face (which may occur from heavy traffic) in which fibers from different tufts become entangled with one another, forming hard masses of fibers and tangled tufts. Pills may be cut off with scissors.
PITCH	Same as gage or gauge in tufted carpet. In woven carpet it is the number of ends of yarn in 27 inches of carpet width.
PLIED YARN	A yarn composed of two or more single yarns twisted or air entangled together.
PLY	<ol style="list-style-type: none">1. A single-end component in a plied yarn.2. The number that tells how many single ends have been ply-twisted together to form a plied yarn. (e.g. 2-ply or 3-ply)
POLYESTER	A fiber-forming, thermo-plastic synthetic polymer. Polyester for carpet is made from terephthalic acid and ethylene glycol and is known chemically as polyethylene terephthalate (P.E.T.).
POLYMERS	High molecular weight, chemical compounds formed by repeated linking of smaller chemical units called monomers. Polymers from which fibers are made are long chain molecules in which the monomers are linked end-to-end linearly. Synthetic polymers used for carpet fiber include nylon-polyester, polypropylene.
POLYPROPYLENE	A synthetic, thermo-plastic polymer used for molded items, sheets, films, and fibers. The Federal Trade Commission (U.S. Government) classification is olefin. The polymer is made by stereo- specific polymerization of propylene. Most polypropylene carpet fiber is solution dyed and sometimes contains ultraviolet stabilizers for outdoor use. The carpet fiber is available as both bulked continuous-filament yarns and staple for spun yarn production. Slit-film polypropylene is used in woven carpet backing.
POOLING	<i>See Pile Reversal.</i>

POWER STRETCHER	A carpet installation tool used to stretch carpet for installation on tack strip. It consists of a pinned plate that grips the carpet, tubular extensions, a padded end that is used to brace against an opposing wall or other structure, and a lever system that multiplies the installer's applied stretching force.
PRIMARY BACKING	A component of tufted carpet, consisting of woven or nonwoven fabric, into which pile yarn tufts are inserted by the tufting needles.
PRIME POLYURETHANE CUSHION	Separate carpet cushion made from virgin polyurethane foam. The sheet of foam is cut from large "loaves." As opposed to prime cushion, rebonded polyurethane is made from recovered materials.
PRINTED CARPET	Carpet having colored patterns applied by methods analogous to those used for printing flat textiles and paper. The primary method is computerized jet printing.
PUCKERING	An installation defect in carpet seams in which one side is longer than the adjoining carpet edge. The excess carpet gathers into wrinkles or pleats causing bulging at the seam.
PVC	Polyvinyl Chloride, a material used as a secondary backing on some carpet (tiles) and some six-foot wide rolled carpet.

Q

QUARTER DROP-MATCH	<i>See Match.</i>
QUARTER TURN	The joining of two cuts at a 90-degree angle to each other. Also, a carpet tile installation method where every other tile turned 90 degrees in a checkerboard pattern.
QUARTER-ROUND	Wooden or plastic molding having a cross section comprising a 90-degree arc of a circle. It is used at joints between walls and floors, or between larger moldings and floors.

R

RADIANT PANEL	<i>See Flooring Radiant Panel.</i>
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RANDOM SHEARED	A carpet texture created by shearing high-low loop carpet lightly so that only the higher loops are sheared. The sheared areas are less reflective than the unsheared loops, which appear brighter and lighter in color. Random shearing of high-low loop carpet produces a texture somewhat similar to cut and loop.
REBOND	<i>See Bonded Polyurethane Cushion.</i>
REED	Part of a carpet-weaving loom consisting of thin strips of metal with spaces between them through which warp yarns pass. The motion of the reed pushes fill yarn tightly into the fabric.
REMNANT	A short piece of carpet roll goods, usually less than nine feet long.
REPEAT	The dimensions of the basic pattern unit in any type of patterned carpet, including printed, woven, high-low tufted loop, cut and loop, etc. <i>See Match for further discussion.</i>
RESILIENCE	Ability of carpet pile or cushion to recover original thickness after being subjected to compressive forces or crushing under traffic.
RESIST PRINTING	A technique for producing colored patterns wherein carpet is first printed with colorless chemicals that alter the dye affinity of the printed areas. The printed areas in nylon carpet, for example, may be altered to be light dyeing and/or cationic dyeable, relative to the un-treated, regular, acid-dyeable nylon. Subsequent piece dyeing in a dye beck with appropriately selected dyestuffs produces a colored pattern. In this fashion, numerous colorways may be produced from a single print run.
RESTRETCH	A carpet installation term used to describe carpet stretching performed subsequent to original installation to remove wrinkles, bubbles, or loose fit. Most restretching is caused by failure of the installer to adequately stretch the carpet during original installation. Restretching should be performed with power stretchers and not with knee kickers. This is true of all stretching operations in overpad, tack strip installations.
RISER	The vertical or front surface of a step, rising from the back of a tread.
ROLL CRUSH	<i>See Crush Marks.</i>
ROUND WIRE OR LOOPED PILE	A Wilton or velvet carpet woven with the pile yarn uncut. <i>See Loop Pile.</i>
ROVING	An intermediate stage in the production of spun yarns consisting of a loose assembly of staple fibers with little or no twist. Roving is smaller than sliver but larger than yarn.
ROWS OR WIRES	In woven carpet this is the number of pile yarn tufts per running inch lengthwise. Called “rows” in Axminster and “wires” in Wilton and velvet carpet. Analogous to “stitches per inch” in tufted carpet.

RUBBER	A term sometimes applied to carpet cushion made from rubber (foam or sponge), and used for both separate and attached cushion.
RUG	Carpet cut into room or area dimensions and loose laid. Also, small floor coverings not installed or attached at wall base.

S

SAXONY	A cut pile carpet texture consisting of heat- set plied yarns in a relatively dense, erect configuration, with well-defined individual tuft tips. Tip definition is more pronounced than in singles plush.
SBR	Styrene-butadiene latex. A synthetic adhesive that is combined with a filler substance and used as a back coating, or a laminating adhesive in carpet manufacture.
SCALE DRAWING	A drawing, such as a building blueprint, having its measurements in fixed proportion to the actual dimensions of the room, floor or building depicted. A typical scale might be “one quarter inch to the foot.” On such a drawing, each quarter inch of linear dimension represents one foot of linear dimension in the actual structure.
SCRIBING	An installation term for the method of transferring the exact irregularities of a wall, floor or other surface onto a piece of carpet by a tracing technique. The carpet is then cut to fit exactly.
SCULPTURED	Any carpet pattern formed from high and low pile areas, such as high-low loop or cut and loop.
SEAM ADHESIVE	A specifically formulated adhesive for securing cut edges of carpet to be seamed. Specialized adhesive products are necessary for either glue-down or stretch-in over a cushion installation, which will help prevent raveling and delaminating at seam edges.
SEAM SEALING	Procedure of coating or “buttering” the trimmed edges of two carpet breadths to be joined with a continuous bead of seam adhesive in order to secure and prevent fraying, raveling, and delamination at the seam.
SEAMING TAPE	Fabric tape used for joining two sections of carpet. “Hot melt” tape is precoated with a thermoplastic adhesive.
SEAMS	In a carpet installation, the line formed by joining the edge of two pieces of carpet by the use of various seaming tapes, hand sewing or other techniques.

SECONDARY BACKING	Woven or nonwoven fabric reinforcement laminated to the back of tufted carpet, usually with latex adhesive, to enhance dimensional stability, strength, stretch resistance, lay-flat stiffness and hand. The term is sometimes used in a broader sense to include attached cushion and other polymeric back coatings.
SECONDS	Off-quality, defective or substandard carpet normally sold at price discounts as “seconds” or “imperfects” by manufacturers.
SELF-TONE	A pattern of two or more shades of the same color. When two shades are used in a pattern or design, it is called “two-tone.”
SELVAGE	The lengthwise, factory-finished edge portion of a carpet.
SERGING	A method of finishing edges of area rugs or samples cut from roll goods by use of heavy, colored yarn sewn around the edges in a close, overcast stitch.
SET OR DROP-MATCH	<i>See Match.</i>
SHADING	A change in the appearance of a carpet due to localized distortions in the orientation of the fibers, tufts or loops. Shading is not a change in color or hue, but a difference in light reflection. Sometimes referred to as “temporary shading,” “tracking” or “pile reversal.” <i>See Pile Reversal.</i>
SHAG	A carpet texture characterized by long pile tufts laid over in random directions in such a manner that the sides of the yarn form the traffic surface. Modern shags are made from plied, heat-set yarns and are either cut pile or cut-and-loop styles.
SHEARING	Carpet manufacturing process for producing a smooth carpet face, removing fuzz or creating random sheared textures. Carpet shears have steel blades mounted on rotating cylinders that cut fibers on carpet surfaces in a manner similar to a lawn mower cutting grass. Depth of shearing may be indicated by a modifying word, e.g., defuzz and tip shear suggest a shallow cut of the sheer, whereas a full shear would imply a deep cut as used for producing mirror-finished plush.
SHOE MOLDING	Wood or plastic strip with one corner edge rounded slightly. It is used to conceal joints between walls and floors, or between larger moldings and floors.
SHORT ROLLS	A length of carpet roll shorter than a full shipping roll and longer than a remnant. Depending on carpet mill quality standards, it may be from 20-to-40 feet long.
SHOT	A weaving term for fill yarn, the yarn inserted at right angles to the warp across the fabric width. In woven carpet, it is the number of picks of fill yarn per row of pile tufts.

SHUTTLE	Part of a weaving loom that carries fill yarn back and forth across the fabric width. In conventional looms, it contains a spool of fill yarn called a bobbin.
SIDE MATCH	A term related to color, describing the difference in shade or contrast of two or more carpets of the same color from within the same production unit or from different production units.
SIDE OR LENGTH SEAMS	Seams running the length of the carpet.
SKEIN-DYED YARN	Yarn dyed while in the form of large, loosely wound skeins hung and dyed in dye vats.
SLIVER	An intermediate stage in the production of spun yarns from staple fiber. It is a large, soft, untwisted strand or rope of fibers produced by carding or pin drafting.
SOIL RESIST TREATMENT	Application of an anti-soiling agent that gives low surface energy properties to carpet face fiber to inhibit wetting of the fibers by oil or water-based materials.
SOIL RETARDANT	An anti-soiling finish applied to fibers or carpet and fabric surfaces that inhibits attachment of soil.
SOLUTION-DYED FIBER	Synthetic fiber colored by pigments dispersed in the polymer melt or solution prior to extrusion into fiber.
SPACE DYED	Yarn dyed two or more colors that alternate along the length, creating a random-colored or mottled effect.
SPINNING	A term for yarn or fiber production which involves the conversion of staple fiber into spun yarn.
SPROUTING	Emergence of long pile tufts above the normal pile surface. The condition is often correctable by cutting the sprouted tufts even with the pile with a pair of scissors or knife before or after installation.
STAIN	A local more permanent discoloration that is not easily removed from carpet by standard cleaning methods.
STAIN-RESIST TREATMENT	Topical treatment, primarily for carpet, to minimize stains from food colors.
STAIR NOSING	Material used to cover the nose of a stair when stairway is not upholstered. Commonly used to demarcate the edge of a stair in restaurants, theaters, etc.
STAPLE FIBER	Short lengths of fiber that may be converted into spun yarns by textile yarn spinning processes. Also called “staple.” Staple may also be converted directly into nonwoven fabrics, such as needlepunched carpet.

For carpet yarns spun on the common, modified worsted systems, most staple is six to eight inches long.

STATIC SHOCK	Discharge of electrostatic potential from carpet to person to conductive ground, e.g., a doorknob. Shoe friction against carpet fiber causes production of electrostatic charge. Various static control systems and finishes are used for contract carpet to dissipate static charge before it builds to the human sensitivity threshold.
STAY NAILING OR TACKING	A carpet installation term for temporary nailing or tacking to hold the stretch until the entire installation is stretched over and fastened onto the tack strip. This is an important technique in contract installations too large to stretch in one step. It is also used in adhesive installation of patterned carpet to aid in installation.
STEP RETURN	A term for that part of a staircase tread that extends over the riser. Also known as a bullnose or extended nosing.
STIFFNESS	Resistance of material, such as carpet, to bending.
STITCH LENGTH	Total length of yarn from which a tuft is made. It is numerically equal to twice the pile height plus the associated backstitch behind the primary backing.
STITCHES PER INCH	Number of yarn tufts per running inch of a single tuft row in tufted carpet.
STOCK-DYED YARN	Colored spun yarn produced from fibers dyed in staple form. The term does not encompass yarns spun from solution-dyed staple.
STOP MARKS	Widthwise, mechanical pile imperfections in tufted carpet. Usually caused by improper stop and start techniques by the machine operator.
STREAK	Any lengthwise, narrow, visible defect in carpet. A single pile end having different dye affinity from the others may cause dye streaks. Other streaks may be yarn defects, such as tight twist, stretched yarn or yarns larger or smaller than the others.
STRETCH	A carpet installation term for the amount of elongation of carpet when it is stretched over cushion onto a tack strip.
STRETCH-IN	An installation procedure where carpet is placed over separate cushion and is secured in place, under tension, utilizing tack strips.
STUFFER	A backing yarn in woven carpet. Stuffers are normally large warp yarns (lengthwise yarns) that increase weight, strength, hand, stiffness and stability.
SUESSEN HEATSETTING	Dry-heat method of twist setting, using a continuous heat setting range by exposing the twisted yarn to extreme dry heat.

**SUPERBA
HEATSETTING**

Wet-heat method of twist setting yarns (primarily) with slight pressure.

SWATCH

A small carpet sample. Carpet specifiers should retain swatches to verify color, texture, weight, and other quality factors when carpet is delivered.

T

TACK STRIP

Wood or metal strips fastened to the floor near the walls of a room that contain either two or three rows of pins angled toward the walls on which the carpet backing is stretched and secured in a stretch-in installation. Sometimes referred to as tackless strip.

TAK DYEING

A continuous dyeing process for producing random, multicolor patterns, which are usually less sharply defined than printed patterns. Colored dye liquor is applied to the carpet in a controlled pattern of droplets.

TEMPLATE

A pattern used by installers as a guide for cutting carpet for areas having complicated or unusual shapes.

**TENSILE
STRENGTH**

The greatest stretching force a yarn, fabric or carpet can bear without breaking.

**TEXTILE FLOOR-
COVERING MATE-
RIAL**

General description used for carpet and rugs.

TEXTURE

Visual and tactile surface characteristics of carpet pile, including such aesthetic and structural elements as high-low or cut and loop patterning, yarn twist, pile erectness or lay-over, harshness or softness to the touch, luster, and yarn dimensions.

**THERMAL CON-
DUCTIVITY**

Ability of a material to transmit heat. Good insulators, including some carpet, have high thermal resistance (R-value) and low thermal conductivity.

THRESHOLD

The raised board beneath a door. Also, known as “sill” or “saddle.”

TILES (Modules)

See Carpet Tiles.

TIP SHEARING

A shearing process to cut the tips of loop yarn tufts in pile yarn floor covering.

TONE ON TONE

A carpet pattern made by using two or more shades of the same color.

TOTAL WEIGHT	Weight per square yard of the total carpet pile, yarn, primary and secondary backings, and coatings.
TRAFFIC	The foot traffic of people over a given carpet surface area.
TREAD	The horizontal part (walking surface) of a stair.
TROWEL	Hand implement used for metering and spreading adhesive to the floor or other substrate.
TUFT BIND	The force required to pull a tuft from the carpet.
TUFTED CARPET	Carpet manufactured by the tufting process, which comprises insertion of pile tufts by a row of eyed needles, which penetrate a primary backing fabric, thus forming tufts from the yarn threaded through the eyes of the tufting needles.
TUFTS	The cut or uncut loops of a pile yarn floorcovering.
TWIST	The number of turns about its axis per unit length observed in a yarn. Twist direction is either right or left handed, also called "S-twist" or "Z-twist."

U

UNDERLAY	<i>See Carpet Cushion.</i>
UNITARY CARPET	Carpet used for glue-down installations that usually has an application of high-quality, back-coating latex to increase tuft bind performance properties without the addition of a secondary backing.

V

VELVET CARPET	Carpet woven on a velvet loom. Velvet carpet is typically cut pile or level loop in solid or tweed colorings, though textured and patterned effects are possible.
VETTERMANN DRUM TESTER	A rotatable drum tester (28.75-inch diameter) designed to subject carpet samples to simulated trafficking with the incorporation of a steel ball, with 14 rubber studs, rolling randomly inside the drum on the pile surface for a specified number of revolutions.

VINYL

See PVC.

VINYL PLASTICIZER

A substance incorporated into vinyl to increase its flexibility and workability.

W

WARP

A weaving term for yarns that run lengthwise in woven fabrics and carpets. Warp yarns are usually delivered to the loom from a beam, a large spool with hundreds of ends of yarn wound on it, mounted behind the loom. Woven carpets usually have three sets of warp yarns, which may be wound on three loom beams. These include stuffer warp for lengthwise strength and stiffness, pile warp, which forms the carpet surface tufts, and chain warp, which interlaces with fill yarn to lock the structure together.

WATERMARKING

See Pile Reversal.

WEAVING

A fabric formation process used for manufacturing carpet in which yarns are interlaced to form the fabric. The weaving loom interlaces lengthwise (warp) and widthwise (filling) yarns. Carpet weaves are complex, often involving several sets of warp and filling yarns. *See Axminster Carpet, Wilton Carpet, and Velvet Carpet.*

WEFT

Yarn that runs widthwise in woven cloth or carpet, interlacing with the warp yarns. *See Filling Yarn.*

WILTON CARPET

Carpet woven on a loom with a Jacquard mechanism, which utilizes a series of punched cards to select pile height and yarn color. The Wilton loom can produce carpet with complex multicolor patterns and highly textured pile surfaces of multilevel cut and looped yarns.

WIRE HEIGHT

In woven carpet, the height of the pile tuft is determined by the wire height. *See Wires.*

WIRES

Component of a carpet-weaving loom on which the pile tufts are formed. Round wires produce loop pile carpet, and flat wires with sharp blades produce cut pile (plush) textures.

WOOLEN SYSTEM YARN

Spun yarn, composed of any natural or synthetic fiber, manufactured by the woollen system spinning process. Compared to worsted-system or parallel-spun yarns, which are common to most tufted carpet, woollen yarns are soft, bulky and hairy.

WORSTED YARN

Spun yarn, composed of any natural or synthetic fiber, manufactured by the worsted, or parallel spinning process. Most spun yarns for tufted

carpet are parallel spun. In worsted yarns, the fibers are relatively parallel, and the yarns are relatively smooth and compact in structure.

WOVEN BACKING	A carpet term for primary or secondary backing manufactured by the weaving process. Secondary backings are usually woven jute or woven polypropylene. Woven primary backings are usually polypropylene.
WOVEN CARPET	Carpet produced on a loom through a weaving process by which the lengthwise (warp) yarns and widthwise (weft or filling) yarns are interlaced to form the fabric. Carpet weaves - such as Wilton, Axminster and velvet - are complex, often involving several sets of warp and filling yarns for the pile and backing.

Y

YARN	A continuous strand composed of fibers or filaments and used in tufting, weaving and knitting to form carpet and other fabrics. Carpet yarn is often plied and may be either spun or continuous filament.
YARN DYEING	Applying color to yarns before tufting or weaving it into carpet. Examples are space dyeing, skein dyeing, and package dyeing.
YARN PLY	The number of single yarn ends twisted together to form a plied yarn.
YARN SIZE	A number used to describe the size of the yarn. Denier, a direct yarn system is often used for BCF yarn, and cotton count an indirect system, is the system most often used for spun yarns.