Welcome
Objectives

This educational forum outlines criteria to be examined in achieving carpet specifications that meet aesthetic and performance expectations.

The course will give an overview of fibers, yarns, dyeing, backings and related manufacturing processes.

Carpet construction will be reviewed including woven and tufted.
Objectives

The professional will gain a **balanced and generic** understanding of specific construction criteria in carpet specifications including fiber types, dye methods, gauge, weight, etc.

Factors will be evaluated for comparing products submitted as “…or equals” on a project.

Inclusions in the specifications address specific expectations with regard to performance.
Elements of a Good Carpet Construction

- Fiber
- Yarn Formation
- Fabric Formation
- Dyeing Method
- Special Treatments
- Backing System
Elements of a Good Performance Specification

Fiber
Yarn Formation
Fabric Formation
Dyeing Method
Special Treatments
Backing System
Factors in Constructing & Specifying Carpet

Aesthetics: Color, design, texture, visual appeal

Appearance: Durability, colorfastness, texture or appearance retention, stability and cleanability

Performance: Flammability, acoustical value, indoor air quality, static propensity, anti-microbial, anti-stain and anti-soil properties

Budget: Cost, installation, maintenance, life cycle

Government or Building Code Requirements
Sifting through the Maze

• Construction details
• What types of constructions should be used?
• Construction vs. Performance: which wins?
• What Elements should a Construction Spec. Contain?
• How does construction affect performance?
• Which Spec. component(s) is/are most important?
• How “tight” should a specification be?
• “or Equal” defined: Performance or Construction?
• Apples to Apples Comparisons
• The Role of Density in a Specification
• Traps to Avoid
• Test Methods
Construction Language

Gauge/Pitch & Stitches/Rows
Tufted - The spacing between needles across the width of the machine is called *gauge*. In an “1/8” gauge” product, the needles are 1/8” apart, resulting in widthwise density of 8 ends per inch.
Stitches/Rows

Tufted Products - The lengthwise number of tufts is called stitches. Stitches per inch determine the lengthwise density of tufts.
Weaving Process

History records that weaving is one of the oldest art forms—tracing back to 5000 BC. Woven floor coverings were first made as early as the 14th century.
Woven Interlace Concept
Tufting Process

Yarns are pushed through a primary backing with needles.

Holes are punched through a thin 3oz. Primary sheet.

More holes are punched as more weight and density are needed.
Fibers

Nylon 6 - Caprolactam

\[
\left[(\text{CH}_2)_5\text{C}^\equiv\text{NH}\right]_n
\]
Fibers

Nylon 6.6 - Hexamethylene Diamine & Adipic Acid

\[
\begin{align*}
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&\text{C(CH}_2\text{)}_4\text{CNH(CH}_2\text{)}_6\text{NH}\nn
\end{align*}
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Fibers - Characteristics of Each Fiber

**Nylon 6**
- Accepts Color Well
- 100% Recyclable into virgin Nylon – Infinitely
- Post Consumer content
- Gaining Market Share

**Nylon 6.6**
- Difficult to Re-process Polymer
- Not recyclable into virgin Nylon
- Post Industrial content Only at the present time.
- Losing Market Share
Yarn Formation
Elements of a Good Construction Specification

Fiber
• State by Manufacturer and Type

Yarn
• Approximate yarn Size
• Number of Piles (2, 3, 4, etc.)

Yarn Process
• Air Entangled
• Twisted Only
• Twisted and Heatset
• Any Hybrid
## Dye Methods

Elements of a Good Construction Specification

<table>
<thead>
<tr>
<th>Piece dye</th>
<th>Solution dye</th>
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<tbody>
<tr>
<td>Beck</td>
<td>• Fiber</td>
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<td>Continuous</td>
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<table>
<thead>
<tr>
<th>Yarn dye</th>
<th>Combinations</th>
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</thead>
<tbody>
<tr>
<td>Skein</td>
<td>• Skein/Solution</td>
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<tr>
<td>Space</td>
<td>• Solution/Space</td>
</tr>
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<td></td>
<td>• Etc.</td>
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</table>
# Fabric Formation Systems

## Woven and Tufted

### Woven—Loom Types

- **Axminster**
  - Cut
- **Wilton**—Complex Pattern
  - Loop - Cut - Cut/Loop
- **Dobby**—Simple Pattern
  - Loop - Cut - Cut/Loop
- **1,2,3,4 Heddle**—Color No.
  - Loop - Cut - Cut/Loop
- **Interlock**
  - Loop

### Tufted

- **Broadloom**
  - Loop - Cut - Cut/Loop
  - Patterning Devices
    - Yarn-side to side
    - Yarn-up and down
- **Modular**
  - Loop - Cut - Cut/Loop
  - Patterning Same
Fabric Formation
Elements of a Good Construction Specification

Type
• Tufted or Woven
• Broadloom or Modular

Texture
• Cut or Uncut
• Tip Shear
• Textured or Level
• Pattern or Non Pattern

Gauge or Pitch
• Give two alternatives - 1/8 or 1/10
• If very fine construction - 1/12 or 5/64
• Woven is more specific
## Acceptable Commercial Gauges

### WOVEN

From Non pattern to sophisticated Axminster Patterns

**Gauges**
- 135 pitch
- 165 pitch
- 216 pitch
- 270 pitch

Since the original woven carpets were 27 inches wide, the widthwise density is called pitch, and is stated as the number of ends across 27 inches of width.

### TUFTED

From Non pattern to sophisticated Single end Pattern control

**Gauges**
- 1/8 gauge
- 1/10 gauge
- 1/12 gauge
- 5/64 gauge
- 1/16 gauge
Backing Systems
Elements of a Good Construction Specification

Standard Secondary
Sometimes known as ActionBac

Performance Cushion Systems
High performance Characteristics

Standard Performance Unitaries
With or without Secondary

Modular Systems
Cushion or Hardback
High Performance

Performance Laminate Systems
High performance Characteristics
Treatments & Special Chemistries
Elements of a Good Construction Specification

Stain Resist
• Generic
• Special Built-In

Antimicrobial

Soil Resist
• General
• Specific

Other Specialized
Which Construction Systems Should Be Used?

All CAN Perform Well

• Minimum Standards must be used
• All factors must be weighed

Depends on 2 Main Factors

• Type of Application
• Type and amount of Traffic
How Should Construction Specifications Be Used?

As a means of achieving desired performance and Aesthetic Objectives.

- It should be the **Outcome** of the Performance Criteria
- It should be the **Outcome** of the Aesthetic needs.
- It is a By-product of the flooring budget

They are a means of obtaining the best flooring solutions for every End use.
Construction vs. Performance: Which Wins

Neither

They are Totally Interrelated

• Performance should be the overriding factor
• But, Performance must be blended with Aesthetic considerations: Color, Texture, Pattern
Construction vs. Performance: Which Wins

Performance
- Rigid

Design/Aesthetics
- Flexible

Final Product
- Rigid & Flexible Components
- Meet all Criteria
How Does Construction Affect Performance

Construction Largely determines performance

Construction consists of many facets:
Each play a role

- Fiber
- Yarn
- Dyeing
- Fabric Formation
- Backing Systems
- Treatments
Which Construction Components are Most Important

They are all Important

Each Component acts as a piece of the puzzle

All pieces of the puzzle must mesh to complete the picture

• Yarn sizes correlate with gauge
• Dye methods consistent w/application
• Dye technique consistent w/end use
• Backing systems appropriate w/performance
How “Tight” should a Spec. Be

Specific enough to achieve the desired performance requirements, but general enough to allow for the manufacturers to use the most effective technology to meet the needs of the project.

Some items can be a little more general
  - Yarn size range
  - Gauge range
  - Pattern size range

Some items can be very specific
  - Texture type
  - Twisted or Entangled yarns

Key is to allow for the best choice from the manufacturer’s technology to achieve the Client’s needs
“Or Equal” Defined Construction or Performance

One of the most misunderstood and confusingly used term in Specifications

“Equal” is defined by the specifier

• What items must be same
  Pattern, Color, Liquid Barrier

• What items can vary
  Gauge, Fabric formation, dye technique

PERFORMANCE rules, and should be “equal” with any competitive product

Aesthetics should be closely duplicated in an “equal”

Construction parameters should be secondary to achieve Performance and Aesthetic specifications
“Or Equal” Stands the Legal Test

Federal Courts have ruled that Proprietary Specifications are not a violation of Antitrust Laws… Specifiers make informed judgments on products which they feel best serves their clients needs.

“Or Equals” actually enhance competition and opens up projects to a wider array of choices among similar products.
How is Specifier Protected from Liability

SPECIFICATION DOCUMENT

It is the only document that protects the specifier with regard to quality of material and proper installation.
All components of specifications should be the same if they are truly to be equals

- Fiber - Nylon
- Twisted vs. Twisted; not Twisted vs. Air Entangled
- Solution vs. Solution; not Solution vs. Space or piece
- Cushion vs. Cushion; not Cushion vs. Laminate
- Tufted vs. Tufted; not Tufted vs. Woven

These are important for pricing/Budget purposes as well as performance purposes
Role of Density

Important Indicator of relative fabric integrity, but only one component of total performance picture

Average Pile yarn Density

- Specify minimum, not an absolute number
- Minimum should be around 5000
- Weight x 36/pile thickness
Traps to Avoid

The most common trap on many specifications is the reliance on **one single factor** of a construction specification by which the entire acceptance of a product is justified.

- Accepting only density
- Accepting only gauge
- Accepting only one yarn size
- Any other single construction parameter
## Test Methods: Assurance of Quality

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<tr>
<th>Property</th>
<th>Method</th>
<th>Related Standard</th>
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<tr>
<td>Appearance Retention</td>
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<td>(Hexapod)</td>
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<tr>
<td>Static Rating</td>
<td>AATCC 134</td>
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<tr>
<td>(less 3.5 KV)</td>
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<tr>
<td>IAQ (GLP)</td>
<td>ASTM D5116</td>
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<tr>
<td>Flammability</td>
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<tr>
<td>(Radiant Panel)</td>
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<td>NBS Smoke</td>
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Thank You

Questions