



CFI STUDY GUIDE

Advanced Certification Levels R-II, C-II and Master-II

LIABILITY WAIVER

The information contained in this CFI Advanced Study Guide is to be used as a tool for continuing education. It is based on the best information available at the time of publication, always subject to revision. No guarantees are made as to results and CFI assumes no liability of responsibility in connection with the use of the information. CFI suggests that you test all procedures before widespread use to determine results in your specific situation, as every circumstance is different. Information is provided as a guide and is not intended to take the place of good judgment, common sense or manufacturer's written specifications.

Study Guide is prepared to assist installers who are preparing for the advanced levels of CFI Certification.

STUDY GUIDE for CFI ADVANCED R-II and C-II CERTIFICATIONS

SECTION ONE - IDENTIFICATION of CARPET CONSTRUCTION

(Essentials of Modern Carpet Installation 1962)

At one time it was fairly easy to distinguish between the different types of carpet construction. Today, each of the various manufacturing methods is increasingly more versatile, so that the end product is harder to identify as to type of weave or construction. To the expert, however, there are some telltale signs by which each type can be identified.

1. TUFTED

Tufted carpet is traditionally identified on the reverse side, where it is often possible to see even rows of tufts punched through the prewoven kraftcord, jute backing or ActionBac. If there is a double backing, look at the edge of the carpet, where it is possible to see that tufts have been punched through the backing and are not interwoven with backing yarns.

- **FOUR COMPONENTS** make up the majority of tufted carpets:
 - 1) Face Yarn
 - 2) Primary Backing
 - 3) Secondary Backing
 - 4) Adhesive / Latex

- **PRIMARY BACKINGS** add strength and dimensional stability to tufted
 - 1) Face yarn is tufted into the primary backing
 - 2) Adhesive laminates secondary and primary backing
 - 3) SBR – Syrene Butadiene Rubber Latex is approximately 15-25% - most expensive ingredient
 - 4) Fillers – Calcium Carbonates 70%-80% - least expensive ingredient
 - 5) Water 5-7%
 - 6) Stiff carpet is not yarn or backings – It is the adhesive used to laminate primary and secondary together. More fillers in adhesive = stiffer carpet backing

- **SECONDARY BACKINGS** add strength and dimensional stability to tufted carpet

2. VELVET WEAVE

If there is a cut edge or open salvage, note the chain warp, which binds all construction yarns together, forms a characteristic pattern. Velvets are solid colors, tweeds or stripes.

3. WILTON WEAVE

In multi-color Wiltons, pile fibers are usually visible on the back and the additional colors provide a heavier body than other types. Residential grades of Wiltons usually have more than two and less than five colors and are often, patterned with sculptured or embossed textures, or combinations of cut and uncut piles. In residential grades, latex backings make it difficult to identify a Wilton Weave.

4. AXMINSTER WEAVE

Axminster Weave often results in a heavily ridged backing so that the carpet can be rolled easily in one direction. Axminsters are the most intricately patterned, “floral type” carpets, which use many colors.

5. KNITTED

If you “grin” the carpet to expose the backing from the front, notice the continuous looping of pile yarns from row to row, held in place by stitching yarn. Rows of piles run in an irregularly diagonal direction, with a random, homespun look – not in straight rows, as in woven or tufted carpets.

6. CHENILLE

A very distinctive carpet; easily identified by “catcher” warp thread, as well as by “fur” or “caterpillars” referred to above. Because Chenille can be a rather costly carpet, making error and waste very serious matters, and also because it requires specialized techniques for correct installation, installation techniques must be thoroughly understood.

SECTION TWO - CONCRETE - MOISTURE as Related to the Flooring Installer

Prepared by Jon Namba, CFI Executive Director, Past President, Master-II Installer

1. Understanding “pH”

For many years, the Industry has looked upon moisture as being the primary contributor to flooring failures. As the Industry has become more knowledgeable with information gathered from some specialists in the field, we are finding that the pH level of a concrete substrate has a significant bearing on the success or failure of the applied floor covering such as ceramic tile, carpet, VCT, hardwood, etc.

pH tests determine the strength of salts, known as a base or the strength of acids in a substance, whether in a liquid or solid state. An aqueous solution, which is pure water (distilled) is applied to the substrate and tested by the use of litmus paper or electronic meters. Test results will determine the value of acid or alkali (salts) present in concrete.

Alkali migrates to the surface through the capillaries in the concrete. Water in vapor form is the transport. Alkali can be present in the ground or in the aggregate mix.

The pH scale is logarithmic; the intervals are exponential and thus, represent far greater differences in concentration than the values themselves seem to indicate – each interval is 10 times itself starting from 7. The pH measures hydrogen-ion concentration of solution.

TESTING the pH of CONCRETE

- The pH scale is from 0-14
- 7 is neutral
- 1 being a strong acid
- 14 being a strong salt (alkali) or base

THREE TYPES OF TESTS

- 1) PH paper – Litmus
- 2) Liquid Indicators
 - Phenolphthalein liquid - turns red with higher pH or pink with lower pH
 - Rainbow Indicator - reacts to the different values of pH
 - pH pencil - reacts to different values of pH
- 3) Electronic Surface Probes - Digital displays

CONDUCTING a pH TEST

- Test is to be conducted at same time as moisture test
- Floor must be free of any sealers or contaminants
- Take three tests for first 1000 square feet
- Take one additional test for every 1000 square feet
- Use distilled water for litmus paper
- Use a buffered solution for electronic test
- Phenolphthalein or liquid solutions – pour directly onto slab – can be toxic
- Pour a small amount of water directly onto slab – let stand for two minutes
- Test by placing litmus paper on wet area
- Compare results with scale, usually provided with paper
- ELECTRONIC SCALE provides a numerical readout
- pH turns red with phenolphthalein
- pH turns different shades with Rainbow Indicator

2. POROSITY

Webster's Dictionary explains Porosity as "possessing or full of pores – permeable to liquids"

Porosity has a direct affect on vapor migration through a slab: The more porous a slab, the more vapor migration can occur. Porosity has a direct affect on adhesives. When conducting pH testing, one can determine the porosity of a slab by watching the water that was applied for the pH:

- If the water absorbs quickly – the slab is porous
- If the water does not absorb – slab has a low porosity
- The more porous the slab, the less open time for adhesive-moisture
- Moisture from the adhesive will absorb into the slab
- The lower the porosity, the longer the open-time is for adhesives
- Moisture needs to evaporate from adhesive, rather than being absorbed into concrete
- Water cement ratios and on-site finishing methods are two key factors determining the amount of porosity a concrete slab will have

3. DEW POINT (condensation)

Dew Point is another factor that comes into play with all the other concerns regarding moisture, pH and concrete science. What is Dew Point? It is the temperature at which condensation forms. (Review following graph)

4. HUMIDITY

Humidity is the amount of water vapor in the air and can be described in different ways. Relative humidity is the term used most often in weather information for the public. Relative humidity is the amount of water vapor in the air compared with the amount of vapor needed to make the air saturated at the air's current temperature or more simply, the amount of moisture in the air in percentage.

5. PATCHING COMPOUNDS

GYSUM BASED: White in color – lower psi rating – susceptible to mold and mildew
Expands during dry out and expands with moisture after it is cured.

PORTLAND BASED or CEMENTITIOUS: Usually gray in color – higher psi rating – will not promote mold and mildew – may shrink during dry out period - may need to apply a second coat

SELF-LEVELING COMPOUNDS: Used for irregular substrates

6. MEMBRANE SYSTEMS

Many of the membrane systems utilize a fiberglass layer to help disperse moisture

- POLYMER COATINGS
- EPOXY COATINGS
- MAT SYSTEMS

7. SEALER – PENETRANTS

- Liquid sealers / penetrants are top coatings for a concrete slab and reduce the amount of vapor emissions by filling in the capillaries – usually silicate-based
- Beware of sealers that are ready for floor coverings within 24-72 hours
- Sealers address moisture, but not pH
- Sealers can react with certain adhesives – causing a failure

8. REMOVAL of EXISTING FLOOR COVERINGS

Proper precaution and OSHA procedures must be taken if there is an existing floor covering that may contain ASBESTOS. If in doubt, assume that flooring contains asbestos until properly tested.

For existing and remodel projects, removal must be addressed at the time of the sale! This is critical to the success of the installation!

A salesperson who is knowledgeable can direct the end user in the right direction and offer the proper corrective procedures, resulting in a successful sale AND installation.

Asbestos removal systems should be used by abatement companies. The majority of installation firms are not experienced or qualified concerning the chemicals necessary for removal or the proper techniques and disposal methods. CFI suggests that a recognized abatement firm be contacted.

9. MOISTURE TESTS

pH TEST

- **PAPER STRIPS:** Mist or place a few drops of distilled water on the area to be tested. Lay a strip of pH paper on the area and wait about 10 seconds or until the strip appears to have stopped changing color, after which time the color of the paper is compared to the chart that came with the paper. Record the findings. A pH meter is a more accurate method.
- **pH METER:** Either mist or place a few drops of distilled water on the area to be tested. The less water, the more accurate the testing. Hold the testing end of the meter against the dampened area until the meter stabilizes. Read the meter and record the findings. Before testing another area, clean the end of the probe with a clean towel.

MAT TEST

- Test for moisture by trapping it under a plastic or rubber mat. Clean the floor where you will be placing the mat. Do not wet mop the floor as this will create moisture. Place the mat on the floor. Tape it on all sides with duct tape, sealing all edges.
- Leave the mat in place for 48 hours and then remove. Performing the test in less time, allows for the margin of error to increase.
- Look for droplets of moisture and changes in the floor's appearance when you remove the mat. Is the surface drying (whitening)? Is the duct tape stuck to the floor? If the duct tape is loose or will hardly stick to the floor, this may be an indication of a moisture condition.

BOND TEST

- This is similar to the mat test except that a section of the floor covering to be installed is used. Apply the adhesive to the floor, allow for the required open time, place carpet into the adhesive. Roll with a roller of recommended weight for the carpet installation.
- Duct tape carpet on all sides. After 72 hours, remove tape, observe if tape is easy to remove indicating a potential moisture condition or is adhesive is adhering, as it should. Is the carpet held tight to adhesive, indicating a good bond? Does the adhesive remain on the back of the carpet instead of the floor or is it wet and stringy? Both indicate moisture problems.

Section Three: The WHITE PAPER

Drafted as a result of a panel, called together by the World Floor Covering Association

October 3, 2000

Moisture Emission Testing - Responsibility and Qualifications for Testing

Foreword:

With the advent of rapid changes within the construction industry, including but not limited to:

1. The loss of asbestos as an ingredient in resilient flooring
2. The loss of solvents from adhesive and coating systems
3. Increased use of water to allow easier placement of concrete
4. Absorptive aggregate in lightweight concrete
5. Fast track construction schedules

Many unforeseen problems have surfaced that have lead to unnecessary disputes, increasing confusion and lawsuits. As an effort to reverse this trend, a more science-based approach was needed to clearly identify contributory problems associated with moisture-related flooring failures, with reasonable expectations for those responsible for moisture testing.

To identify those capable of moisture testing and the ancillary tests that may be appropriate for identification and diagnoses, the following contributing factors are to be considered within the evaluation and selection process of an appropriate inspector and/or testing agency.

Factors to Consider:

Site Conditions

It is important that the selected testing personnel at least be familiar with site conditions with a given building project.

Soil Conditions;

- Wet
- Dry
- Expansive
- Non-expansive
- Free Draining
- Non free draining

Water table

1. Water table location (seasonality to its level and/or volume) Inert - Contaminated

Under slab Conditions;

Vapor retarder - yes or no. Also note: type, location, properly installed, properly protected during placement and subsequent construction.

Sub-base

1. Cut
2. Fill

Blotter layer - note if included or omitted. If included note if it is a compactable or non-compactable type.

Screeding - Note whether screed stakes or form screeding was used.

Concrete;

Water to cement ratio of the mix design

Type and grade of aggregate

Time of transit from plant to site. Also note any delays, for any reason.

Rotations used in each load.

Temperature of the concrete mix at time of delivery.

Slump at time of placement.

How much, if any, add water was used for delivery and placement of the concrete mixture?

Water added to the aggregate (lightweight concrete). Was it factored into the water to cement calculations?

Curing method:

- Curing agent, impermeable sheet, curing compounds, none used. How long was the concrete cured?
- Concrete finishing: hard troweled, power troweled, etc.
- Admixtures: If used, what type (i.e. CaCl, fly ash, plasticizer, water reducers, etc.)?
- Building Envelope Condition/Environment;
- Temperature of room
- Relative humidity of room
- Concrete surface temperature
- Air movement

Summary

With all the above referenced factors listed, it is unreasonable to expect a general contractor, concrete contractor or a flooring installer to have sufficient expertise to anticipate and ask the proper questions for evaluation of potential concrete/flooring problems. Another complicating factor is that each has a vested interest on the testing and/or performance outcome of the installation.

Flooring contractors should be made aware of test results, as all flooring manufacturers have placed upward tolerable limits of moisture vapor emission for the installation of their products; most have also recognized that adhesives will cure within a moderate range of pH. However, flooring contractors' expertise should, by requirement, be limited to flooring materials and their installation. Changes in construction materials and practices should not lead to a mandatory in depth expertise of all the disciplines mentioned above.

It is therefore our recommendation that the responsibility for concrete moisture vapor emission testing be placed in the hands of independent agencies.

A project of the World Floor Covering Association in conjunction with industry association and personnel

SECTION FOUR - INSTALLATION OF PATTERNED CARPETS

An Industry project of the International Certified Floorcovering Installers Association CFI

The Most Important Rules

Patterned carpet installation requires **COMMUNICATION** and **PREPARATION**. The Installation Contractor must be qualified to work with patterned goods! It is understood that the professional expertise, which results in a quality installation will increase the cost. However, if Customer Satisfaction **IS** the *Ultimate Goal*, decisions made by the dealer, architect, general contractor, owner or responsible party, will have a direct impact on the finished product received by the Client.

ALL parties must realize that the installation requires additional time, cost and expertise to provide our Clients with the finest of installations. To achieve this, consider the following:

- The Patterned Carpet Specialist is a proficient, well known flooring installation artist whose reputation includes painting a picture with a patterned carpet in the Client's environment. If everything is in order, ***the effect is long-lasting and beautiful.***
- The salesperson **MUST** discuss characteristics with the client and ONLY "promise" what can be accomplished. *"If it does not start right, it will not finish right!"*
- Even if the material is within manufacturing tolerances, **ALL** parties need to be aware that "standard" installation methods will not always bring patterns to an acceptable level for the Client.
- Whereas, when "Above and Beyond" installation techniques and time are required to satisfy the end user, **ALL** must understand that the Installation Contractor cannot be the **SOLE** party carrying the burden of time, expertise and cost.
- **ONLY** the services of well-trained, professional Installation Contractors whose reputations are that of Patterned Carpet Specialists, proficient with the installation of patterned materials should be utilized.
- Cutting corners or accepting the lowest bid is **never** acceptable or wise. Price **cannot** be the issue. When the above statements are considered, **OUR** Client receives what was expected at the time of the purchase.

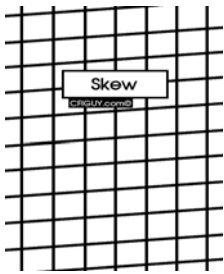
1. Pattern Tolerances

Manufacturer's specifications concerning patterns are **ALWAYS** the primary source of installation instructions. If information is not available, the following guidelines will be helpful.

Do NOT cut or install carpet IF a defect is visible OR if:

- Skew / Bias is greater than 1-1/2 inches in 12-foot width
- Bow is greater than 1-inch in 12-foot width
- Trueness of Edge is greater than 1/2-inch in 12-foot length
- Pattern Elongation in length is more than 1" in 10-feet

1. SKEW



Skew or Bias – Condition exists when the carpet face yarn is set on secondary backing in such a way that the face yarn is not square with that backing. Distortion is noticeable when the pattern on one side is slightly ahead of pattern on opposite side.

Recommended tolerance is no more 1-1/2 inches in 12-feet

If the skew is no more than 1-1/2 inches in 12-feet, the following procedures should correct the problem when implemented by a qualified Installation Contractor who is paid according to the work and time involved.

The use of a powerstretcher and deadman are **mandatory**. If a direct-glue installation is involved, stay nails may also be necessary.

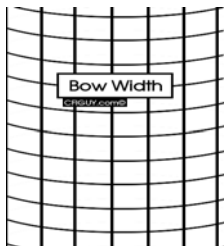
Check for Skew

Some patterned carpets display 4-5 patterns – length, width and multi-diagonals. Often length, width and one diagonal will match, but the other diagonal (or two) may be off.

Procedure

1. Use a carpenter's square and a straightedge
2. Position carpenter's square at selvage edge of carpet and align with pattern along length
3. Lay 6-foot straightedge on top of or beside carpenter's square aligned across the width
4. This ensures that the straightedge is at a 90-degree angle to the straight tufted rows
5. Hold dryline (dry chalkline) at the top of the carpenter's square along the 6-foot straightedge
6. Extend dryline 12-feet across the width of the carpet from one side to the other side
7. Measure pattern on the left side up to the dryline
8. Measure the same pattern on the right side to the dryline
9. If the difference is greater than 1-1/2 inches, contact the Manufacturer.

2. Bow Width

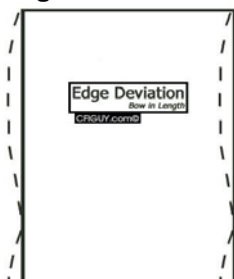


When viewed across the width, the distortion is visible as wavy or crooked lines that occur in the width of either patterned or plain carpet, usually occurs when carpet is not perfectly straight as it is being manufactured.

The recommended tolerance is 1-inch in 12-feet

3. EDGE DEVIATION - TRUENESS of EDGE - BOW in the LENGTH

Lengthwise Pattern Bow



Does not appear in length as a straight line. May be caused because the pattern is not aligned on the tenter hooks during the application of backing or the sizing process.

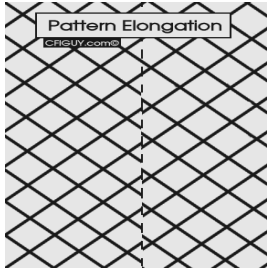
This can be measured between common pattern points along carpet edge at or very close to edge to be trimmed for seaming.

Recommended tolerance 1/2-inch in 12 feet

To correct: Use Powerstretcher and Deadman to stretch in the width. Stay nail And hold the pattern with the Powerstretcher.

4. Pattern Elongation

Pattern Elongation - Pattern Run-off



Variation of patterns occurs from one breadth of carpet to the next. A condition that accounts for the pattern growing along a seam. Usually caused by lack of equal tension across the range during manufacturing or as the secondary backing is applied.

Recommended tolerance 1-inch in 10 feet

5. Figure Pattern Repeat

- Refer to Manufacturer's listed pattern repeat prior both in width and length, prior to installation.
- To determine the actual pattern repeat of product being installed. Use a steel tape-measuring device, not a cloth tape.
- For patterns with decimal values, a simplified conversion table is illustrated.
- Ex: A carpet with a pattern repeat of 18.3750" equals 18-3/8"

6. Figure accurate pattern count

- A. Check Manufacturer's stated pattern size
- B. Measure width of carpet from selvage to selvage and record the distance in inches.
- C. Check actual pattern for ample carpet to trim for a match
- D. Divide stated pattern repeat size into the inches recorded
- E. If the total of inches is more than the exact number of the pattern count, this allows for trimming of the selvage. The pattern count is correct

Correct example:

- Breadth of carpet, 12-feet wide = 144-inches
- Pattern repeat = 18-inches
- $144 \div 18 = 8$ repeats across 12-foot width

If after dividing and checking the count, there are not enough inches to trim, it is necessary to cut in one full pattern. The overall width of the carpet is now diminished by one full pattern. This could create a shortage of carpet to complete the installation. Contact the Manufacturer.

Incorrect Example:

- Breadth of carpet, 12 feet wide = 142-inches
- Pattern repeat = 18-inches
- $142 \div 18 = 7$ patterns plus 16-inches

Carpet repeat is 7 patterns plus 16" of waste. Working material is approximately 10-feet 6-inches.

Understanding tolerances, pattern repeats and the pattern count are critical to the success of the job.

SECTION FIVE – BASIC DIRECT-GLUE INSTALLATION PROCEDURES

A. Direct Glue Installation

1. Identify backing and secure any installation products that are required by Manufacturer
2. Determine the pattern count
3. Arrange cuts to install the longest patterns first
4. Dry-lay areas prior to applying adhesive or hot-melt seaming tape
5. Prestretch the carpet prior to seaming ONLY if it is necessary to match the pattern.
6. For smaller areas of adhesive installation, fold the carpet back approximately 3-feet on each side of the seam. The size of the fold is determined by the amount of pattern distortion. In larger areas or with carpets displaying excessive pattern elongation or runoff, other adhesive applications must be used.
7. Apply adhesive using trowel or spray system application
8. If necessary, lay carpet into wet adhesive to slide carpet for matching the pattern.
9. Use the correct seam sealer.
10. Begin in center of seam and work away to match patterns.
11. Use a two-headed powerstretcher or deadman to stretch shorter patterns to match the longer patterns
12. Stay nails are to be used on wood or concrete substrates to hold pattern on line
13. Use a kneekicker to push the fullness toward the center of the carpet
14. Do not remove stay nails until adhesive has reached bonding strength

SEAM CONSTRUCTION

A. Hot-melt seams if pattern matching is minimal

1. It is recommended that all seams be constructed on a hard surface.
2. Seams are generally constructed in the same direction as the nap lay.
3. Start in center of carpet to match seam in patterned goods. Stay-nail seam as the pattern is matched.
4. Place the Deadman on the short patterns of the seam where the seam is matched.
5. Using the powerstretcher, stretch short side to match long side and stay nail in place.
6. Continue this procedure along the entire length of the seam.
7. Repeat procedure in the opposite direction.
8. When pattern match is achieved, construct the seam running the same direction as the entire length of the nap.
9. Seal seams according to Manufacturer's instructions.

B. Constructing hot-melt seams if pattern distortion is greater

1. Position the seaming iron to move in the same direction as the nap of the carpet.
2. Construct seam while matching the pattern.
3. Complete one-half of the seam.
4. Repeat construction of the other half of seam.
5. Position seaming iron in opposite direction of the nap lay.
6. Do NOT slide the non-heat conducting weight against the grain of the carpet. Lift and place it to avoid distortion of the yarns.
7. Seal seams in accordance with the Manufacturer's Installation guidelines.

Seam Preparation for printed patterns

The printed pattern on the face fibers does not necessarily follow a tufting row. The pattern may not align with the tufted row.

- Separate face fibers and examine full length of the fiber.
- An indication of a printed pattern is fibers that appear white or display no color on the lower 2/3's of the fiber.

Methods of seam preparation to follow for printed patterns

A. Cut from the back

This method is used when face fibers are susceptible to shearing from top-cutting face pile.

Follow this procedure:

1. Locate a designated pattern and mark the same spot on each repeating pattern.
2. Mark by carefully separating the face fibers.
3. Place a cut or slit through the secondary backing
4. Fold carpet back to expose the secondary backing
5. Align the straightedge with the carpet cuts
6. To avoid shearing face yarns, do not cut deep into the face pile.
7. Repeat this method on the adjacent breadth and cut the seam at the match point.

B. Cut from top or face side of carpet

1. This method works well with carpets that have very short, dense face fibers to minimize any shearing from the cushion-back cutter.
2. Use a straight edge and cushion-back cutter.
3. Place the straightedge from a pattern repeat to the next pattern repeat; be aware of a length bow.
4. Follow the straightedge with the cushion-back cutter.
5. Repeat the same procedures on adjacent breadth.
6. Cut the seam at the match point.

C. Run a row and trace cut

Important: When using this method, cut pile in a looped carpet will be reduced by one-half.

1. Run a row on one section of carpet.
2. Overlap this section onto the next section and match the pattern.
3. If necessary, stretch and stay-nail carpet prior to cutting.
4. Use a cushion-back cutter to trace cut the seam.

SECTION SIX – TERMS TO KNOW

Definitions available at www.CFIinstallers.com – Click “Member Resources” and select the CFI Dictionary

Alkalinity	Bow	Mat Test	rH	3-4-5 Rule
Ambient Air	Condensation	Pattern Count	Roll Sequence	3 lbs.
Bias	Dew Point	Pattern Elongation	Skew	
Bond test	Dry Line	pH	Vapor Emission	

Using these guidelines should avoid problems that turn a profitable installation into one that loses money and Customers!

****The detailed 66-page hard-bound CFI Patterned Resource Guide is available by contacting CFI at (816) 231.4646. The cost is \$60.00.